

## SECTION 8 DISASSEMBLY AND ASSEMBLY

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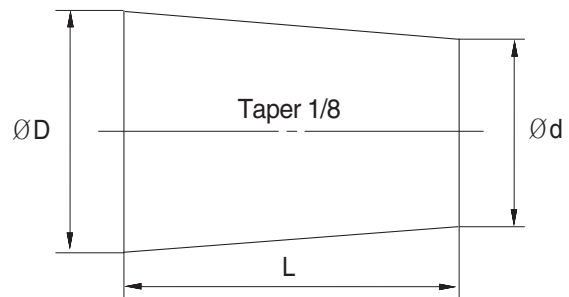
# SECTION 8 DISASSEMBLY AND ASSEMBLY

## GROUP 1 PRECAUTIONS

### 1. REMOVAL WORK

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

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



## 2. INSTALL WORK

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

### **3. COMPLETING WORK**

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

## GROUP 2 TIGHTENING TORQUE

### 1. MAJOR COMPONENTS

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (engine-bracket)	M12 × 1.75	10 ± 1.0	72.3 ± 7.2
3		Engine mounting bolt (bracket-frame)	M24 × 3.0	90 ± 9.0	651 ± 65
4		Radiator, oil cooler mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1
6		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	34.7 ± 2.2
8		Main pump mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1
9		Main control valve mounting nut	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 5.8	419 ± 42
11		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
12	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 5.8	419 ± 42
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M24 × 3.0	84 ± 8.0	608 ± 57.8
16		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track roller mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
19		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
20		Track shoe mounting bolt, nut	M22 × 1.5	123 ± 6.0	890 ± 43.4
21		Track guard mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
22	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 30	2440 ± 217
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

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

## 2. TORQUE CHART

Use following table for unspecified torque.

### 1) BOLT AND NUT

#### (1) Coarse thread

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

#### (2) Fine thread

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

**2) PIPE AND HOSE (FLARE TYPE)**

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

**3) PIPE AND HOSE (ORFS TYPE)**

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

**4) FITTING**

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

## GROUP 3 PUMP DEVICE

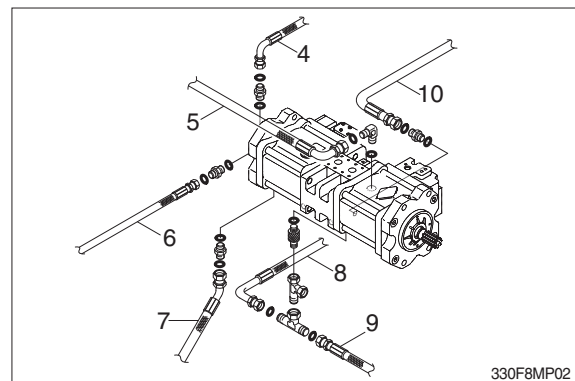
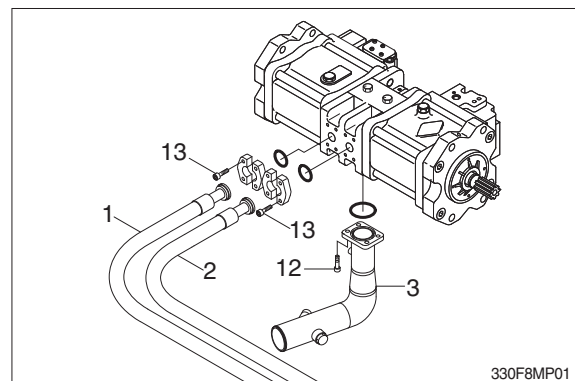
### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

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

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

- (4) 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 : 210 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.**



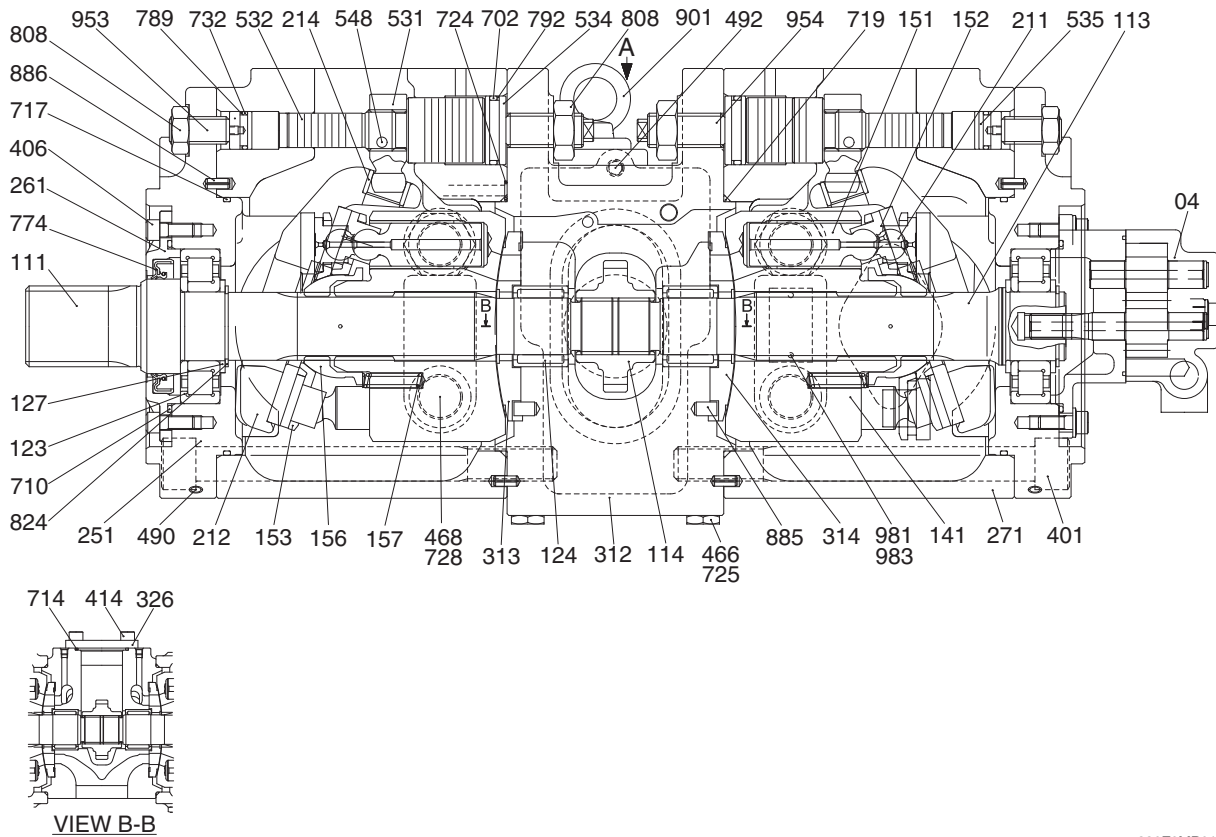


## 2) INSTALL

- (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

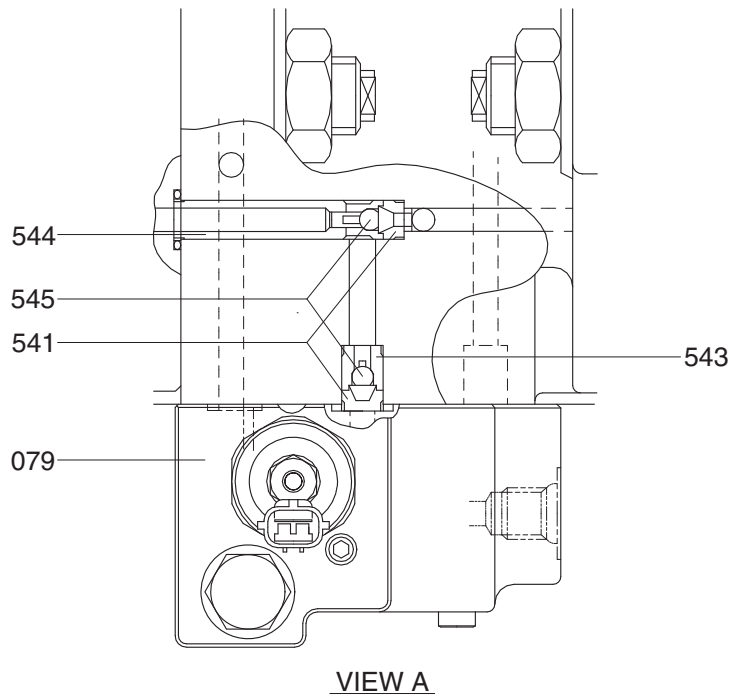


VIEW B-B

330F2MP01

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	Square 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)



32092MP03

079 Proportional reducing valve  
541 Seat

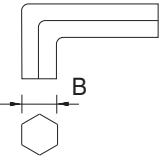

543 Stopper 1  
544 Stopper 2

545 Steel ball

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

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

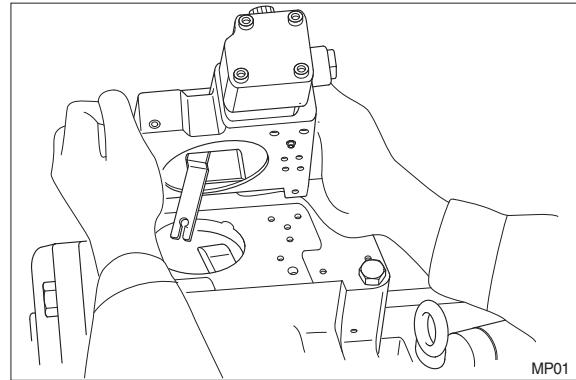
Tool name & size		Part name			
Allen wrench 	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
	8	M10	BP-3/ 8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-
Double ring spanner, 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

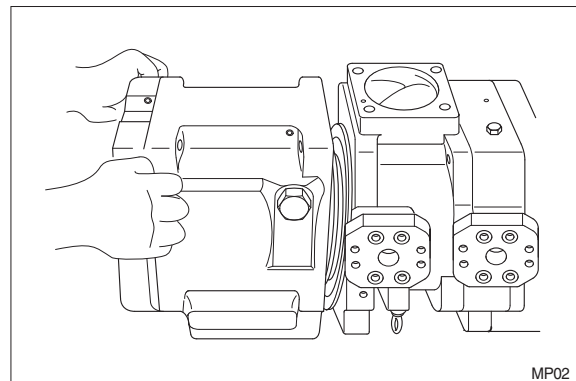
### 3) DISASSEMBLY

- (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.



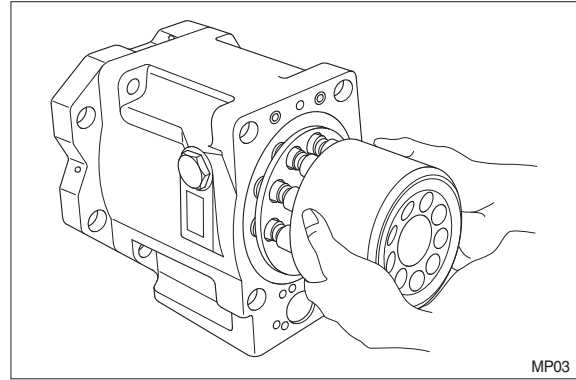
- (5) Loosen hexagon socket head bolts (401) fixing swash plate support (251), pump casing (271) and valve block (312).

- (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.



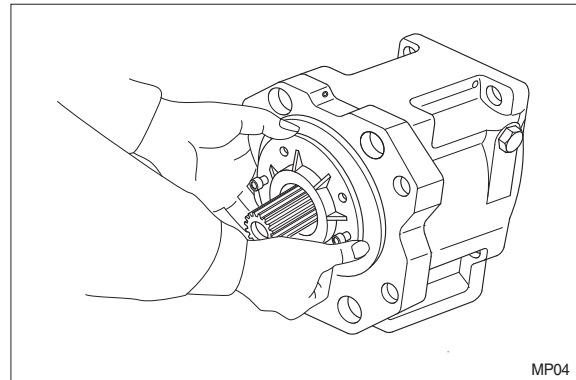
(7) Pull cylinder (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

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



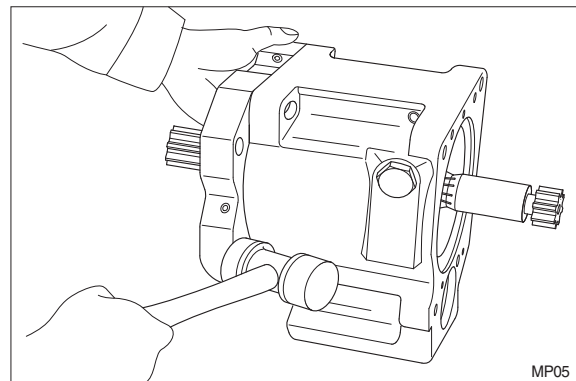
(8) Remove hexagon socket head bolts (406) and then seal cover (F) (261). Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

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

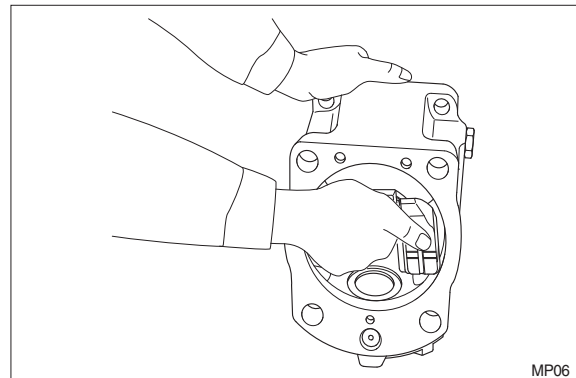


(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262). In case of fitting a gear pump, first, remove gear pump.

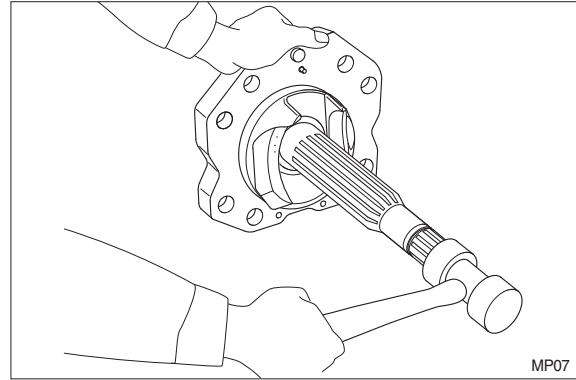
(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



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

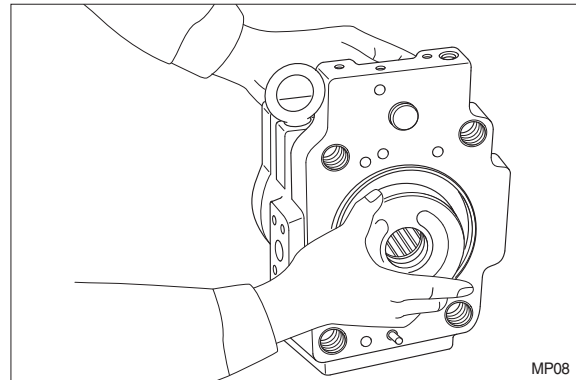


- (12) Tapping lightly shaft's end of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



- (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

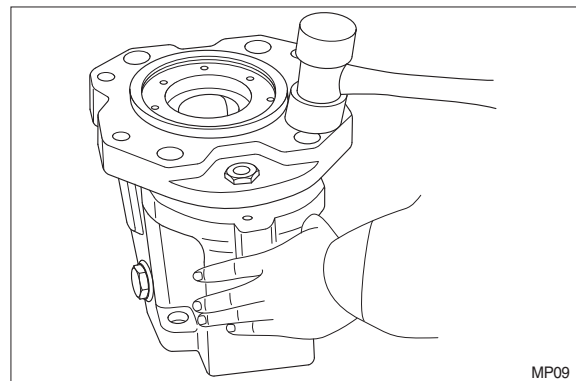
(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

- 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.

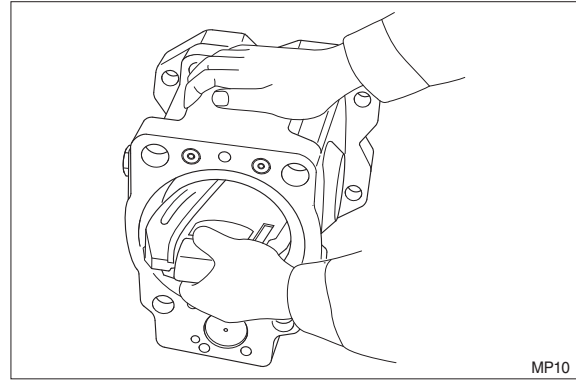
In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply lock-tight (medium strength) to their threaded sections.



MP09

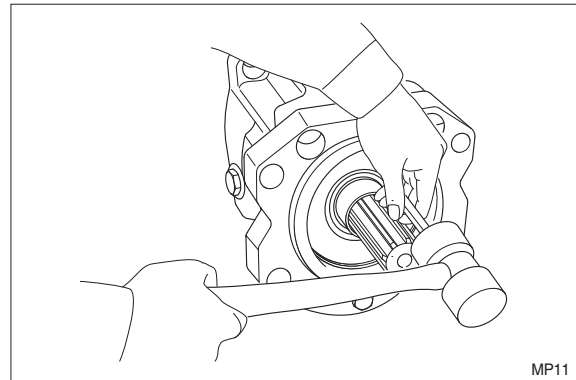
(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531), and fit swash plate (212) to swash plate support (251) correctly.

- ※ 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.



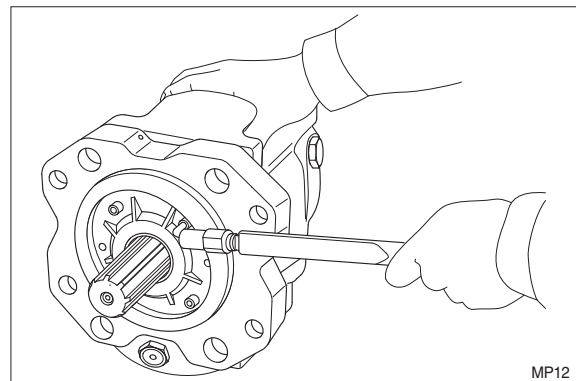
(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

- ※ 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.



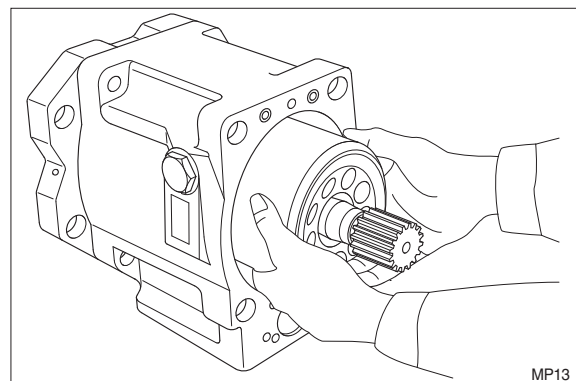
(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

- ※ 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).

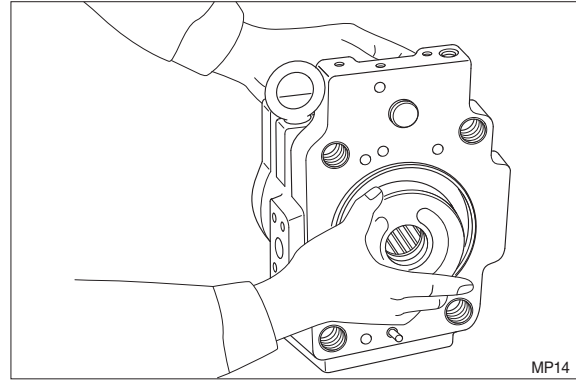


(6) Assemble piston cylinder subassembly [Cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156) and cylinder spring (157).]

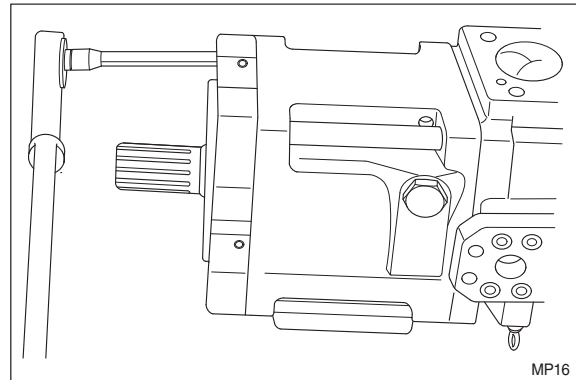
Fit spline phases of retainer and cylinder.  
Then, insert piston cylinder subassembly into pump casing.



- (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.

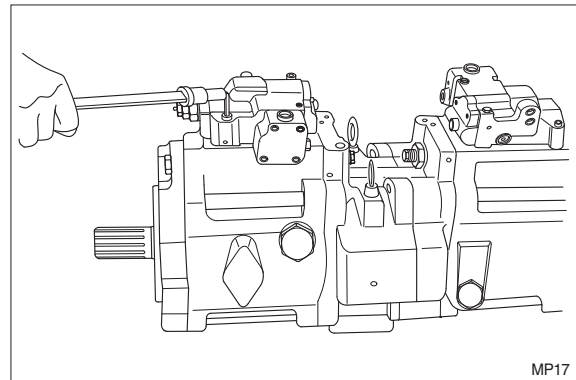


- (8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
- ※ At first assemble this at rear pump side, and this work will be easy.
  - ※ Take care not to mistake direction of valve block.



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

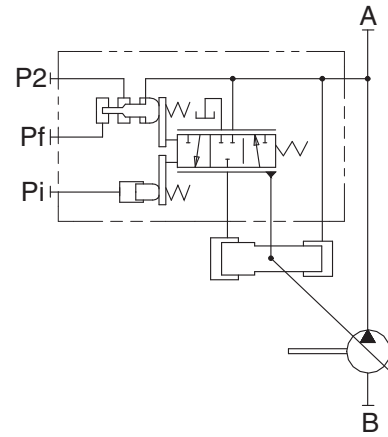
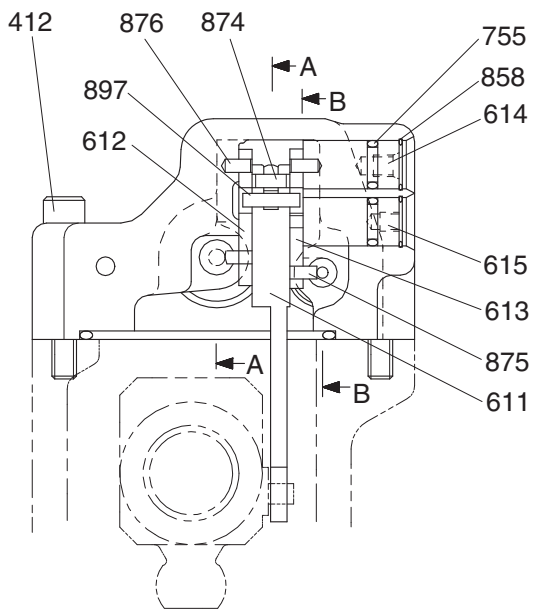
- (9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
- ※ Take care not to mistake regulator of front pump for that of rear pump.



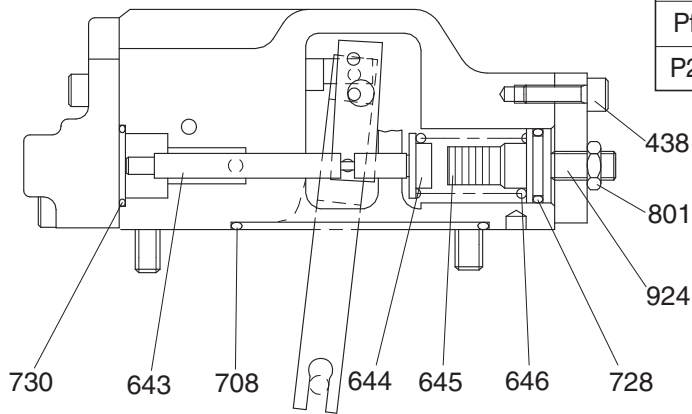
- (10) Fit drain port plug (468).  
This is the end of reassembling procedures.

### 3. REGULATOR

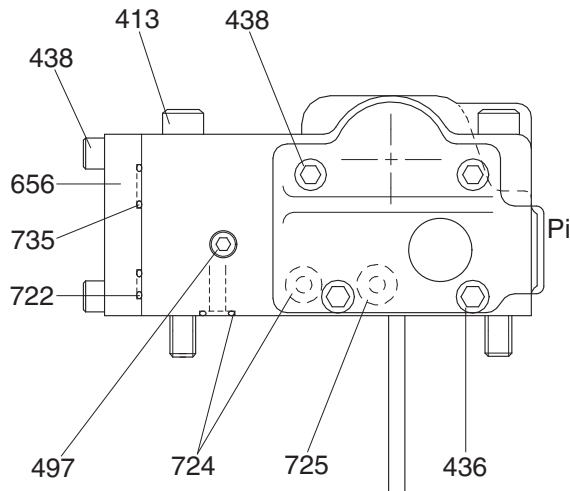
#### 1) STRUCTURE(1/2)



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	-



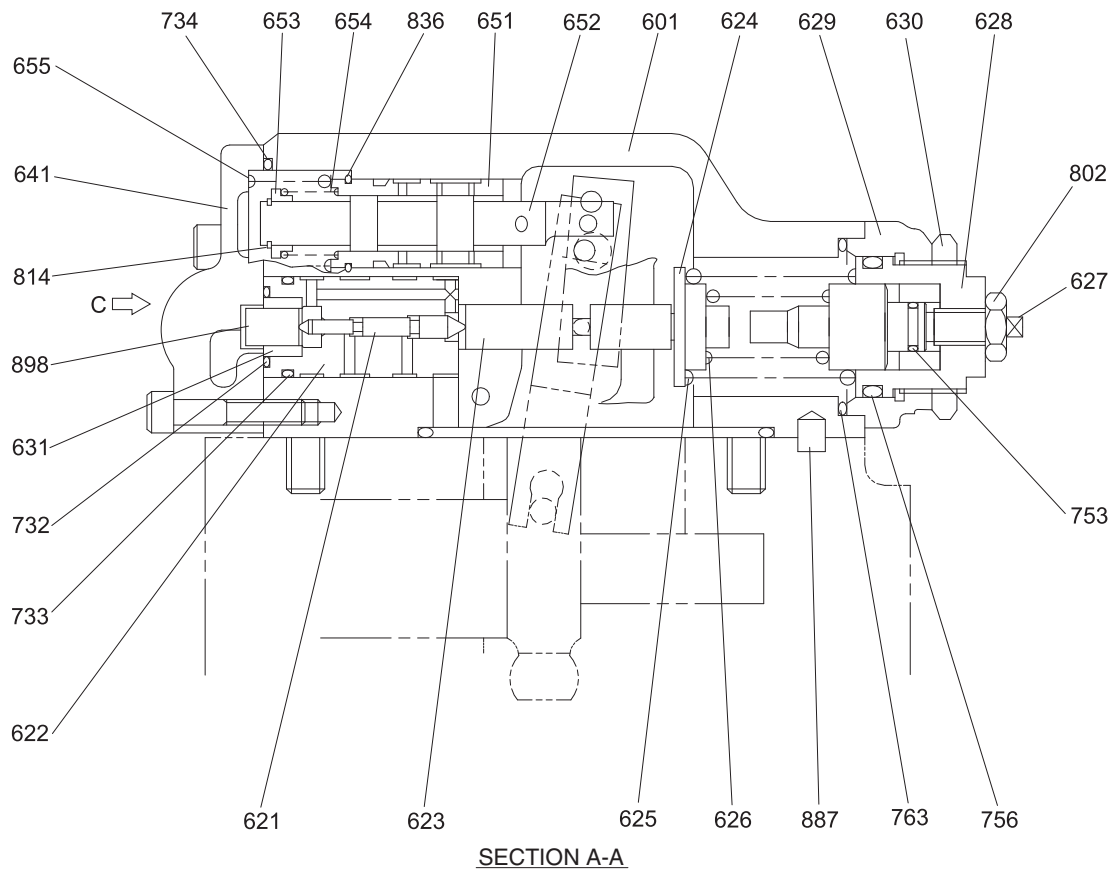
SECTION B-B



VIEW C

330F2MP02

## REGULATOR (2/2)



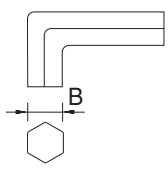

29092MP04A

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
497 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 Square 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**

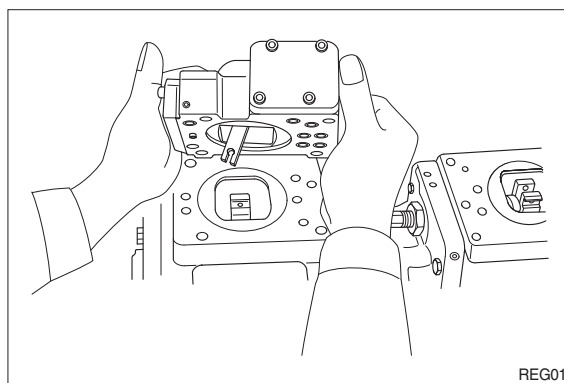
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	115.7	0.47	12
PT plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns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

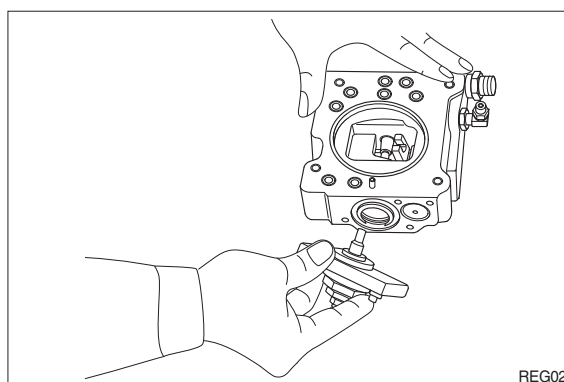
For this reason, replacement of a regulator assembly is not recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

- (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.

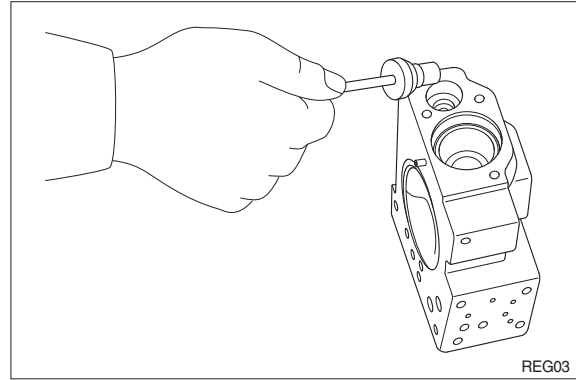




- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.

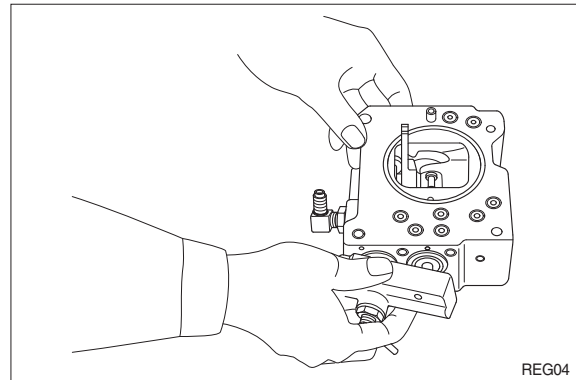
Then draw out adjusting stem (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

- ※ 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).

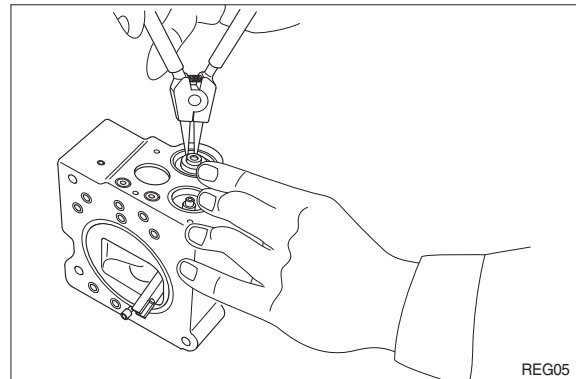
After removing pilot cover, take out set spring (655) from pilot section.



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

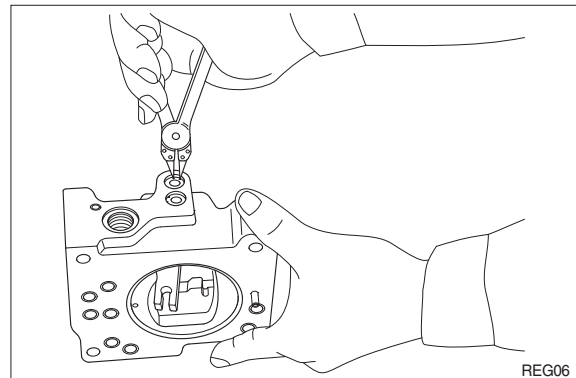
Sleeve (651) is fitted with snap ring (836).

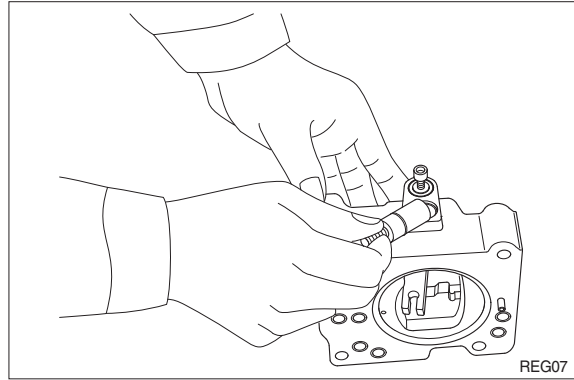
- ※ When removing snap ring (814), return spring (654) may pop out.
- ※ Take care not to lose it.



