

SECTION 8 DISASSEMBLY AND ASSEMBLY

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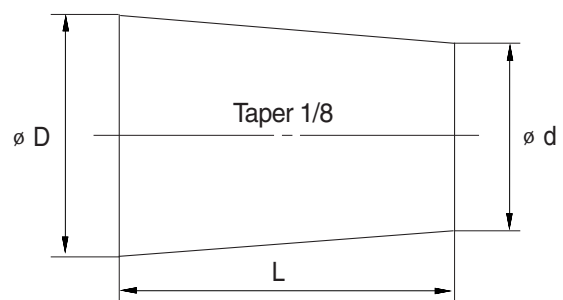
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

3. COMPLETING WORK

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (engine-bracket, FR)	M12 × 1.75	11.2 ± 1.1	81 ± 8.0
2		Engine mounting bolt (engine-bracket, RR)	M12 × 1.75	7.9 ± 2.0	57.1 ± 14.5
3		Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1 ± 5.0	377 ± 36.2
4		Engine mounting bolt (bracket-frame, RR)	M30 × 3.0	90 ± 9.0	651 ± 65.1
5		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
6		Coupling mounting socket bolt	M16 × 2.0	22 ± 1.0	159 ± 7.2
7		Main pump housing mounting bolt	M10 × 1.5	6.0 ± 0.3	43.4 ± 2.2
8	Hydraulic system	Main pump mounting socket bolt	M16 × 2.0	22.5 ± 0.5	163 ± 3.6
9		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
10		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
11		Hydraulic oil tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
12		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	88.9 ± 9.4
13	Power train system	Swing motor mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
14		Swing bearing upper part mounting bolt	M18 × 2.5	41.3 ± 4.5	299 ± 32.5
15		Swing bearing lower part mounting bolt	M16 × 1.5	31.3 ± 3.2	226 ± 23.1
16		Travel motor mounting bolt	M16 × 2.0	25.7 ± 4.0	186 ± 28.9
17		Sprocket mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
19		Track roller mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
20		Track roller mounting bolt (R140LCM-9A)	M 20 × 2.5	57.9 ± 6.0	419 ± 43.4
21		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
22		Track shoe mounting bolt, nut	5/8 - 18UNF	42 ± 4.0	304 ± 28.9
23		Track guard mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
24	Others	Counterweight mounting bolt	M27 × 3.0	140 ± 15	1013 ± 108
25		Cab mounting bolt	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	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.73 ~ 4.12	19.7 ~ 29.8
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 79.5	9.8 ~ 15.8	71 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 167
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 343
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	350 ~ 457	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.5	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1655
M36 × 4.0	174 ~ 236	1261 ~ 1703	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.17 ~ 3.37	15.7 ~ 24.3	3.04 ~ 4.44	22.0 ~ 32.0
M10 × 1.25	4.46 ~ 6.66	32.3 ~ 48.2	5.93 ~ 8.93	42.9 ~ 64.6
M12 × 1.25	7.78 ~ 11.58	76.3 ~ 83.7	10.6 ~ 16.0	76.6 ~ 115
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 130	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 194	26.6 ~ 36.0	193 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 390	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 515	70.7 ~ 95.7	512 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 664	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1338	182 ~ 248	1314 ~ 1795
M36 × 3.0	192 ~ 260	1389 ~ 1879	262 ~ 354	1893 ~ 2561

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 : 124 l (32.8 U.S. gal)

- (5) Remove socket bolts (11) and disconnect hoses (1,2).
- (6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10).

- (7) Remove socket bolts (12) and disconnect pump suction pipe (4).

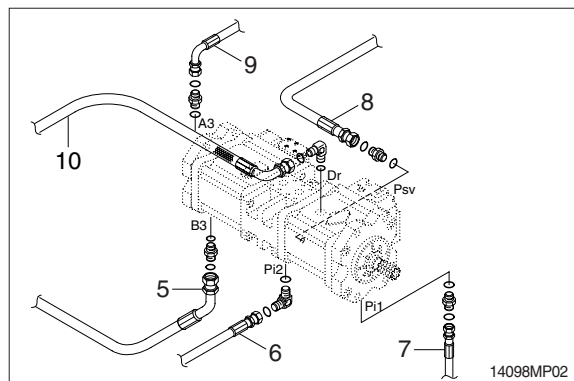
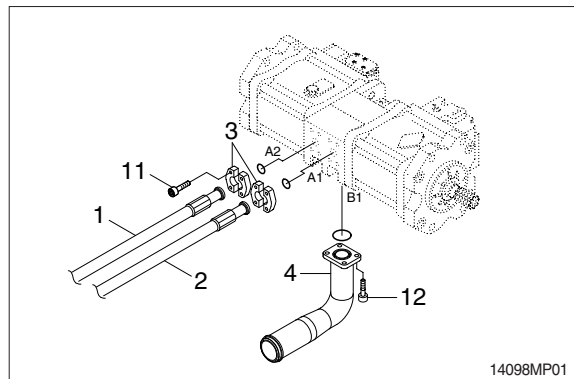
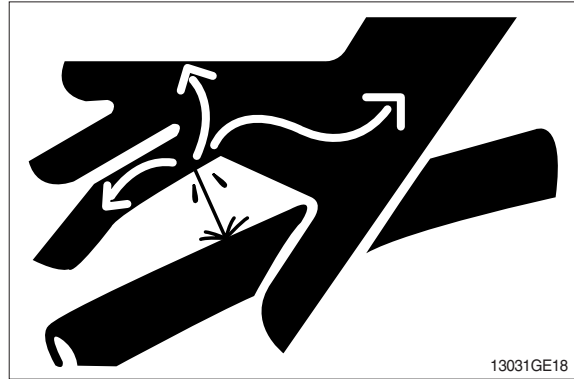
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

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

· Weight : 100 kg (220 lb)

※ Pull out the pump assembly from housing.

When removing the pump assembly, check that all the hoses have been disconnected.

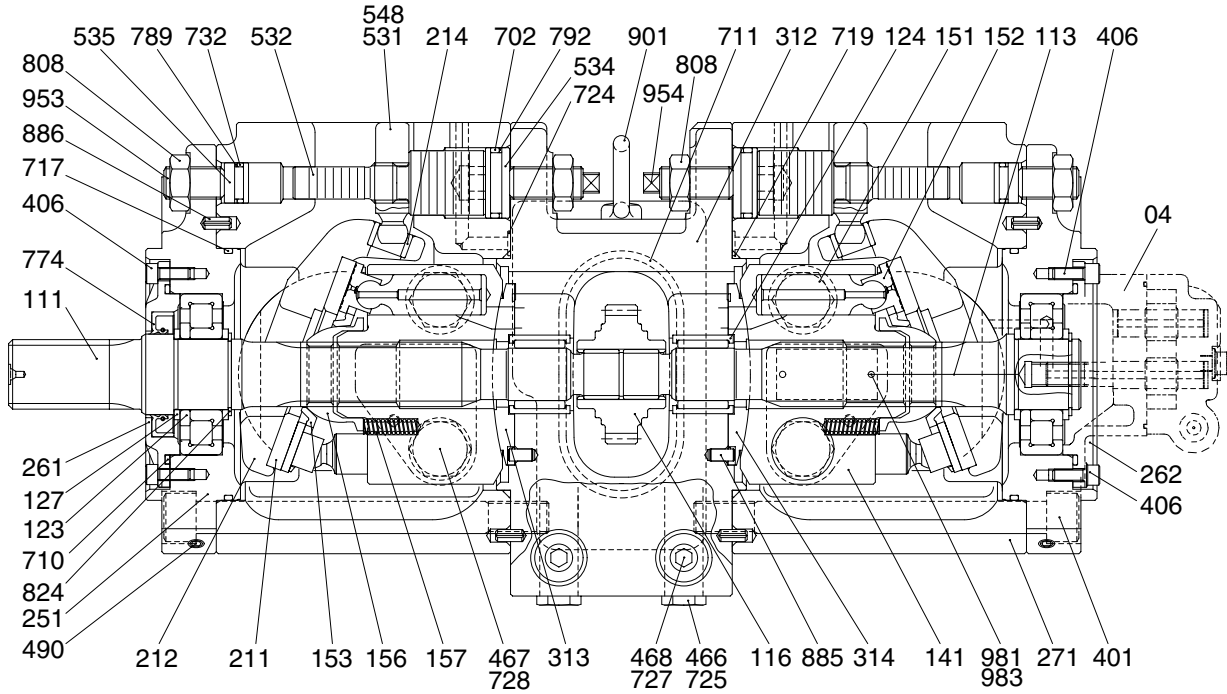


2) INSTALL

- (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



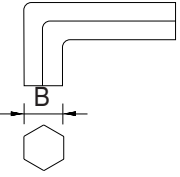
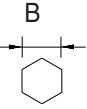
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04	Gear pump	312	Valve block	717	O-ring
111	Drive shaft (F)	313	Valve plate (R)	719	O-ring
113	Drive shaft (R)	314	Valve plate (L)	724	O-ring
116	1st Gear	326	Cover	725	O-ring
123	Roller bearing	401	Hexagon socket bolt	727	O-ring
124	Needle bearing	406	Hexagon socket bolt	728	O-ring
127	Bearing spacer	414	Hexagon socket bolt	732	O-ring
141	Cylinder block	466	Plug	774	Oil seal
151	Piston	467	plug	789	Back up ring
152	Shoe	468	Plug	792	Back up ring
153	Set plate	490	Plug	808	Hexagon head nut
156	Bushing	531	Tilting pin	824	Snap ring
157	Cylinder spring	532	Servo piston	885	Pin
211	Shoe plate	534	Stopper (L)	886	Spring pin
212	Swash plate	535	Stopper (S)	901	Eye bolt
251	Support	548	Pin	953	Set screw
261	Seal cover (F)	702	O-ring	954	Set screw
271	Pump casing	711	O-ring	981	Plate
				983	Pin

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

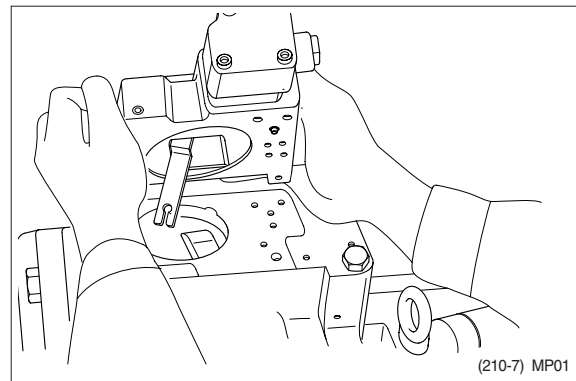
Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PO-1/4	M12, M14
	8	M10	BP-3/8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-
Double ring spanner, 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
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

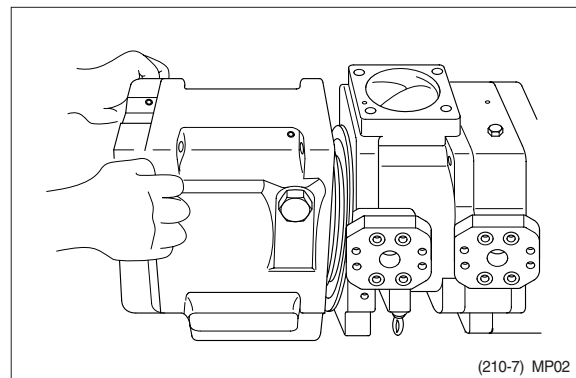
3) DISASSEMBLY

- (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.



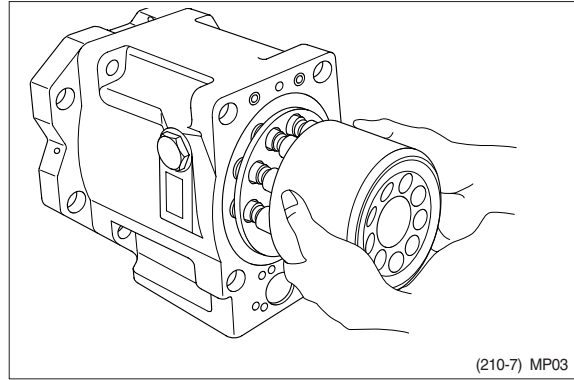
- (5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve block (312).
 - ※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

- (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.

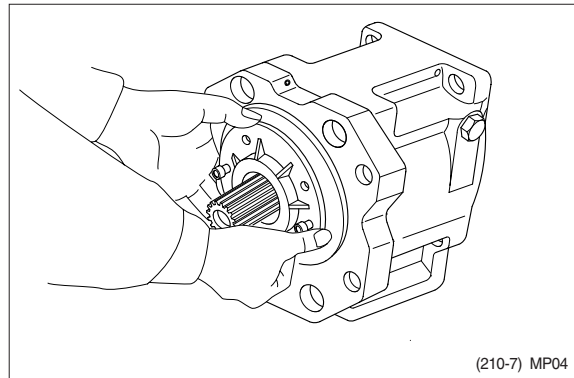
※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.



(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.

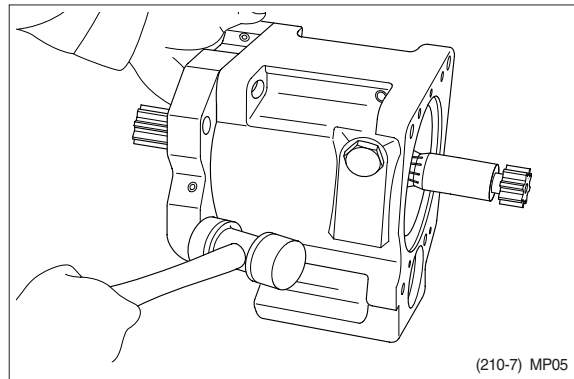
※ Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.



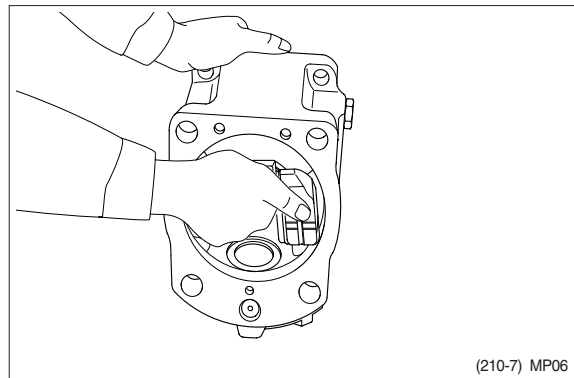
(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).

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

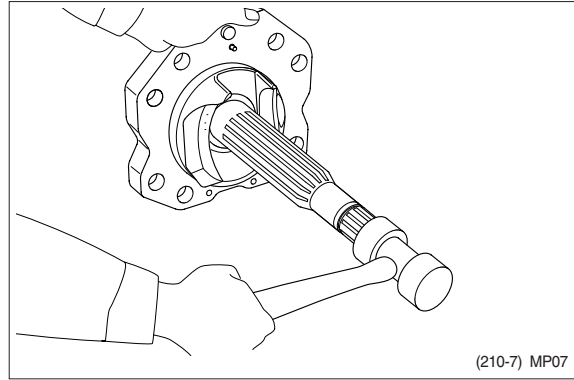
(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



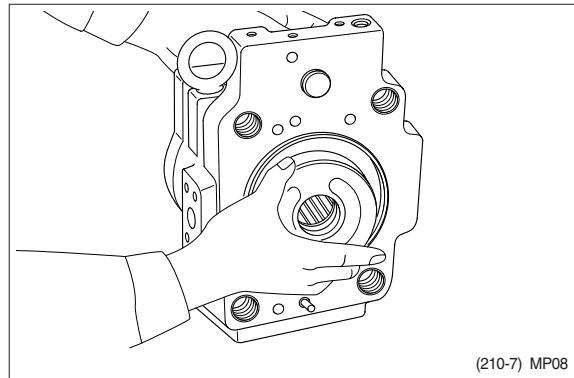
(11) Remove shoe plate (211) and swash plate (212) from pump casing (271).



- (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.

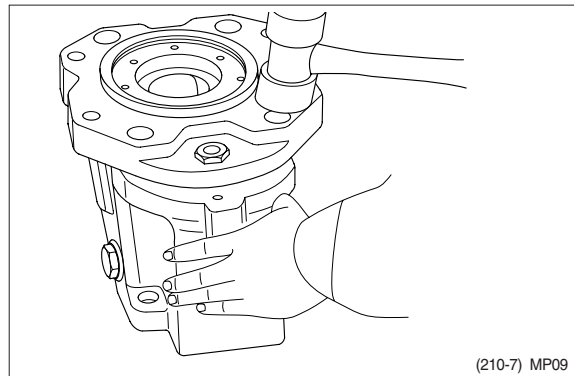
4) ASSEMBLY

(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.

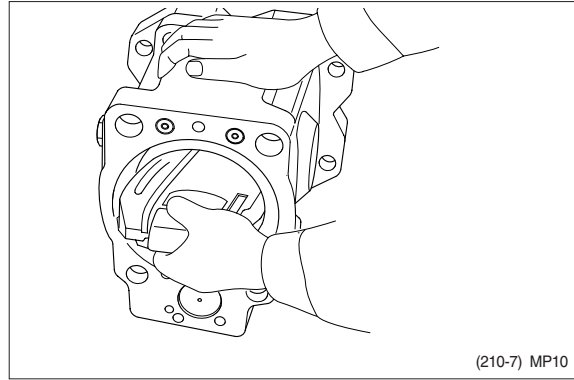
(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

- ※ 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.



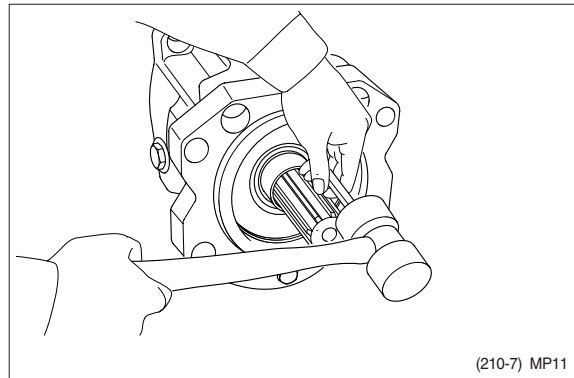
(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.

- ※ 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.



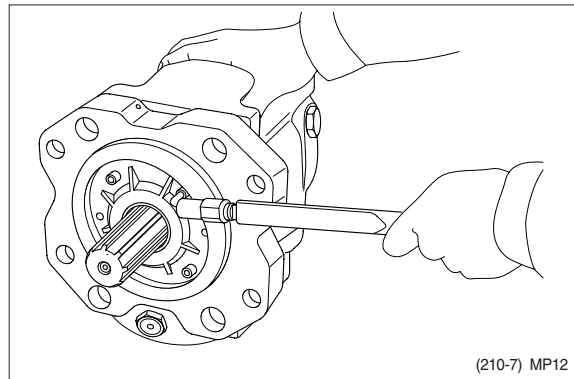
(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

- ※ 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.



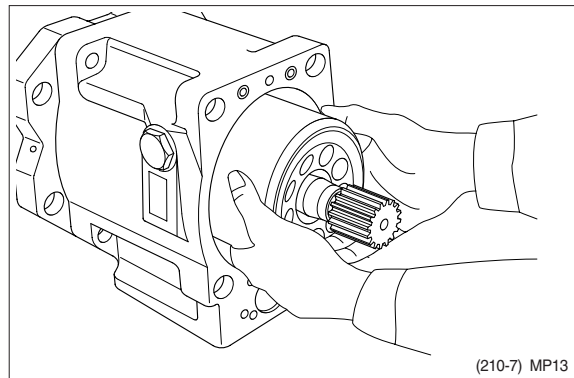
(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

- ※ 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.

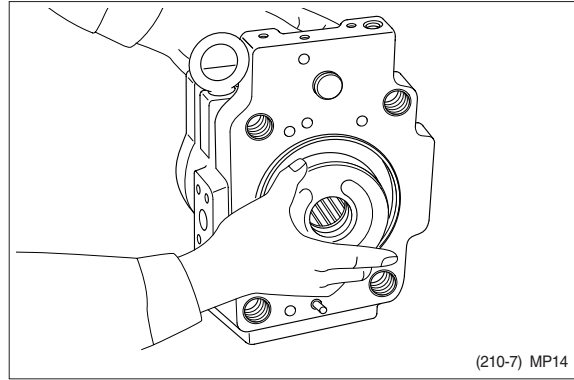


(6) Assemble piston cylinder subassembly [cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157)] .

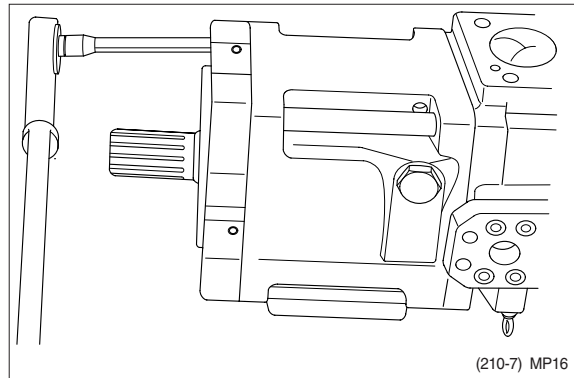
Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.



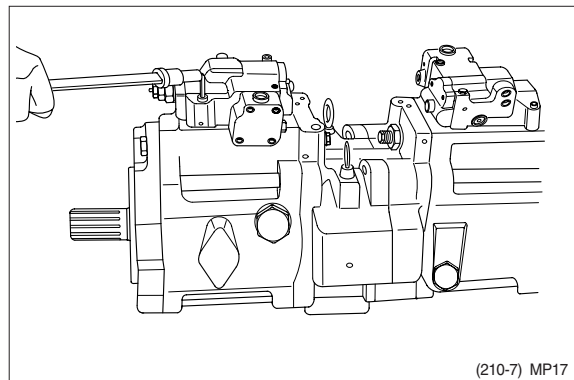
- (7) Fit valve plate (313) to valve block (312), entering pin into pin hole.
- ※ Take care not to mistake suction / delivery directions of valve plate.



- (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.



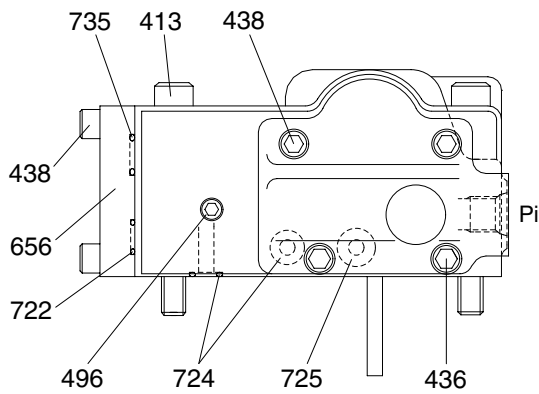
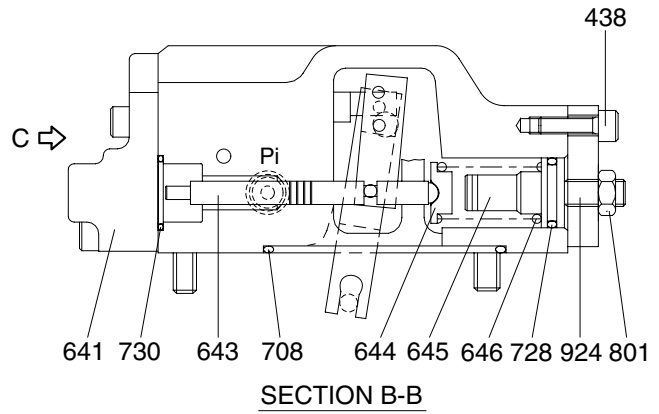
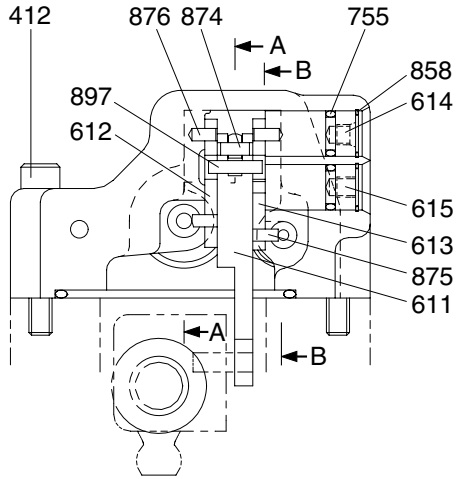
- (9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
- ※ Take care not to mistake regulator of front pump for that of rear pump.



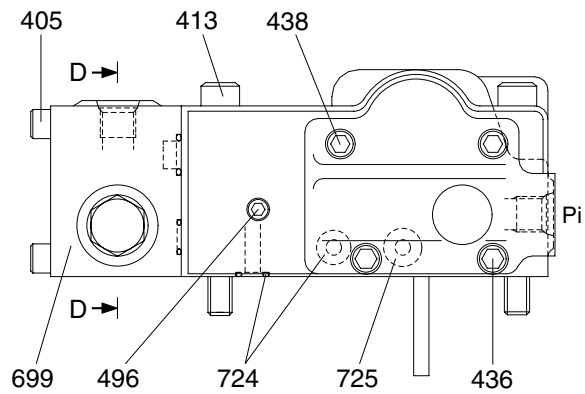
- (10) Fit drain port plug (468).
This is the end of reassembling procedures.

3. REGULATOR

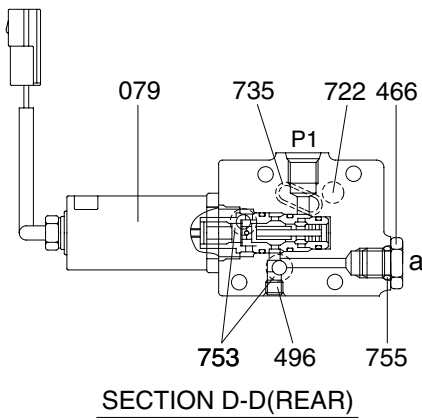
1) STRUCTURE (1/2)



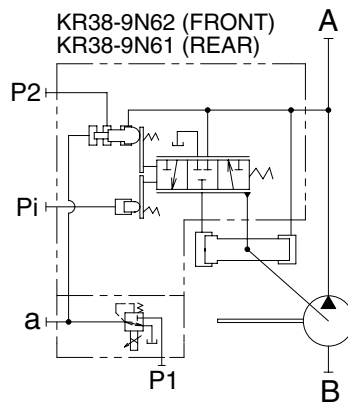
VIEW C (FRONT)



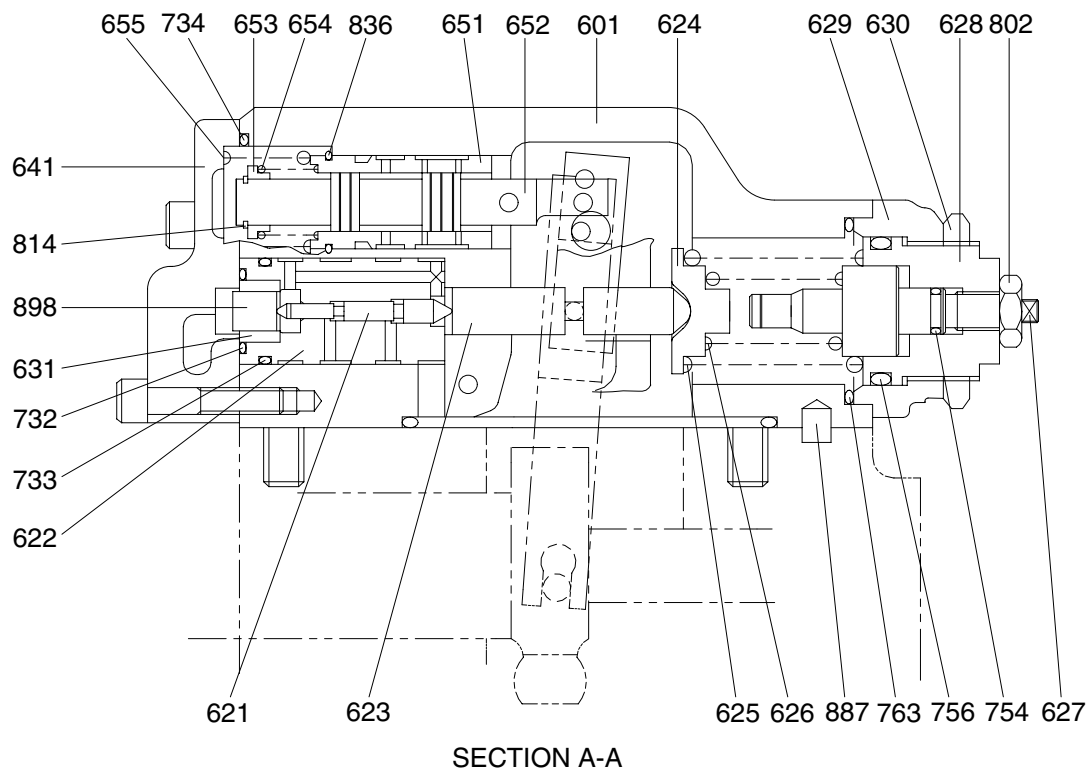
VIEW C (REAR)



SECTION D-D (REAR)



REGULATOR (2/2)



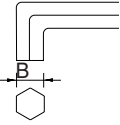

14092MP05

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

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

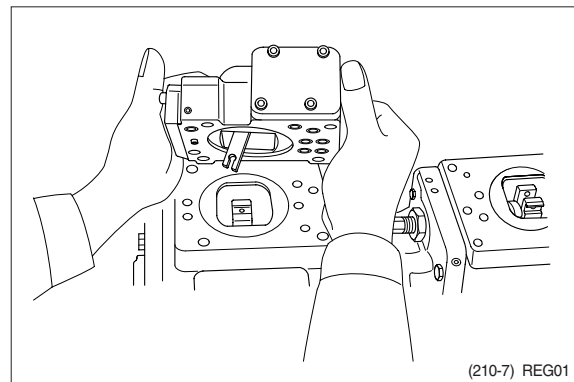
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
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

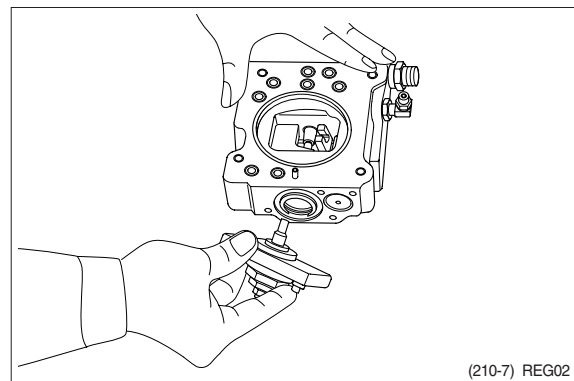
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

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.



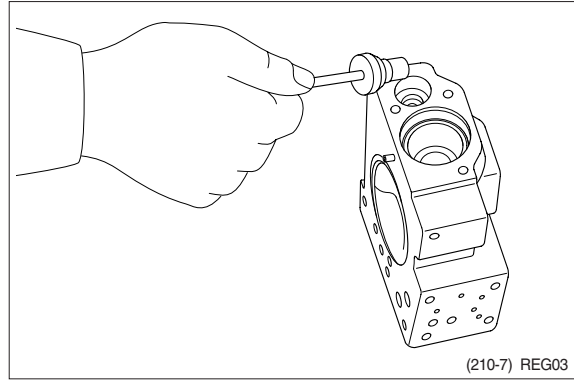
- (4) Remove hexagon socket head screw (438) and remove cover (C,629)
 - ※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
 - ※ Do not loosen these screws and nuts. If they are loosened, adjusted pressure-flow setting will vary.



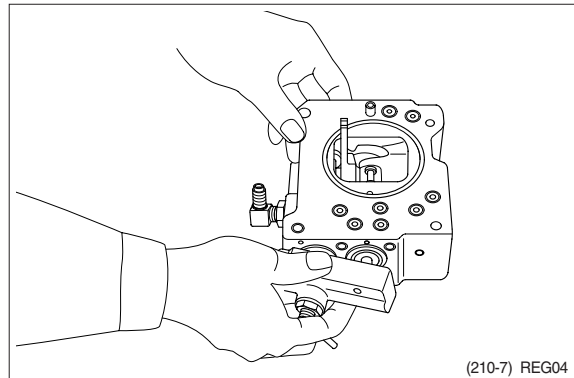
- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.

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.

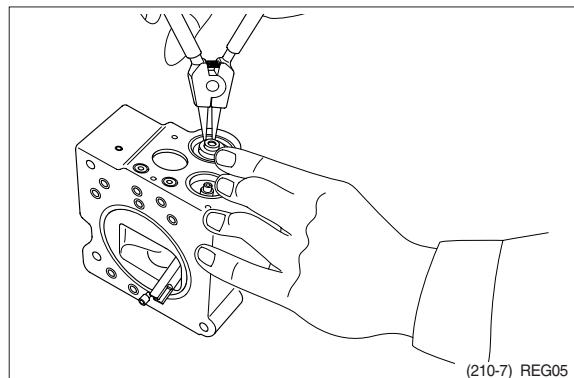


- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641). After removing pilot cover, take out set spring (655) from pilot section.



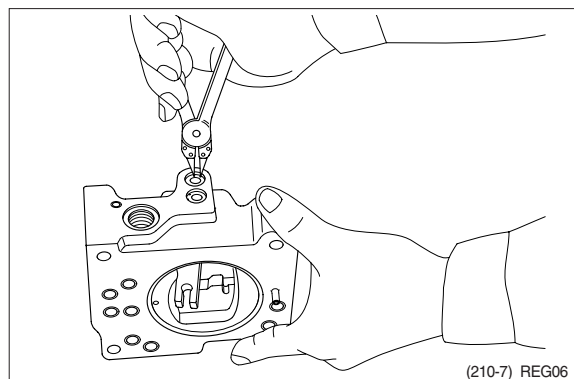
- (7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).

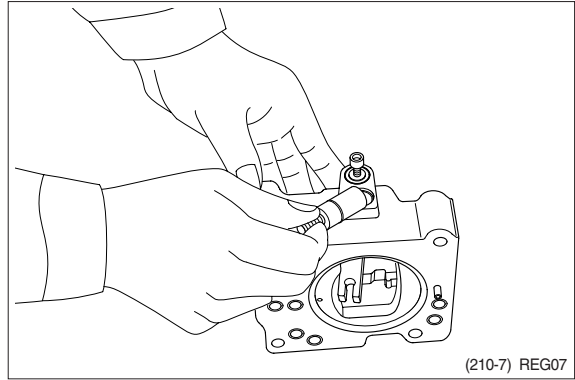
- ※ Sleeve (651) is fitted with snap ring (836).
- ※ When removing snap ring (814), return spring (654) may pop out. Take care not to lose it.



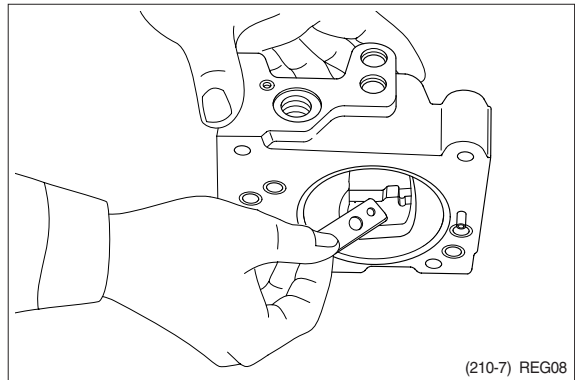
- (8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

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

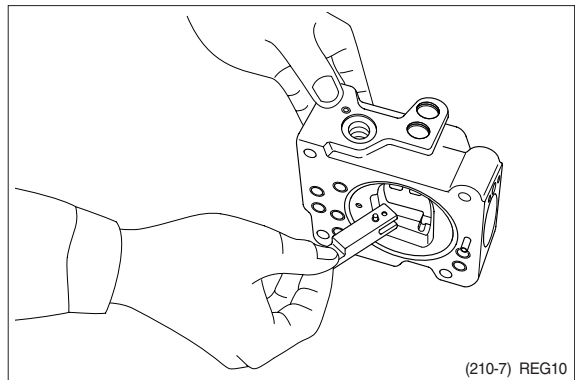
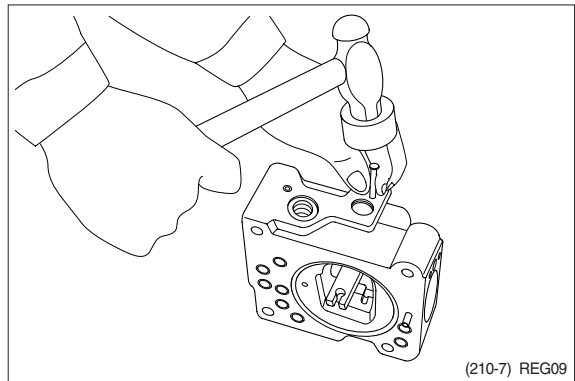




- (9) Remove lever (2, 613). Do not draw out pin (875).
※ Work will be promoted by using pincers or so on.



- (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.

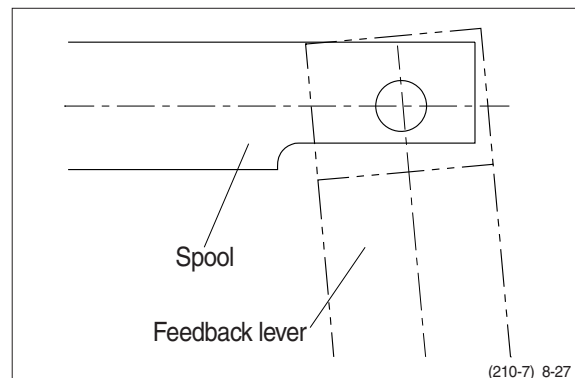
- ① Always repair parts that were scored at disassembly.
- ② Get replacement parts ready beforehand.
Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.
- ③ Always tighten bolts, plugs, etc. to their 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).

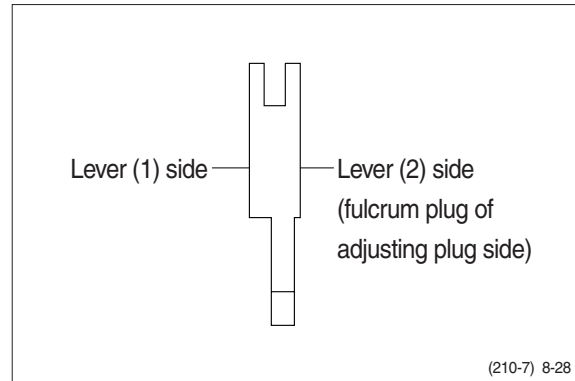
(3) Put pin force-fitted in lever (1, 612) into groove of compensating rod and fit lever (1) to pin force-fitted in casing.

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

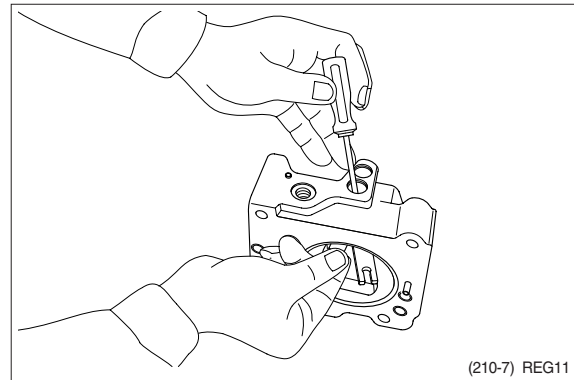
- ※ Confirm that spool and sleeve slide smoothly in casing without binding.
- ※ Pay attention to orientation of spool.



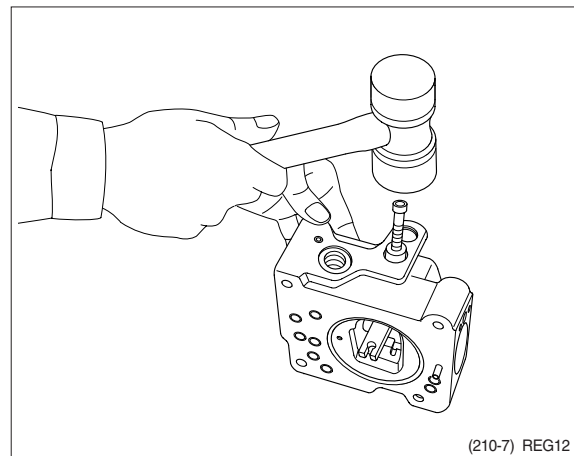
- (5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
- ※ Insert pin in feedback lever a little to ease operation.
 - ※ Take care not to mistake direction of feedback lever.



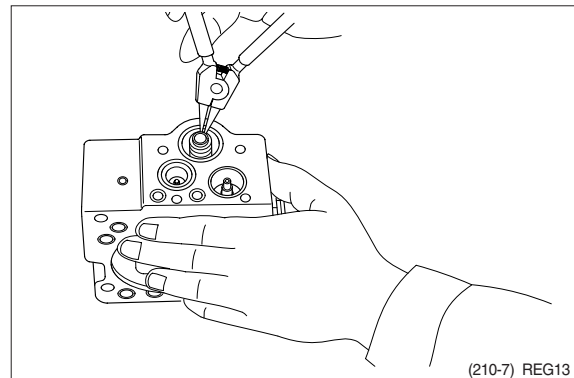
- (6) Put pilot piston (643) into pilot hole of casing.
- ※ Confirm that pilot piston slides smoothly without binding.
- (7) Put pin force-fitted in lever (2, 613) into groove of pilot piston.
Then fix lever (2).



- (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.

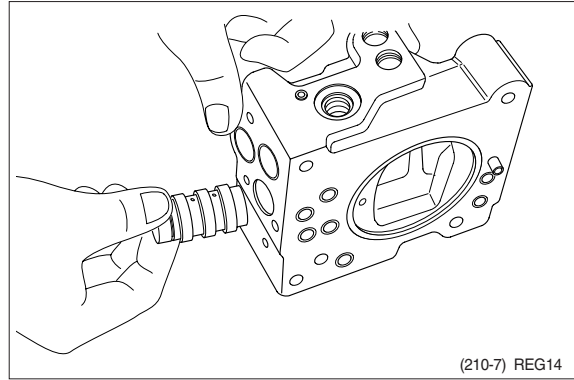


- (10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



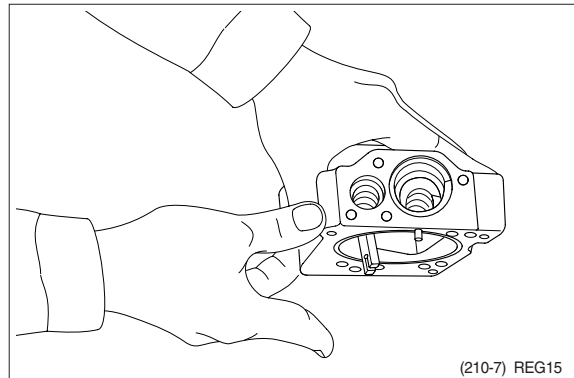
- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.

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



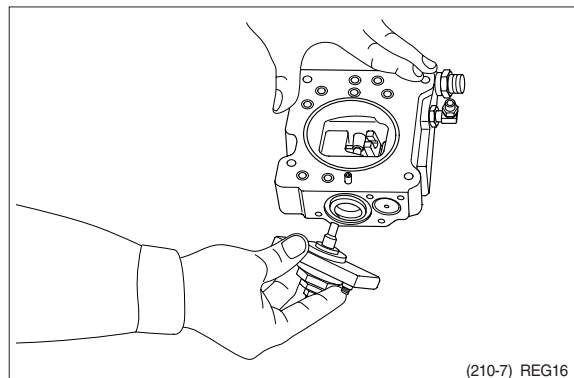
- (12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole. Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

※ 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

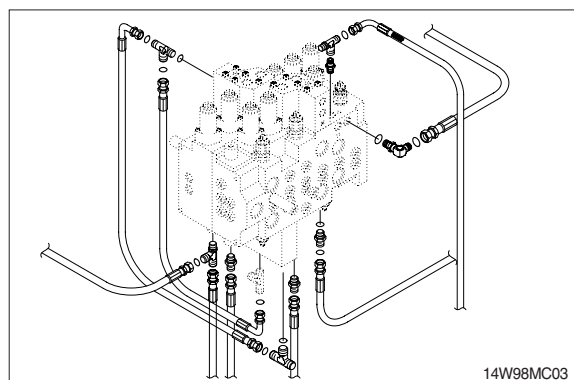
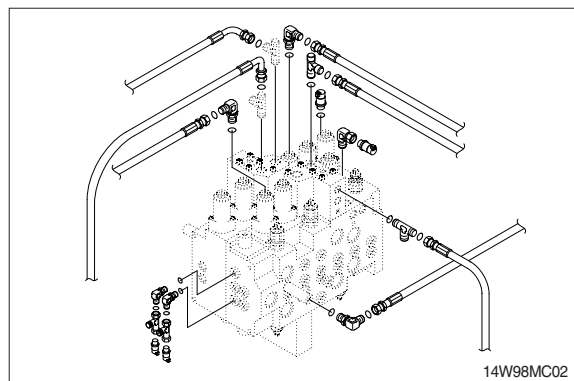
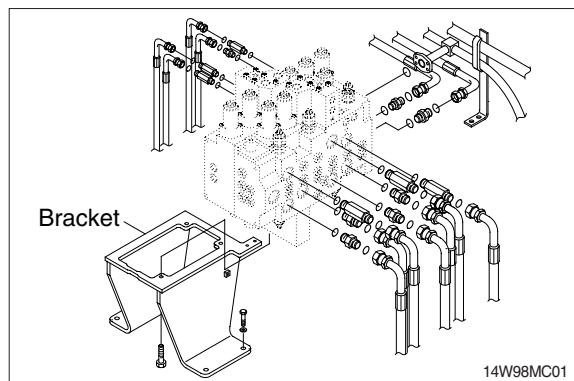
1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

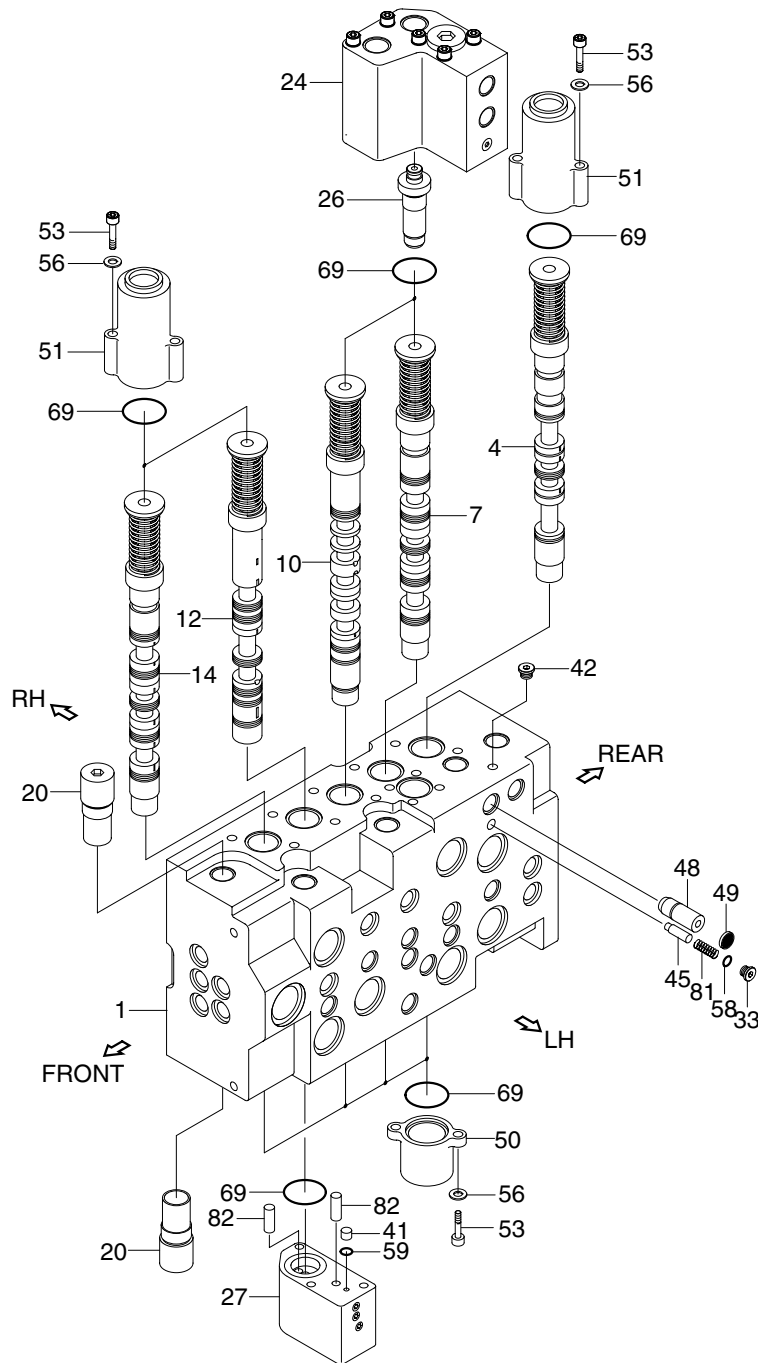
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure 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 : 80kg(175lb)
- (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.



