SECTION 8 DISASSEMBLY AND ASSEMBLY

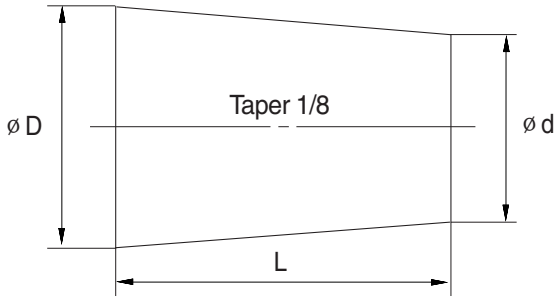
SECTION 8 DISASSEMBLY AND ASSEMBLY

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 100 mm 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

R505LVS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt, nut (FR, bracket)	M20 × 2.5	55 ± 5.5	398 ± 39.8
2		Engine mounting bolt, nut (RR, bracket)	M16 × 2.0	28 ± 3.0	202 ± 21.7
3		Engine mounting bolt (frame)	M22 × 2.5	69.6 ± 7.0	503 ± 50.6
4		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M20 × 2.5	46 ± 2.0	333 ± 14.5
6		Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	35 ± 2.2
7	Hydraulic system	Main pump mounting bolt	M20 × 2.5	44 ± 6.6	318 ± 47.7
8		Main control valve mounting nut	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
9		Fuel tank mounting bolt	M20 × 2.5	45 ± 5.1	325 ± 36.8
10		Hydraulic oil tank mounting bolt	M20 × 2.5	45 ± 5.1	325 ± 36.8
11		Turning joint mounting bolt, nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
12	Power train system	Swing motor mounting bolt	M20 × 2.5	58.4 ± 6.4	422 ± 46.2
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
16		Sprocket mounting bolt (-#0201)	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
		Sprocket mounting bolt (#0202-)	M22 × 2.5	77.4 ± 7.5	560 ± 54.2
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track roller mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
19		Track tension cylinder mounting bolt	M22 × 1.5	87.2 ± 12.5	631 ± 90
20		Track shoe mounting bolt, nut	M24 × 3.0	140 ± 5.0	1012 ± 36
21		Track guard mounting bolt	M24 × 3.0	100 ± 15	723 ± 108
22	Others	Counterweight mounting bolt	M42 × 3.0	390 ± 40	2821 ± 289
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

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

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

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

(2) Fine thread

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

2) PIPE AND HOSE (FLARE TYPE)

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

3) PIPE AND HOSE (ORFS TYPE)

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

4) FITTING

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

1. REMOVAL AND INSTALL

1) REMOVAL

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

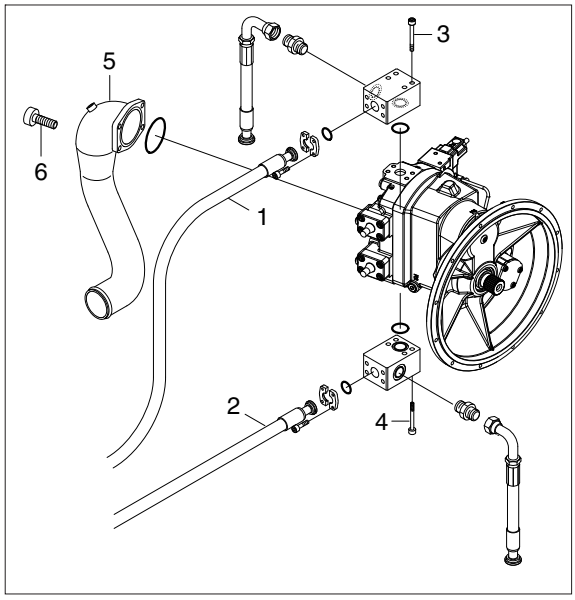
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping

(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 : 275 ℓ



(5) Remove socket bolts (3, 4) and disconnect block with hoses (1, 2).

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

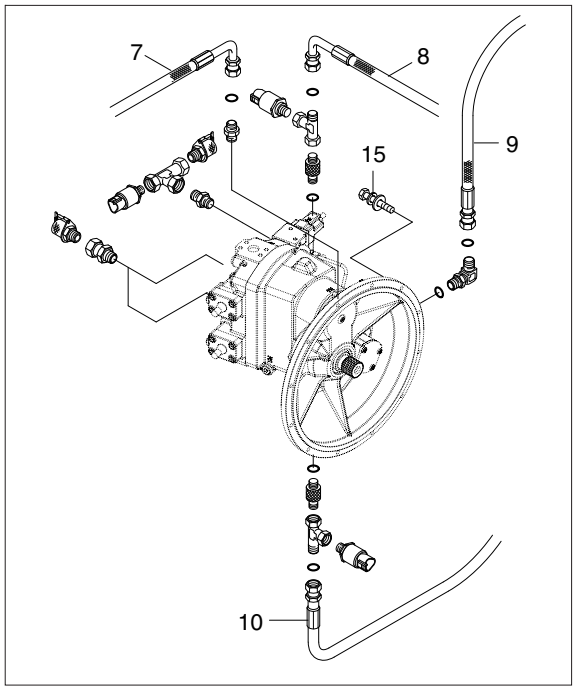
(7) Remove socket bolts (6) and disconnect pump suction tube (5).

※ 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 (15).

· Weight : 194 kg (428 lb)

· Tightening torque : 6.7±1.0 kgf · m (48.5±7.2 lbf · ft)



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

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

(5) After adding oil to the hydraulic tank to the specified level.

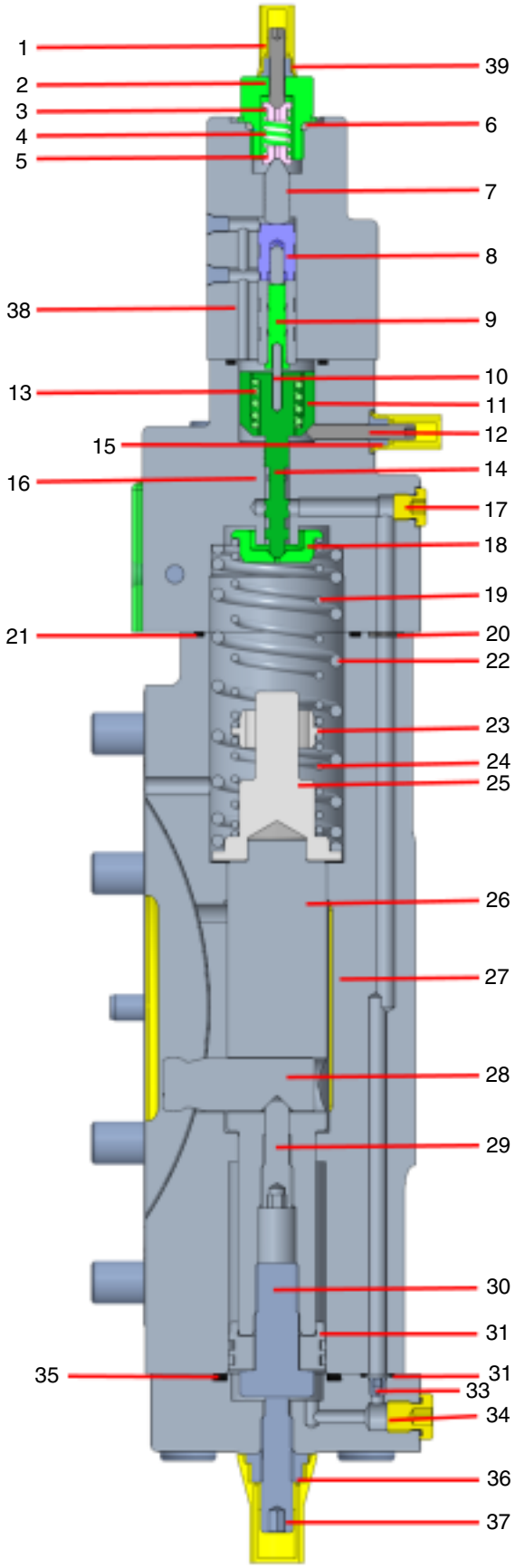
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

(8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. REPAIR GUIDELINES

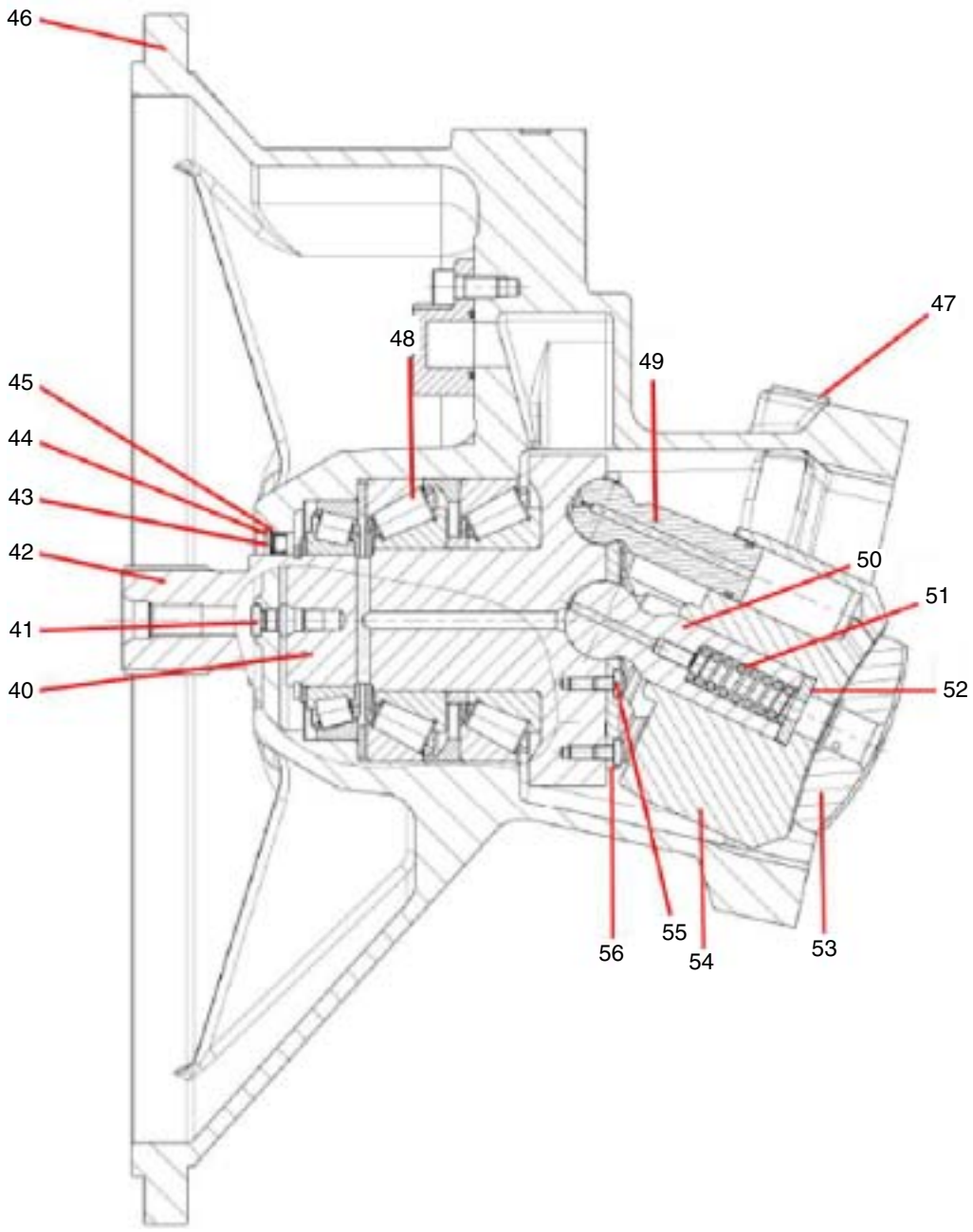
1) PART LIST (1/3)



1	Setting screw
2	Screw plug
3	Spring cup
4	Spring
5	Spring cup
6	O-ring
7	HNC control piston
8	Control bushing
9	LLC control piston
10	Pin
11	Spring bushing
12	Adjustment screw
13	Setting screw
14	Control piston for stroking
15	Sealing screw
16	HNC controller housing
17	Sealing screw
18	Spring cup
19	Spring
20	O-ring
21	O-ring
22	Spring
23	Double spring collar
24	Spring
25	Spring collar
26	Stroke piston
27	Port plate
28	Setting pin
29	Locating screws
30	Bolt
31	Piston with steal rings
32	O-ring
33	Orifice
34	Sealing screw
35	O-ring
36	Sealing screw
37	Setting screw
38	Stroke controller housing
39	Sealing screw

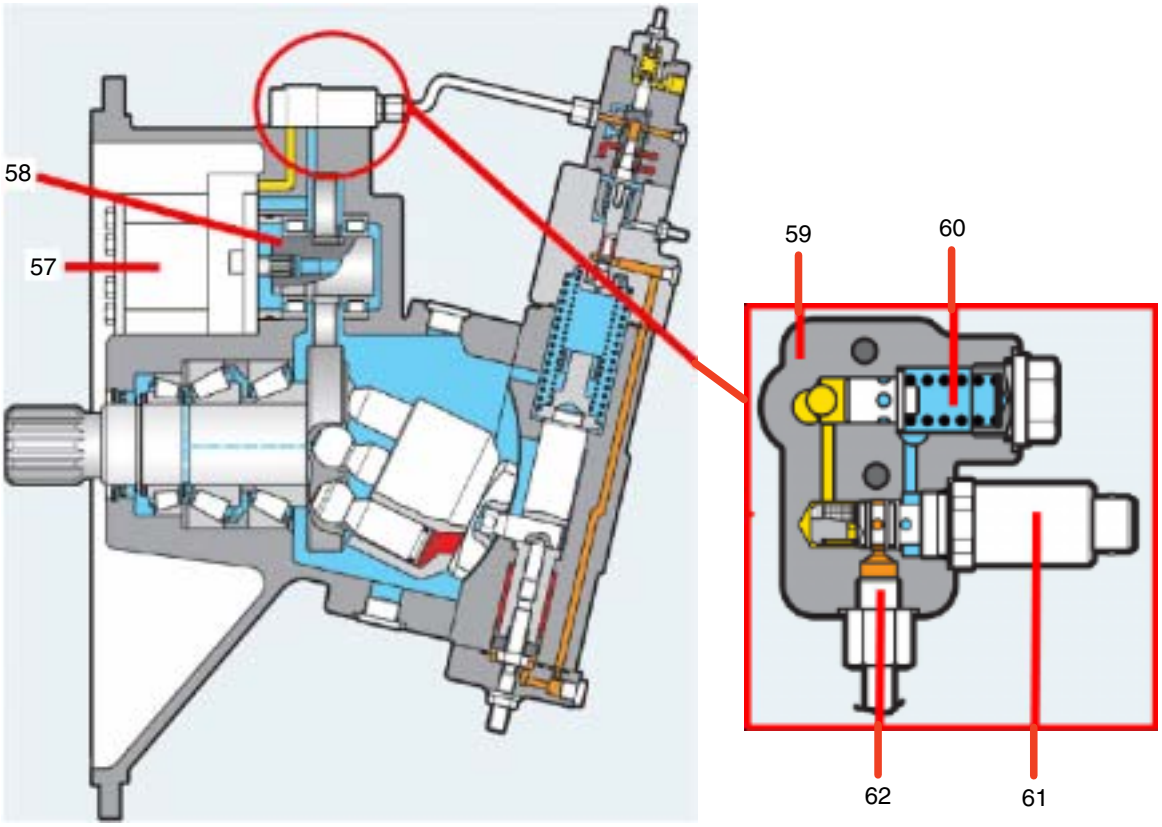
※ HNC : Hydraulic Negative Control
※ LCC : Load Limiting Control

PART LIST (2/3)



40	Rotary group	46	Pump housing	52	Shim
41	Sealing screw	47	Sealing screw	53	Control lense
42	Rotary group	48	Bearings	54	Cylinder
43	Snap ring	49	Piston with steal rings	55	Bolt
44	Shim	50	Center pin	56	Retreat plate
45	Shaft seal ring	51	Spring		

PART LIST (3/3)

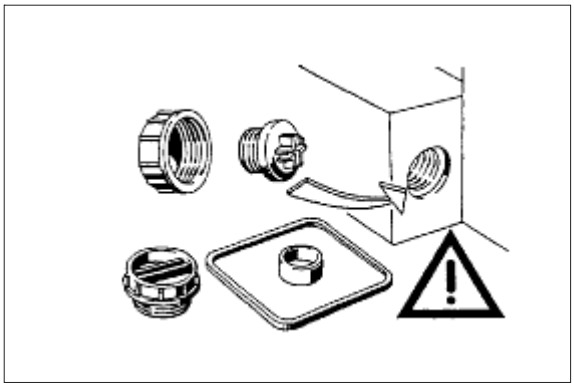


57	Gear pump	59	Valve plate	61	EPPR valve
58	Gear wheel	60	Pressure relieve valve	62	Hydraulic pipe

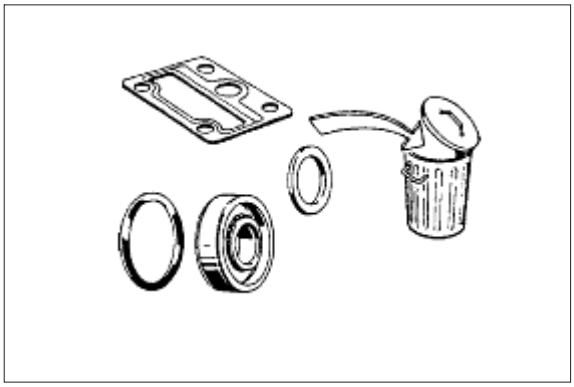
2) GENERAL REPAIR GUIDELINES

※ Observe the following notices when carrying out repairs on hydraulic pumps.

(1) Close off all openings of the hydraulic unit.

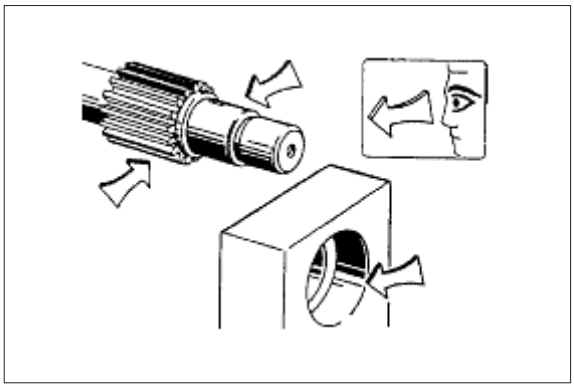


(2) Replace all of the seals.
Use only HYUNDAI spare parts.

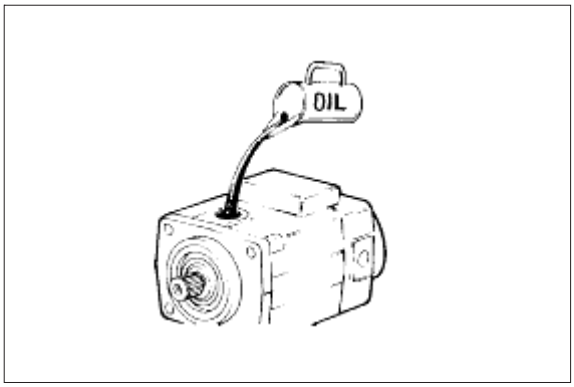


(3) Check all sealing and sliding surfaces for wear.

※ Re-work of the sliding surfaces by using, for example with abrasive paper, can damage the surface.

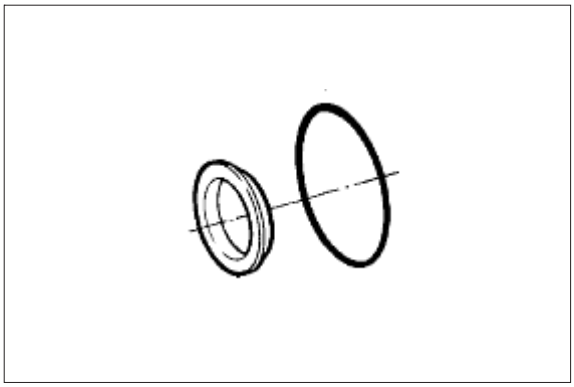


(4) Fill the hydraulic unit with hydraulic oil before commissioning.

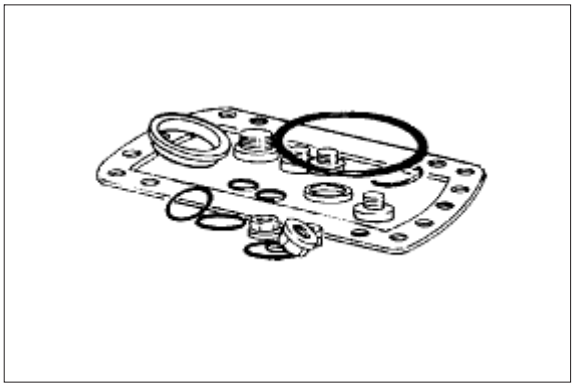


3) SEAL KITS AND SUB ASSEMBLIES

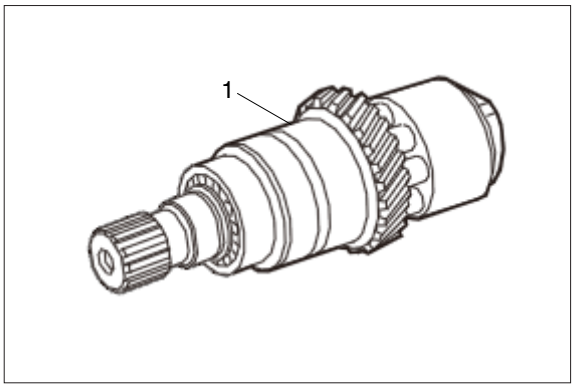
(1) Seal kit for drive shaft.



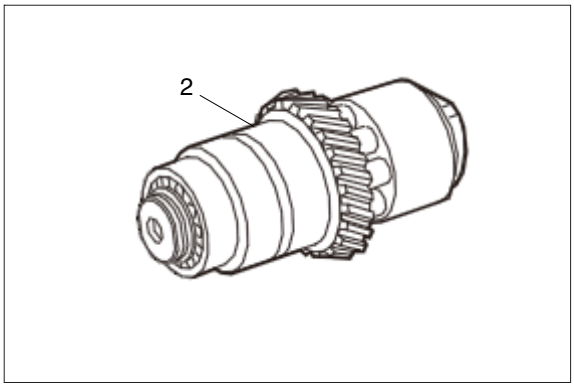
(2) Peripheral seal kit.



(3) Rotary group (1) ready to install.

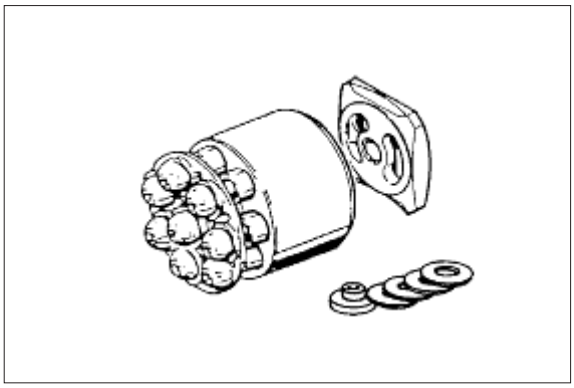


(4) Rotary group (2) ready to install.

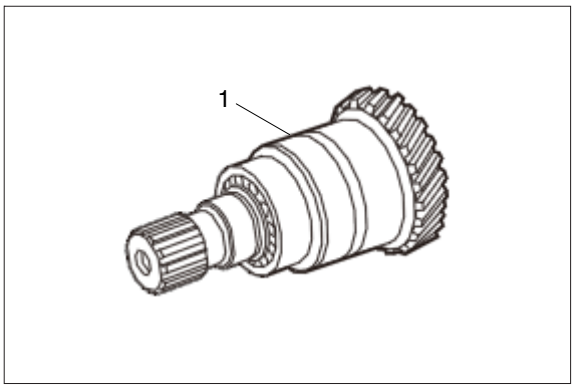


(5) Rotary group, hydraulic component (order rotary groups (1) and (2) separately). Adjustment is necessary.

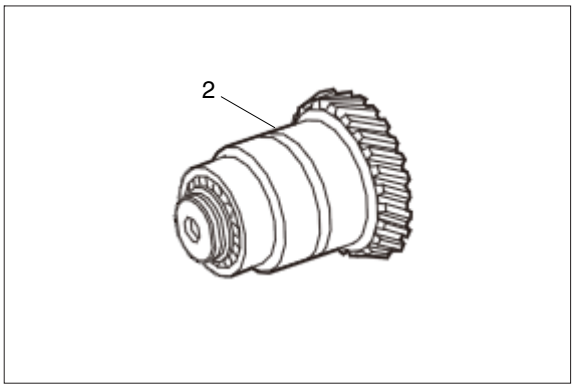
※ Direction of rotation



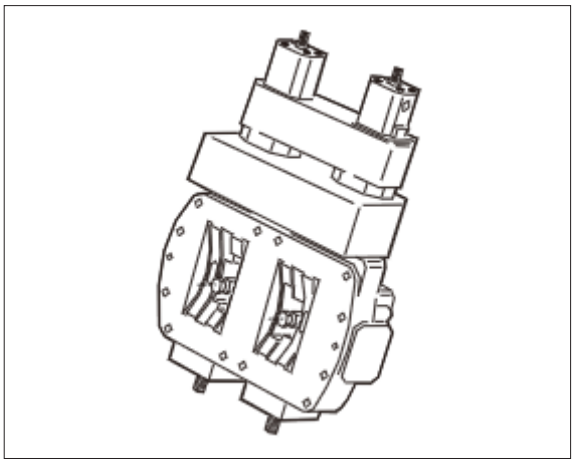
(6) Rotary group (1) mechanical section, ready to install.



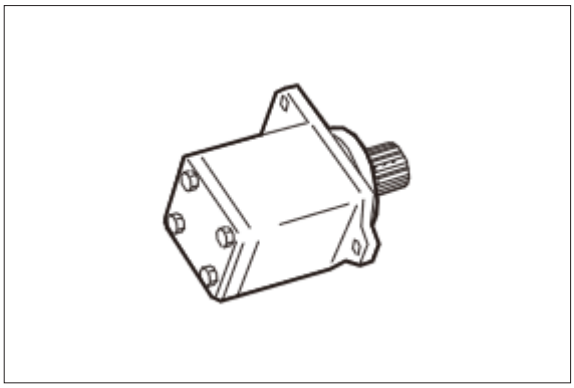
(7) Rotary group (2) mechanical section, ready to install.



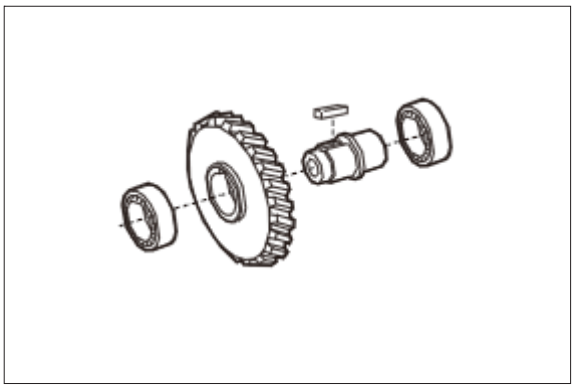
(8) Control, pre-adjusted.



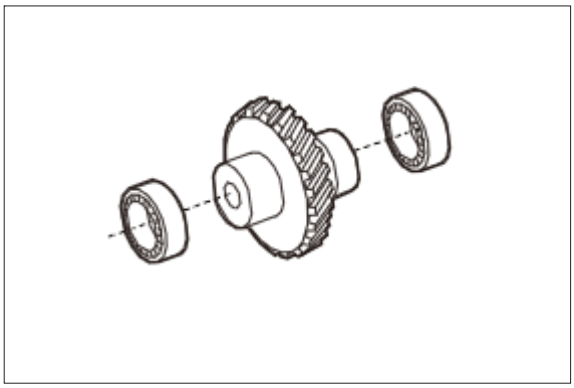
(9) Gear pump, complete.



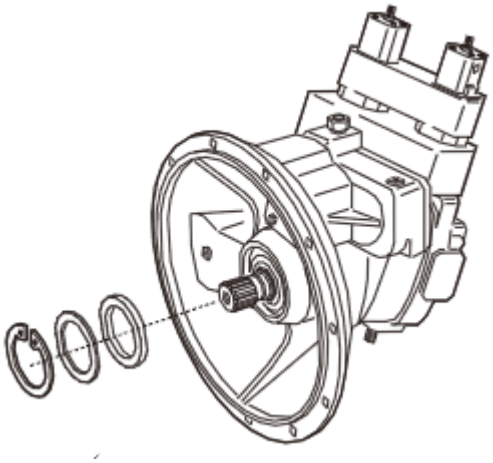
(10) Intermediate gear



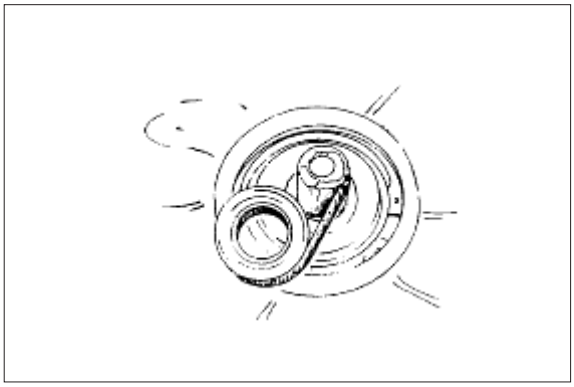
(11) Auxiliary drive



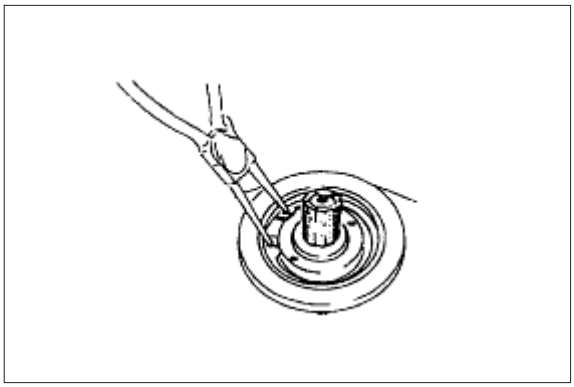
4) SEALING THE DRIVE SHAFT



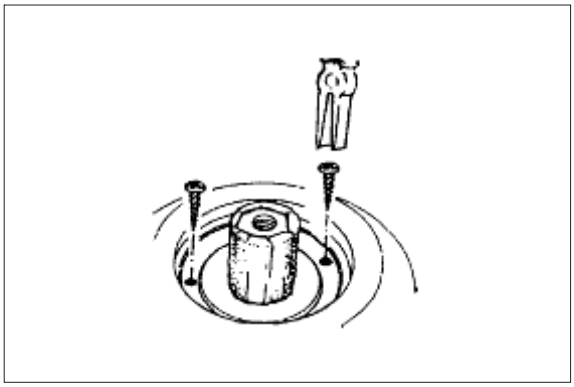
(1) Protect drive shaft. (e.g. tape).



(2) Remove retaining ring and shim.

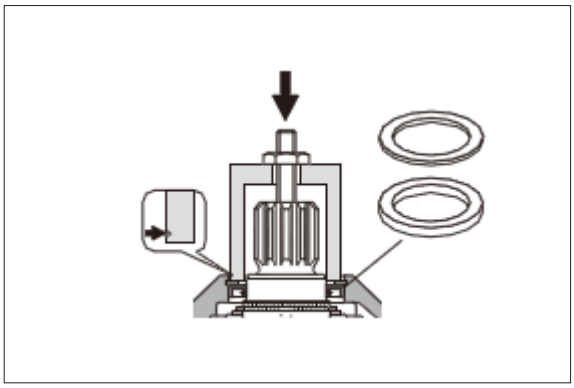


(3) Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.

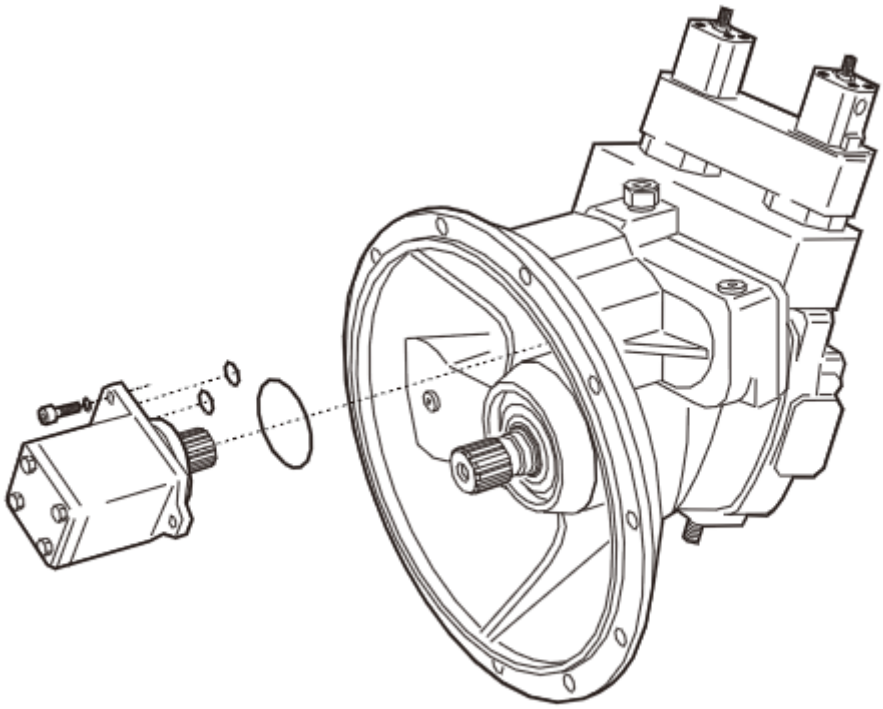


(4) Press in shaft seal ring and shim with bush to stop.
Take note of press-in depth.

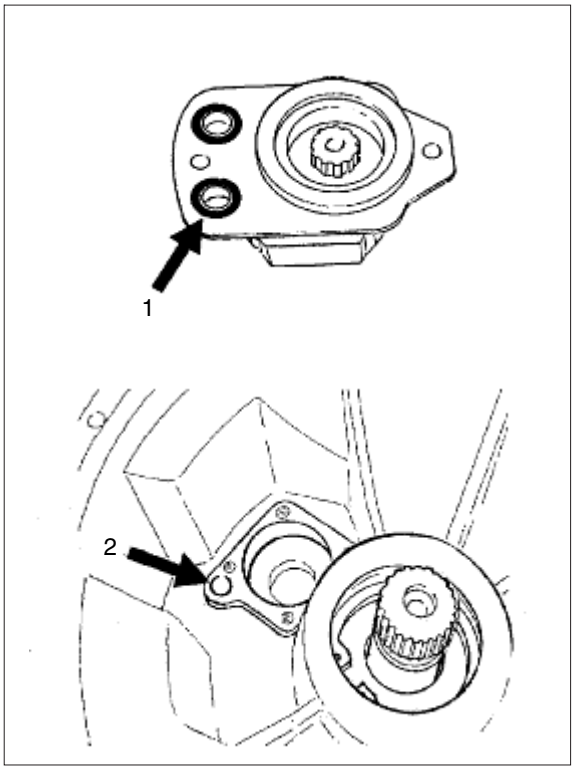
※ Install mark for press-in depth of safety ring.



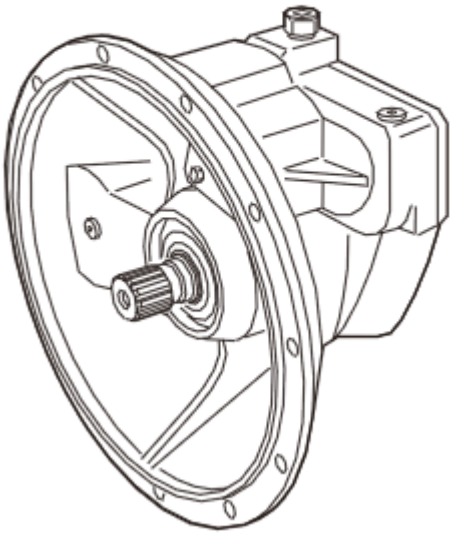
5) GEAR PUMP SEALING

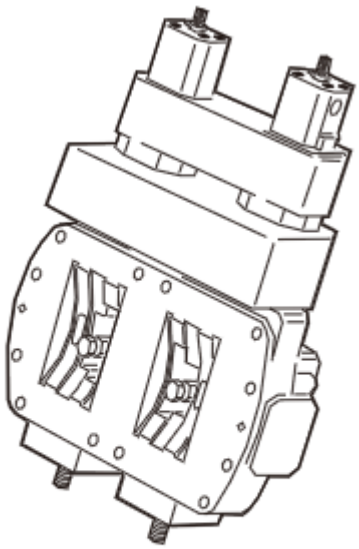


(1) Remove gear pump.
Visual check:
1 O-ring
2 Sealing surface of the housing.

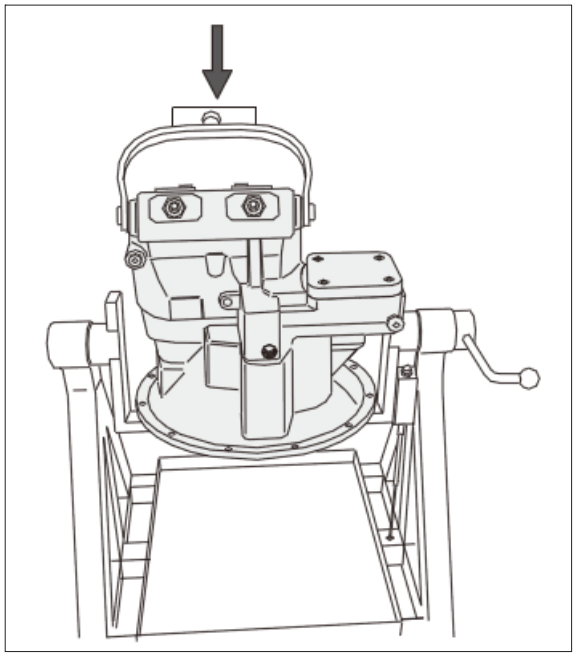


6) REMOVE THE CONTROL HOUSING





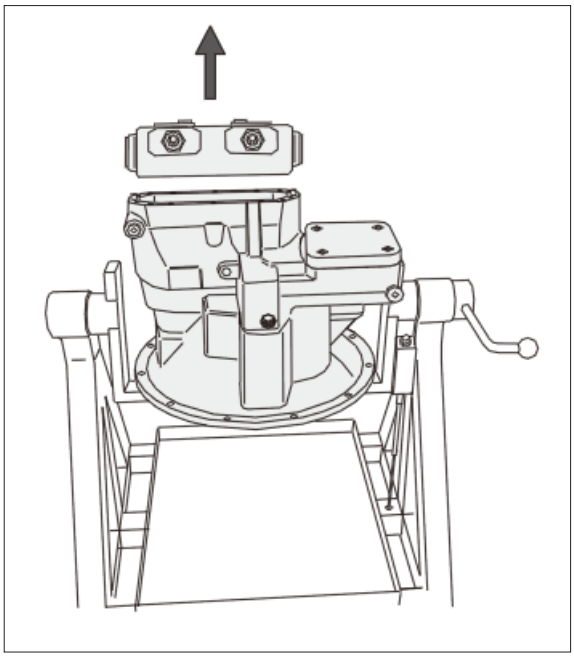
(1) Place the pump into a disassembly/ assembly device with a crane and fix it.



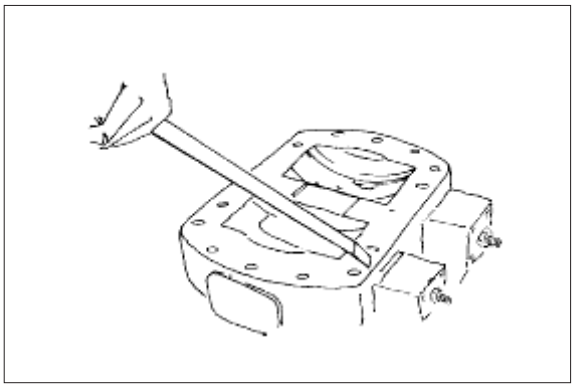
※ Mark installation position.

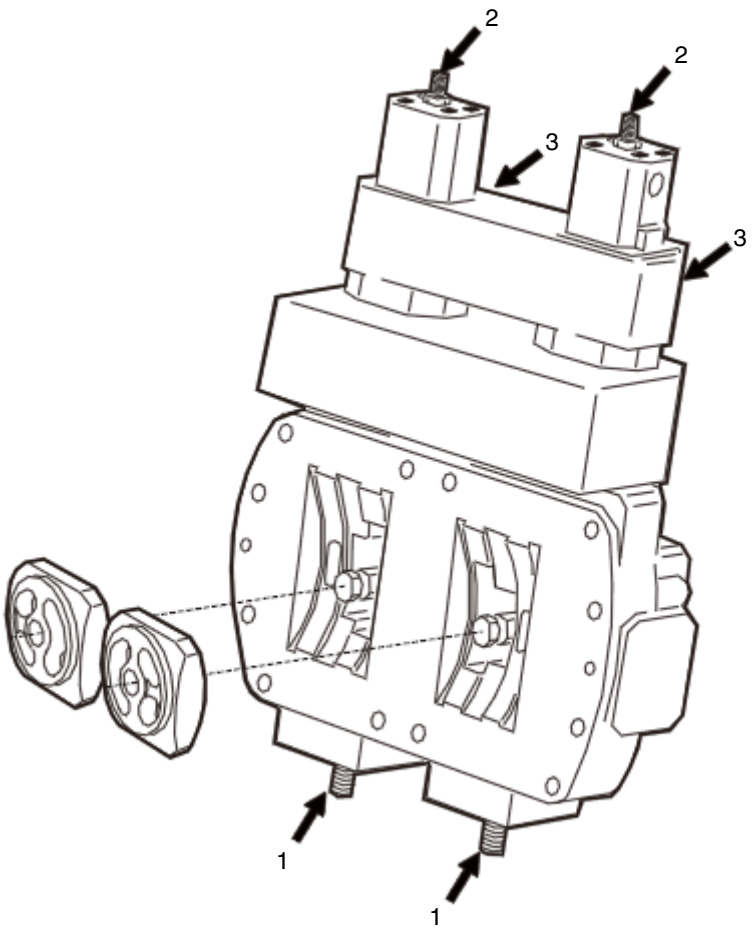
(2) Loosen fixing screws of port plate and remove the port plate.
Lift the port plate away with a crane.

※ Control lenses can fall down.



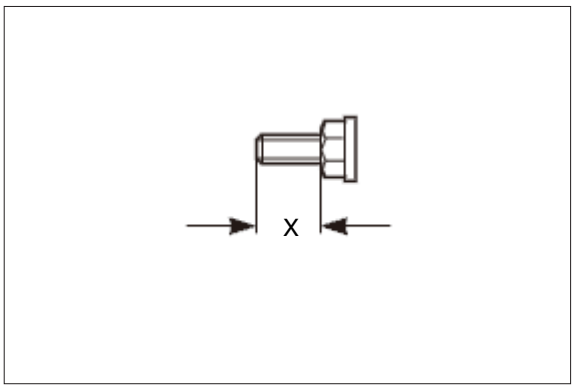
(3) Remove paper seal, clean sealing surface.



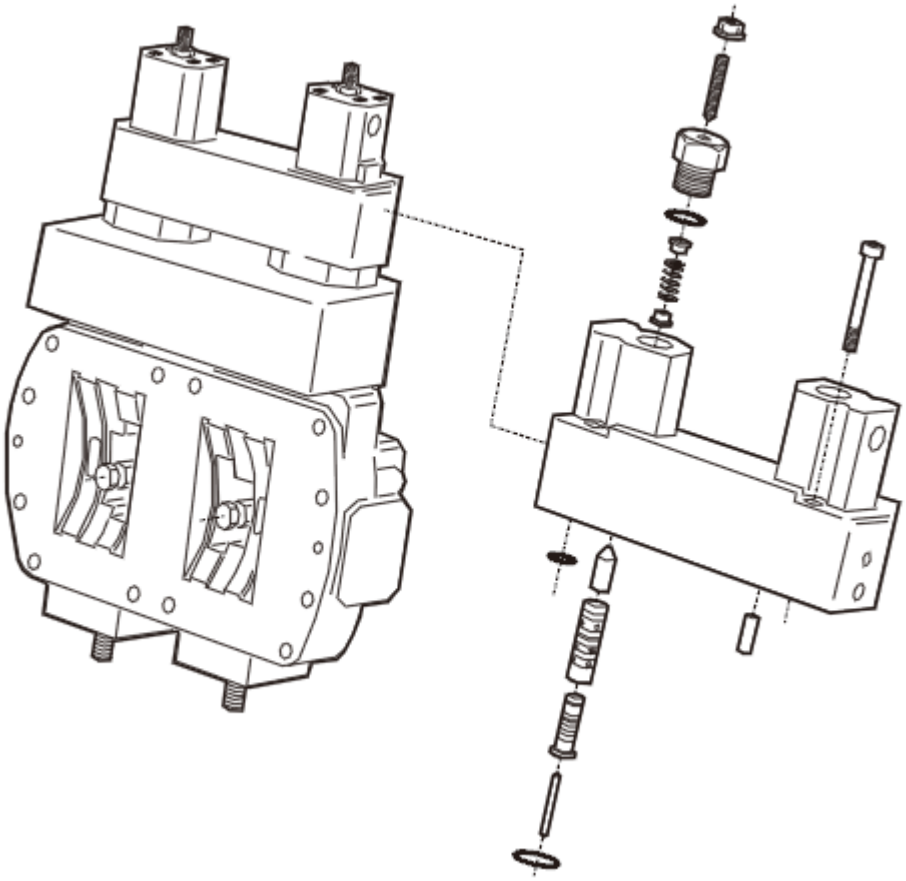


Item 1 ⇒ setting screw Qmax
Item 2 ⇒ setting screw Hydraulic stroke limitation
Item 3 ⇒ setting screw Power characteristic (begin of regulation)

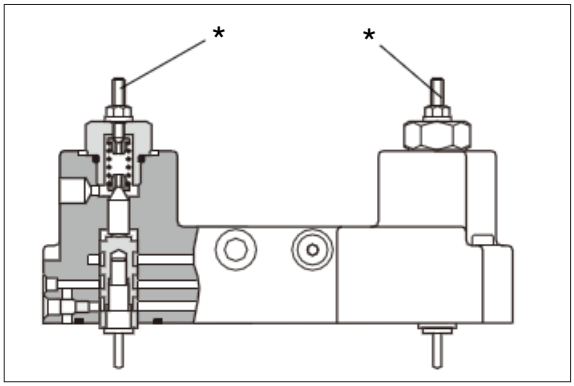
※ Before carrying out a setting or disassembly of the regulator, measure the measurement (X) and note of the setting screw.



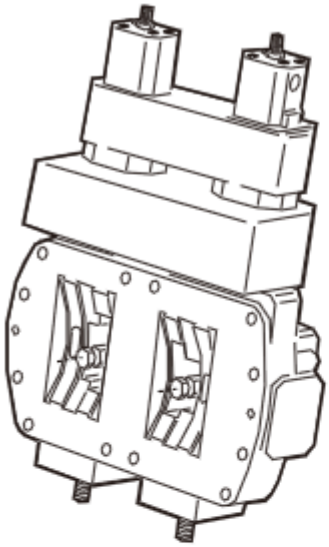
7) CONTROL MODULE LR

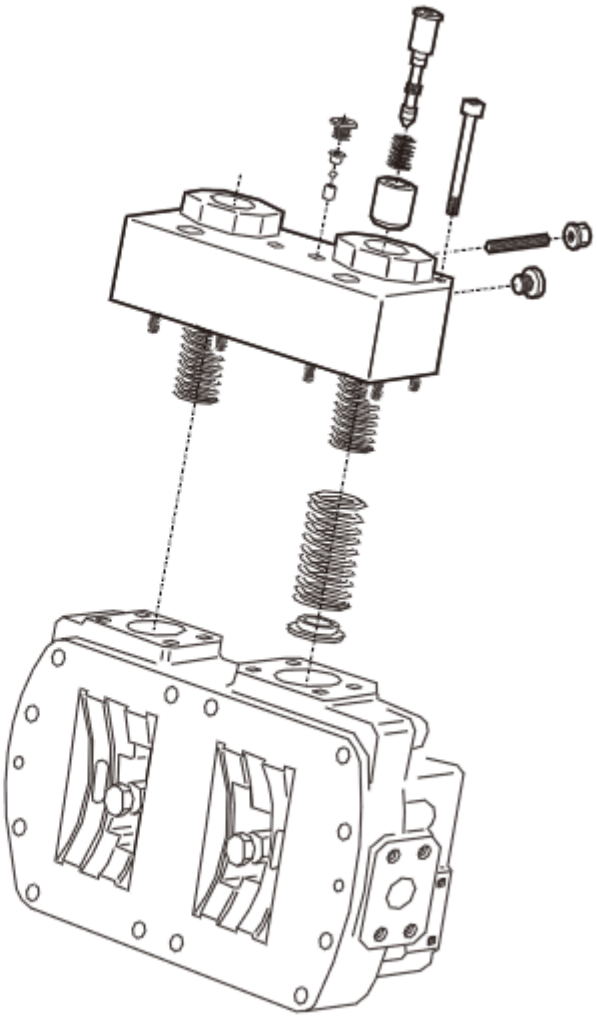


* Remove and disassemble control module LR.