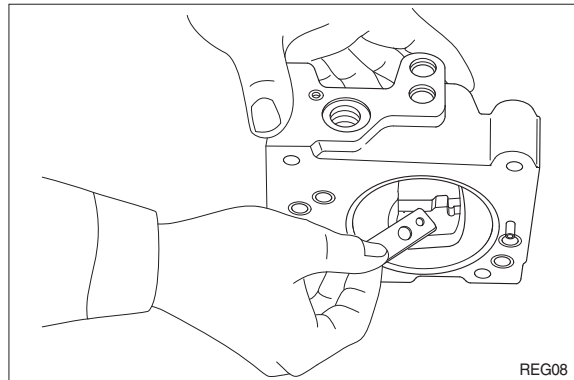
- (8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

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

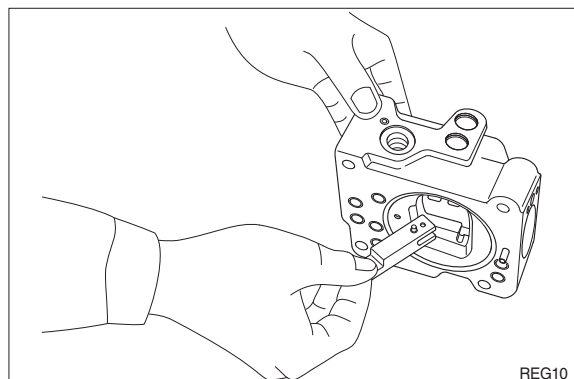
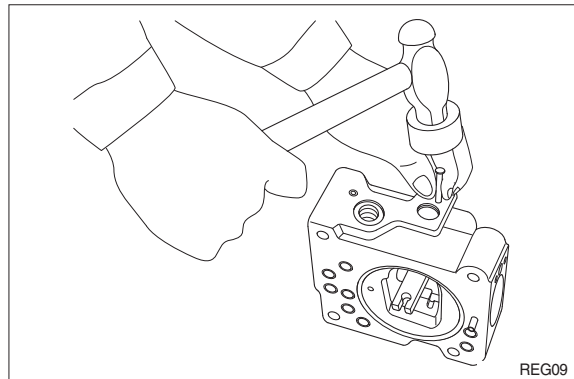




- (9) Remove lever (2, 613). Do not draw out pin (875).  
※ Work will be promoted by using pincers or so on.



- (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.

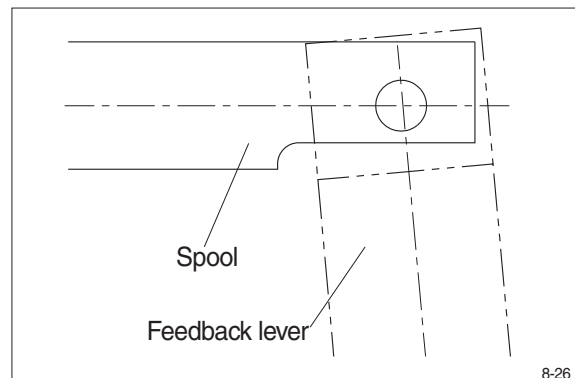
(2) Put compensating rod (623) into compensating hole of casing (601).

(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.

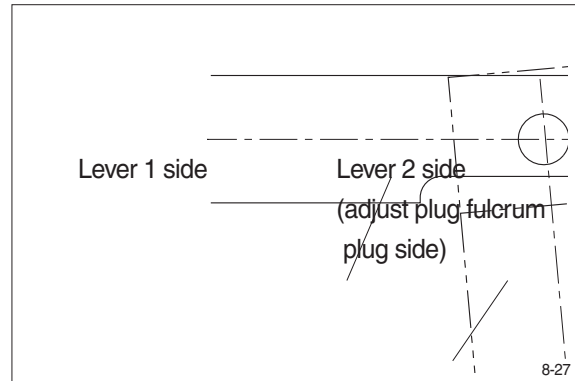
※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.



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

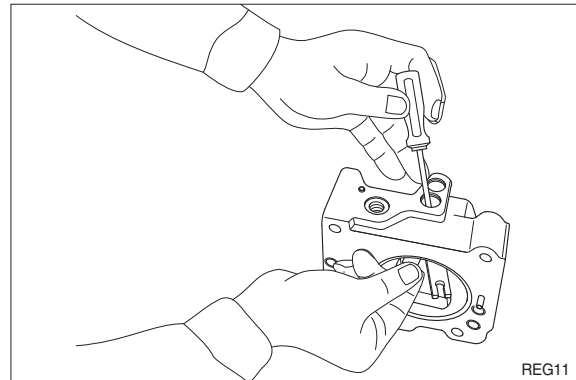
- ※ Insert pin in feedback lever a little to ease operation.
- ※ Take care not to mistake direction of feedback lever.



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

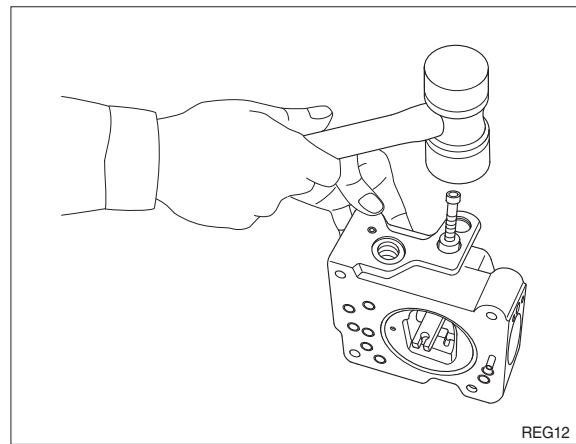
- ※ Confirm that pilot piston slides smoothly without binding.

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

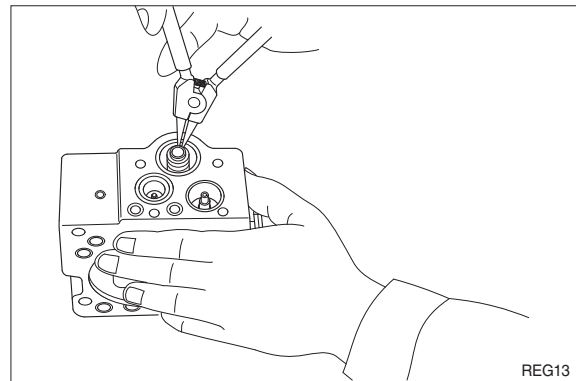


(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever (2).  
Then fix locking ring (858).

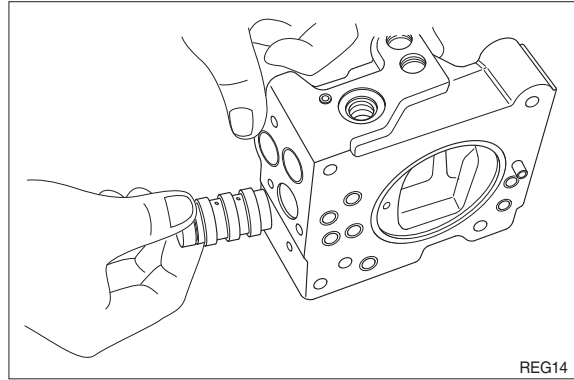
(9) Insert adjusting plug (615) and fit locking ring.  
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.  
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



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

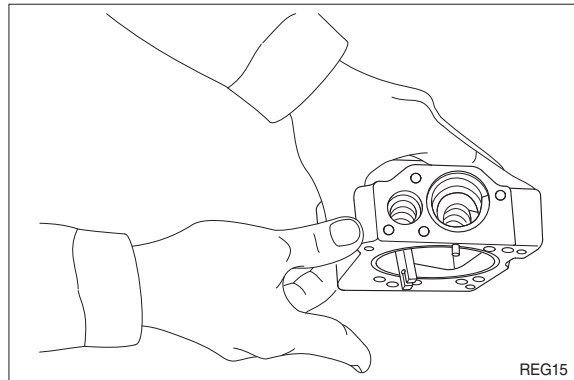


- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole. Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



- (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.

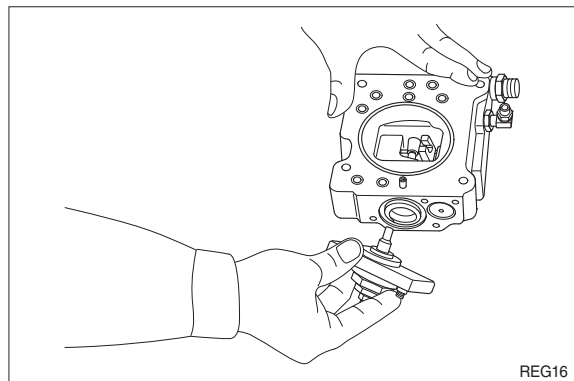
※ When fitting spring seat, take care not to mistake direction of spring seat.



- (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

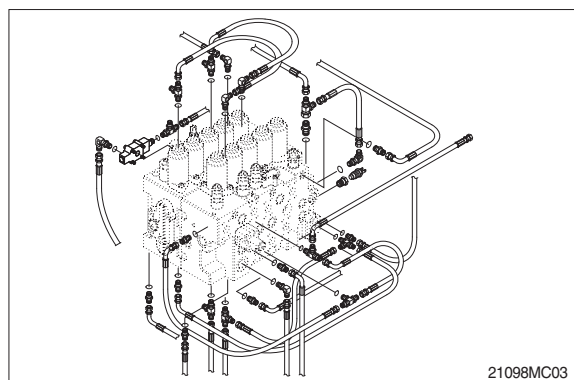
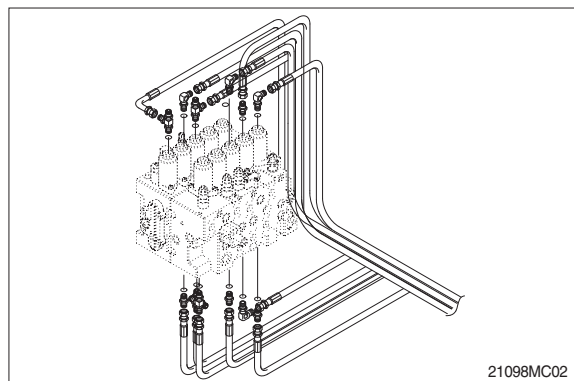
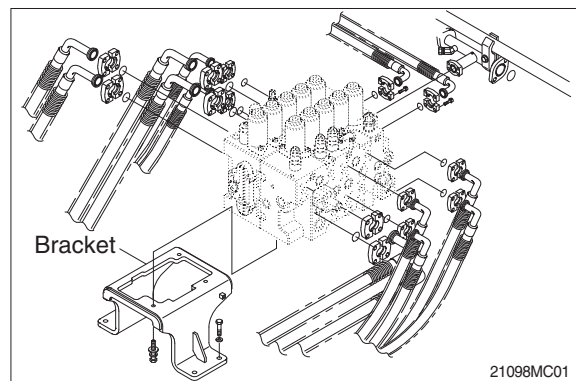
### 1. REMOVAL AND INSTALL OF MOTOR

#### 1) REMOVAL

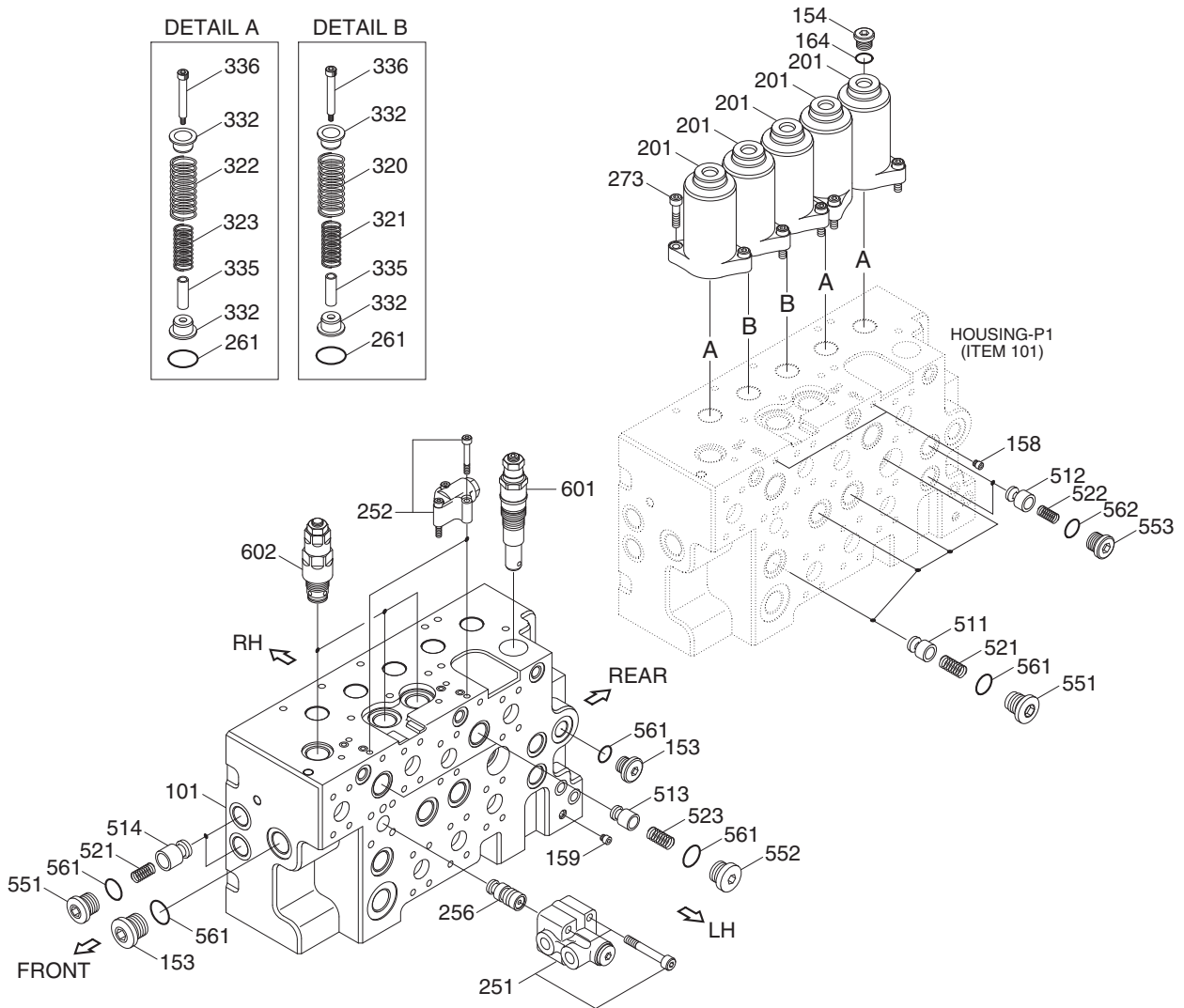
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure 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 : 220 kg (485 lb)
- (9) Remove the control valve assembly.  
When removing the control valve assembly, check that all the piping have been disconnected.

#### 2) INSTALL

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



## 2. STRUCTURE (1/4)

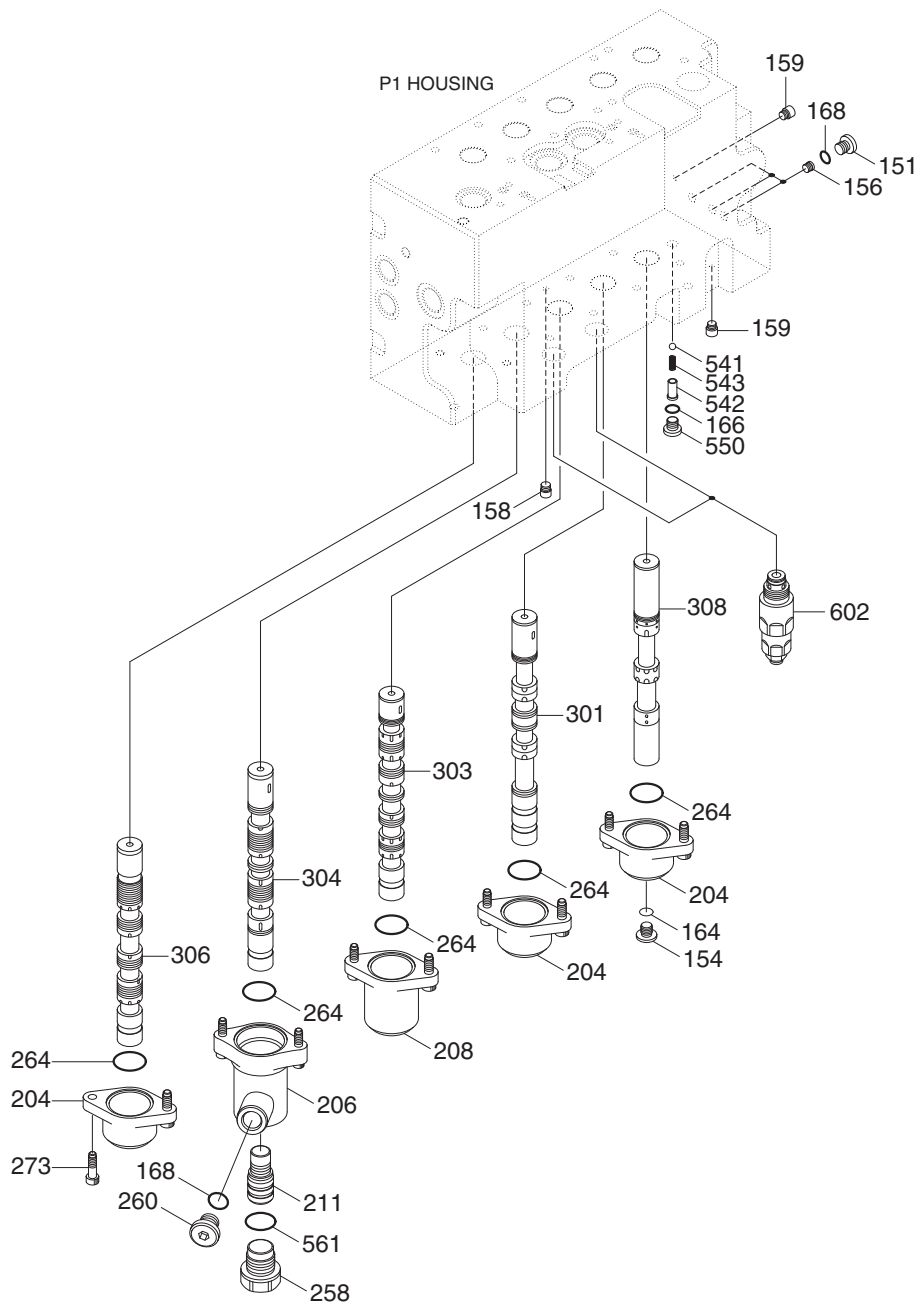


330F8MC01

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



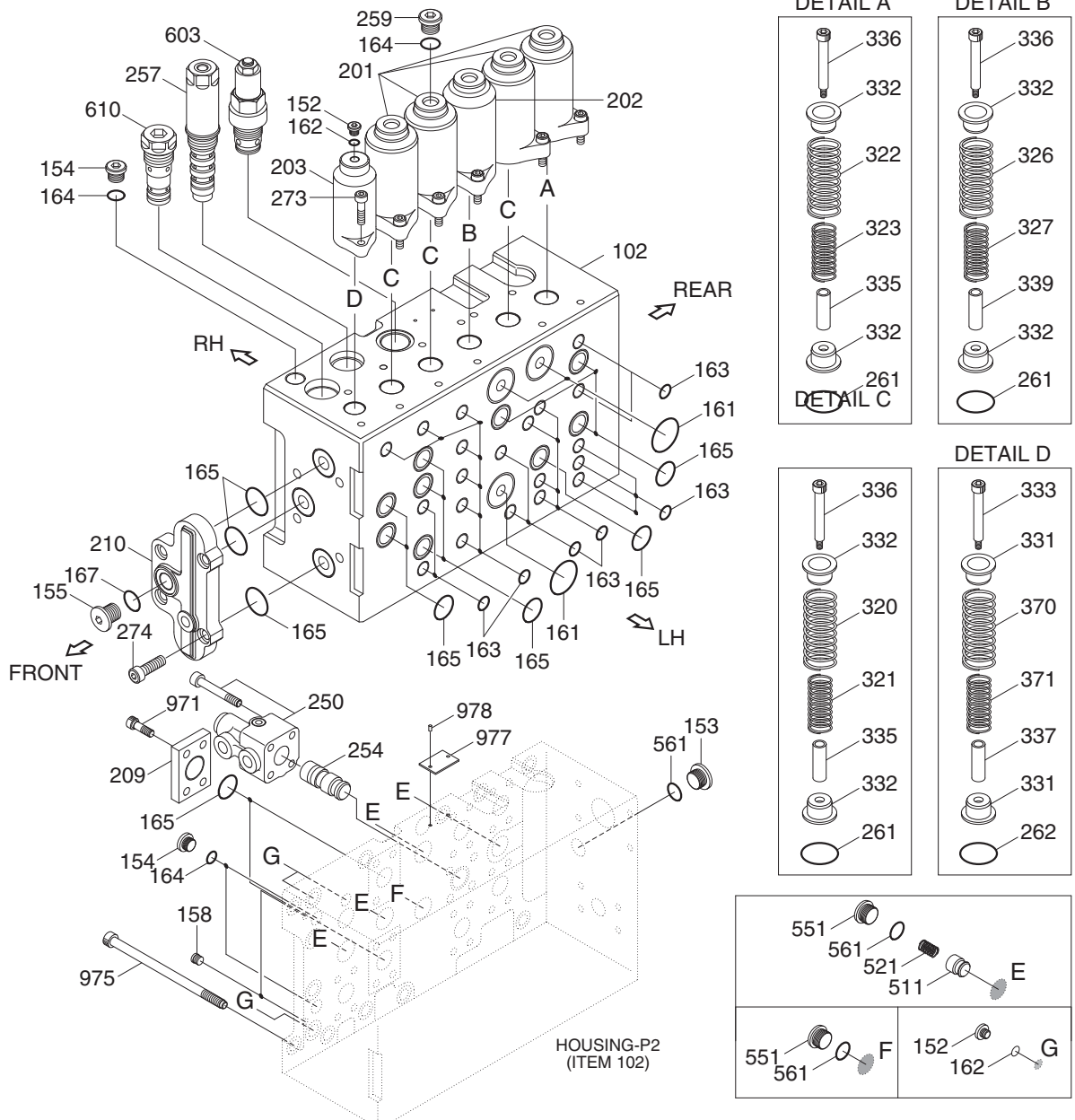
# STRUCTURE (2/4)



330F8MC02

- |             |                      |                           |
|-------------|----------------------|---------------------------|
| 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     |

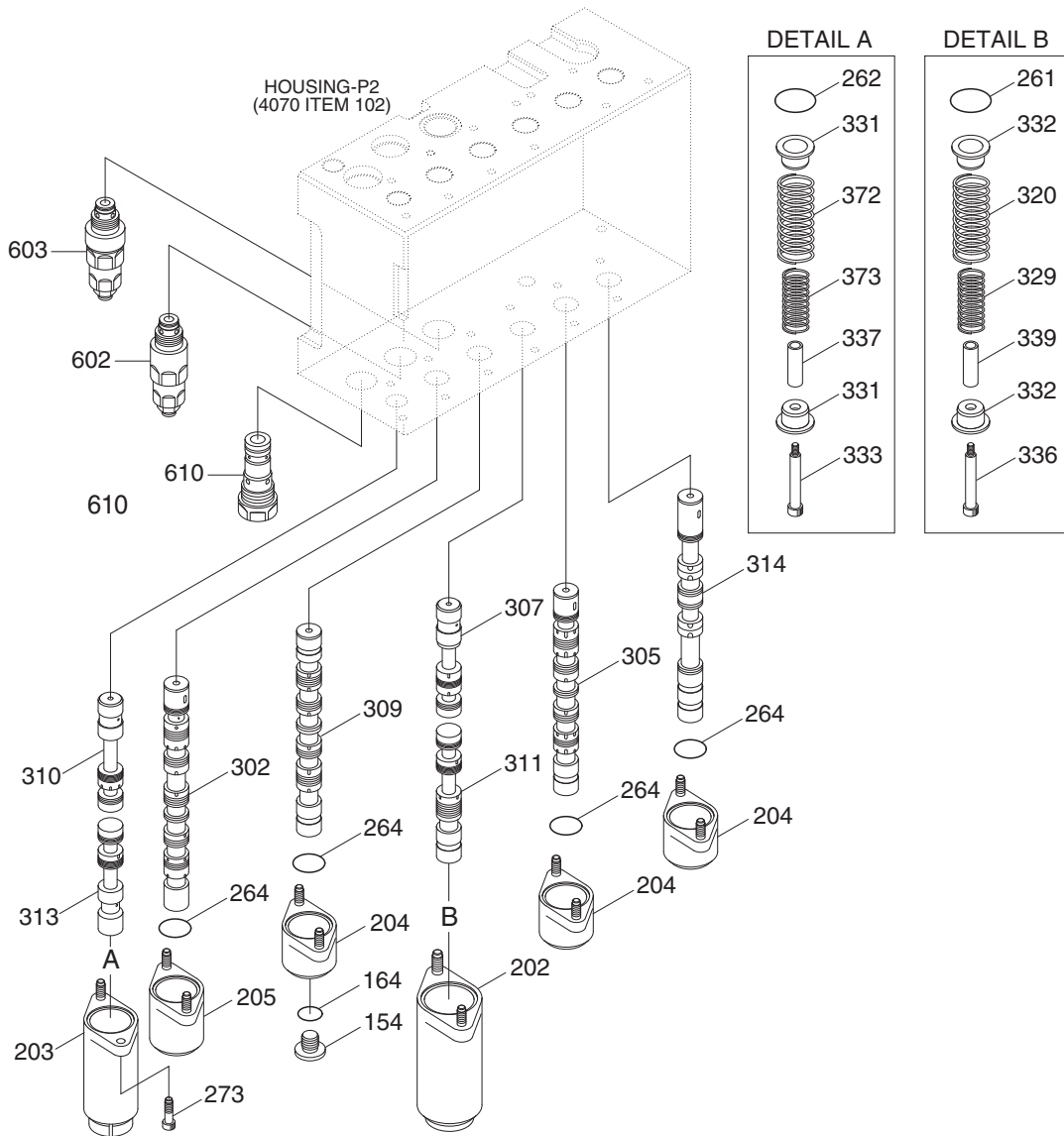
# STRUCTURE (3/4)



330F8MC03

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)



330F8MC04

- |                  |                          |                               |
|------------------|--------------------------|-------------------------------|
| 154 Plug         | 305 Swing spool          | 333 Spacer bolt               |
| 164 O-ring       | 307 Boom 2 spool         | 336 Bolt                      |
| 202 Spring cover | 309 Option spool         | 337 Stopper                   |
| 203 Spring cover | 310 Bypass cut spool     | 339 Stopper                   |
| 204 Cover        | 311 Swing priority spool | 370 Spring                    |
| 205 Cover        | 313 Bypass cut spool     | 371 Spring                    |
| 261 O-ring       | 314 Travel, RH spool     | 602 Port relief valve         |
| 262 O-ring       | 320 Spring               | 603 Port relief valve         |
| 264 O-ring       | 329 Spring               | 610 Nega control relief valve |
| 273 Socket screw | 331 Seat                 |                               |
| 302 Arm 1 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.



21098MC37

#### (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



21098MC38

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

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



21078MC11



- 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



21098MC40

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

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

· Hexagon key wrench : 6 mm

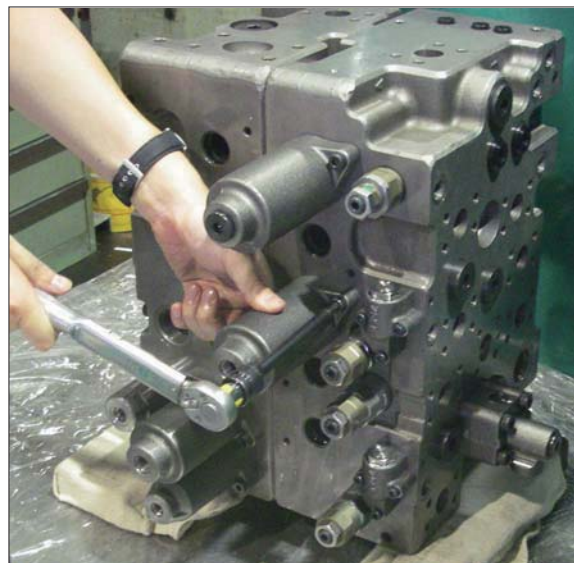
- ② Pull out the boom 1 spool (303), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).

※ When pulling out the spool assembly from P2 housing (101), 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.



21098MC41

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

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

· Hexagon key wrench : 6 mm

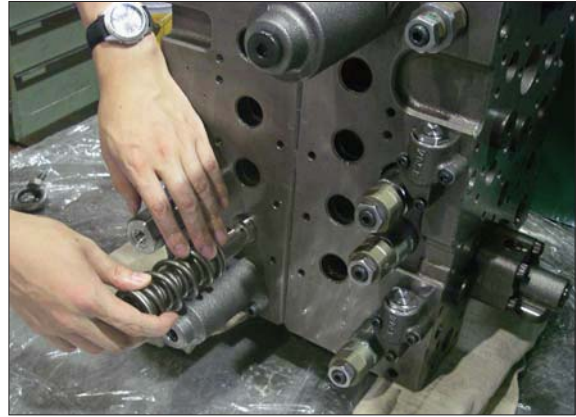
② Pull out the arm 1 spool (302), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P1 housing (102).

※ When pulling out the spool assembly from P1 housing(102), 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.



21098MC42

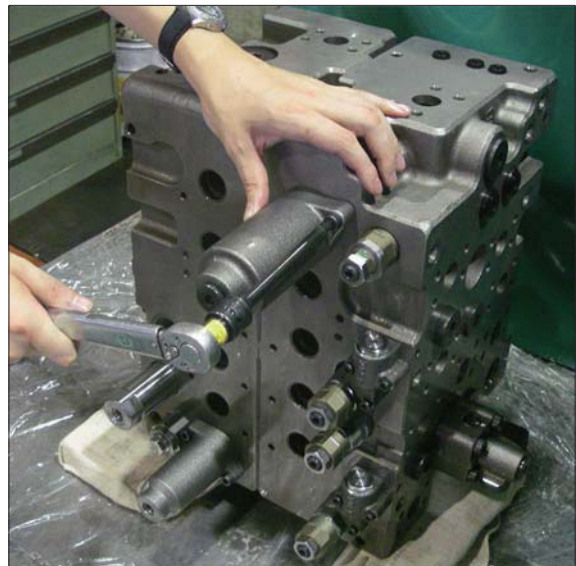
**(5) Disassembling of travel straight spool (308):**

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.

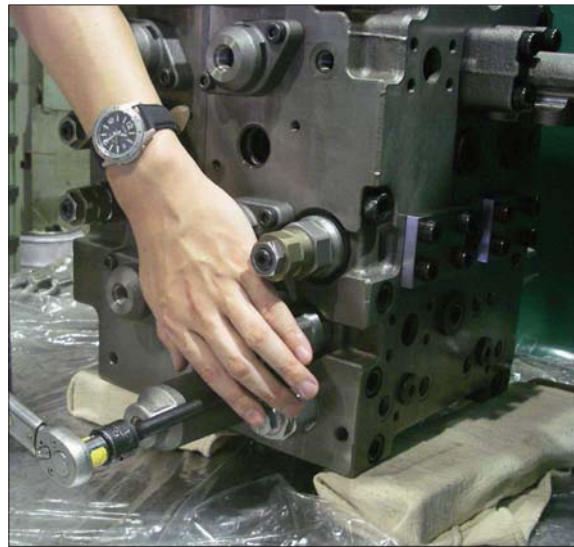


21098MC43

- 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.



21098MC44

- 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



21098MC45



**(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



21098MC46

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

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

Main relief valve (601) : spanner 32mm

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

Port relief valve (603) : spanner 36mm



21098MC47

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



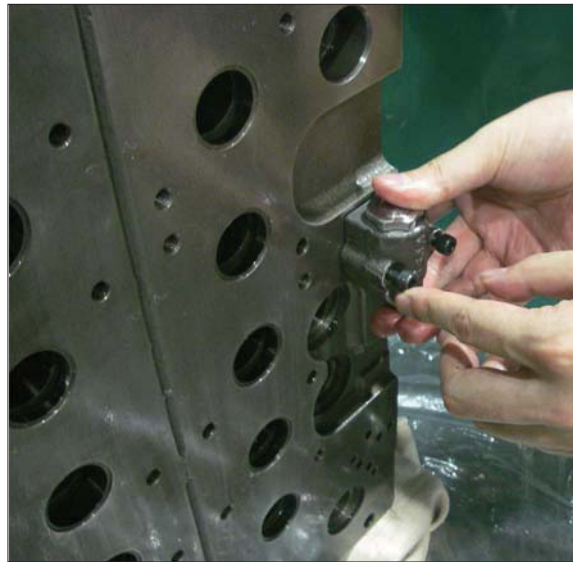
21098MC48



21098MC49

**(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.



21098MC50

**(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.



21098MC51

**(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



21098MC52

**(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



21098MC53

- 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.