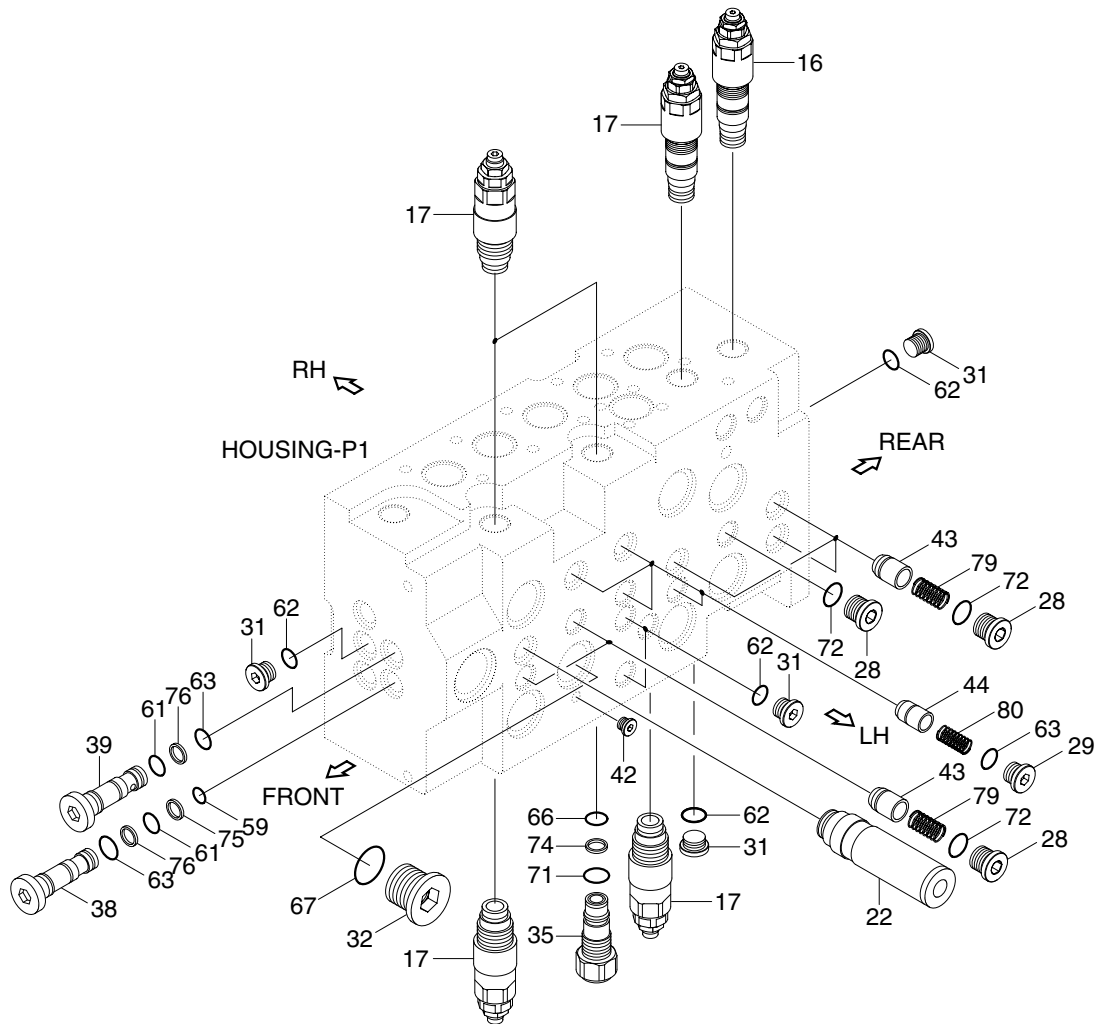
2. STRUCTURE (1/4)



14098MC04

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

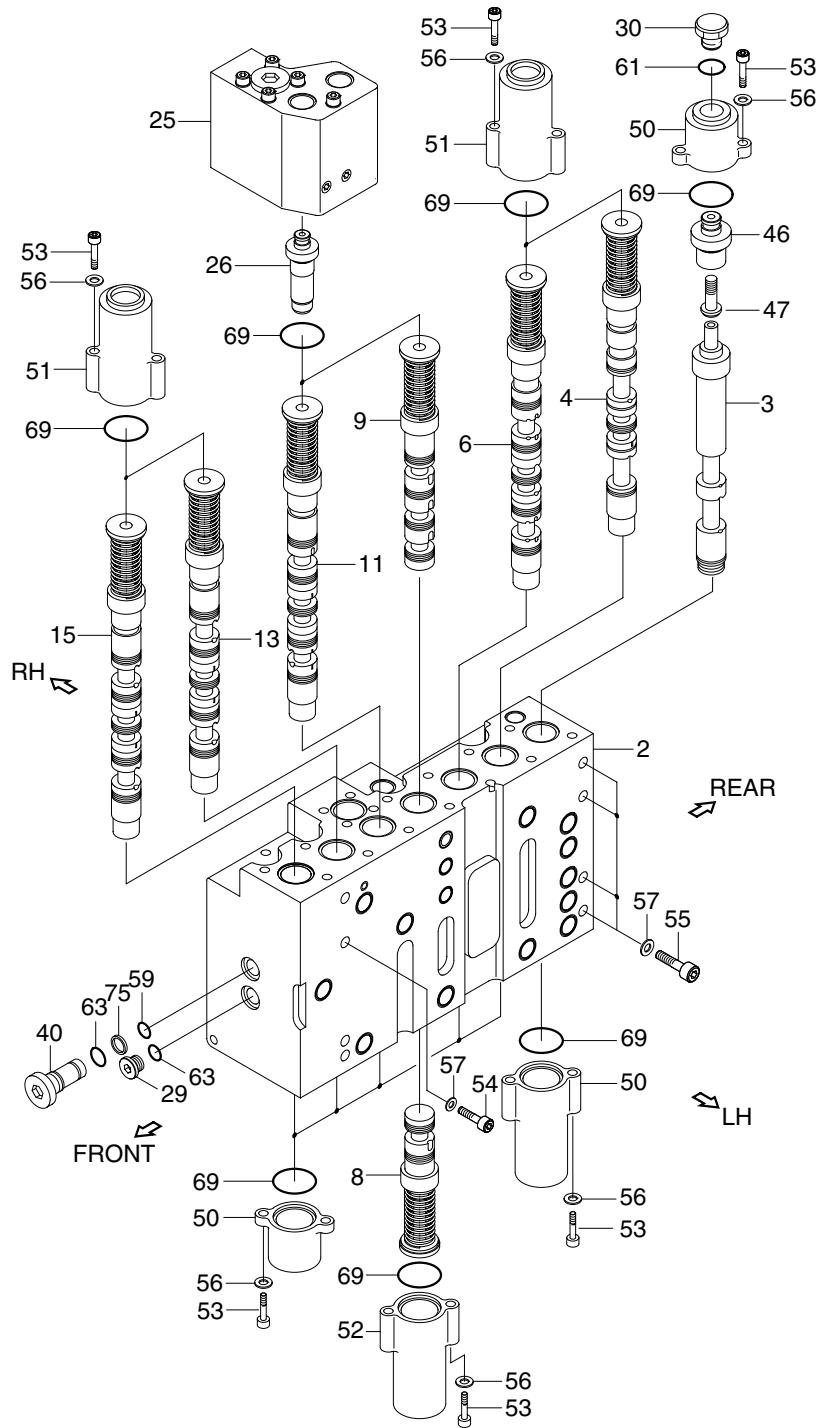
STRUCTURE (2/4)



14W98MC05

16	Main relief valve	39	Plug	67	O-ring
17	Overload relief valve	42	Plug	71	O-ring
22	Bucket logic 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		

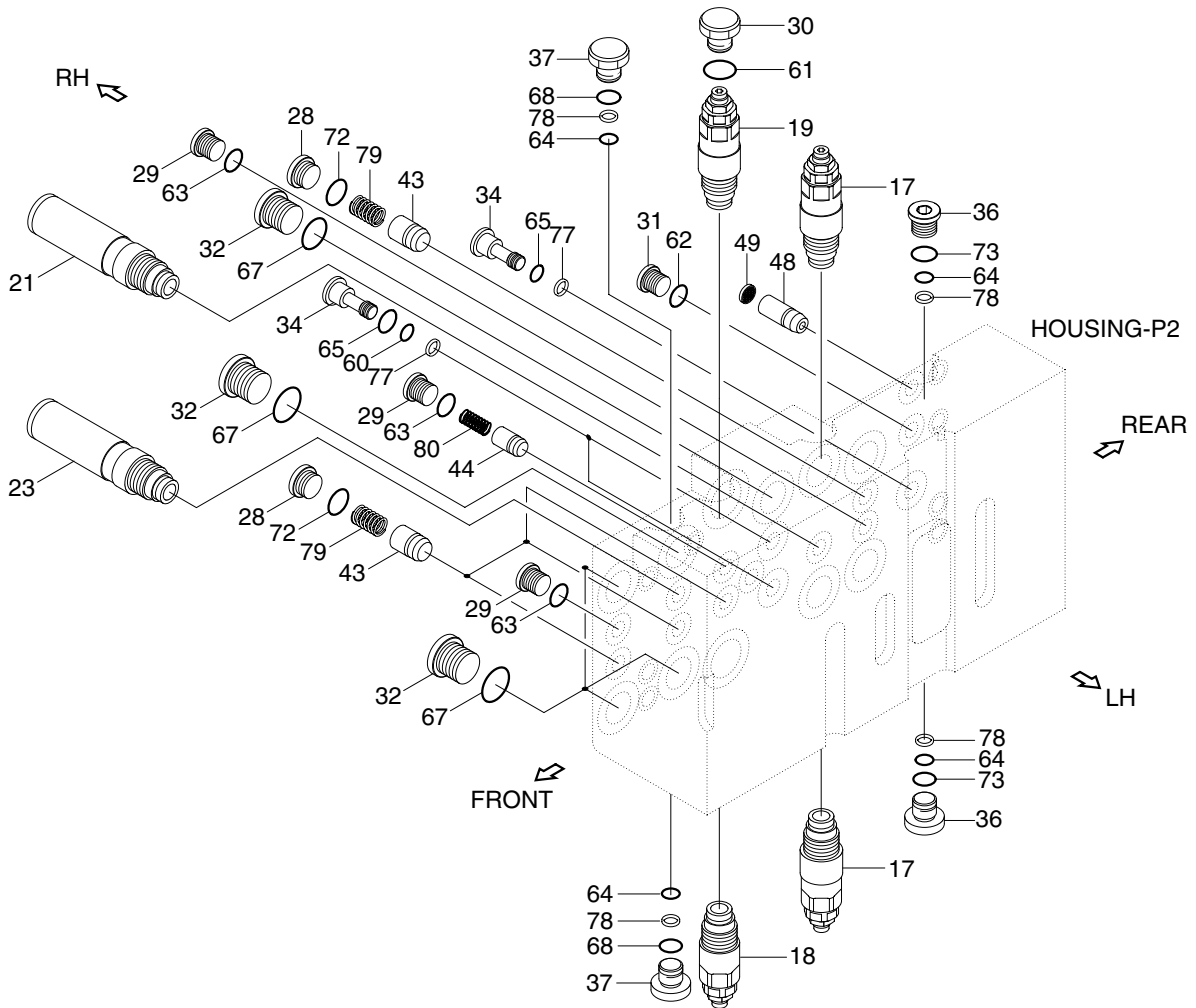
STRUCTURE (3/4)



14098MC06

- | | | | | | |
|----|----------------------------|----|------------------|----|------------------|
| 2 | Housing-P2 | 26 | Lock valve kit B | 54 | Socket head bolt |
| 3 | Spool assy-straight travel | 29 | Plug | 55 | Socket head bolt |
| 4 | Spool assy-travel(RH) | 30 | Plug | 56 | Plain washer |
| 6 | Spool assy-swing | 40 | Plug | 57 | Spring washer |
| 8 | Spool assy-swing priority | 46 | Sleeve | 59 | O-ring |
| 9 | Spool assy-boom 2 | 47 | Piston | 61 | O-ring |
| 11 | Spool assy-arm 1 | 50 | Pilot A cap | 63 | O-ring |
| 13 | Spool assy-option B | 51 | Pilot B1 cap | 69 | O-ring |
| 15 | Spool assy-option C | 52 | Pilot B2 cap | 75 | Back up ring |
| 25 | Holdin valve kit A2 | 53 | Socket head bolt | 75 | Back up ring |

STRUCTURE (4/4)



14098MC07

- | | | | | | |
|----|-----------------------|----|------------------|----|--------------|
| 17 | Overload relief valve | 36 | Plug | 65 | O-ring |
| 18 | Overload relief valve | 37 | Plug | 67 | O-ring |
| 19 | Overload relief valve | 43 | Poppet 1 | 68 | O-ring |
| 21 | Swing logic valve | 44 | Poppet | 72 | O-ring |
| 23 | ON/OFF valve-option | 48 | Orifice | 73 | O-ring |
| 28 | Plug | 49 | Coin type filter | 77 | Back up ring |
| 29 | Plug | 60 | O-ring | 78 | Back up ring |
| 30 | Plug | 61 | O-ring | 79 | Spring |
| 31 | Plug | 62 | O-ring | 80 | Spring |
| 32 | Plug | 63 | O-ring | | |
| 34 | Plug | 64 | O-ring | | |

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

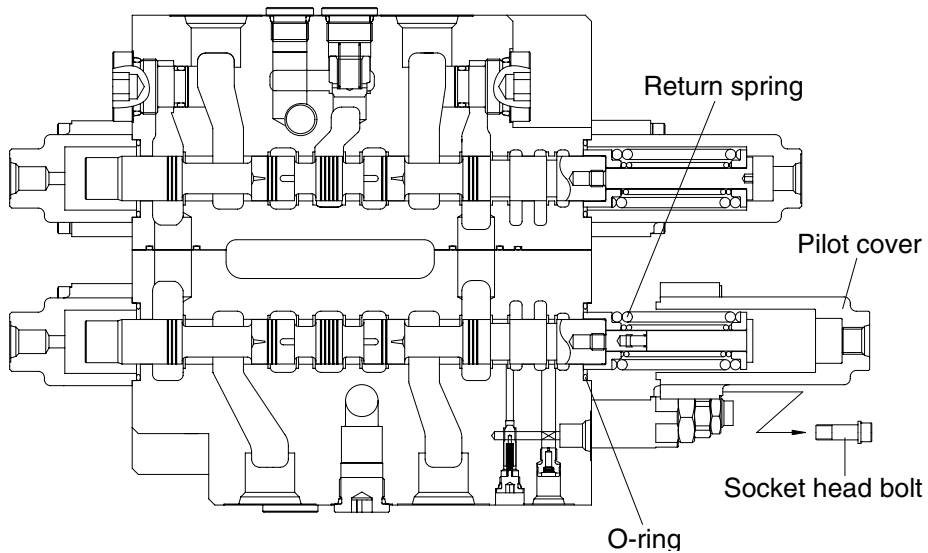
Before disassembling the control valve, prepare the following tools beforehand.

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 (travel right, travel left)

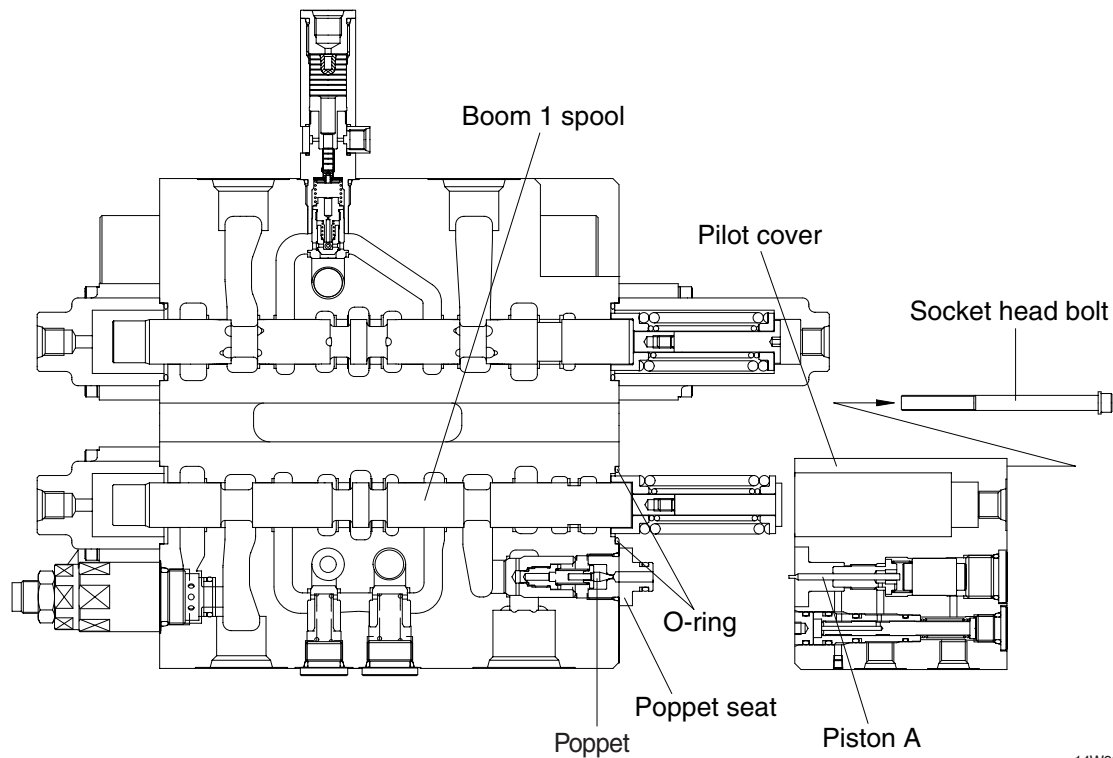
- ① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)
 - ② Remove the pilot cover.
- ※ Pay attention not to lose the O-ring under the pilot cover.
- ③ Remove the spool assembly from the body by hand slightly.
- ※ When extracting each spool from its body, pay attention not to damage 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.



14098MC10

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

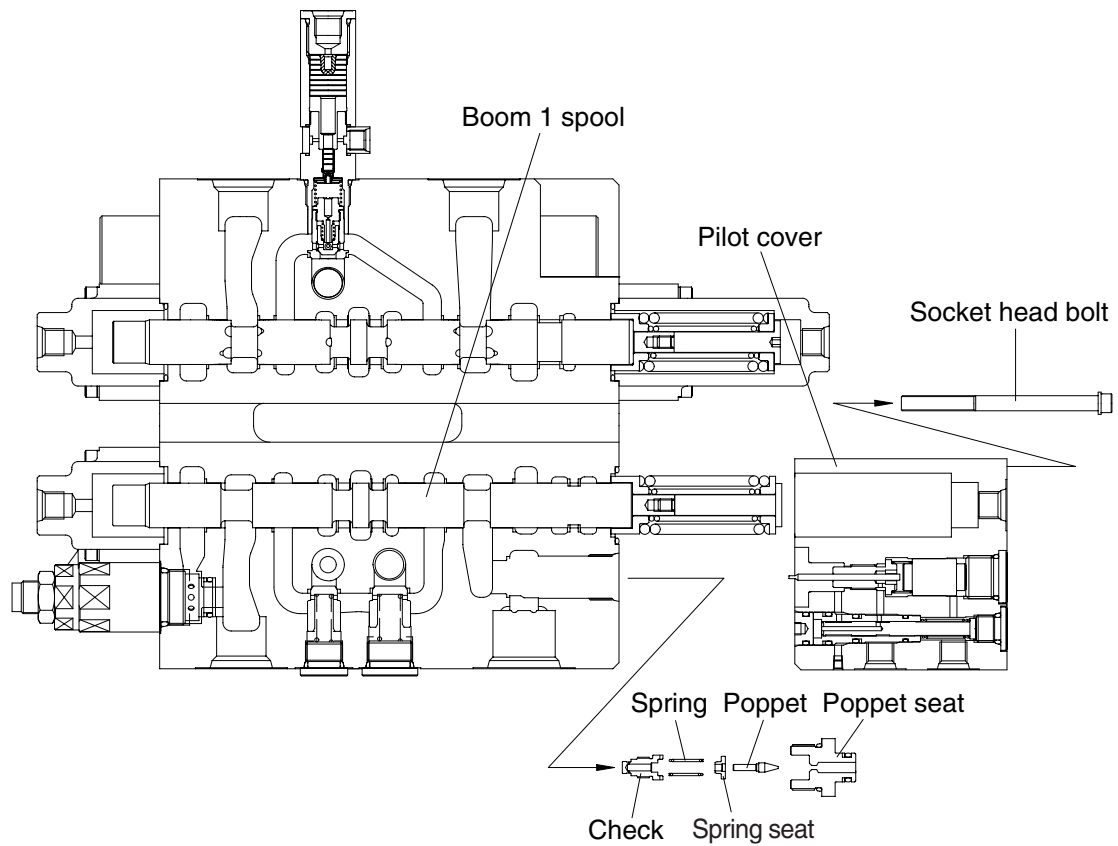
- ① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)
- ② Remove the pilot cover with internal parts.
 - ※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
 - ※ Pay attention not to damage the "piston A" under pilot cover.
- ③ Remove the spool assembly from 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.



14W98MC11

(3) Disassembly of the holding valve

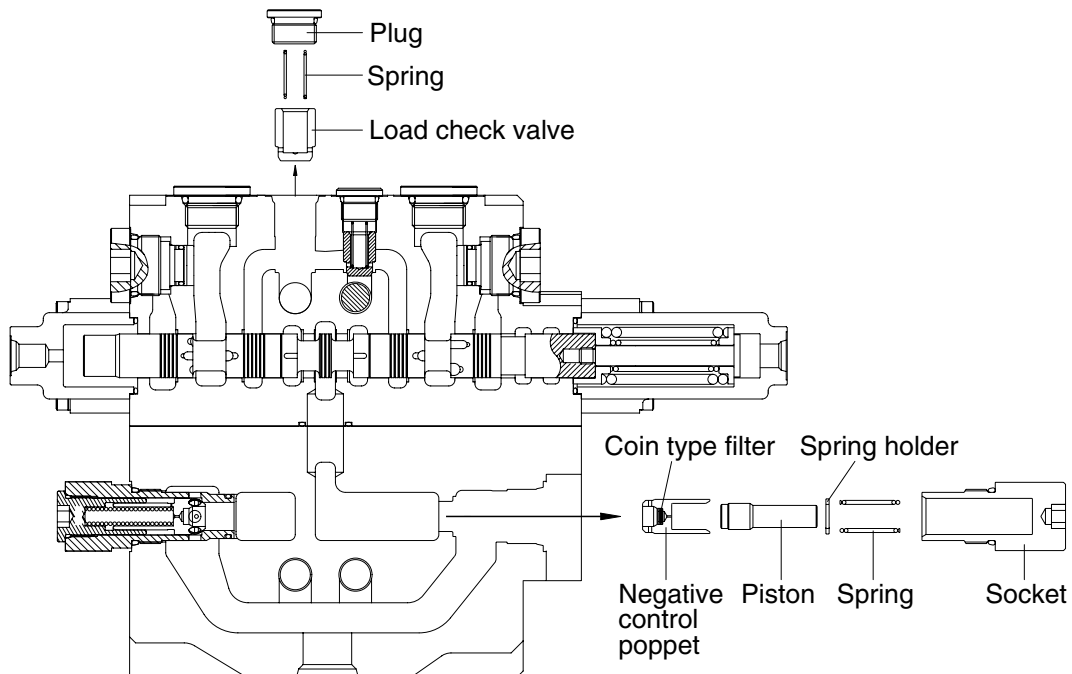
- ① Remove the pilot cover with the holding valve as described on previous page.
 - ※ Do not disassemble internal parts of the pilot cover.
- ② Loosen the poppet seat and remove the poppet, spring seat, spring and check.
(spanner : 26 mm)
 - ※ Pay attention not to lose the poppet.
 - ※ Do not disassemble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



14W98MC12

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

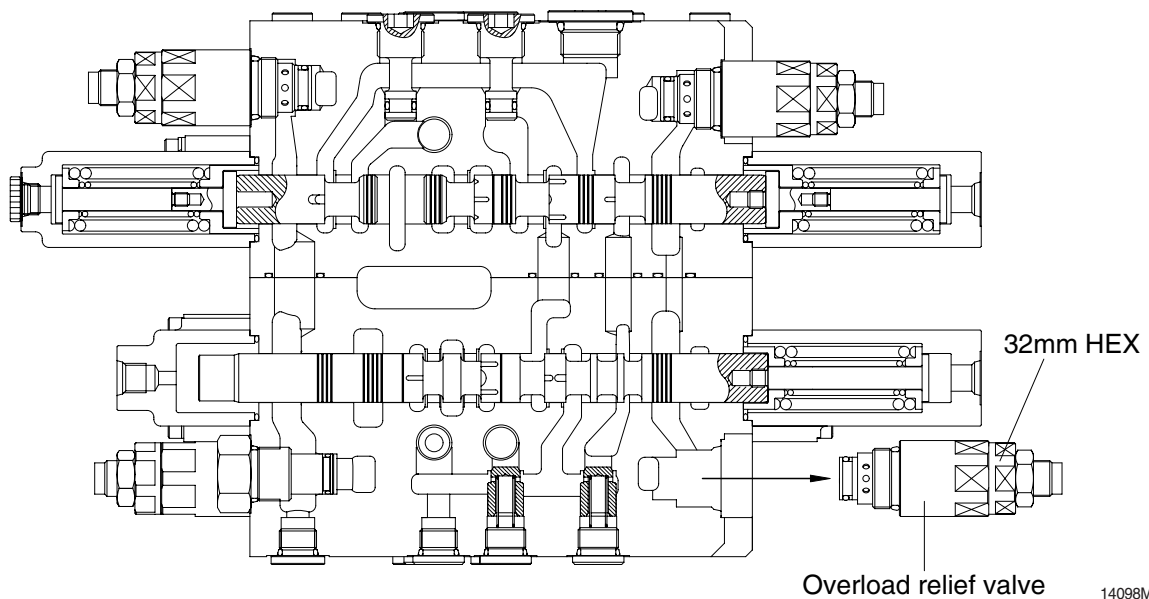
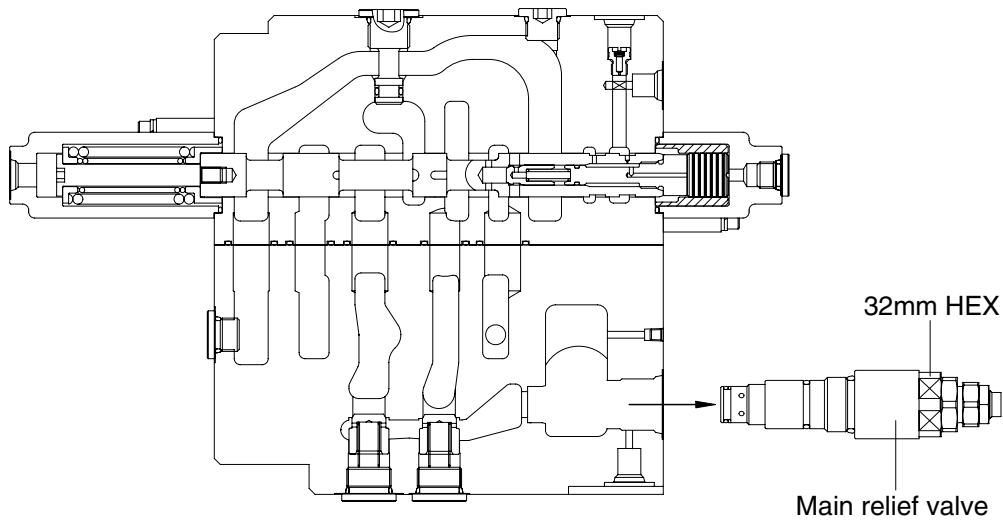
- ① The load check valve
 - a. Fix the body to suitable work bench.
 - ※ Pay attention not to damage the body.
 - b. Loosen the plug (hexagon wrench : 10 mm).
 - c. Remove the spring and the load check valve with pincers or magnet.
- ② The negative relief valve
 - a. Loosen the socket (spanner : 32 mm).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



14W98MC13

(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.



14098MC14

(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 path's 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

1. REMOVAL AND INSTALL OF MOTOR

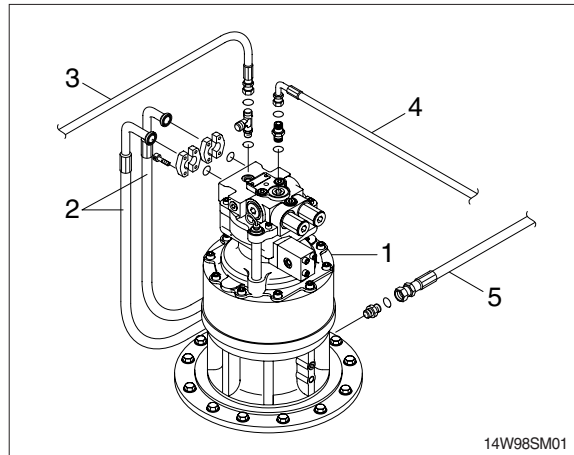
1) REMOVAL

- (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.



13031GE18

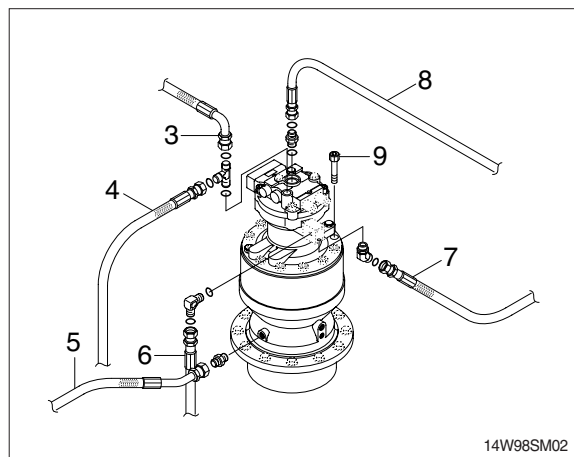
- (4) Disconnect hose assembly (2).
- (5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 9).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (10).
 - Motor device weight : 32kg (71lb)
- (7) Remove the swing motor assembly.
 - ※ When removing the swing motor assembly, check that all the piping have been disconnected.



14W98SM01

2) INSTALL

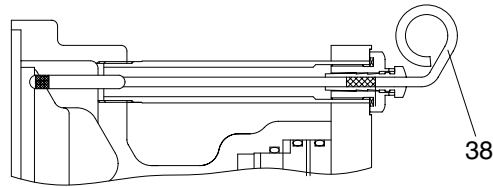
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
 - ① Remove the air vent plug.
 - ② Pour in hydraulic oil until it overflows from the port.
 - ③ Tighten plug lightly.
 - ④ Start the engine, run at low idling and check oil come out from plug.
 -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



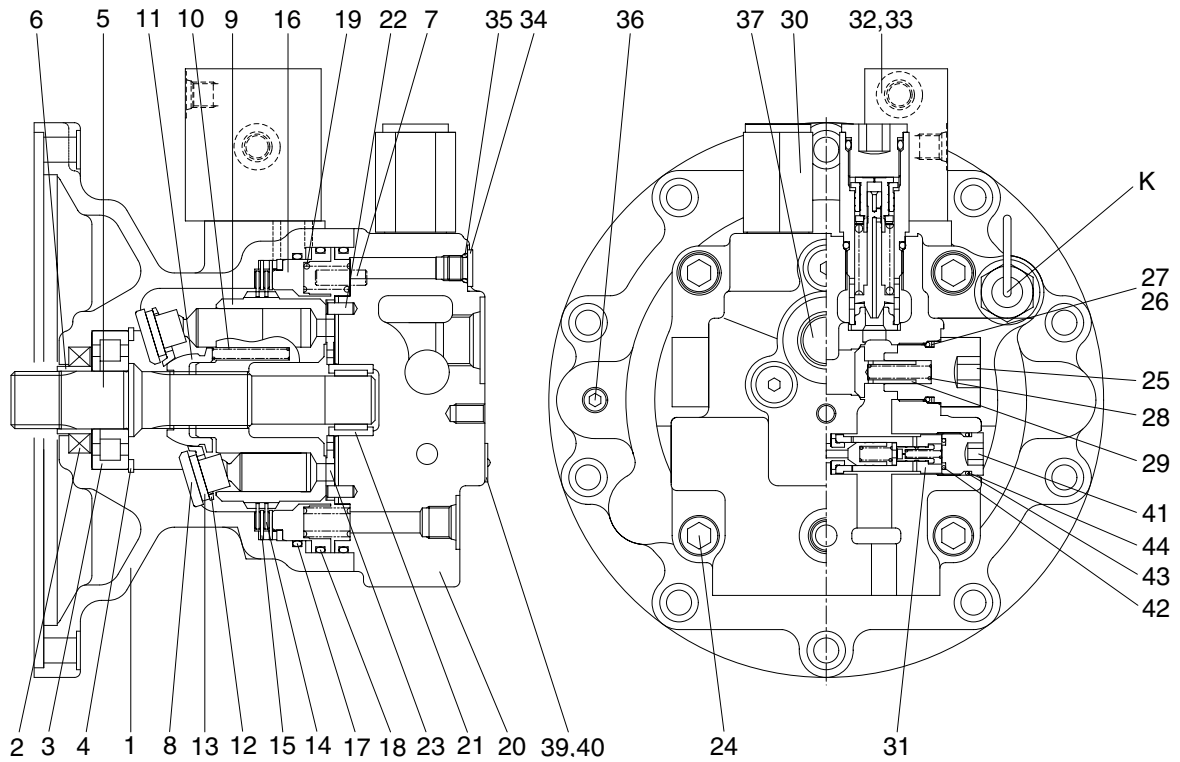
14W98SM02

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



DETAIL K

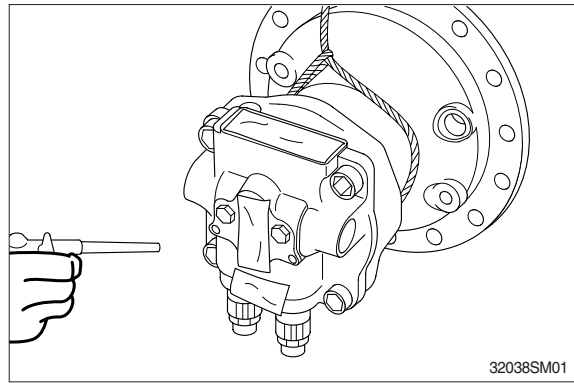


14W92SM02

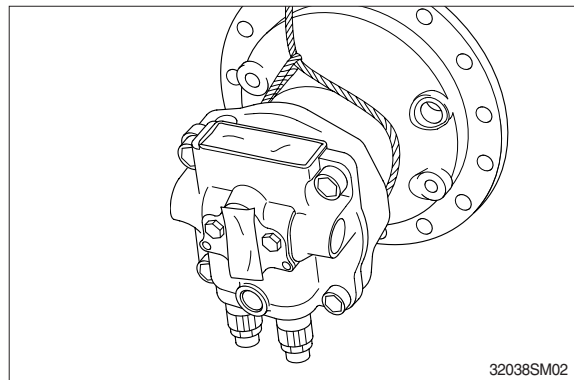
1	Body	16	Brake piston	31	Anti-rotating valve
2	Oil seal	17	O-ring	32	Time delay valve
3	Roller bearing	18	O-ring	33	Wrench bolt
4	Snap ring	19	Brake spring	34	Plug
5	Drive shaft	20	Rear cover	35	O-ring
6	Bushing	21	Needle bearing	36	Plug
7	Pin	22	Pin	37	Plug
8	Shoe plate	23	Valve plate	38	Level gauge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

2) DISASSEMBLY

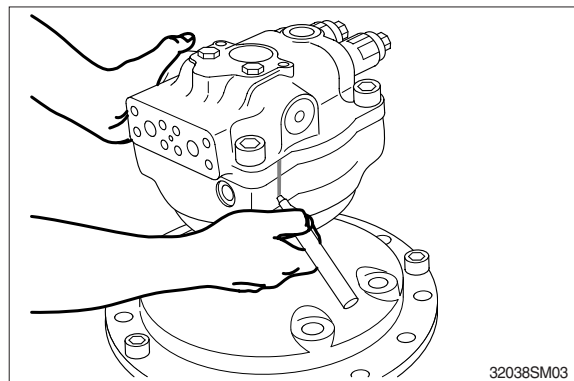
- (1) Lift the motor out. Clean the motor in kerosene and dry with compressed air.
 - ※ To avoid dust inside the motor, mask all the ports of the motor with tapes.



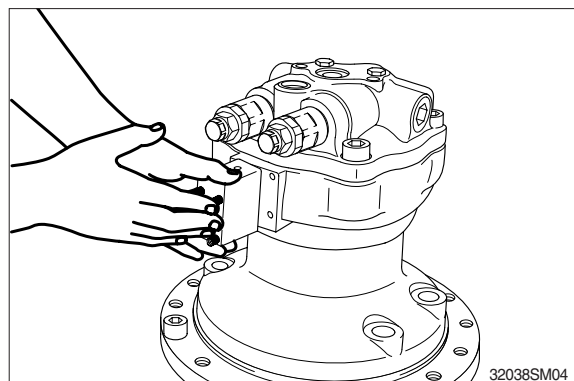
- (2) Loosen the drain plug to discharge oil in the body(1).



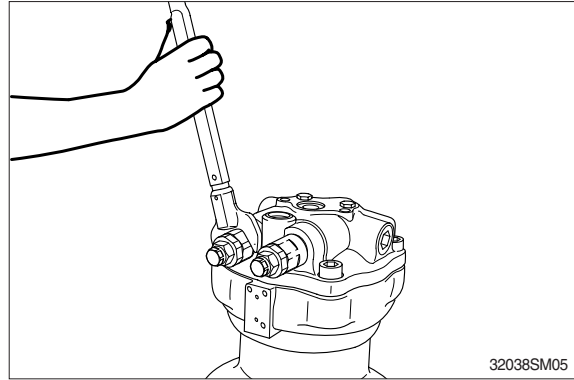
- (3) Fix the drive shaft (5) on the workbench with the end of output shaft down. Put matching marks on body (1) and valve rear cover (20) for easy reassembly.



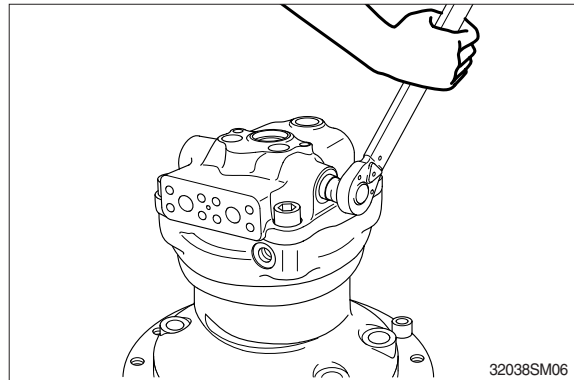
- (4) Remove the valve (32).



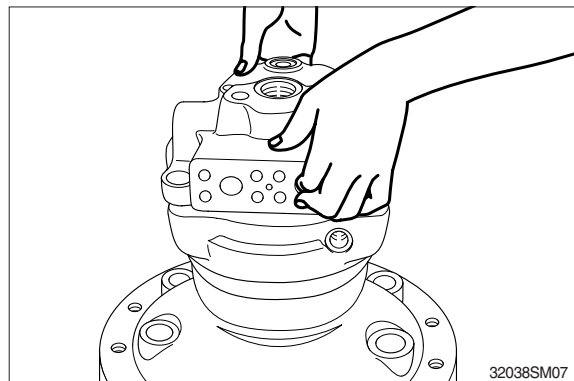
- (5) Remove the relief valve (30) from rear cover (20).



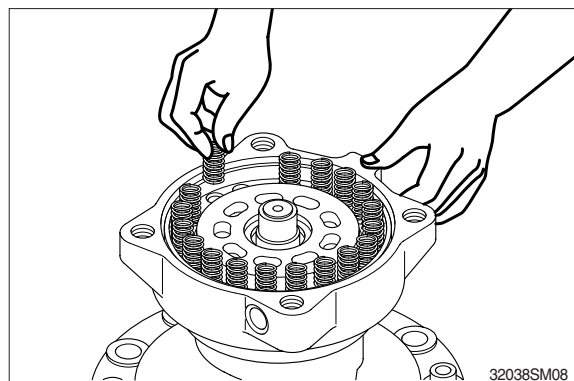
- (6) Remove plug (25) from rear cover (20) and spring (28), check (29).
※ Be careful not to damage the check seat assembly.



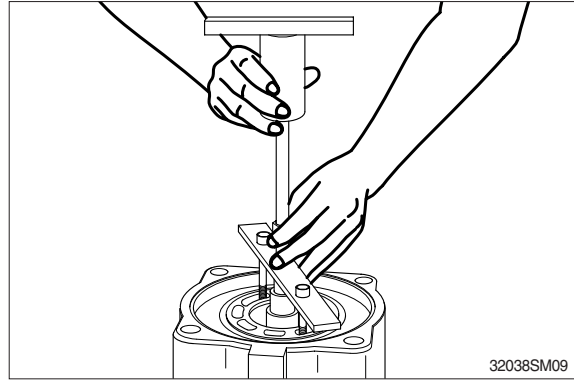
- (7) Remove rear cover (20) from body (1).
Then, remove the valve plate (23) from rear cover (20) with care.



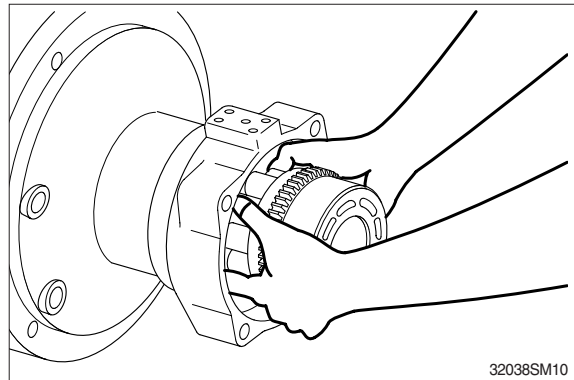
- (8) Remove the brake spring (19) from brake piston (16).



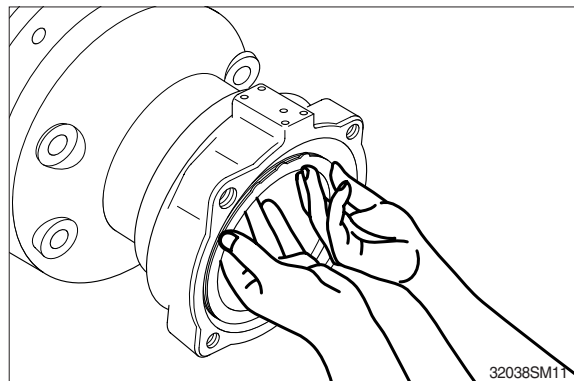
(9) Remove brake piston (16) from body (1).



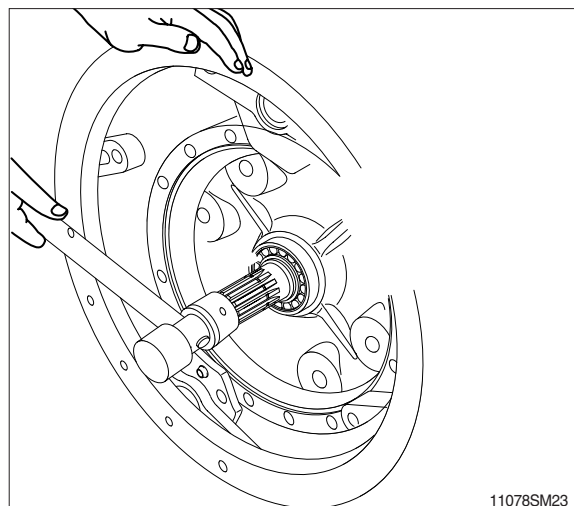
(10) Remove the cylinder (9) from the drive shaft (5) with the motor positioned horizontally. Remove ball guide (11), set plate (12), piston (13) and shoe plate (8).



(11) Remove friction plate (14) and separate plate (15) from body (1).

