

## SECTION 8 DISASSEMBLY AND ASSEMBLY

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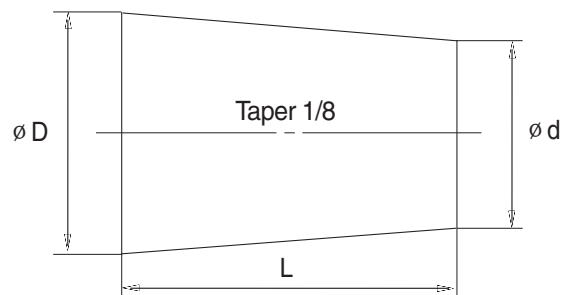
# SECTION 8 DISASSEMBLY AND ASSEMBLY

## 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)	M14 × 2.0	14.5 ± 2.5	10.5 ± 18.1
2		Engine mounting bolt (bracket-frame)	M22 × 2.5	4.8 ± 2.0	34.7 ± 14
3		Radiator mounting bolt	M16 × 2.0	22 ± 1.0	159 ± 7.2
4		Coupling mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1
5		Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	24.7 ± 2.2
5	Hydraulic system	Main pump mounting socket bolt	M20 × 2.5	42 ± 4.5	304 ± 32.5
6		Main control valve mounting nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
7		Fuel tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
8		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
10	Power train system	Swing motor mounting bolt	M24 × 3.0	97.8 ± 15	707 ± 108
11		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
12		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
13		Travel motor mounting bolt	M20 × 2.5	58 ± 6.0	420 ± 43.4
14		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
15	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
16		Track roller mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
17		Track tension cylinder mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
18		Track shoe mounting bolt, nut	M24 × 1.5	140 ± 5.0	1010 ± 36.2
19		Track guard mounting bolt	M24 × 3.0	77.4 ± 11	560 ± 79.6
21	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 33	2440 ± 72.3
22		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
23		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 each component disassembly and assembly.

## 2. TORQUE CHART

Use following table for unspecified torque.

### 1) BOLT AND NUT

#### (1) Coarse thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · 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	
	kg · m	lb · ft	kg · m	lb · 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
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

**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

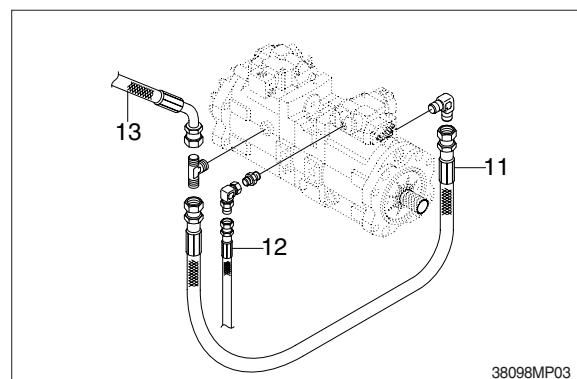
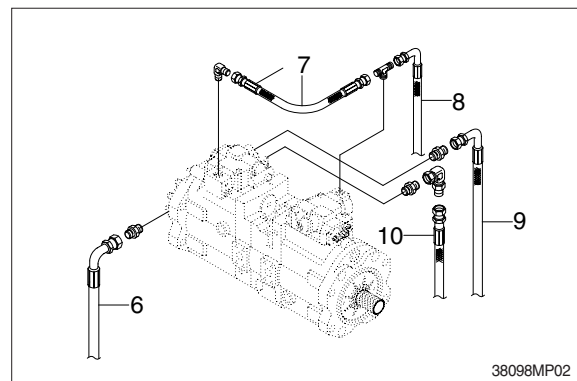
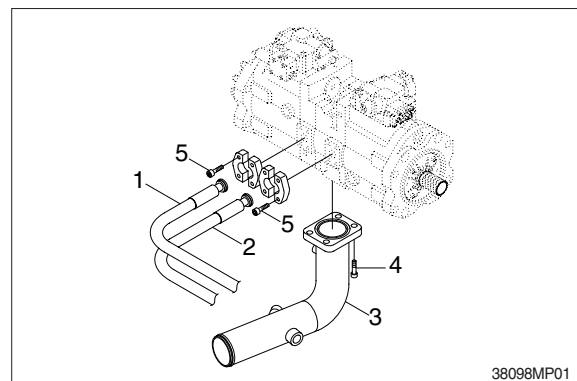
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

**▲ 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 : 230 ℓ

- (5) Remove socket bolts (5) and disconnect pipes (1, 2).
- (6) Disconnect pilot line hoses (6, 7, 8, 9, 10, 11, 12, 13).
- (7) Remove socket bolts (4) and disconnect pump suction tube (3).
  - ※ 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 : 190 kg (420 lb)
  - ※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.

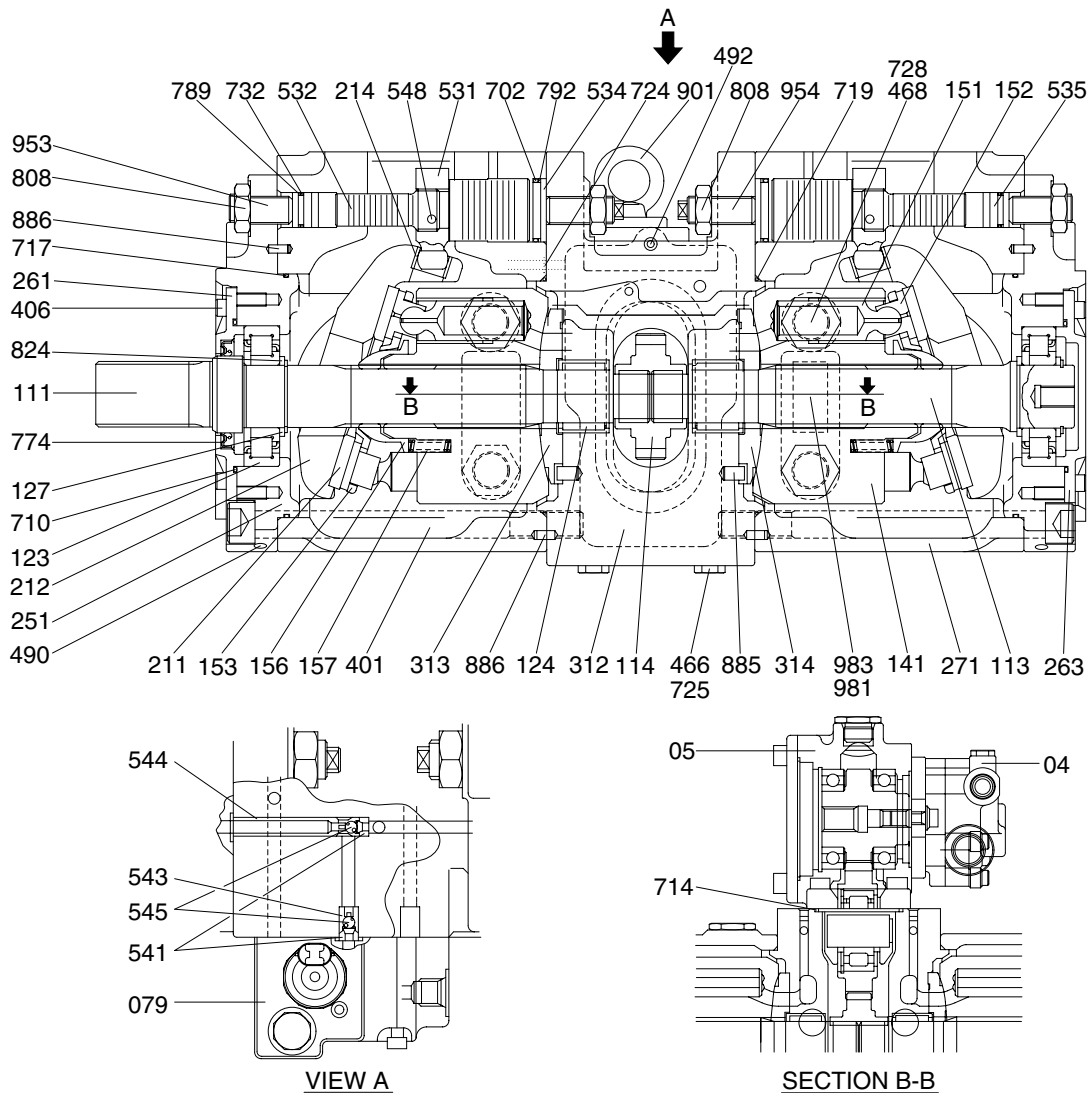


## 2) INSTALL

- (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



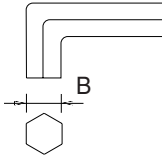

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04	Gear pump	212	Swash plate	531	Tilting pin	725	O-ring
05	PTO unit	214	Bushing	532	Servo piston	728	O-ring
079	Proportional reducing valve	251	Support plate	534	Stopper (L)	732	O-ring
111	Drive shaft (F)	261	Seal cover (F)	535	Stopper (S)	774	Oil seal
113	Drive shaft (R)	263	Seal cover (R)	541	Seat	789	Back up ring
114	Spline coupling	271	Pump casing	543	Stopper	792	Back up ring
123	Roller bearing	312	Valve cover	544	Stopper	808	Hexagon head nut
124	Needle bearing	313	Valve plate (R)	545	Steel ball	824	Snap ring
127	Bearing spacer	314	Valve plate (L)	548	Feedback pin	885	Pin
141	Cylinder block	401	Hexagon screw	702	O-ring	886	Spring pin
151	Piston	406	Hexagon screw	710	O-ring	901	Eye bolt
152	Shoe	466	Plug	714	O-ring	953	Set screw
153	Set plate	468	Plug	717	O-ring	954	Adjust screw
156	Bushing	490	Plug	719	O-ring	981	Name plate
157	Cylinder spring	492	Plug	724	O-ring	983	Pin
211	Shoe plate						

## 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			
Allen wrench 	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 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 head bolt	Hexagon head bolt	VP plug (PF thread)	
	19	M12	M12	VP-1/4	
	24	M16	M16	-	
	27	M18	M18	VP-1/2	
	30	M20	M20	-	
	36	-	-	VP-3/4	
Adjustable angle wrench	Medium size, 1 set				
Screw driver	Minus type screw driver, Medium size, 2 sets				
Hammer	Plastic hammer, 1 set				
Pliers	For snap ring, TSR-160				
Steel bar	Steel bar of key material approx. 10 × 8 × 200				
Torque wrench	Capable of tightening with the specified torques				

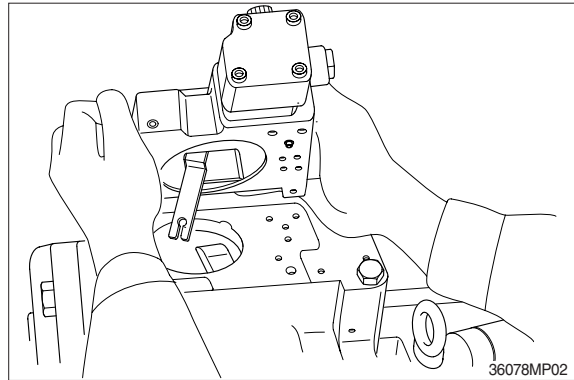
## (2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

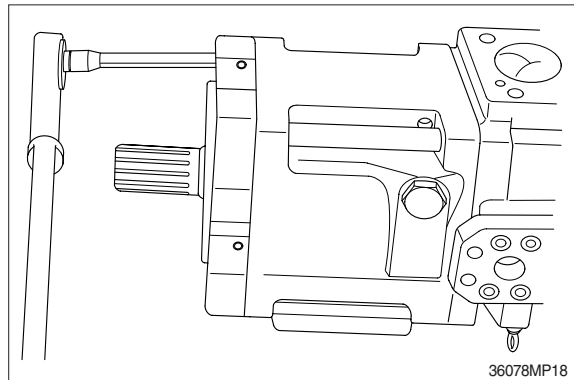


### 3) DISASSEMBLY

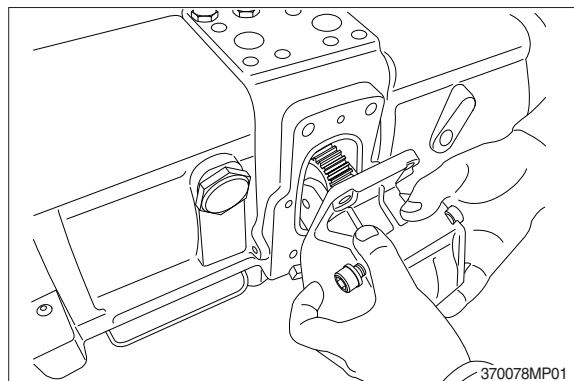
- (1) Select place suitable to disassembling.
  - ※ Select clean place.
  - ※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove drain port plug (468) and let oil out of pump casing (front and rear pump).
- (4) Remove hexagon socket head bolts (412, 413) and remove regulator.
  - ① Remove hexagon socket head bolt (435) and remove gear pump.



- (5) Loosen hexagon screw (401) which tighten swash plate support (251), pump casing (271) and valve block (312).

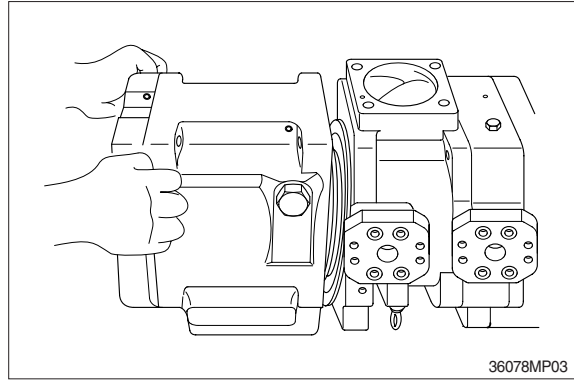


- ② Remove flange socket bolt (435) and remove PTO unit.



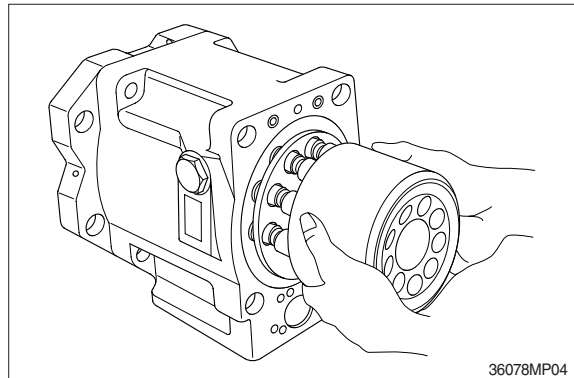
(7) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing (271) from valve cover (F, 312).

- ※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



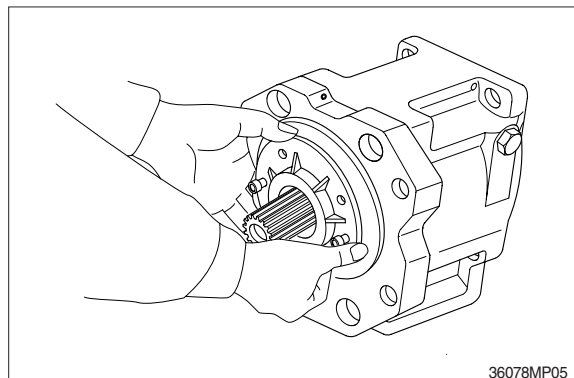
(8) Separate valve cover (R, 312) from pump casing and then pull out the cylinder block (141) of pump casing (271) straightly over drive shaft (R, 113). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

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

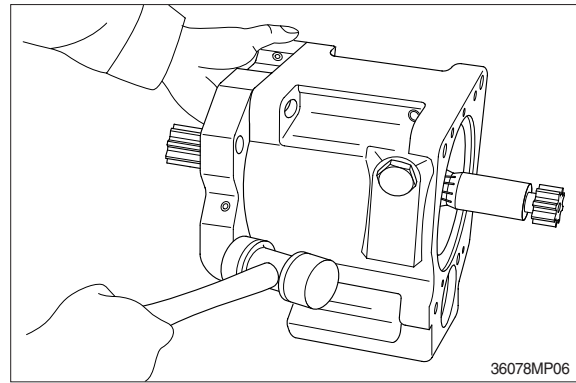


(9) Remove hexagon screw (406) and then seal cover (F, 261).

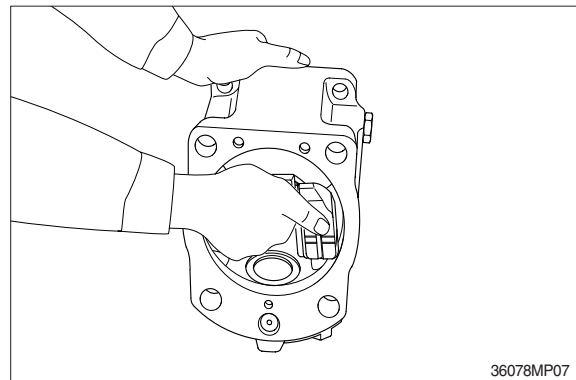
- ※ Fit bolt into pulling-out tapped hole of seal cover (F), and cover can be removed easily.
- ※ Since oil seal is fitted on seal cover (F), take care not to damage it when removing cover.



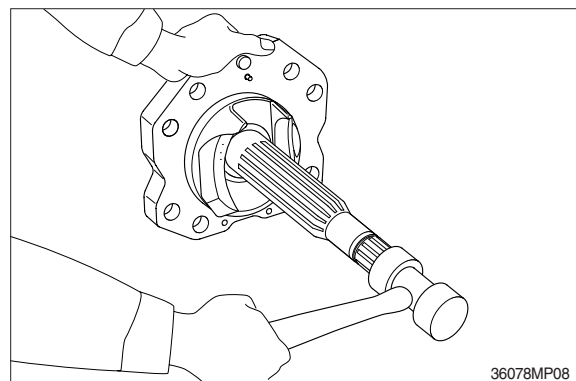
(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



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

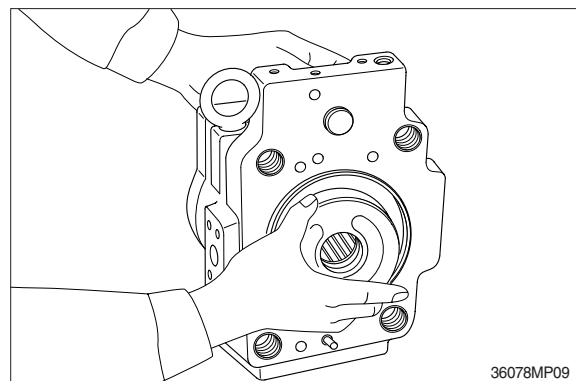


(12) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(13) Remove valve plates (313, 314) from valve cover (312).

※ These may be removed in work 7, 9.



(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) from valve cover (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 cover and swash plate support.  
If loosened, flow setting will be changed.

(15) This is the end of disassembling procedures.

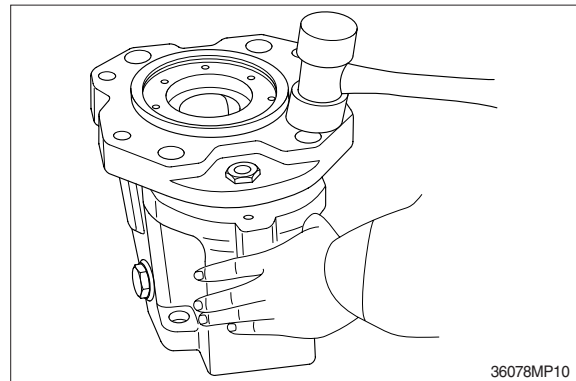
#### 4) ASSEMBLY

(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 8-10, 11.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

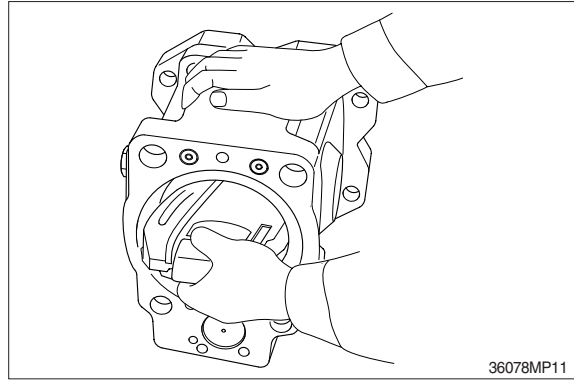
(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

- ※ 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.



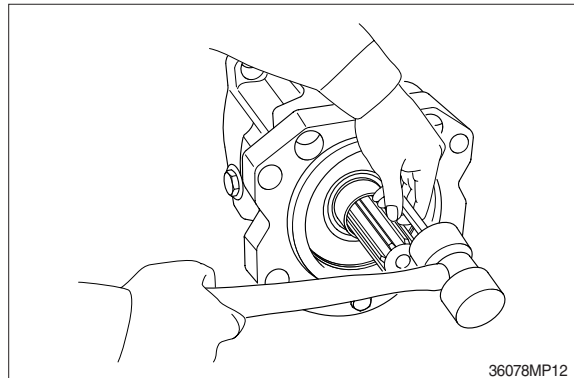
(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.

- ※ 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.



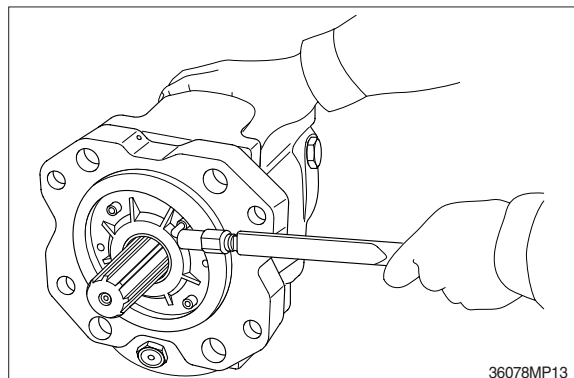
(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

- ※ 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.

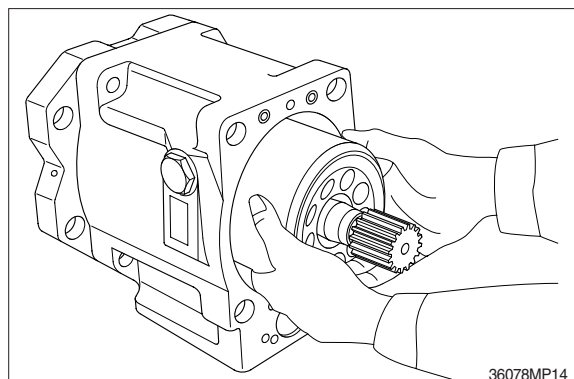


(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon screw (406).

- ※ 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 (261) similarly.

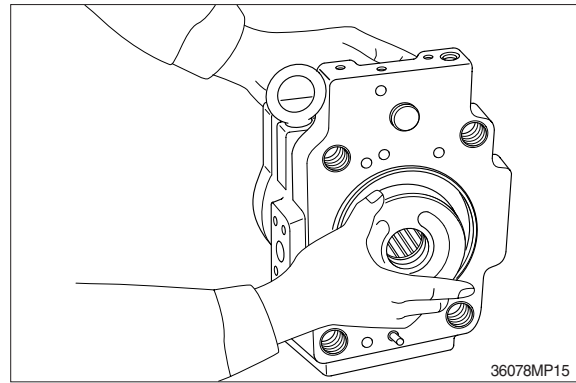


(6) Assemble piston cylinder subassembly [cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bushing (156) and cylinder spring (157)]. Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing (271).



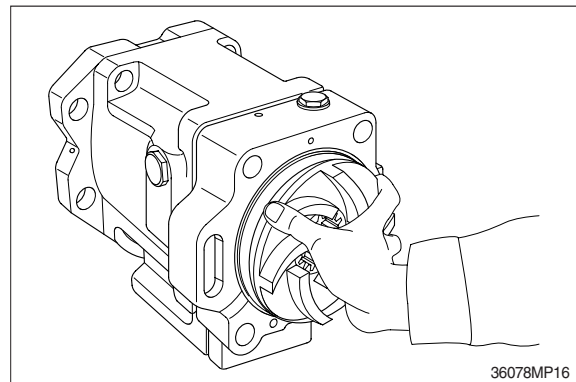
(7) Fit valve plate (313) to valve cover (F, 312), and fit valve plate (314) to valve cover (R, 312), entering pin into pin hole.

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



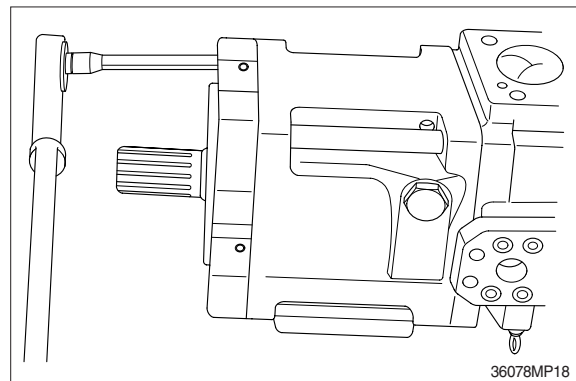
(8) Fit valve block (R, 312) to pump casing (271) and fit spline coupling (114) to shaft (R, 113).

- ※ Take care not to mistake direction of valve cover (312).
- ※ Fit valve cover with regulator up and with delivery flange left, viewed from front side.



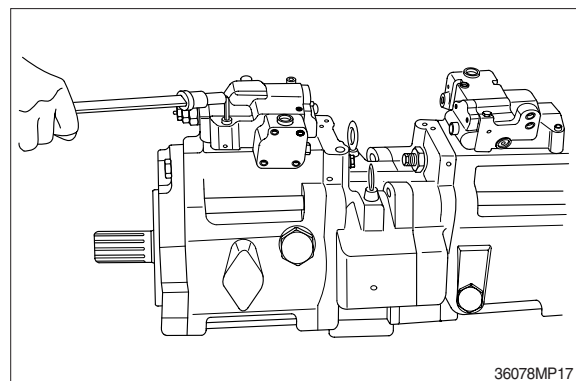
(9) Fit pump casing (271) with shaft (F, 111) to valve cover (F, 312) and tighten hexagon screw (401).

- ※ Mate spline phases of shaft (F) and spline coupling, with shaft (F) been rotating.

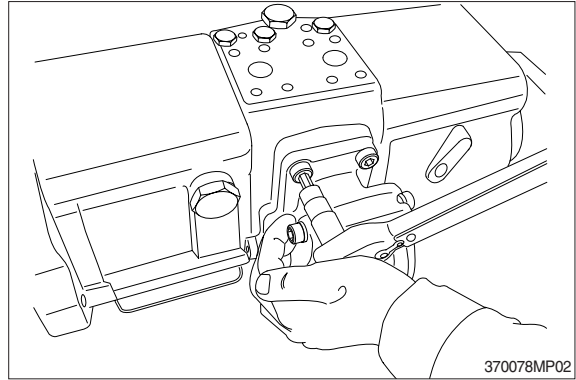


(10) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412,413).

- ※ Take care not to mistake regulator of front pump for that of rear pump.



- (11) Attach the PTO unit by fastening the flange socket bolt (435) to the valve block (312).

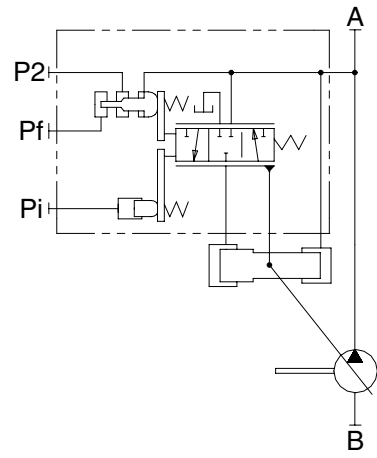
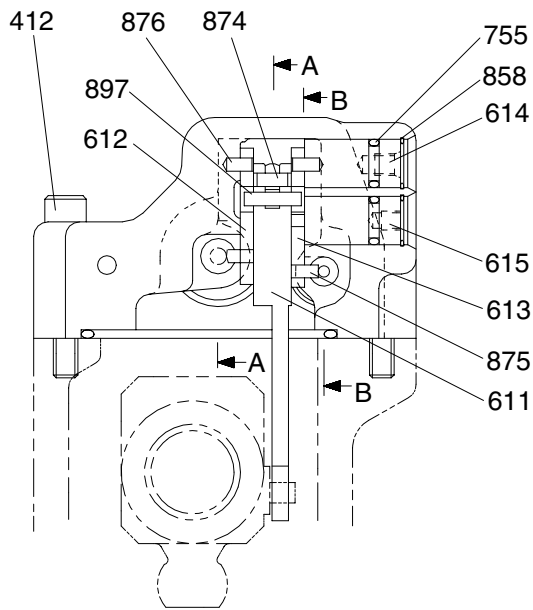


- (12) Fit drain port plug (468).  
This is the end of reassembling procedures.

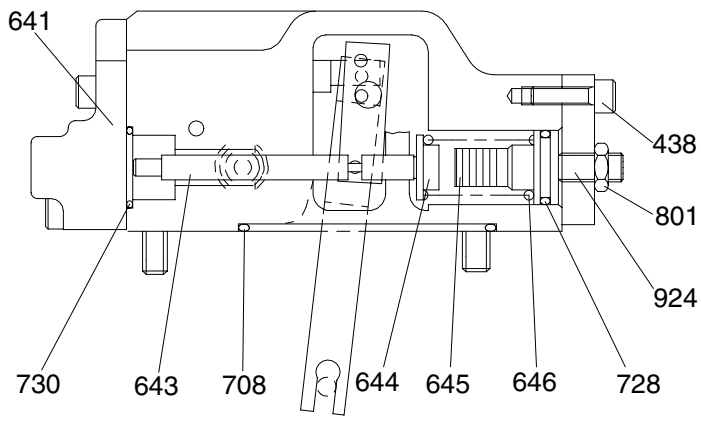


### 3. REGULATOR

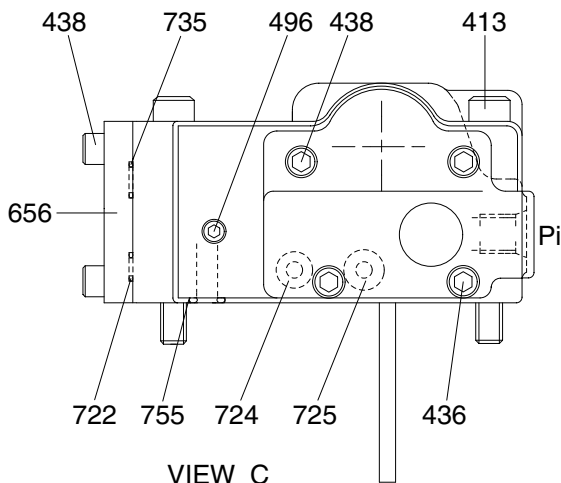
#### 1) STRUCTURE(1/2)



Hydraulic circuit



SECTION B-B

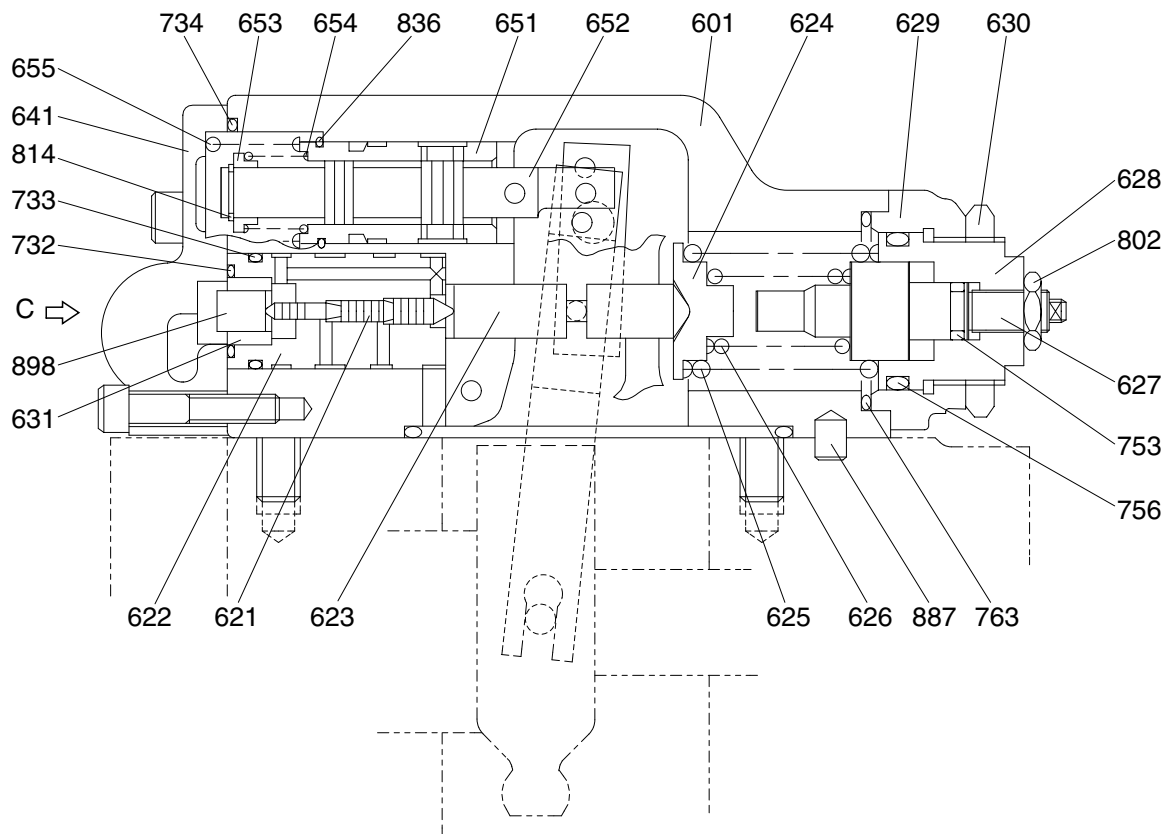


VIEW C

Port	Port name	Port size
Pi1, Pi2	Pilot port	PF 1/4-15
Psv1, Psv2	Servo assist port	PF 1/4-15

3809SH2RG01

## 2) STRUCTURE (2/2)



SECTION A-A

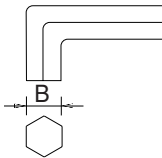

3809SH2RG02

412 Hexagon socket bolt	630 Lock nut	733 O-ring
413 Hexagon socket bolt	631 Sleeve, pf	734 O-ring
436 Hexagon socket bolt	641 Pilot cover	735 O-ring
438 Hexagon socket bolt	643 Pilot piston	753 O-ring
496 Plug	644 Spring seat (Q)	755 O-ring
601 Casing	645 Adjust stem (Q)	756 O-ring
611 Feedback lever	646 Pilot spring	763 O-ring
612 Lever(1)	651 Sleeve	801 Hexagon nut
613 Lever(2)	652 Spool	802 Hexagon nut
614 Center plug	653 Spring seat	814 Snap ring
615 Adjust plug	654 Return spring	836 Stop ring
621 Compensator piston	655 Set spring	858 Snap ring
622 Piston case	656 Block cover	874 Pin
623 Compensator rod	708 O-ring	875 Pin
624 Spring seat (C)	722 O-ring	876 Pin
625 Outer spring	724 O-ring	887 Pin
626 Inner spring	725 O-ring	897 Pin
627 Adjust stem (C)	728 O-ring	898 Pin
628 Adjust screw (C)	730 O-ring	924 Set screw
629 Cover (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			
Allen wrench 	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon head bolt	Hexagon head nut	VP plug (PF thread)	
	6	M8	M8	-	
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		4x100 mm			
Torque wrench		Capable of tightening with the specified torques			
Pincers		-			
Bolt		M4, Length : 50mm			

## (2) Tightening torque

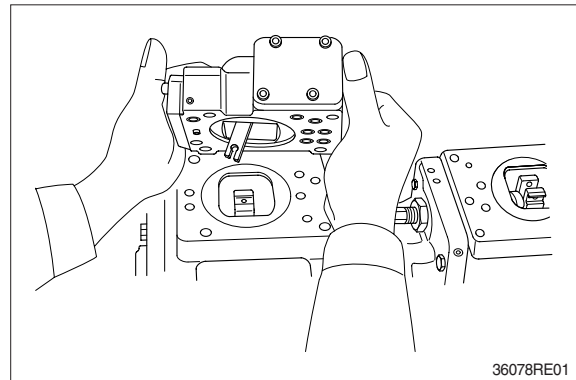
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17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

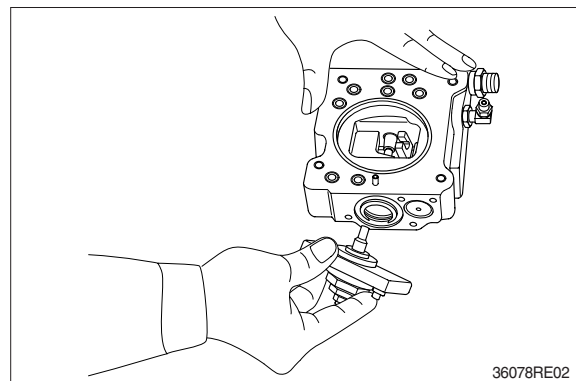
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

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.



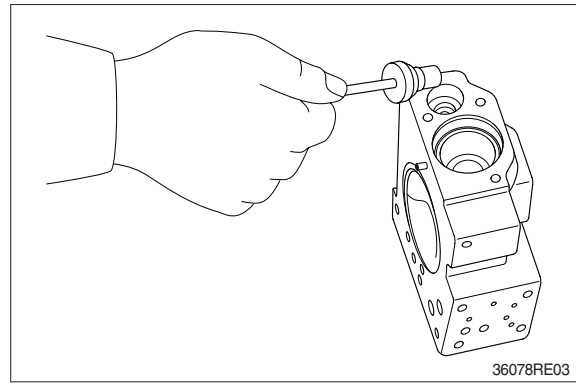
- (4) Remove hexagon socket head screw (438) and remove cover (C,629)
  - ※ Cover (C) is fitted with adjusting screw (C,QI) (628), adjusting stem (C, 627), lock nut (630), hexagon nut (801) and set screw (924).  
Do not loosen these screws and nuts.  
If they are loosened, adjusted pressure-flow setting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

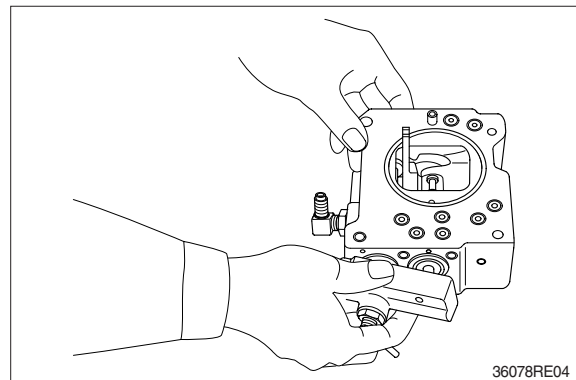
Then draw out adjusting stem (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

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



- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).

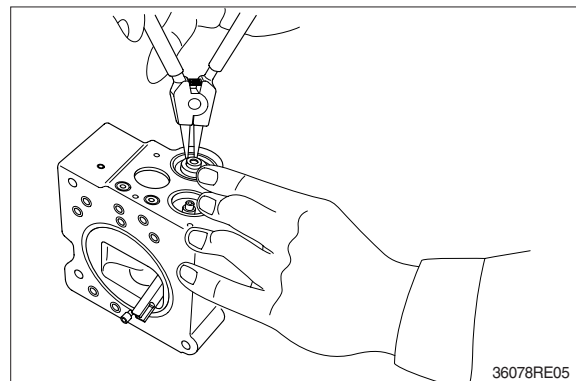
After removing pilot cover, take out set spring (655) from pilot section.



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

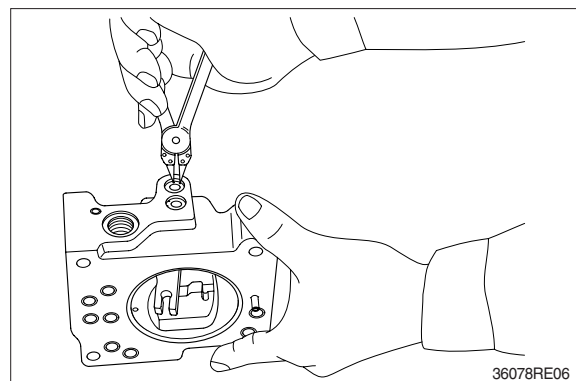
Sleeve (651) is fitted with snap ring (836).

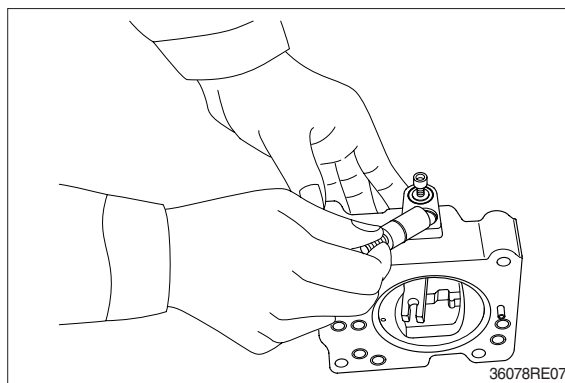
- ※ When removing snap ring (814), return spring (654) may pop out.
- ※ Take care not to lose it.



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

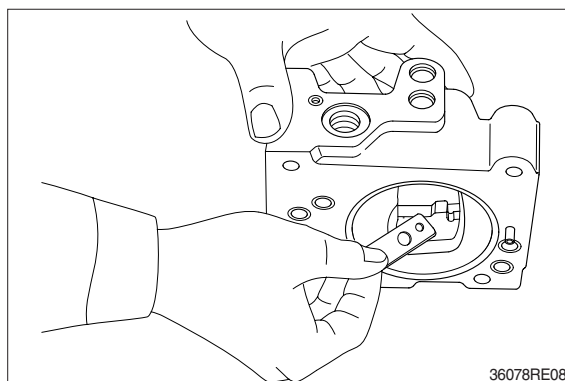
- ※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.





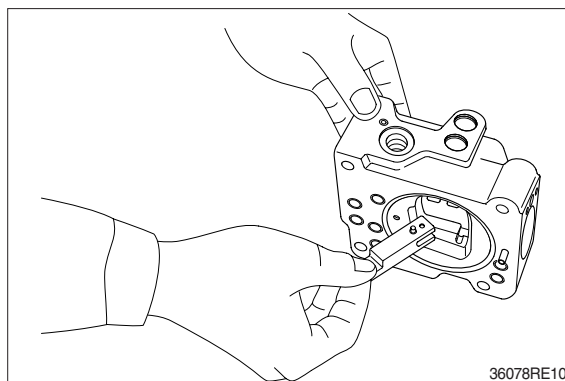
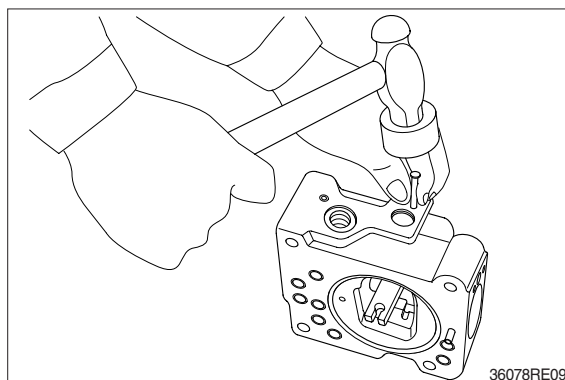
(9) Remove lever2 (613). Do not draw out pin (875).

※ 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 lever1 (612).



(11) Remove lever1 (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.

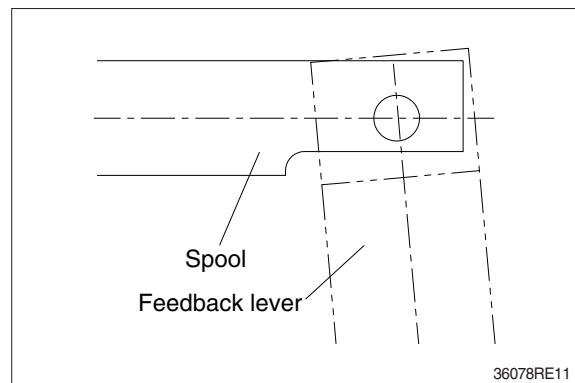
- ① Always repair parts that were scored at disassembly.
- ② Get replacement parts ready beforehand.  
Mixing of foreign matter will cause malfunction.
- ③ Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.
- ④ Always tighten bolts, plugs, etc. to their specified torques.
- ⑤ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.  
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 lever1 (612) into groove of compensating rod and fit lever 1 to pin force-fitted in casing.

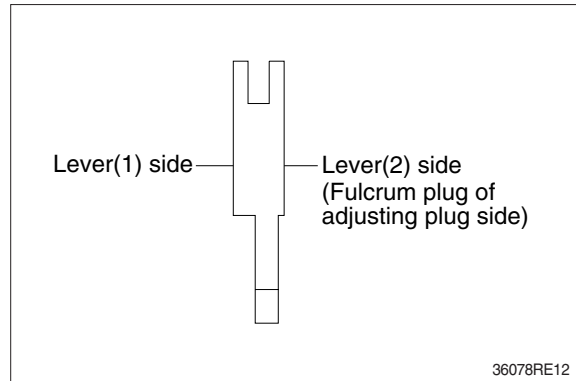
(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

- ※ 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).

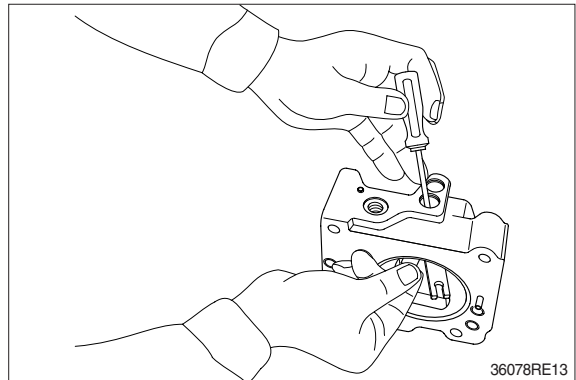
- ※ Insert pin in feedback lever a little to ease operation.
- ※ Take care not to mistake direction of feedback lever.



(6) Put pilot piston (643) into pilot hole of casing.

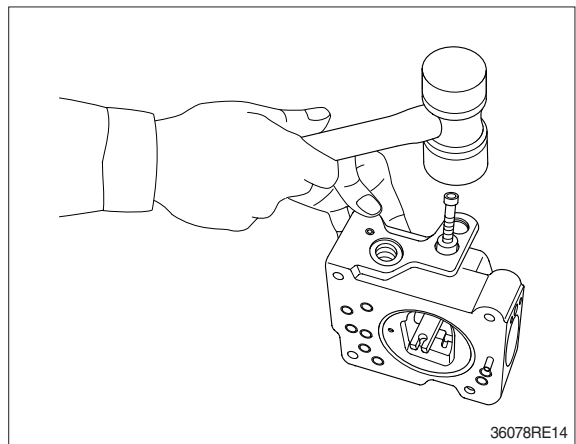
- ※ Confirm that pilot piston slides smoothly without binding.

(7) Put pin force-fitted in lever2 (613) into groove of pilot piston.  
Then fix lever (2).

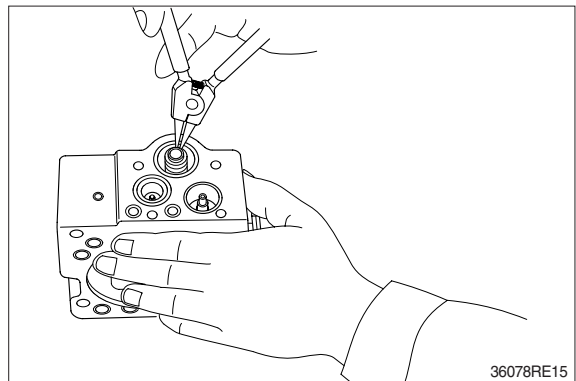


(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever (2).  
Then fix locking ring (858).

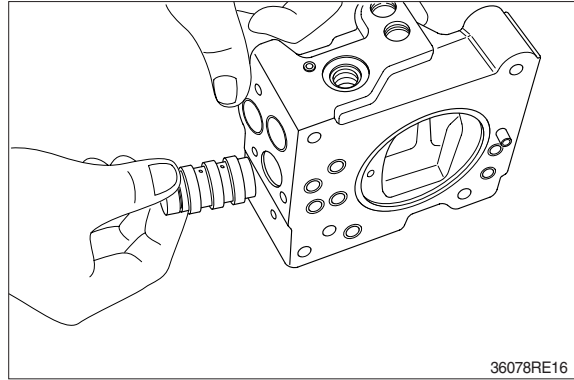
(9) Insert adjusting plug (615) and fit locking ring.  
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.  
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



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

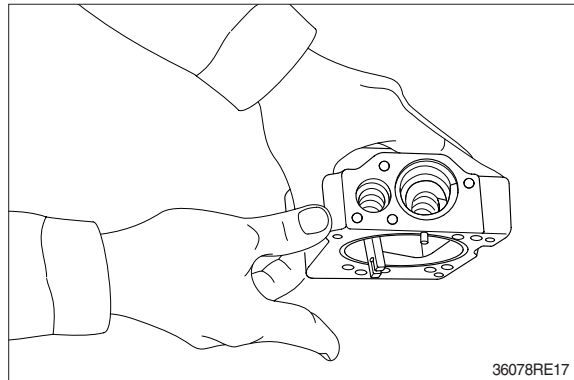


- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.  
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



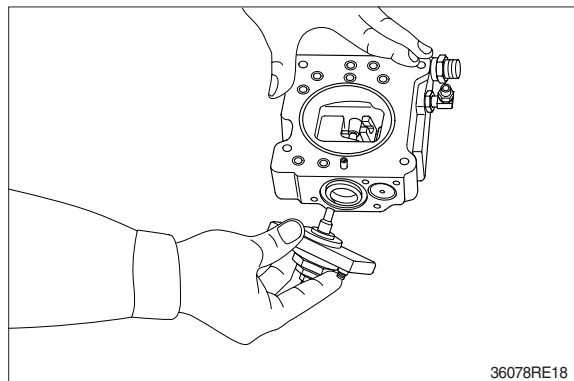
- (12) Put spring seat (644), pilot spring (646) and adjusting stem (Q, 645) into pilot hole.  
Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

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



- (13) Install cover (C, 629) fitted with adjusting screws (628), adjusting stem (C, 627), lock nut (630), hexagon nut (802) and set screw (924).  
Then tighten them with hexagonal socket head screws (438).

This completes assembly.



## GROUP 4 MAIN CONTROL VALVE

### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

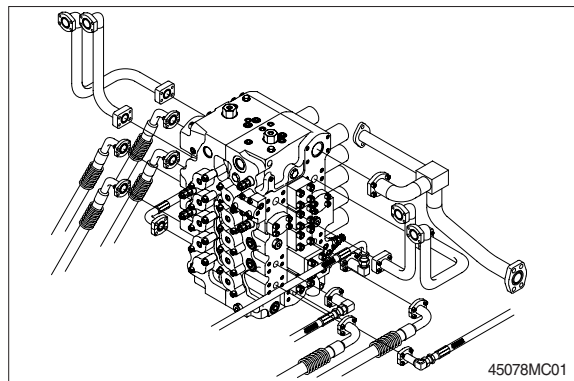
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure can penetrate the skin causing serious injury.**
  - ※ 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.
  - Weight : 420 kg (930 lb)
- (9) Remove the control valve assembly.  
When removing the control valve assembly, check that all the piping have been disconnected.