21098MC54

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

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

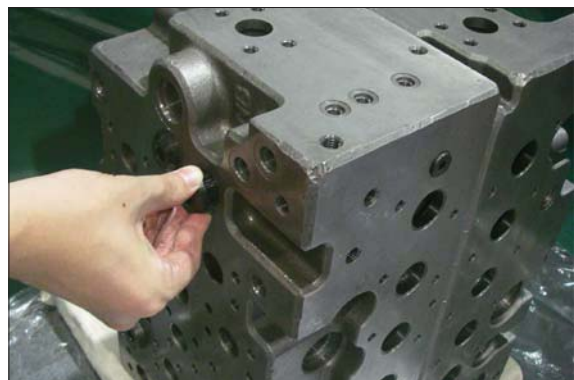
Remove the plug (551) and take out the poppet (511) and the spring (521).

- 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



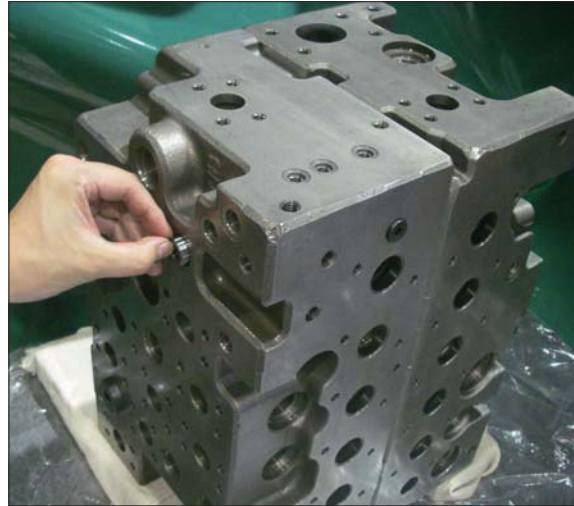
21098MC55



③ CRa, CRb

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

- Hexagon key wrench : 12 mm



21098MC56

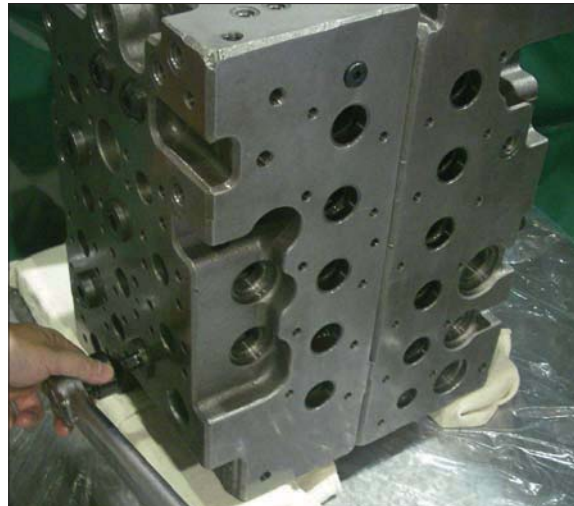
④ CCK, CCo

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

- Hexagon key wrench : 12 mm

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

- Hexagon key wrench : 6 mm



21098MC57

**(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.



21098MC58

### **(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.

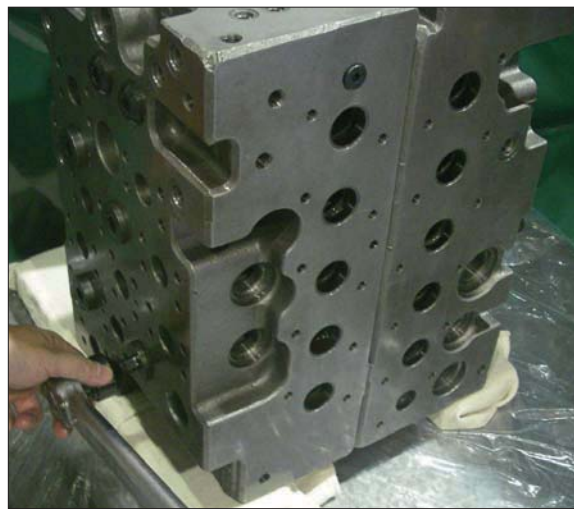
##### (1) Assembly of check valve :

- 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



21098MC57



21098MC56

- 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)



21098MC55

**(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).



21098MC53



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

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

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

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

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

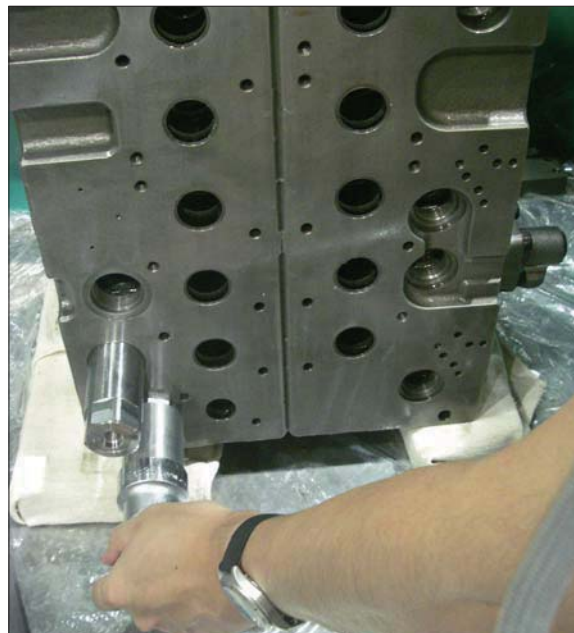
**(5) Assembling of negative control relief valve (610) :**

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)



21098MC54



21098MC51

**(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)

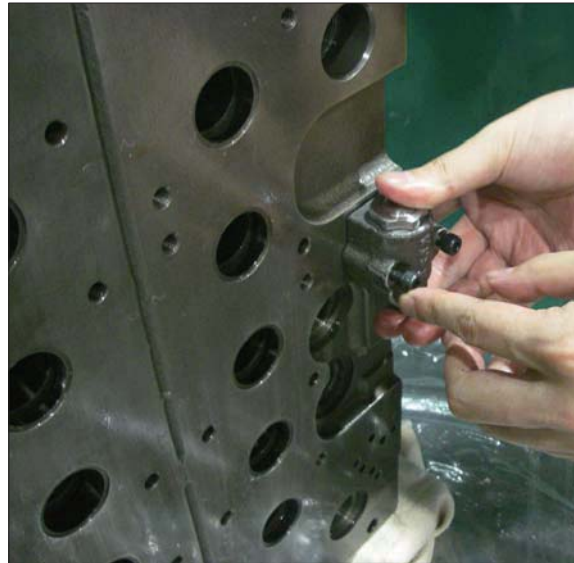


21098MC52

**(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)



21098MC50

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

Assemble the main relief valve (601) and the port relief valves (602, 603) 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



21098MC49



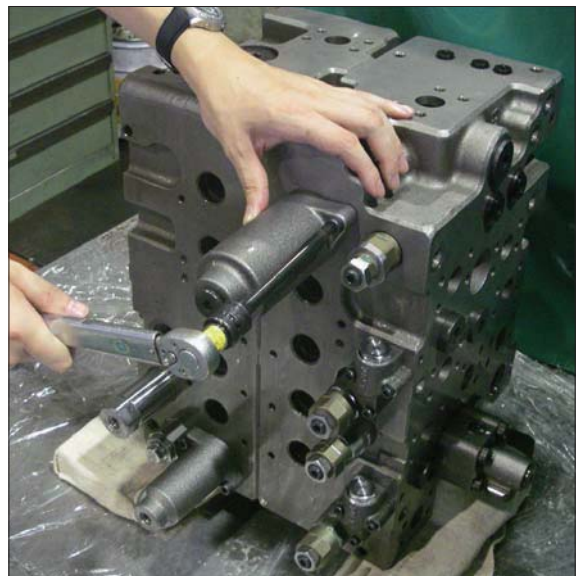
21098MC48



21098MC47

**(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.

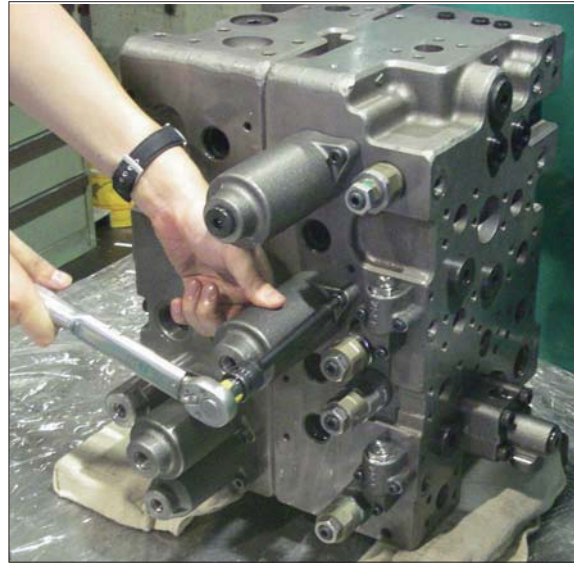


21098MC43



**(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.



21098MC41

**(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.



21098MC42

**(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.



21098MC39



21098MC38

**(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.



21098MC44

**(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)



21098MC46



## GROUP 5 SWING DEVICE

### 1. REMOVAL AND INSTALL OF MOTOR

#### 1) REMOVAL

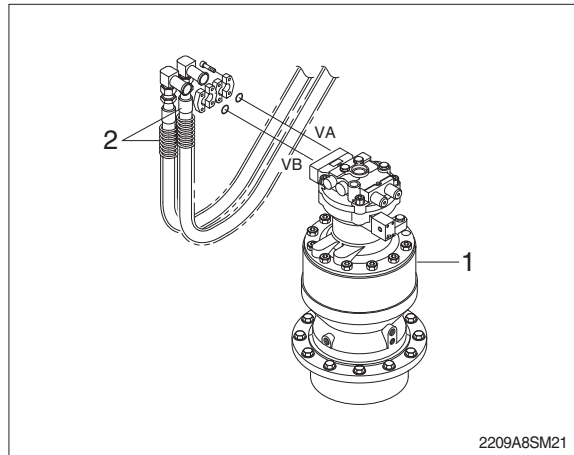
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

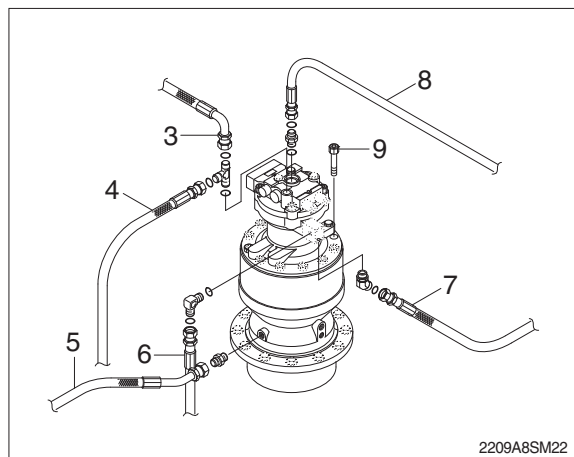
- (4) Disconnect hose assembly (2).
- (5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).
  - Motor device weight : 61 kg (135 lb)

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



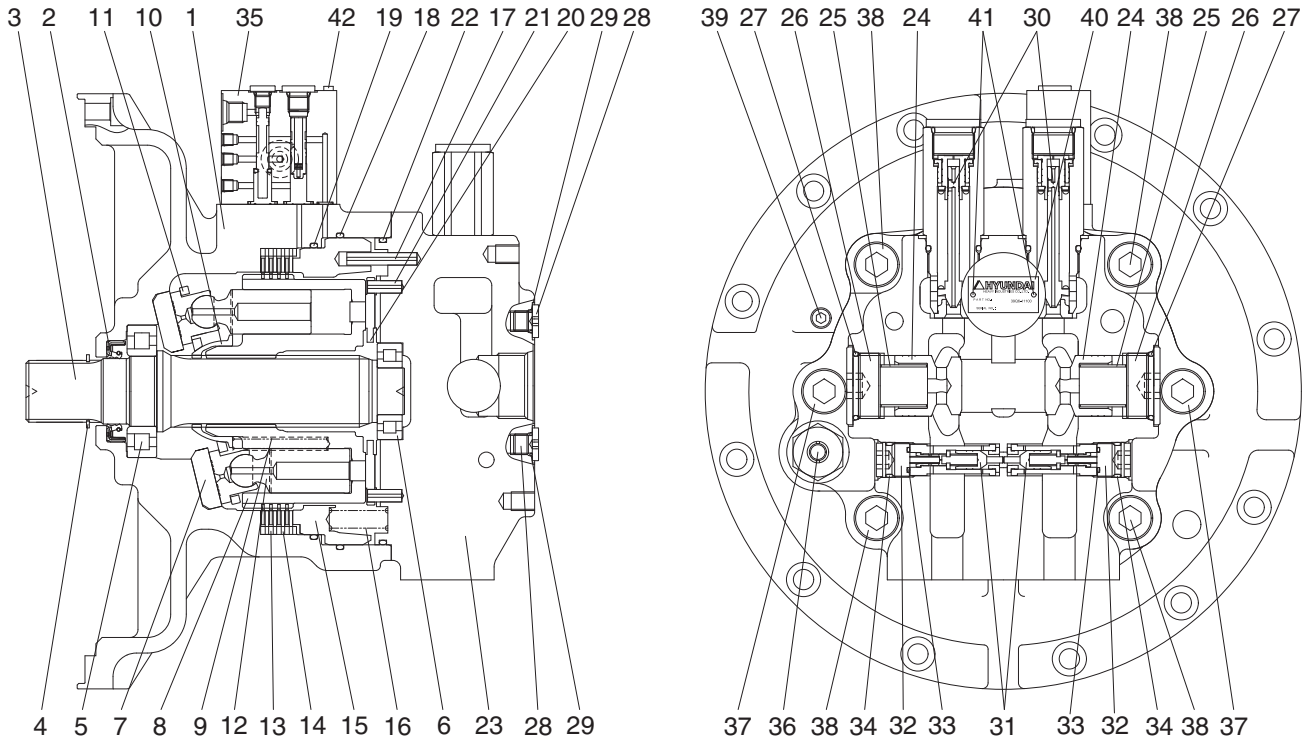
#### 2) INSTALL

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



## 2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

### 1) STRUCTURE



300L2SM02

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



## 2) DISASSEMBLY

### (1) Disassemble drive shaft

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



2209A8SM51

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



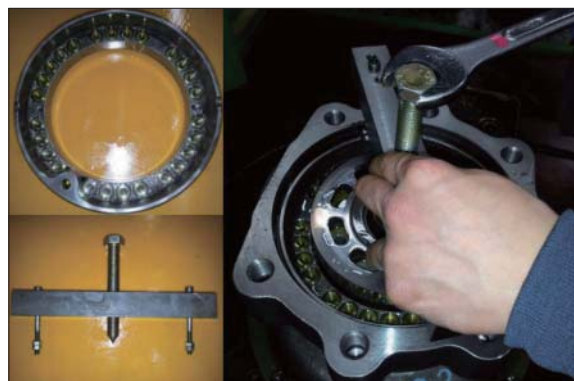
2209A8SM52

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



2209A8SM53

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



2209A8SM54

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



2209A8SM55

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



2209A8SM56

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



2209A8SM57

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



2209A8SM58

## (2) Disassemble cylinder block sub

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



2209A8SM59

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



2209A8SM60

## (3) Disassemble valve casing sub

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



2209A8SM61

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



2209A8SM62

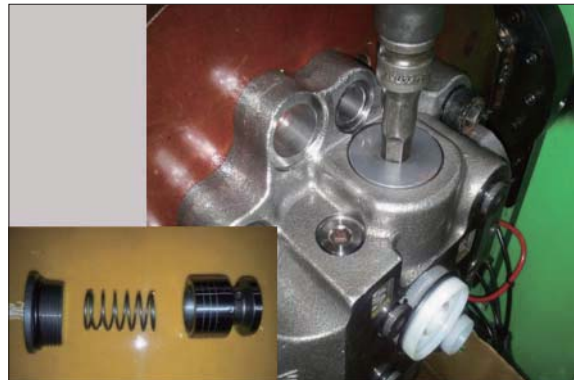


- ③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and reaction-less valve assy (31).



2209A8SM63

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



2209A8SM64

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



2209A8SM65

### 3) ASSEMBLING

#### (1) Assemble shaft sub

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



2209A8SM66

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



2209A8SM67

#### (2) Assemble cylinder block sub

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



2209A8SM68

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



2209A8SM69

- ③ Assemble 9 piston assy (12) into retainer plate (11).
- Piston assy × 9EA
  - Retainer plate × 1EA



2209A8SM70

- ④ Assemble parts of procedure ② and ③.



2209A8SM71

### (3) Assemble valve casing sub

#### ① Assemble make up check valve sub

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

- Make up check valve × 2EA
- Spring × 2EA
- Plug × 2EA
- O-ring × 2EA
- Tightening torque :  $38 \pm 3.8 \text{ kgf} \cdot \text{m}$   
( $275 \pm 27.5 \text{ lbf} \cdot \text{ft}$ )



2209A8SM72

#### ② Assemble reactionless valve assy

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

- Reactionless valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA
- Tightening torque :  $22 \pm 1.5 \text{ kgf} \cdot \text{m}$   
( $159 \pm 11 \text{ lbf} \cdot \text{ft}$ )



2209A8SM73



- ③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).
- Relief valve (30) × 2EA
  - Tightening torque :  $18 \pm 1.8 \text{ kgf} \cdot \text{m}$   
( $130 \pm 13 \text{ lbf} \cdot \text{ft}$ )



2209A8SM74

- ④ Assemble plug (28) and O-ring (27) into valve casing (23).
- Plug (28) × 3EA
  - O-ring (27) × 3EA
  - Tightening torque :  $4.5 \pm 0.4 \text{ kgf} \cdot \text{m}$   
( $32.5 \pm 2.9 \text{ lbf} \cdot \text{ft}$ )



2209A8SM75

- ⑤ Assemble needle bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).
- Needle bearing (6) × 1EA
  - Spring pin (17, 21) × 1EA



2209A8SM76

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



2209A8SM77

#### (4) Assemble drive shaft sub

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



2209A8SM78

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



2209A8SM79

- ③ Using a plier jig, assemble snap ring (4) to shaft (3).  
• Snap ring × 1EA



2209A8SM80

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



2209A8SM81



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

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



2209A8SM82

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



2209A8SM83

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

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



2209A8SM84

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

- Spring × 26EA



2209A8SM85

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

- Tightening torque :  $33 \pm 3.3 \text{ kgf} \cdot \text{m}$   
( $239 \pm 23.9 \text{ lbf} \cdot \text{ft}$ )



2209A8SM86

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

- Tightening torque (36) :  $15 \pm 1.0 \text{ kgf} \cdot \text{m}$   
( $108.5 \pm 7.2 \text{ lbf} \cdot \text{ft}$ )
- Tightening torque (39) :  $3 \pm 0.3 \text{ kgf} \cdot \text{m}$   
( $21.7 \pm 2.2 \text{ lbf} \cdot \text{ft}$ )



2209A8SM87

- ⑪ Assemble time delay valve assy (35) into valve casing (23) with socket bolt (42).

- Time delay valve  $\times 1\text{EA}$
- Socket bolt  $\times 3\text{EA}$
- Tightening torque (42) :  $1.3 \pm 0.1 \text{ kgf} \cdot \text{m}$   
( $9.4 \pm 0.72 \text{ lbf} \cdot \text{ft}$ )



2209A8SM88

- ⑫ **Air pressing test**

Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure :  $2 \text{ kgf/cm}^2$ ).



2209A8SM89

⑬ **Leakage check**

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



2209A8SM90

⑭ **Mount test bench**

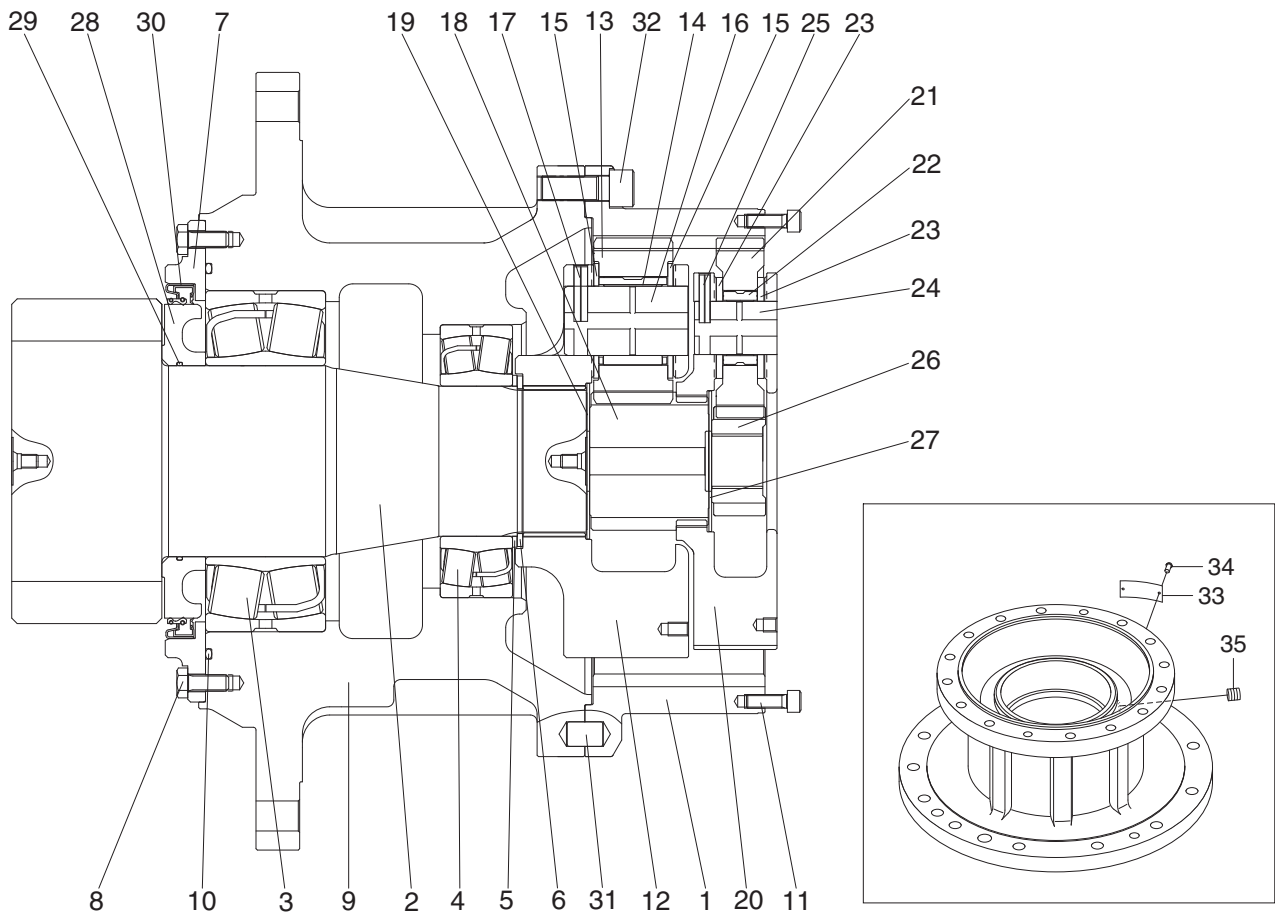
Mounting motor a test bench, test the availability of each part.



2209A8SM91

### 3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

#### 1) STRUCTURE



300L2SM03

1	Ring gear	13	Planetary gear 2	25	Spring pin 1
2	Drive shaft	14	Needle bearing 2	26	Sun gear 1
3	Bearing	15	Thrust washer 2	27	Thrust plate 1
4	Bearing	16	Carrier pin 2	28	Sleeve
5	Thrust plate	17	Spring pin 2	29	O-ring
6	Snap ring	18	Sun gear 2	30	Oil seal
7	Cover	19	Thrust plate 2	31	Parallel pin
8	Hex head bolt	20	Carrier 1	32	Hex socket head bolt
9	Casing	21	Planetary gear 1	33	Name plate
10	O-ring	22	Needle bearing 1	34	Rivet
11	Hex socket head bolt	23	Thrust washer 1	35	Plug
12	Carrier 2	24	Carrier pin 1		



## 2) DISASSEMBLY REDUCTION GEAR

### (1) Preparation

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

### (2) Disassemble the swing motor

- ① Loosen the hex wrench bolt (11, M10), and remove the swing motor.



300L8SR01

### (3) Disassemble the carrier No.1 assy

- ① Disassemble gear-sun No.1 (26), tightening eye-bolt (M10) to screw holes for disassembly in carrier No.1 (20), then disassemble carrier No.1 assy.



300L8SR02

#### (4) Disassemble the carrier No.2 assy

- ① Disassemble gear-sun No.2 (18), tighten eye-bolt (M10) to screw holes for disassembly in carrier No.2 (12), then disassemble carrier No.2 assy.



300L8SR03

#### (5) Disassemble carrier No.1 assy

- ① Hold jig to spring pin No.1 (26), then tap jig with a hammer, so that place spring pin in the center of carrier pin No.1 (24).
  - ※ Do not reuse spring pin.
  - ※ Disassemble method of carrier No.2 assy is same.



300L8SR04

- ② Disassemble carrier pin No.1 (24), then disassemble planetary gear No.1 (21), thrust washer No.1 (23) from the carrier No.1 (20).



300L8SR05

(6) Disassemble the ring gear (1).

① Separate ring gear (1) from casing (9).

※ Separate casing (9) by using the groove area because loctite is spread on joining surface of ring gear (1) and casing (9) to prevent oil leakage.



300L8SR06

(7) Disassemble the drive shaft (2).

① Using the snapping plier, disassemble snap ring (6), then disassemble thrust plate (5).



300L8SR07

② Turn casing (9) over to face pinion gear upward. Then unscrew hex.head bolt (8) 12ea by using the tool.



300L8SR08



- ③ Disassemble drive shaft sub assy by using the press machine.
- ※ The drive shaft sub assy fall all together, so be careful when removing it.



300L8SR09

- ④ Disassemble sph. roller bearing (3), cover (7), oil seal (30), and sleeve (28) from the drive shaft (2).
- ※ Do not reuse oil seal (30).



300L8SR10

- (8) Separate sph. roller bearing (4) from casing (9) by using the press machine.



300L8SR11

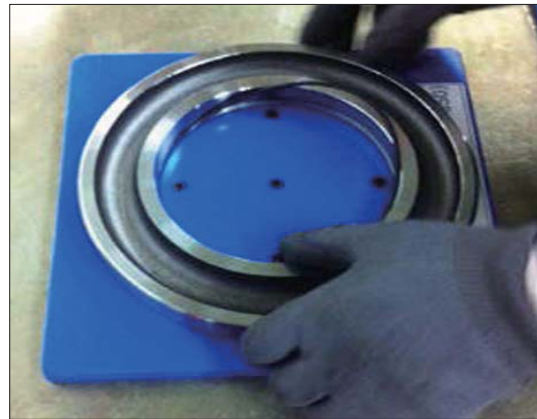
### 3) ASSEMBLY REDUCTION GEAR

(1) Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

- ① Repair the damaged part when disassembling, prepare parts for the exchange in advance.
- ② All parts should be cleaned with cleaner, and dried with compressed air.
- ③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
- ④ Replacement O-ring and oil seal with new parts is generally recommended.
- ⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.
- ⑥ When assembling bolt, spread Loctite.

(2) Assemble drive shaft (2).

- ① After heating sleeve (28) for 5 minutes at 80 ~ 90°C, assemble O-ring (29).
- ※ Apply grease to the O-ring (29) to prevent damage.



300L8SR12

- ② Apply grease to the oil seal (30), placed on the jig and then assemble it to cover (7) by using the press machine.

- ※ Apply grease to oil seal lip portion.  
※ Be careful of damage of oil seal.



300L8SR13

③ Assemble sleeve (28) and cover (7) to drive shaft (2).

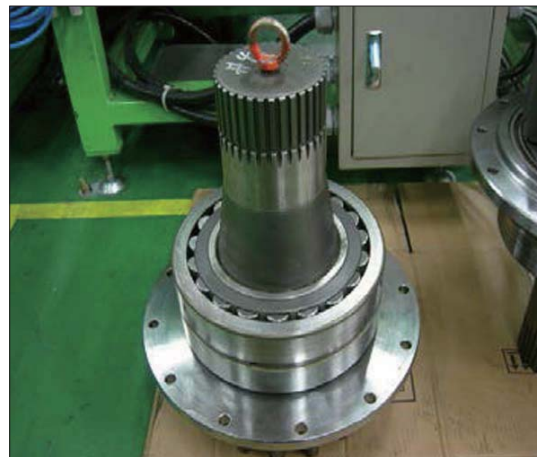
※ Be careful of the direction of cover (7), sleeve (28).

※ Be careful of damage of oil seal.



300L8SR14

④ After heating sph. roller bearing (3) for 13 minutes at 80~90°C and doing demagnetization, then assemble it to drive shaft (2).



300L8SR15

⑤ After assembling O-ring (10) on casing (9), assemble drive shaft sub assy by using a press machine.



300L8SR16



⑥ After spreading loctite #262 on hex.head bolt (8), screw them to fix casing (9) and cover (7).

※ Tightening torque :  $8.8 \pm 0.9 \text{ kgf} \cdot \text{m}$   
( $63.7 \pm 6.51 \text{ lbf} \cdot \text{ft}$ )

※ Screwing when rust inhibitor is not remove.



300L8SR17

(3) Assemble sph. roller bearing (4).

① Assemble sph. roller bearing (4) to casing (9) by using the press machine.



300L8SR18

② After assembling thrust plate (5), assemble snap ring (6) to assembly groove of drive shaft (2).

※ Assemble selected thrust plate (5) to make gap (0.1~0.3 mm) between snap ring (6) and sph. roller bearing (4).

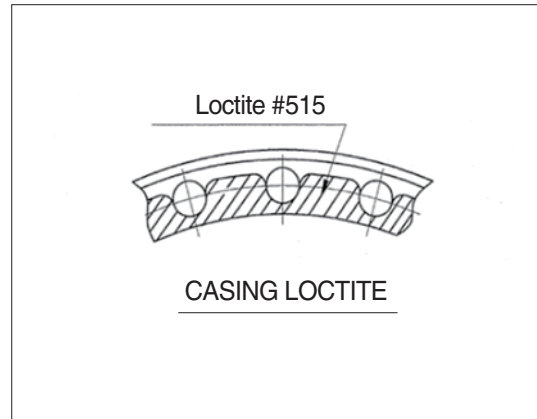


300L8SR19

(4) Assemble ring gear (1).

① Spread the loctite #515 on the casing (9) with reference to the right detail view.

※ Loctite should not flow into casing (9).



300L8SR20

② After press-fitting parallel pin (31) with a hammer on the casing (9). Then spreading loctite #262 on hex.head bolt (32), screw them.

※ Tightening torque :  $33 \pm 3.3 \text{ kgf} \cdot \text{m}$   
( $239 \pm 23.9 \text{ lbf} \cdot \text{ft}$ )

※ Screwing when rust inhibitor is not removed.



300L8SR21

(5) Assemble carrier No.1 assy

① After assembling thrust plate No.1 (27) on carrier No.1 (20), assemble thrust washer No.1 (23), planetary gear No.1 (21), then assemble carrier pin No.1 (24) by using the hammer.

※ Assembly method of carrier No.2 assy is same.



300L8SR22

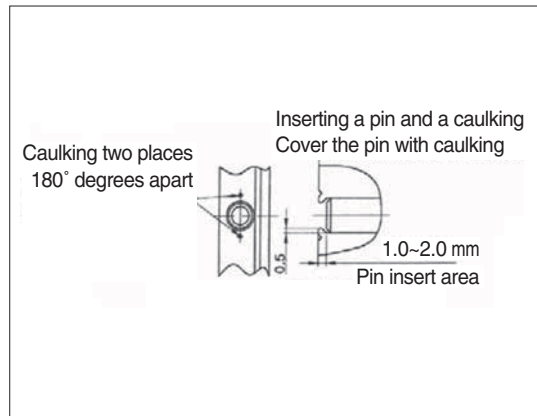
- ② Assemble spring pin No.1 (25) to fix carrier No.1 (20) and spring pin No.1 (25) by using the jig.



300L8SR23

- ③ Caulking is performed on the assembled spring pin unit.

- ※ To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin No.1 (25).



300L8SR24

#### (6) Assemble carrier No.2 assy

- ① Lift pre-assembled carrier No.2 assy.  
Shaking it from side to side, assemble it to ring gear (1) to engage with ring gear (1). Then, press-fit it with polyurethane hammer.
- ※ Check caulking and rotating state before assembly.



300L8SR25

#### (7) Assemble sun gear No.2 (18).

- ① Shaking sun gear No.2 (18) from side to side, assemble it to carrier No.2 assy to engage with planetary gear No.2 (13).



300L8SR26



(8) Assemble carrier No.1 assy.

Lift carrier No.1 assy. Shaking it from side to side, assemble it to ring gear (1) to engage with ring gear (1).

※ Check rotating state before assembly.



300L8SR27

(9) Assemble sun gear No.1 (26).

① Shaking sun gear No.1 (26) from side to side, assemble it to engage planetary gear No.1 (21). Then fill with gear oil 11 liter.