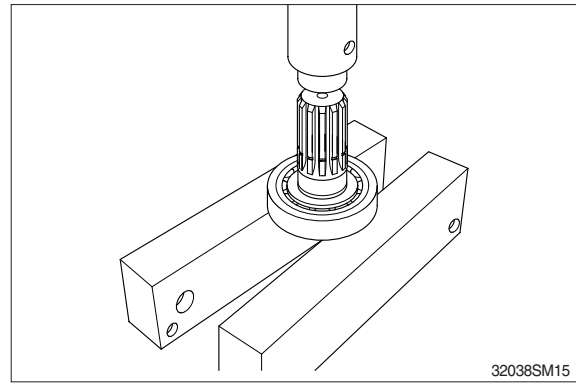
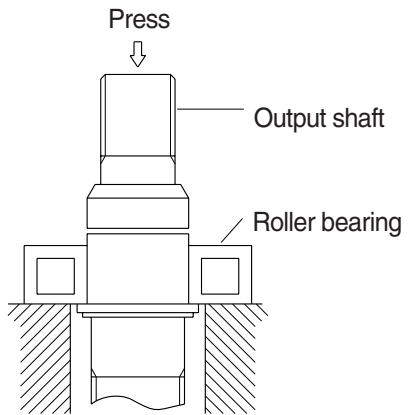


(12) Remove snap ring (4) and remove drive shaft (5) from body (1).

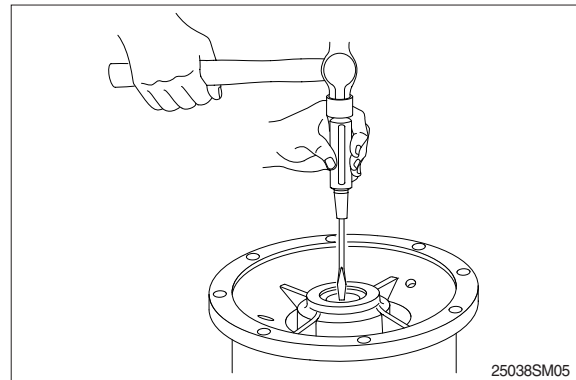


(13) Remove the cone of roller bearing (3) by press.

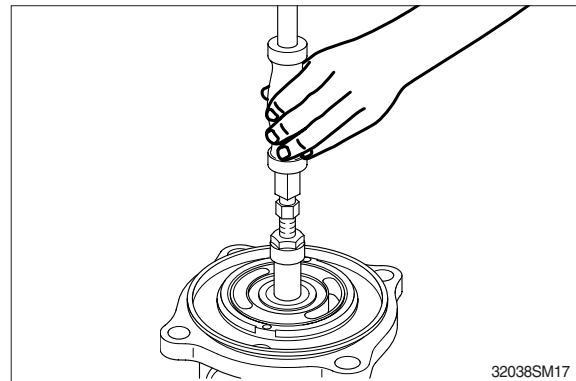
※ Do not reuse bearings.



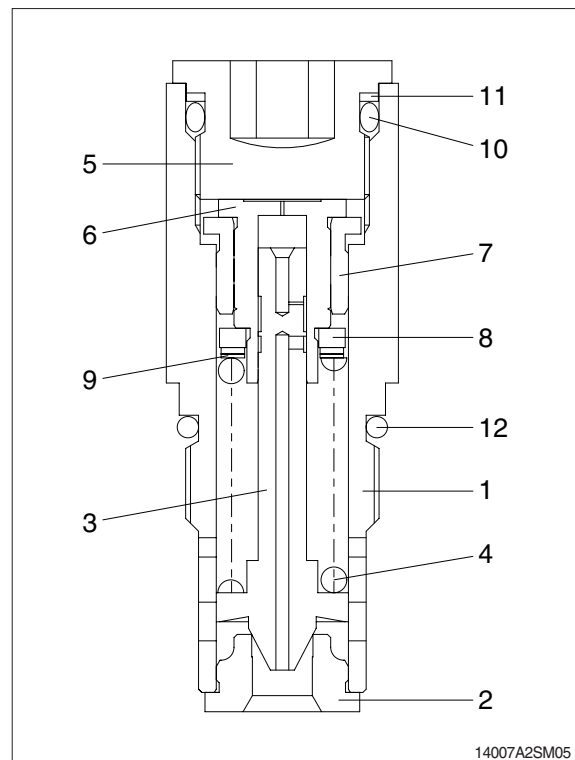
(14) Remove bushing (6) and oil seal (2) from body (1).



(15) Remove the needle bearing (21) from the rear cover (20) by using slide hammer bearing puller.



(16) When disassembling the relief valve, release the adjusting screw (5).
Remove the piston (6), spring seat (8), spring (4) and plunger (3) with the body (1) downwards.

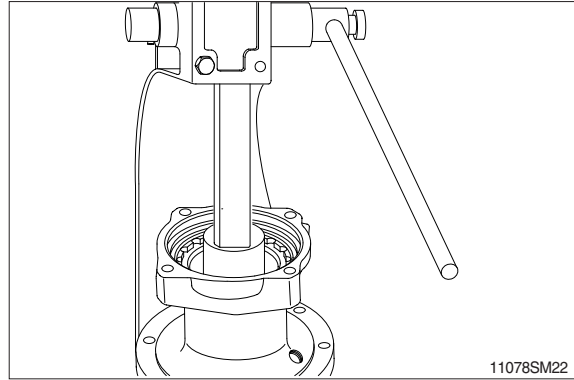


This completes disassembly.

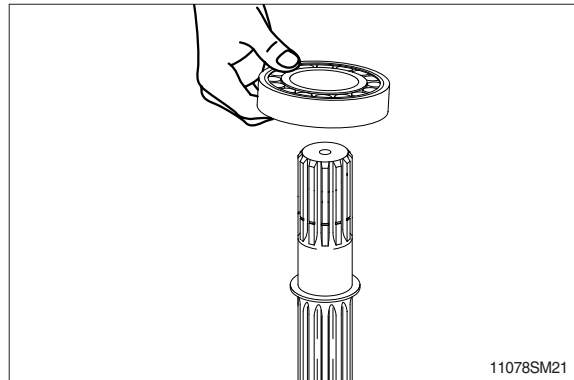
3) ASSEMBLY

Do the reassembly in the reverse procedure of the disassembly.

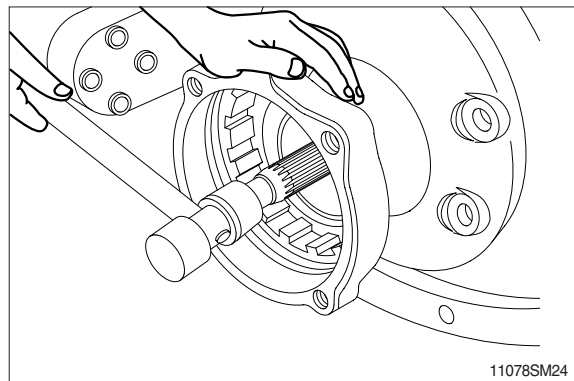
- (1) Apply three bond of white color on outer surface of oil seal (2) and insert it to the body (1).



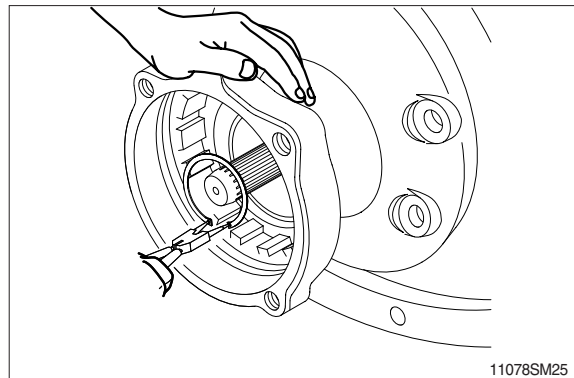
- (2) Install the roller bearing (3) to the drive shaft (5).



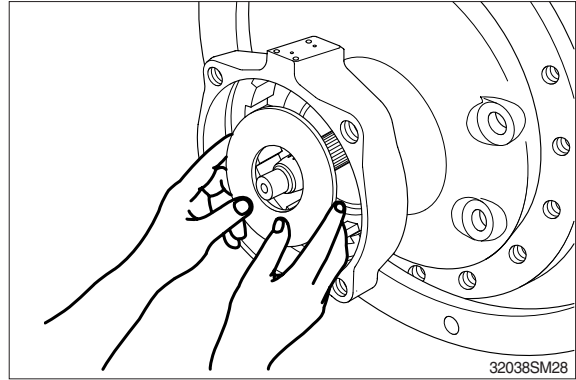
- (3) Insert the drive shaft (5) into the body (1) with the plastic hammer lightly.



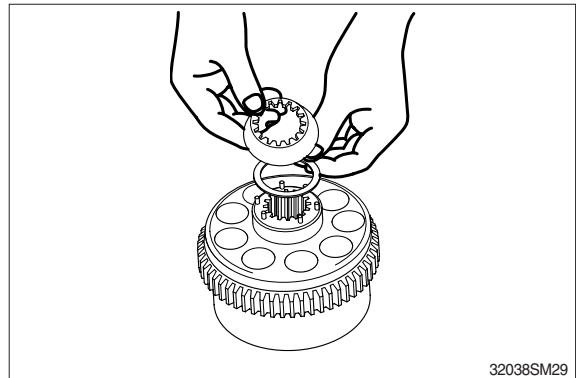
- (4) Install the snap ring (4) to the body (1).



- (5) Insert the shoe plate (8) with the body (1) position horizontally.



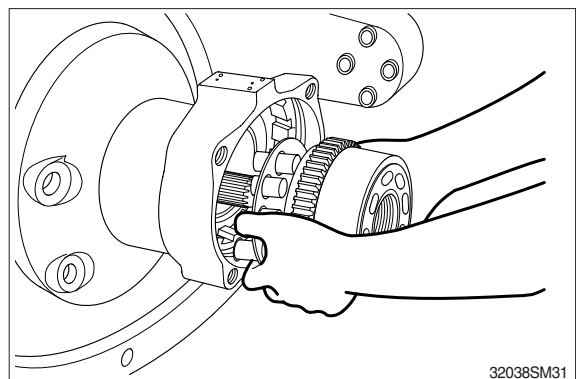
- (6) Insert the ball guide (11) into the cylinder (9).



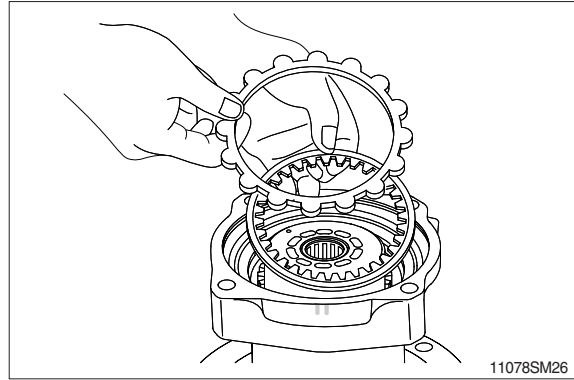
- (7) Install the piston sub-assembly (13) to the set plate (12).



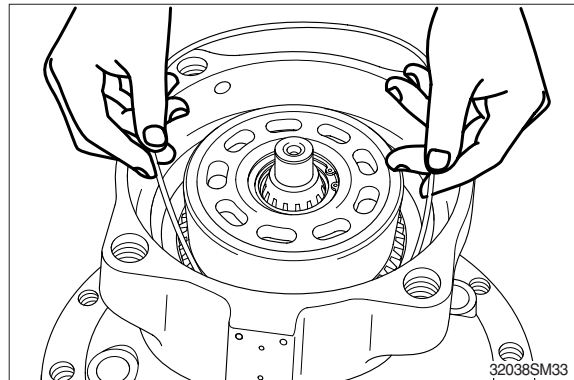
- (8) Reassemble the piston assembly (9) to the body (1).



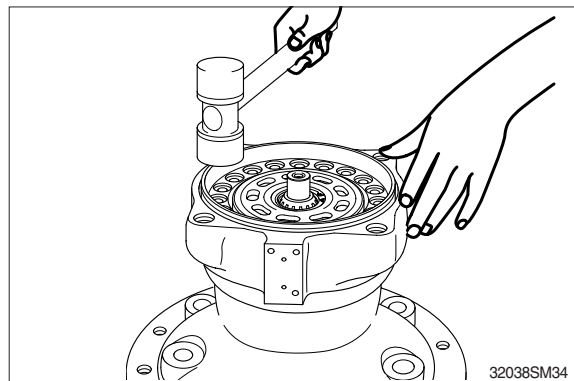
(9) Assembly friction plate (14) and separate plate (15) to the body (1).



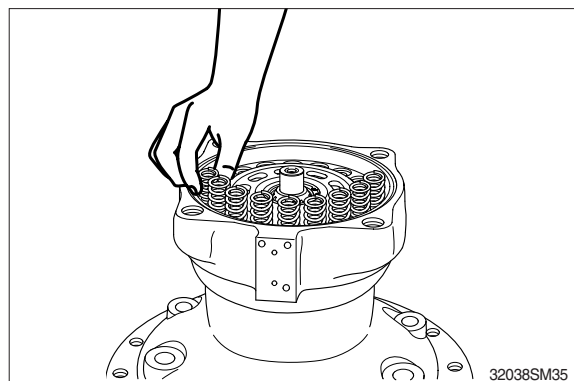
(10) Insert O-ring (17) inside the body (1).



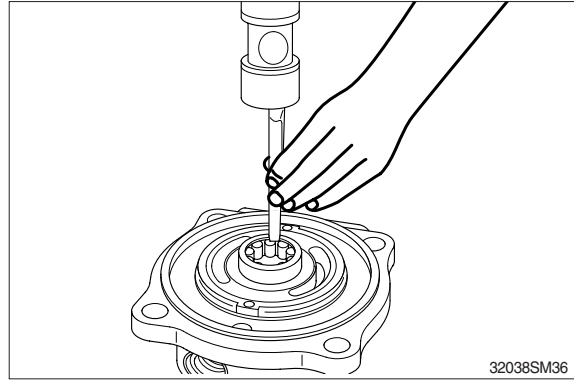
(11) Reassemble brake piston (16) to the body (1).



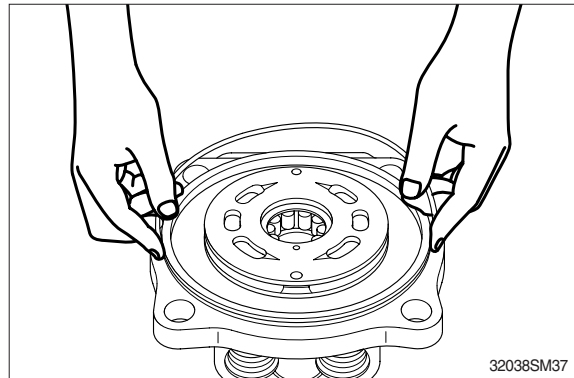
(12) Reassemble brake spring (19) to the brake piston (16).



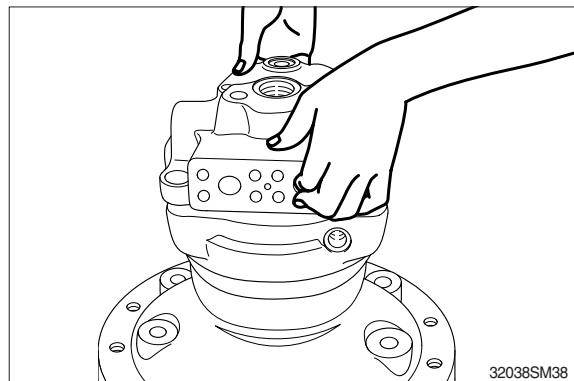
(13) When assembling the needle bearing (21), insert the needle bearing (21) into rear cover (20) by hammering.



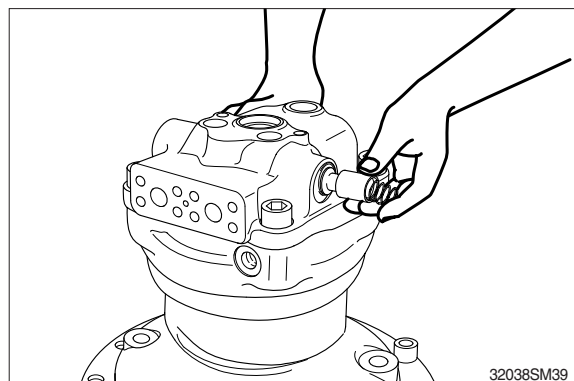
(14) Reassemble valve plate (23) to the rear cover (20) and reassemble O-ring (18).



(15) Connect the rear cover (20) with the body (1) and tighten the wrench bolt (24).

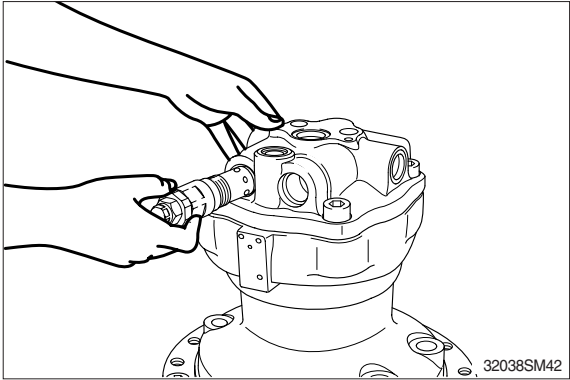


(16) Insert check (29) and spring (28) in the valve casing and install O-ring (27) and back up ring (26). Tighten plug (25) to the rear cover (20).



(17) Insert O-rings to the relief valve (30) and reassemble them to rear cover (20).

This completes assembly.



3. REMOVAL AND INSTALL OF REDUCTION GEAR

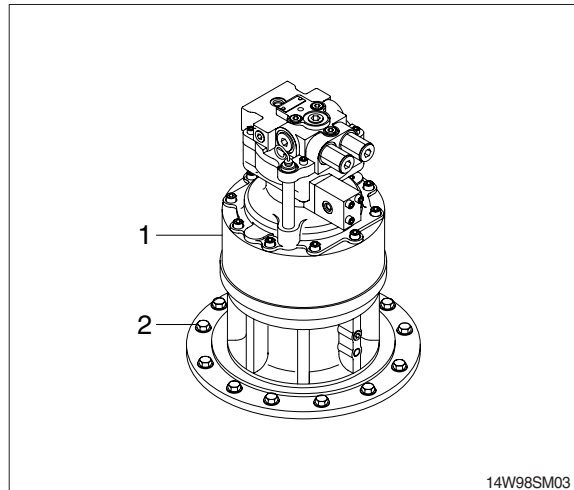
1) REMOVAL

- (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 : 60 kg
(132 lb)



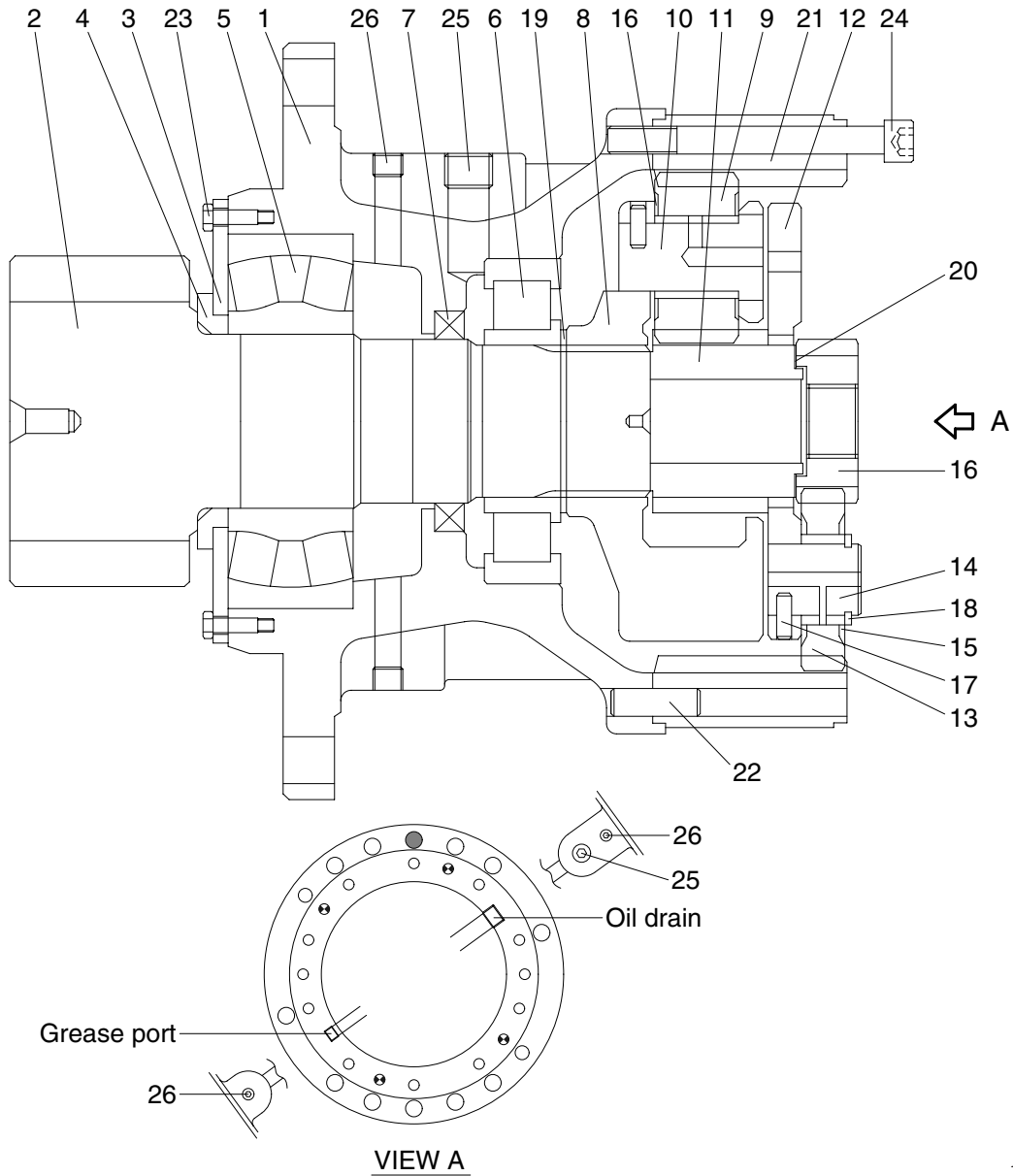
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - Tightening torque : 29.6 ± 3.2 kgf · m
(214 ± 23.1 lbf · ft)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

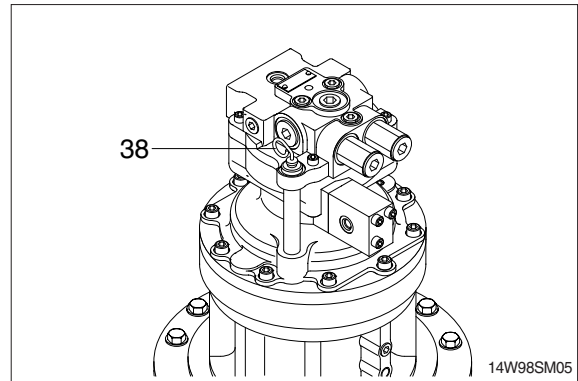


1	Casing	10	Pin No.2 assembly	19	Stop ring
2	Drive shaft	11	Sun gear No. 2	20	Side plate No. 1
3	Cover plate	12	Carrier No. 1	21	Ring gear
4	Spacer	13	Planet gear No. 1	22	Knock pin
5	Roller bearing	14	Pin No.1	23	Hexagonal bolt
6	Roller bearing	15	Thrust washer (B)	24	Socket head bolt
7	Oil seal	16	Sun gear No. 1	25	Plug
8	Carrier No. 2	17	Spring pin	26	Plug
9	Planet gear No. 2	18	Stop ring		

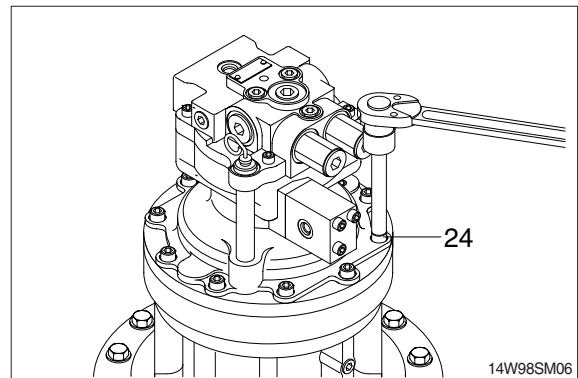
14W92SM03

2) DISASSEMBLY

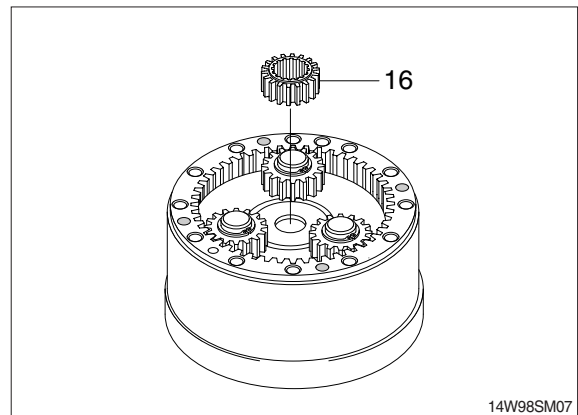
- (1) Remove level gauge (38) from the swing motor casing.
※ Pour the gear oil out of reduction gear into the clean bowl to check out the friction decrease.



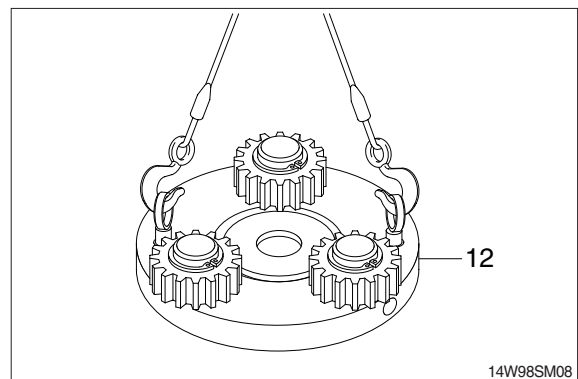
- (2) Loosen the socket bolts (24) to separate swing motor from reduction gear.



- (3) Remove sun gear 1 (16).



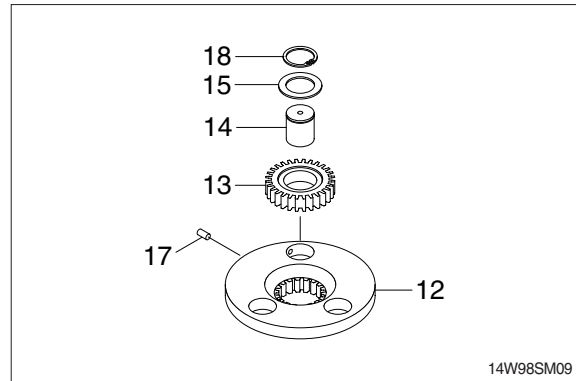
- (4) Tighten two M10 eye bolts to carrier 1 (12) and lift up and remove carrier 1 (12) as subassembly.



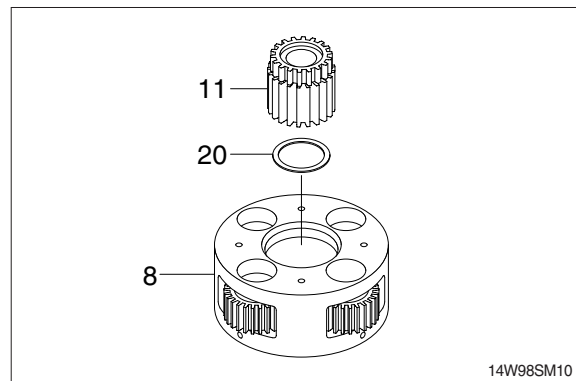
(5) Disassembling carrier 1 (12) assembly.

- ① Remove stop ring (18).
- ② Remove thrust washer (15) and planet gear 1(13) from the carrier 1 (12).
- ③ Using M8 solid drill, crush spring pin (17) so that the pin 1 (14) can be removed by hammering.

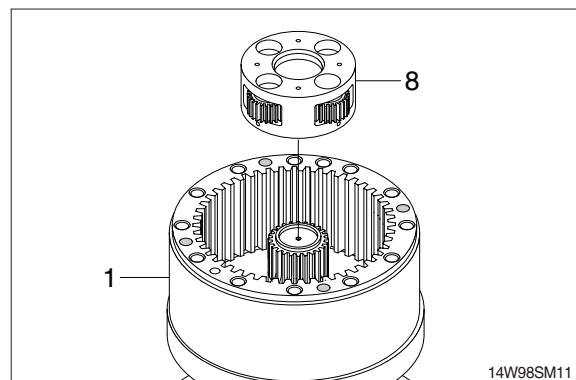
- ※ Do not reuse spring pin (17).
- ※ Do not remove pin 1 (14), carrier 1 (12) and spring pin (17) but in case of replacement.
- ※ Put matching marks on the planet gear 1 (13) and the pin 1 (14) for easy reassembly.



(6) Remove sun gear 2 (11) and side plate 1 (20) from carrier 2 (8).

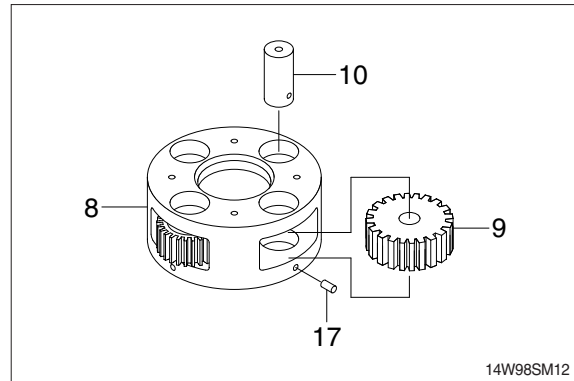


(7) Remove carrier 2 (8) assembly from casing (1).

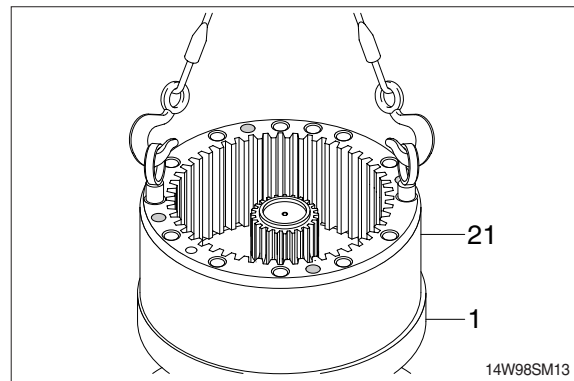


(8) Disassembling carrier 2 (8) assembly.

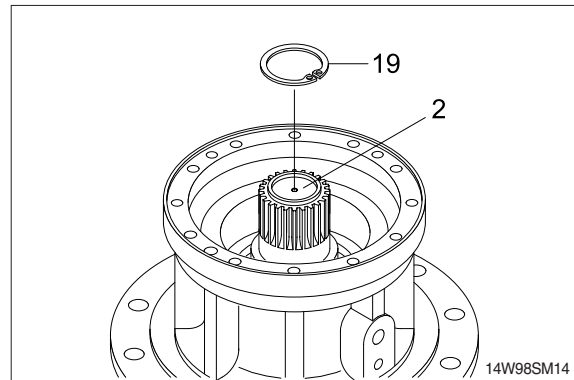
- ① Using M8 solid drill, crush spring pin (17) so that the pin 2 (10) can be removed.
- ※ Do not reuse spring pin (17).
- ② Remove pin 2 (10) and planet gear 2 (9) from the carrier 2 (8).
- ※ Put matching marks on the planet gear 2 (9) and the pin 2 (17) for easy reassembly.
- ※ Do not disassemble pin 2 (10), carrier 2 (8) and spring pin (17) but in case of replacement.



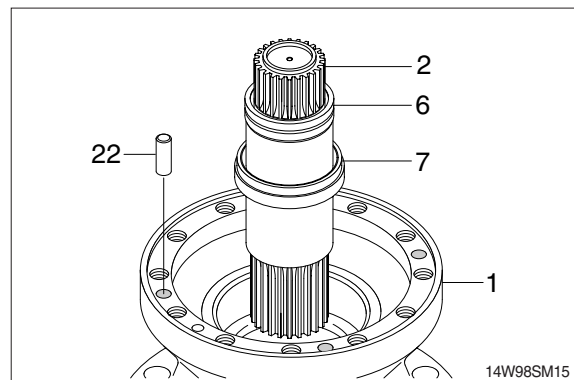
(9) Tighten two M16 eyebolt to the ring gear (21) and then lift the ring gear (21) out of casing (1).



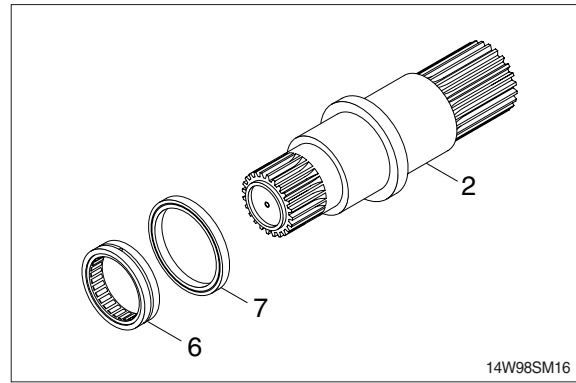
(10) Remove stop ring (19) from the drive shaft (2).



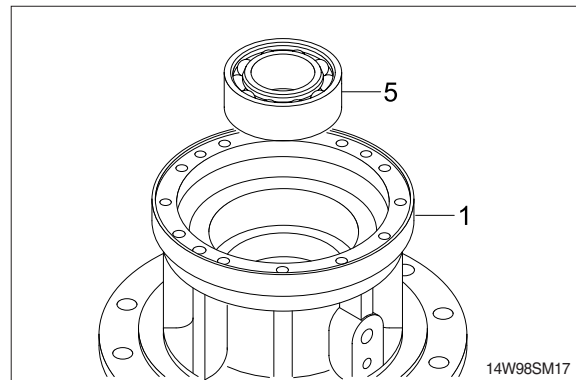
(11) Remove drive shaft (2) with roller bearing (6) and oil seal (7) assembled. Remove knock pin (22) from the casing (1).



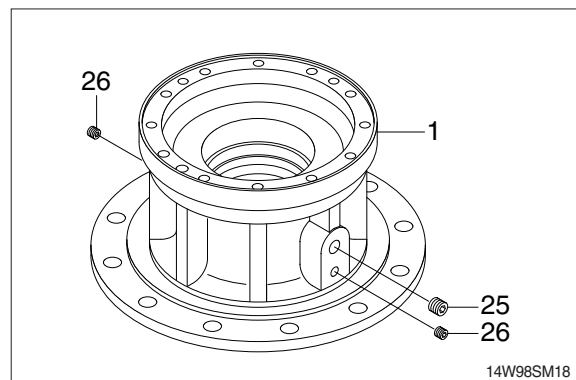
- (12) Remove roller bearing (6) and oil seal (7) from the drive shaft (2).
※ Do not reuse oil seal (20) once removed.



- (13) Using the bearing disassembly tool, remove roller bearing (5).

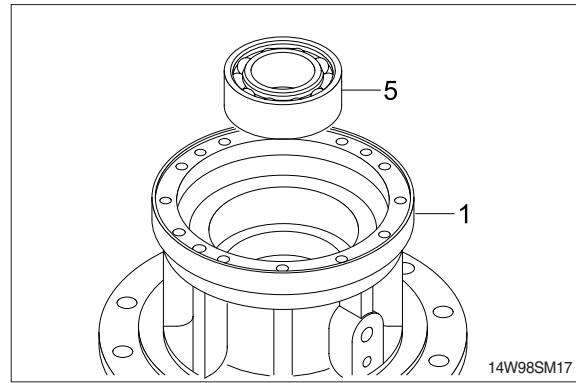


- (14) Remove plugs (25, 26) from the casing (1).

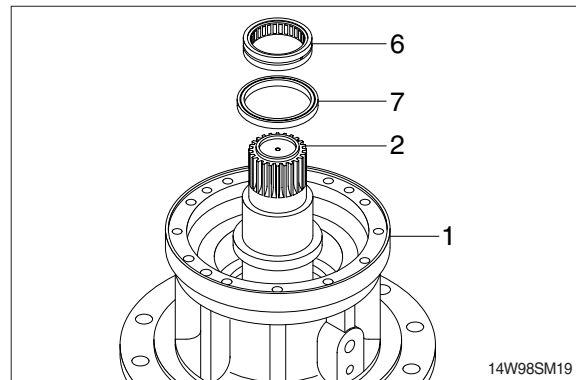


3) ASSEMBLY

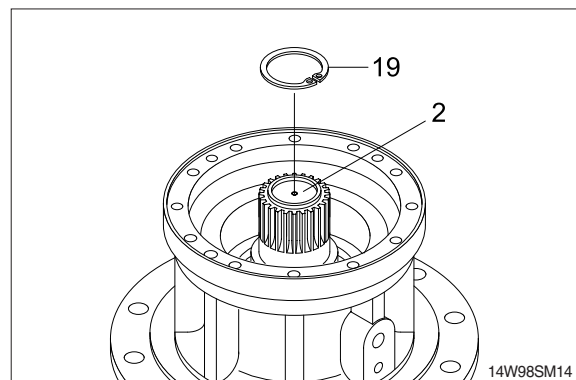
- (1) Assemble roller bearing (5) inside the casing (1).



- (2) Assemble the drive shaft (2) into the casing (1) and then install oil seal (7) and roller bearing (6).



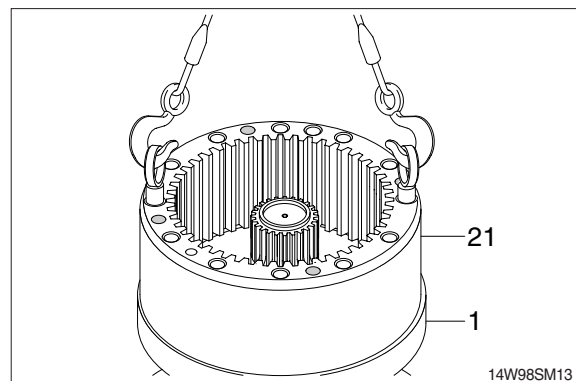
- (3) Install stop ring (19) on top of drive shaft (2).



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

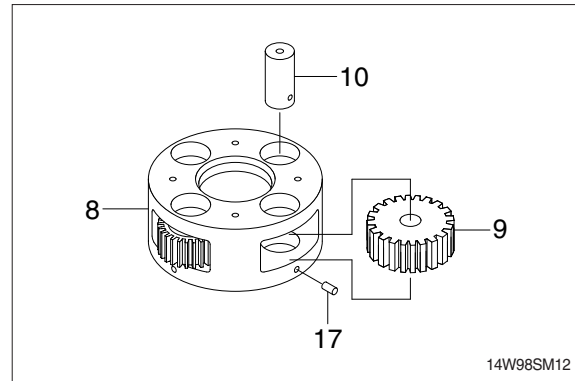
- (5) Tighten 2 M16 eye bolts to the ring gear (21) and lift up and then assemble it onto the casing (1).

※ Don't fail to coincide the knock pin (22) holes.

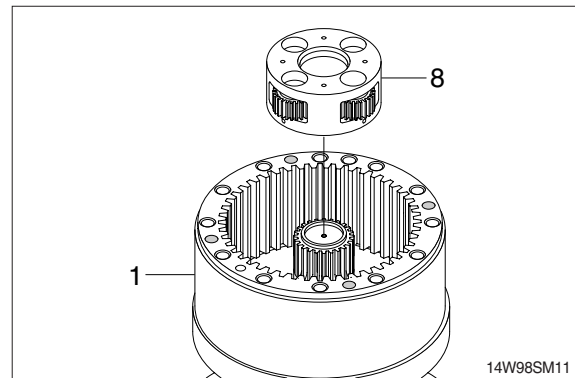


(6) Assembling carrier 2 (8) assembly.

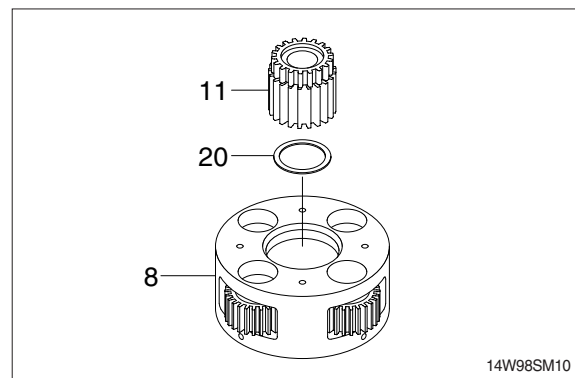
- ① Install the planet gear 2 (9) inside the carrier 2 (8).
 - ② Assemble the pin 2 (10) to the carrier 2 (8) and then press the spring pin (17) by hammering.
 - ③ Punch 2 points of the spring pin (17) lip.
- ※ Take care not to mistake the matching marks of each part.



(7) Assemble carrier 2 (8) assembly correctly to the casing (1).

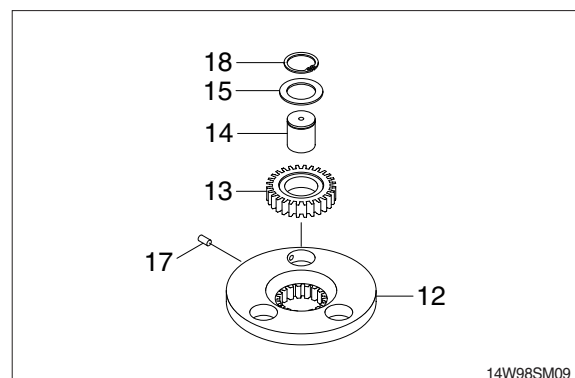


(8) Assemble sun gear 2 (11) and side plate 1 (20) to the center of the carrier 2 (8) assembly.

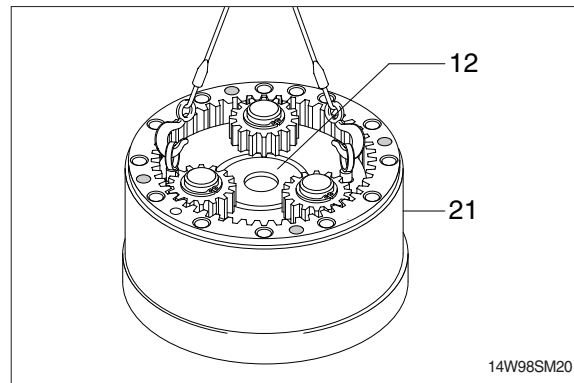


(9) Assembling carrier 1 (12) assembly.

- ① Assemble the pin1 (14) to the carrier 1 (12) and then press the spring pin (17) by hammering.
 - ② Punch 2 points of the spring pin's (17) lip.
 - ③ Assemble thrust washer (15), planet gear 1 (13), and then stop ring (18) to the pin 1 (14).
- ※ Take care not to mistake the matching marks of each part.

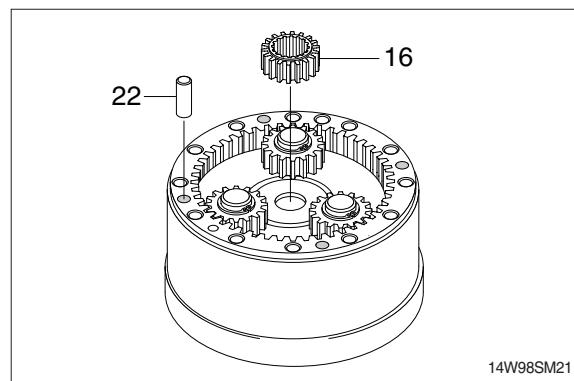


(10) Assemble carrier 1 (12) assembly into the ring gear (21).



(11) Hammer 4 knock pins (22) around the ring gear (21).

(12) Assemble sun gear 1 (16) to the drive shaft of the swing reduction gear.

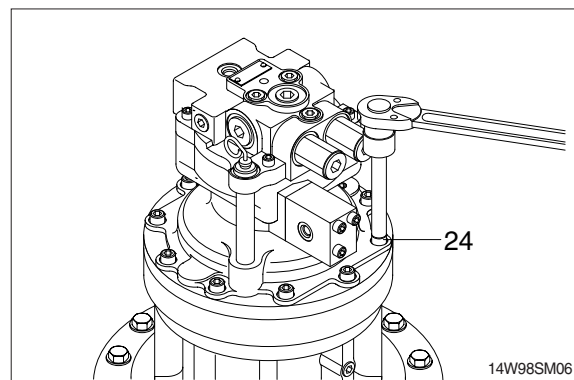


(13) Apply loctite to the tapped holes of the ring gear (21) and then mount swing motor onto the ring gear (21).

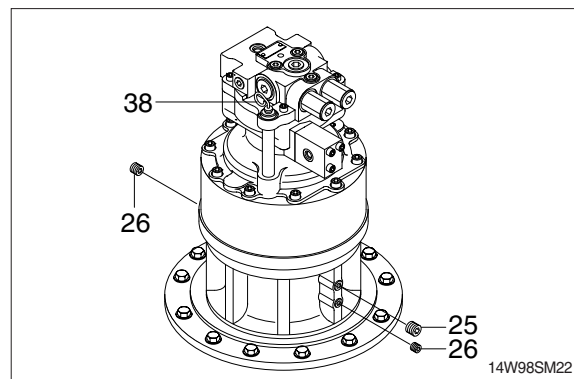
※ Don't fail to coincide the gauge bar hole.

(14) Tighten socket bolts (24) around the swing motor assembly.

· Tightening torque : 13.5 kgf · m (98 lbf · ft)



(15) Assemble plugs (25, 26) and level gauge (38).