#### 2) INSTALL

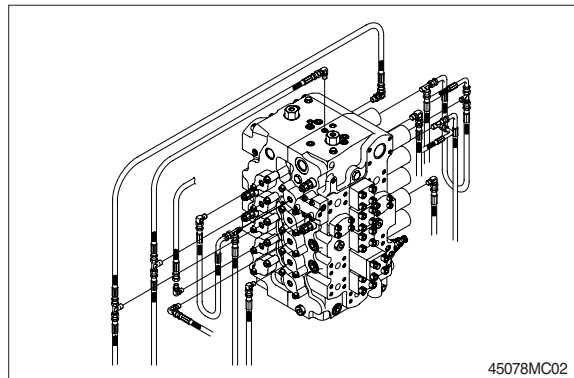
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from below items.
  - ① Cylinder (boom, arm, bucket)
  - ② Swing motor
  - ③ Travel motor
  - ※ See each item removal and install.
- (3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



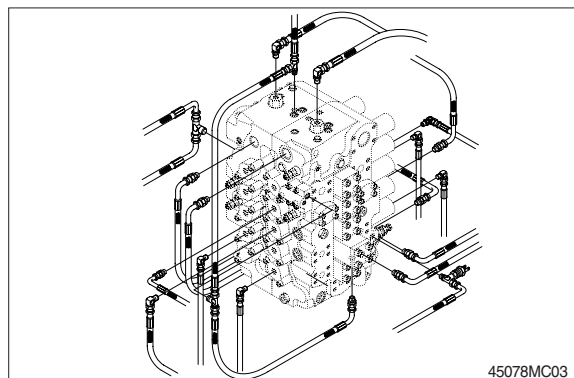
13031GE18



45078MC01

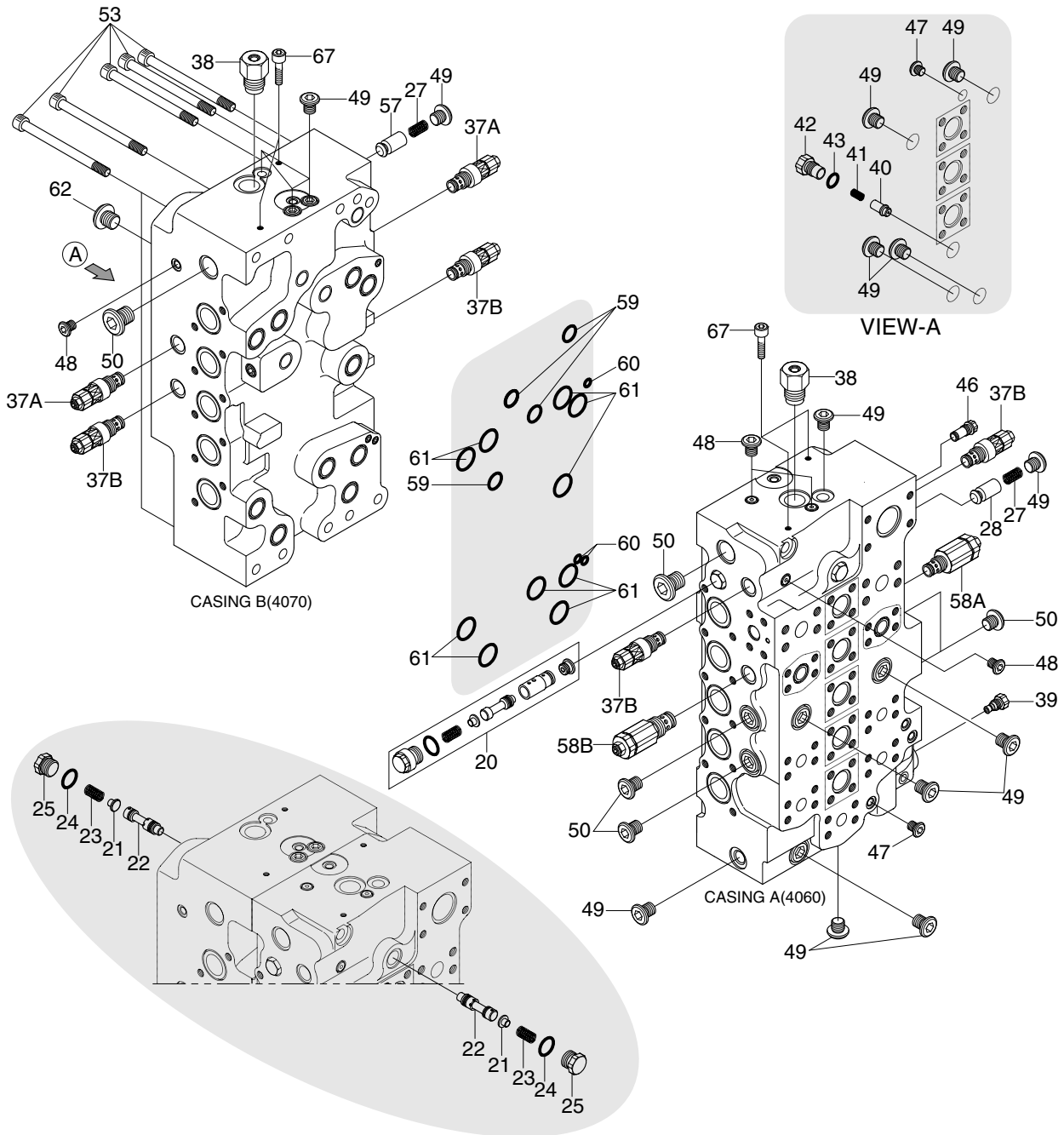


45078MC02



45078MC03

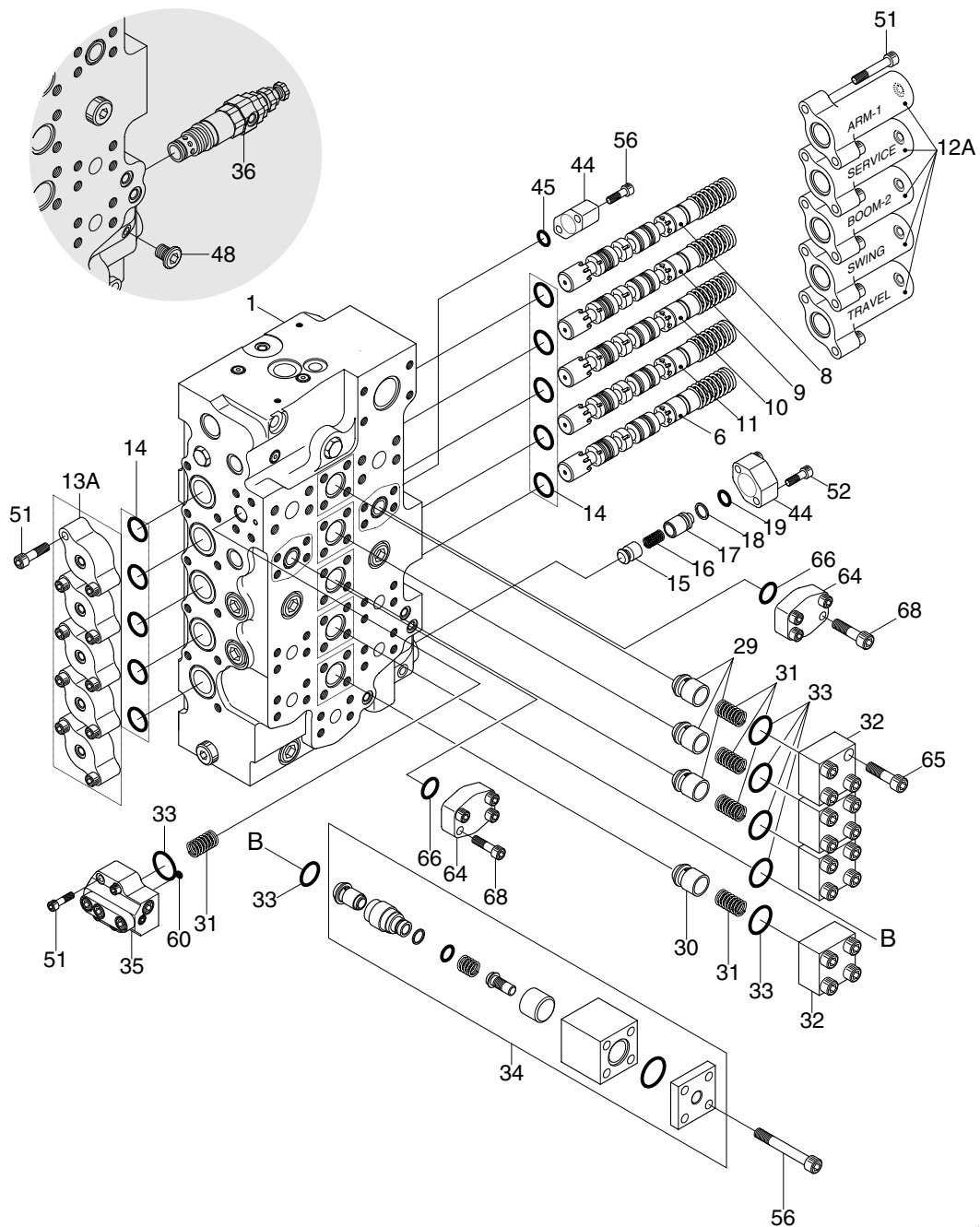
## 2. STRUCTURE (1/3)



- |     |                |    |                    |     |                      |
|-----|----------------|----|--------------------|-----|----------------------|
| 20  | Spool assy     | 38 | Negacon valve assy | 50  | Plug assy            |
| 21  | Spring seat    | 39 | Plug assy          | 53  | Socket head bolt     |
| 22  | Spool assy     | 40 | Poppet             | 57  | Poppet               |
| 23  | Spring         | 41 | Spring             | 58A | Service relief valve |
| 24  | O-ring         | 42 | Plug               | 58B | Service relief valve |
| 25  | Plug           | 43 | O-ring             | 59  | O-ring               |
| 27  | Spring         | 46 | Plug assy          | 60  | O-ring               |
| 28  | Poppet         | 47 | Plug assy          | 61  | O-ring               |
| 37A | Overload valve | 48 | Plug assy          | 62  | Plug                 |
| 37B | Overload valve | 49 | Plug assy          | 67  | Socket head bolt     |

48098MC04

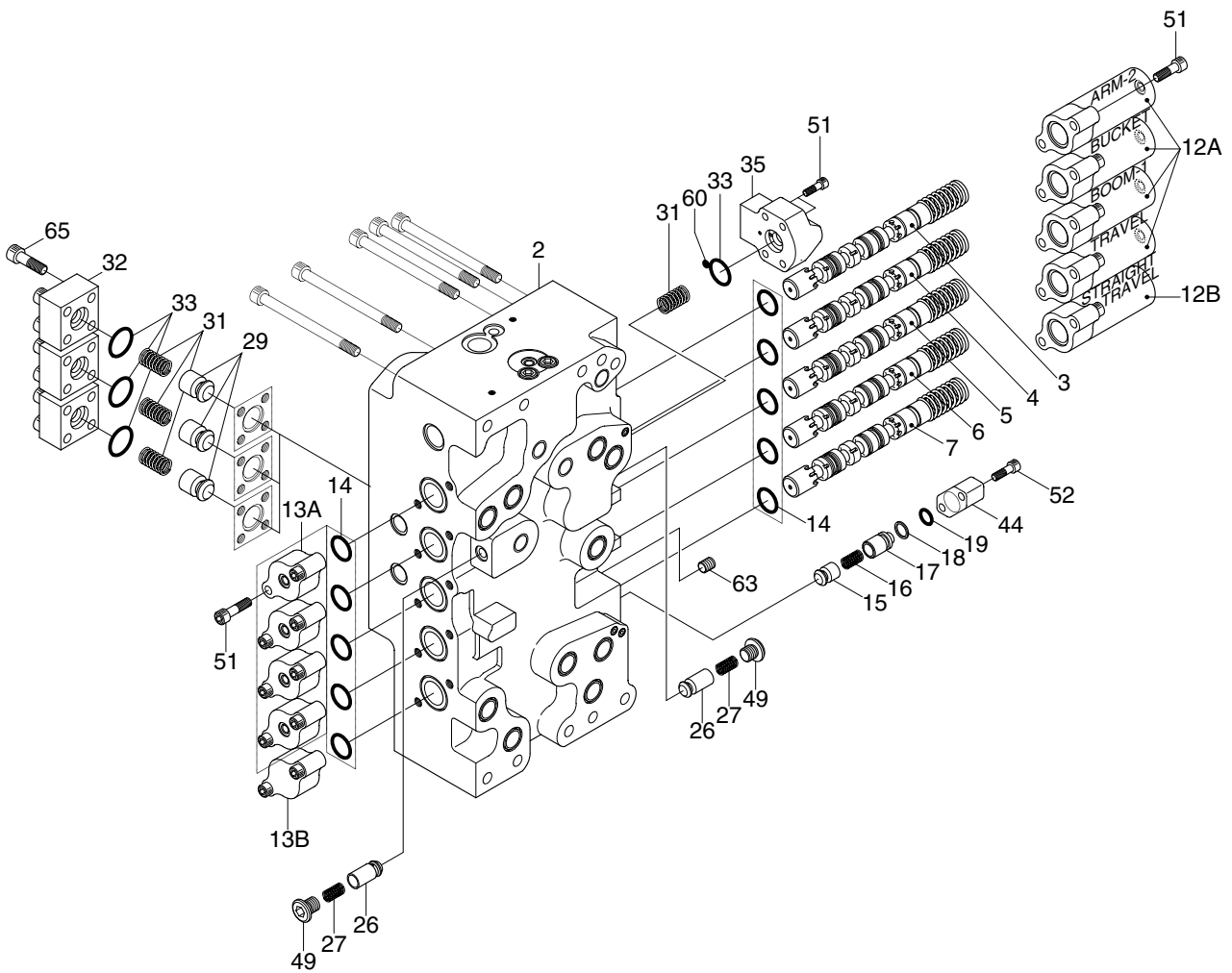
# STRUCTURE (2/3)



- |     |            |    |                     |    |                  |
|-----|------------|----|---------------------|----|------------------|
| 1   | Housing    | 17 | Spacer              | 44 | Flange           |
| 6   | Spool assy | 18 | O-ring              | 45 | O-ring           |
| 8   | Spool assy | 19 | Back up ring        | 48 | Plug assy        |
| 9   | Spool assy | 29 | Poppet              | 51 | Socket head bolt |
| 10  | Spool assy | 30 | Poppet              | 52 | Socket head bolt |
| 11  | Spool assy | 31 | Spring              | 56 | Socket head bolt |
| 12A | Cap        | 32 | Flange              | 60 | O-ring           |
| 13A | Flange     | 33 | O-ring              | 64 | Flange           |
| 14  | O-ring     | 34 | Swing priority assy | 65 | Socket head bolt |
| 15  | Poppet     | 35 | H/D valve assy      | 66 | O-ring           |
| 16  | Spring     | 36 | M/R valve assy      | 68 | Socket head bolt |

48098MC05

# STRUCTURE (3/3)

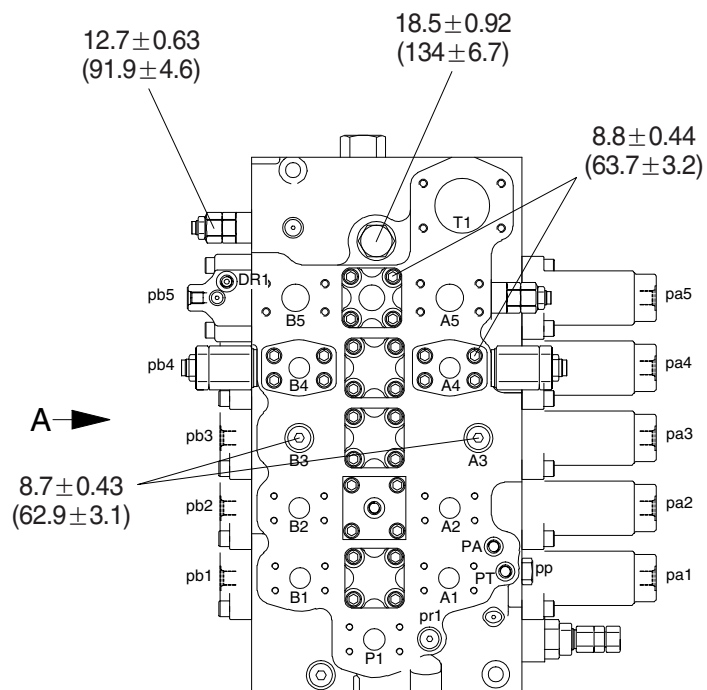
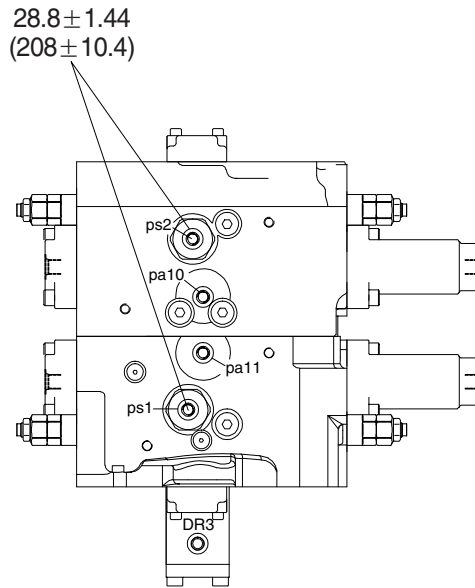


48098MC06

- |     |                |    |              |    |                  |
|-----|----------------|----|--------------|----|------------------|
| 2   | Housing        | 14 | O-ring       | 32 | Flange           |
| 3   | Spool assy     | 15 | Poppet       | 33 | O-ring           |
| 4   | Spool assy     | 16 | Spring       | 35 | H/D valve assy   |
| 5   | Spool assy     | 17 | Spacer       | 44 | Flange           |
| 6   | Spool assy     | 18 | O-ring       | 49 | Plug assy        |
| 7   | Spool assy     | 19 | Back up ring | 51 | Socket head bolt |
| 12A | Spool cap-A    | 26 | Poppet       | 52 | Bolt             |
| 12B | Spool cap-B    | 27 | Spring       | 60 | O-ring           |
| 13A | Spool flange-A | 29 | Poppet       | 63 | Plug             |
| 13B | Spool flange-B | 31 | Spring       | 65 | Socket head bolt |

### 3. TIGHTENING TORQUE (1/2)

※ Unit : kgf · m (lbf · ft)

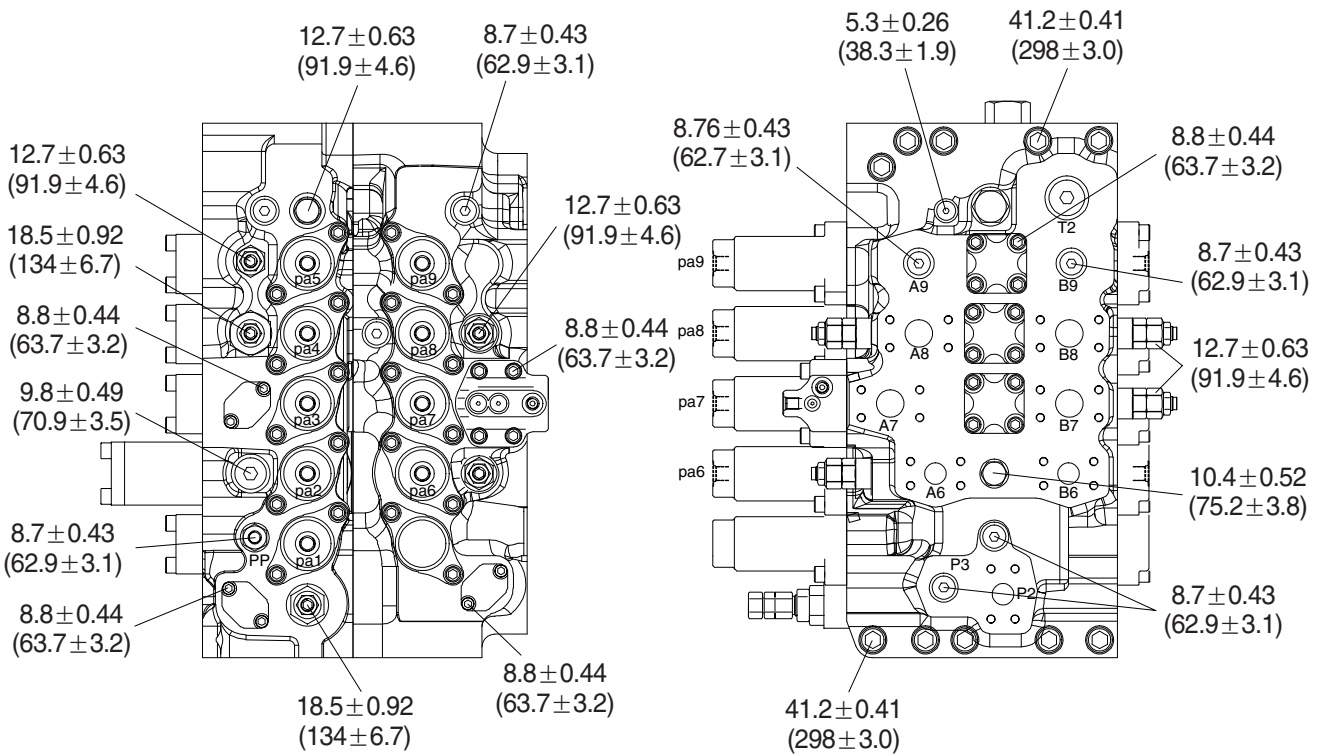
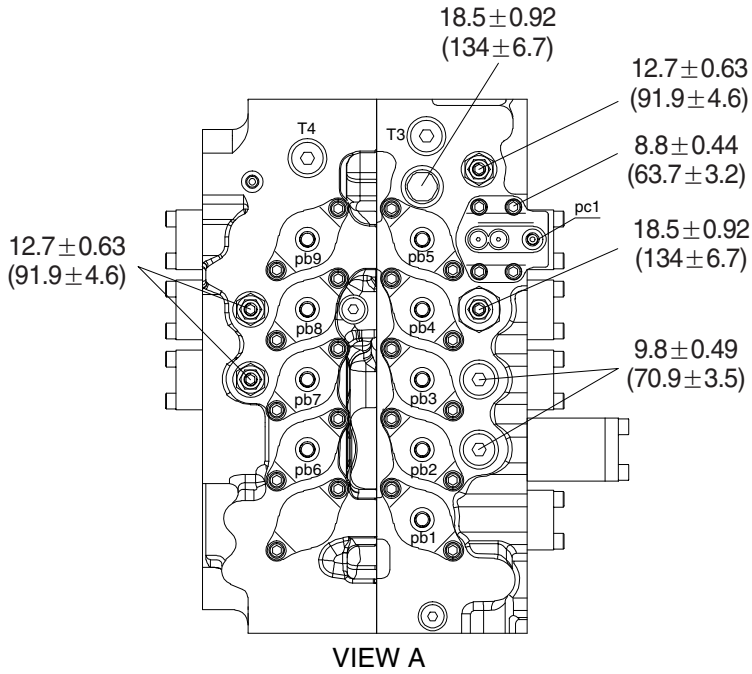


48098MC01



# TIGHTENING TORQUE (2/2)

※ Unit : kgf · m (lbf · ft)



48098MC02

## **4. 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 the hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

## 2) DISASSEMBLY

The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures.

### (1) Place control valve on working bench

※ Disassemble the valve in a clean and dry environment and pay careful attention not to damage the sealing flange faces.

### (2) Main spool

- ① Loosen socket head bolts (65) and remove the lock cap (12A, 12B).  
Pull out O-ring (14) from valve housing.



45078MC07

- ② Remove all spool (3~11) of subassembly itself from valve housing.  
※ Be careful not to be damaged while pulling out spools. Identify them with a tag to prevent from being mistaken at disassembly.



45078MC08

- ③ Spools sub assy (3, 4, 6, 7, 9, 10, 11).



45078MC10

④ Spool sub assy (5).



45078MC11

⑤ Spool sub assy (8).

- ※ When disassemble the spool assembly, fix the spool with vise. On this occasion attach wood between vise blades to prevent the spool from damaging.
- ※ Heat the outer race of spool with industrial drier and then loosen easily. (Temperature : 200~250°C)



45078MC12

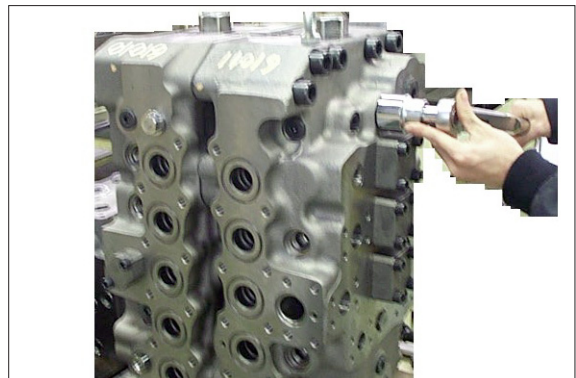
- ⑥ Loosen the socket head bolt (65) and remove the short cap (13A, 13B). Pull out O-ring (14) from valve housing.



45078MC09

**(3) Center bypass cut spool assy (22)**

- ① Loosen the plug (25) and remove spring (23), spring seat (21) and the spool (22).

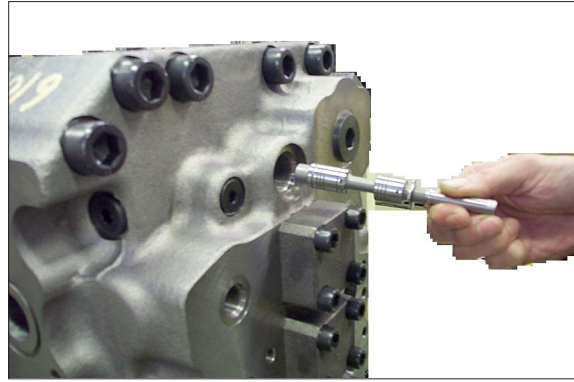


45078MC13

② Pull out O-ring (24).

※ When disassemble the spool assembly, fix the spool with vise. On this occasion attach wood between vise blades to prevent the spool from damaging.

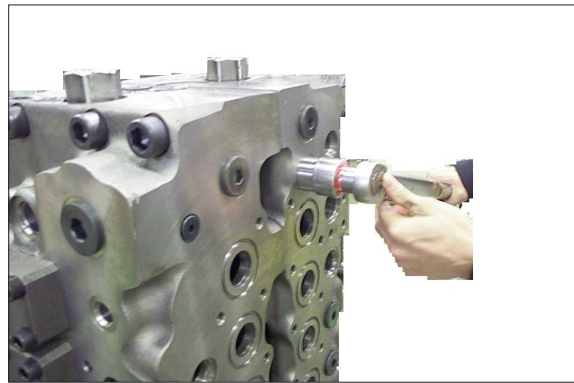
※ Heat the outer race of spool with industrial drier and then loosen easily. (Temperature : 200~250°C)



45078MC14

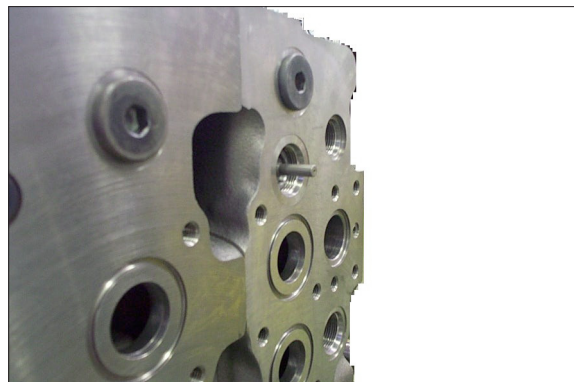
#### (4) Arm1 regeneration spool assy (20)

① Loosen the plug and pull out O-ring.



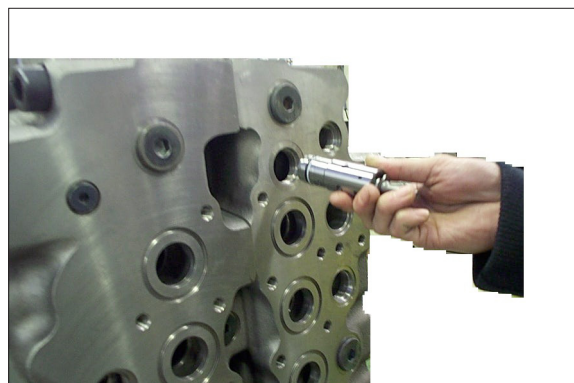
45078MC15

② Disassemble spring, spring seat and spool.



45078MC16

③ Pull out sleeve of hole inside at same time, disassemble sleeve and piston.



45078MC18



## **(5) General precautions**

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 casing and block are smooth and free of dust, dent, rust etc.
- c. Correct dents and damages and check seat faces within the casing, if any, by lapping.  
※ Pay careful attention not to leave any lapping agent within the casing.
- d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from foreign matter.
- e. If any spring is broken or deformed, replace it with new one.
- f. When a relief valve does not function properly, repair it, following 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.

### 3) ASSEMBLY

#### (1) General comments

- ① In this assembly section, explanation only is shown.  
For further understanding, please refer to the figures and photographs shown in the previous disassembly section.
- ② Figure in ( ) shown after the part name in the explanation refers to the reference identity number shown on the construction figure shown in the spares section.
- ③ Cautions in assembling seal
  - a. Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
  - b. Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
  - c. Do not stretch seals so much as to deform them permanently.
  - d. In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
  - e. Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque as shown on the cross section drawings of the spares section.

#### (2) Main spool

- ① Apply loctite to thread of spools (3, 4, 6, 7, 9, 10, 11) and assemble spring seat, spring and spool end. Assemble spool end to spool after fixing spool with a vise attached wood.  
※ Be careful not to applying loctite too much.
  - Tightening torque : 2.4 ~ 2.6 kgf · m (17.4 ~ 18.8 lbf · ft)Fit O-ring into housing and assemble spools (3, 4, 6, 7, 9, 10, 11) into housing.  
Assemble lock cap on housing and tighten hex socket bolt.
  - Tightening torque :  $11 \pm 0.5$  kgf · m ( $79.7 \pm 3.7$  lbf · ft)
- ② Insert poppet, spring into spool (5) and then apply loctite to thread of spool.  
Fit O-ring and backup ring on the plug and then tighten plug.  
Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.
  - Tightening torque : 2.4 ~ 2.6 kgf · m (17.4 ~ 18.8 lbf · ft)Fit O-ring into housing and assemble spool (5) into housing.  
Assemble lock cap on housing and tighten hex socket bolt.
  - Tightening torque :  $11 \pm 0.5$  kgf · m ( $79.7 \pm 3.7$  lbf · ft)
- ③ Insert poppet, spring into spool (8) and then apply loctite to thread for spool.  
Fit O-ring and backup ring on the plug and then tighten plug.  
Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.
  - Tightening torque : 2.4 ~ 2.6 kgf · m (17.4 ~ 18.8 lbf · ft)Fit O-ring into housing and assemble spool (8) into housing.  
Assemble lock cap on housing and tighten hex socket bolt.
  - Tightening torque :  $11 \pm 0.5$  kgf · m ( $79.7 \pm 3.7$  lbf · ft)
- ④ Assemble short cap on housing and tighten hex socket bolt.
  - Tightening torque :  $11 \pm 0.5$  kgf · m ( $79.7 \pm 3.7$  lbf · ft)

**(3) Center bypass cut spool assy (22)**

- ① Apply loctite to thread of spool, assemble spool end to spool.  
※ Be careful not to applying loctite too much.
- ② Assemble spool assy, spring seat, spring and tighten plug with O-ring.
  - Tightening torque : 9.5 ~ 11.0 kgf · m (68.6 ~ 79.7 lbf · ft)

**(4) Arm1 regeneration spool assy (20)**

- ① Assemble backup rings and O-rings to sleeve respectively.
- ② Assemble piston to sleeve which seal is assemble, and insert spool into sleeve.
- ③ Assemble spool assy, spring seat, spring and tighten plug with O-ring.
  - Tightening torque : 9.5 ~ 11.0 kgf · m (68.6 ~ 79.7 lbf · ft)



## GROUP 5 SWING DEVICE

### 1. REMOVAL AND INSTALL OF MOTOR (MACHINE SERIAL NO. : -#0893)

#### 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.

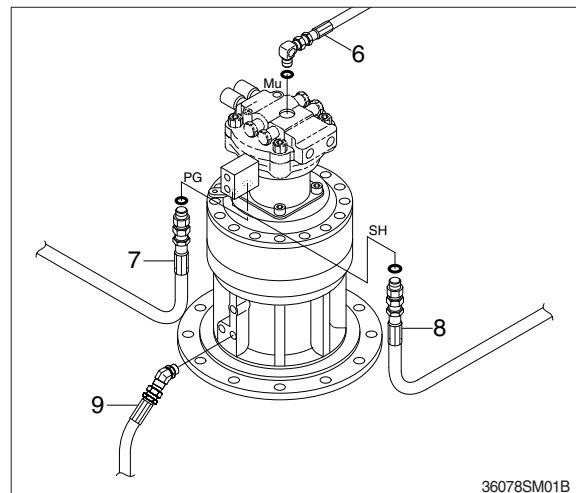
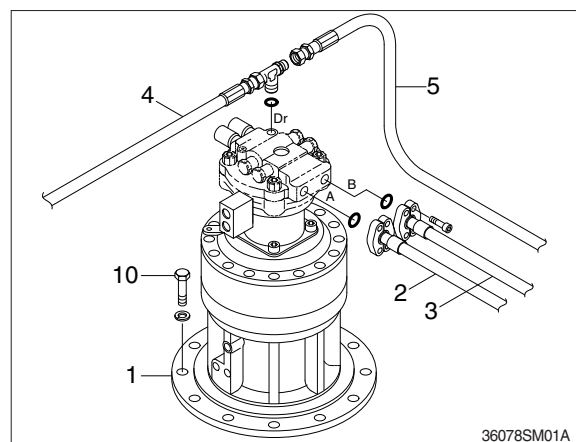
- (4) Disconnect hoses (2, 3, 4, 5, 6, 7, 8, 9).
- (5) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (10).
  - Motor device weight : 75 kg(165 lb)
  - Tightening torque :97.8±15 kgf·m  
(707±108 lbf·ft)

- (6) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.

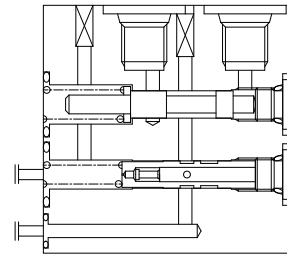
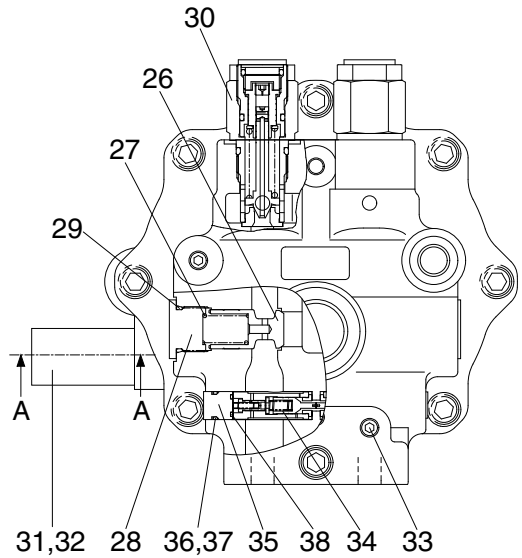
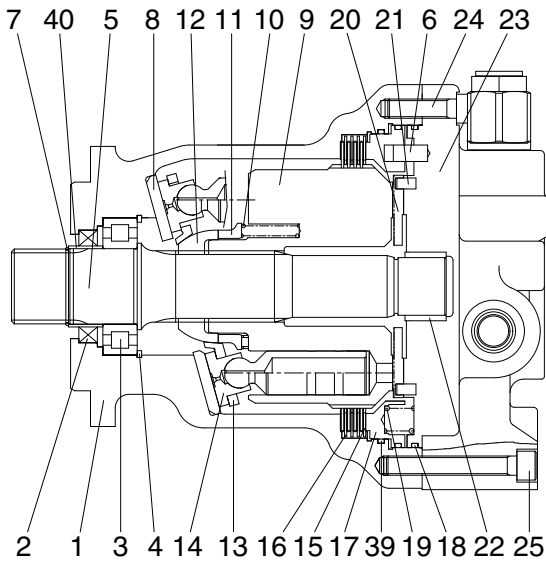
#### 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
  - ① Remove the air vent plug.
  - ② Pour in hydraulic oil until it over flows 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) Confirmed the hydraulic oil level and check the hydraulic oil leak or not.



## 2. SWING MOTOR (MACHINE SERIAL NO. : -#0893)

### 1) STRUCTURE



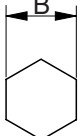
SECTION A-A

38092SM02

1	Body	15	Friction plate	29	O-ring
2	Oil seal	16	Plate	30	Relief valve assy
3	Roller bearing	17	Brake piston	31	Time delay valve
4	Snap ring	18	O-ring	32	Wrench bolt
5	Shaft	19	Spring	33	Plug
6	Pin	20	Valve plate	34	Swing reactionless valve assy
7	Stop ring	21	Pin	35	Plug
8	Shoe plate	22	Needle bearing	36	O-ring
9	Cylinder block	23	Rear cover	37	Back up ring
10	Spring	24	Wrench bolt	38	O-ring
11	Ball guide seat	25	Wrench bolt	39	O-ring
12	Ball guide	26	Poppet	40	Bushing
13	Set plate	27	Spring		
14	Piston assy	28	Plug		

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Tool name	Remark	
Allen wrench	5	
	6	
	12	
	17	
Socket for socket wrench, spanner	36	
Torque wrench	Capable of tightening with the specified torques	
Snap ring plier(for holes, axis)	Snap ring(4)	
Solder hammer	Needle bearing(22), pin(6, 21)	
Oil seal inserting jig	Oil seal(2)	
Induction heating apparatus for bearing	Roller bearing(3)	

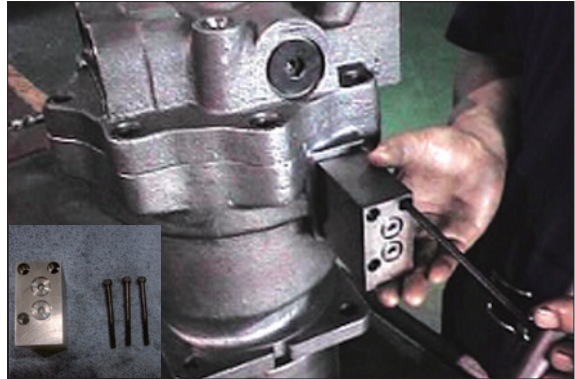
### (2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf · m	lbf · ft	in	mm
Wrench bolt	24	M14	20.9	151.2	0.47	12
Wrench bolt	25	M14	20.9	151.2	0.47	12
Relief valve	30	M33	18.0	130.2	1.42	36
Wrench bolt	32	PF 1/4	6.9	49.9	0.20	5
Plug	33	PF 1/4	20.9	151.2	0.24	6

## 2) DISASSEMBLING

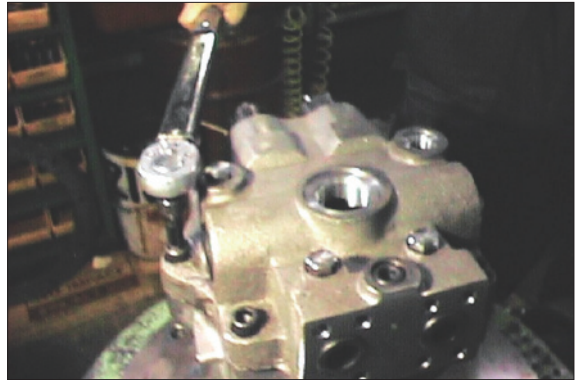
### (1) Disassemble the sub of a TURNING AXIS

- ① Unloosing wrench bolt (32) and disassemble time delay valve assy (31) from rear cover (23)



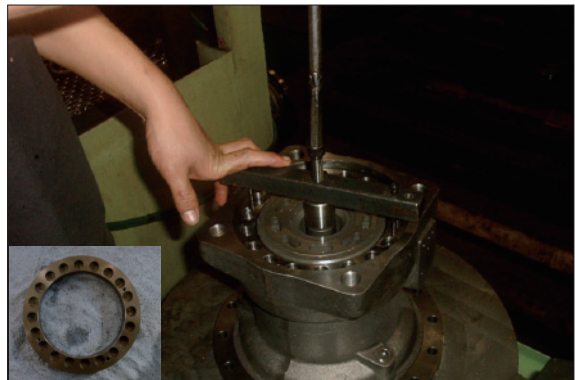
3607A8SM01/01A

- ② Hang rear cover (23) on hoist, unloose wrench bolt (24, 25) and disassemble from body (1).



3607A8SM02

- ③ Using a jig, disassemble break piston (17) from body (1).



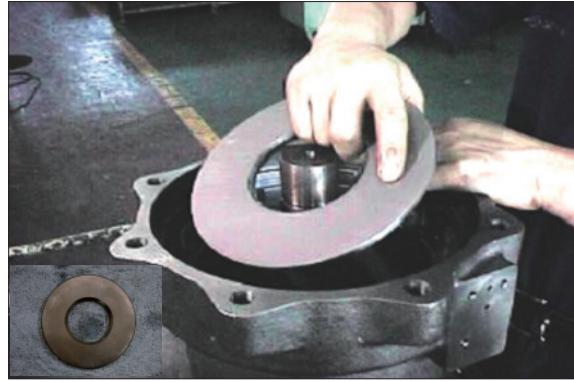
3607A8SM03

- ④ Disassemble respectively cylinder block assy, fricktion plate (15), plate (16) from body (1).



3607A8SM04

- ⑤ Disassemble shoe plate (8) from body (1).



3607A8SM05

- ⑥ Using a plier jig, disassemble snap ring (4) and shaft assy (5).



3607A8SM06/06A

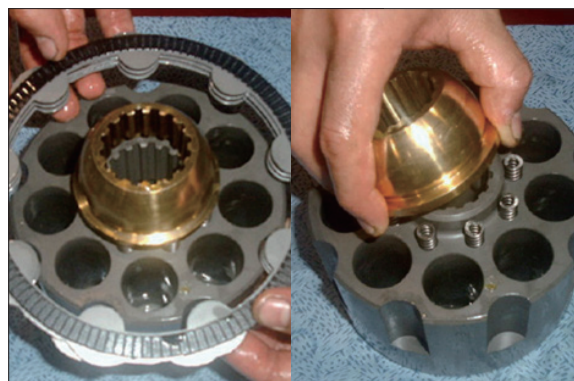
**(2) Disassemble cylinder block assy sub**

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



3607A8SM07

- ② Disassemble ball guide (12), friction plate (15), plate (16) and ball guide seat (11) from cylinder block (9).



3607A8SM08A/08B



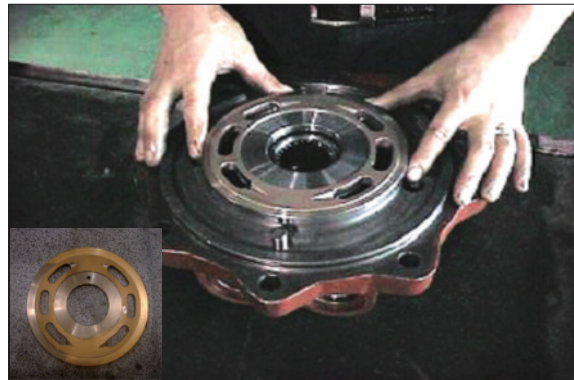
- ③ Disassemble spring (10) from cylinder block (9).



3607A8SM09

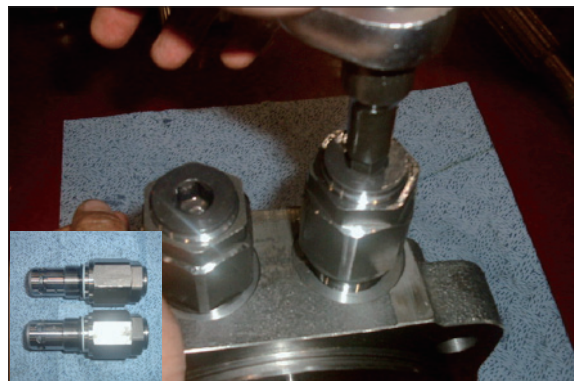
**(3) Disassemble rear cover assy sub**

- ① Disassemble pin (6, 21) and valve plate (20) from rear cover (23).



3607A8SM10/10A

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



3607A8SM11/11A

- ③ Disassemble make up check valve assy with a torque wrench from rear cover (23).



3607A8SM12/12A

#### 4) ASSEMBLING

##### (1) Assemble the sub of a turning axls

- ① Put roller bearing (3) on preheater and provide heat to inner wheel (compressing temp : 290°C for 2 minutes)
  - Roller bearing × 1EA



3607A8SM21

- ② After assembling and compressing pre-heated roller bearing (3), stop ring (7) into shaft (5).
  - Stop ring × 1EA
  - Shaft × 1EA



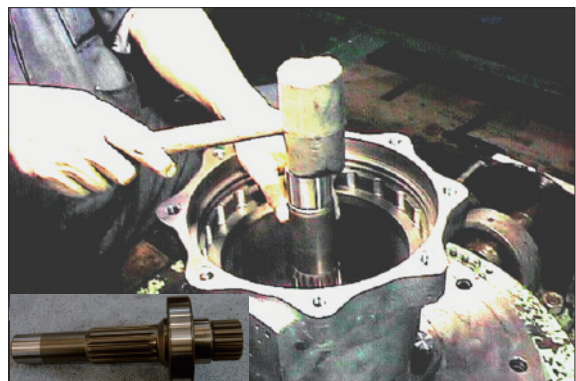
3607A8SM22/22A

- ③ Using a compressing tool and steel stick, assemble oil seal (2) into body (1).
  - Oil seal × 1EA



3607A8SM23/23A

- ④ Insert above shaft sub into body (1) and assemble it with a hammer.



3607A8SM24

- ⑤ Fix snap ring (4) to shaft with a plier jig.  
· Snap ring × 1EA



3607A8SM06

- ⑥ Spread grease on shoe plate (8) and assemble on the body.  
· Shoe plate × 1EA



3607A8SM05

**(2) Assemble the sub of cylinder block assy**

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



3607A8SM25

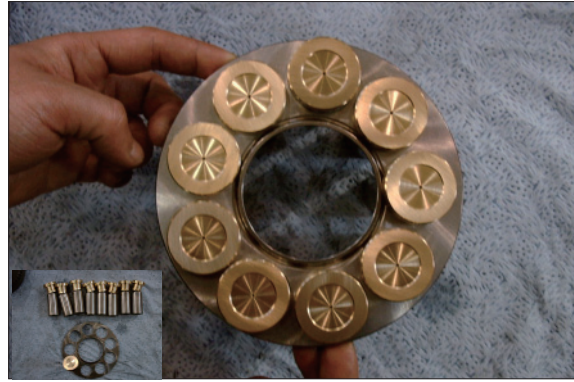
- ② Assemble ball guide (12) and ball guide seat (11) into cylinder block (9).  
· Ball guide × 1EA



3607A8SM26



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



3607A8SM27

- ④ Assemble above item ② and ③.



3607A8SM28

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



3607A8SM04

- ⑥ Assemble 4 set of lining plate (16), friction plate (15) respectively into body.
- Lining plate × 4EA
  - Friction plate × 4EA



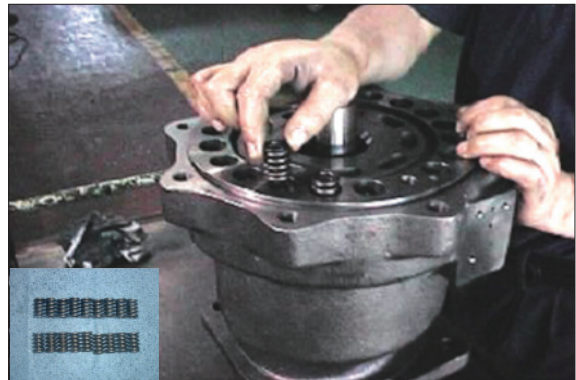
3607A8SM29

- ⑦ Assemble O-ring (18) into break piston (17).  
 · O-ring × 2EA



3607A8SM30

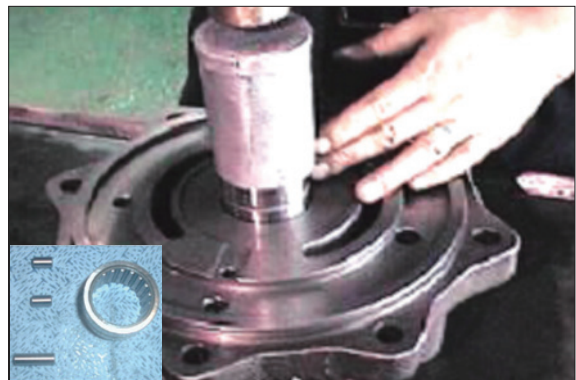
- ⑧ Insert break piston assy into body (1) and assemble spring (19) into break piston (17).  
 · Spring × 19EA



3607A8SM31/31A

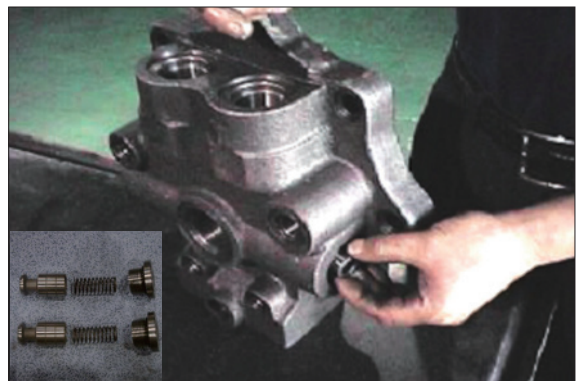
**(3) Assemble the sub of rear cover assy sub**

- ① After assembling needle bearing (22) into rear cover (23), with a hammer assemble pin (6, 21).



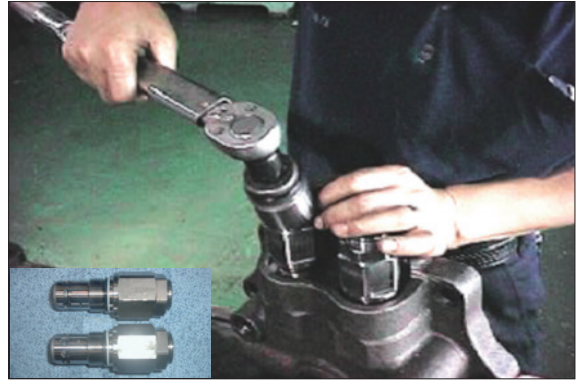
3607A8SM32/32A

- ② Assemble respectively make up check valve assy spring (27), poppet (26), plug (28) into rear cover (23) after then screw it torque wrench.  
 · Make up check sub × 2set  
 · Spring × 2EA  
 · Check × 3EA



3607A8SM33/12A

- ③ Assemble relief valve assy (30) 2set into rear cover (23) with a torque wrench.



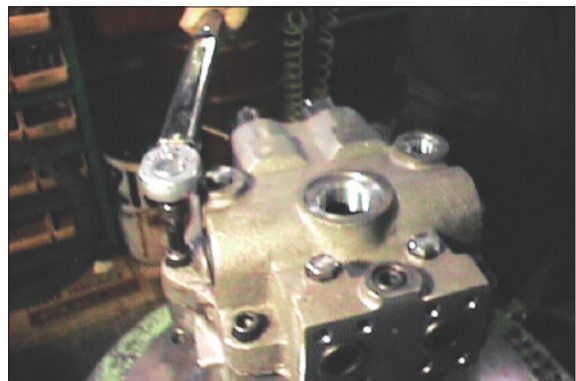
3607A8SM34/11A

- ④ Spreading grease on valve plate (20), assemble into rear cover (23).  
· Valve plate × 1EA



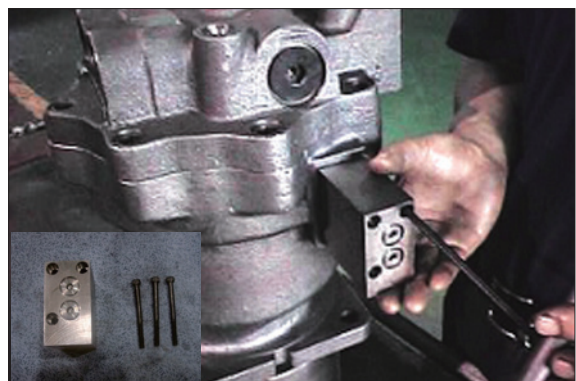
3607A8SM10/10A

- ⑤ Lift up rear cover assy on body (1) by a crane and assemble it with a wrench bolt (24, 25).



3607A8SM02

- ⑥ Assemble time delay valve assy (31) into rear cover (23) with a wrench bolt (32).

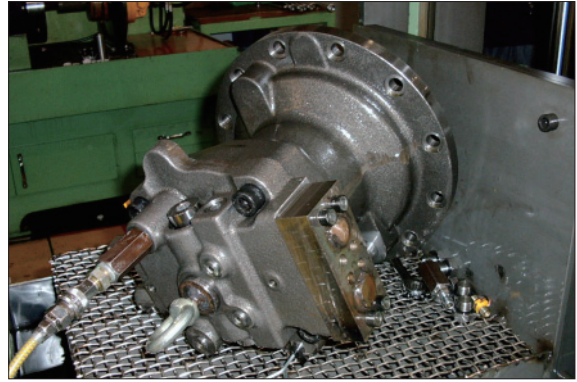


3607A8SM01/01A



**(4) Air pressing test**

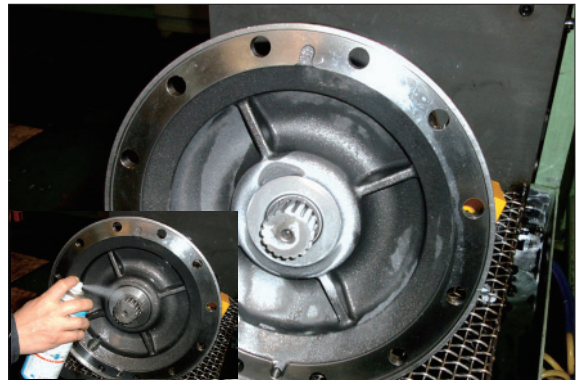
Be sure of leakage, after press air into assembled motor.



14078SM232

**(5) Leakage check**

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



14078SM233/233A

**(6) Mount test bench**

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



220078SM14

# 1. REMOVAL AND INSTALL OF MOTOR (MACHINE SERIAL NO. : #0894-)

## 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.

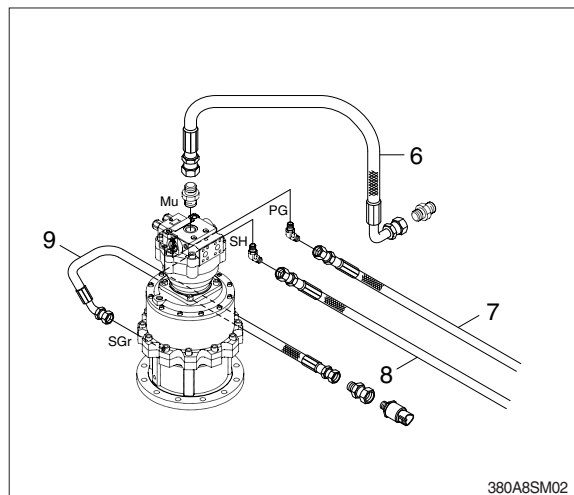
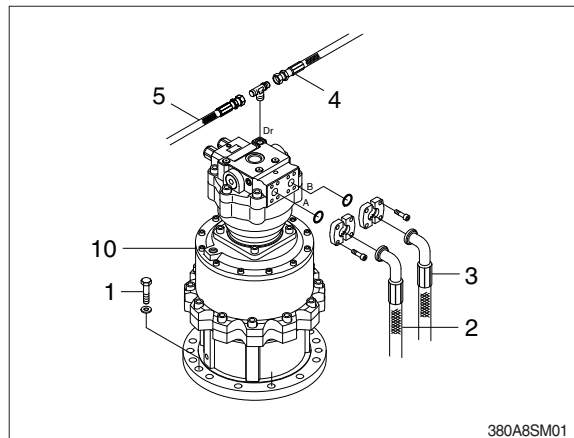
- (4) Disconnect hoses (2, 3, 4, 5, 6, 7, 8, 9).
- (5) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (10).
  - Motor device weight : 95 kg (209 lb)
  - Tightening torque :  $97.8 \pm 15$  kgf·m  
( $707 \pm 108$  lbf·ft)

- (6) Remove the swing motor assembly.
 

