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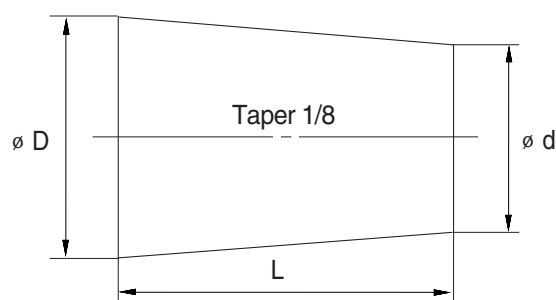
SECTION 7 DISASSEMBLY AND ASSEMBLY

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.
 - ※ 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 disulphide grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (Engine-Bracket)	M10 × 1.5	6.9±1.4	50±10.0
2		Engine mounting bolt (Bracket-Frame)	M12 × 1.75	12.8±3.0	93±22.0
3		Radiator mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
4		Coupling mounting bolt	M12 × 1.75	9.3±0.5	67.1±3.6
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	9.5±1.9	69±14.0
6		Main control valve mounting bolt	M10 × 1.5	6.9±1.4	50±10.0
7		Fuel tank mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
8		Hydraulic oil tank mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
9		Turning joint mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
10		Swing motor mounting bolt	M14 × 2.0	19.6±2.9	142±21.0
11	Power train system	Swing bearing upper mounting bolt	M12 × 1.75	13.3±2.0	96.2±14.5
12		Swing bearing lower mounting bolt	M12 × 1.75	12.8±2.0	93±14.5
13		Travel motor mounting bolt	M12 × 1.75	13.8±1.0	100±7.2
14		Sprocket mounting bolt	M12 × 1.75	12.3±1.2	89±8.7
15	Under carriage	Carrier roller mounting bolt, nut	M12 × 1.75	12.3±1.2	89±8.7
16		Track roller mounting bolt	M18 × 2.0	41.3±4.0	299±28.9
17	Others	Counterweight mounting bolt	M20 × 2.5	57.9±8.7	419±62.9
18		Cab mounting bolt, nut	M12 × 1.75	13.0	94.0
19		Operator's seat mounting bolt	M 8 × 1.25	2.5±0.5	18.1±3.6

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

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

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

2) PIPE AND HOSE (FLARE type)

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

3) PIPE AND HOSE (ORFS type)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130
1-7/16-12	41	21	152
1-11/16-12	50	35	253

4) FITTING

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

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

- Hydraulic tank quantity : 37 l
(9.8 U.S.gal)

- (5) Disconnect hoses (79, 80) and remove connectors (47, 48).

- (6) Disconnect pilot line hoses (101, 102) and remove connectors (44, 96).

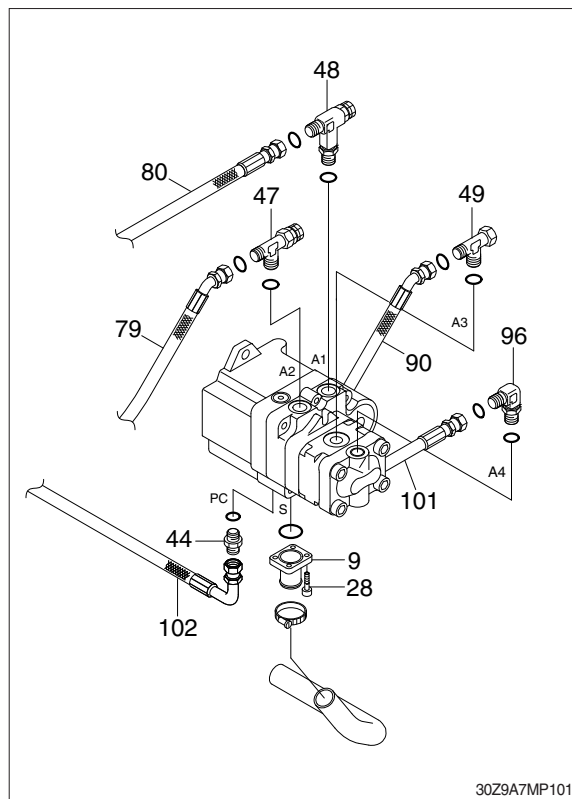
- (7) Remove socket bolts (28) and disconnect pump suction tube (9).

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

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

- Weight : 19 kg (42 lb)

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

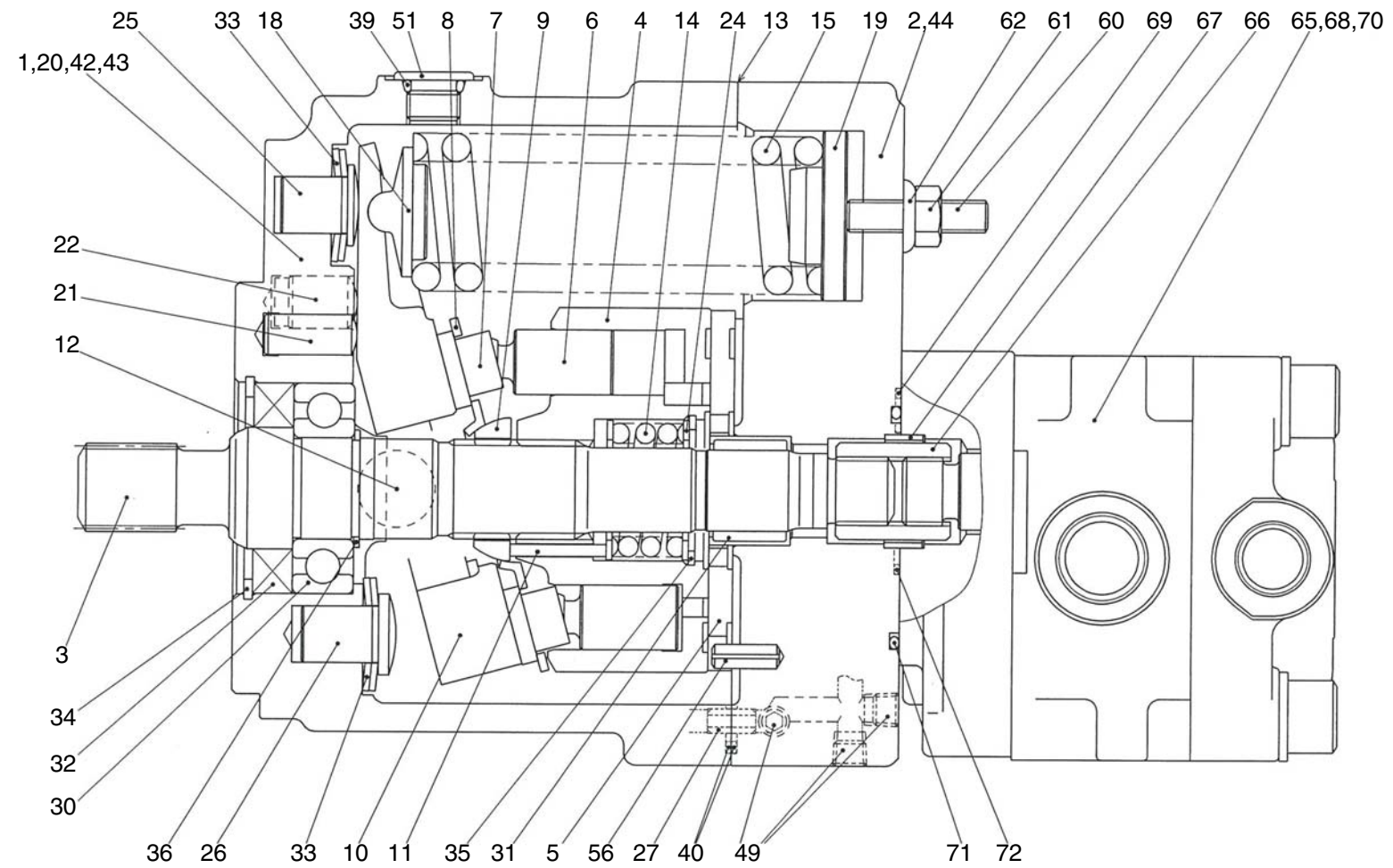


2) INSTALL

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

2. MAIN PUMP

1) STRUCTURE



1	Body S	10	Swash plate	21	Rod G	33	Dish spring	49	Plug	68	Screw
2	Body H	11	Needle	22	Rod C	34	Snap ring	51	Plug	69	O-ring
3	Shaft	12	Ball	24	Retainer	35	Snap ring	56	Spring pin	70	Washer
4	Cylinder barrel	13	Packing	25	Stopper pin A	36	Snap ring	60	Screw	71	O-ring
5	Valve plate	14	Spring C	26	Stopper pin B	39	O-ring	61	Nut	72	O-ring
6	Piston	15	Spring T1	27	Pin	40	O-ring	62	Seal washer		
7	Shoe	18	Spring holder	30	Ball bearing	42	Plug	65	Gear pump		
8	Shoe holder	19	Spring guide	31	Needle bearing	43	O-ring	66	Coupling		
9	Barrel holder	20	Pin	32	Oil seal	44	Screw	67	Collar		

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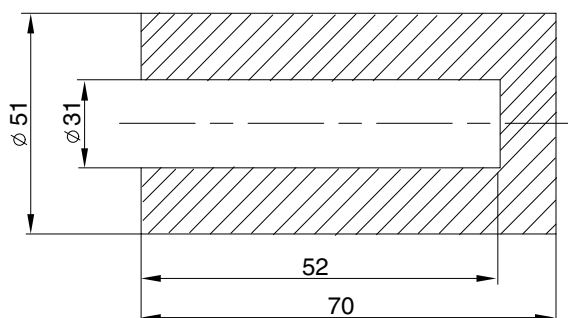
3. ASSEMBLE AND DISASSEMBLE

1) General precautions

- (1) Before disassembling, it is important to have fully understood the internal structure of the pump.
 - ※ The gasket (13), oil seal (32) and O-rings will be probably damaged when you disassemble it, so be sure to have prepared spares.
- (2) After having drained oil inside the pump, wash the pump and put it on a working bench covered with clean paper, cloth, or rubber mat for disassembling and assembling. Then, disassemble and assemble the pump slowly and carefully with necessary tools. Use care not to scratch even slightly, and take proper measures to prevent foreign matters from entering the assembly.

2) Tools

Tool name	Size	Quantity
Hexagon wrench	4, 6, 8 mm	1 each
Circlip player	For hole	1
Spanner wrench	13 mm	1
Torque wrench	45N (JIS B 4650) 90N (JIS B 4650)	1 1
Resin hammer	-	1
Special tooling for oil seal	See below	1
Seal kit	-	1 set
Grease	-	Small amount



Special tooling for oil seal

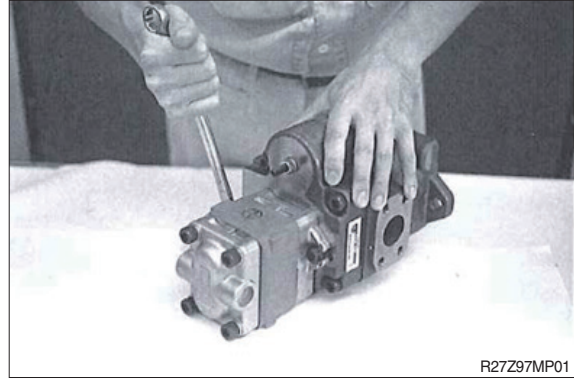
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3) DISASSEMBLING

(1) Disassembling of gear pump

Remove two screws (68) with spanner wrench 13 mm, and after that remove gear pump (65), collar (67) and coupling (66).

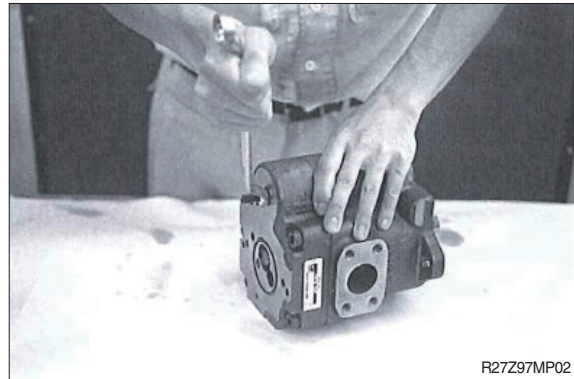
- ※ Coupling (66) and collar (67) may be attached with gear pump kit (65).



(2) Remove the adjustment screw

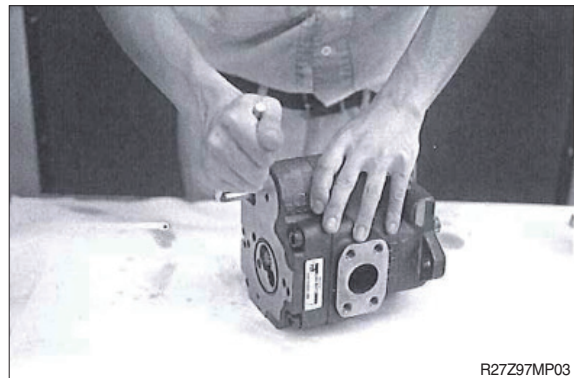
Loose hexagon nut (61) with spanner wrench 13 mm, then remove the adjustment screw (60) with hexagon wrench 4 mm.

- ※ Suggest you to measure the outside length of the adjustment screw. Because it is a good help when you readjust it after reassembling.



(3) Separation of body S and body H

Remove five screws (44) with hexagon wrench 8 mm.

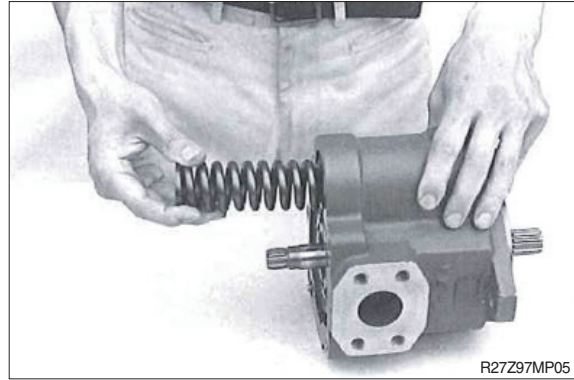


- ※ If you tap the part of inserted spring of body H with hummer softly, it is easy for separation.



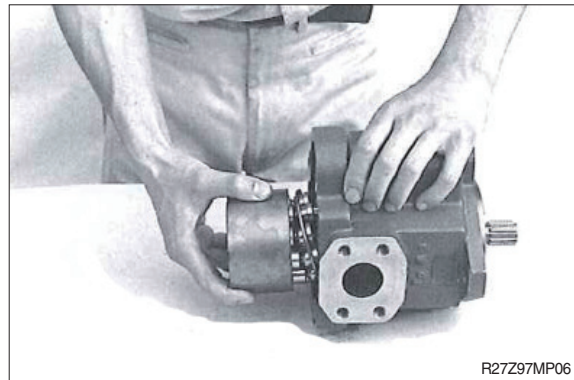
(4) Disassembling of body S kit

Remove spring T1 (15) from body S kit, then take off spring holder (18).



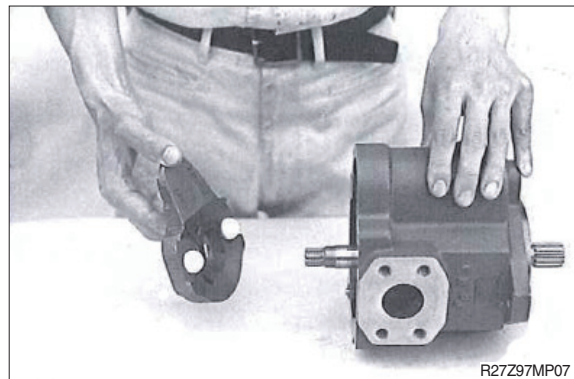
(5) Disassembling of body S kit

Remove cylinder barrel kit.



(6) Disassembling of body S kit

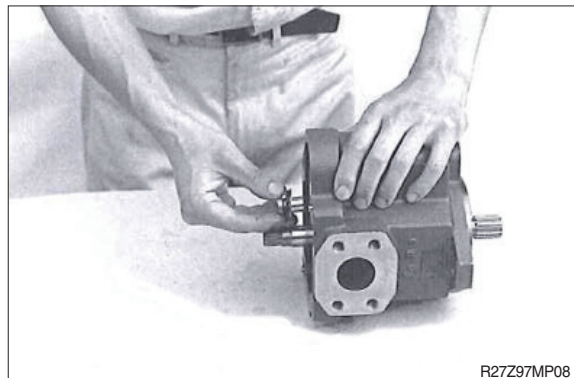
Remove swash plate (10) and two balls (12).



(7) Disassembling of body S kit

Remove stopper pin A (25), stopper pin B (26), dish springs (33), rod G (21) and rod C (22).

- ※ The length of the stopper pin A and B is different. Pay attention not to swap when reassembling.



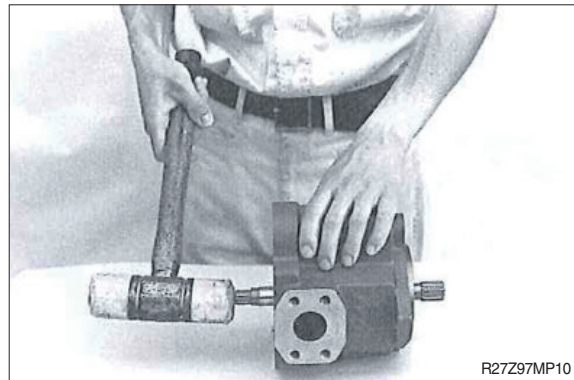
(8) Disassembling of body S kit

Remove snap ring (34) from body S (1).



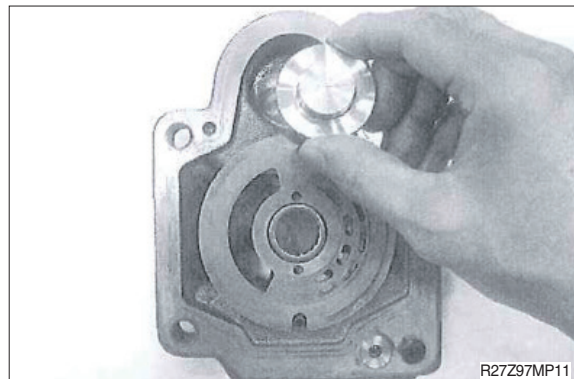
(9) Disassembling of body S kit

Tap the end of shaft (3) with hammer, then oil seal (32) and shaft with bearing (30) come off.



(10) Disassembling of body H kit

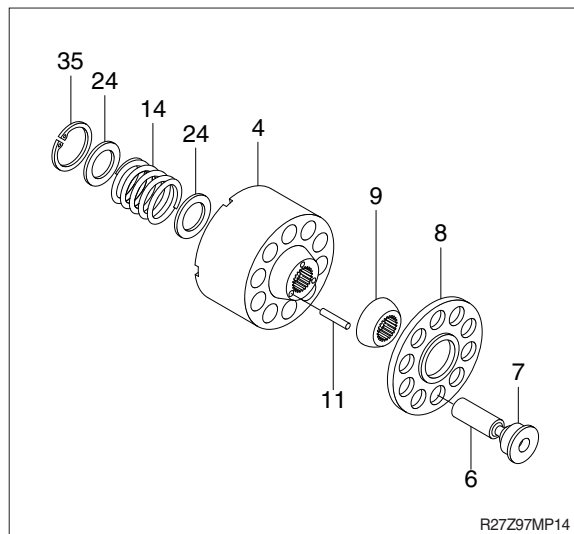
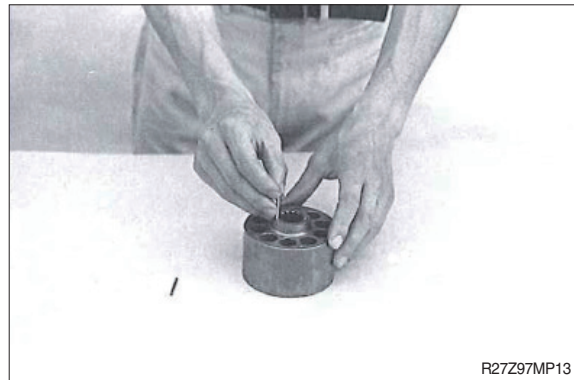
Remove spring guide (19) and valve plate (5) from body H.



(11) Disassembling of cylinder barrel kit

Remove shoe holder (8) on which piston shoe assemblies (6) and (7) are set and disassemble it in the order of barrel holder (9) and needle (11).

Also, take off snap ring (35), retainer (24), spring C (14) and retainer (24), which are set in the cylinder barrel (4) in this order.



4) ASSEMBLING

(1) Precautions during assembling

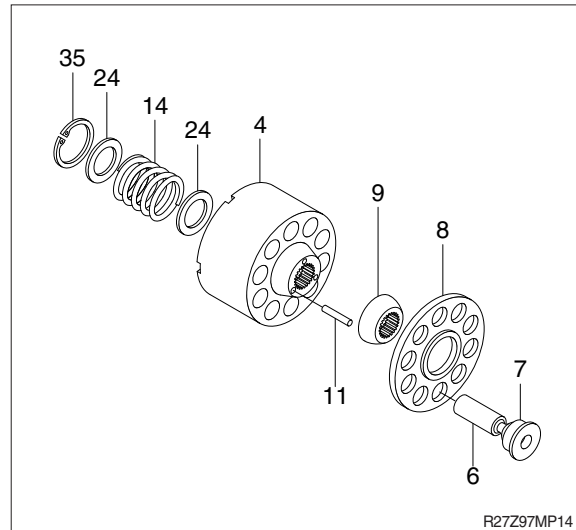
Reverse the above procedures for assembling.

When assembling, be very careful to wash parts in clean oil, to prevent dusts and water from adhering to parts entering assemblies and not to scratch on the sliding surfaces of all parts.

- ※ Apply small quantity of grease to the periphery of O-rings to be set in socket and spigot joints to prevent the O-rings from being damaged.

(2) Assembling of cylinder barrel kit

Set retainer (24), spring C (14), retainer (24) and snap ring (35) in the shaft center hole of cylinder barrel (4) in this order, and carefully set shoe holder (8), on which needle (11), barrel holder (9) and ten piston shoe assemblies have already been set, in cylinder barrel from the opposite side.

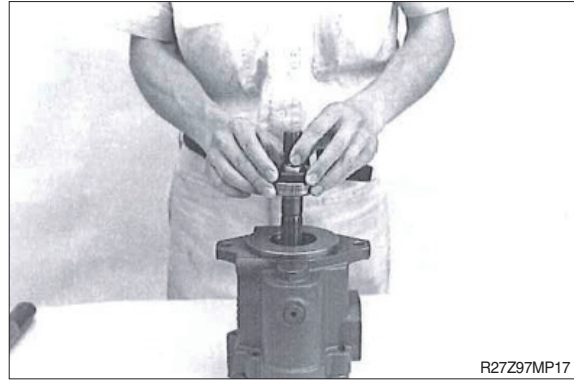


(3) Assembling of body S kit

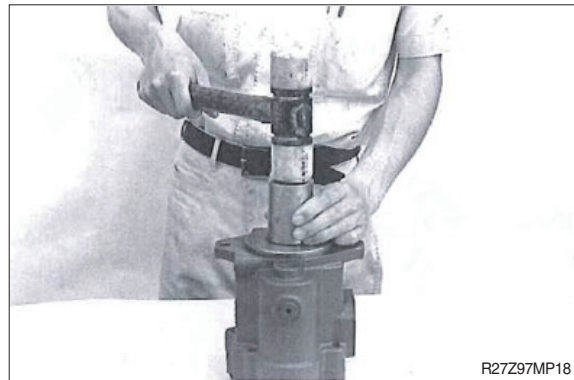
Set shaft (3) with bearing (30), oil seal (32) and snap ring (34) in this order into body S (1).

- ※ Use new oil seal for assembling. Before assembling, apply a small quantity of grease to the periphery of oil seal lip and tap it together with the special tooling with hammer.

When assembling, put body S (1) onto body H (2) tentatively for easy work.



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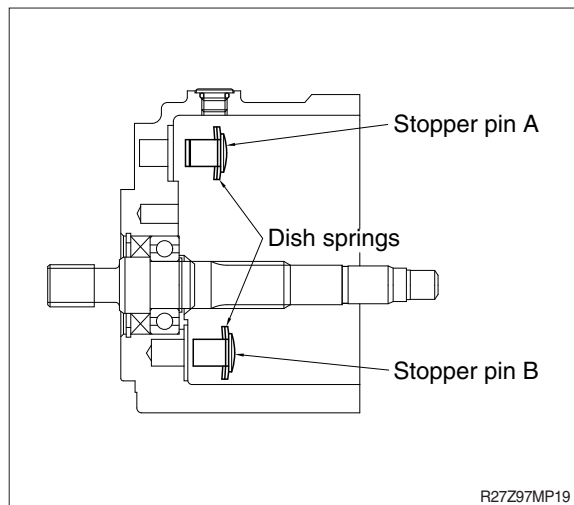


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(4) Assembling of body S kit

Set each four dish springs (33) to stopper pin A (25) and stopper pin B (26), then set them into body S (1).

- ※ Pay attention to the direction of the dish washer.
- ※ Pin A and pin B have different length. Set them to the original position. Otherwise, pump displacement changes, and engine stall or insufficient speed can occur.

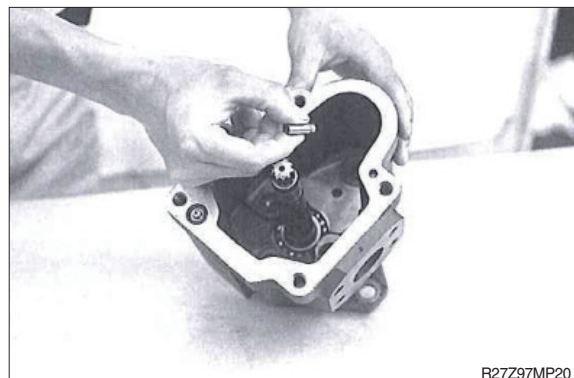


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(5) Assembling of body S kit

Set rod G (21) and rod C (22) into body S (1).

- ※ Pay attention to the direction of the rod G and rod C. (See cross section drawing for the direction.)

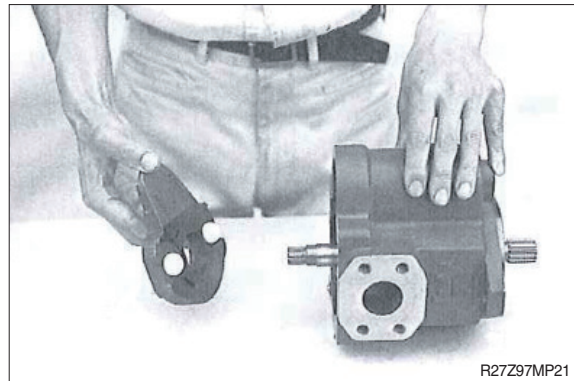


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(6) Assembling of body S kit

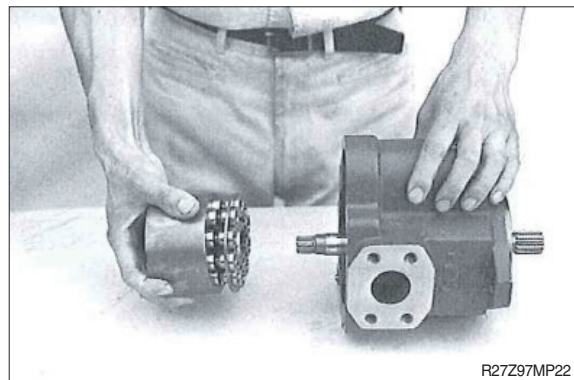
Put two balls (12) in the hole of swash plate (10) and install it in body S.

※ Apply grease on the balls if they drop out.



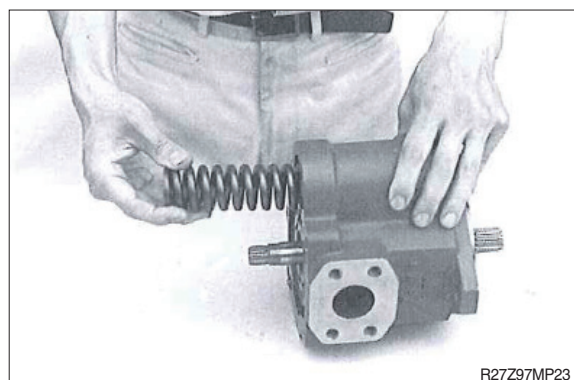
(7) Assembling of body S kit

Assemble cylinder barrel kit into the body S (1).



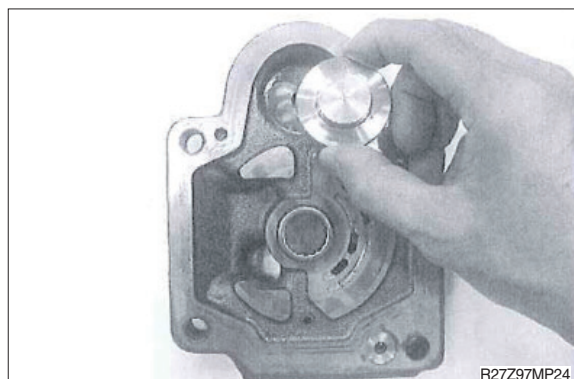
(8) Assembling of body S kit

Set spring T1 (15) to spring holder (18), then set them together into the hole on swash plate (10).



(9) Assembling of body H kit

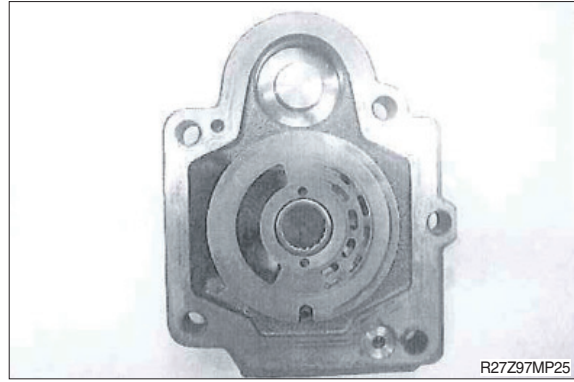
Set spring guide (19) in body H (2).



(10) Assembling of body H kit

Place valve plate (5) slowly on body H (2) by positioning it with spring pin (56).

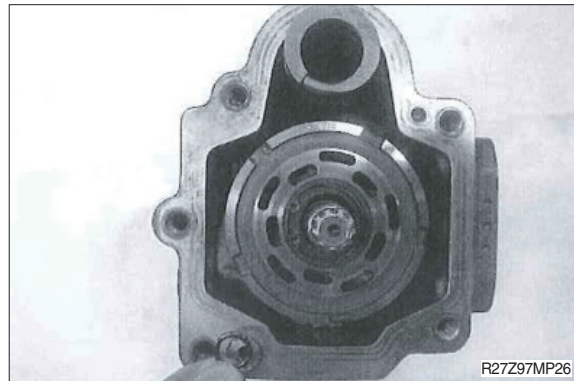
- ※ V notch copper alloy side of valve plate slides with cylinder barrel (4) and be careful not to set the valve plate to a wrong direction.



(11) Assembling of body S kit with body H kit

Place O-ring (40) on body S.

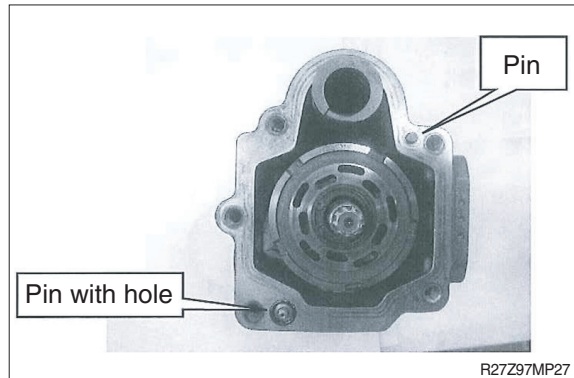
- ※ Use new O-ring for assembling.



(12) Assembling of body S kit with body H kit

Set pin (20) and pin (27) on body S.

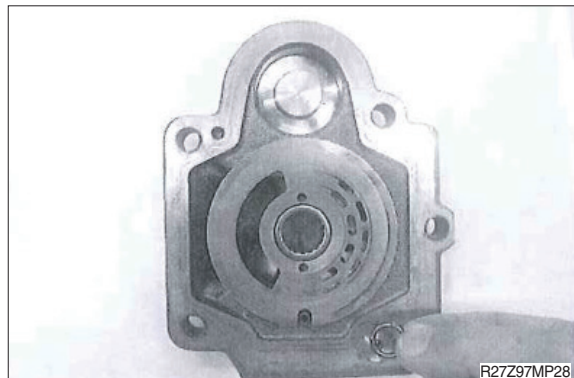
- ※ Pay attention to the position of each pin. Pin (27) has a hole.



(13) Assembling of body S kit with body H kit

Place O-ring (40) on body H.

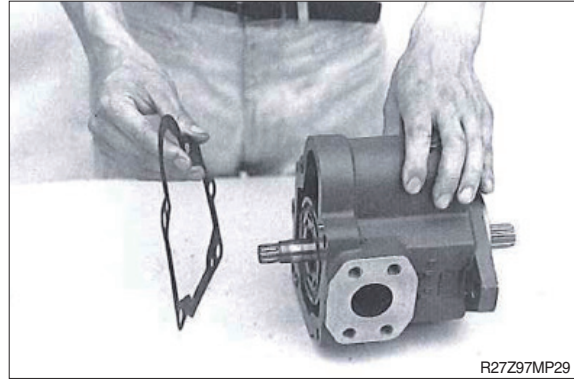
- ※ Use new O-ring for assembling.



(14) Assembling of body S kit with body H kit

Place packing (13), position it with locating pin (27) on body S.

※ Use new packing for assembling.



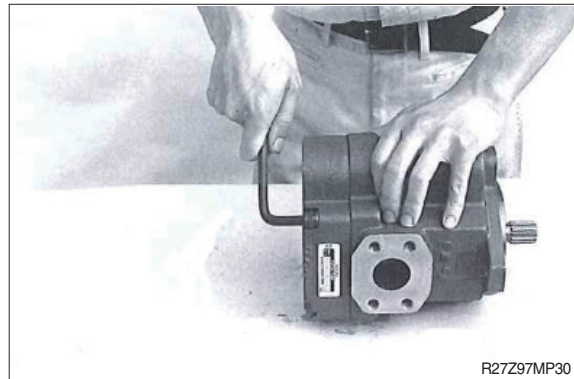
R27Z97MP29

(15) Assembling of body S kit with body H kit

Set two screws (M10×65) into the upper side two screw holes, and tighten them until the distance between body S and body H comes to 5 to 10 mm.

Then set three screws (44) into the three screw holes, after that, replace the upper side two screws (M10×65) to the regular size screws (44) and fix them.

· Tightening torque : 5.2~6.6 kgf · m
(37.6~47.7 lbf · ft)

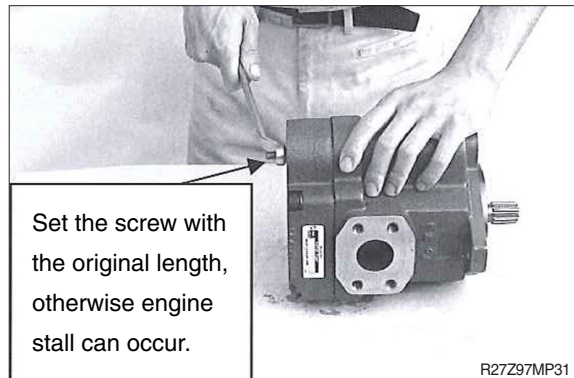


R27Z97MP30

(16) Installation of the adjusting screw

Fasten the adjusting screw (60) with hexagon wrench 4 mm, then adjust the outside length of adjusting screw and fix locknut (61) with spanner wrench 13 mm. At that time, change the seal washer (62) to new one.

· Tightening torque : 1.5~2.0 kgf · m
(10.8~14.5 lbf · ft)

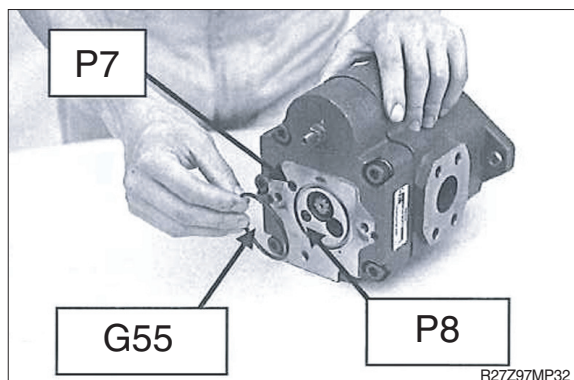


R27Z97MP31

(17) Installation of gear pump kit

Place O-ring (69, 71, 72) on the installation side of body H.

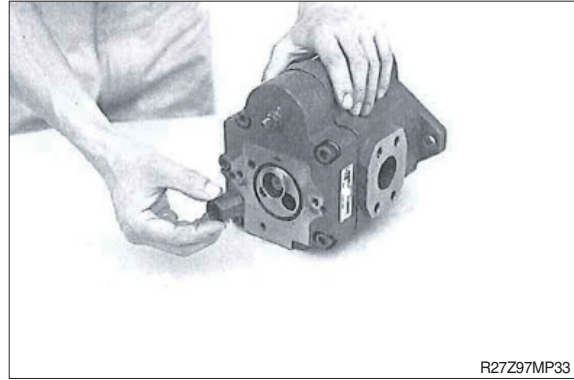
※ Use new O-ring for assembling.



R27Z97MP32

(18) Installation of gear pump kit

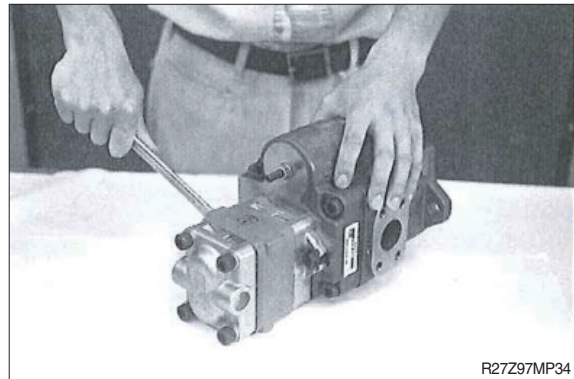
Set collar (67) and coupling (66).



(19) Installation of gear pump kit

Install gear pump kit (65) and fix it by two screws (68) and washers (70) with spanner wrench 13 mm.

- Tightening torque : 2.0~2.4 kgf · m
(14.5~17.3 lbf · ft)



(20) Inspection of assembling

After completed the assembling of pump, make sure that pump shaft rotates smoothly by hand.