GROUP 6 TRAVEL DEVICE

■ TRAVEL MOTOR (TYPE 1)

1. REMOVAL AND INSTALL

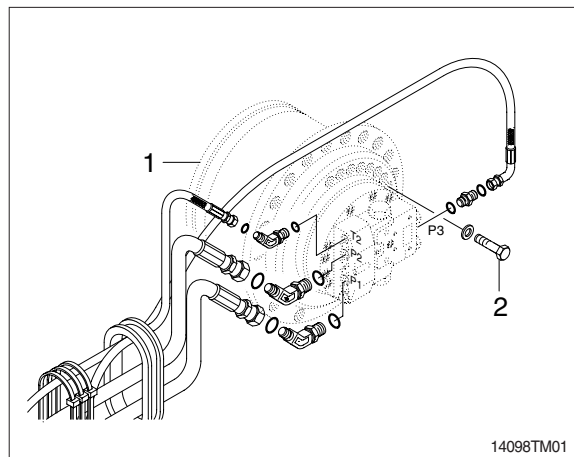
1) REMOVAL

- (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 track shoe assembly.
For details, see **removal of track shoe assembly**.
- (5) Remove the cover.
- (6) Remove the hose.
※ Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 240 kg (530 lb)

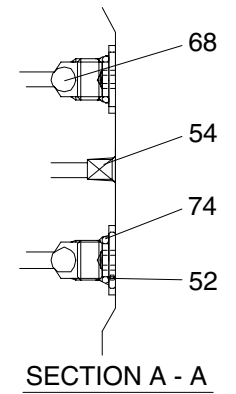
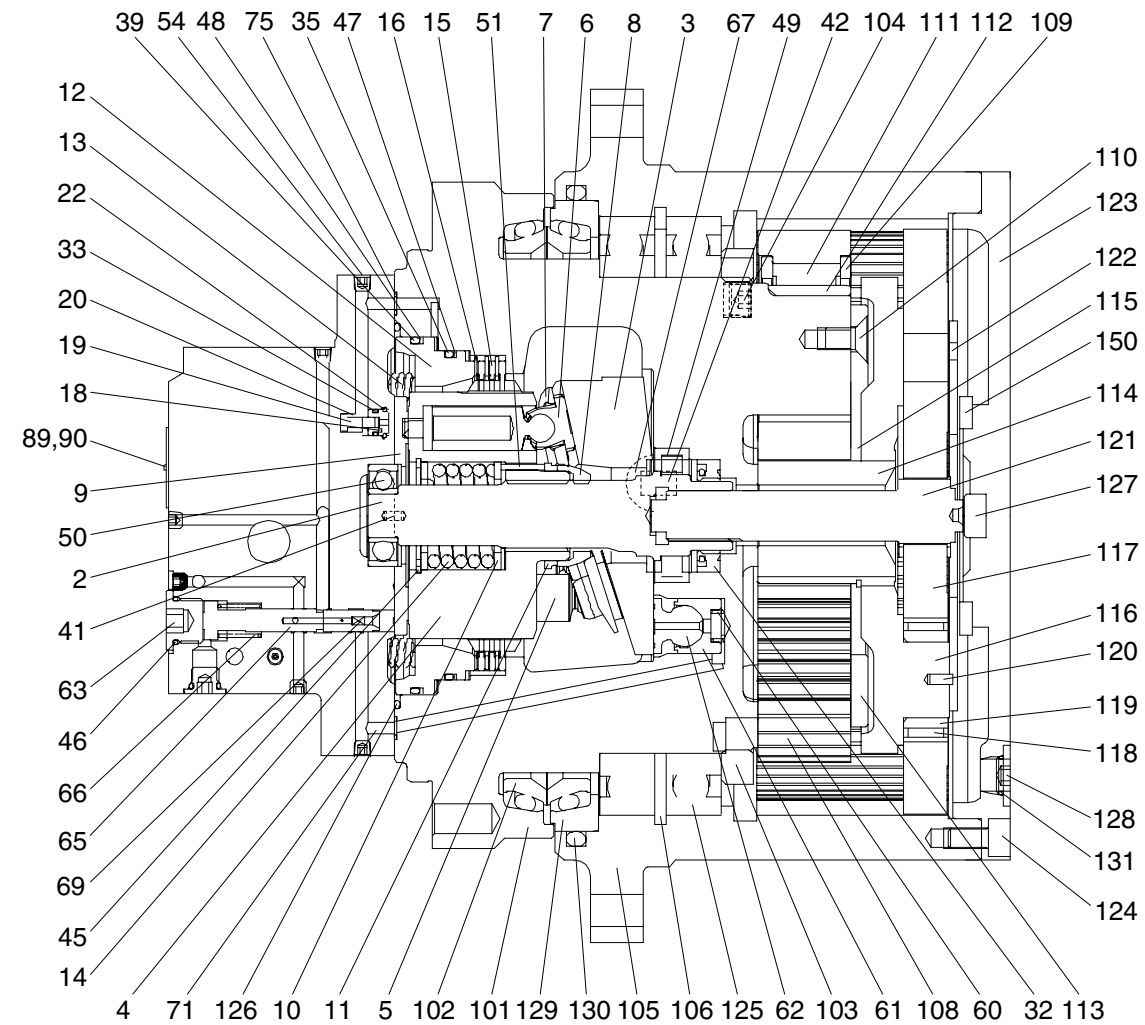
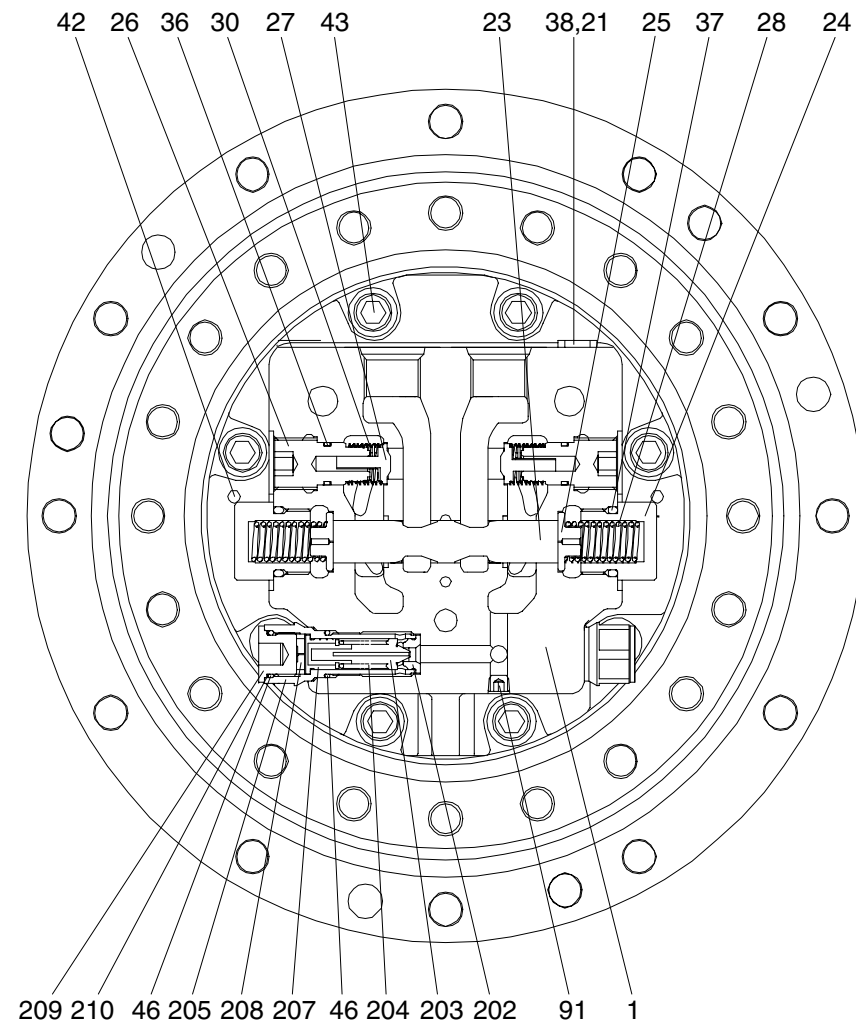


2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel 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. TRAVEL MOTOR

1) STRUCTURE



- | | | | | | |
|-------------------|--------------------|-------------------|-------------------|--------------------|---------------------|
| 1 Rear flange | 19 Valve | 39 O-ring | 65 2 Speed spool | 108 Planetary gear | 125 Angular bearing |
| 2 Shaft | 20 Spring | 41 Parallel pin | 66 2 Speed spring | 109 Thrust washer | 126 O-ring |
| 3 Swash plate | 21 Plug | 42 Parallel pin | 67 Pivot | 110 Screw | 127 Thrust washer |
| 4 Cylinder block | 22 Ring | 43 Socket bolt | 68 Steel ball | 111 Needle bearing | 128 Plug |
| 5 Piston | 23 Main spool | 45 Snap ring | 69 Set screw | 112 Collar | 129 Seal ring |
| 6 Shoe | 24 Main plug | 46 O-ring | 71 Orifice | 113 Thrust plate | 130 O-ring |
| 7 Retainer plate | 25 Retainer spring | 47 Back up-ring | 74 O-ring | 114 Sun gear | 131 O-ring |
| 8 Thrust ball | 26 Check plug | 48 Back up-ring | 75 O-ring | 115 Snap ring | 150 Thrust plate |
| 9 Timing plate | 27 Check valve | 49 Roller bearing | 89 Name plate | 116 Holder | 205 Body |
| 10 Washer | 28 Main spring | 50 Ball bearing | 90 Set screw | 117 Planetary gear | 206 Shim |
| 11 Washer-collar | 30 Check spring | 51 Roller | 91 Plug | 118 Needle bearing | 207 Piston |
| 12 Piston-parking | 32 Oil seal | 52 Plug | 101 Spindle | 119 Inner race | 208 Rod |
| 13 Spring | 33 O-ring | 54 Plug | 102 Floating seal | 120 Spring pin | 209 Plug |
| 14 Spring | 35 O-ring | 60 Spring | 103 Nut ring | 121 Drive gear | 210 Back up-ring |
| 15 Friction plate | 36 O-ring | 61 Piston | 104 Plug | 122 Thrust plate | |
| 16 Mating plate | 37 O-ring | 62 Shoe | 105 Hub | 123 Cover | |
| 18 Seat valve | 38 O-ring | 63 Plug | 106 Snap ring | 124 Socket bolt | |

14092TM03

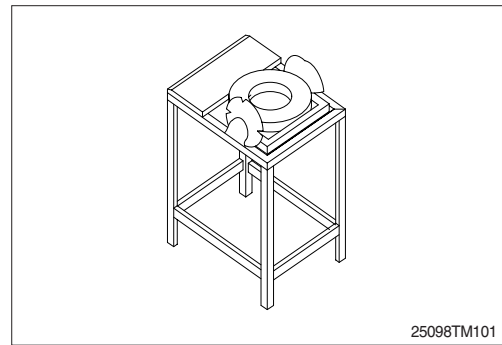
2) TOOLS

(1) Standard tools

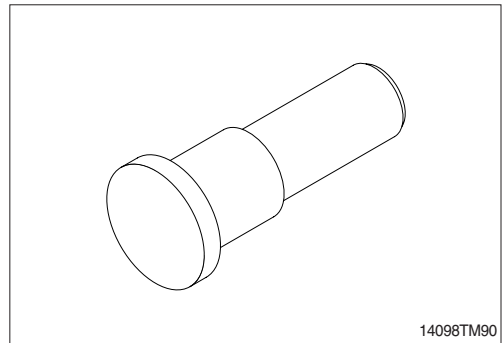
No.	Name	Description/Size	Qty
1	Hexagon wrench (JIS B 4650)	6 (M8) (PT1/4), 8 (M10)	each 1
		10 (M12) (PF1/2)	each 1
		4 (M6)	1
2	Socket wrench	-	1
3	Torque wrench	Nominal 30 kgf · m dial type	1
		Nominal 90 kgf · m dial type	1
4	Adapter for torque wrench	Socket 26, 27, 36	each 1
		Bar 4, 5, 6, 8, 10	each 1
5	Extension bar (JIS B 4637)	150 mm	1
6	Hammer (JIS B 4613)	12	1
7	Plastic hammer	L=300	1
8	(-) driver	150 mm	1
9	Snap ring plier	For shaft, For hole	1
10	Hanger	Weight : over 300 kgf	1
		Eye bolt (M16)	2
		Eye bolt (M10)	2
		Eye bolt (PF 1/2)	2
		Wire	1
11	Press	Press capacity above 200 kgf	1
12	Compressed air	3~5 kgf/cm ² , nozzle	1
13	Vessel	General vessel : W450 × D300 × H120	2
14	Heating vessel	Heating capacity : over 100°C	1
		Volume : 500 × 500 × 500	
15	Depth micro-meter	Measuring range : 0.04 ~ 0.3 mm	1
16	Air hammer	BRH-8 (compressed air 5~6 kgf/cm ²)	1
17	Sealant	Silicone rubber (780-RTV)	1

(2) Special tools

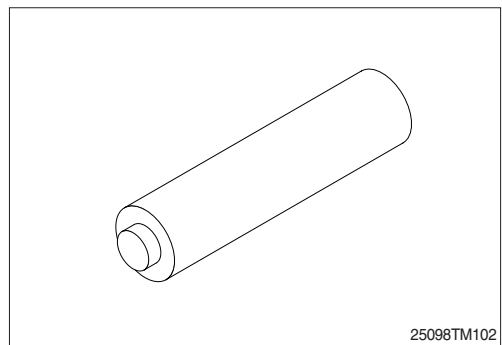
① Inversion working bench



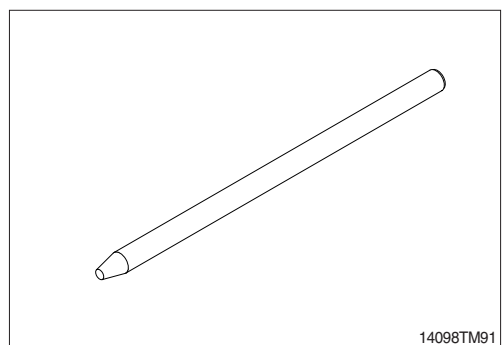
② Pressurize jig (I)



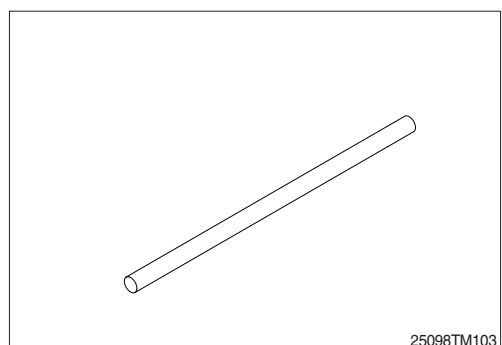
③ Pressurize jig (II)



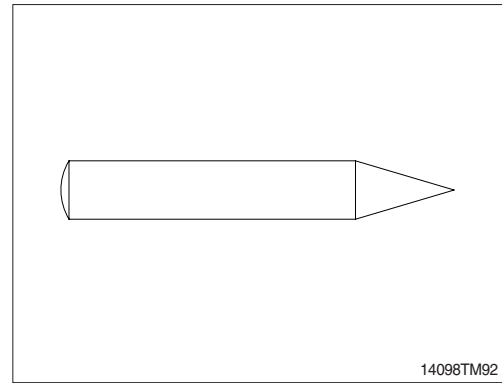
④ Aluminum bar



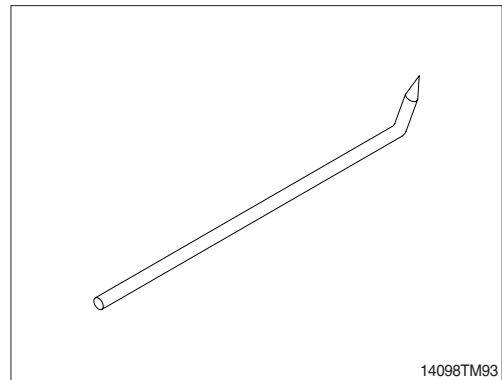
⑤ Steel bar



⑥ Sharp punch



⑦ Draw bar



3) TIGHTENING TORQUE

Item No.	Parts name	Size	Qty	Tightening torque	
				kgf · m	lbf · ft
21	Plug	PF 3/8	1	10 ± 2	72.3 ± 14.5
24	Plug	M30×1.5	2	36 ± 7.2	260 ± 52.1
26	Plug	M24×1.5	2	17 ± 3.4	123 ± 24.6
43	Socket bolt	M10×1.5	8	5.9 ± 1.2	42.7 ± 8.7
52	RO plug	PF 1/4	4	3.0 ± 0.5	21.7 ± 3.6
54	Plug	NPTF 1/16	7	1.0 ± 0.25	7.2 ± 1.8
63, 209	Plug	PF 1/2	1	3.0 ± 0.5	21.7 ± 3.6
91	Plug	PT 1/8	4	1.25 ± 0.2	9 ± 1.4
104	Plug	PT 3/8	3	6.0 ± 0.9	43 ± 6.5
110	Screw	M6	4	0.83 ± 0.12	6 ± 0.9
128	Plug	PF 3/8	3	6.0 ± 0.9	43 ± 6.5
124	Socket bolt	M8	12	1.25 ± 0.2	9 ± 1.4
205	Body	M20	1	12 ± 1.5	86.8 ± 10.8
301	Plug	PF 1 1/2	1	26 ± 5.2	188 ± 37.6

3. DISASSEMBLY

3.1 GENERAL PRECAUTIONS

- 1) Spread rubber or vinyl cover on the work bench.
- 2) When disassembling the travel motor, provide a match mark on the mating face of each part.
- 3) Arrange the detached parts to prevent them from being damaged or lost.
- 4) The disassembled seals must be replaced with new ones as a rule even if they are free from damage. For disassembly, therefore, prepare new seals in advance.

3.2 DISASSEMBLY PROCEDURE

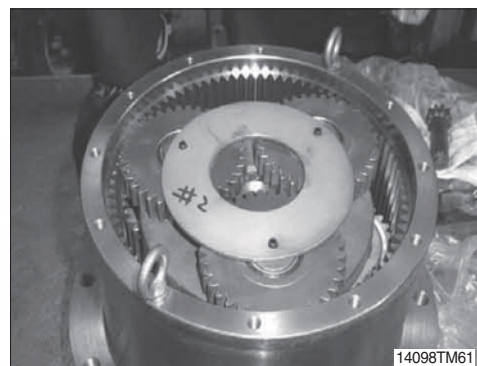
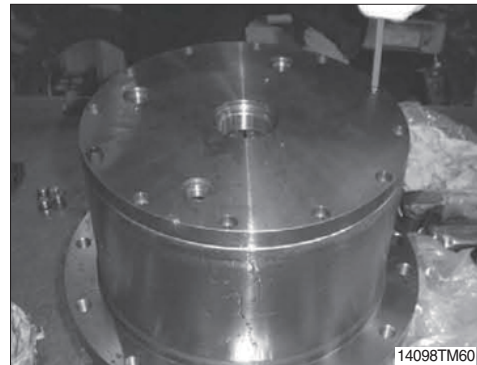
- 1) When inspecting or repairing the travel motors, use the disassembling procedures described below.
- 2) Numerals in brackets () following the part name denote the item numbers used in the structure drawing at page 8-68.
- 3) Prior to disassembly, install the travel motor on an inversion working bench.

3.3 DISASSEMBLING ORDER

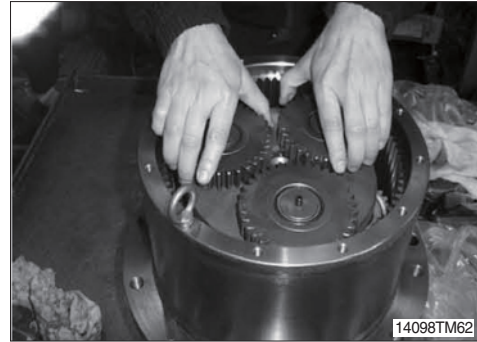
1) DISASSEMBLING THE REDUCTION GEAR PART

- (1) Remove plugs (128, 3EA) and drain the reduction gear oil.
- (2) Loosen socket bolts (124, 16EA) and remove the cover (123).
 - ※ Remove the cover (123), after hook it, fit the eye bolt in a screw hole for use of the plug (128). If it's impossible, please remove the cover using the rod.
 - ※ You can have difficulty removing it because loctite is spread in the socket bolt (124).
 - ※ Tools
 - Hexagon wrench 6, 8

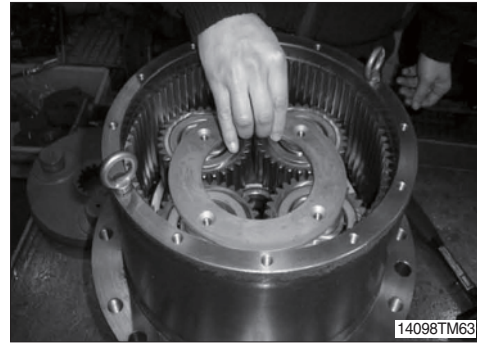
- (3) Remove thrust plate R (122) and drive gear (121).



(4) Remove planetary gear R (117), needle bearing, inner race (119) and holder (116) from hub (105).



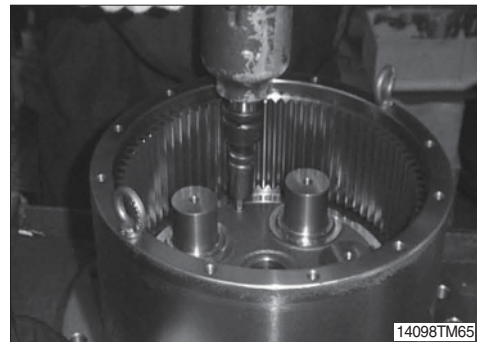
(5) Remove sun gear (114), screw (110) and thrust plate F (113).



(6) Remove the thrust washer (109), planetary gears F (108), needle bearings (111) and collar (112) from hub (105).



(7) Remove the plugs (104, 3EA).

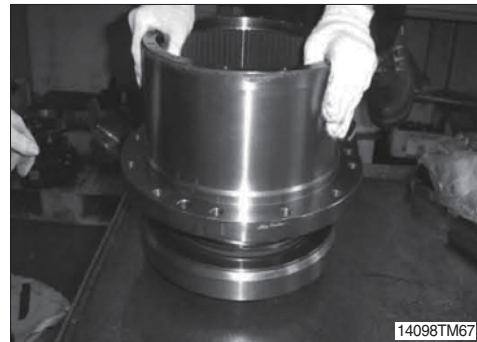


(8) Remove the nut ring (103) from hub (105).

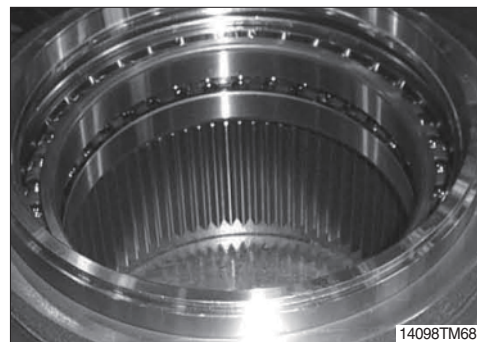


(9) Remove the spindle (101) from the hub (105).

※ Remove it using a crane after eye bolt is assembled at the hub (105).



(10) Remove the floating seal (102), seal ring (129), angular bearings (125, 2EA), snap ring (106) and O-ring (130) from the hub (105).

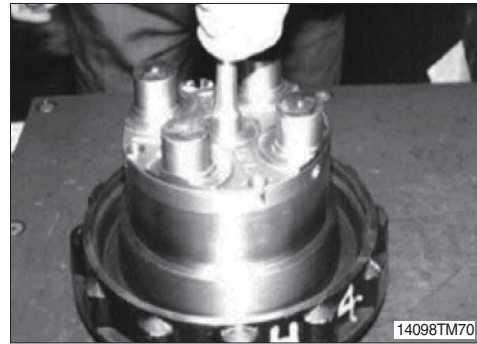


(11) Remove the floating seal (102) from the spindle (101).

※ User can remove easily if using (-) drivers.



(12) Remove the oil seal (32) from spindle (101).

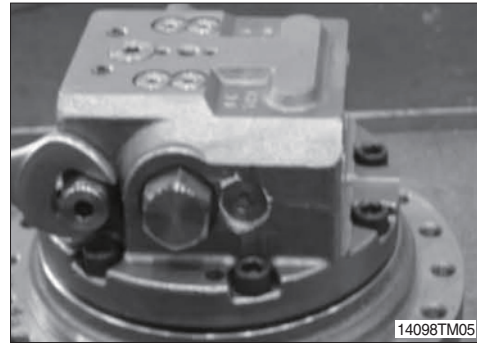


2) DISASSEMBLING THE HYDRAULIC MOTOR PART

(1) Remove the relief valve (70, 2EA) from rear flange (1).

※ Tools

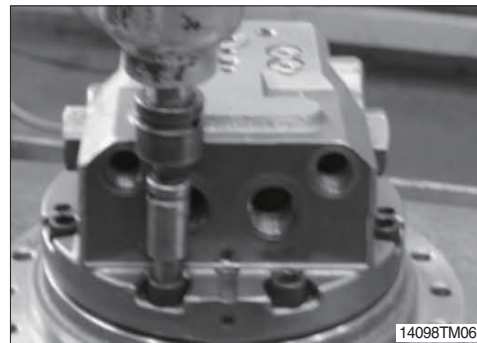
- Hexagon socket
- Torque wrench



(2) Remove hexagon socket head bolts (43, 8EA) from the rear flange (1).

※ Tools

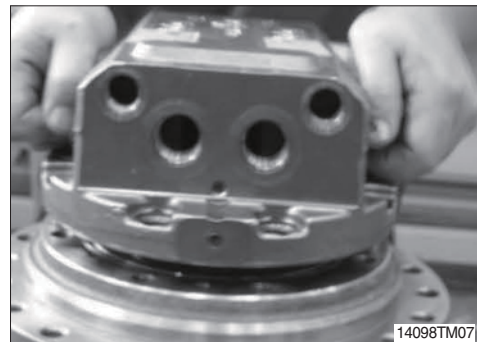
- Hexagon wrench 8



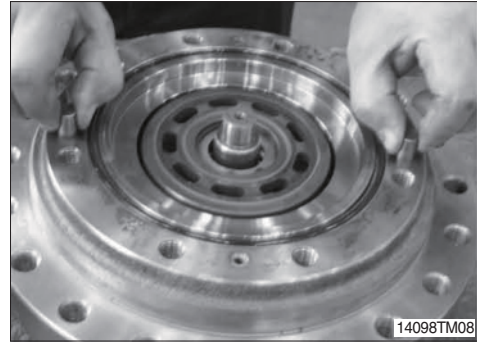
(3) Remove the rear flange (1) from the spindle (101).

(4) Remove the springs (13, 10EA) from the rear flange [1].

※ Remove the rear flange (1) carefully after taken using hands. Be careful not to detach the timing plate (9) and the spring (13) if twisted or beated by constraint.

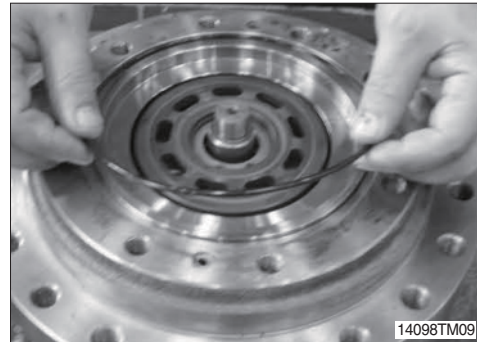


(5) Remove the parallel pin (42) from the spindle (101).



(6) Remove the O-ring (126) from the spindle (101).

※ Do not reuse the O-ring (126).



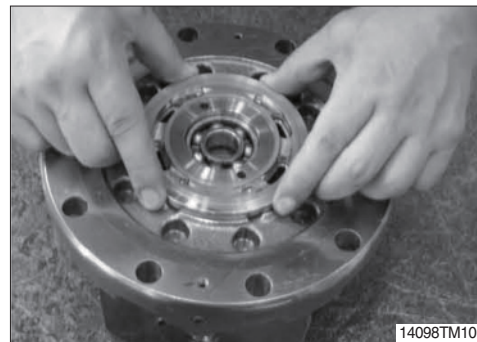
(7) Disassembling the rear flange (1) part

① Place the rear flange with the contact surface of the spindle upward.

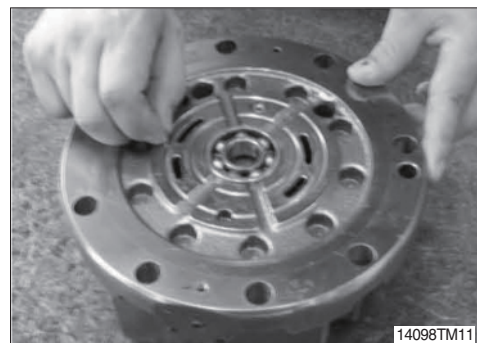
② Remove the timing plate (9) from the rear flange (1).

※ When removing the timing plate, user can have difficulty of the removal due to the close adhesion of rear flange (1) and oil. Remove it after fitting a rod through the hole which is used when a casting is detached.

※ Be careful of the leakage due to both surface scratch if using a sharp tool.



③ Remove the parallel pin (41) from the rear flange (1).

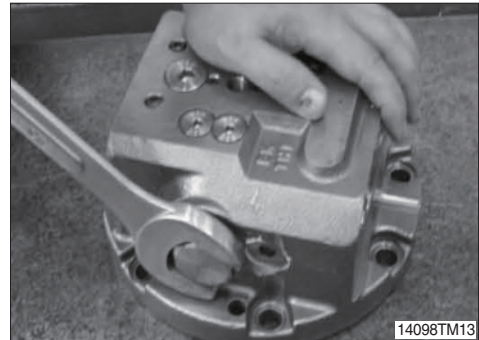


- ④ Remove the ball bearing (50) from the rear flange (1).

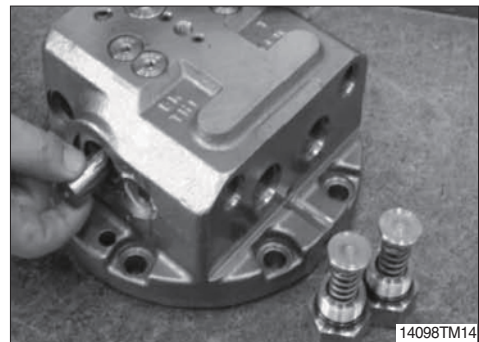


(8) Disassembling the brake valve part

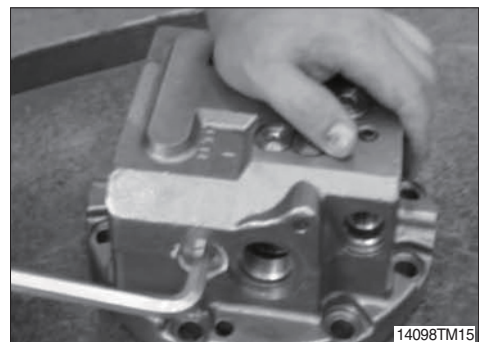
- ① Remove two plugs (24) from the rear flange (1).
- ※ User can work easily if sub-disassembly was done on the reversal table.
 - ※ Tools
 - Hexagon wrench 36
 - Torque wrench



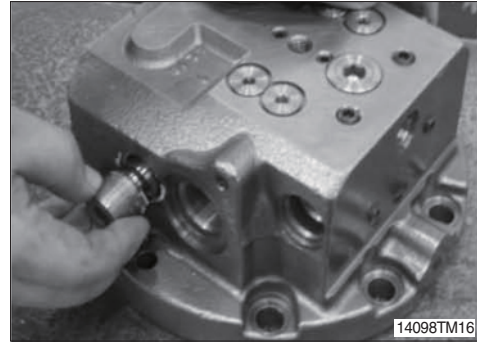
- ② Take out two spring retainers (25), two springs (28) from the rear flange (1).
- ③ Remove the spool (23) from the rear flange (1).
- ※ Be careful not to damage the outer surface of the spool (23) and the sliding surface of the rear flange (1).
 - ※ Since the rear flange (1) and the spool (23) are of the selective fitting type, replace them together as a kit even if only one of the two parts is damaged.



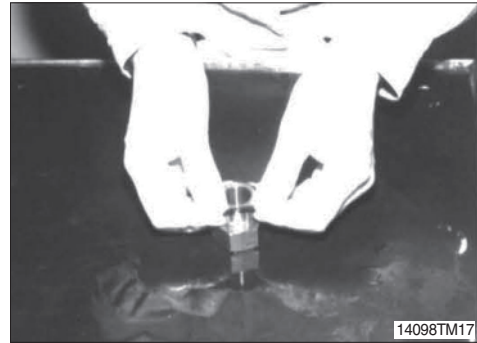
- ④ Remove two plugs (26) from the rear flange (1).
- ※ User can work easily if sub-disassembly was done on the reversal table.
 - ※ Tools
 - Hexagon wrench 10



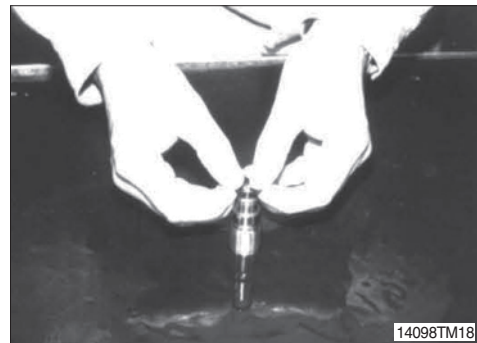
- ⑤ Remove the springs (30, 2EA), valves (27, 2EA) from rear flange (1).



- ⑥ Remove the O-ring (37) from plug (24).
※ Do not reuse the O-ring (37).

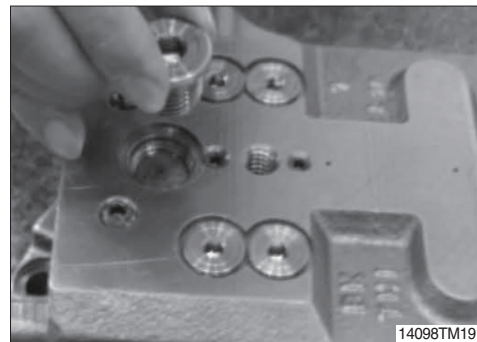


- ⑦ Remove the O-ring (36) from plug (26).
※ Do not reuse the O-ring (36).

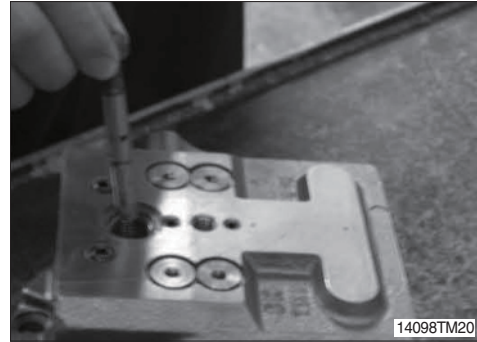


(9) Disassembling the two speed change valve

- ① Remove the plug (63) from the rear flange (1).
※ User can work easily if sub-disassembly was done on the reversal table.
※ Tools
· Hexagon wrench 10



- ② Remove the spool (65) and spring (66) from rear flange (1).



(10) Disassembling the plug (52).

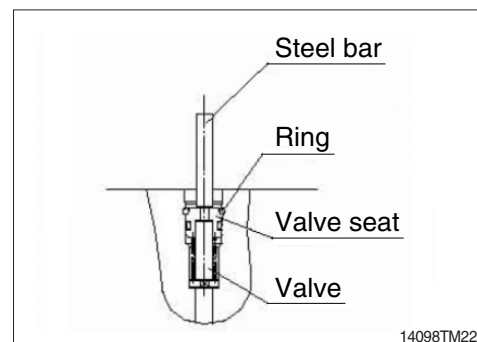
- ① Do not remove plug (52) if it not to be necessary.
Disassembling the plug (52) if it was malfunction because of get mixed with dust.
Clean the plug (52) after disassembled.
- ※ Be careful not to drop the steel ball (68).

(11) Disassembling the parking brake valve (19)

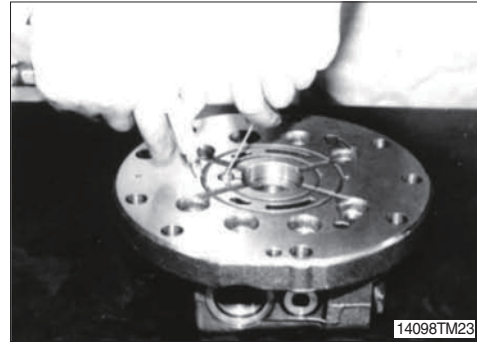
- ① Mount the rear flange (1) on a working bench that the mounting side of the spindle (101) faces upward.
- ② Pushing valve seat (18) by a steel bar, disassemble ring (22) from rear flange (1).



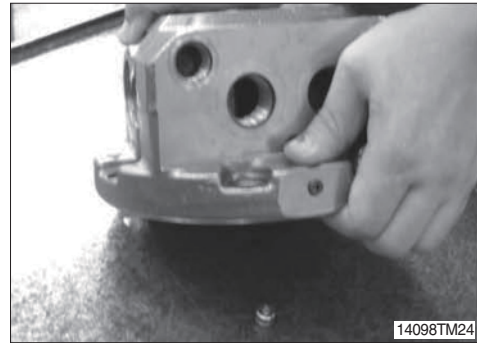
- ※ Do not remove ring (22) if it not to be replace.
- ※ Do not reuse the ring (22), valve seat (18) and O-ring (33).



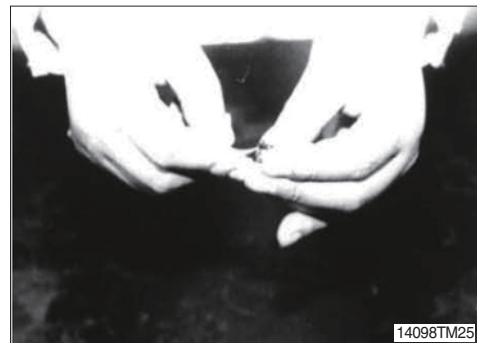
- ③ Remove the valve seat (18) by injecting compressed air from the access hole in the spindle (101) after caulking the hole of valve seat (18).



- ④ Remove the valve (19) and spring (20) from rear flange (1) downside hole with shaking lightly.

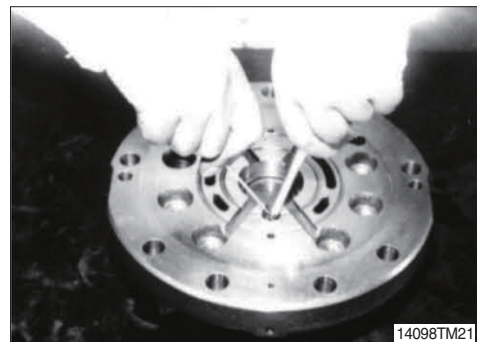


- ⑤ Remove the O-ring (33) and valve seat (18).
※ Do not reuse the O-ring (33).



(12) Disassembling the parking brake

- ① Remove the piston (12) by injecting compressed air from the parking brake access hole in the spindle (101).
※ Use the protection cover on the upper part of spindle (101) when users put the pressed air into suddenly. Otherwise part damage and accident might go on because the piston (12) is rushed out of the spindle (101).



② Remove the O-rings (35, 39) and backup rings (47, 48) from the piston (12).

※ Do not reuse O-rings (35, 39) and backup rings (47, 48) after removal.

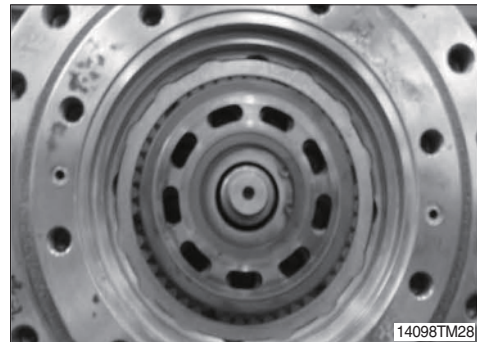


(13) Disassembling the hydraulic motor part

① Lay the travel motor body on the side.

② Drain out the oil from the travel motor.

※ Place an oil receptacle under the travel motor to receive the oil flowing out as the motor is being laid on the side.

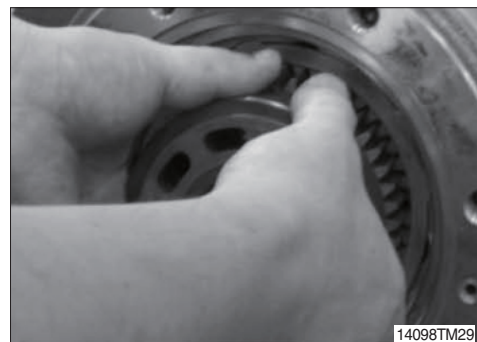


③ Hold the cylinder block (4) with both hands, and remove it from the shaft (2).

④ Remove the mating plates (16) and friction plates (15) from the cylinder block (4).

※ Before removal, hold the cylinder block (4) with both hands and turn it two to three times in a clockwise and a counterclockwise direction alternately to detach the shoe (6) from the swash plate (3).

※ Be careful that if an attempt is made to remove the cylinder block (4) without detaching the shoe (6) from the swash plate (3), then the piston, shoe and other parts that are connected to the cylinder block may come the cylinder loose and fall into the spindle (101).



(14) Disassembling the cylinder block kit

- ① Piston assembly [piston (5), shoe (6)] from the removed cylinder block (4).



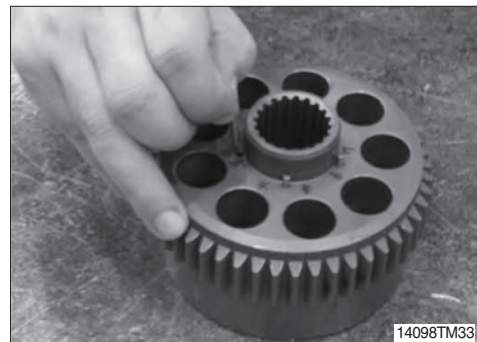
- ② Piston (5) and shoe (6) from the removed retainer plate (7).



- ③ Thrust ball (8) from the removed cylinder block (4).



- ④ Roller (51, 5EA) from the removed cylinder block (204).



(15) Disassembling the spring of the cylinder block

- ① Put the cylinder block (4) on the pressurize jig.
 - ② Press the washer (10) with pressurize jig, and remove the spring (14) after snap ring (45) removed.
- ※ Put a vinyl cover on the sliding surface of cylinder block (4) for protection.
 - ※ Do not remove spring (14) if it not to be replace.

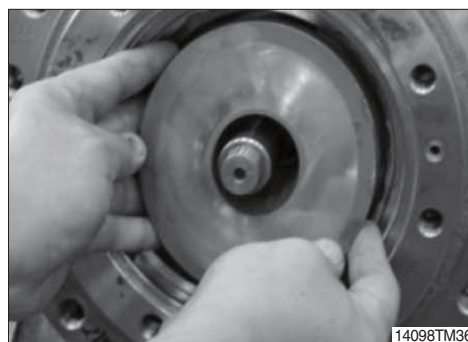


- ③ Remove the snap ring (45), washer (10), spring (14) and washer (10) from cylinder block (4).

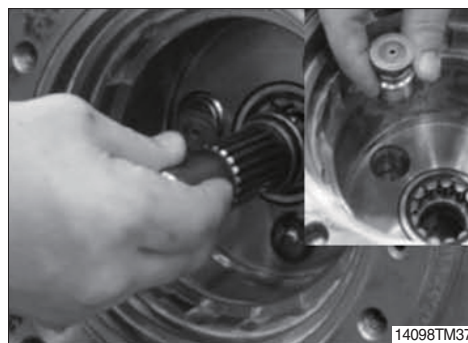


(16) Disassembling the shaft

- ① Remove swash plate (3) from the shaft (2).
 - ② Remove shaft (2) from the spindle (101).
- ※ When separating the swash plate, separate and turn it by using hands to free from intervention of the stopper.



- ③ Remove speed selector piston assembly [piston (61) and shoe (62)] from the spindle [101] by feeding compressed air into the access hole in spindle (101).
 - ④ Remove parallel pins (42, 2EA) and pivots (67, 2EA) from the spindle (101).
 - ⑤ Remove roller bearing (49) from the spindle (101).
- ※ Piston assembly ; Piston (61), Shoe (62)
 - ※ Compressed air ; 3~5 kgf/cm² (43~71 psi)
 - ※ When piston (61) or shoe (62) is damaged, if exchange is necessary, they have to be exchanged together because the separation is impossible. Use the protection cover on the upper part spindle when users put the compressed air into suddenly. Otherwise part damage and accident might go on because the piston is rushed out of the spindle.



4. REASSEMBLY

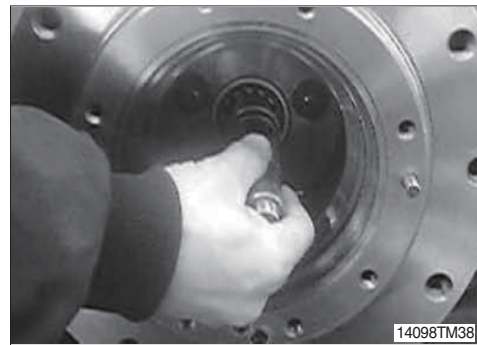
4.1 GENERAL PRECAUTIONS

- 1) Reassemble in a work area that is clean and free from dust and dirt.
- 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 travel 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.

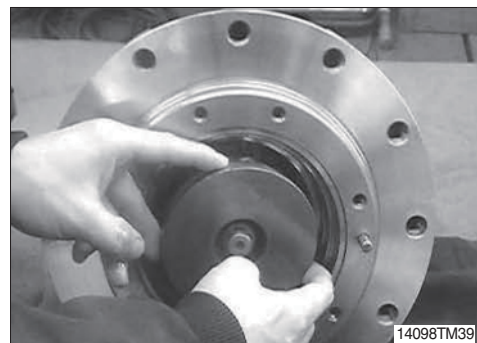
4.2 REASSEMBLY PROCEDURE

1) REASSEMBLE THE HYDRAULIC MOTOR PART

- (1) Install roller bearing (49) into the spindle (101).
 - (2) Install pivots (67, 2EA), parallel pin (42, 2EA) and two speed piston assembly (61, 62) into the spindle (101).
 - (3) Install shaft (2) into the roller bearing (49) assembled spindle (101).
- ※ Be careful not to damage the seal (3) of assembling part.



- (4) Lay the travel motor body on the side.
- (5) Apply lithium grease to the shaft (2)'s spline part.
- (6) Install swash plate (3) to the spindle (101).



(7) Reassemble the cylinder block kit

- ① Install washer (10), spring (14, 9EA), washer (10) and snap ring (45) in that order, into the cylinder block (4) inner part.
- ② Put the cylinder block (4) on the pressurize jig.

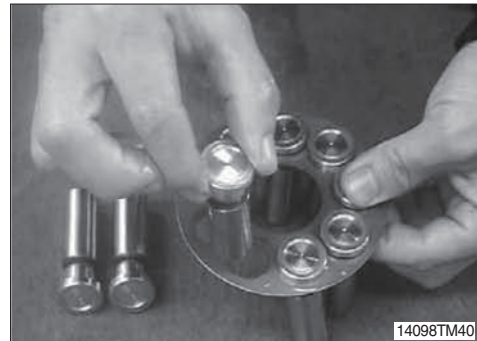


- ③ While pressing washer (10) by pressurize jig, install snap ring (45).
- ※ Put a vinyl cover on the sliding surface of the cylinder block (4) and timing plate (9) for protection.



(8) Reassemble the hydraulic motor

- ① Install roller (51, 5EA) to the pin hole of cylinder block (4).
- ② Install thrust ball (8) to the cylinder block (4).
- ③ Insert piston assembly [piston (61) and shoe (62), 9 set] into retainer plate (7).
- ※ After mounting, immerse the entire them in a working fluid.



