

## SECTION 8 DISASSEMBLY AND ASSEMBLY

Group 1 Precaution .....	8-1
Group 2 Tightening Torque .....	8-4
Group 3 Pump Device .....	8-7
Group 4 Main Control Valve .....	8-30
Group 5 Swing Device .....	8-54
Group 6 Travel Device .....	8-78
Group 7 RCV Lever .....	8-111
Group 8 Turning Joint .....	8-125
Group 9 Boom, Arm and Bucket Cylinder .....	8-130
Group 10 Undercarriage .....	8-147
Group 11 Work Equipment .....	8-159

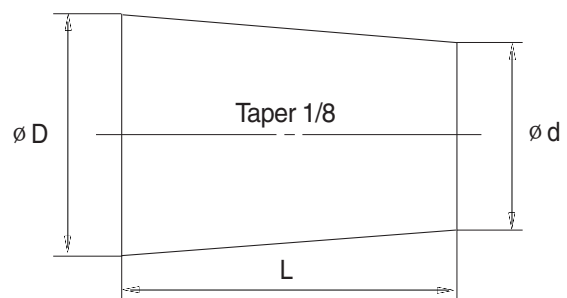
# SECTION 8 DISASSEMBLY AND ASSEMBLY

## 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.
    - ※ 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, nut	M24 × 3.0	90 ± 7.0	651 ± 51
2		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
3		Coupling mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1
4		Main pump housing mounting bolt	M10 × 1.5	5.3 ± 0.5	38.3 ± 3.6
5	Hydraulic system	Main pump mounting socket bolt	M20 × 2.5	42 ± 4.5	304 ± 32.5
6		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.9 ± 9.4
7		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
8		Hydraulic oil tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	88.9 ± 9.4
10	Power train system	Swing motor mounting bolt	M20 × 2.5	58.4 ± 6.4	422 ± 46.2
11		Swing bearing upper part mounting bolt	M24 × 3.0	97.8 ± 10	707 ± 72.3
12		Swing bearing lower part mounting bolt	M24 × 3.0	97.8 ± 10	707 ± 72.3
13		Travel motor mounting bolt	M24 × 3.0	84 ± 8.0	607 ± 58
14		Sprocket mounting bolt	M20 × 2.5	57 ± 6.0	412 ± 43.4
15	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 4.4	215 ± 31.8
16		Track roller mounting bolt	M20 × 2.5	57.9 ± 8.6	419 ± 62.2
17		Track tension cylinder mounting bolt	M12 × 1.25	15 ± 5.0	108 ± 3.6
18		Track shoe mounting bolt, nut	M22 × 1.5	115 ± 5.0	831 ± 36
19		Track guard mounting bolt	M20 × 2.5	46 ± 5.0	333 ± 36
20	Others	Counterweight mounting bolt	M36 × 3.0	308 ± 46	2228 ± 333
21		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
22		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

## 2. TORQUE CHART

Use following table for unspecified torque.

### 1) BOLT AND NUT

#### (1) Coarse thread

Bolt size	8T		10T	
	kgf·m	lbf-ft	kgf-m	lbf-ft
M 6×1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10×1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60.0
M12×1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14×2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16×2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18×2.0	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20×2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22×2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24×3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30×3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36×4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

#### (2) Fine thread

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

## 2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf-m	lbf-ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

## 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
1-7/16-12	41	21	152
1-11/16-12	50	35	253

## 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
1"	41	21	152
1-1/4"	50	35	253

## GROUP 3 PUMP DEVICE

### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

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

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

- (4) Remove the wirings for the pressure sensors and so on.
- (5) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.
  - Hydraulic tank quantity : 190 l
- (6) Remove bolts (13) and disconnect pipe (1,2).

- (7) Disconnect pilot line hoses (4, 5, 6, 7, 8, 9, 10).

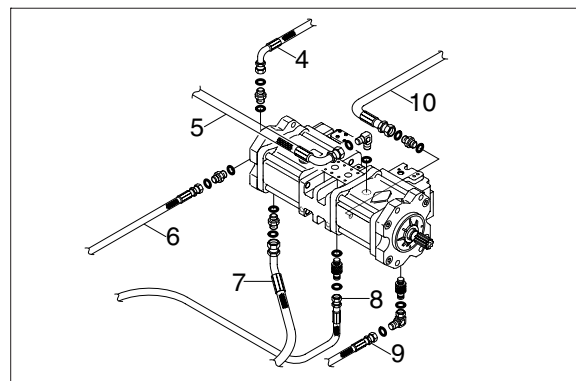
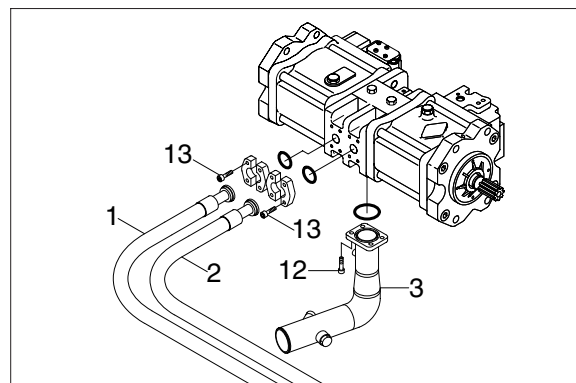
- (8) Remove bolts(12) and disconnect pump suction tube (3).

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

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

· Weight : 200 kg (440 lb)

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

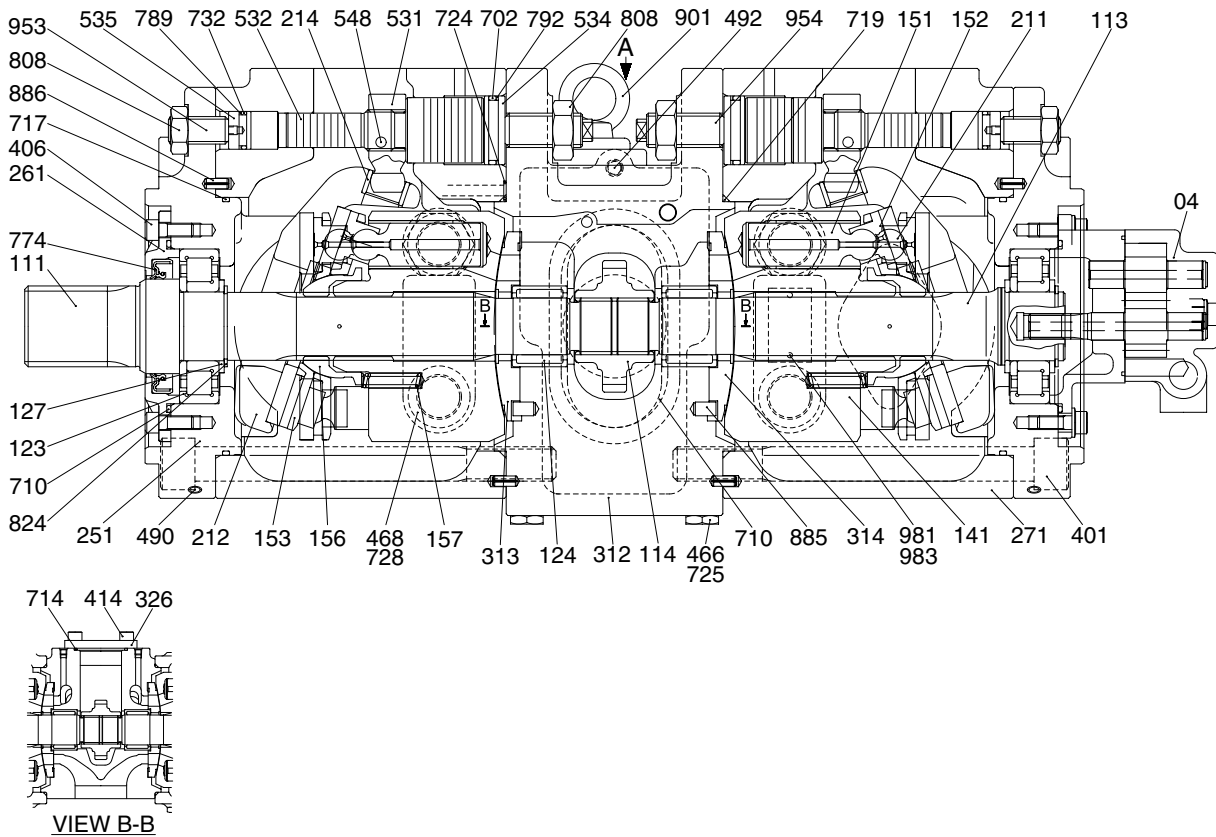


## 2) INSTALL

- (1) Carry out installation in the reverse order to removal
- (2) Remove the suction strainer and clean it.
- (3) Replace the return filter with a 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) Confirmed the hydraulic oil level and check the hydraulic oil leaks or not.

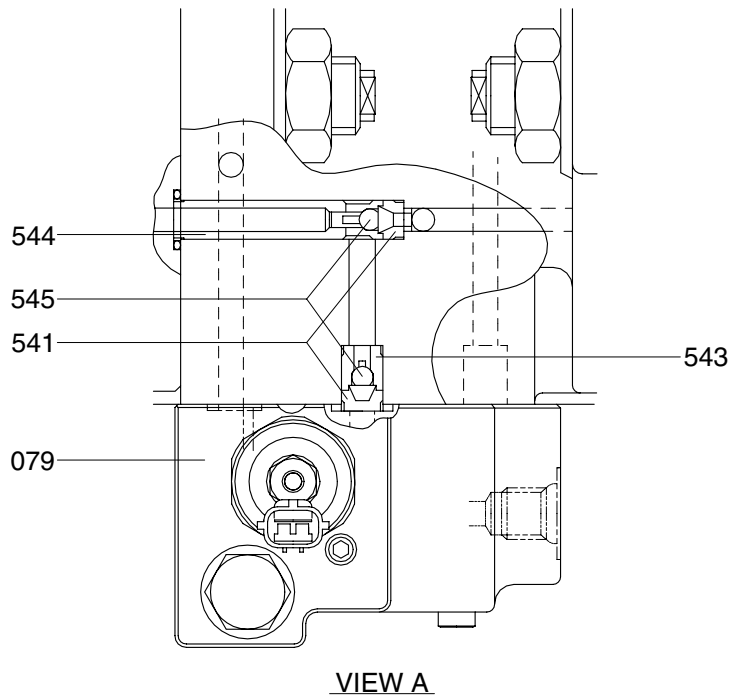
## 2. MAIN PUMP (1/2)

### 1) STRUCTURE



04	Gear pump	312	Valve block	717	O-ring
111	Drive shaft (F)	313	Valve plate (R)	719	O-ring
113	Drive shaft (R)	314	Valve plate (L)	724	O-ring
114	Gear	326	Cover	725	O-ring
123	Roller bearing	401	Hexagon socket bolt	728	O-ring
124	Needle bearing	406	Hexagon socket bolt	732	O-ring
127	Bearing spacer	414	Hexagon socket bolt	774	Oil seal
141	Cylinder block	466	VP plug	789	Back up ring
151	Piston	468	VP plug	792	Back up ring
152	Shoe	490	VP plug	808	Hexagon head nut
153	Set plate	492	VP plug	824	Snap ring
156	Bushing	531	Tilting pin	885	Pin
157	Cylinder spring	532	Servo piston	886	Spring pin
211	Shoe plate	534	Stopper (L)	901	Eye bolt
212	Swash plate	535	Stopper (S)	953	Set screw
214	Bushing	548	Pin	954	Set screw
251	Swash plate support	702	O-ring	981	Name plate
261	Seal cover (F)	710	O-ring	983	Pin
271	Pump casing	714	O-ring		

MAIN PUMP (2/2)



079 Proportional reducing valve  
541 Seat

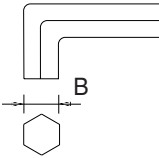

543 Stopper 1  
544 Stopper 2

545 Steel ball

## 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			

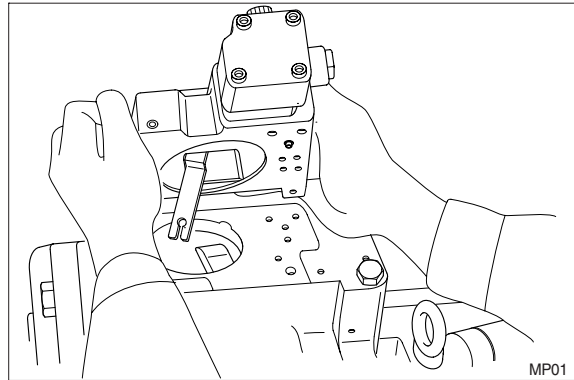


## (2) Tightening torque

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	115.7	0.47	12
	M16	24.0	173.6	0.55	14
	M18	34.0	245.9	0.55	14
	M20	44.0	318.3	0.67	17
PT plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/16	0.7	5.1	0.16	4
	PT 1/ 8	1.05	7.59	0.20	5
	PT 1/ 4	1.75	12.66	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	108.5	0.55	14
	PF 1	19.0	137.4	0.67	17
	PF 1 1/4	27.0	195.3	0.67	17
	PF 1 1/2	28.0	202.5	0.67	17

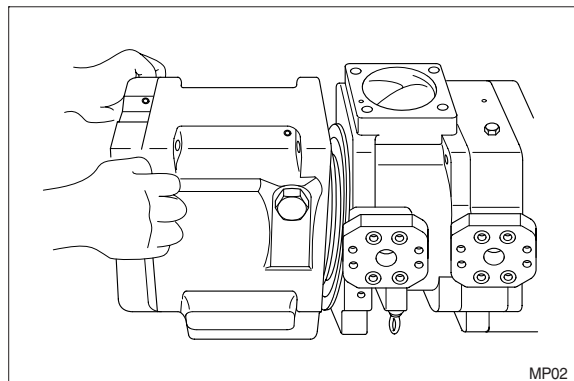
### 3) DISASSEMBLY

- (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.  
Remove hexagon socket head bolts (416) and remove gear pump.



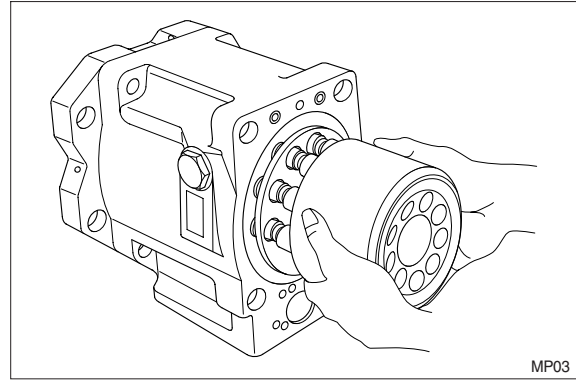
- (5) Loosen hexagon socket head bolts (401) fixing swash plate support (251), pump casing (271) and valve block (312).

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



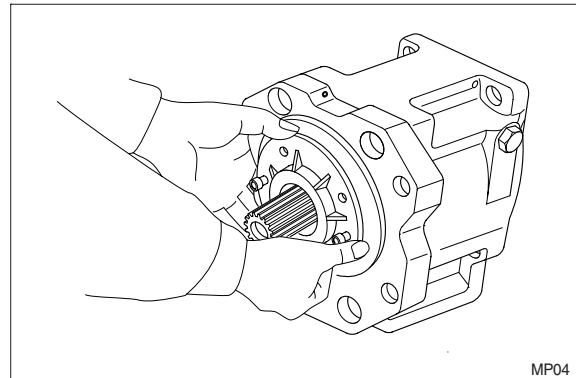
- (7) Pull cylinder (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

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



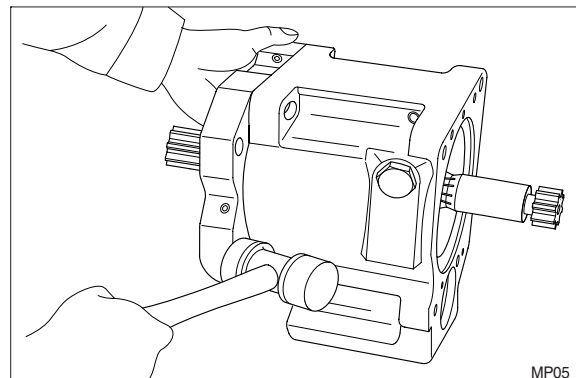
- (8) Remove hexagon socket head bolts (406) and then seal cover (F) (261). Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

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

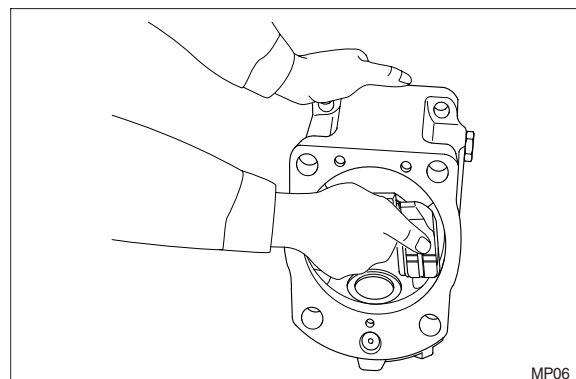


- (9) Remove hexagon socket head bolts (408) and then seal cover (R, 262). In case of fitting a gear pump, first, remove gear pump.

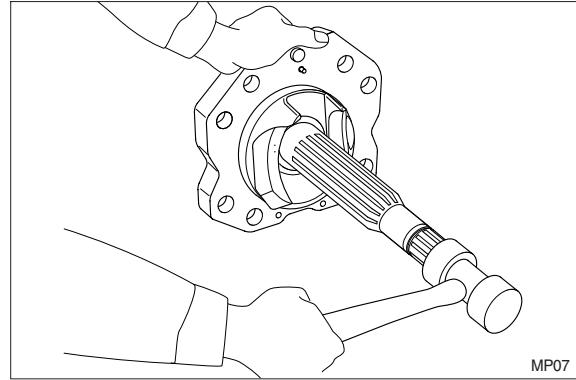
- (10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



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

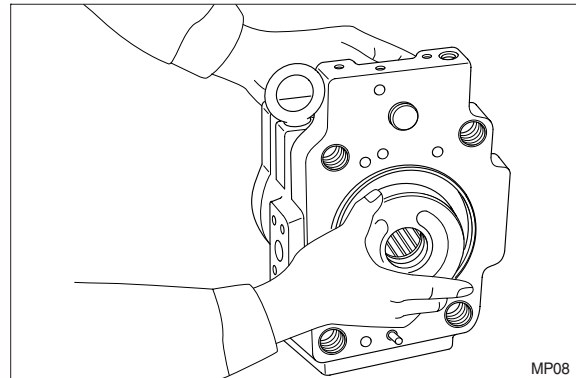


- (12) Tapping lightly shaft's end of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



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

※ These may be removed in work 6.



- (14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) and gear (116) from valve block (312).

※ In removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.

※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve block and swash plate support.

Once loosened, flow setting will be changed.

#### 4) ASSEMBLY

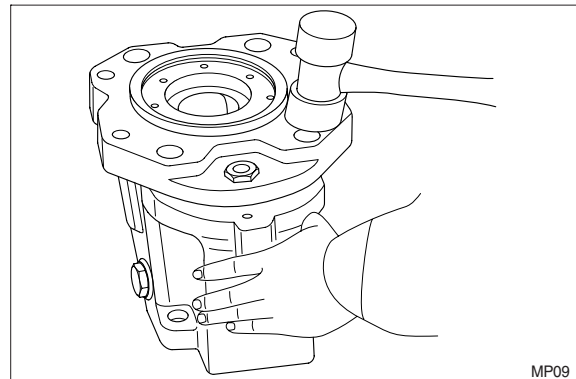
(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

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

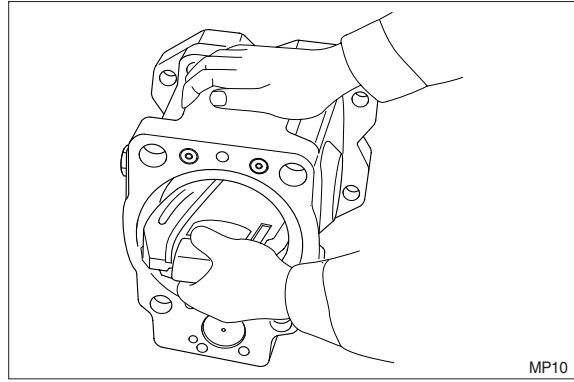
- ※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.

In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply lock-tight (medium strength) to their threaded sections.



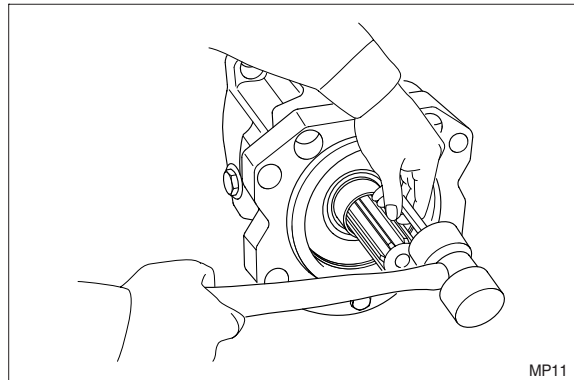
(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531), and fit swash plate (212) to swash plate support (251) correctly.

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



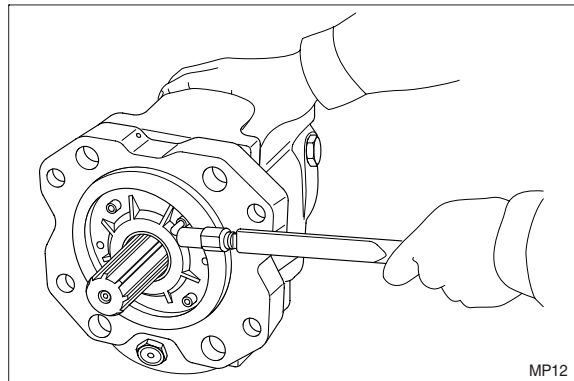
(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

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



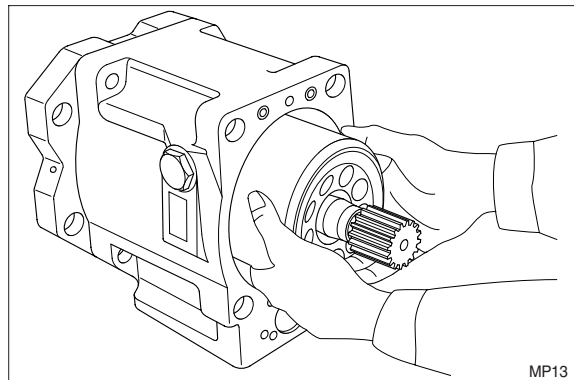
(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

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

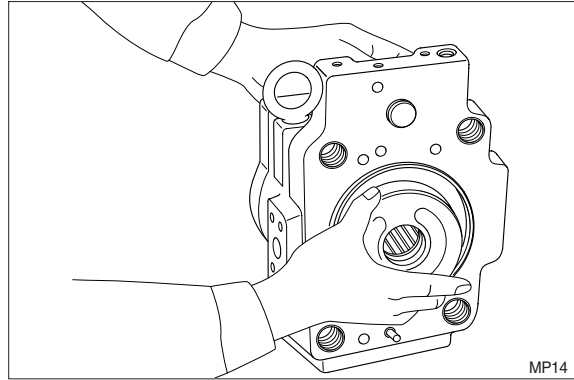


(6) Assemble piston cylinder subassembly [Cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156) and cylinder spring (157).]

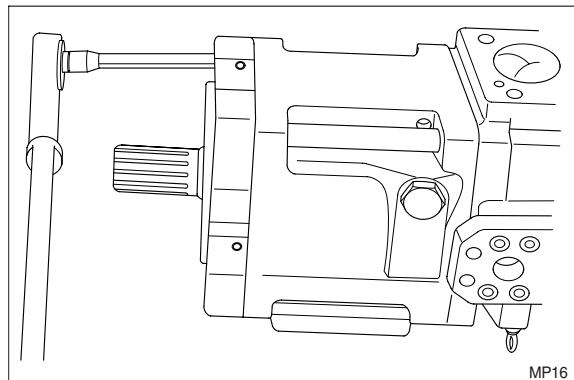
Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.



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

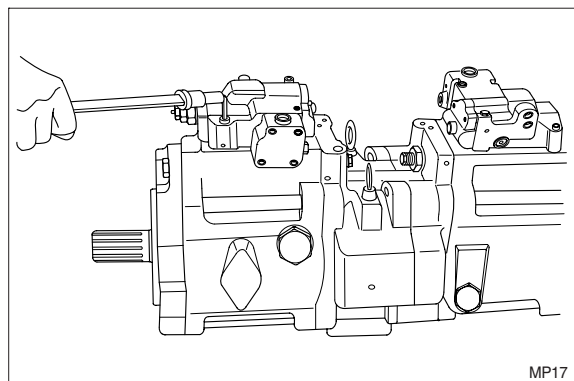


- (8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
- ※ At first assemble this at rear pump side, and this work will be easy.
  - ※ Take care not to mistake direction of valve block.



- ※ Clockwise rotation (viewed from input shaft side)
- ※ Fit block with regulator up and with delivery flange left, viewed from front side.

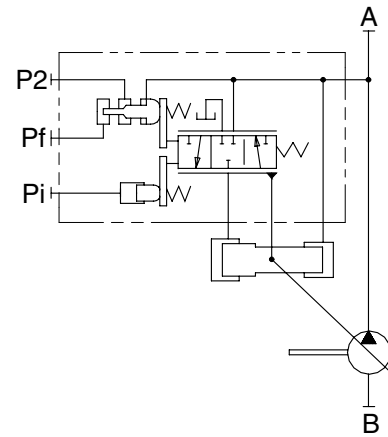
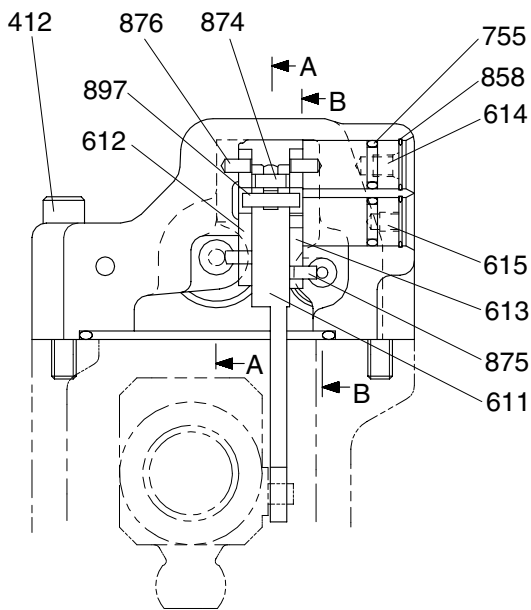
- (9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
- ※ Take care not to mistake regulator of front pump for that of rear pump.



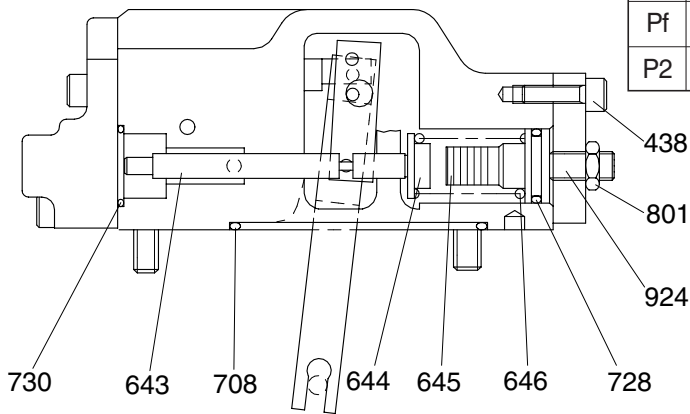
- (10) Fit drain port plug (468).  
This is the end of reassembling procedures.

### 3. REGULATOR

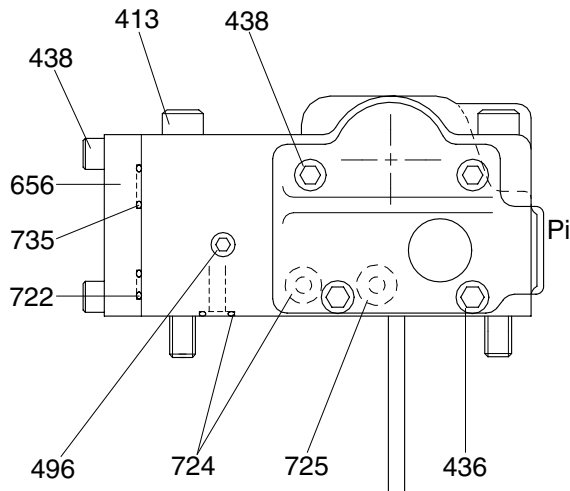
#### 1) STRUCTURE(1/2)



Port	Port name	Port size
A	Delivery port	1"
B	Suction port	3"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



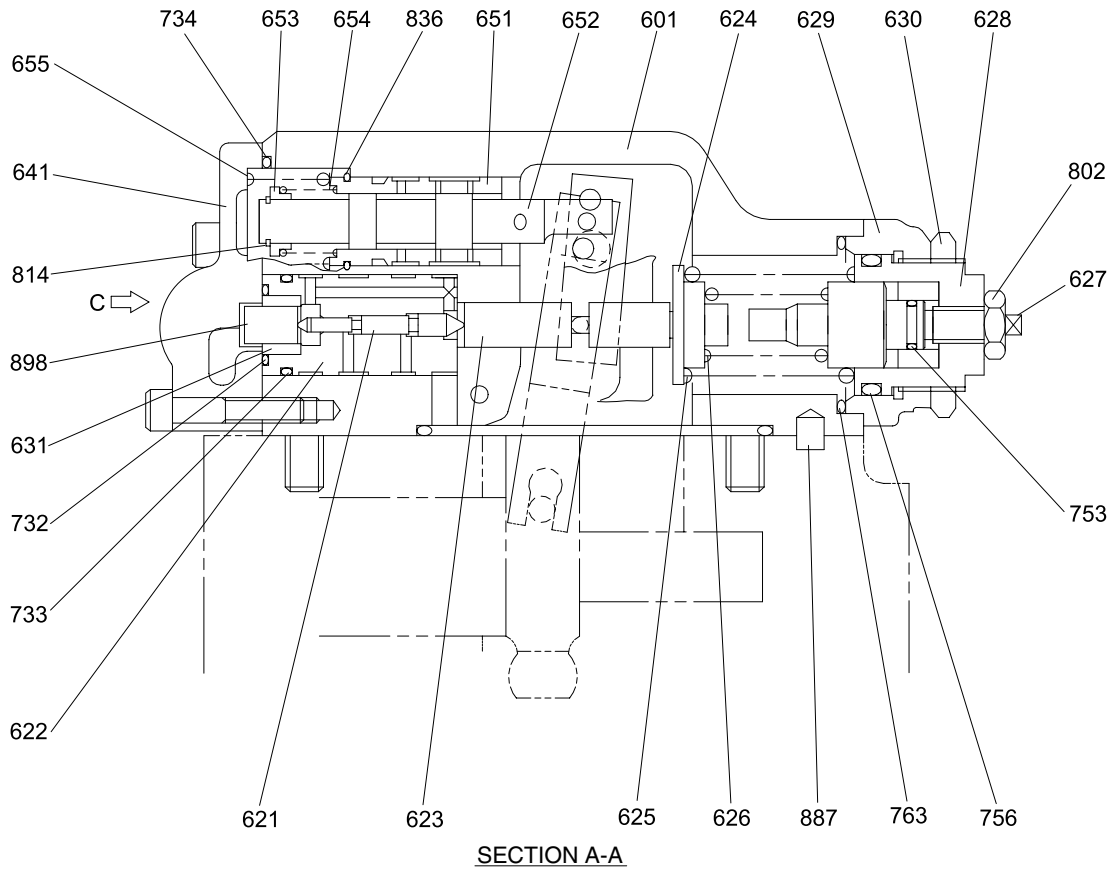
SECTION B-B



VIEW C



## REGULATOR (2/2)

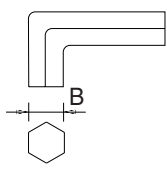



412 Hexagon socket screw	630 Lock nut	733 O-ring
413 Hexagon socket screw	631 Sleeve, pf	734 O-ring
436 Hexagon socket screw	641 Pilot cover	735 O-ring
438 Hexagon socket screw	643 Pilot piston	753 O-ring
496 Plug	644 Spring seat (Q)	755 O-ring
601 Casing	645 Adjust stem (Q)	756 O-ring
611 Feed back lever	646 Pilot spring	763 O-ring
612 Lever (1)	651 Sleeve	801 Nut
613 Lever (2)	652 Spool	802 Nut
614 Fulcrum plug	653 Spring seat	814 Snap ring
615 Adjust plug	654 Return spring	836 Snap 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
Socket wrench, double (single) open end 	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench		Small size, Max 36 mm			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		Steel bar of key material approx. 10×8×200			
Torque wrench		Capable of tightening with the specified torques.			
Pincers		-			
Bolt		M4, Length : 50 mm			

## (2) Tightening torque

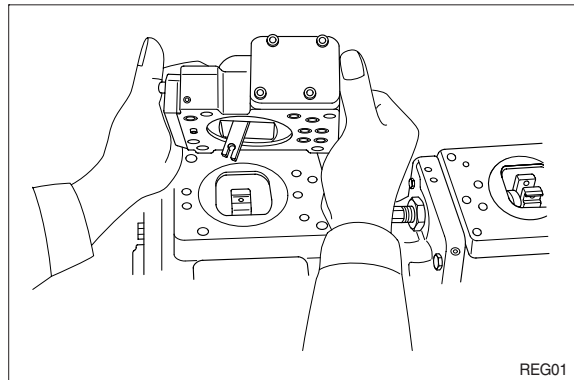
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	115.7	0.47	12
PT plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/16	0.7	5.1	0.16	4
	PT 1/ 8	1.05	7.59	0.20	5
	PT 1/ 4	1.75	12.66	0.24	6
PF plug (material : S45C)	PT 1/ 4	3.0	21.7	0.24	6

### 3) DISASSEMBLY

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

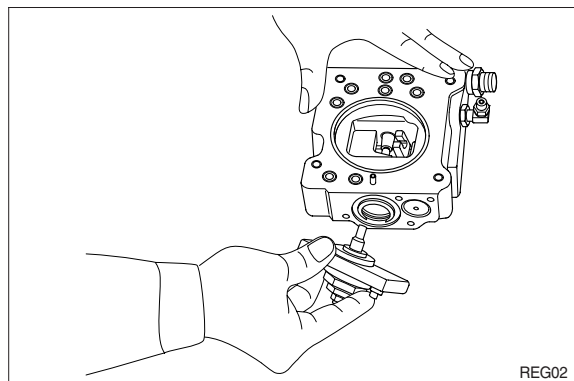
For this reason, replacement of a regulator assembly is not recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

- (1) Choose a place for disassembly.
  - ※ Choose a clean place.
  - ※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.
- (2) Remove dust, rust, etc. from surfaces of regulator with clean oil.
- (3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
  - ※ Take care not to lose O-ring.

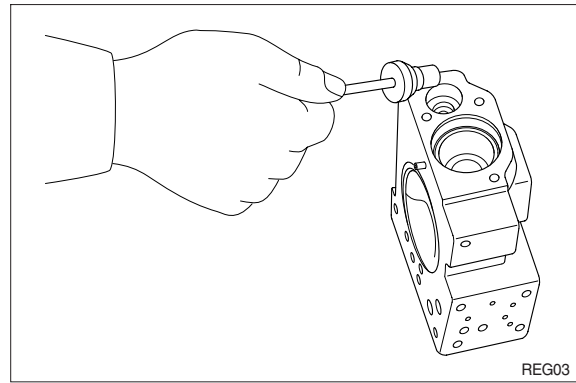


- (4) Remove hexagon socket head screw (438) and remove cover (C, 629).
  - ※ Cover (C) is fitted with adjusting screw (C, 628), adjusting stem (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

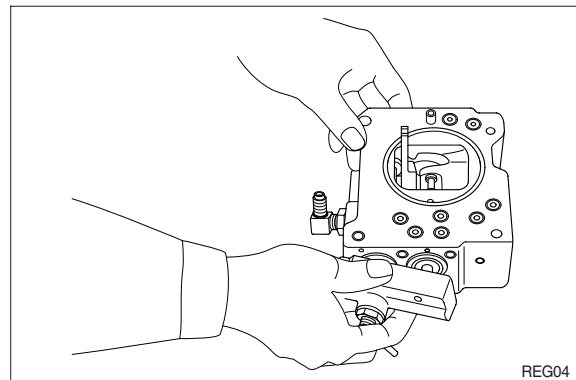
Do not loosen these screws and nuts.  
If they are loosened, adjusted pressure-flow setting will vary.



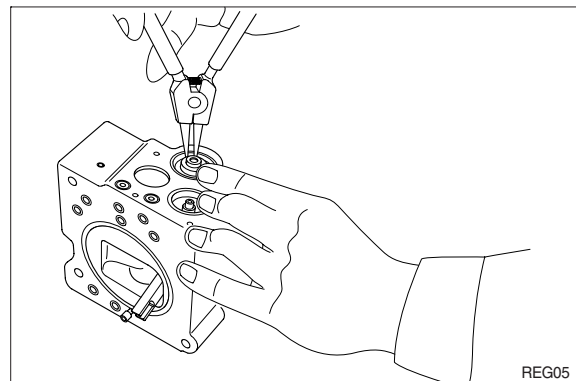
- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.  
Then draw out adjusting stem (Q, 645), pilot spring (646) and spring seat (644) from pilot section.
- ※ Adjusting stem (Q, 645) can easily be drawn out with M4 bolt.



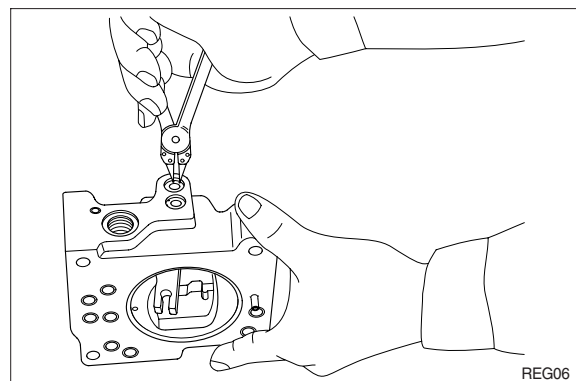
- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).  
After removing pilot cover, take out set spring (655) from pilot section.

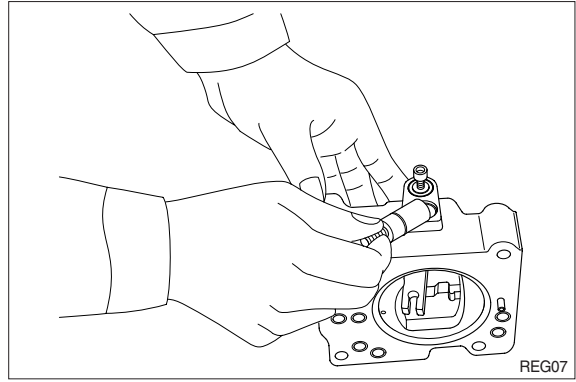


- (7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).  
Sleeve (651) is fitted with snap ring (836).
- ※ When removing snap ring (814), return spring (654) may pop out.
  - ※ Take care not to lose it.

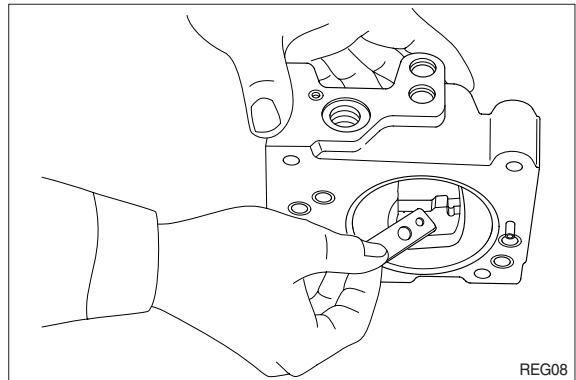


- (8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).
- ※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.

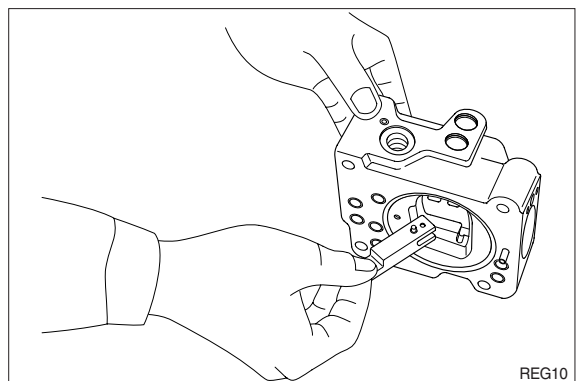
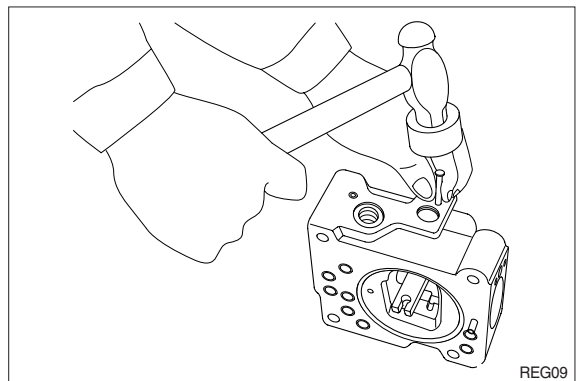




- (9) Remove lever (2, 613). Do not draw out pin (875).  
※ Work will be promoted by using pincers or so on.



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



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

This completes operation.

#### 4) ASSEMBLY

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

① Always repair parts that were scored at disassembly.

Get replacement parts ready beforehand.

② Mixing of foreign matter will cause malfunction.

Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Always tighten bolts, plugs, etc. to their specified torques.

④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.

⑤ Replace seals such as O-ring with new ones as a rule.

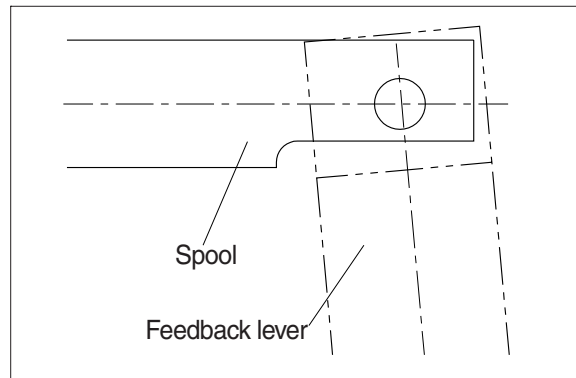
(2) Put compensating rod (623) into compensating hole of casing (601).

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

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

※ Confirm that spool and sleeve slide smoothly in casing without binding.

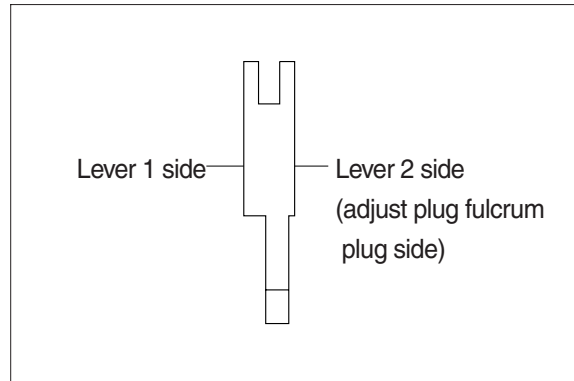
※ Pay attention to orientation of spool.





(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.  
Then insert pin (874).

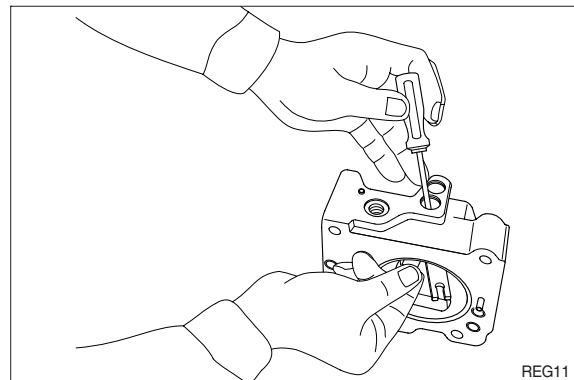
- ※ Insert pin in feedback lever a little to ease operation.
- ※ Take care not to mistake direction of feedback lever.



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

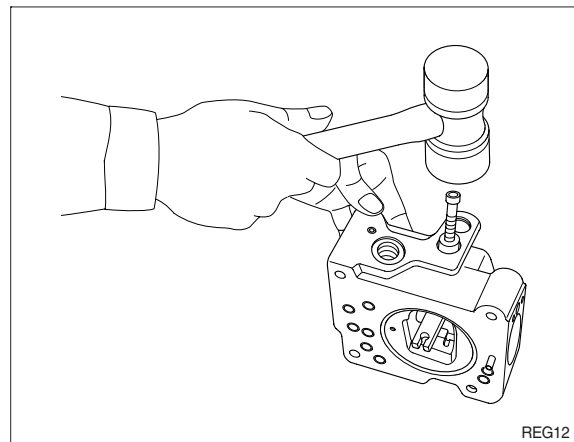
- ※ Confirm that pilot piston slides smoothly without binding.

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

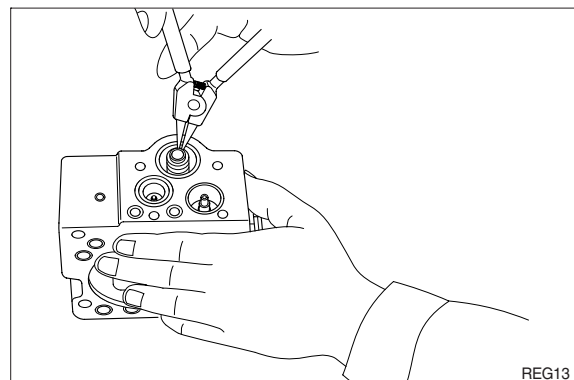


(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever (2).  
Then fix locking ring (858).

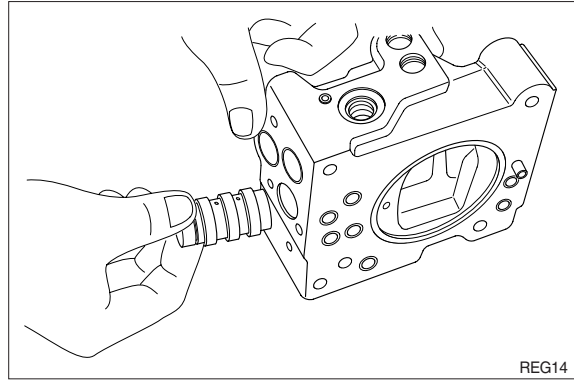
- (9) Insert adjusting plug (615) and fit locking ring.
- ※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.  
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



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

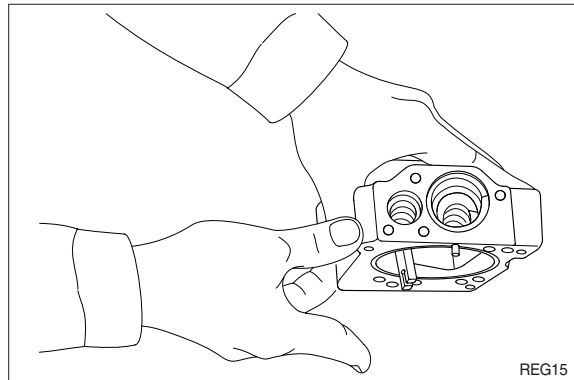


- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole. Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



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

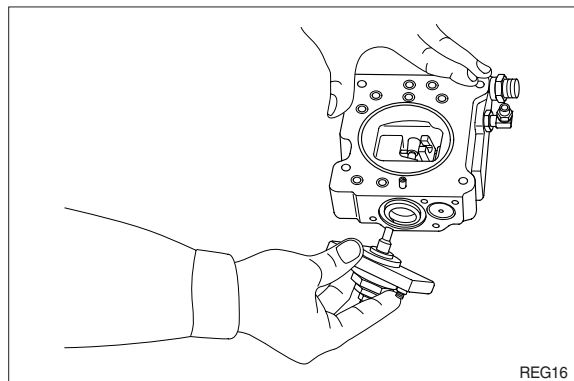
※ When fitting spring seat, take care not to mistake direction of spring seat.



- (13) Install cover (C, 629) fitted with adjusting screws (628), adjusting stem (C, 627), lock nut (630), hexagon nut (802) and adjusting screw (924).

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

This completes assembly.