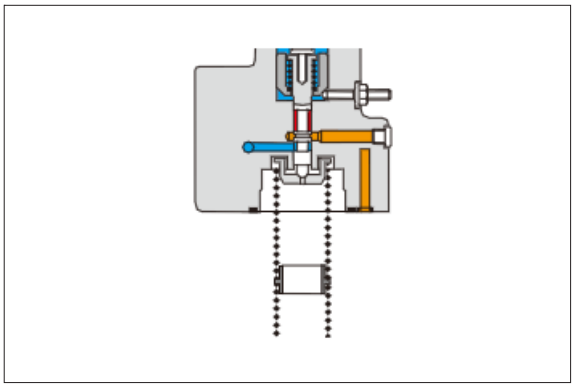


8) CONTROL MODULE H

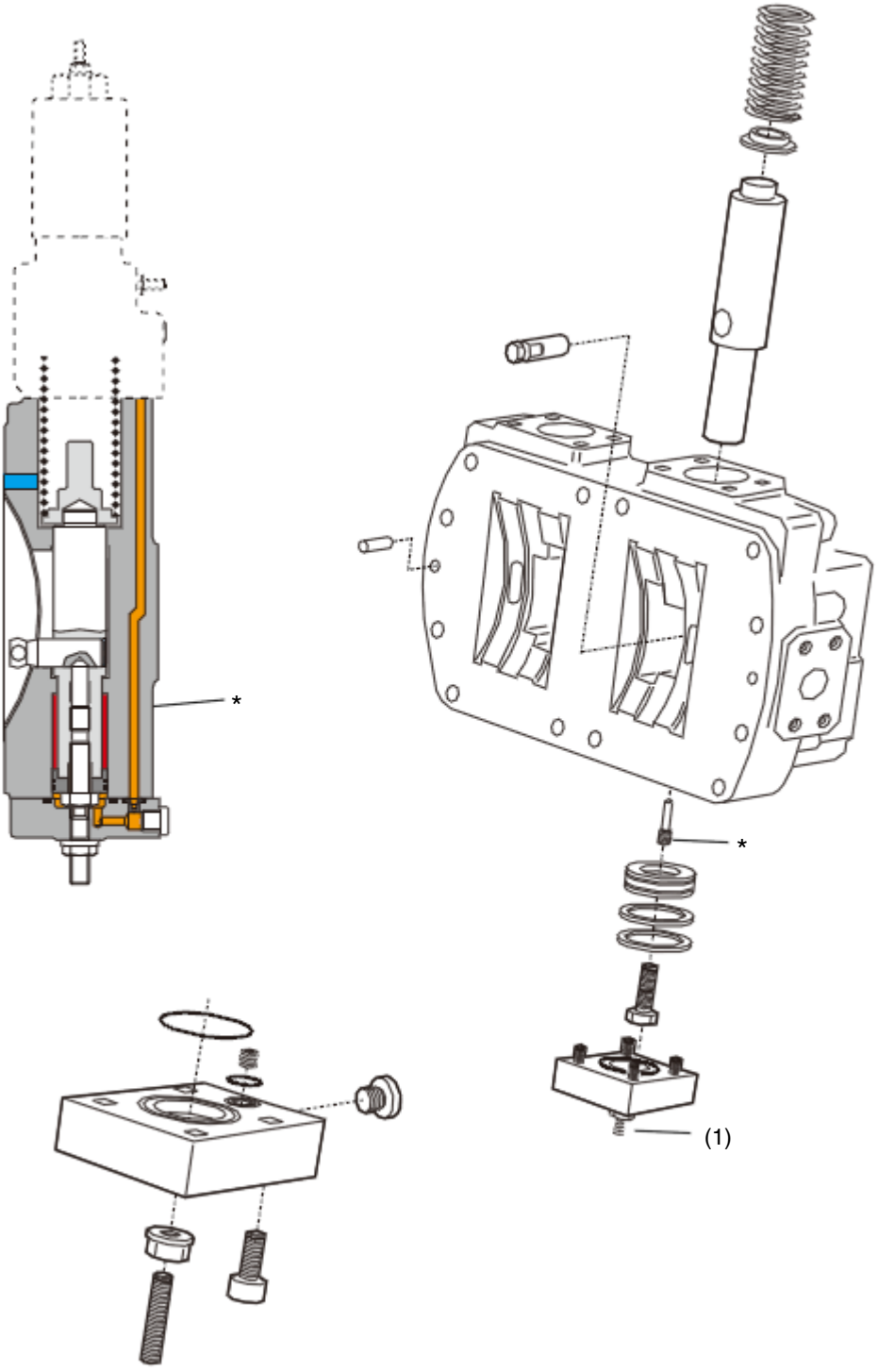




※ Remove and disassemble control module H.



9) REMOVING THE CONTROLLER

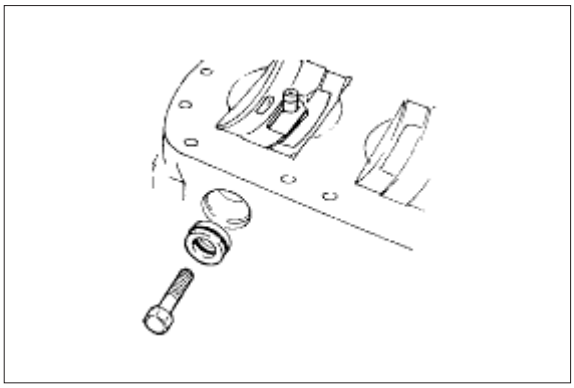


(1) Remove cover.

※ Do not change the setting screw (1).

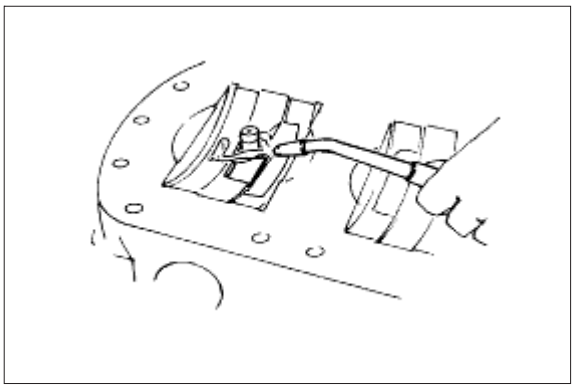
(2) Loosen fixing screws.

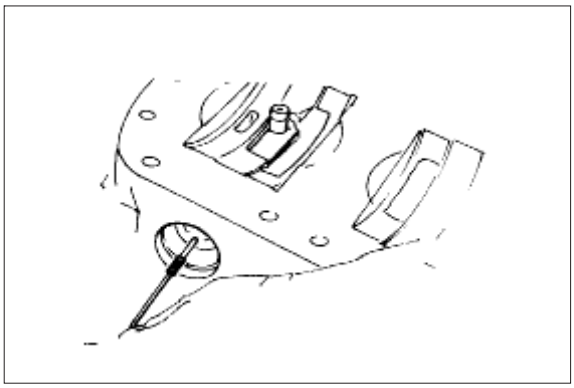
※ Fit control lens - torque support.



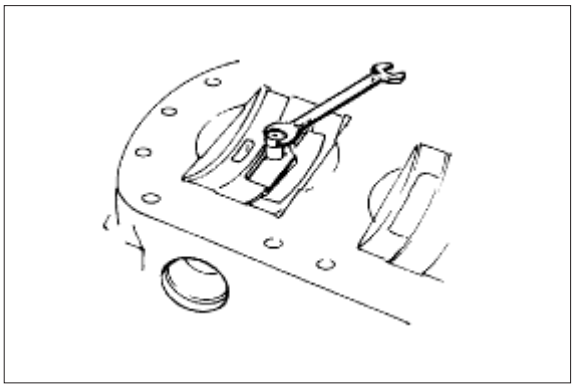
(3) Remove locking screw and replace with a new locking screw.

※ Loosen adhesive with a "gentle" flame (approx. 120℃).

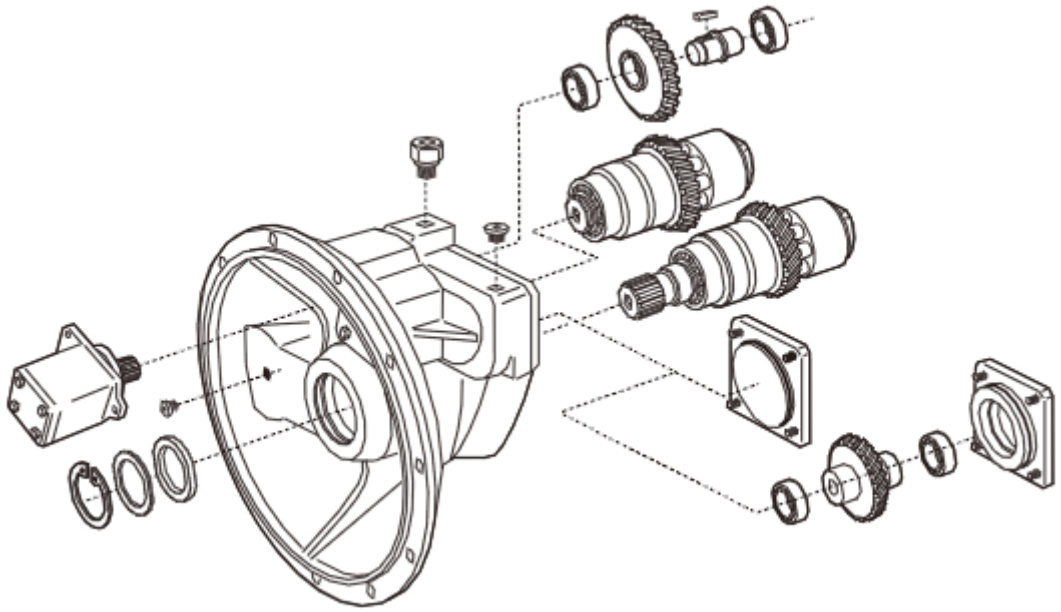




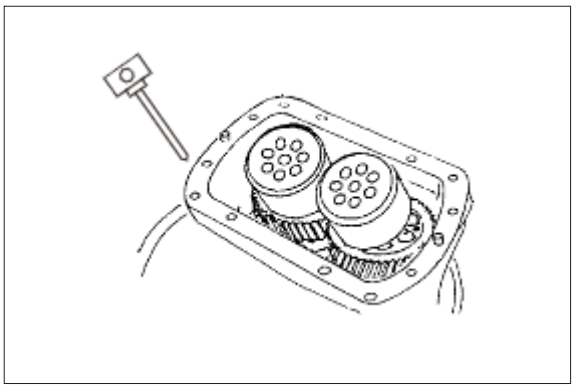
(4) Loosen swivel pin and then remove it



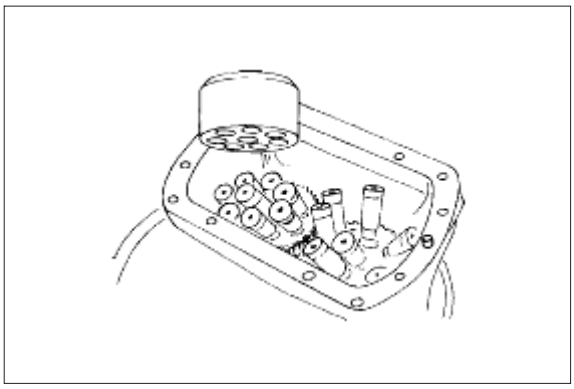
10) REMOVE THE ROTARY GROUPS



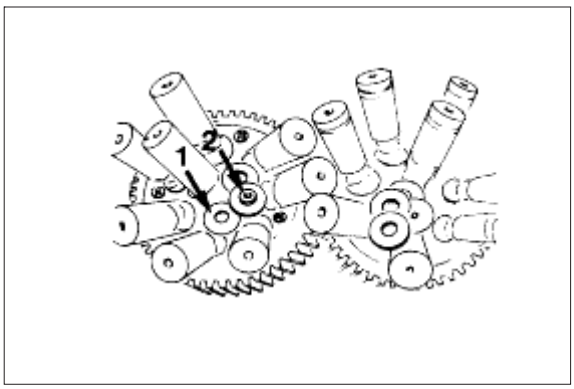
(1) Keep the cylinder with a device (remove it completely with the drive shaft).



(2) Remove cylinder (take out the drive shaft without cylinder).



(3) Remove spring cup (1) and spring cup (2).

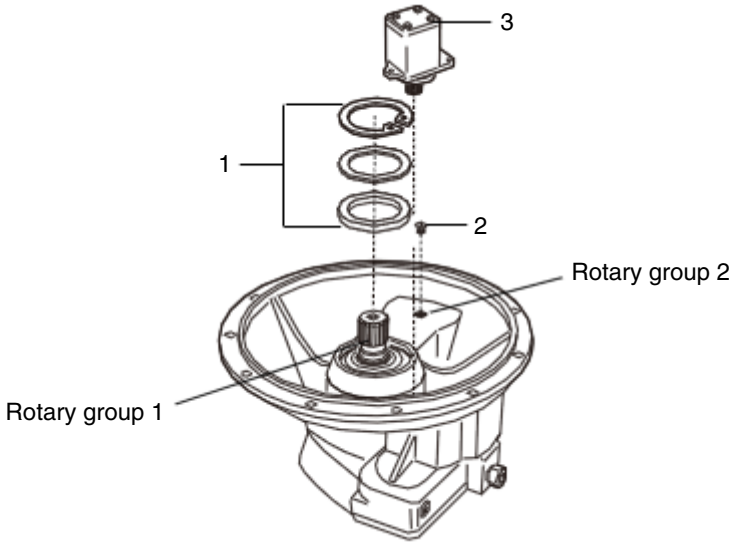


(4) New disassembly position

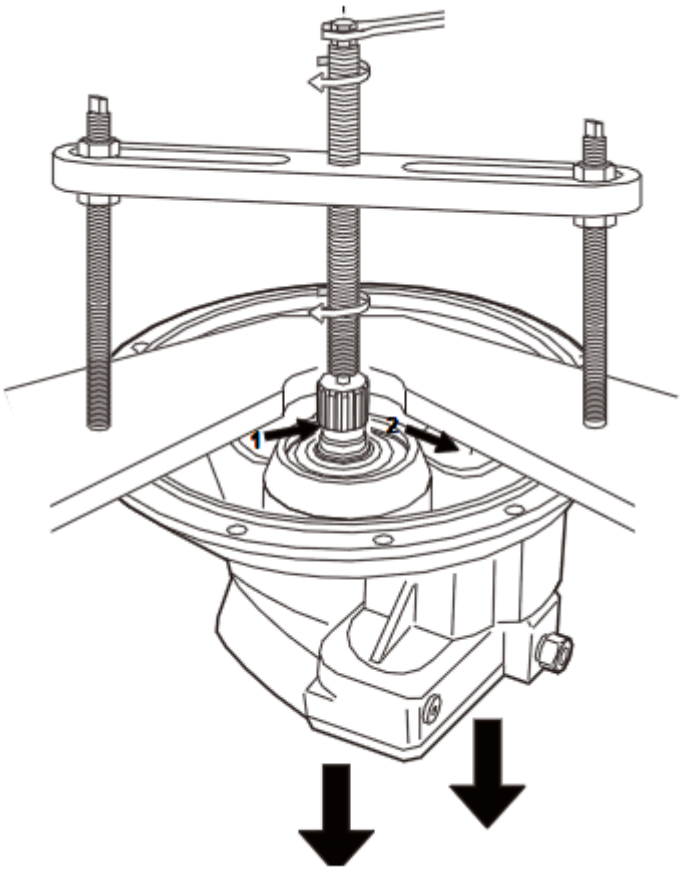
Pos.1 Remove

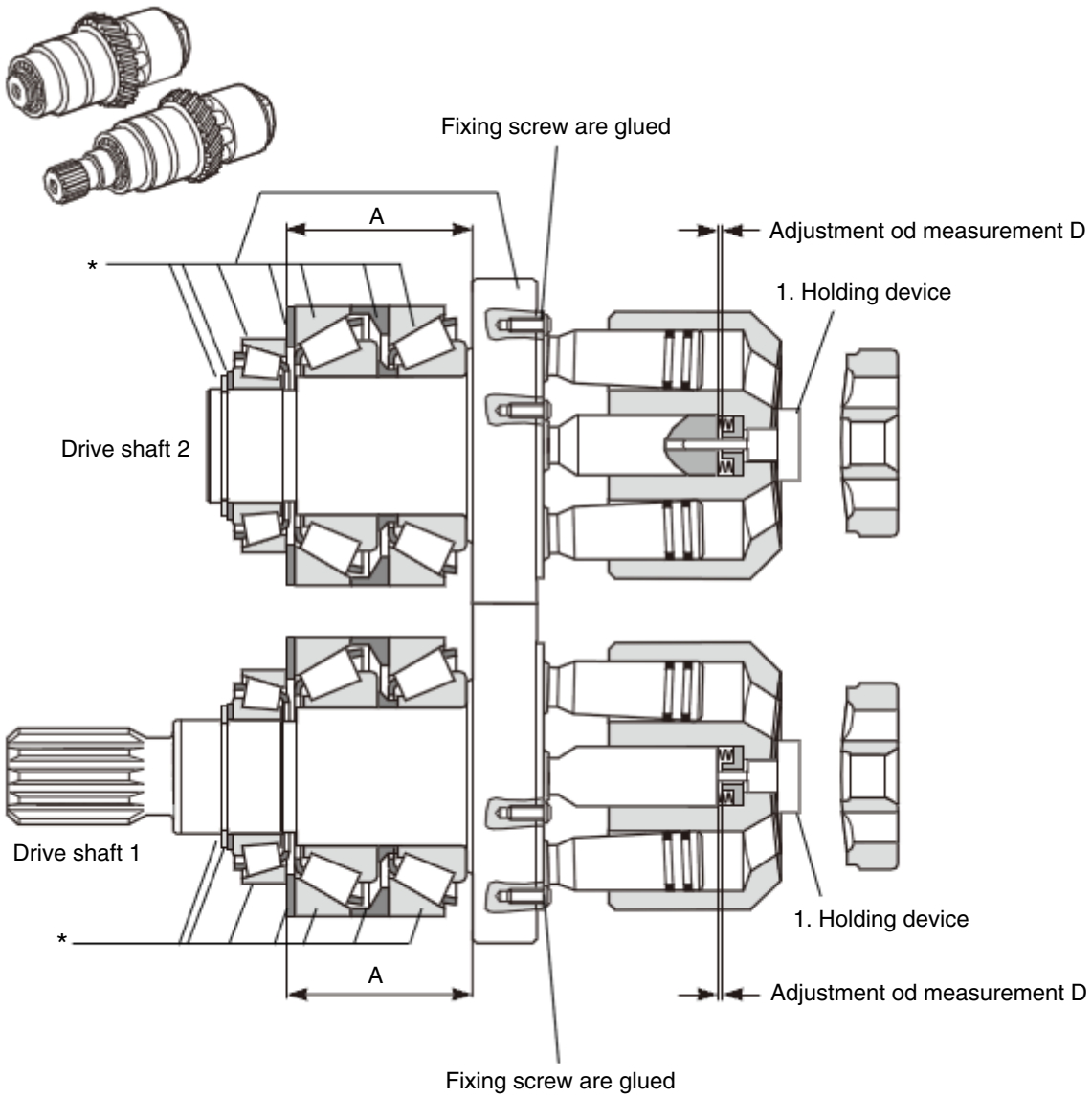
Pos.2 Remove

Pos.3 Remove



(5) Press out hydraulically or mechanically rotary group with a tool device.





※ Pos. * Drive shafts with bearing set are the smallest assembly group.

(1) The assembly group is adjusted to measurement (A)
The tapered roller bearings are adjusted to the specified through-torque.

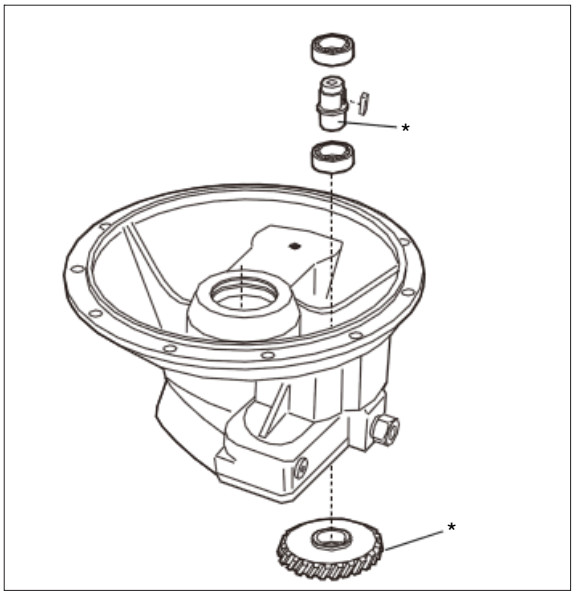
※ Fixing screw - Retaining device

(2) Loosen of the screws is only possible if the drive shaft is warmed up at a temperature of approx. 120℃,1/2 hour in an oil bath or heat air furnace.
Screw out the screw quickly.

12) REMOVE THE INTERMEDIATE WHEEL

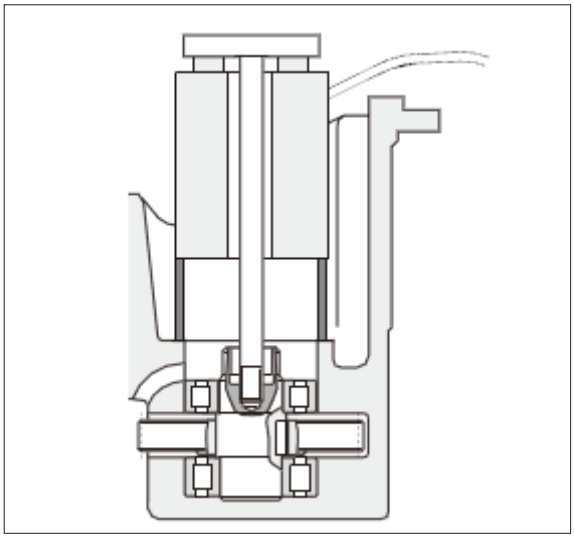
* Press in bolt into the gear wheel.
  (Fixed pressing fit).

(1) Can only be disassembled with a hydraulic press.

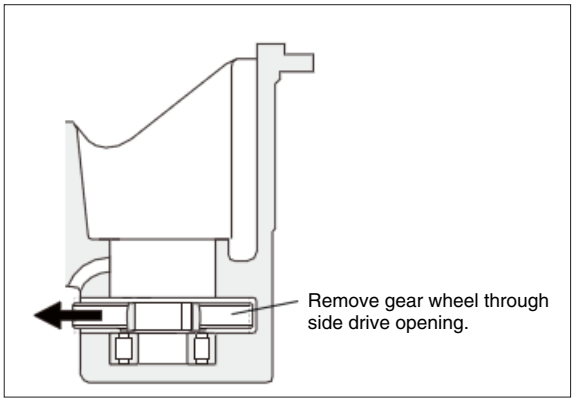


(2) Install sleeve.

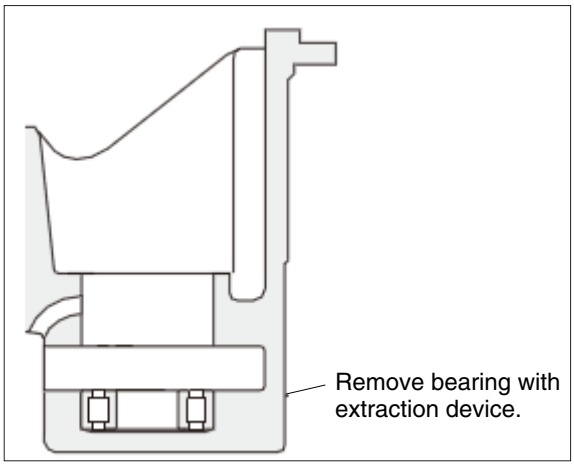
⚠ Press out bolt with a hydraulic manual press.



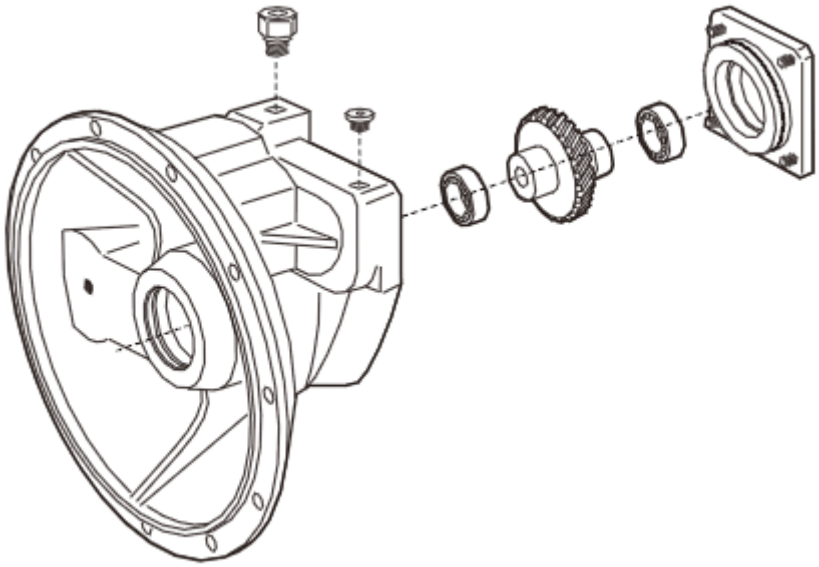
(3) Remove gear wheel through side drive opening.



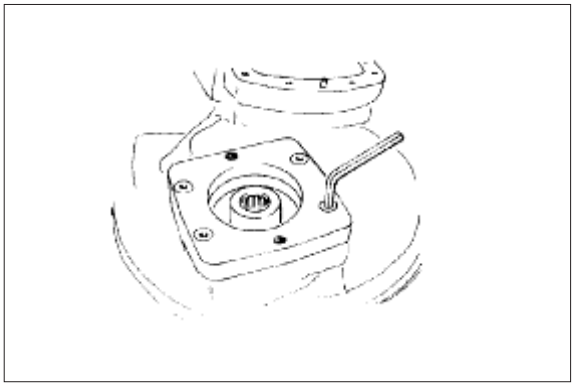
(4) Remove bearing with extraction device.



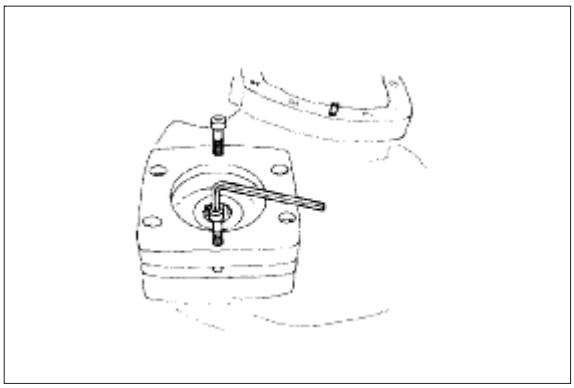
14) REMOVE AUXILIARY DRIVE



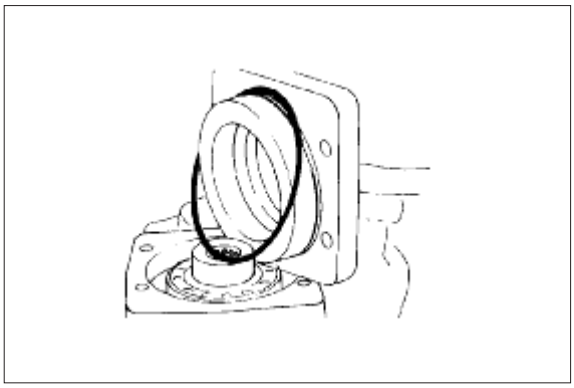
(1) Remove fixing screws - auxiliary drive.



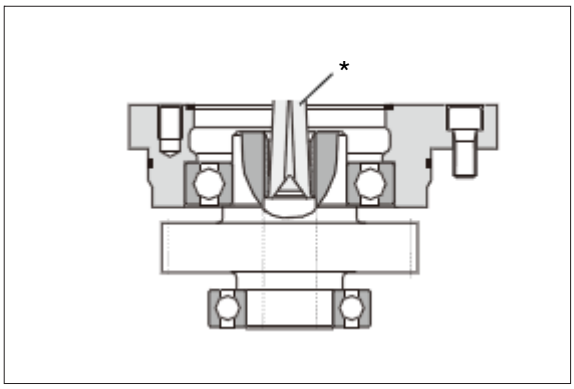
(2) Press off bearing cap.

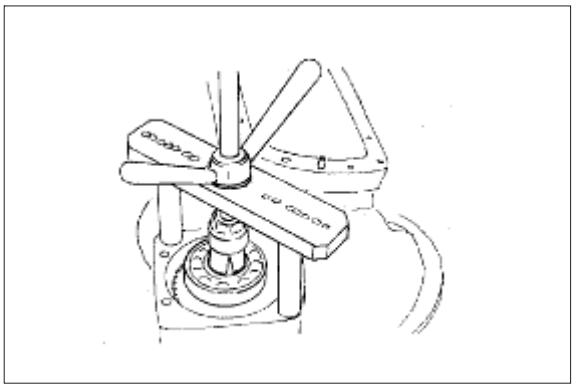


(3) In the event of leakage, visual check of O-ring, housing and groove.

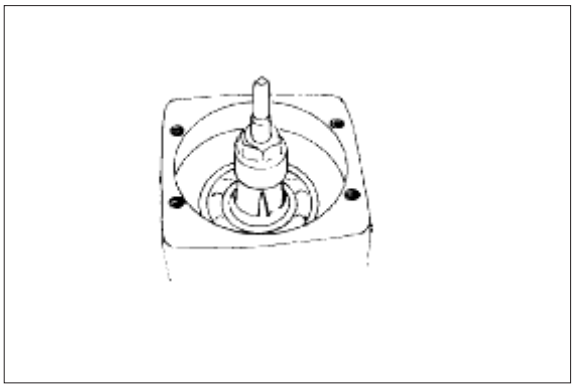


(4) Fit extractor device (*).
Pull out output pinion.

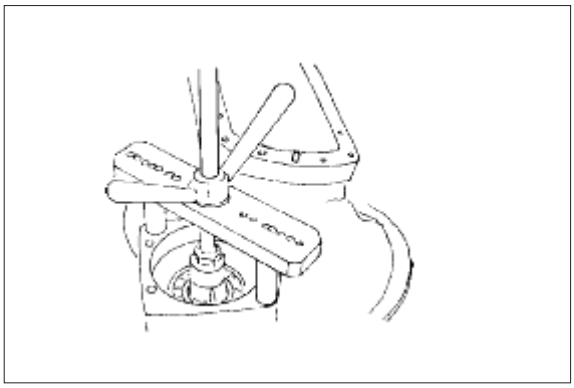




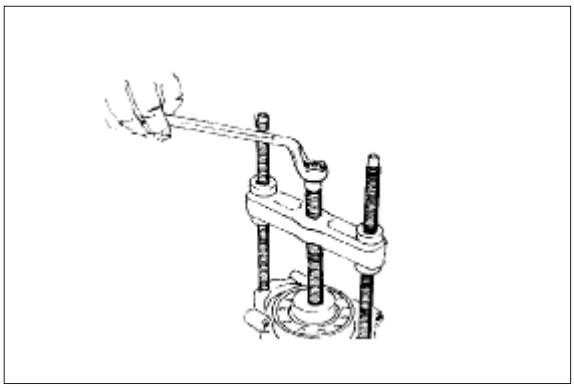
(5) Fit bearing extractor device.



(6) Completely mount device and pull out bearing.

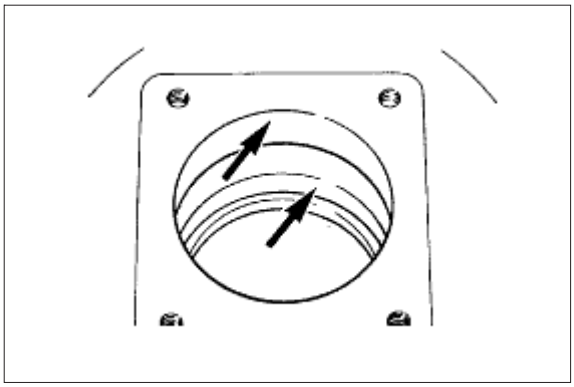


(7) Pull out pinion bearing.

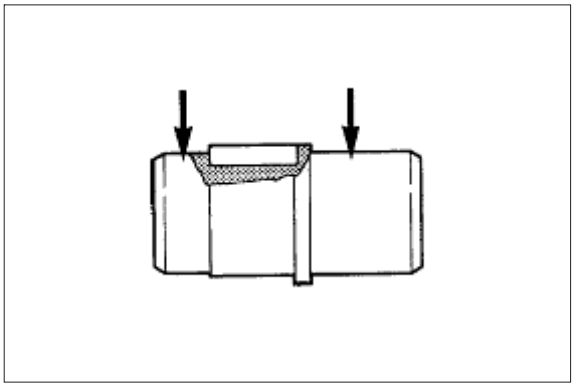


15) INSPECTION HINTS

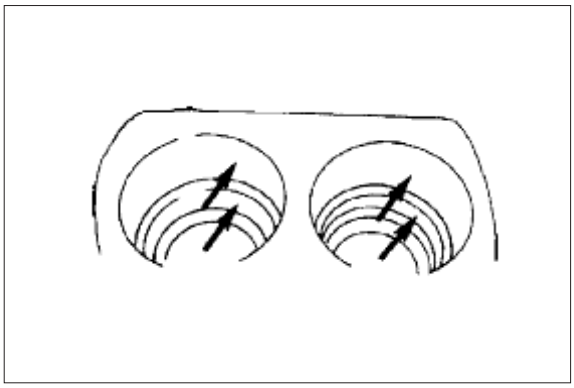
(1) Check to see that the bearing area is free of scores and that there is no evidence of wear.



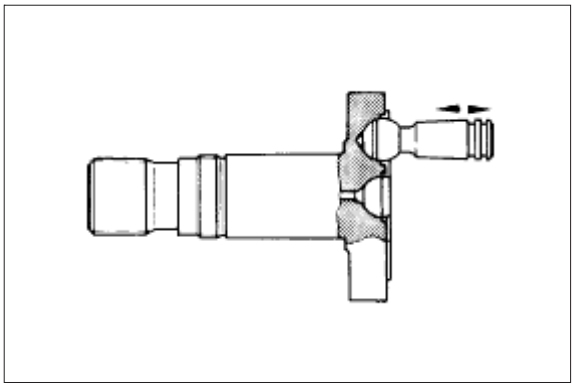
(2) Visual check
To ensure that the bearing seats are free of scores.



(3) Visual check
Check to see that the bearing area is free of scores and that there is no evidence of wear.



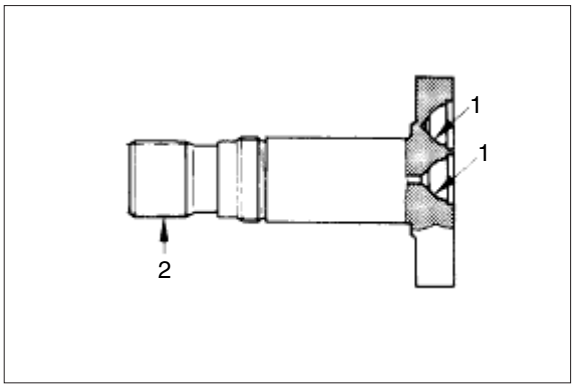
(4) Axial piston play
Checked with the retaining plate fitted.



(5) Drive shafts

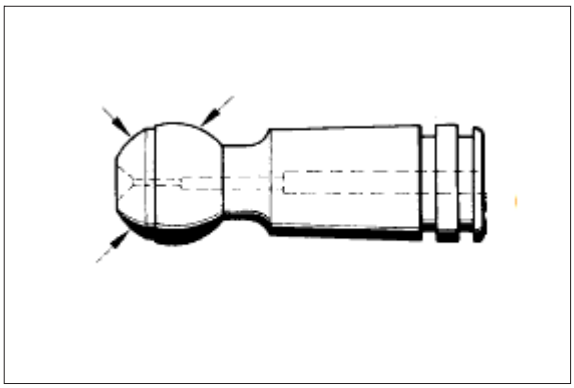
1 Check to ensure that the cups are free of scores and that there are no pittings.

2 Check to see that there is no evidence of corrosion and wear steps.



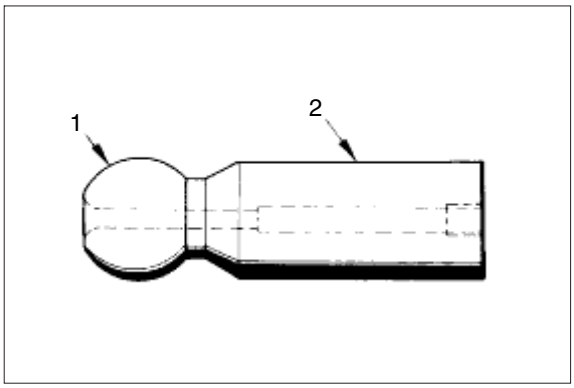
(6) Piston

Check to ensure that they are free of scores and that there are no pittings.



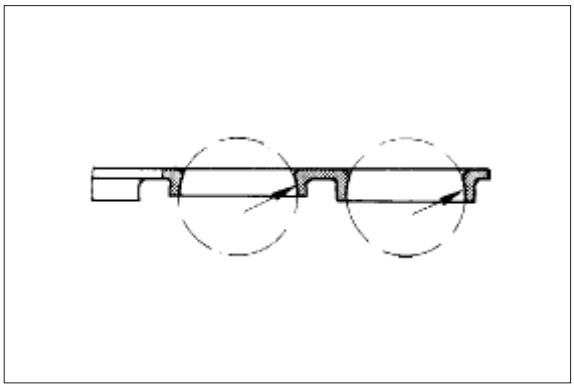
(7) Central pin

Check to ensure that it is free of scores and that there are no pittings.



(8) Retaining plate

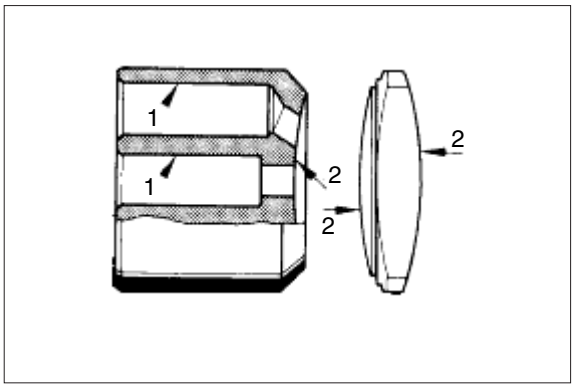
Check to ensure that it is free of scores and that there is no evidence of wear.



(9) Cylinder block / control lens

Check to ensure that :

- The bores (1) are free of scores, no evidence of wear.
- The faces (2) are even, that there are no cracks, no scores.
- The side guides (3) show no evidence of wear, fre of scores.

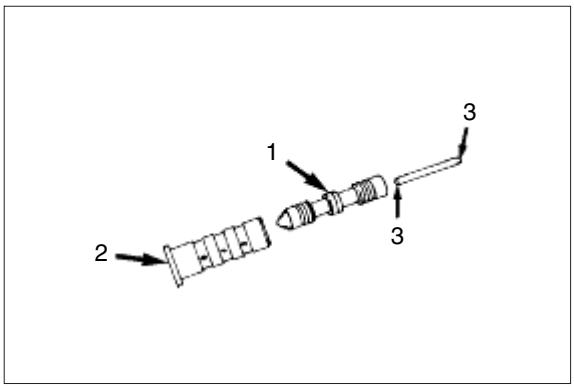


(10) Check

1 Control land

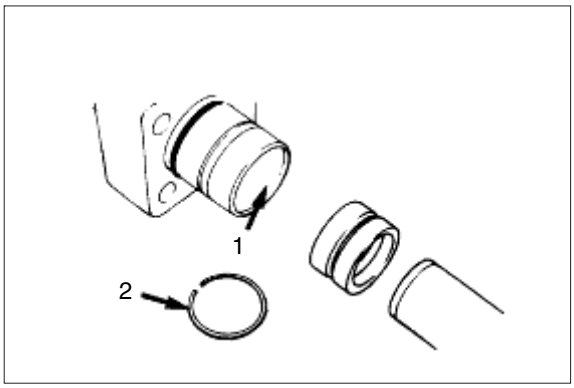
2 Internal control drilling

3 Pin cups



(11) Check

That sliding surfaces (1) are free of scor-es, seal (2).



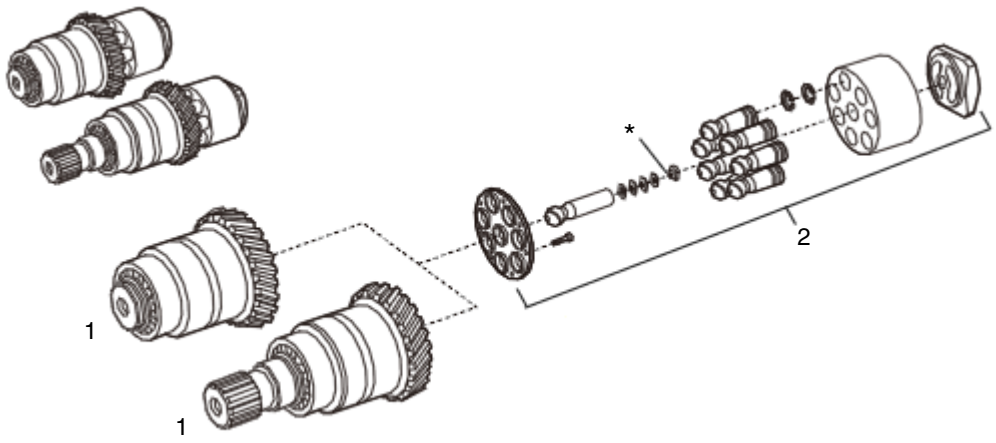
(12) Complete rotary group

※ Adjustment of the hydraulic component is necessary

① Rotary group

1 Mechanical component: drive shaft is adjusted with the bearing

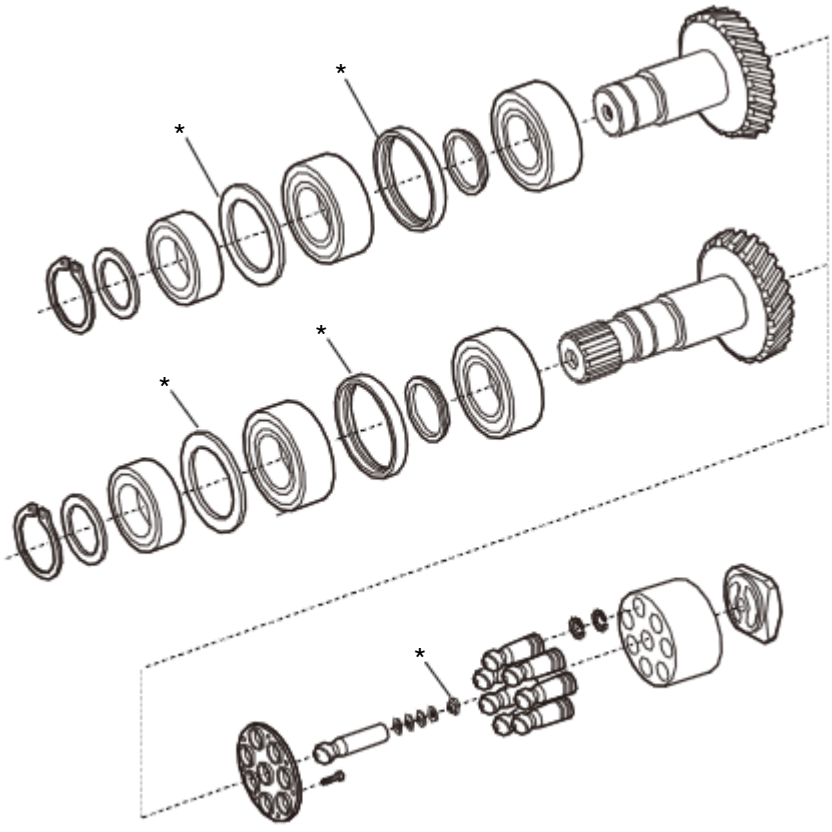
2 Hydraulic component: Adjustment (*) is necessary.



② Rotary group : All of the components

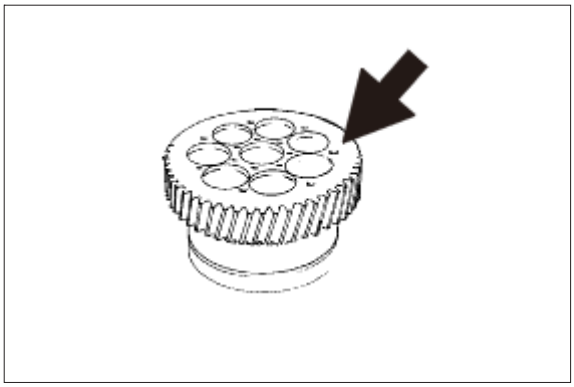
Adjustment (*)

For adjustment values, torque values, see service information

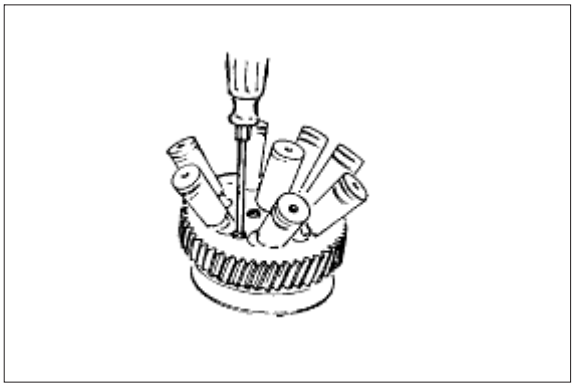


16) RE-FITTING THE ROTARY GROUP

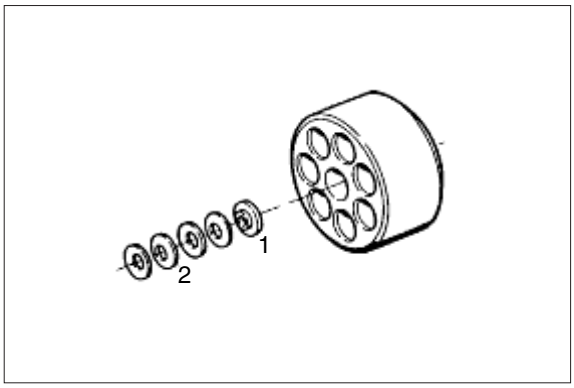
(1) The threads must be free of oil, grease, dust or any other contaminants which may impair the locking of the screws.



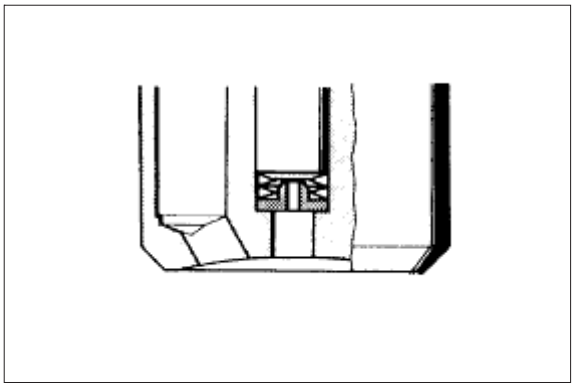
(2) Fit the retaining plate with pistons and centre pin into place.
Use screws that have a Precote coating.
※ For tightening torques, see service information.



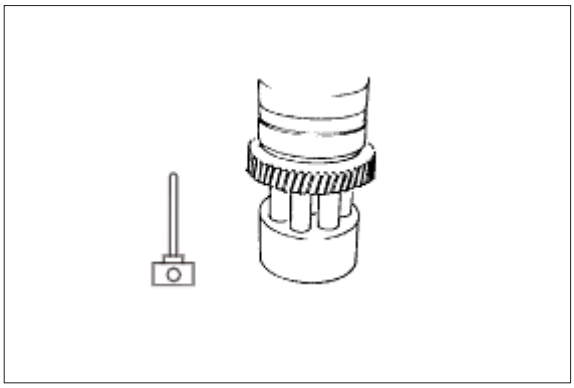
(3) Fit the spring plate (1) and cup springs (2) into their correct position (and orientation) using grease to hold them into place.



(4) Ensure that all of te parts are assembled in correct order and orientation.

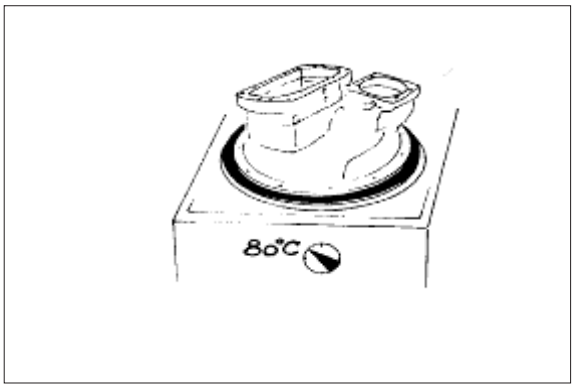


(5) Insert pistons into the cylinder. Using a soft surface as a support to prevent the sliding surfaces from being damaged. Pre-assemble both of the rotary groups in this manner.

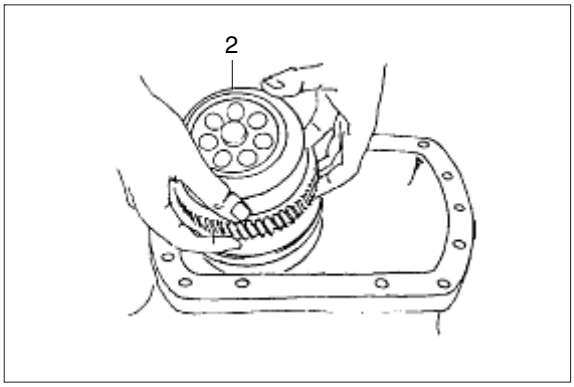


17) PUMP ASSEMBLY

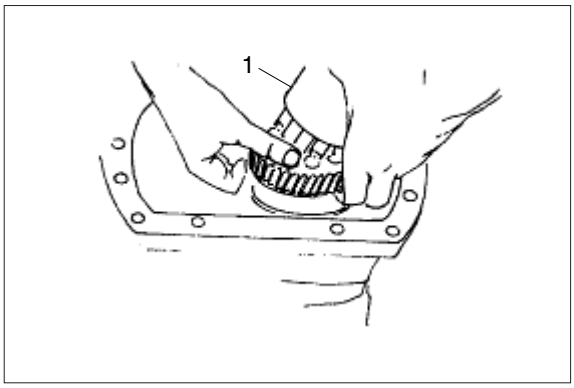
(1) Warm up the housing to approx. 80℃.



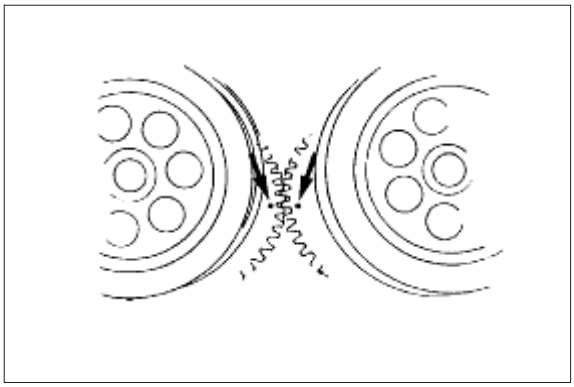
(2) Insert the pre-assembled rotary group (2) taking into account gear tooth markers.



(3) Insert rotary group (1). Align the marked gear teeth.

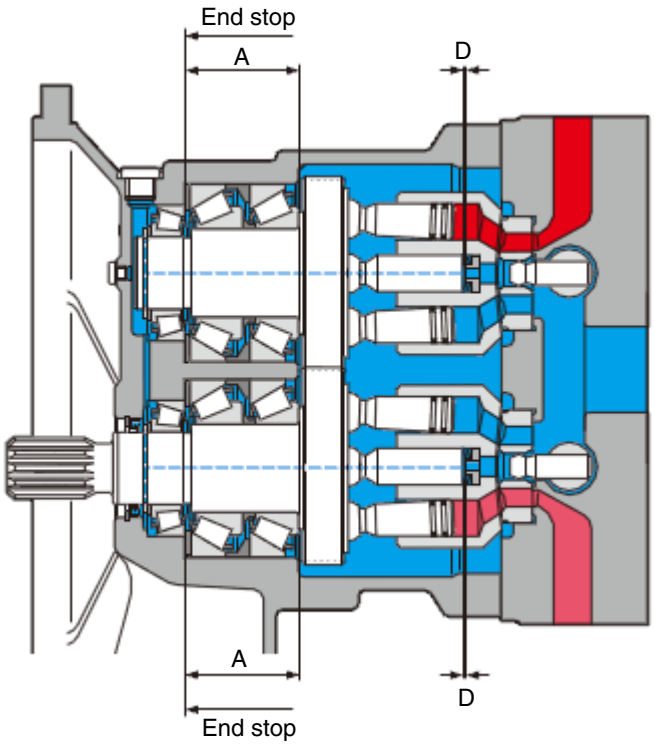


(4) The gear tooth markers must coincide.



(5) Adjustment of measurement D

Control hydraulic part.



※ Drive shafts with bearing set

The assembly group is adjusted to dimension (A). The tapered roller bearings are adjusted to the stipulated breakaway torque.