GROUP 4 MAIN CONTROL VALVE

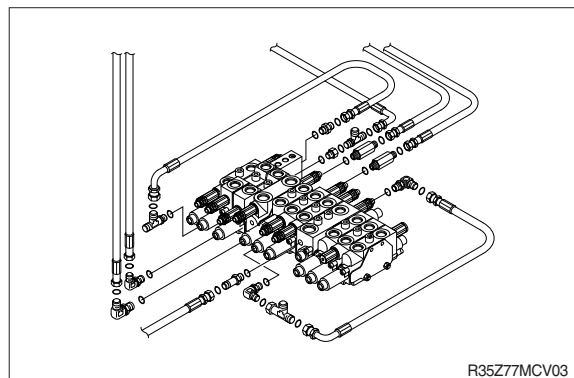
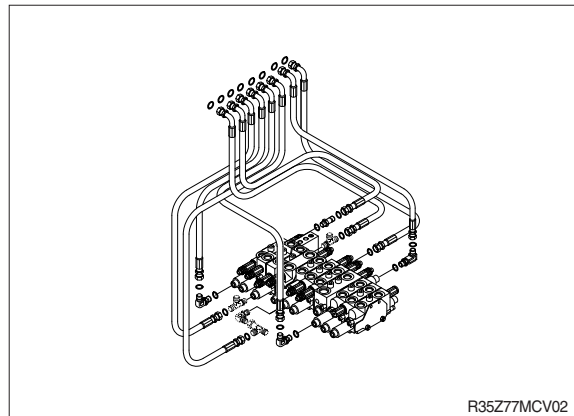
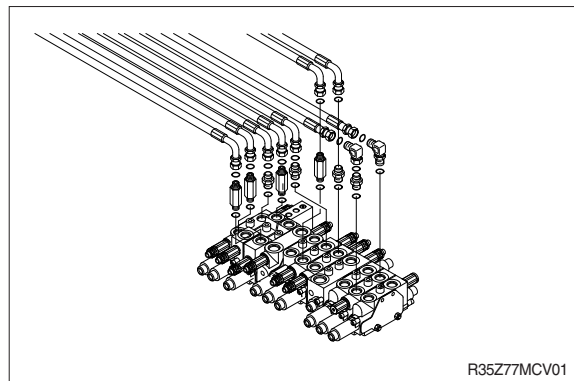
1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

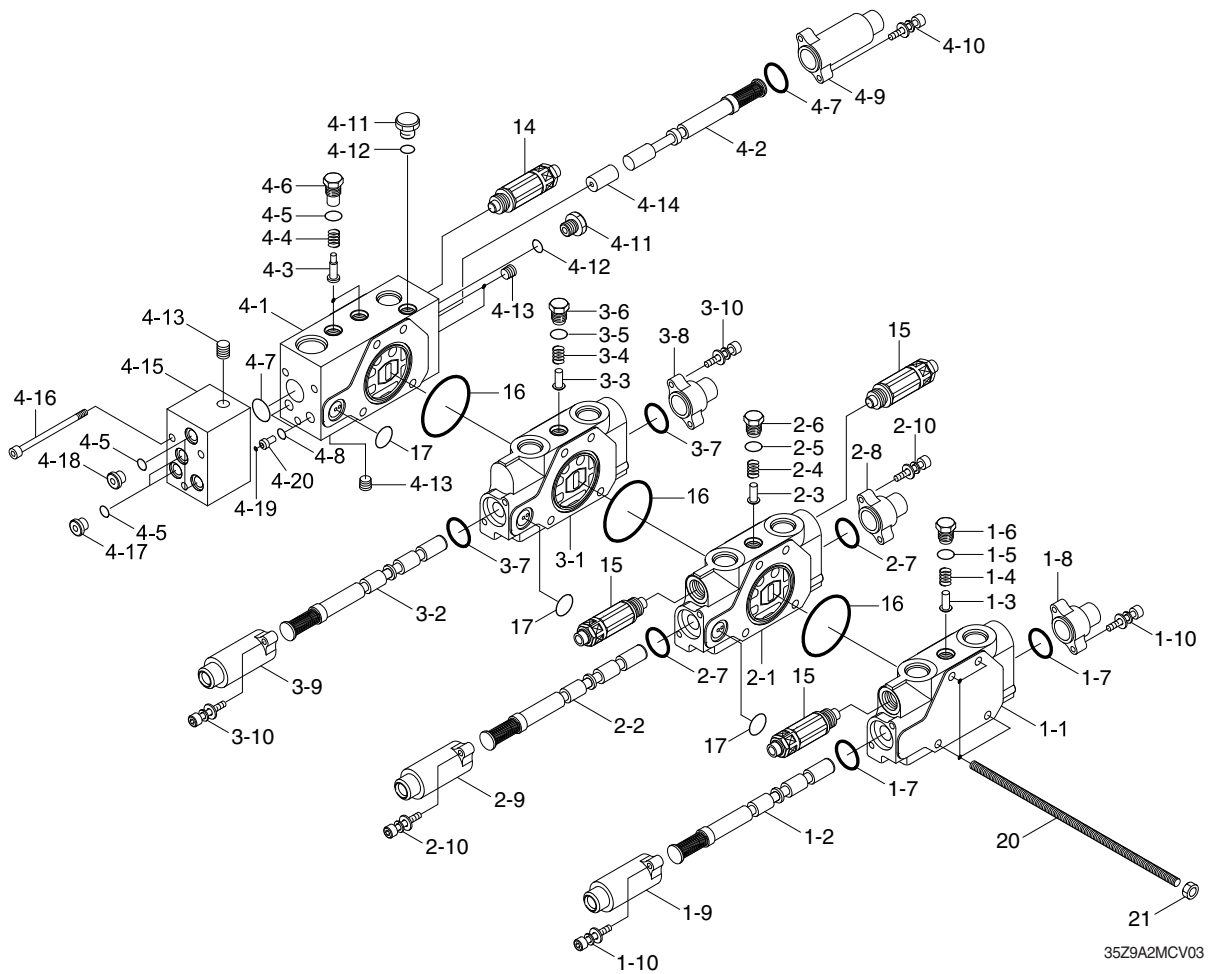
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- ※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Disconnect hydraulic hose.
- (5) Disconnect pilot line hoses.
- (6) Sling the control valve assembly and remove the control valve mounting bolt.
 - Weight : 25 kg (55 lb)
- (7) 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.

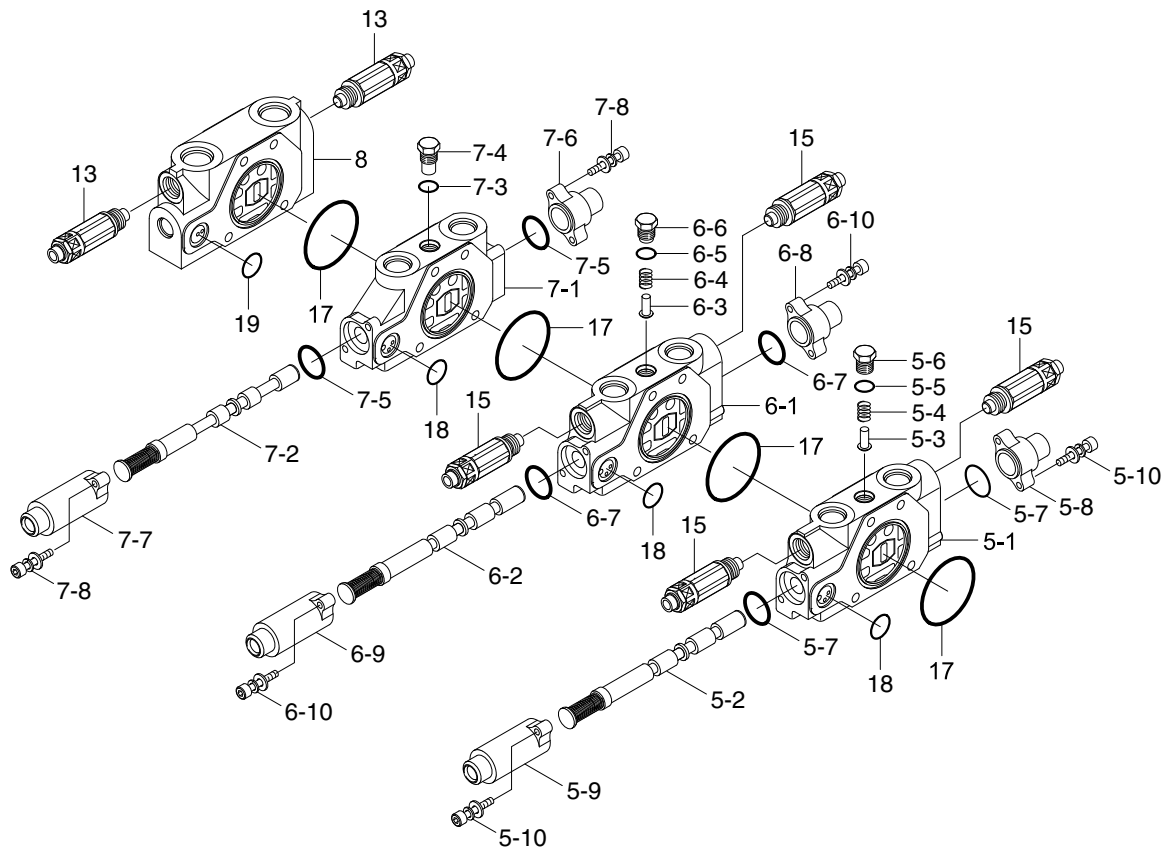


2. STRUCTURE (1/3)



1	Dozer work block	2-9	Cover-pilot	4-7	O-ring
1-1	Body-work	2-10	Bolt-soc head w/washer	4-8	O-ring
1-2	Spool assy	3	Swing work block	4-9	Cover-pilot
1-3	Poppet	3-1	Body-work	4-10	Bolt-soc head w/washer
1-4	Spring	3-2	Spool assy	4-11	Plug
1-5	O-ring	3-3	Poppet	4-12	O-ring
1-6	Plug	3-4	Spring	4-13	Plug
1-7	O-ring	3-5	O-ring	4-14	Piston
1-8	Cover-pilot	3-6	Plug	4-15	Body-pilot
1-9	Cover-pilot	3-7	O-ring	4-16	Bolt-soc head w/washer
1-10	Bolt-soc head w/washer	3-8	Cover-pilot	4-17	Plug
2	Boom swing work block	3-9	Cover-pilot	4-18	Plug
2-1	Body-work	3-10	Bolt-soc head w/washer	4-19	Filter-coin type
2-2	Spool assy	4	Conflux block	4-20	Orifice
2-3	Poppet	4-1	Body-work	14	Relief valve
2-4	Spring	4-2	Spool assy	15	Overload relief valve
2-5	O-ring	4-3	Poppet	16	O-ring
2-6	Plug	4-4	Spring	17	O-ring
2-7	O-ring	4-5	O-ring	20	Bolt-tie
2-8	Cover-pilot	4-6	Plug	21	Nut-hex

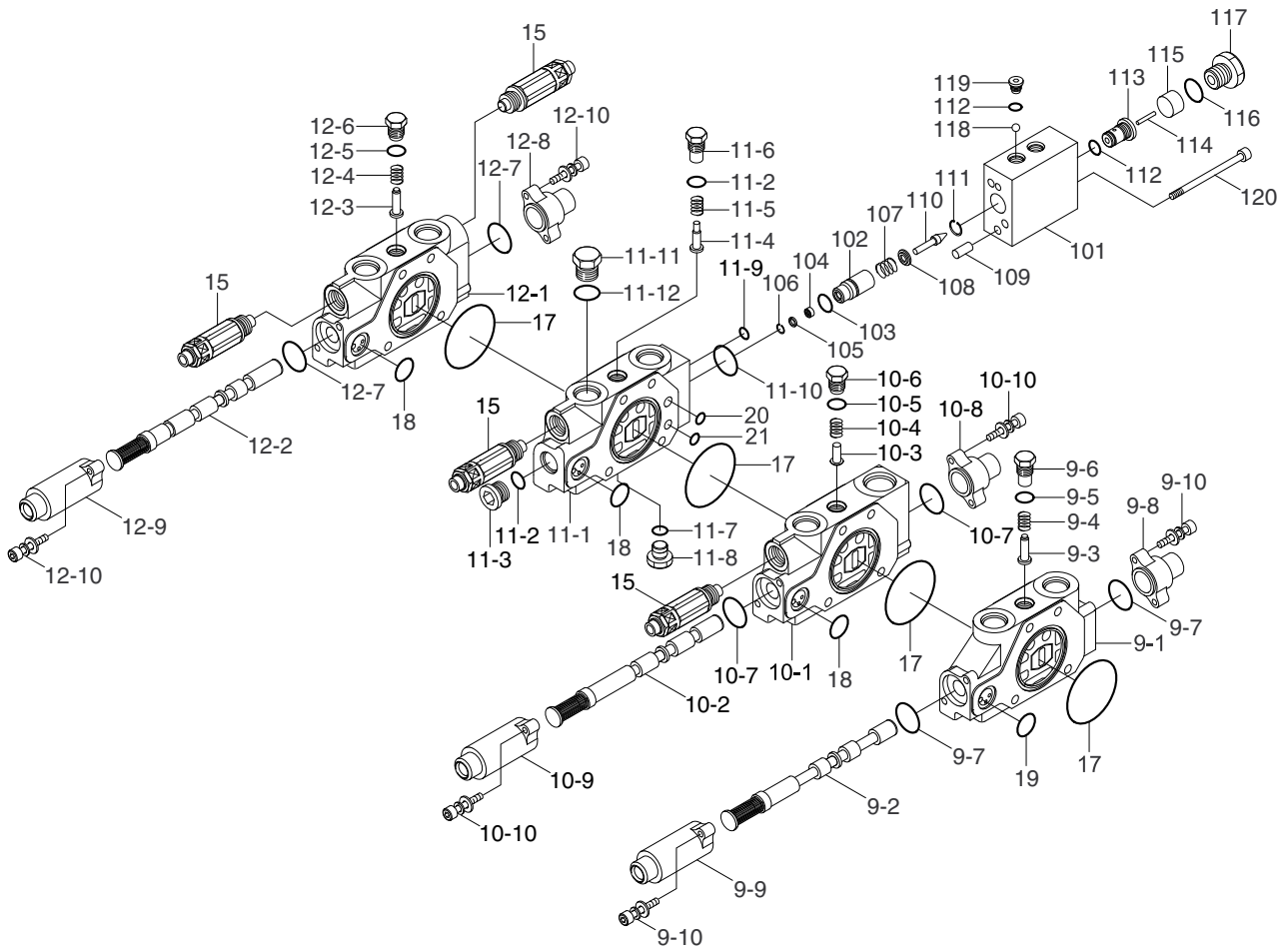
STRUCTURE (2/3)



R35Z92MCV04

5	PTO work block	6-2	Spool assy	7-4	Plug
5-1	Body-work	6-3	Poppet	7-5	O-ring
5-2	Spool assy	6-4	Spring	7-6	Cover-pilot
5-3	Poppet	6-5	O-ring	7-7	Cover-pilot
5-4	Spring	6-6	Plug	7-8	Bolt-soc head w/washer
5-5	O-ring	6-7	O-ring	8	Inlet work block
5-6	Plug	6-8	Cover-pilot	13	Relief valve
5-7	O-ring	6-9	Cover-pilot	15	Overload relief valve
5-8	Cover-pilot	6-10	Bolt-soc head w/washer	17	O-ring
5-9	Cover-pilot	7	Travel work block	18	O-ring
5-10	Bolt-soc head w/washer	7-1	Body work	19	O-ring
6	Arm work block	7-2	Spool assy		
6-1	Body-work	7-3	O-ring		

STRUCTURE (3/3)



R35Z72MCV05

9	Travel work block	10-7	O-ring	12-1	Body-work	103	Seal
9-1	Body-work	10-8	Cover-pilot	12-2	Spool assy	104	Filter
9-2	Spool assy	10-9	Cover-pilot	12-3	Poppet	105	Spacer
9-3	Poppet	10-10	Bolt-soc head w/washer	12-4	Spring	106	Ring-retaining
9-4	Spring	11	Boom lock block	12-5	O-ring	107	Spring A-lock valve
9-5	O-ring	11-1	Body-work	12-6	Plug	108	Spring seat
9-6	Plug	11-2	O-ring	12-7	O-ring	109	Pin
9-7	O-ring	11-3	Plug	12-8	Cover-pilot	110	Poppet
9-8	Cover-pilot	11-4	Poppet	12-9	Cover-pilot	111	Ring-retaining
9-9	Cover-pilot	11-5	Spring	12-10	Bolt-soc head w/washer	112	O-ring
9-10	Bolt-soc head w/washer	11-6	Plug	15	Overload relief valve	113	Guide-piston
10	Boom work block	11-7	O-ring	17	O-ring	114	Piston A1
10-1	Body-work	11-8	Plug	18	O-ring	115	Piston B
10-2	Spool assy	11-9	O-ring	19	O-ring	116	O-ring
10-3	Poppet	11-10	O-ring	20	O-ring	117	Connector
10-4	Spring	11-11	Plug	21	O-ring	118	Ball-steel
10-5	O-ring	11-12	O-ring	101	Cover-lock valve	119	Plug
10-6	Plug	12	Bucket work block	102	Lock valve	120	Bolt-socket head

3. DISASSEMBLY

1) PRECAUTIONS FOR DISASSEMBLY

Since hydraulic devices are all machined precisely with clearances being very little, carry out the disassembly and assembly work at a clean place and make sure to prevent the device from being entered with dust, sand, and the like.

- (1) Before disassembly work, prepare necessary material such as the structural drawing for control valve to fully understand the structure and others.

When removing the control valve from the machine, put a dustproof cap on each port and then

- (2) clean the outside of assembly after checking the installation of caps.

Furthermore, prepare a suitable workbench with clean paper or rubber mat on it for the work.

- (3) Since there is a possibility of rust when the disassembled parts are left, apply anti-corrosive oil to the parts and seal them.

Hold the control valve body when carrying or moving. Especially, do not hold the exposed spool

- (4) after removing a pilot cover from the control valve.

Do not hit the control valve even if it does not move smoothly.

- (5) It is recommend carrying out various tests (relief valve setting, leak test, internal pressure loss check, etc.) after the disassembly and assembly of the control valve, which requires a hydraulic
- (6) test device.

- (7) Accordingly, when the disassembly might be possible technically but the test and/or adjustment might be impossible, do not carry out the work.

▲ The control valve becomes high temperature after operating the machine; after checking that the temperature becomes low, start the work.

▲ Before removing the pipes, attach suitable indications on them to be able to locate their positions later. If there is a mistake in piping between the ports, unintentional movement could result in an accident.

▲ Falling or hitting the control valve could bend the Spool, which could result in an accident.

▲ If foreign matter enters each port, there could be a control valve malfunction, resulting in an accident.

▲ Since the load side port could hold an empty weight or enclosed pressure, release the inside pressure before loosening the piping.

There could be a fall of attachments or a jet of high-temperature hydraulic fluid.

▲ The control valve has complicated connections and seals through the internal passages, which means that there could be enclosed pressure, resulting in an oil jet after disassembly.

Wear safety goggles during disassembly work because there could be a blow off of parts if they are caught.

2) NECESSARY TOOLS AND OTHERS

Before disassembling the control valve, prepare the following tools. The tools below are used to disassemble this control valve only; tools for disassembling the port fittings are not included.

Name	Quantity	Application
Hexagonal wrench	Each 1	4 mm, 5 mm, 6 mm, 8 mm
Screw wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Socket wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~ 14.5 lbf · ft)
Torque wrench	1	2.0 ~ 10.0 kgf · m (14.5 ~ 72.3 lbf · ft)
Magnet	1	
Pliers	1	
Slotted screwdriver	1	
Tweezers	1	

※ Prepare clean wash oil, hydraulic fluid, grease, and others before work.

3) DISASSEMBLY OF EACH PART

Before disassembly work, check that there is no dust on the outside of the control valve and then place it on a workbench with actuator ports facing upward.

The numbers in () in the explanation and in ○ in the figures show reference numbers (No.) in the parts table in the specifications and drawings.

(1) Spool draw-out procedures

Except P3 conflux part

Taking the swing spool as an example, the draw-out procedures are as follows (see Fig.2) .

- ① Remove 2 hex socket head bolts with washers (10) with 4 mm hexagonal wrench.
- ② Remove pilot cover (9).
- ③ With spring in the swing spool exposed, pull out spool assy from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
- ④ The other spools can also be pulled out in the same manner.
 - At this time, check O-ring (7) is on the bottom of body side flange.

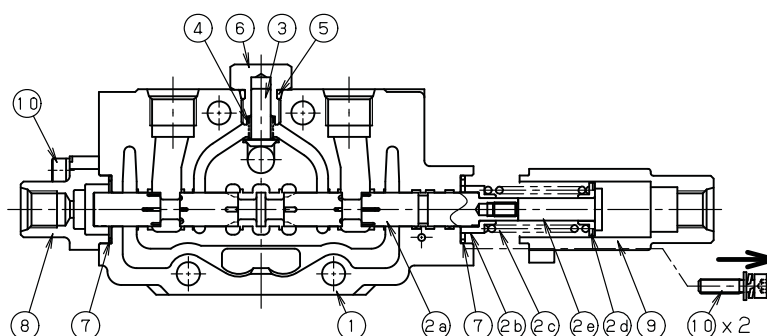


Fig.2 Except P3 Conflux Part

35Z9A7MCMV02

1	Body-work	2d	Spring seat	6	Plug-check valve
2	Spool assy (swing)	2e	End-spool	7	O-ring
2a	Spool (swing)	3	Poppet-check valve	8	Pilot cover B1
2b	Spring seat	4	Spring-check valve	9	Pilot cover A1
2c	Spring	5	O-ring	10	Hex socket bolt with washer

P3 Conflux Part

The draw-out procedures for the conflux spool are as follows (see Fig.3).

- ① Remove 2 hex socket head bolts with washers (10) with 4 mm hexagonal wrench.
- ② Remove pilot cover (9).
- ③ With spring in the connecting spool exposed, pull out spool assy from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
 - At this time, check O-ring (7) is on the bottom of body side flange.

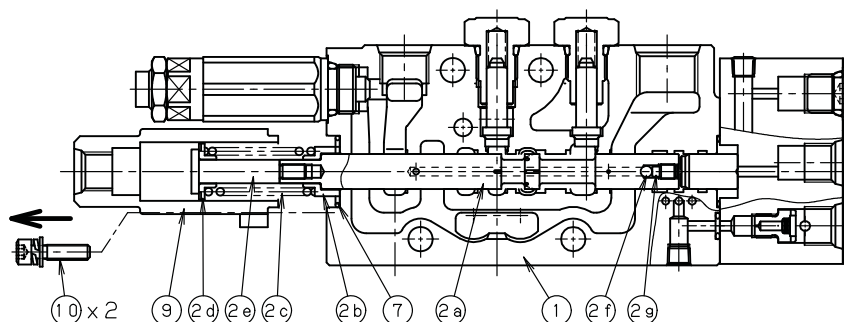


Fig.3 P3 Conflux Part

35Z9A7MCMV03

1	Body-work	2c	Spring	2g	Plug
2	Spool assy (conflux)	2d	Spring seat	7	O-ring
2a	Spool (conflux)	2e	End-spool	9	Pilot cover A1
2b	Spring seat	2f	Steel ball	10	Hex socket bolt with washer

(2) Check valve disassembly procedures

Standard type check valve (see Fig.4)

- ① Hold the control valve body at workbench or hold it by two or more people.
- ② Loosen and remove check valve plug (⑥) at the center of the control valve upper surface with 19 mm screw wrench or socket wrench. When it is hard to loosen the plug because O-ring (⑤) bites the screw, do not loosen forcibly; refasten it once and then try to loosen again.
- ③ From the hole where check valve plug has been removed, remove check valve spring (④) and check valve (③) with tweezers or magnet.

- The numbers in fig.4 are the same as those in the dozer component. In the specifications and drawings.
- Except for the dozer component. The shape of check valve is different; however, they can be disassembled in the same manner.
- The numbers in fig.5 are the same as those in the travel component. In the specifications and drawings.
- The numbers in fig.6 are the same as those in the PTO component. In the specifications and drawings.

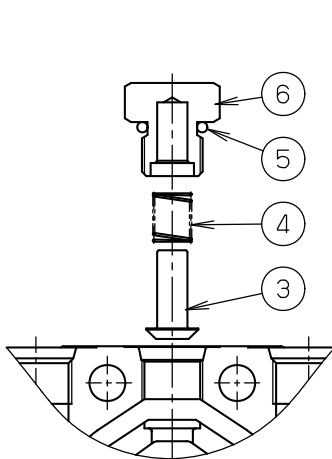


Fig.4 Check valve
(dozer, boom swing, swing,
arm, boom, bucket)

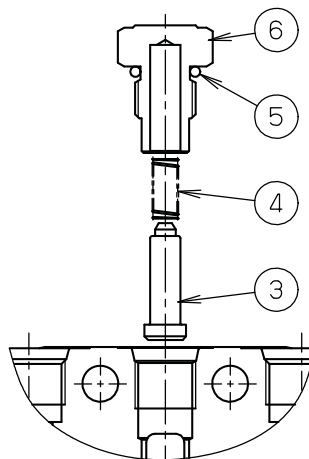


Fig.5 Check valve
(P3 conflux, travel, boom
lock valve)

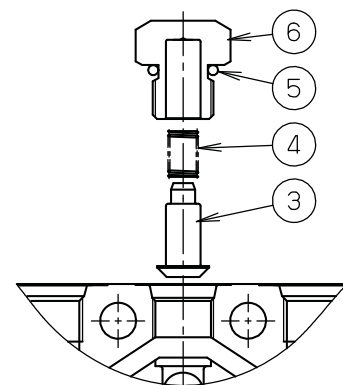


Fig.6 Check valve
(PTO 1, PTO 2)

35Z9A7MCV04

(3) Accessory valve removal procedures

Removing main relief valve (MRV) and overload relief valve (ORV)

Taking ORV in the arm component as an example, the removal procedures are as follows (see Fig.7)

- ① Loosen and remove ORV (15) with 22 mm screw wrench or deep socket wrench.
 - Put screw wrench (or deep socket wrench) to 22 mm hexagonal part of pressure regulating body.
 - If there is no 22 mm screw wrench (or deep socket wrench), it is also possible to loosen and remove by putting 19 mm screw wrench to the hexagonal part as shown in the fig.7.
- ※ If using 19 mm screw wrench to remove, do not put it to the lock nut part. Only lock nut is loosened to change the relief valve setting, which could result in the degradation in performance or damage.

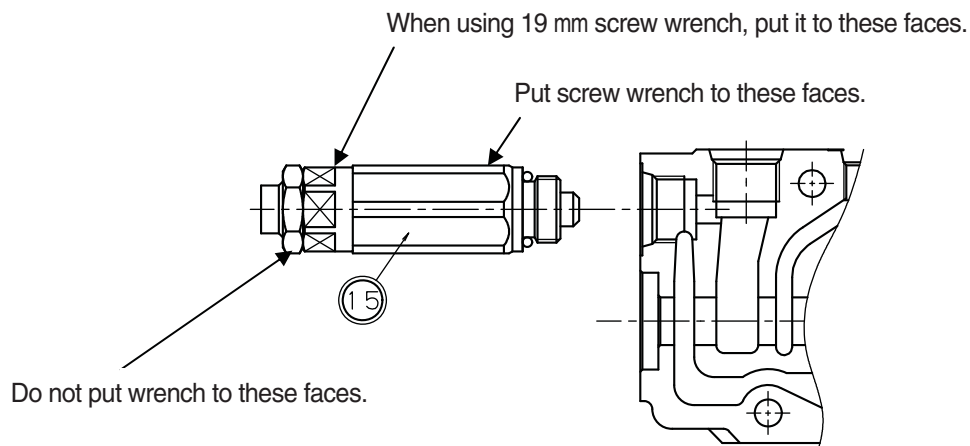


Fig.7 Removing main relief valve and overload relief valve

35Z9A7MCV05

(4) Boom lock valve disassembly procedures

If there is a malfunction, replace the lock valve assy with new one. Disassembly procedures are shown here as reference for investigating malfunction :

(see fig.8 and 9 the reference numbers below except those in double circles are according to "detail of lock valve" in the delivery specifications.)

- ① Remove 2 hex socket bolts (20) by using 5 mm hexagonal wrench.
- ② Remove lock valve lid (11).
 - Be careful not to fall or lose 2 locating pins (9) on lock valve body side.
 - Be careful to handle it to protect the pin from being damaged.
- ③ When lock valve (2) and needle valve (10) are exposed, pull them out.
 - Since the needle valve is easy to fall out, take out it first to store.
 - The lock valve is not to be disassembled but to be stored as a lock valve set (2~8, 10, 11).
- ④ Hold the lock valve cover in a vise bench or the like, and loosen and remove bush (17) by using a 26 mm screw wrench.
 - Hold any two sides except port side in a vise bench or the like.
- ⑤ From the hole that has been used to pull out the bush, pull out piston B (15) and piston A1 (14) by using tweezers or a magnet.
 - For piston B and piston A1, arrange them so that their assembled direction can be recognized.
 - Piston guide (13) is not to be disassembled but to be stored in a combination with lock valve cover.
- ⑥ Loosen and remove plug (19) by using 4 mm hexagonal wrench.
- ⑦ From the hole that has been used to pull out plug, pull out steel ball $\phi 7$ (18) by using a magnet.

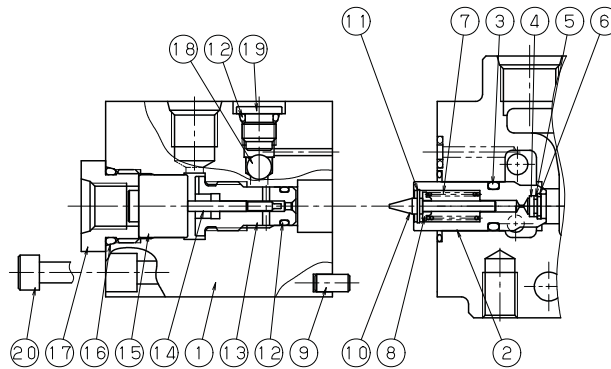


Fig.8 Boom lock valve

35Z9A7MCV06

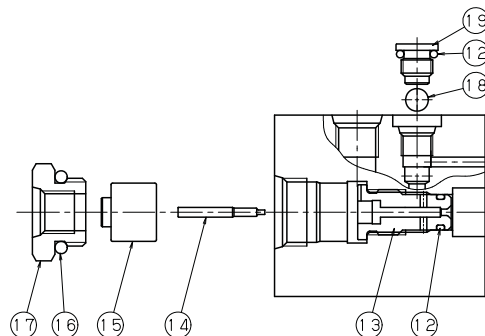


Fig.9 Lock valve cover

35Z9A7MCV07

(5) The other parts disassembly procedures

Remove the other parts that have not been removed at the work (1) through (3) as shown below.

Various plugs in boom lock valve component (see Fig.10).

- ① Loosen and remove plug (11) with 21 mm screw wrench or socket wrench.
 - Check O-ring (12) is on the plug side.
- ② Loosen and remove plug (3) with 6 mm hexagonal wrench.
 - Check O-ring (2) is on the plug side.
- ③ Loosen and remove plug (8) with 6 mm hexagonal wrench.
 - Check O-ring (7) is on the body side for falling off, deformation, or damage.

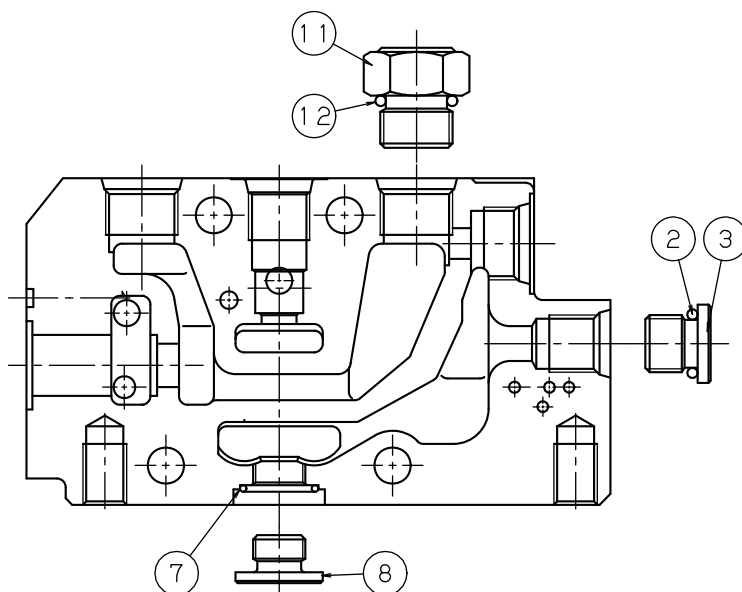


Fig.10 Plugs in boom lock valve component

35Z9A7MCV08

Body-pilot, piston and plugs for P3 conflux component (see Fig.11)

- ① Remove 3 hex socket head bolts (16) with 4 mm hexagonal wrench.
- ② Body-pilot assy (5,13,15,17 ~ 20) can be removed.
 Since orifice (20) and filter (19) cannot be removed from body-pilot (15), store them in assy condition.
 · Check O-ring (7,8) are on the body side.
- ③ Remove piston (14) from the body by using a magnet or the like.
 · When pushing out the piston from the opposite side (left side in the figure blow), be careful not to damage the spool hole. Damaged spool hole could cause a malfunction.
- ④ Loosen and remove 2 plugs (11) by using 4 mm hexagonal wrench.
 4 plugs (13) cannot be removed from the body.

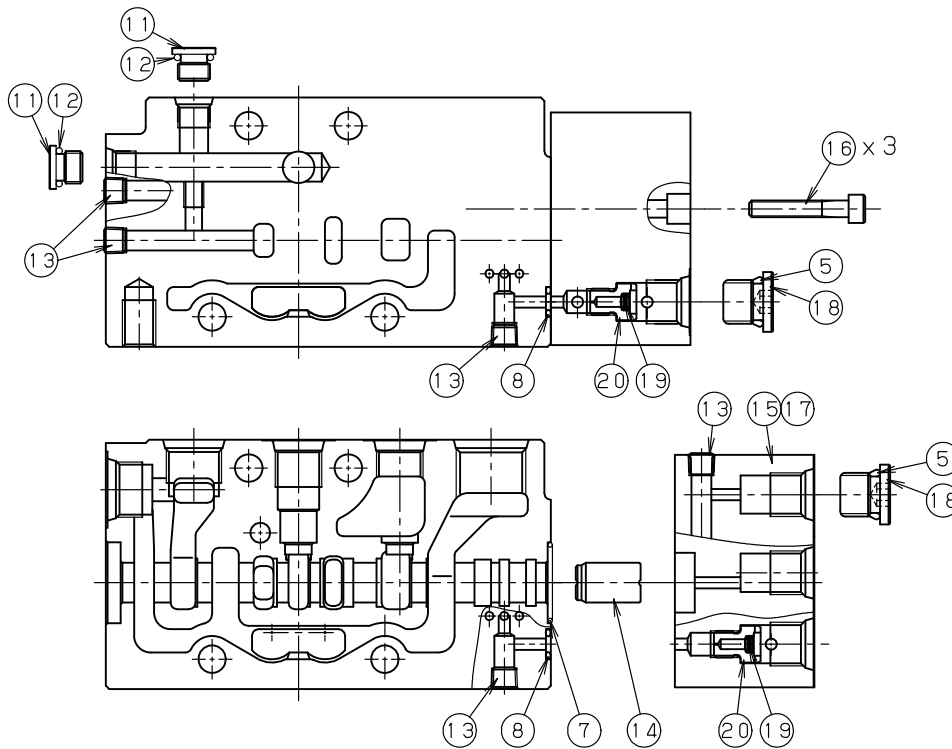


Fig.11 P3 Conflux component

35Z9A7MCV09

Pilot cover (see Fig.12)

- ① Remove 2 hex socket head bolts with washers (10) with 4 mm hexagonal wrench.
- ② Remove pilot cover (8).
 · Check O-ring (7) is on the bottom of body-side flange.

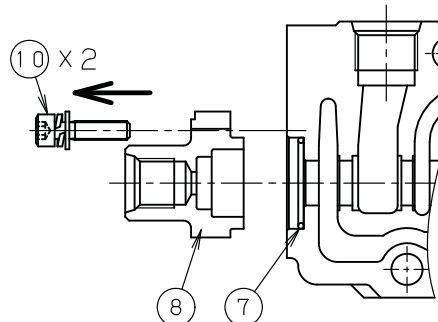


Fig.12 Pilot cover

35Z9A7MCV10

(6) Component body disassembly procedures (see Fig.13)

- ① Loosen and remove 4 M8 hex nuts (21) for assembling component bodies on the dozer (body-Work "sC") side with 13 mm screw wrench or socket wrench.
- ② When 4 tie bolts (20) are pulled out from the dozer side, each component body can be removed.
 - Be careful not to drop or lose various O-ring (16~19) installed on the matching surfaces for each component body.

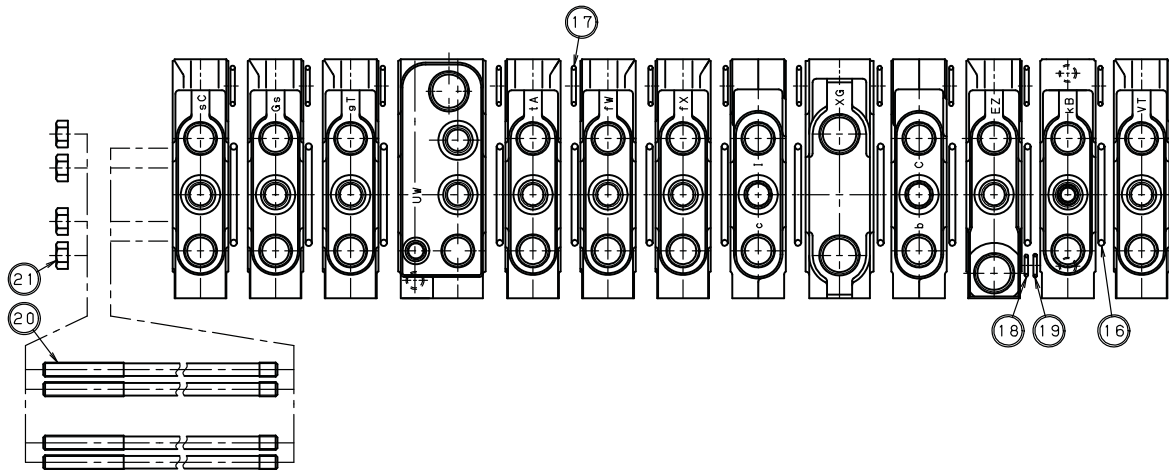


Fig.13 Body Assy

35Z9A7MCV11

- | | |
|-----------|----------------|
| 16 O-ring | 19 O-ring |
| 17 O-ring | 20 Tie bolt |
| 18 O-ring | 21 Hexagon nut |

(7) Precautions after disassembly

- ▲ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace the accessory valve as assy if any malfunction occurs.

Disassembly procedures are shown here as reference for investigating malfunction.