## GROUP 4 MAIN CONTROL VALVE

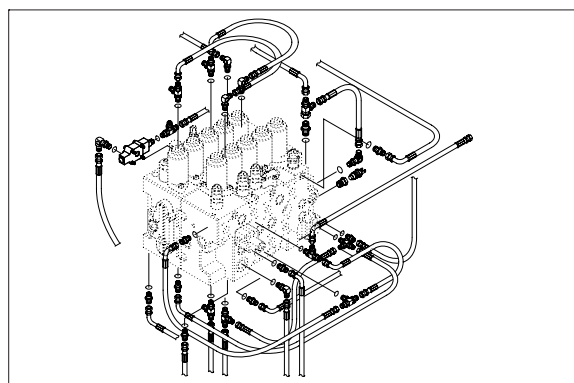
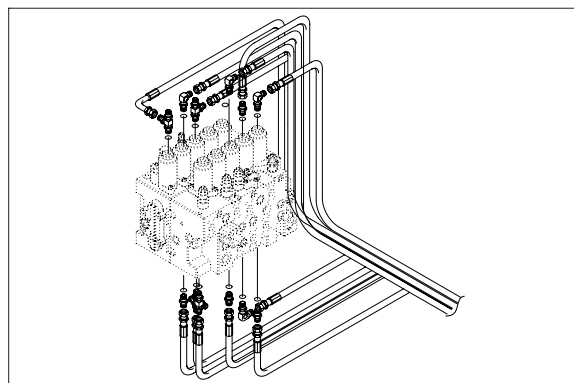
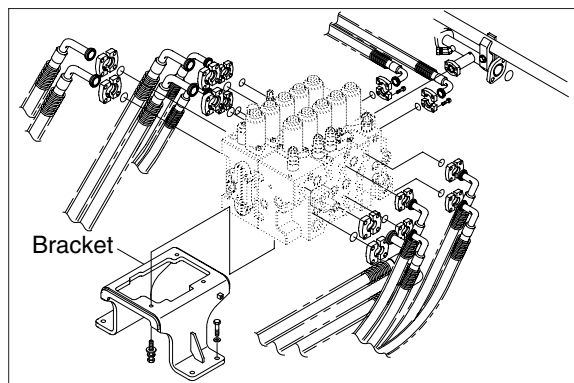
### 1. REMOVAL AND INSTALL OF MOTOR

#### 1) REMOVAL

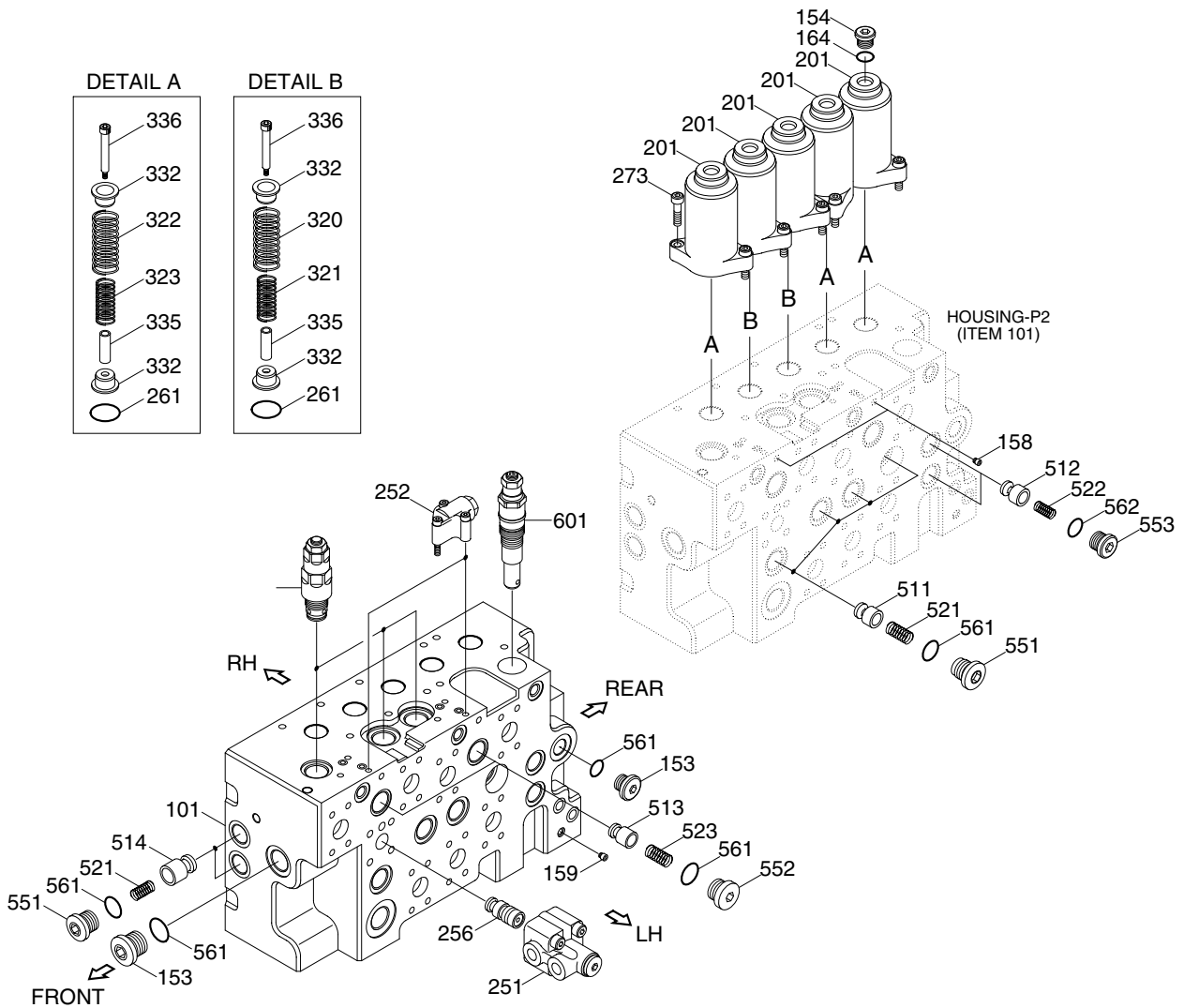
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure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

#### 2) INSTALL

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

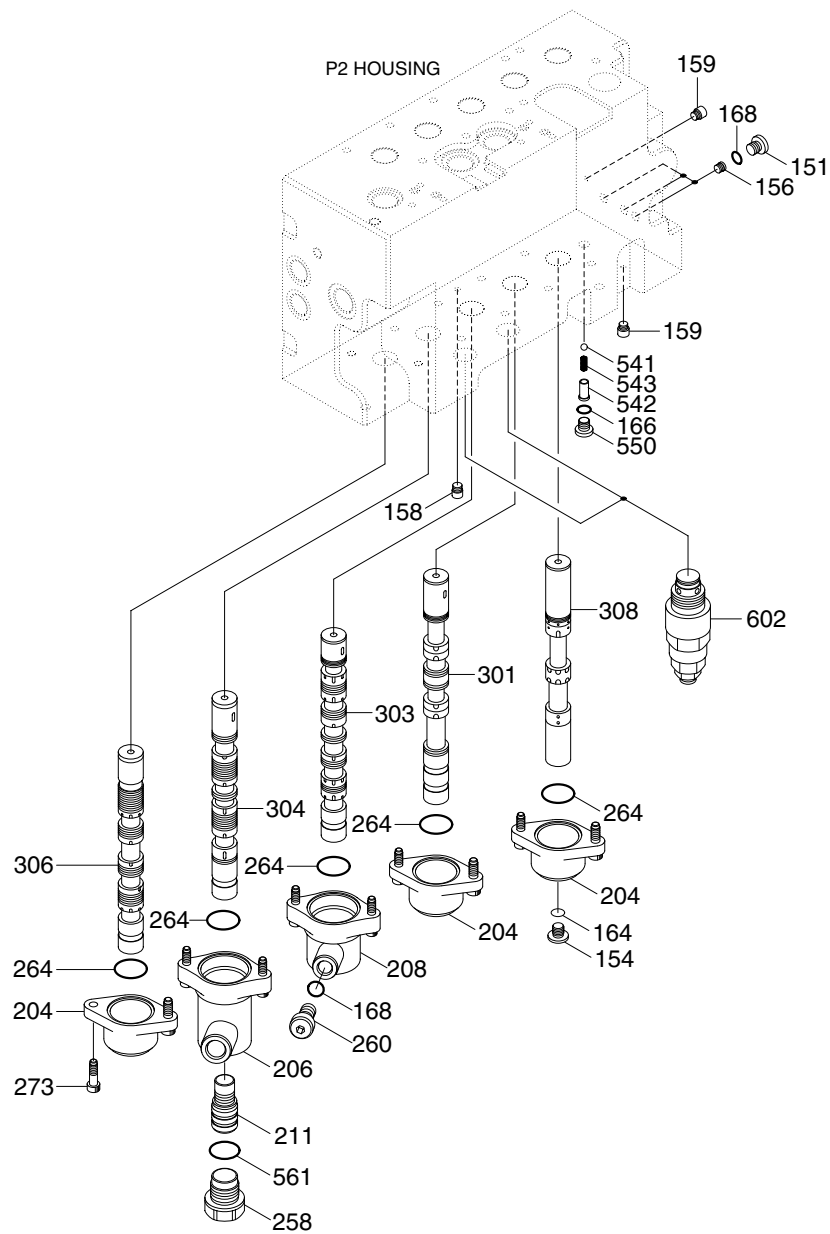


## 2. STRUCTURE (1/4)



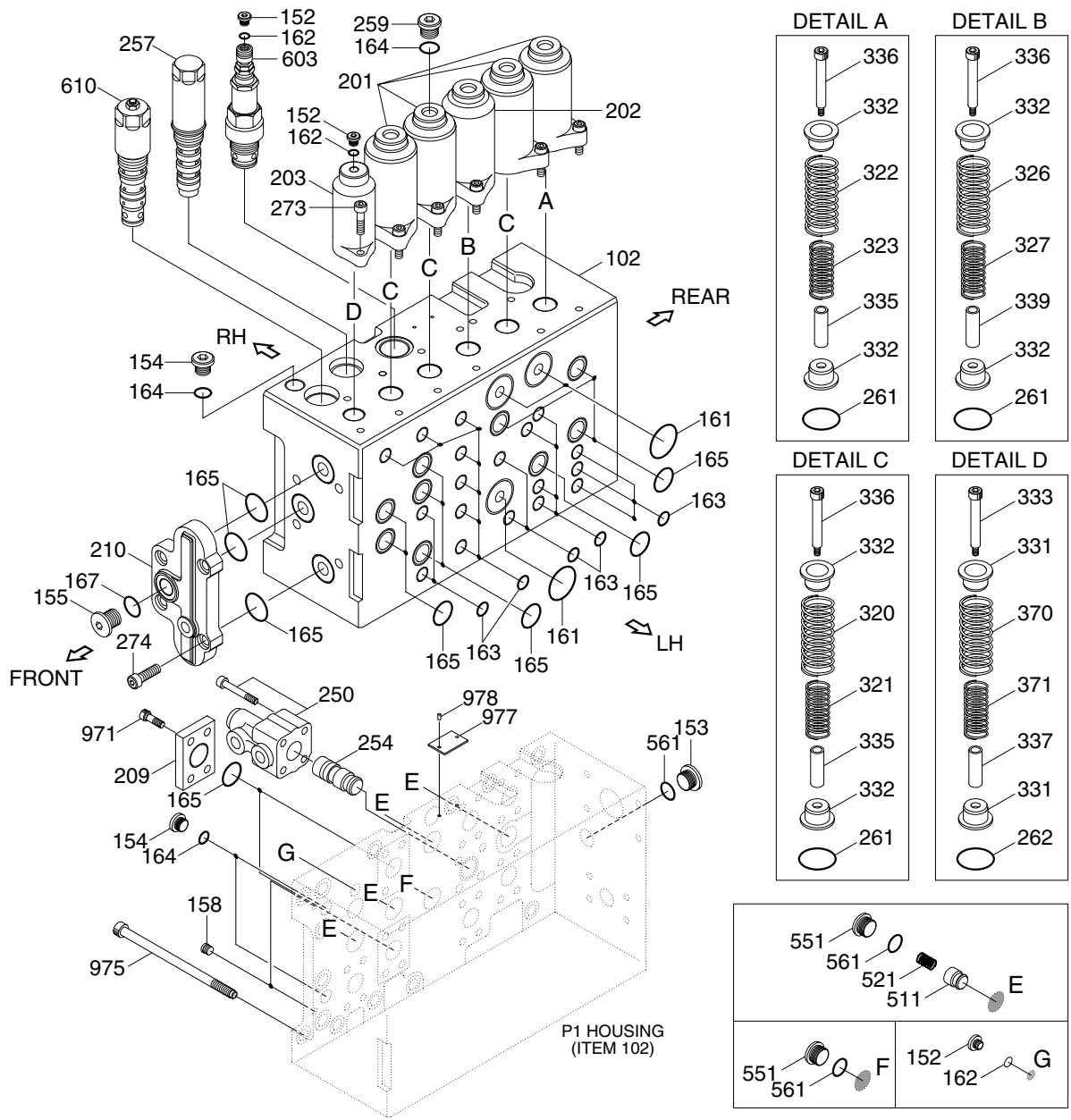
101	P2 housing (casing A)	273	Socket screw	514	Poppet
153	Plug	320	Spring	521	Spring
154	Plug	321	Spring	522	Spring
158	Plug	322	Spring	523	Spring
159	Plug	323	Spring	551	Plug
164	O-ring	332	Seat	552	Plug
201	Spring cover	335	Stopper	553	Plug
251	Logic control valve	336	Bolt	561	O-ring
252	Selector lock valve	511	Poppet	562	O-ring
256	Logic poppet	512	Poppet	601	Main relief valve
261	O-ring	513	Poppet	602	Port relief valve

## STRUCTURE (2/4)



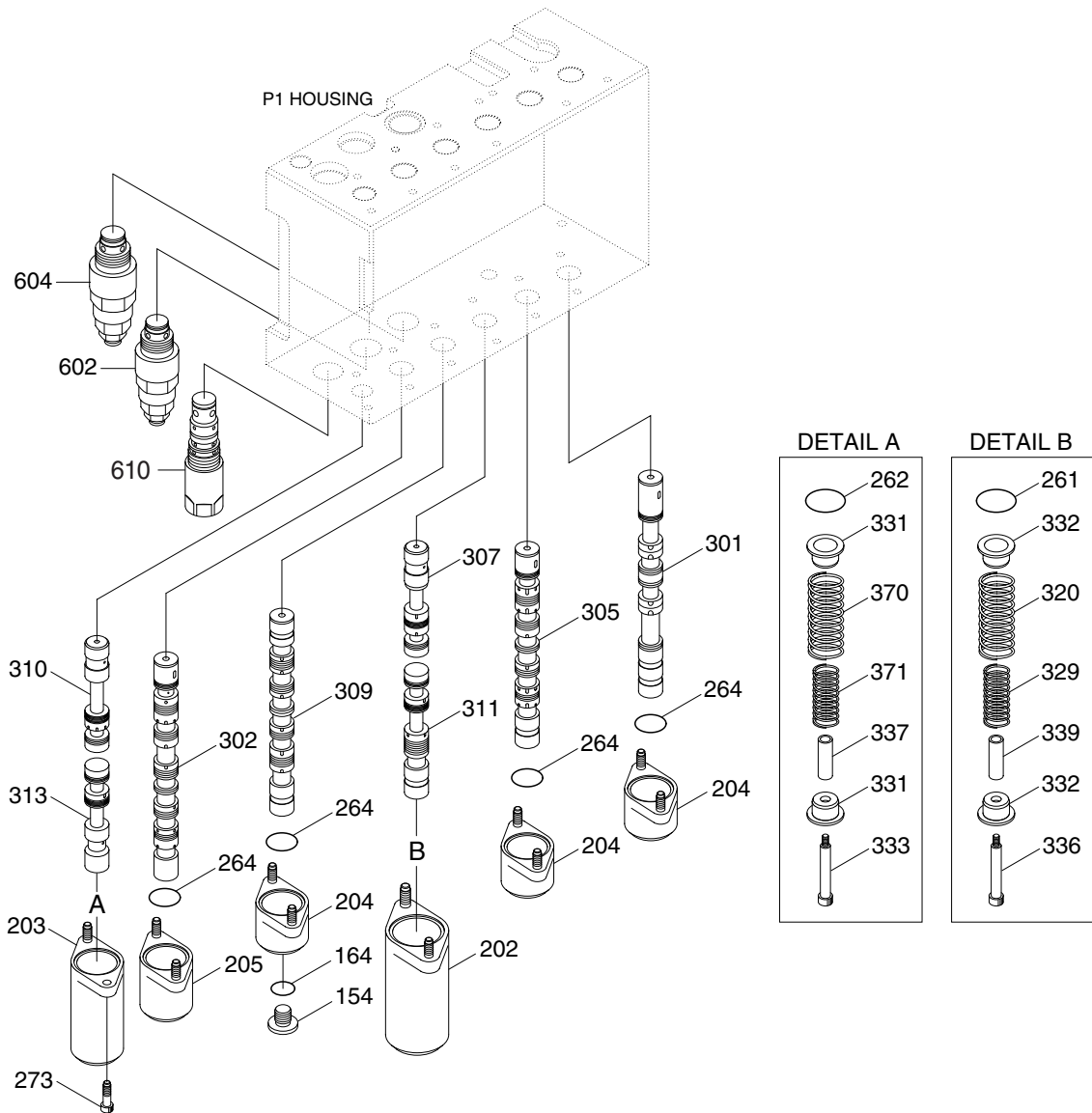
151	Plug	206	Cover	304	Bucket spool
154	Plug	208	Cover-spool	306	Arm 2 spool
156	Orifice	211	Piston	308	Straight travel spool
158	Plug	258	Plug	541	Steel ball
159	Plug	260	Plug	542	Spring seat
164	O-ring	264	O-ring	543	Spring
166	O-ring	273	Socket screw	550	Plug
168	O-ring	301	Travel, LH spool	561	O-ring
204	Cover	303	Boom 1 spool	602	Port relief valve

# STRUCTURE (3/4)



- |                           |                         |                  |                               |
|---------------------------|-------------------------|------------------|-------------------------------|
| 102 P1 housing (casing B) | 201 Spring cover        | 274 Socket screw | 337 Stopper                   |
| 152 Plug                  | 202 Spring cover        | 320 Spring       | 339 Stopper                   |
| 153 Plug                  | 203 Spring cover        | 321 Spring       | 370 Spring                    |
| 154 Plug                  | 209 Flange              | 322 Spring       | 371 Spring                    |
| 155 Plug                  | 210 Plate               | 323 Spring       | 511 Poppet                    |
| 158 Plug                  | 250 Logic control valve | 326 Spring       | 521 Spring                    |
| 161 O-ring                | 254 Logic poppet        | 327 Spring       | 551 Plug                      |
| 162 O-ring                | 257 Arm regen cut sub   | 331 Seat         | 561 O-ring                    |
| 163 O-ring                | 259 Plug                | 332 Seat         | 603 Port relief valve         |
| 164 O-ring                | 261 O-ring              | 333 Spacer bolt  | 610 Nega control relief valve |
| 165 O-ring                | 262 O-ring              | 335 Stopper      | 971 Screw                     |
| 167 O-ring                | 273 Socket screw        | 336 Bolt         | 975 Socket screw              |

# STRUCTURE(4/4)



- |                      |                          |                                |
|----------------------|--------------------------|--------------------------------|
| 154 Plug             | 302 Arm 1 spool          | 333 Spacer bolt                |
| 164 O-ring           | 305 Swing spool          | 336 Bolt                       |
| 202 Spring cover     | 307 Boom 2 spool         | 337 Stopper                    |
| 203 Spring cover     | 309 Option spool         | 339 Stopper                    |
| 204 Cover            | 310 Bypass cut spool     | 370 Spring                     |
| 205 Cover            | 311 Swing priority spool | 371 Spring                     |
| 261 O-ring           | 313 Bypass cut spool     | 602 Port relief valve          |
| 262 O-ring           | 320 Spring               | 604 Port relief valve assembly |
| 264 O-ring           | 329 Spring               | 610 Nega control relief valve  |
| 273 Socket screw     | 331 Seat                 |                                |
| 301 Travel, LH spool | 332 Seat                 |                                |

### 3. DISASSEMBLY AND ASSEMBLY

#### 1) GENERAL PRECAUTIONS

- (1) All hydraulic components must be worked with precision working. Then, before disassembling and assembling them, it is essential to select an especially-clean place.
- (2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working, spread a paper or rubber mat on the bench, and disassemble the valve on it.
- (4) Support the body section carefully when carrying, transferring and so on of the control valve. Do not support the lever, exposed spool, end cover section or so on without fail.
- (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 to 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. Besides, prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

#### 2) TOOLS

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

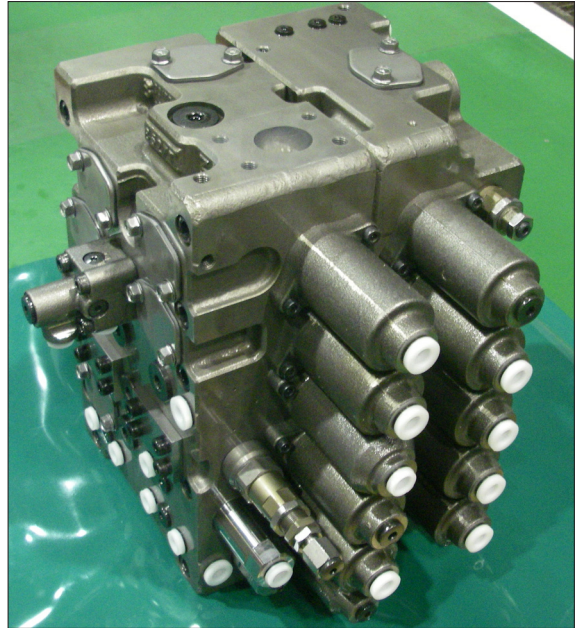
Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Box wrench	Each 1 piece	24, 32, 36
Hexagon key wrench	Each 1 piece	4, 5, 6, 8, 10 and 12
Loctite #262	1 piece	-
Spanner	Each 1 piece	32 (main relief valve, 601) 36 (port relief valve, 603)



### 3) DISASSEMBLY

The figure in ( ) shown after the part name in the explanation sentence shows its number in the structure figures (8-31~34).

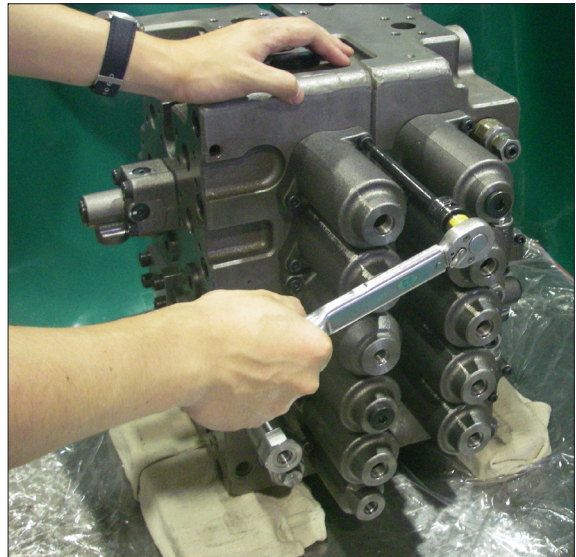
- (1) Place control valve on working bench.
  - ※ Disassemble it in clean place and pay attention not to damage flange faces and plate faces.



#### (2) Disassembling of main spools

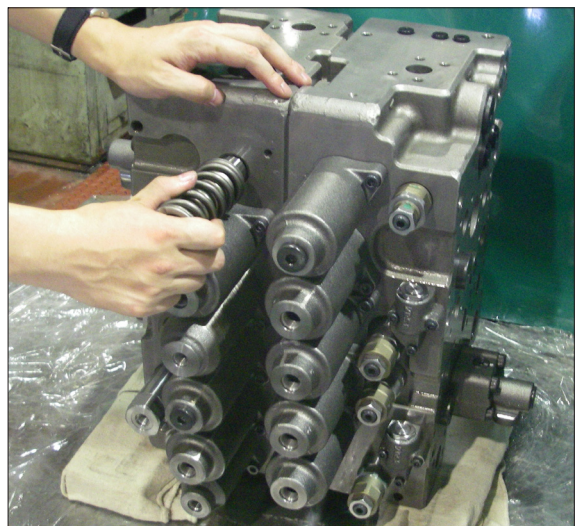
- Travel (301), bucket (304), swing (305), option (308), arm 2 (306), boom 2 (307), swing priority (311).

- ① Loosen the hexagon the socket head bolts (273) and remove the spring cover (201, 202) and the O-ring (261).
  - Hexagon key wrench : 6 mm



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

- ※ When pulling out the spool assembly from housing, pay attention not to damage the housing.



- ③ Hold the spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336) and disassemble the stopper (335 or 339) and spring seats (332).

· Hexagon key wrench : 10 mm



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

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

· Hexagon key wrench : 6 mm

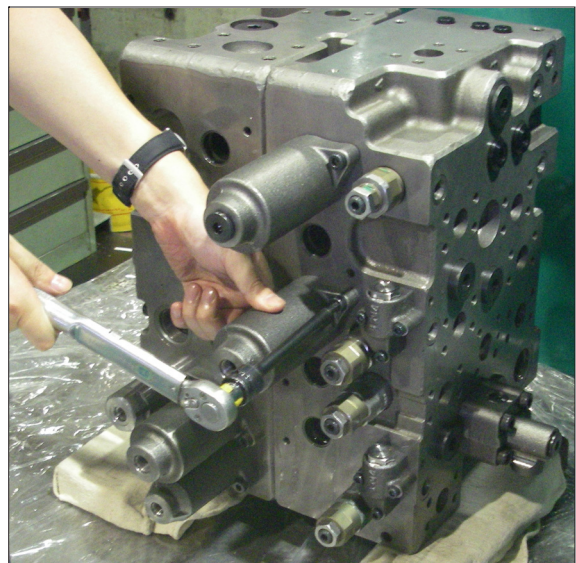
- ② Pull out the boom 1 spool (303), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).

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

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

· Hexagon key wrench : 10 mm

- ④ Do not disassemble the boom1 spool (303) more than these conditions.





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

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

· Hexagon key wrench : 6 mm

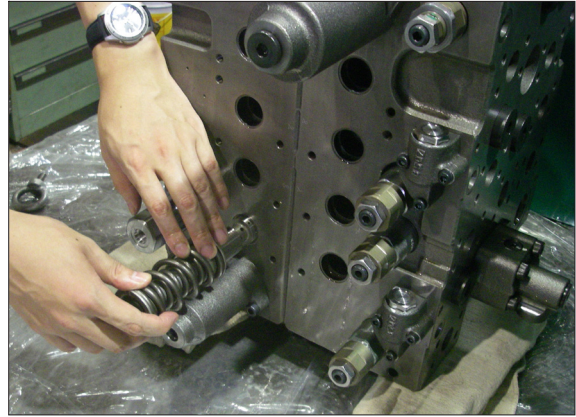
- ② Pull out the arm 1 spool (302), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P1 housing (102).

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

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

· Hexagon key wrench : 10 mm

- ④ Do not disassemble the arm 1 spool (302) more than these conditions.



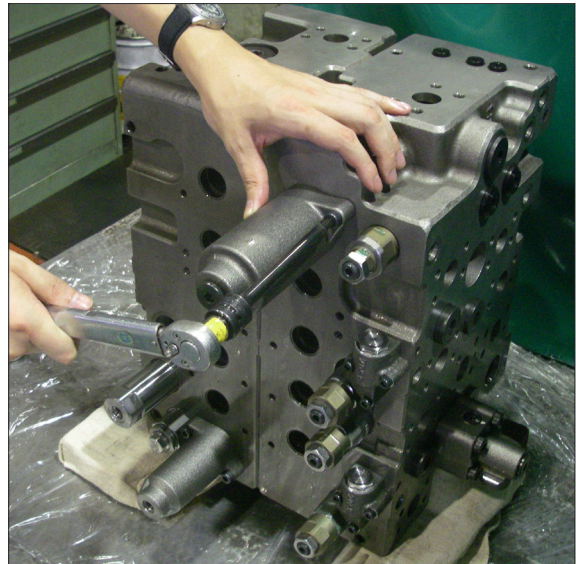
**(5) Disassembling of travel straight spool (308):**

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

· Hexagon key wrench : 6 mm

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

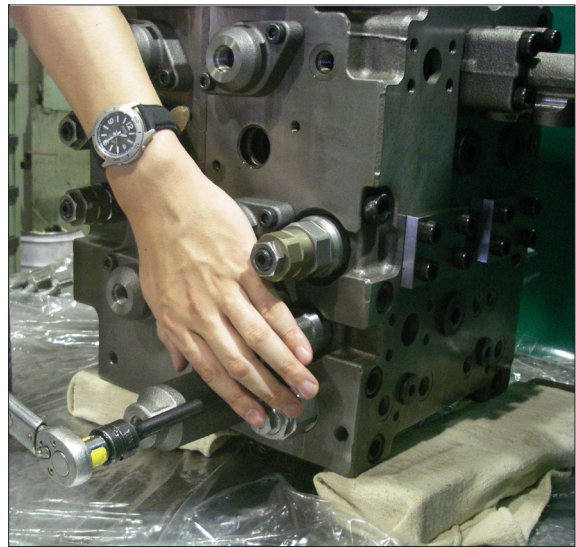
※ When pulling out the spool assembly from P2 housing (101), pay attention not to damage housing.



- ③ Hold the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336) and disassemble the spring(322, 323), spring seats(332) and stopper (335).
  - Hexagon key wrench : 10 mm
- ④ Do not disassemble the travel straight spool (308) more than these conditions.

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

- ① Loosen the hexagon socket head bolts (273), and remove the spring cover (203) and the O-ring (262).
  - Hexagon key wrench : 6 mm
- ② Pull out the bypass cut spool (310, 313), spring (370, 371), spring seats (331), stopper (337) and spacer bolt (333) in the spool assembly condition from the P1 housing (102).
- ※ When pulling out the spool assembly from P1 housing (102), pay attention not to damage housing.



- ③ Hold the bypass cut spool (310,313) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (333) and disassemble the spring (370, 371), spring seats (331) and stopper (337).
  - Hexagon key wrench : 10 mm





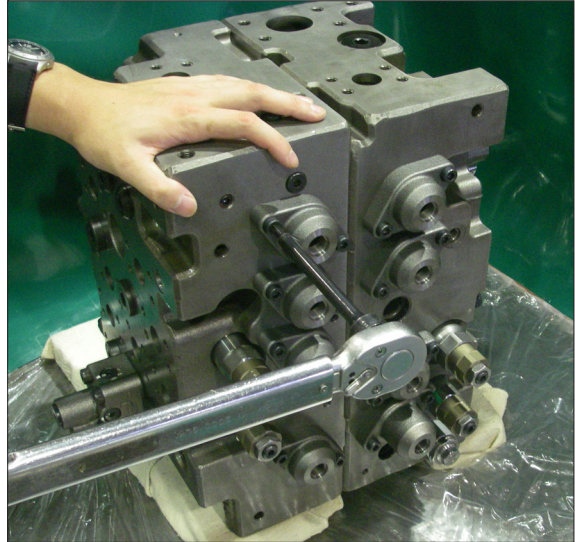
**(7) Disassembling of spool covers (204, 205, 206, 208):**

- ① Remove the hexagon socket head bolts (273), and remove the spool cover (204, 205, 206, 208) and the O-ring (264).

- Hexagon key wrench : 6 mm

- ② In removing the bucket spool cover (206), at first loosen the plug (258) before it is removed from the P1 housing (102). After removing the bucket spring cover (206) remove the plug (551), and take out the piston (211).

- Box wrench : 32 mm



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

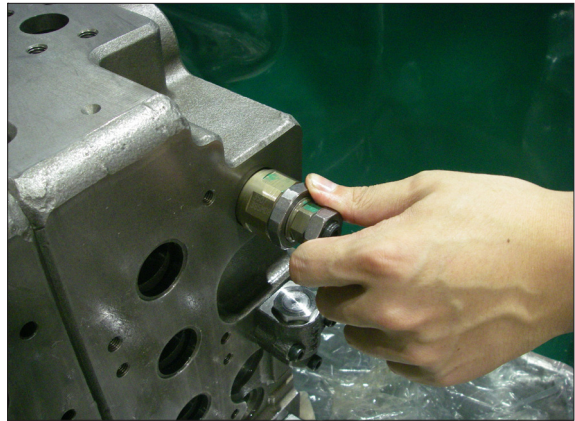
- ① Remove the main relief valve (601) and the port relief valves (602, 603, 604) from the housing.

Main relief valve (601) : spanner 32mm

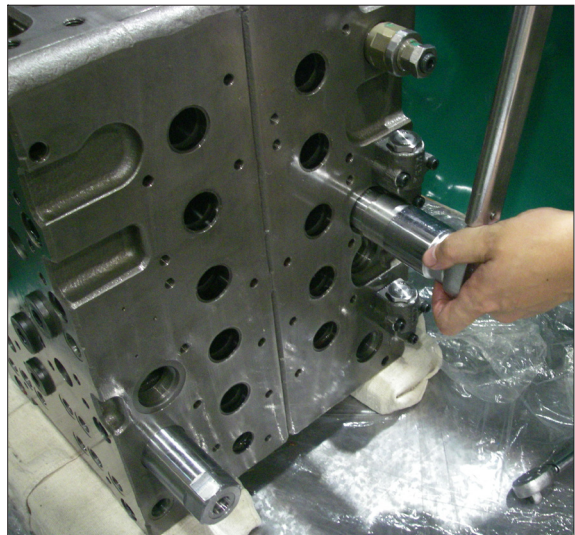
Port relief valve (602) : spanner or box wrench 32mm

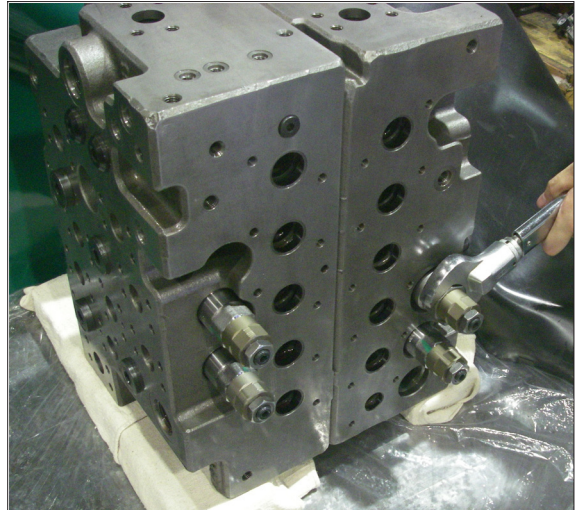
Port relief valve (603) : spanner 36mm

Port relief valve (604) : spanner or box wrench 36mm



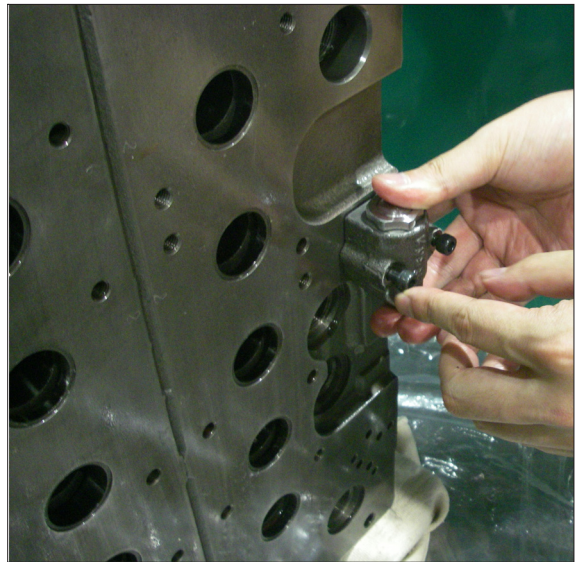
- ② Do not disassemble the relief valves more than these conditions.





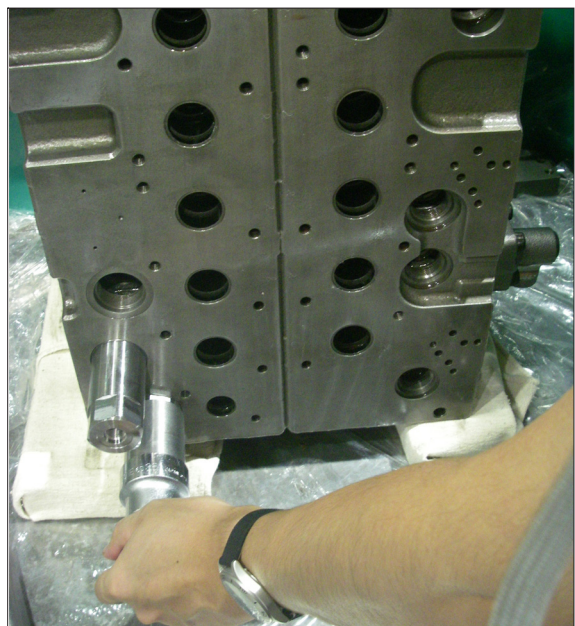
**(9) Removal of lock valve selector (252):**

- ① Loosen the hexagon socket head bolts (252-171) and remove the lock valve selector (252) and the O-rings (252-161).
  - Hexagon key wrench : 5 mm
- ② Do not disassemble the lock valve selector (252) more than these conditions.



**(10) Removal of negative control relief valve (610):**

- ① Remove the negative control relief valve (610) from the P1 housing (102).
  - Box wrench : 36 mm
- ② Do not disassemble the negative control relief valve (610) more than these conditions.

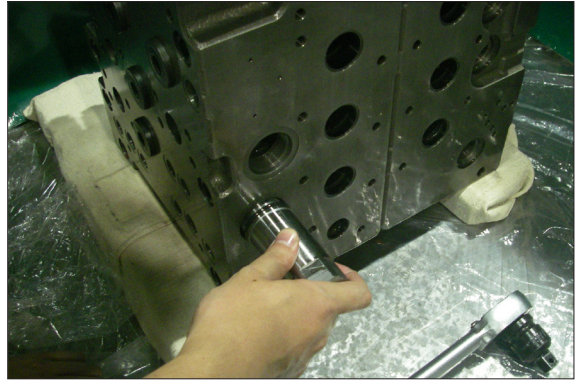




**(11) Removal of arm regeneration cut valve (257):**

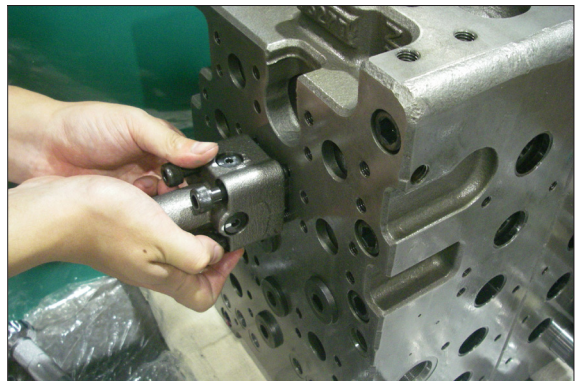
Remove the plug (253), spring (331), spool (211), and sleeve (392) from the P1 housing (102).

- Box wrench : 36 mm



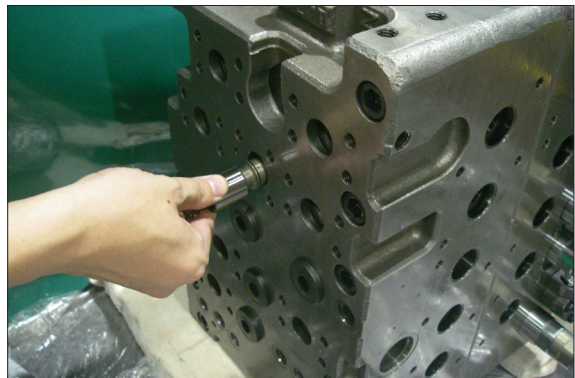
**(12) Disassembly of logic control valve (250, 251) and logic poppet (254, 256):**

- ① Loosen the hexagon socket head bolts (250-120, 251-120) and remove the logic control valve (250, 251) and the O-rings (250-112 and 113, 251-112 and 113).
  - Hexagon key wrench : 8 mm



- ② Pull out the logic poppet (254, 256), spring (254-106, 256-106) and spring seat (254-103, 256-103) from the housing.

- ③ Do not disassemble the logic control valve and the logic poppet more than these condition.



**(13) Disassembly of check valve :**

- ① CP1, C2, CCb, LCb, LCo, Lck, LCa, LCAT2

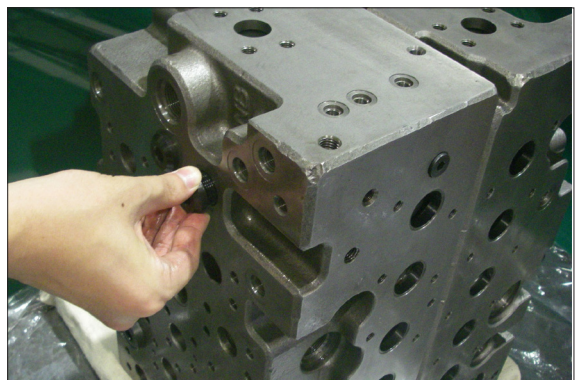
Remove the plug (551) and take out the poppet (511) and the spring (521).

- Hexagon key wrench : 12 mm

- ② CMR1, CMR2

Remove the plug (553) and take out the poppet (512) and the spring (522).

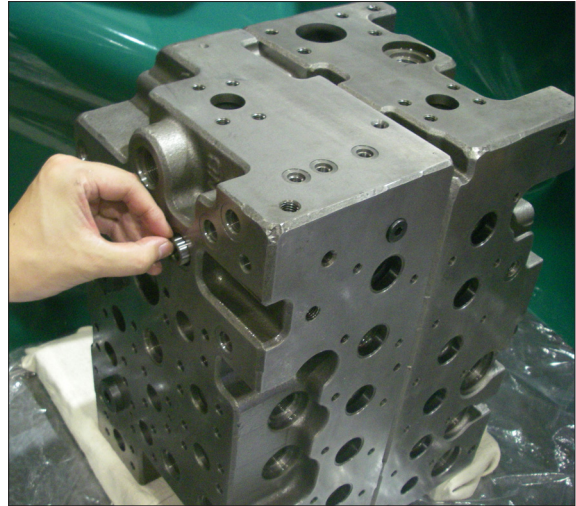
- Hexagon key wrench : 10 mm



③ CRa, CRb

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

- Hexagon key wrench : 12 mm



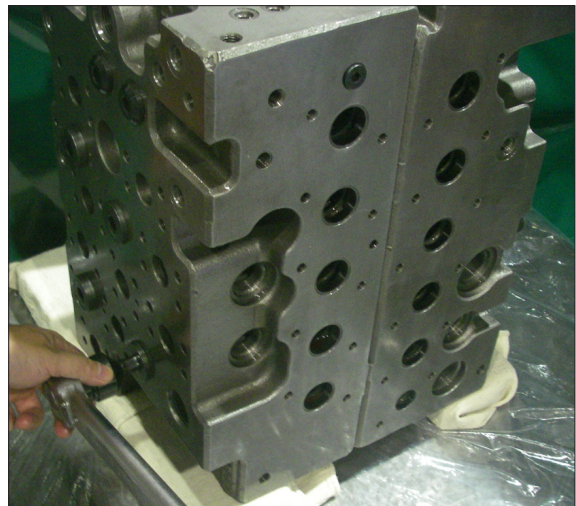
④ CCK, CCo

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

- Hexagon key wrench : 12 mm

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

- Hexagon key wrench : 6 mm



**(14) Disassembly of flanges (209) :**

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

- Hexagon key wrench : 8 mm

**(15) Disassembly of plate (210) :**

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

- Hexagon key wrench : 10 mm

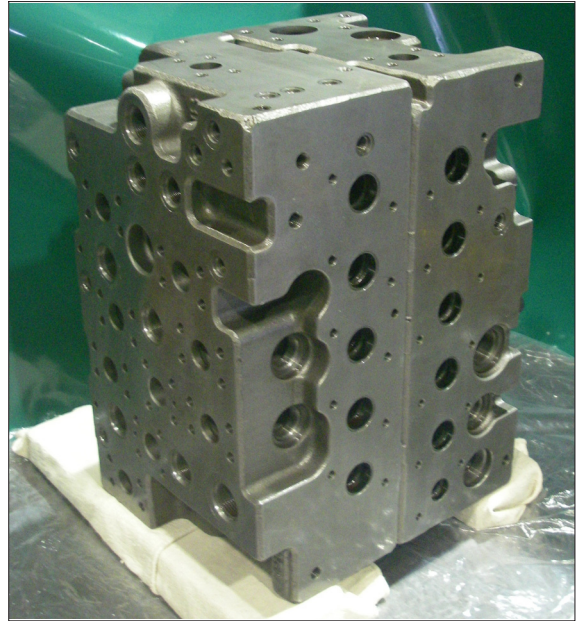
**(16) Disassembly of orifices for signal line :**

Do not disassemble the plug (151) and orifice (156) unless required specifically.



**(17) Disassembly of casing :**

- ① Except when required specially, do not disassemble the tie bolts of the P1 housing.
- ② Since the plugs not described in above disassembling procedures are the blind plugs for sacrifice holes and the blind plugs for the housing sanitation, do not disassemble them as far as not required specially.



### **(18) Inspection after disassembling**

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

#### **② Relief valve**

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

#### 4) ASSEMBLY

- ① In this assembling section, explanation only is shown. Refer to figures and photographs shown in disassembling section.
- ② Figure in ( ) shown after part name in explanation sentence shows number in structure figure.
- ③ Cautions in assembling O-rings
  - a. Pay attention to keep O-rings free from defects in its forming and damages in its handling.
  - b. Apply grease, hydraulic oil or so on to O-rings and seal-fitting sections for full lubrication.
  - c. Do not stretch O-rings so much to deform them permanently.
  - d. In fitting O-ring, pay attention not to roll it into its position. In addition, twisted O-ring cannot remove its twisting naturally with ease after being fitted, and causes oil leakage.
  - e. Tighten fixing the bolts for all sections with a torque wrench to their respective tightening torque.

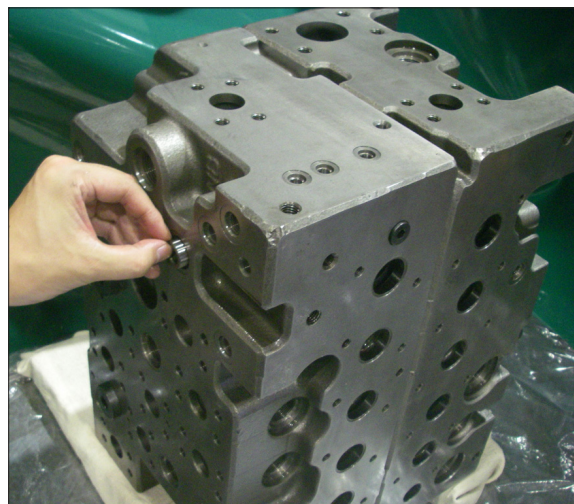
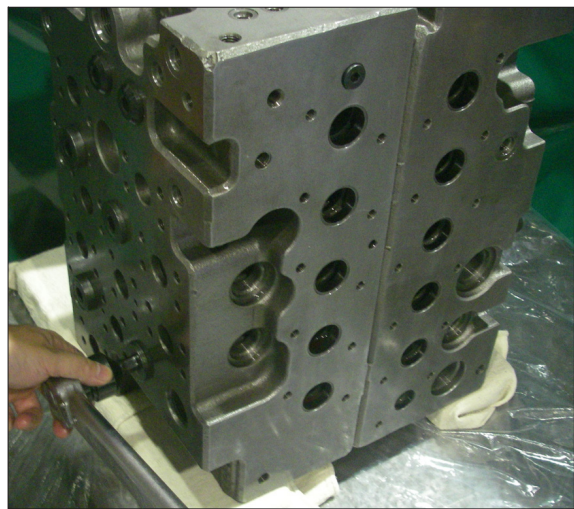
##### (1) Assembly of check valve :

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

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

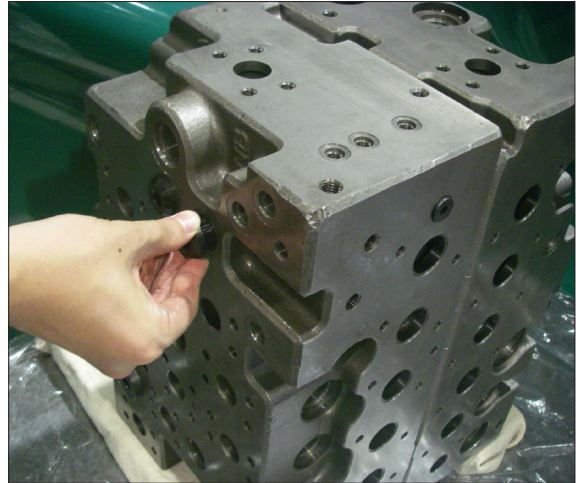
Poppet	Spring	Plug	Remember that
511	521	551	511 in 8 positions
512	522	553	512 in 2 positions
513	523	552	513 in 2 positions
514	521	551	514 in 2 positions

Plug No.	Hexagon key wrench (mm)	Tightening torque (kgf·m)
551	12	23.5 ~ 26.5
552	12	23.5 ~ 26.5
553	10	13.3 ~ 15.3



② Assemble of ball (541), spring Seat (542) and spring (543) : Put the O-ring (166) onto the plug (550), and tighten the plug (550) with specified torque.

- Hexagon key wrench : 6 mm
- Tightening torque : 2.55 ~ 2.96 kgf·m  
(18.4~21.4 lbf·ft)



**(2) Assembly of plate (210) :**

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

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

So turn the control valve that the plate face may be directed downward.

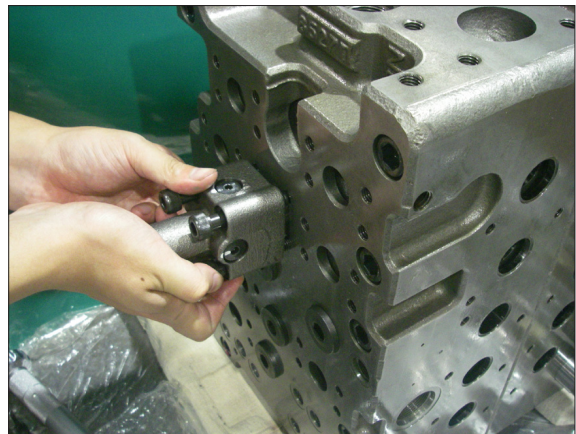
**(3) Assembly of flange (209) :**

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

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

**(4) Assemble of logic control valve (250, 251):**

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





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

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

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

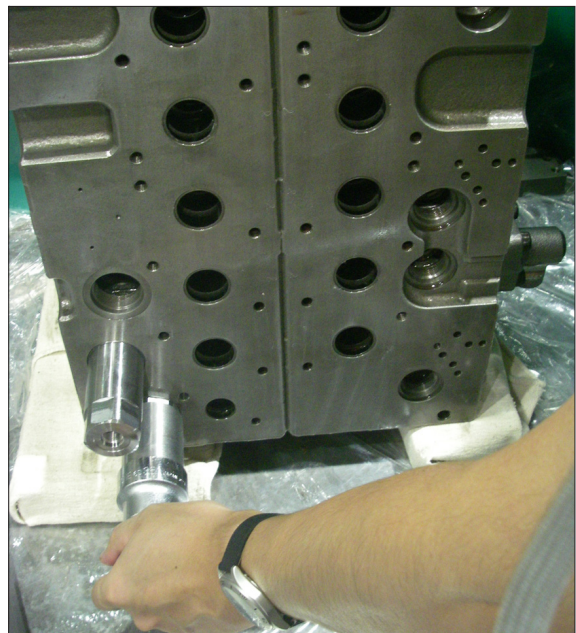
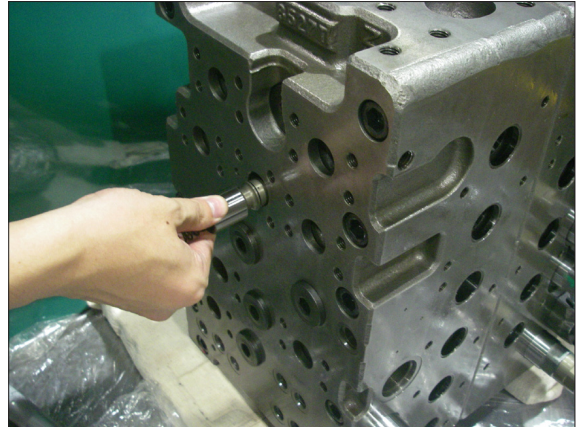
- ④ Fit the O-rings (250-112 and 113, 251-112 and 113) to the casing (250-101, 251-101) of the logic control valve, and tighten the hexagon socket head bolts (250-120, 251-120) with specified torque.

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

**(5) Assembling of negative control relief valve (610) :**

Assemble the negative control relief valve (610) into the P2 housing (101), and tighten it with specified torque.

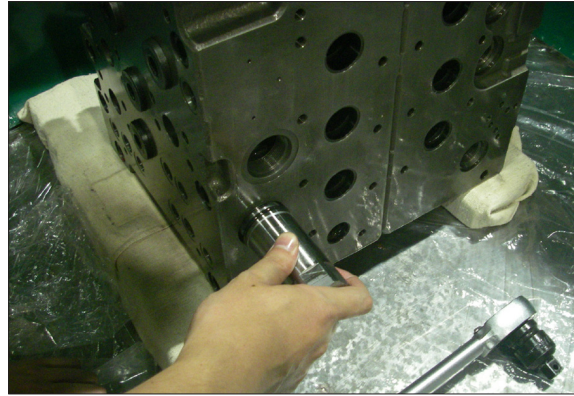
- Box wrench : 36 mm
- Tightening torque : 7.0 ~ 8.0 kgf·m  
(50.6~57.9 lbf·ft)



**(6) Assembly of arm regeneration cut valve (257) :**

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

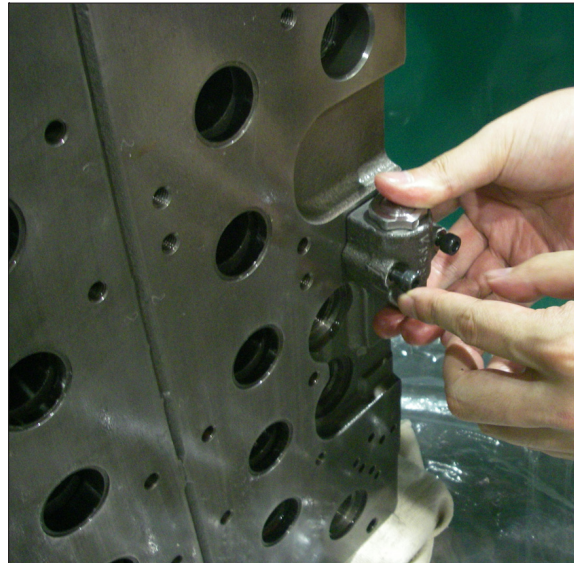
- Box wrench : 36 mm
- Tightening torque : 7.0 ~ 8.0 kgf·m  
(50.6~57.9 lbf·ft)



**(7) Assembling of lock valve selector (252) :**

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

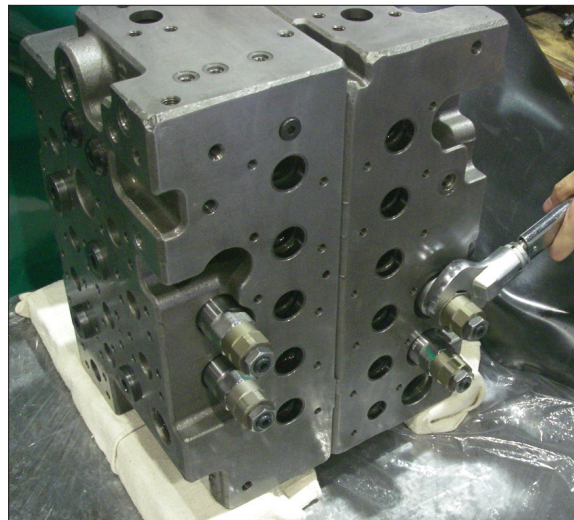
- Hexagon key wrench : 5 mm
- Tightening torque : 1.0 ~ 1.4 kgf·m  
(7.2~10.1 lbf·ft)



**(8) Assembling of main relief valve (601) and port relief valve (602, 603, 604) :**

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

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



21098MC49



**(9) Assemble of travel straight spool (308) :**

① Hold the middle of the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs (322, 323) and stopper (335), and tighten the spacer bolt (336) with specified torque.