① Assembly guideline

Retaining force

After the rotary group has been fitted into the housing, it has to be pressed in until the end stop is reached.

Allow the housing to cool down from its assembly temperature (approx.80℃) to room temperature.

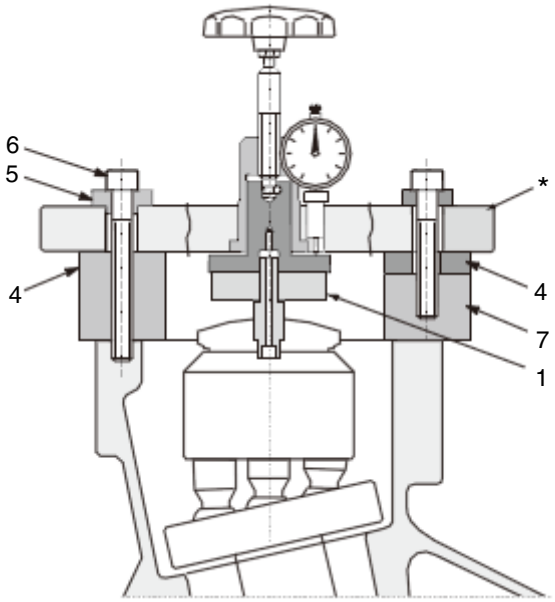
② Adjustment of the hydraulic component of the rotary group

The adjustment of dimension (D) is carried out using spring plates of differing thickness, so that the correct clearance is achieved between the rotary group which is fitted in the housing and the centre pin and spring plates.

Dimension (D) = 0.4 ± 0.1 mm

③ After assembly of the complete unit the breakaway torque of the rotary group has to be checked with the torque wrench.

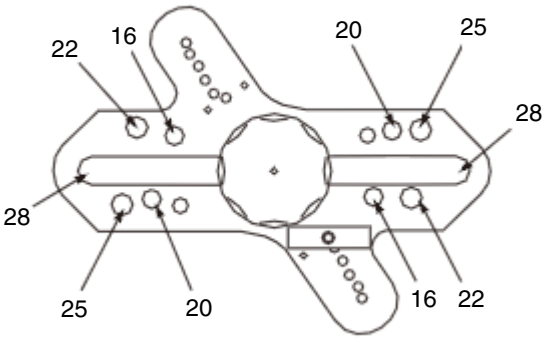
④ Measuring device

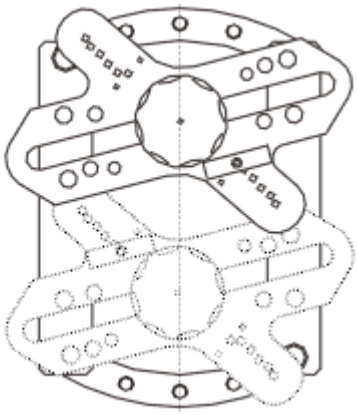


* Measuring device
1 Centering device
4 Intermediate ring
5 Shim
6 Socket screw
7 Intermediate plate

⑤ Mounting position

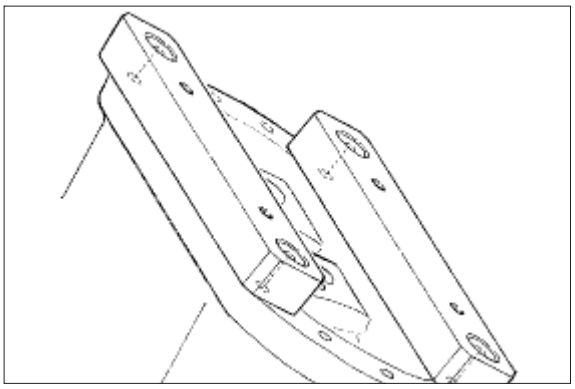
Ensure that the correct mounting position is used.
The numbers on the top of the measuring device (∗) refer to the piston diameter.



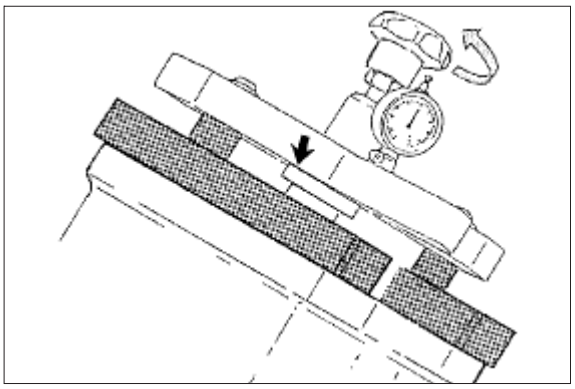


Mounting position (28)

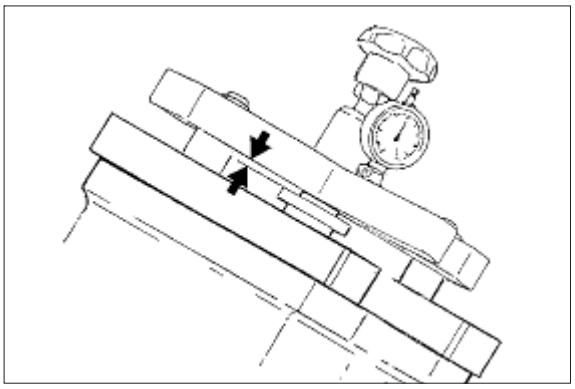
⑥ Fit the intermediate plates onto the housing.



⑦ Zero adjustment - measuring device
Turn using the hand wheel until the stop is reached.
- Set dial gauge to zero

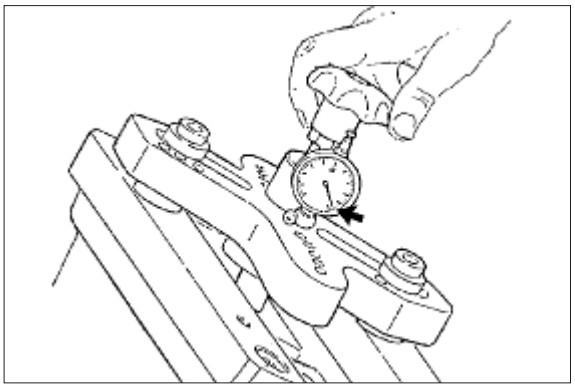


⑧ Measuring procedure
Turn down by 4 turns on the dial gauge.
Check:
2 mm clearance, set dial gauge to "Zero".
Clearance : 0.4 ± 0.1 mm

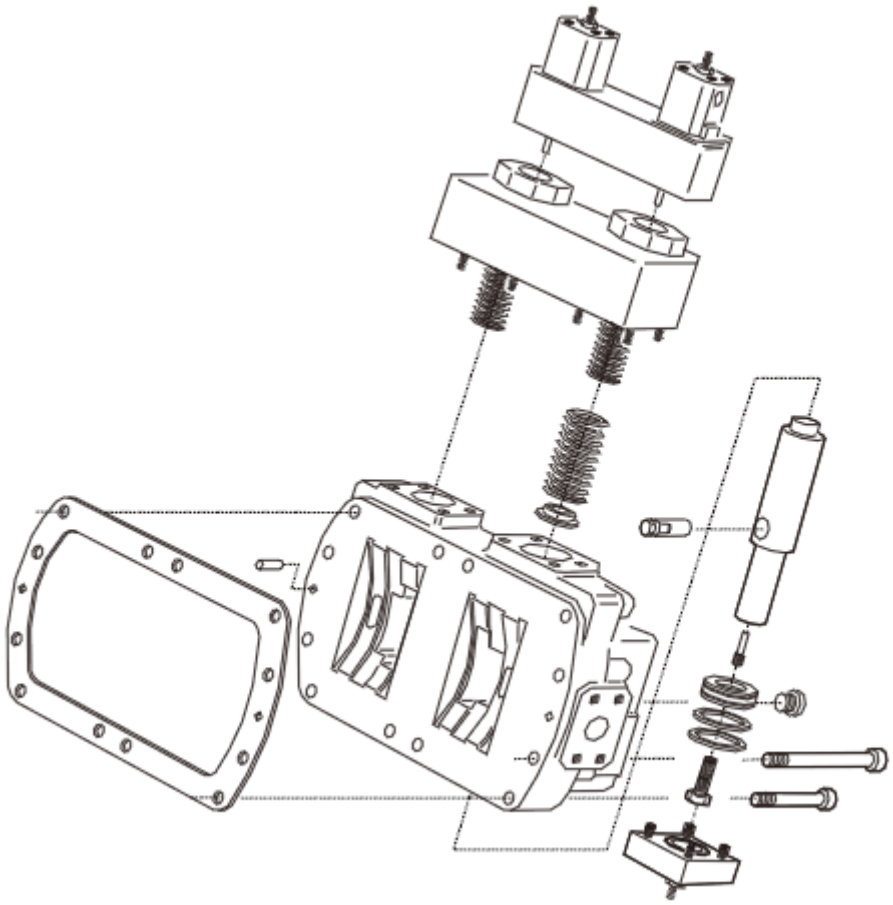


⑨ Measuring procedure
Turn down, using the hand wheel, until resistance is met.
Read the measured value.

※ Don't use excessive force.



18) FIT CONTROL HOUSING



(1) Fit the swivel pin into correct position and orientation.

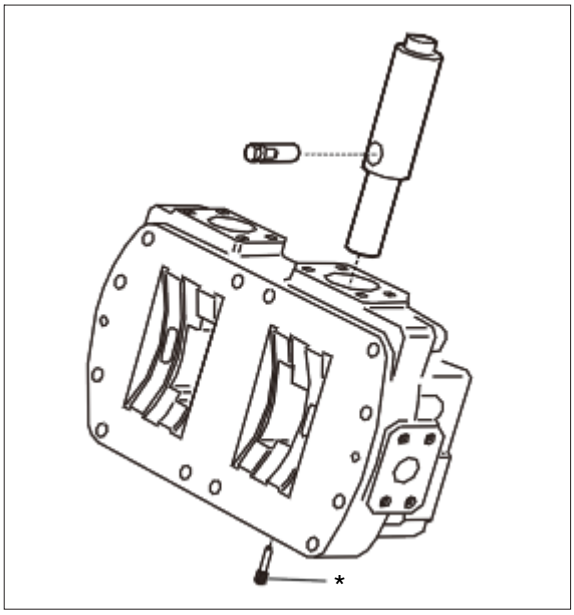
(2) Take the hardening time and tightening torque into account.

M6 : 0.9 kgf · m (6.3 lbf · ft)

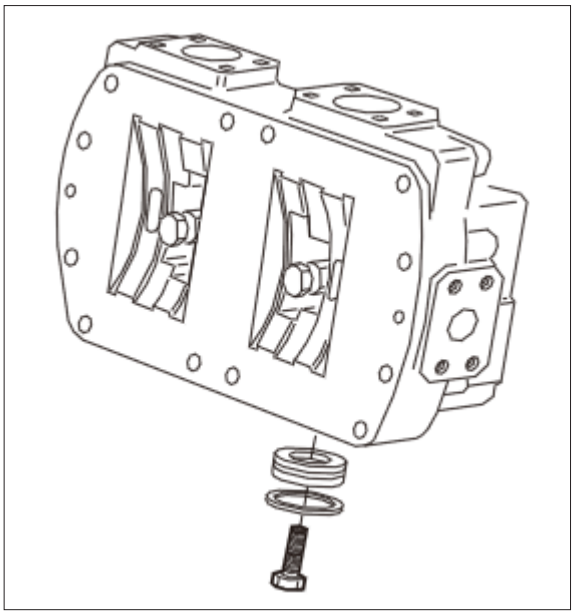
M8 : 1.4 kgf · m (10.3 lbf · ft)

M10 : 3.6 kgf · m (25.8 lbf · ft)

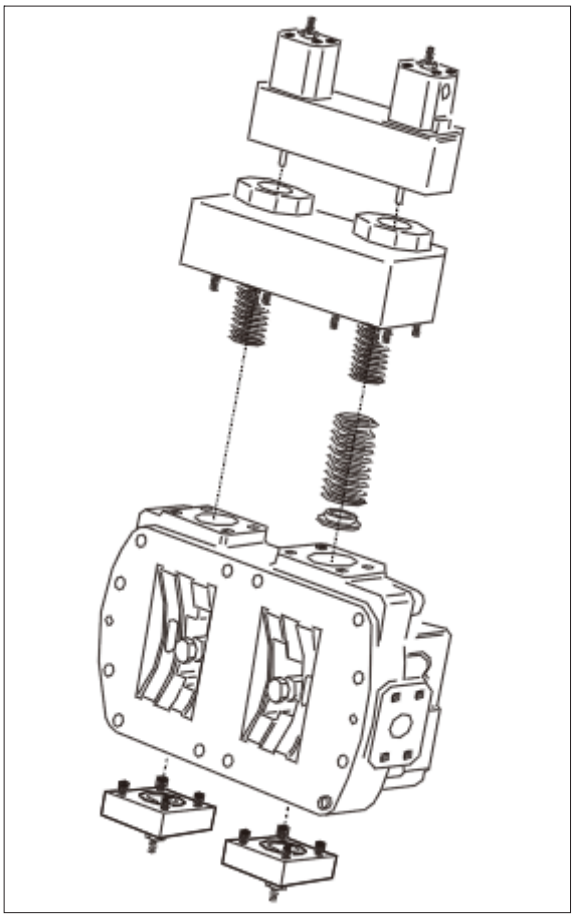
M12 : 7.0 kgf · m (50.9 lbf · ft)



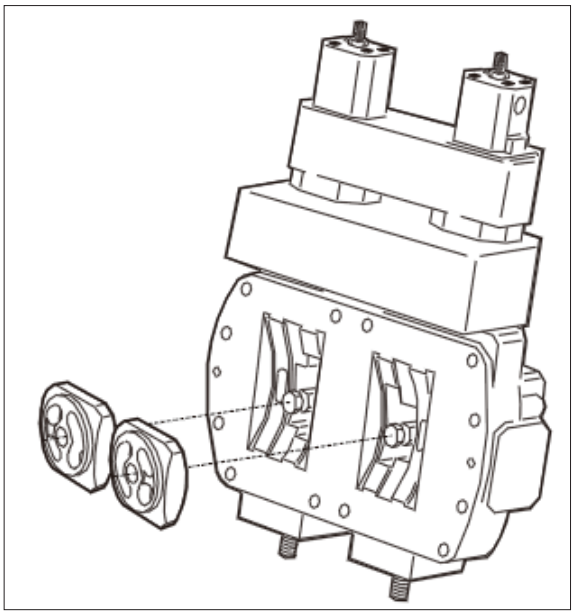
(3) Push on the piston ring by hand.
(4) Fix adjustment piston.
(5) Take the tightening torques into account.

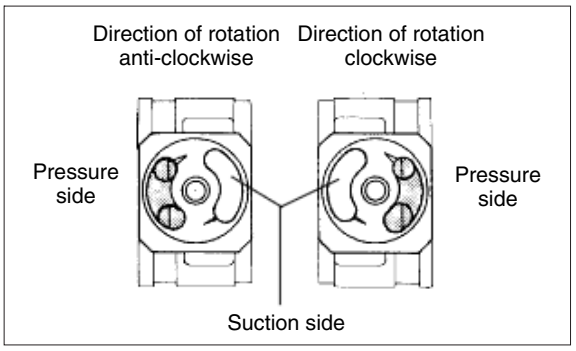


(6) Fit control housing.

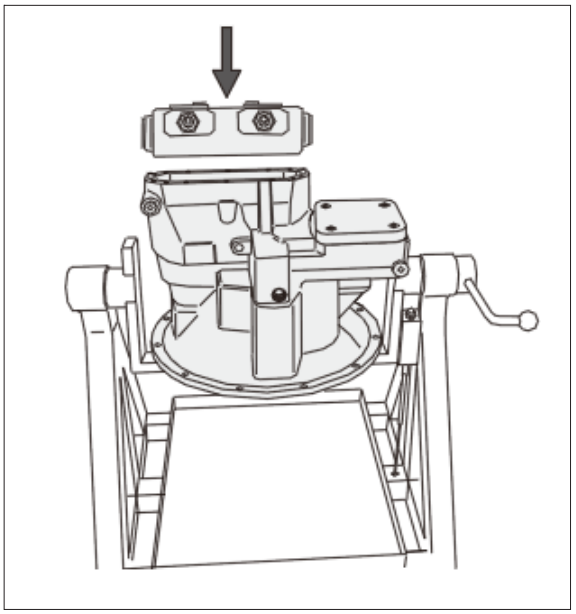


(7) Fit the control lens in its correct position using grease to hold it in place.

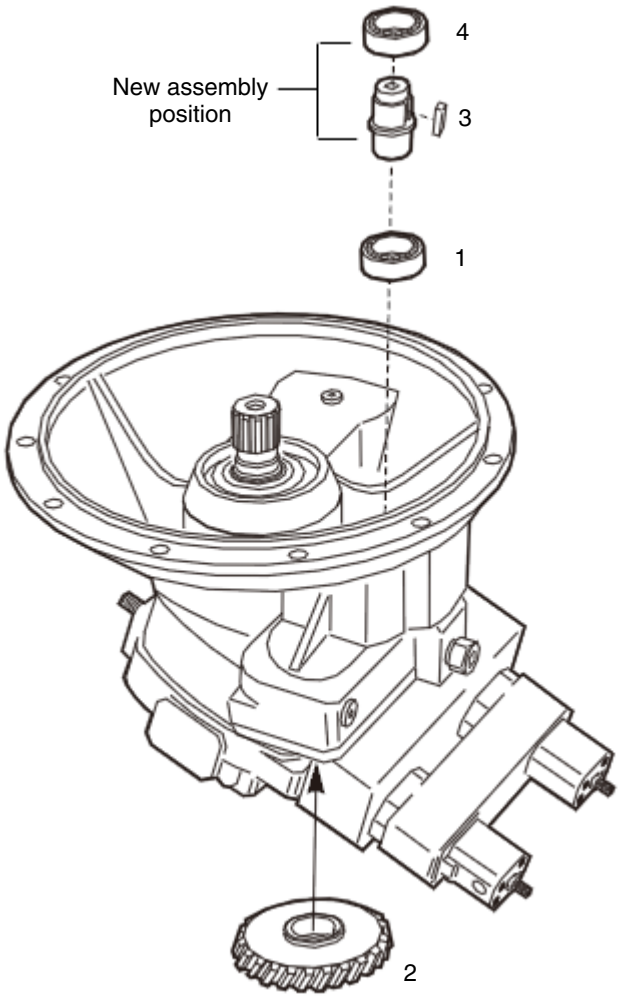




(8) Fit seal and controller.

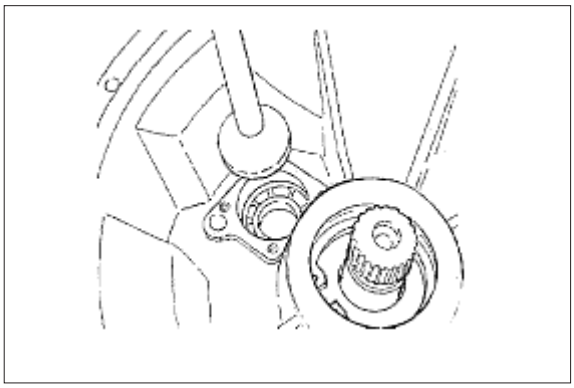


19) ASSEMBLY OF THE INTERMEDIATE WHEEL

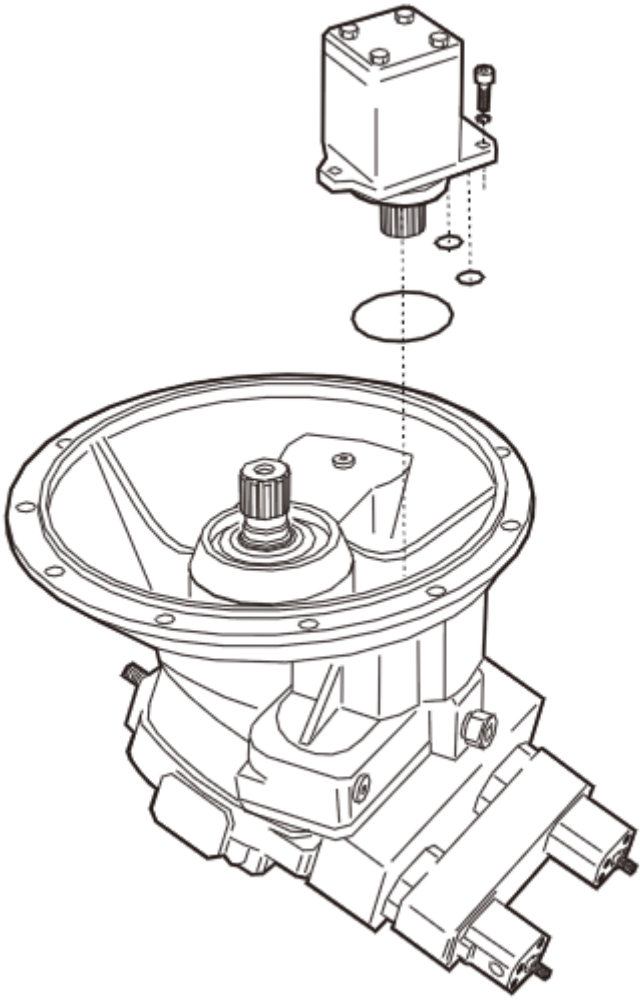


(1) Press in bearing into housing.
(2) Install and align the intermediate wheel through side drive opening.
(3) Cool down the bolt with nitrogen and place it.
(4) Press in bearing.

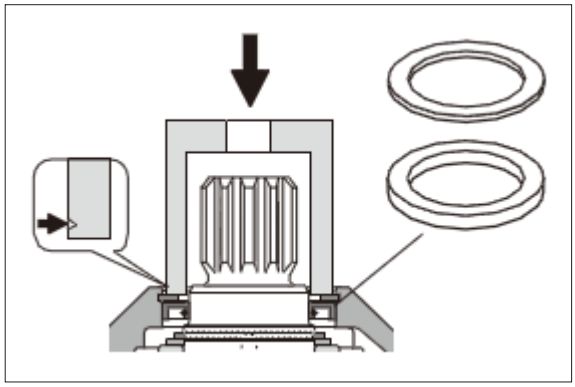
(5) Press in the bearing into the housing.



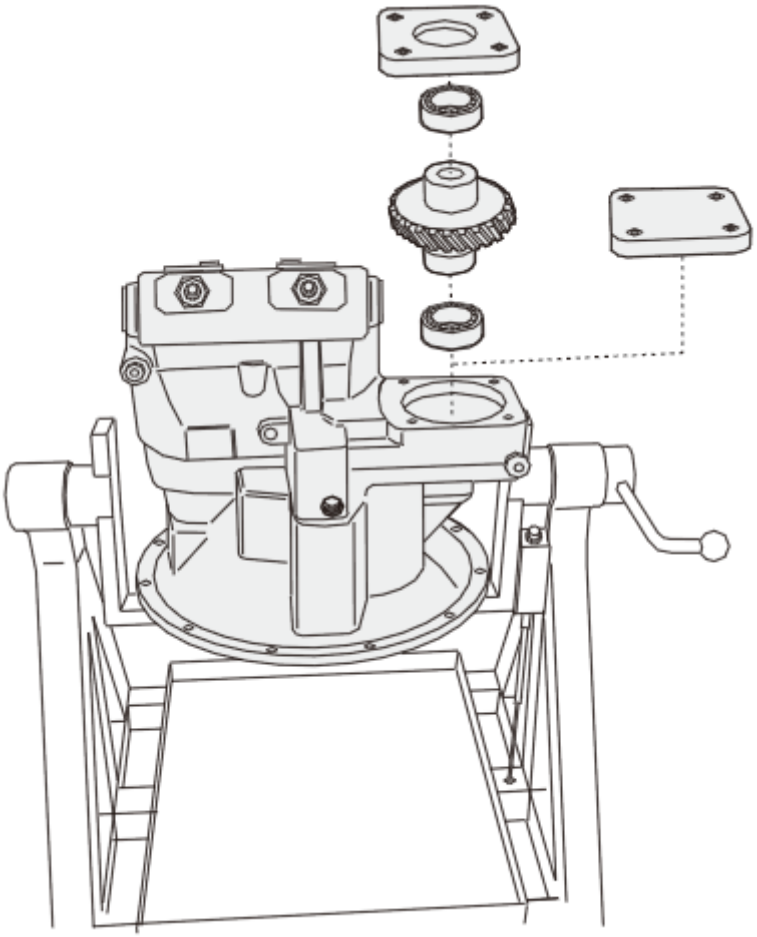
20) FIT THE GEAR PUMP



(1) Assemble shaft seal, disc and safety ring.
(2) Press-in with assemble sleeve.
※ Take care of press-in depth.



21) FIT THE COVER AND AUXILARY DRIVE



1. REMOVAL AND INSTALL

1) REMOVAL

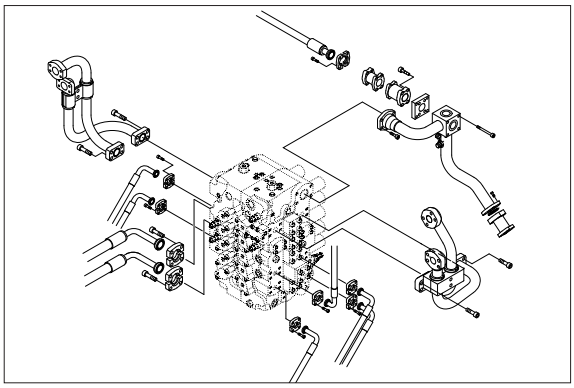
(1) Lower the work equipment to the ground and stop the engine.

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

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

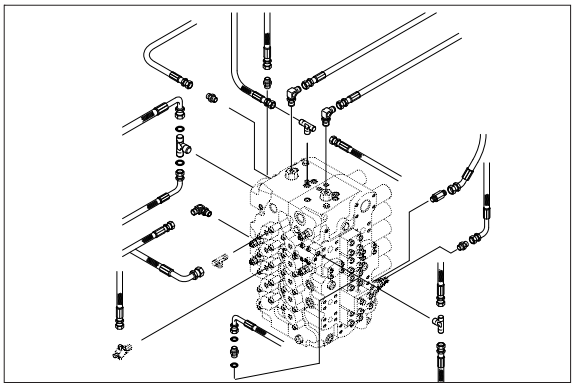


(4) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

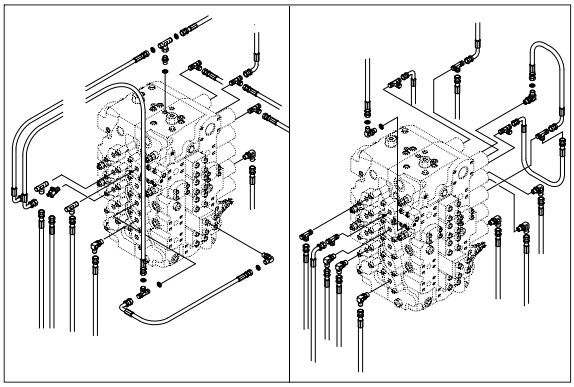
(7) Disconnect pilot piping.



(8) Sling the control valve assembly and remove the control valve mounting bolt.
- Weight : 421 kg (928 lb)
- Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)

(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

2) INSTALL

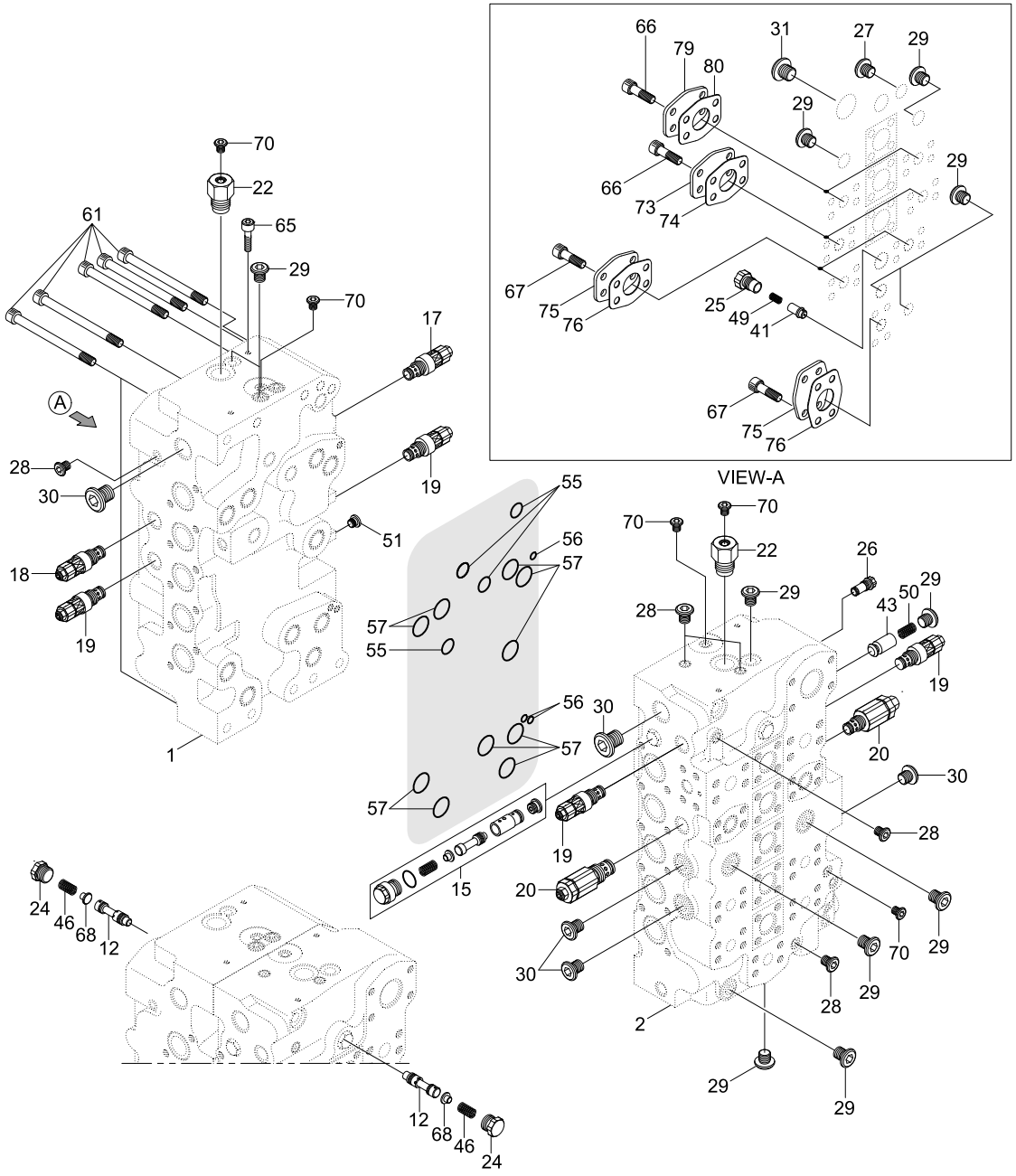


(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.
① Cylinder (boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

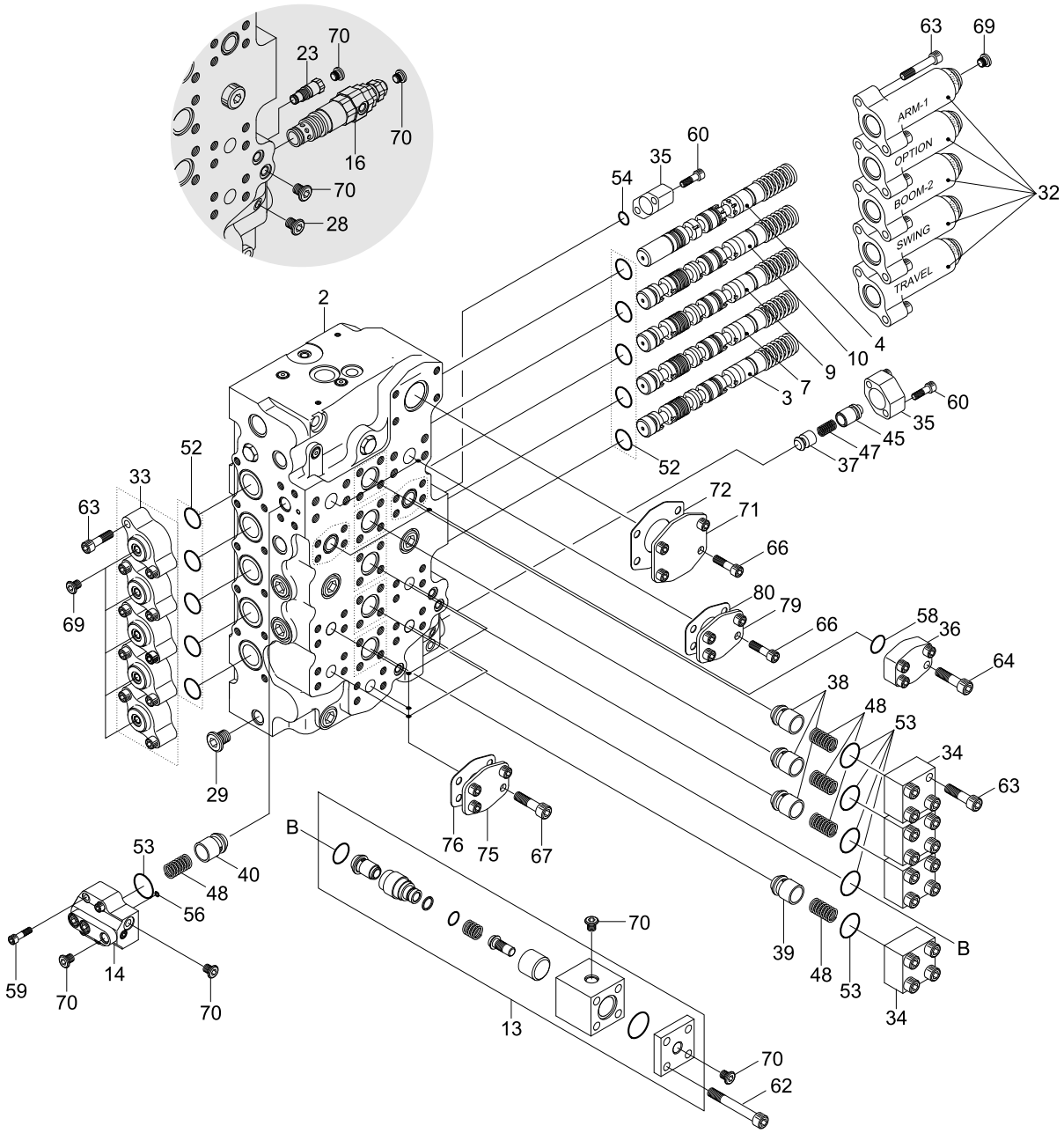
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

2. STRUCTURE (1/3)



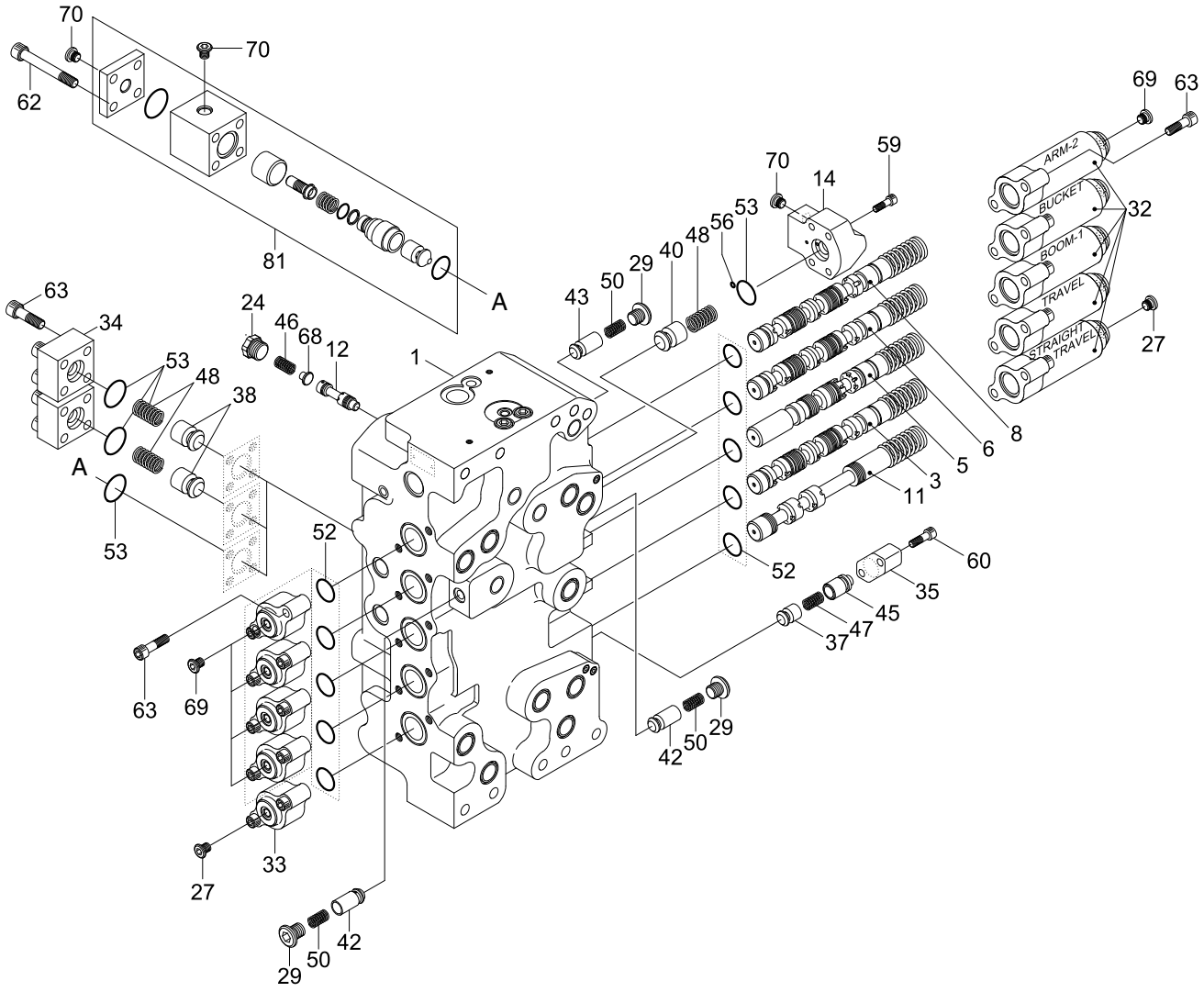
12	Spool assy	29	Plug	65	Socket bolt
15	Arm regen cut spool kit	30	Plug	66	Socket bolt
17	Port relief valve	31	Plug	67	Socket bolt
18	Port relief valve	41	Poppet	68	Socket bolt
19	Port relief valve	43	Poppet	70	Dust cap
20	Port relief valve	46	Spring	73	Cover
21	Port relief valve	49	Spring	74	Gasket
22	Relief valve	50	Spring	75	Cover
24	Plug assy	51	Plug	76	Gasket
25	Plug	55	O-ring	79	Cover
26	Plug	56	O-ring	80	Gasket
27	Plug	57	O-ring		
28	Plug	61	Socket bolt		

STRUCTURE (2/3)



2	Housing	35	Flange	60	Socket bolt
3	Travel spool kit	36	Flange	62	Socket bolt
4	Arm 1 spool kit	37	Poppet	63	Socket bolt
7	Swing spool kit	38	Poppet	64	Socket bolt
9	Boom 2 spool kit	39	Poppet	66	Socket bolt
10	Option spool kit	40	Poppet	67	Socket bolt
13	Swing logic valve	45	Spacer	69	Dust cap
14	Holding valve	47	Spring	70	Dust cap
16	Main relief valve	48	Spring	71	Cover
23	Plug assy	52	O-ring	72	Gasket
28	Plug	53	O-ring	75	Cover
29	Plug	54	O-ring	76	Gasket
32	Pilot cap-large	56	O-ring	79	Cover
33	Pilot cap-small	58	O-ring	80	Gasket
34	Flange	59	Socket bolt		

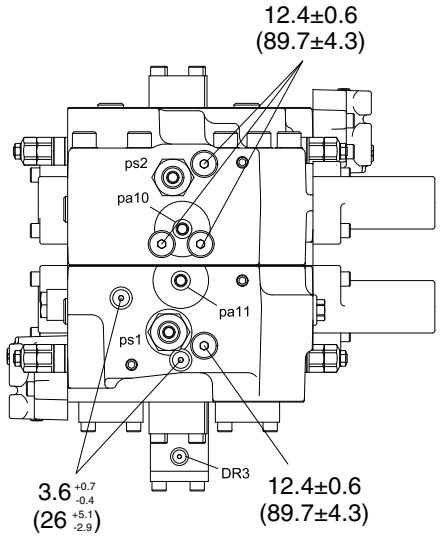
STRUCTURE (3/3)

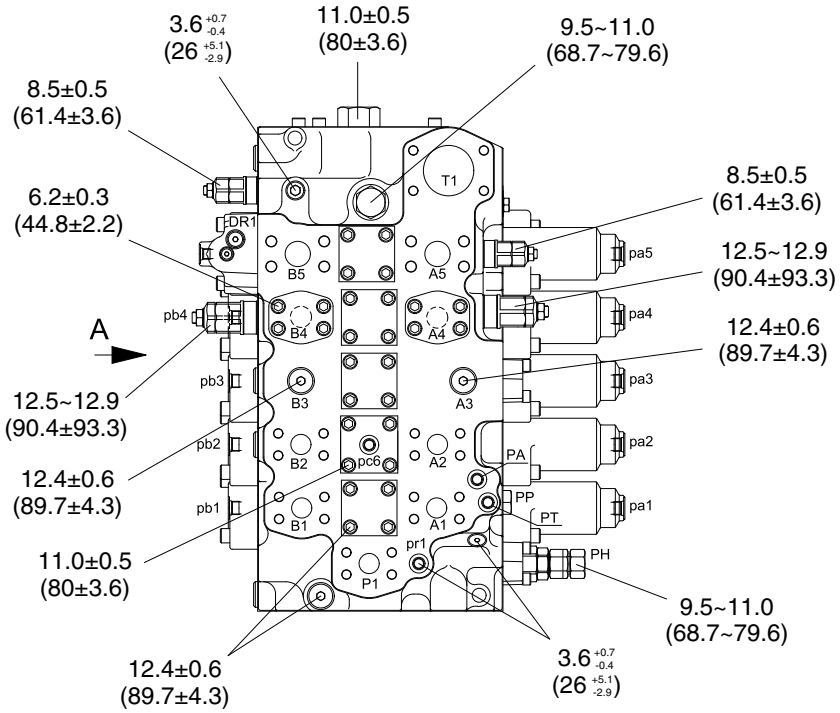


1	Housing	33	Pilot cap-small	50	Spring
3	Travel spool kit	34	Flange	52	O-ring
5	Boom 1 spool kit	35	Flange	53	O-ring
6	Bucket spool kit	37	Poppet	56	O-ring
8	Arm 2 spool kit	38	Poppet	59	Socket bolt
11	Straight travel spool kit	40	Poppet	60	Socket bolt
12	Bypass cut spool kit	42	Poppet	62	Socket bolt
14	Holding valve	43	Poppet	63	Socket bolt
24	Bypass plug	45	Spacer	68	Spring seat
27	Plug	46	Spring	69	Dust cap
29	Plug	47	Spring	70	Dust cap
32	Pilot cap-large	48	Spring	81	Boom 1 logic valve

3. TIGHTENING TORQUE (1/2)

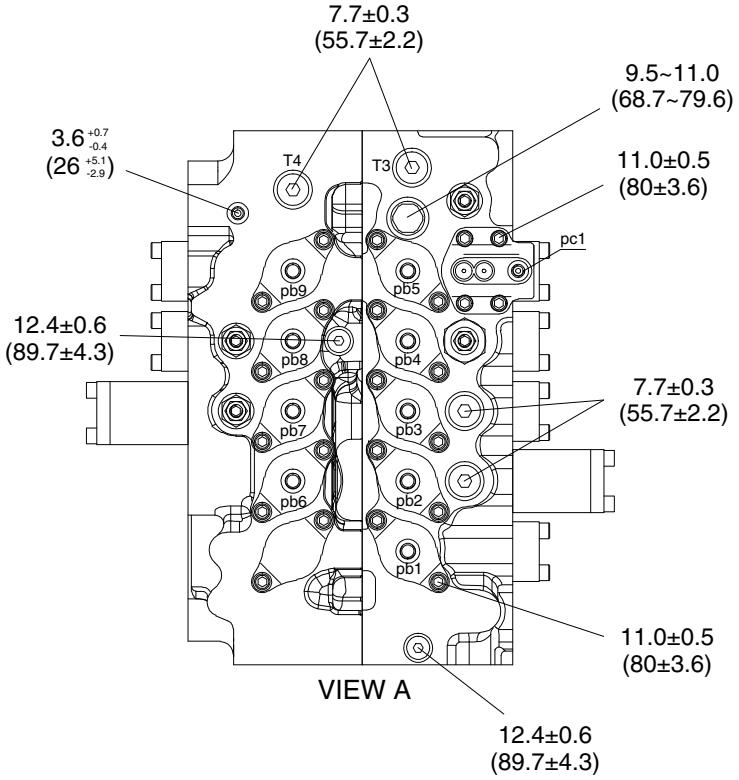
※ Unit : kgf · m (lbf · ft)

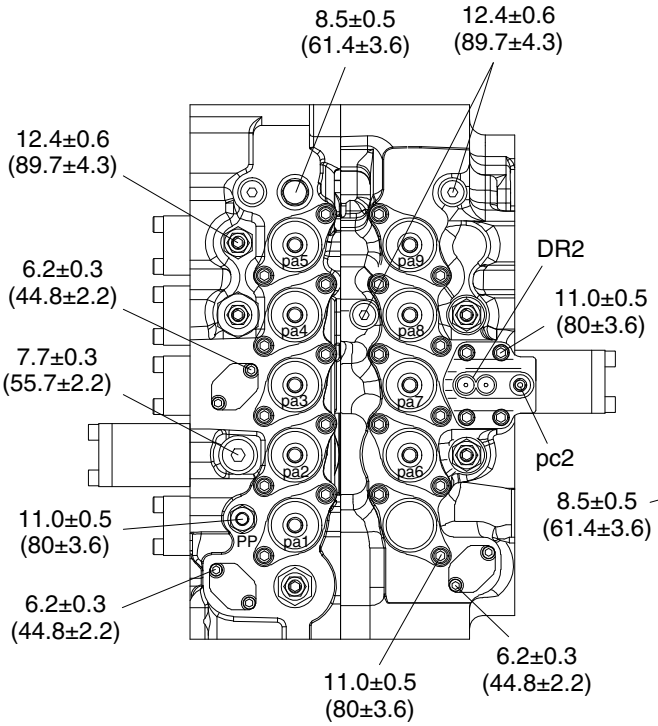


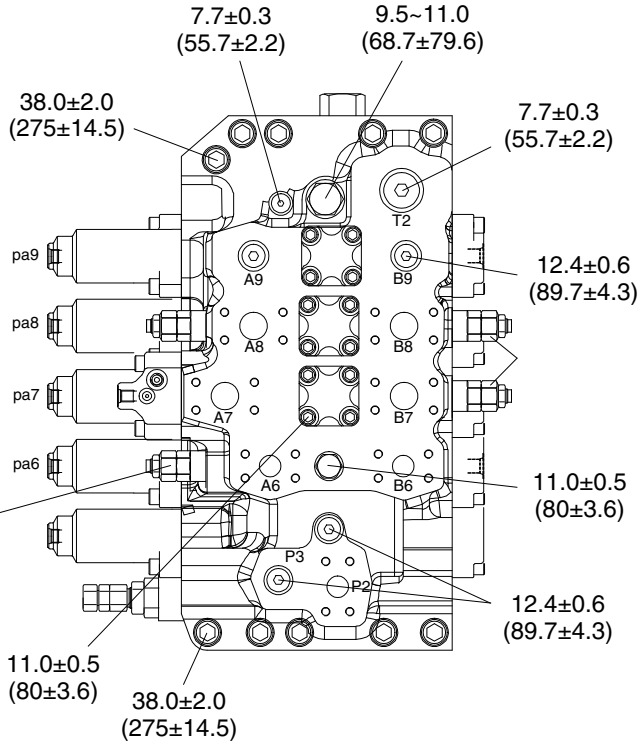


TIGHTENING TORQUE (2/2)

※ Unit : kgf · m (lbf · ft)







4. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but the hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) DISASSEMBLY

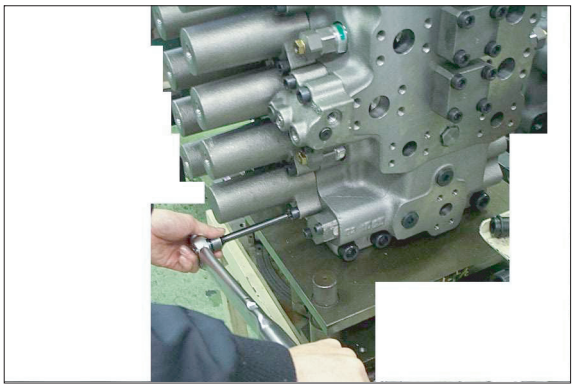
The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures.

(1) Place control valve on working bench

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

(2) Main spool

① Loosen socket head bolts (63) and remove the pilot cap (32).
Pull out O-ring (52) from valve housing.



② Remove all spool (3~11) of subassembly itself from valve housing.

※ Be careful not to be damaged while pulling out spools. Identify them with a tag to prevent from being mistaken at disassembly.

③ Spools sub assy (3, 4, 5, 6, 7, 8, 9, 10, 11).

④ Spool sub assy (5).

⑤ Spool sub assy (4).

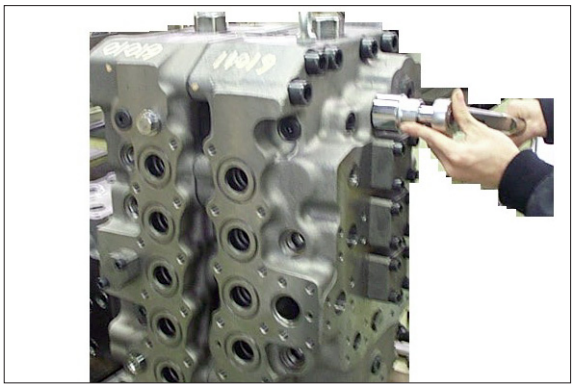
※ When disassemble the spool assembly, fix the spool with vise. On this occasion attach wood between vise blades to prevent the spool from damaging.

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

⑥ Loosen the socket head bolt (63) and remove the small pilot cap (33).
Pull out O-ring (14) from valve housing.

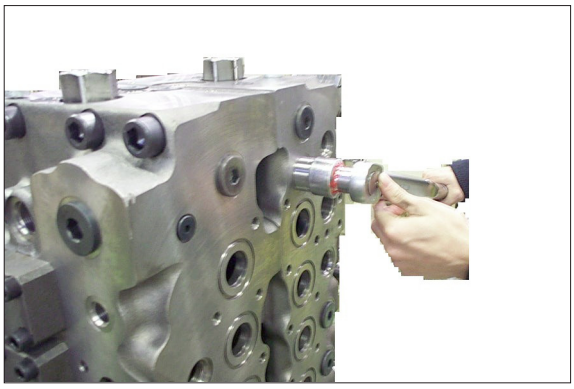
(3) Center bypass cut spool assy (12)

① Loosen the plug (24) and remove spring (46), spring seat (68) and the spool (12).