※ When removing the swing motor assembly, check that all the piping have been disconnected.

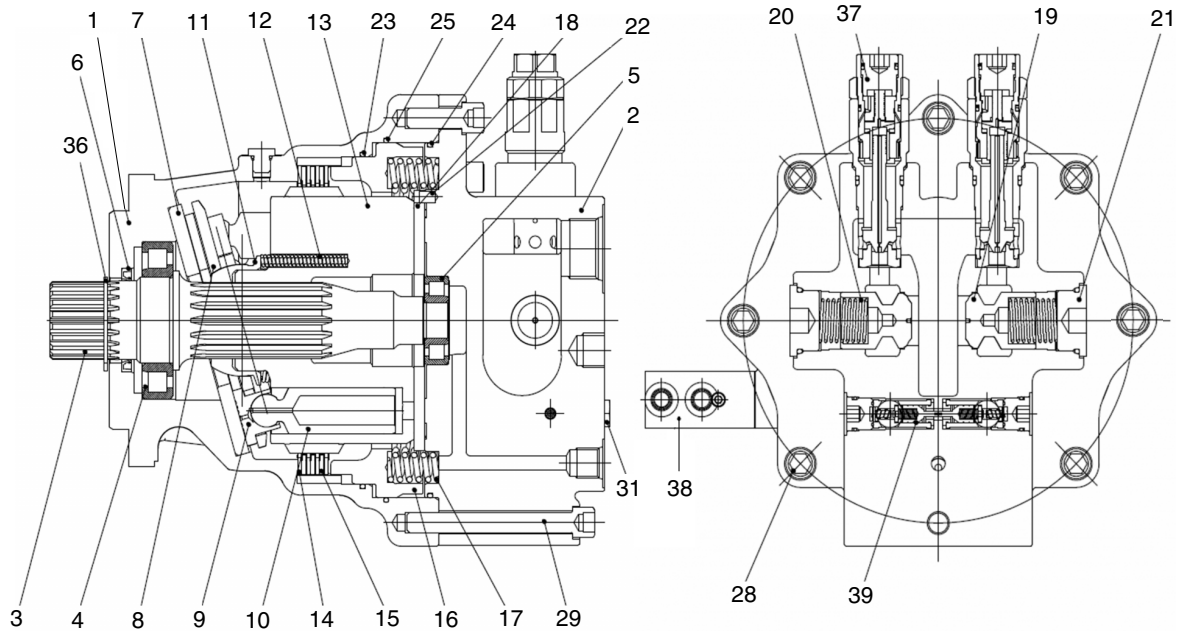
## 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
  - ① Remove the air vent plug.
  - ② Pour in hydraulic oil until it over flows 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) Confirmed the hydraulic oil level and check the hydraulic oil leak or not.



## 2. SWING MOTOR (MACHINE SERIAL NO. : #0894-)

### 1) STRUCTURE

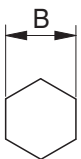


380A8SM05

1	Casing	12	Cylinder spring	23	O-ring
2	Valve casing	13	Cylinder block	24	O-ring
3	Drive shaft	14	Friction plate	25	O-ring
4	Roller bearing	15	Separation plate	28	Socket bolt
5	Roller bearing	16	Brake piston	29	Socket bolt
6	Oil seal	17	Brake spring	30	Socket bolt
7	Shoe plate	18	Valve plate	31	VP plug assy
8	Retainer plate	19	Plunger	36	Snap ring
9	Shoe	20	Check spring	37	Relief valve
10	Piston	21	RO plug assy	38	Brake valve
11	Thrust ball	22	Pin	39	Reactionless valve

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Tool name	Remark	
Allen wrench	17	
Socket for socket wrench, spanner	5	
	19	
	36	
Plier (for stop ring)	For shaft $\Phi$ 45 mm	
Plier (for lock ring)	For hole $\Phi$ 100 mm For hole $\Phi$ 45 mm	
Driver	(-) type, 2EA	
Steel rod	10x8x200 mm, 1EA	
Hammer	Plastic hammer, steel hammer, each 1EA	
Torque wrench (adjust range)	1.0~4.5 kgf·m (7.2~32.5 lbf·ft) 4.0~18 kgf·m (28.9~130 lbf·ft) 12~48 kgf·m (86.8~347 lbf·ft)	
Slide hammer bearing plier	-	
Brake piston subtract jig	-	

### (2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf·m	lbf·ft	mm	inch
Socket bolt	30	M6	$1.2 \pm 0.2$	$8.7 \pm 1.4$	5	0.20
Socket bolt	28, 29	M14	$11.3 \pm 1.1$	$81.7 \pm 8.0$	17	0.67
Relief valve	37	M33	$18 \pm 1.0$	$130 \pm 7.2$	19	0.75
Plug	31	PF 1/4	$3.7 \pm 0.2$	$26.8 \pm 1.4$	36	1.42

### 3) DISASSEMBLING

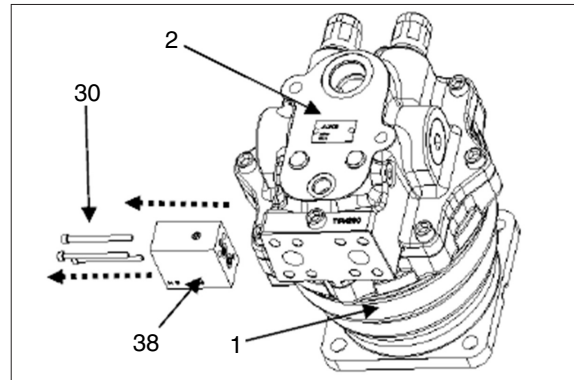
※ The disassembling procedures are as following.

※ Figure in ( ) shown after part name in explanation sentence shows number in construction figure.

- (1) Bind the circumference of the motor and lift up by crane.  
Clean the motor with cleaning oil and dry it with compressed air.
- (2) Drain the oil from the casing (1) through the drain port.

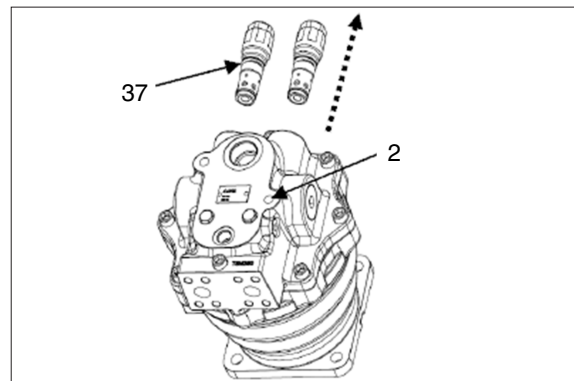
(3) Place the drive shaft (3) with the shaft side with down ward and fix it on a work table for easy disassembling.

(4) Put a fitting mark on the casing (1) and valve casing (2) and loosen the socket bolt (30) and remove the brake valve (38) form the swing motor.



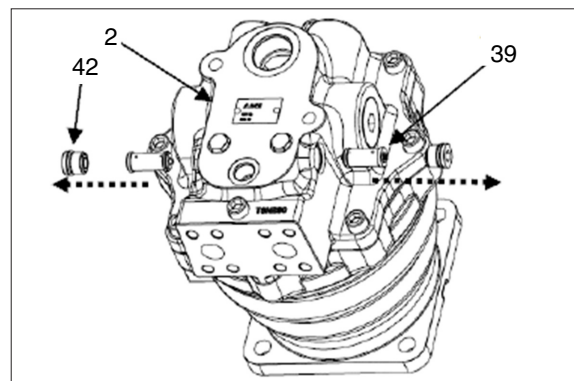
380A8SM06

(5) Loosen the relief valve (37) and take off it from the valve casing (2).



380A8SM07

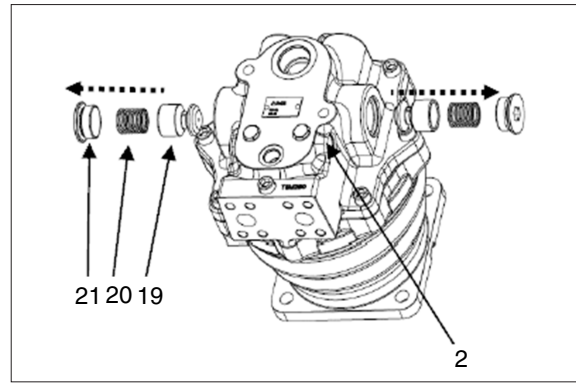
(6) Remove the RO plug (42) from the valve casing (2) and pull out the reactionless valve (39).



380A8SM08

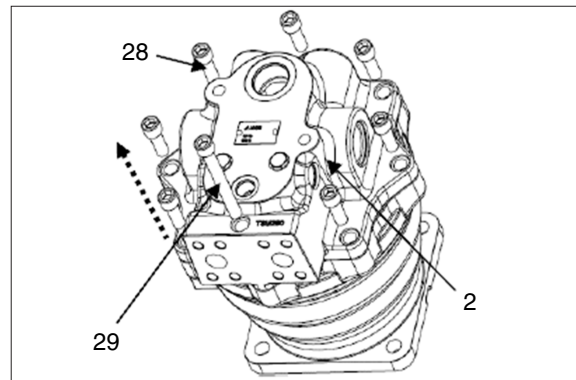


- (7) Loosen the RO plug (21) from the valve casing (2) and pull out the spring (20) and plunger (19).



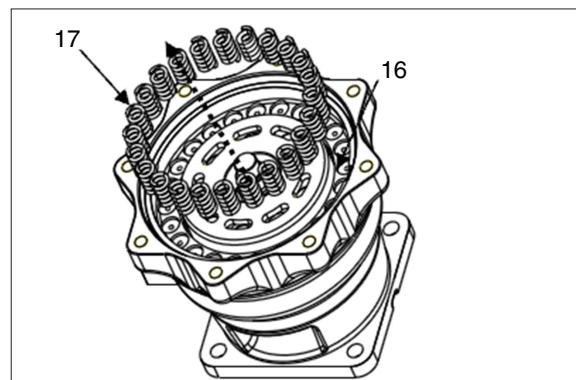
380A8SM09

- (8) Loosen the socket bolt (28, 29) and take off the valve casing (2).  
 ※ The valve casing (2) is separated from the casing (1) automatically by the brake spring (17) force when the socket bolt (28, 29) is loosened.



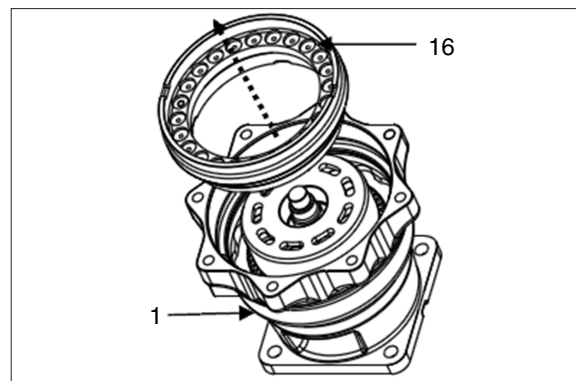
380A8SM10

- (9) Pull out the brake spring (17) from the brake piston (16).



380A8SM11

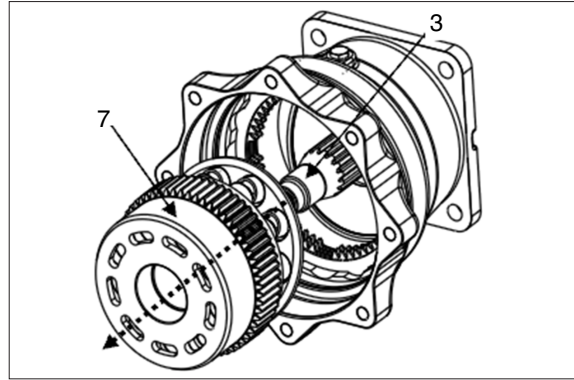
- (10) The brake piston (16) from the casing (1) by using a jig.  
 ※ Pull the brake piston (16) straight up when using the bolt hole of the brake piston (16).



380A8SM12

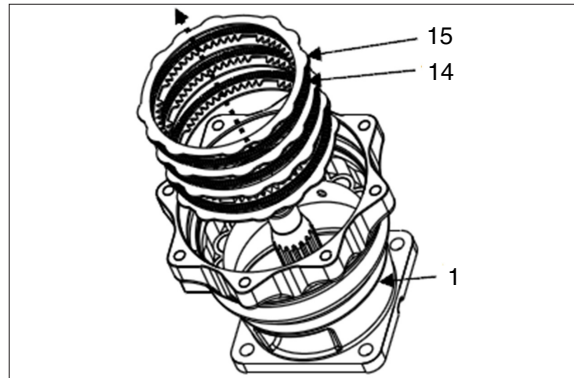
(11) Put the motor horizontally and pull out the cylinder block (13) from the drive shaft (3). And the piston assy (9, 10), retainer (8), thrust ball (11) and shoe plate (7).

※ Take care not to damage sliding face of the cylinder block (13), thrust ball (11) and shoe (9) when pull out the cylinder block (13).



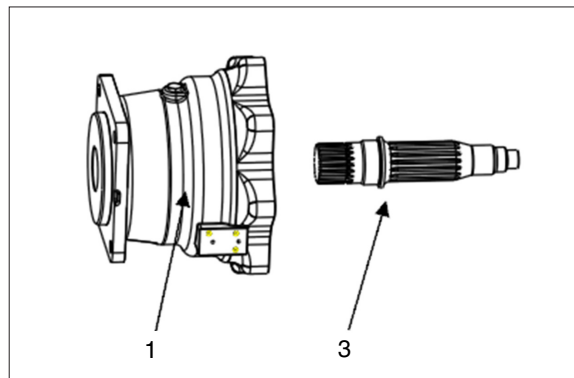
380A8SM13

(12) Take off the friction plate (14) and separation plate (15) from the casing (1).



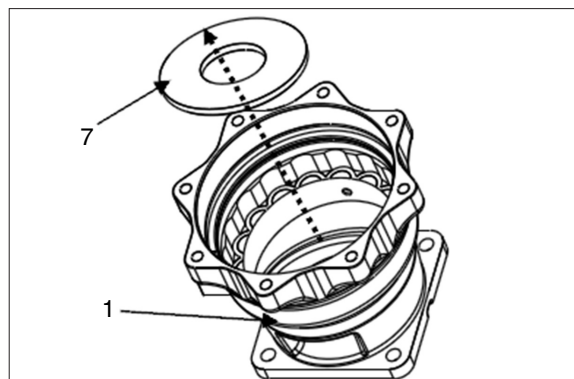
380A8SM14

(13) Separate drive shaft (3) from the casing (1).



380A8SM15

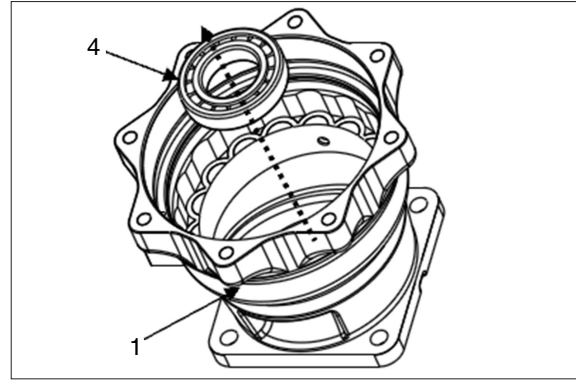
(14) Pull the shoe plate (7) from the casing (1) by tapping lightly the cylindrical roller bearing (4) side with a plastic hammer.



380A8SM16

(15) Pull the roller bearing (4) from the casing (1) by tapping lightly with a steel rod.

- ※ Take care not to damage the bearing by tapping the inner race of the cylindrical roller bearing evenly with a steel rod.
- ※ Do not reuse the disassembled bearing.

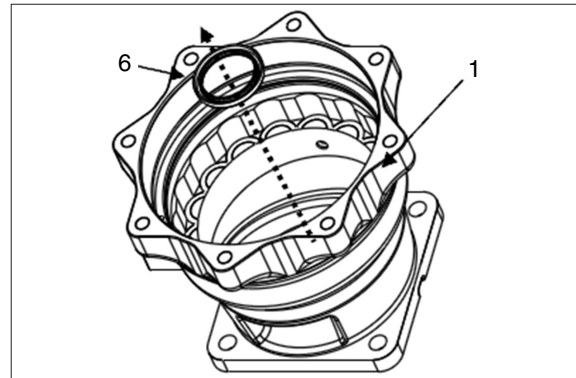


380A8SM17

※ Following works perform if necessary.

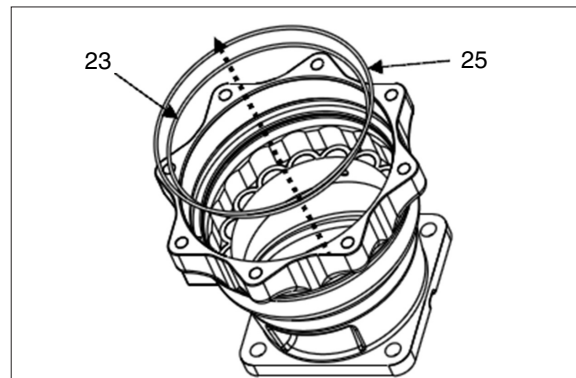
(16) Disassemble the oil seal (6) from the casing (1).

- ※ Disassemble the oil seal (6) by tapping bottom side of the oil seal with a steel rod.



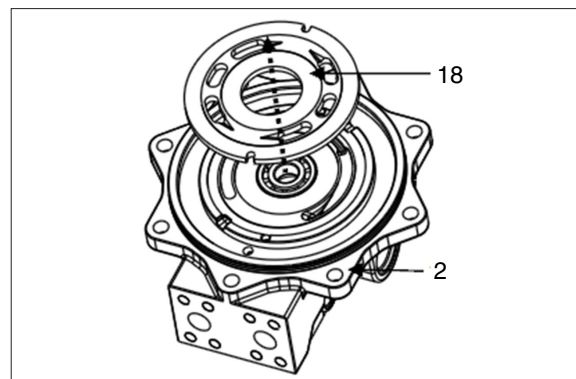
380A8SM18

(17) Disassemble the O-ring (23, 25) from the casing (1).



380A8SM19

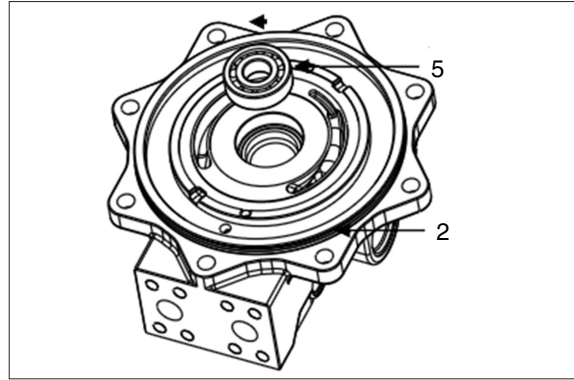
(18) Disassemble the valve (18) from the valve casing (2).



380A8SM20

(19) Disassemble the roller bearing (5) from the valve casing (2) with a plastic hammer.

※ Do not reuse the disassembled bearing.



380A6SM21

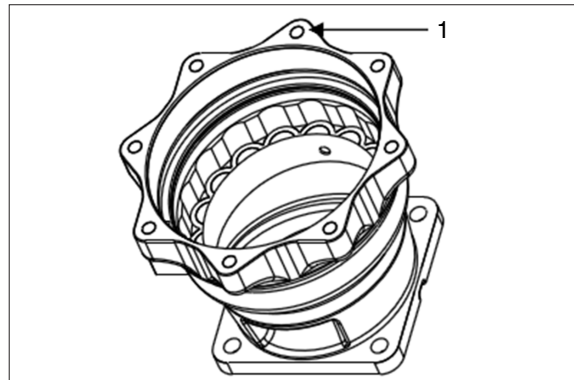
(20) This is the end of disassembling procedures.

※ Check every part for any abnormalities.

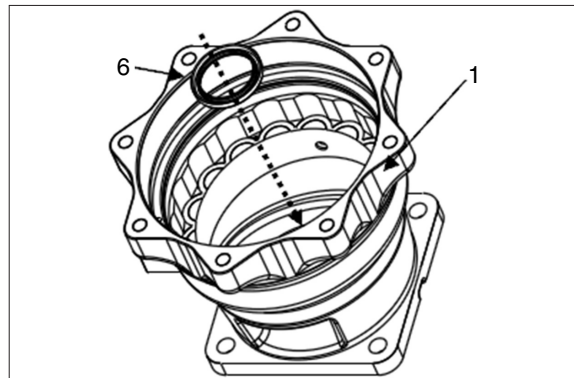
#### 4) ASSEMBLY

- (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 8-62-2.

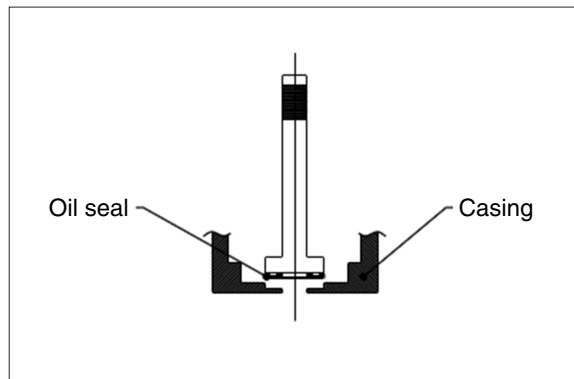
(2) Place the casting (1) on a suitable place.



(3) Assemble the oil seal (6) on the casting (1).



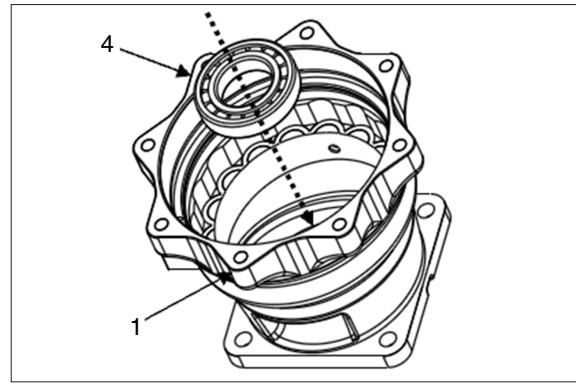
(4) Assemble the oil seal with a jig when assembling it and take care not to damage the lip of the oil seal (6).



(5) Using a jig, assemble the roller bearing (4) on the casting (1) by tapping the roller bearing (4) lightly.

※ Take care not to damage the bearing by tapping the inner race of the cylindrical roller bearing evenly with a steel rod.

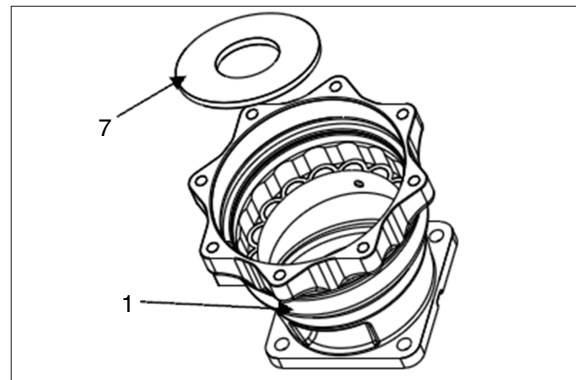
※ Do not reuse the disassembled bearing.



380A8SM25

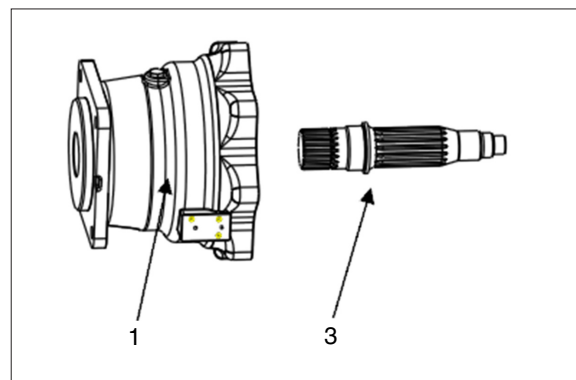
(6) Apply some grease to the back side of the shoe plate (7) and assemble it on the swash plate of the casing (1).

※ Take care not to mistake front and rear side of the shoe plate (7).



380A8SM26

(7) Assemble the drive shaft (3) into the casing (1).

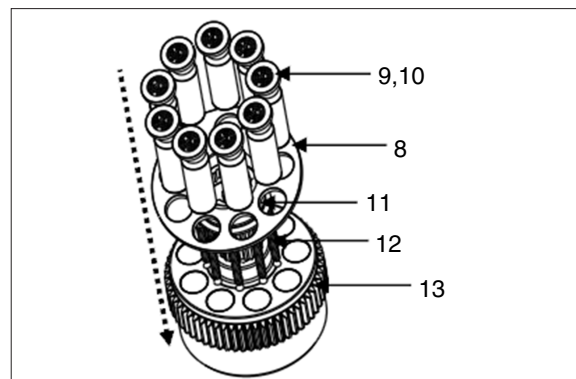


380A8SM27

(8) Insert the nine cylinder block springs (12) into the cylinder block (13).

(9) Confirm the assembling of the springs and put the thrust ball (11) on the springs.

(10) Assemble the retainer (8) and piston assy (9, 10) after assembling thrust ball (11).

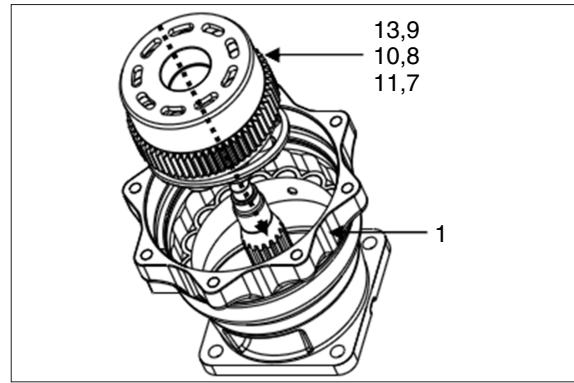


380A8SM28



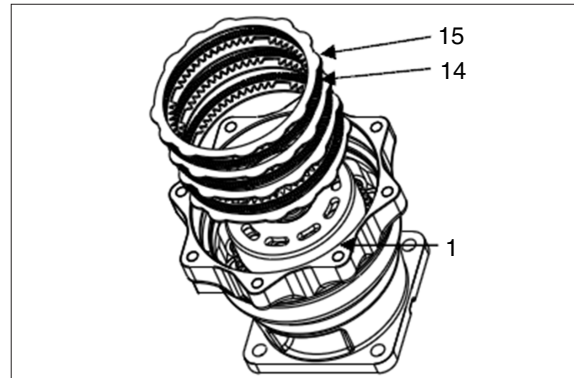
(11) Place the motor horizontally and assemble the cylinder block (13), piston assy (9, 10), retainer (8), thrust ball (11) and shoe plate (7) into the drive shaft (3).

※ Take care not to sliding face of the thrust ball (11) and shoe (9).



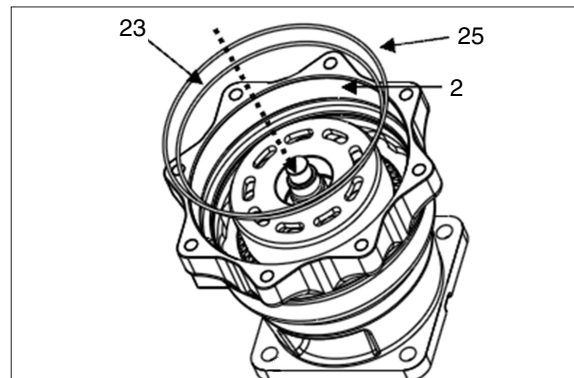
380A8SM29

(12) Assemble the three friction plates (14) and four separation plates into the casing (1).



380A8SM30

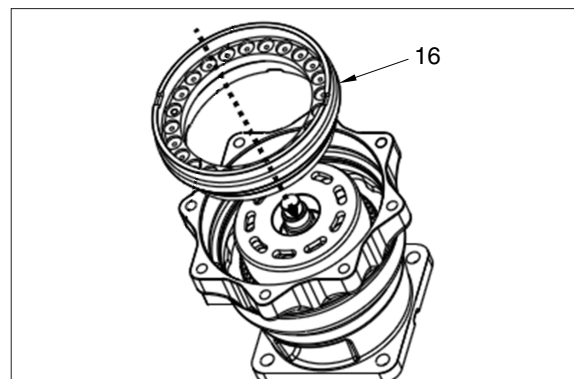
(13) Apply some grease to the O-ring (23, 25) and assemble them on the valve casing (2).



380A8SM31

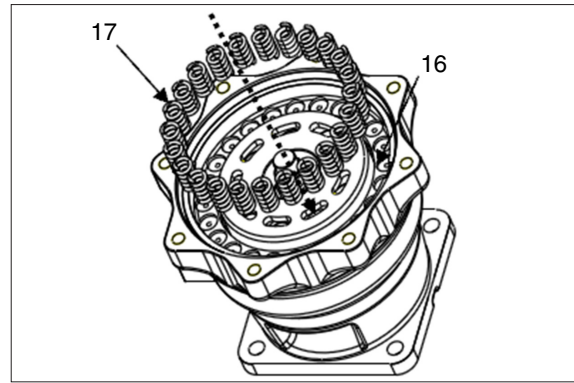
(14) Assemble the brake piston (16) into casing (1).

※ Assemble the brake piston (16) by tapping lightly with a plastic hammer when assembling it.



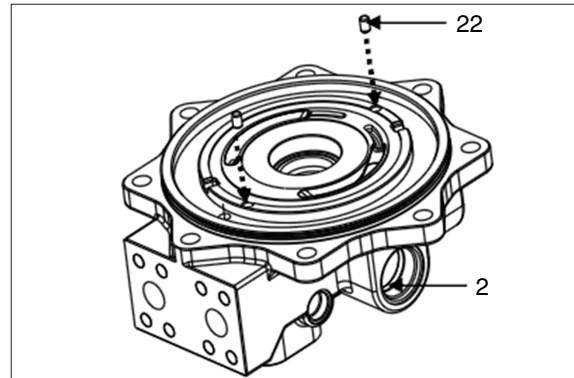
380A8SM32

- (15) Put the twenty four brakes springs (17) on the brake piston (16).
- ※ Take care not to slip down brake springs (17) when assembling them.



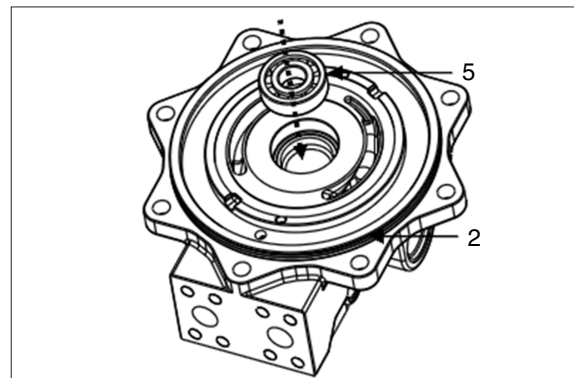
380A8SM33

- (16) Insert the pin (22) into the valve casing (1) by using a jig.



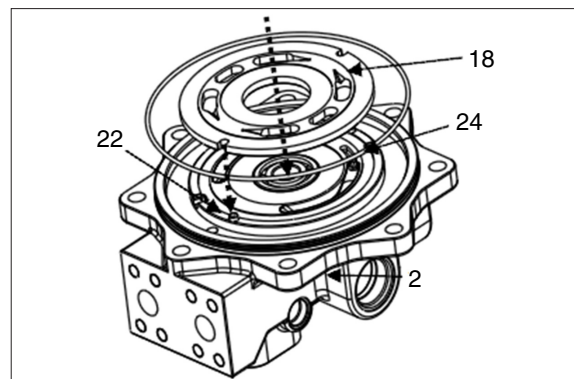
380A8SM34

- (17) Assemble the cylindrical roller bearing (5) into the valve casing (2) by using a plastic hammer.
- ※ Tap the bearing with a hammer lightly when assembling them.



380A8SM35

- (18) Apply some grease to the back side of the valve plate (18) and align the hole of the pin (22) and assemble it on the valve casing (2).  
And assemble the O-ring into the hole of the O-ring.

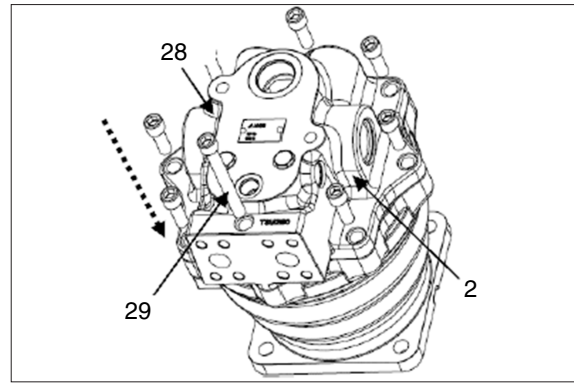


380A8SM36



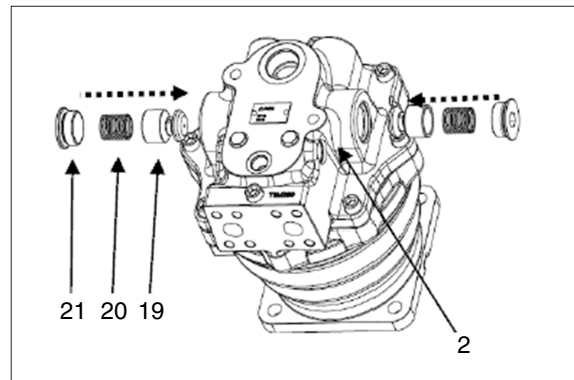
(19) Align the bolt hole of the valve casing (2) and casing (1) and tightening the socket bolt (28, 29) as specification torques.

※ Take care not to damage the bearing when assembling it.



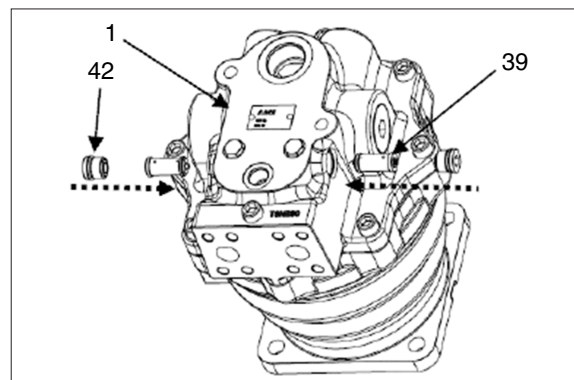
380A8SM37

(20) Assemble the spring (20) and RO plug (21) into the valve casing (2) after seat making the plunger (19) on the valve casing (2) two or three times.



380A8SM38

(21) Assemble the reactionless valve (39) into the valve casing (2) and assemble the RO plug (42) by using L-wrench.

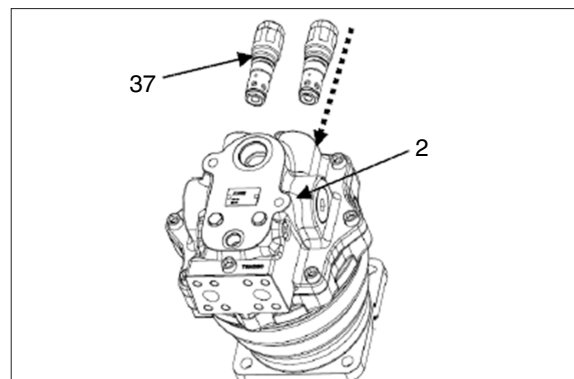


380A8SM39

(22) Assemble the relief valve (37) into the valve casing (2).

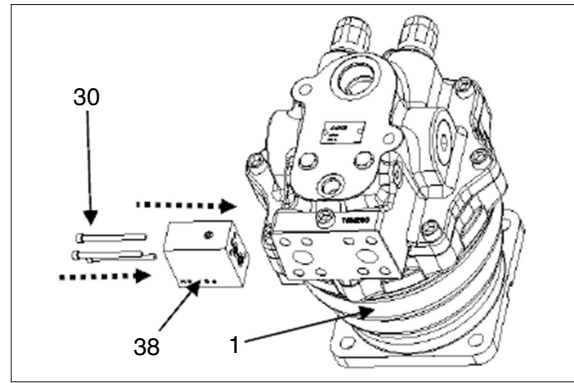
※ Apply some grease to O-ring of the relief valve when assembling it.

※ Tighten with a specified torque when tightening.

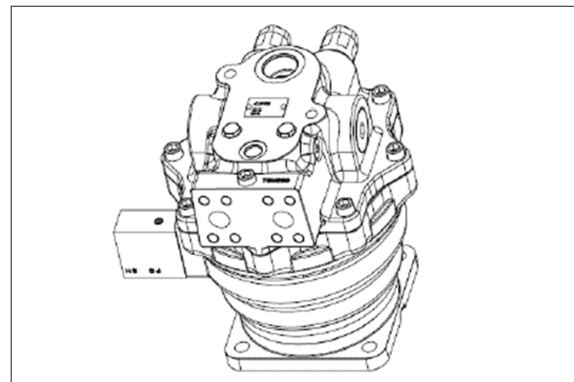


380A8SM40

- (23) Assemble the brake valve (38) on the casing (1) with the socket bolts (30).
- ※ Take care not to miss the O-ring of the brake valve when assembling.



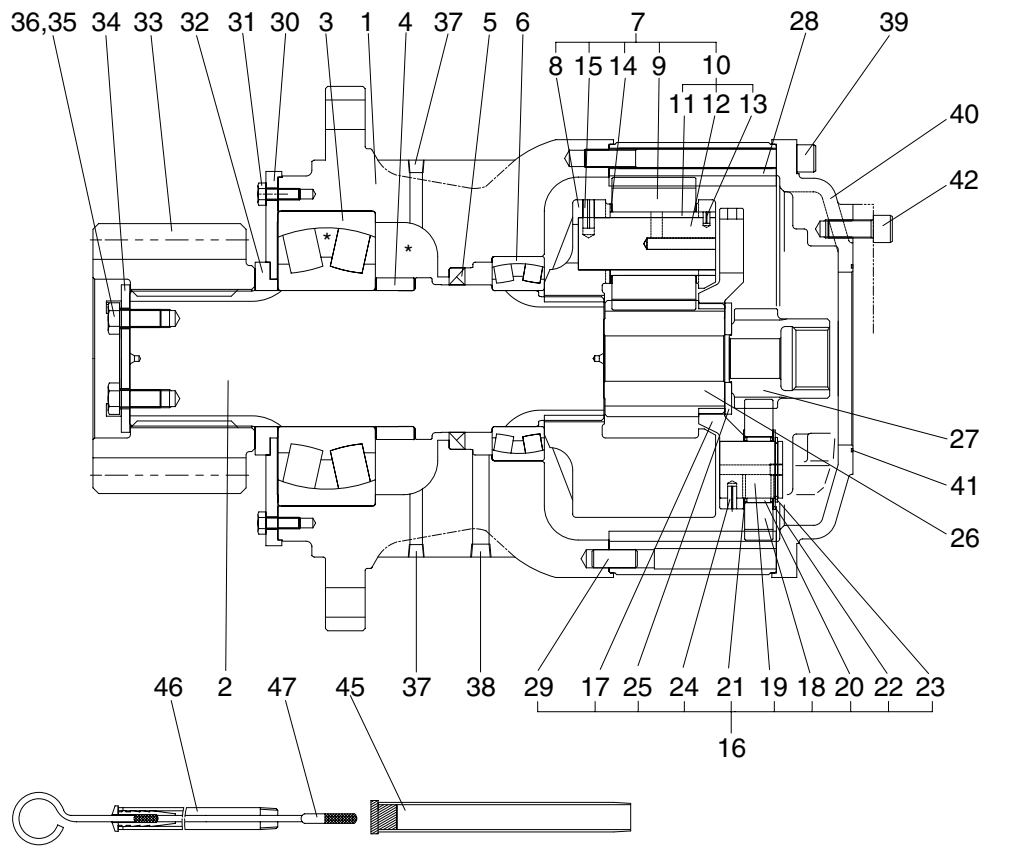
- (24) Clean the face of the motor to the reduction gear with cleaning oil and dry it by compressed air.



- (25) This is the end of assembling procedures.

### 3. REDUCTION GEAR

#### 1) STRUCTURE



38092SM03

1	Casing	17	Carrier 1	33	Pinion gear
2	Drive shaft	18	Planetary gear 1	34	Lock plate
3	Roller bearing	19	Pin 1	35	Hexagon bolt
4	Spacer ring	20	Needle cage	36	Lock washer
5	Oil seal	21	Side plate 1	37	Plug
6	Roller bearing	22	Side plate 2	38	Plug
7	Carrier 2	23	Stop ring	39	Socket bolt
8	Carrier 2	24	Spring pin	40	Cover
9	Planetary gear 2	25	Thrust ring	41	O-ring
10	Pin 2	26	Sun gear 2	42	Hexagon socket bolt
11	Pin 2	27	Sun gear 1	43	Plug
12	Bushing 2	28	Ring gear	45	Air breather assy
13	Spring pin	29	Knock pin	46	Gauge pipe
14	Thrust washer	30	Cover plate	47	Gauge bar
15	Spring pin	31	Hexagon bolt		
16	Carrier 1	32	Spacer		

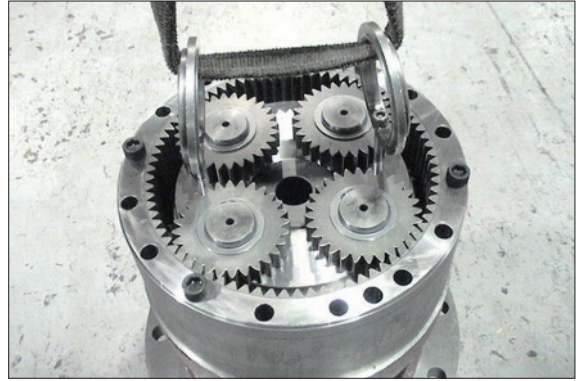
## 2) DISASSEMBLY

### (1) Removal of cover

- ※ Loosen the socket bolt (24) with 16mm hexagonal socket and remove the cover (37).

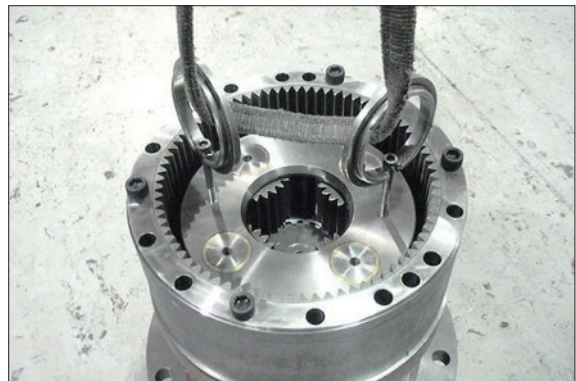
### (2) Removal of sun gear 1 and thrust ring assembly

Remove carrier 1(16), install eye bolt to tap hole (M10) and remove carrier 1 assembly itself.



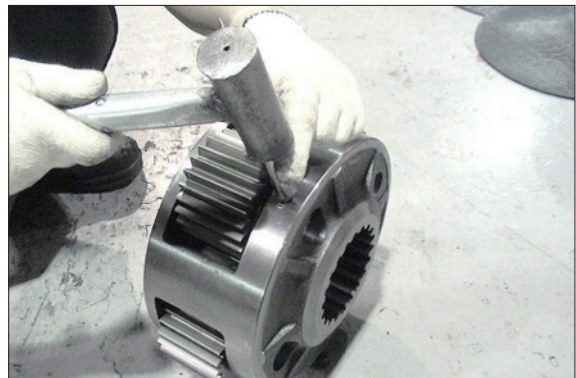
### (3) Removal of sun gear 2

Remove sun gear 2 (26), install eye bolt to tap (M10) of carrier 2 (8) and remove carrier 2 assembly itself.

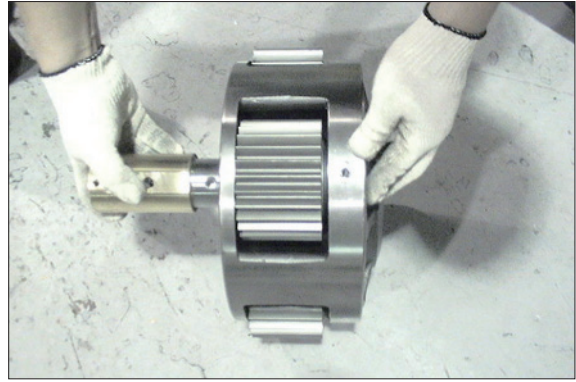


### (4) Disassembly of 2nd carrier assembly

- ① Insert spring pin (15) into pin assy 2(11) by hammering.
- ※ Do not reuse spring pin after removal.



- ② Remove pin assy 2 (11) from carrier 2 (7), planetary gear 2 (9) and thrust washer (14) with hands.

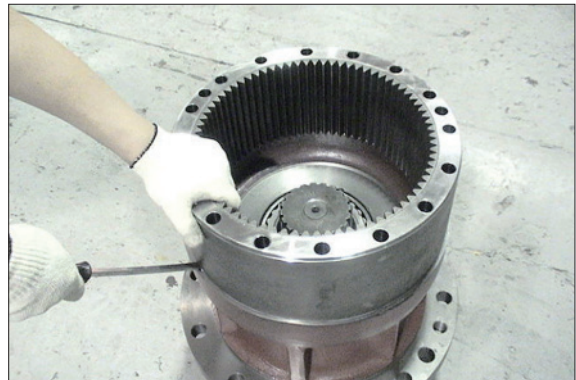


3607A8SR06

#### (5) Removal of ring gear

Remove ring gear (28) from casing (1).

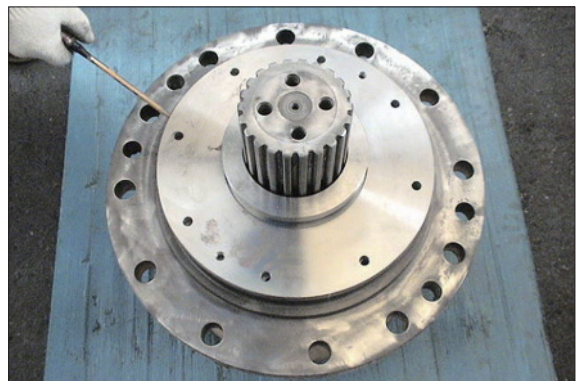
- ※ Fluid packing is applied on contacting face of ring gear and gear casing.  
Therefore, remove ring gear from casing by minus screw driver.



3607A8SR07

#### (6) Removal of drive shaft (2) assembly

- ① Spread off the corners of spacer (32), cover plate (30) and hex bolt (31) with a tool.



3607A8SR08

- ② Install hydraulic press at the end face of shaft, and remove drive shaft(2), spacer ring (4), and roller bearing (3) as assembly.

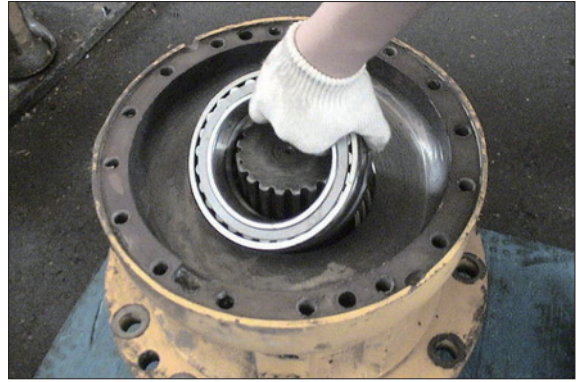
- ※ Do not reuse oil seal after removal.



3607A8SR09



- ③ Remove roller bearing (6) from gear casing (1).



3607A8SR10

- ④ Remove oil seal (5) from gear casing (1).



3607A8SR11

**(7) Disassembly of shaft assembly**

Insert motor side of shaft (2) into steel tube (inner dia :  $\varnothing$  145 mm) and push the end of output shaft side with hydraulic press and then remove roller bearing (3), and spacer ring (4) as assembly from drive shaft (2).



3607A8SR12

### 3) ASSEMBLY

#### (1) Assembly of drive shaft assembly

- ① After assembly drive shaft (2), heat roller bearing (3) up to 50°C plus surrounding temperature and assemble it to shaft with hydraulic press and then assemble spacer ring (4) in this order.
- ※ Pay attention to the assembling direction of cover plate (30).



3607A8SR13

#### (2) Installation of oil seal

Remove oil from assembled face of oil seal of gear casing (1) and oil seal (5). Apply fluid packing (three bond of white color) on outer face of oil seal and assemble at pressing jig of gear casing. After inserting with press, lubricate oil seal with grease.



3607A8SR14

#### (3) Assembly of drive shaft assembly

- ① Be careful lest oil seal lip damage by spline of drive shaft (2). Assemble drive shaft assembly by using seal guide.
- ② Put drive shaft of gear casing (1) upward. Assemble drive shaft assembly to gear casing by tightening eye bolt into tap hole (M16) of output side of drive shaft (2).
- ※ Place support (approx 150 mm) below of gear case (1) for seal protector contact with work table.

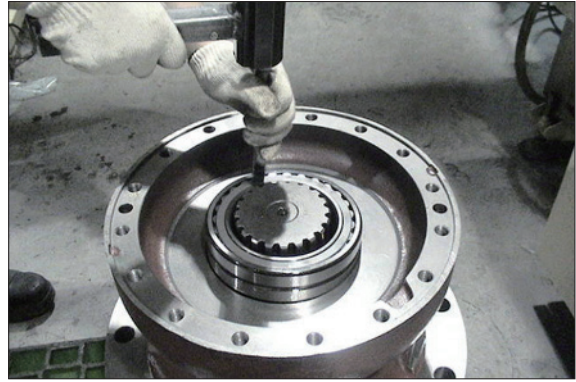


3607A8SR15



#### (4) Install of roller bearing

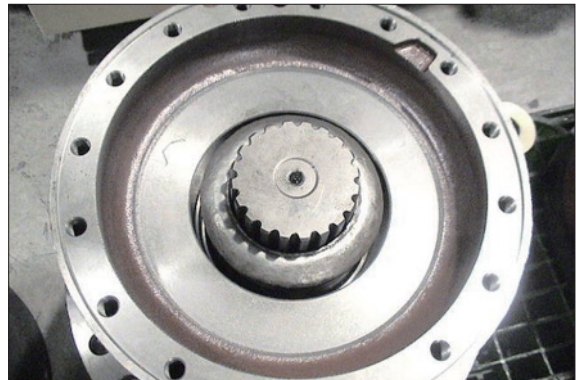
Put gear casing under output shaft and heat roller bearing (6) up to 50°C plus surrounding temperature and then assemble it to the shaft.



3607A8SR16

#### (5) Assembly of ring gear

- ① Remove oil from mating faces between gear casing (1) and ring gear (28), and knock pin (29). Assemble collar of gear casing and apply fluid packing (three bond of grey color).



3607A8SR17

- ② Assemble ring gear (28).



36078SR18

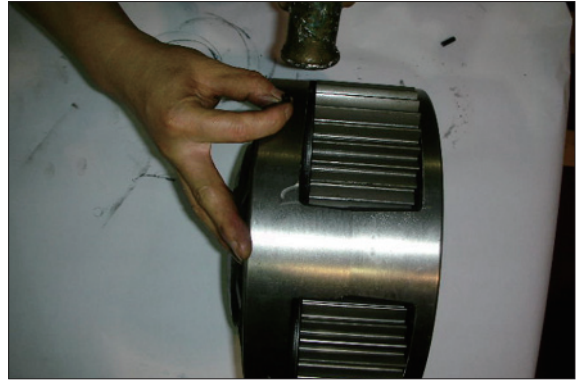
#### (6) Assembly of carrier 2 assembly

- ① Assemble planetary gear 2 (9) to carrier 2 (8) with thrust washer (14) and insert pin assy 2 (11).
- ※ Lubricate gear oil to inside of gear and outside of shaft.



3607A8SR19

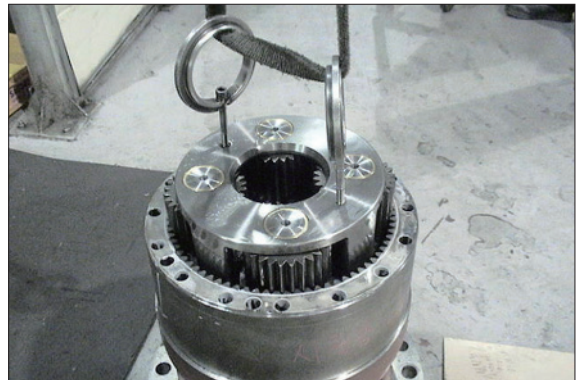
- ② Insert spring pin (15) by hammering.
- \* Insert as the clearance between spring pins toward planetary gear 2 (9).