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

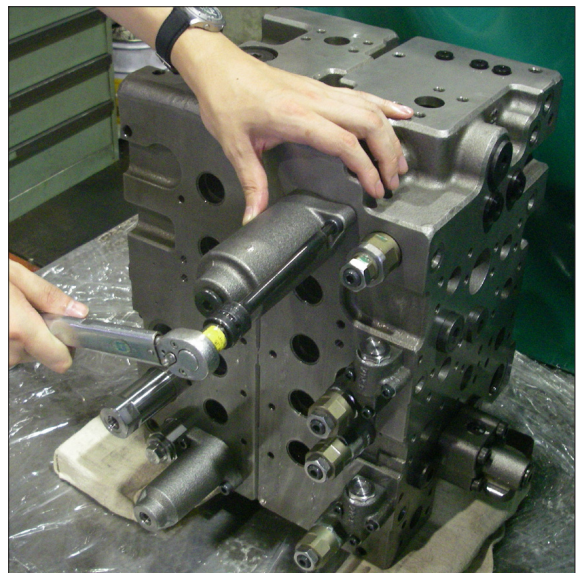
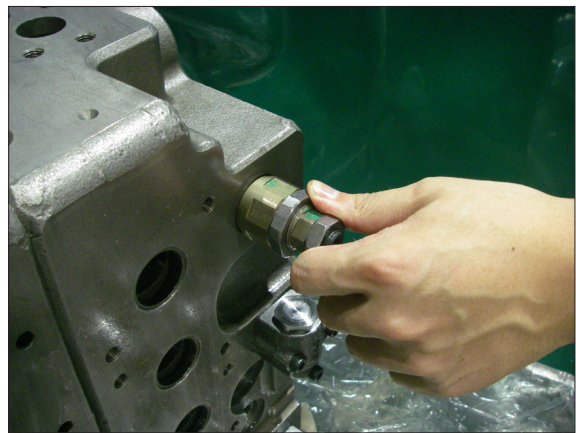
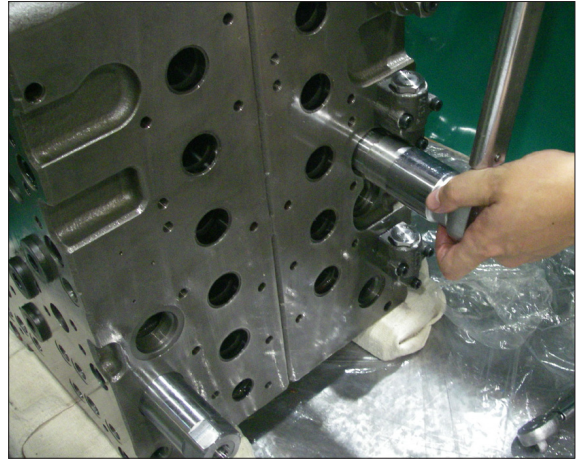
- Hexagon key wrench : 10 mm
- Tightening torque : 1.6 ~ 1.8 kgf·m  
(11.6~13.0 lbf·ft)

※ Pay attention not to fasten the vise excessively to the shape of the travel straight spool (308) is deformed.

② Insert the spool assemblies of ① items above into the P2 housing (101).

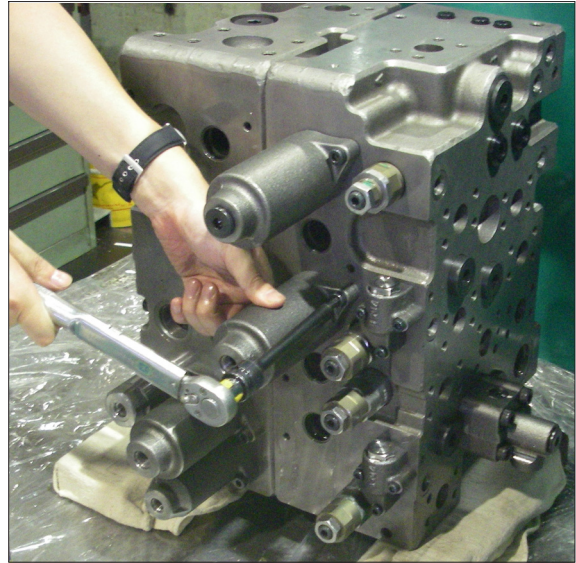
※ Fit spool assemblies into P2 housing (101) carefully and slowly.

※ Do not push them forcibly without fail.



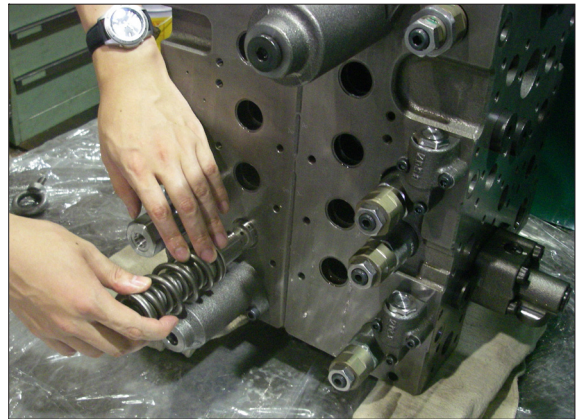
**(10) Assembling of boom 1 spool (303) :**

- ① Hold the middle of the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs (320, 321) and stopper (335), and tighten the spacer bolt (336) with specified torque.
  - ※ Before tightening the spacer bolt (336), apply loctite #262 to it.
    - Hexagon key wrench : 10 mm
    - Tightening torque : 1.6 ~ 1.8 kgf·m  
(11.6~13.0 lbf·ft)
  - ※ Pay attention not to fasten the vise excessively to the shape of the boom 1 spool (303) is deformed.
- ② Insert the spool assemblies of items ① above into the P2 housing (101).
  - ※ Fit spool assemblies into the P2 housing (101) carefully and slowly.
  - ※ Do not push them forcibly without fail.



**(11) Assembling of arm 1 spool (302) :**

- ① Hold the middle of the arm1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs (320, 321) and stopper (335) and tighten the spacer bolt (336) with specified torque.
  - ※ Before tightening the spacer bolt (336), apply loctite #262 to it.
    - Hexagon key wrench : 10 mm
    - Tightening torque : 1.6 ~ 1.8 kgf·m  
(11.6~13.0 lbf·ft)
  - ※ Pay attention not to fasten the vise excessively to the shape of the arm 1 spool (302) is deformed.
- ② Insert the spool assemblies of items ① above into the P1 housing (102).
  - ※ Fit spool assemblies into the P1 housing (102) carefully and slowly.
  - ※ Do not push them forcibly without fail.





**(12) Assembling of main spool (travel (301), bucket (304), swing (305), option (309), arm2 (306), boom2 (307), swing priority (311)):**

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

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

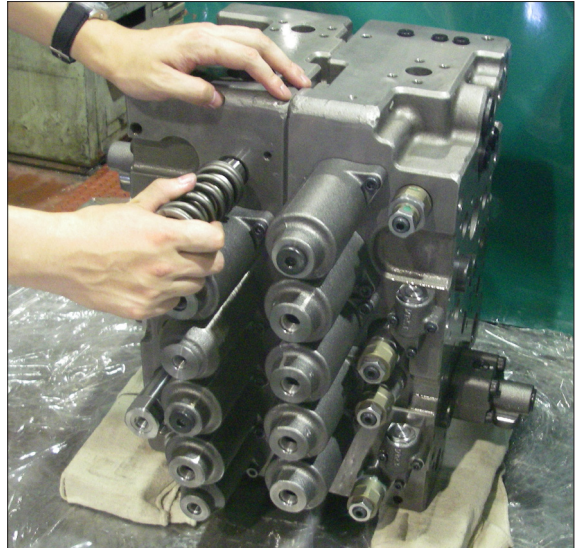
- Hexagon key wrench : 10 mm
- Tightening torque : 1.6 ~ 1.8 kgf·m  
(11.6~13.0 lbf·ft)

※ Pay attention not to fasten the vise excessively to the shape of the spool is deformed.

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

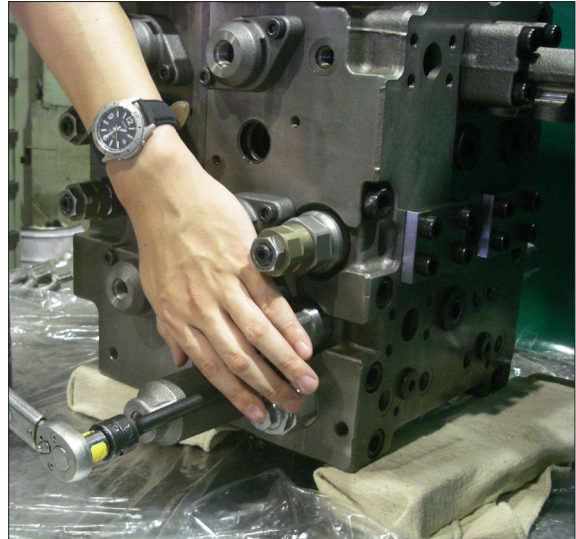
※ Fit spool assemblies into P2 housing (101) and P1 housing (102) carefully and slowly.

※ Do not push them forcibly without fail.



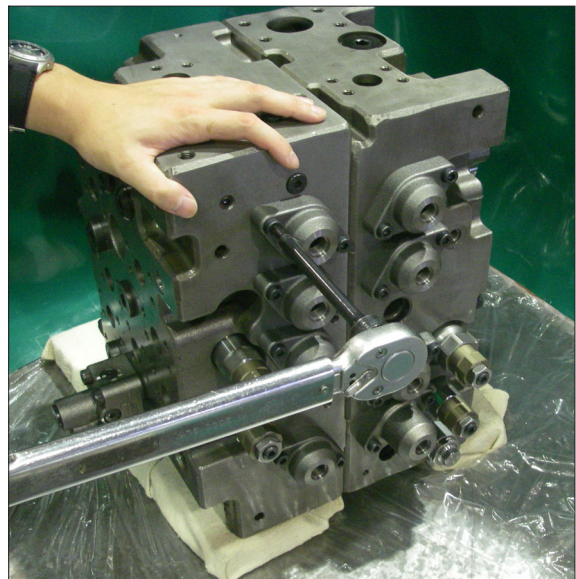
**(13) Assembling of bypass cut spool (310, 313) :**

- ① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (331), springs (370, 371) and stopper (337) and tighten the spacer bolt (333) with specified torque.
  - ※ Before tightening the spacer bolt (333), apply loctite #262 to it.
    - Hexagon key wrench : 10 mm
    - Tightening torque : 1.6 ~ 1.8 kgf·m  
(11.6~13.0 lbf·ft)
  - ※ Pay attention not to fasten the vise excessively to the shape of the bypass cut spool (310, 313) is deformed.
- ② Insert the spool assemblies of Items ① above into the P1 housing (102).
  - ※ Fit spool assemblies into the P1 housing (102) carefully and slowly.
  - ※ Do not push them forcibly without fail.



**(14) Assembling of covers :**

- ① Fit the O-rings (264) to the spool covers (204, 205, 206, 208) to sides reverse to the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.
  - ※ Confirm that O-rings (264) have been fitted to the spool covers (204, 205, 206, 208).
    - Hexagon key wrench : 6 mm
    - Tightening torque : 2.5 ~ 3.5 kgf·m  
(18.1~25.3 lbf·ft)
- ② Bucket spool cover (206) : Assemble piston (355) into bucket spool cover (206). Put O-ring (561) onto plug (258) and tighten it with specified torque.
  - Box wrench : 32 mm
  - Tightening torque : 15.3 ~ 18.4 kgf·m  
(111~133 lbf·ft)
- ③ Fit the O-rings (261, 262) to spring covers (201, 202, 203) to the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.
  - ※ Confirm that O-rings (261,262) have been fitted to spring covers (204, 205, 206).
    - Hexagon key wrench : 6 mm
    - Tightening torque : 2.5 ~ 3.5 kgf·m  
(18.1~25.3 lbf·ft)



## GROUP 5 SWING DEVICE

### 1. REMOVAL AND INSTALL OF MOTOR

#### 1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) 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.

(3) Disconnect pilot line hoses (2, 3, 4, 5, 6, 7, 8, 9).

(4) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (10).

- Motor device weight : 67 kg (148 lb)
- Tightening torque :  $84 \pm 8.0$  kgf · m  
( $608 \pm 58$  lbf · ft)

(5) Remove the swing motor assembly.

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

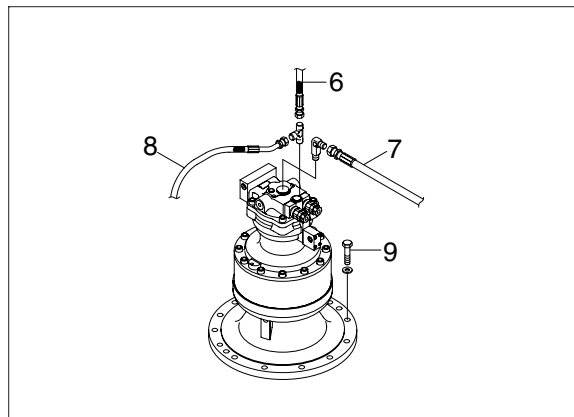
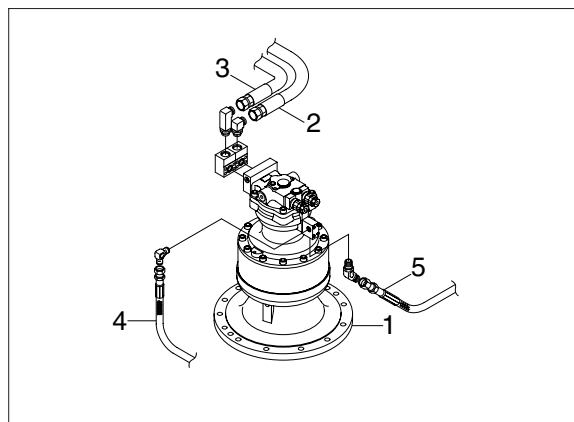
#### 2) INSTALL

(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.

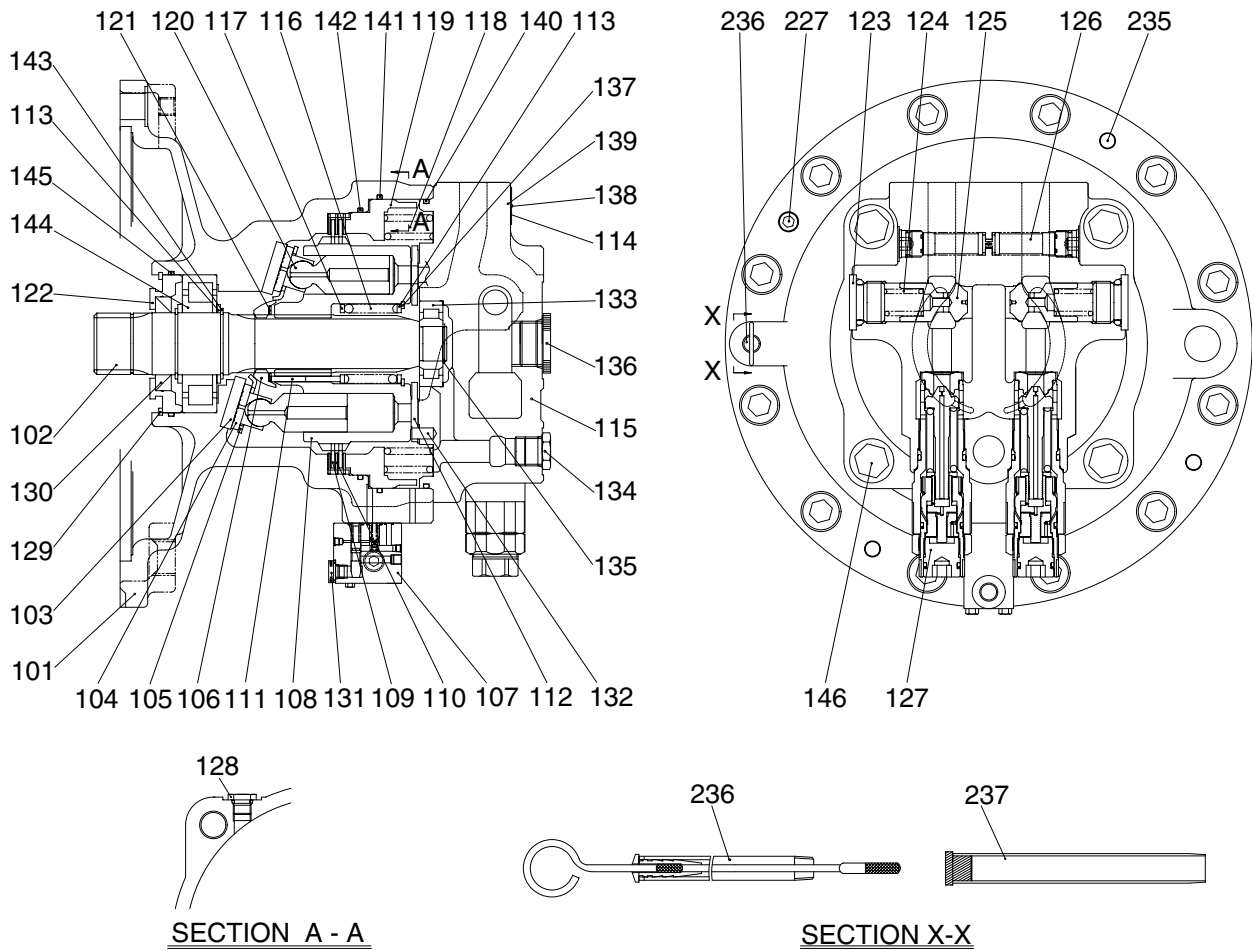
(3) Confirmed the hydraulic oil level and check the hydraulic oil leak or not.





## 2. SWING MOTOR

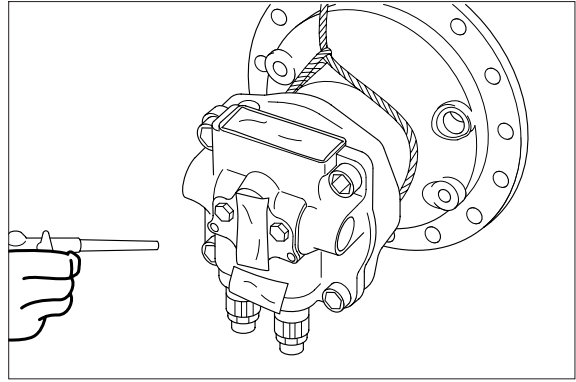
### 1) STRUCTURE



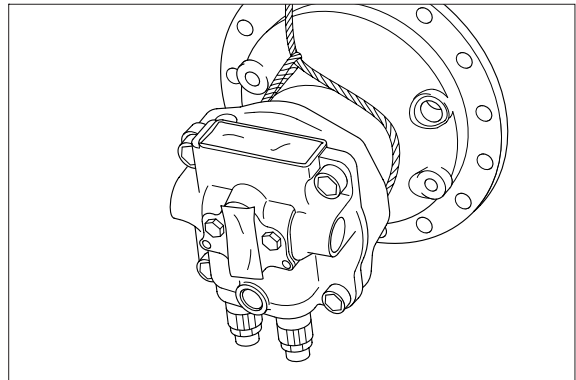
101	Casing A1	118	Brake spring	135	Ring snap
102	Drive shaft	119	Brake piston	136	Dust plug
103	Shoe plate	120	Piston	137	Ring snap
104	Shoe	121	Spacer F	138	Name plate
105	Retainer	122	Front cover	139	Rivet screw
106	Spherical bush	123	RO plug	140	O-ring
107	Brake valve	124	Spring	141	O-ring
108	Cylinder block	125	Plunger K	142	O-ring
109	Friction plate	126	S/reaction less valve	143	Ring snap
110	Separation pate	127	Relief valve	144	Roller bearing
111	Push rod	128	VP plug	145	O-ring
112	Valve plate	129	Ring snap	146	Socket bolt
113	Spacer	130	Oil seal	227	Socket bolt
114	VP plug	131	Dust plug	235	Pin
115	Valve casing	132	Pin spring	236	Level gauge
116	Cylinder spring	133	Roller bearing	237	Air breather assy
117	Spacer R	134	Dust plug		

## 2) DISASSEMBLY

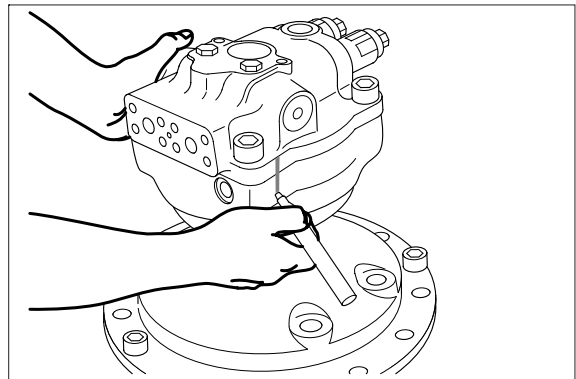
- (1) Lift the motor out. Clean the motor in kerosene and dry with compressed air.
  - ※ To avoid dust inside the motor, mask all the ports of the motor with tapes.



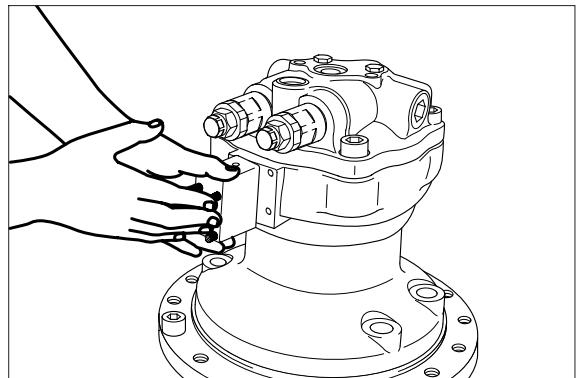
- (2) Loosen the drain plug to discharge oil in the casing (101).



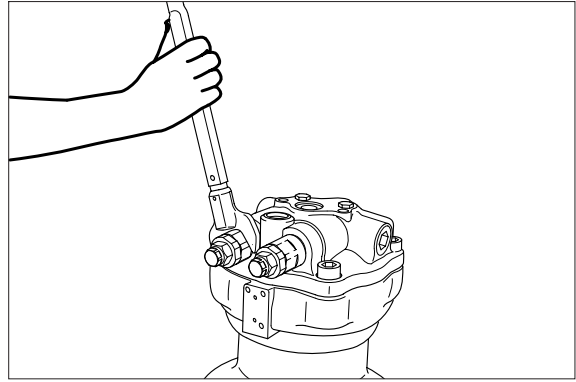
- (3) Fix the drive shaft (102) on the workbench with the end of output shaft down. Put matching marks on casing (101) and valve casing (303) for easy reassembly.



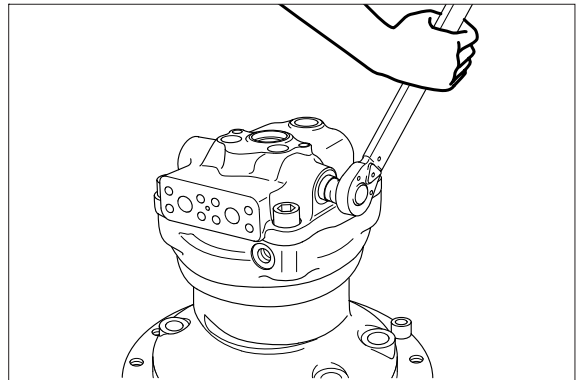
- (4) Remove the valve (107).



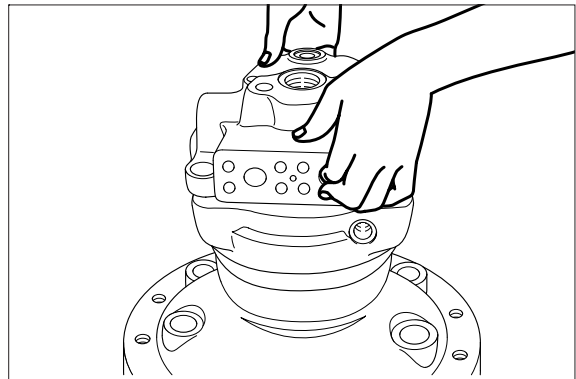
- (5) Remove the relief valve (127) from valve casing (115).



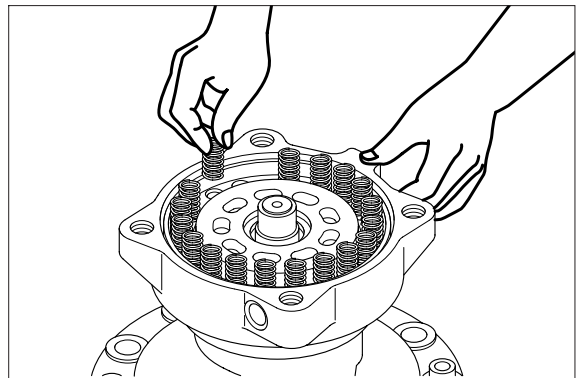
- (6) Remove plug (123) from valve casing (115) and spring (124), plunger (125).  
※ Be careful not to damage the plunger seat assembly.



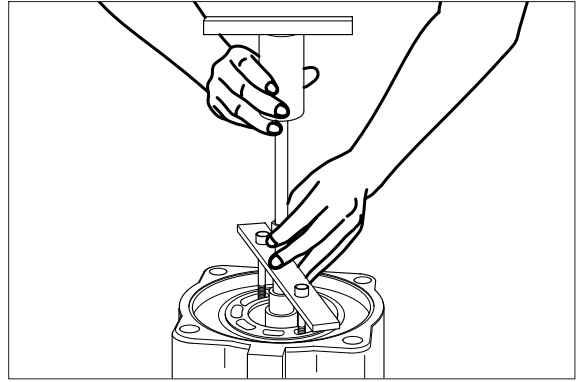
- (7) Remove valve casing (115) from casing (101). Then, remove the valve plate (112) from valve casing (115) with care.



- (8) Remove the brake spring (118) from brake piston (119).

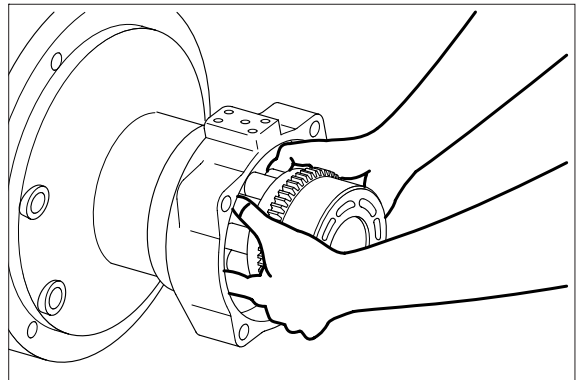


(9) Remove brake piston (119) from casing (101).

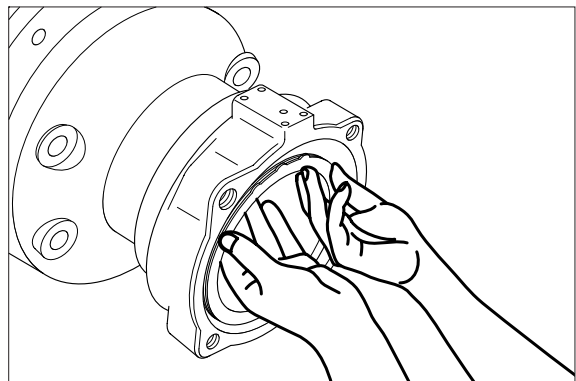


(10) Remove the cylinder (108) from the output shaft (102) with the motor positioned horizontally. Remove piston (104, 120), retainer (105), spherical bush (106), spacer (121) and shoe plate (103).

※ If shoe plate would not removed easily, try again after procedure (14).

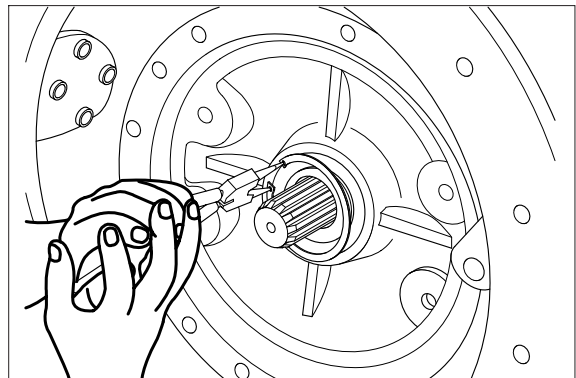


(11) Remove friction plate (109) and separate plate (110) from casing (101).

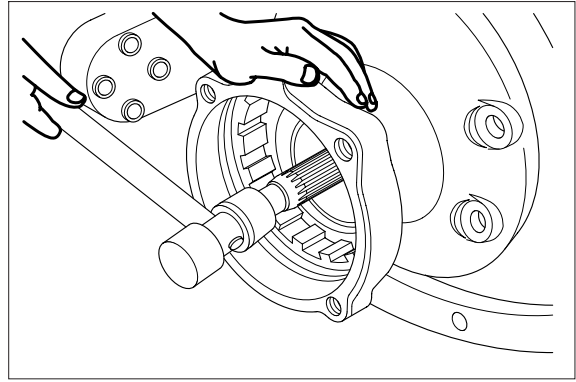


(12) Remove snap ring (129) with pillar and remove the front cover (122) from casing (101).

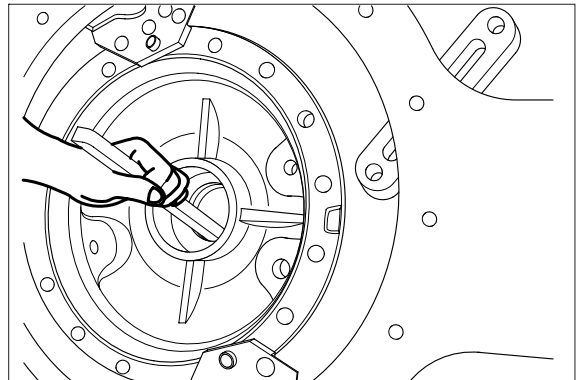
※ Front cover could be removed with sliding shaft if necessary.



(13) Remove drive shaft (102) from casing (101).



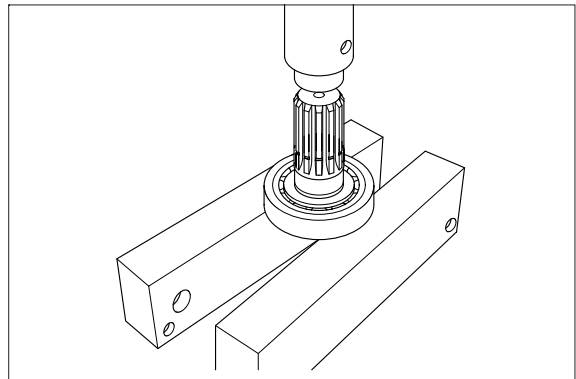
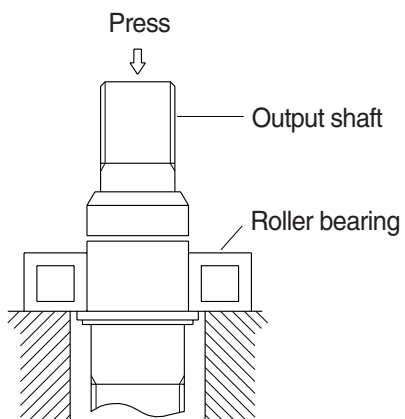
(14) Remove the shoe plate (103) from casing (101).



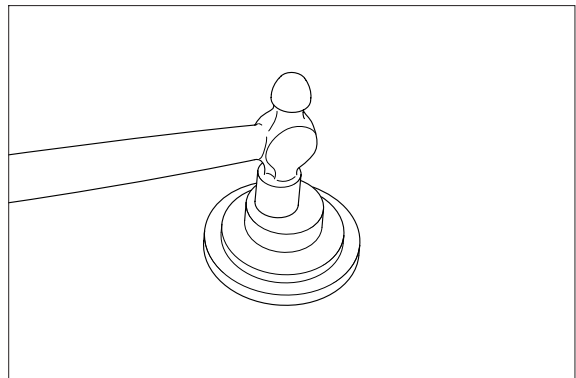
(15) Proceed with following job only when necessary.

- ① Remove the snap ring (143), spacer (113) from drive shaft (102) and remove the cone of roller bearing (144) by press.

※ Do not reuse bearings.

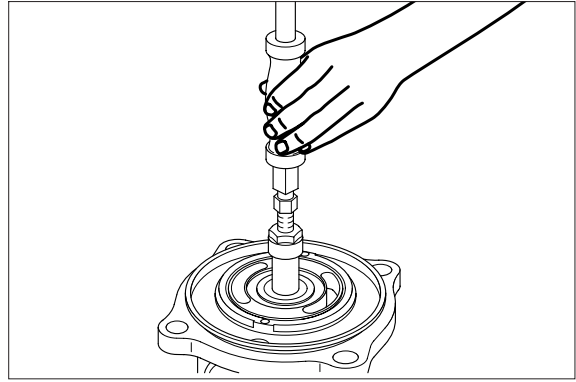


- ② Remove oil seal (130) from front cover (122).



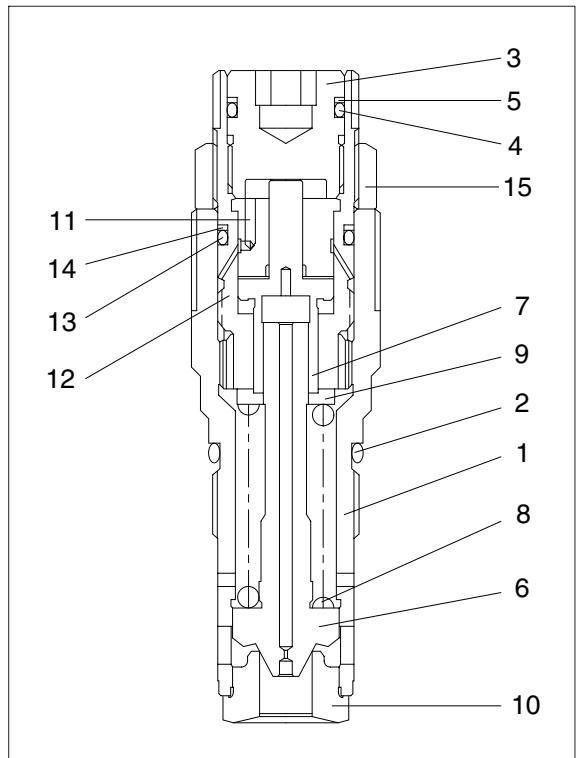


- ③ Remove the roller bearing (133) from the valve casing (101) by using slide hammer bearing puller.



- ④ When disassembling the relief valve, release the plug (3).  
Remove the piston (7), spring seat (9), spring (8) and plunger (6) with the body (1) downwards.

※ Do not release the lock nut (15).

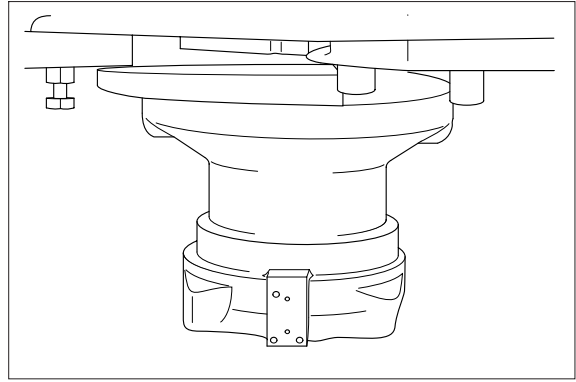


This completes disassembly.

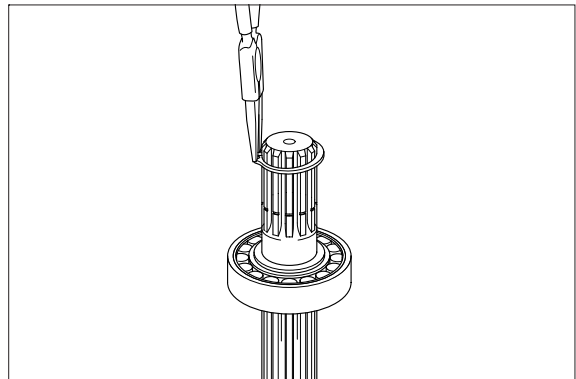
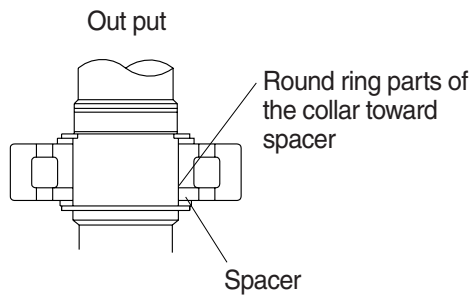
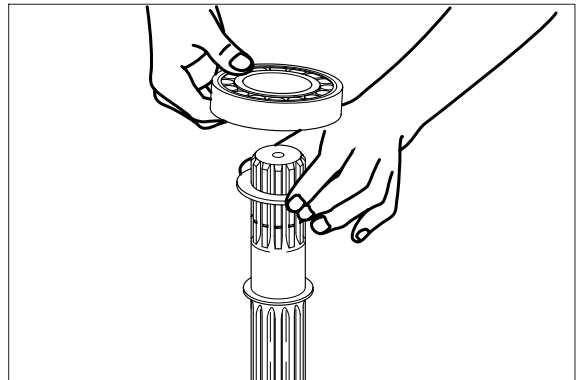
### 3) ASSEMBLY

Do the reassembly in the reverse procedure of the disassembly.

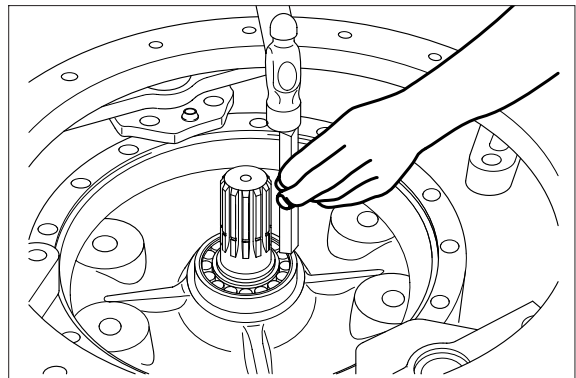
- (1) Place the casing (101) on the workbench with the valve casing (115) downward.



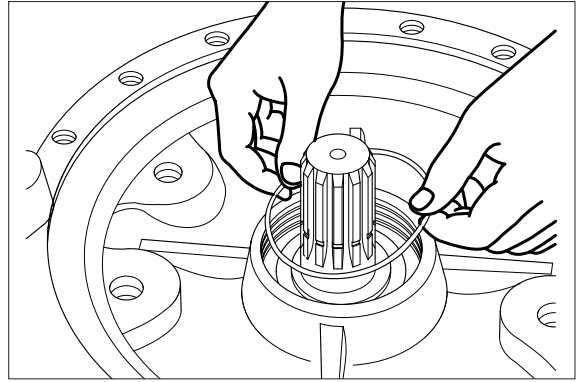
- (2) When reassembling the roller bearing, install the snap ring (143), and spacer (113) to the drive shaft (102). Insert the collar and cone of the roller bearing (144). Install the spacer (113) and stop ring (143). Install stop ring (144) to the output shaft (102) by heating the cone of the roller bearing (133).



- (3) Insert the drive shaft (102) into the casing (101) with the end of output shaft upward and tap the outer race of roller bearing with the hammer.

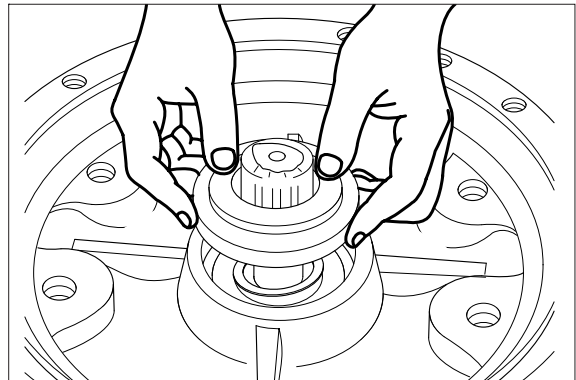


(4) Tack O-ring (145) to the casing (101).

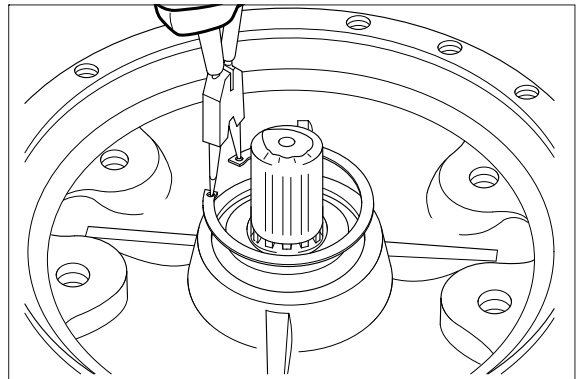


(5) Reassemble the front cover (122) to the casing (101).

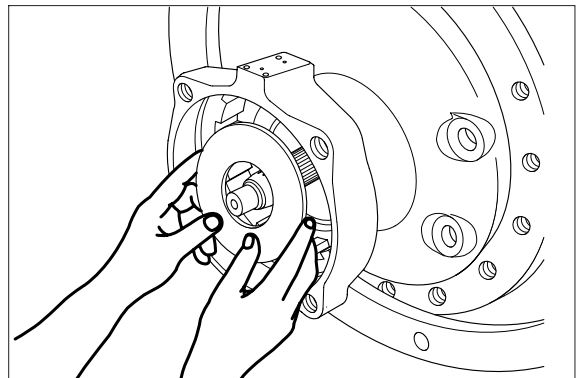
※ Apply grease to the rib of oil seal to avoid damage to the rib.



(6) Install the snap ring (129) to the casing (101).

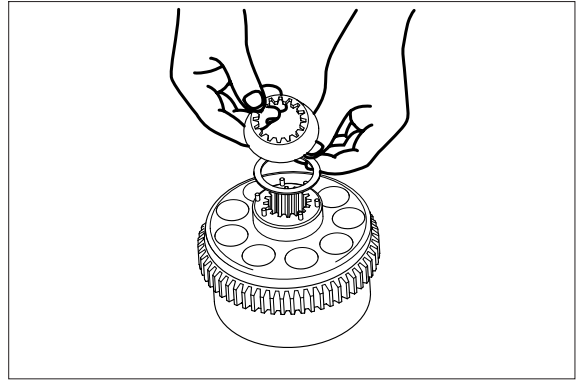


(7) Insert the shoe plate (103) with the casing (101) position horizontally.



(8) Insert the spherical bush (106) into the cylinder (108). Place the retainer (105) assembled with spacer (121) onto the cylinder.

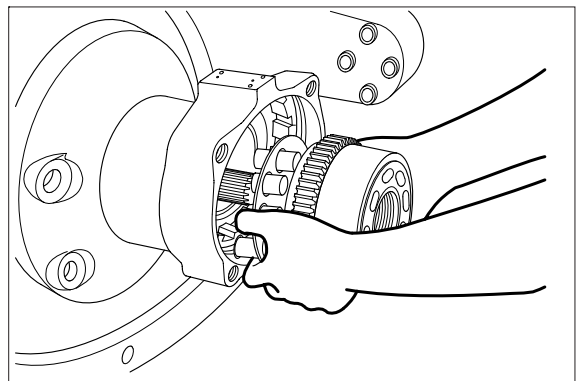
※ Insert two push rods in each hole.



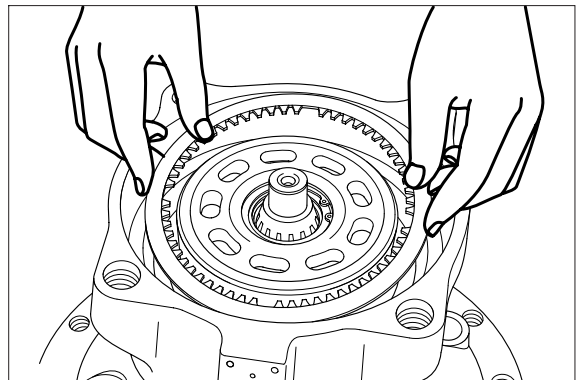
(9) Install the piston sub-assembly (120, 104) to the retainer (105).



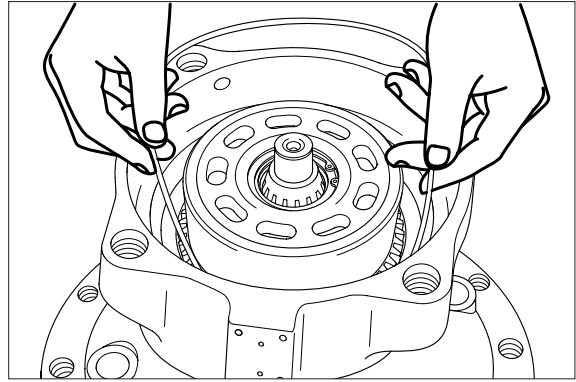
(10) Reassemble the piston assembly (120, 104) to the cylinder block (108).



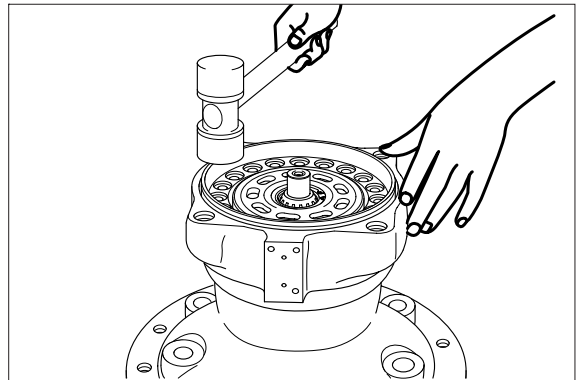
(11) Place the casing (101) under the front cover (122) and reassemble 3 sheets of separate plate (110) and then 2 sheets of friction plate (109) to the casing (101).



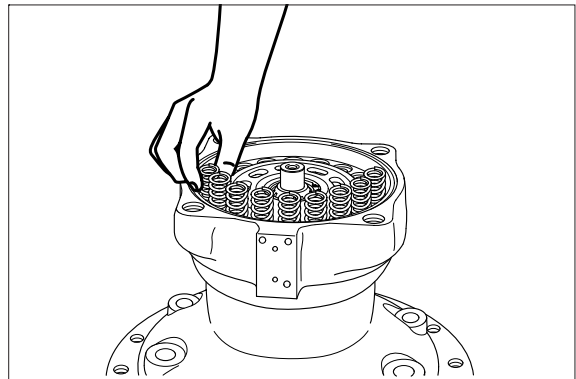
(12) Insert O-ring (141, 142) inside the casing (101).



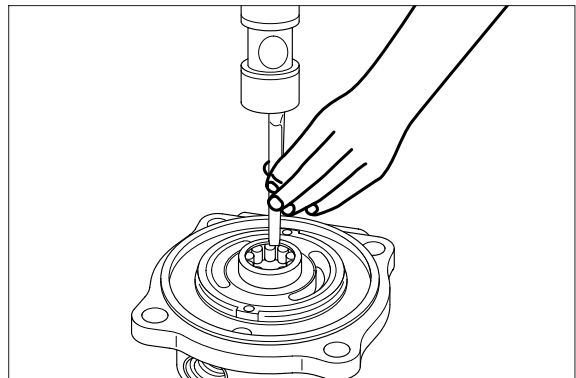
(13) Reassemble brake piston (119) to the casing (101).



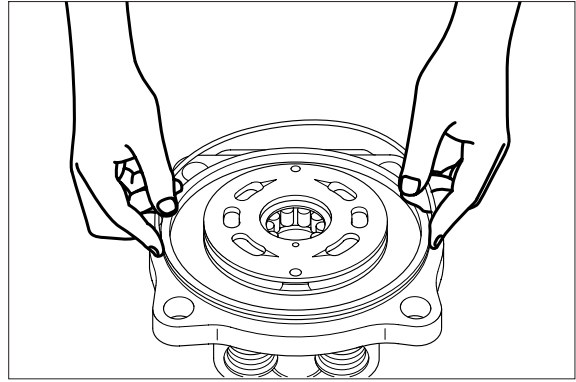
(14) Reassemble brake spring (118) to the brake piston (119).



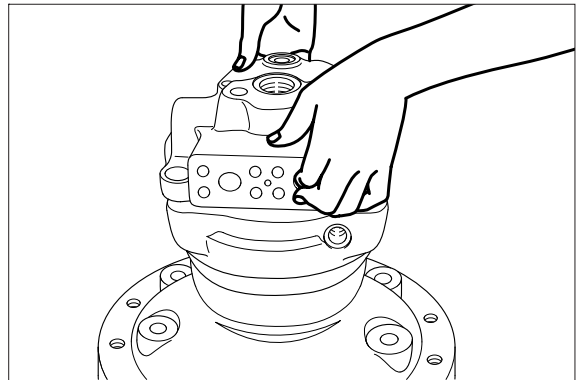
(15) When assembling the roller bearing (133), insert the roller bearing (444) into valve casing (115) by hammering.



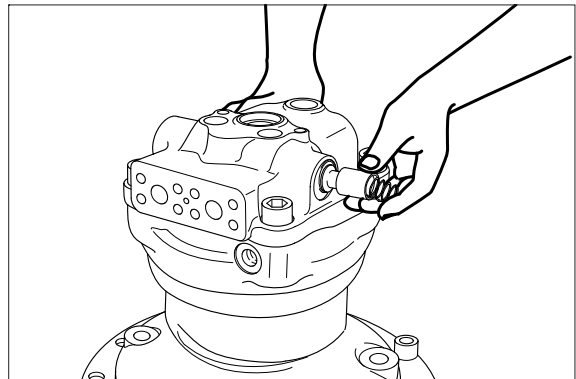
(16) Reassemble valve plate (112) to the valve casing (115) and reassemble O-ring (140).



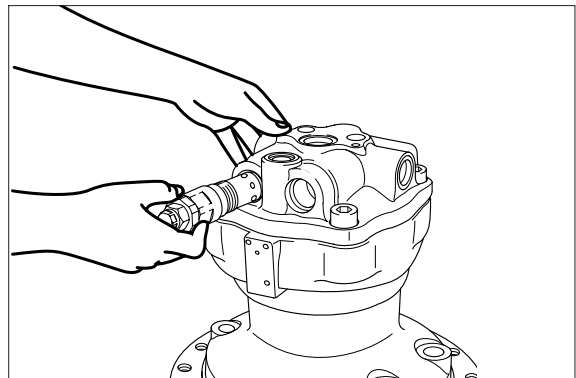
(17) Connect the valve casing (115) with the casing (101) and tighten the socket bolt (146).



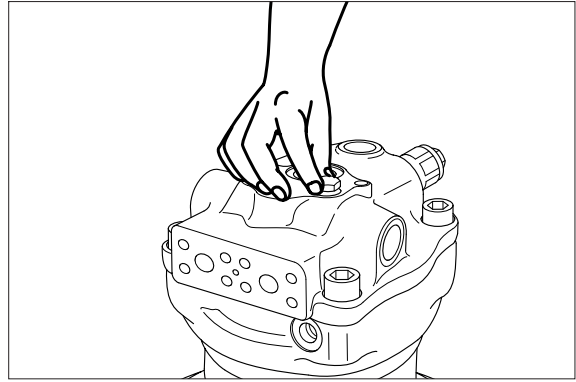
(18) Insert plunger (125) and spring (124) in the valve casing. Tighten plug (123) to the valve casing.



(19) Insert O-rings (127-1) to the relief valve (127) and reassemble them to valve casing (101).



(20) Tighten the plug (114) to valve casing (115) to casing (301).



(21) Connect the valve casing (115) with the casing (101).

This completes assembly.

