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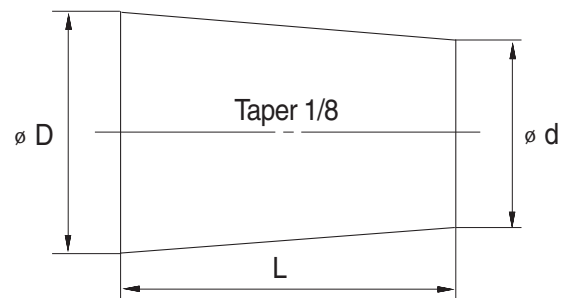
SECTION 8 DISASSEMBLY AND ASSEMBLY

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 (HW160)

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1 ± 5.0	377 ± 36.2
2		Engine mounting bolt (bracket-frame, RR)	M24 × 3.0	90 ± 9.0	651 ± 65.1
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		Fuel tank mounting bolt	M20 × 2.5	57.9 ± 5.8	419 ± 42.0
6		Coupling mounting socket bolt	M18 × 2.5	32.0 ± 1.0	231 ± 7.2
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	34.7 ± 2.2
8		Main pump mounting socket bolt	M16 × 2.0	25.0 ± 2.5	181 ± 18.1
9		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
10		Travel motor mounting socket bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
11		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 5.8	419 ± 42.0
12		Turning joint mounting bolt, nut	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
13	Power train system	Swing motor mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
14		Swing bearing upper mounting bolt	M18 × 2.5	57.9 ± 6.0	419 ± 43.4
15		Swing bearing lower mounting bolt	M16 × 1.5	57.9 ± 6.0	419 ± 43.4
16		Real axle mounting bolt, nut	M20 × 2.5	58 ± 6.3	419 ± 45.5
17		Transmission bracket mounting bolt	M20 × 2.5	58 ± 6.3	419 ± 45.5
18		Transmission mounting bolt	M20 × 2.5	58 ± 6.3	419 ± 45.5
19		Oscillating cylinder mounting bolt	M22 × 1.5	83.2 ± 9.2	602 ± 66.5
20		Oscillating cylinder support mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
21		Wheel nut	M22 × 1.5	60 ⁺⁰ ₋₅	433 ⁺⁰ _{-36.2}
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	M30 × 3.0	199 ± 30	1439 ± 217
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

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

1. MAJOR COMPONENTS (HW180)

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1±5.0	377±36.2
2		Engine mounting bolt (bracket-frame, RR)	M24 × 3.0	90±9.0	651±65.1
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		Fuel tank mounting bolt	M20 × 2.5	57.9±5.8	419±42.0
6		Coupling mounting socket bolt	M18 × 2.5	32.0±1.0	231±7.2
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	4.8±0.3	34.7±2.2
8		Main pump mounting socket bolt	M16 × 2.0	25.0±2.5	181±18.1
9		Main control valve mounting bolt	M12 × 1.75	12.2±1.3	88.2±9.4
10		Travel motor mounting socket bolt	M16 × 2.0	29.6±3.2	214±23.1
11		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9±5.8	419±42.0
12		Turning joint mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
13	Power train system	Swing motor mounting bolt	M16 × 2.0	29.6±3.2	214±23.1
14		Swing bearing upper mounting bolt	M18 × 2.5	57.9±6.0	419±43.4
15		Swing bearing lower mounting bolt	M16 × 1.5	57.9±6.0	419±43.4
16		Real axle mounting bolt, nut	M20 × 2.5	58±6.3	419±45.5
17		Transmission bracket mounting bolt	M20 × 2.5	58±6.3	419±45.5
18		Transmission mounting bolt	M20 × 2.5	58±6.3	419±45.5
19		Oscillating cylinder mounting bolt	M22 × 1.5	83.2±9.2	602±66.5
20		Oscillating cylinder support mounting bolt	M16 × 2.0	29.6±3.2	214±23.1
21		Wheel nut	M22 × 1.5	60 ⁺⁰ ₋₅	433 ⁺⁰ _{-36.2}
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	M30 × 3.0	199±30	1439±217
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

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

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~ 161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

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) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

· Hydraulic tank quantity : 125 l
(33 U.S. gal)

- (5) Remove socket bolts (13) and disconnect hoses (1, 2).

- (6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10, 11).

- (7) Remove socket bolts (14) and disconnect pump suction pipe (4).

※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

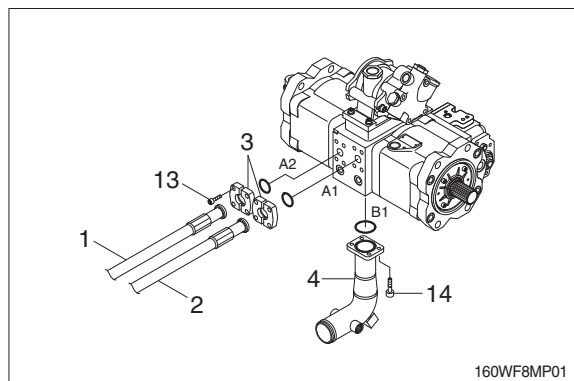
- (8) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 90 kg (200 lb)

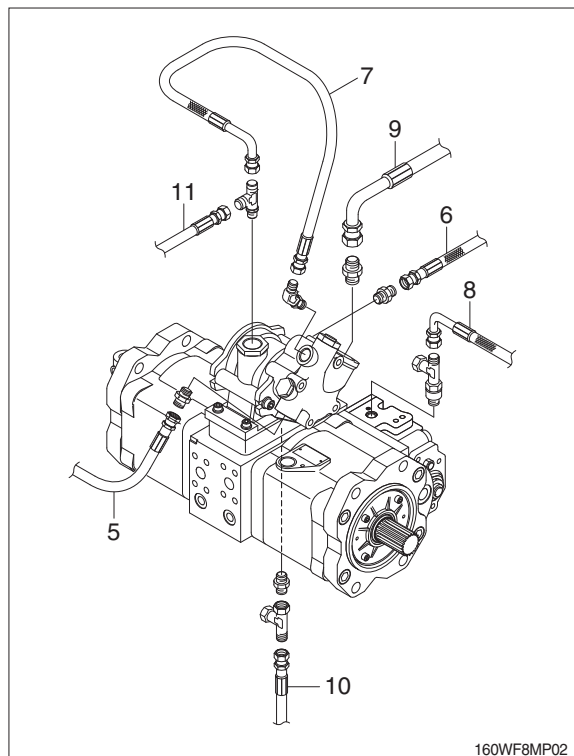
※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.



13031GE18



160WF8MP01



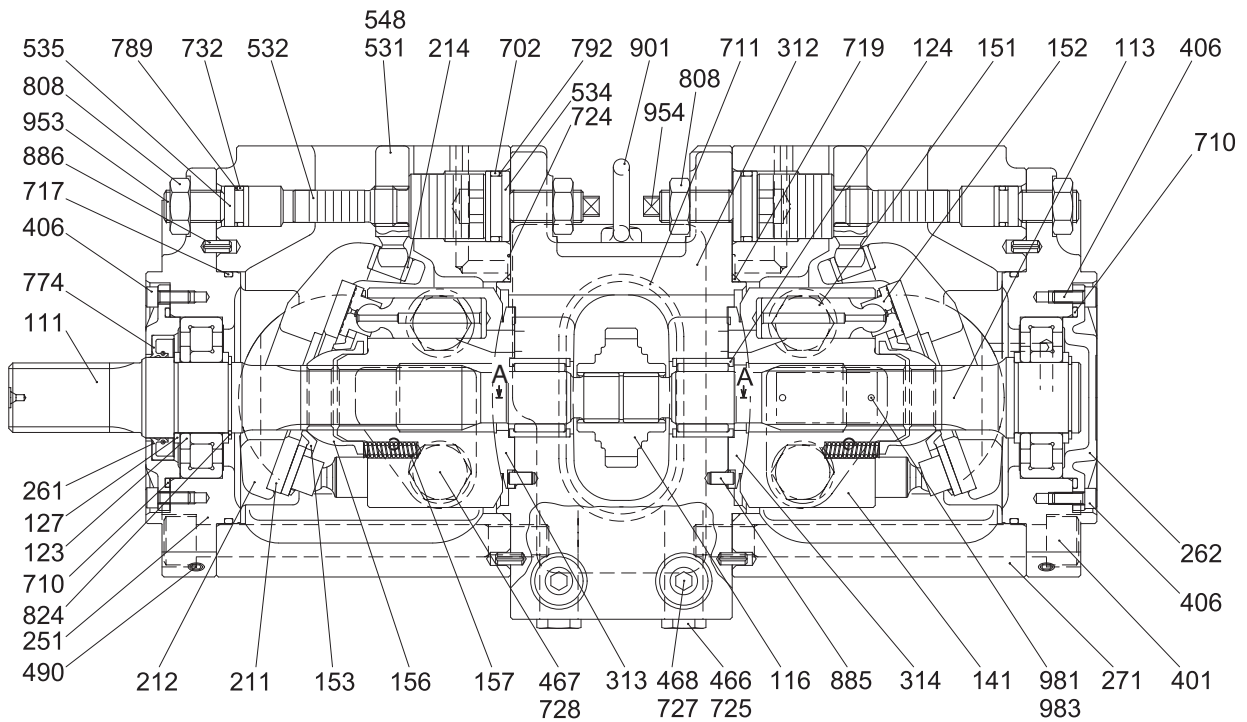
160WF8MP02

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)

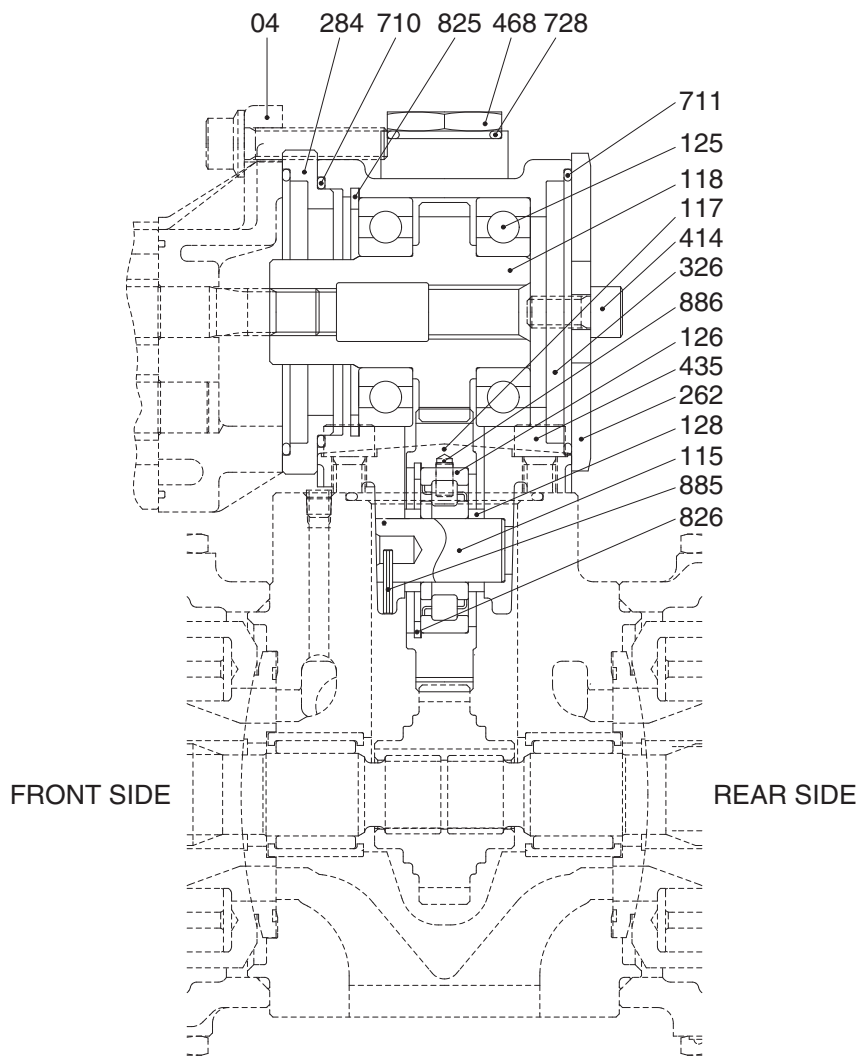
1) STRUCTURE



14W72SF02

111	Drive shaft (F)	312	Valve block	724	O-ring
113	Drive shaft (R)	313	Valve plate (R)	725	O-ring
116	Gear	314	Valve plate (L)	727	O-ring
123	Roller bearing	401	Hexagon socket bolt	728	O-ring
124	Needle bearing	406	Hexagon socket bolt	732	O-ring
127	Bearing spacer	466	VP Plug	774	Oil seal
141	Cylinder block	467	VP Plug	789	Back up ring
151	Piston	468	VP Plug	792	Back up ring
152	Shoe	490	Plug	808	Hexagon head nut
153	Push-plate	531	Tilting pin	824	Snap ring
156	Bushing	532	Servo piston	885	Pin
157	Cylinder spring	534	Stopper (L)	886	Spring pin
211	Shoe plate	535	Stopper (S)	901	Eye bolt
212	Swash plate	548	Pin	953	Set screw
214	Bushing	702	O-ring	954	Set screw
251	Support	710	O-ring	981	Plate
261	Seal cover (F)	711	O-ring	983	Pin
262	Seal cover (R)	717	O-ring		
271	Pump casing	719	O-ring		

MAIN PUMP (2/2)



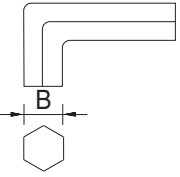

14W92MP03

04	Gear pump	262	Cover	711	O-ring
115	Shaft	284	Plate	728	O-ring
117	Gear No.2	326	Gear case	825	Retainer ring
118	Gear No.3	414	Screw	826	Retainer ring
125	Ball bearing	435	Hexagon socket bolt	827	Retainer ring
126	Roller bearing	468	Plug	885	Spring pin
128	Bearing spacer	710	O-ring	886	Pin

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

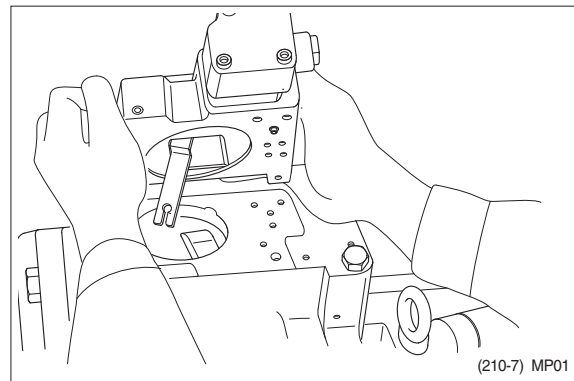
Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PO-1/4	M12, M14
	8	M10	BP-3/8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon bolt	Hexagon nut	VP plug (PF thread)	
	19	M12	M12	VP-1/4	
	24	M16	M16	-	
	27	M18	M18	VP-1/2	
	30	M20	M20	-	
	36	-	-	VP-3/4	
Adjustable angle wrench		Medium size, 1 set			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		Steel bar of key material approx. 10 × 8 × 200			
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	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

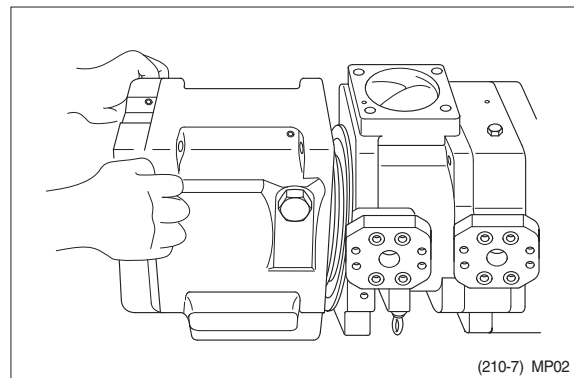
3) DISASSEMBLY

- (1) Select place suitable to disassembling.
 - ※ Select clean place.
 - ※ Spread rubber sheet, cloth or so on 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 oil out of pump casing (front and rear pump).
- (4) Remove hexagon socket head bolts (412, 413) and remove regulator.



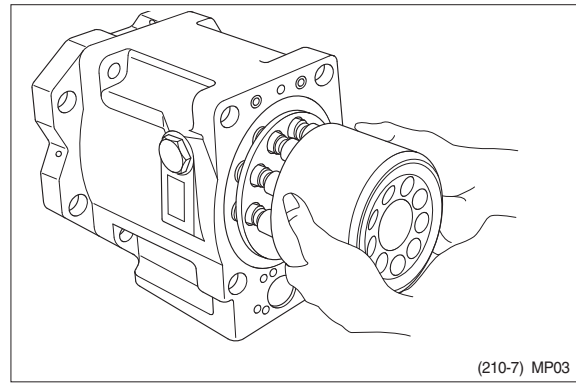
- (5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve block (312).
 - ※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

- (6) Place pump horizontally on workbench with its regulator-fitting surface down and separate pump casing (271) from valve block (312).
 - ※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



(7) Pull cylinder block (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

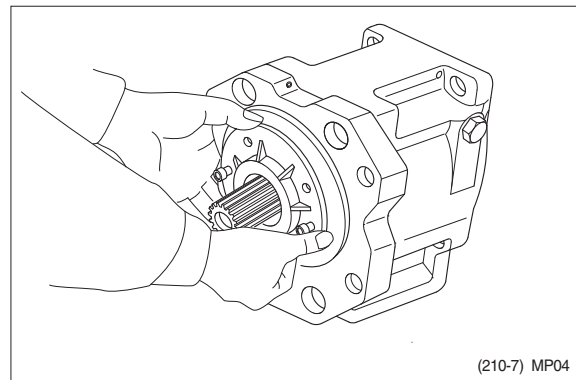
※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.



(8) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

※ Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

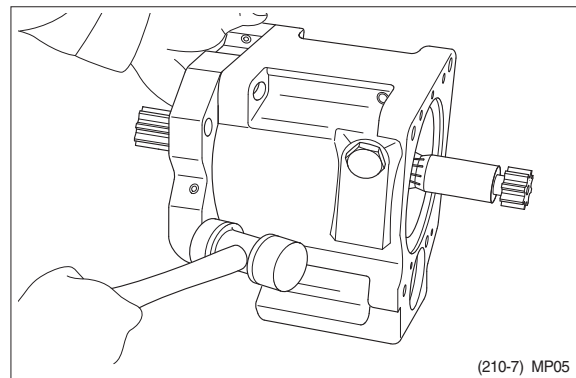
※ Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.



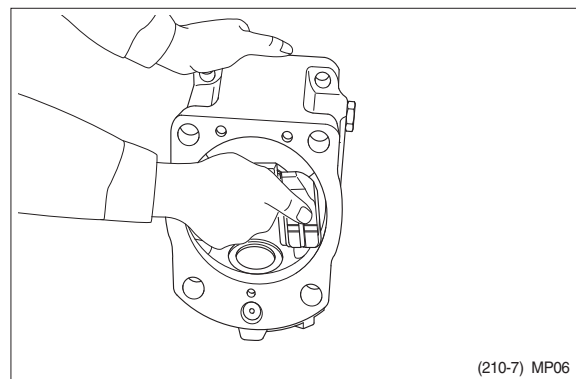
(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).

In case fitting a gear pump, first, remove gear pump.

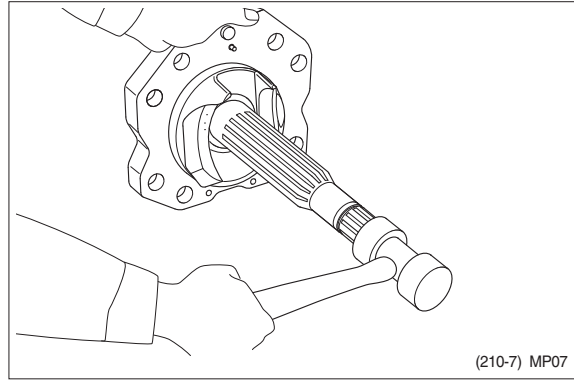
(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



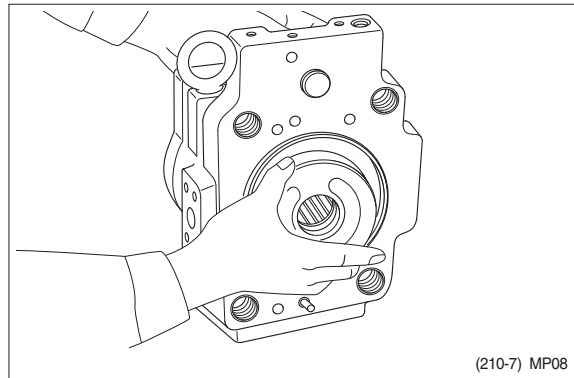
(11) Remove shoe plate (211) and swash plate (212) from pump casing (271).



- (12) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



- (13) Remove valve plates (313, 314) from valve block (312).
※ These may be removed in work (6).



- (14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) and splined coupling (114) from valve block (312).
- ※ In removing tilting pin, use a protector to prevent pin head from being damaged.
 - ※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.
 - ※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.
 - ※ Do not loosen hexagon nuts of valve block and swash plate support.
If loosened, flow setting will be changed.

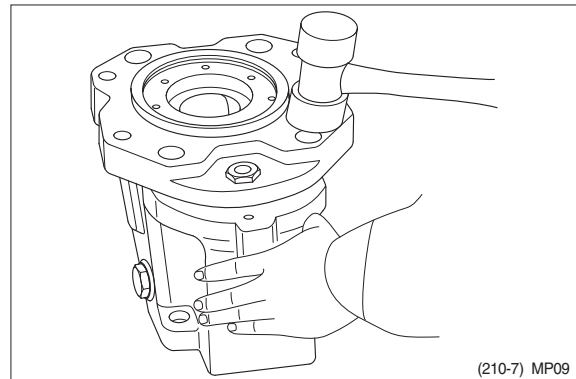
4) ASSEMBLY

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

- ① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.
- ② Clean each part fully with cleaning oil and dry it with compressed air.
- ③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.
- ④ In principle, replace seal parts, such as O-rings, oil seals, etc.
- ⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

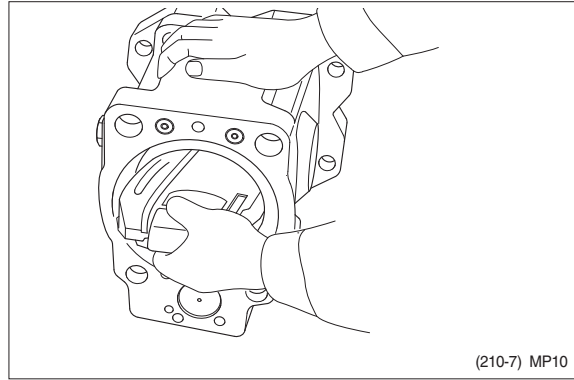
(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

- ※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.
- ※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (Medium strength) to their threaded sections.



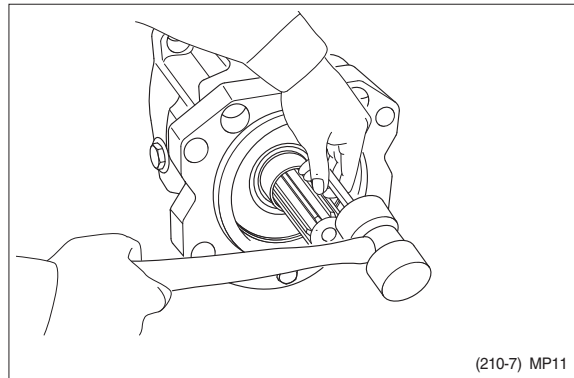
(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.

- ※ Confirm with fingers of both hands that swash plate can be removed smoothly.
- ※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



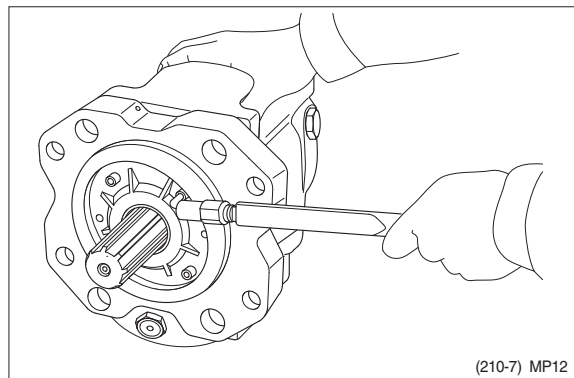
(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

- ※ Do not tap drive shaft with hammer or so on.
- ※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.
- Fit them fully, using steel bar or so on.



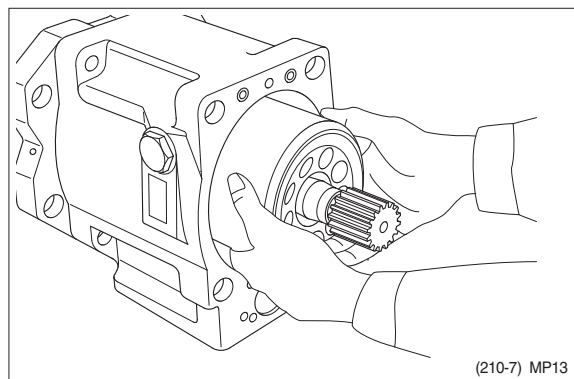
(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

- ※ Apply grease lightly to oil seal in seal cover (F).
- ※ Assemble oil seal, taking full care not to damage it.
- ※ For tandem type pump, fit rear cover (263) and seal cover (262) similarly.

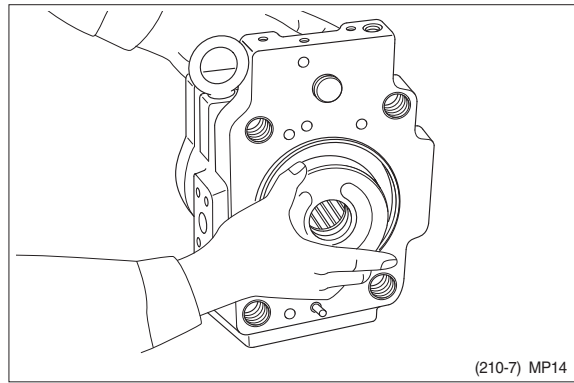


(6) Assemble piston cylinder subassembly [cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157)] .

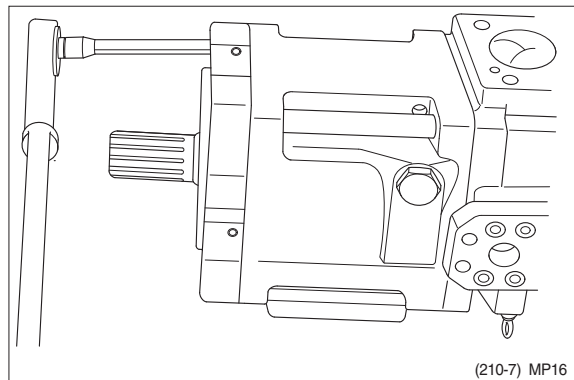
Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.



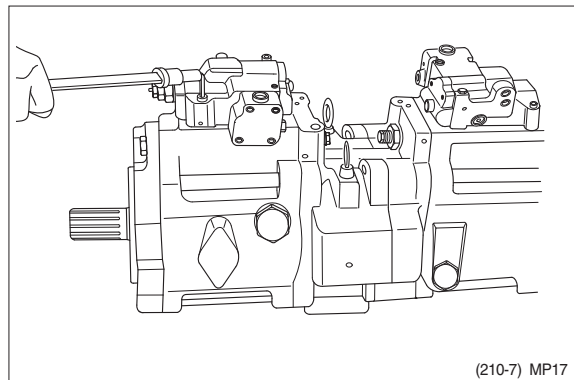
- (7) Fit valve plate (313) to valve block (312), entering pin into pin hole.
- ※ Take care not to mistake suction / delivery directions of valve plate.



- (8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
- ※ At first assemble this at rear pump side, and this work will be easy.
 - ※ Take care not to mistake direction of valve block.
 - ※ Clockwise rotation (Viewed from input shaft side) - Fit block with regulator up and with delivery flange left, viewed from front side.
 - ※ Counter clockwise rotation (Viewed from input shaft side) - Fit block with delivery flange right, viewed from front side.



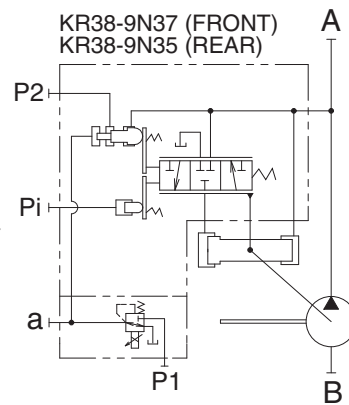
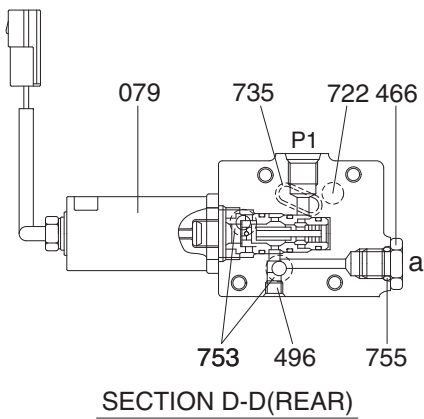
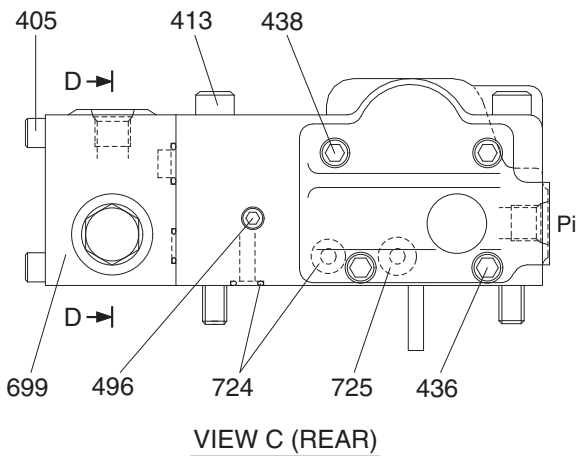
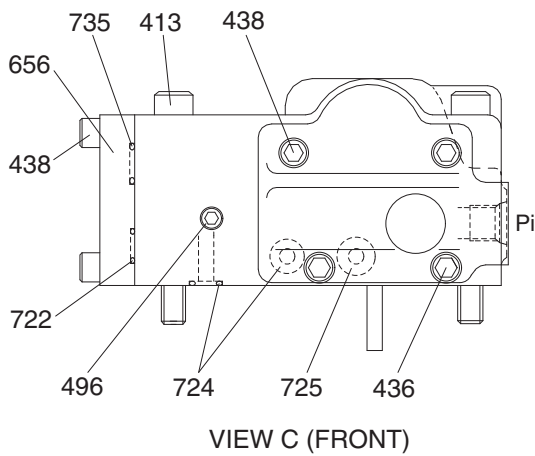
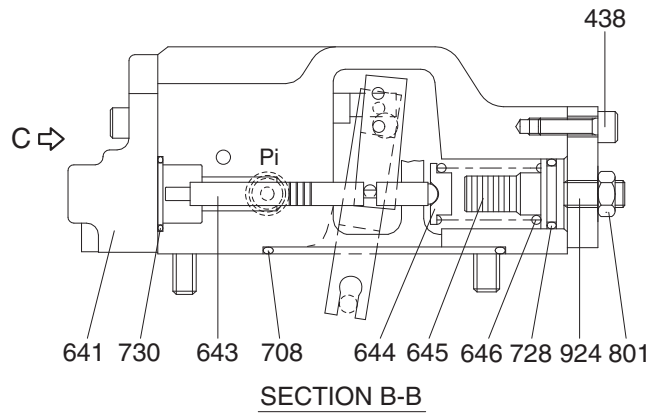
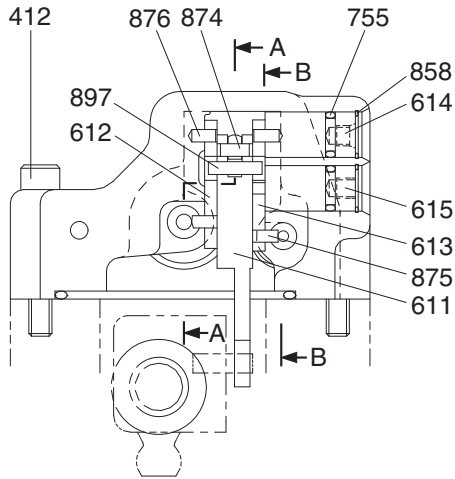
- (9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
- ※ Take care not to mistake regulator of front pump for that of rear pump.



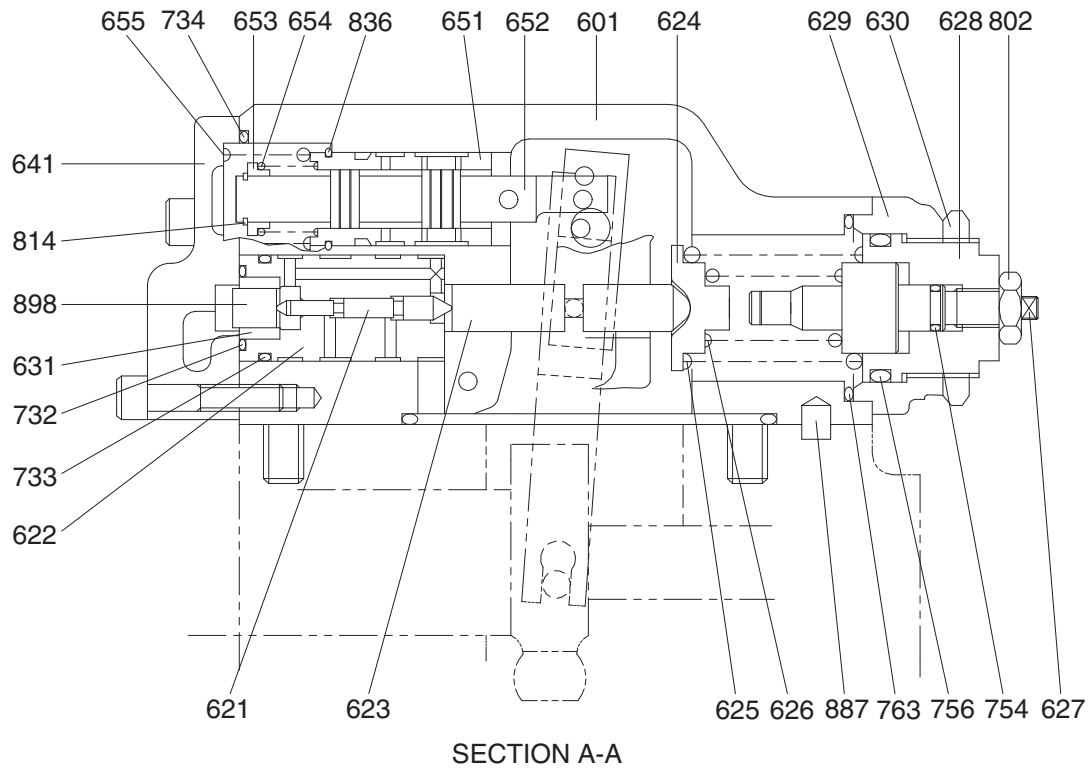
- (10) Fit drain port plug (468).
This is the end of reassembling procedures.

3. REGULATOR

1) STRUCTURE (1/2)



REGULATOR (2/2)



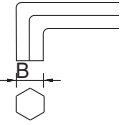

14W92MP05

405 Hexagon socket screw	629 Cover (C)	732 O-ring
412 Hexagon socket screw	630 Lock nut	733 O-ring
413 Hexagon socket screw	631 Sleeve, kf	734 O-ring
436 Hexagon socket screw	641 Pilot cover	735 O-ring
438 Hexagon socket screw	643 Pilot piston	753 O-ring
466 Plug	644 Spring seat (Q)	754 O-ring
496 Plug	645 Adjust stem (Q)	755 O-ring
601 Casing	646 Pilot spring	756 O-ring
611 Feed back lever	651 Sleeve	763 O-ring
612 Lever 1	652 Spool	801 Nut
613 Lever 2	653 Spring seat	802 Nut
614 Fulcrum plug	654 Return spring	814 Snap ring
615 Adjust plug	655 Set spring	836 Snap ring
621 Compensator piston	656 Block cover	858 Snap ring
622 Piston case	699 Valve casing	874 Pin
623 Compensator rod	708 O-ring	875 Pin
624 Spring seat (C)	722 O-ring	876 Pin
625 Outer spring	724 O-ring	887 Pin
626 Inner spring	725 O-ring	897 Pin
627 Adjust stem (C)	728 O-ring	898 Pin
628 Adjust screw (C)	730 O-ring	924 Set screw

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M5	BP-1/16	-	M 8
	5	M6	BP-1/8	-	M10
	6	M8	BP-1/4	PO-1/4	M12, M14
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench		Small size, Max 36 mm			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		4 × 100 mm			
Torque wrench		Capable of tightening with the specified torques			
Pincers		-			
Bolt		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 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	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

3) DISASSEMBLY

Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

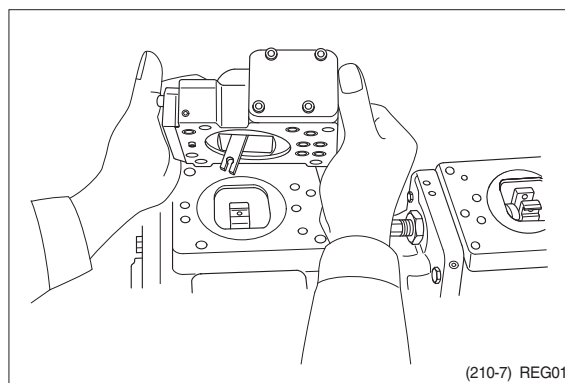
(1) Choose a place for disassembly.

- ※ Choose a clean place.
- ※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.

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

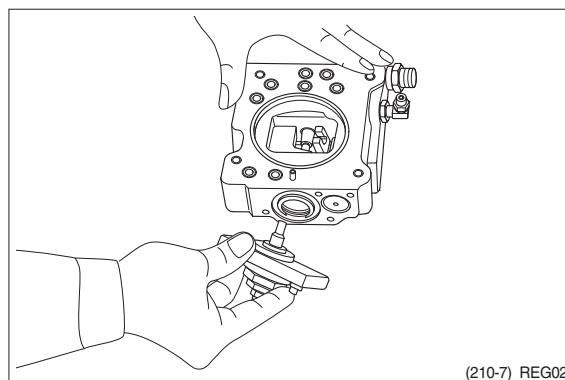
(3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.

- ※ Take care not to lose O-ring.



(4) Remove hexagon socket head screw (438) and remove cover (C,629)

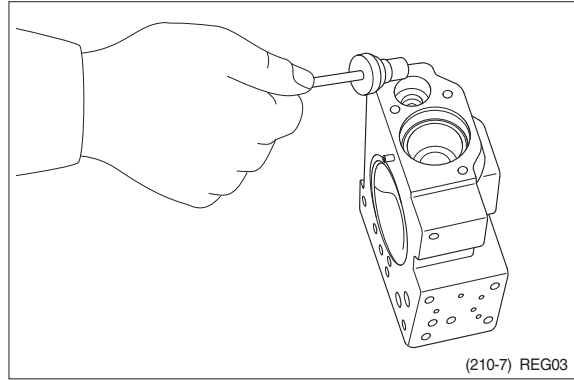
- ※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
- ※ Do not loosen these screws and nuts. If they are loosened, adjusted pressure-flow setting will vary.



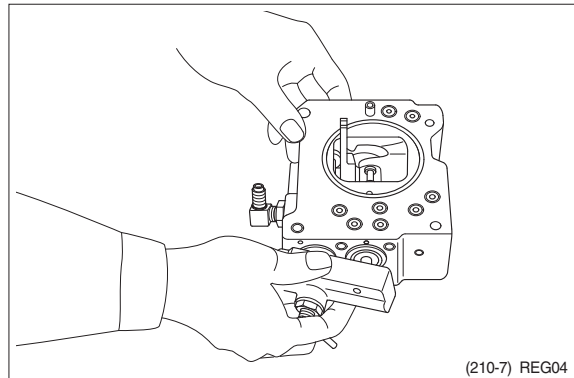
- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.

Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

- ※ Adjusting ring (Q,645) can easily be drawn out with M4 bolt.

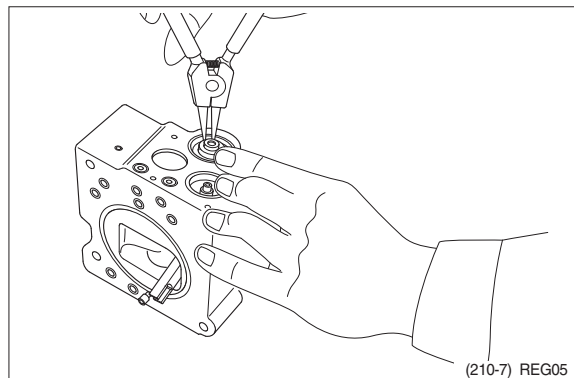


- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641). After removing pilot cover, take out set spring (655) from pilot section.



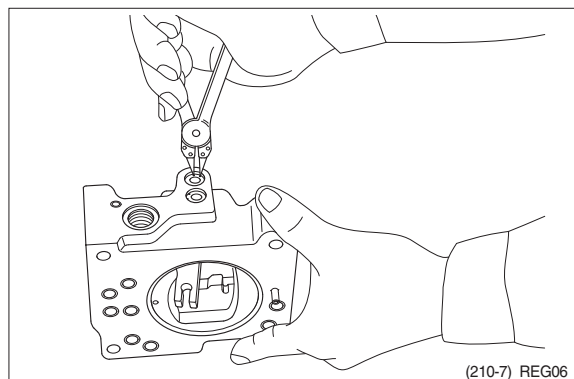
- (7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).

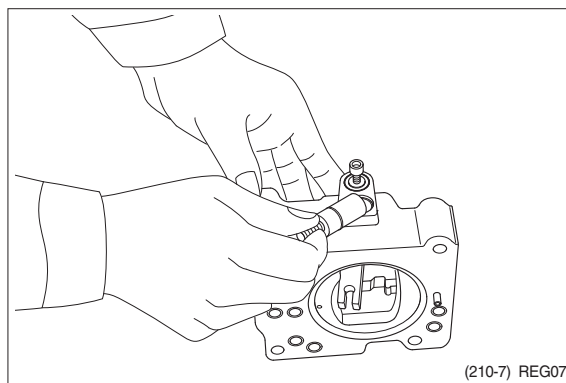
- ※ Sleeve (651) is fitted with snap ring (836).
- ※ When removing snap ring (814), return spring (654) may pop out. Take care not to lose it.



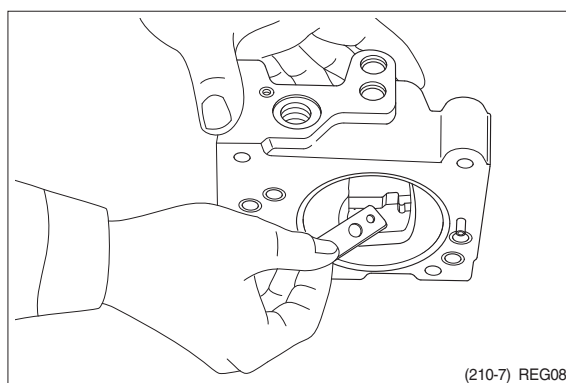
- (8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

- ※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.

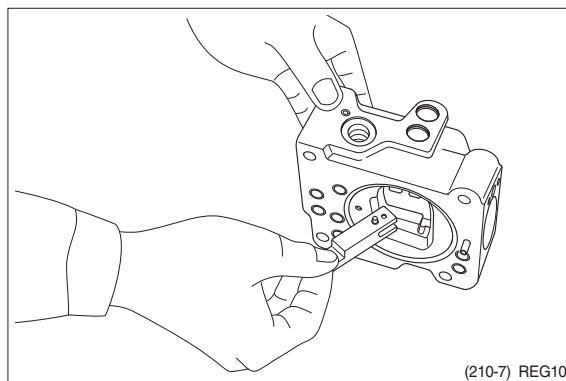
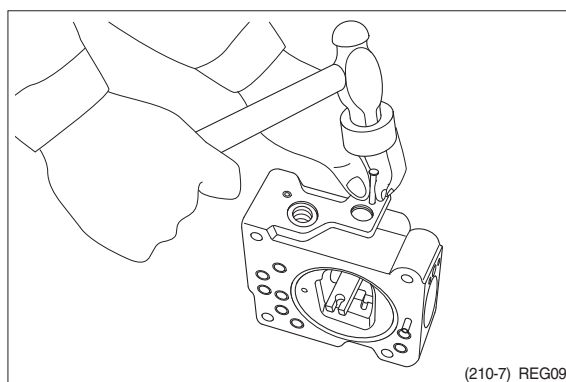




- (9) Remove lever 2 (613). Do not draw out pin (875).
※ Work will be promoted by using pincers or so on.



- (10) Draw out pin (874) and remove feedback lever (611).
Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).



- (11) Remove lever 1 (612). Do not draw out pin (875).
 - (12) Draw out pilot piston (643) and spool (652).
 - (13) Draw out piston case (622), compensating piston (621) and compensating rod (623).
- ※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes disassembly.

4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

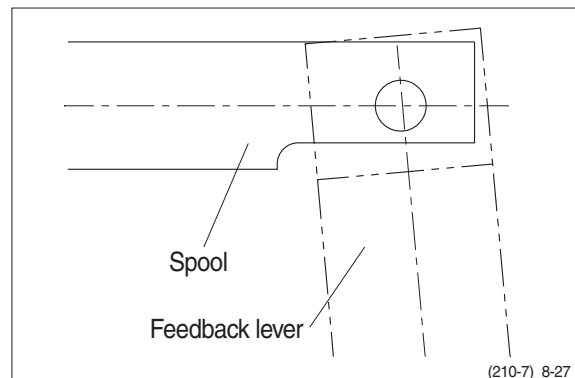
- ① Always repair parts that were scored at disassembly.
- ② Get replacement parts ready beforehand.
Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.
- ③ Always tighten bolts, plugs, etc. to their specified torques.
- ④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.
- ⑤ Replace seals such as O-ring with new ones as a rule.

(2) Put compensating rod (623) into compensating hole of casing (601).

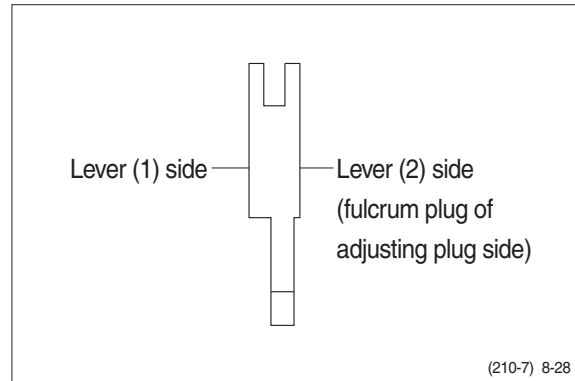
(3) Put pin force-fitted in lever 1 (612) into groove of compensating rod and fit lever 1 to pin force-fitted in casing.

(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

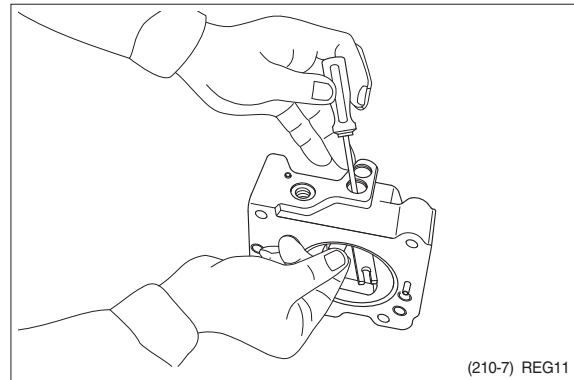
- ※ Confirm that spool and sleeve slide smoothly in casing without binding.
- ※ Pay attention to orientation of spool.



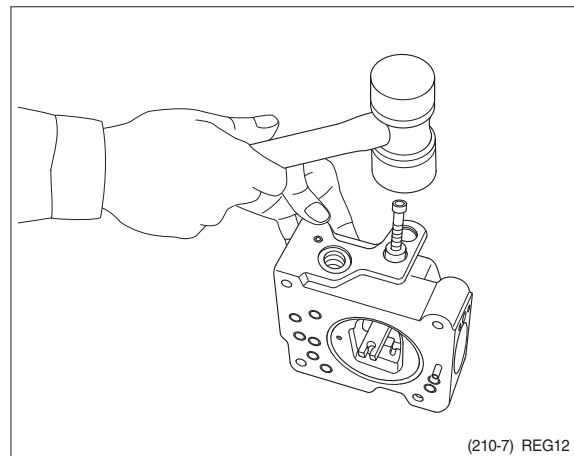
- (5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
- ※ Insert pin in feedback lever a little to ease operation.
 - ※ Take care not to mistake direction of feedback lever.



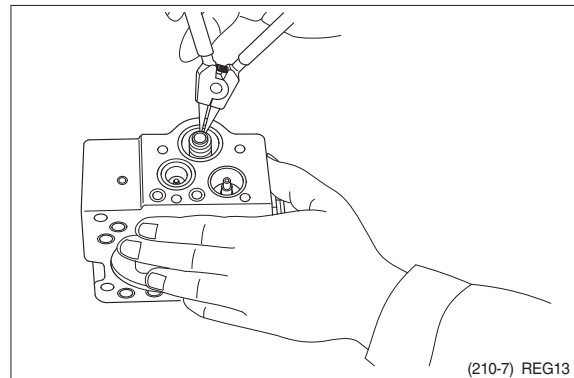
- (6) Put pilot piston (643) into pilot hole of casing.
- ※ Confirm that pilot piston slides smoothly without binding.
- (7) Put pin force-fitted in lever 2 (613) into groove of pilot piston.
Then fix lever 2.



- (8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever 2.
Then fix locking ring (858).
- (9) Insert adjusting plug (615) and fit locking ring.
- ※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
- At this point in time move feedback lever to confirm that it has no large play and is free from binding.

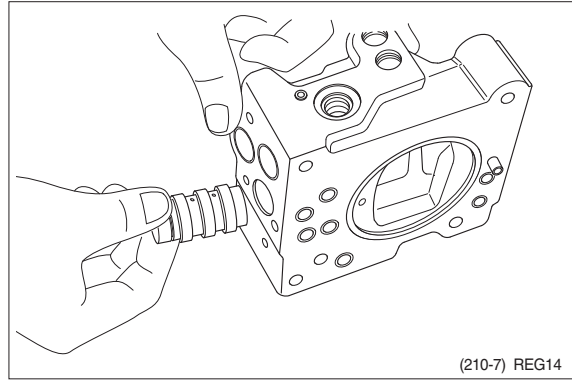


- (10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



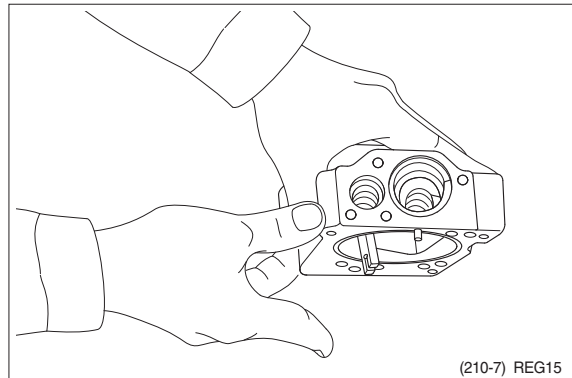
- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.

Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



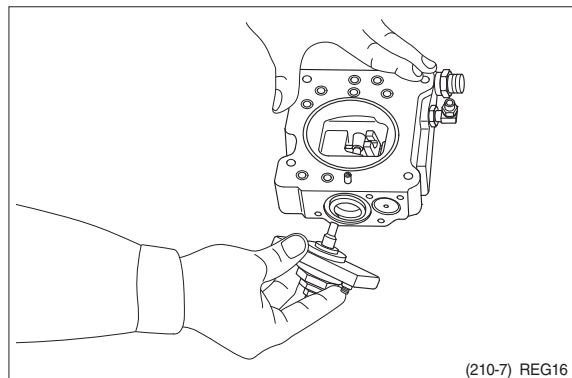
- (12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole. Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

※ When fitting spring seat, take care not to mistake direction of spring seat.



- (13) Install cover (C, 629) fitted with adjusting screws (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

Then tighten them with hexagonal socket head screws (438).



This completes assembly.

GROUP 4 MAIN CONTROL VALVE

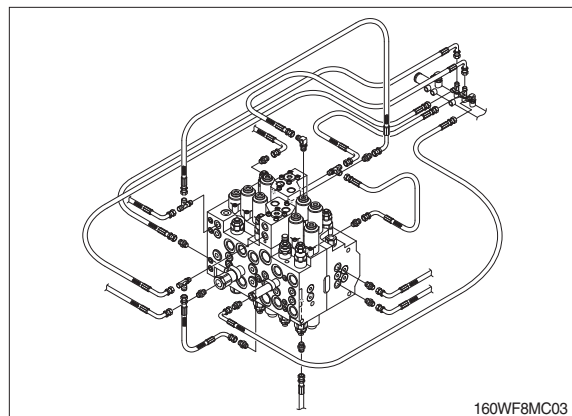
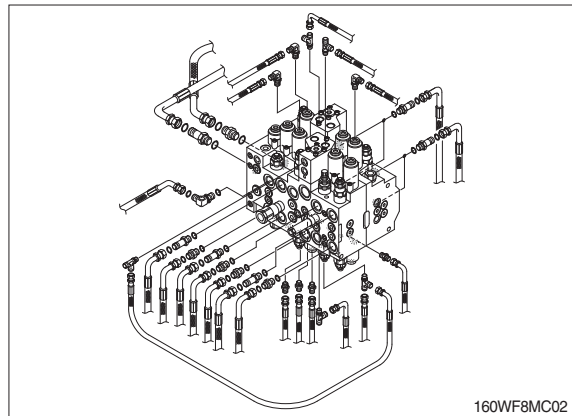
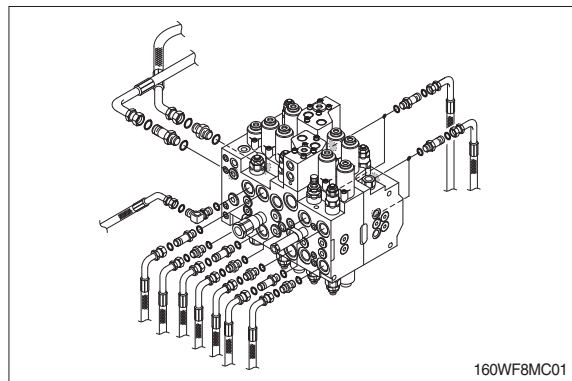
1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

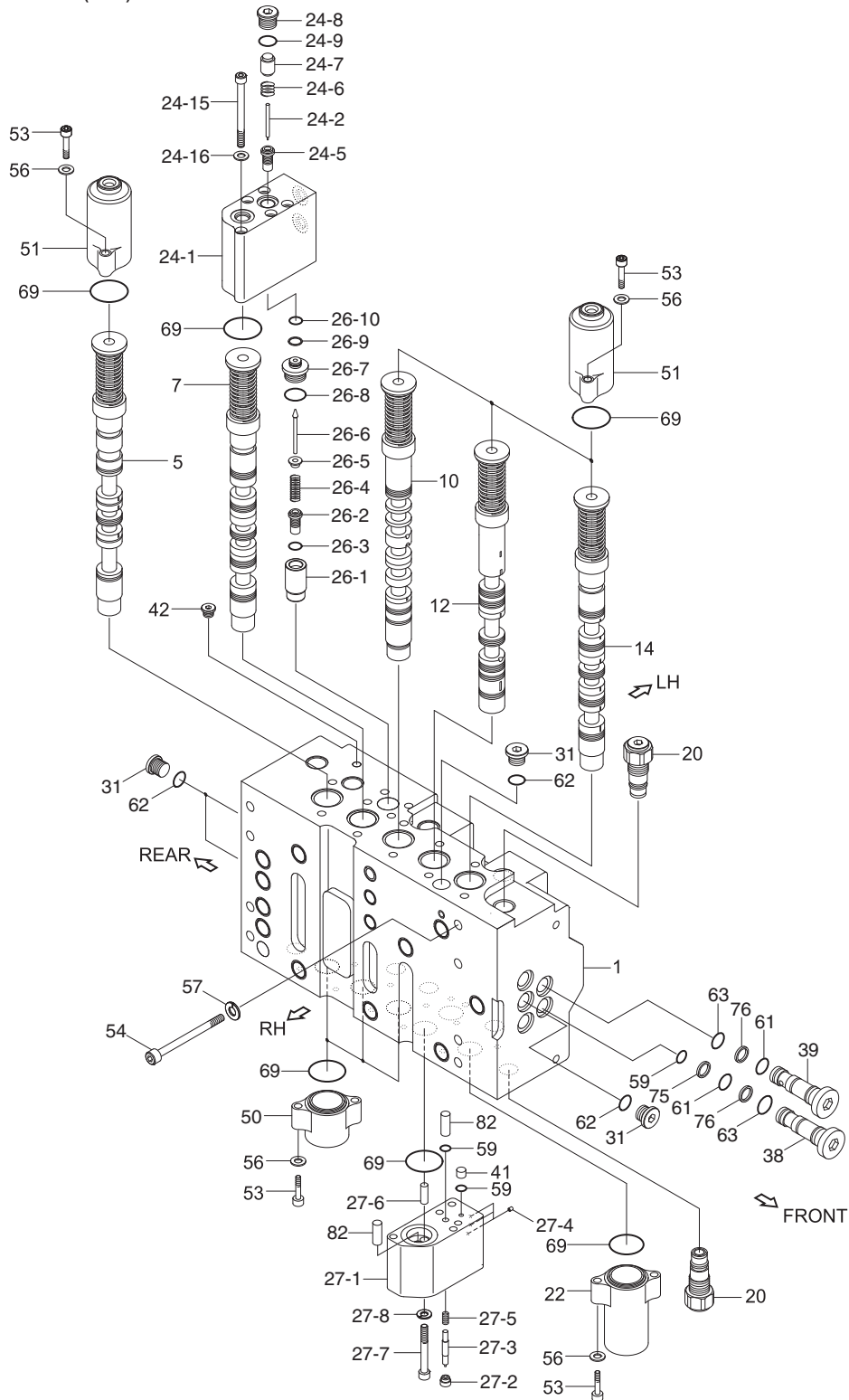
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure 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 : 135 kg (300 lb)
- (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.



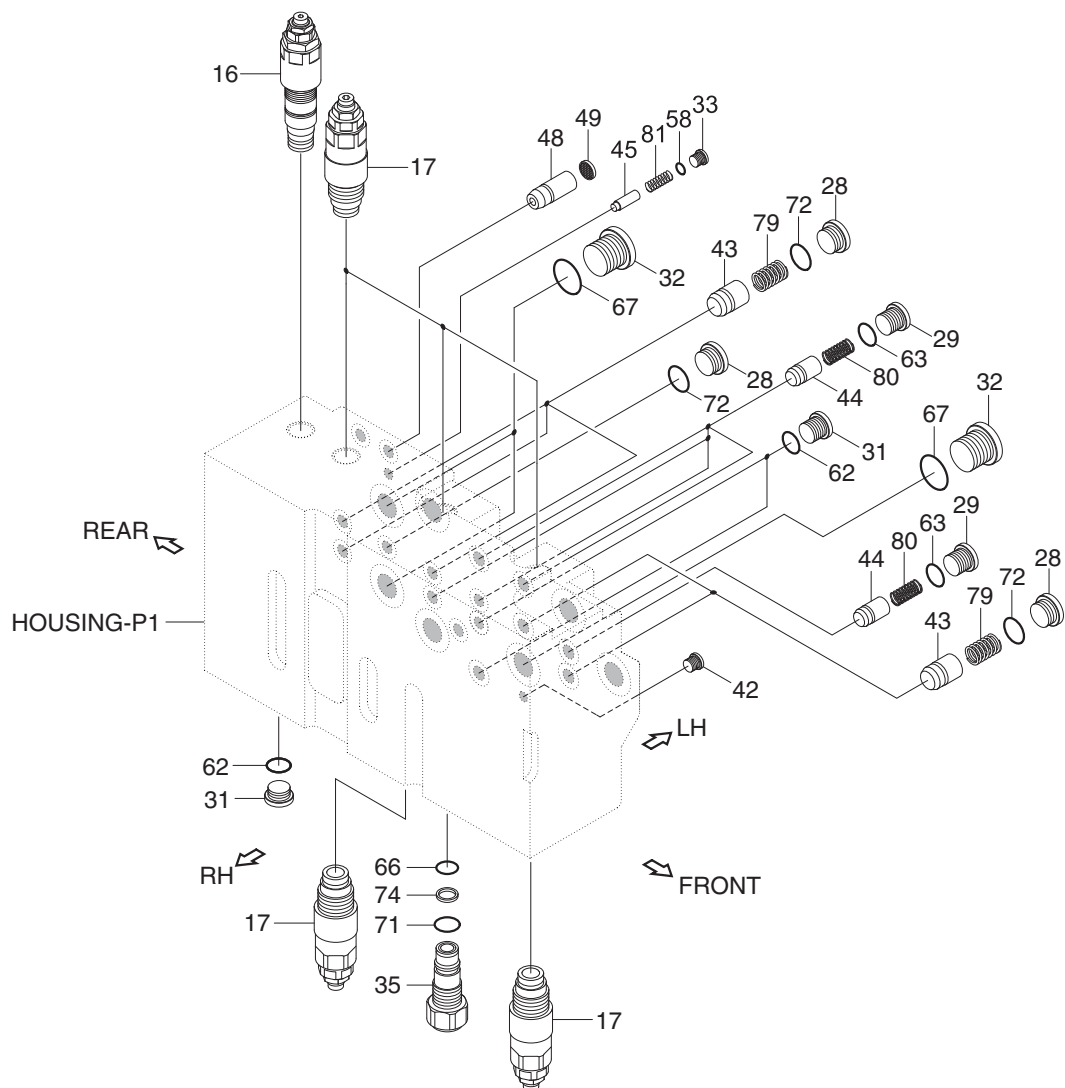
2. STRUCTURE (1/4)



160WF8MC04

- | | | | | | |
|----|-----------------------|----|--------------------|----|------------------|
| 1 | Housing-P1 | 27 | Regeneration block | 51 | Pilot B1 cap |
| 5 | Spool assy-option C | 28 | Plug | 53 | Socket head bolt |
| 7 | Spool assy-boom 1 | 33 | Plug | 56 | Plain washer |
| 10 | Spool assy-arm 2 | 41 | Orifice | 58 | O-ring |
| 12 | Spool assy-arm regen | 42 | Plug | 59 | O-ring |
| 14 | Spool assy-bucket | 45 | Poppet | 69 | O-ring |
| 20 | Nega con relief valve | 48 | Orifice | 72 | O-ring |
| 24 | Holding valve kit A1 | 49 | Coin type filter | 81 | Spring |
| 26 | Lock valve kit B | 50 | Pilot A cap | 82 | Pin-regeneration |

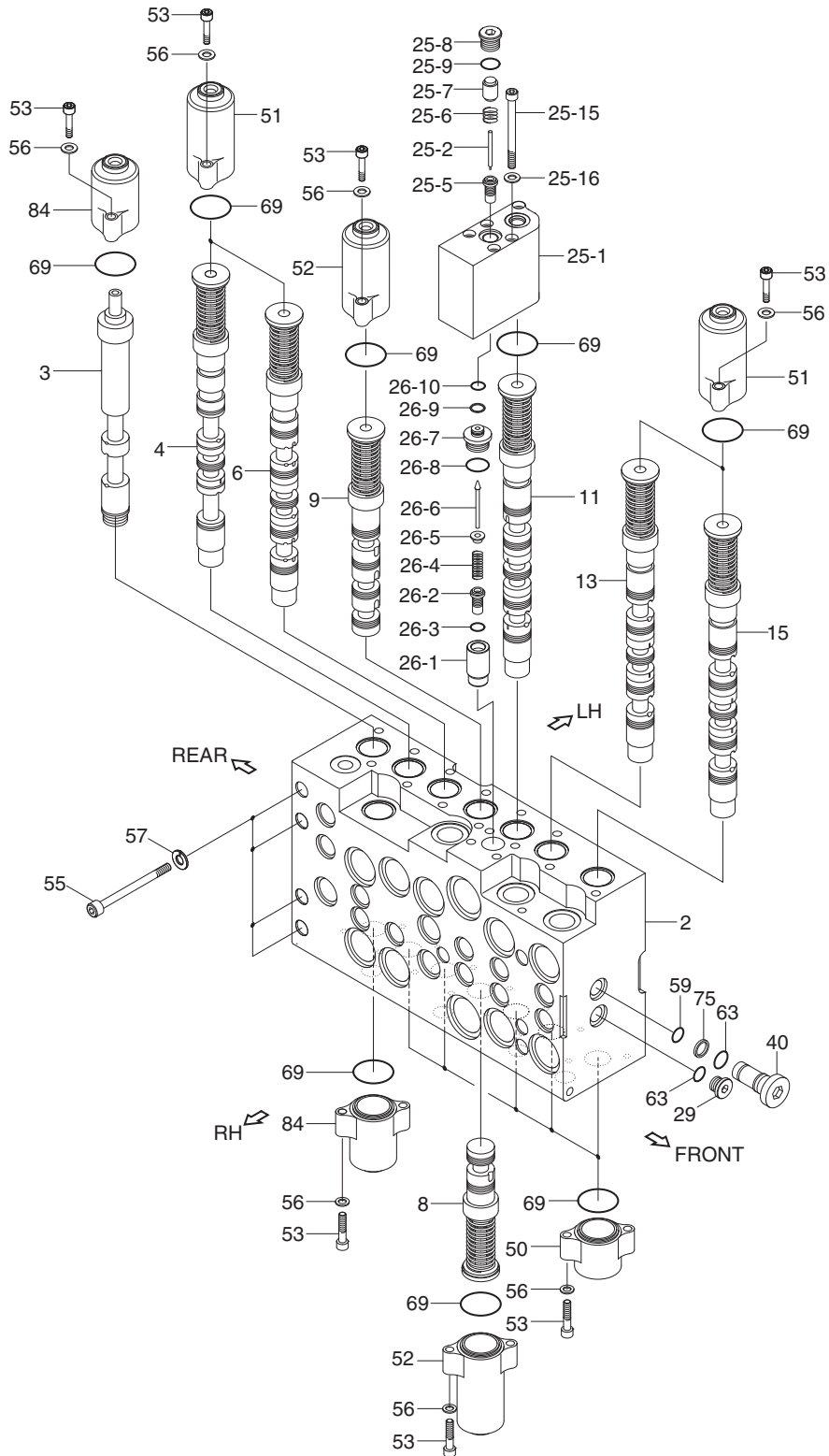
STRUCTURE (2/4)



160WF8MC05

16	Main relief valve	42	Plug	71	O-ring
17	Overload relief valve	43	Poppet 1	72	O-ring
28	Plug	44	Poppet 2	74	Back up ring
29	Plug	59	O-ring	75	Back up ring
31	Plug	61	O-ring	76	Back up ring
32	Plug	62	O-ring	79	Spring
35	Plug	63	O-ring	80	Spring
38	Plug	66	O-ring		
39	Plug	67	O-ring		

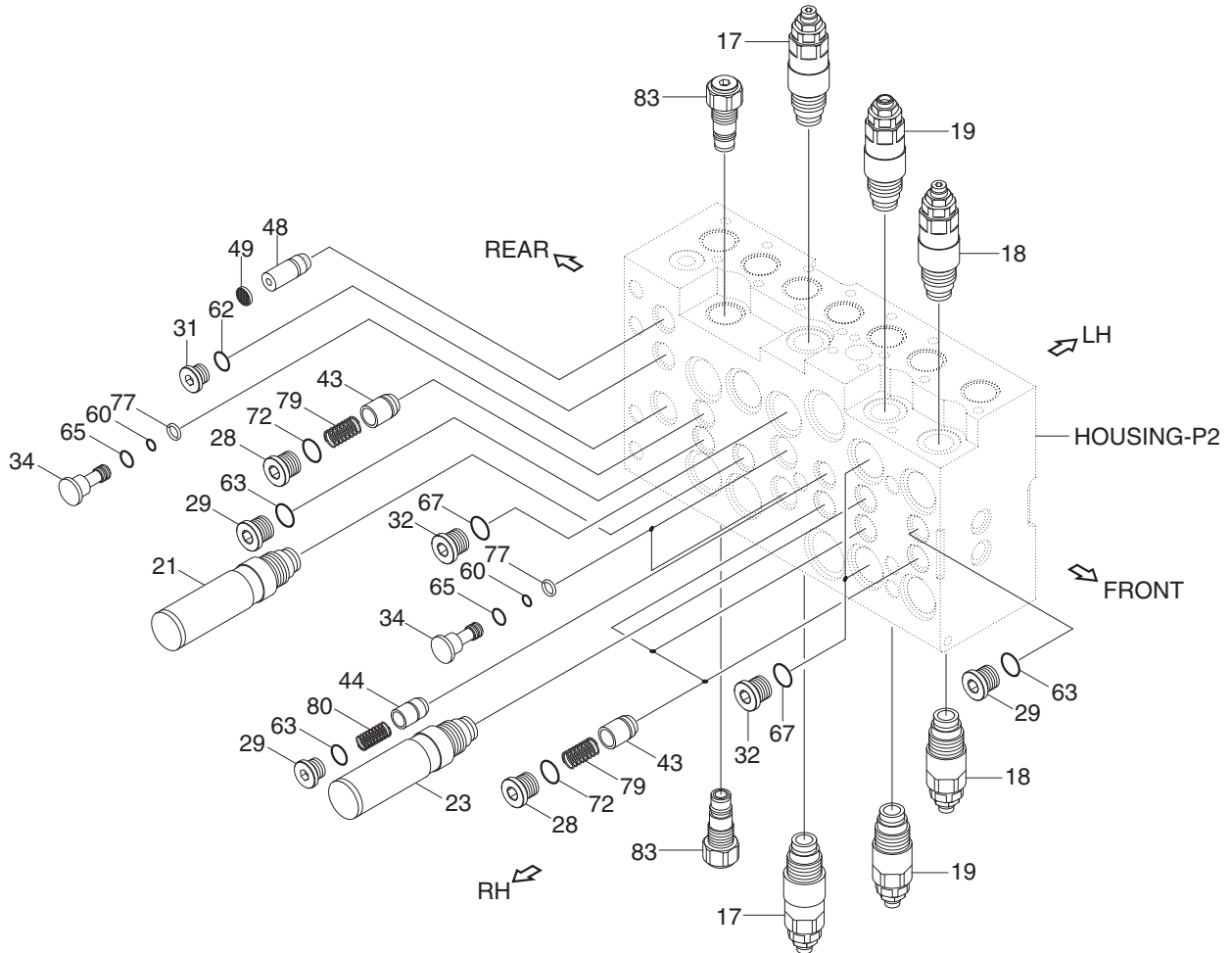
STRUCTURE (3/4)



- | | | | | | |
|----|---------------------------|----|----------------------|----|------------------|
| 2 | Housing-P2 | 25 | Holding valve kit A2 | 54 | Socket head bolt |
| 3 | Spool assy | 26 | Lock valve kit-B | 55 | Socket head bolt |
| 4 | Spool assy-travel | 29 | Plug | 56 | Plain washer |
| 6 | Spool assy-swing | 30 | Plug | 57 | Spring washer |
| 8 | Spool assy-swing priority | 40 | Plug | 59 | O-ring |
| 9 | Spool assy-boom 2 | 50 | Pilot A cap | 61 | O-ring |
| 11 | Spool assy-arm 1 | 51 | Pilot B1 cap | 63 | O-ring |
| 13 | Spool assy-option B | 52 | Pilot B2 cap | 69 | O-ring |
| 15 | Spool assy-dozer | 53 | Socket head bolt | 75 | Back up ring |

160WF8MC06

STRUCTURE (4/4)



160WF8MC07

- | | | | | | |
|----|-----------------------|----|------------------|----|-----------------------|
| 17 | Overload relief valve | 32 | Plug | 63 | O-ring |
| 18 | Overload relief valve | 34 | Plug | 65 | O-ring |
| 19 | Overload relief valve | 43 | Poppet 1 | 67 | O-ring |
| 21 | Swing logic valve | 44 | Poppet - check | 72 | O-ring |
| 23 | ON/OFF valve-option | 48 | Orifice - signal | 77 | Back up ring |
| 28 | Plug | 49 | Coin type filter | 79 | Spring |
| 29 | Plug | 60 | O-ring | 80 | Spring |
| 31 | Plug | 62 | O-ring | 83 | Anti cavitation valve |

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) All hydraulic components are manufactured to a high precision. Consequently, 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 paper or a rubber mat on the bench, and disassemble the valve on it.
- (4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the 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 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

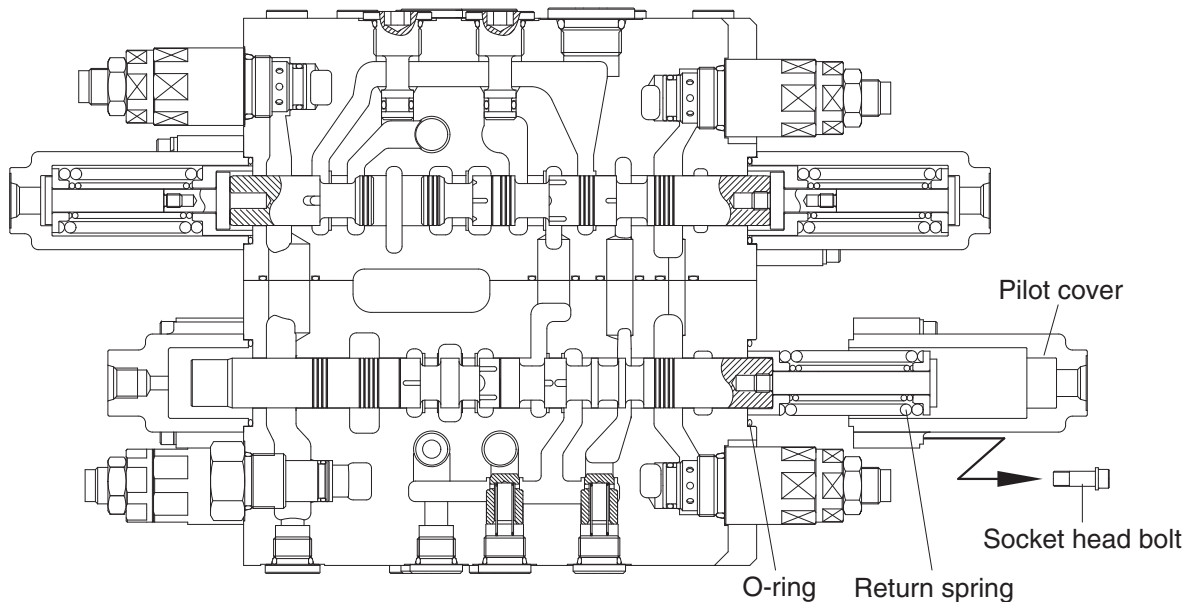
Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	27 and 32
Spanner	Each 1 piece	32 (main relief valve, overload relief valve, negative relief valve) 26 (holding valve)

3) DISASSEMBLY

(1) Disassembly of spools without holding valve

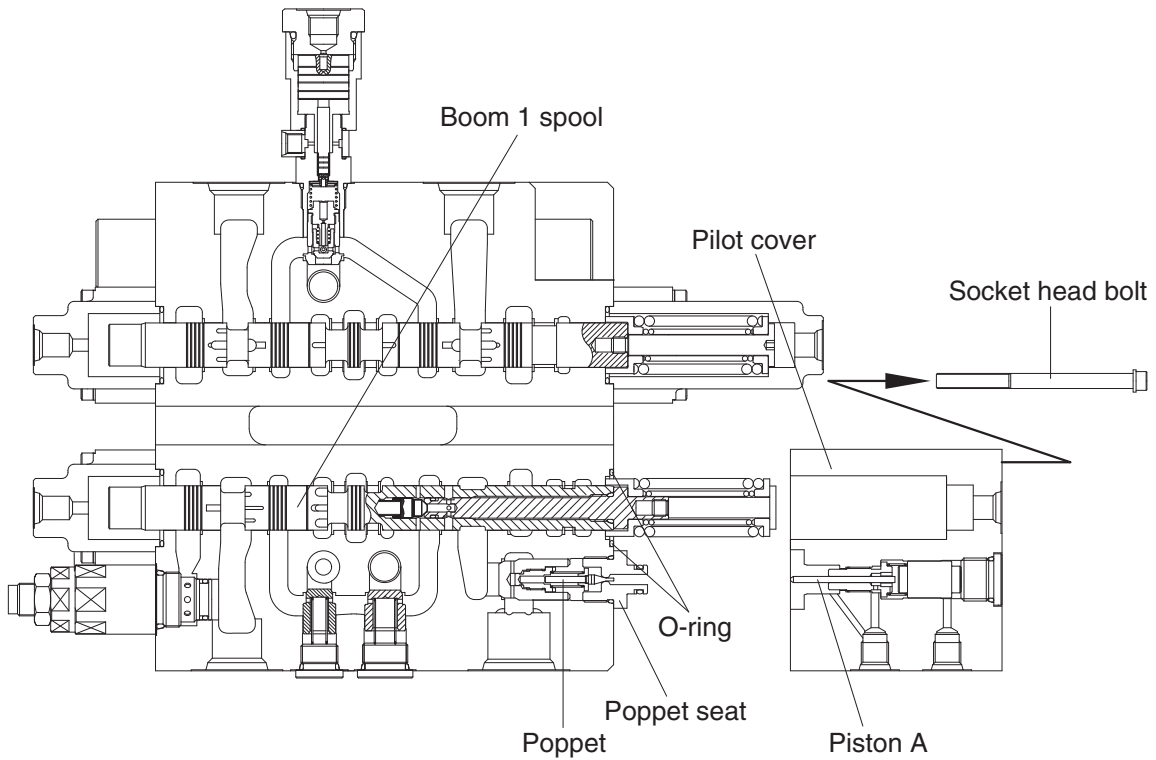
- ① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)
 - ② Remove the pilot cover.
- ※ Pay attention not to lose the O-ring under the pilot cover.
 - ③ Remove the spool assembly from the body by hand slightly.
- ※ When extracting each spool from its body, pay attention not to damage the body.
 - ※ When extracting each spool assembly, it must be extracted from spring side only.
 - ※ When any abnormal parts are found, replace it with completely new spool assembly.
 - ※ When disassembled, tag the components for identification so that they can be reassembled correctly.



160WF8MC10

(2) Disassembly of spools with holding valve (boom 1, Arm 1 spool)

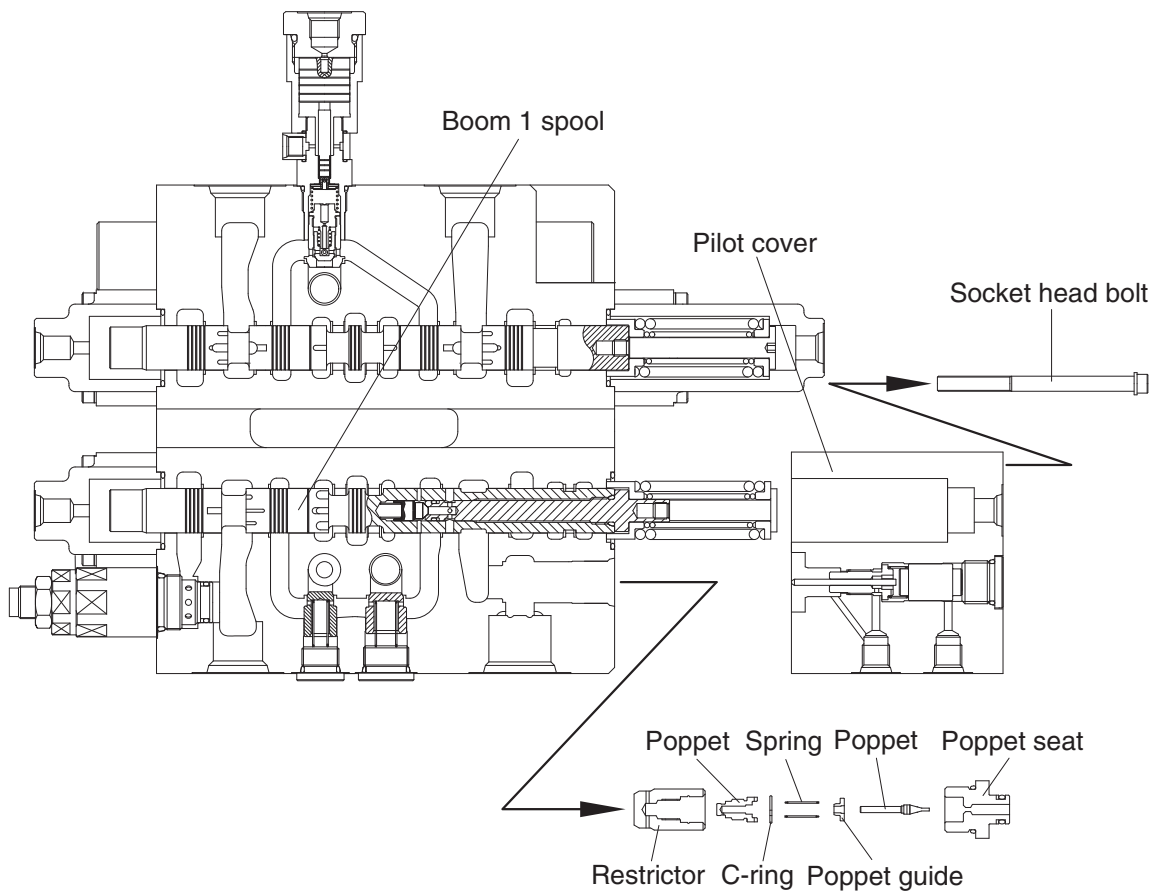
- ① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)
- ② Remove the pilot cover with internal parts.
 - ※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
 - ※ Pay attention not to damage the "piston A" under pilot cover.
- ③ Remove the spool assembly from the body by hand slightly.
 - ※ When extracting each spool from its body, pay attention not to damage the body.
 - ※ When extracting each spool assembly, it must be extracted from spring side only.
 - ※ When any abnormal parts are found, replace it with completely new spool assembly.
 - ※ When disassembled, tag the components for identification so that they can be reassembled correctly.



160WF8MC11

(3) Disassembly of the holding valve

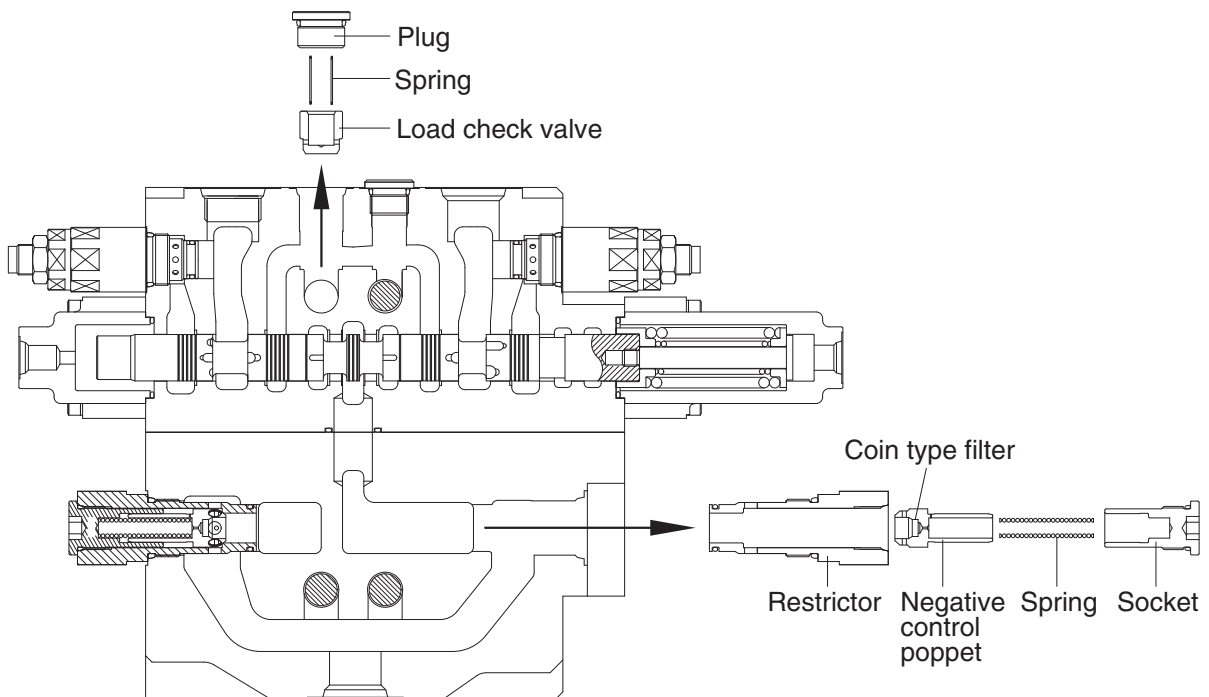
- ① Remove the pilot cover with the holding valve as described on previous page.
 - ※ Do not disassembled internal parts of the pilot cover.
- ② Loosen the poppet seat and remove the poppet, spring seat, spring and check.
(spanner : 26 mm)
 - ※ Pay attention not to lose the poppet.
 - ※ Do not disassembled internal parts of the check.



160WF8MC12

(4) Disassembly of the load check valve and the negative relief valve

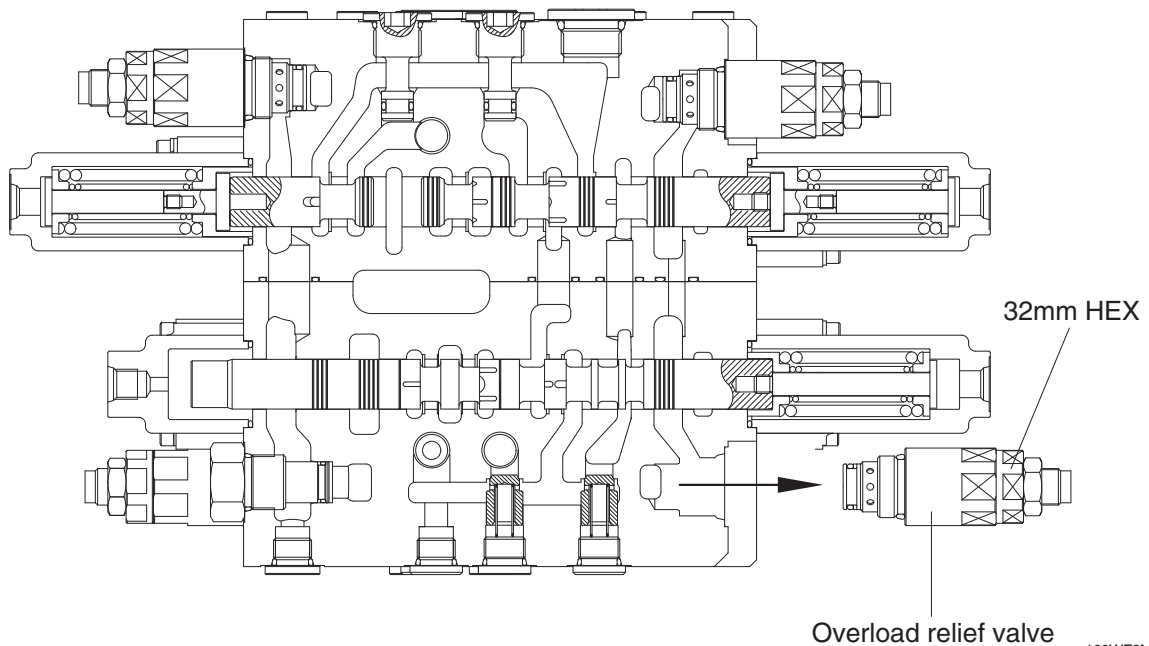
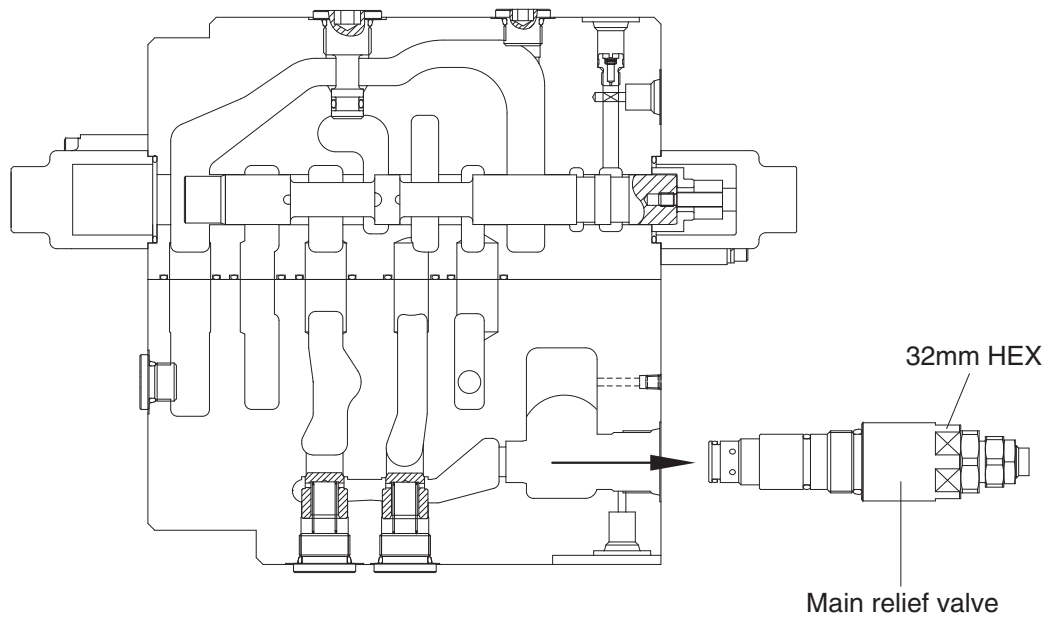
- ① The load check valve
 - a. Fix the body to suitable work bench.
 - ※ Pay attention not to damage the body.
 - b. Loosen the plug (hexagon wrench : 10 mm).
 - c. Remove the spring and the load check valve with pincers or magnet.
- ② The negative relief valve
 - a. Loosen the socket (spanner : 32 mm).
 - b. Remove the spring, spring holder, piston and negative control poppet.



160WF8MC13

(5) Disassembly of the main and overload relief valve

- ① Fix the body to suitable work bench.
 - ② Remove the main relief valve.
(spanner : 32 mm)
 - ③ Remove the overload relief valve.
(spanner : 32 mm)
- ※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.
 - ※ Pay attention not to damage seat face.
 - ※ When any abnormal parts are found, replace it with completely new relief valve assembly.



160WF8MC14

(6) Inspection after disassembly

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

① Control valve

- a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
- b. Confirm that seal groove faces of body and block are smooth and free of dust, dent, rust etc.
- c. Correct dents and damages and check seat faces within the body, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the body.
- d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free 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, following it's the prescribed disassembly and assembly procedures.
- g. Replace all seals and 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 show uniform and consistent 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 and so on.
- d. Confirm that springs are free from breakage, deformation, and wear.
- e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.
- f. Replace all O-rings with new ones.
- g. When any light damage is found in above inspections, correct it by lapping.
- h. When any abnormal part is found, replace it with a completely new relief valve assembly.

4) ASSEMBLY

(1) General precaution

- ① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures shown in the previous structure & disassembly section.
- ② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
- ③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
Do not stretch seals so much as to deform them permanently.
- ④ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted
- ⑤ O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
- ⑥ Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
- ⑦ Do not reuse removed O-rings and seals.

(2) Load check valve

- ① Assemble the load check valve and spring.
- ② Put O-rings on to plug.
- ③ Tighten plug to the specified torque.
 - Hexagon wrench : 10 mm
 - Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

(3) Negative control relief valve

- ① Assemble the nega-con poppet, piston, spring holder and spring together into body.
- ② Put O-ring on to plug and tighten the latter to its specified torque.
 - Hexagon wrench : 12 mm
 - Tightening torque : 8~9 kgf · m (57.8~65.1 lbf · ft)

(4) Main relief, overload relief valves

Install main relief valve, overload relief valve into the body and tighten to the specified torque.

Component	Tools	Tightening torque	
		kgf · m	lbf · ft
Main relief valve	Spanner 32 mm	8~9	57.8~65.1
Overload relief valve	Spanner 32 mm	8~9	57.8~65.1

(5) Main spools

- ① Carefully insert the previously assembled spool assemblies into their respective bores within of body.
- ※ Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

(6) Pilot covers

- ① Fit spool covers to the non-spring assembly end of the spool, and tighten the hexagonal socket head bolts to the specified torque.
 - Hexagon wrench : 5 mm
 - Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)
- ※ Confirm that O-rings have been fitted.
- ② Fit spring covers to the spring end for the spools, and tighten hexagon socket head bolts to the specified torque.
 - Hexagon wrench : 5mm
 - Tightening torque : 1.0~1.1 kgf·m (7.2~7.9 lbf·ft)
- ※ Confirm that O-rings have been fitted.

(7) Holding valves

- ① Assemble the check, spring seat and poppet together into body.
- ② Tighten the poppet seat to the specified torque.
 - Spanner : 26 mm
 - Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)
- ③ Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.
- ④ Tighten hexagon socket head bolt to specified torque.
 - Hexagon wrench : 5mm
 - Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

GROUP 5 SWING DEVICE (TYPE 1)

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.

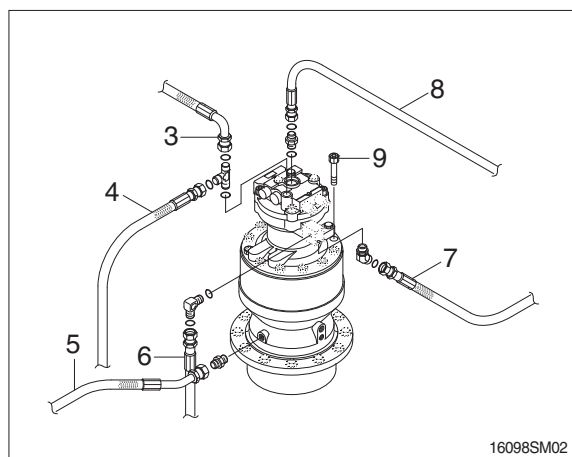
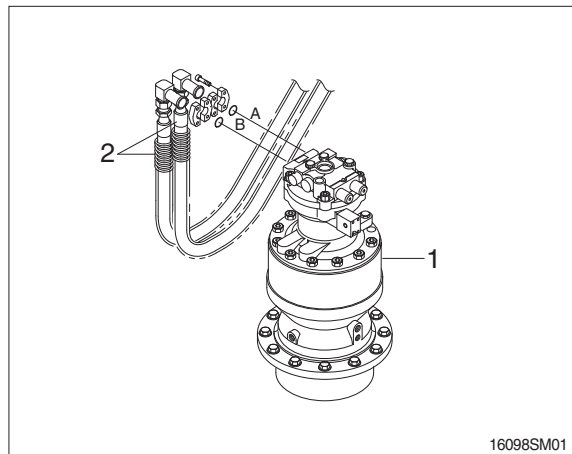
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (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).
 - Motor device weight : 61 kg (135 lb)

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

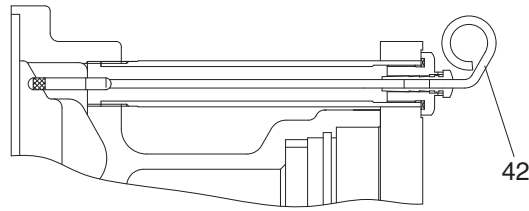
2) INSTALL

- (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.

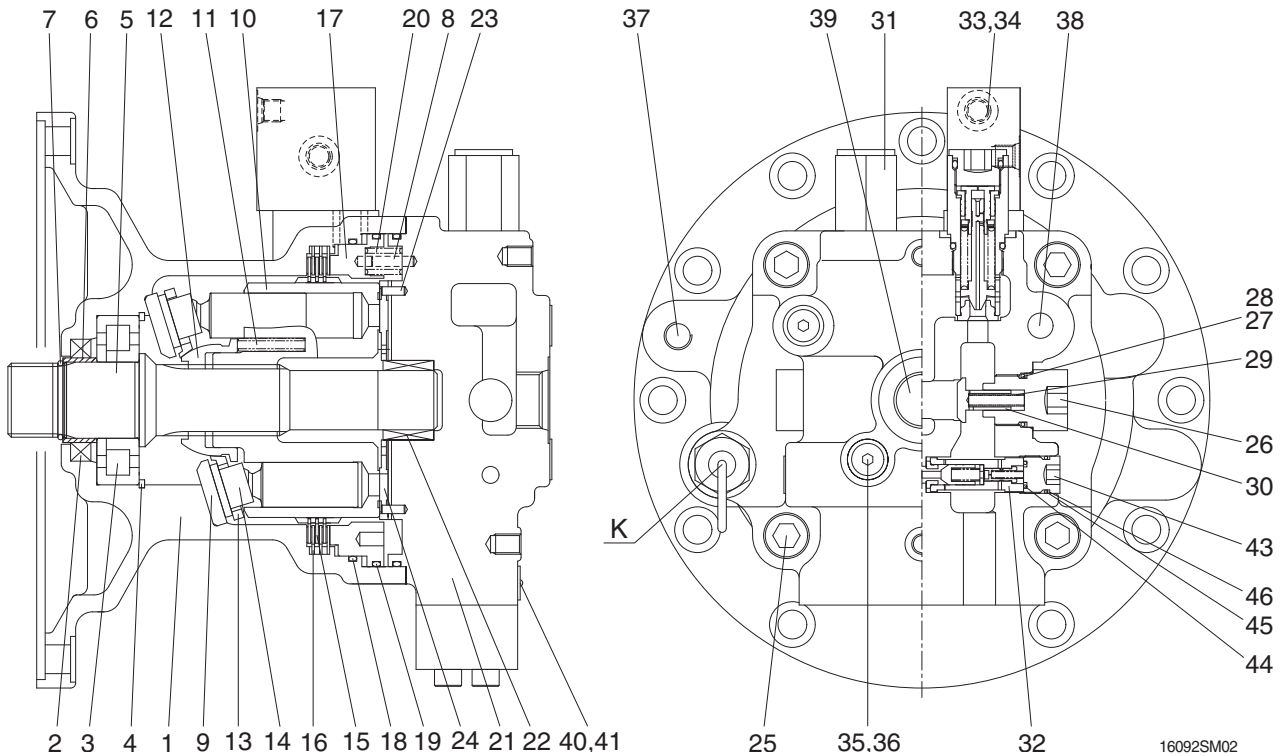


2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



DETAIL K

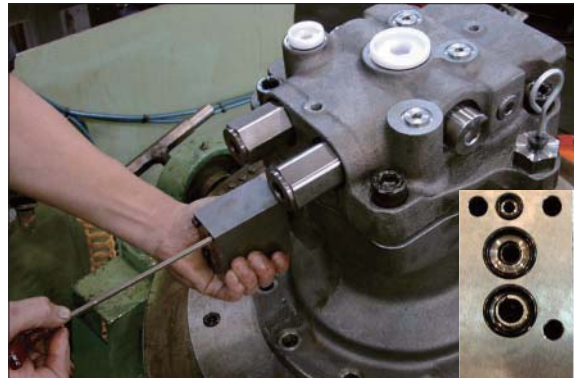


- | | | |
|-------------------|-------------------------|---------------------|
| 1 Body | 17 Brake piston | 33 Time delay valve |
| 2 Oil seal | 18 O-ring | 34 Wrench bolt |
| 3 Roller bearing | 19 O-ring | 35 Plug |
| 4 Snap ring | 20 Brake spring | 36 O-ring |
| 5 Shaft | 21 Rear cover | 37 Plug |
| 6 Bushing | 22 Needle bearing | 38 Plug |
| 7 Stop ring | 23 Pin | 39 Plug |
| 8 Pin | 24 Valve plate | 40 Name plate |
| 9 Shoe plate | 25 Wrench bolt | 41 Rivet |
| 10 Cylinder block | 26 Plug | 42 Level gauge |
| 11 Spring | 27 Back up ring | 43 Plug |
| 12 Ball guide | 28 O-ring | 44 O-ring |
| 13 Set plate | 29 Spring | 45 O-ring |
| 14 Piston assy | 30 Check | 46 Back up ring |
| 15 Friction plate | 31 Relief valve | |
| 16 Separate plate | 32 Anti-inversion valve | |

2) DISASSEMBLING

(1) Disassemble the sub of a TURNING AXIS

- ① Unloosing wrench bolt and disassemble time delay valve assy (33) from rear cover (21)



14078SM201/201A

- ② Disassemble level gauge (42) from body (1).



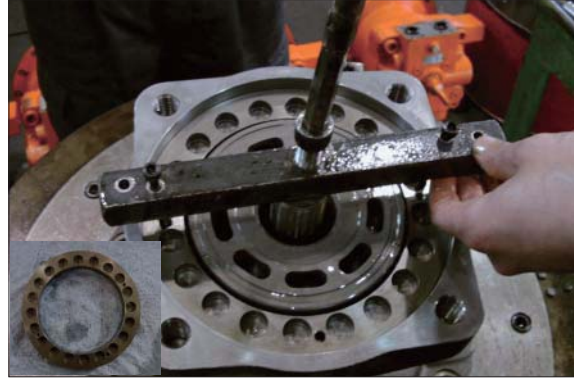
14078SM202/202A

- ③ Hang rear cover (21) on hoist, unloose wrench bolt (25) and disassemble from body (1).



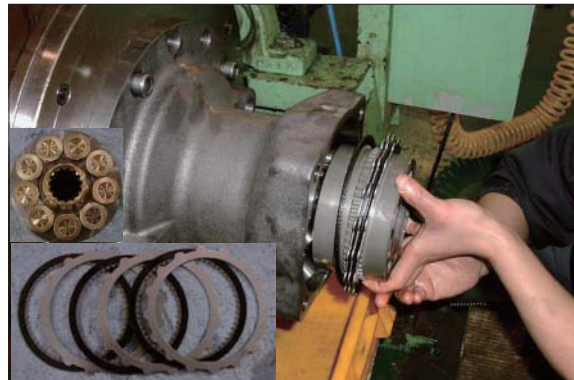
14078SM203/203A

- ④ Using a jig, disassemble brake piston (17) from body (1).



14078SM204/204A

- ⑤ Disassemble respectively cylinder block assy, friction plate (15), separate plate (16) from body (1).



14078SM205/205A/B

(2) Disassemble cylinder block assy sub

- ① Disassemble piston assy (14), set plate (13) from cylinder block assy.



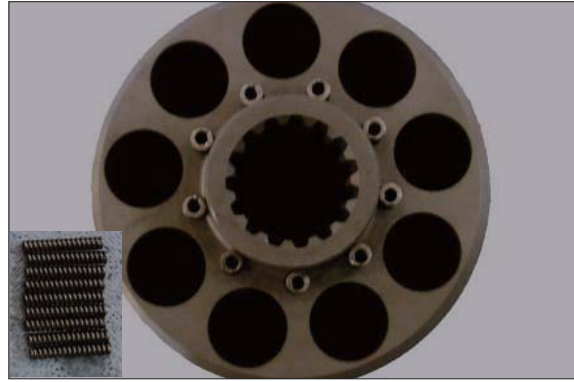
14078SM206/205B

- ② Disassemble ball guide (12) from cylinder block (10).



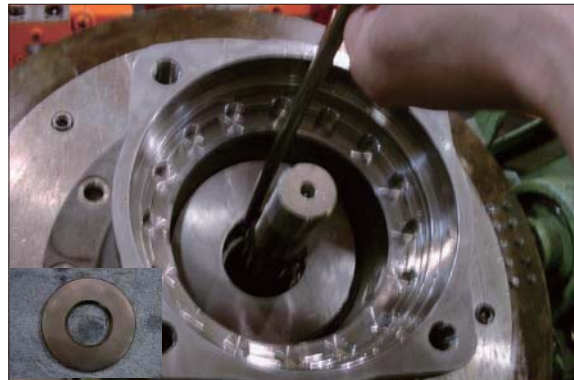
14078SM207/207A

- ③ Disassemble spring (11) from cylinder block (10).