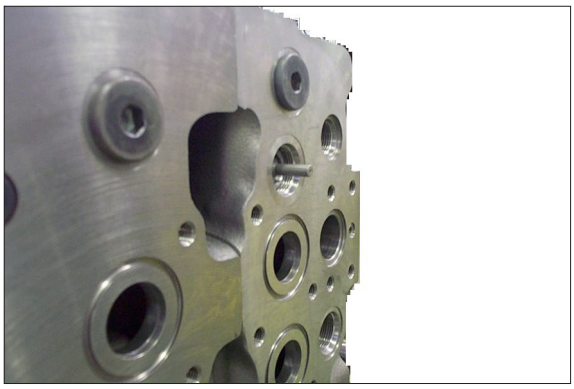


(4) Arm1 regeneration spool assy (15)

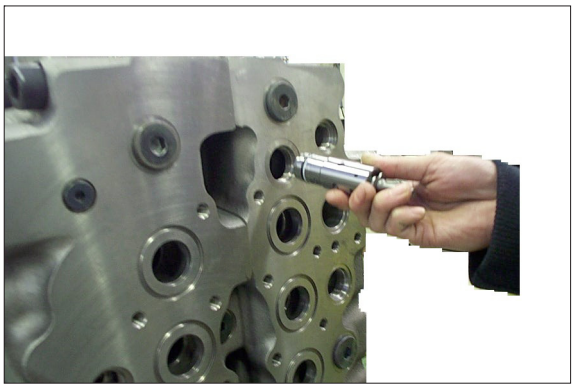
① Loosen the plug and pull out O-ring.



② Disassemble spring, spring seat and spool.



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



(5) General precautions

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

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.

b. Confirm that seal groove faces of casing and block are smooth and free of dust, dent, rust etc.

c. Correct dents and damages and check seat faces within the casing, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the casing.

d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from foreign matter.

e. If any spring is broken or deformed, replace it with new one.

f. When a relief valve does not function properly, repair it, following the prescribed disassembly and assembly procedures.

g. Replace all seals and O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.

b. Confirm manually that main poppet and seat can slide lightly and smoothly.

c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.

d. Confirm that springs are free from breakage, deformation, and wear.

e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.

f. Replace all O-rings with new ones.

g. When any light damage is found in above inspections, correct it by lapping.

h. When any abnormal part is found, replace it with a completely new relief valve assembly.

3) ASSEMBLY

(1) General comments

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures and photographs shown in the previous disassembly section.

② Figure in ( ) shown after the part name in the explanation refers to the reference identity number shown on the construction figure shown in the spares section.

③ Cautions in assembling seal

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

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

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

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

e. Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque as shown on the corss section drawings of the spares section.

(2) Main spool

① Apply loctite to thread of spools (3, 4, 5, 6, 7, 8, 9, 10, 11) and assemble spring seat, spring and spool end. Assemble spool end to spool after fixing spool with a vise attached wood.

※ Be careful not to applying loctite too much.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spools (3, 4, 5, 6, 7, 8, 9, 10, 11) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

② Insert poppet, spring into spool (5) and then apply loctite to thread of spool.

Fit O-ring and backup ring on the plug and then tighten plug.

Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spool (5) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

③ Insert poppet, spring into spool (4) and then apply loctite to thread for spool.

Fit O-ring and backup ring on the plug and then tighten plug.

Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spool (4) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 2.5±2.7 kgf · m (18.1±19.5 lbf · ft)

④ Assemble short cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

(3) Center bypass cut spool assy (12)

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

(4) Arm1 regeneration spool assy (15)

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

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

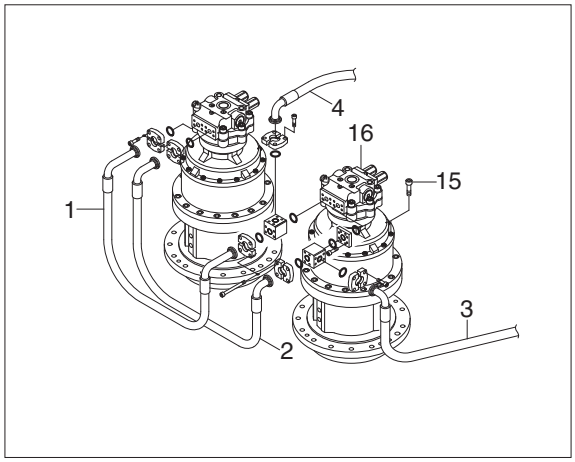
(1) Lower the work equipment to the ground and stop the engine.

(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.



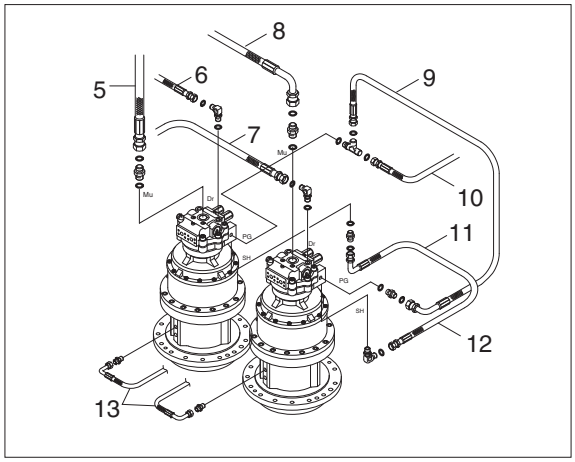
(4) Disconnect hose assembly (1, 2, 3, 4).

(5) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10, 11, 12, 13, 14).

(6) Sling the swing motor assembly (16) and remove the swing motor mounting socket bolts (15).
- Motor device weight : 61 kg (135 lb)
- Tightening torque : 8.27 ± 1.7 kgf·m (59.8 ± 12.3lbf·ft)

(7) Remove the swing motor assembly.

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



2) INSTALL

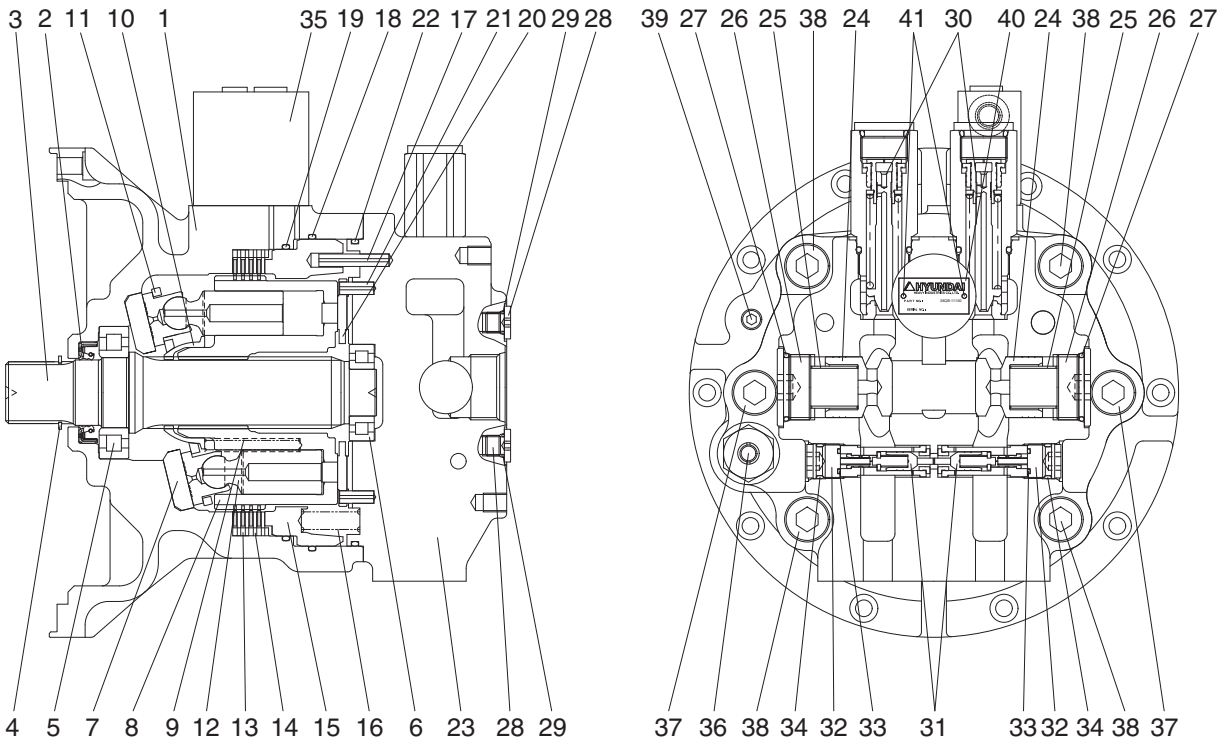
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the swing motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling and check oil come out from plug.
⑤ Tighten plug fully.

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

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



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

2) DISASSEMBLING

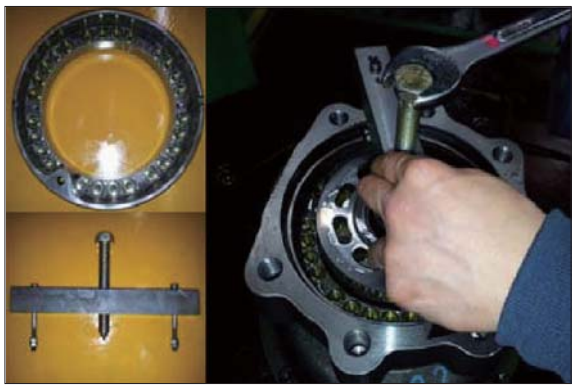
(1) Disassembly the sub of a turning axis

① Unloosing wrench bolt and disassemble time delay valve assy (35) from casing (1).

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

③ Hang buckles on valve casing (23) and unloose the bolt-hex (37, 38) from casing (1).

④ Take springs (16) out of parking piston (15) and disassemble a parking piston (15) from casing (1) using a jig.



⑤ Take cylinder block sub assy (8), friction plates (13), seperated plates (14) out of casing (1) in order.

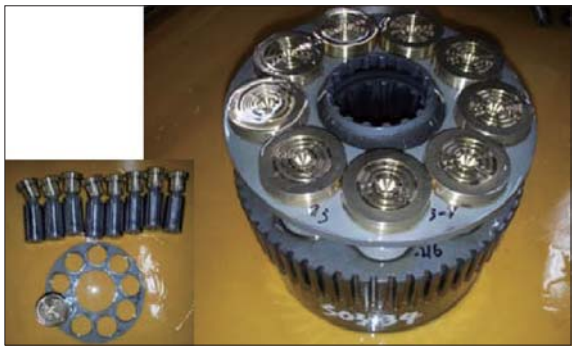
⑥ Disassemble swash plate (7) from casing (1).

⑦ Using a pair of pliers, take snap-ring out of casing (1).

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

(2) Disassemble cylinder block assy

① Disassemble pistion assy (12) from cylinder block assy (8).



② Disassemble ball guide (10) and springs (9) (cylinder block) from cylinder block assy (8).

· Ball guide × 1EA

· Spring × 9EA

(3) Disassemble valve casing assy

① Take pin spring (17, 21), valve plate (20), O-ring (22) out of valve casing (23) in order.

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

③ Disassemble plug (32), O-rings (33, 34) and reactionless valves (31) from valve casing (23) in order with torque wrench.

④ Disassemble plug (26), O-rings (27) and check valve (24) from casing in order with torque wrench.

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

3) ASSEMBLING

(1) Assemble the sub of a shaft assy

① Put bearing-cylinder roller on heating conveyor, inner bearings is being heated around 5 min (Temperature on conveyor : 120˚C, 3~5 min)

② Using robot M/C, heated inner bearing is assembled on shaft with pressure.

(2) Assemble the sub of cylinder block assy

① Put springs (9, cylinder block) on holes of cylinder block.

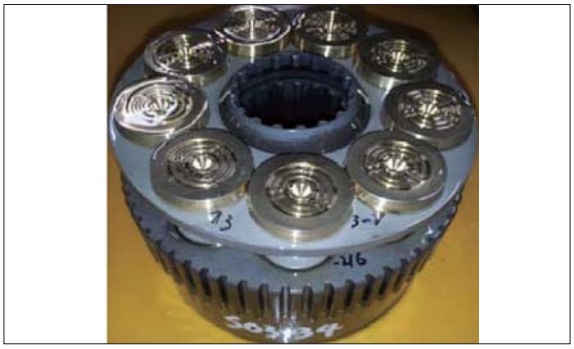
· Spring × 9EA

② Put ball guide (10) on cylinder block (8).

· Ball guide × 1EA

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

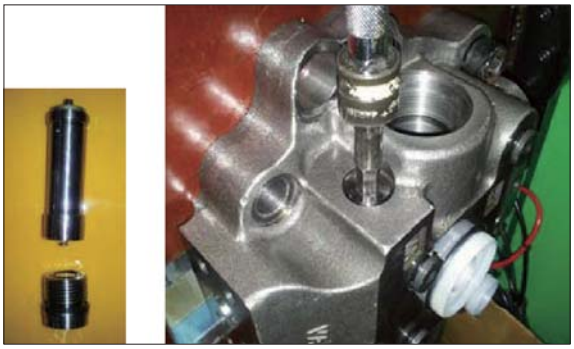
④ Put ② and ③ together as one.



(3) Assemble the sub of valve casing assy

① Assemble the sub of check valve assy.
Assemble check valve (24), spring (25), O-ring (27), and plug (26) into valve casing (23) in order.
- Check valve (24) × 2EA
- Spring (25) × 2EA
- Plug (26) × 2EA
- O-ring (27) × 2EA

② Assemble the sub of reactionless valve assy.
Assemble reactionless valve (31), O-ring (33, 34), and plug (32) into valve casing (23) in order.
- Reactionless valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA

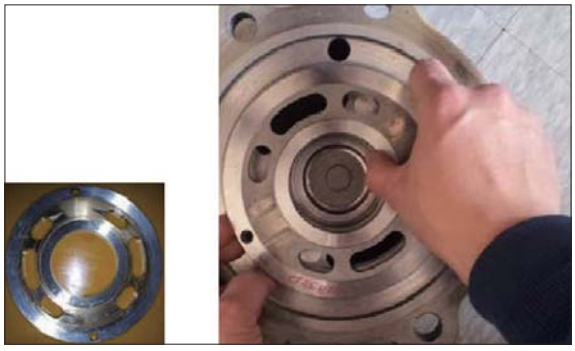


③ Assemble relief valve assy (30) 2set into valve casing (23) with torque wrench (bilateral symmetry assembling).
· Relief valve assy (30)×2EA

④ Assemble plug (28) and O-ring (23) into valve casing with a torque wrench.
· Plug (28)×3EA
· O-ring (27)×3EA

⑤ After assembling needle bearing (6) into valve casing, assemble pin spring (17, 21).
· Needle bearing (6) ×1EA
· Pin spring (17, 21) ×1EA

⑥ After applying grease on valve plate (20), attach it to valve casing (23).
· Valve plate (20) ×1EA



(4) Assemble the sub of moving axis

① Using jig and compressing tool, assemble oil seal into casing.

· Oil seal (2)×1EA

② Insert above shaft sub into casing (1) and assemble it with a jig.

③ Fix snap ring (4) to shaft with a pair of plier jig.

· Snap ring×1EA

④ Apply grease on swash plate (7) and assemble it on the casing.

· Swash plate×1EA

⑤ Put O-ring (18, 19) into a casing.
- O-ring (18) × 1EA
- O-ring (19) × 1EA

⑥ Insert cylinder block assy (8) into casing (1).

⑦ After assemble 4 set of seperated plates (14), friction plate (13) step by step into casing, put parking piston (15) with compressing tool.
- Seperated plate × 4EA
- Friction plate × 4EA
- Parking piston × 1EA

⑧ After putting grease on contact surface of spring, assemble spring (16) into parking piston (15).
- Spring × 26EA

⑨ After hang valve casing (23) on hook, assemble it on casing (1) gently, then , tighten hex bolt (37, 38) tightly.

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

⑪ After assembling time delay valve assy (35) into valve casing (23), tighten hex bolt (42).

· Time delay valve assy × 1EA

· Hex bolt × 3EA

⑫ Air leak test

After putting assembled swing motor into test tank, excute the air leak test for 2 min at 2k.

⑬ Leakage test

After putting assembled motor into bench tester, spraying the color check and be sure of leakage.

⑭ Mount test bench

Mount assembled motor on bench tester, check the availability of each specified tests.

3. REMOVAL AND INSTALL OF REDUCTION GEAR

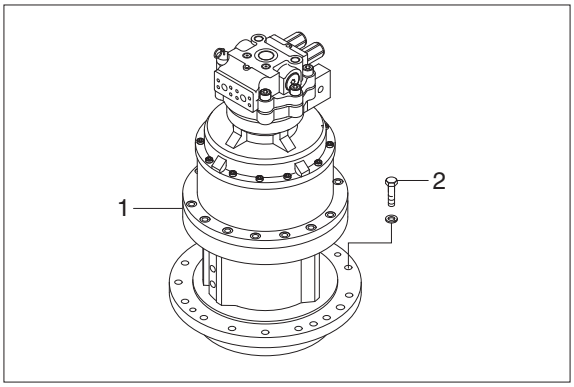
1) REMOVAL

(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 : 180 kgf · m
(396 lbf · ft)

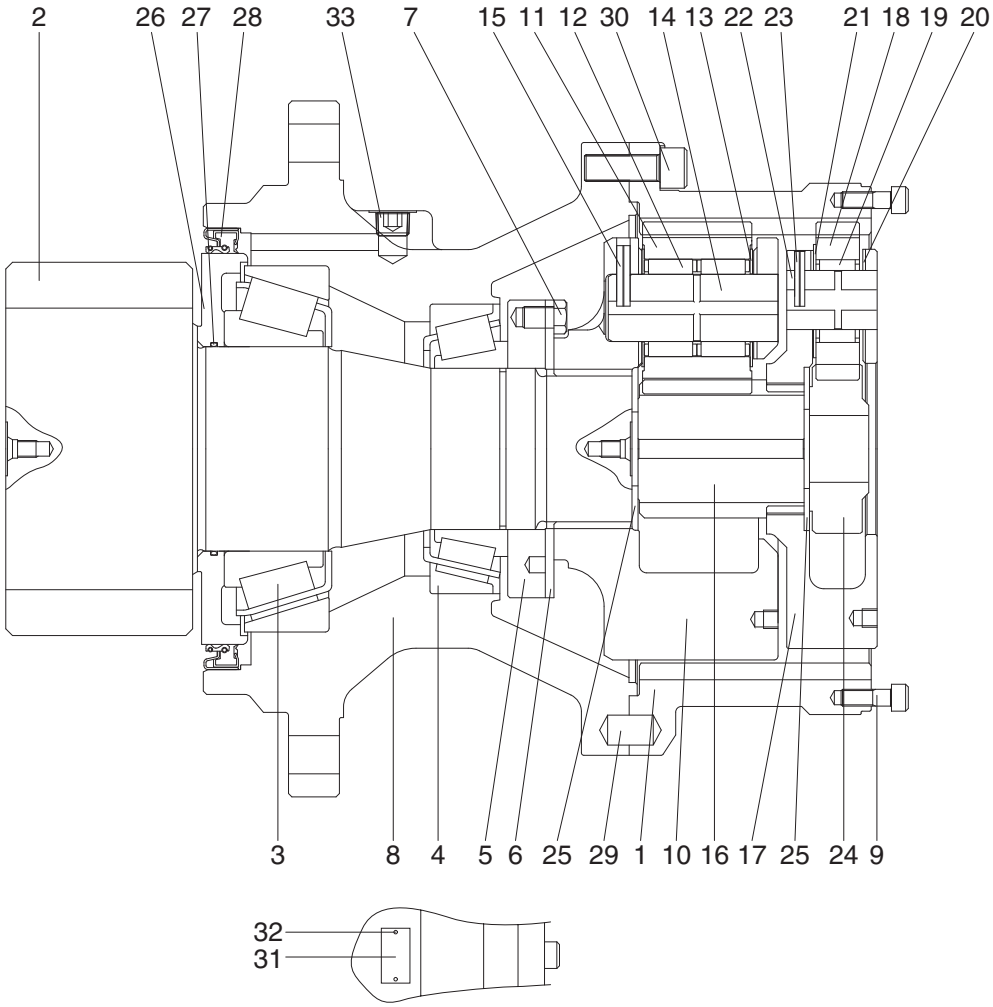
2) INSTALL



(1) Carry out installation in the reverse order to removal.
· Tightening torque : 57.9±8.7 kgf · m
(419±62.9 lbf · ft)

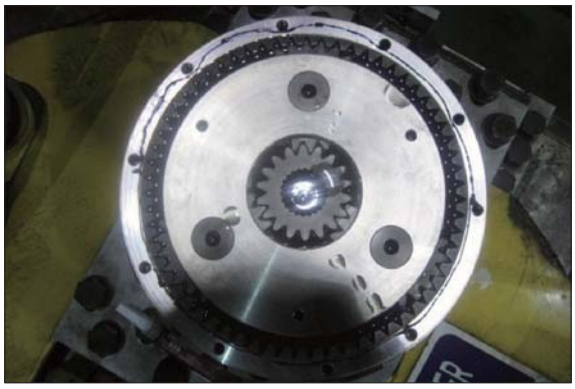
4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



1	Ring gear	12	Needle bearing No. 2	23	Spring pin No. 1
2	Drive shaft	13	Thrust washer No. 2	24	Sun gear No. 1
3	Taper bearing	14	Carrier pin No. 2	25	Thrust plate
4	Taper bearing	15	Spring pin No. 2	26	Sleeve
5	Ring nut	16	Sun gear No. 2	27	O-ring
6	Lock plate	17	Carrier No. 1	28	Oil seal
7	Hexagon head bolt	18	Planetary gear No. 1	29	Parallel pin
8	Casing	19	Needle bearing No. 1	30	Hexagon socket head bolt
9	Hexagon socket head bolt	20	Thrust washer No. 1-upper	31	Name plate
10	Carrier No. 2	21	Thrust washer No. 1-lower	32	Rivet
11	Planetary gear No. 2	22	Carrier pin No. 1	33	Plug

2) PREPARATION FOR DISASSEMBLING



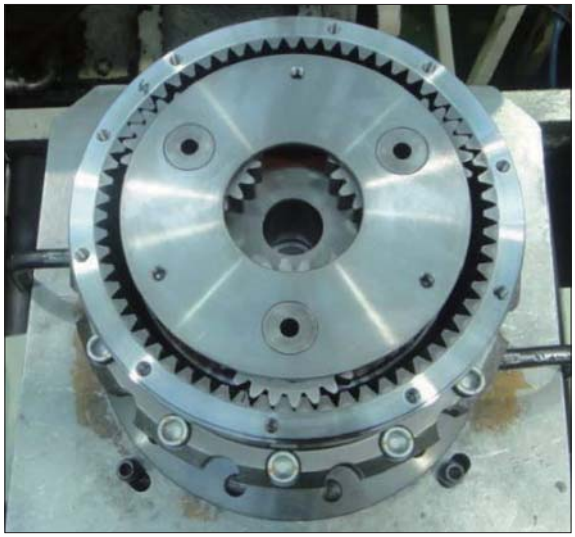
(1) The reduction units removed from excavator are usually covered with mud. Wash out side of unit and dry it.

(2) Setting reduction unit on work stand for disassembling.

(3) Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.

⚠ **Take great care not to pinch your hand between parts while disassembling not left fall parts on your foot while lifting them.**

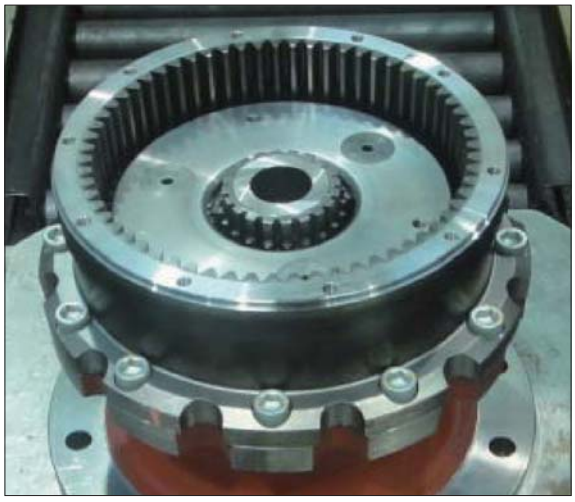
3) DISASSEMBLY



(1) Remove every “socket bolt (M10)” that secure hydraulic motor and reduction gear.

(2) Removing carrier sub assy & sun gear

① Removing No.1 sun gear from No.1 carrier sub assy. (Be sure maintaining it vertical with ground when disassembling No.1 sun gear.)



② Removing No.1 carrier sub assy screwing I-bolt to tab hole (M10) in No.1 carrier. (Lifting it gradually maintaining it vertical with ground.)

※ It’s impossible to disassemble No.1 pin spring. If No.1 pin spring has problem, change whole No.1 carrier sub assy .

③ Removing No.2 sun gear from No.2 carrier sub assy. (Be sure maintaining it vertical with ground when disassembling No.2 sun gear.)

④ Removing No.2 carrier sub assy screwing I-bolt to tab hole (M10) in No.2 carrier. (Lifting it gradually maintaining it vertical with ground.)

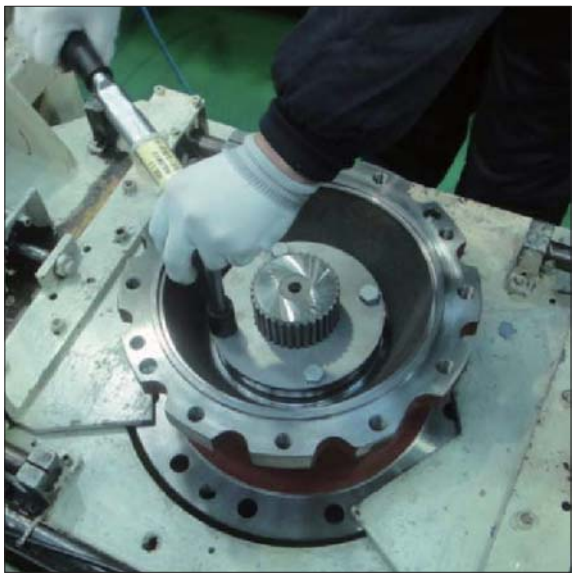
※ It's impossible to disassemble No.2 pin spring. If No.2 pin spring has problem, change whole No.2 carrier sub assy.

(3) Removing ring gear

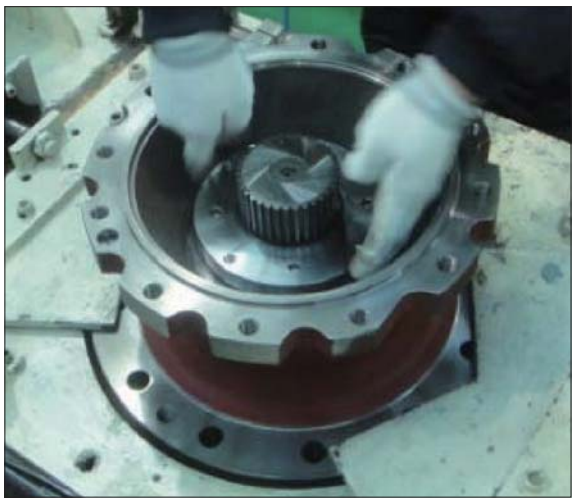
After unscrewing every socket bolt (M16), remove ring gear from casing.
(Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.)

(4) Removing drive shaft sub assy

① Unscrew every hex head bolt (M12) to remove lock plate.



② Rolling nut ring for removing them from drive shaft sub assy.
(Use special tool to roll nut ring to counter clock wise.)



③ Remove drive shaft sub assy from casing.
(Set a rack for flange of casing, and remove drive shaft sub assy from casing by using press.)

④ Remove oil seal & bearing taper (small) from casing.
(Caution, do not re-use oil seal. It is impossible to disassemble drive shaft sub assy.)

4) ASSEMBLY

(1) General notes

① Clean every part by kerosene and dry them in a cool and dry place.

② Loctite on surface must be removed by solvent.

③ Check every part for any abnormal.

④ Each hexagon socket head bolt should be used with loctite #242 applied on its threads.

⑤ Apply gear oil slightly on each part before assembling.

⑥ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

⑦ Inspection before assembling.

⑧ **Thrust washer**

- Check the seizure, abnormal wear or uneven wear.
- Check the unallowable wear.

⑨ **Gears**

- Checnk the pitting or seizure on tooth surface.
- Checnk the cracks on the root of tooth.

⑩ **Bearing**

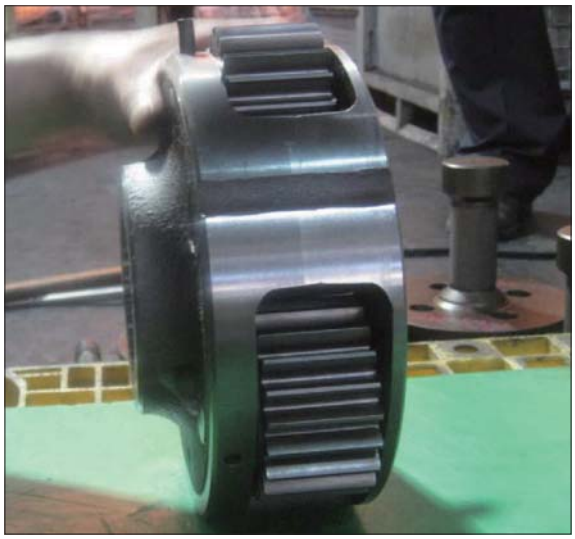
- Rotate it by hands to check such noise or uneven rotation.

(2) Assembling No.1 carrier sub assy

① Put thrust plate firmly in No.1 carrier.

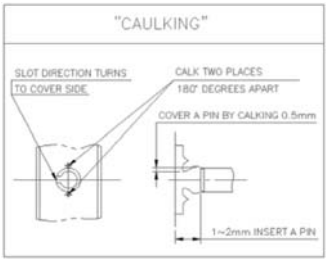
② After assembling No.1 needle bearing to No.1 planetary gear, put a pair of No.1 thrust washer on both sides of bearing and install them to No.1 carrier.

③ Make No.1 pin spring pin hole and No.1 carrier's spring pin hole in line, press No.1 pin spring into the holes.
(Make No.1 pin spring hole head for No.1 planetary gear.)



④ Caulk carrier holes to make No.1 pin spring settle down stably.
(Caution : Refer to “caulking details”)

※ Use paint marker for marking after caulking.



(3) Assembling No.2 carrier sub assy

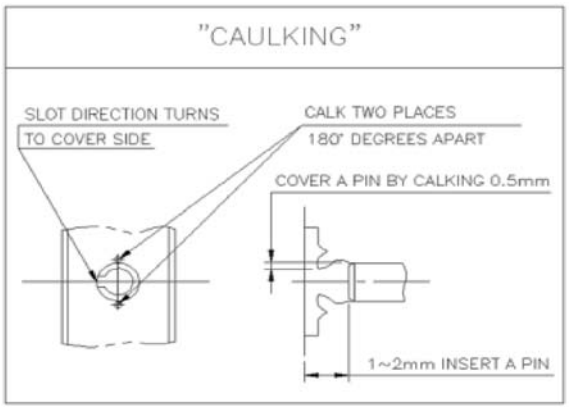
① Put thrust plate in firmly No.2 carrier.

② After assembling No.2 needle bearing to No.2 planetary gear, put 2 pieces of No.2 thrust washer on both sides of bearing and install them to No.2 carrier.

③ Align No.2 pin spring hole and No.2 carrier spring pin hole, put No.2 pin spring into the holes.
(Make No.2 pin spring cutting line face to No.2 planetary gear.)

④ Caulk carrier holes to make No.2 pin spring settle down stably.
(Caution : Refer to “caulking details”)

※ Use paint marker for marking after caulking.

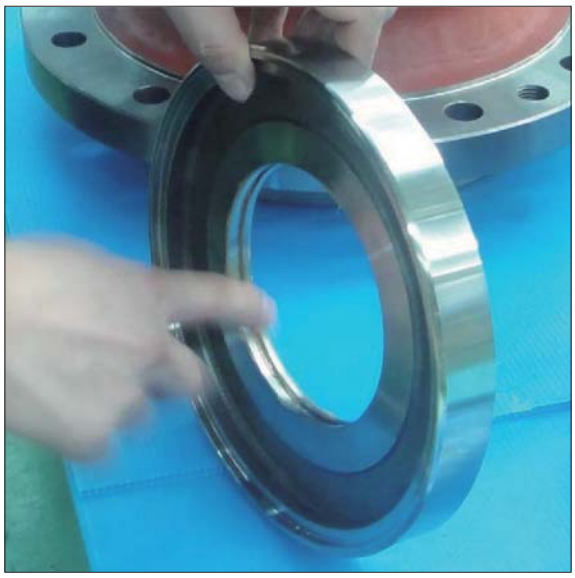


(4) Assembling pinion gear sub assy

① Prepare drive shaft pinion gear vertical with ground.

② Fully apply grease (albania ep02) to sleeve's O-ring gutter.
(Be sure to maintain it vertical with ground when assembling it.)

③ Put O-ring into sleeve's O-ring gutter.
(Fully apply grease on O-ring.)



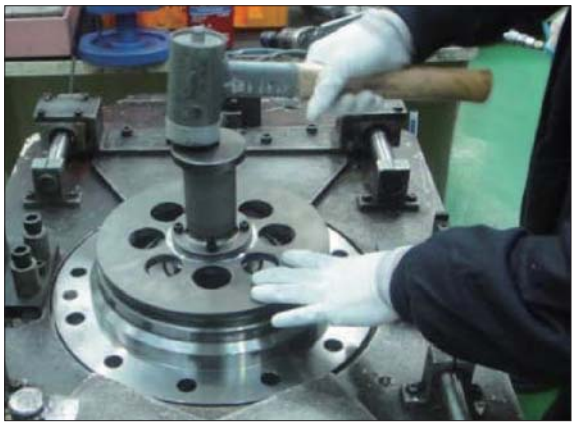
④ Assemble bearing taper and sleeve into drive shaft using press jig.
(Use special jig for pressing. Leave no space between sleeve and bearing taper.)

(5) Assembling bearing cup & oil seal

① Put top, bottom bearing cup into casing. (Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.)

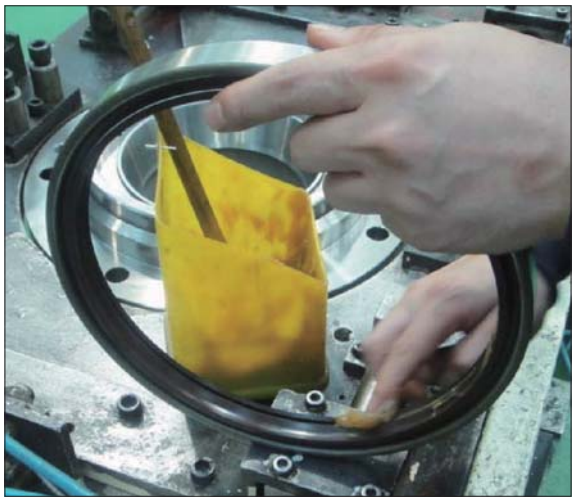
※ Flip over casing to assemble oil seal.

② Assemble oil seal to casing.
(Use special jig for pressing. Pay attention to direction of dust seal and dent.)



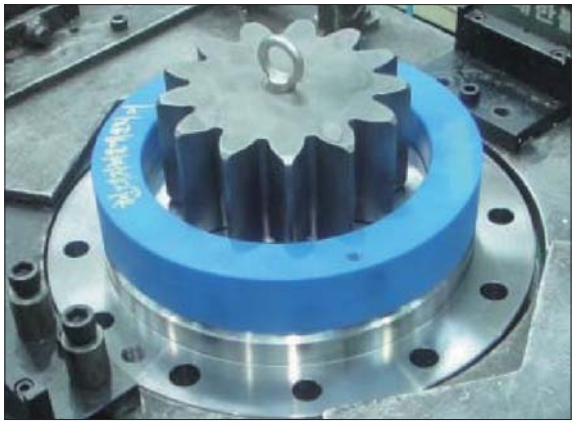
While assembling oil seal

1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease in and outside of oil seal.



(6) Assembling shaft sub assy & nut ring

① After assembling casing & drive shaft sub assy, flip it over.

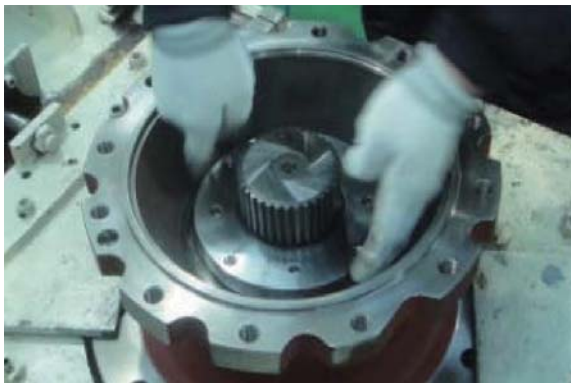


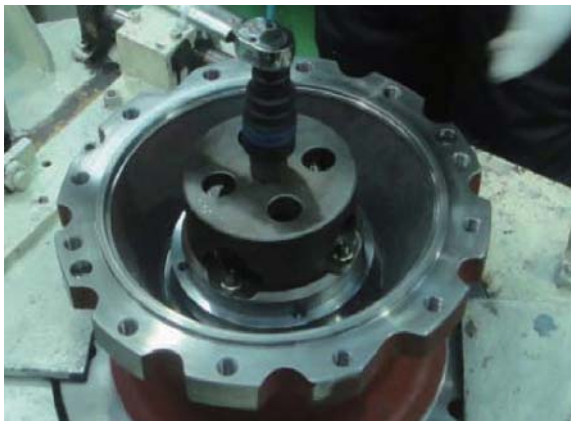
② Put drive shaft sub assy into casing. (Be sure to maintain it vertical with ground when assembling it.)

③ Put bearing taper into it.
(Rotate bearing by hands for checking after assembly.)

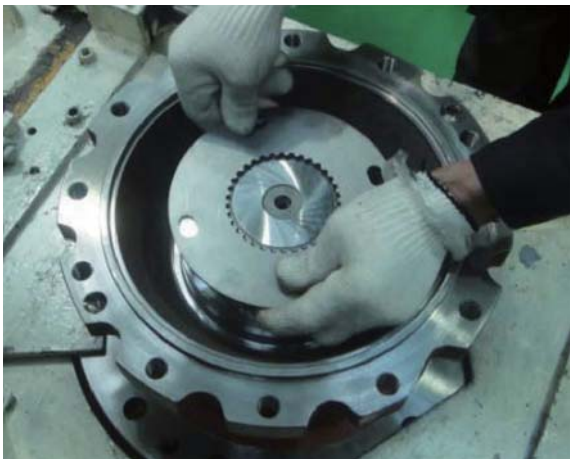
④ Put nut ring into drive shaft sub assy by using special jig.
· M95 / The tightening torque :
3.5±0.4 kgf · m (25.3±2.9 lbf · ft)

※ Apply enough loctite #242 before screwing bolts.





⑤ Align nut ring's bolt screw with lock plate's hole.
(In case of misalign between nut ring's bolt screw and lock plate's hole, put lock plate's hole as near as possible to nut ring's bolt screw and make it in line by increasing tightening torque.)



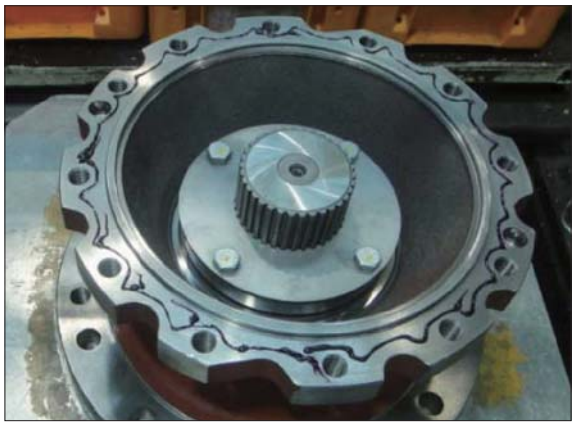
⑥ Screw 4 bolts (M12×16) to connect nut ring and lock plate by using torque wrench.
· 4-M12 / bolt = 12.9T
· The tightening torque :
8.8±0.9 kgf · m (63.7±6.5 lbf · ft)

※ Apply enough loctite #242 before screwing bolts.

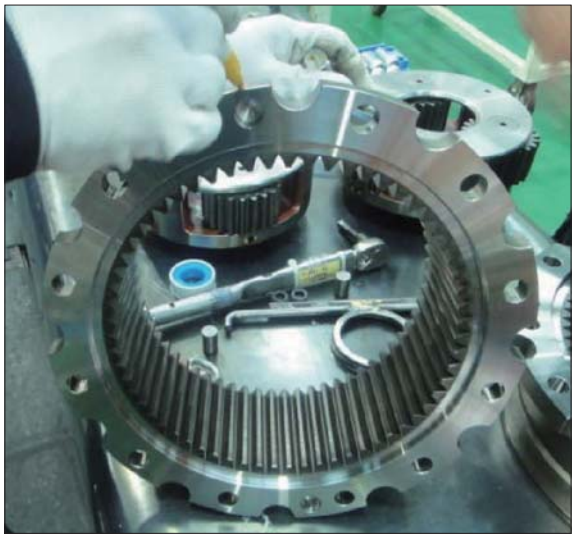
⑦ Use paint marker for checking surplus parts after assembling.

(7) Assembling ring gear

① Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection. (Refer to loctite detail)



② Put pin parallel into casing sub assy hole. (Mark pin parallel position using paint marker.)



③ Align ring gear with pin parallel to put them into casing sub assy.
(Be sure to maintain them vertical with ground while using press.)

④ Screw 12 bolts (M16×45) to connect casing sub assy and ring gear (01) by using torque wrench.

· 12-M16 / bolt : 12.9T

· Tightening torque : 27±2.7 kgf · m (195±19.5 lbf · ft)

※ Apply enough loctite #242 before screwing bolts.

⑤ Use paint marker for checking surplus parts after assembling.

(8) Assembling carrier sub assy & sun gear

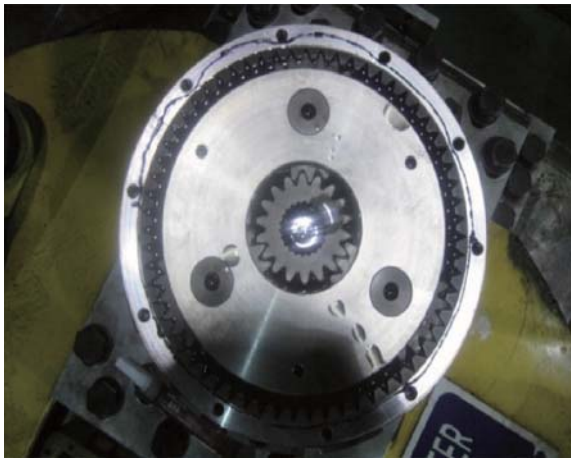
① Put No.2 carrier sub assy along drive shaft's spline.

- Screw M10 I-bolt to No.2 carrier sub assy.
- Lifting up No.2 carrier sub assy and align planetary gear and ring gear's tooth by rotating planetary gear by hands.
- Rotate No.2 carrier sub assy by hands to fit No.2 carrier sub assy into drive shaft spline.

② Put No.2 sun gear into No.2 carrier sub assy.

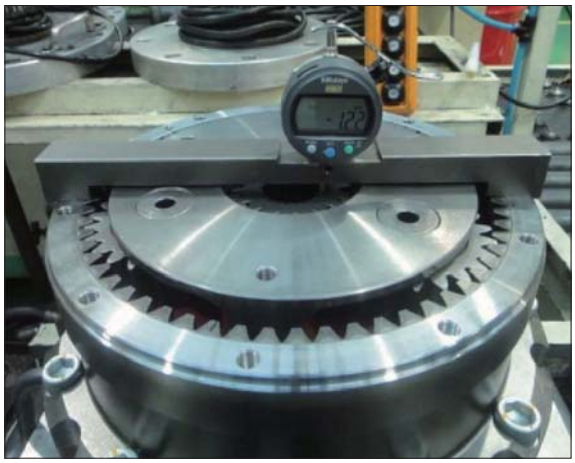
③ Put No.1 carrier sub assy into No.2 sun gear along spline.
- Screw M10 I-bolt to No.1 carrier sub assy.
- Lifting up No.1 carrier sub assy and align planetary gear and ring gear's tooth by rotating planetary gear by hands.
- Rotate No.1 carrier sub assy by hands to fit No.1 carrier into No.2 sun gear spline.

④ Put No.1 sun gear into No.1 carrier sub assy.
(Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.)
⑤ Rotate No.1 carrier sub assy by hands to check noise.



(9) Measuring clearance & assembling name plate

① Check the clearance between ring gear and No.1 sun gear using a tool with dial gauge.
(Check the clearance / Dial gauge = -0.3 ~ +2.95)



1. REMOVAL AND INSTALL

1) REMOVAL

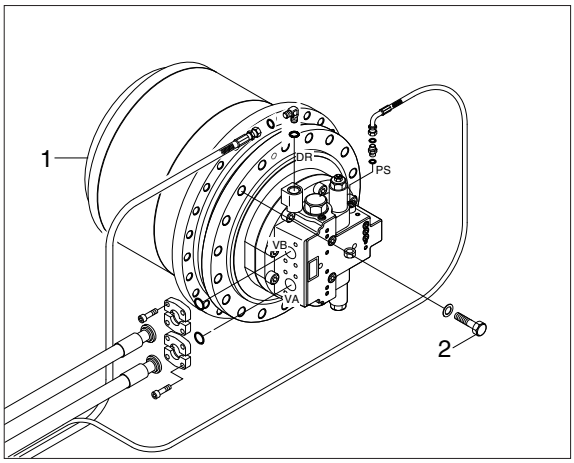
(1) Swing the work equipment 90 °and lower it completely to the ground.

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

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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



(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hoses.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
- Weight : 632 kg (1393 lb)
- Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

2) INSTALL

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

(2) Bleed the air from the travel motor.

① Remove the air vent plug.

② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

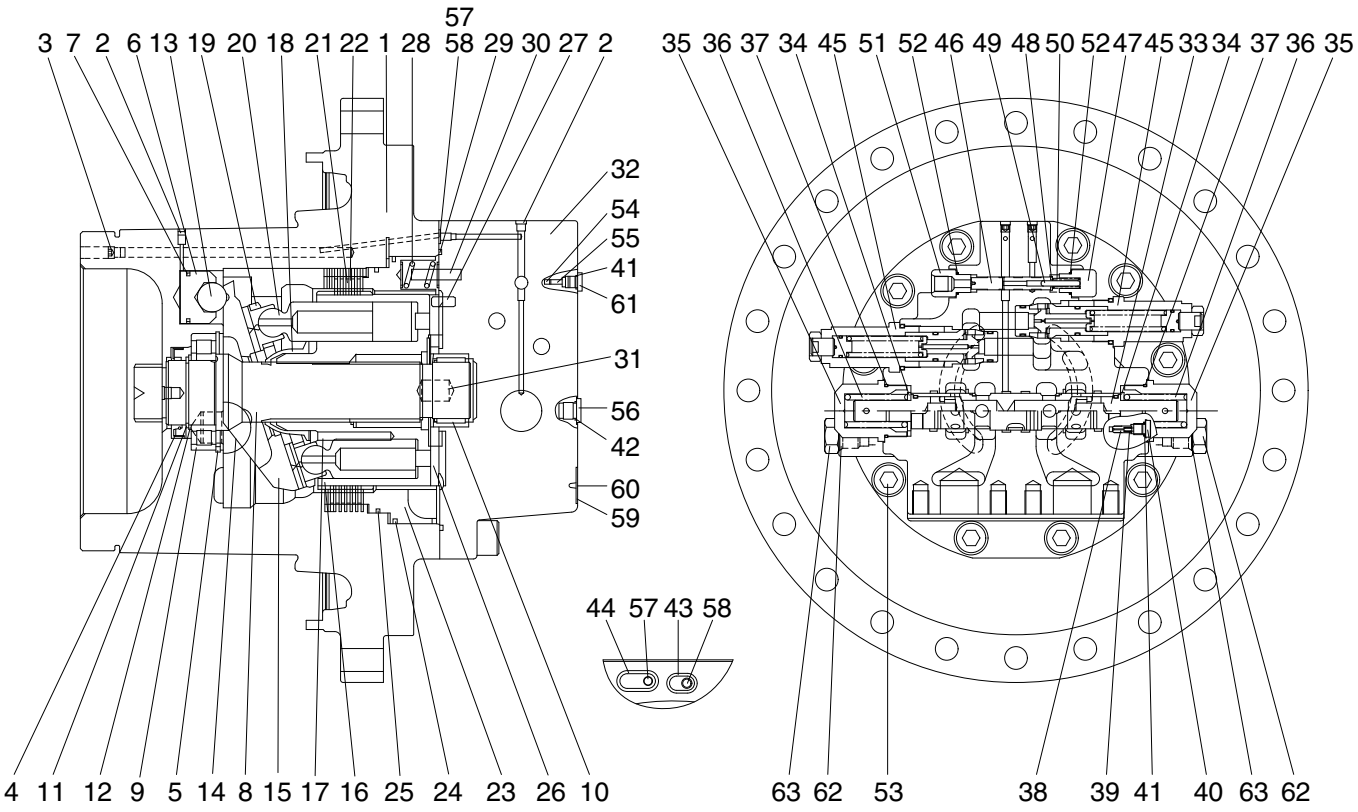
④ Start the engine, run at low idling, and check oil come out from plug.

⑤ Tighten plug fully.