### 3. REMOVAL AND INSTALL OF REDUCTION GEAR

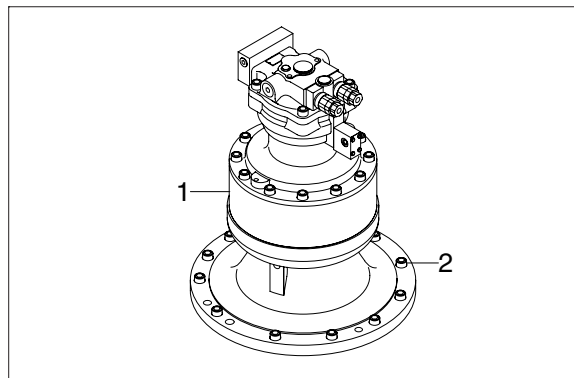
#### 1) REMOVAL

- (1) Remove the swing motor assembly.  
For details, see removal of swing motor assembly.
- (2) Sling reduction gear assembly(1) and remove mounting bolts(2).
- (3) Remove the reduction gear assembly.
  - Reduction gear device weight : 320 kg  
(705 lb)



#### 2) INSTALL

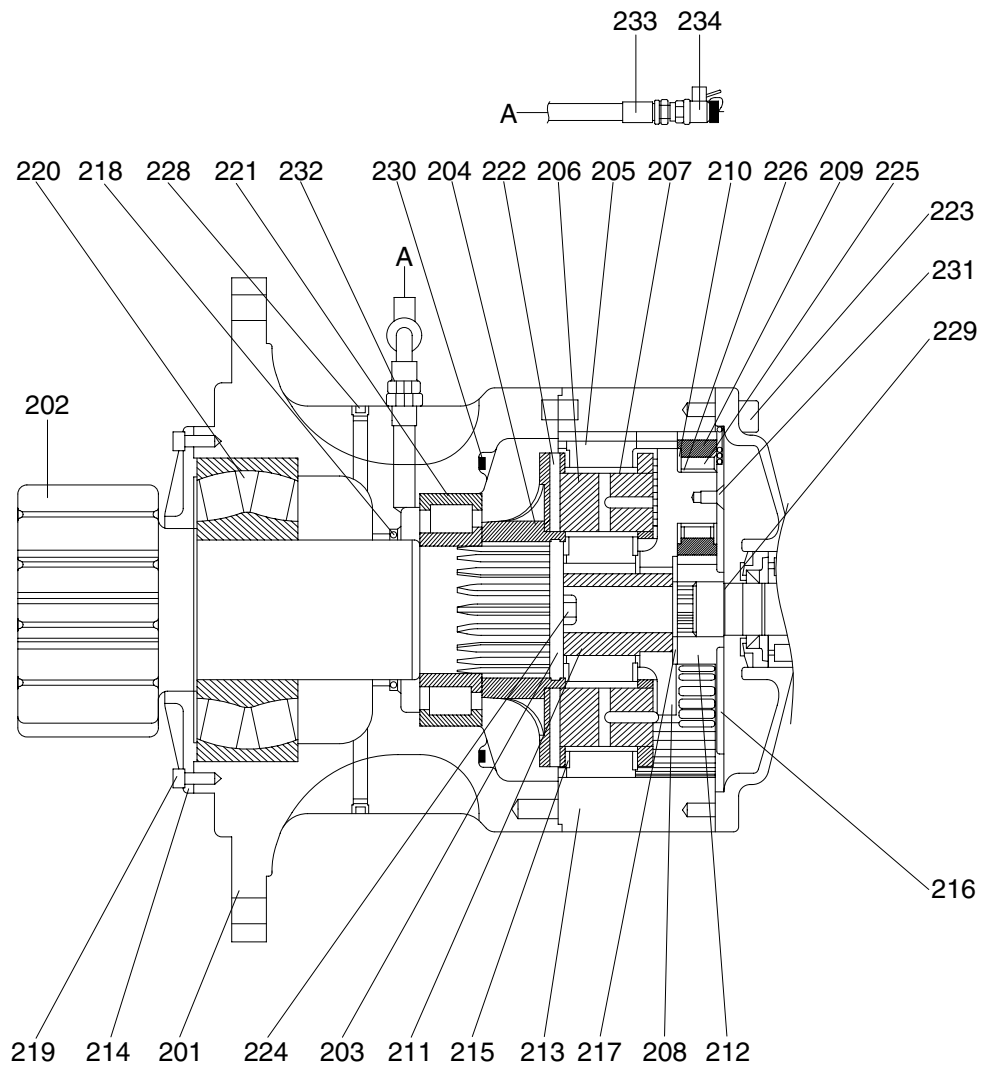
- (1) Carry out installation in the reverse order to removal.
  - Mounting bolt :  $84 \pm 8.0$  kgf · m  
( $608 \pm 58$  lbf · ft)





## 4. REDUCTION GEAR

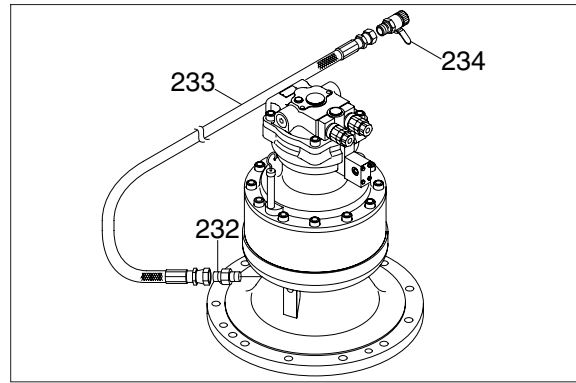
### 1) STRUCTURE



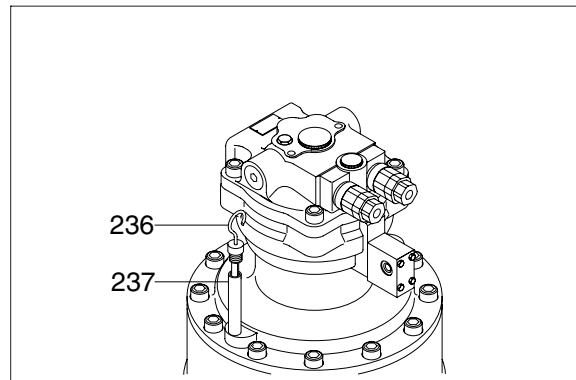
201	Casing	212	Sun gear 1	223	Socket bolt
202	Pinion shaft	213	Ring gear	224	Hex bolt
203	Preload plate	214	Cover	225	Needle bearing
204	Carrier 2	215	Thrust washer	226	Inner ring
205	Planet gear 2	216	Thrust plate	228	PT plug
206	Pin	217	Thrust washer	229	Snap ring
207	Bush	218	Oil seal	230	Magnet
208	Carrier 1	219	Socket bolt	231	Flat head screw
209	Planet gear 1	220	Spherical roller bearing	232	Connector (1/2 inch)
210	Thrust washer	221	Cylindrical roller bearing	233	Hose assembly
211	Sun gear 2	222	Spring pin	234	Drain valve assembly

## 2) DISASSEMBLY

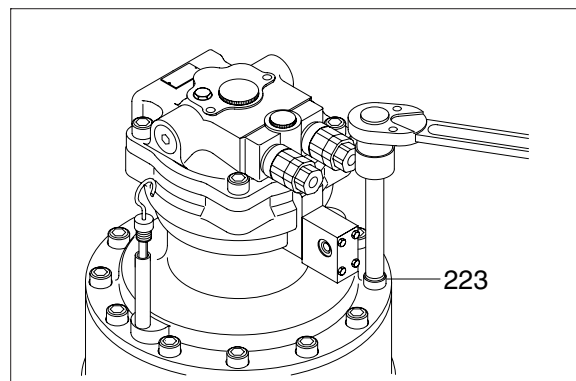
- (1) Remove connector (232), hose assy (233) and drain valve (234).



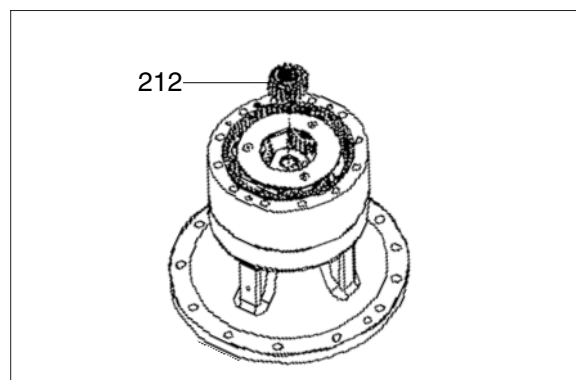
- (2) Remove gauge bar (236) and gauge pipe (237) from the swing motor casing.  
Pour the gear oil out of reduction gear into the clean bowl to check out the friction decrease.



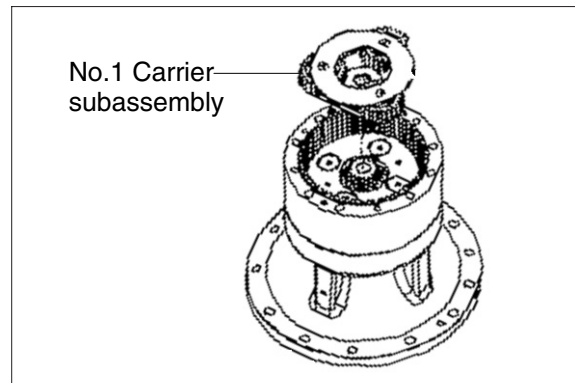
- (3) Loosen the socket bolt (223) to separate swing motor from reduction gear.



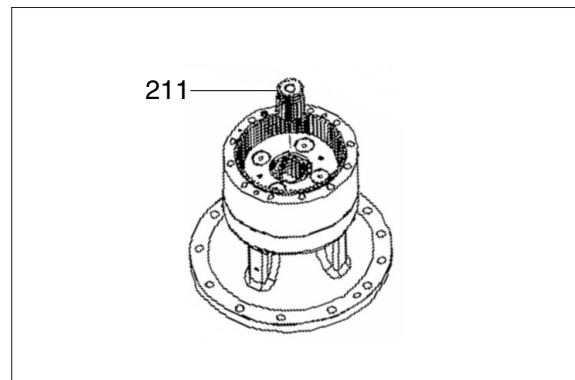
- (4) Full out No.1 sun gear (212).



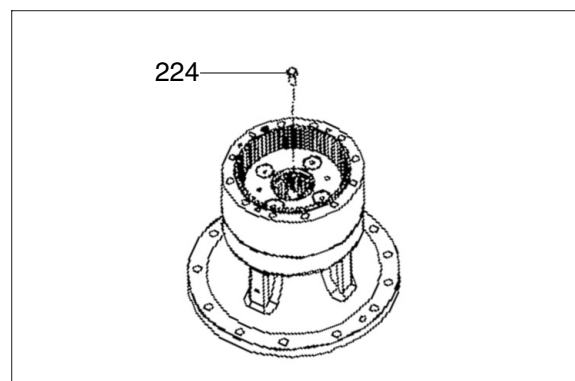
(5) Full out No.1 carrier subassembly.



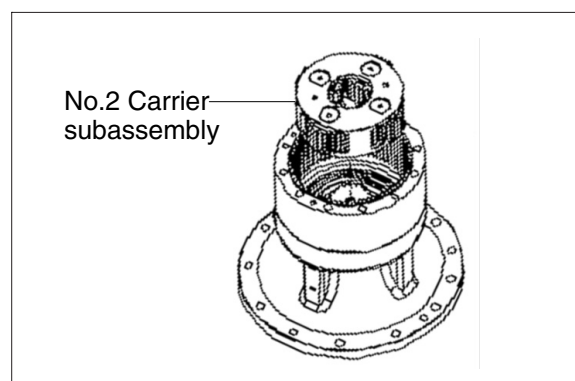
(6) Full out No.2 sun gear (211).  
※ Pay attention to ensure gear is not damaged during disassembling.



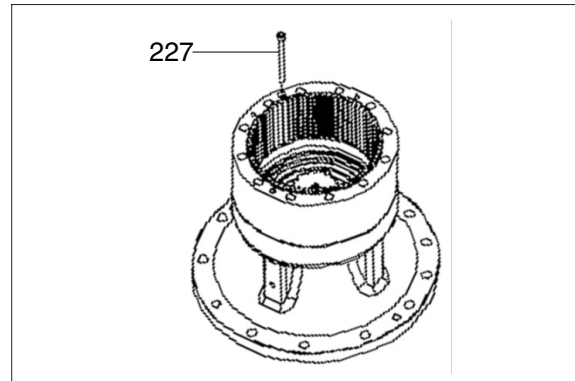
(7) Loosen the hexagon bolt (224).



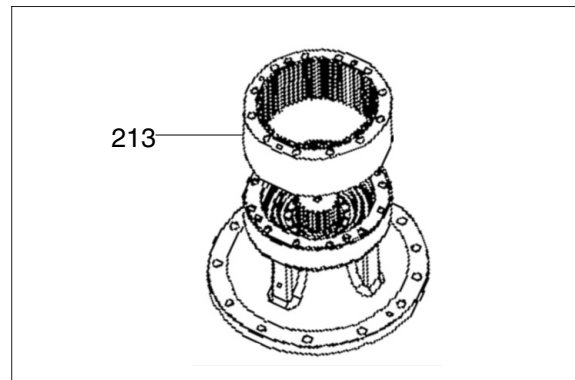
(8) Full out No.2 carrier subassembly.



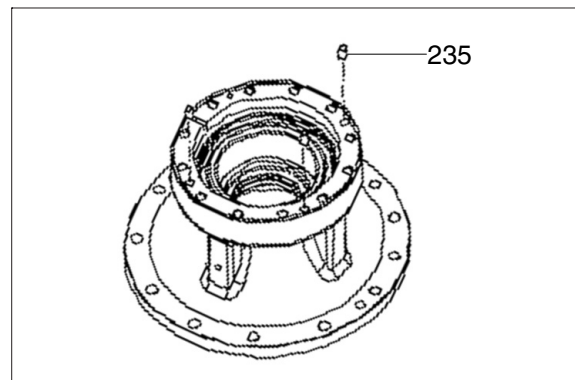
(9) Loosen the hexagon socket bolt (227).



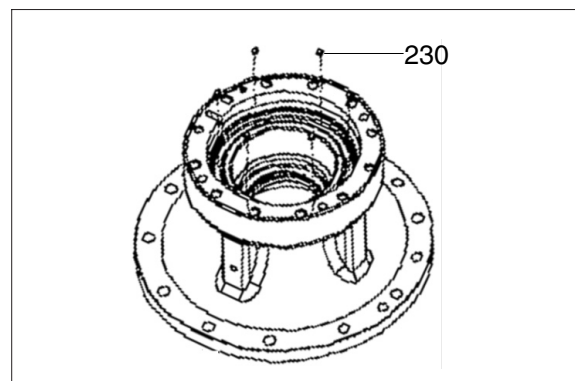
(10) Tighten two M10 eye bolts to ring gear (213) and lift up and remove ring gear (213).



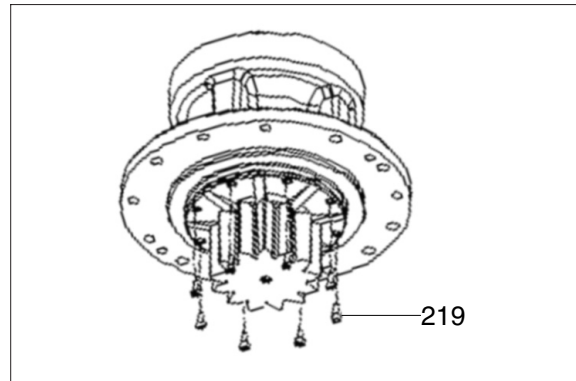
(11) Full out pin (235).



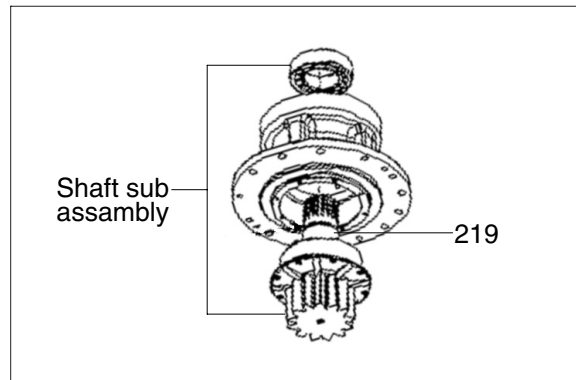
(12) Full out magnet (230).



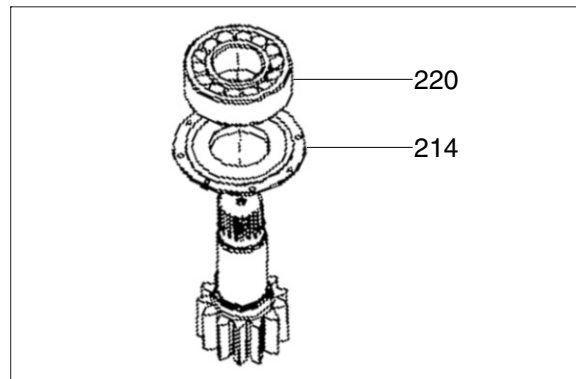
(13) Loosen the hexagon socket bolt (219).



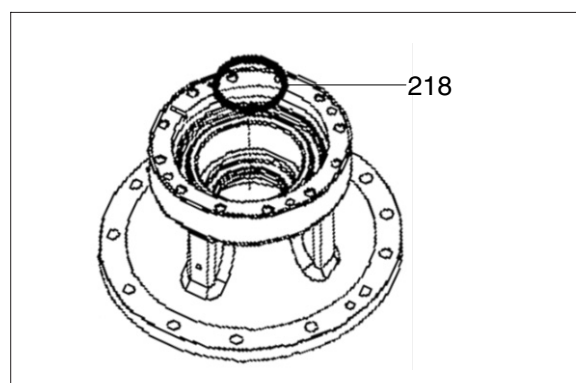
(14) Remove the shaft sub assembly with pinion shaft (202).



(15) Press drive shaft by using jig to remove spherical roller bearing (220) and cover (214).

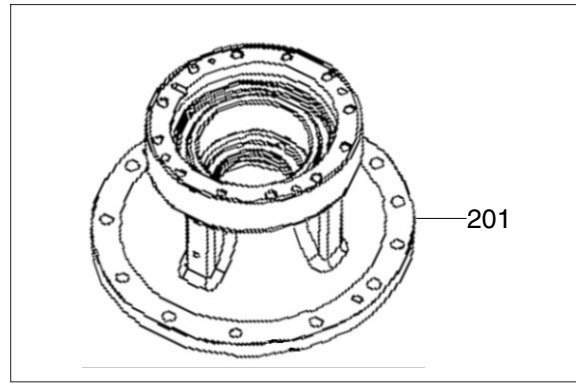


(16) Full out oil gear (218).

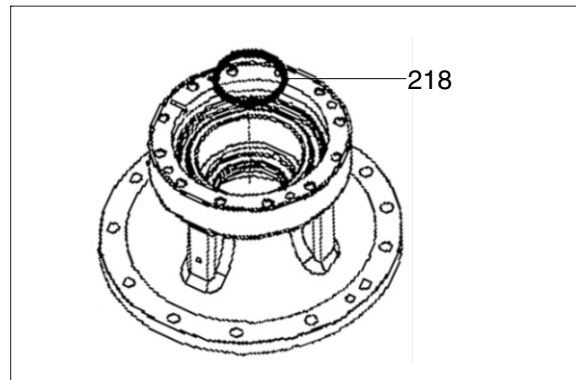


## 2) ASSEMBLY

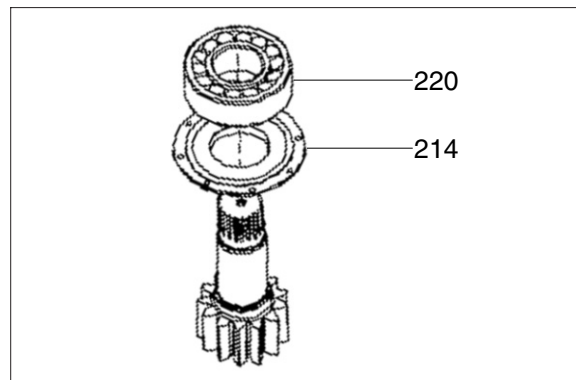
- (1) Place the casing (201) on the reversing machine having the flange side of the casedown.



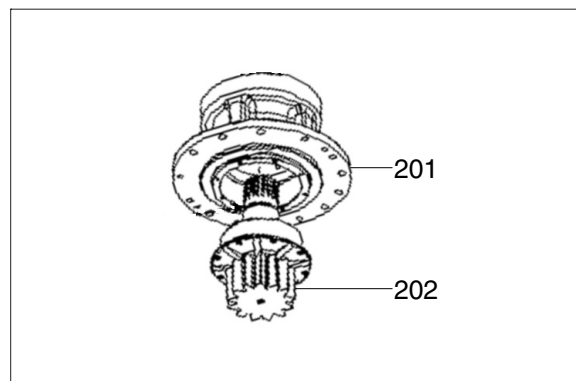
- (2) Press the insert oil seal (218) by using pressure jig after spreading grease oil around the out side ring of the seal.  
Coat grease oil slightly on the lip surface to prevent any scratch when installing.  
※ Be sure to check by eye that the oil seal is seated completely after being installed.



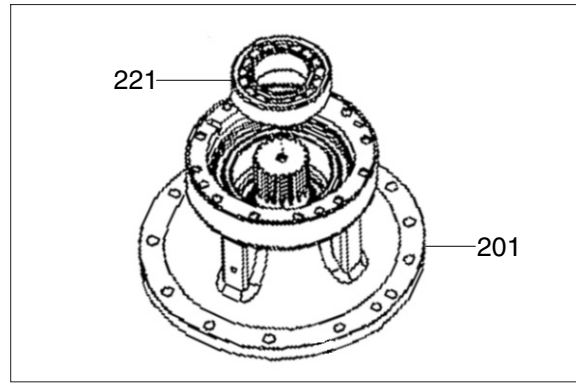
- (3) Insert cover (214) to pinion shaft (202) and insert spherical roller bearing (220) by using a pressing jig.



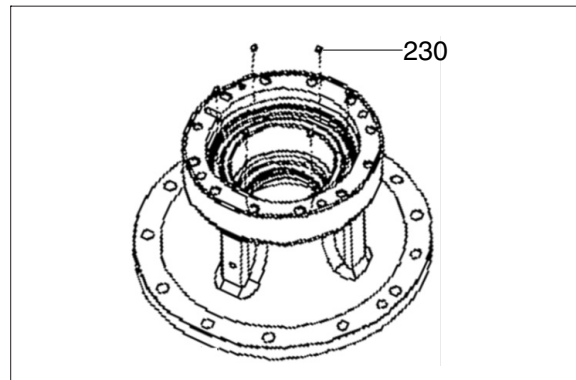
- (4) Install pinion shaft (202) sub assembly into casing by using a pressing jig.



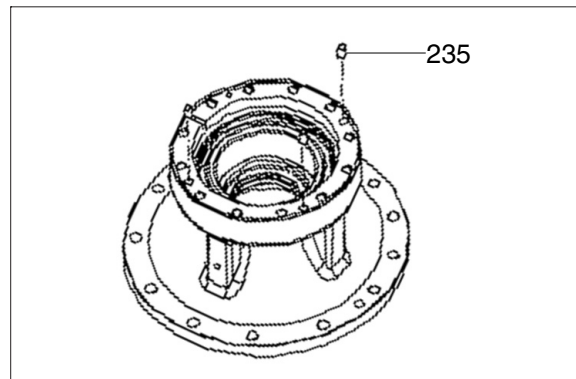
(5) Install roller bearing (221) into casing by using a pressing jig.



(6) Insert magnet (230).

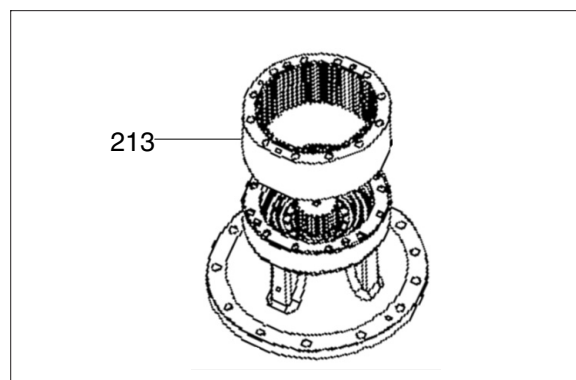


(7) Insert pin (235).

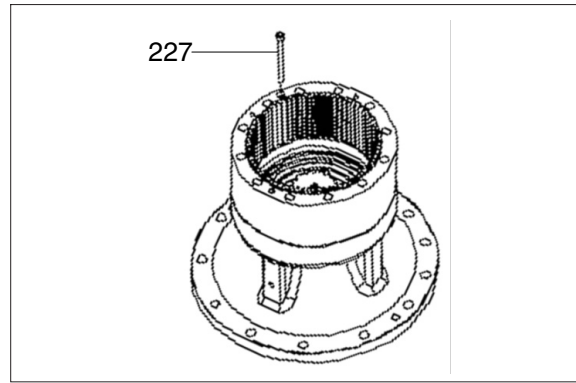


(8) Place ring gear on the case by matching it with pin hole.

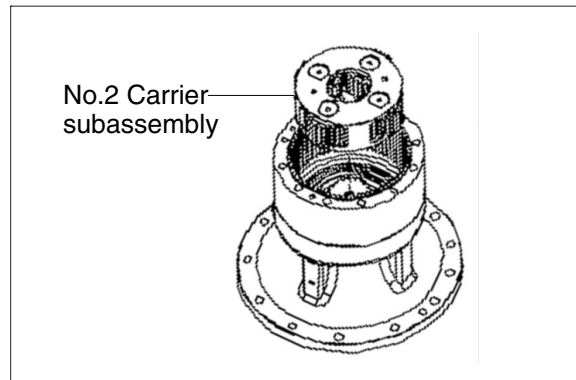
※ Be sure to check the hole location of oil gage before inserting.



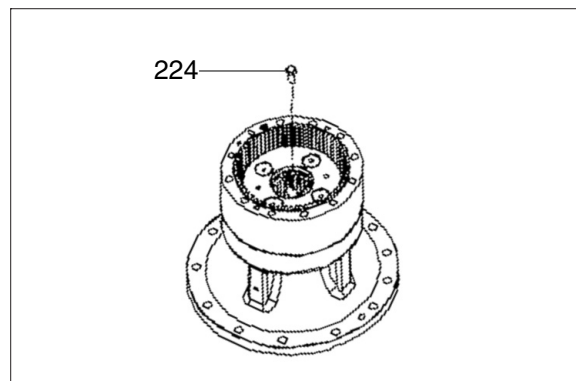
(9) Assemble ring gear with case by screwing socket bolt (227).



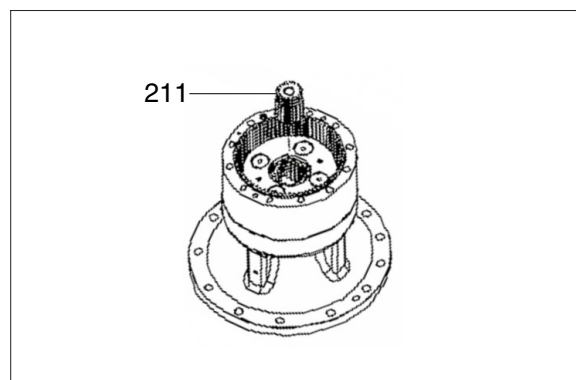
(10) Mount No.2 carrier subassembly in the casing.



(11) Tighten hexagon bolt (224).

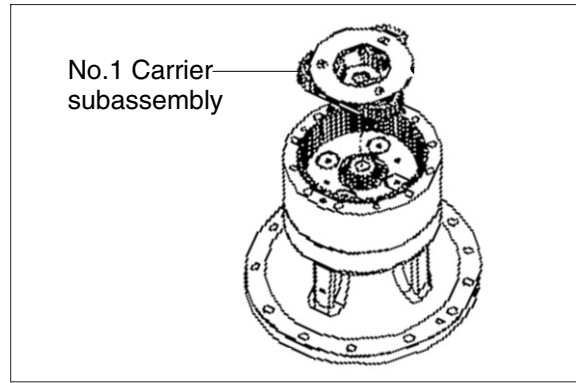


(12) Install No.2 sun gear (211).

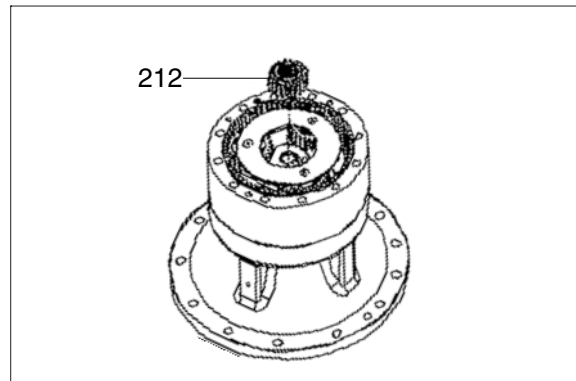




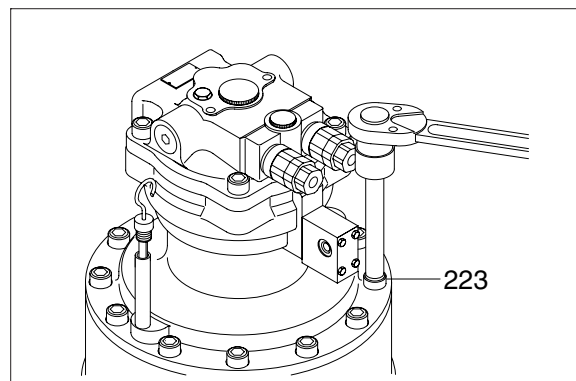
(13) Mount No.1 carrier subassembly.



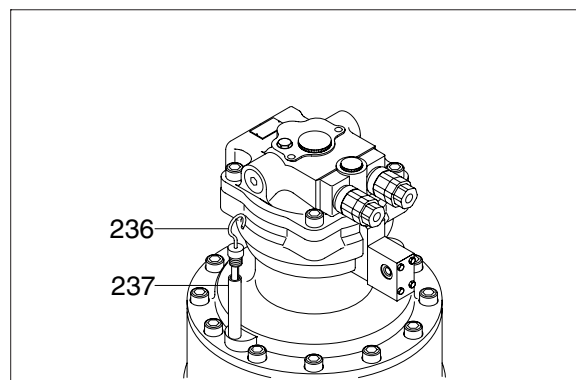
(14) Install No.1 sun gear (212).



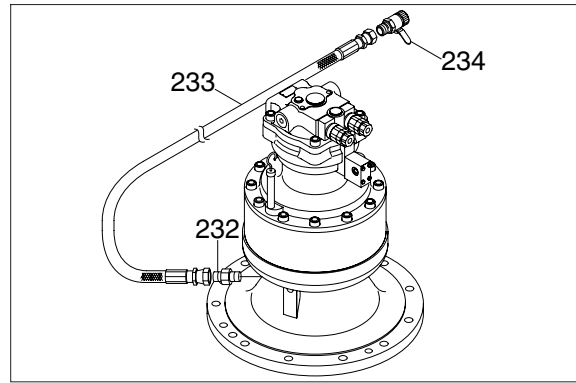
(15) Tighten socket bolt (223) around the swing motor assembly.



(16) Assemble gauge bar (236) and gauge pipe (237).



(17) Assemble connector (232).  
Hose assy (233) and drain valve (234).



## GROUP 6 TRAVEL DEVICE

### 1. REMOVAL AND INSTALL

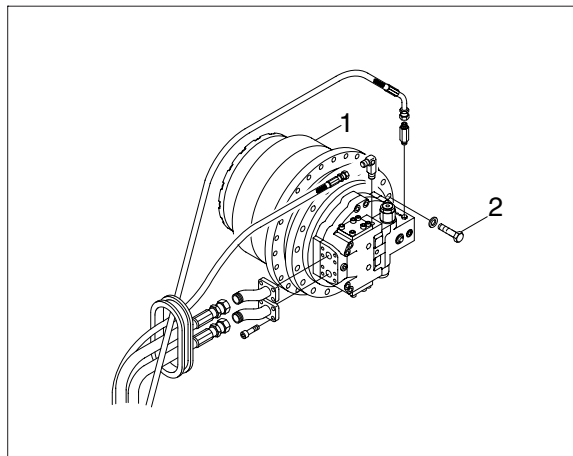
#### 1) REMOVAL

- (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 : 360 kg (790 lb)

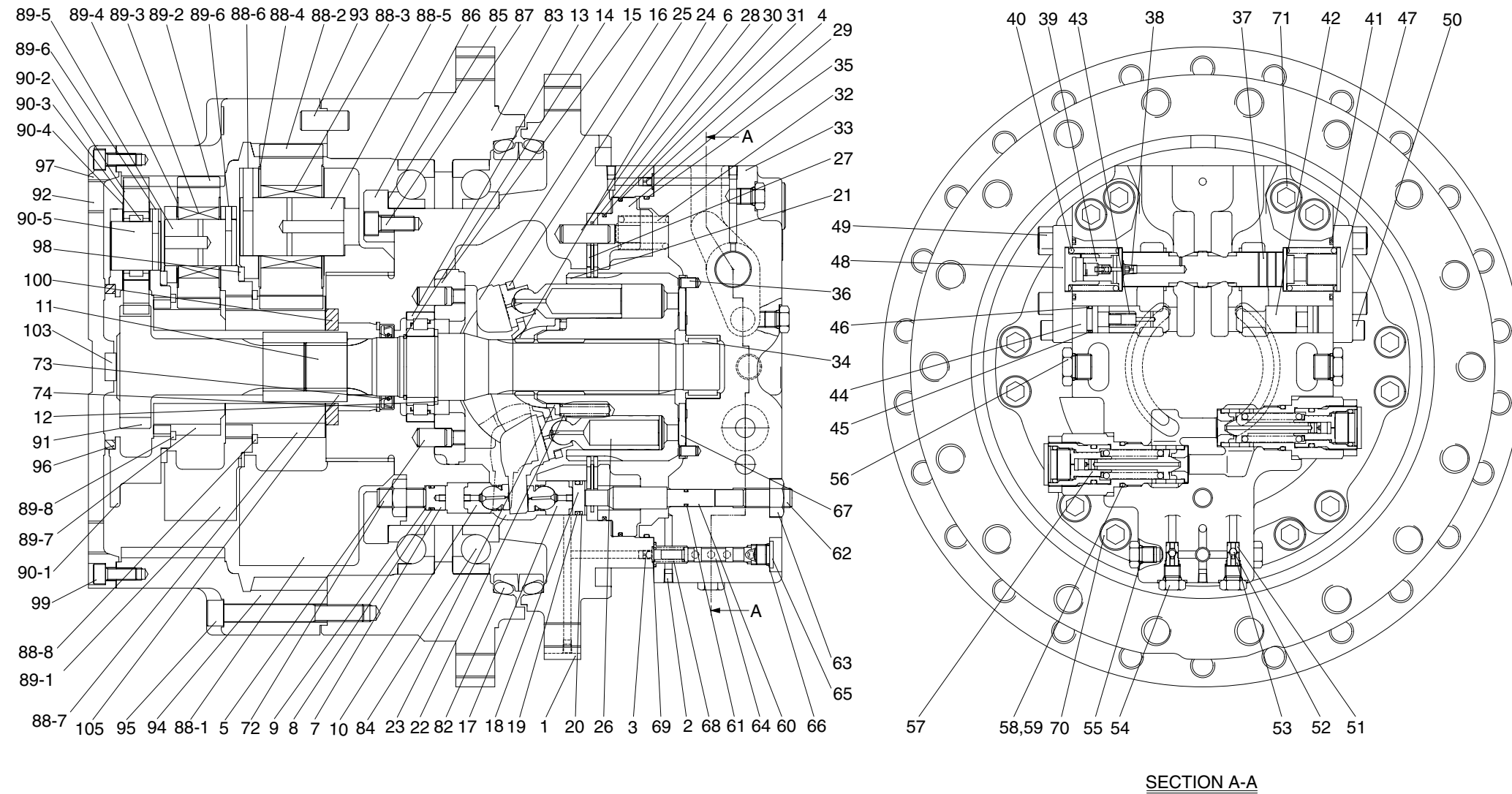


#### 2) INSTALL

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

## 2. TRAVEL MOTOR

### 1) STRUCTURE



SECTION A-A

1 Casing	16 Plate	31 Ring	46 Back up ring	61 O-ring	83 Housing	89-1 Carrier No.2	92 Plug
2 Plug	17 Piston	32 Spring	47 Cap	62 Lock screw	84 Bearing	89-2 Planetary gear No.2	93 Lock pin
3 Screw	18 Stopper	33 Valve casing	48 Cap	63 Nut	85 Shim	89-3 Needle No.2	94 Ring gear
4 Screw	19 O-ring	34 Needle bearing	49 Socket bolt	64 Spool	86 Retainer	89-4 Thrust washer No.2	95 Bolt
5 Pin	20 Back up ring	35 O-ring	50 Socket bolt	65 Plug	87 Bolt	89-5 Pin No.2	96 Thrust ring No.1
6 Pin	21 Cylinder block	36 Pin	51 Seat	66 O-ring	88 Carrier No.3	89-6 Spring pin No.2	97 Cover
7 Stopper	22 Cylinder spring	37 Spool	52 Steel ball	67 Valve plate	88-1 Carrier No.3	89-7 Sun gear No.2	98 Thrust ring No.2
8 O-ring	23 Spacer	38 Screw	53 Stopper	68 Spring	88-2 Planetary gear No.3	89-8 Snap ring No.2	99 Bolt
9 Back up ring	24 Guide	39 Damping check	54 Plug	69 O-ring	88-3 Needle No.3	90 Carrier No.1	100 Motor ring
10 Piston	25 Plate	40 Spring	55 O-ring	70 Socket bolt	88-4 Thrust washer No.3	90-1 Carrier No.1	101 Thrust ring No.3
11 Shaft	26 Piston & Shoe assy	41 O-ring	56 Plug	71 Socket bolt	88-5 Pin No.3	90-2 Planetary gear No.1	103 Pad
12 Spacer	27 Plate	42 Plunger	57 Relief valve	72 Lock screw	88-6 Spring pin No.3	90-3 Needle bearing No.1	105 Coupling
13 Roller bearing	28 Plate	43 Spring	58 O-ring	73 Oil seal	88-7 Sun gear No.3	90-4 Thrust washer No.1	
14 Stop ring	29 Brake	44 Stopper	59 Back up ring	74 Lock ring	88-8 Snap ring No.3	90-5 Pin No.1	
15 Support	30 Ring	45 O-ring	60 Rod	82 Floating Seal	89 Carrier No.2	91 Sun gear No.1	

## 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, 38)
	8	Hex socket bolt(50), Lock screw(62, 72), Plug(65)
	10	Hex socket bolt(49)
	46	Hex(57)
Socket wrench/ spanner	19	Hp plug(54)
	24	Hex nut(63)
	27	Hp plug(56)
Snap-ring plier(for holes, axis)		Ring stop(14), Ring lock(74)
Solder hammer		Needle bearing(34), Pin(5, 6, 36)
Torque wrench		Size : 500, 3000
Jig for assembling oil seal		Oil seal(73)

### (2) Tightening torque

NO.	Part name	Standard	Size	Torque	
				kgf · m	lbf · ft
2	Plug	NPTF 1/16	4	7~11	50.63~79.5
3, 4, 38	Orifice screw	NPTF 1/16	4	7	50.63
49	Hex socket bolt	M12	10	100	723.3
50	Hex socket bolt	M10	8	67	484.6
54	Plug	PF 1/4	19	37	267.6
56	Plug	PF 1/2	27	110	795.6
57	Relief valve	HEX 46	46	170~190	1230~1374
63	Nut	M16	24	240	1736
65	Plug	PF 3/8	8	75	542.4
70, 72	Hex socket bolt	M16	14	240	1736
71	Hex socket bolt	M16	14	240	1736

## 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) DISASSEMBLING TRAVEL MOTOR

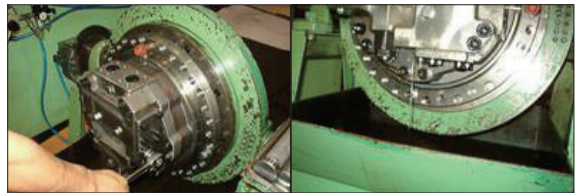
(1) Fix a hydraulic motor on jig with four pieces of bolts (M16 × 60L).

※ When rotating jig up to 90° in disassembling and assembling, fix a motor making drain plug (56) faced to the bottom.



(2) After disassembling drain plug (56), let an oil in a case of a motor discharged.

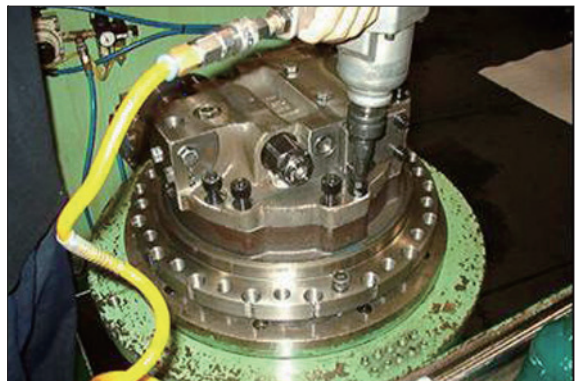
※ Check whether manufactured chips or metal dust are added in a drain oil.



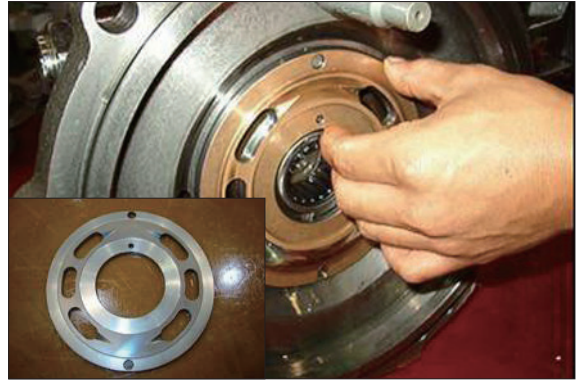
(3) In order to making the out-put axis of a hydraulic motor faced upward, disassemble ring lock (74) with a plier after rotating jig up to 90° in disassembling and assembling.



(4) Disassemble hexagon socket bolts (70, 71) holding valve casing.



- (5) After detaching valve casing sub, disassemble valve plate (67).  
※ In case of serious abrasion of valve plate, exchange it to a new one.



- (6) After taking brake spring (32) and then bonding two pieces of M16 bolts to brake piston (29), disassemble it pulling it upward.  
※ There are 10 pieces of brake spring.



- (7) First, rotate jig in disassembling and assembling up to 90°, then let a motor faced toward the horizon. then disassemble a cylinder and piston sub.a



- (8) Disassemble stopper L (18) and piston swash (17).  
※ Piston swash : Use M5 bolt

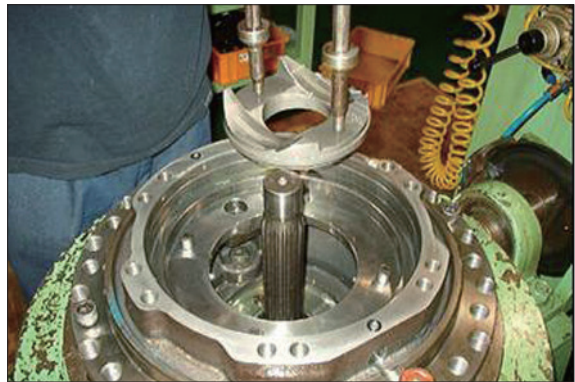




(9) Disassemble swash plate (16).



(10) After put M12 into support (15), disassemble support.



(11) Disassemble piston swash (10) and stopper (7).



(12) In order to making the turning axis (11) faced upward, put it way from shaft casing tapping the bottom of the turning axis with hammer, after rotating jig up to 90° in disassembling and assembling.

※ Try to deal with roller bearing (13) without any damage.



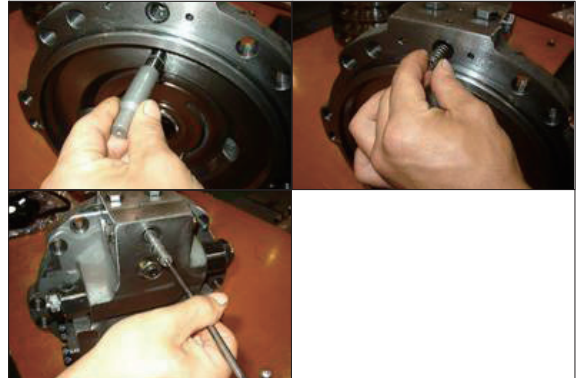
(13) Disassemble valve casing sub.

※ Try to deal with needle bearing (3) without any damage.

① Disassemble plowing road (60), automatic changeover spring (68), and automatic changeover spool (64).

※ Do not touch hexagon nut (63) for controlling the amount of an oil and lock screw (62).

If there is any abnormality on plowing spool and spring, exchange them to new ones.



② After unloading hexagon socket bolts (49, 50) and taking caps (47,48) away, disassemble parts of counter balance valve (37~46).

※ In disassembling counter balance valve, be careful of figuring out the directions such as the right or the left of finger.

If there is any abnormality in spool spring check, exchange it to new one.



(14) Disassemble cylinder sub.

- ① Disassemble set plate (25) and piston (26) sub.



- ② Disassemble friction plate (27) and lee plate (28) in cylinder block (21).



- ③ Dismantle ball guide (24), spacer (23), and cylinder spring (22).



### 3) ASSEMBLING TRAVEL MOTOR

(1) Assemble the sub of a turning axis.

① After assembling bearing spacer (12) into a turning axis (11), have cylinder roller bearing (13) thermal-reacted.

a. In the thermal reaction of cylinder roller bearing, use an induction heating apparatus and adjust the temperature as about 100°C.

b. Deal moisturized copper part oil seal in a turning axis without any damage of it.



(2) Assemble ring stop (14) with a plier.

※ Be careful of the direction of ring stop.  
(The direction of round is the side of bearing)



(3) Assemble valve casing sub.

① Bond seven pieces of plug (2) in valve casing (33) with standard torque.

After taping plug with seal taper and

② spread rock tight, assemble it.

· Tightening torque : 7~11 kgf · m  
(50.63~79.5 lbf · ft)





(4) Compress pin (36) into.

- ※ Using a hammer, make the height of pin 5 mm from the a contact surface of valve plate.



(5) Assemble needle bearing (34).



(6) Assemble seat (51), ball (52), stopper (53), and hp plug (54) with O-ring (55), respectively.

- ① Be careful of the procedure and direction of assembling seat and stopper.
  - Tightening torque : 37 kgf · m  
(267.6 lbf · ft)



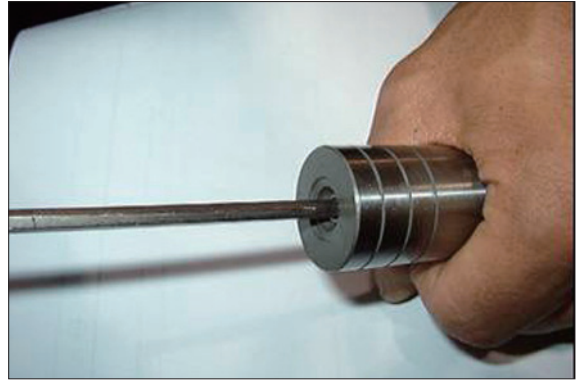
(7) Assemble hp plug (54) set up with O-ring (55).

- 5sites
- Tightening torque : 37 kgf · m  
(267.6 lbf · ft)



(8) Bond orifice screw (38) on the right and left side of spool c.b (37) with a standard torque.

- Tightening torque : 7 kgf · m  
(50.63 lbf · ft)



(9) Insert hold spool c.b (37) and damper check (39) into valve casing.



(10) Bond cap R (47) and cap L (48) with hexagon socket bolts (49, 50).

① Remember not to exchange cap R, L each other in assembling.

Tightening torque

- M12 : 100 kgf · m (item 49)
- M10 : 67 kgf · m (item 50)



(11) After fastening with torque, insert automatic plowing spool (04), spring (68) and O-ring (69).

- Tightening torque : 75 kgf · m  
(542.4 lbf · ft)



(12) Assemble swash road (60) inserted by O-ring (61).



(13) Insert O-ring (32) into valve casing.

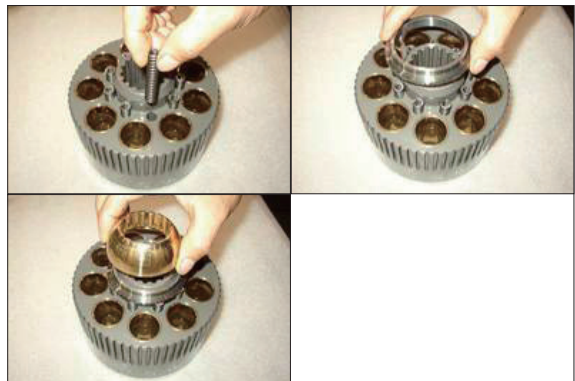


(14) Bond drain plug (30) inserted by O-ring (31) with standard torque.  
· Tightening torque : 100 kgf · m  
(723.3 lbf · ft)



(15) Assemble cylinder sub.

- ① Assemble cylinder spring (22), spacer (23), and spherical surface bush (24) into cylinder (21).  
Set the position of spline of spherical surface bush and cylinder.

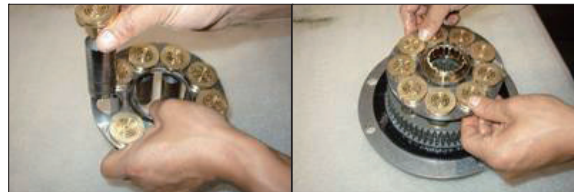




(16) Assemble friction plate (27) and separated plate (28) into cylinder.



(17) After insert piston shoe (26) into set plate (25), assemble it into cylinder.



(18) Using jig, compress oil seal (73) into shaft casing (01).



(19) Assemble the body of a motor.

① Bond seven piece of plug (02) in shaft casing plug with standard torque.

a. After taping plug with seal taper and spread rock tight, assemble it.

· Tightening torque : 7~11 kgf · m  
(50.63~79.5 lbf · ft)



(20) Using a hammer and a handle, compress pin (5, 6).

① Pin (5) : Set the height as 10 mm from the contact surface of a plate supporter. - 2pieces.

Pin (6) : Set the height as 19 mm from the manufactured surface of shaft casing. - 4pieces.



(21) Assemble sub of a turning axis.



(22) Assemble plate supporter (15) with M12 bolt.

※ Be careful of the direction of plate supporter driven.



(23) Assemble plate (16) into plate supporter.

① Spread grease in moisturized copper part of plate.

② Confirm the soft movement of plate.



(24) Assemble stopper L (36) combined by plowing piston (35) and O-ring (42).



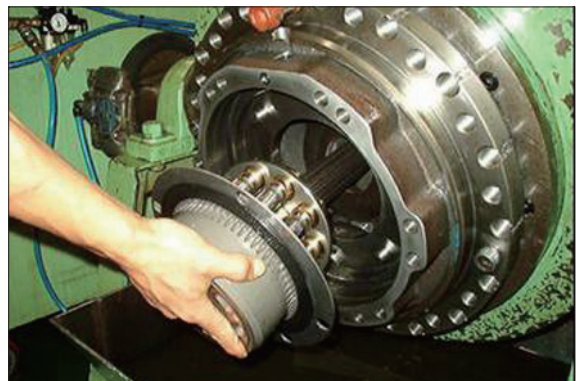
(25) Rotating dismantling and assembling jig up to 90° make shaft from perpendicular to horizontal.

※ Be careful that plate is not segregated from plate supporter.

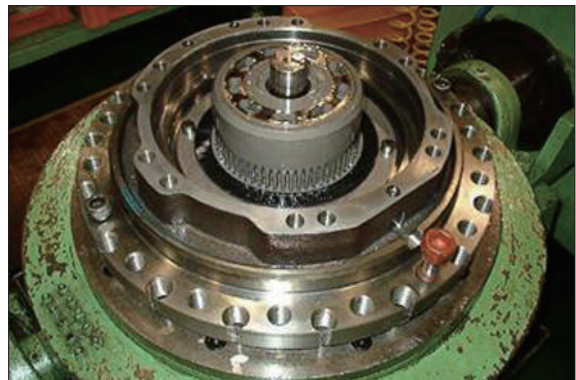


(26) Assemble cylinder sub.

※ Adjusting pin into holes of separated plate, assemble it.



(27) Rotating dismantling and assembling jig up to 90°, make the direction of shaft from the horizon to the perpendicular.





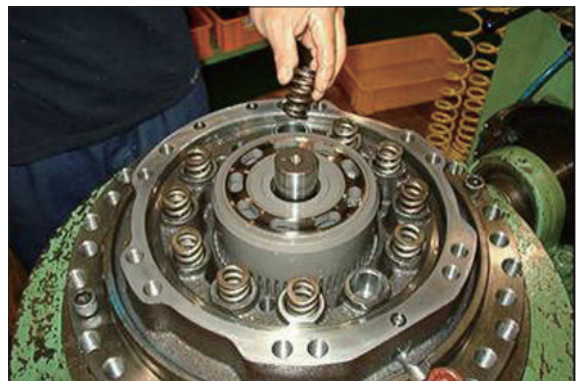
(28) Assemble piston ring (30), piston ring 252 (30) and 278 (31) into brake piston (29).



(29) Assemble brake piston into shaft casing.  
※ Be careful of the direction of assembling brake piston.



(30) Assemble brake spring (32).  
※ Quantity : Spring-10pieces, Holes-11pieces  
※ Do not assemble on the top of brake piston.



(31) Insert O-ring (69), after fastening orifice screw (4) with standard torque.  
· Quantity and size : (4) 2 pieces-  $\phi$  1.0  
(56) 1pieces-  $\phi$  1.5  
· Tightening torque : 7 kgf · m (50.63 lbf · ft)

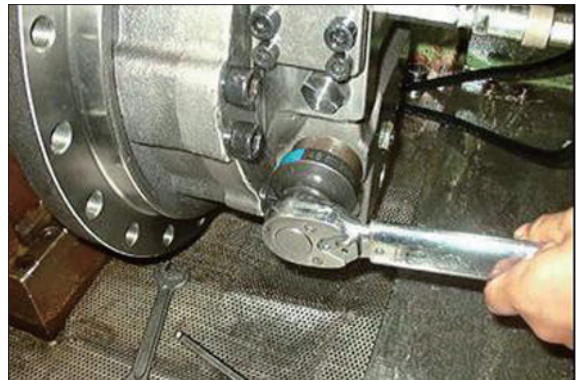


(32)After inserting valve plate (67) into valve casing, bond it into shaft casing with hexagon socket bolt (70).

- ① Spread grease on the back side of valve plate, in order for valve plate to be adhered well.
- ② Use a crane in assembling it into valve plate shaft casing.
- ③ Set holes,  $\varnothing 5$ , of valve plate heading toward the port of the inlet and outlet of valve casing.
- ④ Spread grease in the side of plowing spool of plowing spring in order that plowing spring can not be detached.
  - Tightening torque : 240 kgf · m  
(1736 lbf · ft)
  - Tightening torque :  $180 \pm 10$  kgf · m  
( $1302 \pm 72.3$  lbf · ft)



(33)Bond relief valve (57) with standard torque.



