

SECTION 8 DISASSEMBLY AND ASSEMBLY

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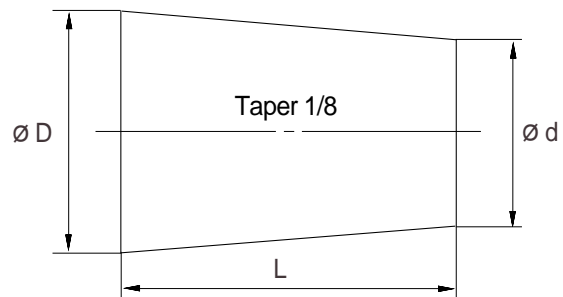
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

3. COMPLETING WORK

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt, nut	M20 × 2.5	55 ± 3.5	397.7 ± 25.3
2		Radiator mounting bolt	M12 × 1.75	12.8 ± 3	92.5 ± 21.6
3		Coupling mounting socket bolt	M16 × 2.0	22 ± 1	159.1 ± 7.2
4		Main pump housing mounting bolt	M10 × 1.5	6.9 ± 0.3	49.9 ± 2.2
5	Hydraulic system	Main pump mounting socket bolt	M16 × 2.0	22.1 ± 2.4	159.8 ± 17.4
6		Main control valve mounting bolt	M12 × 1.75	12.8 ± 3	92.5 ± 21.6
7		Fuel tank mounting bolt	M20 × 2.5	45 ± 5.1	325.4 ± 36.9
8		Hydraulic oil tank mounting bolt	M20 × 2.5	45 ± 1	325.4 ± 7.2
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	88.9 ± 9.4
10	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7 ± 4.5	214.7 ± 32.5
11		Swing bearing upper part mounting bolt	M18 × 2.5	41.3 ± 6.2	298.6 ± 44.8
12		Swing bearing lower part mounting bolt	M16 × 1.5	31.3 ± 4.7	226.3 ± 34
13		Travel motor mounting bolt	M16 × 2.0	23 ± 2.5	166.3 ± 18.1
14		Sprocket mounting bolt	M16 × 2.0	23 ± 2.5	166.3 ± 18.1
15	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	23 ± 2.5	166.3 ± 18.1
16		Track roller mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
17		Track tension cylinder mounting bolt	M16 × 2.0	21.9 ± 3.3	158.3 ± 23.9
18		Track shoe mounting bolt, nut	5/8 - 18UNF	42 ± 4	303.7 ± 28.9
19	Others	Counter weight mounting bolt	M27 × 3.0	140 ± 15	1013 ± 108
20		Cab mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
21		Operator's seat mounting bolt	M 8 × 1.25	2.5 ± 0.5	18.1 ± 3.6

For tightening torque of engine and hydraulic components, see each component disassembly and assembly.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT - Coarse thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.73 ~ 4.12	19.7 ~ 29.8
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 79.5	9.8 ~ 15.8	71 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 167
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 343
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	350 ~ 457	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.5	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1655
M36 × 4.0	174 ~ 236	1261 ~ 1703	250 ~ 310	1808 ~ 2242

2) BOLT AND NUT - Fine thread

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

3) PIPE AND HOSE

Thread size	Width across flat(mm)	kgf · m	lbf · ft
1/4"	19	3	21.7
3/8"	22	4	28.9
1/2"	27	5	36.2
3/4"	36	12	86.8
1"	41	14	101

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	6	43.4
3/4"	36	13	94.0
1"	41	15	109

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

· Hydraulic tank quantity : 124

- (5) Remove socket bolts(74) and disconnect pipe(9).

- (6) Disconnect pilot line hoses(48, 49, 55, 58, 64, 69, 71, 78).

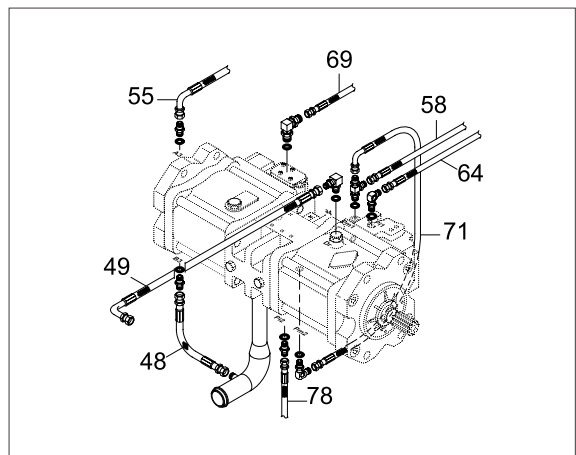
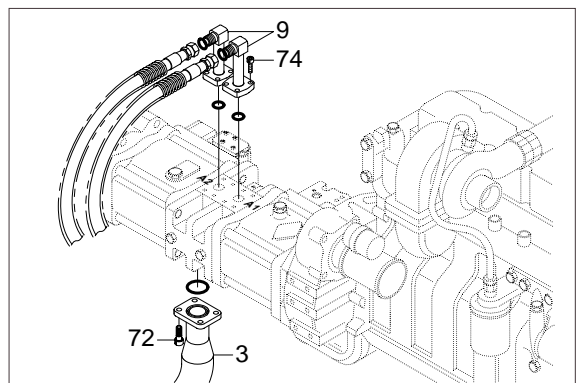
- (7) Remove socket bolts(72) and disconnect pump suction tube(3).

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

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

· Weight : 85kg(188lb)

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

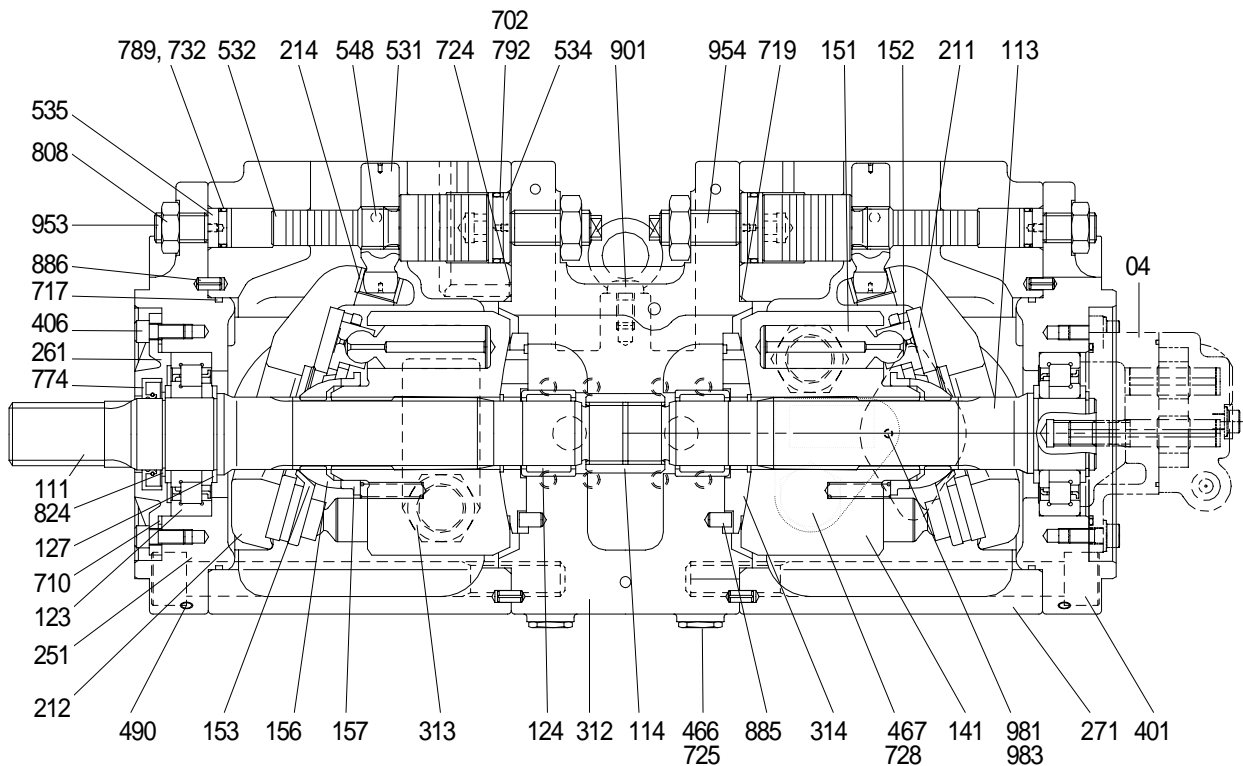


2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Remove the suction strainer and clean it.
- (3) Replace return filter with new one.
- (4) Remove breather and clean it.
- (5) After adding oil to the hydraulic tank to the specified level.
- (6) Bleed the air from the hydraulic pump.
Remove the air vent plug(2EA).
Tighten plug lightly.
Start the engine, run at low idling, and check oil come out from plug.
Tighten plug.
- (7) Start the engine, run at low idling(3~5 minutes) to circulate the oil through the system.
- (8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. MAIN PUMP(1/2)

1) STRUCTURE

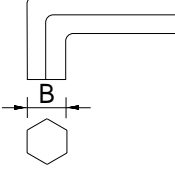



04	Gear pump	261	Seal cover(F)	717	O-ring
111	Drive shaft(F)	271	Pump casing	719	O-ring
113	Drive shaft(R)	312	Valve block	724	O-ring
114	Spline coupling	313	Valve plate(R)	725	O-ring
123	Roller bearing	314	Valve plate(L)	728	O-ring
124	Needle bearing	401	Hexagon socket bolt	732	O-ring
127	Bearing spacer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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

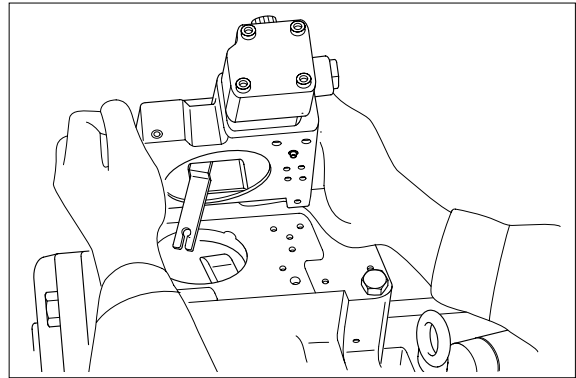
Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PO-1/4	M12, M14
	8	M10	BP-3/8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-
Double ring spanner, socket wrench, double(Single) open end spanner 	-	Hexagon socket head bolt	Hexagon nut	VP plug (PF thread)	
	19	M12	M12	VP-1/4	
	24	M16	M16	-	
	27	M18	M18	VP-1/2	
	30	M20	M20	-	
	36	-	-	VP-3/4	
Adjustable angle wrench		Medium size, 1 set			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		Steel bar of key material approx. 10 × 8 × 200			
Torque wrench		Capable of tightening with the specified torques			

(2) Tightening torque

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

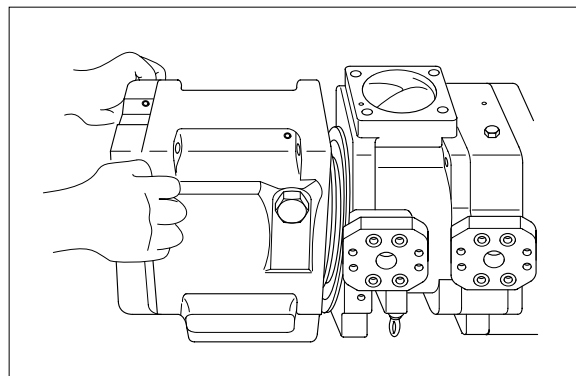
3) DISASSEMBLY

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

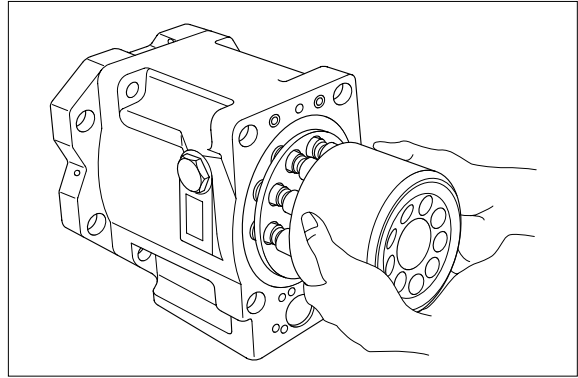


- (5) Loosen hexagon socket head bolts(401) which tighten swash plate support(251), pump casing(271) and valve block(312).
If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

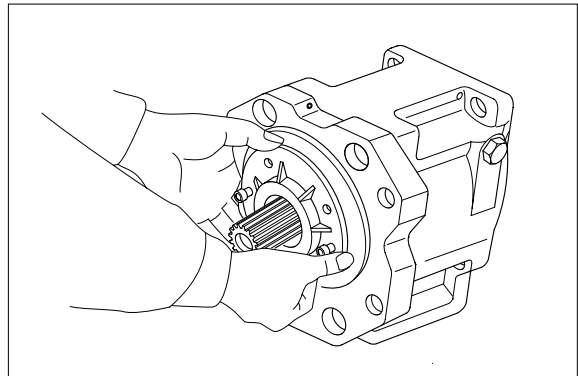
- (6) Place pump horizontally on workbench with its regulator-fitting surface down and separate pump casing(271) from valve block(312).
Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



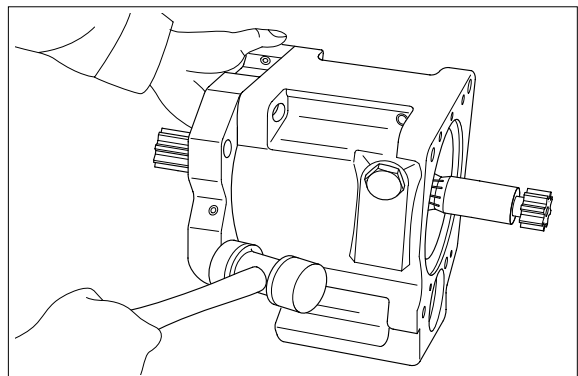
- (7) Pull cylinder block(141) out of pump casing(271) straightly over drive shaft(111). Pull out also pistons(151), set plate(153), spherical bush(156) and cylinder springs(157) simultaneously. Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.



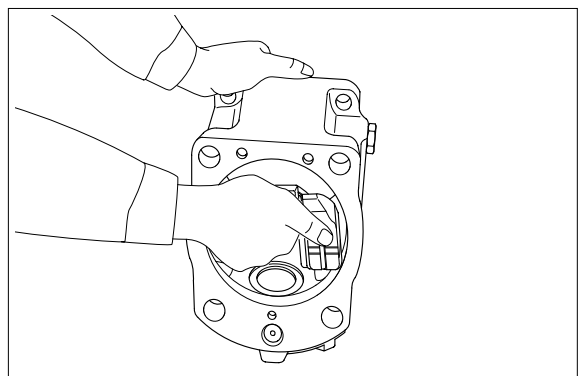
- (8) Remove hexagon socket head bolts(406) and then seal cover(F, 261). Fit bolt into pulling out tapped hole of seal cover(F), and cover can be removed easily. Since oil seal is fitted on seal cover(F), take care not to damage it in removing cover.



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

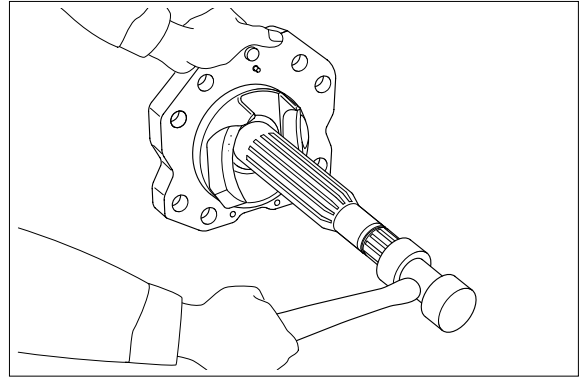


- (10) Tapping lightly fitting flange section of swash plate support(251) on its pump casing side, separate swash plate support from pump casing.

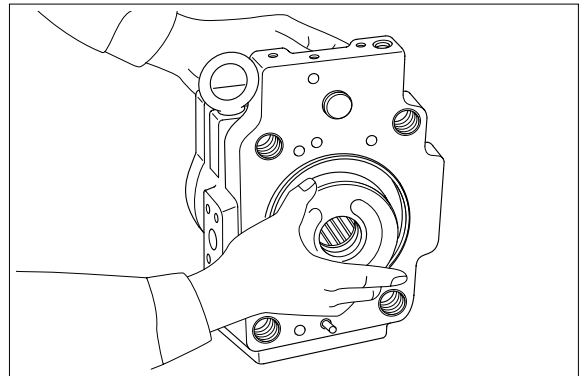


- (11) Remove shoe plate(211) and swash plate(212) from pump casing(271).

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



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



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

4) ASSEMBLY

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

Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.

Clean each part fully with cleaning oil and dry it with compressed air.

Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.

In principle, replace seal parts, such as O-rings, oil seals, etc.

For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.

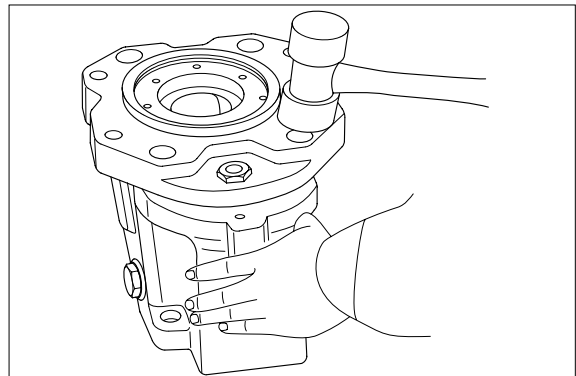
For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

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

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

In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged.

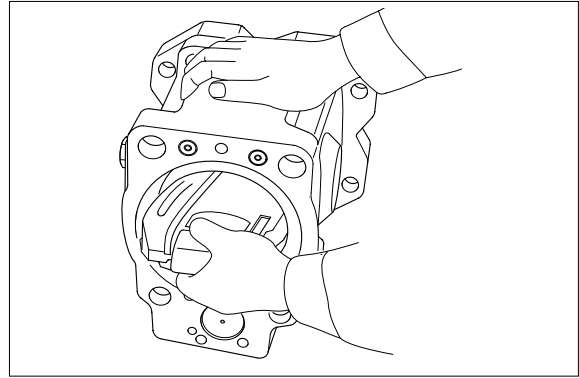
In addition, apply loctite(Medium strength) to their threaded sections.



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

Confirm with fingers of both hands that swash plate can be removed smoothly.

Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.

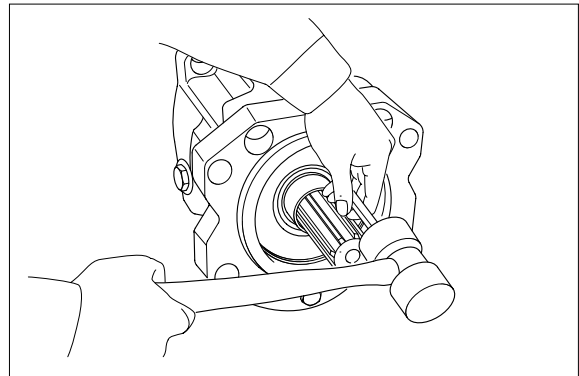


- (4) To swash plate support(251), fit drive shaft(111) set with bearing(123), bearing spacer(127) and snap ring(824).

Do not tap drive shaft with hammer or so on.

Assemble them into support, tapping outer race of bearing lightly with plastic hammer.

Fit them fully, using steel bar or so on.

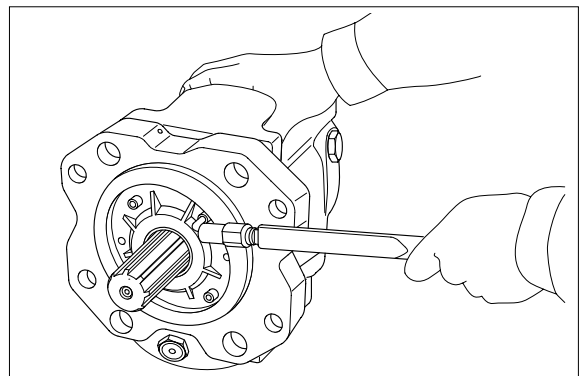


- (5) Assemble seal cover(F, 261) to pump casing(271) and fix it with hexagon socket head bolts(406).

Apply grease lightly to oil seal in seal cover(F).

Assemble oil seal, taking full care not to damage it.

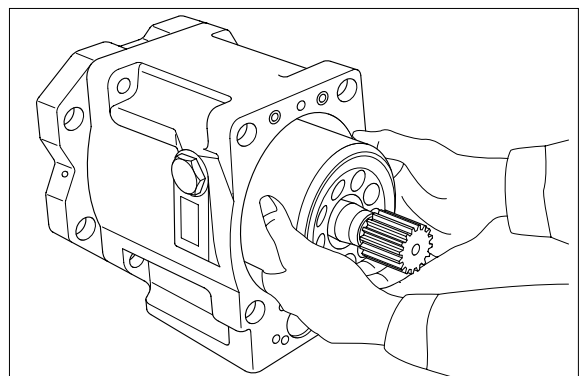
For tandem type pump, fit rear cover(263) and seal cover(262) similarly.



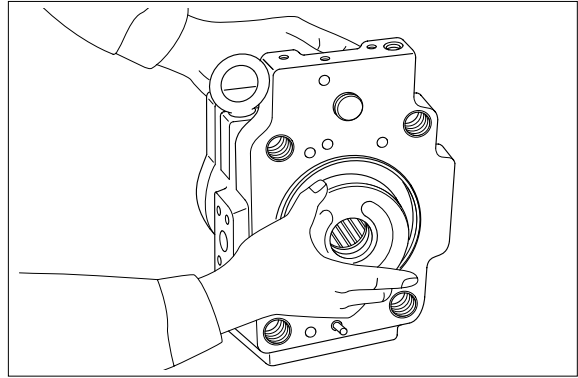
- (6) Assemble piston cylinder subassembly [cylinder block(141), piston subassembly (151, 152), set plate(153), spherical bush (156), spacer(158) and cylinder spring (157)].

Fit spline phases of retainer and cylinder.

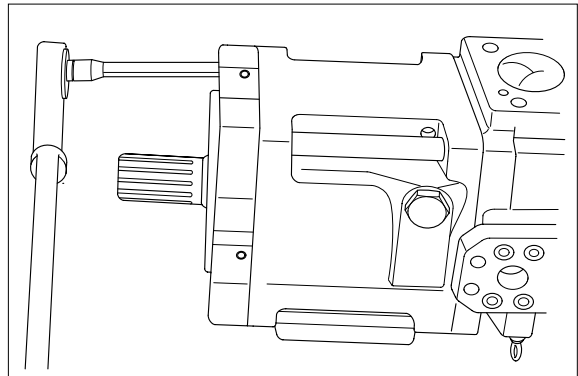
Then, insert piston cylinder subassembly into pump casing.



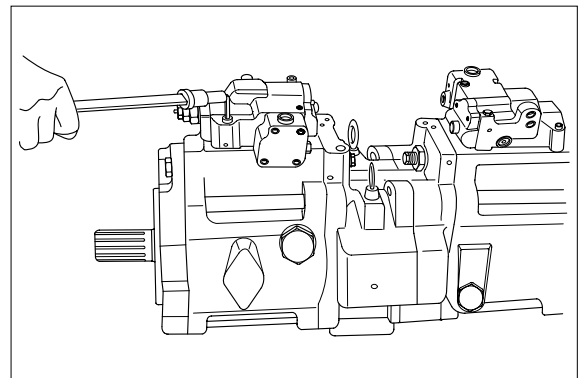
- (7) Fit valve plate(313) to valve block(312), entering pin into pin hole.
Take care not to mistake suction / delivery directions of valve plate.



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



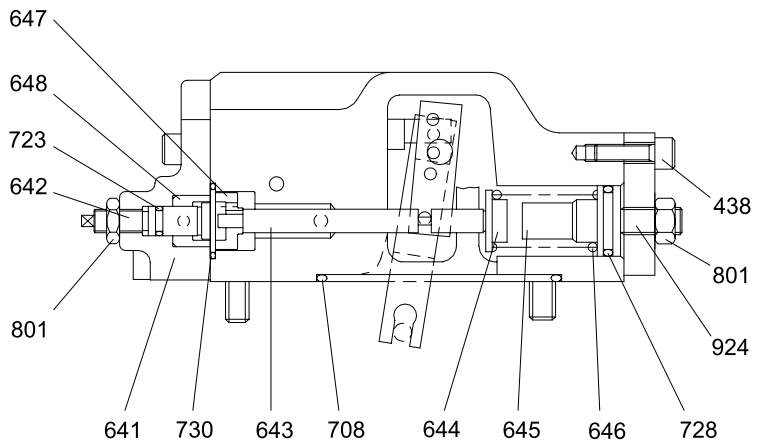
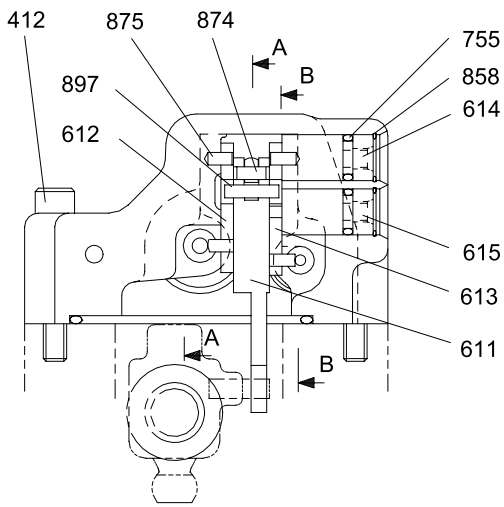
- (9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
Take care not to mistake regulator of front pump for that of rear pump.



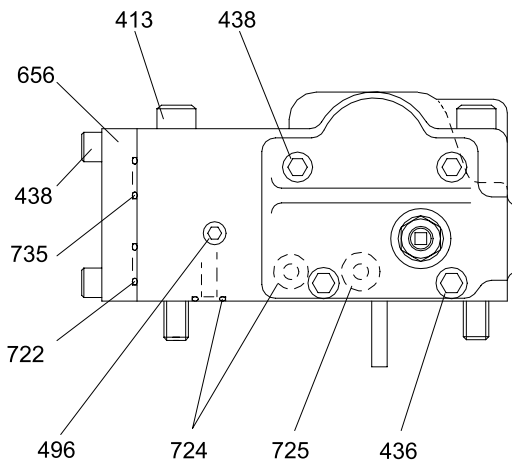
- (10) Fit drain port plug(468).
This is the end of reassembling procedures.

3. REGULATOR

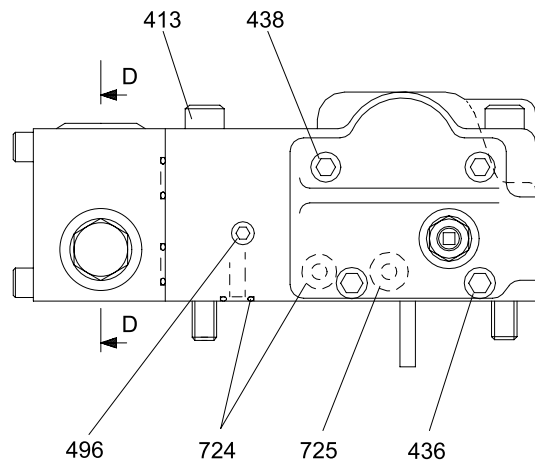
1) STRUCTURE(1/2)



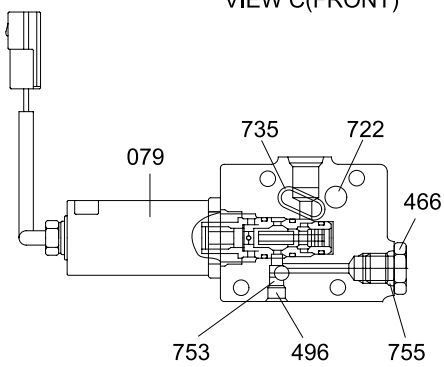
SECTION B-B



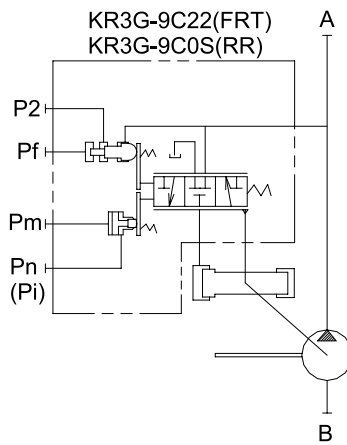
VIEW C(FRONT)



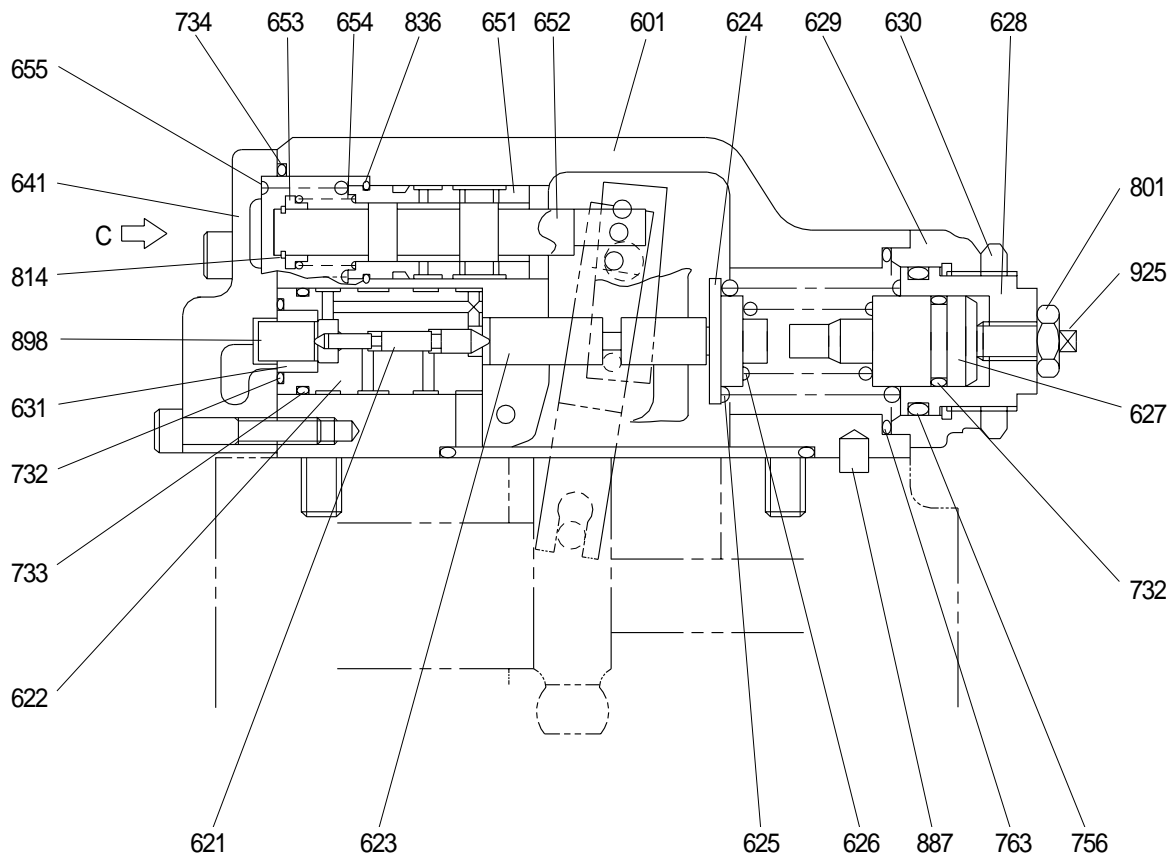
VIEW C(REAR)



SECTION D-D



REGULATOR(2/2)



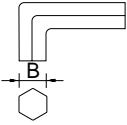

SECTION A-A

412	Hexagon socket screw	631	Sleeve, pf	730	O-ring
413	Hexagon socket screw	641	Pilot cover	732	O-ring
436	Hexagon socket screw	642	Pilot cover(QMC)	733	O-ring
438	Hexagon socket screw	643	Pilot piston	734	O-ring
496	Plug	644	Spring seat(Q)	735	O-ring
601	Casing	645	Adjust stem(Q)	755	O-ring
611	Feed back lever	646	Pilot spring	756	O-ring
612	Lever(1)	647	Stopper	763	O-ring
613	Lever(2)	648	Piston(QMC)	801	Nut
614	Fulcrum plug	651	Sleeve	814	Snap ring
615	Adjust plug	652	Spool	836	Snap ring
621	Compensator piston	653	Spring seat	858	Snap ring
622	Piston case	654	Return spring	874	Pin
623	Compensator rod	655	Set spring	875	Pin
624	Spring seat(C)	656	Block cover	887	Pin
625	Outer spring	708	O-ring	897	Pin
626	Inner spring	722	O-ring	898	Pin
627	Adjust stem(C)	723	O-ring	924	Set screw
628	Adjust screw(C)	724	O-ring	925	Adjust screw(QI)
629	Cover(C)	725	O-ring		
630	Lock nut	728	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PO-1/4	M12, M14
Double ring spanner, socket wrench, double(Single) open end spanner 	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench		Small size, Max 36mm			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		4 x 100mm			
Torque wrench		Capable of tightening with the specified torques			
Pincers		-			
Bolt		M4, Length : 50mm			

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plut(Material : S45C) Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plut(Material : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

3) DISASSEMBLY

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

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

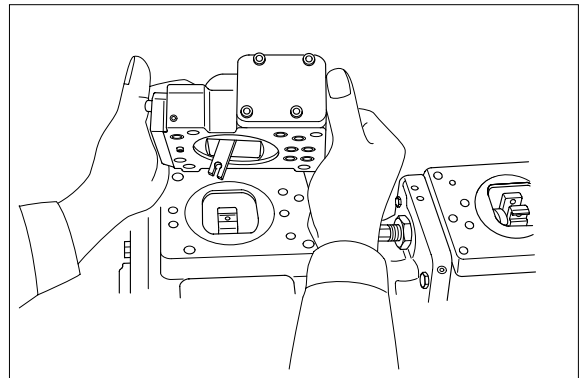
- (1) Choose a place for disassembly.

Choose a clean place.

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

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

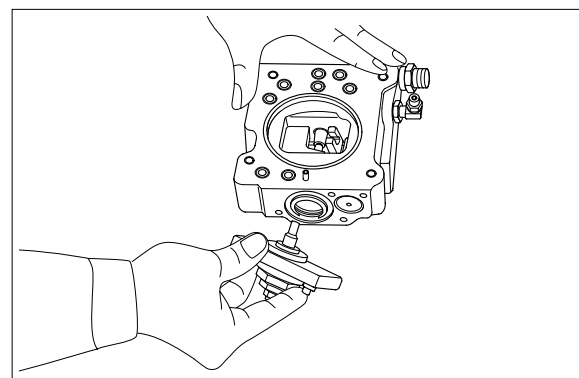
- (3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
Take care not to lose O-ring.



- (4) Remove hexagon socket head screw (438) and remove cover(C,629)
Cover(C) is fitted with adjusting screw (C,QI) (628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).

Do not loosen these screws and nuts.

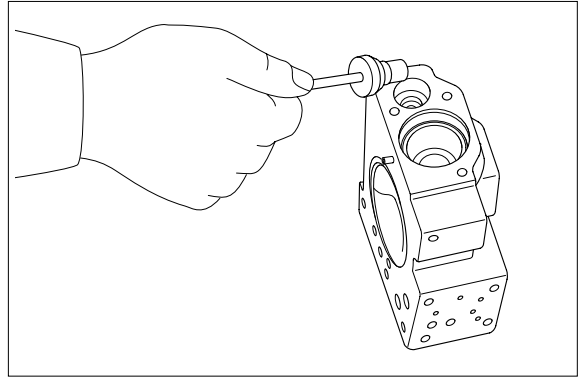
If they are loosened, adjusted pressure-flow setting will vary.



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

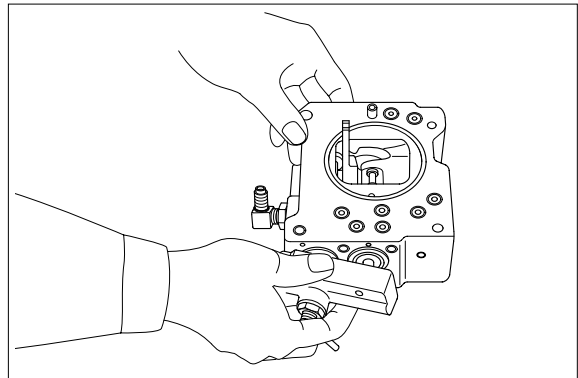
Then draw out adjusting ring(Q, 645), pilot spring(646) and spring seat(644) from pilot section.

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



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

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

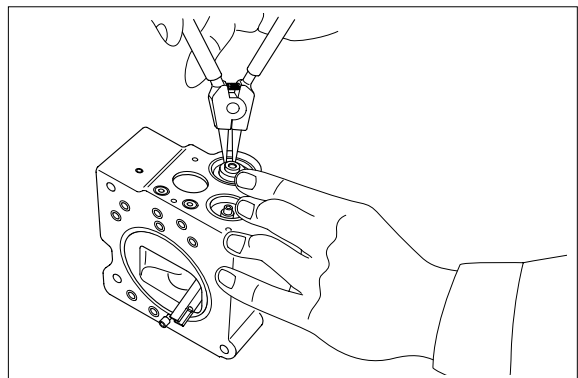


- (7) Remove snap ring(814) and take out spring seat(653), return spring(654) and sleeve(651).

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

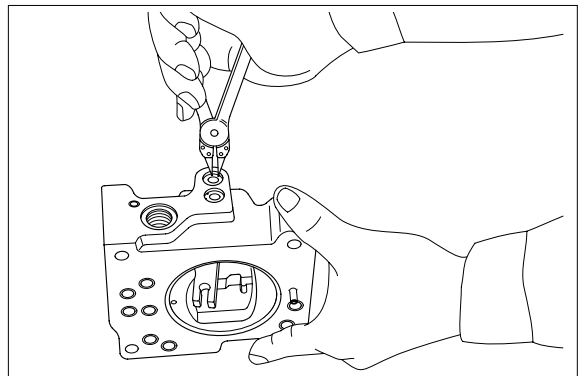
When removing snap ring(814), return spring(654) may pop out.

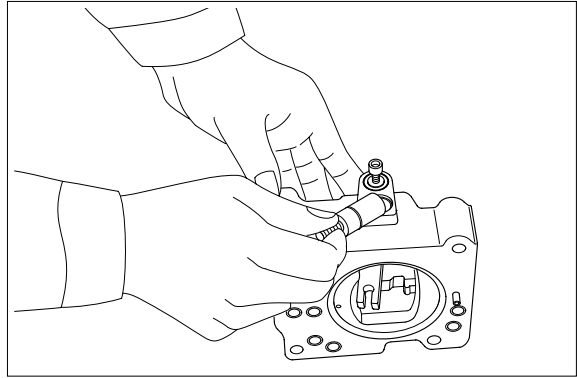
Take care not to lose it.



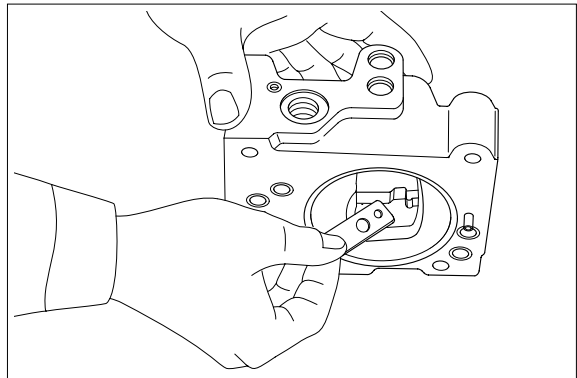
- (8) Remove locking ring(858) and take out fulcrum plug(614) and adjusting plug (615).

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

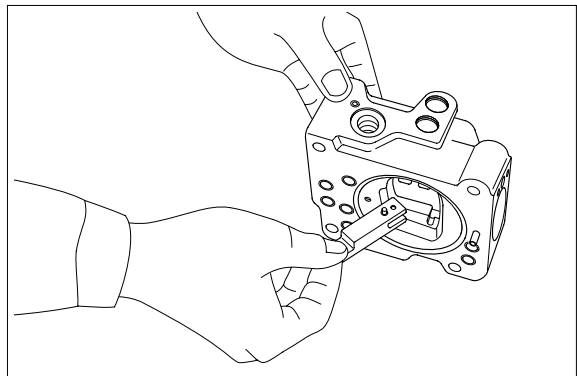
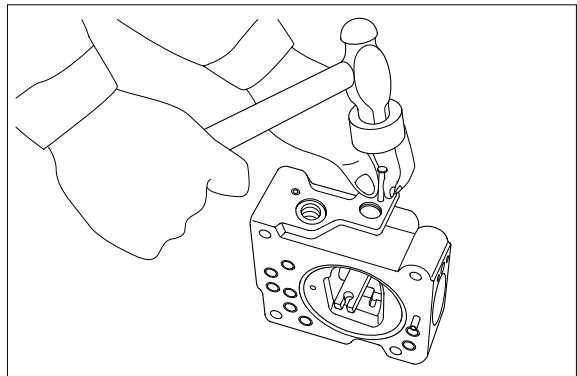




- (9) Remove lever(2, 613). Do not draw out pin(875).
Work will be promoted by using pincers or so on.



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



(11) Remove lever(1, 612). Do not draw out pin(875).

(12) Draw out pilot piston(643) and spool(652).

(13) Draw out piston case(622), compensating piston(621) and compensating rod(623).

Piston case(622) can be taken out by pushing compensating rod(623) at opposite side of piston case.

This completes disassembly.

4) ASSEMBLY

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

Always repair parts that were scored at disassembly.

Get replacement parts ready beforehand.

Mixing of foreign matter will cause malfunction.

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

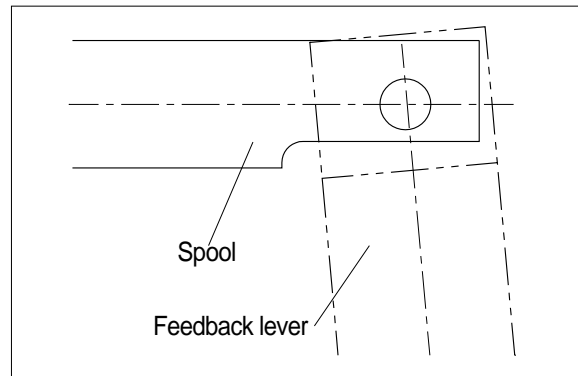
Always tighten bolts, plugs, etc. to their specified torques.

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

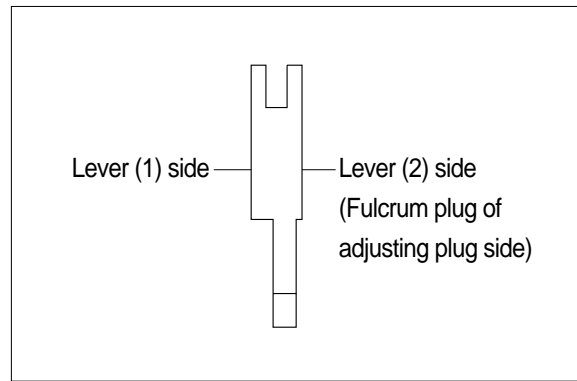
Replace seals such as O-ring with new ones as a rule.

- (2) Put compensating rod(623) into compensating hole of casing(601).
- (3) Put pin force-fitted in lever(1, 612) into groove of compensating rod and fit lever (1) to pin force-fitted in casing.

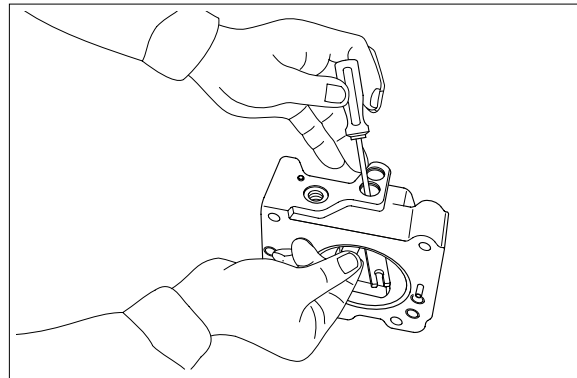
- (4) Fit spool(652) and sleeve(651) into hole in spool of casing.
- Confirm that spool and sleeve slide smoothly in casing without binding.
- Pay attention to orientation of spool.



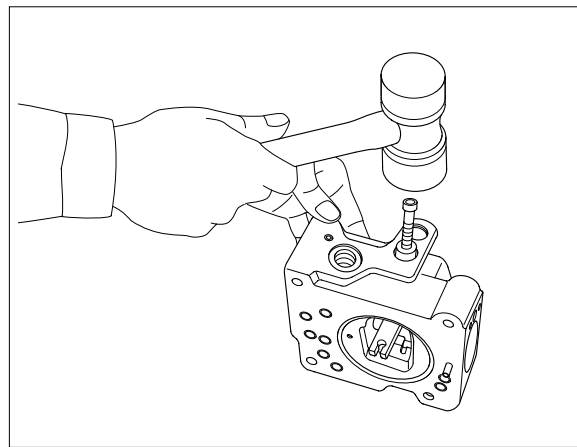
- (5) Fit feedback lever(611), matching its pin hole with pin hole in spool.
Then insert pin(874).
Insert pin in feedback lever a little to ease operation.
Take care not to mistake direction of feedback lever.



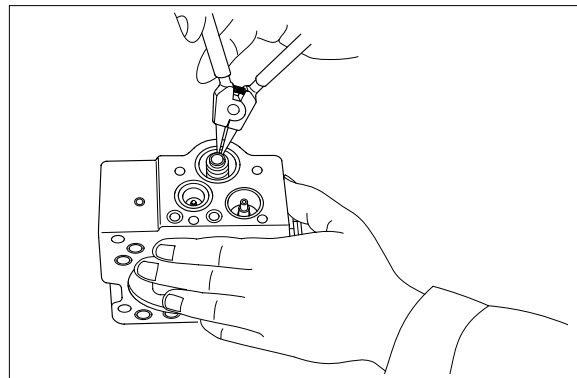
- (6) Put pilot piston(643) into pilot hole of casing.
Confirm that pilot piston slides smoothly without binding.
(7) Put pin force-fitted in lever(2, 613) into groove of pilot piston.
Then fix lever(2).



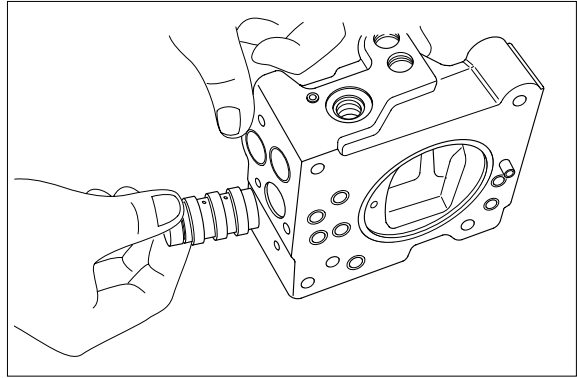
- (8) Fit fulcrum plug(614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever(2).
Then fix locking ring(858).
(9) Insert adjusting plug(615) and fit locking ring.
Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback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



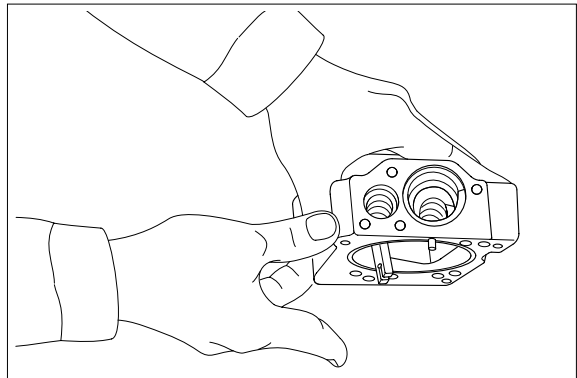
- (10) Fit return spring(654) and spring seat (653) into spool hole and attach snap ring (814).



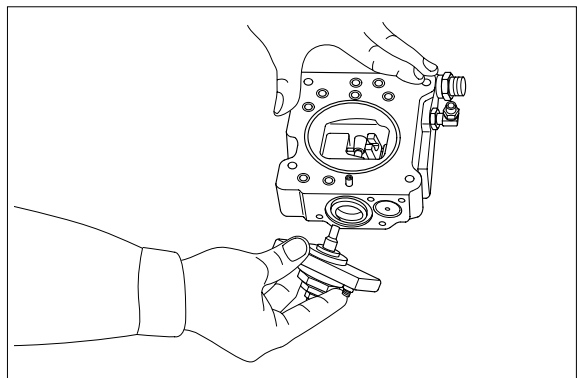
- (11) Fit set spring(655) to spool hole and put compensating piston(621) and piston case(622) into compensating hole.
Fit pilot cover(641) and tighten it with hexagonal socket head screws(436, 438).



- (12) Put spring seat(644), pilot spring(646) and adjusting ring(Q, 645) into pilot hole.
Then fix spring seat(624), inner spring (626) and outer spring(625) into compensating hole.
When fitting spring seat, take care not to mistake direction of spring seat.



- (13) Install cover(C, 629) fitted with adjusting screws(628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).
Then tighten them with hexagonal socket head screws(438).



This completes assembly.