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

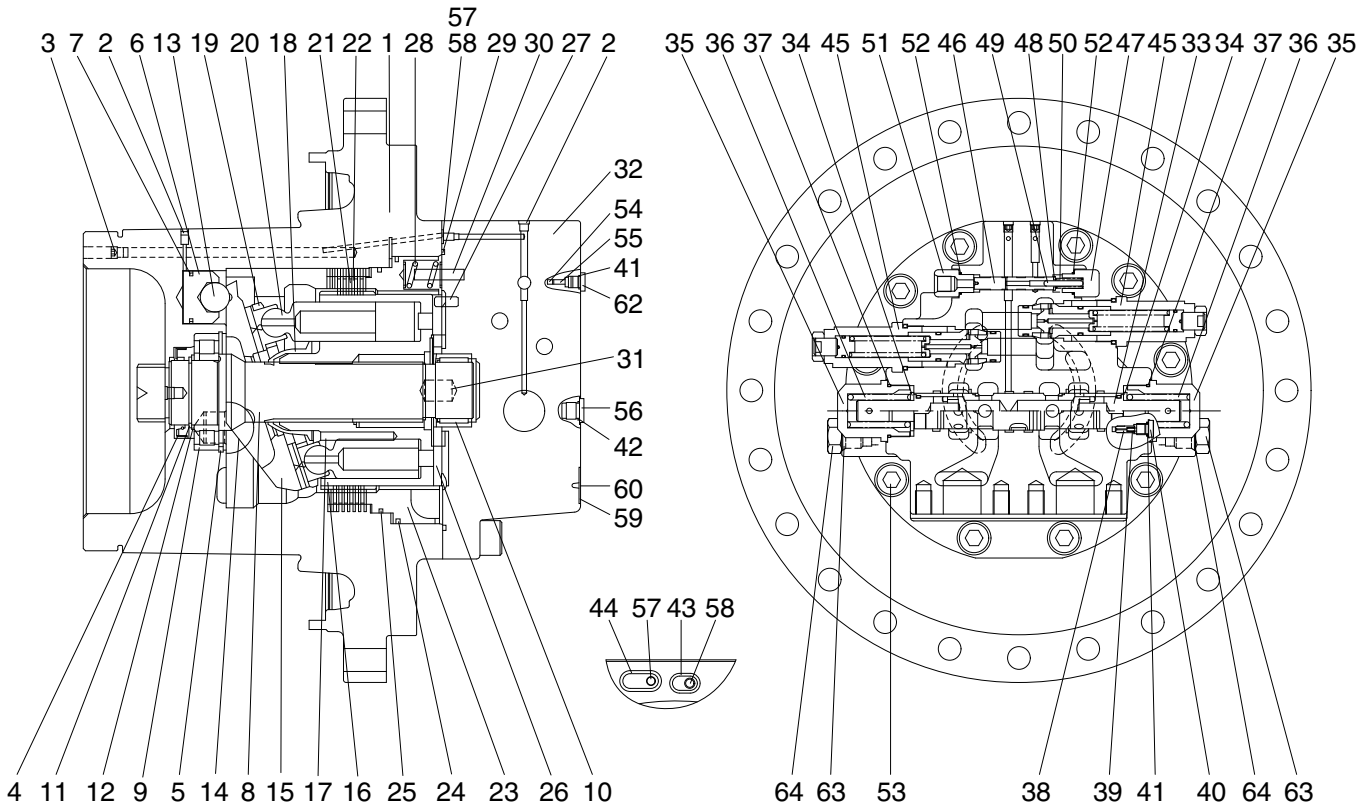
2. TRAVEL MOTOR

1) STRUCTURE (TYPE 1)



1	Casing	22	Separate plate	43	O-ring
2	Plug	23	Parking piston	44	O-ring
3	Plug	24	D-ring	45	Relief valve assy
4	Oil seal	25	D-ring	46	Spool
5	Retainer ring	26	Valve plate	47	Plug
6	Piston	27	Parallel pin	48	Spring seat
7	Piston seal	28	Spring	49	Parallel pin
8	Shaft	29	O-ring	50	Spring
9	Roller bearing	30	Spring pin	51	Connector
10	Needle bearing	31	Parallel pin	52	O-ring
11	Retainer ring	32	Rear cover	53	Hex socket head bolt
12	Thrust plate	33	Main spool kit	54	Check valve
13	Steel ball	34	Spring seat	55	Spring
14	Pivot	35	Plug	56	Plug
15	Swash plate	36	Spring	57	Restrictor
16	Rotary block	37	O-ring	58	Restrictor
17	Spring	38	Restrictor	59	Name plate
18	Ball guide	39	Spring	60	Rivet
19	Retainer plate	40	Plug	61	Plug
20	Piston and shoe	41	O-ring	62	Plug
21	Friction plate	42	O-ring	63	O-ring

STRUCTURE (TYPE 2)



1	Casing	22	Separate plate	43	O-ring
2	Plug	23	Parking piston	44	O-ring
3	Plug	24	D-ring	45	Relief valve assy
4	Oil seal	25	D-ring	46	Spool
5	Retainer ring	26	Valve plate	47	Plug
6	Piston	27	Parallel pin	48	Spring seat
7	Piston seal	28	Spring	49	Parallel pin
8	Shaft	29	O-ring	50	Spring
9	Roller bearing	30	Spring pin	51	Connector
10	Needle bearing	31	Parallel pin	52	O-ring
11	Retainer ring	32	Rear cover	53	Hex socket head bolt
12	Thrust plate	33	Main spool kit	54	Check valve
13	Steel ball	34	Spring seat	55	Spring
14	Pivot	35	Plug	56	Plug
15	Swash plate	36	Spring	57	Restrictor
16	Rotary block	37	O-ring	58	Restrictor
17	Spring	38	Restrictor	59	Name plate
18	Ball guide	39	Spring	60	Rivet
19	Retainer plate	40	Plug	62	Plug
20	Piston and shoe	41	O-ring	63	Plug
21	Friction plate	42	O-ring	64	O-ring

3. DISASSEMBLING OF MOTOR

1) GENERAL PRECAUTIONS

(1) Pay attention to not damaging contact surfaces for O-rings, oil seals, etc. and contact/sliding surfaces for gears, pins, bearings, etc.

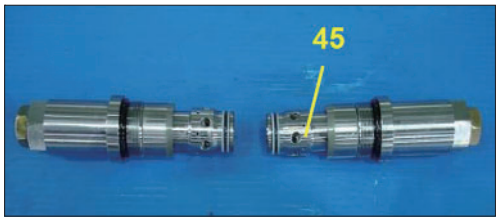
(2) This motor can be disassembled even in a state on the reduction gear.
However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.

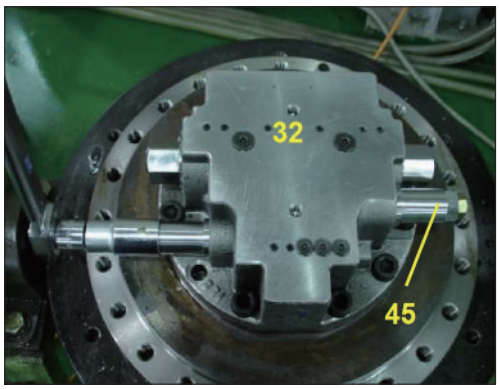
(3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings.**

(4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

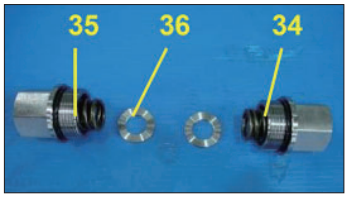
2) DISASSEMBLY OF REDUCTION GEAR

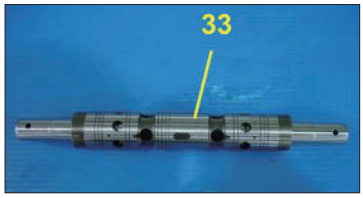
(1) Disassemble relief valve assy (45) from rear cover (32) using spanner and torque wrench.

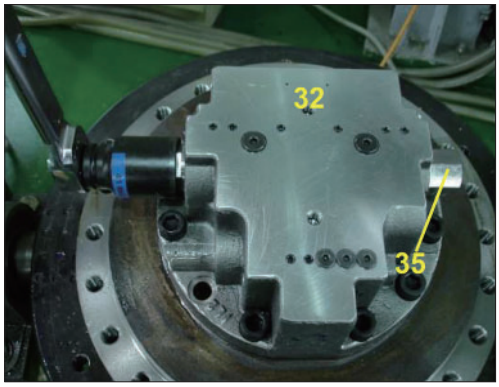




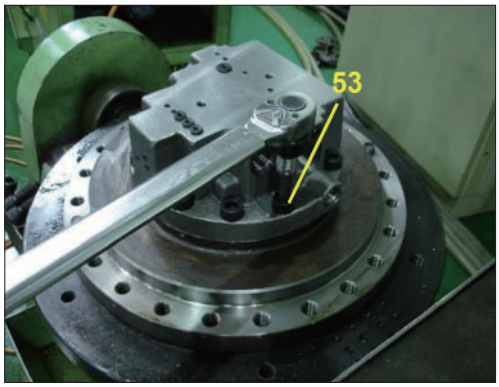
(2) Disassemble plug (35) from rear cover (32) and then disassemble spring (36), spring seat (34), main spool kit (33) in regular sequence.



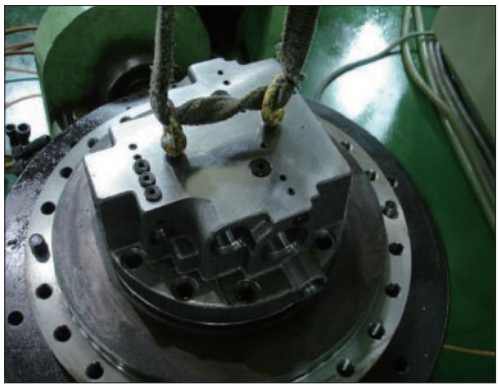




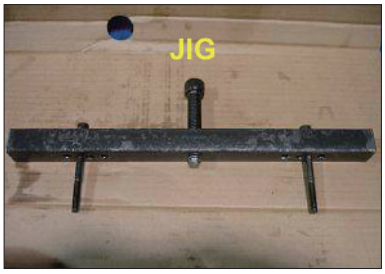
(3) Disassemble socket bolt (53)-10EA using torque wrench.

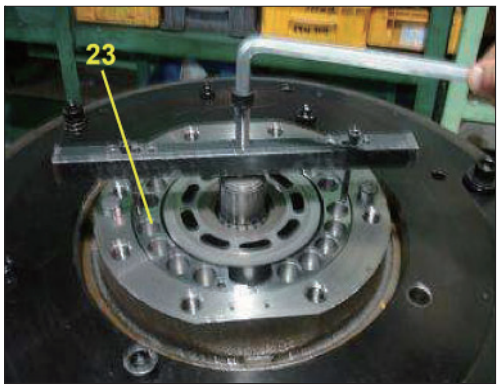


(4) Take out rear cover (32) from casing (1).

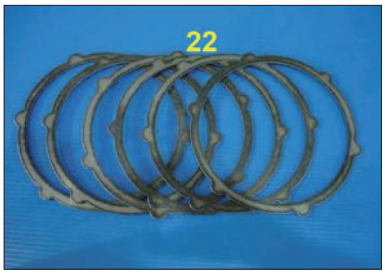


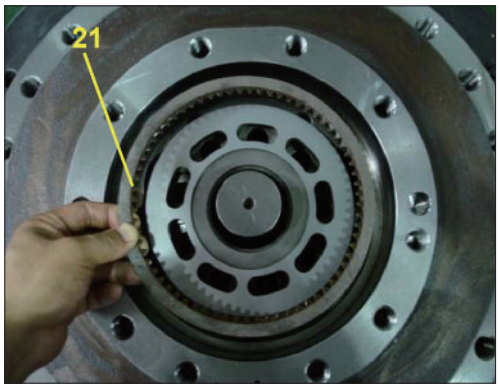
(5) Disassemble parking piston (23) using jig.

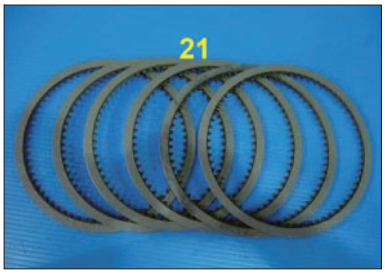


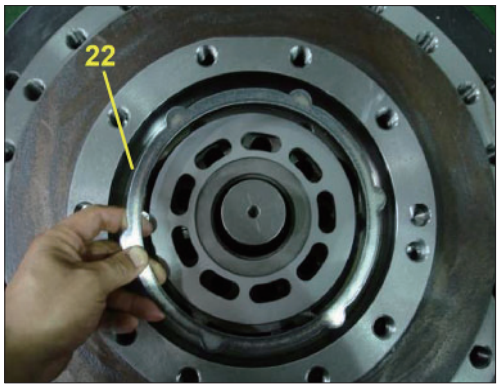


(6) Disassemble separate plate (22)-7EA, friction plate (21)-6EA

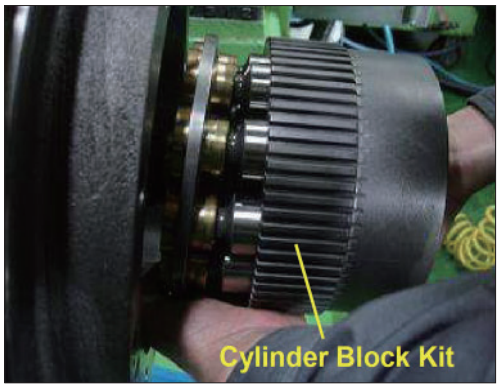




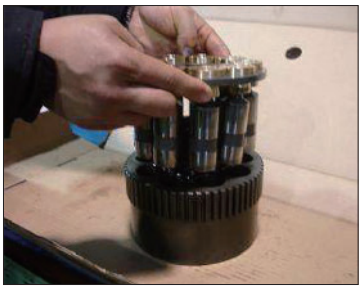


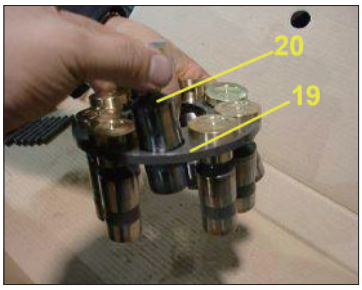


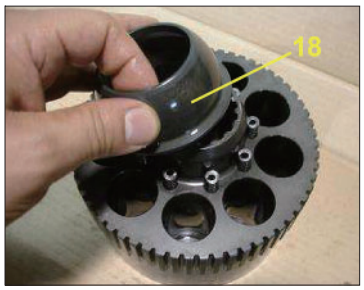
(7) Remove rotary block kit.
It is easier to work by placing the casing (1) horizontal.

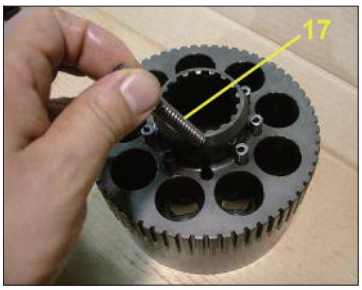


(8) Disassemble rotary block (16), retaner plate (19), piston and shoe (20), ball guide (18), spring (17) from rotary block kit.



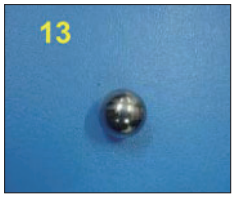


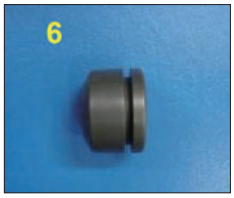




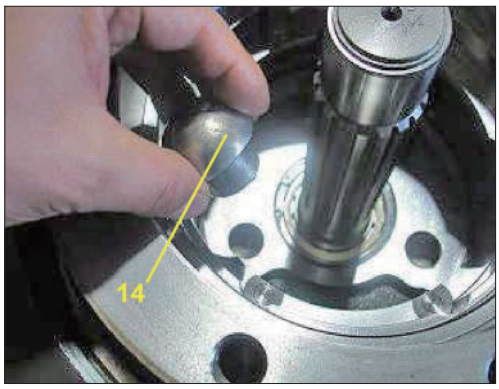
(9) Disassemble swash plate (15) from shaft casing (1).

(10) Disassemble steel ball (13), swash piston (6) Hole in the casing (1) of two speed line is decomposed by injecting oil.

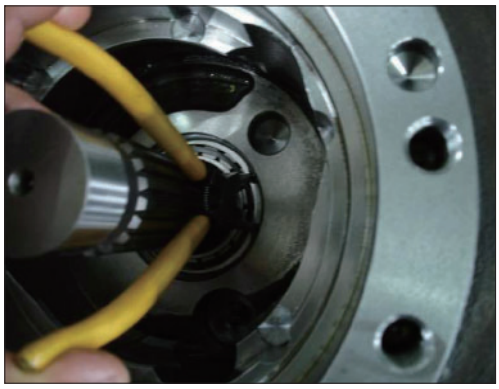




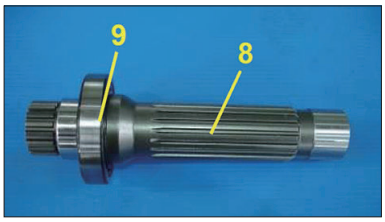
(11) Disassemble pivot (14)-2EA from casing (1).

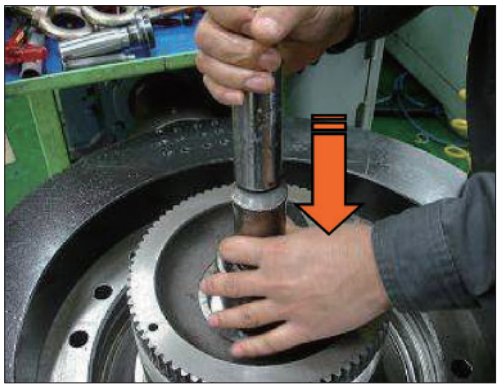


(12) Disassemble retainer ring (5) using pliers.

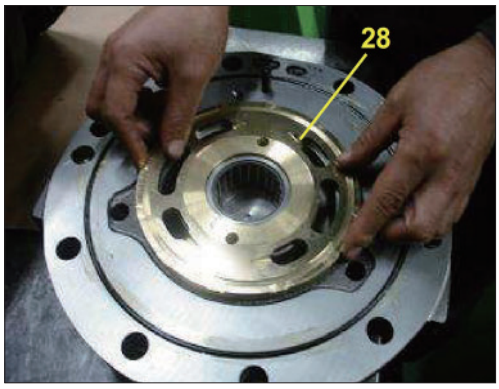


(13) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and roller bearing (9) to the other side.

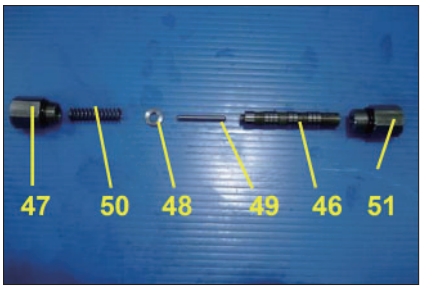


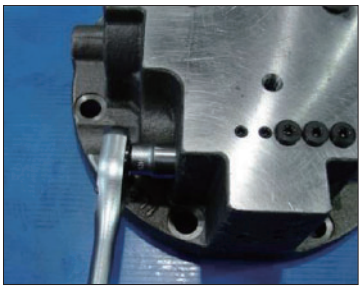


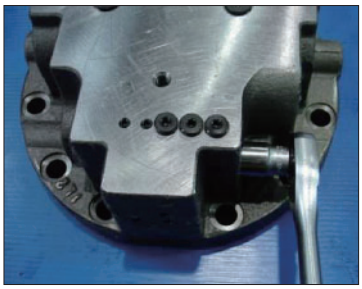
(14) Disassemble valve plate (36) from rear cover (32).



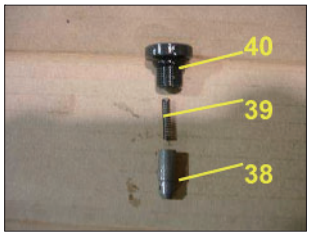
(15) Disassemble plug (47), connector (51) from rear cover (32) and then disassemble spring (50), spring seat (48), parallel pin (49), spool (46) in regular sequence.

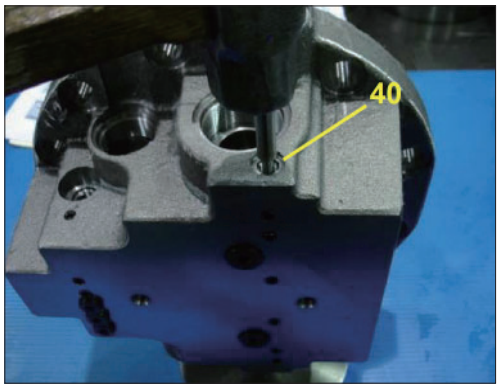




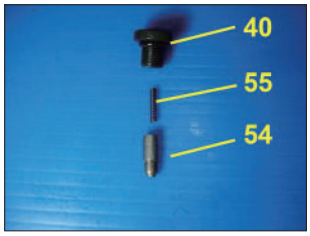


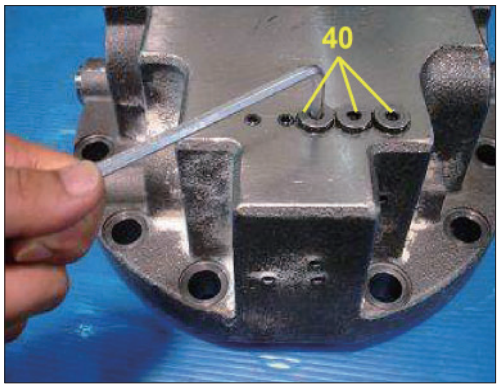
(16) Disassemble plug (40) from rear cover (32) and then disassemble spring (39), restictor (38) from rear cover (34) in regular sequence.



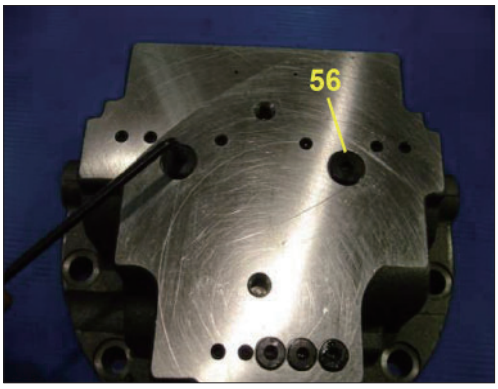


(17) Disassemble plug (40) from rear cover (32) and then disassemble spring (55), check valve (54) from rear cover (32) in regular sequence.





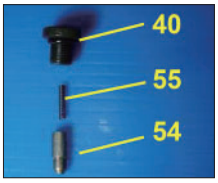
(18) Disassemble plug (56) from rear cover (32).

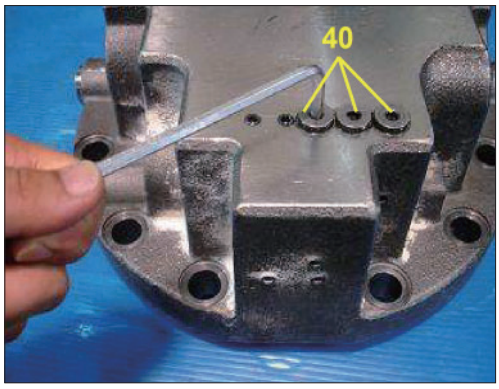


2) ASSEMBLY OF MOTOR

(1) Insert check valve (54), spring (55) into rear cover (32) and then assemble plug (40) using torque wrench.

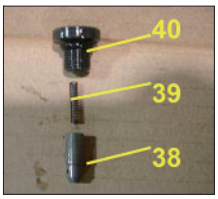
· Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)

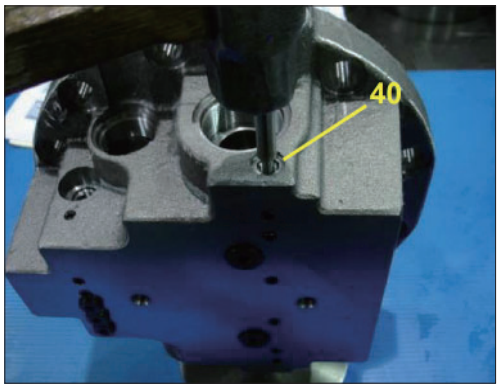




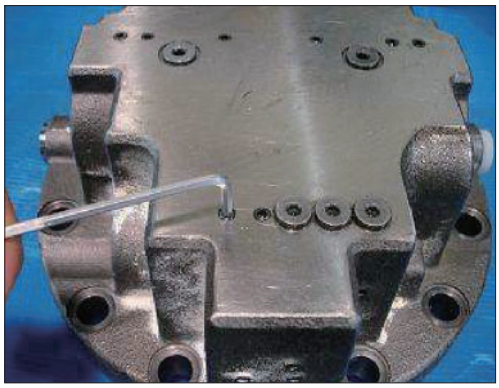
(2) Insert restrictor (38), spring (39) into rear cover (32) and then assemble plug (40) using torque-wrench.

· Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)



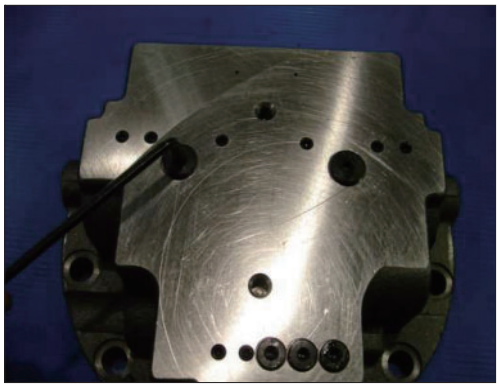


(3) Apply loctitle #242 on the 14-NPTF 1/16 plug (2) and then assemble 14-NPTF 1/16 plug (2) into rear cover (32).

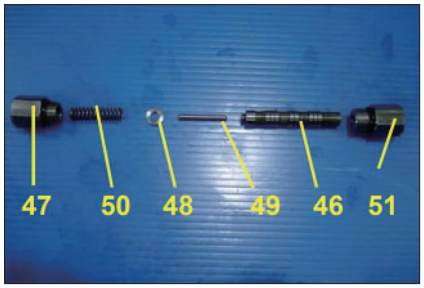


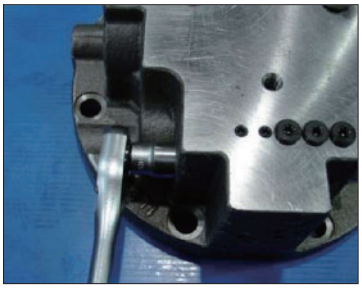
(4) Assemble 2-PF1/4 plug (56, 61) using torque-wrench.

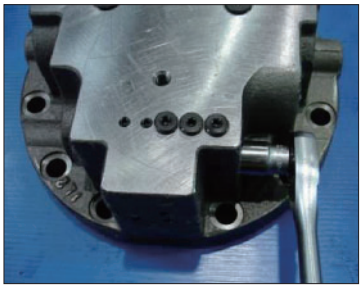
· Tightening torque : 4.5±0.5 kgf · m
(32.5±3.6 lbf · ft)



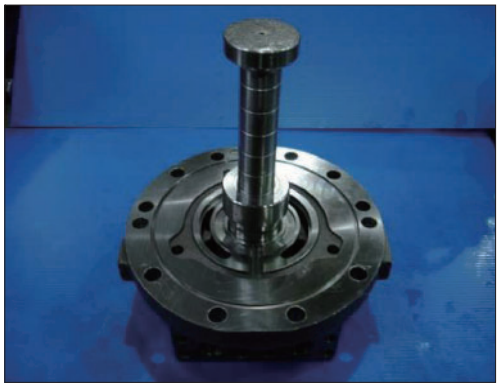
(5) Insert spool (46), parallel pin (49), spring seat (48), spring (50) in regular sequence and then assemble plug (47), connector (51) using torque wrench.
・Tightening torque : 5.5±0.5 kgf・m (40±3.6 lbf・ft)



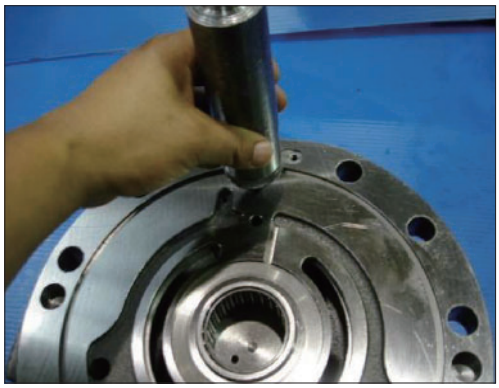




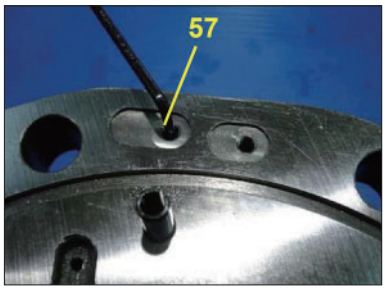
(6) Press needle bearing (10) into rear cover (32) using jig.

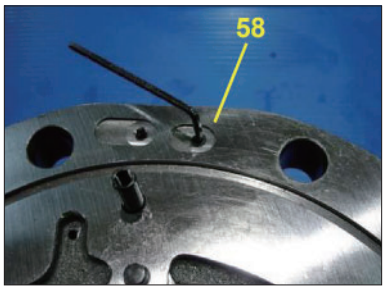


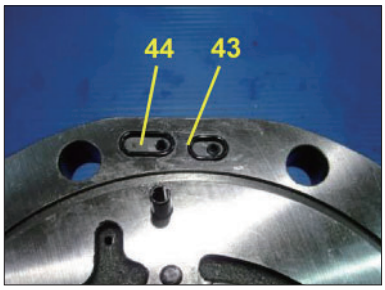
(7) Assemble spring pin (30), parallel pin (27) using small hammer.



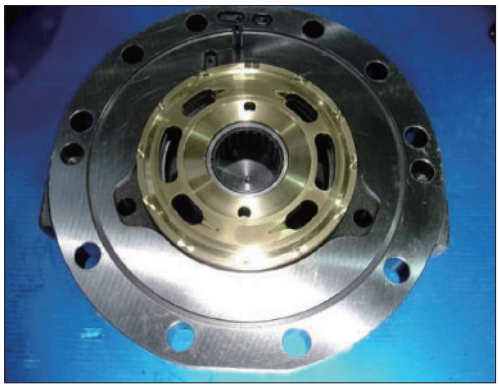
(8) Apply loctitle #242 on the restrictor (57, 58) and then assemble restrictor (57, 58), O-ring (43, 44) into rear cover (32).



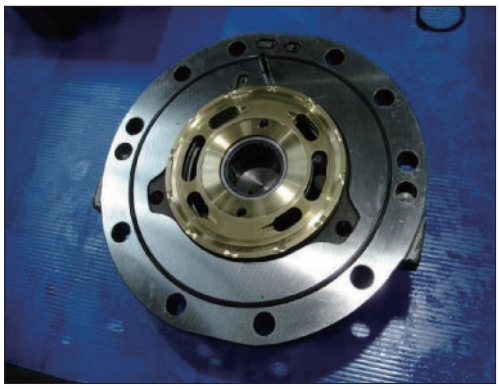




(9) Assemble valve plate (26) into rear cover (32). Apply grease to the valve plate contact and then assemble valve plate into rear cover (32).



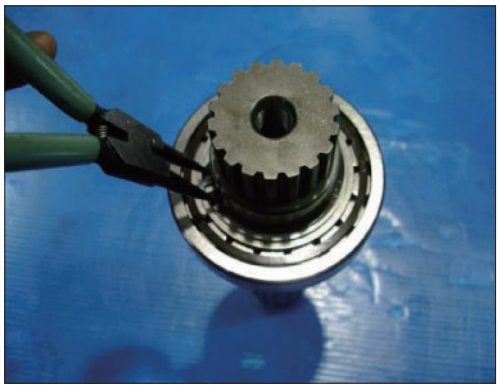
(10) Apply grease to the O-ring (29), and then assemble O-ring into rear cover (32).



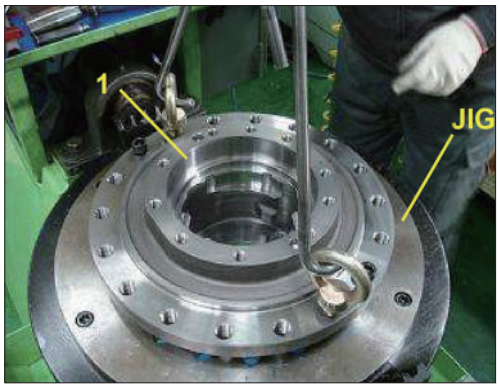
(11) Assemble the heated roller bearing (9) onto the shaft (8) and then assemble retainer ring (5) into shaft (8).

① The temperature of the roller bearing : 100˚C
* Using tool : heater.

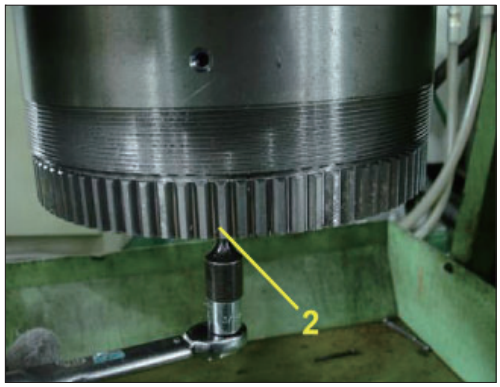
② Be careful not to damage the sliding surface for the oil seal on the shaft.

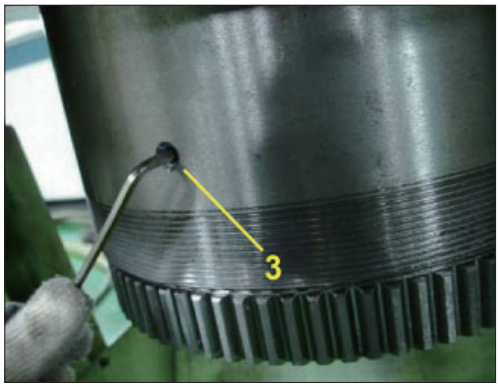


(12) Install casing (1) into assembling jig.

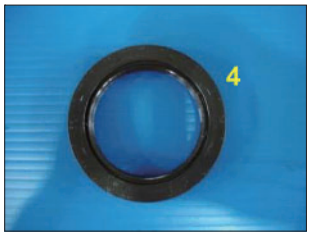


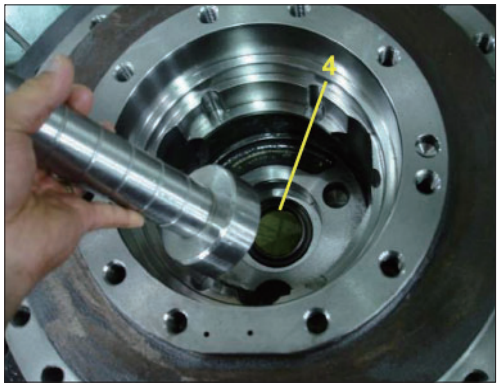
(13) Assemble plug (2), (3) into casing (1).



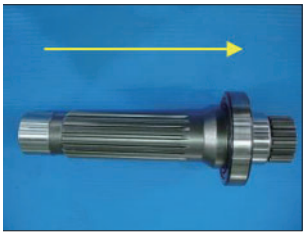


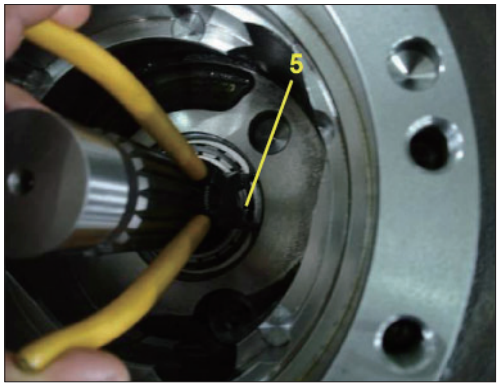
(14) Assemble oil seal (4) into casing (1) with assembling jig.



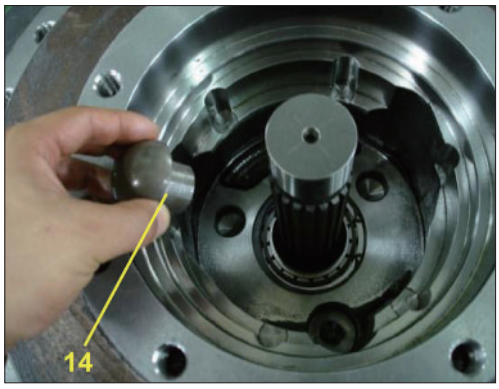


(15) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.

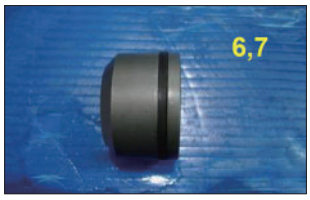


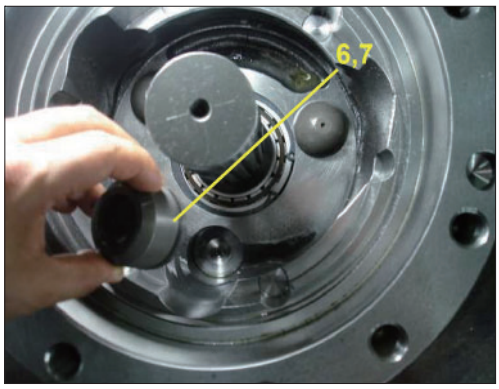


(16) Apply the grease to pivot (14)-2EA and then assemble pivot (14) into casing (1).

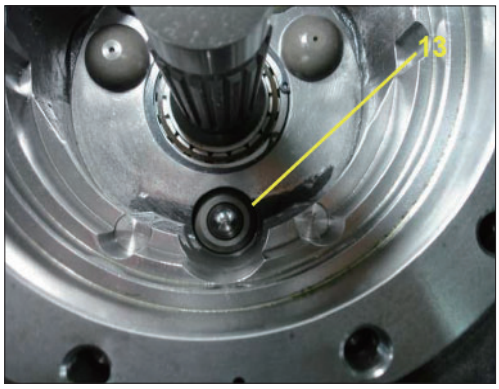


(17) Warm piston seal (7) and assemble it on swash piston (6) and then bind the piston seal (7) with a bend for a minute.
Remove the bend and assemble it into casing (1).

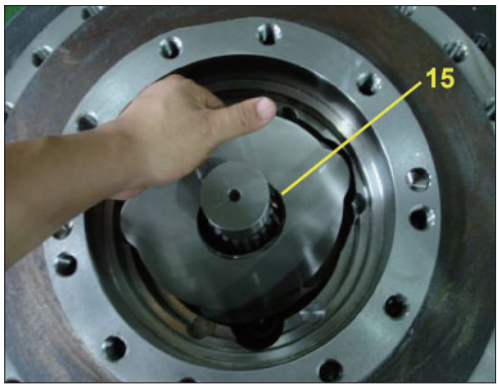




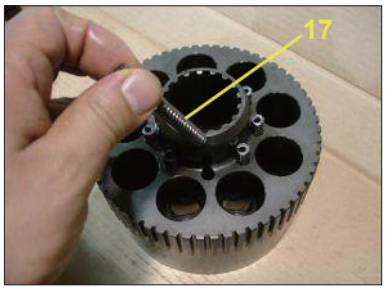
(18) Apply the grease to steel ball (13) and then assemble steel ball (13) into casing (1).

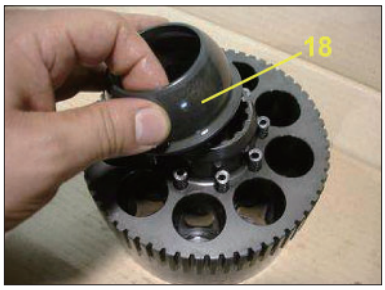


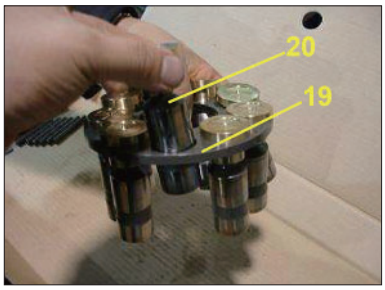
(19) Apply the grease to swash plate (15) and then assemble swash plate (15) into casing (1).

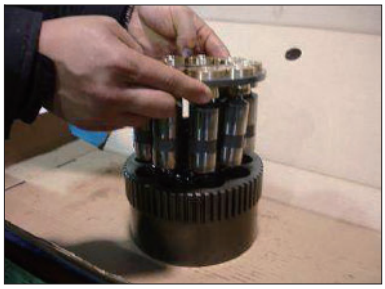


(20) Assemble spring (17), ball guide (18), retainer plate (19), piston and shoe (20) into rotary block (16) in regular sequence.

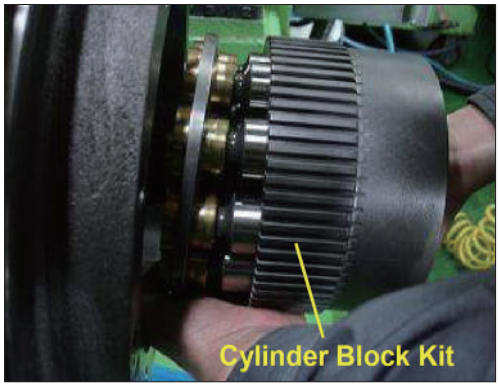




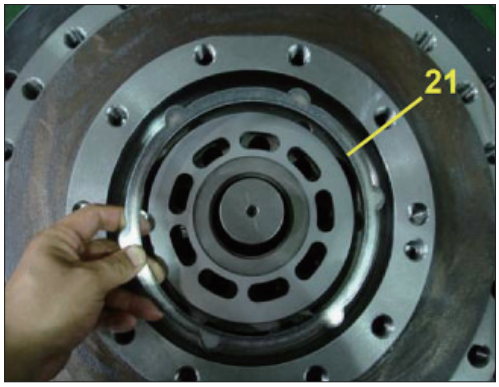


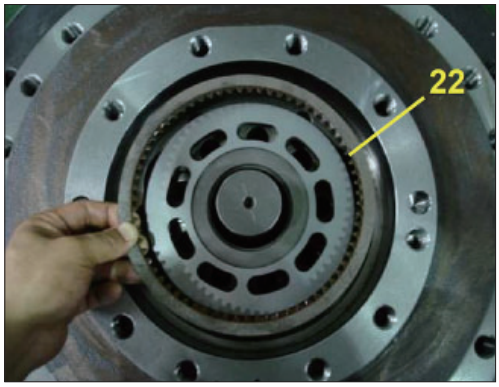


(21) Assemble rotary block kit into casing (1).



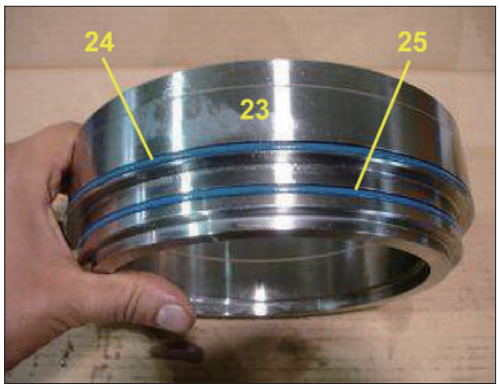
(22) Assemble separate plate (22), friction plate (21) into rotary block in regular sequence.
Friction plate : 6 EA
Separate plate : 7 EA



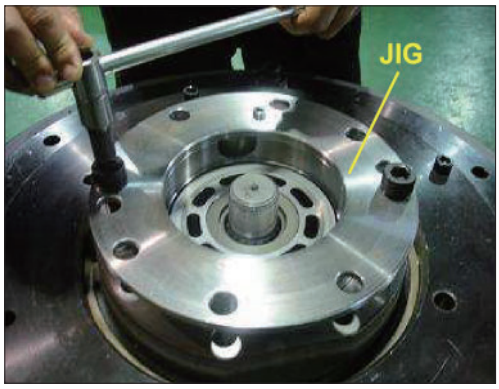


(23) Assemble parallel pin (31) into casing (1).

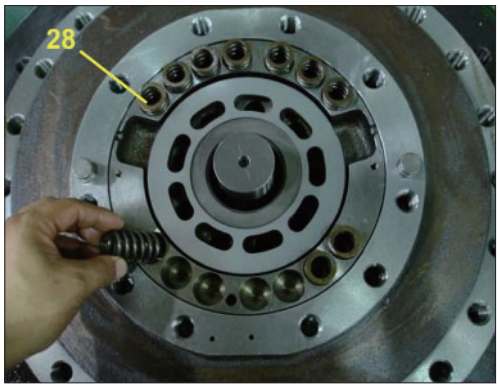
(24) Apply the grease to D-ring (24,25) and then assemble D-ring (24, 25) into parking piston (23)



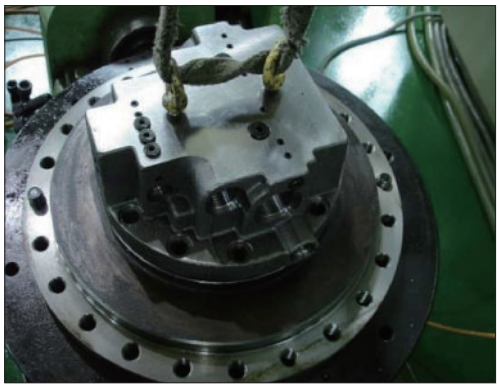
(25) Assemble parking piston (23) into casing using jig.



(26) Assemble parking spring (28)-14EA.

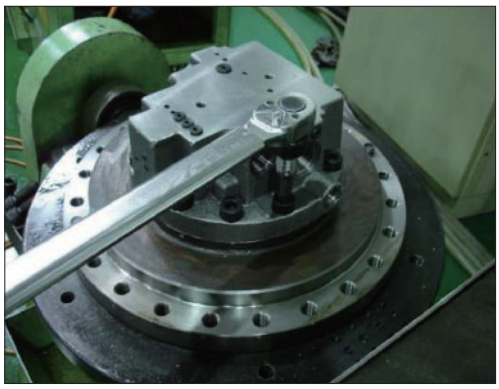


(27) Put on the rear cover (32) on the casing (1).

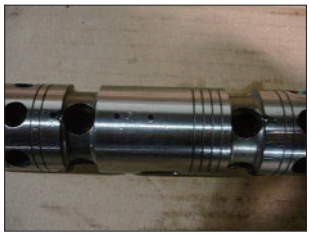


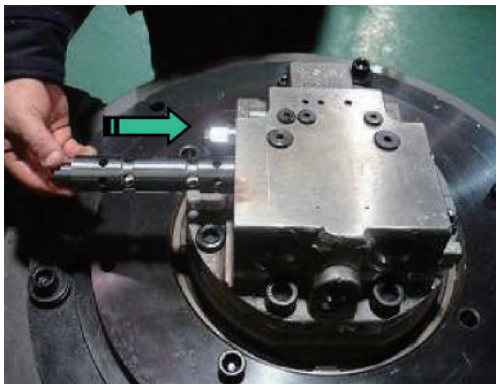
(28) Assemble rear cover (32) into casing (1) and then tighten the socket bolt (53) using torque wrench.

・Tightening torque : 33±3.3 kgf・m
(239±23.9 lbf・ft)



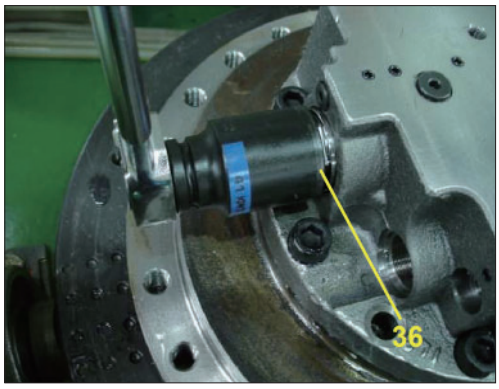
(29) Assemble main spool kit (33) into rear cover (32) after checking the direction to be correct.





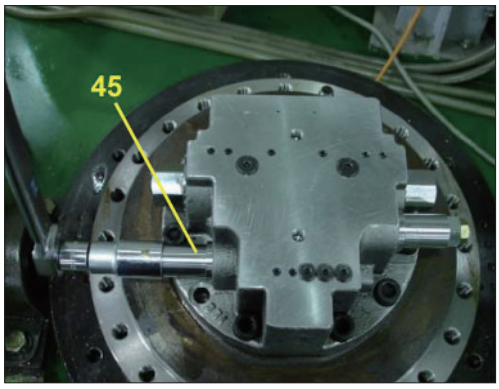
(30) Assemble spring (36), plug (35) into rear cover (32) in regular sequence and then plug (35) into rear cover (32) using torque wrench.

・Tightening torque : 45±4.5 kgf・m (325±32.5 lbf・ft)



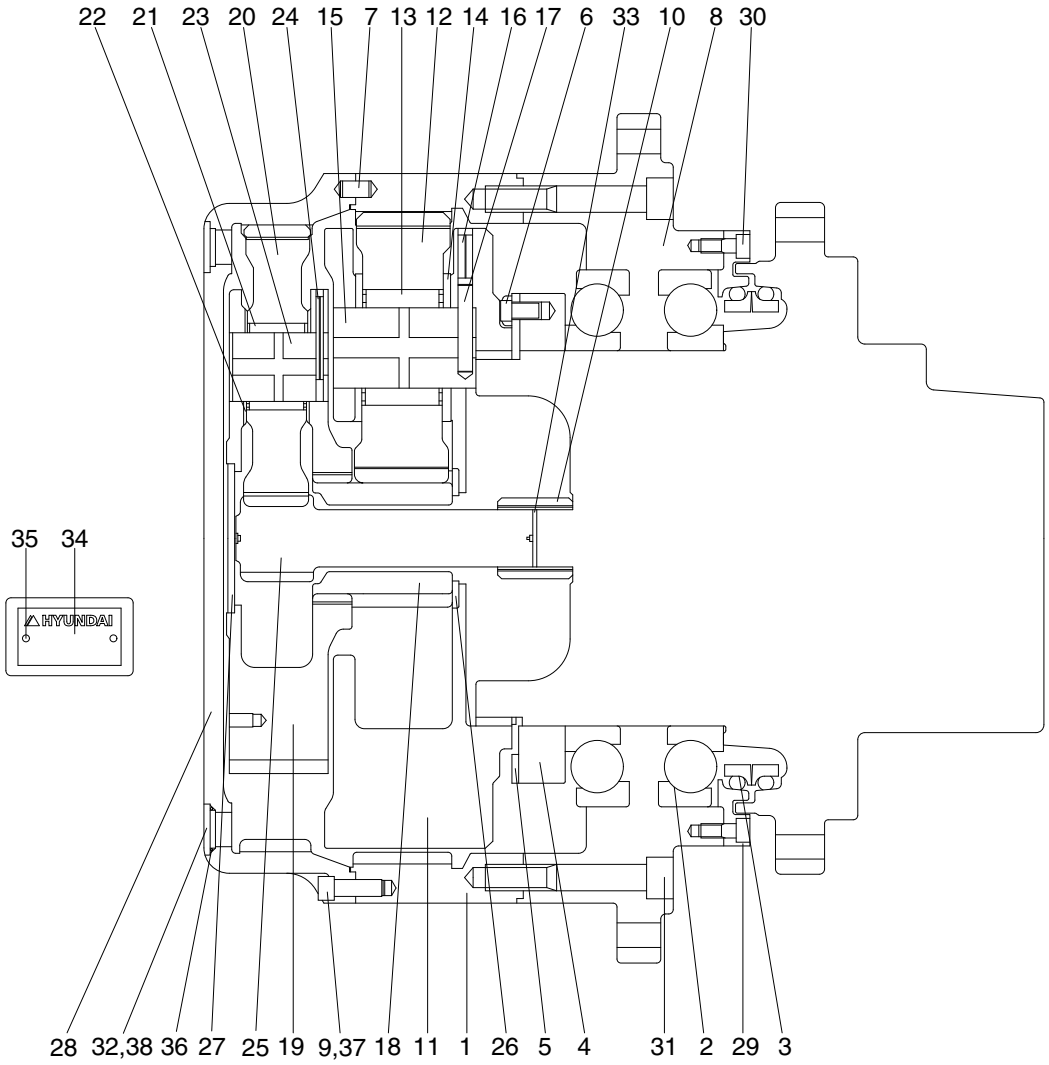
(31) Assemble relief valve assy (45) using torque wrench.