- ④ Mount the piston assembly (9 set) into the cylinder block (4).
- ※ The retainer plate (7) must be in contact with the round part of thrust ball (8).

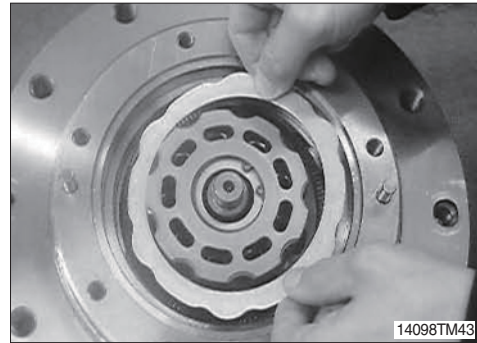


- ⑤ Install cylinder block (4) assembly to the shaft (2).
- ※ After fitting splines of both cylinder block (4) and shaft (2), assemble them.
- ※ After installing the cylinder (4), confirm whether it revolves or not by turning using both hands.
- ※ Motor is malfunction when it isn't revolve.



(9) Reassemble the parking brake

- ① Install mating plate (16) first and then a friction plate (15), one by one, into the grooves of the outer surface of the cylinder block (4).
- ※ Immerse the friction plates (15) in a working fluid before fitting them into the grooves.



- ② Install two O-rings (35, 39) and two back up ring (47, 48) into O-ring grooves.
- ③ Mount a piston (12) in the spindle (101).
- ※ Apply a thin coat of grease to the O-rings (35, 39).
- ※ If the piston (12) does not fit into the spindle (101) because of the resistance of the O-ring, tap the edge of the piston (12) lightly and equally with a plastic hammer.
- ※ Be careful not to damage the O-ring and back up ring at this time.



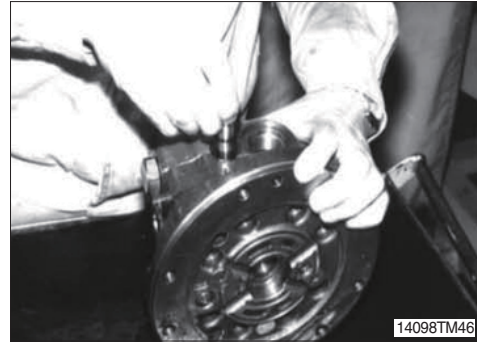
2) REASSEMBLE THE REAR FLANGE (1) PART

(1) Reassemble the check valve

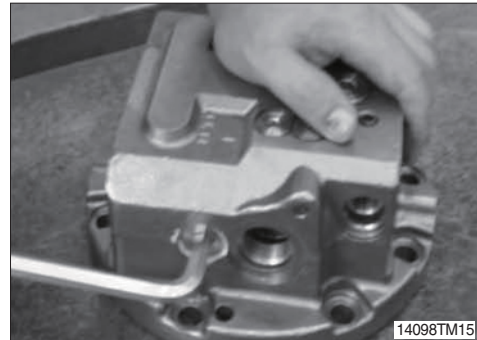
- ① Install O-ring (36, 2EA) on the plug (26, 2EA).
- ※ Apply grease to the O-ring (36).



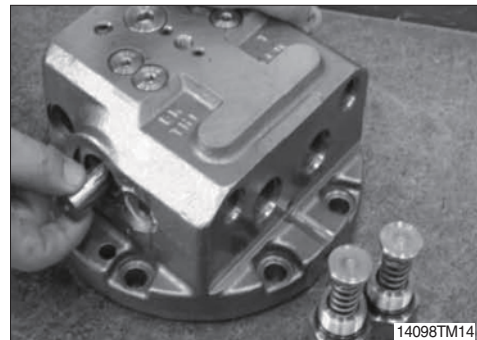
- ② Install spring (30) and valve (27) into the plug (26).
- ③ Install plug (26) into the rear flange (1).
- ※ Install spring (30) and valve (27) into the plug (26), and then grease the spring (30) and the valve (27) and hand-lock the former.



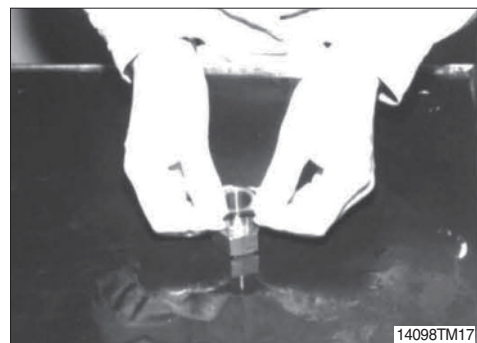
- ④ Install plug (26) in conjunction with the spring (30) and the valve (27) into the rear flange (1), and tighten the plug to the required torque.
- ※ Tightening torque : $17 \pm 2.6 \text{ kgf} \cdot \text{m}$ ($123 \pm 18.8 \text{ lbf} \cdot \text{ft}$)
- ※ Tools
 - Adapter for hexagon wrench 10
 - Torque wrench



- ⑤ Install spool (23) into the rear flange (1).
- ※ Before installing the spool (23), apply hydraulic oil to the spool. Be careful not to damage the spool's surface and the inner of rear flange (1).



- ⑥ Install O-ring (37) on the plug (24).
- Apply grease to the O-ring (37).



⑦ Install spring retainer (25) and spring (28) into the plug (24).

⑧ Install plug (24) into the rear flange (1).

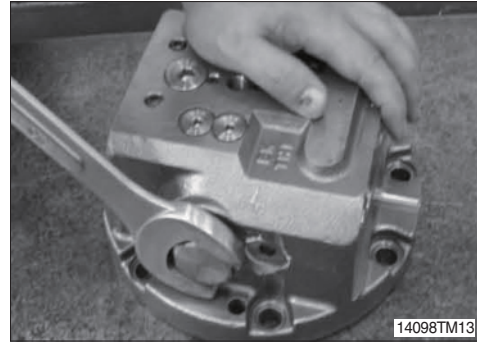
⑨ Tighten the plug (24) to the required torque.

※ Tightening torque : $36 \pm 5.4 \text{ kgf} \cdot \text{m}$ ($260 \pm 39 \text{ lbf} \cdot \text{ft}$)

※ Socket (#36) / Torque for hexagon wrench.

※ Tools

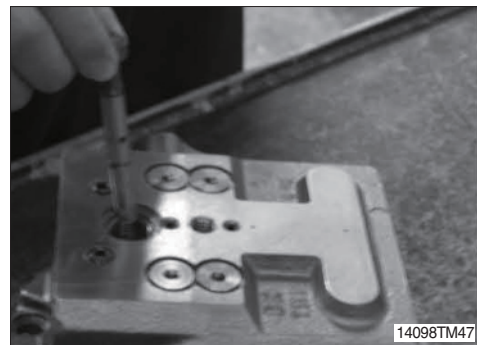
- Hexagon socket 36
- Torque wrench



(2) Reassemble the two speed change valve

① Install spring (66) into the valve (65).

② Insert the valve (65) into the rear flange (1).

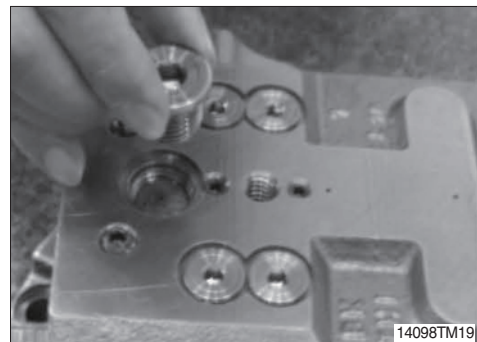


③ Insert a plug (63) into the rear flange (1).

※ Tightening torque : $13 \pm 2.6 \text{ kgf} \cdot \text{m}$ ($94 \pm 18.8 \text{ lbf} \cdot \text{ft}$)

※ Tools

- Adapter for hexagon wrench 10
- Torque wrench



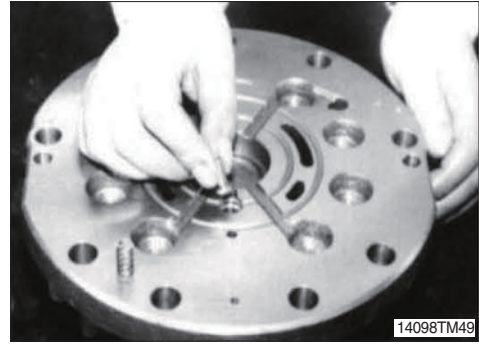
(3) Reassemble the parking brake valve

① Install O-ring (33) on the valve seat (18).

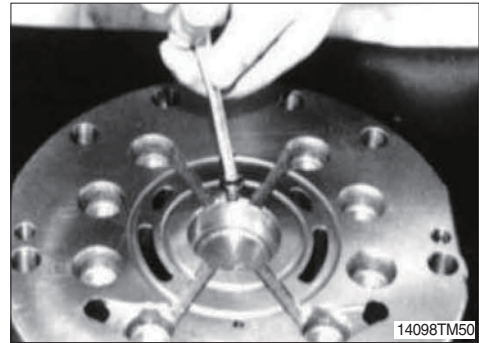
※ Do not reuse the O-ring (33).



- ② Mount the rear flange (1) on a working bench that the mounting side of the spindle (101) faces upward.
- ③ Install valve (19), spring (20) and valve seat (18) in that order.



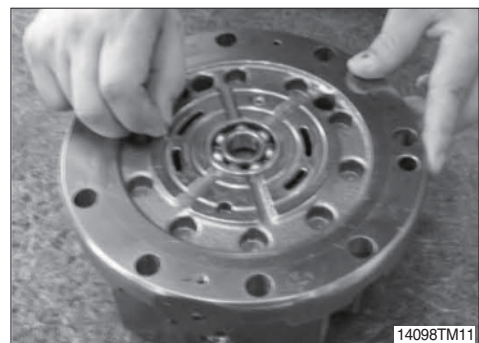
- ④ After new ring (22) bend somewhat and put the valve seat (18), then into the rear flange (1) ring's groove.
- ※ Do not reuse the ring (22).



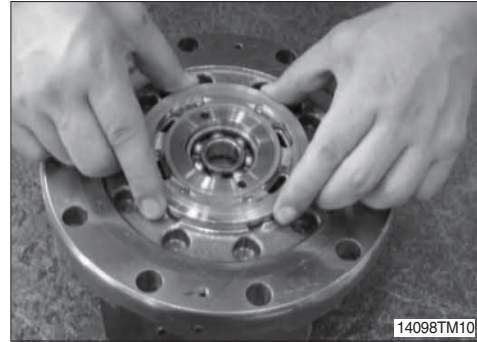
- ⑤ Install ball bearing (50) into the rear flange (1).
- ※ Apply hydraulic oil to the ball bearing (50).



- ⑥ Install parallel pin (41) into the pin hole of rear flange (1).



- ⑦ Install timing plate (9) into the rear flange (1).
※ Apply hydraulic oil to the contact surface of rear flange.



(4) Reassemble the rear flange (1) and spindle (101)

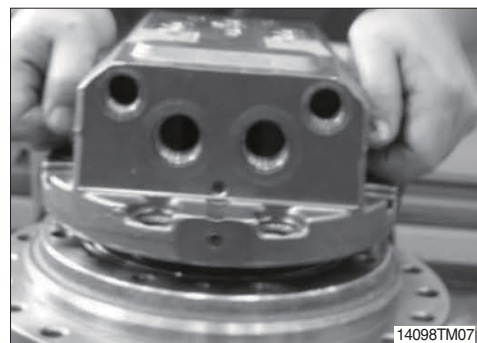
- ① Tilt the work bench 90° for travel motor reassembling.
② Insert the O-ring (75, 126) on the spindle (101).
※ Apply grease to the O-rings (75, 126) thinly.



- ③ Install parallel pins (42, 2EA) into the spindle (101).



- ④ Mount the rear flange (1) on the spindle (101).
※ When the rear flange (1) is mounted on the spindle (101), fix the spring (13) applied grease to not drop.

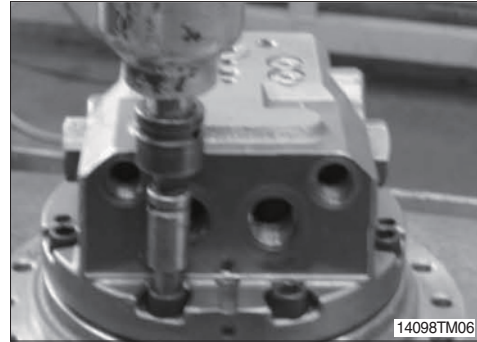


⑤ Tighten the socket bolt (43) into the spindle (101) to the required torque.

※ Tightening torque : $5.9 \pm 1.0 \text{ kgf} \cdot \text{m}$ ($42.7 \pm 7.2 \text{ lbf} \cdot \text{ft}$)

※ Tools

- Adapter for hexagon wrench 8
- Torque wrench



⑥ Tighten the plug (24) into the rear flange (1) to the required torque.

※ Tightening torque : $13 \pm 4.0 \text{ kgf} \cdot \text{m}$ ($94 \pm 28.9 \text{ lbf} \cdot \text{ft}$)

※ Tools

- Hexagon socket 36
- Torque wrench



⑦ Tighten the plug (26) into the rear flange (1) to the required torque.

※ Tightening torque : $36 \pm 1.5 \text{ kgf} \cdot \text{m}$
($260 \pm 10.8 \text{ lbf} \cdot \text{ft}$)

※ Tools

- Hexagon socket 10
- Torque wrench



3) REASSEMBLE THE REDUCTION GEAR ASSEMBLY

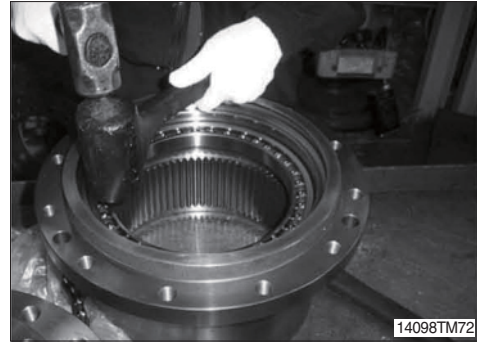
(1) Install floating seal (102) on the spindle (101).

※ Apply grease to the floating seal (102).



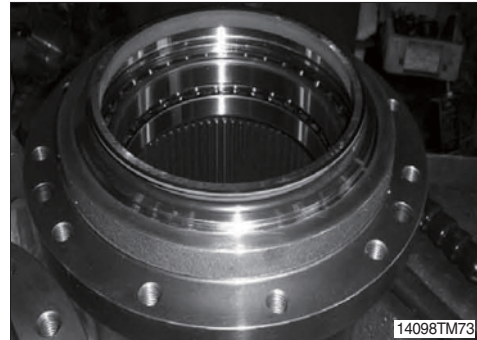
(2) Install angular bearing (125) and snap ring (106) into the hub (105).

※ Be careful for the insert direction.

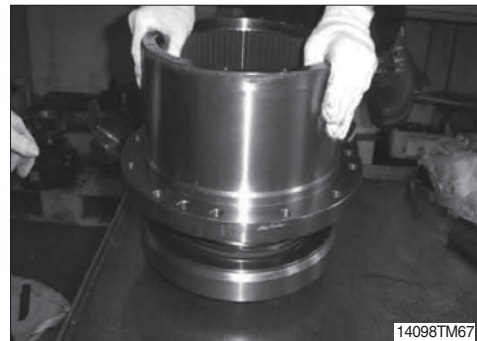


(3) Insert the O-ring (130), the sealing (129) and floating seal (102) in the hub (105).

※ Apply grease to the floating seal (102) thinly.



(4) Install the spindle (101) into the hub (105) assembly.



(5) Tighten the nut ring (103) and plug (104) into the hub (105) to the required torque.

※ Do not wind the seal tape to the plug (104).

※ Punch two place for not to loosen the plug (104).

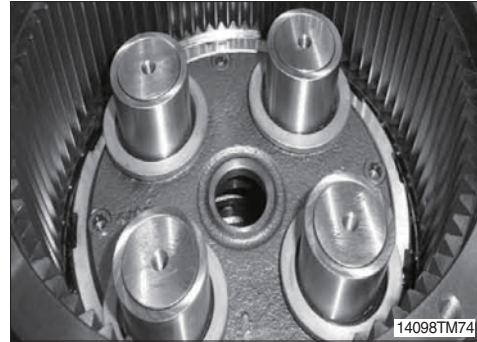
※ Tightening torque : 3.5 ± 0.7 kgf · m (25.3 ± 5.1 lbf · ft)

· Hexagon socket 8

· Torque wrench

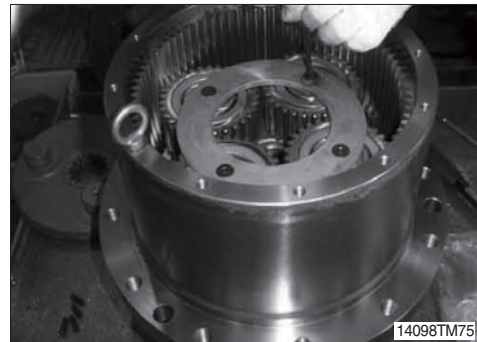


(6) Install thrust washer (109) and collar (112) into the hub (105).



(7) Install needle bearing (111) planetary gear F (108), thrust washer (109), thrust plate F (113) and screw (110) into the hub (105).

- ※ Tightening torque : 0.83 kgf · m (6.0 lbf · ft)
- Hexagon socket 5
- Torque wrench

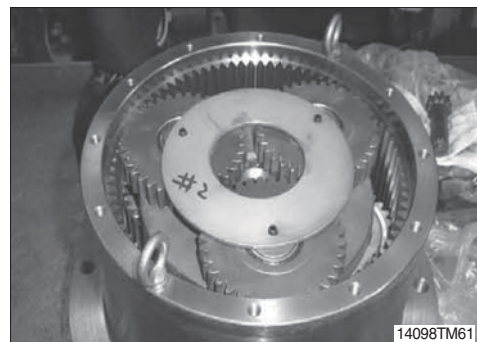


(8) Install sun gear (114) and holder assembly, then insert needle bearing (118) and planetary gear R (117) into the hub (105).

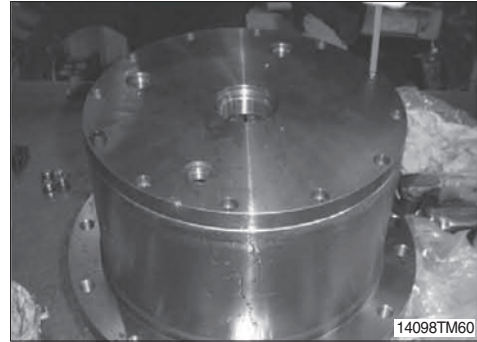
- ※ Holder assembly : holder (116) + spring pin (120) + inner race (119)



(9) Install drive gear (121) and thrust plate R (122) into the hub (105).

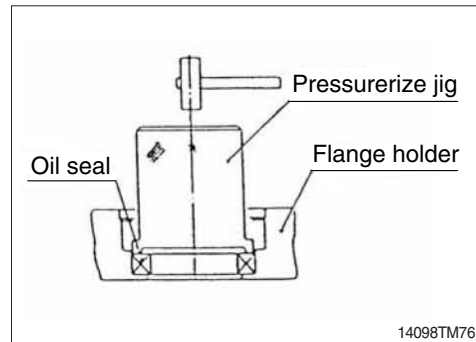


- (10) Install cover (123), thrust plate (150), plug (301, 128) and socket bolt (124) into the hub (105).
※ Apply grease to the cover (123) after installed O-ring (127).



(11) Pressing the oil seal

- ① Insert the oil seal (32) by hit the pressurize jig with plastic hammer.
※ Apply grease to the seat of oil seal (32).



3.4 CHECKING FACTS AFTER ASSEMBLY

1) AIR TEST OF REDUCTION GEAR

Disassemble plug (128) of reduction gear part. When compressed air (0.3 kgf/cm^2) is inserted that in water during the 2 minutes, it should be not happened air bubble.

Fill the gear oil.

- Oil amount : 3.0 liter (0.79 U.S.gallon)

2) AIR TEST OF HYDRAULIC MOTOR

One port should be opened, the others port should be closed. When compressed air (3 kgf/cm^2) is inserted opened port in water during the 2 minutes, it should be not happened air bubble.

Fill the hydraulic oil.

- Oil amount : 0.55 liter (0.15 U.S.gallon)

■ TRAVEL MOTOR (TYPE 2)

1. REMOVAL AND INSTALL

1) REMOVAL

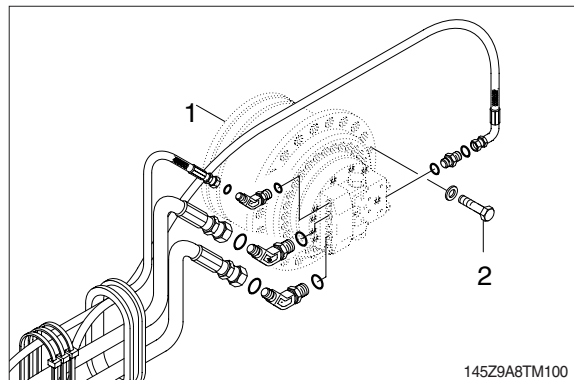
- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ 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 track shoe assembly.
For details, see **removal of track shoe assembly**.
 - (5) Remove the cover.
 - (6) Remove the hose.
 - ※ Fit blind plugs to the disconnected hoses.
 - (7) Remove the bolts and the sprocket.
 - (8) Sling travel device assembly (1).
 - (9) Remove the mounting bolts (2), then remove the travel device assembly.
 - Weight : 185 kg (410 lb)

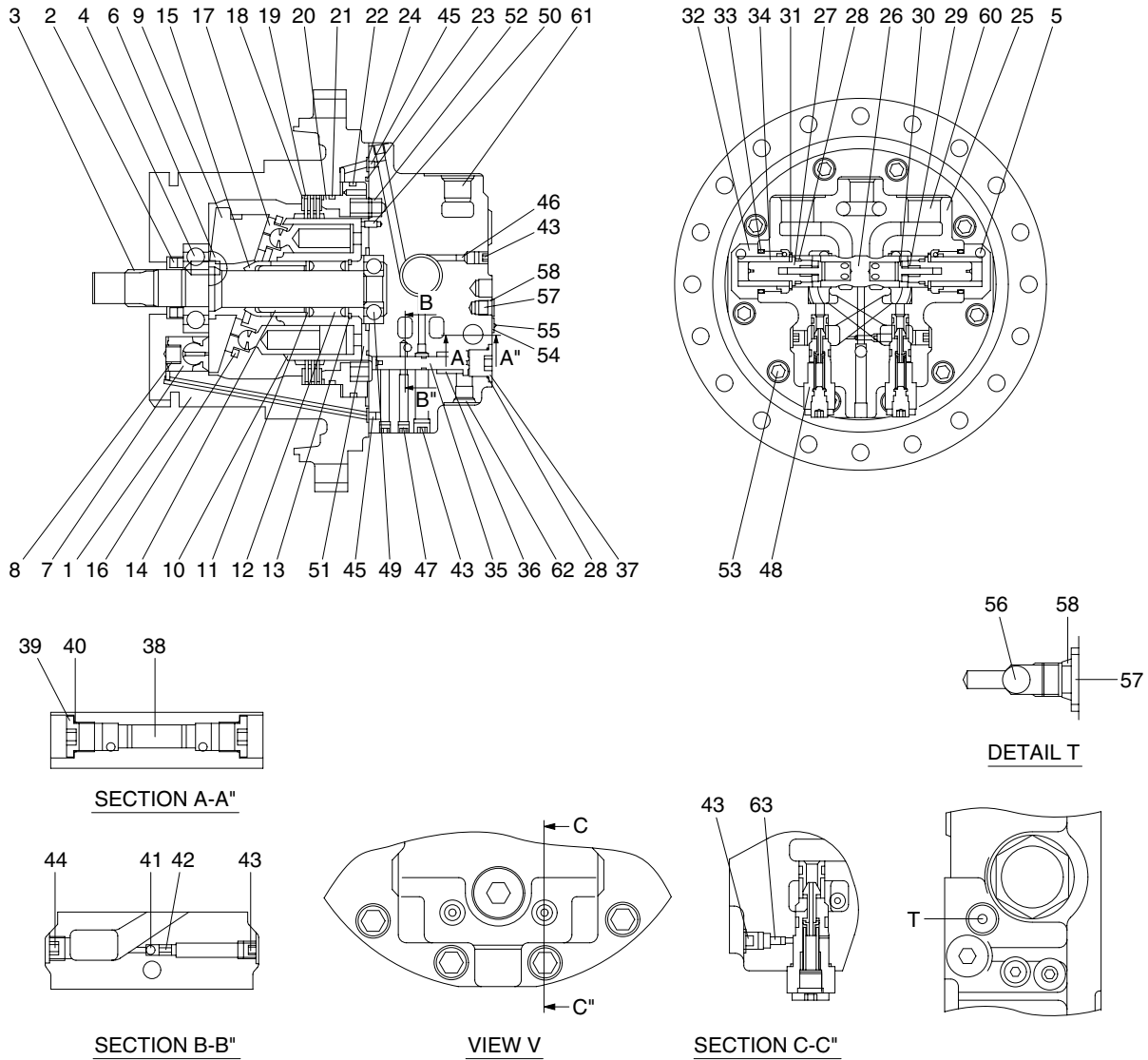
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel 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.



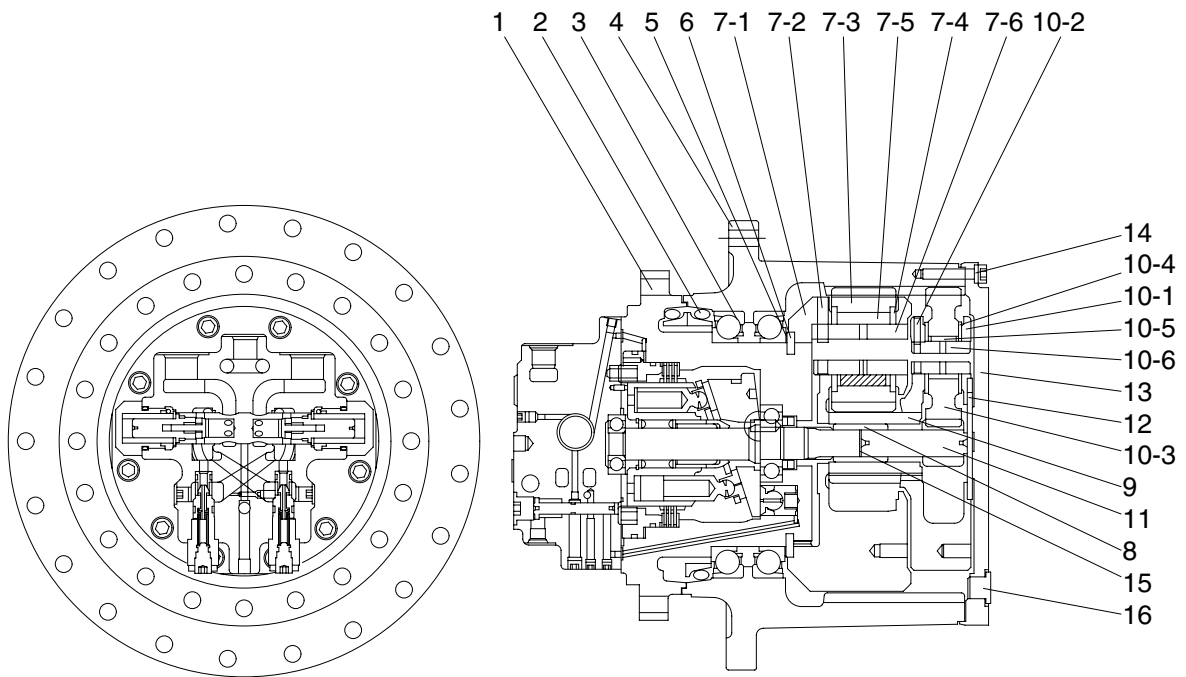
2. SPECIFICATION

1) STRUCTURE



1 Shaft casing	17 Piston assy	33 O-ring	49 Bearing
2 Oil seal	18 Steel plate	34 Spring	50 Pin
3 Shaft	19 Friction plate	35 Spool	51 Valve plate
4 Bearing	20 Brake piston	36 Spring	52 Spring
5 Pin	21 Ring	37 Plug	53 Wrench bolt
6 Swash ball	22 Ring	38 Piston	54 Name plate
7 Swash piston	23 O-ring	39 Plug	55 Rivet
8 Spring	24 O-ring	40 O-ring	56 Steel ball
9 Swash plate	25 Valve casing	41 Steel ball	57 Plug
10 Cylinder block	26 Main spool	42 Orifice	58 O-ring
11 Spring seat	27 Plug	43 Plug	60 Plastic plug
12 Spring	28 O-ring	44 Plug	61 Plastic plug
13 Snap ring	29 Spring	45 Orifice	62 Plastic plug
14 Pin	30 Check	46 Orifice	63 Orifice
15 Ball guide	31 Plate	47 Plug	
16 Set plate	32 Plug	48 Relief valve assy	

145Z9A2TM02



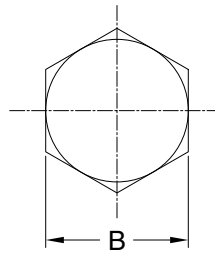
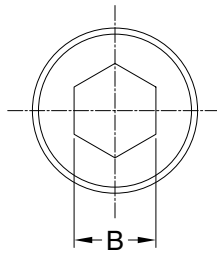
145Z9A2TM02A

- | | | |
|----------------------|-----------------------|----------------|
| 1 Spindle | 7-4 Washer 2 | 10-5 Bearing 1 |
| 2 Floating sesal | 7-5 Bearing 2 | 10-6 Pin 1 |
| 3 Ball bearing | 7-6 Pin 2 | 11 Sun gear 1 |
| 4 Housing | 8 Coupling | 12 Plate 1 |
| 5 Shim | 9 Sun gear 2 | 13 Cover |
| 6 Shim | 10 Carrier assy 1 | 14 Bolt |
| 7 Carrier assy 2 | 10-1 Carrier 1 | 15 Snap ring |
| 7-1 Carrier 2 | 10-2 Spring pin 1 | 16 Plug |
| 7-2 Spring pin 2 | 10-3 Planetary gear 1 | |
| 7-3 Planetary gear 2 | 10-4 Washer 1 | |

2) TOOL AND TIGHTENING TORQUE

(1) Tools

Name of tools	B (mm)	Name of part applied
Hexagonal L-Wrench	4	Plug (42, 45, 46, 47)
	6	Plug (43, 44)
	8	Plug (39)
	10	Plug (37, 57), Wrench bolt (53)
Socket wrench/ spanner	24	Relief plug (48)
	41	Main spool plug (32)
Snap ring plier (for holes, axis)		∅ 42 (13)
Hammer		Ball bearing (49), Pin (50)
Torque wrench		Size : 5 kgf · m, 100 kgf · m
Jig for oil seal assembling		Oil seal (2)
Heating tool for bearing		Parking spring (20)



Size B

145Z9A8TM99

(2) Tightening torque

Item no.	Part name	Size	B (mm)	Torque	
				kgf · m	lbf · ft
25	Wrench bolt	-	-	68	491.8
32	Main spool plug	M36	41	45	325.5
37	Plug	PF 3/8	10	6	43.4
39	Plug	PF 1/4	8	3	21.7
42, 45, 46, 47	Plug	PT 1/16	4	0.7~1.1	5.1~8.0
43	Plug	PT 1/8	6	1.25	9.0
48	Relief valve plug	PF 1/2	24	10	72.3
53	Wrench bolt	M12 × 30	10	10.4	75.2

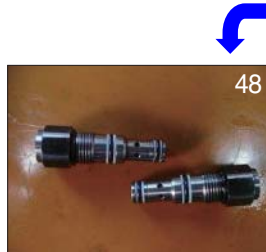
2. DISASSEMBLING AND ASSEMBLING

1) GENERAL INSTRUCTIONS

- (1) Generally, hydraulic equipment is precisely manufactured and clearances between each parts are very narrow. Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather. Tools and kerosene to wash parts should also be clean and handled with great care.
 - (2) When motor is removed from the host machine, wash around the ports sufficiently and put the plugs so that no dust and/or water may invade. Take off these plugs just before the piping works when re-attach it to the host machine.
 - (3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in advance.
 - (4) The piston can be inserted to whichever cylinder block for the initial assembling.
However, their combination should not be changed if they are once used. To reuse them, put the matching mark on both pistons and cylinder block before disassembling.
- ▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

2) DISASSEMBLING MOTOR UNIT

- (1) Disassemble relief valve (48) from valve casing (25) using a torque wrench.



145Z9A8TM01



145Z9A8TM02

- (2) Disassemble wrench bolt (53) (M12 × 30) and take out valve casing sub assembly.



145Z9A8TM03

- (3) Remove parking spring (52) - 12EA.



145Z9A8TM04

- (4) Remove O-ring (23).

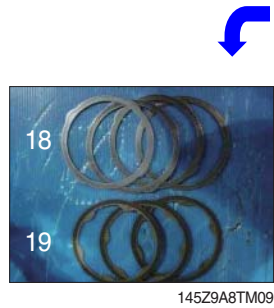


145Z9A8TM05

(5) Disassemble brake piston (20) using a jig.



(6) Disassemble friction plate (19)-3EA, steel plate (18)-4EA.



(7) Remove the cylinder block kit (II).

※ It is easier to work by placing the shaft casing (1) horizontal.



(8) Disassemble cylinder block (10), ball guide (15), set plate (16), piston assy (17), pin (14) from cylinder block kit (II).

Press spring (12) using a jig and take out snap ring (14) using a plier.

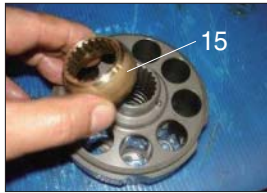
Disassemble snap ring (13), spring seat (11), spring (12) from cylinder block kit (II).



145Z9A8TM13



145Z9A8TM14



145Z9A8TM15



145Z9A8TM16



145Z9A8TM17



145Z9A8TM18

(9) Disassemble swash plate (9).



145Z9A8TM19

(10) Disassemble swash ball (6).



145Z9A8TM20

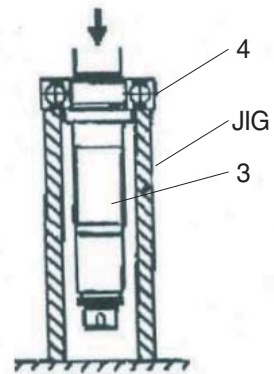
(11) Disassemble shaft (3) from shaft casing (1).



- After disassembled shaft (3) is placed on a jig, top of shaft is pressed down using a press. It can remove ball bearing (4) portion.

※ Remove ball bearing (4) in case it is replaced only.

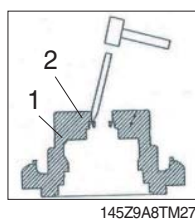
- Dismantled bearing can't be reused.



(12) Disassemble swash piston (7), spring (8) into shaft casing(1).



(13) Disassemble oil seal (2) from shaft casing (1) using a tool.



(14) Disassemble valve plate (51) and ball bearing (49) from valve casing (25).



145Z9A8TM30



145Z9A8TM31



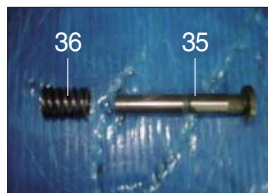
145Z9A8TM32

(15) Disassemble plug (47) from valve casing (25).

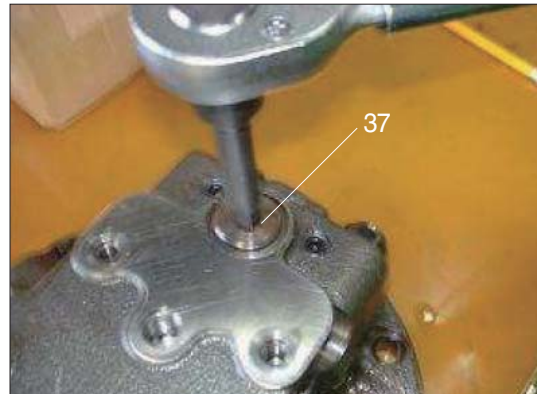


145Z9A8TM33

(16) Disassemble plug (37) from valve casing (25) using a torque wrench and disassemble two speed control spool (35), spring (36) in regular sequence.



145Z9A8TM34



145Z9A8TM35

(17) Disassemble main spool plug (32) from valve casing (25) using a torque wrench and disassemble spring (34), plate (31), main spool (26) in regular sequence.



145Z9A8TM36



145Z9A8TM37

(18) Disassemble plug (43) from valve casing (25) and then disassemble orifice (42), steel ball (41) one by one.

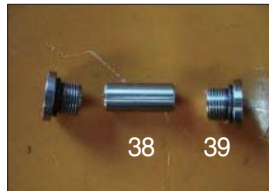


145Z9A8TM38



145Z9A8TM39

(19) Disassemble plug (39), relief valve damping piston (38) from valve casing (25).



145Z9A8TM40



145Z9A8TM41

(20) Disassemble plug (43) from valve casing (25) and disassemble orifice (63).



145Z9A8TM42

(21) Disassemble plug (57), steel ball (56) from valve casing (25).



145Z9A8TM43



145Z9A8TM44

3) ASSEMBLING MOTOR UNIT

- (1) Put oil seal into shaft casing (1) using a jig.
 ※ Caution direction of oil seal.



145Z9A8TM45



145Z9A8TM46

- (2) Assemble swash spring (8) into shaft casing (1) and put swash piston (7) into shaft casing (1).



145Z9A8TM47



145Z9A8TM48

- (3) Press the ball bearing (4) into shaft (3) after preheating of ball bearing (4).

- ① Induction heating apparatus temperature : 100°C
- ② Be careful not to damage the sliding surface for the seal on the shaft.



145Z9A8TM49

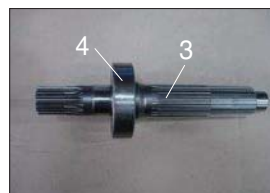


145Z9A8TM50



145Z9A8TM51

- (4) Assemble shaft into shaft casing (1).



145Z9A8TM52



145Z9A8TM53

(5) Assemble swash ball (6)-2EA.



145Z9A8TM54

(6) Apply grease to swash plate (9) and assemble swash plate (9) into shaft casing (1).



145Z9A8TM55



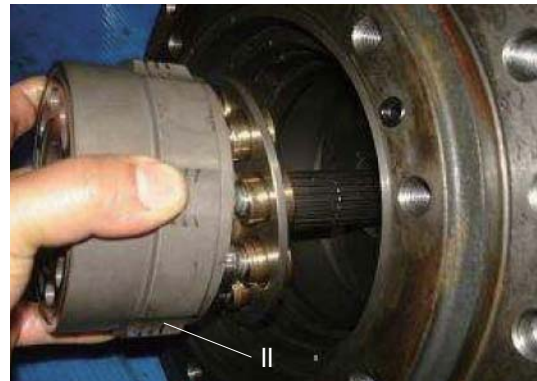
145Z9A8TM56

(7) Slant the shaft casing (1) and then assemble cylinder block kit (II).

- Assemble spring seat (11), spring (12), spring seat (11) into cylinder block kit (II) in regular sequence.

Push down spring(12) and then assemble snap ring (13) into gap of cylinder block(10) using a plier.

- Assemble pin (14), ball guide (15), set plate (16), piston assy (17) into cylinder block (10) in regular sequence.



145Z9A8TM57



145Z9A8TM58



145Z9A8TM59



145Z9A8TM60



145Z9A8TM61



145Z9A8TM62



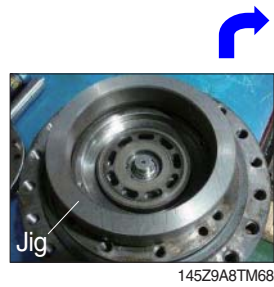
145Z9A8TM63



(8) Assemble friction plate (19), steel plate (18) into cylinder block in regular sequence.
Friction plate : 3 EA
Steel Plate : 4 EA



(9) Assemble parking piston (20) into shaft casing (1) using a jig.



(10) Put O-ring (23) into shaft casing (1).
Apply the grease to O-ring.

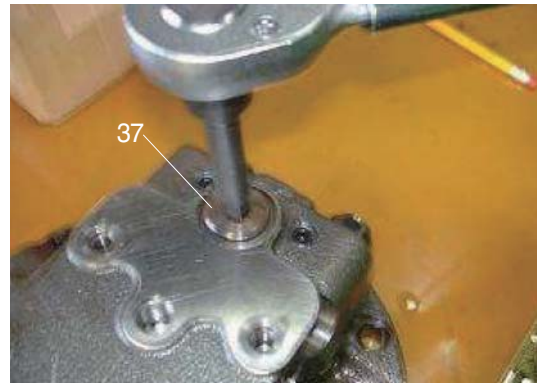


(11) Put spring (36), two speed control spool (35) into valve casing (25) in regular sequence and assemble plug (37) into valve casing (25) using a torque wrench.

• Tighten torque : 10 kgf-m (72.3 lbf-ft)

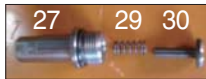


145Z9A8TM70



145Z9A8TM71

(12) Assemble check (30), spring (29), plug (27) into main spool (26) in regular sequence.



145Z9A8TM72



145Z9A8TM73



145Z9A8TM74



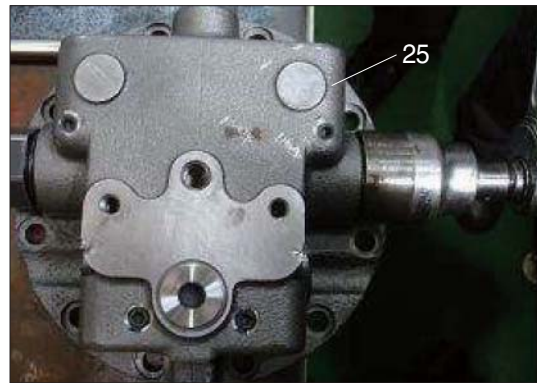
145Z9A8TM75

(13) Put the main spool (26) into valve casing (25) and assemble plate (31), spring (29) into it. Tighten main spool plug (32) using a torque wrench.

• Tighten torque : 45 kgf-m (325.5 lbf-ft)



145Z9A8TM76



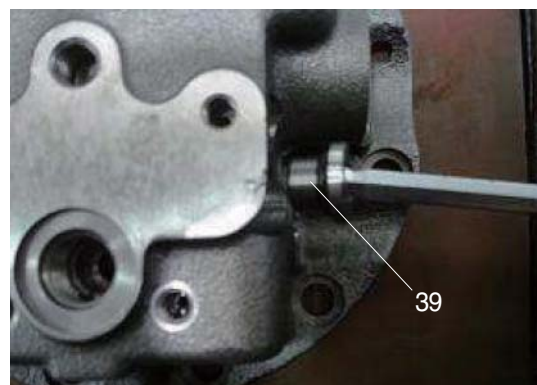
145Z9A8TM77

(14) Put relief valve damping piston (38) into valve casing (25) and assemble plug (39) into valve casing (25).

• Tighten torque : 6 kgf-m (43.4 lbf-ft)



145Z9A8TM78



145Z9A8TM79

- (15) Put steel ball (41), orifice (42) into valve casing (25) and tighten the plug (43).
 · Tighten torque : 1.25 kgf-m (9.0 lbf-ft)



145Z9A8TM80



145Z9A8TM81

- (16) Put steel ball (56) into valve casing (25) and tighten the plug (57).
 · Tighten torque : 1.25 kgf-m (9.0 lbf-ft)



145Z9A8TM82



145Z9A8TM83

- (17) Assemble orifice (63) into valve casing (25) and tighten the plug (43).
 · Tighten torque : 1.25 kgf-m (9.0 lbf-ft)



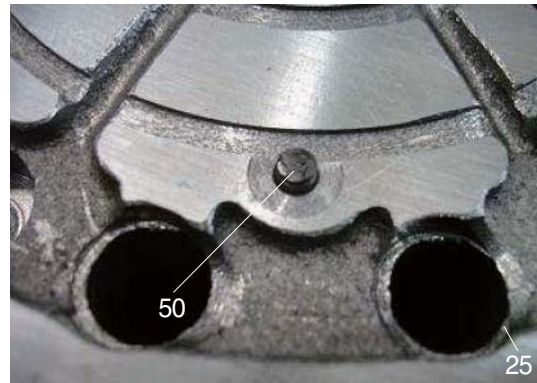
145Z9A8TM84

- (18) Assemble orifice (63) into valve casing (25) and tighten the plug (47).
 · Tighten torque : 0.7~1.1 kgf-m
 (5.1~8.0 lbf-ft)



145Z9A8TM85

(19) Assemble pin (50) into valve casing (25).



145Z9A8TM86

(20) Assemble pin (5) into valve casing (25).



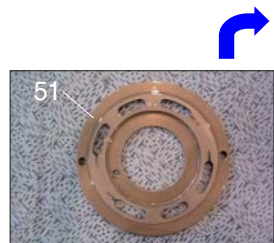
145Z9A8TM87

(21) Assemble ball bearing (49) into valve casing (25).



145Z9A8TM88

(22) Apply grease on the face of valve plate and assemble valve plate (51) into valve casing (25).



145Z9A8TM89



145Z9A8TM90

(23) Apply grease to brake spring (52)-12EA and assemble brake spring (52)-12EA into valve casing (25).



145Z9A8TM91

(24) Assemble valve casing (25) into shaft casing (1) and tighten the wrench bolt (53) using a torque wrench.
· Tighten torque : 10.4 kgf-m (75.2 lbf-ft)



145Z9A8TM92

(25) Assemble relief valve (48) into valve casing (25) using a torque wrench.
· Tighten torque : 10 kgf-m (72.3 lbf-ft)



145Z9A8TM93



145Z9A8TM94

4) DISASSEMBLING REDUCTION GEAR

(1) Loose plug (26)-3EA and drain reduction oil.



145Z9A8TR02

(2) Loose wrench bolt (25) using a tool.



145Z9A8TR03

(3) Disassemble end cover (24).



145Z9A8TR04

(4) Disassemble trust plate (23).



145Z9A8TR05



145Z9A8TR06

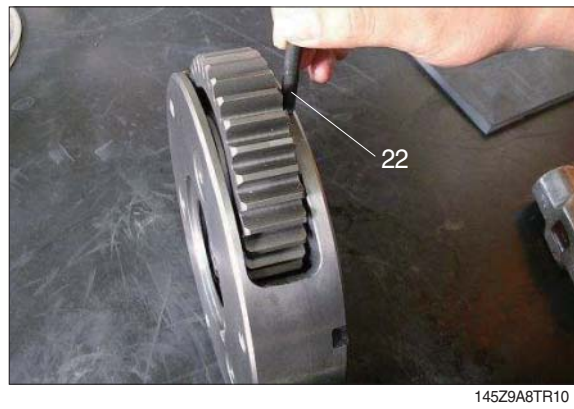
(5) Disassemble driver gear (16).