■ Disassembling main relief valve and overload relief valve (see Fig.14)

- ① Lightly hold any two surfaces of body (⑤) in a vise bench, whose hexagonal intervals are 22 mm.
- ② Loosen and remove M14 nut (⑧) by using 19 mm screw wrench.
- ③ Loosen and remove adjustable screw (⑦) by using 4 mm hexagonal wrench.
- ④ Take out regulating valve spring (⑨) by using tweezers or the like.
- ⑤ Loosen and remove valve seat (④) by using 19 mm screw wrench.
- ⑥ The other parts can also be removed in the following order:
Socket (①) → Piston (③) → Spring (⑩) → Valve (②)

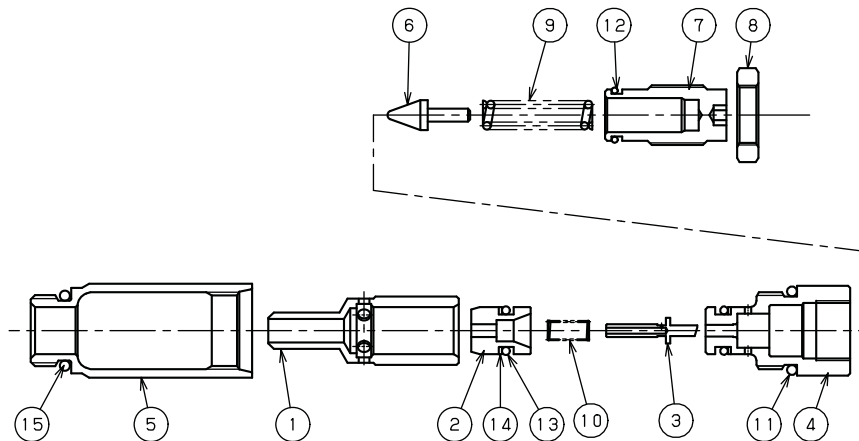


Fig.14 Disassembling main relief valve and overload relief valve

35Z9A7MCV12

1	Socket	6	Pilot poppet	11	O-ring
2	Main valve poppet	7	Adjustable screw	12	O-ring
3	Piston	8	Nut	13	O-ring
4	Pilot valve seat	9	Pilot spring	14	Back-up ring
5	Body	10	Main valve spring	15	O-ring

(8) Precautions after disassembly

- ▲ For the parts already removed in the work, store and/or transport them with attention to flaws and dirt. When carrying out another work, storage, or transportation with the parts removed condition, apply caps or plastic tape to the holes from which the parts have been taken out, protecting the holes from being entered with dust or the like.

4. ASSEMBLY

1) PRECAUTIONS FOR ASSEMBLY

Be careful that the unevenness of fastening torque and the contamination of dust during assembly work could result in malfunction.

In addition, observe fastening torque values specified in the specifications and drawings.

- (1) During assembly work, compare valves with the specifications and drawings and check the number of parts whether there is any improper assembly and/or the omission of parts.

For the parts to be used in assembly, dip in fluid oil as need arises to reassemble after washing

- (2) well in washing oil and being dried.

After cleaning and degreasing the surface sufficiently, apply loctite to 2 threads of the screw from

- (3) the tip (too much loctite could result in malfunction after squeezing out).

For the part to be attached or assembled with two or more bolts and nuts, fastening them evenly

- (4) and alternately for several times, not once with the specified torque.

The unevenness of fastening torque could result in the leakage of hydraulic fluid to the outside

- (5) and/or malfunctions.

2) PRECAUTIONS FOR ASSEMBLING SEAL PARTS

- (1) All seals are to be renewed at assembly.

- (2) Check seals for defects in molding and flaws in handling.

Do not use the seal with defect and/or flaw.

- (3) The seals used on sliding surfaces and the places to be installed with seals are to be applied with grease or hydraulic fluid for sufficient lubrication where not specially noted.

- (4) Do not make seals longer up to permanent deformation.

- (5) O-ring is not to be twisted during assembly.

Kinked O-ring could cause oil leakage after installation because kinks are hard to restore.

3) NECESSARY TOOLS AND OTHERS

Before assembling the control valve, prepare the following tools.

The tools below are used to assemble this control valve only; tools for assembling the port fittings are not included.

Name	Quantity	Application
Hexagonal wrench	Each 1	4 mm, 5 mm, 6 mm, 8 mm
Screw wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Socket wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~ 14.5 lbf · ft)
Torque wrench	1	2.0 ~ 10.0 kgf · m (14.5 ~ 72.3 lbf · ft)
Magnet	1	
Pliers	1	
Slotted screwdriver	1	
Tweezers	1	

※ Prepare clean wash oil, hydraulic fluid, grease, and others before work.

4) ASSEMBLING WORK

- ※ The numbers in () in the explanation and in ○ in the figures show reference numbers in the parts table in the specifications and drawings.
- ※ For the fastening torque values for screws, see the latest specifications and drawings.

(1) Assembling body work (see figure 15 and 16)

- ① On a surface plate with clean rubber plates on it, place component bodies with actuator port surface facing downward in the order shown in "Orders of assembling bodies" on the next page.
 - ※ Check the matching surface in each component body for dust or the like, and check whether O-rings (⑬~⑭) shown in the specifications and drawings are surely put in each groove for O-ring. Kinked O-ring could cause the leakage of hydraulic fluid to the outside due to the malfunction of sealing performance.
If O-rings are not installed surely in O-ring grooves, there would be the nip of O-ring, resulting in the leakage of hydraulic fluid to the outside when assembling the bodies.
- ② Put and fasten 4 tie bolts (⑳) through the bodies from the side of dozer component (body sC side), and fasten 4 M8 hex nuts (㉑) to the bolts by hand.
- ③ Check that all the body surfaces are in alignment in this condition.
If not, make all the body surfaces in alignment by hitting them with plastic hammers or the like. Since the bottom surfaces (the opposite side of actuator port surfaces) of the control valve are not in alignment, place the bodies with actuator port facing downward to align actuator port surfaces when arranging the body surfaces.
Before aligning the body surfaces, remove the rubber plates and others that have been laid at ①. However, check that there is no dust or no unevenness on the surface from which the above rubber plates have been removed.
 - ※ Do not hit hard when using a plastic hammer.
Hard hitting could cause displacements in the portion that has been aligned.
Check the alignment with a flat plate or the like after aligning.
If there is large displacement in any component, bad connection between internal passages could cause a malfunction.
If any seal position overlaps the passage, there could be the leakage of hydraulic fluid to the outside.
- ④ After checking that the surfaces are in alignment, fasten 4 M8 hex nuts (㉑) that have been put on in ②. with the torque specified in the specifications and drawings with 13 mm socket wrench.
 - ※ Fasten 4 M8 hex nuts evenly and little by little in several times.
Uneven fastening makes the body assy curve easily, which could result in leakage or malfunction after installation on the machine.
If you find any curve in the body assy, it is necessary to reassemble or to correct it by pressing machine or the like.

ORDERS OF ASSEMBLING BODIES

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
ID	sC	Gs	gT	UW	tA	fW	fX	cl	XG	bC	EZ	kB	VT

※ Identifications (ID) are engraved on the top (actuator port side) of the body.

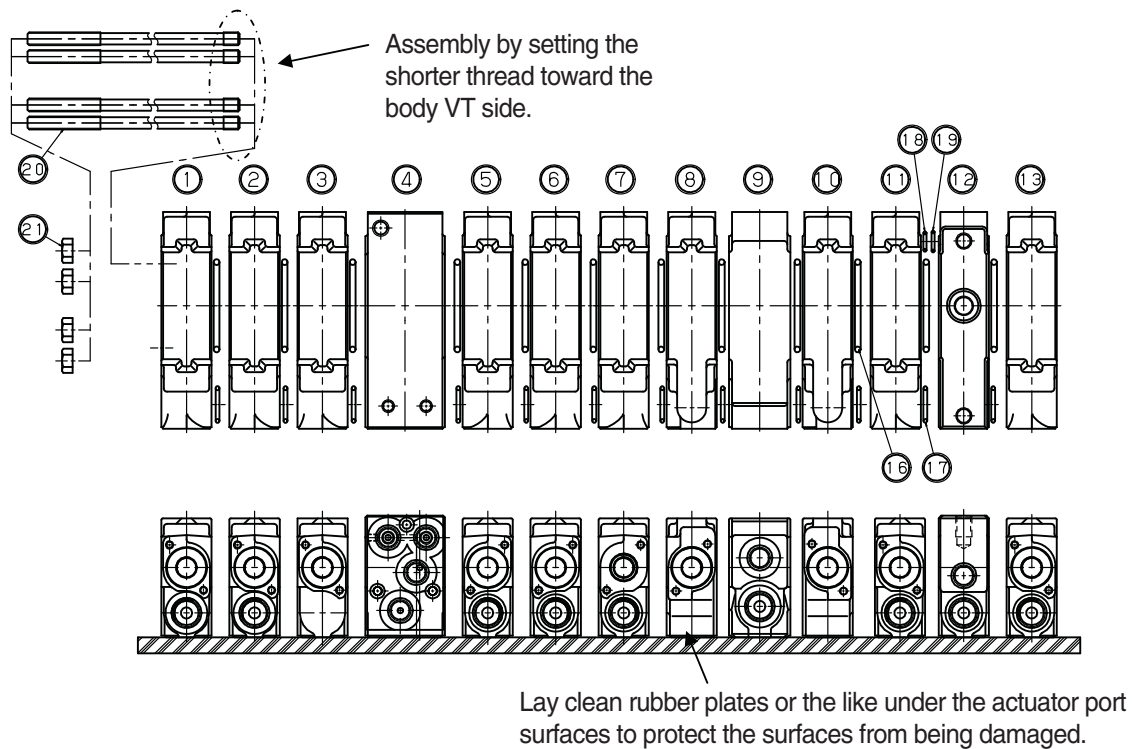


Fig.15 Body assy

35Z9A7MCV13

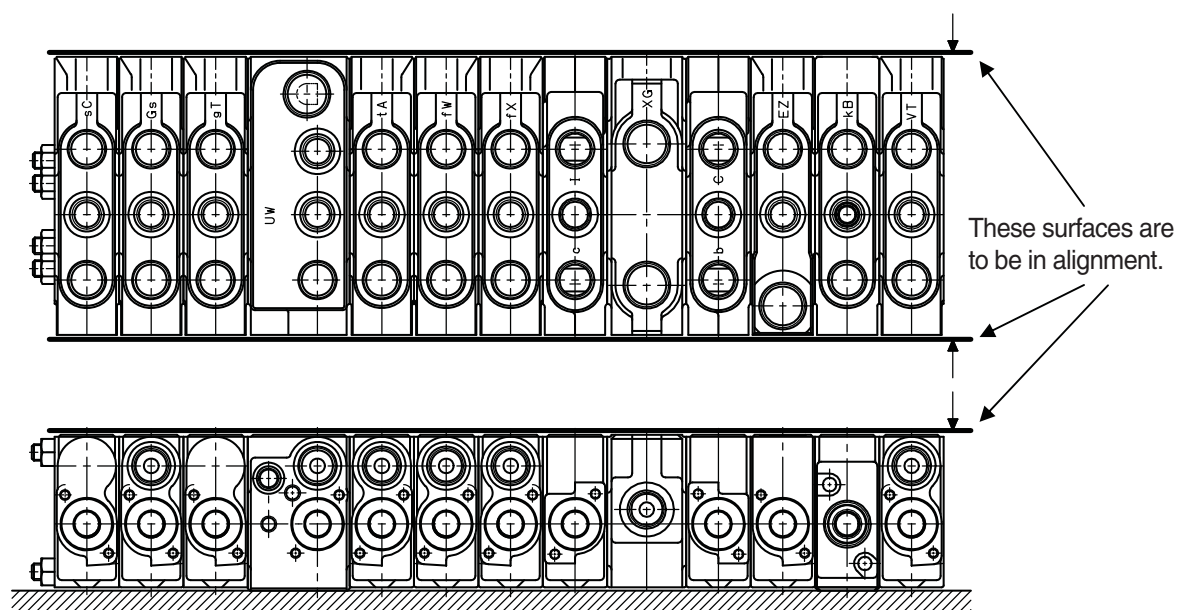


Fig.16 Body assy (after assembly)

35Z9A7MCV14

(2) Assembling small parts

Various plugs in boom lock valve (see Fig.17 and 18)

- ① Place control valve assy on a workbench with actuator port faces facing downward.
- ② Install O-ring (7) securely into an O-ring groove at the center of body.
- ※ Then, apply a light coating of grease to O-ring (7) as an anti-kink measure when assembling plug (8).
Kinked O-rings can cause the malfunction of sealing performance, resulting in the leakage of hydraulic fluid to the outside.
However, too much coating of grease to O-ring could cause the squeezing out of O-ring (leakage of hydraulic fluid to the outside) or suspected grease leakage at high temperature; a light coating of grease to O-ring is recommended.
- ③ Tighten plug (8) with specified torque by using 6 mm hexagonal wrench.
- ④ Place control valve assy on a workbench with actuator ports surface facing upward.
- ⑤ Check that plug (3) is securely installed with O-ring (2).
- ⑥ Tighten plug (3) with specified torque by using 6 mm hexagonal wrench.
- ⑦ Check that plug (11) is securely installed with O-ring (12).
- ⑧ Tighten plug (11) with specified torque by using 21 mm screw wrench (or socket wrench).

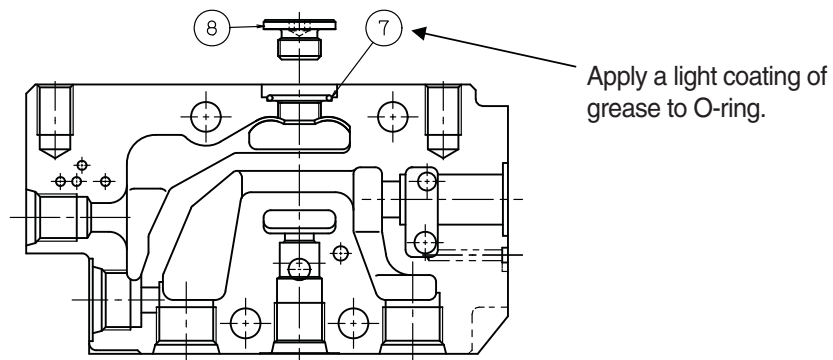


Fig.17 Bottom plug on boom lock valve

35Z9A7MCV15

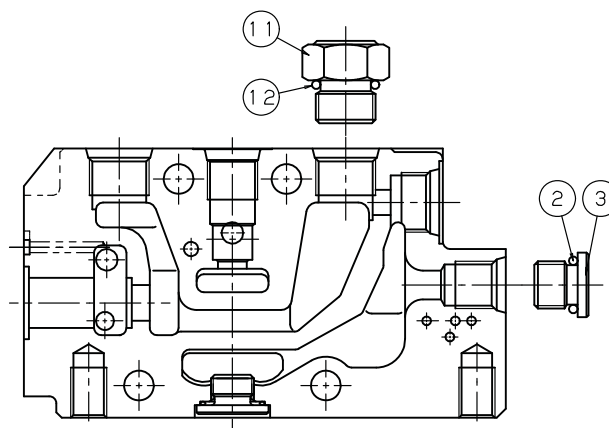


Fig.18 Plug on boom lock valve

35Z9A7MCV16

Body-pilot, piston and plugs for P3 conflux component (see Fig.19).

- ① Install O-rings (7, 8) securely into O-ring grooves on the body.
- ② Insert piston (14) into spool sleeve with caution in the direction.
- ※ Piston (14) is to be inserted with small-diameter side (stepped side) facing the spool sleeve.
If not, the wrong direction causes malfunction.
- ③ Insert 3 hex. socket head bolts (16) toward the bolt holes of pilot body assy (5,13,15,17~20).
Press and hold pilot body assy (5,13,15,17~20) to the body.
- ④ Fasten 3 hex socket head bolts (16) with specified torque with 4 mm hexagonal wrench.
- ⑤ Check that O-ring (12) is securely installed with plug (11).
- ⑥ Fasten plug (11) with specified torque with 4 mm hexagonal wrench.

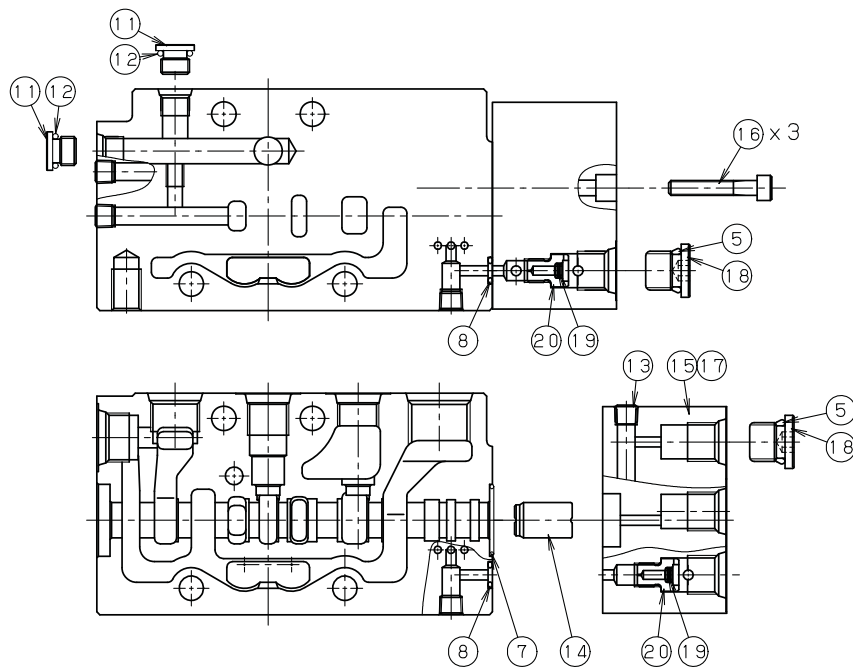


Fig.19 P3 conflux component

35Z9A7MCV17

■ Pilot cover (see Fig.20)

- ① Install O-ring (7) securely on the flange bottom of the body.
- ② Insert pilot cover (8) into the flange of the body.
- ③ Fasten 2 hex socket head bolts with washers (10) with specified torque with 4 mm hexagonal wrench.

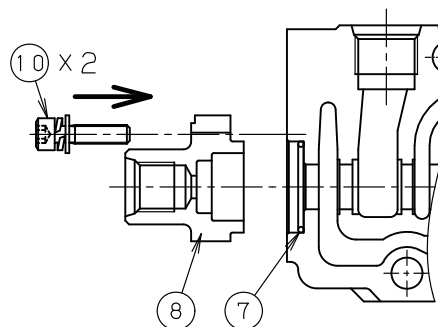


Fig.20 Pilot cover

35Z9A7MCV18

(3) Boom lock valve assembly procedures

(See Fig.21 and 22. The reference numbers below except those in double circles are according to "Detail of lock valve" in the delivery specifications.)

- ① Hold lock valve cover set (①, ⑫, ⑬) in a vise bench or the like.
 - ② Put steel ball $\phi 7$ (⑮) into a hole on top surface of lock valve cover set.
 - ③ Check that O-ring (⑫) is securely installed and then tighten plug (⑰) with specified torque by using 4 mm hexagonal wrench.
 - ④ Insert piston A1 (⑭) and piston B (⑮) in sequence from a hole on lock valve cover set side (screw machined).
- ※ Then, check the direction of those pistons.
 If the direction of piston A1 (⑭) is wrong, lock valve will not be released.
 If the direction of piston B (⑮) is wrong, lock valve will be left being released.
 In addition, since vush (⑰) cannot be tightened to the end, there will be the leakage of hydraulic fluid to the outside.
- ⑤ Check that vush (⑰) is securely installed with O-ring (⑯) and then screw bush (⑰) to the hole, into which the piston has been inserted, with specified torque by using 26 mm screw wrench (or socket wrench).
 - ⑥ Install O-rings (⑳,㉑) securely into O-ring grooves on lock valve body.
 - ⑦ Insert lock valve set (㉒~㉔, ㉕) into a hole for lock valve.
 - ⑧ Insert needle valve (㉖) into lock valve set from the rear of lock valve set.
 - ⑨ Install 2 positioning pins (㉗) to the surface facing the body of lock valve cover set.
 - ⑩ Pressing lock valve cover set to the body, screw in 1-2 threads of 2 hex socket bolts (㉘) by hand.
- ※ Then, make sure that needle valve (㉖) is settled in the seat of piston guide (⑬) in lock valve cover set. If not, needle valve will not be seated so that lock valve will also be released.
 To check the settlement, under the condition ⑩, loosen the force that is used to press lock valve cover set to the body and then check whether lock valve cover set can depart from the body by the force of spring inside lock valve set. If there is no feel of spring reaction, remove the unit once and then carry out the assembly again.
- ⑪ Tighten hex socket bolts (㉘) with specified torque by using hexagonal wrench.

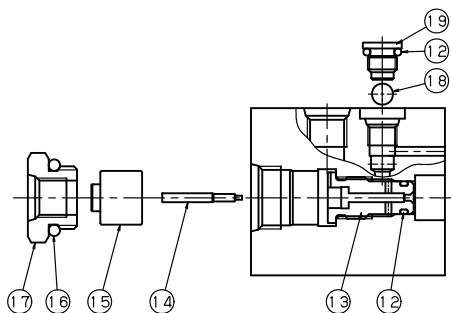


Fig.21 Lock valve cover

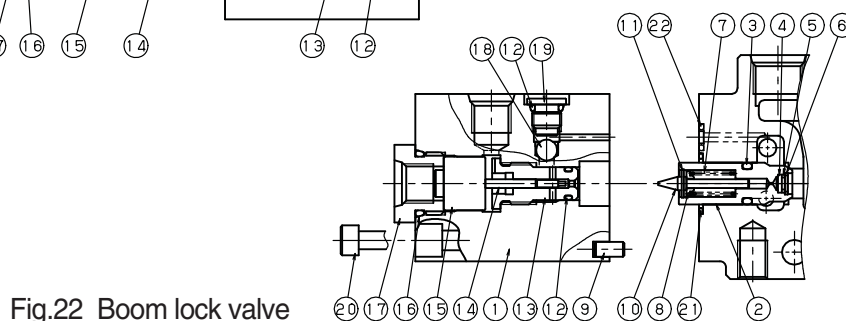


Fig.22 Boom lock valve

(4) Accessory valve installing procedures

- ※ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace in assy if any malfunction occurs.

Installing main relief valve (MRV) and overload relief valve (ORV) (see Fig.23)

Taking ORV in the arm component as an example, the installing procedures are as follows.

- ① Fasten ORV (15) with specified torque with 22 mm screw wrench or deep socket wrench.
 - Put screw wrench (or deep socket wrench) to 22 mm hexagonal part of pressure regulating body. Screw wrench to put the hexagonal part as shown in the Fig.23.
- ※ Be careful not to damage the seat of socket that sticks out above the tip when installing MRV and ORV to the body.
If the seat is damaged, there could be internal leakage, resulting in the malfunction of holding attachment.
 - ※ Do not put 19 m screw wrench to the lock nut part when installing.
Lock nut turns with adjustable screw free turning, resulting in the degradation in performance or damage.

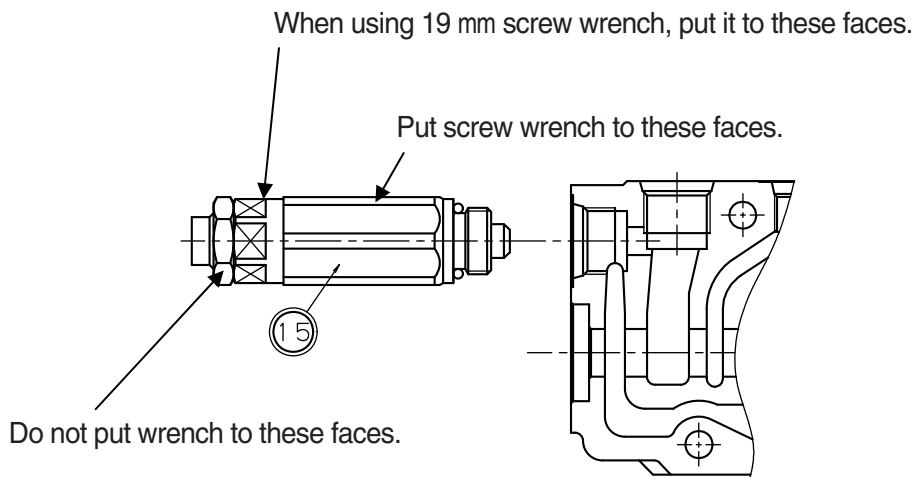


Fig.23 Installing main relief valve and overload relief valve

35Z9A7MCV20

(5) Check valve assembly procedures

Installing main relief valve (MRV) and overload relief valve (ORV) (see Fig.23)

- ① Hold the control valve body at workbench or hold it by two or more people.
- ② Assemble check valve (③) and check valve spring (④) in sequence at the center of control valve top surface.
Then, set check valve (③) vertically (check that the check valve is in nearly at the center of hole).
- ③ Check that O-ring (⑤) is securely installed with check valve plug (⑥) and then screw it into the part where check valve has been assembled.
- ④ Fasten check valve plug (⑥) with specified torque with 19 mm screw wrench or socket wrench.

· The other check valves can be assembled in the same manner; use suitable parts in the drawing (see Fig.25 and 26.).

If assembly is mistaken, check valve could not function or there could be damage.

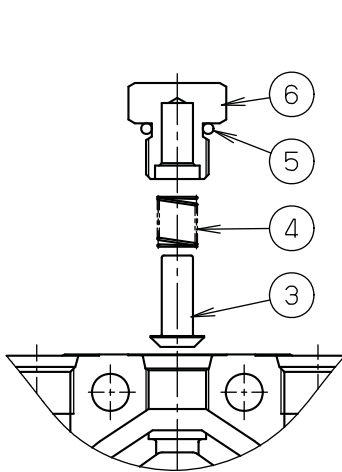


Fig.24 Check valve
(dozer, boom swing, swing,
arm, boom, bucket)

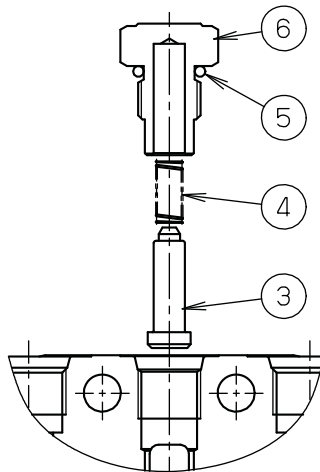


Fig.25 Check valve
(P3 conflux, travel,
boom lock valve)

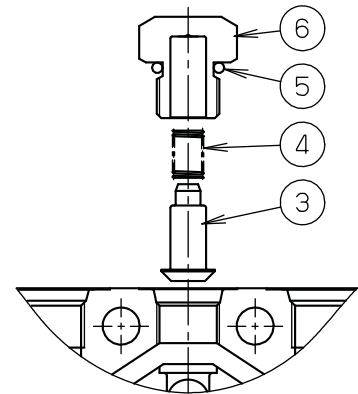


Fig.26 Check valve
(PTO 1,PTO 2)

35Z9A7MCV21

(6) Spool installing procedures

Except P3 conflux part

Taking the swing spool as an example, the installing procedures are as follows (see Fig.27).

- ① After checking whether there is no dust or the like in the spool sleeve of the body and/or spool ass'y and O-ring (7) is securely installed with that the flange bottom of the body, insert the dozer spool ass'y into spool sleeve of the body with attention to the position and direction.
 - Then, apply little hydraulic fluid to the spool before insertion.
- ※ Carefully insert spool ass'y into the spool sleeve horizontally.
 - If it is hard to insert, forcible insertion could cause impressions on spool sleeve and/or spool, resulting in malfunction.
 - If you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr.
 - If there are flaws or burrs, there could be malfunction so that replace body and spool in set.
 - When there is no feeling of wrongness, move it slowly several times checking the movement and no feeling of wrongness again.
- ② Press pilot cover (9) in a direction from the spring side of spool ass'y to the flange of the body.
 - Fasten 2 hex socket head bolts with washers (10) with specified torque with 4 mm hexagonal wrench.
- ③ The other spools can be assembled in the same manner.

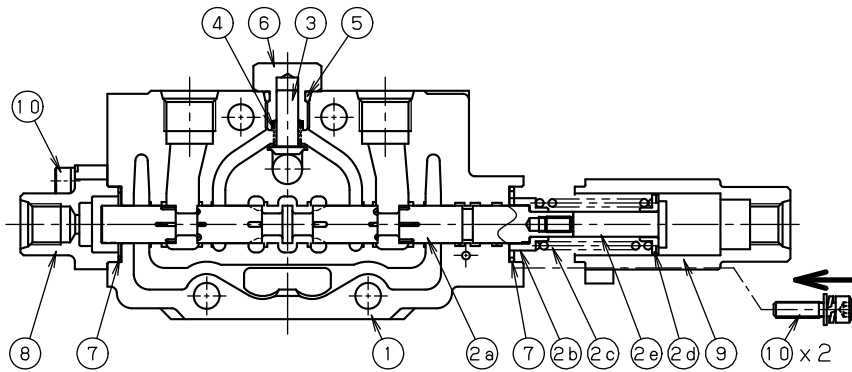


Fig.27 Except P3 conflux part

35Z9A7MCMV22

1	Body-work	2d	Spring seat	6	Plug-check valve
2	Spool ass'y (swing)	2	End-spool	7	O-ring
2a	Spool (swing)	3	Poppet-check valve	8	Pilot cover B1
2b	Spring seat	4	Spring-check valve	9	Pilot cover A1
2c	Spring	5	O-ring	10	Hex socket bolt with washer

(7) Assembling accessory valve

Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace in assy if any malfunction occurs.

Assembly procedures are shown here as reference for investigating malfunction:

The accessory valve assembled according to the procedures below should not be used practically.

Assembling main relief valve and overload relief valve (see Fig.29)

- ① After checking that O-ring (12) is securely installed into grooves on the top of adjustable screw (7), assemble regulating valve spring (9) and regulating valve (6) into the hole of adjustable screw (7).
- ② After check that back-up ring (14) and O-rings (13,11) are installed into regulating body (4), put the screw hole side of regulating body (4) on the assy that has been assembled in ①. and then fasten them with screws.
 - ※ Pay attention to the positional relationship between O-ring (13) and back-up ring (14).
(Back-up ring is installed on the screw machined side of regulating body)
If it is installed oppositely, there would be the squeezing out of O-ring or the like, resulting in internal leakage, malfunction, or damage to other hydraulic devices at worst.
Then, look in the inside from a small-diameter hole of regulating body (4) to check that regulating valve (6) is settled in the seat of regulating body (4).
If the regulating valve is not settled, there will be no rise in pressure, resulting in malfunction.
- ③ Attach M14 nut (8) to the adjustable screw (7) sticking out from assy that has been assembled in ②.
- ④ After checking that O-ring (13) and back-up ring (14) are securely installed into grooves on the peripheral of regulating valve (2), insert regulating valve (2) into socket (1).
 - ※ Pay attention to the positional relationship between O-ring (13) and back-up ring (14).
(Back-up ring is installed on the seat side of regulating valve)
If it is installed oppositely, there would be the same malfunction in ②.
- ⑤ Assemble piston (3) and regulating valve spring (10) in sequence into a small-diameter hole of the assy that has been assembled until ③.
 - Be careful of the direction to install piston.
(The side machined with drill hole is to be the outside)
If it is inserted oppositely, the following assembly work cannot be proceeding.
- ⑥ Assemble the assy that has been assembled in 5. with the Ass'y that has been assembled in ④.
- ⑦ Insert the assy that has been assembled in 6. into regulating body (5) by turning regulating body.
- ⑧ Lightly hold any two surfaces of body (5) in a vise bench or the like and then fasten regulating body (4) with specified torque by using 19 mm screw wrench.
- ⑨ Check the installation of O-ring (15).

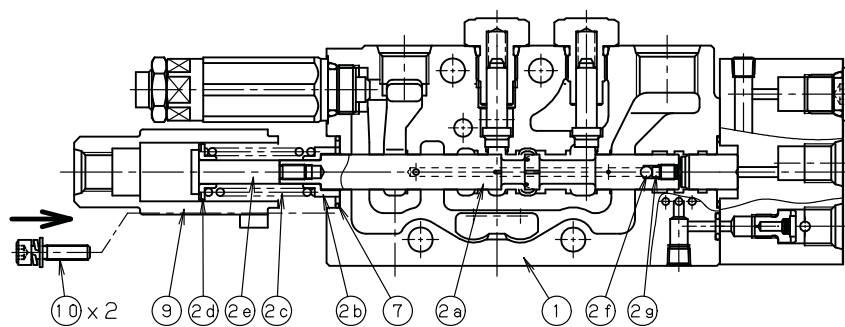


Fig.29 Assembling main relief valve and overload relief valve

35Z9A7MCV23

- | | | | | | |
|---|-------------------|----|-------------------|----|--------------|
| 1 | Socket | 6 | Pilot poppet | 11 | O-ring |
| 2 | Main valve poppet | 7 | Adjustable screw | 12 | O-ring |
| 3 | Piston | 8 | Nut | 13 | O-ring |
| 4 | Pilot valve seat | 9 | Pilot spring | 14 | Back-up ring |
| 5 | Body | 10 | Main valve spring | 15 | O-ring |

5. MAINTENANCE STANDARD

1) PARTS CHECK

Name	Inspection item	Criterion and treatment
Component body	Presence of scratch, rust, corrosion.	Replace it if any of the followings is damaged. <ul style="list-style-type: none"> · Sliding parts for spools, especially lands with holding pressure. · Body flanges receiving spools. · Seal parts contacting with O-ring in ports. · Seats in relief and overload relief valves. · Damage spoiling normal functions.
Spool	Presence of scratch, scuff, rust, corrosion. Insert spool into body and stroke it with turning.	Replace it if scratch is on outer sliding part. Replace or correct it if spool does not move smoothly.
Check valve (load check valve)	Damage to check valve or check valve spring. Insert check valve into check valve plug to operate.	Replace or correct it if flaw or dent is on seat. Smooth moving without scratch is normal. Replace it if not.
Spring and related parts	Rust, corrosion, deformation, breakage in return spring seat, plug, cover.	Replace it if there is non-smooth operation or heavy damage.
Sealing of spools	Hardened, deformed, or damaged O-ring.	Replace it.
MRV, ORV	Rust in appearance. Matching surface of valve seat. O-ring, back-up ring.	Replace it. Replace it if there is flaw or dent. 100% replacement in principle.

6. PROBLEM CAUSES AND MEASURES

- If any abnormal condition is found, check whether control valve itself fails or there is problem in pump, cylinder, motor, or hydraulic circuit. for this check, it is necessary to measure pilot pressure, pump discharge pressure, and load pressure. observe the above disassembly and assembly procedures even if any part is disassembled or inspected.
- Be careful of dust proofing. dust is very harmful to hydraulic devices.
- Carefully handle moving movable parts. correct it with oilstone or replace it even if there is a minor flaw.
Clean it sufficiently after correction.
- Protect the seal surface of o-ring from being damaged. the damage could cause oil leakage.

1) CONTROL VALVE

Phenomenon	Possible causes	Treatment
No movement in each attachment. slow operation (power shortage). Or slow response.	<p>Operation failure in relief valve</p> <ul style="list-style-type: none"> · Dust between regulating valve and seat★ · Dust between regulating valve seats★ · Stick of regulating valve★ · Breakage or fatigue of spring★ · Loosened adjustable screw★ <p>Dust between body and spool, or stick</p>	<p>Measure relief valve pressure</p> <ul style="list-style-type: none"> · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ <p>Disassemble and clean it. Replace body and spool if damage is big.</p>
Cylinder's empty weight falling in neutral is big.	<p>Excessive gap between comp. Body and spool.</p> <p>Spool is not returned to neutral completely.</p> <ul style="list-style-type: none"> · Dust storage between body and spool, or stick. · Breakage or fatigue of spring. <p>Operation failure in overload relief valve. (see Maintenance standard)</p> <p>Operation failure in lock valve.</p> <ul style="list-style-type: none"> · Dust between lock valves or needle valve seats. · Stick of lock valve or needle valve. · Orifice clogging in lock valve. 	<p>Replacement in spool assy.</p> <p>Measure pilot secondary pressure.</p> <ul style="list-style-type: none"> · Disassemble and clean, or replace body and spool in set for stick. · Replacement in spool assy. <p>Measure overload relief valve pressure. (see 8. Maintenance standard)</p> <p>Replace lock valve assy (including lock valve body)</p>
When operating to rise cylinder at starting operation, it lowers.	<p>Operation failure in load check valve.</p> <ul style="list-style-type: none"> · Dust between load check valve and body. · Stick in load check valve. · Breakage or fatigue of spring. 	<ul style="list-style-type: none"> · Disassemble and clean Replace body and load check valve if damage is big · Disassemble and clean Replace body and load check valve if damage is big · Replace spring

For problem with ★ mark, must replace relief valve in assy.

2) RELIEF VALVE

Relief valve is the most important part for performance and safety, and is very difficult to readjust the setting at a place except maintenance shops with adequate equipment.

Replace in assy if any of the following malfunctions occurs.

Phenomenon	Possible causes	Treatment
Pressure cannot rise	Any pressure regulating valve, regulating valve, or piston in relief valves has stuck to keep opening, or dust presents on any seat in relief valves.	· Replacement in assy.
Relief pressure is unstable	Each regulating valve in relief valves is damaged. Piston has stuck in pressure regulating Valve.	· Replacement in assy.
Relief pressure is out of setting range	Attrition by dust Lock nut and adjustable screw are loosened. Breakage or fatigue of spring. Operation failure in relief valve (main relief valve and overload relief valve)	· Replacement in assy.
Oil leakage	Damage in each seat Attrition in O-ring Stick of each part due to dust	· Replacement in assy.

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

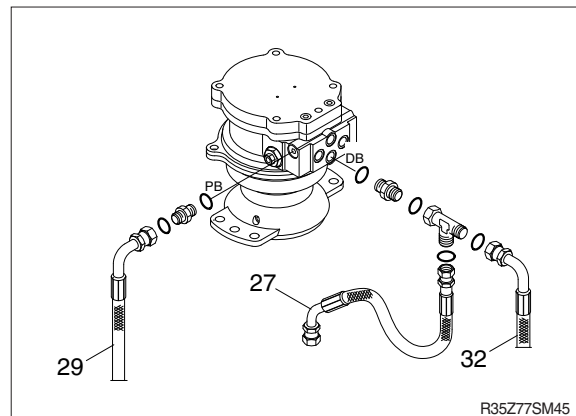
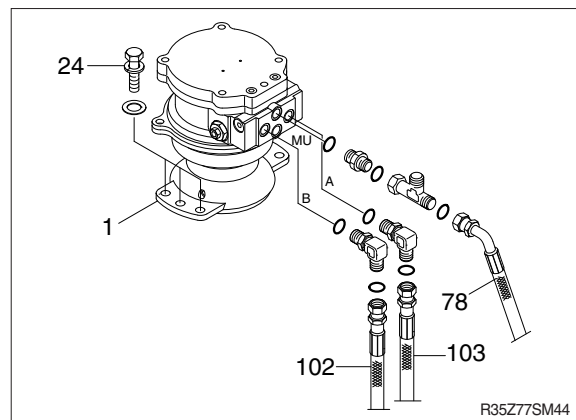
- (4) Disconnect hose assembly (78, 102, 103).
- (5) Disconnect pilot line hoses (27, 29, 32).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (24).