3607A8SR20

**(7) Assembly of carrier 2 assembly and sun gear 2**

- ① Mount eye bolt into tap hole (M10) of carrier 2 (8) and lift carrier assembly and then insert carrier assembly being engaged with internal teeth of ring gear (28). Rotate carrier assembly lightly so that splines of drive shaft (2) are engaged.



3607A8SR21

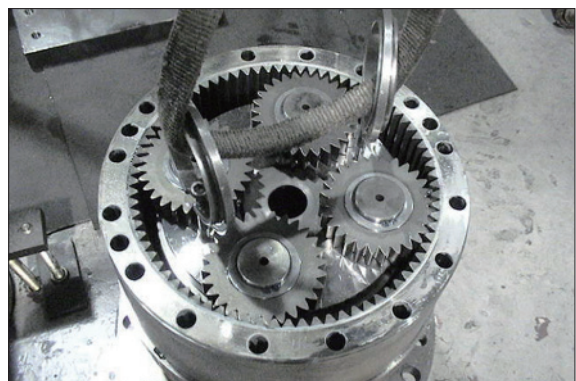
- ② Insert sun gear 2 (26) to planetary gear 2 (9).



3607A8SR22

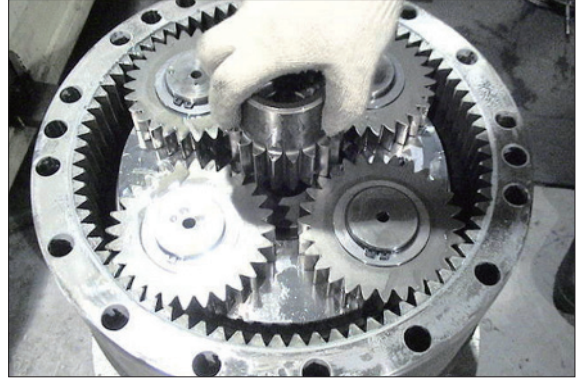
**(8) Assembly of sun gear 1, carrier 1 assembly**

- ① Mount eye bolt into tap hole (M10) of lift carrier assembly and then insert carrier assembly being engaged with internal teeth of ring gear (28). Rotate holder assembly lightly so that sun gear 2 (26) is engaged with teeth of carrier 1 (17).



3607A8SR23

- ② Insert sun gear 1 (27) to planetary gear 1 (18).



- (9) Check rotation of sun gear by turning plunge part of gear casing with hands.

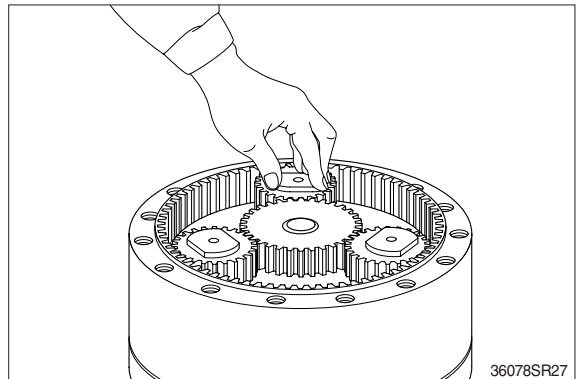
**(10) Assembly of cover**

Remove oil from mating faces between ring gear (28) and cover (40) and apply fluid packing.

Assemble cover (40) and tighten socket bolt (39) with 16mm hexagonal socket.

Tightening torque :  $28.5 \pm 3.0 \text{ kgf} \cdot \text{m}$   
( $206 \pm 21.7 \text{ lbf} \cdot \text{ft}$ )

This completes assembly



## 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.

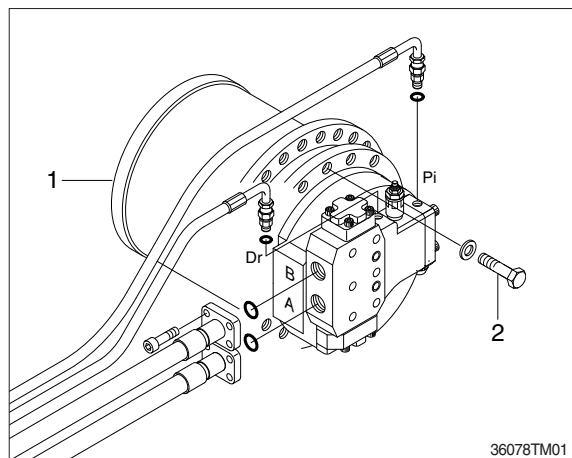
**▲ Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ 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 hoses.  
※ 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 : 380 kg(840 lb)

##### 2) INSTALL

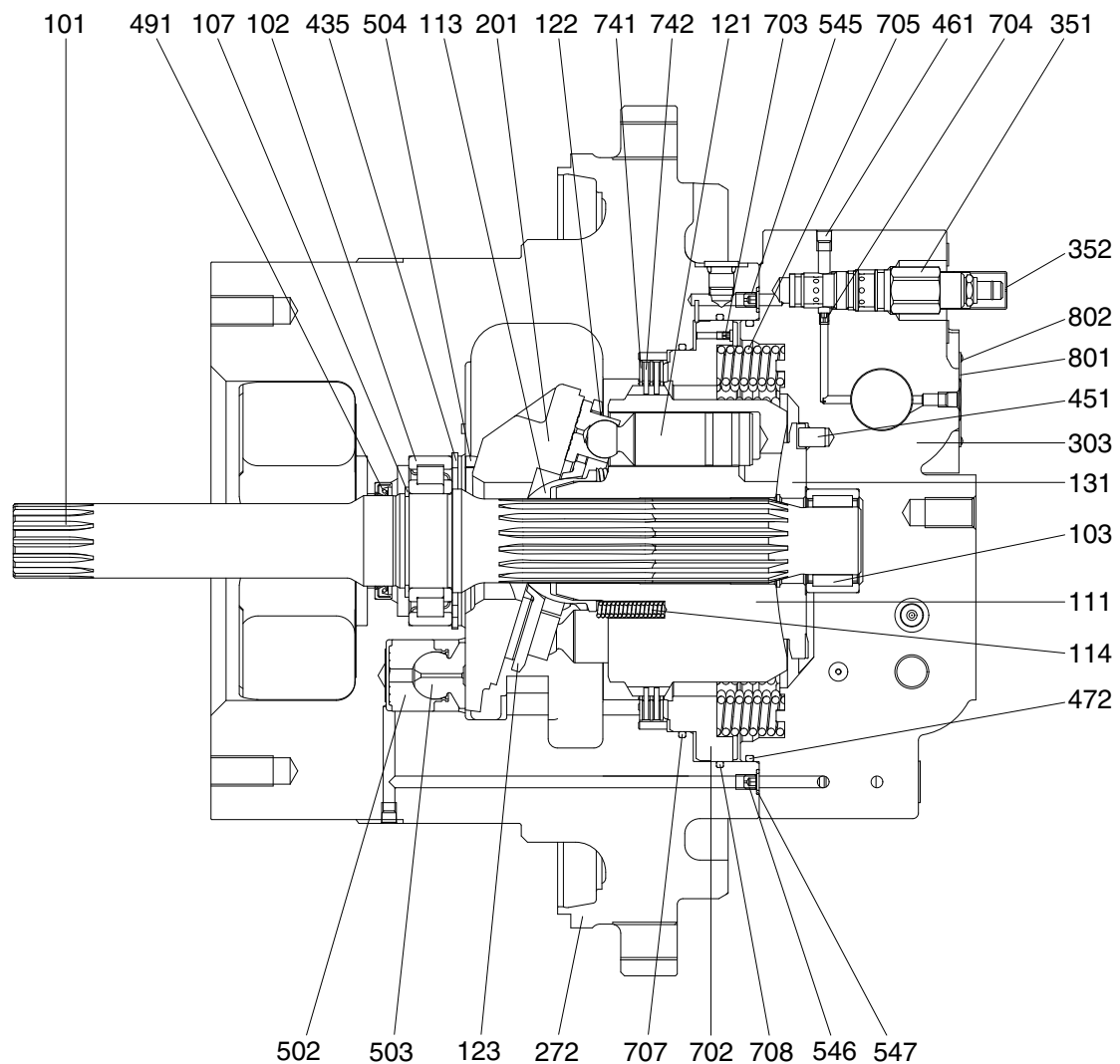
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel motor.
  - ① Remove the air vent plug.
  - ② Pour in hydraulic oil until it overflows from the port.
  - ③ Tighten plug lightly.
  - ④ Start the engine, run at low idling, and check oil come out from plug.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





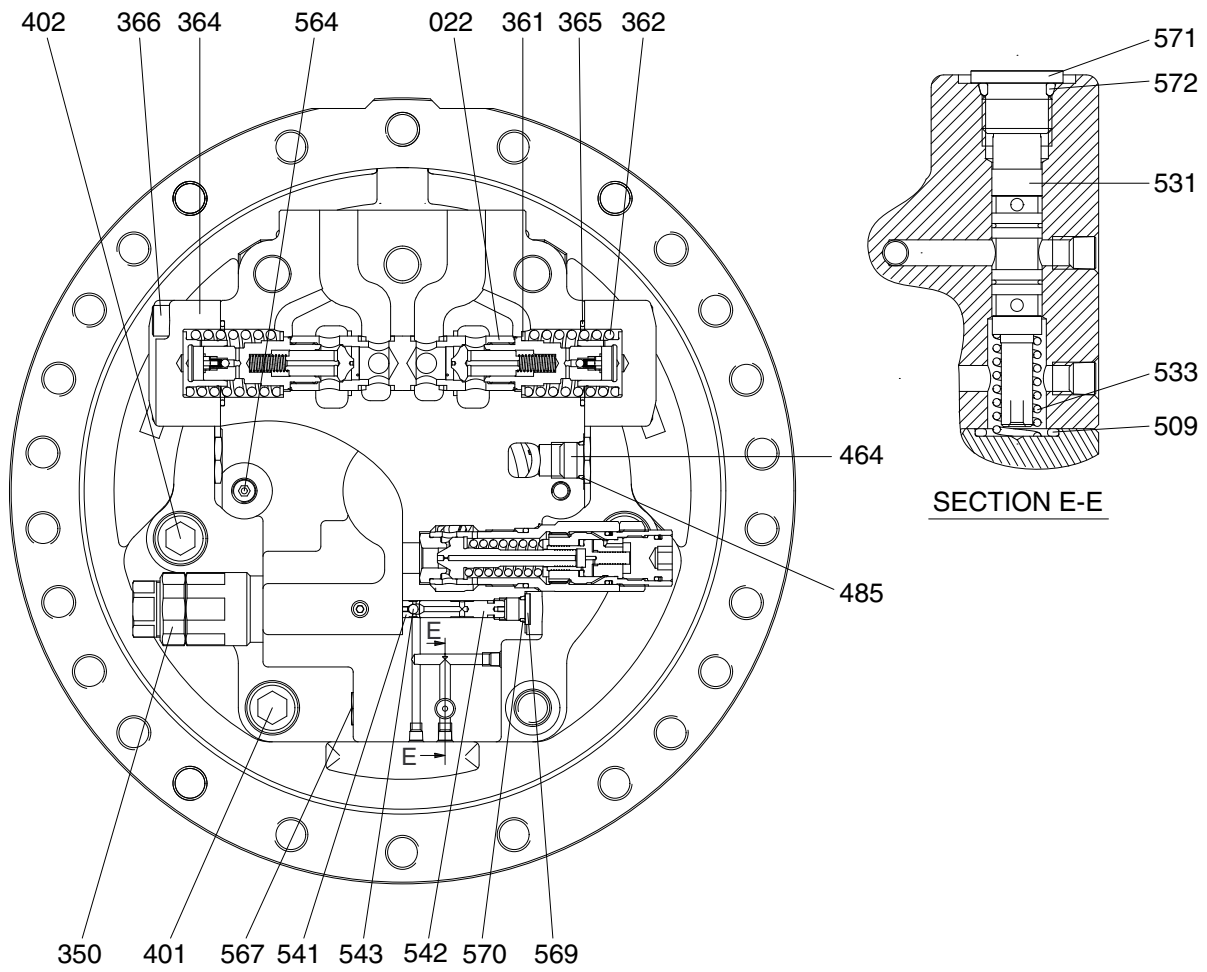
## 2. TRAVEL MOTOR (TYPE 1)

### 1) STRUCTURE (1/2)



101 Drive shaft	303 Valve casing	547 O-ring
102 Roller bearing	351 Reducing valve	702 Brake piston
103 Needle bearing	352 Cover	703 Orifice
107 Snap ring	435 Snap ring	704 Orifice
111 Cylinder block	451 Pin	705 Brake spring
113 Spherical bushing	461 Plug	707 O-ring
114 Cylinder spring	472 O-ring	708 O-ring
121 Piston	491 Oil seal	741 Separation plate
122 Shoe	502 Piston	742 Friction plate
123 Set plate	503 Shoe	801 Name plate
131 Valve plate	504 Pivot ball	802 Rivet
201 Swash plate	545 Orifice	
272 Shaft casing	546 Orifice	

## STRUCTURE (2/2)

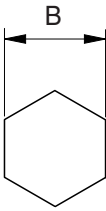


022	Counterbalance spool	402	Hex socket bolt	543	Steel ball
350	Relief valve	464	VP plug	564	Plug
361	Washer	485	O-ring	567	VP plug
362	Counterbalance spring	509	O-ring	569	RO plug
364	Counterbalance cover	531	Tilting spool	571	RO plug
365	O-ring	533	Tilting spring	572	O-ring
366	Hex socket	541	Seat		
401	Hex socket	542	Stopper		

3607A2TM03

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Tool name	Remark	
Allen wrench	2	
	2.5	
	4	
	6	
	8	
	10	
	17	
Socket for socket wrench, spanner	19	
	22.4	
	27	
	42	
Torque wrench	Capable of tightening with the specified torques.	
Plier(For hole, TPR-90)	For snap ring(435)	
Plier(For shaft)	For snap ring(107)	
( - ) Driver	-	
Plastic hammer	Wooden hammer allowed. Nominal 1 or so	
Steel rod approx	7×7×200mm, Bearing(102, 103)	
Monkey wrench	-	
Oil seal inserting jig	-	
Bearing plier	-	
Seal tape	-	

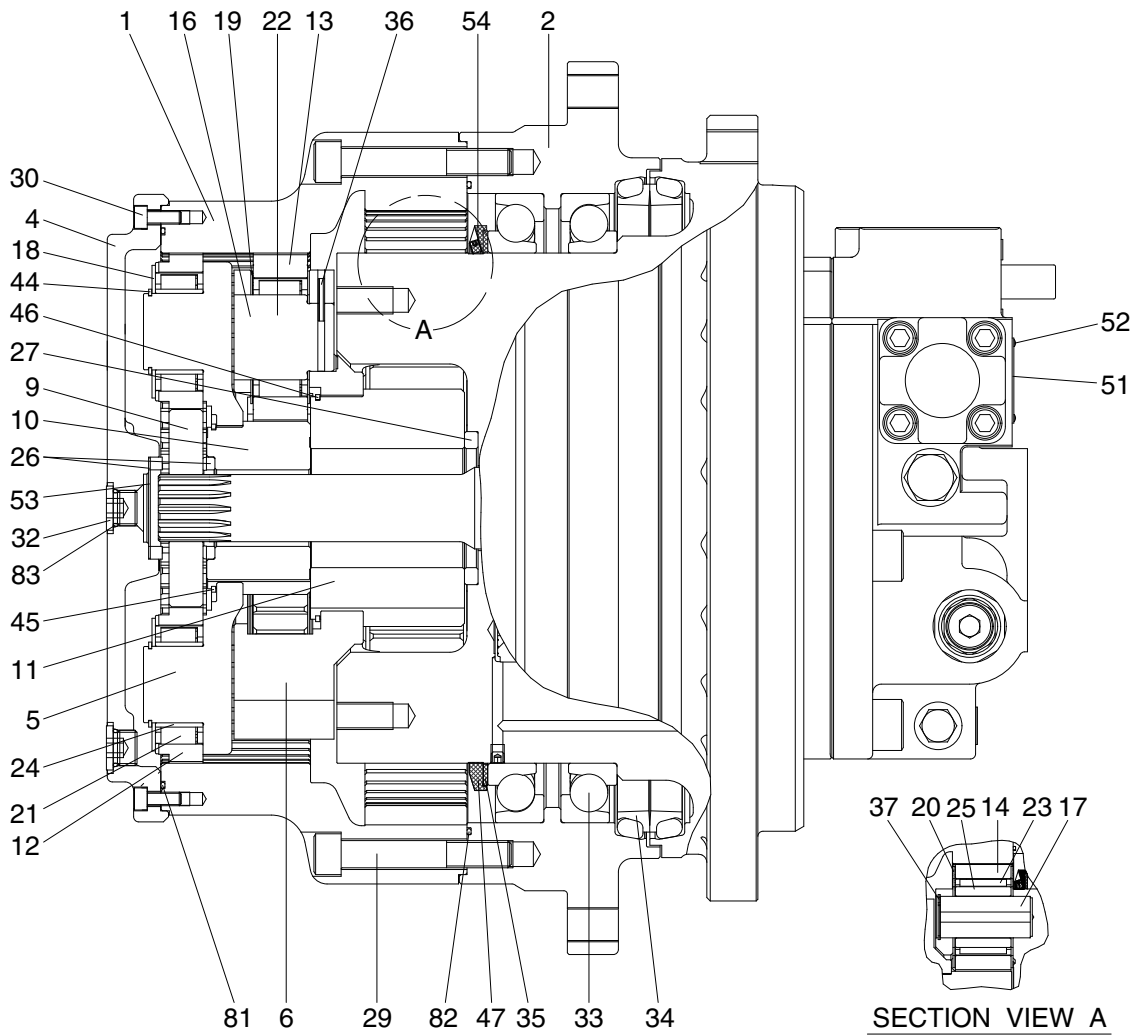
### (2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf · m	lbf · ft	in	mm
Socket bolt	366	M12×45	10	72.3	0.39	10
Socket bolt	401	M20×100	44	318	0.67	17
Socket bolt	402	M20×50	44	318	0.67	17
Plug	461	NPTF 1/16	0.9	6.5	0.16	4
VP Plug	464	PF 1/4	11	79.6	1.06	27
Orifice	545, 546	NPTF 1/16	0.7	5.1	0.16	4
Plug	564	PT 1/2	2.2	15.9	0.24	6
VP Plug	567	PF 1/4	3.7	26.8	0.75	19
Plug	569	PF 1/4	3.7	26.8	0.24	6
Plug	571	PF 3/8	7.5	54.2	0.31	8
Orifice	703	M4×0.7	0.35	2.5	0.08	2
Orifice	704	M5×0.8	0.7	5.1	0.1	2.5



### 3. TRAVEL REDUCTION GEAR (TYPE 1)

#### 1) STRUCTURE

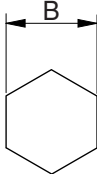


3607A2TRG01

1	Ring gear	19	Side plate	35	Shim
2	Housing	20	Side plate	36	Spring pin
4	Side cover	21	Needle cage	37	Snap ring
5	Carrier 1	22	Needle cage	44	Snap ring
6	Carrier 2	23	Needle cage	45	Clip
9	Sun gear 1	24	Inner ring	46	W clip
10	Sun gear 2	25	Floating bushing	47	Nut ring
11	Sun gear 3	26	Thrust ring	51	Name plate
12	Planetary gear 1	27	Thrust ring	52	Rivet
13	Planetary gear 2	29	Socket bolt	53	Washer
14	Planetary gear 3	30	Socket bolt	54	Set screw
16	Pin 2	32	RO plug	81	O-ring
17	Pin 3	33	Angular bearing	82	O-ring
18	Side plate	34	Floating seal	83	O-ring

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Tool name	Remark	
Allen wrench	4	
	8	
	10	
	14	
Spanner	27	
Torque wrench	Capable of tightening with the specified torques.	
Plier (for shaft)	Snap ring (037, 044)	
( - ) Driver	For removing floating seal	
Plastic hammer	Wooden hammer allowed	
Eye bolt	M8, M10, M16, M20, For lifting-up	
Press (1 ton)	Angular bearing (033)	
Depth gauge straight edge	100mm depth, for adjusting shins (053)	
Tap M16	For removing screw lock in tapped holes	
Oil stone	For finishing mating faces	
Punch	For preventing spring pin from coming out	
Loctite (three bond 1373B)	Set screw (054)	
Loctite	Socket bolt (029)	
Nut ring inserting jig	Nut ring (047)	

### (2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf · m	lbf · ft	in	mm
Socket bolt	29	M16×100	30	217	0.55	14
	30	M8×20	3.5	25.3	0.24	6
Plug	32	PF 1/2	11	79.6	0.39	10
Set screw	54	M8×16	1.0	7.2	0.24	6

## 4. DISASSEMBLING

### 1) GENERAL PRECAUTIONS

- (1) Pay attention to not damaging contact surfaces for O-rings, oil seals, etc. and contact/sliding surfaces for gears, pins, bearings, etc.
- (2) This motor can be disassembled even in a state on the reduction gear.  
However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.
- (3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings**.
- (4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

### 2) DISASSEMBLY OF REDUCTION GEAR

- (1) Select a disassembling place.
  - ※ Select a clean place.
  - ※ Spread rubber sheet or cloth on work bench to prevent parts from being damaged.
- (2) Remove dust, mud, etc. from reduction gear surfaces with washing oil or so.
- (3) Place reduction gear with its gear oil drain port or level gauge at the lowest position, and drain reduction gear oil.
  - ※ Receive gear oil with clean vessel and check it for abnormalities.  
Renew gear oil.
- (4) Place reduction gear with its side cover (4) upward, and remove socket bolt (30), and remove side cover (4) and O-ring (81).



370078TM01

- (5) Remove sun gear 1 (9).



370078TM02

- (6) Remove carrier 1 (5), together with planetary gears 1 (12), sun gear 2 (10), etc. fitted.



370078TM03

**(7) Disassembling of carrier 1 sub-assembly**

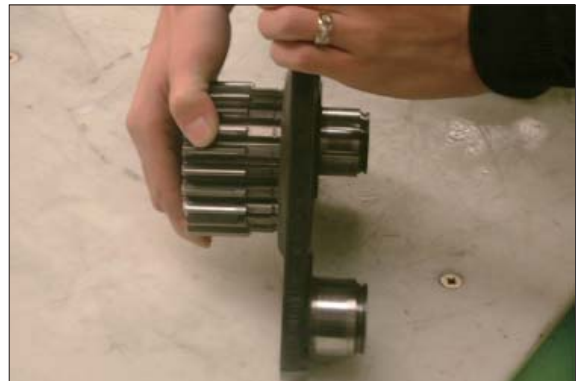
- ① Remove snap ring (44), and then remove side plate (18), planetary gear 1 (12), needle cage (21) and side plate (18).

※ If flaking is observed on the inner ring surface replace inner ring. In this case, replace planetary gear 1 and needle cage simultaneously.



370078TM04

- ② Remove circlip (45), and then remove carrier 1 (5) from sun gear 2 (10).



370078TM05

- ③ Remove thrust ring (26).



370078TM06

(8) Remove carrier 2 (6), with planetary gears 2 (13), sun gear 3 (11), etc. fitted.

※ Use M10 eyebolt. In this case, thrust ring (26) is removed simultaneously.



370078TM07

### (9) Disassembling of carrier 2 sub-assembly

① Push in spring pin (36), and remove pin 2 (16), from carrier 2.

※ Carry out the following check in advance. If any abnormality should be found, carry out disassembling.

- Is there any crevice, crack or pitting on tooth surface of planetary gear?
- When turning planetary gear lightly, is there any abnormal noise or eccentric clearance? Carry out check similarly to the above for carrier 3.



370078TM08

② Remove side plate (20), planetary gear 2 (13), and needle bearing (22) from carrier 2.

③ Remove thrust ring (26).



370078TM09

④ Remove snap ring (46), and remove carrier 2 (6) from sun gear 3 (11).

⑤ Remove thrust ring (27) from sun gear 3 (11).



370078TM10



(10) Remove socket bolt (29), and then screw two M8 eyebolts on front side of ring gear (1), lift up ring gear with crane, and remove O-ring (82) from housing (2).

※ It is difficult to separate them, because it is assembled by LOCTITE.  
In this case, if you can use wrench and pipe, it is easy to separate them.

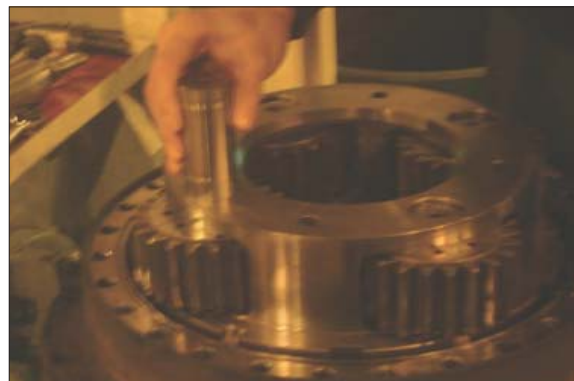


370078TM11

(11) Remove snap ring (37) and then remove pin 3 (17) from shaft casing (272).



370078TM12



370078TM13

(12) Remove side plate (20), planetary gear 3 (14), needle cage (23), floating bushing (25) from shaft casing (272).



370078TM14

(13) Remove set screw (54) from nut ring (47), and then remove nut ring (47) from shaft casing (272).

- ※ When disassembling nut ring, remove dust, mud, etc. from set screw hole by blasting compressed air.  
And remove the nut ring by using the special tool for removing the nut ring.



370078TM15

(14) Remove housing (2), angular bearing (33), floating seal (34) from shaft casing (272).

- ※ Screw two M16 eye bolts on front side of housing (2).  
Lift up housing (2) with crane.



370078TM17

(15) Remove floating seal (34) from housing (2), paying attention to not damaging it.

- ※ Pay attention to O-ring and sheet faces.



370078TM18

(16) Remove floating seal (34) from casing (272), pay attention to not damaging it.

- ※ Pay attention to O-ring and sheet faces.



370078TM19



(17) Remove angular bearing (33) from housing (2).

※ Bearing should be renewed once it is removed.



370078TM20

### 3) DISASSEMBLY OF MOTOR

#### (1) Disassembling of motor main body

① Place hydraulic motor on bench with its output shaft down.



370078TM21

② Loosen relief valve (350), reducing valve (351), cover (352), plug, etc. They are fitted to valve casing (303).

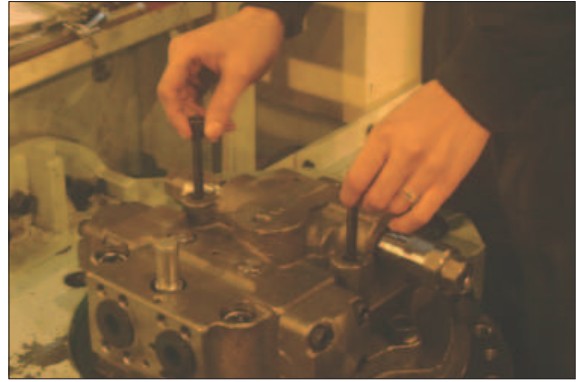


370078TM22



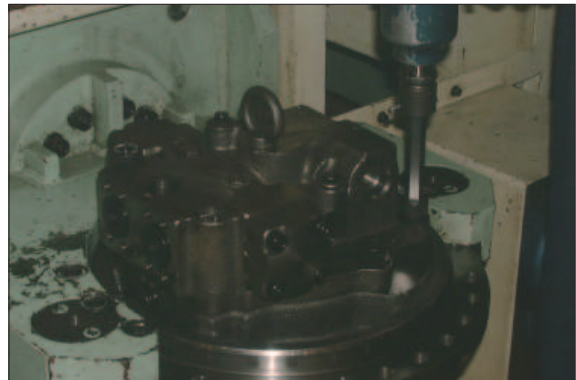
370078TM23

- ③ Remove plug (564) from valve casing (303). And then screw two M10×135 bolts on the holes of compelling brake release. Sub assembly (valve casing & brake piston)



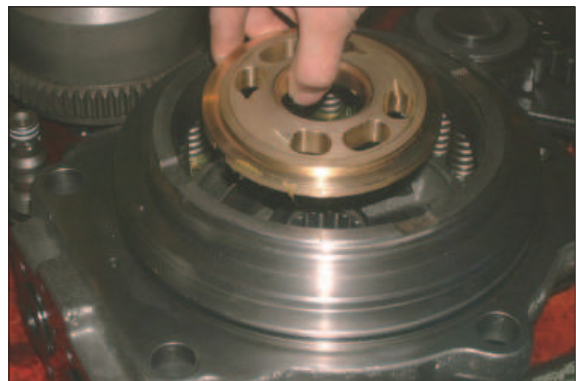
370078TM24

- ④ Remove socket bolts (401, 402) that assemble valve casing (303).



370078TM25

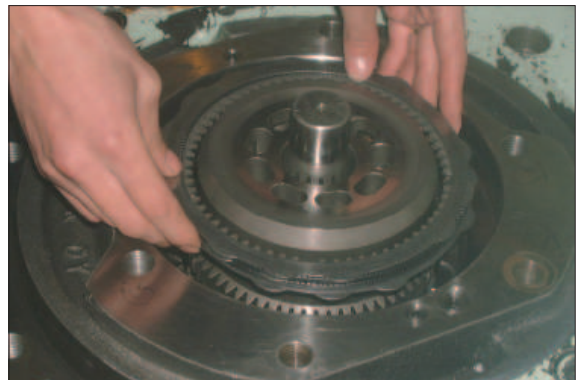
- ⑤ Remove the above socket bolt, and then separate valve casing sub-assembly and remove valve plate (131).



370078TM26

- ⑥ Pull out friction plate (742) and separation plate (741) from cylinder block (111).

- ※ In this case, motor should be located in horizontally.



370078TM27

⑦ Pull out cylinder block and piston sub-assembly.

- ※ After placing the motor horizontally, take out cylinder block from casing.
- ※ Be careful not to damage the sliding parts of the cylinder block, spherical bushing and shoe.



370078TM28

⑧ Remove swash plate (201).



370078TM29

⑨ Remove pivot ball (504) and tilting piston sub assembly.



370078TM30

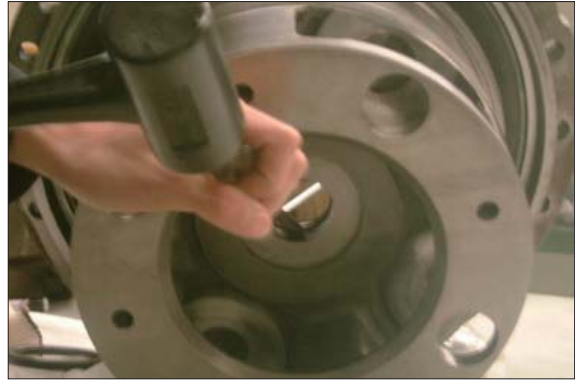
⑩ Take out snap ring (435), and then hit front side end face of shaft (101) lightly with plastic hammer or so to remove from casing (272).

- ※ Do not remove cylindrical roller bearing (102) as far as it remains normal.



370078TM31

- ① Take out oil seal (491) from shaft casing (272).
- ※ Do not reuse the disassembling oil seal (491).



370078TM32

## (2) Disassembling of valve casing sub-assembly

- ① Remove two M10 × 135 bolts for compelling brake release. Disassemble brake piston from valve casing.



370078TM33

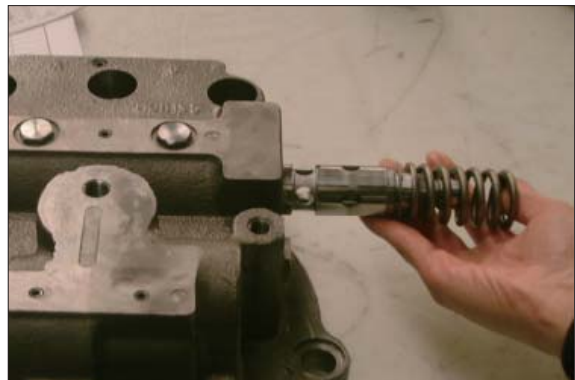
- ② Remove plug (571), tilting spring (533), and tilting spool (531) from valve casing.



370078TM34

- ③ Remove socket bolts (366), counterbalance cover (364), and counterbalance spool assembly.

- ※ When any abnormality is found in counterbalance spool, counterbalance spring, etc. replace with the counterbalance spool sub assembly as a set.



370078TM35



- ④ Remove plug (569), stopper (542), steel ball (543) and seat (541).

※ When no abnormality is found in displacement changeover, it is not necessary to overhaul it specifically.  
And don't remove needle bearing (103) as far as it remains normal.



370078TM36

### (3) Disassembling of cylinder sub-assembly

- ① Pull out set plate (123), piston (121), and shoe (122) sub-assembly.



370078TM37

- ② Remove spherical bush (113) and cylinder spring (114).  
That is all of the disassembling work.  
The pins (451) force-fitted to the valve casing cannot be removed.



370078TM38

## 5. ASSEMBLING

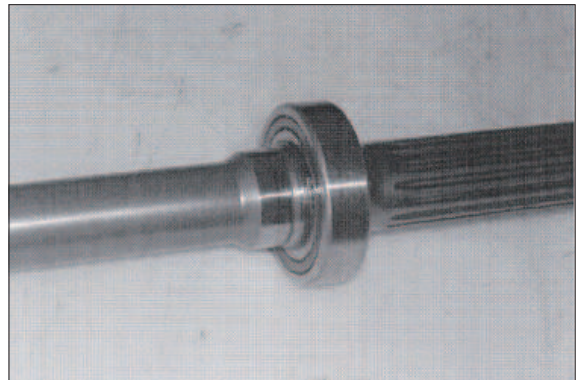
### 1) GENERAL CAUTIONS

- (1) Clean each part fully with washing oil and dry it by blasting compressed air. It is better not to use waste cloths as much as possible.  
However, if they are to be used, use clean ones, and pay attention to not leaving lint and so on.  
Don't clean the friction plate with washing oil without fail.
- (2) Use the torque wrench in tightening fitting screws and plugs to their respective torque shown in page 8-67, 8-69.
- (3) When hammering is required, use the plastic hammer and try to hit parts lightly.
- (4) Similarly to the disassembling procedures, the numeral in parentheses following each part name indicates its item number shown in the attached assembly drawings.

### 2) ASSEMBLY OF MOTOR

#### (1) Assembling driving shaft sub-assembly

- ① Put roller bearing (102) on drive shaft (101), and assemble snap ring (107) by using the plier.
  - ※ Roller bearing is press fit by the heat to drive shaft.
  - ※ Pay attention to not damaging oil seal sliding area of driving shaft.
  - ※ Pay attention to not fitting snap ring the other way around.



370078TM39

#### (2) Assembling of valve casing sub-assembly

- ① Tighten plugs (461, 564) into valve casing (303) with specified torque.
  - Plug(461) : 0.9 kgf · m (6.5 lbf · ft)
  - Plug(564) : 2.2 kgf · m (15.9 lbf · ft)



370078TM40

- ② Interference-fit pin (451).



370078TM41

③ Interference-fit needle bearing (103).

- ※ It is necessary when needle bearing was disassembled from the valve casing.



370078TM42

④ Assemble seat (541), steel ball (543), stopper (542) and RO plug (569) in the order named.

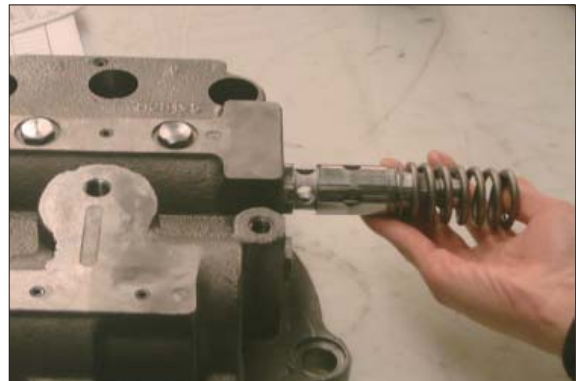
- Tightening torque : 3.7 kgf · m (26.8 lbf · ft)

- ※ Pay attention to not assembling seat and stopper the other way around.



370078TM43

⑤ Assemble counterbalance spool (360), washer (361), spring (362) in the order named.

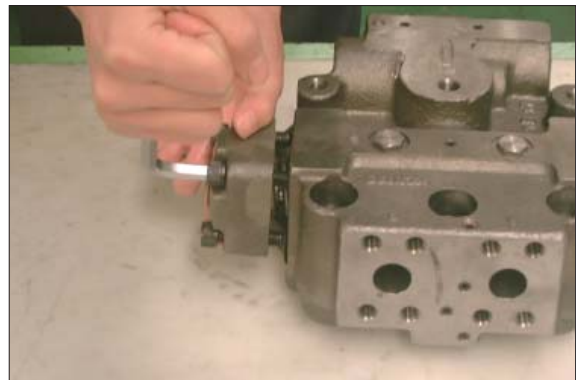


370078TM44

⑥ Fit counterbalance cover (364) by tightening socket bolt (366).

- Tightening torque : 10 kgf · m (72.3 lbf · ft)

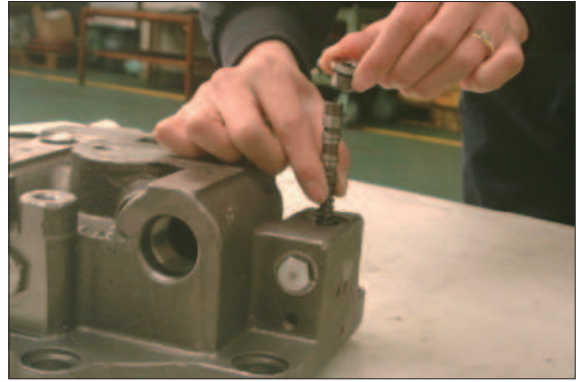
- ※ Confirm that O-ring (365) has been inserted in cover.



370078TM45



- ⑦ Assemble tilting spool (531), tilting spring (533) and plug (571) in the order named.  
· Tightening torque : 7.5 kgf · m (54.2 lbf · ft)



370078TM46

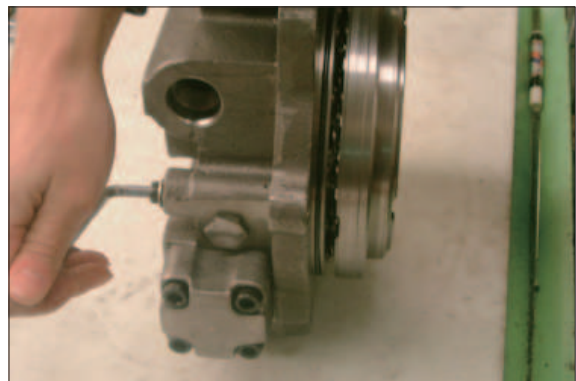
- ⑧ Assemble orifice (703) and tighten them into brake piston (702) to specified torque.  
· Tightening torque : 0.35 kgf · m (2.5 lbf · ft)



370078TM47

- ⑨ Assemble brake spring (705) in brake piston (702). And then screw two M10×135 bolts on the holes for compelling brake release.  
Sub-assembly (valve casing & brake piston)

- ※ After finishing assembly, two M10×135 bolts will be removed.



370078TM48

### (3) Assembling of cylinder sub-assembly

- ① Fit cylinder spring (114) and spherical bush (113) to cylinder block (111).  
※ Match spline phase of cylinder block (111) to that of spherical bush.



370078TM49

- ② Put piston (121), shoe (122) sub-assembly in set plate (123) and then assemble them to cylinder block (111).



370078TM50

#### (4) Assembling of motor main body

- ① Tighten plug (461) and orifice (545, 546) into shaft casing (272) to specified torque.
- Plug (461) : 0.9 kgf · m (6.5 lbf · ft)
  - Plug (545, 546) : 0.7 kgf · m (5.1 lbf · ft)



370078TM51



370078TM51A

- ② Interference-fit oil seal (491) into shaft casing (272) by special tool.

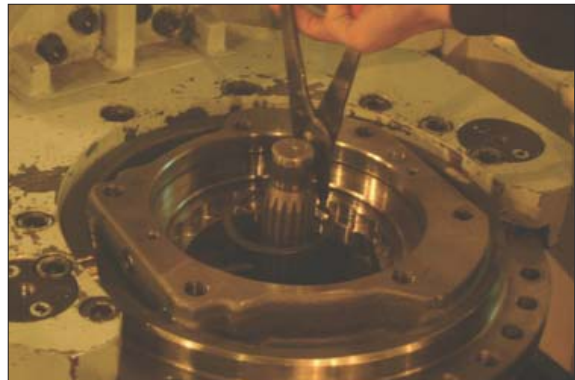


370078TM52

- ③ Interference-fit the shaft sub-assembly.  
And then assemble snap ring (435).
- ※ Interference-fit outer race of cylindrical roller bearing (102) by hitting lightly with hammer, utilizing key.



370078TM53



370078TM54A

- ④ Assemble tilting piston sub-assembly and pivot ball (504) into shaft casing (272).



370078TM54



370078TM54A

⑤ Assemble swash plate (201) onto pivot ball (504).

※ Apply grease on sliding area of swash plate rear surface.

※ Confirm with finger tips of both hands if swash plate moves smoothly.



370078TM55

⑥ Change position of shaft casing (272) from vertical one to horizontal one. And then mount cylinder block sub-assembly.

※ Pay attention to not dropping swash plate.



370078TM56

⑦ Change position of shaft casing (272) from horizontal one to vertical one.



370078TM57

⑧ Fit separation plate (741) and friction plate (742) into cylinder block (111).

※ Mate hole of separation plate each other.



370078TM27



⑨ Assemble O-ring (707, 708) into shaft casing (272).

- ※ Do not reuse the disassembling O-ring (707, 708).
- ※ Coat the O-ring with grease.  
(O-ring can be protected by grease)



370078TM59

⑩ Fit valve plate (131) to valve casing (303) sub-assembly. Assemble them to casing, and then tighten them with socket bolt (401, 402).

- Socket bolt (401, 402) Tightening torque : 44 kgf · m (318 lbf · ft)

- ※ Apply grease on valve plate rear surface and pay attention to not dropping valve plate.
- ※ Use guide bolt.
- ※ Apply grease on roller of needle bearing and pay attention to easy to assemble with driving shaft.
- ※ Use crane in assembling valve casing to shaft casing.



370078TM60



370078TM60A

⑪ Tighten to specified torque plugs, relief valve (350), reducing valve (351), etc. fitted to valve casing sub-assembly.

- Tightening torque :
  - Relief valve (350) : 18 kgf · m (130 lbf · ft)
  - Reducing valve (351) : 4.5 kgf · m (32.5 lbf · ft)

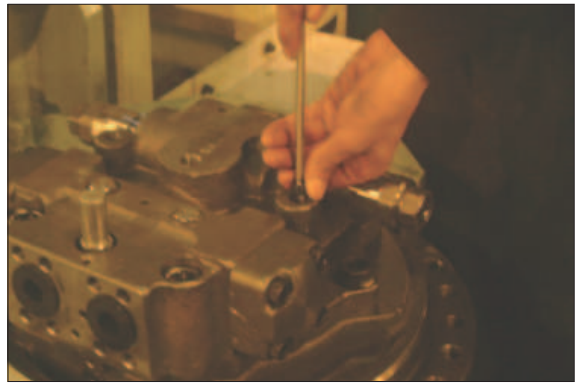


370078TM61



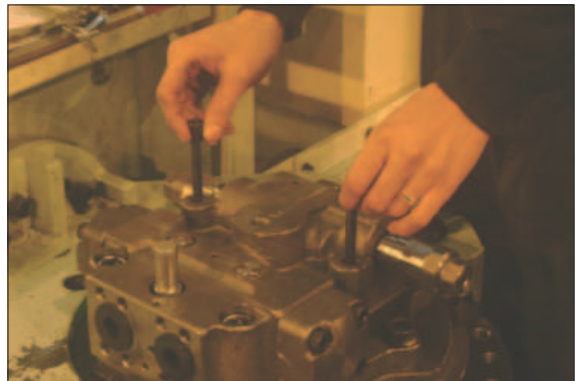
370078TM61A

⑫ Mount cover (352).



370078TM63

⑬ Disassemble two M10×135 bolts on the holes for compelling brake release. And then assemble plug (564).  
· Tightening torque : 2.2 kgf · m (15.9 lbf · ft)



370078TM24

### 3) ASSEMBLY OF REDUCTION GEAR

(1) Place housing (2) with its front side up, and fit angular bearings (33) with their back faces mated.

- ※ Fit angular bearings one by one with press or key hammer.
- ※ When housing is to be reused, remove screw lock of its tapped holes with M16 tap.

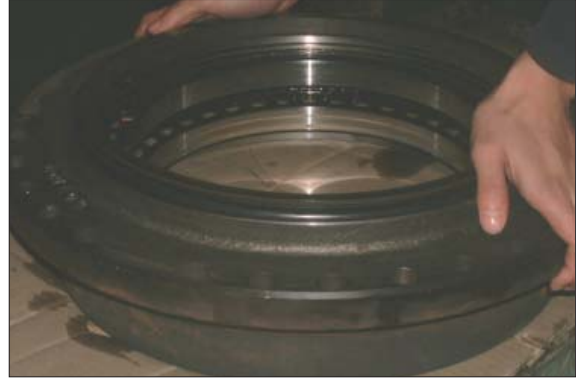


370078TM64



(2) Fit O-ring to floating seal (34) without twisting it, and then to housing (2).

- ※ Apply grease to O-ring thinly.
- ※ Do not reuse the disassembling O-ring.



370078TM65

(3) Similarly, fit floating seal to shaft casing (272) of hydraulic motor.

- ※ Do not reuse the disassembling O-ring.



370078TM66

(4) Lift up housing sub-assembly with its floating seal side down, and put inner diameter of angular bearing on outer diameter of shaft casing.

- ※ Pay attention to not damaging sliding faces of floating seal.



370078TM67

(5) Assemble shim (35) to nut ring (47).

- ※ Apply grease between shim and nut ring.



370078TM68

(6) Insert nut ring assembled shim to shaft casing, and then tighten it to specified torque, utilizing special tool.

- ※ After tighten it to maximum torque and then disassemble, and then tighten it to specified torque.
  - Tightening torque : 60 kgf · m (434 lbf · ft)



370078TM70

(7) After assemble set screw (54) affixed LOCTITE, and punch at hole to lock it. Pay attention to not be lifted nut ring (47).

- ※ Screw the set screw, until upper side of set screw is lower than tilting side of nut ring.
  - Loctite specifications : Three bond 1373B
  - Tightening torque : 1 kgf · m (7.2 lbf · ft)



370078TM71

(8) Assemble thrust ring (27) into shaft casing (272).

- ※ Pay attention to not assembling thrust ring (27) the other way around. (Oil groove is located upside.)



370078TM72

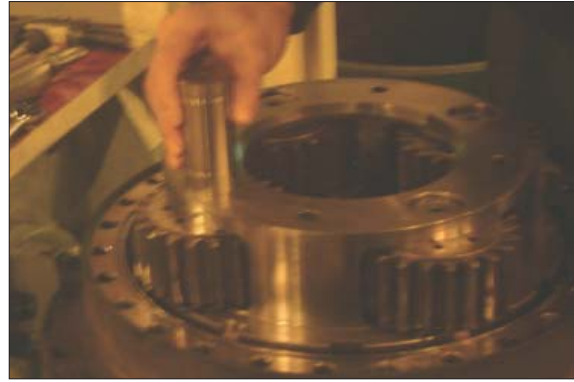
(9) Put needle cage (23) into inside of planetary gears 3 (14), and insert them into shaft casing, holding them between side plates (20).

- ※ Mate pin hole of shaft casing with center of planetary gear.



370078TM73

(10) Insert pin 3 (17) into shaft casing, and then assemble snap ring (37).



370078TM74



370078TM74A

(11) Assemble O-ring (82) to housing (2), and then assemble ring gear (1).  
Pay attention to its meshing planetary gear 3 (14) and ring gear (1), utilizing crane.

- ※ Applying grease to O-ring thinly.
- ※ Do not reuse the disassembling O-ring.



370078TM75

(12) Assemble ring gear (1) and housing (29).  
(Screw socket bolt (29), and tighten it to specified torque, with torque wrench.)  
· Tightening torque : 30 kgf · m (217 lbf · ft)  
· Loctite specifications : #636



370078TM76

**(13) Assembling carrier 2 sub-assembly**

- ① Assemble carrier 2 (6) to sun gear 3 (11), and fit clip (46).
- ② Place carrier 2 with sun gear 3 up.



370078TM77

- ③ Put needle cage (22) into inside of planetary gear 2 (13), and insert them into carrier 2, holding them between side plates (19).



370078TM78

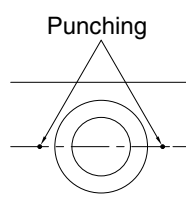
- ④ Insert pins 2 (16) into carrier 2.



370078TM78A

- ⑤ Insert spring pin (36) into pin holes of carrier 2 and pin 2, and punch at two points as figure to lock it.

※ Mate pin hole of carrier 2 with center of planetary gear.



370078TM79



- (14) Screw two M10 eyebolts into carrier 2 sub-assembly, and assemble it with crane, paying attention to its meshing with planetary gear 2 and ring gear.



370078TM80

**(15) Assembling of carrier 1 sub-assembly**

- ① Interference-fit inner ring (24) to carrier 1 (5).

※ Inner ring is press-fit by the heat to carrier 1 (5).



370078TM81

- ② Assemble carrier 1 (5) to sun gear 2 (10), and fit clip (45).



370078TM82

- ③ Assemble thrust ring (26) to sun gear 2 (10).

※ Pay attention to not assembling thrust ring (26) the other way around. (Oil groove is located upside.)



370078TM83

- ④ Put needle cage (21) into inside of planetary gear 1 (12), and assemble them, holding them between side plates (18). Then fit snap ring (44) on them.



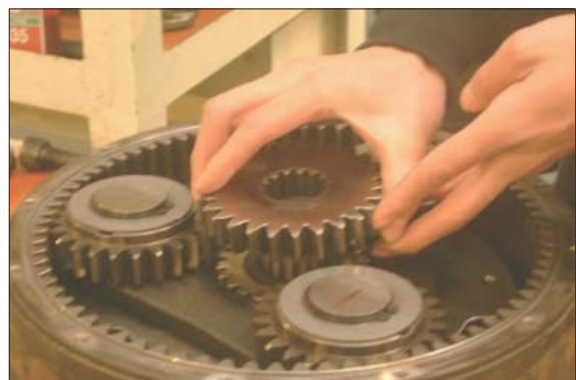
370078TM84

- (16) Assemble carrier 1 (5) sub-assembly to ring gear (1).  
Paying attention to its meshing with carrier 1 sub-assembly and ring gear (1).



370078TM85

- (17) Assemble sun gear 1 (9) to drive shaft (101) paying attention to its meshing with sun gear and drive shaft (101).



- (18) Measure height "A" from sun gear 1 end face to ring gear (1) mating face with straight edge and depth gage.



370078TM87



- (19) Measure height "B" from side cover (4) mating face to center hold bottom with straight edge and depth gage.



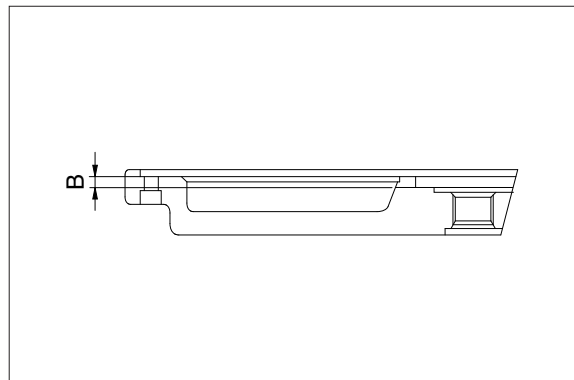
370078TM88

- (20) Obtain optimum thickness with the following formula.

$$1.5 \sim 2.0 = (B+A)$$

- (Thickness of thrust ring + thickness of washer)

- ※ Keep axial clearance between sun gear and washer 1.5~2.0 mm.



370078TM89

- (21) Place washer (53) of above-selected thickness and thrust ring (26) to center of side cover (4).

- ※ Pay attention to not assembling thrust ring (26) the other way around and punch it (Oil groove is located upside)



370078TM90

- (22) Assemble O-ring (81) into ring gear.

And degrease and dry mating faces of side cover & ring gear. Then lift side cover(4) up, and place it on ring gear.

And tighten socket bolt (30) to specified torque to fix side cover.

- Tightening torque : 3.5 kgf · m (25.3 lbf · ft)



370078TM91

- (23) Tighten plug (32) to specified torque at side cover (4).
- Tightening torque : 11.0 kgf · m (79.6 lbf · ft)

That is all of the assembling work. After fitting the motor this reduction gear, supply oil until overflows from the level gauge.



370078TM92

#### 4) CHECKING FACTS AFTER ASSEMBLY

##### (1) Air test of reduction gear

Disassemble plug (32) of reduction gear part.

When compressed air(0.3 kgf/cm<sup>2</sup>) is inserted that in water during the 2 minutes, it should be not happened air bubble.

- Gear oil : 5.5 liter (SAE 85W-140, API GL-5 or better)

##### (2) Air test of hydraulic motor

One port should be opened, the others port should be closed.

When compressed air (3 kgf/cm<sup>2</sup>) is inserted opened port in water during the 2 minutes, it should be not happened air bubble.