· Tightening torque : 26±2.6 kgf·m
(188±18.8 lbf·ft)



4. TRAVEL REDUCTION GEAR

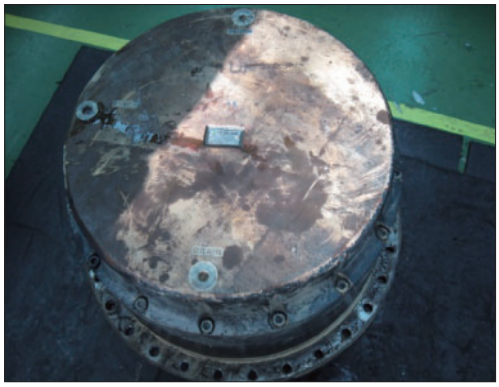
1) STRUCTURE



1	Ring gear	14	Thrust washer	27	Thrust plate
2	Ball bearing	15	Carrier pin No. 2	28	Cover
3	Floating seal assy	16	Spring pin	29	Cover seal
4	Ring nut	17	Solid pin No. 2	30	Hex socket head bolt
5	Lock plate	18	Sun gear No. 2	31	Hex socket head bolt
6	Hexagon head bolt	19	Carrier No. 1	32	Plug
7	Parallel pin	20	Planetary gear No. 1	33	Retainer ring
8	Housing	21	Needle bearing	34	Name plate
9	Hexagon socket head bolt	22	Thrust washer	35	Rivet
10	Coupling	23	Carrier pin No. 1	36	O-ring
11	Carrier No. 2	24	Spring pin	37	Rubber cap
12	Planetary gear No. 2	25	Sun gear No. 1	38	Rubber cap
13	Needle bearing	26	Thrust plate		

5. DISASSEMBLY OF REDUCTION GEAR

1) READY FOR DISASSEMBLING



(1) Reduction gear removed from machine usually covered with dirt, so clean it with cleaning liquid and dry it.

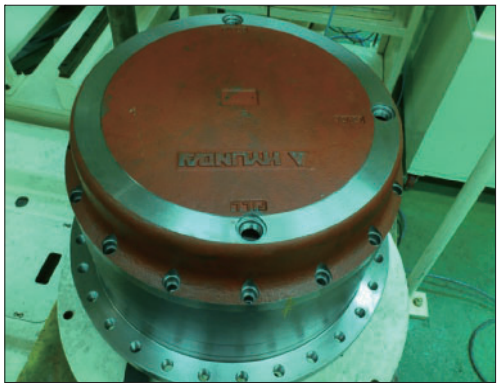
(2) Put reduction gear on stable place with drain port down side and remove oil plug (PF3/4) to pull-out gear oil through drain port.

※ When the oil is hot, there are high chance to blow out hot oil because of the pressure difference between container and out side.

(3) Set reduction gear on work table.

(4) Mark surface of cover, ring gear and housing for proper reassembly.

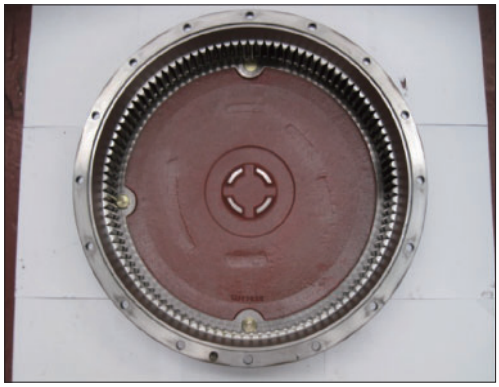
2) PUT REDUCTION GEAR ON WORK TABLE TO DISASSEMBLE



(1) Set eye bolt (M20) into M20 tap hole on housing flange. Make reduction gear cover upper direction using hoist machine.

⚠ **Be aware of safety. There are some chances of accidents when put down the reduction gear. Do not place the part pall on your foot.**

3) COVER REMOVE

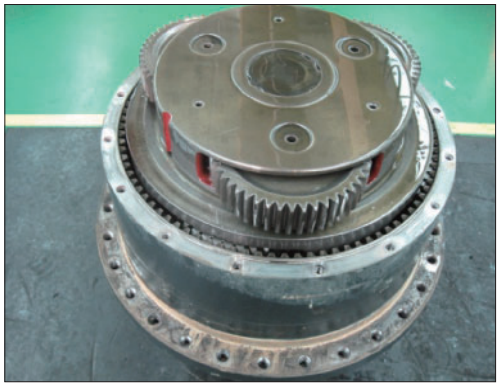


(1) Remove 16 of bolt-hex. socket head (M12X35L) connecting cover and ring gear using torque wrench.

(2) Using sharp tools to separate cover and ring gear. Put sharp tools into the gap between ring gear and cover and tap the tool tenderly.

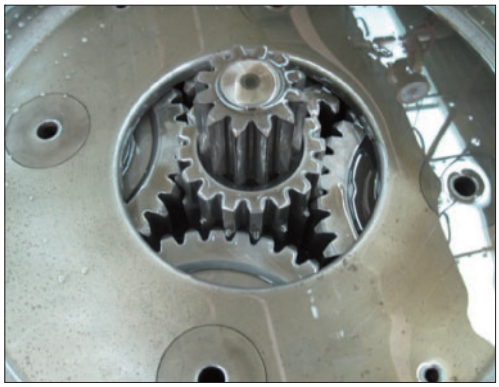
4) REMOVE THRUST PLATE AND NO.1 CARRIER SUB

(1) Remove thrust plate first, set eye bolt (M10) in No.1 carrier tap hole. After these, pull-up No.1 carrier assy slowly.



(2) Remove No.1 sun gear from reduction gear slowly.

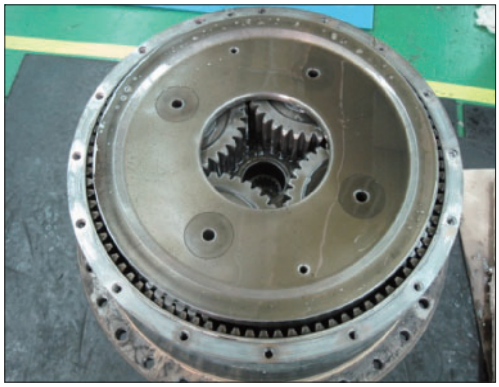
※ When disassemble No.1 sun gear, be sure to keep vertical against ground with No.1 sun gear.



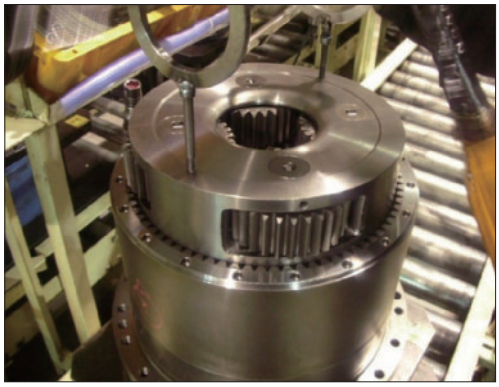
5) REMOVE NO.2 CARRIER SUB

(1) Remove No.2 sun gear slowly.

※ When disassemble No.2 sun gear, be sure to keep vertical against ground with No.2 sun gear.

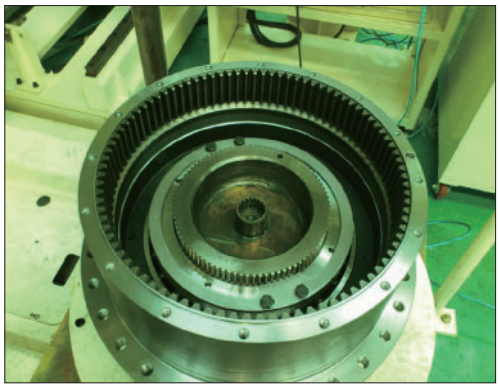


(2) Set eye bolt (M10) in No.2 carrier assy, pull-up slowly.



6) REMOVE COUPLING

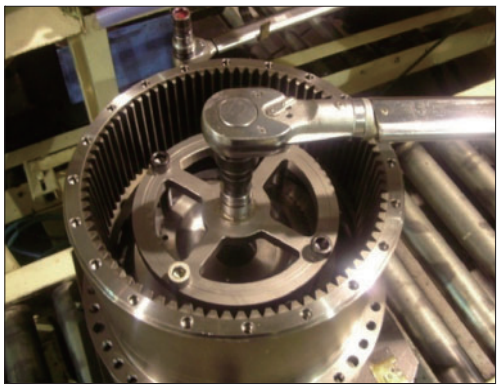
(1) Remove coupling on motor spline.



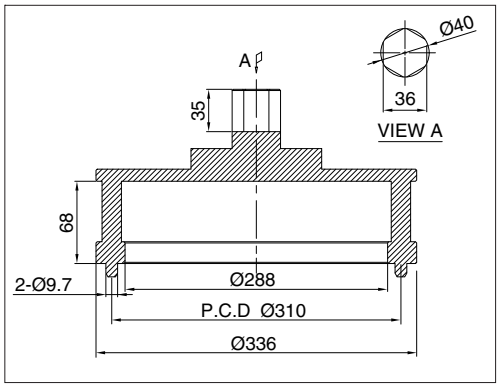
7) REMOVE RING NUT AND LOCK PLATE

(1) Remove hex head bolt (M12×20L) using torque wrench which is connecting ring nut and lock plate.

(2) Remove lock plate from motor casing spline.

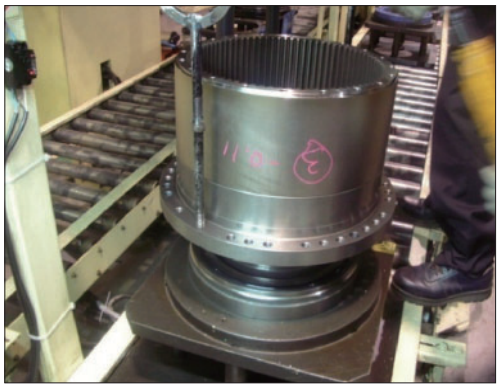


(3) Remove ring nut using designed tools.



8) DISASSEMBLE RING GEAR AND HOUSING

(1) Set eye bolt (M20) in flange of housing, pulling ring gear and housing from motor.

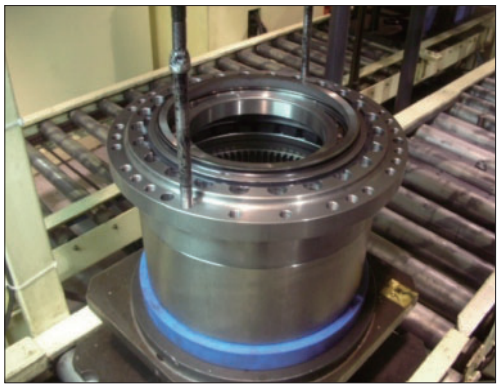


(2) Put disassembled ring gear and housing on work table. Be sure to set floating seal upper side, and remove floating seal.

※ Do not re-use floating seal.

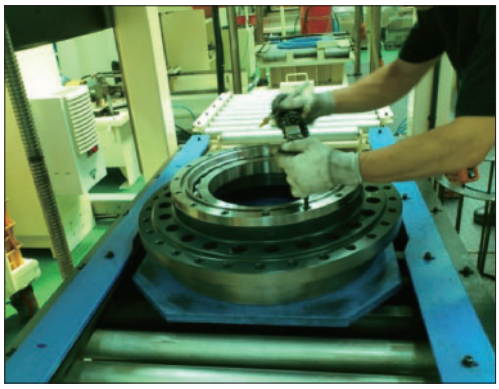
(3) Remove hex socket head bolt (M20×120L) connecting housing and ring gear using torque wrench.

(4) Put sharp tool into gap between ring gear and housing and tap it tenderly to separate gear and housing.



9) DISASSEMBLE HOUSING COMPONENTS

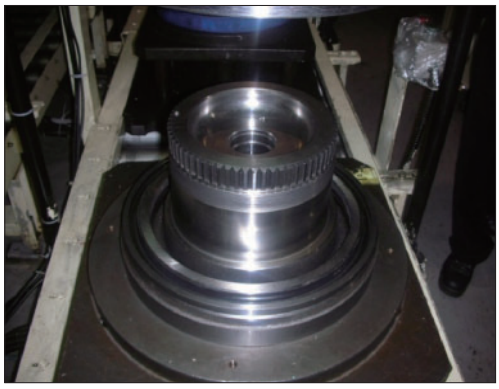
Hex socket head bolt (M10×25L) connecting housing and seal cover using torque wrench, and remove seal cover.



10) SEPARATE MOTOR CASING AND FLOATING SEAL

Pull floating seal in motor casing slowly and remove floating seal from motor casing.

※ Do not re-use floacting seal.



11) NO.1 CARRIER ASS'Y DISASSEMBLE

(1) Put spring pin into spring pin hole using specially designed tool.

(2) Disassemble No.1 planetary gear, thrust washer, spring pin, needle bearing form No.1 carrier.

※ Do not re-use spring pin.

12) NO.2 CARRIER ASS'Y DISASSEMBLE

(1) Cut No.2 solid pin by pressing spring pin using press machine.

⚠ **Be aware of scattering of components when operator use press machine.**

(2) Disassemble No.2 planetary gear, thrust washer, spring pin, needle bearing from No.2 carrier.

※ Do not re-use spring pin.

3. ASSEMBLY OF REDUCTION GEAR

1) GENERAL PRECAUTIONS

(1) Clean all components with kerosene and dry them in shade. Remove all loctite with solvent. Check the components.
Apply loctite #262 on thread of bolt-hex.socket head.
Be aware of dropping of parts on foot and safety accident.
Check the quantity of all parts in advance.

(2) Check the abnormality of thrust washer like twist or wear.

(3) Check the surface of every gear. Whether there is pitting or crack on them.

(4) Rolling the bearing and check the rolling condition and the noise.

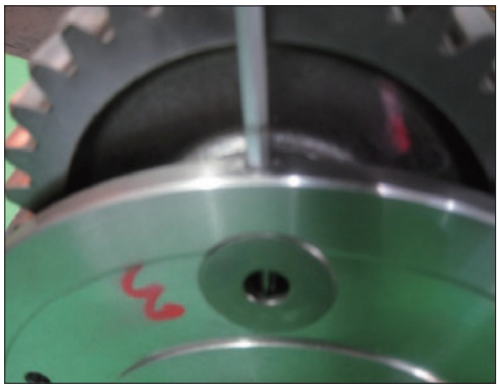
(5) Check the surface of floating seal and crack of O-ring.

2) NO.1 CARRIER ASSEMBLY

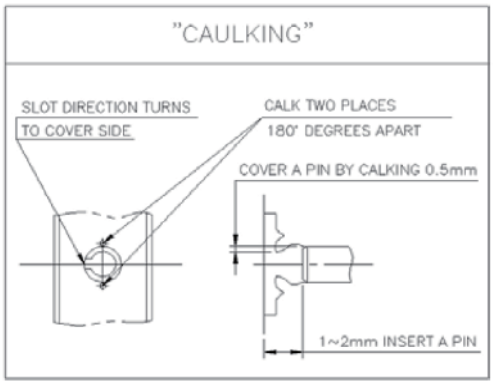
(1) Set No.1 carrier on stable and even place.
(2) Put needle bearing in No.1 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.

(3) Align spring pin with No.1 carrier spring pin hole and assemble spring pin accordingly.

(4) Put spring pin into No.1 carrier using jig with force.



(5) Caulking both side of pressed spring pin 180˚ using caulking jig.



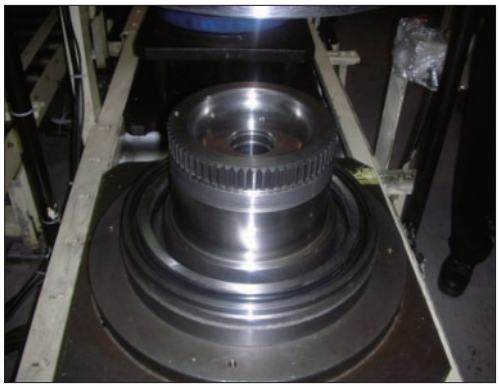
3) NO.2 CARRIER ASSEMBLY

(1) Set No.2 carrier on stable and even place.
(2) Put needle bearing in No.2 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.
(3) Align solid pin hole of spring pin and No.2 carrier spring pin hole. and assemble spring pin accordingly.
(4) After assembly solid pin, put spring pin with force.
(5) Caulking both sides of pressed spring pin 180˚ using caulking jig.

4) FLOATING SEAL ASSEMBLY

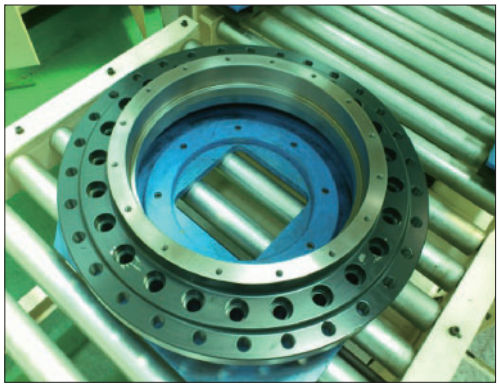
Wipe O-ring side of floating seal and contact surface of floating seal of motor casing with oil applied lint free towel, and press fitting floating seal into motor casing with special jig.

※ Keep the floating seal vertical against ground.



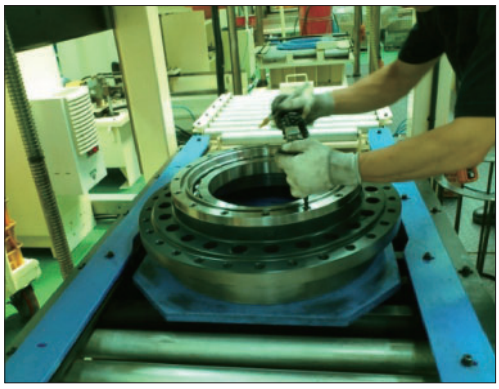
5) HOUSING & MAIN BEARING ASSEMBLY

(1) Heating and cleaning housing with 60~70˚C temperature.
(2) Set the housing on working table safely, press fitting main bearing into both side of housing.



6) SEAL COVER ASSEMBLY

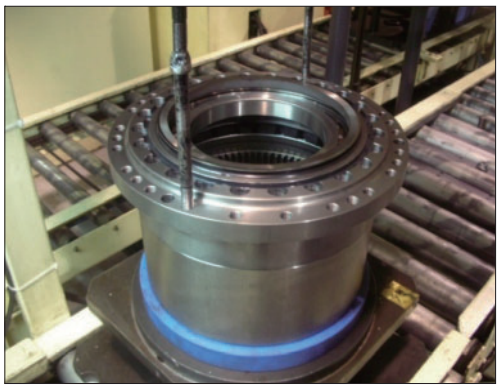
Apply three bond #1194 on contact surface of housing and seal cover, tighten hex socket head bolt (M10×25L) with designed torque 6.3±0.6 kgf · m (45.6±4.3 lbf · ft) using torque wrench.



7) HOUSING COMPONENTS AND RING GEAR ASSEMBLY

(1) Apply three bond #1194 on the surface of ring gear and housing contact surface, tighten hex socket head bolt (M20×120L) with designed torque 53±5.3 kgf · m (383±38.3 lbf · ft) using torque wrench.

(2) Wipe O-ring side of floating seal and contact surface of floating seal of seal cover with oil applied lint free towel, and press fitting floating seal into seal cover.

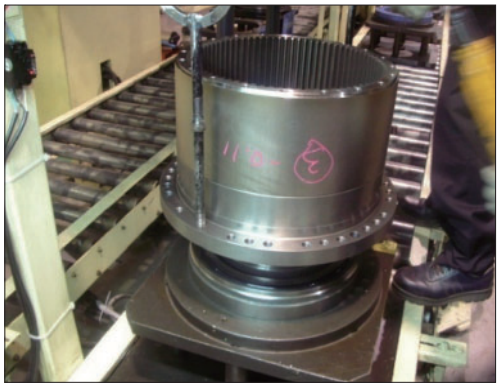


8) MOTOR & ASSEMBLED HOUSING COMPONENTS ASSEMBLY

(1) Set eye bolt (M20) in housing flange tap hole.

(2) Assemble assembled housing components on motor using hoist.

※ Be sure set eye bolt firmly to keep operator safe.

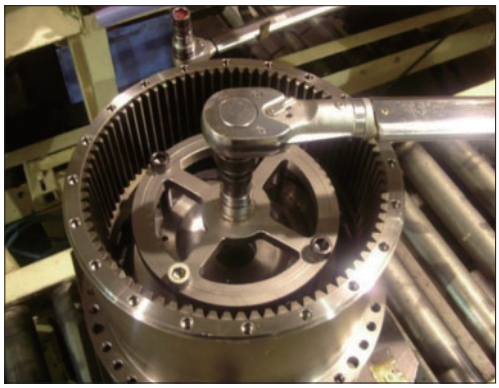


9) NUT RING AND LOCK PLATE ASSEMBLY

(1) Tighten nut ring with designed torque using torque wrench.

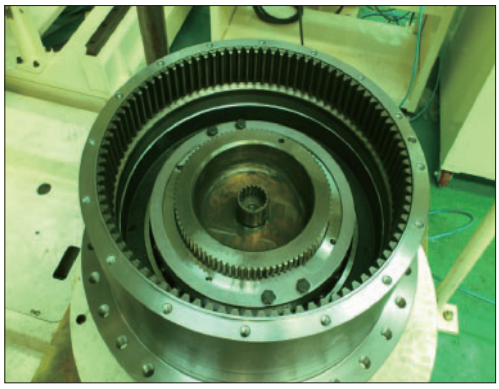
(2) Set lock plate along with bolt hole of nut ring and assemble them.

(3) Tighten hex head bolt (M12×20L) with designed torque 8.8±0.9 kgf · m (63.6±6.5 lbf · ft).



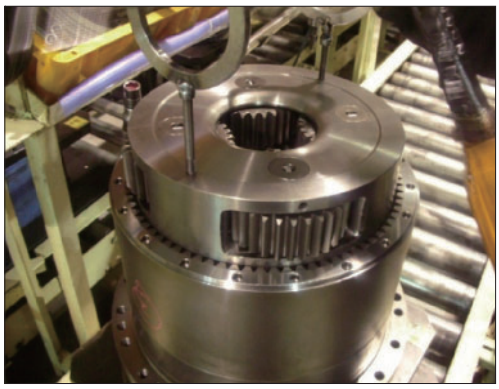
10) COUPLING ASSEMBLY

Assemble coupling with motor's spline.

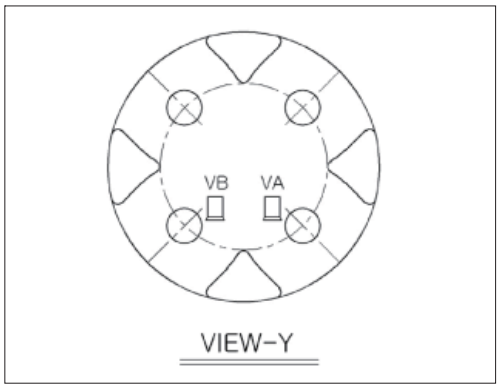


11) NO.2 CARRIER SUB ASSEMBLY

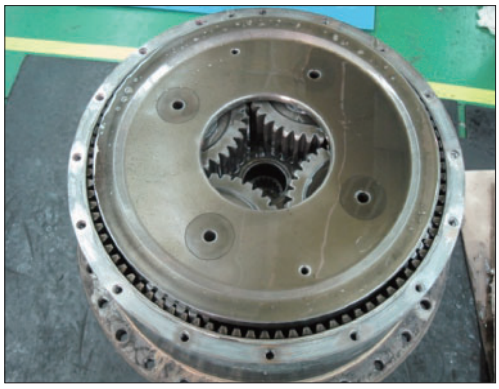
(1) Set eye bolt (M10) in No.2 carrier assy, lift them using hoist and set down No.2 carrier assy into motor.



※ To set the align valve ports, refer to right drawing.

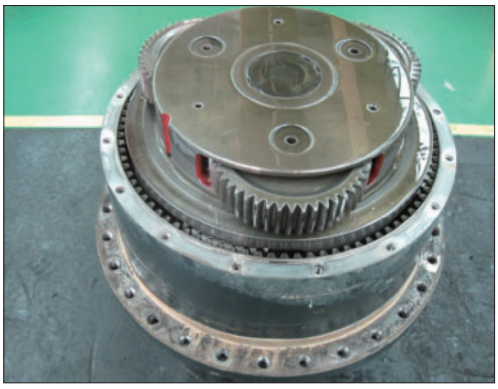


(2) Assemble No.2 sun gear into No.2 carrier assy.



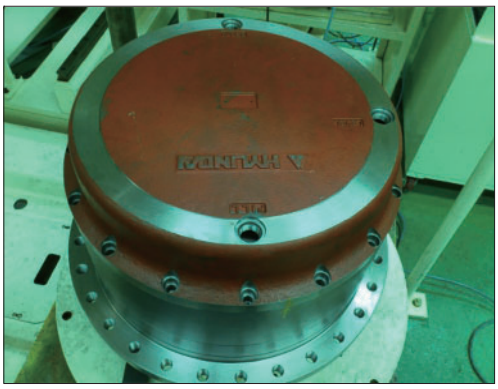
12) NO.1 CARRIER SUB ASSEMBLY

(1) Set eye bolt (M10) in No.1 carrier tap hole and set down No.1 carrier assy slowly.
(2) Assemble No.1 sun gear and No.1 carrier assy.
(3) Assemble thrust plate and carrier.



13) COVER ASSEMBLY

(1) Put parallel pin (Ø13×20L) into parallel pin hole of ring gear with rubber hammer.
(2) Apply three bond #1194 on cover contacting surface of ring gear and assemble cover.
(3) Tighten 16 of hex socket head bolt (M12×35L) with designed torque 14.3±1.4 kgf · m (103± 10.1 lbf · ft) using torque wrench.



14) PUTTING GEAR OIL

(1) Put gear oil 12±0.5L through drain port and check the level gage.
(2) Tighten oil plug with torque 10±1.0 kgf · m (72.3±7.2 lbf · ft).

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

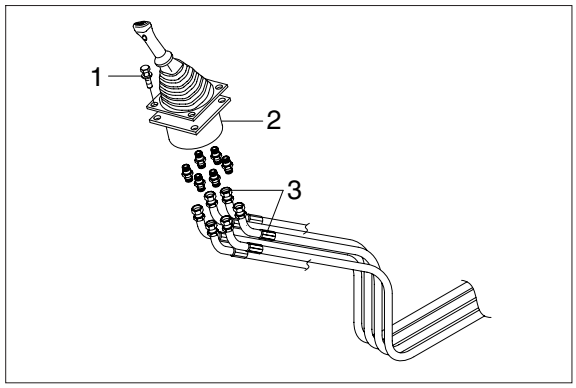
(4) Loosen the socket bolt (1).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



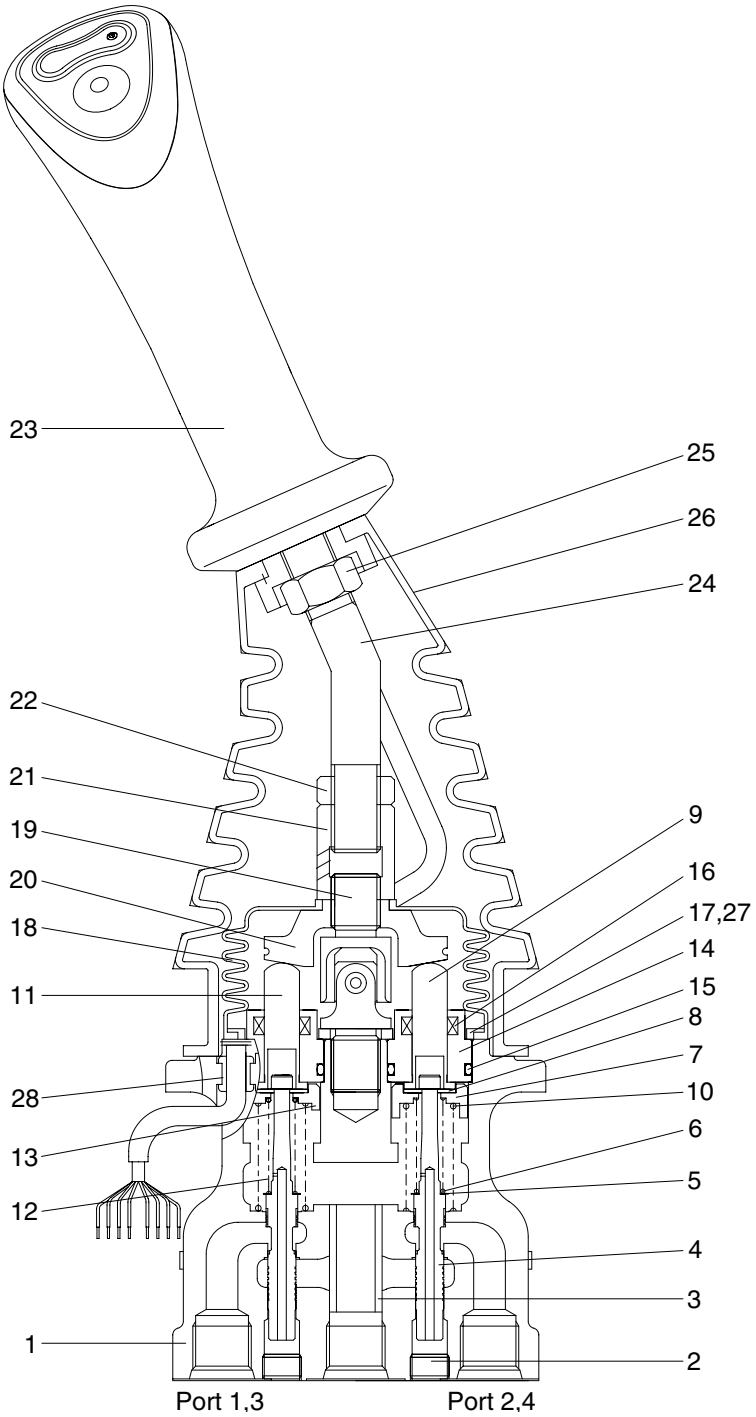
2) INSTALL

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

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

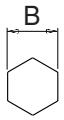
1) STRUCTURE



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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

(2) Tightening torque

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

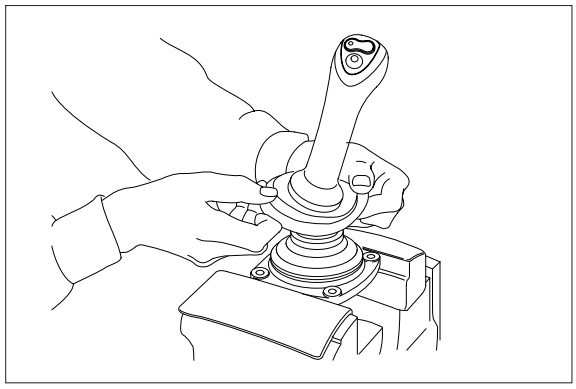
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

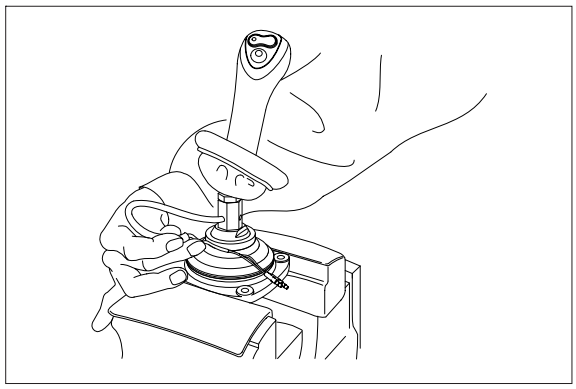
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

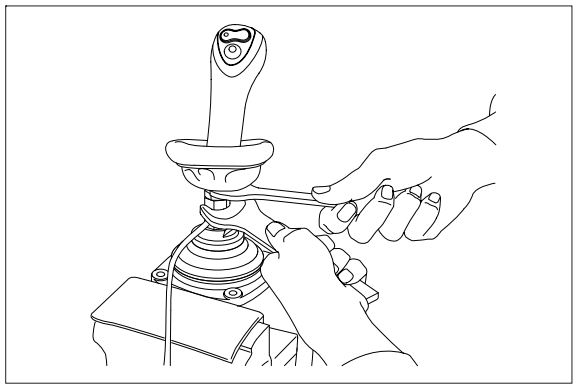
(3) Remove end of boot (26) from case (1) and take it out upwards.



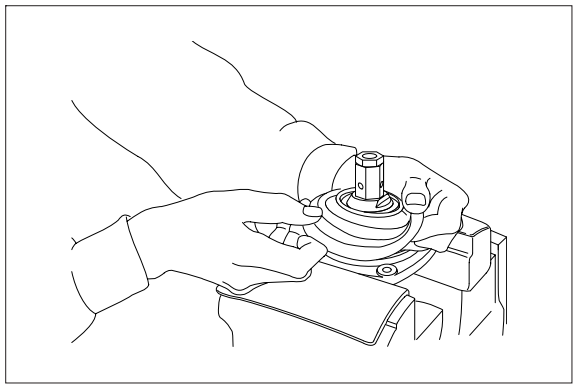
※ For valve with switch, remove cord also through hole of casing.



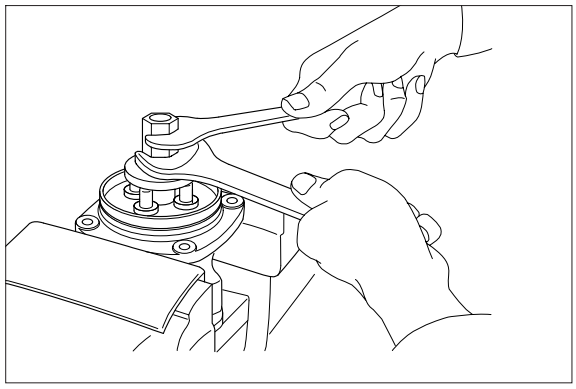
(4) Loosen lock nut (22) and adjusting nut (21) with spanners on them respectively, and take out handle section as one body.

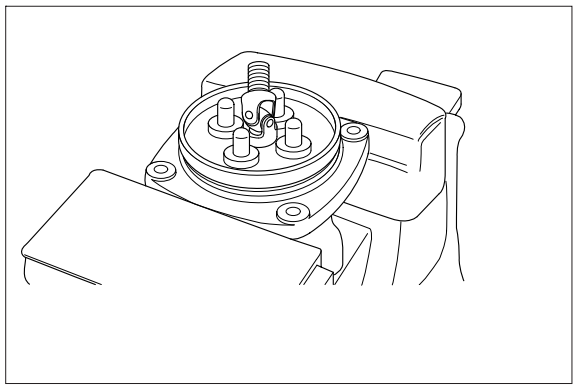


(5) Remove the boot (18).



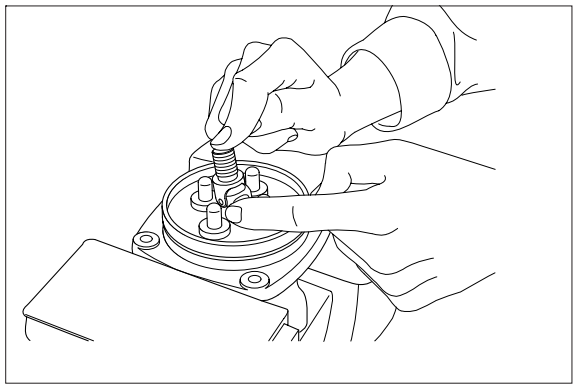
(6) Loosen adjusting nut (21) and swash plate (20) with spanners on them respectively, and remove them.

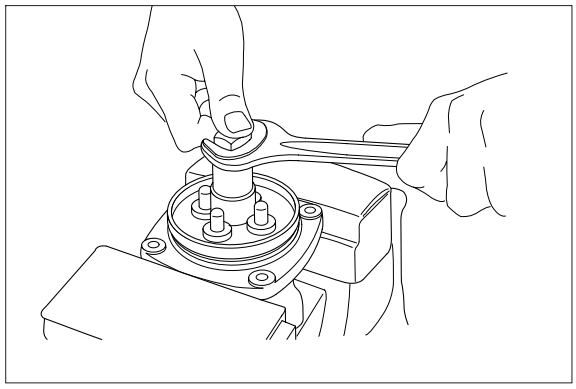




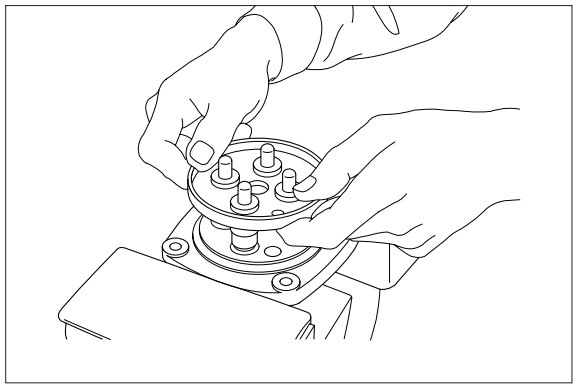
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

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





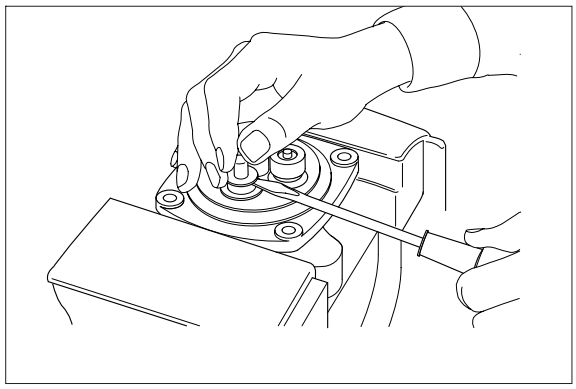
(8) Remove plate (17).



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

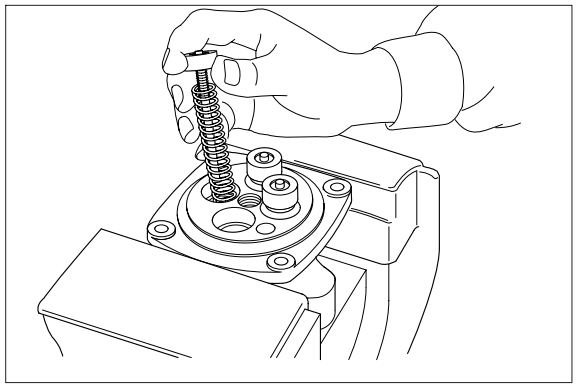
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (10) force.
Pay attention to this.

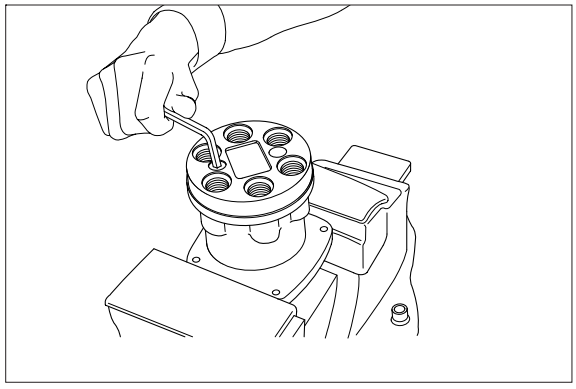


(10) Remove reducing valve subassembly and return spring (10) out of casing.

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



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

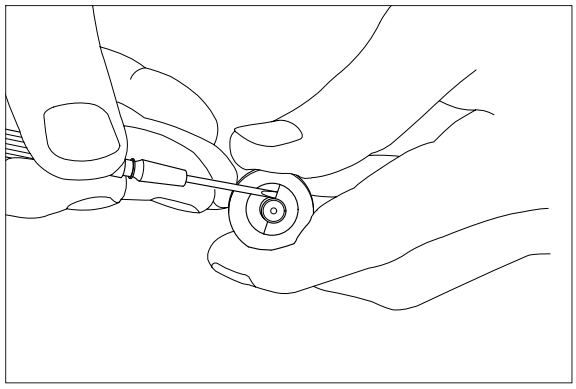


(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

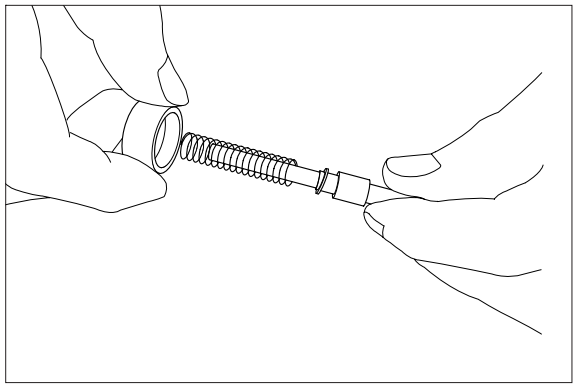
※ Record original position of spring seat (7).

※ Do not push down spring seat more than 6㎜.

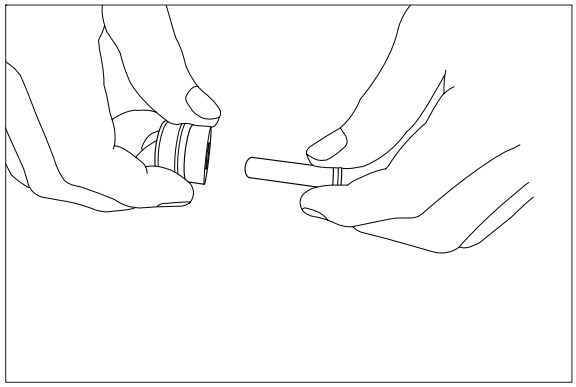


(13) Separate spool (4), spring seat (7), spring (6) and shim (5) individually.

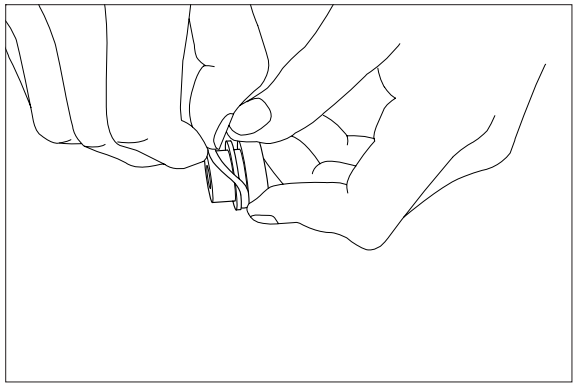
※ Until being assembled, they should be handled as one subassembly group.

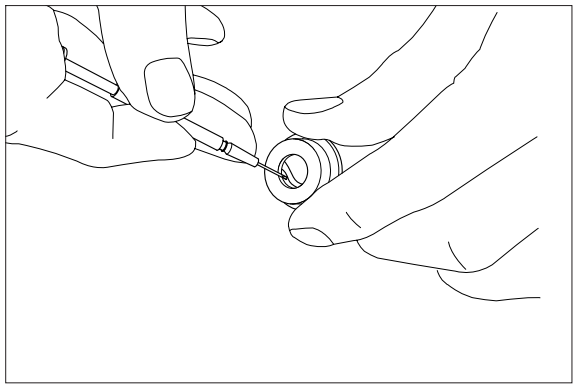


(14) Take push rod (11) out of plug (14).

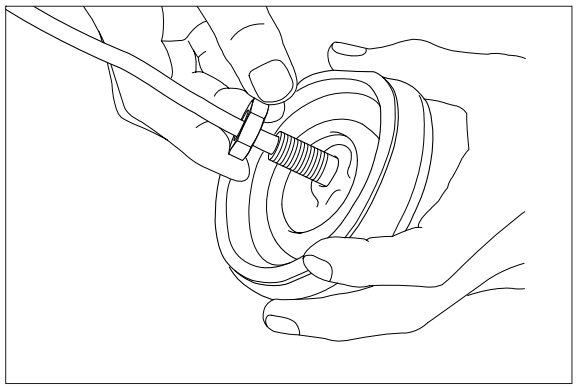


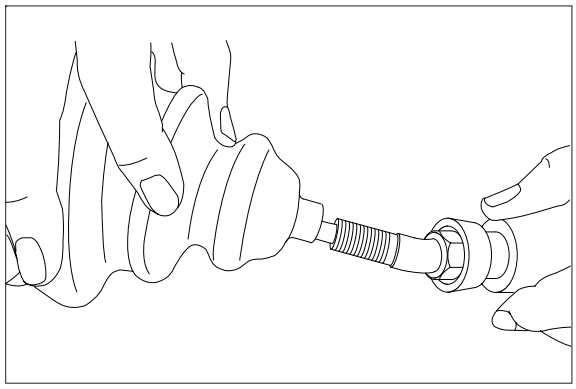
(15) Remove O-ring (15) and seal (16) from plug (14).
Use small minus screwdriver or so on to remove this seal.





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





(16) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

(17) Rust prevention of parts

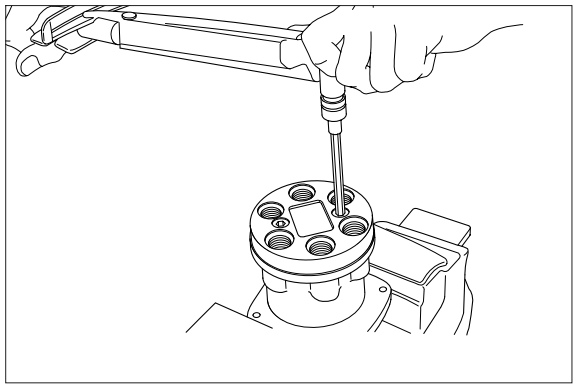
Apply rust-preventives to all parts.

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

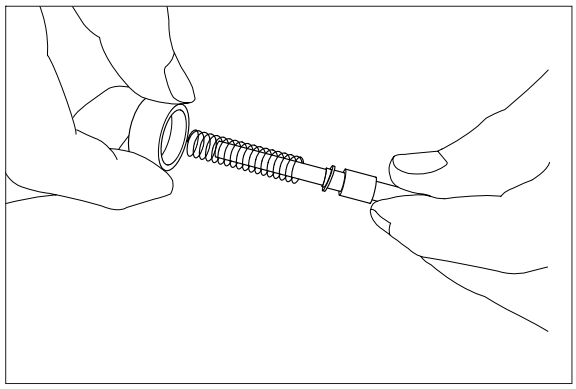
4) ASSEMBLY

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

※ Tighten two bolts alternately and slowly.

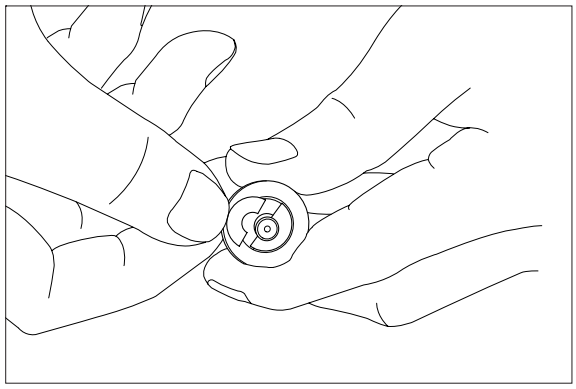


(2) Put shim (5), springs (6) and spring seat (7) onto spool (4) in this order.



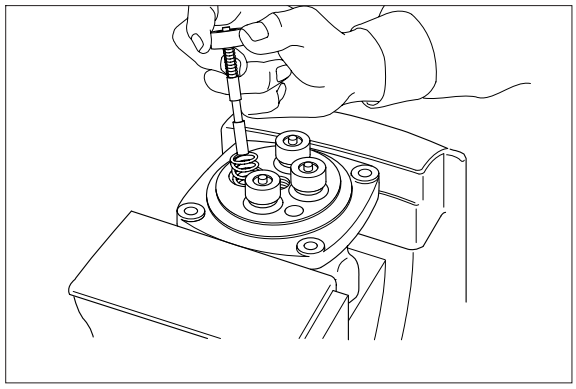
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.

※ Assemble stopper (8) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.

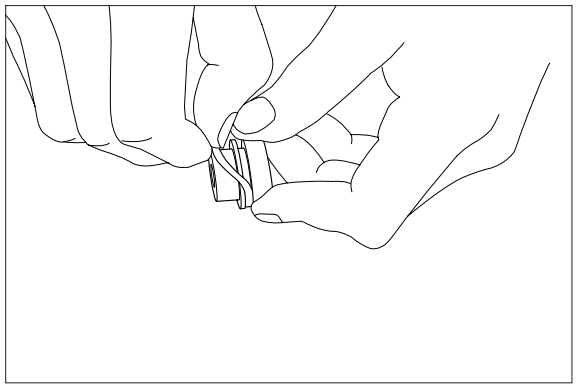


(4) Assemble spring (10) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

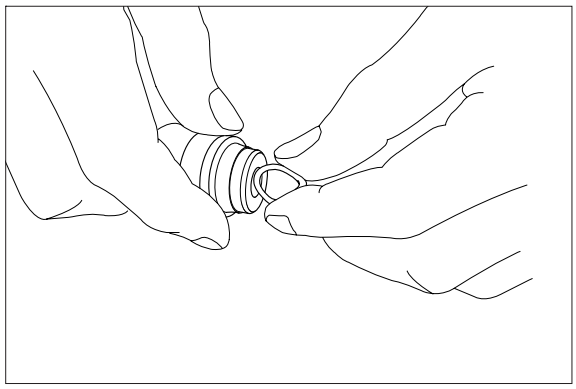


(5) Assemble O-ring (15) onto plug (14).



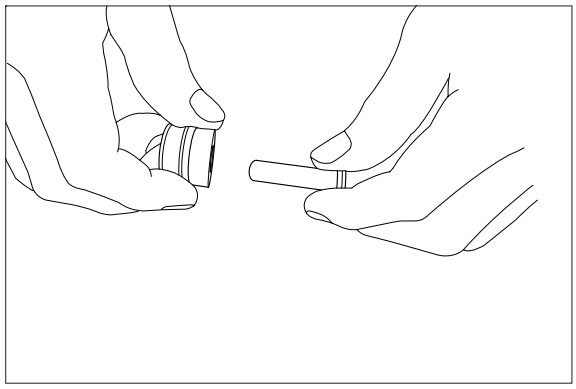
(6) Assemble seal (16) to plug (14).

※ Assemble seal in such lip direction as shown below.



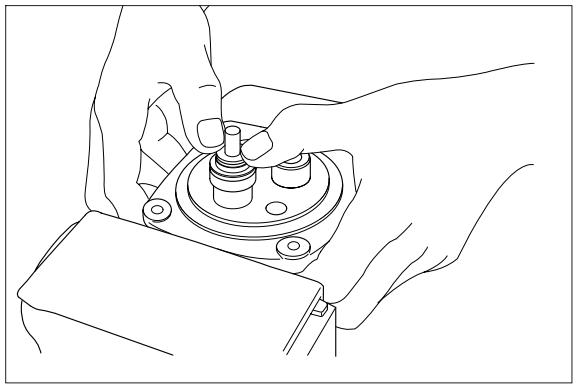
(7) Assemble push rod (11) to plug (14).

※ Apply working oil on push-rod surface.

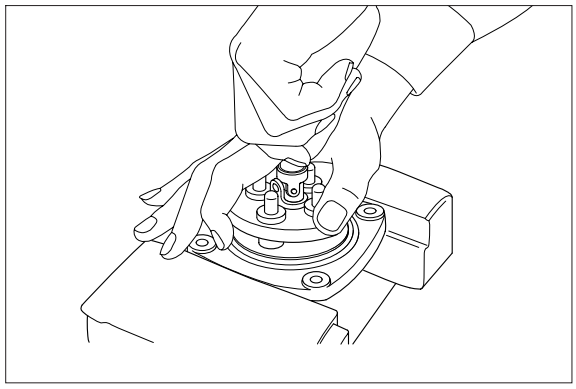


(8) Assemble plug subassembly to casing.

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

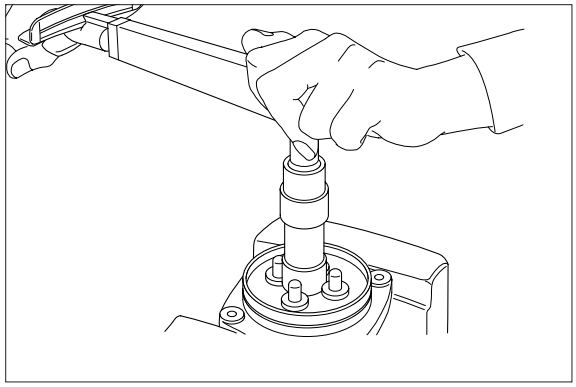


(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.