※ Motor device weight : 39 kg (86 lb)

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

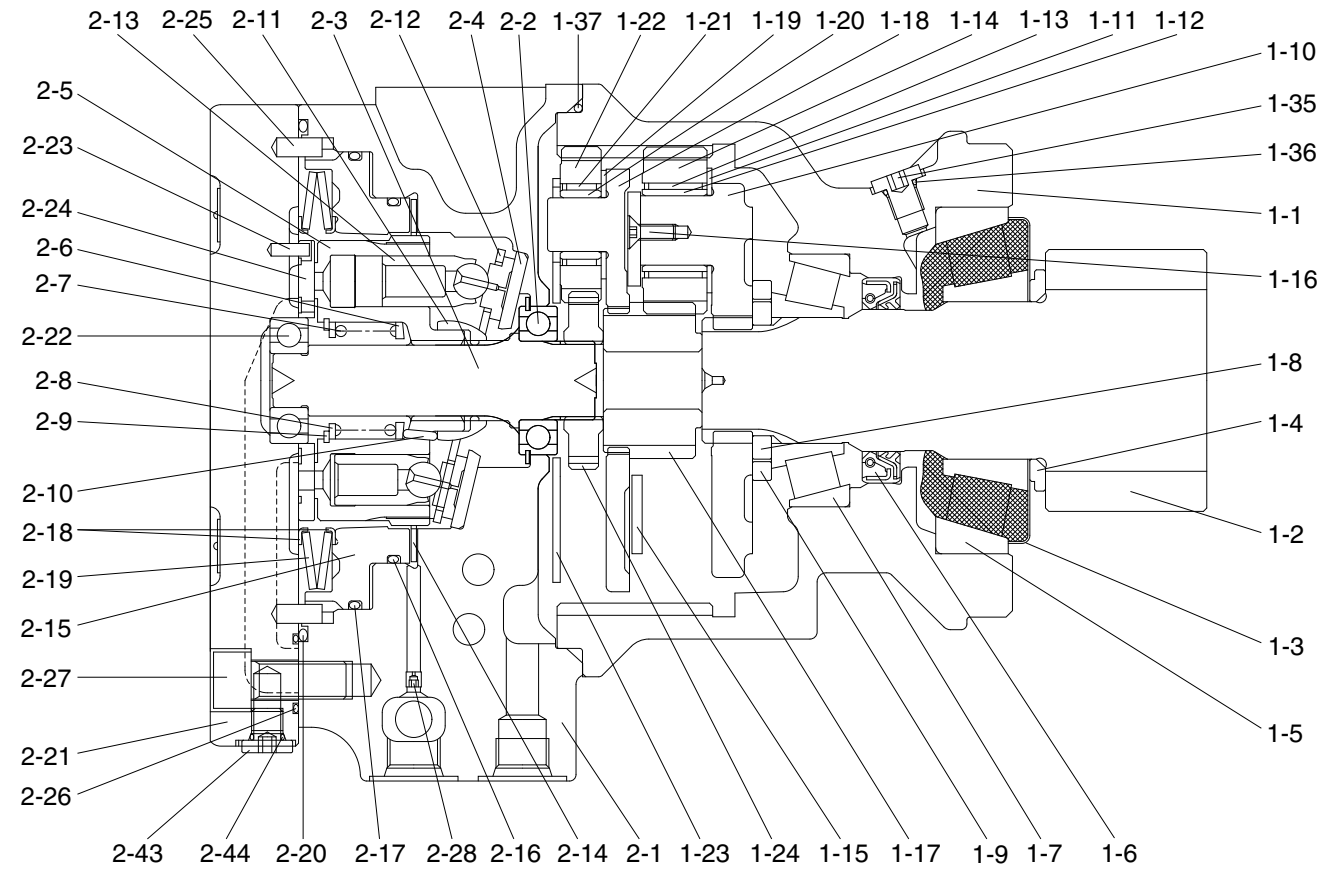
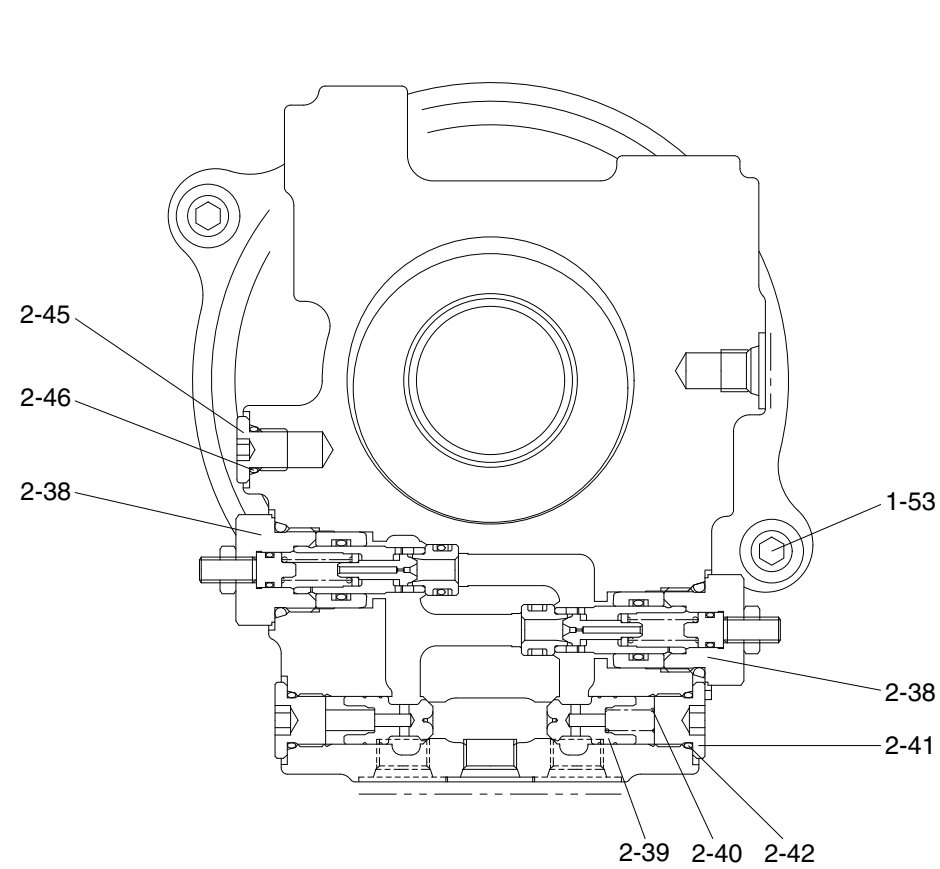
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



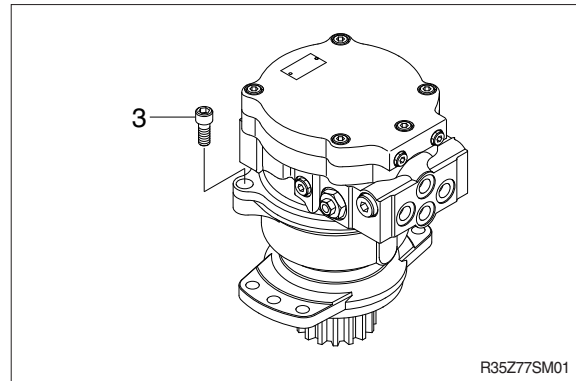
1 Gear box	1-11 Thrust washer	1-22 Planetary gear	2-4 Thrust plate	2-15 Brake piston	2-26 O-ring
1-1 Housing	1-12 Inner race	1-23 Thrust plate	2-5 Cylinder block	2-16 O-ring	2-27 Socket head bolt
1-2 Pinion shaft	1-13 Needle bearing	1-24 Drive gear	2-6 Collar	2-17 O-ring	2-28 Orifice
1-3 Plate	1-14 Planetary gear B	1-35 Plug	2-7 Spring	2-18 Spring seat	2-38 Relief valve assy
1-4 Collar	1-15 Thrust plate	1-36 O-ring	2-8 Washer	2-19 Spring	2-39 Check valve
1-5 Tapper roller bearing	1-16 Screw	1-37 O-ring	2-9 Snap ring	2-20 O-ring	2-40 Spring
1-6 Oil seal	1-17 Sun gear B	1-53 Socket bolt	2-10 Pin	2-21 Cover	2-41 Plug
1-7 Tapper roller bearing	1-18 Holder	2 Axial piston motor	2-11 Retainer holder	2-22 Ball bearing	2-42 O-ring
1-8 Plate	1-19 Thrust washer	2-1 Case	2-12 Retainer plate	2-23 Pin	2-43 Plug
1-9 Collar	1-20 Inner race	2-2 Ball bearing	2-13 Piston assy	2-24 Valve plate	2-44 O-ring
1-10 Holder	1-21 Needle bearing	2-3 Shaft	2-14 Disc	2-25 Pin	2-45 Plug
					2-46 O-ring

2) DISASSEMBLY

Disassemble the parts by the following procedure.

(1) Separating the motor and the reduction gear

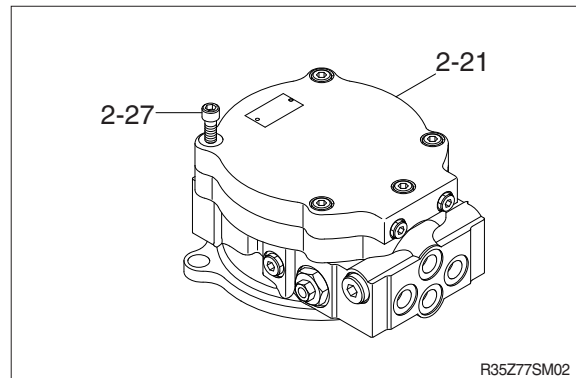
Secure the motor assembly in a vice and remove the socket head bolt (3).



(2) Disassembling the motor

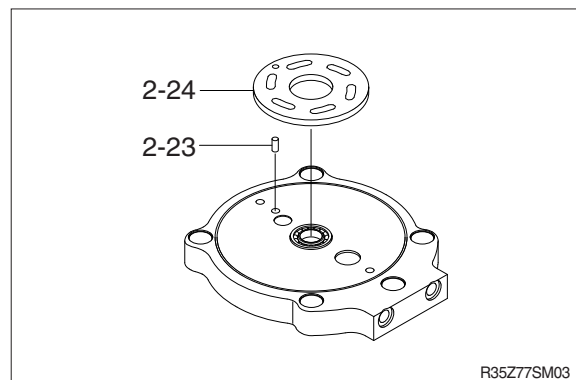
① Secure the motor assembly in a vice. Remove the socket head bolts (2-27) and separate the cover (2-21).

※ When separating the cover (2-21), be careful not to drop the valve plate (2-24).

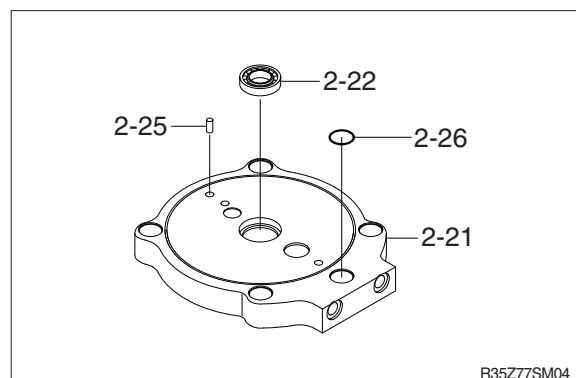


② Remove the valve plate (2-24) and the pin (2-23).

※ The valve plate (2-24) may remain on the motor side.

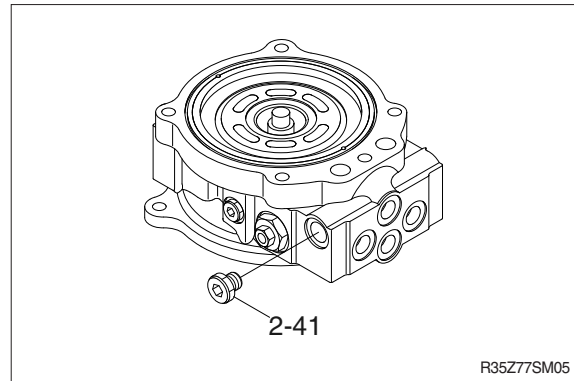


③ Remove the bearing (2-22). Remove the O-ring (2-26).

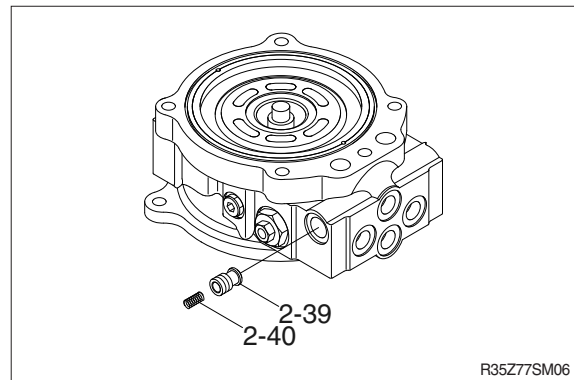


④ Disassemble the check valve.

- a. Loosen to remove the plug (2-41).



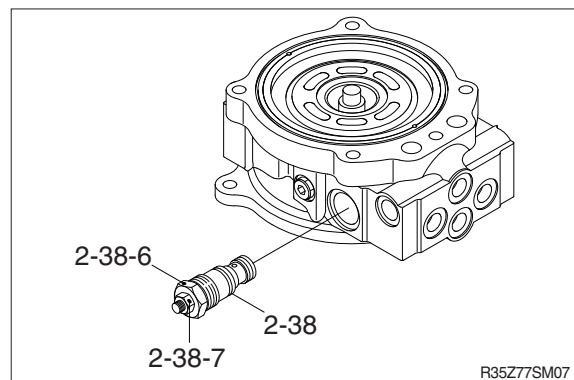
- b. Remove the spring (2-40) and the check valve (2-39).



⑤ Remove the relief valve.

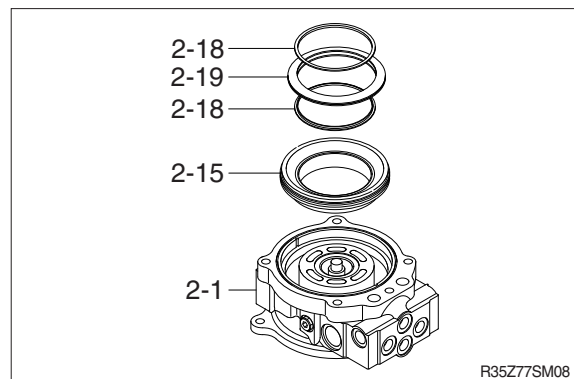
- a. Loosen the plug (2-38-6) to remove the relief valve assembly (2-38).

- ※ Do not move the adjuster kit (2-38-7). Otherwise, the set pressure will change.
- ※ Do not disassemble the relief valve assembly (2-38) because it is a functional component.



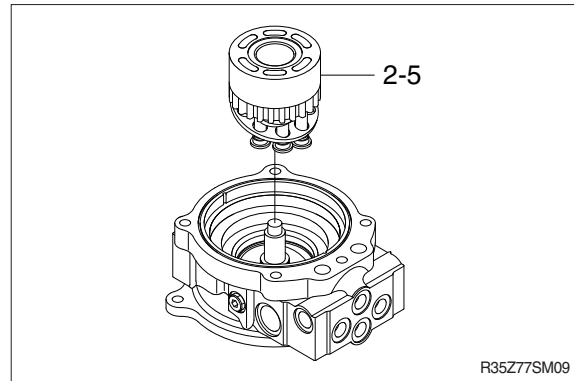
- ⑥ Remove the disc spring assembly (2-19) and the spring seat (2-18), and utilizing the gage port of the case (2-1), remove the parking brake piston (2-15).

- ※ The piston may be ejected by the air pressure. Exercise sufficient care during removal. At the beginning of the work, set a lower air pressure and adjust it while checking the piston for ejection.

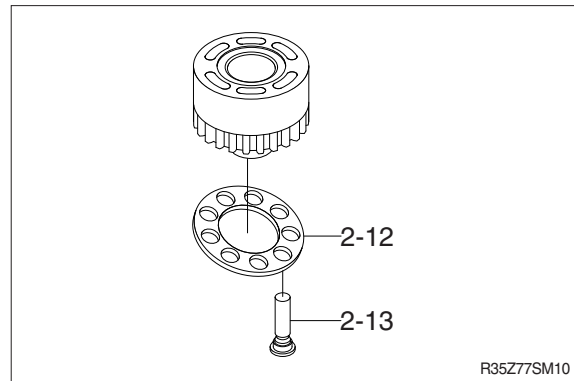


- ⑦ Remove the cylinder block and other associated parts.

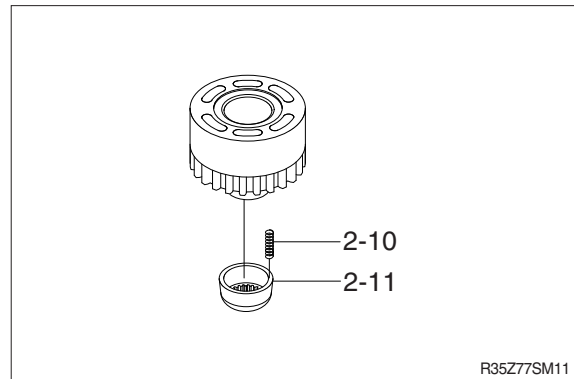
- (2-5) Cylinder block
- (2-6) Collar
- (2-7) Spring
- (2-8) Washer
- (2-9) Snap ring
- (2-10) Pin
- (2-11) Retainer holder
- (2-12) Retainer plate
- (2-13) Piston assembly
- (2-14) Disc(Parking brake spec. only)



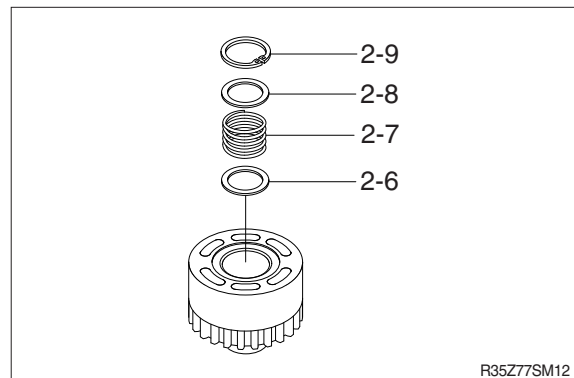
- ⑧ Remove the retainer plate (2-12) and the piston assembly (2-13).



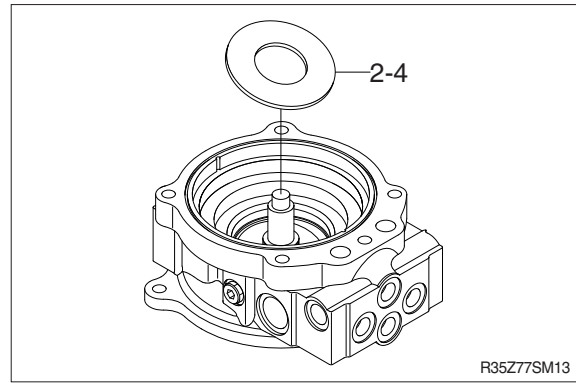
- ⑨ Remove the pin (2-10) and the retainer holder (2-11).



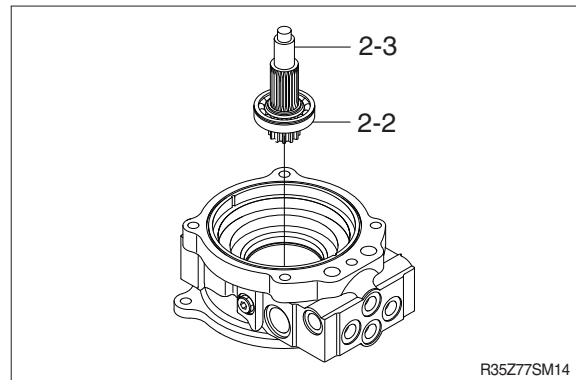
- ⑩ While pushing the washer (2-8), remove the snap ring (2-9).
- ⑪ Remove the collar (2-6), the spring (2-7) and the washer (2-8).



⑫ Remove the thrust plate (2-4).

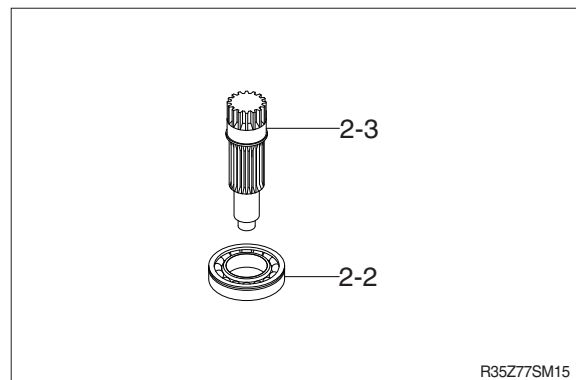


⑬ Lightly strike the end of the shaft (2-3) with a plastic hammer to remove the shaft.



⑭ Disassemble the ball bearing (2-2) and the shaft (2-3).

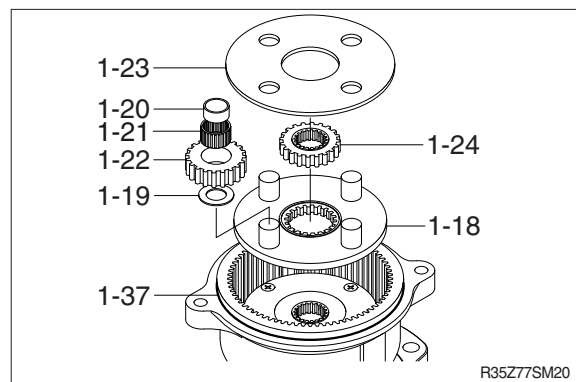
※ The disassembled bearing must not be used.



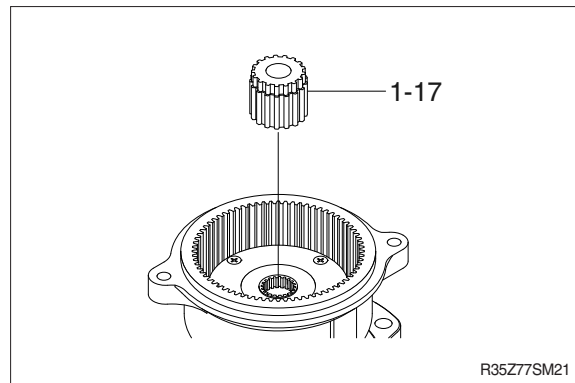
(3) Disassembling the reduction gear

① Remove the following parts.

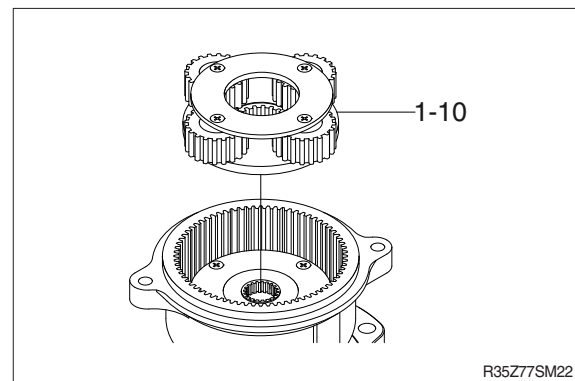
- (1-37) O-ring
- (1-24) Drive gear
- (1-23) Thrust plate
- (1-22) Planetary gear
- (1-21) Needle bearing
- (1-20) Inner race
- (1-19) Thrust washer
- (1-18) Holder



- ② Remove the sun gear (1-17).



- ③ Remove the holder (1-10) and other associated parts.

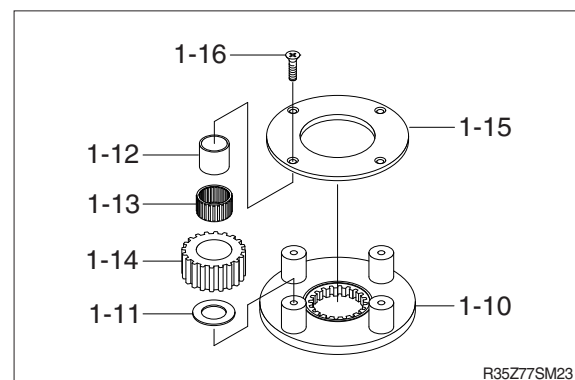


- ④ Secure the holder (1-10) in a vice and loosen the screw (1-16) to remove the thrust plate (1-15).

※ The screw is hard to remove because loctite was used during assembly. To facilitate the removal of the screw, warm the screw with a drier.

- ⑤ Remove the following parts.

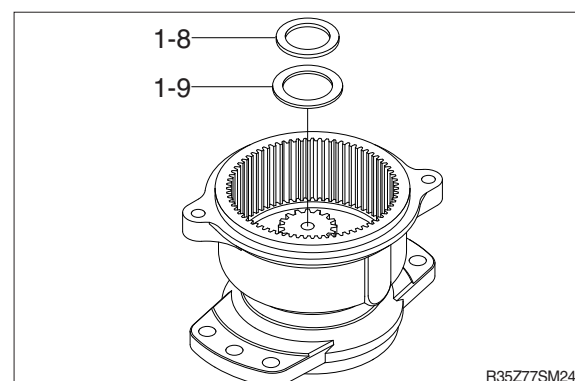
- (1-14) Planetary gear
- (1-13) Needle bearing
- (1-12) Inner race



※ When replacing the taper roller bearings (1-5) and (1-7), the collar (1-9) and the plate (1-8), they are to be replaced by the body assembly.

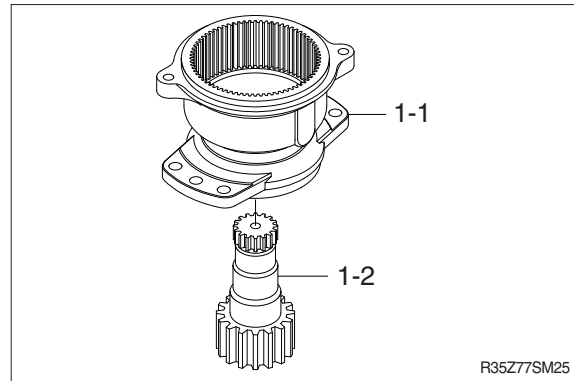
- ⑥ Remove the following parts.

- (1-8) Plate
- (1-9) Collar

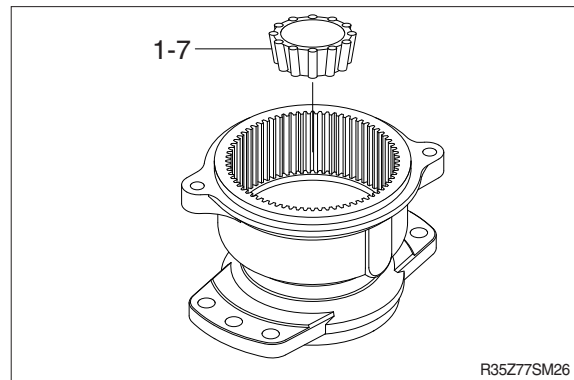


⑦ Remove the pinion shaft (1-2)

※ When removing the shaft, be careful not to drop it. If it is hard to remove, lightly strike it with a plastic hammer.



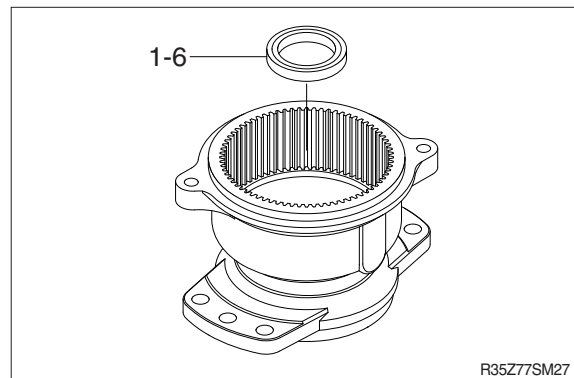
⑧ Remove the inner race of the taper roller bearing (1-7).



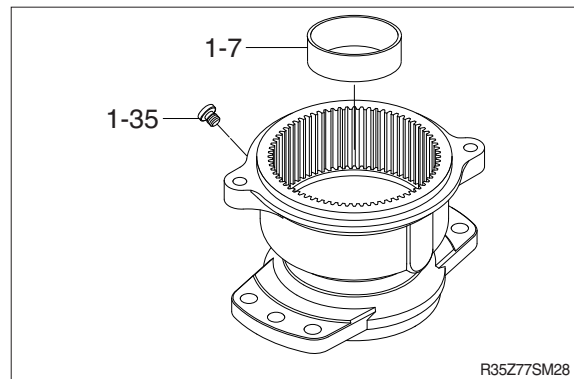
⑨ Break the oil seal (1-6) to remove it.

※ The removed oil seal must not be used again.

When removing it, exercise care to prevent damage to the outer races of the taper roller bearing (1-8) and (1-6).



⑩ Remove the outer race of the taper roller bearing (1-7) and the plug (1-35).



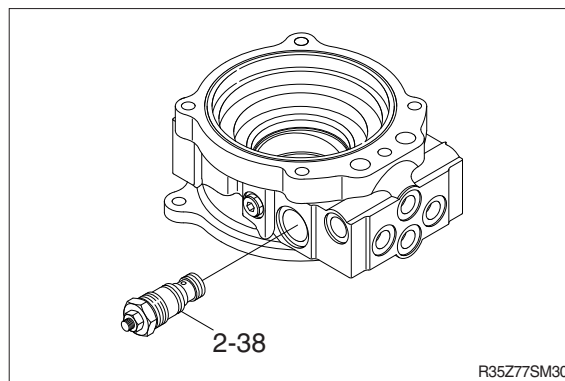
3) ASSEMBLY

Assemble the parts by the following procedure.

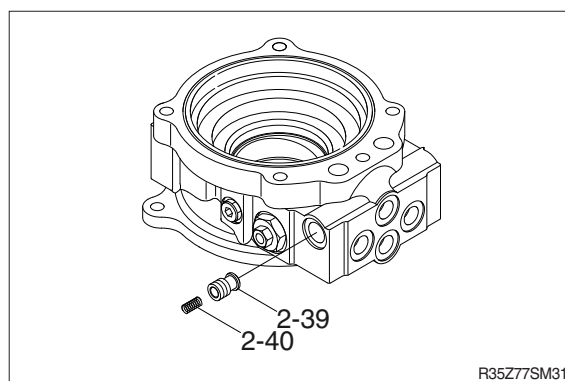
(1) Assembling the motor

- ① Install the relief valve assembly (2-38).

· Tightening torque : $157 \pm 10 \text{ N} \cdot \text{m}$
 $161 \pm 1 \text{ kgf} \cdot \text{m}$

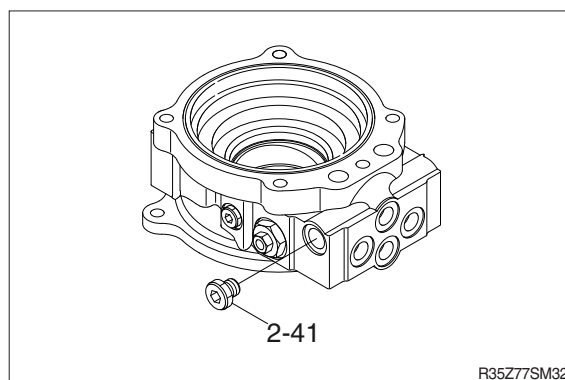


- ② Assemble the check valve (2-39) and the spring (2-40).



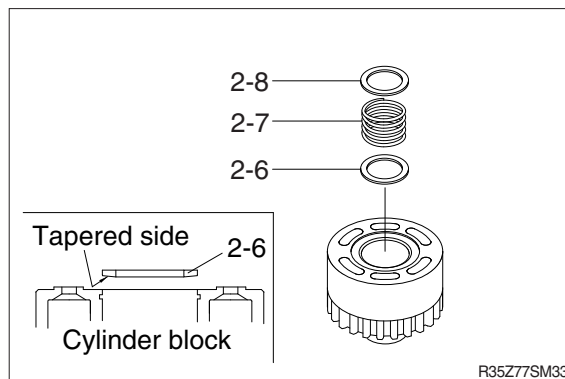
- ③ Install the plug (2-41).

· Tightening torque : $39.2 \pm 2.0 \text{ N} \cdot \text{m}$
 $4.0 \pm 0.2 \text{ kgf} \cdot \text{m}$

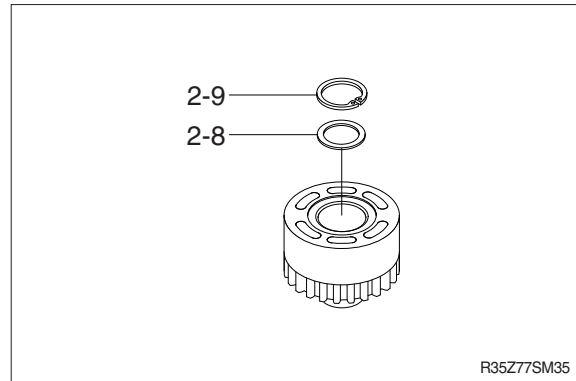


- ④ Assemble the collar (2-6), the spring (2-7) and the washer (2-8) in the cylinder block (2-5).

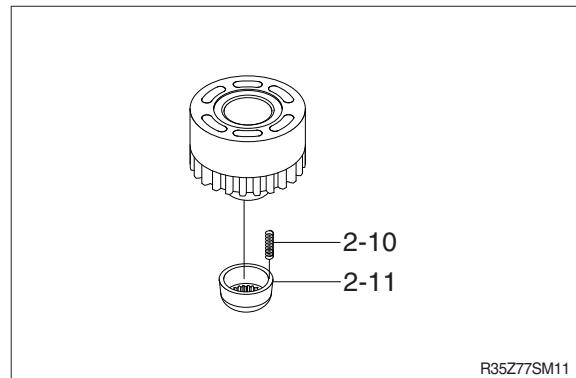
※ Be sure to assemble the collar (2-6) in the correct direction.



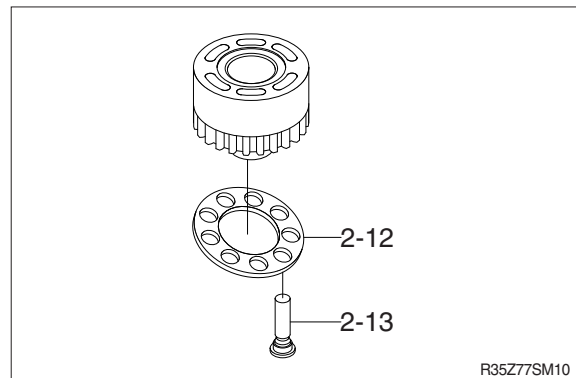
- ⑤ While pushing the washer (2-8), assemble the snap ring (2-9).



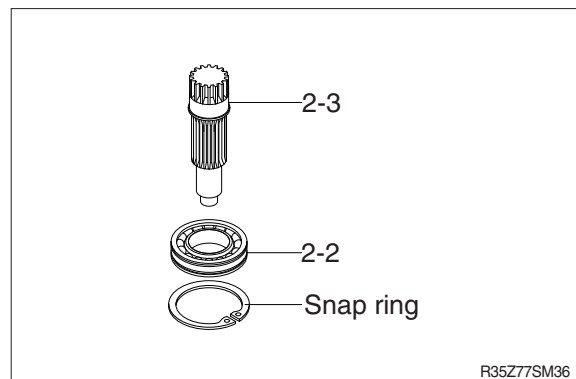
- ⑥ Apply grease to the pin (2-10) and assemble it in the cylinder block (2-5).
⑦ Assemble the retainer holder (2-11).



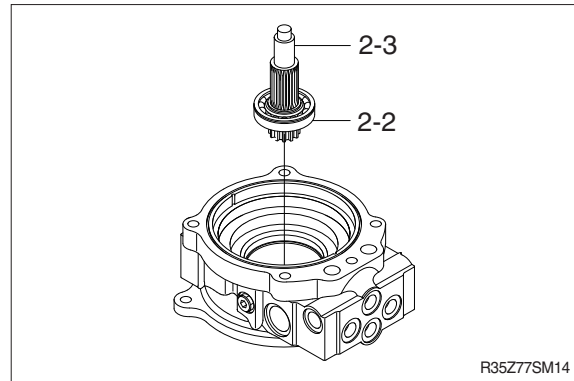
- ⑧ Set the piston assembly (2-13) on the retainer plate (2-12) and assemble it in the cylinder block (2-5).
※ Apply an ample amount of hydraulic fluid to the sliding part before assembly.



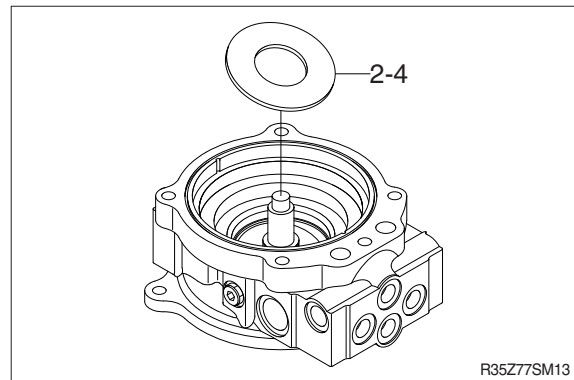
- ⑨ Press-fit the ball bearing (2-2) on the shaft (2-3).
※ Press-fit the ball bearing (2-2) with the attached snap ring facing as shown in the figure.



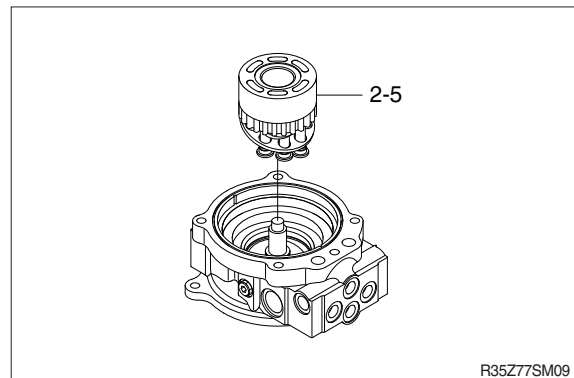
- ⑩ Press-fit the shaft (2-3) and the ball bearing (2-2) in the case (2-1).



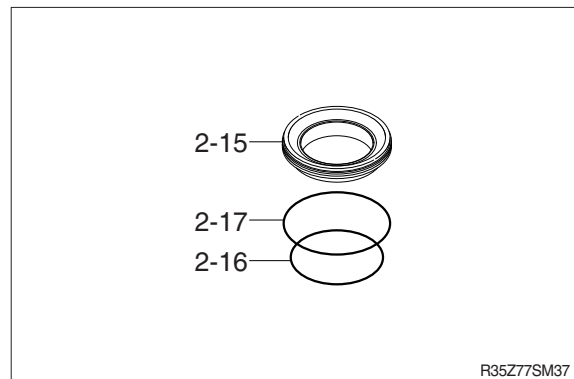
- ⑪ Apply grease to the back side of the thrust plate (2-4) and assemble it.
- ※ The thrust plate must be assembled in the correct direction.



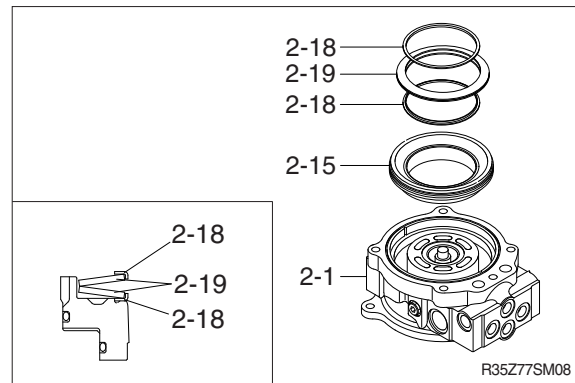
- ⑫ Assemble the cylinder block (2-5) and other associated parts.
- ※ During assembly, be sure that the pin (2-10) will not come out.
 - ※ The disc (2-14) is assembled only for the parking brake spec only.



- ⑬ Apply grease to the O-ring (2-16) and the O-ring (2-17) and assemble them on the brake piston (2-15).
- ⑭ While paying attention to the location of the hole of the pin (2-25), assemble the brake piston (2-15) in the case (2-1).