300L8SR28

## 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.

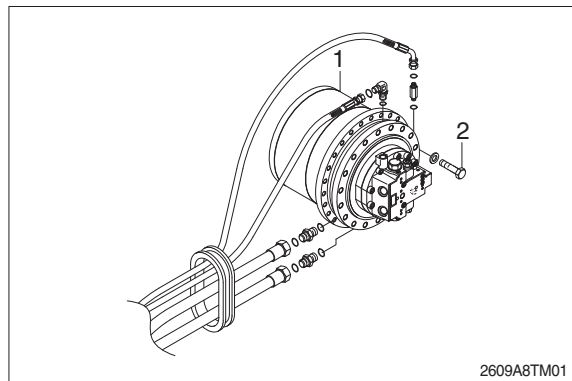
**▲ Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ 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 hoses.  
※ Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.  
· Weight : 430 kg (950 lb)

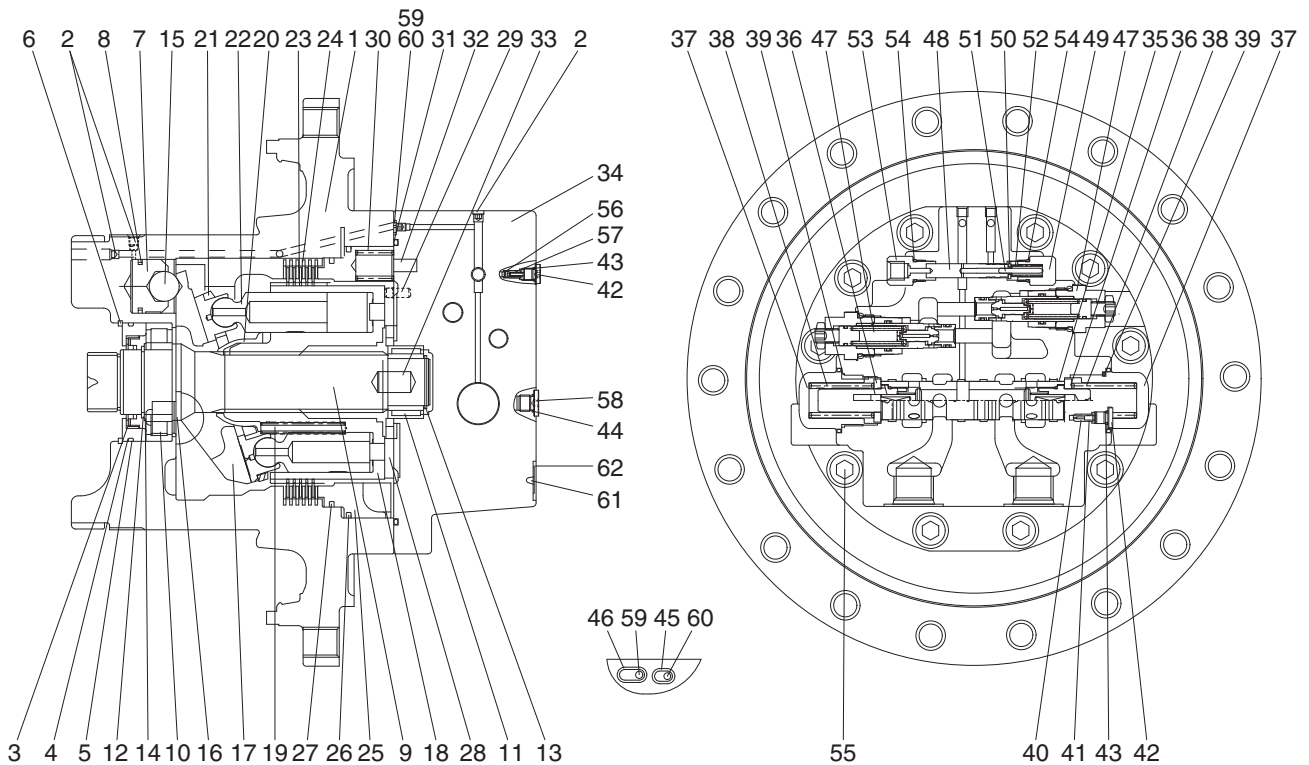
#### 2) INSTALL

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



## 2. SPECIFICATION

### 1) TRAVEL MOTOR



2609A2TM02

1	Casing	22	Piston assy	43	O-ring
2	Plug	23	Friction plate	44	O-ring
3	Oil seal	24	Separated plate	45	O-ring
4	Thrust block	25	Parking piston	46	O-ring
5	O-ring	26	D-ring	47	Relief valve
6	Snap ring	27	D-ring	48	Spool
7	Piston	28	Valve plate	49	Plug
8	Piston seal	29	Parallel pin	50	Spring seat
9	Shaft	30	Spring	51	Parallel pin
10	Cylinder roller bearing	31	O-ring	52	Spring
11	Needle bearing	32	Spring pin	53	Connector
12	Snap ring	33	Parallel pin	54	O-ring
13	Snap ring	34	Rear cover	55	Hexagon socket head bolt
14	Thrust plate	35	Main spool assy	56	Check valve
15	Steel ball	36	Spring seat	57	Spring
16	Pivot	37	Plug	58	Plug
17	Swash plate	38	Spring	59	Restrictor
18	Cylinder block	39	O-ring	60	Restrictor
19	Spring	40	Restrictor	61	Name plate
20	Ball guide	41	Spring	62	Rivet
21	Retainer plate	42	Plug		

## 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)
Induction heating apparatus for bearing		Roller bearing (13)

### (2) Tightening torque

NO.	Part name	Standard	Size	Torque	
				kgf · m	lbf · ft
2	Plug	NPTF 1/16	4	0.9±0.2	6.51±1.45
3, 4, 38	Orifice screw	NPTF 1/16	4	0.7	5.06
49	Hex socket bolt	M12	10	10	72.33
50	Hex socket bolt	M10	8	6.7	48.46
54	Plug	PF 1/4	19	3.7	26.76
56	Plug	PF 1/2	27	11	79.56
57	Relief valve	HEX 27	1 5/16	34±3.4	246±24.6
63	Nut	M16	24	24	173.59
65	Plug	PF 3/8	8	7.5	54.25
70, 72	Hex socket bolt	M16	14	24	173.59
71	Hex socket bolt	M16	14	24	173.59

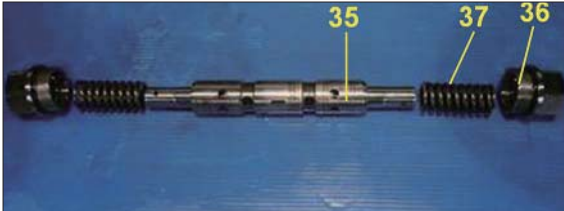
### 3. DISASSEMBLING

#### 1) GENERAL INSTRUCTIONS

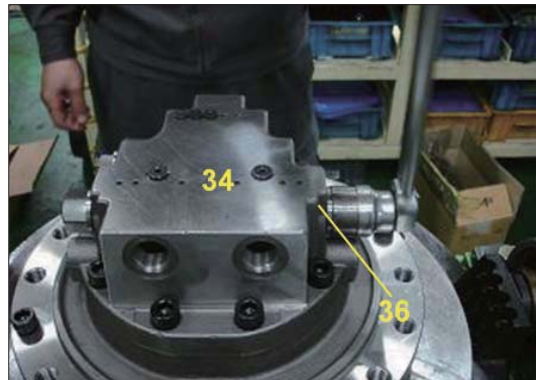
- ▲ **Combustibles such as white kerosene are used for washing parts.**  
These combustibles are easily ignited, and could result in fire or injury.  
Be very careful when using.
  - ▲ **Internal parts are coated with hydraulic fluid during disassembling and are slippery.**  
If a part slips out of your hand and falls, it could result in bodily injury or could damage the park.  
Be very careful when handling.
- (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) Disassemble main spool cover (36) into rear cover (34) using spanner and torque wrench and then disassemble spring (37), main spool assy (35).



2609A8TM02



2609A8TM03

- (2) Disassemble wrench bolt (54) using torque wrench.



2609A8TM04

- (3) Take out rear cover (34) into casing (1).



2609A8TM05

- (4) Remove brake spring (30, 14EA)



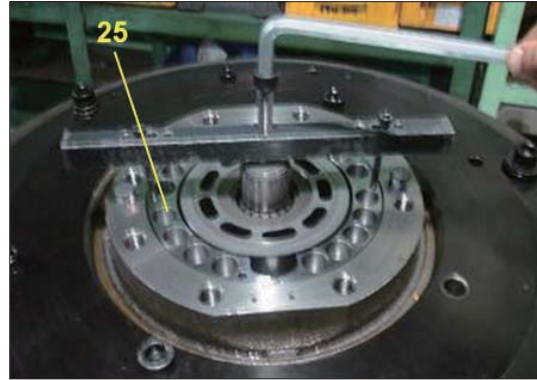
2609A8TM06



(5) Disassemble parking piston (25) using jig.

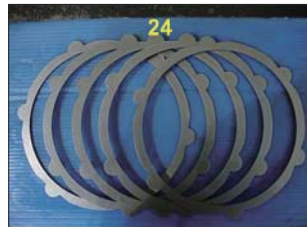


2609A8TM07



2609A8TM08

(6) Disassemble separate plate (24, 5EA) and friction plate (23, 4EA).



2609A8TM09



2609A8TM10



2609A8TM11



2609A8TM12

(7) Remove cylinder block kit.

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



2609A8TM13

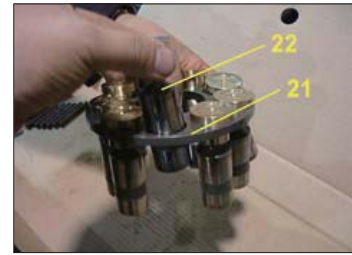
(8) Disassemble cylinder block (18), retainer plate (21), piston assy (22), ball guide (20) and spring (19) into cylinder block kit.



2609A8TM14



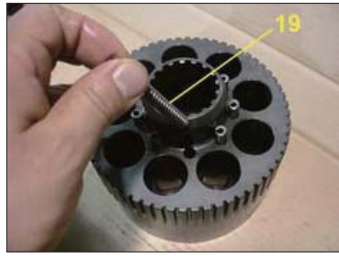
2609A8TM15



2609A8TM16



2609A8TM17



2609A8TM18

(9) Disassemble swash plate (17) into casing (1).



2609A8TM19



2609A8TM20

(10) Disassemble steel ball (15), swash piston (7) into casing (1).

※ Hole in the Casing(1) of two speed line is decomposed by injecting air.



2609A8TM21



2609A8TM22



2609A8TM23

(11) Disassemble pivot (16, 2EA) into casing (1).



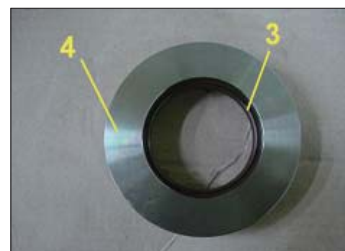
2609A8TM24

(12) Disassemble snap ring (6) using pliers.



2609A8TM25

(13) Disassemble trust block (4) and oil-seal (3) into casing (1).



2609A8TM26

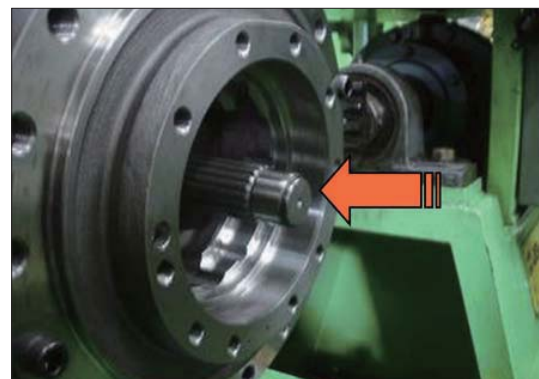


2609A8TM27

(14) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and bearing-roller (10) to the other side.



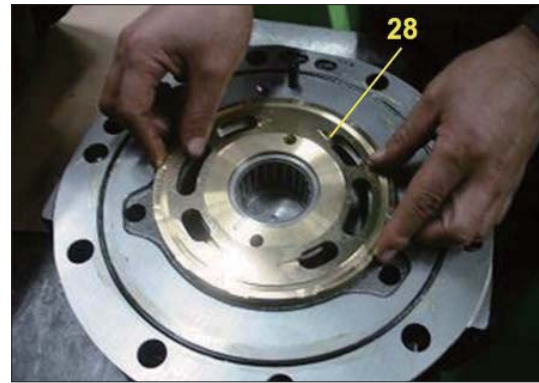
2609A8TM28



2609A8TM29



(15) Disassemble valve plate (28) into rear cover (34).



2609A8TM30

(16) Disassemble relief valve (46, 2EA) into rear cover (34) using the torque wrench.



2609A8TM31

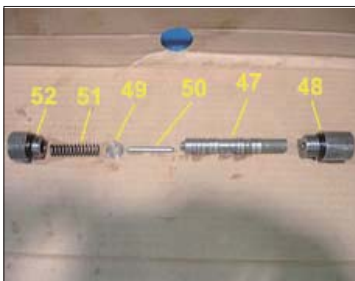


2609A8TM32



2609A8TM33

(17) Disassemble plug (48), connector (52) into rear cover (34) using the torque wrench and then disassemble spring (51), spring seat (49), parallel pin (50) and spool (47) in regular sequence.



2609A8TM34

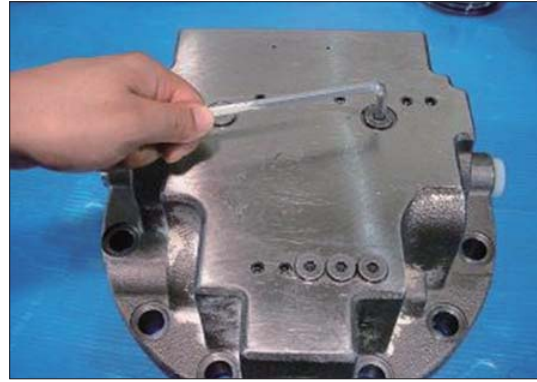


2609A8TM35



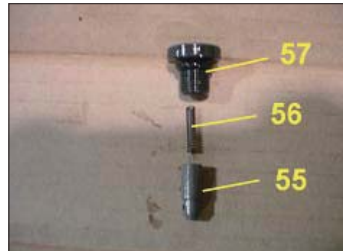
2609A8TM36

(18) Disassemble plug (57) into rear cover (34).

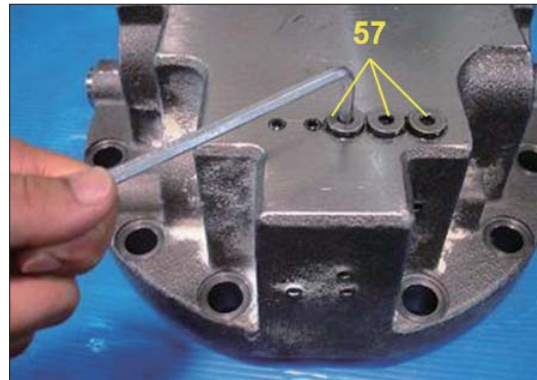


2609A8TM37

(19) Disassemble plug (57) into rear cover (34) and then disassemble spring (56), check valve (55) into rear cover (34) in regular sequence.



2609A8TM38



2609A8TM39

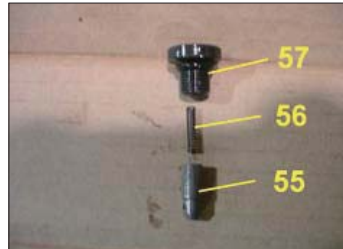


## 4. REASSEMBLING

### 1) ASSEMBLING MOTOR

#### - REAR COVER ASSY

- (1) Assemble check valve (55), spring (56) into rear cover (34) and then assemble plug (57) using L-wrench.



2609A8TM40

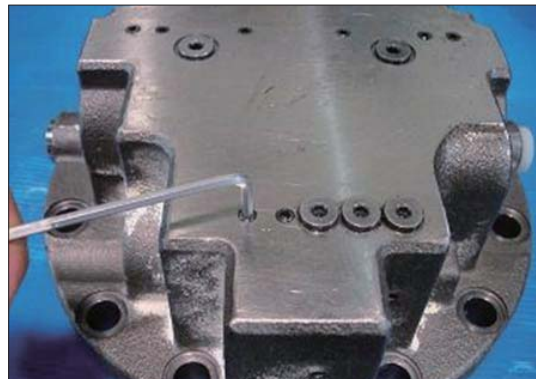


2609A8TM41

- (2) Apply loctite #242 on the NPTF 1/16 plug (2) and then assemble 12-NPTF 1/16 Plug (2) into rear cover(34).

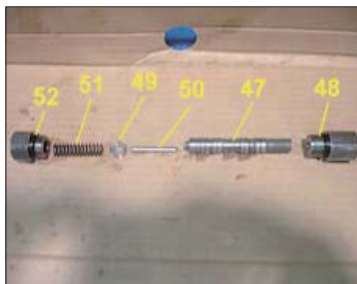


2609A8TM42



2609A8TM43

- (3) Assemble spool (47), parallel pin (50), spring seat (49) and spring (51) into rear cover (34) in regular sequence and then assemble plug (48) and connector (52).



2609A8TM44



2609A8TM45



2609A8TM46

- (4) Assemble relief valve (42, 2EA) into rear cover (34).



2609A8TM47



2609A8TM48



2609A8TM49

- (5) Press needle bearing (11) into rear cover (34) using jig.



2609A8TM50

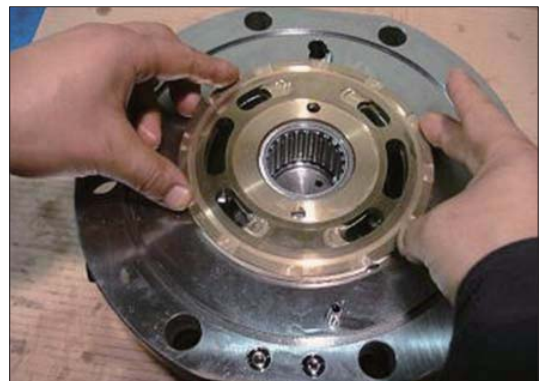
- (6) Assemble spring pin (32) and parallel pin (29) using small hammer.



2609A8TM51

- (7) Assemble valve plate (28) into rear cover (34).

- ※ Apply grease to the valve plate contact and then assemble valve plate into rear cover (34).



2609A8TM52

- (8) Apply grease to the O-ring and then assemble O-ring into rear cover (34).



2609A8TM53

(9) Install casing (1) into assembling jig.



2609A8TM54

(10) Assemble the heated Roller Bearing(10) onto the Shaft(8).

① The temperature of the Roller Bearing : 100°C.

Using tool : Heater.

※ **Be careful not to damage the sliding surface for the Oil seal on the shaft.**



2609A8TM55



2609A8TM56

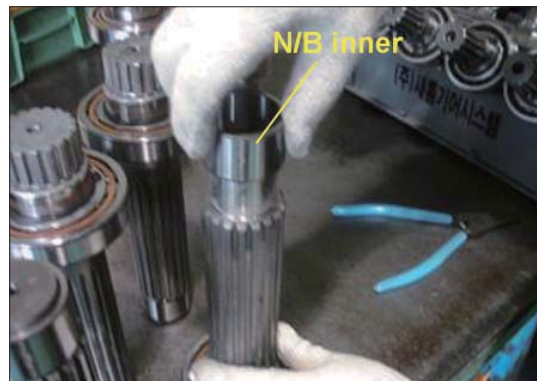


2609A8TM57

(11) Assemble the heated needle bearing inner ring on the shaft (8).



2609A8TM58



2609A8TM59

(12) Assemble snap ring (13) into Shaft (8) using pliers.



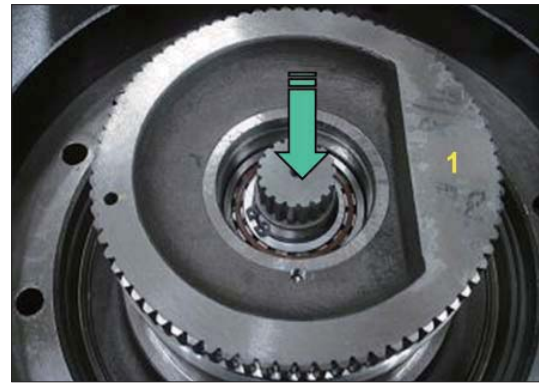
2609A8TM60



(13) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.

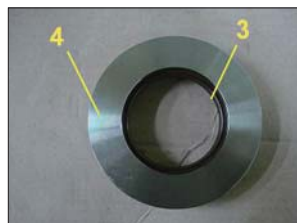


2609A8TM61



2609A8TM62

(14) Assemble oil seal(3) into trust block (4) with a assembling jig and press it into casing (1). Caution the direction of oil seal (3).



2609A8TM63



2609A8TM64

(15) Assemble snap ring(6) into casing(1) using pliers.



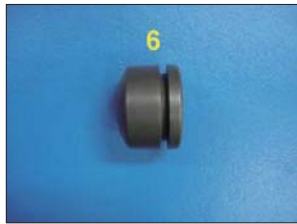
2609A8TM65

(16) Apply the grease to pivot (16, 2EA) and then assemble pivot (16) into casing(1).



2609A8TM66

(17) Warm piston seal (8) and assemble it on swash piston (7) and then bind the piston seal (8) with a bend for a minute. Remove the bend and assemble it into casing (1).



2609A8TM67



2609A8TM68

(18) Apply the grease to steel ball (15) and then assemble steel ball (15) into casing (1).



2609A8TM69



2609A8TM70

(19) Apply the grease to swash plate (17) and then assemble swash plate (17) into casing (1).



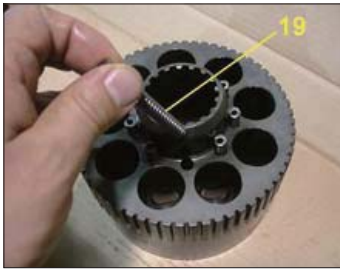
2609A8TM71



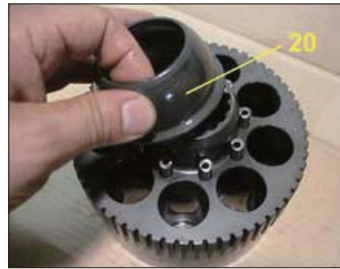
2609A8TM72



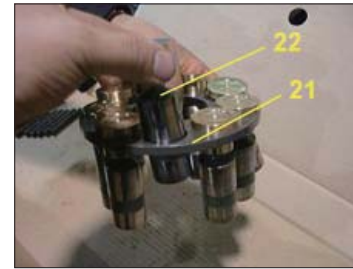
(20) Assemble spring (19), ball guide((20), retainer plate (21), piston assy (22) into cylinder block (18) in regular sequence.



2609A8TM73



2609A8TM74



2609A8TM75



2609A8TM76



2609A8TM77

(21) Start the casing (1) and then assemble cylinder block kit into casing (1).

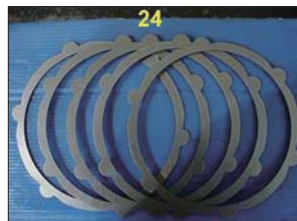


2609A8TM78

(22) Assemble separated plate (24), friction plate (23) into cylinder block in regular sequence.

Friction plate : 4EA

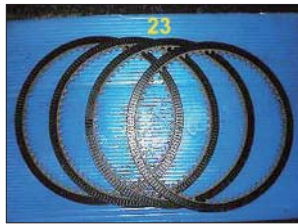
Separated plate : 5EA



2609A8TM79



2609A8TM80

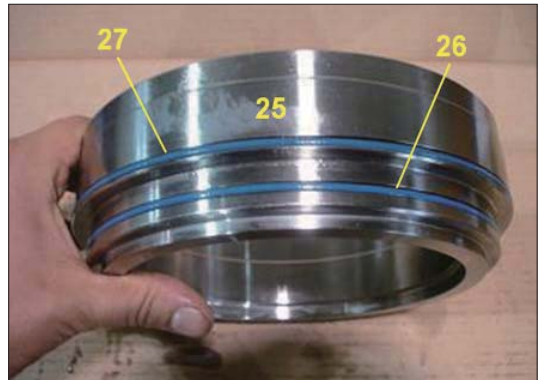


2609A8TM81



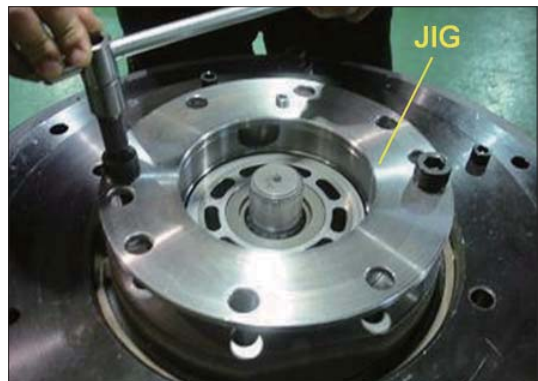
2609A8TM82

(23) Apply the grease to D-ring (26, 27) and then assemble D-ring (26, 27) into parking piston (25).



2609A8TM83

(24) Assemble parking piston into casing using jig.



2609A8TM84

(25) Assemble brake spring (30, 18EA).



2609A8TM85

(26) Put on the rear cover (34) on the casing (1).



2609A8TM86

(27) Assemble rear cover (34) into casing (1) and then tighten the wrench bolt (54, 55) using torque wrench.

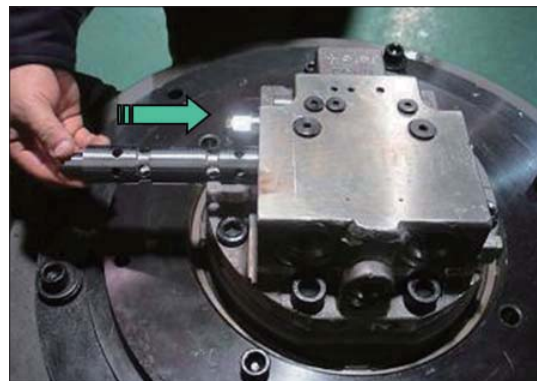


2609A8TM87

(28) Assemble main spool assy (35) into rear cover (34) after checking the direction to be correct.



2609A8TM88



2609A8TM89

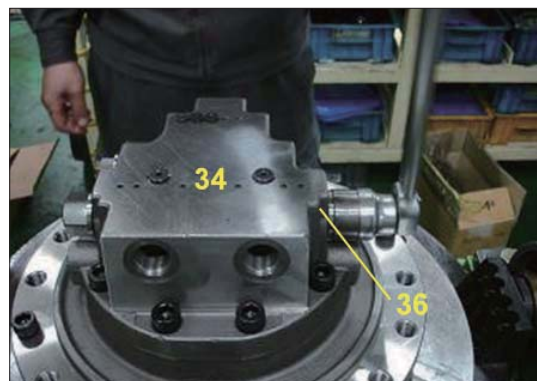
(29) Assemble spring (37), plug (36) into rear cover (34) in regular sequence and then plug (36) into rear cover (34) using torque wrench.



2609A8TM90

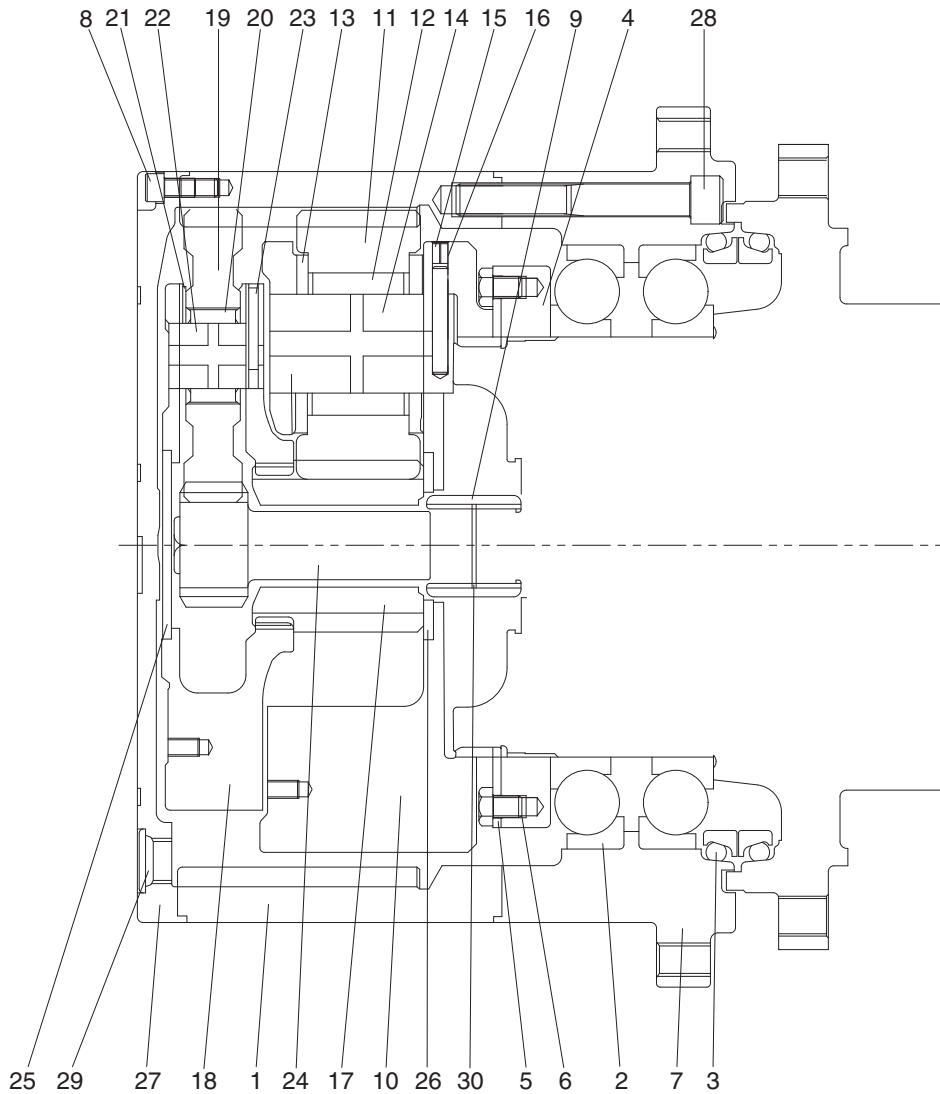


2609A8TM91



2609A8TM92

## 2) TRAVEL REDUCTION GEAR



2609A2TM03

- |    |                          |    |                  |    |                          |
|----|--------------------------|----|------------------|----|--------------------------|
| 1  | Gear ring                | 11 | Planetary gear 2 | 21 | Thrust washer 1          |
| 2  | Ball bearing             | 12 | Needle bearing 2 | 22 | Carrier pin 1            |
| 3  | Floating seal assy       | 13 | Thrust washer 2  | 23 | Spring pin 1             |
| 4  | Nut ring                 | 14 | Carrier pin 2    | 24 | Sun gear 1               |
| 5  | Lock plate               | 15 | Spring pin 2     | 25 | Thrust plate             |
| 6  | Hexagon socket head bolt | 16 | Solid pin 2      | 26 | Thrust plate             |
| 7  | Housing                  | 17 | Sun gear 2       | 27 | Cover                    |
| 8  | Hexagon socket head bolt | 18 | Carrier 1        | 28 | Hexagon socket head bolt |
| 9  | Coupling                 | 19 | Planetary gear 1 | 29 | Plug                     |
| 10 | Carrier 2                | 20 | Needle bearing 1 | 30 | Snap ring                |



## 6. DISASSEMBLING

### 1) GENERAL INSTRUCTIONS

- ▲ **Combustibles such as white kerosene are used for washing parts.**  
These combustibles are easily ignited, and could result in fire or injury.  
Be very careful when using.
  - ▲ **Internal parts are coated with gear oil during disassembling and are slippery.**  
If a part slips off from your hand and falls, it could result in bodily injury or could damage the park.  
Be very careful when handling.
- (1) 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) 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.
- ▲ **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 REDUCTION GEAR

### (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) Set the reduction unit on table

- ① Remove 7/16-14UNC hexagon socket head bolts at 3 places from cover almost equally apart each other, and then install 7/16-14UNC eye bolts.

▲ 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 22 socket bolts (7/16-14UNC) those are attached to ring gear.
- ② Cover is stuck (27) to ring gear (1).  
So use sharp chisel for removing cover (27) from ring gear (1).



2609A8TM02

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

Pull sun gear No.1 (24) vertically slow after removing thrust plate (25).



2609A8TM03

**(5) Removing carrier No.1 sub assembly**

Pull away carrier No.1 (18) with attached eye-bolt (M10) that is assembled to hole on carrier sub-assembly.



2609A8TM04

**(6) Removing sun gear No.2**

Pull away sun gear No.2 (17) for removing.



2609A8TM05

**(7) Deassembling carrier No.2 sub-assembly**

Attach eye-bolt (M10) to the hole of carrier No.2 (10), and remove the carrier No.2 sub-assembly to lift up slowly.

※ **Keep horizontal to ground and make sure the eye-bolts to be safe operation.**



2609A8TM06

**(8) Take away coupling**

Take away the coupling (9) from casing (1).



2609A8TM07

**(9) Lock plate**

Release four hex head bolts (6, M12) and remove lock plate (5).