GROUP 4 MAIN CONTROL VALVE

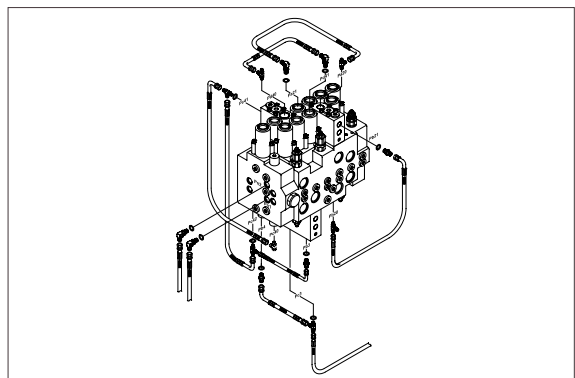
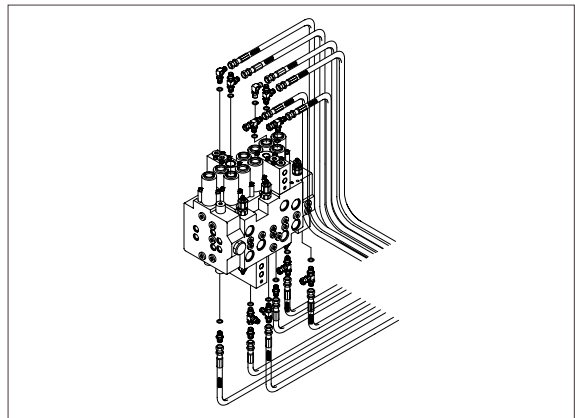
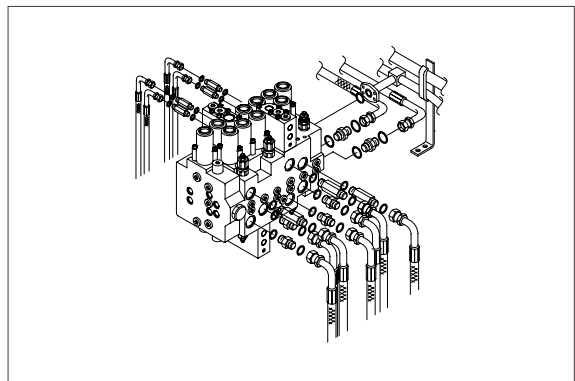
1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

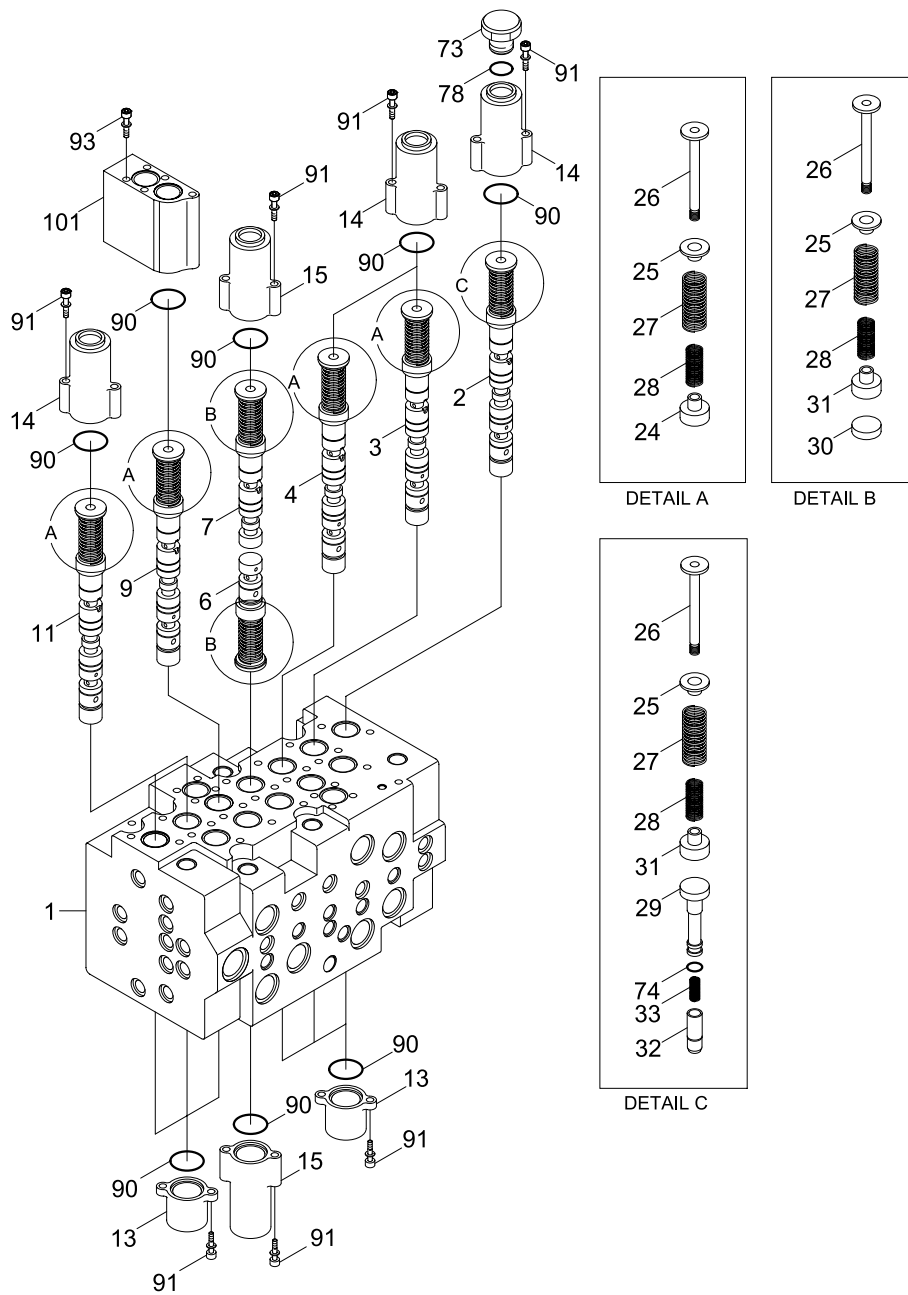
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
▲ Escaping fluid under pressure can penetrate the skin causing serious injury. When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove bolts and disconnect pipe.
- (5) Disconnect pilot line hoses.
- (6) Disconnect pilot piping.
- (7) Sling the control valve assembly and remove the control valve mounting bolt.
· Weight : 80kg(180lb)
- (8) 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.
Cylinder(Boom, arm, bucket)
Swing motor
Travel motor
See each item removal and install.
- (3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

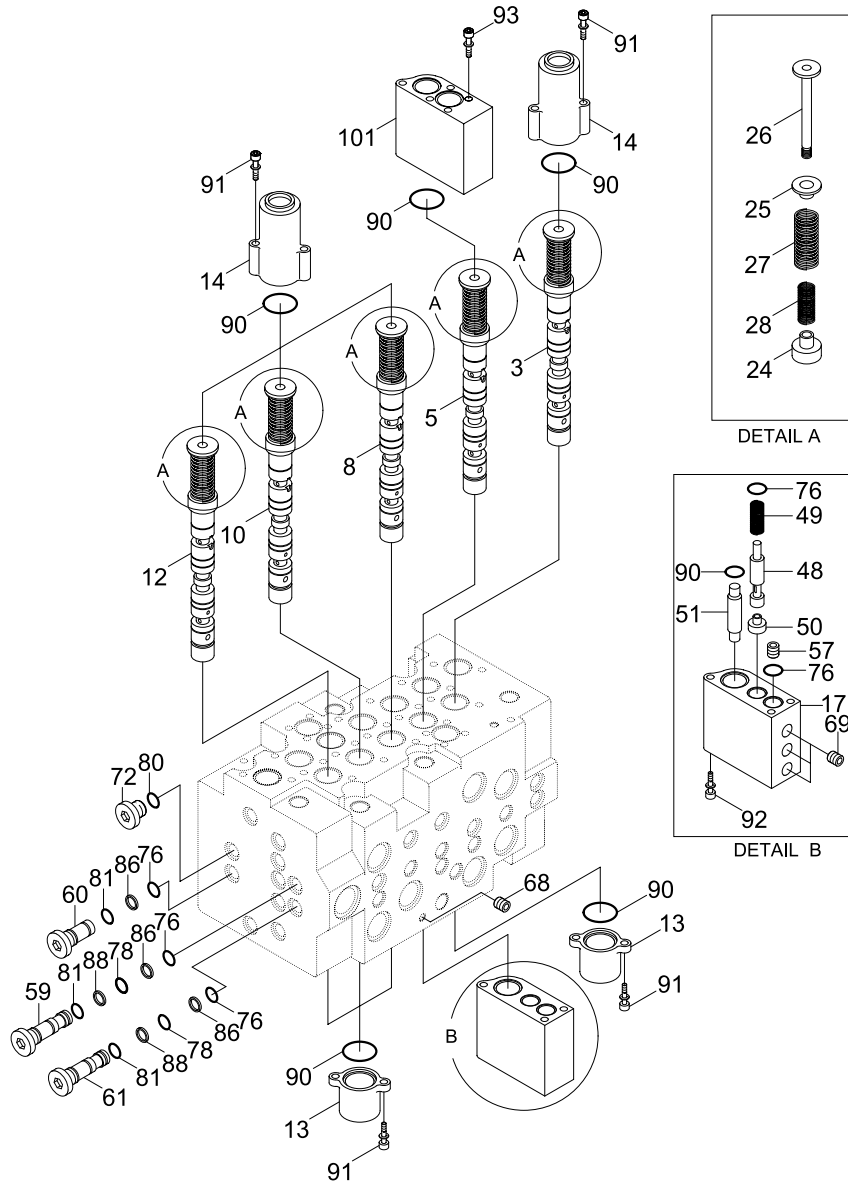


2. STRUCTURE(1/4)



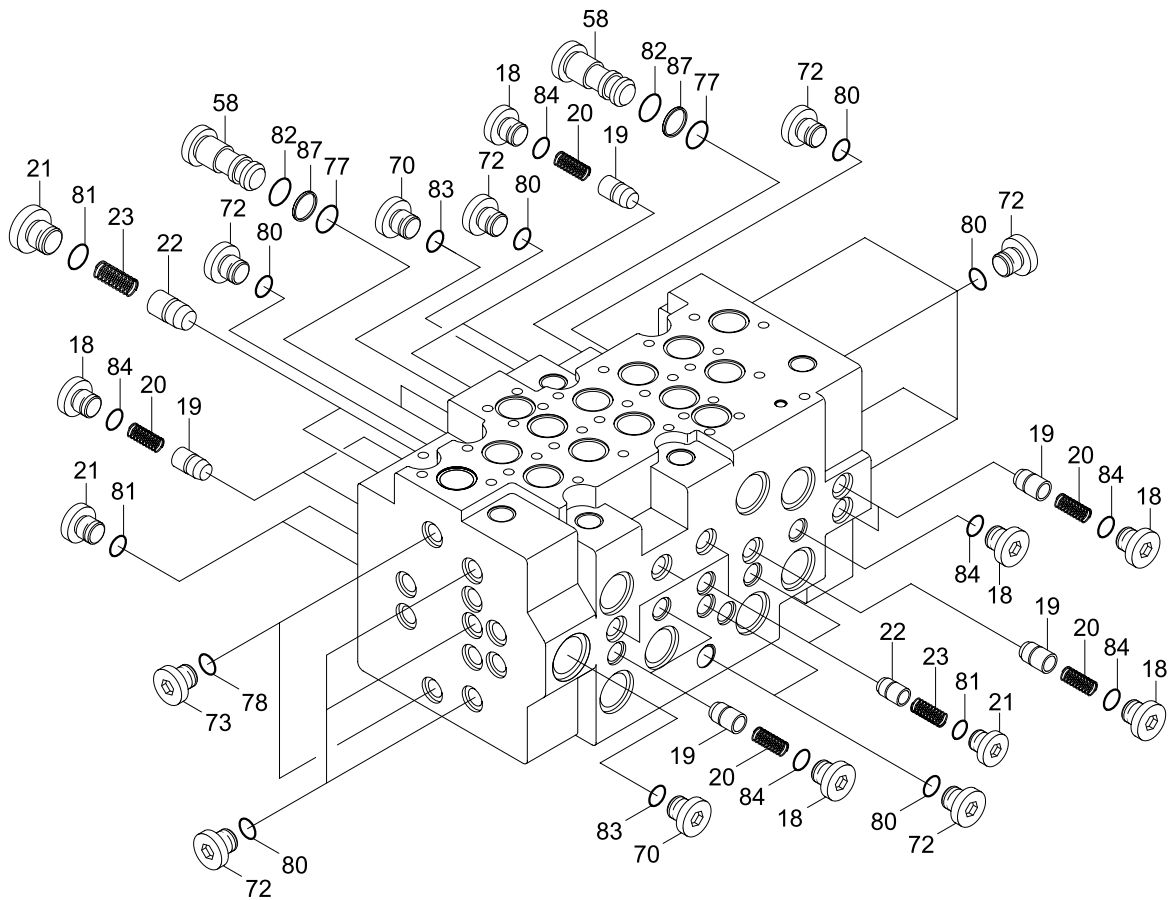
- | | | | | | |
|----|-------------|----|---------------|-----|--------------------|
| 1 | Body | 14 | Cover-pilot | 31 | Holder-spring |
| 2 | Spool | 15 | Cover-pilot | 32 | Valve-check |
| 3 | Spool | 24 | Holder-spring | 33 | Spring-check valve |
| 4 | Spool | 25 | Holder-spring | 73 | Plug |
| 6 | Spool | 26 | End-spool | 74 | O-ring |
| 7 | Spool | 27 | Spring | 78 | O-ring |
| 9 | Spool | 28 | Spring | 90 | O-ring |
| 11 | Spool | 29 | Stopper | 91 | Bolt-socket head |
| 13 | Cover-pilot | 30 | Stopper | 93 | Bolt-socket head |
| | | | | 101 | Lock-valve |

STRUCTURE(2/4)



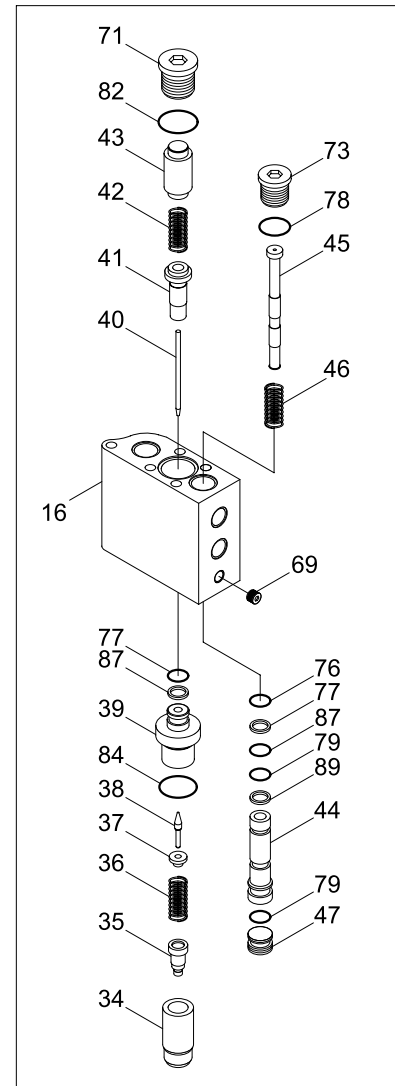
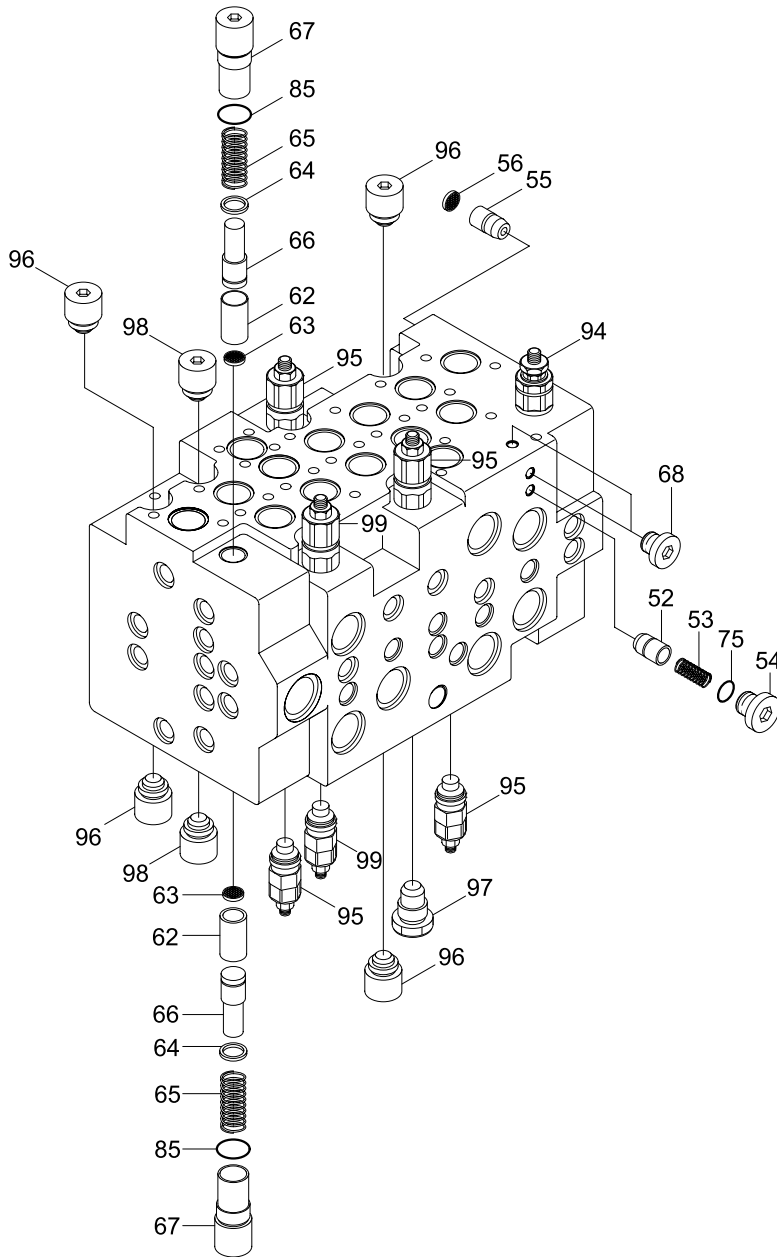
- | | | | | | |
|----|---------------|----|------------------|-----|------------------|
| 3 | Spool | 27 | Spring | 72 | Plug |
| 5 | Spool | 28 | Spring | 76 | O-ring |
| 8 | Spool | 48 | Spool-selector | 78 | O-ring |
| 10 | Spool | 49 | Spring | 80 | O-ring |
| 12 | Spool | 50 | Stopper | 81 | O-ring |
| 13 | Cover-pilot | 51 | Piston | 86 | Back-up ring |
| 14 | Cover-pilot | 57 | Restrictor | 88 | Back-up ring |
| 17 | Cover-pilot | 59 | Plug | 90 | O-ring |
| 24 | Holder-spring | 60 | Plug | 91 | Bolt-socket head |
| 25 | Holder-spring | 61 | Restrictor | 92 | Bolt-socket head |
| 26 | End-spool | 68 | Plug-socket head | 93 | Bolt-socket head |
| | | 69 | Plug-socket head | 101 | Lock-valve |

STRUCTURE(3/4)



- | | | | | | |
|----|--------------------|----|--------|----|--------------|
| 18 | Plug | 58 | Plug | 80 | O-ring |
| 19 | Valve-check | 70 | Plug | 81 | O-ring |
| 20 | Spring-check valve | 72 | Plug | 82 | O-ring |
| 21 | Plug | 73 | Plug | 83 | O-ring |
| 22 | Valve-check | 77 | O-ring | 84 | O-ring |
| 23 | Spring-check valve | 78 | O-ring | 87 | Back-up ring |

STRUCTURE(4/4)



DETAIL OF LOCK VALVE

- | | | | | | |
|----|-----------------------|----|--------------------|----|-----------------------|
| 16 | Cover-pilot | 52 | Valve-check | 75 | O-ring |
| 34 | Valve-lock | 53 | Spring-check valve | 76 | O-ring |
| 35 | Restrictor-lock valve | 54 | Plug | 77 | O-ring |
| 36 | Spring-lock valve | 55 | Restrictor | 78 | O-ring |
| 37 | Holder-spring | 56 | Filter-coin type | 79 | O-ring |
| 38 | Poppet | 62 | Poppet-negative | 82 | O-ring |
| 39 | Seat-poppet | 63 | Filter-coin type | 84 | O-ring |
| 40 | Piston | 64 | Holder-spring | 85 | O-ring |
| 41 | Guide-piston | 65 | Spring-negative | 87 | Back-up ring |
| 42 | Spring-lock valve | 66 | Piston-negative | 89 | Back-up ring |
| 43 | Piston | 67 | Socket-negative | 94 | Relief valve-main |
| 44 | Socket-lock valve | 68 | Plug | 95 | Bolt-socket head |
| 45 | Spool-lock valve | 69 | Plug | 96 | Relief valve-overload |
| 46 | Spring-lock valve | 71 | Plug | 97 | Plug-relief valve |
| 47 | Plug-lock valve | 73 | Plug | 98 | Plug-relief valve |
| | | | | 99 | Relief valve-overload |

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.
- (2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (3) When a control valve is to be removed from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.
- (4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.
- (5) After disassembling and assembling of the component it is desired to carry out various tests (For the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

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

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

3) DISASSEMBLY

(1) Disassembly of spools without holding valve

Loosen hexagon socket head bolts with washer
(Hexagon wrench : 5mm)

Remove the pilot cover.

Pay attention not to lose the O-ring under the pilot cover.

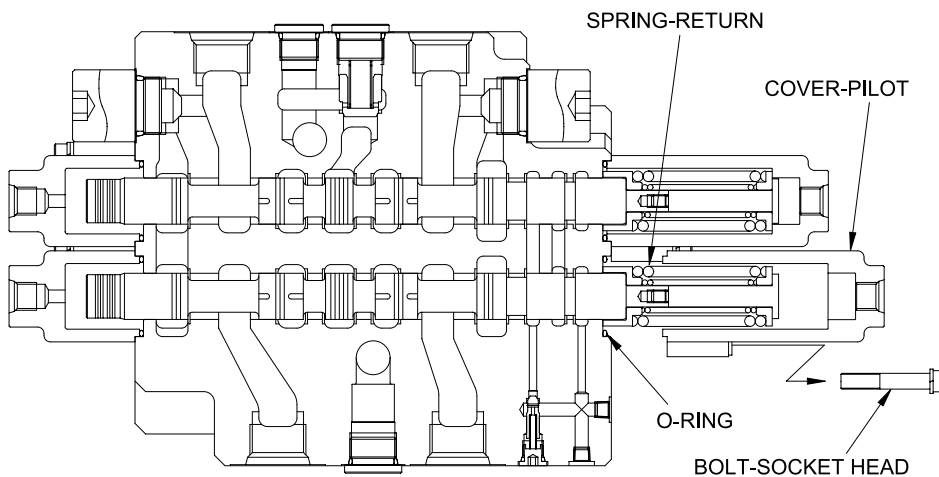
Remove the spool assembly from the body by hand slightly.

When extracting each spool from its body, pay attention not to damage the body.

When extracting each spool assembly, it must be extracted from spring side only.

When any abnormal parts are found, replace it with completely new spool assembly.

When disassembled, tag the components for identification so that they can be reassembled correctly.



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

Loosen hexagon socket head bolts with washer
(Hexagon wrench : 5mm)

Remove the pilot cover with internal parts.

Pay attention not to lose the O-ring and the poppet under the pilot cover.
Pay attention not to damage the "piston A" under pilot cover.

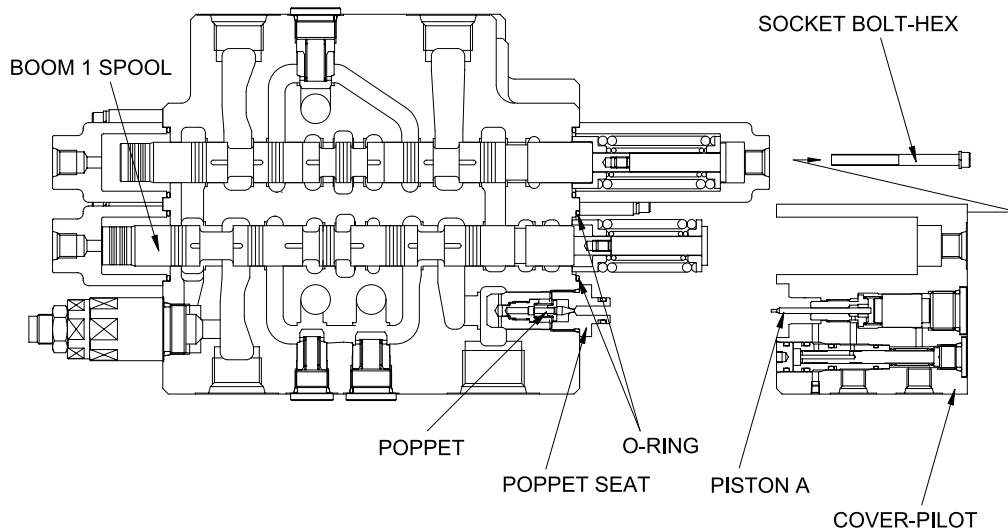
Remove the spool assembly from the body by hand slightly.

When extracting each spool from its body, pay attention not to damage the body.

When extracting each spool assembly, it must be extracted from spring side only.

When any abnormal parts are found, replace it with completely new spool assembly.

When disassembled, tag the components for identification so that they can be reassembled correctly.



(3) Disassembly of the holding valve

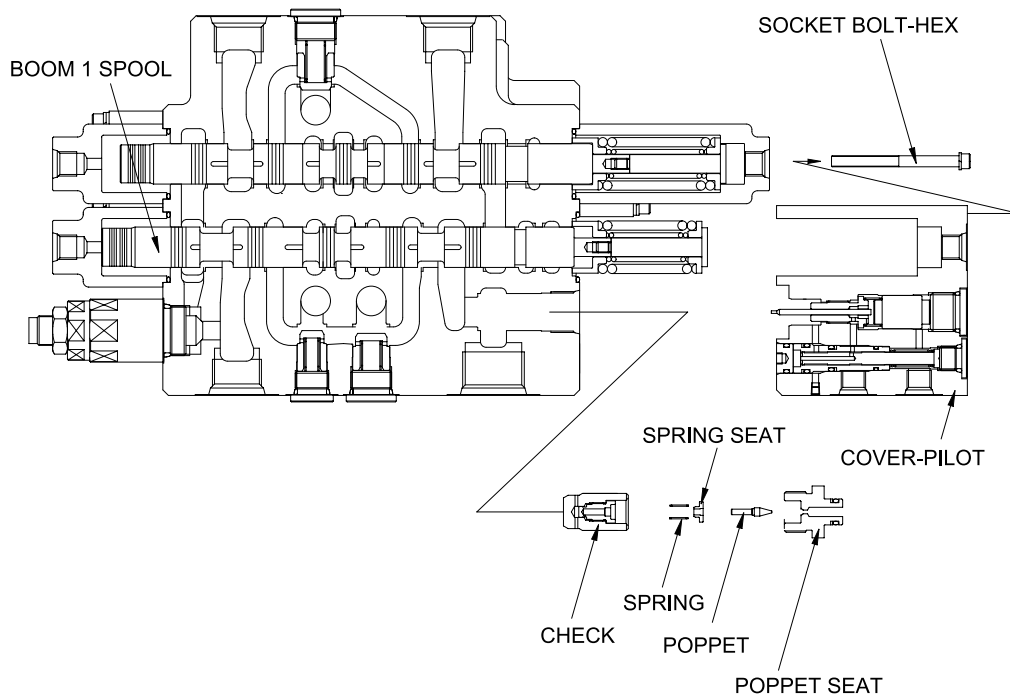
Remove the pilot cover with the holding valve as discribed on previous page.

Do not disassembled internal parts of the pilot cover.

Loosen the poppet seat and remove the poppet, the spring seat, the spring and the check.
(Spanner : 32mm)

Pay attention not to lose the poppet.

Do not disassembled internal parts of the check.



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

The load check valve

a. Fix the body to suitable work bench.

Pay attention not to damage the body.

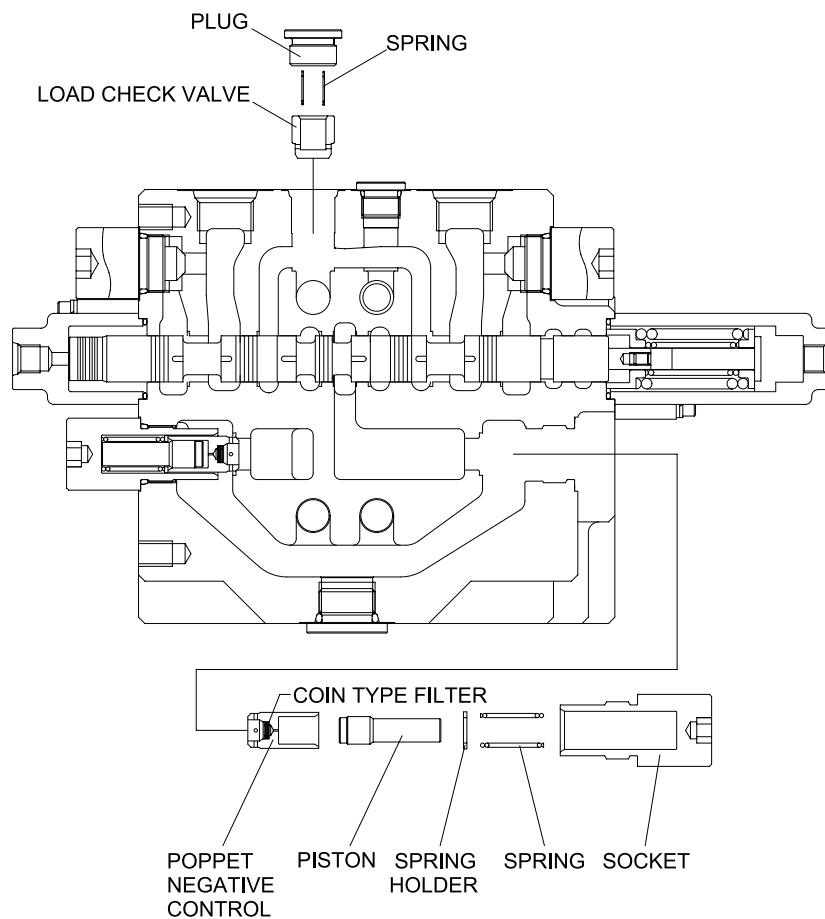
b. Loosen the plug (Hexagon wrench : 10mm).

c. Remove the spring and the load check valve with pincers or magnet.

The negative relief valve

a. Loosen the socket (Hexagon wrench : 12mm).

b. Remove the spring, the spring holder, the piston and the negative control poppet.



(5) Disassembly of the main and overload relief valve

Fix the body to suitable work bench.

Remove the main relief valve.

(Spanner : 32mm)

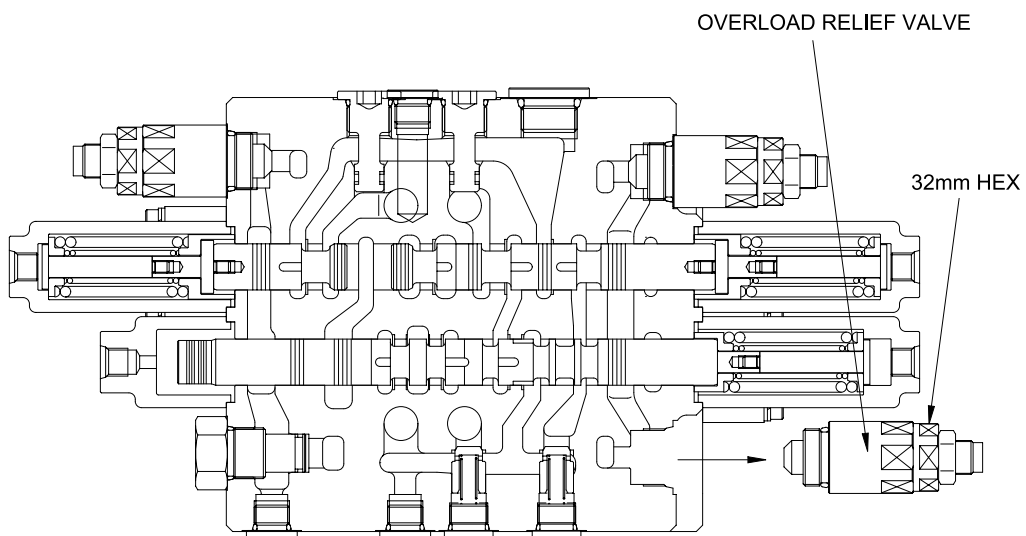
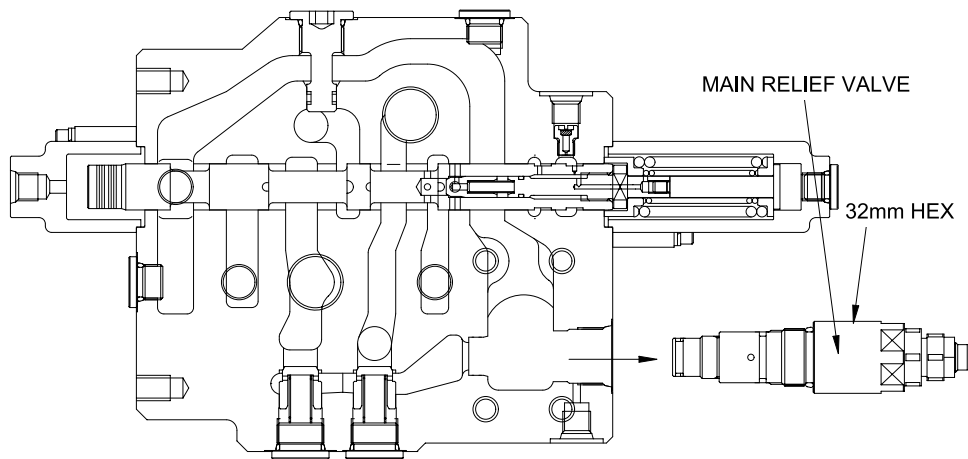
Remove the overload relief valve.

(Spanner : 32mm)

When disassembled, tag the relief valve for identification so that they can be reassembled correctly.

Pay attention not to damage seat face.

When any abnormal parts are found, replace it with completely new relief valve assembly.



(6) Inspection after disassembly

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

Control valve

- a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
- b. Confirm that seal groove faces of body and block are smooth and free of dust, dent, rust etc.
- c. Correct dents and damages and check seat faces within the body, if any, by lapping.
Pay careful attention not to leave any lapping agent within the body.
- d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free foreign matter.
- e. If any spring is broken or deformed, replace it with new one.
- f. When a relief valve does not function properly, repair it, following it's the prescribed disassembly and assembly procedures.
- g. Replace all seals and O-rings with new ones.

Relief valve

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

4) ASSEMBLY

(1) General precaution

In this assembly section, explanation only is shown.

For further understanding, please refer to the figures shown in the previous structure & disassembly section.

Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.

Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.

Do not stretch seals so much as to deform them permanently.

In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.

Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.

Do not reuse removed O-rings and seals.

(2) Load check valve

Assemble the load check valve and spring.

Put O-rings on to plug.

Tighten plug to the specified torque.

- Hexagon wrench : 10mm
- Tightening torque : 6~7kgf · m(43.4~50.6lbf · ft)

(3) Negative control relief valve

Assemble the nega-con poppet, piston, spring holder and spring together into body.

Put O-ring on to plug and tighten the latter to its specified torque.

- Hexagon wrench : 12mm
- Tightening torque : 8~9kgf · m(57.8~65.1lbf · ft)

(4) Main relief, port relief valves

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

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

(5) Main spools

Carefully insert the previously assembled spool assemblies into their respective bores within of body.

Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

(6) Covers

Fit spool covers to the non-spring assembly end of the spool, and tighten the hexagonal socket head bolts to the specified torque.

- Hexagon wrench : 5mm
- Tightening torque : 1~1.1kgf · m(7.2~7.9lbf · ft)

Confirm that O-rings have been fitted.

Fit spring covers to the spring end for the spools, and tighten hexagon socket head bolts to the specified torque.

- Hexagon wrench : 5mm
- Tightening torque : 1~1.1kgf · m(7.2~7.9lbf · ft)

Confirm that O-rings have been fitted.

(7) Holding valves

Assemble the check, spring seat and poppet together into body.

Tighten the poppet seat to the specified torque.

- Spanner : 26mm
- Tightening torque : 6~7kgf · m(43.4~50.6lbf · ft)

Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.

Tighten hexagon socket head bolt to specified torque.

- Hexagon wrench : 5mm
- Tightening torque : 1~1.1kgf · m(7.2~7.9lbf · ft)

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

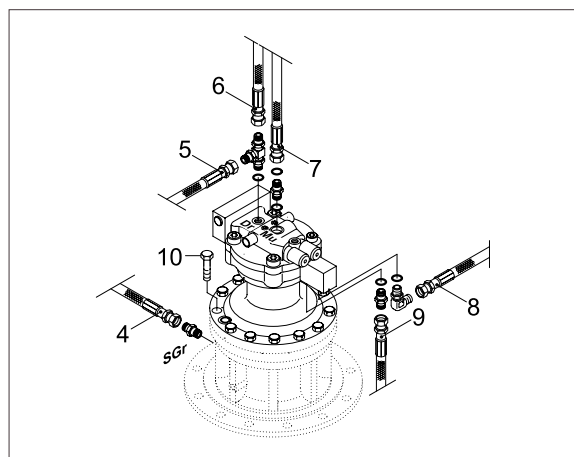
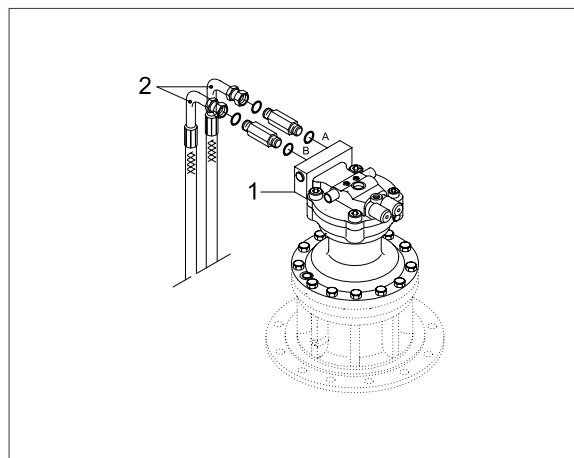
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury. When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Disconnect hose assembly(2).
- (5) Disconnect pilot line hoses(4,5,6,7,8,9).
- (6) Sling the swing motor assembly(1) and remove the swing motor mounting bolts (10).

Motor device weight : 36kg(79.4lb)

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

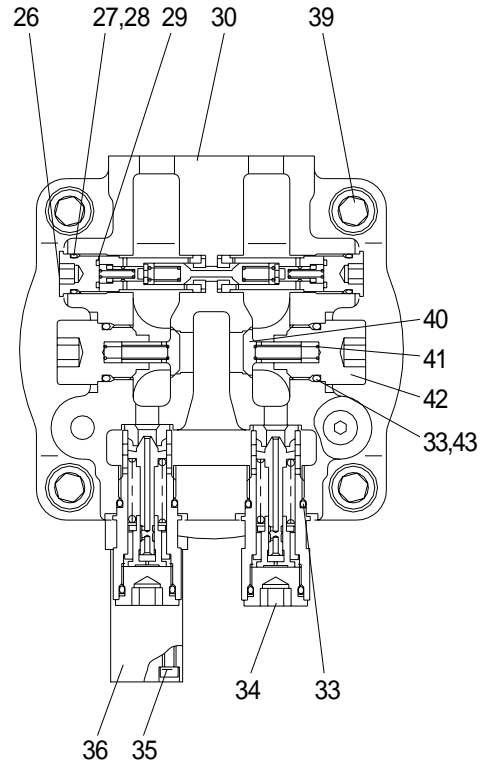
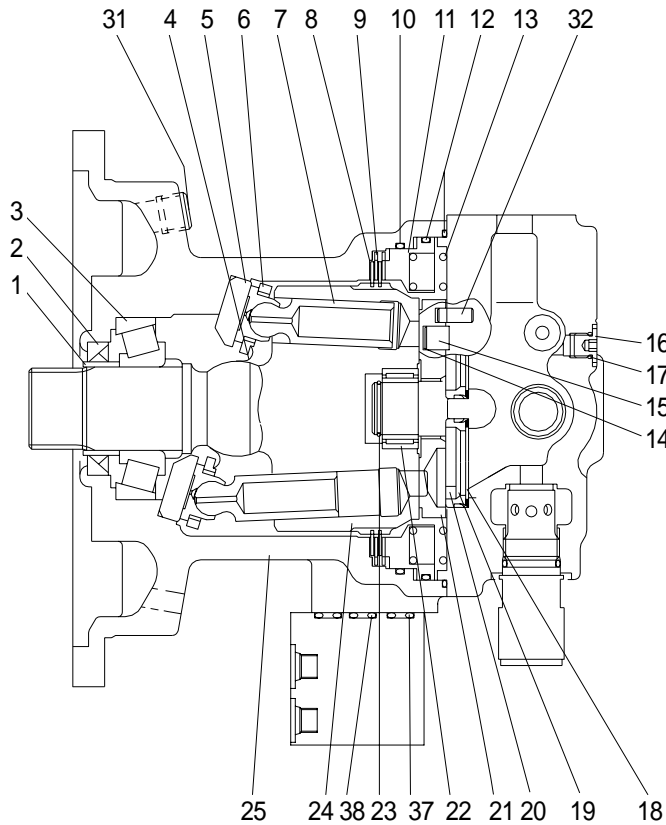
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
Remove the air vent plug.
Pour in hydraulic oil until it overflows from the port.
Tighten plug lightly.
Start the engine, run at low idling and check oil come out from plug.
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



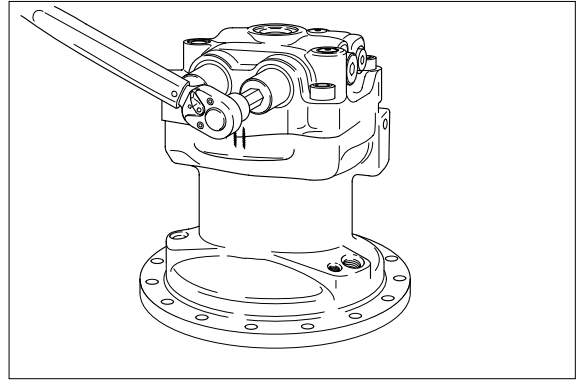
1	Inner ring	15	Piston	29	O-ring
2	Oil seal	16	Cap	30	Cover
3	Tapered roller bearing	17	O-ring	31	Plug
4	Backing spring	18	Scrowave	32	Parallel pin
5	Cam plate	19	Teflon ring	33	O-ring
6	Return plate	20	Bush	34	Relief valve
7	Piston assembly	21	Balance plate	35	Bolt
8	Lining plate	22	Needle bearing	36	Time delay valve
9	Plate	23	Snap ring	37	O-ring
10	O-ring	24	Cylinder assembly	38	O-ring
11	Piston	25	Housing	39	Bolt
12	O-ring	26	Bypass valve assy	40	Check
13	Spring	27	Back-up ring	41	Spring
14	Teflon ring	28	O-ring	42	Cap
				43	Back-up ring

2) DISASSEMBLY

(1) Removal of relief valve assembly

Remove cap of relief valve assembly(34) with 14mm hexagonal wrench.

Assemble removed relief valve assembly (34) to original state when reassembling.

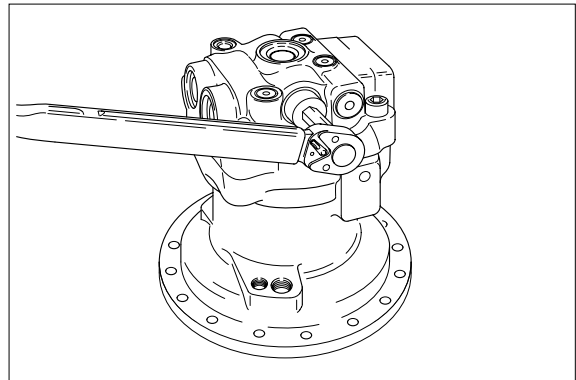


(2) Removal of make up valve and bypass valve assembly

Loosen cap(42) with 14mm hexagonal wrench, and remove check valve(40) and spring(41).

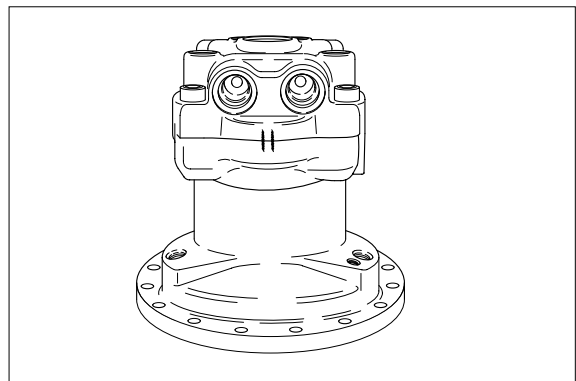
Remove bypass valve assembly(26) with 10mm hexagonal wrench.

Assemble removed bypass valve assembly(26) to original state when reassembling.



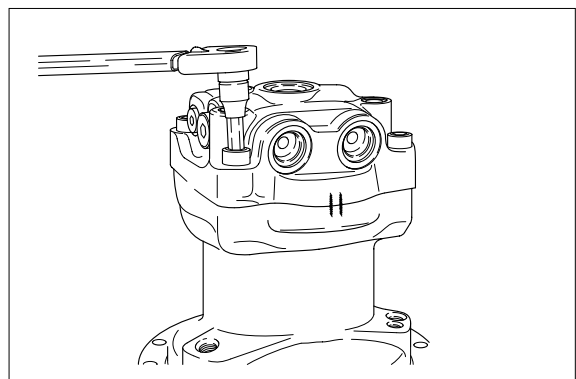
(3) Marking at swing motor

Before disassembling motor, make a matching mark between cover(30) and housing(25) for easy reassembling.



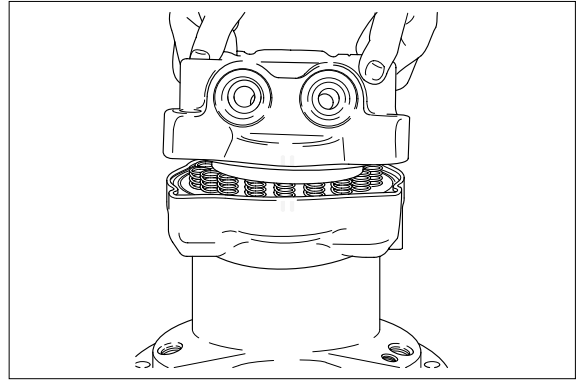
(4) Remove mounting bolts of cover

Loosen hexagon socket bolt(39) with 12mm hexagonal wrench.

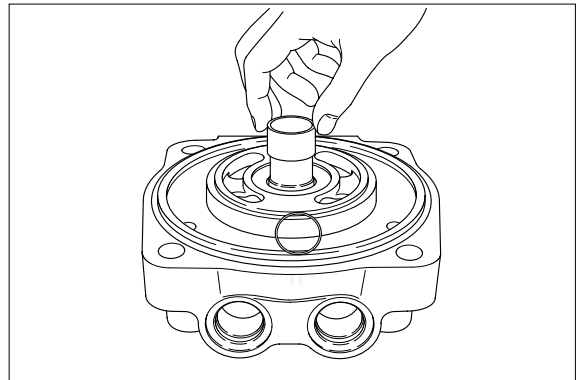


(5) Removal of cover assembly

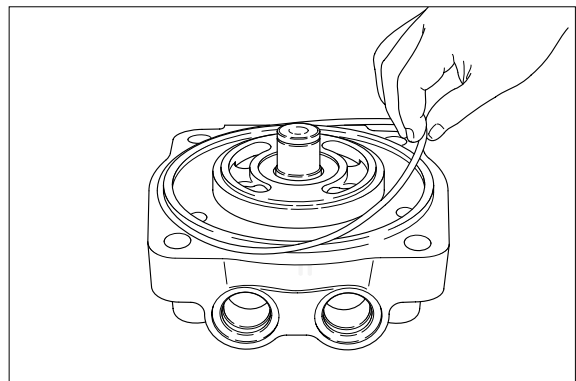
Place shaft of motor assembly to downward and take cover(30) out.



(6) Remove snap ring(23) with steel pointer and remove inner race of needle bearing (22) by bearing puller.



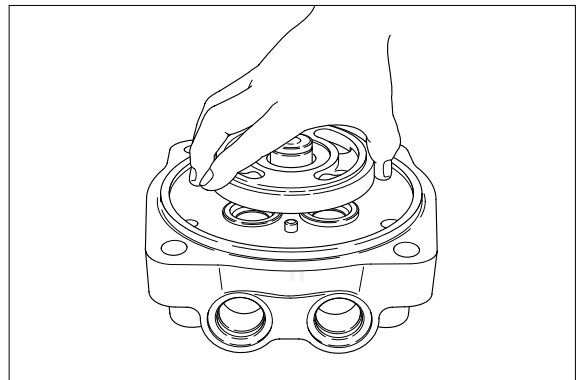
(7) Remove O-ring(12) from cover.



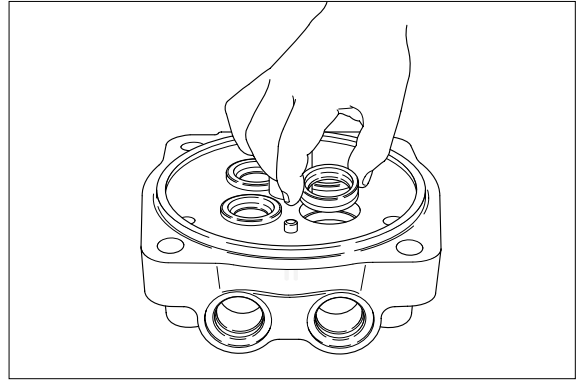
(8) Remove balance plate

Balance plate(21) is adhered on end surface of cylinder(24) by oil viscosity. Take off balance plate(21) with hands. Assembling method of balance plate(21) depends on cover(30).

(Band groove and round groove of high · low pressure transmission area)
Before removing, check and record location of balance plate(21) to prevent misassembling.

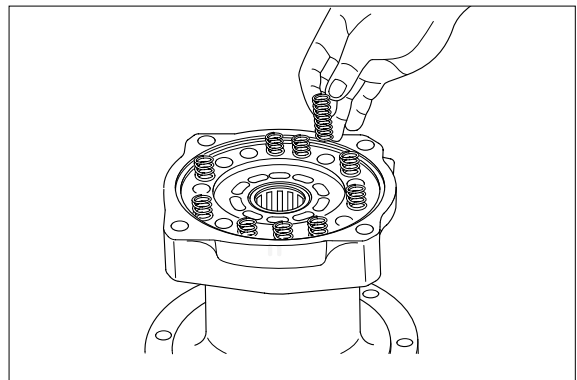


- (9) Remove bushing(20) and scrowave(18) from teflon ring(19).



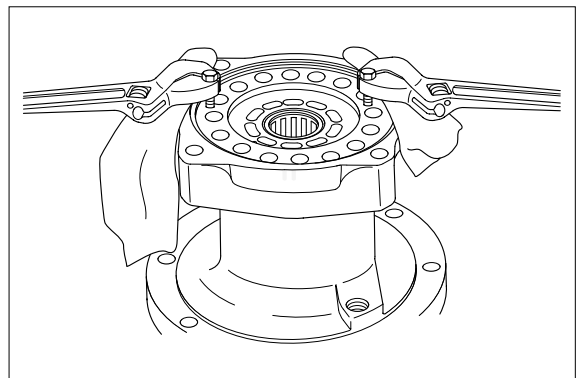
(10) Removal of spring(13, brake area)

Remove spring(13) from piston(11).
Check and record original position of each spring(13) for correct assembling.