- Working fluid : 1.5 liter

## ■ 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.

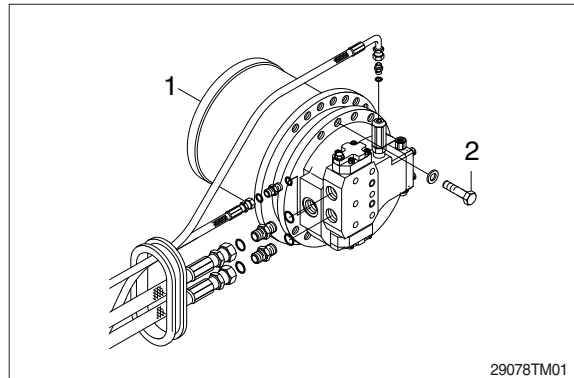
- (4) Remove the track shoe assembly.  
For details, see **removal of track shoe assembly**.
- (5) Remove the cover.
- (6) Remove the hose.  
※ Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.  
· Weight : 425 kg (940 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.



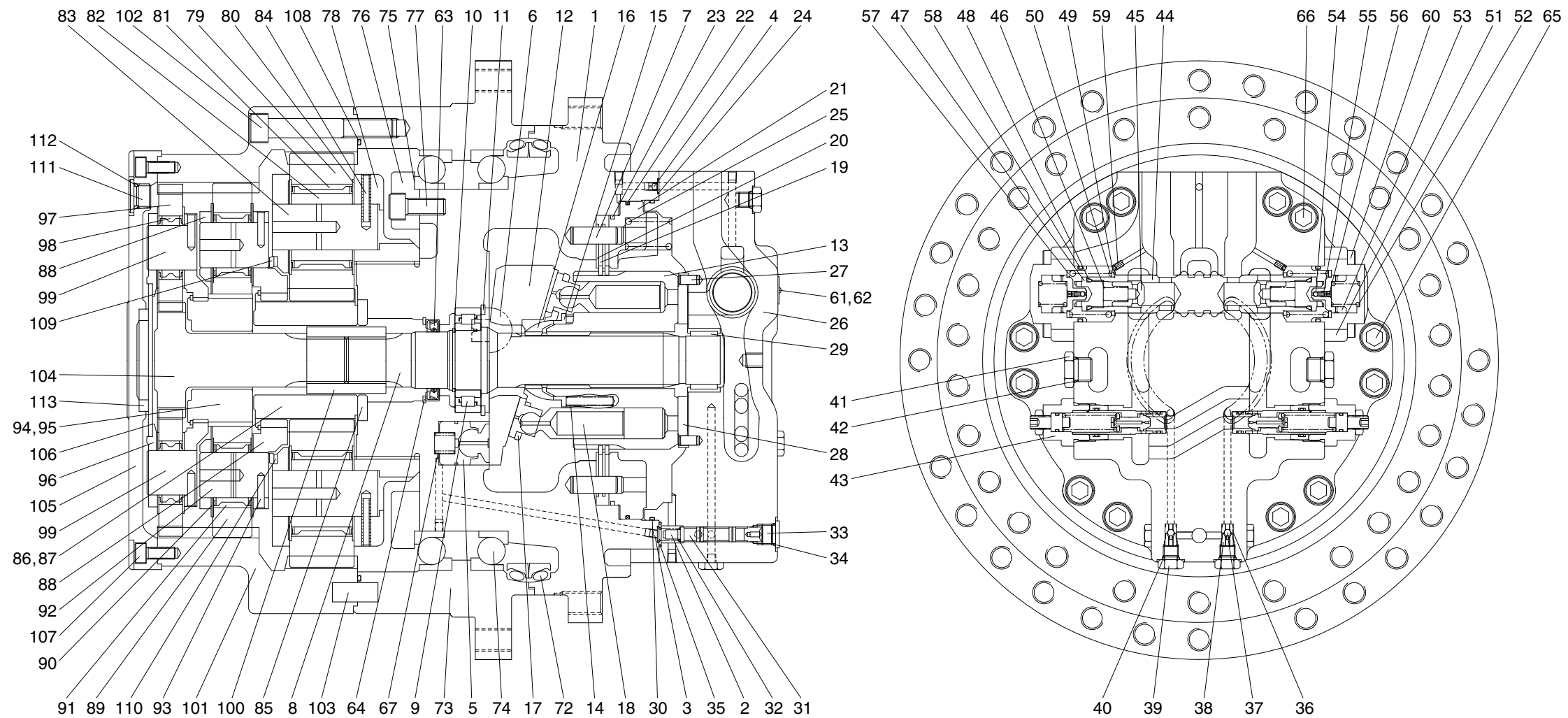
13031GE18



29078TM01

## 2. SPECIFICATION

### 1) TRAVEL MOTOR



3809A2TM22

1 Shaft casing	15 Spacer	29 Needle bearing	43 Relief valve assy	57 Spring seat	75 Shim	89 Planetary gear	103 Planetary pin
2 Plug	16 Ball guide	30 O-ring	44 Main spool	58 O-ring	76 Bearing guide	90 Plate	104 Drive gear
3 Orifice	17 Set plate	31 Swash spool	45 Check	59 Orifice	77 Wrench bolt	91 Needle bearing	105 End cover
4 Orifice screw	18 Piston & Shoe assy	32 Swash spring	46 Spring	60 Wrench bolt	78 Carrier	92 Pin	106 Plate
5 Swash piston	19 Friction plate	33 Plug	47 Plug	61 Name plate	79 Planetary gear	93 Spring pin	107 Wrench bolt
6 Swash ball	20 Separator plate	34 O-ring	48 O-ring	62 Rivet	80 Plate	94 Sun gear	108 O-ring
7 Brake pin	21 Brake piston	35 O-ring	49 Spring seat	63 Oil seal	81 Needle bearing	95 Snap ring	109 Ring
8 Shaft	22 Piston ring	36 Seat	50 Spring	64 Snap ring	82 Bearing bushing	96 Carrier	110 Ring
9 Roller bearing	23 Piston ring	37 Steel ball	51 Cover	65 Wrench bolt	83 Pin	97 Planetary gear	111 Plug
10 Stop ring	24 O-ring	38 Stopper	52 Spring	66 Wrench bolt	84 Spring pin	98 Needle bearing	112 O-ring
11 Lock ring	25 Brake spring	39 Plug	53 Spool	67 Spring pin	85 Thrust plate	99 Pin	113 Bushing
12 Swash plate	26 Valve casing	40 O-ring	54 Steel ball	72 Floating seal	86 Sun gear	100 Coupling	
13 Cylinder block	27 Valve plate pin	41 Plug	55 Spring	73 Hub	87 Snap ring	101 Ring gear	
14 Cylinder spring	28 Valve plate	42 O-ring	56 Plug	74 Bearing	88 Carrier	102 Wrench bolt	

## 2) TOOL AND TIGHTENING TORQUE

### (1) Tools

Name of tools	B-size	Name of part applied
Hexagonal L-Wrench	4	Plug (2), Orifice screw (3, 4)
	8	Plug (33)
	10	Wrench bolt (60)
	27	Hex (43)
Socket wrench/ spanner	19	Hp plug (39)
	27	Hp plug (41)
Snap-ring plier (for holes, axis)		Ring stop (10), Snap ring (64)
Hammer		Needle bearing (29), Pin (7, 27)
Torque wrench		Size : 500 kgf · m, 3000 kgf · m
Jig for oil seal assembling		Oil seal (63)
Heating tool for bearing		Roller bearing (11)

### (2) Tightening torque

NO.	Part name	Standard	Size	Torque	
				kgf · m	lbf · ft
2	Plug	NPTF 1/16	4	0.9±0.2	6.51 ± 1.45
3, 4	Orifice screw	NPTF 1/16	4	0.7	5.06
33	Plug	PF 3/8	8	7.5	54.25
39	HP plug	PF 1/4	19	3.7	26.76
41	HP plug	PF 1/2	27	11	79.56
43	Relief valve	HEX 27	27	18±1.0	130±7.0
60	Wrench bolt	M12×35L	10	13	94.03
65	Wrench bolt	M16×50L	14	13	94.03
66	Wrench bolt	M16×100L	14	6.7	48.46

## 2. DISASSEMBLING

### 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) DISASSEMBLEING

(1) Set up the motor assembly on the workbench for disassembly.

※ When you spin the disassembly-assembly jig at 90°, please fix the motor drain plug (56) to the bottom.



3809A2TM040

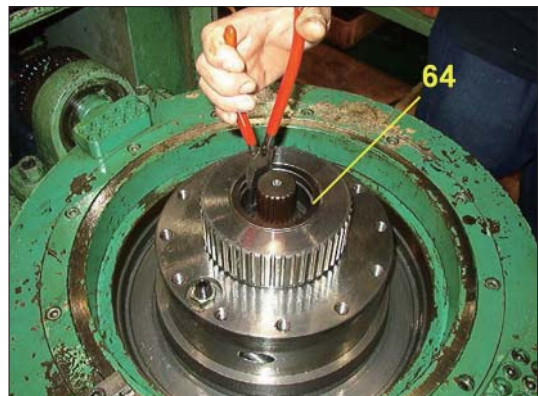
(2) Please emit the oil in the motor case with dismantlement for the drain plug (56).

※ Please inspect whether there are some kinds of foreign substance (metal powders, processed chips and others) during drain oil.



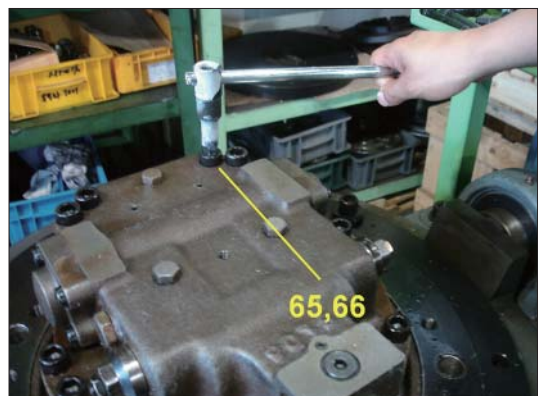
3809A2TM041

(3) Disassemble the snap-ring (64) using pliers.



3809A2TM042

(4) Please disassemble the hexagonal socket bolt (65, 66) fixing the valve casing.



3809A2TM043

- (5) Disassemble the valve plate (28) after the valve casing sub.  
 ※ If abrasion on the valve plate, please change to new product.



3809A2TM044A

3809A2TM044

- (6) Remove brake springs (25) and take the brake piston out by screwing a M16 screw into the brake piston.  
 ※ Number of brake springs is 10.



3809A2TM045A

3809A2TM045

- (7) Remove the cylinder and piston assembly.  
 ※ It is easier to work by placing the motor shaft horizontal.



3809A2TM046

- (8) Take swash plate (12) out.



3809A2TM047

(9) Take swash piston kit out.



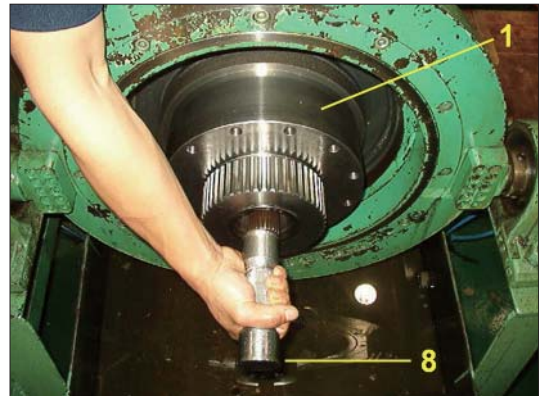
3809A2TM048

(10) Take swash ball (06) out.



3809A2TM049

(11) Take out shaft (8) from shaft casing (1) by striking the bottom part lightly with a hammer.  
※ Be careful not to damage the roller bearing (9).



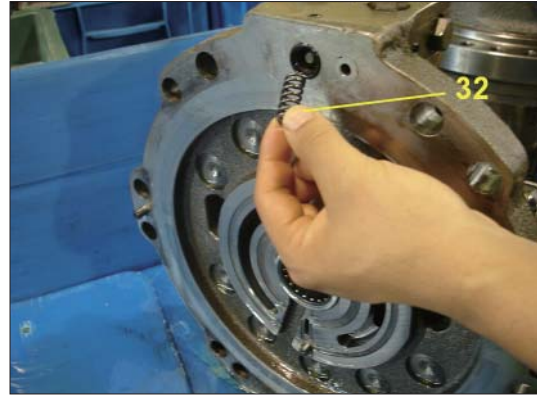
3809A2TM050



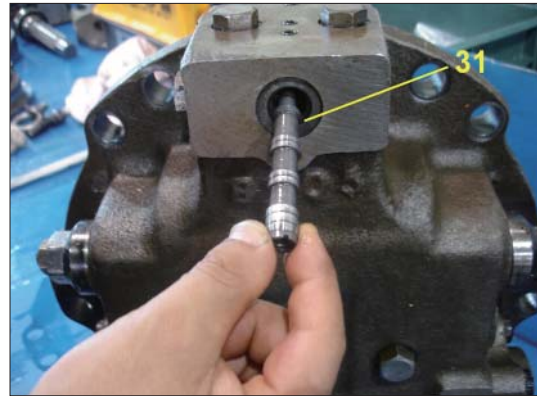
(12) Take valve casing sub out.

※ Be careful not to damage the needle bearing (29).

① Remove automatic control spring (32), automatic control spool (31).



3809A2TM051

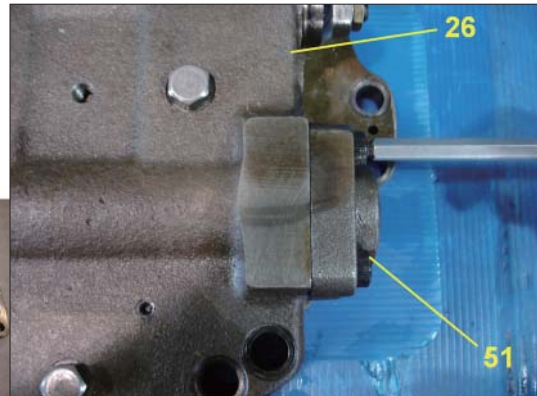


3809A2TM052

② Take out main spool cover (51) from valve casing (26). Remove spring (52), spool (53), spring seat (49), spring (50) and main spool (44) in sequence.

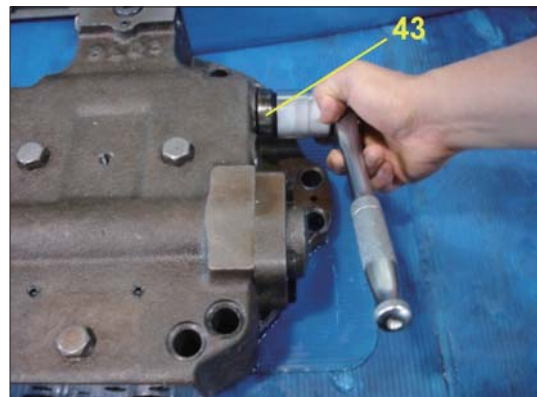


3809A2TM053A



3809A2TM053

③ Remove relief valve assembly (43).



3809A2TM054

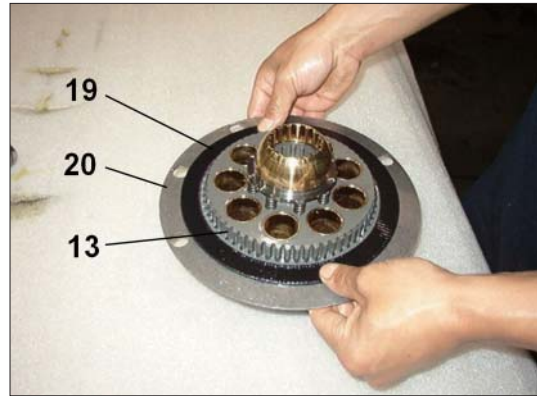
(13) Take cylinder sub out.

① Remove set plate (17) and piston (18) sub.



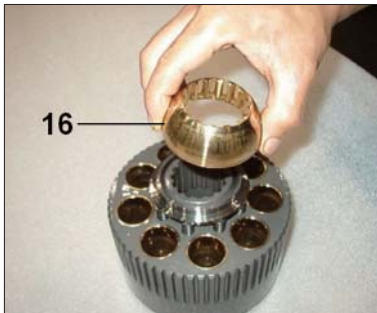
3809A2TM055

② Remove friction plates (19) and separate plates (20) from cylinder block (13).



3809A2TM056

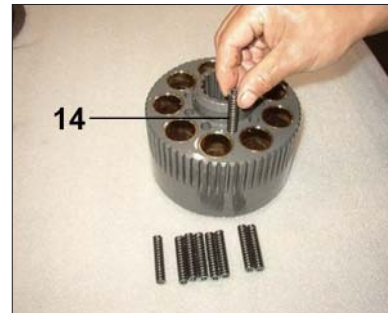
③ Remove ball guide (16), spacer (15), cylinder spring (14).



3809A2TM057



3809A2TM058



3809A2TM059

※ Disassembly has completed.

Check that the motor parts are broken or not.

### 3) ASSEMBLING TRAVEL MOTOR

#### (1) Shaft sub assembly

- ① Fit bearing spacer to shaft (08) and press-fit roller bearing (09).
- ※ Press the roller bearing after preheating.



3809A2TM060



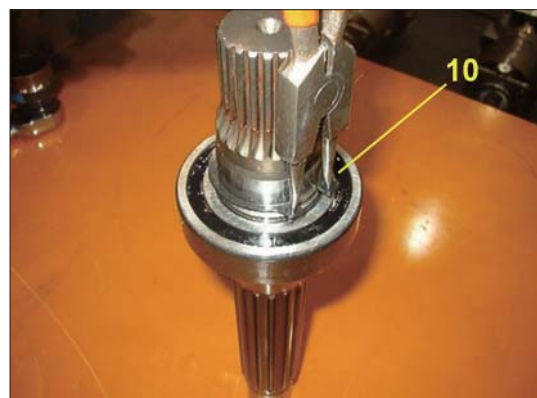
3809A2TM061

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



3809A2TM062

- ② Insert stop ring (10) with snap ring pliers.
- ※ Pay attention to the direction of the stop ring.  
(round direction is bearing direction.)

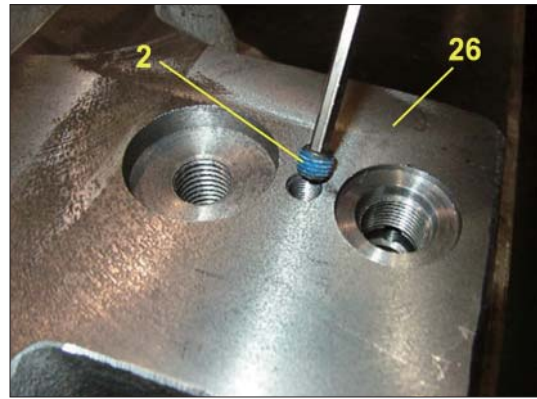


3809A2TM063



## (2) Assemble valve casing sub assembly

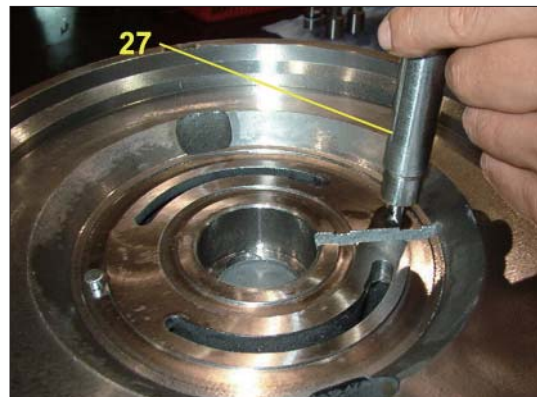
- ① Tighten plugs (2) to valve casing (26) to the specified torque.
  - a. Apply loctite to the plug, and tighten them to the specified torque.
    - Tightening torque : 70~110 kgf · cm



3809A2TM064

- ② Press-fit pin (27).

The pin's length will be 5 mm from valve plate with contacted area using a hammer.



3809A2TM065

- ③ Assemble needle bearing (29).
  - Tools : Press-fit jig and hammer.



3809A2TM066

④ Assemble seat (36), ball (37), stopper (38), O-ring (40) and HP plug (39) in sequence.



3809A2TM067

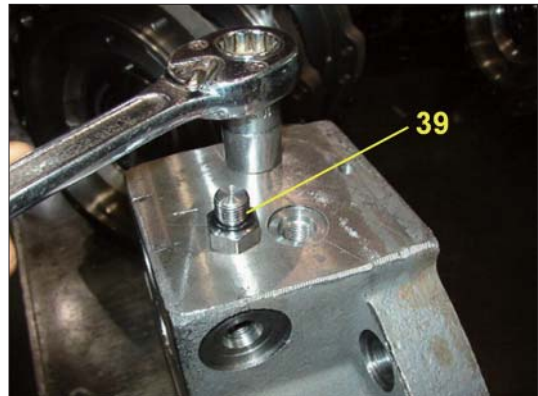


3809A2TM068

※ Pay attention to the direction of the seat and stopper.  
· Tightening torque : 370 kgf · cm

⑤ Assemble HP plug (39) to the specified torque.

- 5 places
- Tightening torque : 370 kgf · cm



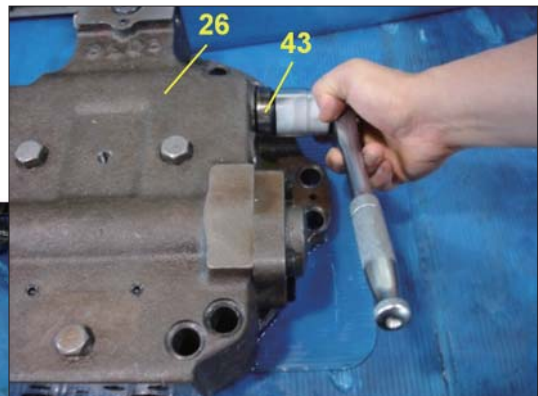
3809A2TM069

⑥ Mount relief valve (43) to the specified torque.

- Tightening torque : 2200 kgf · cm

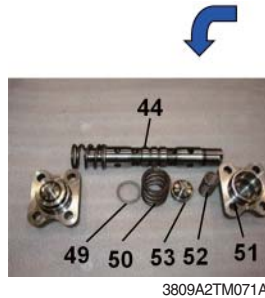


3809A2TM070A

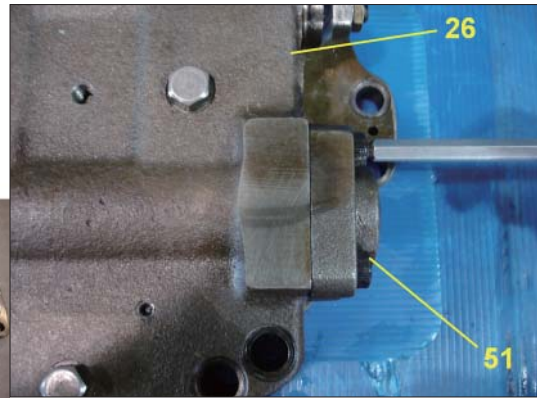


3809A2TM070

- ⑦ Assemble main spool cover (51), spring (52), spool (53), spring seat (49), spring (50), and main spool (44) in sequence.

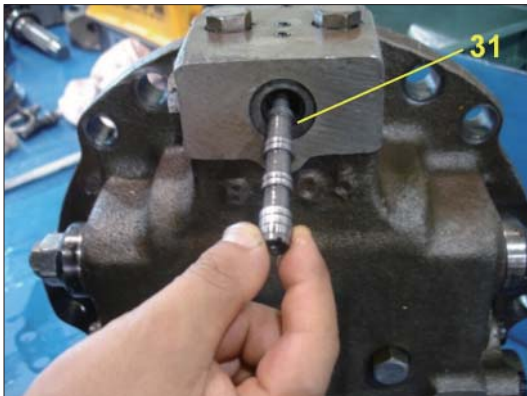


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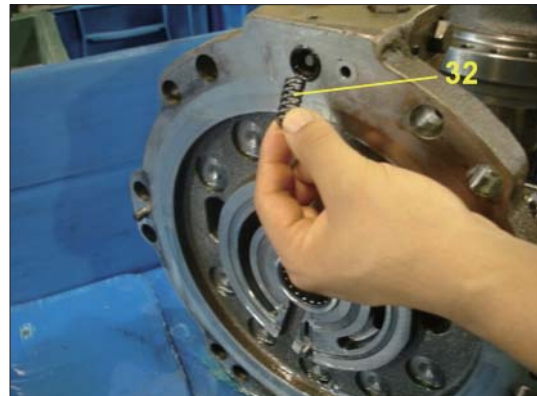


3809A2TM071

- ⑧ Assemble automatic control spool (31), spring (32), O-ring (35).  
 · Tightening torque : 750 kgf · cm



3809A2TM072



3809A2TM073

- ⑨ Insert O-ring (30) to valve casing.  
 Apply grease to the O-ring.



3809A2TM074

- ⑩ Assemble drain plug (41) to the specified torque.  
 · Tightening torque : 1100 kgf · cm

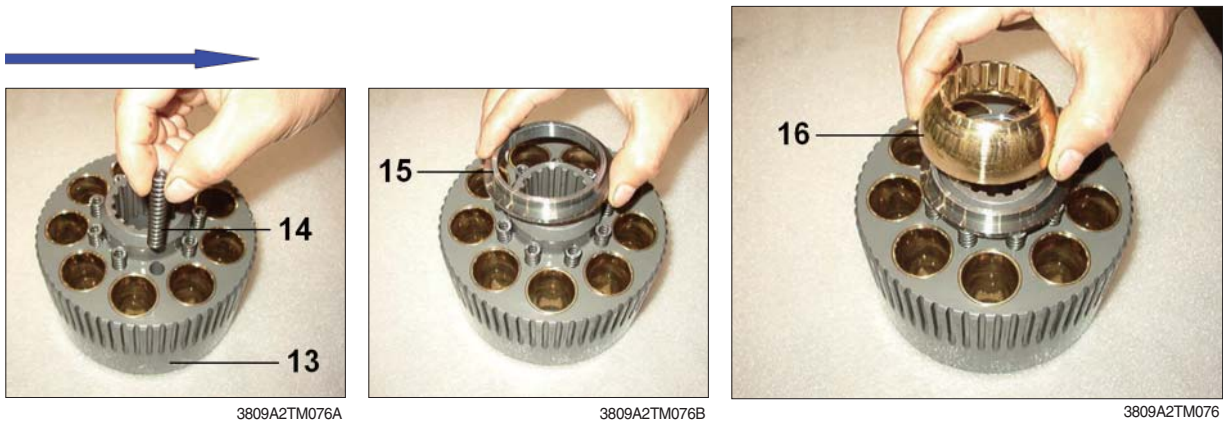


3809A2TM075

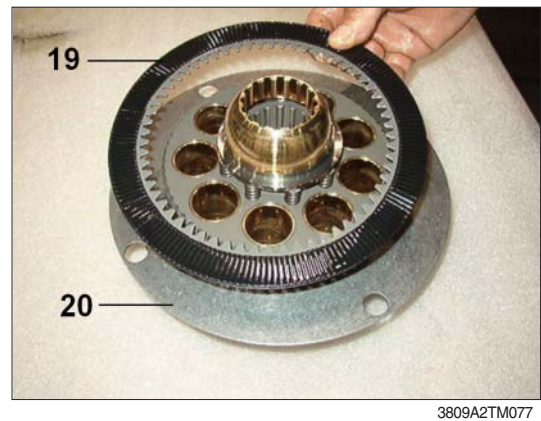


### (3) Assemble cylinder sub assembly

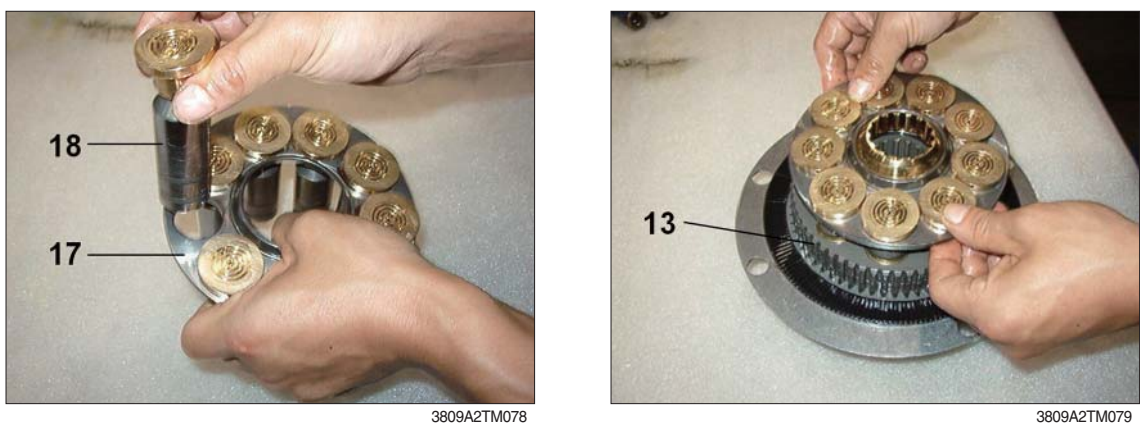
- ① Fit cylinder spring (14), spacer (15) and ball guide (16) to cylinder block (13).  
Align the phase of the cylinder and the spline of the ball guide.



- ② Assemble friction plates (19) and separate plates (20).

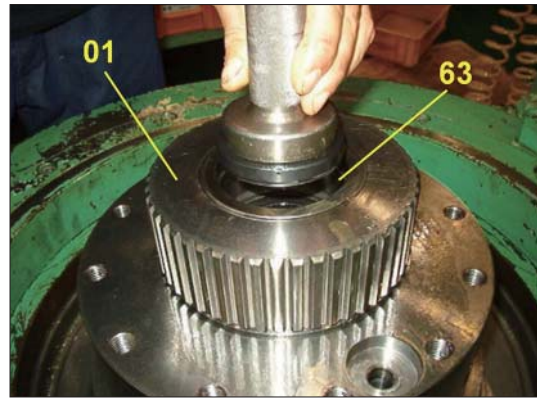


- ③ Insert the assembly of piston shoe (18) to retainer set plate (17) and fit it to the cylinder block (13).



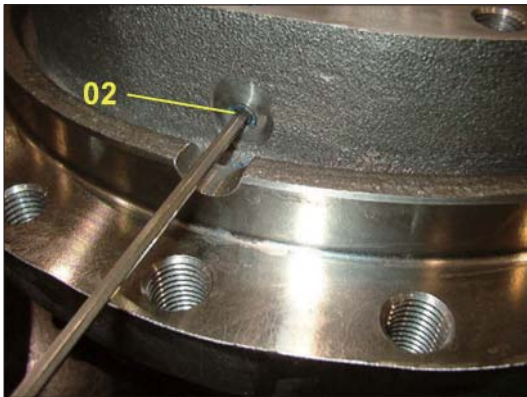
(4) Fit oil-seal (63).

※ Be careful not to damage the lip of the seal.

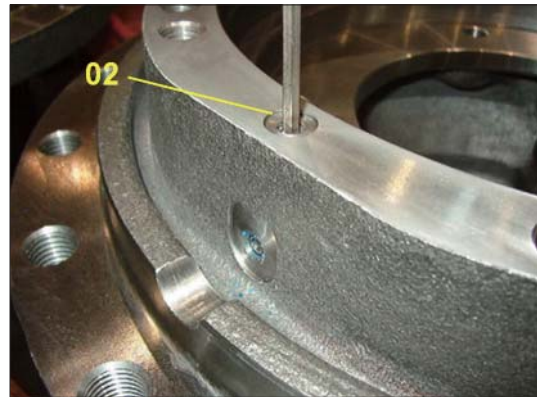


3809A2TM080

(5) Assemble plug (02) to the specified torque.



3809A2TM081



3809A2TM082

① Apply loctite to the plug and assemble.

② Tightening torque : 70~110 kgf · cm

(6) Fit pins (7).

- Tools : Hammer

Pin (7) : Please keep the length at 19 mm  
from surface of the shaft casing.

Pin (7) numbers - 4 EA



3809A2TM083



(7) Assemble the shaft sub assembly.



3809A2TM084

(8) Assemble swash plate (12).



3809A2TM085

(9) Assemble swash piston kit assembly.



3809A2TM086

(10) Assemble swash ball (06).



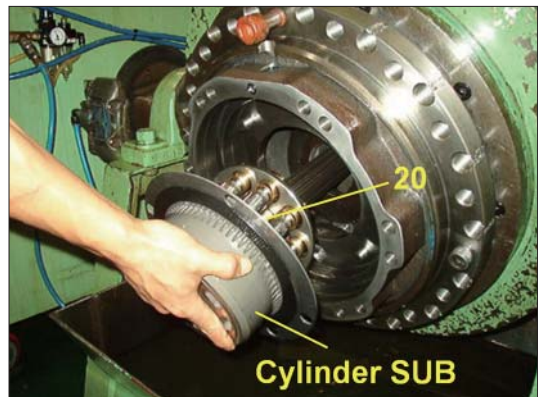
3809A2TM087

- (11) Work when the shaft casing is at the vertical direction.  
※ Be careful not to drop the swash plate.



3809A2TM088

- (12) Fit the cylinder sub assembly.  
※ Align the separate plates (20) to the pin.



3809A2TM089

- (13) Place the motor vertical again.



3809A2TM090

- (14) Fit piston ring (22), piston ring (23) to brake piston (21).



3809A2TM091

(15) Fit the brake piston (21) to the shaft casing (01).

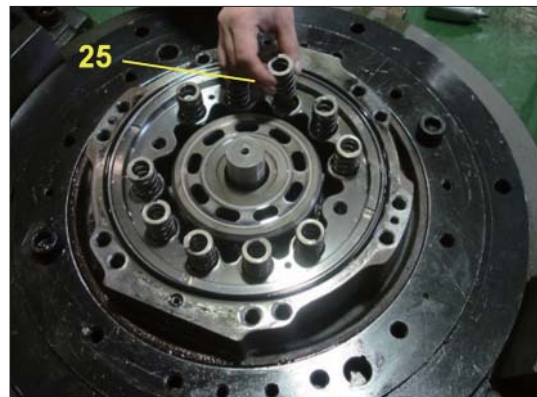
※ Pay attention to the direction of the brake piston.



3809A2TM092

(16) Mount brake springs (25).

① Numbers : Springs - 10EA , Holes - 10EA



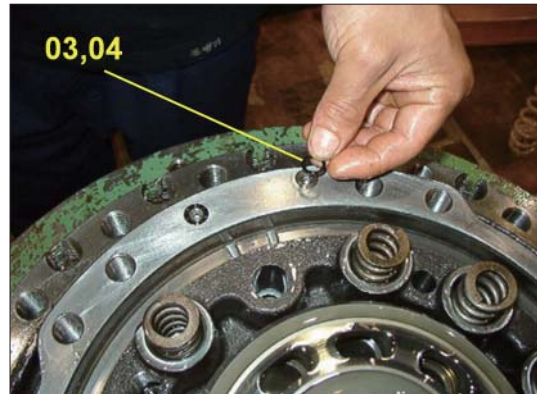
3809A2TM093

(17) Tighten orifice (03, 04) to the specified torque.

① Numbers and size : (03) 1 EA -  $\varnothing$  0.6

(04) 1 EA -  $\varnothing$  0.8

② Tightening torque : 70 kgf · cm

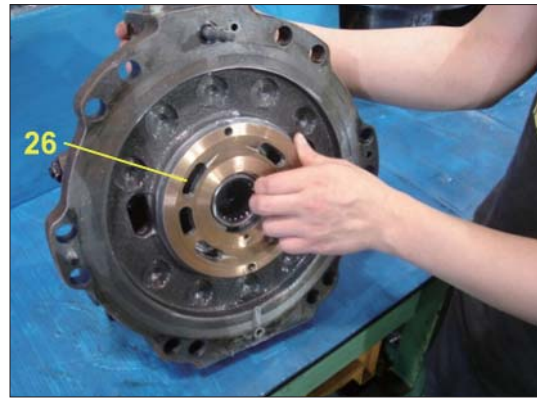


3809A2TM094



(18) Mount valve plate (26) to valve casing and tighten it with hexagonal socket bolt (66).

- ① Apply grease to the valve plate back and be careful not to drop the valve plate.
- ② When you assemble the valve casing to shaft casing, please use a crane.
- ③ The hole ( $\varnothing 5$ ) of valve plate will be located for inlet and outlet port of valve casing.
- ④ Coat grease to swash spool of swash spring.
  - Tightening torque : 2400 kgf · cm
  - Bolt tightening torque :  $1800 \pm 100$  kgf · cm



3809A2TM095



3809A2TM096

(19) Tighten relief valves (43) to the specified torque.



3809A2TM097

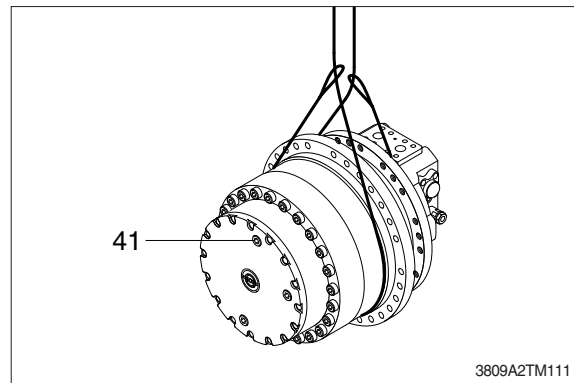
※ Assembly has completed.

### 3. DISASSEMBLING REDUCTION GEAR

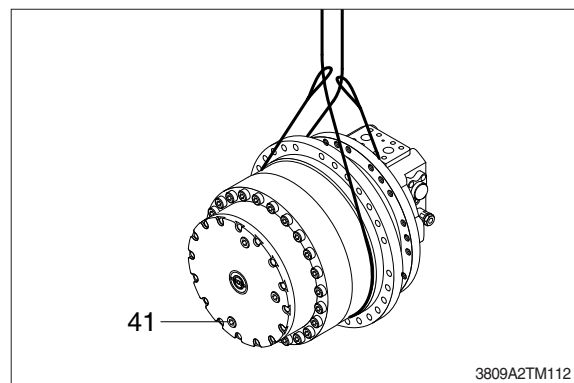
#### 1) DISASSEMBLY

(1) Loosen drain plug (41).

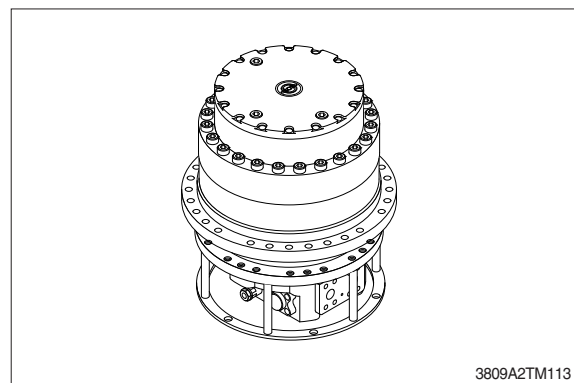
- Do not remove drain plug (41) at once.
- Because gear oil was compressed, plug and oil protrude suddenly.



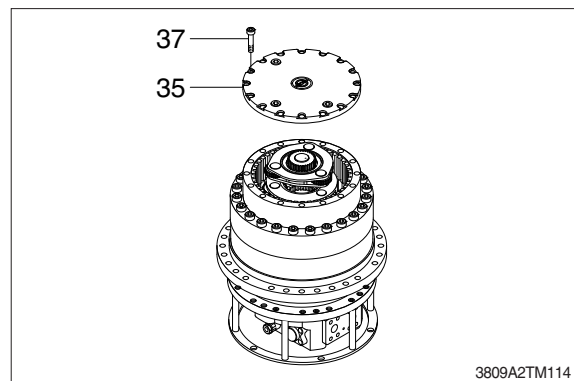
(2) After loosening drain plug (41), drain gear oil.



(3) Overturn the traveling device.

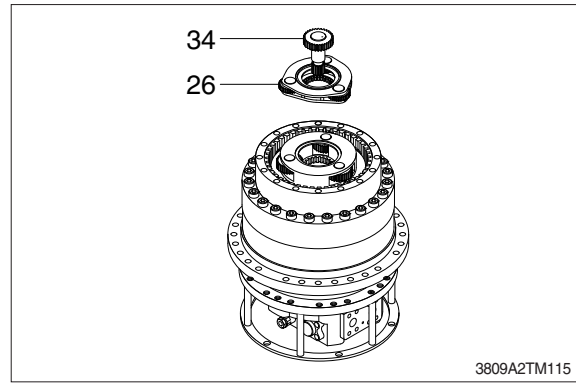


(4) After loosening bolt (37), take cover (35) off.

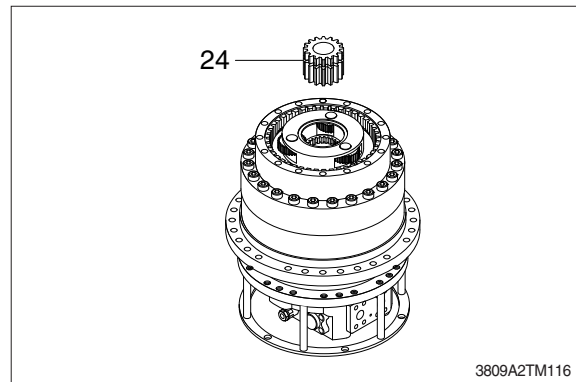




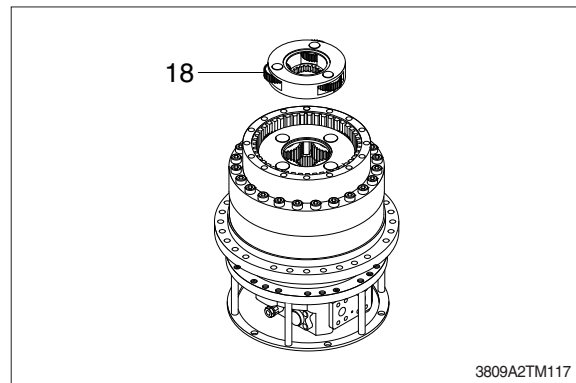
(5) Remove drive gear (34) and No.3 carrier (26).



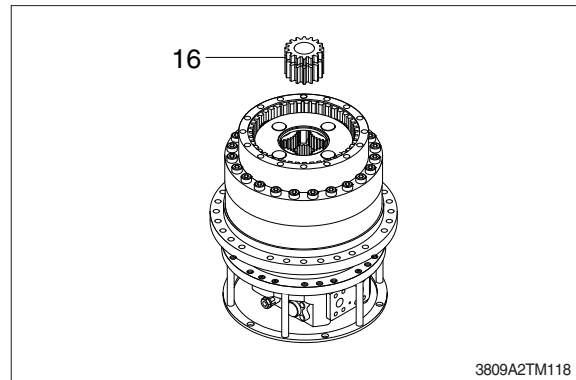
(6) Remove No.2 sun gear B (24).



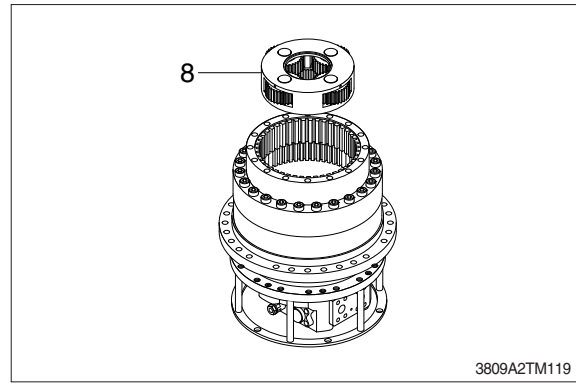
(7) Remove No.2 carrier B (18).



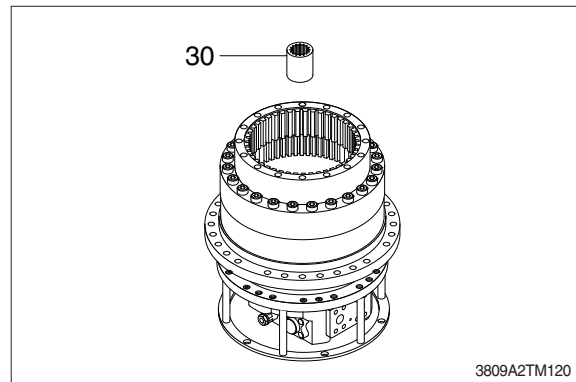
(8) Remove No.1 sun gear A (16).



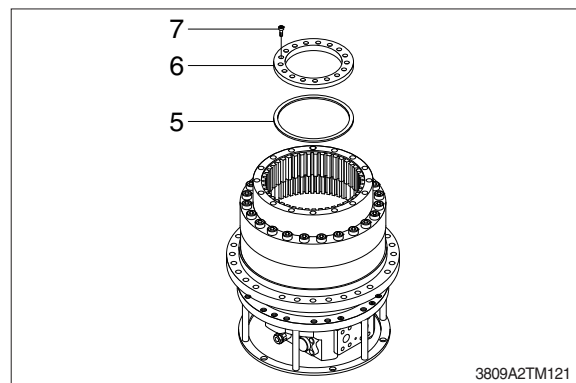
(9) Remove No.1 carrier A (8).



(10) Remove coupling (30).

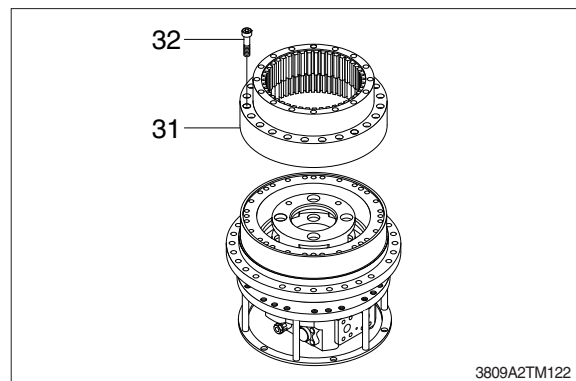


(11) After loosening bolt (7), remove bearing guide (6) and shim (5).

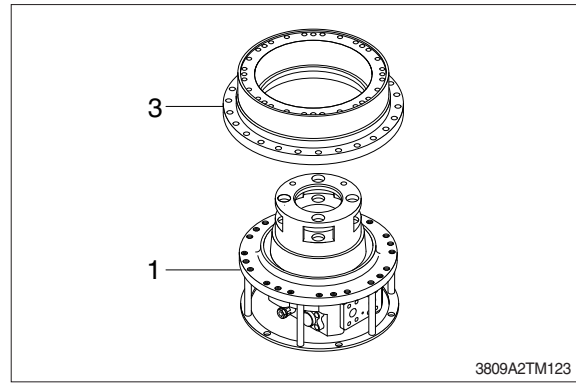


(12) After loosening bolt (32), remove ring gear (31).

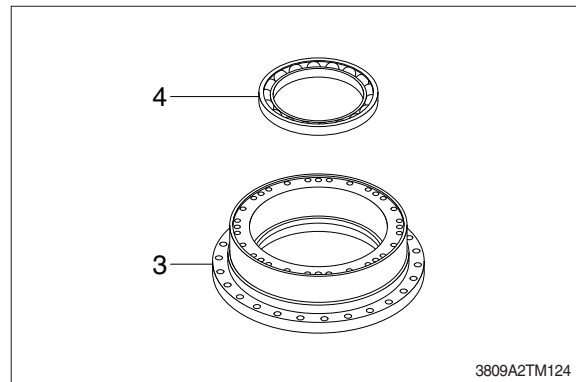
- Tools : I-bolt, Hoist



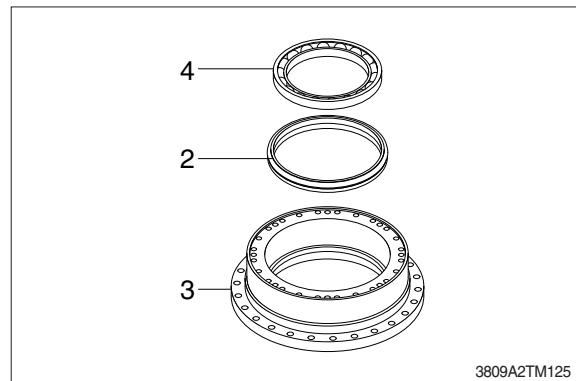
(13) Remove hub (3) from assembly (1).  
- Tools : I-bolt, Hoist



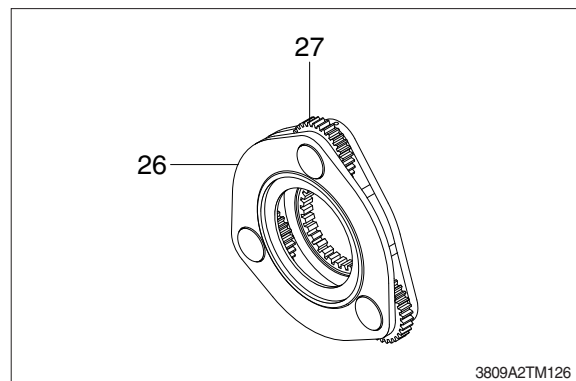
(14) Remove angular bearing (4) from hub (3).



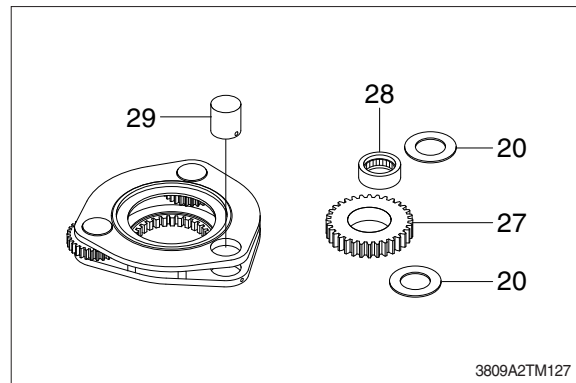
(15) Remove floating seal (2) and angular bearing (4) at opposite of hub (3).



(16) Remove planetary gear C (27) from No.3 carrier C (26).



(17)After removing pin (29), remove No.3 planetary gear C (27), needle bearing (11) and plate C ( 20).



(18)Remove No.2 carrier B (18) assy.

(19)Remove No.1 carrier A (8) assy.

※ Disassembly has completed.

#### 4. ASSEMBLING REDUCTION GEAR

- General precautions

Clean every part by kerosene and dry them by air blow.

Surfaces to be applied by loctite must be decreased by solvent.

Check every part for any abnormalities.

Each hexagon socket head bolt should be used with loctite No. 242 applied on its threads.

Apply gear oil slightly on each part before assembling.

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

#### Inspection before reassembling

##### Thrust washer

- Check if there are seizure, abnormal wear or uneven wear.
- Check if wear is over the allowable limit.

##### Gears

- Check if there are pitting or seizure on the tooth surface.
- Check if there are cracks on the root of tooth by die check.

##### Bearings

- Rotate by hand to see if there are something unusual such as noise or uneven rotation.

##### Floating seal

- Check flaw or score on sliding surface or on O-rings.



## 1) Track gearbox, assembly

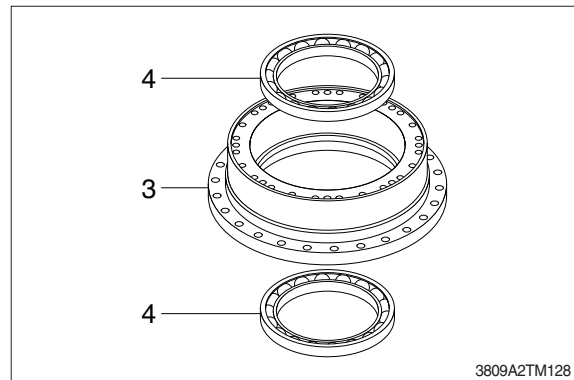
Before assembly track gearbox

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.

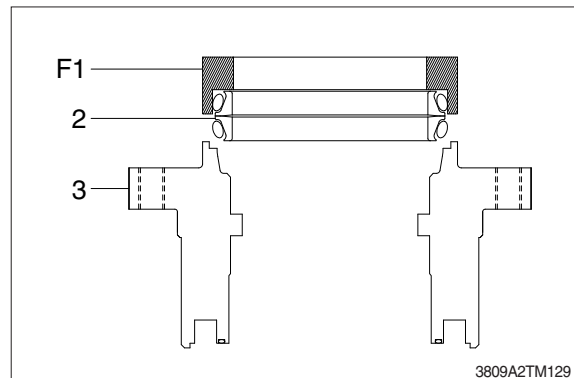
### (1) Assemble hub

- ① Press fit angular bearing (4) to hub (3).



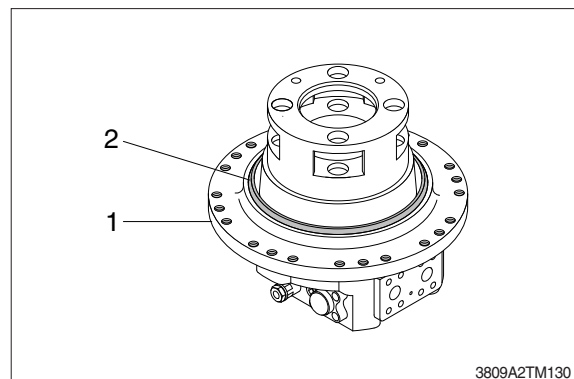
- ② Assemble floating seal (2) to hub (3) using press jig (F1).

- Remove completely the oil of surface that O-ring and O-ring contact.
- Dry completely the floating seal.
- After assembling the floating seal, check floating seal angle (within 1 mm).
- After assembling the floating seal, coat lubricant to the sliding surface of the floating seal.

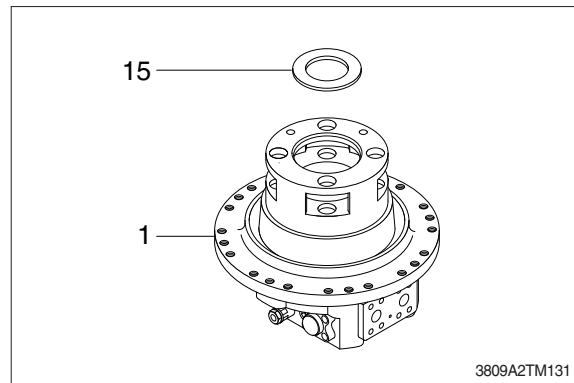


- ③ Assemble floating seal (2) to track motor (1) using press jig (F1).  
Assembling sequence is same with sequence (②).