(34)Unloosen four pieces of bolts (M20 × 50L) fixing a motor and remove the motor away from jig.



### 3. DISASSEMBLING REDUCTION UNIT

#### 1) Preparation for disassembling

(1) The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.

(2) Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.

※ While oil is still hot, inside of the unit may be pressurized.

**▲ Take care of the hot oil gushing out of the unit when loosening the plug.**

#### (3) Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

2) Setting reduction unit (or whole propelling unit) on work stand for disassembling

(1) Remove hexagon socket head bolts (M10, 19) at 3 places from cover (17) almost equally each other, and then install eye bolts (M10).

Lift up the unit using them and place it on work stand with cover upward.

※ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

#### 3) Removing cover

(1) Remove the rest of hexagon socket head bolts (M10, 19) that secure ring gear.

Loosen all the socket bolts and then, disassemble cover.

(2) As the cover (17) is adhered to ring gear (14), disassemble ring gear (14) and cover (17) by lightly hammering slantwise upward using sharpened punch inserted between the cover and ring gear.





#### 4) Removing No.1 carrier sub assy

(1) Remove No.1 sun gear

- \* Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.



(2) Screw three eye bolt (M10, 15) in No.1 carrier and lift up and remove No.1 carrier assy.



#### 5) Removing No. 2 carrier sub assy

(1) Remove No.2 sun gear

- \* Be sure to maintain it vertical with the ground when disassembling No.2 sun gear.

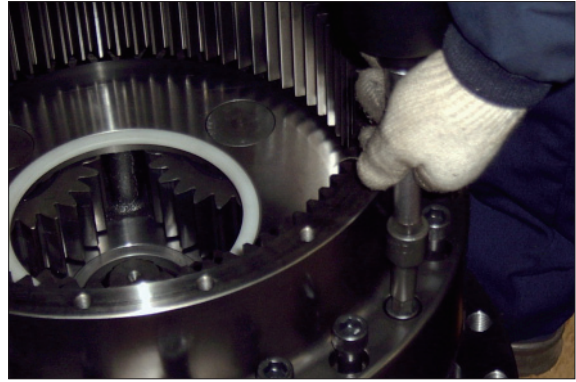


(2) Screw three M10 eye bolt in No.2 carrier and lift up and remove No.2 carrier assy.



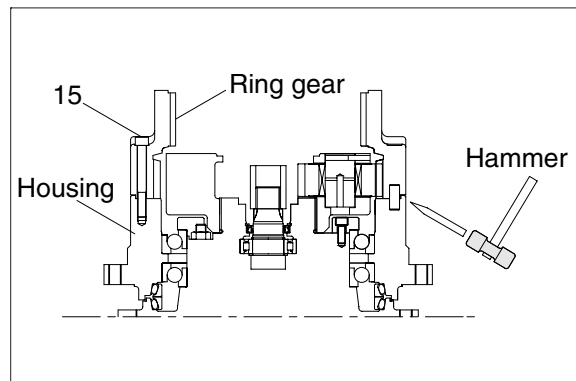
## 6) Removing ring gear

- (1) Remove hexagon socket head bolts(M14, 15) that secure ring gear and housing.

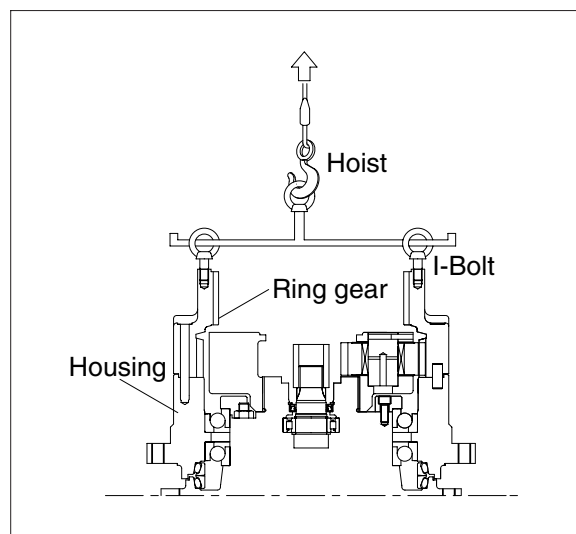


- (2) As the ring gear (14) is adhered to housing (3), disassemble ring gear (14) and housing (3) by lightly hammering slantwise upward using sharpen punch inserted between the ring gear and housing.

※ Carefully disassembling ring gear not to make scratch on it.



- (3) Screw three eye bolt (M10) in ring gear and lift up and remove it.



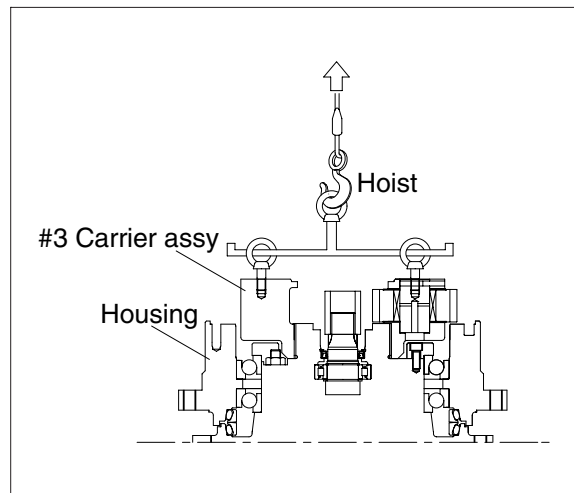
## 7) Remove No.3 carrier sub assy

### (1) Removing No.3 sun gear

- \* Be sure to maintain it vertical with the ground when disassembling No.3 sun gear.

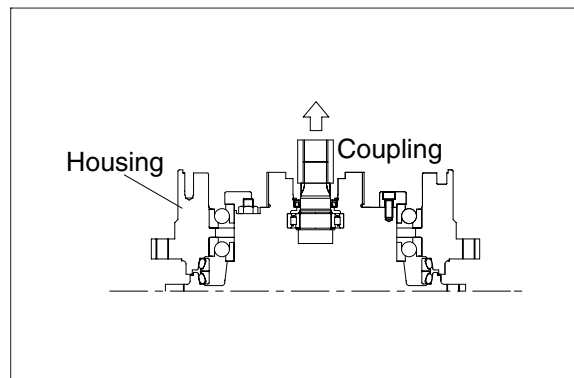


- ### (2) Screw three eye bolt (M10) in No.3 carrier and lift up and remove No.3 carrier assy.



## 8) Remove coupling

### (1) Remove coupling



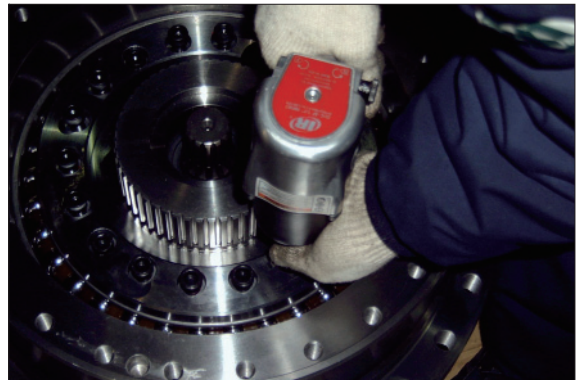
### 9) Remove motor ring

- (1) Remove motor ring using hand.



### 10) Removing retainer & shim

- (1) Remove hexagon socket (M12) head bolts that retainer and motor.
- (2) Remove retainer & shim.

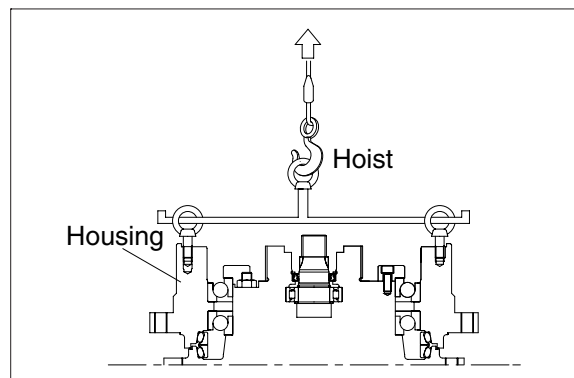


### 11) Removing housing sub assy

- (1) Screw eye bolt (M14) in housing and lift up housing assembly including angular bearing and floating seal.

### 12) Removing floating seal

- (1) Lift up a piece of floating seal of motor side.



### 13) Disassembling housing assembly

- (1) After turning housing, lift up a piece of floating seal from housing and then remove it.
- ※ Don't disassemble angular bearing.

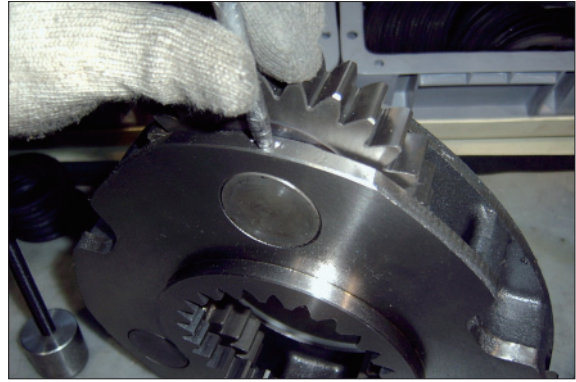


**14) Disassembling No.1 carrier**

- (1) Remove thrust ring (16) from carrier.
- (2) Knock spring pin (89-6) fully into No.1 pin (90-5).
- (3) Remove planetary, thrust washer, No.1 pin, bearing from carrier.

**15) Disassembling No.2,3 carrier**

- (1) Disassemble (14) carriers, using the same method for No.1 carrier assembly.



## 6. ASSEMBLING REDUCTION GEAR

### - General precautions

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

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

Check every part for any abnormalities.

Each hexagon socket head bolt should be used with locktite 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.

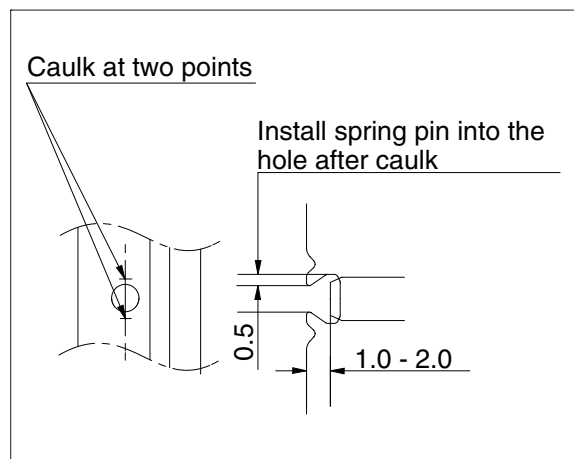
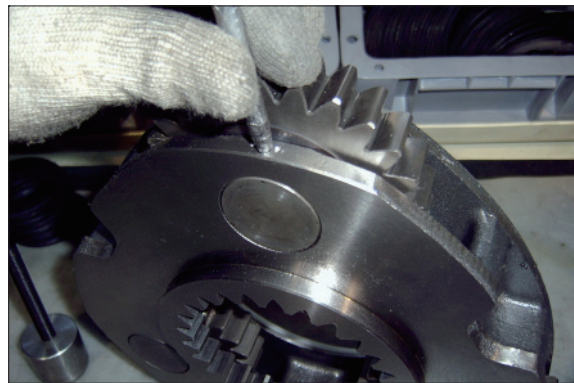
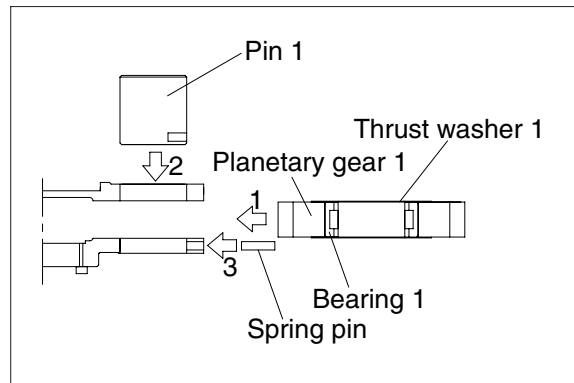
### **Floating seal**

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



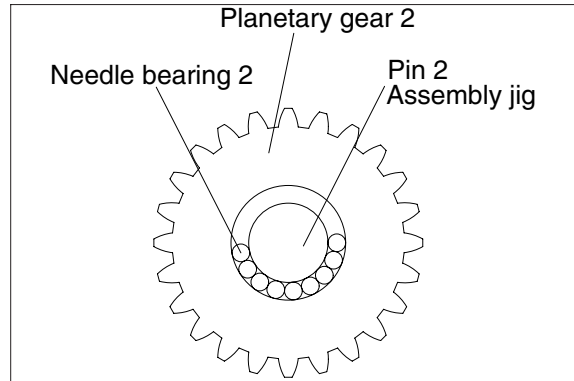
### 1) Assembling No.1 carrier

- (1) Put No.1 carrier (90-1) on a flat place.
- (2) Install No.1 needle bearing (90-3) into No.1 planetary gear (90-2), put 2 ea of No.1 thrust washer (90-4) on both sides of bearing, and then install it into carrier.
- (3) Install No.1 pin (90-5) into No.1 carrier where the holes for No.1 pin (90-5) are to be in line with those of No.1 carrier, and then, install spring pins into the holes.
- (4) Caulk carrier holes as shown on the picture.
- (5) Assembly ring thrust (96) into carrier.



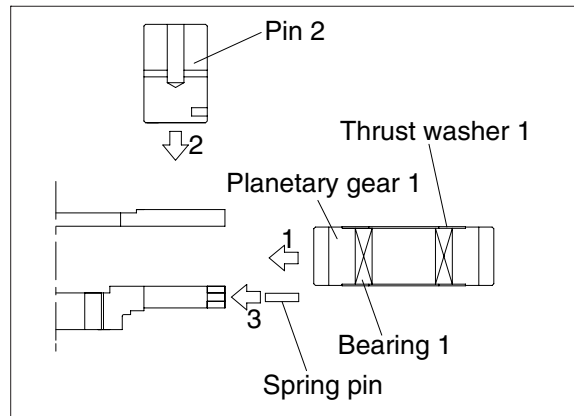
## 2) Assembling No.2 carrier

- (1) Make No.2 planetary gear (89-2) vertical, assemble 8-9 ea of No.2 needle (89-3), and then, assemble the remaining No.2 needle by use of the assembly jig for No.2 pin (89-5).
- (2) Remove out the assembly jig for No.2 pin and assemble 2 ea of No.2 thrust washer (89-4) into No.2 carrier (89-1).
- (3) Insert No.2 pin (89-5) into carrier where the holes of No.2 pin (89-5) are in line with those of carrier.
- (4) Hammer spring pin (89-6) to insert into carrier hole and No.2 pin hole, and then, caulk. Assemble 2 sets using the same method.
- (5) Assemble ring thrust (98) into carrier.



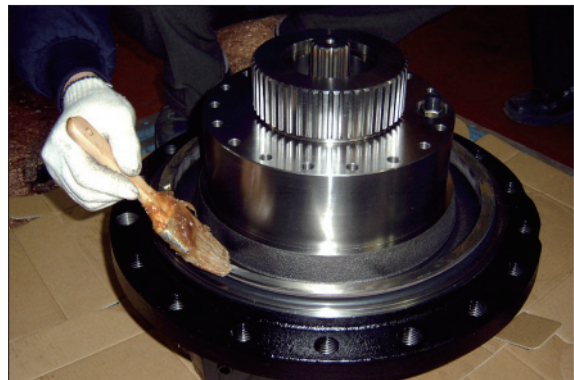
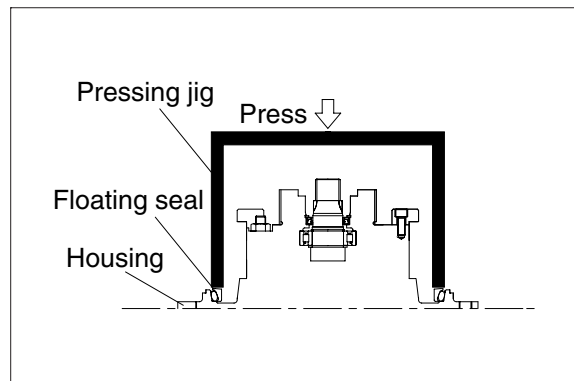
## 3) Assembling No.3 carrier

- (1) Assemble 4 sets, using the same method for assembly of No.2 carrier.



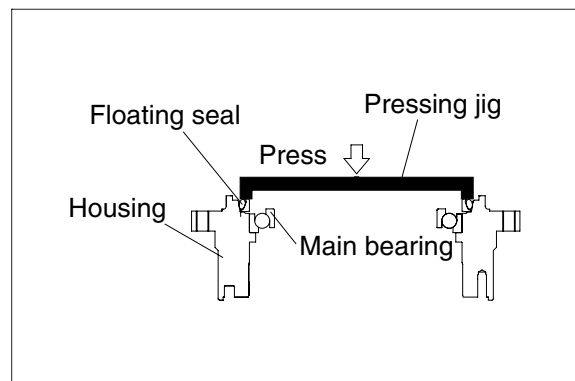
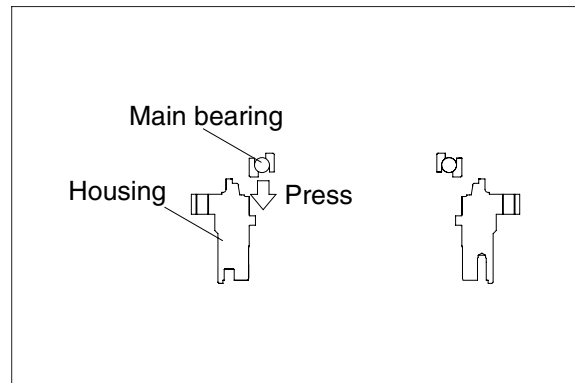
## 4) Installing floating seal

- (1) Assemble floating seal into motor by use of pressing jig.
- (2) Grease the contact parts for floating seal which is assembled into motor.



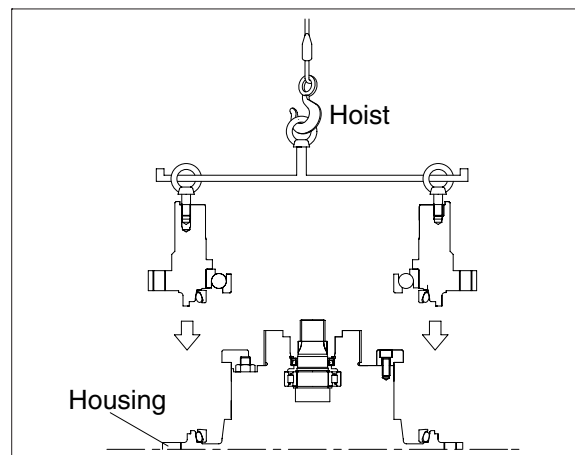
### 5) Assembling housing

- (1) Heat housing at 60~70°C while clearing it out and then, assemble bearing.
  - (2) Assemble floating seal into housing by use of pressing jig as shown on the picture.
- ※ Be sure to maintain it vertical with the ground when assembling bearing and floating seal.



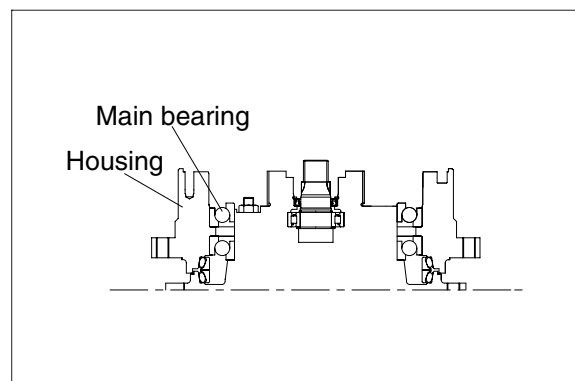
### 6) Installing housing assembly

- (1) Install 2 ea of eye bolt (M14) into housing assembly.
  - (2) Assemble housing into motor by use of hoist and eye bolt.
- ※ Be sure to tighten eye bolt deep enough.



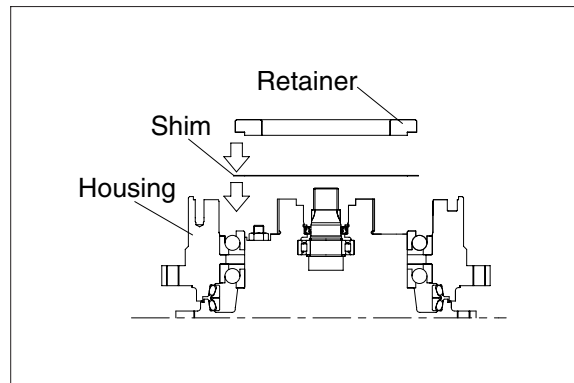
### 7) Installing main bearing

- (1) Heat main bearing at 60~70°C and then, install.
- ※ Be sure to maintain it vertical with the ground when assembling bearing.



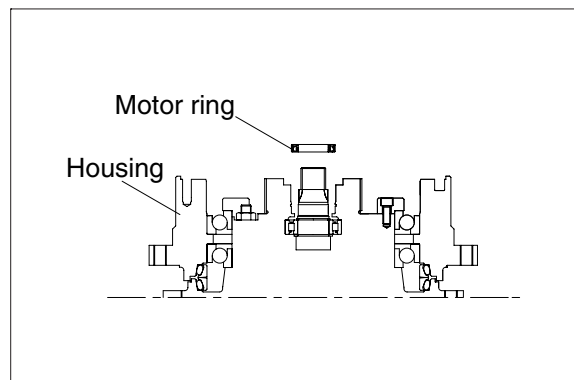
### 8) Installing retainer (86) and shim (85)

- (1) Measure clearance between main bearing and retainer by use of jig to decide the thickness of shim and select and appropriate shim, and then, assemble retainer.
- (2) Apply locktite (#242) on hexagon socket head bolt (M12), and then, bolt.



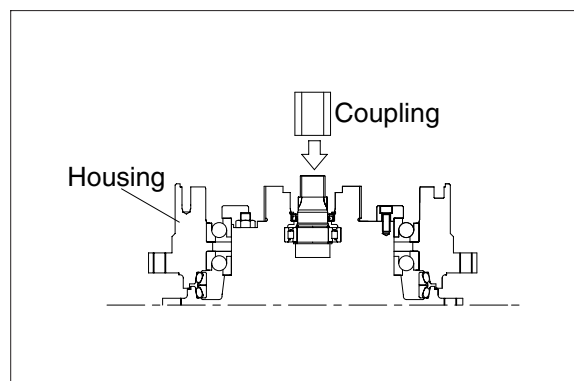
### 9) Installing motor ring

- (1) Insert motor ring into motor to install.



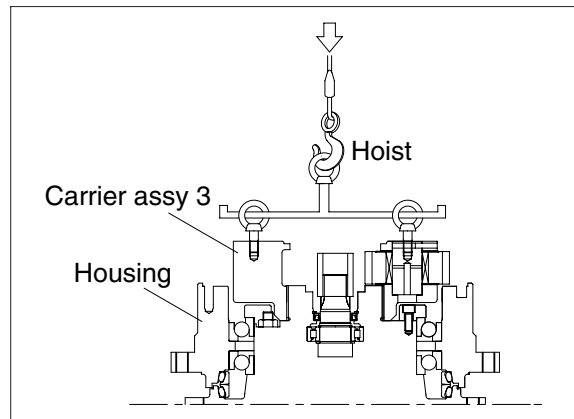
### 10) Installing coupling

- (1) Install coupling on spline of the motor.



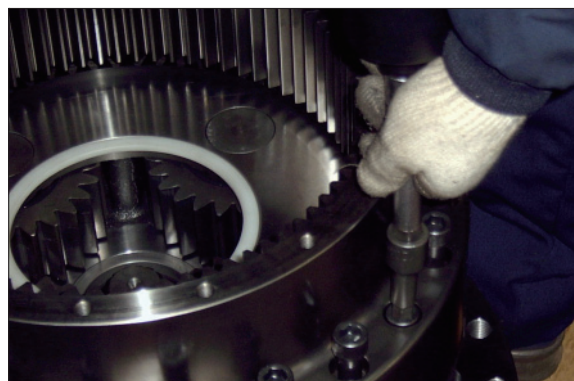
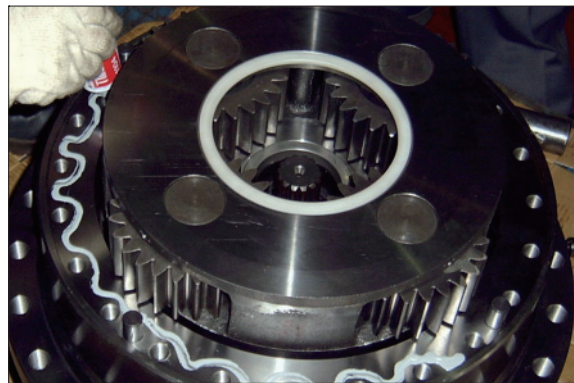
### 11) Installing No.3 carrier sub assy

- (1) Install eye bolt(M10) on No.3 carrier assembly.
  - (2) Lift No.3 carrier assembly and then, assemble it into reducer.
- ※ Match it vertical with the spline of the motor and the, slowly lower.



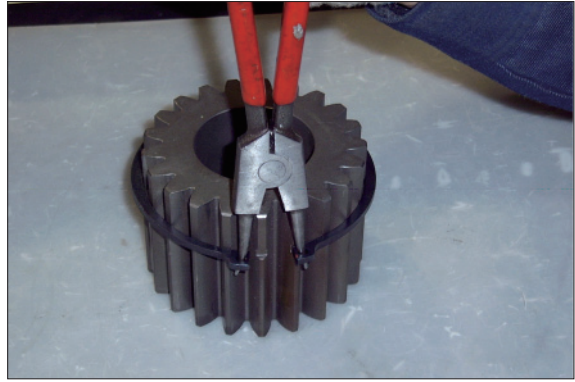
### 12) Installing ring gear

- (1) Apply three bond #1104 (Locktite #515) on housing for ring gear without gap.
- (2) Insert lock pin into housing hole.
- (3) Install eye bolt (M12) on the tap for cover of ring gear.
- (4) Lift ring gear and then, assemble into housing.
- (5) Apply locktite to hexagon socket bolt (M14) and then, bolt, having appropriate torque.



### 13) Installing No.3 sun gear (88-7)

- (1) Install snap ring (88-8) in No.3 sun gear(88-7) by use if snap ring flier.
- (2) Install No.3 sun gear on the spline of No.3 carrier, matching teeth of them.



### 14) Installing No.2 carrier sub assy

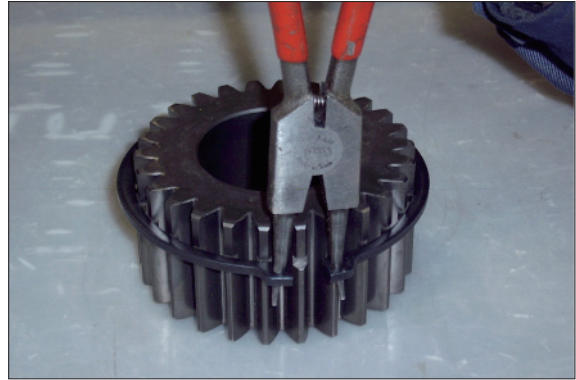
- (1) Install eye bolt (M10) on No.2 carrier assembly.
- (2) Lift No.2 carrier assembly and then, slowly put it down on ring gear.
- (3) Rotate planetary gear by hands and install in ring gear.





### 15) Installing No.2 sun gear (89-7)

- (1) Install snap ring (89-8) on No.2 sun gear (89-7) by use of snap ring flier.
- (2) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.



### 16) Installing No.1 carrier sub assy

- (1) Install eye bolt (M10) on No.1 carrier assembly.
- (2) Lift No.1 carrier assembly and then, put it down on ring gear slowly.
- (3) Rotate planetary gear by hands to install on ring gear, matching their teeth.



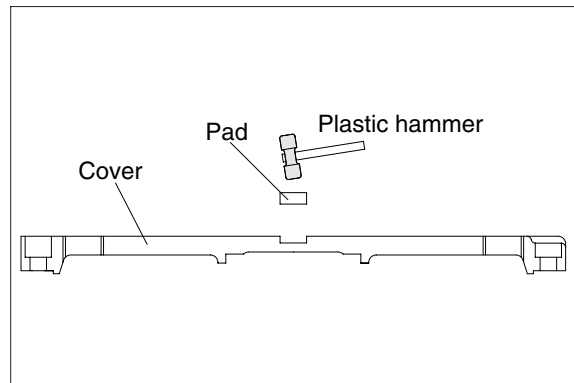
### 17) Installing No.1 sun gear (91)

- (1) Put down No.1 sun gear on No.1 carrier, maintaining it vertical with spline of coupling.
- (2) Install No.1 sun gear on No.1 planetary gear, matching their teeth.



### 18) Installing cover (97)

- (1) Beat pad with plastic hammer, and press it into the center of cover.
- (2) Apply three bond #104 (locktite #515) on the ring gear for without gap.
- (3) Put cover on ring gear, apply locktite (#242) in hexagon socket head bolt (M10), and then, bolt.
- (4) Fill gear oil (8L) into drain port.
- (5) Apply sealing tape (teflon) on PT3/4 plug and then, bolt.



## GROUP 7 RCV LEVER

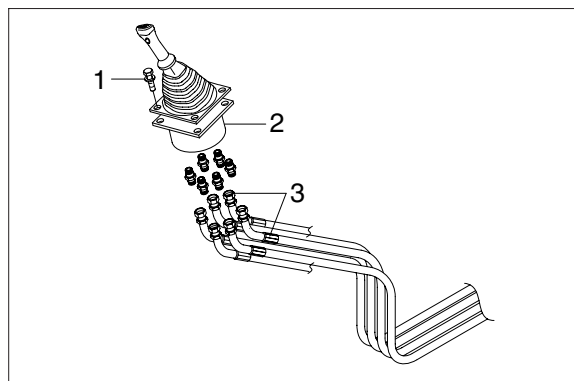
### 1. REMOVAL AND INSTALL

#### 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.

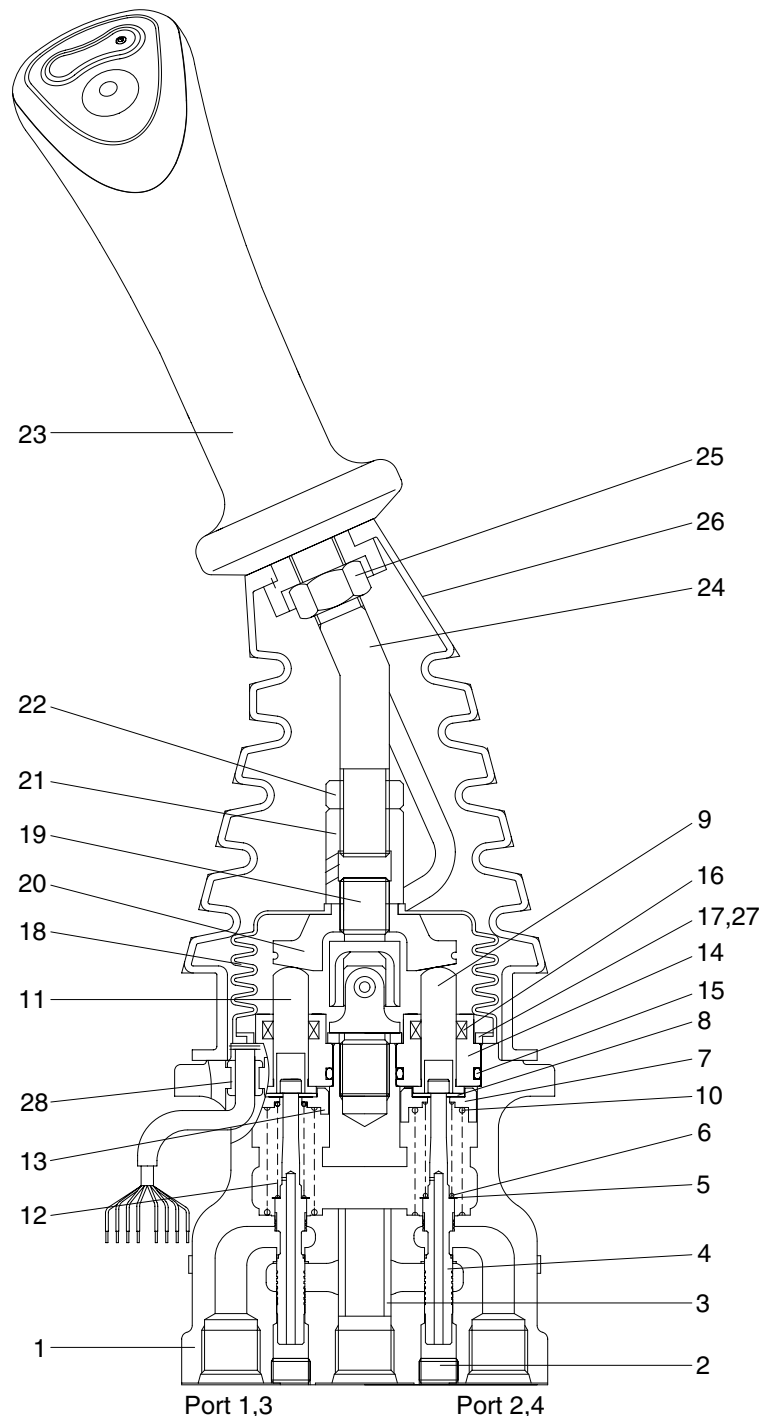


#### 2) INSTALL

- (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

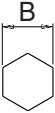
### 1) STRUCTURE



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 seat	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	
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

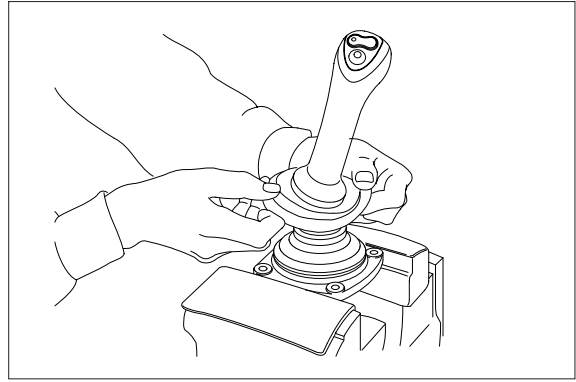
### (2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
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

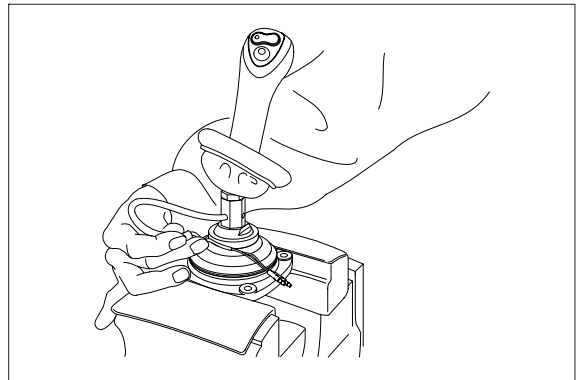


### 3) DISASSEMBLY

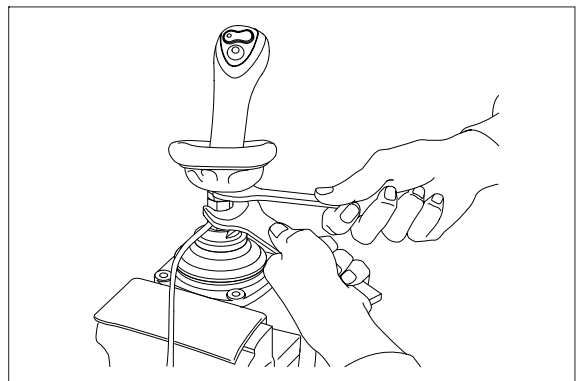
- (1) Clean pilot valve with kerosene.
  - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (26) from case (1) and take it out upwards.



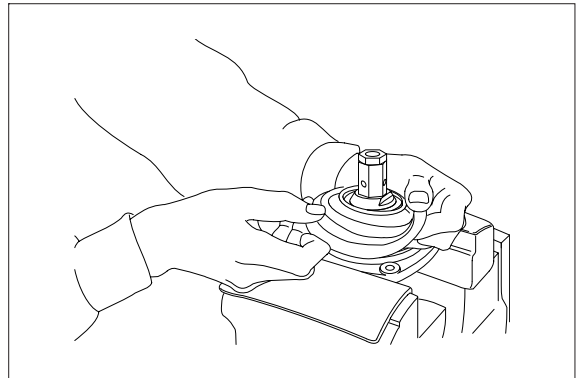
- ※ For valve with switch, remove cord also through hole of casing.



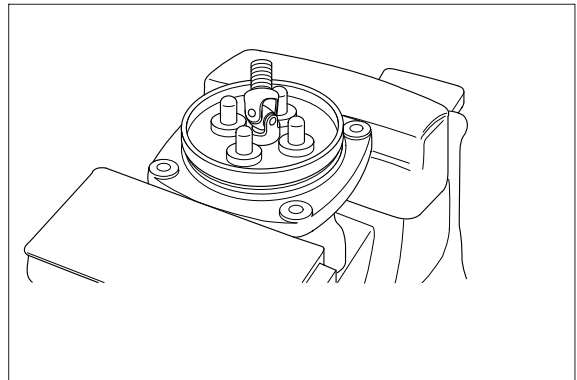
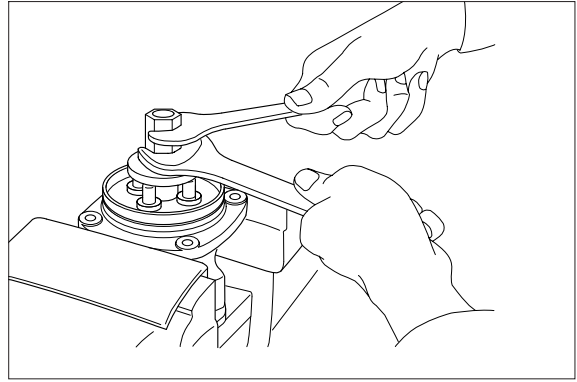
- (4) Loosen lock nut (22) and adjusting nut (21) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (18).

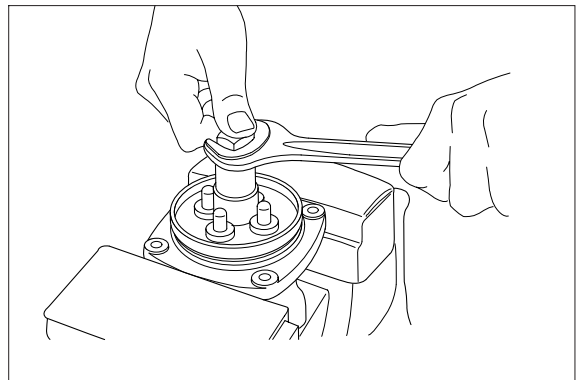
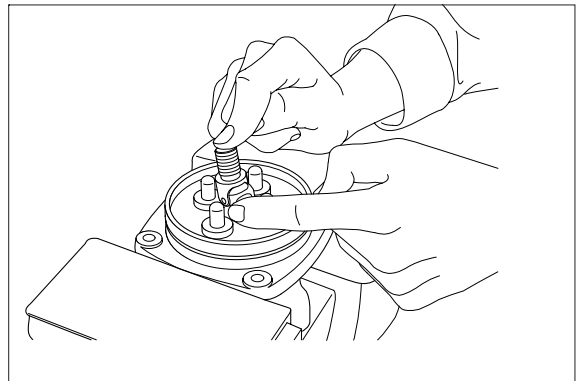


- (6) Loosen adjusting nut (21) and swash plate (20) with spanners on them respectively, and remove them.

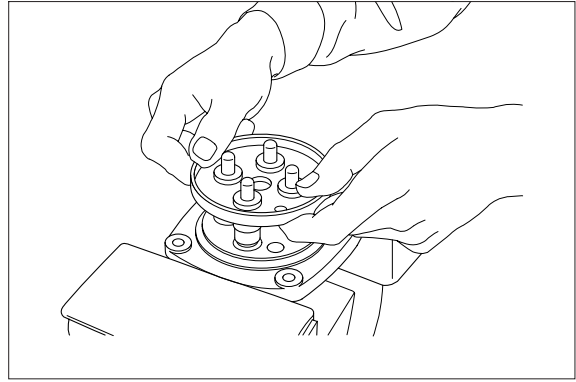


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

- ※ 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.

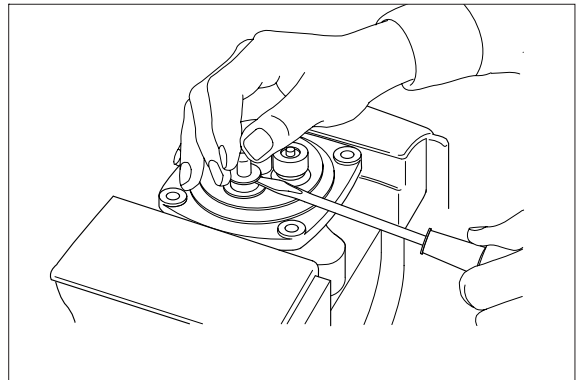


(8) Remove plate (17).



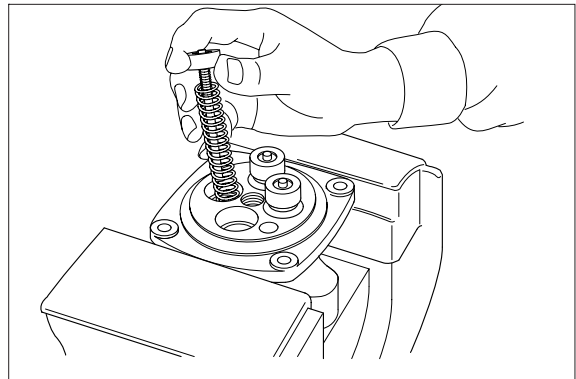
(9) When return spring (10) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.

- ※ 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.

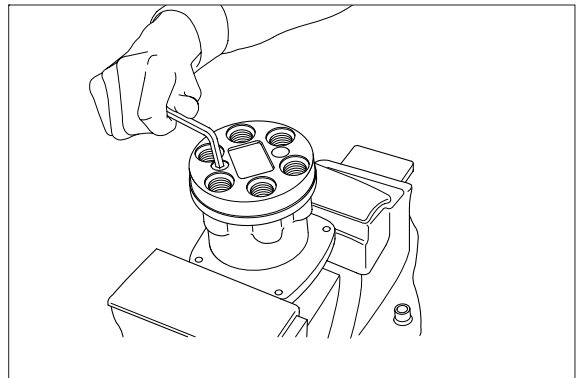


(10) Remove reducing valve subassembly and return spring (10) out of casing.

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

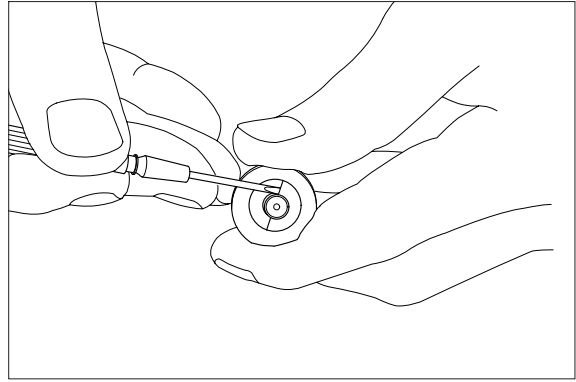


(11) Loosen hexagon socket head plug(2) with hexagon socket screw key.



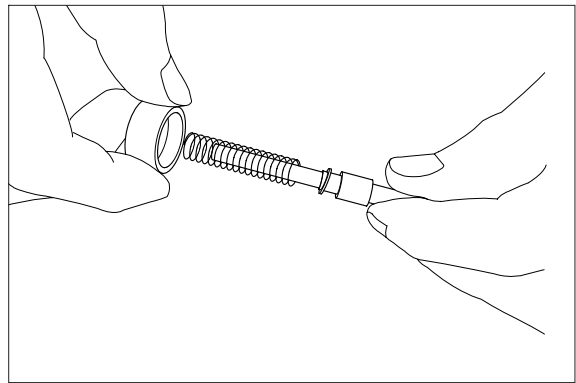
(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.

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

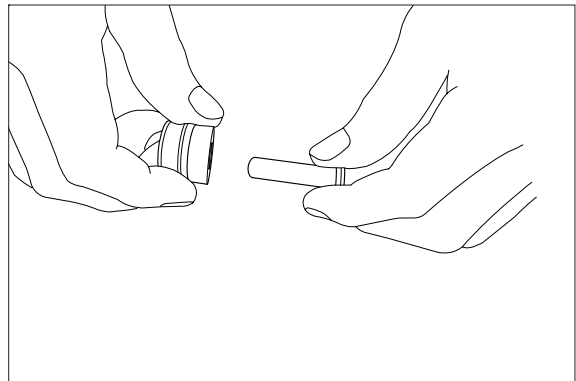


(13) Separate spool (4), spring seat (7), spring (6) and shim (5) individually.

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

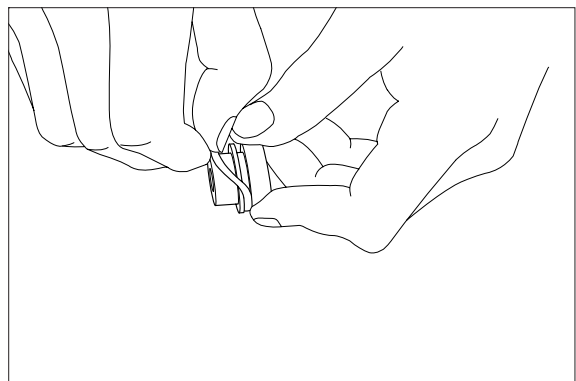


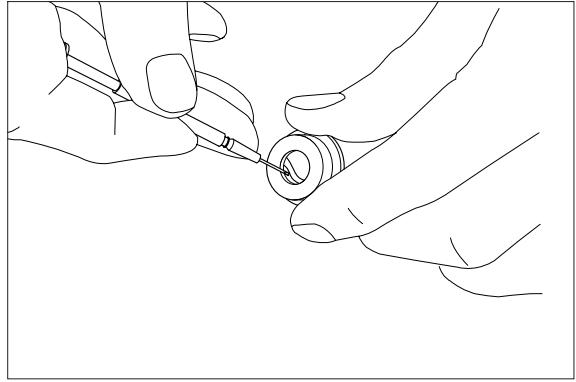
(14) Take push rod (11) out of plug (14).



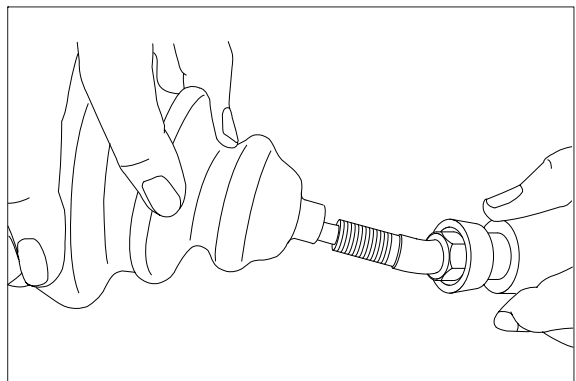
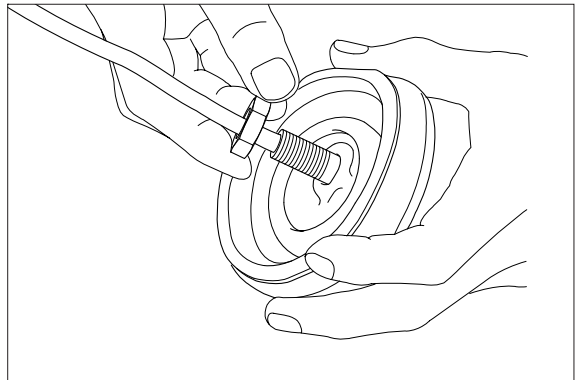
(15) Remove O-ring (15) and seal (16) from plug (14).

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.

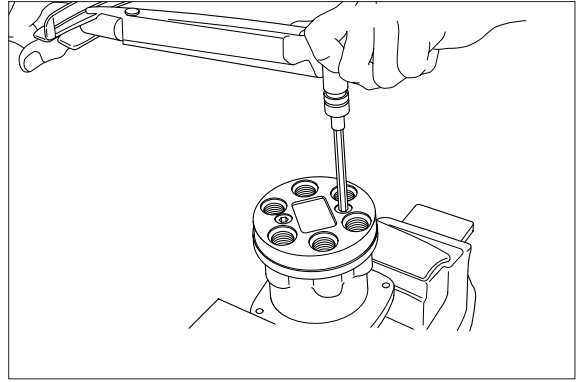
### **(17) Rust prevention of parts**

- 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.

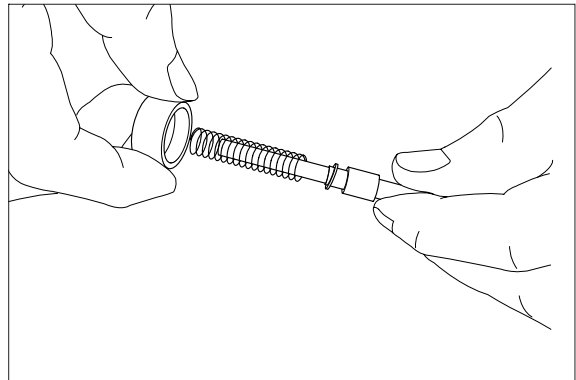
#### 4) ASSEMBLY

(1) Tighten hexagon socket head plug (2) to the specified torque.

※ Tighten two bolts alternately and slowly.

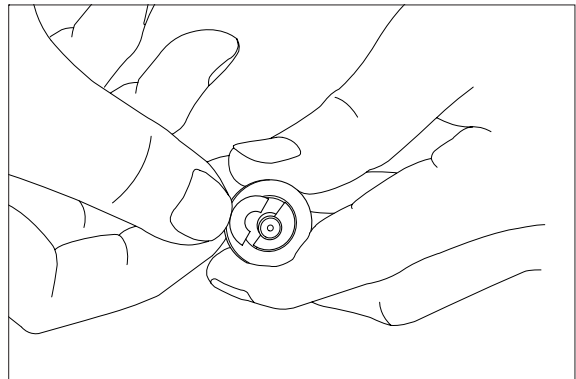


(2) Put shim (5), springs (6) and spring seat (7) onto spool (4) in this order.



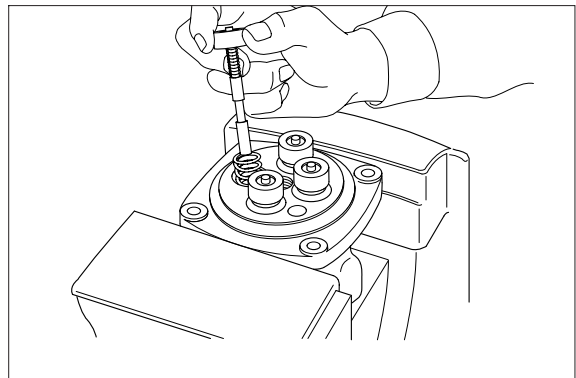
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.

※ 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.

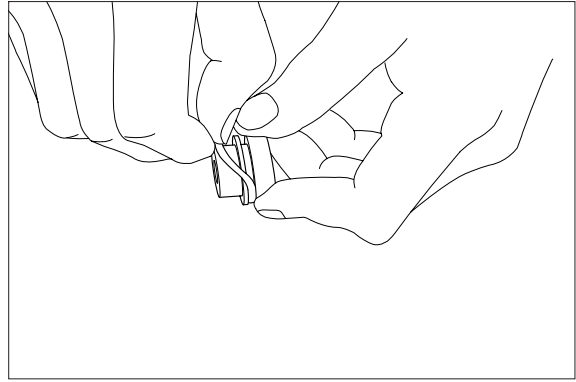


(4) Assemble spring (10) into casing (1).  
Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

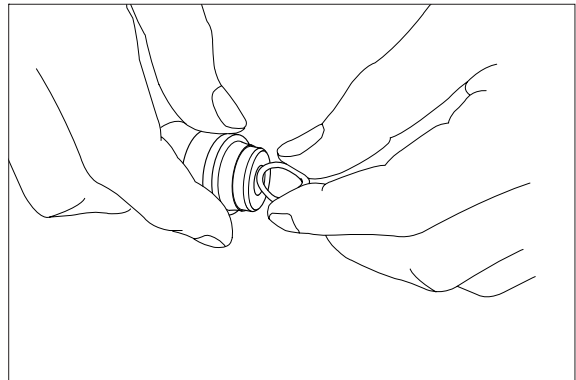


(5) Assemble O-ring (15) onto plug (14).



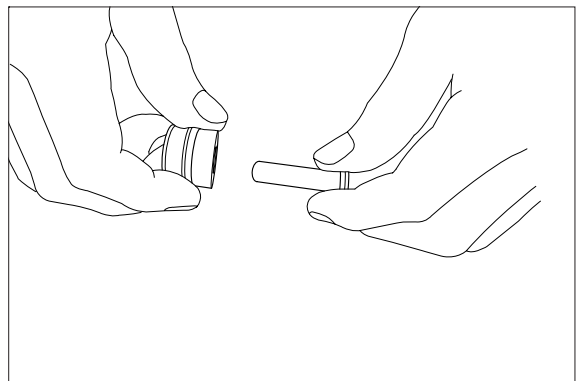
(6) Assemble seal (16) to plug (14).