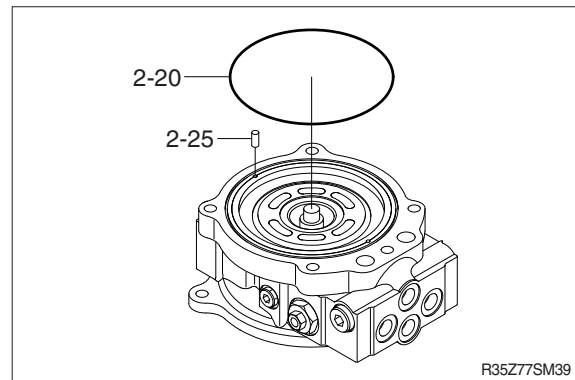


- ⑮ Assemble the spring seat (2-18) and the disc spring (2-19) in the correct direction.

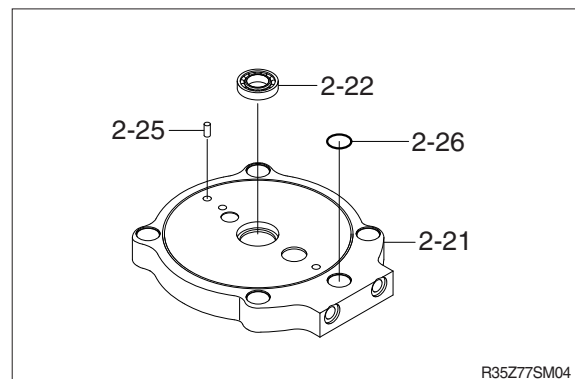


- ⑯ Apply grease to the O-ring (2-20) and assemble it in the case (2-1).
Check to see if the pin (2-25) can be assembled in the brake piston and case hole. If not, remove the brake piston (2-15) and re-orient it, then reassemble.

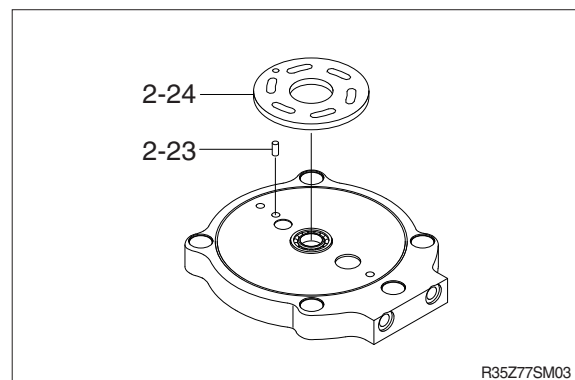
※ Assemble the pin (2-25) while being attached on the cover.



- ⑰ Apply grease to the O-ring (2-26) and the pin (2-25), then assemble them in the cover (2-21).
Press-fit the ball bearing (2-22).



- ⑱ Install the pin (2-23), then install the valve plate (2-24).
To prevent it from falling, apply grease to the back side.

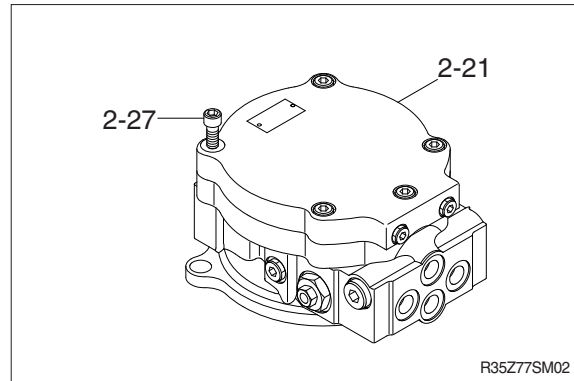


- ⑰ While paying attention to the location of the pin (2-25), install the cover (2-21) and other associated parts to the case
 ※ (2-1).

Exercise care so that the pin (2-25) and

- ⑱ Loosely tighten the socket head bolts (2-27), then using a torque wrench, tighten them to the specified torque.

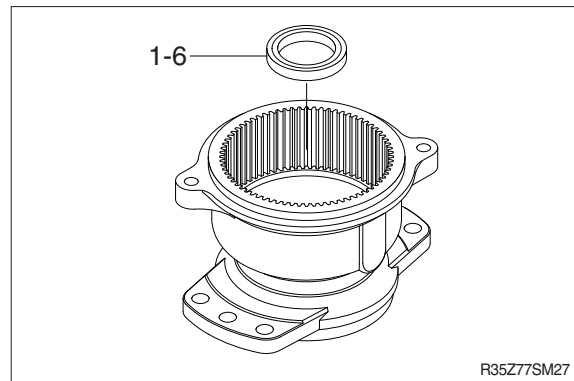
· Tightening torque : $13 \pm 0.7 \text{ kgf} \cdot \text{m}$
 $(94.4 \pm 5 \text{ lbf} \cdot \text{ft})$



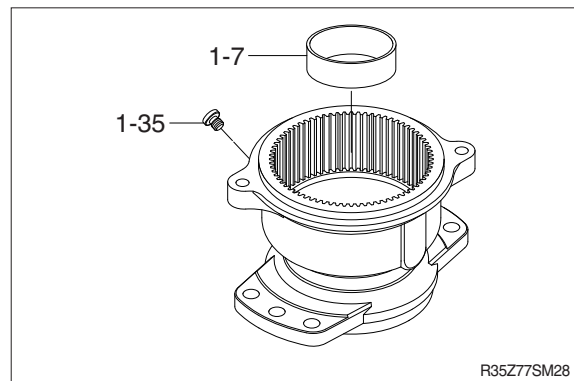
(2) Assembling the reduction gear

- ① Press-fit the oil seal (1-6).

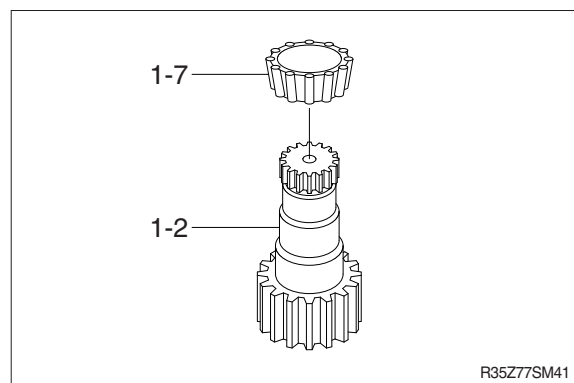
※ Prior to press-fit, apply grease to the oil seal mounting area of the housing and the periphery of the oil seal.



- ② Press-fit the taper roller bearing (1-7) and install the plug (1-35).

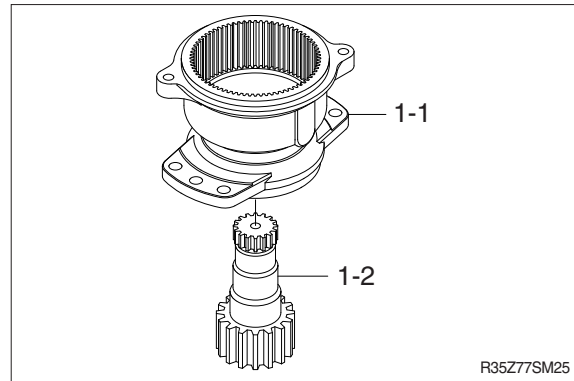


- ③ Apply grease to the inner race of the taper roller bearing (1-7) assembled on the pinion shaft (1-2).



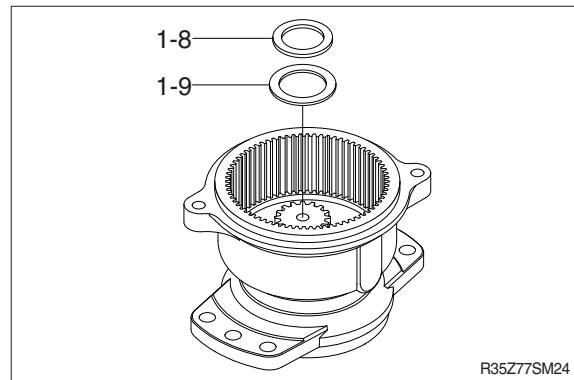
- ④ Install the pinion shaft (1-2) and other associated parts. Install the taper roller bearing inner race (1-7).

※ Prior to assembling the pinion shaft (1-2), etc. apply grease to the lip of the oil seal (1-6).



R35Z77SM25

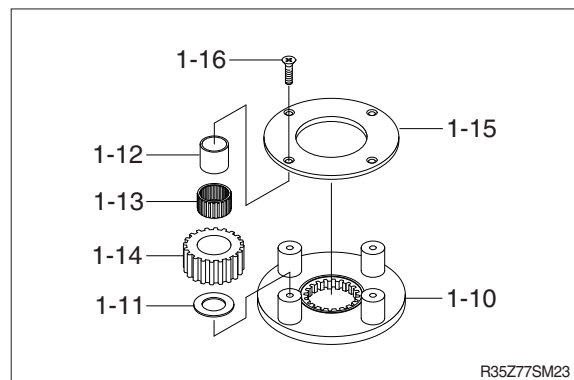
- ⑤ Install the collar (1-9) and the plate (1-8).



R35Z77SM24

- ⑥ Install the following parts on the holder.

- (1-10) Holder
- (1-11) Thrust washer
- (1-12) Inner race
- (1-13) Needle bearing
- (1-14) Planetary gear B
- (1-15) Thrust plate
- (1-16) Screw

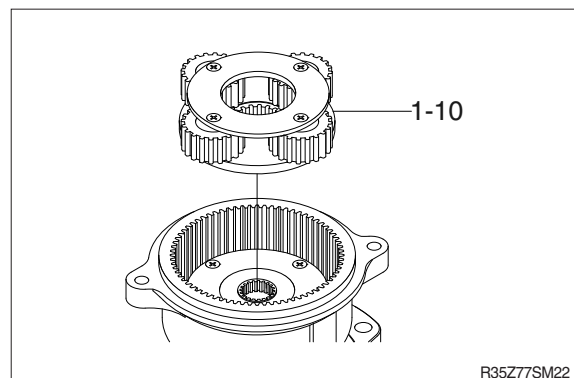


R35Z77SM23

※ Apply loctite 242 to the screw prior to tightening it.

- Tightening torque : $0.4 \pm 0.05 \text{ kgf} \cdot \text{m}$
 $2.9 \pm 0.3 \text{ lbf} \cdot \text{ft}$

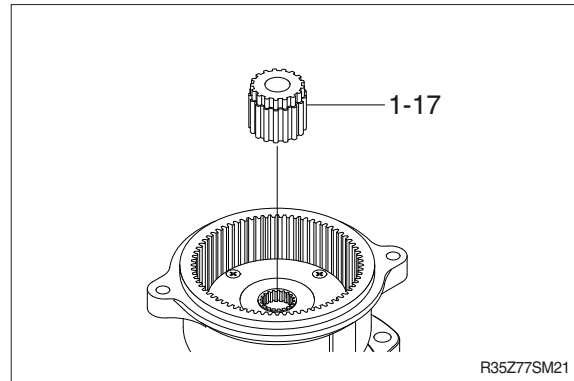
- ⑧ Install the holder (1-10) and other associated parts.



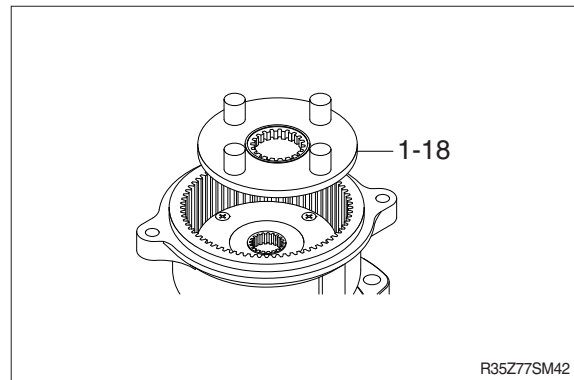
R35Z77SM22

⑨ Install the sun gear (1-17).

※ Install the sun gear (1-17) with the snap ring facing as shown in the figure.

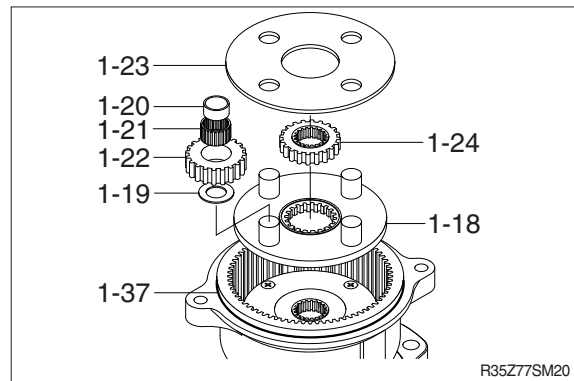


⑩ Install the holder (1-18).



⑪ Install the following parts.

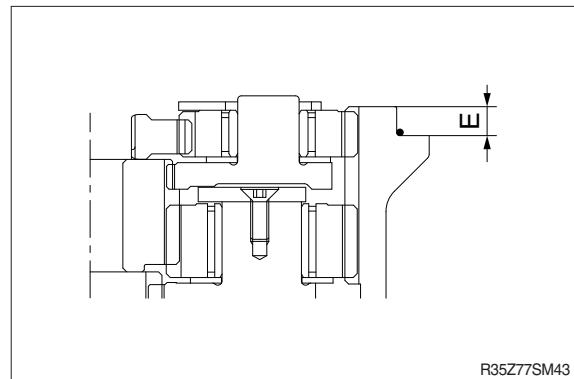
- (1-19) Thrust washer
- (1-20) Inner race
- (1-21) Needle bearing
- (1-22) Planetary gear A
- (1-23) Thrust plate
- (1-24) Drive gear
- (1-37) O-ring



※ Selection for thrust plate (1-15).

When any consisting parts of reduction unit were changed, select and install thrust plate corresponding to the measured value "E" referring to the below table.

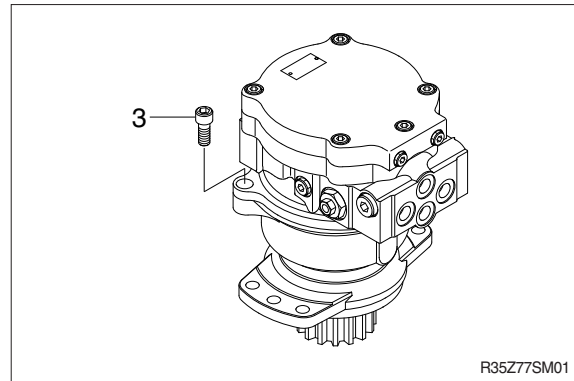
E dimension (measured value)	Less than 6.6	6.6~7.2	More than 7.2
Part no. of thrust plate 1-23 (plate thickness)	XJBV-00129 (3.2 mm)	XJBV-00130 (2.8 mm)	XJBV-00131 (2.3 mm)



(3) Assembling the whole motor assembly

Place the reduction gear assembly on the motor assembly and loosely tighten the socket head bolt (3), then tighten it to the specified torque.

- Tightening torque : $13 \pm 0.7 \text{ kgf} \cdot \text{m}$
($94.4 \pm 5 \text{ lbf} \cdot \text{ft}$)



GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

- (1) Swing the work equipment 90 ° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

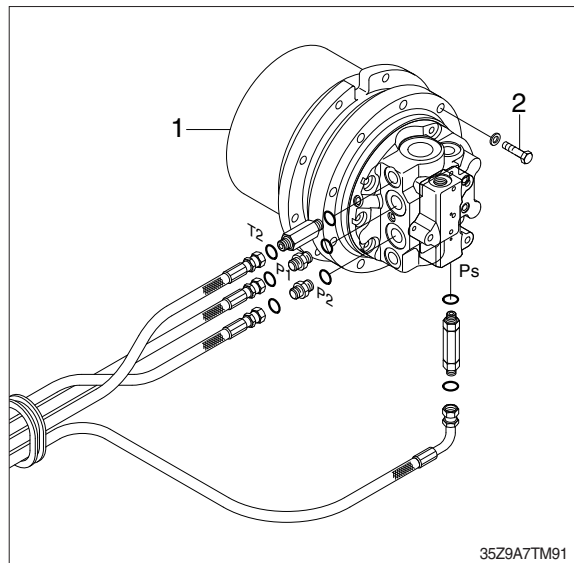
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

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

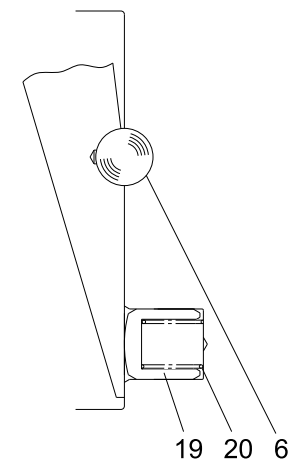
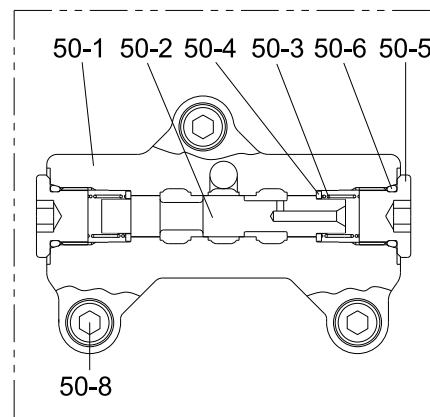
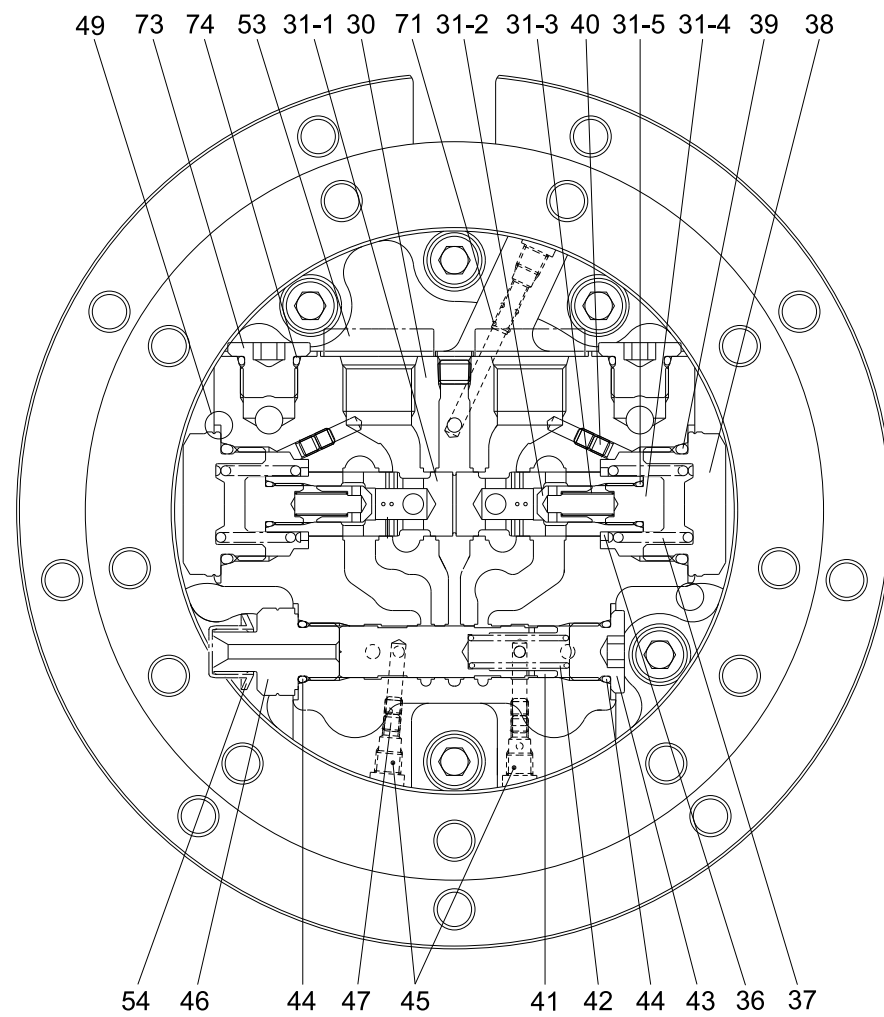
- (4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly**.
- (5) Remove the cover.
- (6) Remove the hose.
※ Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 40 kg (88 lb)

2) INSTALL

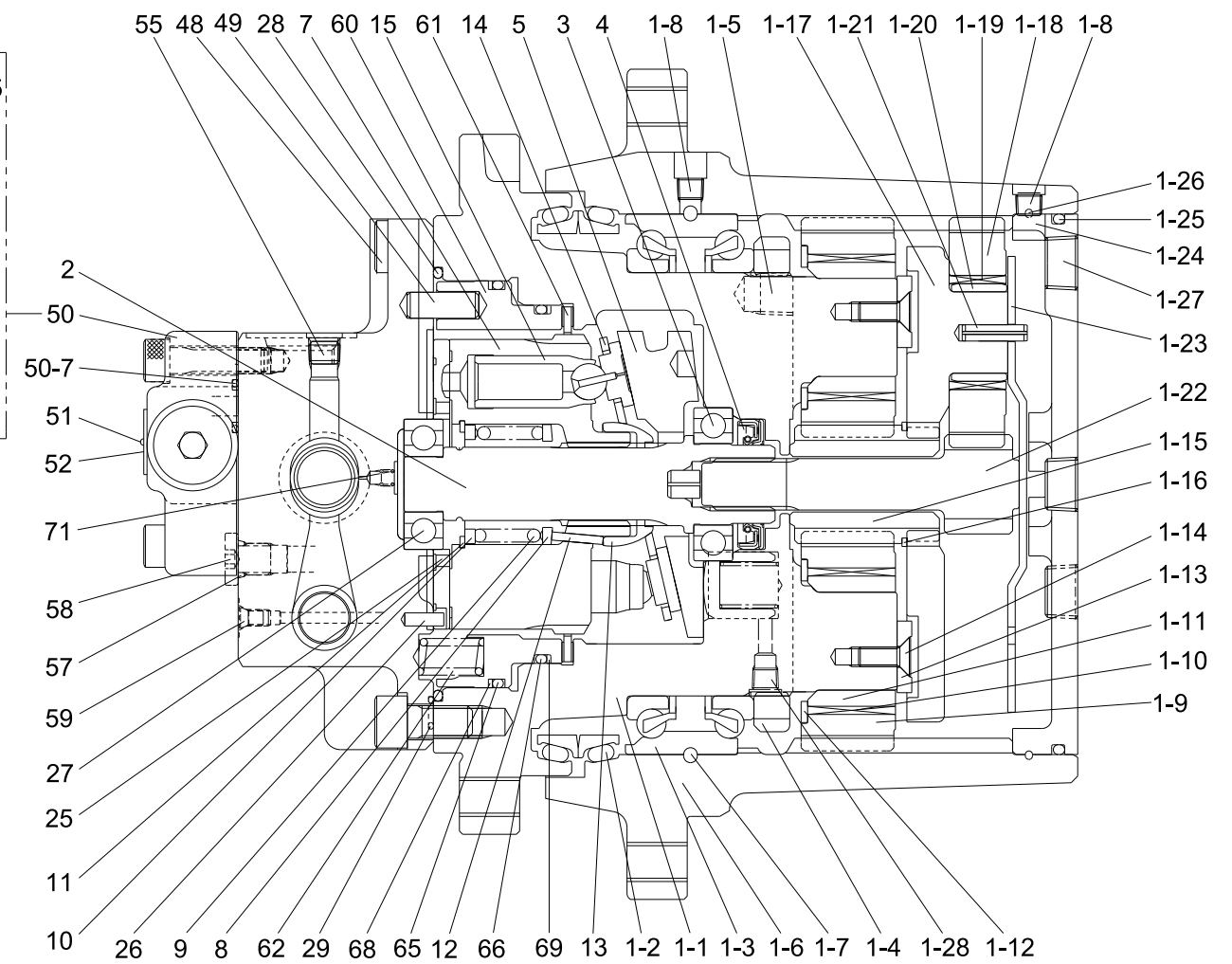
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel motor.
 - ① Remove the air vent plug.
 - ② Pour in hydraulic oil until it overflows from the port.
 - ③ Tighten plug lightly.
 - ④ Start the engine, run at low idling, and check oil come out from plug.
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



2) STRUCTURE



DETAIL OF 2 SPEED
LEAN TURNING PORTION



- | | |
|----------------------|-----------------------------|
| 1 Gear box | 1-17 Holder |
| 1-1 Flange holder | 1-18 Planetary gear (A) |
| 1-2 Floating seal | 1-19 Needle bearing |
| 1-3 Angular bearing | 1-20 Inner race |
| 1-4 Ring nut | 1-21 Spring pin |
| 1-5 Plug | 1-22 Drive gear |
| 1-6 Housing | 1-23 Thrust plate (T = 1.8) |
| 1-7 Steel ball | 1-23 Thrust plate (T = 2.3) |
| 1-8 Plug | 1-23 Thrust plate (T = 2.8) |
| 1-9 Planetary gear B | 1-24 Cover |
| 1-10 Needle bearing | 1-25 O-ring |
| 1-11 Collar | 1-26 Wire |
| 1-12 Thrust washer | 1-27 Plug |
| 1-13 Thrust plate | 1-28 Plug |
| 1-14 Screw | 2 Shaft sub assy |
| 1-15 Sun gear | 3 Ball bearing |
| 1-16 Snap ring | 4 Oil seal |

- | | |
|-------------------|------------------|
| 5 Swash plate | 29 O-ring |
| 6 Steel ball | 30 Base plate |
| 7 Cylinder block | 31 Plunger assy |
| 8 Color | 31-1 Plunger |
| 9 Spring | 31-2 Check valve |
| 10 Washer | 31-3 Spring |
| 11 Snap ring | 31-4 Plug |
| 12 Pin | 31-5 O-ring |
| 13 Holder | 36 Spring seat |
| 14 Retainer plate | 37 Spring |
| 15 Piston assy | 38 Cap |
| 19 Piston assy | 39 O-ring |
| 20 Spring | 40 Orifice |
| 25 Valve plate | 41 Spool |
| 26 Pin | 42 Spring |
| 27 Ball bearing | 43 Plug |
| 28 O-ring | 44 O-ring |

- | | |
|-----------------------|-----------------|
| 45 Plug | 57 O-ring |
| 46 Plug | 58 Plug |
| 47 Orifice | 59 Plug |
| 48 Socket head bolt | 60 Brake piston |
| 49 Pin | 61 Disc |
| 50 Valve assy | 62 Spring |
| 50-1 Valve body | 65 O-ring |
| 50-2 Spool | 66 O-ring |
| 50-3 Spring | 68 Backup ring |
| 50-4 Spring seat | 69 Backup ring |
| 50-5 Plug | 71 Spring |
| 50-6 O-ring | 73 Plug |
| 50-7 O-ring | 74 O-ring |
| 50-8 Socket head bolt | |
| 51 Name plate | |
| 52 Drive screw | |
| 55 Plug | |

35Z9A2TM01

3) MAINTENANCE INSTRUCTION

(1) Necessary tool to assemble

No.	Parts name		Applicable components or parts
1	Torque wrench (preset type)	~23 N.m	Plug (1-5), (1-8), (45), (55), (58), (59), (73), Screw (1-14) Orifice (40), (47), (71) Socket head bolt (50-7), (50-8)
2		~45 N.m	Socket head bolt (48) Plug (1-27), (31-4), (43), (46), (50-4), (50-5)
3		~400 N.m	Ring nut (1-4) Cap (38)
5	Hexagon bit for torque wrench	Width across flats 2.5	Orifice (40), (47), (71)
6		Width across flats 4.0	Plug (45), Screw (1-14)
7		Width across flats 5.0	Plug (1-8), Screw (1-14)
8		Width across flats 6.0	Socket head bolt (50-7), (50-8) Plug (1-5), (1-27), (31-4), (58), (59) Socket head bolt (48)
9		Width across flats 8.0	Plug (1-5), (43), (50-4), (50-5), (73)
10		Width across flats 10.0	Socket head bolt (48), Housing (1-6)
		Width across flats 12.0	Housing (1-6)
11	Socket for socket wrench	Width across flats 22.0	Plug (46)
12		Width across flats 36.0	Cap (38)
13	Screw driver		Floating seal (1-2) Wire (1-26), Base plate (30) Oil seal (4)
14	Hammer		Angular bearing (1-3) Plug (1-5), Steel ball (1-7) Shaft (2), Oil seal (4) Pin (26)
15	Plastic hammer		Base plate (30), Cover (1-24)
16	Cutting pliers		Wire (1-26)
17	Snap ring pliers		Snap ring (11)
18	Punch		Plug (1-5), Pin (26)

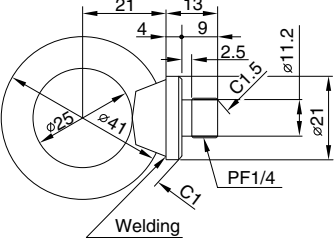
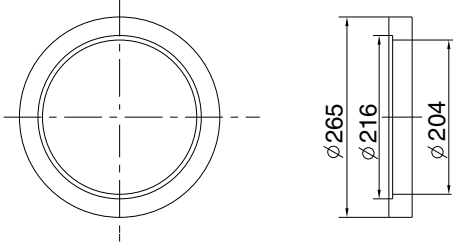
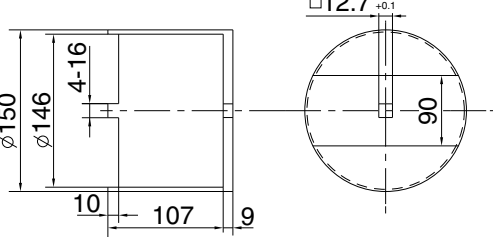
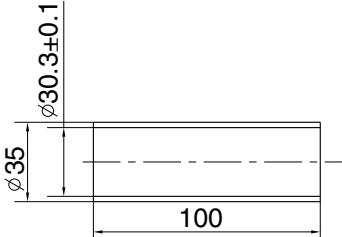
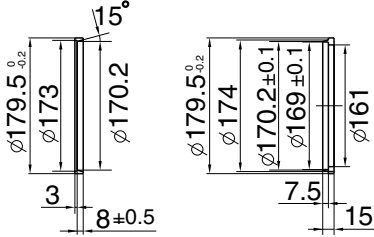
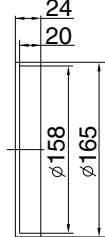
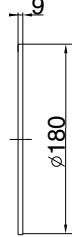
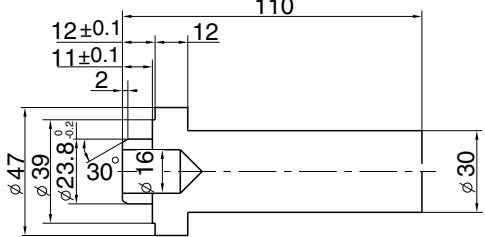
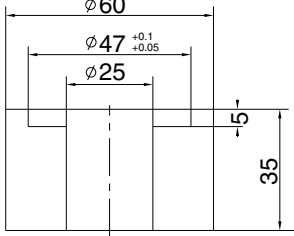
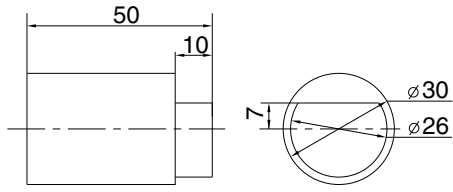
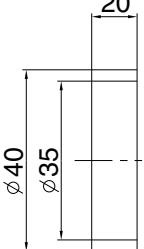
(2) Special Tools

Table

No.	Parts name	Applicable components or parts
S-1	Pin Dia. 5.5×30 mm	Plug (31-4)
S-2	Eyebolt PF 1/4	Cover (1-24), Wire (1-26)
S-3	Round bar dia. 20×1000 mm	Cover (1-24), Wire (1-26)
S-4	Piano wire dia. 0.2×700 mm	Steel ball (1-7)
S-5	Housing disassembly jig	Housing (1-6)
S-6	Ring nut tightener	Ring nut (1-4)
S-7	Round bar dia. 10×150 mm	Angular bearing (1-3), Shaft (2)
S-8	Ball bearing disassembly jig	Ball bearing (3)
S-9	Floating seal assembly jig	Floating seal (1-2)
S-10	Angular bearing press fitting jig	Angular bearing (1-3)
S-11	Flange holder press fitting jig	Flange holder (1-1)
S-12	Oil seal press fitting jig	Oil seal (4)
S-13	Ball bearing press fitting jig	Shaft (2), Ball bearing (3)
S-15	Snap ring assembly jig	Snap ring (11)
S-16	Ball bearings press fitting jig	Ball bearing (27)

※ Refer to the next page for detail figure. (S1~S16)

• Tools

 <p>S-2 Eye bolt</p>	 <p>S-5 Housing disassembly</p>
 <p>S-6 Ring nut tightener</p>	 <p>S-8 Ball bearing disassembly</p>
 <p>S-9 Floating seal assembly</p>	 <p>S-10 Angular bearing press fitting</p>
 <p>S-11 Flange holder press fitting</p>	 <p>S-12 Oil seal press fitting</p>
 <p>S-13 Ball bearing press fitting</p>	 <p>S-15 Snap ring assembly</p>
 <p>S-16 Ball bearing press fitting</p>	

2. DISASSEMBLY

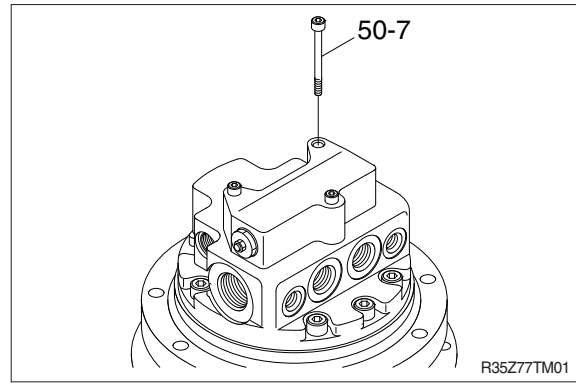
1) GENERAL PRECAUTIONS

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

2) DISASSEMBLE TRAVEL MOTOR BY THE FOLLOWING PROCEDURE

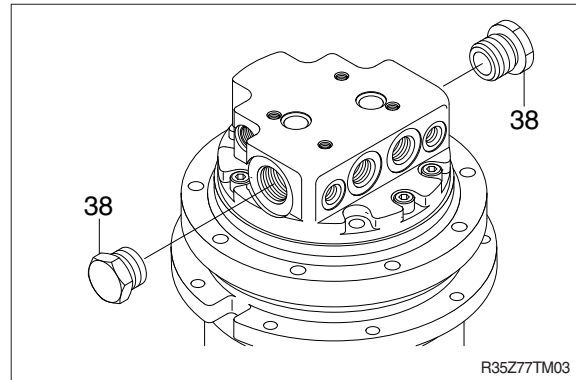
- (1) Fix the motor with vise.
Loosen socket head bolt (50-7), (50-8)
and remove valve assy (50).

· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7)

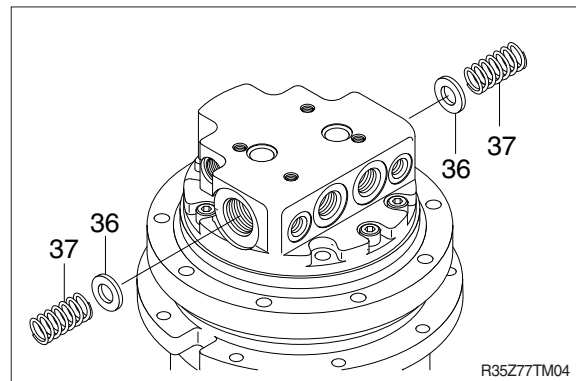


- (2) Remove cap (38).

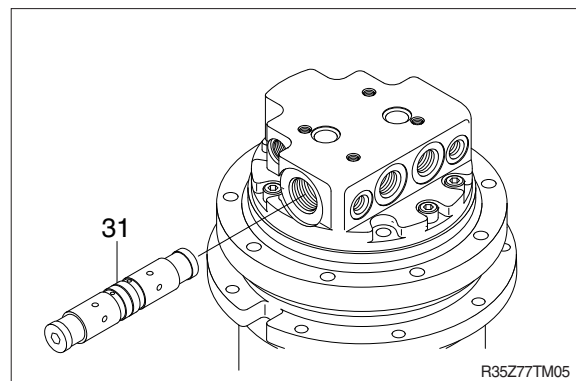
· Tools required :
Torque wrench (No. 3)
Socket for torque wrench (No. 12)



- (3) Take out spring (37), spring seat (36).

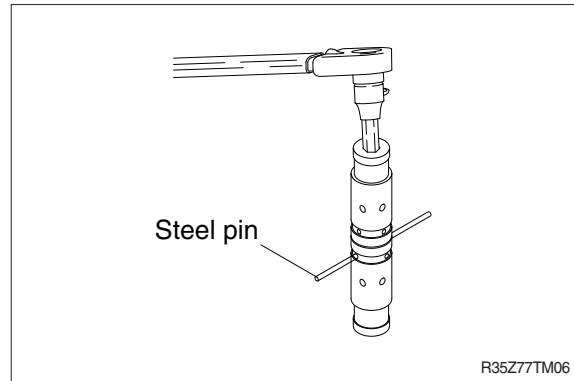


- (4) Remove plunger sub assy (31) turning slowly.
Be careful not to damage around the
perimeter part of the plunger.

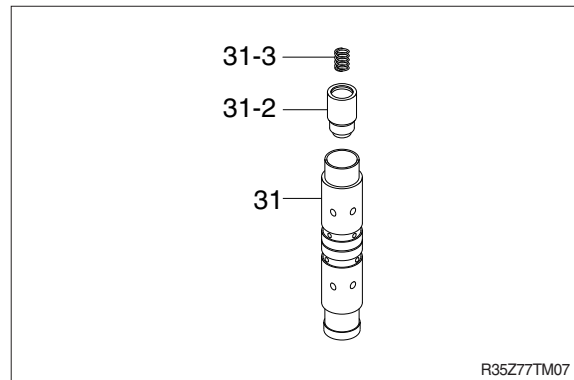


(5) Disassembly of plunger sub assy is not required when it operates normally. Insert pin S-1, dia. 5.5×30, in the through hole of the plunger sub assy, and fix it with vase.

- Tools required :
 Torque wrench (No. 2)
 Hexagonal bit for torque wrench (No. 7)
 Pin (S-1)

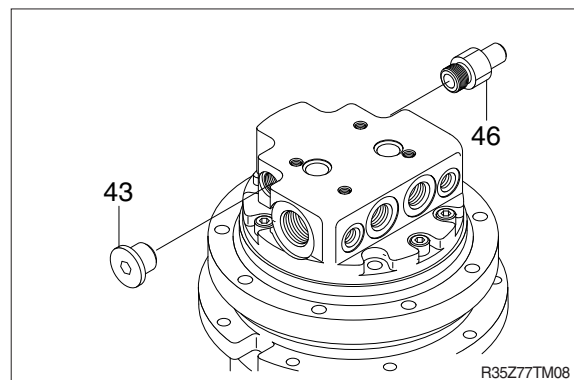


(6) Remove spring (31-3), check valve (31-2). Note the position of the right and left check valves to the plunger. When assembling, keep the parts in the same position as when disabled.



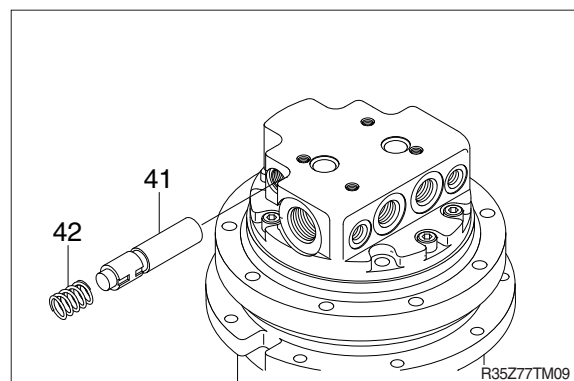
(7) Remove plugs (43), (46).