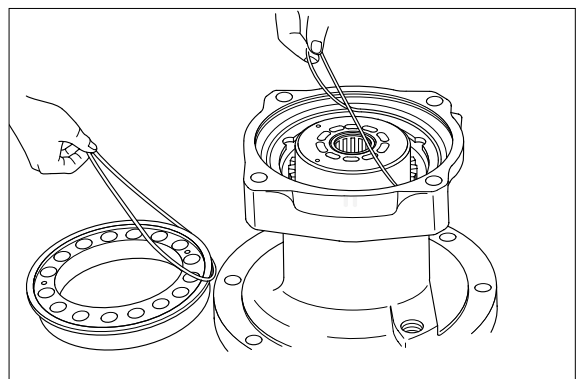


(11) Removal of brake piston

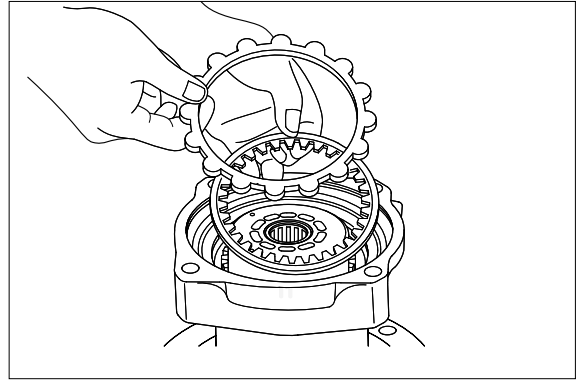
When removing piston(11) from housing (25), there is a sliding resistance against tightening of O-rings(10,12). Use tap hole(M6) on piston(11) as shown in the picture.



- (12) Remove O-rings(10,12) from piston(11) and housing(25).



- (13) Remove friction plate(9) and lining plate (8) from housing(25).



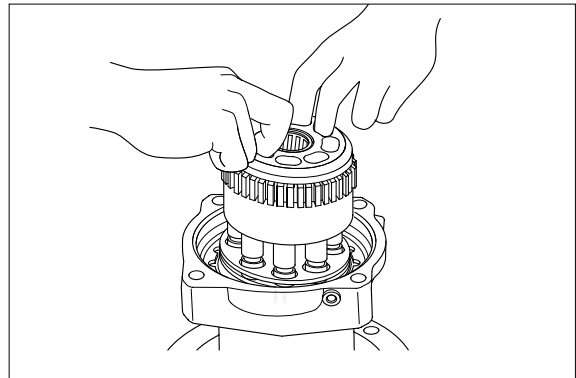
(14) Removal of cylinder assembly

Holding end of cylinder assembly(24) with hand, draw out cylinder assembly from housing.

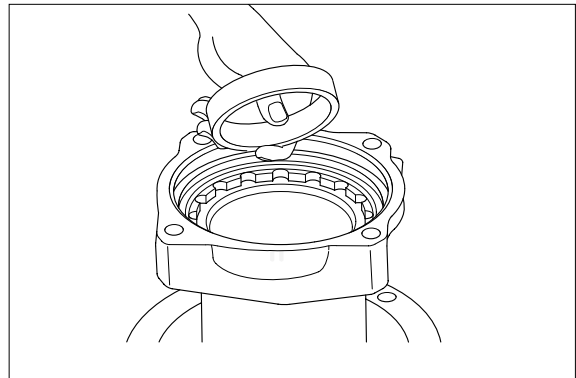
Oil seal(2) and outer race of taper roller bearing(3) are left inside of housing.

End surface of cylinder(24) is sliding face .
So, protect the surface with a scrap of cloth against damage.

Make a matching mark on piston hole of cylinder(24) and piston assembly(7) to fit piston into the same hole when reassembling.



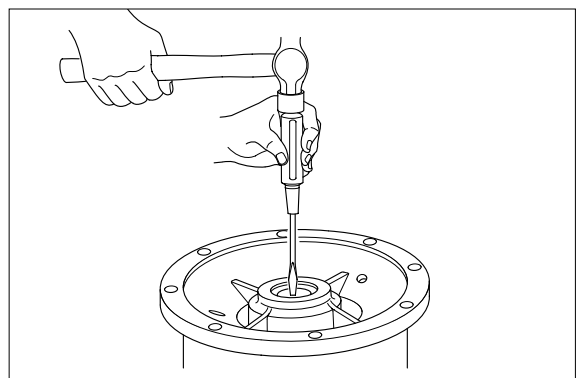
- (15) Separate outer race of taper roller bearing(3) from housing.



(16) Removal of oil seal

Remove oil seal(2) from housing(25) with driver and hammer.

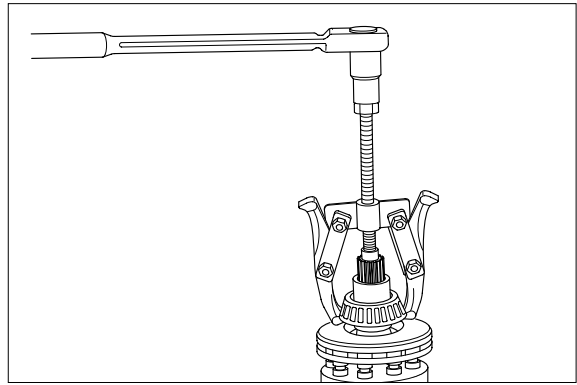
Do not reuse oil seal after removal.



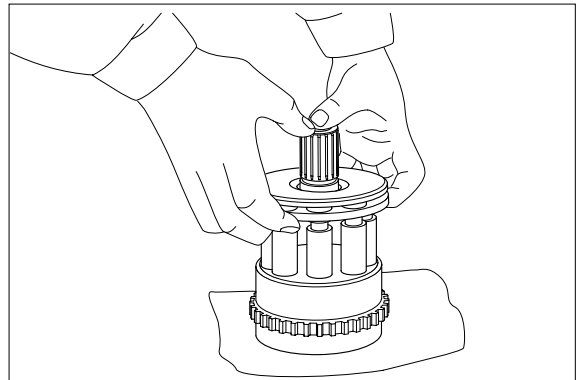
(17) Disassembly of cylinder assembly

Removal of inner race of taper roller bearing(3).

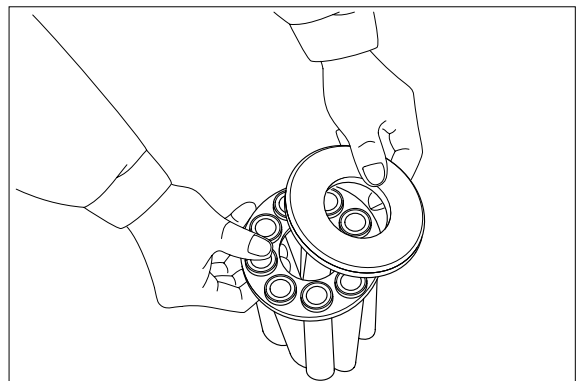
After removing snap ring(23), lift out cylinder(24) with 2 inner race of roller bearing(3) by applying gear puller at the end of spline in the cylinder.



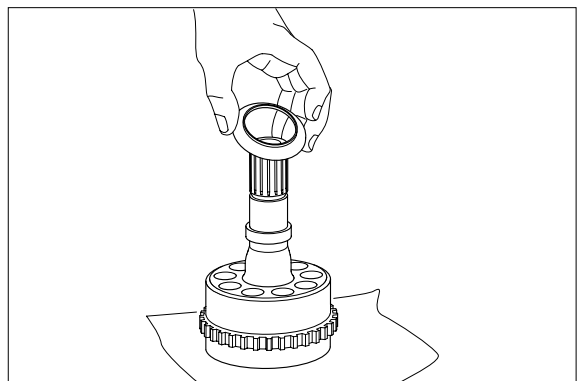
Separate cam plate(5), piston assembly (7), return plate(6) from cylinder(24).



Get cam plate(5) slide on sliding face of piston assembly(7) and remove it. Be cautious not to damage on sliding face of cam plate.



Remove backing spring(4) from cylinder (24).



This completes disassembly.

3) ASSEMBLY

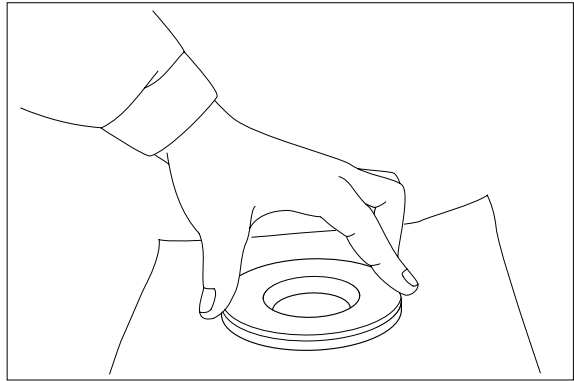
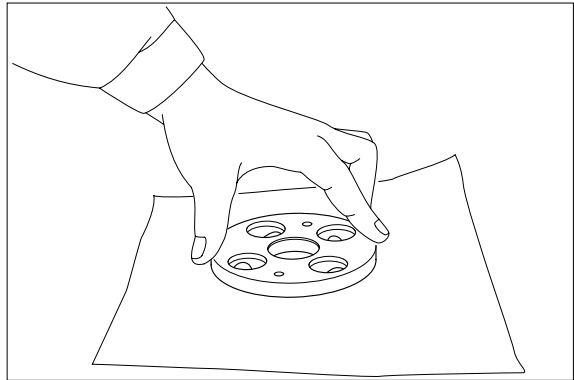
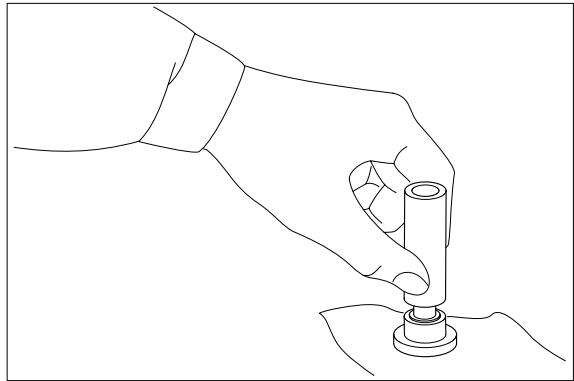
(1) Preparation

Before reassembling, perform below procedure.

Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

Replace seal with new one.

Grind sliding face of piston assembly(7), balance plate(21) and cam plate(5) with sandpaper #2000.

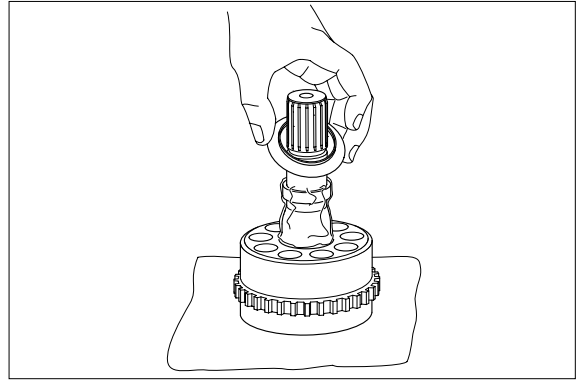


When assembling, lubricate with specified clean hydraulic oil.

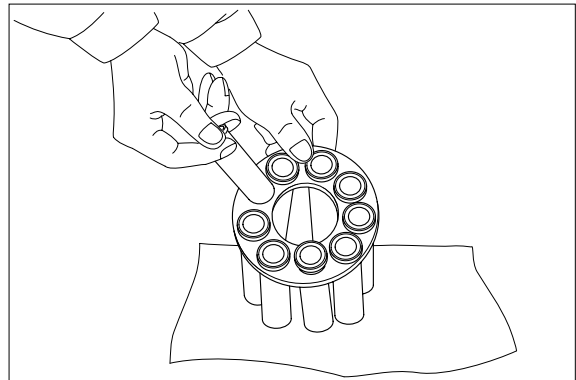
When assembling piston assembly(7) to piston hole of cylinder(24), check matching mark between them.

(2) Cylinder assembly

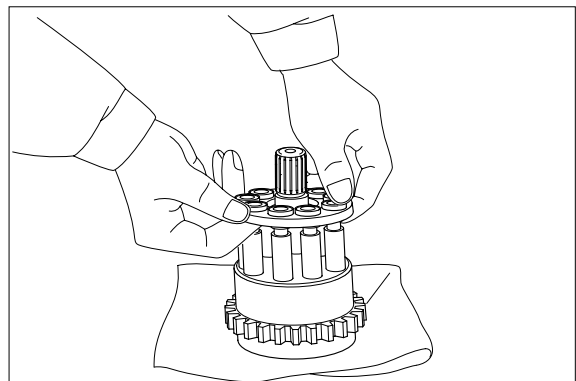
Lubricate grease on round area (Contacting area with spring(4)) of cylinder(24) and assemble spring(4).



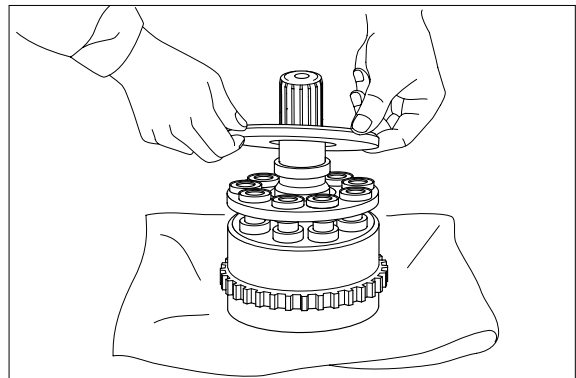
Insert piston assembly(7) in hole of return plate(6).



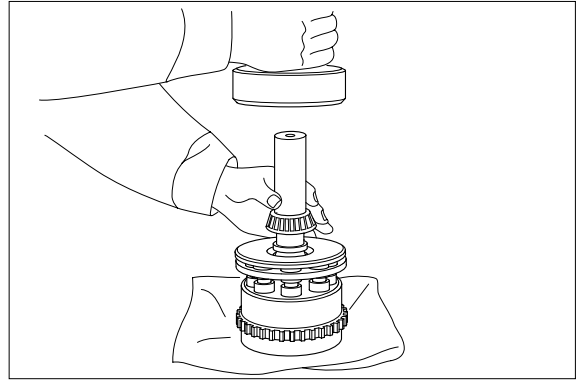
Assemble piston assembly(7) and return plate(6) to cylinder(24). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder(24).



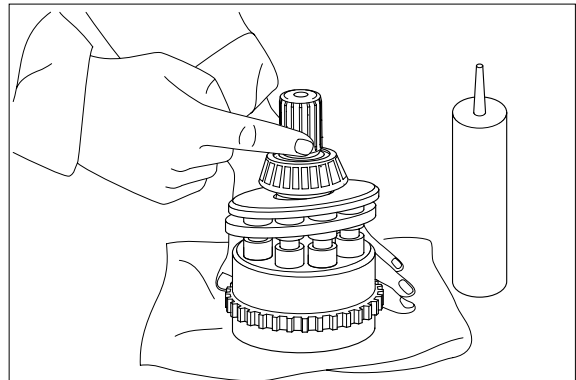
Lubricate specified hydraulic oil on shoe sliding face of piston assembly(7) and assemble cam plate(5).



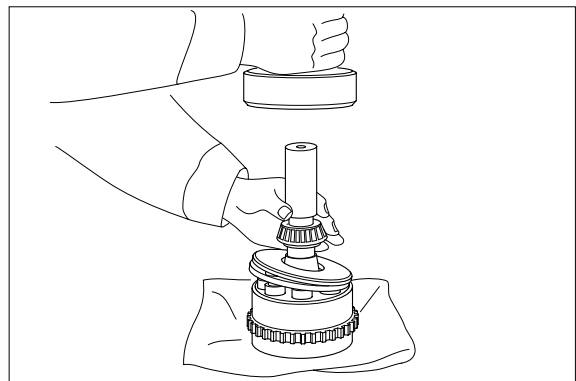
Assemble inner race of taper roller bearing(3) to cylinder(24).



Apply loctite to bearing mounting area of inner race of cylinder(24) lightly.



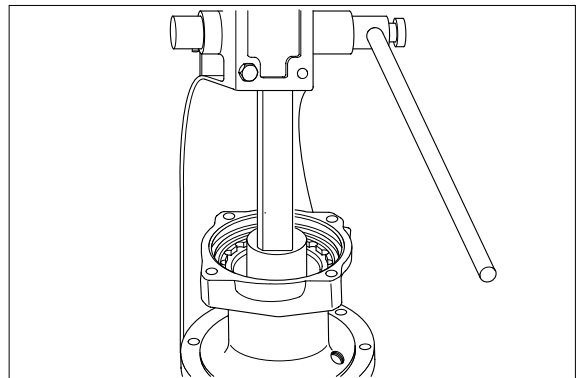
Assemble inner ring(1) to cylinder(24).



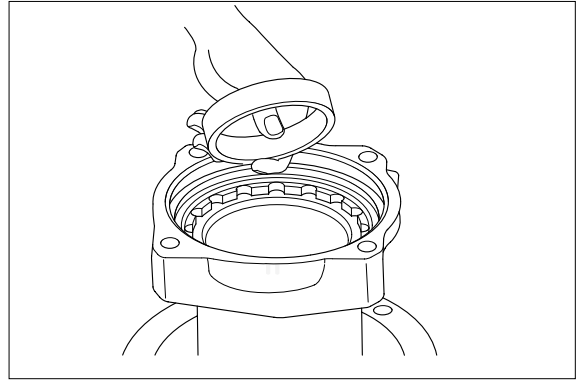
(3) Oil seal

Apply three bond of white color on outer surface of oil seal(2) and assemble and insert it.

Before assembling, lubricate lip of oil seal with grease.

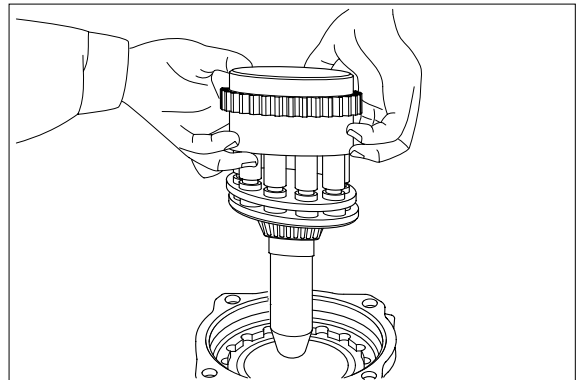


- (4) Assemble outer race of taper roller bearing(3) to motor housing(25).

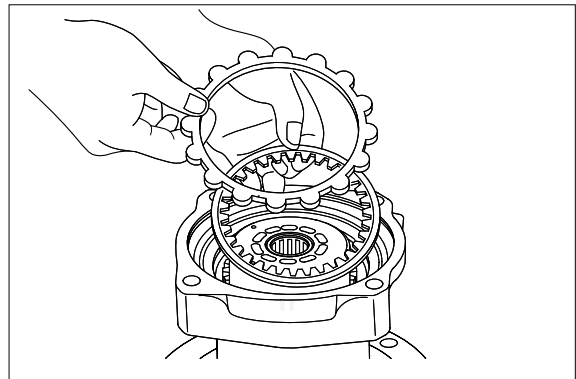


(5) Cylinder assembly

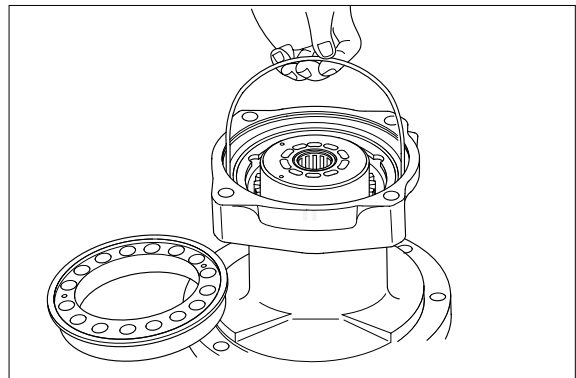
Hold end of cylinder assembly(24) with hands and assemble cylinder assembly to housing(25). Be careful to prevent damage of seal by spline of shaft. When assemble cylinder assembly, spline shaft of cylinder is protruded from end of housing, therefore put pads with length 30~50mm under bottom of housing.



- (6) Assemble plate(9) and lining plate(8).
Lubricate specified hydraulic oil on each side.



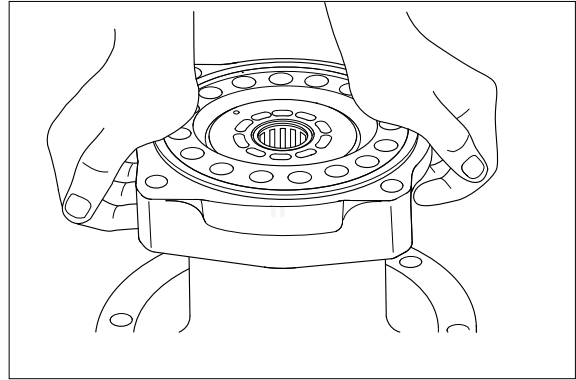
- (7) Insert O-rings(10,12) into housing(25) and piston(11).
Lubricate O-ring with grease.



(8) Brake piston

Lubricate specified hydraulic oil on outer sliding face of piston(11) and assemble brake piston to housing(25).

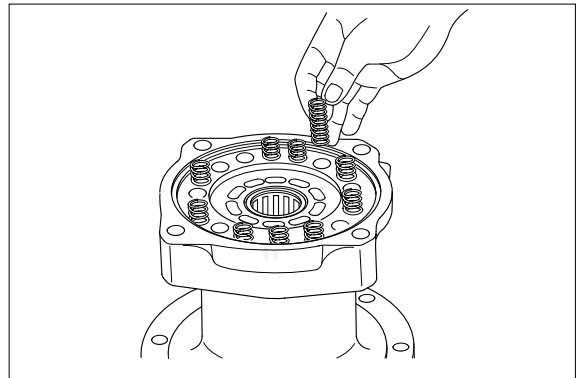
It is too tight to assemble piston(7) because O-rings(10,12) are fitted, therefore it is recommended to push piston(11) horizontally by hands at once.



(9) Spring(13, brake unit)

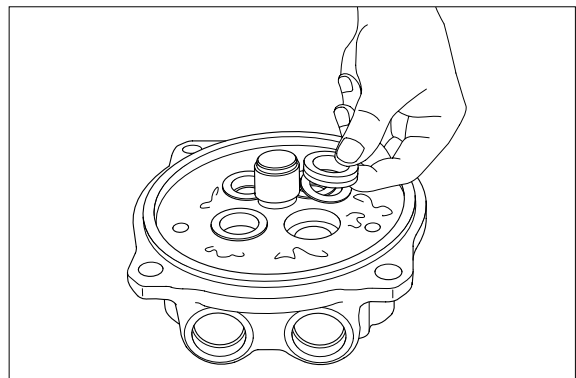
Assemble spring(13) to piston(11) of brake unit.

Insert spring(13) into original position.

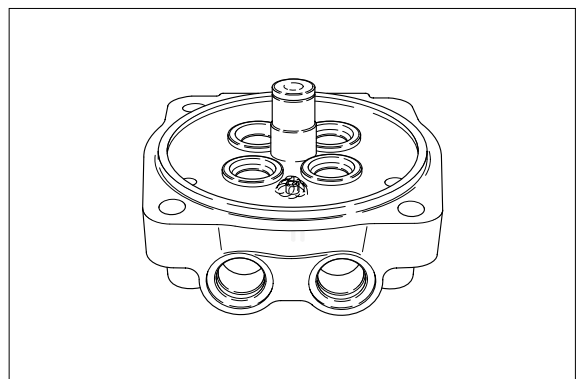


(10) Assemble bushing(20) with teflon ring(19) and scrowave(18) to bushing hole of cover(30).

Lubricate on both end surfaces of bushing(20) and outer face of teflon ring(19) with grease and assemble cover to housing, and parts are adhered on cover by grease viscosity which makes assembling easy.

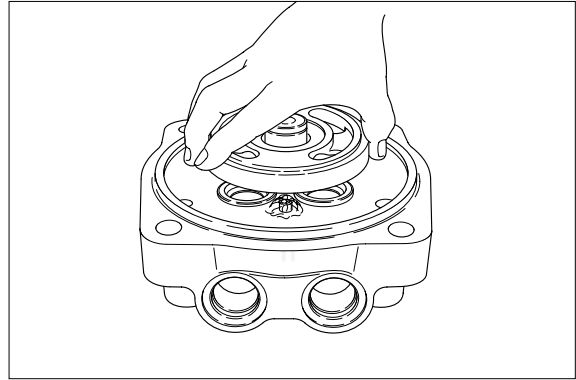


(11) Lubricate locating pin for antirotation of balance plate(21) of cover(30) with grease sufficiently and install locating pin to housing.

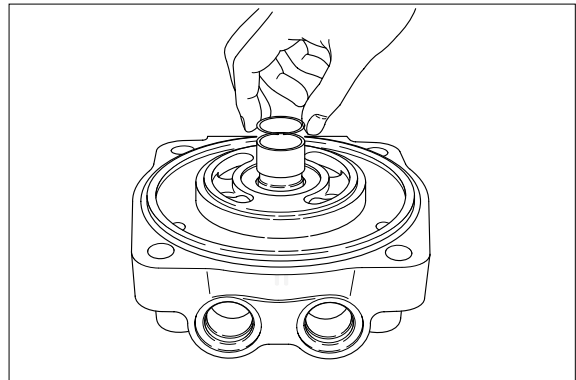


(12) Balance plate

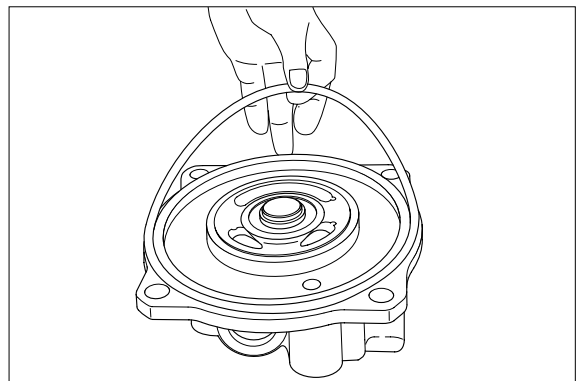
Assemble balance plate(21) to cover(30).
Be cautious of assembling direction.



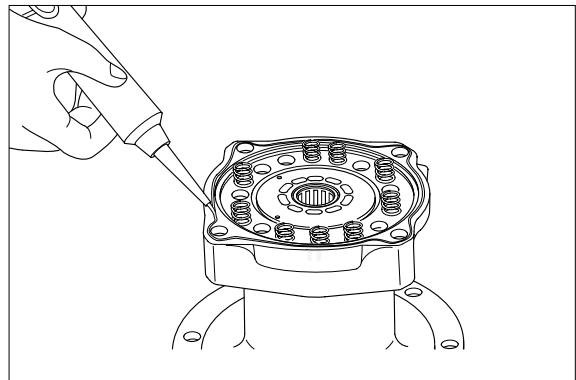
(13) Assemble inner race of needle bearing (22) and snap ring(23) to cover(30).



(14) Assemble O-ring(12) to cover(30).
Lubricate O-ring with grease.



(15) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole(M14) of cover(30).

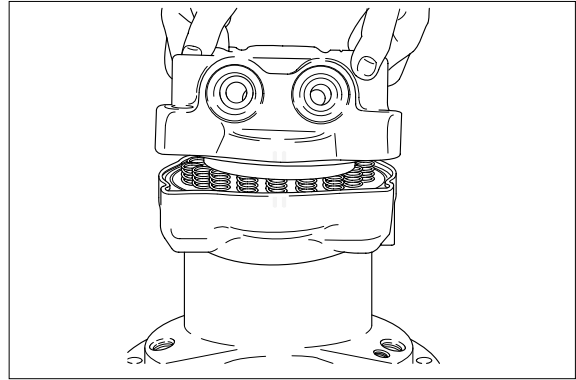


(16) Cover

Assemble cover(30) and balance plate (21) to housing(25) lightly, holding them up with hands.

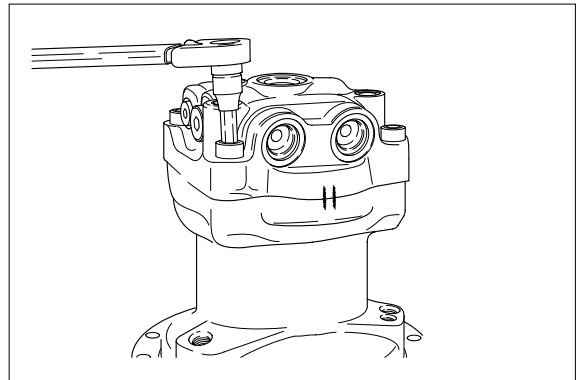
When assembling, be careful not to detach balance plate(21) and bushing (20) from cover(30).

Fit matching marks on housing(25) and cover(30) made before disassembling.



(17) Tighten cover(30) and housing(25) with 12mm hexagonal socket bolt(35).

- Tightening torque : 16kgf · m(116lbf · ft)



(18) Make up valve

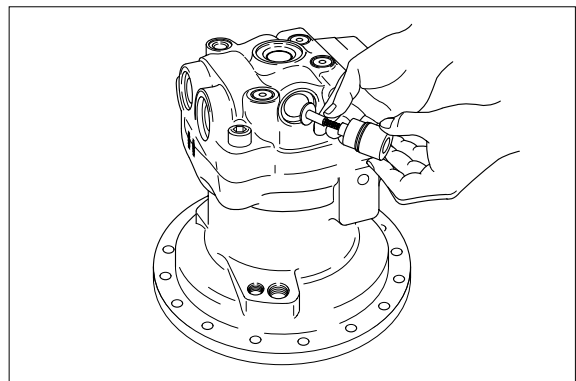
Assemble check(40) and spring(41) to cover(30) and tighten cap(42) with 14mm hexagonal socket bolt.

- Tightening torque : 14kgf · m(101lbf · ft)

(19) Bypass valve assembly

Assemble bypass valve assembly(26) to cover(30) with 10mm hexagonal socket bolt.

- Tightening torque : 8kgf · m(58lbf · ft)

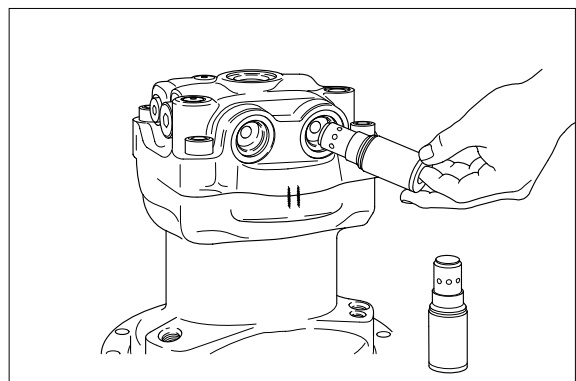


(20) Relief assembly

Assemble relief valve assembly(34) to cover(30) with 14mm hexagonal socket bolt.

- Tightening torque : 8kgf · m(58lbf · ft)

Be cautious of assembling method.



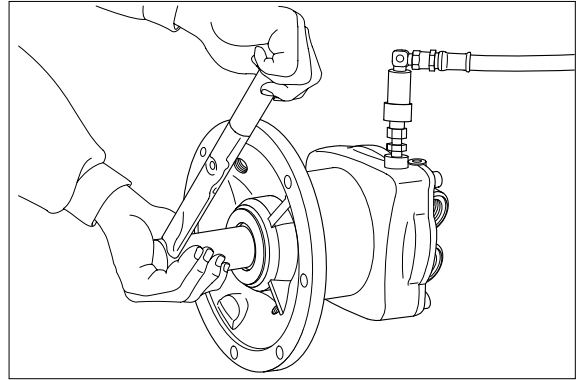
(21) Check of assembly

Load pilot pressure of 20kgf/cm² to brake release port after opening inlet and outlet port.

Check if output shaft is rotated smoothly around torque of 0.5~1kgf · m.

If not rotated, disassemble and check.

This completes assembly.



3. REMOVAL AND INSTALL OF REDUCTION GEAR

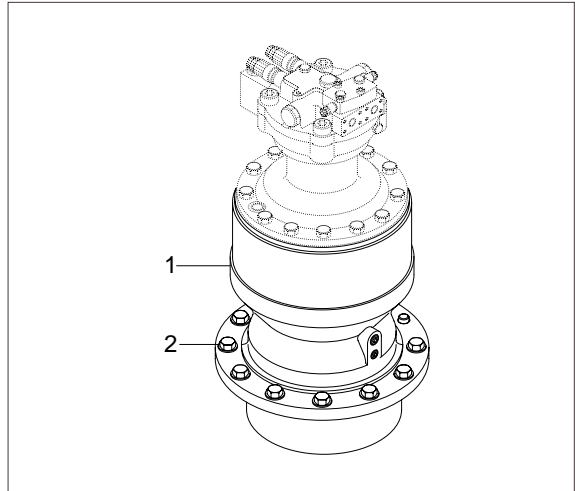
1) REMOVAL

- (1) Remove the swing motor assembly.
For details, see **removal of swing motor assembly**.
- (2) Sling reduction gear assembly(1) and remove mounting bolts(2).
- (3) Remove the reduction gear assembly.
 - Reduction gear device weight : 95kg
(209lb)



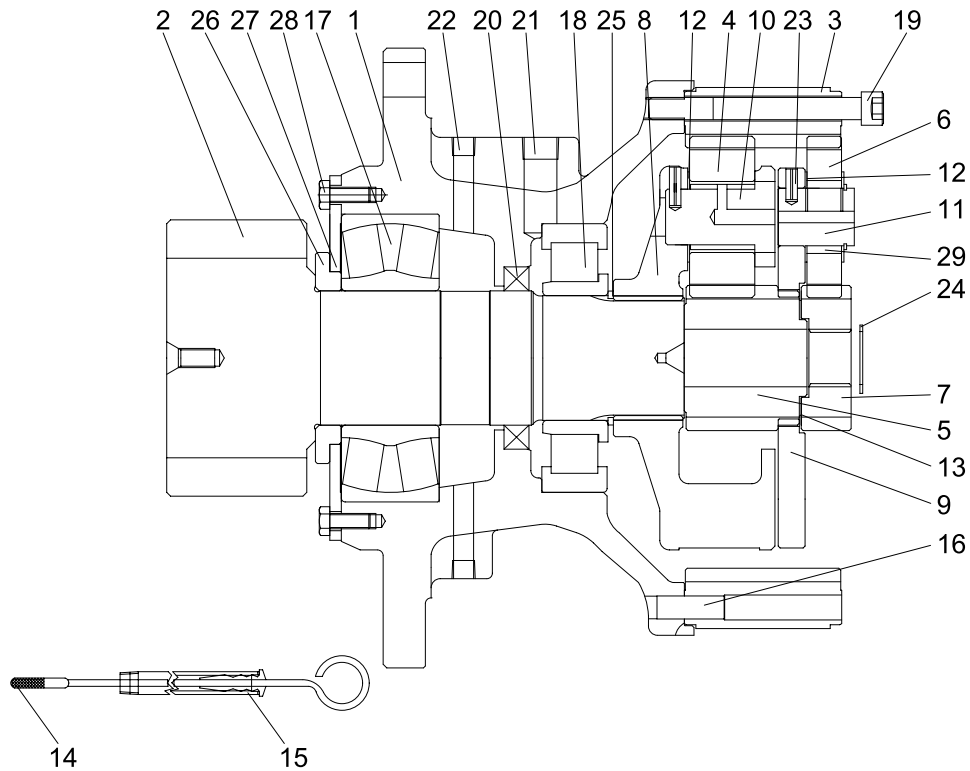
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - Tightening torque : $29.7 \pm 4.5 \text{kgf} \cdot \text{m}$
($215 \pm 32.5 \text{lb} \cdot \text{ft}$)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

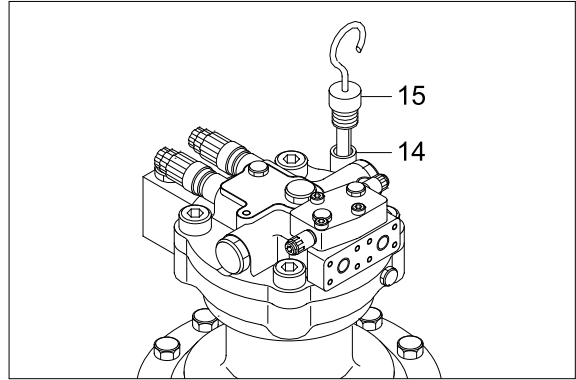
1) STRUCTURE



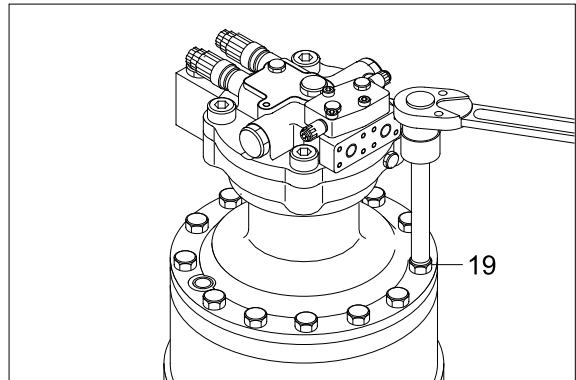
1	Casing	10	Pin No.2 assembly	20	Oil seal
2	Drive shaft	11	Pin No.1	21	Plug(B)
3	Ring gear	12	Thrust washer(B)	22	Plug(A)
4	Planet gear No.2	13	Thrust washer(A)	23	Spring pin
5	Sun gear No.2	14	Gage bar	24	Stop ring
6	Planet gear No.1	15	Gage pipe	25	Stop ring
7	Sun gear No.1	16	Knock pin	26	Spacer
8	Carrier No.2	17	Sph roller bearing	27	Cover plate
9	Carrier No.1	18	Cyl roller bearing	28	Bolt
		19	Bolt	29	Needle cage

2) DISASSEMBLY

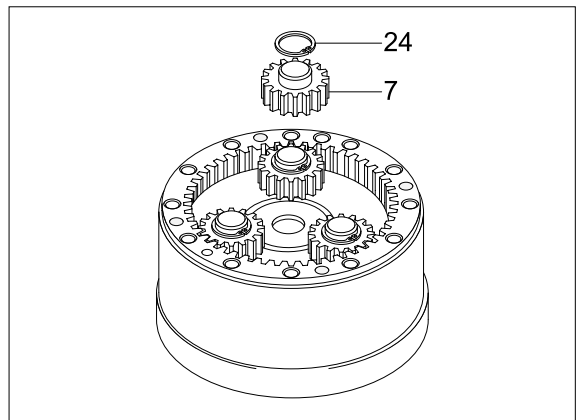
- (1) Remove gauge bar(14) and gauge pipe (15) from the swing motor casing.
Pour the gear oil out of reduction gear into the clean bowl to check out the friction decrease.



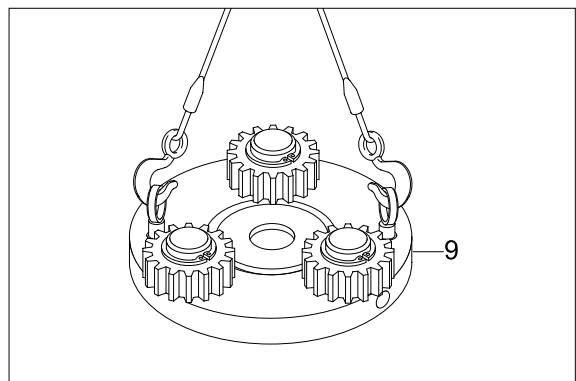
- (2) Loosen the socket bolts(19) to separate swing motor from reduction gear.



- (3) Remove stop ring(24) and then sun gear(7).



- (4) Tighten two M10 eye bolts to carrier(9) and lift up and remove carrier(9) as subassembly.



(5) Disassembling carrier1(9) assembly.

Remove stop ring(24).

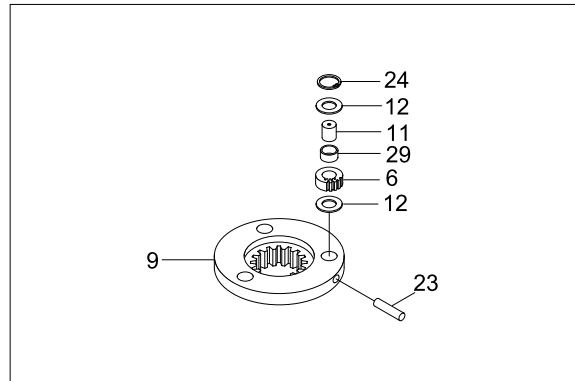
Remove thrust washer(12), planet gear1 (6), needle cage(29), and thrust washer(12) from the carrier.

Using M8 solid drill, crush spring pin(23) so that the pin1(11) can be removed by hammering.

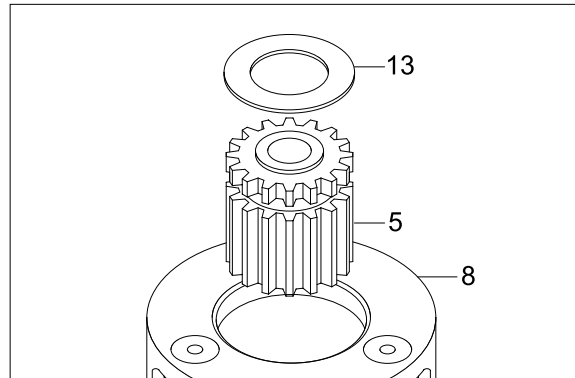
Do not reuse spring pin(23).

Do not remove pin1(11), carrier1(9) and spring pin(23) but in case of replacement.

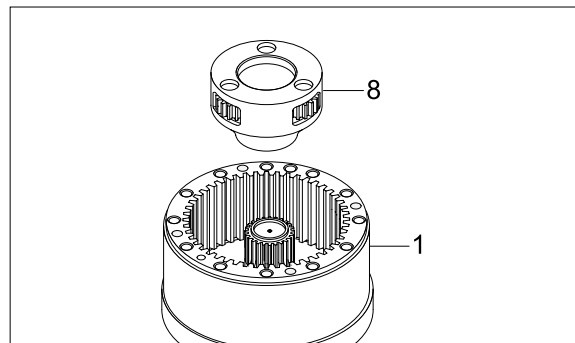
Put matching marks on the planet gear1 (6) and the pin1(11) for easy reassembly.



(6) Remove sun gear2(5) and thrust washer (13).



(7) Remove carrier2(8) assembly from casing (1).



(8) Disassembling carrier2(8) assembly

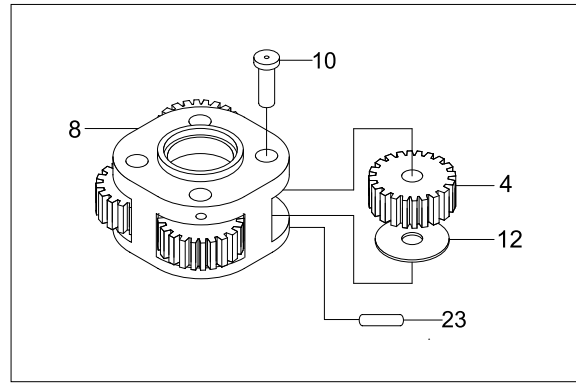
Using M8 solid drill, crush spring pin(23) so that the pin2(10) can be removed.

Do not reuse spring pin(23).

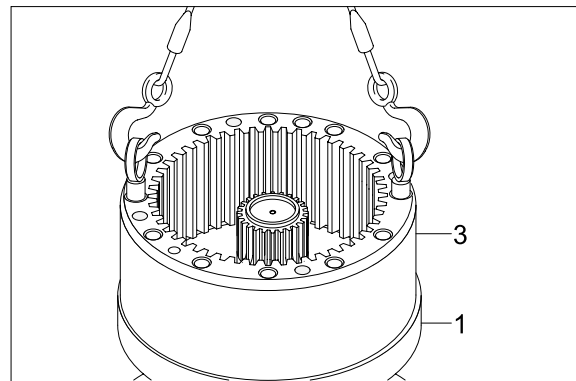
Remove pin2(10), planet gear2(4) and thrust washer(12) from the carrier2(8).

Put matching marks on the planet gear2 (4) and the pin2(23) for easy reassembly.

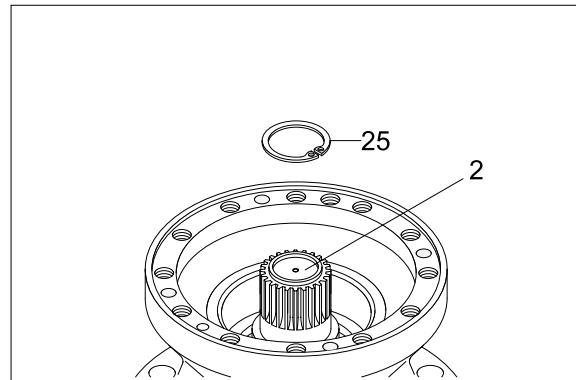
Do not disassemble pin2(23), carrier2(8) and spring pin(23) but in case of replacement.



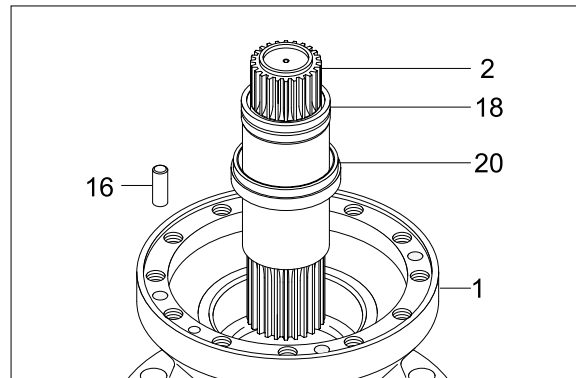
(9) Tighten two M16 eyebolt to the ring gear(3) and then lift the ring gear(3) out of casing(1).



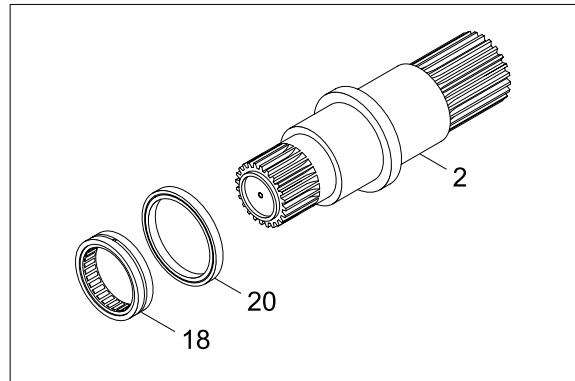
(10) Remove stop ring (25) from the drive shaft(2).



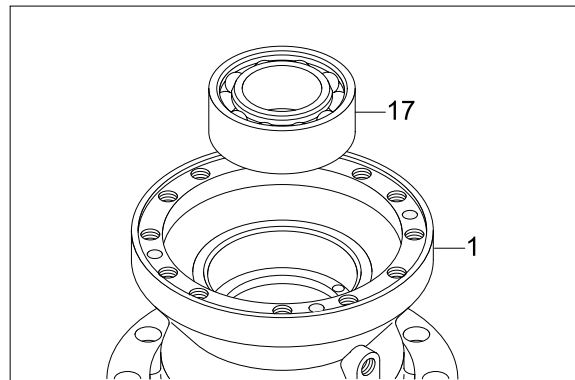
(11) Remove drive shaft(2) with roller bearing(18) and oil seal(20) assembled. Remove knock pin(16) from the casing(1).



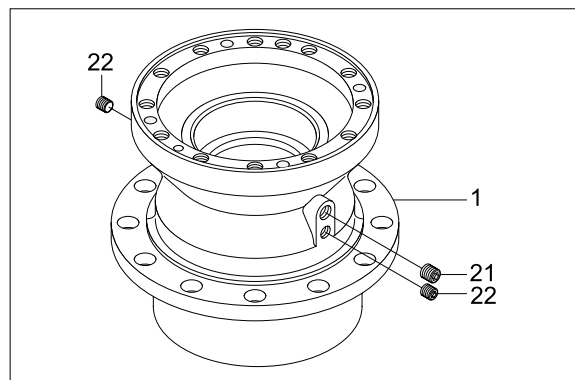
- (12) Remove roller bearing(18) and oil seal(20) from the drive shaft(2).
Do not reuse oil seal(20) once removed.



- (13) Using the bearing disassembly tool, remove roller bearing(17).

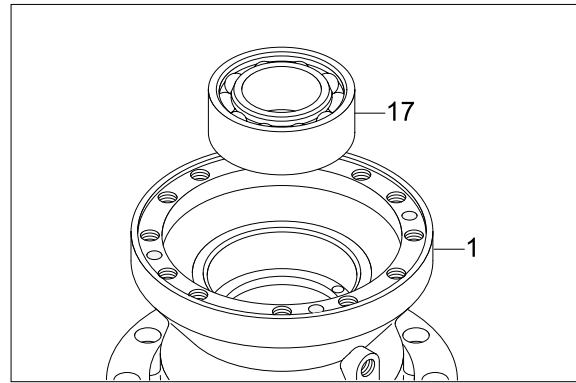


- (14) Remove plugs(21, 22) from the casing(1).

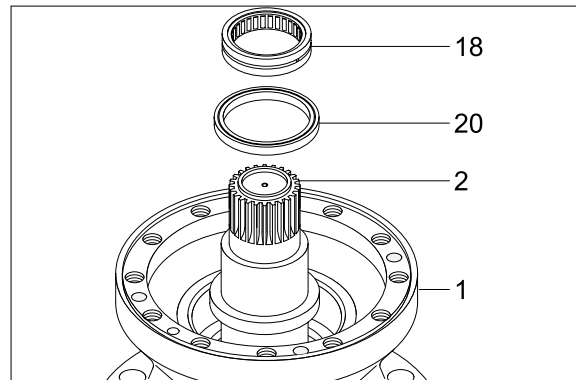


3) ASSEMBLY

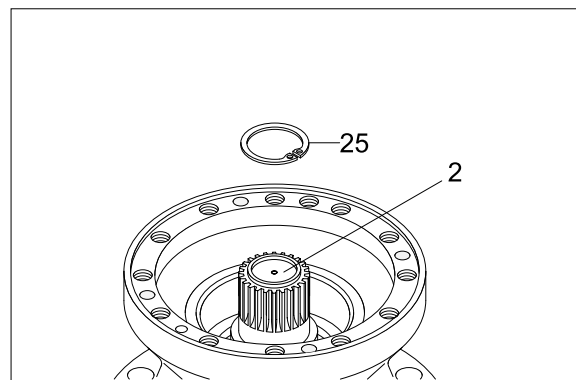
- (1) Assemble roller bearing(17) inside the casing(1).



- (2) Assemble the drive shaft(2) into the casing(1) and then install oil seal(20) and roller bearing(18).



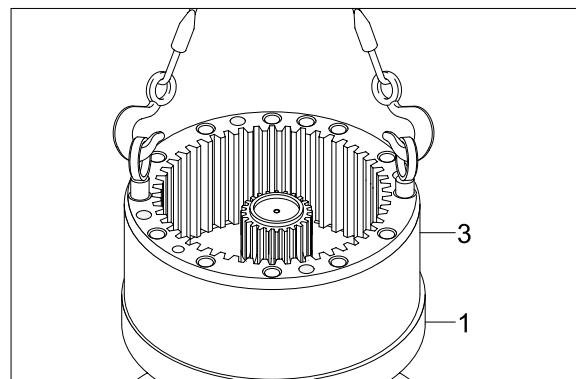
- (3) Install stop ring(25) on top of drive shaft (2).



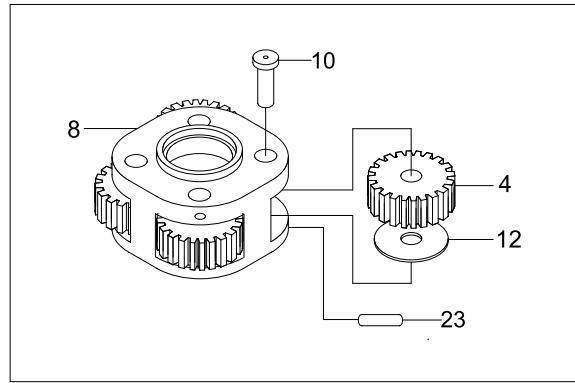
- (4) Apply loctite to the tapped holes of casing (1).