※ Assemble seal in such lip direction as shown below.



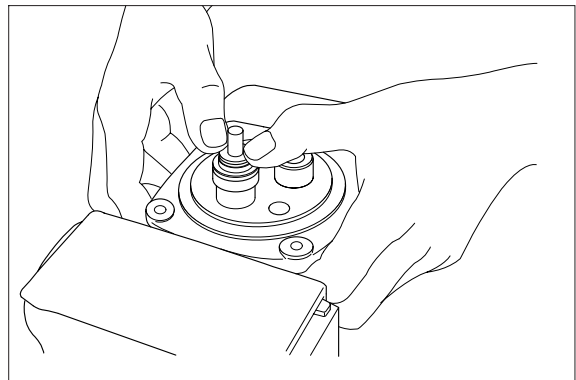
(7) Assemble push rod (11) to plug (14).

※ Apply working oil on push-rod surface.

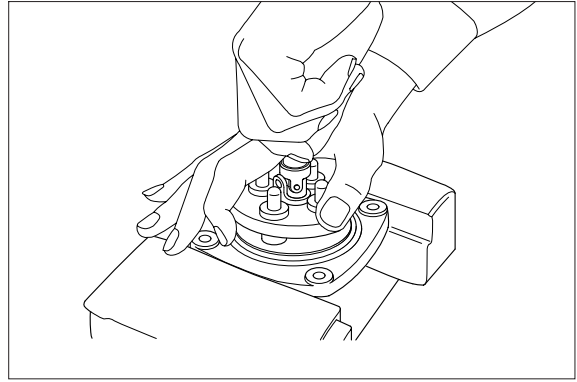


(8) Assemble plug subassembly to casing.

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

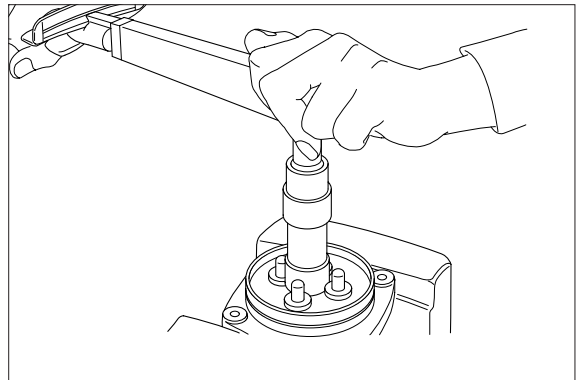


(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.



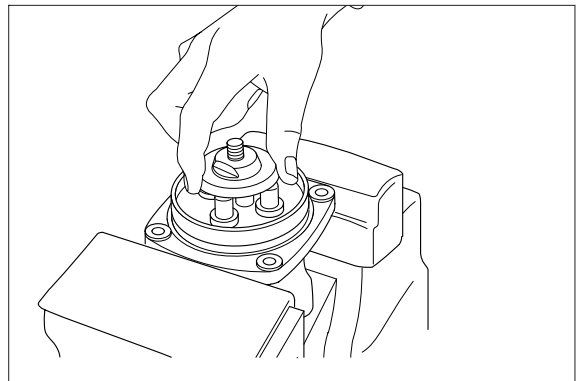
(10) Fit plate (17).

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



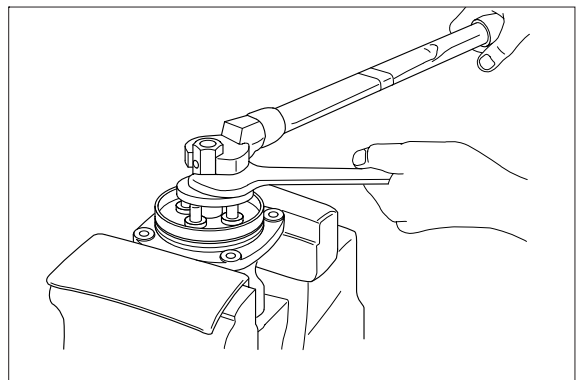
(12) Assemble swash plate (20) to joint (19).

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

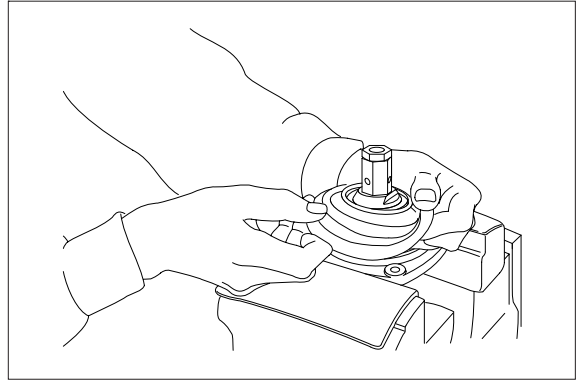


(13) Assemble adjusting nut (21), apply spanner to width across flat of plate (20) to fix it, and tighten adjusting nut to the specified torque.

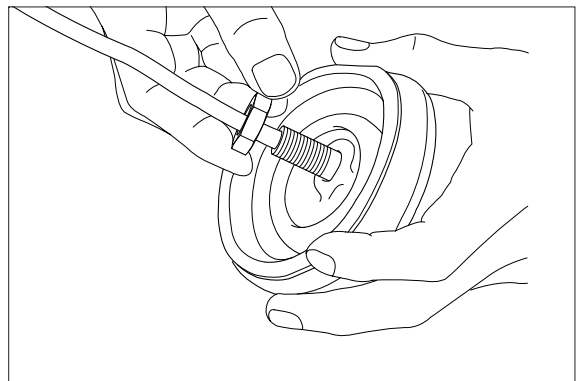
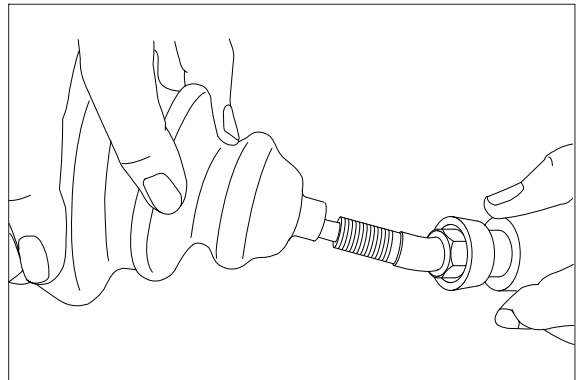
- ※ During tightening, do not change position of disk.



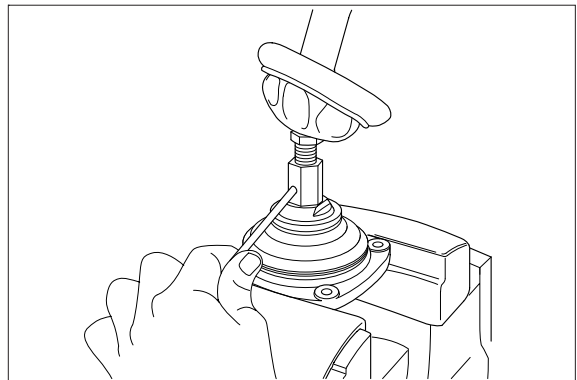
(14) Fit boot (18) to plate.



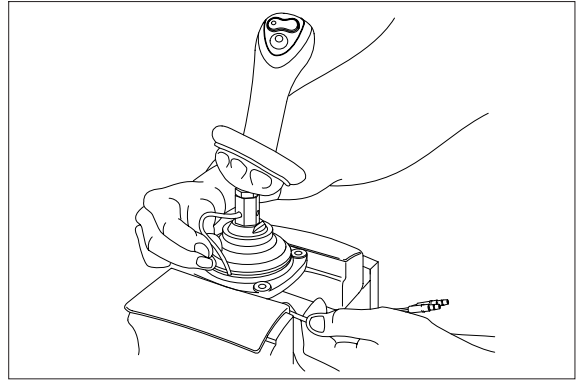
(15) Fit boot (26) and lock nut (22), and handle subassembly is assembled completely.



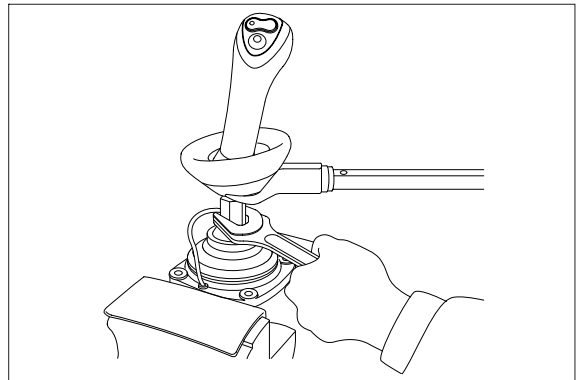
(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



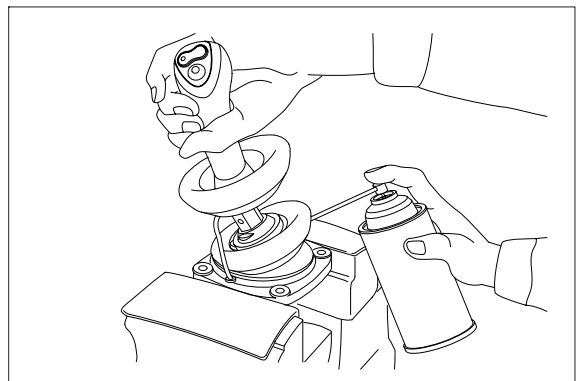
- (17) Assemble bushing (27) to plate and pass cord and tube through it.  
※ Provide margin necessary to operation.



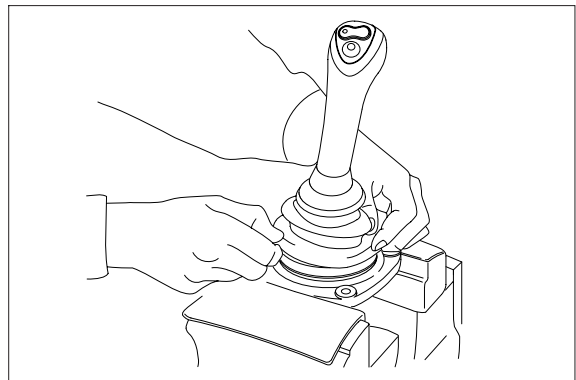
- (18) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



- (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.**

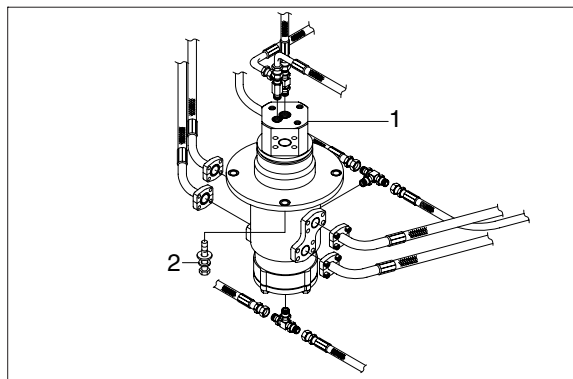
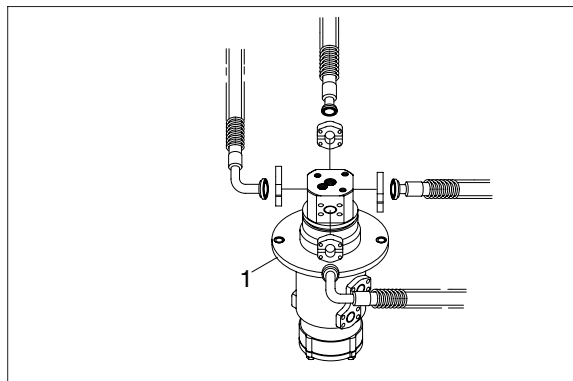
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (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.

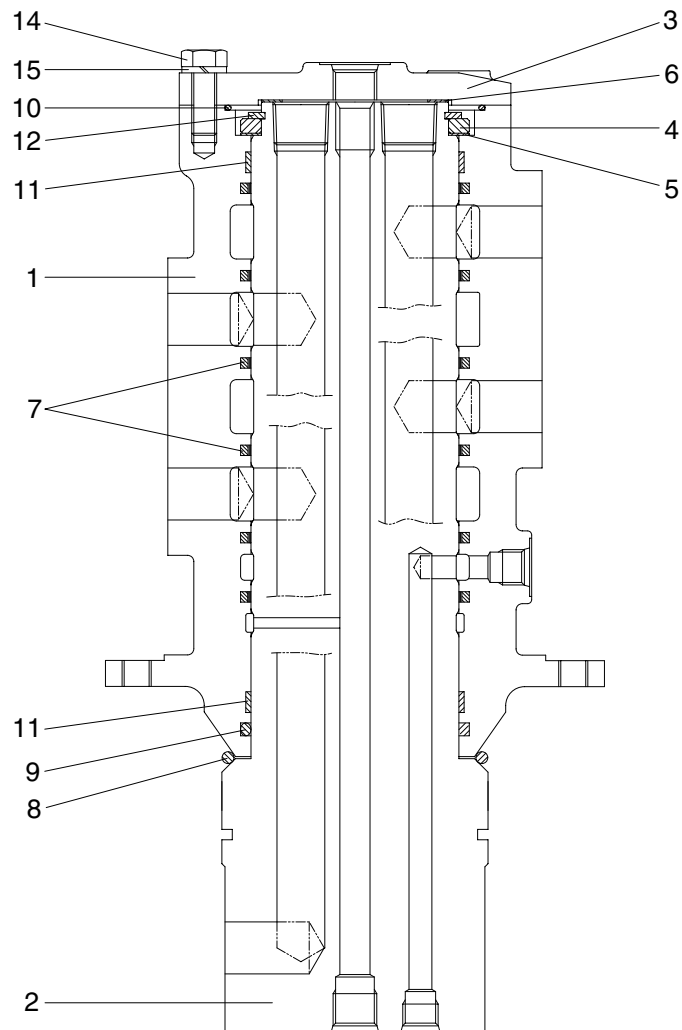
#### 2) INSTALL

- (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

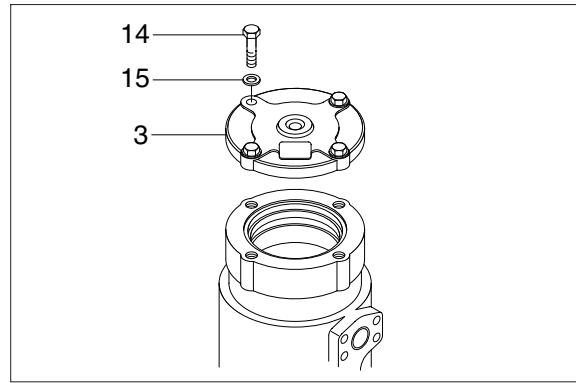


- |   |        |    |              |    |               |
|---|--------|----|--------------|----|---------------|
| 1 | Hub    | 6  | Shim         | 11 | Wear ring     |
| 2 | Shaft  | 7  | Slipper seal | 12 | Retainer ring |
| 3 | Cover  | 8  | O-ring       | 13 | Plug          |
| 4 | Spacer | 9  |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

## 2) DISASSEMBLY

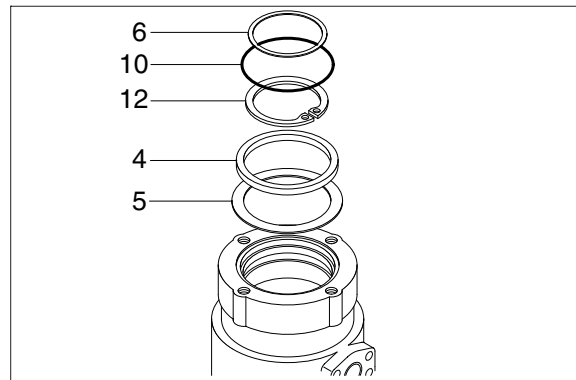
※ Before the disassembly, clean the turning joint.

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



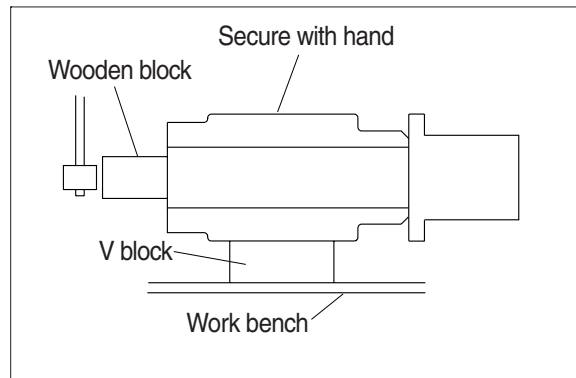
- (2) Remove shim (6) and O-ring (10).

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

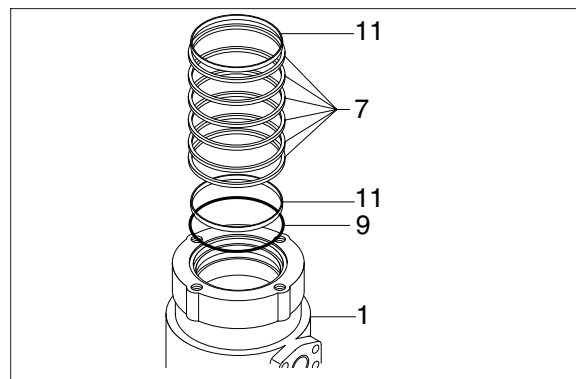


- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).

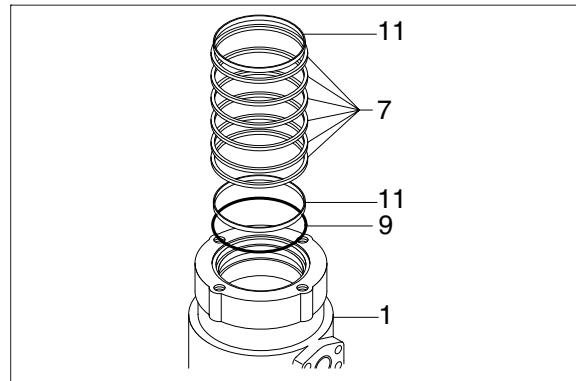


### 3) ASSEMBLY

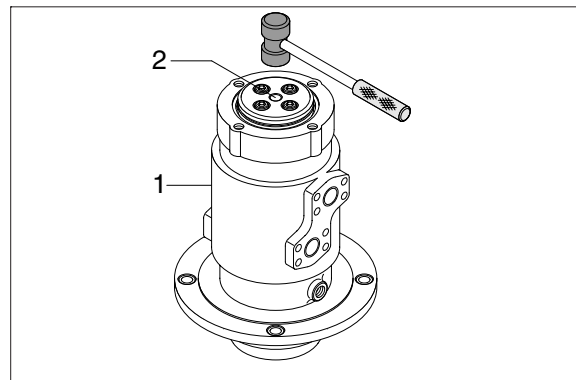
- ※ Clean all parts.
- ※ As a general rule, replace oil seals and O-ring.
- ※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(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).



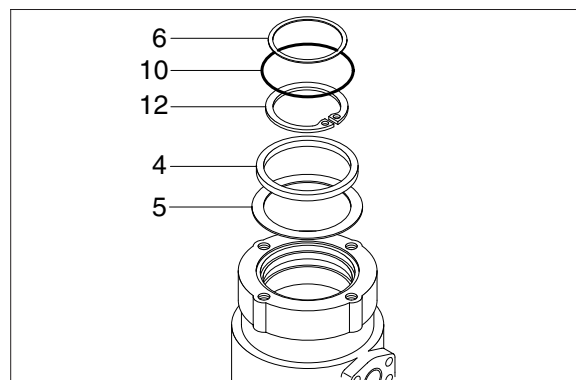
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



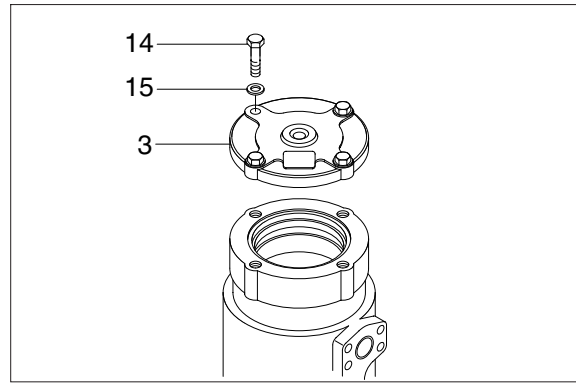
(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(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

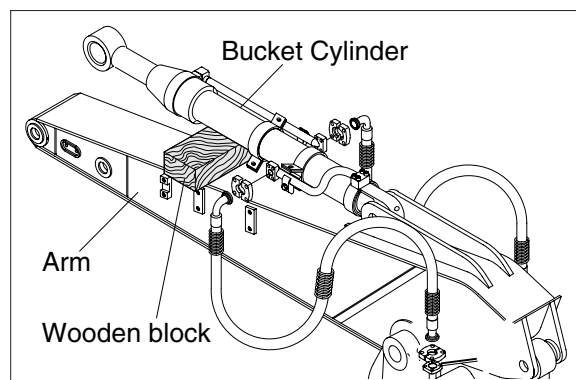
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.**

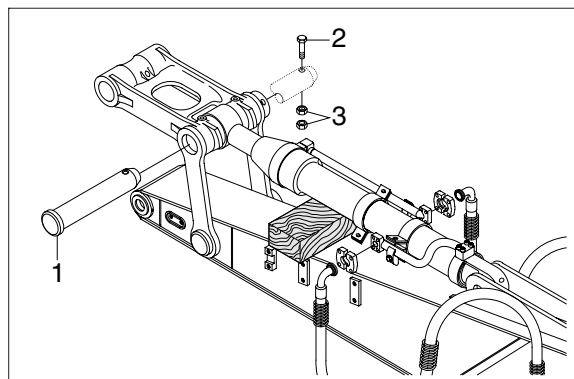
※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

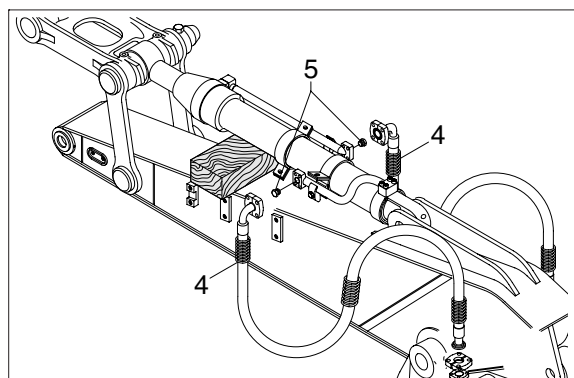


② Remove bolt (2), nut (3) and pull out pin (1).

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

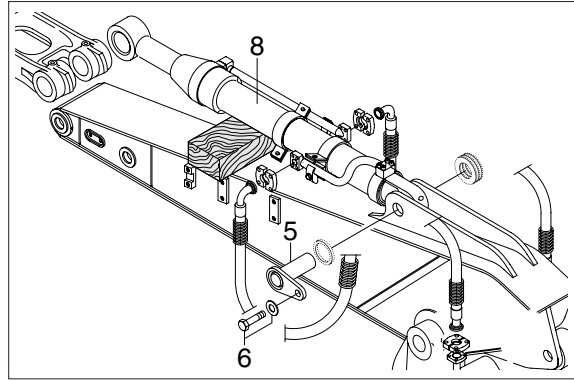


③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.





- ④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
- ⑤ Remove bucket cylinder assembly (8).
  - Weight : 220 kg (485 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

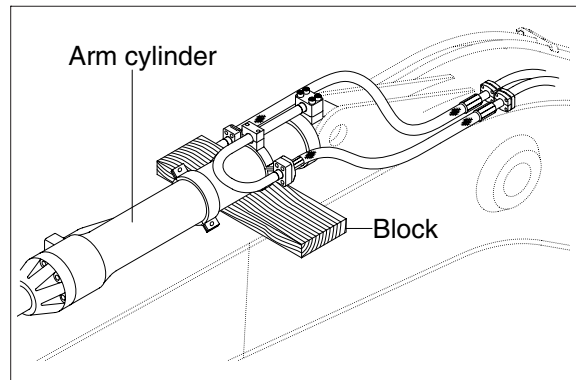
### (1) Removal

- ※ 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.**

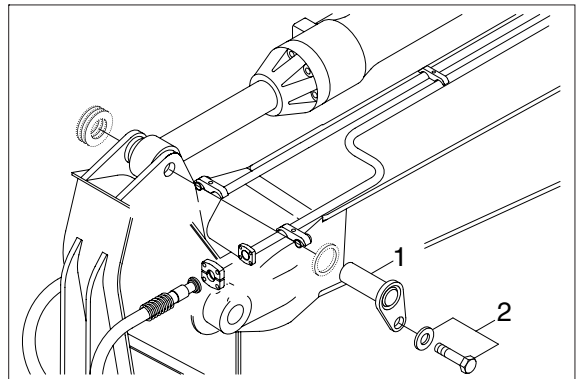
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



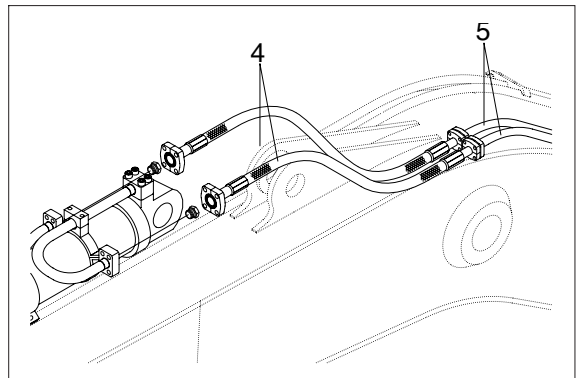
② Remove bolt (2) and pull out pin (1).

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

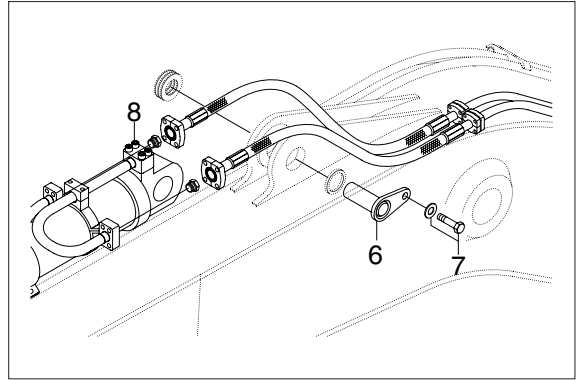


③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).



- ⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).
- ⑥ Remove arm cylinder assembly (8).
  - Weight : 360 kg (790 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

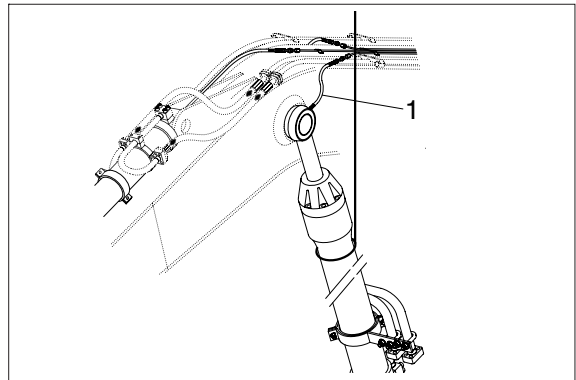
#### (1) Removal

- ※ 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.

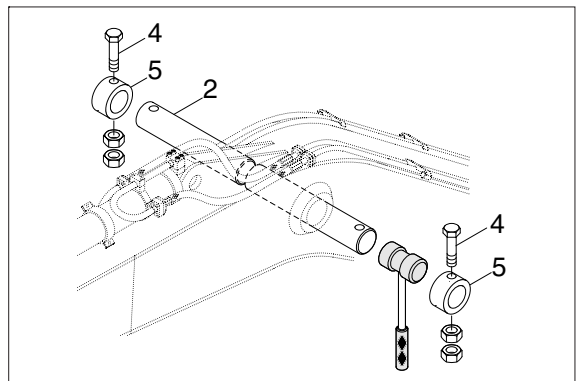
**▲ Loosen the breather slowly to release the pressure inside the hydraulic tank.**

- ※ 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.

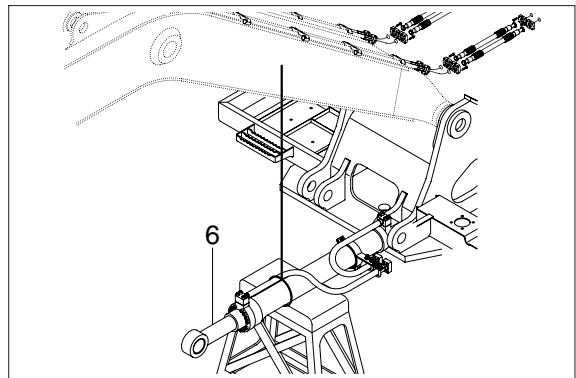
- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.



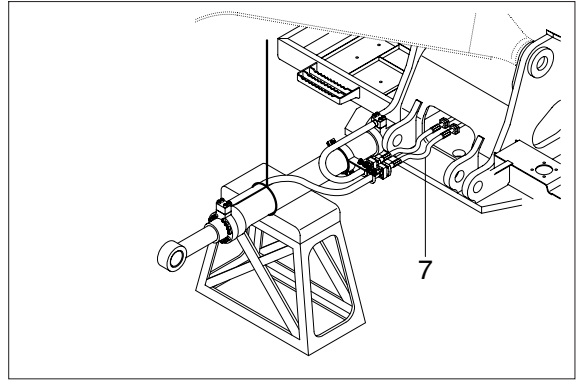
- ③ Remove bolt (4), pin stopper (5) and pull out pin (2).
- ※ Tie the rod with wire to prevent it from coming out.



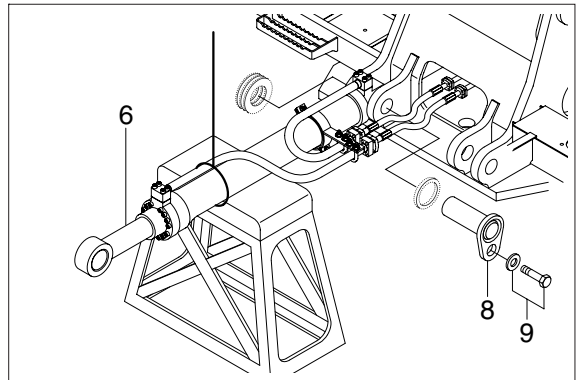
- ④ Lower the boom cylinder assembly (6) on a stand.



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



- ⑥ Remove bolt (9) and pull out pin (8).  
⑦ Remove boom cylinder assembly (6).  
· Weight : 300 kg (660 lb)



## (2) Install

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

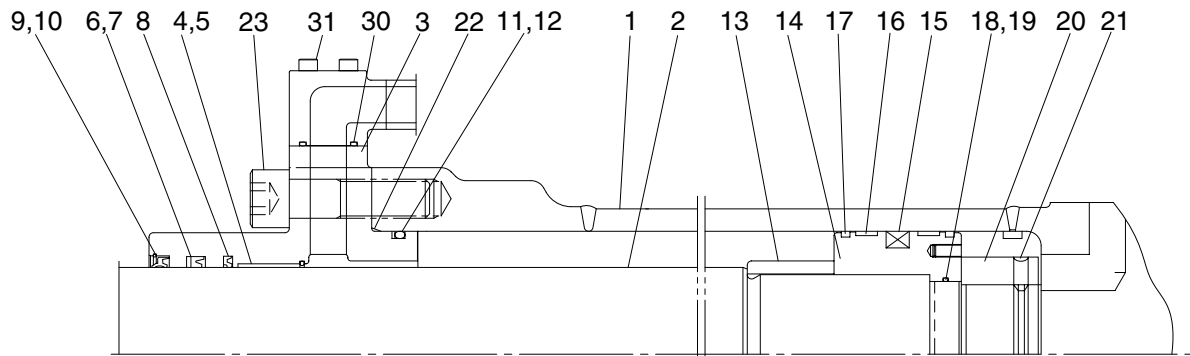
**▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

- ※ Bleed the air from the boom cylinder.
- ※ Confirmed the hydraulic oil level and check the hydraulic oil leak or not.

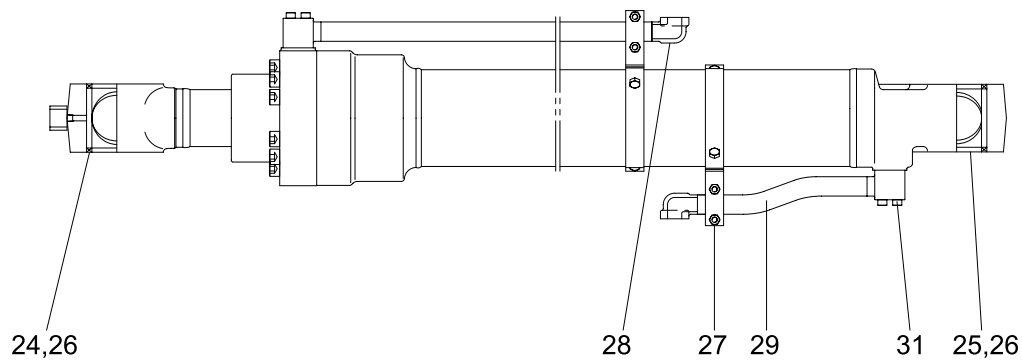
## 2. DISASSEMBLY AND ASSEMBLY

### 1) STRUCTURE

#### (1) Bucket cylinder



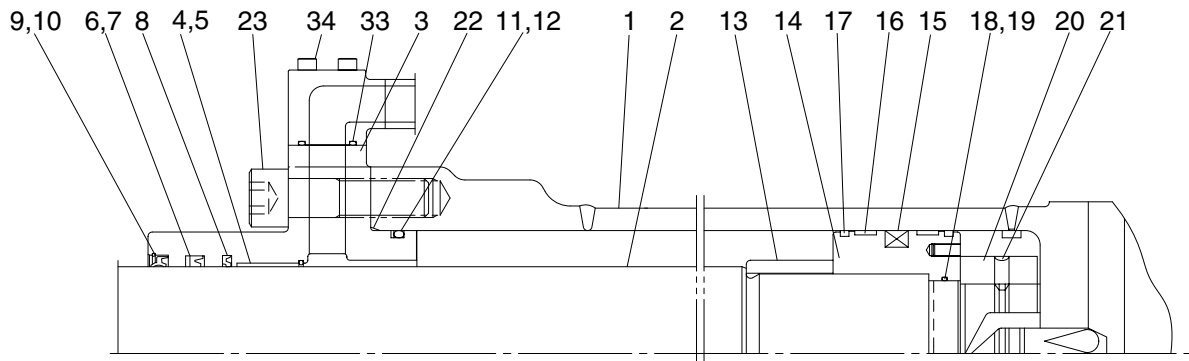
Internal detail



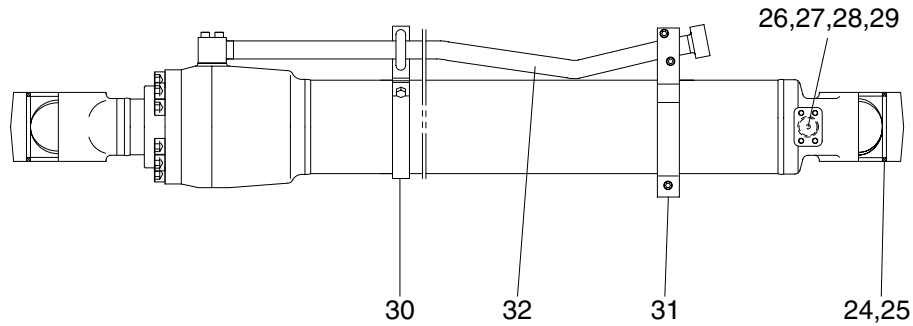
1	Tube assembly	12	Back up ring	23	Hexagon socket head bol
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly
7	Back up ring	18	O-ring	29	Pipe assembly
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket set screw		
11	O-ring	\ 22	O-ring		



(2) Arm cylinder

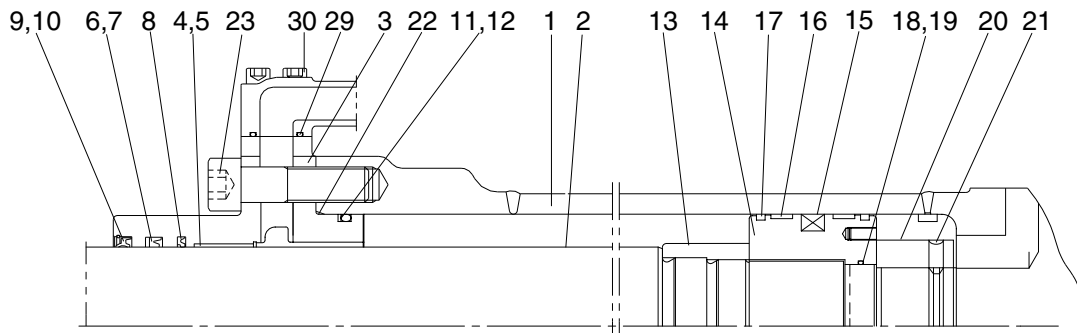


Internal detail

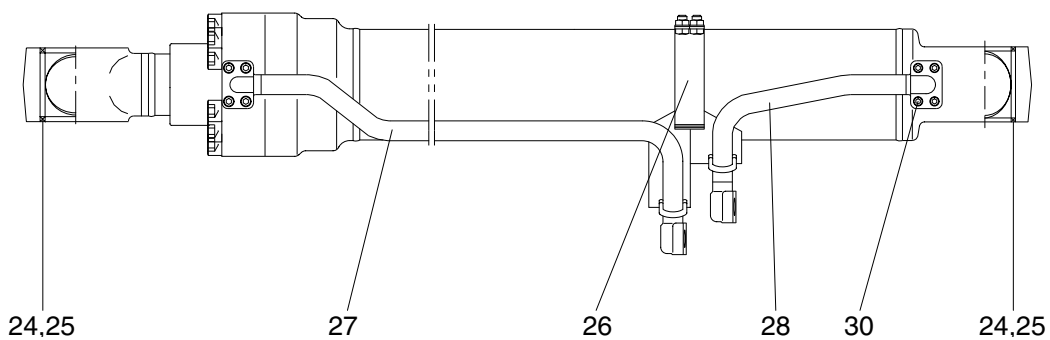


- |    |               |    |                          |    |                          |
|----|---------------|----|--------------------------|----|--------------------------|
| 1  | Tube assembly | 13 | Cushion ring             | 25 | Dust seal                |
| 2  | Rod assembly  | 14 | Piston                   | 26 | Check valve              |
| 3  | Gland         | 15 | Piston seal              | 27 | Coil spring              |
| 4  | DD2 bushing   | 16 | Wear ring                | 28 | O-ring                   |
| 5  | Snap ring     | 17 | Dust ring                | 29 | Plug                     |
| 6  | Rod seal      | 18 | O-ring                   | 30 | Band assembly            |
| 7  | Back up ring  | 19 | Back up ring             | 31 | Band assembly            |
| 8  | Buffer ring   | 20 | Lock nut                 | 32 | Pipe assembly            |
| 9  | Dust wiper    | 21 | Hexagon socket set screw | 33 | O-ring                   |
| 10 | Snap ring     | 22 | O-ring                   | 34 | Hexagon socket head bolt |
| 11 | O-ring        | 23 | Hexagon socket head bolt |    |                          |
| 12 | Back up ring  | 24 | Pin bushing              |    |                          |

### (3) Boom cylinder



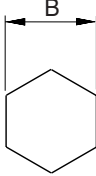
Internal detail



- |    |               |    |              |    |                          |
|----|---------------|----|--------------|----|--------------------------|
| 1  | Tube assembly | 11 | O-ring       | 21 | Hexagon socket set screw |
| 2  | Rod assembly  | 12 | Back up ring | 22 | O-ring                   |
| 3  | Gland         | 13 | Cushion ring | 23 | Hexagon socket head bolt |
| 4  | DD2 bushing   | 14 | Piston       | 24 | Pin bushing              |
| 5  | Snap ring     | 15 | Piston seal  | 25 | Dust seal                |
| 6  | Rod seal      | 16 | Wear ring    | 26 | Band assembly            |
| 7  | Back up ring  | 17 | Dust ring    | 27 | Pipe assembly            |
| 8  | Buffer ring   | 18 | O-ring       | 28 | Pipe assembly            |
| 9  | Dust wiper    | 19 | Back up ring | 29 | O-ring                   |
| 10 | Snap ring     | 20 | Lock nut     | 30 | Hexagon socket head bolt |

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

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

### (2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23	M18	32.0±3.0	232±21.7
	Boom cylinder	23	M12	46.0±5.0	333±7.2
	Arm cylinder	23	M22	63.0±6.0	457±43.4
Socket head bolt	Bucket cylinder	31	M12	9.4±1.0	68.0±7.2
	Boom cylinder	30	M12	9.4±1.0	68.0±7.2
	Arm cylinder	34	M12	9.4±1.0	68.0±7.2
Lock nut	Bucket cylinder	20	-	100±10.0	723±72.3
	Boom cylinder	20	-	100±10.0	723±72.3
	Arm cylinder	20	-	150±15.0	1085±108
Piston	Bucket cylinder	14	-	150±15.0	1085±108
	Boom cylinder	14	-	150±15.0	1085±108
	Arm cylinder	14	-	200±20.0	1447±145

### 3) DISASSEMBLY

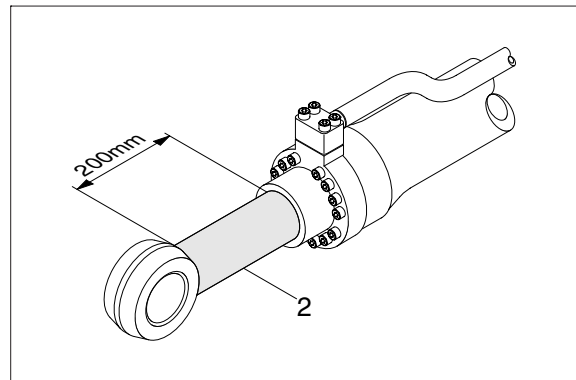
#### (1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

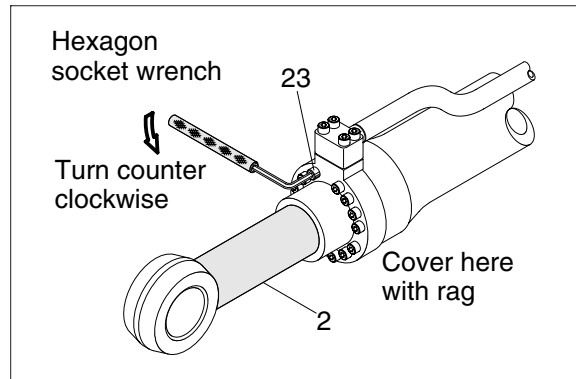
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



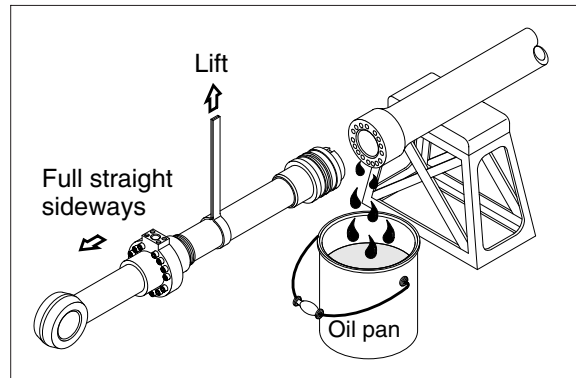
③ Loosen and remove socket bolts (23) of the gland in sequence.

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



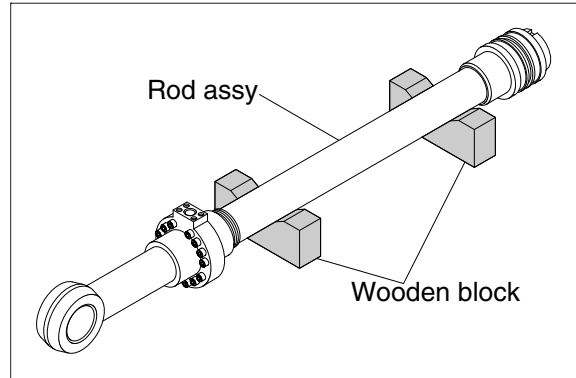
④ Draw out cylinder head and rod assembly together from tube assembly (1).

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



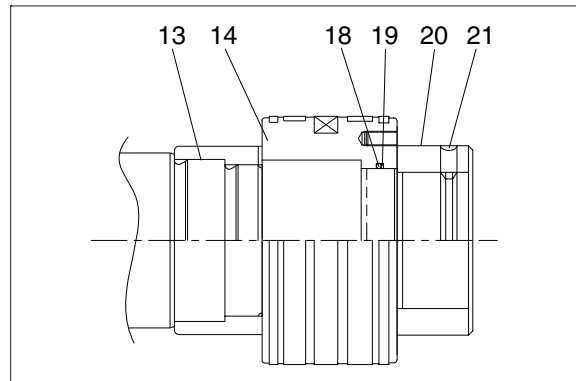
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

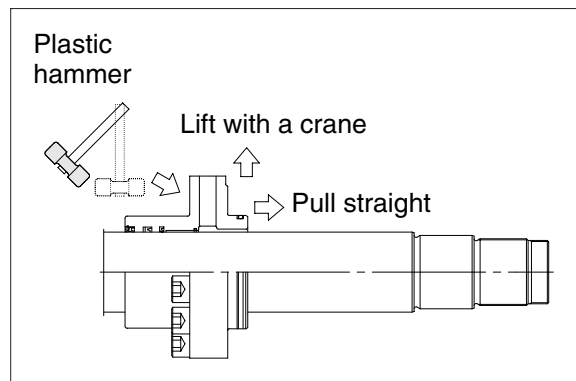


## (2) Remove piston and cylinder head

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

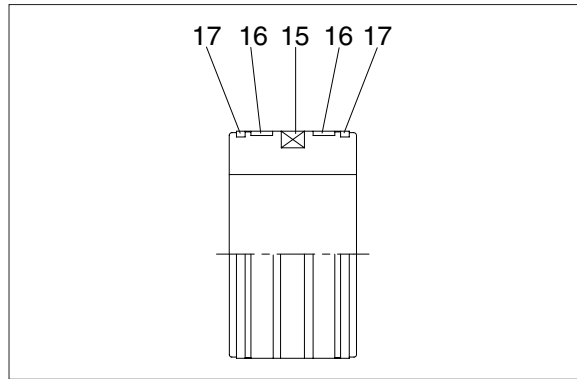


- ③ Remove the cylinder head assembly from rod assembly (2).
- ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
- ※ Pull it straight with cylinder head assembly lifted with a crane. Exercise care so as not to damage the lip of rod bushing (4)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



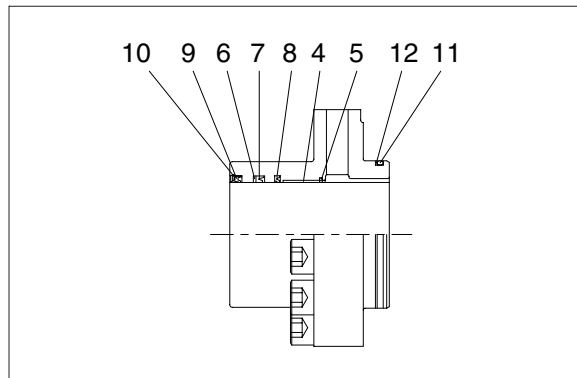
**(3) Disassemble the piston assembly**

- 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.



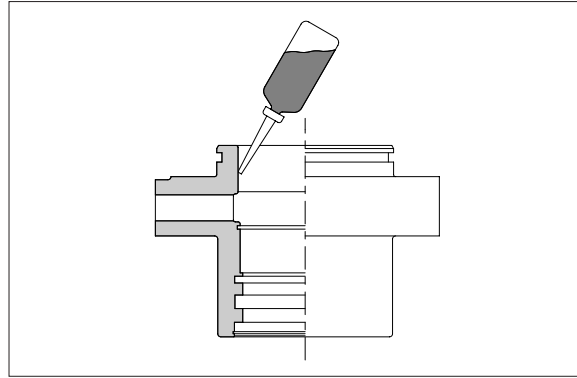


### 3) ASSEMBLY

#### (1) Assemble cylinder head assembly

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

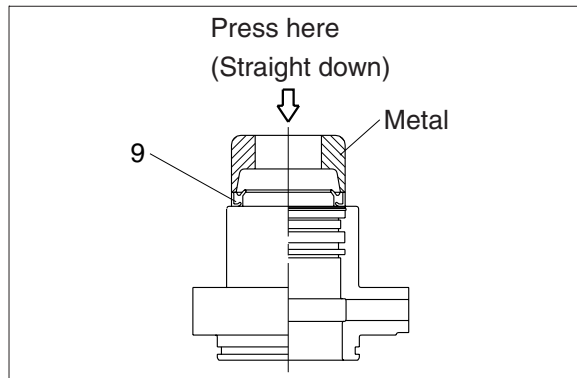
① Coat the inner face of gland (3) with hydraulic oil.



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.

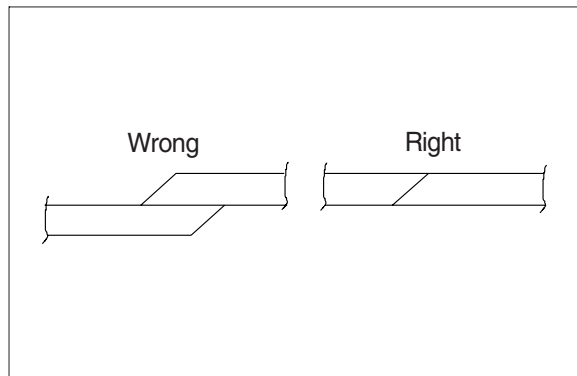
③ Fit snap ring (10) to the stop face.



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

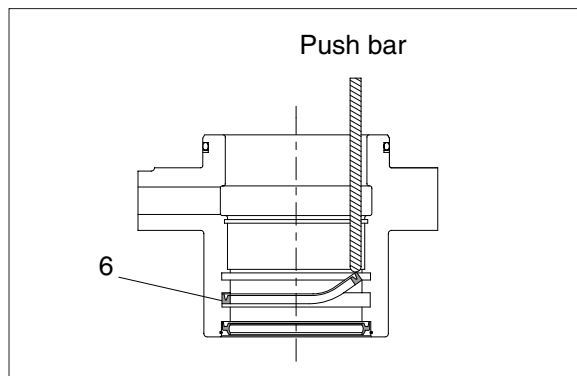
※ Coat each packing with hydraulic oil before fitting it.

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

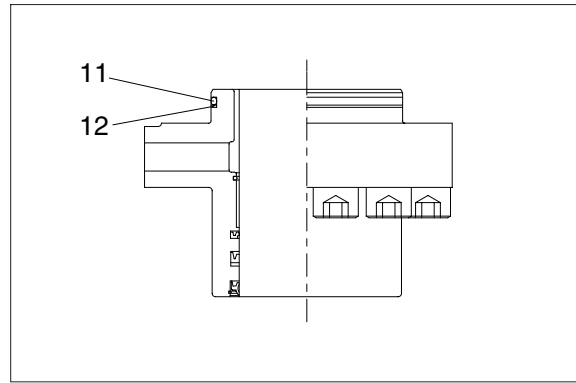


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

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

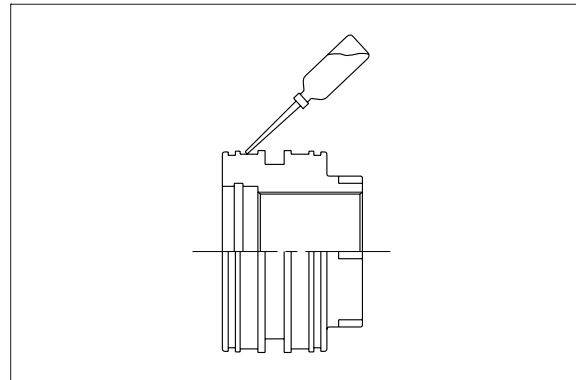


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) to gland (3).

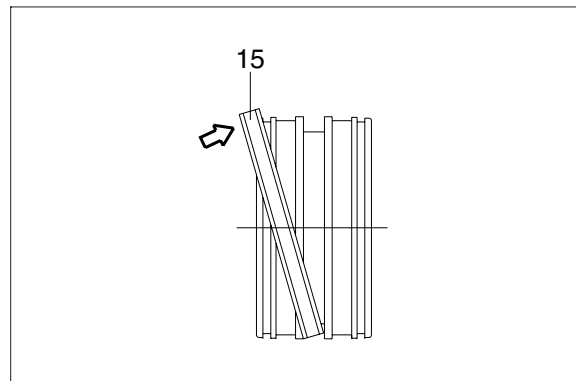


**(2) Assemble piston assembly**

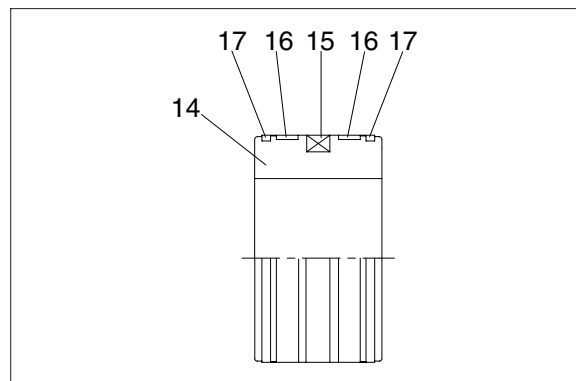
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- 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.