(6) Disassemble carrier No.1 (17) sub assy.
※ Assemble eyebolt into carrier No.1 tap hole and disassemble carrier No.1 (17) sub assy using a hoist.



(7) Disassemble carrier No.1 sub assy.
※ Remove spring pin No.1 (22) from carrier No.1 (17) and planetary gear No.1 (18), washer No.1 (19), needle bearing No.1 (20), carrier pin No.1 (21) in regular sequence.



(8) Disassemble carrier No.2 (7) sub assy.

- ※ Assemble eyebolt into carrier No.2 tap hole and disassemble carrier No.2 (7) sub assy using a hoist.



145Z9A8TR15

(9) Disassemble carrier No.2 (7) sub assy.

- ※ Remove spring pin No.2 (12) from carrier No.2 (7) and disassemble planetary gear No.2 (8), washer No.2 (9), needle bearing No.2 (10), carrier pin No.2 (11) in regular sequence.



145Z9A8TR16



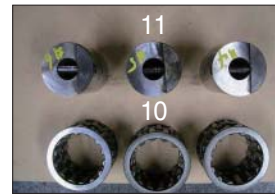
145Z9A8TR17



145Z9A8TR18

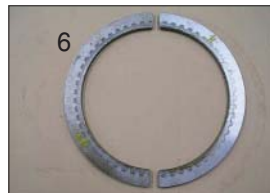


145Z9A8TR19



145Z9A8TR20

(10) Push down ring gear (4) using a jig and disassemble shim (6).



145Z9A8TR21



145Z9A8TR22

(11) Disassemble ring gear sub assy (4) into motor assy.

- ※ Assemble eye bolt into tap hole of ring gear sub assy (4) and disassemble ring gear sub assy (4) using a hoist.



145Z9A8TR23

(12) Disassemble floating seal (2) from ring gear sub assy (4).



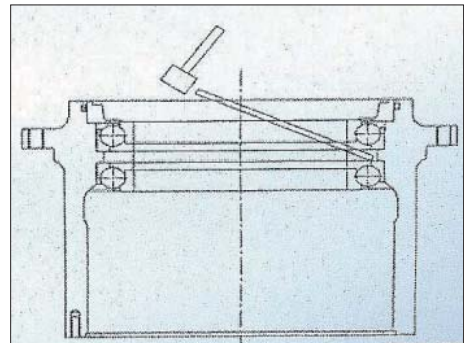
145Z9A8TR24



145Z9A8TR25

(13) Disassemble angular bearing (3) from ring gear sub assy (4).

- ※ Be careful not to damage the parts using a hammer.



145Z9A8TR26

4) ASSEMBLING REDUCTION GEAR

Before assembling please observe following item.

- Wash all parts cleanly using solvent and dry all parts perfectly using compressed air.
- Check metal dust in casing and cleansing solution.
- Before application packing, please remove oil certainly.
- Before insert needle bearing, apply grease to bearing inlet enough.
- Apply lubricant to rotation part and sliding part.
- Damaged part or discolored part exchanges by new parts.

(1) Assemble hub

- ① Place the motor assy on the bench and assemble floating seal (2) into motor (1) using a jig.



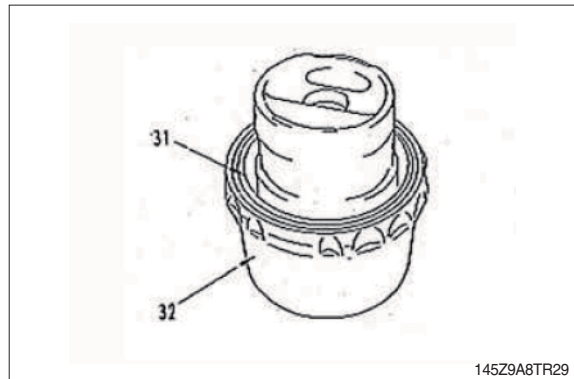
145Z9A8TR27



145Z9A8TR28

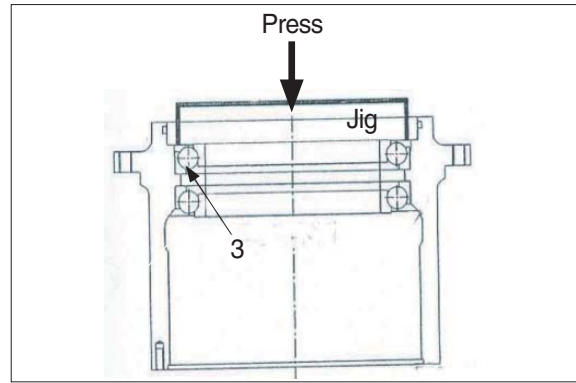
- ② Remove completely the oil of surface that O-ring and O-ring contact.

- Dry completely the floating seal.
- After assembling the floating seal, coat lubricant to the sliding surface of the floating seal.



145Z9A8TR29

(2) Press angular bearing (3) into ring gear (4) using a jig.



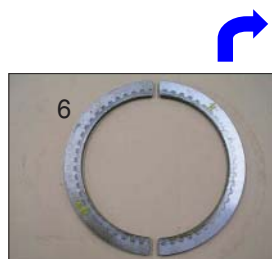
(3) Assemble floating seal(2) into ring gear(4) using a jig.



(4) Assemble ring gear sub assy (4) into motor assy using a assembly equipment.



(5) Push down ring gear (4) using a jig and assemble shim (6).



(6) Assemble carrier No.2 sub assy.

- Assemble planetary gear No.2 (8), washer No.2 (9), needle bearing No.2 (10) and carrier pin No.2 (11) into carrier No.2 (7) in regular sequence.
Assemble spring pin No.2 (12).
- Assemble spring pin No.2 (12) and caulk spring pin into pin hole.



145Z9A8TR37



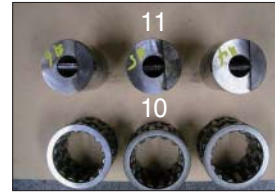
145Z9A8TR38



145Z9A8TR39



145Z9A8TR40



145Z9A8TR41



(7) Disassemble carrier No.2 (7) sub assy.

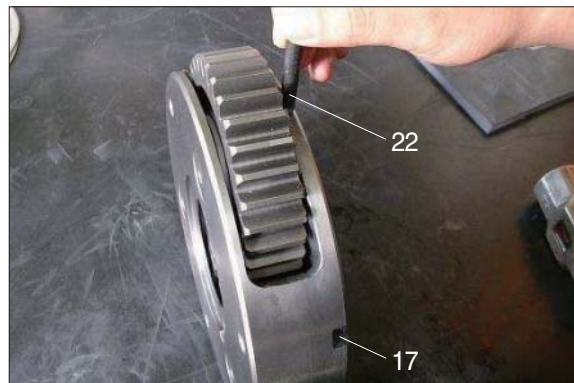
- Assemble eyebolt into carrier No.2 and assemble carrier No.2 (7) sub assy into ring gear using hoist.



145Z9A8TR42

(8) Disassemble carrier No.2 (7) sub assy.

- Assemble planetary gear No.1 (18), washer No.1 (19), needle bearing No.1 (20) and carrier pin No.1 (21) into carrier No.1 (17) in regular sequence.
Assemble spring pin No.1 (22).
- Assemble spring pin No.1 (22) and caulk spring pin into pin hole.



145Z9A8TR43



145Z9A8TR44



145Z9A8TR45



145Z9A8TR46



145Z9A8TR47

- (9) Assemble carrier No.1 (17) sub assy.
 - Assemble eyebolt into carrier No.1 and assemble carrier No.1 (17) sub assy into ring gear using hoist.



145Z9A8TR48

- (10) Assemble driver gear(16).



145Z9A8TR49



145Z9A8TR50

- (11) Assemble trust plate (23).



145Z9A8TR51



145Z9A8TR52

- (12) Assemble end cover (24).



145Z9A8TR53

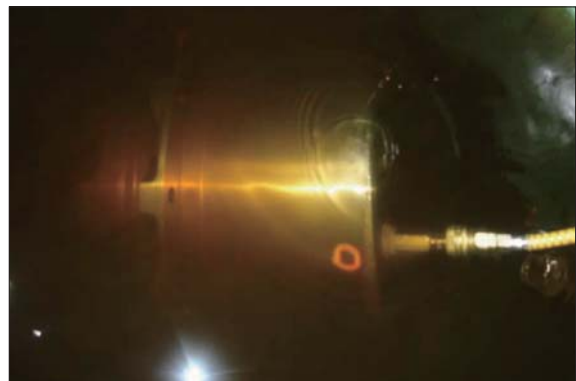
(13) Tighten wrench bolt (25) using a air impact.

- Tighten torque : 68 kgf-m (491.8 lbf-ft)



(14) Adjust control lever to be sunk the product under the test oil and then check the air leak.

- *TEST : Air pressure 0.7 kgf/cm² × 30sec



(15) Inject gear oil and assemble plug (26)-3EA.

- Volume of gear oil : 2.2 ℓ
- Tightening torque : 10 kgf-m (72.3 lbf-ft)



GROUP 7 RCV LEVER

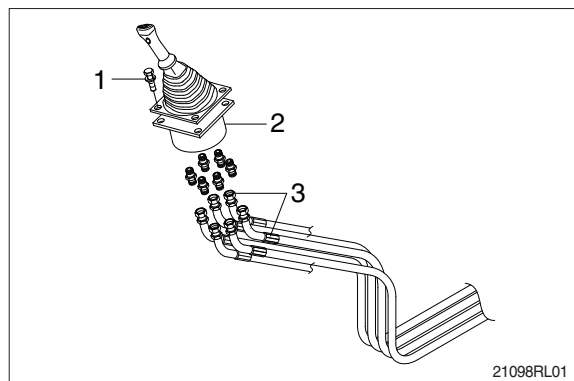
1. REMOVAL AND INSTALL

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.

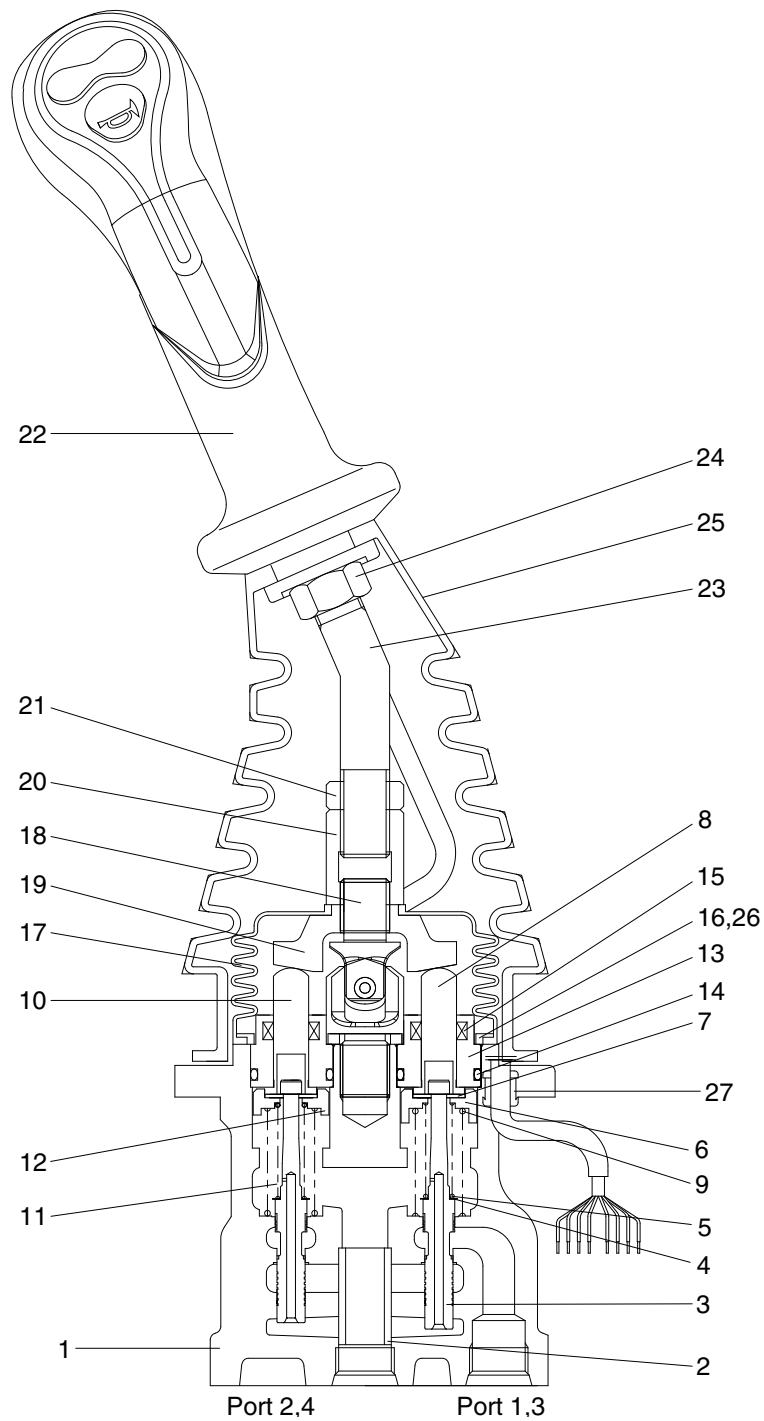


2) INSTALL

- (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

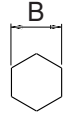


1409S2RL02

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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

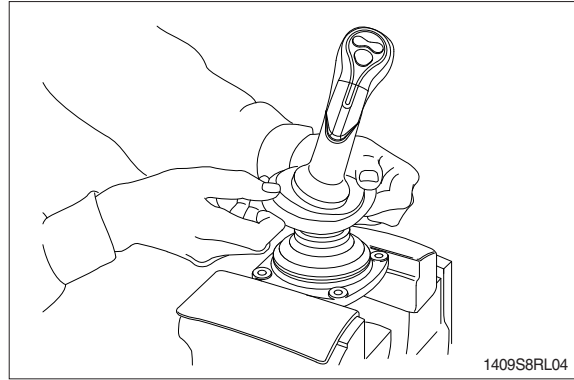
Tool name	Remark	
Allen wrench	6	
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

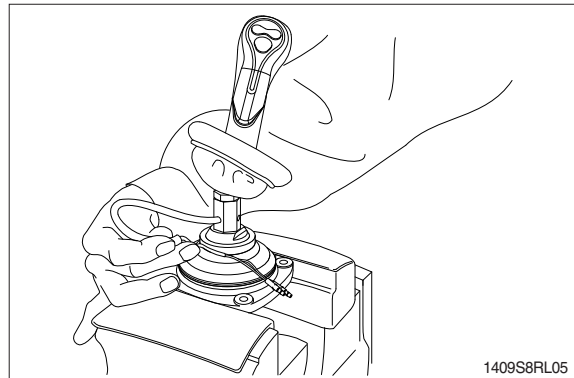
Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	18	M14	3.5	25.3
Swash plate	19	M14	5.0±0.35	36.2±2.5
Adjusting nut	20	M14	5.0±0.35	36.2±2.5
Lock nut	21	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

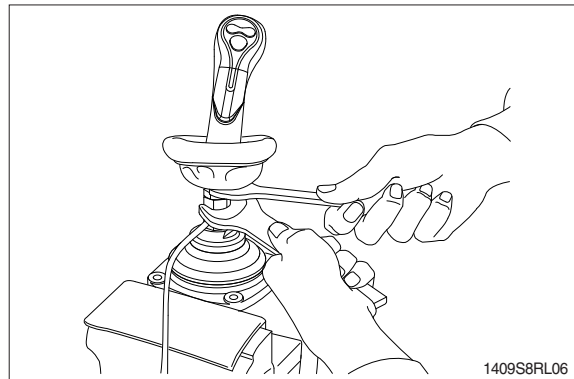
- (1) Clean pilot valve with kerosene.
 - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (25) from case (1) and take it out upwards.



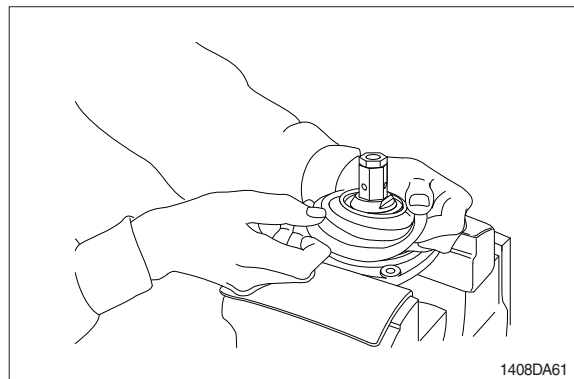
- ※ For valve with switch, remove cord also through hole of casing.



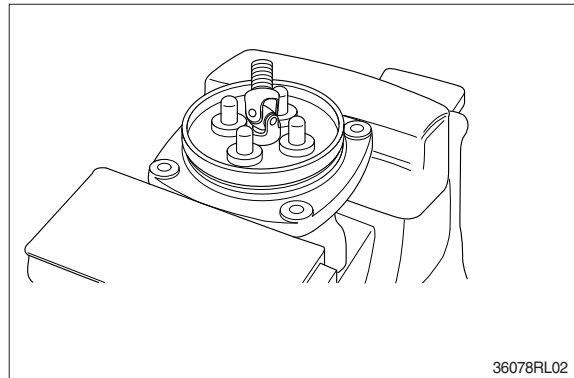
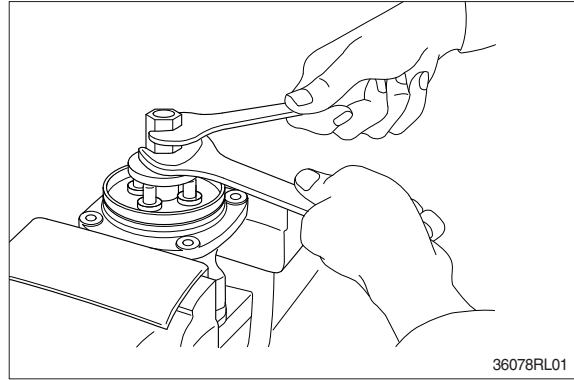
- (4) Loosen lock nut (21) and adjusting nut (20) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (17).

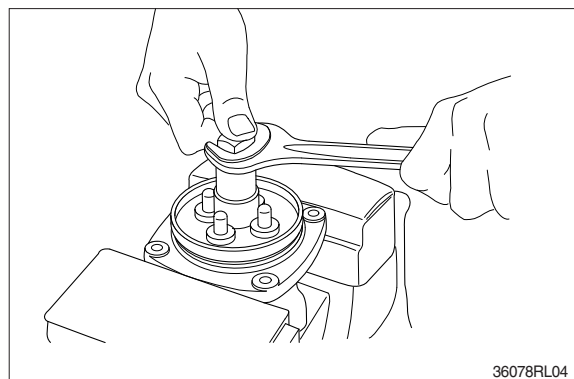
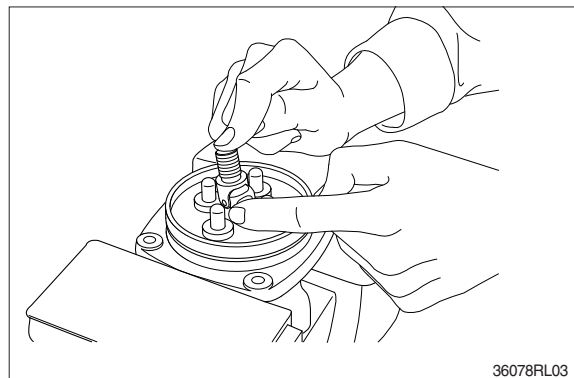


- (6) Loosen adjusting nut (20) and swash plate (19) with spanners on them respectively, and remove them.

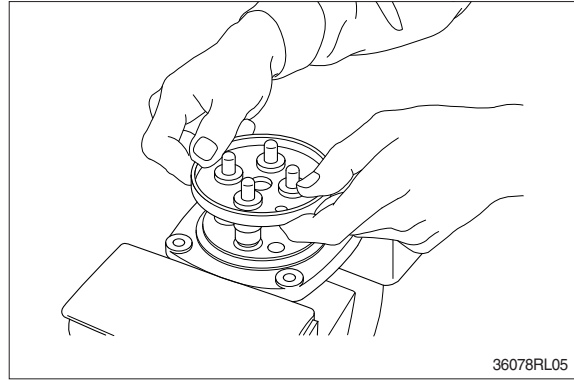


- (7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

- ※ When return spring (9) is strong in force, plate (16), plug (13) and push rod (10) will come up on loosening joint. Pay attention to this.

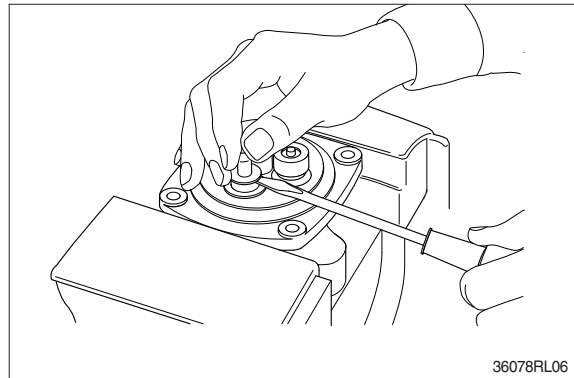


(8) Remove plate (16).



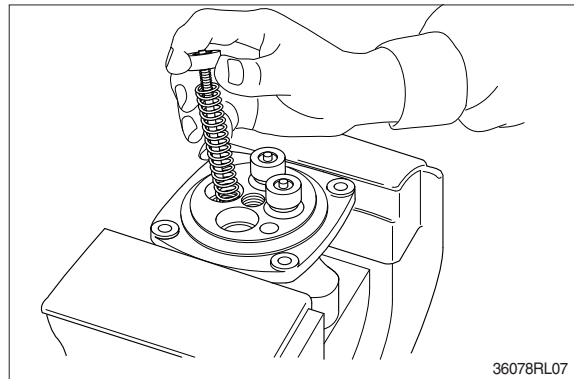
(9) When return spring (9) is weak in force, plug (13) stays in casing because of sliding resistance of O-ring.

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



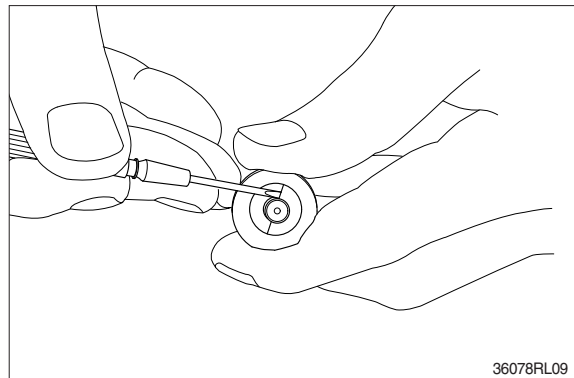
(10) Remove reducing valve subassembly and return spring (9) out of casing.

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

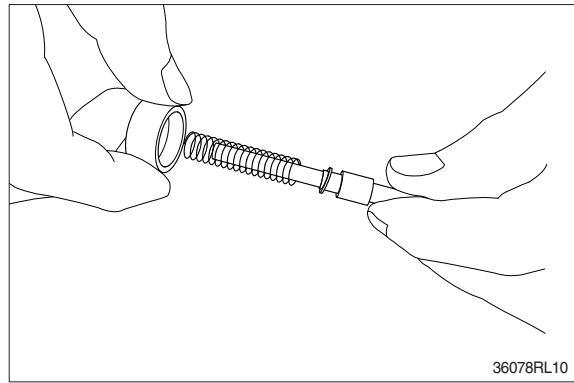


(11) For disassembling reducing valve section, stand it vertically with spool (3) bottom placed on flat workbench. Push down spring seat (6) and remove two pieces of semicircular stopper (7) with tip of small minus screwdriver.

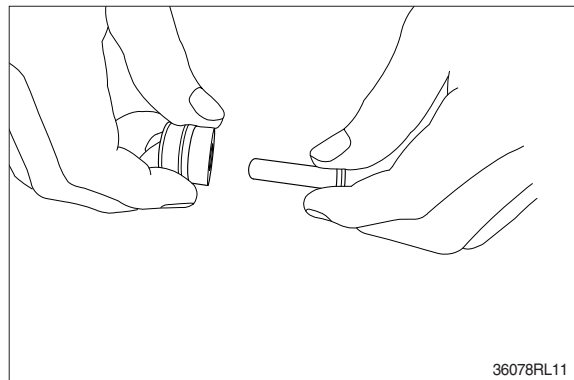
- ※ Pay attention not to damage spool surface.
- ※ Record original position of spring seat (6).
- ※ Do not push down spring seat more than 6mm.



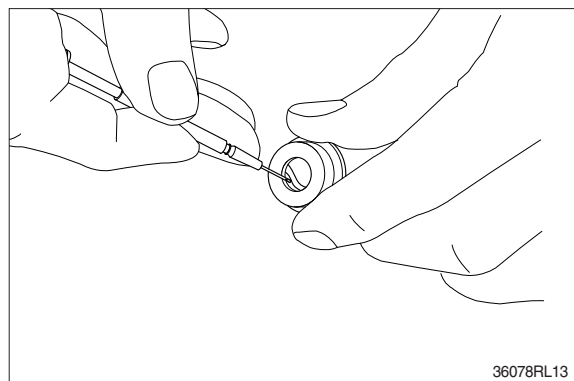
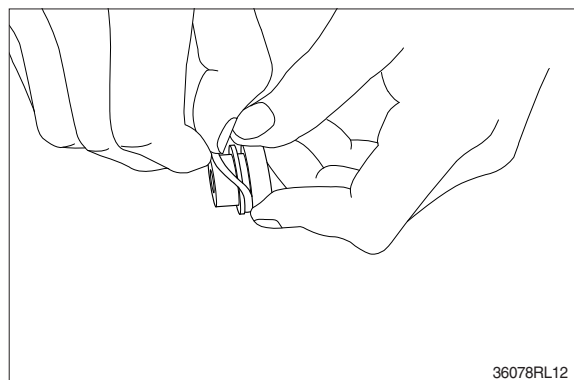
- (12) Separate spool (3), spring seat (6), spring (5) and shim (5) individually.
※ Until being assembled, they should be handled as one subassembly group.



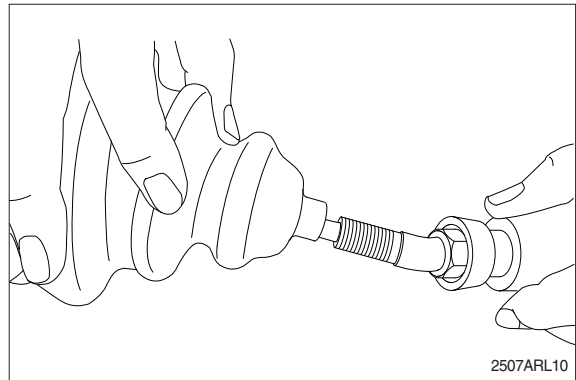
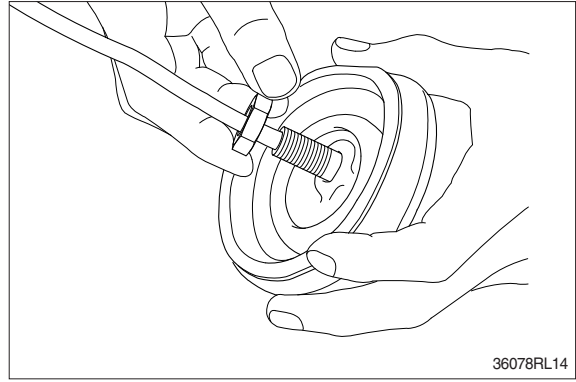
- (13) Take push rod (10) out of plug (13).



- (14) Remove O-ring (14) and seal (15) from plug (13).
Use small minus screwdriver or so on to remove this seal.



(15) Remove lock nut (21) and then boot (25).



(16) Cleaning of parts

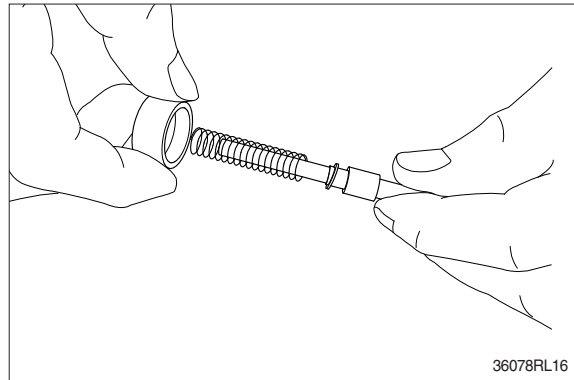
- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
 - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
 - ※ If this kerosene is polluted, parts will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

(17) 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.

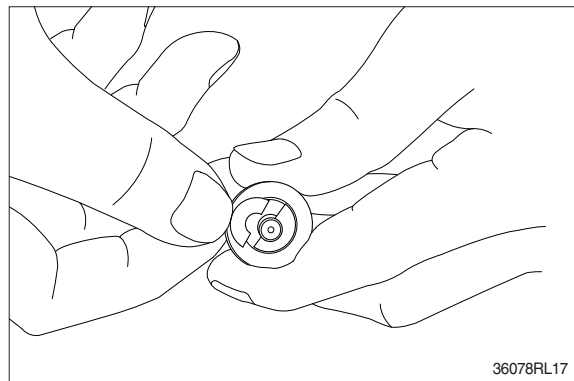
4) ASSEMBLY

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



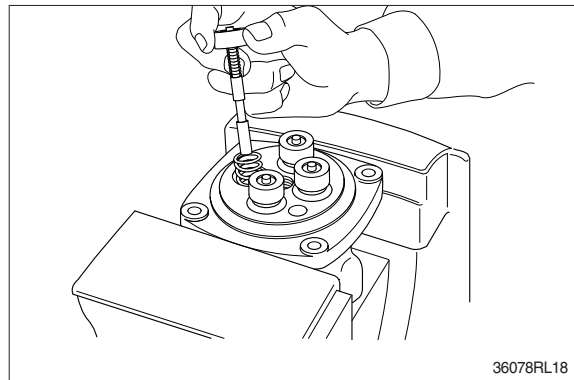
- (2) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (7) on spring seat without piling them on.

- ※ Assemble stopper (7) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.

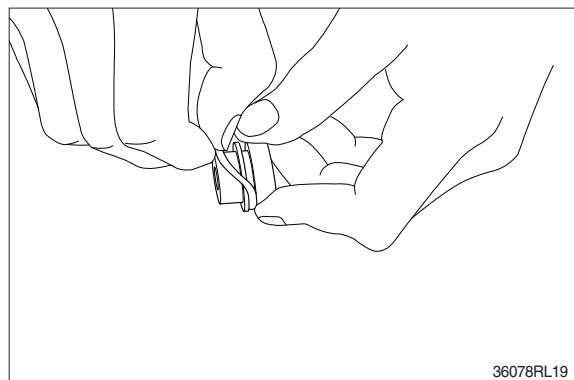


- (3) Assemble spring (9) into casing (1).
Assemble reducing valve subassembly into casing.

- ※ Assemble them to their original positions.

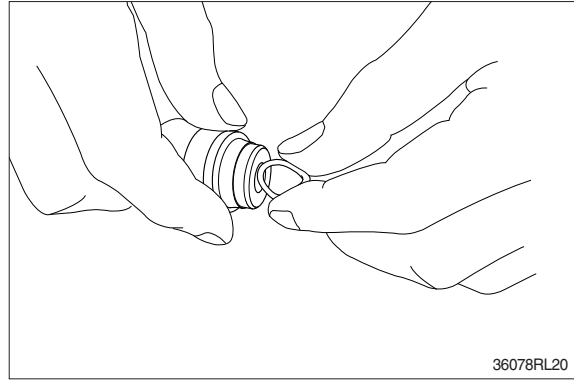


- (4) Assemble O-ring (14) onto plug (13).



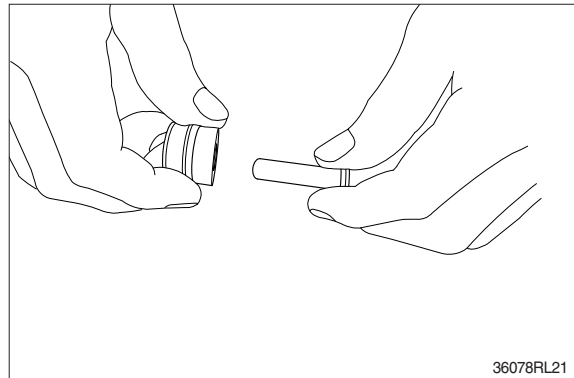
(5) Assemble seal (15) to plug (13).

- ※ Assemble seal in such lip direction as shown below.



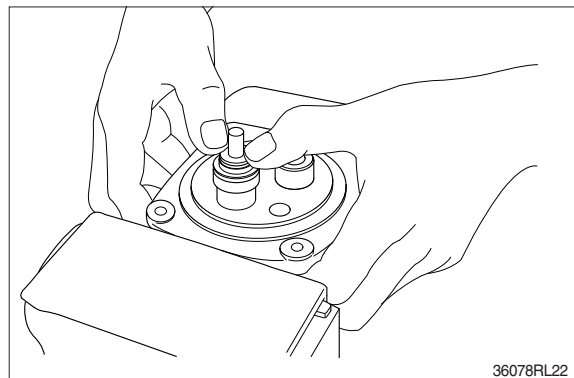
(6) Assemble push rod (10) to plug (13).

- ※ Apply working oil on push-rod surface.

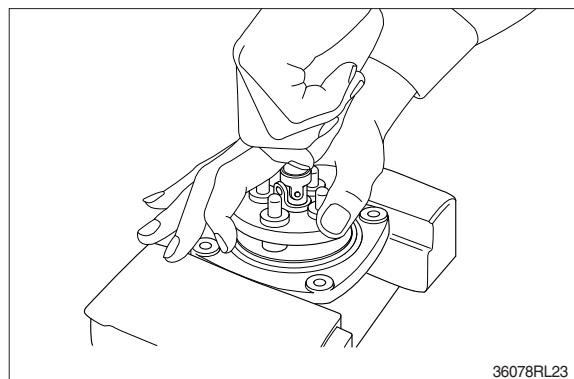


(7) Assemble plug subassembly to casing.

- ※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

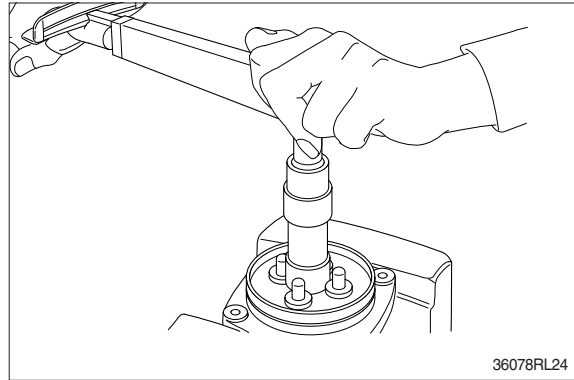


(8) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (16), and tighten joint (18) temporarily.



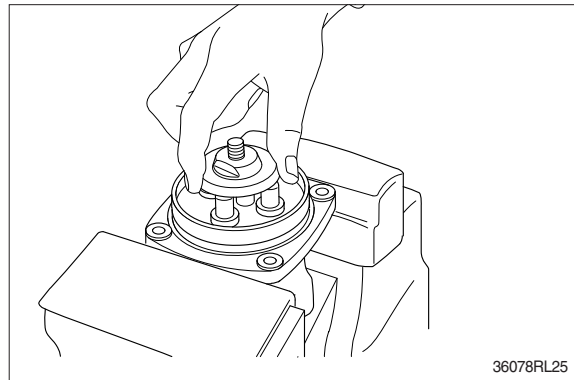
(9) Fit plate (16).

(10) Tighten joint (18) with the specified torque to casing, utilizing jig.



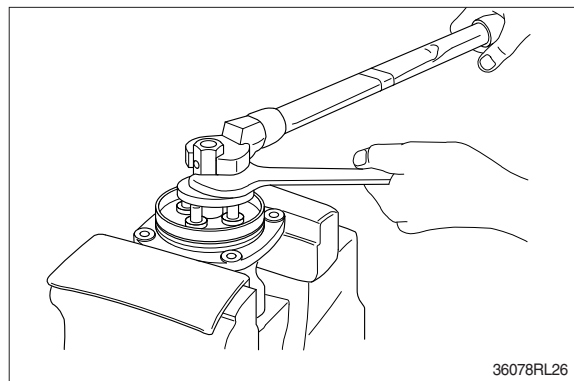
(11) Assemble swash plate (19) to joint (18).

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

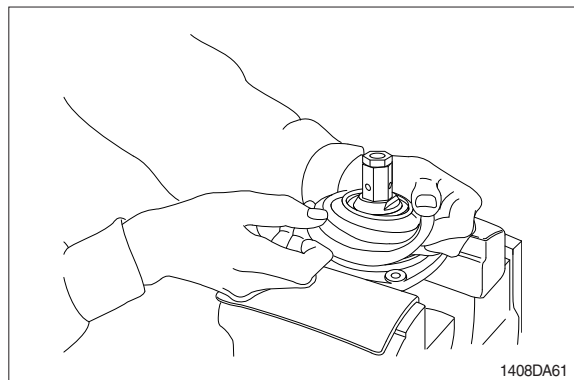


(12) Assemble adjusting nut (20), apply spanner to width across flat of plate (19) to fix it, and tighten adjusting nut to the specified torque.

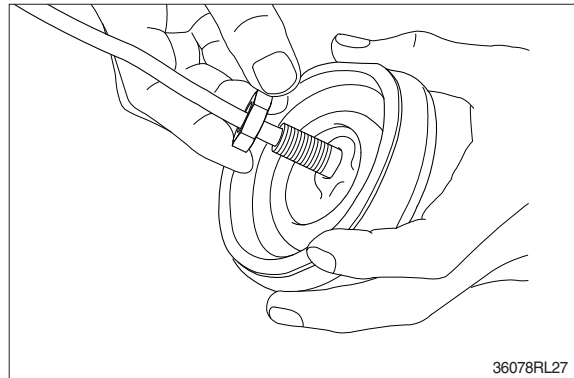
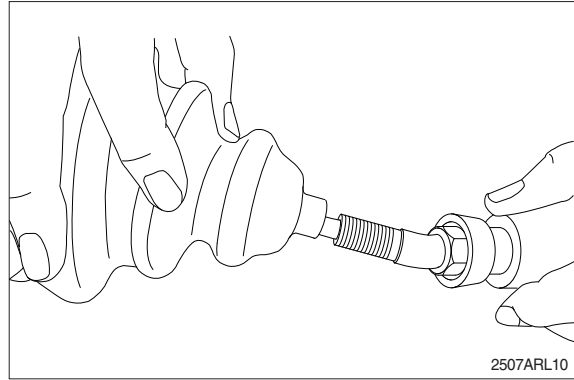
- ※ During tightening, do not change position of disk.



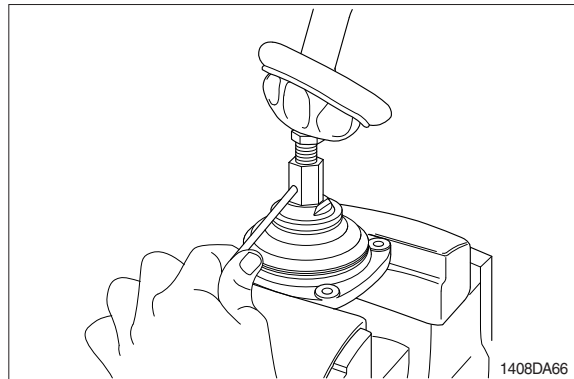
(13) Fit boot (17) to plate.



(14) Fit boot (25) and lock nut (21), and handle subassembly is assembled completely.

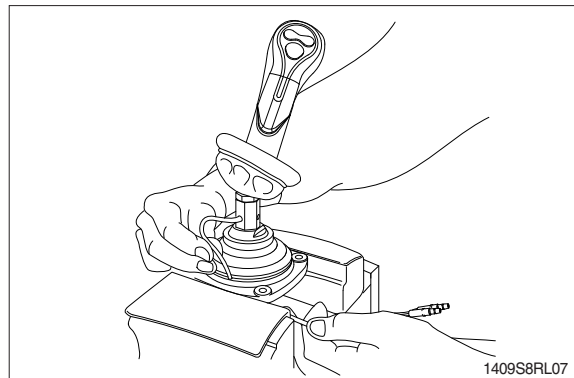


(15) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.

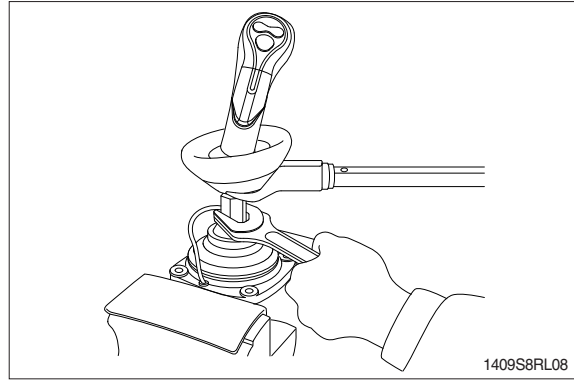


(16) Assemble bushing (27) to plate and pass cord and tube through it.

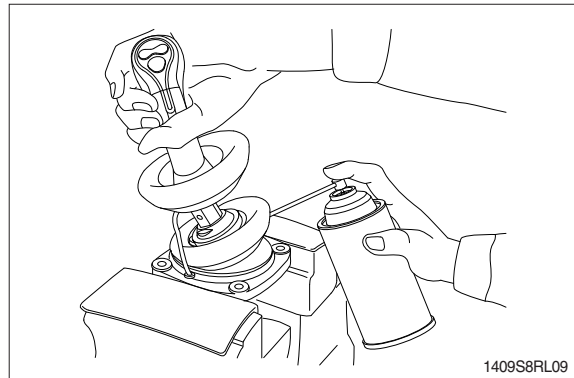
※ Provide margin necessary to operation.



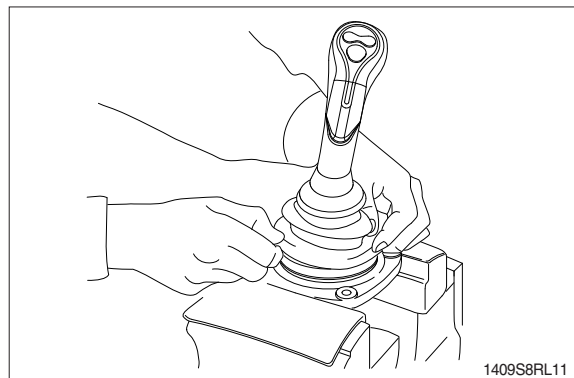
(17) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



(18) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(19) Assemble lower end of bellows to casing.
(20) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 8 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.

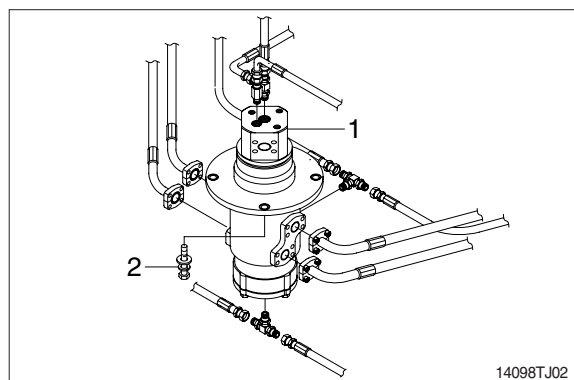
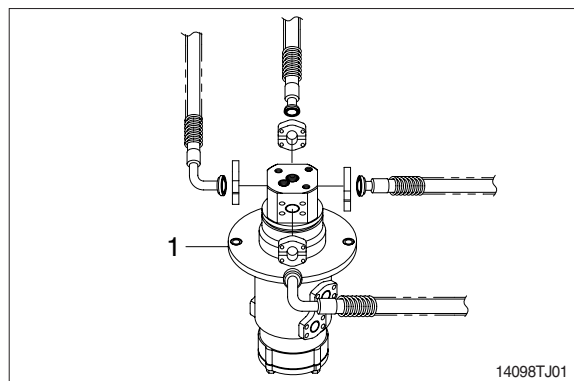
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
 - Weight : 50 kg (110 lb)
 - Tightening torque : $12.3 \pm 1.3 \text{ kgf} \cdot \text{m}$
($88.9 \pm 9.4 \text{ lbf} \cdot \text{ft}$)
- (6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

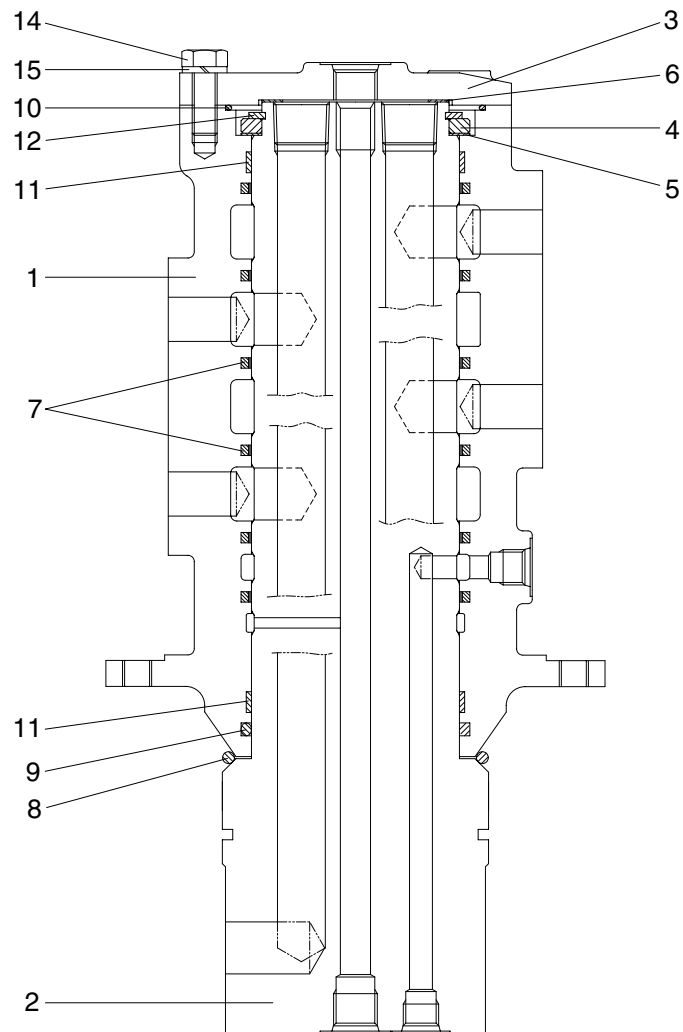
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - ※ Take care of turning joint direction.
 - ※ Assemble hoses to their original positions.
 - ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



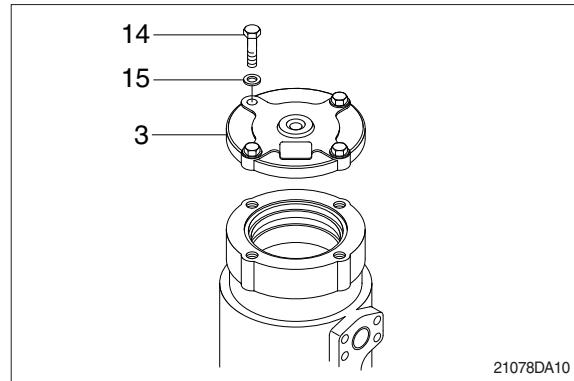
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- | | | | | | |
|---|--------|----|--------------|----|---------------|
| 1 | Hub | 6 | Shim | 11 | Wear ring |
| 2 | Shaft | 7 | Slipper seal | 12 | Retainer ring |
| 3 | Cover | 8 | O-ring | 13 | Plug |
| 4 | Spacer | 9 | O-ring | 14 | Hexagon bolt |
| 5 | Shim | 10 | O-ring | 15 | Spring washer |

2) DISASSEMBLY

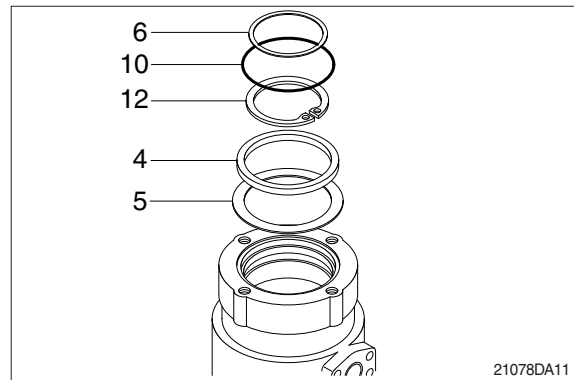
※ Before the disassembly, clean the turning joint.