2609A8TM08

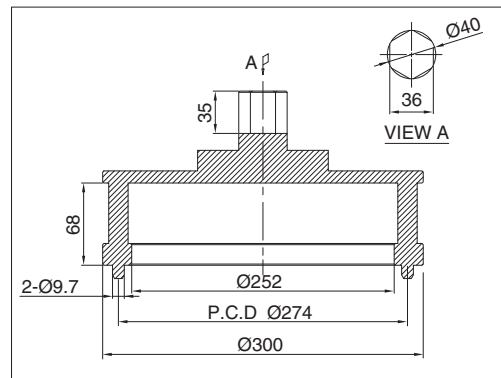
**(10) Nut ring**

Release nut ring with removing jig.



2609A8TM09

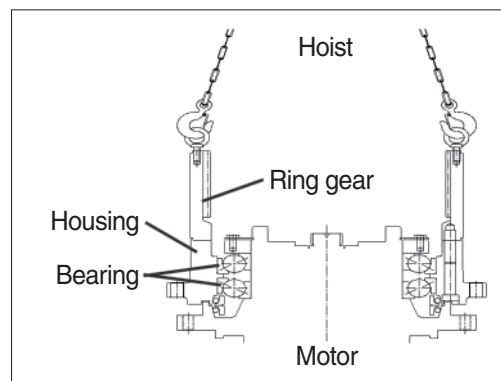
※ Remove the ring nut by using the special tool for removing the ring nut.



300L8TM01

**(11) Housing sub-assembly**

Lift up housing part slowly with hoist after attaching eye-bolt (7/16-14UNC) on it. If you hit softly the center of motor with hammer and particular jig, you can remove the device easily.



2609A8TM10

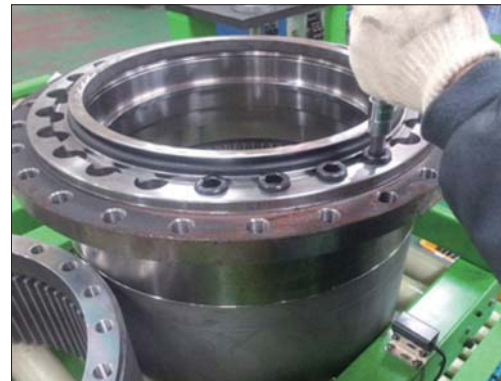
## (12) Ring gear

- ① Reverse the housing sub-assembly part with machine, and remove floating seal (3) from the inside.



2609A8TM11

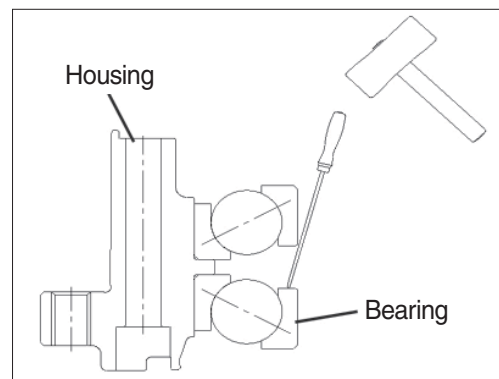
- ② Release 25 hex wrench bolts (28. M18) and remove ring gear (1) from housing (7).



2609A8TM12

## (13) Angular Bearing

Put the housing sub-assembly (7) like this figure. And hit each opposite side of bearing with driver and hammer.



2609A8TM13

## (14) Carrier No.1 sub-assembly

- ① Lay it on deassemblig jig. And remove pin No.1 (22) with press machine.



2609A8TM14



- ② Then remove planet gear No.1 (19) and thrust washer No.1 (21) from carrier No.1 (18).



2609A8TM15

**(15) Carrier No.2 sub-assembly**

Same as carrier No.1 (12) sub-assembly.



2609A8TM16

**(16) Coupling**

Remove snap ring (30) inside coupling (9) with nipper.



2609A8TM17



## 7. ASSEMBLY REDUTION UNIT

### 1) GENERAL NOTES

- (1) Clean every part by kerosene and dry them by air blow.
- (2) Surfaces to be applied by loctite must be decreased by solvent.
- (3) Check every part for any abnormal.
- (4) Each hexagon socket head bolt should be used with loctite No.242 applied on its threads.
- (5) Apply gear oil slightly on each part before assembling.

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

#### **Thrust washer**

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

#### **Gear**

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

#### **Bearing**

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

#### **Floating seal**

- Check flaw or score on sliding surfaces or O-ring.

### 2) ASSEMBLING CARRIER 1 SUB-ASSY

- (1) Put carrier No.1 (18) on the flat table.
- (2) Insert needle bearing No.1 (20) in planet gear No.1 (20), and attach 2 thrust washers No.1 (21) on the both side of planet gear No.1. then assemble them in carrier No.1 (18).

※ **When assembling thrust washer, rounded edge-side should be facing casting side of carrier.**

- (3) Insert pin No.1 (22) into pinhole of carrier correctly.

※ **Insert careful the pin not to scratch thrust washer and needle bearing.**



2609A8TM18



2609A8TM19

(4) Press spring pin No.1 (23) with jig and strike round spring pinhole (2 symmetrical point) with tool.

※ **After striking, draw the line by marker pen.**

※ **Check swinging conditon of planet gears.**

(5) Press two more pins and spring pins on the same way.



2609A8TM20

### 3) ASSEMBLING CARRIER 2 SUB-ASSY

(1) Put thrust plate (26) inside of carrier No.2 (10).



2609A8TM21

(2) Insert needle bearing No.2 (12) in planet gear No.2 (11) and attach 2 thrust washers No.2 (13) on the both side of planet gear No.2. Then assemble them in carrier No.2 (10).

※ **When assembling thrust washer, rounded edge-side should be facing casting side of carrier.**

(3) Insert pin No.2 (14) into pinhole of carrier No.2 correctly.

※ **Insert careful pin No.2 not to scratch thrust washer and needle bearing.**



2609A8TM22

(4) Insert solid pin No.2 (16) with pressing jig and insert spring pin No.2 (15) in the same position. When insertion is done, strike inner circle of spring pin (2 symmetrical point) with tool.

※ **After striking, draw the line by marker pen.**

※ **Check the spining condition of planet gear.**

(5) Insert two more pins and spring pins on the same way.



2609A8TM23

#### 4) ANGULAR BEARING

(1) Put the jig on housing (7) and insert angular bearing (2) into it with pressing machine, and turn down the upside of housing (7) by reversing machine.

※ Check the direction of bearing when inserting it.



2609A8TM24

(2) Insert angular bearing (2) into reversed housing (7) on the same way.



2609A8TM25

#### 5) ASSEMBLING FLOATING SEAL

(1) Paint alchole on floating seal (3) and polish it.



2609A8TM26

(2) Put floating seal (3) on the right position of housing (3) and insert it by pressing jig. After complete, check the condition by lifting with hand softly.

※ Keep clean on surface of floating seal while assembling.



2609A8TM27



(3) Put the gauge for seal measurement on floating seal (3) and check the horizontal angle by gauge scale.

※ **Two gauge scales should be same.**  
**(pass inspection)**



2609A8TM28

(4) Attach floating seal to motor that will be assembled with housing (on the same way to (1), (2))



2609A8TM29

(5) Put the measuring jig on floating seal (3) and check the horizontal angle condition with both gauge scale.

※ **Two gauge scales should be same.**  
**(pass inspection)**



2609A8TM30

## 6) ASSEMBLING RING GEAR

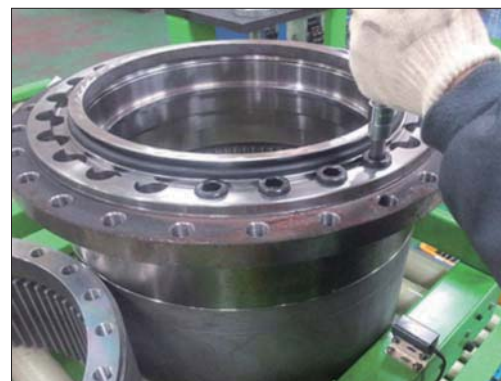
(1) Put ring gear (1) on contact surface (should be upside) of housing (7).

(2) Paint loctite #515 on ring gear (1) and put on housing (7). Then assemble 25 hexwrench bolts (28, M18)

※ **Paint loctite #262 on hex-wrench bolts (28) before assembling.**

※ **Tightening torque :  $38.5 \pm 3.8 \text{ kgf} \cdot \text{m}$**   
**( $278.5 \pm 27.5 \text{ lbf} \cdot \text{ft}$ )**

※ **Bolts should be assembled with luster preventing oil.**



2609A8TM31

## 7) ASSEMBLING NUT RING

- (1) Put housing (7) sub-assembly upside down (ring gear side is up), and attach it to motor by lifting with hoist. (shaking it lightly)
  - (2) When housing (7) sub-assembly is set, put nut ring (4) on it, and assemble with jig.
- ※ **Tightening torque for assembling nut ring :**  
 $66 \pm 6.0 \text{ kgf} \cdot \text{m}$  ( $477.3 \pm 43.3 \text{ lbf} \cdot \text{ft}$ )
  - ※ **Floating seal should not be damaged or separated while assembling.**



2609A8TM32

## 8) ASSEMBLING LOCK PLATE

- (1) Put lock plate (5) on nut ring (4) to fit to M12 bolt hole. Then assemble 4 hex-head bolts (6, M12)
- ※ **Paint loctite #262 on hex-head bolts.**
  - ※ **Tightening torque :  $6.05 \pm 0.6 \text{ kgf} \cdot \text{m}$**   
 $(43.8 \pm 4.3 \text{ lbf} \cdot \text{ft})$
  - ※ **Bolts should be assembled with lust preventing oil.**



2609A8TM33

## 9) ASSEMBLING COUPLING

- (1) Attach snap ring (3) into coupling (9) with nipper.



2609A8TM34

- (2) Put coupling (9) on motor shaft to fit.



2609A8TM35



### 10) ASSEMBLING NO.2 CARRIER SUB-ASSY

- (1) Lift carrier No.2 subassembly and put on ring gear (1), and fit it into internal side of ring gear (1). Then hit urethan hammer to fit.

※ Check turning and cocking condition before assembling.



2609A8TM36

### 11) ASSEMBLING NO.2 SUN GEAR

- (1) Insert sun gear No.2 (17) in the middle of carrier No.2 sub assembly and make it fit in carrier No.2.



2609A8TM37

### 12) ASSEMBLING NO.1 CARRIER SUB-ASSY

- (1) Lift carrier No.1 sub-assembly and put it into ring gear (1) and shake carrier No.1 to fit into ring gear.

※ Check turning and cocking condition before assembling.



2609A8TM38

### 13) SWINGING TORQUE INSPECTION

- (1) Attach inspection jig before assembling sun gear No.1 (24).



2609A8TM39

(2) Attach torque wrench to the jig, check the torque when it swings.

※ **Swinging torque : below 3.0 kgf · m (21.7 lbf · ft)**



2609A8TM40

#### 14) ASSEMBLING NO.1 SUN GEAR

(1) Remove the jig and wrench after torque inspection complete. And assemble sun gear No.1 (24) with pushing round to fix to the center of carrier No.1



2609A8TM41

#### 15) ASSEMBLING THRUST PLATE

(1) Put thrust plate (25) on carrier No.1 sub assembly. And paint loctite #515 on flat side of ring gear (1).

※ **When assembling thrust washer, rounded edge-side should be facing casting side of carrier.**



2609A8TM42

#### 16) ASSEMBLING COVER

(1) Attach cover on ring gear (1) with assembling 22 hex-wrench bolts (8, 7/16-16UNC).

※ **Paint loctite #262 on screw of hex bolts.**

※ **Tightening torque : 8.1 ± 0.8 kgf · m  
(58.6 ± 5.8 lbf · ft)**

※ **Bolts should be assembled with luster preventing oil.**



2609A8TM43

## 17) ASSEMBLING OIL INJECTION

- (1) Inject the oil (10 ℓ ) through PF3/4 hole on cover (27).



2609A8TM44

## 18) ASSEMBLING PLUG

- (1) Assemble 3 plugs (29, PF3/4) after oil injection complete.

※ **Tightening torque** :  $10 \pm 1.0 \text{ kgf} \cdot \text{m}$   
( $72.3 \pm 7.2 \text{ lbf} \cdot \text{ft}$ )



2609A8TM45

## GROUP 7 RCV LEVER

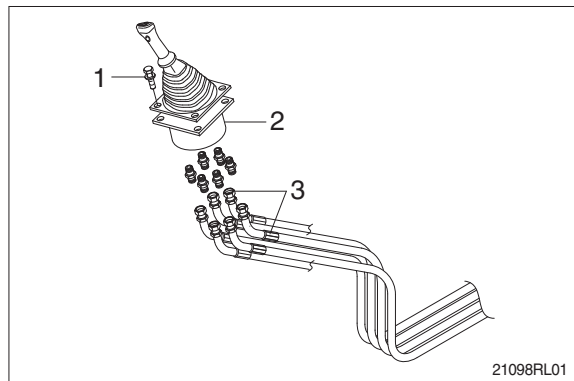
### 1. REMOVAL AND INSTALL

#### 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.

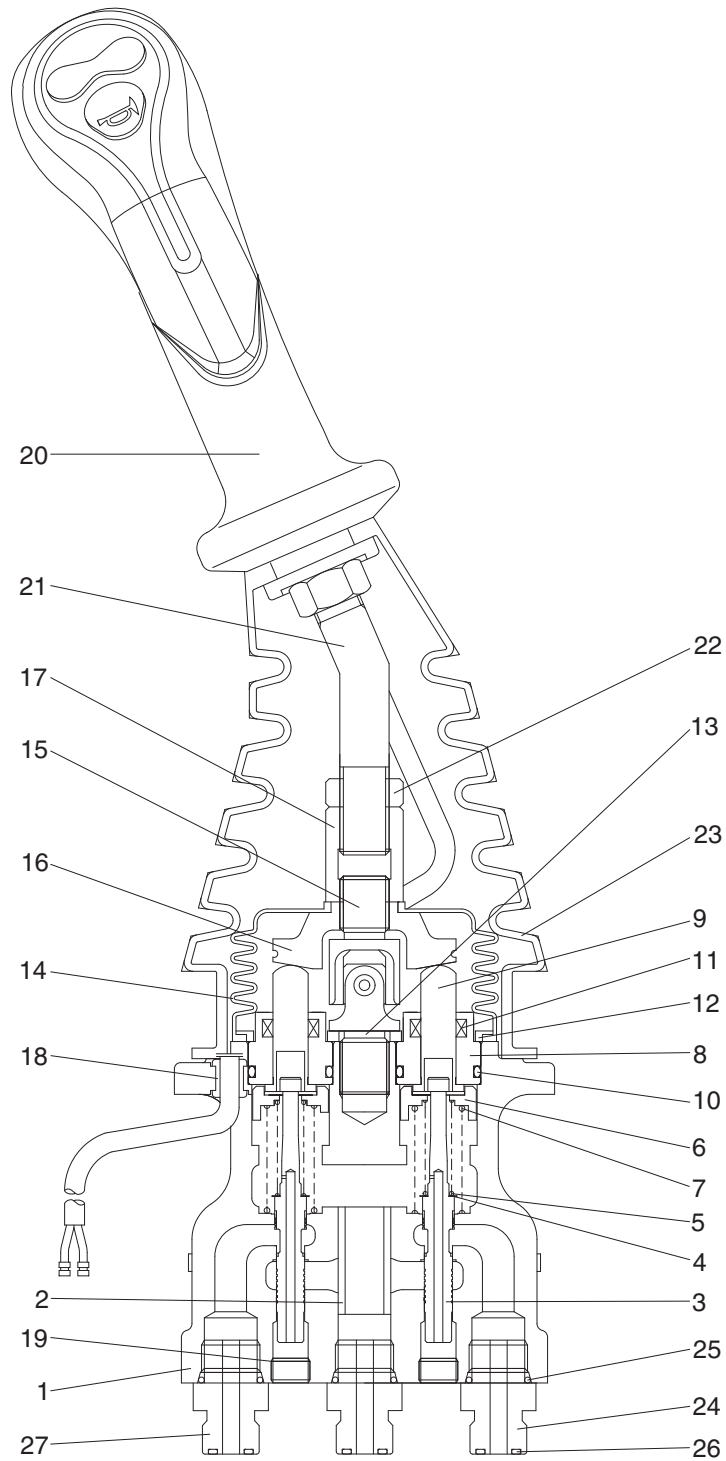


#### 2) INSTALL

- (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



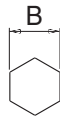
300L2RL06

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



## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

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

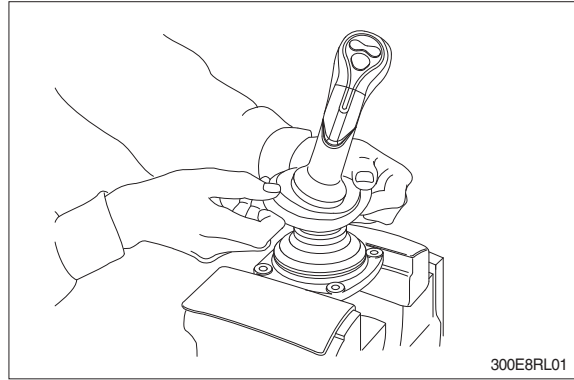
### (2) Tightening torque

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

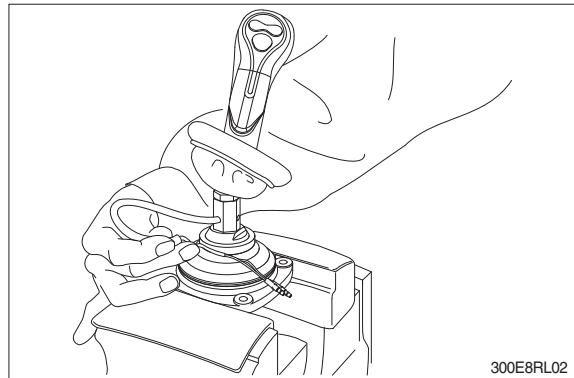
### 3) DISASSEMBLY

※ Procedures are based on the type L1.

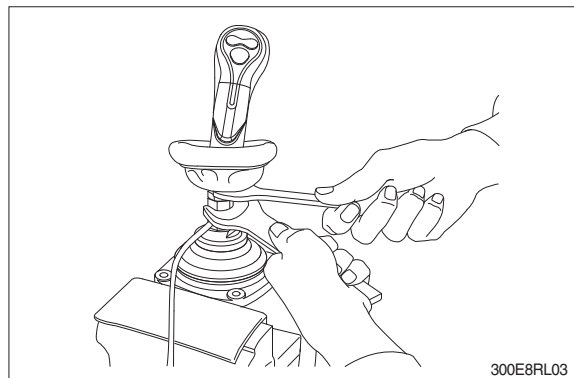
- (1) Clean pilot valve with kerosene.
  - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (23) from case (1) and take it out upwards.



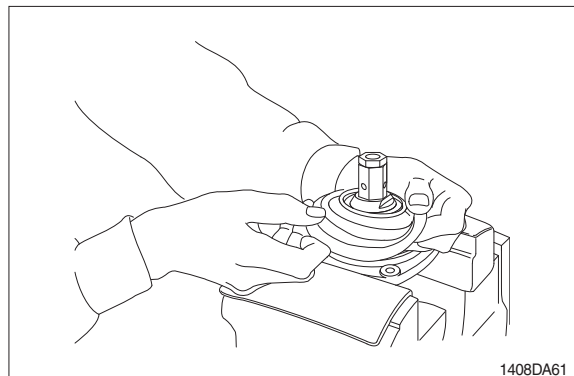
※ For valve with switch, remove cord also through hole of casing.



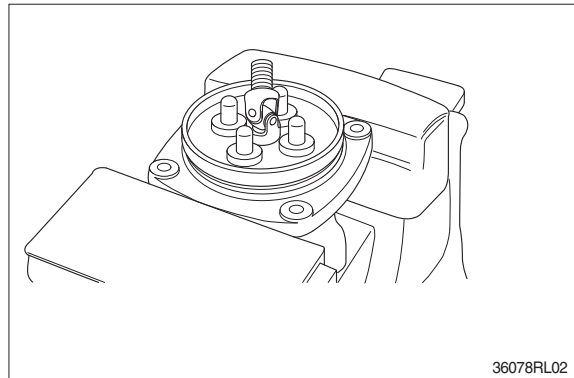
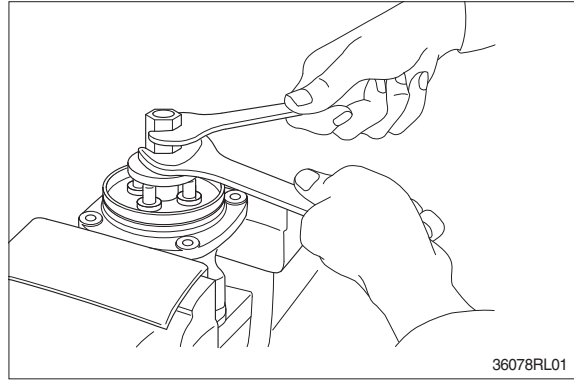
- (4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (14).

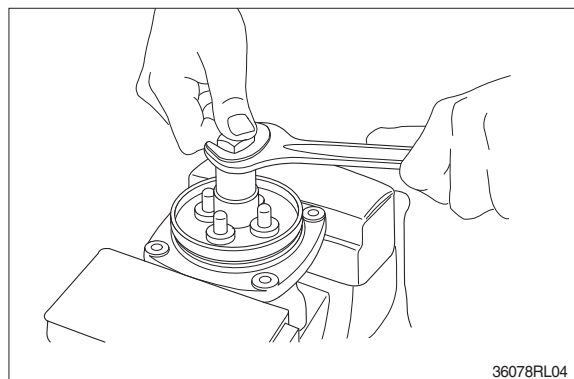
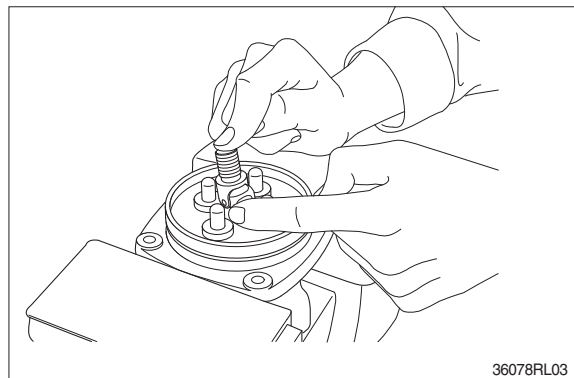


- (6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

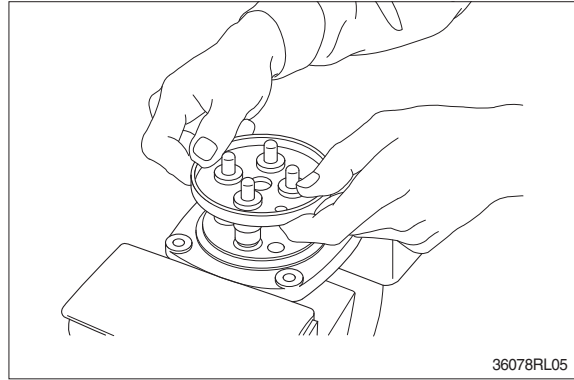


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

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

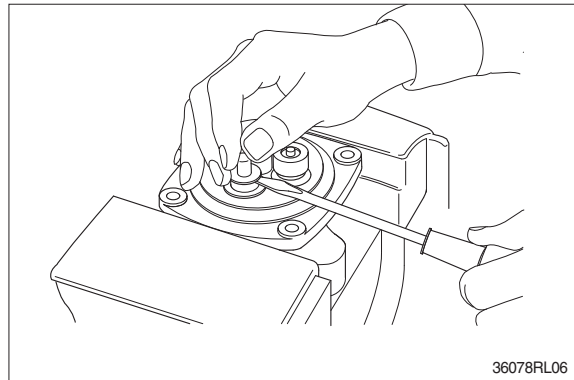


(8) Remove plate (12).



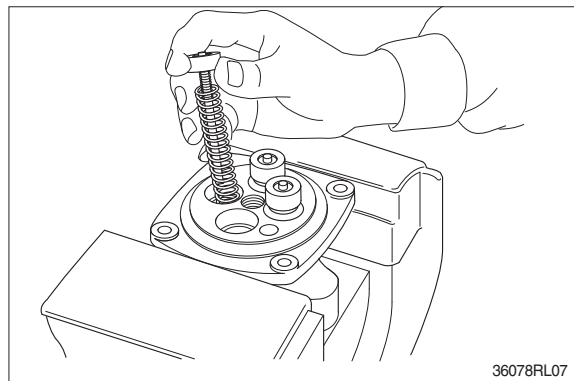
(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

- ※ Take it out with minus screwdriver. Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.
- ※ During taking out, plug may jump up due to return spring (7) force. Pay attention to this.



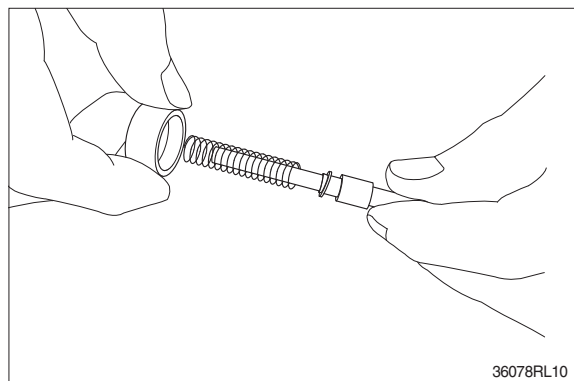
(10) Remove reducing valve subassembly and return spring (7) out of casing.

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

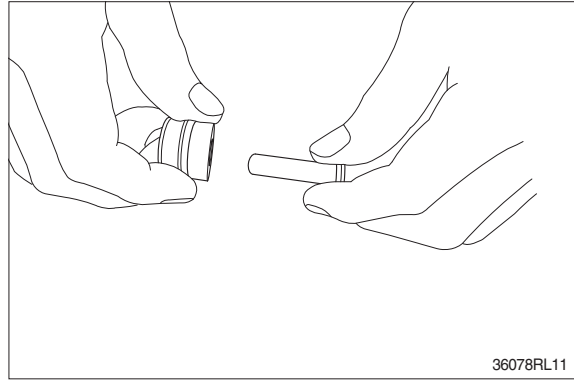


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

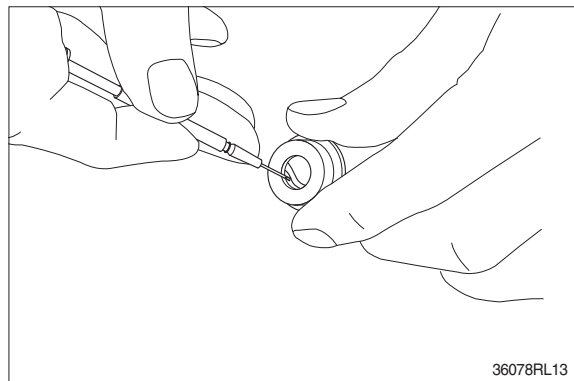
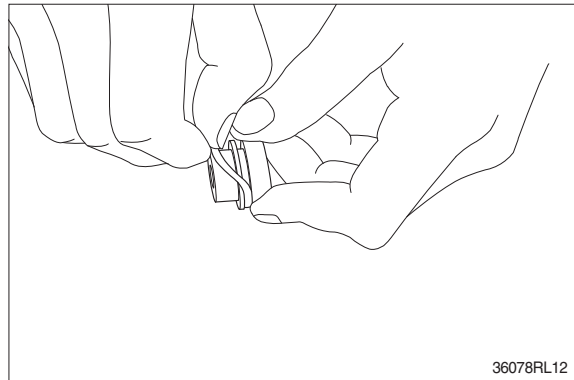
- ※ Pay attention not to damage spool surface.
- ※ Record original position of spring seat (6).
- ※ Until being assembled, they should be handled as one subassembly group.



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

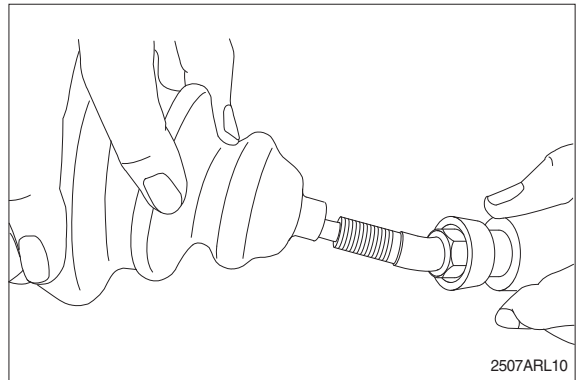
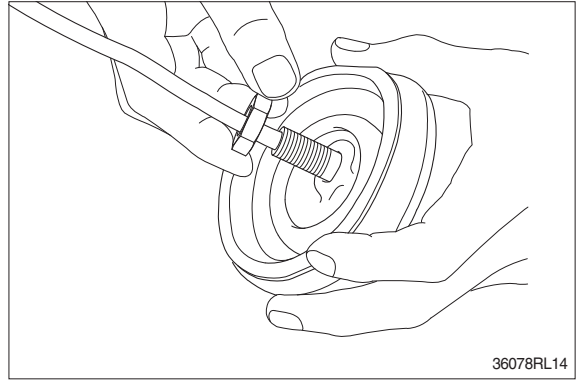


(13) Remove O-ring (10) and seal (11) from plug (8).  
Use small minus screwdriver or so on to remove this seal.





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



### **(15) Cleaning of parts**

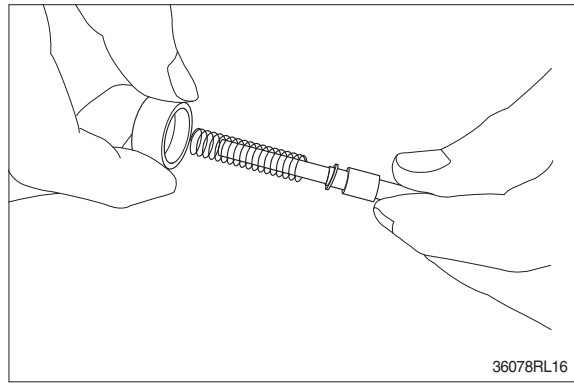
- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
  - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
  - ※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.  
Therefore, control cleanliness of kerosene fully.
- ② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).
  - ※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

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

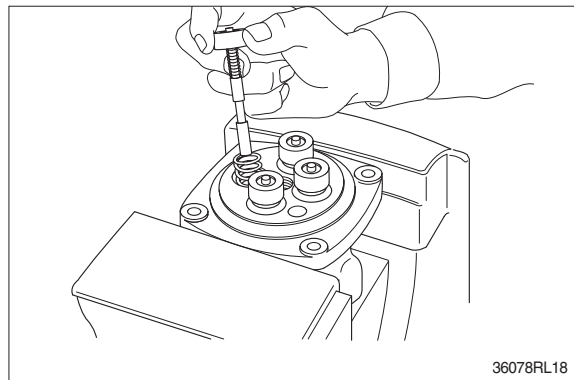
- Apply rust-preventives to all parts.
- ※ If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

#### 4) ASSEMBLY

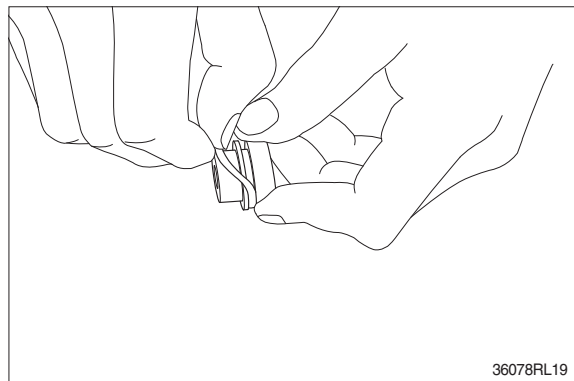
- (1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



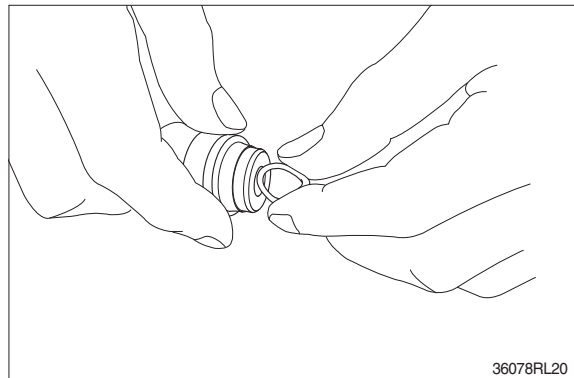
- (2) Assemble spring (7) into casing (1).  
Assemble reducing valve subassembly into casing.  
※ Assemble them to their original positions.



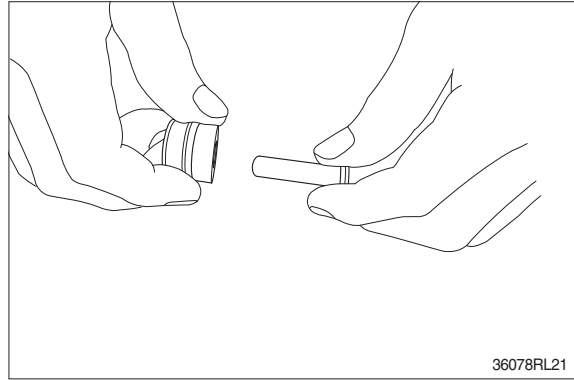
- (3) Assemble O-ring (10) onto plug (8).