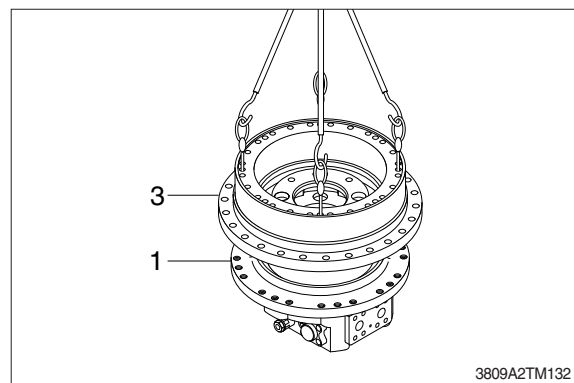
- Remove completely the oil of surface that O-ring and O-ring contact.
- Dry completely the floating seal.
- After assembling floating seal, coat lubricant to the sliding surface of the floating seal.



(2) Assemble thrust plate (15) to spline surface of track motor (1).

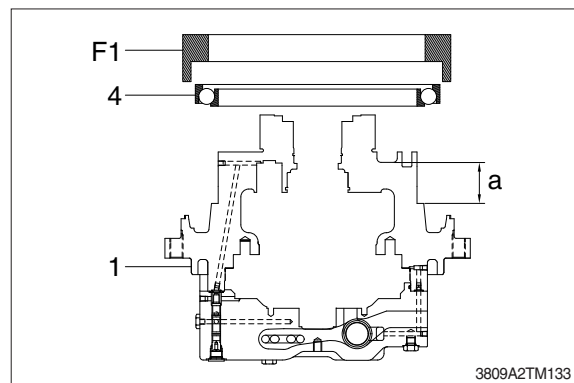


(3) Insert the assembly of hub (3) to track motor (1).



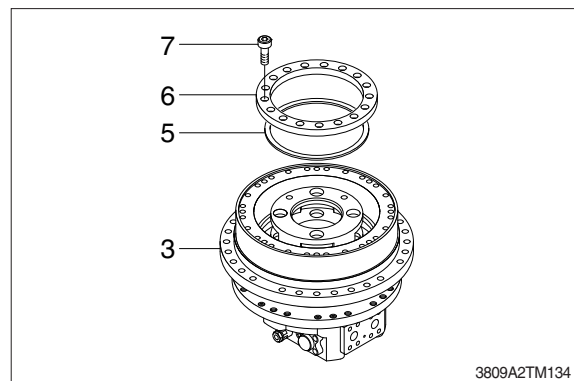
(4) Stick bearing (4) to track motor (1) using press jig (F1).

- Don't heat the bearing.
- Don't hit the bearing retainer.
- Spin the hub. (two times ~ three times)
- Measure "a" size of figure.



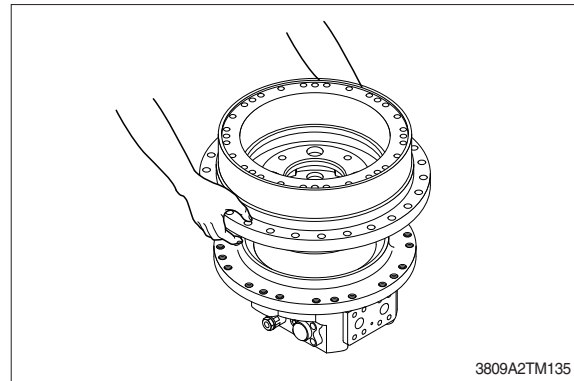
(5) After assembling shim (5), assemble bearing guide (6) using bolt (7).

- Select thickness of shim (5) and assembly.
- Apply loctite #262 to bolt (7).
- Tightening torque : 1300 kgf · cm



(6) Assemble bearing guide.

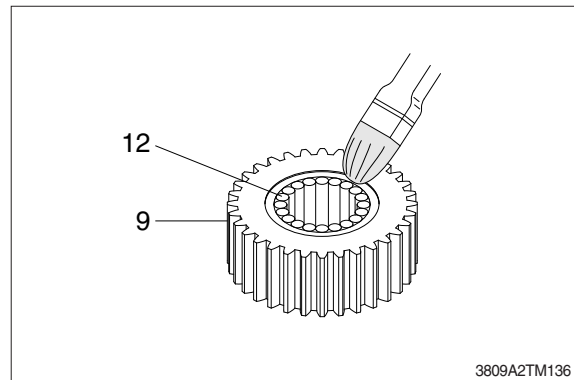
According to the hub turn, we can check it goes on smoothly or not.



(7) Assemble No.1 carrier A (8) sub.

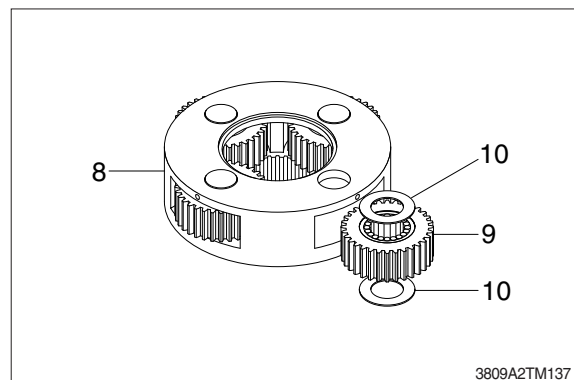
① Mount bearing bushing (12) to No.1 planetary gear A (9).

- Bearing bushing numbers : 18EA
- Insert needle and coat grease.



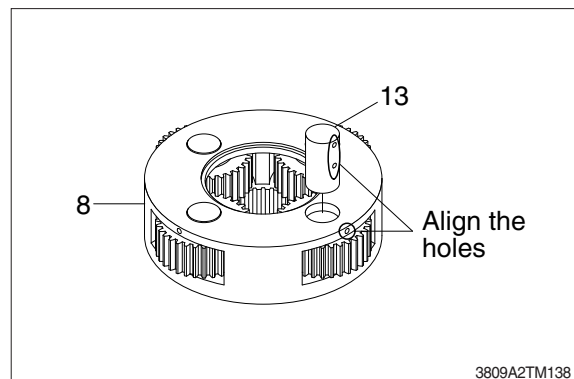
② Mount No.1 planetary gear A (9) and plate A (10) to No.1 carrier A (8).

- Align the hole of carrier and needle inside diameter.

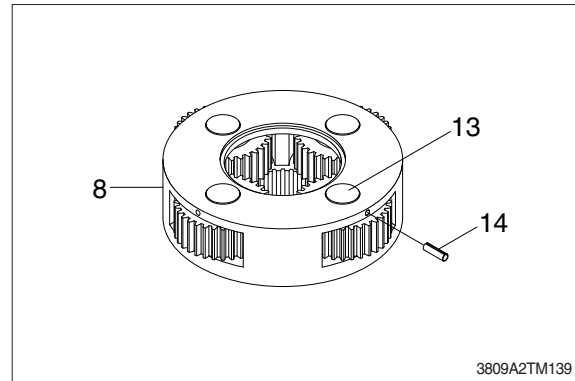


③ Put pin (13) on holes of No.1 carrier A (8).

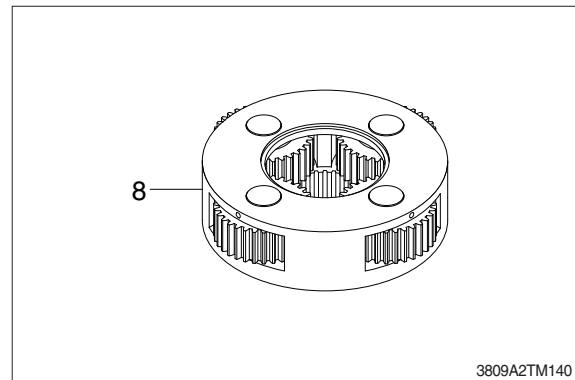
- ※ Align the holes of the carrier and pin holes.
- ※ Beat on it lightly with hammer and put in.



- ④ Assemble carrier (8) and pin (13) striking pin (14) by hammer.  
After assembly pin (14), caulking.



- ⑤ Complete remainder by equal method.

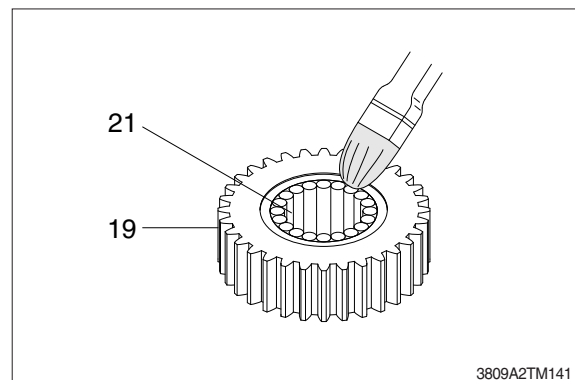


- (8) Assemble No.2 carrier B (18) sub.

- ① Mount needle (21) to No.2 planetary gear B (19).

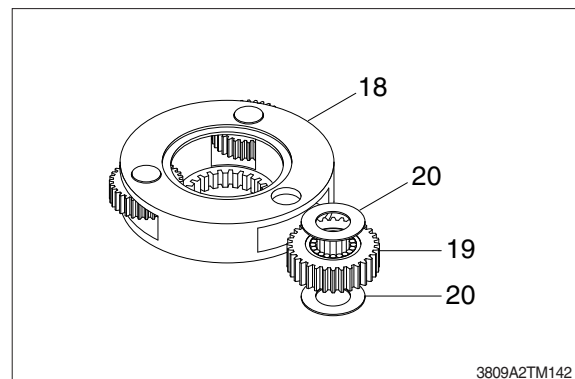
- Needle numbers : 15 EA

Insert needle and coat grease.



- ② Insert No.2 planetary gear B (19) and plate B (20) to No.2 carrier B (18).

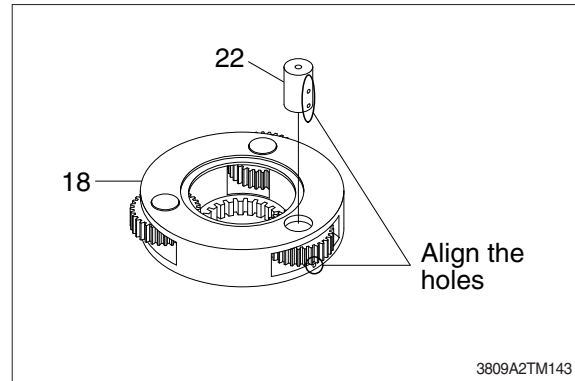
- Align the holes of the carrier and pin holes.



③ Put pin (22) on holes of No.2 carrier B (18).

※ Align the holes of the carrier and pin holes.

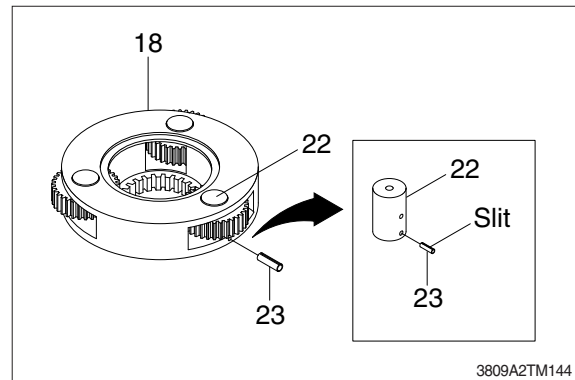
※ Beat on it lightly with hammer and put in.



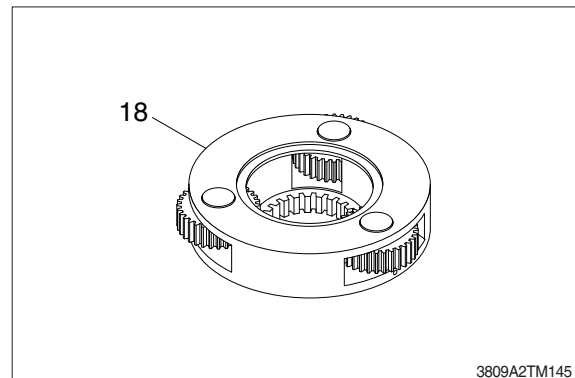
④ Assemble carrier (18) and pin (22), striking pin (23) by hammer.

- If the pin's divided side is not located in the above, it will be damaged during operation.

- After assembly pin, caulking.

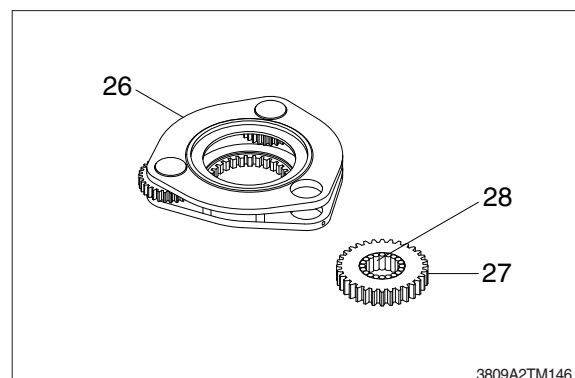


⑤ Complete remainder by equal method.



(9) Assemble No.3 carrier C (26) sub.

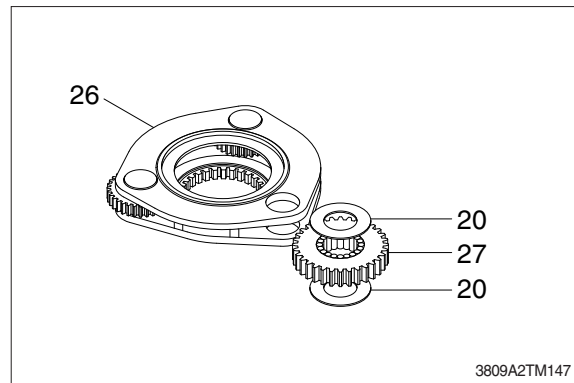
① Insert needle bearing (28) to No.3 planetary gear C (27).  
Insert needle and coat grease.





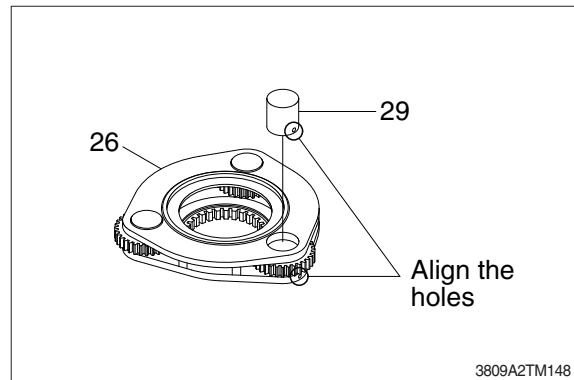
② Insert No.3 planetary gear C (27) and plate C (20) to No.3 carrier C (26).

- Align the holes of the carrier and inside diameter of needle bearing.



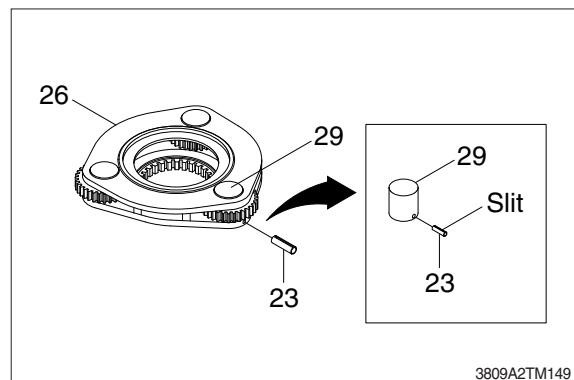
③ Put pin (29) on holes of No.3 carrier C (26).

- ※ Align the holes of the carrier and pin holes.
- ※ Beat on it lightly with hammer and put in.

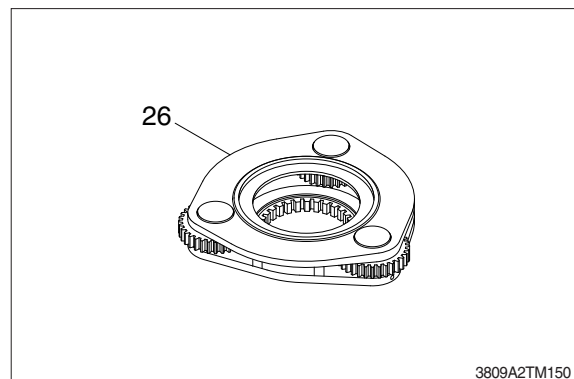


④ Assemble carrier (26) and pin (29) striking pin (23) by hammer.

- If the pin's divided side is not located in the above, it will be damaged during operation.
- After assembly pin, caulking.

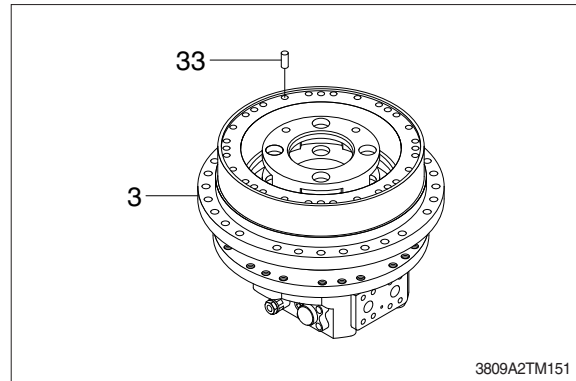


⑤ Complete remainder by equal method.



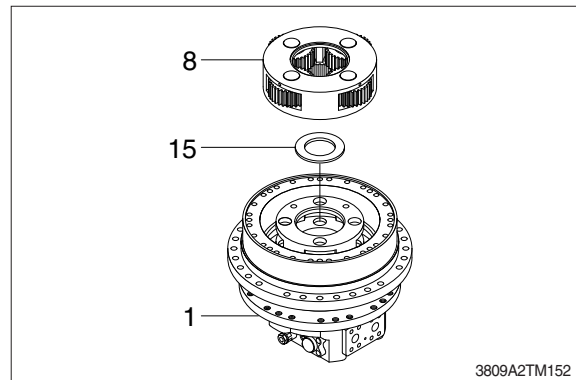
(10) Press-fit parallel pin (33) to the surface of hub (3).

- Parallel pin numbers : 8EA

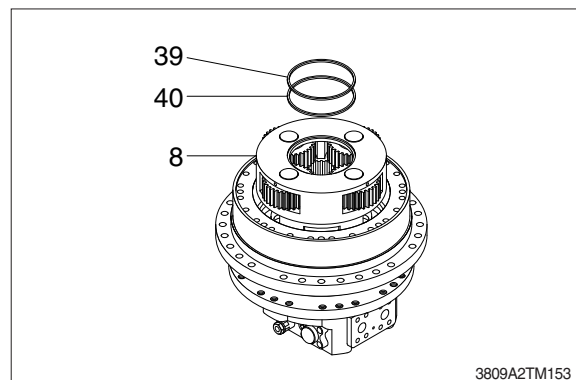


(11) Insert thrust plate (15) to shaft casing of track motor (1).

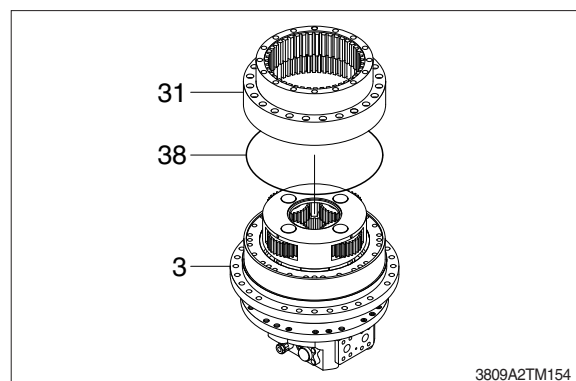
Press-fit No.1 carrier A (8) assy to shaft casing spline using hoist.



(12) Press-fit ring (39, 40) to the No.1 carrier A (8) assy.

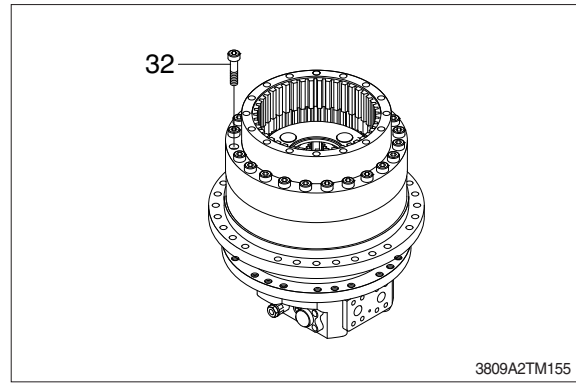


(13) Mounting O-ring (38) into hub (3), and assemble ring gear (31) to hub (3).

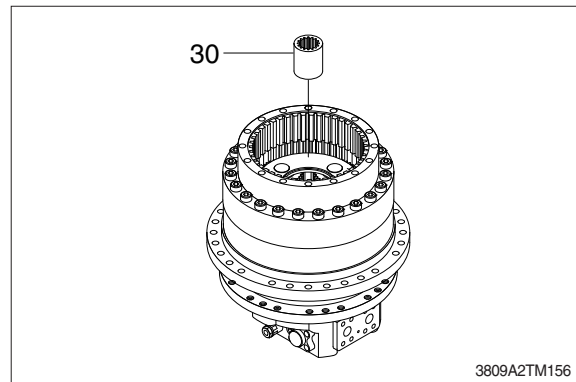


(14) Tighten hub and ring gear.

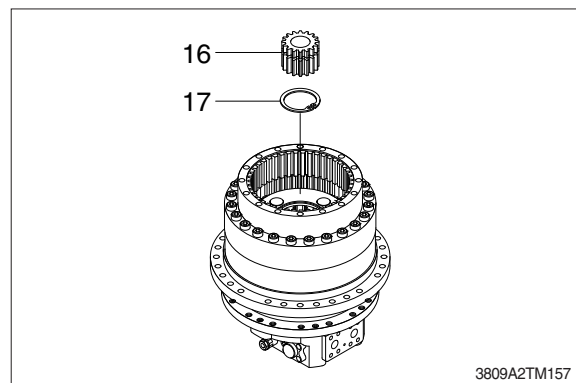
- Bolt numbers : 24 EA
- Tightening torque : 1800 kgf · cm



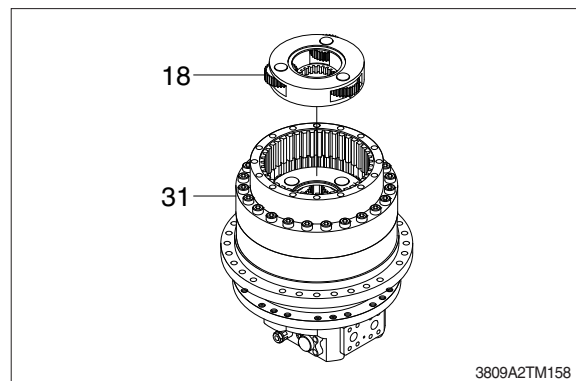
(15) Insert coupling (30) to spline of shaft.



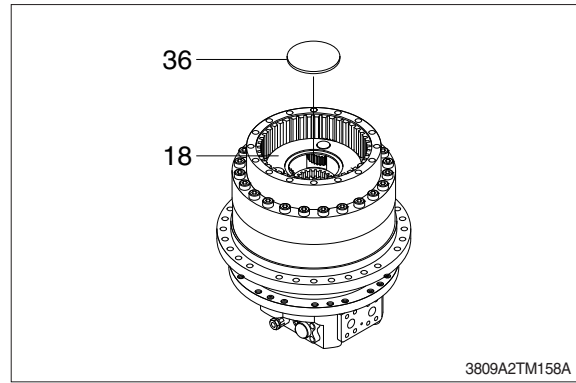
(16) Assemble snap ring (17) to sun gear A (16).  
Insert sun gear A (16) to carrier A.



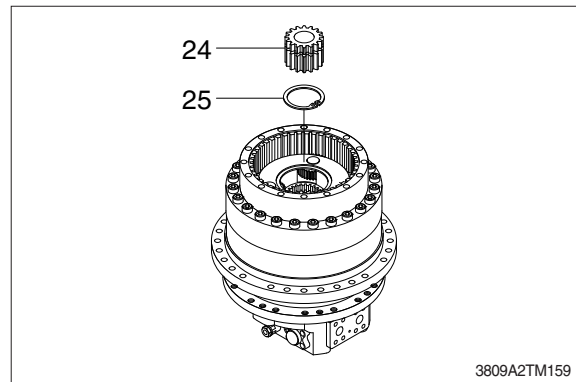
(17) Assemble carrier B (18) to ring gear (31).



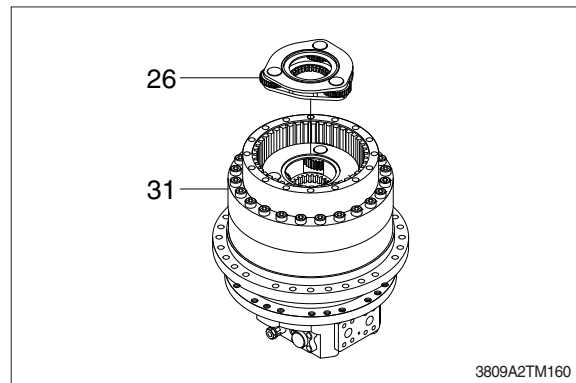
(18) Assemble plate (36) to carrier B (18).



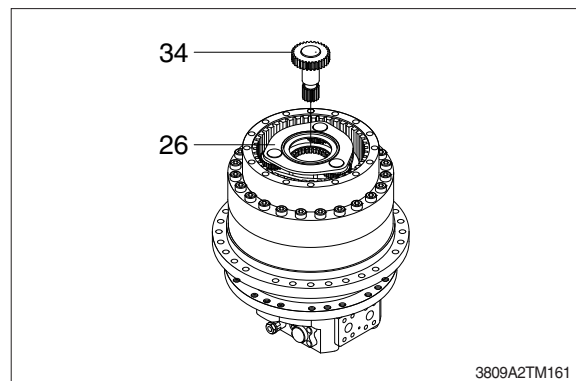
(19) Assemble snap ring (25) to sun gear B (24).  
Insert carrier B to sun gear B (24).



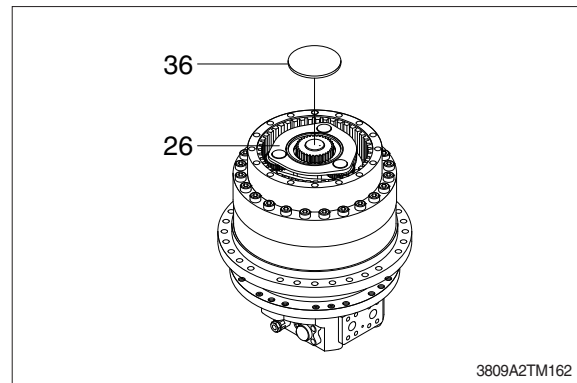
(20) Assemble carrier C (26) assy to ring gear (31).  
After assembling, check whether gear rotate or not.



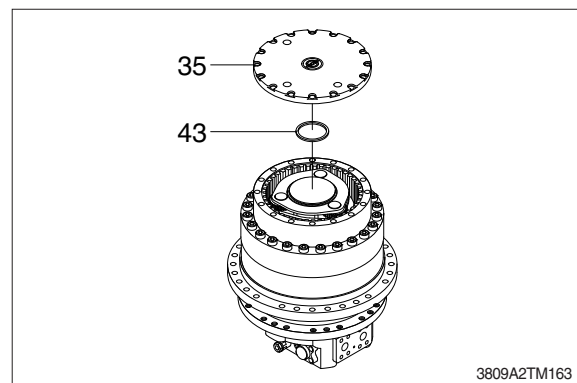
(21) Assemble carrier C (26) to drive gear (34).



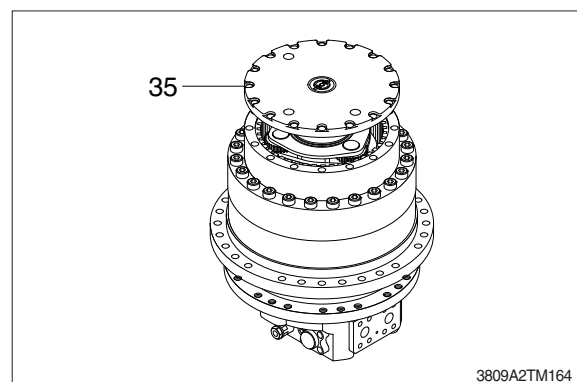
(22) Assemble plate (36) to carrier C (26).



(23) Press-fit bushing (43) to cover (35).

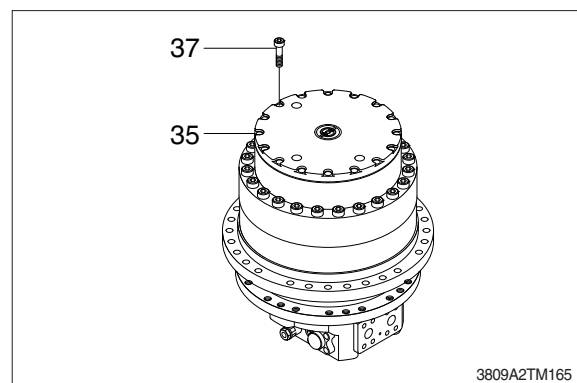


(24) Assemble cover (35).



(25) Assemble cover (35) and tighten them to the specified torque.

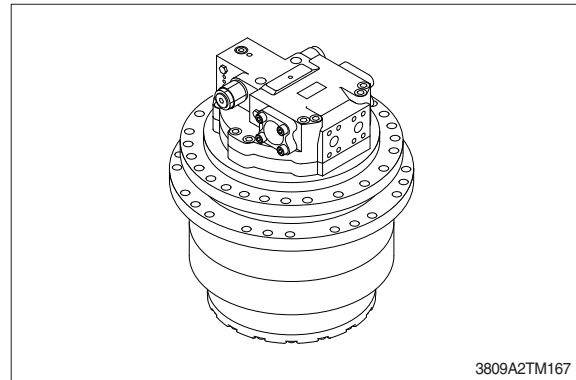
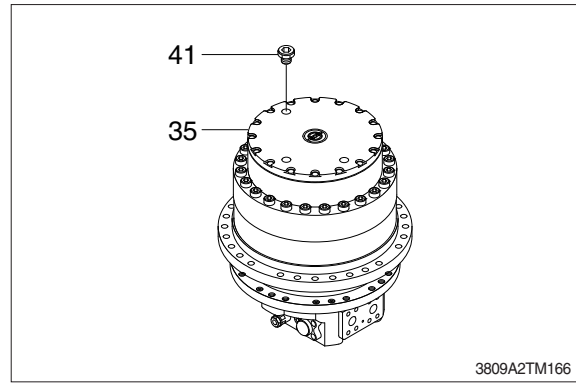
· Tightening torque : 750 kgf · cm





(26) Inject gear oil and assemble plug (41) of cover (35).

- Volume of gear oil : 4.5 liter



※ Assembly has completed.

## GROUP 7 RCV LEVER

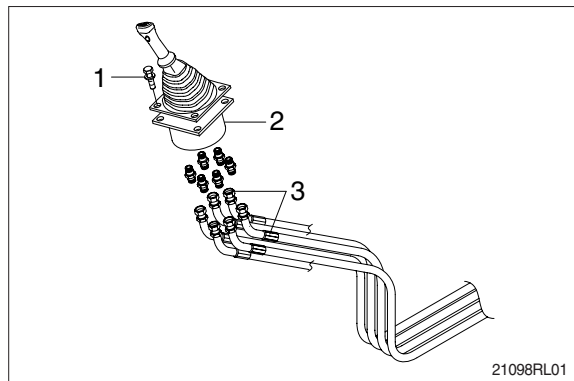
### 1. REMOVAL AND INSTALL

#### 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.

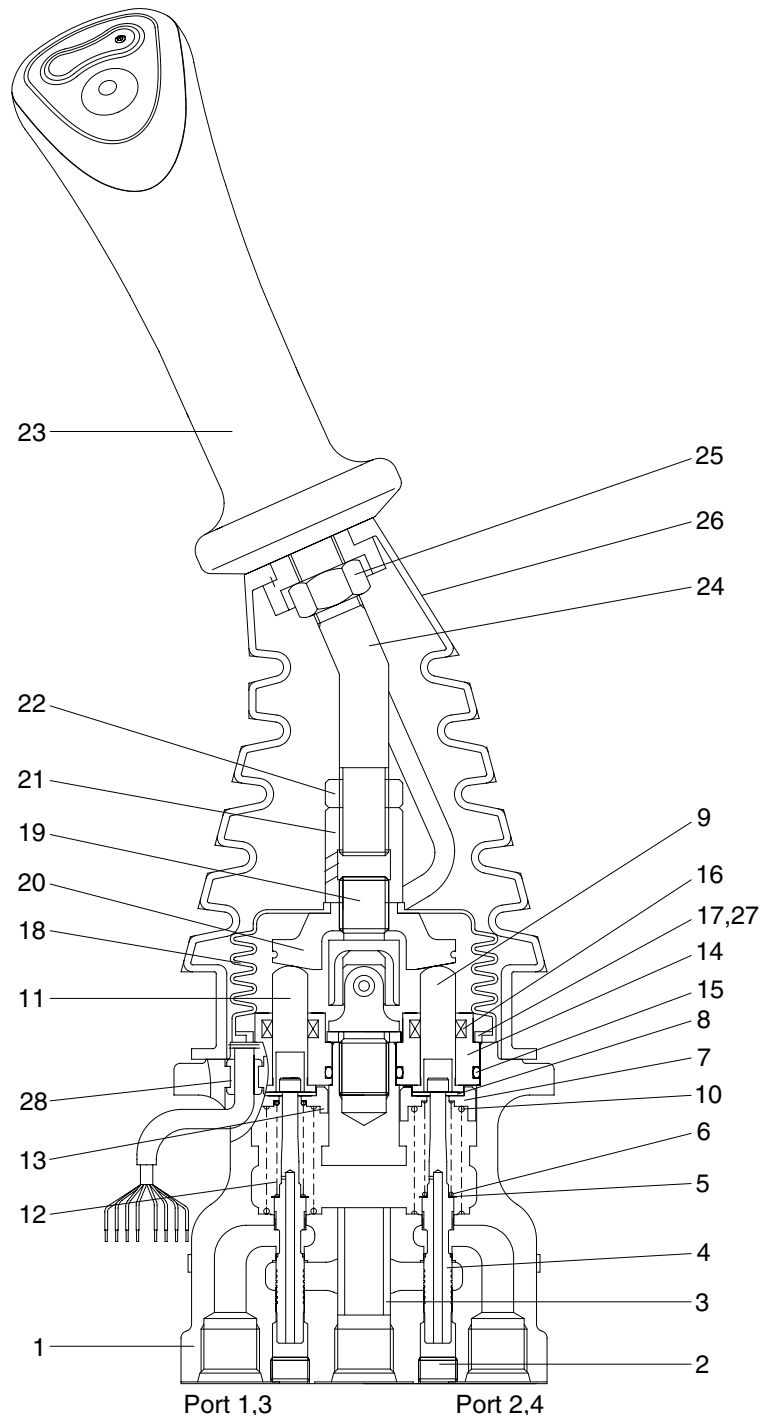


#### 2) INSTALL

- (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

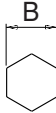


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1	Case	8	Stopper	15	O-ring	22	Lock nut
2	Plug	9	Push rod	16	Rod seal	23	Handle assembly
3	Bushing	10	Spring	17	Plate	24	Handle bar
4	Spool	11	Push rod	18	Boot	25	Nut
5	Shim	12	Spring	19	Joint assembly	26	Boot
6	Spring	13	Spring seat	20	Swash plate	27	Spring pin
7	Spring seat	14	Plug	21	Adjusting nut	28	Bushing

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

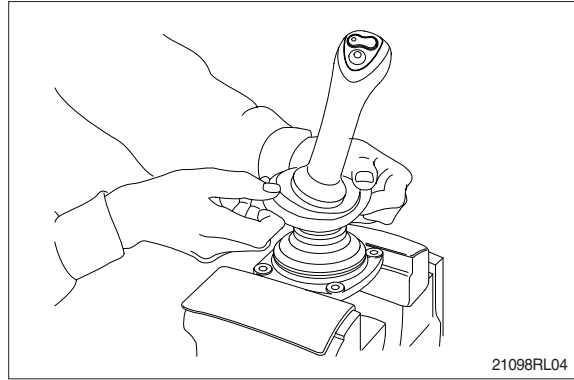
Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

### (2) Tightening torque

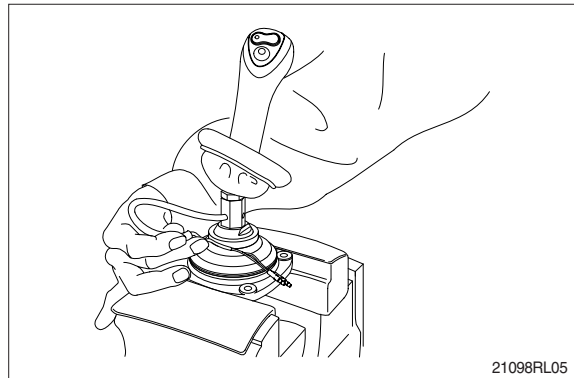
Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	PT 1/8	3.0	21.7
Joint	19	M14	3.5	25.3
Swash plate	20	M14	5.0±0.35	36.2±2.5
Adjusting nut	21	M14	5.0±0.35	36.2±2.5
Lock nut	22	M14	5.0±0.35	36.2±2.5

### 3) DISASSEMBLY

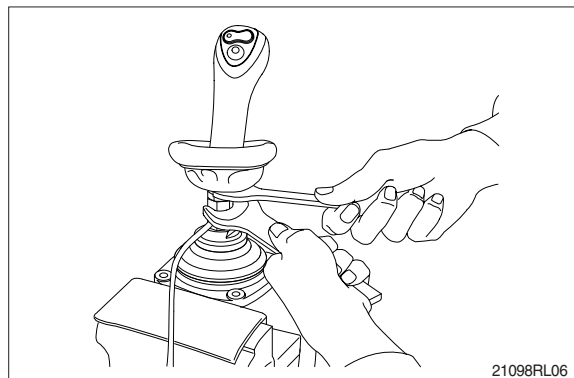
- (1) Clean pilot valve with kerosene.
  - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (26) from case (1) and take it out upwards.



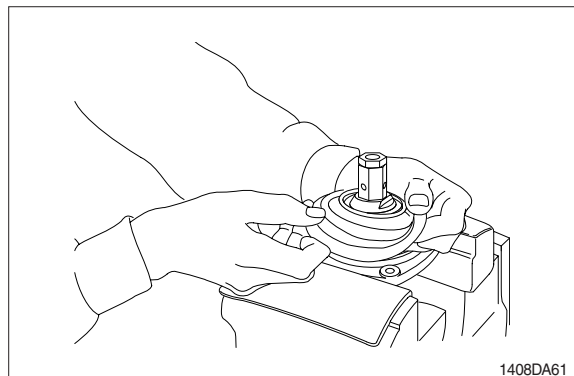
- ※ For valve with switch, remove cord also through hole of casing.



- (4) Loosen lock nut (22) and adjusting nut (21) with spanners on them respectively, and take out handle section as one body.

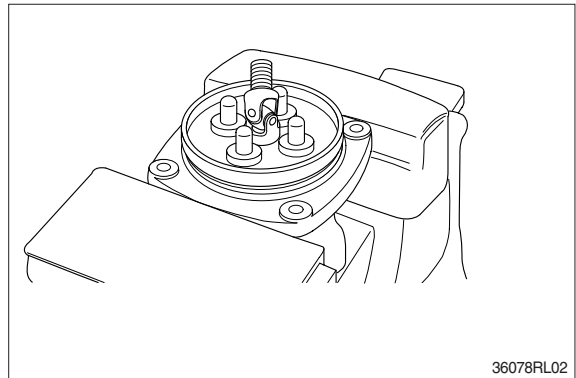
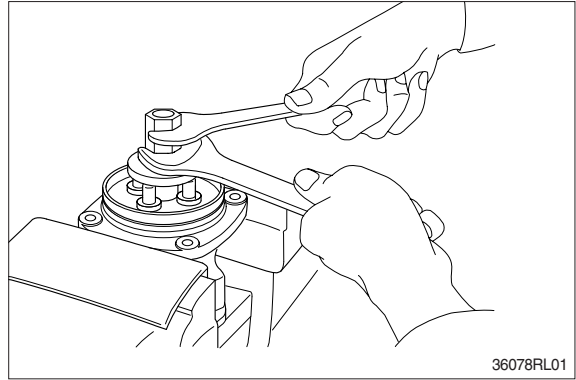


- (5) Remove the boot (18).



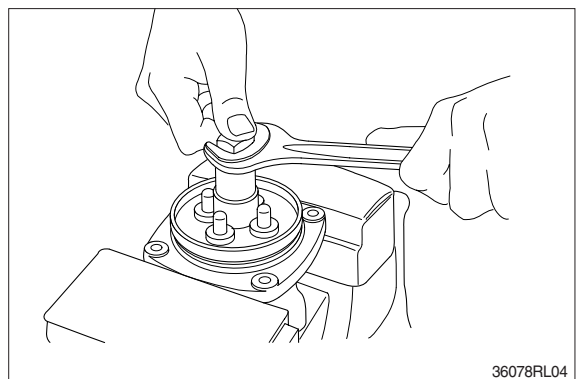
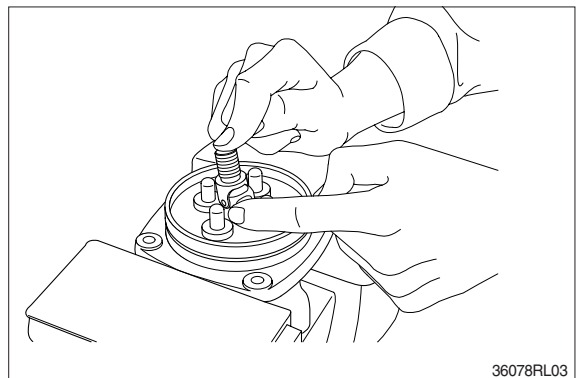


- (6) Loosen adjusting nut (21) and swash plate (20) with spanners on them respectively, and remove them.

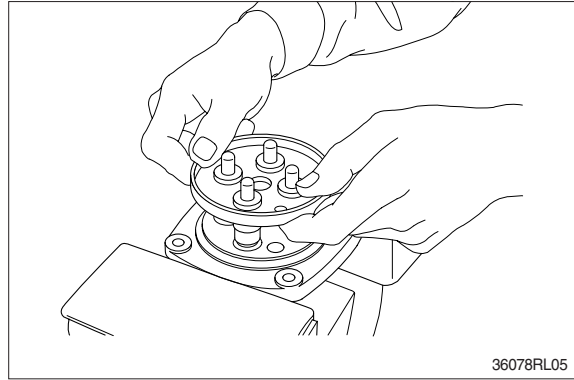


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (10) is strong in force, plate (17), plug (14) and push rod (11) will come up on loosening joint. Pay attention to this.

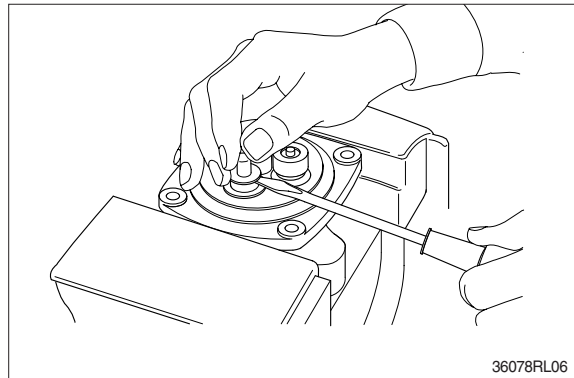


(8) Remove plate (17).



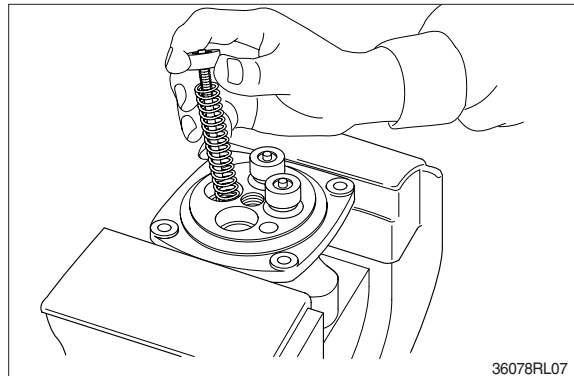
(9) When return spring (10) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.

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

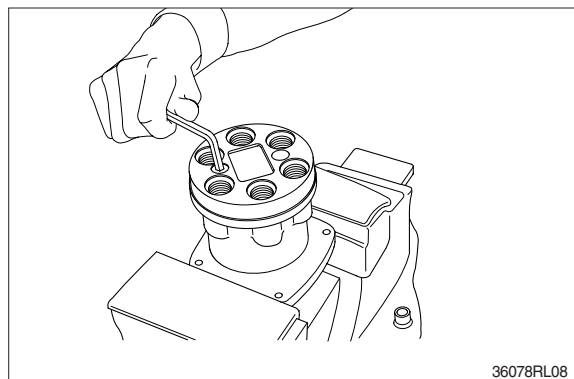


(10) Remove reducing valve subassembly and return spring (10) out of casing.

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

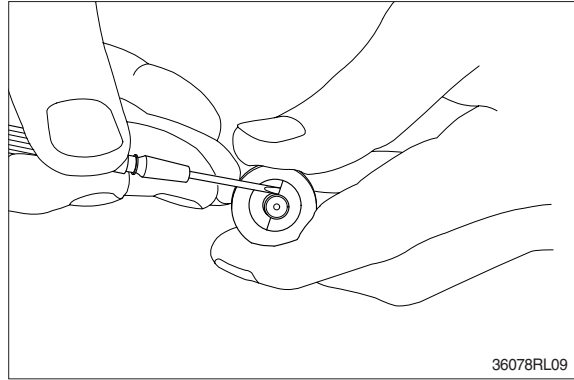


(11) Loosen hexagon socket head plug(2) with hexagon socket screw key.



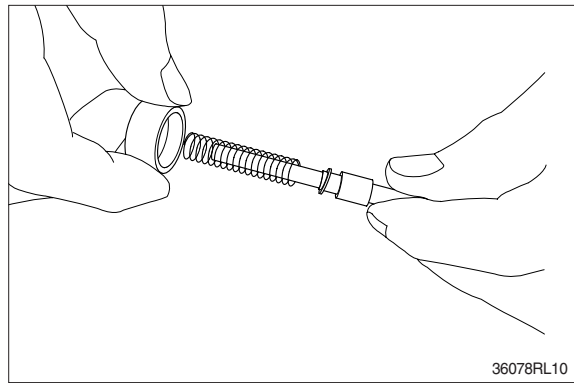
(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.

- ※ Pay attention not to damage spool surface.
- ※ Record original position of spring seat (7).
- ※ Do not push down spring seat more than 6mm.

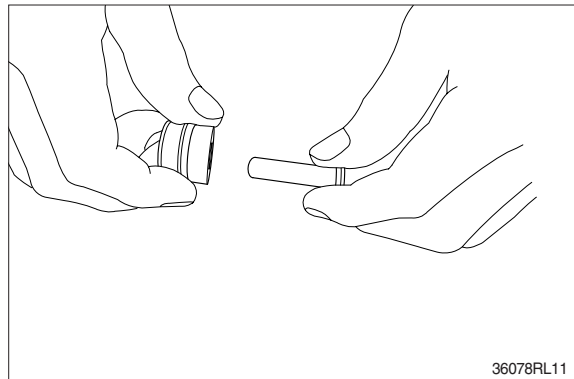


(13) Separate spool (4), spring seat (7), spring (6) and shim (5) individually.

- ※ Until being assembled, they should be handled as one subassembly group.

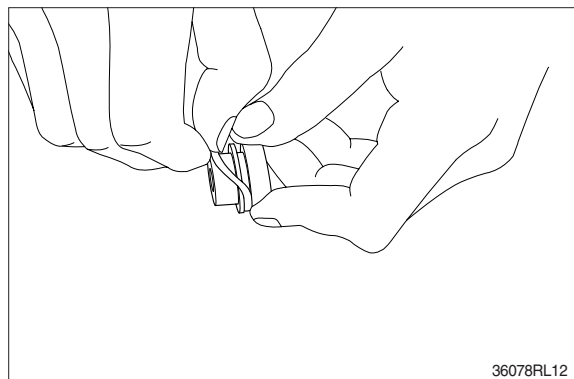


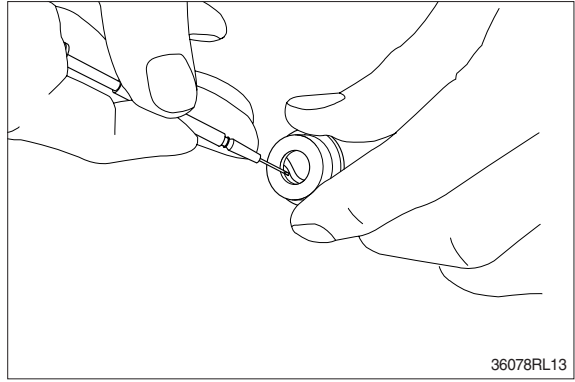
(14) Take push rod (11) out of plug (14).



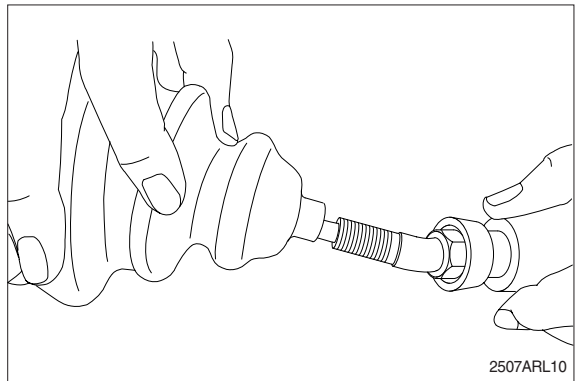
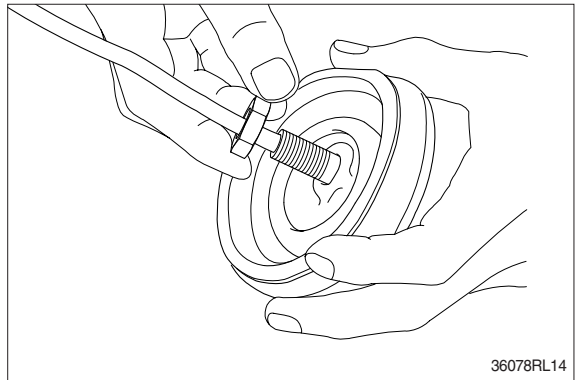
(15) Remove O-ring (15) and seal (16) from plug (14).

Use small minus screwdriver or so on to remove this seal.





(16) Remove lock nut (22) and then boot (26).



### **(16) Cleaning of parts**

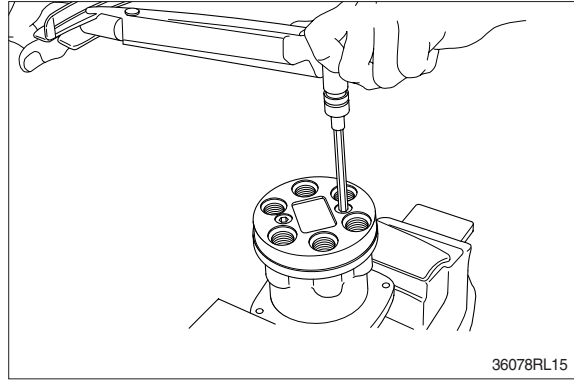
- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
  - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
  - ※ If this kerosene is polluted, parts will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

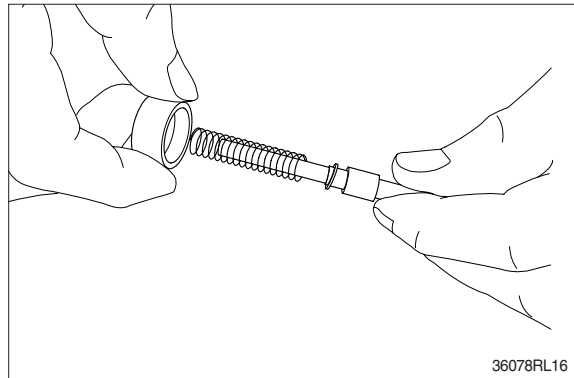
- Apply rust-preventives to all parts.
- ※ If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

#### 4) ASSEMBLY

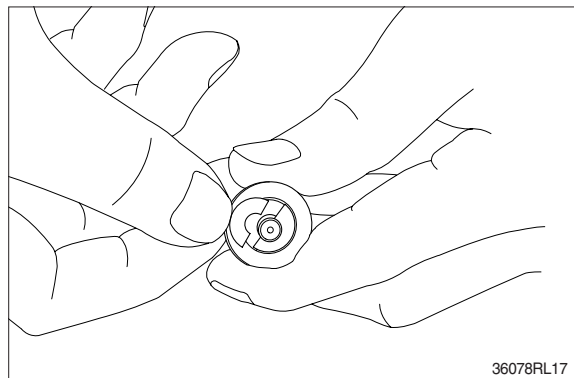
- (1) Tighten hexagon socket head plug (2) to the specified torque.
- ※ Tighten two bolts alternately and slowly.