- Tools required :
 Torque wrench (No. 2)
 Hexagonal bit for torque wrench (No. 8)
 Socket for torque wrench (No. 10)



(8) Removing spring (42), spool assy (41) and spring seat (72).

Be careful not to damage around the spool.

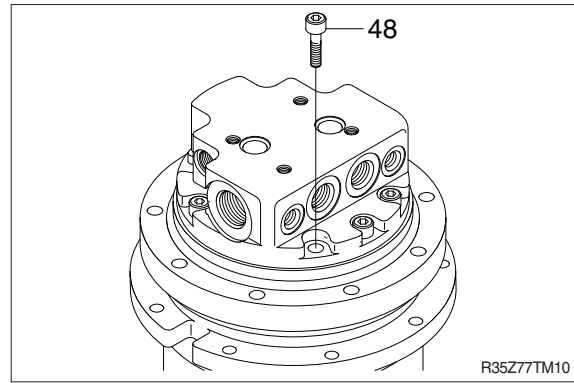


(9) Remove socket head bolt (48).

- Tools required :
Torque wrench (No. 3)
Hexagonal bit for torque wrench (No. 8, 9)

※ **Points (with parking brake type)**

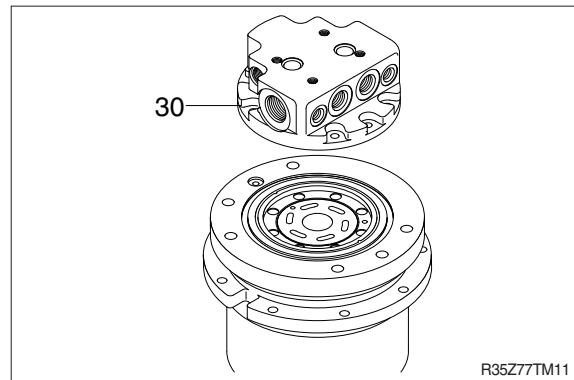
Since base plate (30) lifts up by the reactive force of springs (62), (63), evenly loosening the socket head bolt (48) makes motor disassembly easier.



(10) Remove base plate (30).

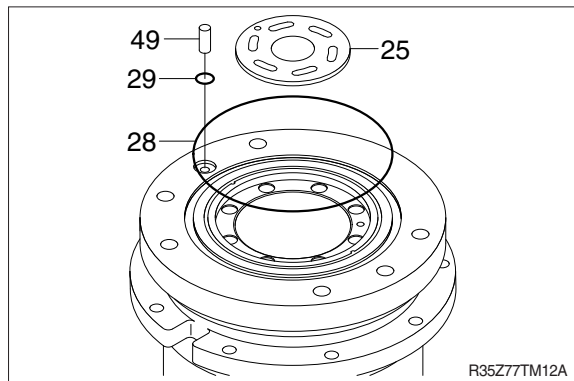
Then, pay attention so that cylinder block (7) does not come out. When it is difficult to remove, strike it by use of plastic hammer. If it is more difficult to remove, remove it by lightly prying with screwdriver.

- Tools required :
Plastic hammer (No. 15)
Screwdriver (No. 13)



(11) With parking brake type.

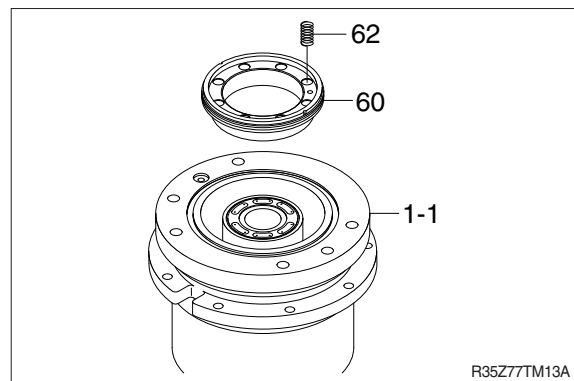
Remove pin (49), valve plate (25), O-rings (28, 29).



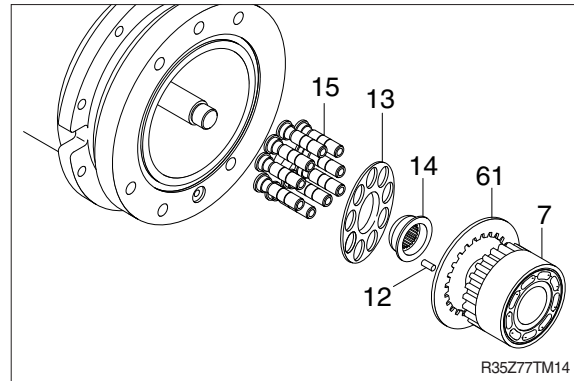
(12) This process is the only parking brake type.

Remove springs (62) and brake piston (60). Blow compressed air into parking brake releasing port on flange holder(1-1).

- ※ Before work, put a rag on all surface of the brake piston because the brake piston pops out and oil may be sprayed simultaneously during work.



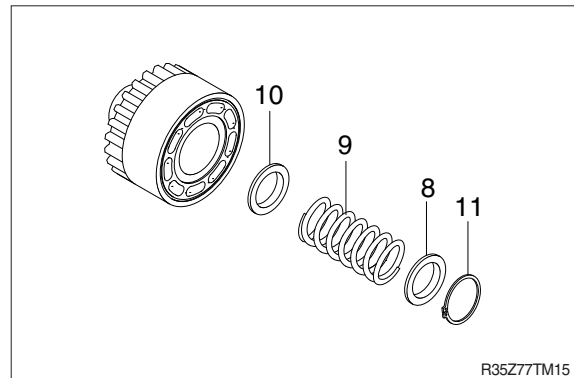
- (13) Remove cylinder block sub assy (7), pin (12), retainer holder (13), retainer plate (14), piston sub assy (15). Be careful not to damage the sliding surface of the cylinder block.
 Only parking brake type, remove disk plate (61)



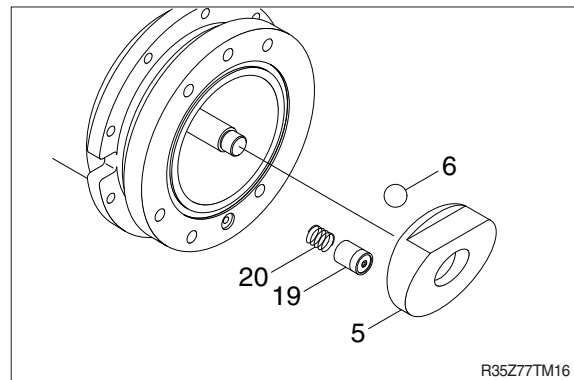
- (14) Remove snap ring (11) by use of plier.
 Remove washer (8), spring seat (10) and spring (9). Be careful not to damage the sliding surface of the cylinder block.

· Tools required :
 Snap ring pliers (No. 17)

- ※ Since the inside spring is under pressure, when removing the snap ring, be cautions about ejecting parts and protect fingers.

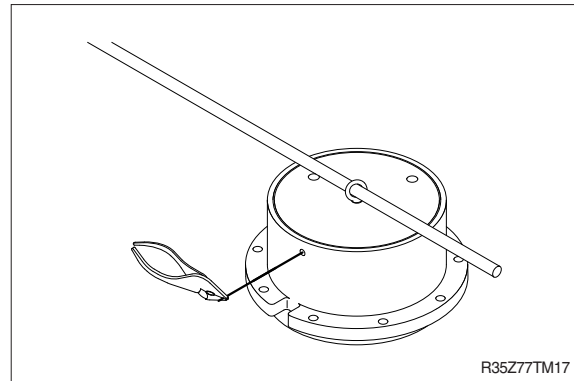


- (15) Remove swash plate (5), steel ball (6), piston sub assy (19) and spring (20).



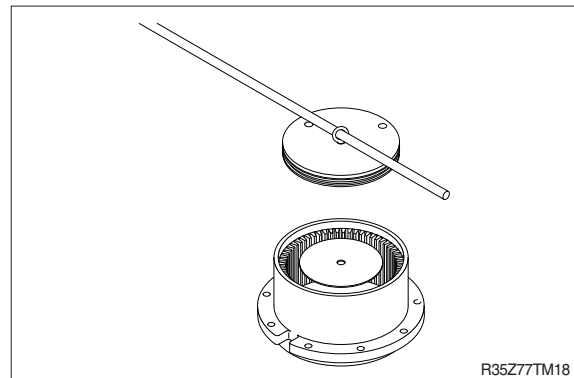
(16) Remove plugs (1-27), (1-8). Attach eyebolt (PF 1/4) to the threaded hole of plug (1-27) and insert pry-bar (length 1 [m]) in the eye hole, and turn the bar until wire (1-26) can be seen through the threaded hole of plug (1-8). Draw the wire outside when the wire end can be seen.

- Tools required :
 - Torque wrench (No. 1, No. 2)
 - Eyebolt PF 1/4 (S-2)
 - Hexagonal bit for torque wrench (No. 6, No. 7, No. 8)
 - Round bar dia. 20×1000 mm (S-3)
 - Screw driver (No. 13), cutting pliers (No. 16)

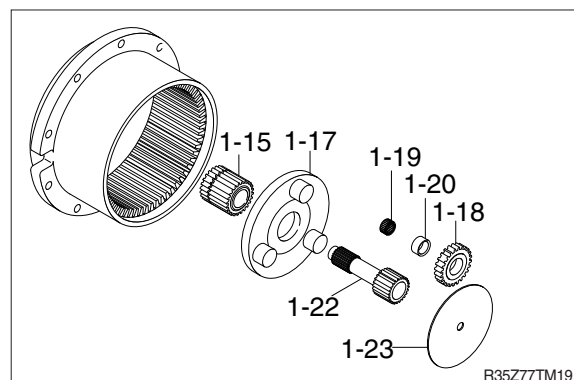


(17) Hook eyebolt and remove cover (1-24)

- Tools required :
 - Eyebolt PF 1/4 (S-2)
 - Round bar dia. 20×1000 mm (S-3)



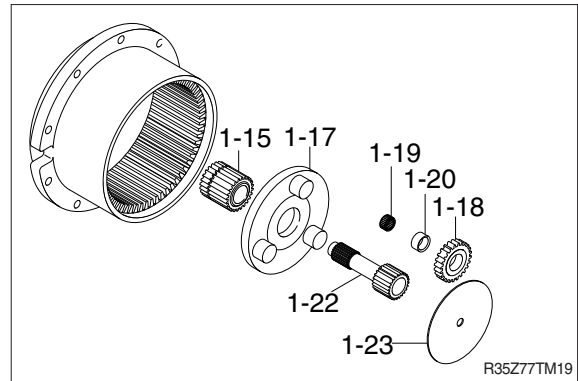
(18) Remove sun gear assy (1-15), holder (1-17), planetary gear A (1-18), needle bearing (1-19), inner race (1-20), drive gear (1-22) and thrust plate (1-23).



(19) Remove thrust plate (1-13) and screw (1-14).

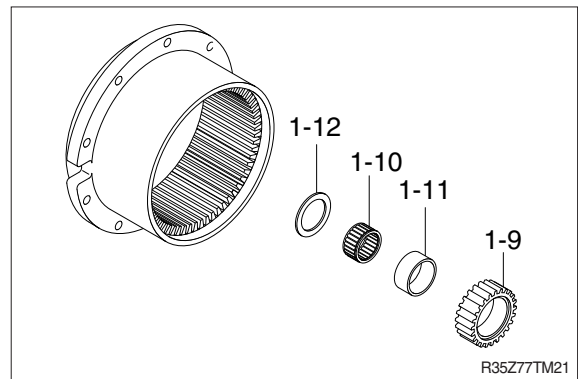
- Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 5, No. 6)

※ Heating screws will make removal easier because screw (1-14) is coated with locite when installed.



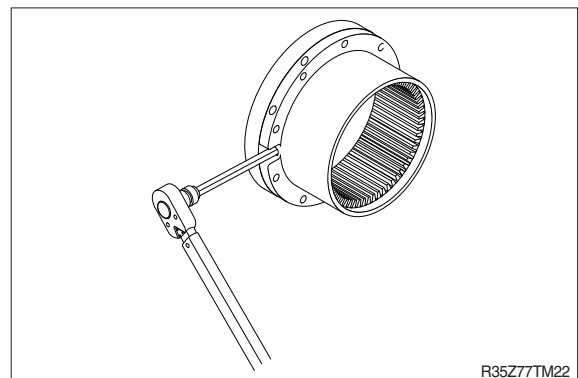
(20) Remove planetary gear B (1-9), needle bearing (1-10), inner race (1-11) and thrust washer (1-12).

Be careful not to damage the tooth surface of gear and the rolling section of the collar.



(21) Remove plug (1-8).

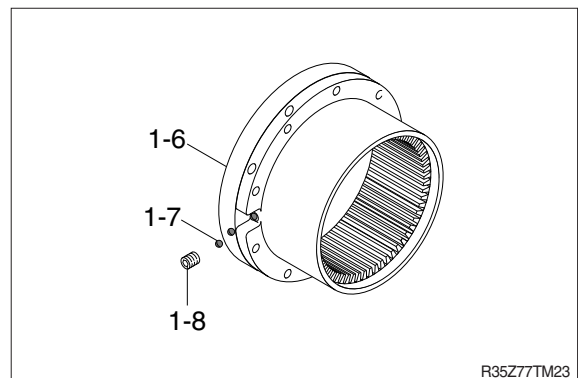
- Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 6)



(22) Take out steel balls (1-7) from the threaded hole of plug (1-8). After decreasing (thinner, cleaner. etc), remove by blowing air. Check that all steel balls (1-7) are removed by using wire.

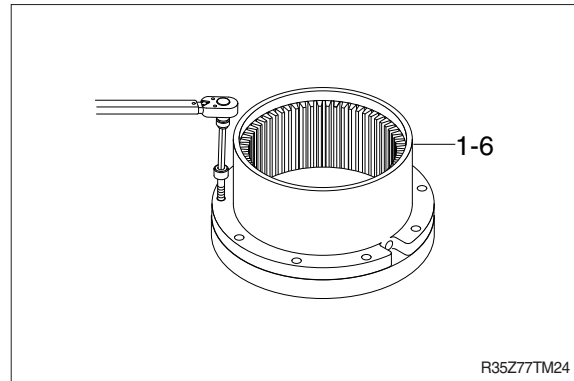
- Tools required :
Hammer (No. 14), wire (S-4)

※ When difficult to remove, steel balls (1-7) may be removed by striking the perimeter of housing (1-6) with a hammer.



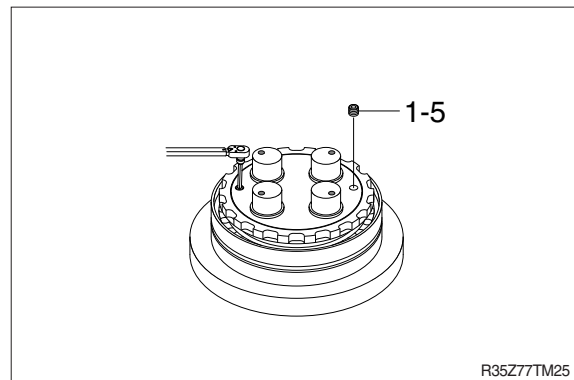
(23) Attach jig between flange holder (1-1) and housing (1-6), and tighten 3 bolts M14×2.0 uniform from the housing side.

- Tools required :
Torque wrench (No. 3)
Hexagonal bit for torque wrench (No. 9, No. 10)
Housing disassembly jig (S-5)



(24) Remove plug (1-5).

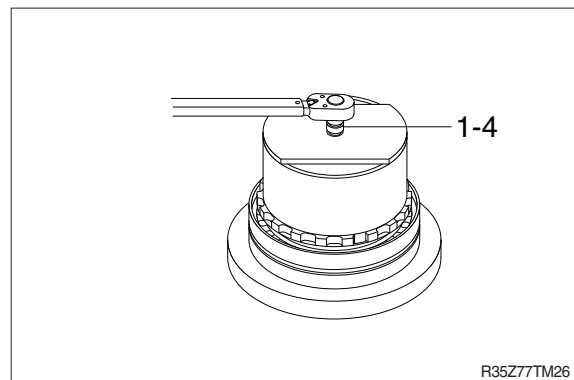
- Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7)



(25) Removing ring nut (1-4).

- Tools required :
Torque wrench (No. 3)
Ring nut tightener (S-6)

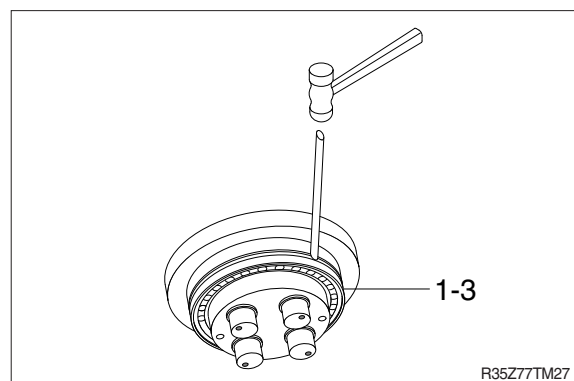
※ If using a vise, fix the perimeter of the flange holder.



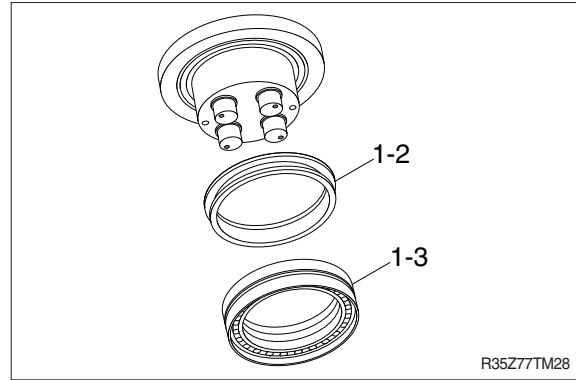
(26) Fix round bar to the groove for steel balls (1-7), and remove angular bearing (1-3) while striking by hammer lightly.

- Tools required :
Hammer (No. 14)
Round bar dia. 10×150 mm (S-7)

※ Rotate the striking position around the angular bearing (1-13) gradually the angular-bearing may not be removed if striking one place only.



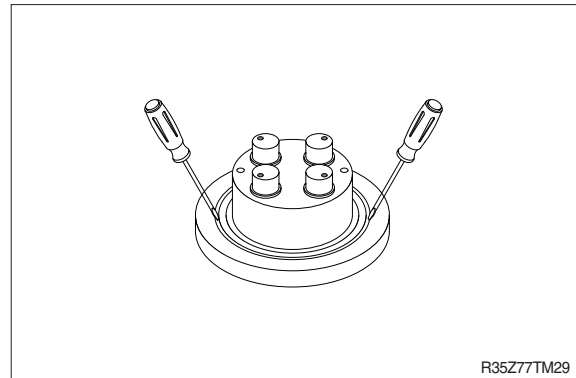
(27) Remove floating seal (1-2) and angular bearing (1-3).



(28) Remove other floating seal (1-2) using two drivers.

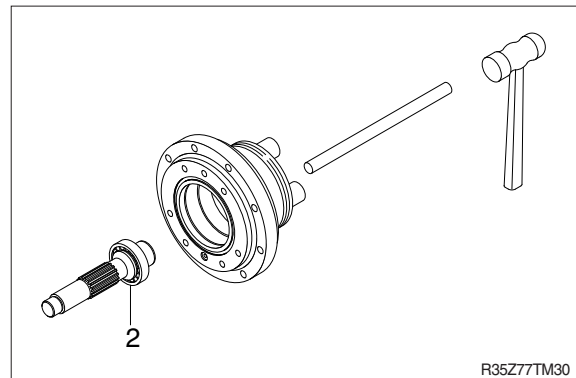
- Tools required :
Screw driver (No. 13)

※ Be careful not to damage the sliding surface of floating seal (1-2).



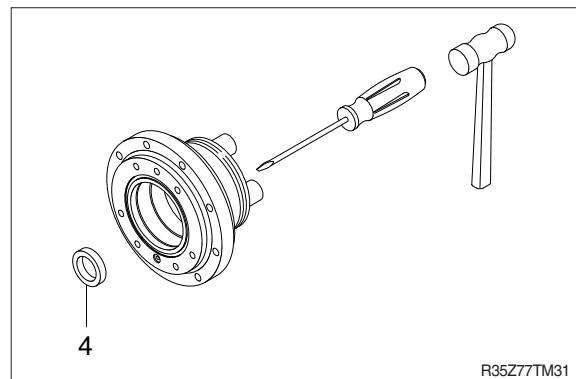
(29) Fit around bar into the shaft hole and remove shaft (2) while striking by hammer lightly.

- Tools required :
Screw driver (No. 13)
Round bar dia. 10 × 150 mm (S-7)



(30) Remove oil seal (4).

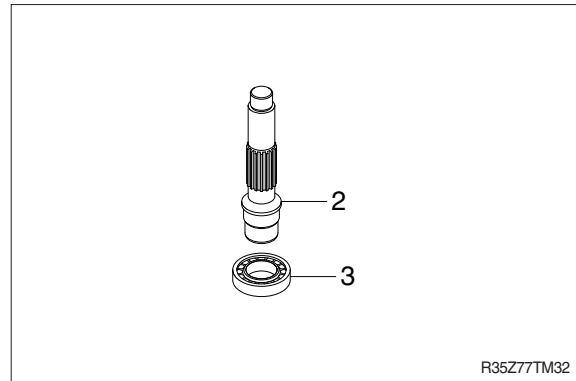
- Tools required :
Screw driver (No. 13)
Hammer (No. 14)



(31) Take out ball bearing (3) from shaft (2).

- Tools required :
Ball bearing disassembly jig (S-8)

(32) Completed.



3. REASSEMBLY

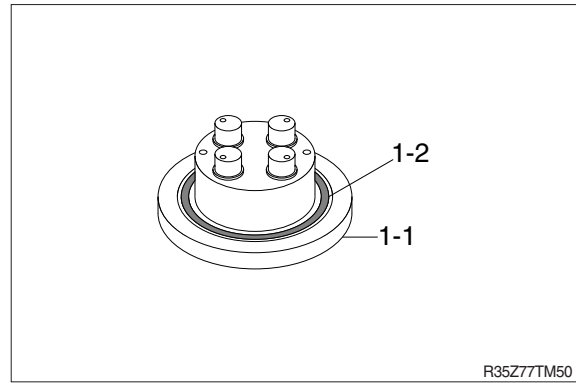
1) GENERAL PRECAUTIONS

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

2) ASSEMBLE THE TRAVEL MOTOR BY THE FOLLOWING PROCEDURE

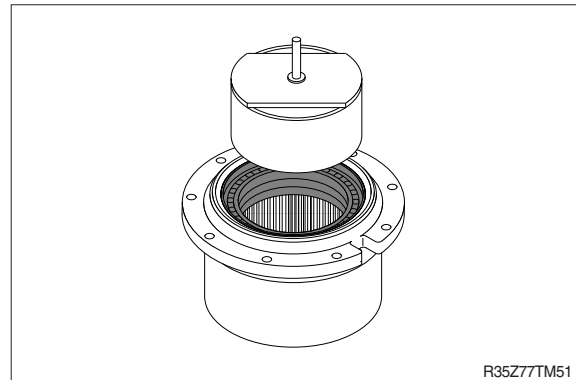
(1) Apply grease to floating seal (1-2) and install it on flange holder (1-1).

- Tools required :
Floating seal assembly jig (S-9)



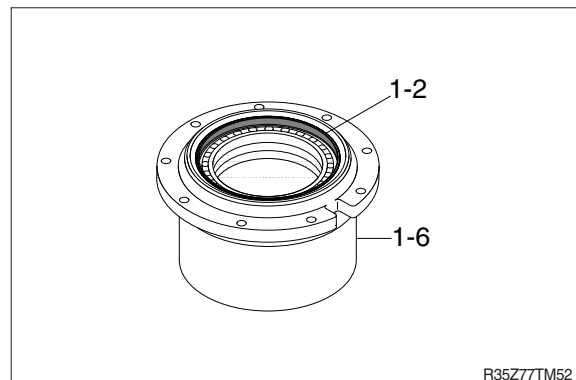
(2) Press fit angular bearings (1-3) to housing (1-6).

- Tools required :
Angular bearings press fitting jig (S-10)



(3) Apply grease to the second floating seal and place it on the concentric circle. Install it on housing (1-6).

- Tools required :
Floating seal assembly jig (S-9)

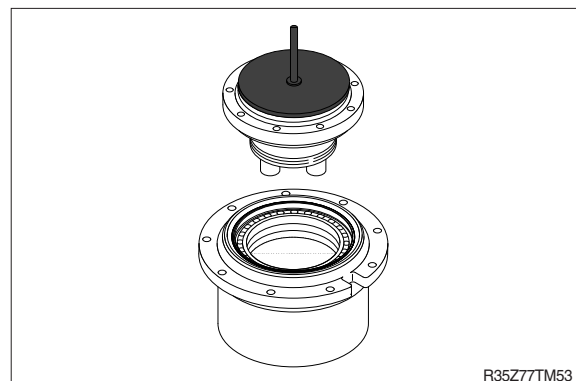


(4) Apply lubricating oil on the sliding surface of floating seal after making the surface clean.

Install flange holder (1-1) in housing (1-6).

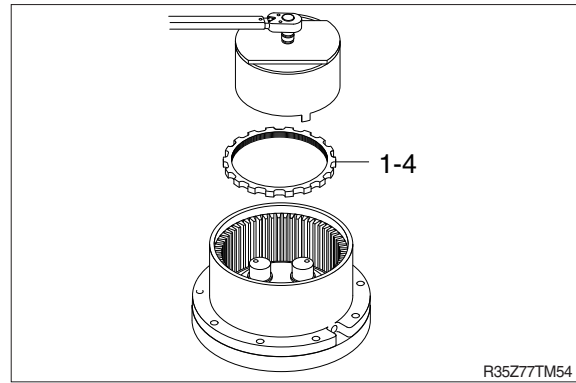
- Tools required :
Flange holder press fitting jig (S-11)

※ If there are foreign substance on the sliding surface of floating seal (1-2), it will cause oil leak.



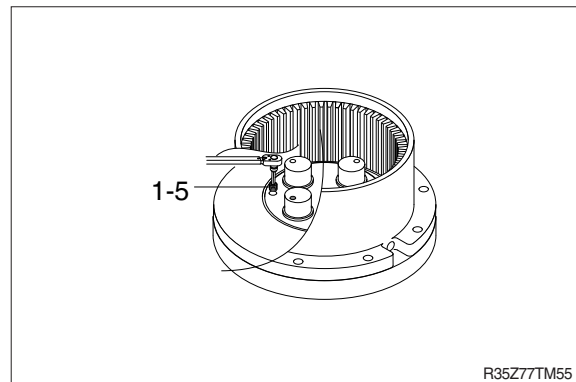
(5) Tighten angular bearing (1-3) with ring nut (1-4)

- Tools required :
Torque wrench (No. 3)
Ring nut tightener (S-6)
Tightening torque $23.9 \pm 1.0 \text{ kgf} \cdot \text{m}$
($173 \pm 7.2 \text{ lbf} \cdot \text{ft}$)



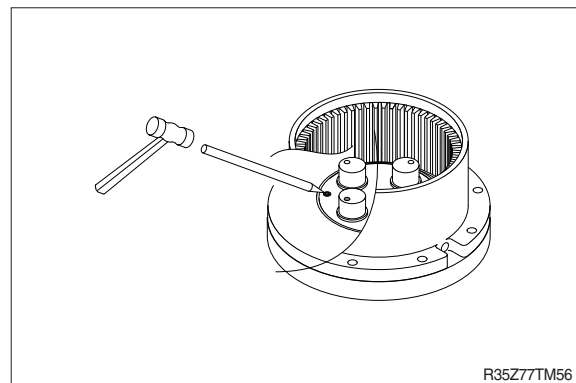
(6) Tighten plug (1-5).
Seal tape is not allowed to wrap for assembling of the plug.

- Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7), (No. 8)
Tightening torque $3.5 \pm 0.5 \text{ kgf} \cdot \text{m}$
($25.2 \pm 3.6 \text{ lbf} \cdot \text{ft}$)



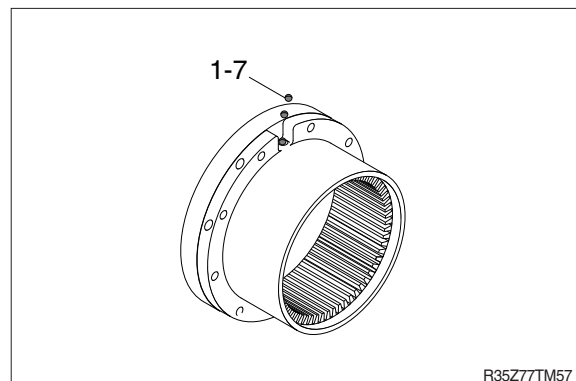
(7) After tightening plug (55), punch two positions of the plug to prevent loosening.

- Tools required :
Hammer (No. 14)
Punch (No. 18)



(8) Insert steel balls (1-7) (99 pcs) in.

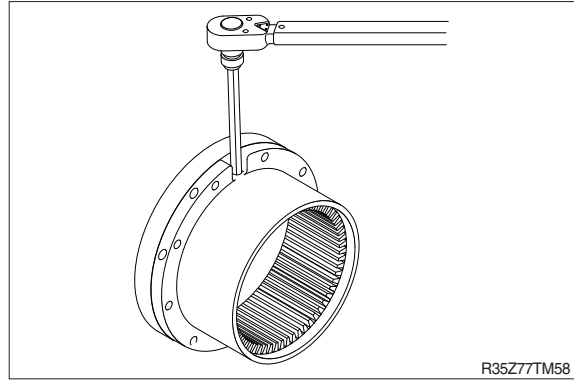
- ※ If it is difficult to insert steel balls (1-7) strike the housing (1-6) side with a plastic hammer.



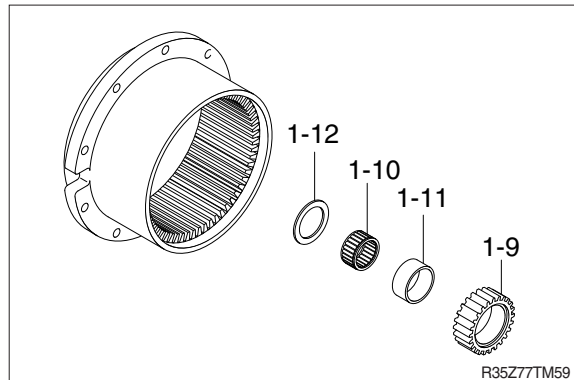
(9) Install plug (1-8) with seal tape, and tighten it.

- Tools required :
 Torque wrench (No. 1)
 Hexagonal bit for torque wrench (No. 6)
 Tightening torque $0.8 \pm 0.1 \text{ kgf} \cdot \text{m}$
 $(5.8 \pm 0.7 \text{ lbf} \cdot \text{ft})$

※ Tighten the plug (1-8) until the head is below the surface of sprocket guide.

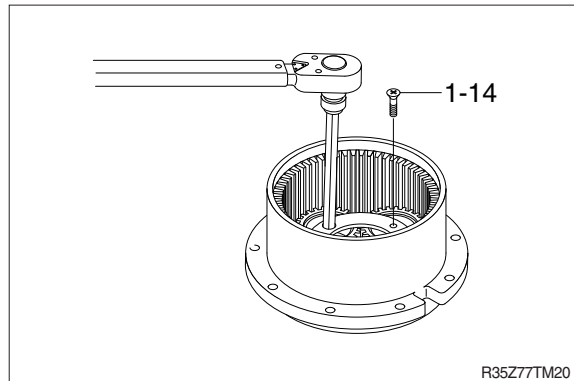


(10) Install planetary gear B (1-9), needle bearing (1-10), inner race (1-11) and thrust washer (1-12).

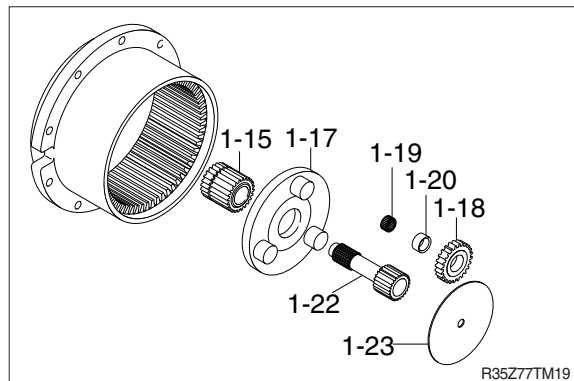


(11) Put thrust plate (1-13) on the trunnion section of flange holder, apply loctite #262 to screw (1-14) and tighten it. Before applying the loctite, decrease the parts completely and use hardening catalyst.

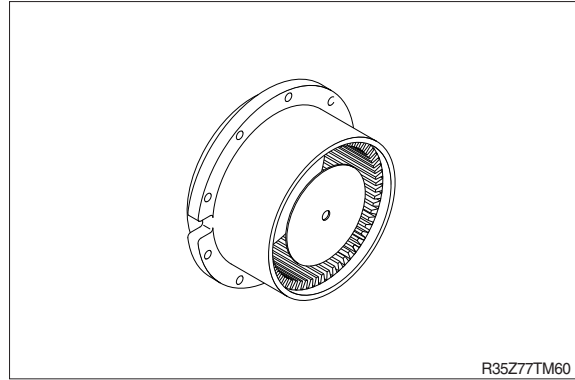
- Tools required :
 Torque wrench (No. 1)
 Hexagonal bit for torque wrench (No. 5), (No. 6)
 Tightening torque $1.3 \pm 0.06 \text{ kgf} \cdot \text{m}$
 $(9.4 \pm 0.4 \text{ lbf} \cdot \text{ft})$



(12) Install sun gear assy (1-15) with snap ring (1-16), holder (1-17) with inner race (1-20), planetary gear A (1-18), needle bearing (1-19) and drive gear (1-22).

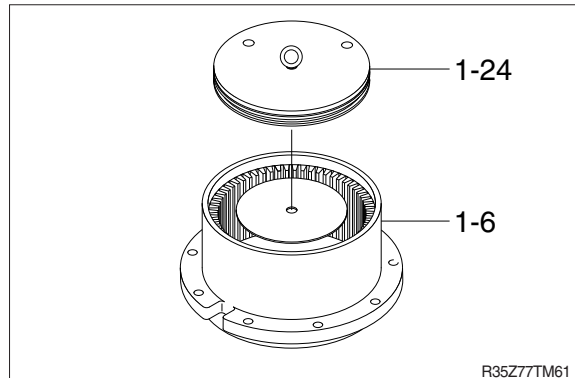


(13) Install thrust plate (1-23).



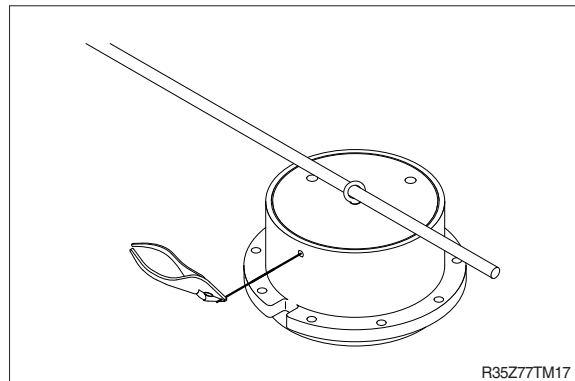
(14) Apply grease to O-ring (1-25), fit the O-ring on cover (1-24), and install housing (1-6) so that the cover may be fitted in line with the U-groove (for wire) and the screw hole position of the housing plug.

- Tools required :
Plastic hammer (No. 14)
Eye bolt (S-2)



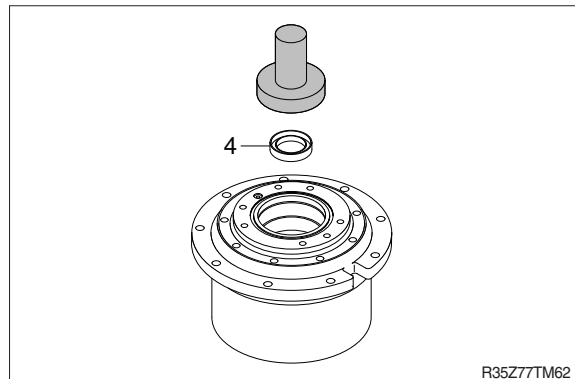
(15) Bend 6 [mm] of the top end of wire (1-26) at right angle, insert it into the threaded hole of the housing, and wind the piano wire turning the cover. Wrap socket plug (1-8) with seal tape before tightening.

- Tools required :
Eye bolt (S-2)
Round bar dia. 20 × 1000 [mm] (S-3)
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7)
Tightening torque 0.8 ± 0.1 kgf · m
(5.8 ± 0.7 lbf · ft)



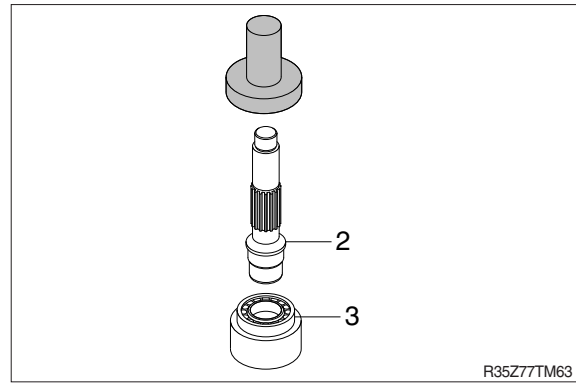
(16) Grease oil seal (4) and perform press-fitting into flange holder.

- Tools required :
Oil seal press fitting jig (S-12)



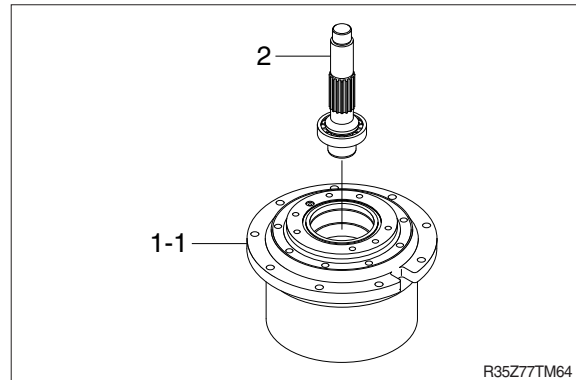
(17) Perform press-fitting of ball bearing (3) into shaft (2).

- Tools required :
Ball bearing press fitting jig (S-13)



(18) Perform press-fitting of shaft sub assy (2) into flange holder (1-1).

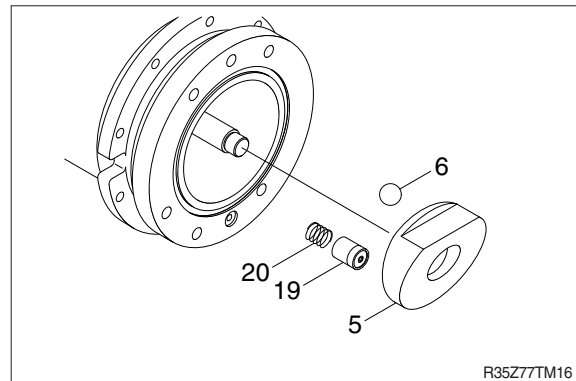
- Tools required :
Shaft sub assembly press fitting jig (S-14)



(19) Install steel ball (6), spring (20), piston assy (19) and swash plate (5) in flange holder (1-1).