(10) Fit plate (17).

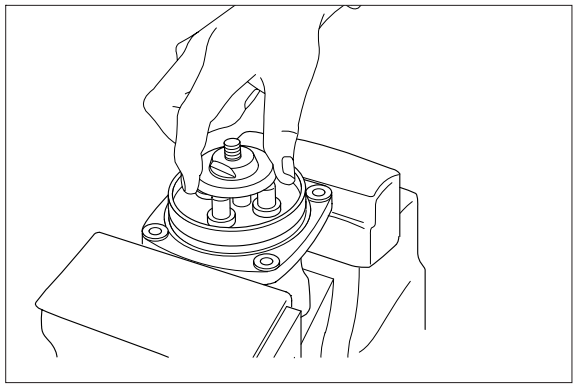
(11) Tighten joint (19) with the specified torque to casing, utilizing jig.



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

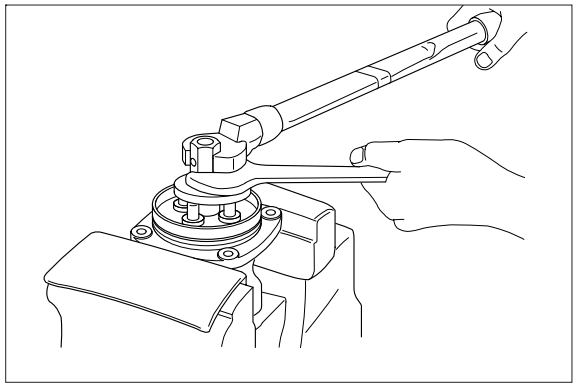
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

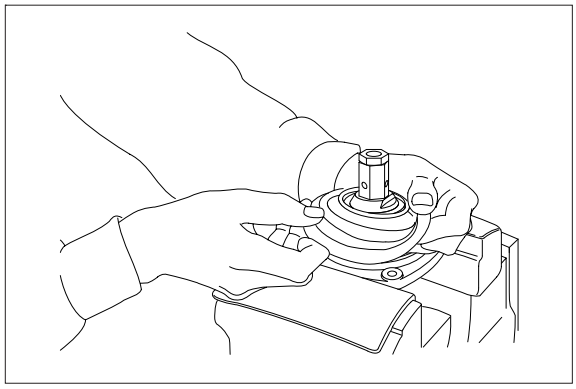


(13) Assemble adjusting nut (21), apply spanner to width across flat of plate (20) to fix it, and tighten adjusting nut to the specified torque.

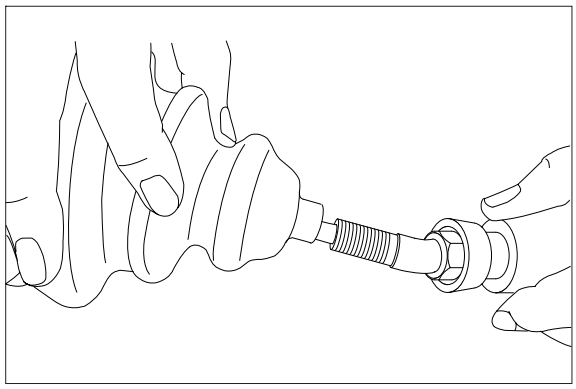
※ During tightening, do not change position of disk.

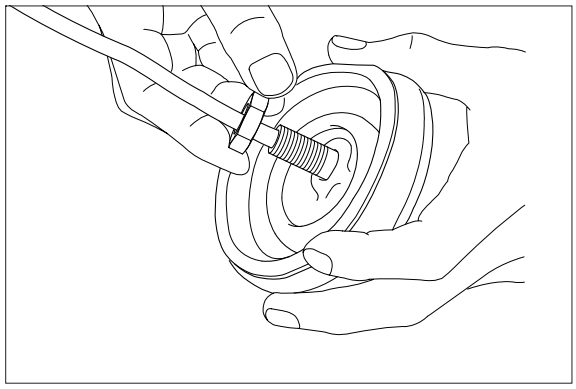


(14) Fit boot (18) to plate.

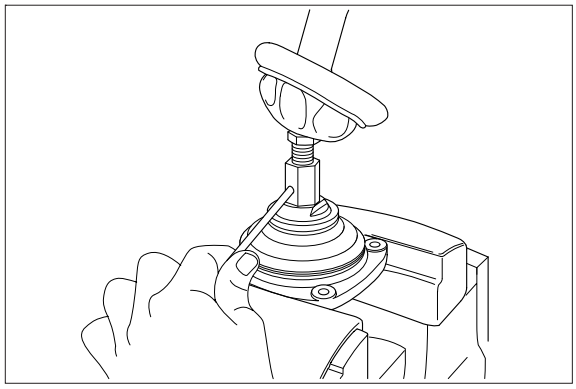


(15) Fit boot (26) and lock nut (22), and handle subassembly is assembled completely.



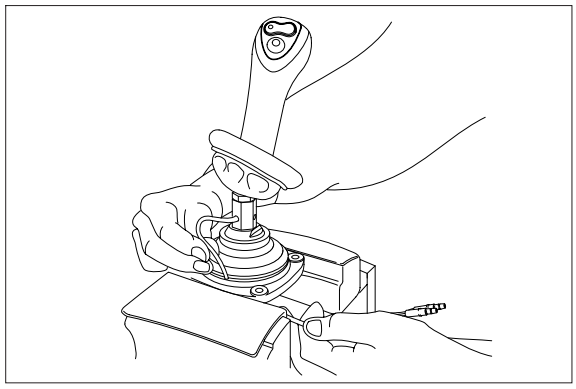


(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.

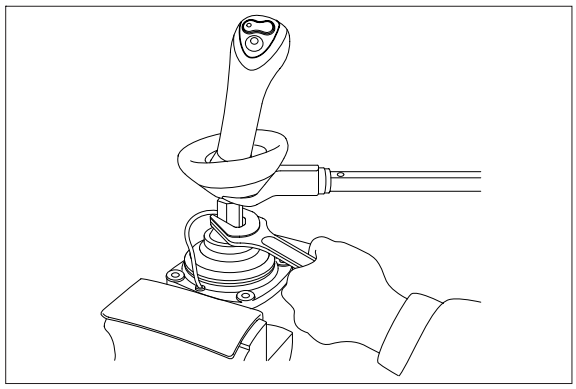


(17) Assemble bushing (27) to plate and pass cord and tube through it.

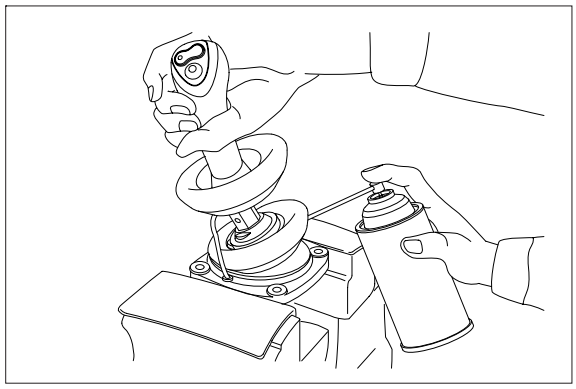
※ Provide margin necessary to operation.



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

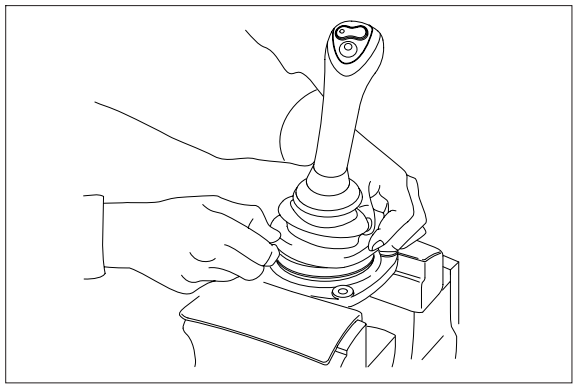


(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(20) Assemble lower end of bellows to casing.

(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



1. REMOVAL AND INSTALL

1) REMOVAL

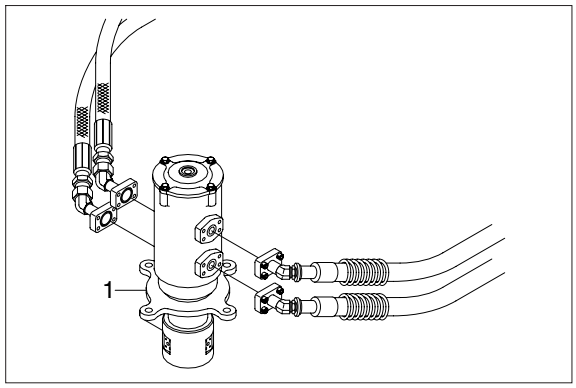
(1) Lower the work equipment to the ground and stop the engine.

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

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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



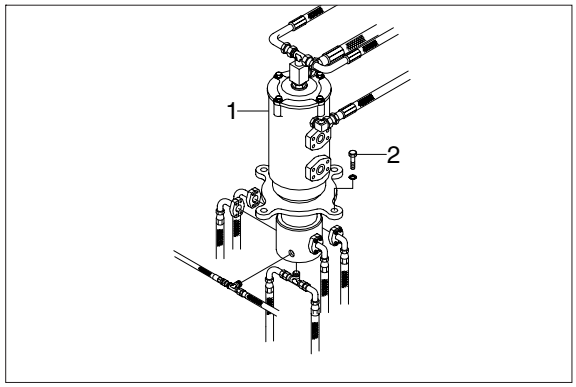
(4) Disconnect all hoses .

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
- Weight : 50 kg (110 lb)
- Tightening torque : 29.7 ± 45 kgf · m (215 ± 32.5 lbf · ft)

(6) Remove the turning joint assembly.

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

2) INSTALL



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

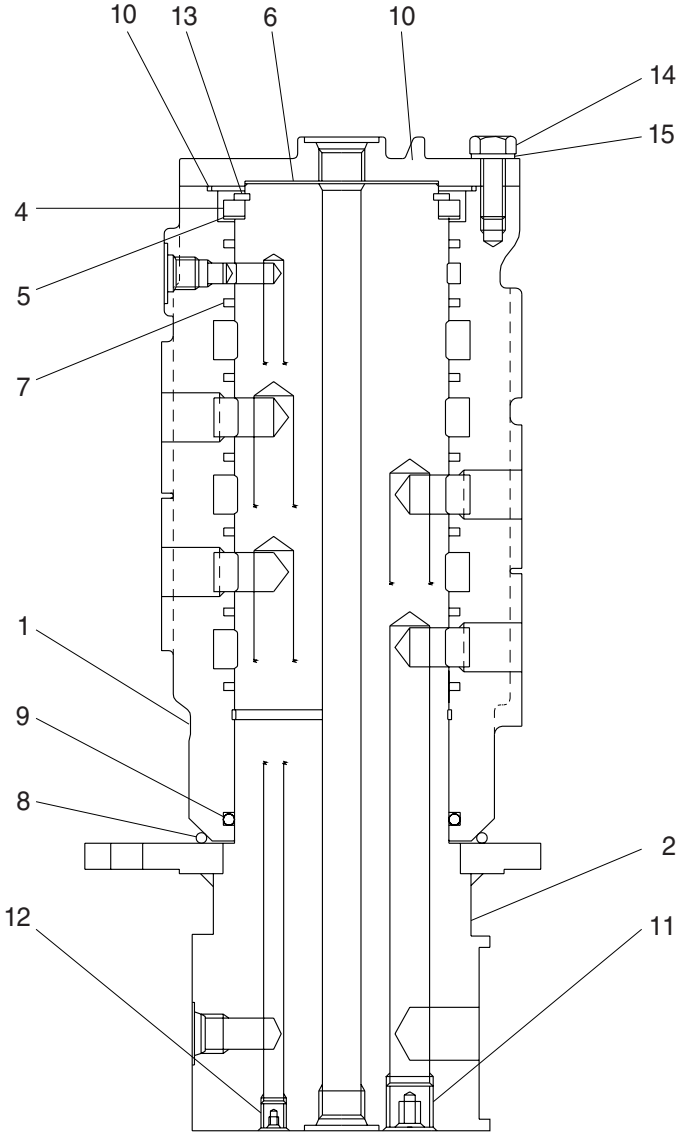
※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

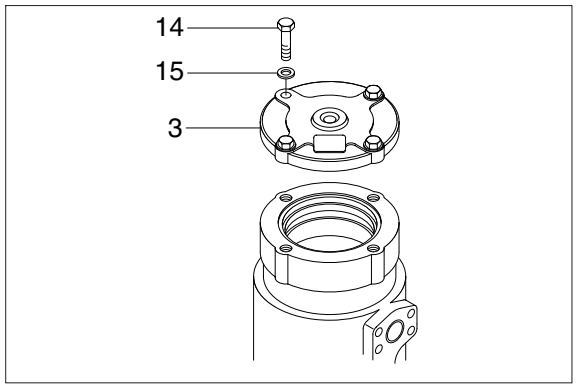


1	Hub	6	Shim	11	Plug
2	Shaft assembly	7	Slipper seal	12	Plug
3	Cover	8	O-ring	13	Retaining ring
4	Spacer	9	O-ring	14	Hexagon bolt
5	Shim	10	O-ring	15	Spring washer

2) DISASSEMBLY

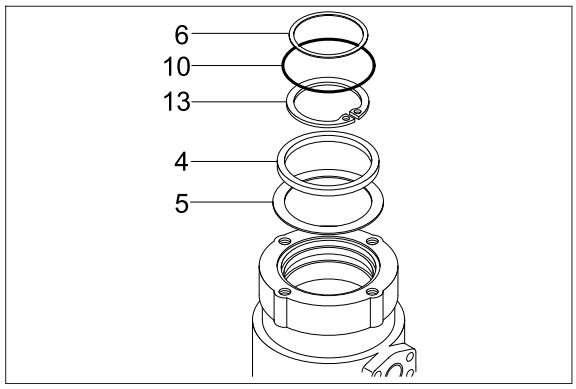
※ Before the disassembly, clean the turning joint.

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



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

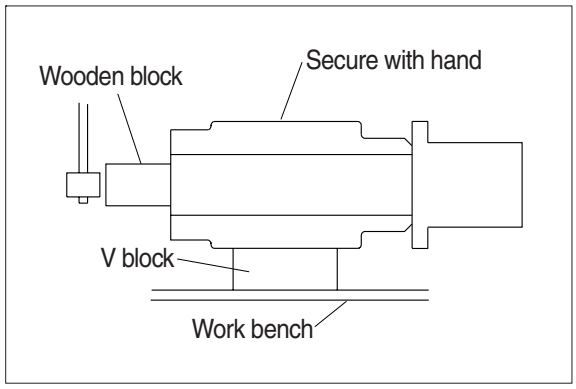
(3) Remove retainer ring (13), spacer (4) and shim (5).



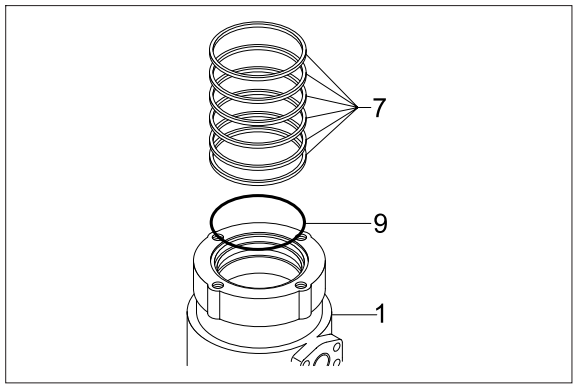
(4) Place body (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft (2) when remove body (1) or rest it sideway.

※ Put a fitting mark on body (1) and shaft (2).



(5) Remove six slipper seals (7) and O-ring (9), from body (1).

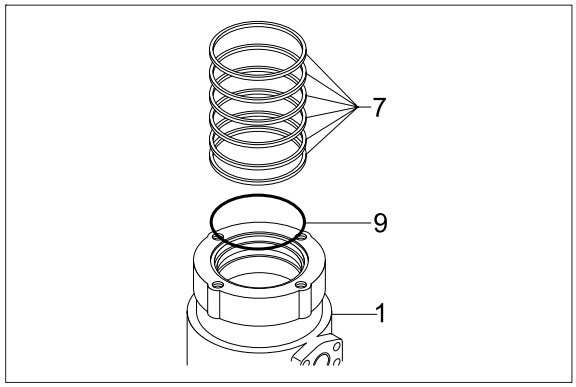


3) ASSEMBLY

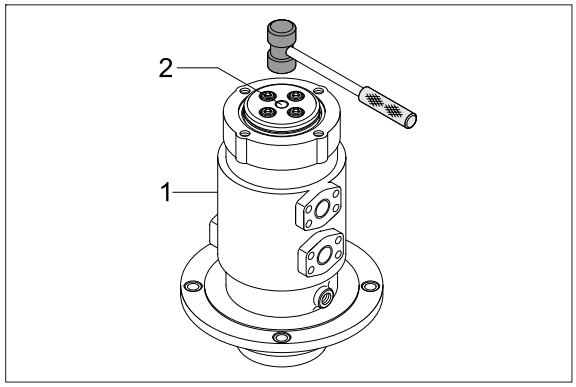
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal (7) and O-ring (9), to body (1).

(2) Fit O-ring (8) to shaft (2).



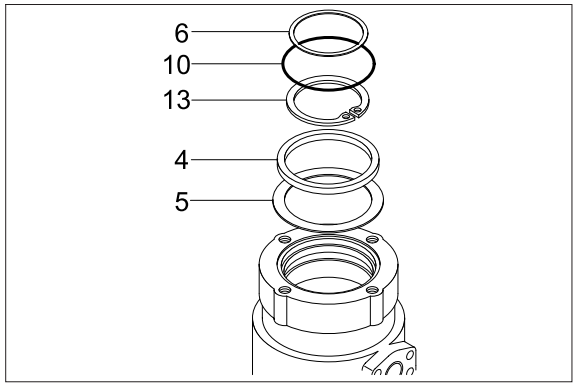
(3) Set shaft (2) on block, tap body (1) with a plastic hammer to install.



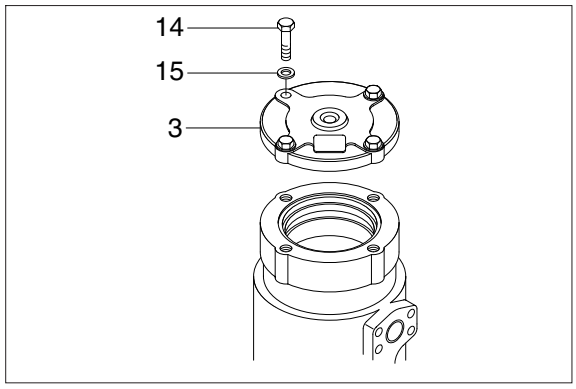
(4) Fit shim (5), spacer (4) and retainer ring (13) to shaft (2).

(5) Fit O-ring (10) to body (1).

(6) Fit shim (6) to shaft (2).



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



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

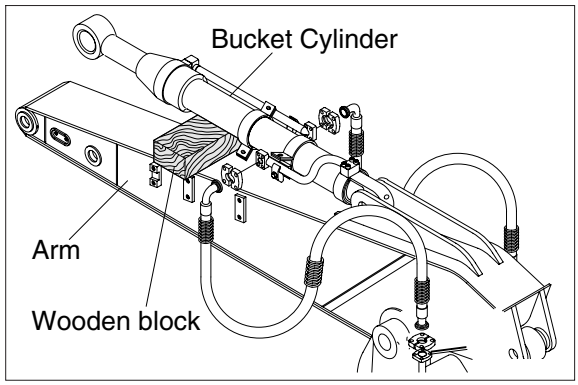
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

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

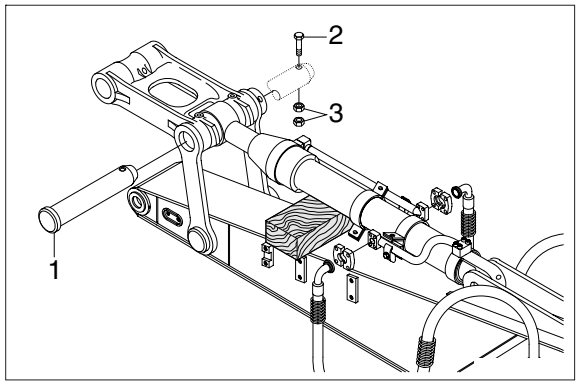
※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

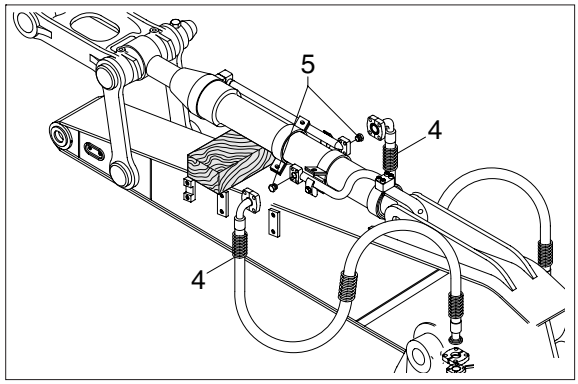


② Remove bolt (2), nut (3) and pull out pin (1).

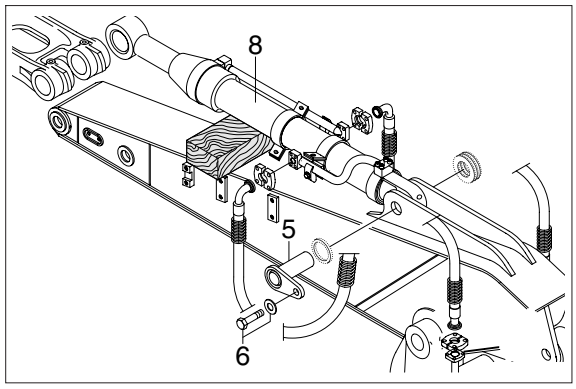
※ Tie the rod with wire to prevent it from coming out.



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



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
⑤ Remove bucket cylinder assembly (8).



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the bucket cylinder.

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

2) ARM CYLINDER

(1) Removal

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

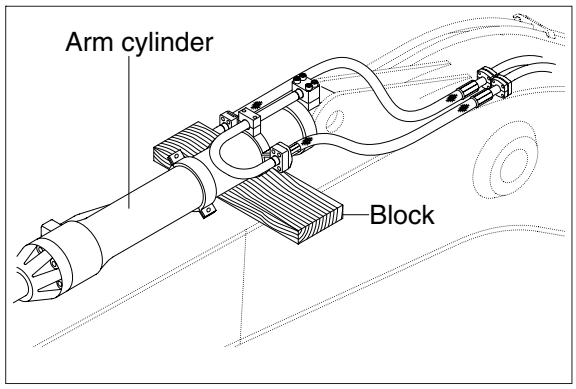
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

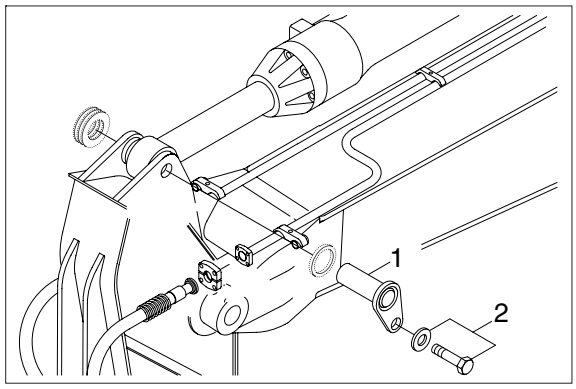
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



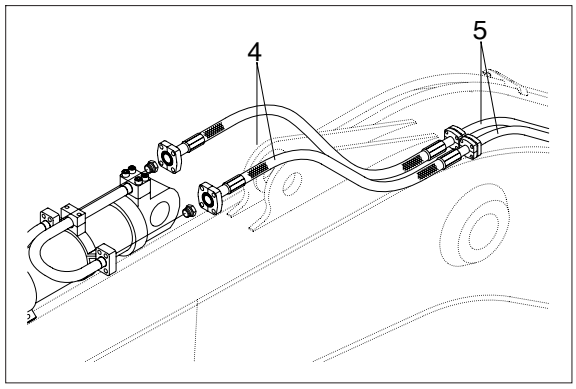
② Remove bolt (2) and pull out pin (1).

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



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

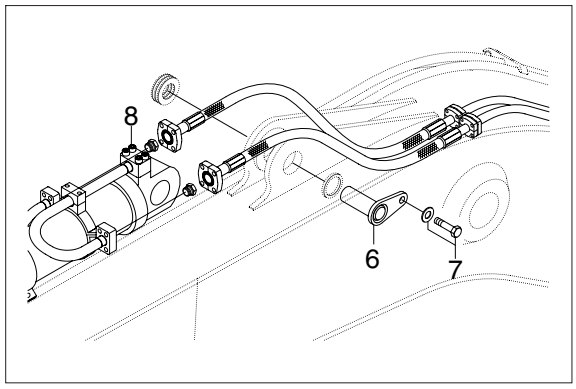
④ Disconnect greasing pipings (5).



⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 630 kg (1390 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the arm cylinder.

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

3) BOOM CYLINDER

(1) Removal

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

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

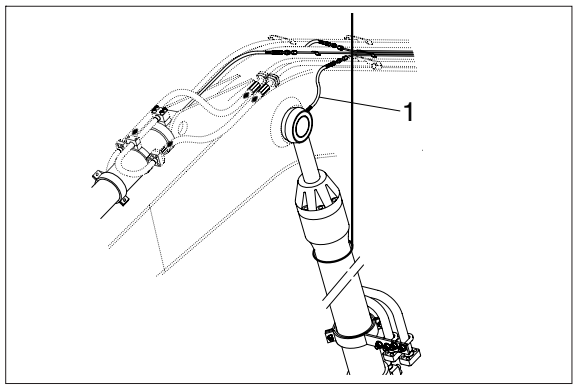
⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

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

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

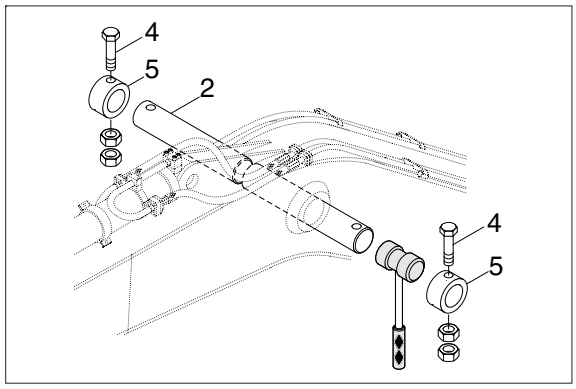
① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

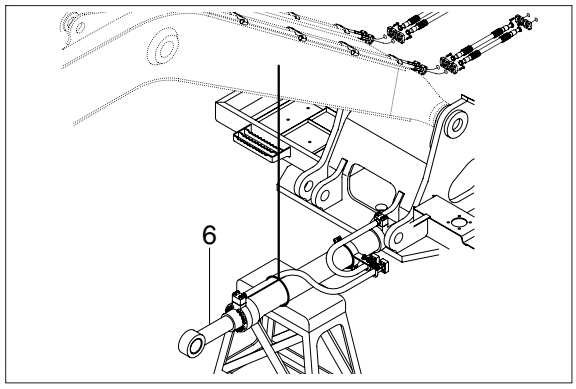


③ Remove bolt (4), pin stopper (5) and pull out pin (2).

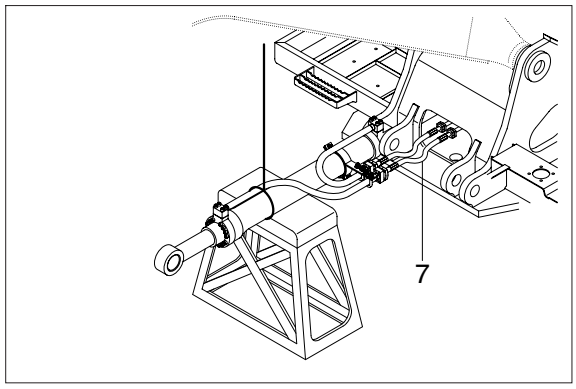
※ Tie the rod with wire to prevent it from coming out.



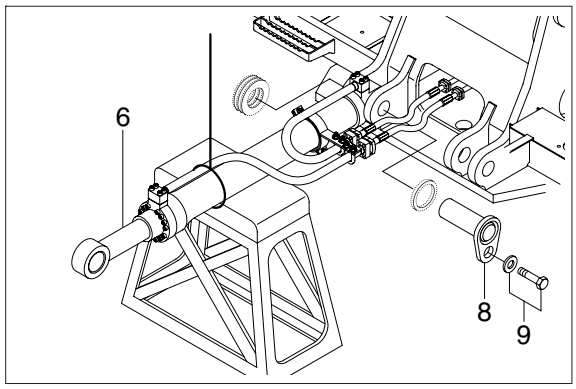
④ Lower the boom cylinder assembly (6) on a stand.



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



⑥ Remove bolt (9) and pull out pin (8).
⑦ Remove boom cylinder assembly (6).
- Weight : 415 kg (915 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

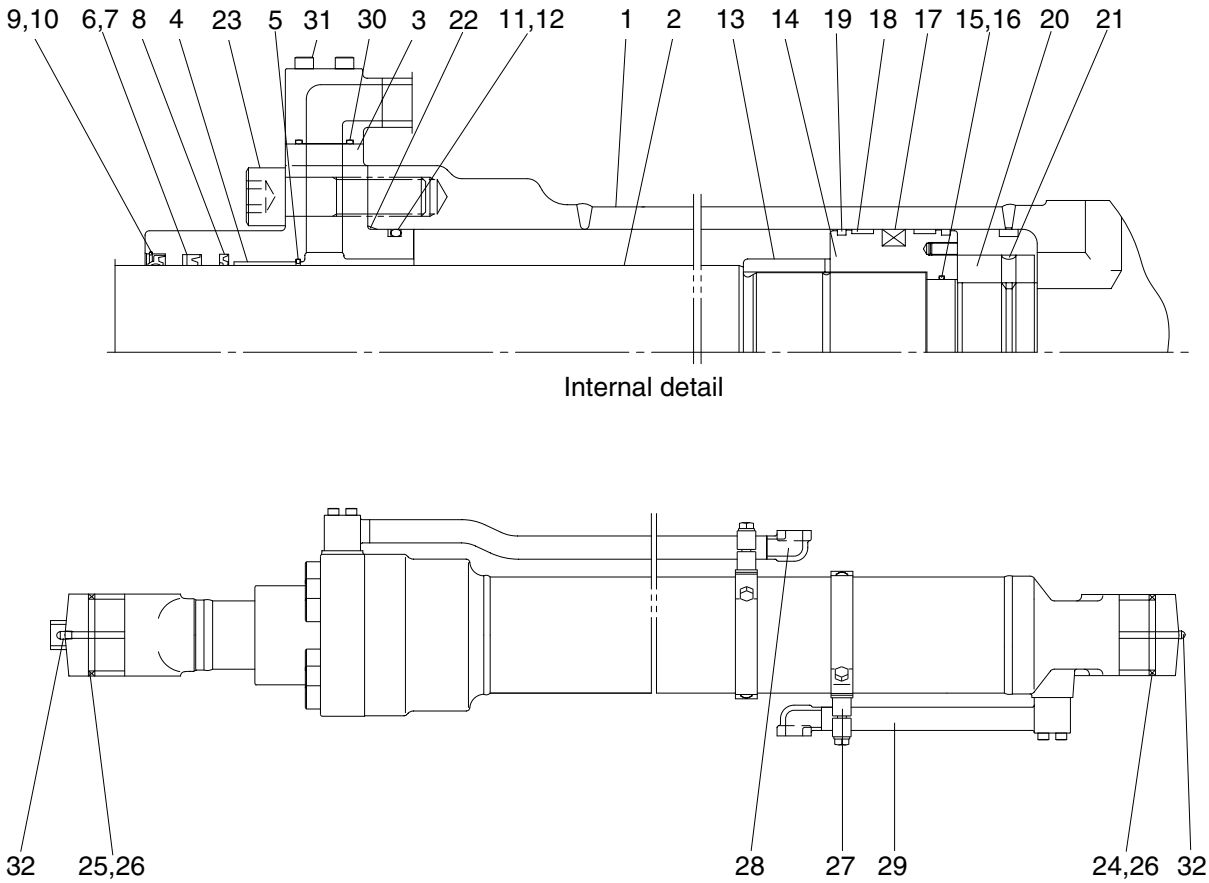
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

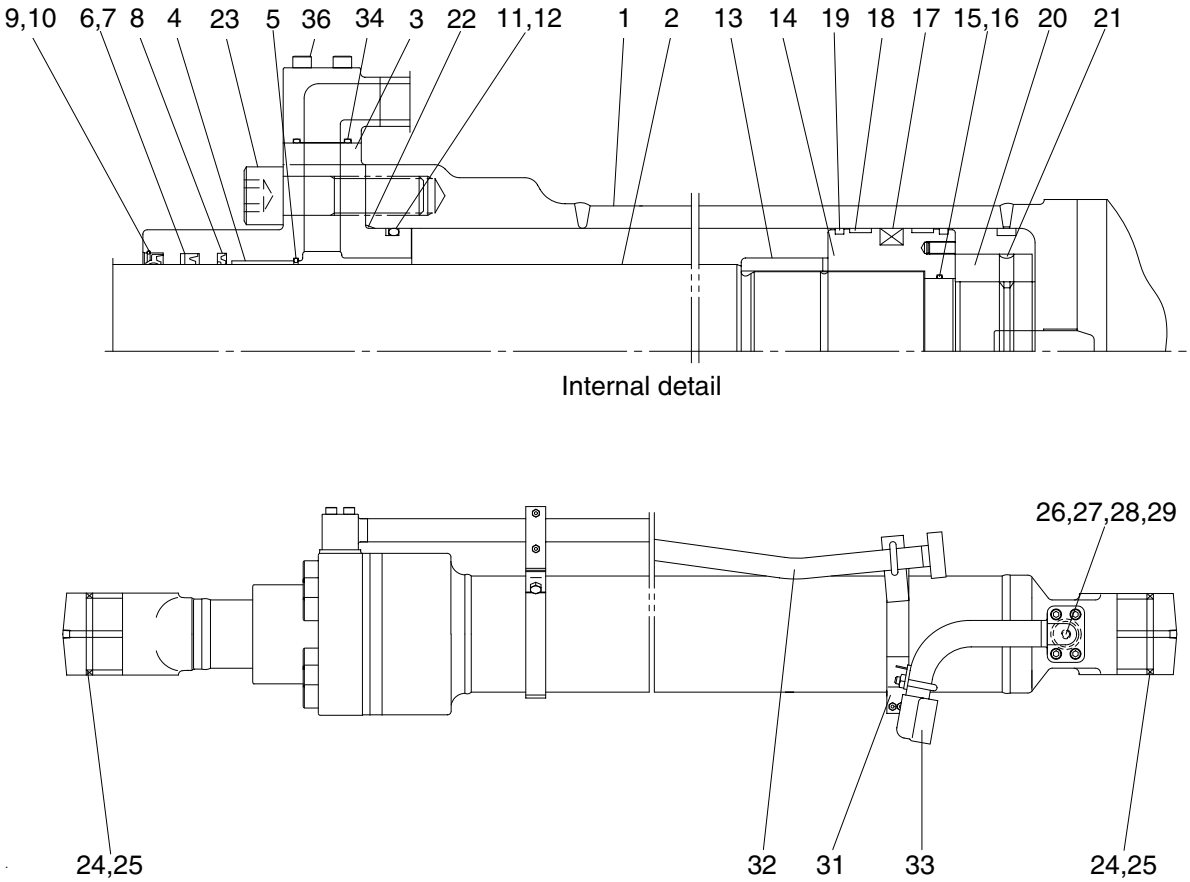
1) STRUCTURE

(1) Bucket cylinder



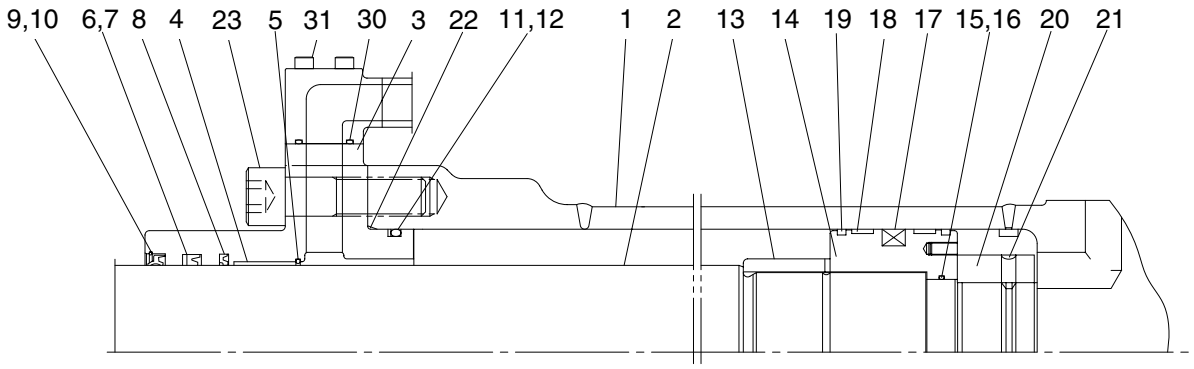
1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly
7	Back up ring	18	Wear ring	29	Pipe assembly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

(3) Arm cylinder

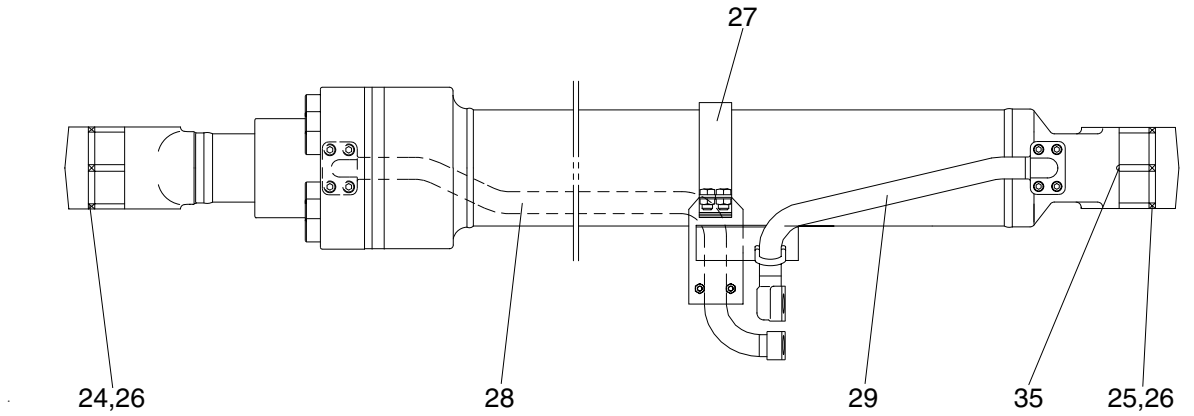


1	Tube assembly	14	Piston	27	Coil spring
2	Rod assembly	15	O-ring	28	O-ring
3	Gland	16	Back up ring	29	Plug
4	DD2 bushing	17	Piston seal	30	Band assembly
5	Snap ring	18	Wear ring	31	Band assembly
6	Rod seal	19	Dust ring	32	Pipe assembly
7	Back up ring	20	Lock nut	33	Pipe assembly
8	Buffer ring	21	Hexagon socket set screw	34	O-ring
9	Dust wiper	22	O-ring	35	O-ring
10	Snap ring	23	Hexagon socket head bolt	36	Hexagon socket head bolt
11	O-ring	24	Pin bushing	37	Hexagon socket head bolt
12	Back up ring	25	Dust seal		
13	Cushion ring	26	Check valve		

(4) Boom cylinder



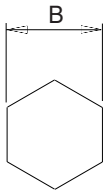
Internal detail



1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly
7	Back up ring	18	Wear ring	29	Pipe assembly
8	Buffer ring	19	Dust ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket set screw	35	Grease nipple
11	O-ring	22	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Allen wrench	10 14 18 24 30	
(-) 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
Piston	Bucket cylinder	14	-	150±15	1085±108
	Boom cylinder	14	-	150±15	1085±108
	Arm cylinder	14	-	200±20	1447±145
Piston lock nut	Bucket cylinder	20	-	100±10	723±72
	Boom cylinder	20	-	100±10	723±72
	Arm cylinder	20	-	150±15	1085±108
Socket head bolt	Bucket cylinder	23	M22	63.0±6.0	456±43
		31	M12	9.4±1.0	67.9±7.2
	Boom cylinder	23	M22	63.0±6.0	456±43
		31	M12	9.4±1.0	67.9±7.2
	Arm cylinder	23	M24	79.0±8.0	571±58
		36	M12	9.4±1.0	67.9±7.2

3) DISASSEMBLY

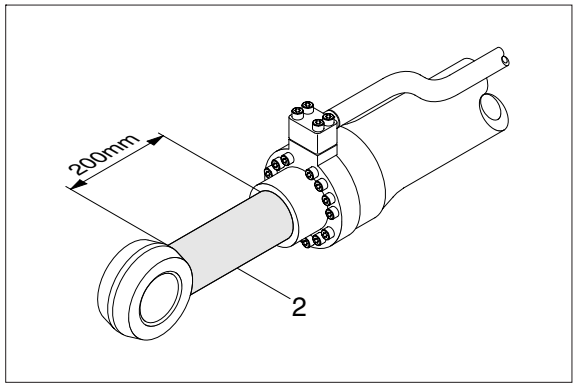
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

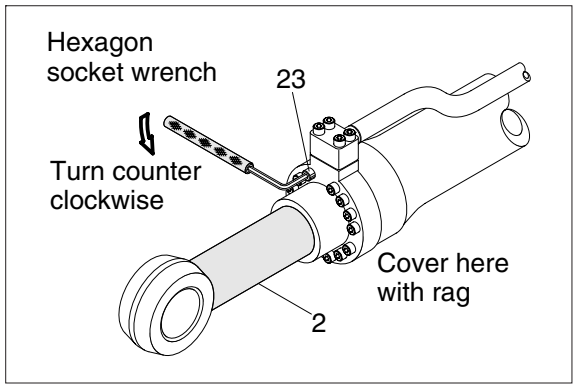
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



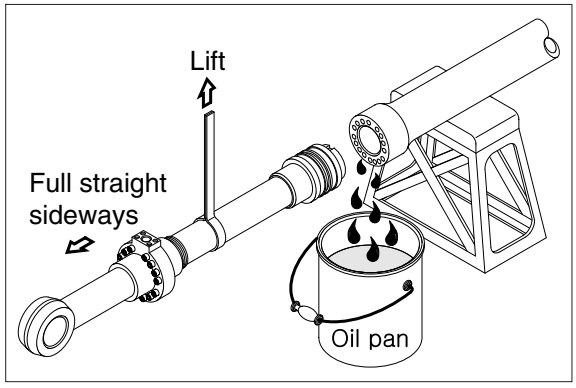
③ Loosen and remove socket bolts (23) of the gland in sequence.

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



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

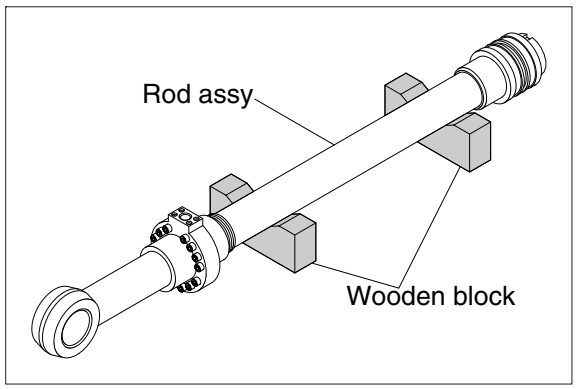
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

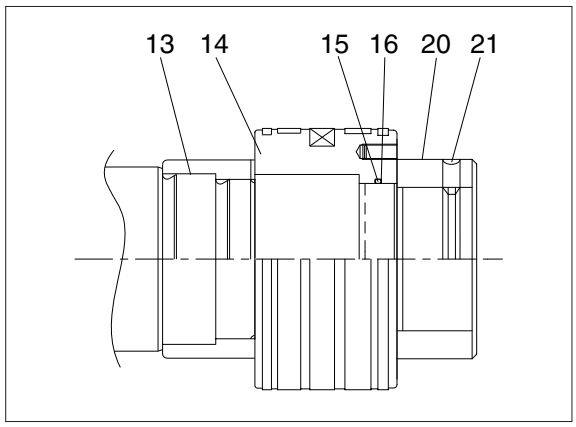


(3) Remove piston and cylinder head

① Loosen socket set screw (21) and remove lock nut (20).

※ Since lock nut (20) is tightened to a high torque use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove lock nut (20).

② Remove piston assembly (14), back up ring (16), and O-ring (15).

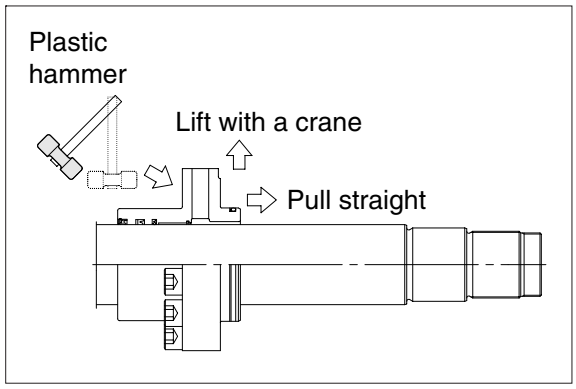


③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.

Exercise care so as not to damage the lip of rod bushing (4) and packing (5, 6, 7, 8, 9, 10) by the threads of rod assembly (2).

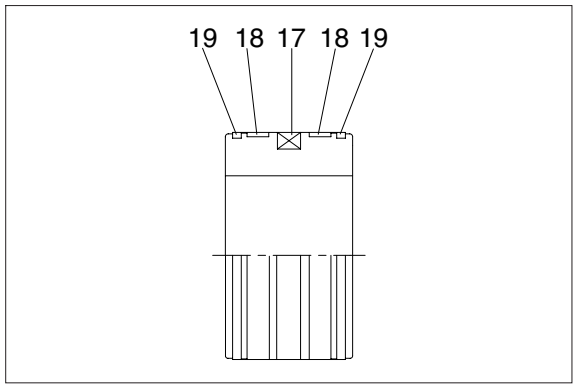


(3) Disassemble the piston assembly

① Remove wear ring (18).

② Remove dust ring (19) and piston seal (17).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

① Remove back up ring (12) and O-ring (11).

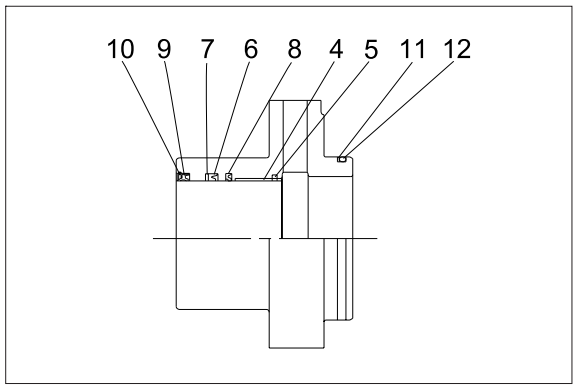
② Remove snap ring (10), dust wiper(9).

③ Remove back up ring (7), rod seal (6) and buffer ring (8) and snap ring (5).

※ Exercise care in this operation not to damage the grooves.

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

※ Do not remove bushing (4).

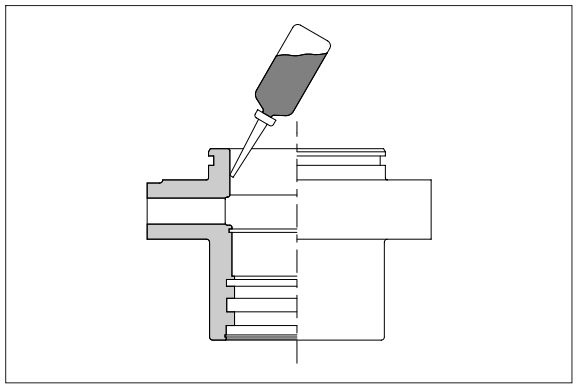


3) ASSEMBLY

(1) Assemble cylinder head assembly

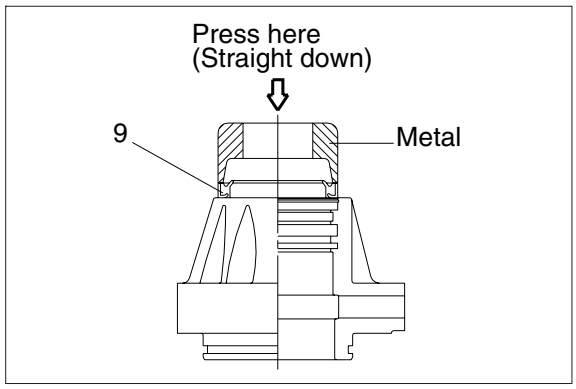
※ Check for scratches or rough surfaces if found smooth with an oil stone.

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



② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

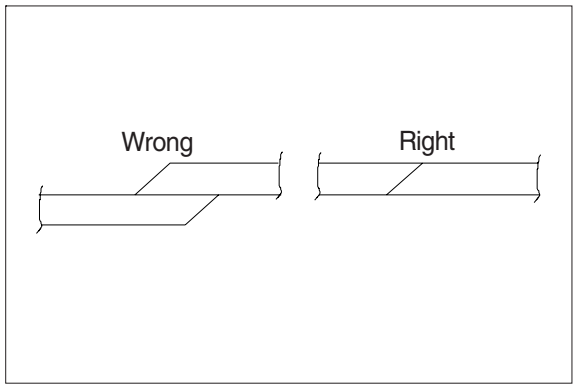
③ Fit snap ring (10) to the stop face.



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

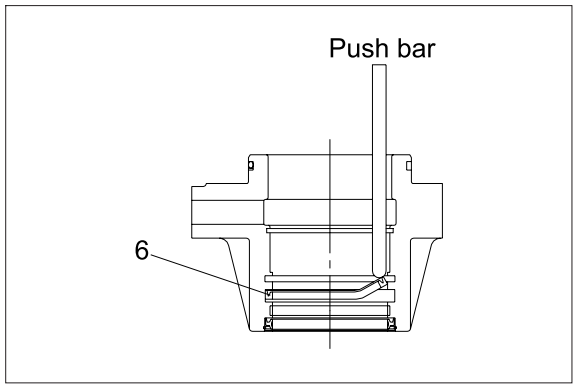
※ Coat each packing with hydraulic oil before fitting it.

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



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

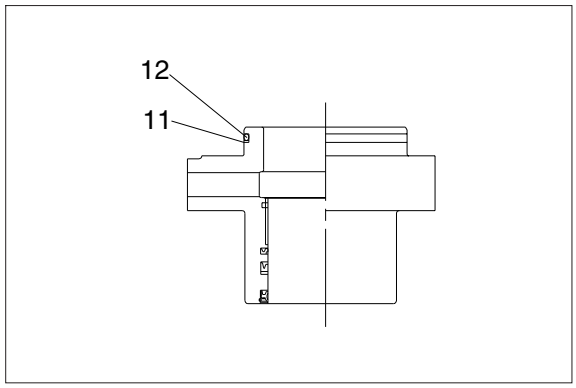
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

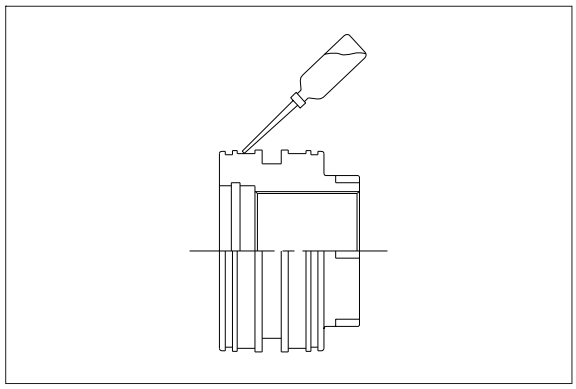
⑥ Fit O-ring (11) to gland (3).