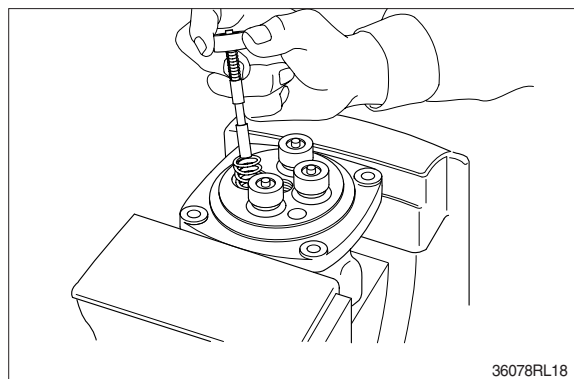
- (2) Put shim (5), springs (6) and spring seat (7) onto spool (4) in this order.



- (3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.
- ※ Assemble stopper (8) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.

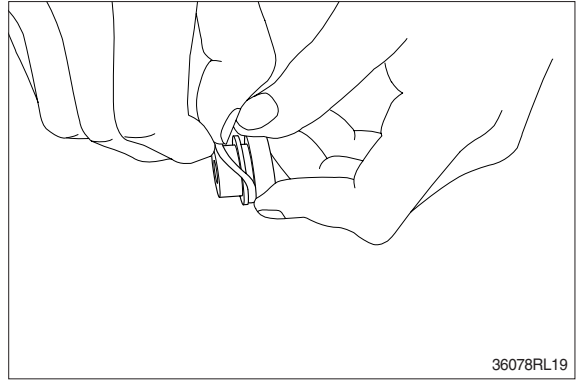


- (4) Assemble spring (10) into casing (1). Assemble reducing valve subassembly into casing.
- ※ Assemble them to their original positions.



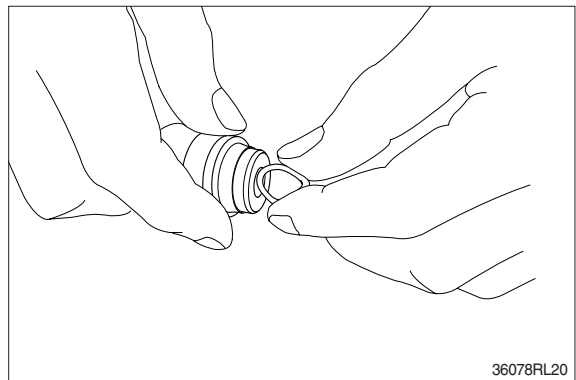


(5) Assemble O-ring (15) onto plug (14).



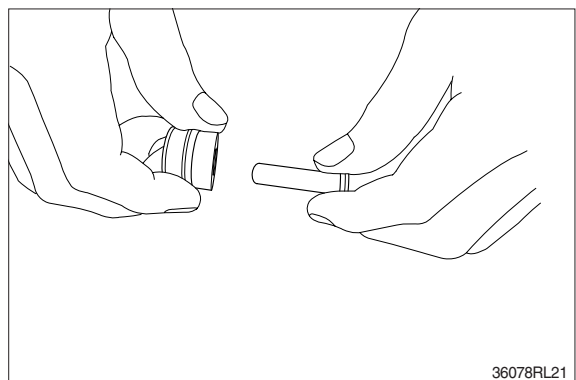
(6) Assemble seal (16) to plug (14).

※ Assemble seal in such lip direction as shown below.



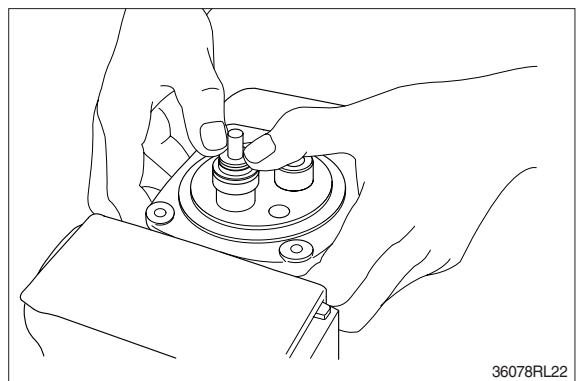
(7) Assemble push rod (11) to plug (14).

※ Apply working oil on push-rod surface.

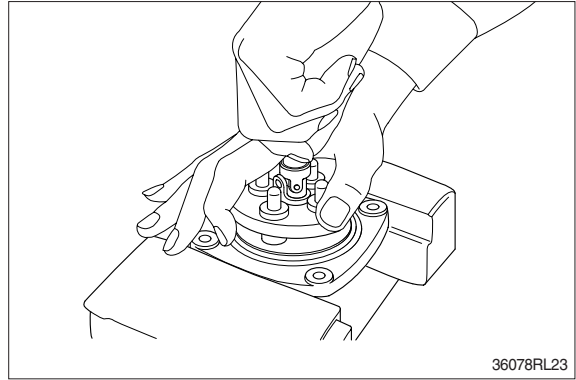


(8) Assemble plug subassembly to casing.

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

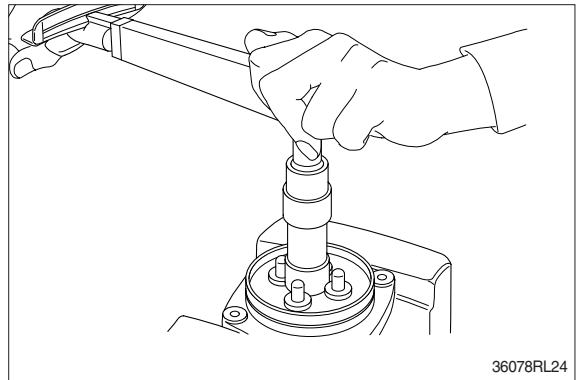


- (9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.

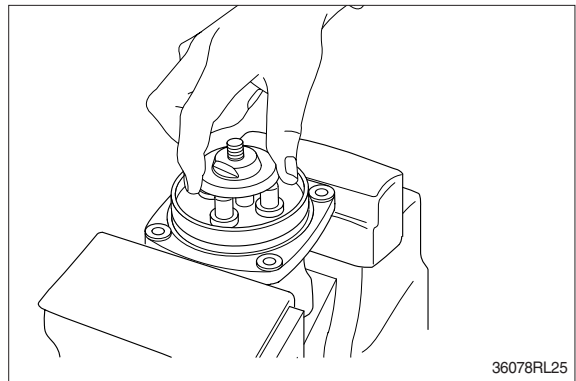


- (10) Fit plate (17).

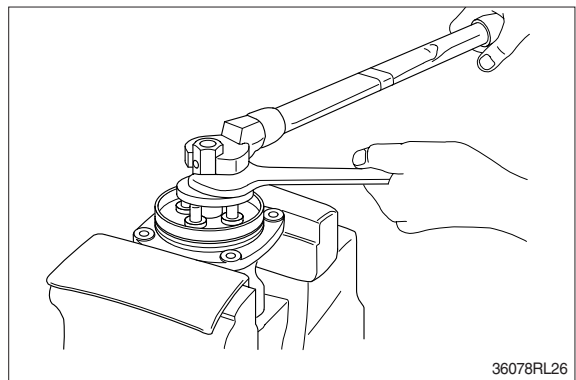
- (11) Tighten joint (19) with the specified torque to casing, utilizing jig.



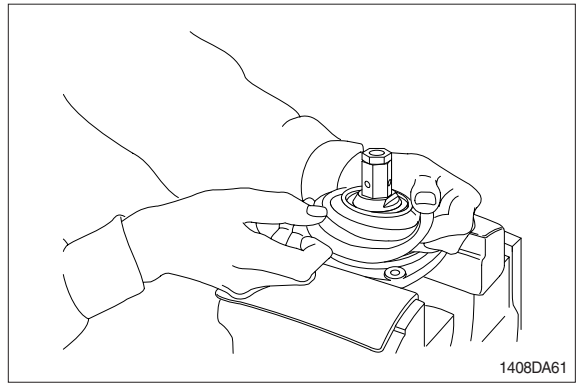
- (12) Assemble swash plate (20) to joint (19).
- ※ Screw it to position that it contacts with 4 push rods evenly.
  - ※ Do not screw it over.



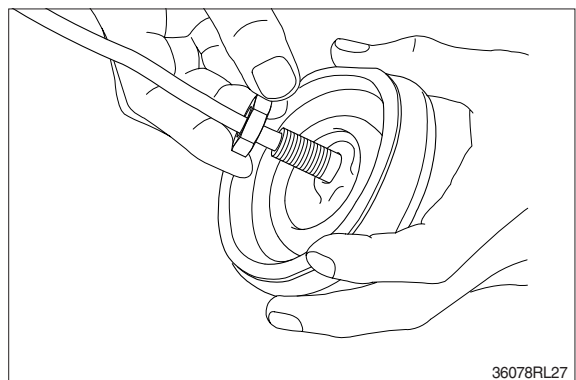
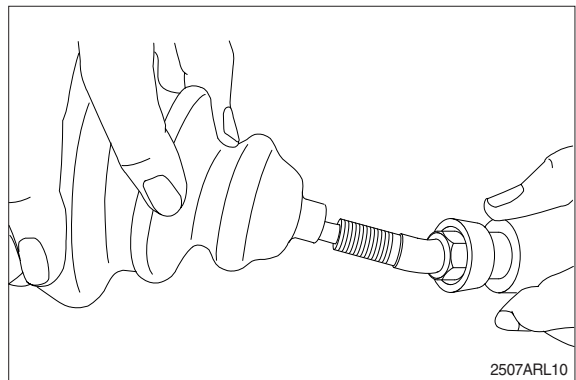
- (13) Assemble adjusting nut (21), apply spanner to width across flat of plate (20) to fix it, and tighten adjusting nut to the specified torque.
- ※ During tightening, do not change position of disk.



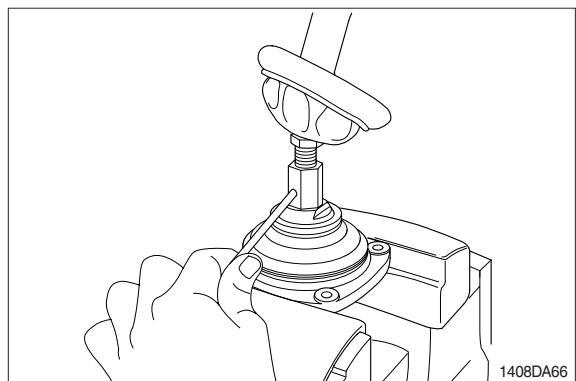
(14) Fit boot (18) to plate.



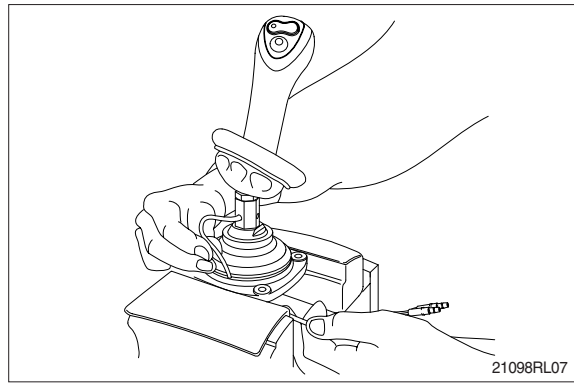
(15) Fit boot (26) and lock nut (22), and handle subassembly is assembled completely.



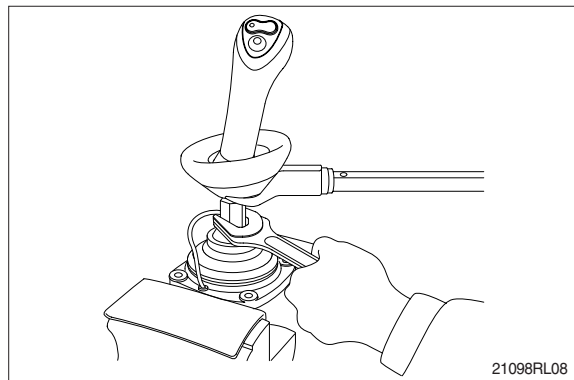
(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



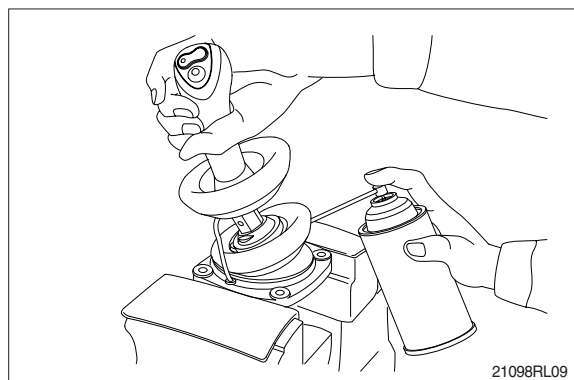
- (17) Assemble bushing (27) to plate and pass cord and tube through it.  
※ Provide margin necessary to operation.



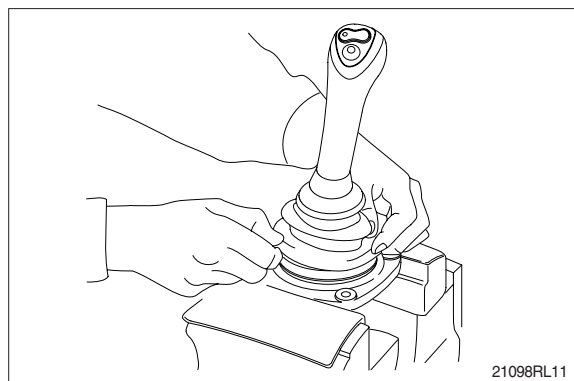
- (18) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



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



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



## GROUP 8 TURNING JOINT

### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

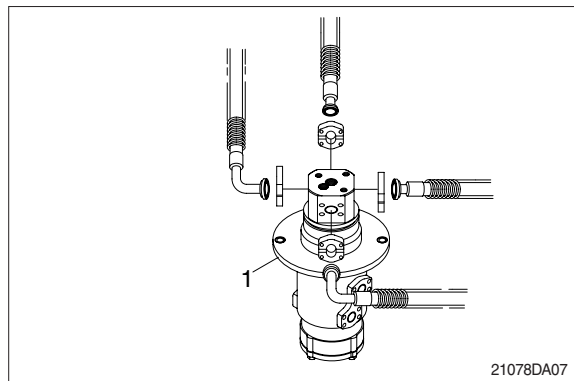
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

**▲ 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.

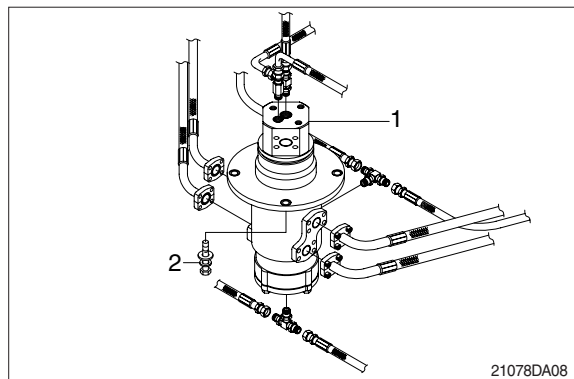
- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
  - Weight : 55 kg (120 lb)
  - Tightening torque :  $12.3 \pm 1.3 \text{ kgf} \cdot \text{m}$   
( $89 \pm 9.4 \text{ lbf} \cdot \text{ft}$ )

- (6) Remove the turning joint assembly.
  - ※ When removing the turning joint, check that all the hoses have been disconnected.



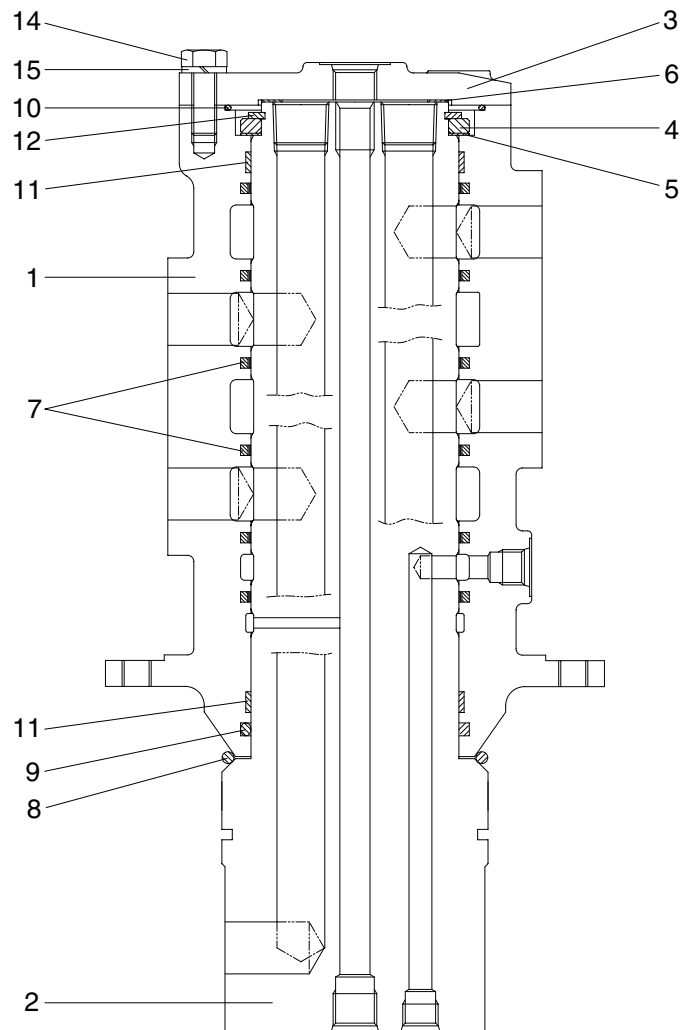
#### 2) INSTALL

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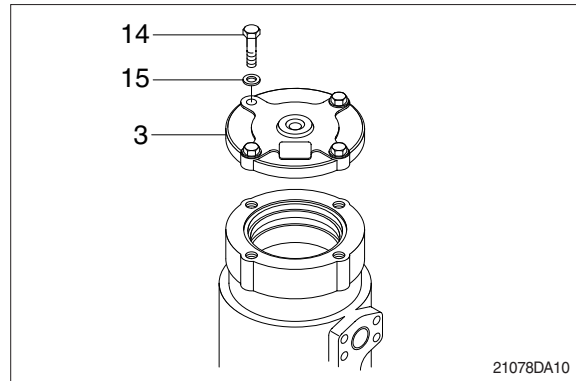
- |   |        |    |              |    |               |
|---|--------|----|--------------|----|---------------|
| 1 | Hub    | 6  | Shim         | 11 | Wear ring     |
| 2 | Shaft  | 7  | Slipper seal | 12 | Retainer ring |
| 3 | Cover  | 8  | O-ring       | 13 | Plug          |
| 4 | Spacer | 9  |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



## 2) DISASSEMBLY

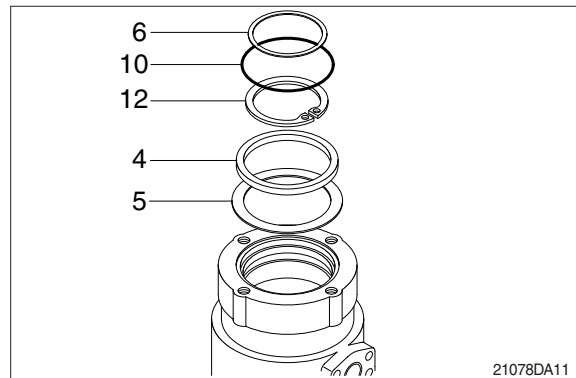
※ Before the disassembly, clean the turning joint.

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



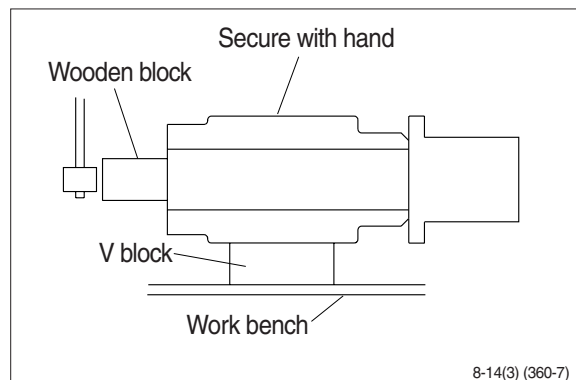
- (2) Remove shim (6) and O-ring (10).

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

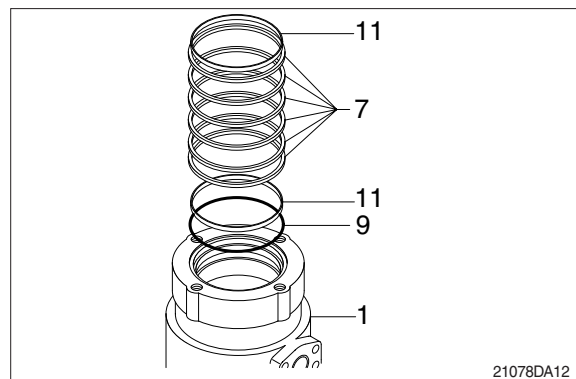


- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

- ※ 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).



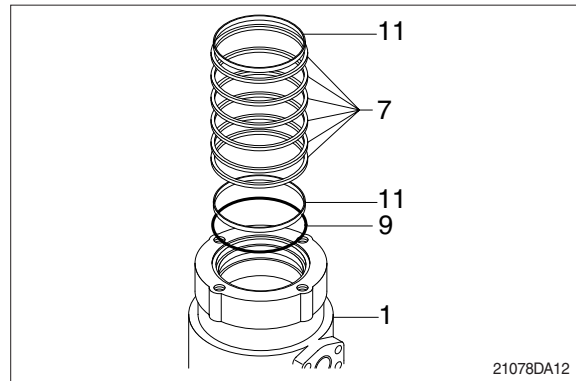
- (5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).



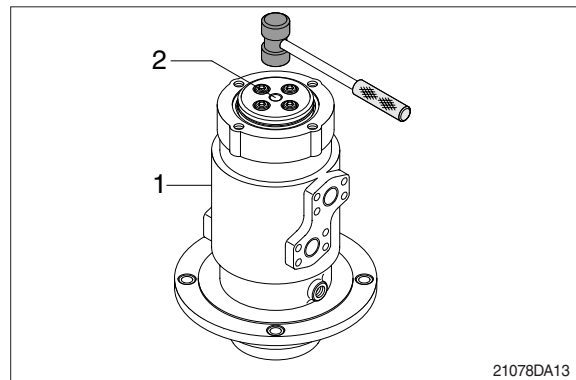
### 3) ASSEMBLY

- ※ 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.

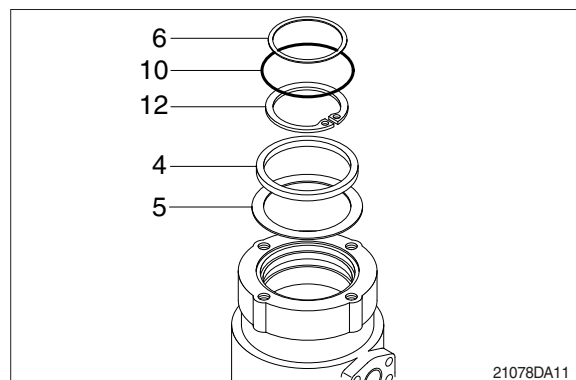
- (1) Fix seven slipper seal (7) and O-ring (9), two wear ring (11) to hub (1).
- (2) Fit O-ring (8) to shaft (2).



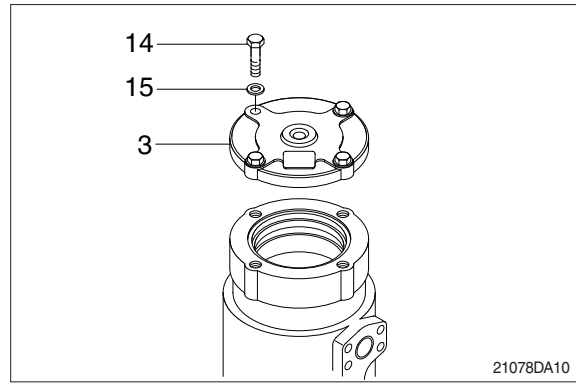
- (3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



- (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 CYLINDER

### 1. REMOVAL AND INSTALL

#### 1) BUCKET CYLINDER

##### (1) Removal

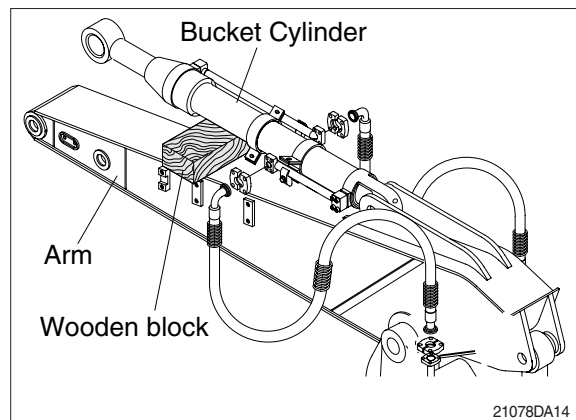
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

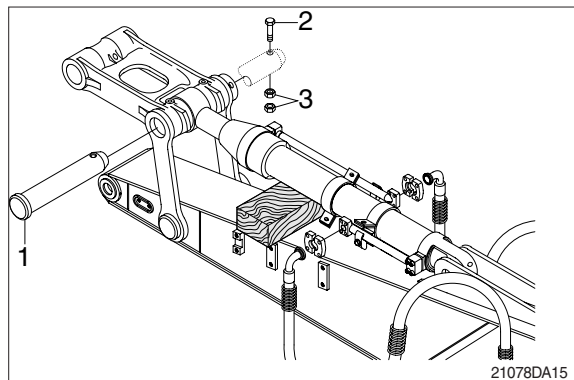
※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

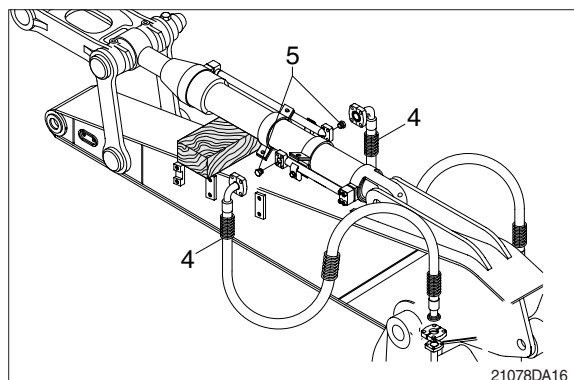


② Remove nuts (3), bolt (2) and pull out pin (1).

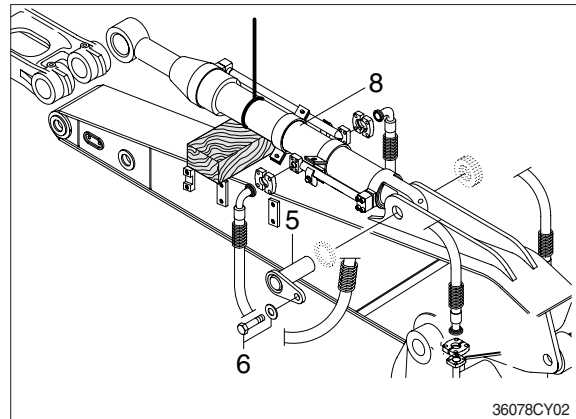
※ Tie the rod with wire to prevent it from coming out.



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



- ④ Sling bucket cylinder assembly, and remove bolt (6), plate (7) then pull out pin (5).
- ⑤ Remove bucket cylinder assembly (8).
  - Weight : 320 kg (710 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

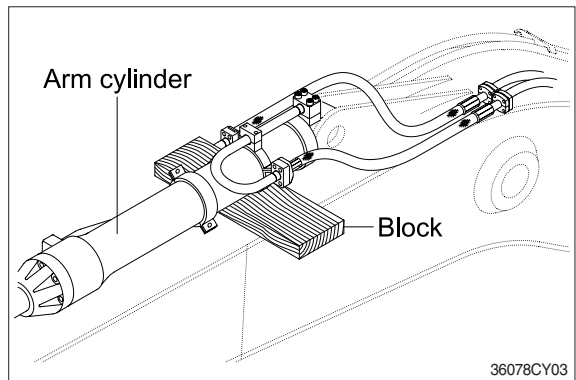
### (1) Removal

- ※ 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.

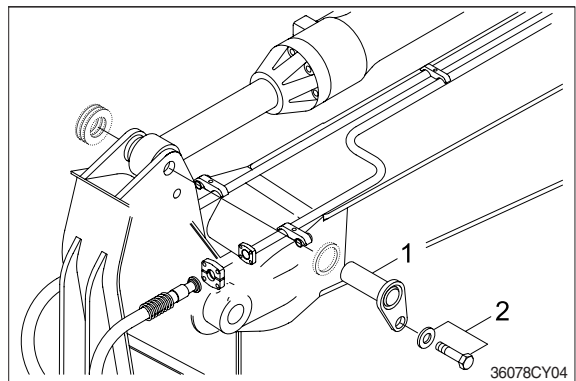
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between arm cylinder and boom.



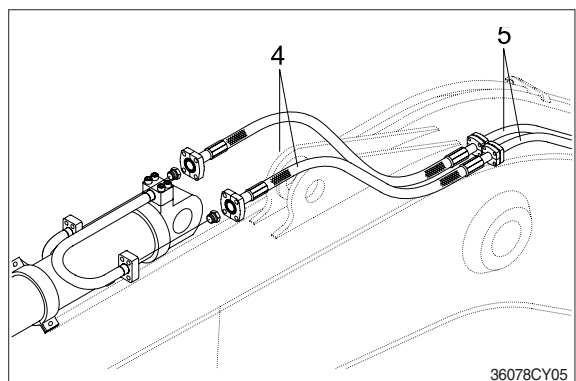
- ② Remove bolt (2) and pull out pin (1).

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



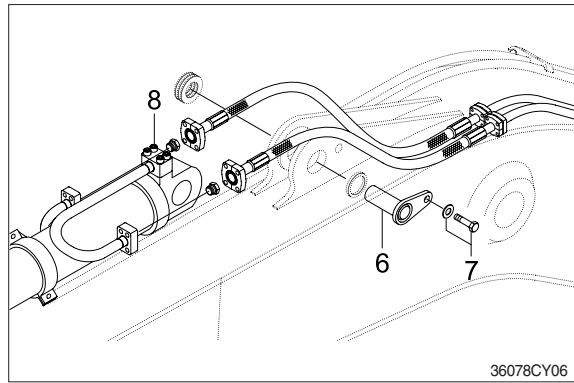
- ③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

- ④ Disconnect greasing pipings (5).





- ⑤ Sling arm assembly (9), and remove bolt (7), plate (8) then pull out pin (6).
- ⑥ Remove arm cylinder assembly (9).
  - Weight : 490 kg (1080 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

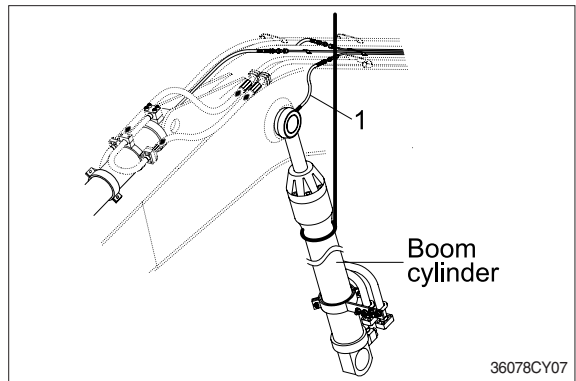
#### (1) Removal

- ※ 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.

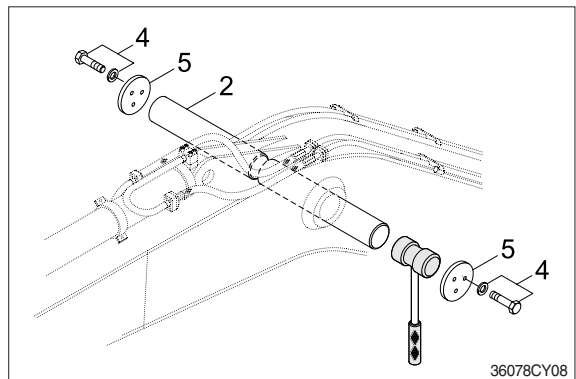
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.

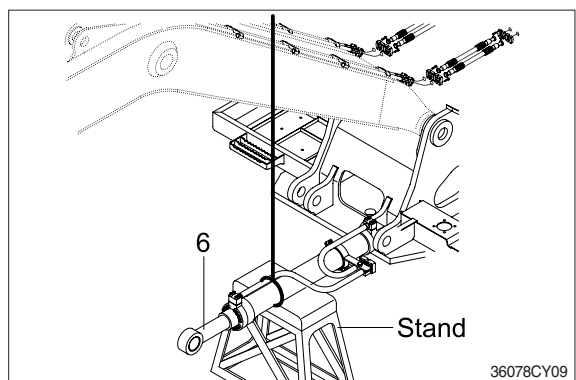


- ③ Remove bolt (4), stop plate (5) and pull out pin (2).

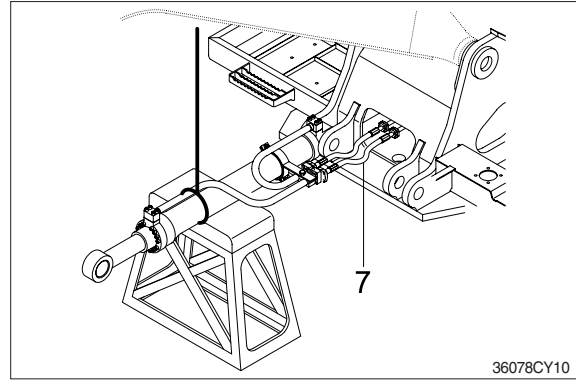
- ※ Tie the rod with wire to prevent it from coming out.



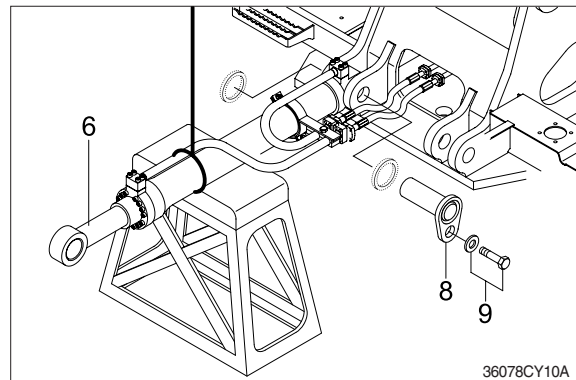
- ④ Lower the boom cylinder assembly (6) on a stand.



- 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 : 370 kg (820 lb)



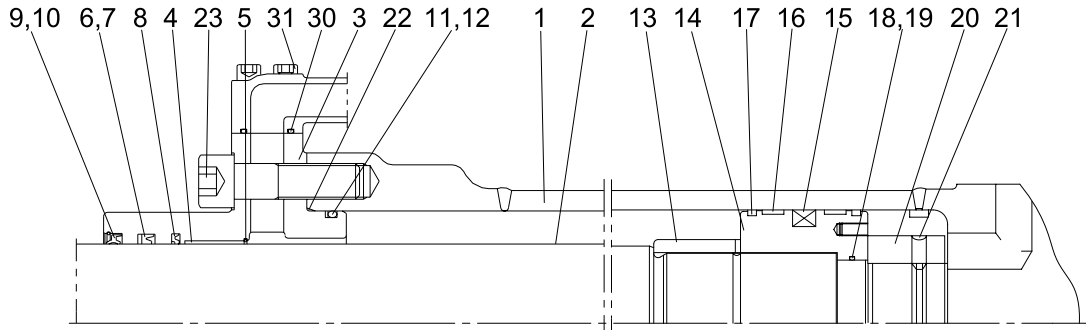
## (2) Install

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

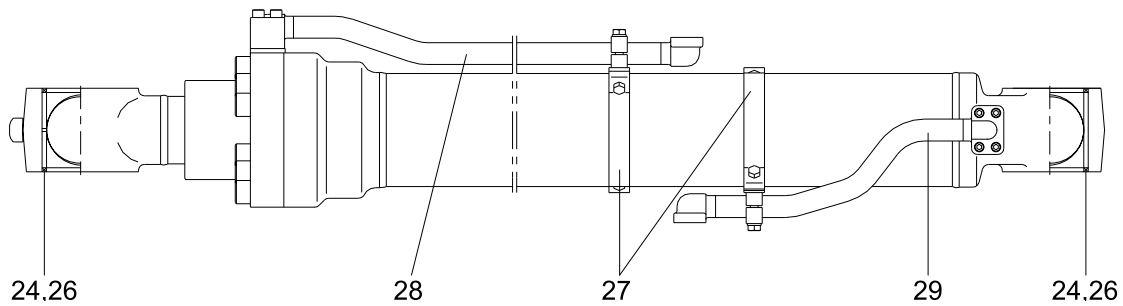
## 2. DISASSEMBLY AND ASSEMBLY

### 1) STRUCTURE

#### (1) Bucket cylinder



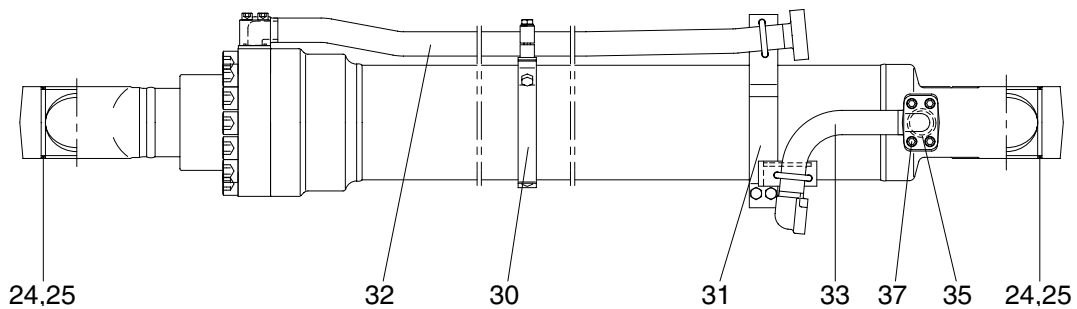
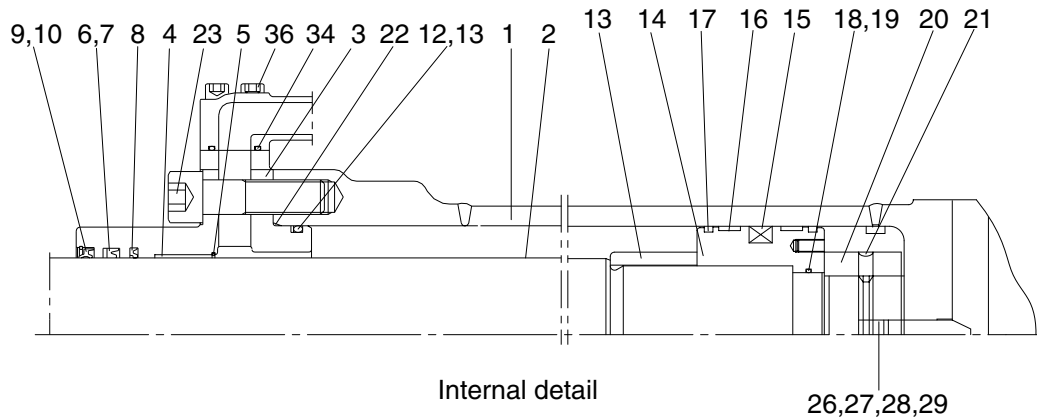
Internal detail



38098CY01A

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	Du bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly (R)
7	Back up ring	18	O-ring	29	Pipe assembly (B)
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket screw		
11	O-ring	22	O-ring		

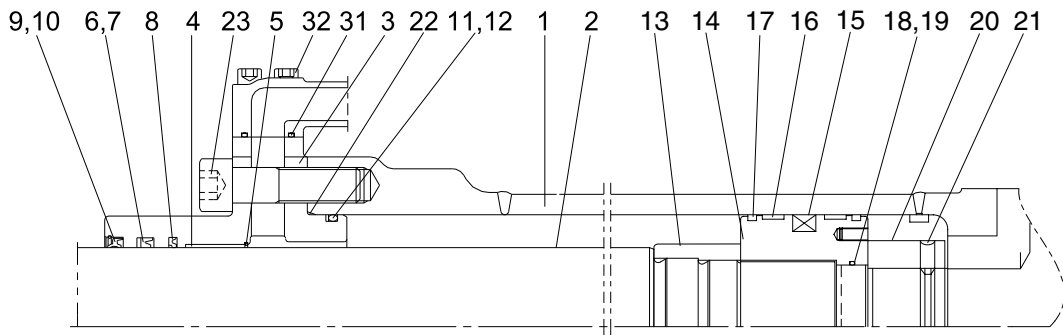
## (2) Arm cylinder



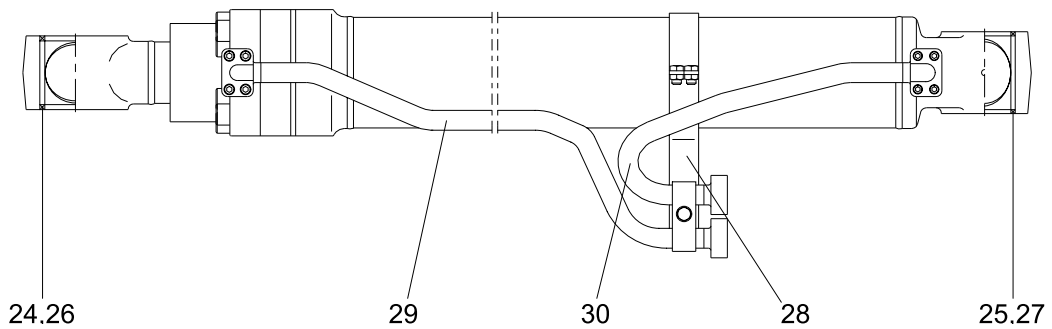
38098CY02

- |    |               |    |                          |    |                          |
|----|---------------|----|--------------------------|----|--------------------------|
| 1  | Tube assembly | 14 | Piston                   | 27 | Coil spring              |
| 2  | Rod assembly  | 15 | Piston seal              | 28 | O-ring                   |
| 3  | Gland         | 16 | Wear ring                | 29 | Plug                     |
| 4  | Du bushing    | 17 | Dust ring                | 30 | Band assembly (R)        |
| 5  | Snap ring     | 18 | O-ring                   | 31 | Band assembly (B)        |
| 6  | Rod seal      | 19 | Back up ring             | 32 | Pipe assembly (R)        |
| 7  | Back up ring  | 20 | Lock nut                 | 33 | Pipe assembly (B)        |
| 8  | Buffer ring   | 21 | Hexagon socket screw     | 34 | O-ring                   |
| 9  | Dust wiper    | 22 | O-ring                   | 35 | O-ring                   |
| 10 | Snap ring     | 23 | Hexagon socket head bolt | 36 | Hexagon socket head bolt |
| 11 | O-ring        | 24 | Pin bushing              | 37 | Hexagon socket head bolt |
| 12 | Back up ring  | 25 | Dust seal                |    |                          |
| 13 | Cushion ring  | 26 | Check valve              |    |                          |

### (3) Boom cylinder



Internal detail



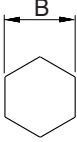
38098CY03

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing (R)
3	Gland	14	Piston	25	Pin bushing (B)
4	Du bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Dust seal
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Pipe assembly (R)
8	Buffer ring	19	Back up ring	30	Pipe assembly (B)
9	Dust wiper	20	Lock washer	31	O-ring
10	Snap ring	21	Hexagon socket screw	32	Hexagon socket head bolt
11	O-ring	22	O-ring		



## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Allen wrench	10	
	19	
Spanner	19	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

### (2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23	M20	46±5	333±36.1
	Boom cylinder	23	M22	63±6	456±43.4
	Arm cylinder	23	M22	63±6	456±43.4
Socket head bolt	Bucket cylinder	31	M12	9.4±1	68.0±7.2
	Boom cylinder	32	M12	9.4±1	68.0±7.2
	Arm cylinder	36	M12	9.4±1	68.0±7.2
		37	M12	9.4±1	68.0±7.2
Lock nut	Bucket cylinder	20	M76	100±10	723±72.3
	Boom cylinder	20	M80	150±15	1085±108
	Arm cylinder	20	M90	150±15	1085±108
Piston	Bucket cylinder	14	-	150±15	1085±109
	Boom cylinder	14	-	200±20	1447±145
	Arm cylinder	14	-	200±20	1447±145

### 3) DISASSEMBLY

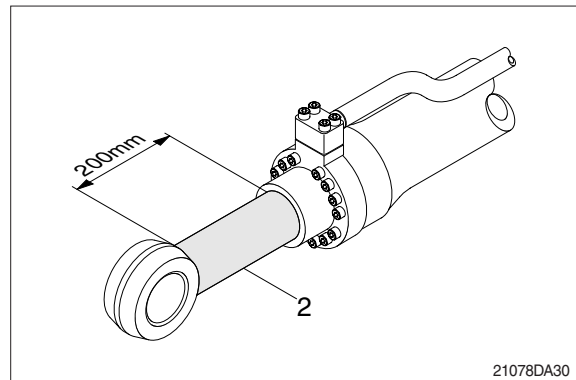
#### (1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

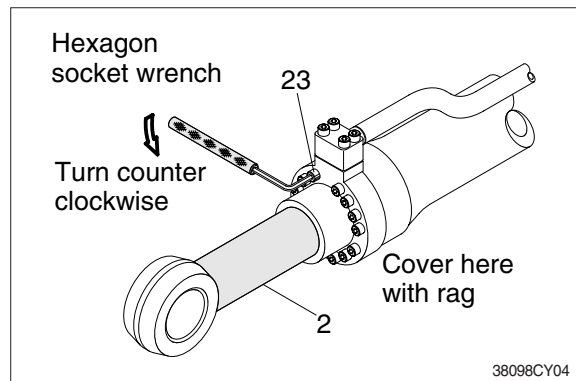
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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.



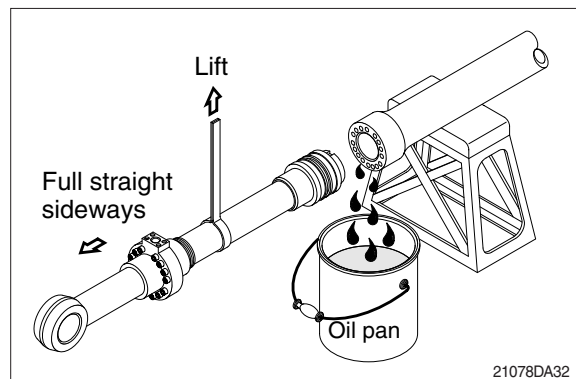
③ Loosen and remove socket bolts (23) of the gland in sequence.

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



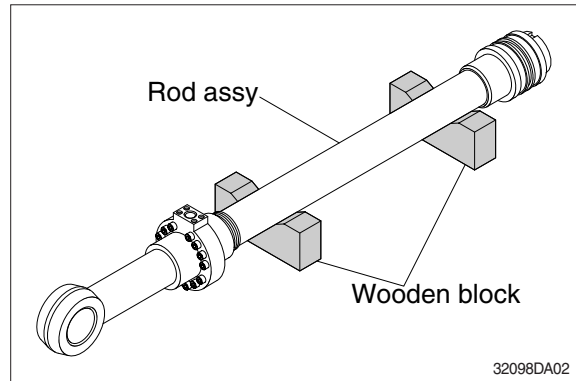
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



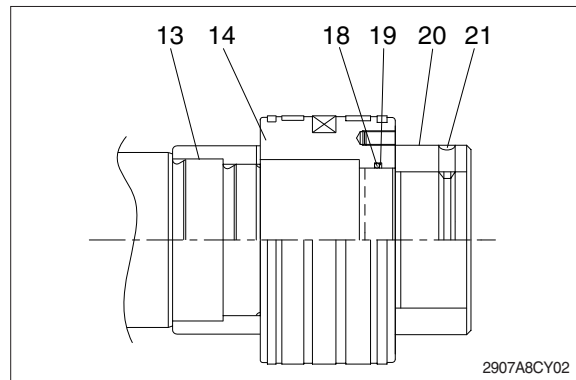
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

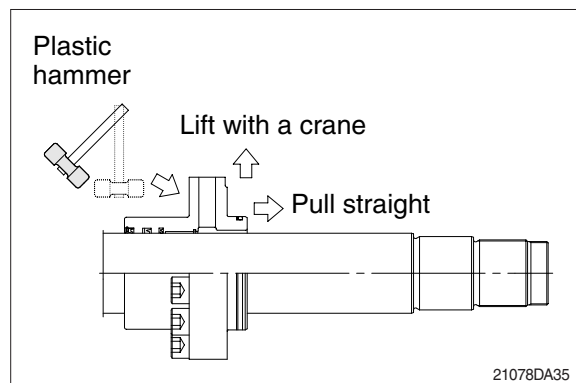


## (2) Remove piston and cylinder head

- ① Loosen socket set screw (21) and 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).

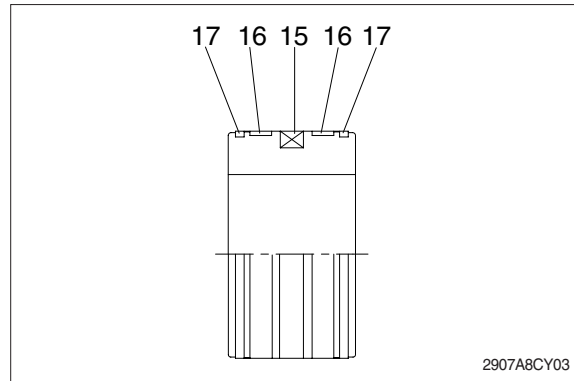


- ③ Remove the cylinder head assembly from rod assembly (2).
  - ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
  - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of rod bushing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



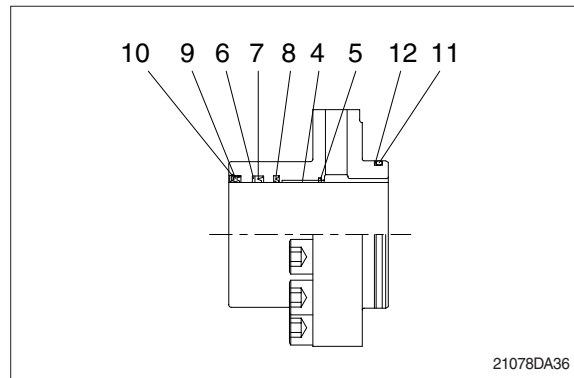
### (3) Disassemble the piston assembly

- 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), buffer ring (8) and snap ring (5).
- ※ 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).

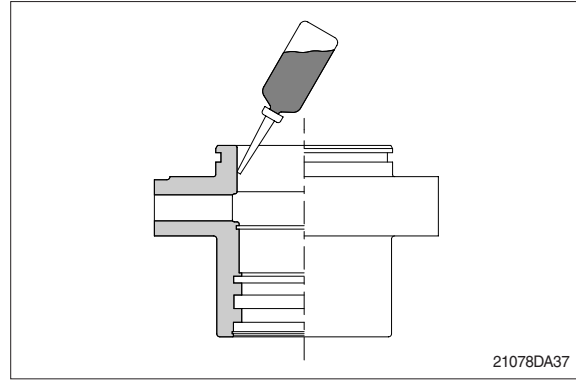


### 3) ASSEMBLY

#### (1) Assemble cylinder head assembly

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

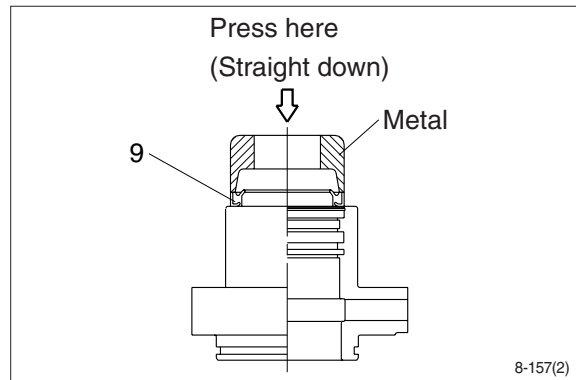
- ① Coat the inner face of gland (3) with hydraulic oil.



- 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.

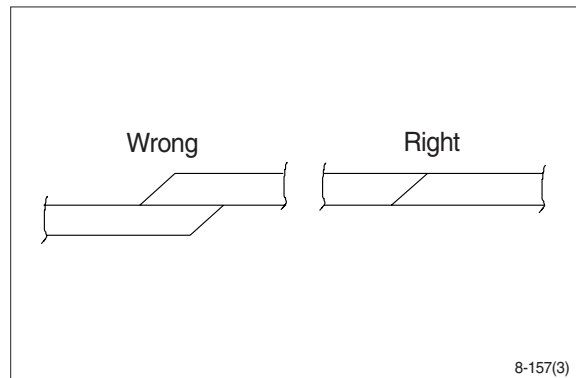
- ③ Fit snap ring (10) to the stop face.



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

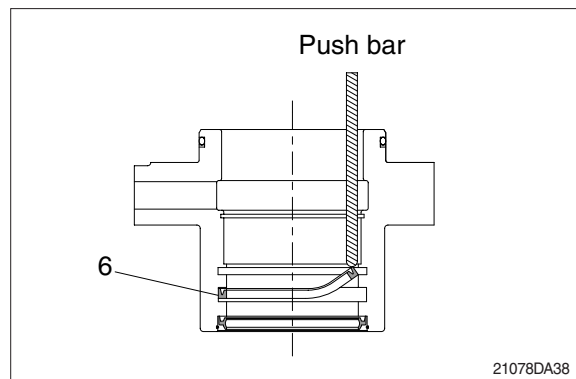
※ Coat each packing with hydraulic oil before fitting it.