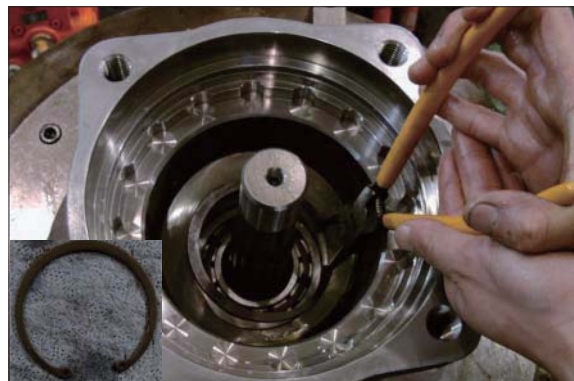
14078SM208/208A

- ④ Disassemble shoe plate (9) from body (1).



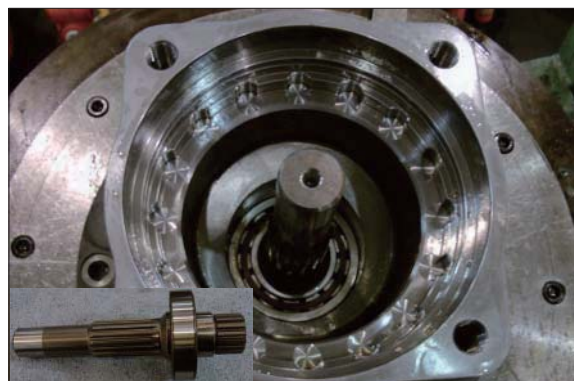
14078SM209/209A

- ⑤ Using a plier jig, disassemble snap ring (4) from shaft (5).



14078SM210/210A

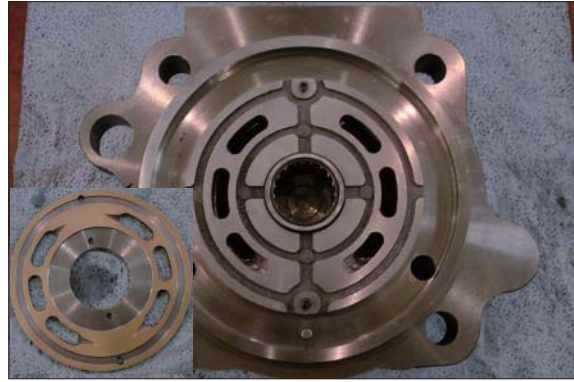
- ⑥ Disassemble shaft assembly from body (1).



14078SM211/211A

(3) Disassemble rear cover assy sub

- ① Disassemble pin (8, 23), valve plate (24) from rear cover (21).



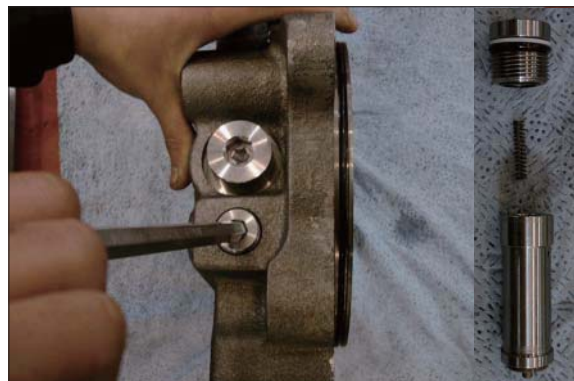
14078SM212/212A

- ② Using a torque wrench, disassemble relief valve assy (31) 2 set from rear cover (21).



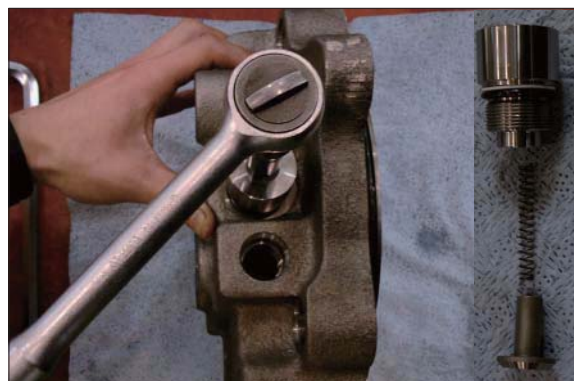
14078SM213/213A

- ③ After disassembling plug with a L-wrench from rear cover (21), disassemble respectively back up ring, O-ring, O-ring, spring, anti-inversion valve assy (32)



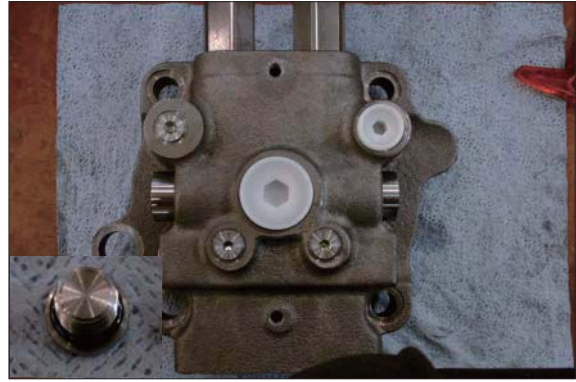
14078SM214/214A

- ④ Disassemble make up check valve assy with a torque wrench from rear cover (21).



14078SM215/215A

- ⑤ Disassemble respectively plug (35, 38, 39), with a L-wrench from rear cover (21).

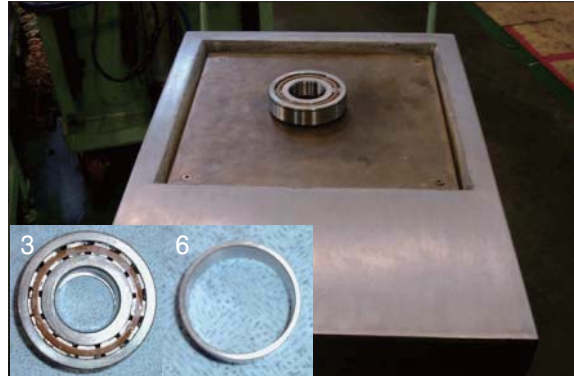


14078SM216/216A

3) ASSEMBLING

(1) Assemble the sub of a turning axls

- ① Put roller bearing (3), bushing (6) on pre-heater and provide heat to inner wheel (compressing temp : 290°C for 2minutes)
- Roller bearing × 1 EA
 - Bushing × 1 EA



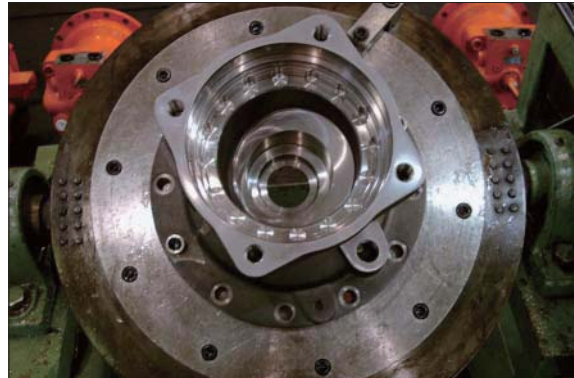
14078SM217/217A/B

- ② After assembling and compressing pre-heated roller bearing (3), bushing (6) into shaft (5).
- Stop ring × 1 EA
 - Shaft × 1 EA



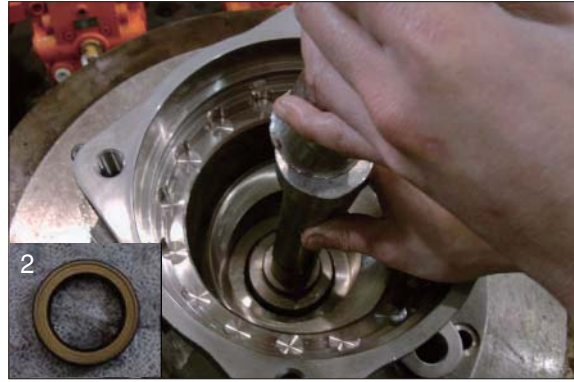
14078SM218/218A/B

- ③ Put body (1) on a assembling jig, fix it with bolts to prohibit moving.



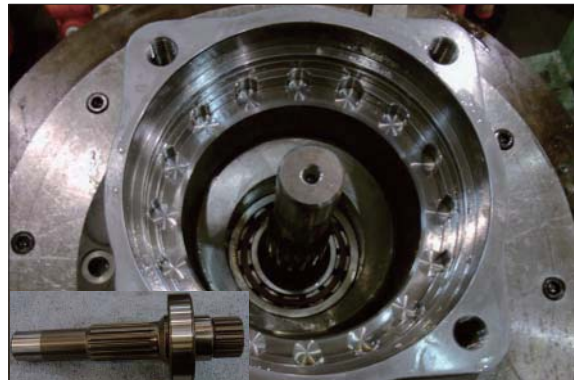
14078SM219

- ④ Using a compressing tool and steel stick, assemble oil seal (2) into body (1).
· Oil seal × 1 EA



14078SM220/220A

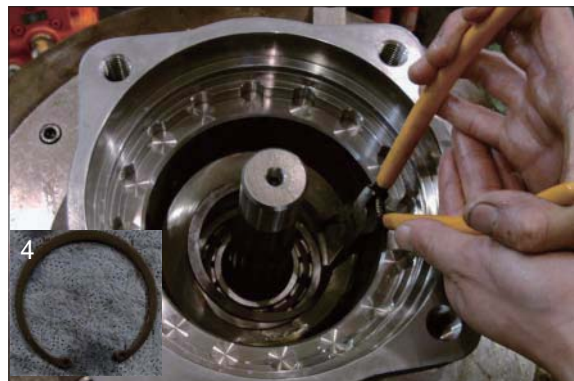
- ⑤ Insert above shaft sub into body (1) and assemble it with a steel stick.



14078SM211/211A

- ⑥ Fix snap ring (4) to shaft with a plier jig.

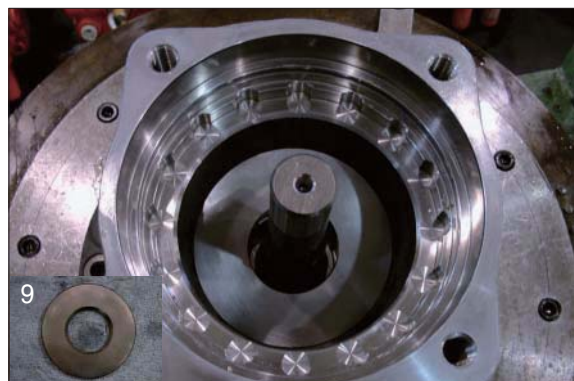
· Snap ring × 1 EA



14078SM210/210A

- ⑦ Spread grease on shoe plate (9) and assemble on the body.

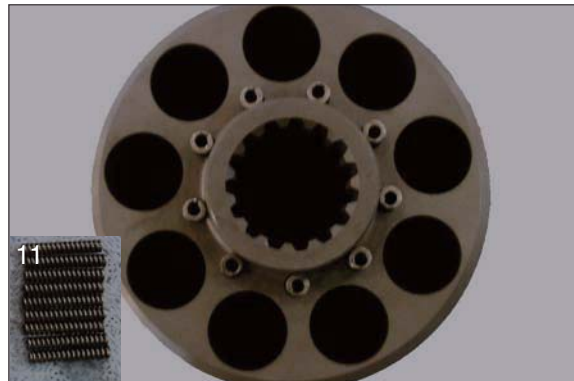
· Shoe plate × 1 EA



14078SM222/209A

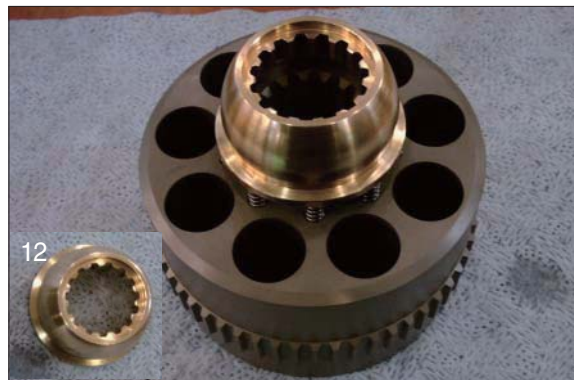
(2) Assemble the sub of cylinder block assy

- ① Assemble spring (11) 9 set into cylinder block (10).
· Spring × 9 EA



14078SM208/208A

- ② Assemble ball guide (12) into cylinder.
· Ball guide × 1 EA



14078SM207/207A

- ③ Assemble piston assy (14) 9 set into set plate (13).
· Piston assy × 9 EA
· Set plate × 1 EA



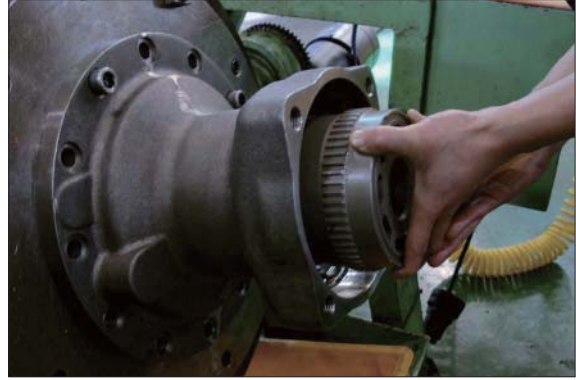
14078SM223/223A

- ④ Assemble above item ② and ③.



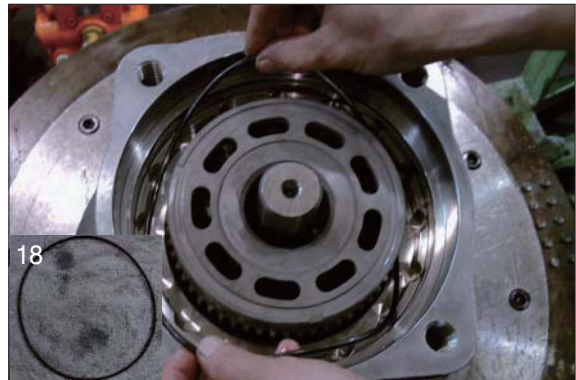
14078SM224

- ⑤ Assemble cylinder block assy into body (1).



14078SM225

- ⑥ Assemble O-ring (18) into body (1).
· O-ring × 1 EA



14078SM226/226A

- ⑦ Assemble 3 set of plate (16), friction plate (15) respectively into body.
· Plate × 3 EA
· Friction plate × 3 EA



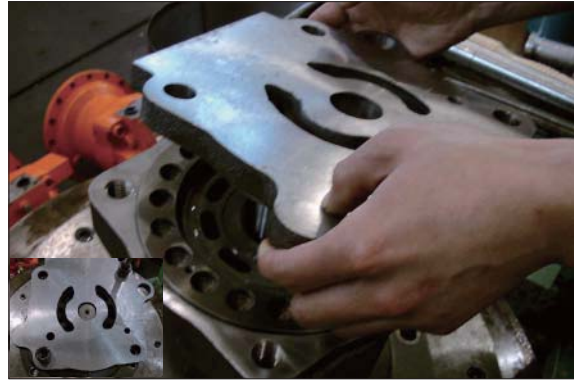
14078SM227/205A

- ⑧ Assemble O-ring (19) into break piston (17).
· O-ring × 2 EA



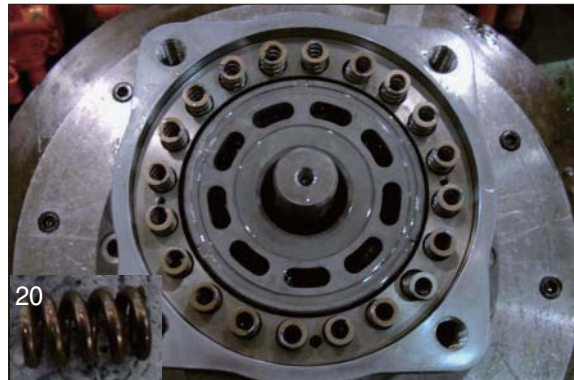
14078SM228/226A

- ⑨ Insert break piston assy into body (1) and compress it with a jig and hammer.



14078SM229/229A

- ⑩ Assemble spring (20) (20 EA) into break piston (17).
 · Spring × 20 EA



14078SM230/230A

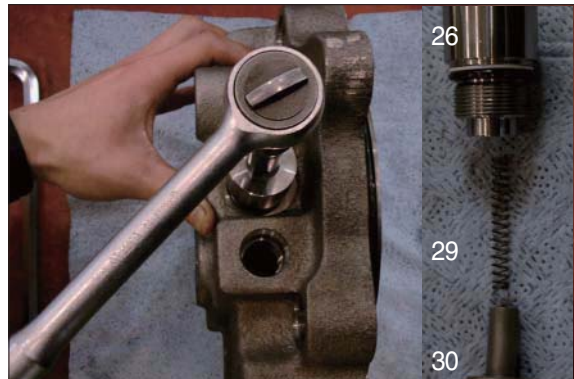
(3) Assemble the sub of rear cover assy sub

- ① Assemble the sub of make up check valve assy.
 Assemble O-ring (28), back up ring (27) into plug (26) with a O-ring assembling jig.
 · Plug × 1 EA
 · Back up ring × 1 EA
 · O-ring × 1 EA



16098SM231/231A/B

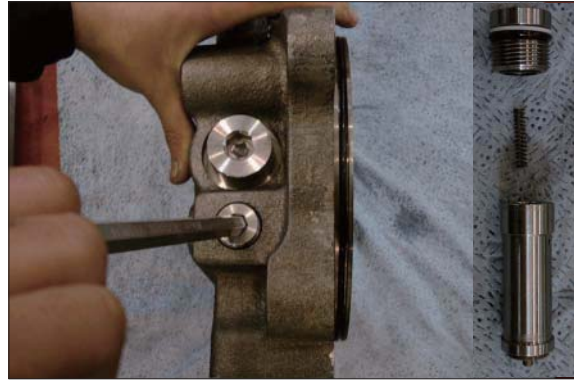
- ② Assemble respectively make up check valve assy spring (29), check (30), plug (26) into rear cover (21) after then screw it torque wrench.
 · Make up check sub × 2 set
 · Spring × 2 EA
 · Check × 3 EA



16098SM215/215A

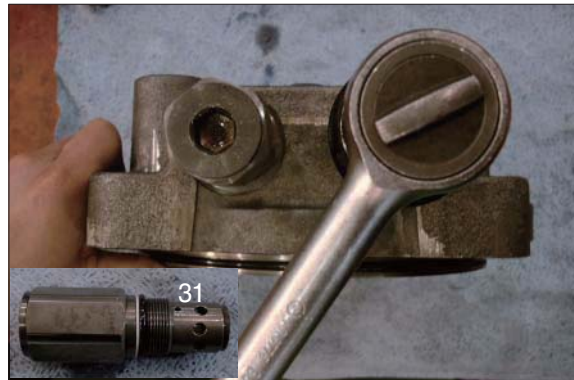
- ③ Assemble respectively plug (43), back up ring, O-ring, O-ring, spring, anti-inversion valve assy (32) into rear cover (21).
(Bilateral symmetry assembling)

- Anti-Inversion v/v assy × 2 set
- O-ring (P12) × 2 EA
- O-ring (P18) × 2 EA
- Back up ring (P18) × 2 EA



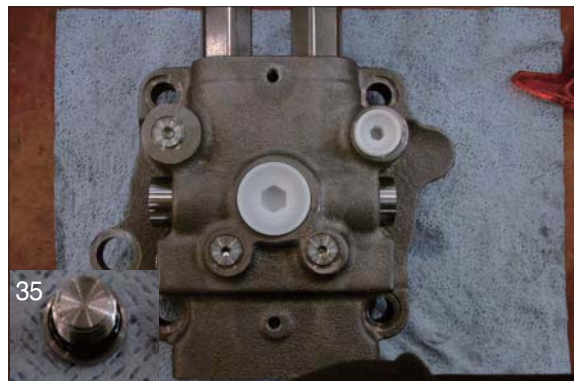
14078SM214/214A

- ④ Assemble relief valve assy (31) 2set into rear cover (21) with a torque wrench.
(Bilateral symmetry assembling)



16098SM213/213A

- ⑤ Assemble plug (35), plug (38, 39) into rear cover (21) with a L-wrench.
* Plug × 3 EA (PF1/4)



16098SM216/216A

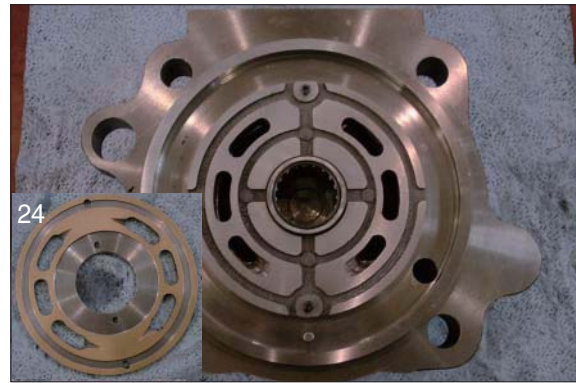
- ⑥ After assembling needle bearing (22) into rear cover (21), with a hammer assemble pin (8, 23).

- * Pin × 1 EA
- * Pin × 2 EA



14078SM212

- ⑦ Spreading grease on valve plate (24),
assemble into rear cover (21).
· Valve plate × 1 EA



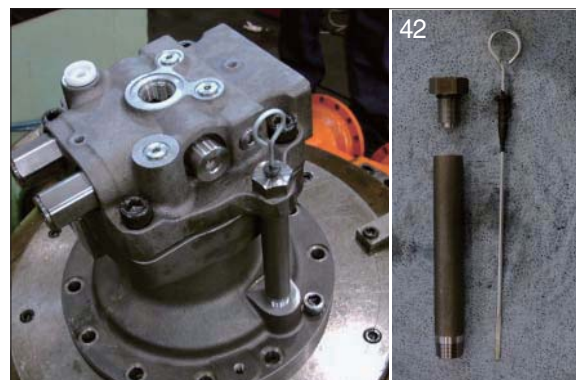
14078SM212/212A

- ⑧ Lift up rear cover assy on body (1) by a crane and assemble it with a wrench bolt (25).



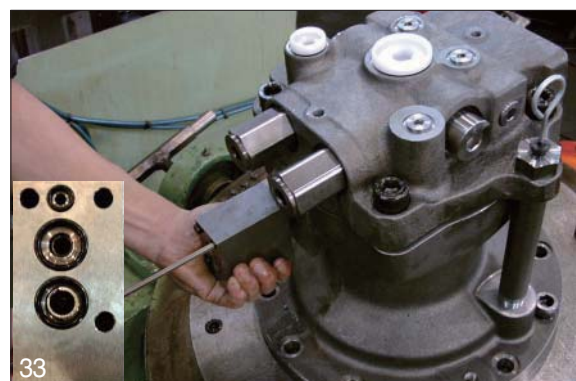
14078SM203/203A

- ⑨ Assemble level gauge (42) into body (1).



16098SM202/202A

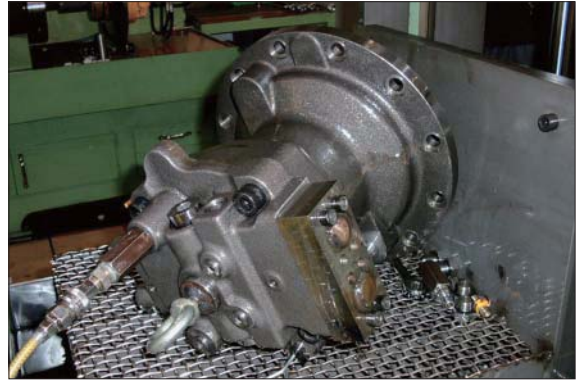
- ⑩ Assemble time delay valve assy (33) into rear cover (21) with a wrench bolt (34).



16098SM201/201A

(4) Air pressing test

Be sure of leakage, after press air into assembled motor



14078SM232

(5) Leakage check

After cleaning motor by color check No.1, paint No.3 and be sure of leakage.



14078SM233/233A

(6) Mount test bench

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



220078SM14

3. REMOVAL AND INSTALL OF REDUCTION GEAR

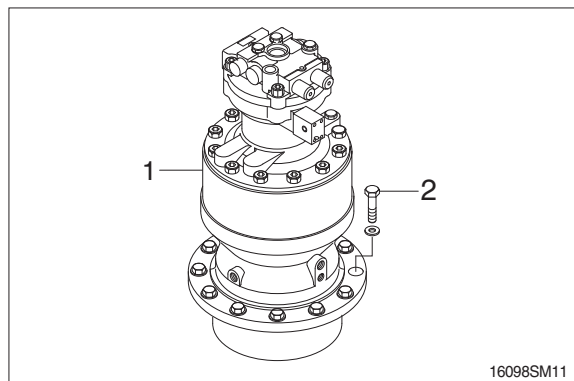
1) REMOVAL

- (1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.
- (2) Sling reduction gear assembly (1) and remove mounting bolts (2).
- (3) Remove the reduction gear assembly.
 - Reduction gear device weight : 180 kg
(396 lb)



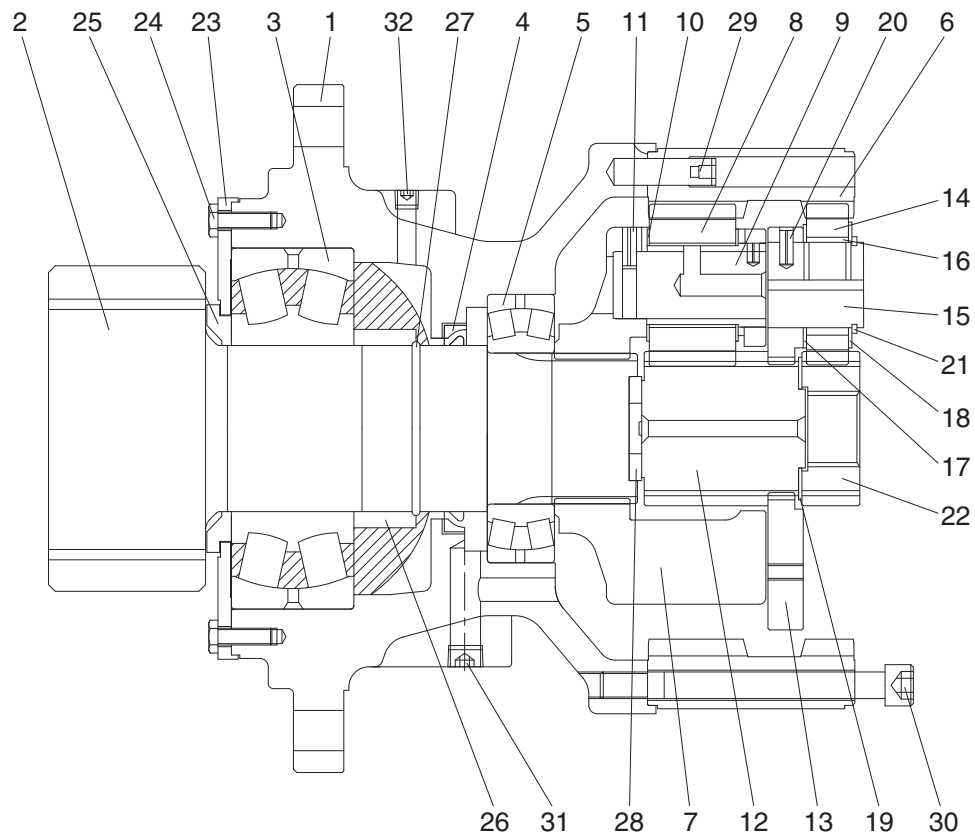
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - Tightening torque : 57.9 ± 8.7 kgf · m
(419 ± 62.9 lbf · ft)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

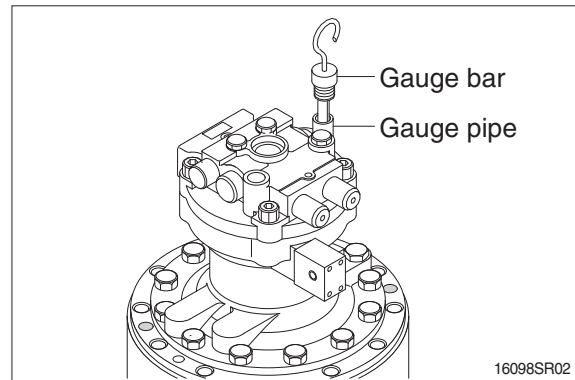


160F2SM05

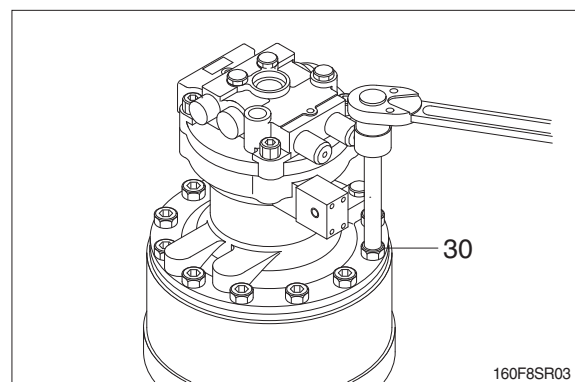
1	Casing	12	Sun gear 2	23	Cover plate
2	Drive shaft	13	Carrier 1	24	Hexagon bolt
3	Roller bearing	14	Planet gear 1	25	Spacer
4	Oil seal	15	Pin 1	26	Spacer pipe
5	Roller bearing	16	Needle cage	27	Wire
6	Ring gear	17	Side plate 1	28	Thrust plate
7	Carrier 2	18	Side plate 2	29	Knock pin
8	Planet gear 2	19	Side plate 3	30	Socket bolt
9	Pin 2	20	Spring pin	31	Plug
10	Thrust washer	21	Stop ring	32	Plug
11	Spring pin	22	Sun gear 1		

2) DISASSEMBLY

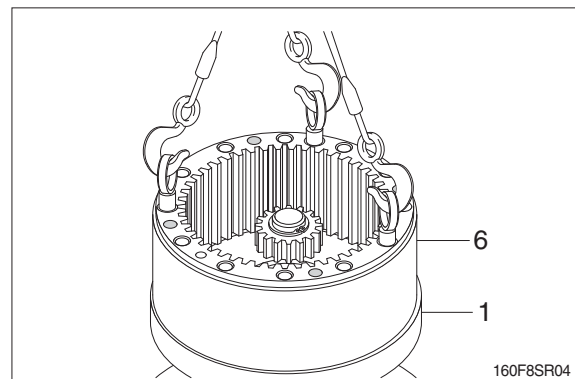
- (1) Remove gauge bar and gauge pipe from the swing motor casing.
 - ※ Pour the gear oil out of reduction gear into the clean bowl to check out the friction decrease.



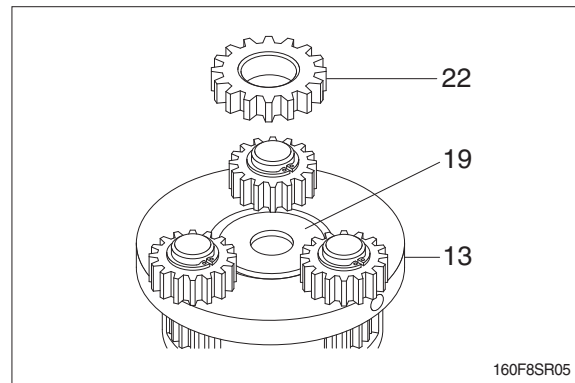
- (2) Loosen the socket bolts (30) to separate swing motor from reduction gear.



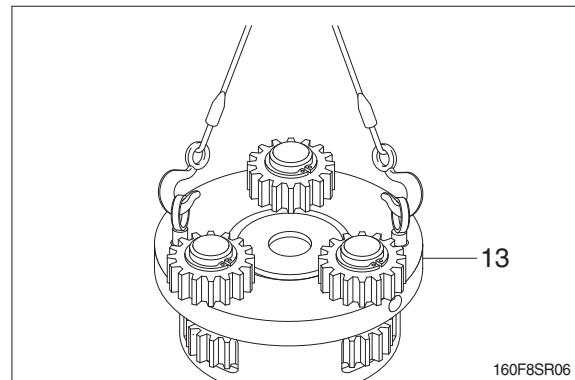
- (3) Tighten 3 M16 eye bolts to the ring gear (6) and then lift the ring gear (6) out of the casing (1).



- (4) Remove sun gear1 (22) from side plate 3 (19).

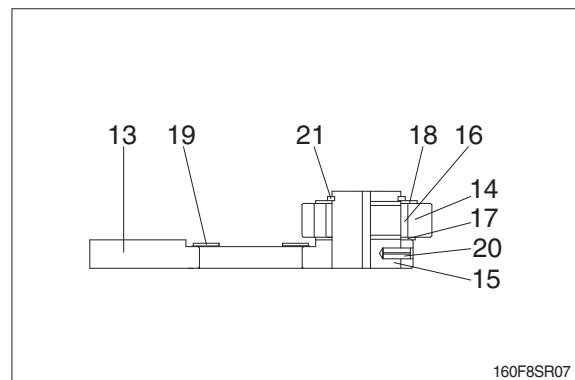


- (5) Tighten two M10 eye bolts to carrier 1 (13) and lift up and remove carrier 1 (13) as subassembly.

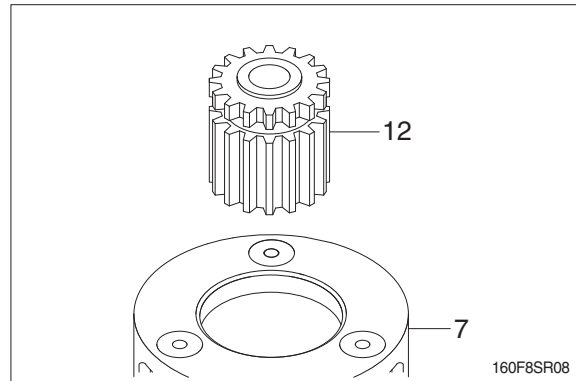


- (6) Disassembling carrier 1 (13) assembly.

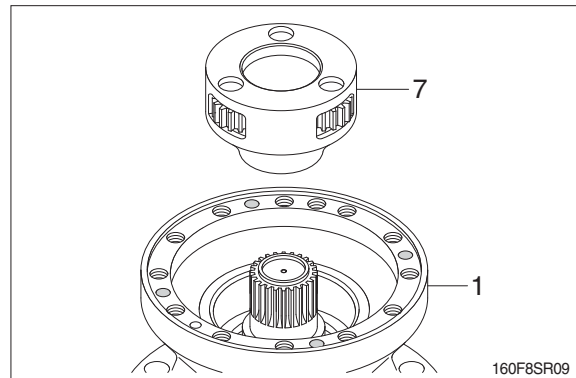
- ① Remove stop ring (21).
 - ② Remove side plate 2 (23), planet gear 1 (14), needle cage (16), side plate 1 (17) and side plate 3 (19) from the carrier.
 - ③ Using M8 solid drill, crush spring pin (20) so that the pin 1 (15) can be removed by hammering.
 - ④ Remove side plate 3 (19) from carrier 1 (13).
- ※ Do not reuse spring pin (20).
 - ※ Do not remove pin 1 (15), carrier 1 (13) and spring pin (20) but in case of replacement.
 - ※ Put matching marks on the planet gear 1 (14) and the pin 1 (15) for easy reassembly.



(7) Remove sun gear 2 (12) from carrier 2 (7).



(8) Remove carrier 2 (7) assembly from casing (1).



(9) Disassembling carrier 2 (7) assembly

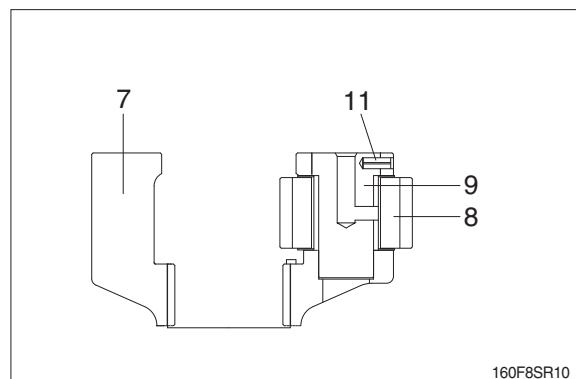
① Using M8 solid drill, crush spring pin (11) so that the pin assembly (9) can be removed.

※ Do not reuse spring pin (11).

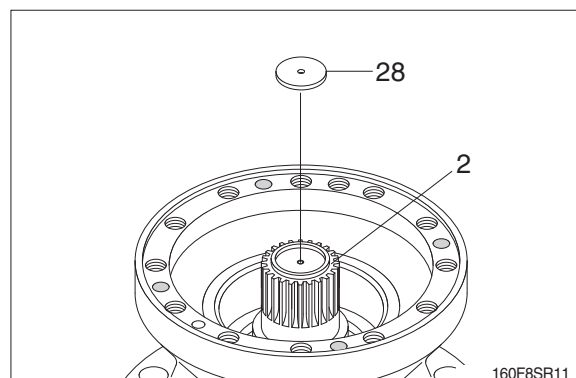
② Remove pin assembly (9), planet gear 2 (8) from the carrier 2 (7).

※ Put matching marks on the planet gear 2 (8) and the pin assembly (9) for easy reassembly.

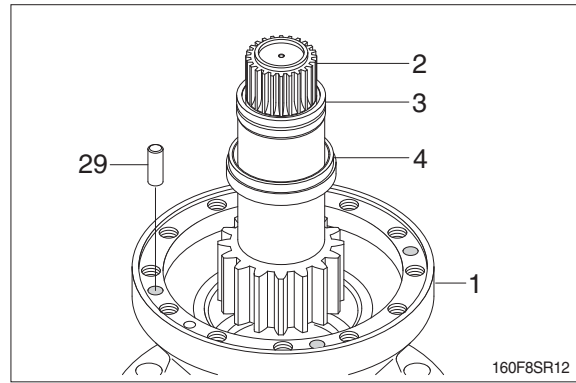
※ Do not disassemble pin assembly (9), carrier 2 (7) and spring pin (11) but in case of replacement.



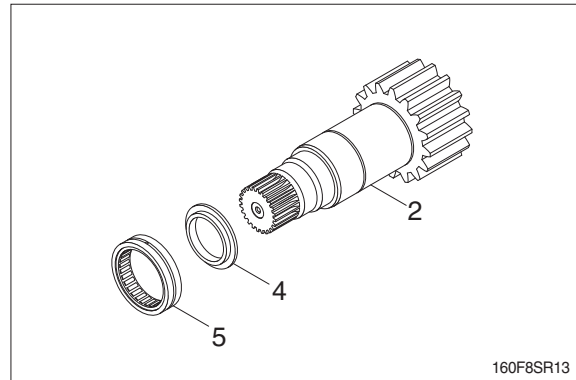
(10) Remove thrust plate 3 (28) from the drive shaft (2).



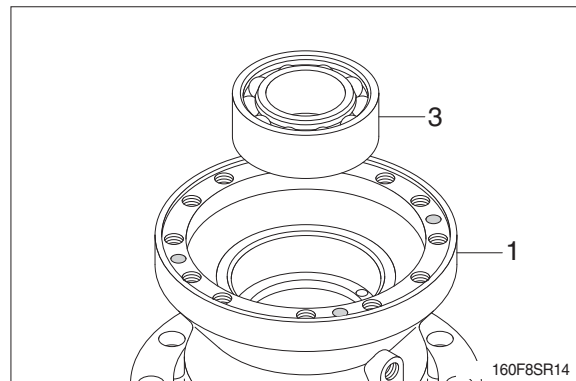
- (11) Remove drive shaft (2) with roller bearing (3) and oil seal (4) assembled.
Remove knock pin (29) from the casing (1).



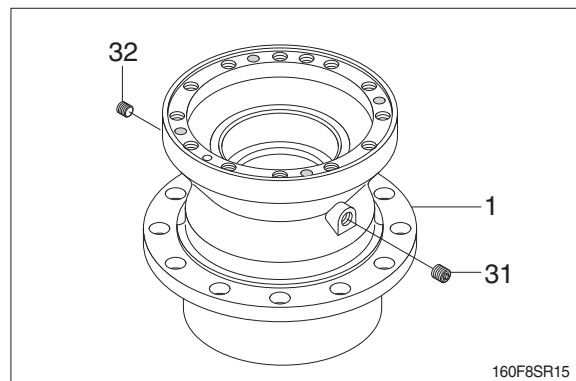
- (12) Remove roller bearing (5) and oil seal (4) from the drive shaft (2).
※ Do not reuse oil seal (5) once removed.



- (13) Using the bearing disassembly tool, remove roller bearing (3).

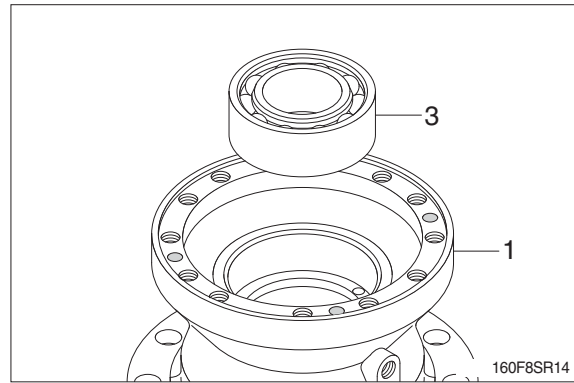


- (14) Remove plugs (31, 32) from the casing (1).

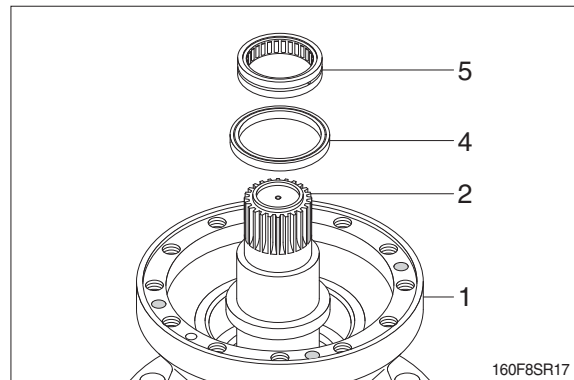


3) ASSEMBLY

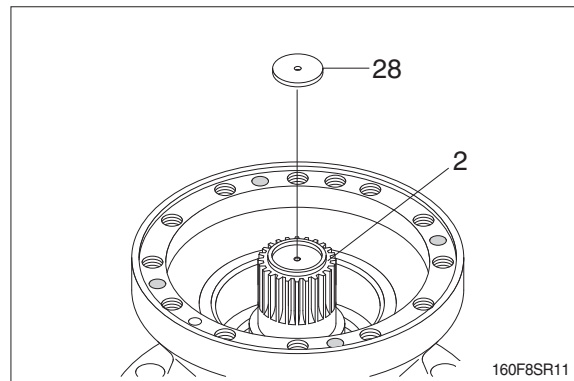
- (1) Assemble roller bearing (3) inside the casing (1).



- (2) Assemble the drive shaft (2) into the casing (1) and then install oil seal (4) and roller bearing (5).

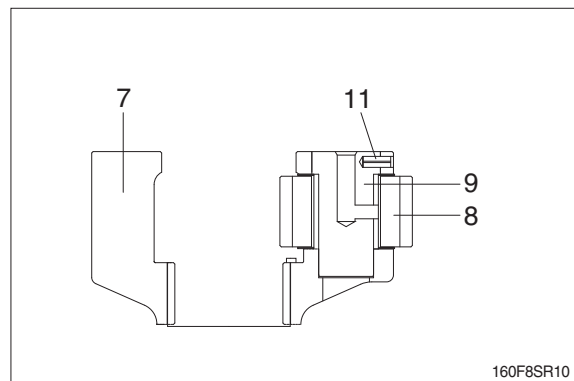


- (3) Install thrust plate 3 (28) on top of drive shaft (2).

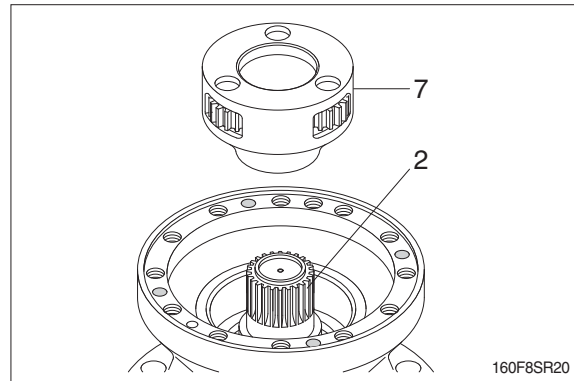


- (4) Assembling carrier 2 (7) assembly.

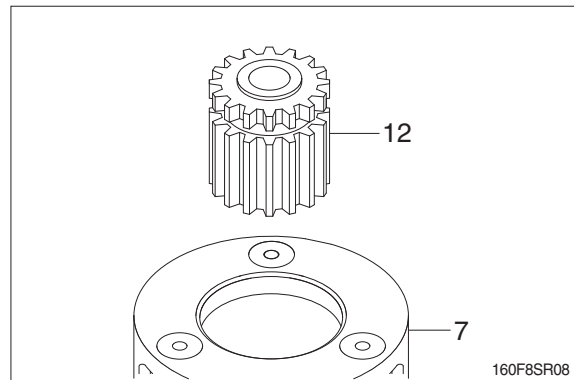
- ① Install thrust washer (10) inside the carrier 2 (7).
 - ② Assemble planetary gear 2 (8) to the carrier 2 (7).
 - ③ Assemble the pin assembly (12) to the carrier 2 (7) and then press the spring pin (11) by hammering.
 - ④ Punch 2 points of the spring pin (11) lip.
- ※ Take care not to mistake the matching marks of each part.



- (5) Assemble carrier 2 (7) assembly correctly to the drive shaft (2).

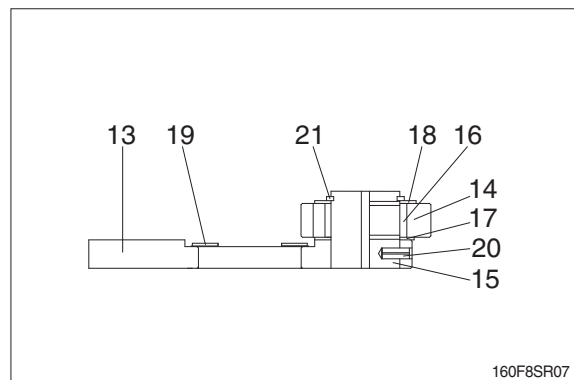


- (6) Assemble sun gear 2 (12) to the center of the carrier 2 (7) assembly.

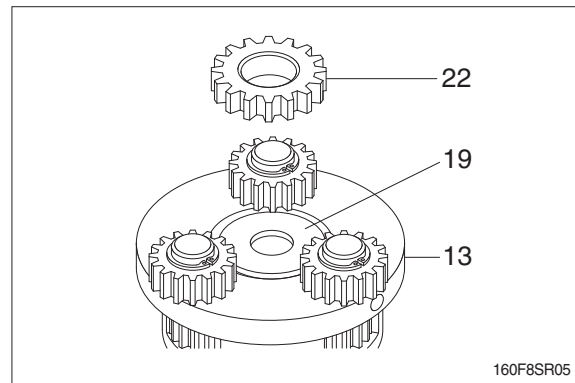


- (7) Assembling carrier 1 (13) assembly.

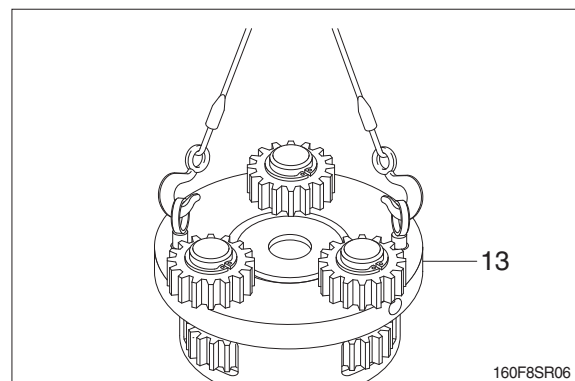
- ① Assemble the pin 1 (15) to the carrier 1 (13) and then press the spring pin (20) by hammering.
 - ② Punch 2 points of the spring pin's (20) lip.
 - ③ Install side plate 3 (19) onto the center of carrier 1 (15).
 - ④ Install needle cage (16) into the planet gear 1 (18).
 - ⑤ Assemble side plate (17), planet gear 1 (14), side plate 2 (18) and then stop ring (21) to the pin 1 (15).
- ※ Take care not to mistake the matching marks of each part.



- (8) Install sun gear 1 (22) onto the side plate 3 (19).



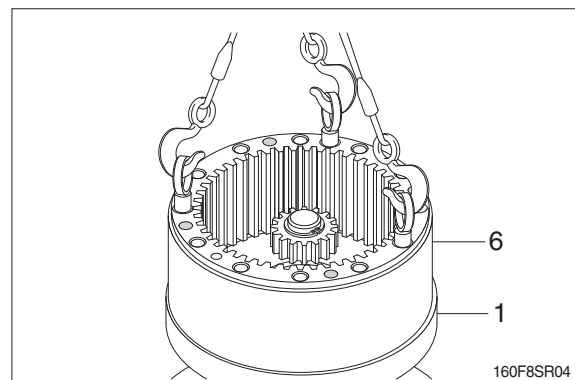
- (9) Assemble carrier 1 (13) assembly onto the carrier 2 (7) assembly.



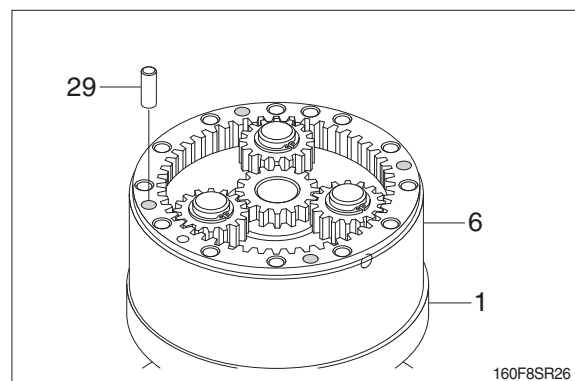
- (10) Apply loctite to the tapped holes of casing (1).

- (11) Tighten 3 M16 eye bolts to the ring gear (6) and lift up and then assemble it onto the casing (1).

- ※ Don't fail to coincide the knock pin (29) holes.



- (12) Hammer 4 knock pins (29) around the ring gear (6).

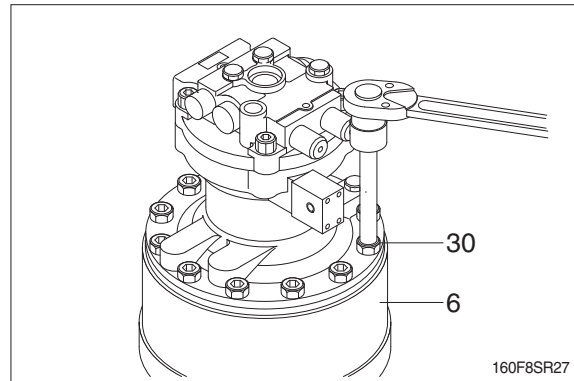


(13) Apply loctite to the tapped holes of the ring gear (6) and then mount swing motor onto the ring gear (6).

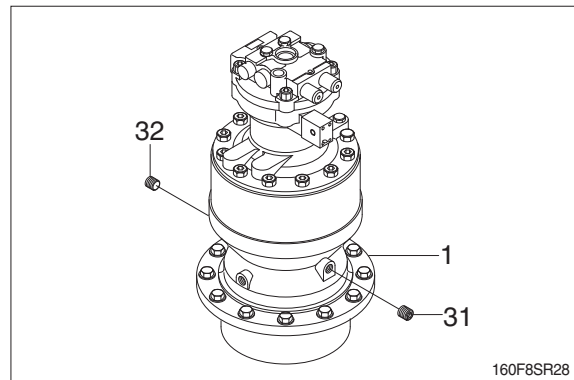
※ Don't fail to coincide the gauge bar hole.

(14) Tighten socket bolts (30) around the swing motor assembly.

- Tightening torque : $24 \pm 2.5 \text{ kgf} \cdot \text{m}$
($173 \pm 18.1 \text{ lbf} \cdot \text{ft}$)



(15) Assemble plugs (31, 32) to the casing (1).



GROUP 5 SWING DEVICE (TYPE 2)

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.

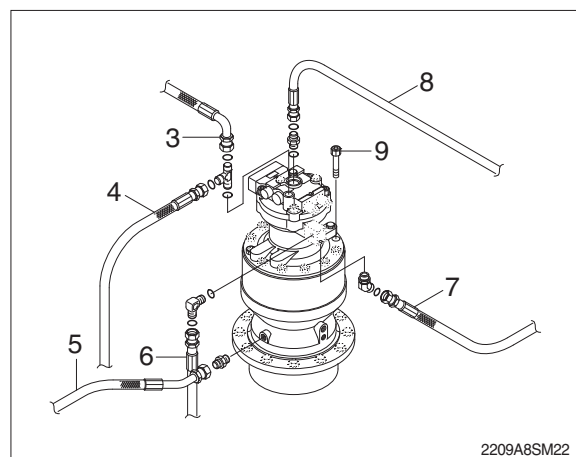
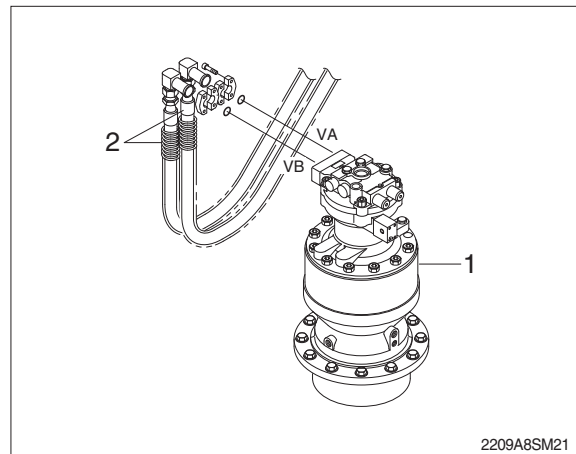
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (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).
 - Motor device weight : 61 kg (135 lb)

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

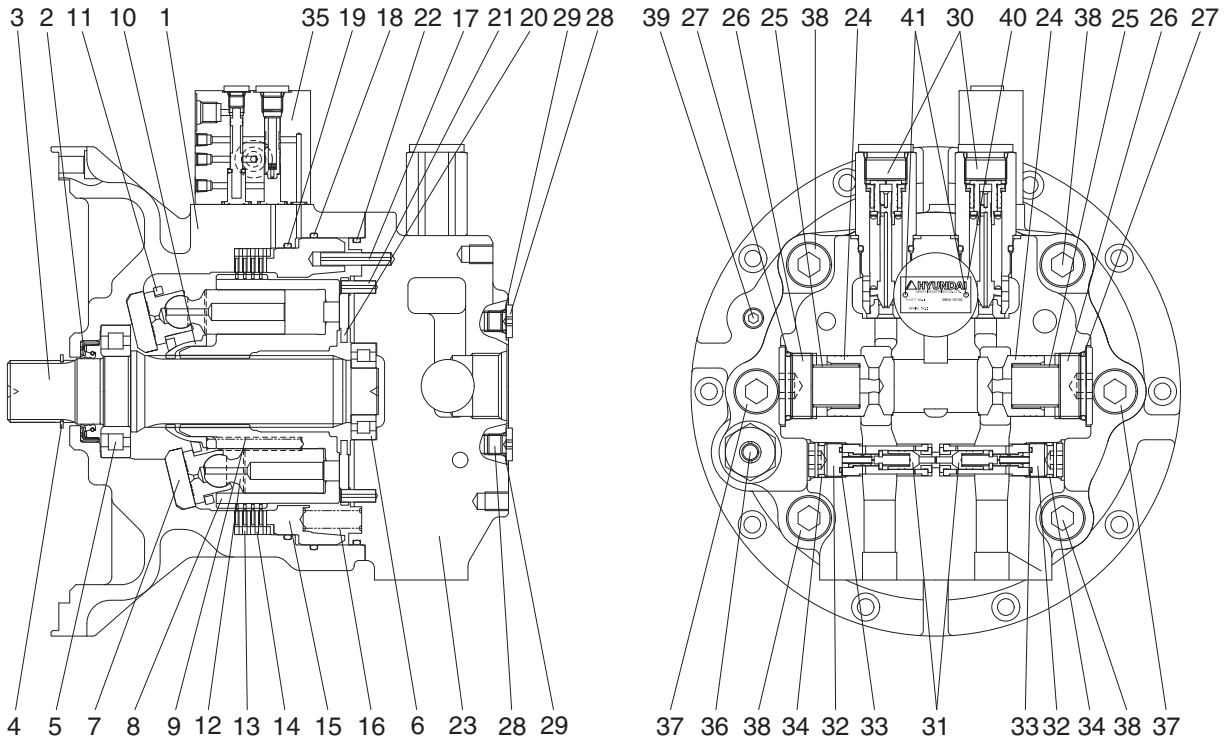
2) INSTALL

- (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



220L2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge
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		

2) DISASSEMBLY

(1) Disassemble drive shaft

- ① Unloosing socket bolt (time delay valve, 42) and disassemble time delay valve assy (35) from casing (1).



2209A8SM51

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



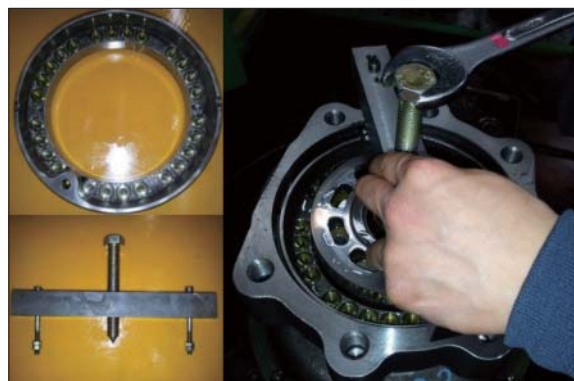
2209A8SM52

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



2209A8SM53

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



2209A8SM54

- ⑤ Disassemble respectively cylinder 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 snap ring (4) from casing (1).



2209A8SM57

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



2209A8SM58

(2) Disassemble cylinder block sub

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



2209A8SM59

- ② Disassemble ball guide (10) and spring (cylinder block, 9) from cylinder 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 (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 reaction-less valve assy (31).



2209A8SM63

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



2209A8SM64

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

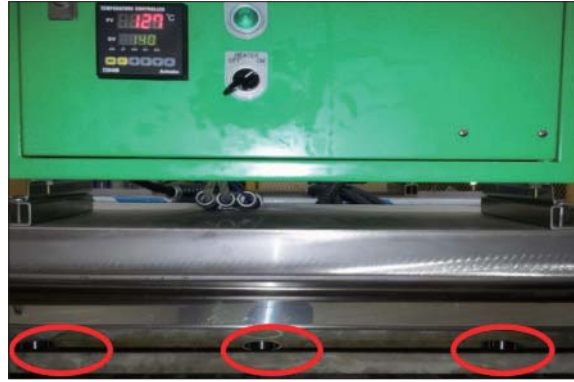


2209A8SM65

3) ASSEMBLING

(1) Assemble shaft sub

- ① Put roller bearing (3) 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 (3) into shaft (5).



2209A8SM67

(2) Assemble cylinder block sub

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



2209A8SM68

- ② Assemble ball guide (10) into cylinder 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 torque wrench.

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



2209A8SM72

② Assemble reactionless valve assy

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

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



2209A8SM73

- ③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).
- Relief valve (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 needle bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).
- Needle 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 sealing (2) into casing (1).



2209A8SM78

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



2209A8SM79

- ③ Using a plier jig, assemble snap ring (4) to shaft (3).
 - Snap 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 cylinder 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).



2209A8SM86

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



2209A8SM87

- ⑪ Assemble time delay valve assy (35) into valve casing (23) with socket bolt (42).
- Time delay valve × 1EA
 - Socket bolt × 3EA



2209A8SM88

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).



2209A8SM89

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**

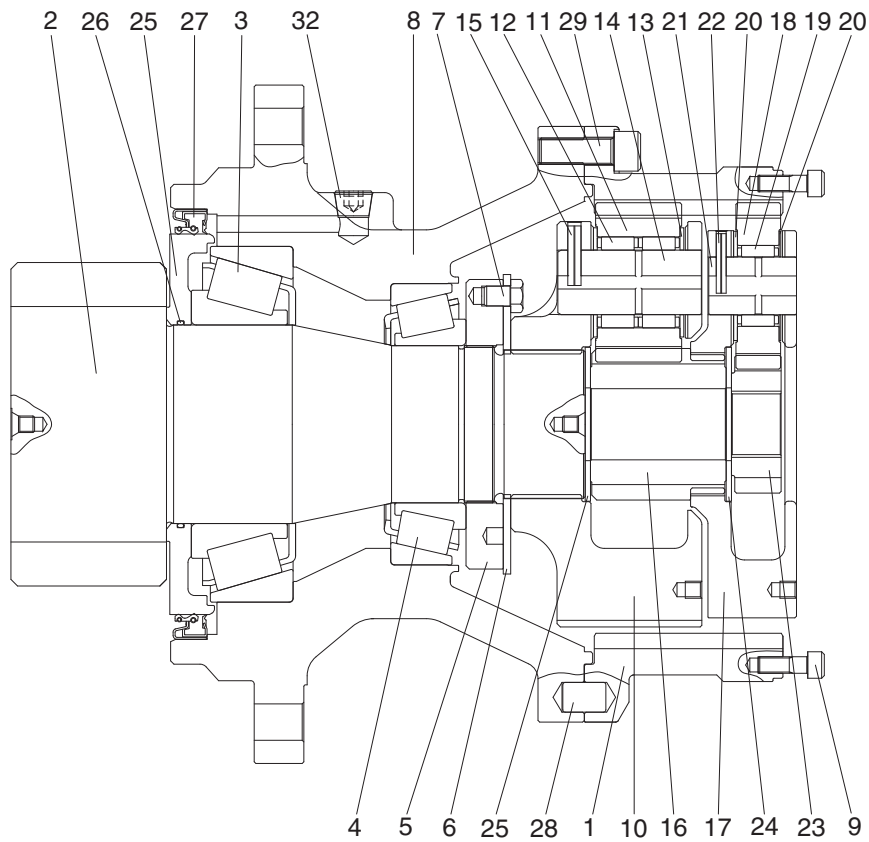
Mounting motor a test bench, test the availability of each part.



2209A8SM91

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



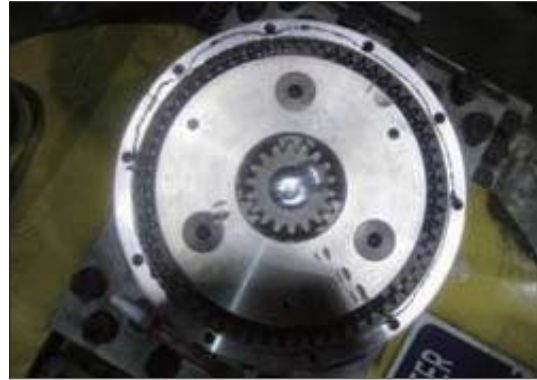
160F2SM03

1	Ring gear	11	Planetary gear 2	21	Carrier pin 1
2	Drive shaft	12	Needle bearing 2	22	Spring pin 1
3	Taper bearing	13	Thrust washer 2	23	Sun gear 1
4	Taper bearing	14	Carrier pin 2	24	Thrust plate
5	Ring nut	15	Spring pin 2	25	Sleeve
6	Lock plate	16	Sun gear 2	26	O-ring
7	Hexagon bolt	17	Carrier 1	27	Oil seal
8	Casing	18	Planetary gear 1	28	Parallel pin
9	Socket bolt	19	Needle bearing 1	29	Socket bolt
10	Carrier 2	20	Thrust washer 1	32	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.



2209A8SM02

- 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.



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

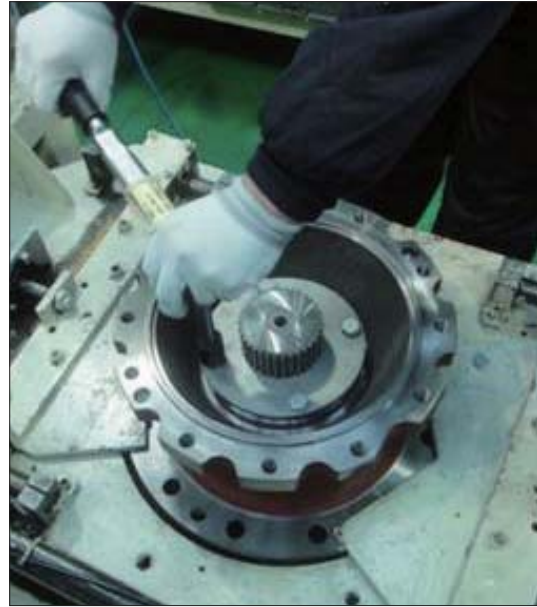
- After unscrewing every socket bolt (M16), remove ring gear from casing.
※ Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.



2209A8SM06

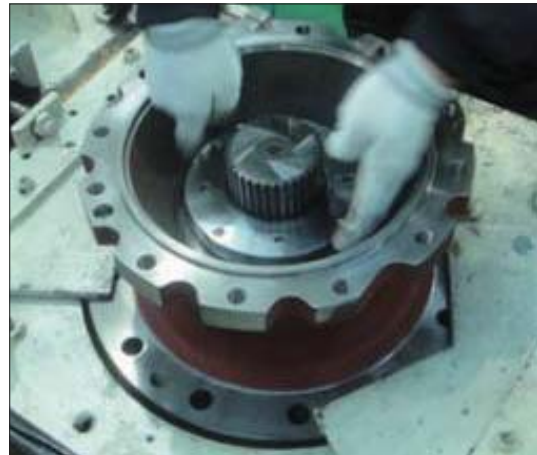
④ Removing drive shaft sub assy

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



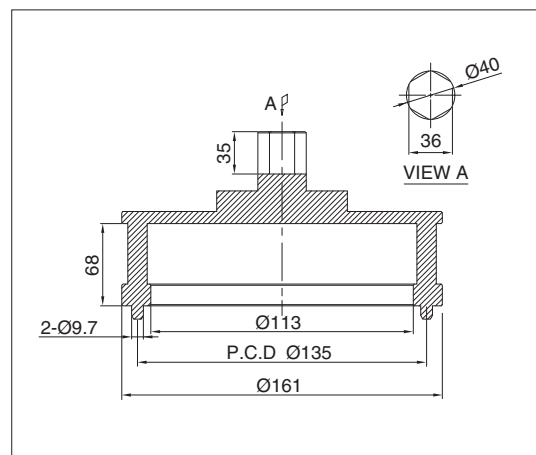
2209A8SM07

- 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.



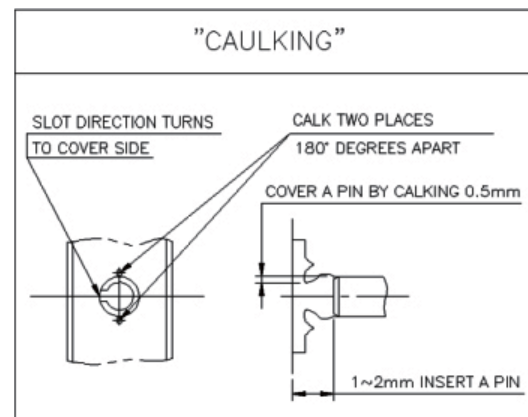
2209A8SM14

- (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.



2209A8SM16

2) 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.

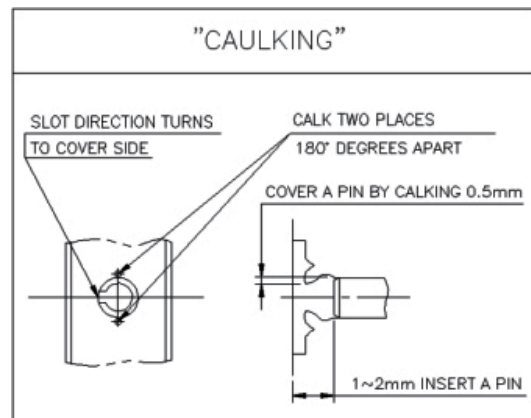


2209A8SM19

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

※ Refer to “Caulking details”

Use paint marker for marking after caulking.



2209A8SM20

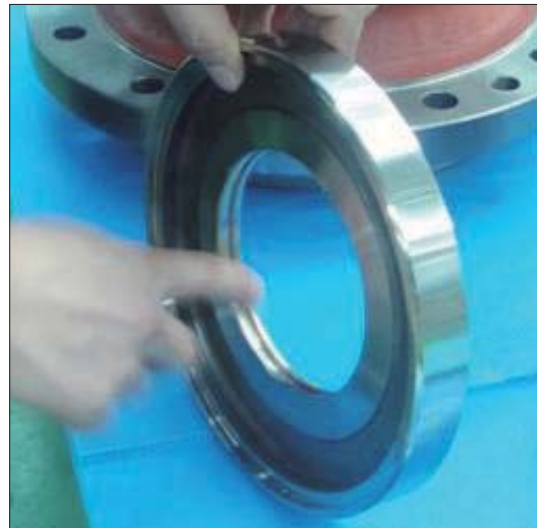
3) ASSEMBLING PINION GEAR SUB ASSY

- (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

4) 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

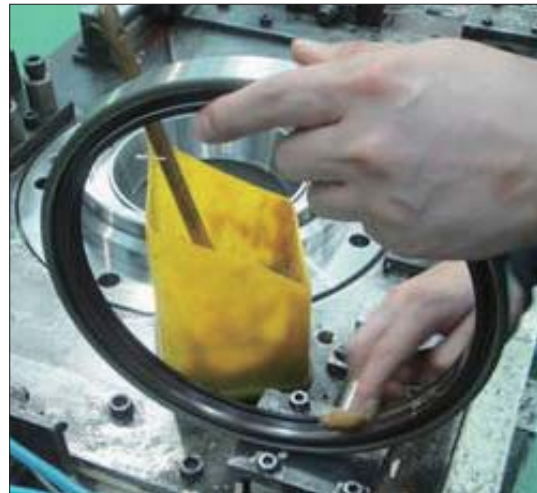
- (2) Assemble oil seal to casing.
Use special jig for pressing. Pay attention to direction of dust seal and dent.



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

5) 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.



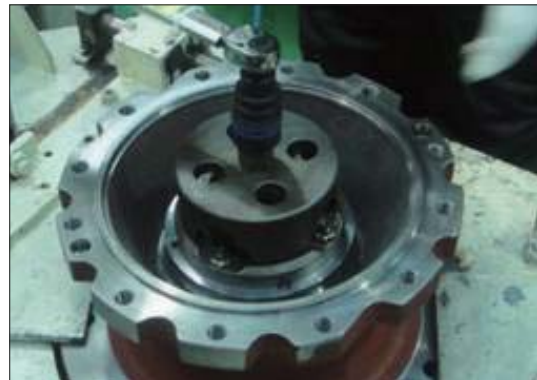
2209A8SM31

- (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



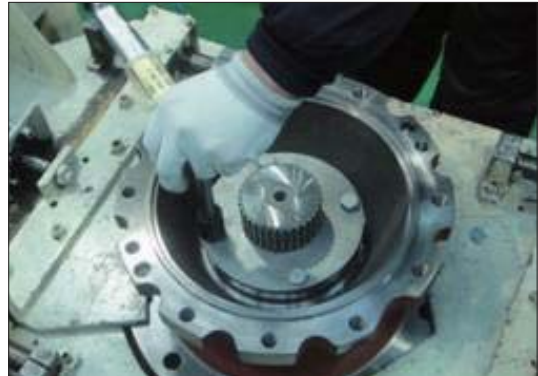
2209A8SM35

- (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

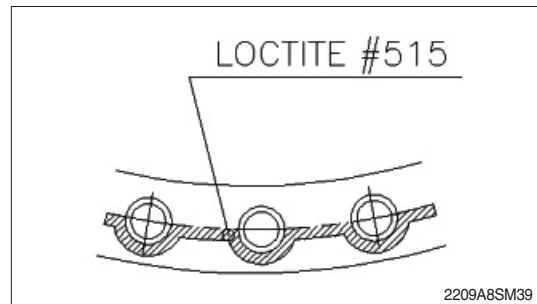
6) ASSEMBLING RING GEAR

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



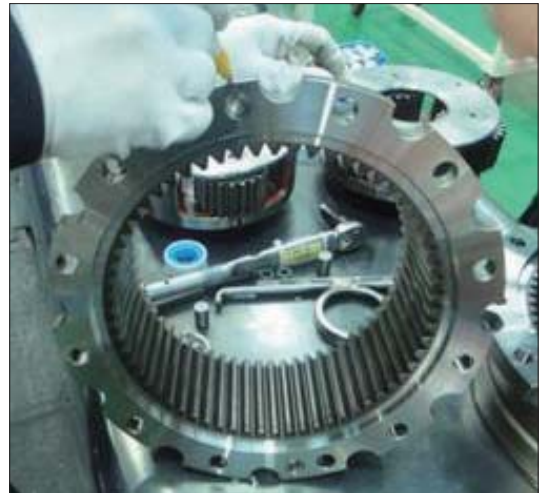
2209A8SM38

Refer to loctite detail.



2209A8SM39

- (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

7) 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.



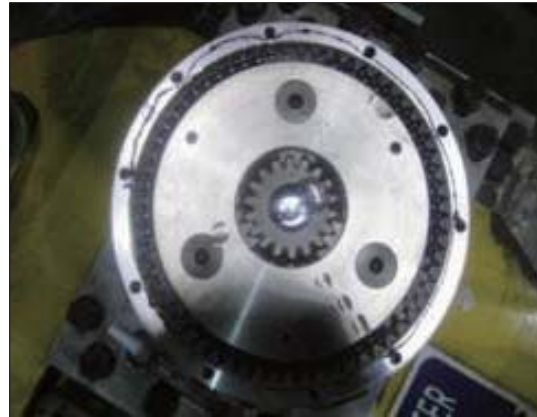
2209A8SM46

- (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

8) 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



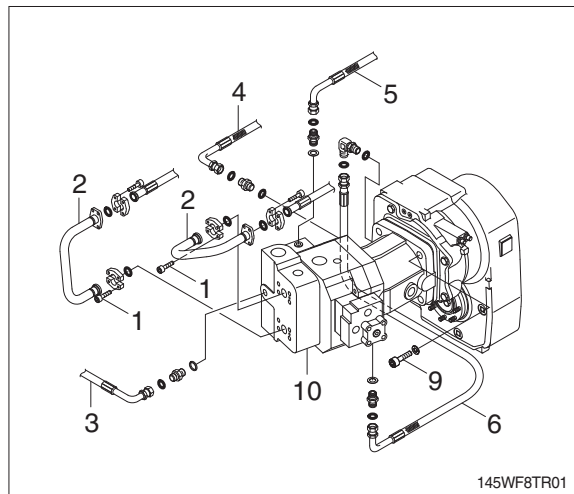
2209A8SM49

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).
- (6) Loosen the socket bolt (9) and remove travel motor (10).
 - Weight : 80 kg (176 lb)
- ※ When removing the travel motor assembly, check that all the hoses have been disconnected.

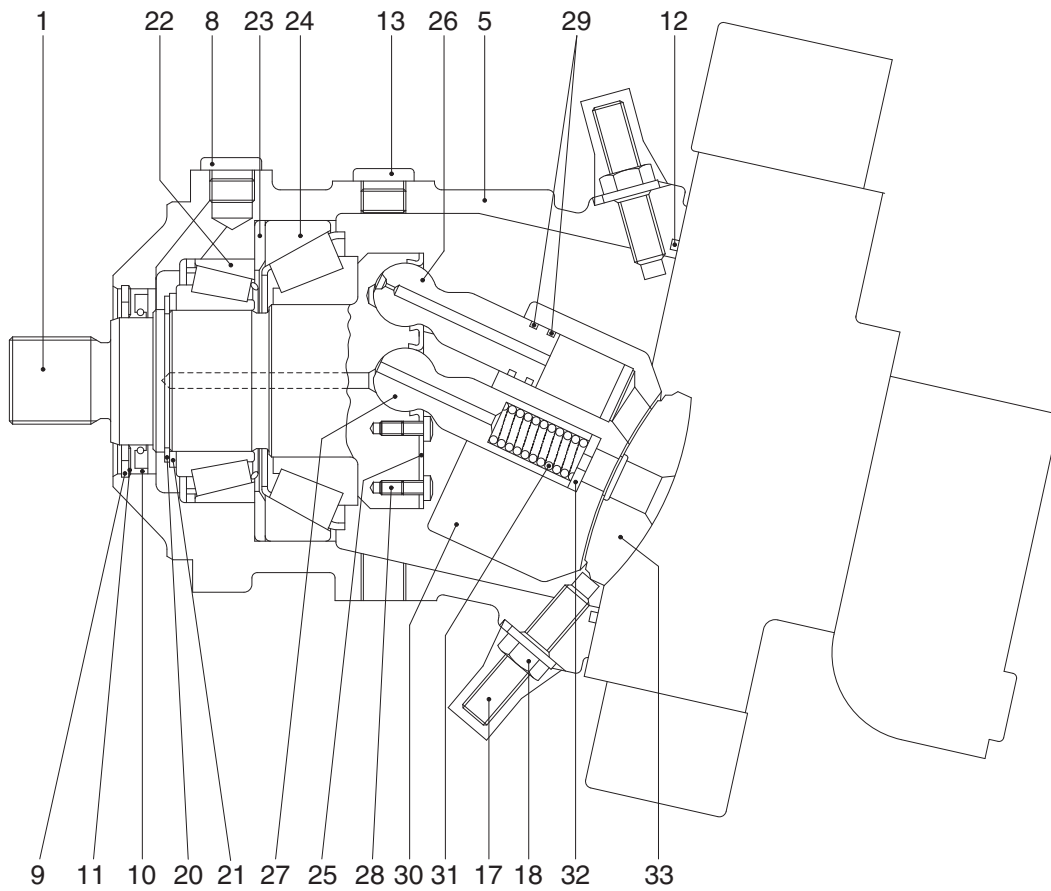


2) INSTALL

- (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. STRUCTURE

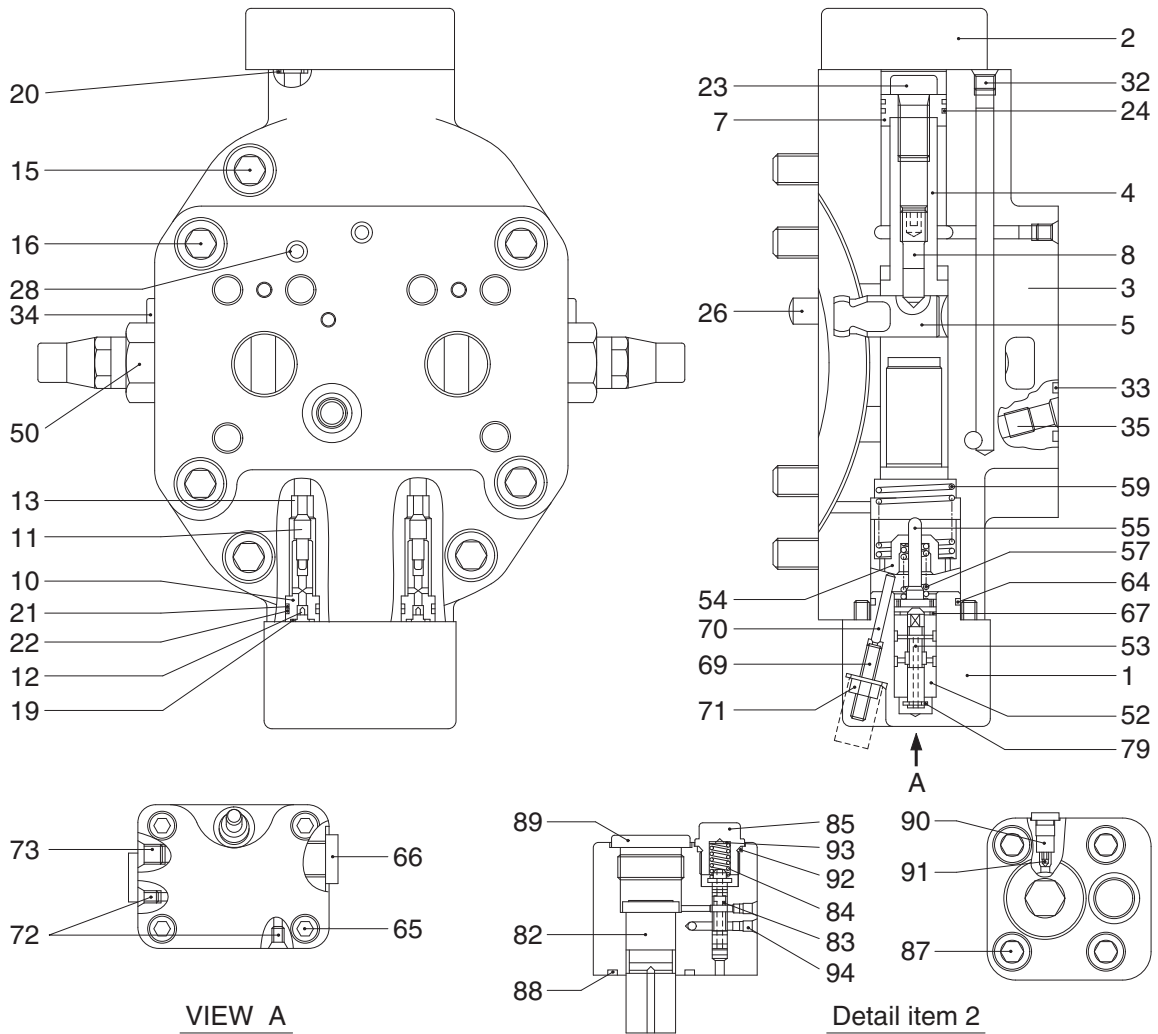
1) MOTOR UNIT



180W9A2TR02

1	Drive shaft	17	Threaded pin	26	Piston
5	Housing	18	Seal lock nut	27	Center pin
8	Locking screw	20	Retaining ring	28	Pan head screw
9	Retaining ring	21	Back up plate	29	Steel sealing ring
10	Shaft seal ring	22	Taper roller bearing	30	Cylinder block
11	Back up plate	23	Shim	31	Pressure spring
12	O-ring	24	Taper roller bearing	32	Adjustment shim
13	Locking screw	25	Retaining plate	33	Control lens

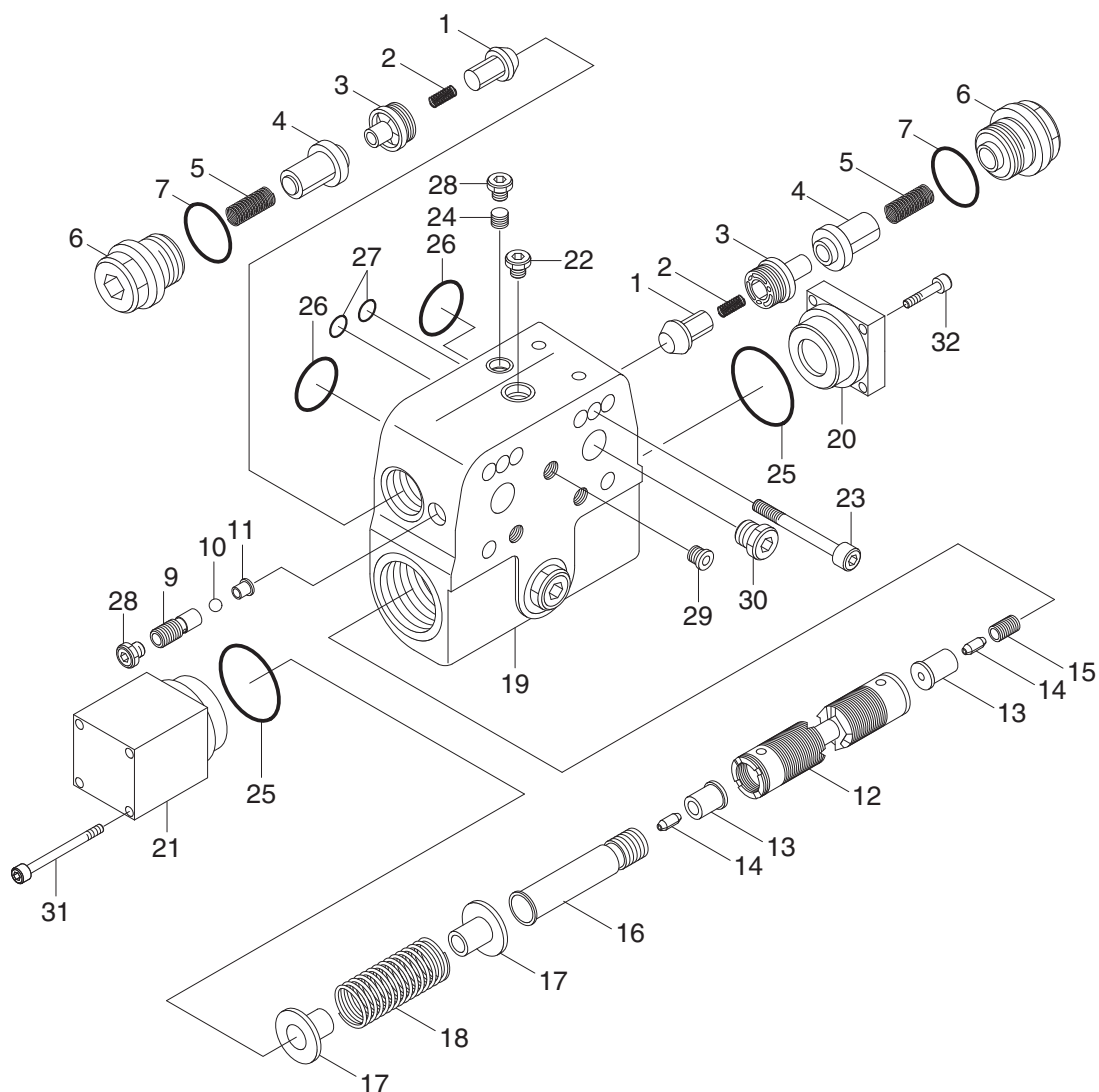
2) CONTROL UNIT



180W9A2TR03

1	Control housing	24	Square ring	70	Cylinder pin
2	Stroke limiter	26	Cylinder pin	71	Seal lock nut
3	Port plate	28	Double break off pin	72	Double break off pin
4	Positioning piston	32	Double break off pin	73	Double break off pin
5	Positioning trunnion	33	O-ring	79	Retaining disc
7	Piston	34	Locking screw	82	Piston
8	Threaded pin	50	Relief valve	83	Control piston
10	Valve guide	52	Control bushing	84	Pressure spring
11	Bolt	53	Control piston	85	Locking screw
12	Throttle screw	54	Adjusting bushing	87	Socket head screw
13	Bushing	55	Spring collar	88	O-ring
15	Socket head screw	57	Pressure spring	89	Locking screw
16	Socket head screw	59	Pressure spring	90	Locking screw
19	O-ring	64	O-ring	91	Orifice
20	O-ring	65	Socket head screw	92	O-ring
21	O-ring	66	Locking screw	93	Shim
22	Back up ring	67	Retaining ring	94	Double break off pin
23	Socket head screw	69	Threaded pin		

3) COUNTER-BALANCE VALVE



17W98TR05

- | | | | | | |
|----|-----------------|----|-----------------|----|----------------------|
| 1 | Valve poppet | 13 | Valve bushing | 24 | Plug |
| 2 | Pressure spring | 14 | Throttle pin | 25 | O-ring |
| 3 | Poppet seat | 15 | Valve screw | 26 | O-ring |
| 4 | Valve poppet | 16 | Bolt | 27 | O-ring |
| 5 | Pressure spring | 17 | Spring collar | 28 | Locking screw |
| 6 | Locking screw | 18 | Pressure spring | 29 | Double brake off pin |
| 7 | O-ring | 19 | Housing | 30 | Locking screw |
| 9 | Valve screw | 20 | Cover | 31 | Socket screw |
| 10 | Ball | 21 | Cover | 32 | Socket screw |
| 11 | Bushing | 22 | Locking screw | | |
| 12 | Brake piston | 23 | Socket 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
8-70	8	M22 × 1.5	6.1	44
	13	M26 × 1.5	7.1	51
	18	M12	7.0	50.9
	28	M 6 × 20	1.4	10.3
8-71	76	-	32.6	236
	77	M10 × 1.0	5.2	37.6
	78	M12 × 1.5	3.6	25.8
8-72	20	M12 × 1.5	10.2	73.8
	21	M12 × 1.5	10.2	73.8

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

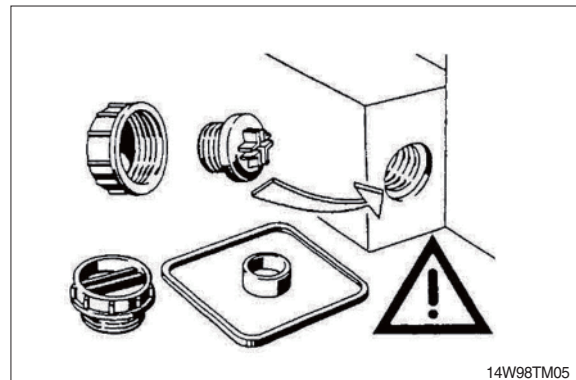
- ① Reassemble in a work area that is clean and free from dust and grit.
- ② Handle parts with bare hands to keep them free of linty contaminants.
- ③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.
- ④ Do not reuse O-ring oil seal and floating seal that were removed 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

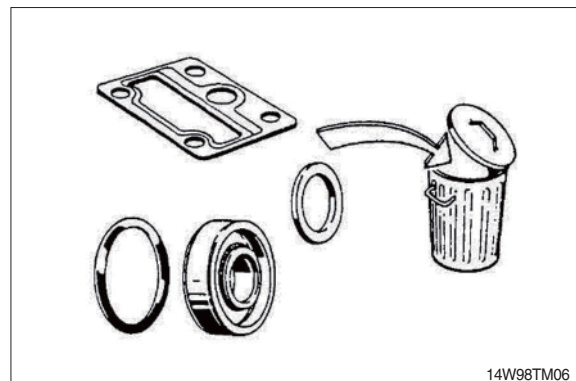
Observe the following notices when carrying out repair work at hydraulic aggregates.



(1) Close all ports of the hydraulic aggregates.

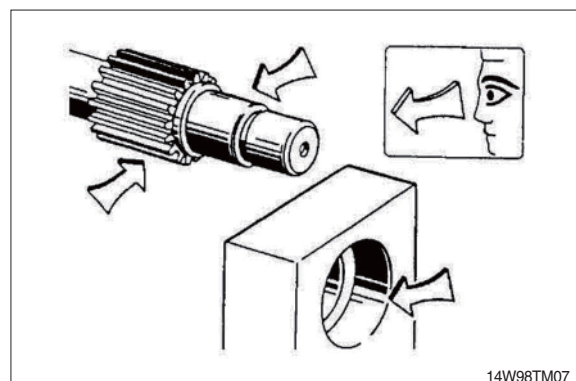


(2) Replace all seals.
Use only original spare parts.

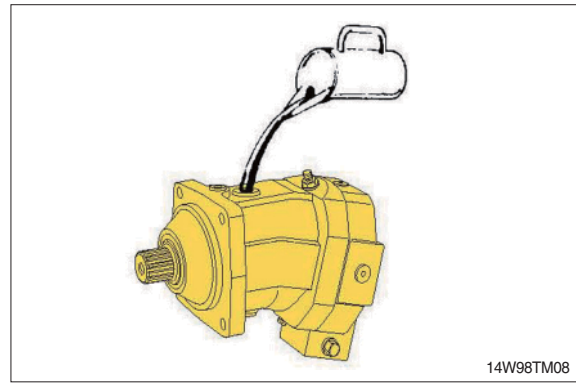


(3) Check all seal and sliding surfaces for wear.

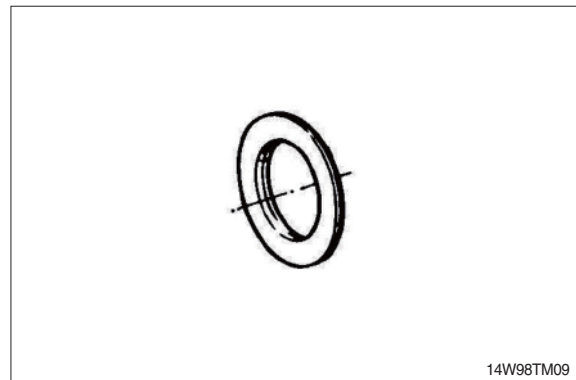
※ Rework of sealing area f.ex. with abrasive paper can damage surface.



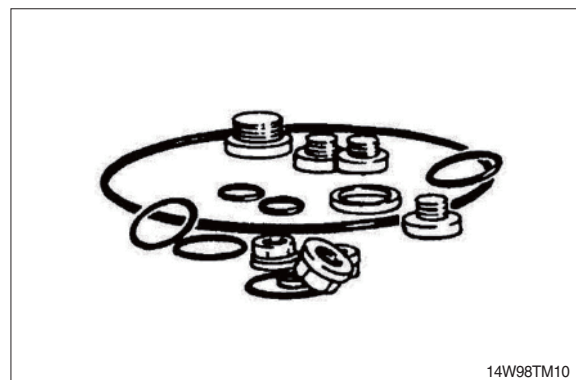
- (4) Fill up hydraulic aggregates with hydraulic oil before start up.
※ Without fill up bearing damage happens!



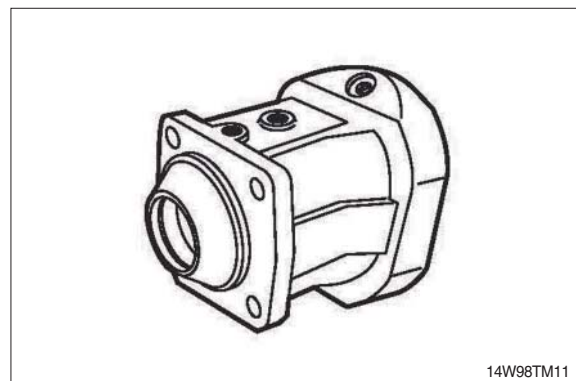
- (5) Seal kit for drive shaft



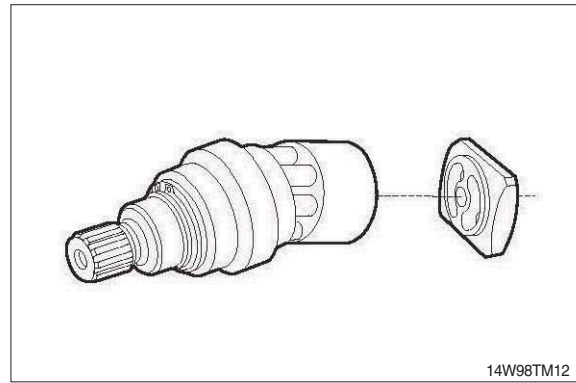
- (6) External seal kit.



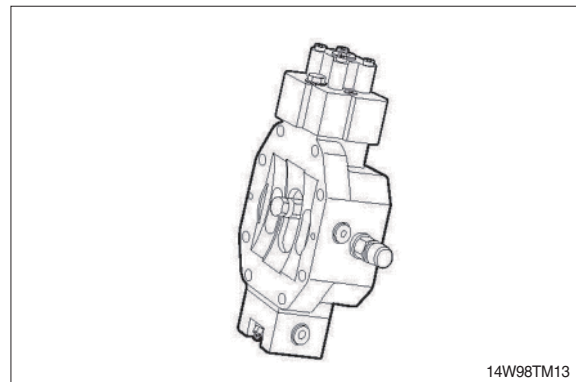
- (7) Housing.



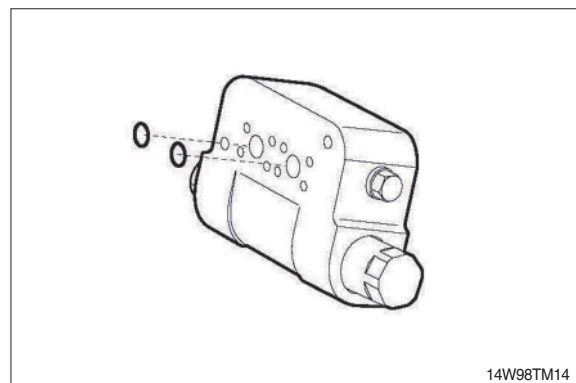
(8) Complete rotary group.



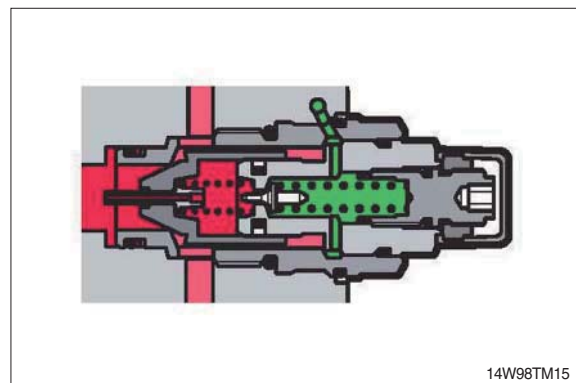
(9) Port plate with control piston.



(10) Counter balance valve.

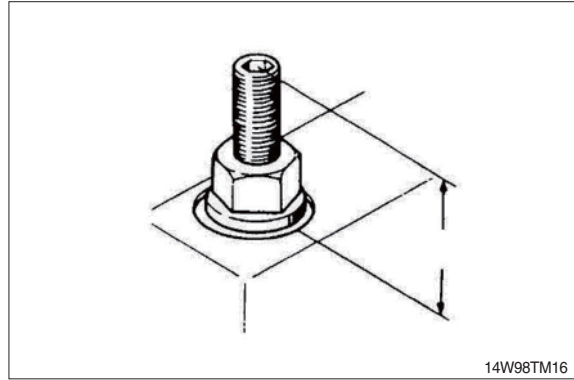


(11) Relief valve.

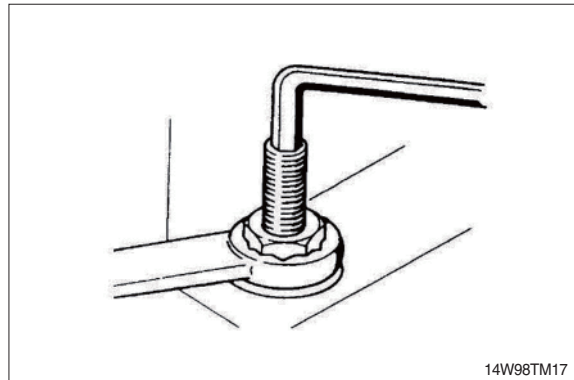


3) SEAL NUT

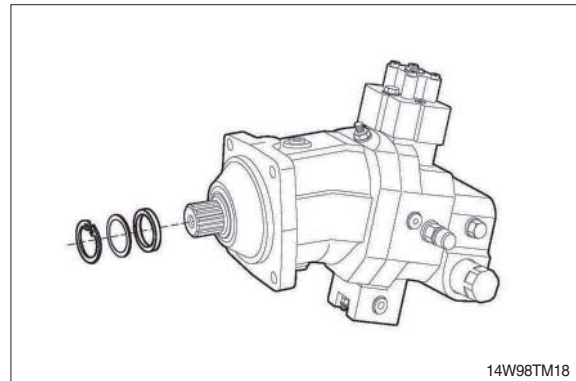
- (1) Replace seal nut.
First measure and record setting height.



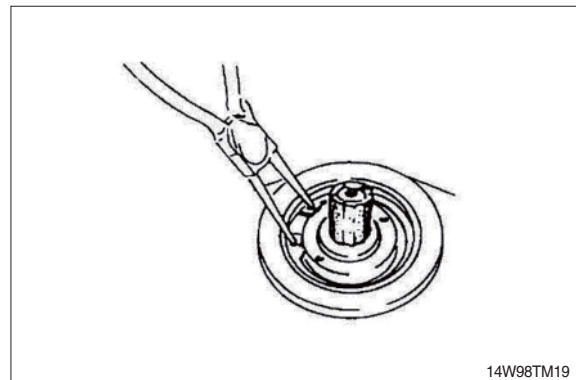
- (2) When tightening, counterhold setting screw, then check setting height.



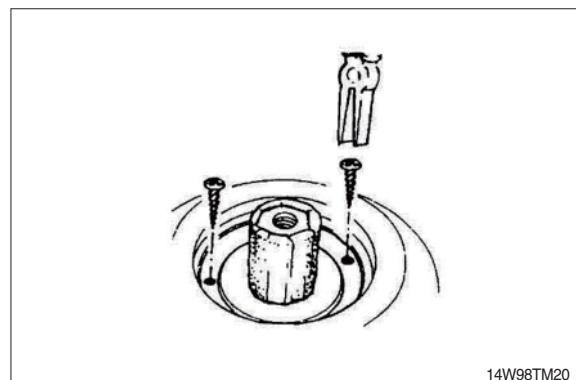
4) SEALING THE DRIVE SHAFT



- (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.

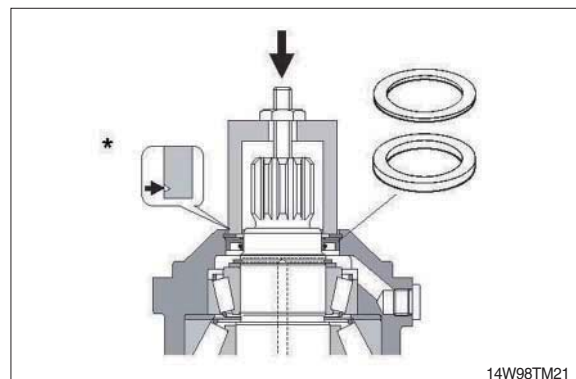


- (3) Press in shaft seal and shim with bush to stop.

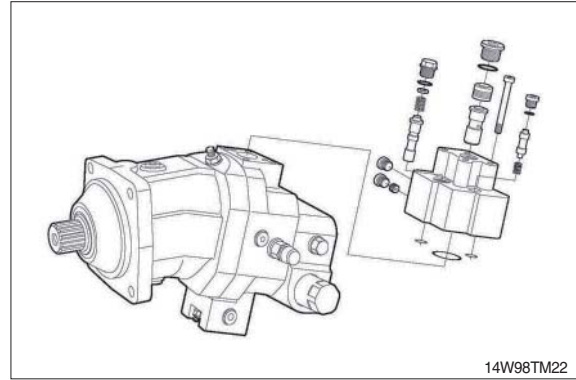
▲ Pay attention to pressing depth.

* Mark for pressing depth.

Assemble retaining ring.

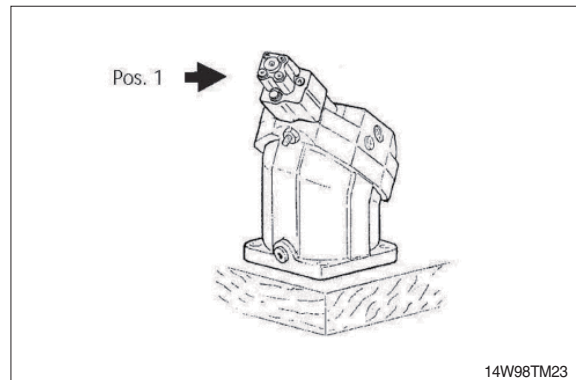


5) SEALING OF THE CONTROL PARTS



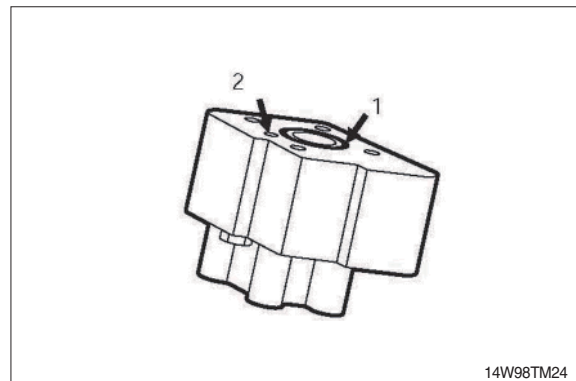
(1) Disassembly position

Remove cover pos. 1.