(2) Assemble piston assembly

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

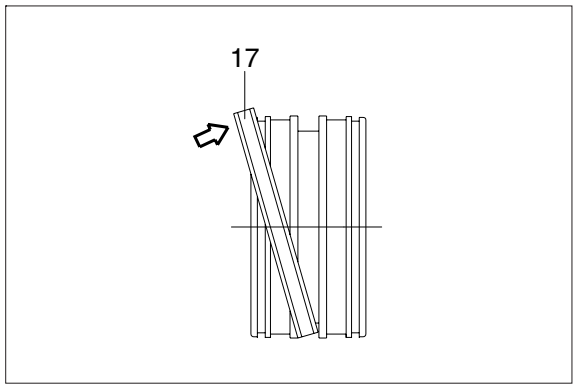
① Coat the outer face of piston (14) with hydraulic oil.



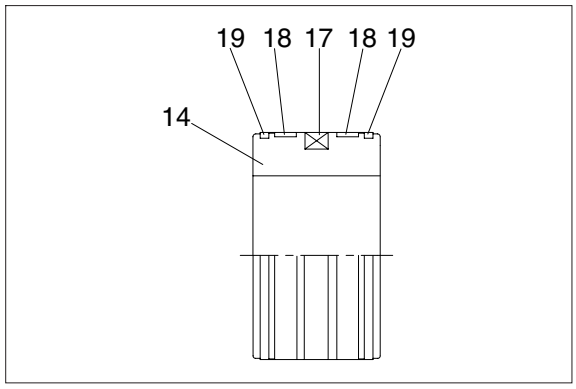
② Fit piston seal (17) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring (18) and dust ring (19) to piston (14).

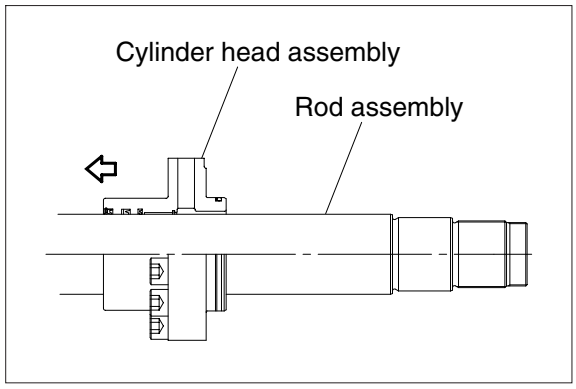


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

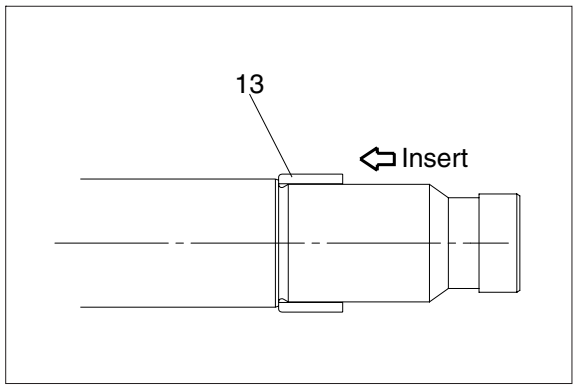
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



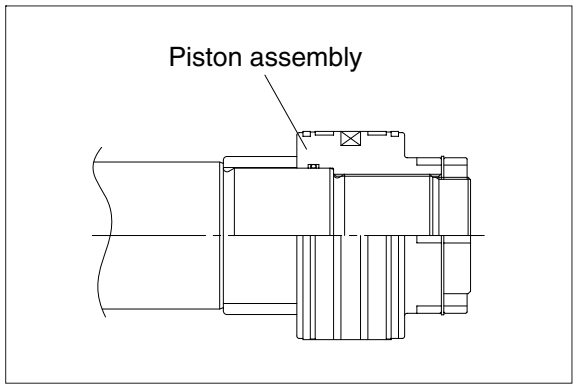
④ Insert cushion ring (13) to rod assembly.

※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

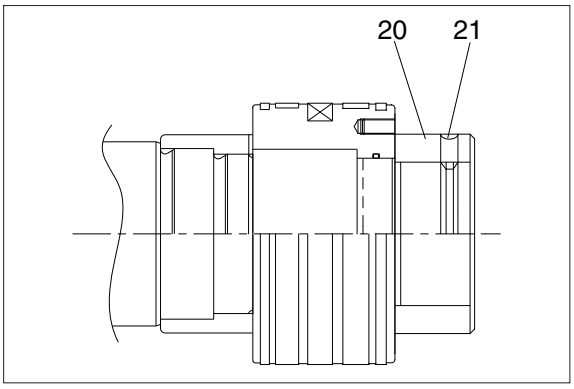
· Tightening torque : 150±15.0 kgf · m
(1085±108 lbf · ft)



⑥ Fit lock nut (20) and tighten the set screw (21).

· Tightening torque :

Item		kgf · m	lbf · ft
Bucket	20	100±10	723±72
	21	5.4±0.5	39.1±3.6
Boom	20	100±10	723±72
	21	5.4±0.5	39.1±3.6
Arm	20	150±15	1085±108
	21	5.4±0.5	39.1±3.6



(3) Overall assemble

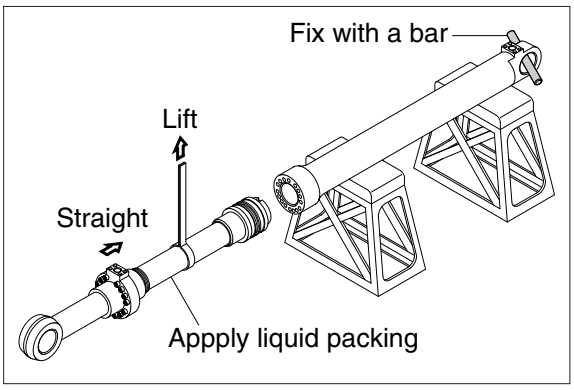
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

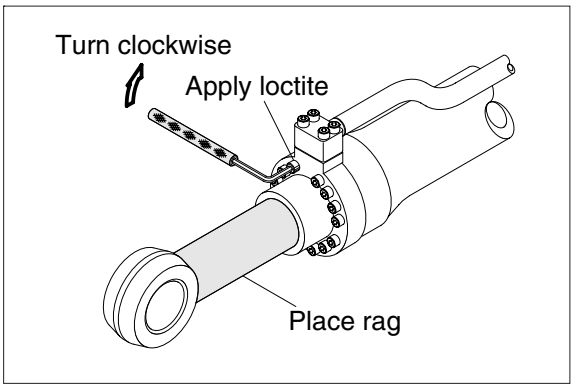
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.





1. TRACK LINK

1) REMOVAL

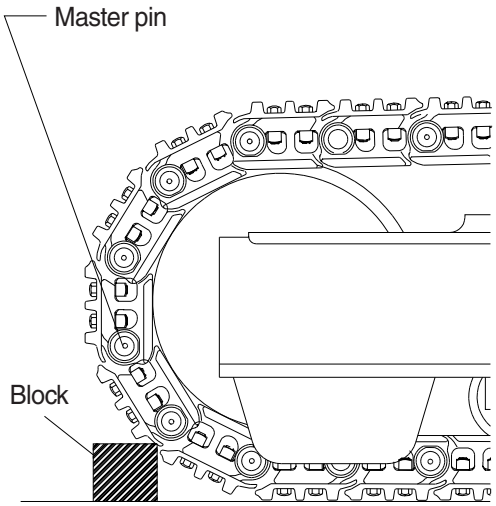
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

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

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

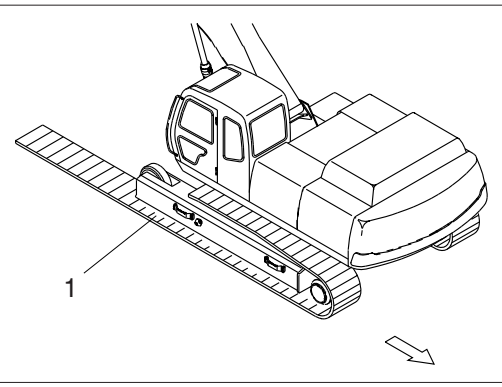
(3) Push out master pin by using a suitable tool.



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

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

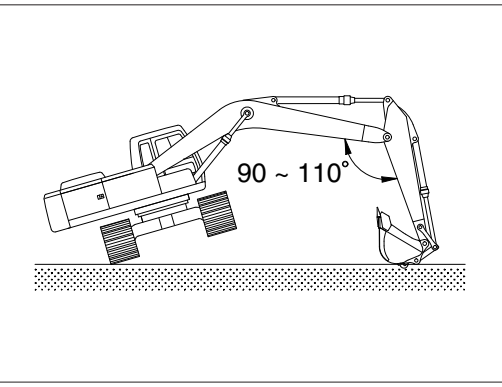
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

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

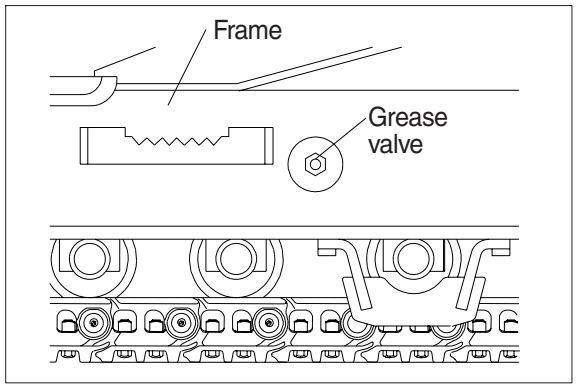
※ Adjust the tension of the track link.



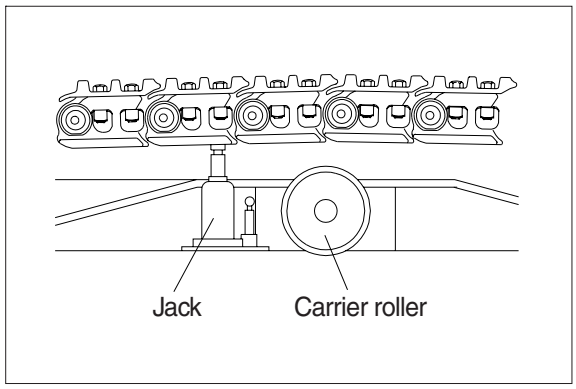
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.

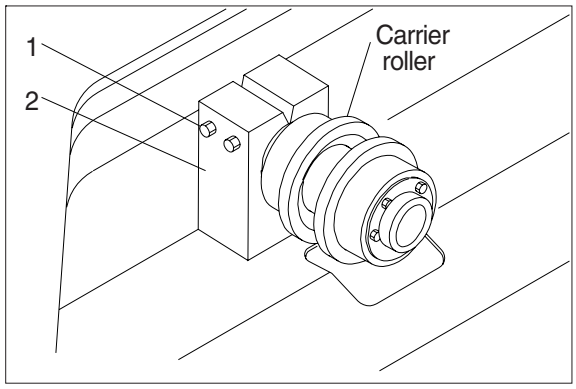


(2) Jack up the track link height enough to permit carrier roller removal.



(3) Loosen the lock nut (1).

(4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.
- Weight : 80 kg (180 lb)



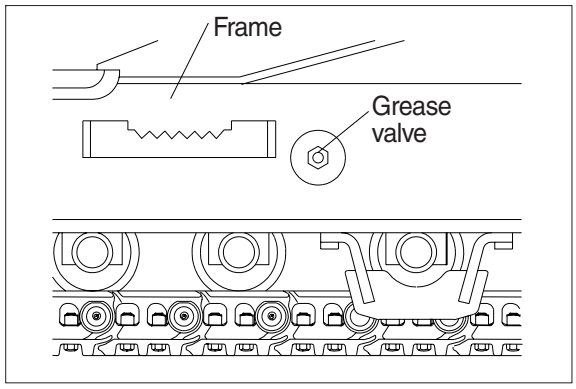
2) INSTALL

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

3. TRACK ROLLER

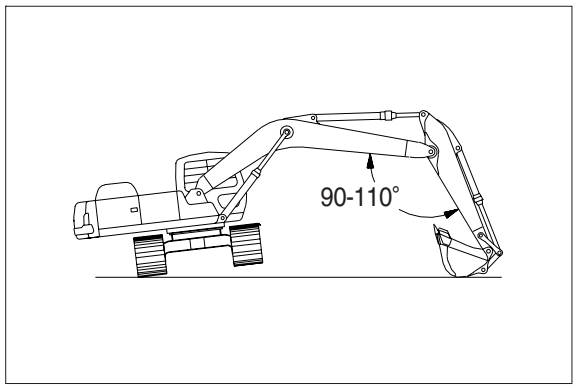
1) REMOVAL

(1) Loosen tension of the track link.



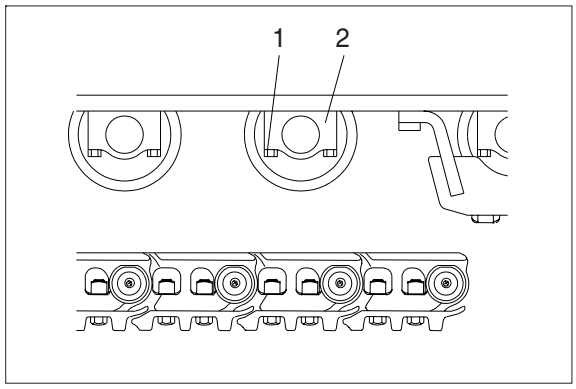
(2) Using the work equipment, push up track frame on side which is to be removed.

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



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

· Weight : 80 kg (180 lb)



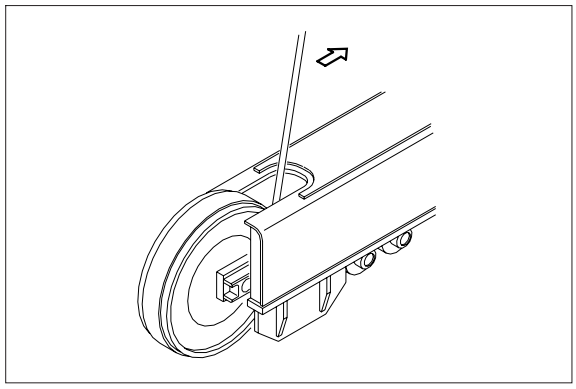
2) INSTALL

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

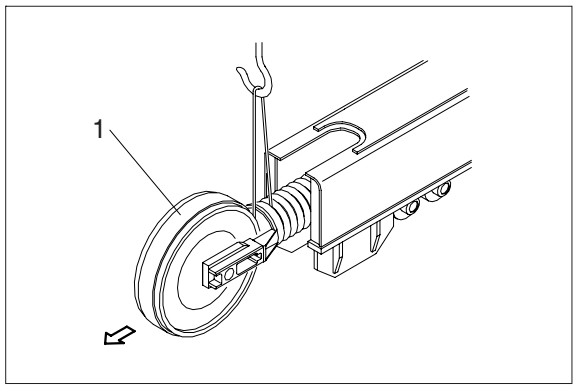
4. IDLER AND RECOIL SPRING

1) REMOVAL

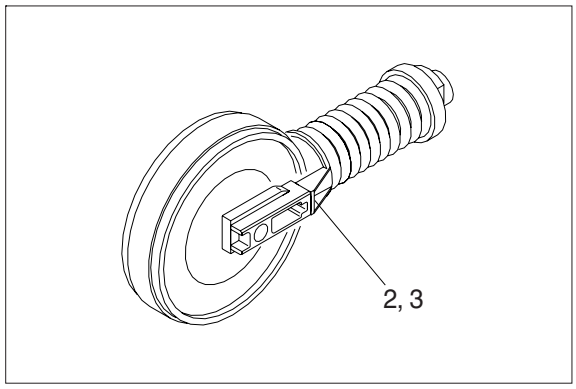
(1) Remove the track link.
For detail, see removal of track link.



(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 550 kg (1210 lb)



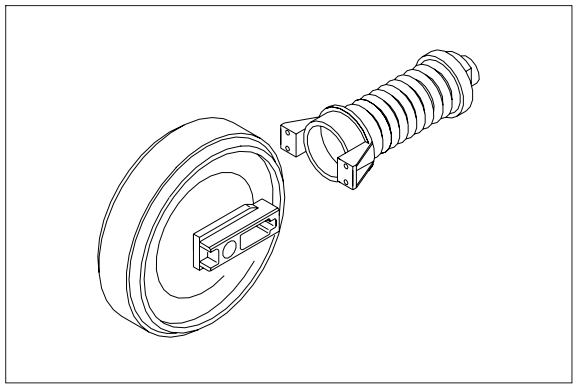
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.



2) INSTALL

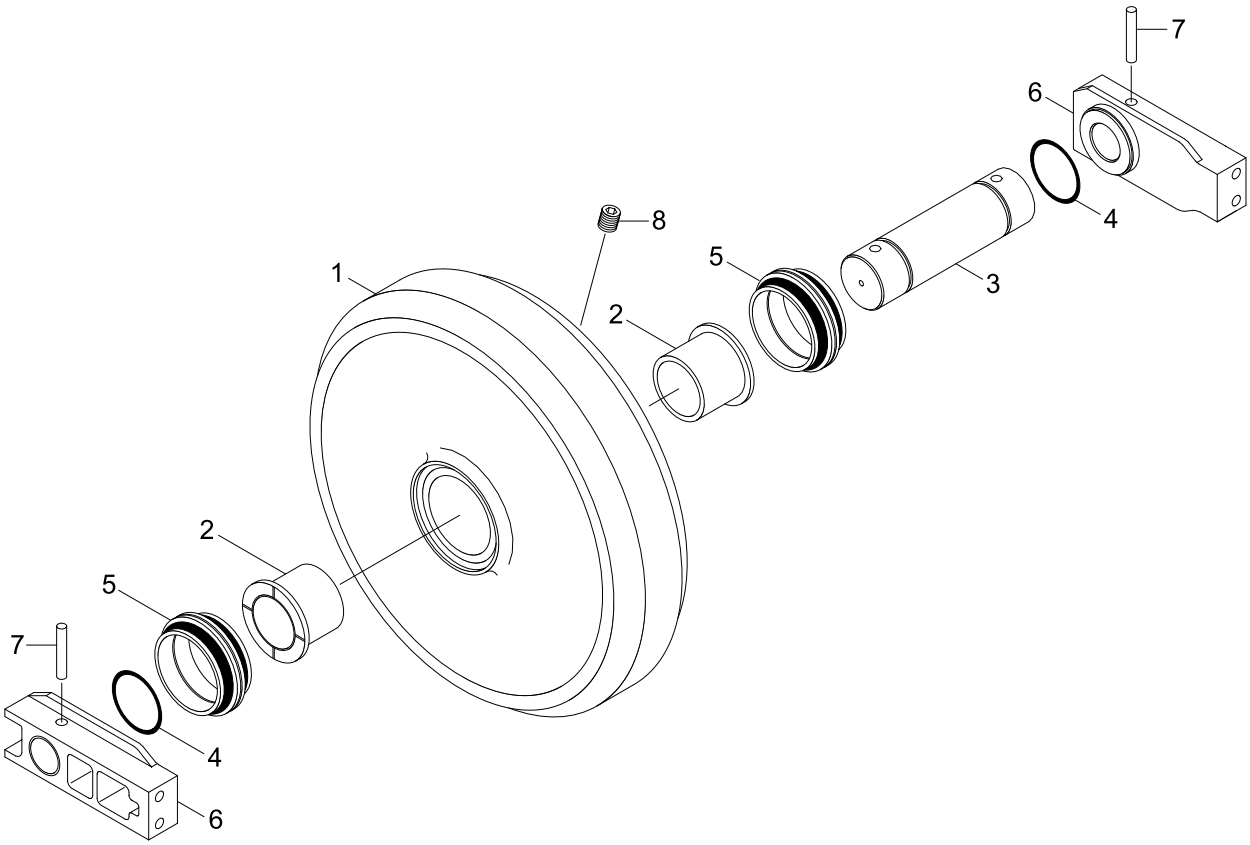
(1) Carry out installation in the reverse order to removal.

※ 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

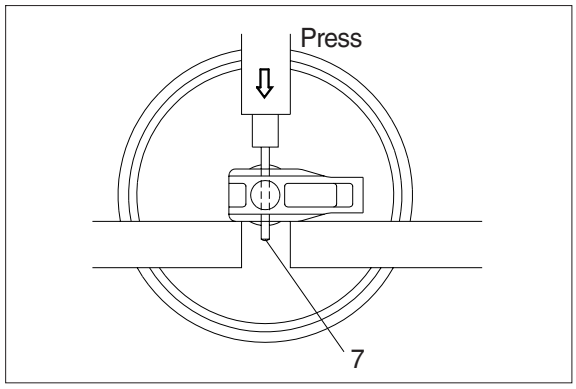


1	Shell	4	O-ring	7	Spring pin
2	Bushing	5	Seal assembly	8	Plug
3	Shaft	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

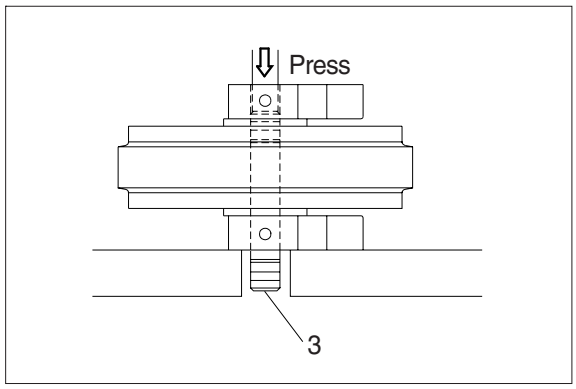
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

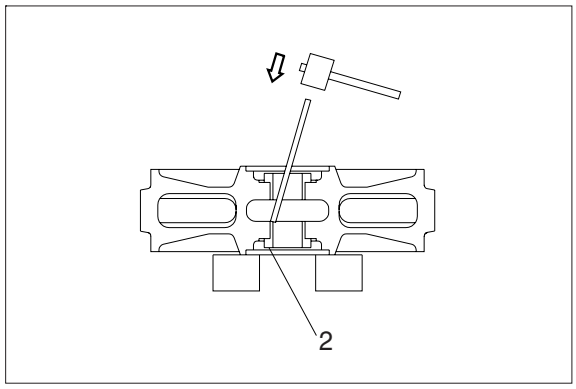
④ Remove seal (5) from shell (1) and bracket (6).

⑤ Remove O-ring (4) from shaft.



⑥ Remove the bushing (2) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

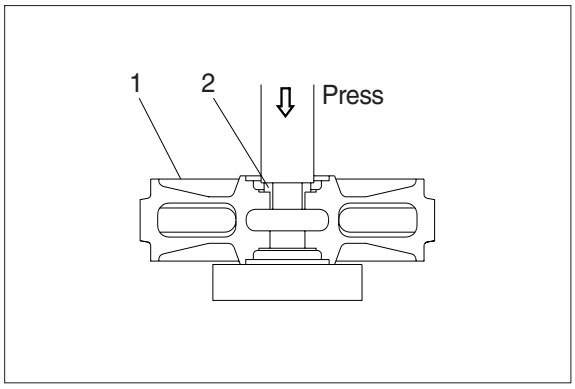


(3) Assembly

※ Before assembly, clean the parts.

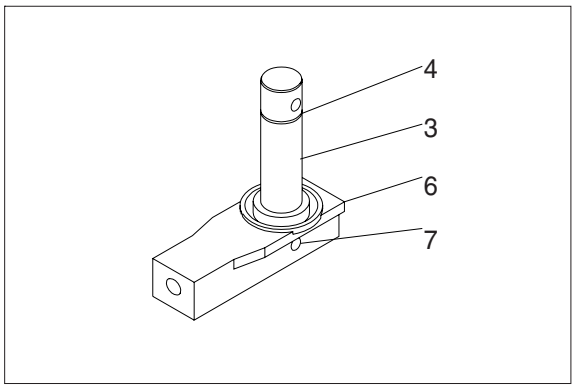
※ Coat the sliding surfaces of all parts with oil.

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

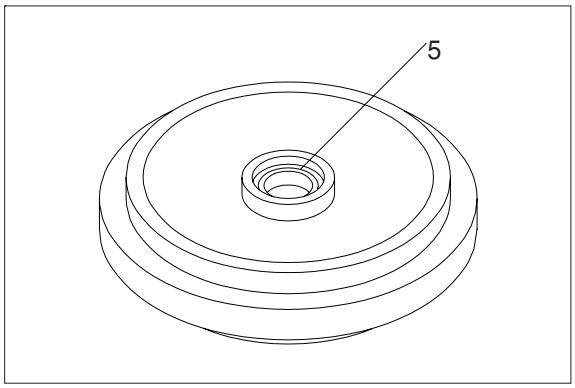


② Coat O-ring (4) with grease thinly, and install it to shaft (3).

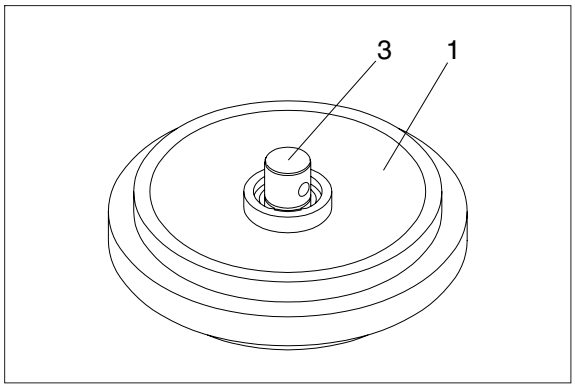
③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



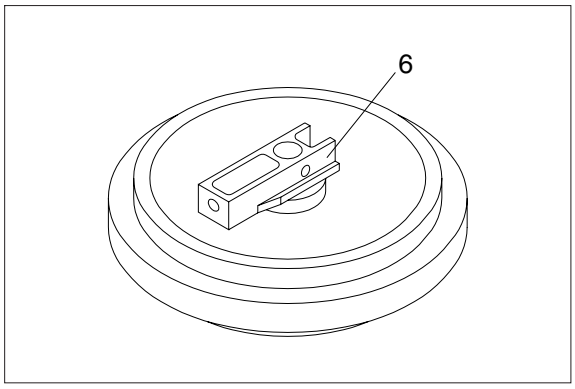
④ Install seal (5) to shell (1) and bracket (6).



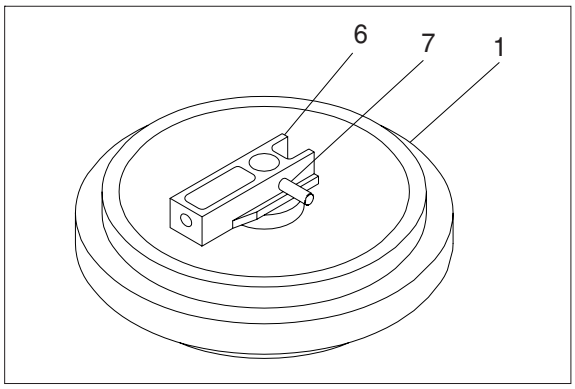
⑤ Install shaft (3) to shell (1).



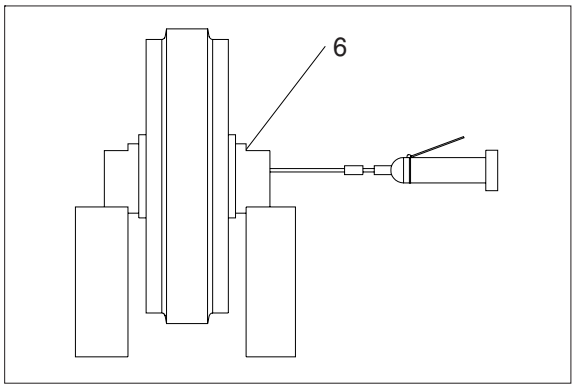
⑥ Install bracket (6) attached with seal (5).



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

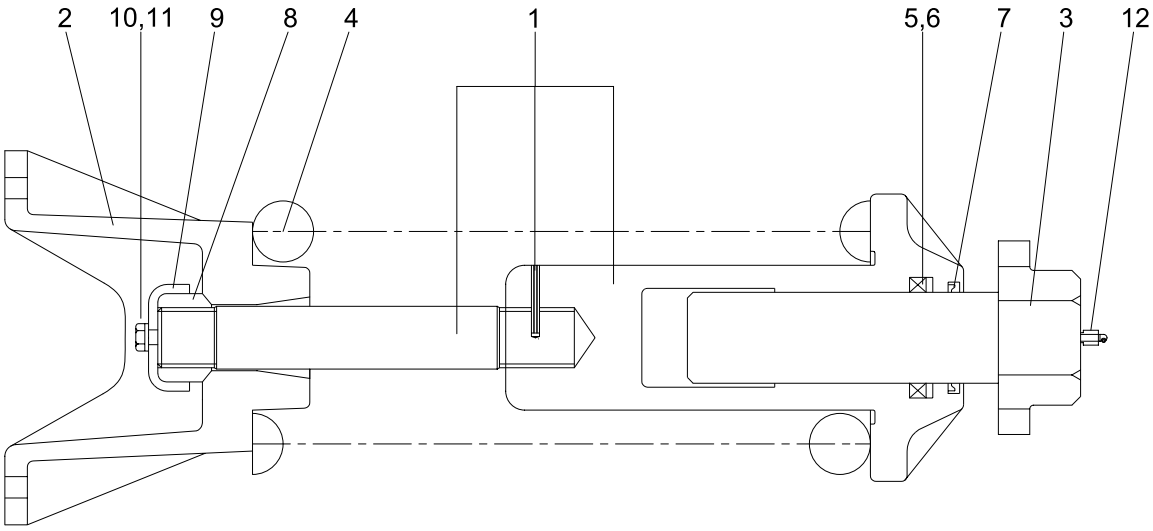


⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



1	Body	5	Rod seal	9	Lock plate
2	Bracket	6	Back up ring	10	Hex bolt
3	Rod assembly	7	Dust seal	11	Spring washer
4	Spring	8	Lock nut	12	Grease valve

(2) Disassembly

① Apply pressure on spring (4) with a press.

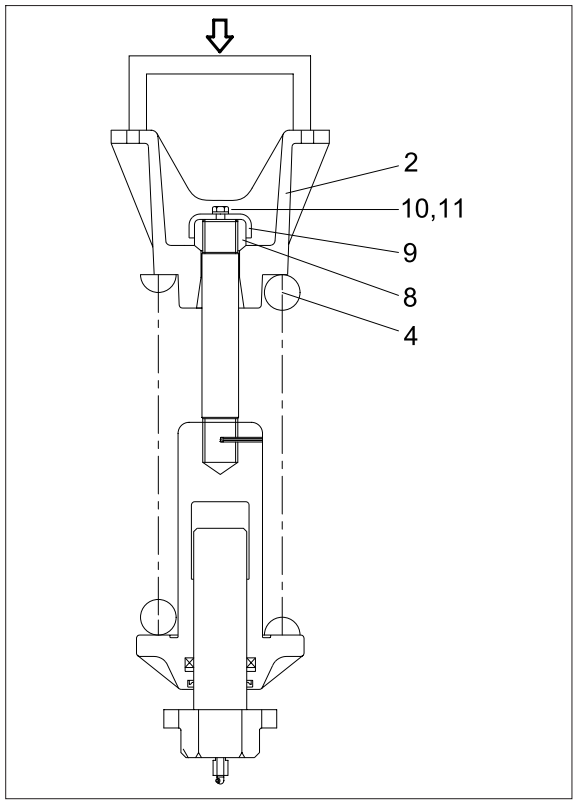
※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

・Spring set load : 28840 kg (63580 lb)

② Remove bolt (10), spring washer (11) and lock plate (9).

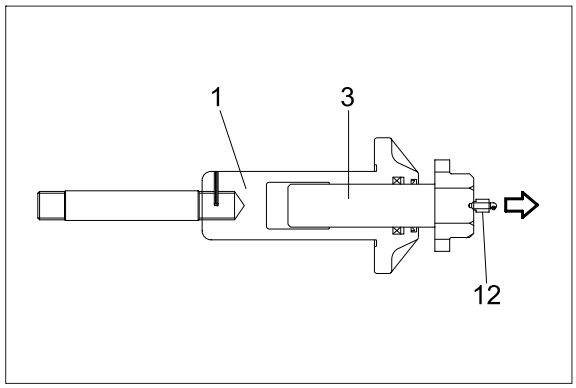
③ Remove lock nut (8).

④ 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 (2) and spring (4).

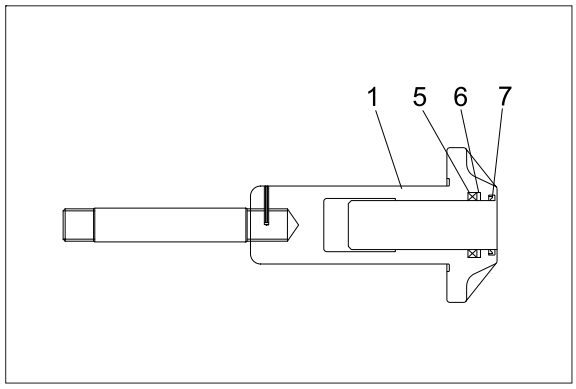


⑤ Remove rod (3) from body (1).

⑥ Remove grease valve (12) from rod (3).



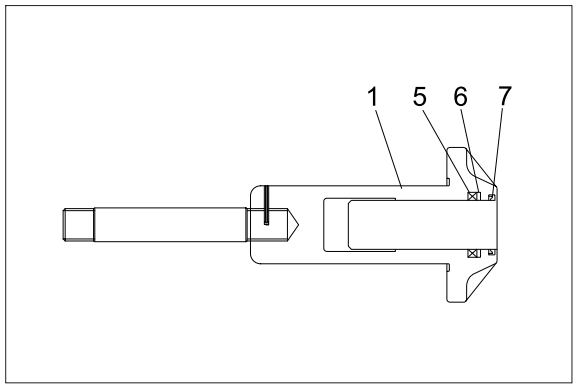
⑦ Remove rod seal (5), back up ring (6) and dust seal (11).



(3) Assembly

① Install dust seal (7), back up ring (6) and rod seal (5) to body (1).

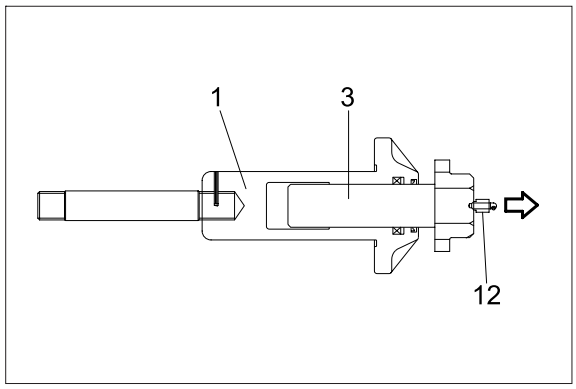
※ When installing dust seal (7) and rod seal (5), take full care so as not to damage the lip.



② Pour grease into body (1), then push in rod (3) by hand.
After take grease out of grease valve mounting hole, let air out.

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

③ Fit grease valve (12) to rod (3).
· Tightening torque : 13.0±1.0 kgf · m
(94±7.2lbf · ft)

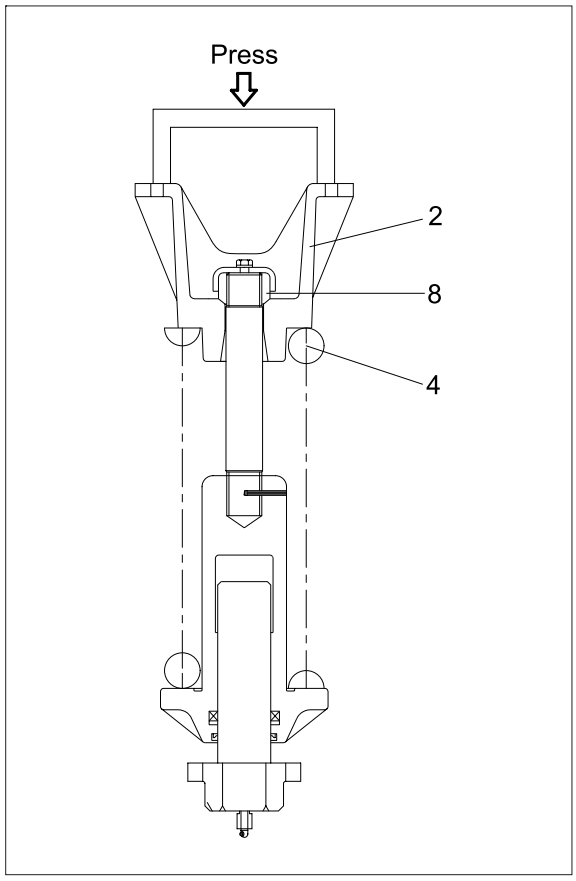


④ Install spring (4) and bracket (2) to body (1).

⑤ Apply pressure to spring (4) with a press and tighten lock nut (8).

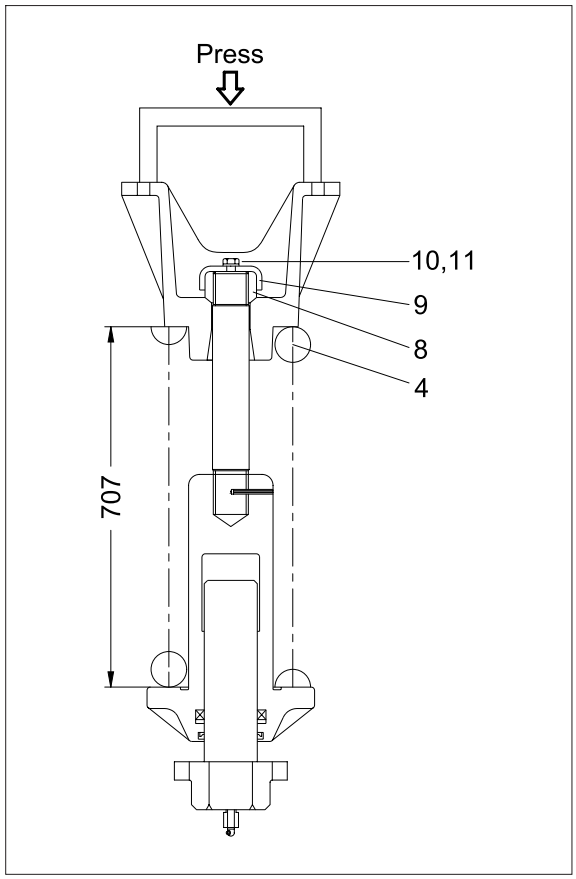
※ Apply sealant before assembling.

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

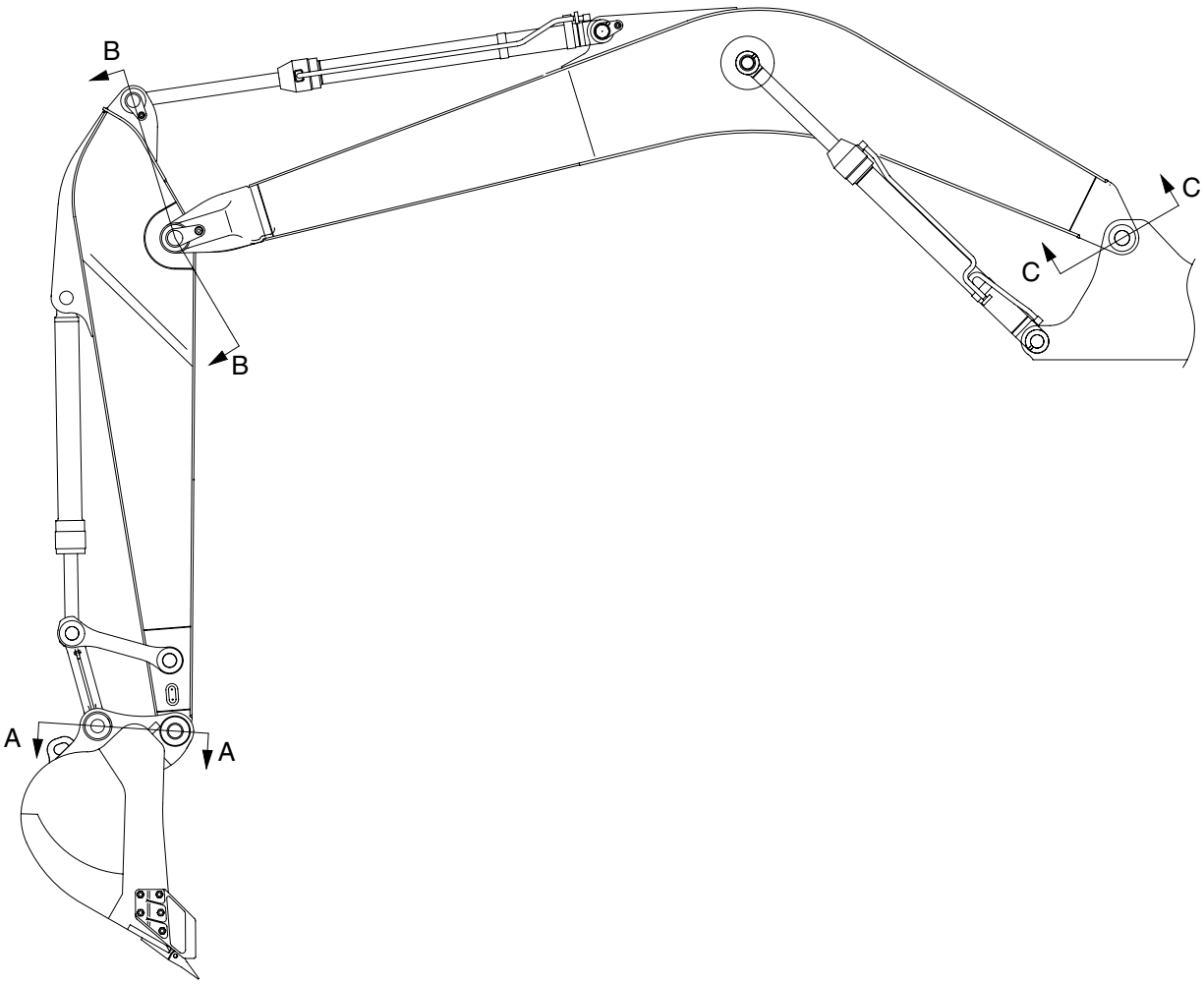


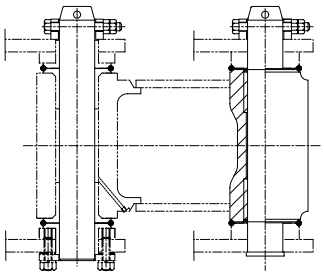
⑥ Lighten the press load and confirm the set length of spring (4).

⑦ After the setting of spring (4), install lock plate (9), spring washer (11) and bolt (10).

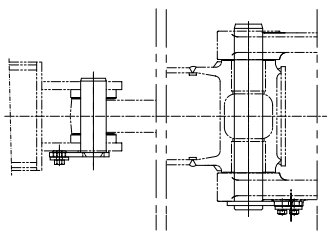


1. STRUCTURE

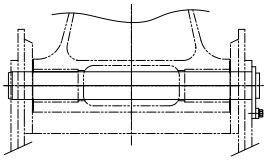




SECTION A



SECTION B



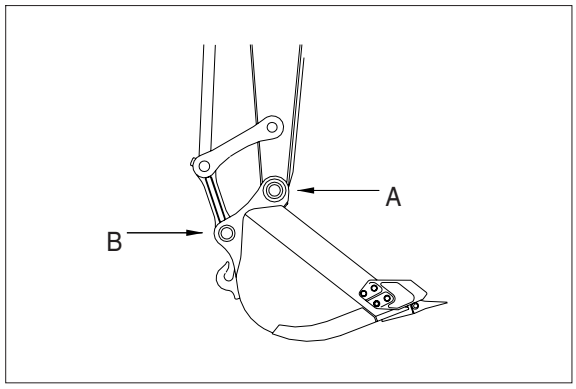
SECTION C

2. REMOVAL AND INSTALL

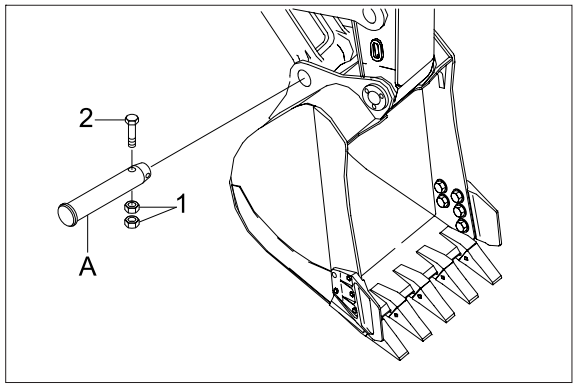
1) BUCKET ASSEMBLY

(1) Removal

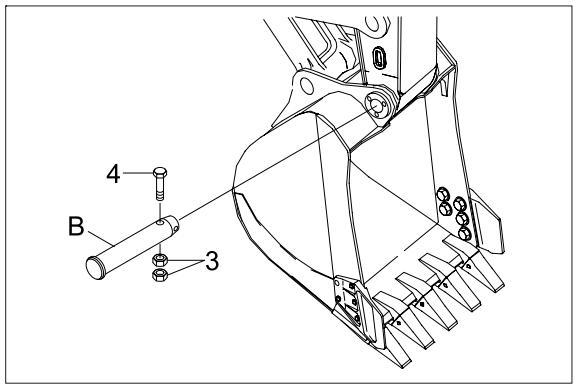
① Lower the work equipment completely to ground with back of bucket facing down.



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



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

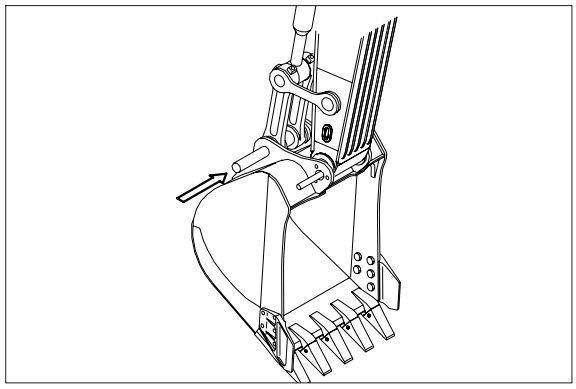


(2) Install

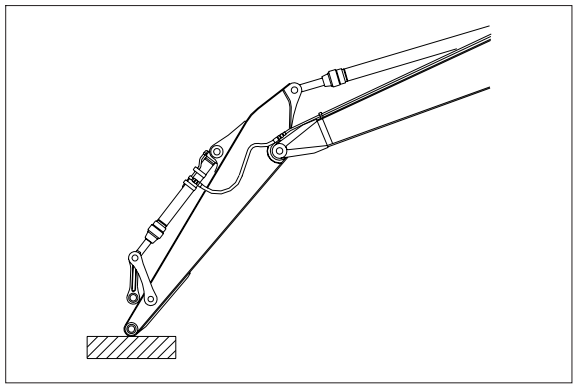
① Carry out installation in the reverse order to removal.

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

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



2) ARM ASSEMBLY



(1) Removal

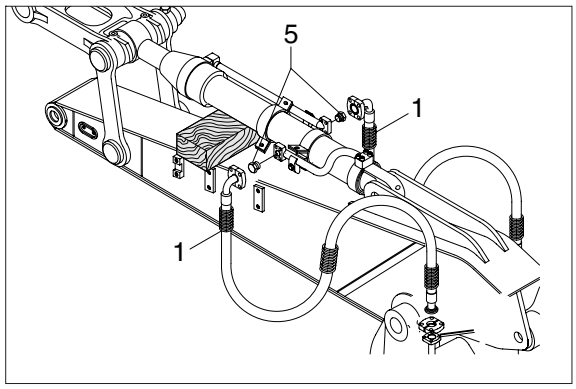
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrated the skin causing serious injury.

① Remove bucket assembly.
For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (1).

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



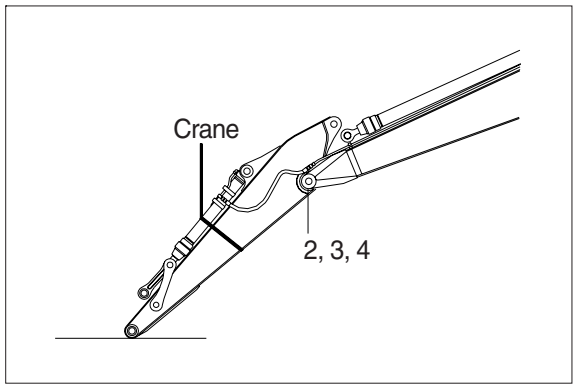
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

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

④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.
· Weight : 1450 kg (3200 lb)

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



(2) Install

① Carry out installation in the reverse order to removal.

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

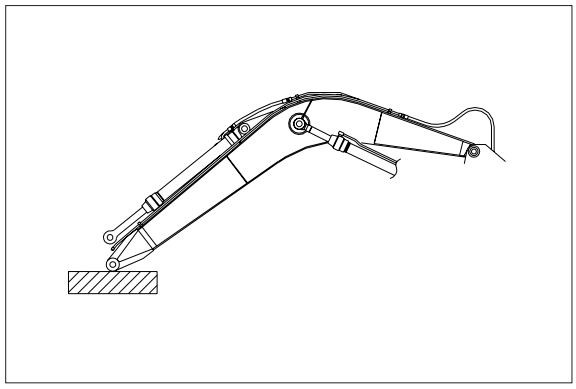
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

① Remove arm and bucket assembly.

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

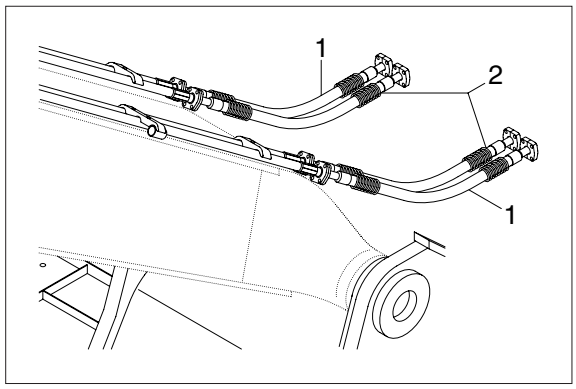


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

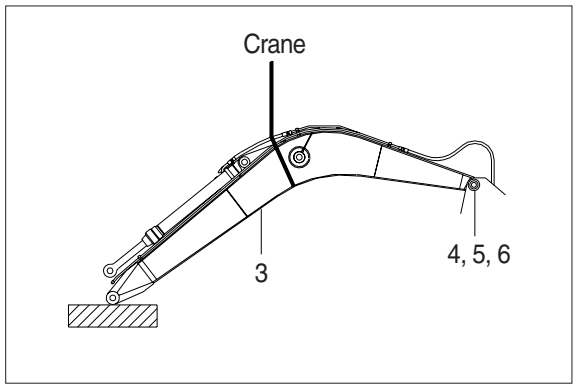
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight : 3300 kg (7360 lb)

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



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the cylinder.