- (5) Tighten 2 M16 eye bolts to the ring gear(3) and lift up and then assemble it onto the casing(1).

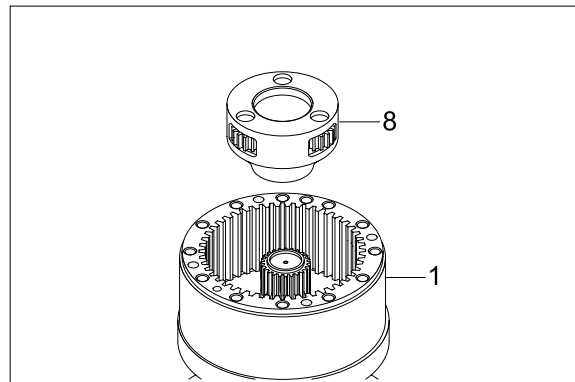
Don't fail to coincide the knock pin(16) holes.



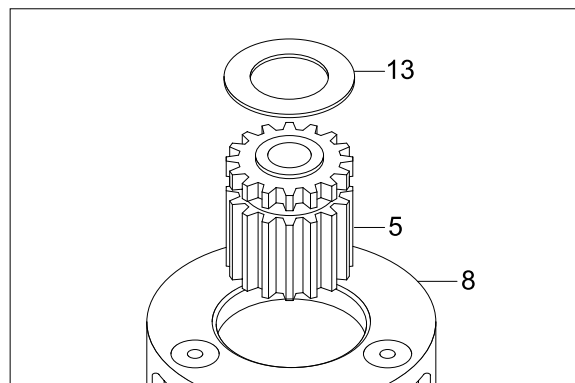
- (6) Assembling carrier2(8) assembly.
 Install thrust washer(12) and the planet gear2(4) inside the carrier2(8).
 Assemble the pin2(10) to the carrier2(8) and then press the spring pin(23) by hammering.
 Punch 2 points of the spring pin(23) lip.
 Take care not to mistake the matching marks of each part.



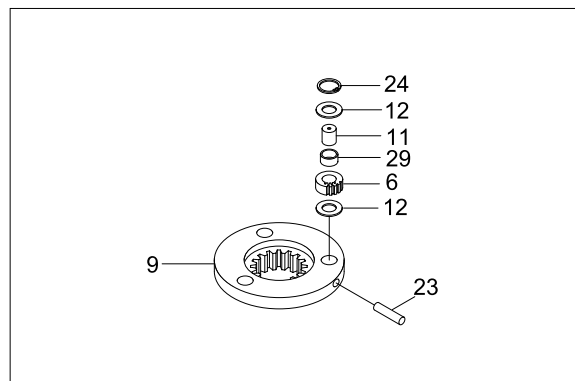
- (7) Assemble carrier2(8) assembly correctly to the drive shaft(2).



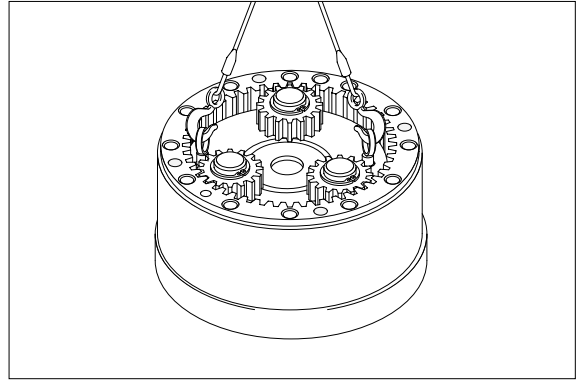
- (8) Assemble sun gear2(5) and thrust gear (13) to the center of the carrier2(8) assembly.



- (9) Assembling carrier1(9) assembly.
 Assemble the pin1(11) to the carrier1(9) and then press the spring pin(23) by hammering.
 Punch 2 points of the spring pin's(23) lip.
 Install needle cage(29) into the planet gear1(6).
 Assemble thrust washer(12), planet gear1(6), and then stop ring(24) to the pin1(11).
 Take care not to mistake the matching marks of each part.

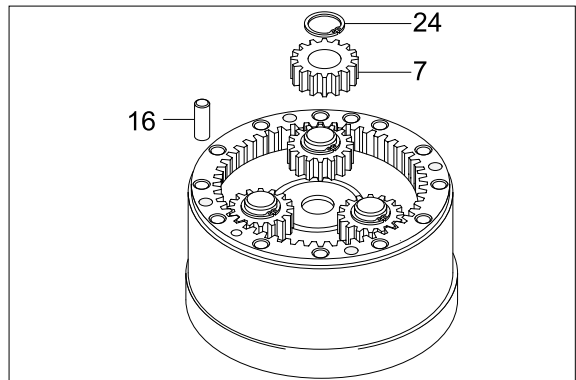


(10) Assemble carrier(9) assembly into the ring gear.



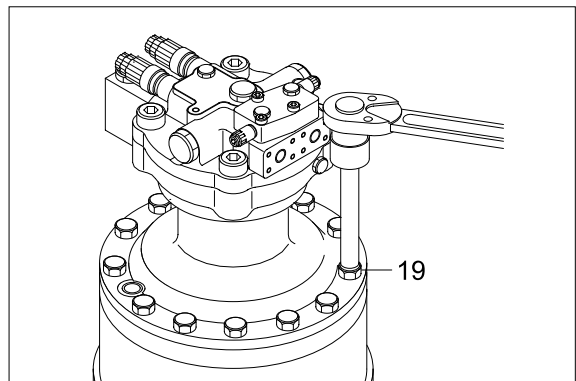
(11) Hammer 4 knock pins(16) around the ring gear(3).

(12) Assemble sun gear(7) and stop ring(24) to the drive shaft of the swing reduction gear.

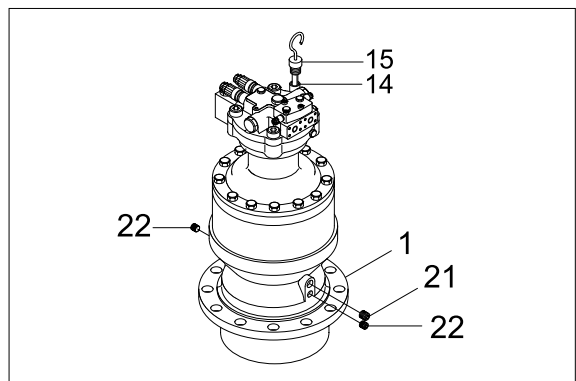


(13) Apply loctite to the tapped holes of the ring gear(3) and then mount swing motor onto the ring gear(3).
Don't fail to coincide the gauge bar(14) hole.

(14) Tighten socket bolts(19) around the swing motor assembly.
· Tightening torque : 24kgf · m(173lbf · ft)



(15) Assemble plugs(21, 22), gauge bar(14) and gauge pipe(15).

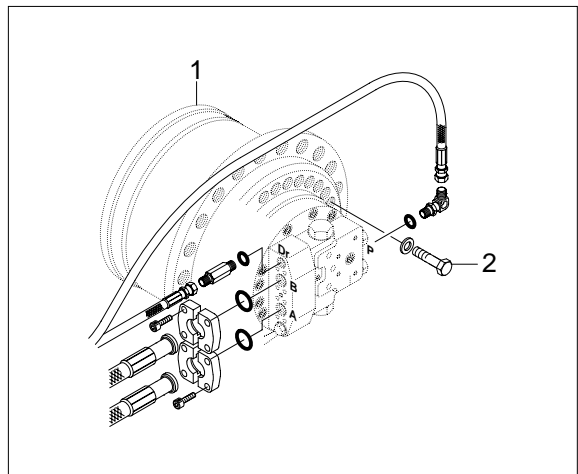


GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

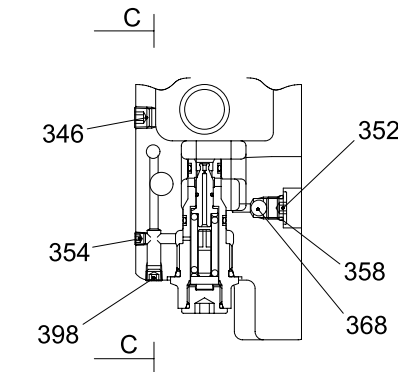
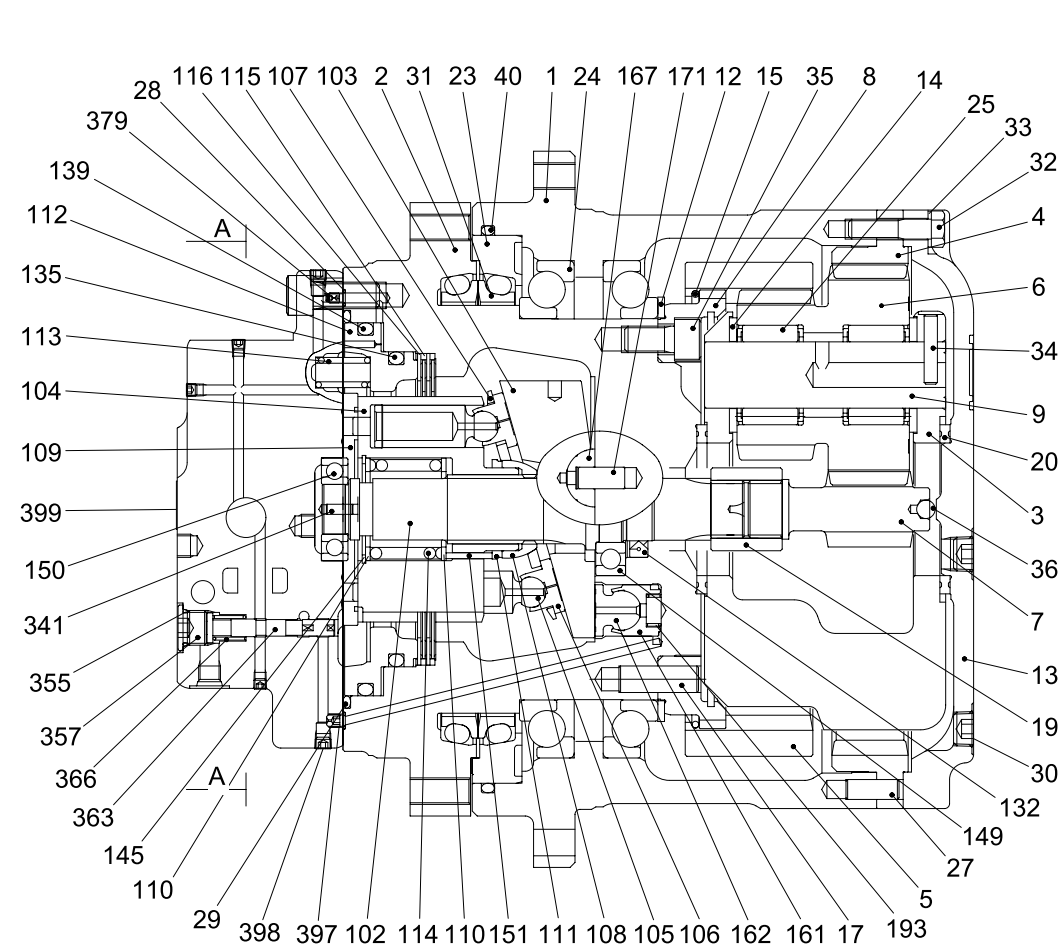
- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury. When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly**.
- (5) Remove the cover.
- (6) Remove the hose.
Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly(1).
- (9) Remove the mounting bolts(2), then remove the travel device assembly.
· Weight : 240kg(530lb)



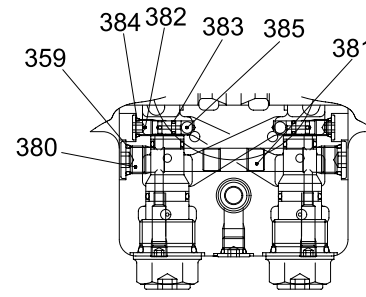
2) INSTALL

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

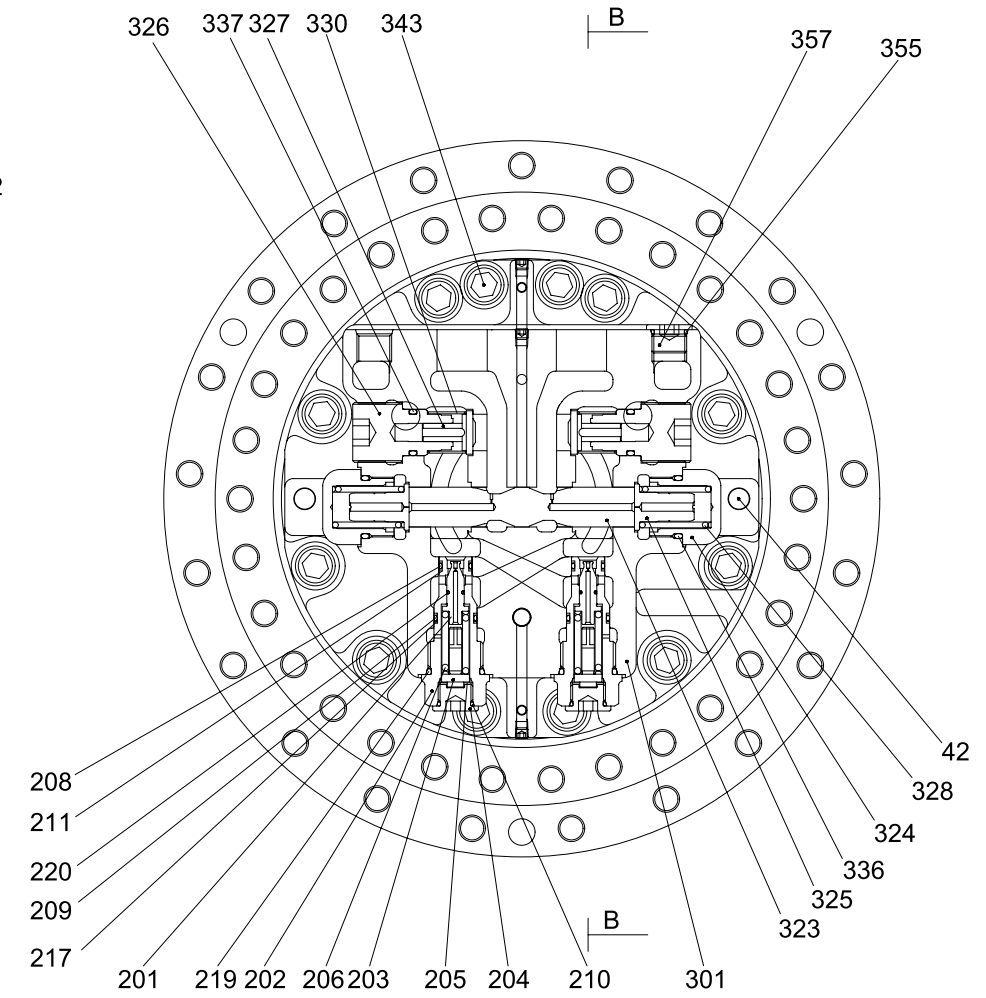
2) STRUCTURE



SECTION B - B



SECTION C - C

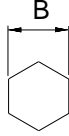


SECTION A - A

1	Hub	25	Needle bearing	106	Shoe	151	Rolling	219	O-ring	355	O-ring
2	Spindle	27	Parallel pin	107	Retainer plate	161	Piston(2)	220	Piston seal	357	RO plug
3	Carrier	28	O-ring	108	Thrust ball	162	Shoe(2)	301	Rear flange	358	O-ring
4	Ring gear A	29	O-ring	109	Timing plate	167	Pivot	323	Spool	359	O-ring
5	Ring gear B	30	PT plug	110	Washer	171	Paralell pin	324	Plug	363	Spool(2)
6	Cluster gear	31	Floating seal	111	Collar	193	Spring	325	Stopper	366	Spring
7	Sun gear	32	Socket bolt	112	Piston	201	Valve	326	Plug	368	Steel ball
8	Coupling gear	33	Spring washer	113	Spring	202	Sleeve	327	Valve	379	Filter
9	Shaft(cluster)	34	Parallel pin	114	Spring	203	Spring retainer	328	Spring	380	Plug
12	Distance piece	35	Socket bolt	115	Friction plate	204	Plug	330	Spring	381	Piston
13	Cover	36	Steel ball	116	Mating plate	205	Shim	336	O-ring	382	Plug
14	Thrust collar	40	O-ring	132	Oil seal	206	Spring	337	O-ring	383	O-ring
15	Ring	42	Parallel pin	135	O-ring	208	O-ring	341	Parallel pin	384	O-ring
17	Pin	102	Main shaft	139	O-ring	209	O-ring	343	Socket bolt	385	Steel ball
19	Coupling	103	Swash plate	145	Snap ring	210	O-ring	346	PT plug	397	Orifice
20	Thrust plate	104	Cylinder block	149	Ball bearing	211	Back-up ring	352	RO plug	398	PT plug
23	Seal ring	105	Piston	150	Ball bearing	217	Back-up ring	354	PT plug	399	Name plate
24	Ball bearing										

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name		Remark	
Allen wrench		5, 6, 8, 10, 14	
Socket for socket wrench, spanner	Socket	22, 30, 32, 41	
	Rod	5, 6, 8, 10, 14, 19	
Torque wrench		Capable of tightening with the specified torques	
Pliers		-	
(-) Driver		150mm	
Plastic and iron hammer		Wooden hammer allowed. Normal 1 or so	
Steel rod approx		7 x 7 x 200mm	
Monkey wrench		-	
Oil seal inserting jig		-	
Bearing pliers		-	
Seal tape		-	
Eye bolt		PF1/2, M16	
Press(0.5 ton)		-	
Oil stone		-	
Bearing assembling jig		-	
Liquid packing		Loctite #577	
Screw lock		Loctite #243	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Hexagon socket plug	30	PT 1/2	6.0 ± 2.0	43.4 ± 14.5
Hexagon socket bolt	32	M12 x 1.75 x 50	10.4 ± 1.6	75.2 ± 11.6
Hexagon socket bolt	35	M16 x 2.0 x 30	25.7 ± 4	186 ± 28.9
Sleeve	202	PF 1	25.0 ± 5.0	181 ± 36.2
Plug	204	PF 1/2	10.0 ± 2.0	72.3 ± 14.5
Plug	324	M36 x 1.5	45.0 ± 9.0	326 ± 65.1
Plug	326	M36 x 1.5	26.0 ± 4.0	188 ± 28.9
Hexagon socket bolt	343	M16 x 2.0 x 40	25.7 ± 4.0	186 ± 28.9
Plug	346	PT 1/4	3.0 ± 0.5	21.7 ± 3.6
Plug	352	PF 1/4	3.0 ± 0.5	21.7 ± 3.6
Hexagon socket plug	354	NTPF 1/16	0.6 ± 0.25	4.3 ± 1.8
Plug	357	PF 1/2	10.0 ± 2.0	72.3 ± 14.5
Plug	380	PF 3/8	6.0 ± 1.0	43.4 ± 7.2
Plug	382	PF 1/8	1.5 ± 0.25	10.8 ± 1.8
Hexagon socket plug	398	PT 1/8	1.25 ± 0.25	9.0 ± 1.8

3. DISASSEMBLY

1) GENERAL PRECAUTIONS

- (1) Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.
- (2) To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.
- (3) Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.
- (4) During disassembly, give a match mark to the mating surfaces of each part.
- (5) Arrange removed parts in order so that they will not become damaged or missing during disassembly.
- (6) Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

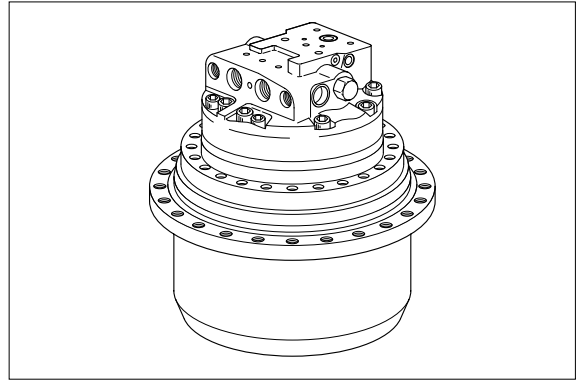
2) DISASSEMBLING PROCEDURE

(1) Disassembling the brake valve section and the hydraulic motor section

When inspecting or repairing the motor, use the disassembling procedures described below.

Numbers in parentheses () following the part name denote the item numbers shown in the attached assembly drawings.

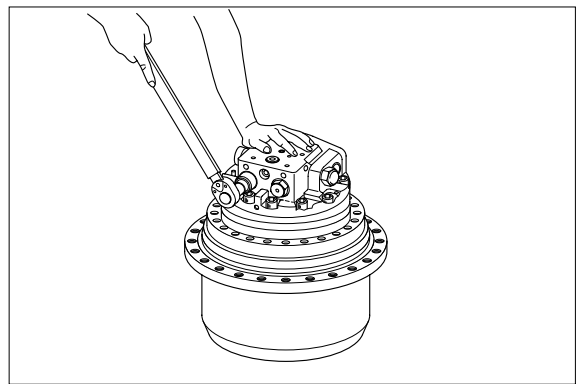
Prior to disassembly, install the motor on an inversion working bench.



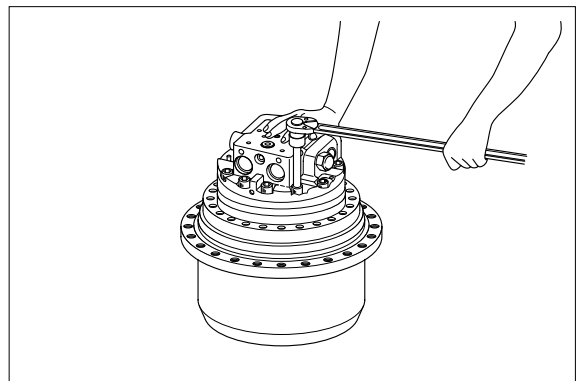
Remove valve kit from the rear flange (301).

Remove the O-rings(208, 209, 210) and back up rings(211, 217) from the valve kit.

Do not reuse the O-ring after removal.



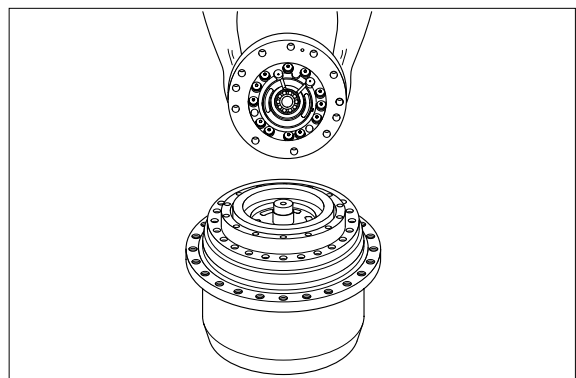
Remove the twelve hexagon socket head bolts(343).



Remove the rear flange kit(301) from the spindle(2).

Pay attention, shaft(102) may pulled up with the rear flange kit.

Proceed to pages 8-83 through 8-87 to see the brake valve disassembling procedure.

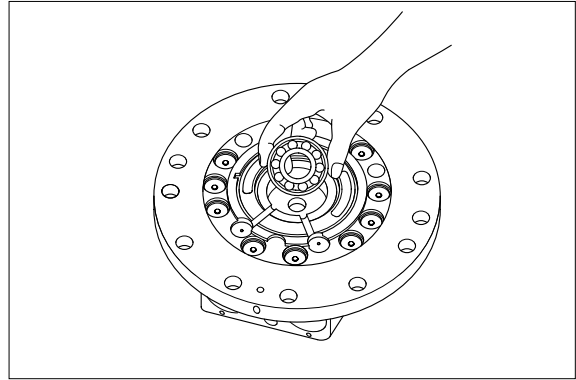


Remove the timing plate(109), the two pins(341) and the ball bearing(150) from the rear flange kit(301).

Remove the two O-ring(27) and O-ring (29) from spindle(2).

Do not reuse the O-rings(27, 29) after removal.

Proceed to pages 8-89 through 8-90 to see the description of the hydraulic motor disassembling procedure.

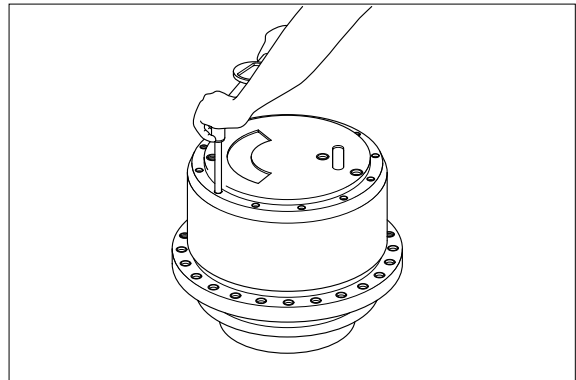


**(2) Disassembling the reduction gear/
Hydraulic motor shafts and oil seals**

Turn the motor and cover(8) over.

Remove three plugs(30).

Remove twelve hexagon socket head bolts(32).



Install two eye bolt(PF 1/2) to the threads for plugs(33).

Fasten hook to the eye bolts then lift up cover(8).

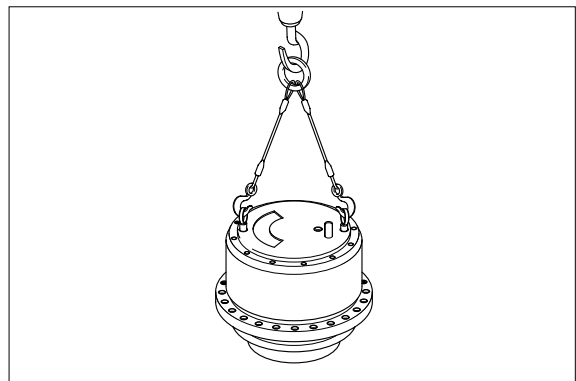
When cover(8) do not come up easily due to friction of O-ring(30), bang cover (8) evenly using a plastic hammer.

Remove O-ring(30) from cover(8).

Do not reuse the removed O-ring.

Drain lubricating oil from the reduction gear.

Proceed to page 8-92 through 8-95 to see the reduction gear disassembling procedure.



3) DISASSEMBLY OF BRAKE VALVE

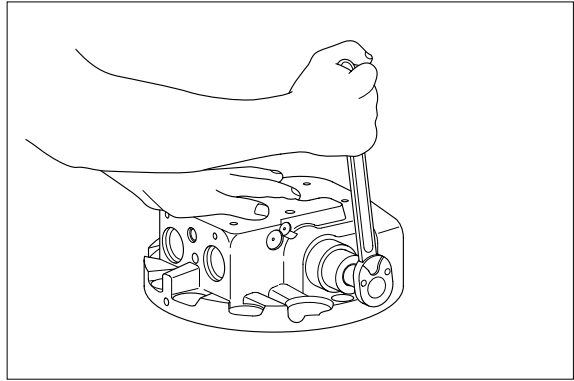
(1) Disassembly of the spool(323)

Remove the two plugs(324) from the rear flange(301).

Remove the two O-ring(336) from the plug(324).

Removal of the two plugs(324) from the rear flange(301) is facilitated by loosening plugs(324) with rear flange (301) attached to the spindle(2).

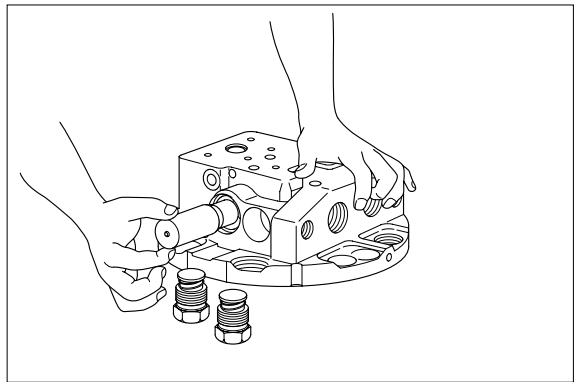
Do not reuse the O-ring(336) after removal.



Remove the two springs(328), the two stoppers(325), and the spool(323) from the rear flange(301).

Be careful not to damage the outer surface of the spool(323) and the sliding surface of the rear flange(301).

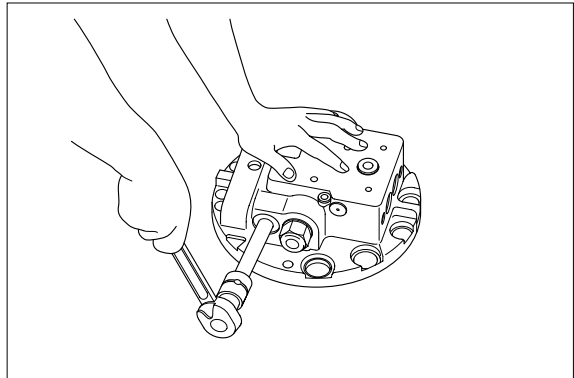
Spool is selectively fitted to the rear flange(301). When replacing either or them, therefore, the rear flange kit should be replaced.



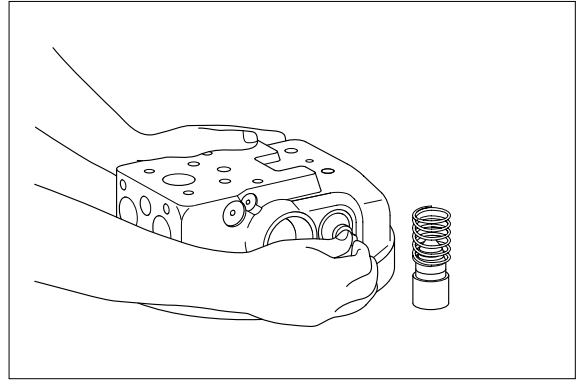
(2) Disassembly of the check valves

Remove the two plugs(326) from the rear flange(301).

Removal of the two plug(326) from the rear flange(301) is facilitated by loosening plug(326) with the rear flange (301) attached to the spindle(2).



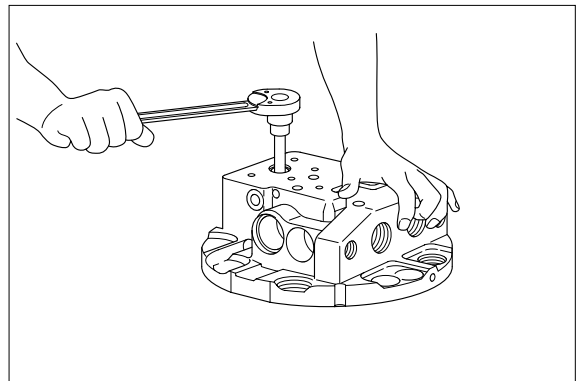
Remove the two springs(330) and the two valves(327) from the rear flange(301). Be careful not to damage the seat sections of the valves(327) or rear flange (301).



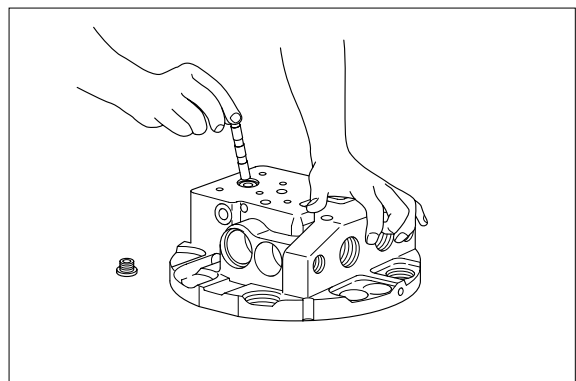
Remove the O-ring(337) from the plug (326). Do not reuse the O-ring(337) after removal.

(3) Disassembly of the spool(363) from the rear flange(301)

Remove plug(357) from rear flange(301). Removal of plug(357) from rear flange(301) is facilitated by loosening plugs(324) with rear flange(301) attached to spindle(2).

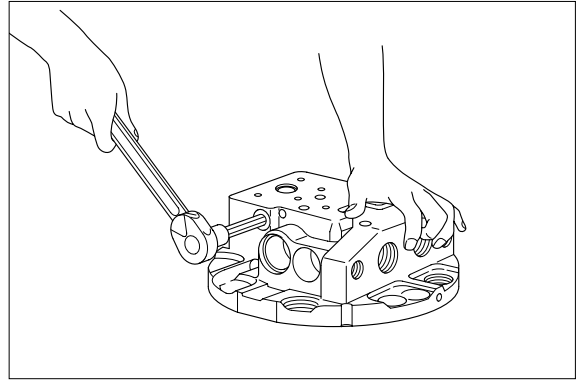


Take out spool(363) and spring(366) from rear flange (301). Remove O-ring(355) from plug(357). Do not reuse removed O-ring(355).



(4) Removal inner parts of the rear flange assembly

Remove the two plugs(380) from rear flange(301).

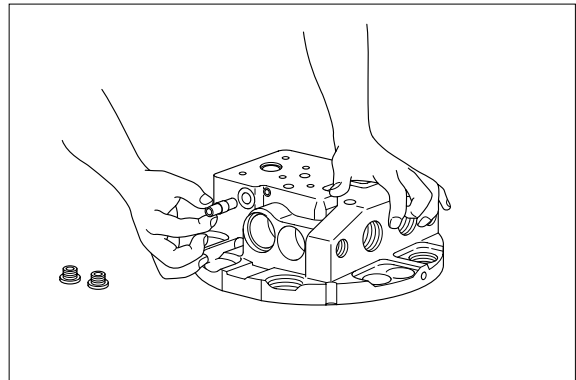


Remove the two O-rings(359) from each plug(380).

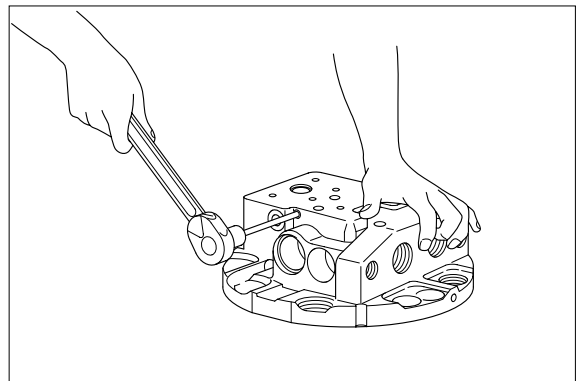
Take out piston(381) from rear flange (301).

Do not reuse removed the O-rings(359).
Be careful not to scratch the outer surface of the piston(381) and the sliding surface of the rear flange(301).

Piston(381) is selectively fitted to rear flange(301). When replacing either of them, therefore, the rear flange kit should be replaced.



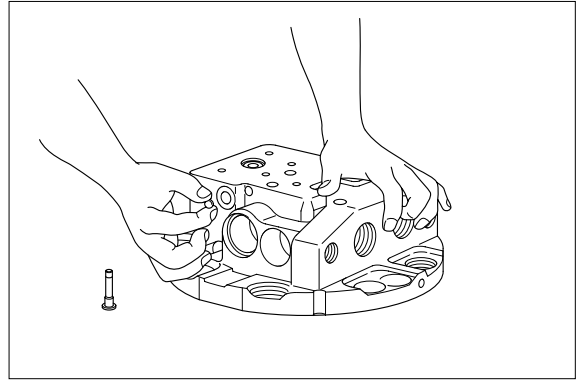
Removed the two plugs(382) from rear flange(301).



Take out each two O-rings(383, 384) from each plug(382).

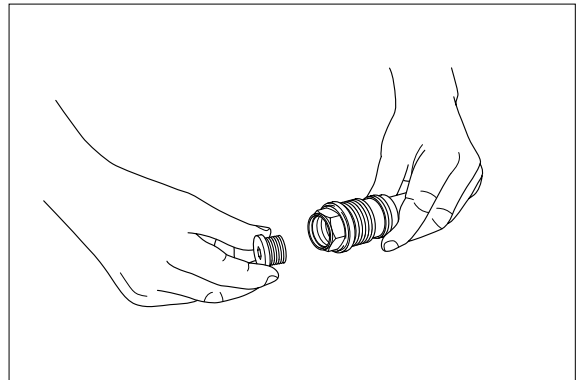
Do not reuse removed O-rings(383, 384).

Take out two steel balls(385) from the rear flange.

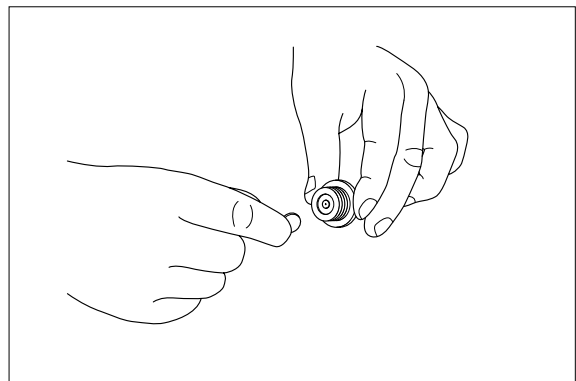


(5) Removal of the valve kit

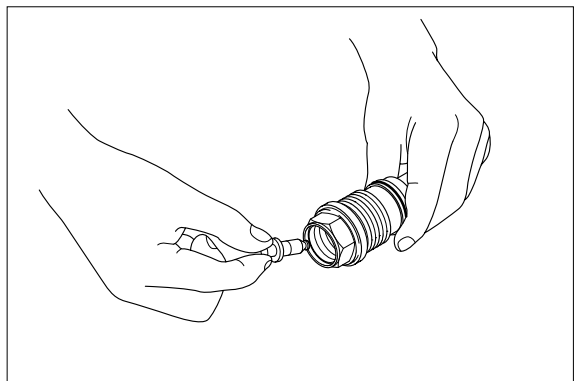
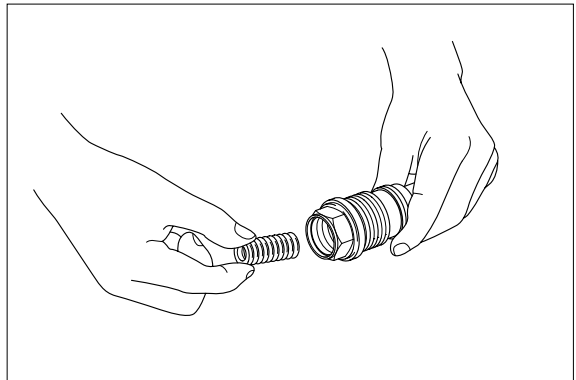
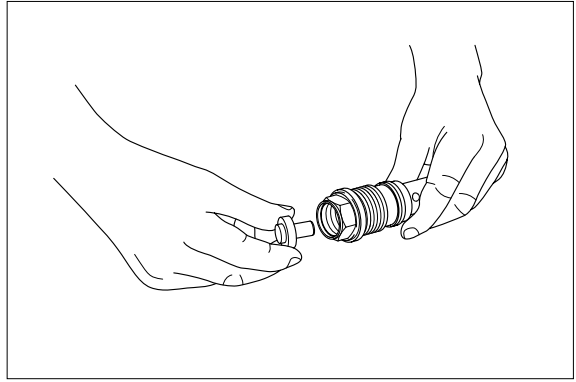
Remove the plug(204) from sleeve(202).
The valve kit is pressure adjusted by shim(205), when replacing of inner parts, therefore, the valve kit should be replaced.



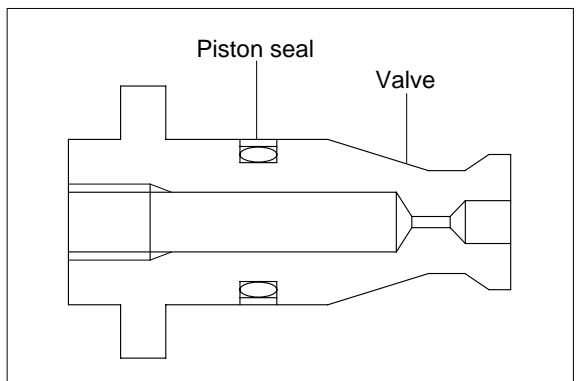
Remove the O-ring(210) from plug(204).
Take out shim(205) from plug(204).
Do not reuse removed the O-ring(210).



Take out spring retainer(203), spring (206) and valve(201) in that order.



Remove piston seal(220) from valve (201).



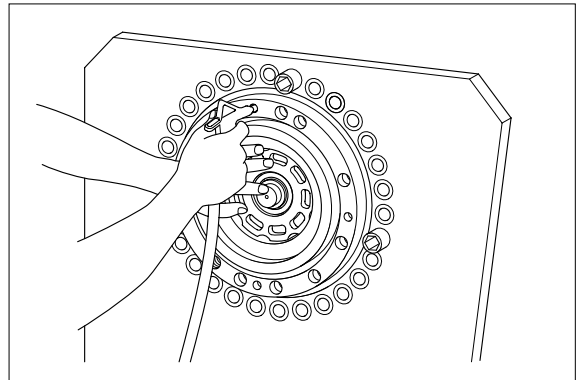
4) DISASSEMBLY OF HYDRAULIC MOTOR

(1) Disassembly of the parking brake parts

Remove the piston(112) by injecting compressed air from the parking brake access hole in the spindle(2).

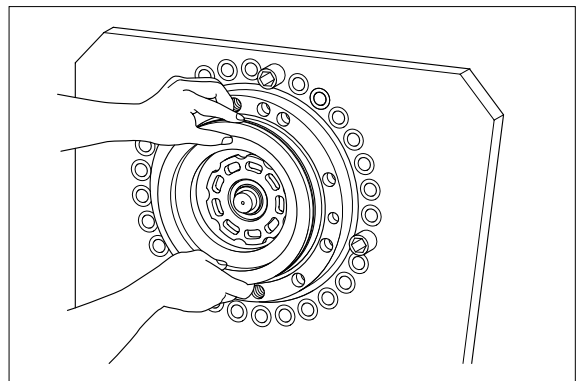
Take care that abrupt injection of compressed air(3~5kgf/cm²) may cause the piston(112) to pop out.

To ensure your safety, apply a protective cover to the piston.



Remove the two O-rings(135, 139) from the piston(112).

Do not reuse O-rings(135, 139) after removal.



(2) Disassembly of the internal parts of the motor

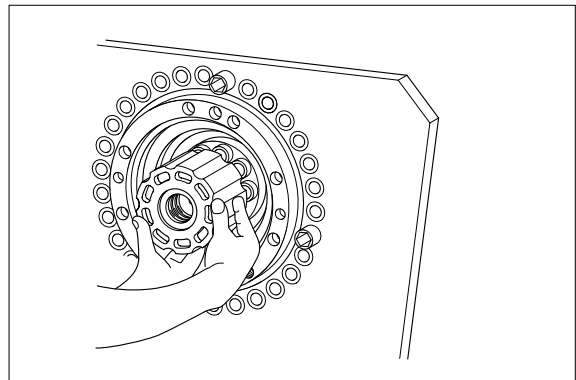
Lay the motor body on the side.

Drain out the oil from the motor.

Hold the cylinder block(104) with both hands, and remove it from the spindle(2).

When laying the motor on its side, place a receptacle under it to receive spilling hydraulic oil.

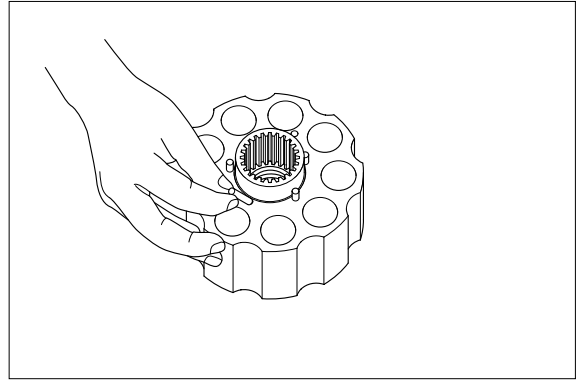
Before pull out cylinder block(104), turn it alternately clockwise & counterclockwise two or three times to separate the piston kit from swash plate(103). This means that the parts attached to the cylinder block(104) come out of it and fall in the spindle.



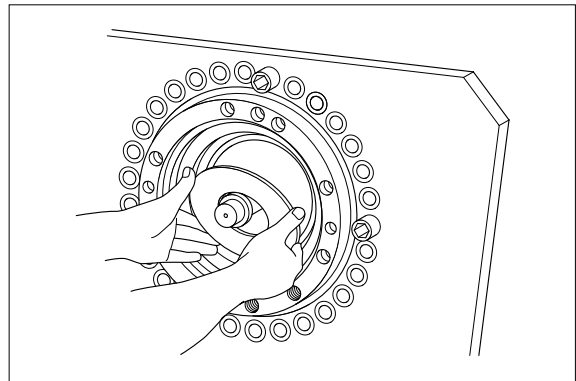
Detach the two friction plates(115) and two mating plates(116) from cylinder block(104) which has been taken out in step .

Separate the piston assembly(105, 106), retainer plate(107), thrust ball(108), washer(111) and five needle rollers(151) from cylinder block(104) which has been taken out in step .

Cylinder block(104), piston assembly, retainer plate, etc. which are included in cylinder & piston kit and are not supplied one by one, therefore, cylinder & piston kit should be replaced.(Refer to class shown in parts list.)



Take out swash plate(103) from spindle (2).



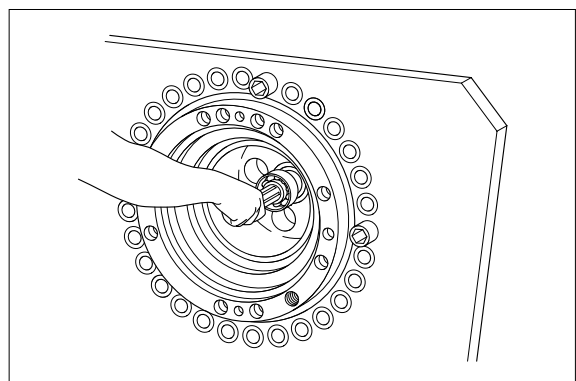
Take out shaft(102) from spindle(2). At this time, ball bearing(149) is also taken out together with shaft(102).

Oil seal(132) cannot be taken out.

Lightly shaft(102) end on the reduction gear side with a plastic hammer to make the removal easier.

Take notice when removing the shaft (102) rap strongly and swiftly, the shaft will come quickly free from the spindle.

Take out two pivots(167) and two pins (171) from spindle(2).

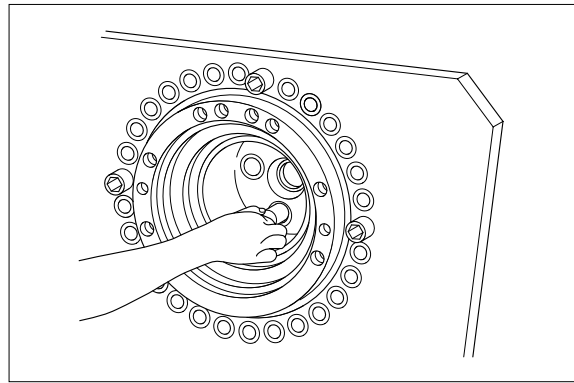


Remove the piston assembly and spring (193) by compressed air(3~5kgf/cm²) trough the passage for the piston assembly in spindle(2).

Piston(161) and shoe(162) are included in the piston assembly and are not supplied one by one, therefore, the piston assembly should be replaced.

Abrupt compressed air causes the piston assembly to spring out which dangerous.

The piston assembly can be taken out safely by putting a protective cover or the lie on it.



(3) Disassembly of the cylinder block

Place the cylinder block on the work bench and take out snap ring(145) with the snap ring pliers while pressing the retainer against washer(110).

Before compressing spring(114), make sure that cylinder block(104), retainer and press arbor are in good alignment: This is for galling or denting cylinder block(104).

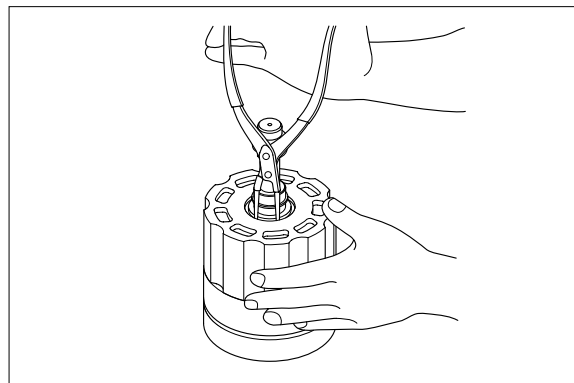
Put a vinyl cover on the sliding surface of cylinder block(104) for protection.

Slacking the press force slowly, until free of the spring force.

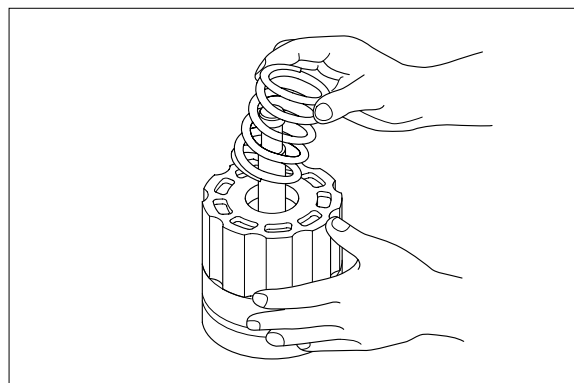
Do not remove spring(114) if it not to be replaced.

When disassembling there is a possibility that the spring may be injured.

Slacking very slowly in order to prevent injury to the spring.



Remove the snap ring(145), washer(110), spring(114) and washer(110).



5) DISASSEMBLY OF REDUCTION GEAR

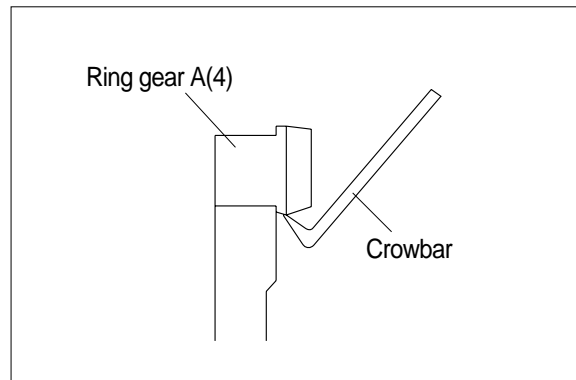
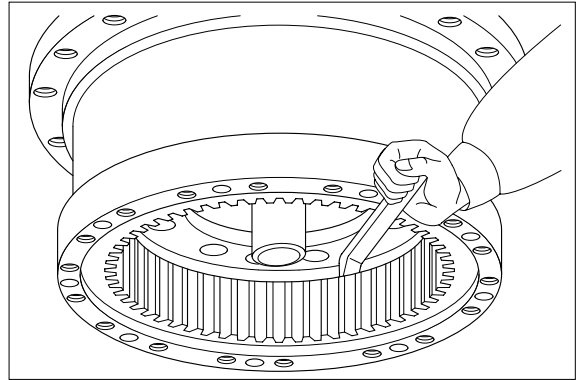
(1) Disassembly of ring gear A(4)

Before removing ring gear A, give an alignment match mark to both the ring gear and hub(1).

Remove the ring gear A(4) using a crowbar or any other suitable tool.