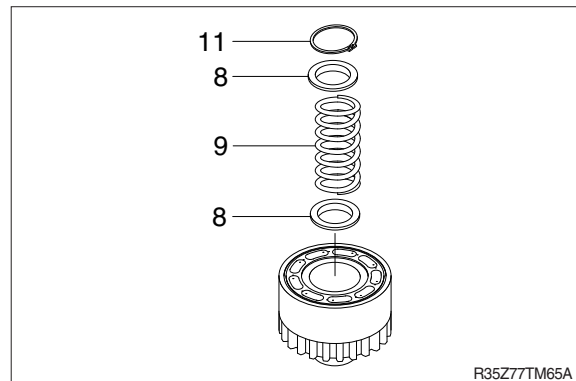
Apply hydraulic oil to the sliding surface of the swash plate.

- ※ If there are foreign substances on the sliding surface of swash plate (5), it will cause damage.

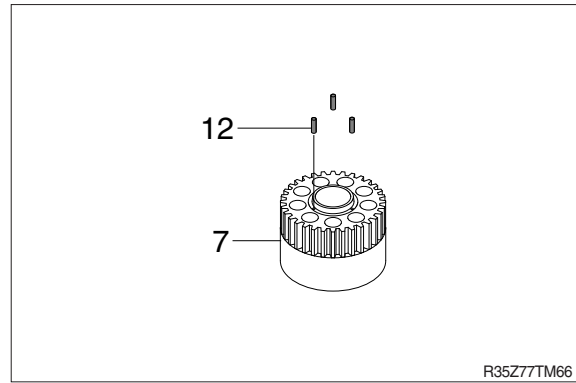


(20) Install washer (8), spring (9), spring seat (8) and snap ring (11) on cylinder block (7).

- Tools required :
Snap ring pliers (No. 17)
Snap ring assembly jig (S-15)



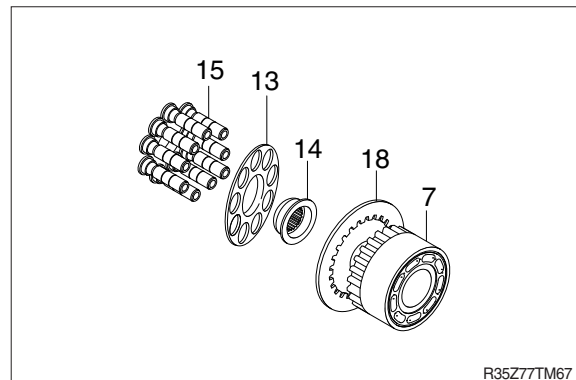
(21) Grease pins (12) and install in holes of cylinder block (7).



(22) Install retainer holder (13), retainer plate (14) and piston sub assy (15). Apply hydraulic oil in 99 holes of cylinder block (7).

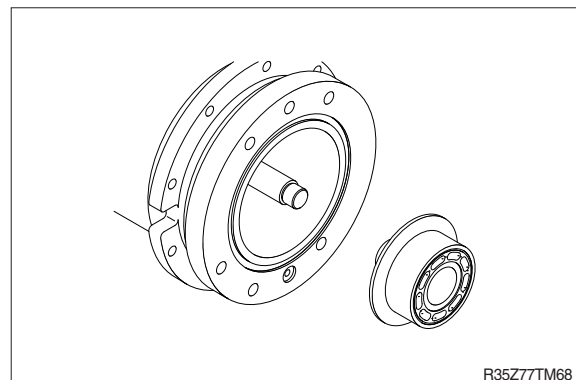
Only parking brake type

Install disk plate (61).



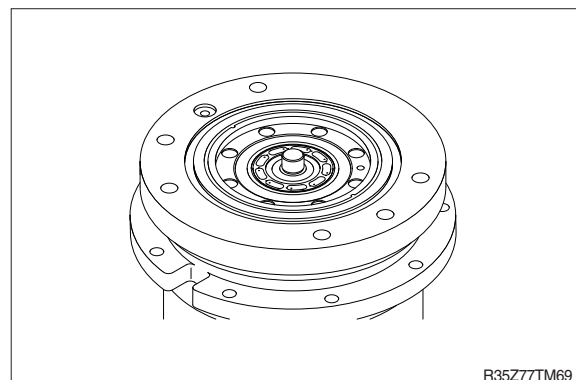
(23) Place the motor laterally, and install the cylinder block sub assy using spline of the shaft as a guide.

※ It is easier to install if spline teeth of the cylinder block (7) and retainer holden (13) are aligned before installing.

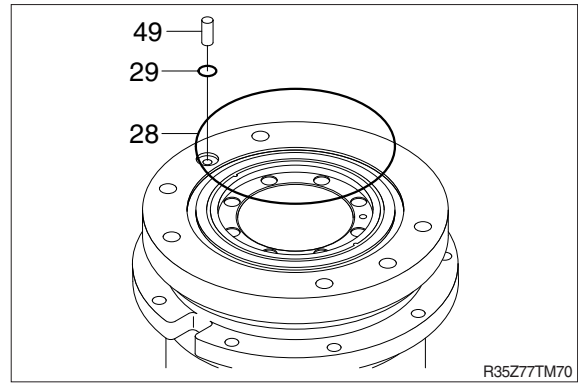


(24) Push the cylinder block by hand, and check that the spring contracts. Apply hydraulic oil to the sliding surface of the cylinder block.

※ Confirm no foreign articles on surface of cylinder block, marked a circle. If there are foreign articles on it, wipe off them.



(25) Grease O-rings (28), (29) slightly and install pin (49) and the O-rings in the groove of flange holder (1-1).

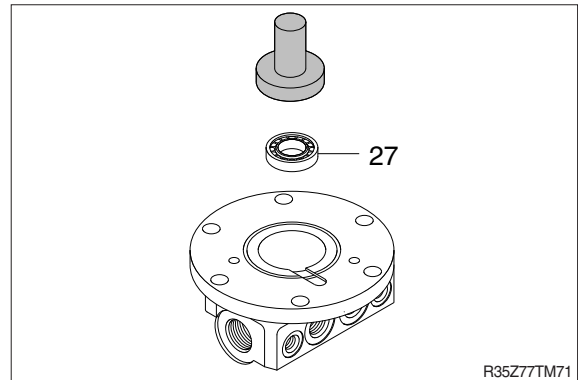


(26) Perform press-fitting of ball bearing (27) onto base plate (30).

· Tools required :
Ball bearing press fitting jig (S-16)

Install pin (26) and punch one place.

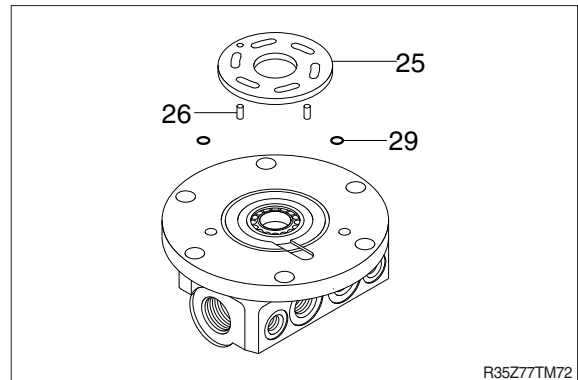
· Tools required :
Hammer (No. 14)
Punch (No. 18)



※ Pay attention to the punch position and direction.

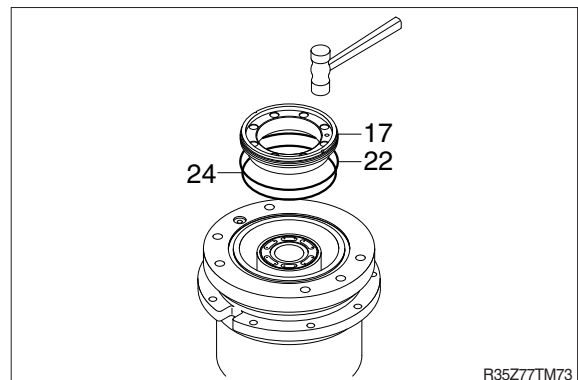
(27) Apply grease on the back side of valve plate (25), and install it and pin (26), O-ring (29) on base plate.

※ Excessive grease will prevent proper performance.



(28) This process is only parking brake type.
Apply grease to O-rings (65), (66) and install them to brake piston (60).
Align the pin (49) holes for the brake piston installed and flange holder (1-1).
Tap the brake piston perimeter equally by using plastic hammer.

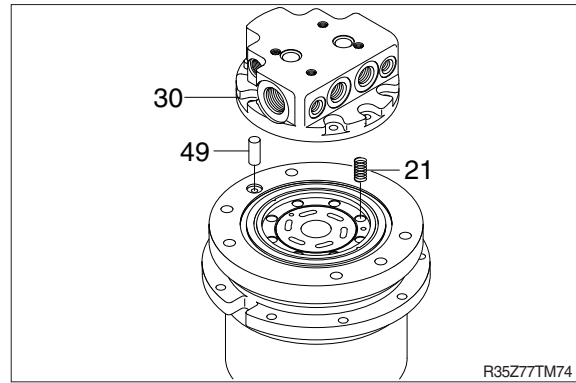
· Tools required :
Plastic hammer (No. 15)



(29) With parking brake type.

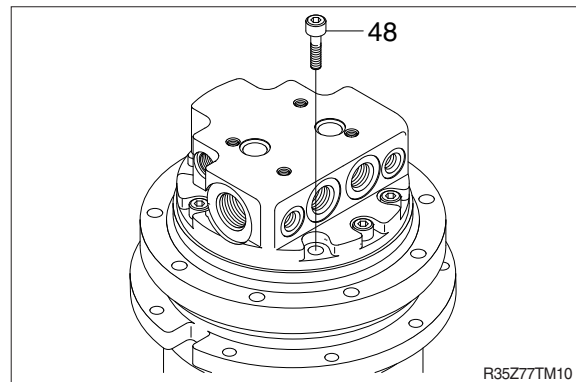
Install springs (62), base plate (30), Pin (49).

- ※ Apply grease to springs to prevent dropping when base plate is turned over for installation.
- ※ Install gently so the springs (62), (63) don't fall.



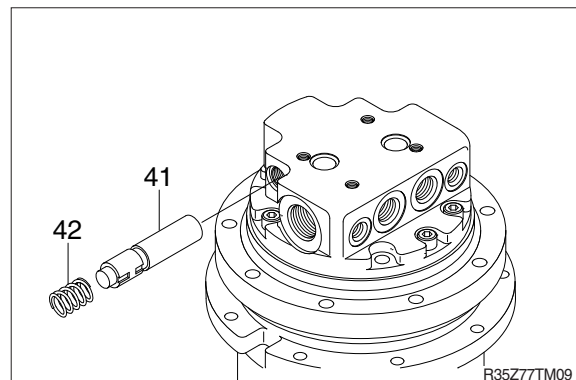
(30) Tighten socket head bolt (48).

- Tools required :
 - Torque wrench (No. 2)
 - Hexagonal bit for torque wrench (No. 8), (No. 9)
- Tightening torque : $13.1 \pm 0.7 \text{ kgf} \cdot \text{m}$
($94.8 \pm 5.1 \text{ lbf} \cdot \text{ft}$)



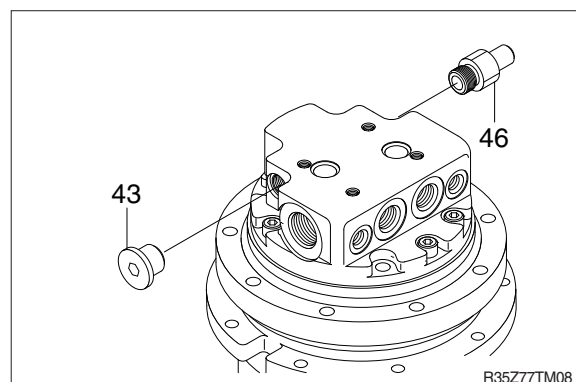
(31) Place spool (41) and spring (42) in.

Place the spool in while turning to prevent them from sticking.
Apply hydraulic oil to the spool before installation.



(32) Tighten plugs (43), (46) with O-ring (44).

- Tools required :
 - Torque wrench (No. 2)
 - Hexagonal bit for torque wrench (No. 9)
 - Socket for torque wrench (No. 11)
- Tightening torque : $5.5 \pm 0.5 \text{ kgf} \cdot \text{m}$
($39.8 \pm 3.6 \text{ lbf} \cdot \text{ft}$)



(33) Install check valve (31-2), spring (31-3) and plug (31-4) with O-ring (31-5) to plunger (31-1).

Apply a slight grease to the O-ring.

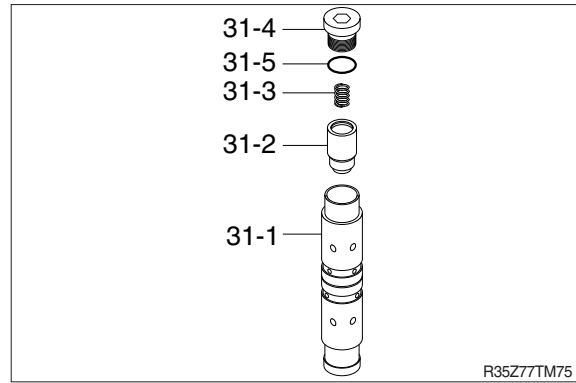
· Tools required :

Torque wrench (No. 2)

Hexagonal bit for torque wrench (No. 7)

Tightening torque : $3.3 \pm 0.2 \text{ kgf} \cdot \text{m}$

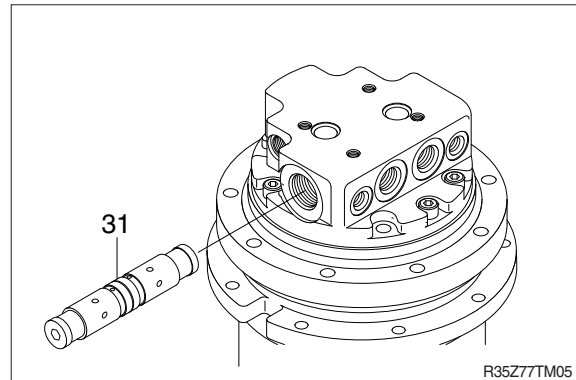
($23.5 \pm 1.8 \text{ lbf} \cdot \text{ft}$)



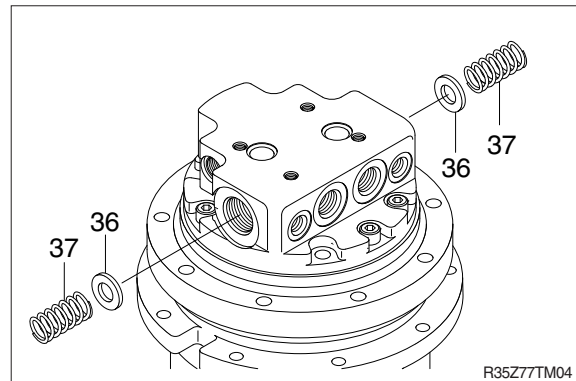
(34) Install plunger assy (31) on base plate (30).

Install it while turning to prevent it from sticking.

Apply hydraulic oil to plunger assy (31) before installation.



(35) Place spring (37) and spring seat (36) in.



(36) Tighten cap (38) with O-ring (39).

Apply a slight grease to the O-ring.

· Tools required :

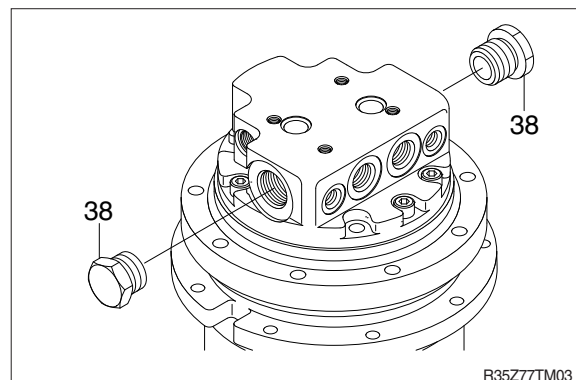
Torque wrench (No. 3)

Hexagonal bit for torque wrench (No. 10)

Tightening torque :

$24.5 \pm 0.5 \text{ kgf} \cdot \text{m}$

($177 \pm 3.7 \text{ lbf} \cdot \text{ft}$)



(37) With parking brake type

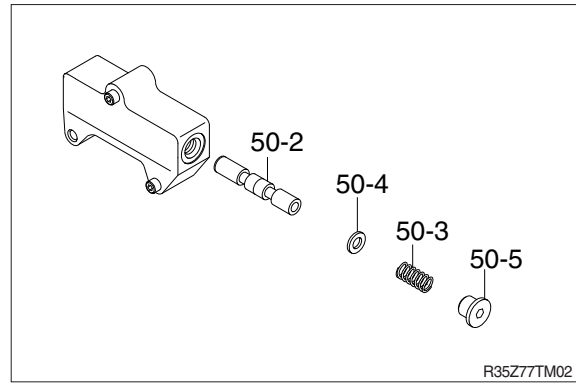
Install spool (50-2), spring (50-3) and spring seat (50-4) in valve body (50-1), and tighten plug (50-5)

· Tools required :

Torque wrench (No. 2)

Hexagonal bit for torque wrench (No. 8)

Tightening torque : $5.5 \pm 0.5 \text{ kgf} \cdot \text{m}$
($39.8 \pm 3.6 \text{ lbf} \cdot \text{ft}$)



(38) Fit O-rings (50-6) or (50-7) in valve body, and put valve assy (50) on base plate (30).

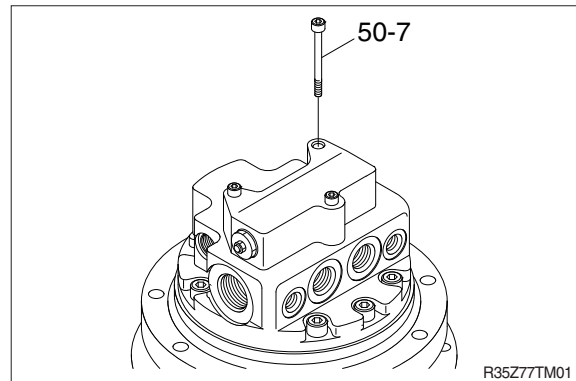
Tighten socket head bolt (50-7), (50-8).

· Tools required :

Torque wrench (No. 1)

Hexagonal bit for torque wrench (No. 7)

Tightening torque : $3.8 \pm 0.2 \text{ kgf} \cdot \text{m}$
($27.2 \pm 1.4 \text{ lbf} \cdot \text{ft}$)



(39) Pour the gear oil through the threaded hole of plug (1-27).

Wind the plug with seal tape before tightening.

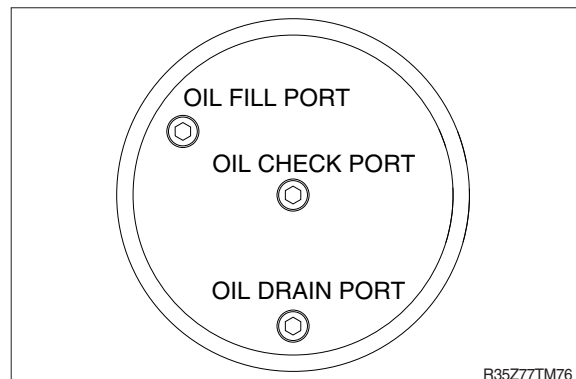
· Tools required :

Torque wrench (No. 2)

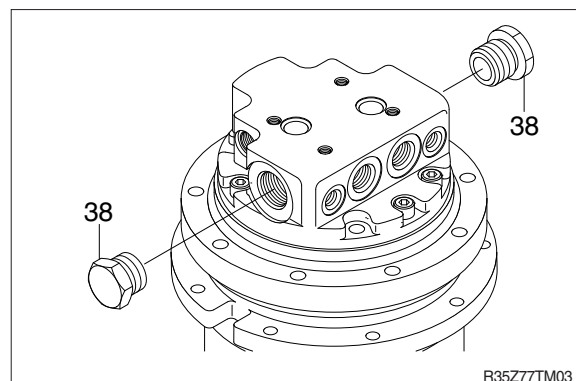
Hexagonal bit for torque wrench (No. 8)
(No. 9)

PF 1/4 ... Tightening torque wrench
 $3.5 \pm 0.5 \text{ kgf} \cdot \text{m}$
($25.3 \pm 3.6 \text{ lbf} \cdot \text{ft}$)

PF 1/4 ... Tightening torque wrench
 $4.0 \pm 0.2 \text{ kgf} \cdot \text{m}$
($28.9 \pm 1.5 \text{ lbf} \cdot \text{ft}$)



(40) Completed.



3) QUALITY CHECK AFTER REASSEMBLY

(1) Air leak test of reduction unit

Remove one plug (① or ② or ③) of the reduction unit apply compressed air (0.03 [MPa]) through tapped hole of plug in water for two minutes, and observe that are no bubbles.

(2) Air leak test of motor

Seal all piping ports on the motor except one port with plugs, and apply compressed air (0.03 [MPa]) through open port in water for two minutes. Observe that there are no bubbles.

(3) Upon completion of leak test in subparagraphs (1) and (2) above, fill the motor case with new hydraulic fluid. Run the motor crosswise for two minutes filling hydraulic fluid at flow rate of 20 liters per minute.

Confirm that there is no excessive heat, vibration or noise during running.

GROUP 7 RCV LEVER

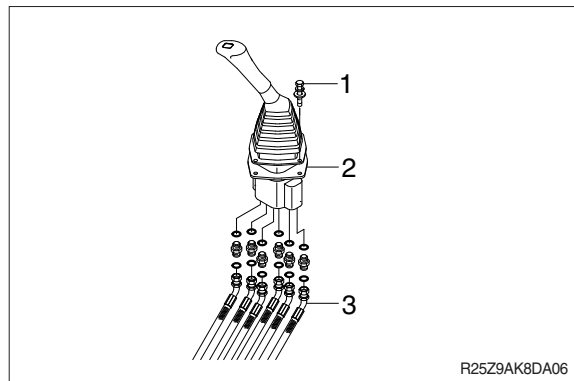
1. REMOVAL AND INSTALL

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.

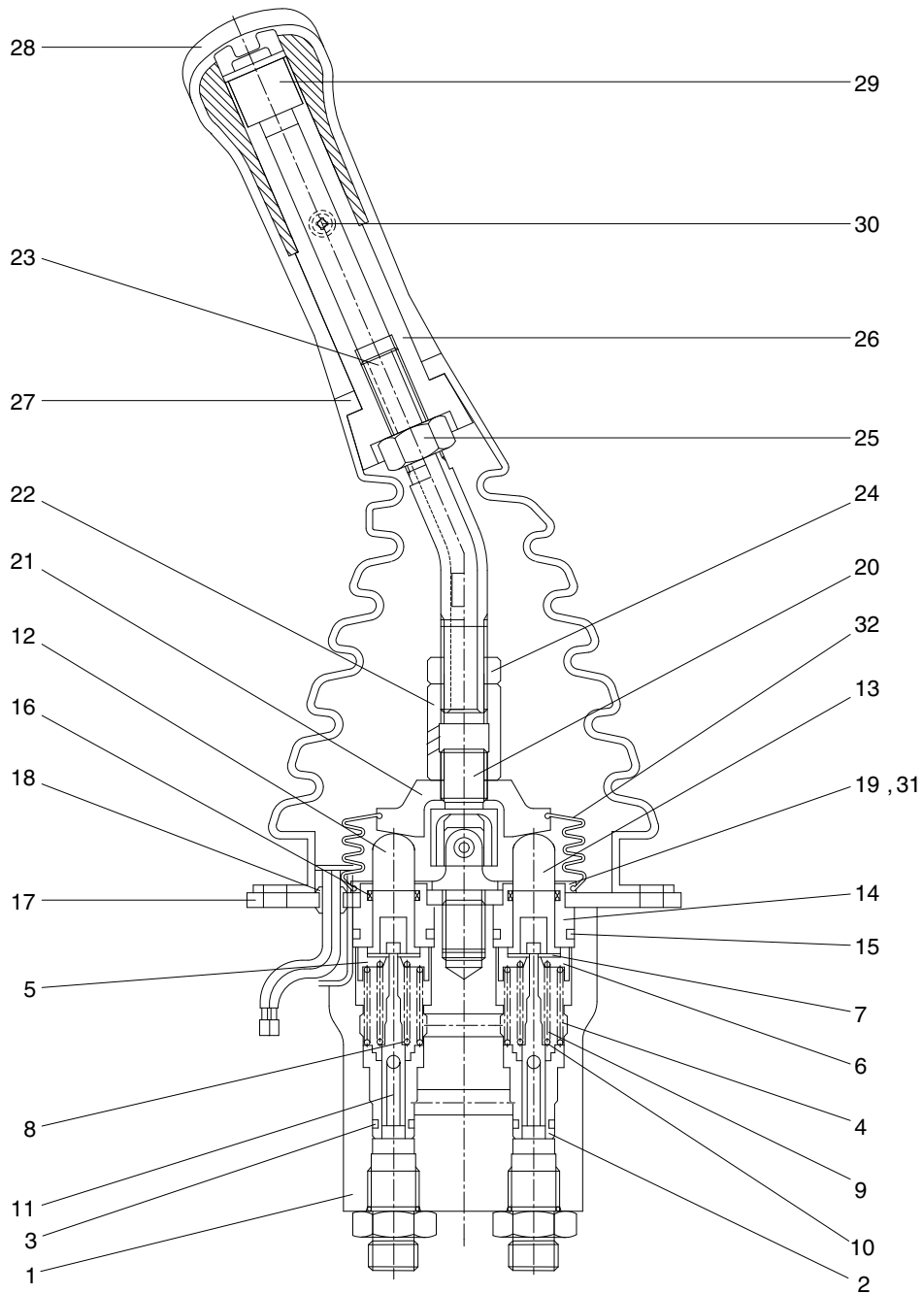


2) INSTALL

- (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 (Type 1)

1) STRUCTURE

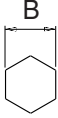


R25Z9A2RL02

1	Case	12	Push rod (1, 3)	23	Connector
2	Plug	13	Push rod (2, 4)	24	Nut
3	O-ring	14	Plug	25	Nut
4	Spring	15	O-ring	26	Insert
5	Spring seat (1, 3)	16	Rod seal	27	Boot
6	Spring seat (2, 4)	17	Plate (A)	28	Handle
7	Stopper	18	Bushing	29	Switch assembly
8	Spring (1, 3)	19	Machine screw	30	Screw
9	Spring (2, 4)	20	Joint assembly	31	Plate
10	Spring seat	21	Swash plate	32	Boot
11	Spool	22	Hex nut		

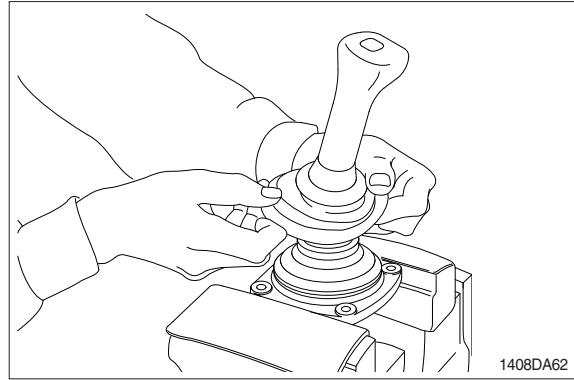
2) TOOLS AND TIGHTENING TORQUE

(1) Tools

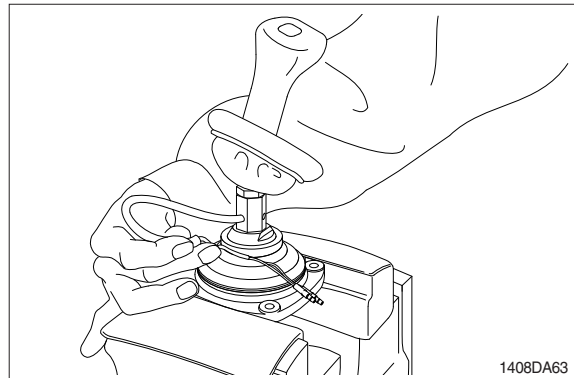
Tool name	Remark	
(L) Hexagonal wrench	10	
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

3) DISASSEMBLY

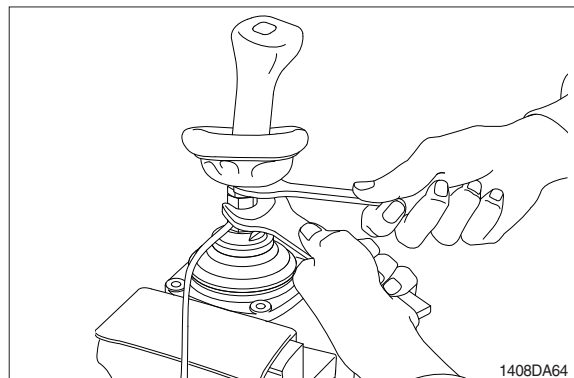
- (1) Clean pilot valve with kerosene.
 - ※ Put blind plugs into all ports.
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (32) from case (1) and take it out upwards.



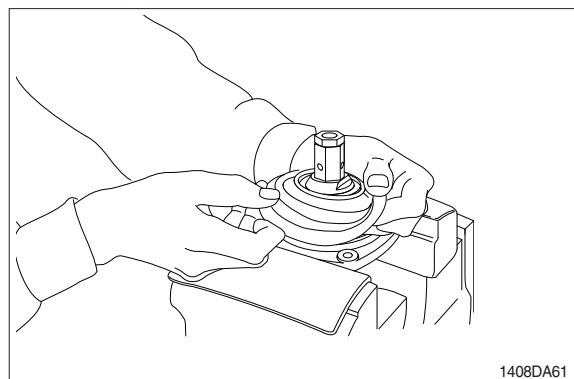
- ※ For valve with switch, remove cord also through hole of casing.



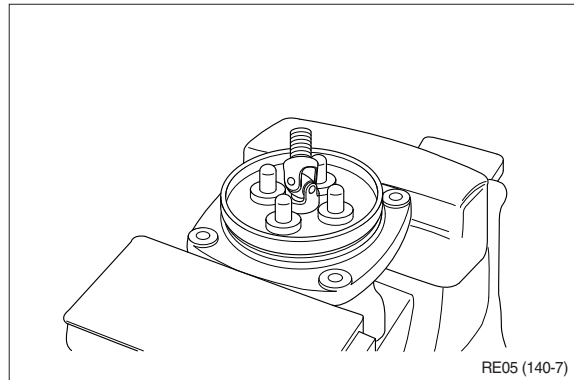
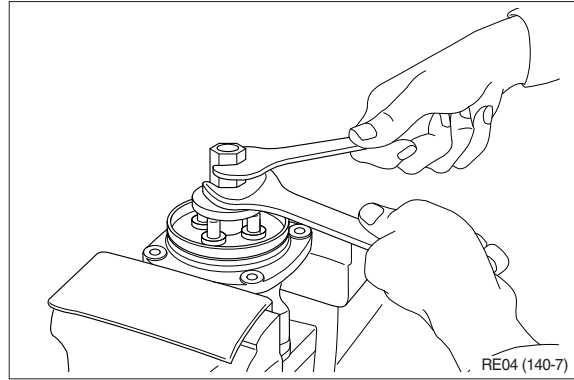
- (4) Loosen lock nut (24) and adjusting nut (22) with spanners on them respectively, and take out handle section as one body.



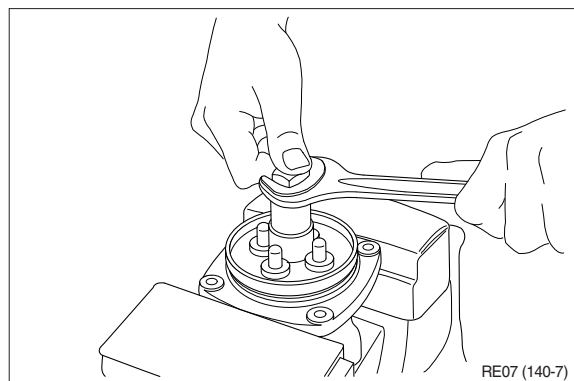
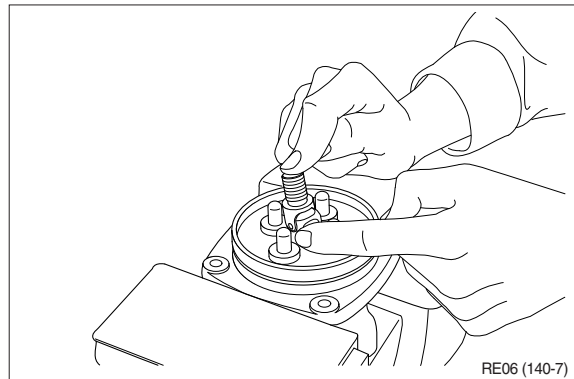
- (5) Remove the boot (32).



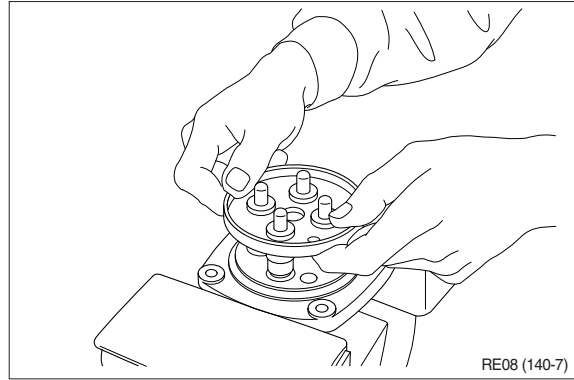
- (6) Loosen adjusting nut(22) and plate(31) with spanners on them respectively, and remove them.



- (7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).
※ When return spring(8, 9) is strong in force, plate(31), plug(14) and push rod(12, 13) will come up on loosening joint.
Pay attention to this.



(8) Remove plate (31).



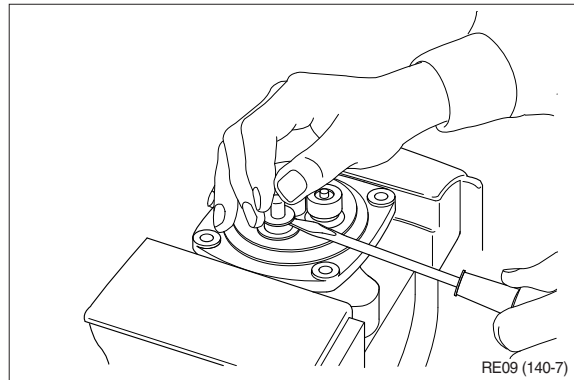
(9) When return spring (8, 9) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.

※ 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.

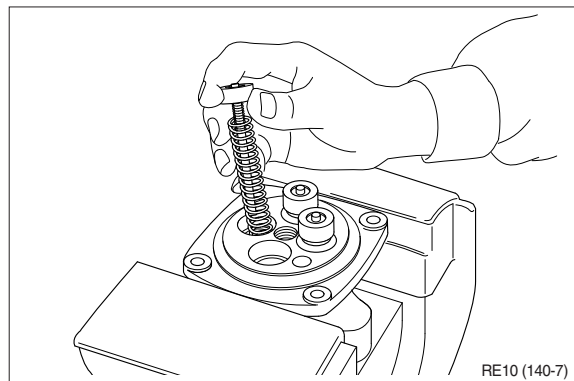
※ During taking out, plug may jump up due to return spring (8, 9) force.

Pay attention to this.

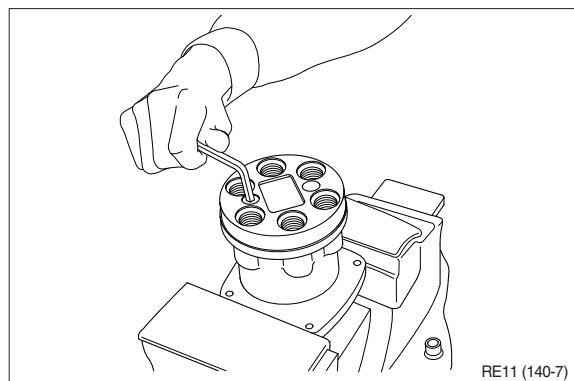


(10) Remove reducing valve subassembly and return spring (8, 9) out of casing.

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

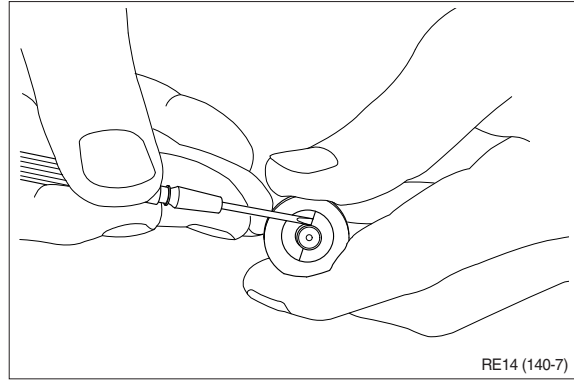


(11) Loosen hexagon socket head plug (2) with hexagon socket screw key.



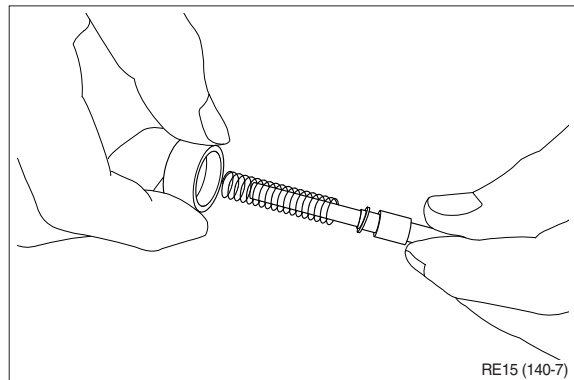
(12) For disassembling reducing valve section, stand it vertically with spool (11) bottom placed on flat workbench. Push down spring seat (5, 6) and remove two pieces of semicircular stopper (7) with tip of small minus screwdriver.

- ※ Pay attention not to damage spool surface.
- ※ Record original position of spring seat (5, 6).
- ※ Do not push down spring seat more than 6 mm.

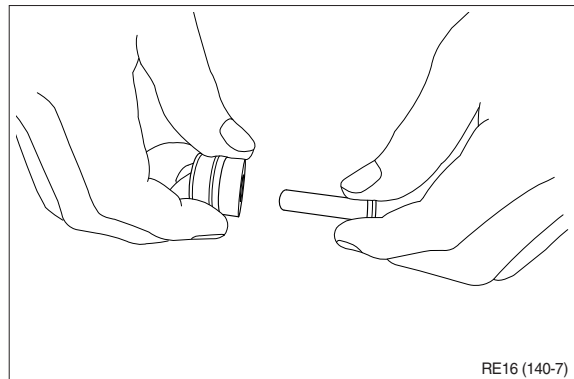


(13) Separate spool (11), spring seat (5, 6), spring (8, 9) and spring seat (10) individually.