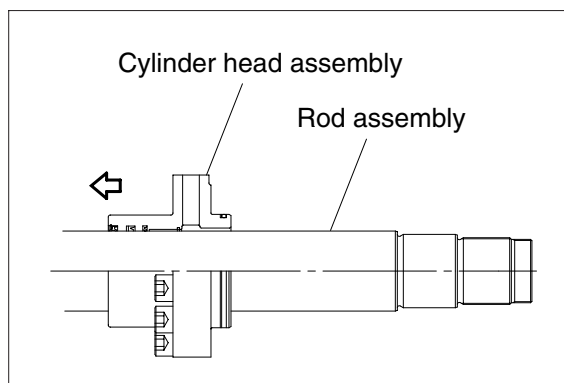


- ③ Fit wear ring (16) and dust ring (17) to piston (14).

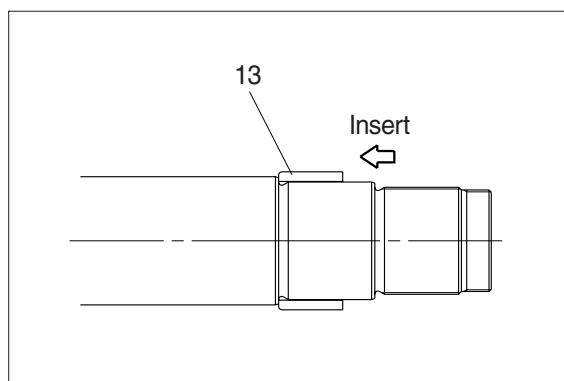


### (3) Install piston and cylinder head

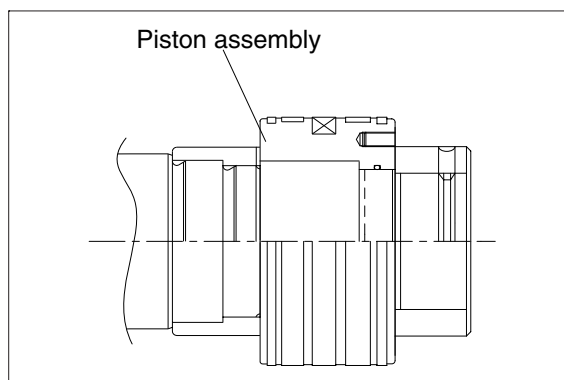
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.



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

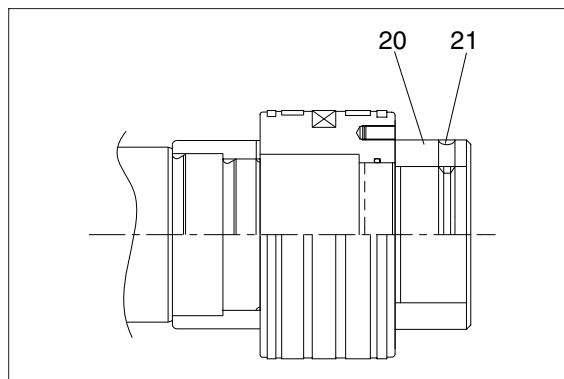


- ⑤ Fit piston assembly to rod assembly.
- Tightening torque :  $100 \pm 10.0 \text{ kgf} \cdot \text{m}$   
( $723 \pm 72.3 \text{ lbf} \cdot \text{ft}$ )



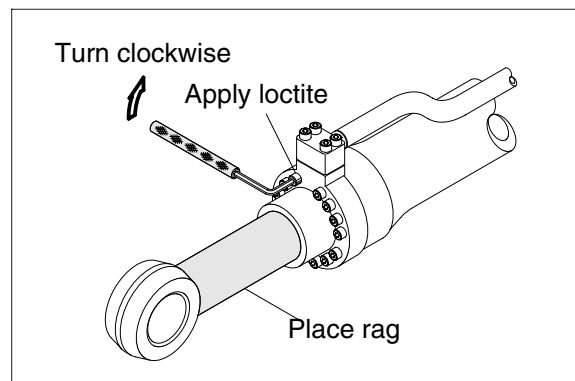
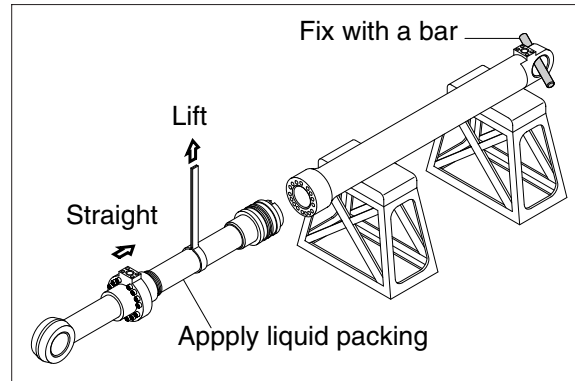
- ⑥ Fit lock nut (20) and tighten the set screw (21).
- Tightening torque :

Item		kgf · m	lbf · ft
Bucket	20	$100 \pm 10$	$723.3 \pm 72.3$
	21	$5.4 \pm 0.5$	$39.1 \pm 3.6$
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.

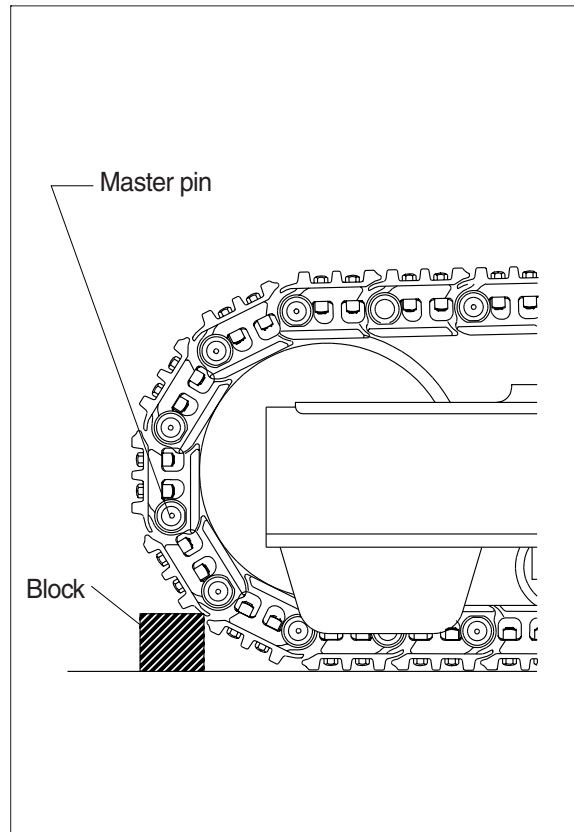


## GROUP 10 UNDERCARRIAGE

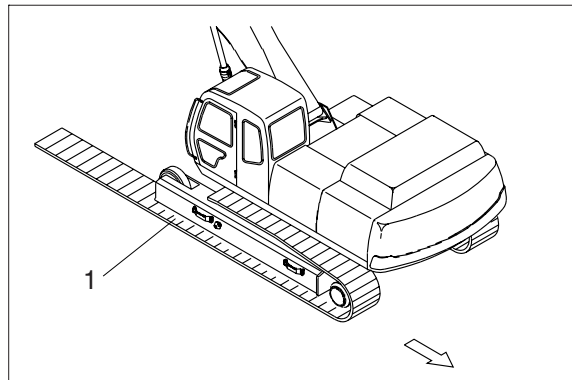
### 1. TRACK LINK

#### 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.

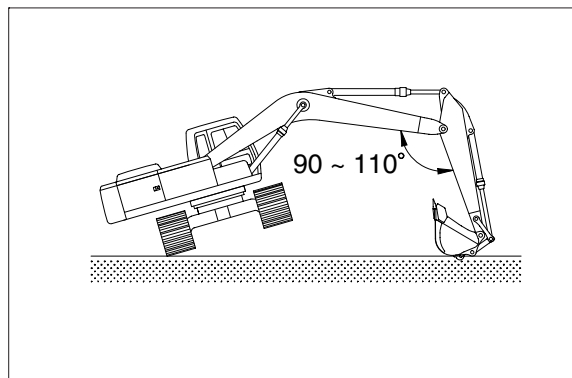


- (4) Move the machine slowly in reverse, and lay out track link assembly (1).
  - ※ Jack up the machine and put wooden block under the machine.
  - ※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



#### 2) INSTALL

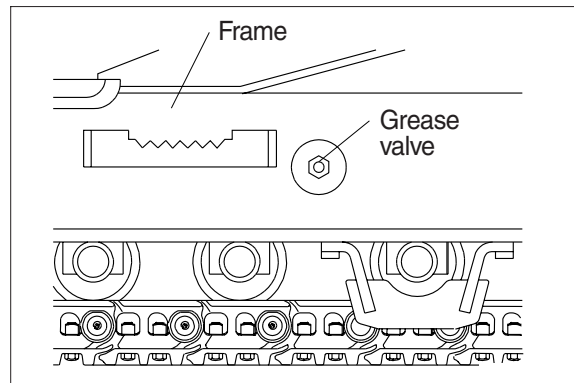
- (1) Carry out installation in the reverse order to removal.
  - ※ Adjust the tension of the track link.



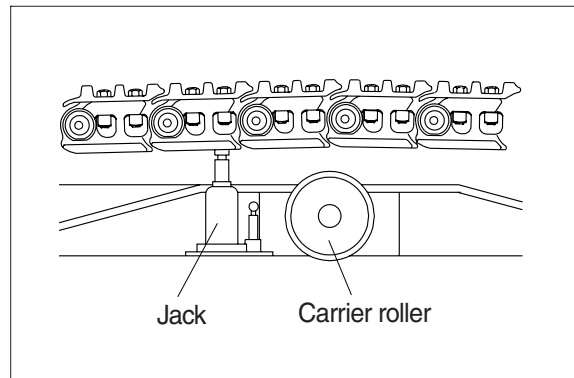
## 2. CARRIER ROLLER

### 1) REMOVAL

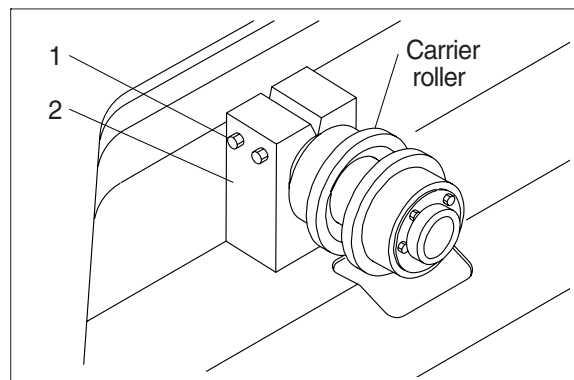
- (1) Loosen tension of the track link.



- (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 : 48 kg (88 lb)



### 2) INSTALL

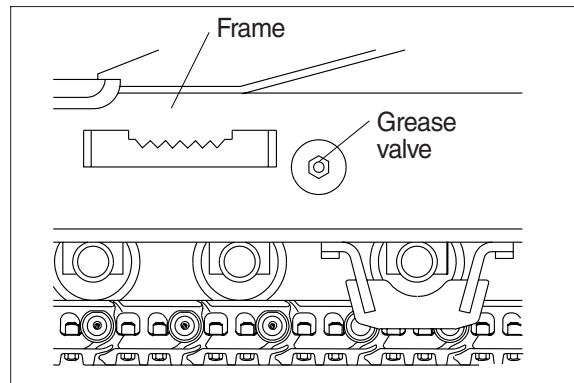
- (1) Carry out installation in the reverse order to removal.



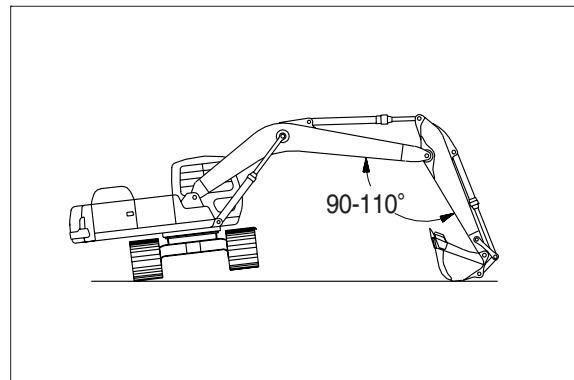
### 3. TRACK ROLLER

#### 1) REMOVAL

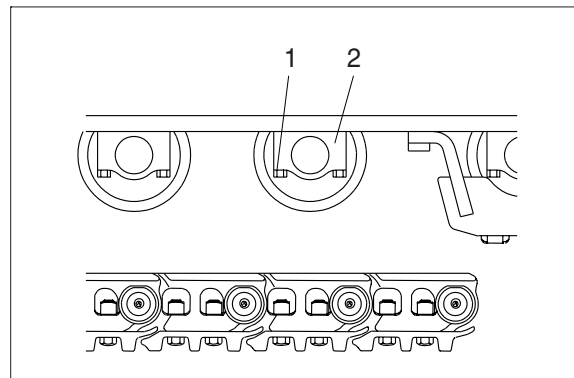
- (1) Loosen tension of the track link.



- (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 bolt (1) and draw out the track roller (2).  
· Weight : 54 kg (119lb)



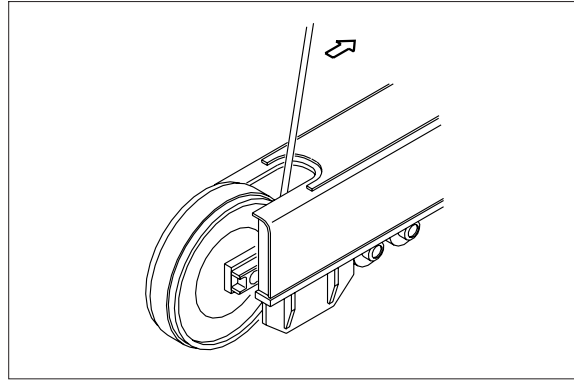
#### 2) INSTALL

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

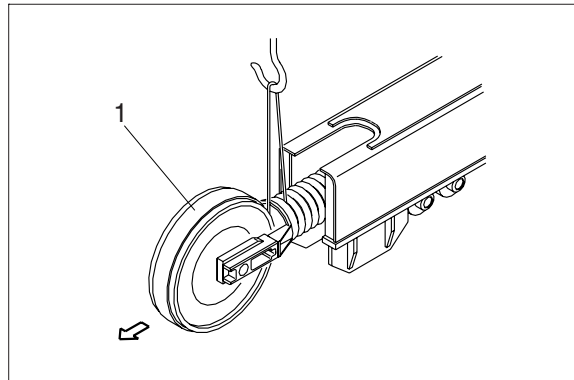
## 4. IDLER AND RECOIL SPRING

### 1) REMOVAL

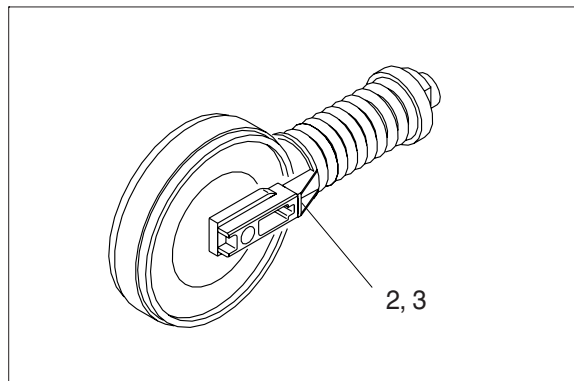
- (1) Remove the track link.  
For detail, see **removal of track link**.



- (2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.  
· Weight : 457 kg (1010 lb)

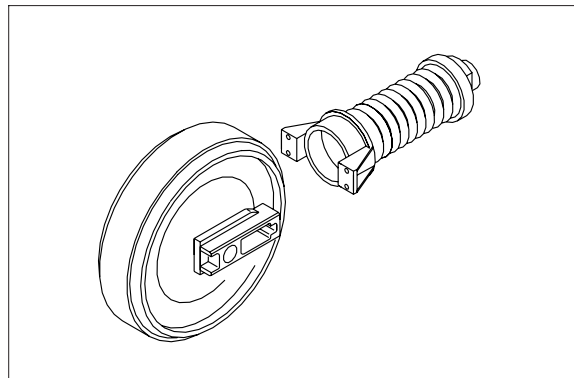


- (3) Remove the bolts (2), washers (3) and separate idler from recoil spring.



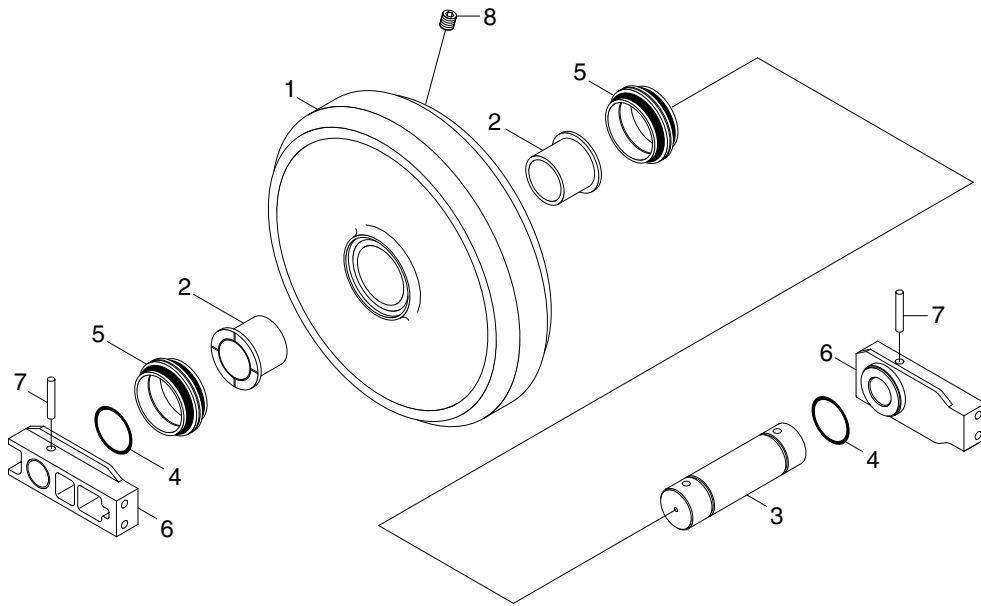
### 2) INSTALL

- (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



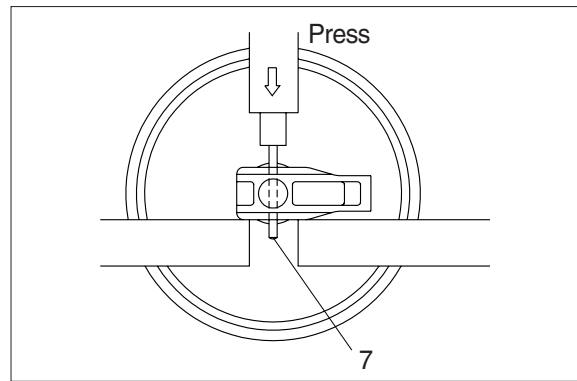
- 1 Shell
- 2 Bushing
- 3 Shaft

- 4 O-ring
- 5 Seal assembly
- 6 Bracket

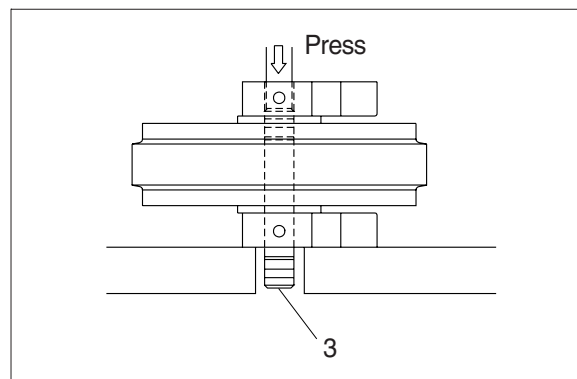
- 7 Spring pin
- 8 Plug

## (2) Disassembly

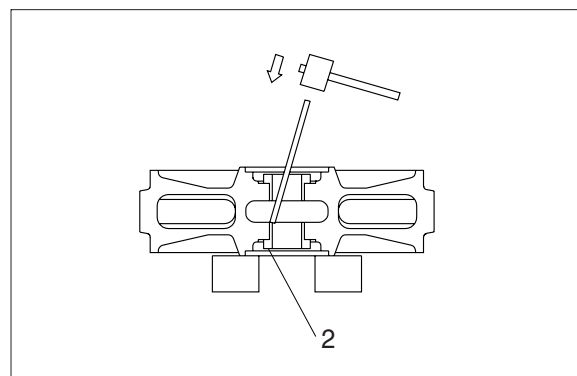
- ① Remove plug and drain oil.
- ② Draw out the spring pin (7), using a press.



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

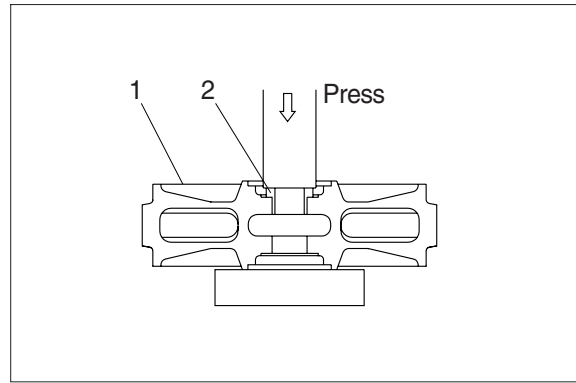


- ⑥ Remove the bushing (2) from idler, using a special tool.
- ※ Only remove bushing if replacement is necessary.

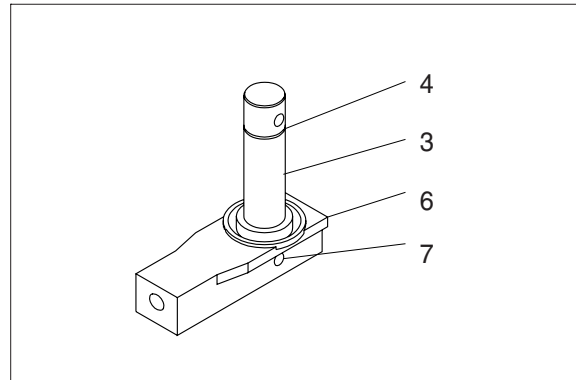


### (3) Assembly

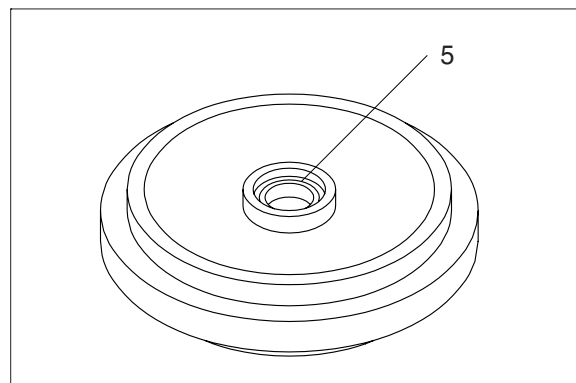
- ※ Before assembly, clean the parts.
- ※ Coat the sliding surfaces of all parts with oil.
- ① Cool up bushing (2) fully by some dry ice and press it into shell (1).  
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



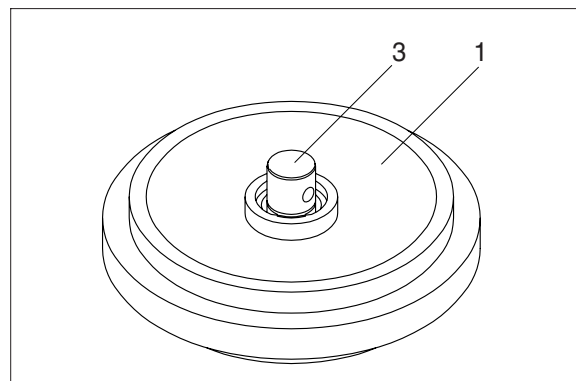
- ② Coat O-ring (4) with grease thinly, and install it to shaft (3).
- ③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



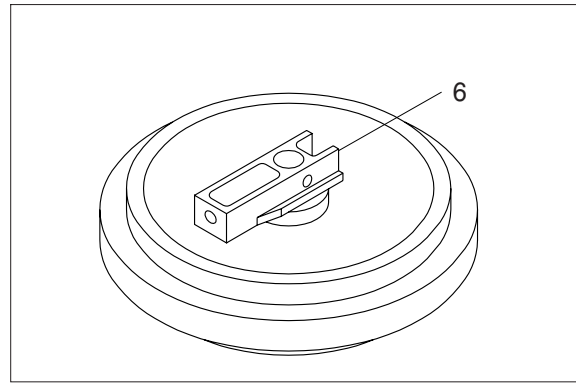
- ④ Install seal (5) to shell (1) and bracket (6).



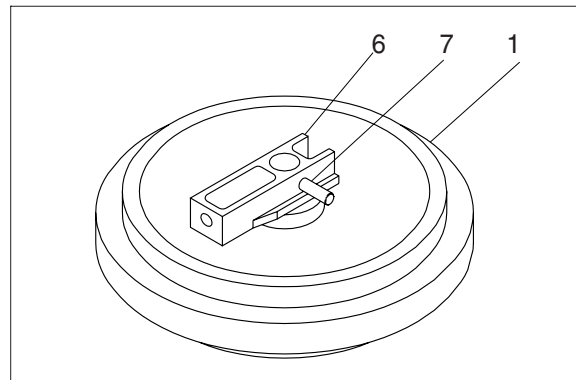
- ⑤ Install shaft (3) to shell (1).



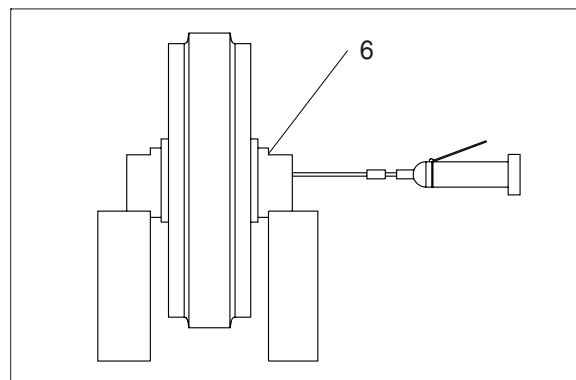
⑥ Install bracket (6) attached with seal (5).



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



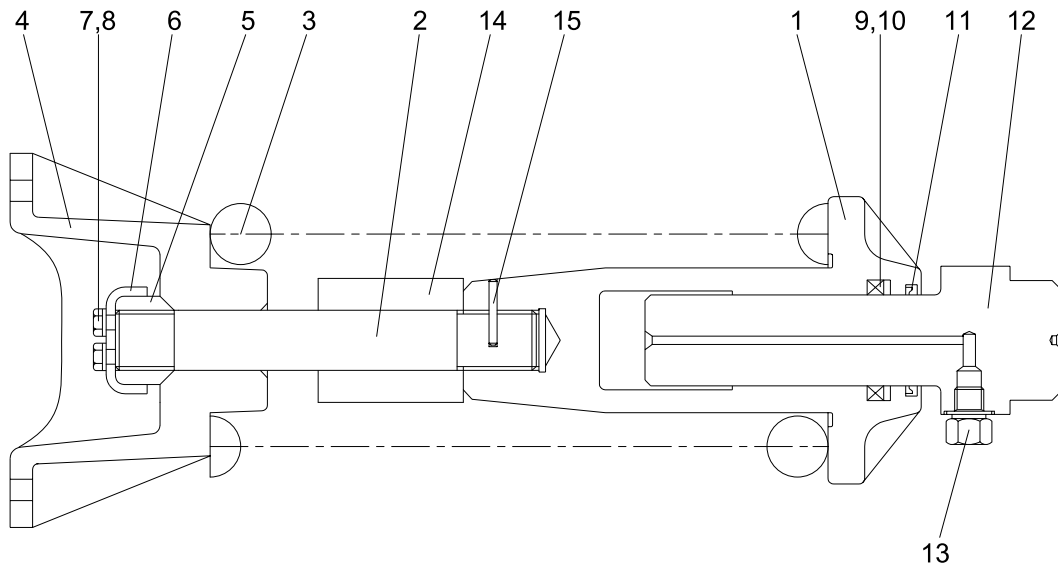
⑧ Lay bracket (6) on its side.  
Supply engine oil to the specified level,  
and tighten plug.





#### 4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

##### (1) Structure



- 1 Body
- 2 Tie bar
- 3 Spring
- 4 Bracket
- 5 Lock nut

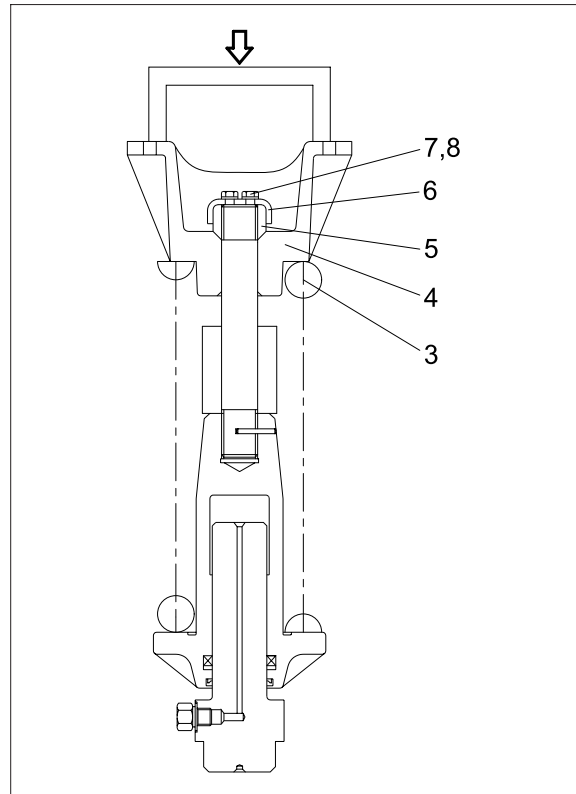
- 6 Lock plate
- 7 Bolt
- 8 Spring washer
- 9 Rod seal
- 10 Back up ring

- 11 Dust seal
- 12 Rod assembly
- 13 Grease valve
- 14 Stopper tube
- 15 Spring pin

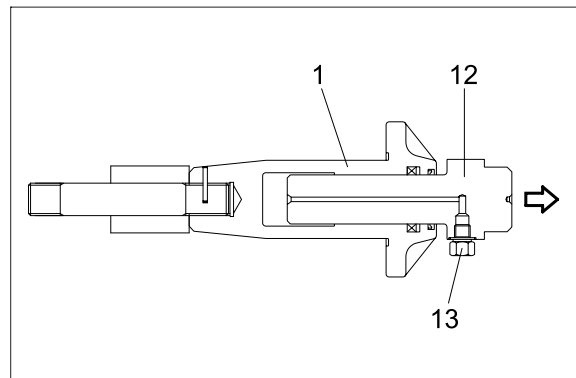
## (2) Disassembly

- 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 : 19012 kg (41826 lb)
- ② Remove bolt (7), spring washer (8) and lock plate (6).
- ③ Remove lock nut (5).

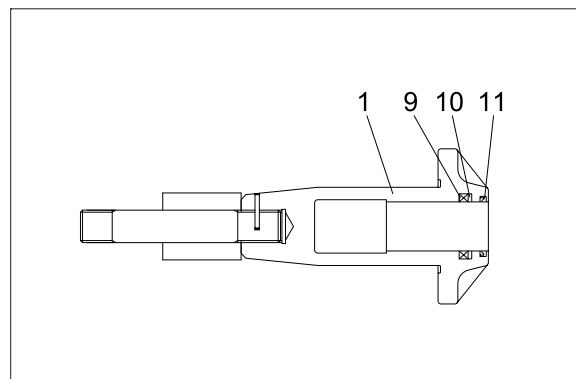
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.
- ④ Lighten the press load slowly and remove bracket (4) and spring (3).



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



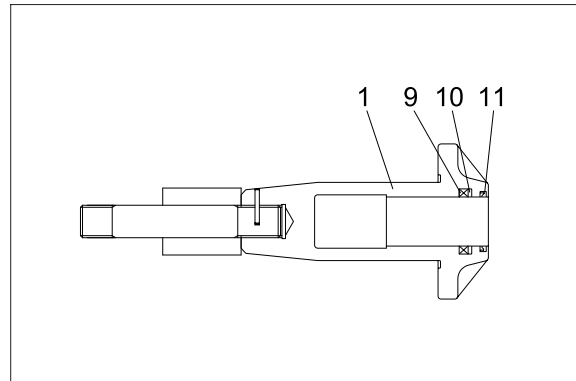
- ⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



### (3) Assembly

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

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



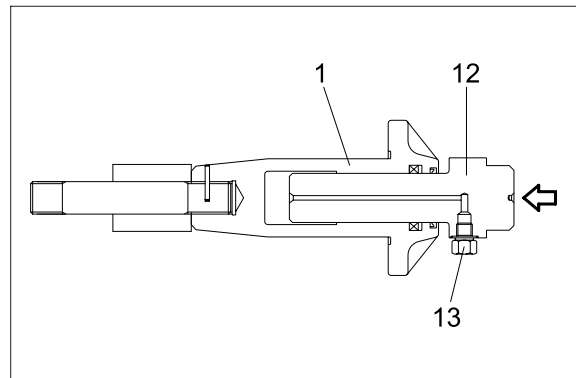
② Pour grease into body (1), then push in rod (12) by hand.

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

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

③ Fit grease valve (13) to rod (12).

·Tightening torque :  $13.0 \pm 1.0 \text{ kgf} \cdot \text{m}$   
( $94 \pm 7.2 \text{ lbf} \cdot \text{ft}$ )

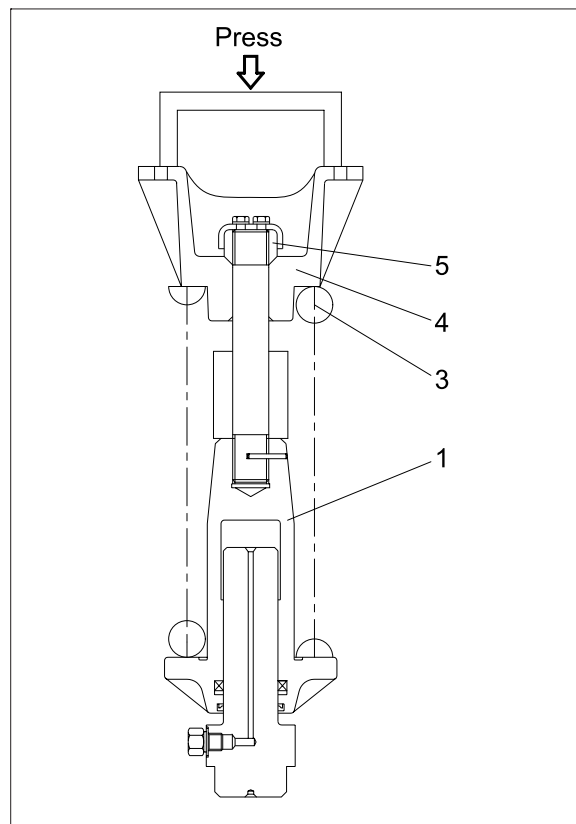


④ Install spring (3) and bracket (4) to body (1).

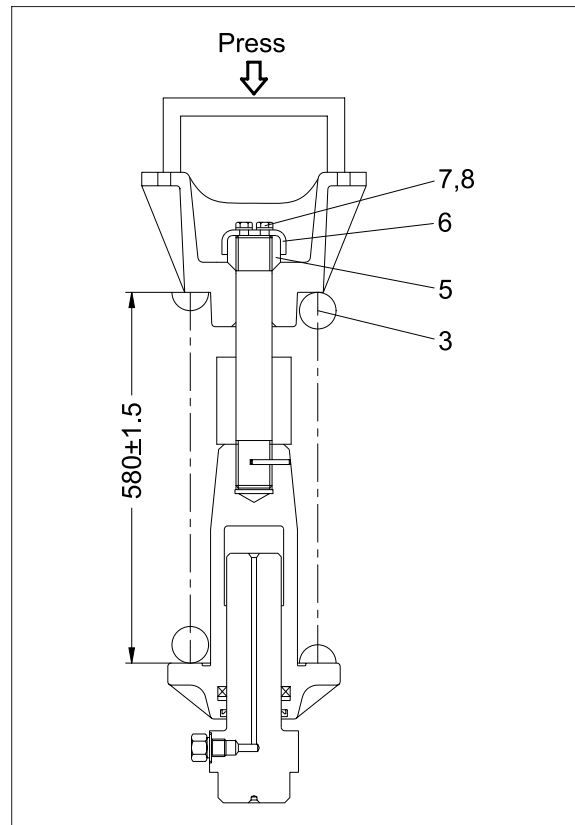
⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).

※ Apply sealant before assembling.

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

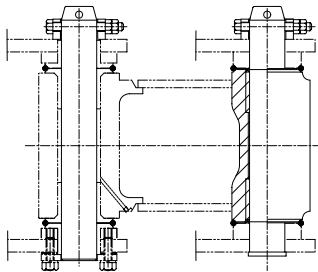
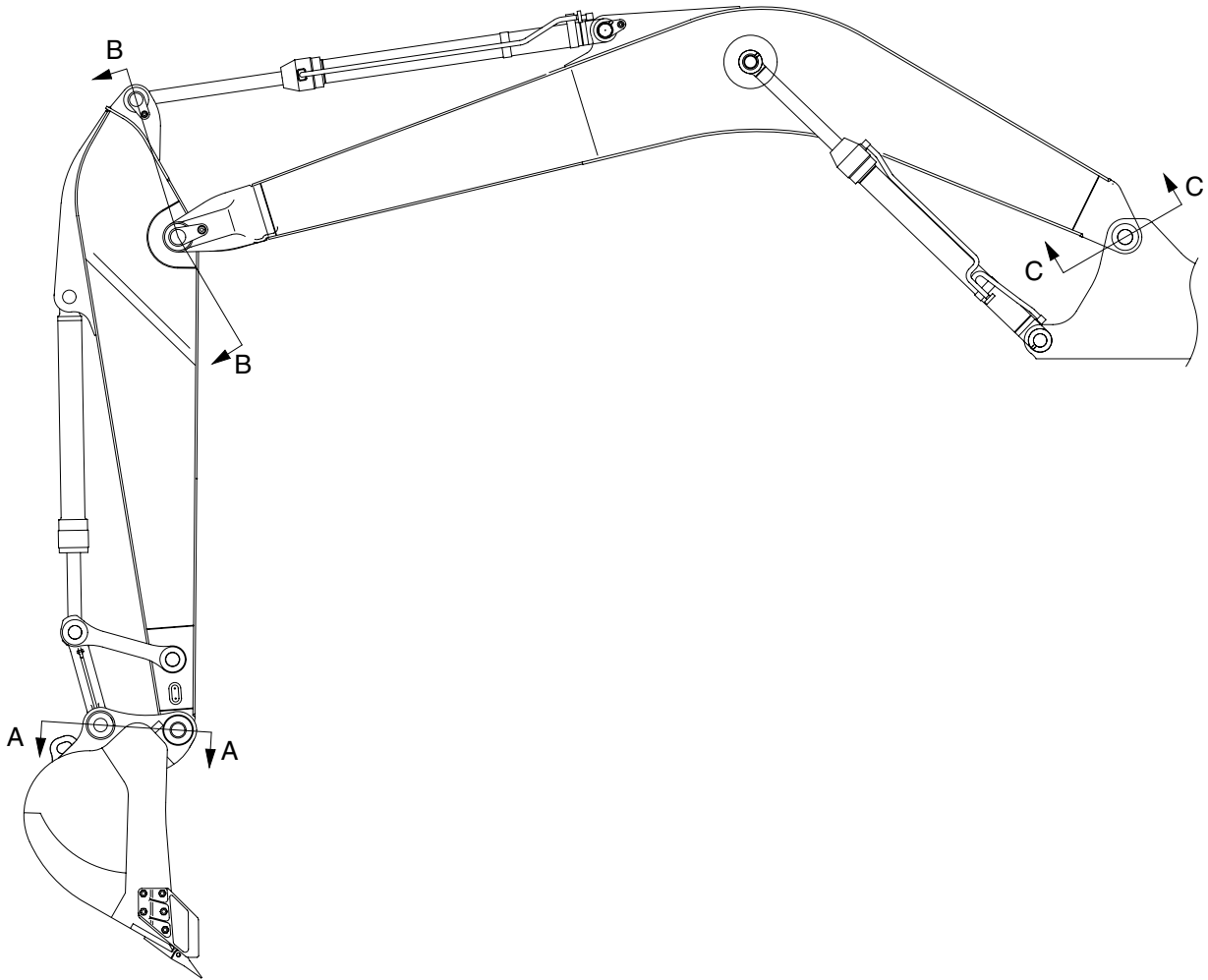


- ⑥ Lighten the press load and confirm the set length of spring (3).
- ⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).

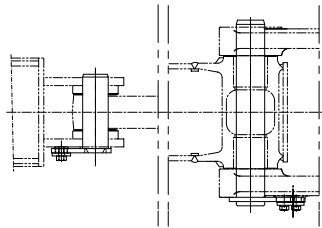


# GROUP 11 WORK EQUIPMENT

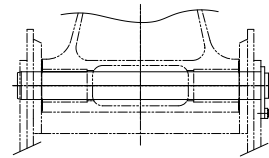
## 1. STRUCTURE



SECTION A



SECTION B



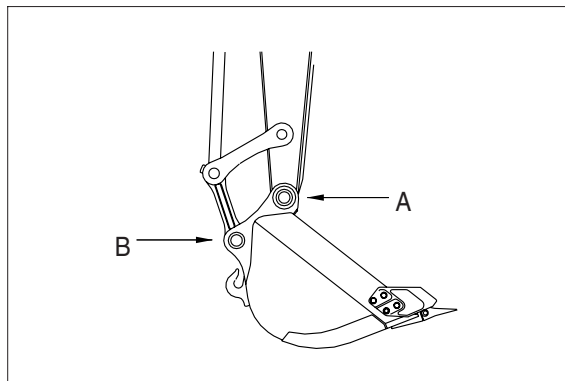
SECTION C

## 2. REMOVAL AND INSTALL

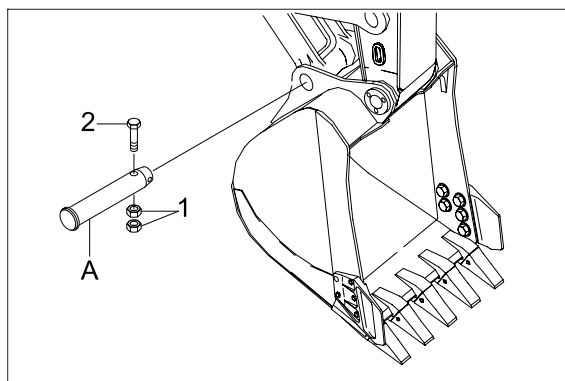
### 1) BUCKET ASSEMBLY

#### (1) Removal

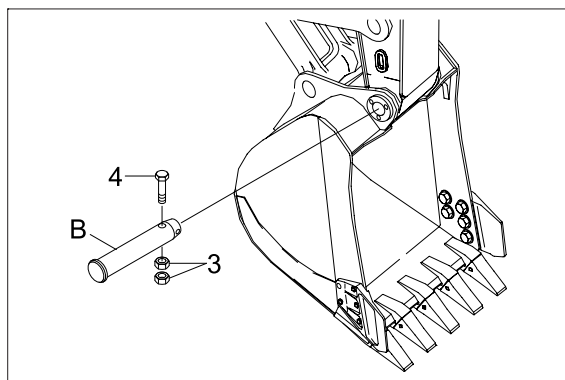
- ① Lower the work equipment completely to ground with back of bucket facing down.



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



- ③ Remove nut (3), bolt (4) and draw out the pin (B).

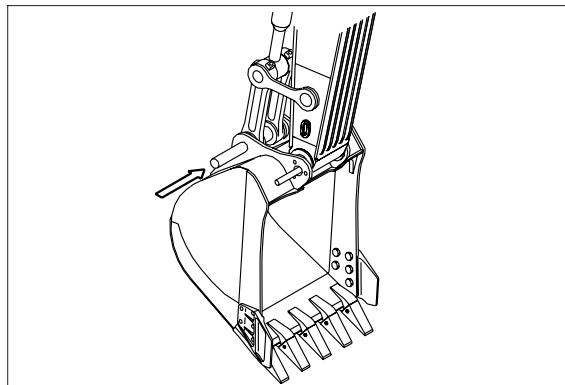


#### (2) Install

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

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

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



## 2) ARM ASSEMBLY

### (1) Removal

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

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

① Remove bucket assembly.

For details, see **removal of bucket assembly**.

② Disconnect bucket cylinder hose (1).

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

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

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

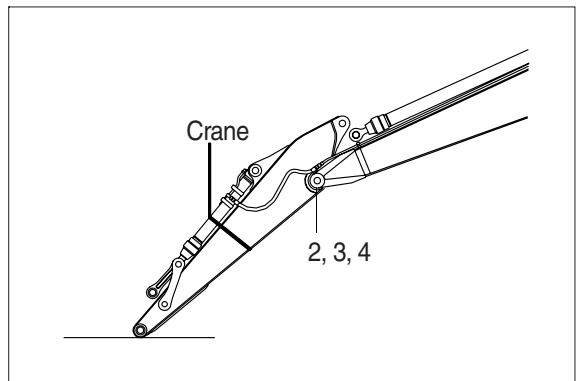
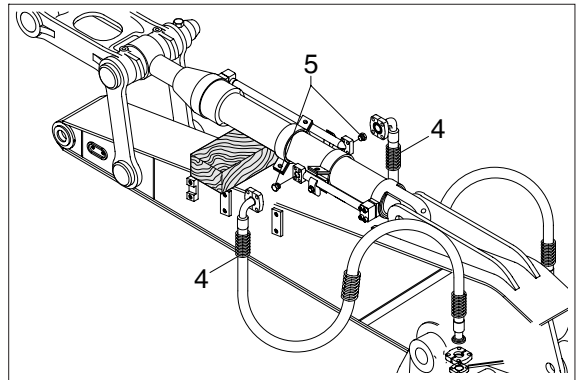
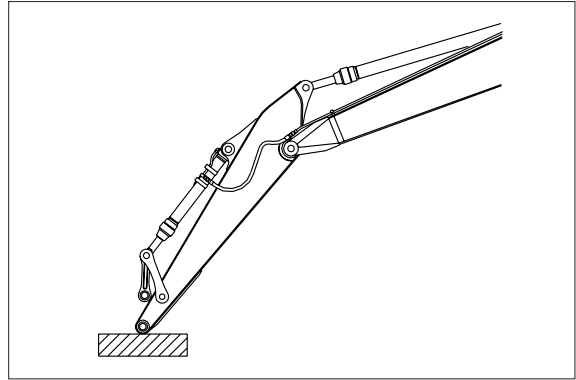
④ For details, see **removal of arm cylinder assembly**.

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

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

· Weight : 1160 kg (2560 lb)

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



### (2) Install

① Carry out installation in the reverse order to removal.

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

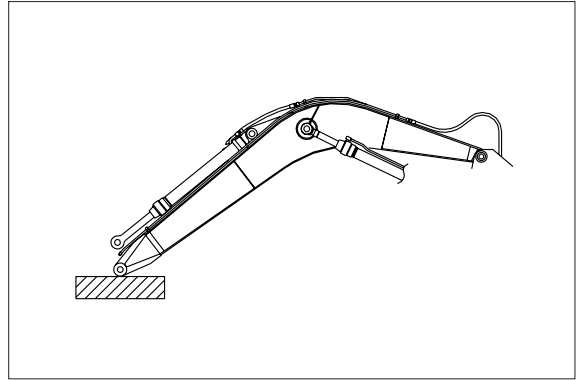
※ Bleed the air from the cylinder.



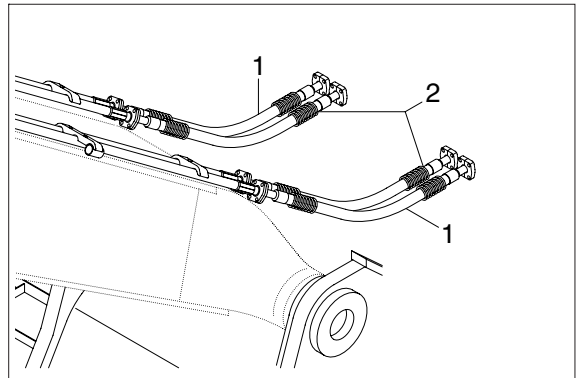
### 3) BOOM CYLINDER

#### (1) Removal

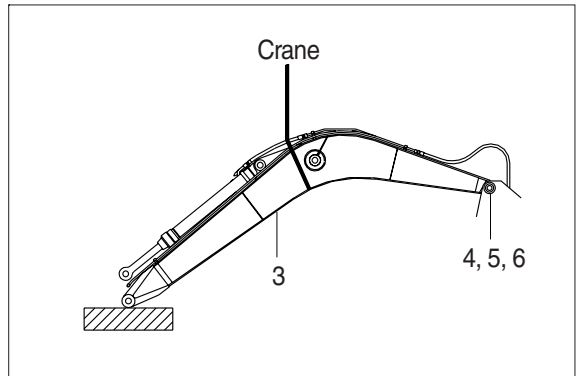
- ① Remove arm and bucket assembly.  
For details, see **removal of arm and bucket assembly**.
- ② Remove boom cylinder assembly from boom.  
For details, see **removal of arm cylinder assembly**.



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

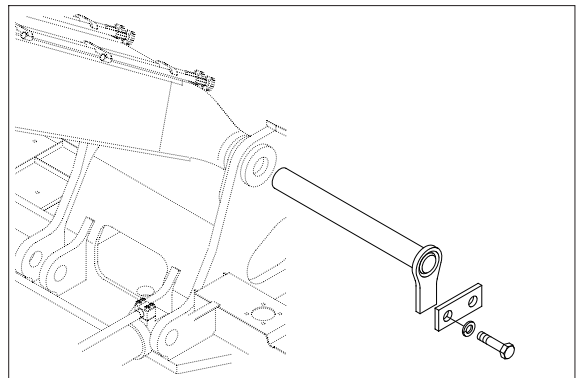


- ⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.  
· Weight : 2540 kg (5600 lb)
- ※ When lifting the boom assembly always lift the center of gravity.