After ring gear A(4) has been removed, remove any adhesive residue from the mating surfaces of the ring gear and the hub.

Remove the ten dowel pins(27) from the hub(1).



(2) Disassembly of the hub(1), ring gear B(5), and the coupling gear(8)

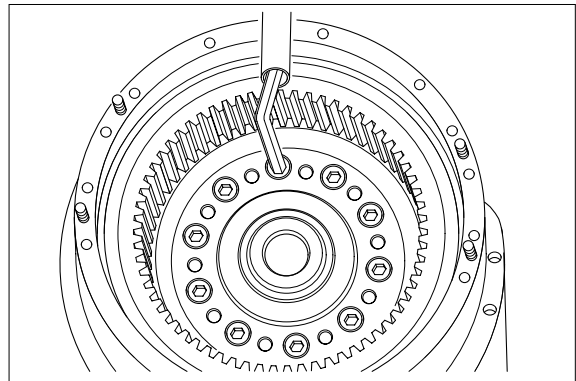
Remove the ten hexagon socket head bolts(35).

Since the hexagon socket head bolts(35) have their threaded sections coated with an adhesive, a loosening torque larger than the tightening one is needed to remove the bolts.

Tightening torque : $35.5 \pm 5.5 \text{ kgf} \cdot \text{m}$
($256.8 \pm 39.8 \text{ lbf} \cdot \text{ft}$)

Be extra careful during removal not to let the threaded sections of the hexagonal socket head bolts(35) seize.

Before removing the coupling gear(8) from the spindle(2), mark the mating surfaces of the coupling gear(8) and the spindle(2) using a paint marker.



Mount ring bolts in the M12 tapped holes of the hub(1), and then lift the hub(1) using lifter and separate the hub(1) and the spindle(2).

This also disconnects the two ball bearings(24), the seal ring(23), the O-ring(40), the coupling gear(8), ring gear B(5), the ring(15), and the distance piece(12).

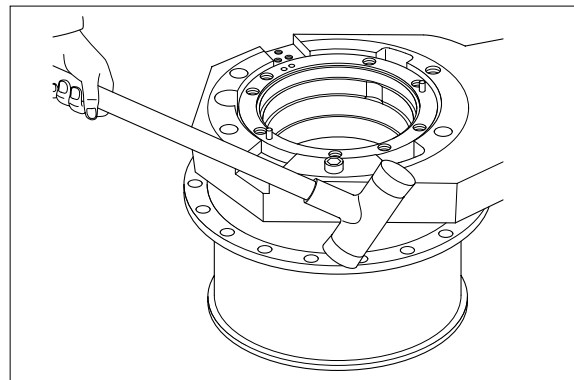
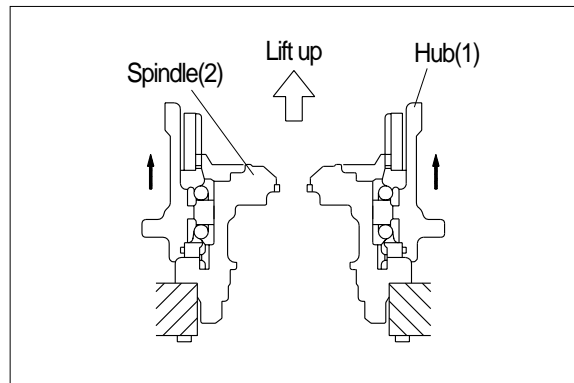
Proceed as follows if disassembly is not possible with the method mentioned above :

- Rotate the motor through 180 degrees to let the spindle side of the motor face upward.
- As shown in the photo, lightly tap the edge of the hub(1) equally with an aluminum rod and a hammer until the hub(1) has become disconnected from the spindle(2).

This will also disconnect the following parts :

Two ball bearing(24), seal ring(23), O-ring(40), coupling gear(8), ring gear B(5), ring(15), distance piece(12).

Lay a rubber mat under the working bench to prevent damage to hub(1) and other parts due to possible fall from the working bench.



(3) Disassembly of the inside of the spindle(2)

Remove the O-ring(29) from the spindle(2).
Rotate the spindle(2) through 180 degrees.
Remove the oil seal(132) from the spindle(2).

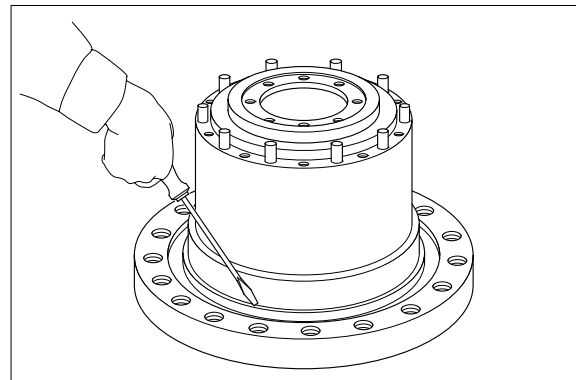
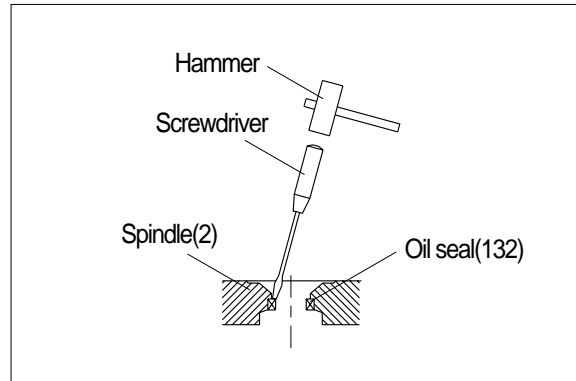
(To remove the oil seal, set a (-) screwdriver at the cylindrical edge of the oil seal and lightly tap with a hammer.)

Do not reuse the O-ring(29) after removal.

Remove the oil seal(132) only if it is to be replaced.

Do not reuse the oil seal(132) once it has been removed.

Remove the floating seal(31) from the spindle(2).



(4) Disassembly of the inside of the hub(1)

Place the hub(1) on the working bench so that the cover side of the hub faces upward.

Remove one of the two ball bearings(24) from the hub(1) as shown in the figure. This also lets the seal ring(23) come loose.

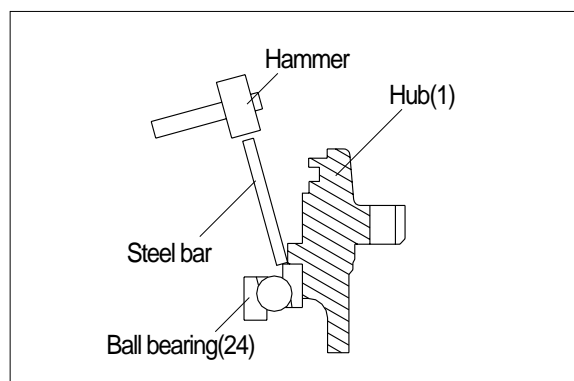
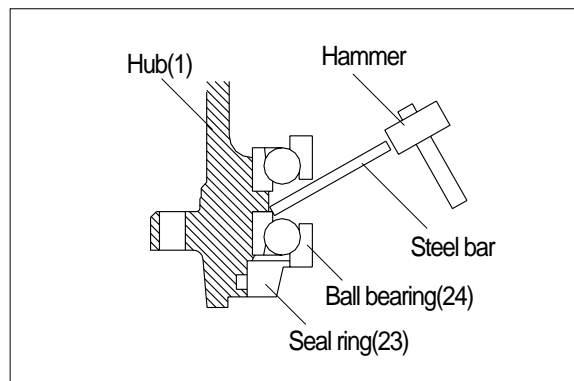
In principle, the ball bearings(24) should not be removed from the hub(1) since the former is shrinkage-fitted into the latter.

Do not reuse the ball bearings(24) after removal.

Place the hub(1) on the working bench so that the hub end facing the spindle points upward.

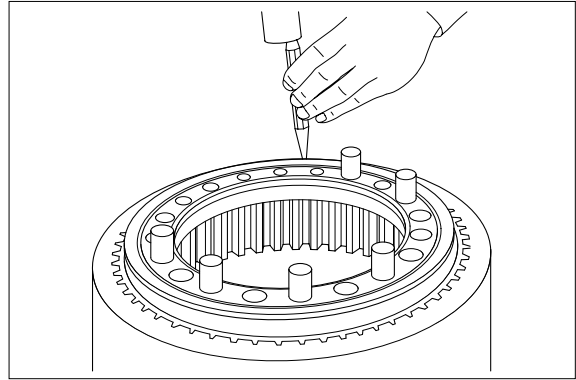
Remove the other ball bearing(24) from the hub(1) as shown in the figure.

Remove the O-ring(40) from the hub(1). Do not reuse the O-ring(40) after removal.



(5) Disassembly of the coupling gear(8)

Remove the ring(15) from ring gear B(5).
Do not reuse the ring(15) after removal.



Remove the coupling gear(8) from ring gear B(5).

Except for their replacement, do not disassemble the coupling gear(8) or ring gear B(5).

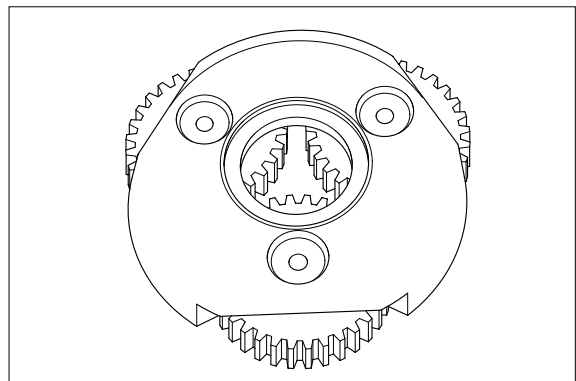
(6) Disassembly of the carrier assembly

Do not disassemble the carrier assembly any further.

If a component of the carrier assembly is irrecoverably damaged, replace the entire carrier assembly with a new one.

Components of the carrier assembly

- Carrier(3)
- Cluster gear(6)
- Shaft(9)
- Thrust collar(14)
- Needle bearing(25)
- Dowel pin(34)



4. ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) Reassemble in a work area that is clean and free from dust and grit.
- (2) Handle parts with bare hands to keep them free of lint contaminants.
- (3) Repair or replace the damaged parts.
Each part must be free of burrs at its corners.
- (4) Do not reuse O-rings, oil seal and floating seal that were removed in disassembly.
Provide the new parts.
- (5) Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.
- (6) When reassembling oil motor components of motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil. (NAS class 9 or above)
- (7) Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

2) ASSEMBLY OF BRAKE VALVE

(1) Assembly of the check valve

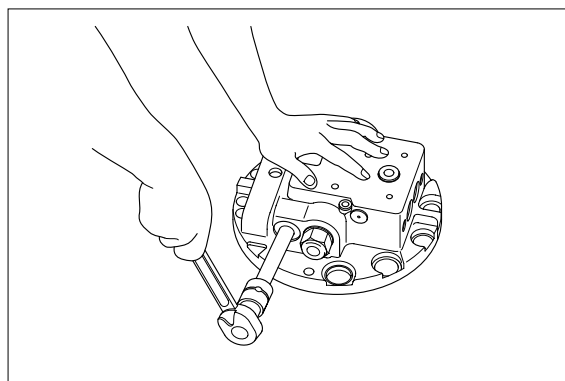
Fit the O-ring(337) on the plug(326).

Insert the spring(330) and the valve(327) into the plug(326), and then grease the spring(330) and the valve(327) and hand-lock the former.

Insert the plug(326) in conjunction with the spring(330) and the valve(327) into the rear flange(301), and tighten the plug to the required torque.

Apply grease to the O-ring(337).

Tighten the plug(326) to a torque of $26 \pm 4\text{kgf} \cdot \text{m}$ ($188 \pm 29\text{lb} \cdot \text{ft}$).



(2) Assembly of the spool

Insert the spool(323) into the rear flange (301).

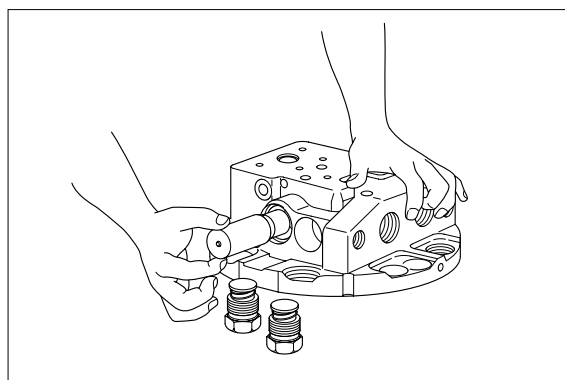
Apply a working fluid to the spool(323) and insert it into the rear flange(301).

Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the spool due to contact.

Above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.

Attach the O-ring(336) to the plug(324).

Apply grease to O-ring(336).

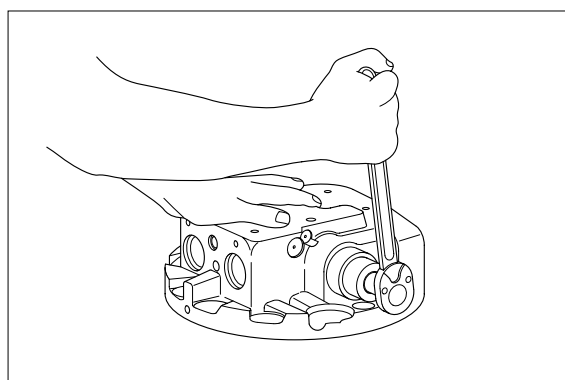


Install stopper(325) and the spring(328) into both plugs(324) and tighten the plugs(324) into the rear flange(301) at the required torque.

Apply grease to the O-ring(355).

Required torque : $45 \pm 9\text{kgf} \cdot \text{m}$
($325 \pm 65\text{lb} \cdot \text{ft}$)

Even if either the rear flange(301) or the spool(323) is to be replaced, their entire assembly(kit) must be replaced.



(3) Assembly of the two-speed control valve

Fit O-ring(355) on plug(357).

Insert spring(366) in spool(363) and insert spool(363) to rear flange(301).

Apply grease to O-ring(355).

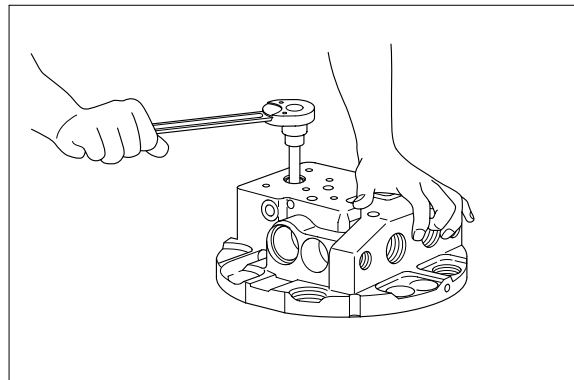
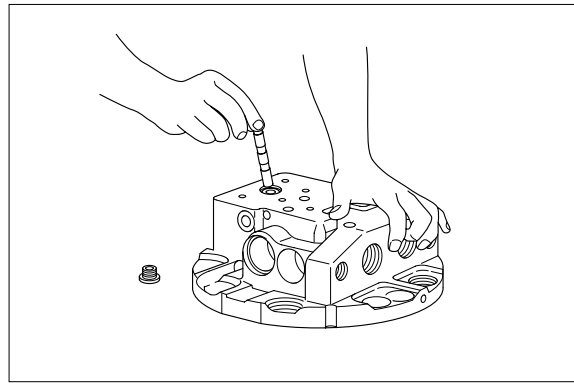
Apply hydraulic oil to spool(363).

Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the spool due to contact.

Above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.

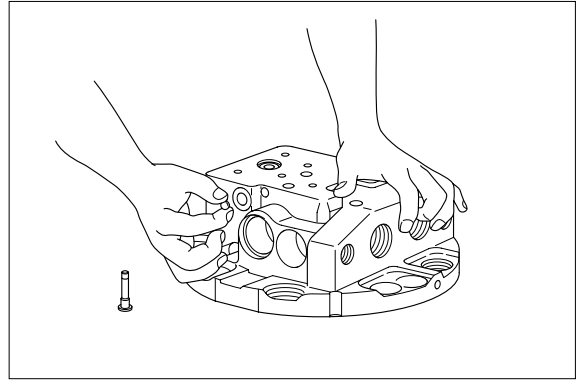
Tighten plug(357) to rear flange(301) with specified torque.

Tightening torque : $10 \pm 2\text{kgf} \cdot \text{m}$
($72.3 \pm 14.5\text{lbf} \cdot \text{ft}$)



(4) Assembly the inner parts of the rear flange assembly

Insert steel ball(385) to rear flange(301).



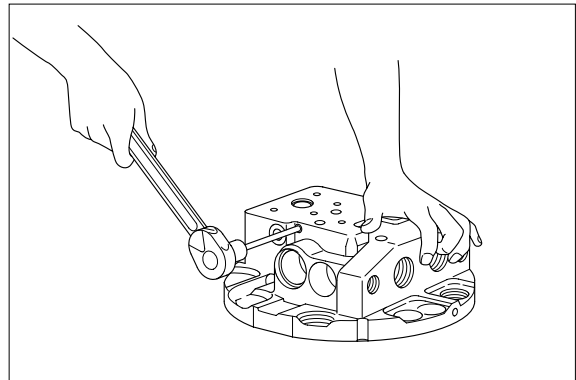
Fit O-rings(383, 385) on plug(382).

Tighten plug(382) to rear flange(301) with specified torque.

Tightening torque : $1.5 \pm 0.25\text{kgf} \cdot \text{m}$
($10.8 \pm 1.8\text{lbf} \cdot \text{ft}$)

Apply grease to O-rings(383, 384).

Apply sealant to threaded section of plug(382).

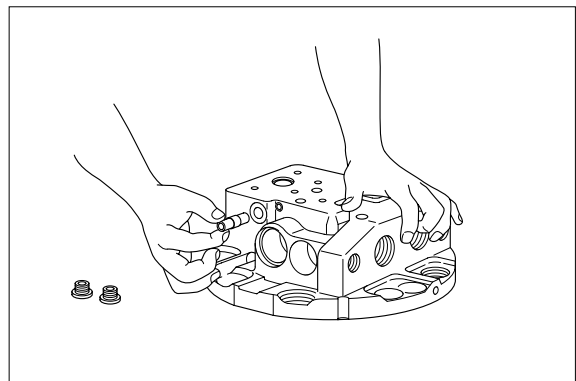


Insert piston(381) to rear flange(301).

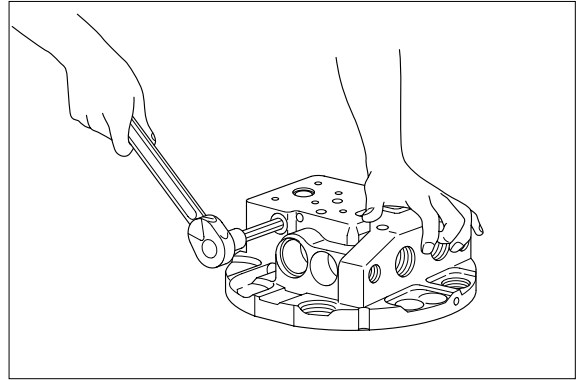
Apply hydraulic oil to piston(381) and then insert it into rear flange(301).

Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the piston due to contact. The above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.

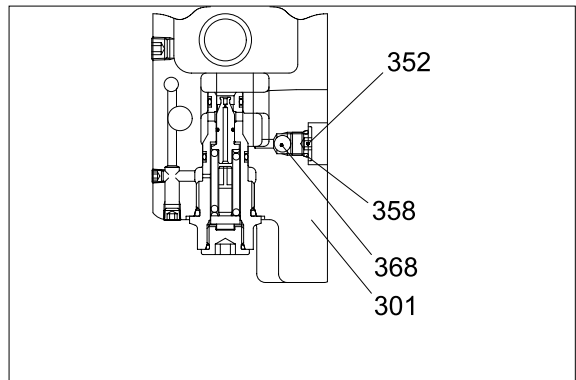
Rear flange(301) and piston(381) constitutes a rear flange kit. When replacing either of them, therefore, replace the rear flange kit.



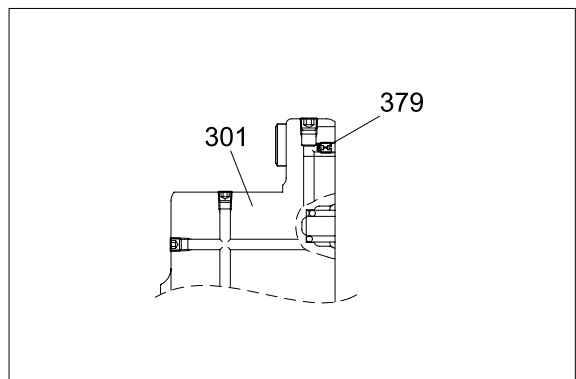
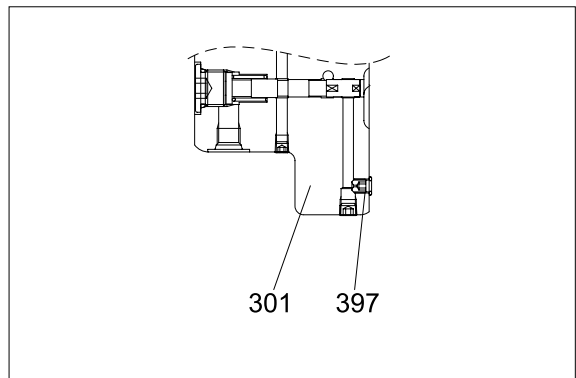
Fit O-ring(359) on plug(380).
Install plug(380) to rear flange(301), and
tighten plug(380) to rear flange(301) with
the specified torque.
Apply grease to O-ring(359).
Tightening torque : $6 \pm 1 \text{kgf} \cdot \text{m}$
($43.4 \pm 7.2 \text{lb} \cdot \text{ft}$)



After fitted O-ring(358) on plug(352),
install steel ball(368) and plug(352) to
rear flange(301).
Apply grease to O-ring(358),
Do not disassemble and assemble any
further.



Install orifice(397) and filter(379) to rear
flange(301).
Do not disassemble and assemble any
further.



(5) Assembly of the relief valve

Fit O-rings(208, 209, 219) and back up rings(211, 217) on sleeve(202).

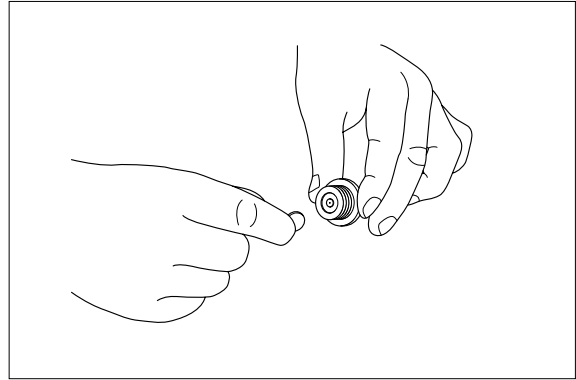
Fit O-ring(210) on plug(204).

Apply grease to the O-ring.

Insert shim(205) into plug(204).

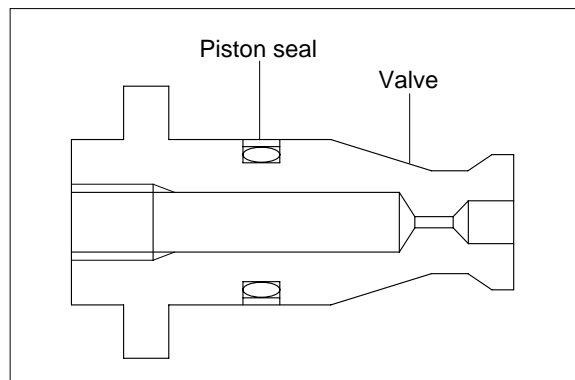
Use the disassembled shim, because the pressure adjustment made by shim.

When replacing the inner parts of relief valve, therefore, the valve kit should be replaced.



Fit piston seal(220) to valve(201).

Piston seal(220) consist of O-ring and polyester ring, apply grease to them and then fit the O-ring and after fit the polyester ring to valve(201).



Insert valve(201), spring(206) and spring retainer(203) to sleeve(202) and tighten plug(204) fitted with shim(205) to the specified torque.

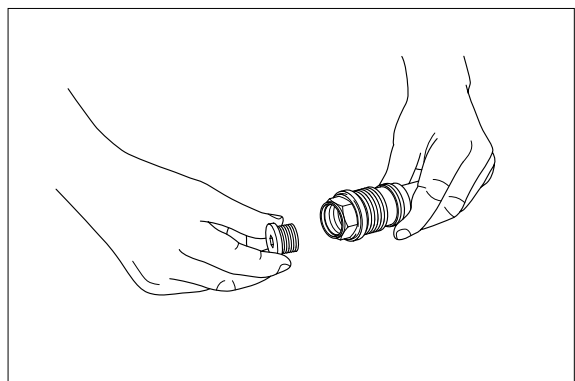
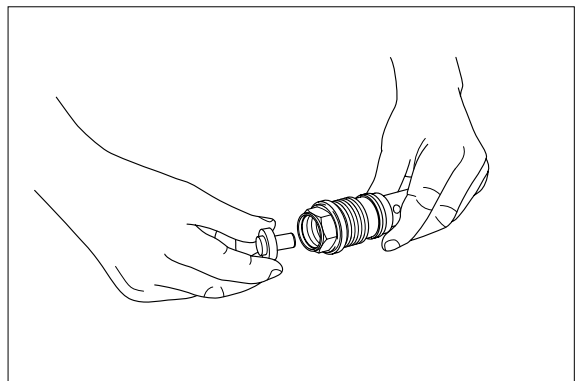
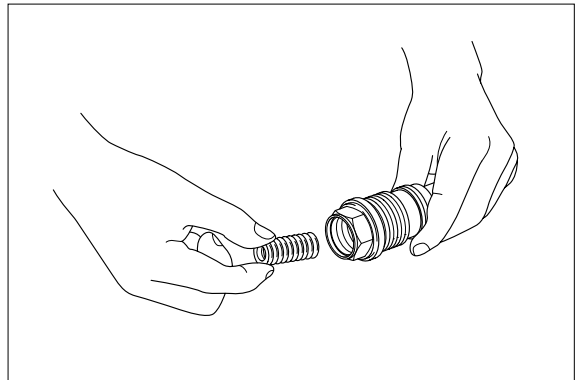
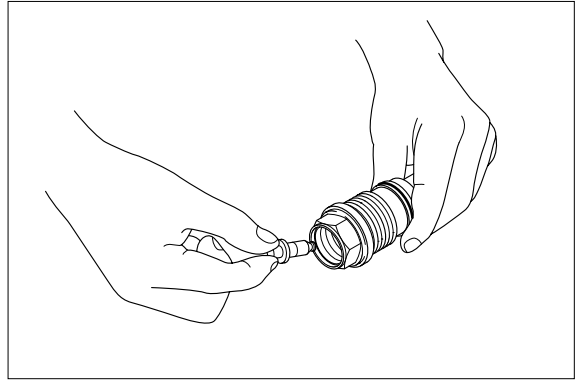
Apply hydraulic oil to valve(201) and then insert it to sleeve(202).

Align the center of hole in sleeve(202) with the axial center of valve(201) to prevent damage to the inner surface of the sleeve and outer surface of the valve due to contact.

- Tightening torque : $10 \pm 2 \text{kgf} \cdot \text{m}$
($72.3 \pm 14.5 \text{lb} \cdot \text{ft}$)

Use the disassembled parts, because the relief valve is pressure adjusted. When replacing the inner parts of the relief valve, therefore, the valve kit should be replaced.

Apply grease to mating surface of the shim and then fit into the plug. The above mentioned will keep the two faces practically glued together, the shim will not drop down when install the plug to the sleeve.



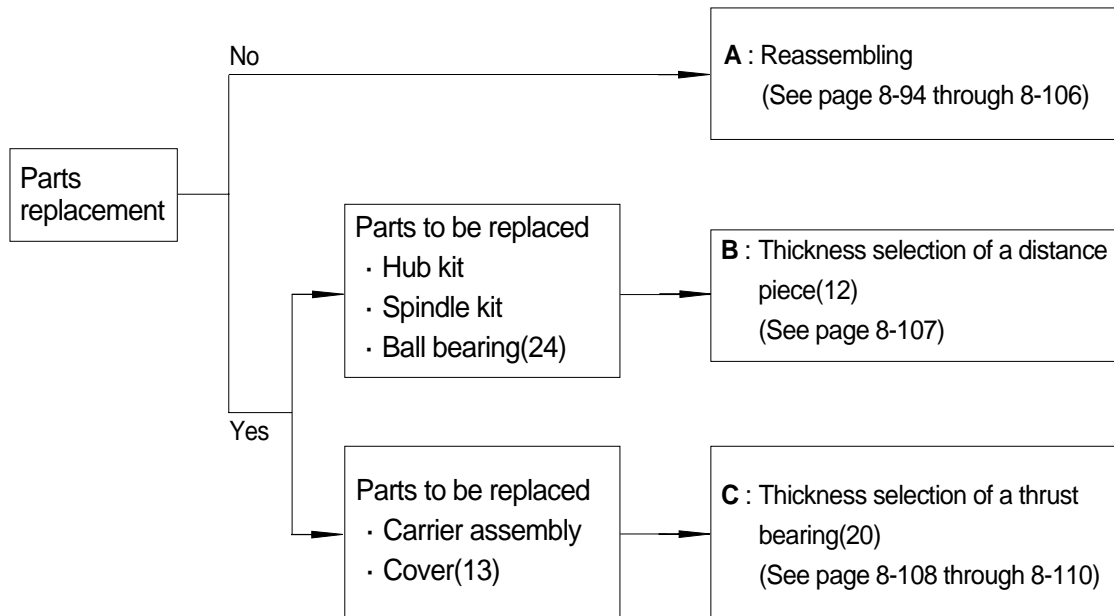
3) ASSEMBLY OF REDUCTION GEAR AND HYDRAULIC MOTOR

Before reassembling the reduction gear and the hydraulic motor following completion of parts replacement, one of the following two operations must be carried out:

- Selecting a distance piece(12) of the appropriate thickness.
- Selecting a thrust bearing(20) of the appropriate thickness.

Reassembling must be down only after clearance adjustment of these parts.

Prior to the start of reassembling, check for parts that require replacement.



If all of the above-name parts can be reused in reassembly, be sure to make these adjustments. Disregard of these adjustments will result in malfunction or premature failure of the motor.

A : REASSEMBLING

(1) Assembly of the hub section

Mount the hub(1) on a working bench so that the mounting side of the cover(13) faces upward.

Insert the ball bearing(24) into the hub(1) using a force-fitting jig.

Heat the hub(1) to a temperature of 90 ± 5 °C.

Shrinkage-fit the ball bearing(24).

If a force-fitting jig is not available, insert the ball bearing(24) into the hub(1) and then hammer the former.

Rotate the hub(1) through 180 degrees to make the mounting side of the spindle(2) face upward.

Insert the ball bearing(24) into the hub(1) using a force-fitting jig.

Shrinkage-fit the ball bearing(24).

Assemble the O-ring(40) into the hub(1).

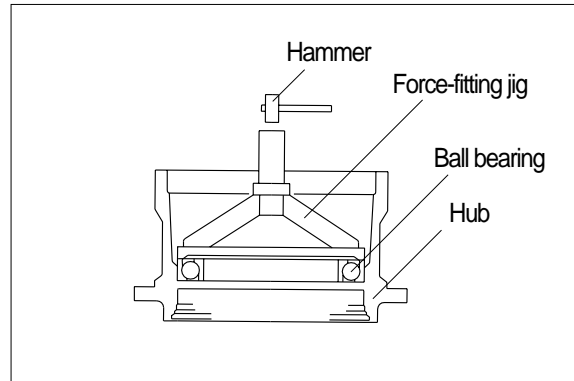
Apply a thin coat of grease to the O-ring(40).

Assemble the seal ring(23) into the hub(1).

The seal ring can better be assembled into the hub by tapping the edge of the seal ring lightly with a plastic hammer.

When assembling the seal ring(23) into the hub(1).

Be extra careful not to damage the O-ring(40).

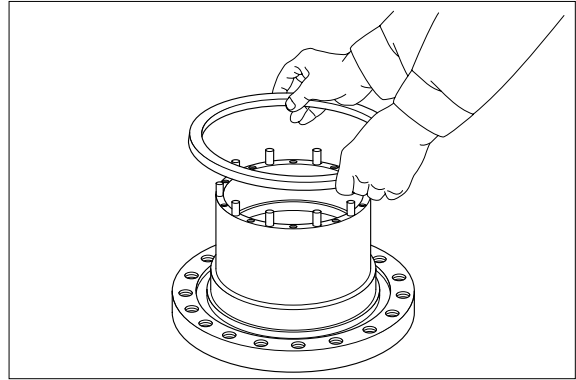


(2) Assembly of the spindle(2) section

Mount the two floating seals(26) in the spindle(2).

Apply a thin coat of grease to the O-ring in the floating seal(26).

Be extra careful to ensure that dust does not stick to the seal surface.

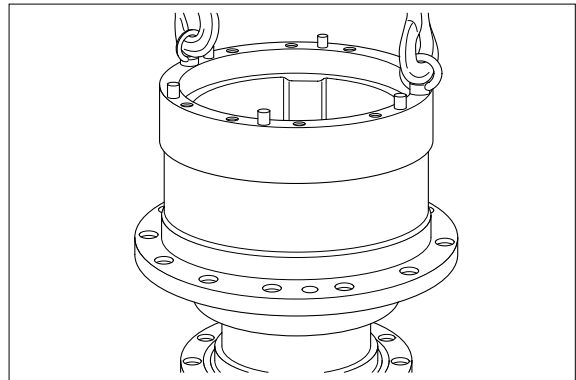


(3) Assembly of the hub(1) and the spindle(2)

Mount the spindle(2) on a working bench so that the cover side of the spindle faces upward.

Fit eye-bolts to the hub(1), and then lift it with a crane and gently insert it into the spindle(2).

If the hub(1) or the spindle(2) does not snugly fit because of the presence of the ball bearing(24) evenly tap the top of the hub(1) with a plastic hammer during fitting.



(4) Assembly of the coupling gear(8) in ring gear B(5) and ring gear B(5)

Mount the coupling gear(8) in ring gear B(5).

Fit the ring(15) into the ring groove of ring gear B(5).

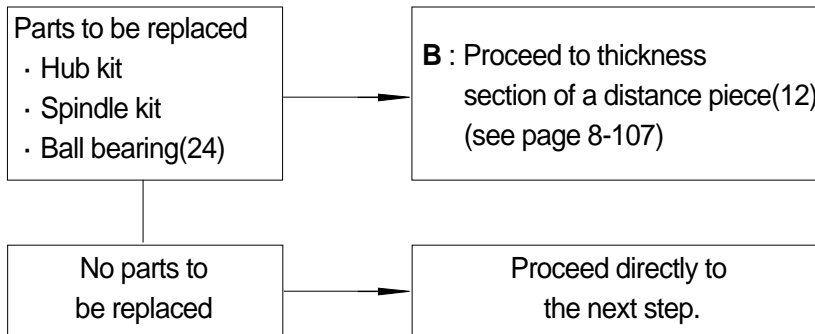
Do not reuse the ring(15) after removal.

Use a new one during reassembling.

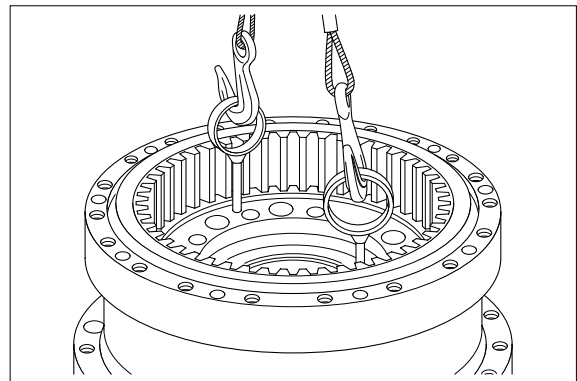
(5) Assembly of the coupling gear(8)

Attach a distance piece(12) to the coupling gear(8) using grease.

During attachment, apply a thin coat of grease to the mounting surface of the coupling gear(8) to prevent possible fall of the distance piece(12).



Mount the coupling gear(8) (fitted with ring gear B(5)) on a coupling gear lifter, and then lift it with the crane and mount it in the spindle. Match the match marks on the coupling gear(8) and the spindle(2). Insert the ten pins(17), and caulk the pin hole edges of the coupling gear(8). Do not reuse the pins(17) after removal. Use new ones during reassembling.



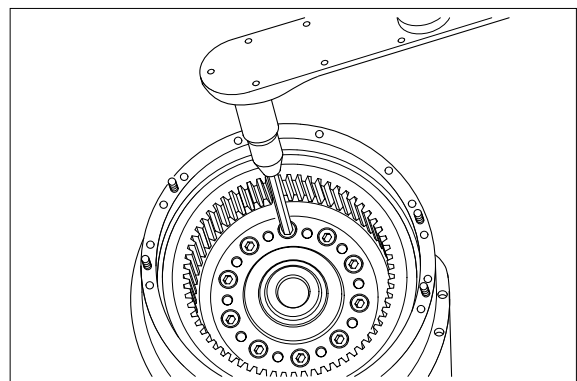
Tighten the ten hexagonal socket bolts(35) to the required torque using a torqu wrench.

Tightening torque : $25.7 \pm 4 \text{ kgf} \cdot \text{m}$
($185.9 \pm 28.9 \text{ lbf} \cdot \text{ft}$)

Apply an adhesive to the threaded section of the spindle(2) and the pin holes after degreasing both.

After completely degreasing the hexagonal socket bolts(35), apply molycoat to the bottom of each such bolt neck.

Rotate the motor through 180 degrees to make the spindle side face upward.

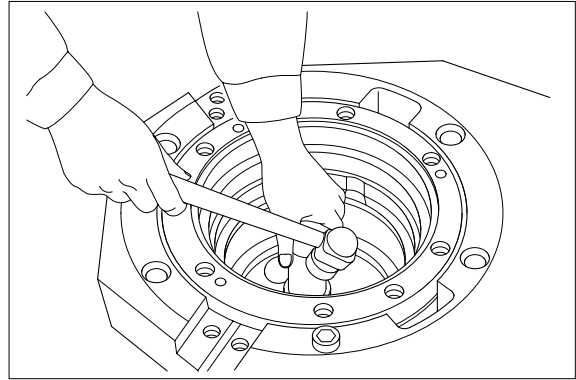


(6) Assembly of the oil seal(132)

Fit the oil seal(132) into the oil seal mounting hole of the spindle(2).

Apply white petrolatum or lithium grease to the lip section of the oil seal(132).

Use a new oil seal during reassembling.



(7) Assembly of the roller bearing(149)

Shrinkage-fit the roller bearing(149) onto the shaft(102).

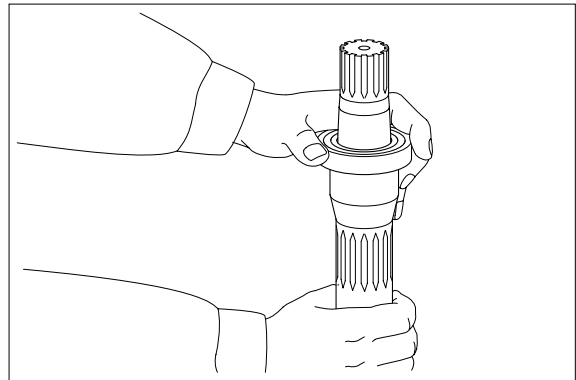
If the roller bearing(149) has been removed from the shaft(102) during disassembling, replace the former with a new one and then shrinkage-fit it onto the shaft(102).

Shrinkage-fitting temperature :

$100 \pm 10_{\circ}\text{C}$.

Apply molybdenum disulfide grease to the outer contact surface of the roller bearing(149).

When inserting the poller bearing(149), use leather gloves and take care not to get burned.



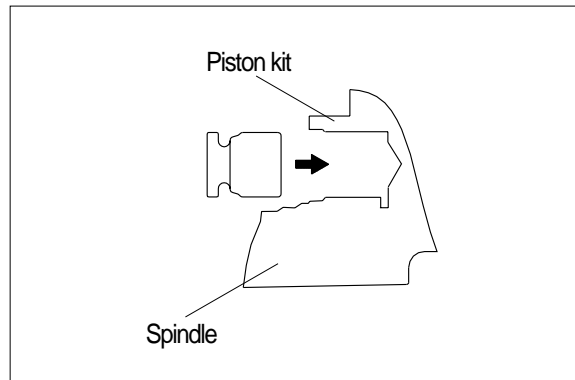
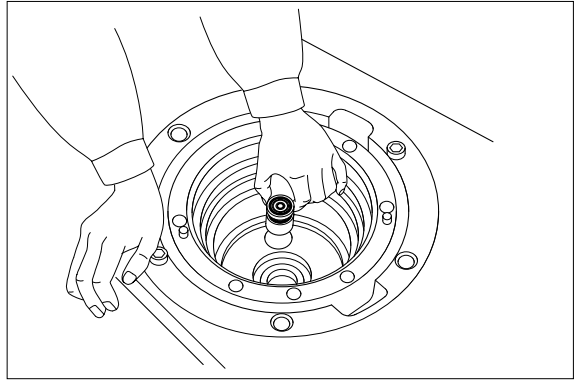
(8) Assembly of the piston assembly (161, 162)

Mount spring(193) to piston assembly (161,162).

Apply grease to spring(193).

Mount the piston assembly(161, 162) in the piston hole of the spindle(2).

Apply grease to piston assembly (161,162).



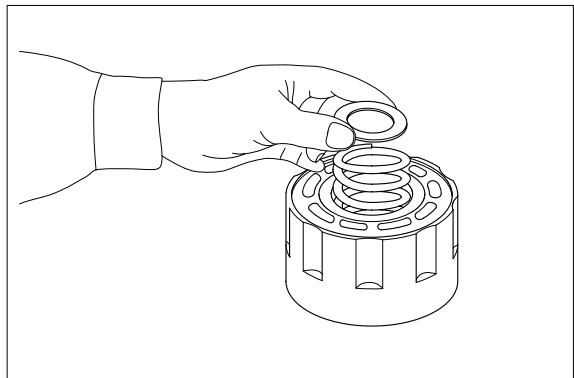
(9) Assembly of the pivot(167)

Mount two pins(171) to the spindle(2) and two pivots(171).

Apply grease on half round section of pivot(167).

(10) Assembly of cylinder block section

Insert washer(110), spring(114), washer(110) and snap ring(145) in that order, into the shaft bore of cylinder block(104).



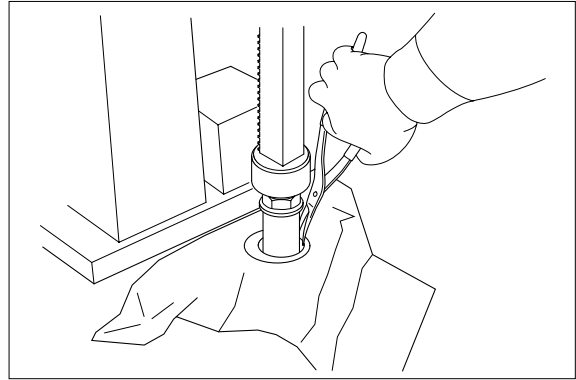
Set cylinder block in the press in order to compress the spring(114).

Place retainer on the washer(110) and push down this tool with the press arbor until the snap ring groove becomes cleared.

Fit snap ring(145) into the groove.

When working on the cylinder block, protect its sliding face by covering it with a vinyl sheet.

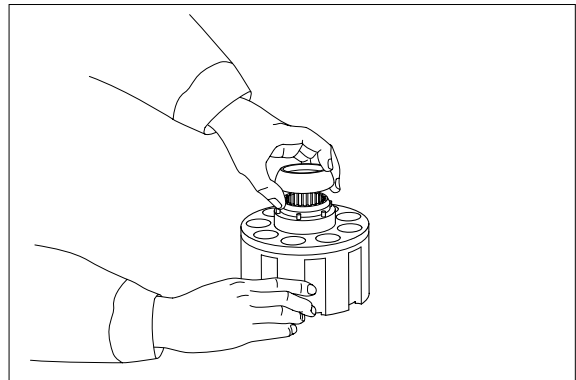
A push of about 200kgf(440.9lbf) will be needed to compress the spring.



(11) Assembly of piston motor sub assembly

Fit 5-rollers(151) into the pin holes of cylinder block(104), and then, put collar(111) and thrust ball(108) on it.

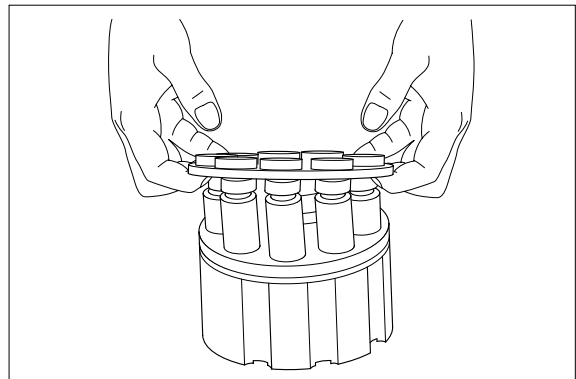
Immerse piston assembly in hydraulic oil.



Insert piston assembly into retainer plate(107).

Mount the piston assembly in the cylinder block(104).

After mounting, immerse the entire them in a working fluid.



As shown in the figure, mount the swash plate(103), the thrust plate(153), the thrust ball(108), collar(111) the retainer plate(107), the roller(151), the cylinder block(104), and the piston assembly (105,106) in the shaft(102).

Then, mount a lifter() and make the shaft(102) upright.

The outer lacing of the roller bearing (149) must be mounted in the spindle(2) beforehand.

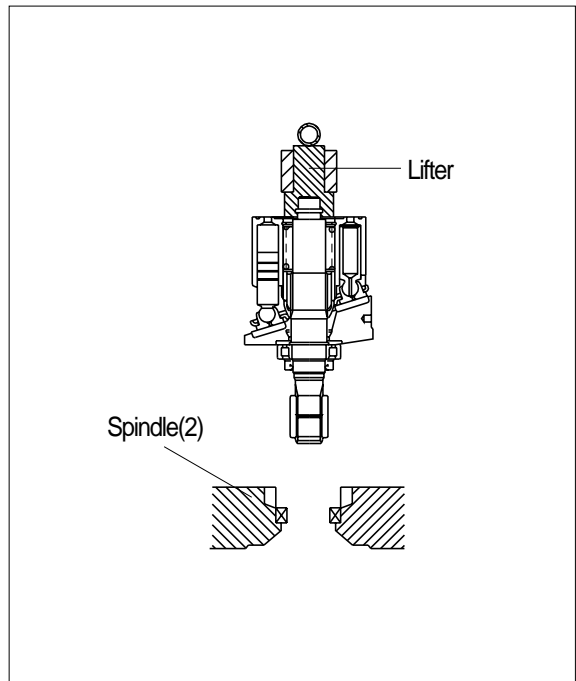
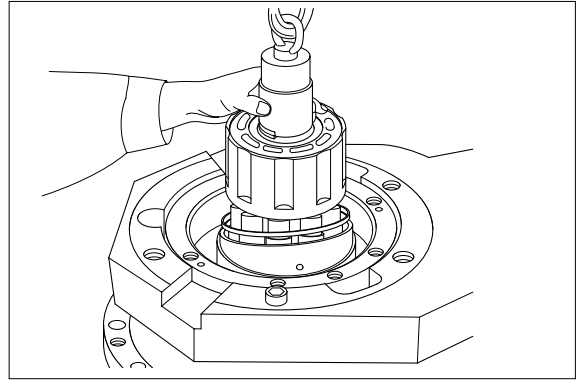
Accurately align and assemble the retainer plate(107) and the spherical section of the thrust ball(108).

Lift the motor assembly using a lifter, and mount it in the spindle(2).

Mounting must be done so that the steel-ball hole in the swash plate(103) and the steel ball(167) come into a fit. Mounting must also be done gently so that no parts come into contact with the spindle(2) or other sections.

Contact may damage parts.

After the motor assembly has been mounted, turn the cylinder block by hand to check for backlash. Perform inspections if back-lash is present.

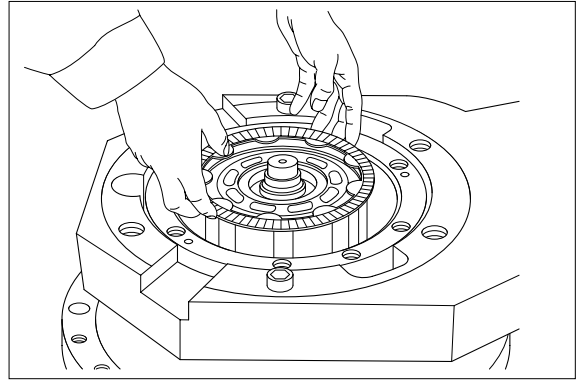


(12) Assembly of the parking brake section

Fit the mating plate(116) first and then the friction plate(115), one by one, into the grooves of the outer surface of the cylinder block(104).

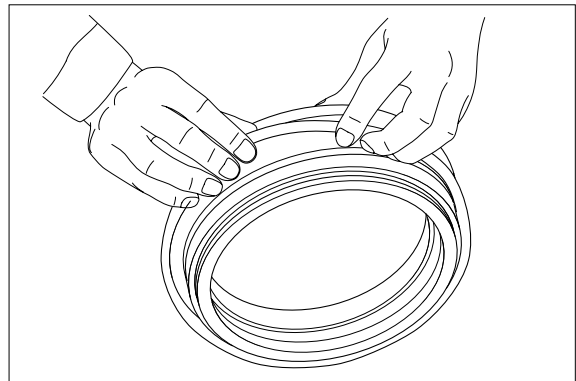
This order of fitting must be strictly observed.

Immerse the friction plates(115) in a working fluid before fitting them into the grooves.



Fit the O-rings(139,178) in the O-ring grooves of the piston(112).

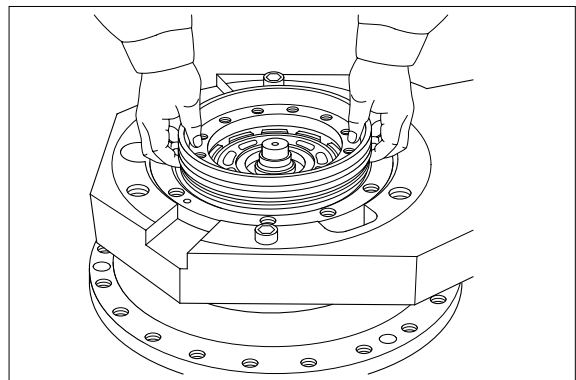
Apply a thin coat of grease to the O-rings(139,178).



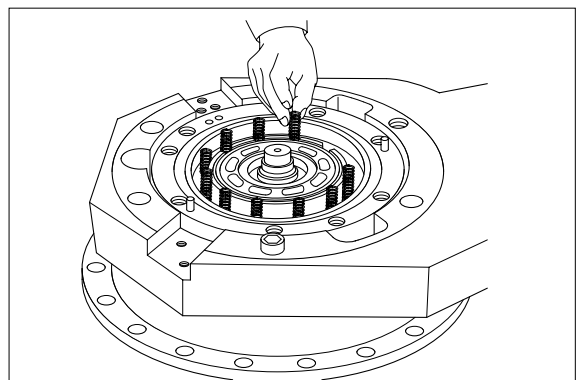
Mount the piston(112) in the spindle(2).