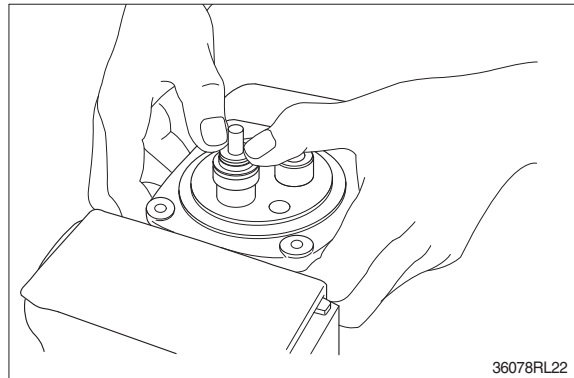
- (4) Assemble seal (11) to plug (8).  
※ Assemble seal in such lip direction as shown below.



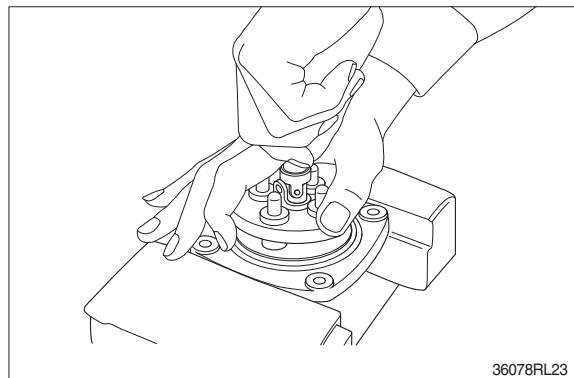
- (5) Assemble push rod (9) to plug (8).  
※ Apply working oil on push-rod surface.



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

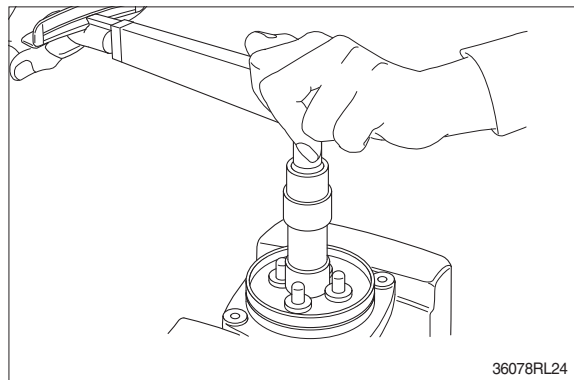


- (7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



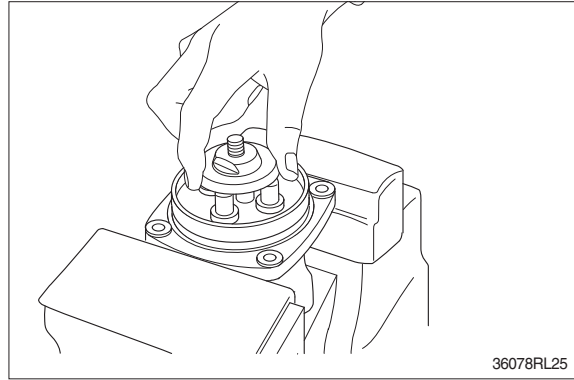
- (8) Fit plate (12).

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



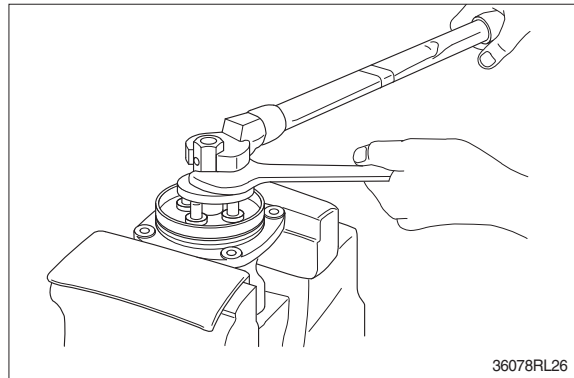
(10) Assemble swash plate (16) to joint (15).

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

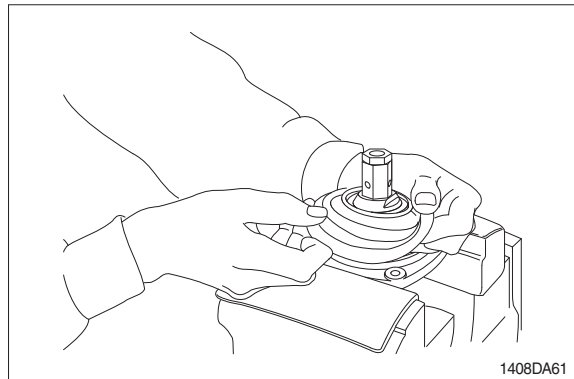


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

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

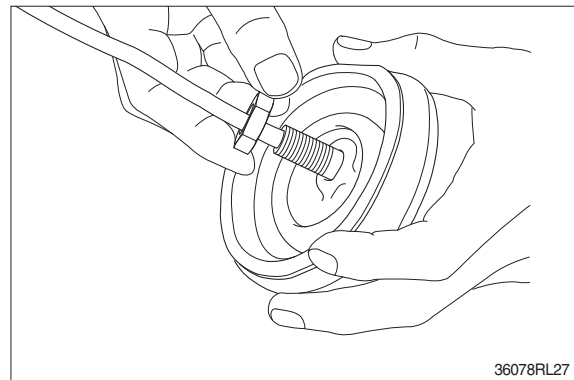
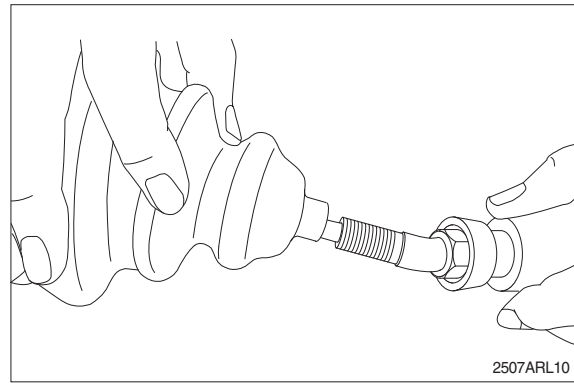


(12) Fit boot (14) to plate.

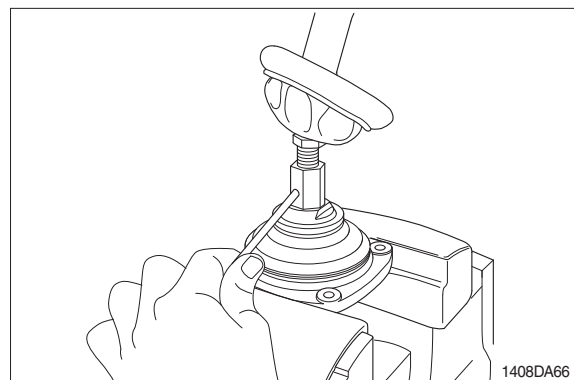




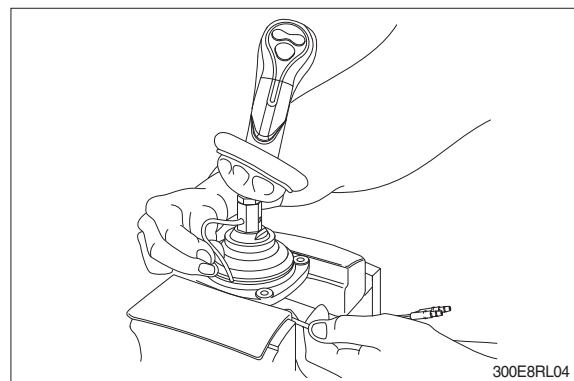
(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



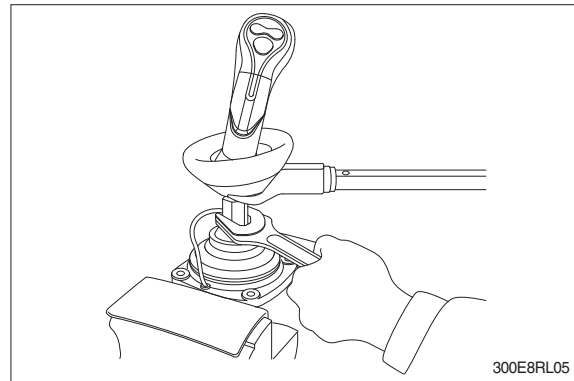
(14) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



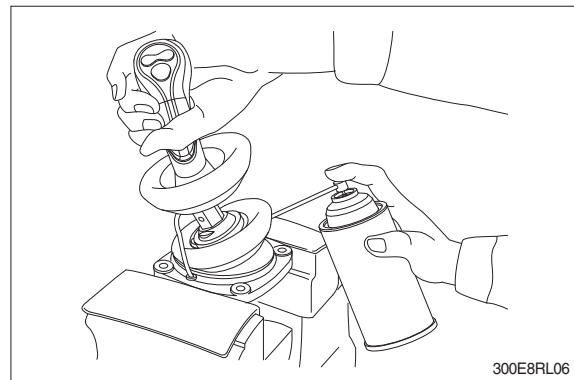
(15) Assemble bushing (18) to plate and pass cord and tube through it.  
※ Provide margin necessary to operation.



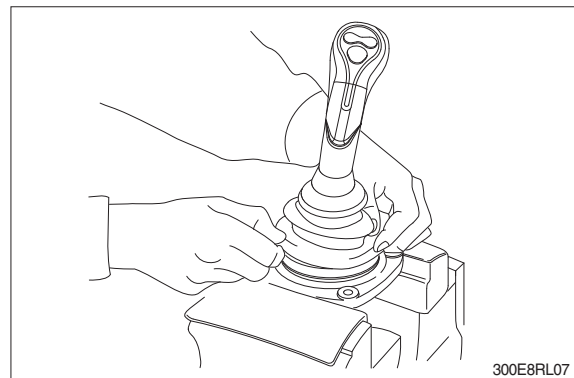
(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



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



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



## GROUP 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.**

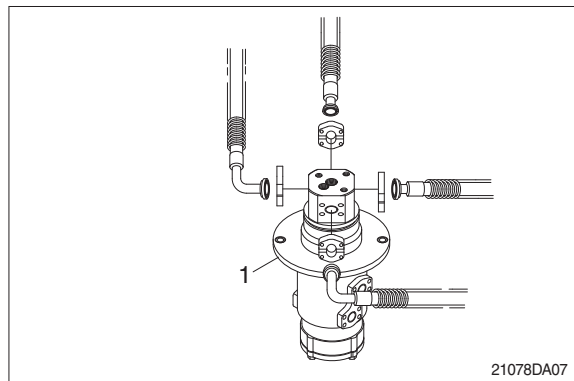
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

Weight : 55 kg (120 lb)

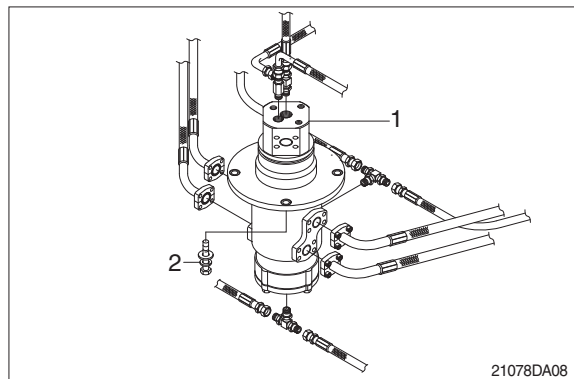
Tightening torque :  $12.3 \pm 1.3$  kgf · m  
( $89 \pm 9.4$  lbf · ft)

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



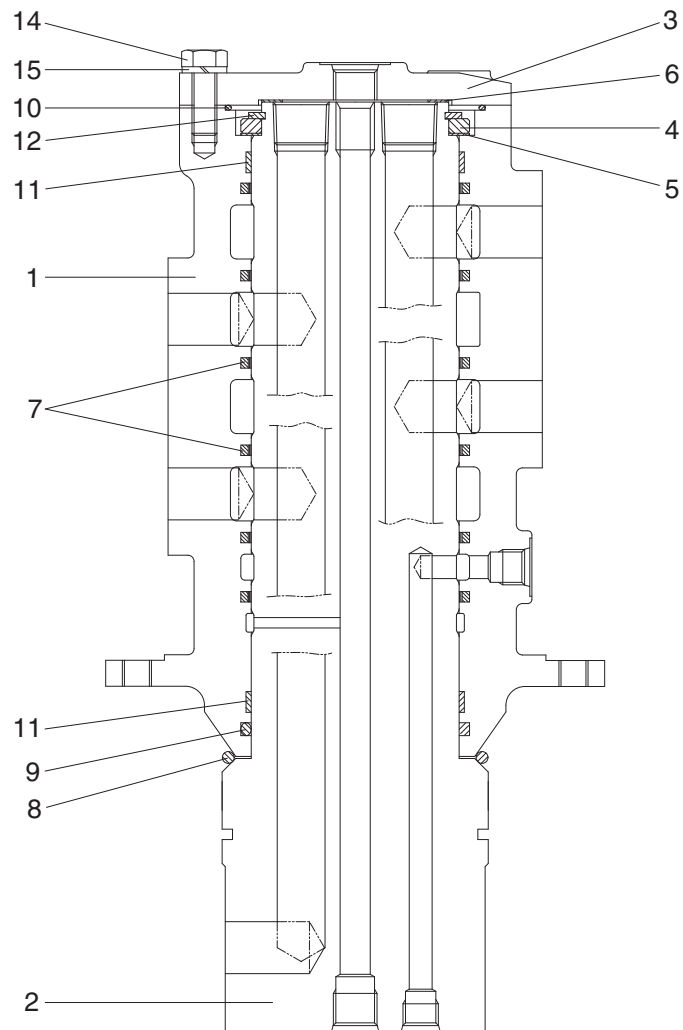
#### 2) INSTALL

- (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



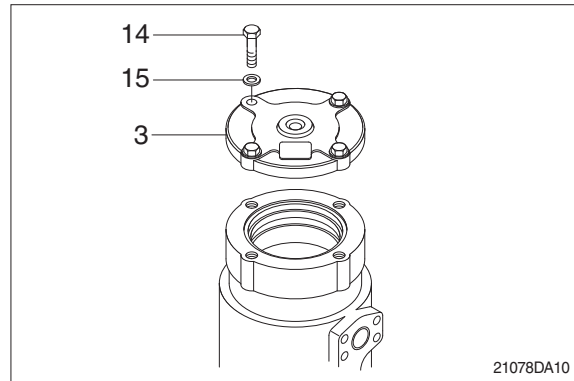
21098TJ01

- |   |        |    |              |    |               |
|---|--------|----|--------------|----|---------------|
| 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

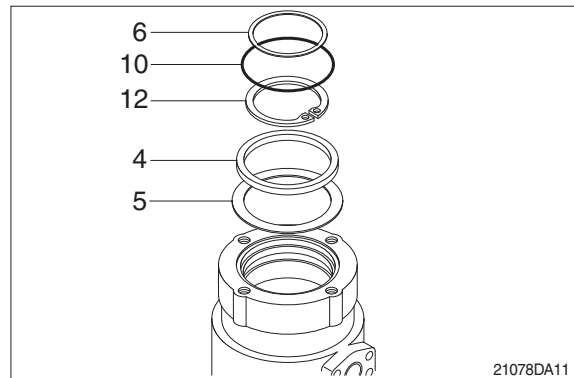
※ Before the disassembly, clean the turning joint.

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



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

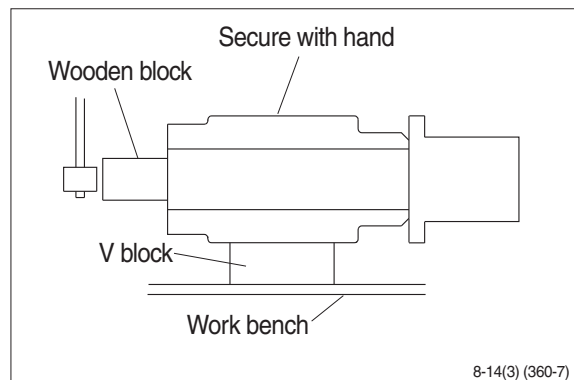
- (3) Remove retainer ring (12), spacer (4) and shim (5).



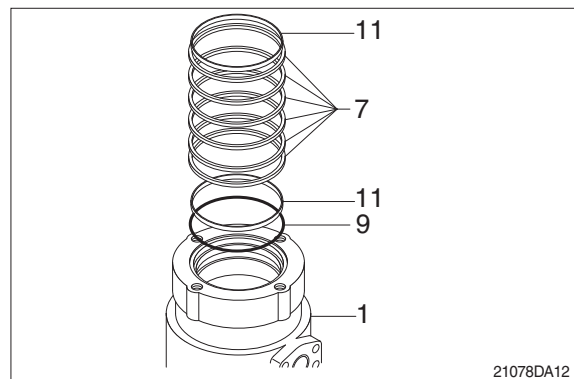
- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).



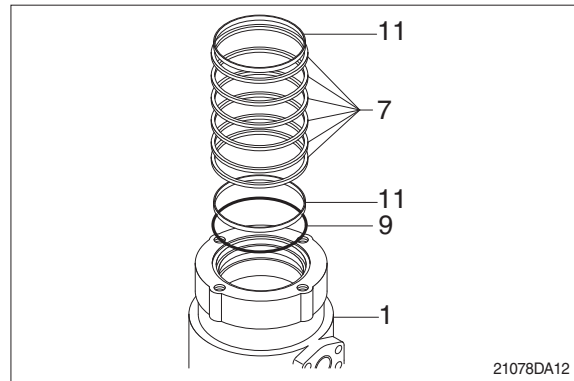


### 3) ASSEMBLY

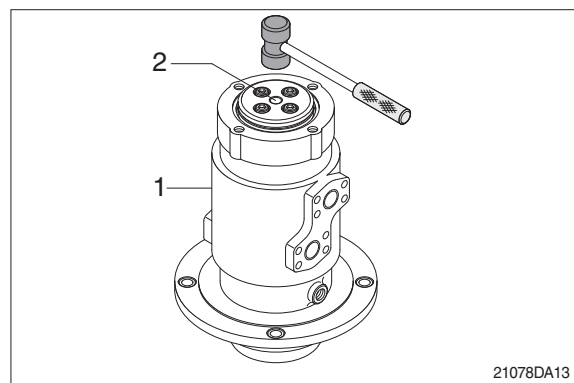
- ※ Clean all parts.
- ※ As a general rule, replace oil seals and O-ring.
- ※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(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).



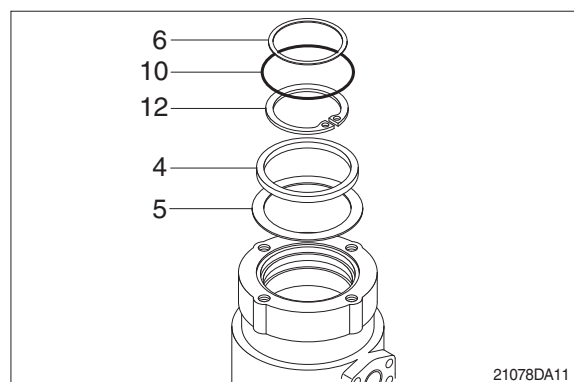
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



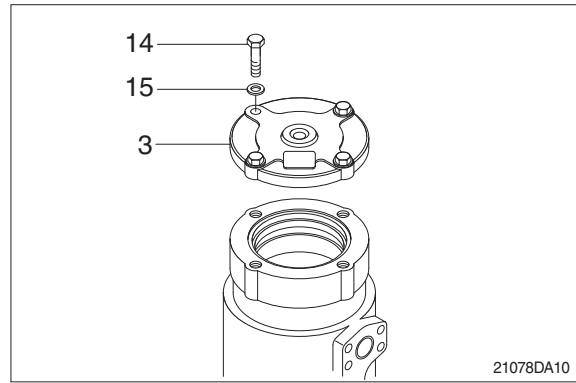
(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(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

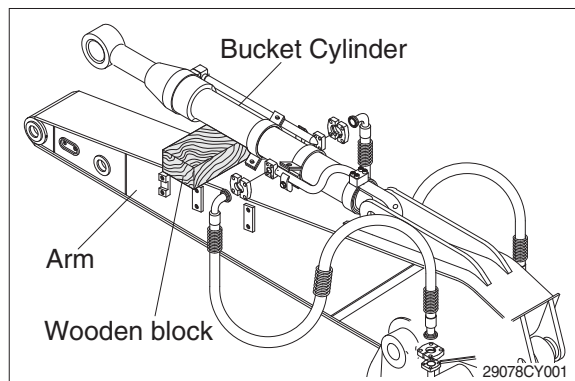
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.**

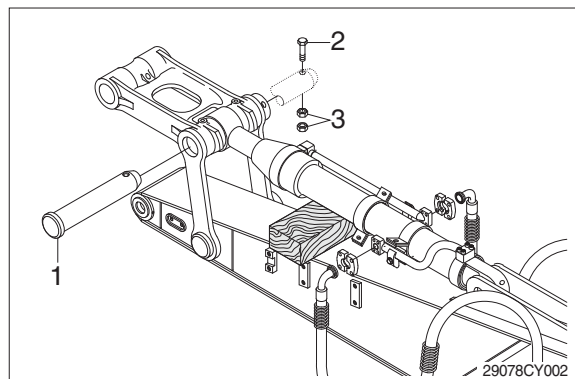
※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

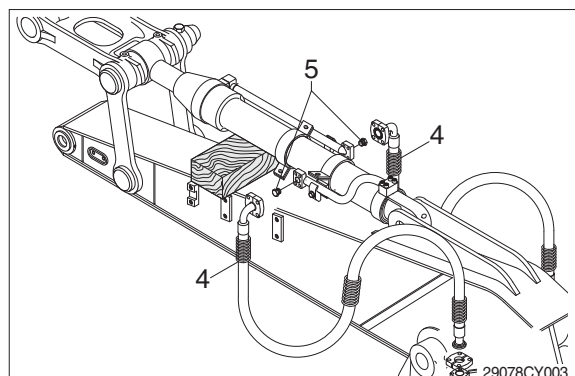


② Remove bolt (2), nut (3) and pull out pin (1).

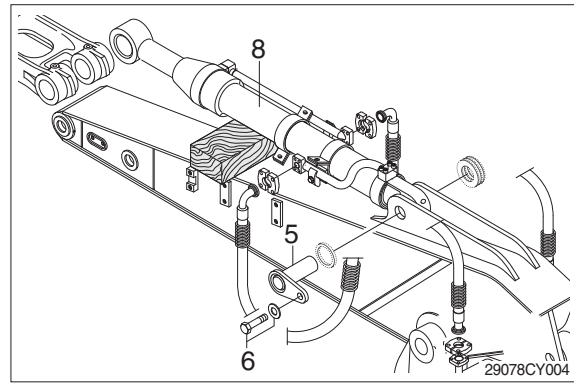
※ Tie the rod with wire to prevent it from coming out.



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 : 270 kg (600 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

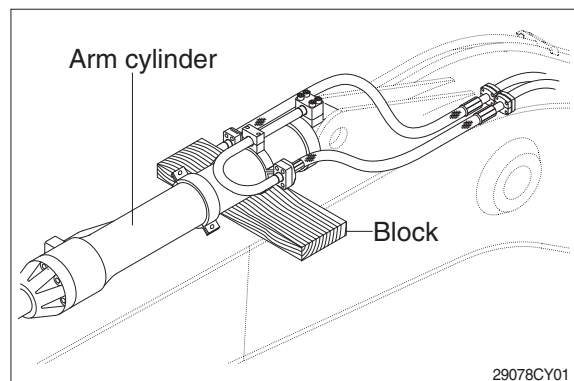
### (1) Removal

- ※ 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.**

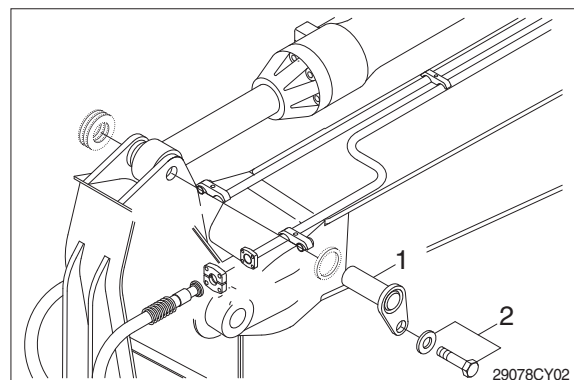
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



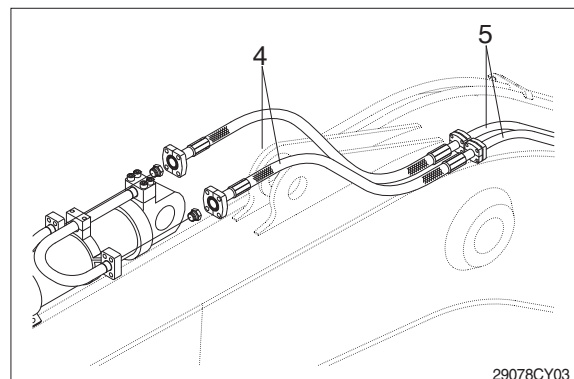
② Remove bolt (2) and pull out pin (1).

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



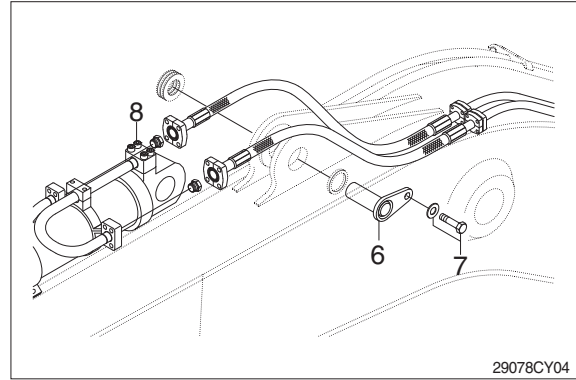
③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

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 : 380 kg (840 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

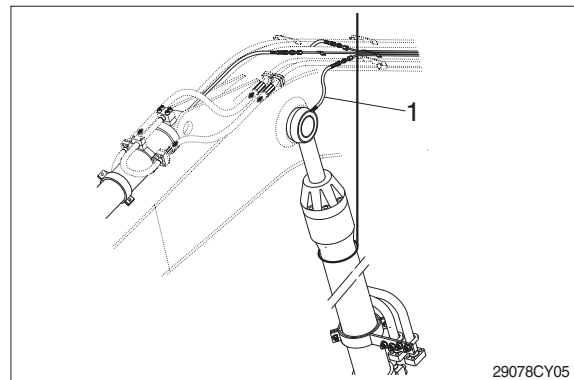
#### (1) Removal

- ※ 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.

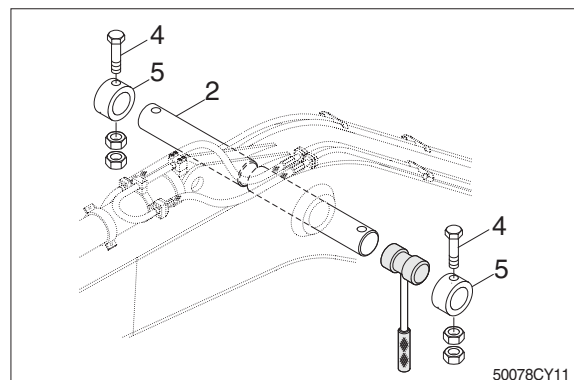
**▲ Loosen the breather slowly to release the pressure inside the hydraulic tank.**

- ※ 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.

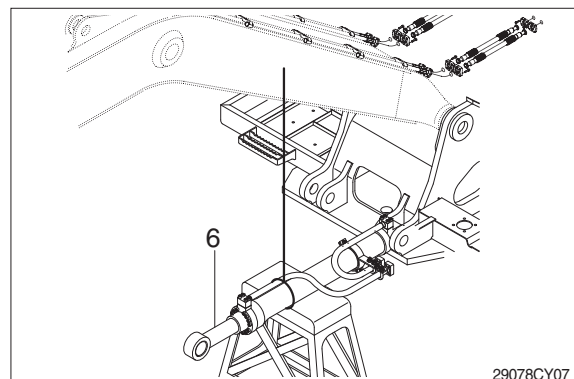
- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.



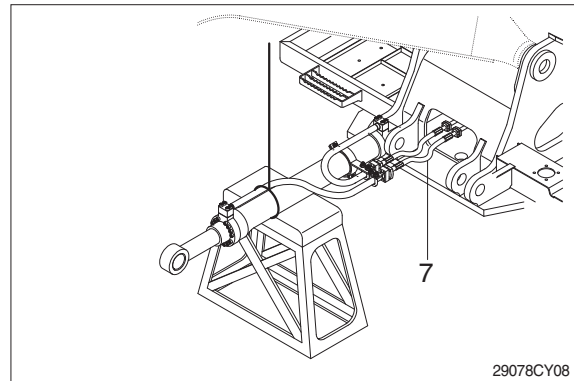
- ③ Remove bolt (4), pin stopper (5) and pull out pin (2).
- ※ Tie the rod with wire to prevent it from coming out.



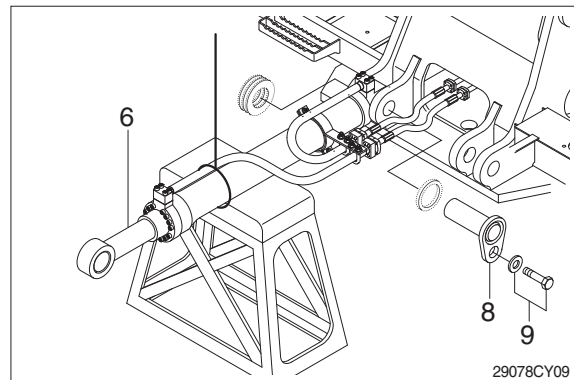
- ④ Lower the boom cylinder assembly (6) on a stand.



- 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)



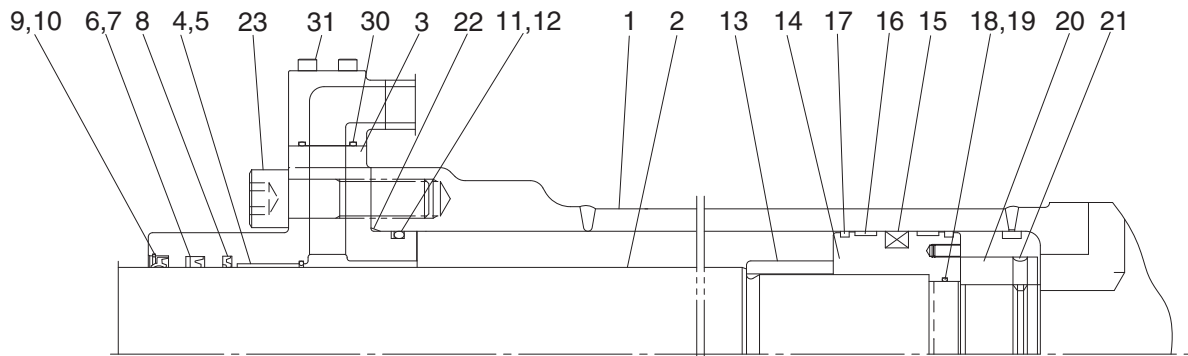
## (2) Install

- 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.