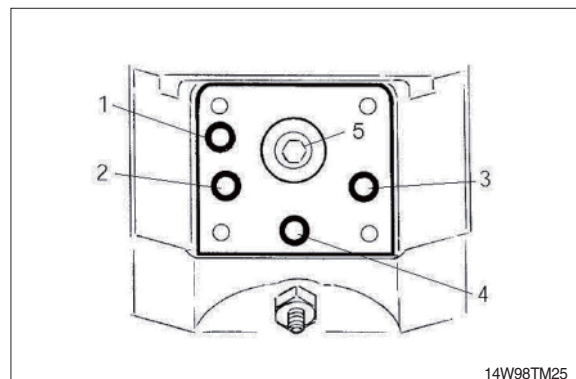


- 1 O-ring
- 2 Input flow of oil control

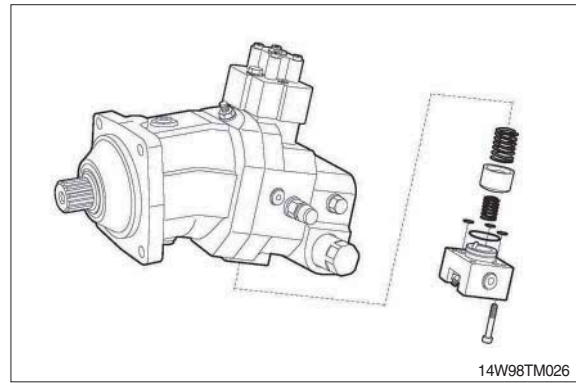
※ Installation position differs according to the control components.



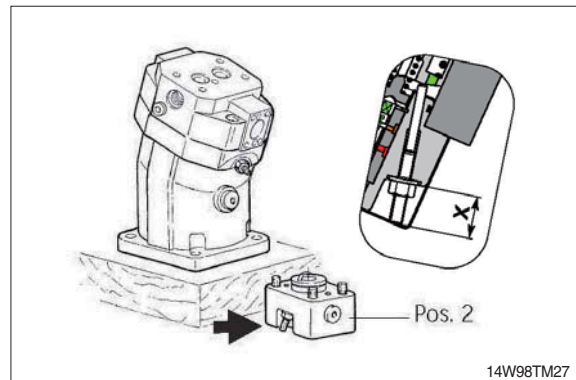
- 1 Input flow of oil control
- 2 High pressure / Low pressure
- 3 High pressure / Low pressure
- 4 Leakage oil
- 5 Control piston



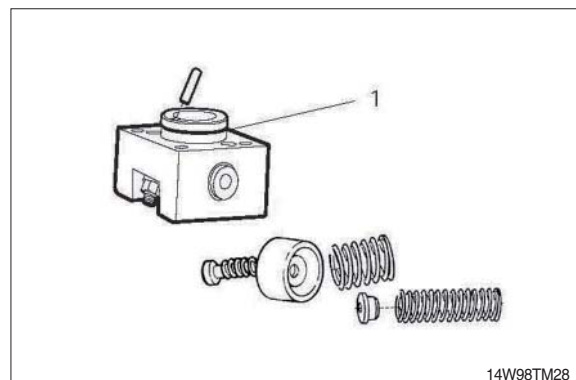
- (2) Disassembly position : Remove cover 2.
 ※ Attention spring load.



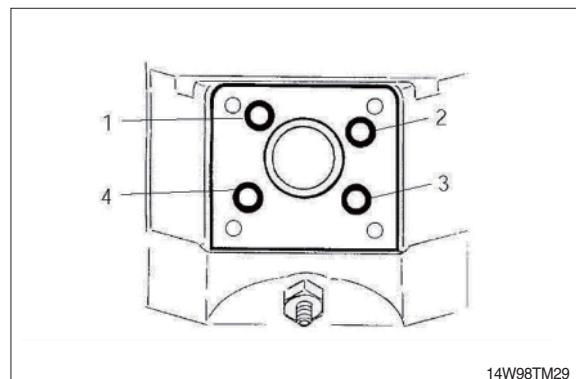
- ※ Dimension X : Note dimension (begin of regulation)



- 1 Check of O-ring

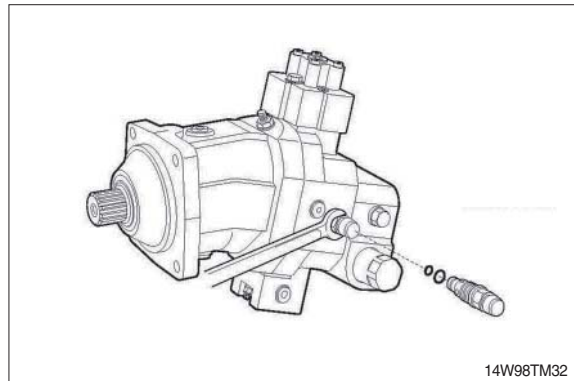


- 1 O-ring / High pressure-small control position side
 2 O-ring / Control pressure
 3 O-ring / High pressure-check valve
 4 O-ring / High pressure-check valve

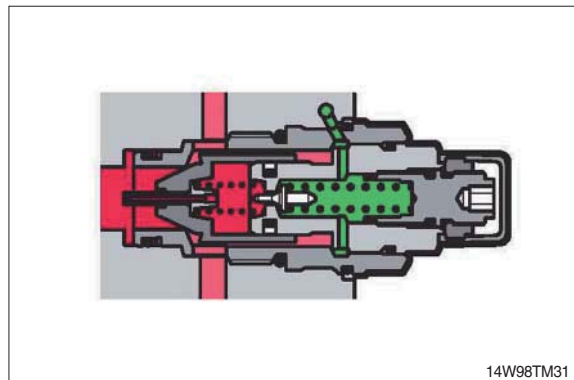


6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

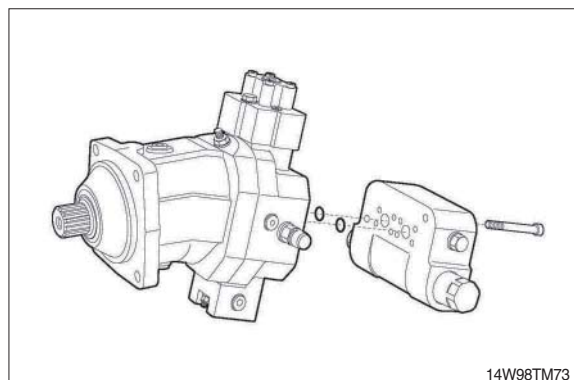
(1) Remove relief valve.



(2) Inspect
O-ring

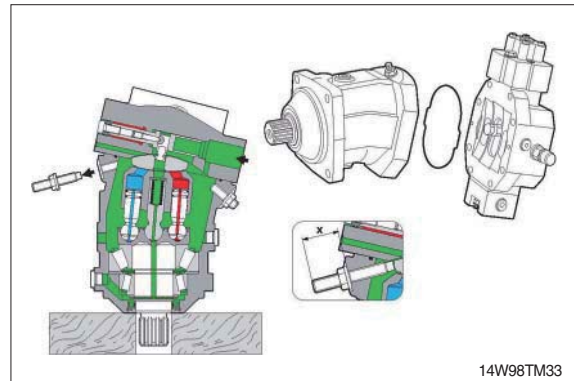


(3) Remove counter-balance valve.
Inspect
O-ring

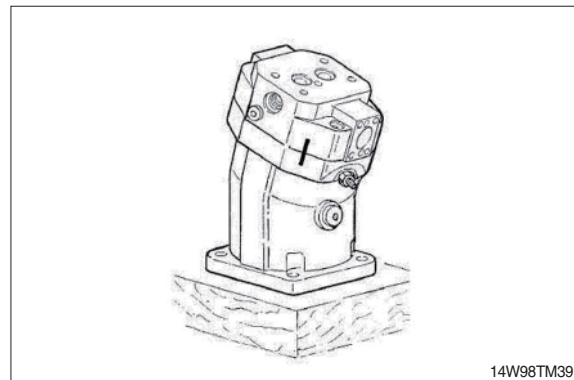


7) DISASSEMBLY OF THE PORT PLATE

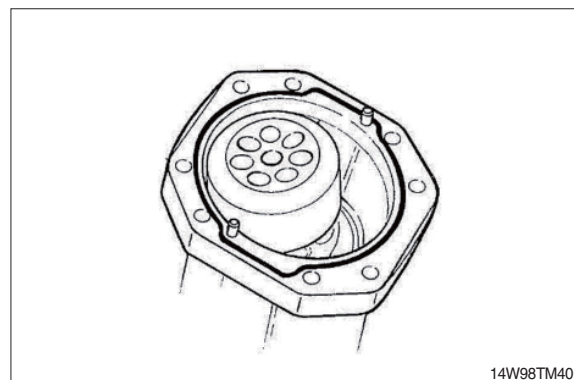
- Note dimension X
 - Remove Q_{min} screw
 - Swivel rotary group to zero P
- ※ For disassembly of the port plate, swivel always rotary group to zero position. Piston rings to hang out of the cylinder boring.



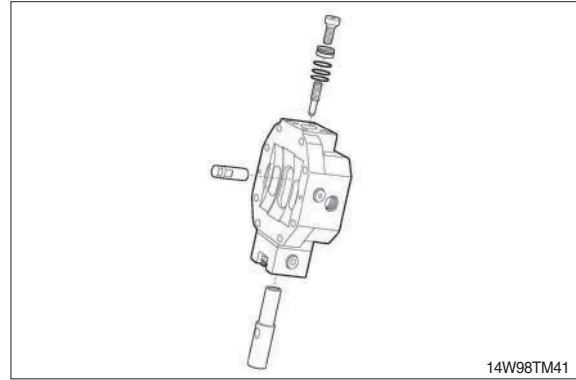
- (1) Port plate.
Mark position. Loosen screws.
Removal.



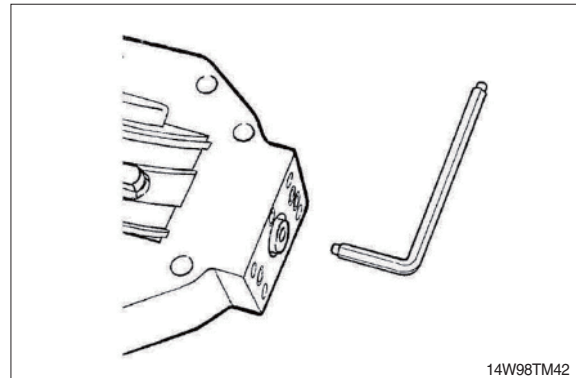
- (2) Check O-ring.
※ Stick new O-ring with some grease.
Do not swivel rotary group.
Piston rings to hang out from the
cylinder boring.



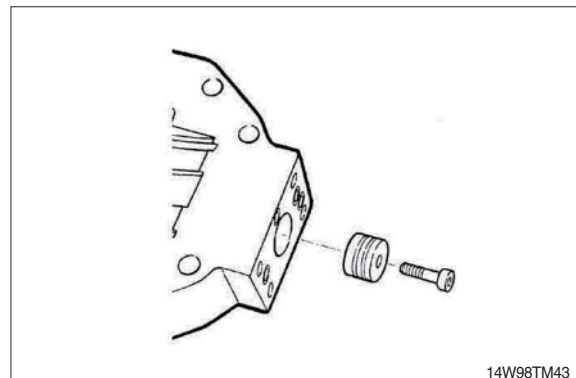
8) REMOVE OF THE POSITIONING PISTON



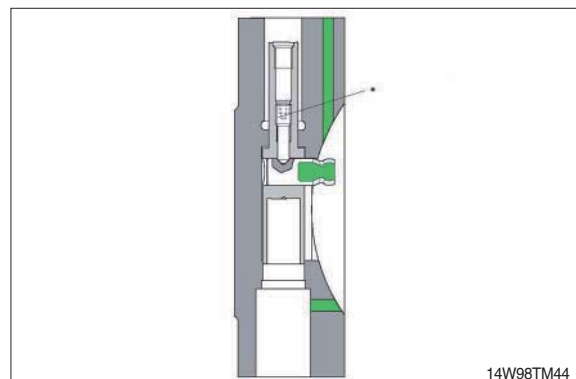
- (1) Loosen fixing screw.
Use only socket wrench.



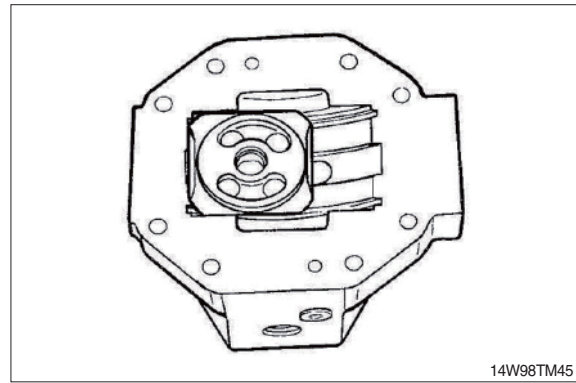
- (2) Remove piston with piston ring.



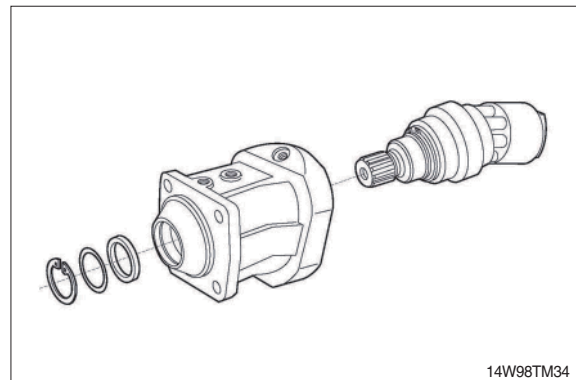
- (3) Warm up fixation screw * for positioning plug via boring (screw glued-to turn out).
※ Use new screw.
Precote coating.
Note tightening torque.



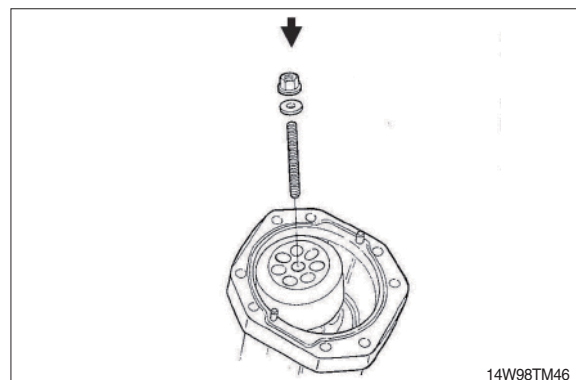
- ※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.
- ※ Rotary group vertical.



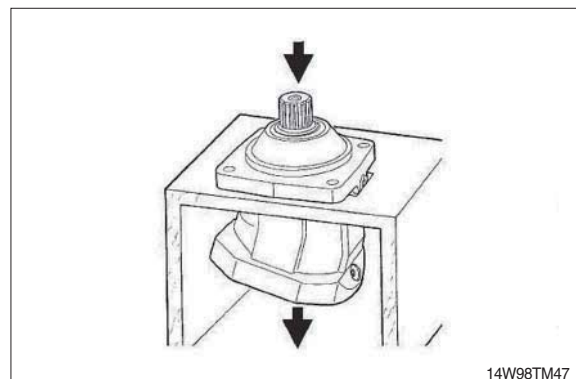
9) REMOVE ROTARY GROUP



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

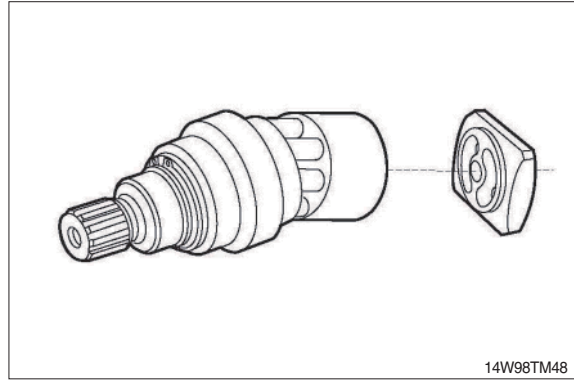


- (2) Press out rotary group.
 - ※ If the bearings are used again do not hit on the drive shaft.



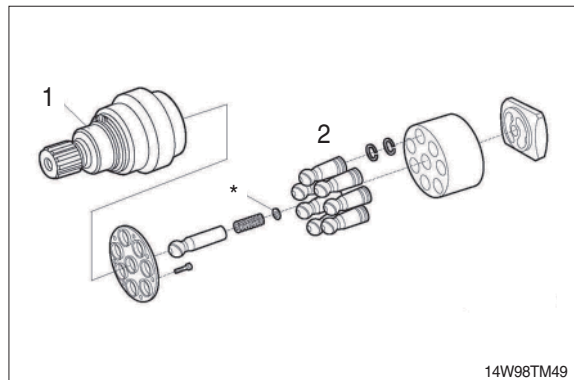
10) EXCHANGING OF THE ROTARY GROUP

- ※ Complete rotary group
Setting of hydraulic part necessary.

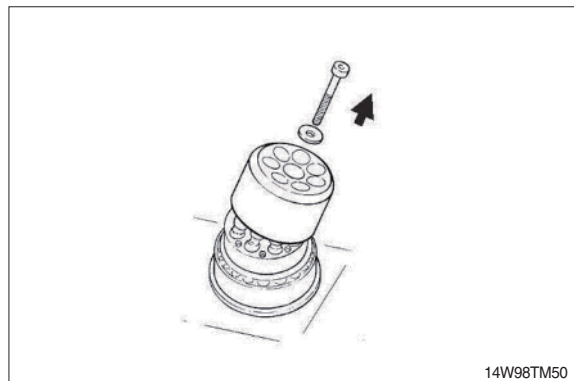


Rotary group

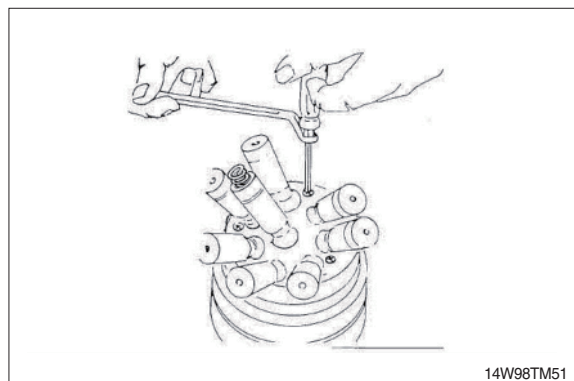
- 1 Mechanical part : Adjust drive shaft with bearing
- 2 Hydraulic part : Adjustment necessary



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

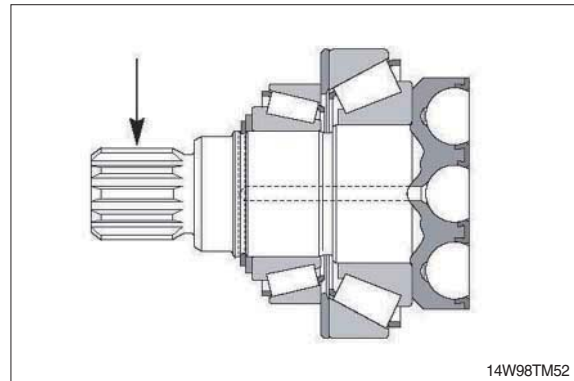


- (2) Disassemble retaining plate.
 - ※ Screws are glued.
 - Use Torx tools.



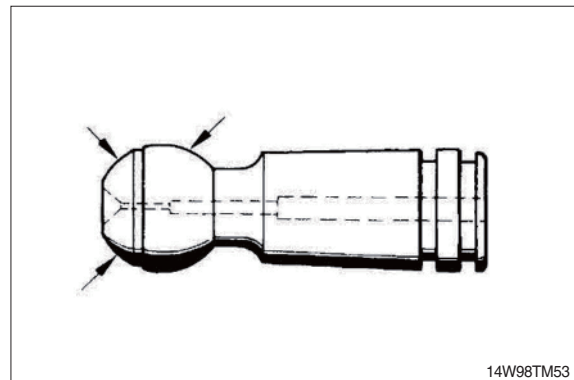
11) INSPECTION INSTRUCTIONS

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



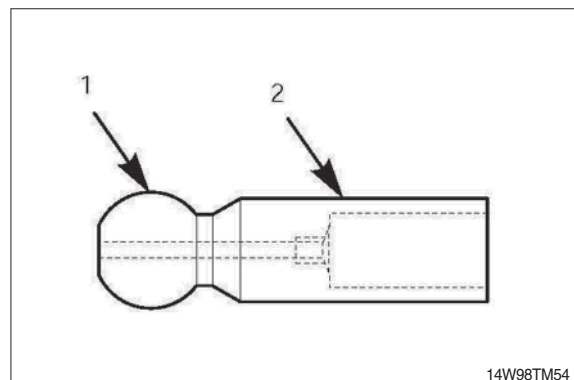
(2) Pistons

- No scoring and no pittings.



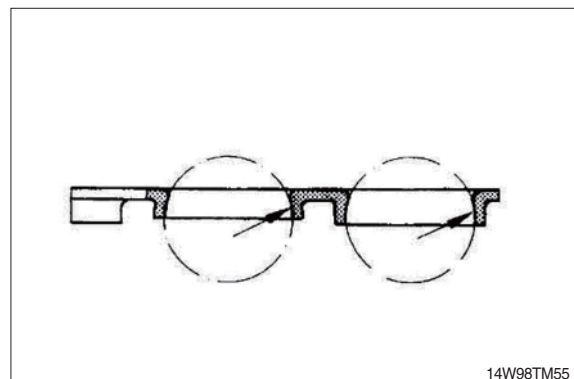
(3) Center pin

- No scoring and no pittings.



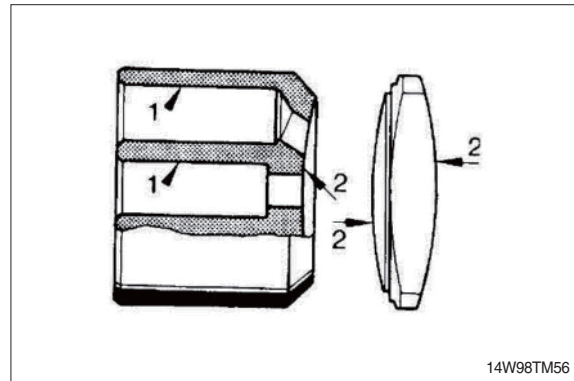
(4) Retaining plate

- No scoring and no evidence of wear.



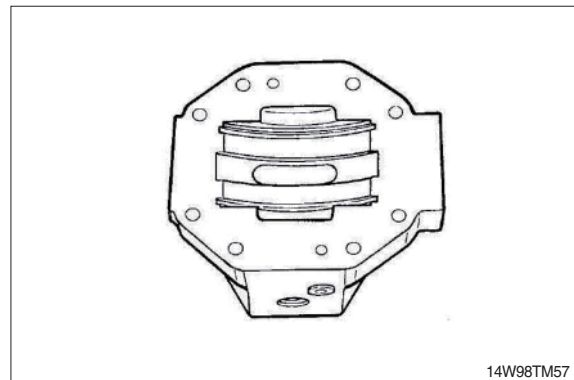
(5) Cylinder block / Control lens

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



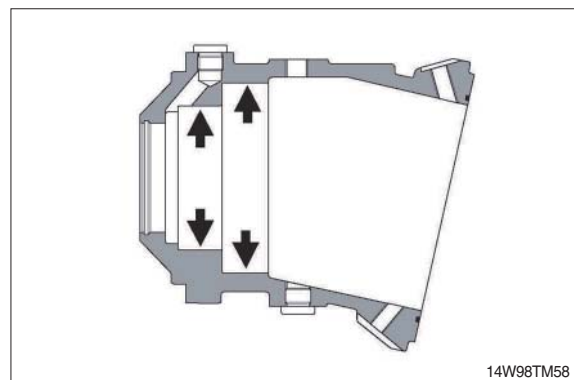
(6) Control housing

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



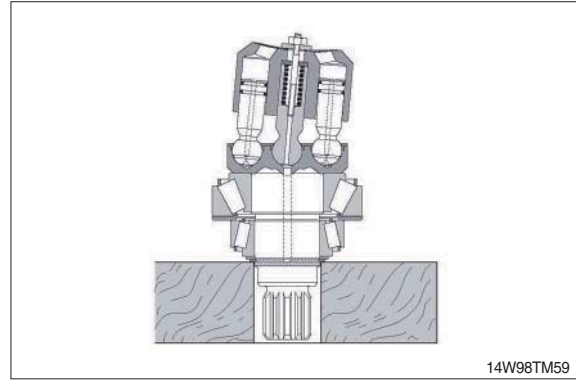
(7) Visual check

- Bearing areas free of scoring and no evidence of wear.

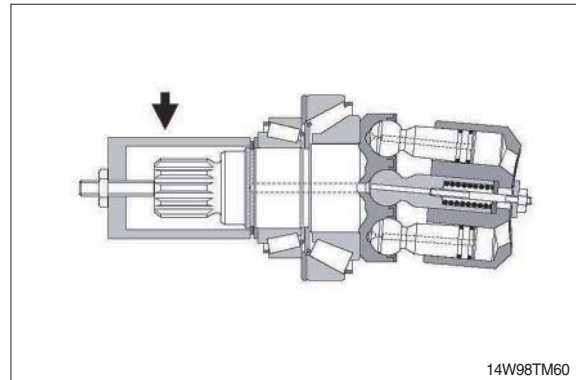


12) ROTARY GROUP ASSEMBLY

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



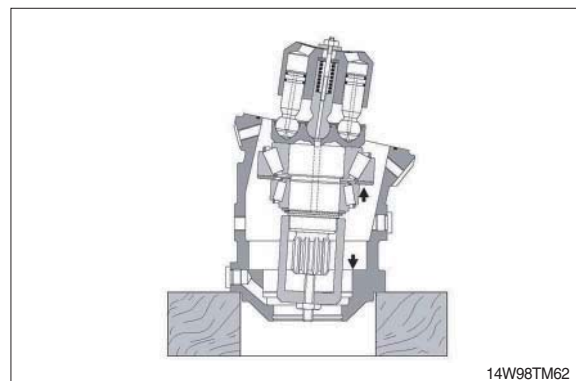
- (2) Place assembly sleeve.



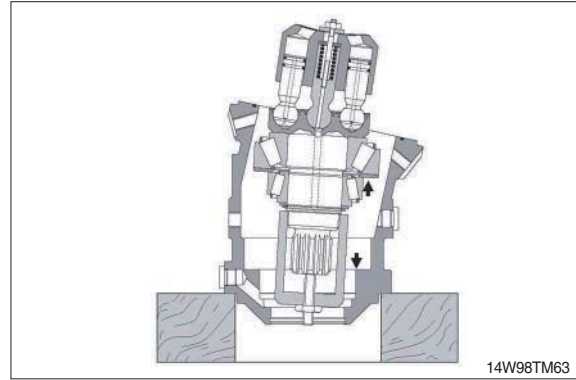
- (3) Warm up housing to 80°C.



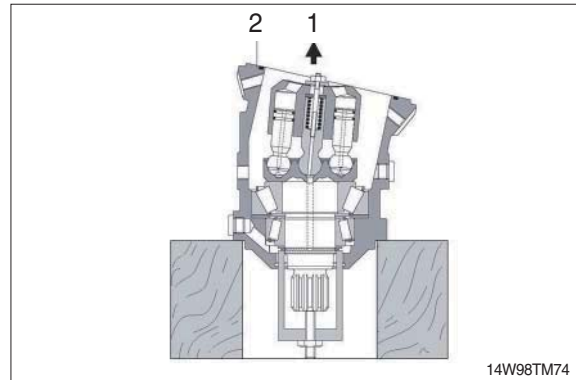
- (4) Insert rotary group into housing to seat position.



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

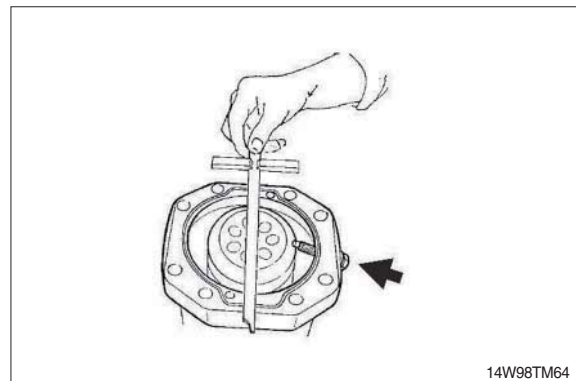


- (6) Fix zero position of cylinder with Q_{max} screw.
- 1 Disassemble cylinder fixing screw
 - 2 Insert O-ring

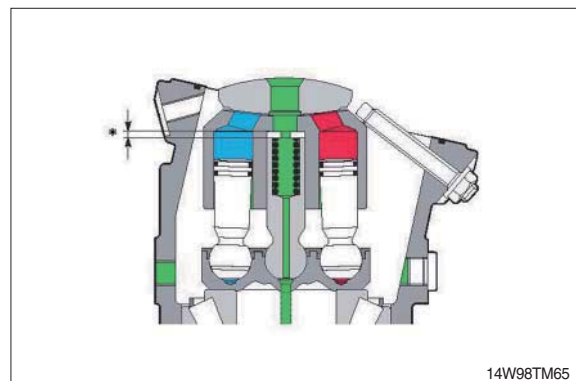


13) ROTARY GROUP ADJUSTMENT

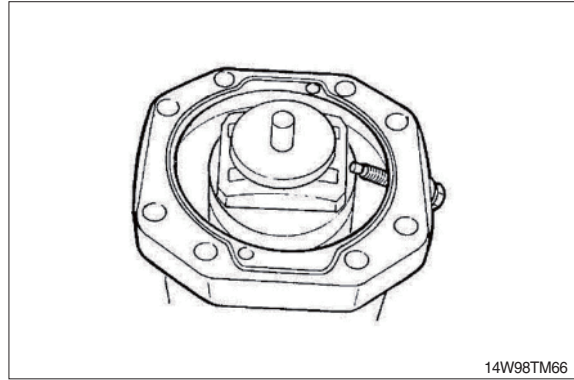
- (1) Determine cylinder swivel range to max angle with screw.



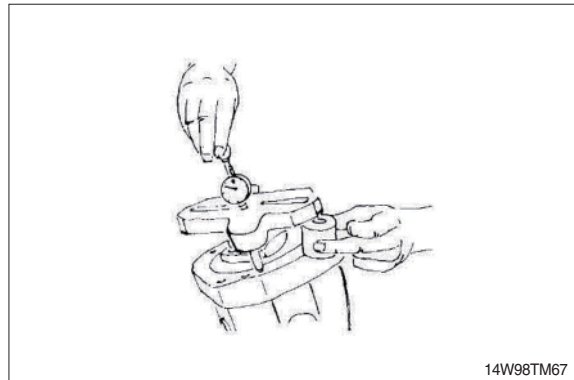
- (2) * Disc



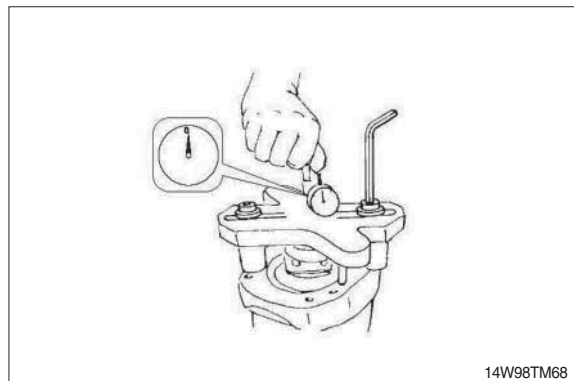
(3) Place centering disc.



(4) Mount measuring device.

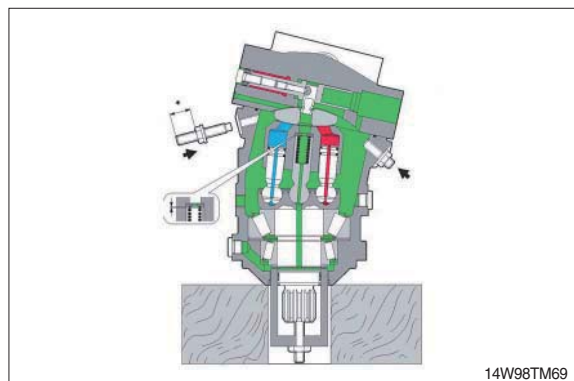


(5) Check dimension X.

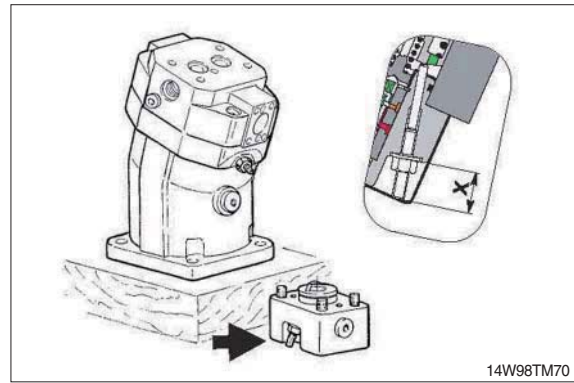


14) ASSEMBLY OF THE PORT PLATE

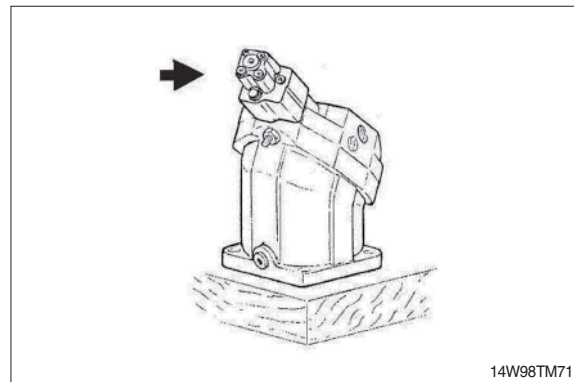
- (1) Assemble port plate.
 - ※ Take care of assembly design.
 - Tighten fixing screws with torque.
- (2) Set Q_{\min} screw to dimension(*).
- (3) Assemble plug.
- (4) Remove assembly sleeve.



(5) Assemble control components.



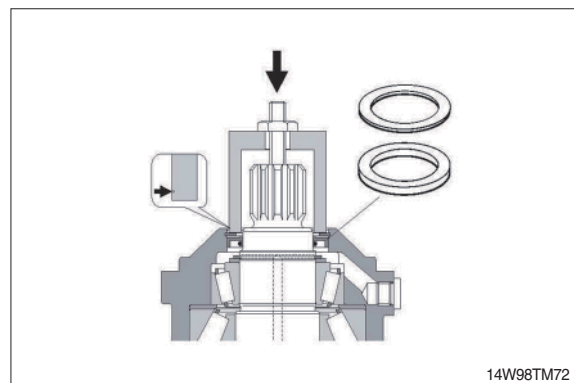
(6) Assemble cover.



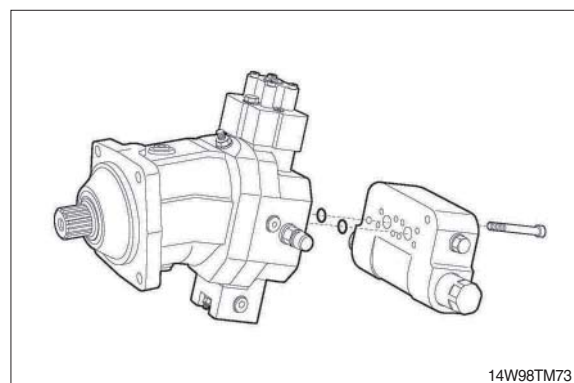
(7) Assemble shaft seal, disc and safety ring.

Press in with assembly sleeve.

※ Take care of press in depth.



(8) Assemble counter balance valve.



GROUP 7 TRANSMISSION

1. REMOVAL AND INSTALL

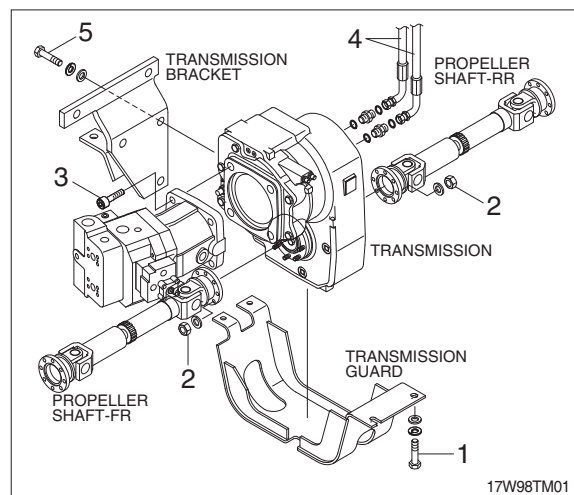
1) REMOVAL

- (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) Remove the transmission guard plate mounting bolt (1).
- (5) Remove the propeller shaft mounting nuts (2).
 - 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 (3).
 - Tightening torque : $29.6 \pm 3.2 \text{ kgf} \cdot \text{m}$
($214 \pm 23.1 \text{ lbf} \cdot \text{ft}$)
- (7) Remove the hoses (4).
Fit blind plugs to the disconnected hoses.
- (8) Remove the mounting bolts (5), then remove the transmission device assembly.
 - Weight : 135 kg (298 lb)
 - Tightening torque : $58 \pm 6.3 \text{ kgf} \cdot \text{m}$
($420 \pm 45.6 \text{ lbf} \cdot \text{ft}$)



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.

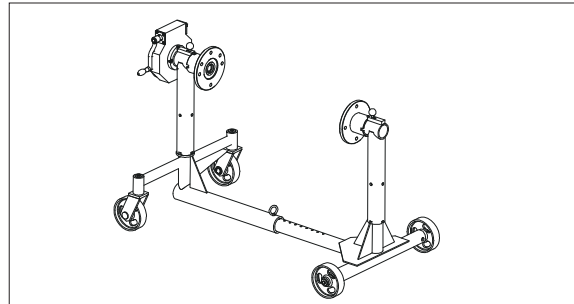
2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

- (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

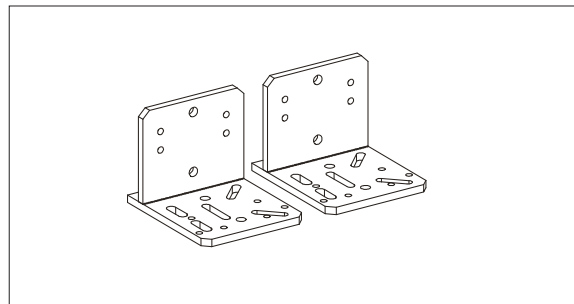
5870 350 000



14WF8TM01

- 2) Supporting bracket

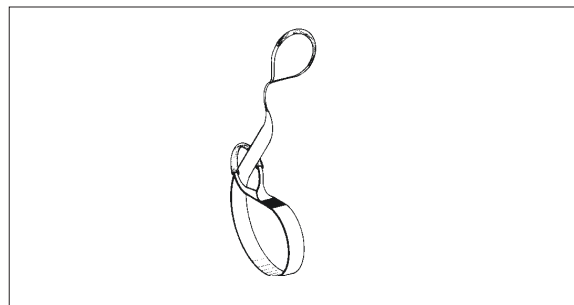
5870 350 106



14WF8TM02

- 3) Lifting strap

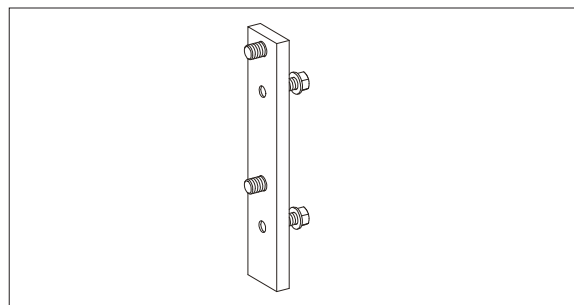
5870 281 026



14WF8TM03

- 4) Fixture

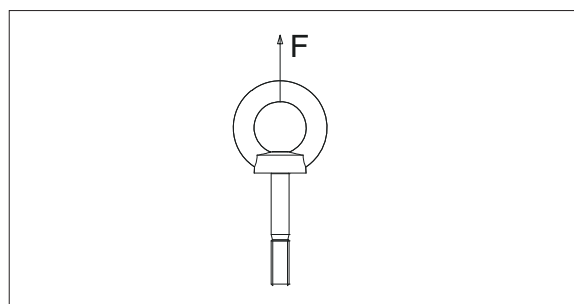
5870 350 079



14WF8TM04

- 5) Eye bolt assortment

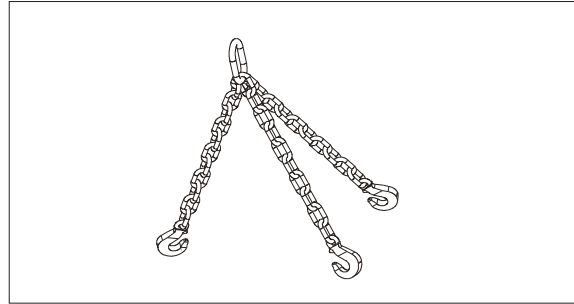
5870 204 002



14WF8TM05

6) Lifting chain

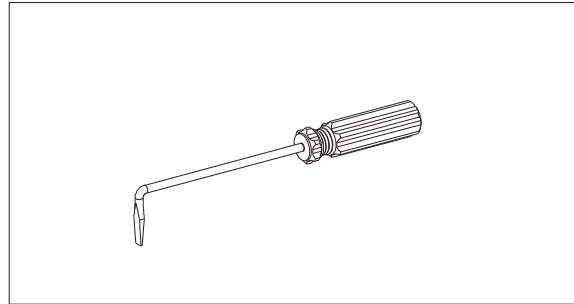
5870 221 047



14WF8TM06

7) Resetting device

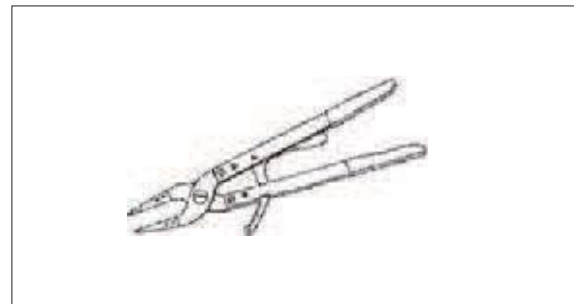
5870 400 001



14WF8TM07

8) Clamping pliers

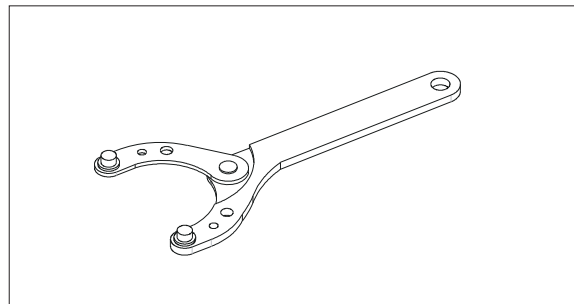
5870 900 021



14WF8TM08

9) Clamping fork

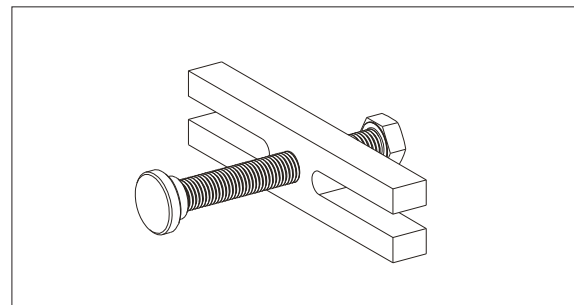
5870 240 025



14WF8TM09

10) Extractor

5870 000 017



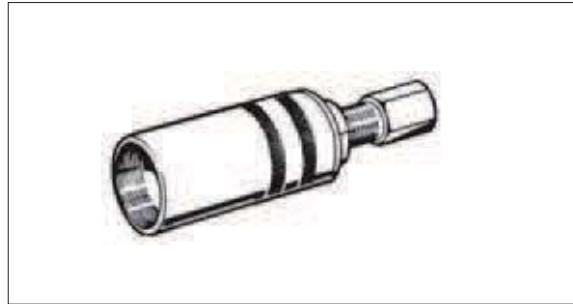
14WF8TM10

11) Rapid grip
5873 012 021



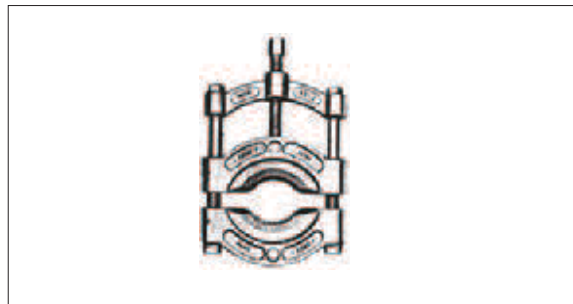
14WF8TM11

12) Basic tool
5873 002 001



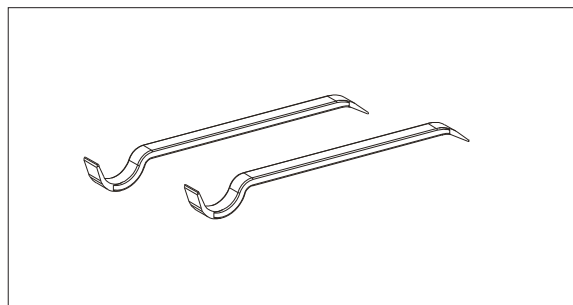
14WF8TM12

13) Cut-off device
5870 300 028



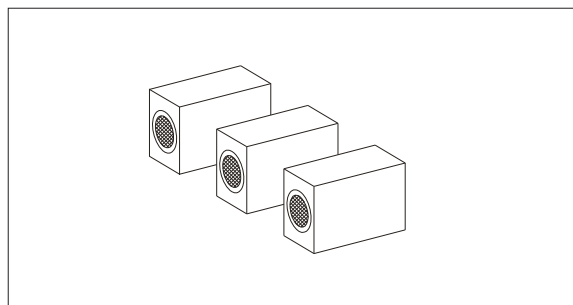
14WF8TM13

14) Assembly lever
5870 345 036



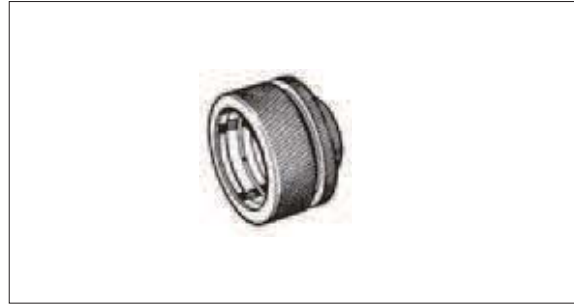
14WF8TM14

15) Solenoid block
5870 450 003



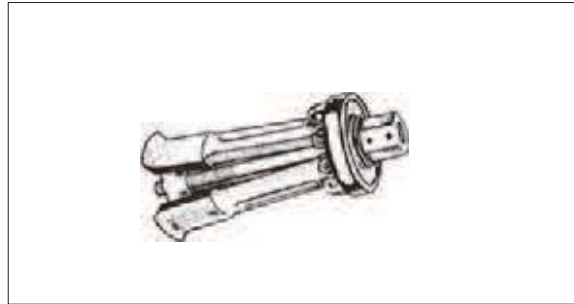
14WF8TM15

16) Grab sleeve
5873 001 037



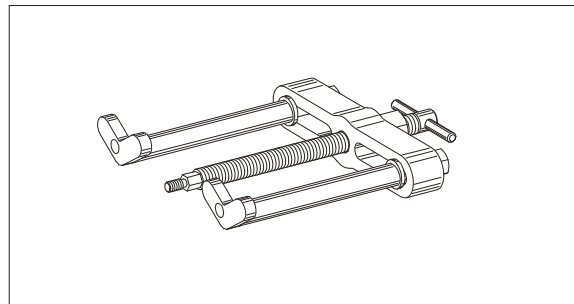
14WF8TM16

17) Inner extractor
5870 300 019



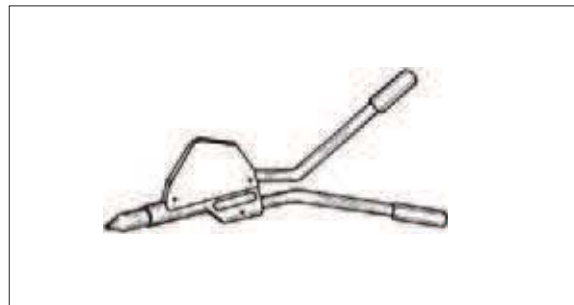
14WF8TM17

18) Counter support
5870 300 020



14WF8TM18

19) Lever riveting tongs
5870 320 016



14WF8TM19

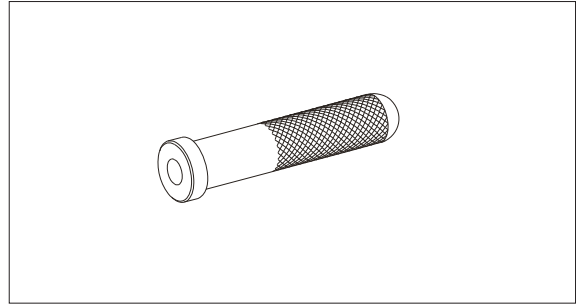
20) Driver tool
5870 058 073



14WF8TM20

21) Handle

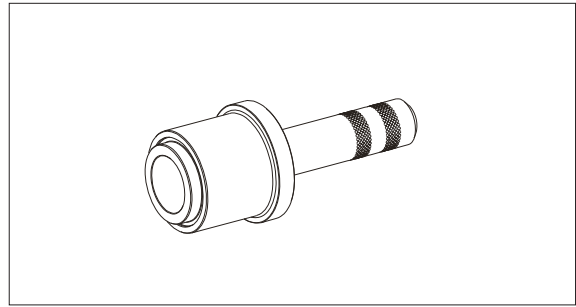
5870 260 002



14WF8TM21

22) Driver tool

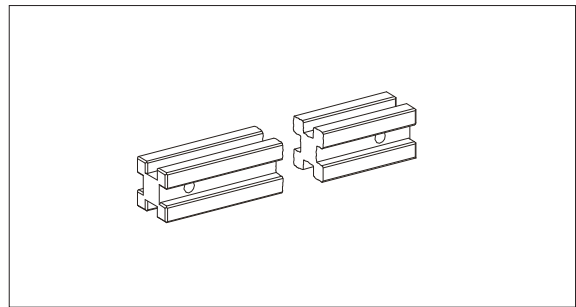
5870 048 281



14WF8TM22

23) Straightedge

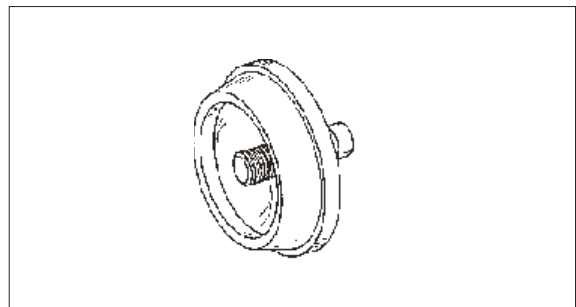
5870 200 108



14WF8TM23

24) Driver tool

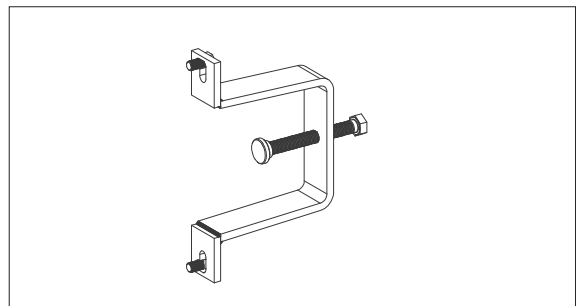
5870 058 078



14WF8TM24

25) Clamping bar

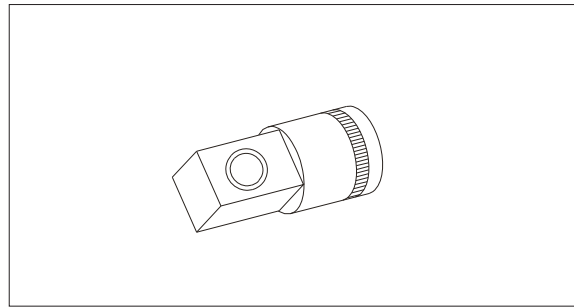
5870 654 049



14WF8TM25

26) Reduction

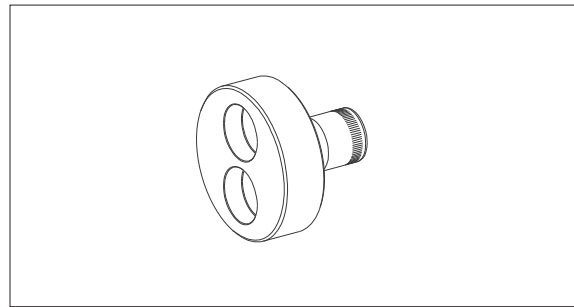
5870 656 056



14WF8TM26

27) Plug insert

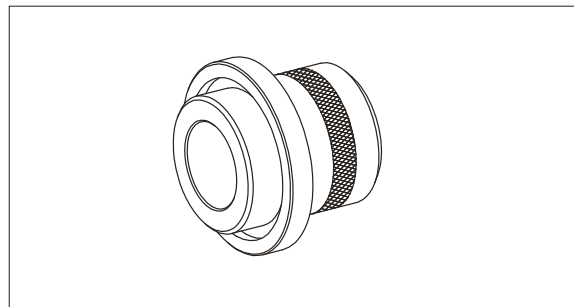
AA00 392 461



14WF8TM27

28) Driver tool

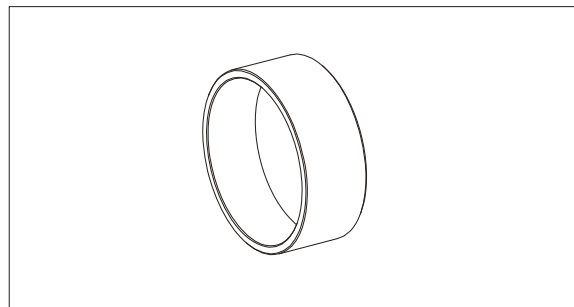
5870 048 279



14WF8TM28

29) Pressure piece

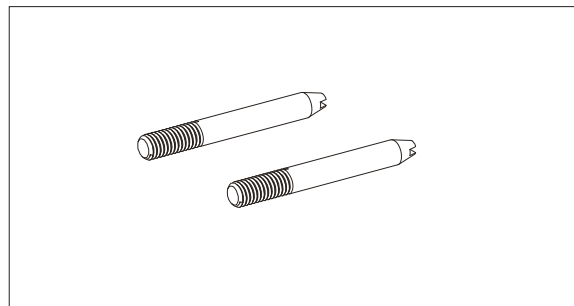
5870 506 150



14WF8TM29

30) Adjusting screws (M12)

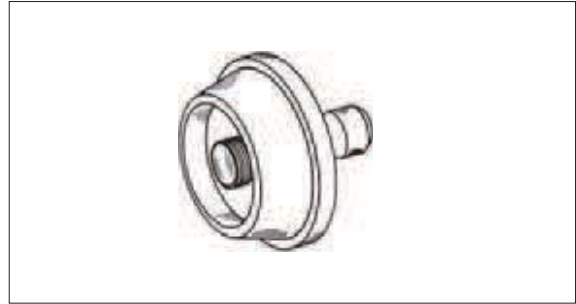
5870 204 021



14WF8TM30

31) Driver tool

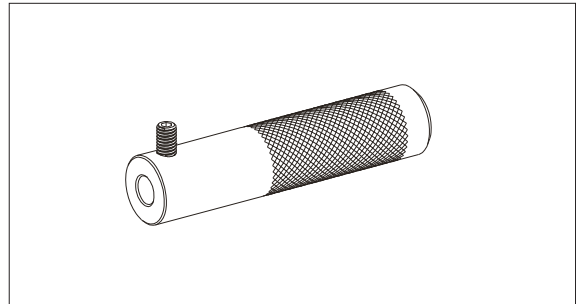
5870 058 051



14WF8TM31

32) Press-fit mandrel

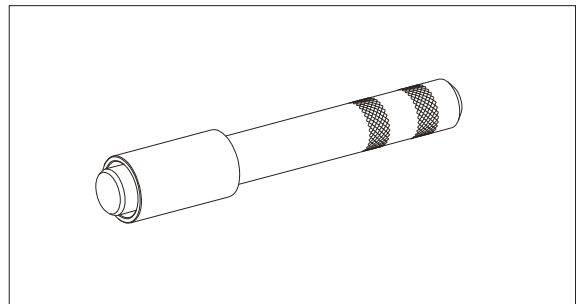
AA00 392 151



14WF8TM32

33) Driver tool

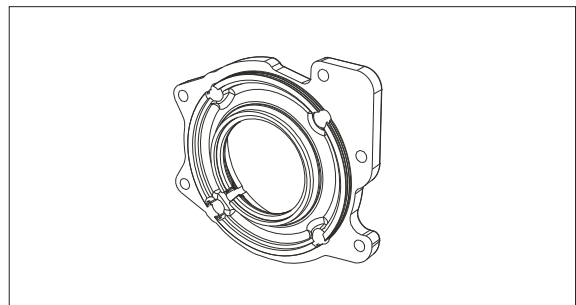
5870 048 283



14WF8TM33

34) Measuring device

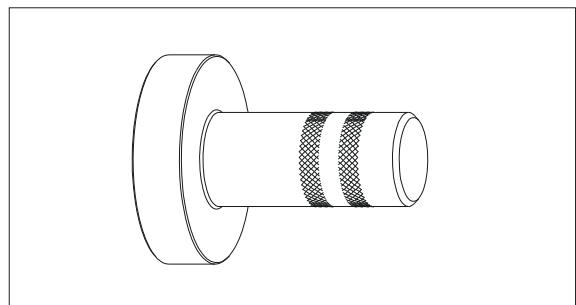
5870 200 131



14WF8TM34

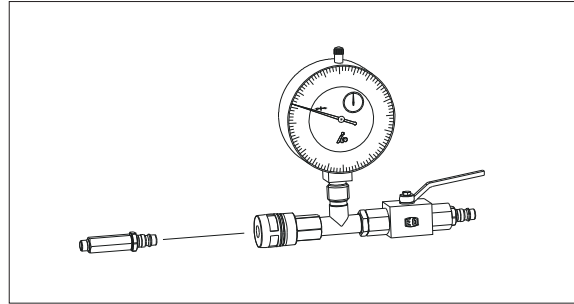
35) Driver tool

5870 506 161



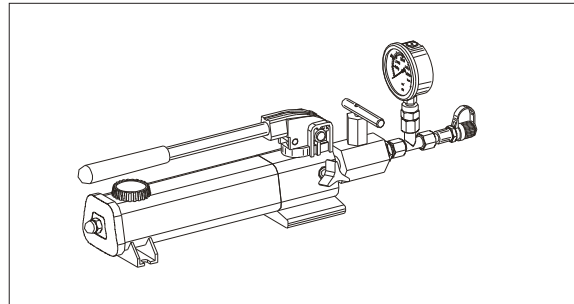
14WF8TM35

36) Air connection
5870 505 012



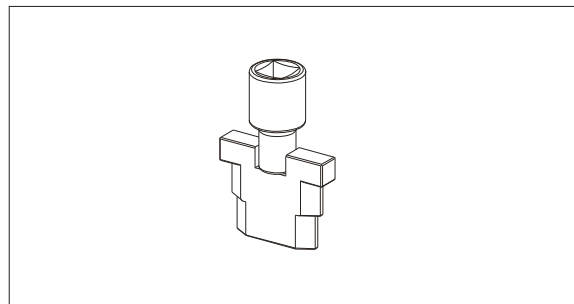
14WF8TM36

37) HP pump
5870 287 007



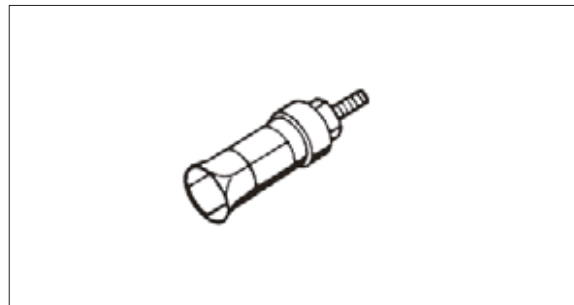
14WF8TM37

38) Spline mandrel
5870 510 039



14WF8TM38

39) Inner extractor
5870 300 012



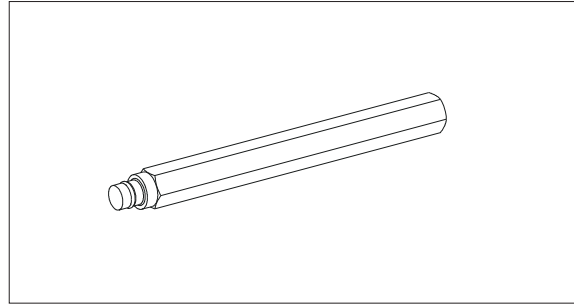
14WF8TM39

40) Counter support
5870 300 011



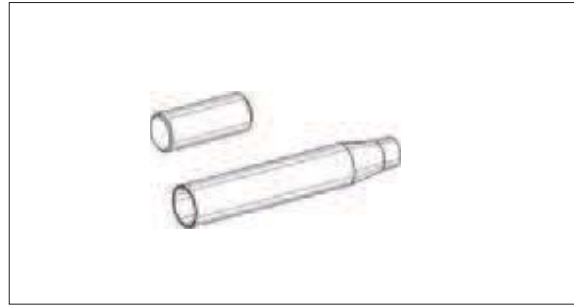
14WF8TM40

41) Driver tool
5870 705 003



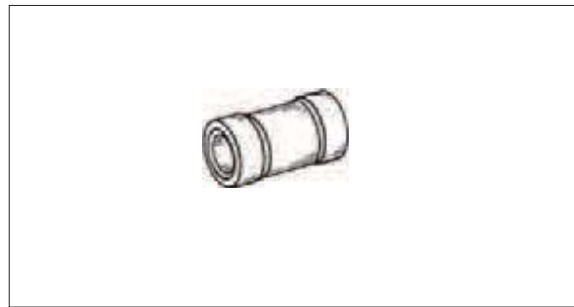
14WF8TM41

42) Inner installer
5870 651 055



14WF8TM42

43) Calibrating mandrel
5870 651 056



14WF8TM43

4. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

1) Magnetic stand

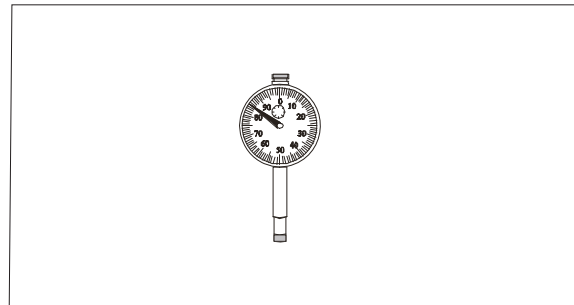
5870 200 055



14WF8TM44

2) Dial indicator

5870 200 057



14WF8TM45

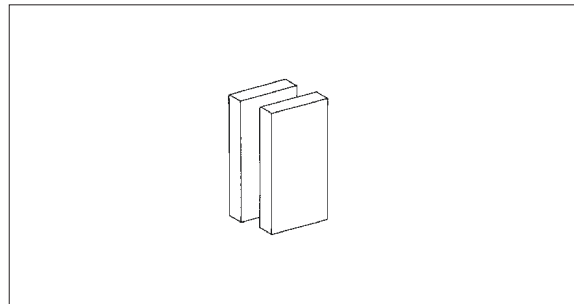
3) Gauge blocks

5870 200 066

70 mm

5870 200 067

100 mm



14WF8TM46

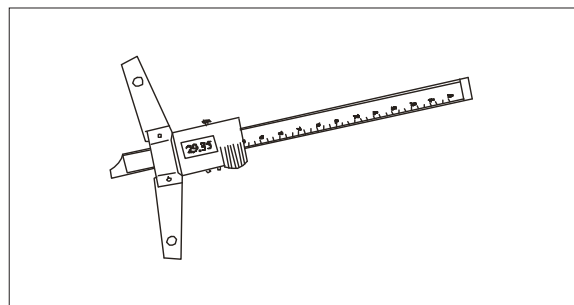
4) Digital depth gauge

5870 200 072

200 mm

5870 200 114

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



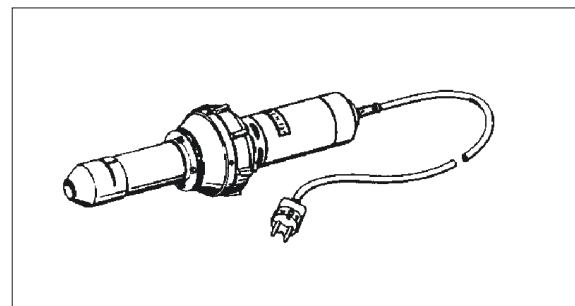
14WF8TM49



14WF8TM50

7) Hot air blower

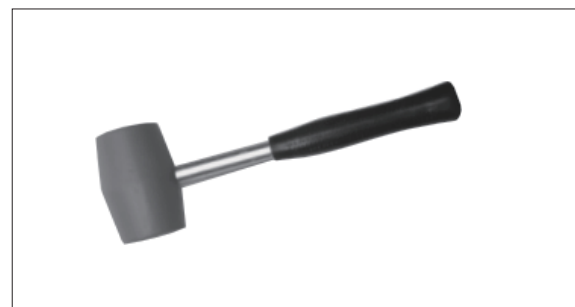
5870 221 500	230 V
5870 221 501	115 V



14WF8TM51

8) Plastic hammer

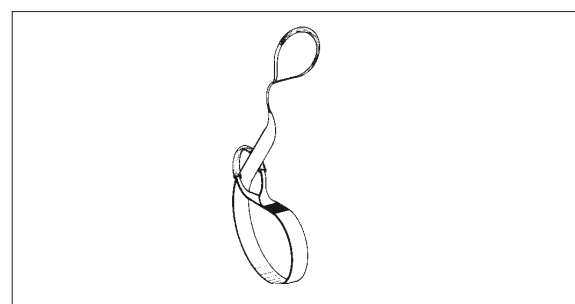
5870 280 004	Ø 60 mm
Substitute nylon insert	
5870 280 006	



14WF8TM52

9) Lifting strap

5870 281 026



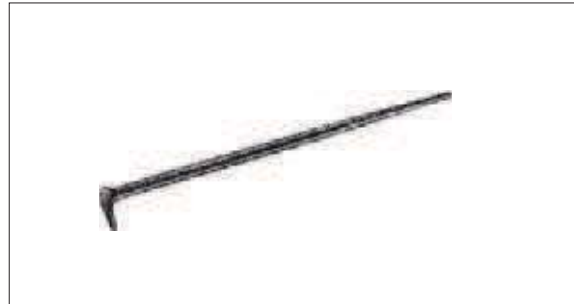
14WF8TM53

10) Lifting chain
5870 281 047



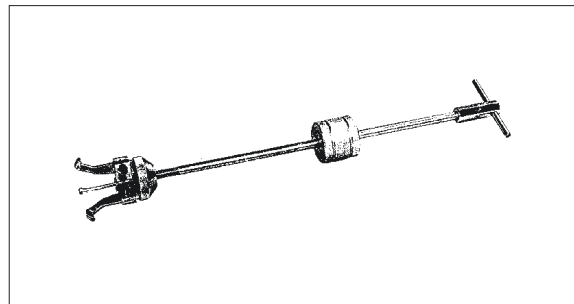
14WF8TM54

11) Pry bar
5870 345 071



14WF8TM55

12) Striker
5870 650 004



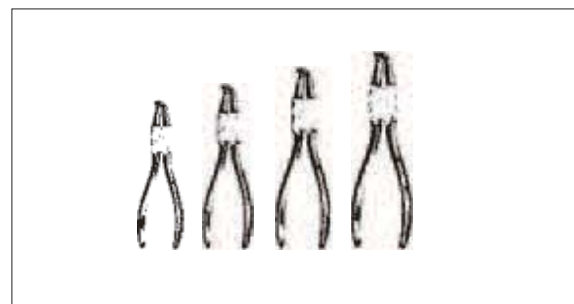
14WF8TM56

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

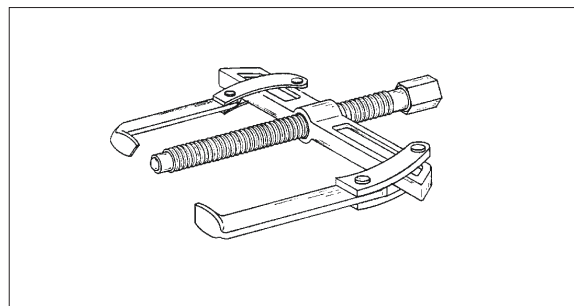
Jaw width 250 mm

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

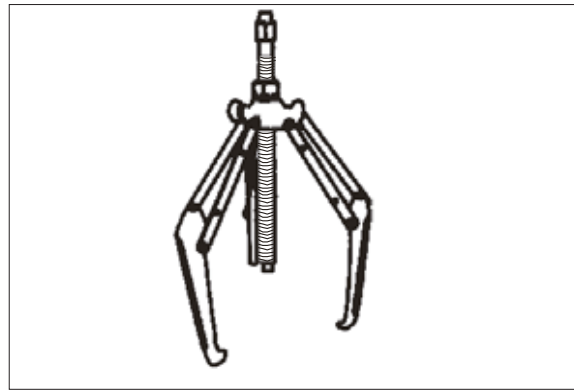
Jaw width 390 mm

Throat depth 230 mm

5870 971 006

Jaw width 640 mm

Throat depth 290 mm



14WF8TM62

5. SEPARATE TRANSMISSION FROM AXLE HOUSING

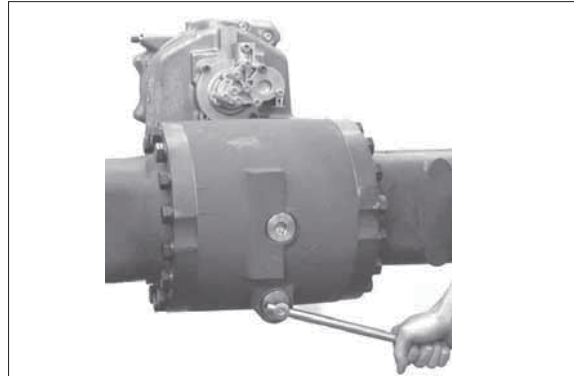
(only for version Axle attachment)

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

(S) Assembly truck 5870 350 000

(S) Clamping fork 5870 350 106

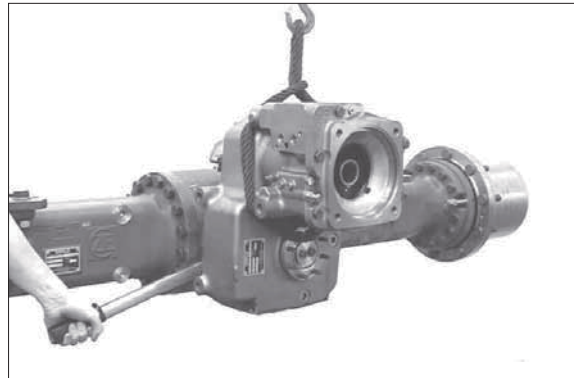
▲ Waste oil to be disposed of ecologically.



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

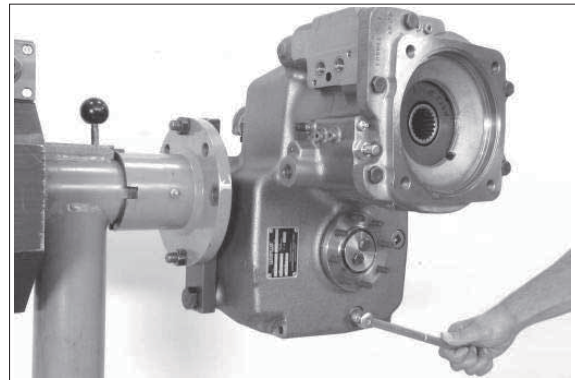
(S) Fixture 5870 350 079



14WF8TM65

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

⚠ Waste oil to be disposed of ecologically.

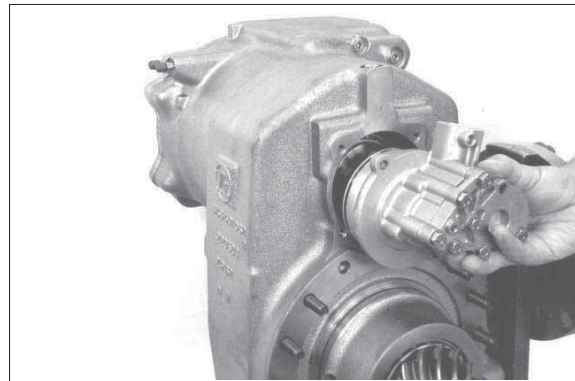


14WF8TM66

Lubrication pump

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

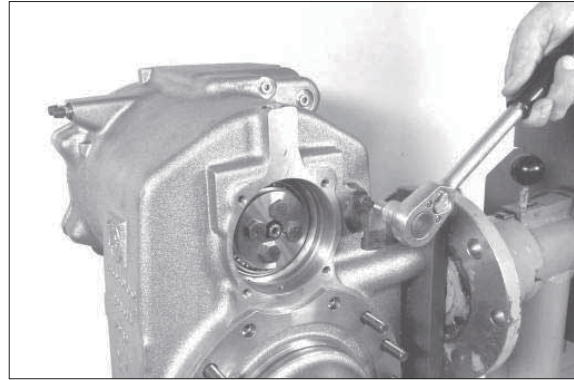
※ Complete disassembly of lubrication pump / shift interlock – see page 8-154-20.



14WF8TM67

Speed sensor

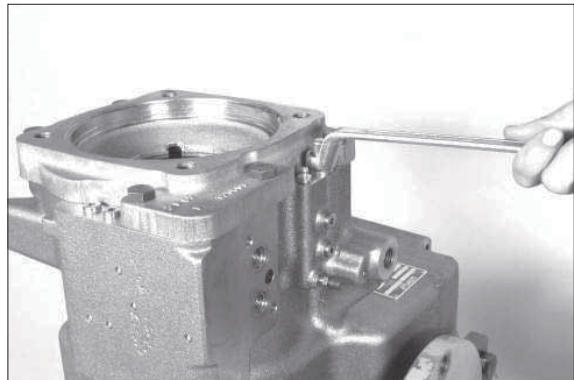
- 4) Loosen screw and pull off speed sensor.



14WF8TM68

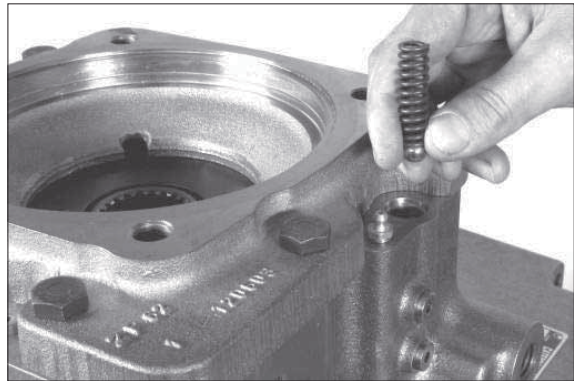
Emergency release (Parking brake)

- 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.



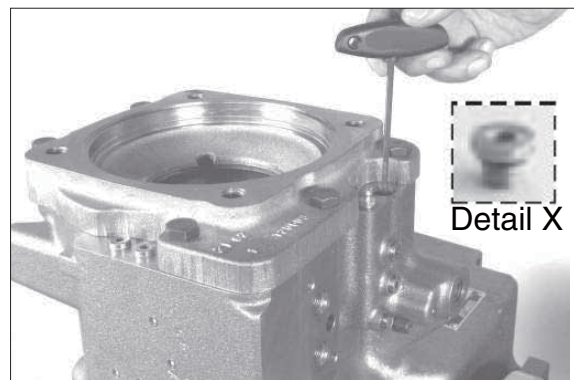
14WF8TM69

- 6) Remove compression spring and ball.



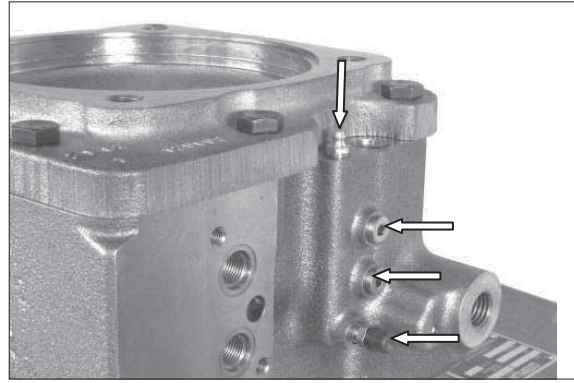
14WF8TM70

- 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

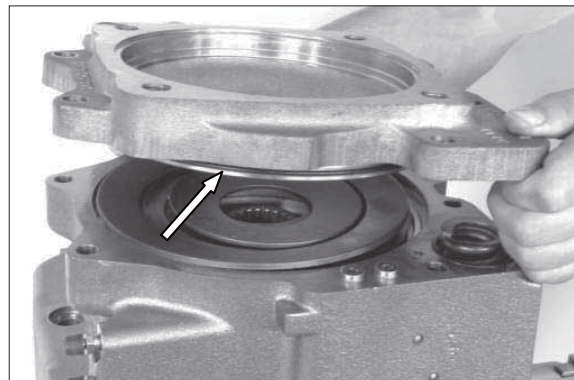
Input housing and modulation valve

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



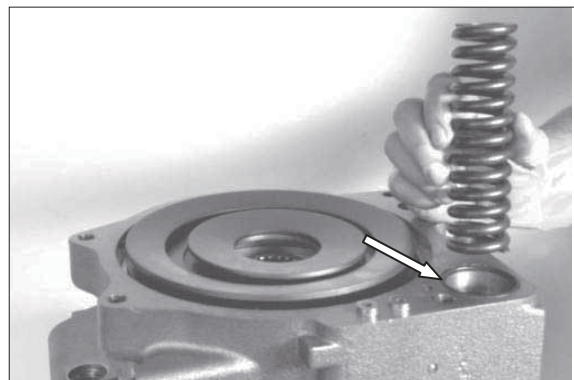
14WF8TM73

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



14WF8TM74

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



14WF8TM75

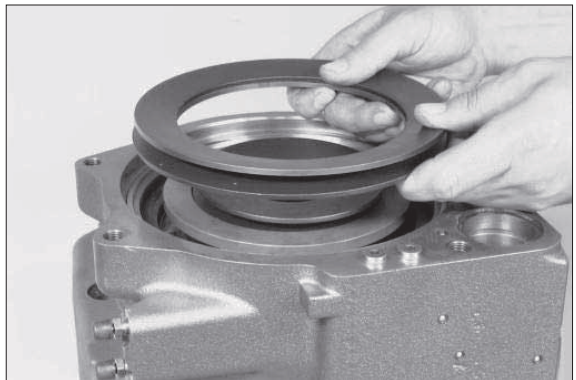
12) Pull complete piston out of hole.



14WF8TM76

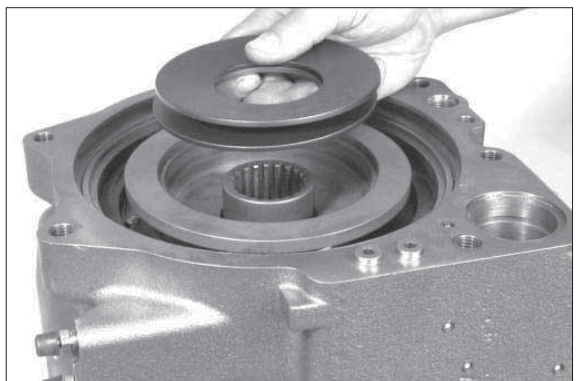
Brake and clutch

13) Remove cup springs from brake.



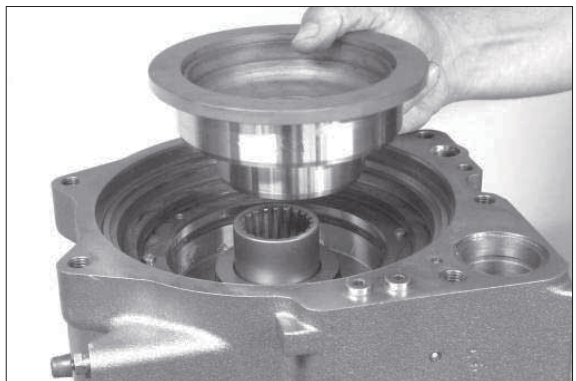
14WF8TM77

14) Remove cup springs from clutch.



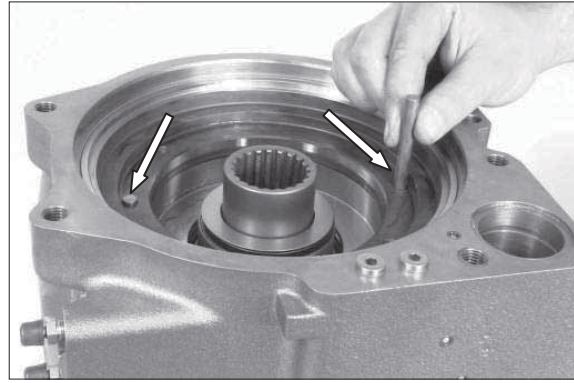
14WF8TM78

15) Remove piston.



14WF8TM79

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

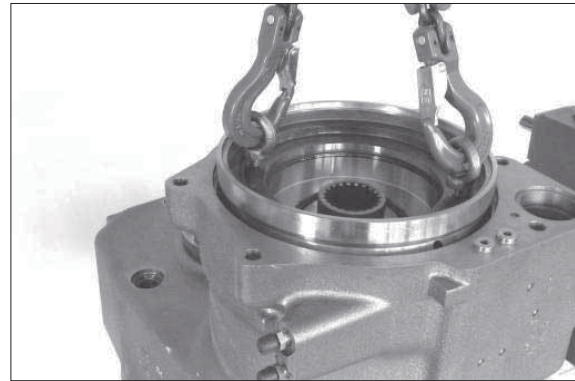


14WF8TM80

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.



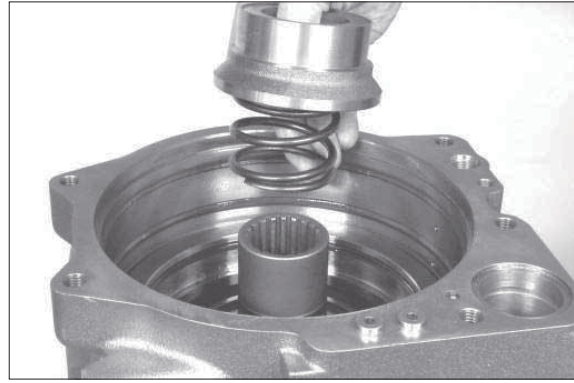
14WF8TM82

19) Remove axial roller cage with both thrust washers.



14WF8TM83

20) Remove pressure piece and compression spring.

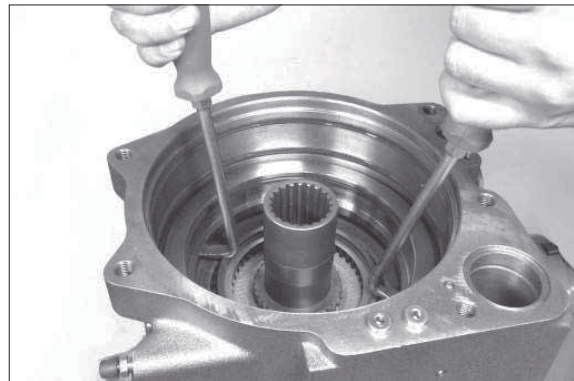


14WF8TM84

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

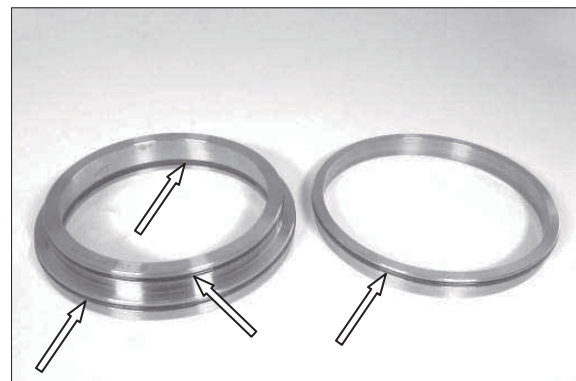
22) Remove pressure ring from ring cautiously with lever – risk of damaging sealing surfaces .

(S) Resetting device 5870 400 001



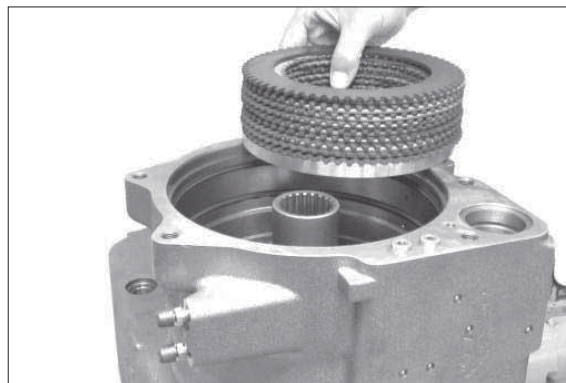
14WF8TM86

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



14WF8TM87

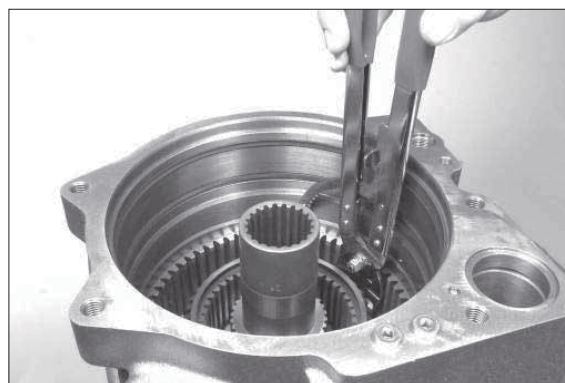
24) Take disk package of brake with end plate(s) out of housing.



14WF8TM88

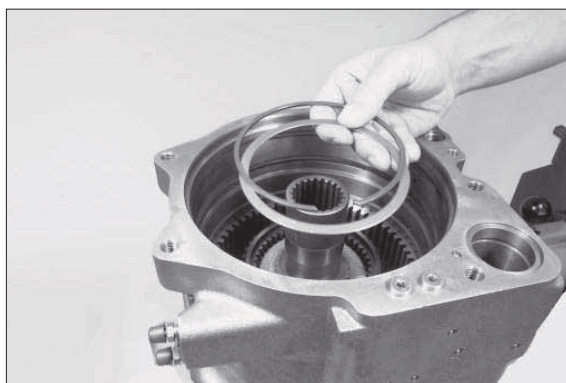
25) Disengage retaining ring.

(S) Clamping pliers 5870 900 021



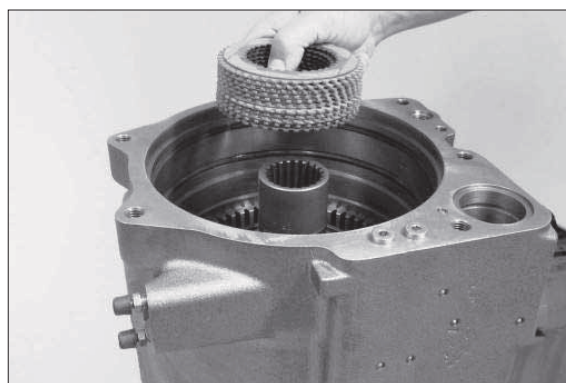
14WF8TM89

26) Remove snap ring and shim.



14WF8TM90

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



14WF8TM91

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

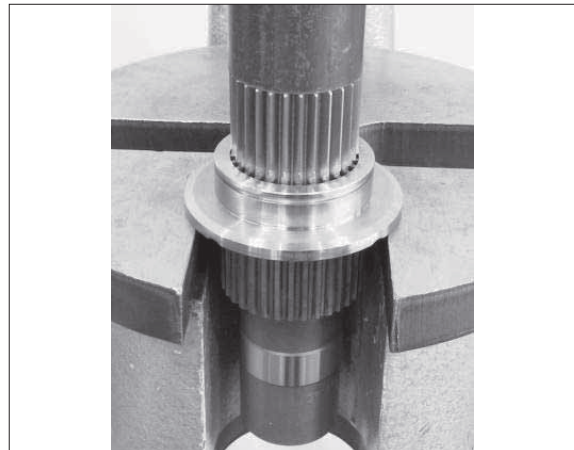
31) Unsnap retaining ring.



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.

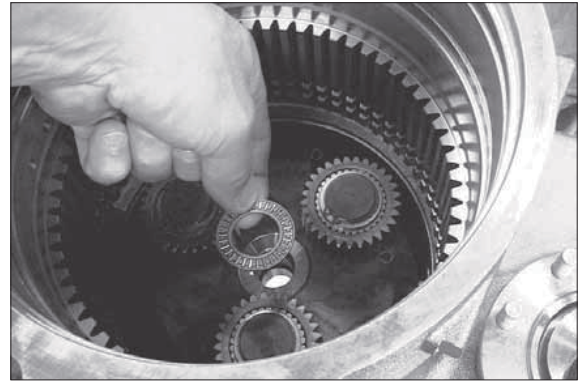
(S) Clamping pliers 5870 900 021



14WF8TM97

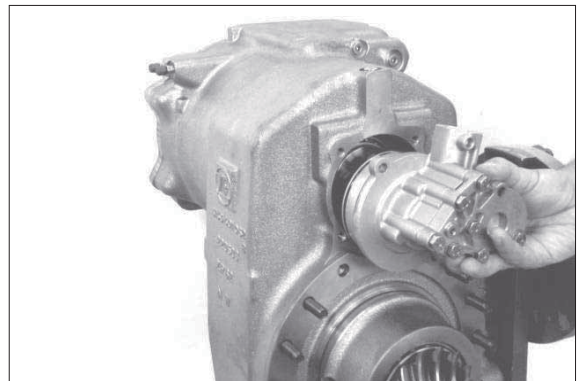
Planetary carrier

34) Remove axial needle cage.



14WF8TM98

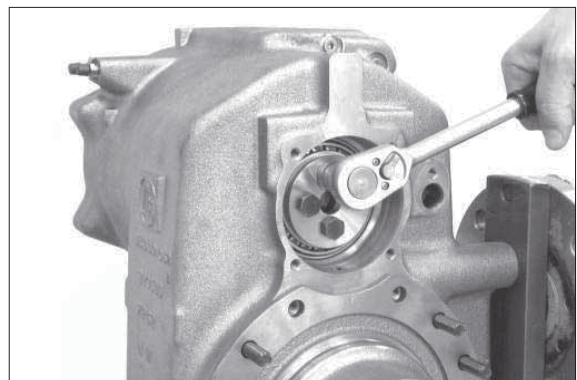
35) If not yet disassembled previously – remove lubrication pump or shift interlock (depending on version). (Illustration shows version - Lubrication pump).



14WF8TM99

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

(S) Clamping fork 5870 240 025

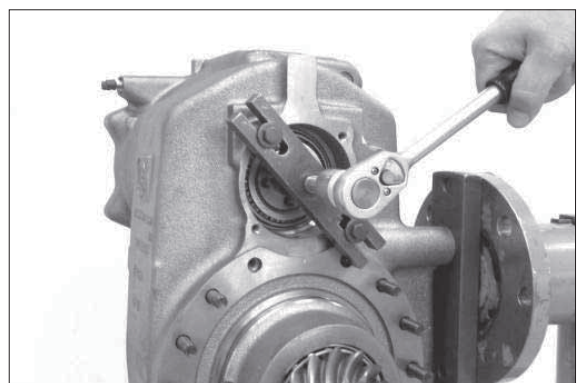


14WF8TM100

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

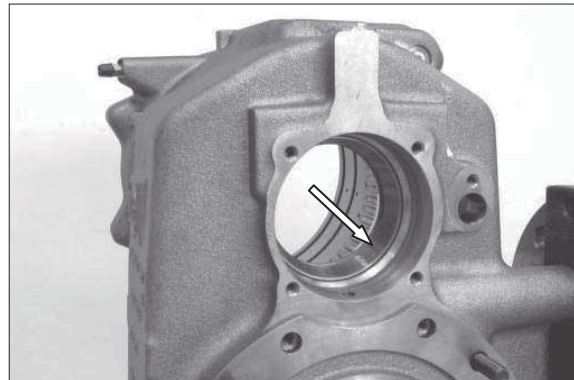
(S) Basic tool 5873 002 001



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.

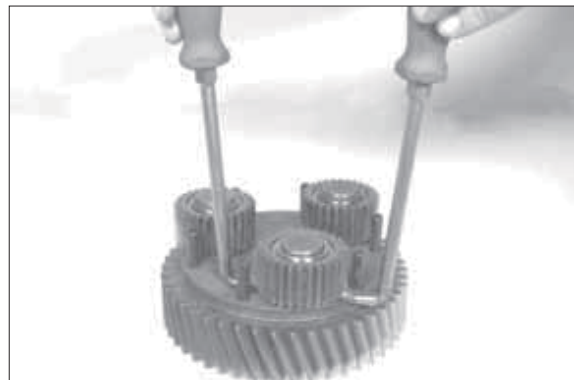


14WF8TM104

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).

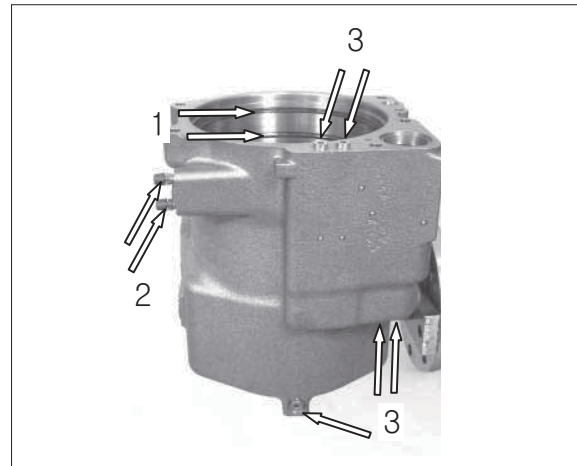


14WF8TM105

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 .



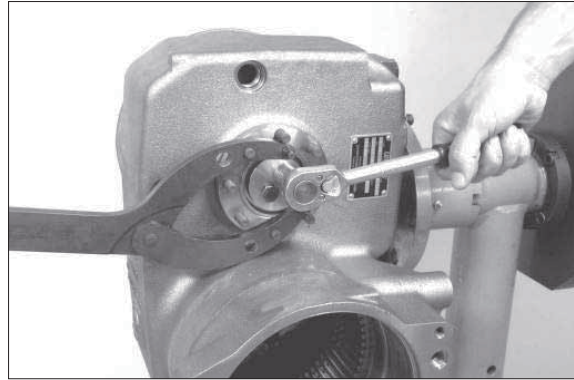
14WF8TM107

7. DISASSEMBLY - OUTPUT

Version "Axle attachment"

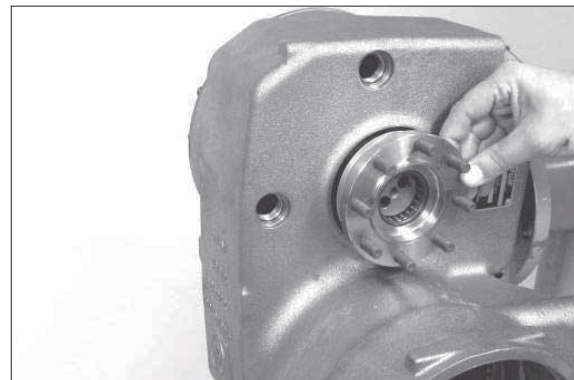
- 1) Loosen threaded joint, remove cover and O-ring.

※ (S) Clamping fork 5870 240 025



14WF8TM108

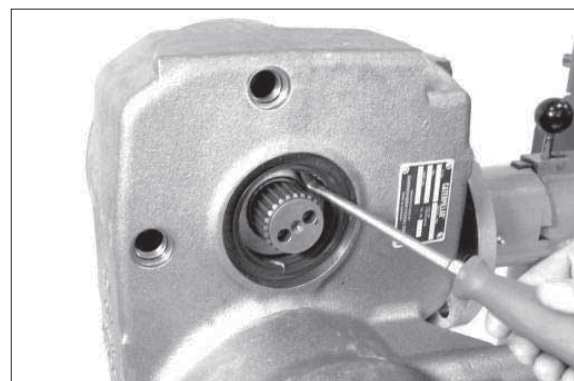
- 2) Pull off flange.



14WF8TM109

- 3) Remove shaft seal with a lever.

※ (S) Resetting device 5870 400 001



14WF8TM110

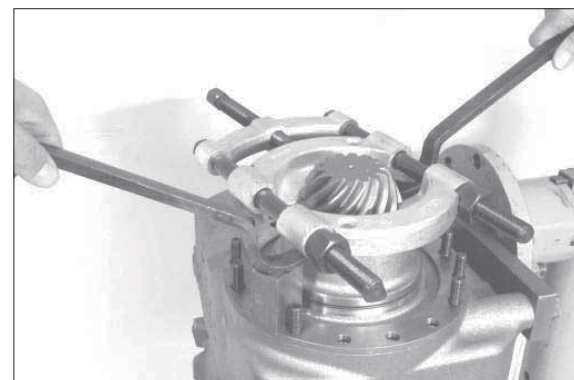
- 4) Fix pinion with fixture and press off.

(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

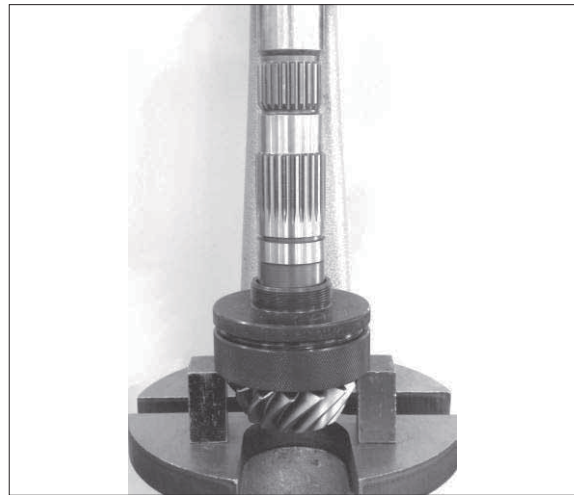
5) Remove O-ring (see arrow) and bush from pinion.



14WF8TM12

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

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



14WF8TM13

7) Pull bearing outer ring out of bearing cover.

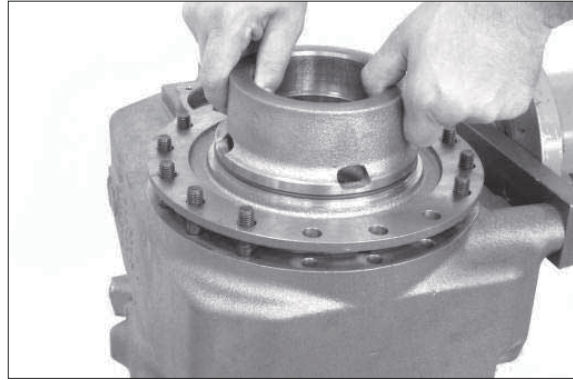
(S) Inner extractor 5870 300 019
(S) Counter support 5870 300 020

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



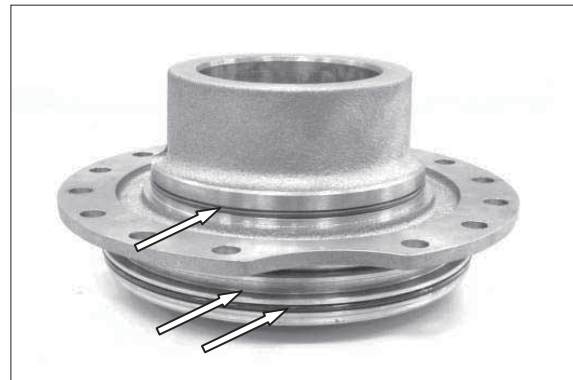
14WF8TM14

8) Pull off bearing cover.



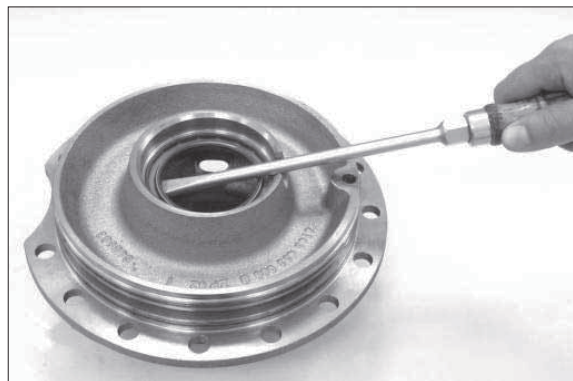
14WF8TM115

9) Remove O-rings (arrows).



14WF8TM116

10) Remove shaft seal.



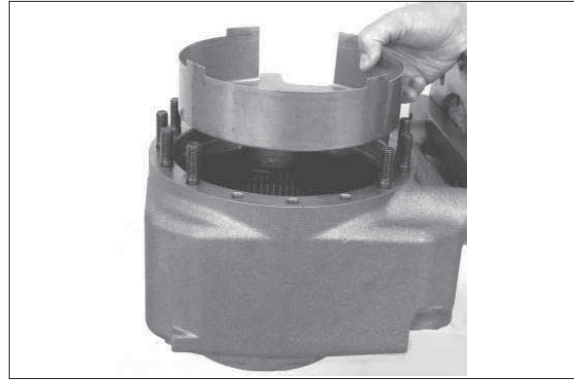
14WF8TM117

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



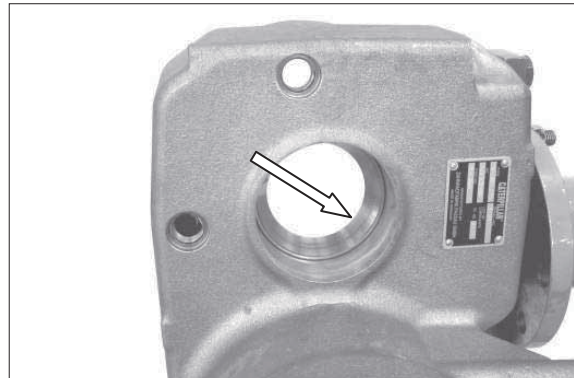
14WF8TM118

12) Remove screen sheet.



14WF8TM119

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



14WF8TM120

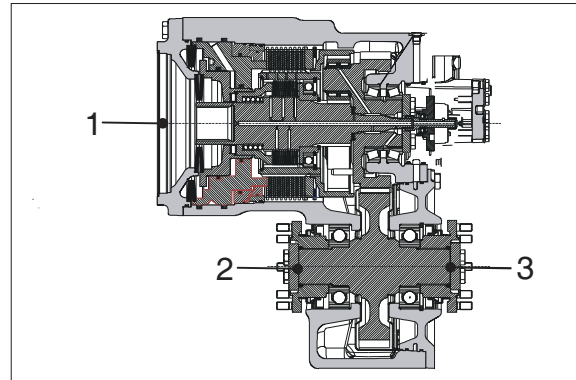
14) If necessary, remove stud bolts.



14WF8TM121

Version "Separate installation"

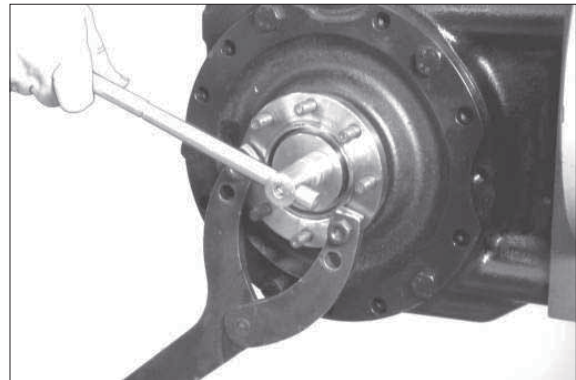
- 15) 1 = Input
- 2 = Output – front axle
- 3 = Output – rear axle



14WF8TM122

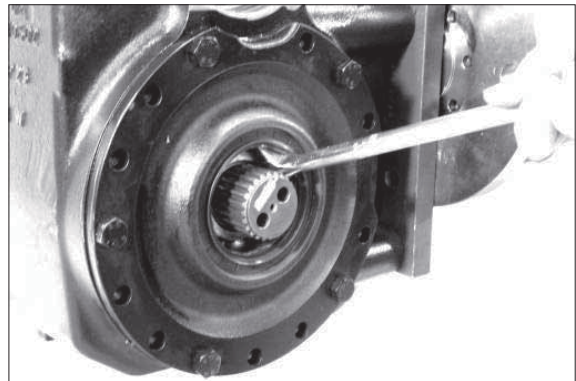
- 16) Use clamping fork to fix output flange.
Loosen threaded joint, pull off disk, O-ring and flange.