If the piston(112) does not fit into the spindle(2) because of the resistance of the O-ring, tap the edge of the piston(112) lightly and equally with a plastic hammer.

Be careful not to damage the O-ring at this time.



Arrange the twelve springs(113) correctly in the spring mounting hole of the piston(112).



Fit the two O-rings(39) and the O-ring(29) in the O-ring grooves of the spindle(2).

Apply a thin coat of grease to the two O-rings(39).

Remount the O-ring(29) without greasing it.

If this O-ring is greased and remounted, possible oozing of the grease from the contact surfaces of the rear flange(101) and the spindle(2) during motor operation may be mistaken for oil leakage.

Fill the spindle(2) with a working fluid.

Quantity required : 1.7 liters.

(13) Assembly of the rear flange(101) back in the spindle(2)

Mount the ball bearing(150) in the rear flange(101).

Apply molybdenum disulfide grease to the outer contact surface of the ball bearing(150).

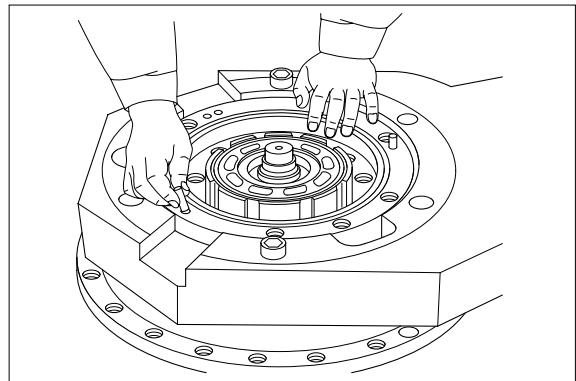
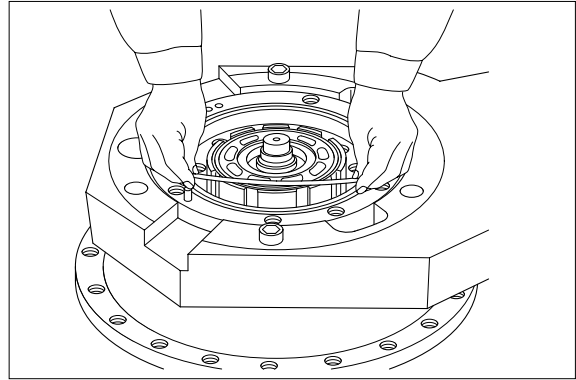
Fit the two dowel pins(341) into the pin holes of the rear flange(301).

Using the dowel pins(341) as a guide, mount the timing plate(109) in the rear flange(301).

At this time, apply grease to the contact surfaces of the timing plate(109) and the rear flange(301).

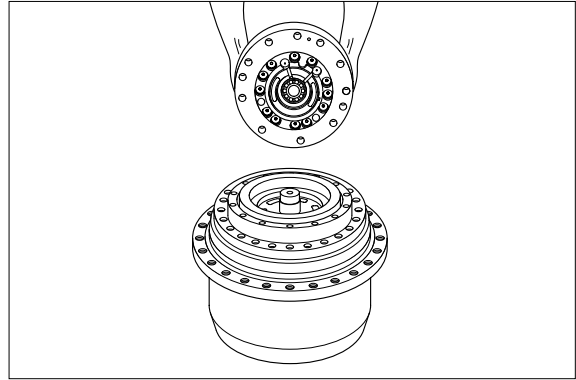
Fit the two dowel pins(42) into the spindle(2).

Mount the timing plate(109) firmly in the rear flange(301) to prevent the former from falling out of the latter.



Mount the rear flange(301) on the spindle(2).

At this time, the two dowel pins(42) that have been fitted into the spindle(2) must be aligned with the pin holes.

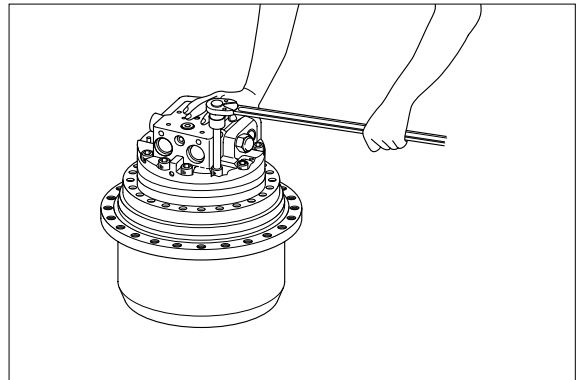


Tighten the nine hexagon socket head bolts into the spindle(2) at the required torque.

Tightening torque :

$25.7 \pm 4 \text{ kgf} \cdot \text{m} (185.9 \pm 28.9 \text{ lbf} \cdot \text{ft})$

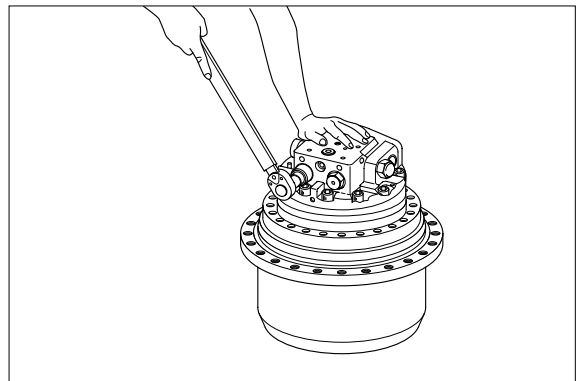
If, in step (12)- above, the piston(112) does not fit into the spindle(2) because of the resistances of the O-rings, proceed as follows to mount the rear flange(101) on the spindle(2) : mount four hexagon socket bolts(182) in diagonal form, and tighten them equally so that the rear flange(101) is kept horizontal.



Assemble the relief valve to rear flange(301), then tighten at required torque.

Tightening torque :

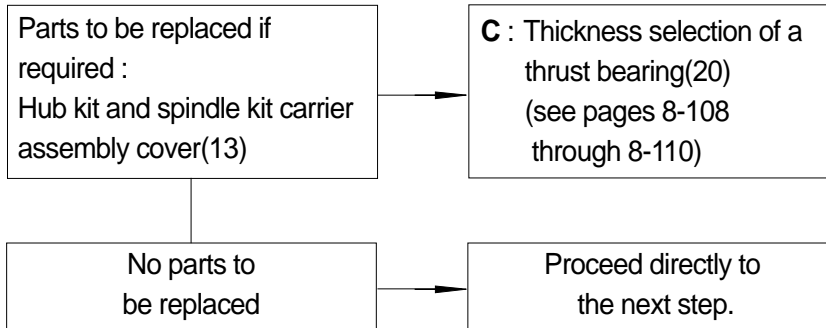
$25 \pm 5 \text{ kgf} \cdot \text{m} (185 \pm 36 \text{ lbf} \cdot \text{ft})$



(15) Assembly of the carrier assembly

Attach one of the two thrust bearing(20) to the coupling gear(8) using grease.

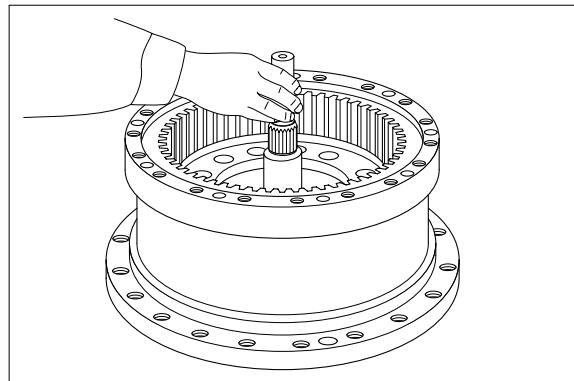
Apply a thin coat of molybdenum disulfide grease to the thrust bearing(20).



Mount the coupling(19) on the shaft(102).

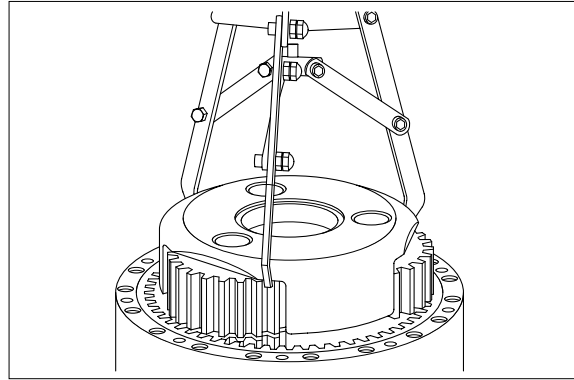
Apply a thin coat of molybdenum disulfide grease to the spline section of the coupling(19).

Place the steel ball(36) in the sun gear(7), and place the sun gear in the coupling(19).



Insert the carrier assembly into the hub(1), and correctly engage the teeth of ring gear B(5) and teeth B of the cluster gear(6).

This must be done only after determining the timing point of carrier assembly reassembling (see next for further details).



Determining the timing point of carrier assembly reassembling

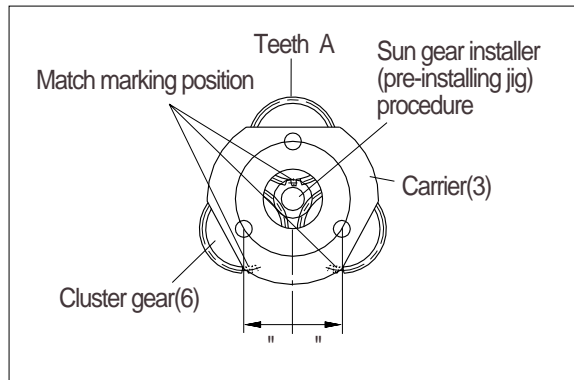
To insert the carrier assembly into the hub(1) and correctly engage teeth B of the cluster gear(6) and the teeth of ring gear B(5), carry out the operating procedure described after this figure :

Procedure

Align the match marks of the three cluster gears(6) at the positions shown.

At those positions, engage the sun gear installer correctly with the cluster gears(6) and fix the sun gear installer.

Insert the carrier assembly into the hub(1). This dismounts the sun gear installer automatically.



(16) Assembly of ring gear A(4)

Mount ring gear A(4) on the hub(1). Check at this time that the teeth of ring gear A and teeth A of the cluster gear are in correct engagement.

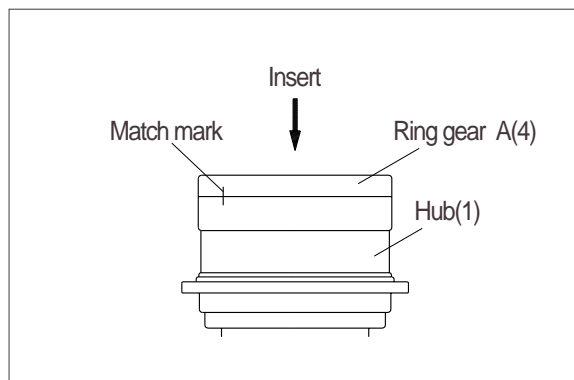
Rotate the hub(1) to fit the match marks on ring gear A and the hub.

Fit the ten dowel pins(27) into the hub(1).

After completely degreasing that surface of ring A(4) that contacts the hub(1), apply a thin coat #SS60F hermetic sealant to that contact surface.

Fill the reducer section with a lubricating oil.

Quantity required : Approx. 3.3 liters



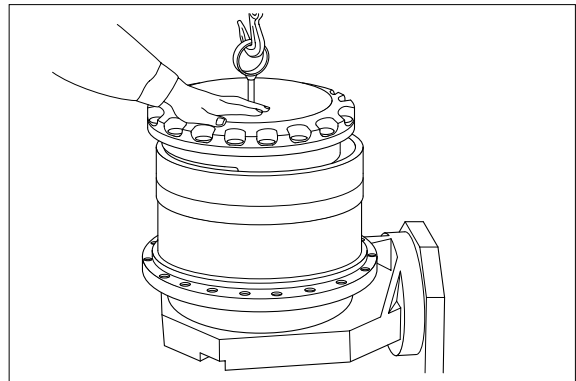
(17) Assembly of the cover(13)

Attach the thrust bearing(20) to the carrier(3) using grease.

Apply a thin coat of molybdenum disulfide grease to the surface of the thrust bearing(20).

Install cover(8) to hub(1).

Apply slightly loctite No. 24 to that matching face of cover which is to mate with the surface of hub(1).



Fasten cover(13) to hub(1) with 20 hexagonal bolts(32) and 20 super lock washers(33), applying to the specified torque.

Tightening torque :

$10.4 \pm 1.6 \text{ kgf} \cdot \text{m} (75.2 \pm 11.6 \text{ lbf} \cdot \text{ft})$

Before tightening bolts, apply loctite 242 to the hexagon bolts(32).

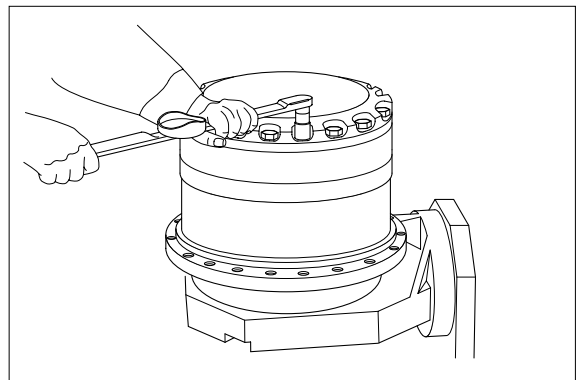
Tighten 3-plugs(30) to cover(13) to the specified torque.

Tightening torque :

$6 \pm 2 \text{ kgf} \cdot \text{m} (45 \pm 14 \text{ lbf} \cdot \text{ft})$

Before tightening plugs, wrap the threaded portion of each plug with two layers of the seal tape.

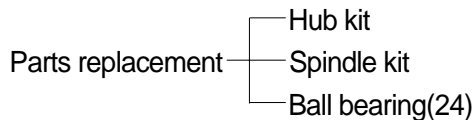
Tighten each plug until the last thread becomes nearly flush with the cover surface within an extent equal to plus or minus one thread relative to the surface.



B : THICKNESS SELECTION OF A DISTANCE PIECE(12)

(1) If the parts listed below have been replaced, select a distance piece(12) of the appropriate thickness.

After selection, return to the original reassembling procedure [procedure (5) of subsection 3] and carry out the next step of that procedure.



(2) Steps(1) through(4) of the original reassembling procedure must be carried out as directed.

Mount a measure plate on the spindle(2) without inserting a distance piece(12).

Lightly tighten a few hexagon socket bolts(35).

As shown in the figure at right, measure dimension **A** using a depth micrometer.

Tighten the hexagon socket head bolts equally.

Measure dimension **C** of the coupling gear(8) to be mounted see the figure at right.

Using the clearance measurements, calculate the appropriate distance piece thickness as follows.

- Measure the clearance between the edge of the spindle(2) and that of the ball bearing(24). Take this clearance as **X**.

Take this clearance as **X**.

$$X = A - B$$

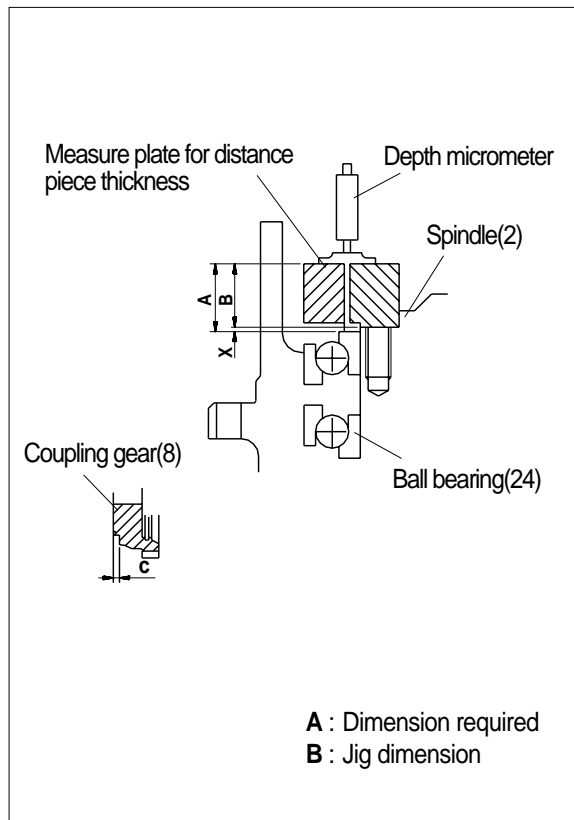
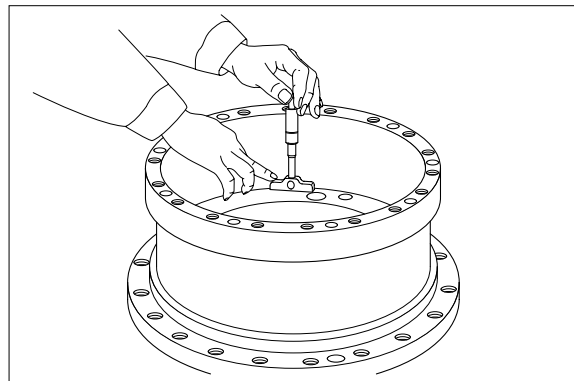
- Next, determine the distance piece of the appropriate thickness.

Take this thickness as **T**.

$$T = (C + X) \pm 0.1$$

Using the results of steps (1) through (5) above, select the appropriate thickness.

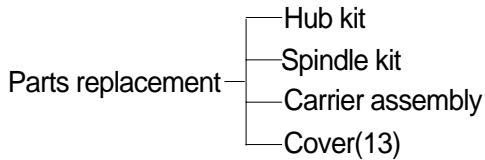
Then, proceed with the original reassembling operation.



C : THICKNESS SELECTION OF A THRUST BEARING(20)

(1) If the parts listed below have been replaced, select a thrust bearing(20) of the appropriate thickness.

After selection, return to the original reassembling procedure [procedure (15) at page 8-104] and carry out the next step of that procedure.



(2) Steps(1) through(4) of the original reassembling procedure must be carried out as directed.

Attach one of the two thrust bearings(20) to the coupling gear(8).

At this time, use the thinnest distance piece.

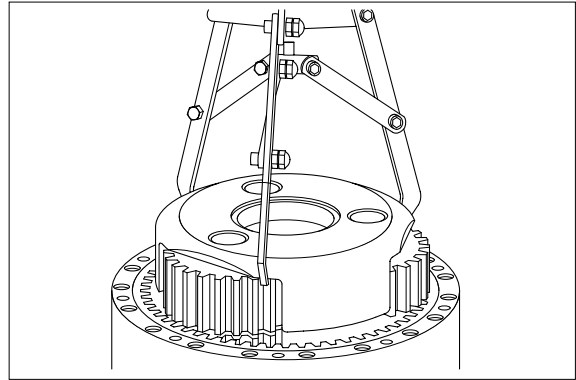
Mount the coupling(19) on the shaft(102).

Place the sun gear(7) in the coupling(19).

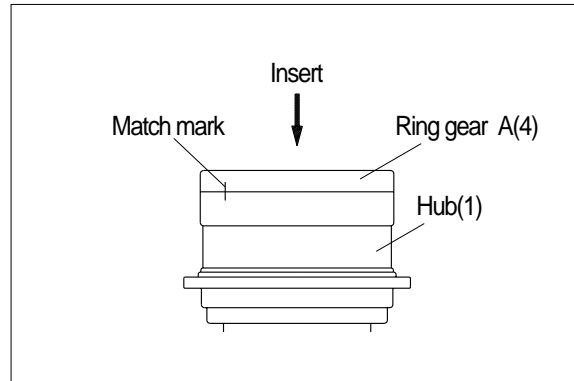
Insert the carrier assembly into the hub(1), and correctly engage the teeth B of the cluster gear(6).

This must be done only after determining the timing point of carrier assembly reassembling (see page 8-105 for further details.)

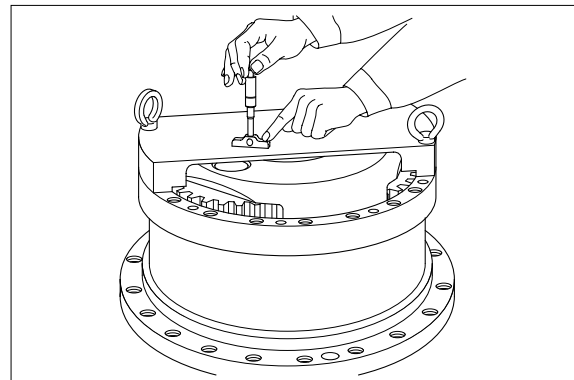
Do not apply molybdenum disulfide grease to the thrust bearing(20).



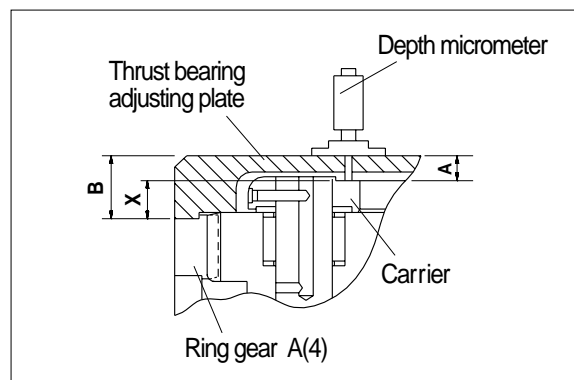
Fit the match marks on ring gear A(4) and the hub(1), and mount the ring gear on the hub. Check at this time that teeth A of the cluster gear(6) and the teeth of ring gear A(4) are in correct engagement.



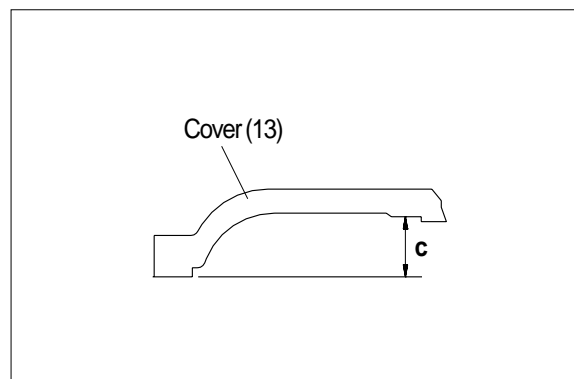
Mount a thrust-bearing adjusting plate on the hub(1), and lightly tighten the former using two M12 hexagon socket bolts. Don not mount the thrust bearing(20) at this time.



As shown in the figure at right, measure dimension **A** using a depth micrometer.



Measure dimension **C** of the cover(13) to be mounted. See the figure at right.



Using the clearance measurements, calculate the appropriate thrust bearing thickness as follows.

- Measure the clearance between the edge of the carrier(3) and that of ring gear A(4).

Take this clearance as **X**

$$\mathbf{X = B - A}$$

A : Dimension required

B : Jig dimension

- Next, determine the thrust bearing of the appropriate thickness.

Take this thickness as **T**.

$$\mathbf{T = (C - X) - (0.3 \text{ to } 0.6)}$$

Using the results of steps(7) through(9) above,select the appropriate thickness from three types.

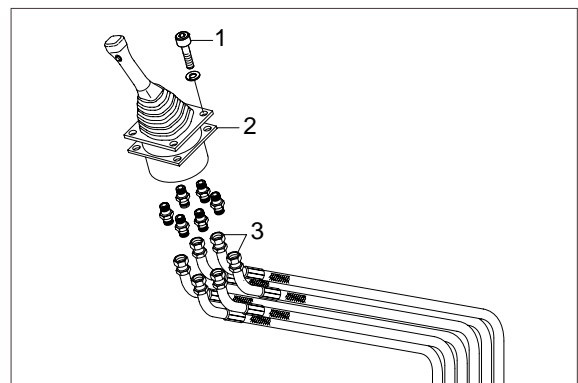
Then, proceed with the original reassembling operation.

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(2).
- (5) Remove the cover of the console box.
- (6) Disconnect pilot line hoses(3).
- (7) Remove the pilot valve assembly(1).
When removing the pilot valve assembly, check that all the hoses have been disconnected.

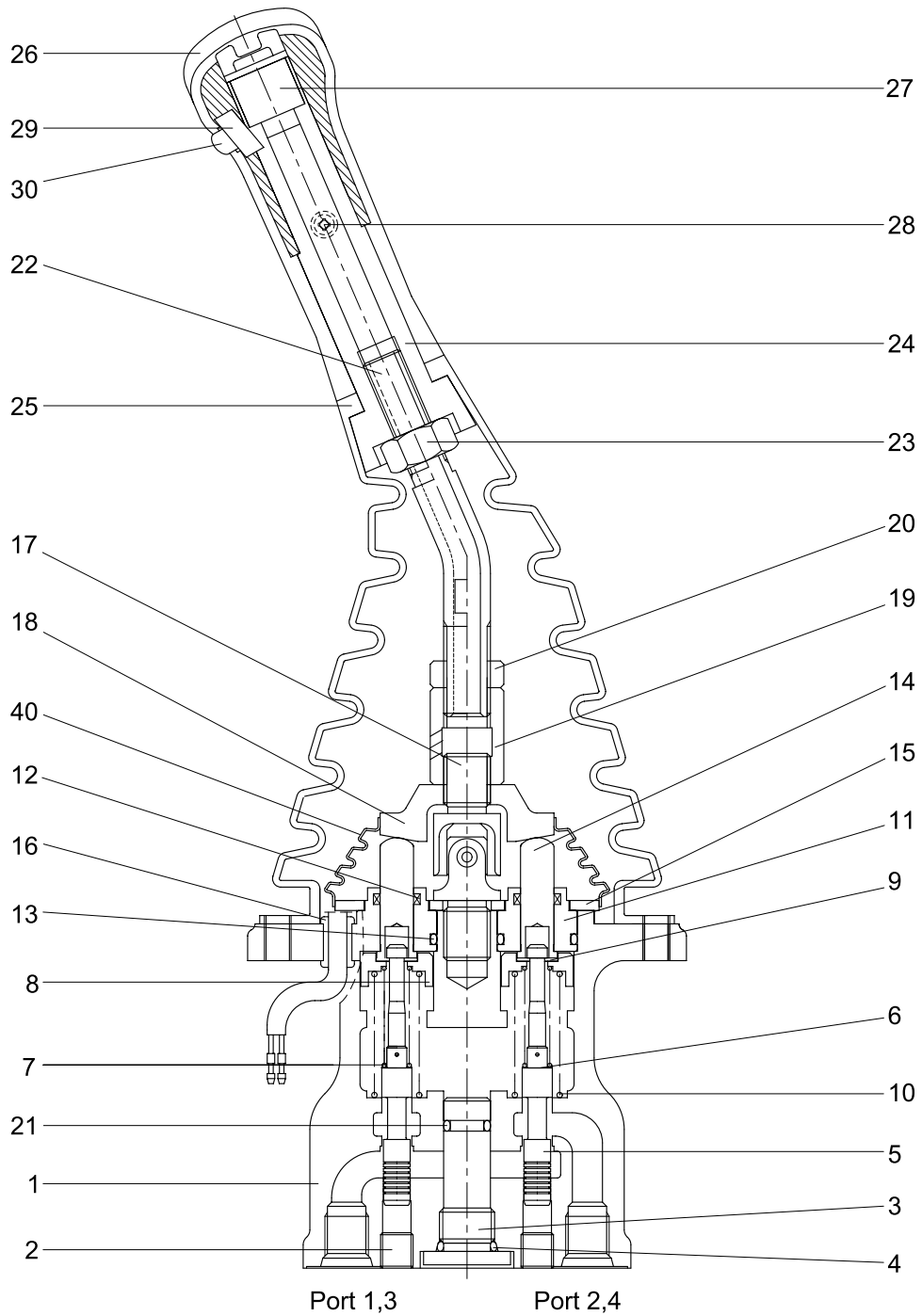


2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

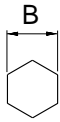
1) STRUCTURE



1	Case	11	Plug	21	O-ring
2	Plug	12	Rod seal	22	Handle connector
3	Plug	13	O-ring	23	Nut
4	O-ring	14	Push rod	24	Insert
5	Spool	15	Plate	25	Boot
6	Shim	16	Bushing	26	Handle
7	Spring	17	Joint assembly	27	Switch assembly
8	Spring seat	18	Swash plate	28	Screw
9	Stopper	19	Adjusting nut	29	Switch assembly
10	Spring	20	Lock nut	30	Switch cover
				40	Boot

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

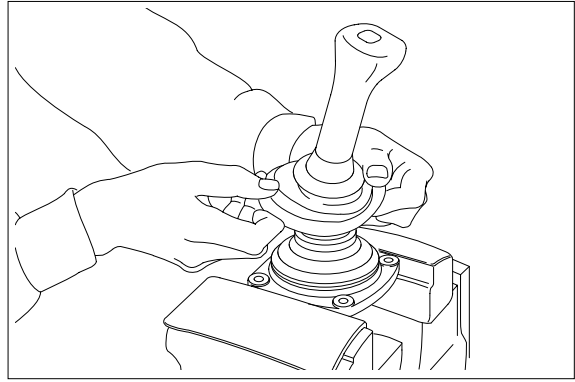
Tool name	Remark	
Allen wrench	6	
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

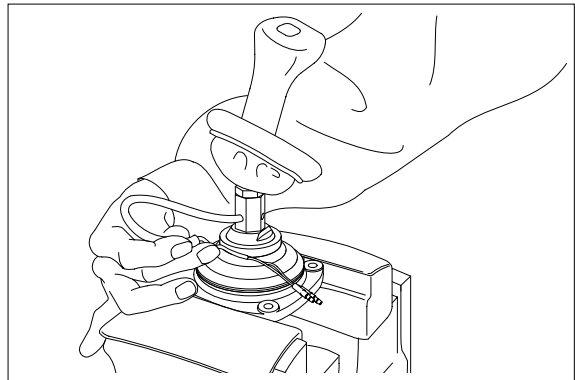
Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	PT 1/8	3.0	21.7
Joint	18	M14	3.5	25.3
Swash plate	19	M14	5.0 ± 0.35	36.2 ± 2.5
Adjusting nut	20	M14	5.0 ± 0.35	36.2 ± 2.5
Lock nut	21	M14	5.0 ± 0.35	36.2 ± 2.5
Screw	29	M 3	0.05	0.36

3) DISASSEMBLY

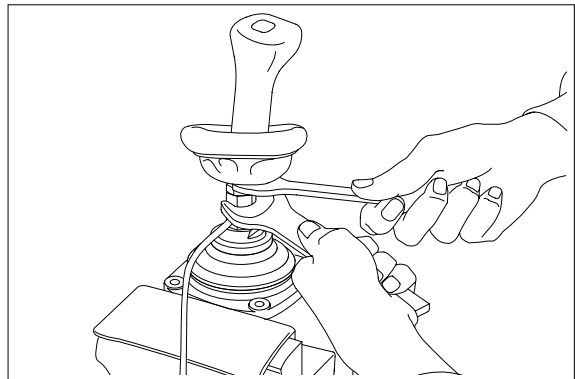
- (1) Clean pilot valve with kerosene.
Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper(or lead) sheets.
- (3) Remove end of boot(26) from case(1) and take it out upwards.



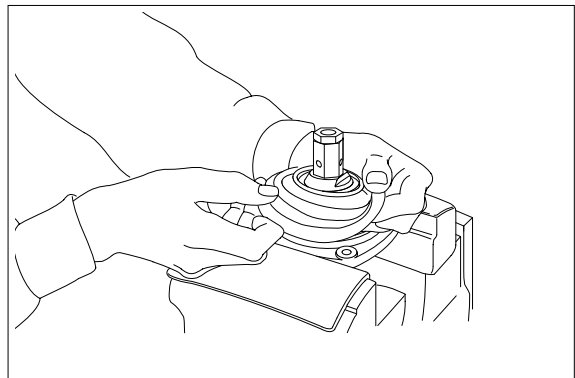
For valve with switch, remove cord also through hole of casing.



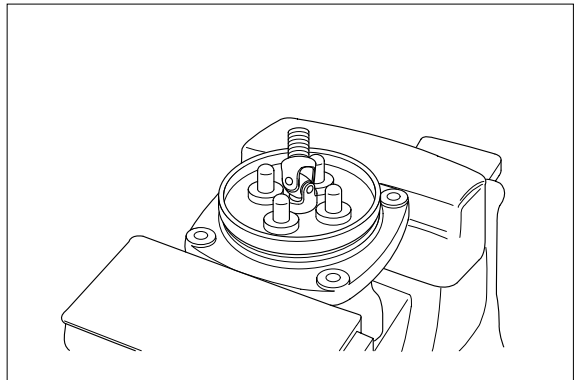
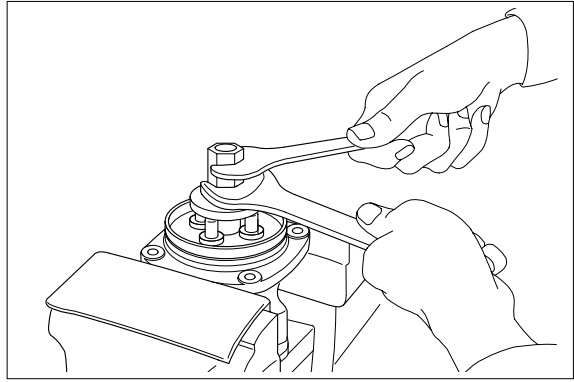
- (4) Loosen lock nut(21) and adjusting nut(20) with spanners on them respectively, and take out handle section as one body.



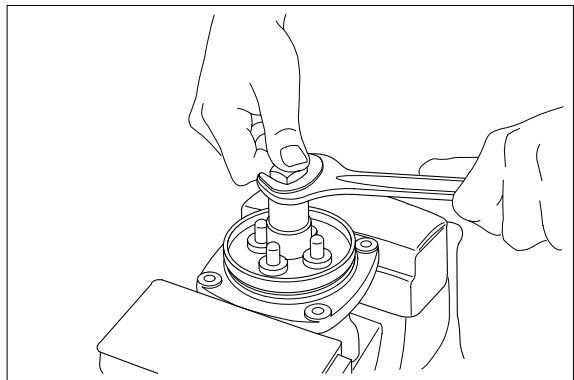
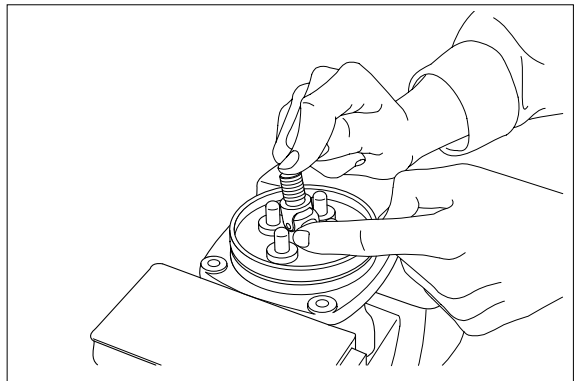
- (5) Remove the boot(40)



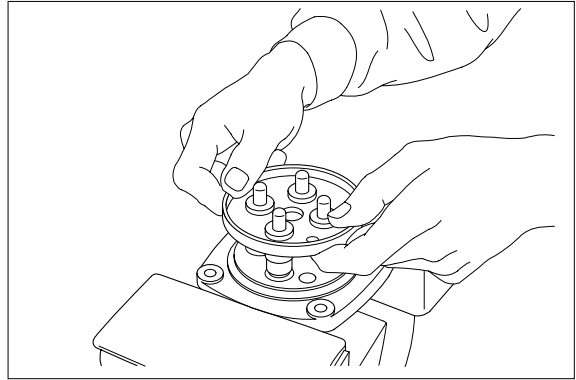
- (6) Loosen adjusting nut(20) and plate(19) with spanners on them respectively, and remove them.



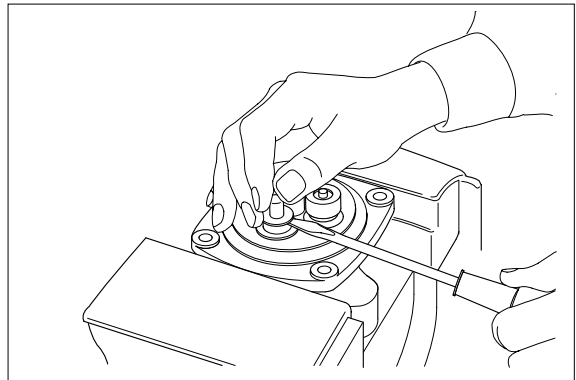
- (7) Turn joint anticlockwise to loosen it, utilizing jig(Special tool).
When return spring(10) is strong in force, plate(16), plug(11) and push rod(14, 15) will come up on loosening joint.
Pay attention to this.



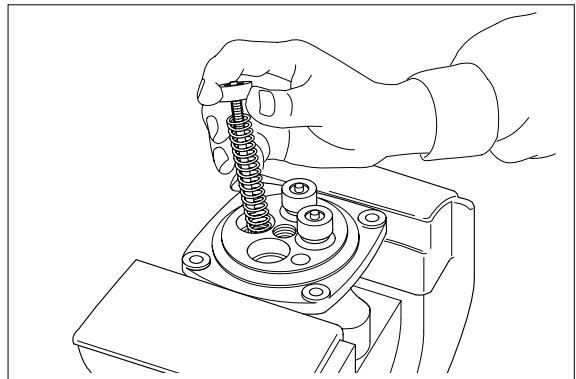
(8) Remove plate(16).



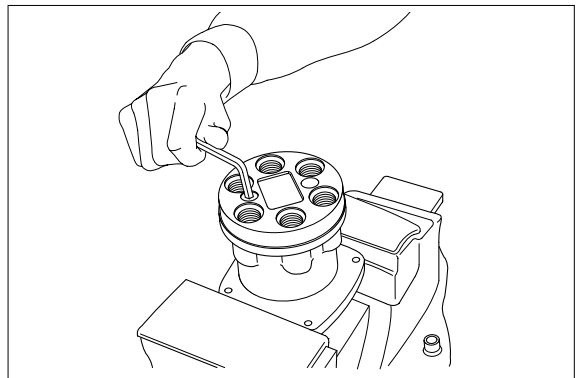
(9) When return spring(10) is weak in force, plug(11) stays in casing because of sliding resistance of O-ring.
Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.
During taking out, plug may jump up due to return spring(10) force.
Pay attention to this.



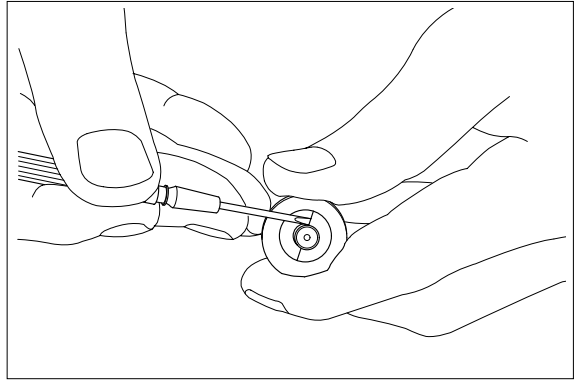
(10) Remove reducing valve subassembly and return spring(10) out of casing.
Record relative position of reducing valve subassembly and return springs.



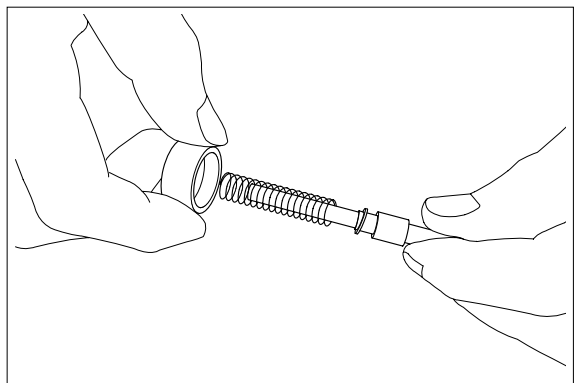
(11) Loosen hexagon socket head plug(2) with hexagon socket screw key.



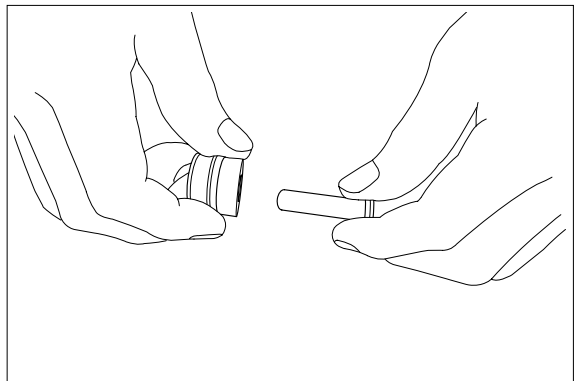
- (12) For disassembling reducing valve section, stand it vertically with spool(5) bottom placed on flat workbench. Push down spring seat(8, 31) and remove two pieces of semicircular stopper(9) with tip of small minus screwdriver. Pay attention not to damage spool surface. Record original position of spring seat(8, 31). Do not push down spring seat more than 6mm.



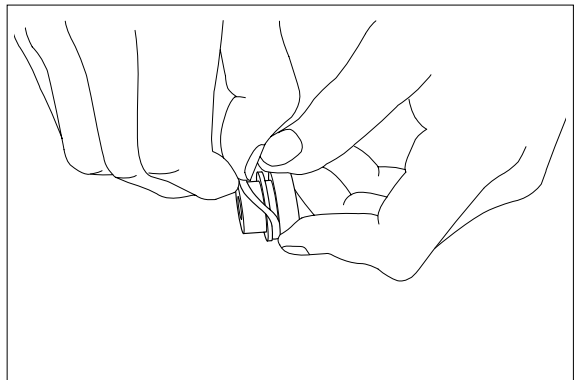
- (13) Separate spool(5), spring seat(8, 31), spring(7, 30) and shim(6) individually. Until being assembled, they should be handled as one subassembly group.

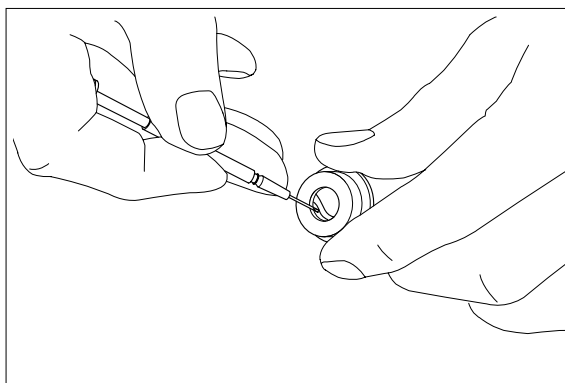


- (14) Take push rod(14, 15) out of plug(11).

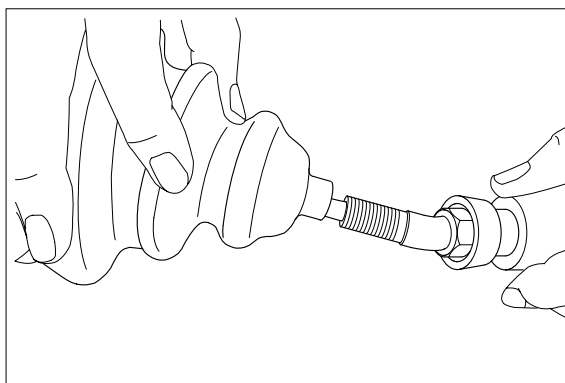
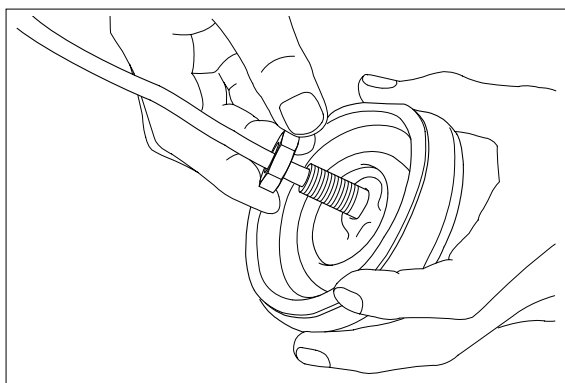


- (15) Remove O-ring(13) and seal(12) from plug(11). Use small minus screwdriver or so on to remove this seal.





(16) Remove lock nut(21) and then boot(26).



(17) Cleaning of parts

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.

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.

(18) Rust prevention of parts.

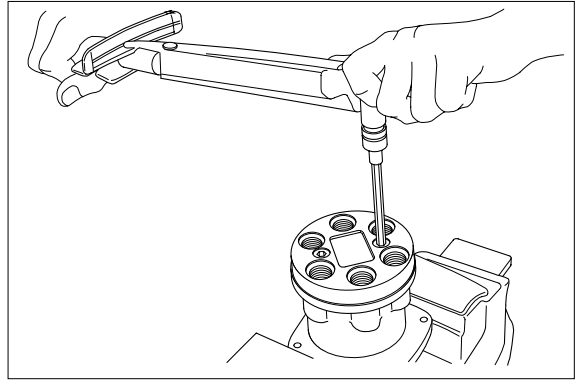
Apply rust-preventives to all parts.

If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

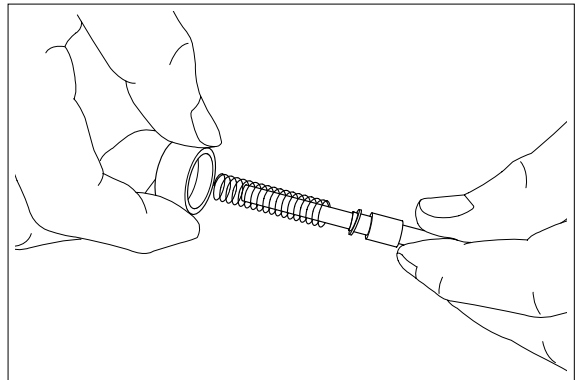
4) ASSEMBLY

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

Tighten two bolts alternately and slowly.

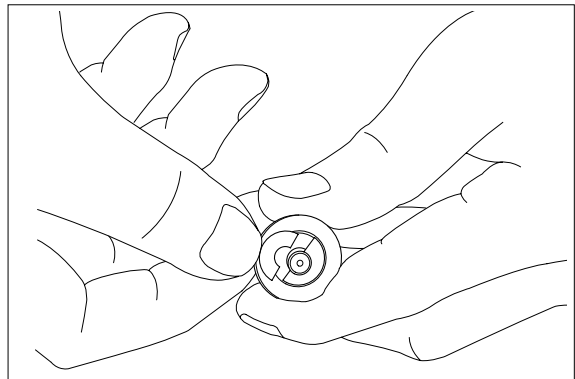


- (2) Put shim(6), springs(7, 30) and spring seat(8, 31) onto spool(5) in this order.

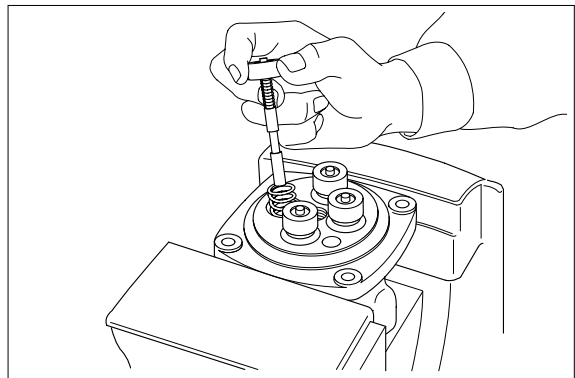


- (3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper(9) on spring seat without piling them on.

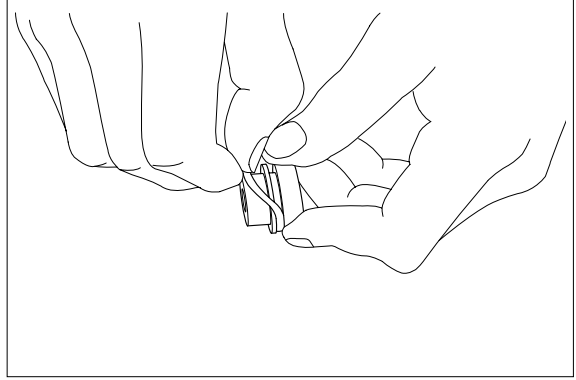
Assemble stopper(9) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.



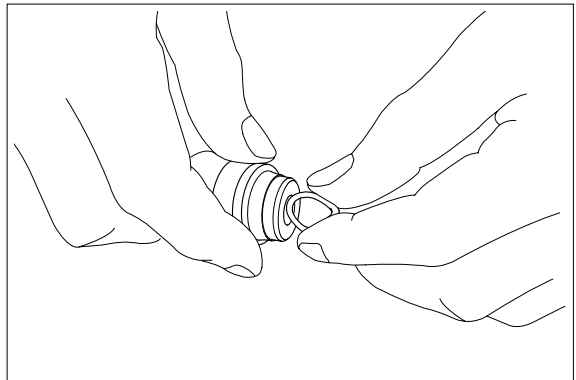
- (4) Assemble spring(10) into casing.
Assemble reducing valve subassembly into casing.
Assemble them to their original positions.



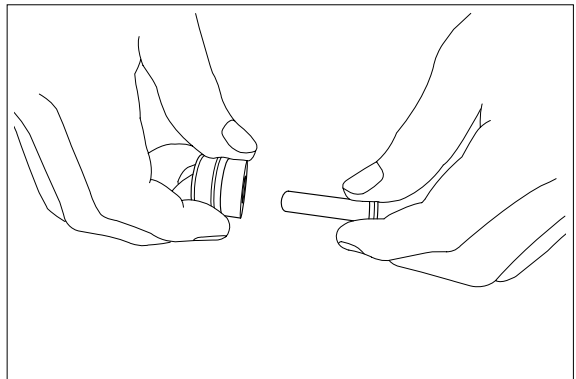
(5) Assemble O-ring(13) onto plug(11).



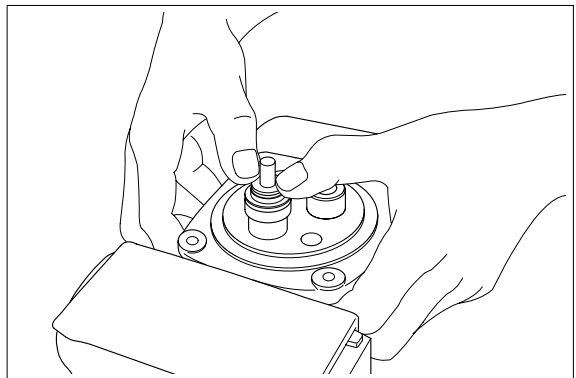
(6) Assemble seal(12) to plug(11).
Assemble seal in such lip direction as shown below.



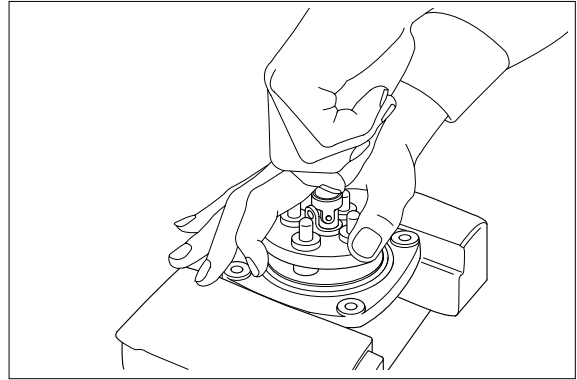
(7) Assemble push rod(14, 15) to plug(11).
Apply working oil on push-rod surface.