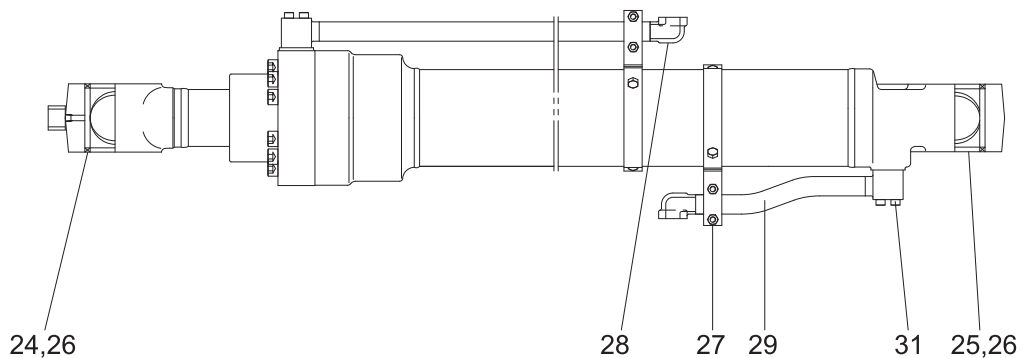
## 2. DISASSEMBLY AND ASSEMBLY

### 1) STRUCTURE

#### (1) Bucket cylinder



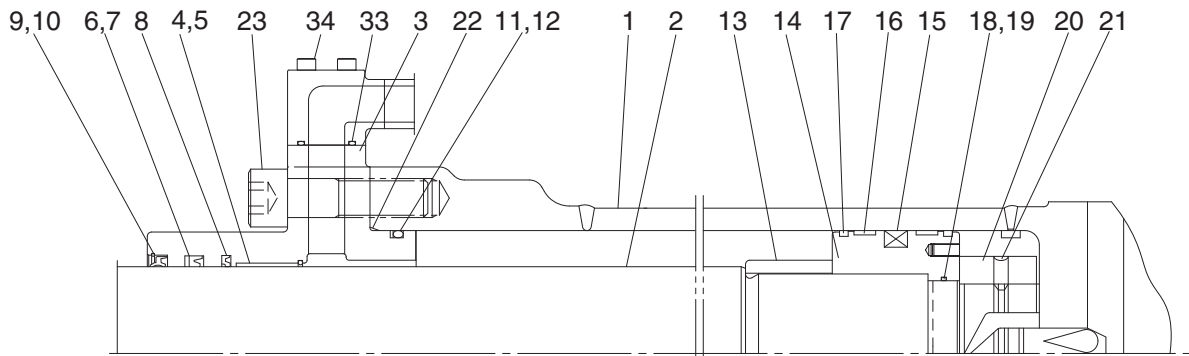
Internal detail



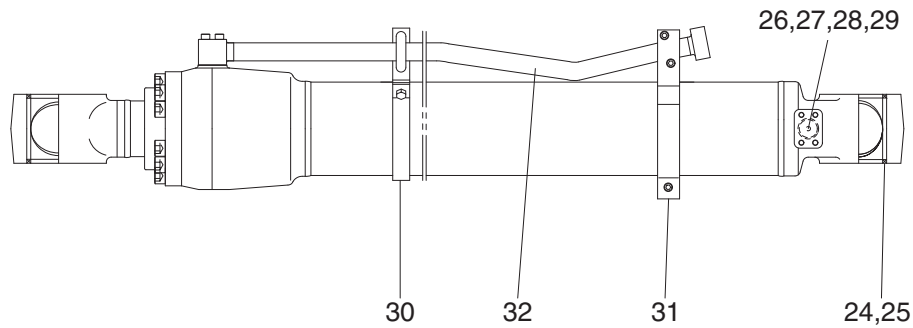
32098BK01

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

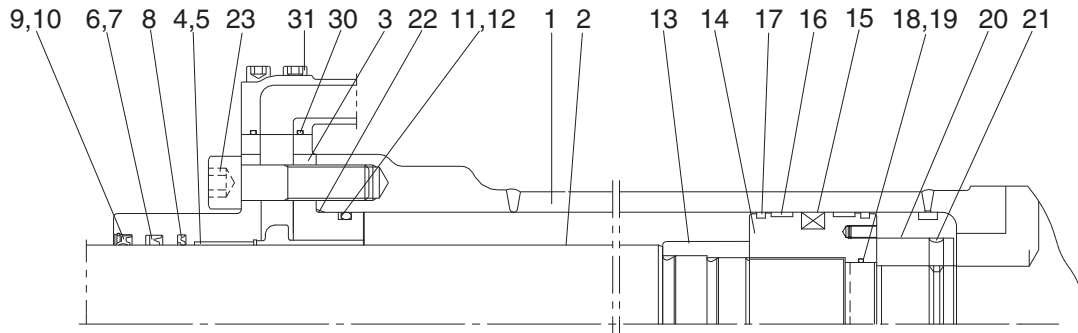


32098AM01

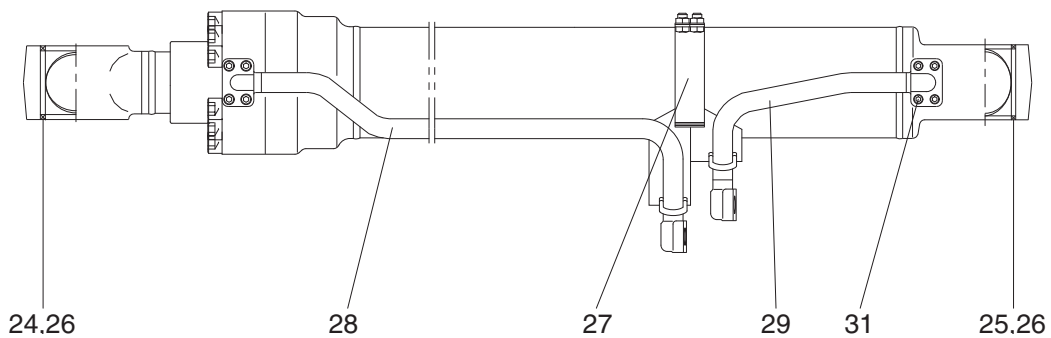
1	Tube assembly	13	Cushion ring	25	Dust seal
2	Rod assembly	14	Piston	26	Check valve
3	Gland	15	Piston seal	27	Coil spring
4	DD2 bushing	16	Wear ring	28	O-ring
5	Snap ring	17	Dust ring	29	Plug
6	Rod seal	18	O-ring	30	Band assembly
7	Back up ring	19	Back up ring	31	Band assembly
8	Buffer ring	20	Lock 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

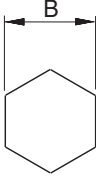


330F8BO01

- |    |               |    |                          |    |                          |
|----|---------------|----|--------------------------|----|--------------------------|
| 1  | Tube assembly | 12 | Back up ring             | 23 | Hexagon socket head bolt |
| 2  | Rod assembly  | 13 | Cushion ring             | 24 | Pin bushing              |
| 3  | Gland         | 14 | Piston                   | 25 | Pin bushing              |
| 4  | DD2 bushing   | 15 | Piston seal              | 26 | Dust seal                |
| 5  | Snap ring     | 16 | Wear ring                | 27 | Band assembly            |
| 6  | Rod seal      | 17 | Dust ring                | 28 | Pipe assembly            |
| 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) 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	M20	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	31	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

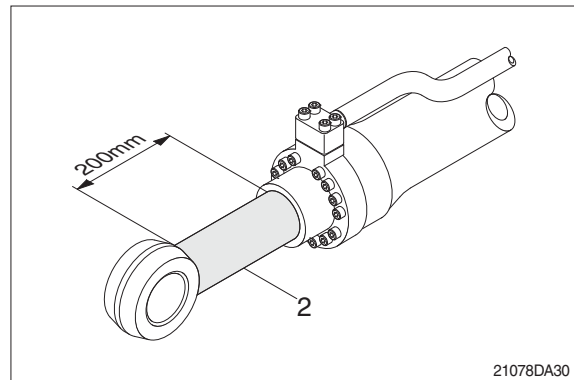
#### (1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

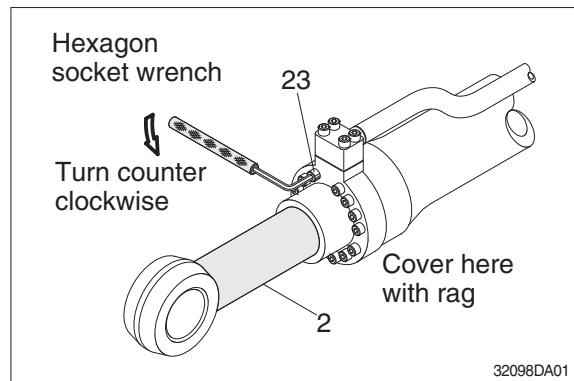
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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.



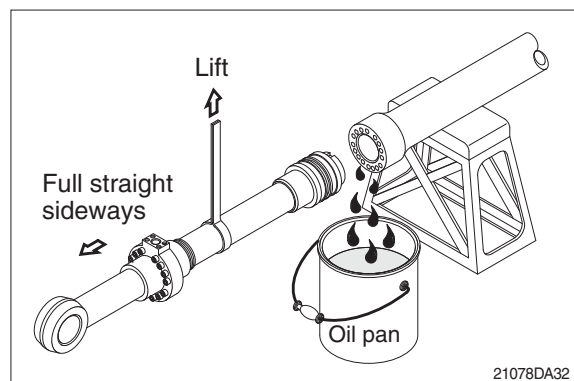
③ Loosen and remove socket bolts (23) of the gland in sequence.

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



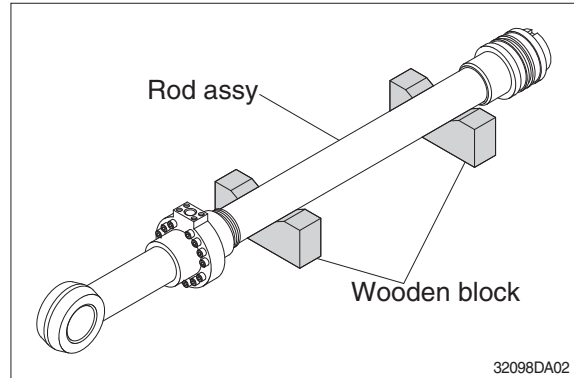
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ 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.



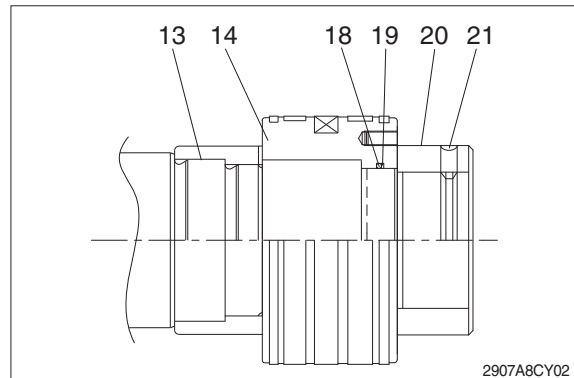
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

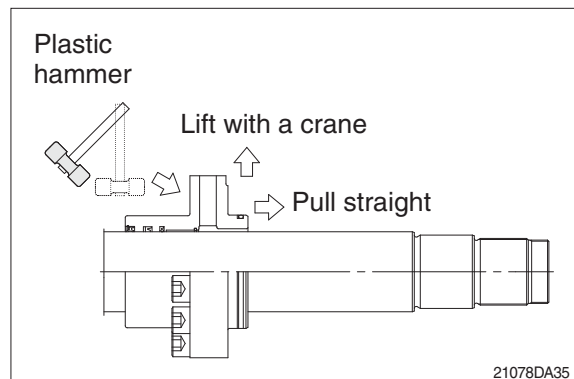


## (2) Remove piston and cylinder head

- ① Loosen sochet 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).

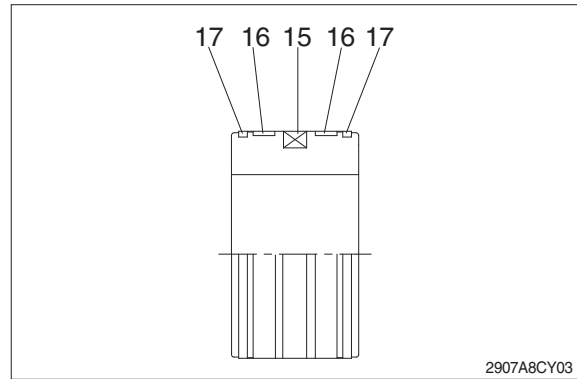


- ③ Remove the cylinder head assembly from rod assembly (2).
  - ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
  - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of rod bushing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



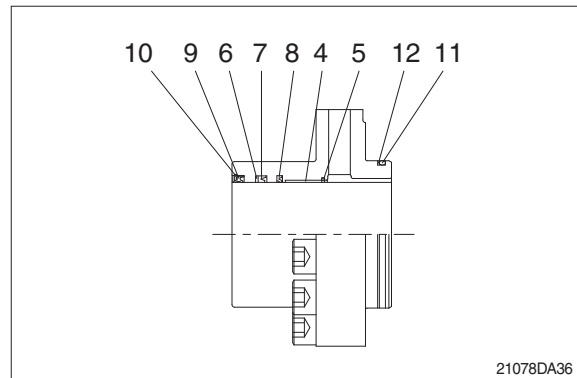
### (3) Disassemble the piston assembly

- 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.



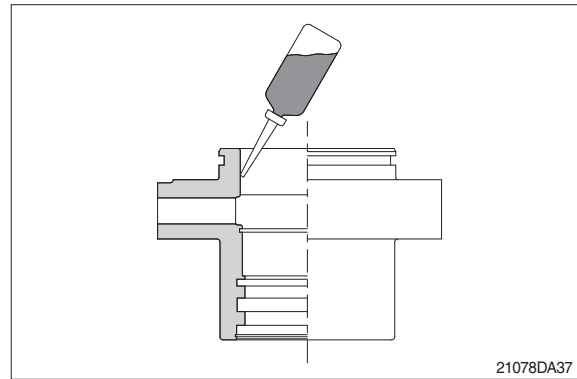


### 3) ASSEMBLY

#### (1) Assemble cylinder head assembly

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

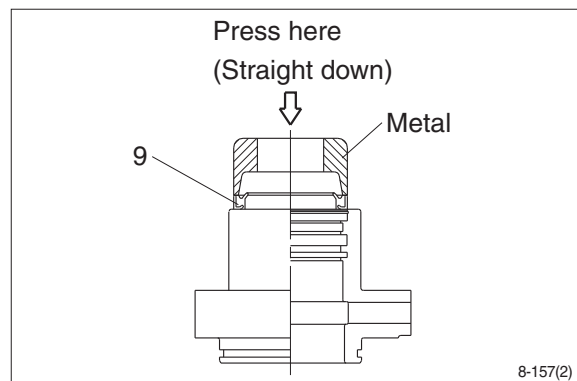
- ① Coat the inner face of gland (3) with hydraulic oil.



- 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.

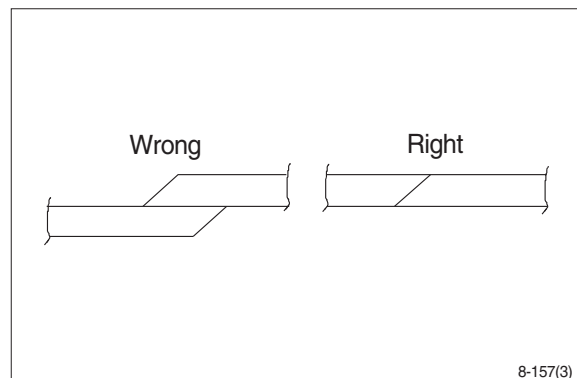
- ③ Fit snap ring (10) to the stop face.



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

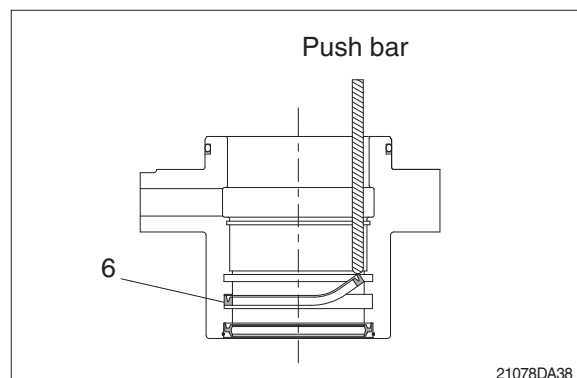
※ Coat each packing with hydraulic oil before fitting it.

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

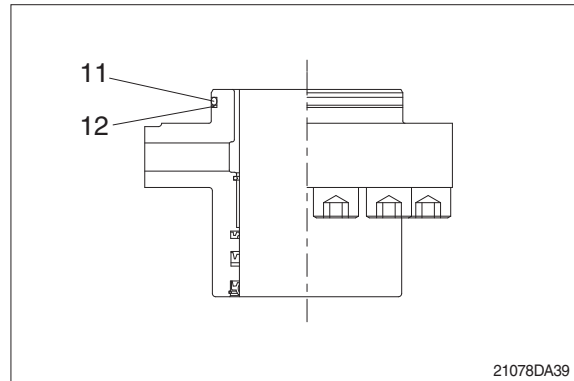


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

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

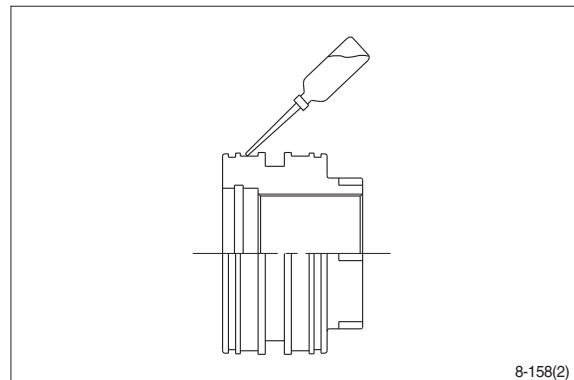


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) to gland (3).

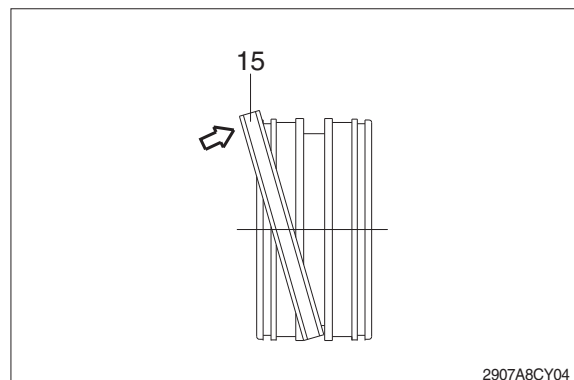


**(2) Assemble piston assembly**

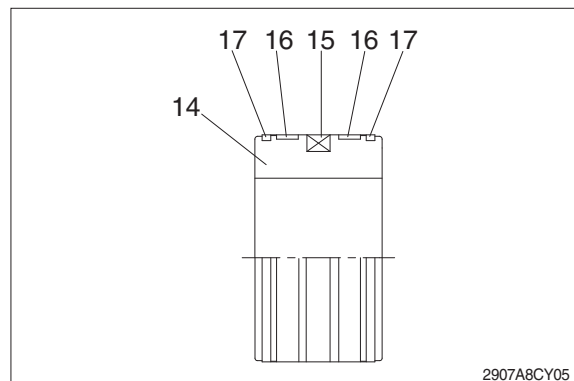
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- 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.

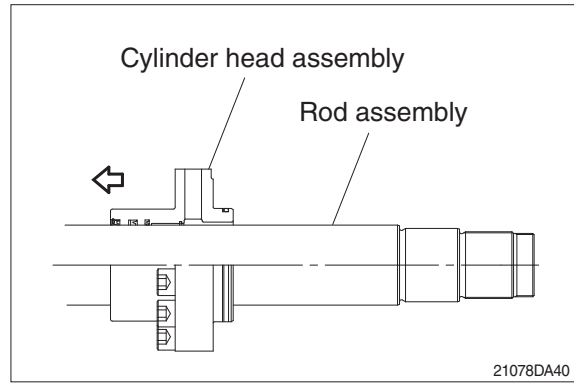


- ③ Fit wear ring (16) and dust ring (17) to piston (14).

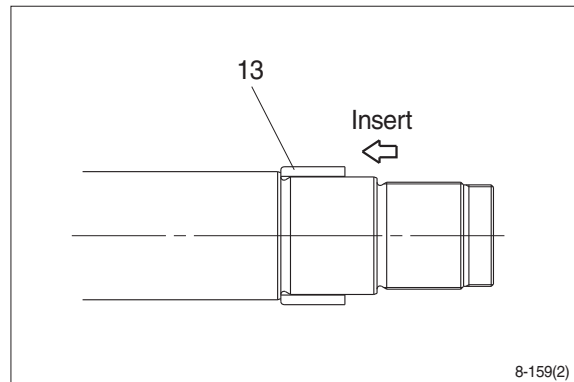


**(3) Install piston and cylinder head**

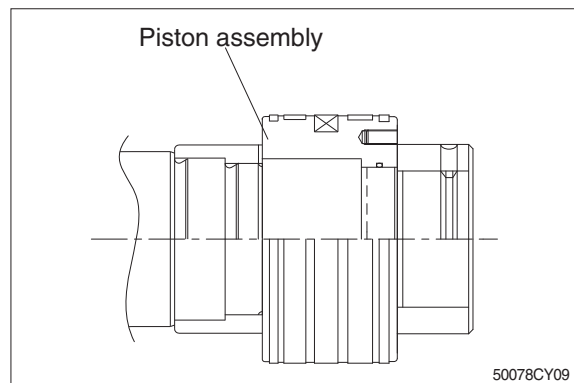
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.



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

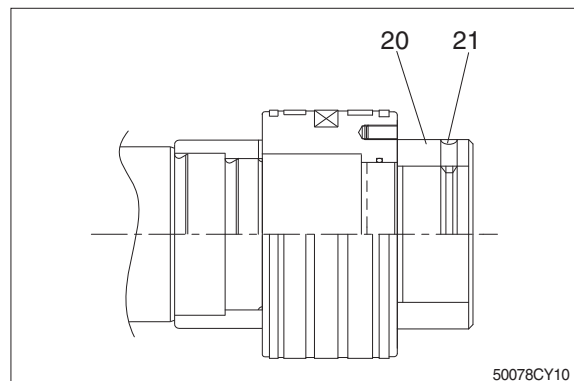


- ⑤ Fit piston assembly to rod assembly.
- Tightening torque :  $150 \pm 15.0 \text{ kgf} \cdot \text{m}$   
( $1085 \pm 108 \text{ lbf} \cdot \text{ft}$ )



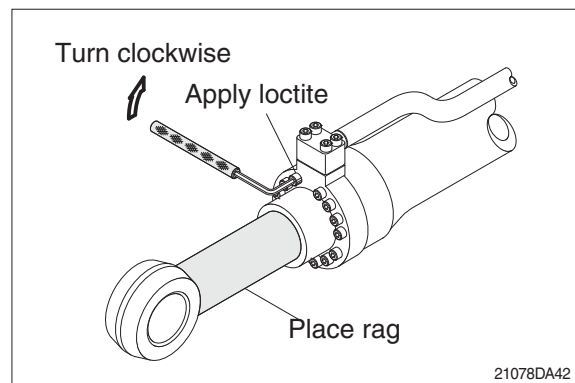
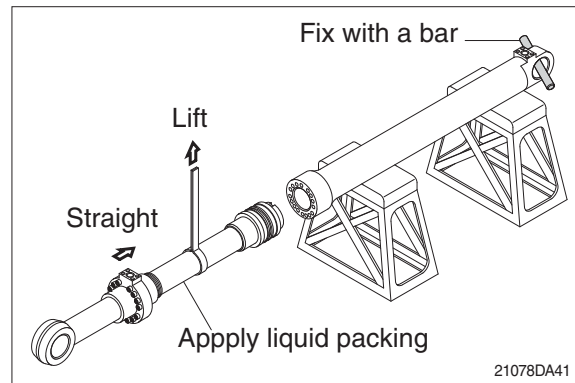
- ⑥ Fit lock nut (20) and tighten the set screw (21).
- Tightening torque :

Item		kgf · m	lbf · ft
Bucket	20	$100 \pm 10$	$723.3 \pm 72.3$
	21	$5.4 \pm 0.5$	$39.1 \pm 3.6$
Arm	20	$150 \pm 15$	$1085 \pm 108$
	21	$5.4 \pm 0.5$	$39.1 \pm 3.6$



### (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.

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

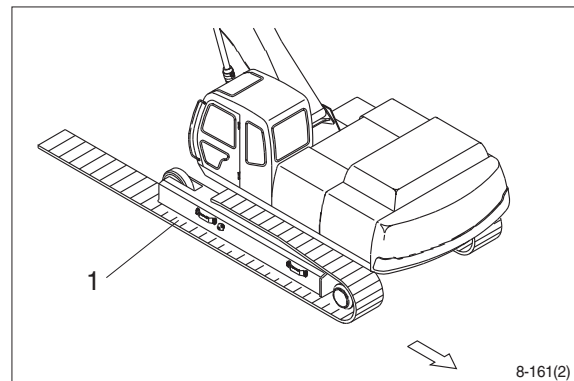
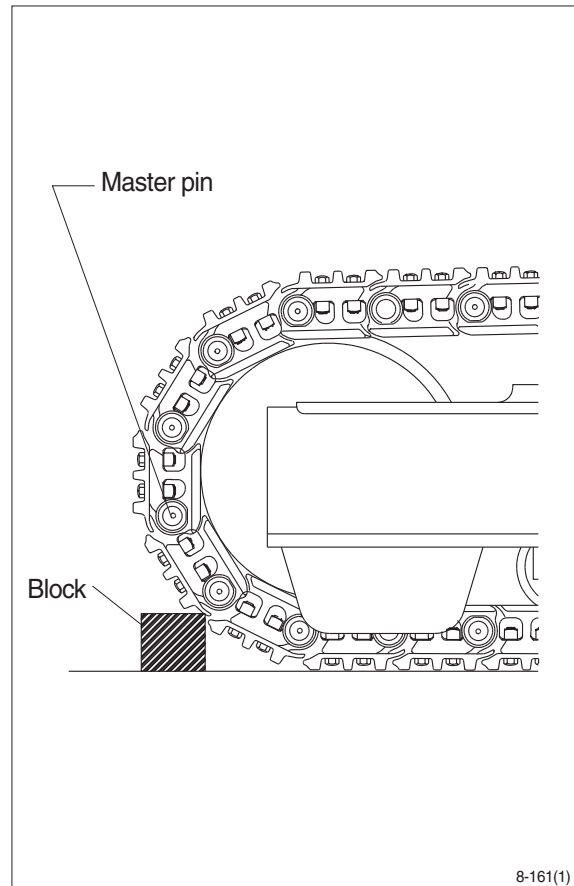
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

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

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

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

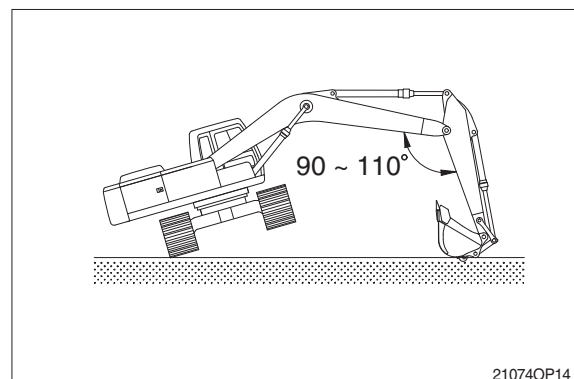
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



#### 2) INSTALL

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

※ Adjust the tension of the track link.

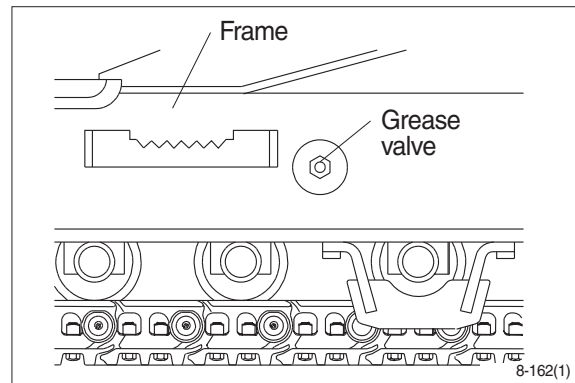




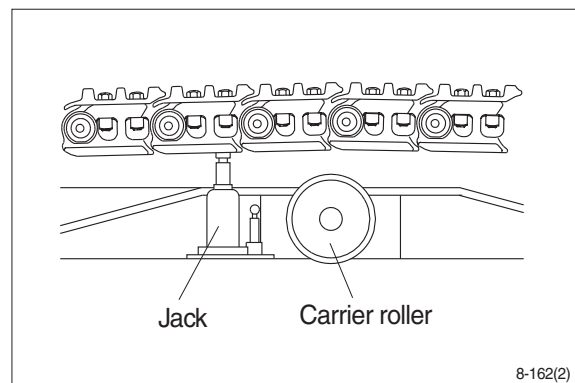
## 2. CARRIER ROLLER

### 1) REMOVAL

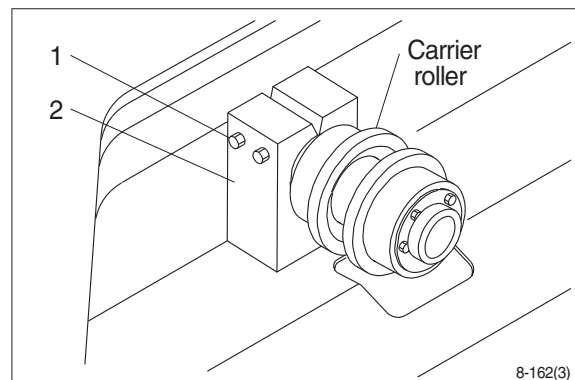
- (1) Loosen tension of the track link.



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



- (3) Loosen the lock nut (1).
- (4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.
  - Weight : 40 kg (88 lb)



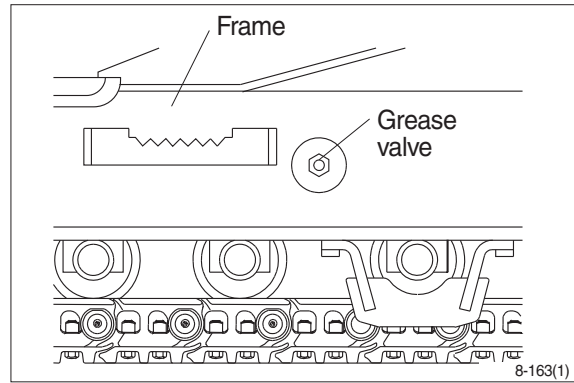
### 2) INSTALL

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

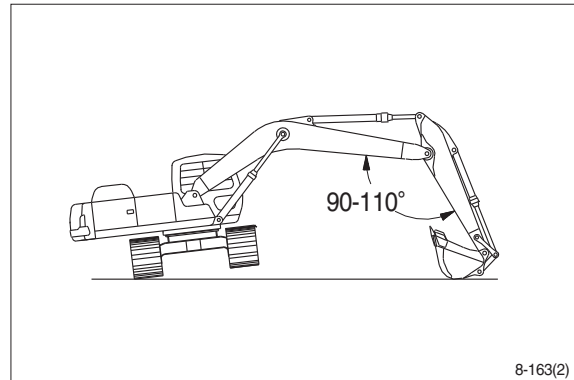
### 3. TRACK ROLLER

#### 1) REMOVAL

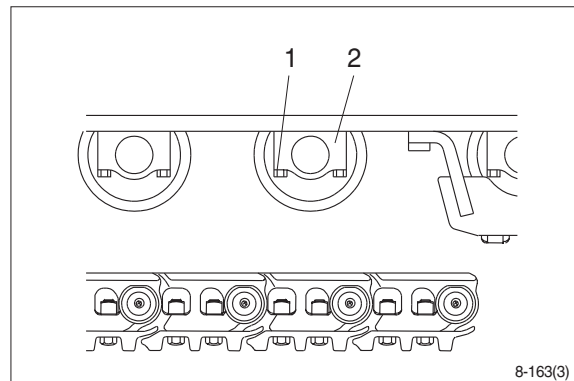
- (1) Loosen tension of the track link.



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



- (3) Remove the mounting bolt (1) and draw out the track roller (2).  
· Weight : 60 kg (130 lb)



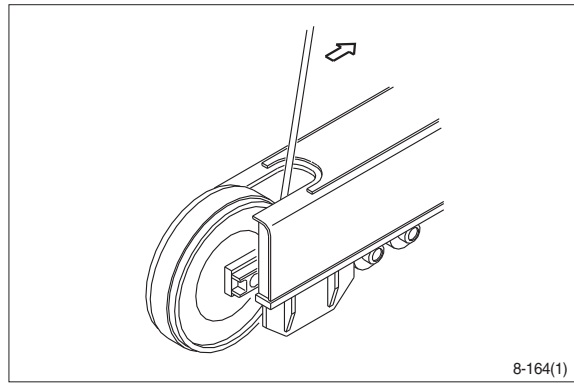
#### 2) INSTALL

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

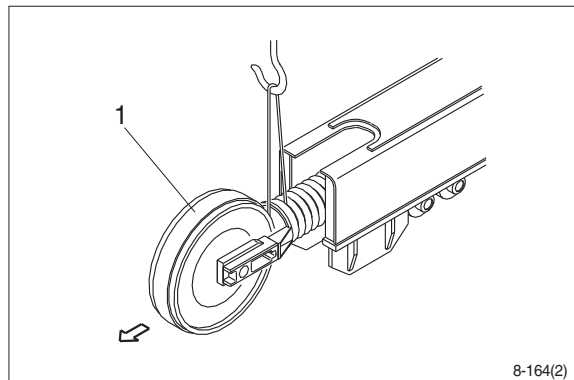
## 4. IDLER AND RECOIL SPRING

### 1) REMOVAL

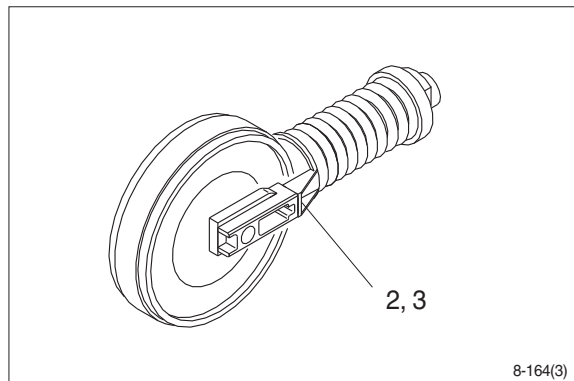
- (1) Remove the track link.  
For detail, see **removal of track link**.



- (2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.  
· Weight : 475 kg (1020 lb)

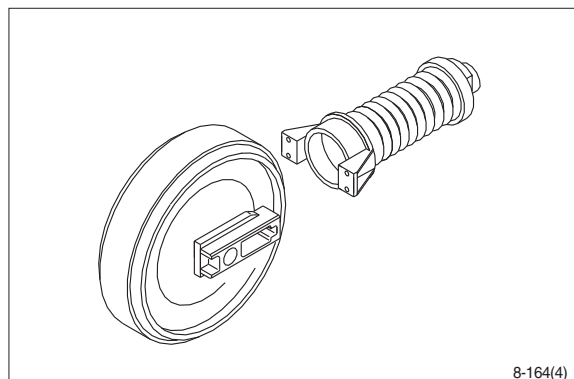


- (3) Remove the bolts (2), washers (3) and separate idler from recoil spring.