(S) Clamping fork 5870 240 025



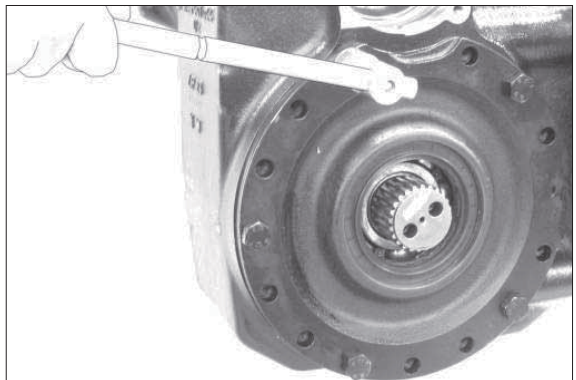
14WF8TM123

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



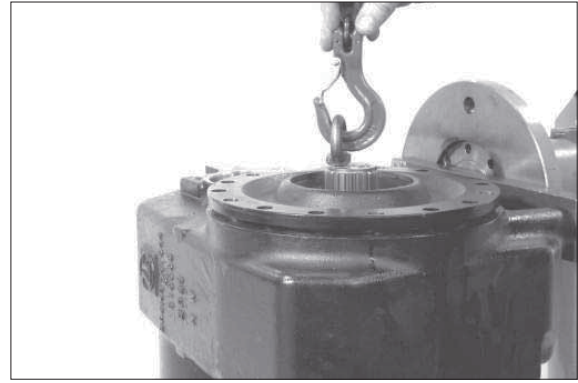
14WF8TM124

- 18) Loosen threaded joint.



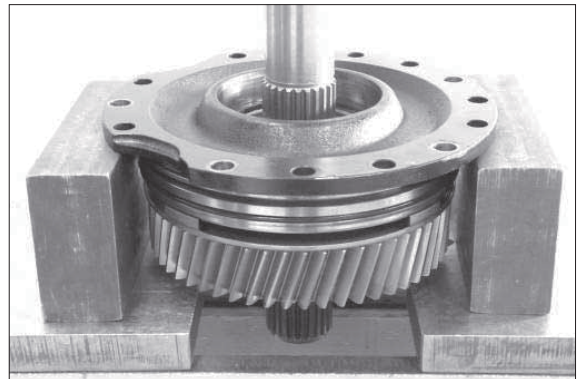
14WF8TM125

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



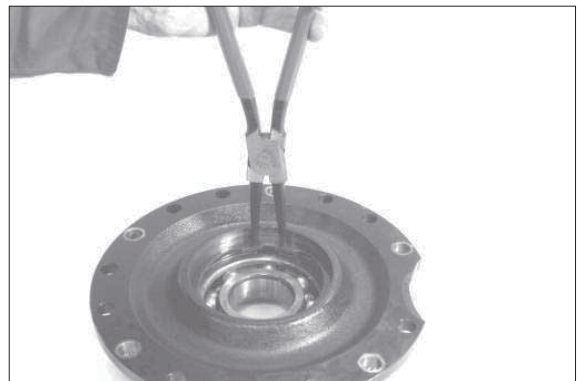
14WF8TM126

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.



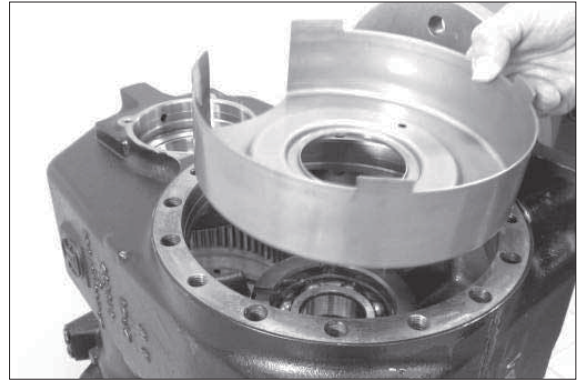
14WF8TM128

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



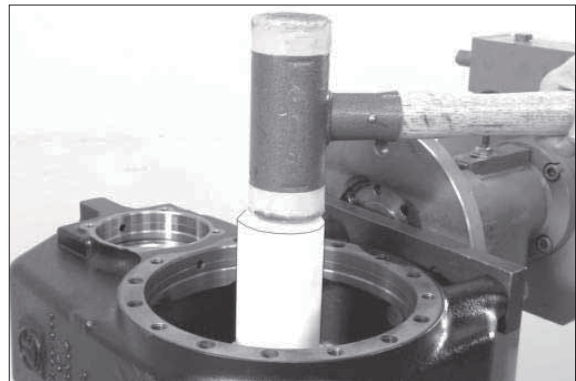
14WF8TM129

23) Remove screen sheet from transmission housing.



14WF8TM130

24) Disassemble ball bearing from housing hole.

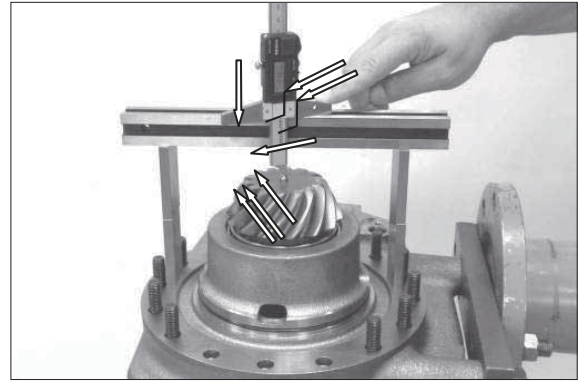


14WF8TM131

8. REASSEMBLY - OUTPUT

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

(S) Lever riveting tongs 5870 320 016



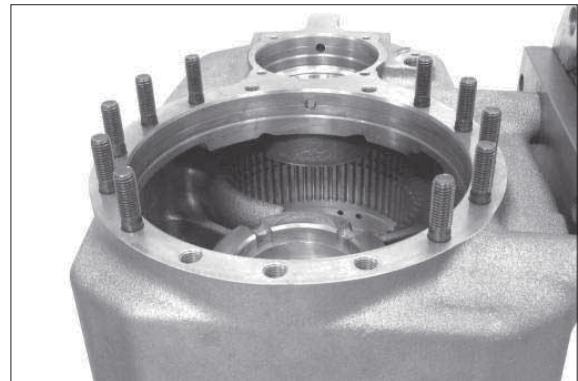
14WF8TM132

Version "Axle attachment"

- 2) Install stud bolts.

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

※ Pay attention to installation position.

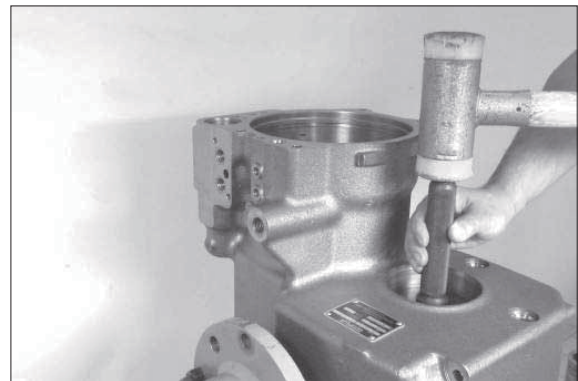


14WF8TM133

- 3) Install bearing outer ring until contact.

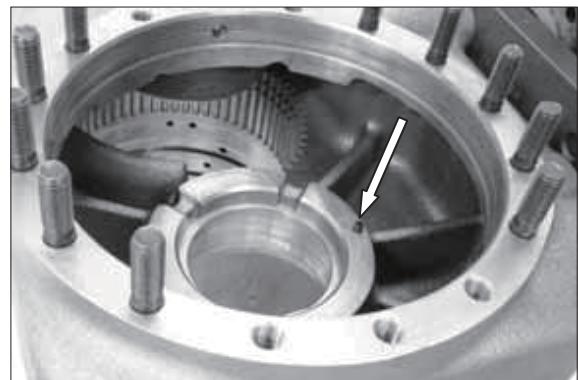
(S) Driver tool 5870 058 073

(S) Handle 5870 260 002



14WF8TM134

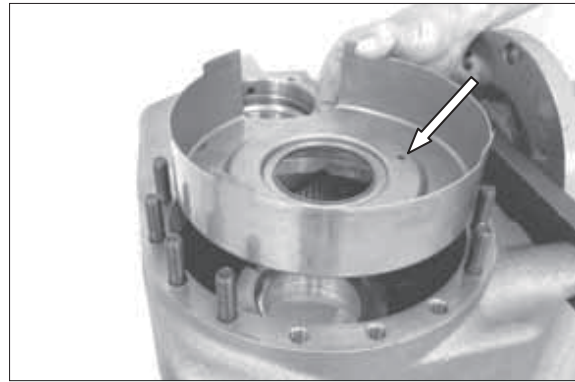
- 4) Insert slotted pin (see arrow) to the bottom.



14WF8TM135

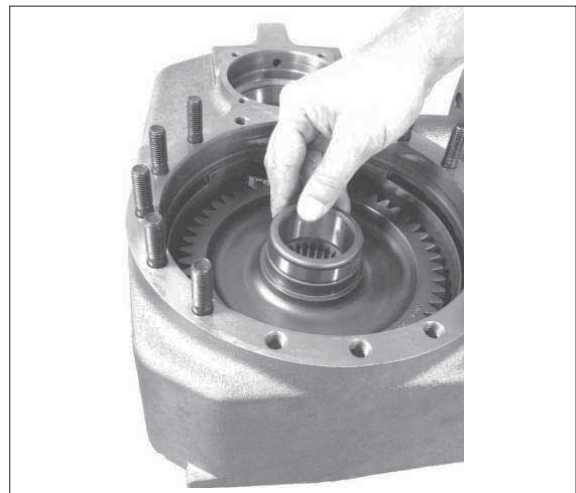
5) Position screen sheet – with slotted pin (see 14WF8TM135) into fixing hole (arrow).

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



14WF8TM136

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



14WF8TM137

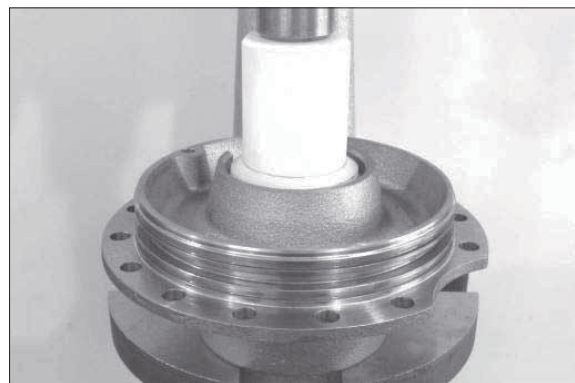
7) Press shaft seal into bearing cover.

(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.

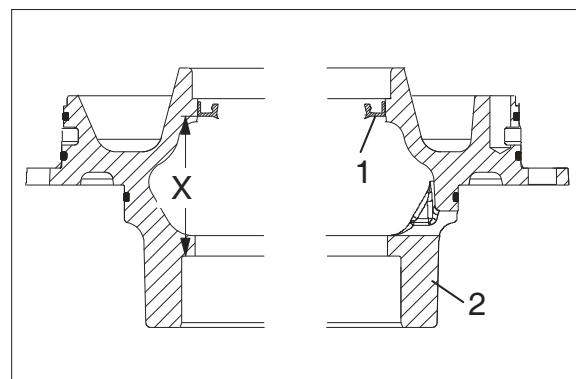


14WF8TM138

8) 1 = Shaft seal

2 = Bearing cover

X = Installation dimension



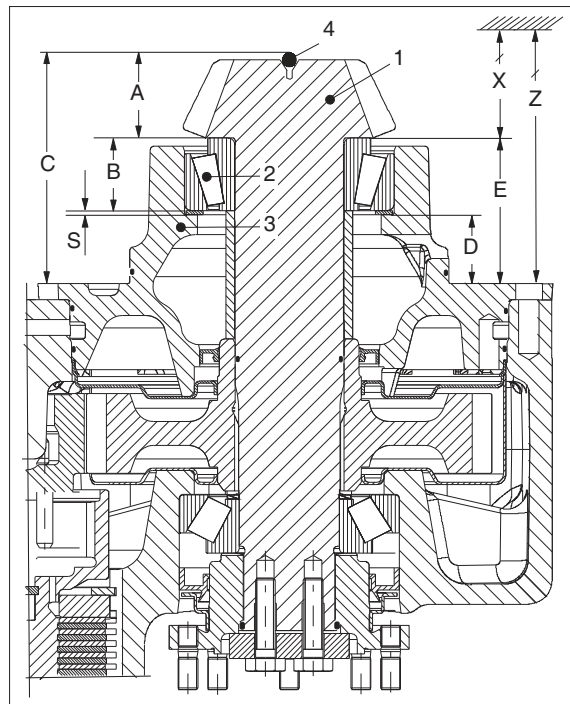
14WF8TM139

Determine shim for pinion gap

- 9) 1 = Pinion
 2 = Roller bearing
 3 = Bearing cover
 4 = Ball ($\varnothing = 7 \text{ mm}$)

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 ($\varnothing = 7 \text{ mm}$) 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



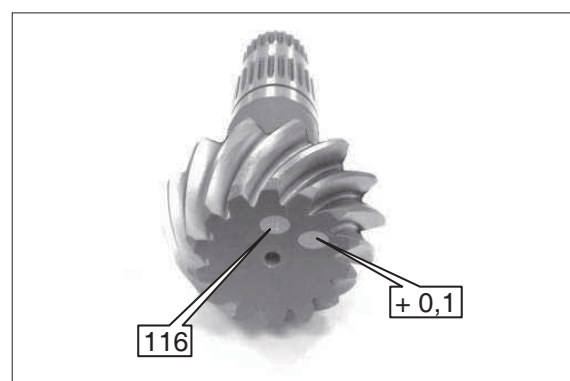
14WF8TM141

- 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

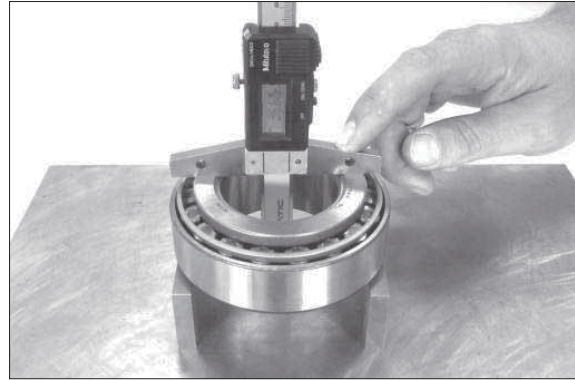


14WF8TM142

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.

$$\text{Dim. B} = \text{e.g. } 36.65 \text{ mm} - 0.1 \text{ mm} \rightarrow 36.55 \text{ mm}$$

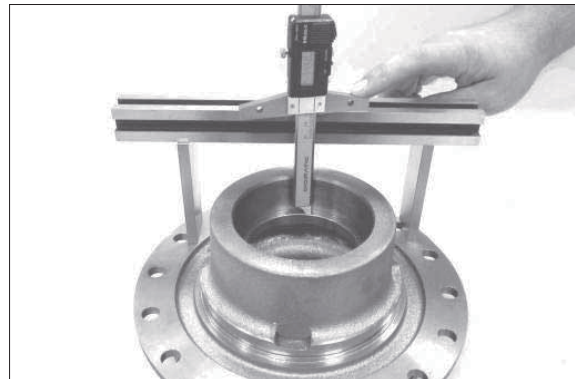


14WF8TM143

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

$$\text{Dim. D} = \text{e.g. } 35.10 \text{ mm}$$

(S) Straightedge (2 sets) 5870 200 066

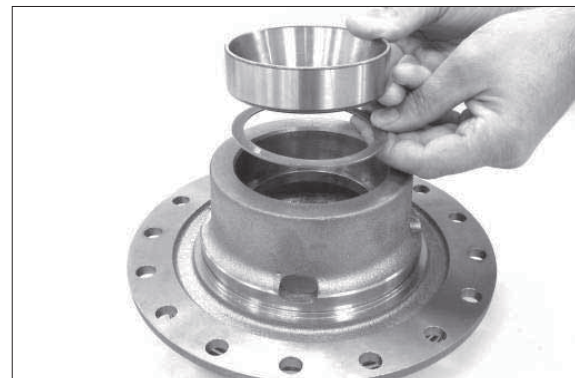


14WF8TM144

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



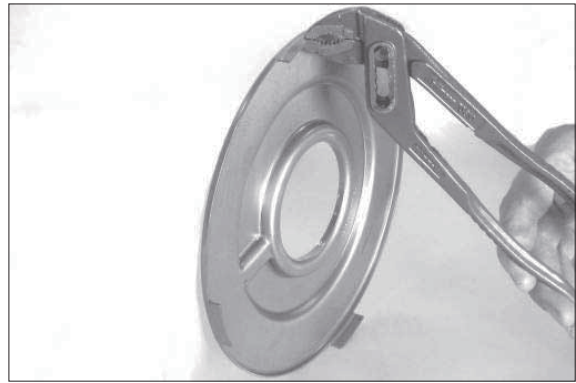
14WF8TM145

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



14WF8TM146

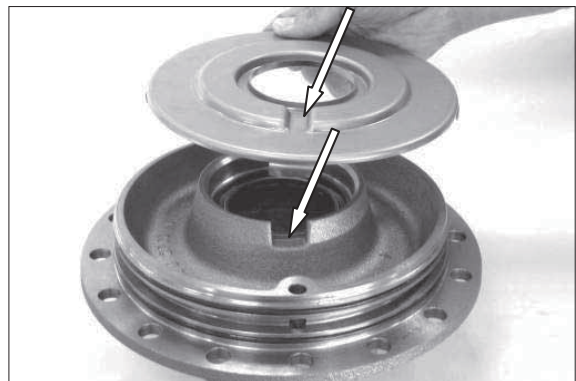
- 16) Bend edges of fixing straps of oil screen sheet slightly – assembly aid (sheet is fixed to bearing cover – see 14WF8TM148).



14WF8TM147

- 17) Mount oil screen sheet on bearing cover.

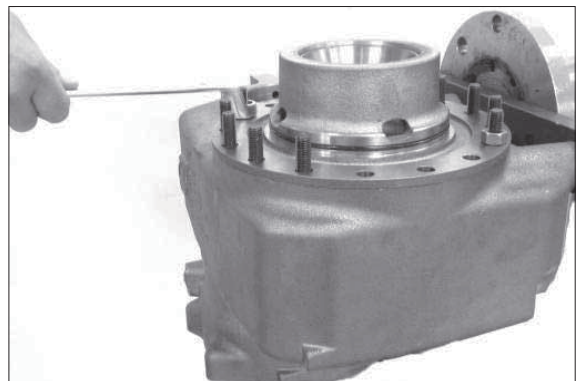
- ※ Pay attention to installation position – place locating tab of oil screen sheet into recess of bearing cover (see arrow).



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

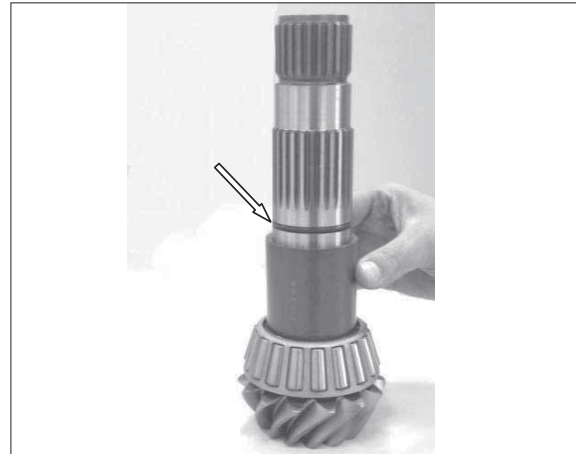
- 19) Install heated bearing inner ring until contact.

- ※ Adjust bearing inner ring after cooling down.



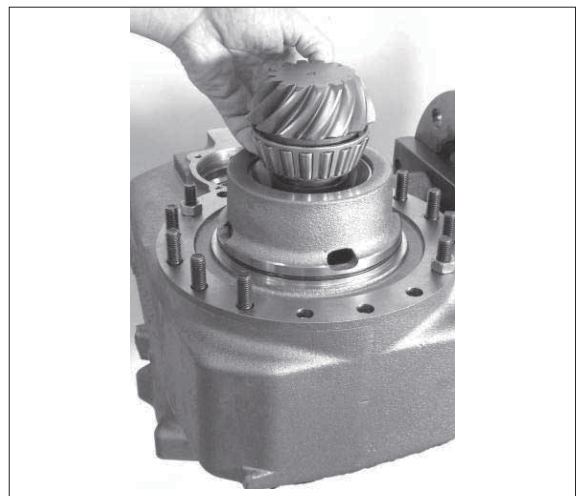
14WF8TM150

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



14WF8TM151

21) Mount preassembled pinion.

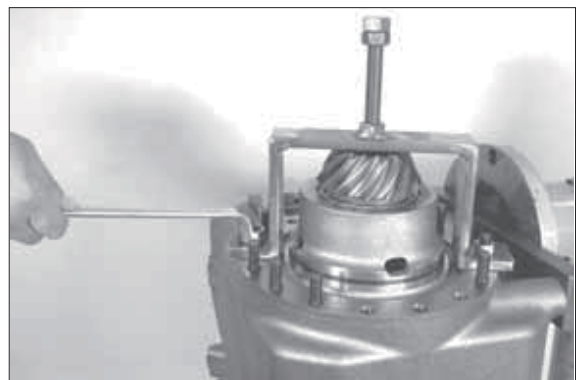


14WF8TM152

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°.

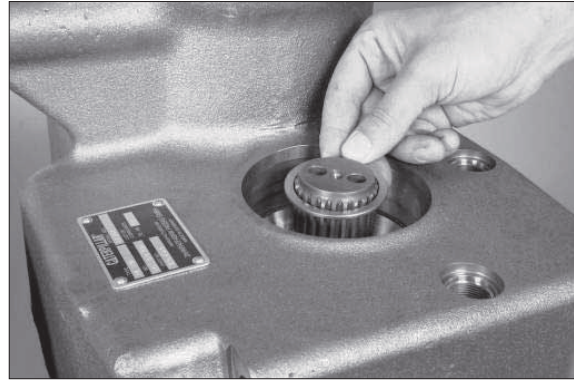
Mount adjusting ring (s = optional).

※ 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.

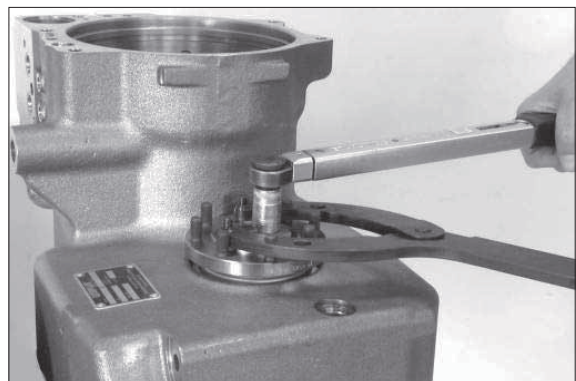


14WF8TM156

26) Place shim and fix flange with hexagon screws.

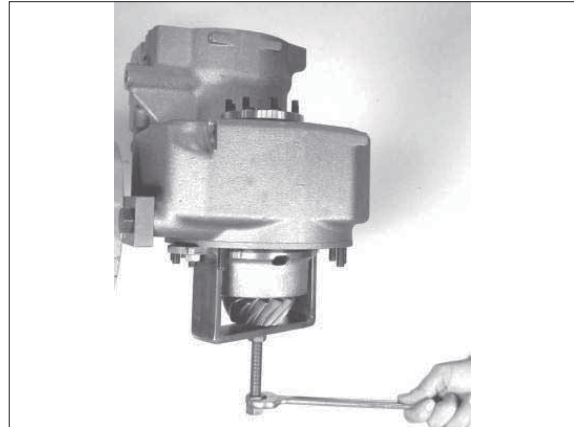
Tightening torque (M 10/10.9) $M_A = 68 \text{ Nm}$
(S) Clamping fork 5870 240 025

※ 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.



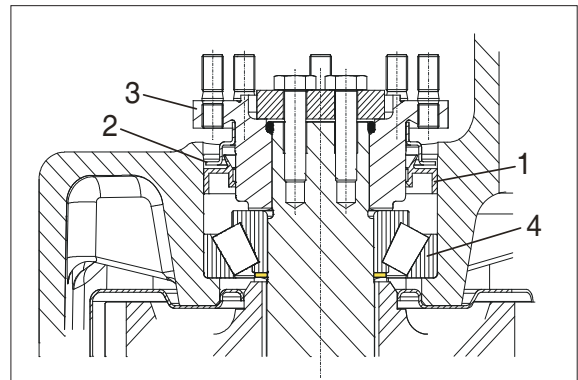
14WF8TM161

31) 1 = Shaft seal

2 = Metal sheet

3 = Output flange

4 = Roller bearing

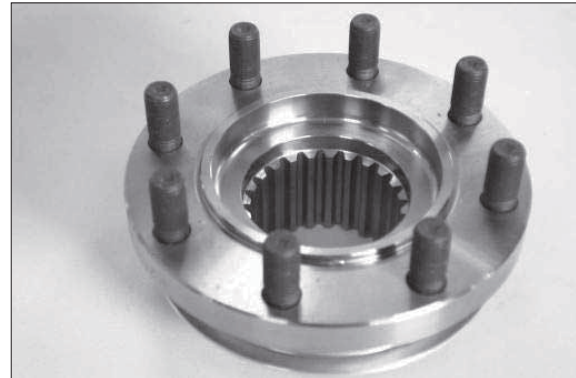


14WF8TM162

32) Install stud bolts.

Tightening torque (M10×1) MA = 20 Nm

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

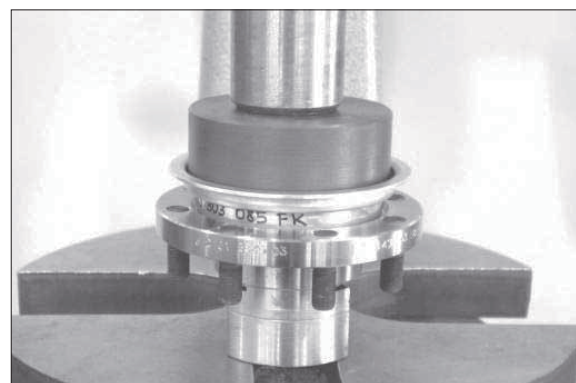


14WF8TM163

33) Install screen sheet (see 14WF8TM162).

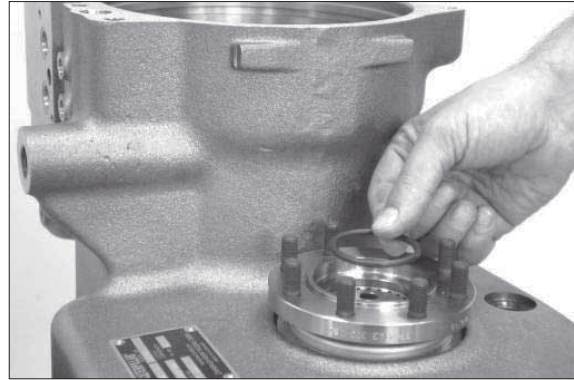
(S) Pressure piece 5870 506 150

- ※ 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

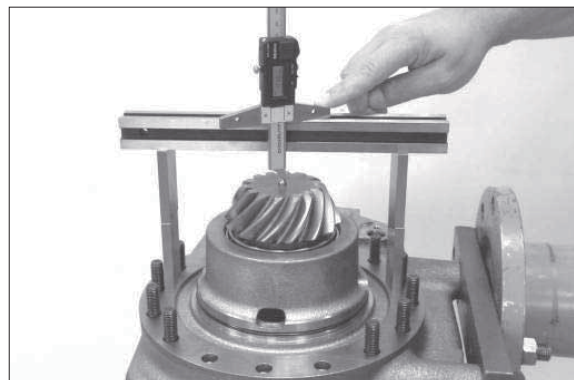
36) Position ball [use $\varnothing = 7 \text{ mm}$ → ball \varnothing like for determination of auxiliary dimension A into centering hole of the pinion and determine dim. C (see 14WF8TM140), from contact surface/bearing cover to ball.

(S) Straightedge 5870 200 108

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

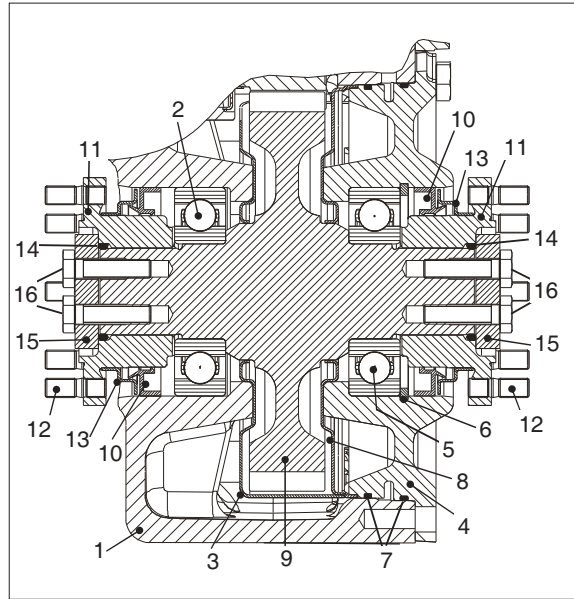
If the constant value of Dim. E = $73.00 \pm 0.05 \text{ mm}$ is not achieved, correct with an adequate shim/pinion gap (see 14WF8TM145).

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

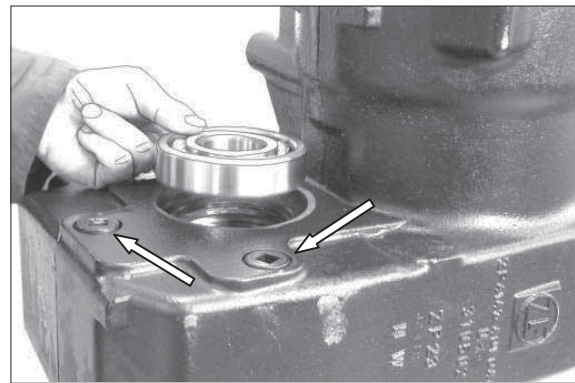


14WF8TM168

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

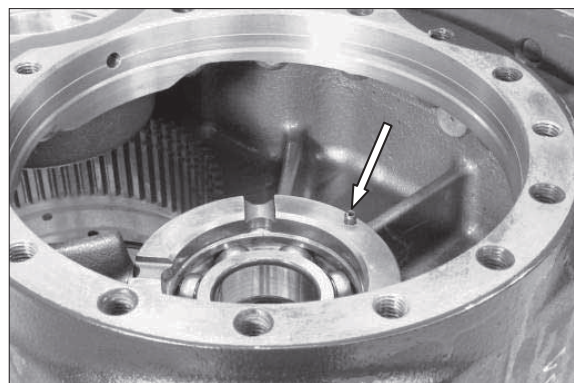
Tightening torque $M_A = 80 \text{ Nm}$

※ Then insert ball bearing (2) until contact.



14WF8TM169

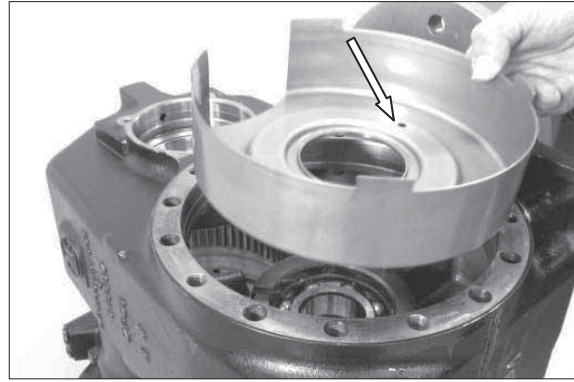
39) Rotate transmission by 180°.
 Insert slotted pin (see arrow) to the bottom.



14WF8TM170

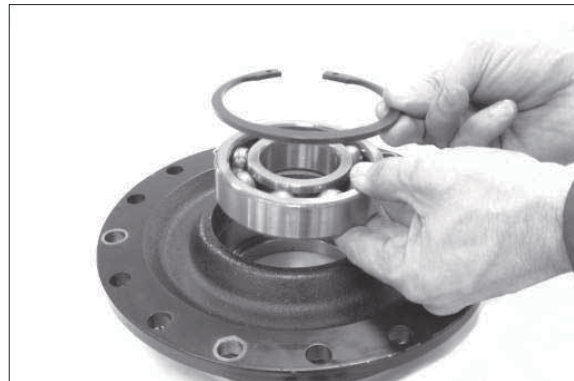
40) Position screen sheet – with slotted pin into fixing hole (arrow).

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



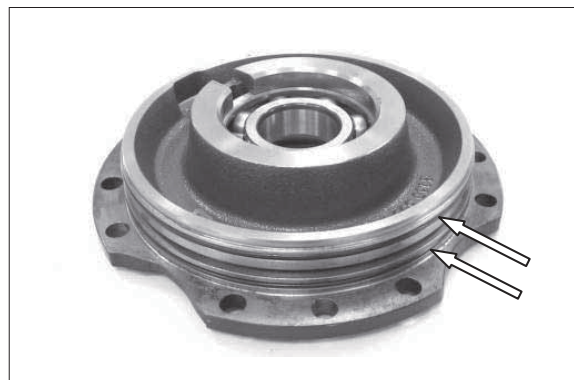
14WF8TM171

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

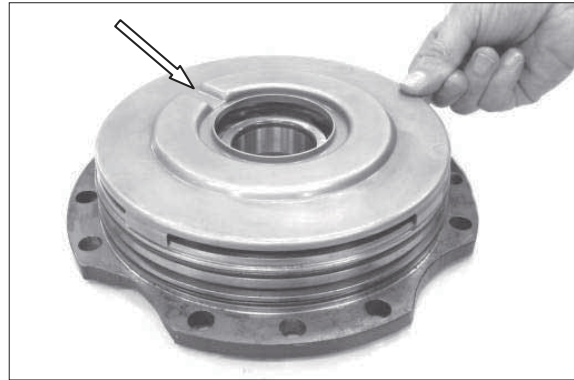
43) Bend edges of fixing straps of oil screen sheet slightly. Assembly aid screen sheet is fixed to bearing cover – see 14WF8TM176).



14WF8TM174

44) Insert oil screen sheet onto bearing cover

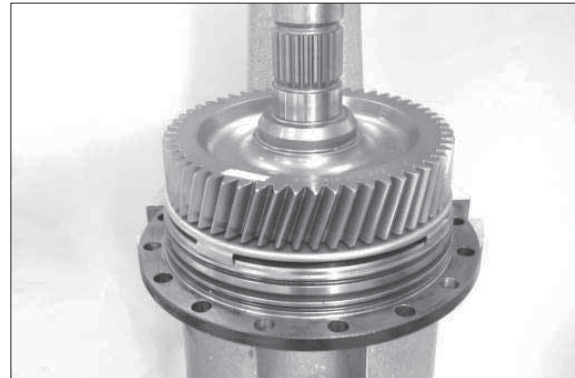
- ※ Observe installation position - place locating tab (see arrow) into recess of bearing cover (radial fixing).



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

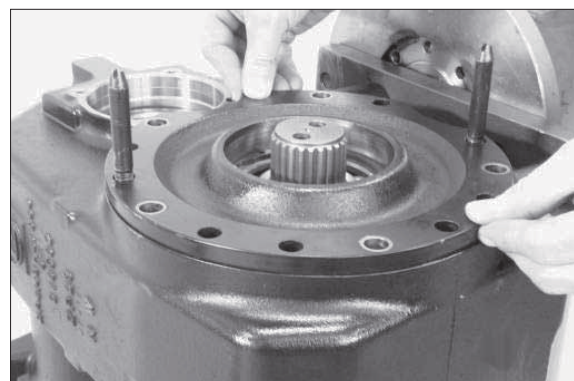
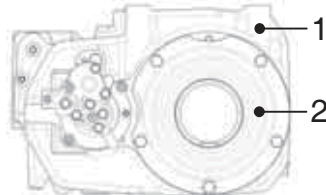
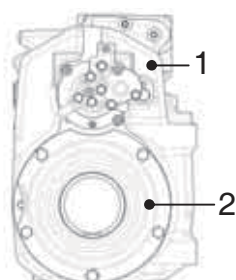
47) Attach two adjusting screws and mount preassembled bearing cover/output gear until contact.

(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>

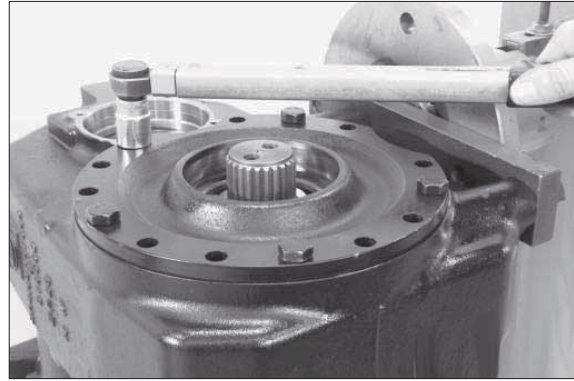
<HORIZONTAL>



14WF8TM178

48) Fix bearing cover by means of hexagon screws.

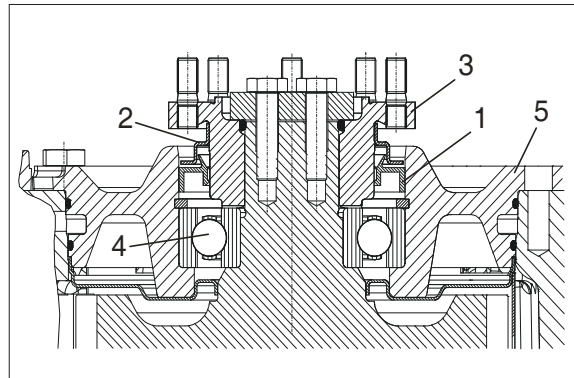
Tightening torque (M 12/8.8) $M_A = 80 \text{ Nm}$



14WF8TM181

Shaft seal output flange

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

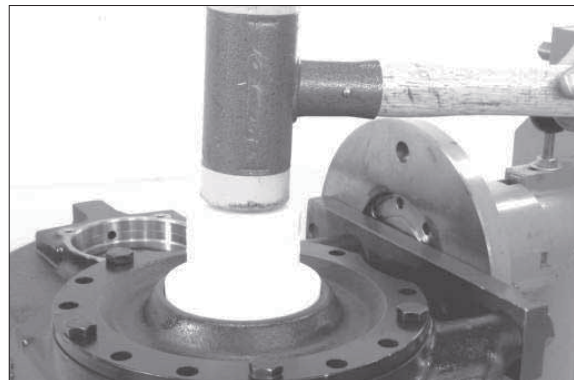


14WF8TM182

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.

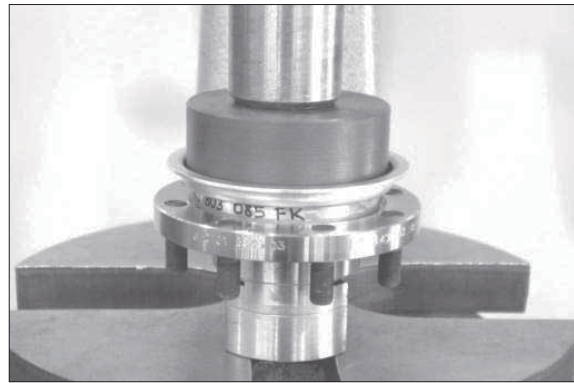


14WF8TM184

52) Install screen sheet (see 14WF8TM183).

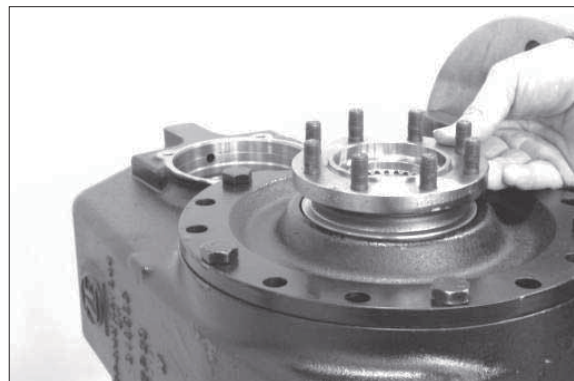
(S) Pressure piece 5870 506 150

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



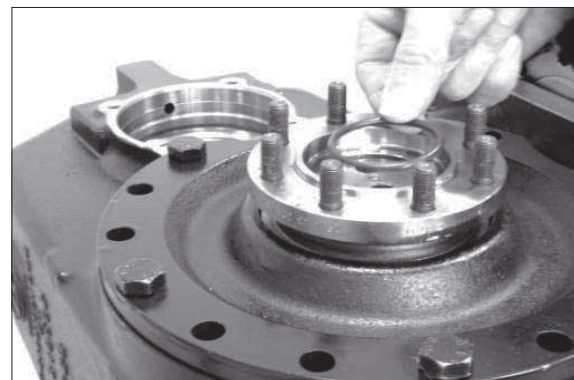
14WF8TM185

53) Install preassembled output flange.



14WF8TM186

54) Insert O-ring.

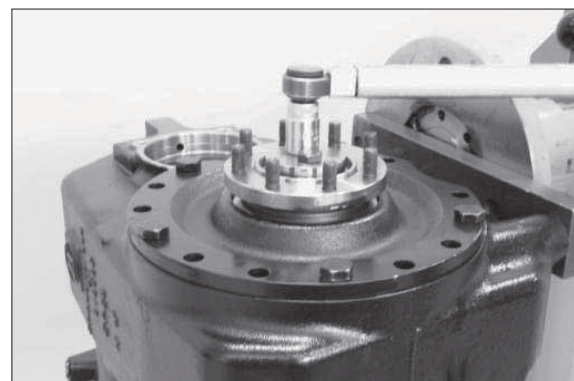


14WF8TM187

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

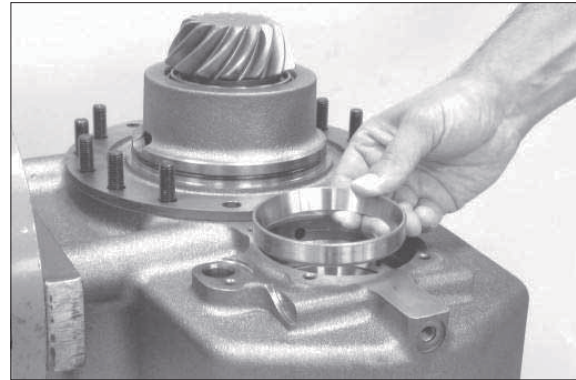
Planetary carrier

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

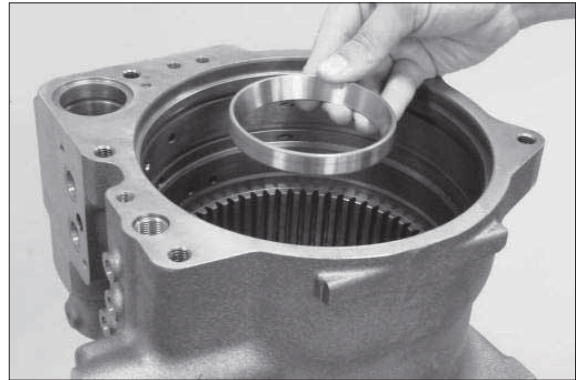
2) Rotate transmission by 180°.

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.



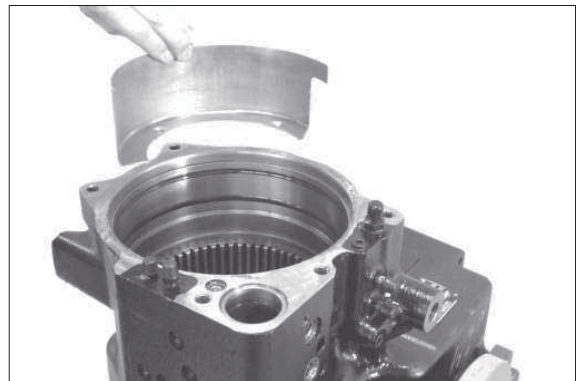
14WF8TM190

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

※ Insert screen sheet and fasten with countersunk screws.

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

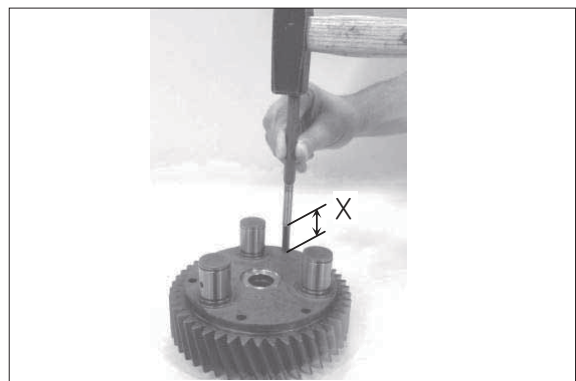
Wet countersunk screws with Loctite type no.243.



14WF8TM191

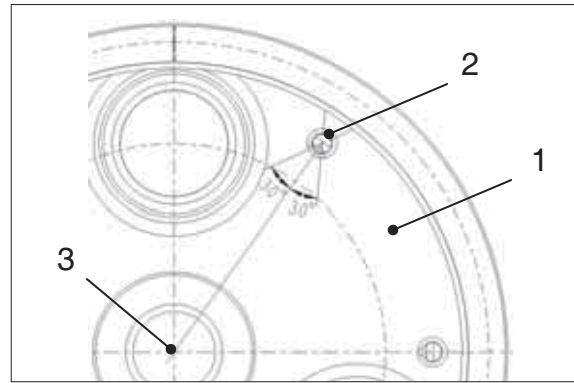
4) Install slotted pins (2) considering installation dimension X and installation position, see 14WF8TM193 (groove showing to center).

(S) Press-fit mandrel AA00 392 151



14WF8TM192

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

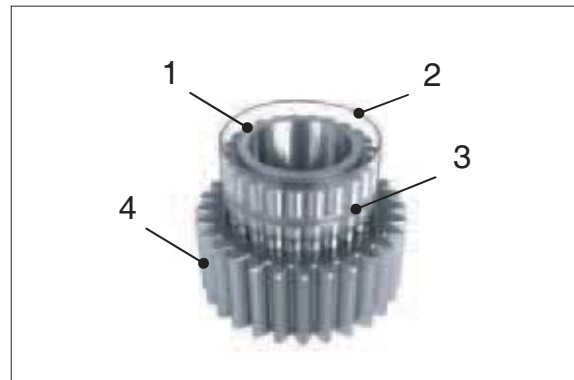


14WF8TM193

- 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

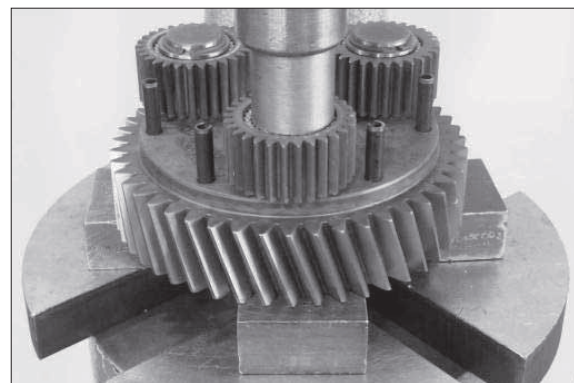


14WF8TM194

- 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

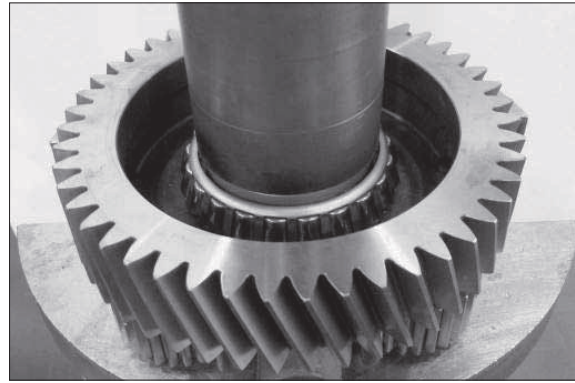
- 8) Engage retaining ring.

※ 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

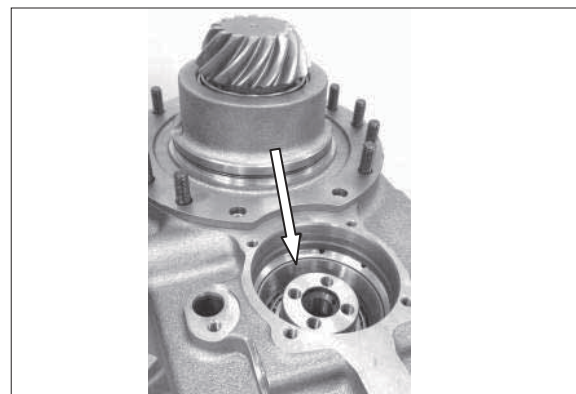
- 11) Fix planetary carrier with pressure plate and clamping bar.

(S) Clamping bar 5870 654 049



14WF8TM199

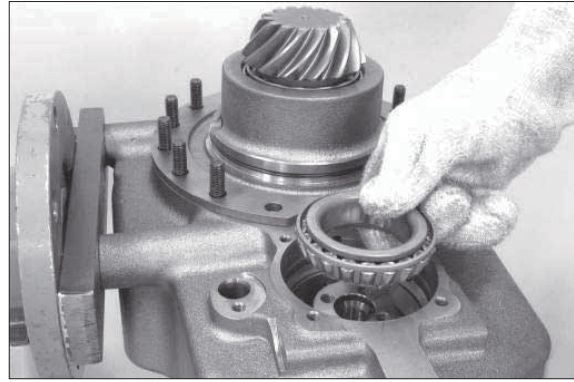
- 12) Rotate transmission by 180°.
Check contact of bearing outer ring (see arrow). Reassembly of bearing outer ring, see 14WF8TM189.



14WF8TM200

13) Install heated bearing inner ring until contact.

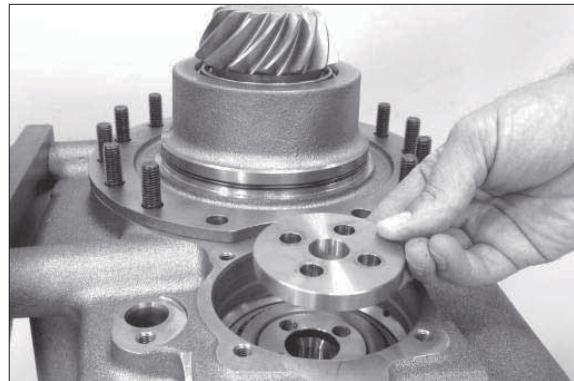
※ Adjust bearing inner ring after cooling down.



14WF8TM201

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

Then remove clamping bar, see 14WF8TM199.



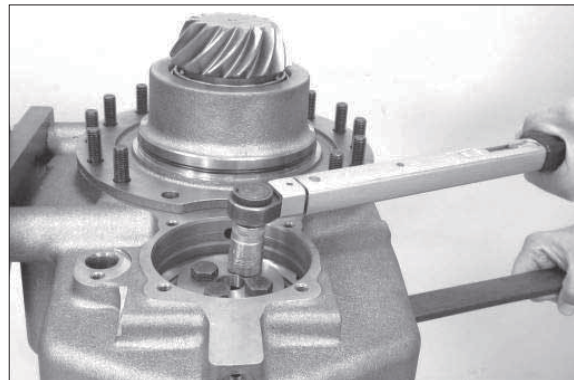
14WF8TM202

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

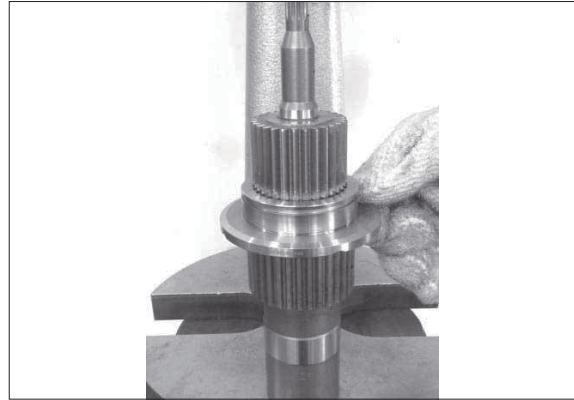
※ While tightening hexagon screws, rotate planetary carrier several times in both directions (roller setting).



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

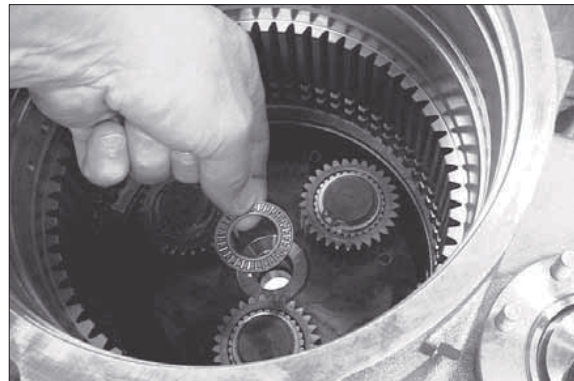
21) Engage retaining ring into annular groove of input shaft.



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).

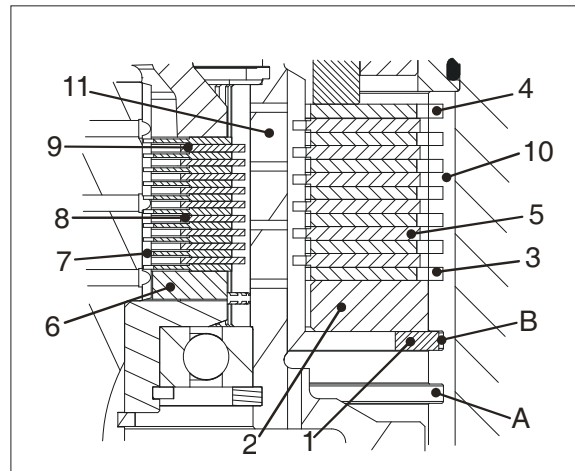


14WF8TM211

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



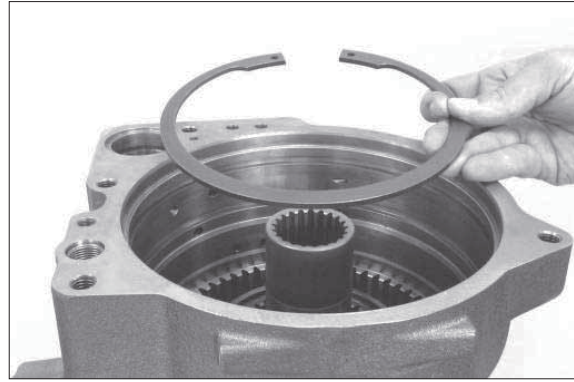
14WF8TM213

Reassembly brake :

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

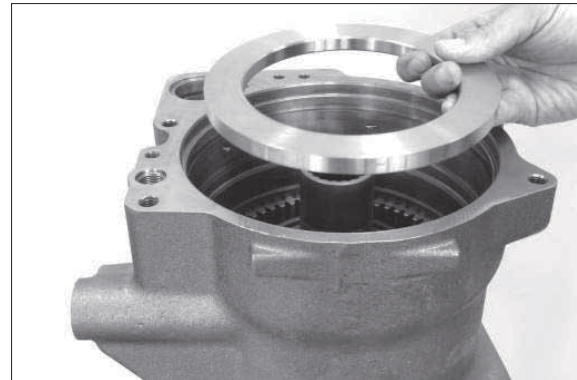
(S) Clamping pliers 5870 900 021

※ Observe installation position of retaining ring (1).



14WF8TM215

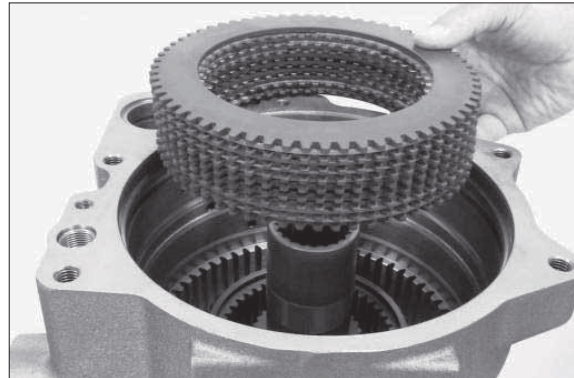
26) Insert end plate (2).



14WF8TM216

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

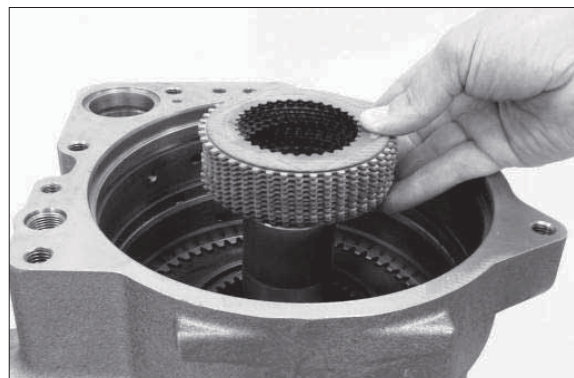
※ Position outer disk (1 pc) $s = \text{variable } 2.8 \sim 3.7 \text{ mm}$ to top of disk package (piston side).
With outer disk $s = \text{variable}$, disk clearance / piston stroke is adjusted - see 14WF8TM229.



14WF8TM217

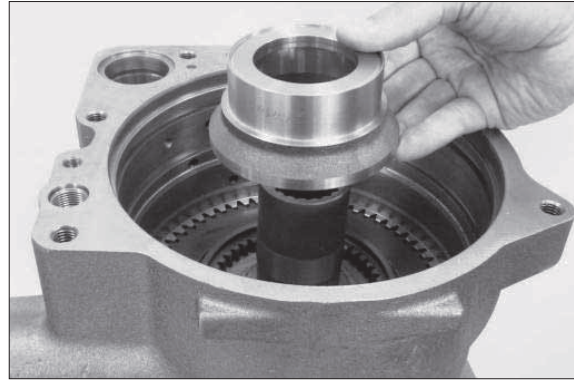
38) Insert disk package alternately, beginning with a lining disk.

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



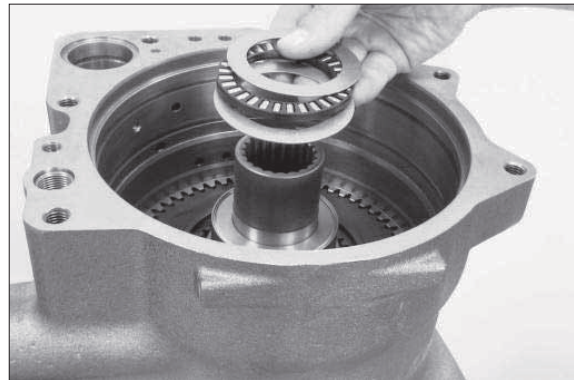
14WF8TM218

29) Mount pressure piece (without compression spring).



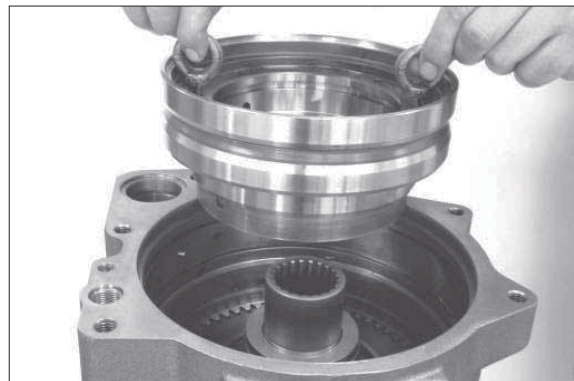
14WF8TM219

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



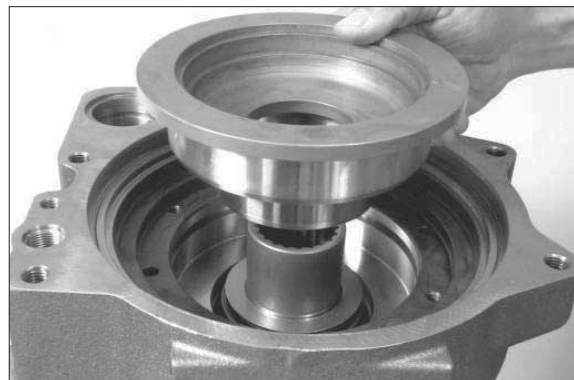
14WF8TM220

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



14WF8TM221

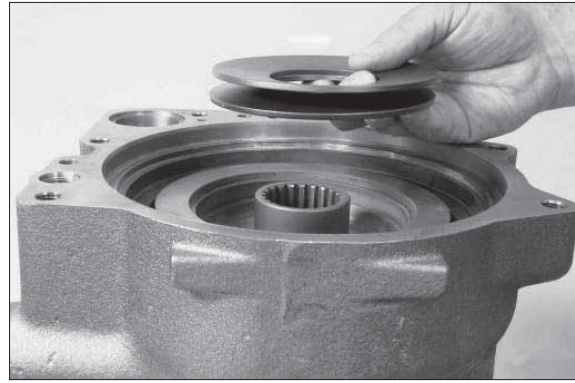
32) Insert piston (clutch) – without mounted sealing elements.



14WF8TM222

33) Insert both cup springs/clutch.

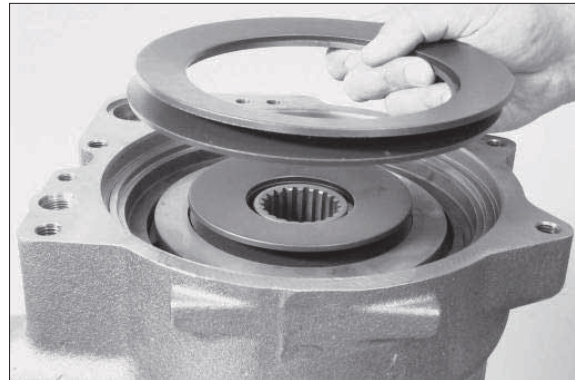
- ※ Fix cup springs with grease and position them centrally.
- ※ Observe installation position, see 14WF8TM225.



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

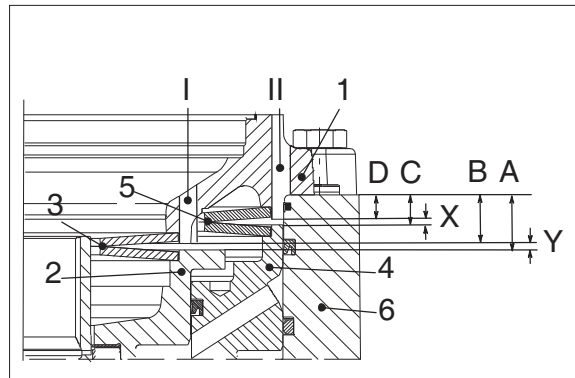
B = Mounting face/Housing – Piston contact/Housing

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)

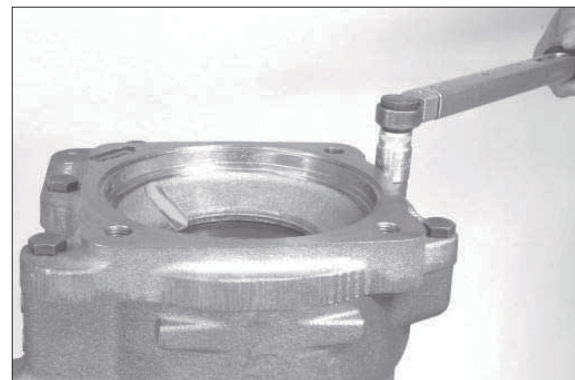


14WF8TM225

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

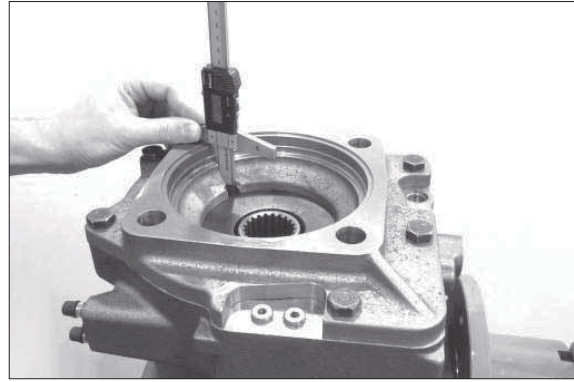


14WF8TM226

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

Dim. A e.g. = 22.45 mm

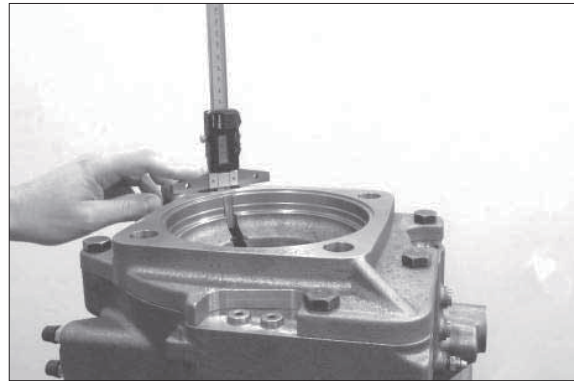
(S) Straightedge 5870 200 108



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

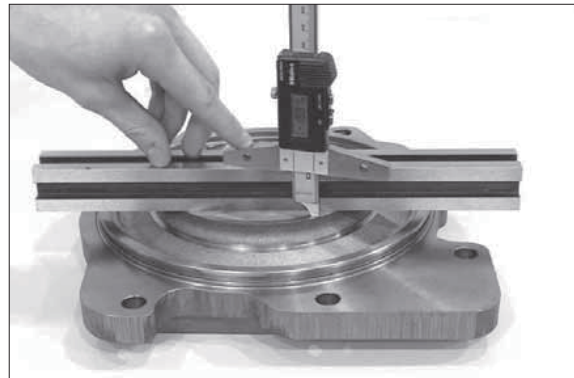
39) Determine Dim. B from mounting face/housing to clutch piston contact/housing.

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

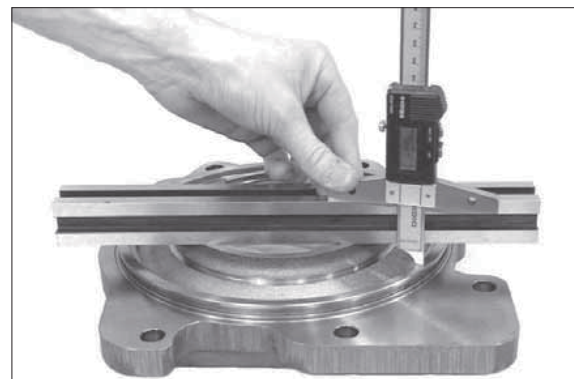
40) Determine Dim. D from mounting face/housing to brake piston contact/housing.

Dim. D e.g. = 9.95 mm

C-D = 1.90 mm (disk clearance)

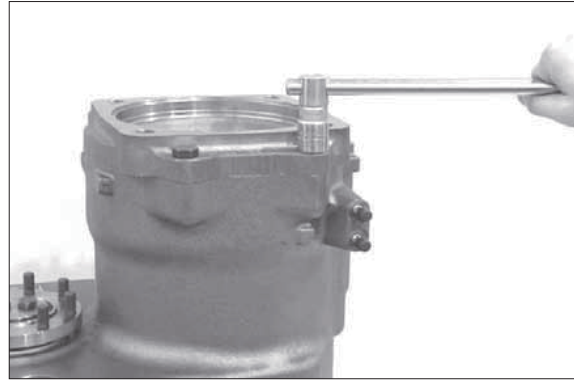
Disk clearance (piston stroke) Brake = $1.8^{+0.3}$ mm

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



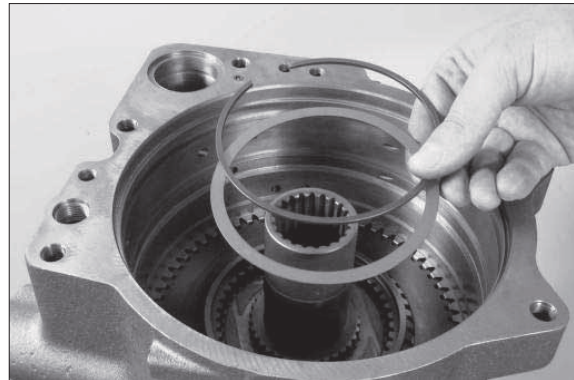
14WF8TM230

- 41) Remove measuring device again – loosen screws evenly.
Remove all cup springs, both pistons, axial roller cage with axial washers and pressure piece.



14WF8TM231

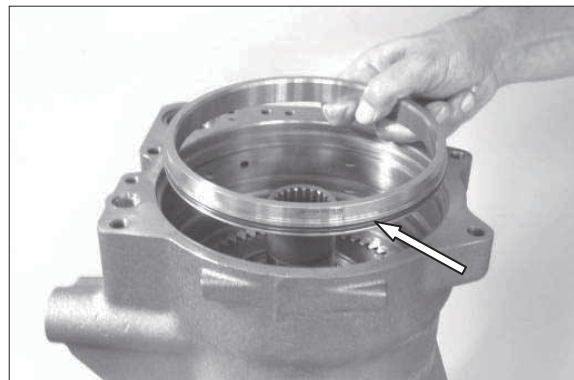
- 42) Insert shim into ring gear and fix by engaging snap ring into annular groove of ring gear.



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

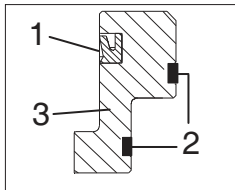
- 44) Mount ring with driver tool until contact.

(S) Driver tool 5870 506 161

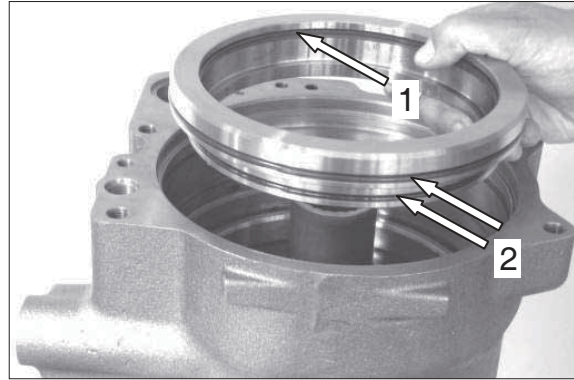


14WF8TM234

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



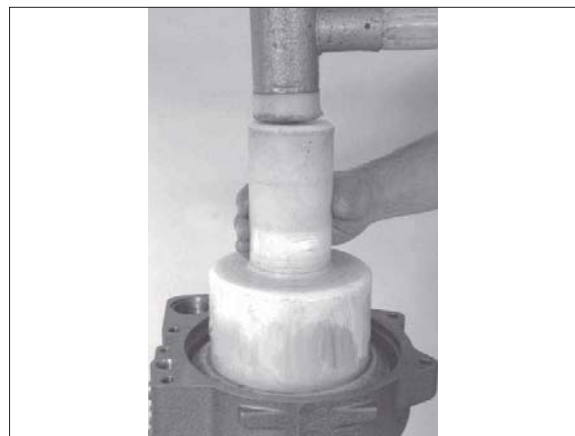
Put both O-rings (2) into annular grooves of pressure ring (3) and insert preassembled pressure ring into housing.



14WF8TM235

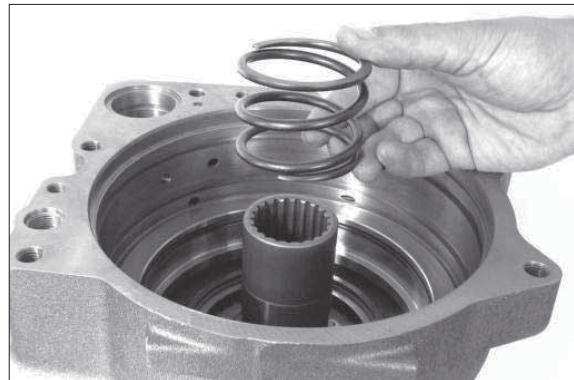
46) Bring pressure ring with driver tool into contact position.

(S) Driver tool 5870 506 161



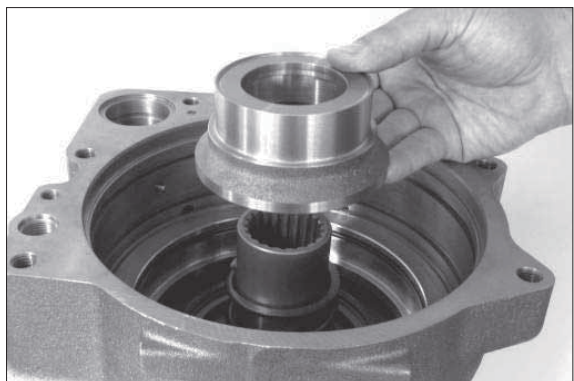
14WF8TM237

47) Insert compression spring until contact.



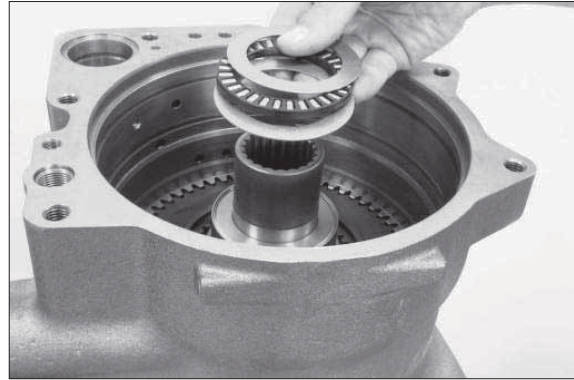
14WF8TM238

48) Insert pressure piece over compression spring until contact.



14WF8TM239

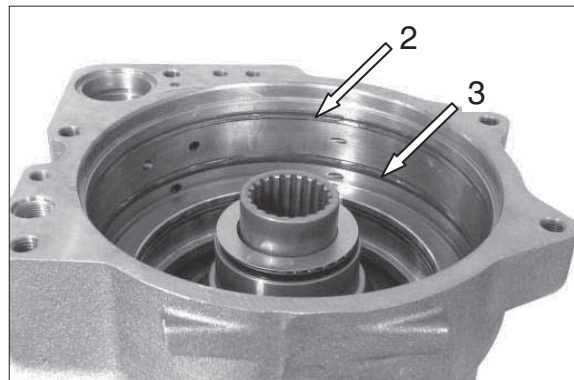
49) Oil axial roller cage and mount it with both axial washers (1x each to be positioned underneath and onto axial needle cage).



14WF8TM240

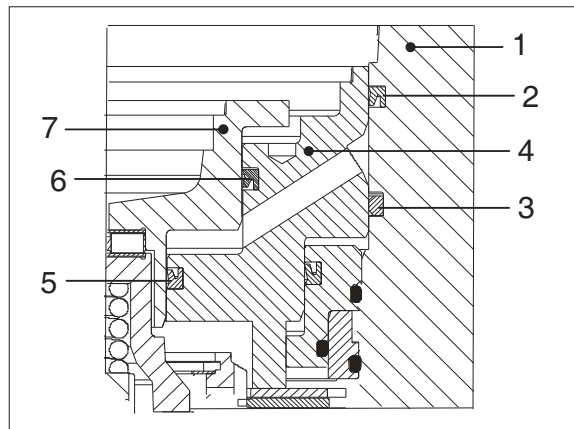
50) Insert seal (2, with sealing lip showing to oil sump) and seal (3) – see 14WF8TM242 into housing (1).

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



14WF8TM241

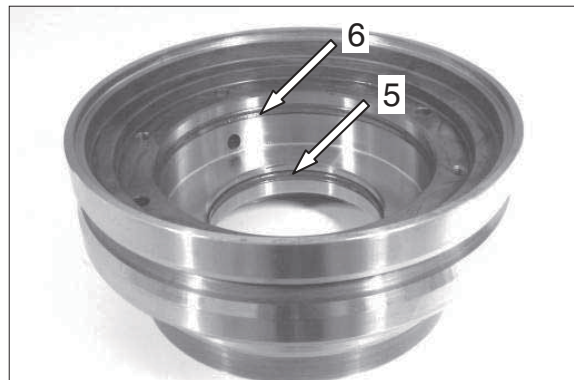
- 51) 1 = Housing
- 2 = Seal (with sealing lip)
- 3 = Seal
- 4 = Piston / Brake
- 5 = Seal (with sealing lip)
- 6 = Seal (with sealing lip)
- 7 = Piston / Clutch



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.

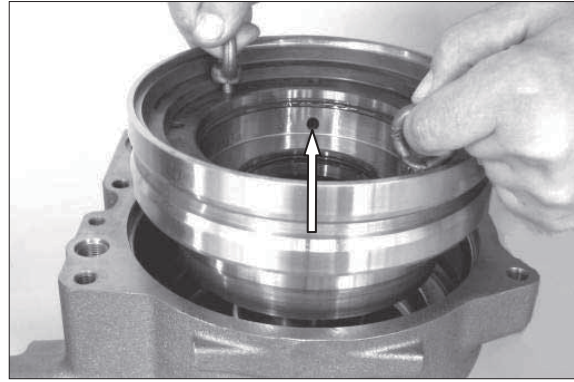


14WF8TM243

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.

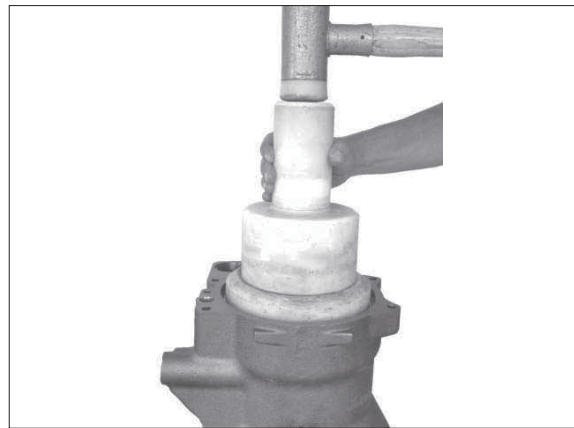


14WF8TM244

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

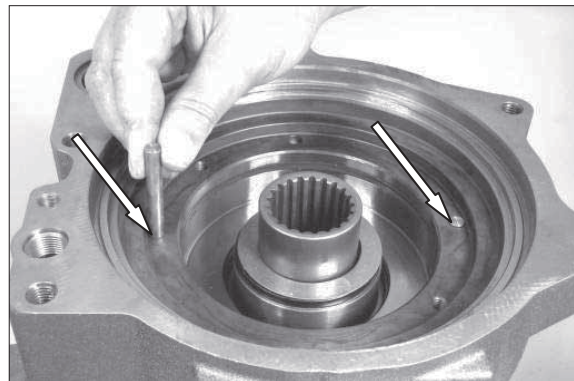
(S) Driver tool

5870 506 161



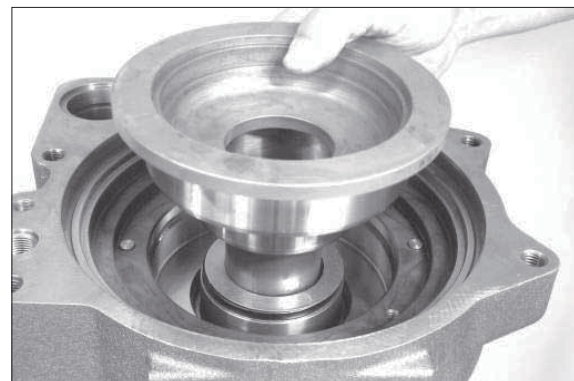
14WF8TM245

55) Insert both cyl. pins (arrow).



14WF8TM246

56) Insert piston/clutch until contact.

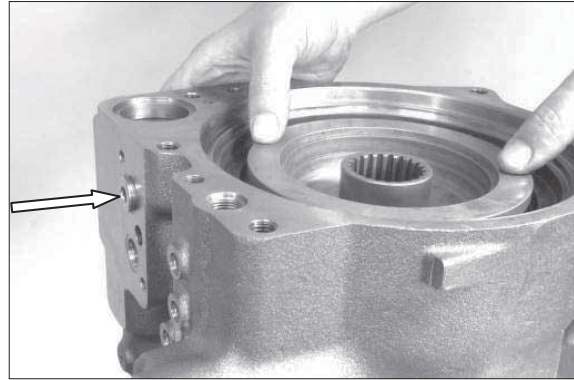


14WF8TM247

- 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 $M_A = 40 \text{ Nm}$

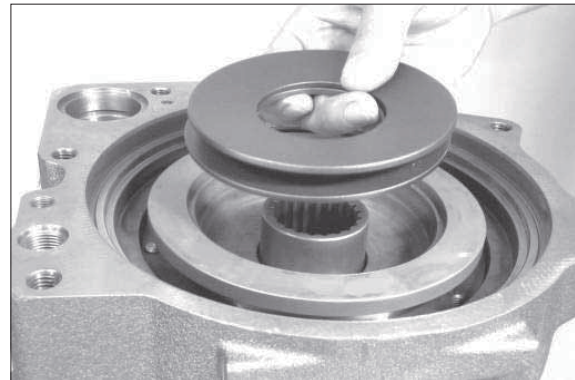
- ※ Axial position of piston is maintained
(Facilitate assembly for installation of input housing, see 14WF8TM254~ 14WF8TM255).



14WF8TM248

- 58) Insert both cup springs/clutch.

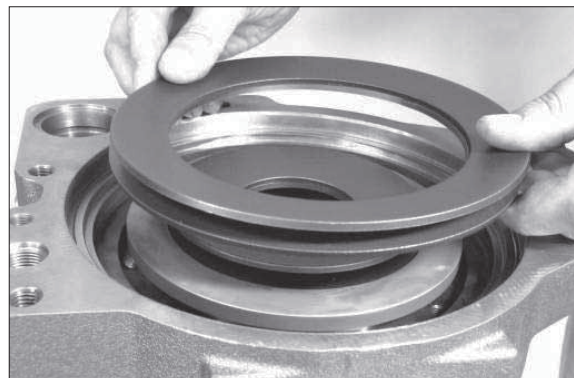
- ※ Observe installation position, see also 14WF8TM225.



14WF8TM249

- 59) Insert both cup springs/brake.

- ※ Observe installation position – see also 14WF8TM225.



14WF8TM250

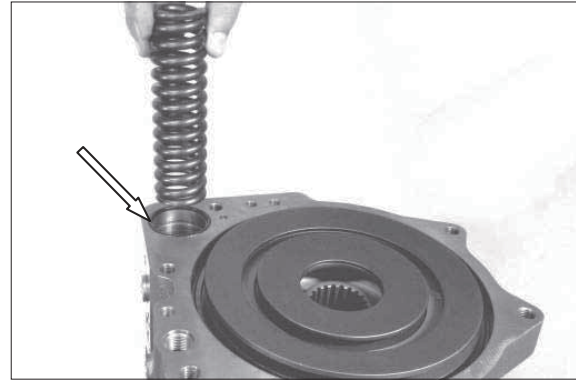
Install modulation valve and input housing

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



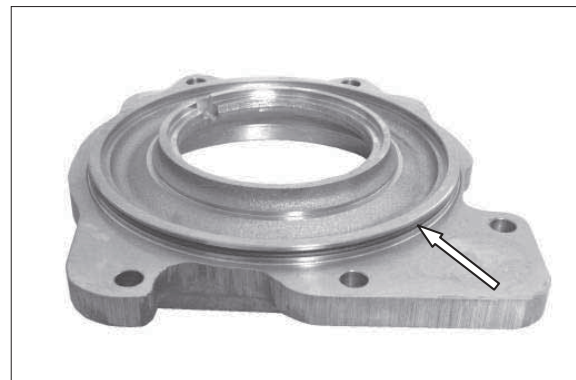
14WF8TM251

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.

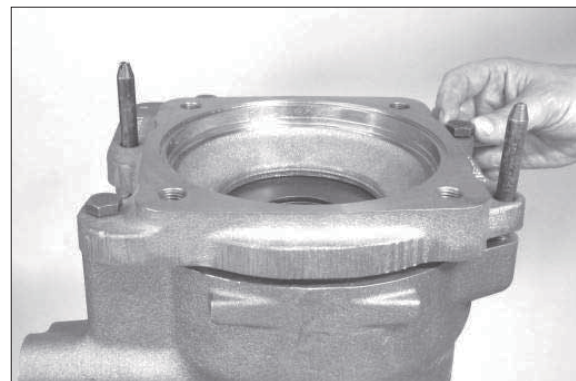


14WF8TM253

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

(S) Adjusting screws (M12) 5870 204 021

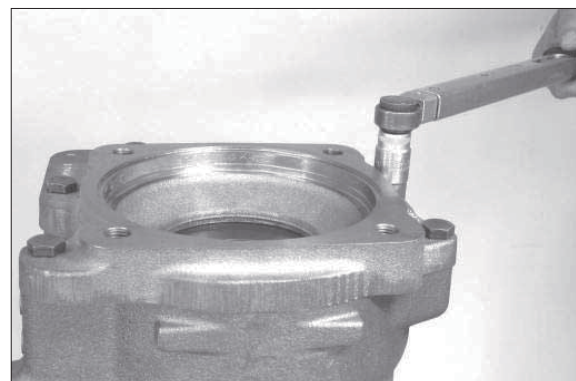
※ For installation of input housing align cup springs centrally.



14WF8TM254

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

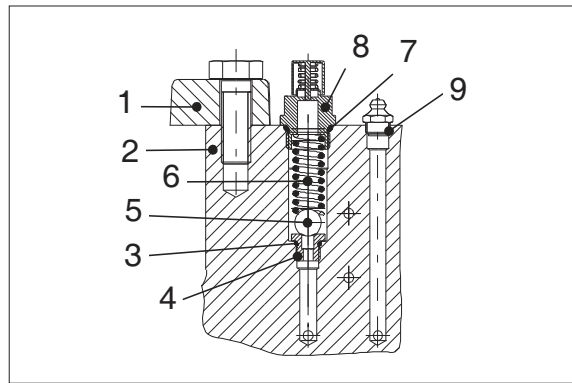
Tightening torque (M 12/8.8) $M_A = 80 \text{ Nm}$



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

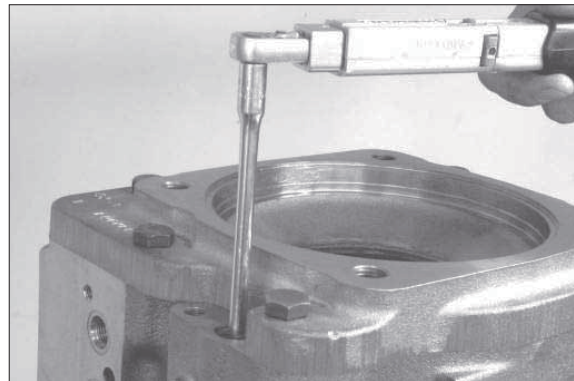


14WF8TM256

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

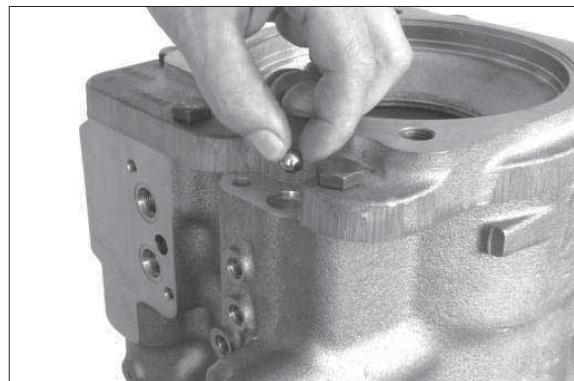
- 66) Install threaded element (4) with new O-ring (3).

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



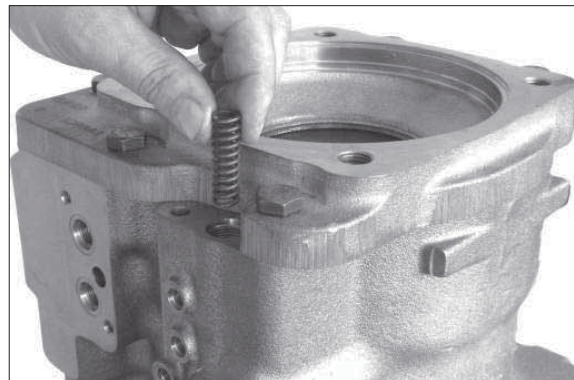
14WF8TM257

- 67) Insert ball (5).



14WF8TM258

- 68) Insert compression spring (6).



14WF8TM259

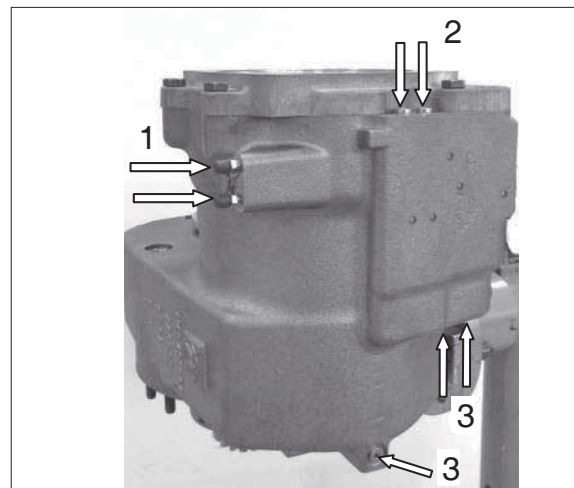
Check emergency release for leak tightness

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.

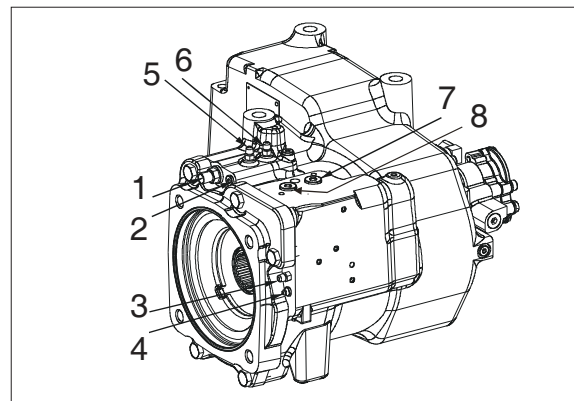
Install both breather valves (1), screw plugs (2) with new seal rings and screw plugs (3) with new O-rings.

Breather valve (M 10×1) MA = 15 Nm
 Screw plug (M 10×1 with seal ring) MA = 20 Nm
 Screw plug (M 10×1 with O-ring) MA = 20 Nm



14WF8TM260

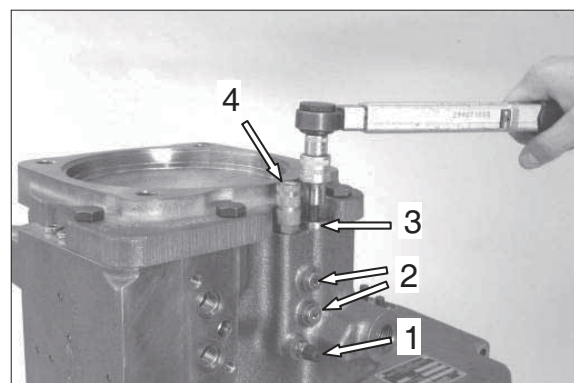
- 70) 1 = Breather/Pressure relief-valve (emergency release – parking brake)
- 2 = Screw plug
- 3 = Breather valve (emergency release – parking brake)
- 4 = Lubrication nipple (emergency release – parking brake)
- 5 = Breather valve (multi-disk clutch)
- 6 = Breather valve (mulit-disk brake)
- 7 = Pressure 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).

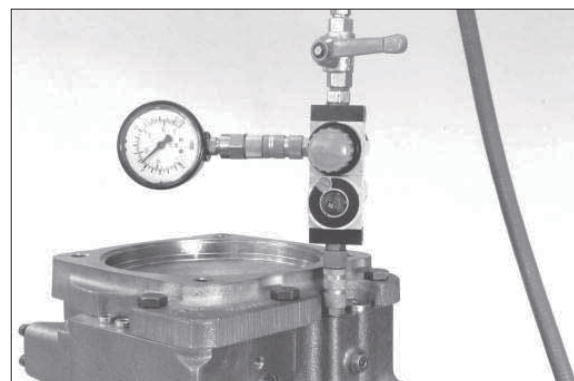
Breather valve (M 10×1) MA = 15 Nm
 Screw plug (M 10×1 with O-ring) MA = 20 Nm
 Screw plug (M 18×1.5 with O-ring) MA = 35 Nm
 Compressed air connect. piece (M 10×1) with seal ring MA = 20 Nm



14WF8TM262

72) Pressurize emergency release with compressed air $p = 5 + 1$ 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) MA = 15 Nm
Breather (M 18×1.5) MA = 22 Nm

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

74) 1 = Transmission housing
2 = Input housing

AB = Pressure oil connection – multi-disk brake

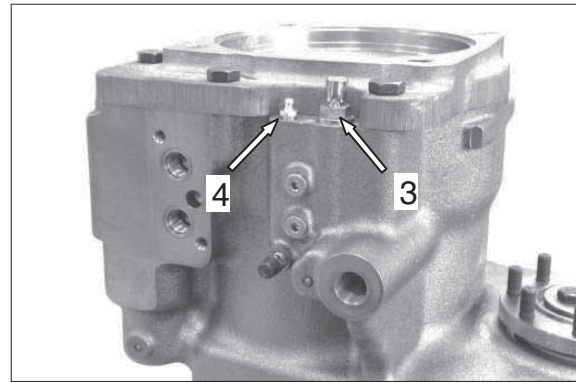
AK = Pressure oil connection – multi-disk clutch

EB = Breather valve – multi-disk brake

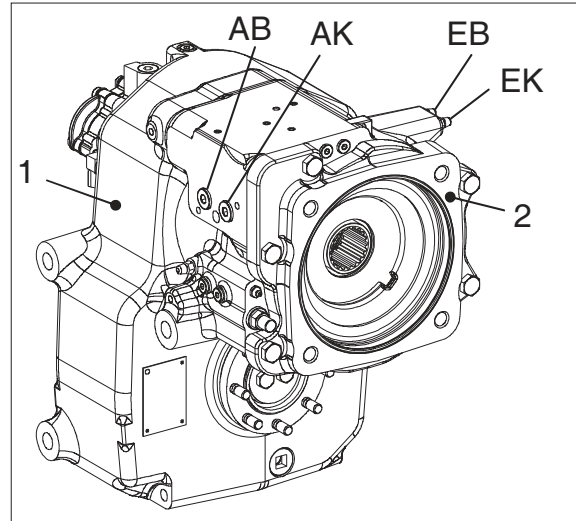
EK = Breather valve – multi-disk clutch

※ 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

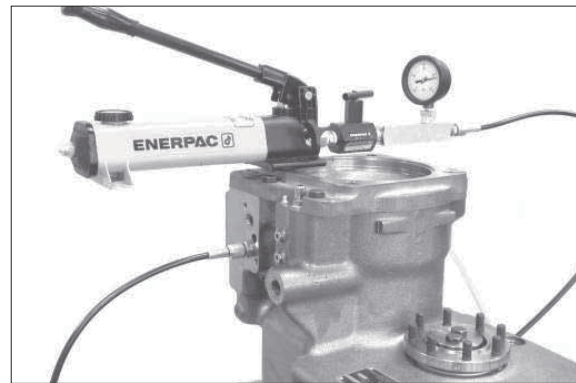
Multi-disk brake

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.



14WF8TM267

(S) Spline mandrel 5870 510 039

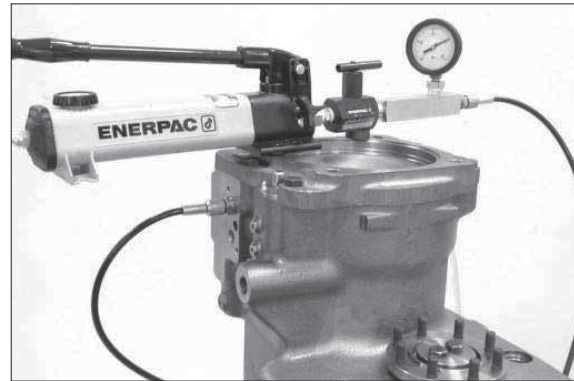
Multi-disk clutch

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

- 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

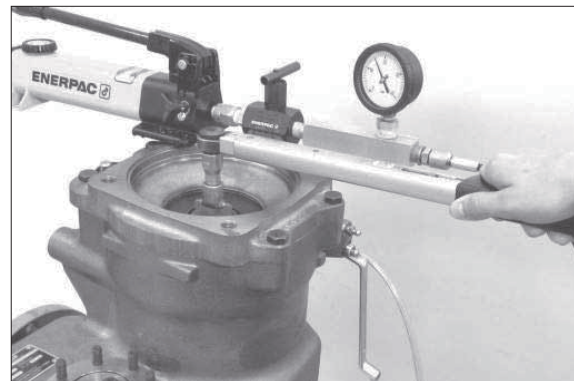
Closing pressure test (Cup spring preloading force)

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

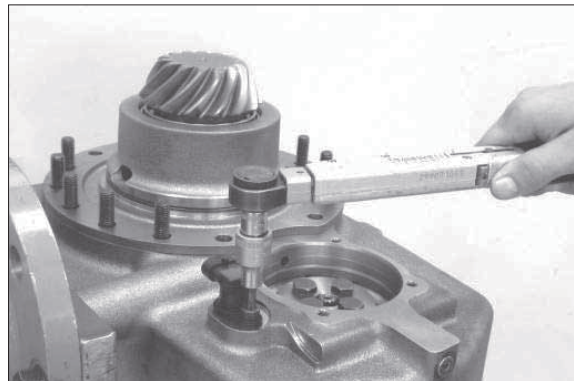


14WF8TM269

Speed sensor

79) Install speed sensor with new O-ring.

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

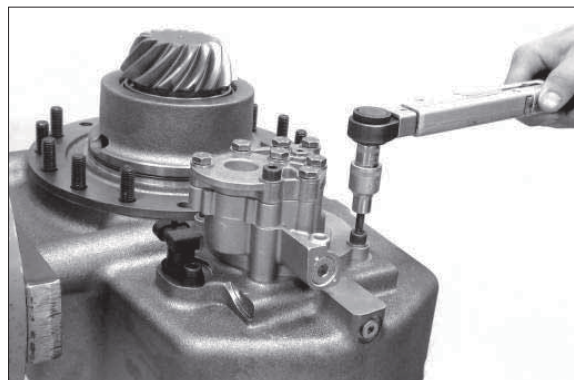


14WF8TM270

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) $M_A = 23 \text{ Nm}$

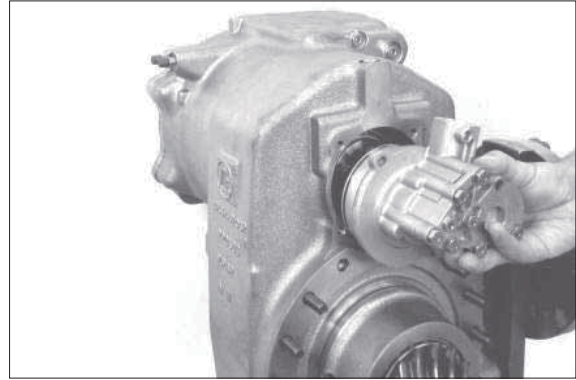


14WF8TM271

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

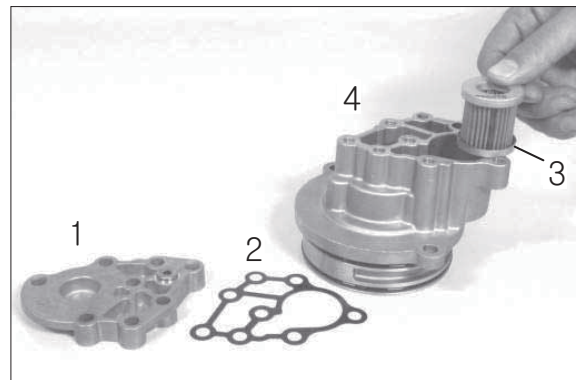
Lubrication pump version

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



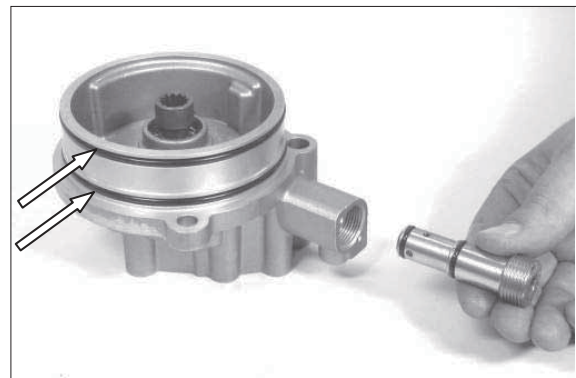
14WF8TM272

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



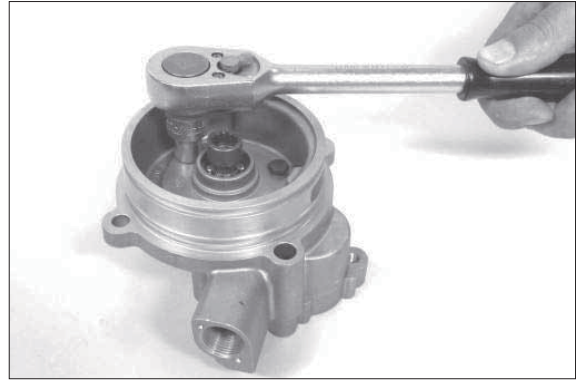
14WF8TM273

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



14WF8TM274

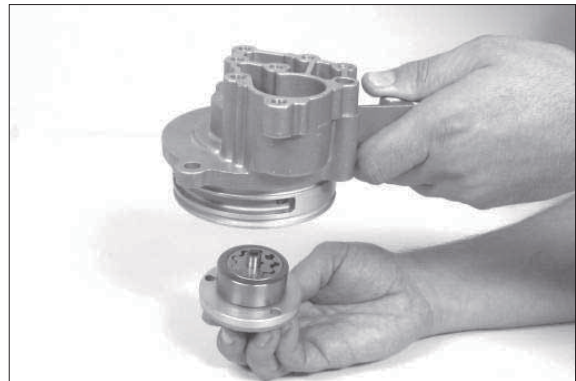
- 4) Keep housing in vertical position, while loosening pump cover screws.



14WF8TM275

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

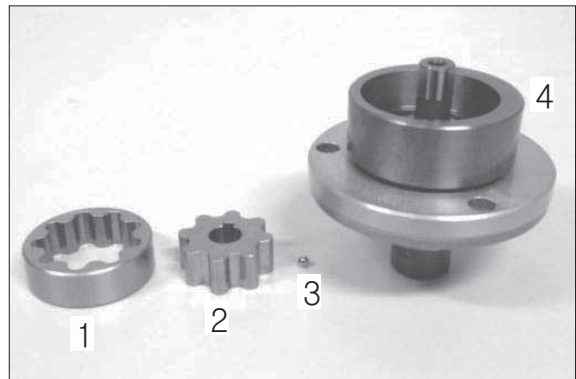
- 5) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs.