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

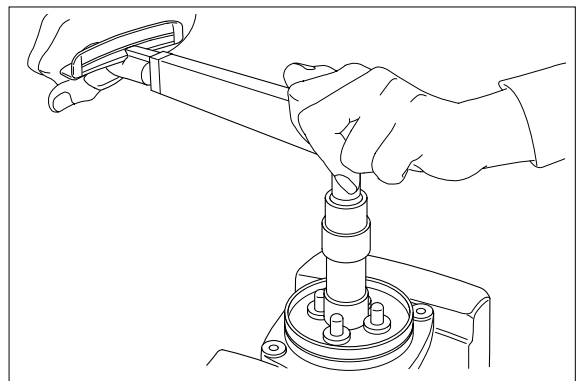


- (9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate(16), and tighten joint(18) temporarily.

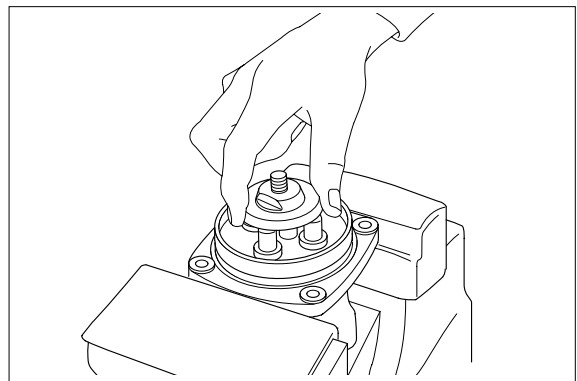


- (10) Fit plate(16).

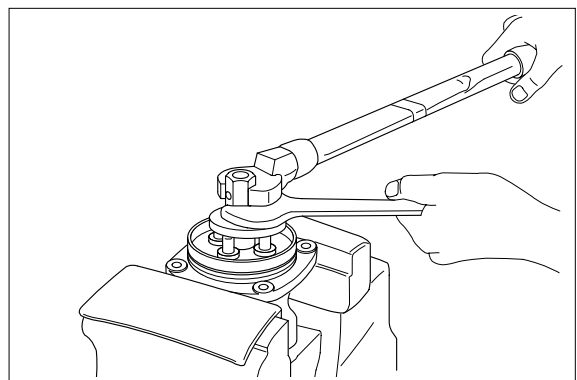
- (11) Tighten joint(18) with the specified torque to casing, utilizing jig.



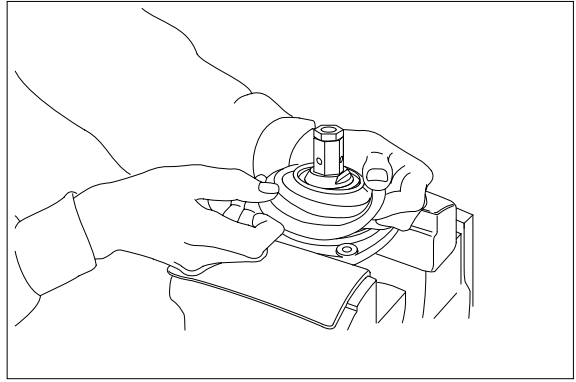
- (12) Assemble plate(19) to joint(18).
Screw it to position that it contacts with 4 push rods evenly.
Do not screw it over.



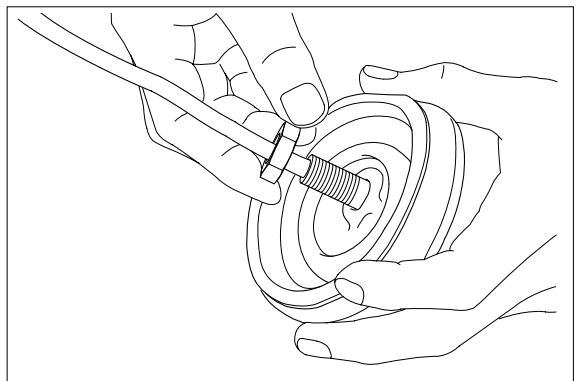
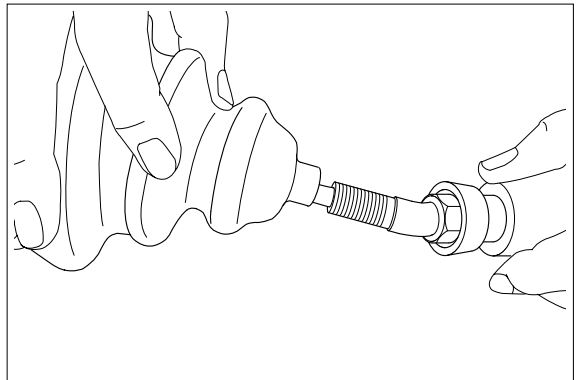
- (13) Assemble adjusting nut(20), apply spanner to width across flat of plate(19) to fix it, and tighten adjusting nut to the specified torque.
During tightening, do not change position of disk.



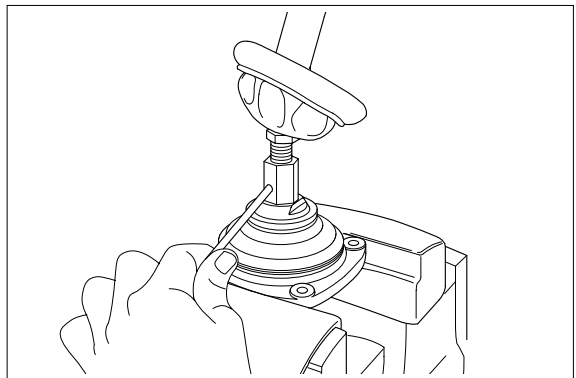
(14) Fit boot(40) to plate.



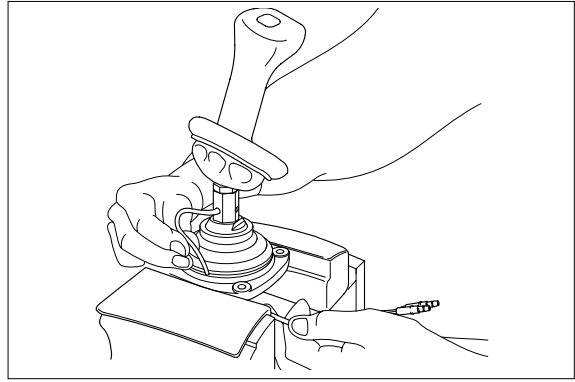
(15) Fit boot(26) and lock nut(21), and handle subassembly is assembled completely.



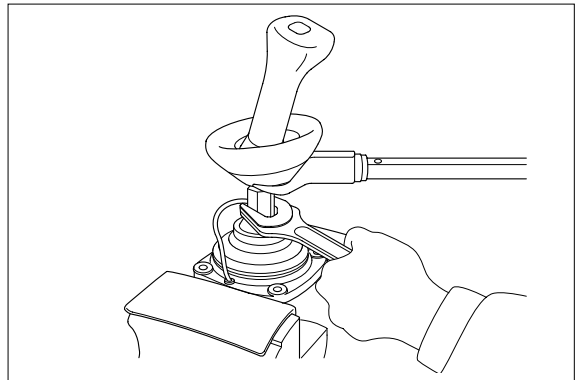
(16) Pull out cord and tube through adjusting nut hole provided in direction 60. to 120. from casing hole.



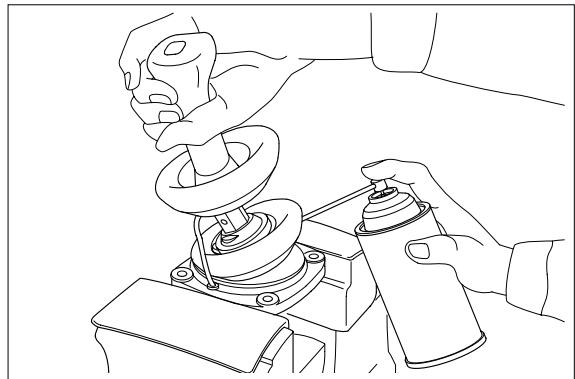
- (17) Assemble bushing(17) to plate and pass cord and tube through it.
Provide margin necessary to operation.



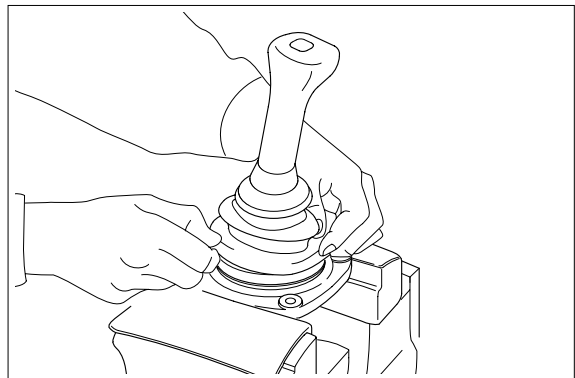
- (18) Determine handle direction, tighten lock nut(21) to specified torque to fix handle.



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



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

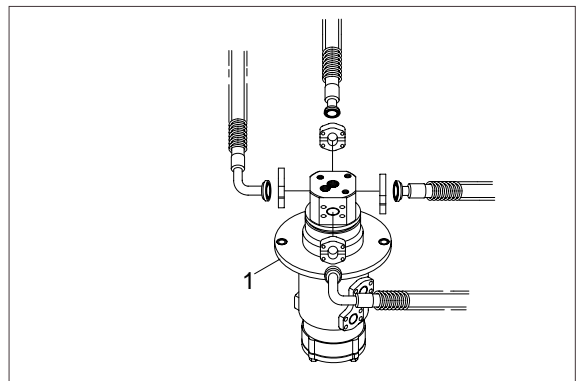


GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

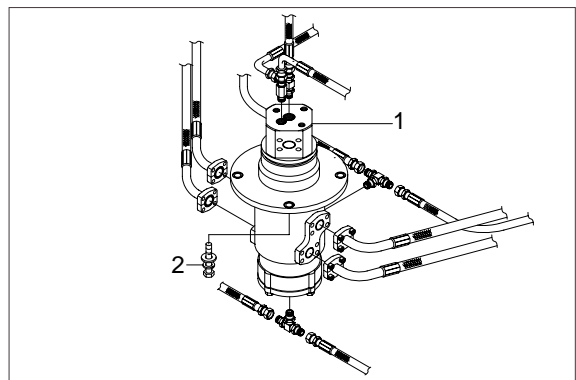
1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury. When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt(2).
 - Weight : 54kg(119lb)
 - Tightening torque : $12.3 \pm 1.3\text{kgf} \cdot \text{m}$
($88.9 \pm 9.4\text{lbf} \cdot \text{ft}$)
- (6) Remove the turning joint assembly.
When removing the turning joint, check that all the hoses have been disconnected.



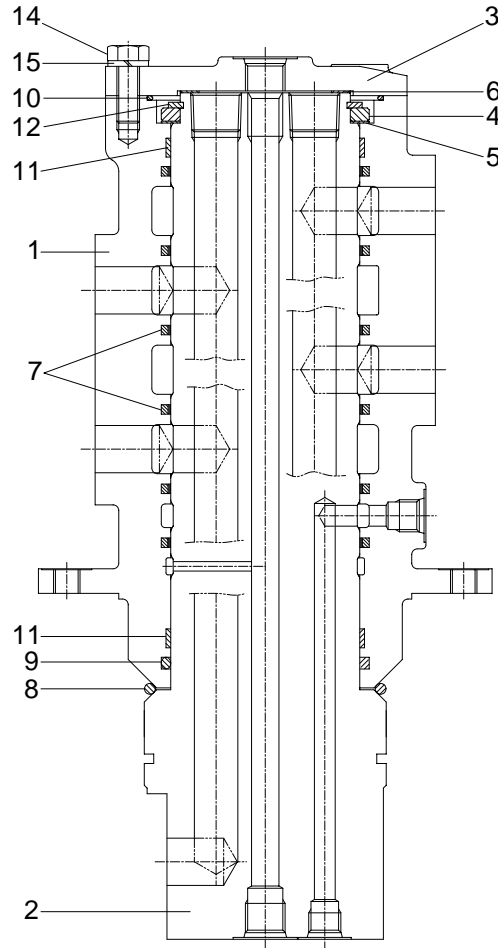
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

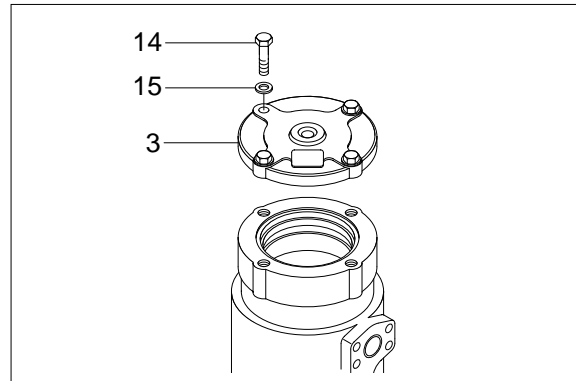


- | | | | | | |
|---|--------|----|--------------|----|---------------|
| 1 | Hub | 6 | Shim | 11 | Wear ring |
| 2 | Shaft | 7 | Slipper seal | 12 | Retainer ring |
| 3 | Cover | 8 | O-ring | 13 | Plug |
| 4 | Spacer | 9 | O-ring | 14 | Hexagon bolt |
| 5 | Shim | 10 | O-ring | 15 | Spring washer |

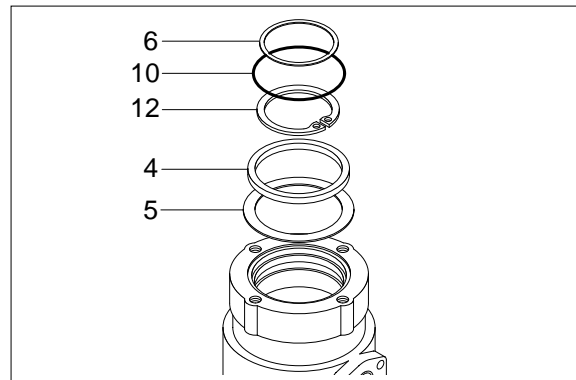
2) DISASSEMBLY

Before the disassembly, clean the turning joint.

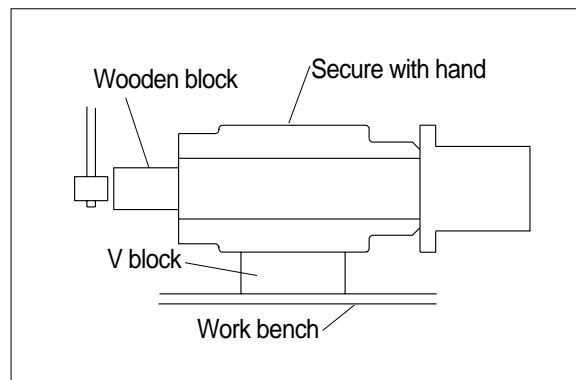
- (1) Remove bolts(14), washer(15) and cover(3).



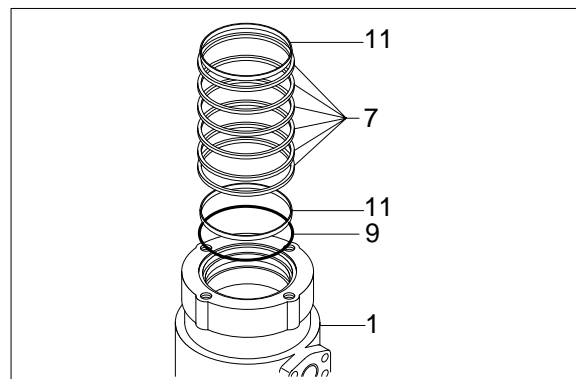
- (2) Remove shim(6) and O-ring(10).
- (3) Remove retainer ring(12), spacer(4) and shim(5).



- (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 ring wear(11) from hub(1).



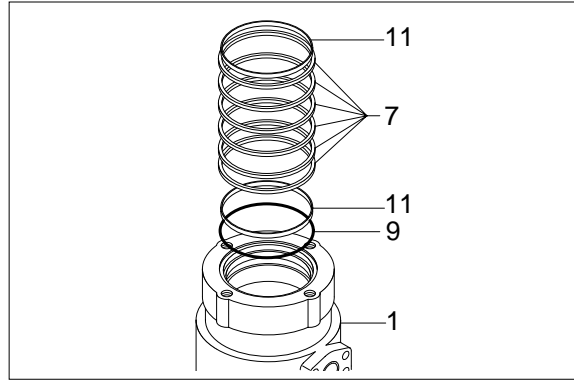
3) ASSEMBLY

Clean all parts.

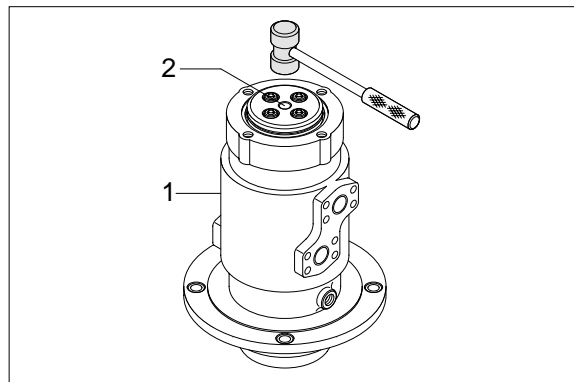
As a general rule, replace oil seals and O-ring.

Coat the sliding surfaces of all parts with engine oil or grease before installing.

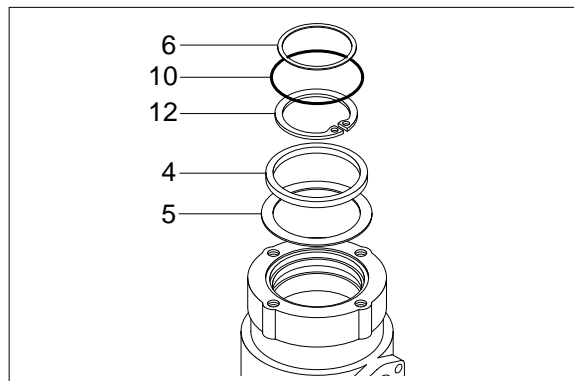
- (1) Fix seven slipper seal(7) and O-ring(9), two ring wear(11) to hub(1).
- (2) Fit O-ring(8) to shaft(2).



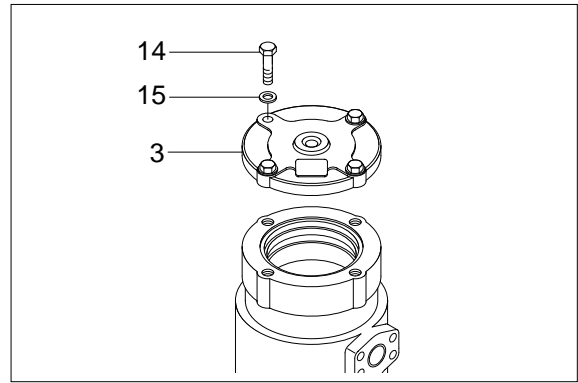
- (3) Set shaft(2) on block, tap hub(1) with a plastic hammer to install.



- (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 : 10~12.5kgf · m(72.3~90.4lbf · 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.

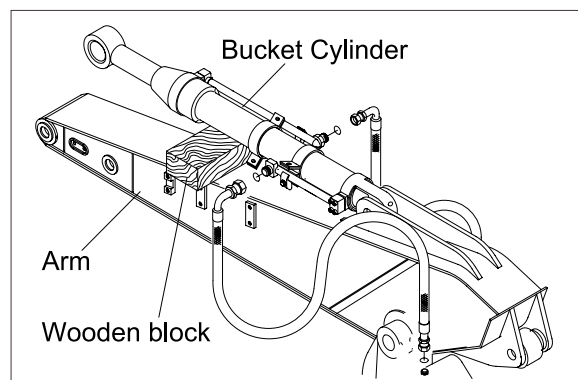
Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

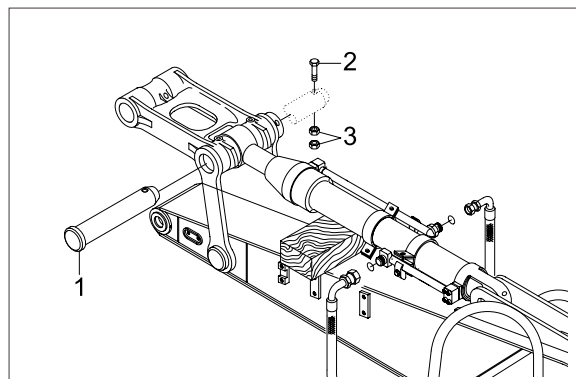
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

Set block between bucket cylinder and arm.

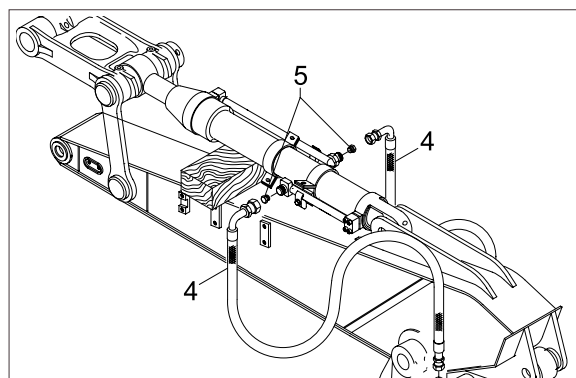


Remove bolt(2), nut(3) and pull out pin (1).

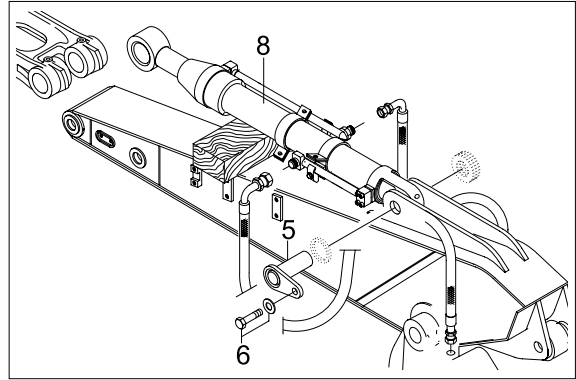
Tie the rod with wire to prevent it from coming out.



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



Sling bucket cylinder assembly(8) and remove bolt(6) then pull out pin (5).
Remove bucket cylinder assembly(8).
· Weight : 105kg(231.5lb)



(2) Install

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.

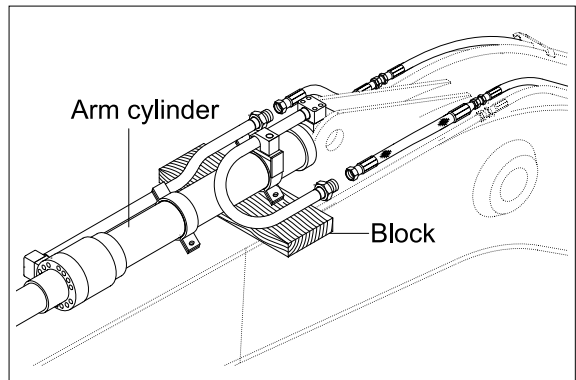
Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

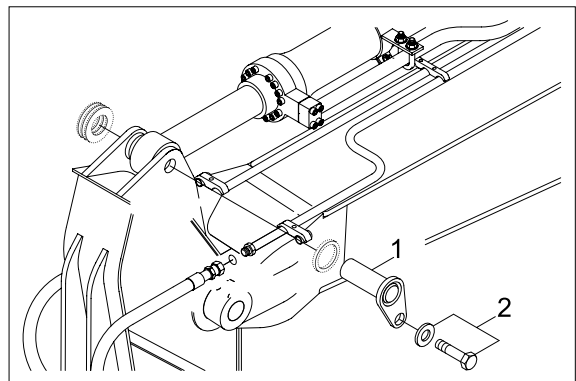
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

Set block between arm cylinder and boom.



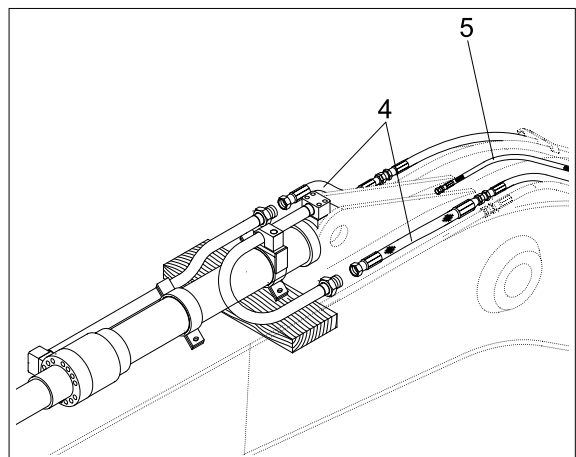
Remove bolt(2) and pull out pin(1).

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

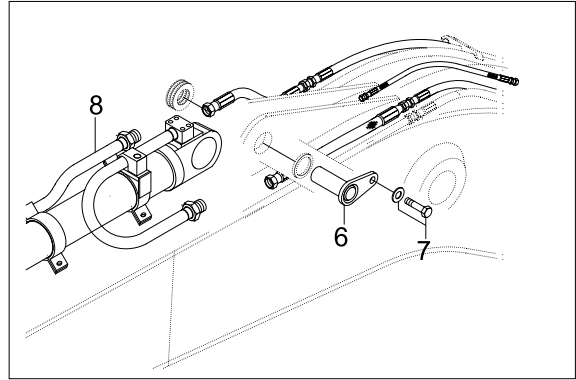


Disconnect arm cylinder hoses(4) and put plugs on cylinder pipe.

Disconnect greasing pipings(5).



Sling arm assembly(8) and remove bolt (7) then pull out pin(6).
Remove arm cylinder assembly(8).
· Weight : 161kg(354.9lb)



(2) Install

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.

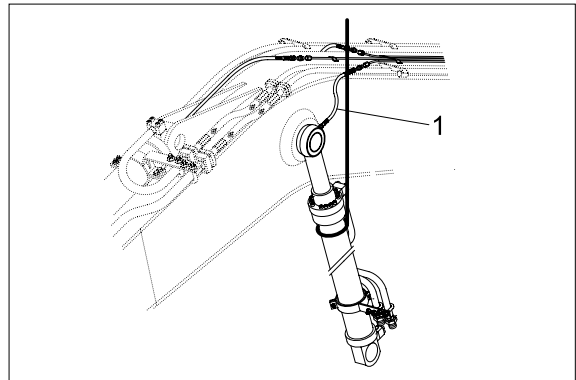
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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.

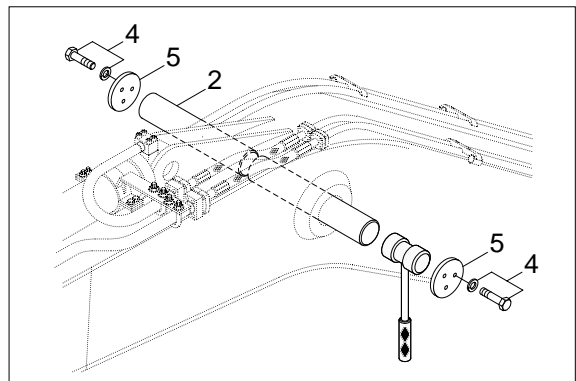
Disconnect greasing hoses(1).

Sling boom cylinder assembly.

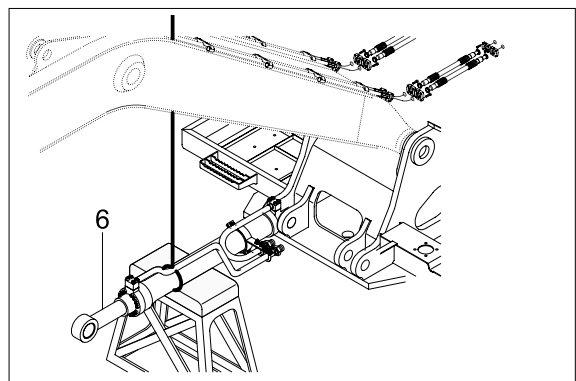


Remove bolt(4), stop plate(5) and pull out pin(2).

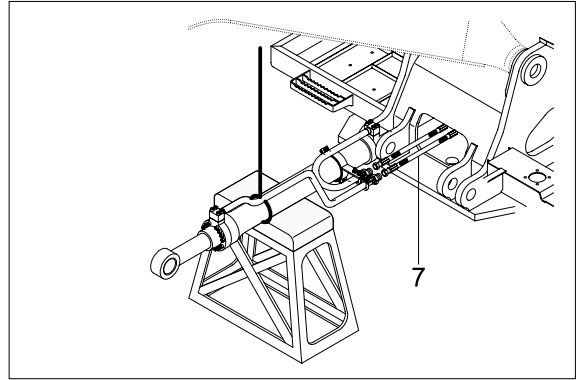
Tie the rod with wire to prevent it from coming out.



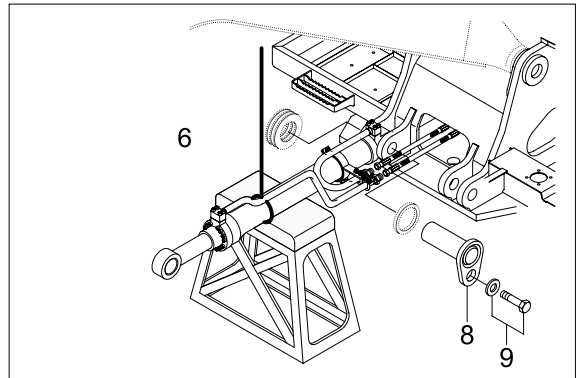
Lower the boom cylinder assembly(6) on a stand.



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



Remove bolt(9) and pull out pin(8).
Remove boom cylinder assembly(6).
· Weight : 128kg(282.2lb)



(2) Install

Carry out installation in the reverse order to removal.

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

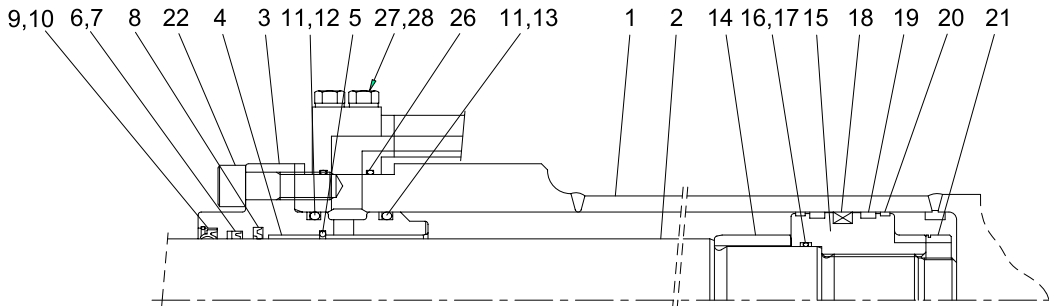
Bleed the air from the boom cylinder.

Confirmed the hydraulic oil level and check the hydraulic oil leak or not.

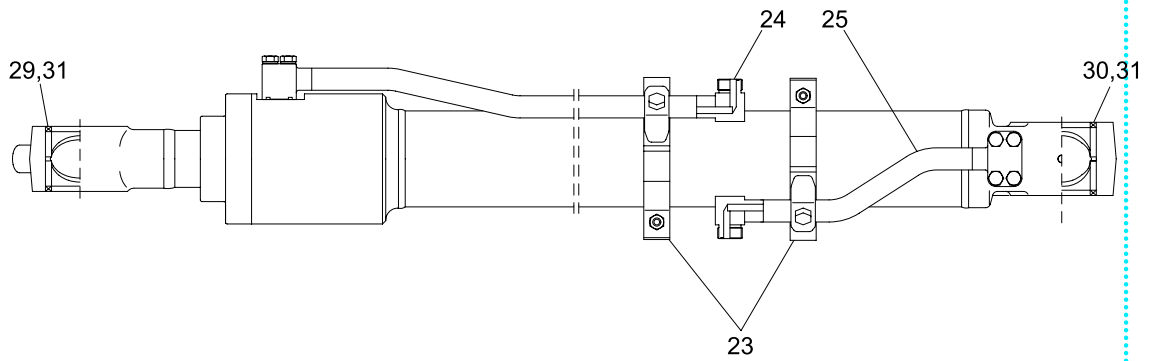
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder

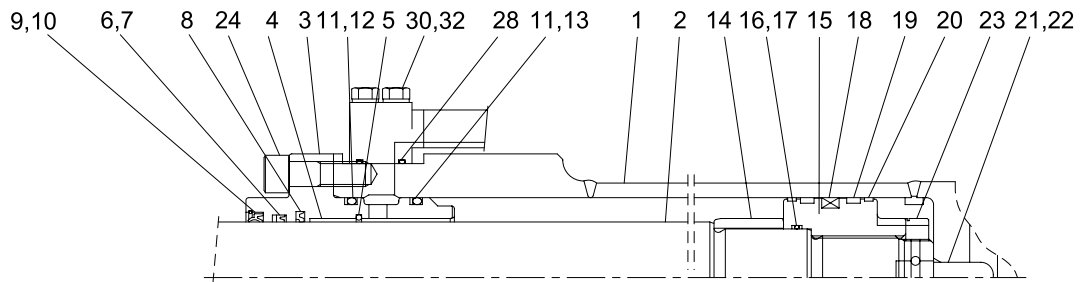


Internal detail

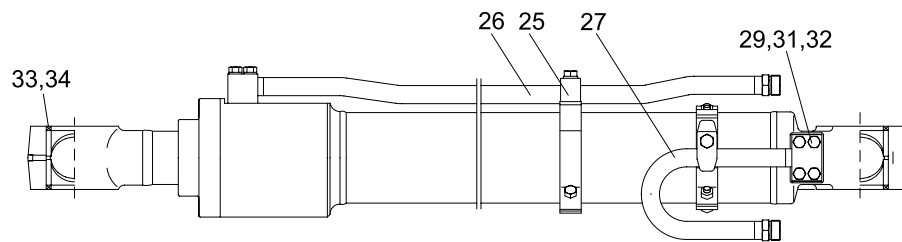


1	Tube assembly	11	O-ring	21	Nut-lock
2	Rod assembly	12	Ring-back up	22	Bolt-hexagon socket head
3	Gland	13	Ring-back up	23	Band assembly
4	DD2 bush	14	Ring-cushion	24	Pipe assembly(R)
5	Ring-snap	15	Piston	25	Pipe assembly(B)
6	Seal-rod	16	O-ring	26	O-ring
7	Ring-back up	17	Ring-back up	27	Bolt-hexagon head
8	Ring-buffer	18	Seal-piston	28	Washer-spring
9	Wiper-dust	19	Ring-wear	29	Bush-pin
10	Ring-snap	20	Ring-dust	30	Bush-pin
				31	Seal-dust

(2) Arm cylinder

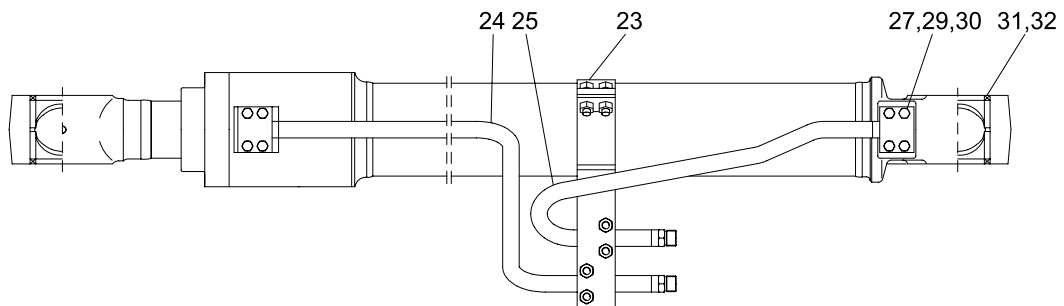
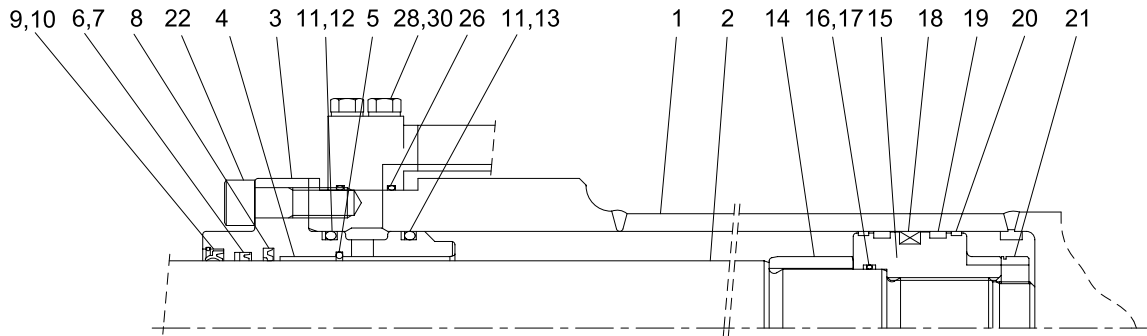


Internal detail



1	Tube assembly	13	Ring-back up	24	Bolt-hexagon socket head
2	Rod assembly	14	Ring-cushion	25	Band assembly
3	Gland	15	Piston	26	Pipe assembly(R)
4	DD2 bush	16	O-ring	27	Pipe assembly(B)
5	Ring-snap	17	Ring-back up	28	O-ring
6	Seal-rod	18	Seal-piston	29	O-ring
7	Ring-back up	19	Ring-wear	30	Bolt-hexagon head
8	Ring-buffer	20	Ring-dust	31	Bolt-hexagon head
9	Wiper-dust	21	Spear-cushion	32	Washer-spring
10	Ring-snap	22	Ball-steel	33	Bush-pin
11	O-ring	23	Nut-lock	34	Seal-dust
12	Ring-back up				

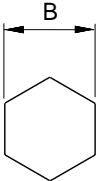
(3) Boom cylinder



1	Tube assembly	12	Ring-back up	23	Band assembly
2	Rod assembly	13	Ring-back up	24	Pipe assembly(R, LH/RH)
3	Gland	14	Ring-cushion	25	Pipe assembly(B, LH/RH)
4	DD2 bush	15	Piston	26	O-ring
5	Ring-snap	16	O-ring	27	O-ring
6	Seal-rod	17	Ring-back up	28	Bolt-hexagon head
7	Ring-back up	18	Seal-piston	29	Bolt-hexagon head
8	Ring-buffer	19	Ring-wear	30	Washer-spring
9	Wiper-dust	20	Ring-dust	31	Bush-pin
10	Ring-snap	21	Nut-lock	32	Seal-dust
11	O-ring	22	Bolt-hexagon socket head		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	B	Remark
Allen wrench	16	
	18	
Spanner	10	
	45	
	50	
	55	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	22	M16	23.0 ± 2.0	166 ± 14.5
	Boom cylinder	22	M16	23.0 ± 2.0	166 ± 14.5
	Arm cylinder	24	M18	32.0 ± 3.0	232 ± 21.7
Hexagon head bolt	Bucket cylinder	27	M10	5.4 ± 0.5	39.1 ± 3.6
	Boom cylinder	28.29	M10	2.7 ± 0.3	19.6 ± 1.8
	Arm cylinder	30.31	M10	5.4 ± 0.5	39.1 ± 3.6
Lock nut	Bucket cylinder	21	M45	100 ± 10.0	723 ± 72.3
	Boom cylinder	21	M50	100 ± 10.0	723 ± 72.3
	Arm cylinder	23	M55	100 ± 10.0	723 ± 72.3
Piston	Bucket cylinder	14	-	150 ± 15.0	1085 ± 109
	Boom cylinder	15	-	150 ± 15.0	1085 ± 109
	Arm cylinder	14	-	150 ± 15.0	1085 ± 109

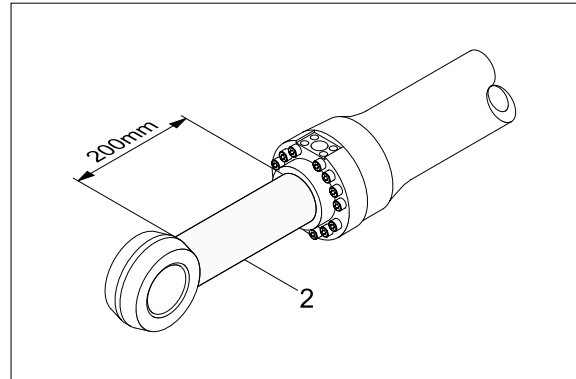
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

Hold the clevis section of the tube in a vise.

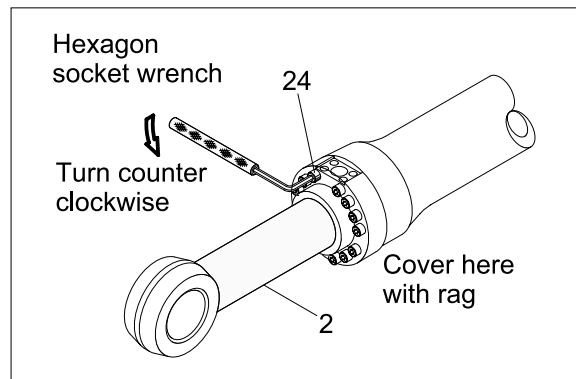
Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



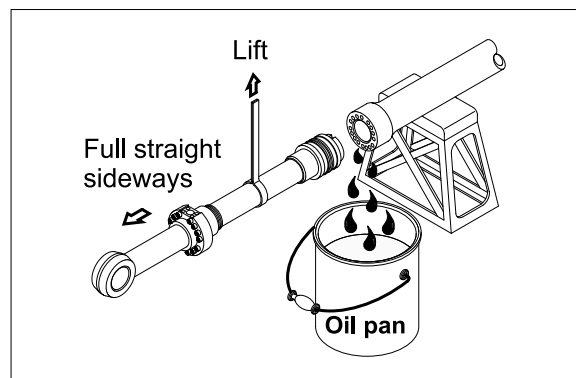
Loosen and remove socket bolts(24) of the gland in sequence.

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



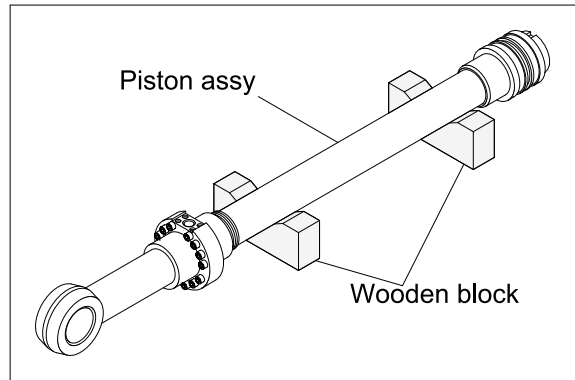
Draw out cylinder head and rod assembly together from tube assembly(1).

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.



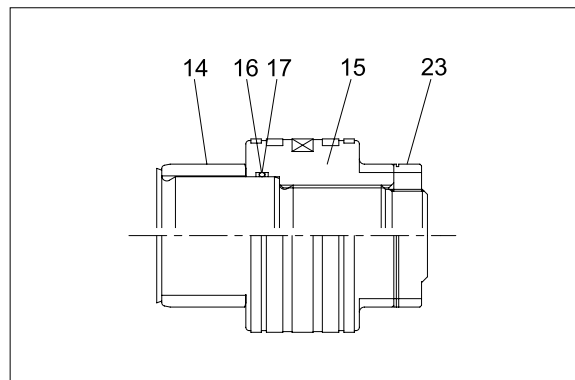
Note that the plated surface of rod assembly(2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

Remove lock nut(23).
Since lock nut(23) is tightened to a high torque, use a hydraulic and power wrench that utilizes a hydraulic cylinder, to remove the lock nut(21).
Remove piston assembly(15), back up ring(17), and O-ring(16).

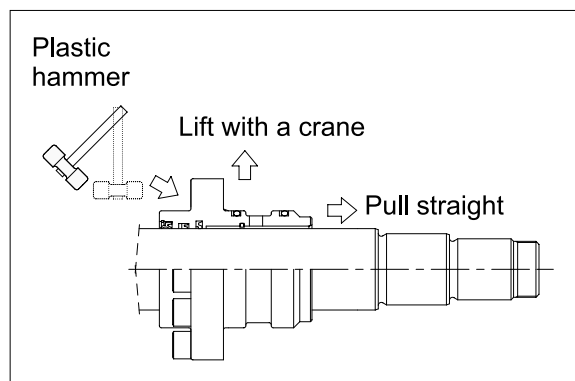


Remove the cylinder head assembly from rod assembly(2).

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).

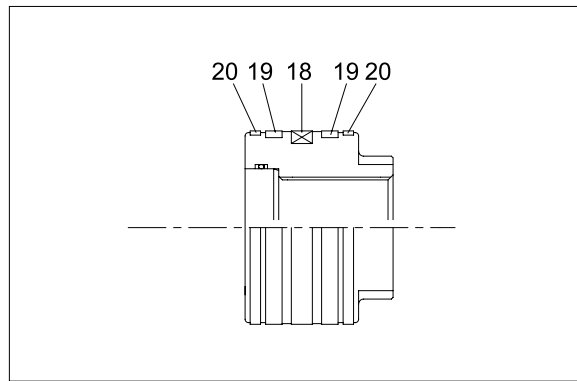


(3) Disassemble the piston assembly

Remove wear ring(19).

Remove dust ring(20) and piston seal (18).

Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

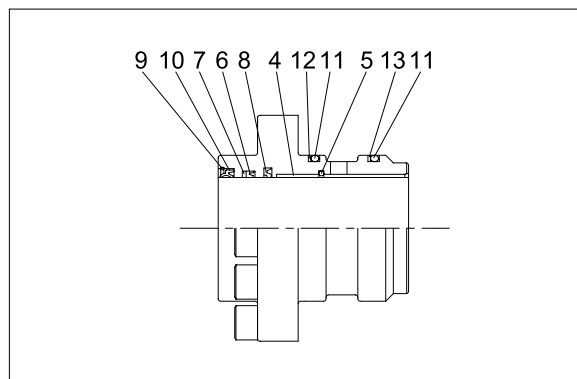
Remove back up ring(11) and O-ring (12,13).

Remove snap ring(10), dust wiper(9).

Remove back up ring(7), rod seal(6) and buffer ring(8).

Exercise care in this operation not to damage the grooves.

Do not remove seal and ring, if does not damaged.

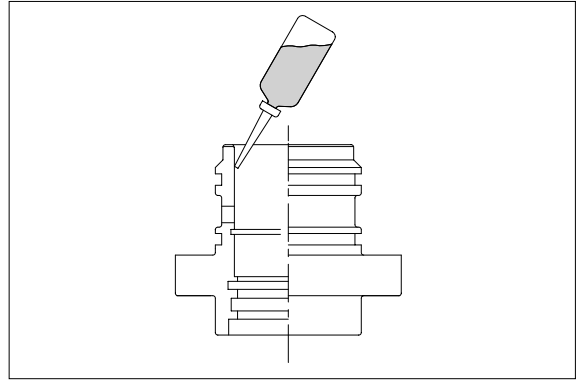


3) ASSEMBLY

(1) Assemble cylinder head assembly

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

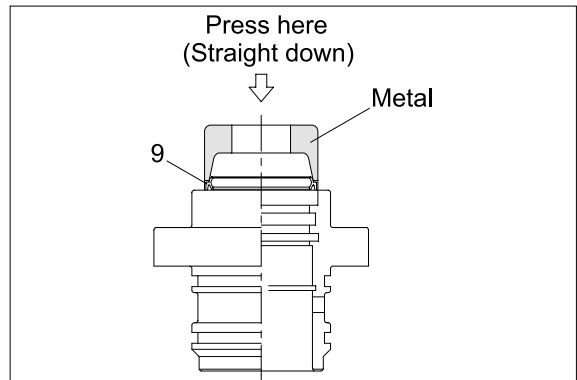
Coat the inner face of gland(3) with hydraulic oil.



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.

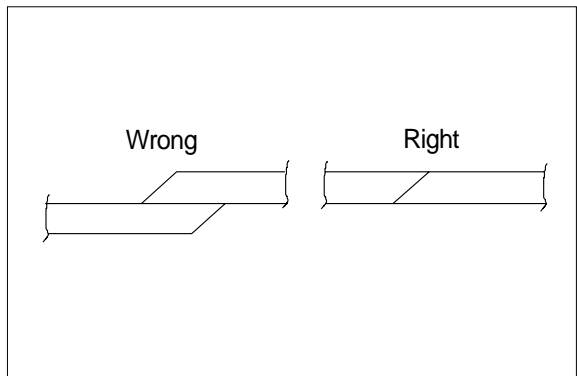
Fit snap ring(10) to the stop face.



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

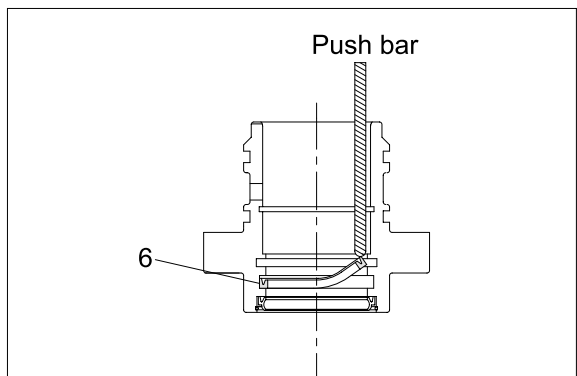
Coat each packing with hydraulic oil before fitting it.

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

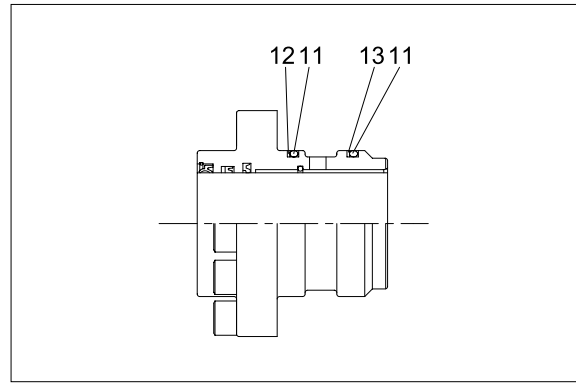


Rod seal(6) has its own fitting direction. Therefore, confirm it before fitting them.

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

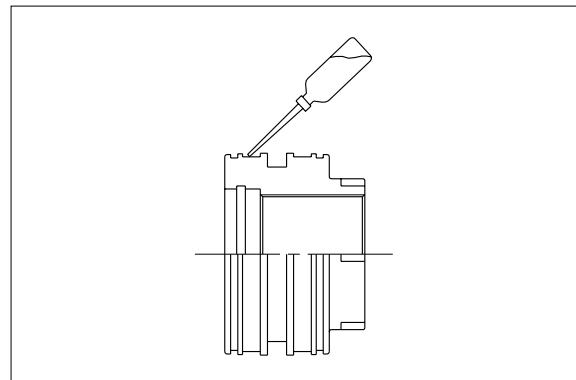


Fit back up ring(12,13) to gland(3).
 Put the backup ring in the warm water of 30~50,C.
 Fit O-ring(11) to gland(3).