#### (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.



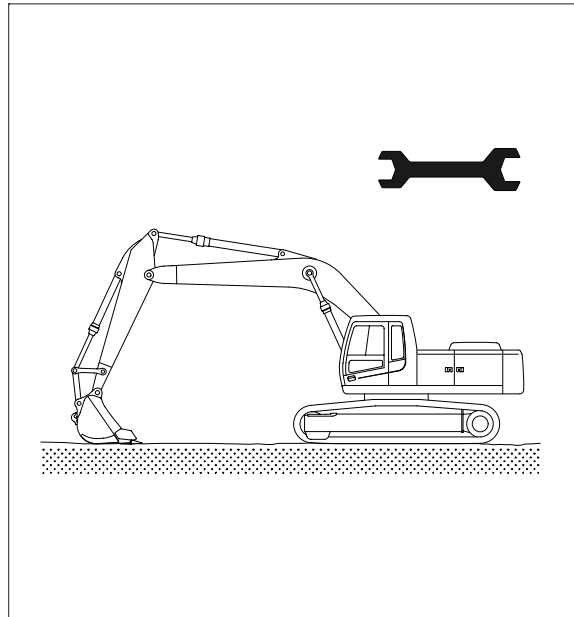
## SECTION 9 COMPONENT MOUNTING TORQUE

Group 1 Introduction guide .....	9-1
Group 2 Engine system .....	9-2
Group 3 Electric system .....	9-4
Group 4 Hydraulic system .....	9-6
Group 5 Undercarriage .....	9-9
Group 6 Structure .....	9-10
Group 7 Work equipment .....	9-14

# SECTION 9 COMPONENT MOUNTING TORQUE

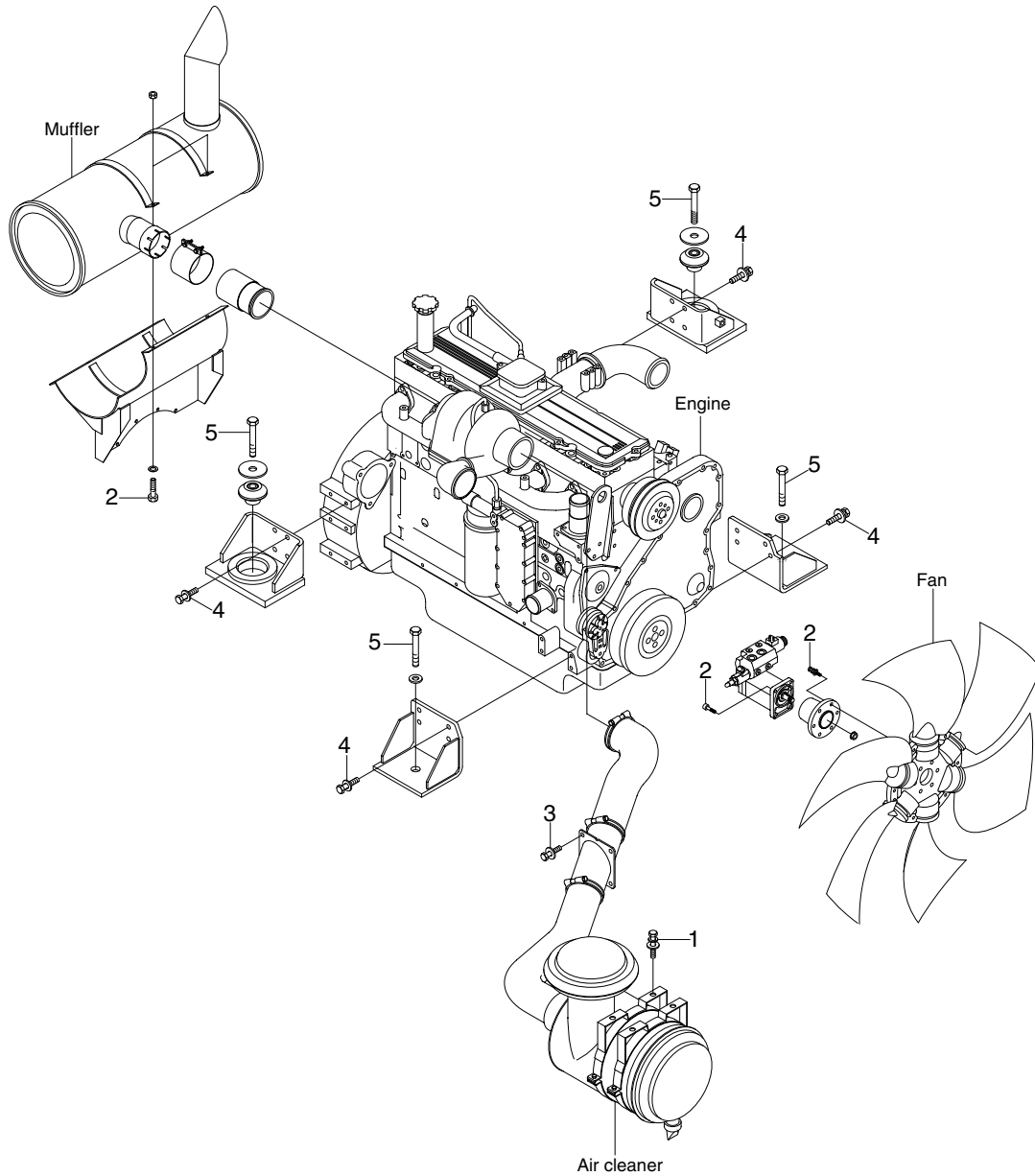
## GROUP 1 INTRODUCTION GUIDE

1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
  2. Use genuine Hyundai spare parts.  
We expressly point out that Hyundai will not accept any responsibility for defects resulted from non-genuine parts.  
In such cases Hyundai cannot assume liability for any damage.
- ※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.
  - ※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.



## GROUP 2 ENGINE SYSTEM

### ENGINE AND ACCESSORIES MOUNTING

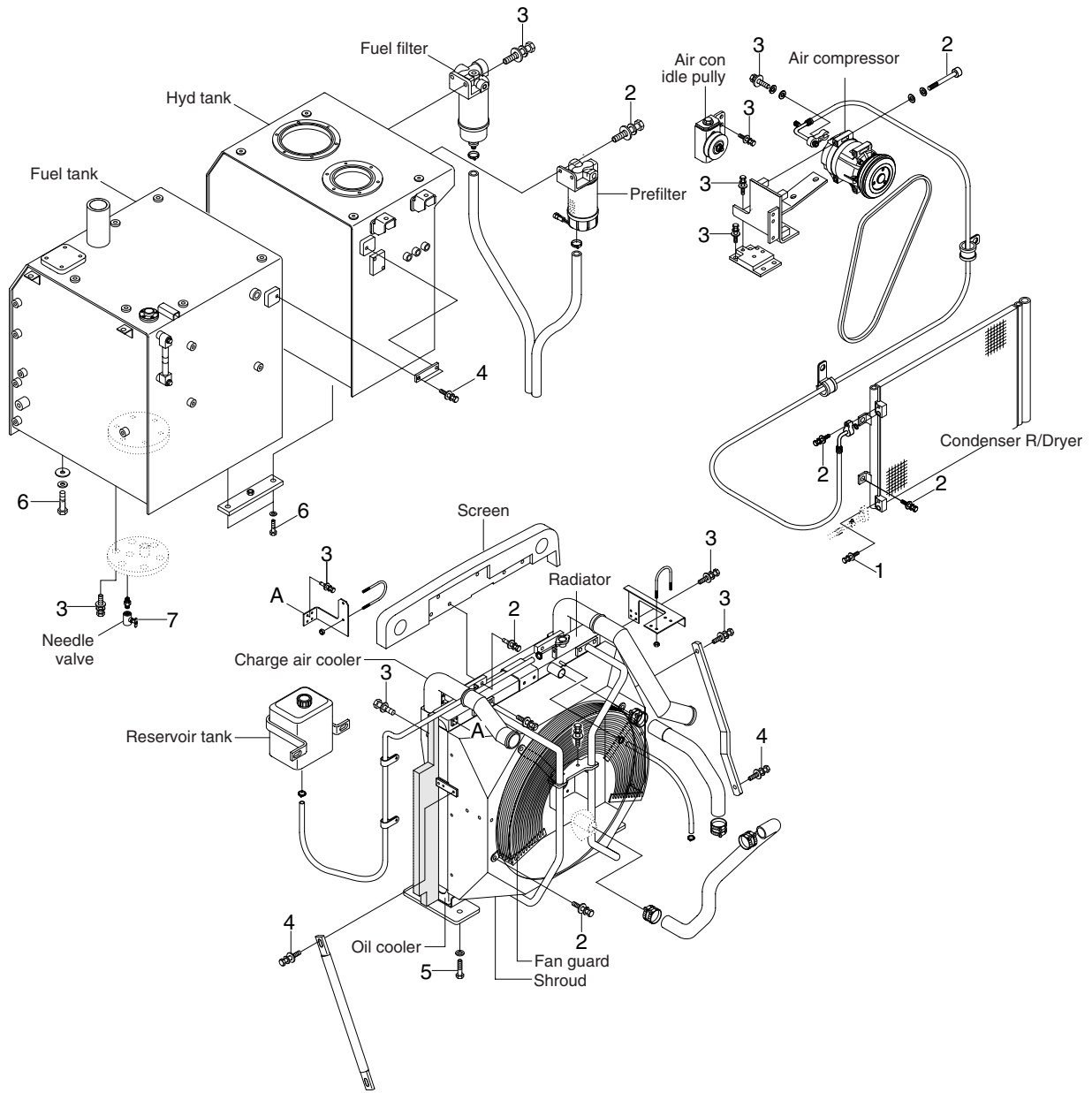


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1
3	M12×1.75	10.0±2.0	72.3±14.5

Item	Size	kgf · m	lbf · ft
4	M12×1.75	12.8±3.0	92.6±21.7
5	M24×3.0	90±7.0	651±51
-	-	-	-

# COOLING SYSTEM AND FUEL TANK MOUNTING



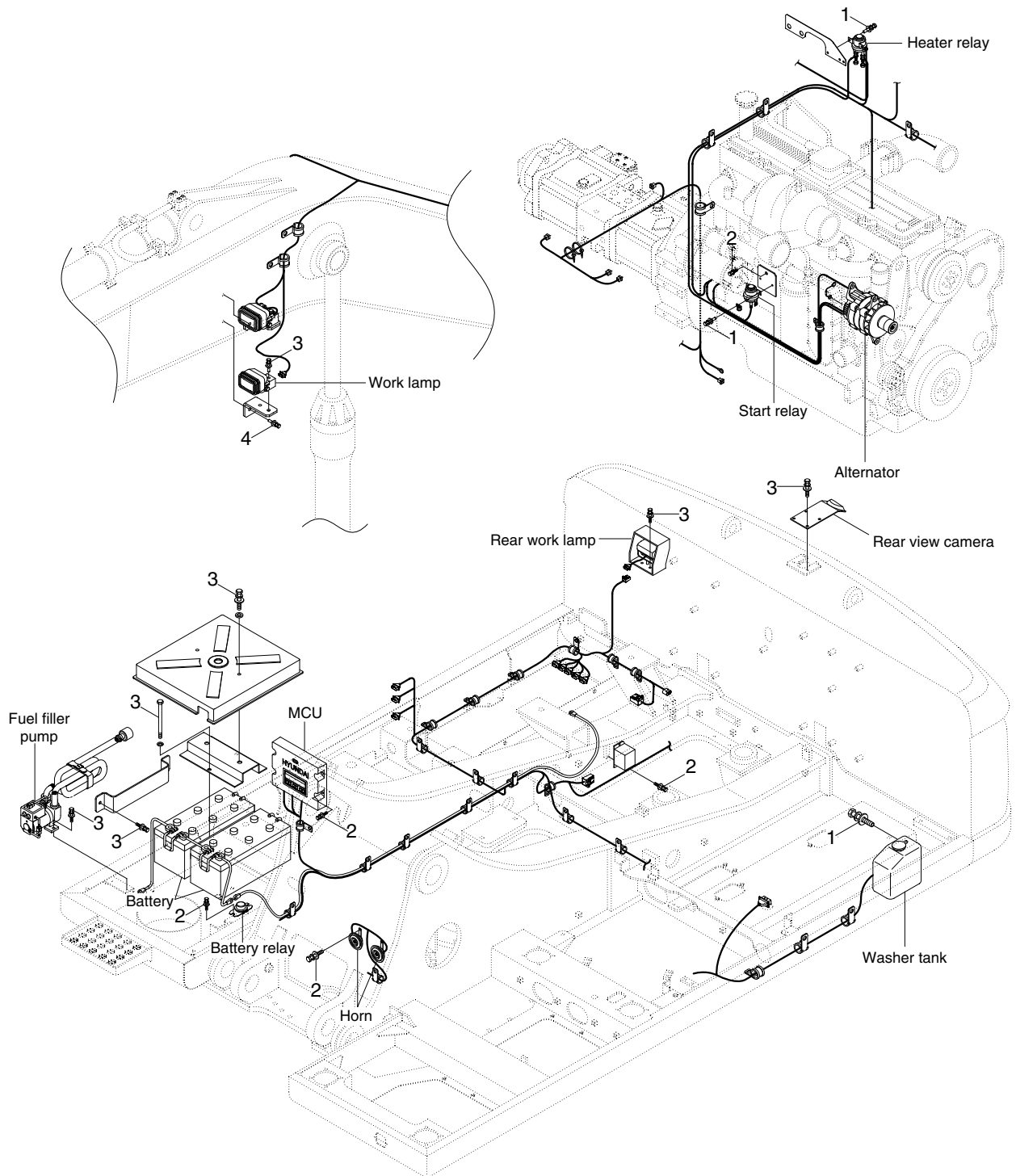
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	0.5±0.2	3.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.25	6.9±1.4	49.4±10.1
4	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
5	M16×2.0	29.7±4.5	215±32.5
6	M20×2.5	46±5.1	333±36.9
7	-	2.3±0.6	16.6±4.3
-	-	-	-

# GROUP 3 ELECTRIC SYSTEM

## ELECTRIC COMPONENTS MOUNTING 1

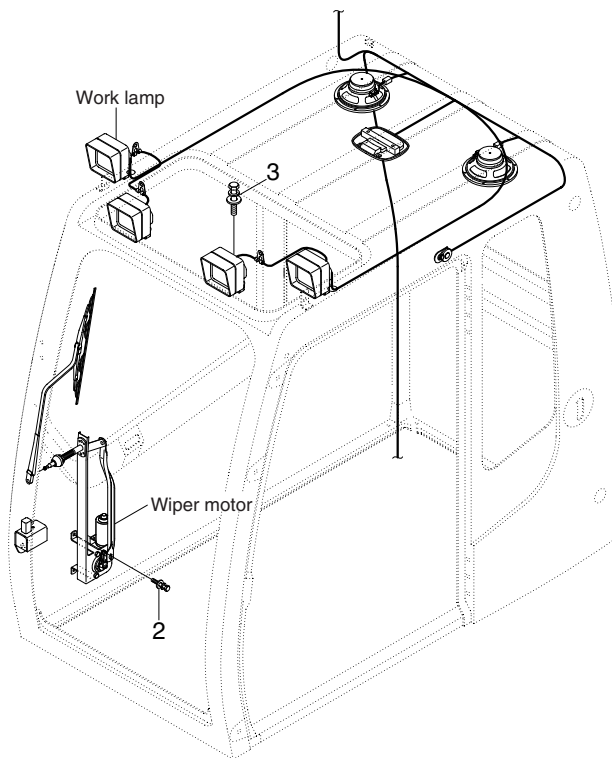


• Tightening torque

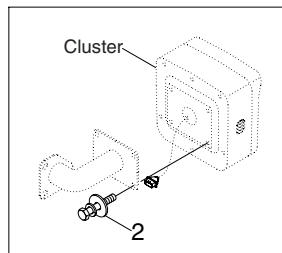
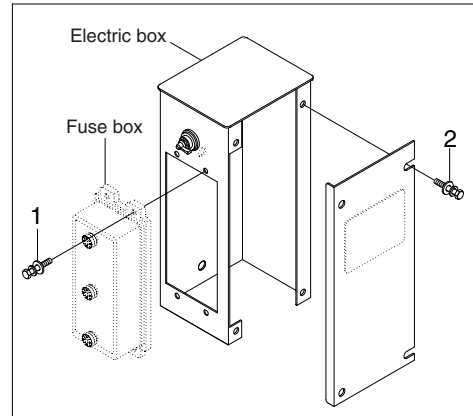
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
4	M12×1.75	12.8±3.0	92.6±21.7

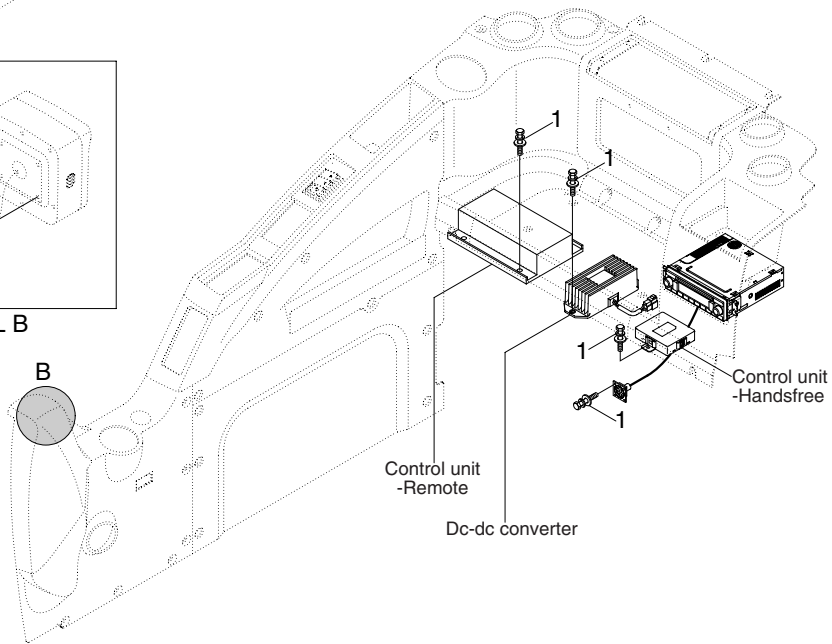
## ELECTRIC COMPONENTS MOUNTING 2



VIEW A



DETAIL B



· Tightening torque

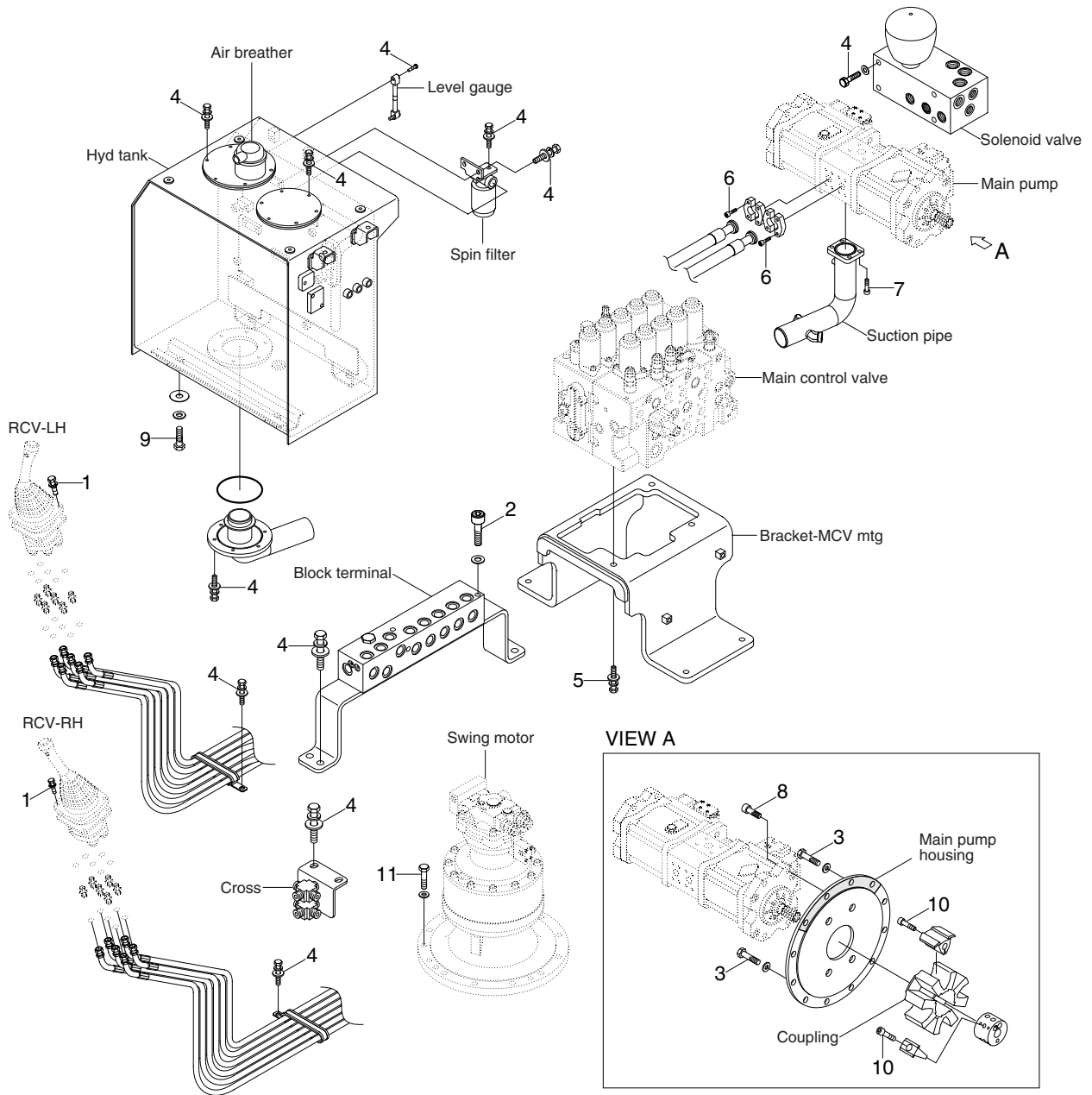
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
-	-	-	-



# GROUP 4 HYDRAULIC SYSTEM

## HYDRAULIC COMPONENTS MOUNTING 1



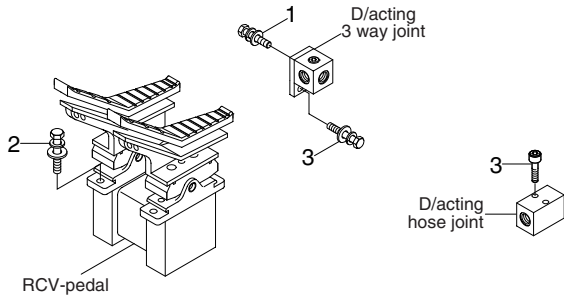
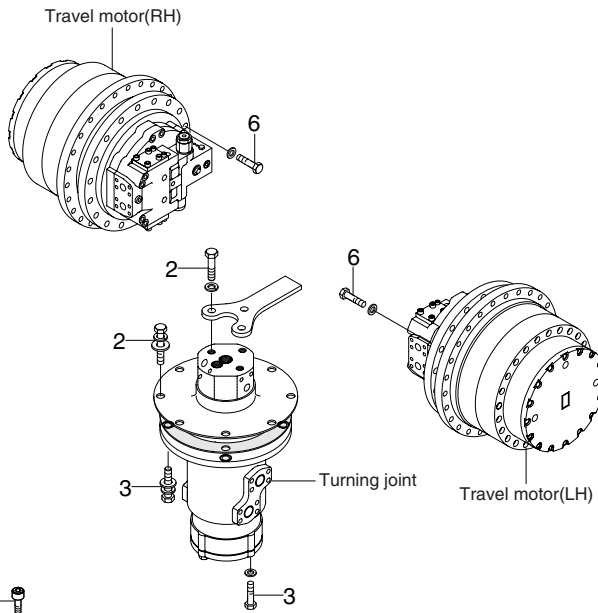
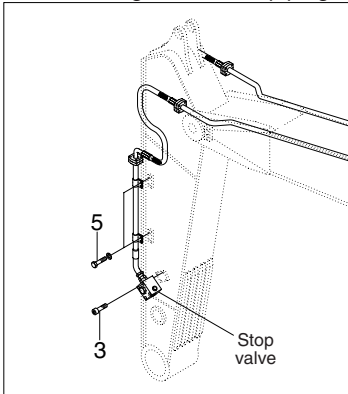
### · Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	5.3±0.5	38.3±3.6
4	M10×1.5	6.9±1.4	49.9±10.1
5	M12×1.75	12.3±1.3	88.9±9.4
6	M12×1.75	12.3±1.3	92.5±21.6

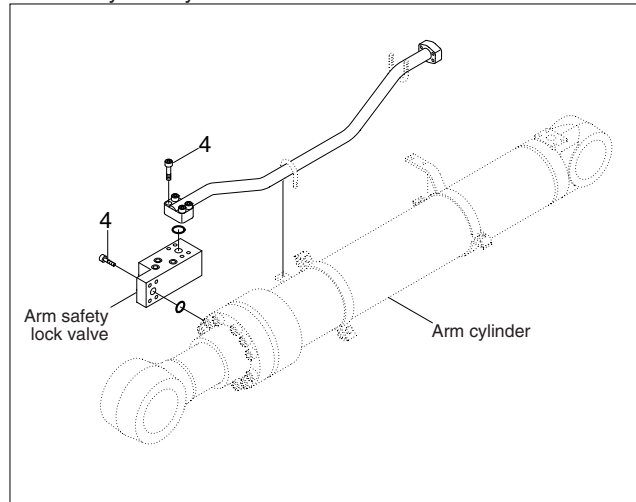
Item	Size	kgf · m	lbf · ft
7	M16×2.0	29.7±4.5	215±32.5
8	M20×2.5	42±4.5	304±32.5
9	M20×2.5	46±5.1	333±36.9
10	M20×2.5	46.5±2.5	336±18.1
11	M20×2.5	58.4±6.4	422±46.2
-	-	-	-

# HYDRAULIC COMPONENTS MOUNTING 2

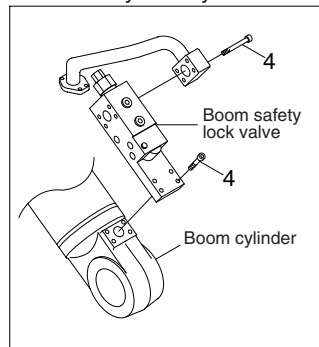
## Double acting attachment piping



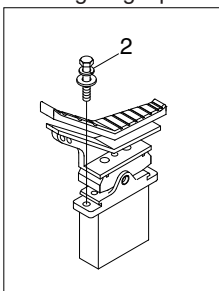
## Arm safety lock system



## Boom safety lock system



## D/acting single pedal

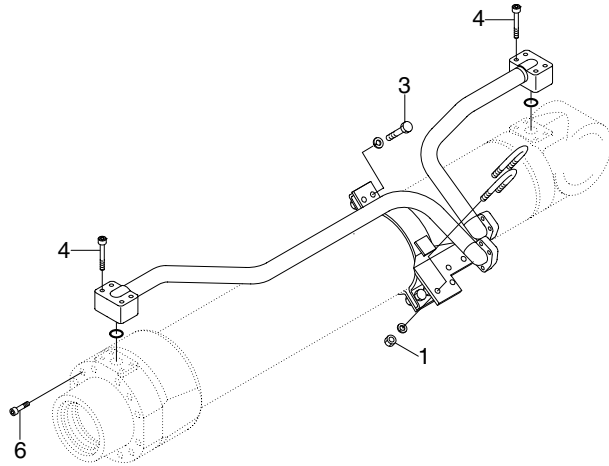


## · Tightening torque

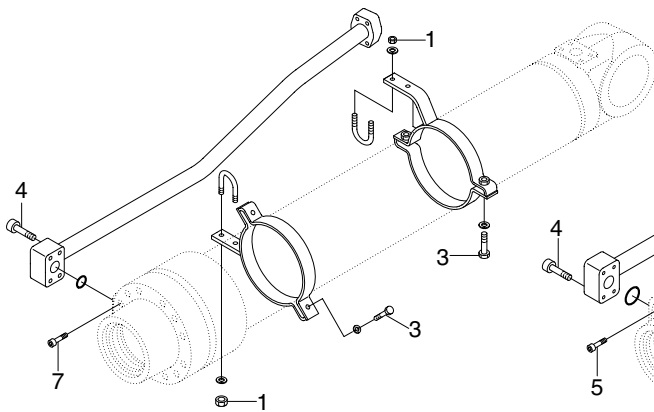
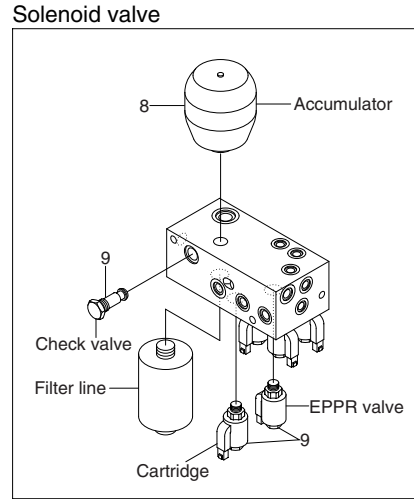
Item	Size	kgf · m	lbf · ft
1	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8
2	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
3	M12 × 1.75	12.3 ± 1.3	88.9 ± 9.4

Item	Size	kgf · m	lbf · ft
4	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
5	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
6	M24 × 3.0	84 ± 8.0	608 ± 32.5

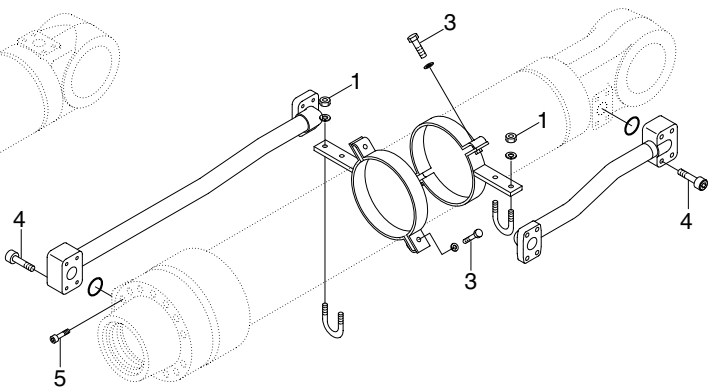
# HYDRAULIC COMPONENTS MOUNTING 3



BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER

· Tightening torque

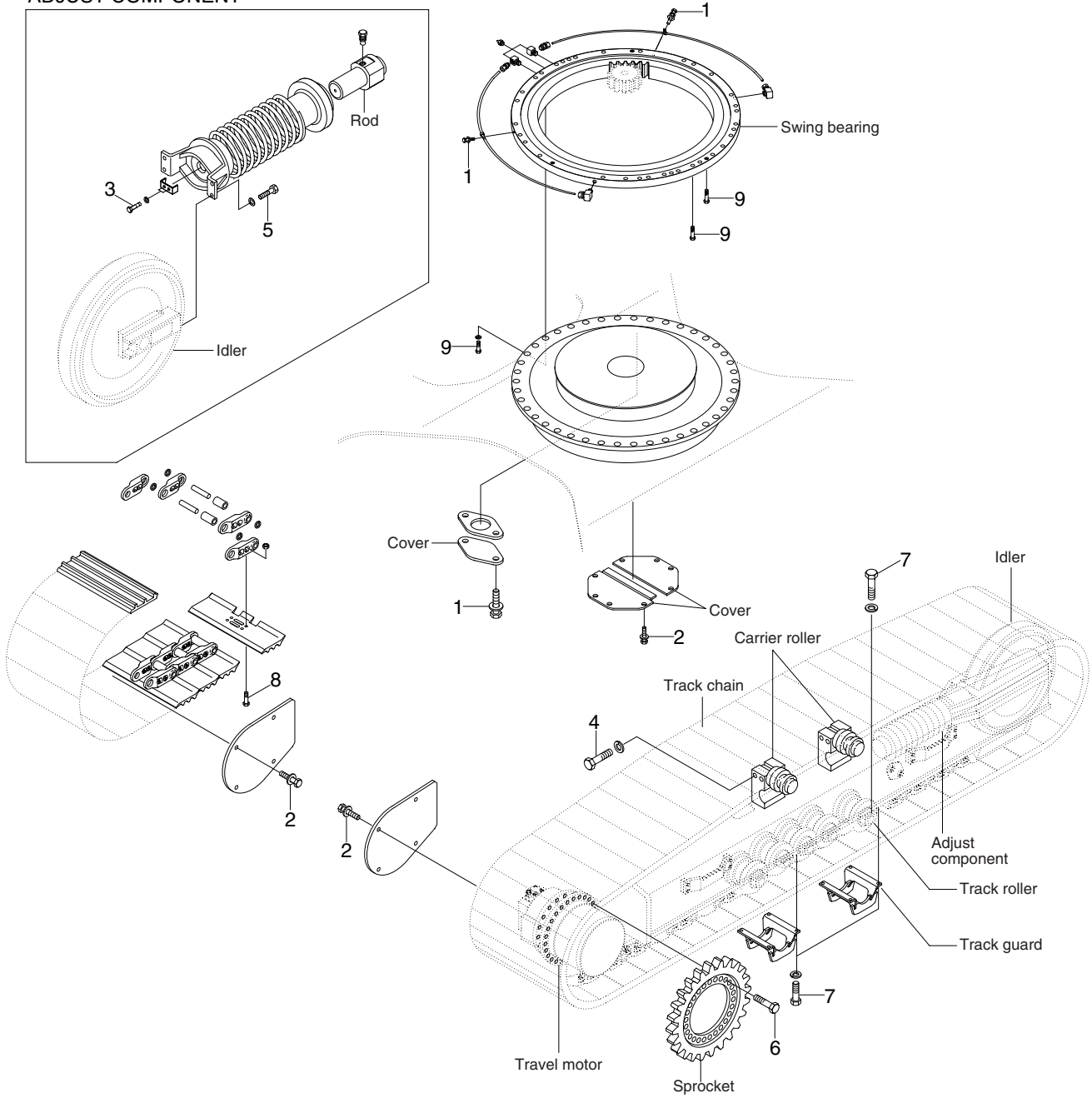
Item	Size	kgf · m	lbf · ft
1	M10×1.5	3.2±0.3	23.1±2.2
2	M10×1.5	5.4±0.5	29.1±3.6
3	M12×1.75	5.5±0.6	39.8±4.3
4	M12×1.75	9.4±1.0	68.0±7.2
5	M18×2.5	32±3.0	232±21.7

Item	Size	kgf · m	lbf · ft
6	M20×2.5	46±5.0	333±36.2
7	M22×2.5	63±6.0	456±43.4
8	M22×2.5	4.1	29.6
9	M27×3.0	5.1	36.9
-	-	-	-

# GROUP 5 UNDERCARRIAGE

## UNDERCARRIAGE MOUNTING

### ADJUST COMPONENT



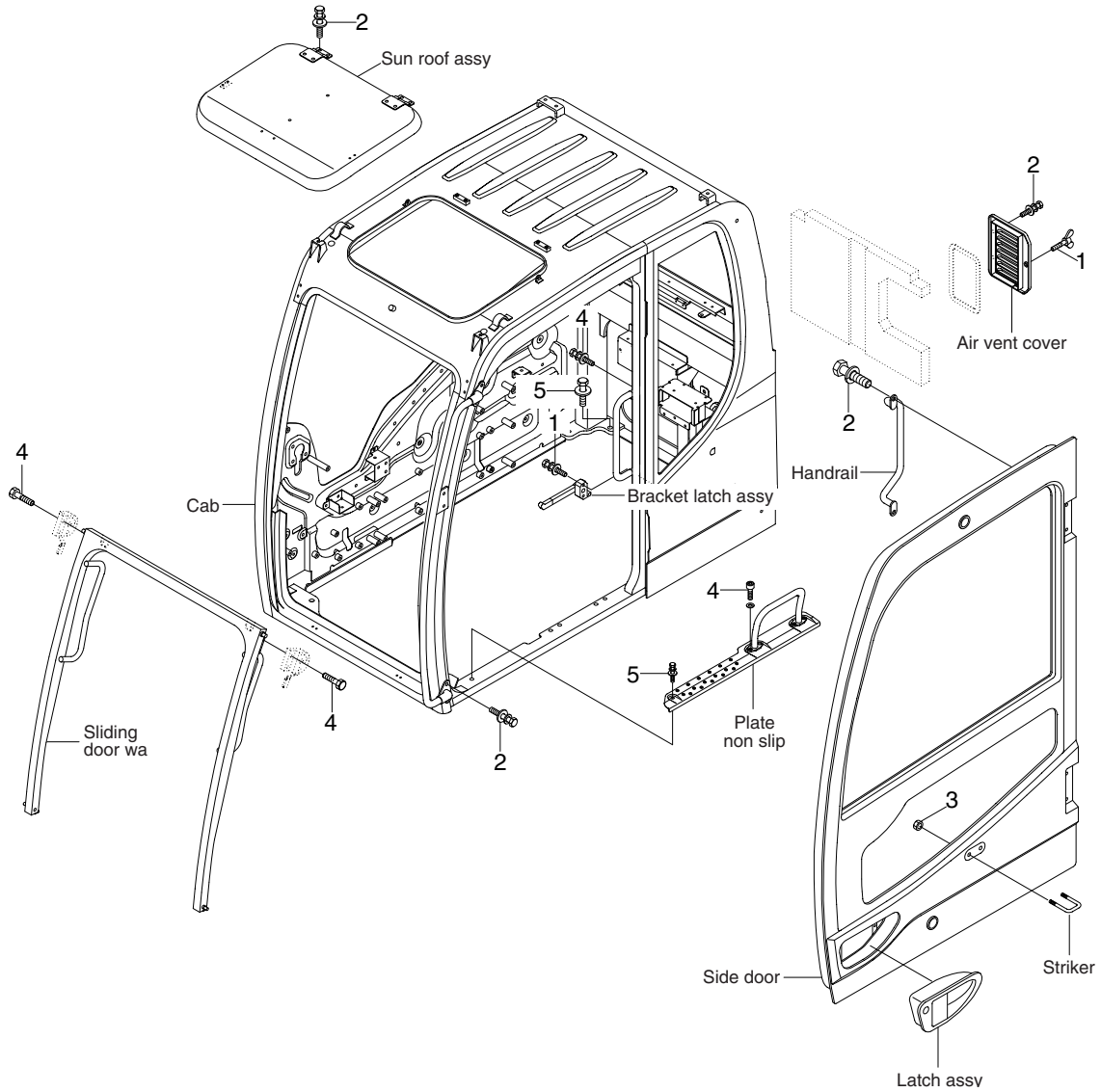
### · Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7
3	M12×1.75	15±0.5	108±3.6
4	M16×2.0	29.7±4.5	215±32.5
5	M16×1.5	31.3±4.7	226±34

Item	Size	kgf · m	lbf · ft
6	M20×2.5	57±6.0	412±43.3
7	M20×2.5	57.9±8.6	419±62.2
8	M22×1.5	115±5.0	831±36
9	M24×3.0	97.8±10	707±72.3
-	-	-	-

# GROUP 6 STRUCTURE

## CAB AND ACCESSORIES MOUNTING

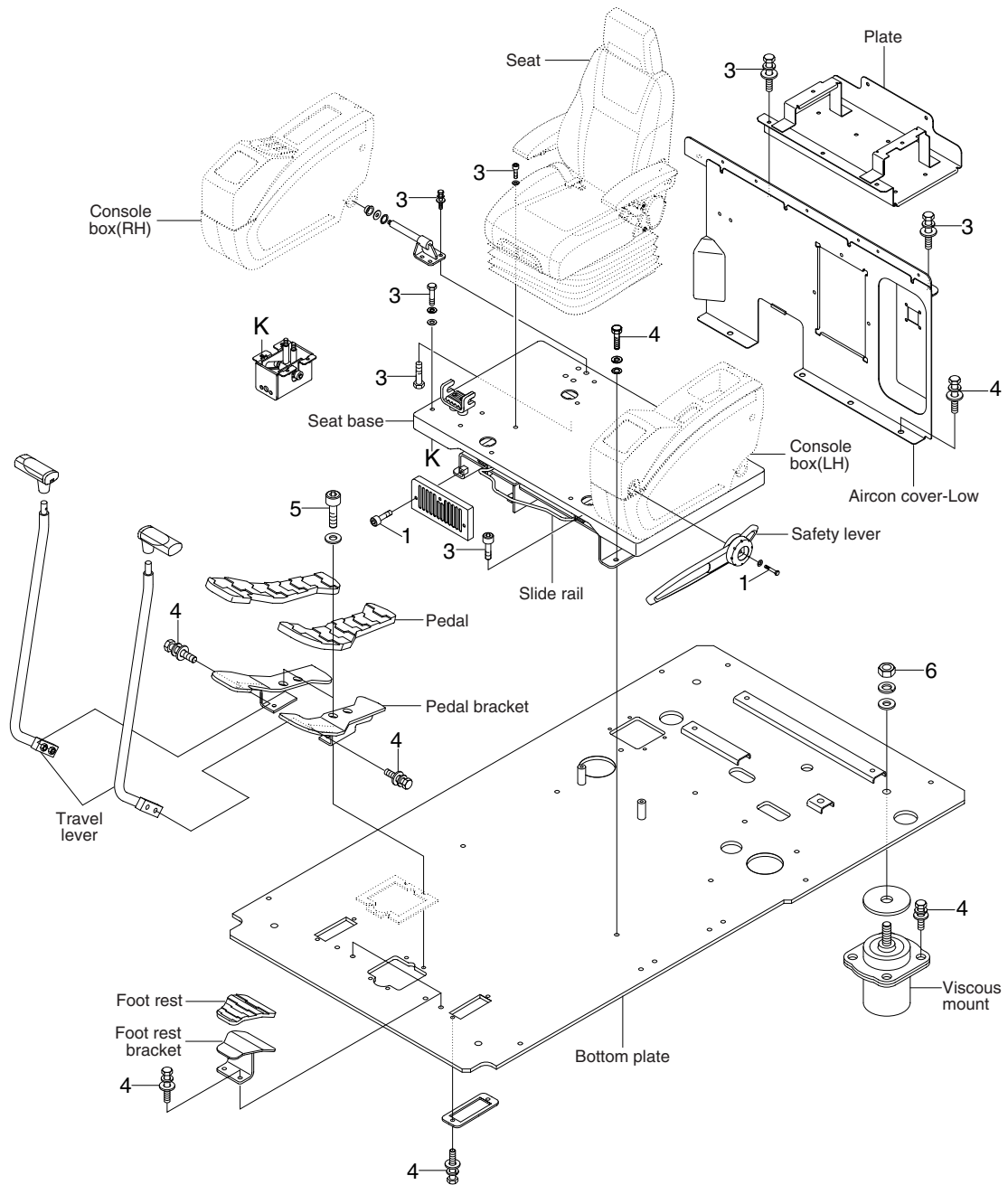


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	0.49±0.1	3.5±0.7
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	4.7±0.9	34±6.5

Item	Size	kgf · m	lbf · ft
4	M10×1.5	6.9±1.4	49.9±10.1
5	M12×1.75	12.8±3.0	92.6±21.7
-	-	-	-

# CAB INTERIOR MOUNTING

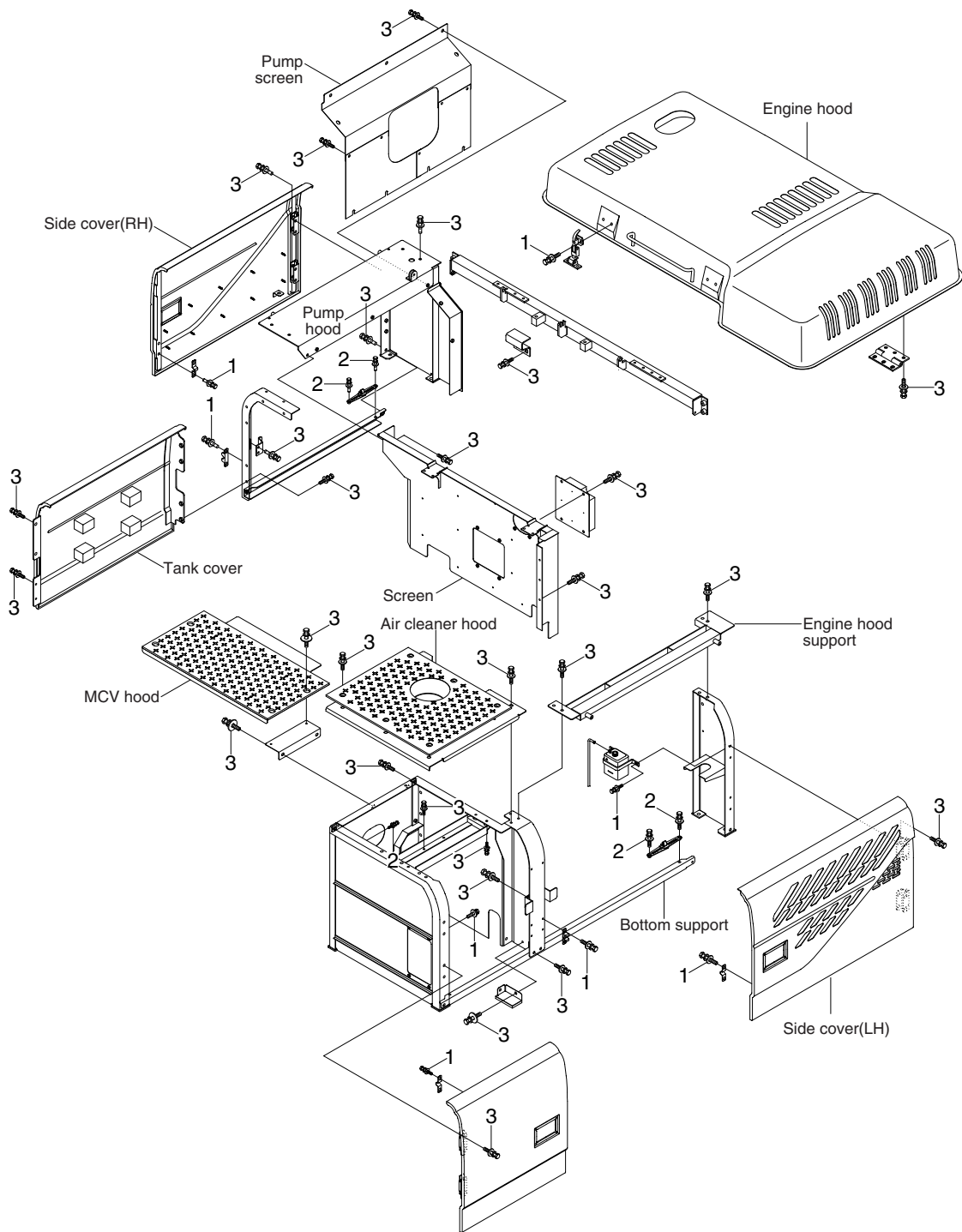


## · Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	0.49±0.1	3.5±0.7
2	M 8×1.25	4.05±0.8	29.3±5.8
3	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
4	M10×1.5	6.9±1.4	49.9±10.1
5	M10×1.5	8.27±1.7	59.8±12.3
6	M16×2.0	29.7±4.5	215±32.5

# COWLING MOUNTING



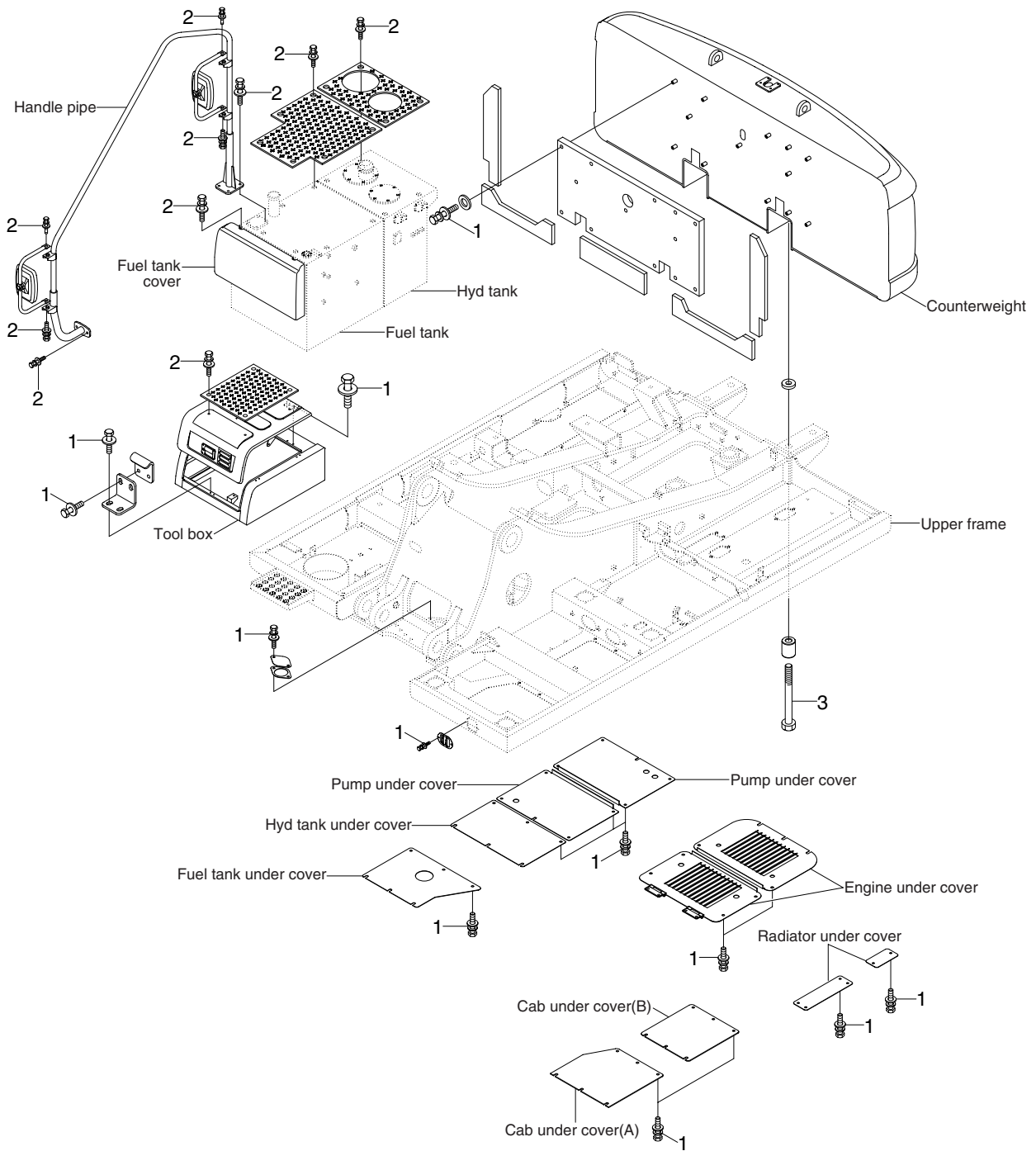
## · Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±4.5	215±32.5



# COUNTERWEIGHT AND COVERS MOUNTING

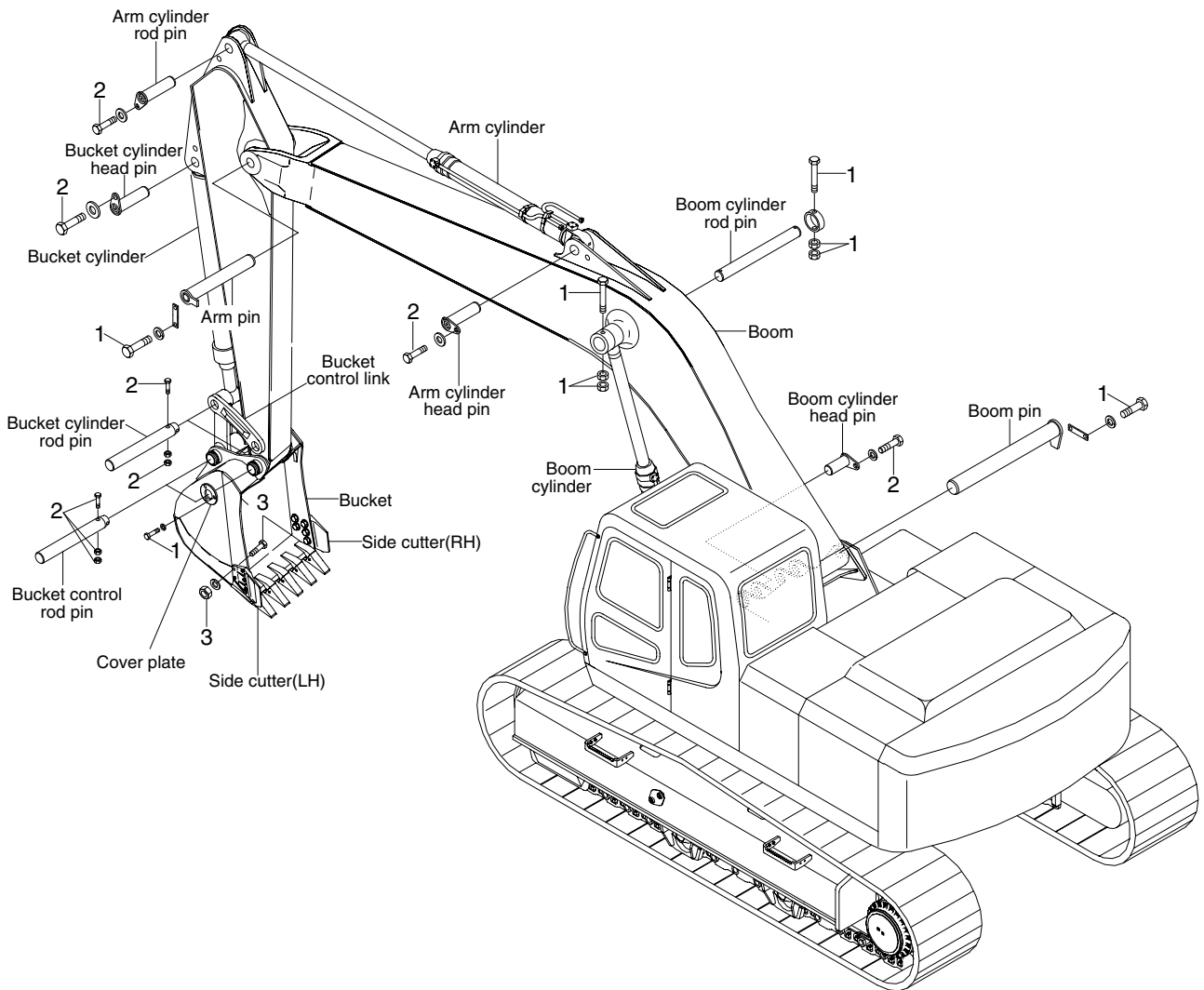


## · Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
3	M36×3.0	308±46	2228±333
-	-	-	-

## GROUP 7 WORK EQUIPMENT



### · Tightening torque

Item	Size	kgf · m	lbf · ft
1	M16×2.0	29.7±4.5	215±32.5
2	M20×2.5	57.9±8.7	419±62.9

Item	Size	kgf · m	lbf · ft
3	M22×2.5	81.9±16.1	592±116
-	-	-	-