14WF8TM276

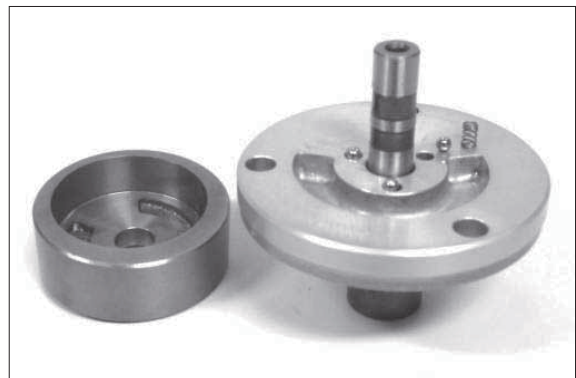
- 6) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



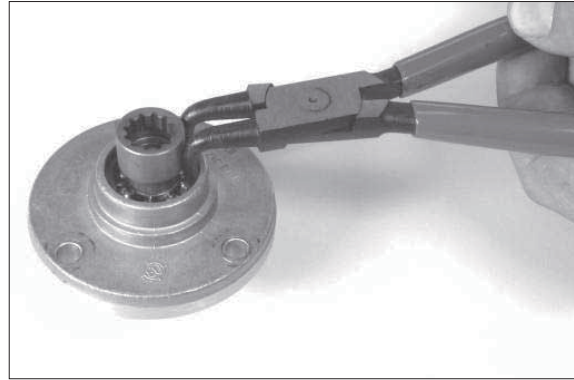
14WF8TM277

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



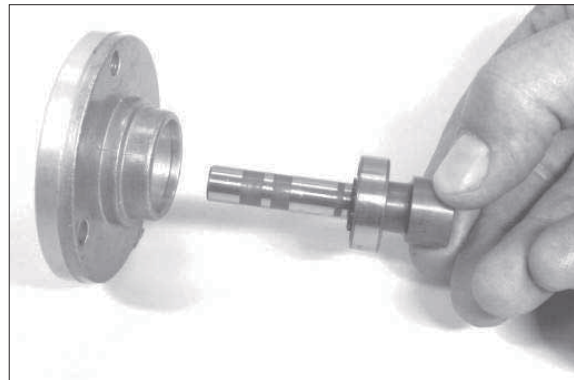
14WF8TM278

8) Unsnap retaining ring.



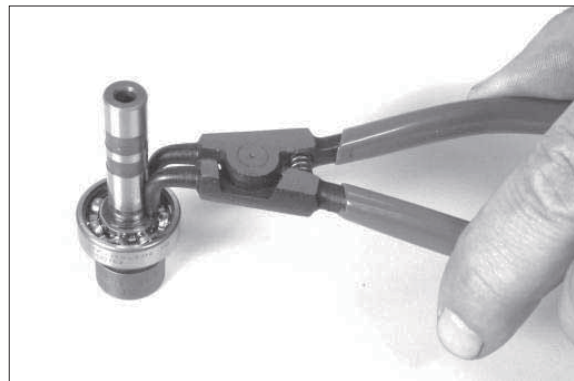
14WF8TM279

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



14WF8TM280

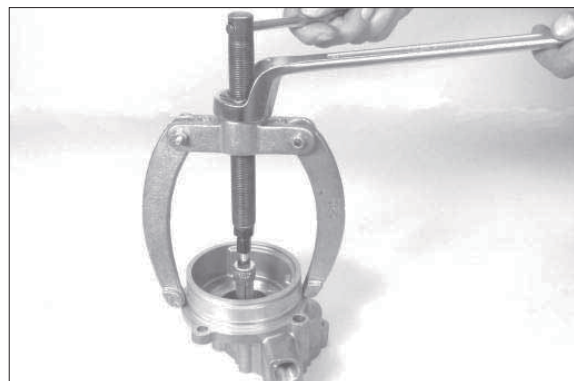
10) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM281

11) Pull needle sleeve out of housing hole.

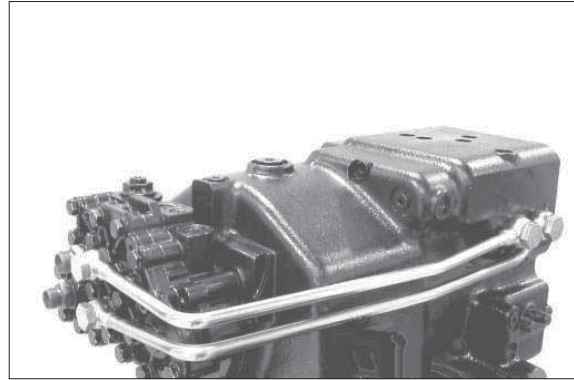
(S) Inner extractor 5870 300 012
(S) Counter support 5870 300 011



14WF8TM282

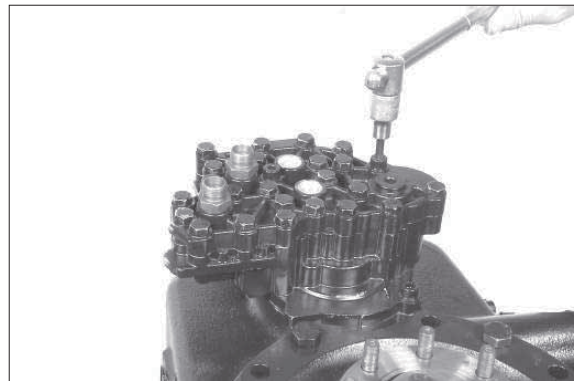
Shift interlock version

12) Disassemble both oil tubes.



14WF8TM283

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



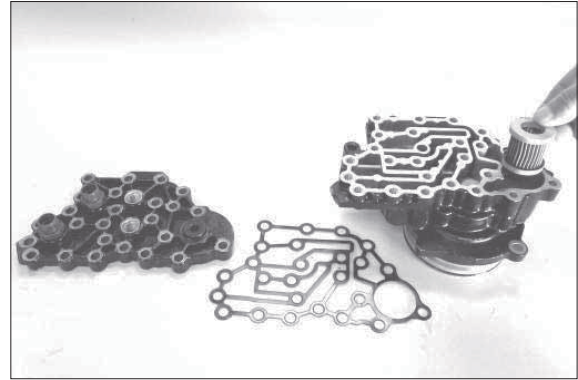
14WF8TM284

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



14WF8TM285

15) Take filter out of housing.



14WF8TM286

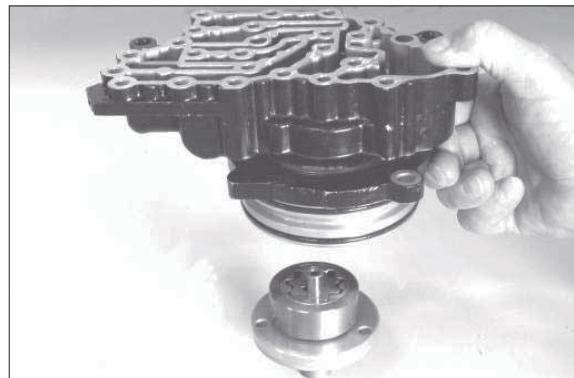
16) Loosen cover screws of pump.



14WF8TM287

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

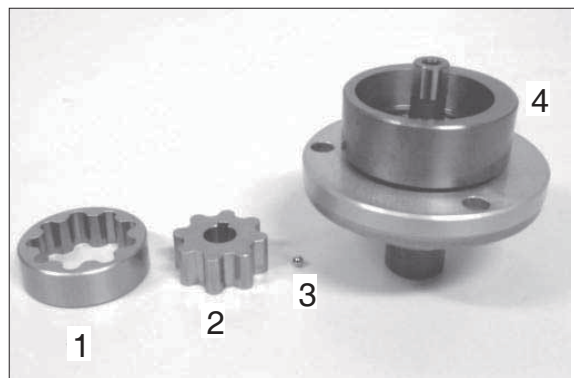
17) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs (see 14WF8TM289 and 14WF8TM290).



14WF8TM288

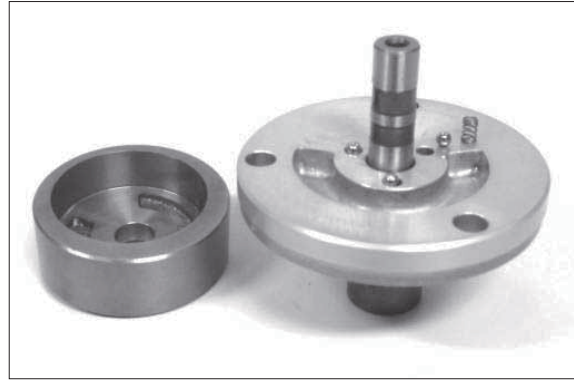
18) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



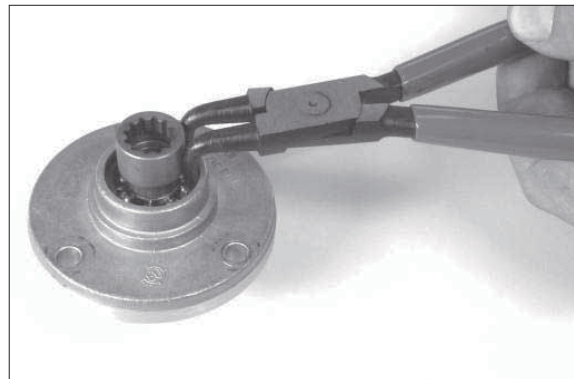
14WF8TM289

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



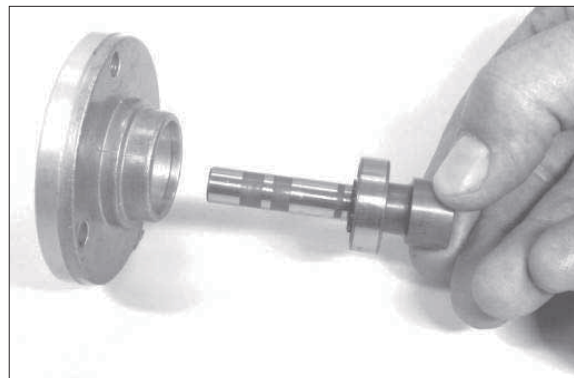
14WF8TM290

20) Unsnap retaining ring.



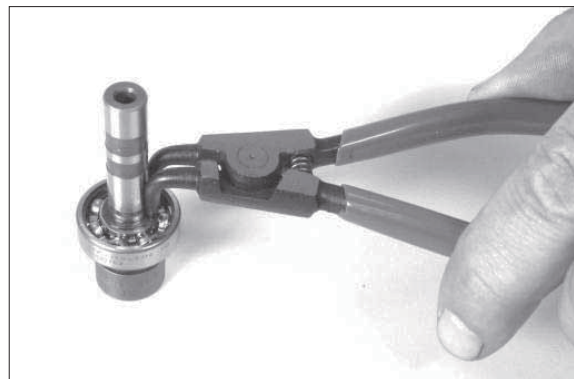
14WF8TM291

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



14WF8TM292

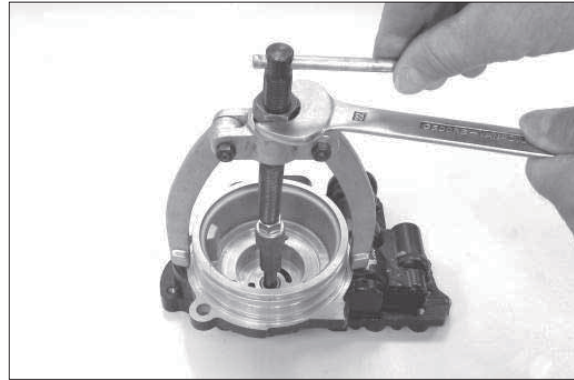
22) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM293

23) Pull needle sleeve out of housing hole.

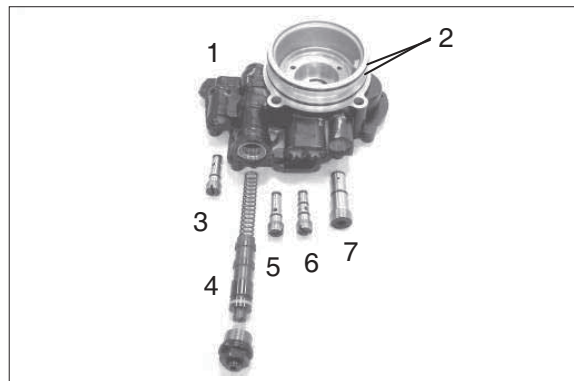
- (S) Inner extractor 5870 300 012
- (S) Counter support 5870 300 011



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

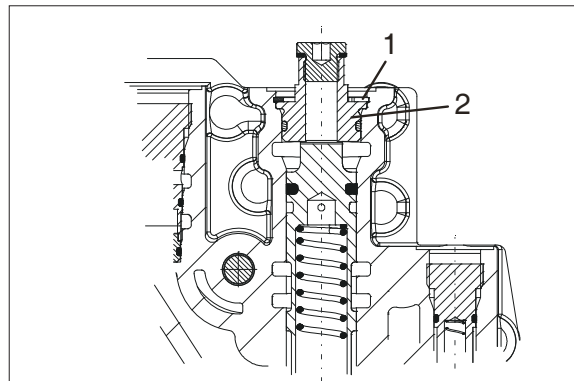


14WF8TM295

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

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

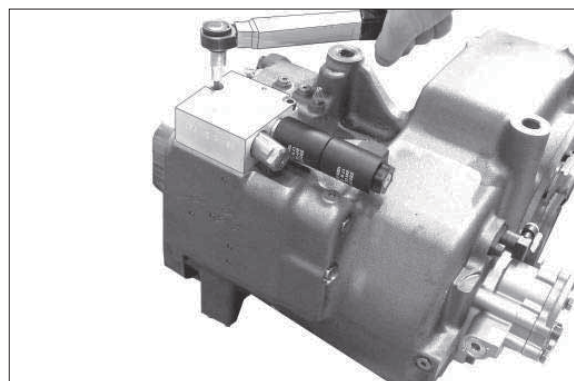
⚠ When disengaging retaining ring – Pay attention to spring preload. Protect against movement.



14WF8TM296

Disassemble valve block

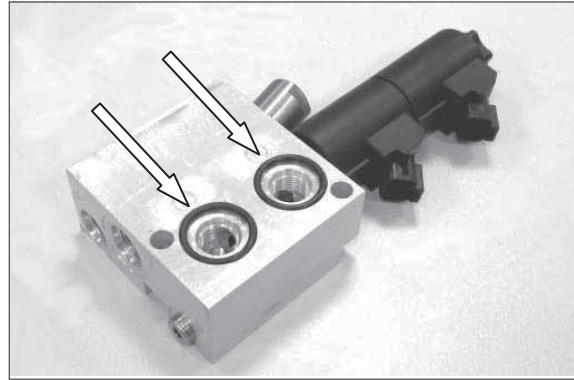
26) Loosen fixing screws and remove cpl. valve block.



14WF8TM297

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

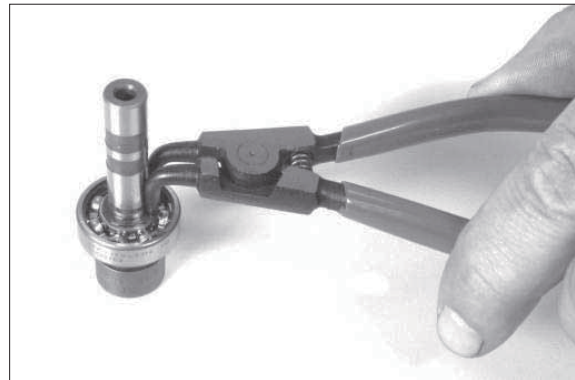
※ Do not further disassemble. Valve block may only be replaced as component.



14WF8TM298

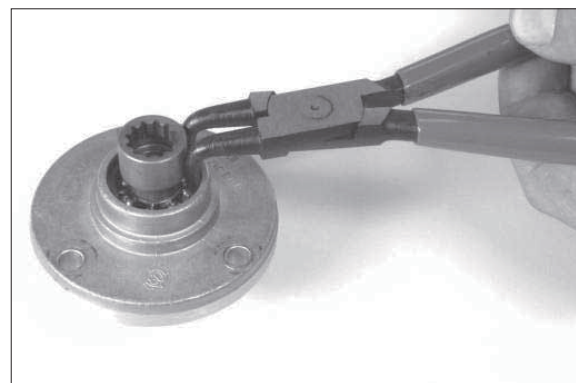
11. REASSEMBLY LUBRICATION PUMP

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



14WF8TM299

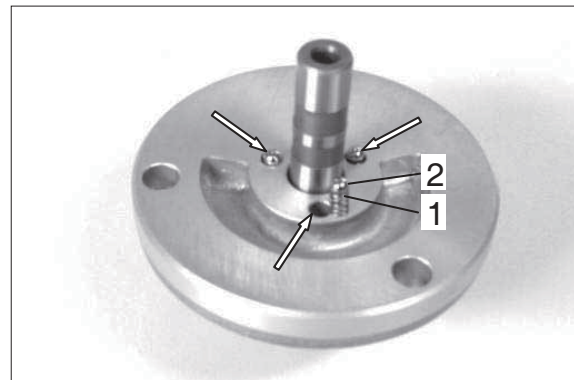
- 2) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.



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

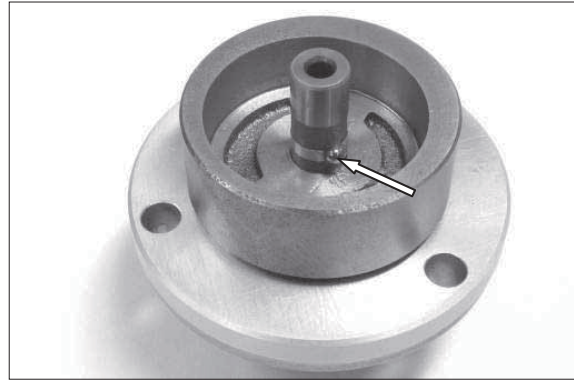
- 4) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



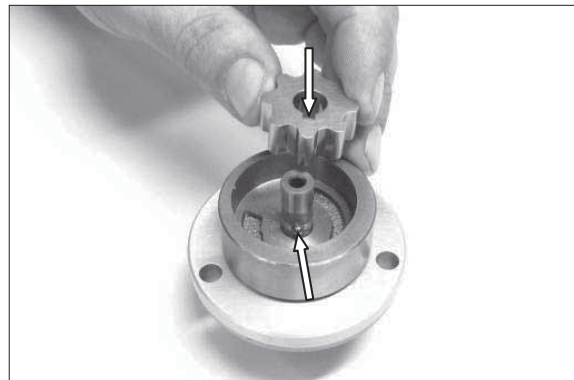
14WF8TM302

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



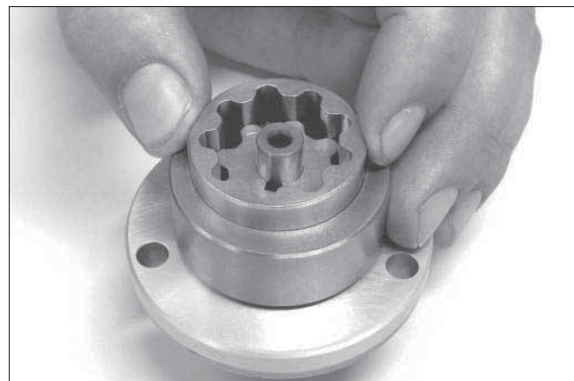
14WF8TM303

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



14WF8TM304

- 7) Mount outer rotor



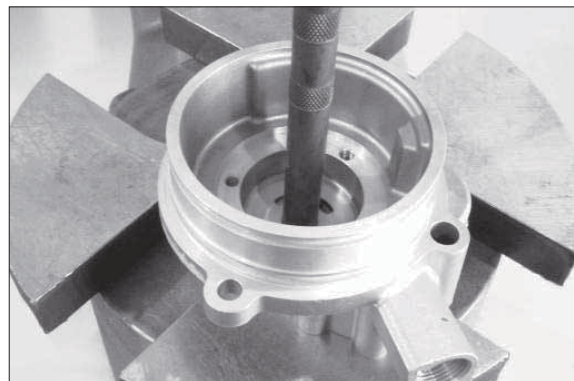
14WF8TM305

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

X = 0.2~0.7 mm below plane face / housing

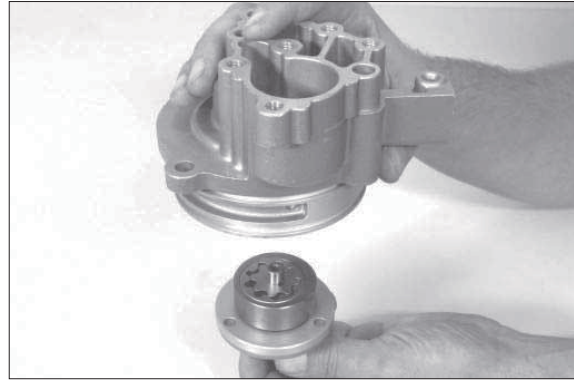
(S) Driver tool 5870 705 003

- ※ 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.



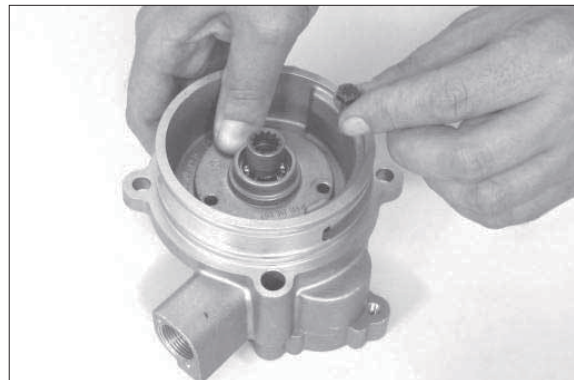
14WF8TM306

- 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) $M_A = 9.5 \text{ Nm}$



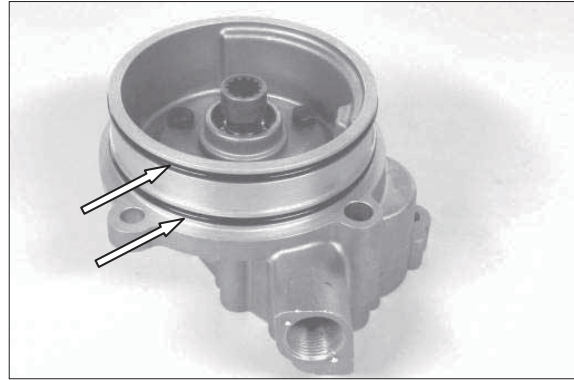
14WF8TM309

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



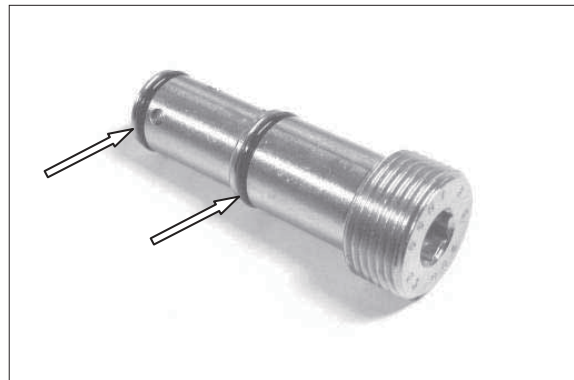
14WF8TM310

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.

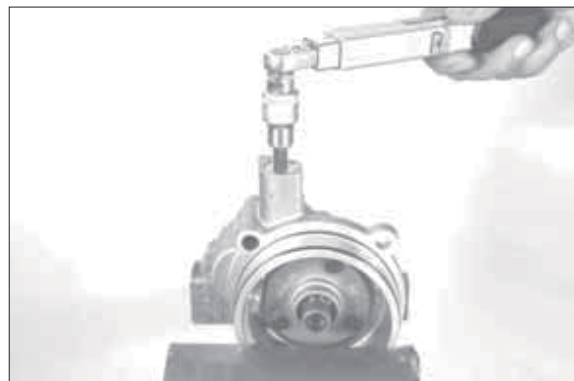


14WF8TM312

15) Mount pressure relief valve.

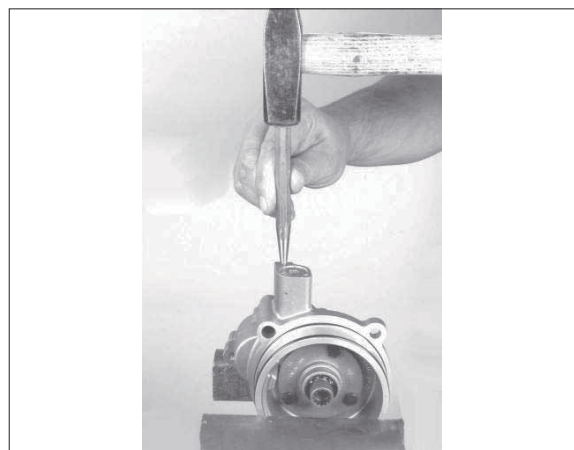
Tightening torque

$M_A = 10 \text{ Nm}$



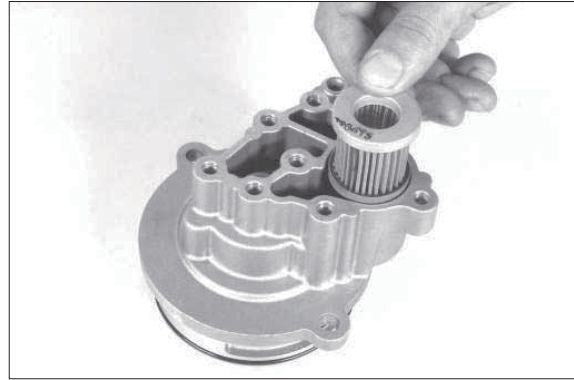
14WF8TM313

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



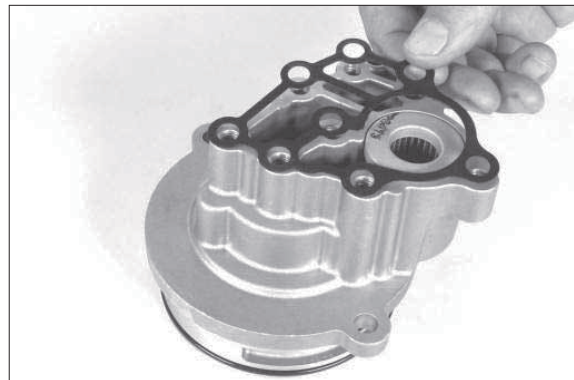
14WF8TM314

17) Insert filter.



14WF8TM315

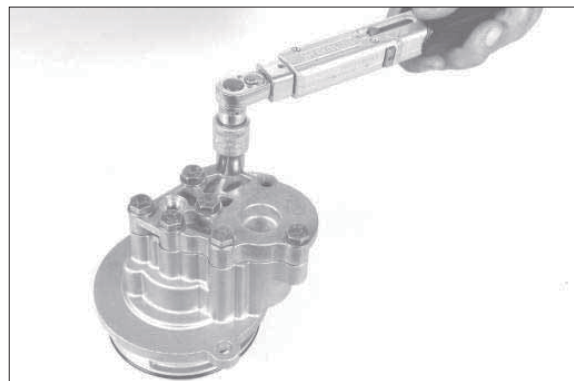
18) Place gasket.



14WF8TM316

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

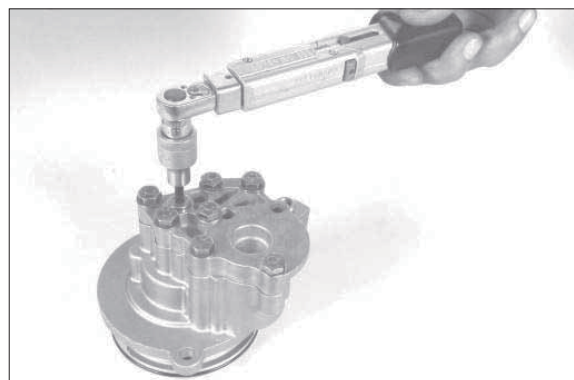
Tightening torque (M8/8.8) $M_A = 23 \text{ Nm}$



14WF8TM317

20) Insert screw plug with new O-ring.

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

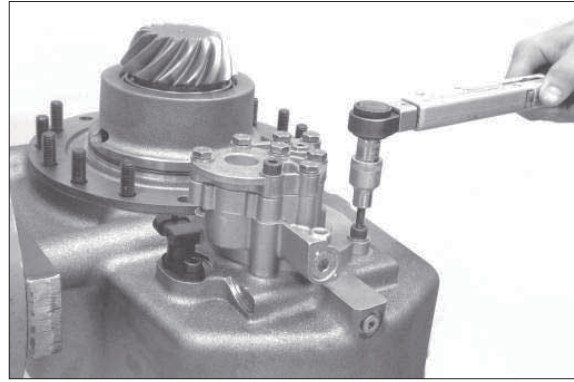


14WF8TM318

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

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

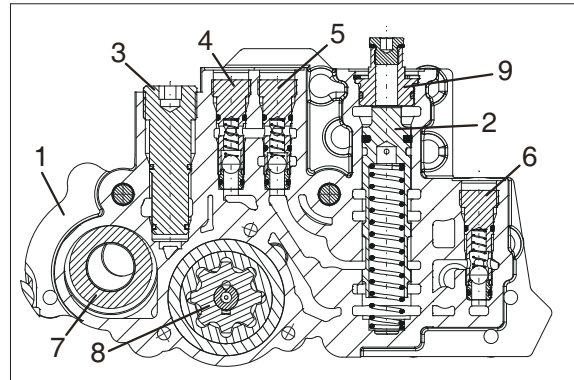
※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM319

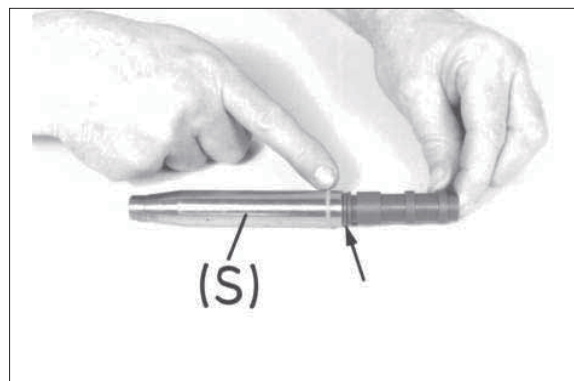
12. REASSEMBLY SHIFT INTERLOCK

- 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



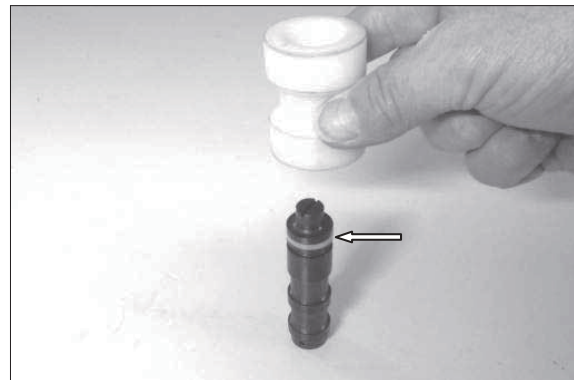
14WF8TM320

- 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.



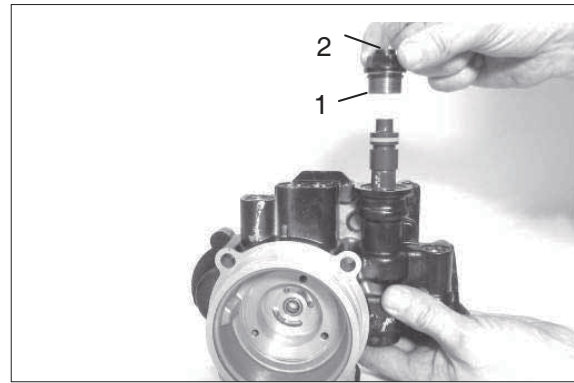
14WF8TM323

Version I :

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

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

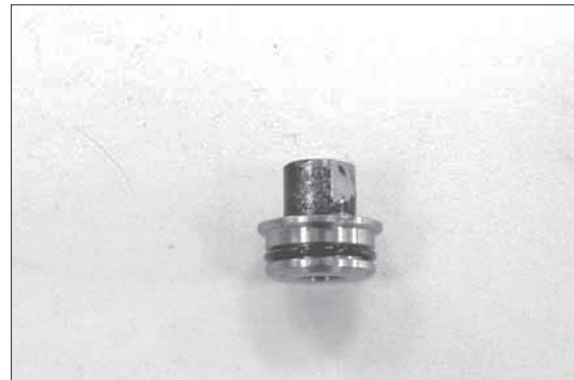
Screw plug (M10 × 1) $M_A = 15 \text{ Nm}$



14WF8TM324

Version II (14WF8TM325 ~ 14WF8TM327) :

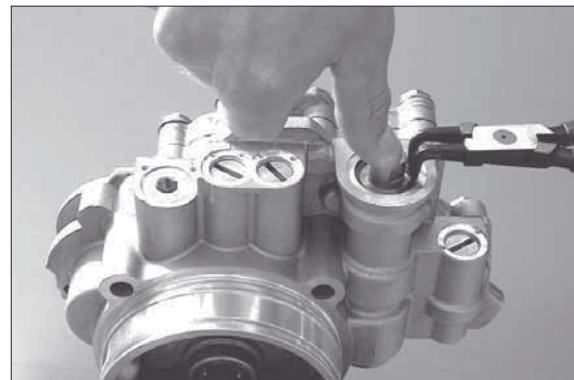
- 6) Oil O-ring and insert it into annular groove of plug.



14WF8TM325

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

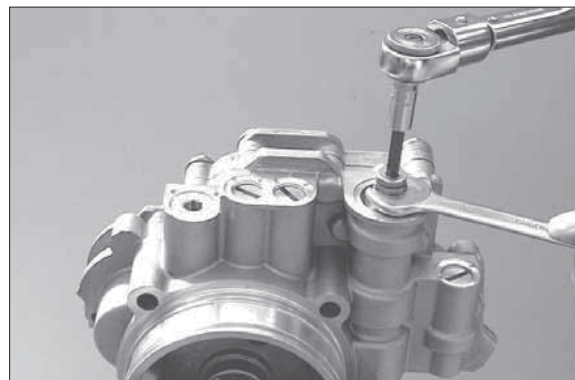
※ Pay attention to spring preload – protect against movement.



14WF8TM326

- 8) Mount screw plug with seal.

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

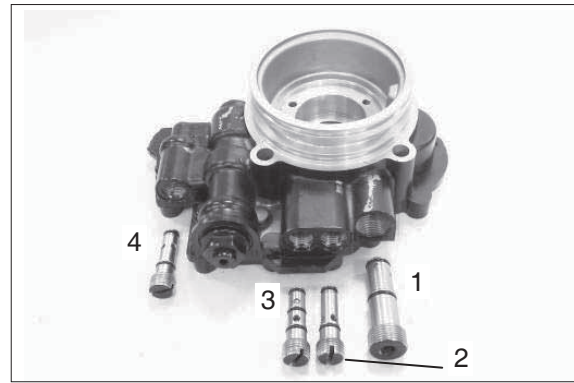


14WF8TM327

9) Install single parts according to adjacent illustration.

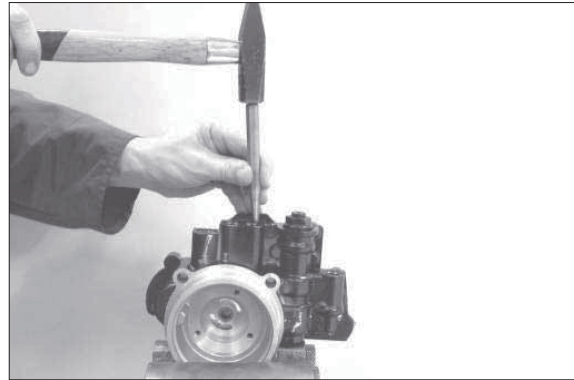
- 1 = Pressure relief valve cpl. $M_A = 10 \text{ Nm}$
- 2 = Check valve cpl. $M_A = 10 \text{ Nm}$
- 3 = Check valve cpl. $M_A = 10 \text{ Nm}$
- 4 = Check valve cpl. $M_A = 10 \text{ Nm}$

※ 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.



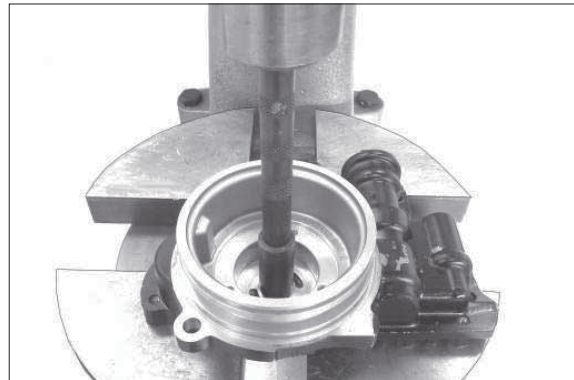
14WF8TM329

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

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

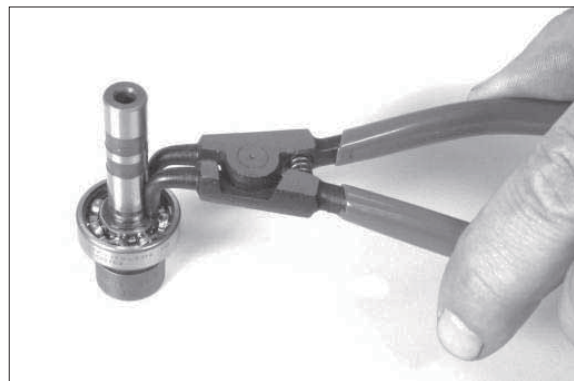
(S) Driver tool 5870 705 003

- ※ 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.



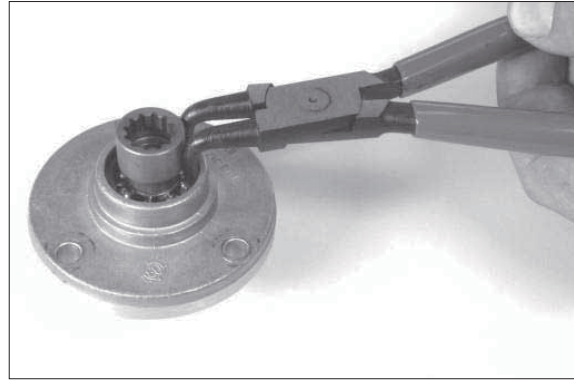
14WF8TM330

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.

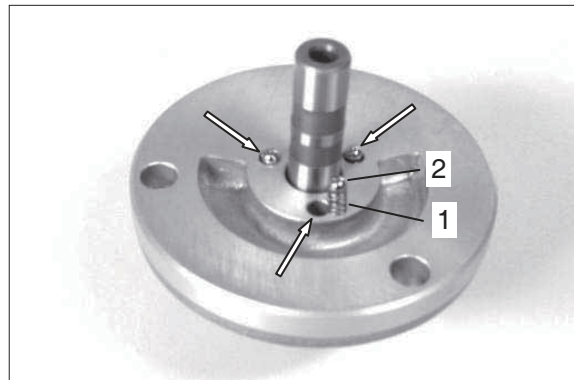


14WF8TM332

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

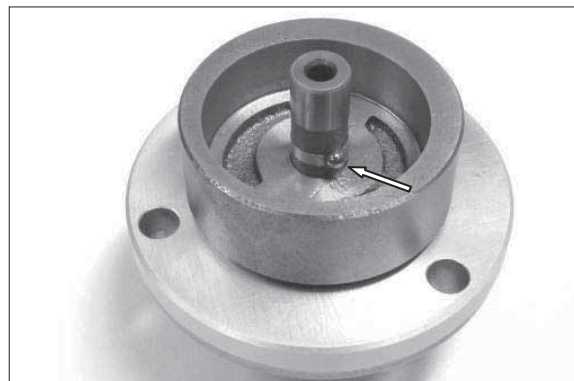
15) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



14WF8TM334

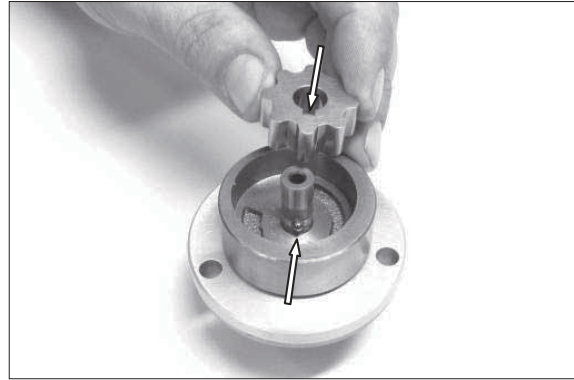
16) Position ball – (see arrow –engagement for inner rotor) with grease into countersink of pump shaft



14WF8TM335

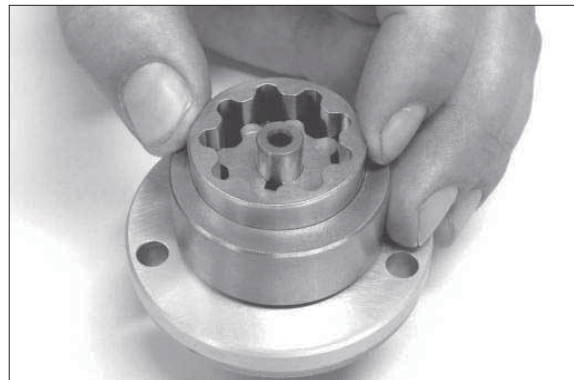
17) Mount inner rotor.

- ※ 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.

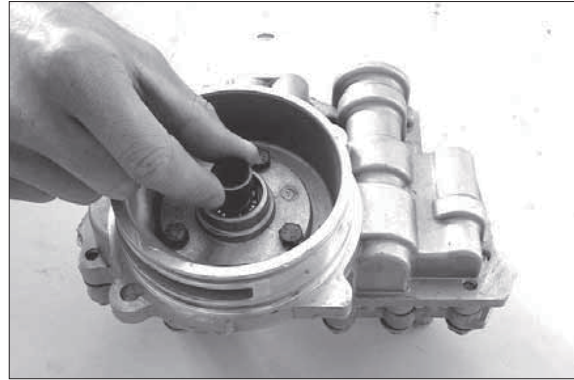
Tightening torque (M6/8.8) $M_A = 9.5 \text{ Nm}$

- ※ Maintain contact position of inserted pump.



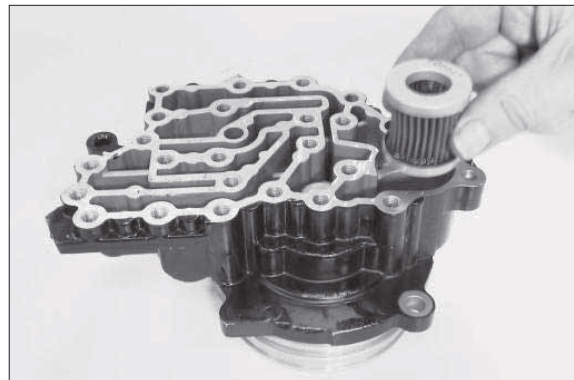
14WF8TM339

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



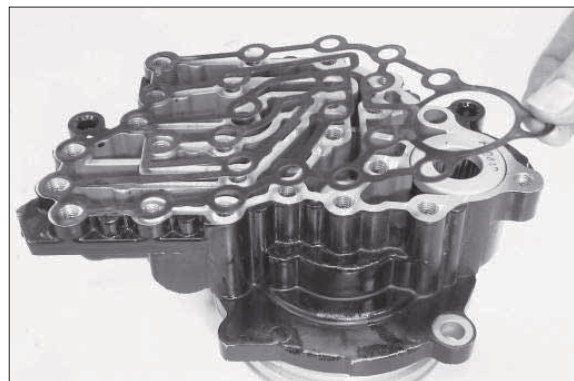
14WF8TM340

22) Insert screen filter.



14WF8TM341

23) Place gasket.

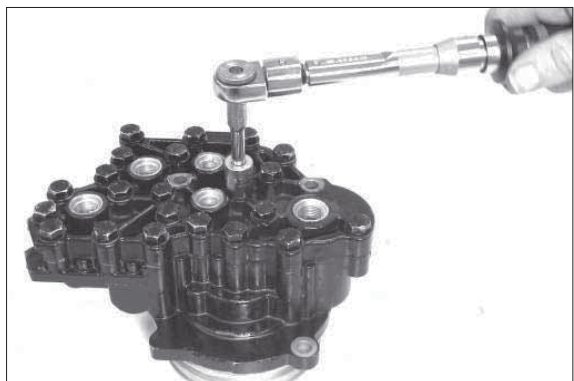


14WF8TM342

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

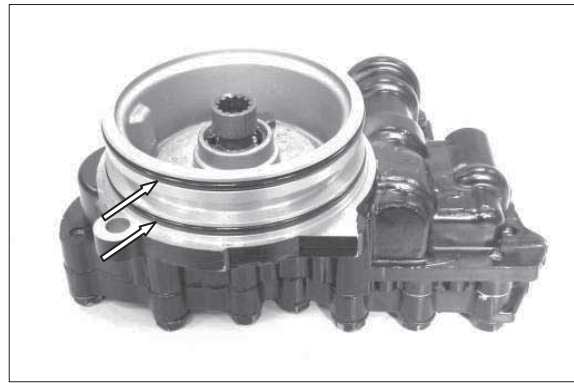
Tightening torque (M8/8.8) $MA = 23 \text{ Nm}$

※ Pay attention to different screw length.



14WF8TM343

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

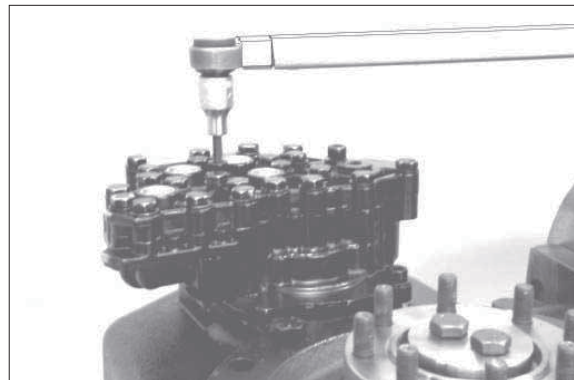


14WF8TM344

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.

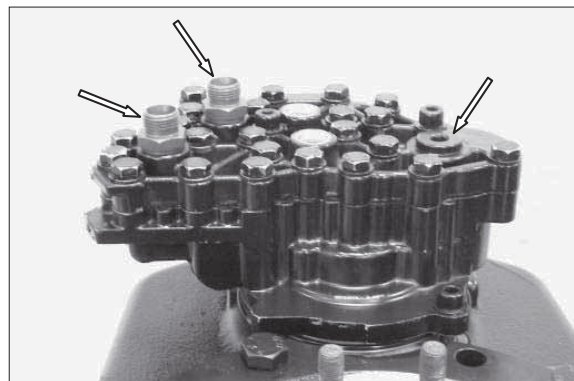


14WF8TM345

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

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

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



14WF8TM346

28) 1 = Oil tube

2 = Hollow screw (M16 × 1.5)

3 = Seal ring

4 = Hollow screw (M14 × 1.5)

5 = Seal ring



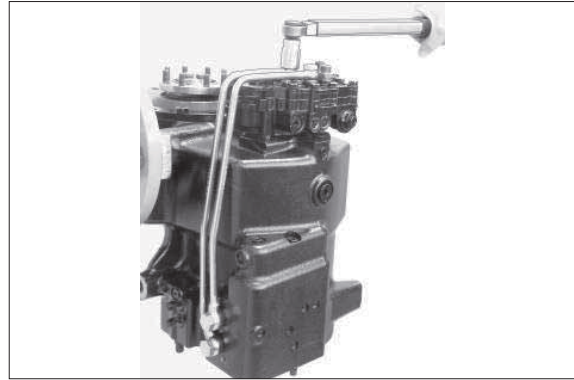
14WF8TM347

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.

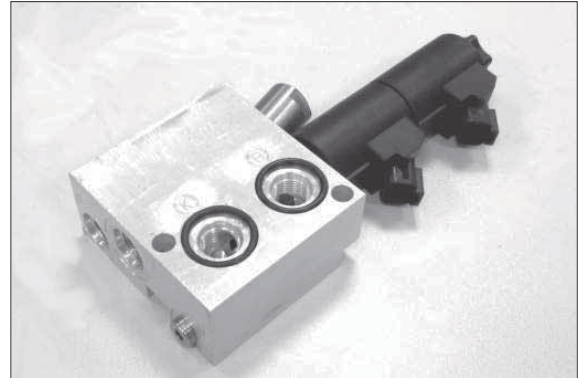


14WF8TM3428

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

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

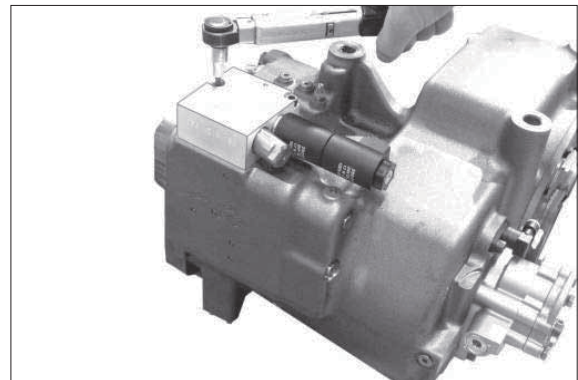
※ Use grease as assembly aid.



14WF8TM349

2) Fix cpl. valve block with cylindrical screws.

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

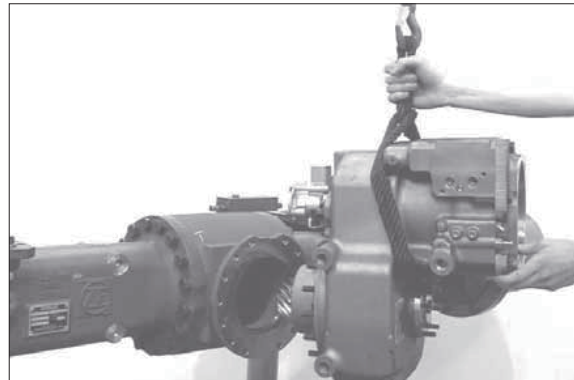


14WF8TM350

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

1) Position complete transmission to axle.

(S) Lifting strap 5870 281 026

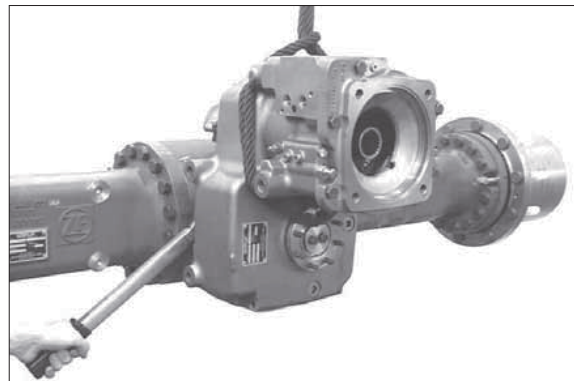


14WF8TM351

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

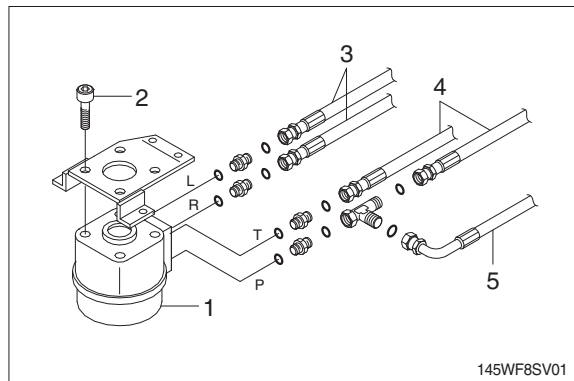
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

- (4) Disconnect steering line hoses (3, 4, 5).
- (5) Loosen the socket bolt (2) and remove the steering valve assembly (1).
 - Tightening torque : $6.9 \pm 1.4 \text{ kgf} \cdot \text{m}$
($49.9 \pm 10.1 \text{ lbf} \cdot \text{ft}$)

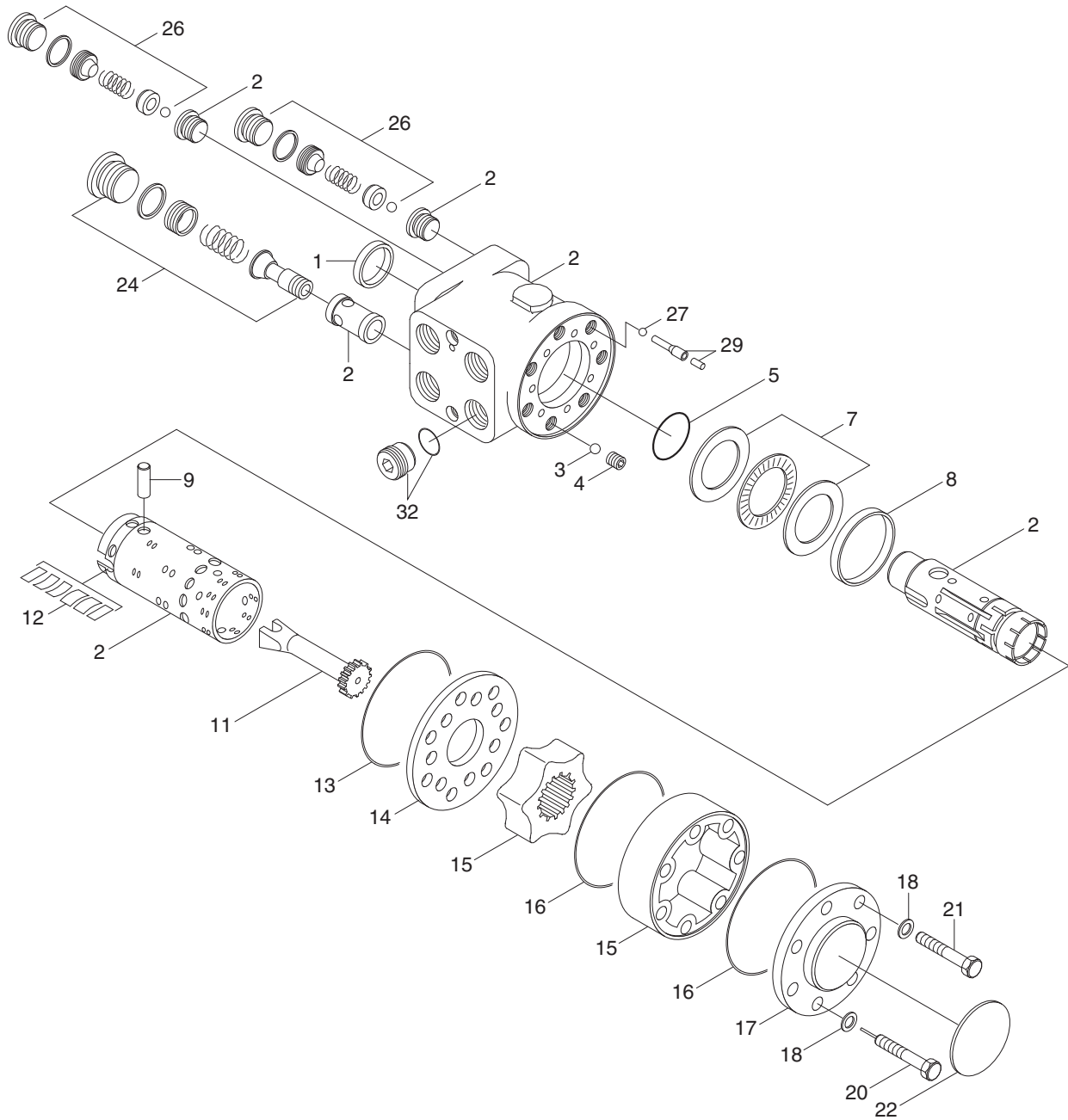
2) INSTALL

- (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



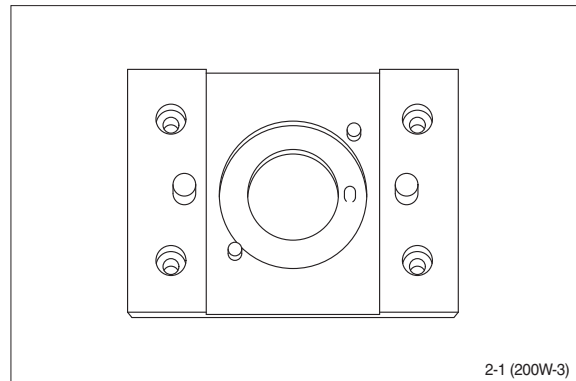
14W7A8SV02

1	Dust seal ring	11	Cardan shaft	20	Pin screw
2	*Housing, spool, sleeve	12	Spring set	21	Screw
3	Ball	13	O-ring	22	Name plate
4	Bushing	14	Distributor plate	24	Relief valve assy
5	O-ring	15	Gear wheel set	26	Shock valve
7	Bearing assy	16	O-ring	27	Ball
8	Ring	17	End cover	29	W/pin bushing
9	Cross pin	18	Washer	32	Check valve

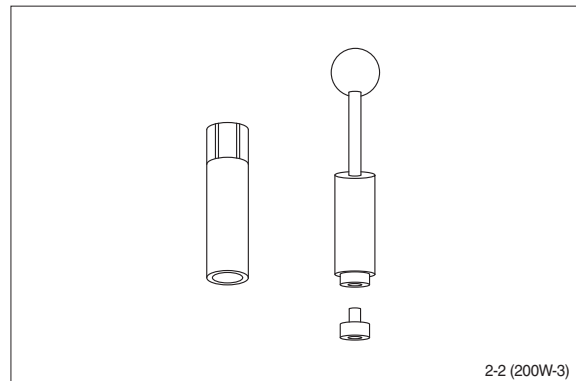
* Housing, spool and sleeve (check valve and the seats for relief and dual shock valves are loctited).

2) TOOLS

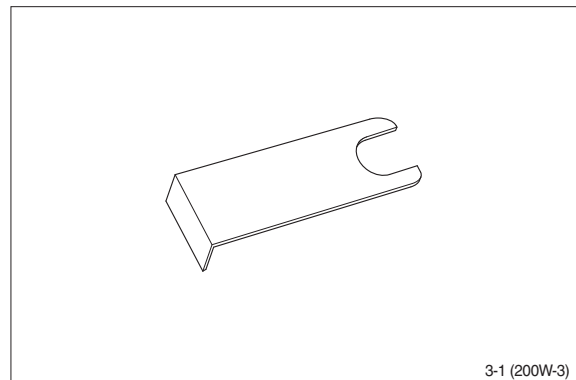
(1) Holding tool.



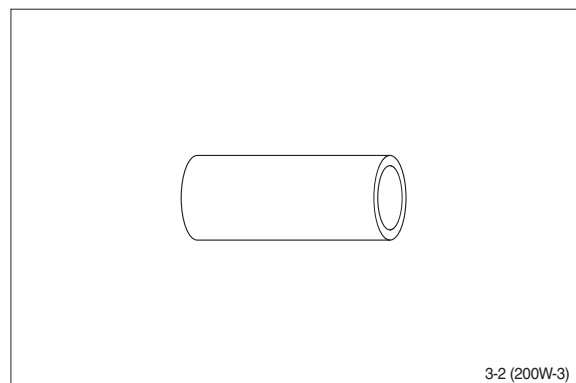
(2) Assembly tool for O-ring (5,13,16) and kin-ring (6).



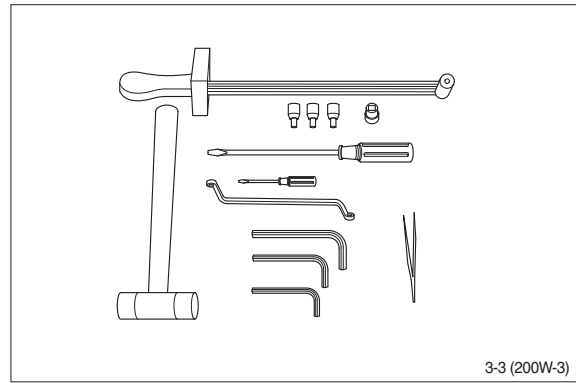
(3) Assembly tool for cardan shaft (11).



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



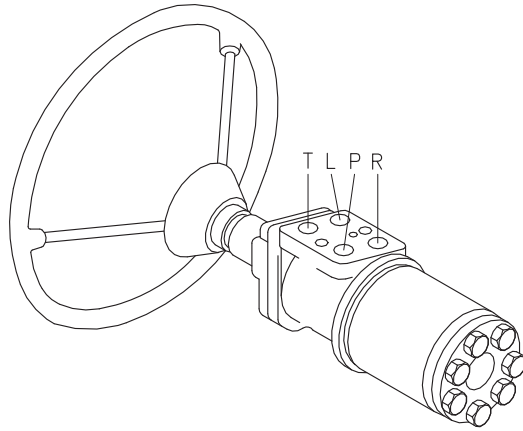
- (5) Torque wrench : 0~7.1 kgf · m
(0~54.4 lbf · ft)
- 13 mm socket spanner.
 - 6, 8 mm and 12 mm hexagon sockets.
 - 12 mm screwdriver.
 - 2 mm screwdriver.
 - 13 mm ring spanner.
 - 6,8 mm and 12 mm hexagon socket spanners.
 - Plastic hammer.
 - Tweezers.



3-3 (200W-3)

3) TIGHTENING TORQUE AND HYDRAULIC CONNECTIONS

(1) Hydraulic connections



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

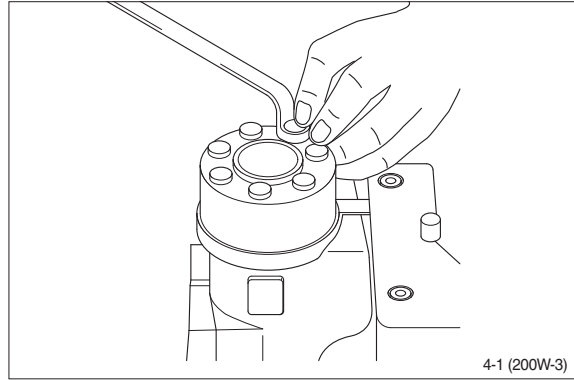
17038SV03

(2) Tightening torque

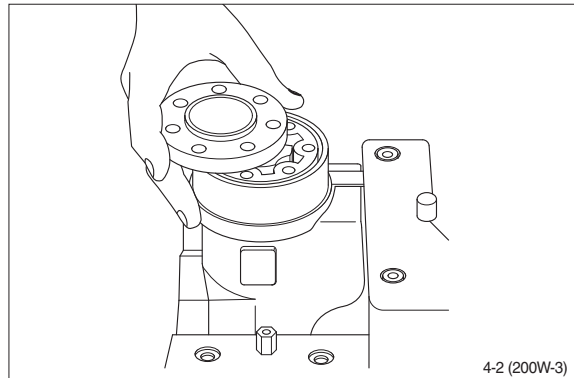
Screwed connection	Max. tightening torque kgf · m (lbf · ft)			
	With cutting edge	With copper washer	With aluminum washer	With O-ring
1.4 BSP.F	4.1 (29.7)	2.0 (14.5)	3.1 (22.4)	-
3/8 BSP.F	6.1 (44.1)	2.0 (14.5)	5.1 (36.9)	-
1/2 BSP.F	10.2 (73.8)	3.1 (22.4)	8.2 (59.3)	-
7/16-20 UNF	-	-	-	2.0 (14.5)
3/4-16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

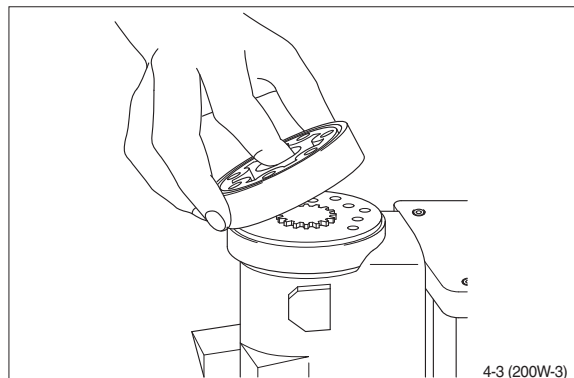
- (1) Disassemble steering column from steering valve and place the steering valve in the holding tool.
Screw out the screws in the end cover (6-off plus one special screw).



- (2) Remove the end cover, sideways.



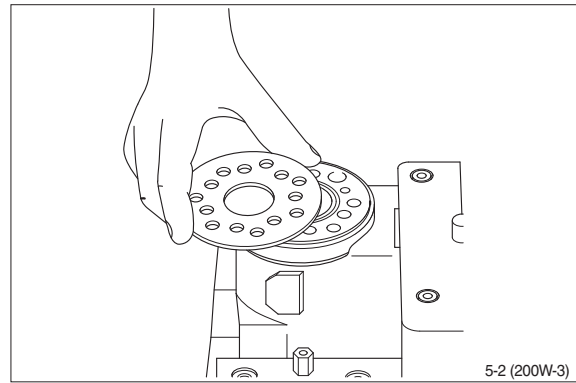
- (3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.



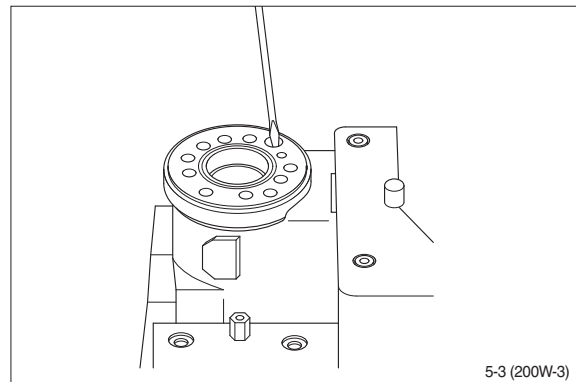
- (4) Remove cardan shaft.



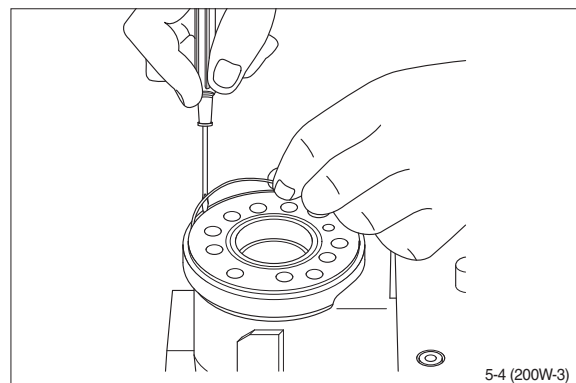
(5) Remove distributor plate.



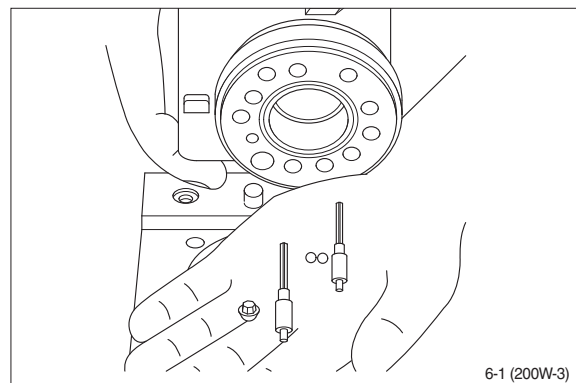
(6) Screw out the threaded bushing over the check valve.



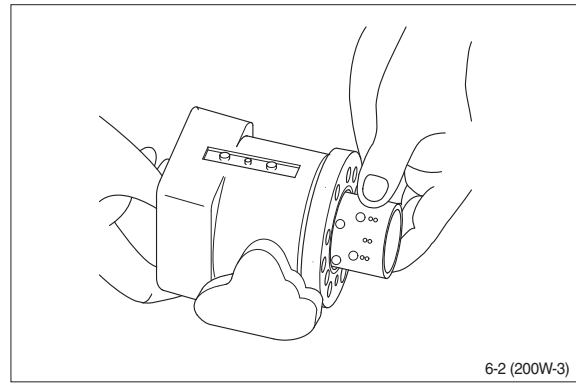
(7) Remove O-ring.



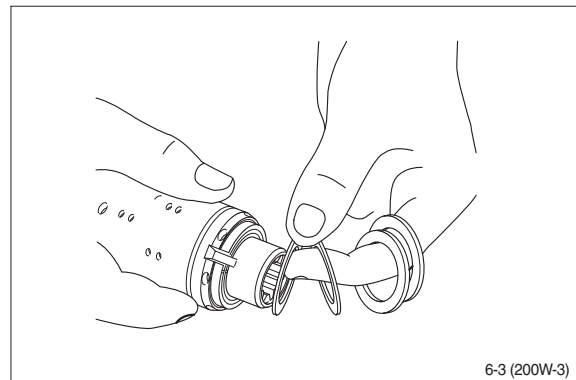
(8) Shake out the check valve ball and suction valve pins and balls.



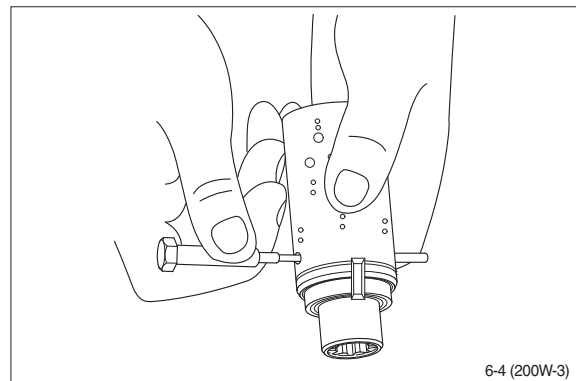
- (9) Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and needle bearing will be pushed out of the housing together.



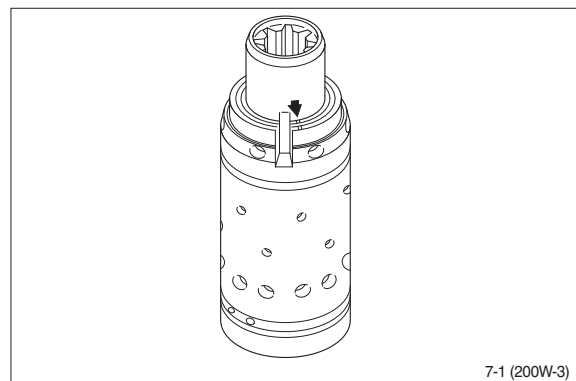
- (10) Take ring, bearing races and needle bearing from sleeve and spool. The outer(thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



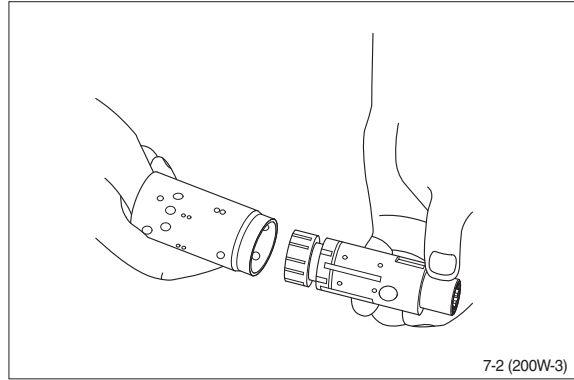
- (11) Press out the cross pin. Use the special screw from the end cover.



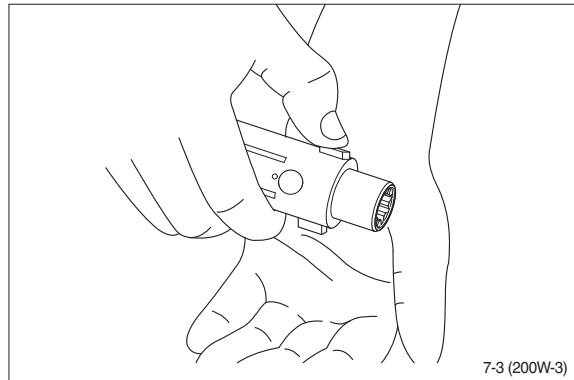
- ※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position spring as figure. If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



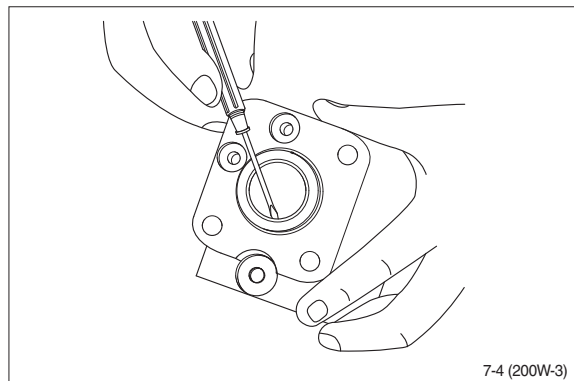
(12) Carefully press the spool out of the sleeve.



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

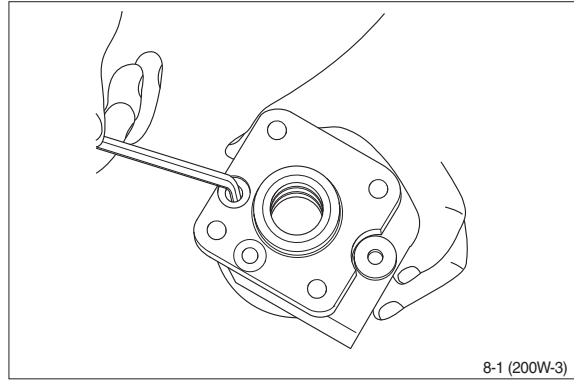


(14) Remove dust seal and O-ring.

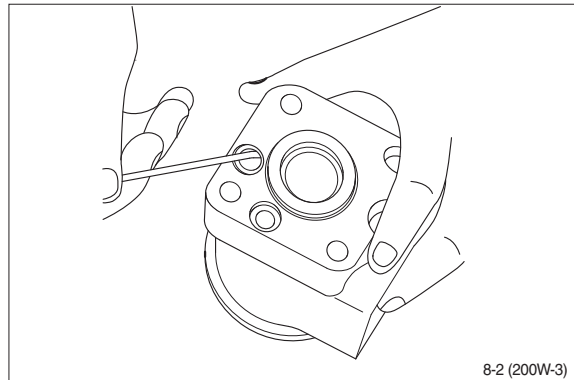


(15) Disassemble the dual shock valve

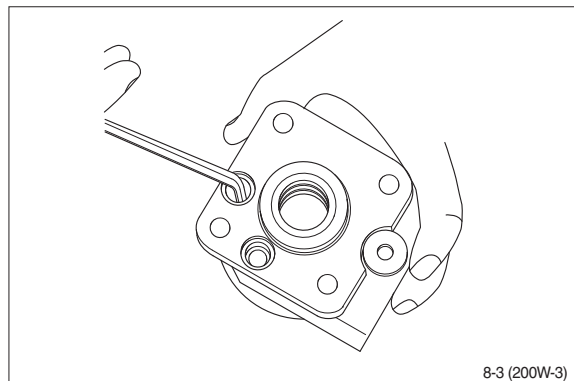
- ① Remove plugs from shock valves using a 6mm hexagon socket spanner.



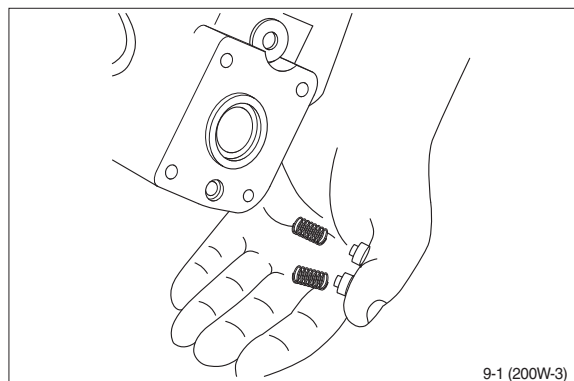
- ② Remove seal washers (2-off).



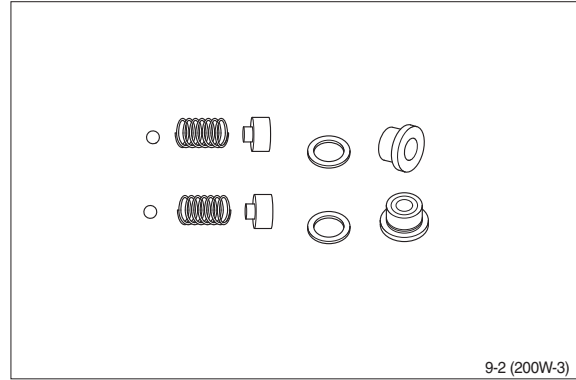
- ③ Unscrew the setting screws using a 6 mm hexagon socket spanner.



- 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.

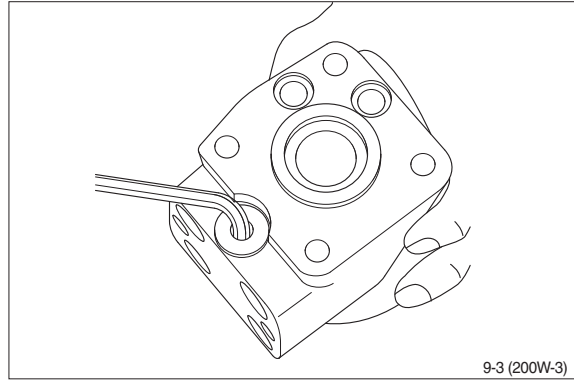


⑤ The dual shock valves are now disassembled.

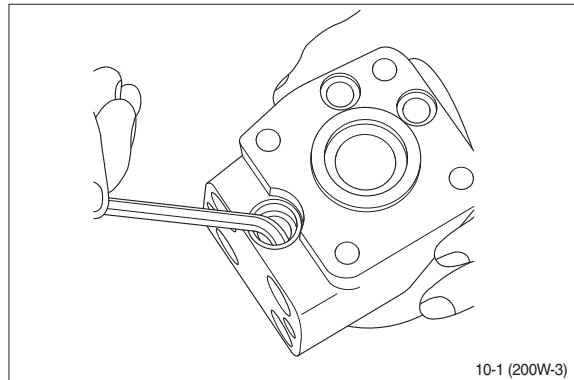


(16) Disassemble the pressure relief valve (cartridge)

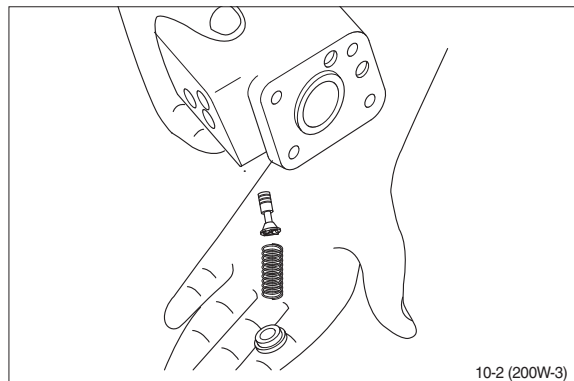
- ① Screw out the plug using an 8 mm hexagon socket spanner. Remove seal washers.



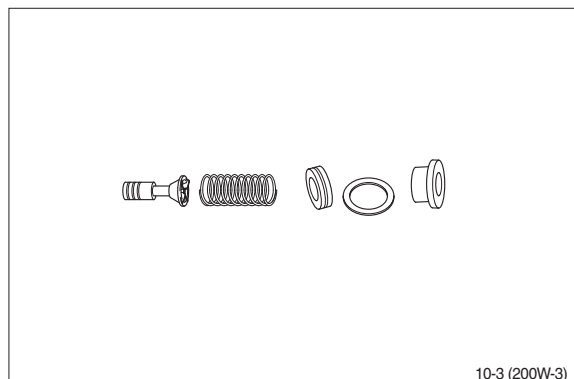
- ② Unscrew the setting screw using an 8mm hexagon socket spanner.



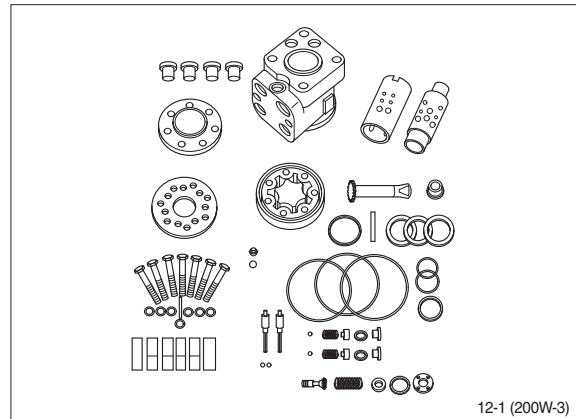
- ③ Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.



- ④ The pressure relief valve is now disassembled.



- ⑤ The steering valve is now completely disassembled.



12-1 (200W-3)

※ **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**

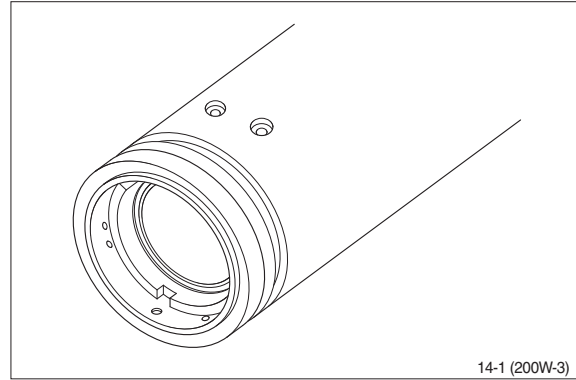
Before assembly, lubricate all parts with hydraulic oil.

5) ASSEMBLY

(1) Assemble spool and sleeve.

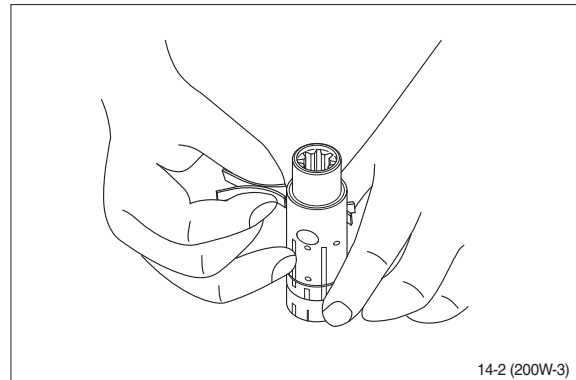
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.

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.



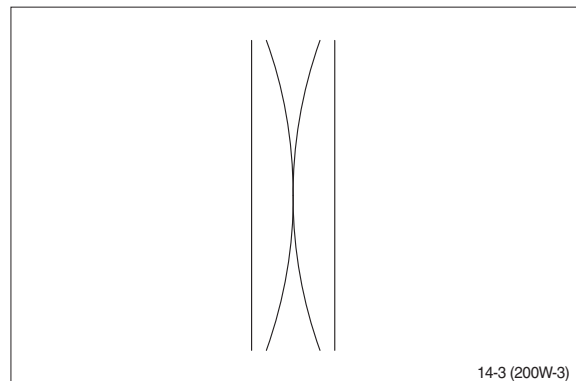
(2) Place the two flat neutral position springs in the slot.

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

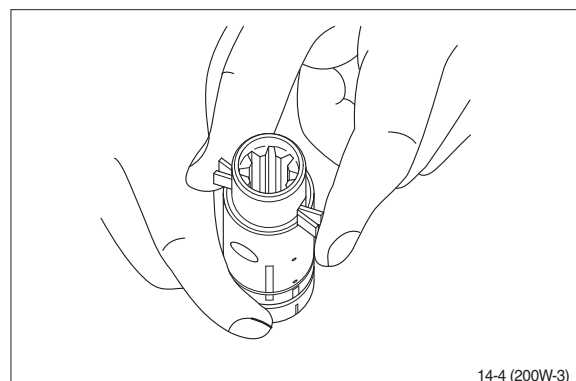


※ Assembly pattern.

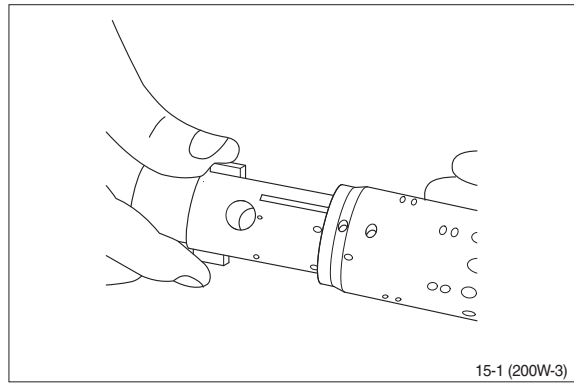
· Part no : 150N4035



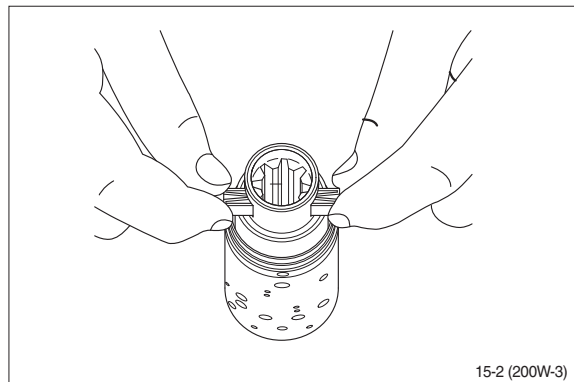
(3) Line up the spring set.



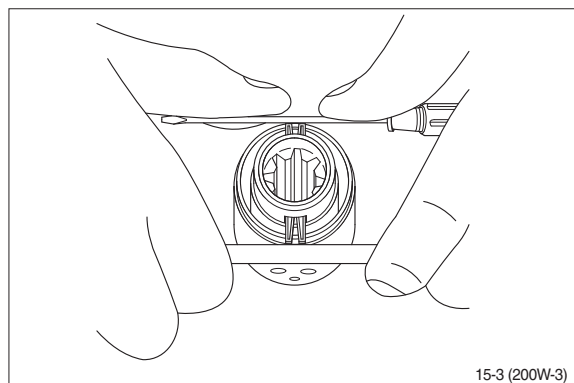
- (4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other.



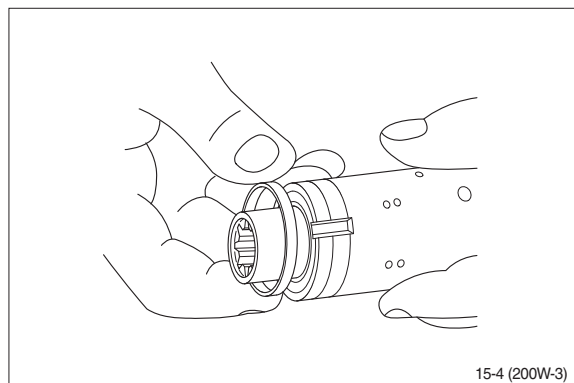
- (5) Press the springs together and push the neutral position springs into place in the sleeve.



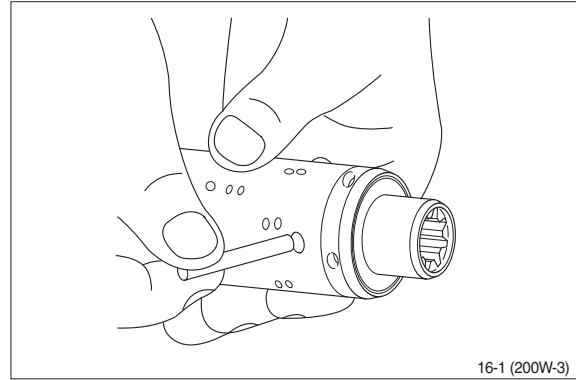
- (6) Line up the springs and center them.



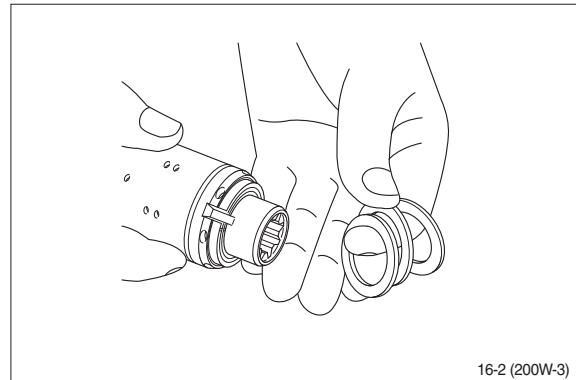
- (7) Guide the ring down over the sleeve.
※ The ring should be able to rotate free of the springs.



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

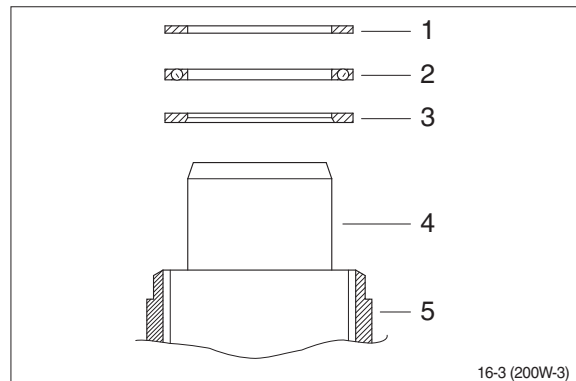


(9) Fit bearing races and needle bearing as shown on below drawing.



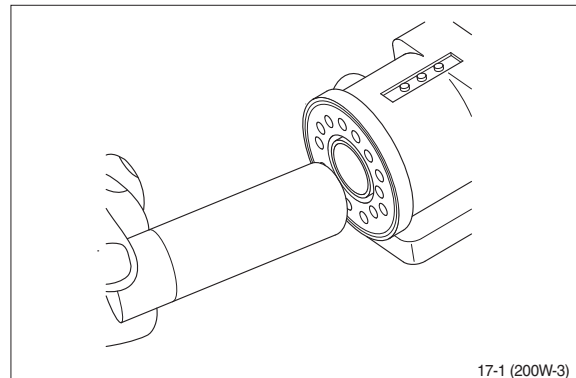
※ Assembly patted for standard bearings

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

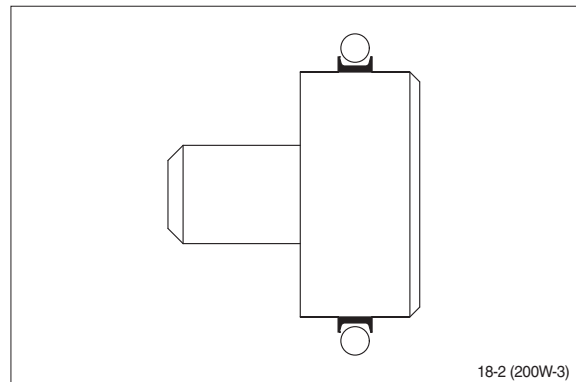
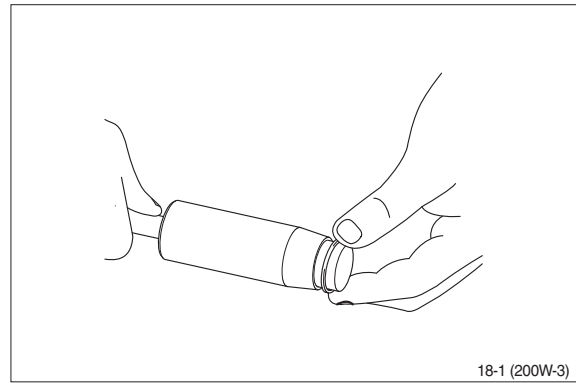


Installation instruction for O-ring

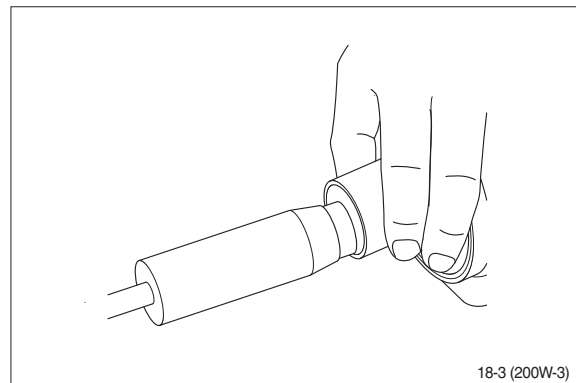
(10) Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.



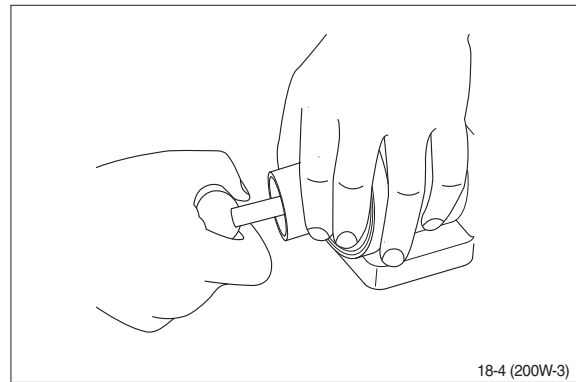
(11) Grease O-ring with hydraulic oil and place them on the tool.



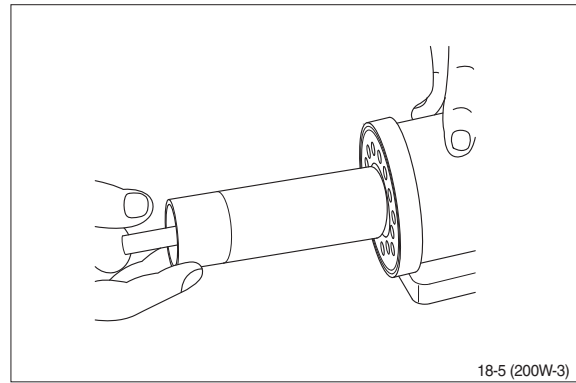
(12) Hole the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



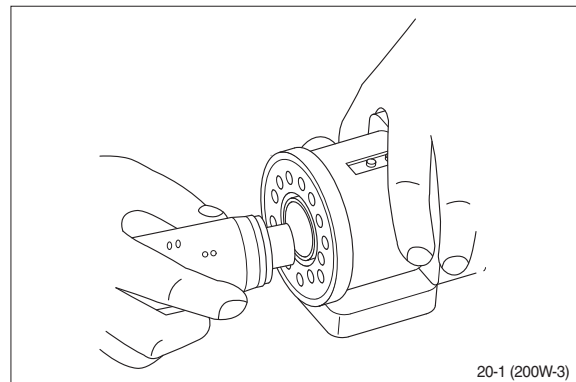
(13) Press and turn the O-ring into position in the housing.



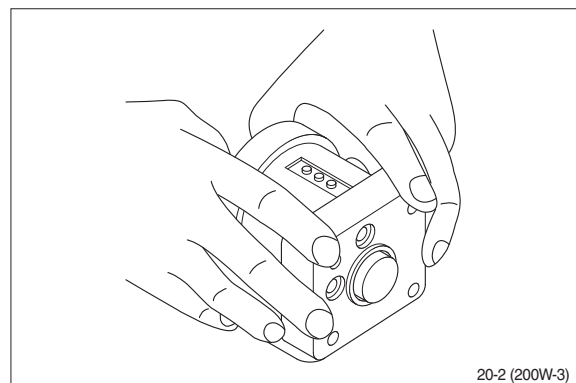
- (14) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



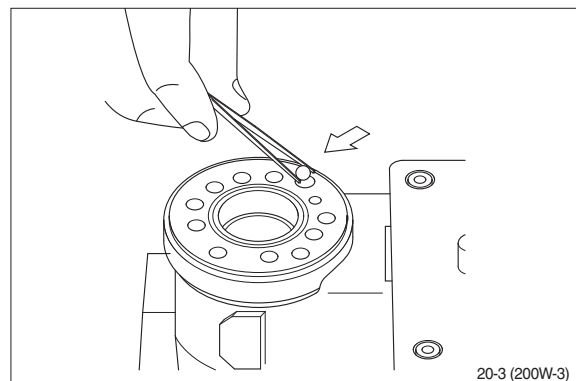
- (15) With a light turning movement, guide the spool and sleeve into the bore.
※ Fit the spool set holding the cross pin horizontal.



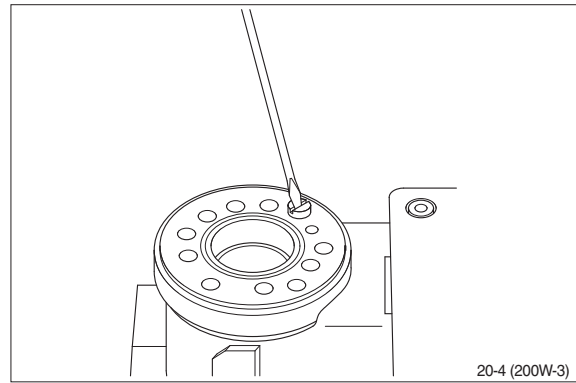
- (16) The spool set will push out the assembly tool guide. The O-ring is now in position.



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

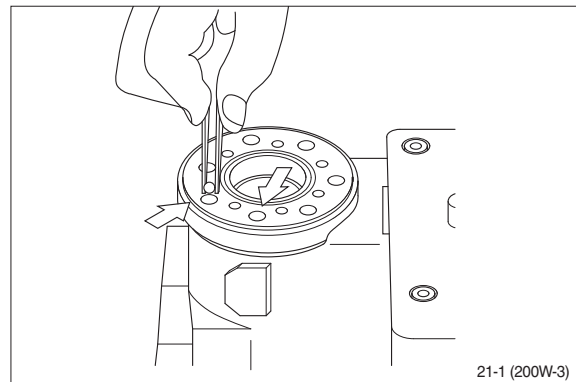


(18) Screw the threaded bush lightly into the check valve bore. The top of the bushing must lie just below the surface of the housing.

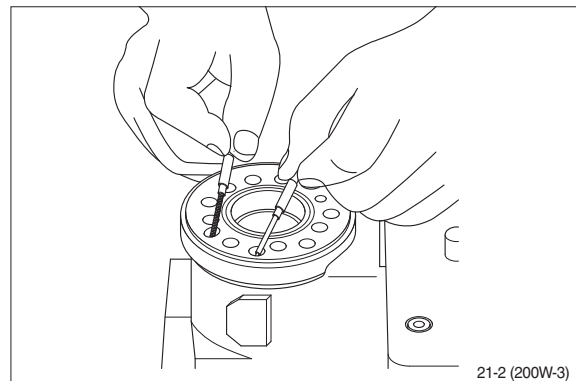


Assembly of the two suction valve

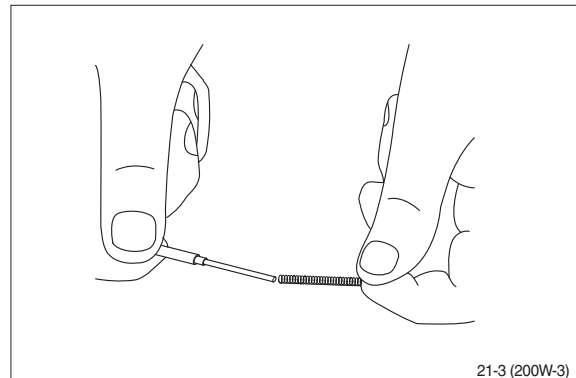
(19) Place a ball in the two holes indicated by the arrows.



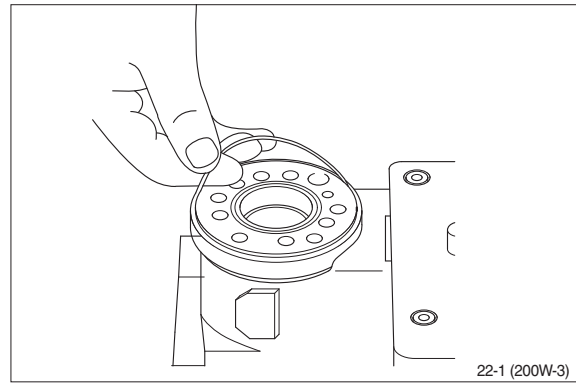
(20) Place a pin in the same two holes.



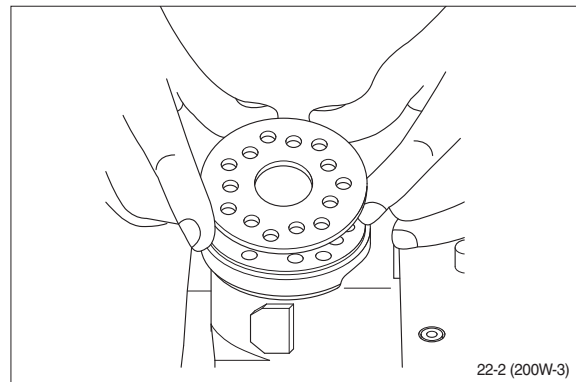
(21) In some cases a spring has to be fitted on the pin before it is placed in the housing.



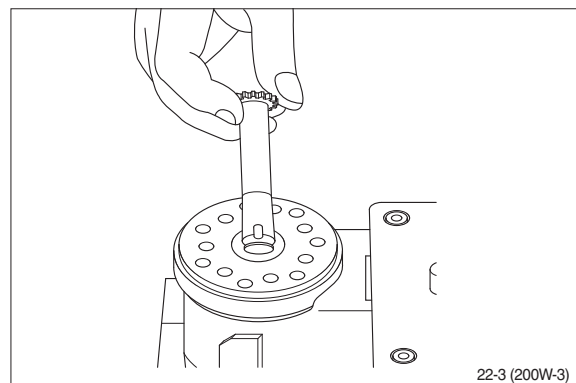
(22) Grease the O-ring with mineral oil approx viscosity 500 cST at 20°C.



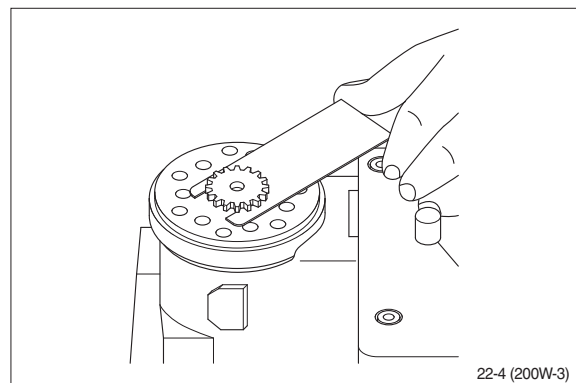
(23) Place the distributor plate so that the channel holes match the holes in the housing.



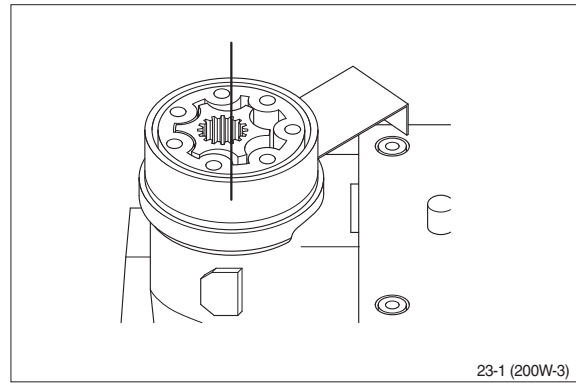
(24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



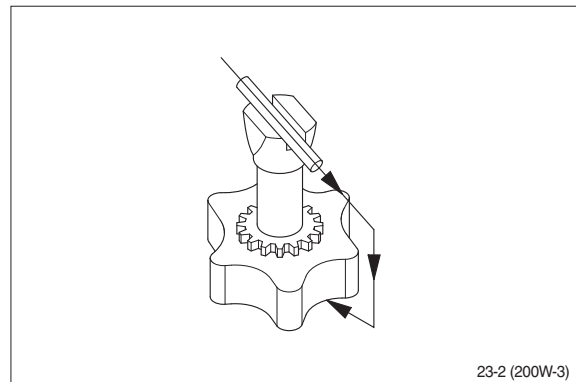
(25) Place the cardan shaft as shown so that it is held in position by the mounting fork.



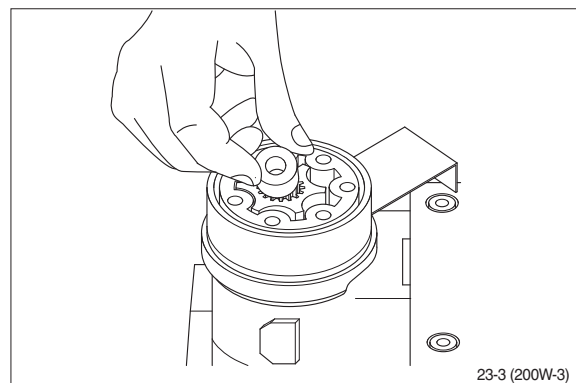
(26) Grease the two O-rings with mineral oil approx. viscosity 500 cST at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



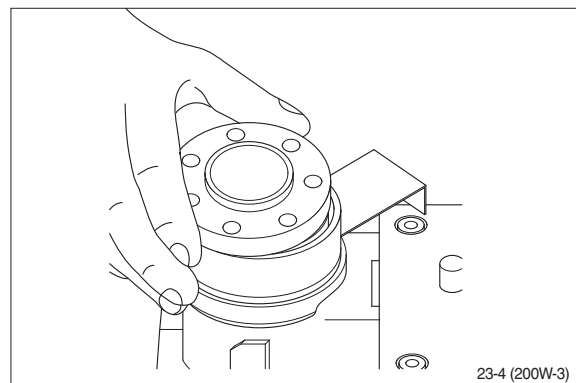
(27) Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing.