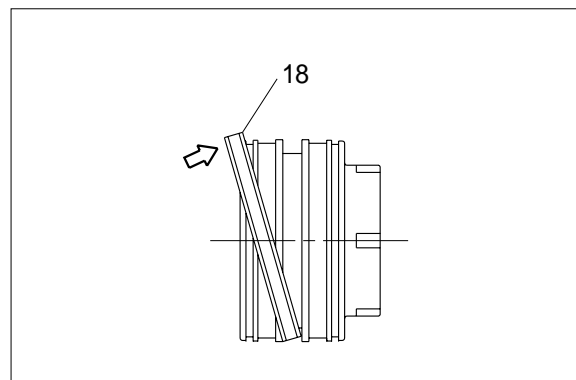


(2) Assemble piston assembly

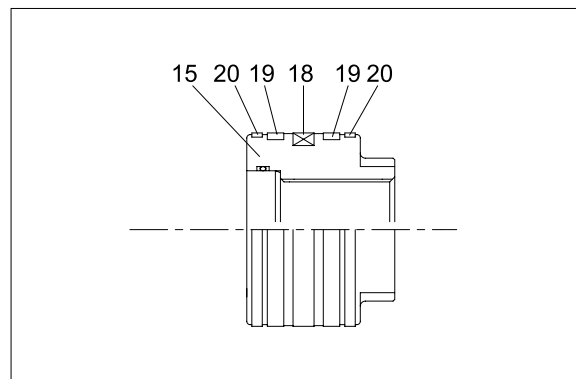
Check for scratches or rough surfaces.
 If found smooth with an oil stone.
 Coat the outer face of piston(14) with hydraulic oil.



Fit piston seal(18) 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.

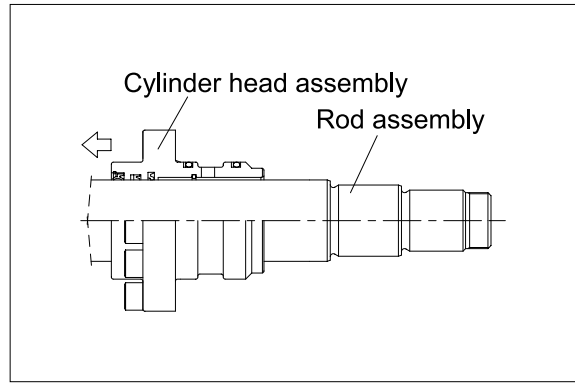


Fit wear ring(19) and dust ring(20) to piston(15).

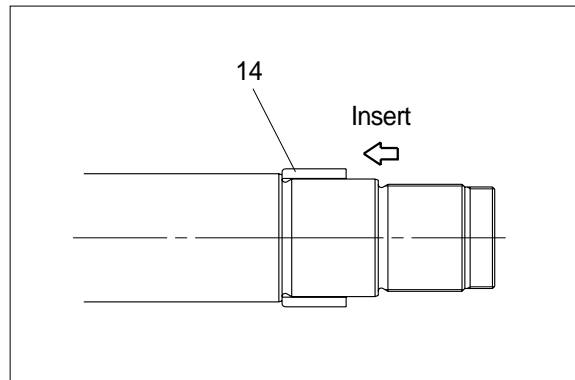


(3) Install piston and cylinder head

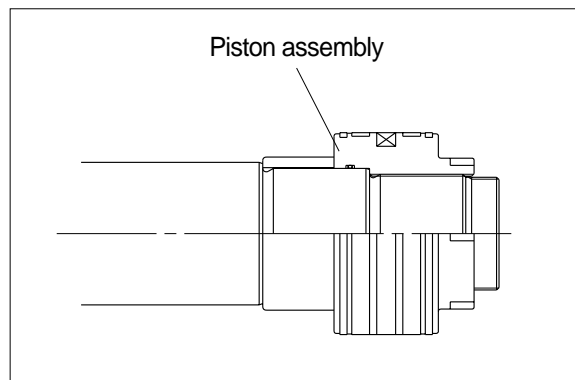
Fix the rod assembly to the work bench.
 Apply hydraulic oil to the outer surface of rod assembly(2), the inner surface of piston and cylinder head.
 Insert cylinder head assembly to rod assembly.



Insert cushion ring(14) to rod assembly.
 Note that cushion ring(14) has a direction in which it should be fitted.

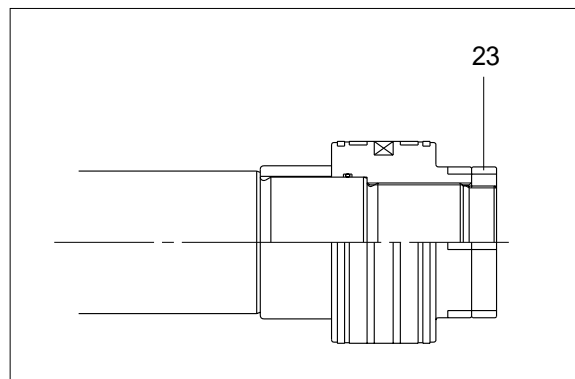


Fit piston assembly to rod assembly.
 · Tightening torque : $150 \pm 15 \text{ kgf} \cdot \text{m}$
 ($1085 \pm 1090 \text{ lbf} \cdot \text{ft}$)



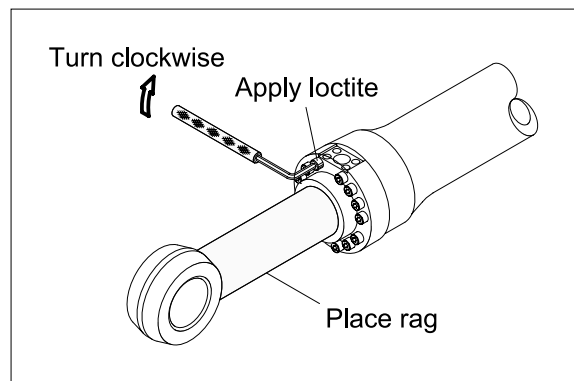
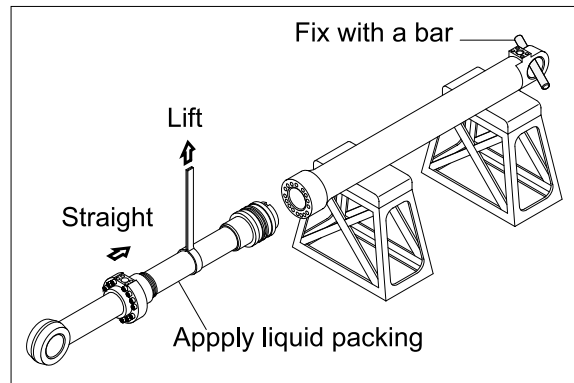
Fit lock nut(23) to piston.
 · Tightening torque :

Item		kgf · m	lbf · ft
Bucket	21	100 ± 10	723.3 ± 72.3
Boom	21	100 ± 10	723.3 ± 72.3
Arm	25	100 ± 10	723.3 ± 72.3



(3) Overall assemble

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.
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.
Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.
Refer to the table of tightening torque.

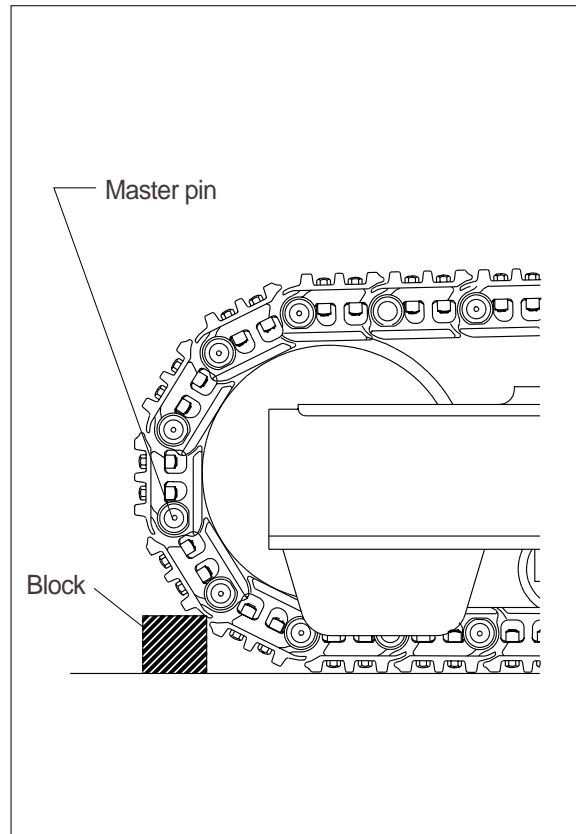


GROUP 10 UNDERCARRIAGE

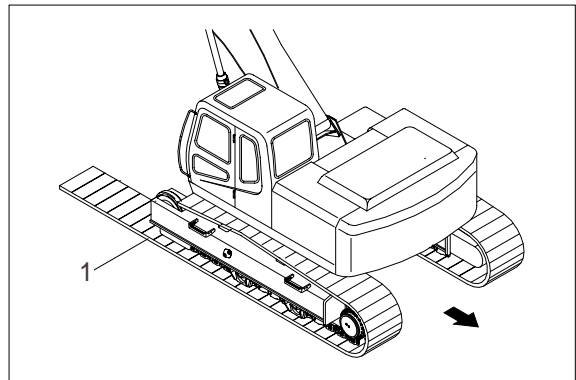
1. TRACK LINK

1) REMOVAL

- (1) Move track link until master pin is over front idler in the position put wooden block as shown.
- (2) Loosen tension of the track link.
If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.
- (3) Push out master pin by using a suitable tool.

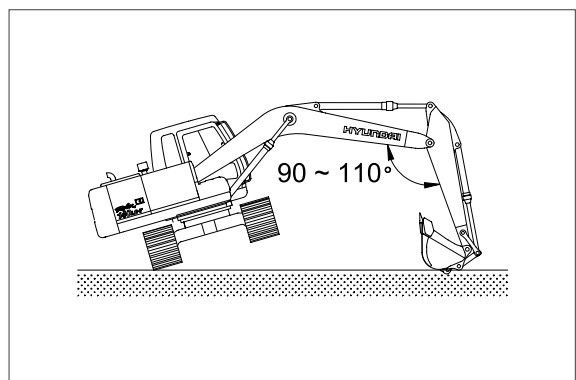


- (4) Move the machine slowly in reverse, and lay out track link assembly (1).
Jack up the machine and put wooden block under the machine.
Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

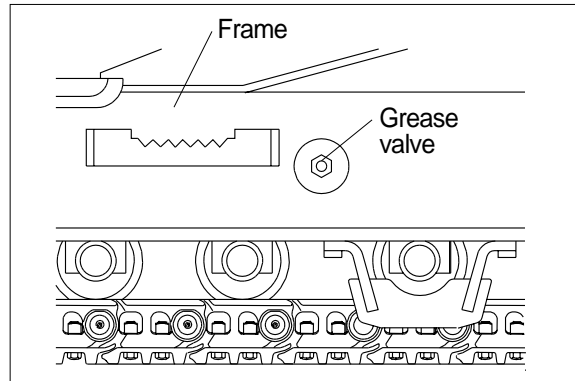
- (1) Carry out installation in the reverse order to removal.
Adjust the tension of the track link.



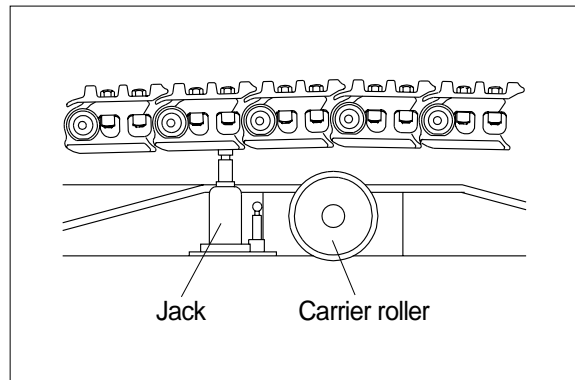
2. CARRIER ROLLER

1) REMOVAL

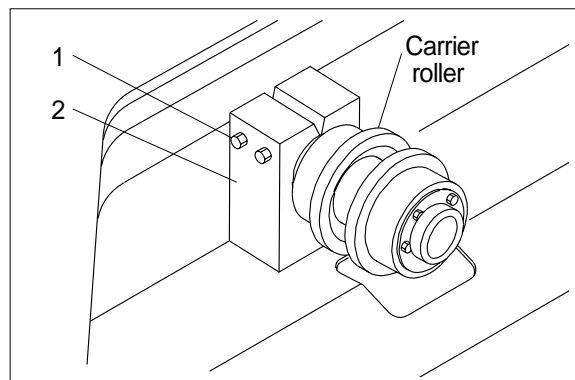
- (1) Loosen tension of the track link.



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



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



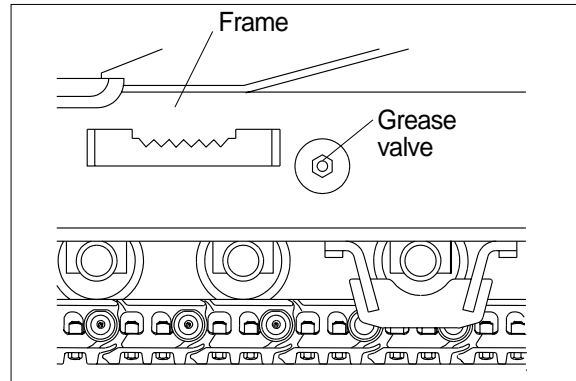
2) INSTALL

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

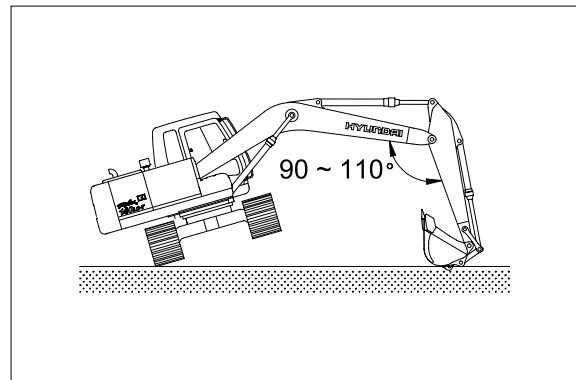
3. TRACK ROLLER

1) REMOVAL

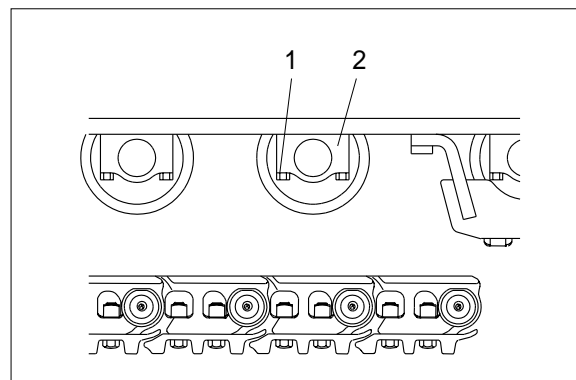
- (1) Loosen tension of the track link.



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



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



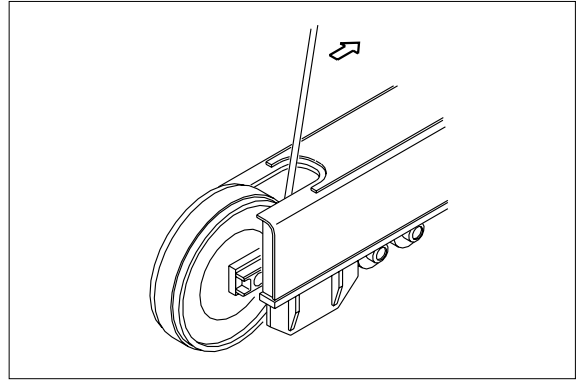
2) INSTALL

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

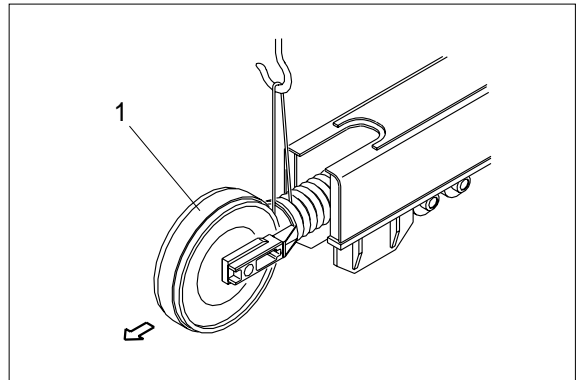
4. IDLER AND RECOIL SPRING

1) REMOVAL

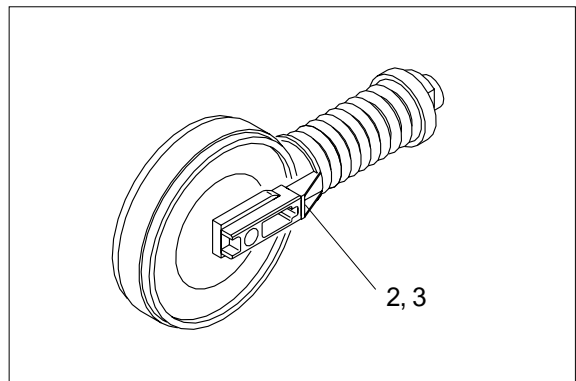
- (1) Remove the track link.
For detail, see **removal of track link**.



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

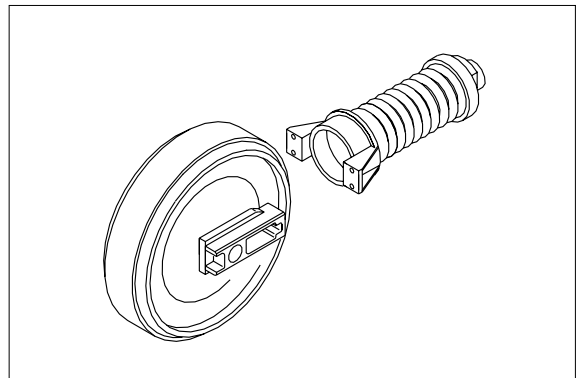


- (3) Remove the bolts(2), washers(3) and separate idler from recoil spring.



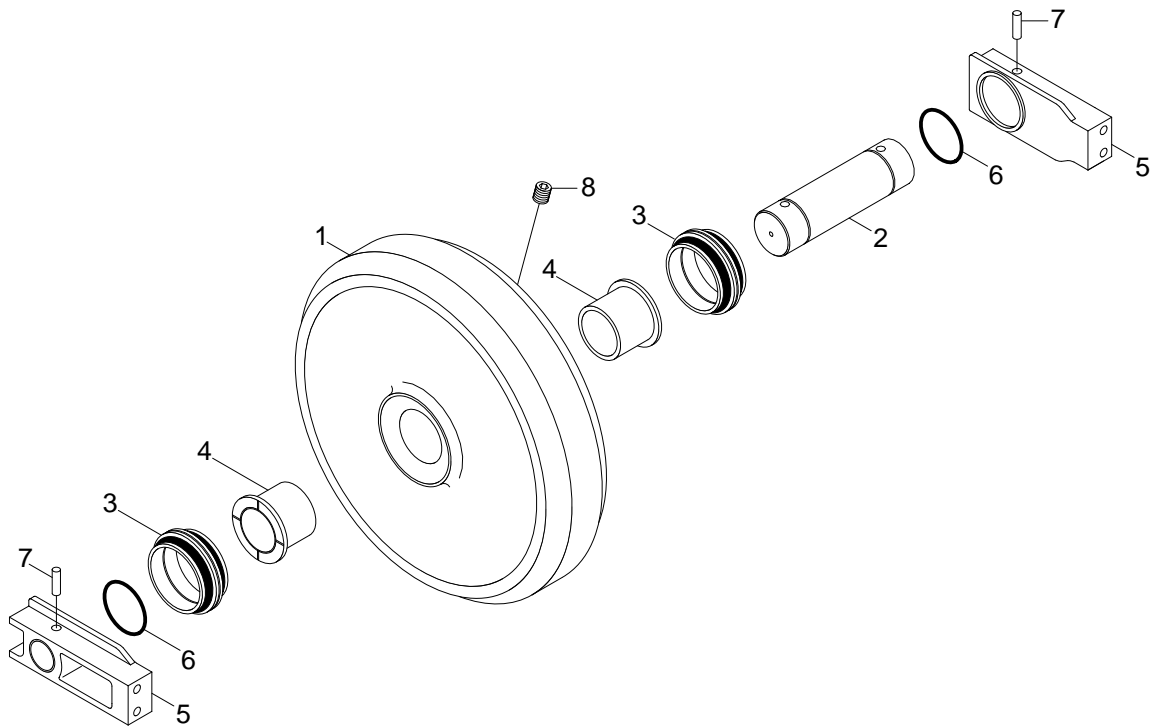
2) INSTALL

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



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



- 1 Shell
- 2 Shaft
- 3 Seal assembly

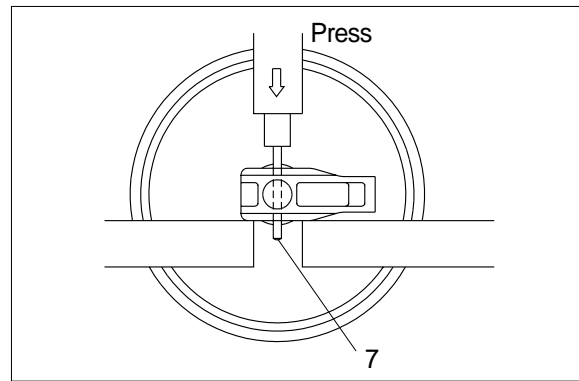
- 4 Bushing
- 5 Bracket
- 6 O-ring

- 7 Spring pin
- 8 Plug

(2) Disassembly

Remove plug and drain oil.

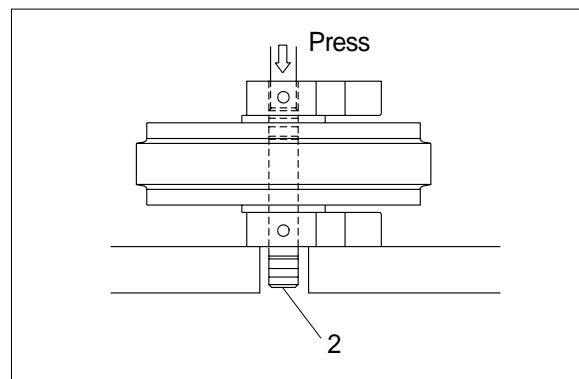
Draw out the spring pin(7), using a press.



Pull out the shaft(2) with a press.

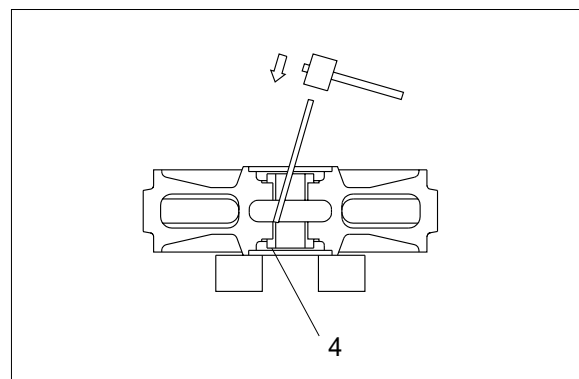
Remove seal(3) from idler(1) and bracket (5).

Remove O-ring(6) from shaft.



Remove the bushing(4) from idler, using a special tool.

Only remove bushing if replacement is necessary.



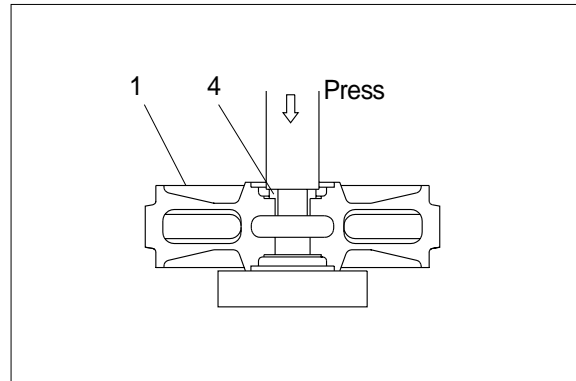
(3) Assembly

Before assembly, clean the parts.

Coat the sliding surfaces of all parts with oil.

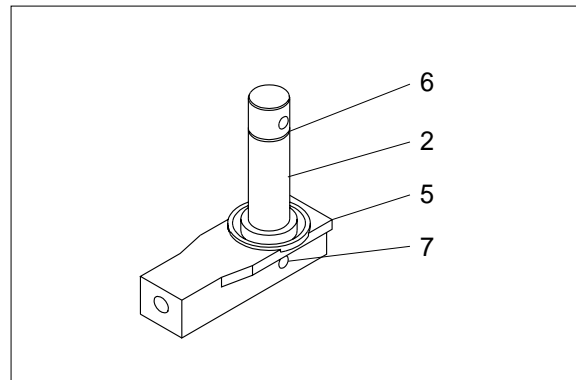
Cool up bushing(4) fully by some dry ice and press it into shell(1).

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

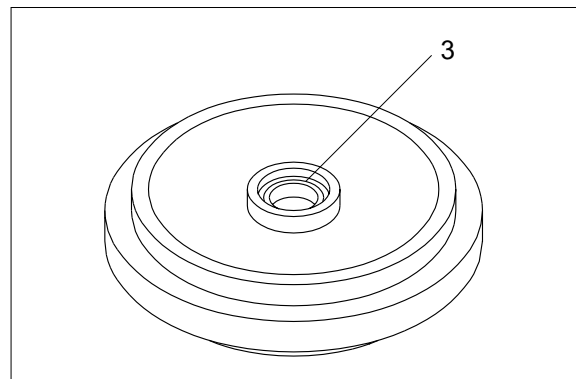


Coat O-ring(6) with grease thinly, and install it to shaft(2).

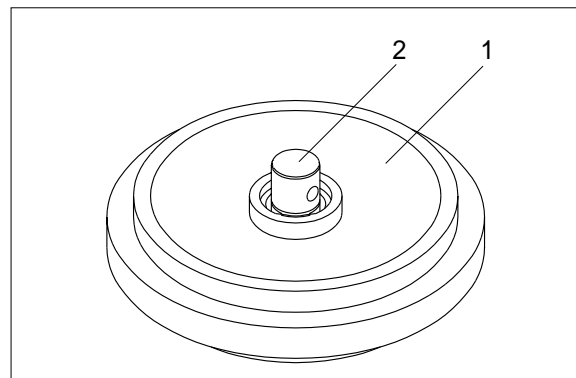
Insert shaft(2) into bracket(5) and drive in the spring pin(7).



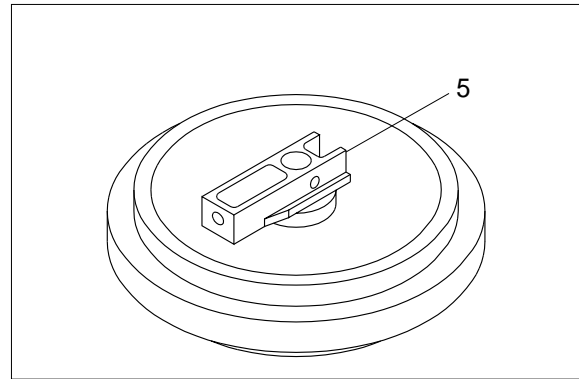
Install seal(3) to shell(1) and bracket(5).



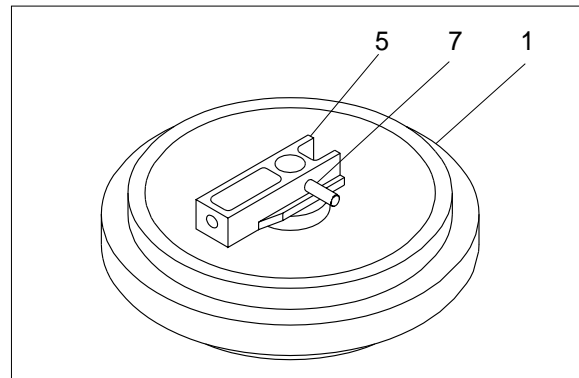
Install shaft(2) to shell(1).



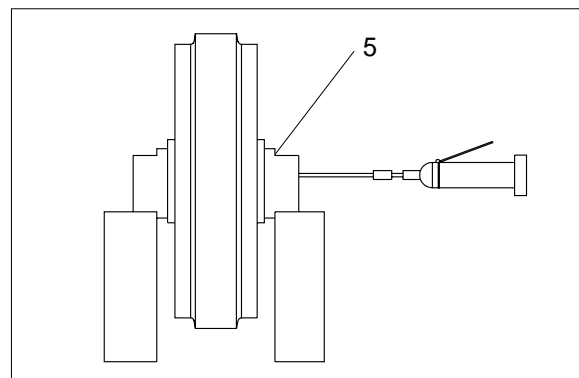
Install bracket(5) attached with seal(3).



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

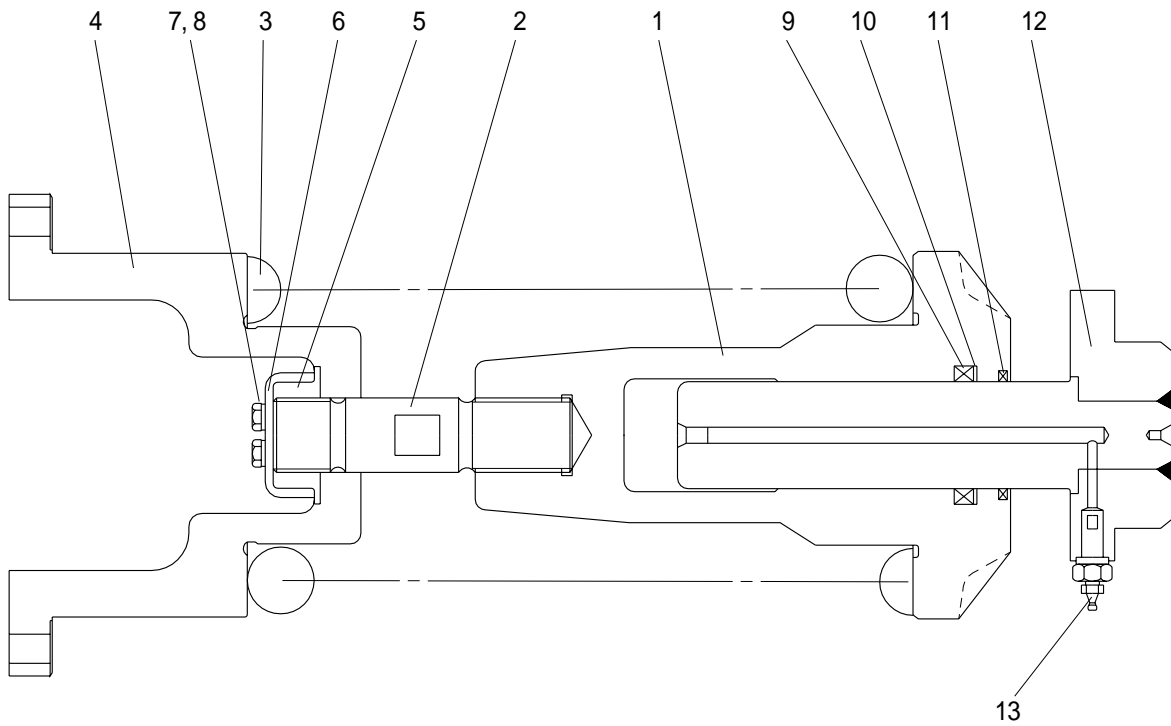


Lay bracket(5) on its side.
Supply engine oil to the specified level,
and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



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

(2) Disassembly

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.

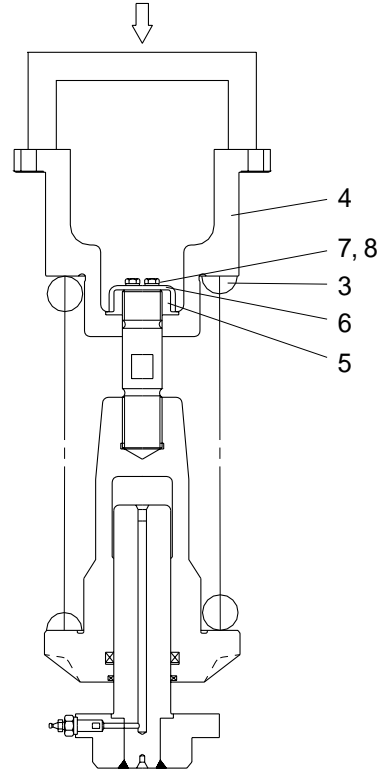
· Spring set load : 11132kg(24542lb)

Remove bolt(7), spring washer(8) and lock plate(6).

Remove lock nut(5).

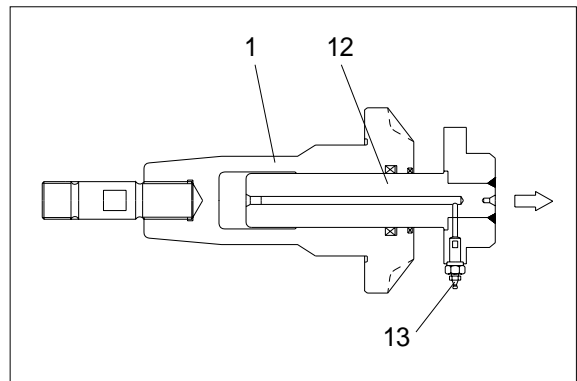
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

Lighten the press load slowly and remove bracket(4) and spring(3).

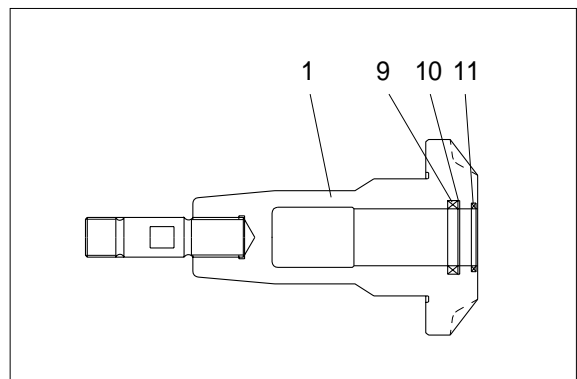


Remove rod(12) from body(1).

Remove grease valve(13) from rod(12).



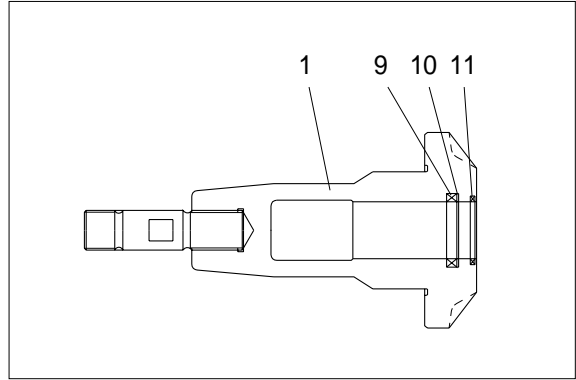
Remove rod seal(9), back up ring(10) and dust seal(11).



(3) Assembly

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

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



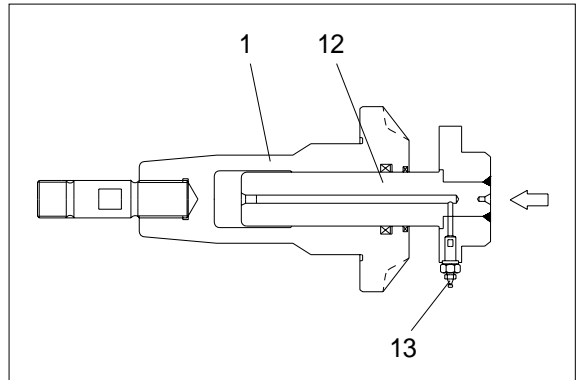
Pour grease into body(1), then push in rod(12) by hand.

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.

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

- Tightening torque : $5 \pm 0.5 \text{ kg} \cdot \text{m}$
($36.2 \pm 3.6 \text{ lb} \cdot \text{ft}$)

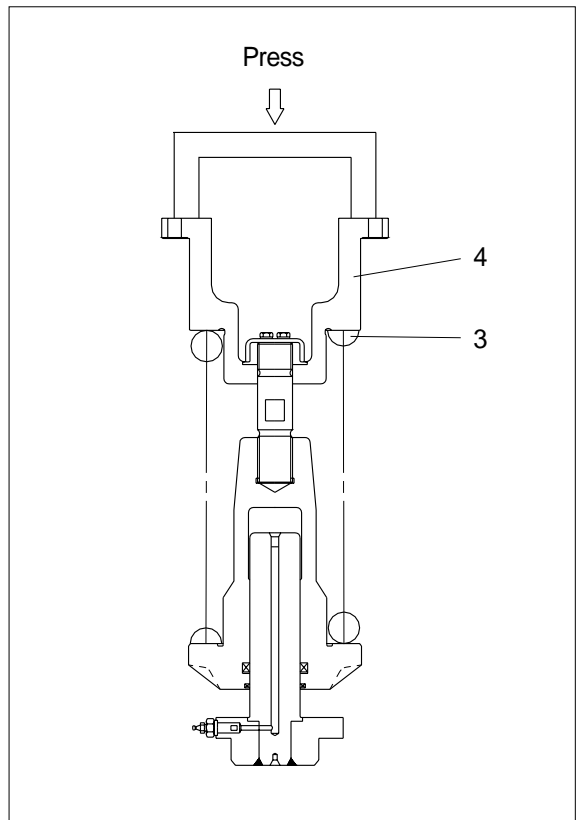


Install spring(3) and bracket(4) to body (1).

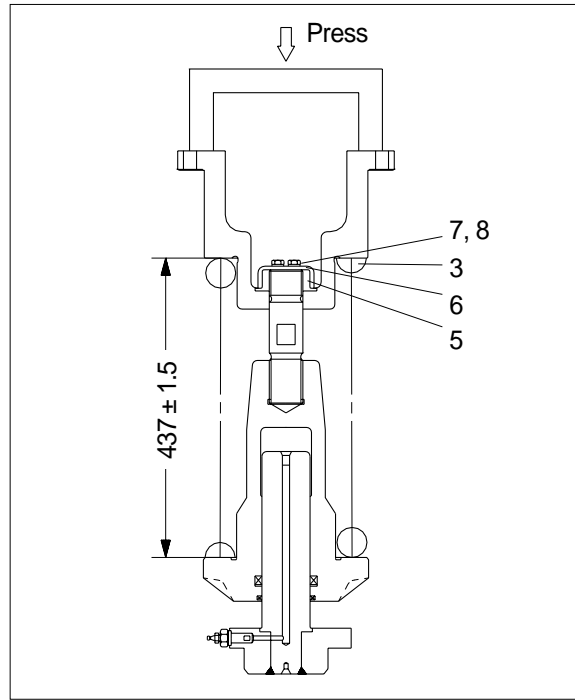
Apply pressure to spring(3) with a press and tighten lock nut(5).

Apply sealant before assembling.

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

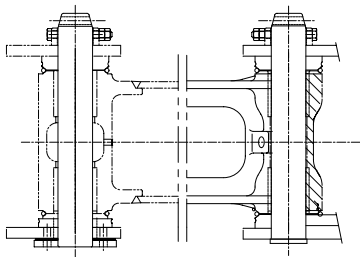
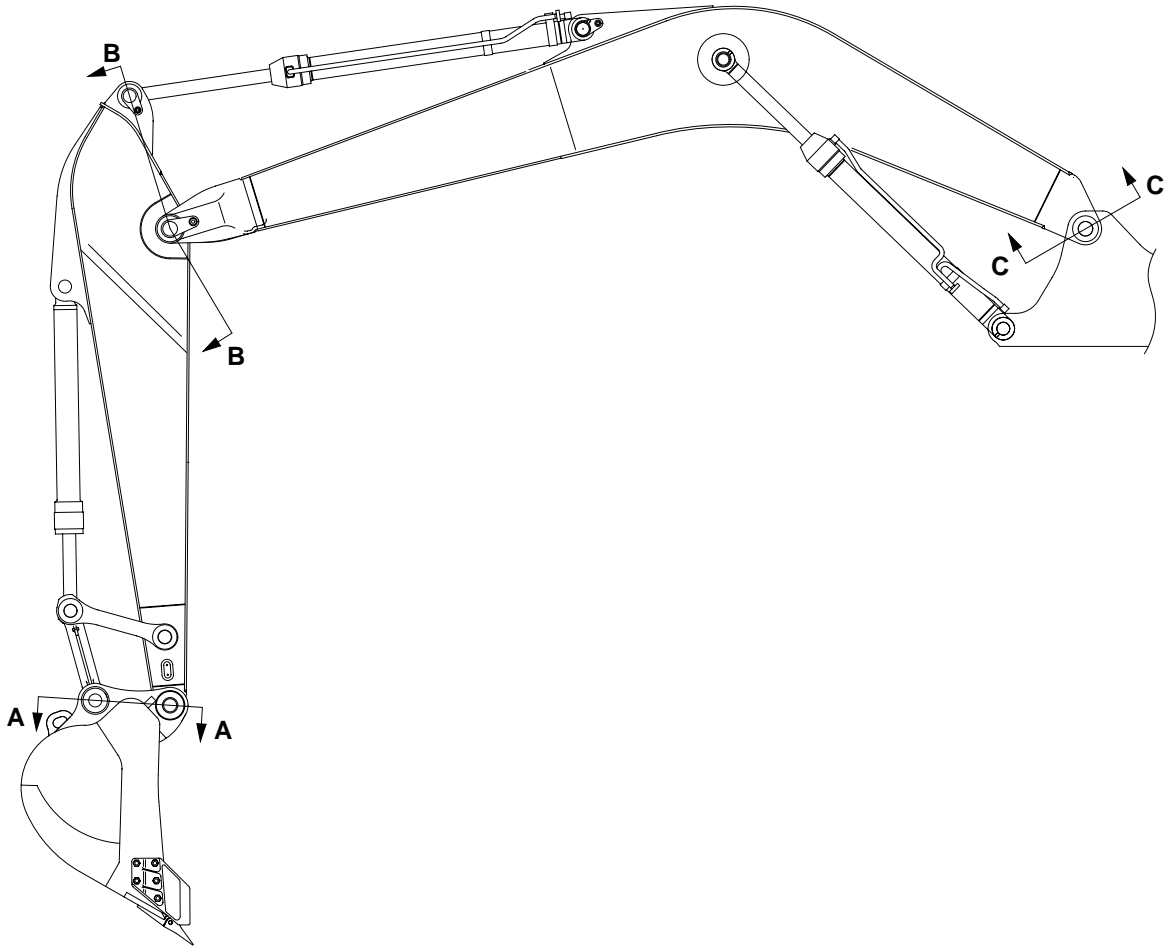


Lighten the press load and confirm the set length of spring(3).
After the setting of spring(3), install lock plate(6), spring washer(8) and bolt(7).

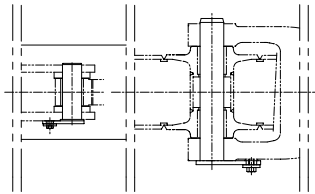


GROUP 11 WORK EQUIPMENT

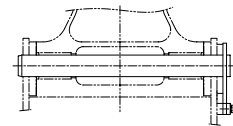
1. STRUCTURE



SECTION A



SECTION B



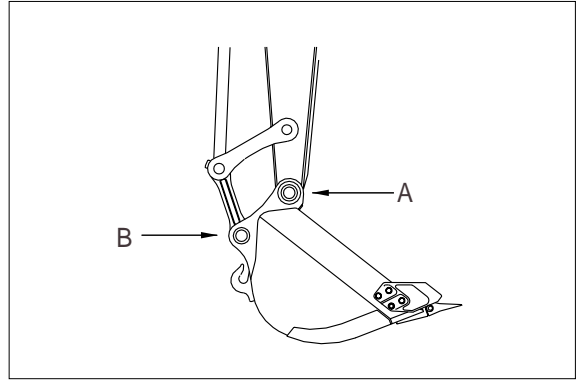
SECTION C

2. REMOVAL AND INSTALL

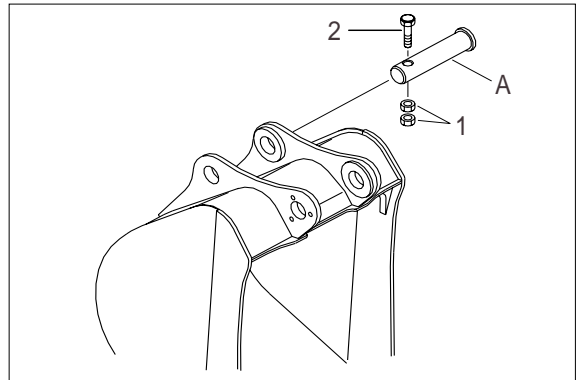
1) BUCKET ASSEMBLY

(1) Removal

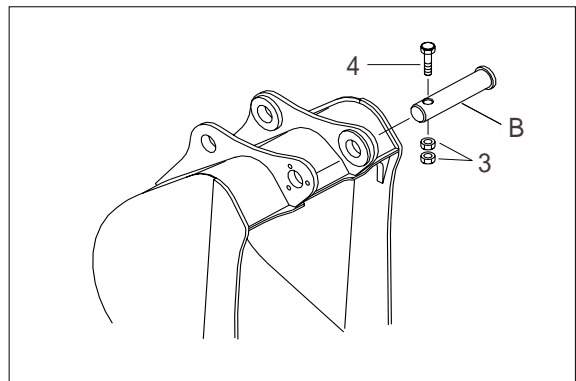
Lower the work equipment completely to ground with back of bucket facing down.



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



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



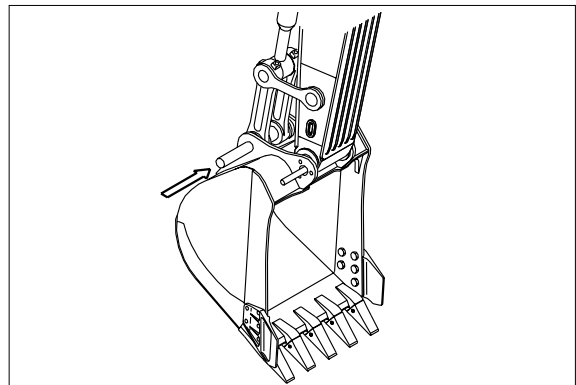
(2) Install

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.

Remove bucket assembly.

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

Disconnect bucket cylinder hose(1).

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

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

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

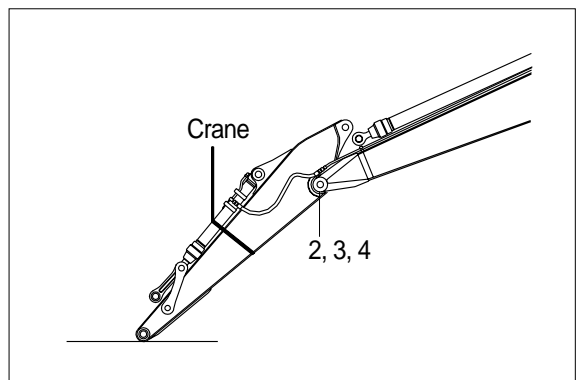
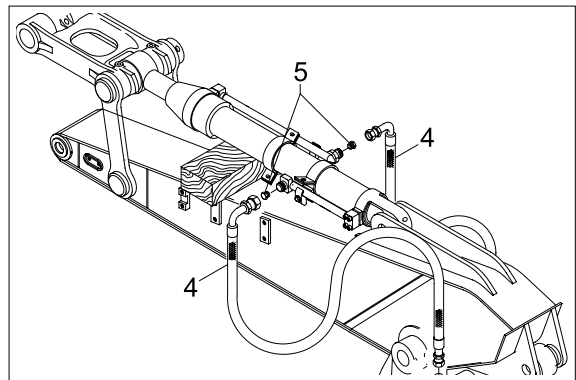
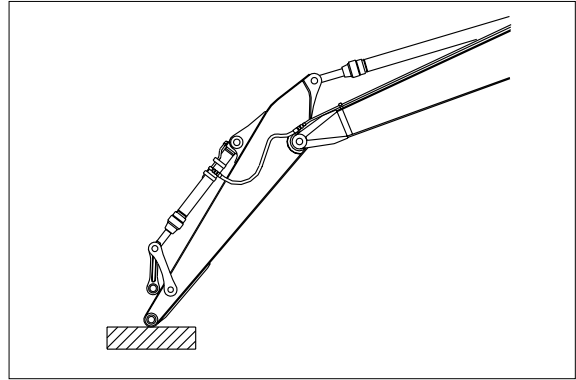
For details, see **removal of arm cylinder assembly**.

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

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

· Weight : 1050kg(2310lb)

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



(2) Install

Carry out installation in the reverse order to removal.

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

Bleed the air from the cylinder.

3) BOOM ASSEMBLY

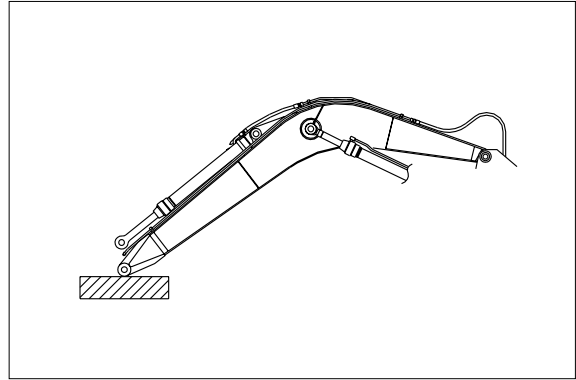
(1) Removal

Remove arm and bucket assembly.

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

Remove boom cylinder assembly from boom.

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

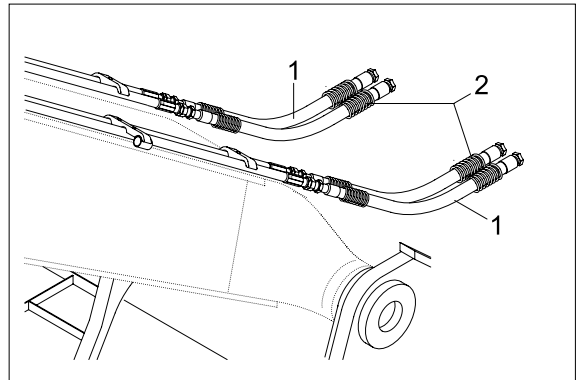


Disconnect head lamp wiring.

Disconnect bucket cylinder hose(2) and arm cylinder hose(1).

When the hose are disconnected, oil may spurt out.

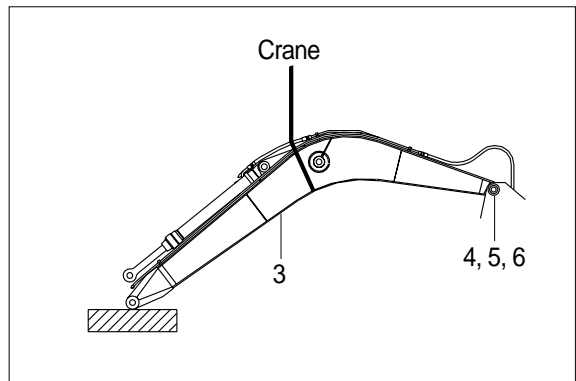
Sling boom assembly(3).



Remove bolt(4), plate(5) and pull out the pin(6) then remove boom assembly.

· Weight :1040kg(2290lb)

When lifting the boom assembly always lift the center of gravity.



(2) Install

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.