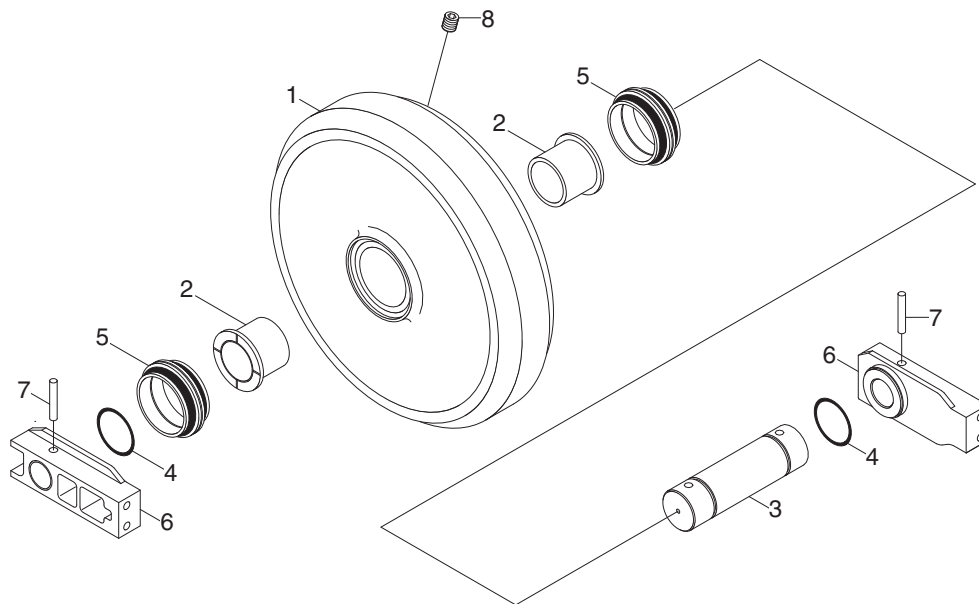
### 2) INSTALL

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



### 3) DISASSEMBLY AND ASSEMBLY OF IDLER

#### (1) Structure

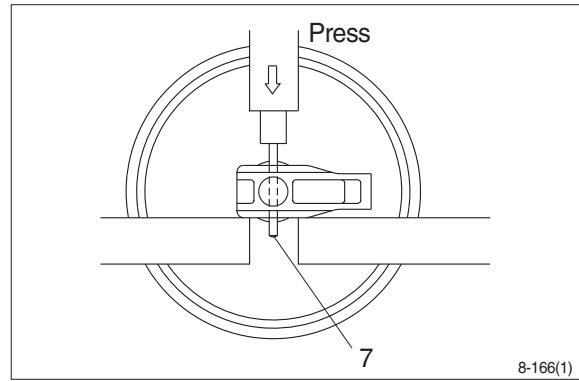


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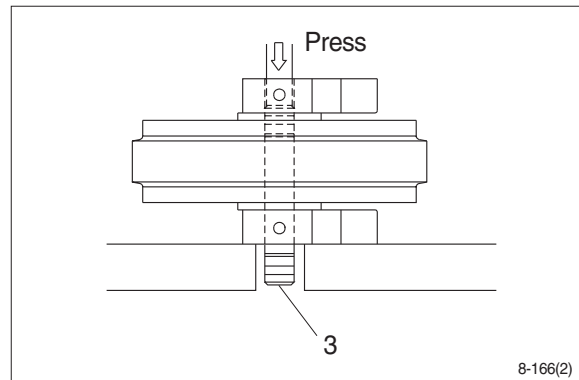
- |   |         |   |               |   |            |
|---|---------|---|---------------|---|------------|
| 1 | Shell   | 4 | O-ring        | 7 | Spring pin |
| 2 | Bushing | 5 | Seal assembly | 8 | Plug       |
| 3 | Shaft   | 6 | Bracket       |   |            |

## (2) Disassembly

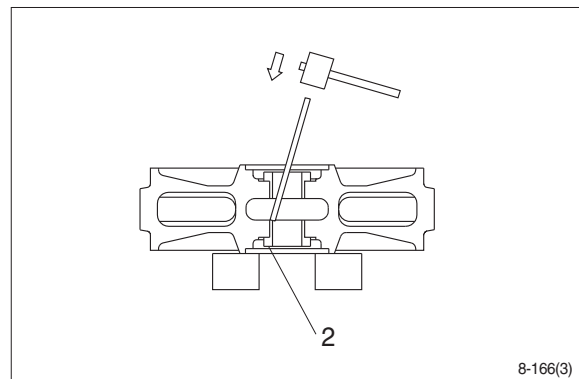
- ① Remove plug and drain oil.
- ② Draw out the spring pin (7), using a press.



- ③ Pull out the shaft (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.

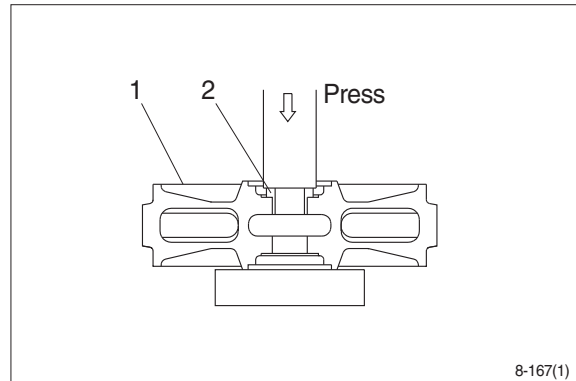


### (3) Assembly

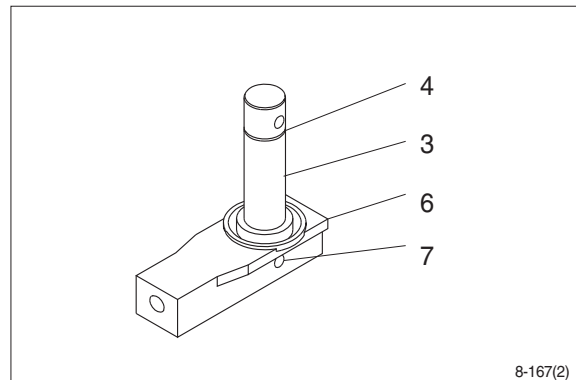
- ※ Before assembly, clean the parts.
- ※ Coat the sliding surfaces of all parts with oil.

- ① Cool up bushing (2) fully by some dry ice and press it into shell (1).

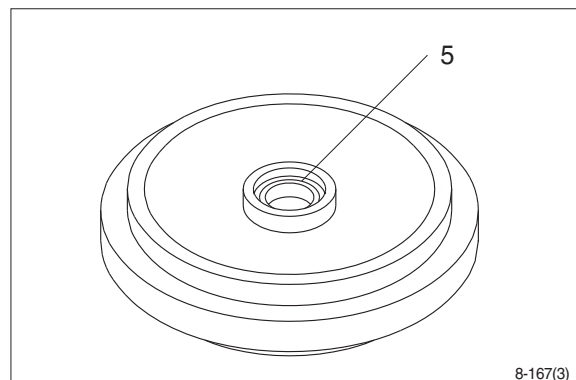
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



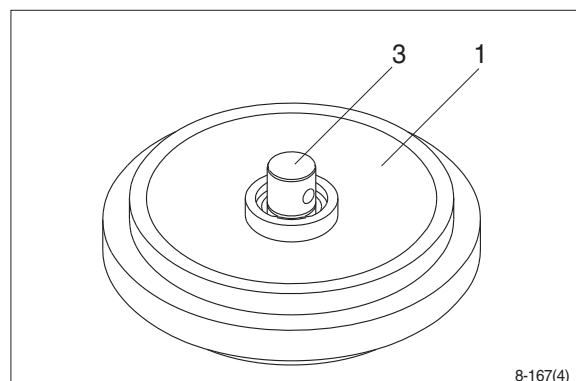
- ② Coat O-ring (4) with grease thinly, and install it to shaft (3).
- ③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



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

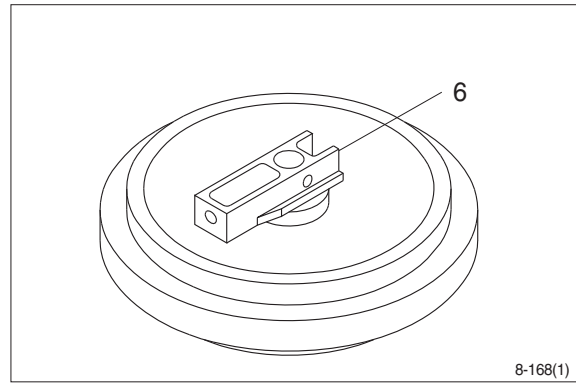


- ⑤ Install shaft (3) to shell (1).

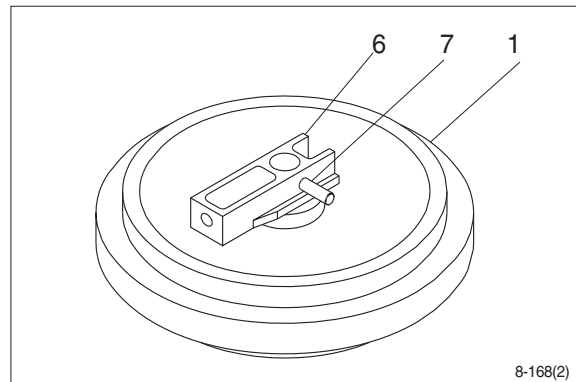




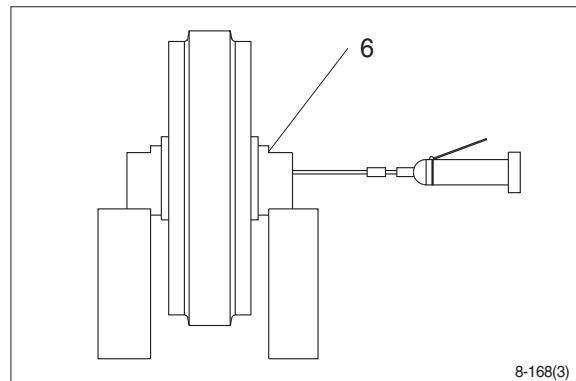
- ⑥ Install bracket (6) attached with seal (5).



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

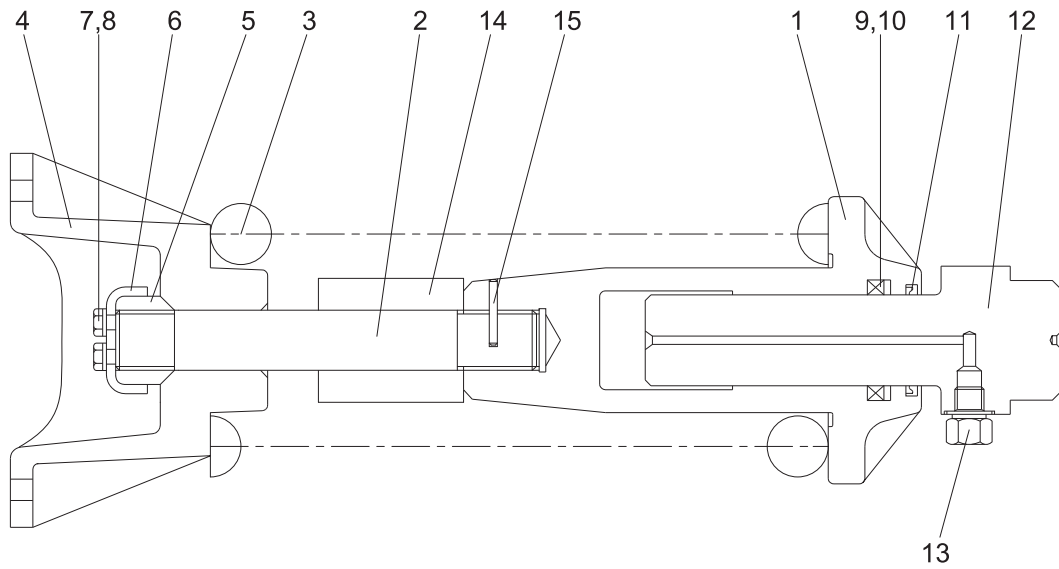


- ⑧ Lay bracket (6) on its side.  
Supply engine oil to the specified level,  
and tighten plug.



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

##### (1) Structure



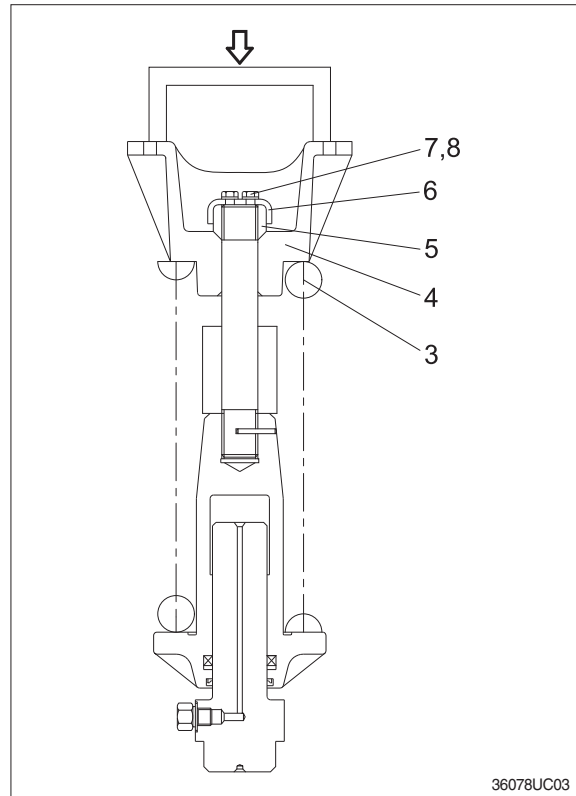
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- |   |          |    |               |    |              |
|---|----------|----|---------------|----|--------------|
| 1 | Body     | 6  | Lock plate    | 11 | Dust seal    |
| 2 | Tie bar  | 7  | Bolt          | 12 | Rod assembly |
| 3 | Spring   | 8  | Spring washer | 13 | Grease valve |
| 4 | Bracket  | 9  | Rod seal      | 14 | Stopper tube |
| 5 | Lock nut | 10 | Back up ring  | 15 | Spring pin   |

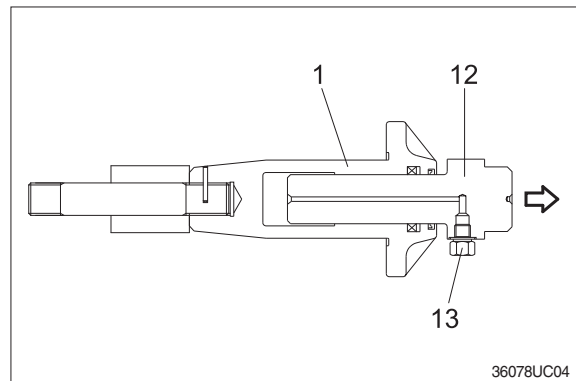
## (2) Disassembly

- ① Apply pressure on spring (3) with a press.
  - ※ The spring is under a large installed load. This is dangerous, so be sure to set properly.
  - Spring set load : 19012 kg (41826 lb)
- ② Remove bolt (7), spring washer (8) and lock plate (6).
- ③ Remove lock nut (5).

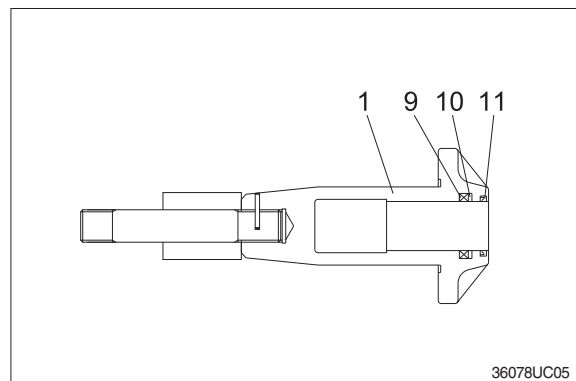
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.
- ④ Lighten the press load slowly and remove bracket (4) and spring (3).



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



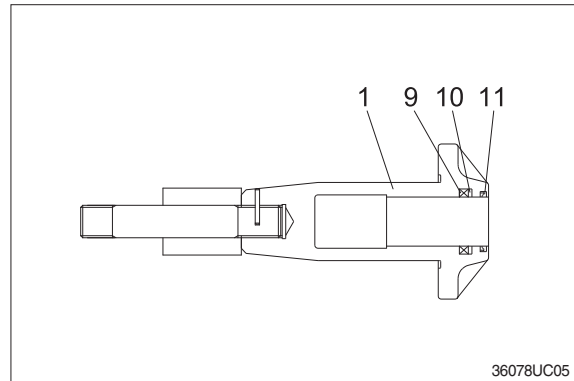
- ⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



### (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.



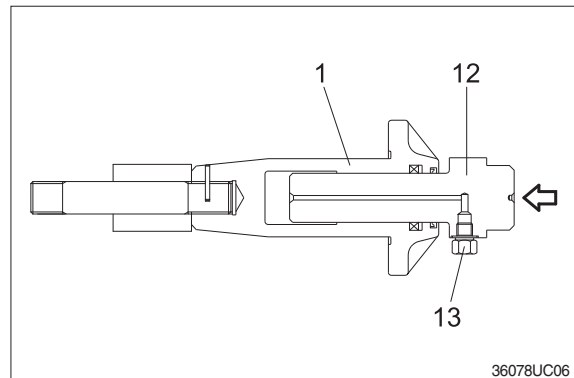
② Pour grease into body (1), then push in rod (12) by hand.

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

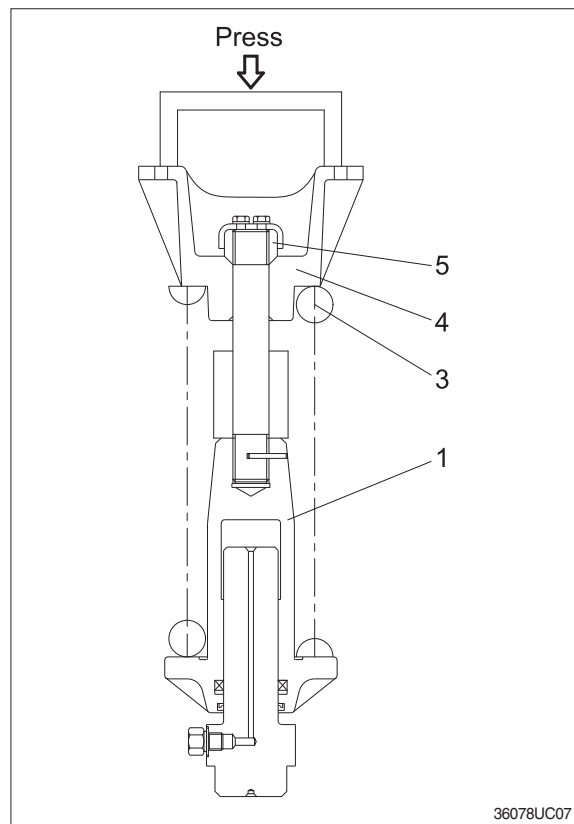


④ Install spring (3) and bracket (4) to body (1).

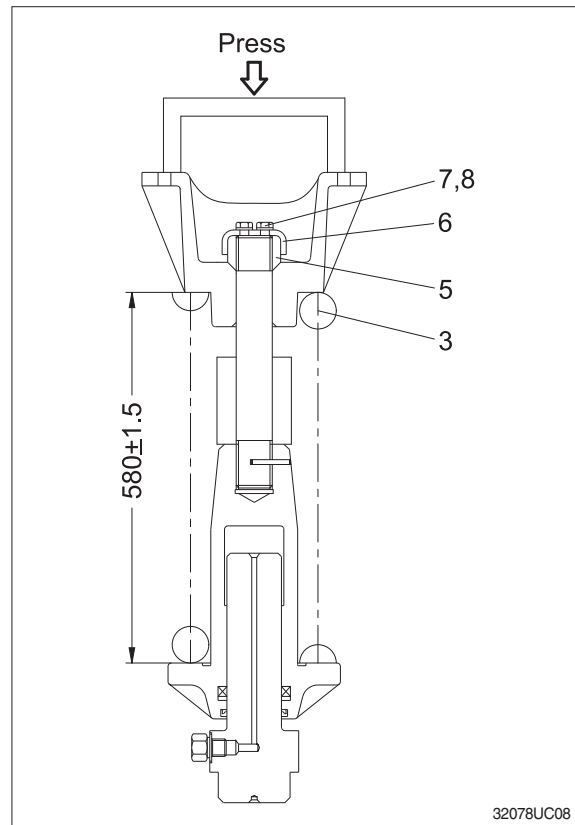
⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).

※ Apply sealant before assembling.

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



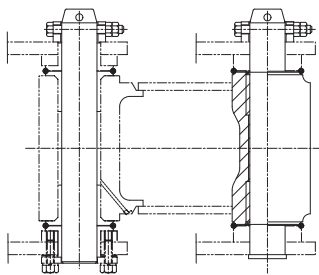
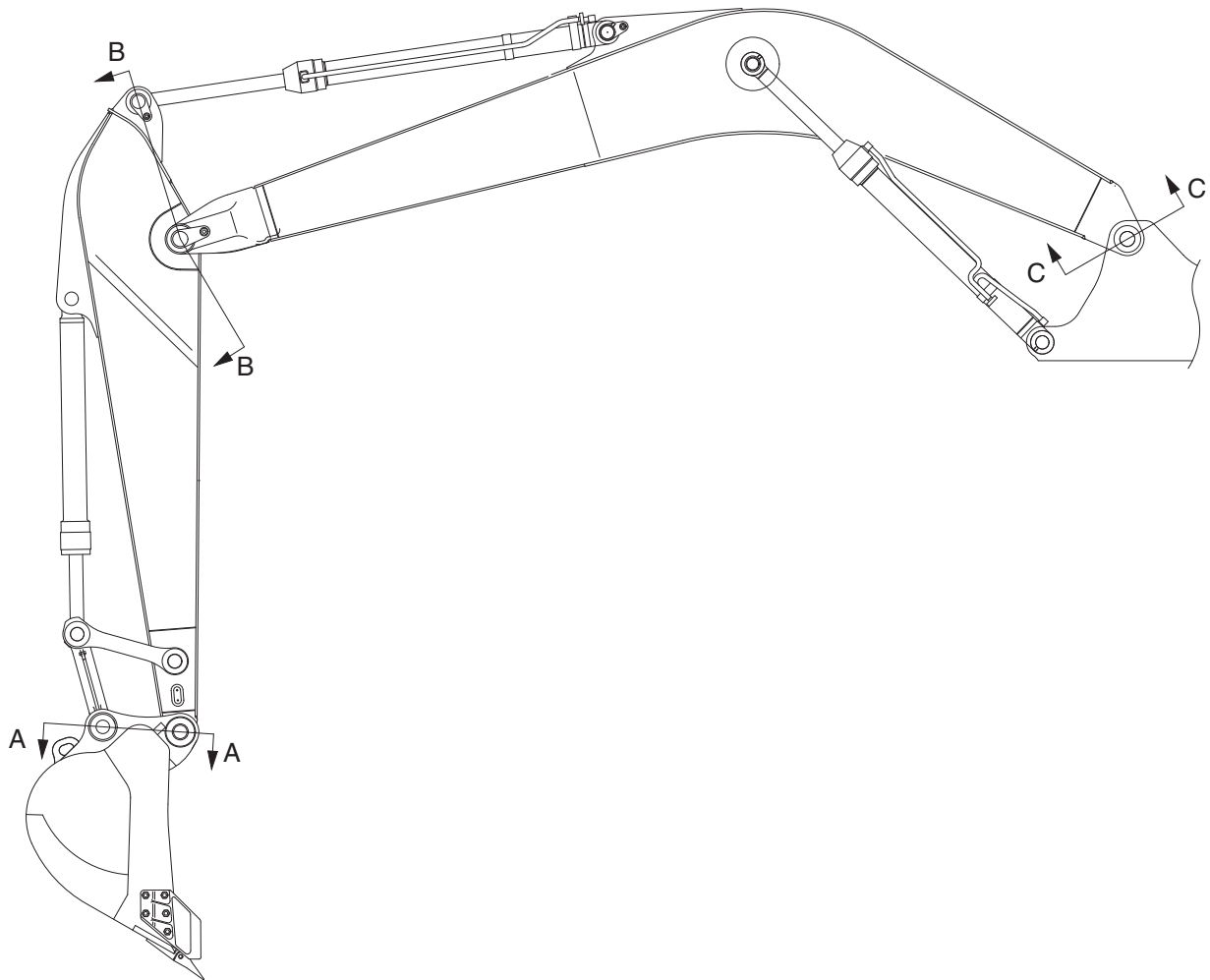
- ⑥ Lighten the press load and confirm the set length of spring (3).
- ⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).



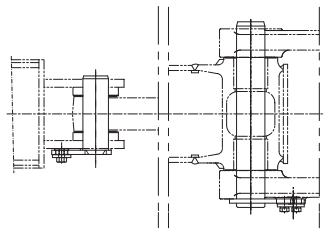
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# GROUP 11 WORK EQUIPMENT

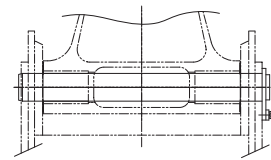
## 1. STRUCTURE



SECTION A



SECTION B



SECTION C

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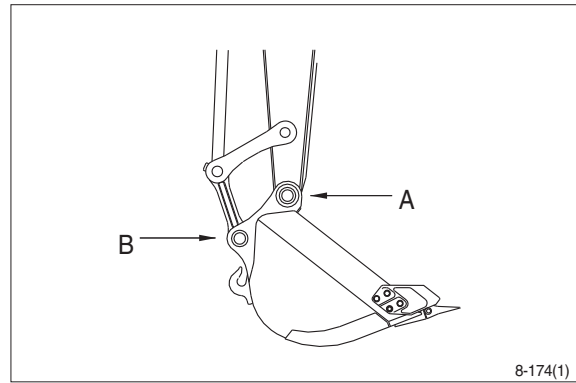


## 2. REMOVAL AND INSTALL

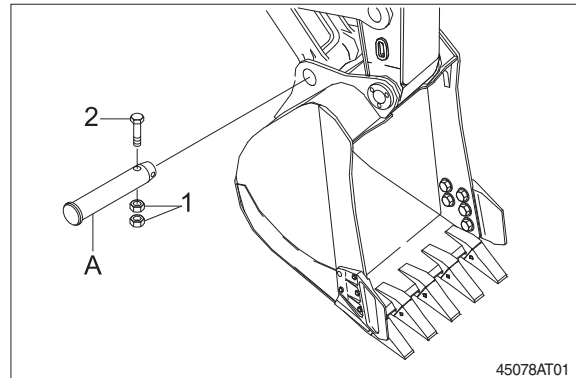
### 1) BUCKET ASSEMBLY

#### (1) Removal

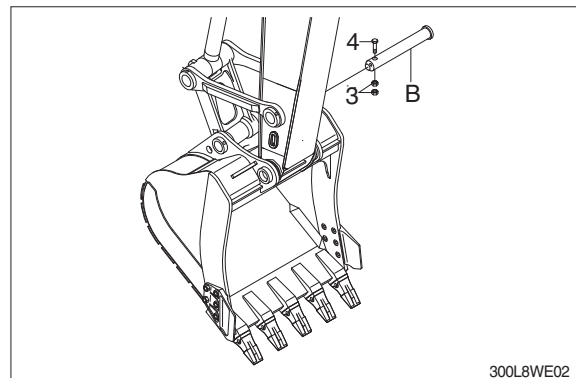
- ① Lower the work equipment completely to ground with back of bucket facing down.



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



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

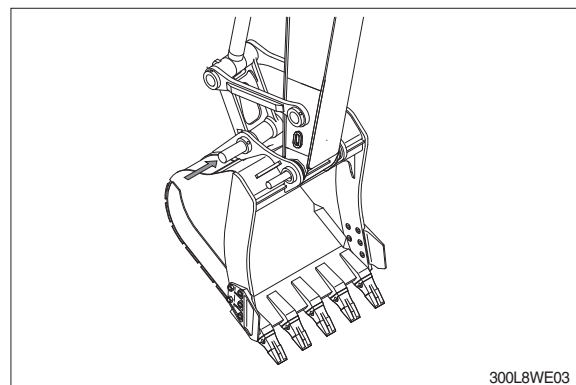


#### (2) Install

- 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.

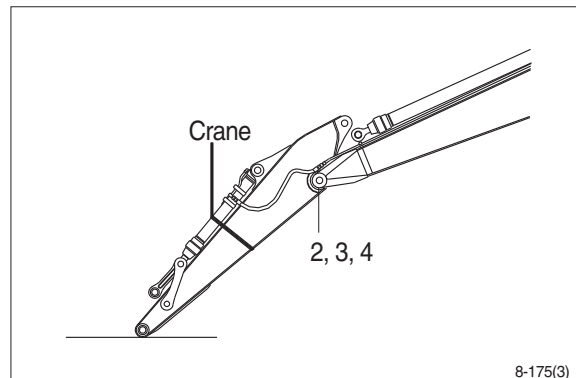
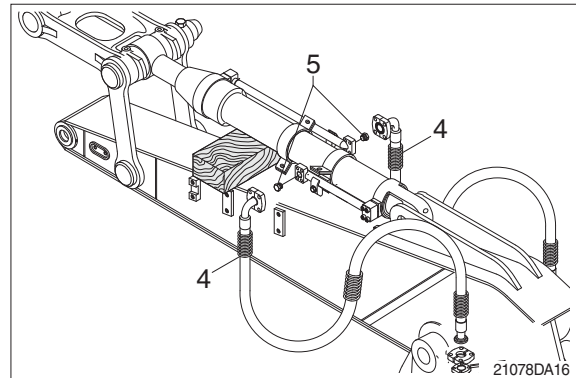
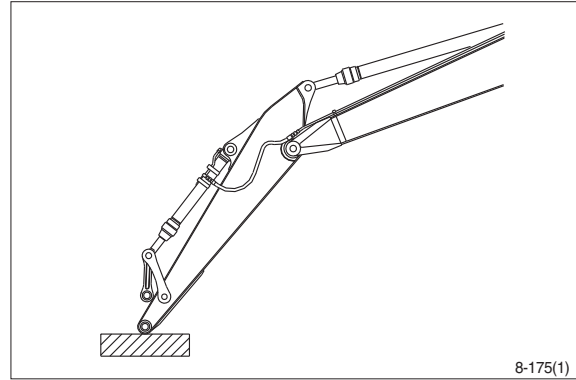
④ For details, see **removal of arm cylinder assembly**.

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.

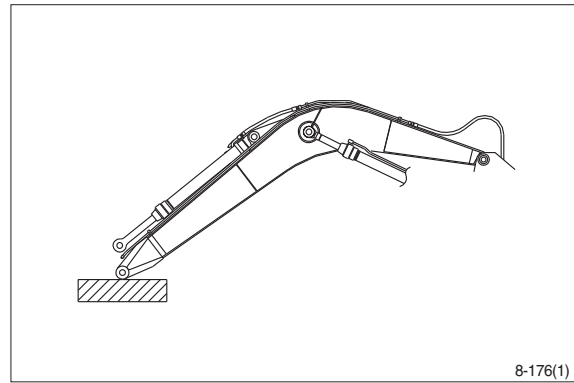
**▲ When lifting the arm assembly, always lift the center of gravity.**

※ Bleed the air from the cylinder.

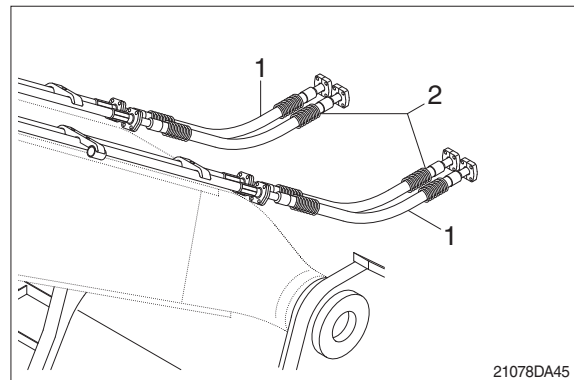
### 3) BOOM CYLINDER

#### (1) Removal

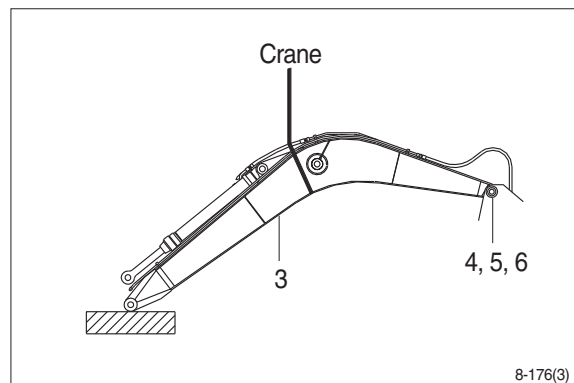
- ① Remove arm and bucket assembly.  
For details, see **removal of arm and bucket assembly**.
- ② Remove boom cylinder assembly from boom.  
For details, see **removal of arm cylinder assembly**.



- 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.