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

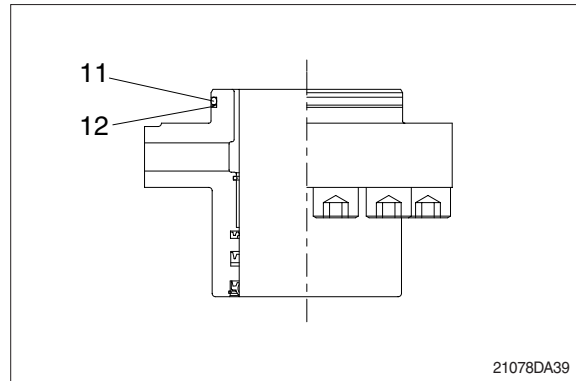


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

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

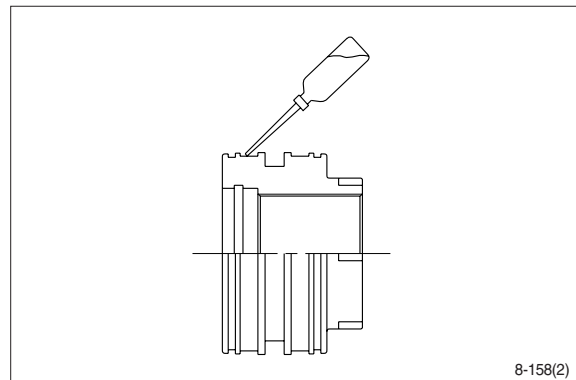


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) to gland (3).

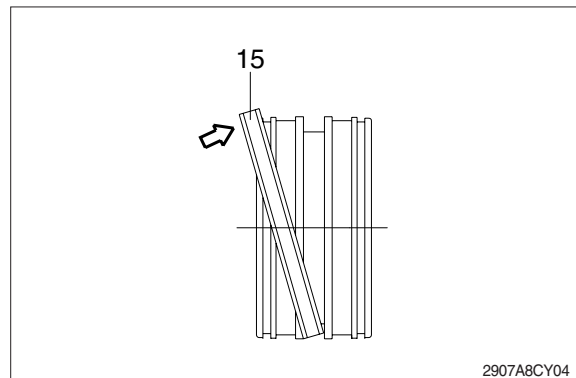


**(2) Assemble piston assembly**

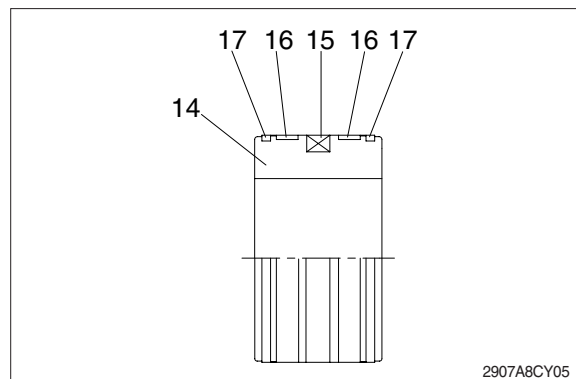
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- 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.



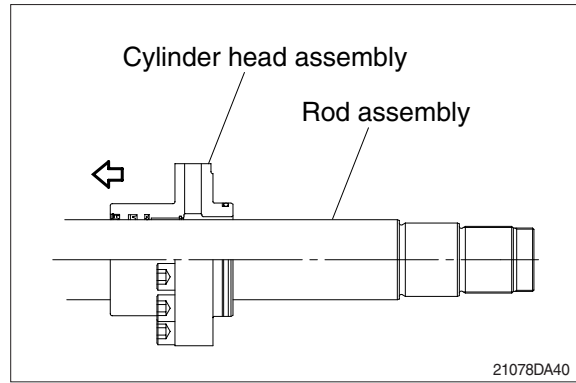
- ③ Fit wear ring (16) and dust ring (17) to piston (14).



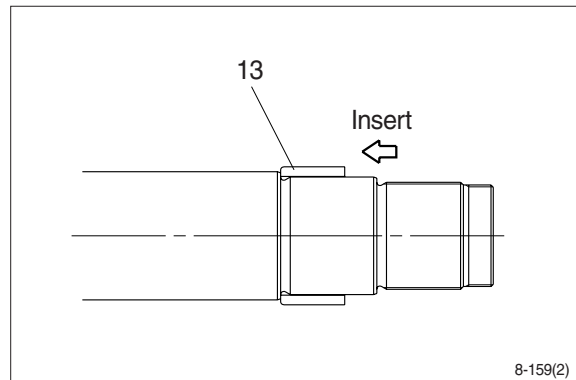


**(3) Install piston and cylinder head**

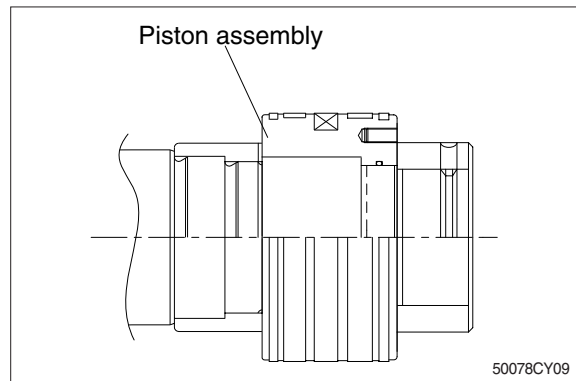
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.



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

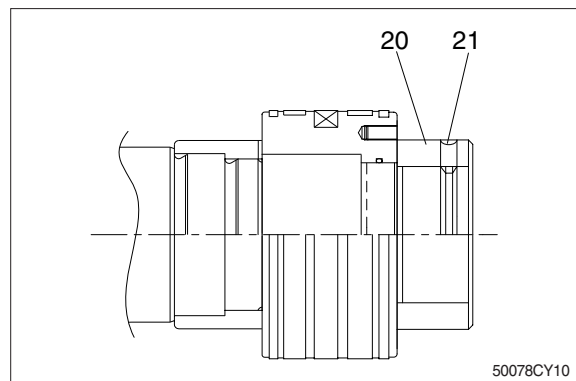


- ⑤ Fit piston assembly to rod assembly.
- Tightening torque :  $150 \pm 15 \text{ kgf} \cdot \text{m}$   
( $1085 \pm 108 \text{ lbf} \cdot \text{ft}$ )



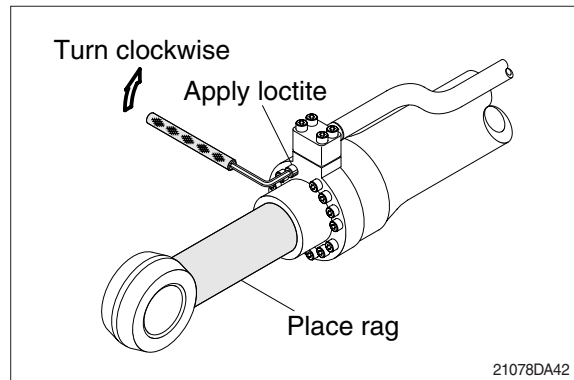
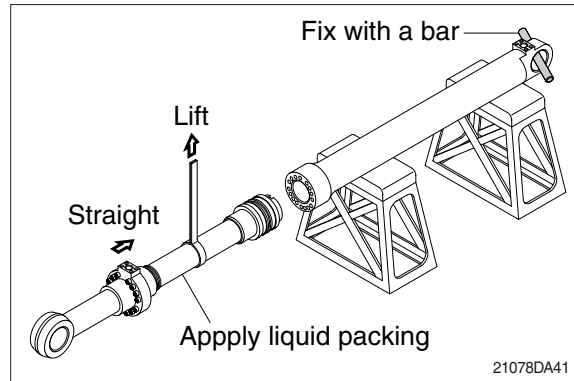
- ⑥ Fit lock nut (20) and tighten the set screw (21).
- Tightening torque :

Item		kgf · m	lbf · ft
Bucket	20	$100 \pm 10$	$723 \pm 72.3$
	21	$5.4 \pm 0.5$	$391 \pm 3.6$
Boom Arm	21	$150 \pm 15$	$1085 \pm 108$
	22	$5.4 \pm 0.5$	$39.1 \pm 3.6$



### (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.

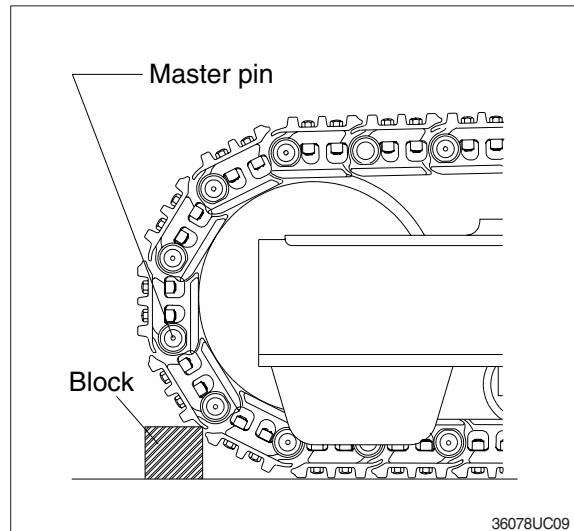


## GROUP 10 UNDERCARRIAGE

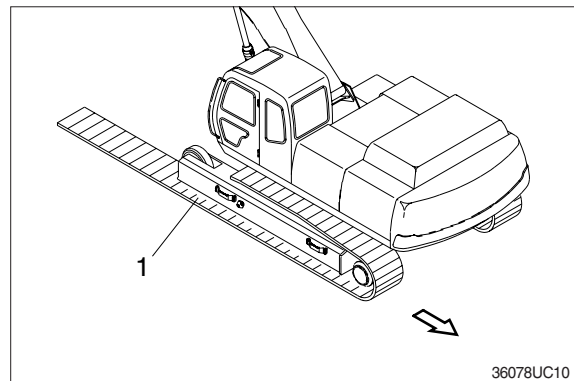
### 1. TRACK LINK

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

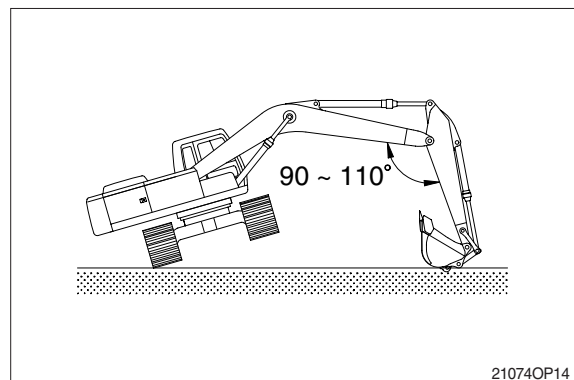


- (4) Move the machine slowly in reverse, and lay out track link assembly (1).
  - ※ Jack up the machine and put wooden block under the machine.
  - ※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



#### 2) INSTALL

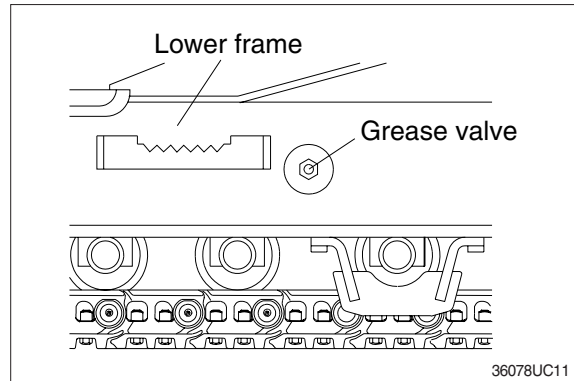
- (1) Carry out installation in the reverse order to removal.
  - ※ Adjust the tension of the track link.



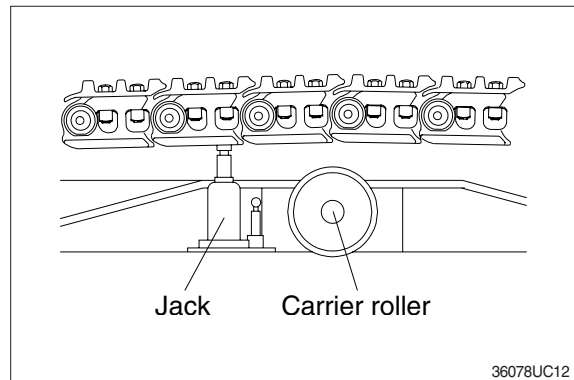
## 2. CARRIER ROLLER

### 1) REMOVAL

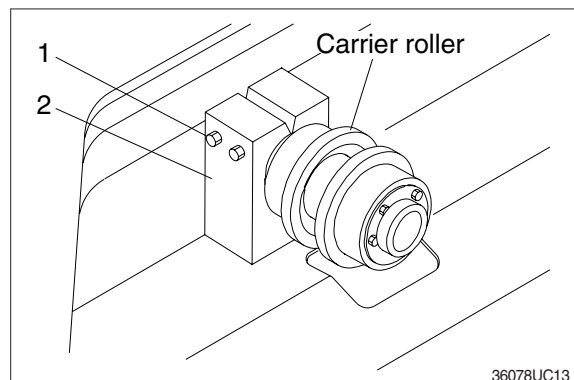
- (1) Loosen tension of the track link.



- (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 : 40 kg (88 lb)



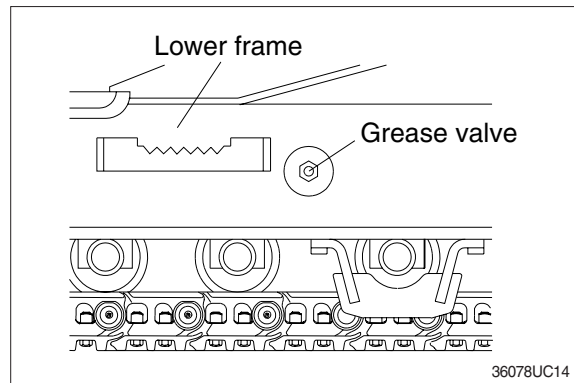
### 2) INSTALL

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

### 3. TRACK ROLLER

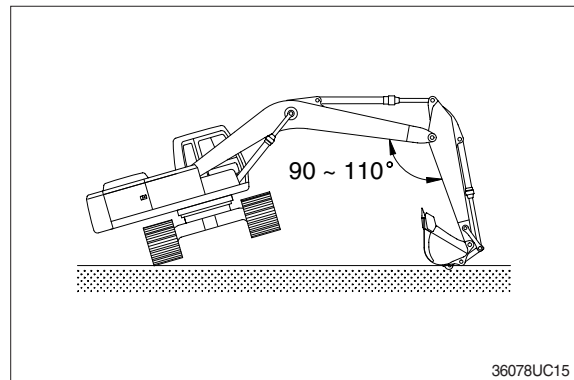
#### 1) REMOVAL

- (1) Loosen tension of the track link.



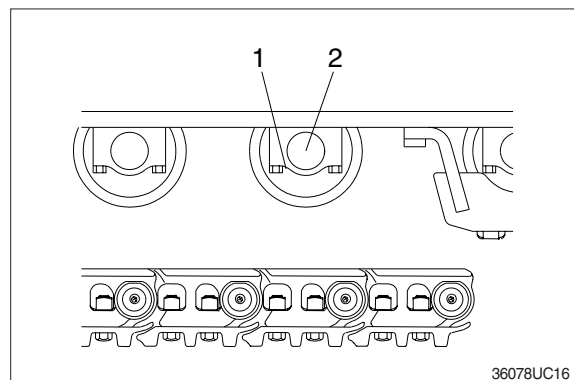
- (2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



- (3) Remove the mounting bolts (1) and draw out the track roller (2).

· Weight : 80 kg (176.4 lb)



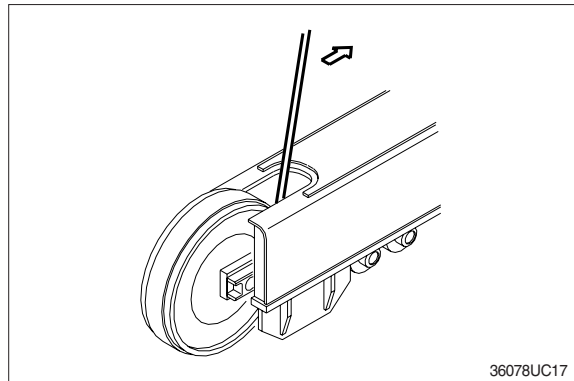
#### 2) INSTALL

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

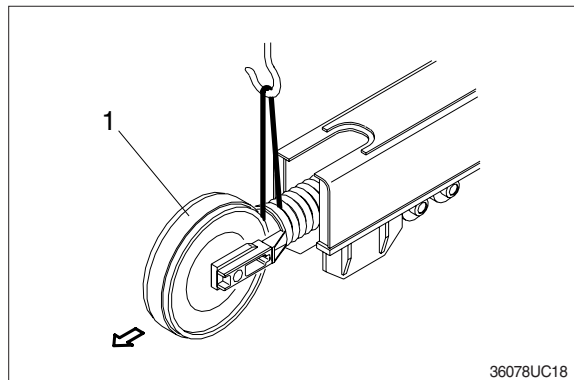
## 4. IDLER AND RECOIL SPRING

### 1) REMOVAL

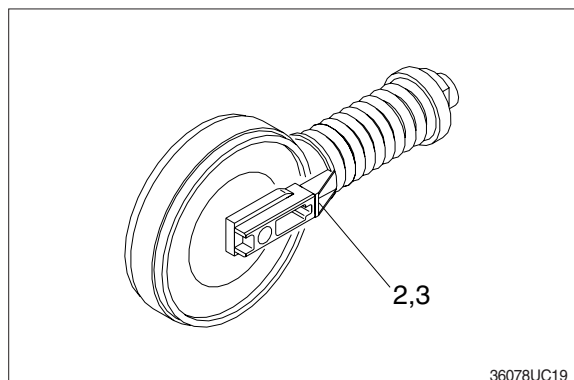
- (1) Remove the track link.  
For detail, see removal of track link.



- (2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.  
· Weight : 420 kg (930 lb)

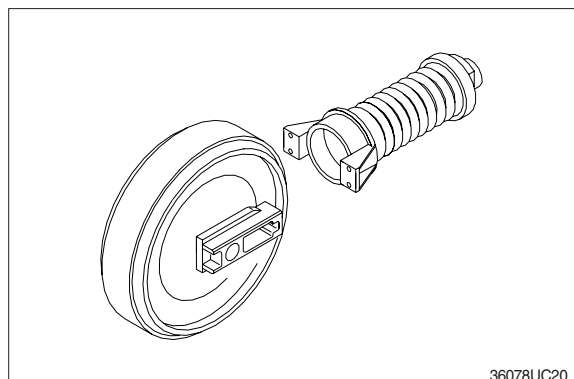


- (3) Remove the bolts (2), washers (3) and separate idler from recoil spring.



### 2) INSTALL

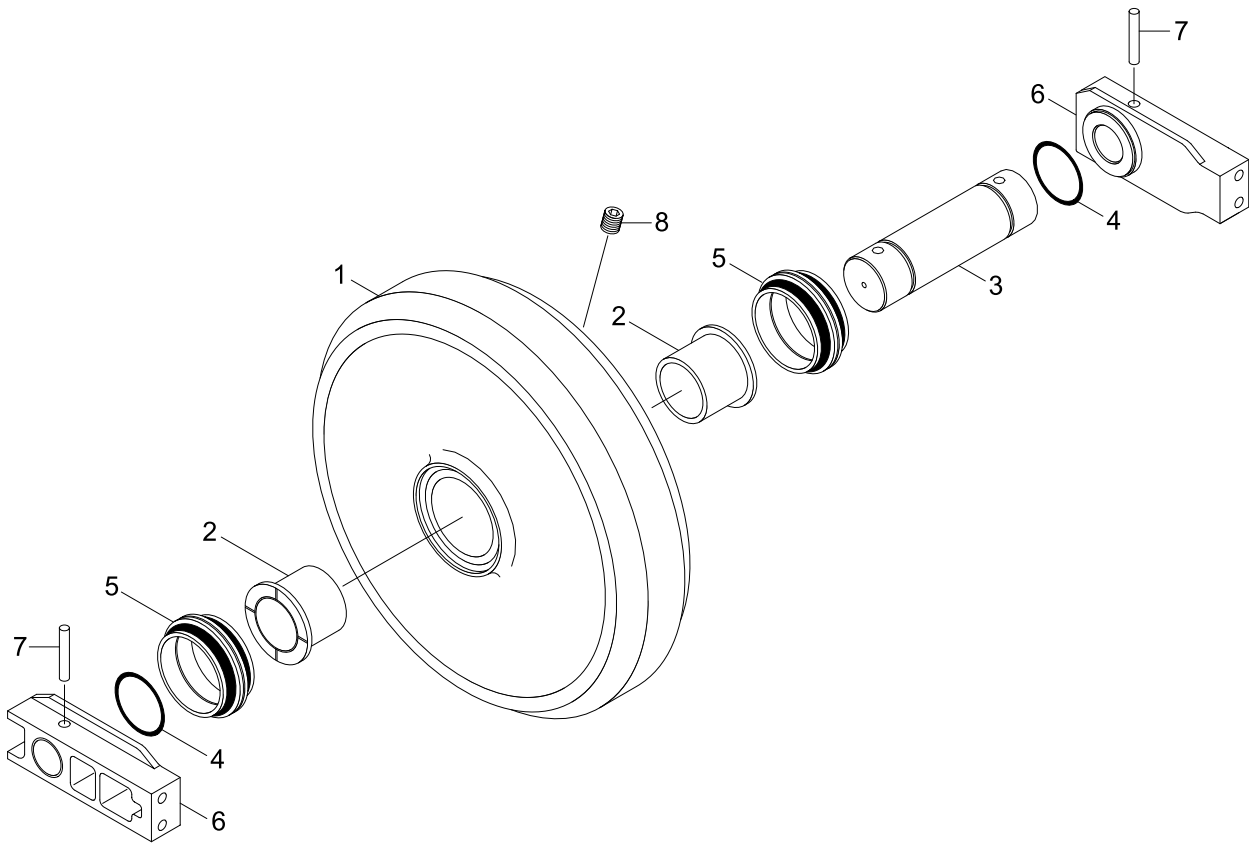
- (1) Carry out installation in the reverse order to removal.
- ※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.





3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

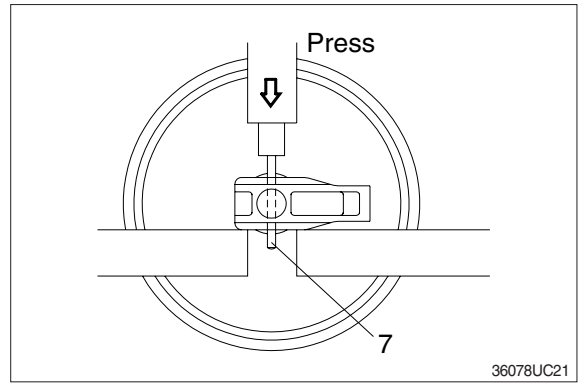


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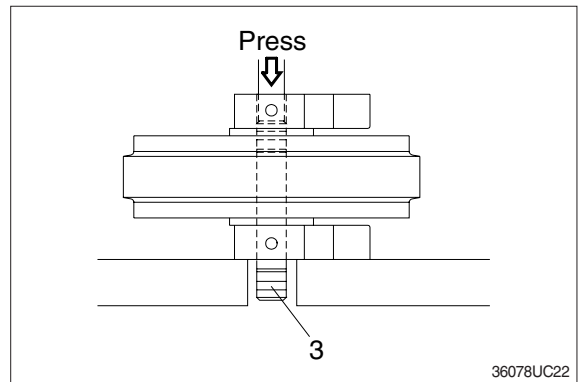
- |   |         |   |               |   |            |
|---|---------|---|---------------|---|------------|
| 1 | Shell   | 4 | O-ring        | 7 | Spring pin |
| 2 | Bushing | 5 | Seal assembly | 8 | Plug       |
| 3 | Shaft   | 6 | Bracket       |   |            |

## (2) Disassembly

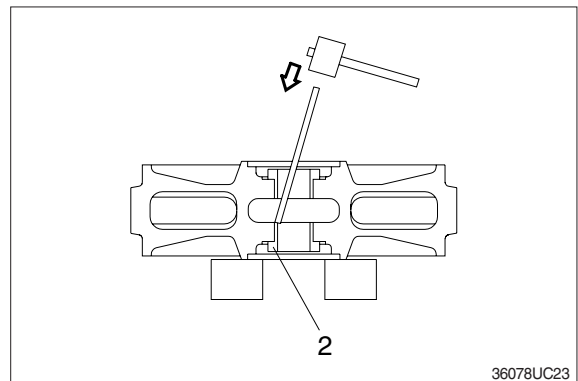
- ① Remove plug and drain oil.
- ② Draw out the spring pin (7), using a press.



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



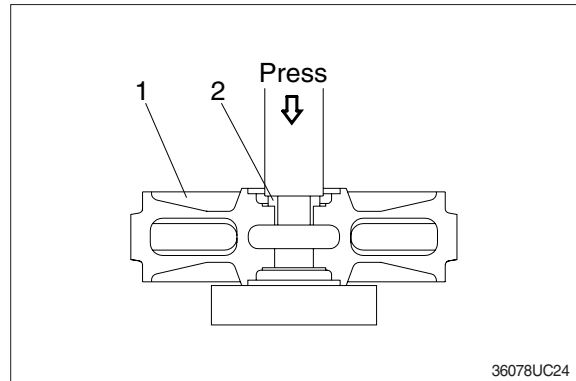
- ⑥ Remove the bushing (2) from shell, using a special tool.
- ※ Only remove bushing if replacement is necessary.



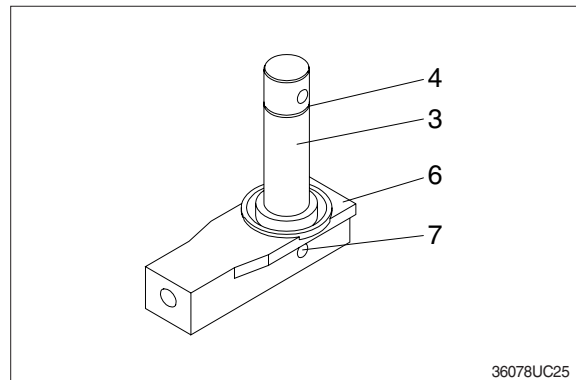
### (3) Assembly

- \* Before assembly, clean the parts.
- \* Coat the sliding surfaces of all parts with oil.

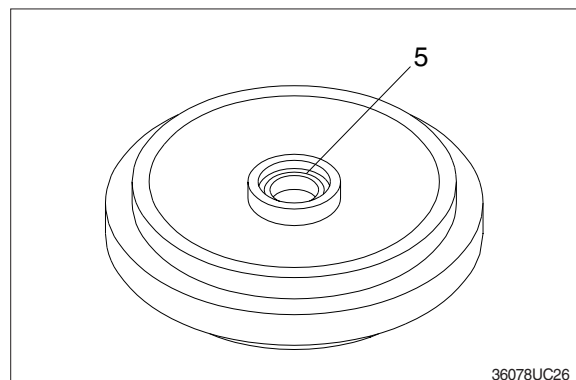
- ① Cool up bushing (2) fully by some dry ice and press it into shell (1).  
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



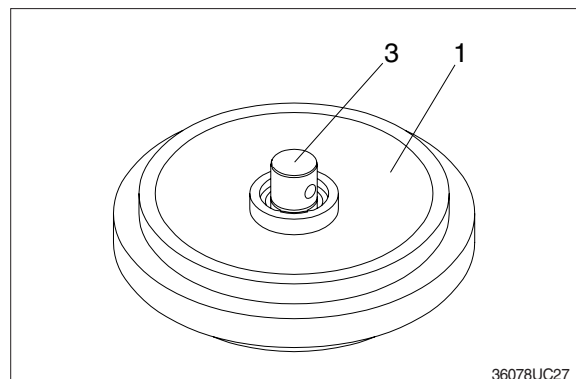
- ② Coat O-ring (4) with grease thinly, and install it to shaft (3).
- ③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



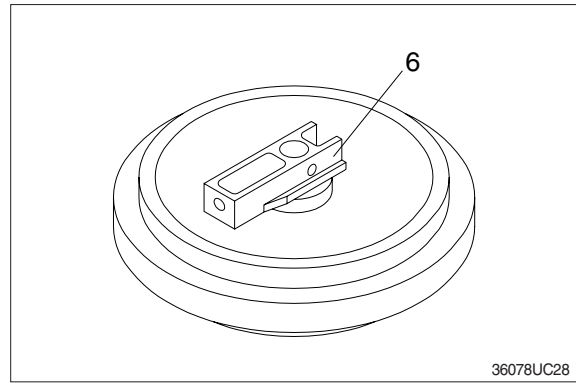
- ④ Install seal (5) to shell (1) and bracket (6).



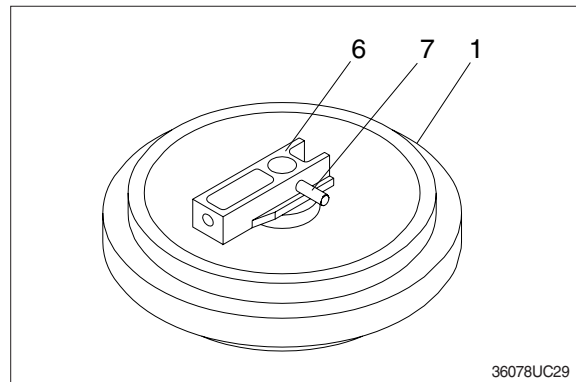
- ⑤ Install shaft (3) to shell (1).



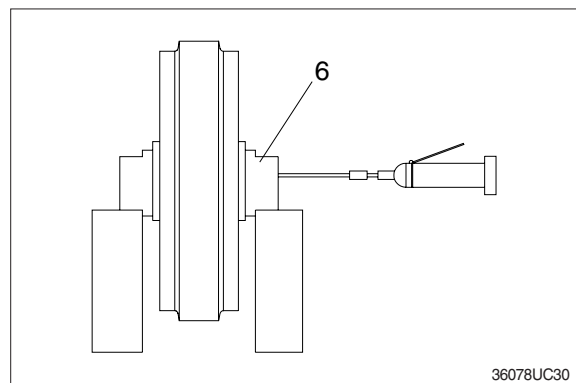
- ⑥ Install bracket (6) attached with seal (5).



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

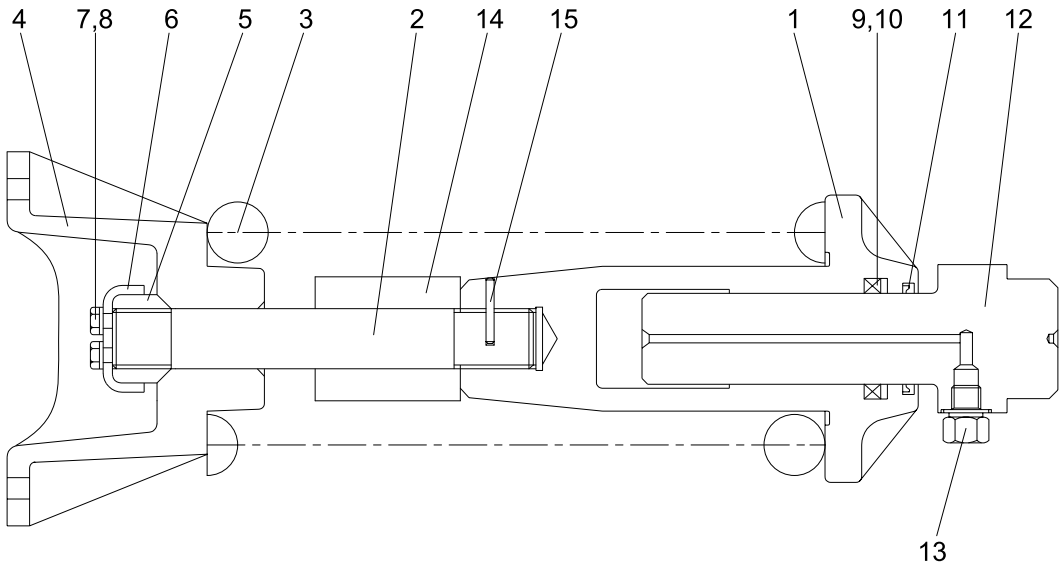


- ⑧ Lay bracket (6) on its side.  
Supply engine oil to the specified level,  
and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



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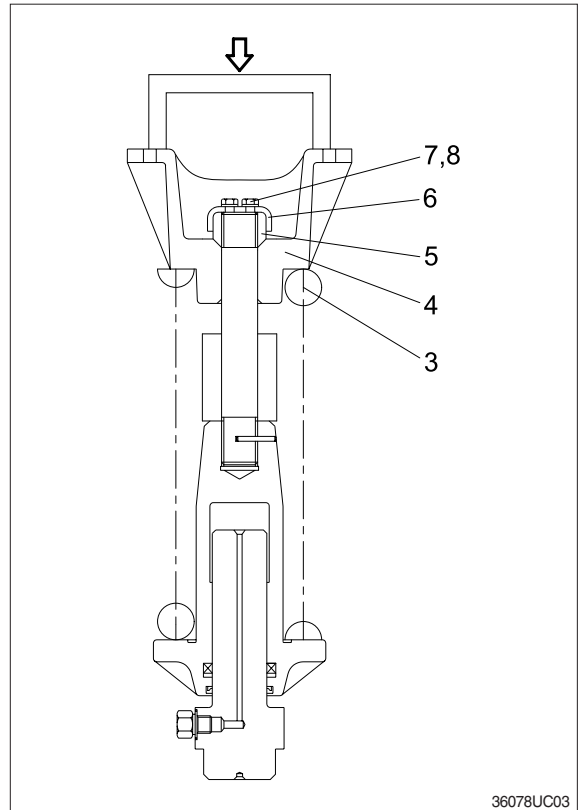
- |   |          |    |               |    |              |
|---|----------|----|---------------|----|--------------|
| 1 | Body     | 6  | Lock plate    | 11 | Dust seal    |
| 2 | Tie bar  | 7  | Hexagon bolt  | 12 | Rod          |
| 3 | Spring   | 8  | Spring washer | 13 | Grease valve |
| 4 | Bracket  | 9  | Rod packing   | 14 | Tube stopper |
| 5 | Lock nut | 10 | Back up ring  | 15 | Spring pin   |

## (2) Disassembly

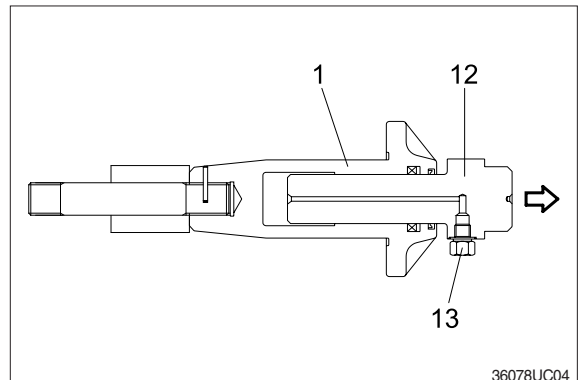
- ① Apply pressure on spring (3) with a press.
  - ※ The spring is under a large installed load. This is dangerous, so be sure to set properly.
  - Spring set load :  $21100 \pm 1688$  kg  
( $46517 \pm 3721$  lb)

- ② Remove bolt (7), spring washer (8) and lock plate (6).
- ③ Remove lock nut (5).

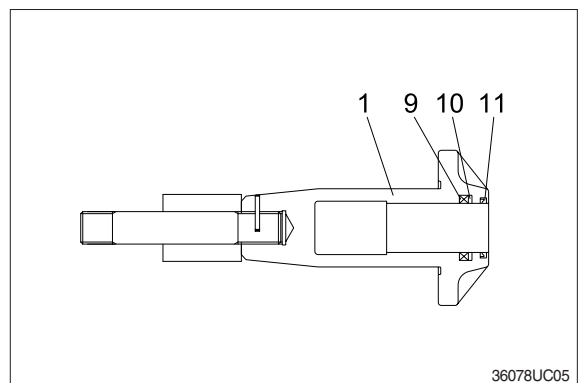
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.
- ④ Lighten the press load slowly and remove bracket (4) and spring (3).



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



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

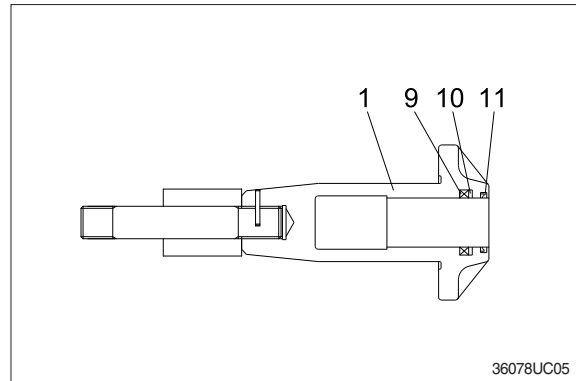




### (3) Assembly

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

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



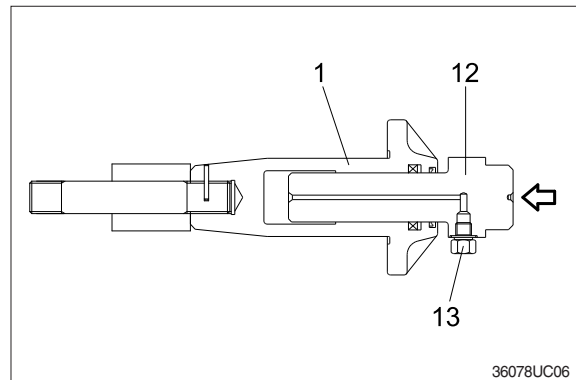
② Pour grease into body (1), then push in rod (12) by hand.

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 :  $13 \pm 1.0$  kgf·m  
( $94 \pm 7.2$  lbf·ft)

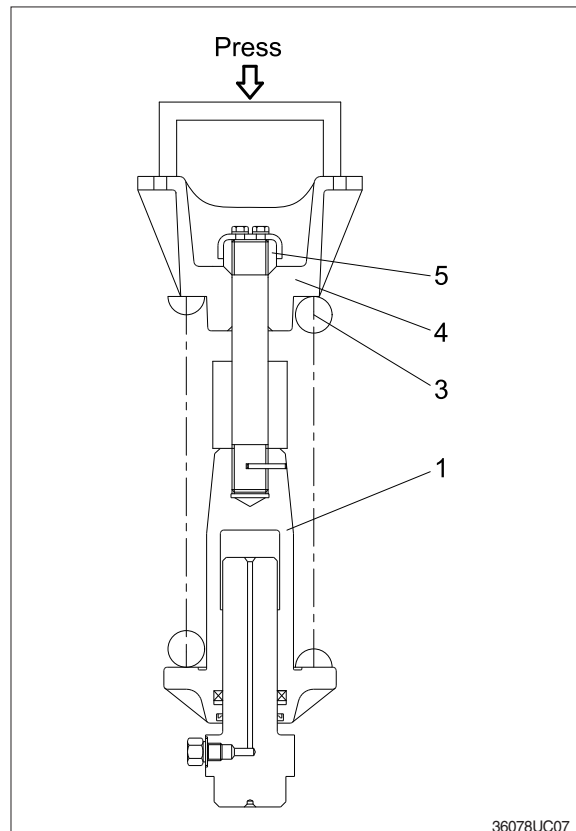


④ Install spring (3) and bracket (4) to body (1).

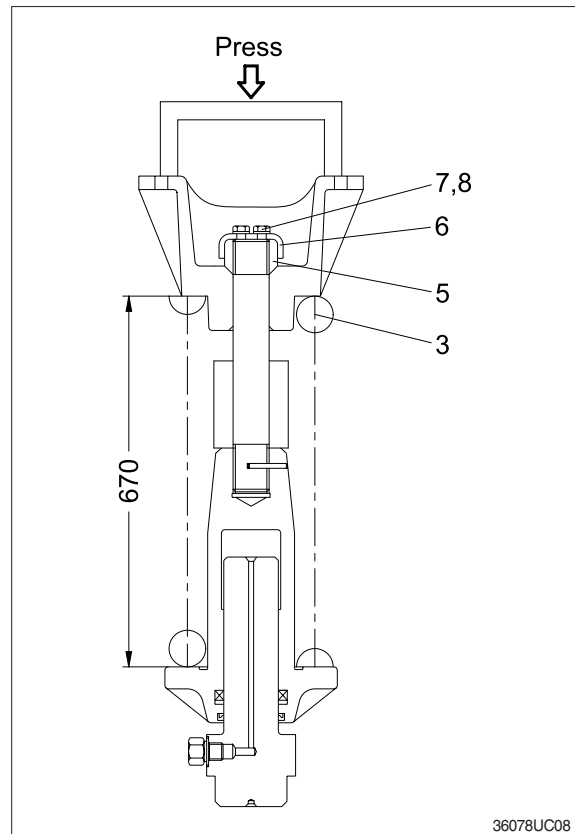
⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).

※ Apply sealant before assembling.

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



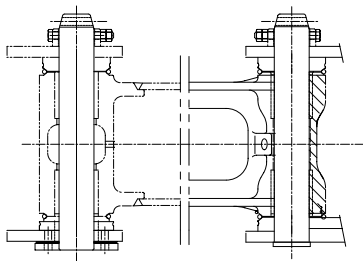
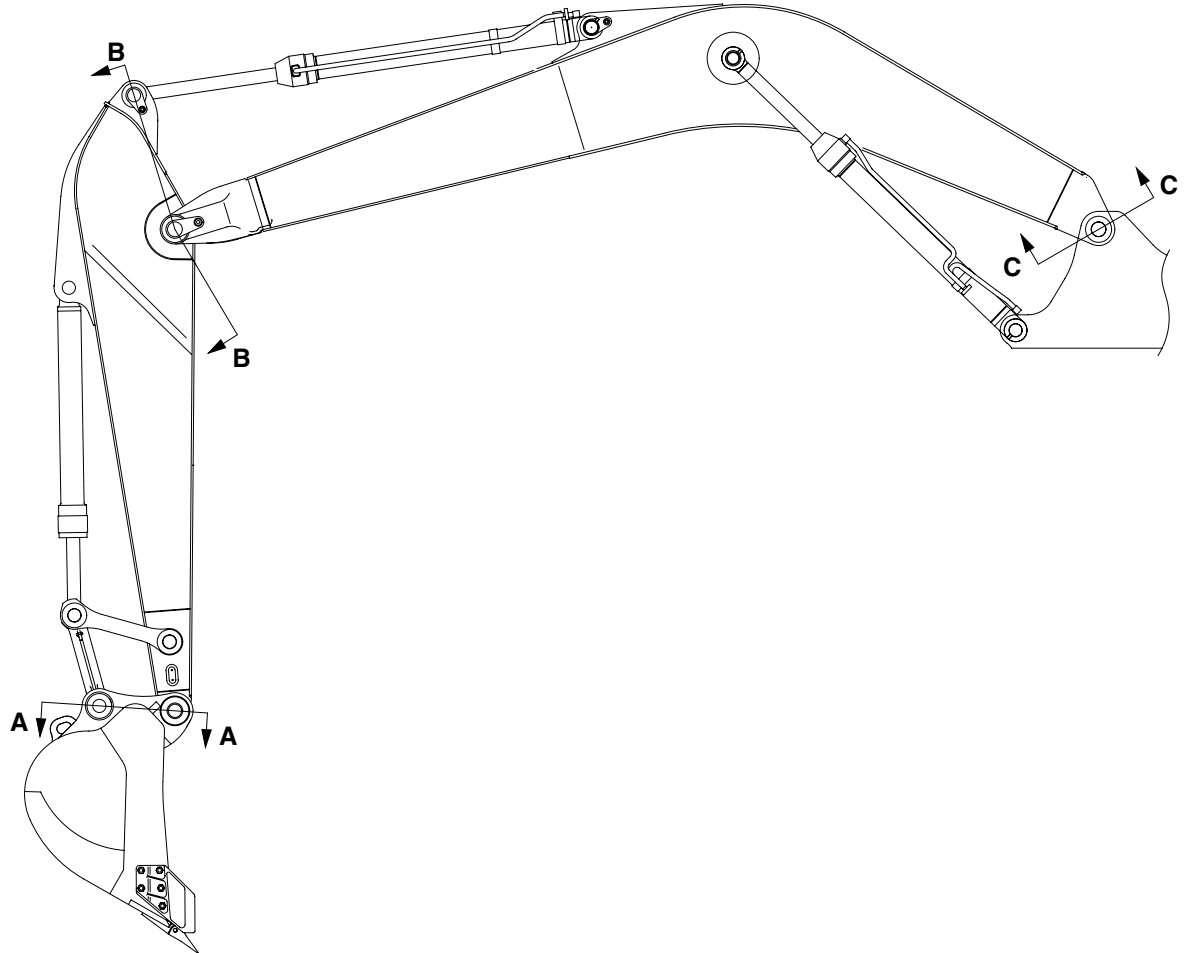
- ⑥ Lighten the press load and confirm the set length of spring (3).
- ⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).



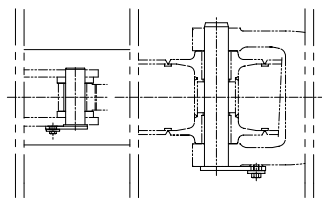
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# GROUP 11 WORK EQUIPMENT

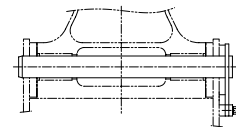
## 1. STRUCTURE



SECTION



SECTION



SECTION C

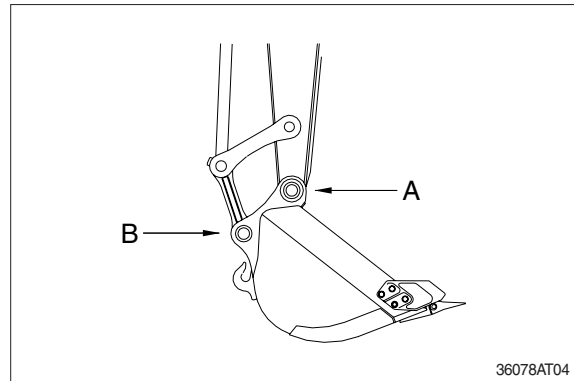
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## 2. REMOVAL AND INSTALL

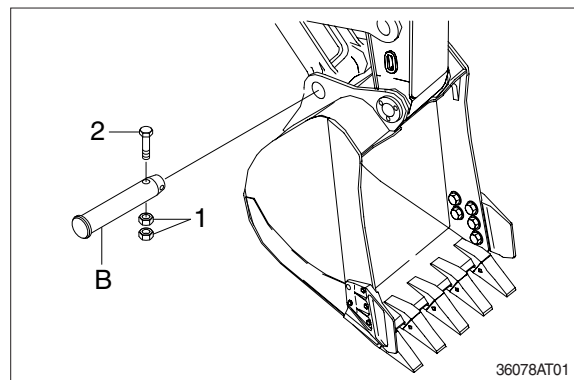
### 1) BUCKET ASSEMBLY

#### (1) Removal

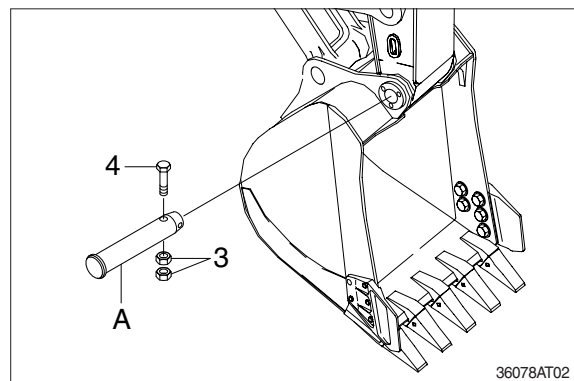
- ① Lower the work equipment completely to ground with back of bucket facing down.



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



- ③ Remove nuts (3), bolt (4) and draw out the pin (A).

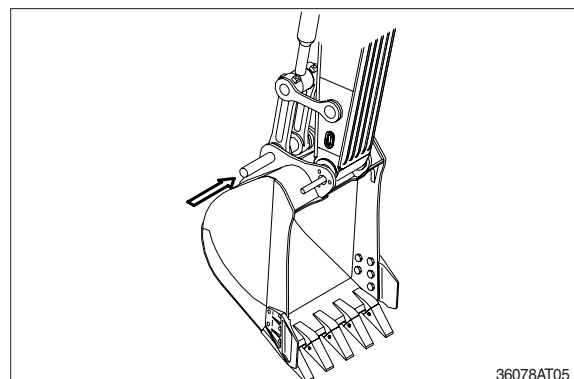


#### (2) Install

- 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 **operator's 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.

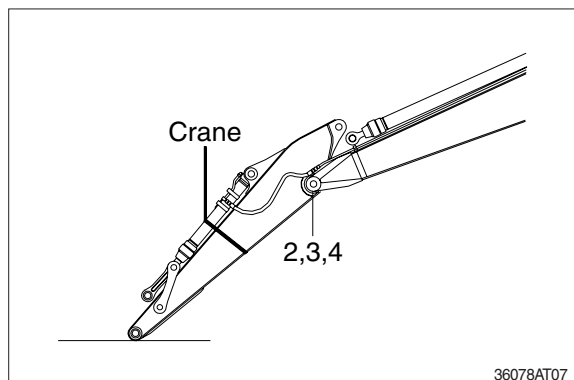
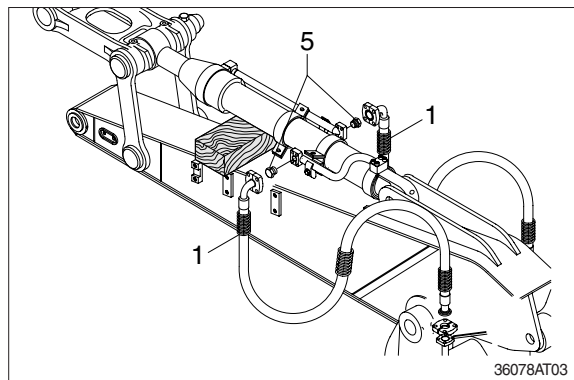
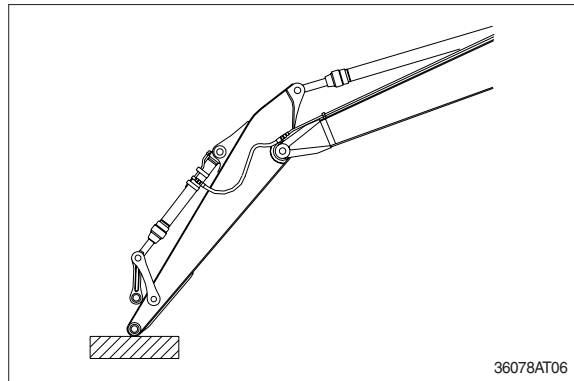
※ Tie the rod with wire to prevent it from coming out.

For details, see removal of arm cylinder assembly.

④ 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 : 1243 kg(2740 lb)

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



### (2) Install

① Carry out installation in the reverse order to removal.

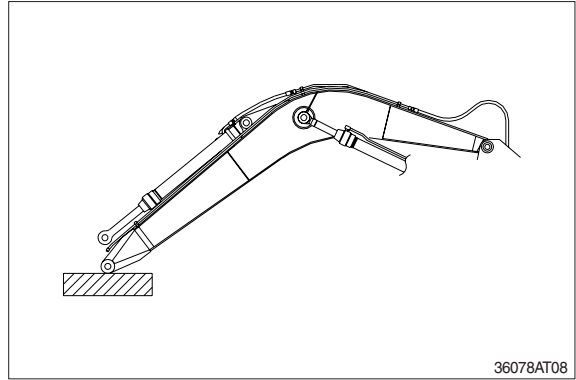
**▲ When lifting the arm assembly, always lift the center of gravity.**

※ Bleed the air from the cylinder.

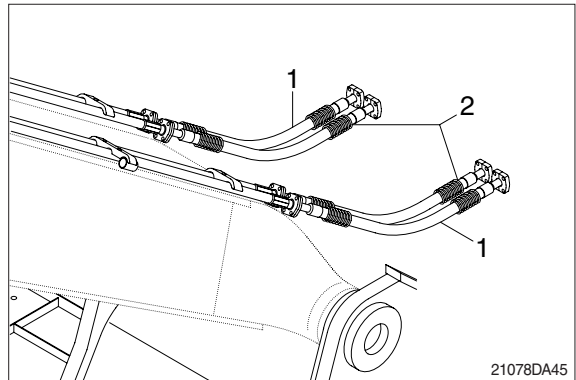
### 3) BOOM ASSEMBLY

#### (1) Removal

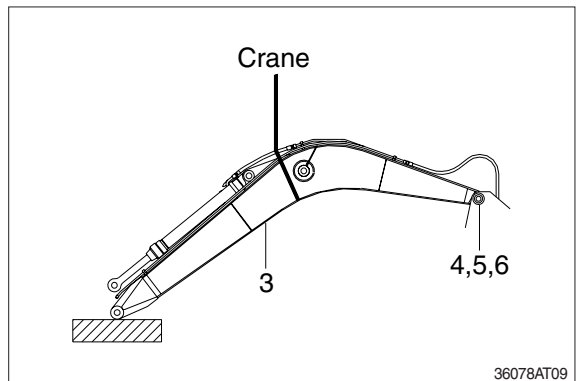
- ① Remove arm and bucket assembly.
- ② For details, see removal of arm and bucket assembly.  
Remove boom cylinder assembly from boom.  
For details, see removal of arm cylinder assembly.



- ③ Disconnect head lamp wiring.
  - ④ Disconnect bucket cylinder hoses (2) and arm cylinder hoses (1).
- ※ When the hoses 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 : 2600 kg (5730 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.