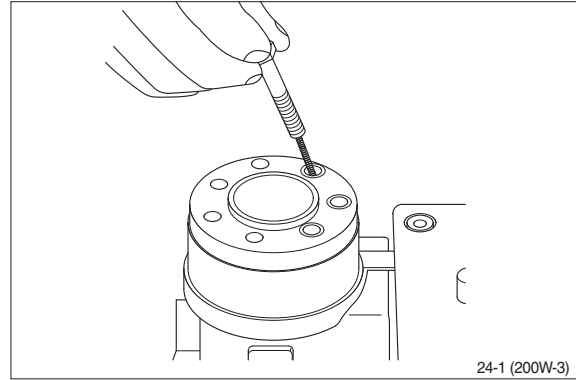
(28) Fit the spacer, if any.



(29) Place the end cover in position.

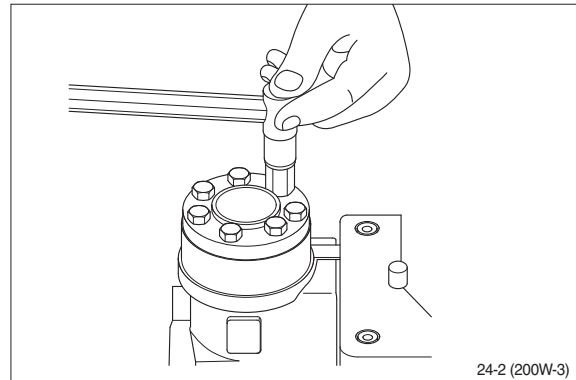


(30) Fit the special screw with washer and place it in the hole shown.

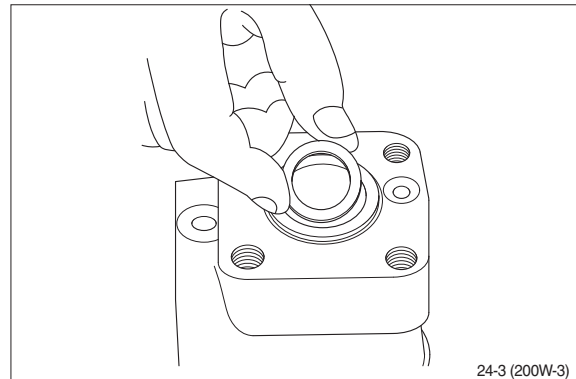


(31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

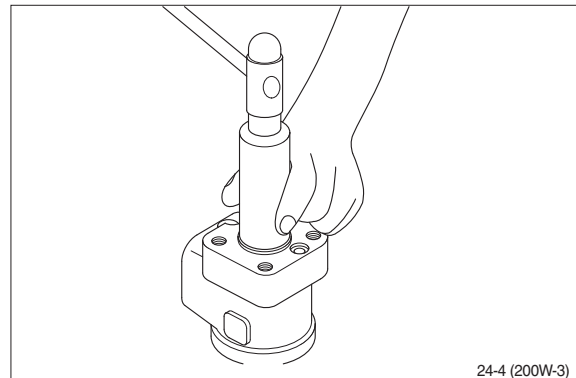
- Tightening torque : $3.0 \pm 0.6 \text{ kgf} \cdot \text{m}$
($22.4 \pm 4.3 \text{ lbf} \cdot \text{ft}$)



(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.

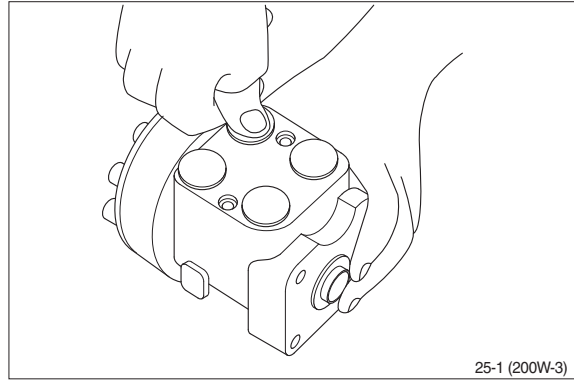


(33) Fit the dust seal ring in the housing.



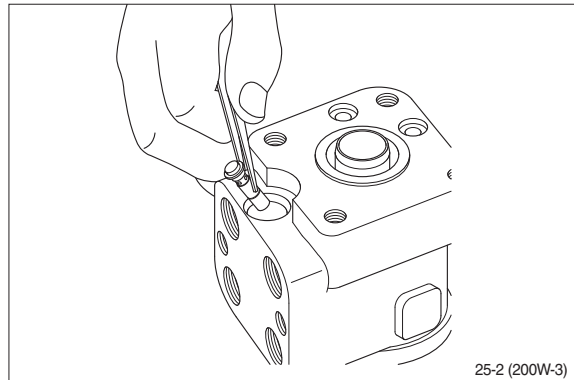
(34) Press the plastic plugs into the connection ports.

※ Do not use a hammer!

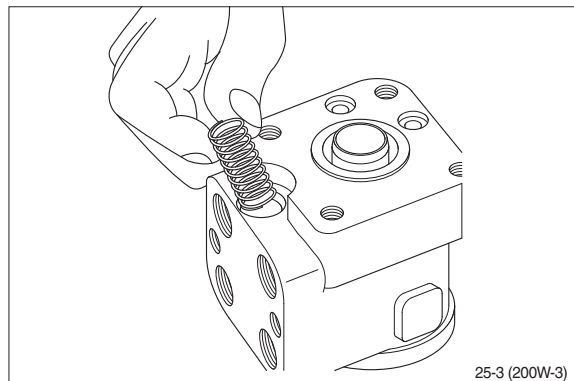


Assembly of the pressure relief valve

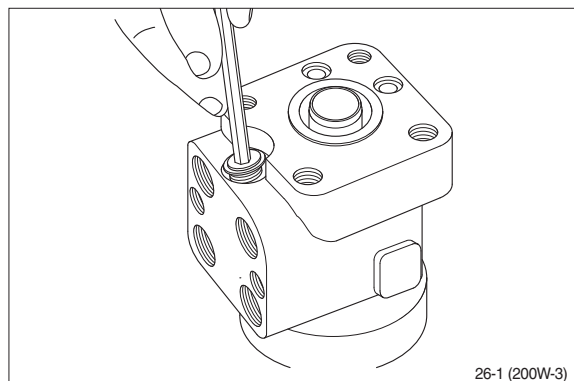
(35) Fit the piston.



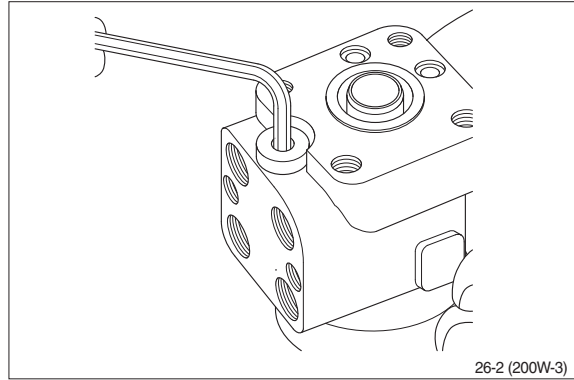
(36) Fit the spring.



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

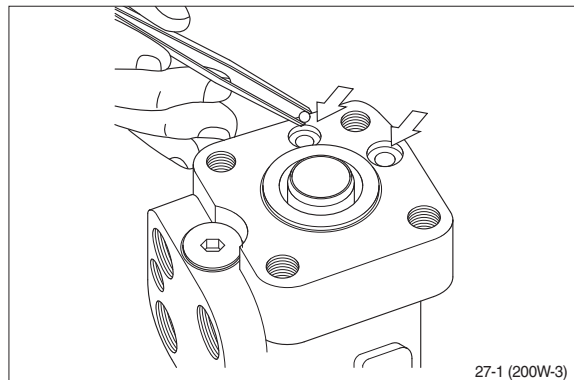


- (38) Screw plug with dust seal into the housing using an 8mm hexagon socket spanner.
- Tightening torque : $5.1 \pm 1.0 \text{ kgf} \cdot \text{m}$
($36.9 \pm 7.2 \text{ lbf} \cdot \text{ft}$)

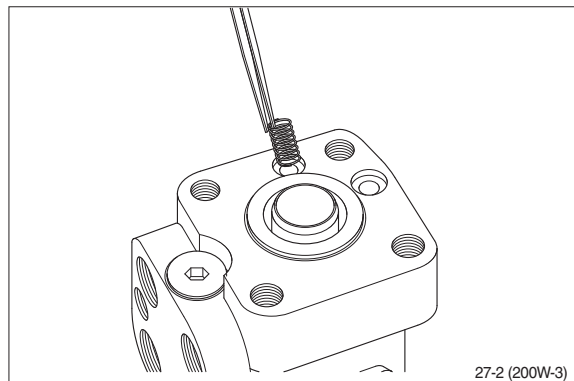


Assembly of the dual shock valve

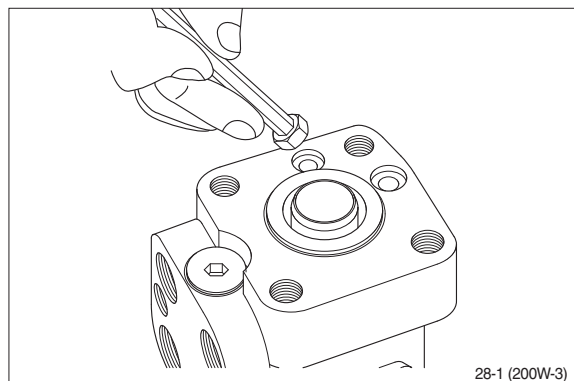
- (39) Put a ball in the two holes indicated by the arrows.



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

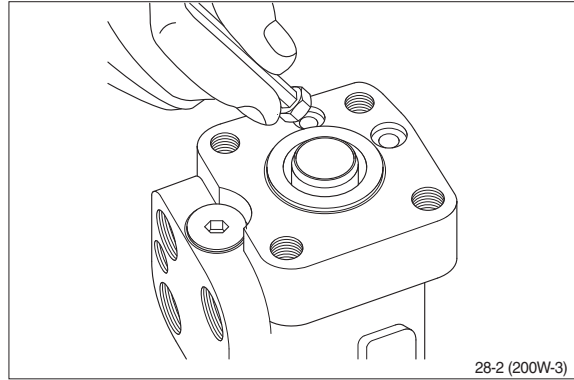


- (41) Screw in the two setting screws using a 6mm hexagon socket spanner. Make the pressure setting on a panel or the machine.



(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)

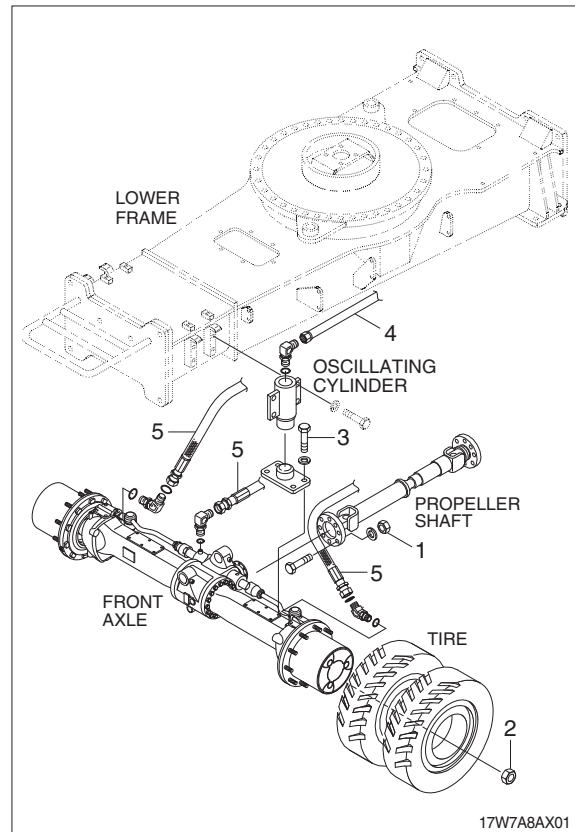


Steering valve is now assembled.

GROUP 9 FRONT AXLE

1. REMOVAL FRONT AXLE

- 1) Propeller shaft mounting nut (1, M10)
 - Tightening torque : 5.9 ± 0.6 kgf · m
(42.7 ± 4.3 lbf · ft)
- 2) Wheel nut (2, M22)
 - Tightening torque : 60^{+0}_{-5} kgf · m
(433^{+0}_{-36} lbf · ft)
- 3) Oscillating cylinder supporting mounting bolt (3, M16)
 - Tightening torque : 29.6 ± 3.2 kgf · m
(214 ± 23.1 lbf · ft)
- 4) Pipe assy (4)
- 5) Hose assy (5)
- 6) Front axle weight : 630 kg (1390 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)

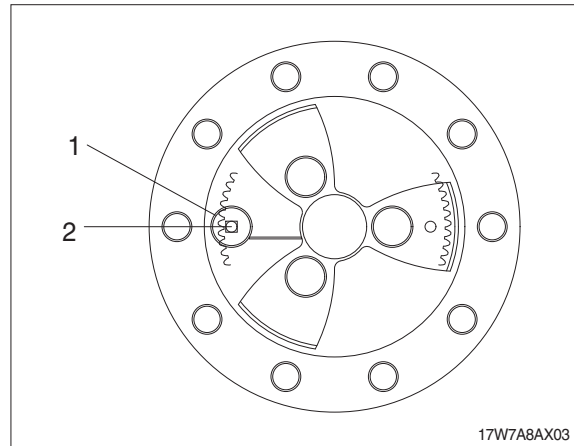
4) BRAKE LINING WEARING TEST

(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 :

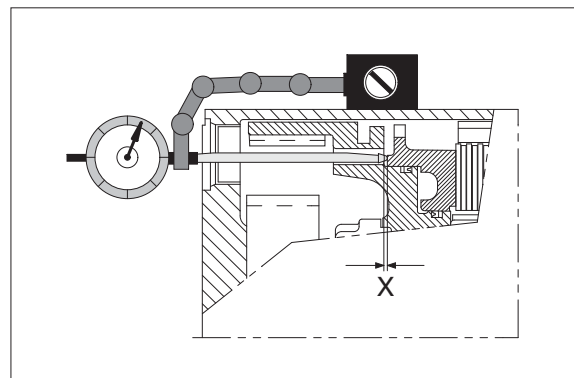
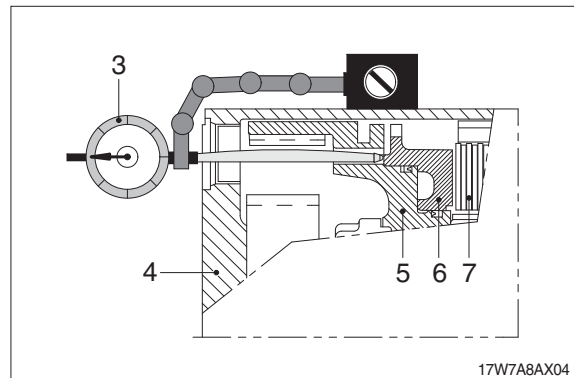
- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

※ 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).



(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



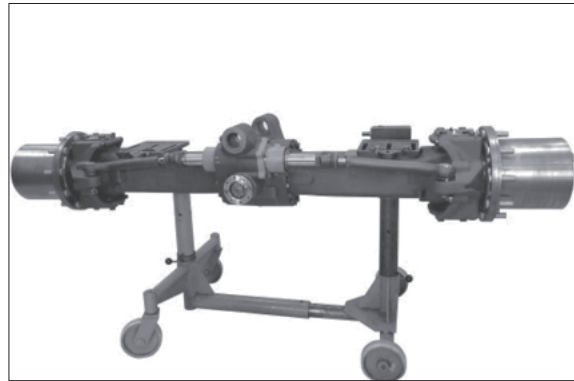
3. DISASSEMBLY

1) STEERING

(1) Fix the axle to the assembly truck.

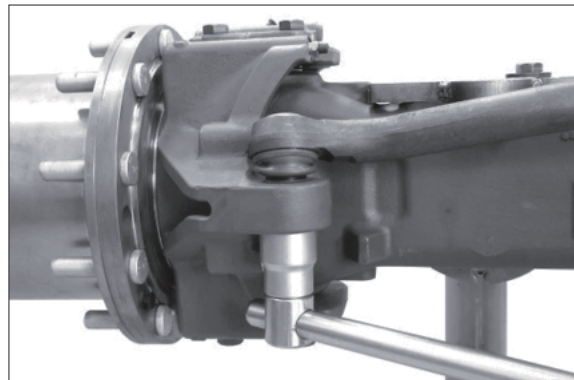
(S) Assembly truck 5870 350 000

(S) Support 5870 350 106



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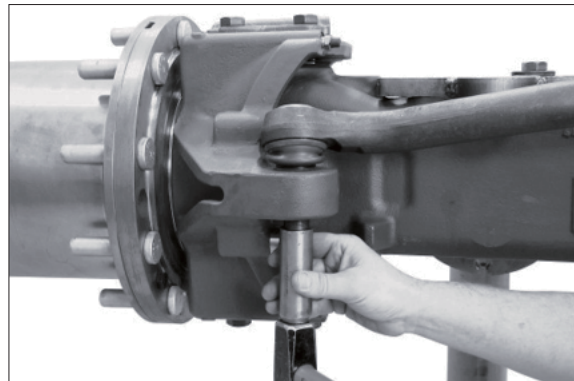
(2) Loosen locknut.



17W98FA002

(3) Force out tie rod from bevel seat.

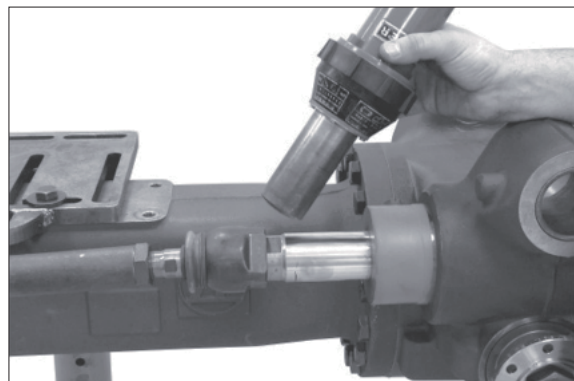
※ Use suitable mandrel (brass or aluminum).



17W98FA003

(4) Warm up piston rod by means of hot air blower.

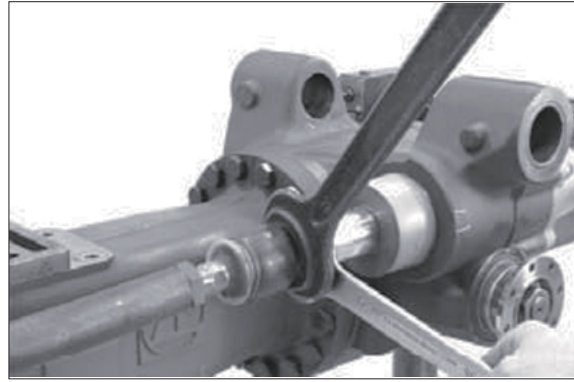
※ Axial joint is installed with Loctite no. 243.



17W98FA004

(5) Separate both tie rods from piston rod.

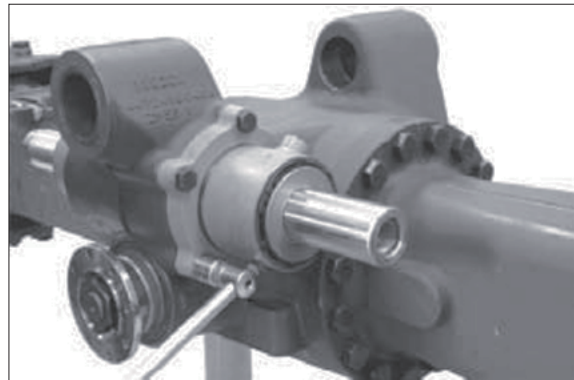
- ※ If work is just to be done on piston rod, guide or sealing elements, no disassembly of the steering cylinder assy is required.



17W98FA005

(6) Loosen hexagon screws.

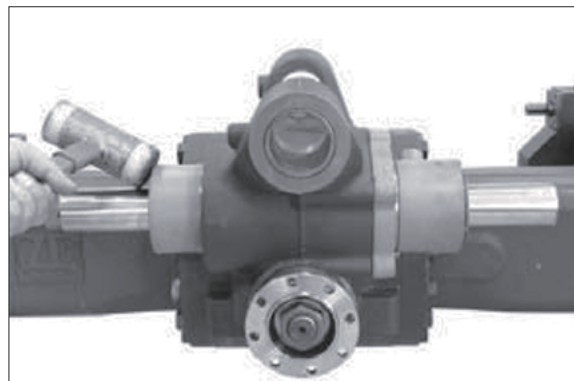
- ※ Mark radial installation position of steering cylinder to axle housing – assembly aid.



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.

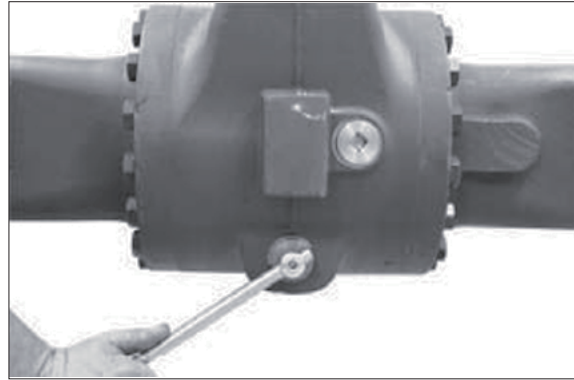
Then remove all sealing elements from piston rod, brake head and cylinder tube.



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.

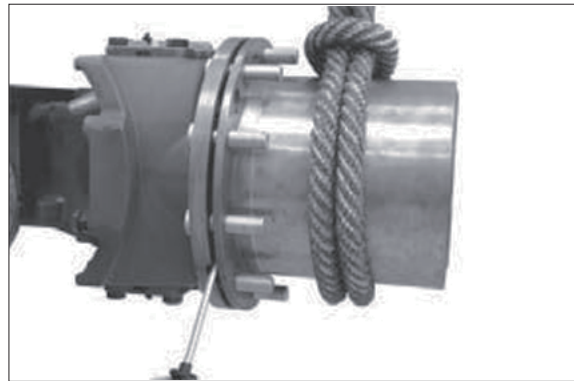
- ※ To avoid injury due to a possible pressure build-up in the oil system of the planetary carrier, bring oil filler and control plug to 12 o'clock position and carefully unscrew. Then bring drain hole to 6 o'clock position and drain oil.
- ※ Use suitable collecting basin environmental protection.



17W98FA014

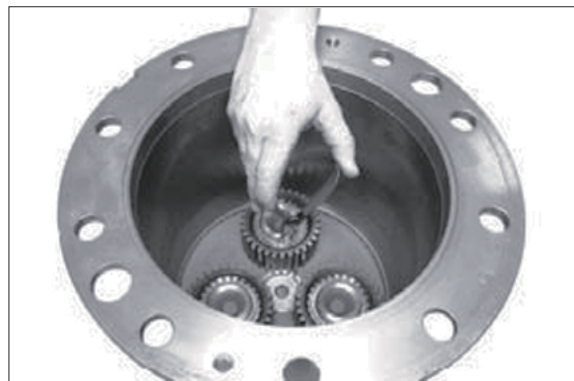
(3) Planetary carrier

Loosen both hexagon screws and separate planetary carrier from hub.



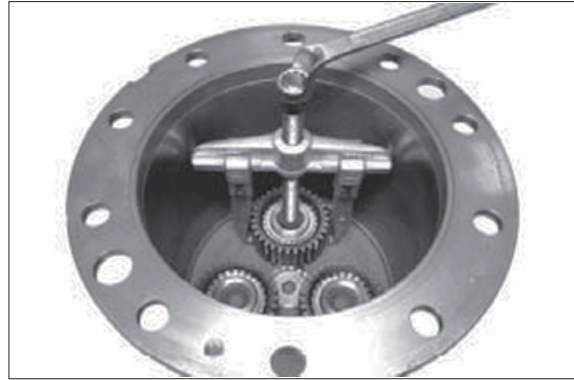
17W98FA015

- (4) Unsnap retaining ring.



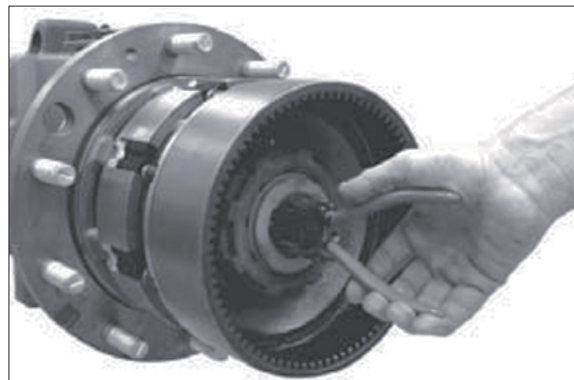
17W98FA016

- (5) Pull off planetary gear together with cylindrical roller bearing.



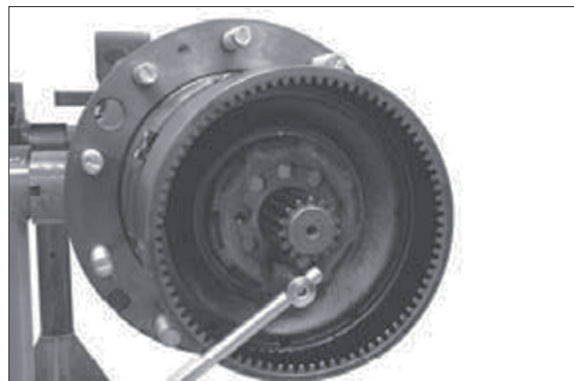
17W98FA017

- (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

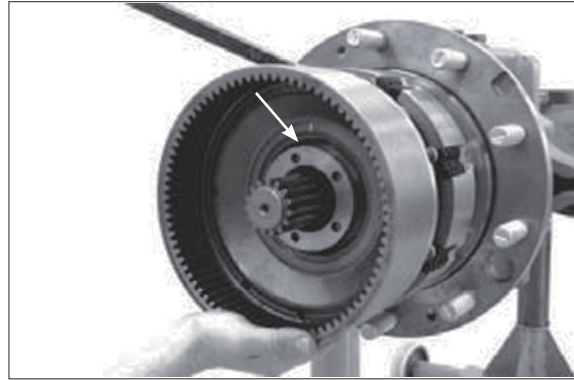


17W98FA020

(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.



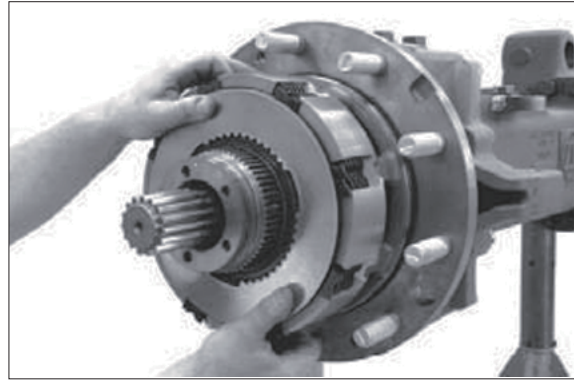
17W98FA023

(12) Remove sealing elements from the annular grooves (see arrows) of the ring gear.



17W98FA024

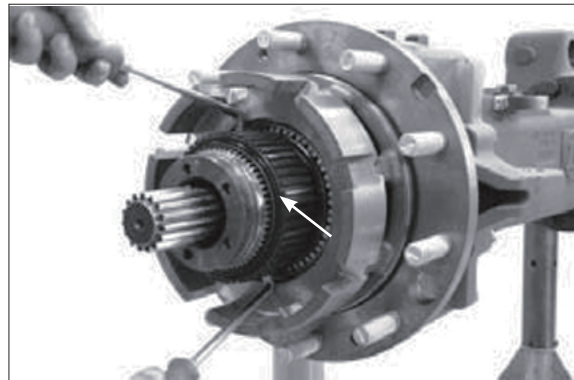
(13) Remove disk package.



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

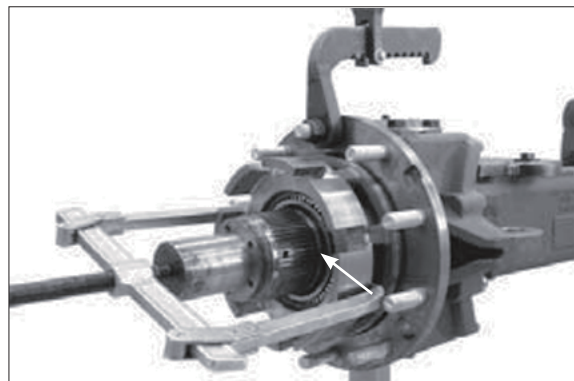
Remove O-ring (see arrow).

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.



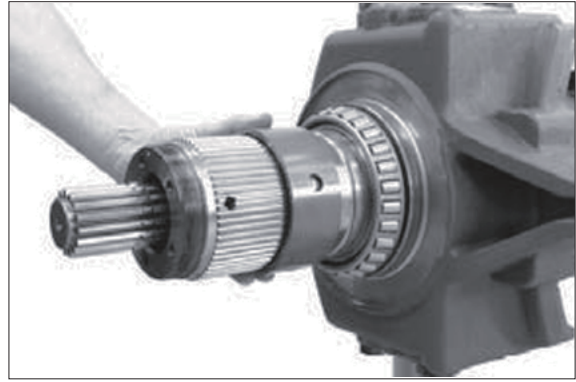
17W98FA027

(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 004 026

(S) Pressure piece 5870 100 067



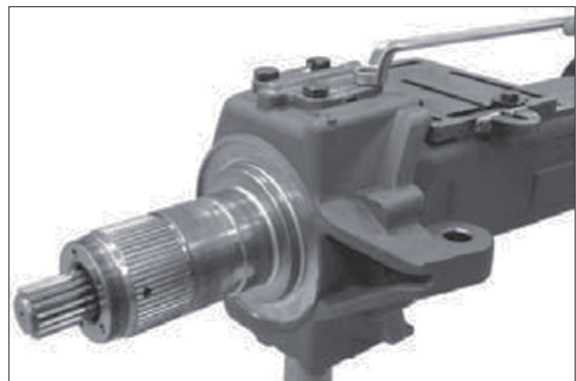
17W98FA030

(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).

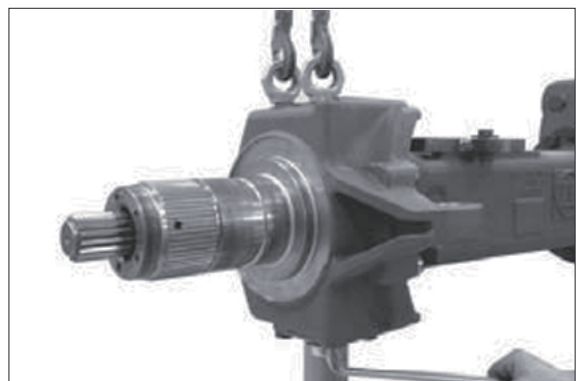


17W98FA031

(20) Secure knuckle housing by means of lifting tackle.

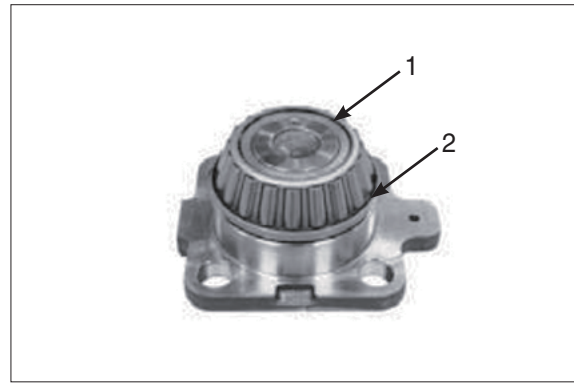
Then loosen threaded joint and remove lower bearing pin.

(S) Eyebolts (M 18) 5870 204 085



17W98FA032

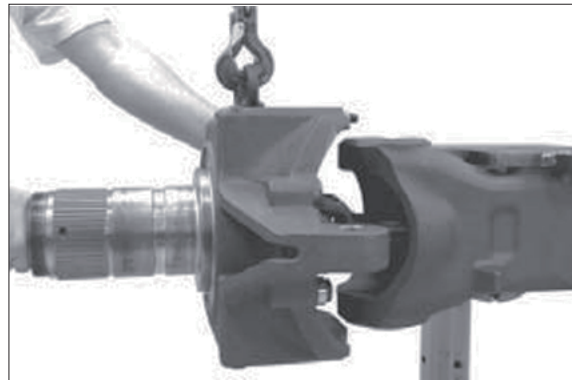
(21) Use lever to remove tapered roller bearing (1) from bearing pin, remove releasing sealing cap (2) and the O-ring lying behind.



17W98FA033

(22) Separate knuckle housing with double u-joint shaft from the axle housing.

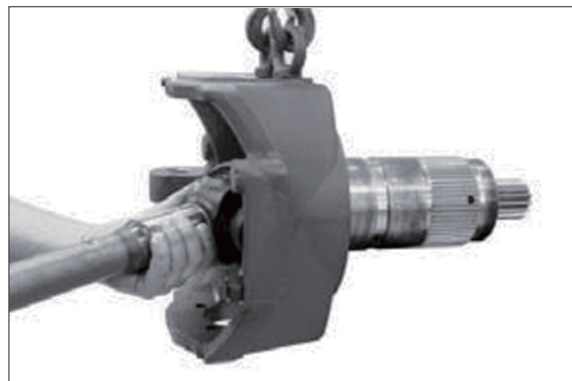
※ Pay attention to shaft seal ring in the axle housing risk of damage.



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

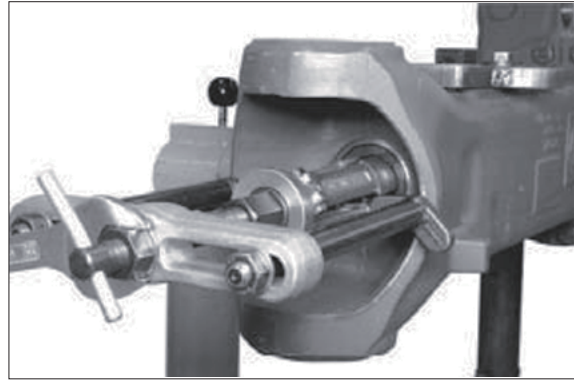


17W98FA036

(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

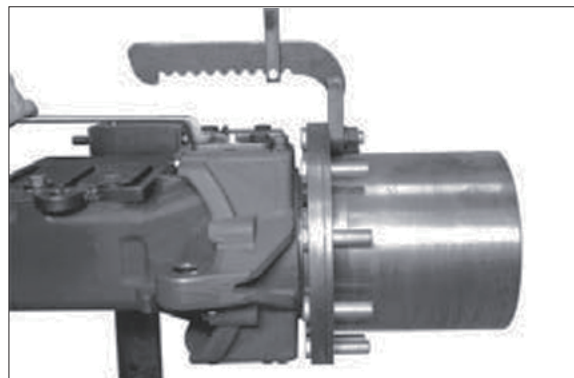
(27) Output assy

※ 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).

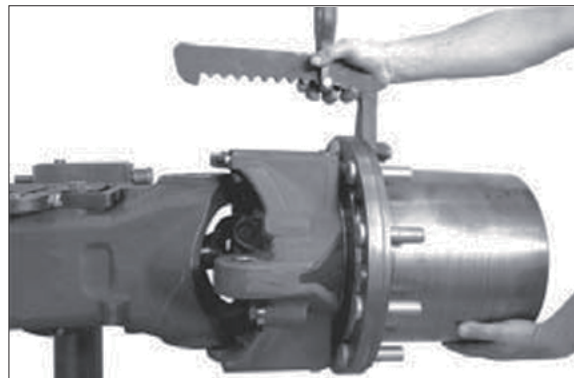
(S) Lifting bracket 5870 281 043

Then loosen threaded joints of both bearing pins.



17W98FA039

(28) Remove both bearing pins and separate the output assy from the axle housing.



17W98FA040

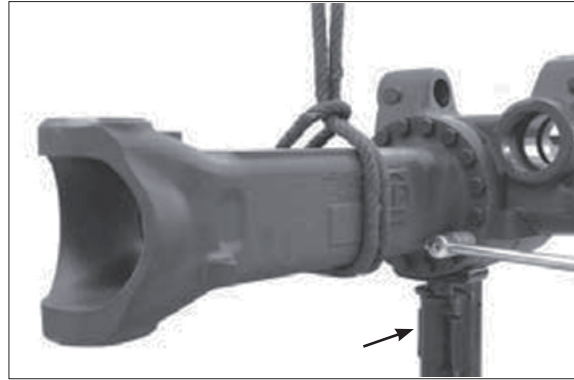
3) INPUT

- (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.

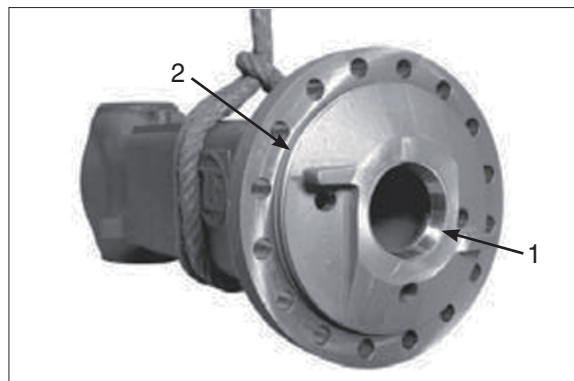
- ※ Pay attention to possibly releasing differential.



17W98FA041

- (2) Pull bearing outer ring (arrow 1) from the bearing hole and remove releasing shim. Then remove O-ring (arrow 2).

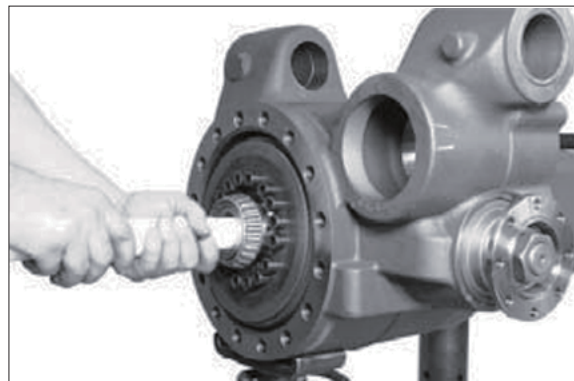
(S) Striker 5870 650 004



17W98FA042

- (3) Lift differential out of the axle drive housing.

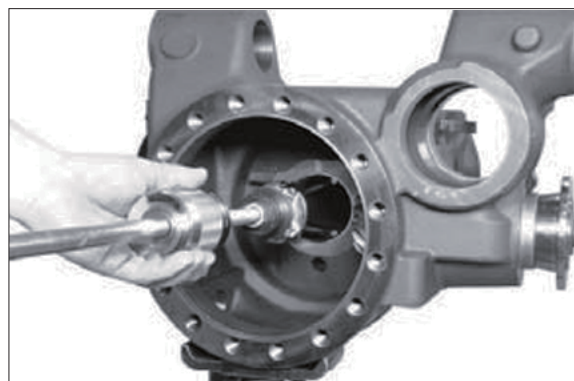
- ※ Disassembly of the differential is described as of page 8-189.



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

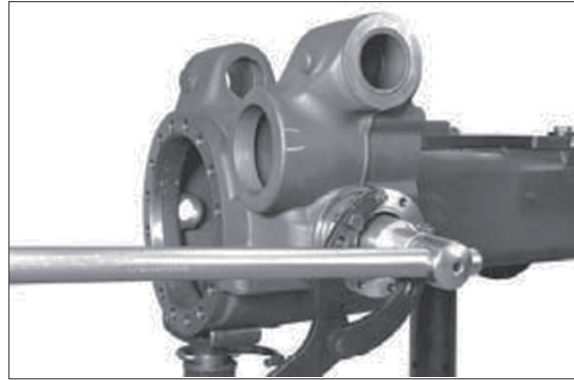


17W98FA044

- (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

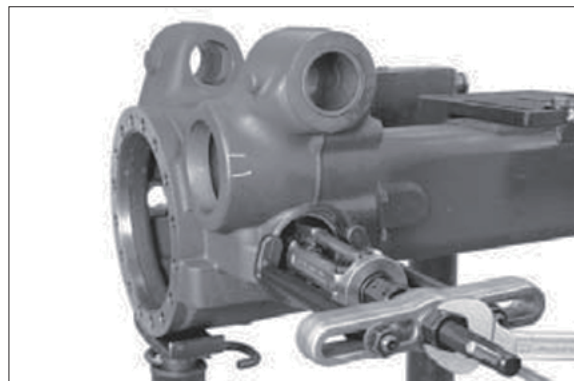


17W98FA050

(11) Pull off outer bearing outer ring from bearing hole.

(S) Internal extractor 5870 300 019

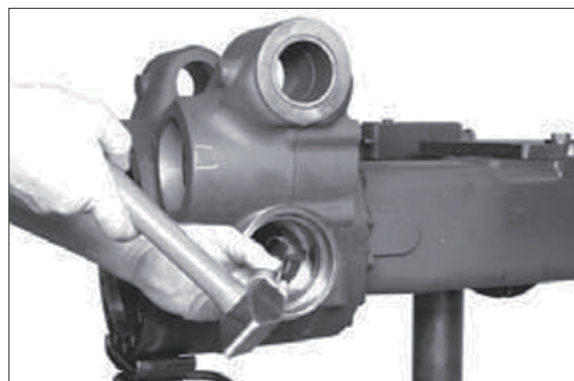
(S) Counter support 5870 300 020



17W98FA051

(12) Force out bearing outer ring from the inner bearing hole pay attention to the shim behind.

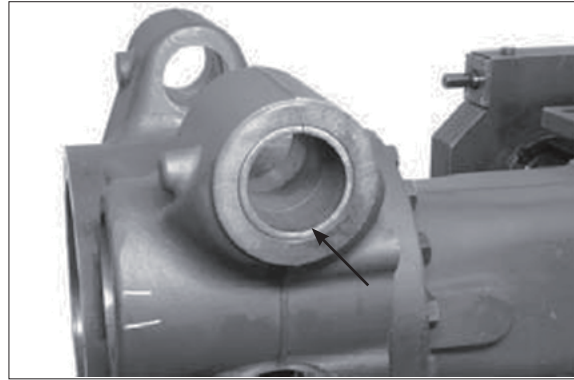
※ Mark shim (with regard to position/bearing allocation) assembly aid.



17W98FA052

(13) If necessary, provide bushings with a separating slot (see arrow) and remove from holes.

※ Bushings are destroyed by this.

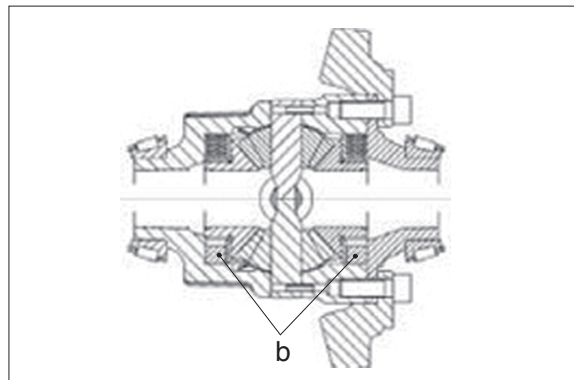


17W98FA053

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.



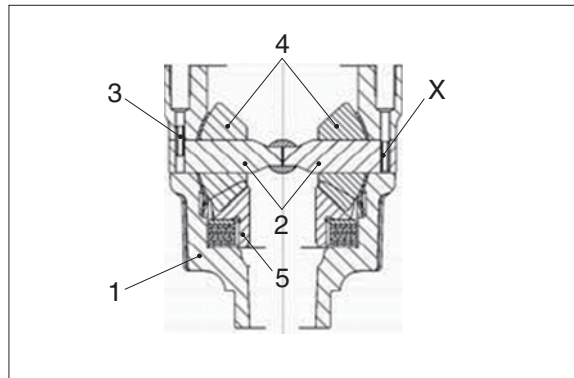
17W98FA058

(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.

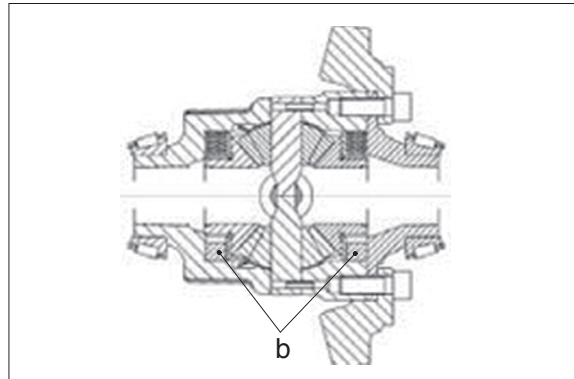


17W98FA062

4. REASSEMBLY

1) DIFFERENTIAL

(1) b = Constant spacers



17W98FA054

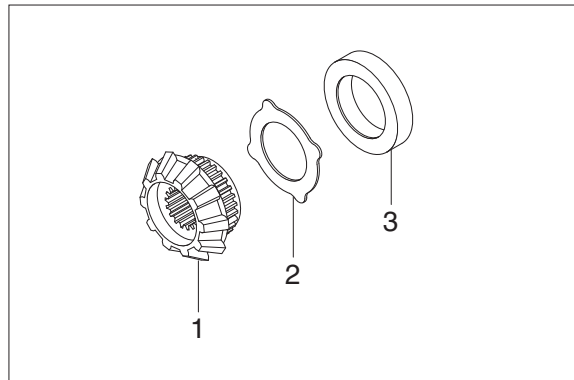
(2) All outer and inner disks are replaced by a constant spacer (see figure FA066).

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).



17W98FA068

(6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch FA070).



17W98FA069

(7) Comment on sketch:

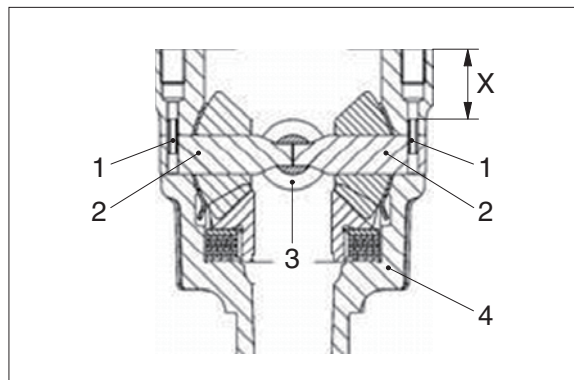
1 = Slotted pin

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)

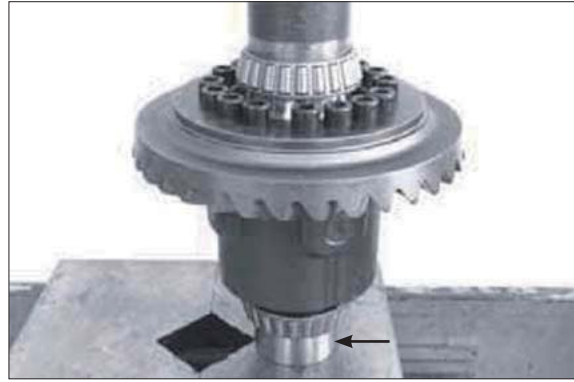
. MA = 145 Nm



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

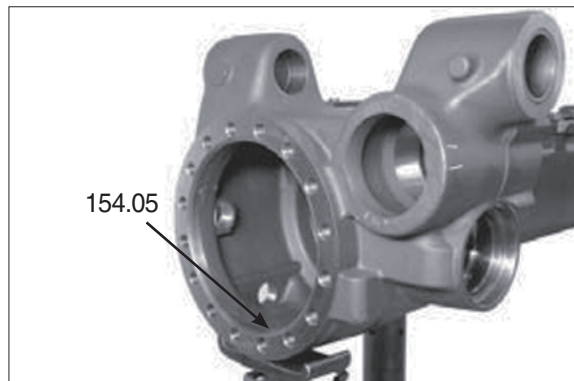
(1) Input pinion

- ※ 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).

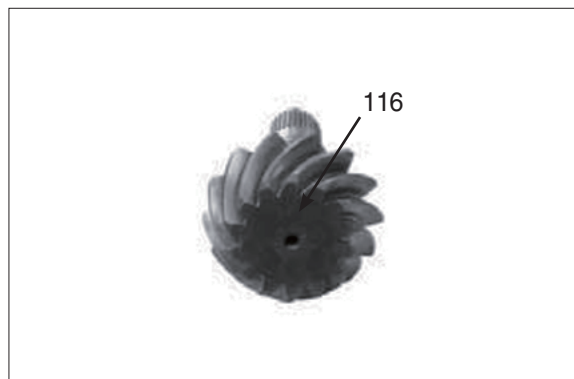
Dimension II e.g. 116.00 mm

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

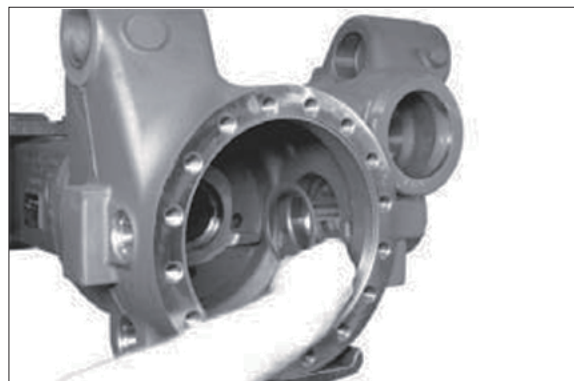


17W98FA079

(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.



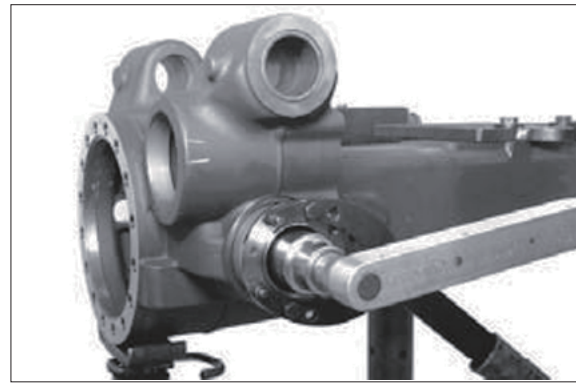
17W98FA086

(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.

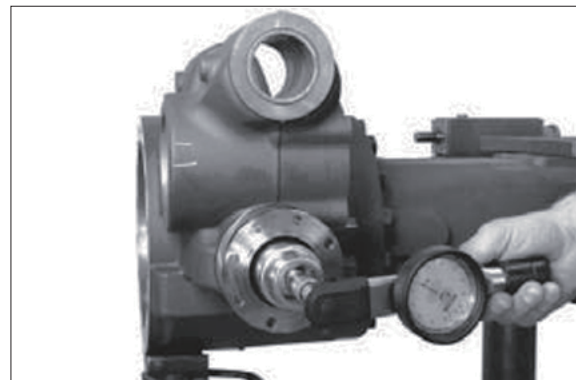


17W98FA087

(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.



17W98FA089

- ※ 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.

※ 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.

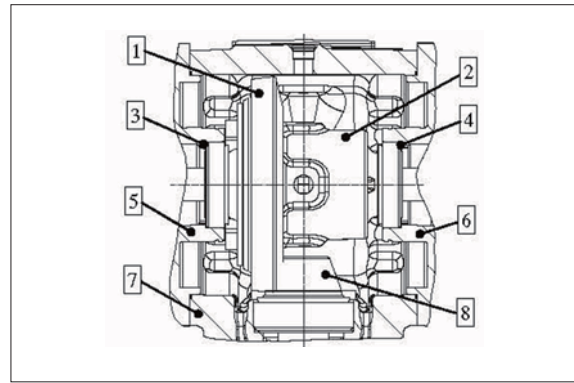
(15) Comment on sketch:

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

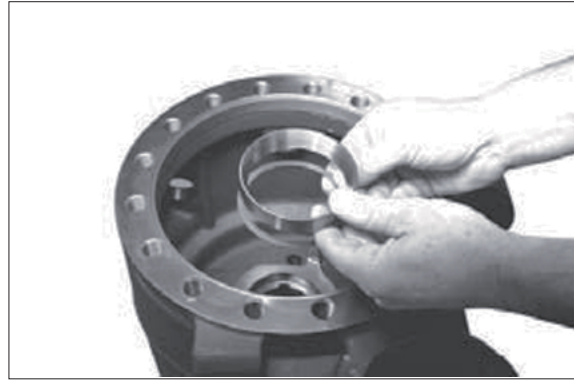


17W98FA090

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

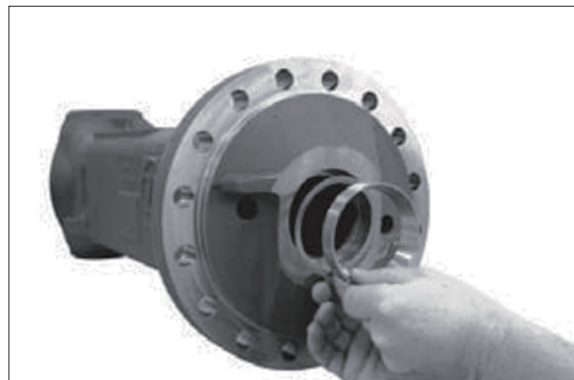
(16) Insert the determined shim (e.g. $s = 1.15$ mm) and the bearing outer ring into the hole of the axle housing on the differential carrier side.

※ 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.

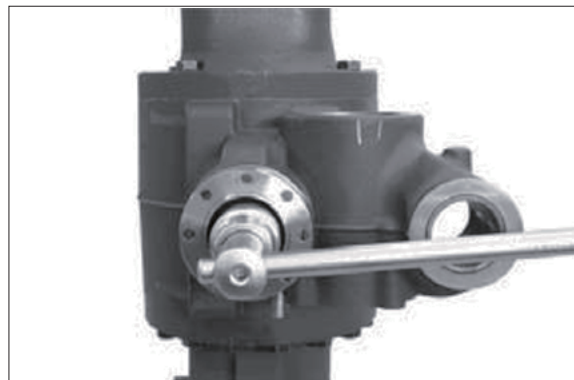


17W98FA095

(21) Roll the crown wheel by rotation on the input flange several times in both directions over the input pinion.

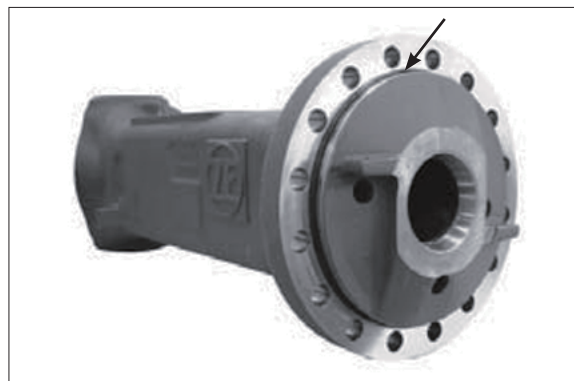
Then remove axle housing again and lift differential out of the axle drive housing. Compare the obtained contact pattern with contact pattern example page 0/4 and 0/5.

※ 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 (M18/10.9)
..... MA = 390 Nm

Then bring axle into horizontal position and reassemble the second clamping angle (S) (see also figure FA001).

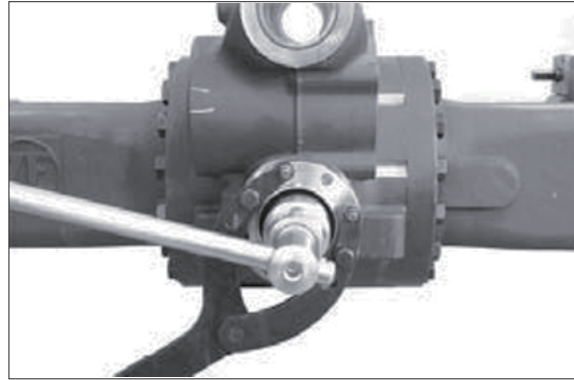


17W98FA098

(24) Mount shaft seal ring (input flange)

Loosen hexagon nut and pull the input flange from the input pinion.

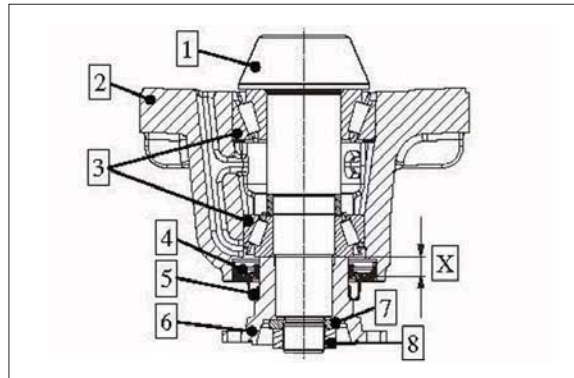
(S) Clamping fork 5870 240 025



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 → 13.5 +0, 2 mm

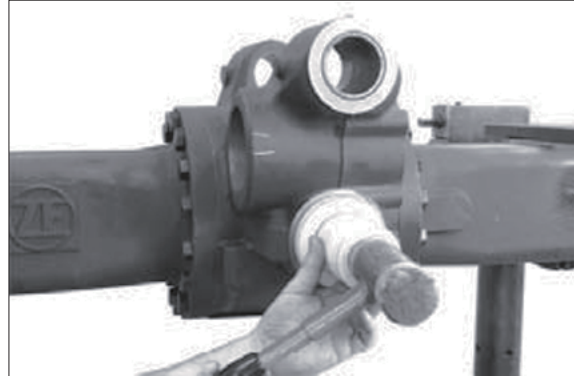


17W98FA100

(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

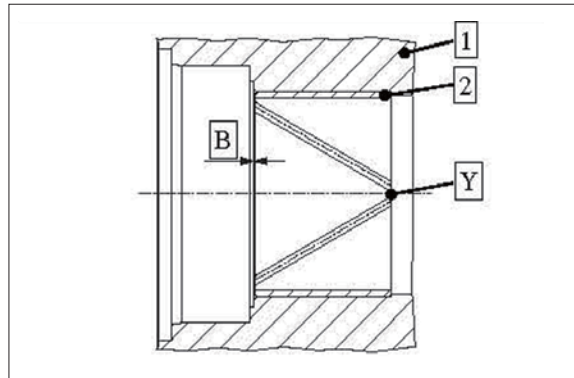
2 = Bushing

B = Installation dimension 1.0 ± 0.3 mm

Y = Installation position / lubrication groove outlet of bushing (top view)

※ 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.



17W98FA104

(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

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.



17W98FA105

※ 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:

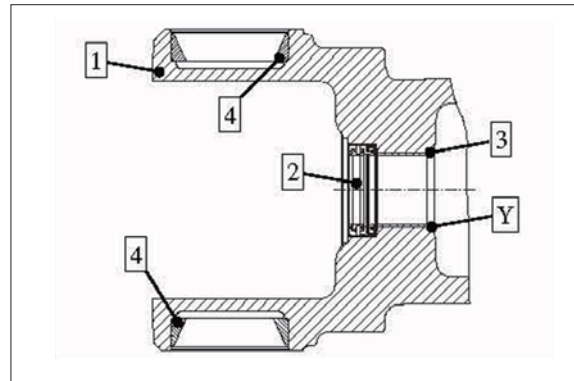
1 = Axle housing

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)

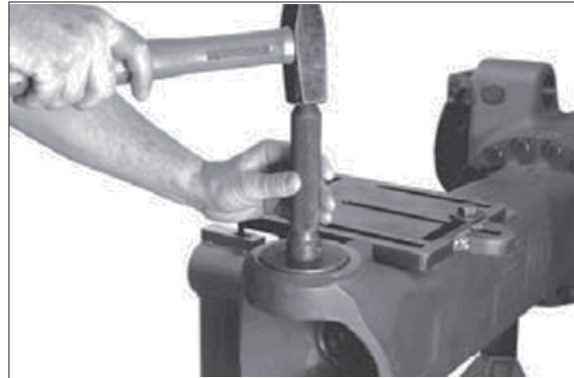


17W98FA106

(5) Insert both bearing outer rings into the pivot bearing holes of the axle housing.

(S) Driver tool 5870 058 022

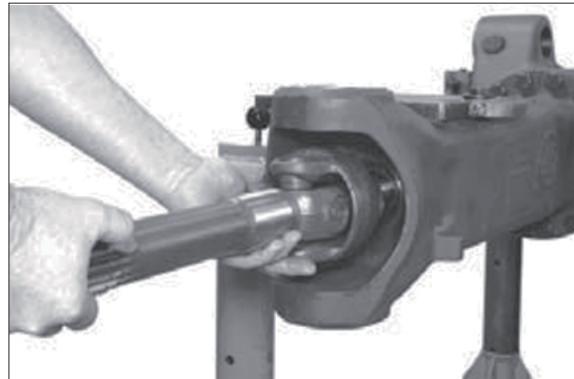
(S) Handle 5870 260 002



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.



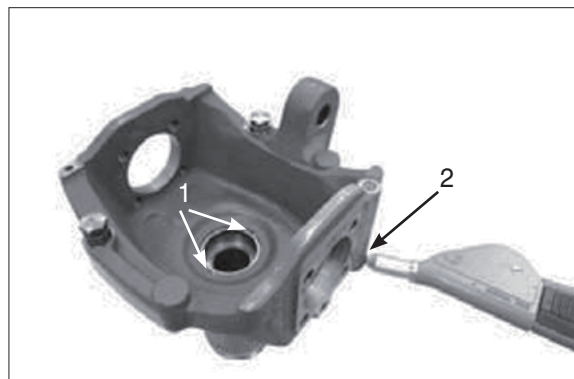
17W98FA108

(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:

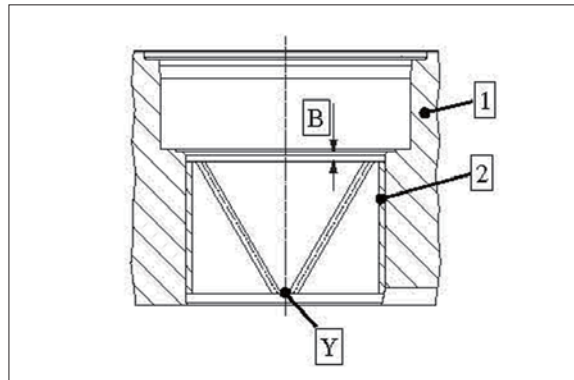
1 = Knuckle housing

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:

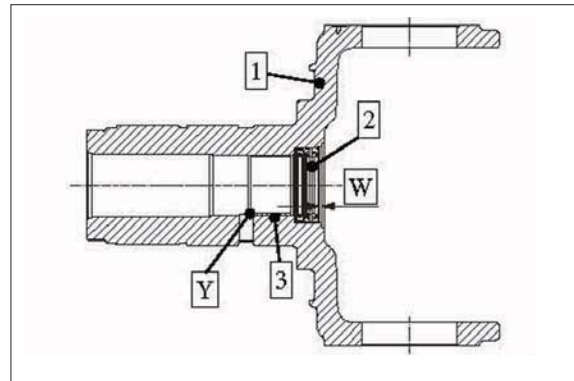
1 = Knuckle housing

2 = Shaft seal ring

3 = Bushing

W = Installation dimension – shaft seal ring 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.

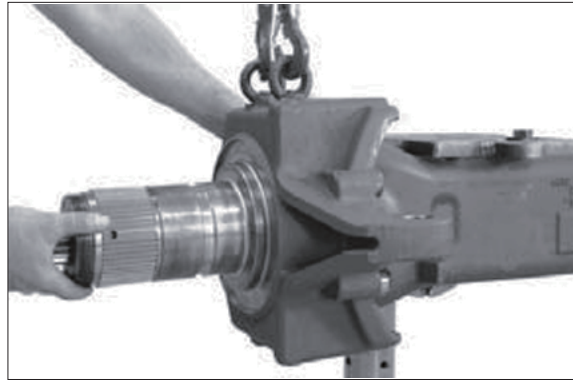


17W98FA115

(14) Locate pre-assembled knuckle housing on axle housing and carefully mount u-joint shaft.

(S) Eyebolts (M 18) 5870 204 085

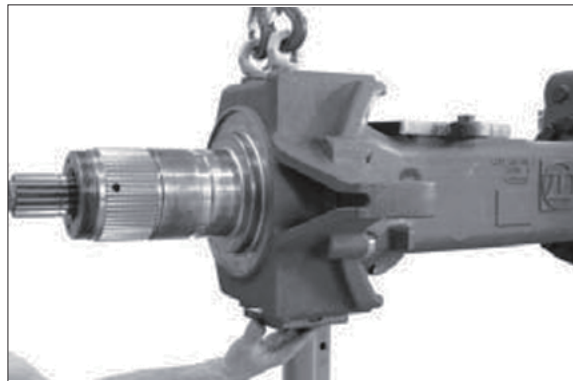
※ Pay attention to shaft seal ring in the knuckle housing risk of danger.



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.

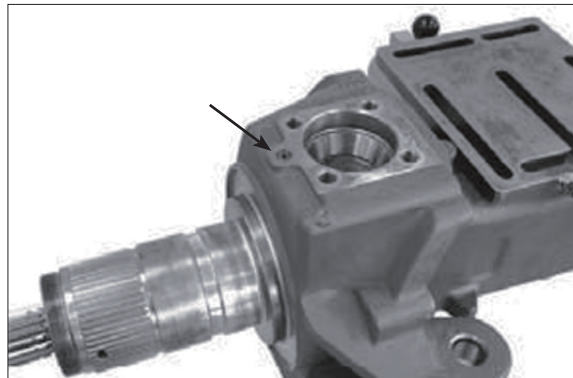


17W98FA117

(16) Insert O-ring (see arrow) or O-rings into countersink of the knuckle housing.

1 pcs for version with breather valve in the knuckle housing

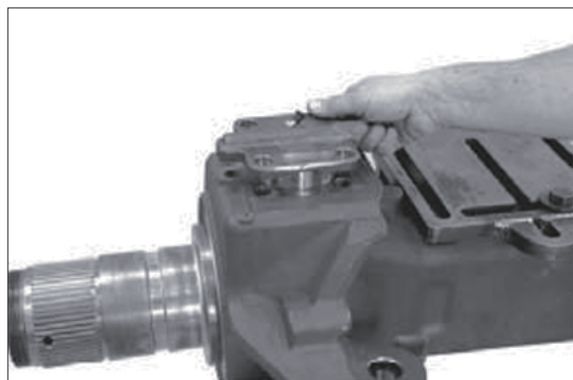
2 pcs for version with breather valve in the bearing pin



17W98FA118

(17) Insert pre-assembled upper bearing pin.

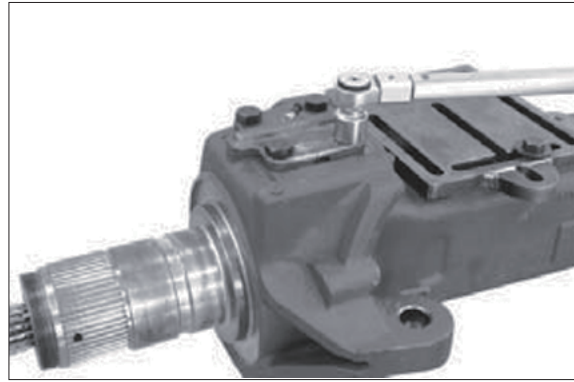
※ Observe installation position mount bearing pin with oil supply holes showing to axle centre.



17W98FA119

(18) Fix both bearing pins definitely.

※ Tightening torque (M 18/10.9)
..... MA = 390 Nm



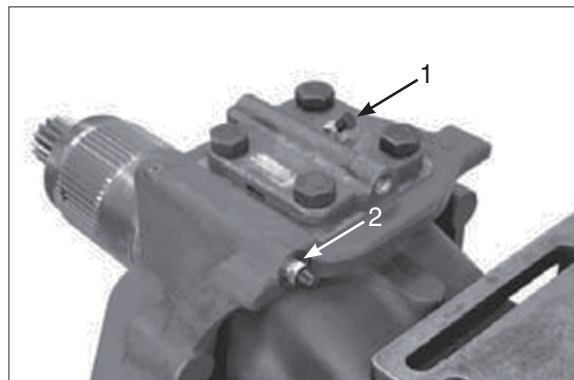
17W98FA120

(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 = 20Nm



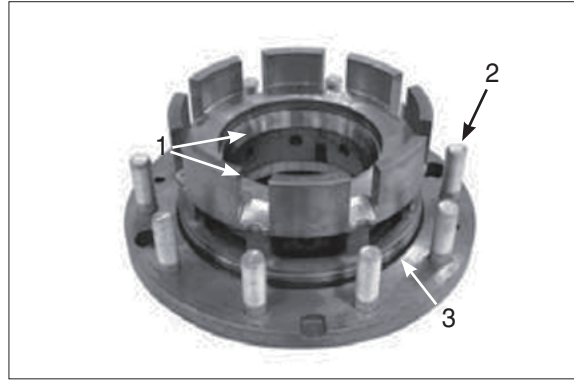
17W98FA121

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.

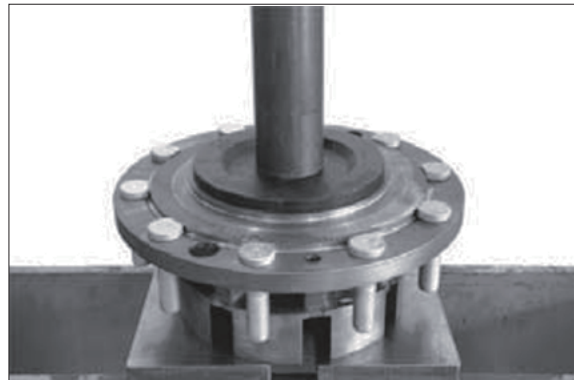


17W98FA122

- (2) Press shaft seal ring with the marking "OUT SIDE" showing outside (upwards) into the hub.

(S) Driver tool 5870 051 035

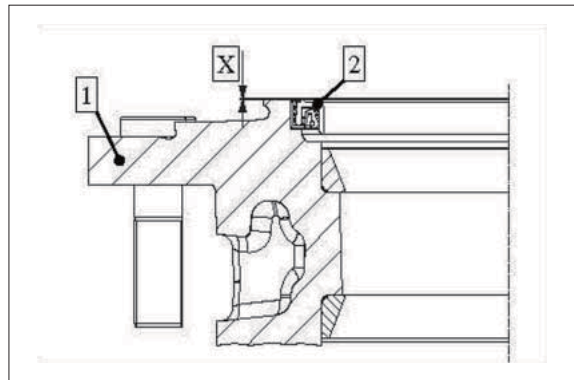
- ※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.
- ※ Wet the outer diameter of the shaft seal ring with Loctite no. 574.



17W98FA123

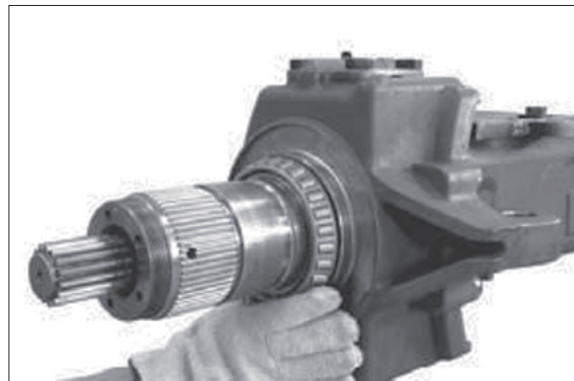
- (3) Comment on sketch:

1 = Hub
2 = Shaft seal ring
X = Installation dimension – Shaft seal ring
..... 0.0~0.3 mm



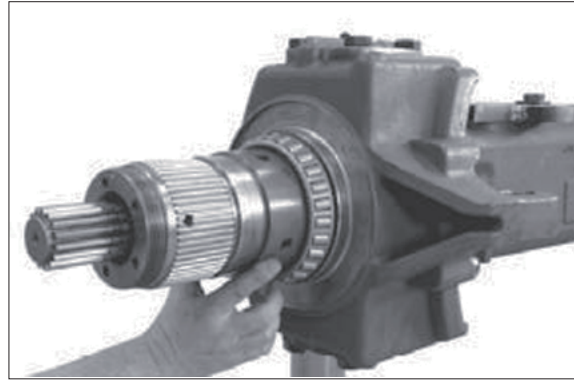
17W98FA124

- (4) Heat the tapered roller bearing and mount until contact position with the knuckle housing is obtained.



17W98FA125

(5) Insert spacer bushing.

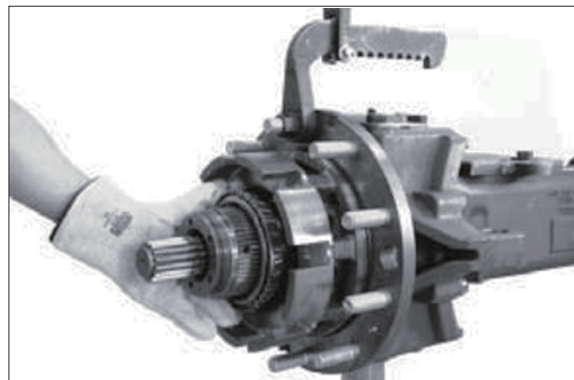


17W98FA126

(6) Install preassembled hub until contact is obtained and fix with heated tapered roller bearing.

(S) Lifting bracket 5870 281 043

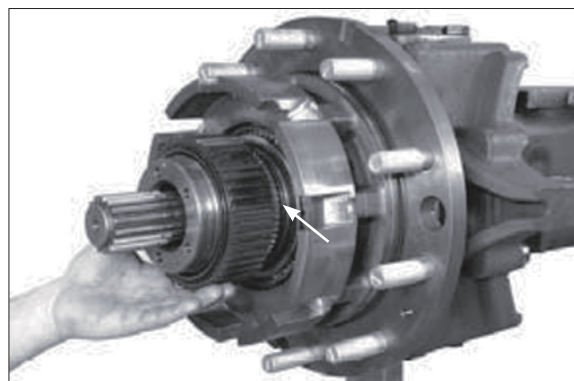
※ Just before fitting wet the seal lips of the shaft seal ring with lubricant.



17W98FA127

(7) Oil O-ring and insert it into the annular groove (see arrow) of the knuckle housing.

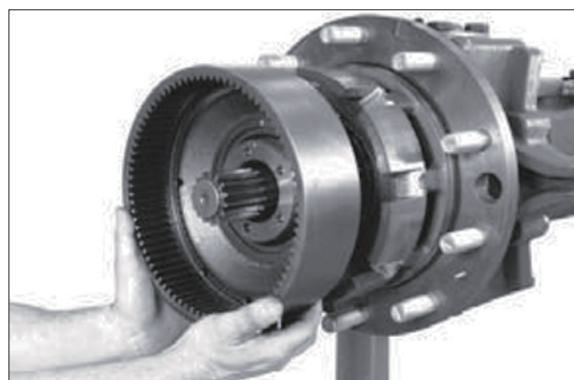
Then install disk carrier.



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.

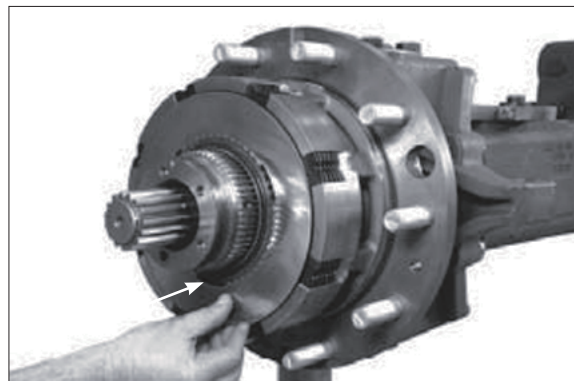


17W98FA131

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.

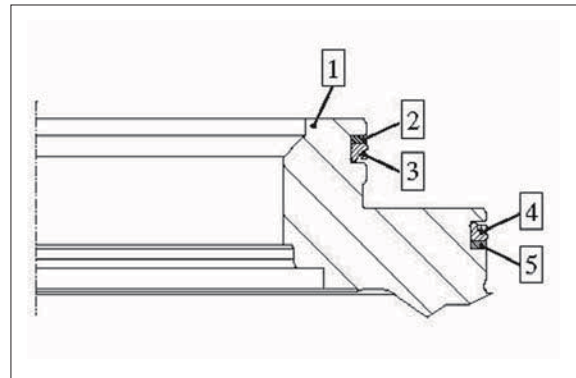
※ Observe installation position, see sketch below.



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

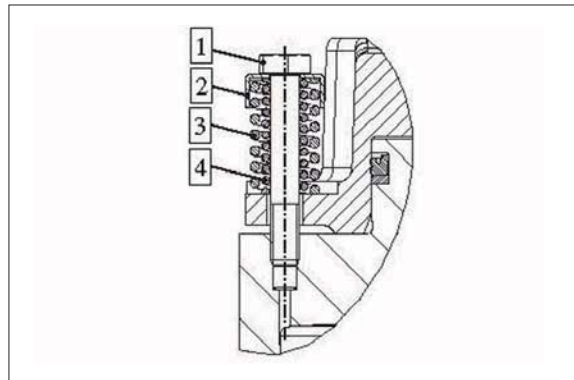
- (8) Comment on sketch:

1 = Hexagon screw (special version)

2 = Spring sleeve

3 = Compression spring

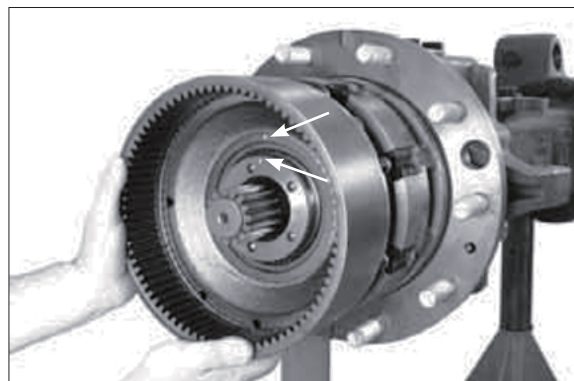
4 = Compression spring



17W98FA139

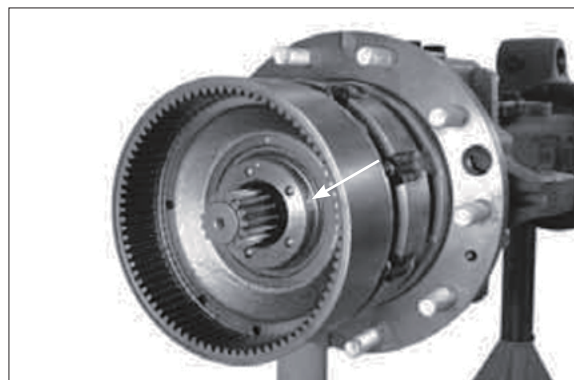
- (9) Mount preassembled ring gear considering the installation position (markings O in 12 o'clock position - see arrows).

※ Ensure exact tooting 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:

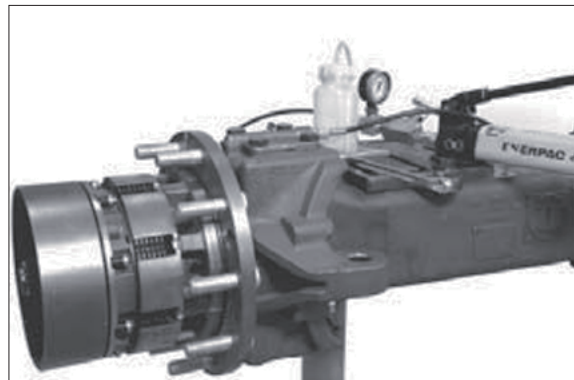
Build up test pressure $p = 100$ bar and close locking valve of HP pump.

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

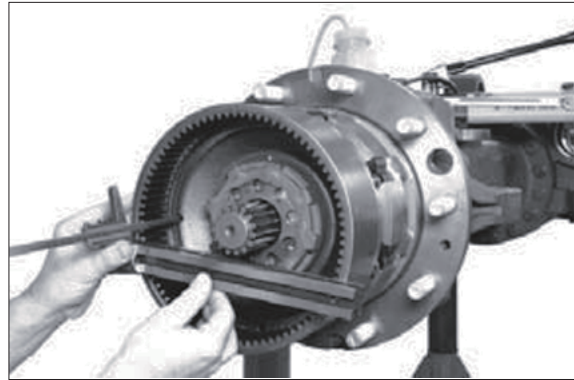
(13) Adjust and check piston stroke

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.

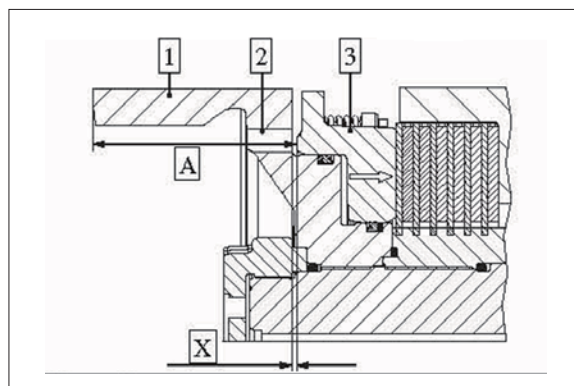


17W98FA144

(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:

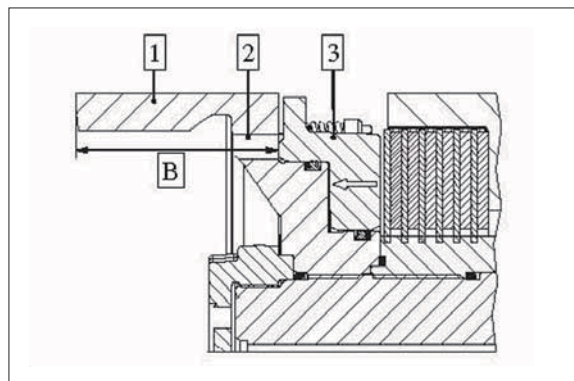
1 = Ring gear

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)

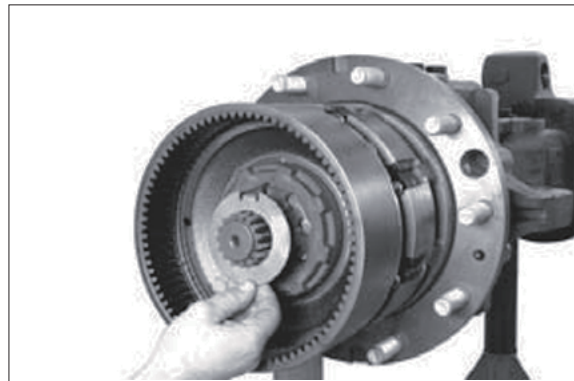
Tightening torque (M 10/8.8)
..... MA = 32 Nm



17W98FA147

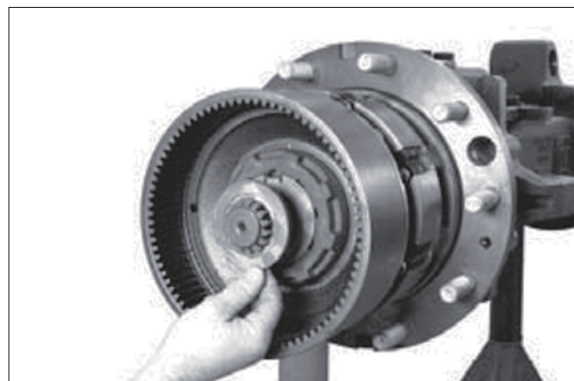
(17) Insert thrust washer.

※ Observe installation position ensure that
both lugs of the thrust washer are
engaged each in a spare fixing hole of the
slotted nut.



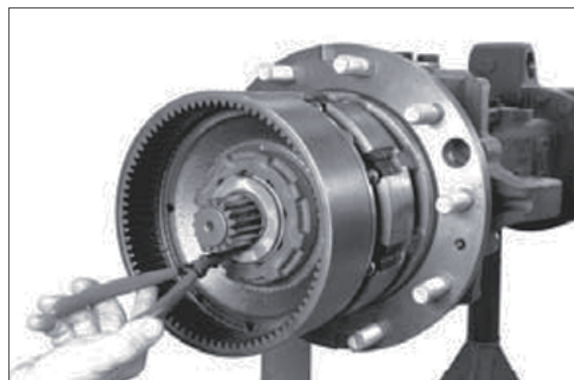
17W98FA148

(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

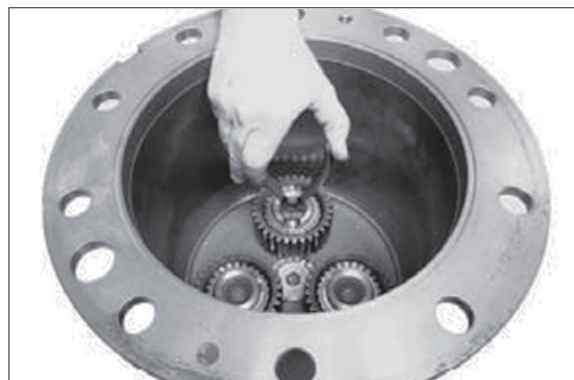
- (3) Warm up bearing inner ring and install pre-assembled planetary gear until contact is obtained.

※ Mount bearing inner ring with large radius, showing to the planetary carrier (downwards).



17W98FA153

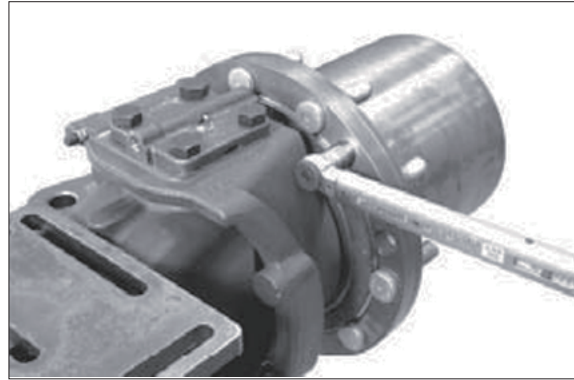
- (4) Fix planetary gear by means of retaining ring.



17W98FA154

- (5) Install preassembled planetary carrier and fix with hexagon screws.

Tightening torque (M12/8.8)
 MA = 55 Nm



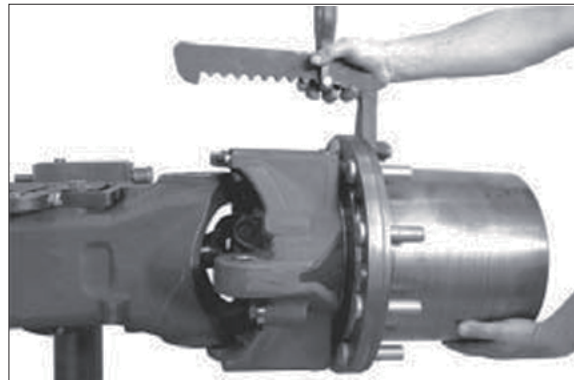
17W98FA155

(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.

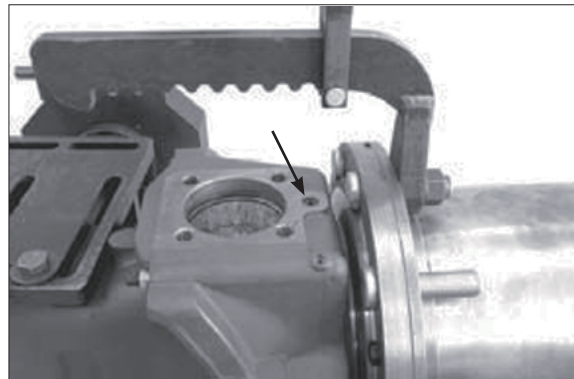


17W98FA156

- (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 pin.

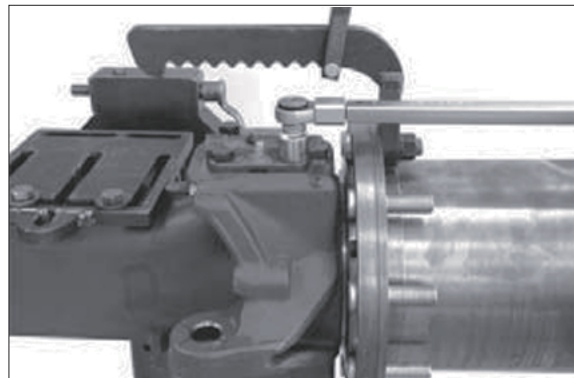


17W98FA157

- (8) Mount both bearing pins and fix with hexagon screws or locking screws.

Tightening torque (M 18/10.9)
 MA = 390 Nm

- ※ Observe installation position, mount upper bearing pin with oil supply holes showing to axle centre.

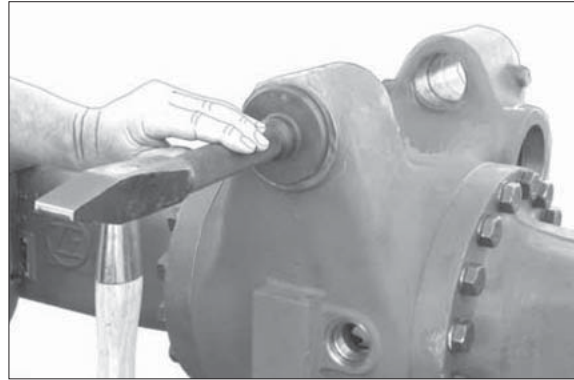


17W98FA158

(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.

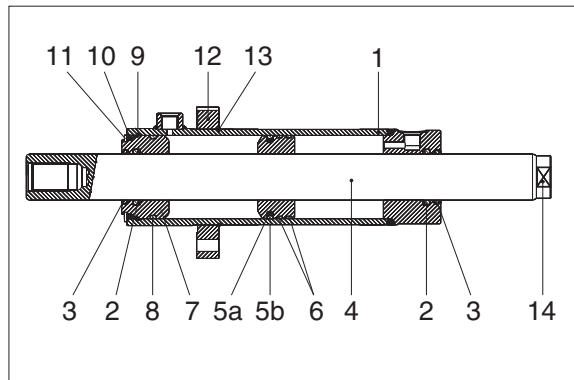


17W98FA159

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



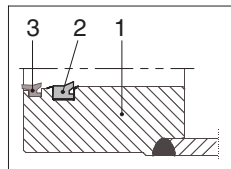
17W98FA160

(2) Preassemble steering

Mount U-ring (2) and scraper (3) in the steering cylinder (1).

- ※ Observe installation position – see detailed sketch.

Detailed sketch:



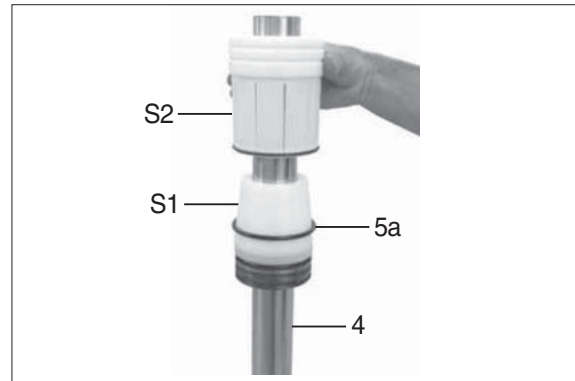
17W98FA161

- (3) Position inner installer (S1) on piston rod (4).

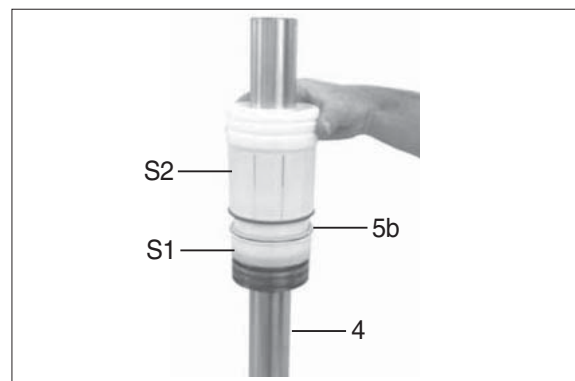
Mount O-ring (5a) and press with inner installer (S2) into annular groove (arrow) of the piston (4).

(S) Inner installer (S1) 5870 651 086

(S) Inner installer (S2) 5870 651 087

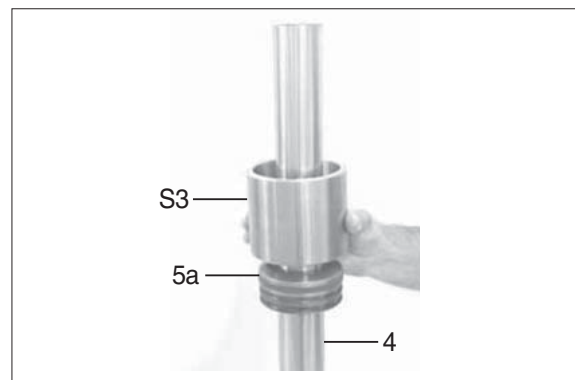


- (4) Install form seal ring (5b) and press with inner installer (S2) into the annular groove of the piston (4).

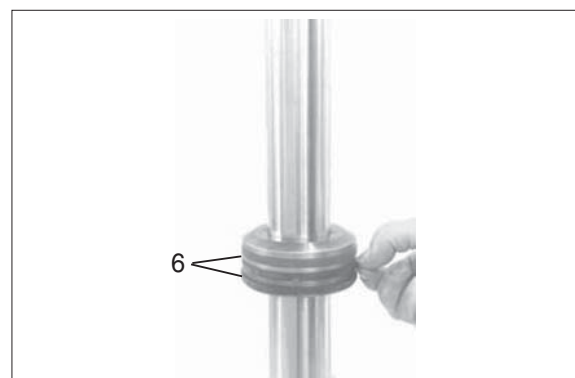


- (5) Calibrate form seal ring (5b) with calibration bushing (S3).

(S) Calibration bushing (S3) 5870 651 090

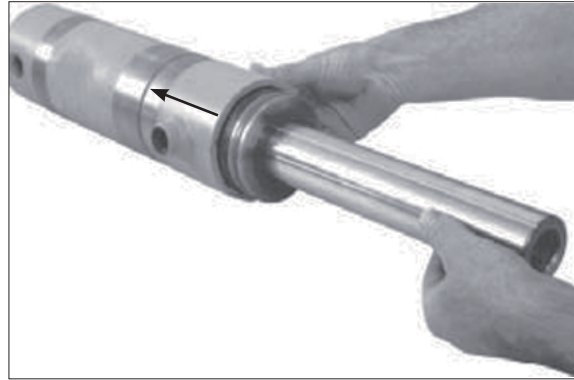


- (6) Place both guide rings (6) into the annular grooves of the piston rod.



(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.

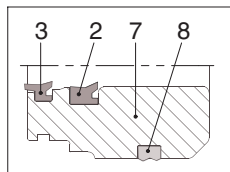


17W98FA166

(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

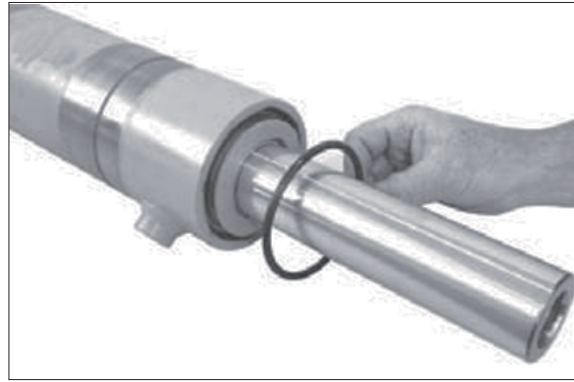
(10) Engage retaining ring (9) into the groove of the cylinder tube.



17W98FA169

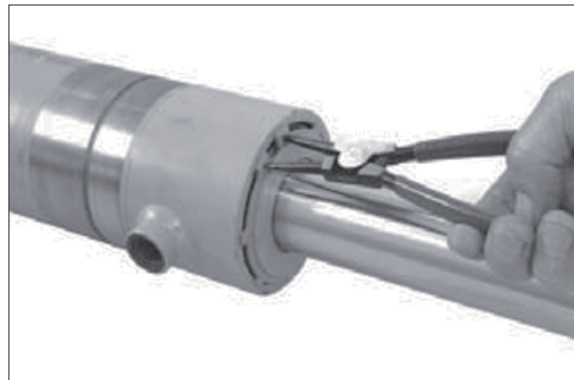
(11) Position the inserted brake head (7) on the snap ring (9) until contact is obtained (arrow).

Only for version with O-ring (see corresponding spare parts list) : Oil O-ring (10) and place into the recess.



17W98FA170

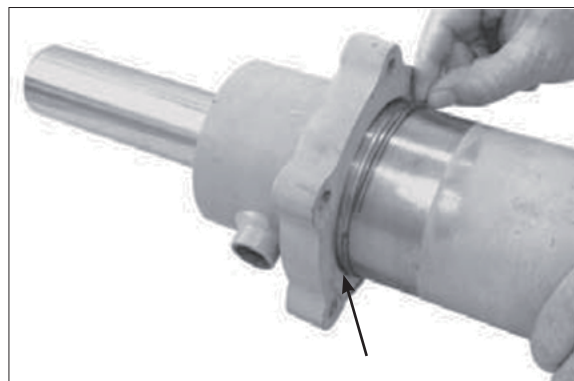
(12) Fix brake head (7) with retaining ring (11).



17W98FA171

(13) Install flange (12) and engage retaining ring (13).

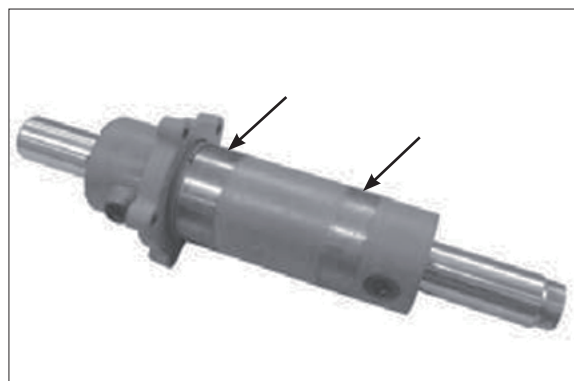
※ Observe installation position of flange mount flange with chamfer (see arrow) showing to the snap ring.



17W98FA172

(14) Mount steering

Apply anti-corrosive agent (Weicon Anti-Seize) on contact faces (cylinder tube / axle housing, see arrow).



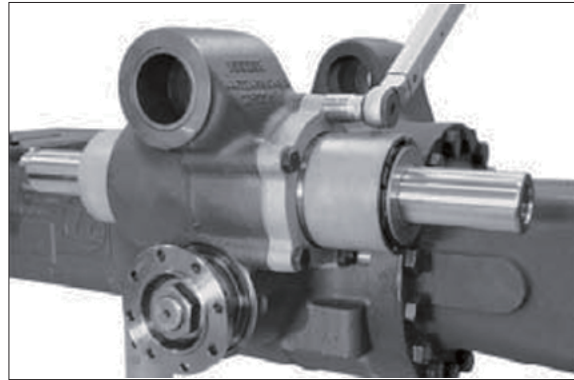
17W98FA173

(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.

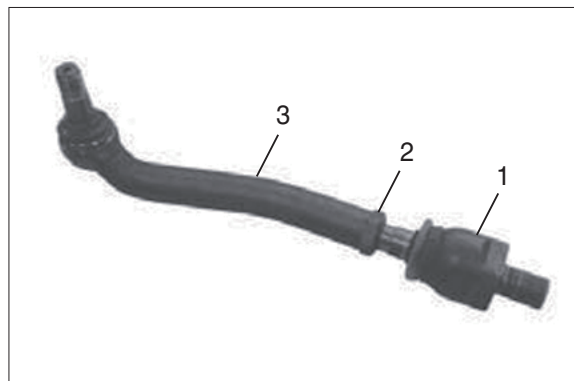
※ Wet the thread of the hexagon screws with Loctite no. 243.



17W98FA174

(16) Bolt hexagon nut (2) and ball joint (3) to axial joint (1).

※ Do not tighten hexagon nut before setting the track.



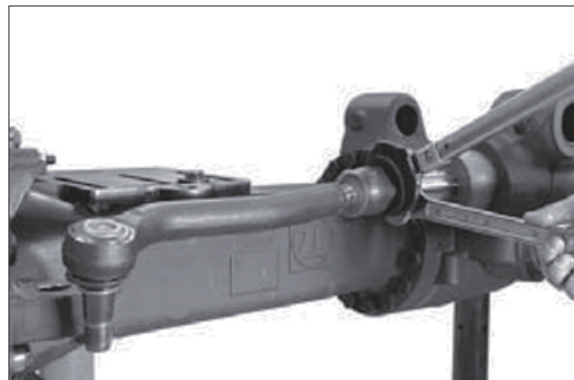
17W98FA175

(17) Fix both tie rods to piston rod (with offset showing to the axle housing).

Tightening torque (M30 × 1.5)
..... MA = 450 Nm

(S) Socket wrench (SW 55) 5870 656 100

※ Wet thread of the axial joint with Loctite no. 243.

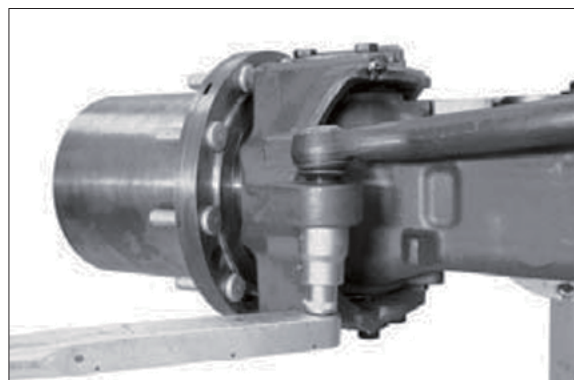


17W98FA176

(18) Install tie rod into knuckle housing and fix with "new" locking nut.

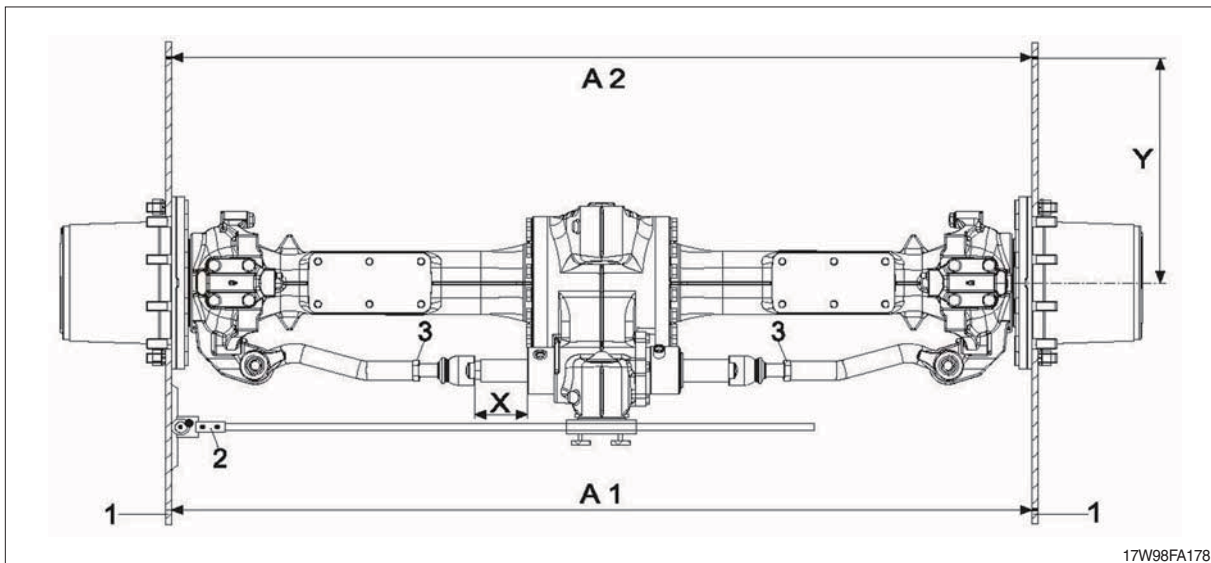
Tightening torque (M 27 × 1.5)
..... MA = 600 Nm

※ 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 = 119 mm (measured from front face/steering cylinder to contact 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.