- (1) Remove bolts (14), washer (15) and cover (3).



- (2) Remove shim (6) and O-ring (10).

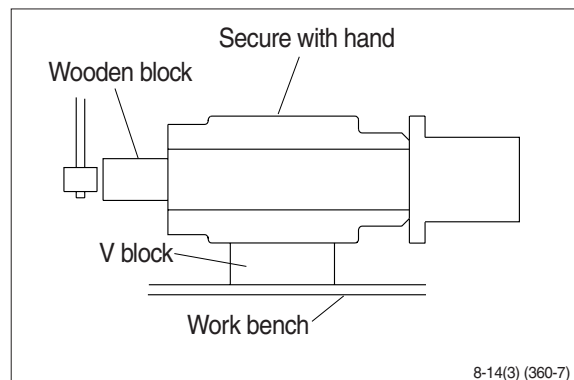
- (3) Remove retainer ring (12), spacer (4) and shim (5).



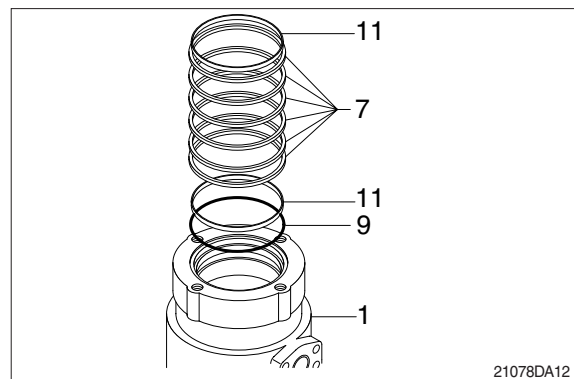
- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).



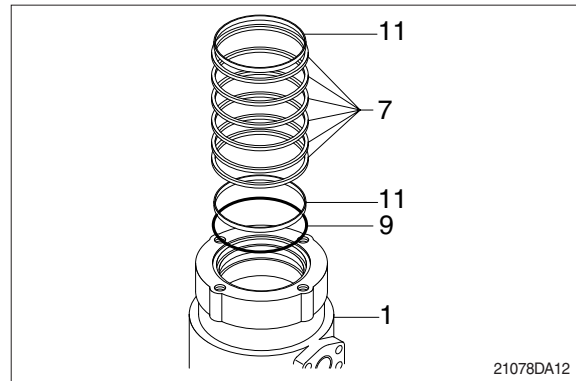
- (5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).



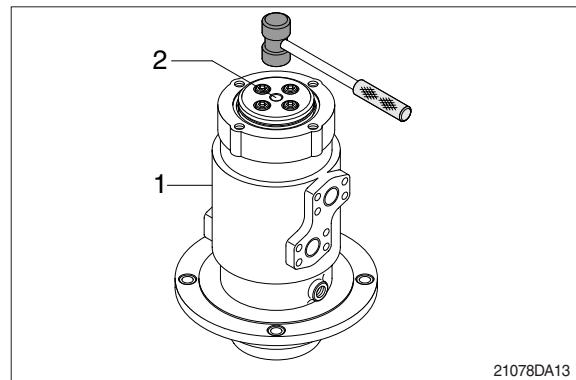
3) ASSEMBLY

- ※ 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.

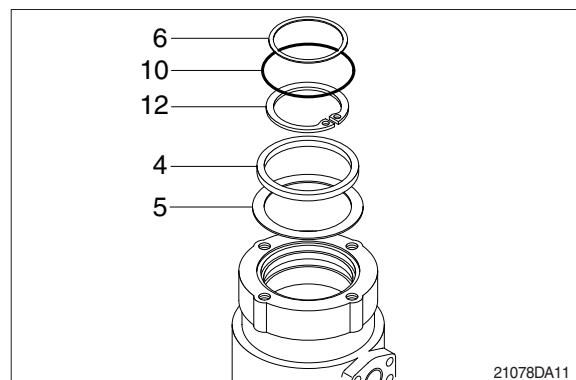
- (1) Fix seven slipper seal (7) and O-ring (9), two wear ring (11) to hub (1).
- (2) Fit O-ring (8) to shaft (2).



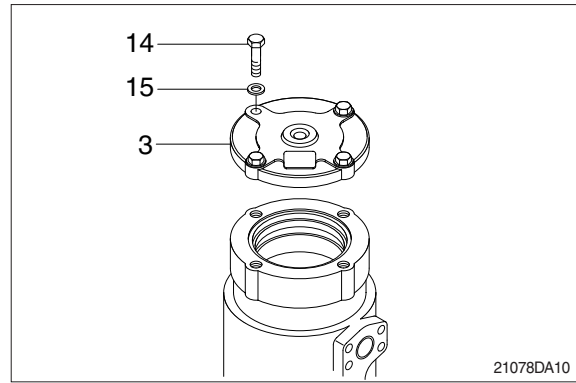
- (3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



- (4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).
- (5) Fit O-ring (10) to hub (1).
- (6) Fit shim (6) to shaft (2).



- (7) Install cover (3) to body (1) and tighten bolts (14).
- Torque : 10~12.5 kgf · m
(72.3~90.4 lbf · ft)



GROUP 9 BOOM, ARM AND BUCKET CYLINDERS

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

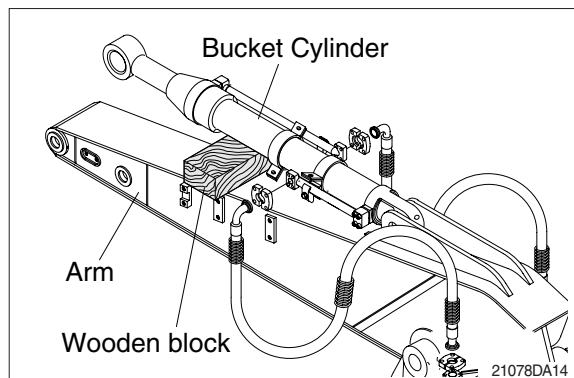
(1) Removal

- ※ 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.

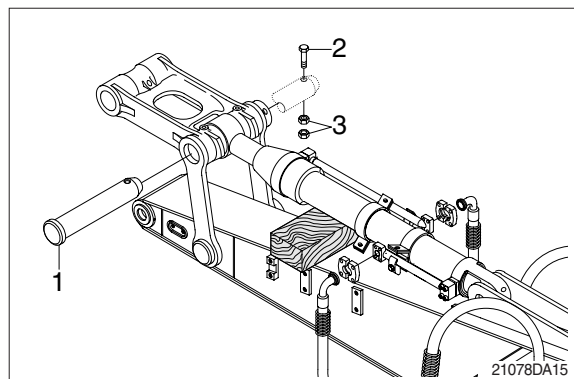
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between bucket cylinder and arm.

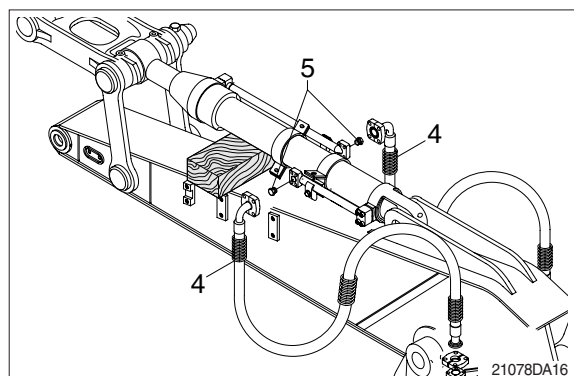


- ② Remove bolt (2), nut (3) and pull out pin (1).

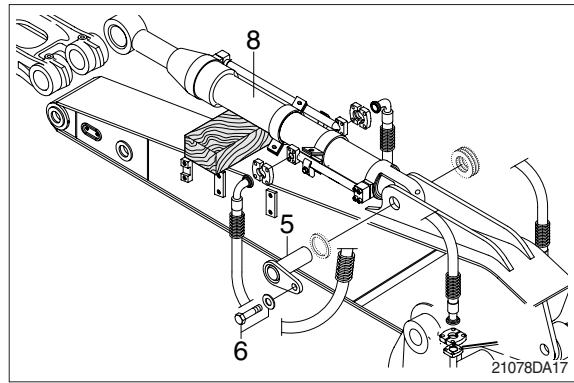
- ※ Tie the rod with wire to prevent it from coming out.



- 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 : 100 kg (220 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.

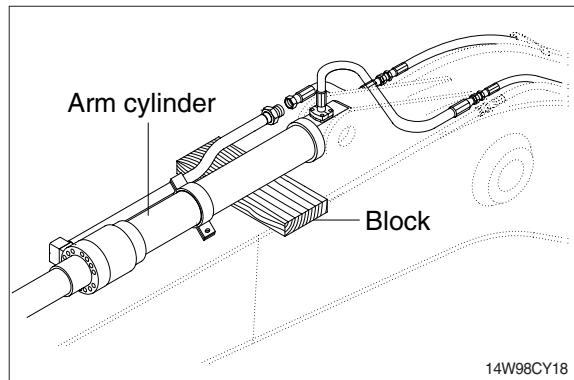
2) ARM CYLINDER

(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.

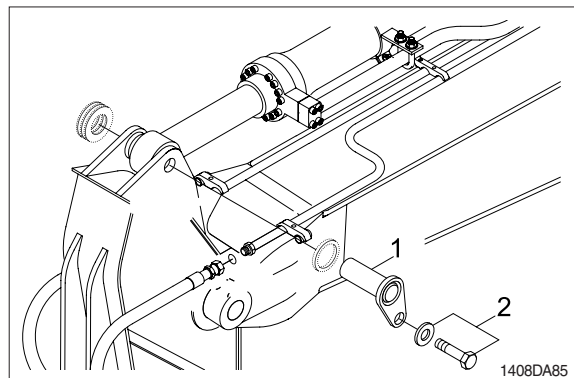
▲ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between arm cylinder and boom.



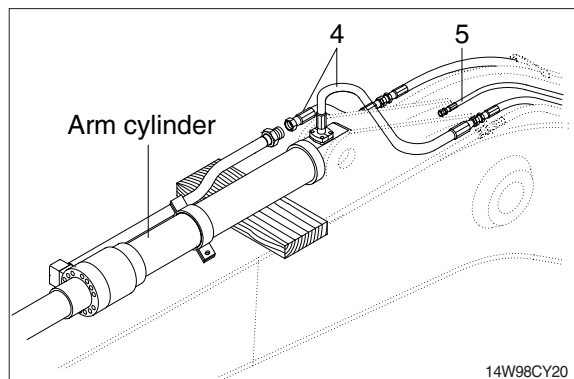
- ② Remove bolt (2) and pull out pin (1).

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

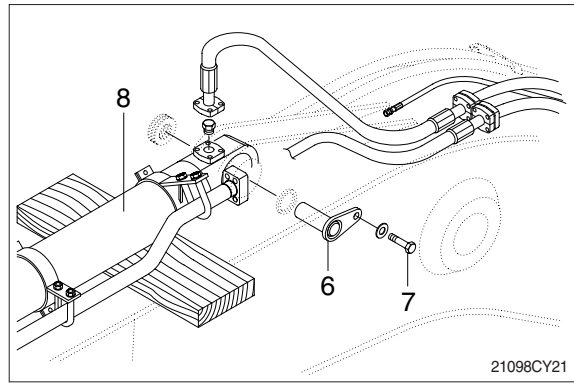


- ③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

- 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 : 160 kg (350 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.

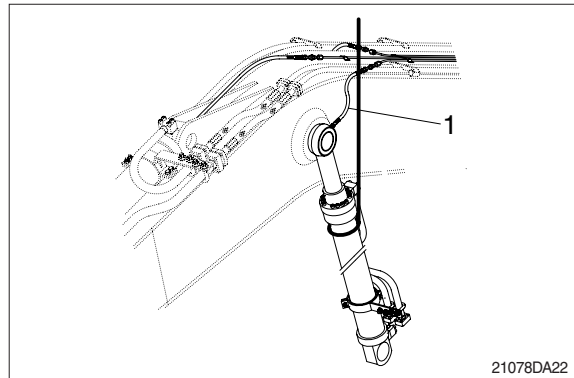
3) BOOM CYLINDER

(1) Removal

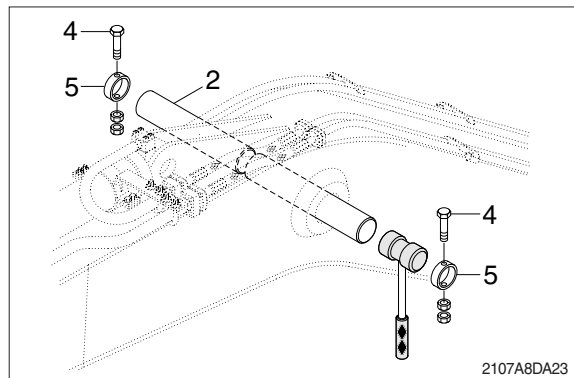
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- ※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

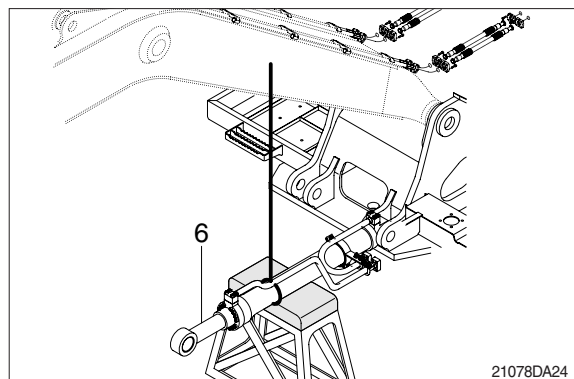
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Disconnect greasing hoses (1).
 - ② Sling boom cylinder assembly.



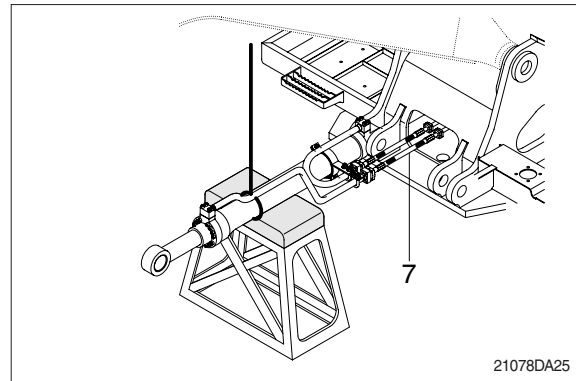
- ③ Remove bolt (4), stopper (5) and pull out pin (2).
- ※ Tie the rod with wire to prevent it from coming out.



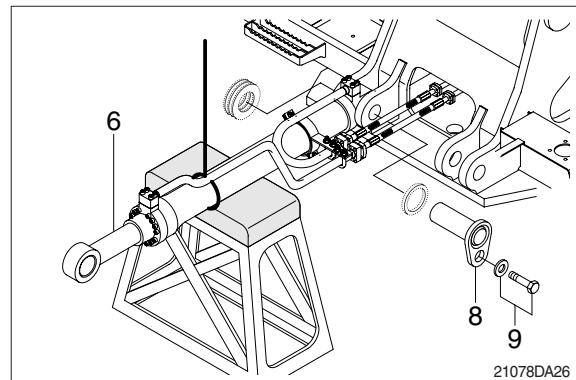
- ④ Lower the boom cylinder assembly (6) on a stand.



- 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 : 130 kg (285 lb)



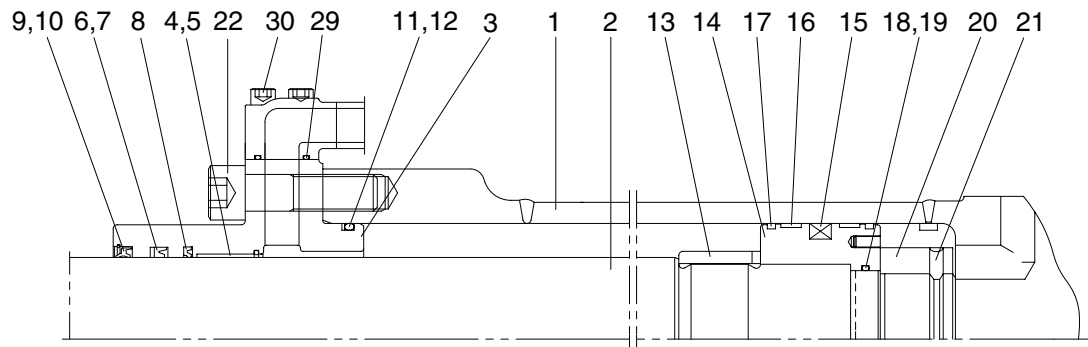
(2) Install

- 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.

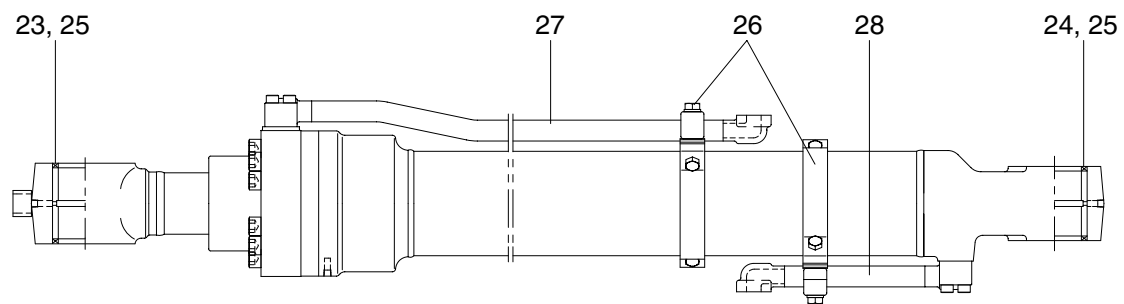
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder



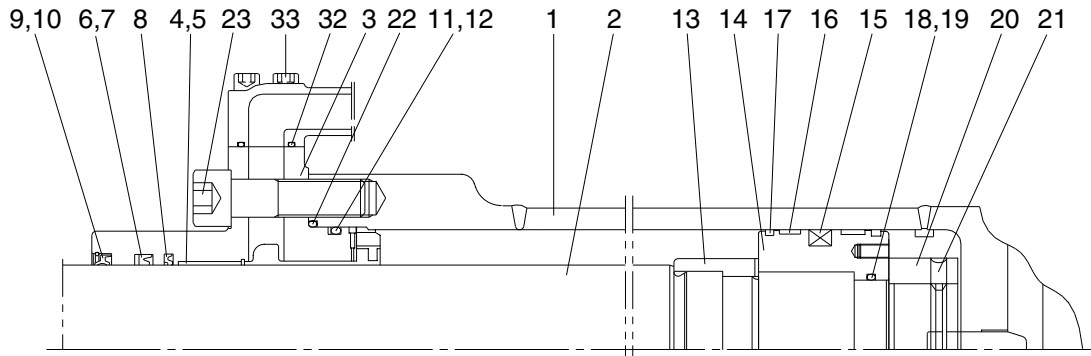
Internal detail



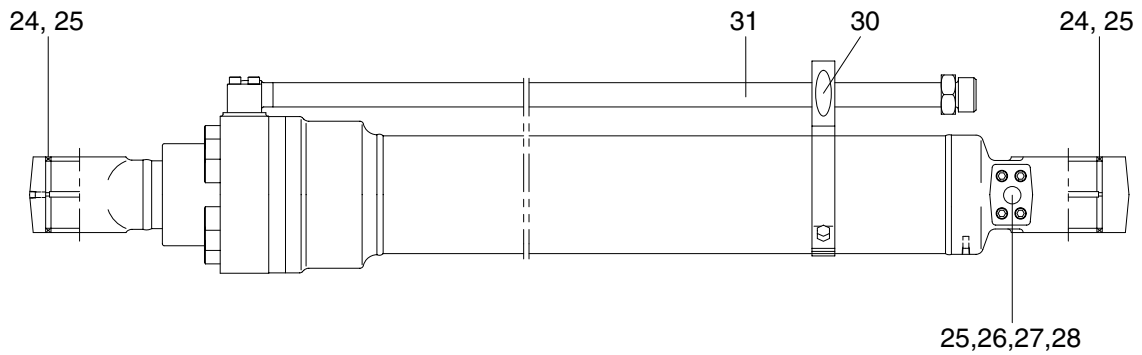
14W98CY01

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	Pin bushing
5	Snap ring	15	Piston seal	25	Dust seal
6	Rod seal	16	Wear ring	26	Band assembly
7	Back up ring	17	Dust ring	27	Pipe assembly-R
8	Buffer ring	18	O-ring	28	Pipe assembly-B
9	Dust wiper	19	Back up ring	29	O-ring
10	Snap ring	20	Lock nut	30	Hexagon socket head bolt

(2) Arm cylinder



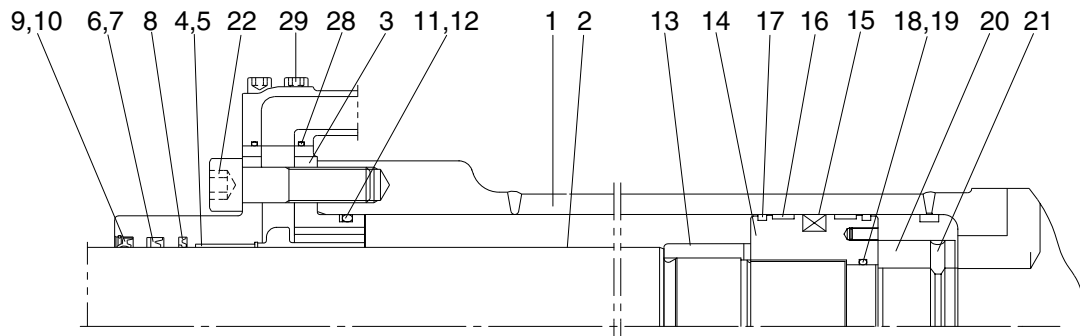
Internal detail



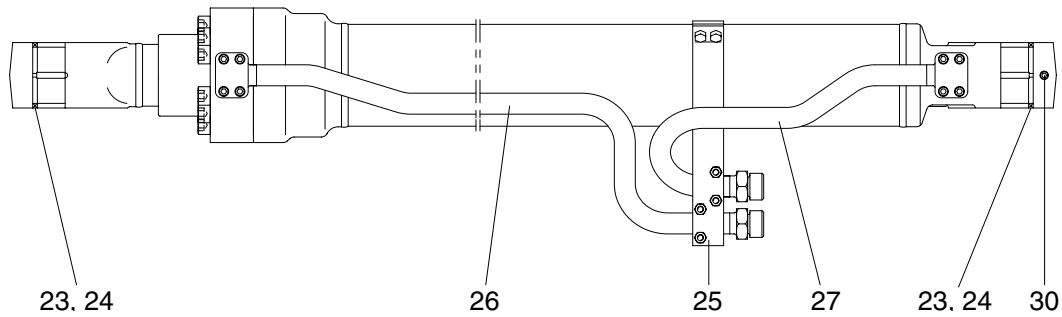
14W98CY02

- | | | | | | |
|----|---------------|----|--------------------------|----|--------------------------|
| 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 | Dust seal |
| 4 | DD2 bushing | 15 | Piston seal | 26 | Check valve |
| 5 | Snap ring | 16 | Wear ring | 27 | Coil spring |
| 6 | Rod seal | 17 | Dust ring | 28 | O-ring |
| 7 | Back up ring | 18 | O-ring | 29 | Plug |
| 8 | Buffer ring | 19 | Back up ring | 30 | Band assembly |
| 9 | Dust wiper | 20 | Lock nut | 31 | Pipe assembly-R |
| 10 | Snap ring | 21 | Hexagon socket set screw | 32 | O-ring |
| 11 | O-ring | 22 | O-ring | 33 | Hexagon socket head bolt |

(3) Boom cylinder



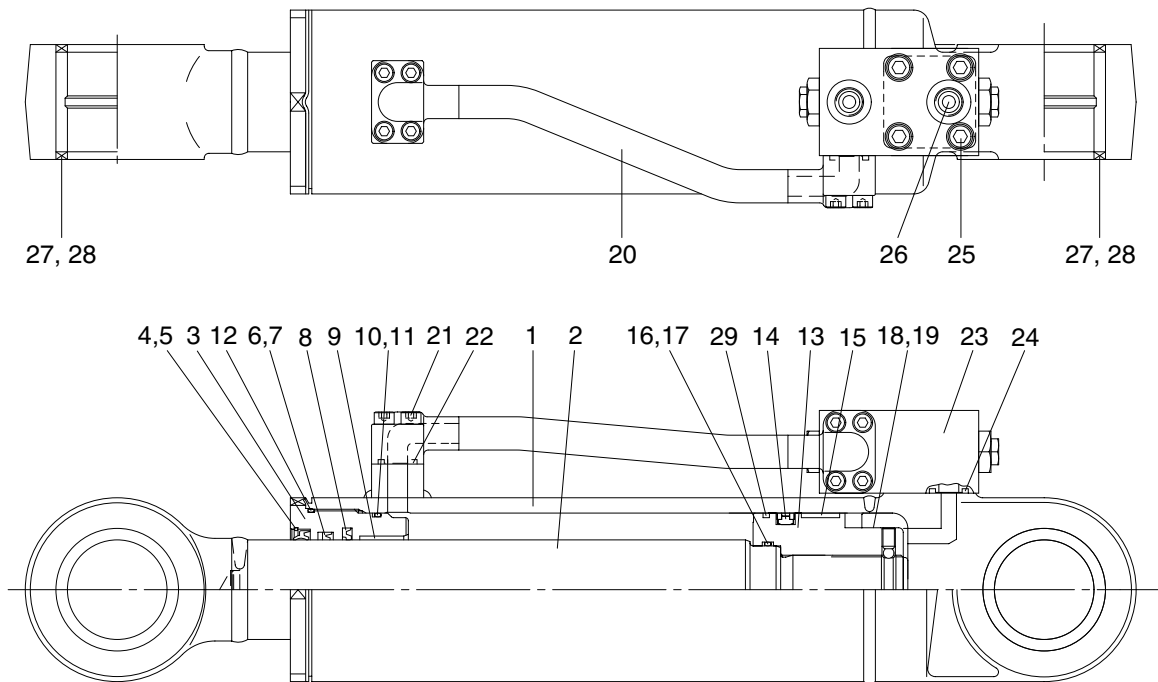
Internal detail



1409S8CY03

- | | | | | | |
|----|---------------|----|--------------|----|--------------------------|
| 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 | 30 | Plug |

(4) Dozer cylinder

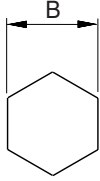


1409S8CY05

1	Tube assembly	11	Back up ring	21	Hexagon socket head bolt
2	Rod assembly	12	O-ring	22	O-ring
3	Gland	13	Piston	23	Check valve assembly
4	Dust wiper	14	Piston seal	24	O-ring
5	Retainer ring	15	Wear ring	25	Hexagon socket head bolt
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	29	Dust ring
10	O-ring	20	Pipe assembly		

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

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	22	M14	15±2.0	108±14.5
	Boom cylinder		M14	15±2.0	108±14.5
	Arm cylinder	23	M16	23±2.0	166±14.5
	Dozer cylinder	21	M8	2.7±0.3	19.5±2.2
		25, 26	M10	5.4±0.5	39.1±3.6
Pipe mounting socket head bolt	Bucket	30	M10	5.4±0.5	39.1±3.6
	Boom	29	M8	2.7±0.3	19.6±2.2
	Arm	33	M10	5.4±0.5	39.1±3.6
Lock nut	Bucket cylinder	20	M45	100±10.0	723±72.3
	Boom cylinder		M50		
	Arm cylinder		M55		
Piston	Bucket cylinder	14	-	150±15.0	1085±109
	Boom cylinder				
	Arm cylinder				
	Dozer cylinder - Rear	13	M52		

3) DISASSEMBLY

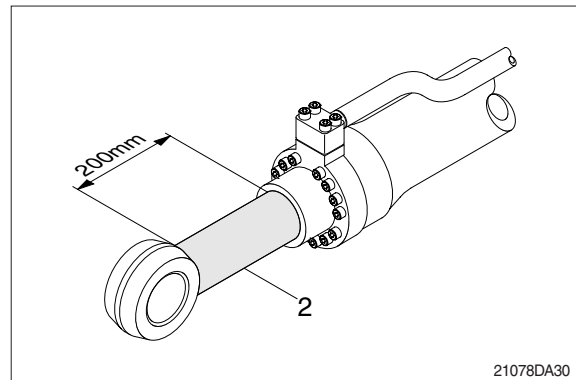
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

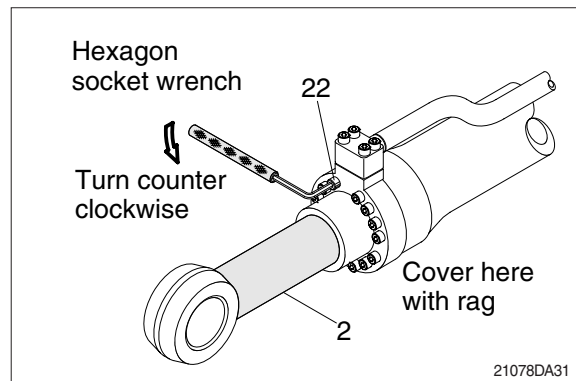
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200mm (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



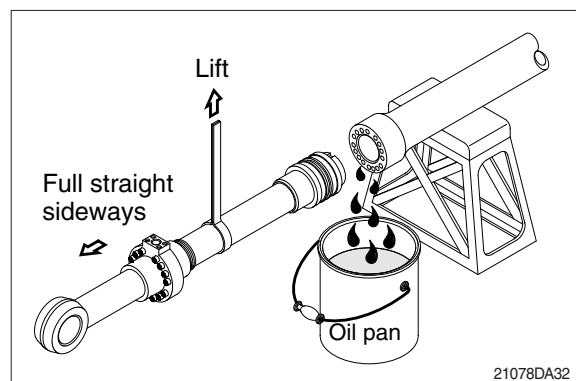
③ Loosen and remove socket bolts (22) of the gland in sequence.

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



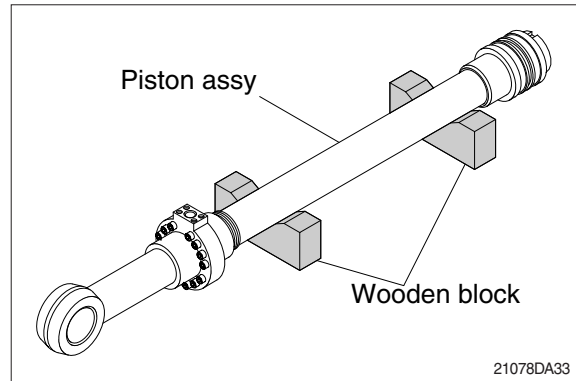
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ 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.



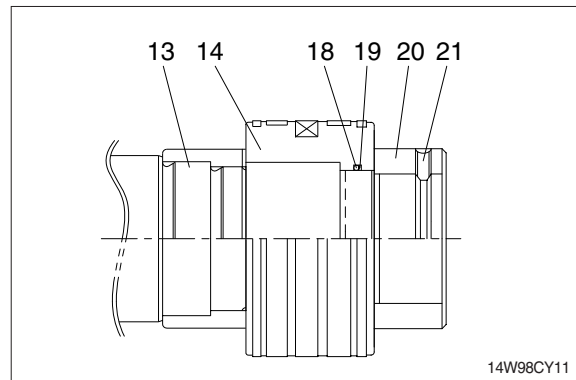
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

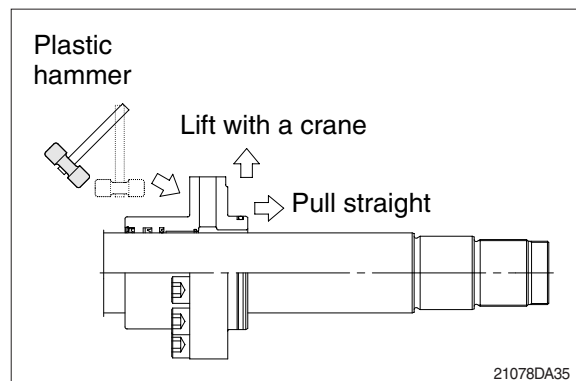


(2) Remove piston and cylinder head

- 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).

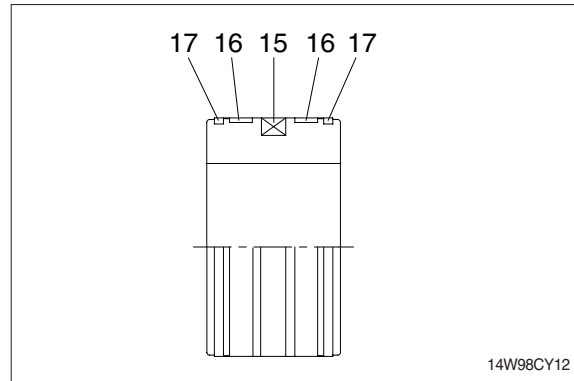


- ③ Remove the cylinder head assembly from rod assembly (2).
 - ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
 - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of rod bushing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



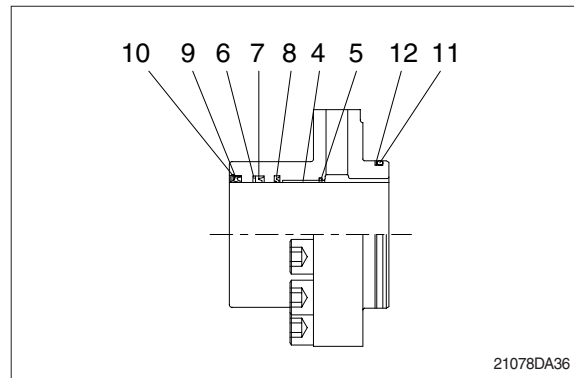
(3) Disassemble the piston assembly

- 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

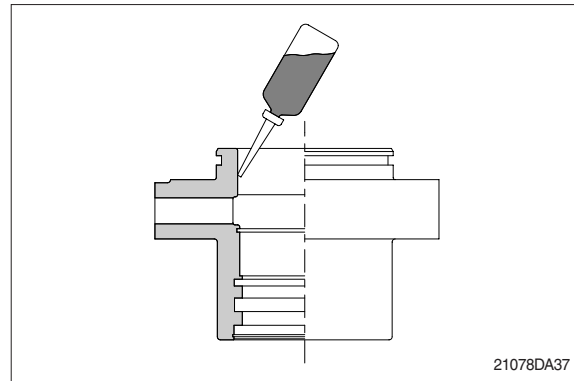
- ① Remove back up ring (12) and O-ring (11).
 - ② Remove snap ring (10), dust wiper (9).
 - ③ Remove back up ring (7), rod seal (6) and buffer ring (8).
- ※ Exercise care in this operation not to damage the grooves.
- ※ Do not remove seal and ring, if does not damaged.
- ※ Do not remove bushing (4).



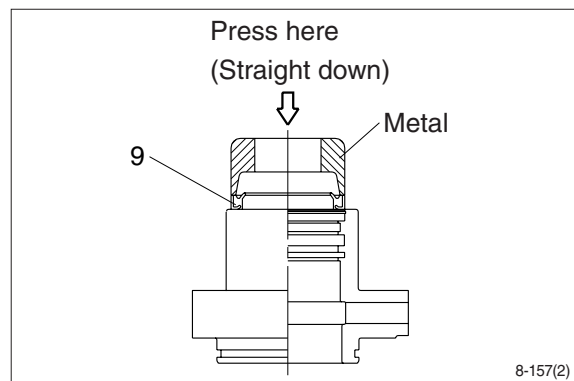
3) ASSEMBLY

(1) Assemble cylinder head assembly

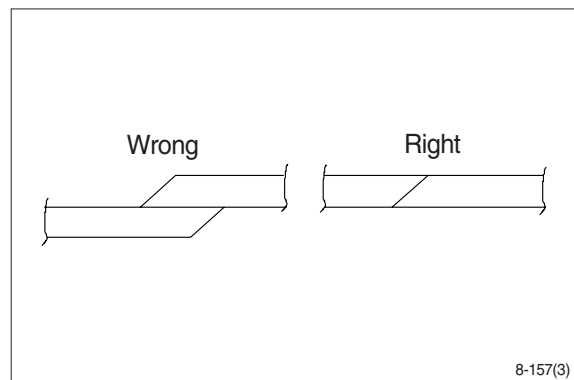
- * Check for scratches or rough surfaces if found smooth with an oil stone.
- ① Coat the inner face of gland (3) with hydraulic oil.



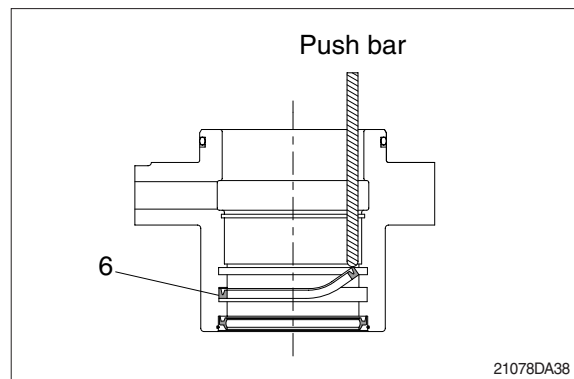
- ② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.
- ③ Fit snap ring (10) to the stop face.



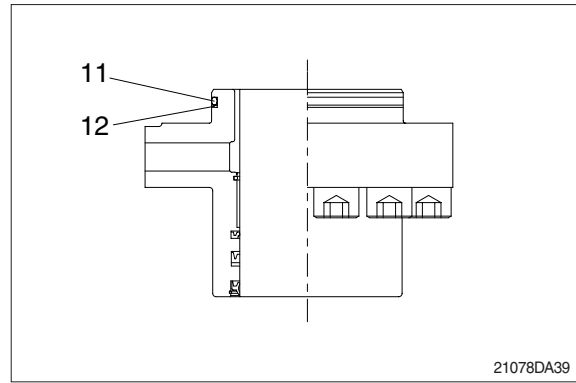
- ④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.
 - * Coat each packing with hydraulic oil before fitting it.
 - * Insert the backup ring until one side of it is inserted into groove.



- * 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.

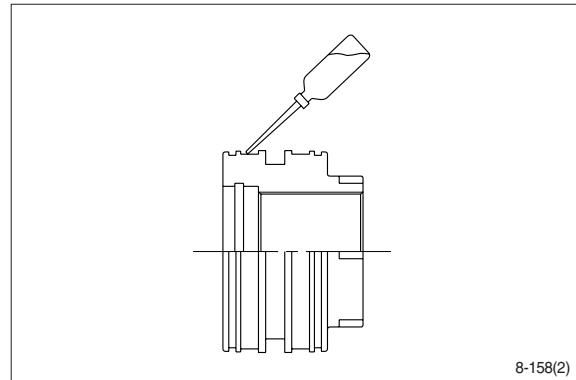


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) to gland (3).

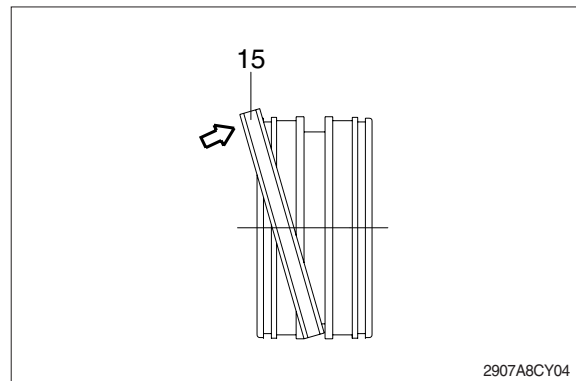


(2) Assemble piston assembly

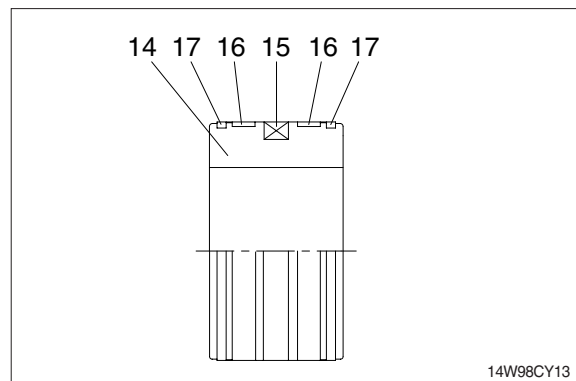
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- 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.

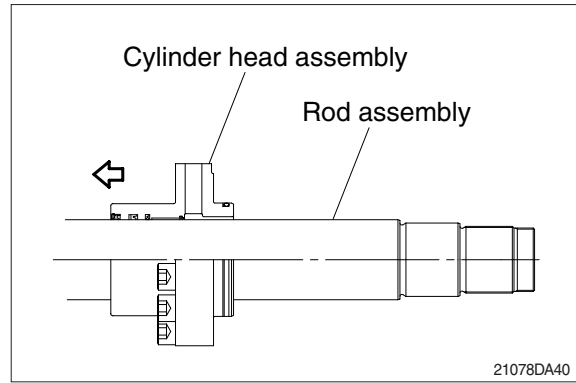


- ③ Fit wear ring (16) and dust ring (17) to piston (14).

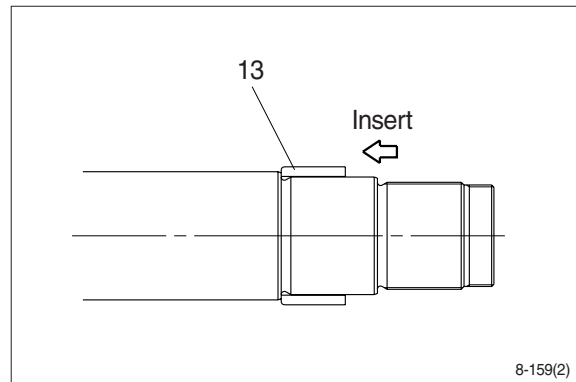


(3) Install piston and cylinder head

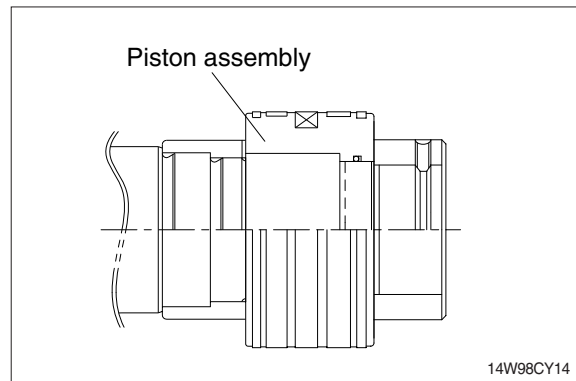
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.



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

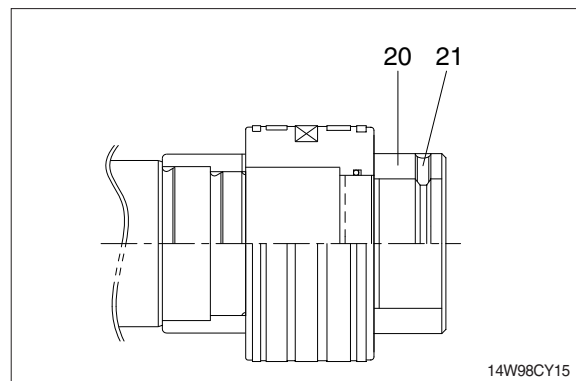


- ⑤ Fit piston assembly to rod assembly.
- Tightening torque : $150 \pm 15 \text{ kgf} \cdot \text{m}$
($1085 \pm 108 \text{ lbf} \cdot \text{ft}$)



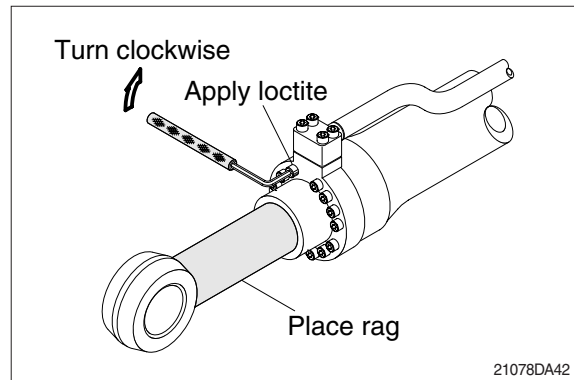
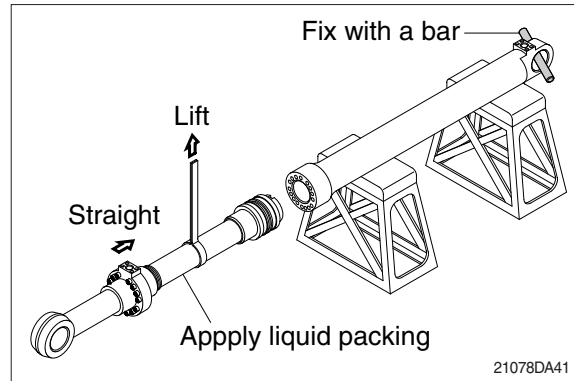
- ⑥ Fit lock nut (20) and tighten the screw (21).
- Tightening torque :

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 10 UNDERCARRIAGE

1. TRACK LINK

1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.