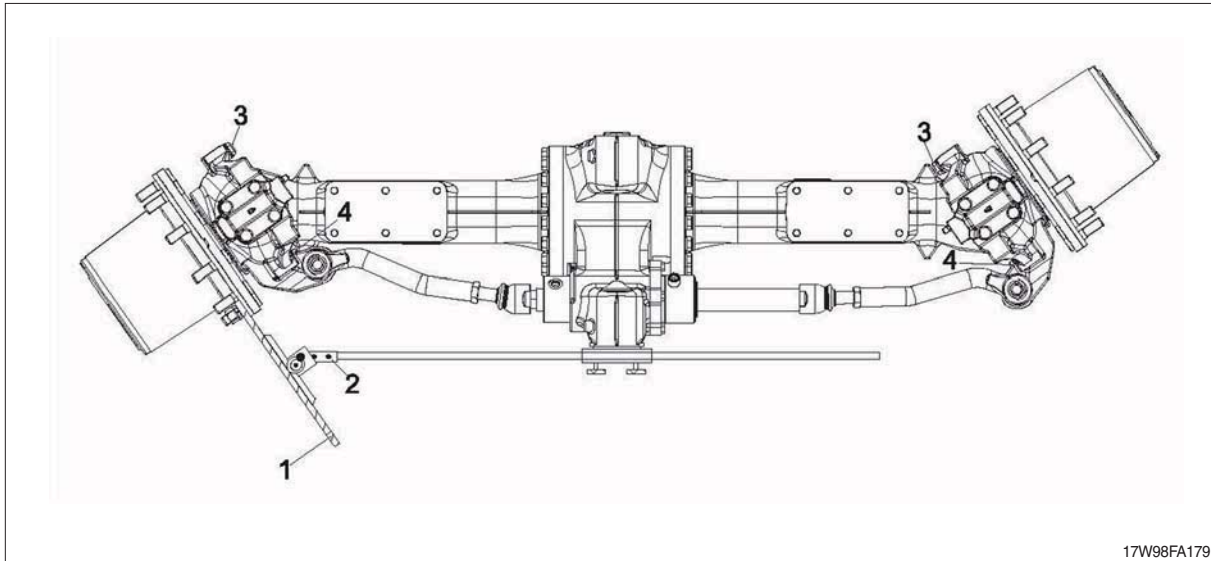
Dimension "Y" = distance between rim center and rim flange.

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.



- 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.

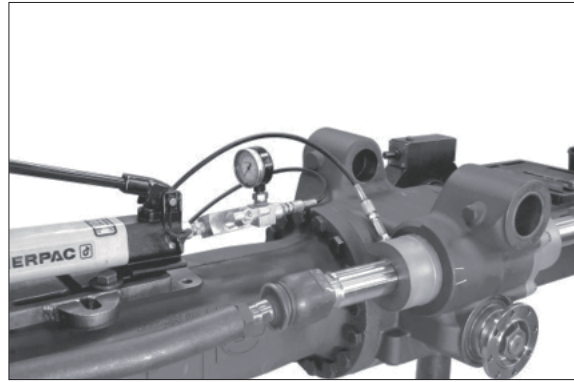
A 5 bar pressure drop is permissible during a test duration of 20 sec.

(S) HP pump 5870 287 007

(S) Reduction 5870 950 161

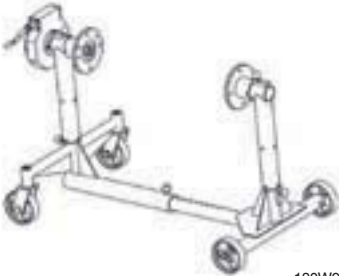
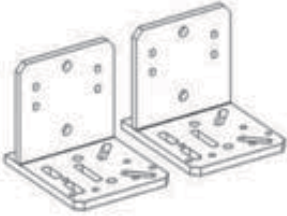
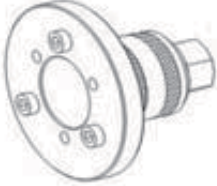


(S) Clutch 0501 207 939

※ Prior to putting the axle into operation fill it with oil.




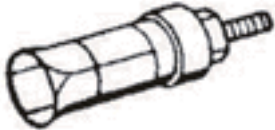
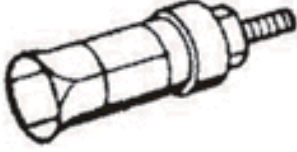


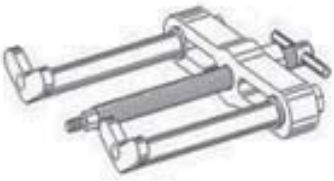


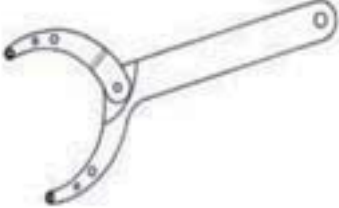

17W98FA180

5. SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

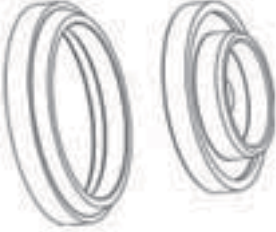
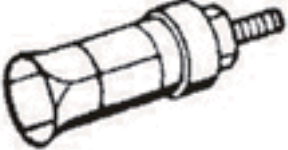
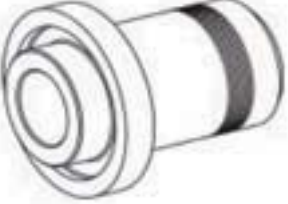

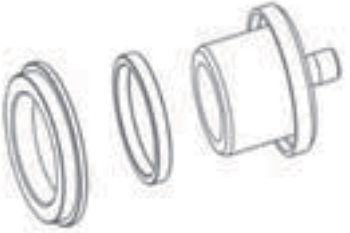
No.	Figure	Designation order no.	Qty	Page
1	 <p>180W9A8FA501</p>	Assembly truck assy with tilting device 5870 350 000	1	8-176 8-247
2	 <p>180W9A8FA502</p>	Supporting bracket 5870 350 106	1	8-176 8-247
3	 <p>180W9A8FA503</p>	Socket wrench 5870 656 097	1	8-180 8-248
4	 <p>180W9A8FA504</p>	Assembly lever 5870 345 036	1	8-181 8-249
5	 <p>180W9A8FA505</p>	Adjusting device 5870 400 001	2	8-182 8-250




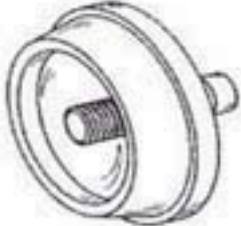

No.	Figure	Designation order no.	Qty	Page		
6	 <p style="text-align: right; font-size: small;">180W9A8FA506</p>	Lifting bracket 5870 281 043	1	8-182, 185, 210, 218 8-252, 276, 284		
7	 <p style="text-align: right; font-size: small;">180W9A8FA507</p>	Pressure piece 5870 100 067 (FR axle) 5870 100 063 (RR axle)	1 1	8-182, 183 8-250		
8	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;"> FR axle  <p style="text-align: right; font-size: small;">180W9A8FA508-1</p> </td> <td style="width: 50%; text-align: center;"> RR axle  <p style="text-align: right; font-size: small;">180W9A8FA508-2</p> </td> </tr> </table>	FR axle  <p style="text-align: right; font-size: small;">180W9A8FA508-1</p>	RR axle  <p style="text-align: right; font-size: small;">180W9A8FA508-2</p>	Grab sleeve R140W-9A 5873 003 022 (FR axle) 5873 013 015 (RR axle)	1	-
FR axle  <p style="text-align: right; font-size: small;">180W9A8FA508-1</p>	RR axle  <p style="text-align: right; font-size: small;">180W9A8FA508-2</p>					
9	 <p style="text-align: right; font-size: small;">180W9A8FA509</p>	Grab sleeve R180W-9A / R210W-9A 5873 004 026	1	8-183 8-251		
10	 <p style="text-align: right; font-size: small;">180W9A8FA510</p>	Grab sleeve R210W-9A 5873 004 022	1	8-183		


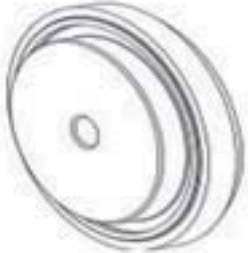
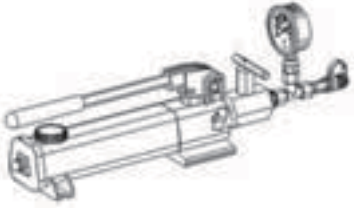


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11	 <p data-bbox="639 555 746 577">180W9A8FA511</p>	<p data-bbox="770 353 970 387">Eyebolts (FR axle)</p> <p data-bbox="770 409 895 443">R140W-9A</p> <p data-bbox="770 454 991 488">0636 804 001 (M16)</p>	2	-
12	 <p data-bbox="639 898 746 920">180W9A8FA512</p>	<p data-bbox="770 712 970 745">Eyebolts (FR axle)</p> <p data-bbox="770 768 991 801">5870 204 085 (M18)</p>	2	8-183, 207
13	 <p data-bbox="639 1234 746 1256">180W9A8FA513</p>	<p data-bbox="770 1032 970 1066">Eyebolts (FR axle)</p> <p data-bbox="770 1088 895 1122">R210W-9A</p> <p data-bbox="770 1133 991 1167">0636 804 003 (M20)</p>	2	-
14	 <p data-bbox="639 1576 746 1599">180W9A8FA514</p>	<p data-bbox="770 1375 1023 1408">Inner installer (FR axle)</p> <p data-bbox="770 1431 895 1464">R140W-9A</p> <p data-bbox="770 1476 1086 1509">5870 300 007 (Ø 46 ~ 56 mm)</p>	1	-
15	 <p data-bbox="639 1912 746 1935">180W9A8FA515</p>	<p data-bbox="770 1733 1023 1767">Inner installer (FR axle)</p> <p data-bbox="770 1789 1086 1823">5870 300 017 (Ø 56 ~ 70 mm)</p>	1	8-184, 185




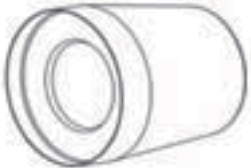
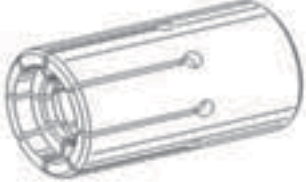
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16	 <p data-bbox="638 555 746 577">180W9A8FA516</p>	<p data-bbox="767 376 948 405">Counter support</p> <p data-bbox="767 432 919 461">5870 300 020</p>	1	<p data-bbox="1203 383 1374 412">8-184, 185, 188</p> <p data-bbox="1257 423 1319 452">8-256</p>
17	 <p data-bbox="638 898 746 920">180W9A8FA517</p>	<p data-bbox="767 712 916 741">Inner installer</p> <p data-bbox="767 768 1094 797">5870 300 019 (Ø 56 - 110 mm)</p>	1	<p data-bbox="1230 719 1353 748">8-185, 188</p> <p data-bbox="1257 759 1319 788">8-256</p>
18	 <p data-bbox="638 1234 746 1256">180W9A8FA518</p>	<p data-bbox="767 1055 842 1084">Striker</p> <p data-bbox="767 1111 919 1140">5870 650 004</p>	1	<p data-bbox="1257 1061 1326 1090">8-186</p> <p data-bbox="1203 1102 1374 1131">8-253, 254, 255</p>
19	 <p data-bbox="638 1574 746 1597">180W9A8FA519</p>	<p data-bbox="767 1395 922 1424">Clamping fork</p> <p data-bbox="767 1451 919 1480">5870 240 025</p>	1	<p data-bbox="1230 1402 1353 1431">8-187, 202</p> <p data-bbox="1230 1442 1353 1471">8-255, 274</p>
20	 <p data-bbox="638 1910 746 1933">180W9A8FA520</p>	<p data-bbox="767 1731 903 1760">Grab sleeve</p> <p data-bbox="767 1787 919 1816">5873 001 037</p>	1	<p data-bbox="1257 1738 1326 1767">8-188</p> <p data-bbox="1257 1778 1319 1807">8-256</p>

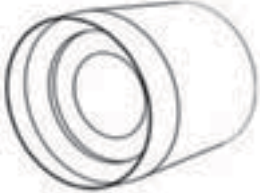

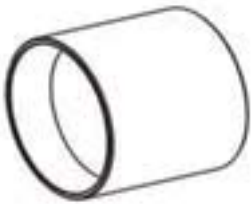
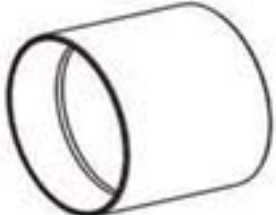

No.	Figure	Designation order no.	Qty	Page
21	 <p data-bbox="639 562 746 577">180W9A8FA521</p>	<p data-bbox="770 376 903 405">Grab sleeve</p> <p data-bbox="770 432 919 461">5873 011 019</p>	1	<p data-bbox="1259 383 1326 412">8-189</p> <p data-bbox="1259 427 1326 456">8-257</p>
22	 <p data-bbox="639 898 746 913">180W9A8FA522</p>	<p data-bbox="770 719 874 748">Basic tool</p> <p data-bbox="770 775 919 804">5873 001 000</p>	1	<p data-bbox="1259 725 1326 754">8-189</p> <p data-bbox="1259 770 1326 799">8-257</p>
23	 <p data-bbox="639 1234 746 1249">180W9A8FA523</p>	<p data-bbox="770 1055 935 1084">Pressure piece</p> <p data-bbox="770 1111 919 1140">5870 100 009</p>	1	<p data-bbox="1259 1061 1326 1090">8-189</p> <p data-bbox="1259 1106 1326 1135">8-257</p>
24	 <p data-bbox="639 1570 746 1585">180W9A8FA524</p>	<p data-bbox="770 1391 951 1420">Adjusting screws</p> <p data-bbox="770 1447 1046 1476">5870 204 027 (M12 × 1.5)</p>	1	<p data-bbox="1259 1397 1326 1426">8-194</p> <p data-bbox="1259 1442 1326 1471">8-262</p>
25	 <p data-bbox="639 1906 746 1921">180W9A8FA525</p>	<p data-bbox="770 1727 951 1756">Assembly fixture</p> <p data-bbox="770 1783 919 1812">5870 345 049</p>	1	<p data-bbox="1259 1733 1326 1762">8-196</p> <p data-bbox="1259 1778 1326 1807">8-269</p>



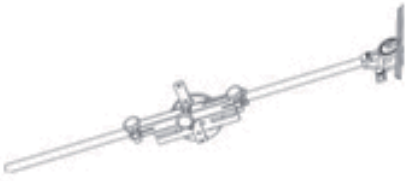

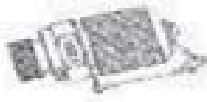
No.	Figure	Designation order no.	Qty	Page
26	 <p data-bbox="639 562 746 577">180W9A8FA526</p>	<p data-bbox="770 376 919 405">Pressure ring</p> <p data-bbox="770 432 919 461">5870 345 056</p>	1	<p data-bbox="1259 387 1326 416">8-196</p> <p data-bbox="1259 427 1326 456">8-269</p>
27	 <p data-bbox="639 904 746 920">180W9A8FA527</p>	<p data-bbox="770 719 951 748">Internal extractor</p> <p data-bbox="770 775 1090 804">5870 300 005 (Ø 36 ~ 46 mm)</p>	1	<p data-bbox="1259 730 1326 759">8-200</p> <p data-bbox="1259 770 1326 799">8-265</p>
28	 <p data-bbox="639 1238 746 1254">180W9A8FA528</p>	<p data-bbox="770 1055 986 1084">Driver tool (FR axle)</p> <p data-bbox="770 1111 919 1140">5870 048 286</p>	1	8-202
29	 <p data-bbox="639 1581 746 1597">180W9A8FA529</p>	<p data-bbox="770 1373 986 1402">Driver tool (FR axle)</p> <p data-bbox="770 1413 890 1442">R140W-9A</p> <p data-bbox="770 1469 919 1498">5870 055 081</p>	1	-
30	 <p data-bbox="639 1912 746 1928">180W9A8FA530</p>	<p data-bbox="770 1731 986 1760">Driver tool (FR axle)</p> <p data-bbox="770 1787 919 1816">5870 055 090</p>	1	8-203, 205

No.	Figure	Designation order no.	Qty	Page
31	 <p style="text-align: right; font-size: small;">180W9A8FA531</p>	Handle (FR axle) 5870 260 002	1	8-203, 204, 205
32	 <p style="text-align: right; font-size: small;">180W9A8FA532</p>	Driver tool R140W-9A 5870 058 058	1	-
33	 <p style="text-align: right; font-size: small;">180W9A8FA533</p>	Driver tool 5870 058 022	1	8-204
34	 <p style="text-align: right; font-size: small;">180W9A8FA534</p>	Driver tool (FR axle) R210W-9A 5870 058 078	1	-
35	 <p style="text-align: right; font-size: small;">180W9A8FA535</p>	Lever riveting tongs (RR axle) 5870 320 016	1	8-275



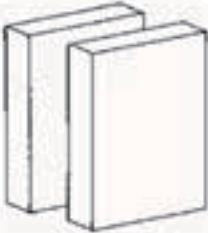
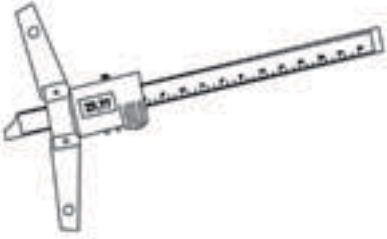

No.	Figure	Designation order no.	Qty	Page
36	 <p data-bbox="639 557 746 577">180W9A8FA536</p>	<p data-bbox="770 376 879 405">Driver tool</p> <p data-bbox="770 432 919 461">5870 051 035</p>	1	<p data-bbox="1259 383 1326 412">8-209</p> <p data-bbox="1259 427 1326 456">8-276</p>
37	 <p data-bbox="639 898 746 918">180W9A8FA537</p>	<p data-bbox="770 696 879 725">Driver tool</p> <p data-bbox="770 736 890 766">R210W-9A</p> <p data-bbox="770 792 919 822">5870 051 068</p>	1	-
38	 <p data-bbox="639 1234 746 1254">180W9A8FA538</p>	<p data-bbox="770 1055 874 1084">HP pump</p> <p data-bbox="770 1111 919 1140">5870 287 007</p>	1	<p data-bbox="1230 1061 1350 1090">8-214, 226</p> <p data-bbox="1259 1106 1321 1135">8-281</p>
39	 <p data-bbox="639 1576 746 1597">180W9A8FA539</p>	<p data-bbox="770 1397 970 1426">Threaded coupling</p> <p data-bbox="770 1453 1034 1482">5870 950 102 (M14x1.5)</p>	1	<p data-bbox="1259 1404 1326 1433">8-214</p> <p data-bbox="1259 1449 1326 1478">8-281</p>
40	 <p data-bbox="639 1912 746 1933">180W9A8FA540</p>	<p data-bbox="770 1733 927 1762">Breather bottle</p> <p data-bbox="770 1789 919 1818">5870 286 072</p>	1	<p data-bbox="1259 1740 1326 1769">8-214</p> <p data-bbox="1259 1785 1326 1814">8-281</p>


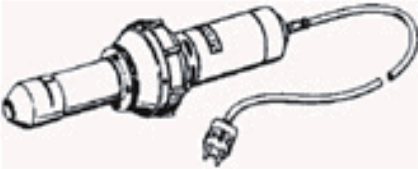


No.	Figure	Designation order no.	Qty	Page
41	 <p data-bbox="639 555 746 577">180W9A8FA541</p>	<p data-bbox="770 376 906 405">Straightedge</p> <p data-bbox="770 432 916 461">5870 200 022</p>	1	<p data-bbox="1257 383 1326 412">8-215</p> <p data-bbox="1257 423 1326 452">8-282</p>
42	 <p data-bbox="639 898 746 920">180W9A8FA542</p>	<p data-bbox="770 696 890 763">Driver tool R140W-9A</p> <p data-bbox="770 790 916 819">5870 048 245</p>	1	-
43	 <p data-bbox="639 1234 746 1256">180W9A8FA543</p>	<p data-bbox="770 1055 890 1084">Driver tool</p> <p data-bbox="770 1111 916 1140">5870 048 263</p>	1	<p data-bbox="1257 1061 1326 1090">8-217</p> <p data-bbox="1257 1102 1326 1131">8-283</p>
44	 <p data-bbox="639 1576 746 1599">180W9A8FA544</p>	<p data-bbox="770 1397 1018 1426">Inner installer (FR axle)</p> <p data-bbox="770 1453 916 1482">5870 651 086</p>	1	8-220
45	 <p data-bbox="639 1912 746 1935">180W9A8FA545</p>	<p data-bbox="770 1733 1018 1762">Inner installer (FR axle)</p> <p data-bbox="770 1789 916 1818">5870 651 087</p>	1	8-220





No.	Figure	Designation order no.	Qty	Page
46	 <p data-bbox="638 555 750 577">180W9A8FA546</p>	<p data-bbox="769 376 1023 405">Inner installer (FR axle)</p> <p data-bbox="769 432 919 461">5870 651 088</p>	1	-
47	 <p data-bbox="638 896 750 918">180W9A8FA547</p>	<p data-bbox="769 719 916 748">Inner installer</p> <p data-bbox="769 775 919 804">5870 651 089</p>	1	-
48	 <p data-bbox="638 1232 750 1254">180W9A8FA548</p>	<p data-bbox="769 1055 975 1084">Calibration bushing</p> <p data-bbox="769 1111 919 1140">5870 651 090</p>	1	8-220
49	 <p data-bbox="638 1579 750 1601">180W9A8FA549</p>	<p data-bbox="769 1391 975 1420">Calibration bushing</p> <p data-bbox="769 1447 919 1476">5870 651 091</p>	1	-
50	 <p data-bbox="638 1915 750 1937">180W9A8FA550</p>	<p data-bbox="769 1715 1034 1744">Socket wrench (FR axle)</p> <p data-bbox="769 1771 1015 1800">5870 656 100 (SW 55)</p> <p data-bbox="769 1827 919 1856">5870 656 097</p>	1	8-211, 214, 223, 8-277



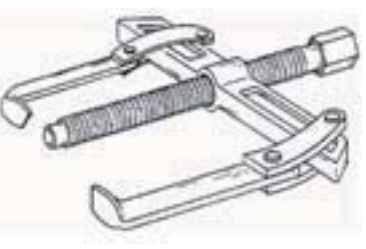
No.	Figure	Designation order no.	Qty	Page
51	 <p data-bbox="639 555 746 577">180W9A8FA551</p>	<p data-bbox="770 353 1038 387">Socket wrench (FR axle)</p> <p data-bbox="770 412 895 439">R210W-9A</p> <p data-bbox="770 450 1018 483">5870 656 099 (SW 75)</p>	1	8-211, 214
52	 <p data-bbox="639 898 746 920">180W9A8FA552</p>	<p data-bbox="770 712 1027 745">Straightedges (FR axle)</p> <p data-bbox="770 770 922 797">5870 200 029</p>	1	8-224, 225
53	 <p data-bbox="639 1234 746 1256">180W9A8FA553</p>	<p data-bbox="770 1055 1066 1088">Measuring device (FR axle)</p> <p data-bbox="770 1113 922 1140">5870 200 033</p>	1	8-224, 225
54	 <p data-bbox="639 1570 746 1592">180W9A8FA554</p>	<p data-bbox="770 1391 986 1424">Reduction (FR axle)</p> <p data-bbox="770 1449 922 1476">5870 950 161</p>	1	8-226
55	 <p data-bbox="639 1906 746 1928">180W9A8FA555</p>	<p data-bbox="770 1727 948 1760">Clutch (FR axle)</p> <p data-bbox="770 1785 922 1812">0501 207 939</p>	1	8-226

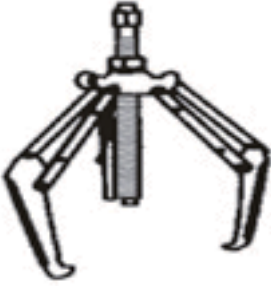
6. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

No.	Figure	Designation order no.	Qty	Remark
1	 <p>180W9A8FA556</p>	Magnetic stand 5870 200 055	1	Universal
2	 <p>180W9A8FA557</p>	Dial indicator 5870 200 057	1	Universal
3	 <p>180W9A8FA558</p>	Gauge blocks 5870 200 066 (70 mm) 5870 200 067 (100 mm)	1	Universal 8-268
4	 <p>180W9A8FA559</p>	Digital depth gauge 5870 200 072 (200 mm) 5870 200 114 (300 mm)	1	Universal
5	 <p>180W9A8FA560</p>	Digital caliper gauge 5870 200 109 (150 mm)	1	Universal

No.	Figure	Designation order no.	Qty	Remark
6	 <p style="text-align: right; font-size: small;">180W9A8FA561</p>	<p>Torque wrench</p> <p>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</p>	1	Universal
7	 <p style="text-align: right; font-size: small;">180W9A8FA562</p>	<p>Hot air blower</p> <p>5870 221 500 230 V 5870 221 501 115 V</p>	1	Universal
8	 <p style="text-align: right; font-size: small;">180W9A8FA563</p>	<p>Plastic hammer</p> <p>5870 280 004 Ø 60 mm</p> <p>Substitute nylon insert</p> <p>5870 280 006</p>	1	Universal
9	 <p style="text-align: right; font-size: small;">180W9A8FA564</p>	<p>Lifting strap</p> <p>5870 281 026</p>	1	Universal

No.	Figure	Designation order no.	Qty	Remark
10	 <p data-bbox="639 557 746 577">180W9A8FA565</p>	<p data-bbox="770 376 900 405">Lifting chain</p> <p data-bbox="770 432 919 461">5870 281 047</p>	1	Universal
11	 <p data-bbox="639 898 746 918">180W9A8FA566</p>	<p data-bbox="770 712 852 741">Pry bar</p> <p data-bbox="770 768 919 797">5870 345 071</p>	1	Universal
12	 <p data-bbox="639 1234 746 1254">180W9A8FA567</p>	<p data-bbox="770 1055 842 1084">Striker</p> <p data-bbox="770 1111 919 1140">5870 650 004</p>	1	Universal
13	 <p data-bbox="639 1576 746 1597">180W9A8FA568</p>	<p data-bbox="770 1373 986 1402">Set of internal pliers</p> <p data-bbox="770 1413 874 1442">I1-I2-I3-I4</p> <p data-bbox="770 1469 919 1498">5870 900 013</p>	1	Universal
14	 <p data-bbox="639 1912 746 1933">180W9A8FA569</p>	<p data-bbox="770 1715 986 1744">Set of internal pliers</p> <p data-bbox="770 1756 970 1785">I11-I21-I31-I41 90°</p> <p data-bbox="770 1812 919 1841">5870 900 014</p>	1	Universal

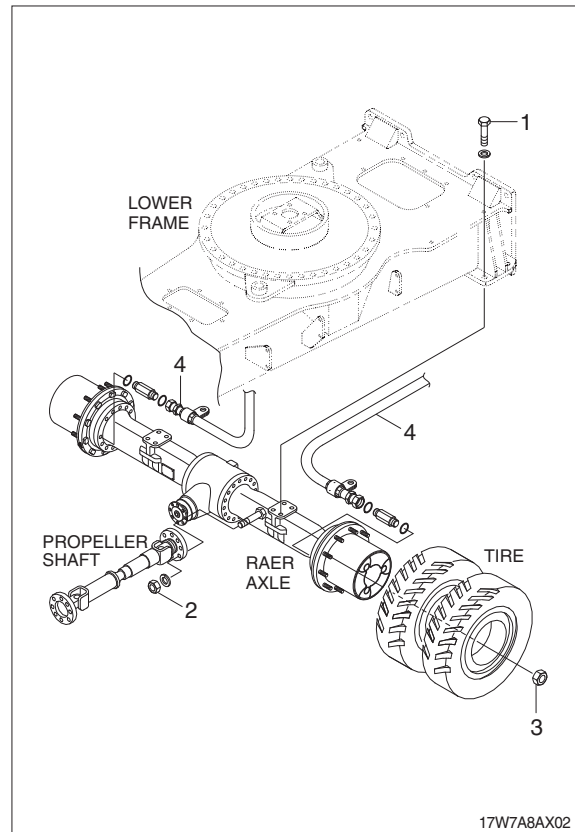
No.	Figure	Designation order no.	Qty	Remark
15	 <p style="text-align: right; font-size: small;">180W9A8FA570</p>	Set of external pliers A1-A2-A3-A4 5870 900 015	1	Universal
16	 <p style="text-align: right; font-size: small;">180W9A8FA571</p>	Set of external pliers A01-A02-A03-A04 90° 5870 900 016	1	Universal
17	 <p style="text-align: right; font-size: small;">180W9A8FA572</p>	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 data-bbox="619 808 727 831">180W9A8FA573</p>	<p data-bbox="746 255 935 286">Two-armed puller</p> <p data-bbox="746 313 895 344">5870 971 001</p> <p data-bbox="746 353 1011 385">Jaw width 85 mm</p> <p data-bbox="746 394 1011 425">Throat depth 65 mm</p> <p data-bbox="746 434 895 465">5870 971 002</p> <p data-bbox="746 474 1027 506">Jaw width 130 mm</p> <p data-bbox="746 515 1027 546">Throat depth 105 mm</p> <p data-bbox="746 555 895 586">5870 971 003</p> <p data-bbox="746 595 1027 627">Jaw width 230 mm</p> <p data-bbox="746 636 1027 667">Throat depth 150 mm</p> <p data-bbox="746 676 895 707">5870 971 004</p> <p data-bbox="746 716 1027 748">Jaw width 295 mm</p> <p data-bbox="746 757 1027 788">Throat depth 235 mm</p> <p data-bbox="746 797 895 828">5870 971 005</p> <p data-bbox="746 837 1027 869">Jaw width 390 mm</p> <p data-bbox="746 878 1027 909">Throat depth 270 mm</p> <p data-bbox="746 918 895 949">5870 971 006</p> <p data-bbox="746 958 1027 990">Jaw width 640 mm</p> <p data-bbox="746 999 1027 1030">Throat depth 300 mm</p>	1	Universal

GROUP 10 REAR AXLE

1. REMOVAL FRONT AXLE

- 1) Rear axle mounting nut (1, M20)
 - Tightening torque : 58 ± 6.3 kgf · m
(419 ± 45.5 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_{-5}^0 kgf · m
(434_{-36}^0 lbf · ft)
- 4) Hose assy (4)
- 5) Axle weight : 540 kg (1190 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

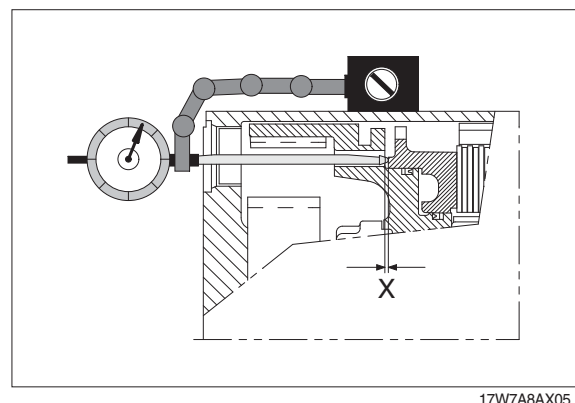
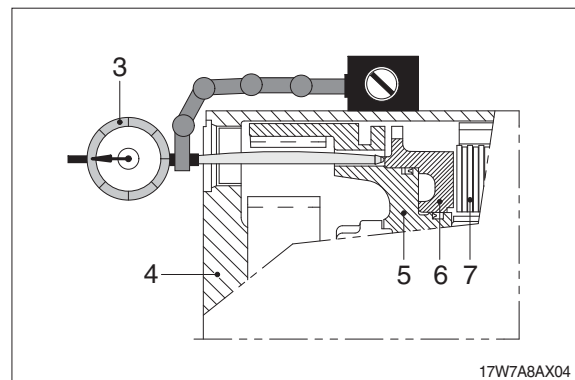
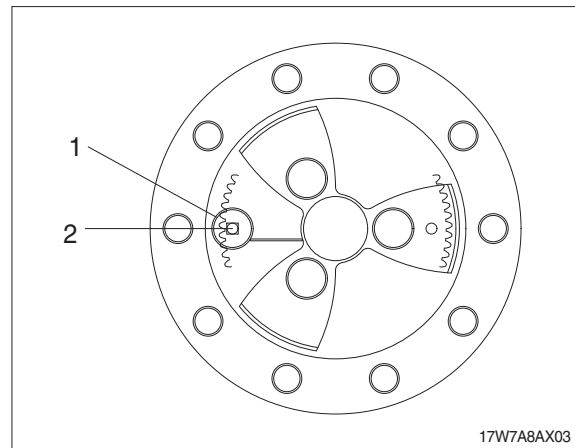
4 = Planetary carrier

5 = Ring gear

6 = Piston

7 = Plate pack

X = Piston stroke

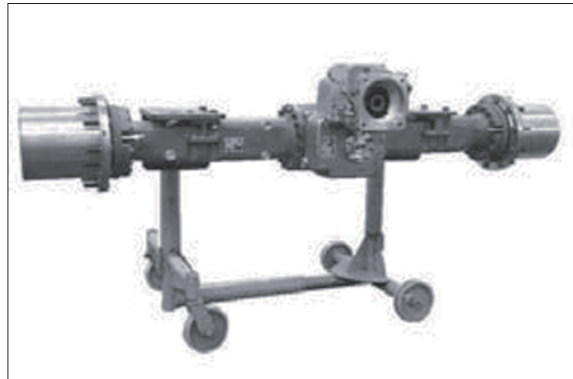


3. DISASSEMBLY

1) OUTPUT

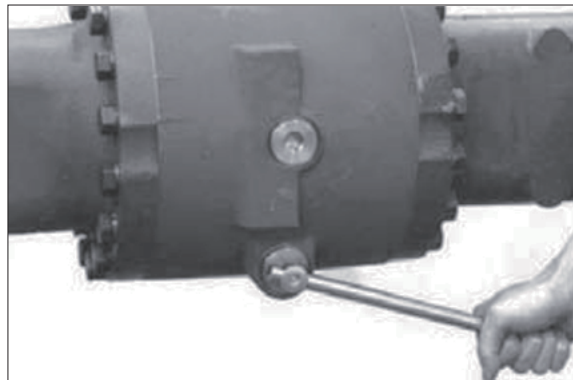
(1) Attach axle to the assembly truck.

- (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.

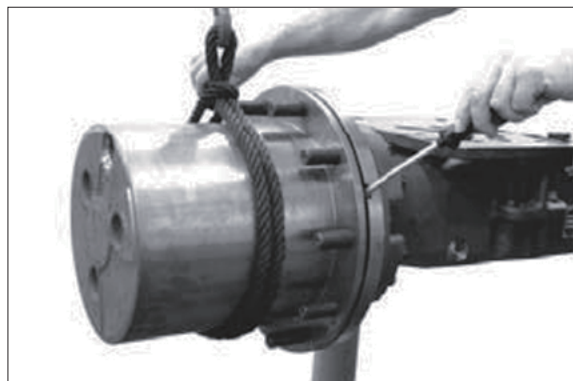


17W98RA003

- ※ Use suitable oil reservoir environmental protection.

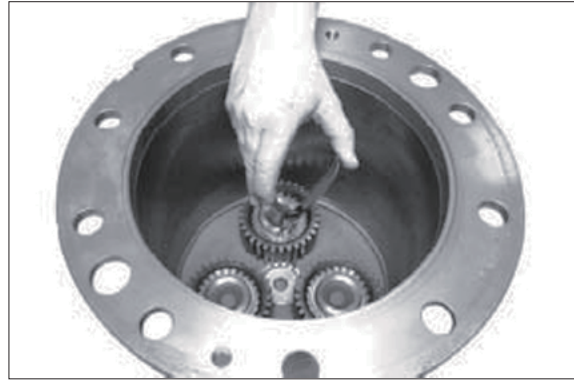
(4) Planetary carrier

Loosen both hexagon screws and separate planetary carrier from the hub.



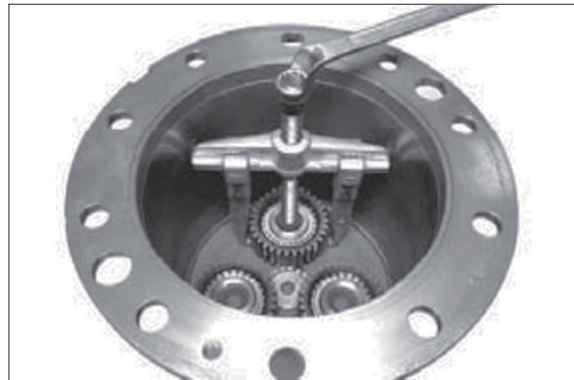
17W98RA004

(5) Snap out retaining ring.



17W98RA005

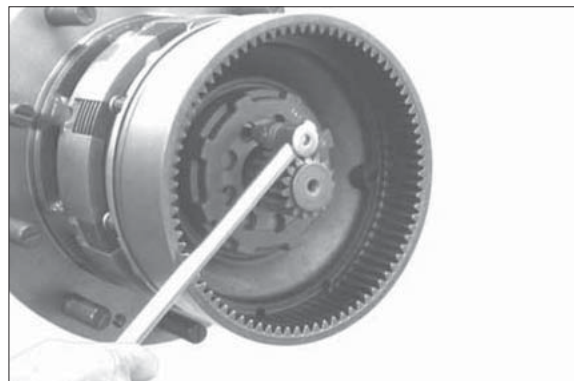
(6) Pull off planetary gear together with cylindrical roller bearing.



17W98RA006

(7) Brake

Loosen cylindrical screw (slotted nut fixing).

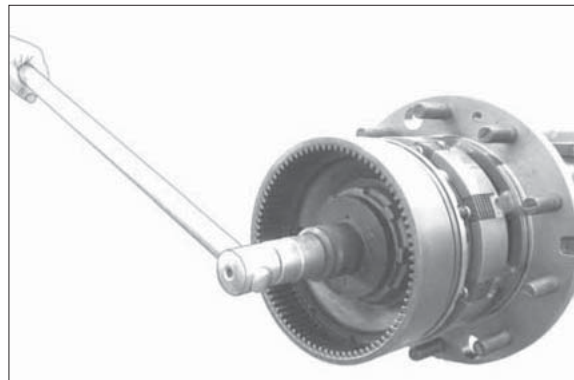


17W98RA007

(8) Loosen slotted nut.

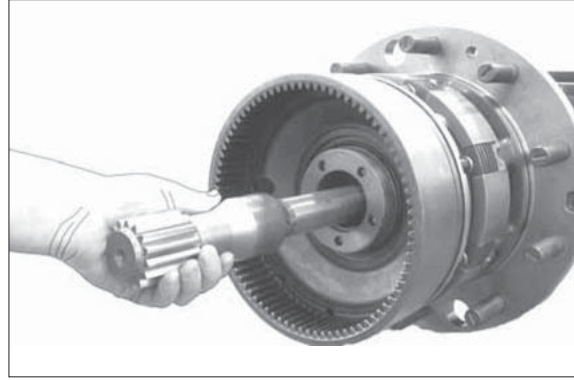
(S) Socket wrench

5870 656 097



17W98RA008

- (9) Pull sun gear together with stub shaft out of the axle housing.

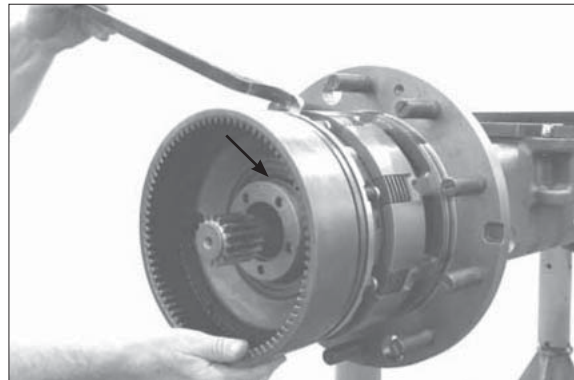


17W98RA009

- (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.



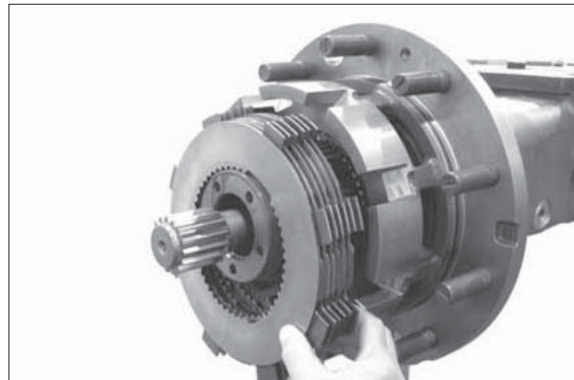
17W98RA012

(13) Remove sealing elements from the annular grooves (see arrows) of the ring gear.



17W98RA013

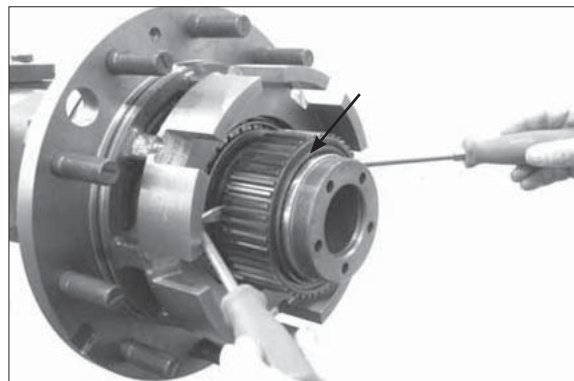
(14) Remove disk package.



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

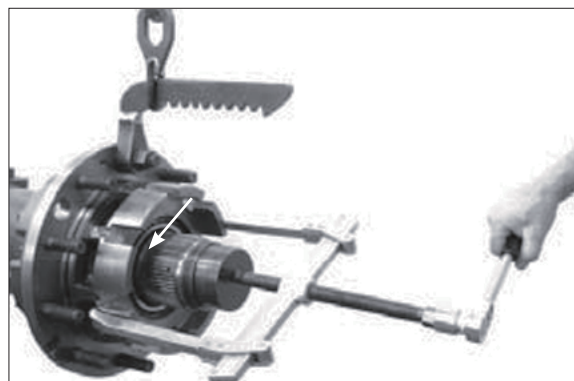
Remove O-ring (see arrow).

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.



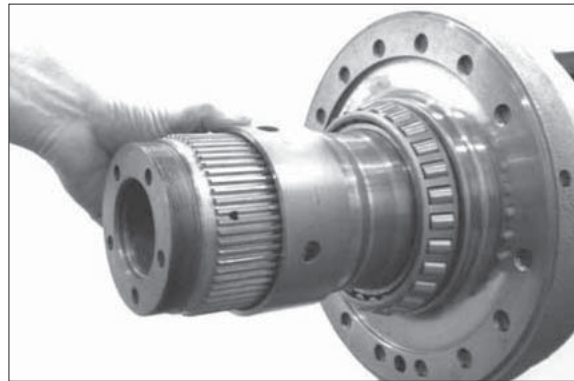
17W98RA016

- (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.

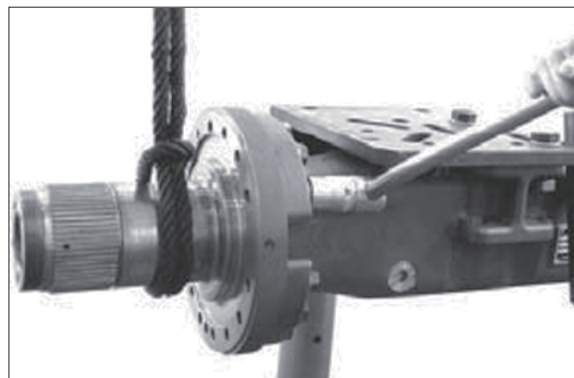
- (S) Grab sleeve 5873 004 026
- (S) Pressure piece 5870 100 063



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.



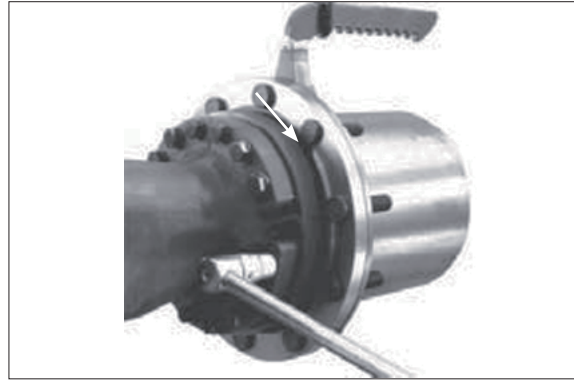
17W98RA020

(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).

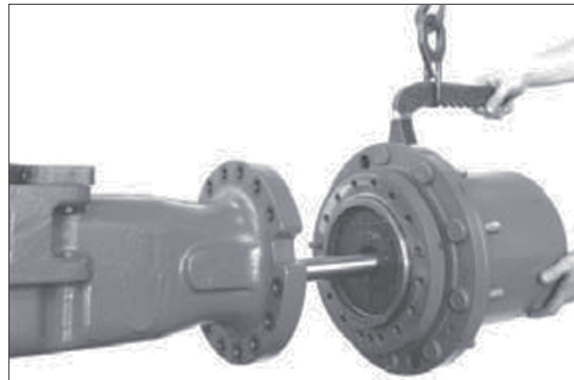
Secure output by means of lifting tackle (S) and loosen threaded joint.

(S) Lifting bracket 5870 281 043



17W98RA021

- (22) Separate output assy from the axle housing and pull out stub shaft.



17W98RA022

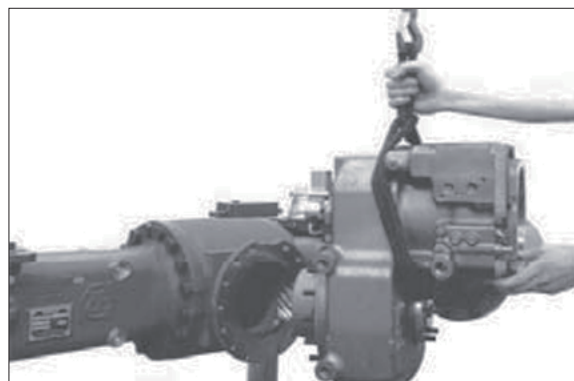
2) INTPUT

- (1) Secure transmission with lifting tackle and loosen threaded joint (transmission/axle drive housing).



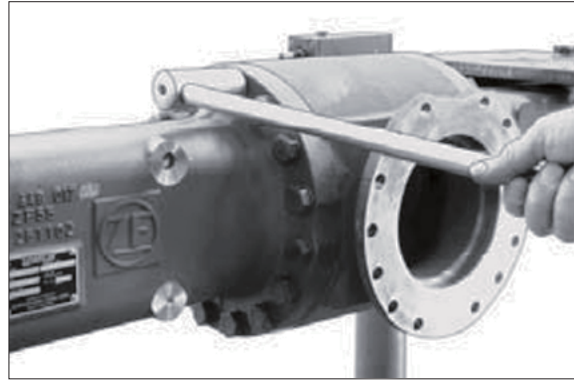
17W98RA023

- (2) Separate transmission from the axle.



17W98RA024

- (3) Secure axle housing (on crown wheel side) by means of lifting tackle and loosen threaded joint.

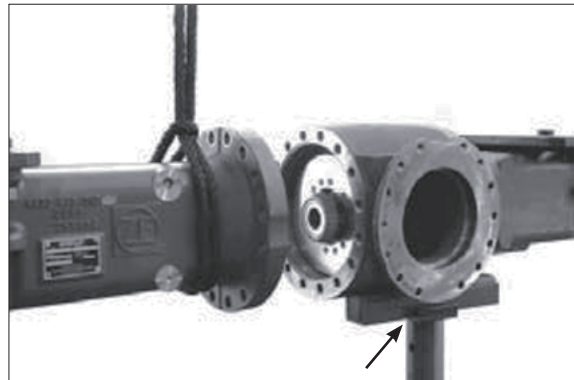


17W98RA025

- (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.

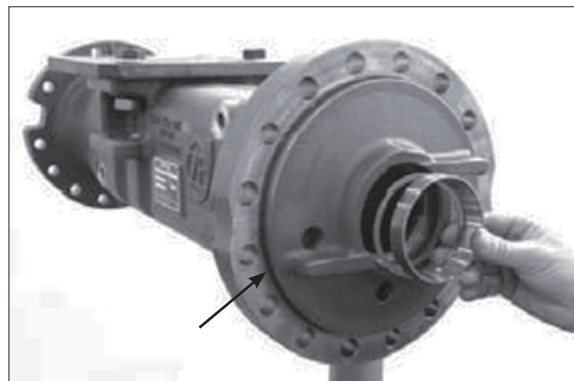


17W98RA026

- (5) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

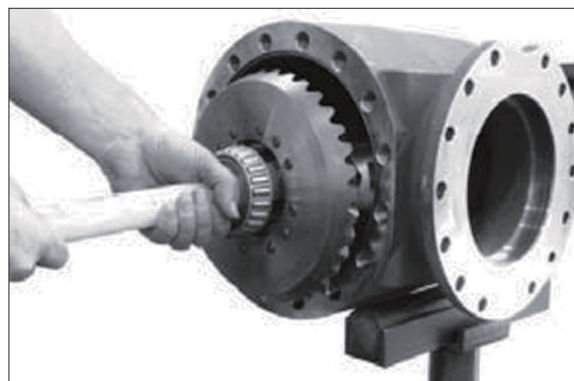
- (S) Striker 5870 650 004



17W98RA027

- (6) Lift differential out of the axle drive housing.

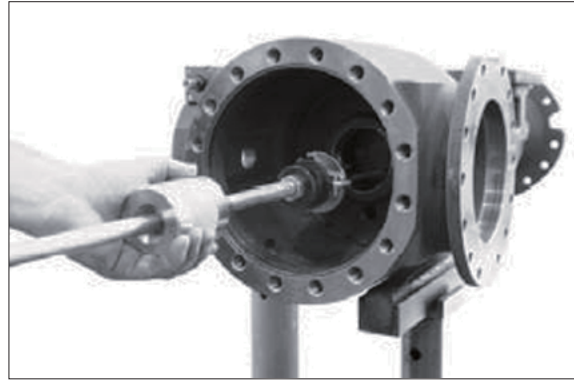
- ※ Disassembly of the differential see description on page 8-257 and following.



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

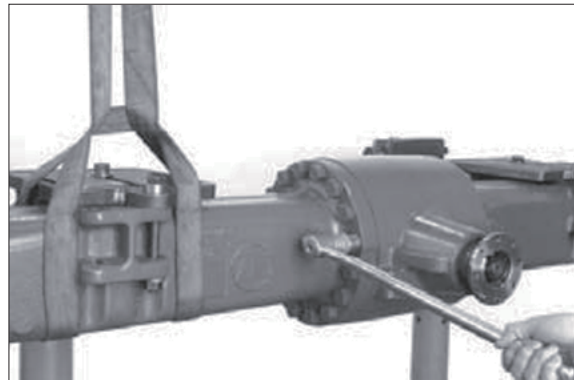


17W98RA029

- (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.

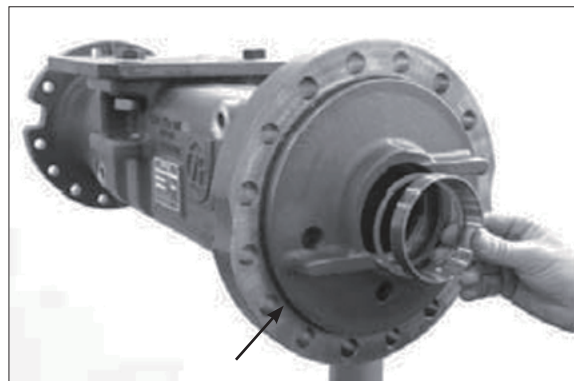


17W98RA030

- (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

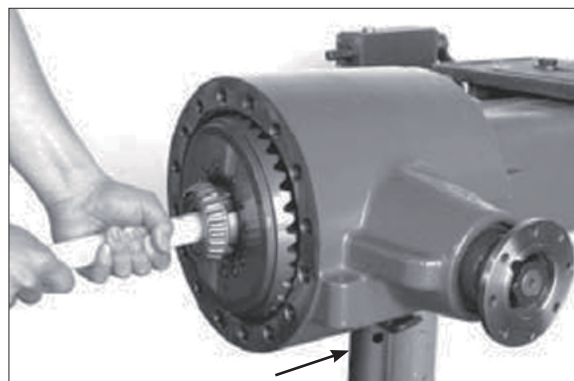


17W98RA031

- (10) Support axle at the axle drive housing (see arrow).

Then lift differential out of the axle drive housing.

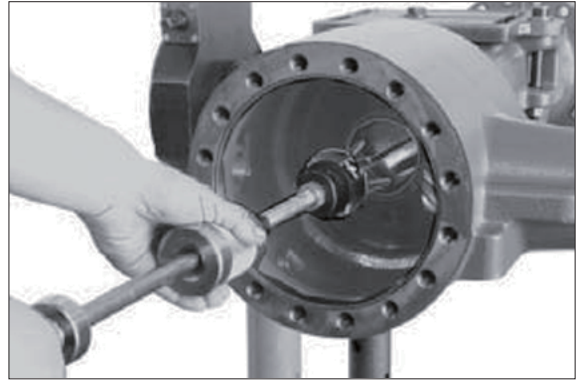
- ※ Disassembly of the differential see description on page 8-257 and following.



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



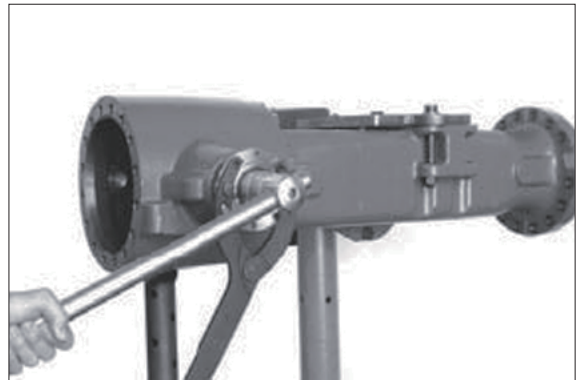
17W98RA033

- (12) Heat up hexagon nut with hot-air blower.

Then loosen hexagon nut and remove the releasing washer.

(S) Clamping fork 5870 240 025

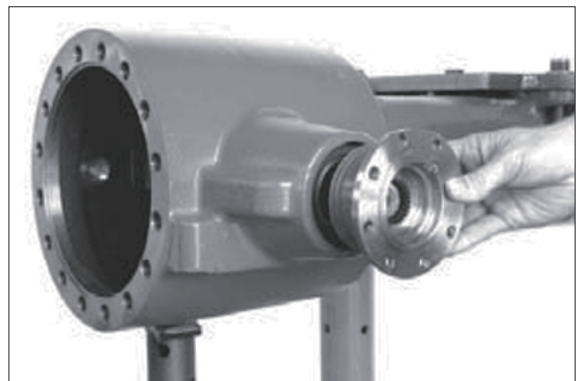
※ Hexagon nut is secured with Loctite no. 262.



17W98RA034

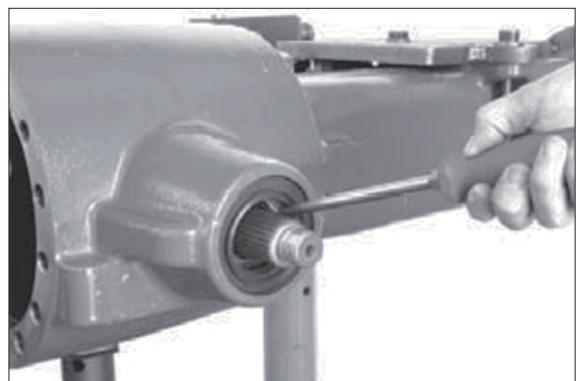
- (13) Pull input flange off the pinion.

If required, remove screen sheet from the flange.



17W98RA035

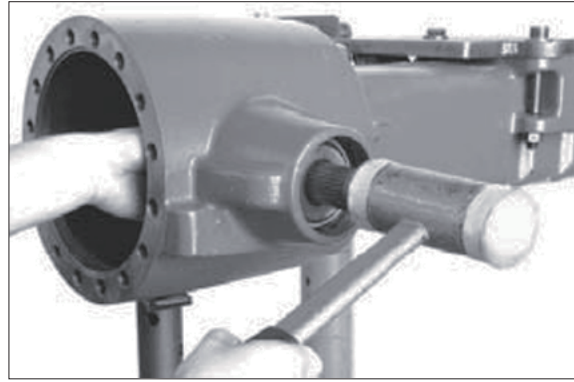
- (14) Use a lever to remove the shaft seal ring out of the housing hole.



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

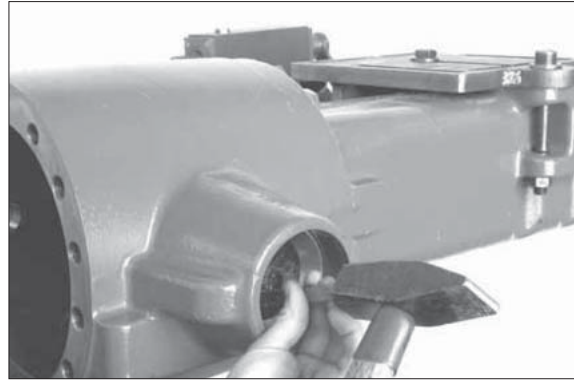
(S) Counter support 5870 300 020



17W98RA040

(19) Force bearing outer ring off the inner bearing hole pay attention to the shim behind.

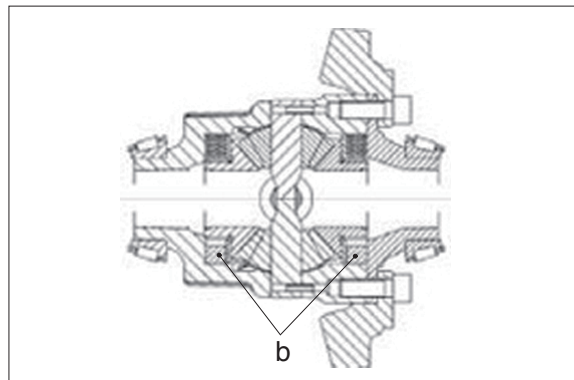
- ※ Mark shim regarding position/bearing allocation reassembly aid.



17W98RA041

3) DIFFERENTIAL

(1) b = Constant spacers



17W98RA042

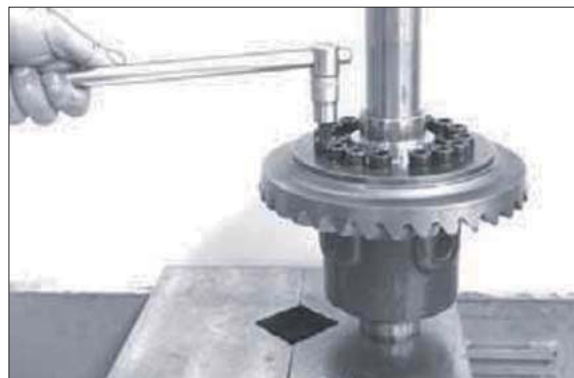
(2) Pull both tapered roller bearings from differential carrier.

- (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

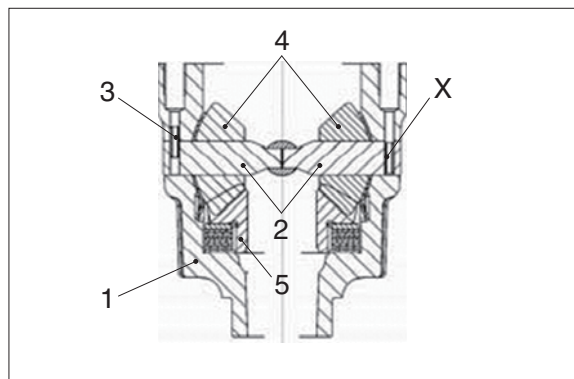
(6) Force slotted pins (considering position "X", see subsequent sketch) into the spider shafts.



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.

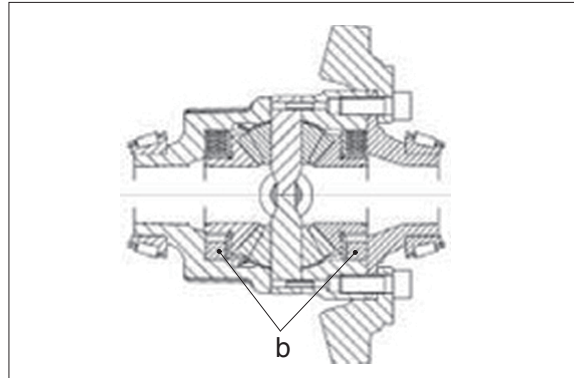


17W98RA050

4. REASSEMBLY

1) DIFFERENTIAL

(1) b = Constant spacers



17W98RA042

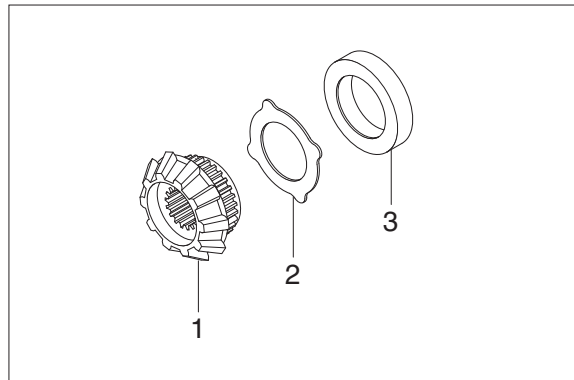
(2) All outer and inner disks are replaced by a constant spacer (see figure FA054).

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

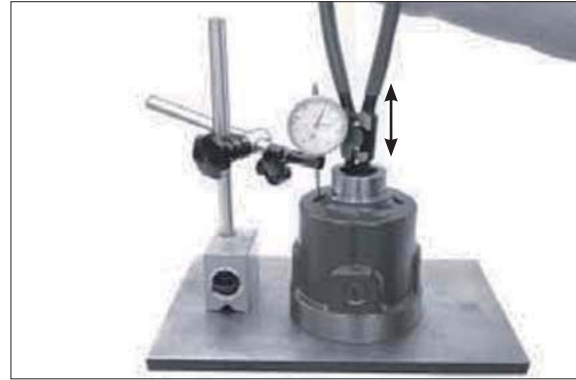
(5) Check axial play of the axle bevel gear 0.0 ... 0.15 mm.

※ 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:

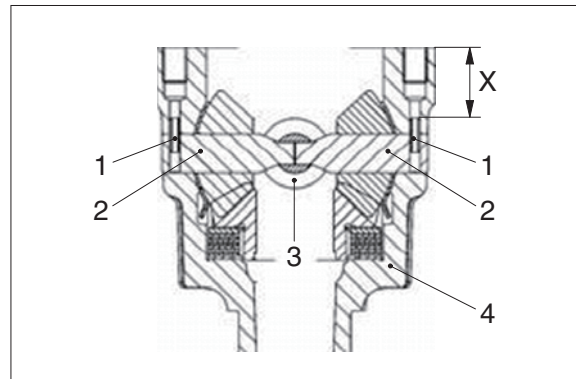
1 = Slotted pin

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.

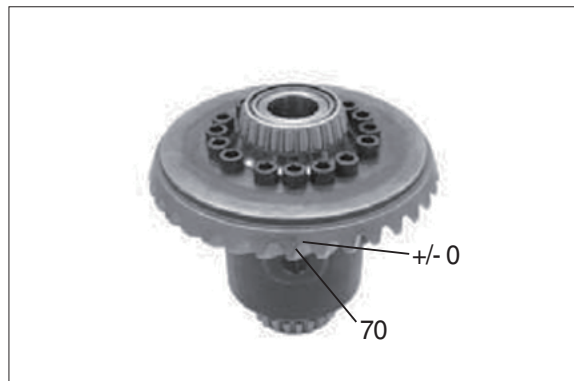


17W98RA064

2) INPUT

(1) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set).

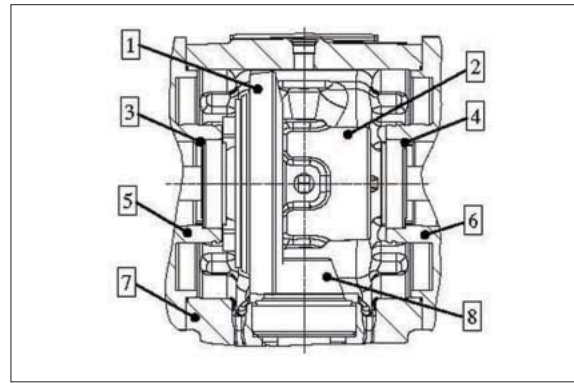
※ Determine the required shims on basis of the read value (test dimension/crown wheel) and the corresponding specifications of the table next page :
(KRS – SET – RIGHT) (KRS = bevel gear set)



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.



17W98RA066

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.

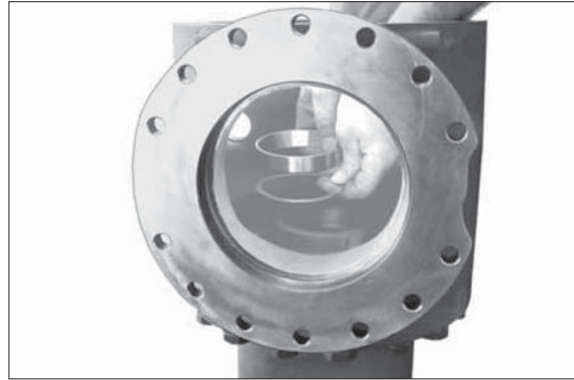
· Legend to sketch:

- 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 (M18/10.9)
..... MA = 390 Nm

- ※ Preliminarily fix axle housing without O-ring.

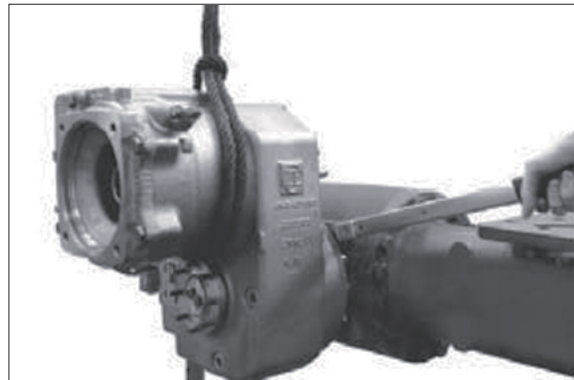


17W98RA071

- (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.

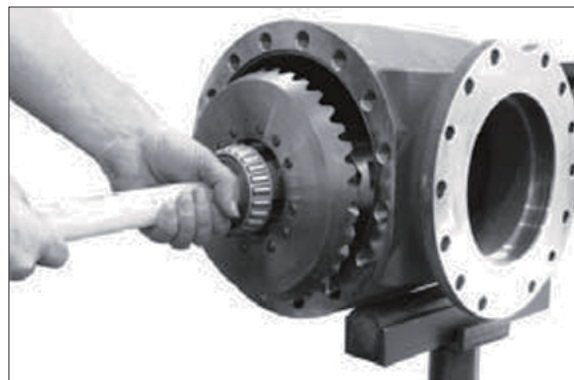
Compare the obtained contact pattern.

- ※ 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 (M18/10.9)
..... MA = 390 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

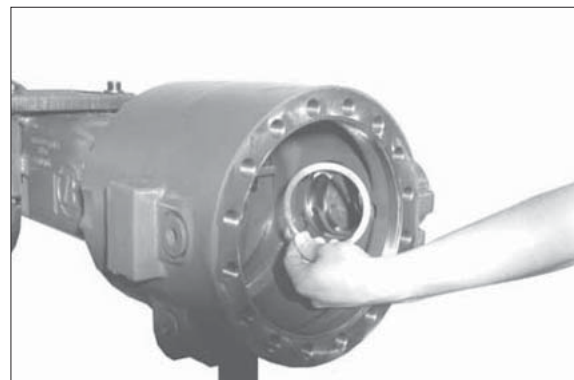
(4) Calculation example :

Dimension I 154.05 mm

Dimension X - 152.50 mm

Difference = shim s = 1.55 mm

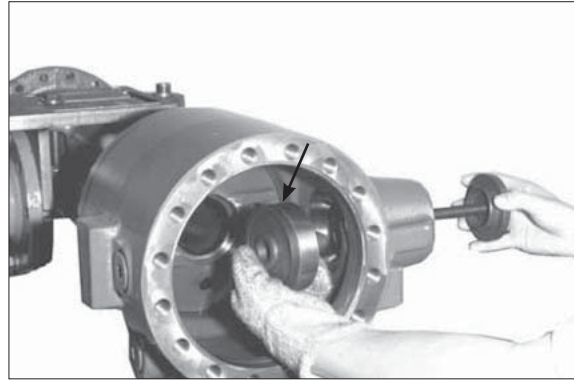
Place the determined shim (e.g. thickness = 1.55 mm) into the inner bearing hole.



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.



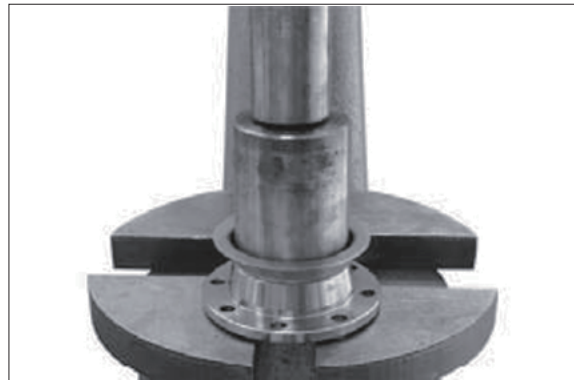
17W98RA084

- (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.



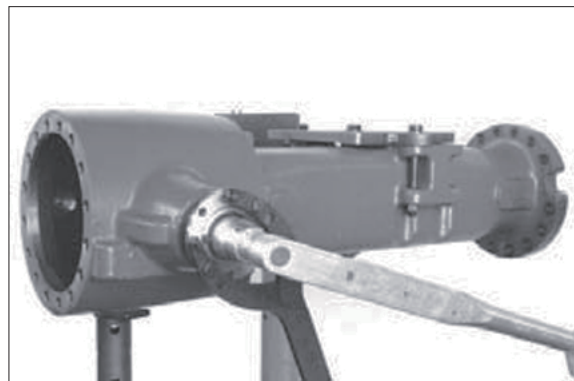
17W98RA086

- (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.

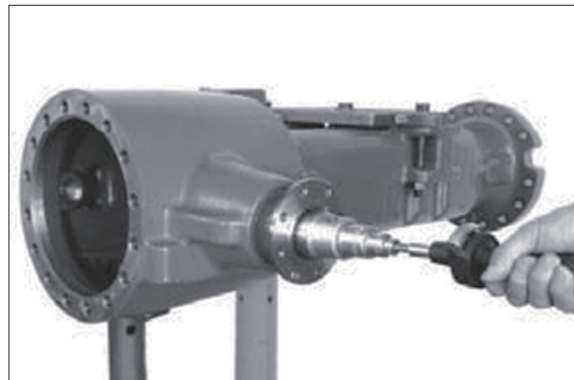


17W98RA087

- (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.

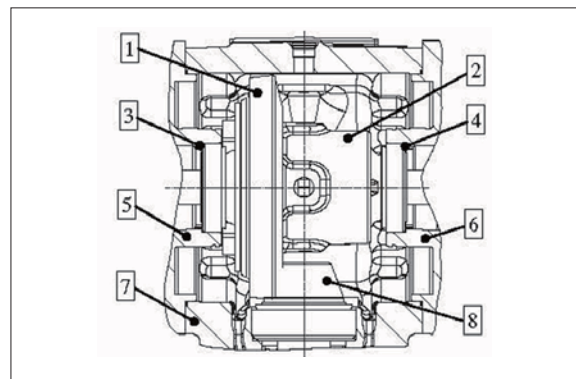
※ Any + or – deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. – 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.



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 (M18/10.9)
..... MA = 390 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 (M18/10.9)
..... MA = 390 Nm

Then bring axle into horizontal position and reassemble the second supporting bracket (S) (see also figure RA001).

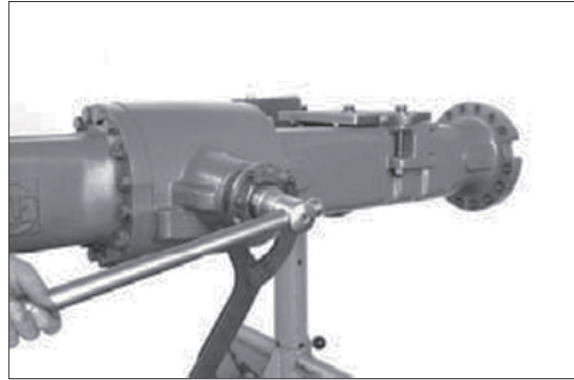


17W98RA098

(23) Fitting of shaft seal ring (input flange)

Loosen hexagon nut and pull input flange off the input pinion.

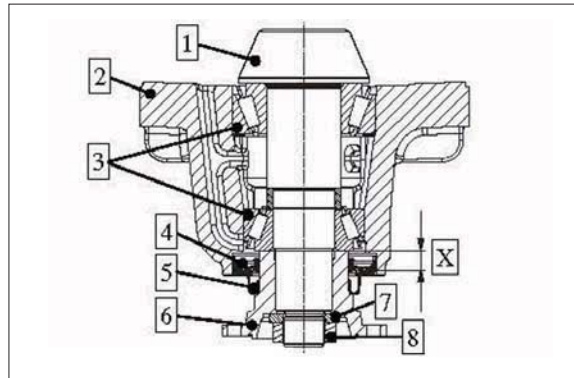
(S) Clamping fork 5870 240 025



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

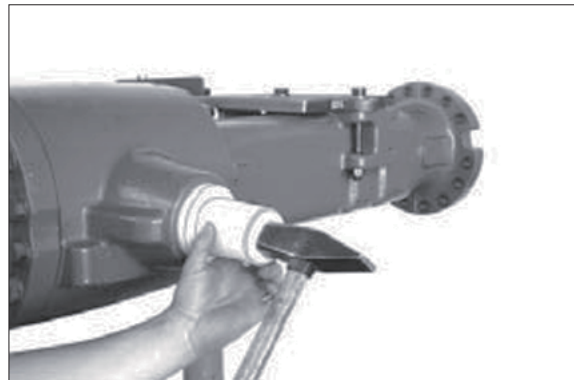


17W98RA100

(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.



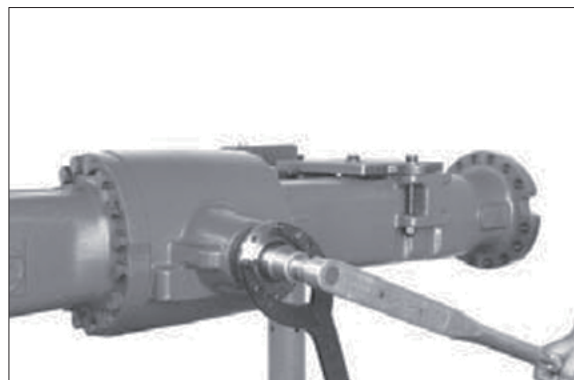
17W98RA101

(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

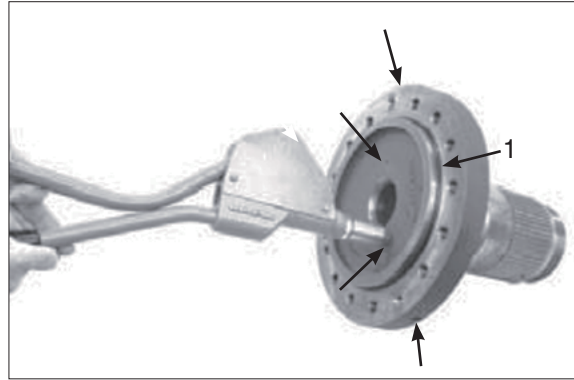
(1) Hub carrier

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

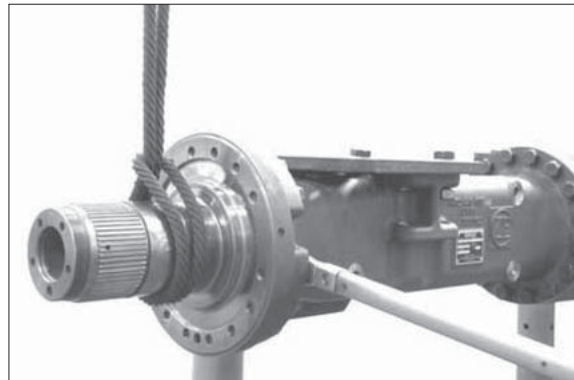


17W98RA103

(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

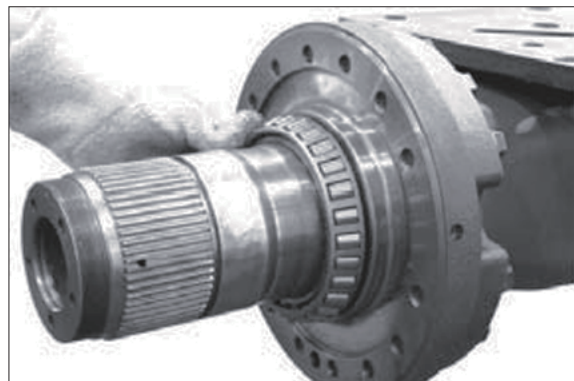
※ Ensure radial installation position.
Stamped circle (see arrow) must be in uppermost (12 o'clock) position.



17W98RA104

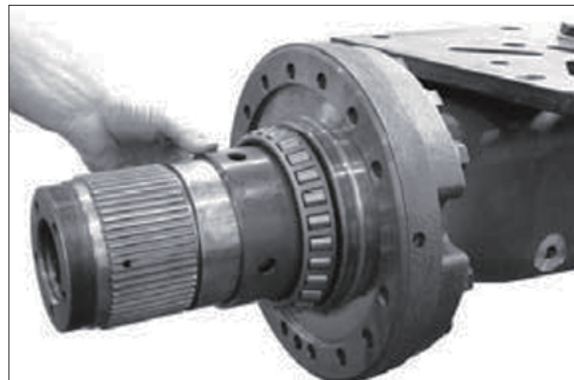
(3) Hub (Hub bearing SET-RIGHT)

Heat up tapered roller bearing and mount it to hub carrier until contact is obtained.



17W98RA105

(4) Mount spacer bushing.

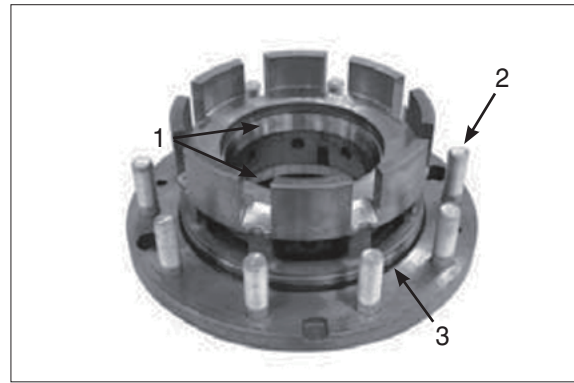


17W98RA106

- (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.

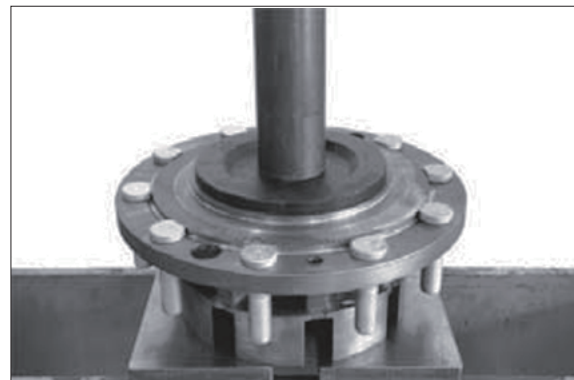


17W98RA107

- (6) Press shaft seal ring into the hub, with the marking "OUT SIDE" showing outwards (facing up):

(S) Driver tool 5870 051 035

- ※ 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.



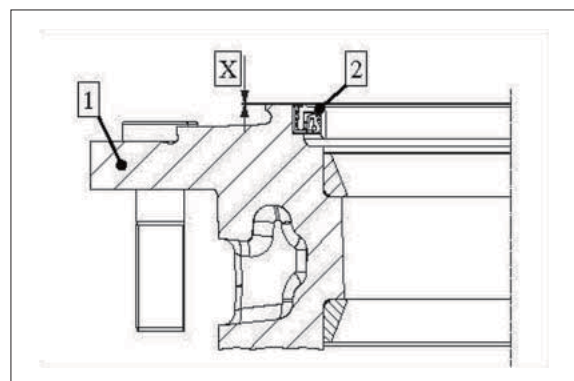
17W98RA108

- (7) Legend to sketch:

1 = Hub

2 = Shaft seal ring

X = Installation dimension – shaft seal ring
 0.0~0.3 mm

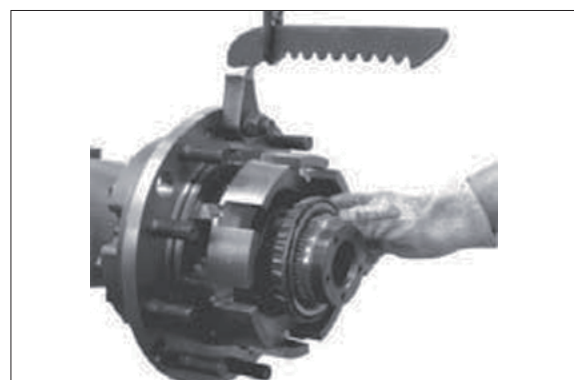


17W98RA109

- (8) Mount preassembled hub until contact is obtained and fix it with heated tapered roller bearing.

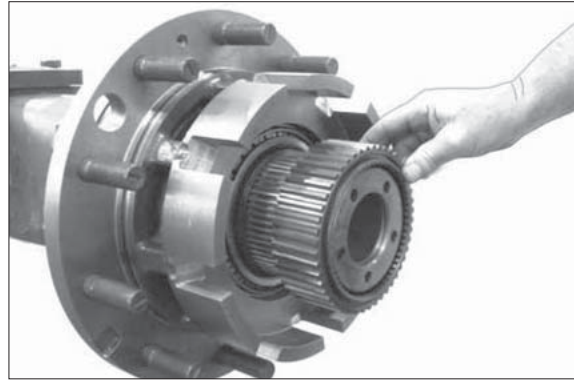
(S) Lifting bracket 5870 281 043

- ※ Just before fitting, wet sealing lips of shaft seal ring with lubricant.



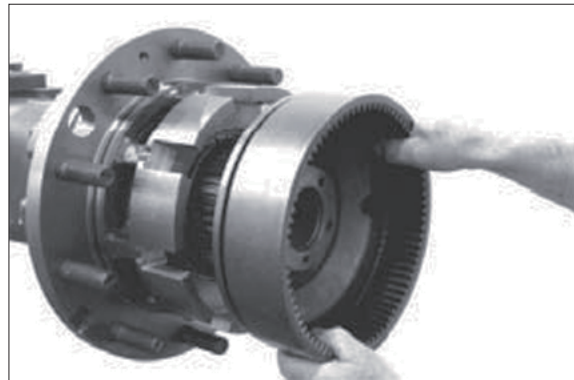
17W98RA110

- (9) Oil O-ring and insert it into the annular groove (see arrow) of the hub carrier.
Then mount disk carrier.



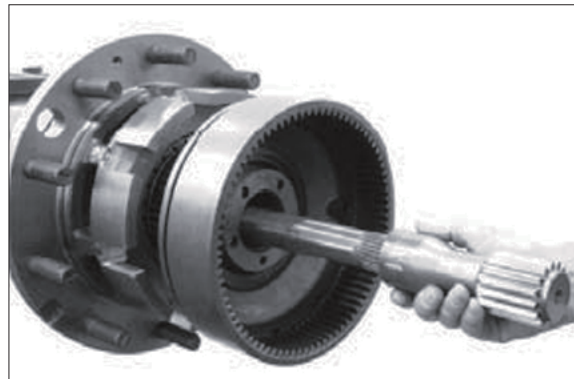
17W98RA111

- (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).

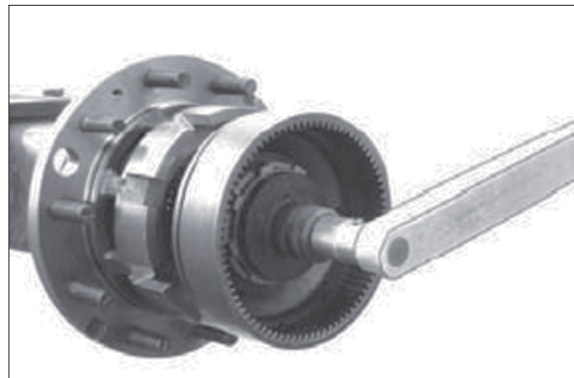


17W98RA113

- (12) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of 1400 Nm max.

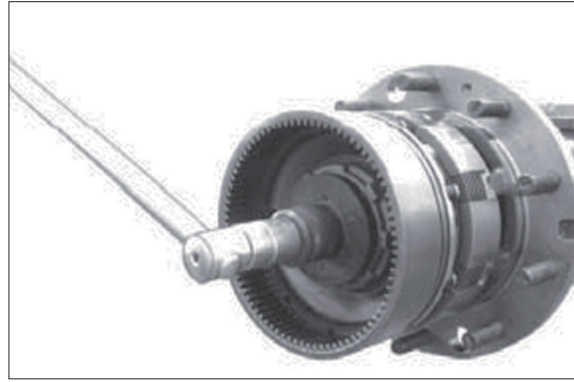
(S) Socket wrench 5870 656 097

- ※ 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

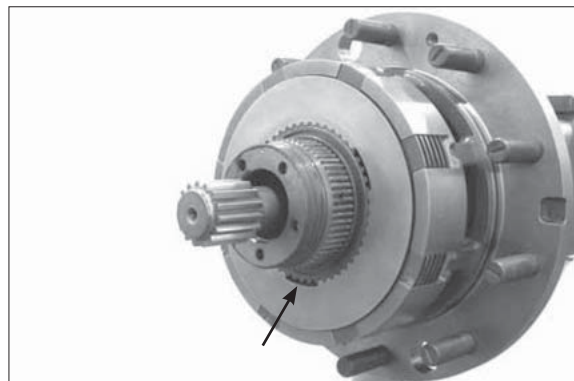
Mount outer and inner disks of the disk package alternately, starting with an outer disk.

- ※ For the actually required disk fitting/ arrangement please refer to the corresponding spare parts list.



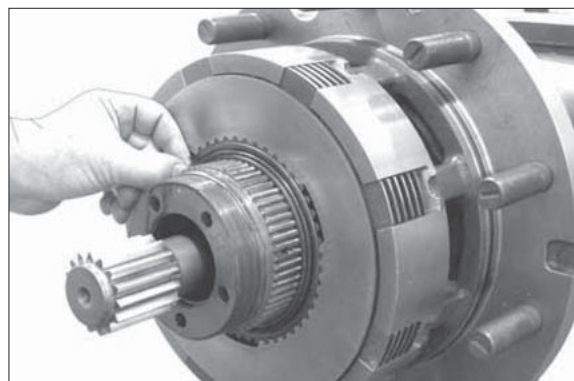
17W98RA116

(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.

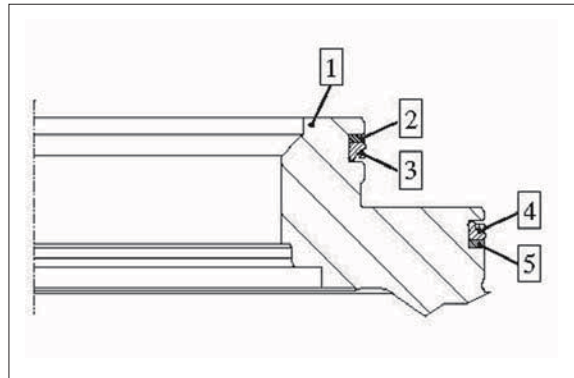
※ Observe installation position, see sketch below.



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

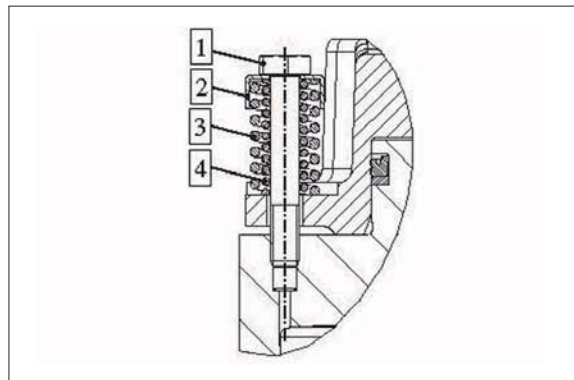
※ Use hexagon screws just once.



17W98RA123

(22) Legend to sketch:

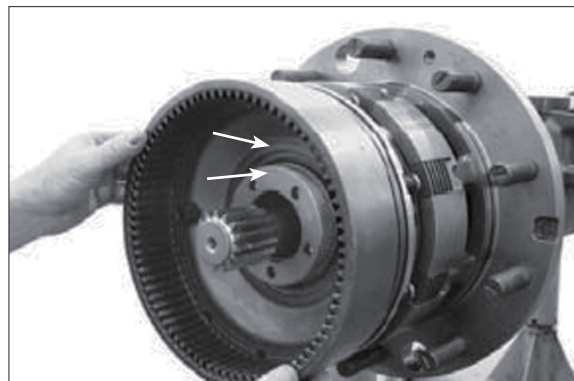
- 1 = Hexagon screw (special version)
- 2 = Spring sleeve
- 3 = Compression spring
- 4 = Compression spring



17W98RA124

(23) Mount preassembled ring gear, considering the installation position (markings O in 12 o'clock position – see arrows).

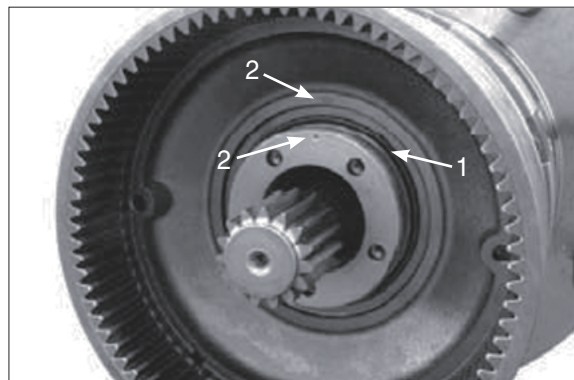
※ Ensure exact tothing position of oil supply holes – hub carrier/ring gear (pressure oil supply to brake piston).



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.

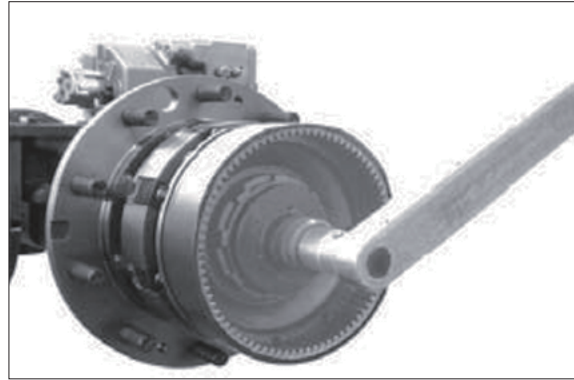
Tightening torque (M110 × 1.5)
. MA = 1400 + 600 Nm

(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:

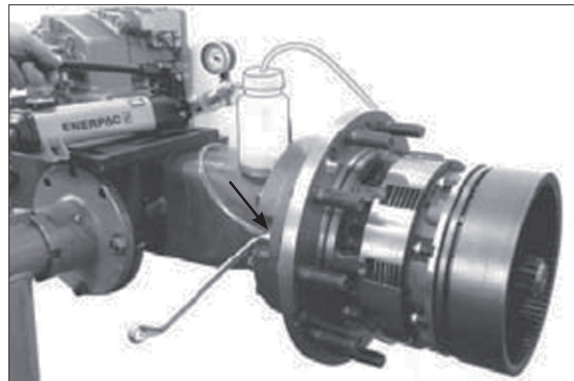
Build up test pressure $p = 100$ bar and close shut-off valve of HP pump.

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

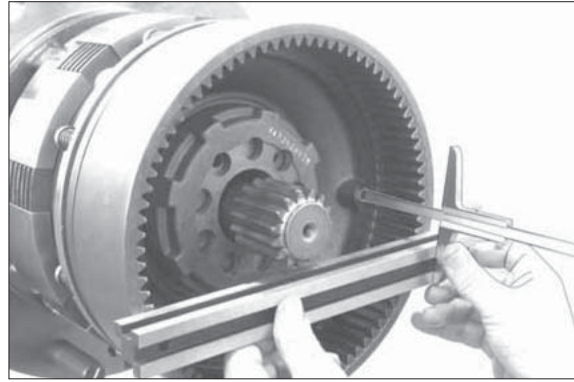
Piston stroke / disk clearance =
0.7 ... 1.3 mm

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.

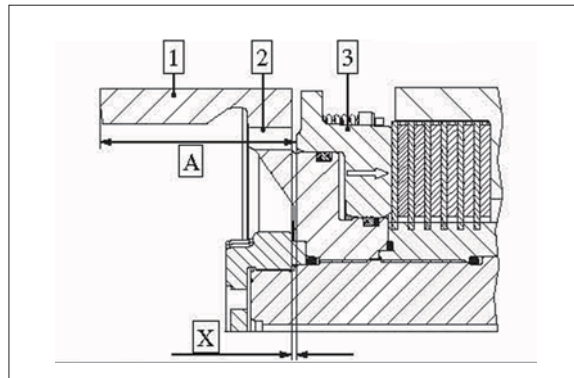


17W98RA129

(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:

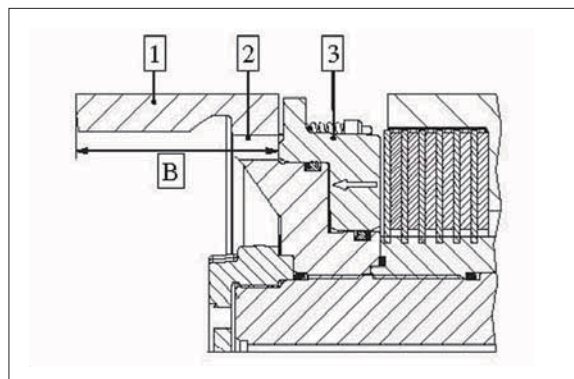
1 = Ring gear

2 = Measuring hole

3 = Piston

X = Piston stroke/disk clearance

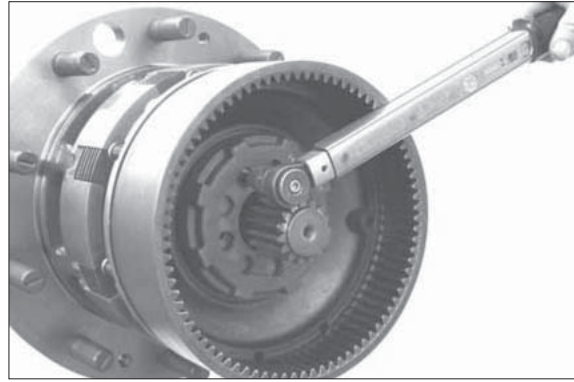
(S) Straightedge 5870 200 022



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

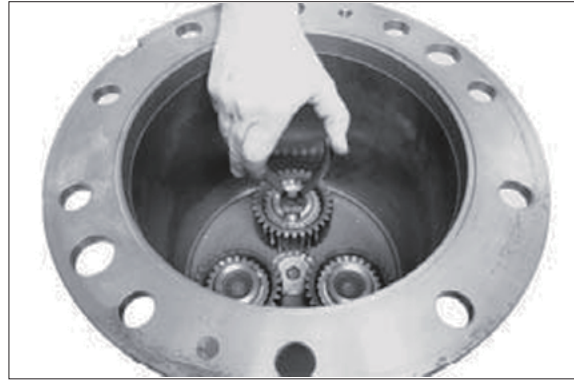
(33) Heat up bearing inner ring and mount preassembled planetary gear until contact is obtained.

※ 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



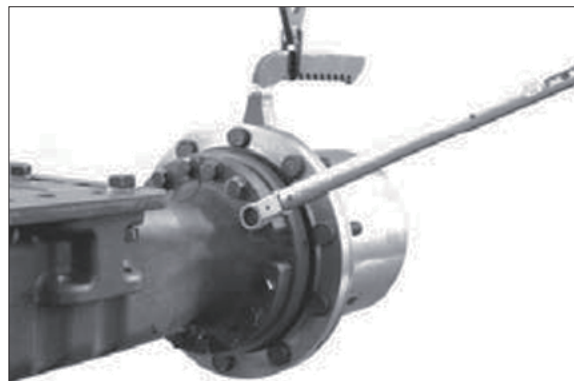
17W98RA137

(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

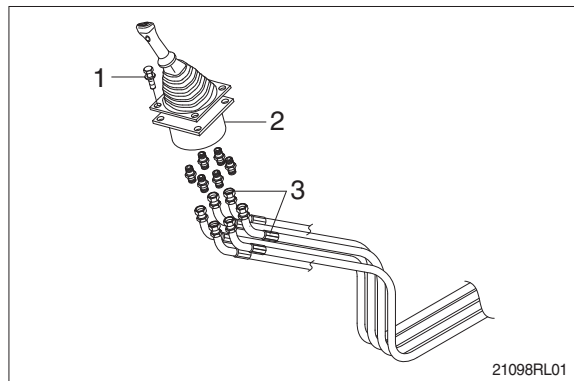
1. REMOVAL AND INSTALL

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).
- (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.

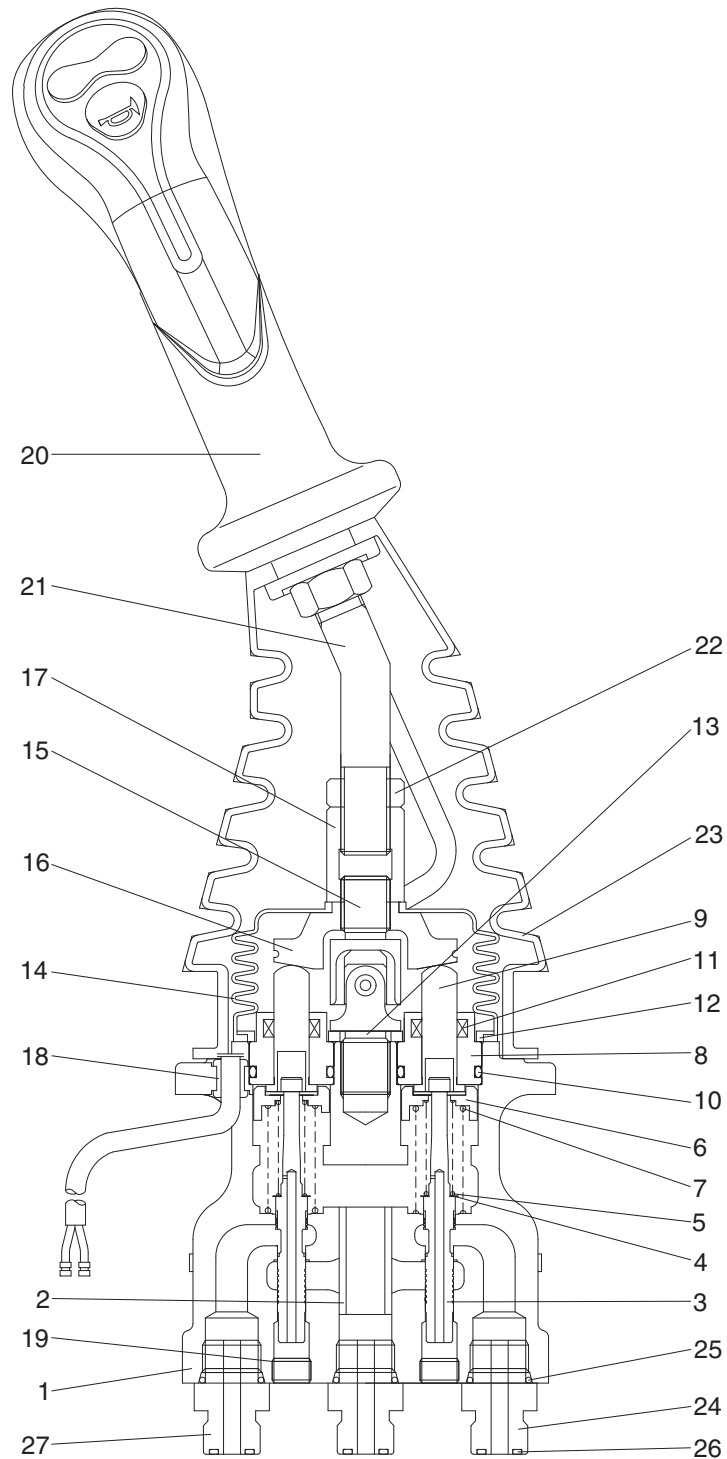


2) INSTALL

- (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

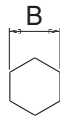


300L2RL06

1	Case	8	Plug	15	Joint assembly	22	Nut
2	Bushing	9	Push rod	16	Swash plate	23	Boot
3	Spool	10	O-ring	17	Adjusting nut	24	Last guard filter
4	Shim	11	Rod seal	18	Bushing	25	O-ring
5	Spring	12	Plate	19	Plug	26	O-ring
6	Spring seat	13	Spacer	20	Handle assembly	27	Connector
7	Spring	14	Boot	21	Handle bar		

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	

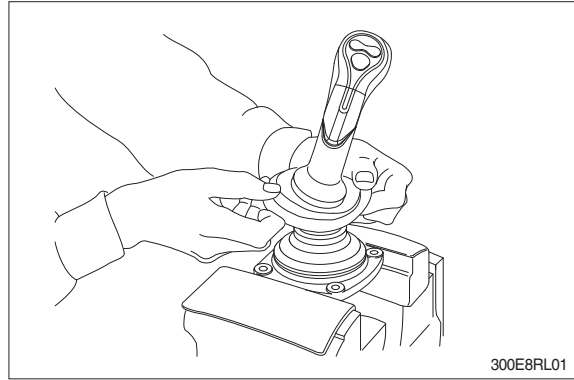
(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.5	25.3
Swash plate	16	M14	5.0±0.35	36.2±2.5
Adjusting nut	17	M14	5.0±0.35	36.2±2.5
Lock nut	22	M14	5.0±0.35	36.2±2.5

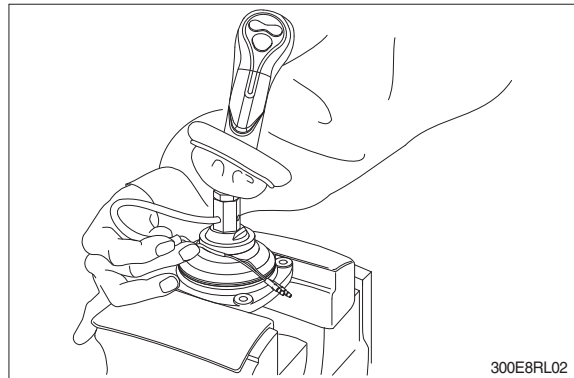
3) DISASSEMBLY

※ Procedures are based on the type M1.

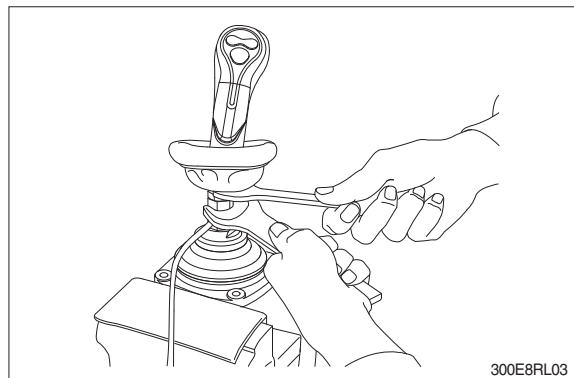
- (1) Clean pilot valve with kerosene.
 - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (23) from case (1) and take it out upwards.