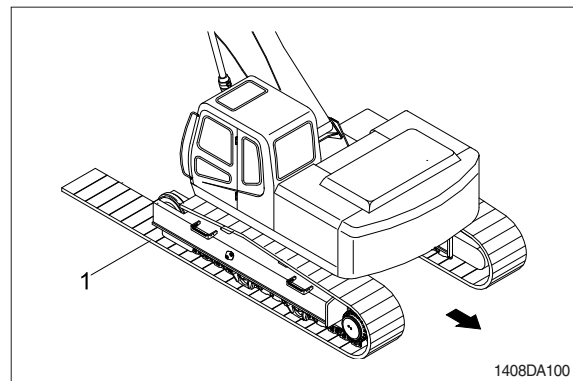
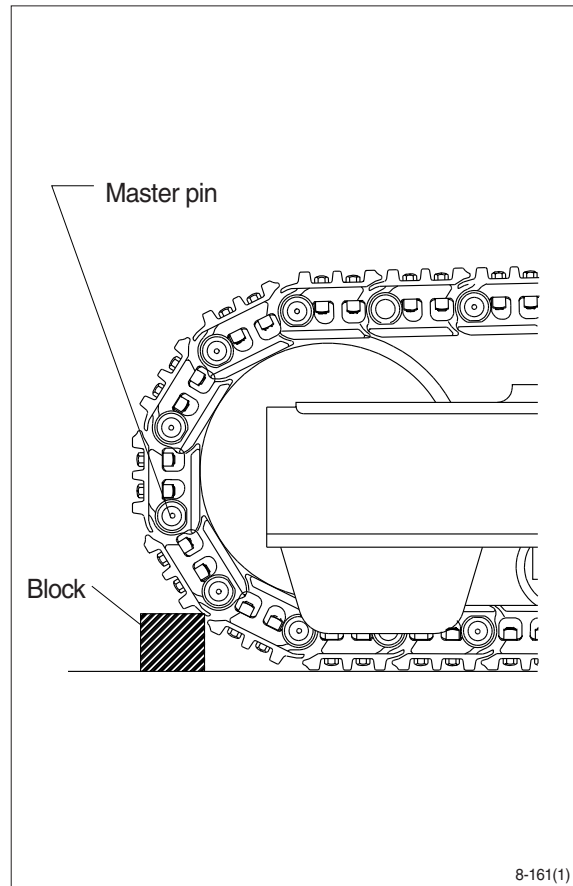
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

(3) Push out master pin by using a suitable tool.

(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

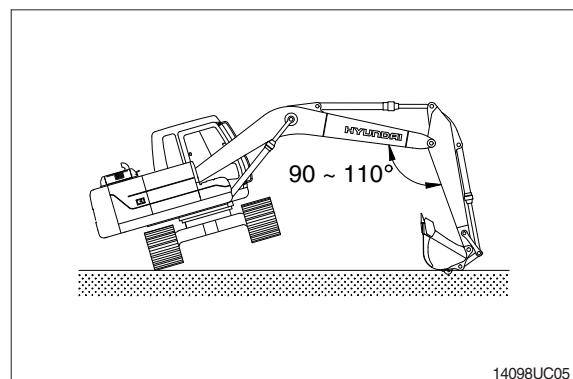
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

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

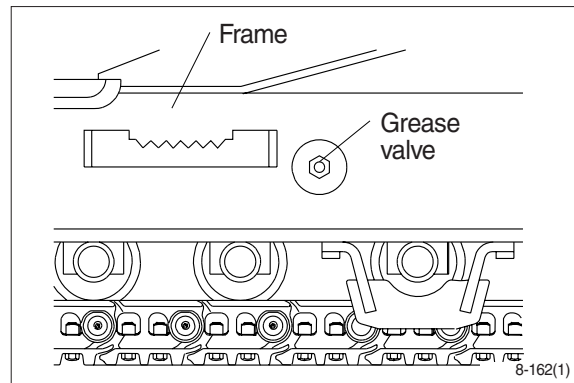
※ Adjust the tension of the track link.



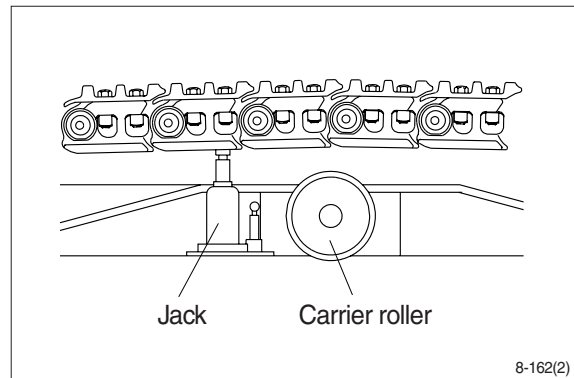
2. CARRIER ROLLER

1) REMOVAL

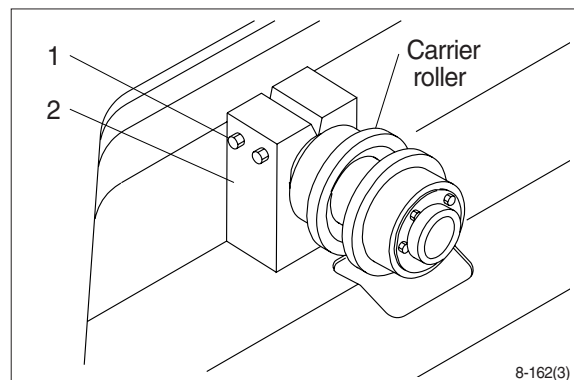
- (1) Loosen tension of the track link.



- (2) Jack up the track link height enough to permit carrier roller removal.



- (3) Loosen the lock nut (1).
- (4) Open bracket(2) with a screwdriver, push out from inside, and remove carrier roller assembly.
 - Weight : 21 kg (46 lb)



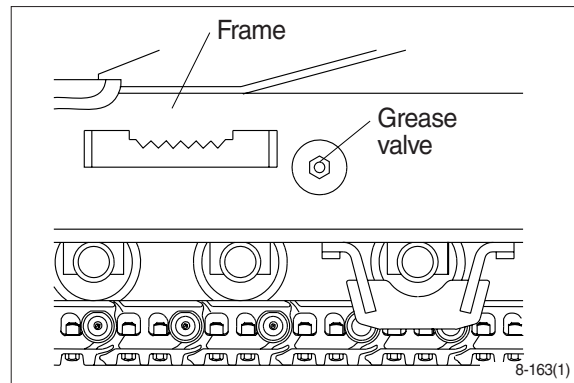
2) INSTALL

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

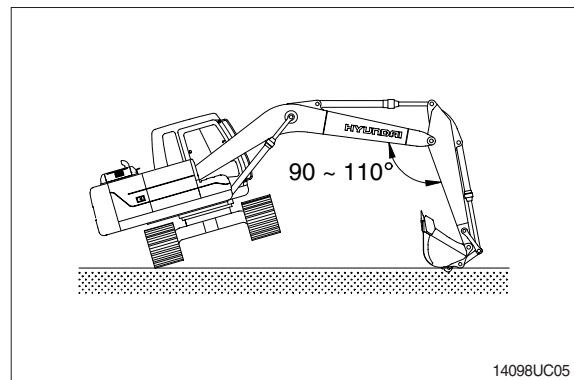
3. TRACK ROLLER

1) REMOVAL

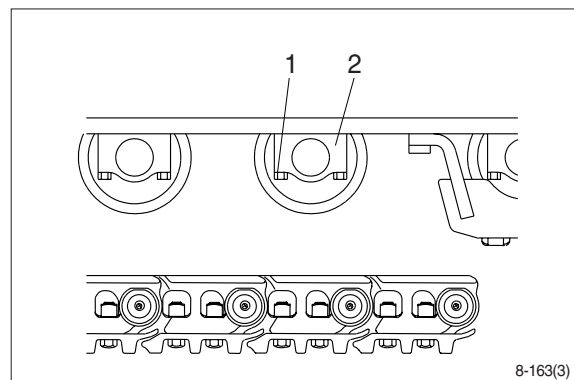
- (1) Loosen tension of the track link.



- (2) Using the work equipment, push up track frame on side which is to be removed.
※ After jack up the machine, set a block under the unit.



- (3) Remove the mounting bolt (1) and draw out the track roller (2).
· Weight : 38.3 kg (84.4 lb)



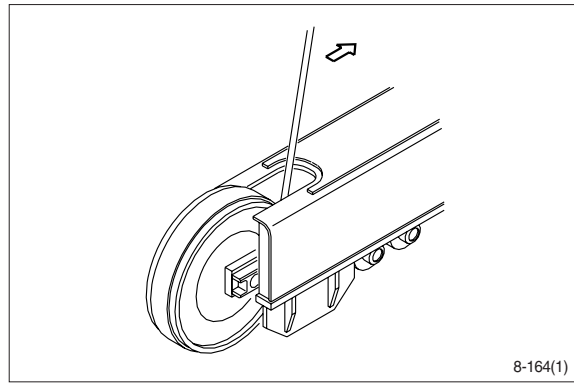
2) INSTALL

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

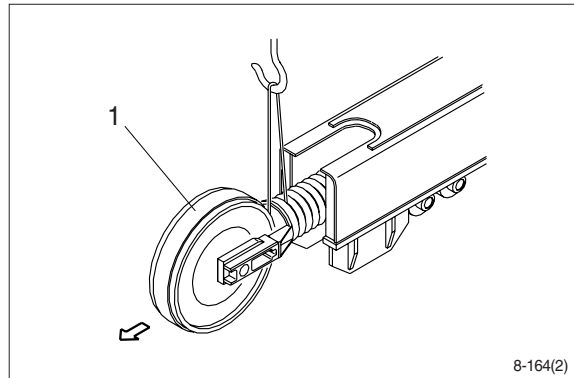
4. IDLER AND RECOIL SPRING

1) REMOVAL

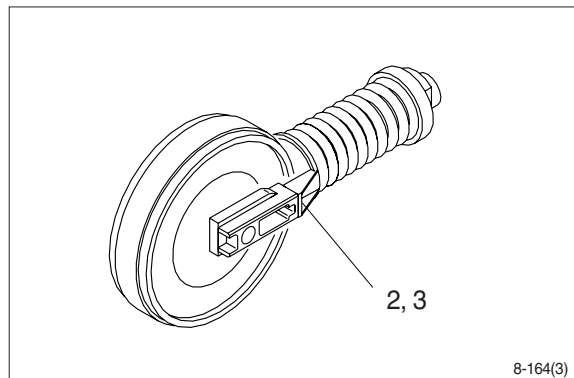
- (1) Remove the track link.
For detail, see removal of track link.



- (2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 192 kg (423 lb)

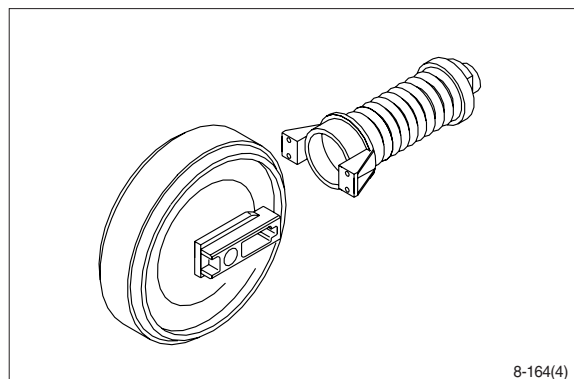


- (3) Remove the bolts (2), washers (3) and separate idler from recoil spring.



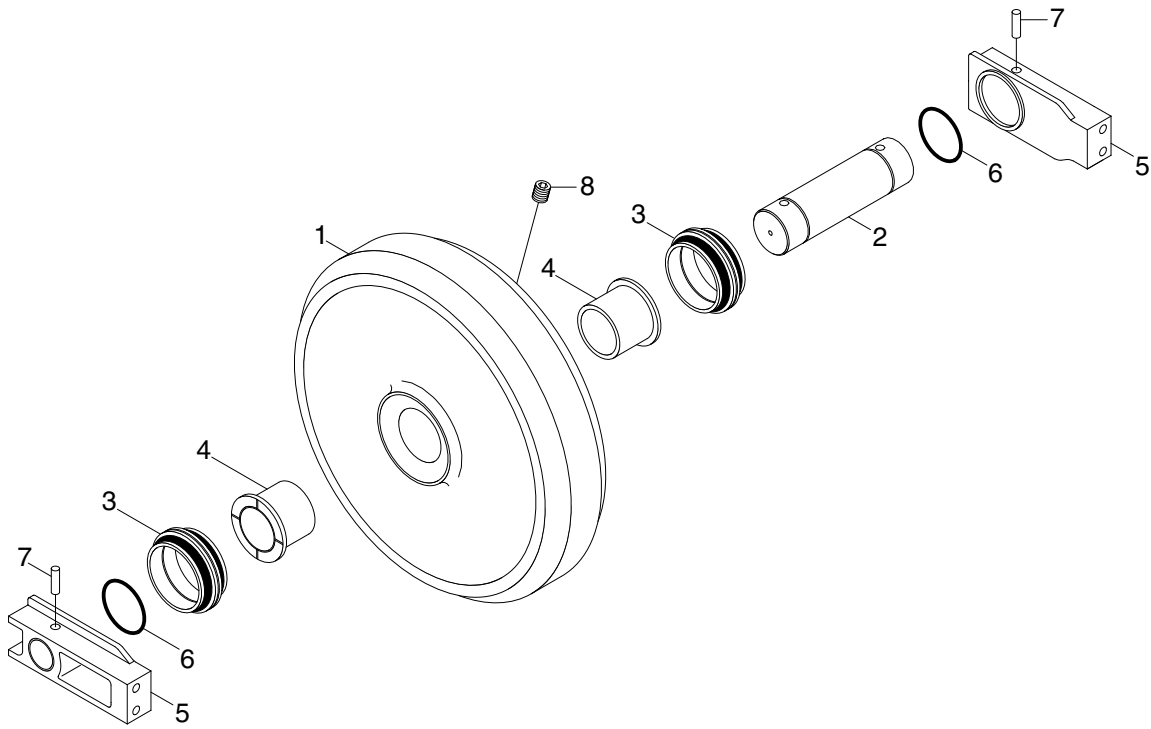
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



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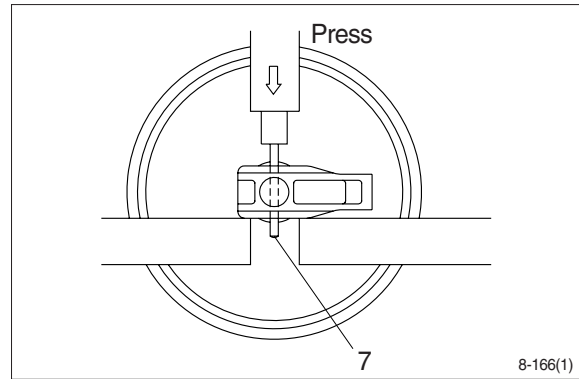
- 1 Shell
- 2 Shaft
- 3 Seal assembly

- 4 Bushing
- 5 Bracket
- 6 O-ring

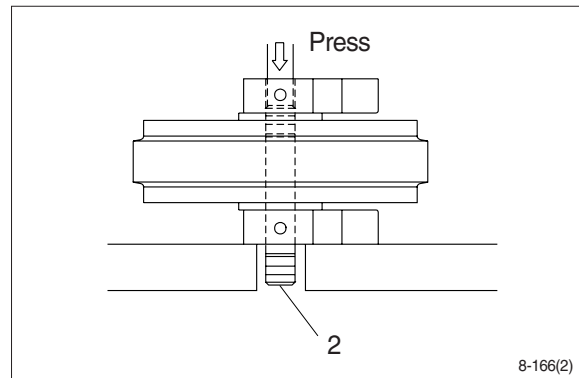
- 7 Spring pin
- 8 Plug

(2) Disassembly

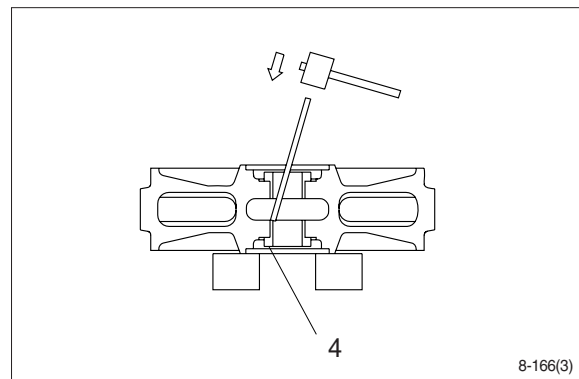
- ① Remove plug and drain oil.
- ② Draw out the spring pin (7), using a press.



- ③ Pull out the shaft (2) with a press.
- ④ Remove seal (3) from idler (1) and bracket (5).
- ⑤ Remove O-ring (6) from shaft.

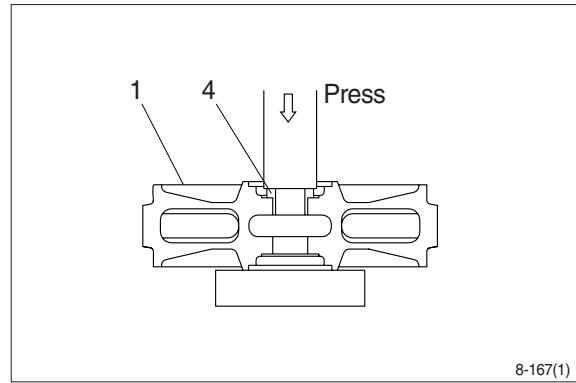


- ⑥ Remove the bushing (4) from idler, using a special tool. Only remove bushing if replacement is necessary.

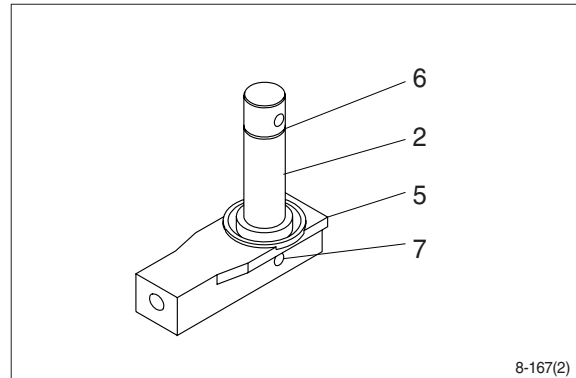


(3) Assembly

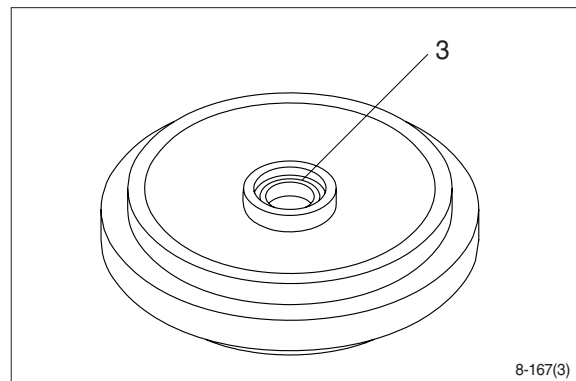
- ※ Before assembly, clean the parts.
- ※ Coat the sliding surfaces of all parts with oil.
- ① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



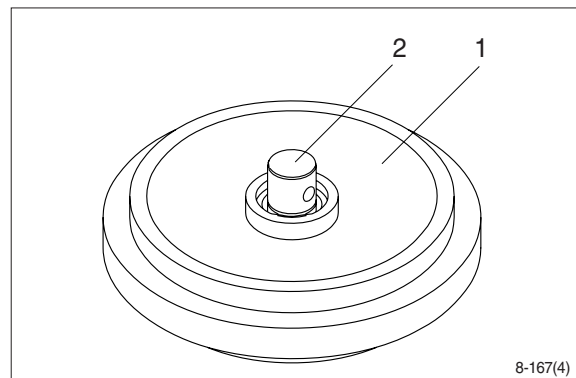
- ② Coat O-ring (6) with grease thinly, and install it to shaft (2).
- ③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



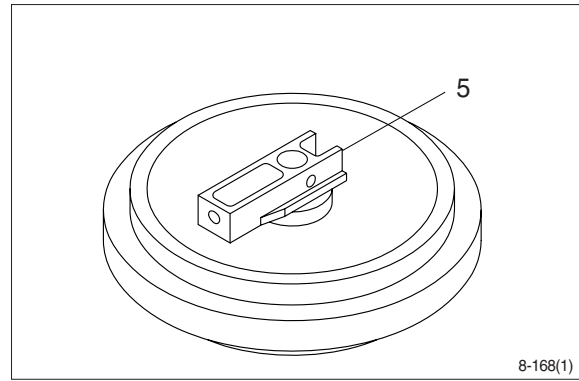
- ④ Install seal (3) to shell (1) and bracket (5).



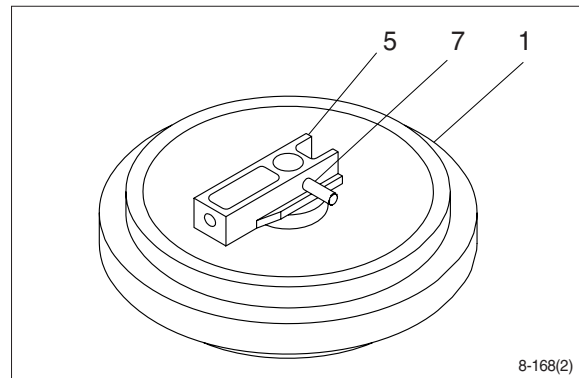
- ⑤ Install shaft (2) to shell (1).



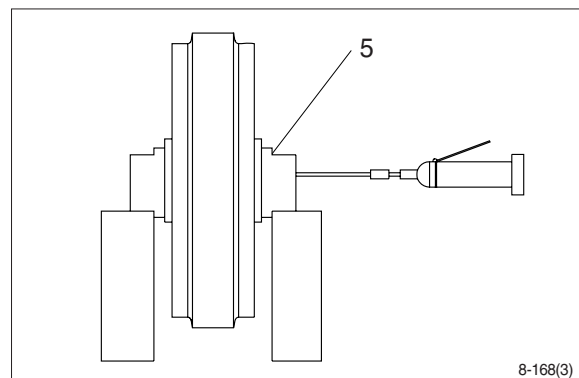
⑥ Install bracket (5) attached with seal (3).



⑦ Knock in the spring pin (7) with a hammer.

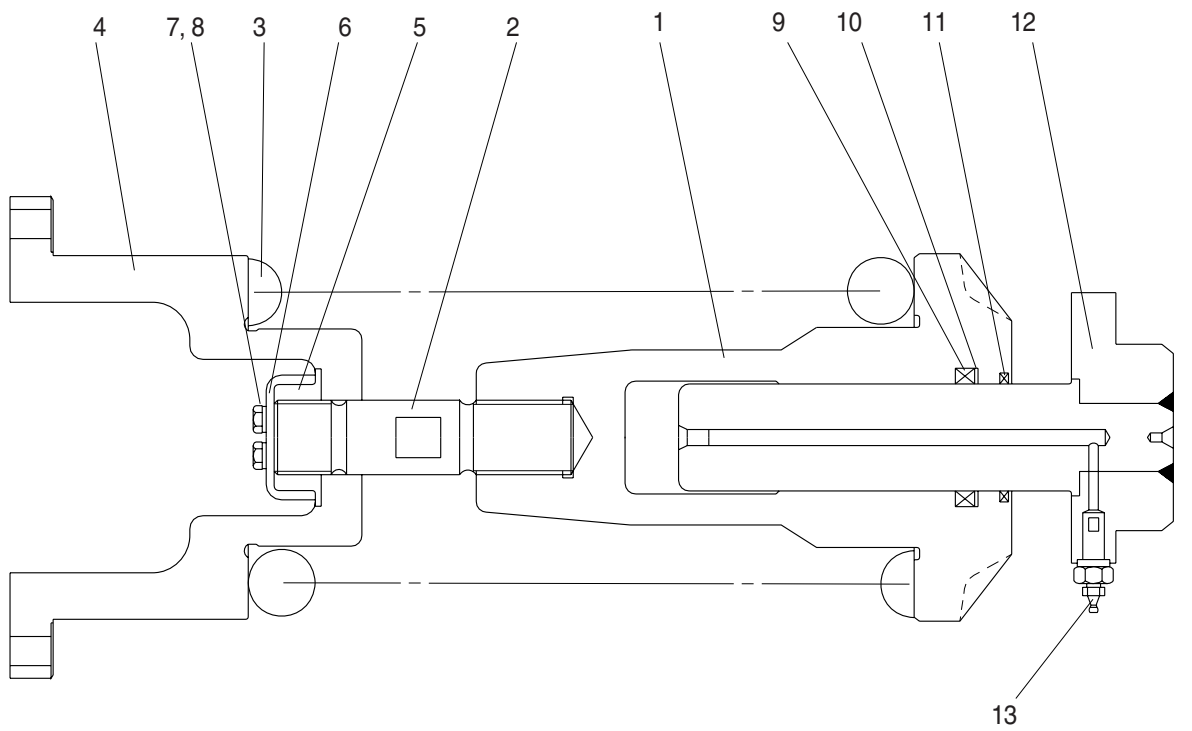


⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level,
and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



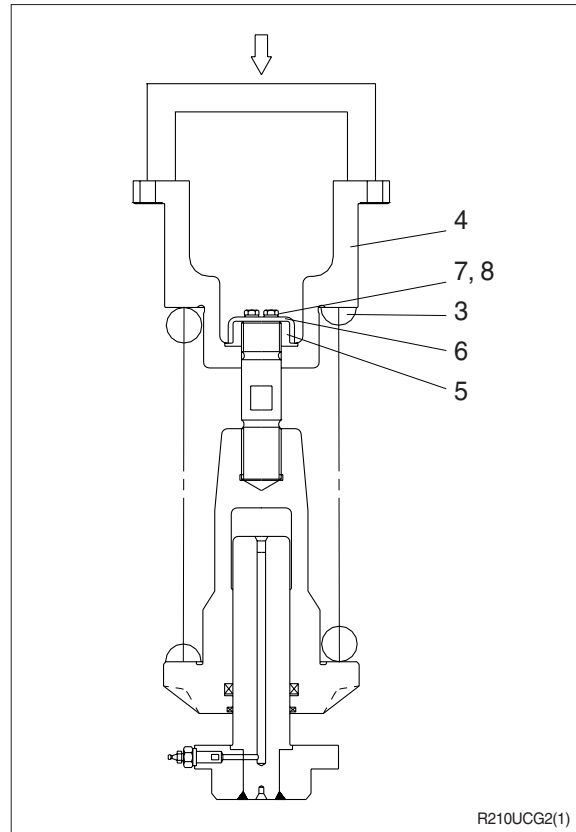
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- | | | | | | |
|---|----------|----|---------------|----|--------------|
| 1 | Body | 6 | Lock plate | 11 | Dust seal |
| 2 | Tie bar | 7 | Bolt | 12 | Rod assembly |
| 3 | Spring | 8 | Spring washer | 13 | Grease valve |
| 4 | Bracket | 9 | Rod seal | | |
| 5 | Lock nut | 10 | Back up ring | | |

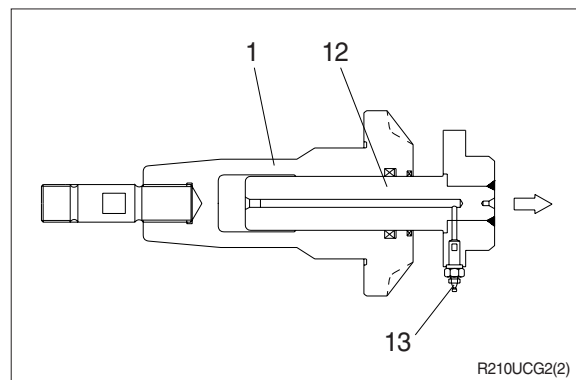
(2) Disassembly

- ① Apply pressure on spring (3) with a press.
 - ※ The spring is under a large installed load. This is dangerous, so be sure to set properly.
 - Spring set load : 11132 kg (24542 lb)
- ② Remove bolt (7), spring washer (8) and lock plate (6).
- ③ Remove lock nut (5).

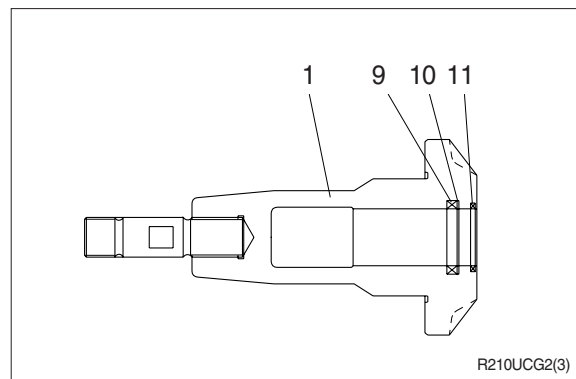
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.
- ④ Lighten the press load slowly and remove bracket (4) and spring (3).



- ⑤ Remove rod (12) from body (1).
- ⑥ Remove grease valve (13) from rod (12).



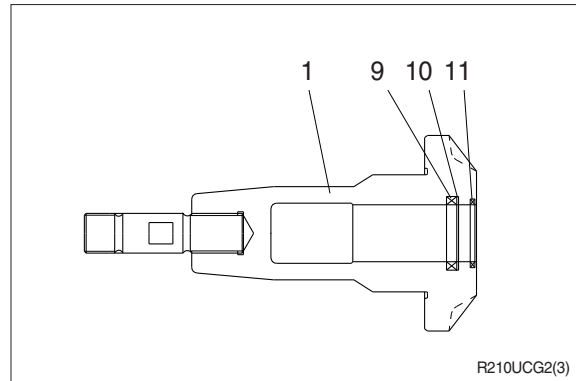
- ⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



(3) Assembly

Install dust seal (11), back up ring (10) and rod seal (9) to body (1).

- ※ When installing dust seal (11) and rod seal (9), take full care so as not to damage the lip.



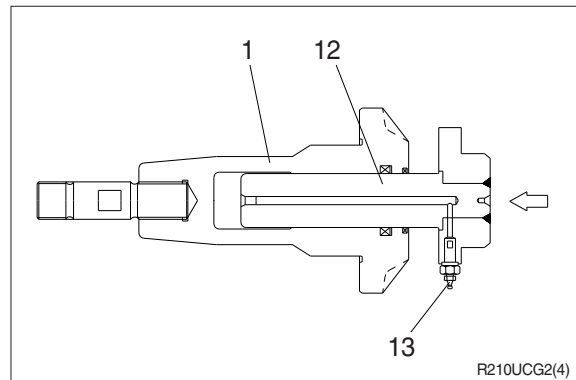
- ② Pour grease into body (1), then push in rod (12) by hand.

After take grease out of grease valve mounting hole, let air out.

- ※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

- ③ Fit grease valve (13) to rod (12).

·Tightening torque : 13 ± 1.0 kgf·m
(94 ± 7.2 lbf·ft)

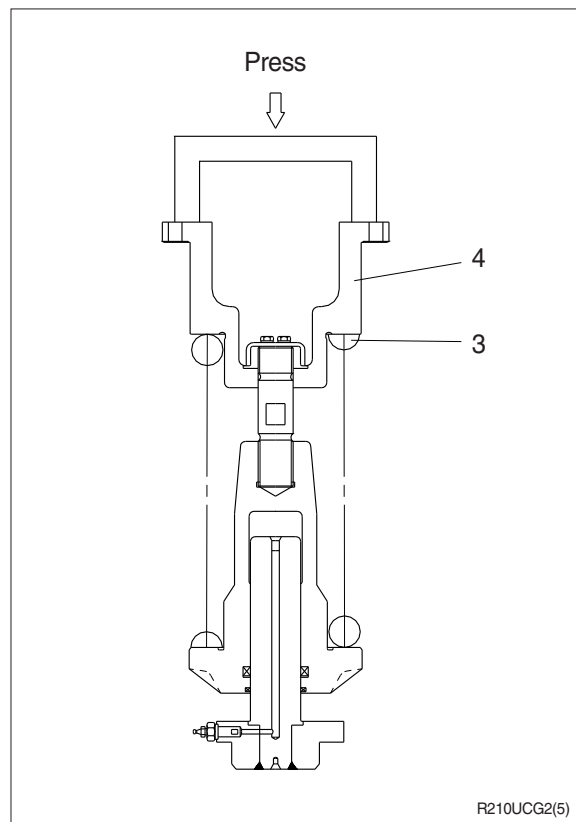


- ④ Install spring (3) and bracket (4) to body (1).

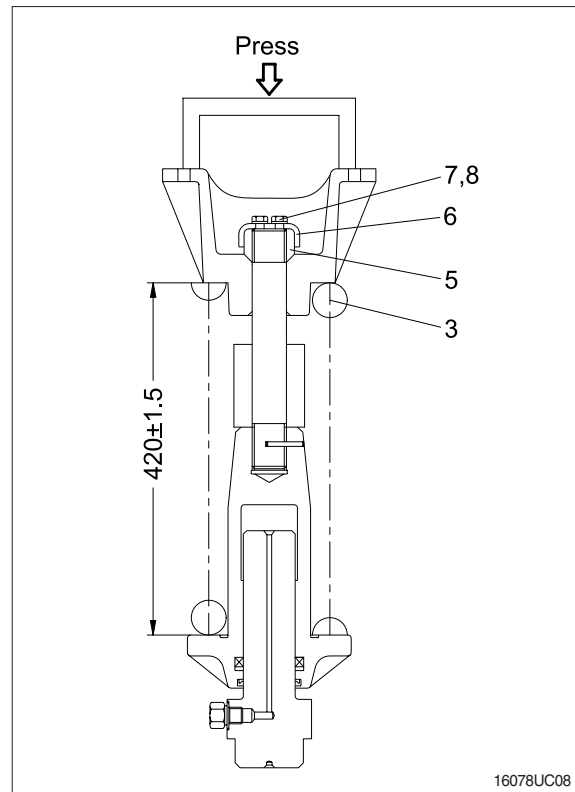
- ⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).

- ※ Apply sealant before assembling.

- ※ During the operation, pay attention specially to prevent the press from slipping out.

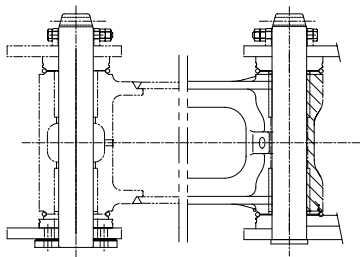
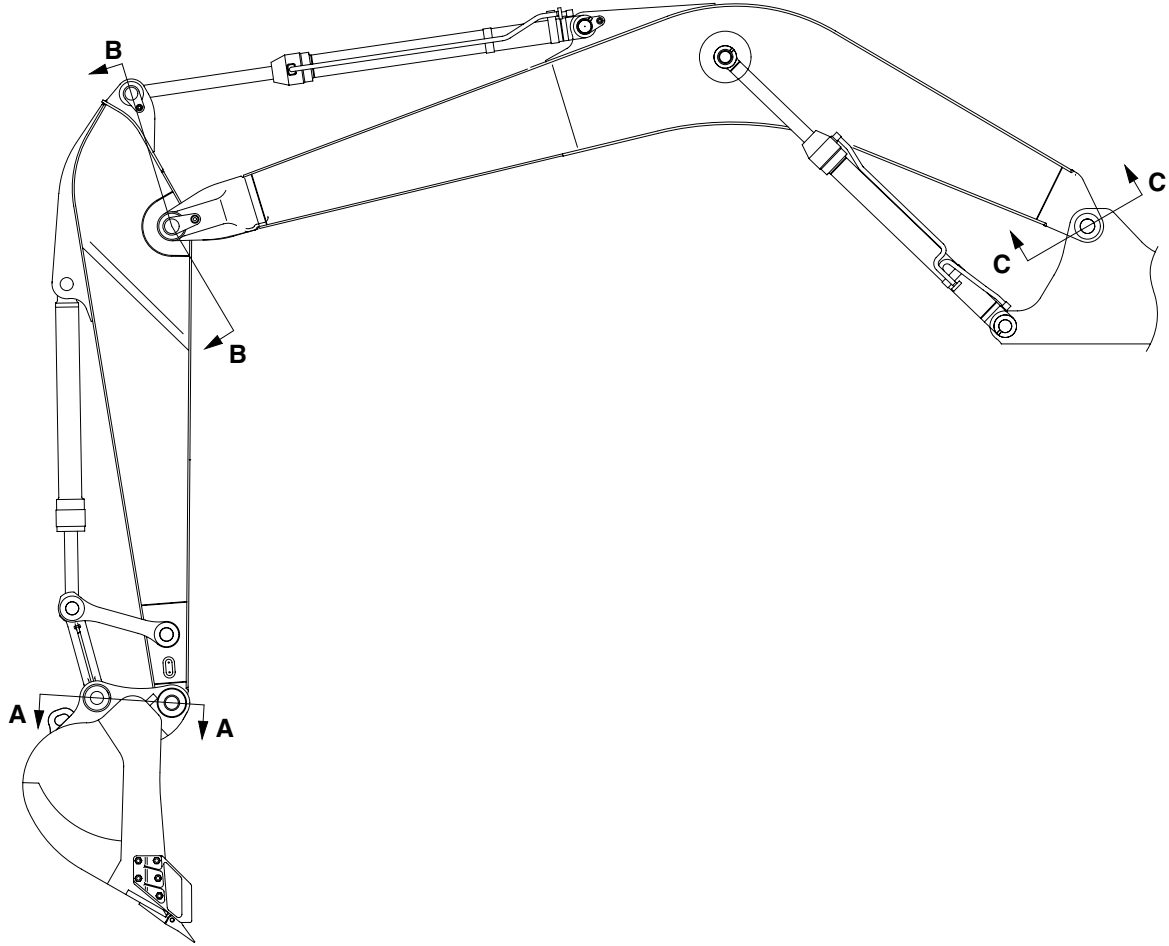


- ⑥ Lighten the press load and confirm the set length of spring (3).
- ⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).

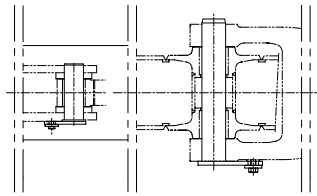


GROUP 11 WORK EQUIPMENT

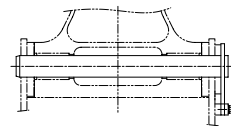
1. STRUCTURE



SECTION A



SECTION B



SECTION C

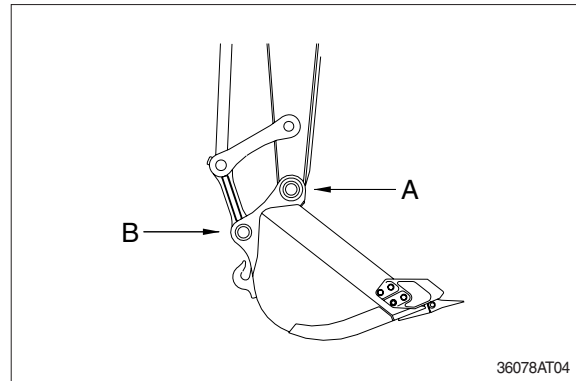
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2. REMOVAL AND INSTALL

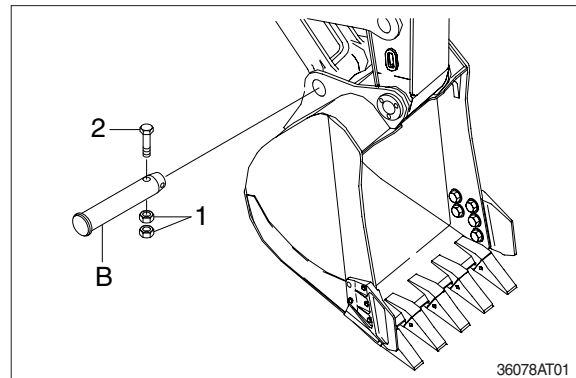
1) BUCKET ASSEMBLY

(1) Removal

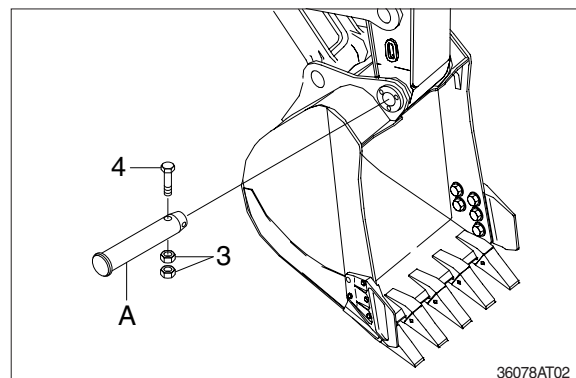
- ① Lower the work equipment completely to ground with back of bucket facing down.



- 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.
· Weight : 480 kg (1060 lb)

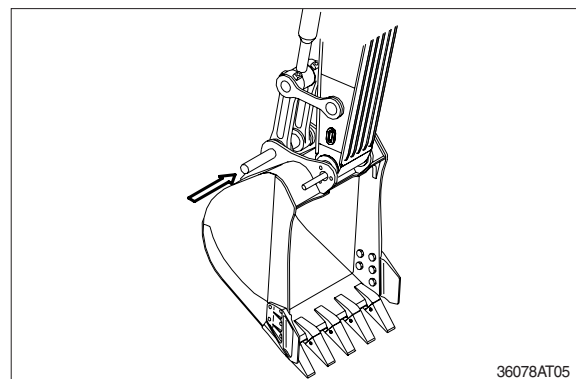


(2) Install

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

▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

- ※ Adjust the bucket clearance.
For detail, see operation manual.



2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

① Remove bucket assembly.

For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (1).

▲ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

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

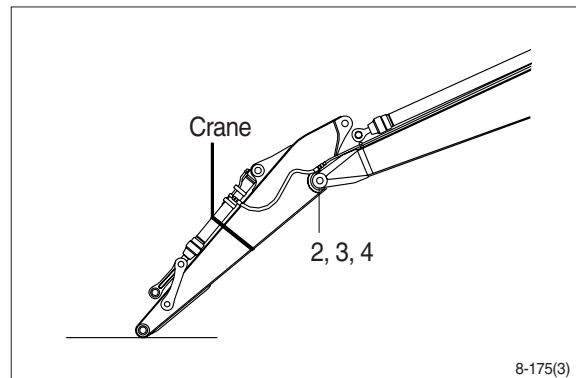
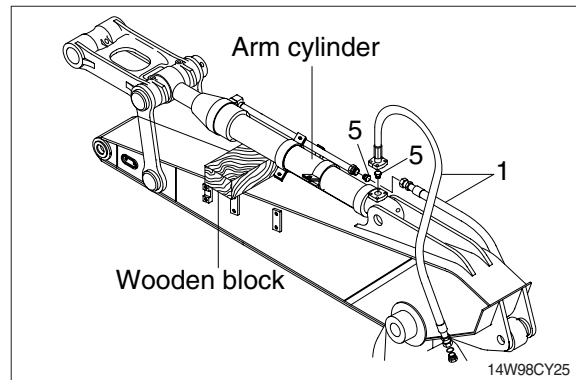
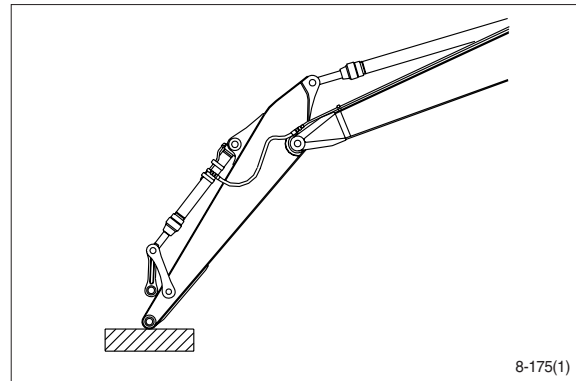
④ For details, see removal of arm cylinder assembly.

Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.

※ · Weight : 385 kg (850 lb)

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



(2) Install

① Carry out installation in the reverse order to removal.

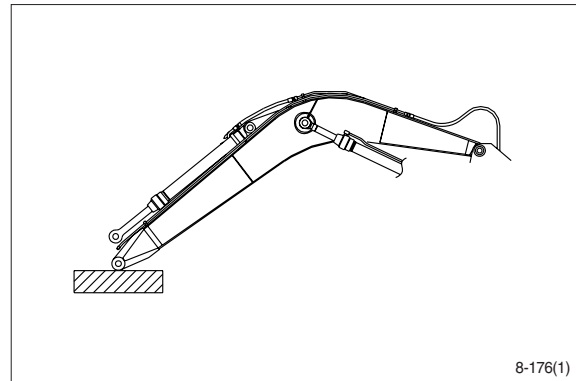
▲ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.

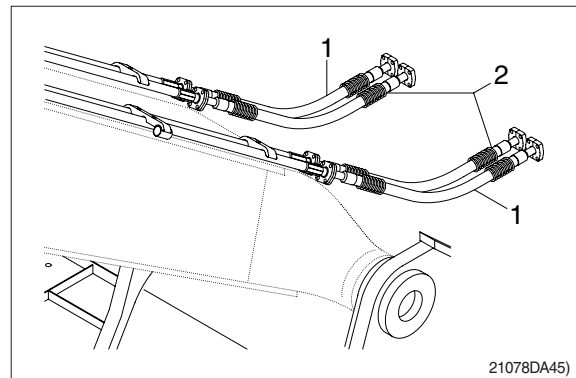
3) BOOM CYLINDER

(1) Removal

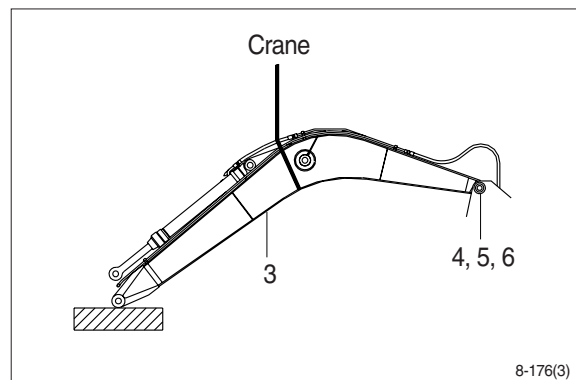
- ① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.
- ② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



- 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.
· Weight :760 kg (1675 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.