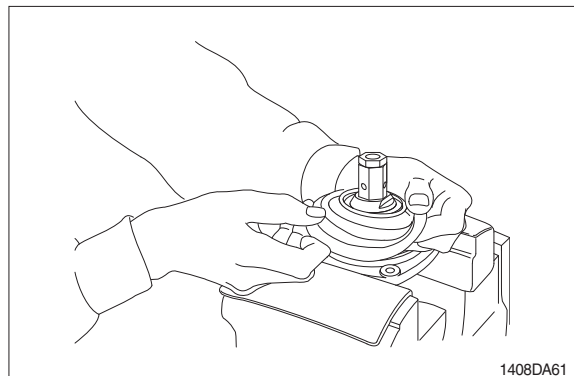
※ For valve with switch, remove cord also through hole of casing.



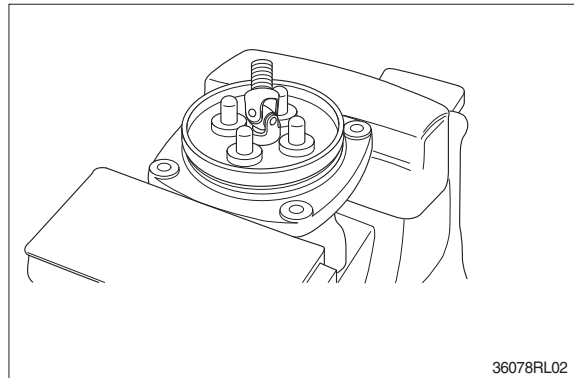
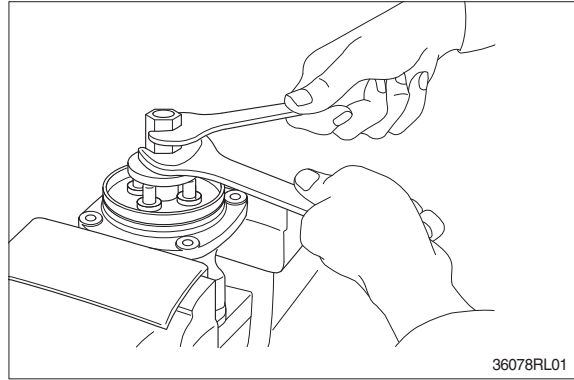
- (4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (14).

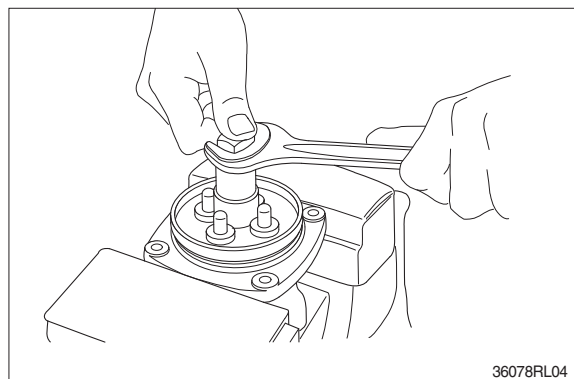
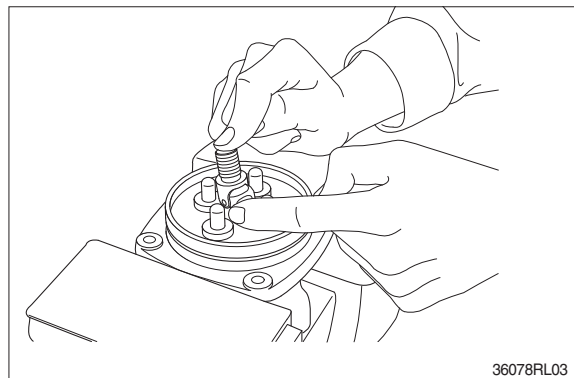


- (6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

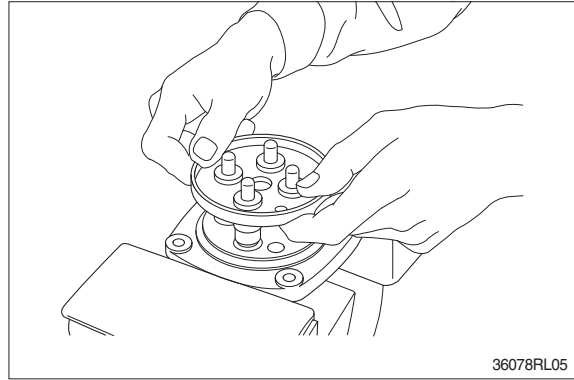


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

- ※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint. Pay attention to this.

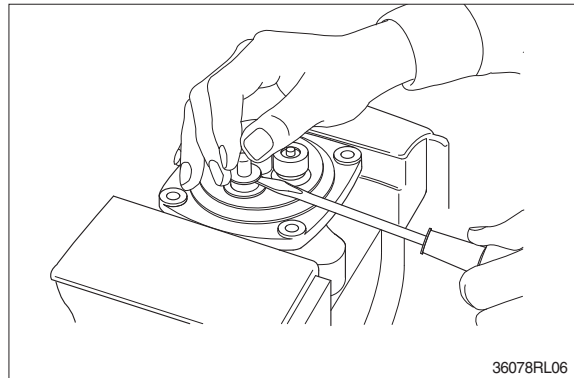


(8) Remove plate (12).



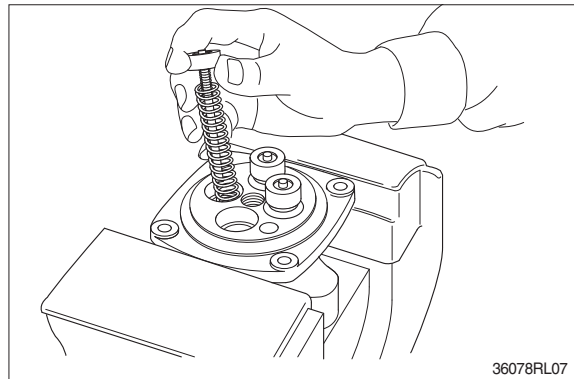
(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

- ※ 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 (7) force. Pay attention to this.



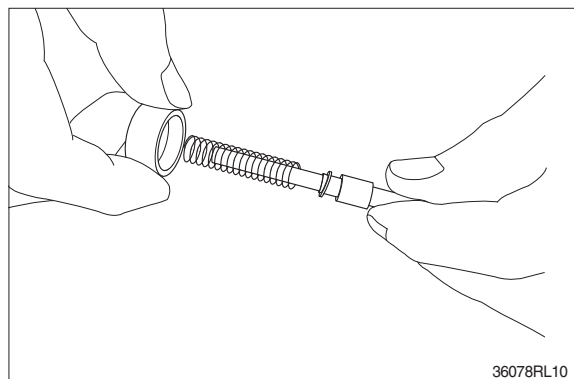
(10) Remove reducing valve subassembly and return spring (7) out of casing.

- ※ Record relative position of reducing valve subassembly and return springs.

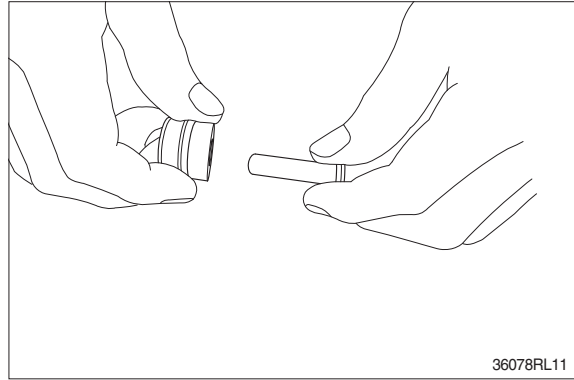


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

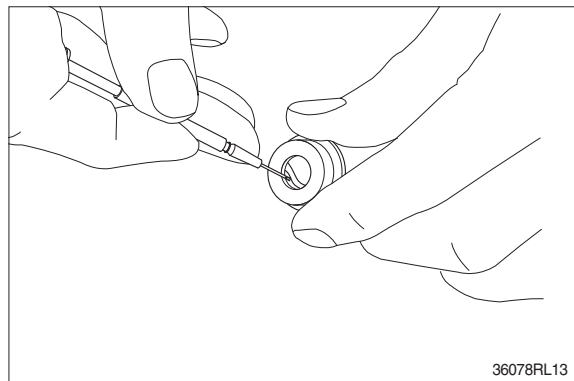
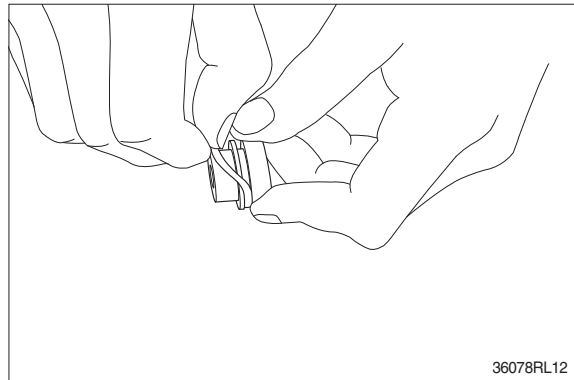
- ※ Pay attention not to damage spool surface.
- ※ Record original position of spring seat (6).
- ※ Until being assembled, they should be handled as one subassembly group.



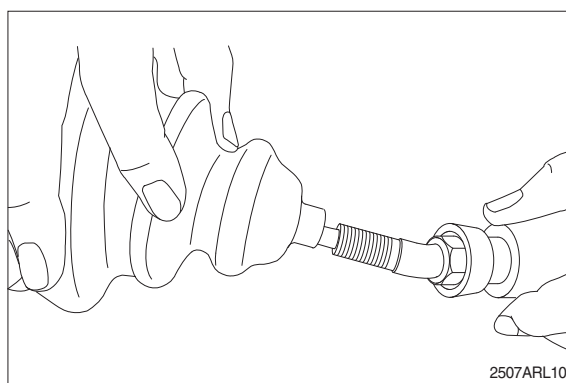
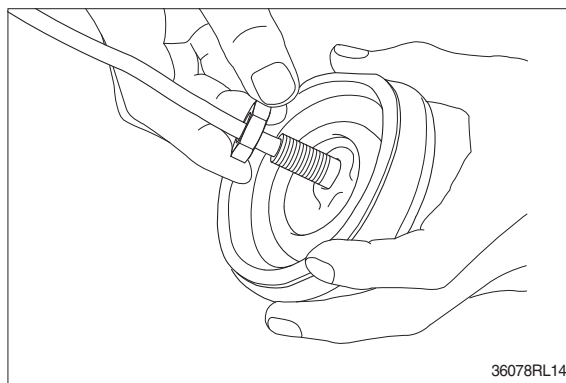
(12) Take push rod (9) out of plug (8).



(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.



(14) Remove lock nut (22) and then boot (23).



(15) Cleaning of parts

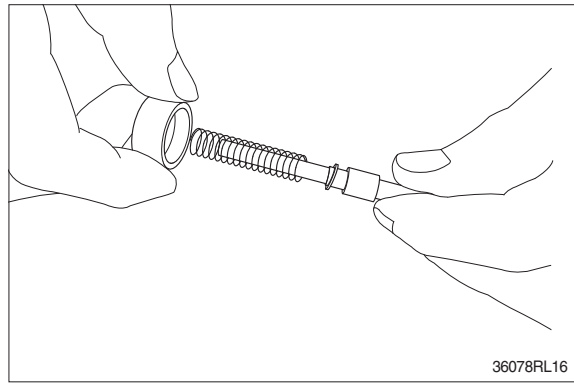
- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
 - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
 - ※ If this kerosene is polluted, parts will 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

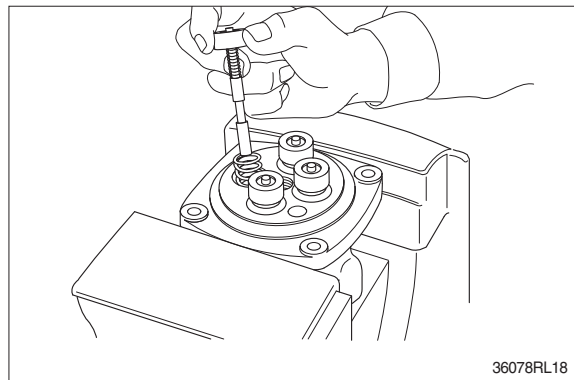
- Apply rust-preventives to all parts.
- ※ If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

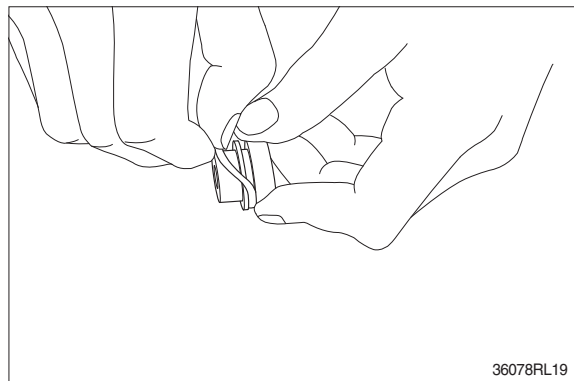
- (1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



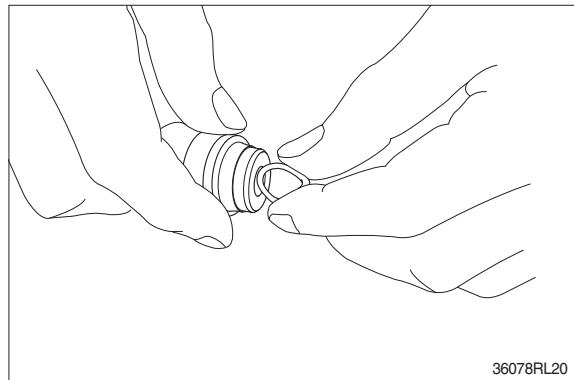
- (2) Assemble spring (7) into casing (1).
Assemble reducing valve subassembly into casing.
※ Assemble them to their original positions.



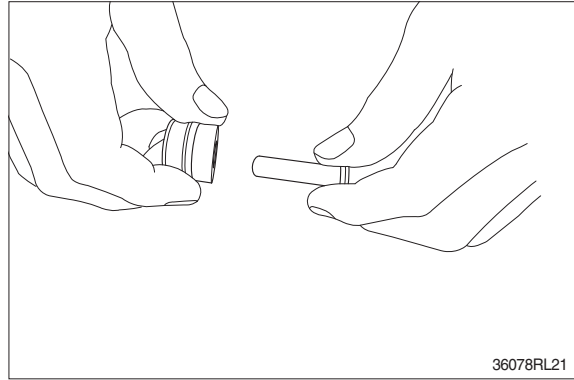
- (3) Assemble O-ring (10) onto plug (8).



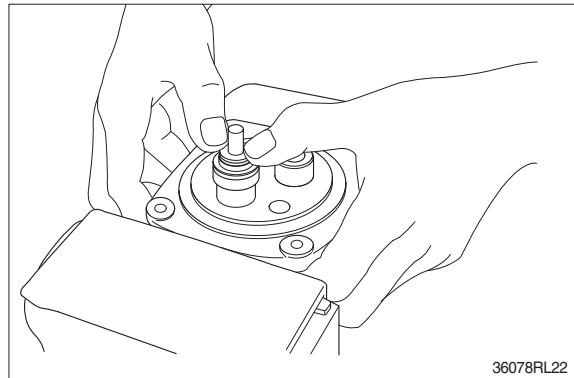
- (4) Assemble seal (11) to plug (8).
※ Assemble seal in such lip direction as shown below.



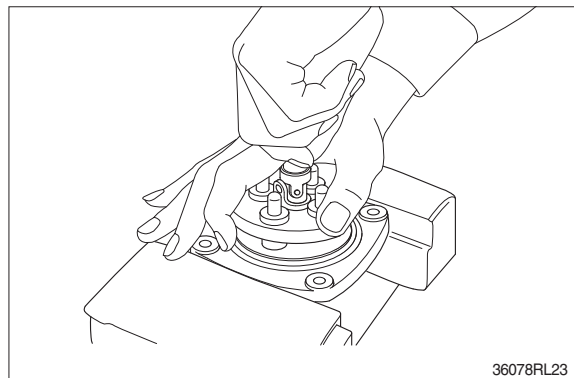
- (5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.



- (6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

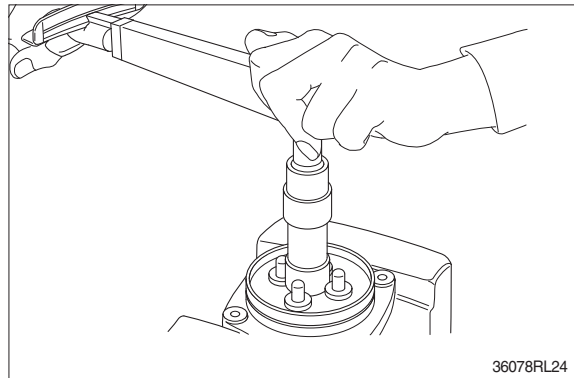


- (7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



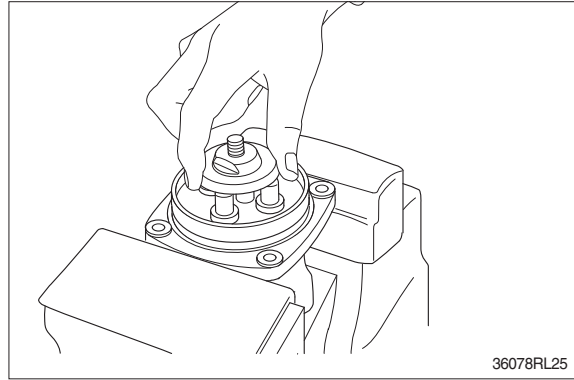
- (8) Fit plate (12).

- (9) Tighten joint (15) with the specified torque to casing, utilizing jig.



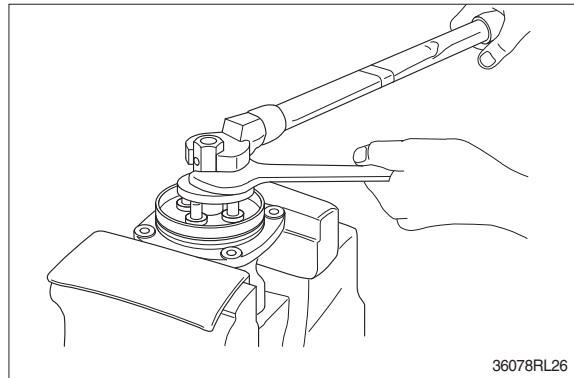
(10) Assemble swash plate (16) to joint (15).

- ※ Screw it to position that it contacts with 4 push rods evenly.
- ※ Do not screw it over.

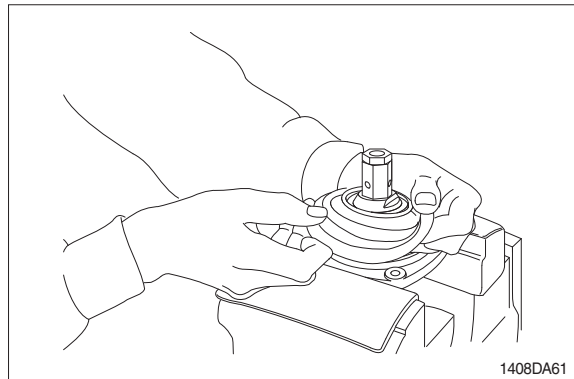


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

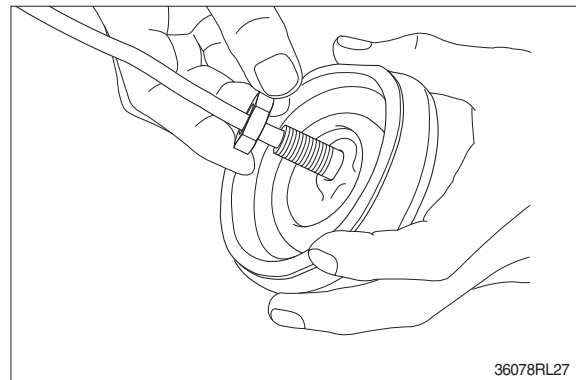
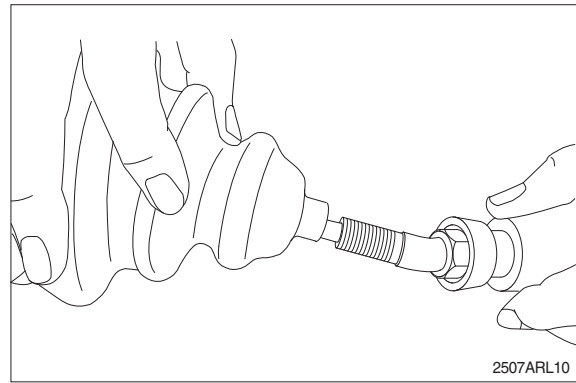
- ※ During tightening, do not change position of disk.



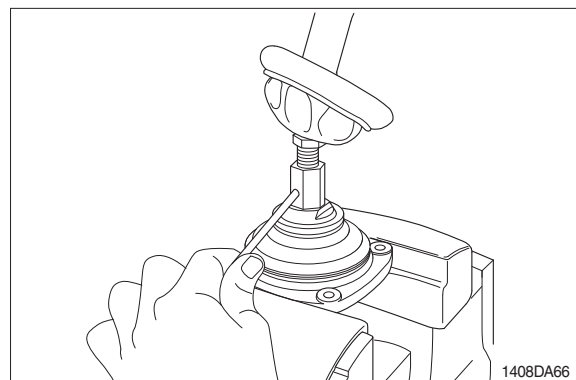
(12) Fit boot (14) to plate.



(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.

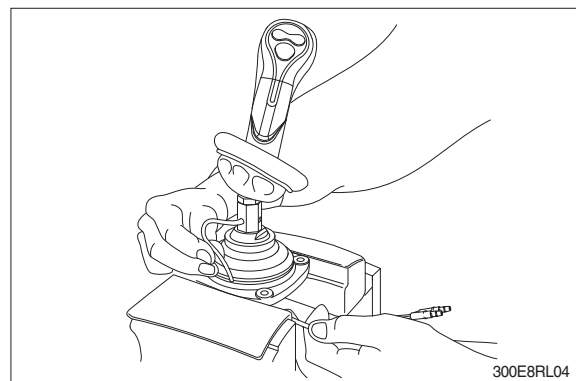


(14) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.

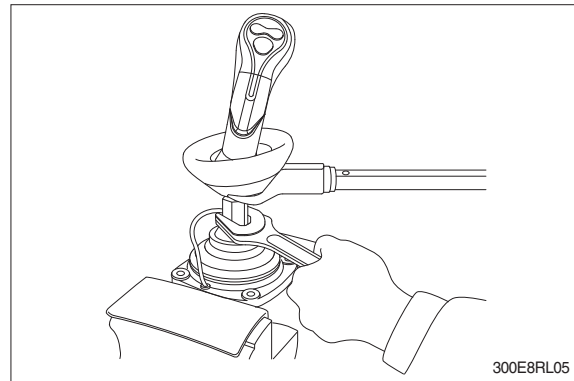


(15) Assemble bushing (18) to plate and pass cord and tube through it.

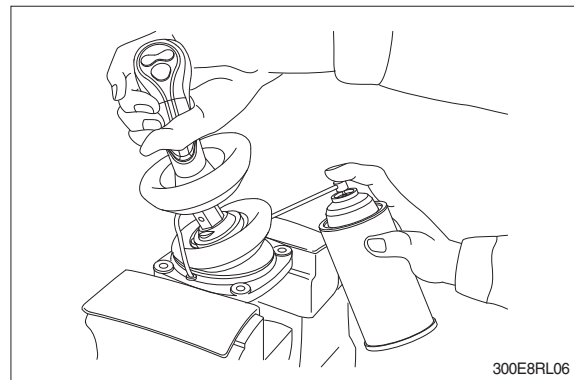
※ Provide margin necessary to operation.



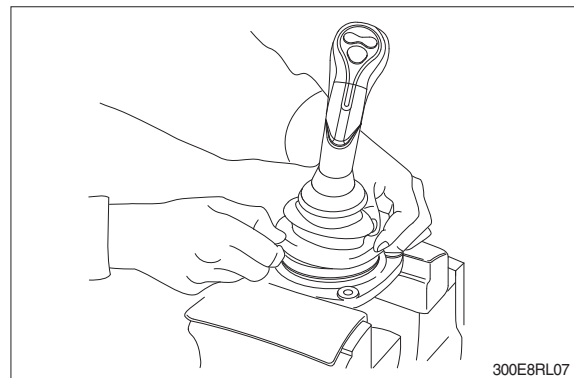
(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



(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

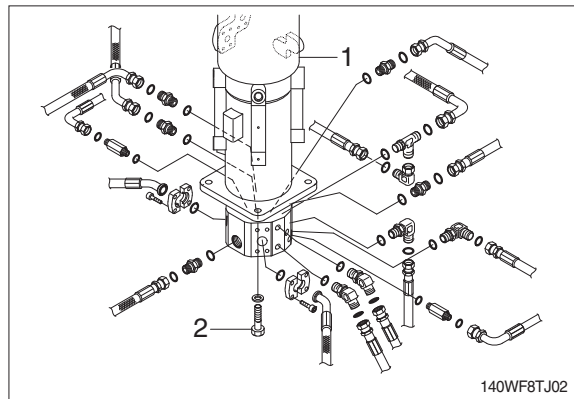
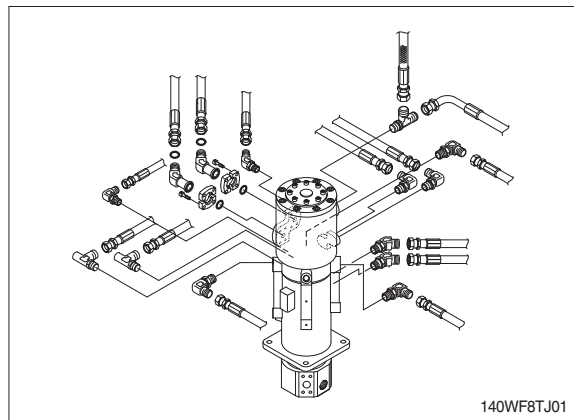
1) REMOVAL

- (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).
 - Weight : 120 kg (265 lb)
 - Tightening torque : $12.3 \pm 1.3 \text{ kgf} \cdot \text{m}$
($89 \pm 9.4 \text{ lbf} \cdot \text{ft}$)
 - (6) Remove the turning joint (1) assembly.
- ※ When removing the turning joint, check that all the hoses have been disconnected.

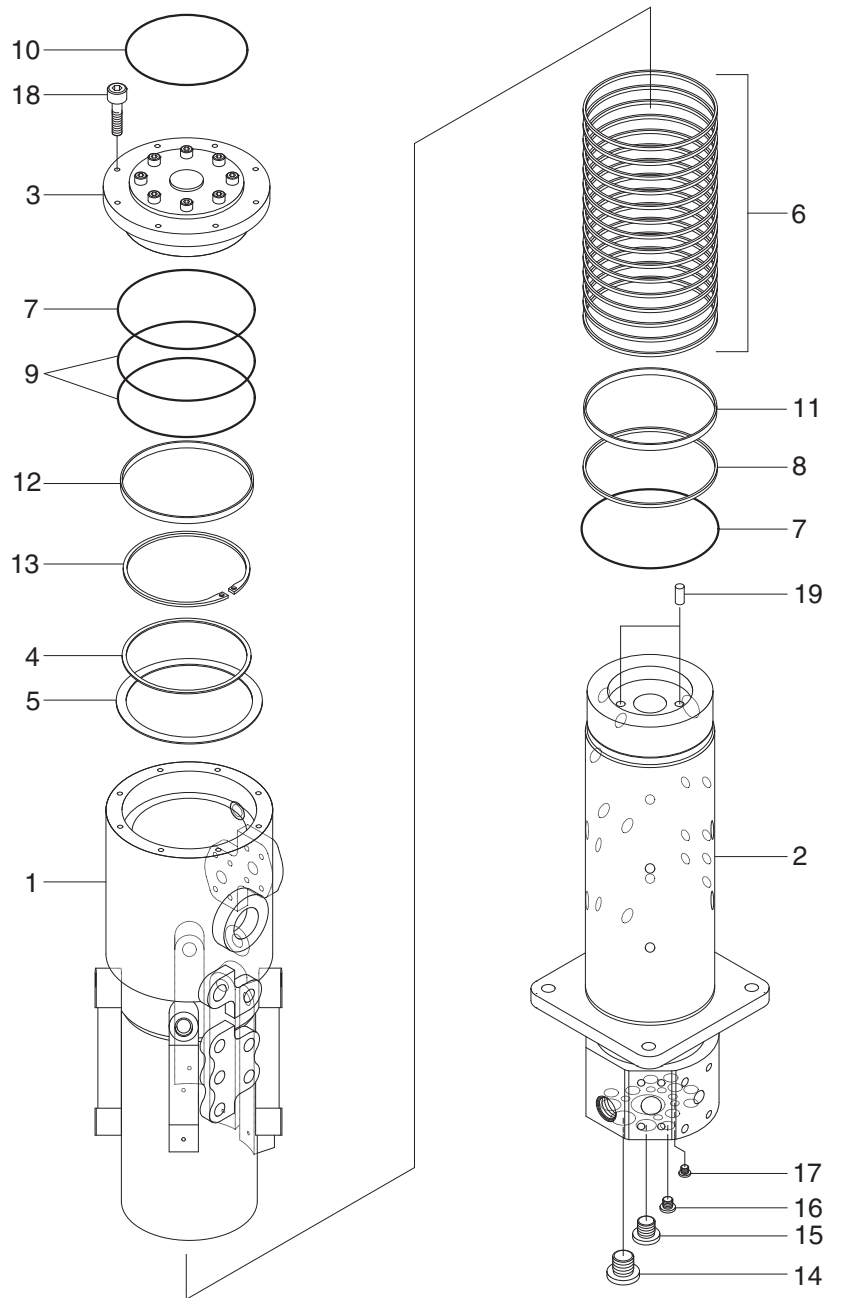


2) INSTALL

- (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



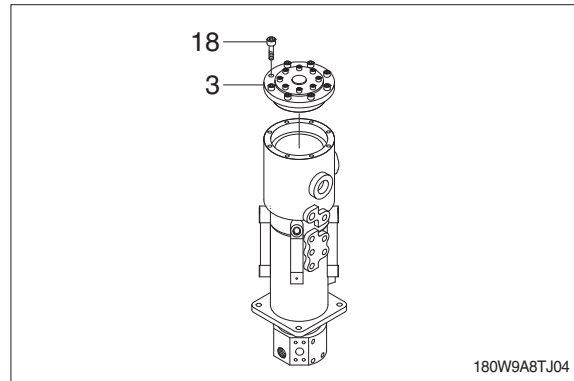
- | | | | | | |
|---|--------------|----|---------------|----|-------------|
| 1 | Hub | 8 | O-ring | 15 | Plug |
| 2 | Shaft | 9 | O-ring | 16 | Plug |
| 3 | Cover | 10 | O-ring | 17 | Plug |
| 4 | Spacer | 11 | Wear ring | 18 | Socket bolt |
| 5 | Shim | 12 | Wear ring | 19 | Spring pin |
| 6 | Slipper seal | 13 | Retainer ring | | |
| 7 | O-ring | 14 | Plug | | |

180W9A8TJ03

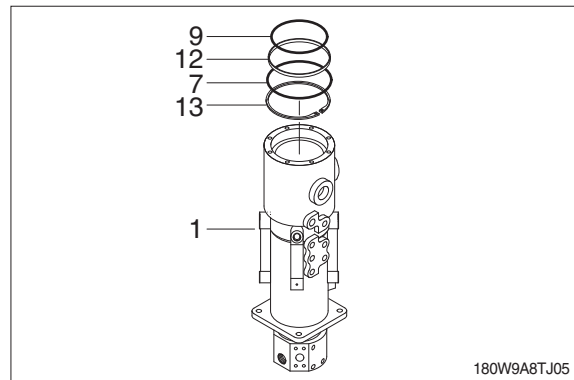
2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

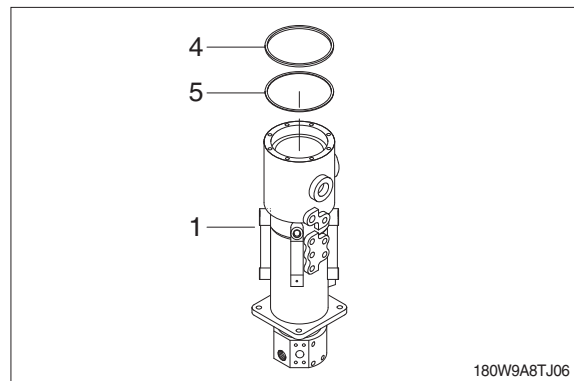
(1) Loosen the socket bolt (18) and remove cover (3).



(2) Remove O-ring (9), wear ring (12), O-ring (7) and retainer ring (13) from hub (1).



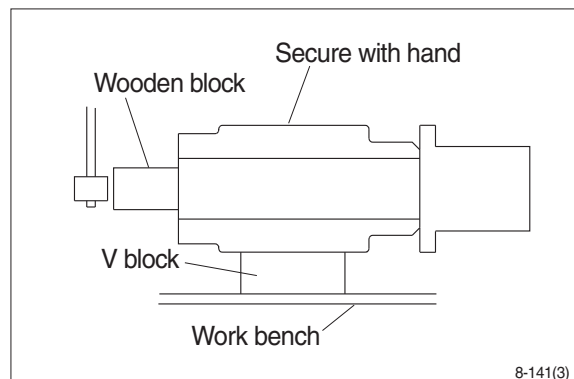
(3) Remove spacer (4) and shim (5) from hub (1).



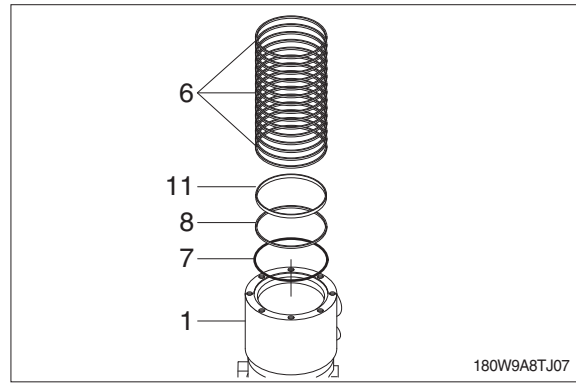
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the hub with a hammer.

※ 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).



(5) Remove seventeen slipper seal (6), O-ring (7, 8) and wear ring (11) from hub (1).

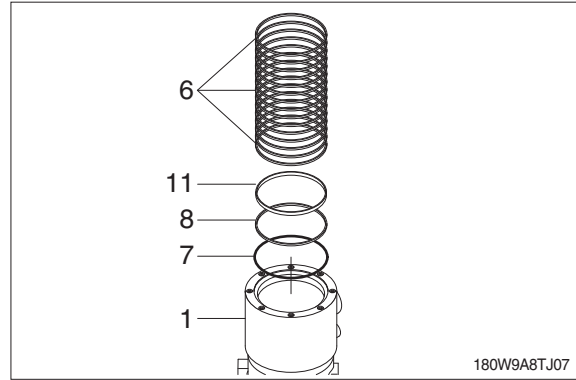


3) ASSEMBLY

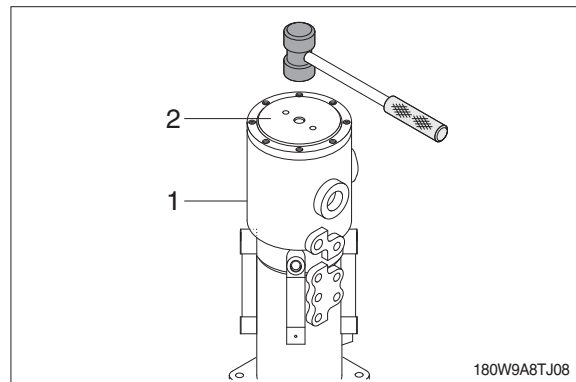
- ※ Clean all parts.
- ※ As a general rule, replace oil seals and O-ring.
- ※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fit O-ring (8), seventeen slipper seal (6), and wear ring (11).

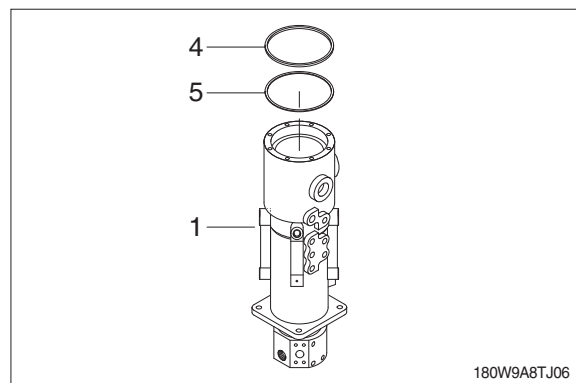
(2) Fit O-ring (7) to shaft (2).



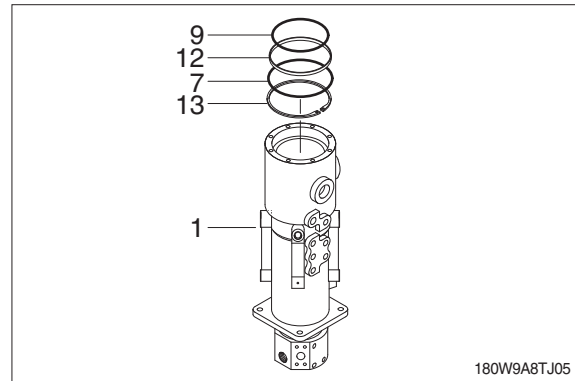
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



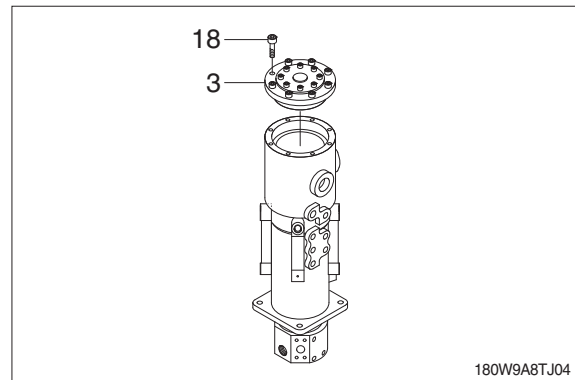
(4) Fit shim (5), and spacer (4) to hub (1) of turning joint upside.



- (5) Fit retainer ring (13), O-ring (7) and wear ring (12) to shaft (2).
- (6) Fit O-ring (9) to hub (1).



- (7) Install cover (3) to hub and tighten bolts (18).
- Torque : $2.35 \pm 0.35 \text{ kgf} \cdot \text{m}$
($17.0 \pm 2.5 \text{ lbf} \cdot \text{ft}$)



GROUP 13 BOOM, ARM, BUCKET, DOZER AND OUTRIGGER CYLINDERS

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

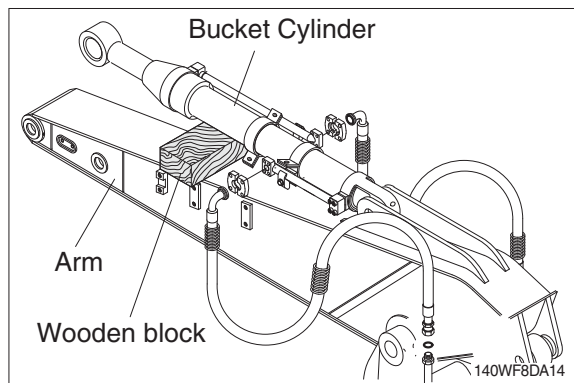
(1) Removal

- ※ 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.

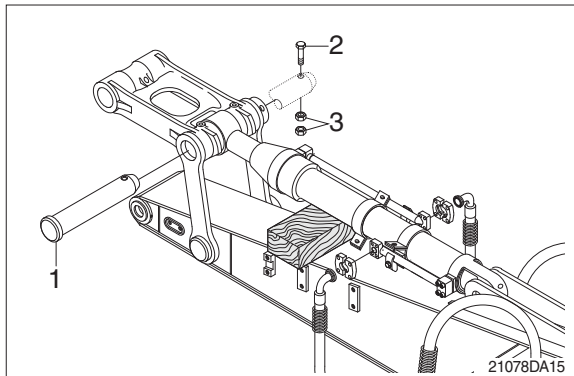
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

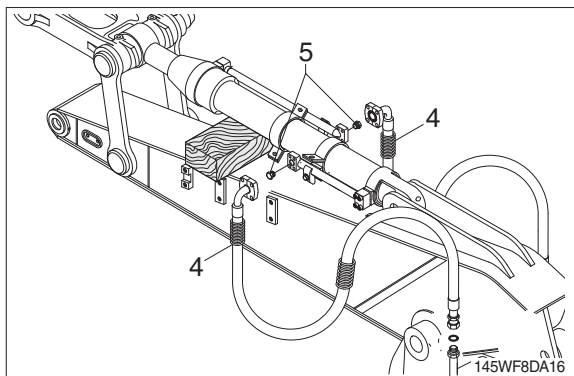


② Remove bolt (2), nut (3) and pull out pin (1).

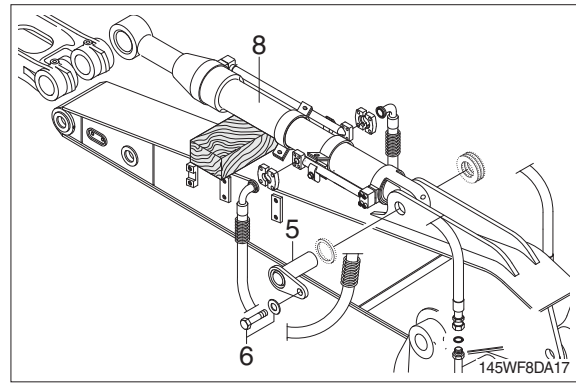
- ※ Tie the rod with wire to prevent it from coming out.



③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



- ④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
- ⑤ Remove bucket cylinder assembly (8).
 - Weight : 125 kg (260 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.

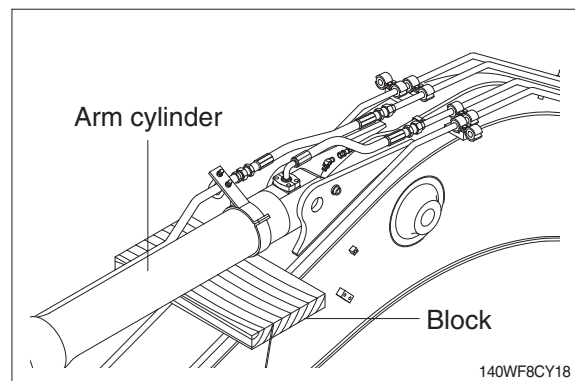
2) ARM CYLINDER

(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.

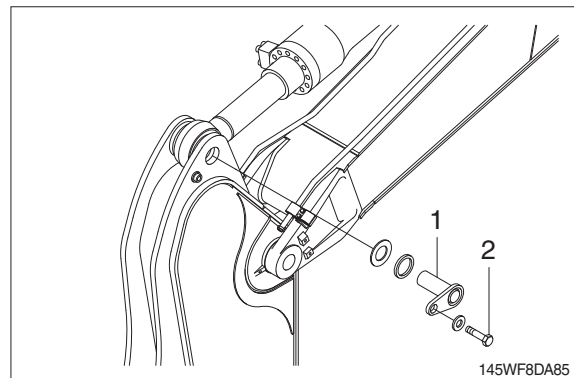
▲ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between arm cylinder and boom.



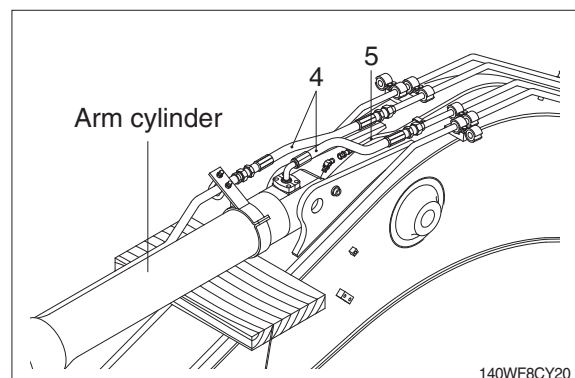
- ② Remove bolt (2) and pull out pin (1).

- ※ Tie the rod with wire to prevent it from coming out.

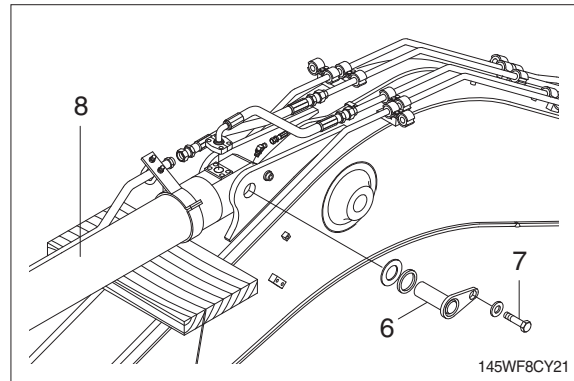


- ③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

- ④ Disconnect greasing pipings (5).



- ⑤ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).
- ⑥ Remove arm cylinder assembly (8).
 - Weight : 180 kg (400 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.

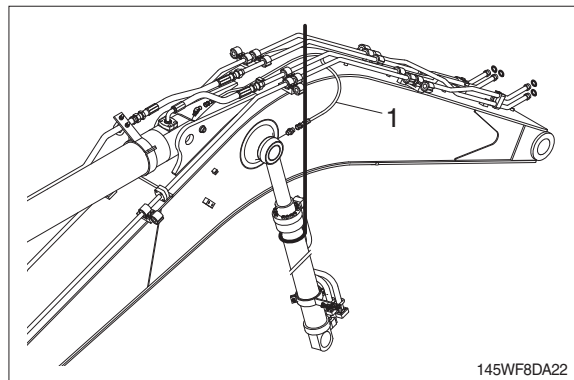
3) BOOM CYLINDER

(1) Removal

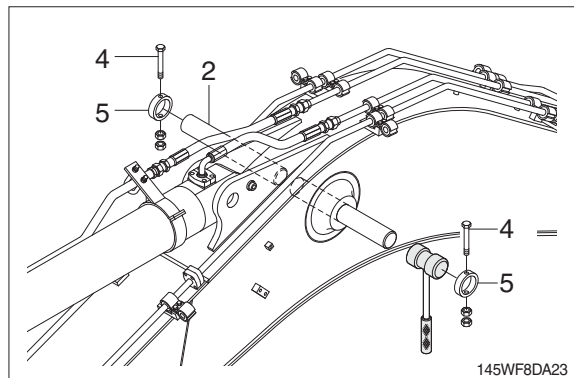
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

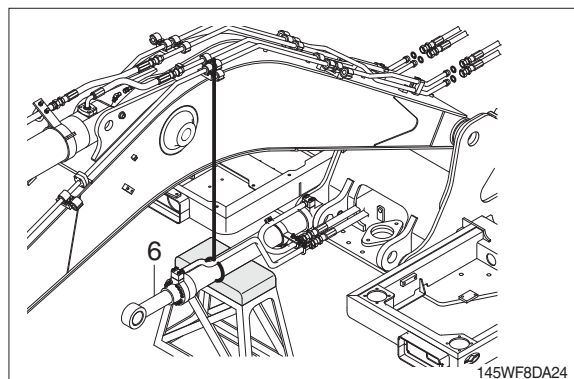
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.



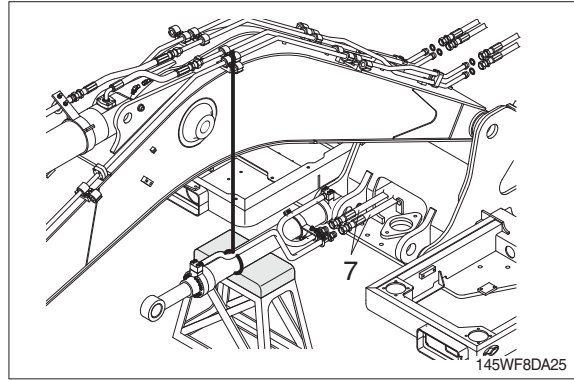
- ③ Remove bolt (4), stopper (5) and pull out pin (2).
- ※ Tie the rod with wire to prevent it from coming out.



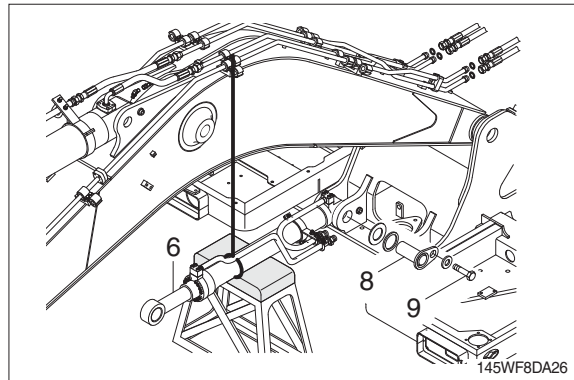
- ④ Lower the boom cylinder assembly (6) on a stand.



- ⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



- ⑥ Remove bolt (9) and pull out pin (8).
⑦ Remove boom cylinder assembly (6).
· Weight : 155 kg (340 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

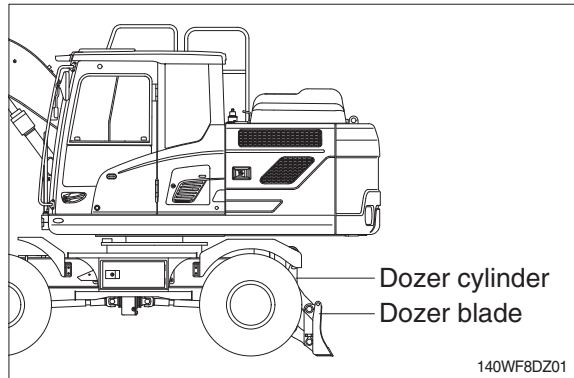
(1) Removal

- ※ 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.

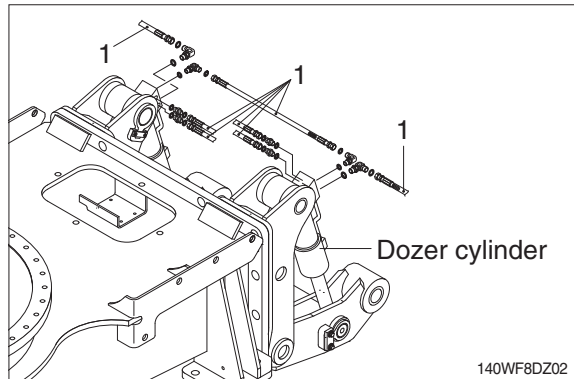
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Lower the dozer blade to the ground.



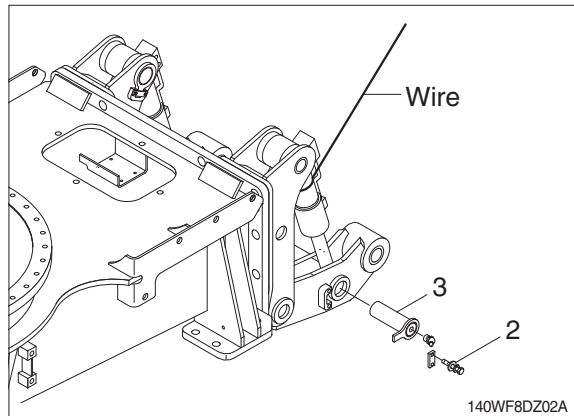
② Disconnect dozer cylinder hoses (1), and put plugs on cylinder pipe.



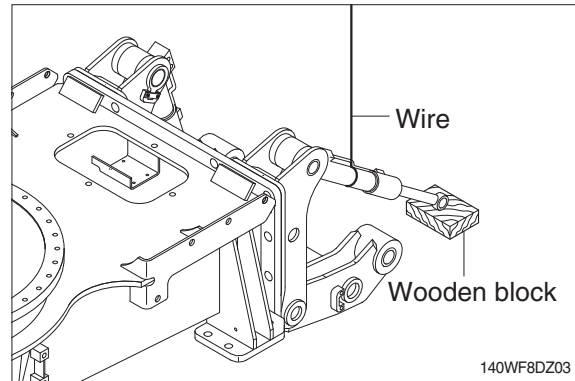
③ Sling dozer cylinder assembly.

④ Remove bolt (2) and pull out pin (3).

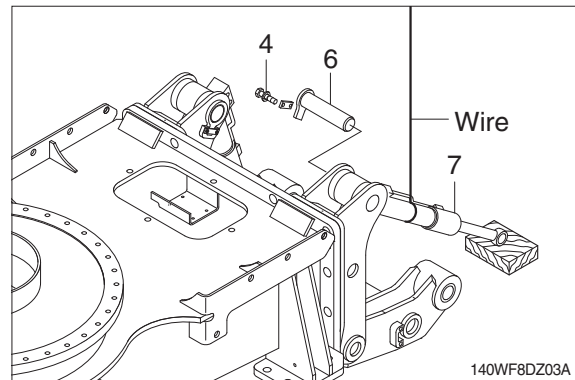
- ※ Tie the rod with wire to prevent it from coming out.



- ⑤ Lower the dozer cylinder rod side on a wooden block.



- ⑥ Loosen the bolt (4) and nut (5), and pull out pin (6).
⑦ Remove the dozer cylinder assy (7).
⑧ · Weight : 55 kg (120 lb)



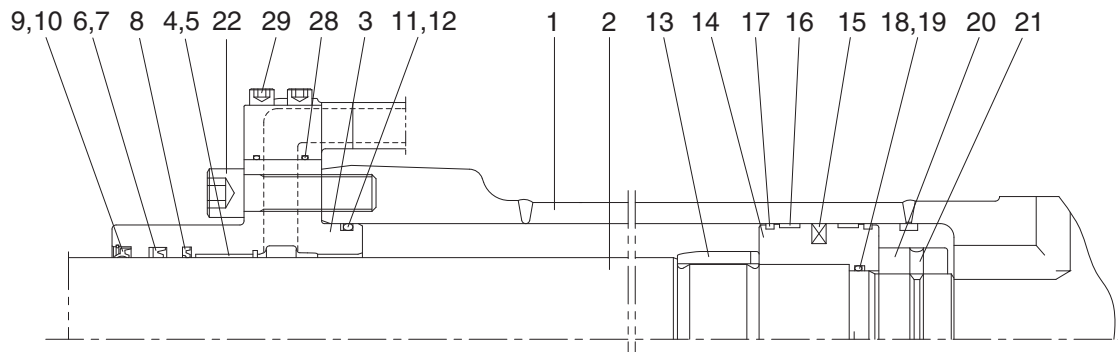
(2) Install

- 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 dozer cylinder.
 - ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

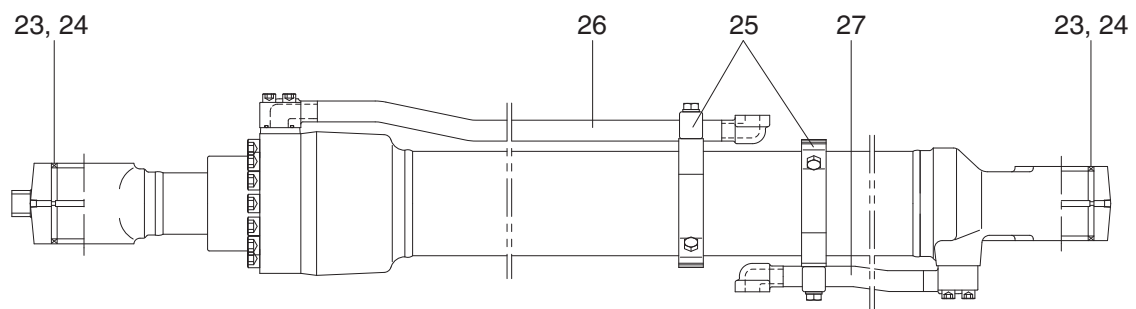
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder (HW160)



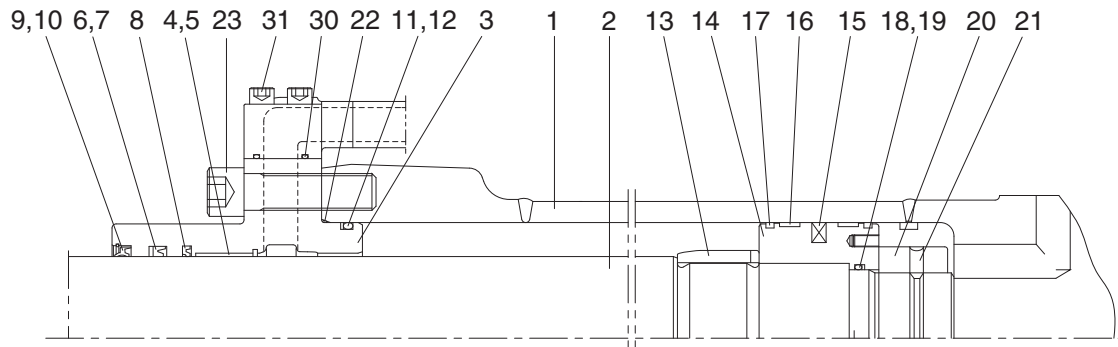
Internal detail



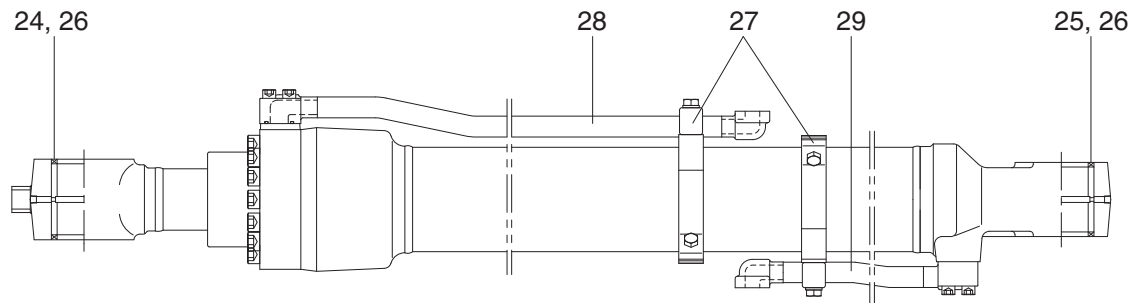
160WF8CY01

1	Tube assembly	11	O-ring	21	Hexagon socket set screw
2	Rod assembly	12	Back up ring	22	Hexagon socket head bolt
3	Gland	13	Cushion ring	23	Pin bushing
4	DD2 bushing	14	Piston	24	Dust seal
5	Snap ring	15	Piston seal	25	Band assembly
6	Rod seal	16	Wear ring	26	Pipe assembly-R
7	Back up ring	17	Dust ring	27	Pipe assembly-B
8	Buffer ring	18	O-ring	28	O-ring
9	Dust wiper	19	Back up ring	29	Hexagon socket head bolt
10	Snap ring	20	Lock nut		

(2) Bucket cylinder (HW180)



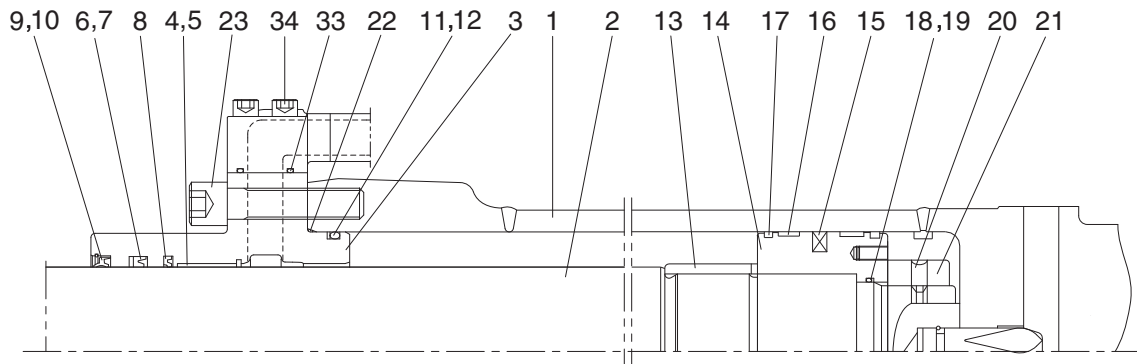
Internal detail



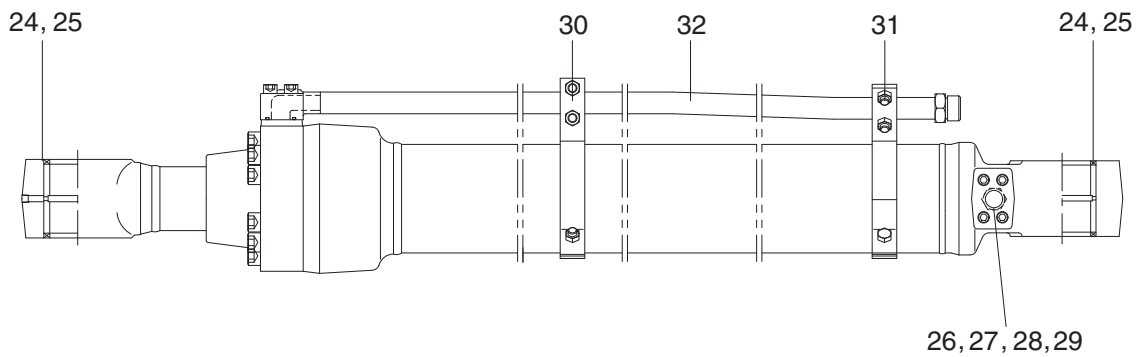
180WF8CY01

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	Hexagon socket set screw		
11	O-ring	22	O-ring		

(3) Arm cylinder



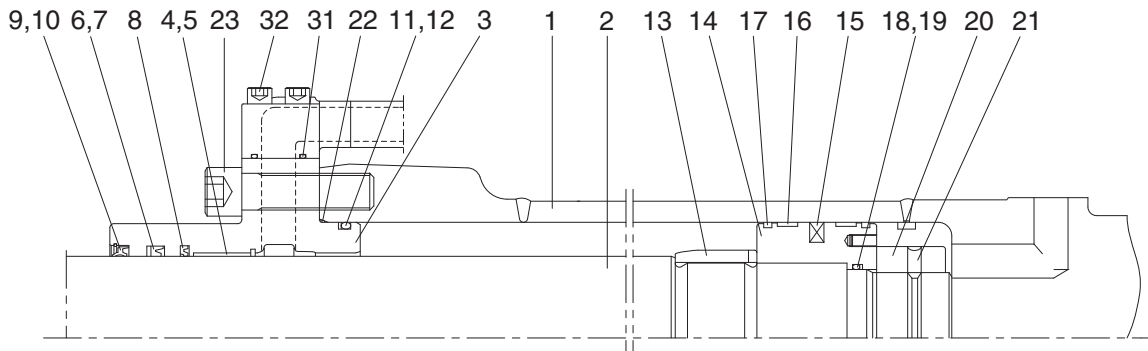
Internal detail



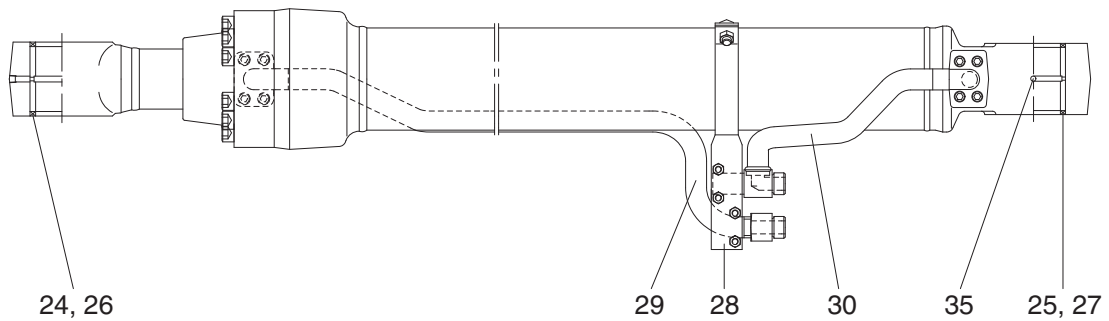
160WF8CY02

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	Hexagon socket 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	Pin bushing		

(4) Boom cylinder



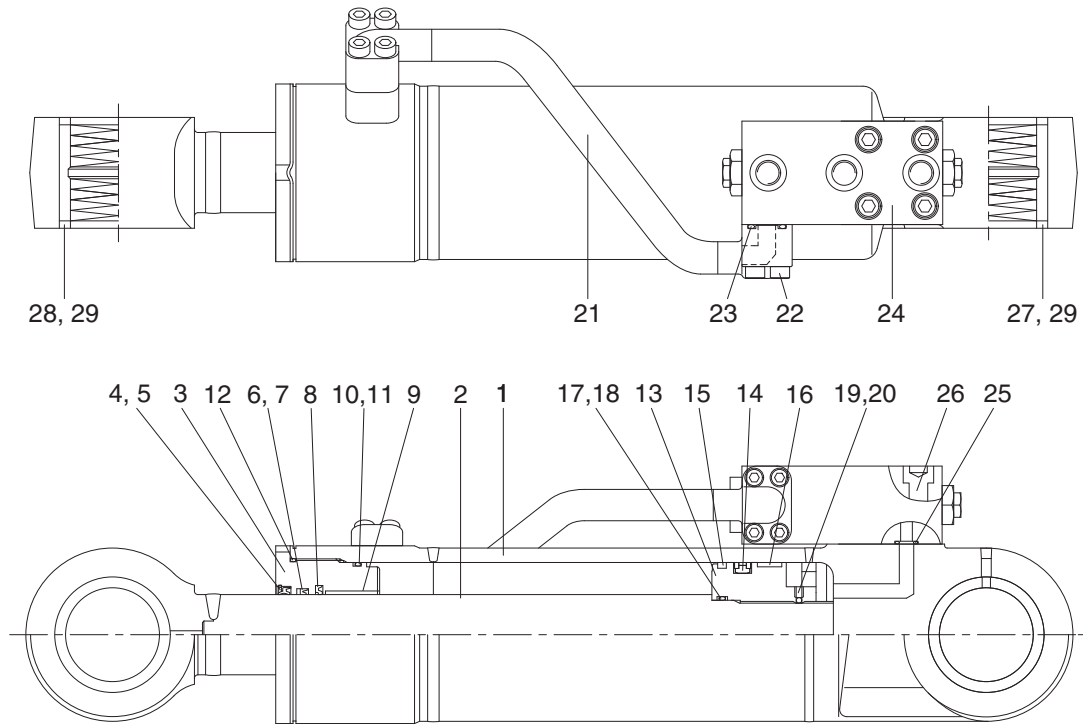
Internal detail



160WF8CY03

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	Dust seal
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Pipe assembly-R
8	Buffer ring	19	Back up ring	30	Pipe assembly-B
9	Dust wiper	20	Lock nut	31	O-ring
10	Snap ring	21	Hexagon socket set screw	32	Hexagon socket head bolt
11	O-ring	22	O-ring	35	Socket plug

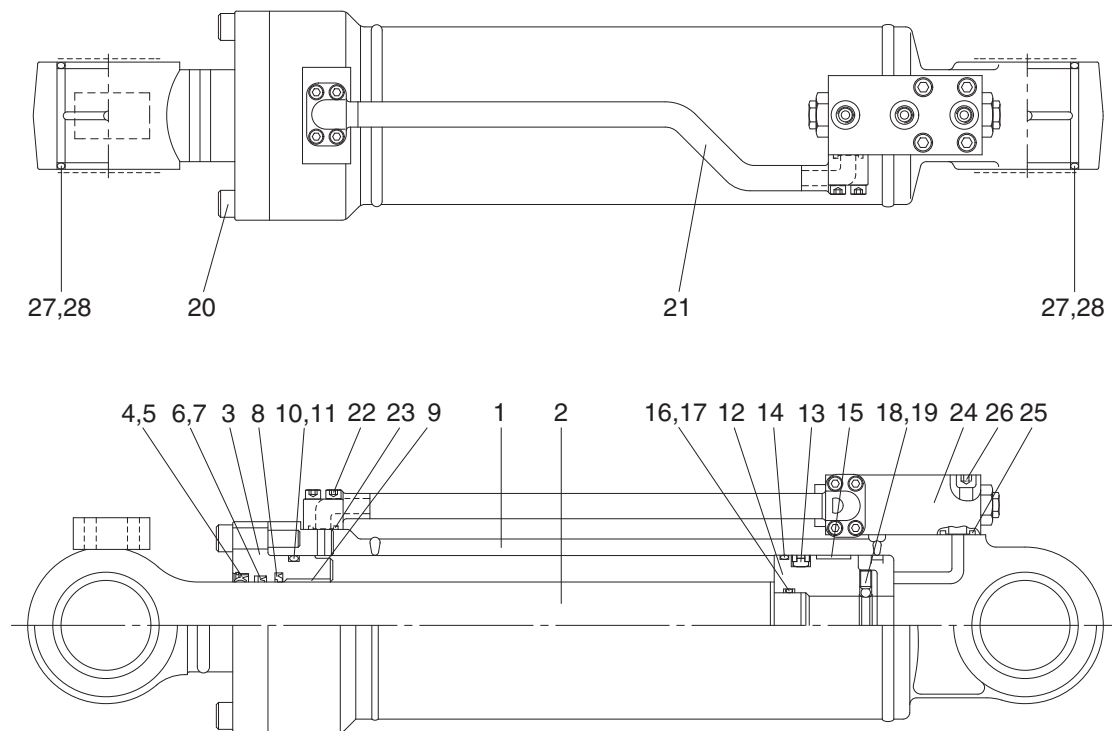
(5) Dozer cylinder



160WF8CY04

- | | | | | | |
|----|---------------|----|--------------|----|--------------------------|
| 1 | Tube assembly | 11 | Back up ring | 21 | Pipe assembly |
| 2 | Rod assembly | 12 | O-ring | 22 | Hexagon socket head bolt |
| 3 | Gland | 13 | Piston | 23 | O-ring |
| 4 | Dust wiper | 14 | Piston seal | 24 | Check valve assembly |
| 5 | Retainer ring | 15 | Dust ring | 25 | O-ring |
| 6 | Rod seal | 16 | Wear ring | 26 | Hexagon socket head bolt |
| 7 | Back up ring | 17 | O-ring | 27 | Pin bushing |
| 8 | Buffer ring | 18 | Back up ring | 28 | Pin bushing |
| 9 | DU bushing | 19 | Steel ball | 29 | Dust seal |
| 10 | O-ring | 20 | Set screw | | |

(6) Outrigger cylinder

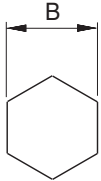


17W98CY06

1	Tube assembly	11	Back up ring	21	Pipe assembly
2	Rod assembly	12	Piston	22	Hexagon socket head bolt
3	Gland	13	Piston seal	23	O-ring
4	Dust wiper	14	Dust ring	24	Check valve assembly
5	Retainer ring	15	Wear ring	25	O-ring
6	Rod seal	16	O-ring	26	Hexagon socket head bolt
7	Back up ring	17	Back up ring	27	Pin bushing
8	Buffer ring	18	Steel ball	28	Dust seal
9	Du bushing	19	Set screw		
10	O-ring	20	Hexagon socket head bolt		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark		
Allen wrench	6		
	8		
	14		
	17		
Spanner	7		
	8		
(-) Driver	Small and large sizes		
Torque wrench	Capable of tightening with the specified torques		

(2) Tightening torque (HW160)

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder (★1)	22	M14	15±2.0	108±14.5
	Boom cylinder (★1)	23	M14	15±2.0	108±14.5
	Arm cylinder (★1)	23	M16	23±2.0	166±14.5
Check valve mounting socket head bolt	Dozer cylinder	26	M10	5.4±0.5	39.1±3.6
	Outrigger cylinder	26	M10	5.4±0.5	39.1±3.6
Pipe mounting socket head bolt	Bucket	29	M10	5.4±0.5	39.1±3.6
	Boom	32	M10	5.4±0.5	39.1±3.6
	Arm	34	M10	5.4±0.5	39.1±3.6
	Dozer cylinder	22	M8	2.7±0.3	19.5±2.2
	Outrigger cylinder	22	M8	2.7±0.3	19.5±2.2
Lock nut	Bucket cylinder	20	M52	100±10.0	723±72.3
	Boom cylinder	20	M52		
	Arm cylinder	20	M56		
Piston	Bucket cylinder	14	-	125±12	904±86.8
	Boom cylinder	14			
	Arm cylinder	14		150±15.0	1085±109
	Dozer cylinder	13	M45	112±11.2	810±81.0
	Outrigger cylinder	12	M56	140±14	1012±101
Gland	Dozer cylinder	3	M115	92±9.2	665±66.5
Set screw	Bucket cylinder	21	M8	2.7±0.3	19.5±2.2
	Boom cylinder	21	M8	2.7±0.3	19.5±2.2
	Arm cylinder	21	M8	2.7±0.3	19.5±2.2
	Dozer cylinder	20	M8	2.7±0.3	19.5±2.2
	Outrigger cylinder	19	M8	2.7±0.3	19.5±2.2

※ Apply loctite #243 (★1) on the thread before tightening.

(3) Tightening torque (HW180)

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder (★1)	23	M14	15±2.0	108±14.5
	Boom cylinder (★1)	23	M16	23±2.0	166±14.5
	Arm cylinder (★1)	23	M16	23±2.0	166±14.5
Check valve mounting socket head bolt	Dozer cylinder	26	M10	5.4±0.5	39.1±3.6
	Outrigger cylinder	26	M10	5.4±0.5	39.1±3.6
Pipe mounting socket head bolt	Bucket	31	M10	5.4±0.5	39.1±3.6
	Boom	32	M10	5.4±0.5	39.1±3.6
	Arm	34	M10	5.4±0.5	39.1±3.6
	Dozer cylinder	22	M8	2.7±0.3	19.5±2.2
	Outrigger cylinder	22	M8	2.7±0.3	19.5±2.2
Lock nut	Bucket cylinder	20	M52	100±10.0	723±72.3
	Boom cylinder	20	M56		
	Arm cylinder	20	M56		
Piston	Bucket cylinder	14	-	150±15.0	1085±109
	Boom cylinder	14			
	Arm cylinder	14			
	Dozer cylinder	13	M45	112±11.2	810±81.0
	Outrigger cylinder	12	M56	140±14	1012±101
Gland	Dozer cylinder	3	M115	92±9.2	665±66.5
Set screw	Bucket cylinder	21	M8	2.7±0.3	19.5±2.2
	Boom cylinder	21	M8	2.7±0.3	19.5±2.2
	Arm cylinder	21	M8	2.7±0.3	19.5±2.2
	Dozer cylinder	20	M8	2.7±0.3	19.5±2.2
	Outrigger cylinder	19	M8	2.7±0.3	19.5±2.2

※ Apply loctite #243 (★1) on the thread before tightening.

3) DISASSEMBLY

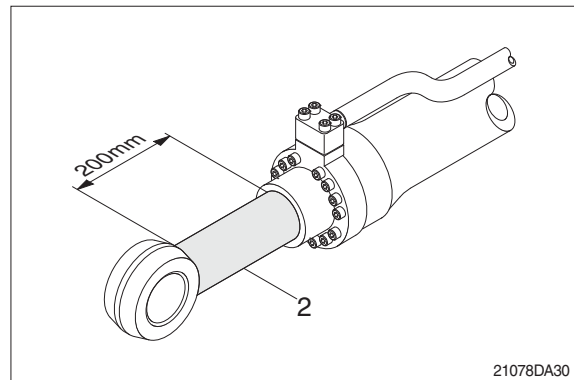
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder of HW160.

① Hold the clevis section of the tube in a vise.

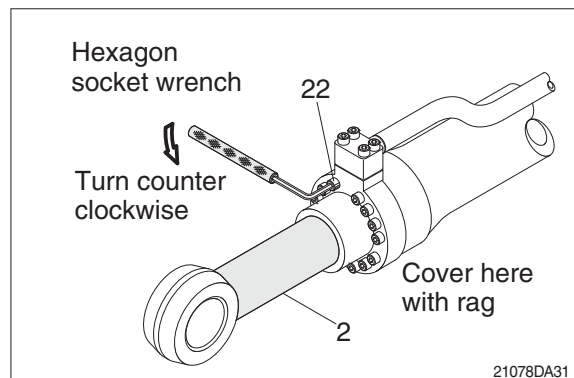
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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 (22) of the gland in sequence.

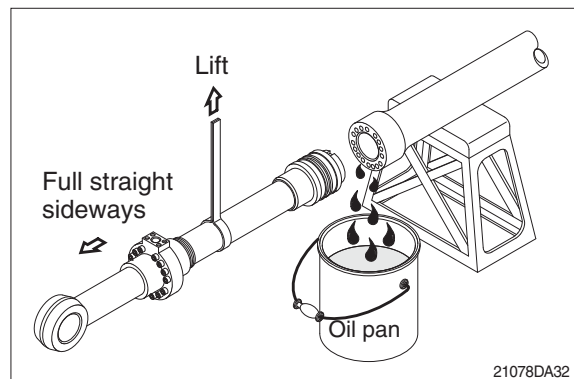
※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly together from tube assembly

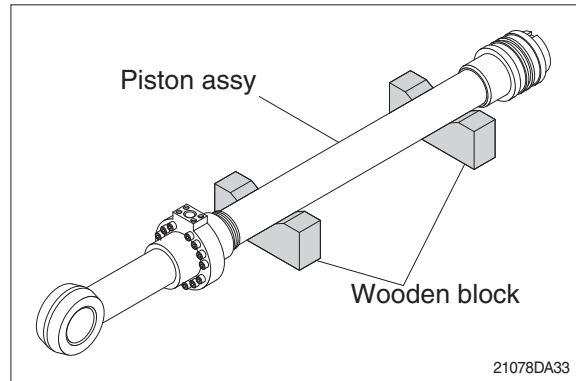
※ (1).

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.



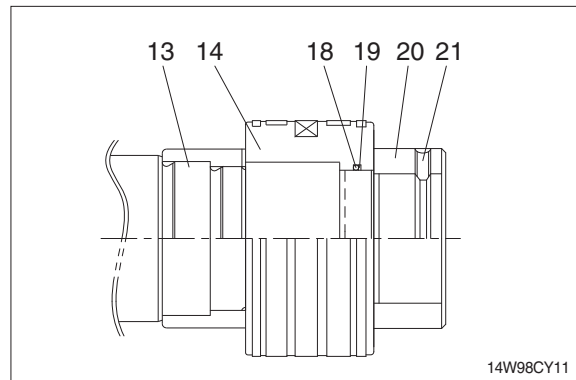
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

- ⑤ Place the removed rod assembly on a wooden V-block that is set level.
- ※ Cover a V-block with soft rag.

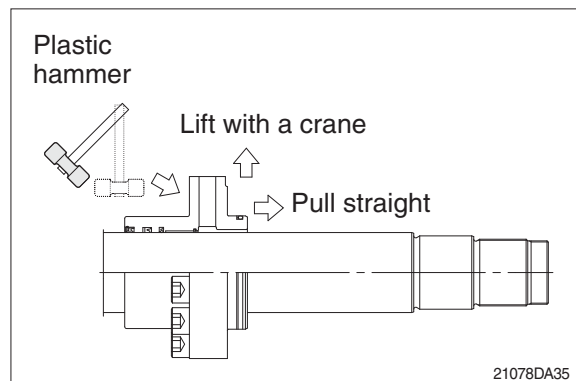


(2) Remove piston and cylinder head

- ① Remove set screw (21).
- ※ Since set screw (21) and lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizes a hydraulic cylinder, to remove the lock set screw (21) and lock nut (20).
- ② Remove piston assembly (14), back up ring (19), and O-ring (18).

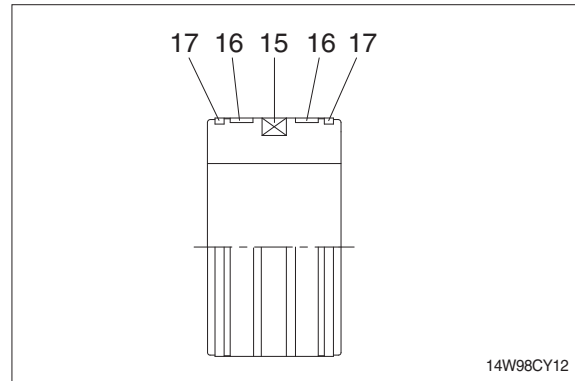


- ③ Remove the cylinder head assembly from rod assembly (2).
 - ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
 - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).



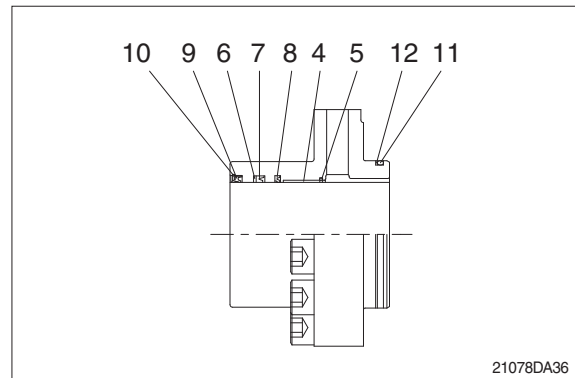
(3) Disassemble the piston assembly

- 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) and O-ring (11).
 - 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).

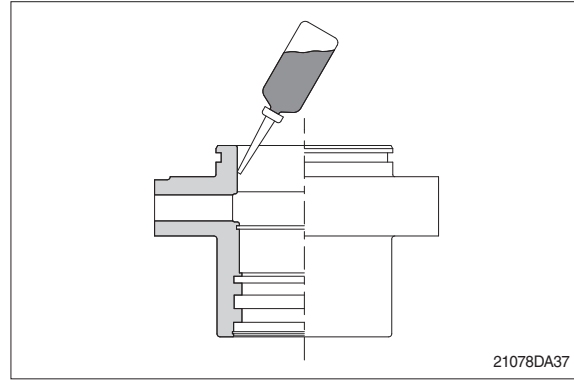


3) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

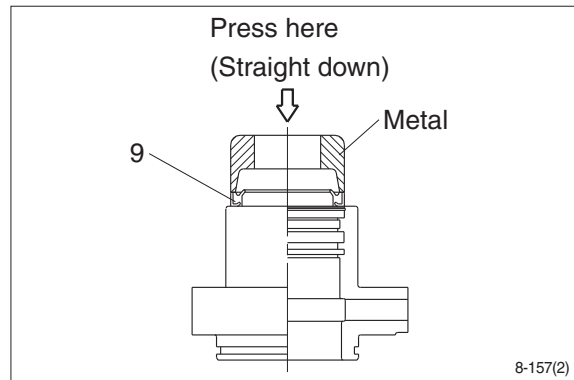
- ① Coat the inner face of gland (3) with hydraulic oil.



- 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.

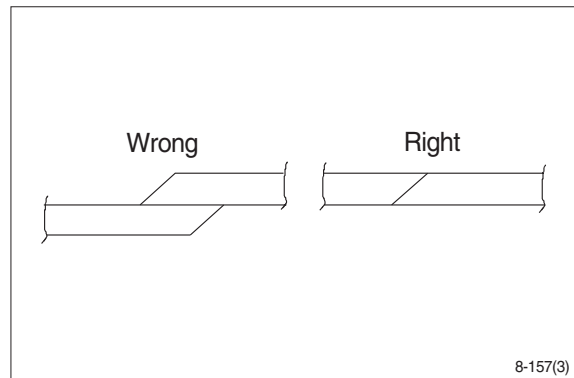
- ③ Fit snap ring (10) to the stop face.



- ④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

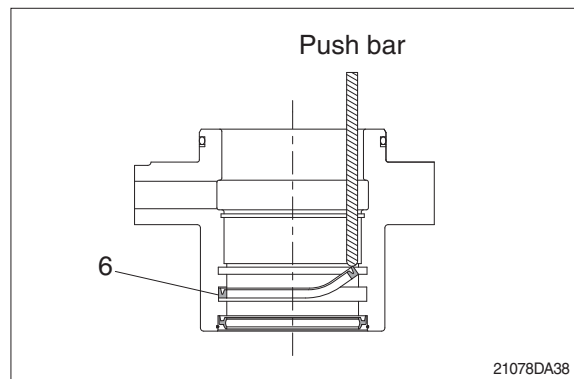
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.

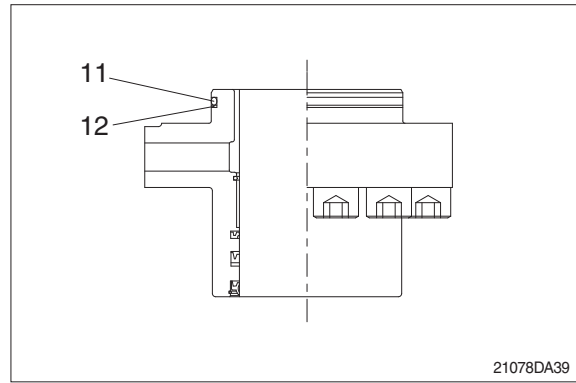


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.

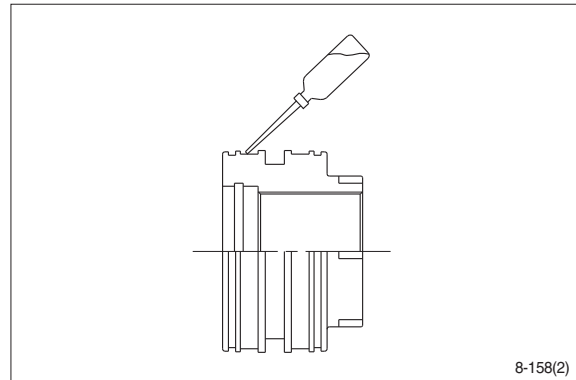


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) to gland (3).

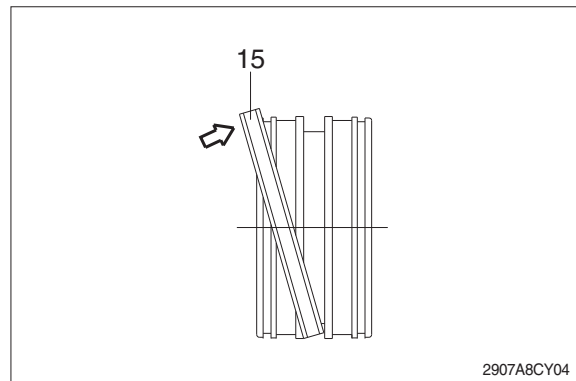


(2) Assemble piston assembly

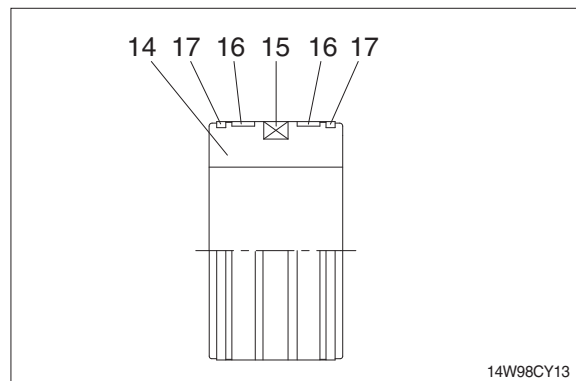
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- 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.

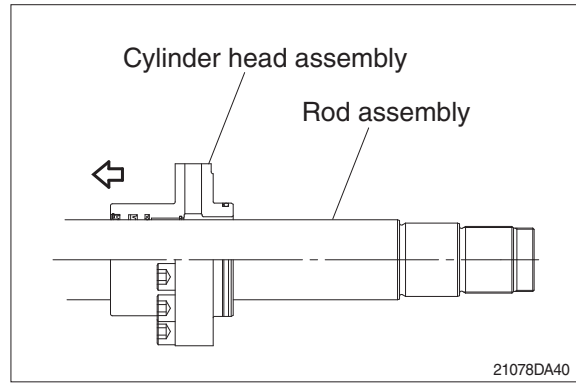


- ③ Fit wear ring (16) and dust ring (17) to piston (14).

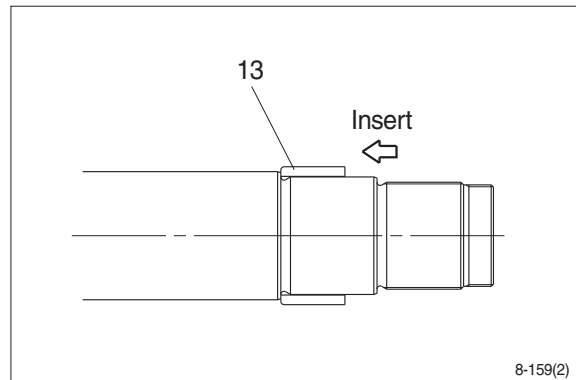


(3) Install piston and cylinder head

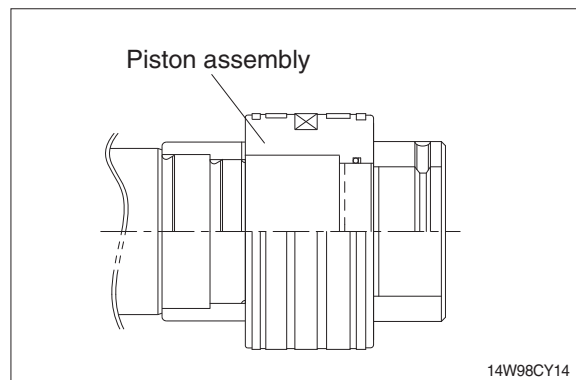
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.



- ④ Insert cushion ring (13) to rod assembly.
- ※ Note that cushion ring (13) has a direction in which it should be fitted.

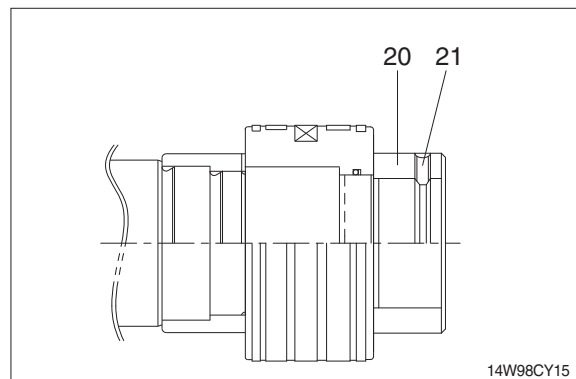


- ⑤ Fit piston assembly to rod assembly.
- Tightening torque : 125 ± 12 kgf · m
(904 ± 86.8 lbf · ft)



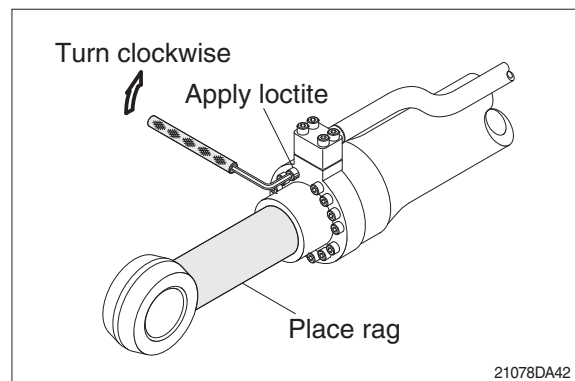
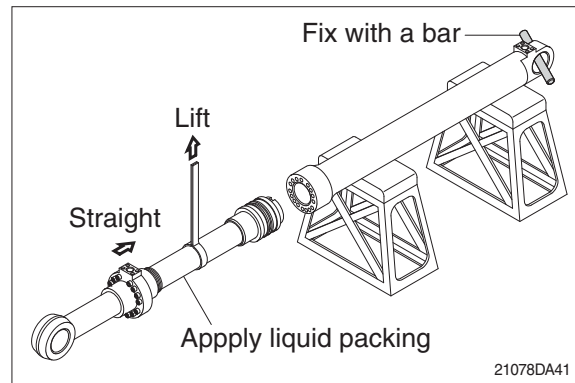
- ⑥ Fit lock nut (20) and tighten the set screw (21).
- Tightening torque :

Item		kgf · m	lbf · ft
20	Bucket	100 ± 10	723 ± 72.3
	Boom		
	Arm		
21		2.7 ± 0.3	19.6 ± 2.2



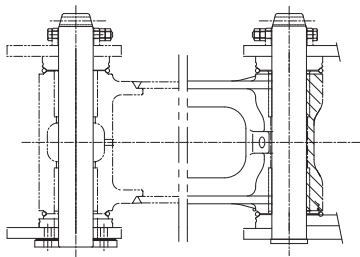
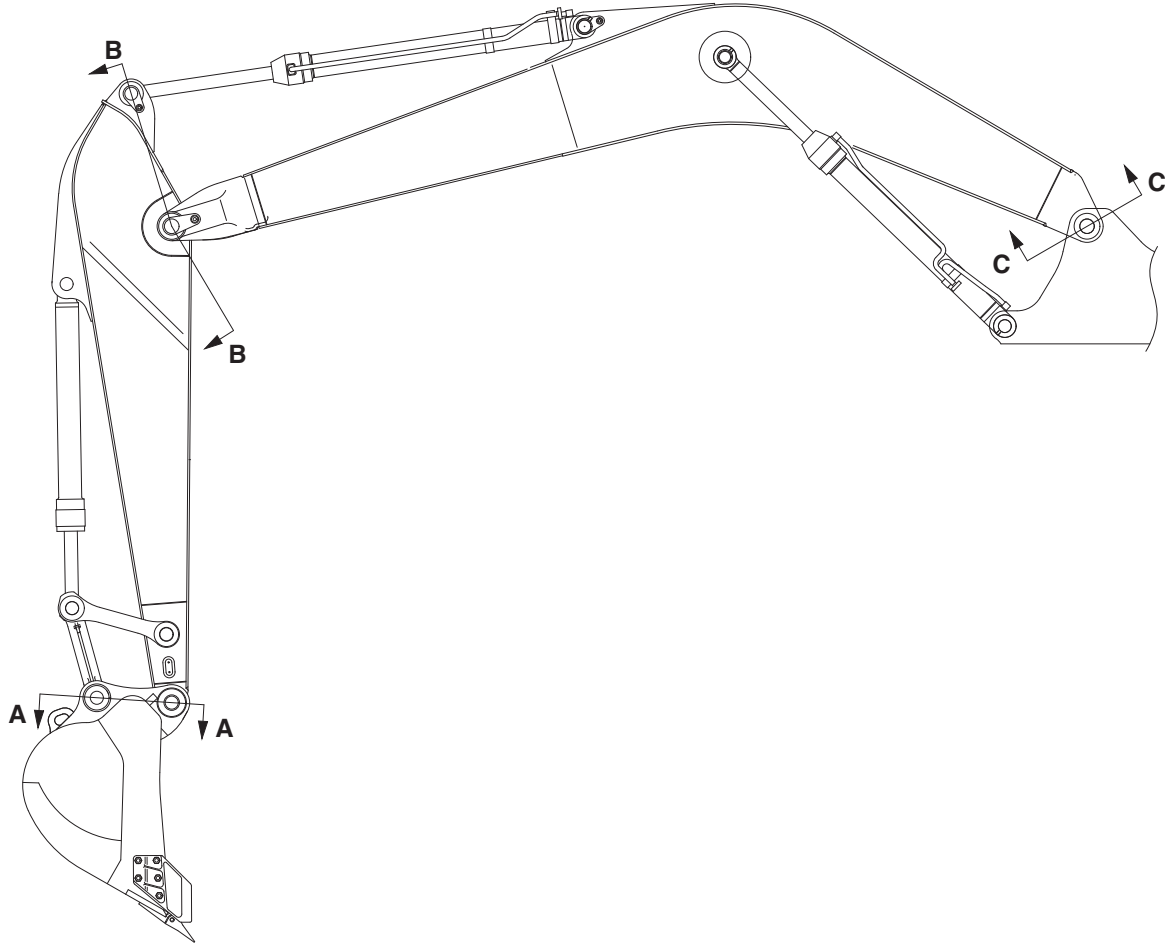
(3) Overall assemble

- 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.

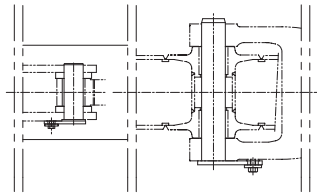


GROUP 14 WORK EQUIPMENT

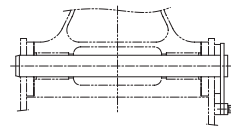
1. STRUCTURE



SECTION A



SECTION B



SECTION C

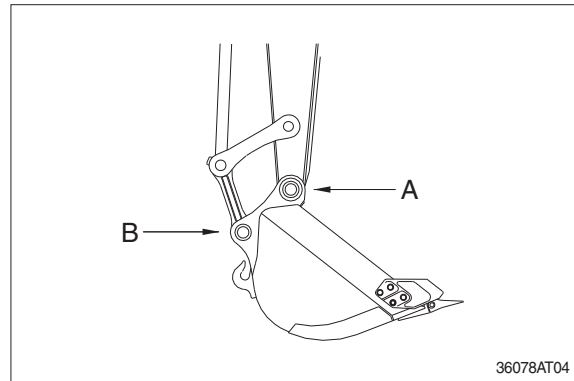
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2. REMOVAL AND INSTALL

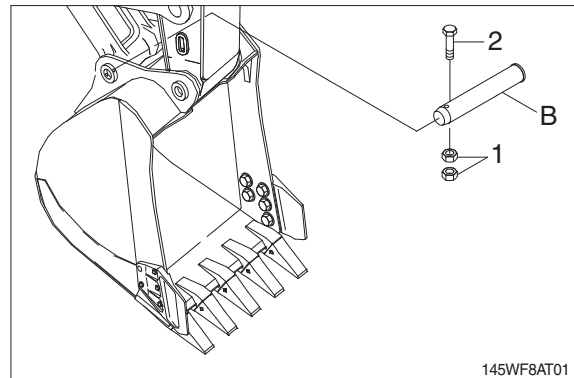
1) BUCKET ASSEMBLY

(1) Removal

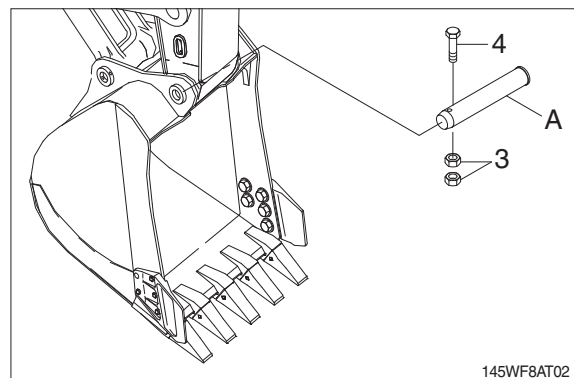
- ① Lower the work equipment completely to ground with back of bucket facing down.



- ② Remove nut (1), bolt (2) and draw out the pin (B).



- ③ Remove nut (3), bolt (4) and draw out the pin (A) then remove the bucket assembly.
 - HW160
Weight : 600 kg (1320 lb)
 - HW180
Weight : 620 kg (1370 lb)

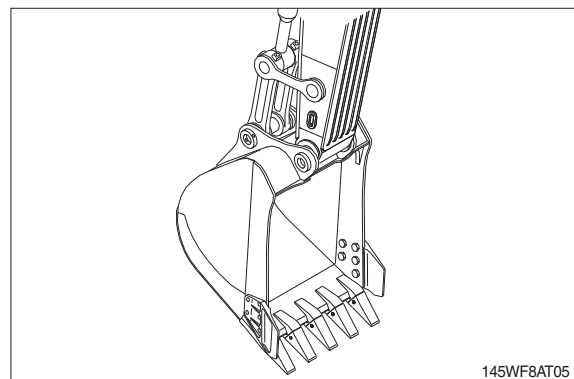


(2) Install

- 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.

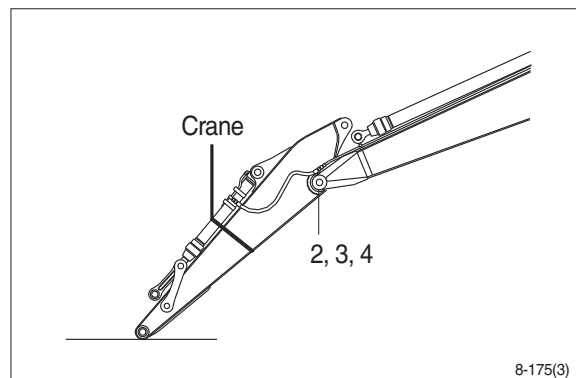
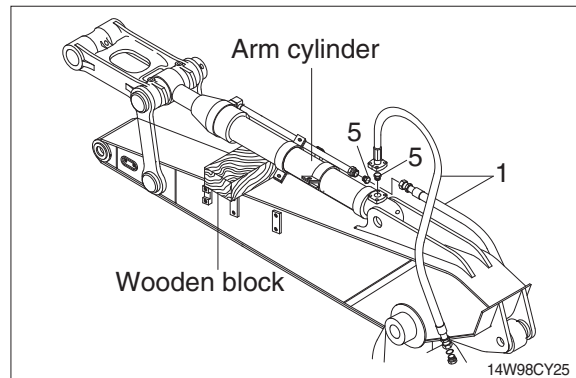
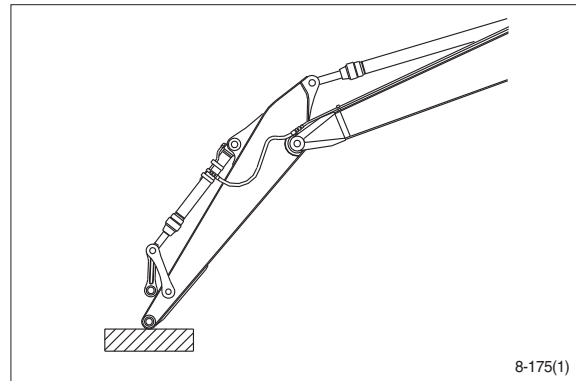
· HW160

Weight : 490 kg (1080 lb)

· HW180

Weight : 535 kg (1180 lb)

※ When lifting the arm assembly, always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

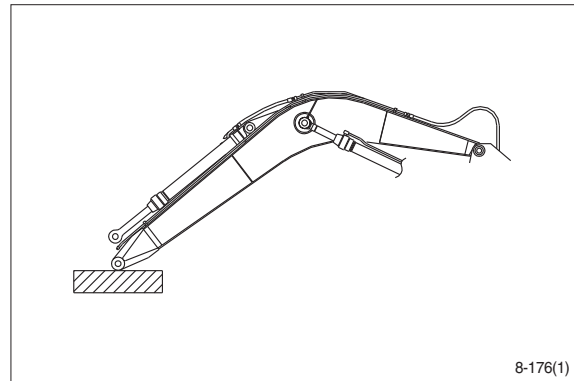
▲ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.

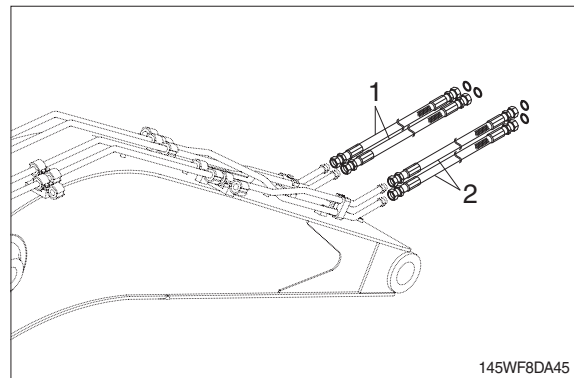
3) BOOM CYLINDER

(1) Removal

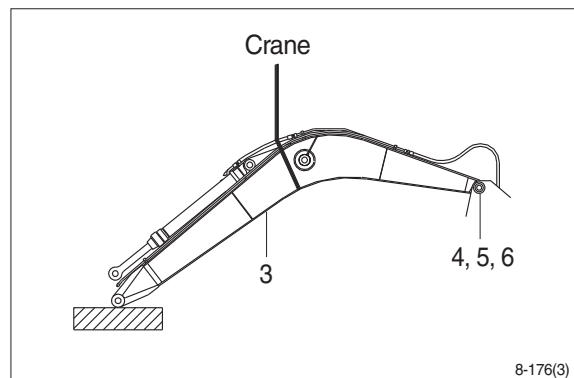
- ① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.
- ② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



- ③ Disconnect head lamp wiring.
- ④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).
※ When the hose are disconnected, oil may spurt out.
- ⑤ Sling boom assembly (3).



- ⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· HW160
Weight : 1040 kg (2290 lb)
· HW180
Weight : 1060 kg (2340 lb)
※ When lifting the boom 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.