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

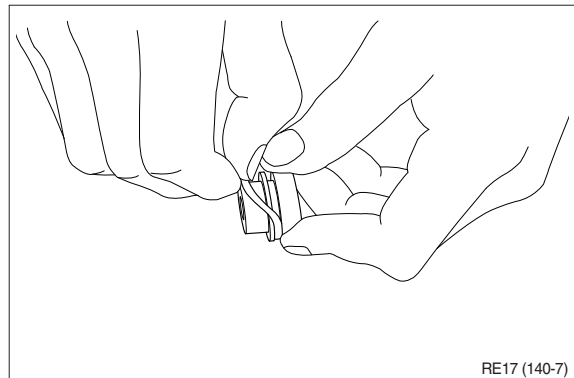


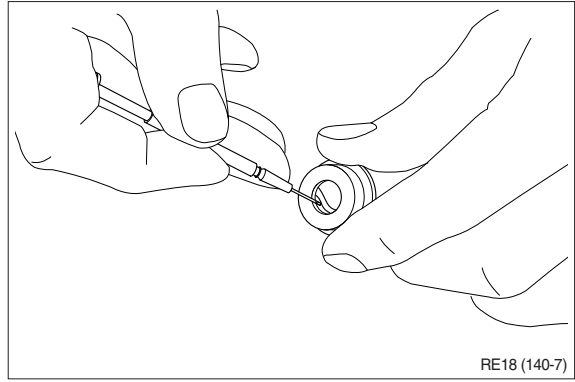
(14) Take push rod (12, 13) out of plug (14).



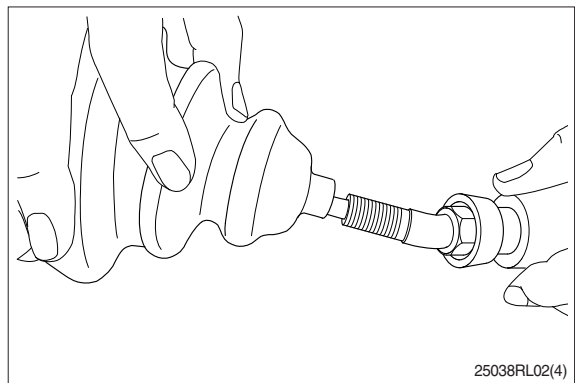
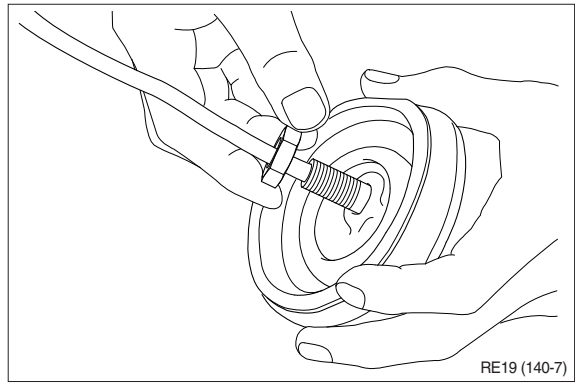
(15) Remove O-ring (15) and seal (16) from plug (14).

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





(16) Remove lock nut (24) and then boot (27).



(17) 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.

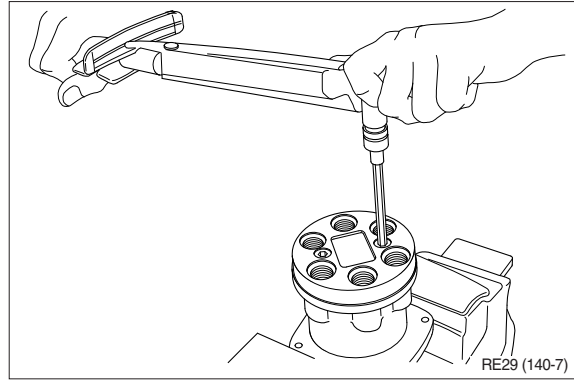
(18) Rust prevention of parts.

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

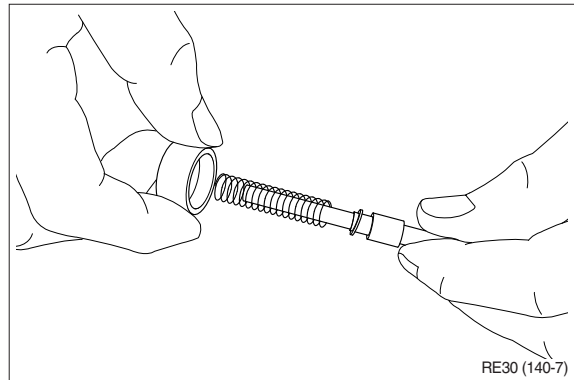
4) ASSEMBLY

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

※ Tighten two bolts alternately and slowly.

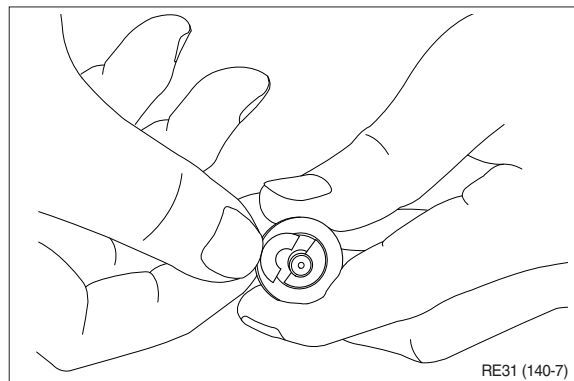


(2) Put spring seat (10), springs (8, 9) and spring seat (5, 6) onto spool (11) in this order.



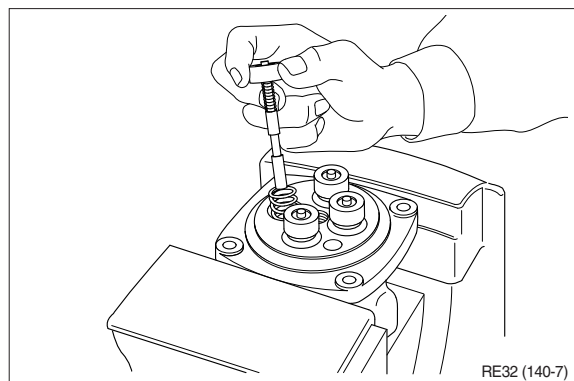
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (7) on spring seat without piling them on.

※ Assemble stopper (7) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.

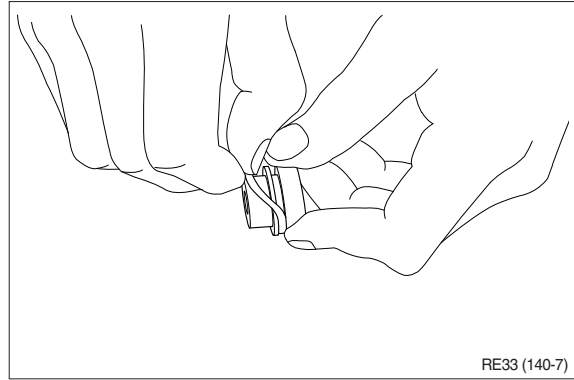


(4) Assemble spring (8, 9) into casing. Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

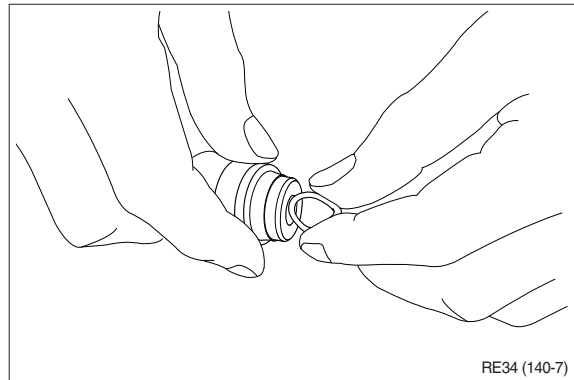


(5) Assemble O-ring (15) onto plug (14).



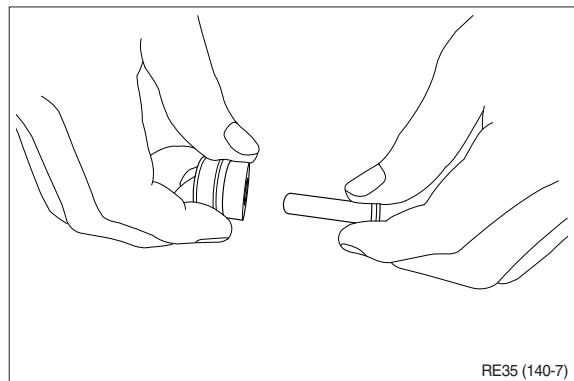
(6) Assemble seal (16) to plug (14).

※ Assemble seal in such lip direction as shown below.



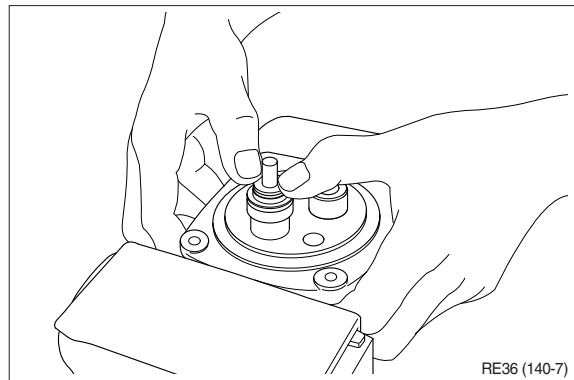
(7) Assemble push rod (12, 13) to plug (14).

※ Apply working oil on push-rod surface.



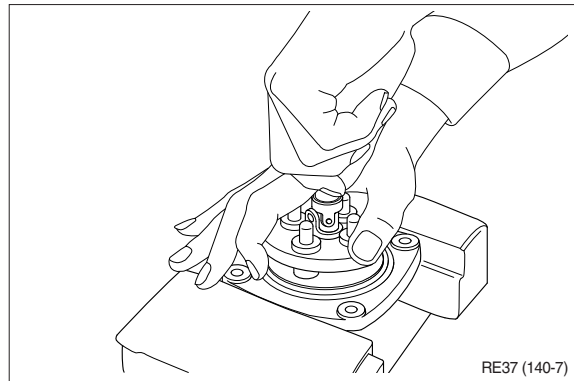
(8) Assemble plug subassembly to casing.

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

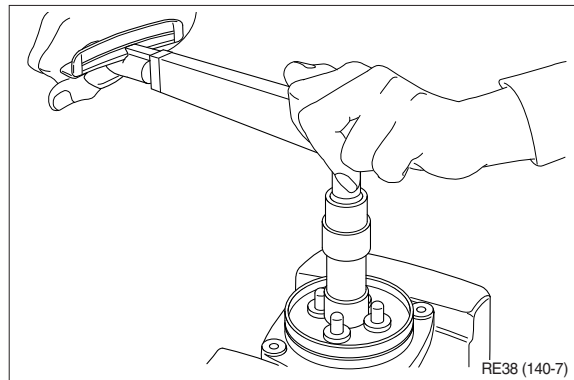


(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (31), and tighten joint (20) temporarily.

(10) Fit plate (31).

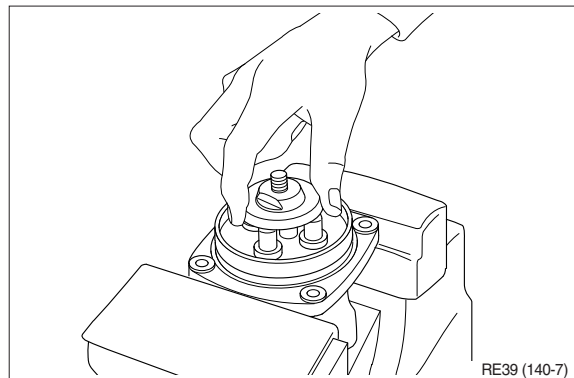


(11) Tighten joint (20) with the specified torque to casing, utilizing jig.



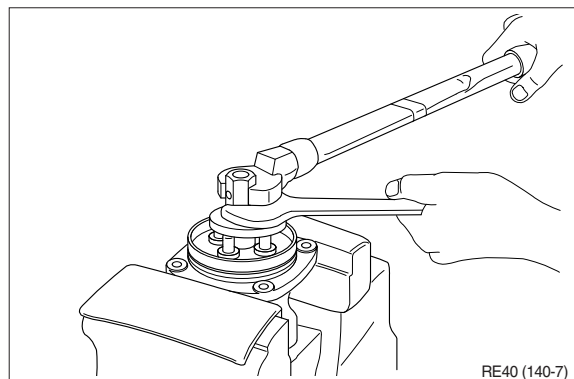
(12) Assemble plate (21) to joint (20).

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

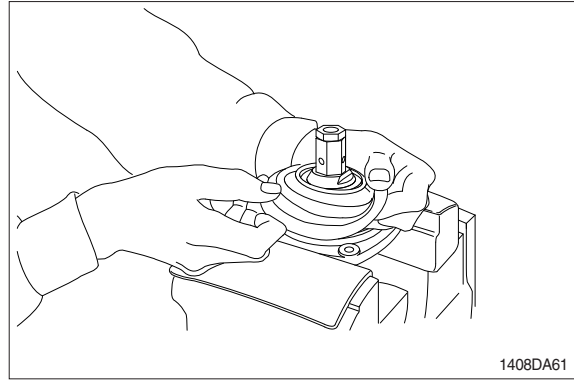


(13) Assemble adjusting nut (22), apply spanner to width across flat of plate (21) to fix it, and tighten adjusting nut to the specified torque.

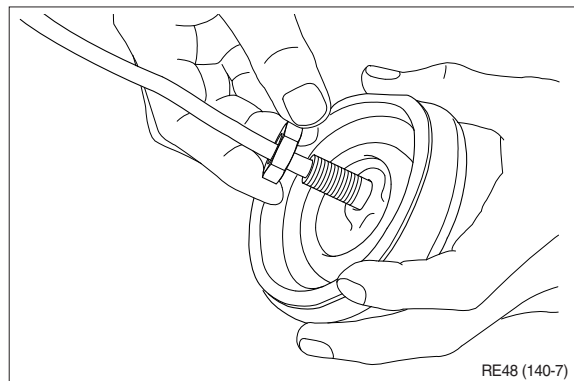
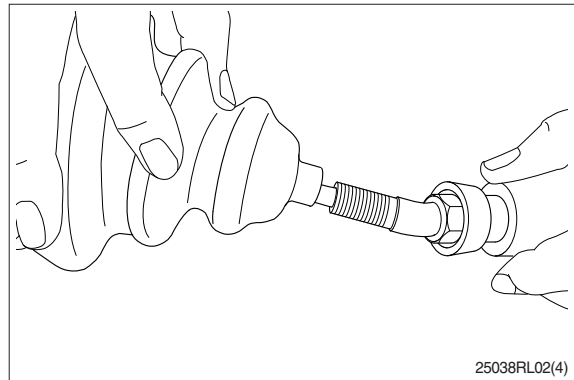
- ※ During tightening, do not change position of disk.



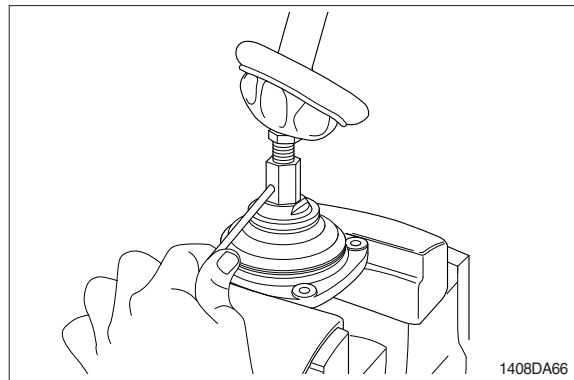
(14) Fit boot (32) to plate.



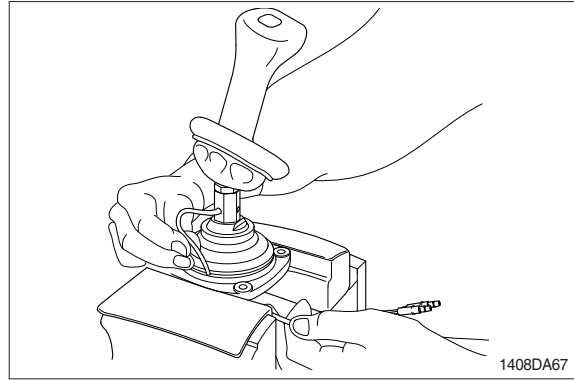
(15) Fit boot (27) and lock nut (24), and handle subassembly is assembled completely.



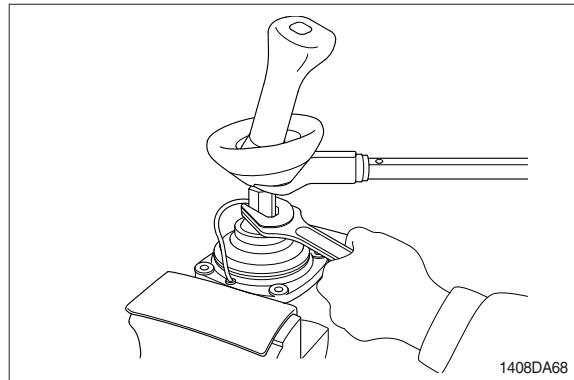
(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



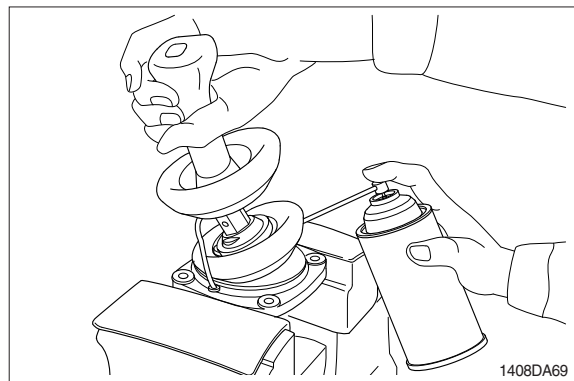
- (17) Assemble bushing (18) to plate and pass cord and tube through it.
※ Provide margin necessary to operation.



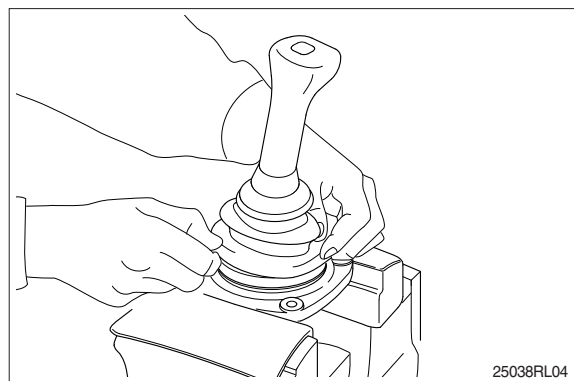
- (18) Determine handle direction, tighten lock nut (21) to specified torque to fix handle.



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

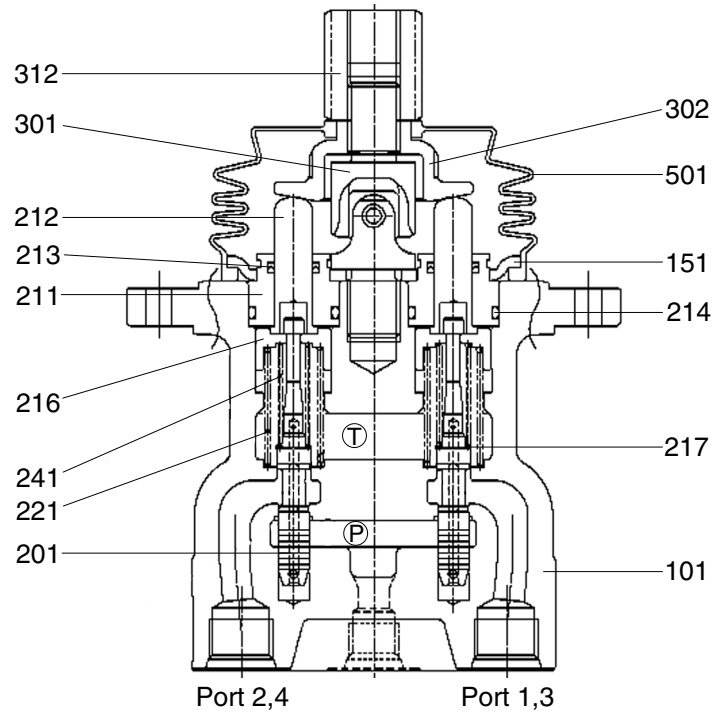


- (20) Assemble lower end of bellows to casing.
(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



3. DISASSEMBLY AND ASSEMBLY (Type 2)

1) STRUCTURE



17Z9A7RCV50

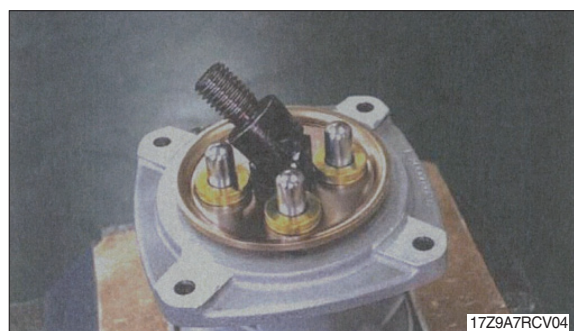
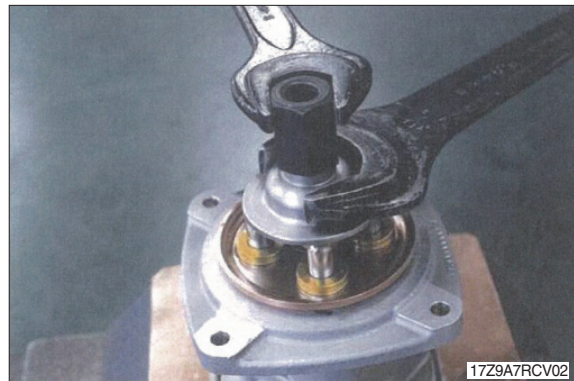
101	Casing	213	Seal	241	Spring
151	Plate	214	O-ring	301	Joint
201	Spool	216	Spring seat	302	Disc
211	Plug	217	Washer	312	Nut
212	Push rod	221	Spring	501	Bellows

2) DISASSEMBLY AND ASSEMBLY

- (1) Rinse the pilot valve in paraffin.
 - ※ Place blind plug in all ports.
- (2) Secure the pilot valve in a vice using a copper or aluminium faced jaws.
- (3) Detach the bellows (501) (If outer bellows is attached, then this bellows may not be attached).
 - ※ Take care not to damage the bellows (501).

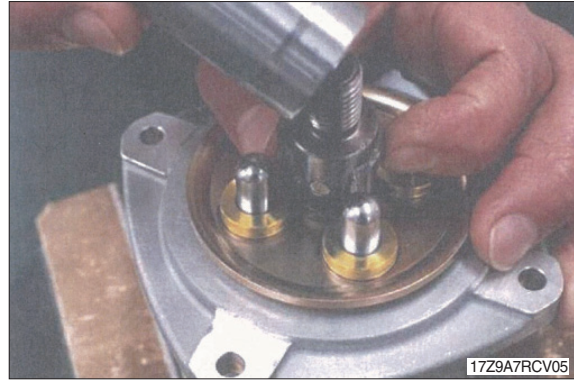


- (4) Use a spanner applied to both the adjustment nut (312) and disc (302) and loosen and then remove them.



▲ Items under tension. The return spring (221), plate (151) and push-rod (212) will rise as joint (301) is loosened. Make sure the items do not fly out and damage personnel in the vicinity.

- (5) Using the jig, turn the joint (301) counter-clockwise to loosen it.
The right illustration shows the jig attached.



- (6) Remove the plate (151).
- When the return spring (221) is strong



- When the return spring (221) is weak



▲ Items under tension. The return spring (221) tension will be released when plug (211) is removed. Make sure the item does not fly out and damage personnel in the vicinity.

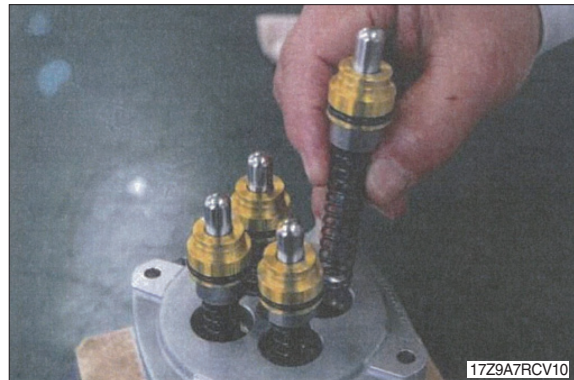
(7) When the return spring (221) is weak, the plug (211) is held in the casing (101) by the friction of the O-ring. Remove this using a screwdriver.

※ Use the groove around the plug and take care to apply force evenly to avoid damage.



(8) Remove the push-rod (212), plug (211), reduction valve assembly and return spring (221) from the casing (101).

※ The location in relationship with the casing aperture.



※ The surface of the spool (201) and the spring seat (216) can be damaged by mis-handling. Take care not to damage the surface of the spool during removal and do not push the spring seat down more than 6 mm.

(9) The reduction valve is disassembled by pressing down the spring seat (216) and flexing the secondary pressure spring (241), sliding the spring seat (216) sideways and removing it from the spool (201) via the larger aperture.

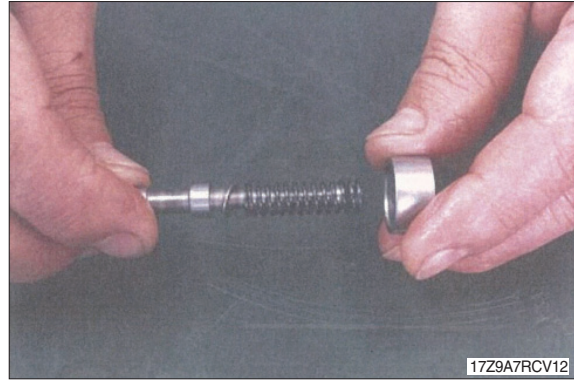
※ Take care not to damage the surface of the spool (201).



(10) Take the spool (201), spring seat (216), secondary pressure spring (241) and washer #2 (217) apart.

※ Take care not to damage the surface of the spool (201).

※ Keep these parts together until reassembly.



(11) Extract the push-rod (212) from the plug (211).



(12) Detach the O-ring (214) and seal (213) from the plug (211). Detach the seal (213) using a small screwdriver.



(13) CLEANING OF PARTS

- ① Wash the parts by placing in an initial bath containing paraffin oil (or similar cleaning fluid).
 - ※ To reduce the risk of damage if dirty parts are initially washed in oil. To remove the dirt and oil, soak thoroughly so that dirt and oil float to the surface.
 - ※ Dirty paraffin could result in damage to the parts, and deterioration in performance after reassembly. Ensure the contamination of the paraffin is thoroughly monitored and controlled.
- ② Place the parts in a finish wash container, rotate this slowly until even the inner areas of the parts are clean (Finish wash).
 - Wipe of the paraffin oil on the parts using clean cloth.
 - ※ If compressed air is used for drying, dust and moisture in the compressed air may damage the parts and make corrosion more likely.

(14) PREVENTION OF CORROSION OF PARTS

Coat the parts with the anti-corrosion preparation.

- ※ If the parts are left to stand for some time after cleaning, they may start to corrode and the performance after reassembly will be impaired.

3) ASSEMBLY

- ※ The surface of the spool (201) and the spring seat (216) can be damaged by mis-handling. Take care not to damage the surface of the spool during assembly and do not push the spring seat down more than 6 mm.

- (1) Insert, in this order, the washer #2 (217), secondary spring (241) and spring seat (216) onto the spool (201).



- (2) Press down the spring seat (216) to flex the secondary pressure spring (241) while sliding the spring sideways through the larger aperture to attach it to the spool (201).

Fit the return spring (221) into the casing (101).

- ※ Do not press the spring seat down more than 6mm.



- (3) Fit the reduction valve assembly into the casing (101).

- ※ Fit in the locations noted in step 8 of the disassembly procedure.



(4) Fit the O-ring (214) into the plug (221).



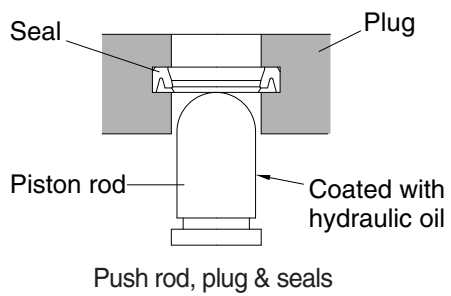
(5) Fit the seal (213) into the plug (211).

※ Fit the lip of the seal (213) as shown right.



(6) Fit the push-rod (212) into the plug (211).

※ Apply hydraulic oil to the surface of the push rod.



⚠ Items under tension. The plug assembly and plate (151) have to be assembled against spring tension. Make sure the item does not fly out and damage personnel in the vicinity.

※ The surface of the spool (201) and aperture (101) can be damaged by mis-handling. Take care not to damage the surface of either during assembly.

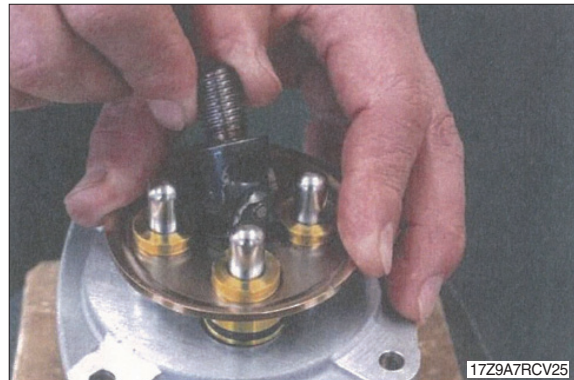
(7) Fit the plug assembly into the casing (101). When the return spring (221) is weak, it is held in place by the friction of the O-ring (214).

When the return spring (221) is strong, use the plate (151) to insert all four simultaneously and temporarily secure them with the joint (301).

(8) Attach the plate (151).

(9) Tighten the joint (301) to the casing (101) to the specified torque using the special jig.

※ The right figure shows the jig attached. Screw down to a position where the four push rods (212) are in contact equally.



- ※ Excessive tightening or wrong positioning of the disc can cause the valve to malfunction.

(10) Attach the disc (302) onto the joint (301).



(11) Install the adjustment nut (312), tighten up the discs (302) with a spanner on both and tighten the adjustment nut to the specified torque.

- ※ Do not allow the position of the disc (302) to shift during tightening.



(12) Apply grease to the rotating part of the joint (301) and end of the push-rod (212).



(13) Attach the bellows (501).

If outer bellows is attached, then this bellows may not be attached.

- ※ Take care not to tear the bellows.

(14) Fit the handle assembly into the valve.

(15) Spray anti-corrosion preparation into each port and insert blind plugs.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

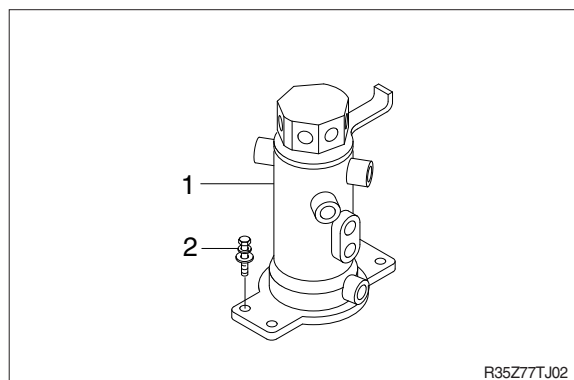
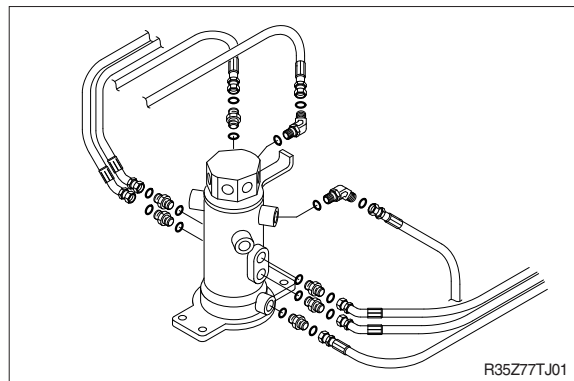
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
 - Weight : 15 kg (35 lb)
 - Tightening torque : $6.9 \pm 1.4 \text{ kgf} \cdot \text{m}$
($49.9 \pm 10.1 \text{ lbf} \cdot \text{ft}$)
- (6) Remove the turning joint assembly.

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

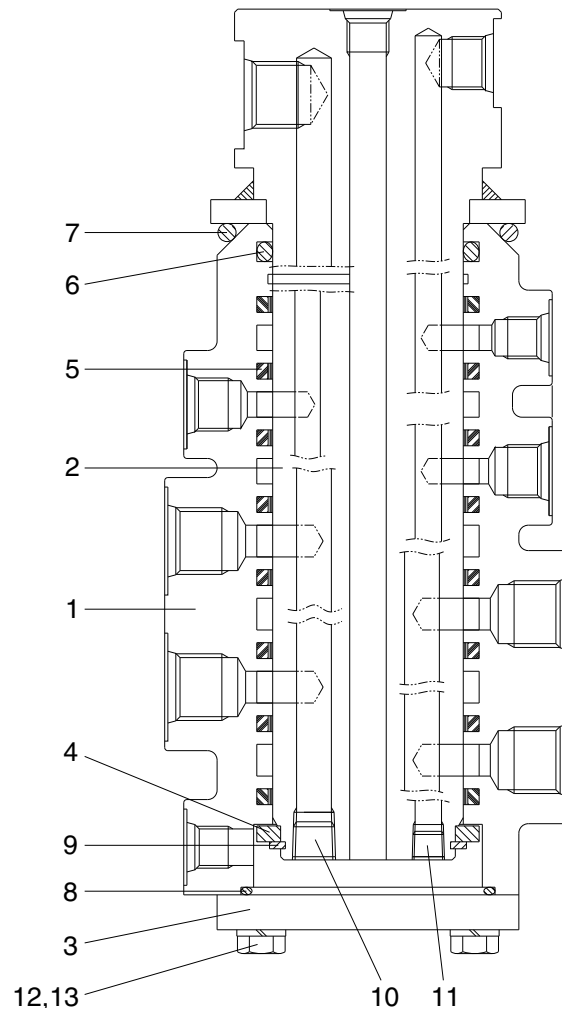
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



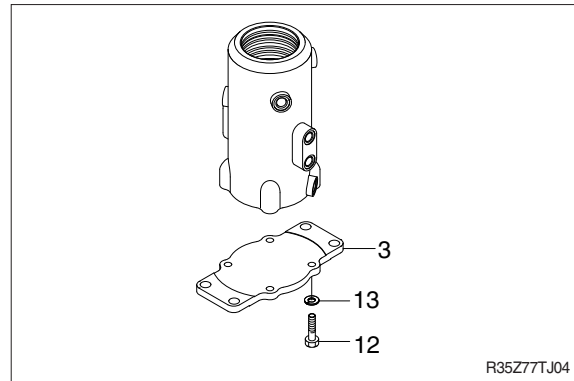
R35Z77TJ03

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

2) DISASSEMBLY

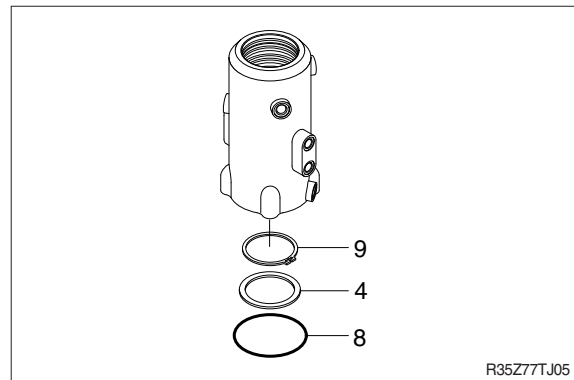
※ Before the disassembly, clean the turning joint.

- (1) Remove bolts (12), washer (13) and cover (3).



- (2) Remove O-ring (8).

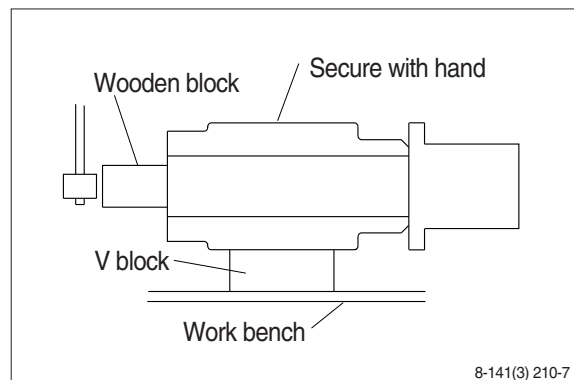
- (3) Remove retainer ring (9) and spacer (4).



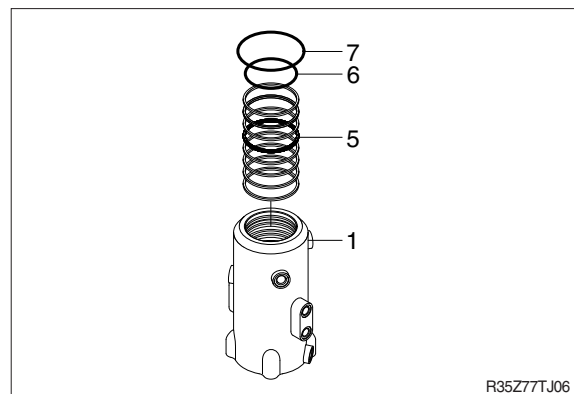
- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

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

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



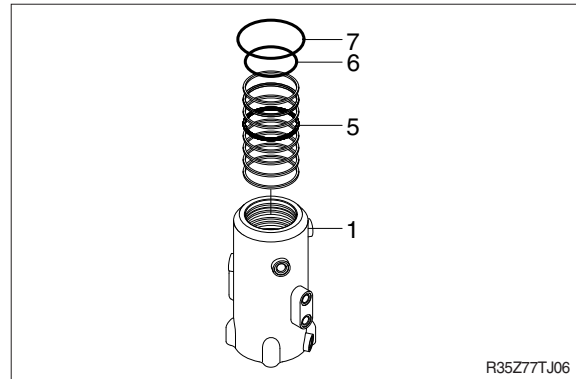
- (5) Remove eight slipper seals (5) and O-ring (6, 7) from hub (1).



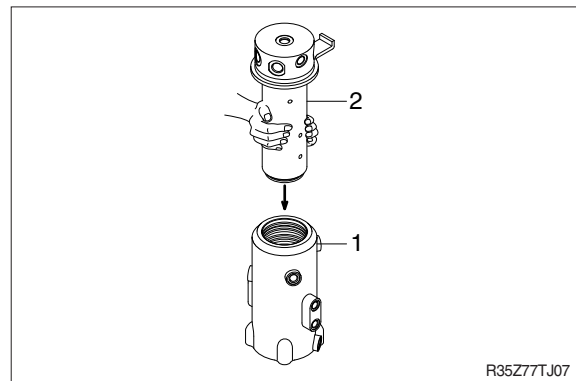
3) ASSEMBLY

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

(1) Fix eight slipper seal (5) and O-ring (6, 7) to hub (1).

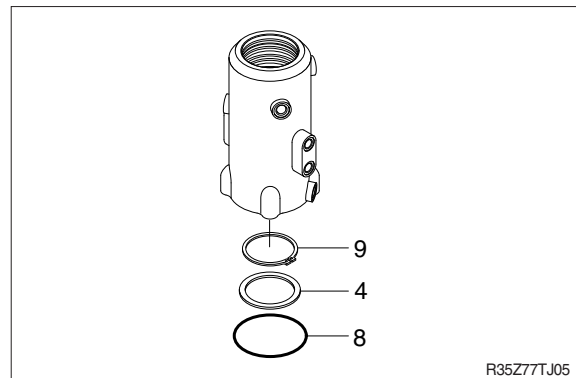


(2) Set hub (1) on block, install shaft (2) into hub (1) by hand.

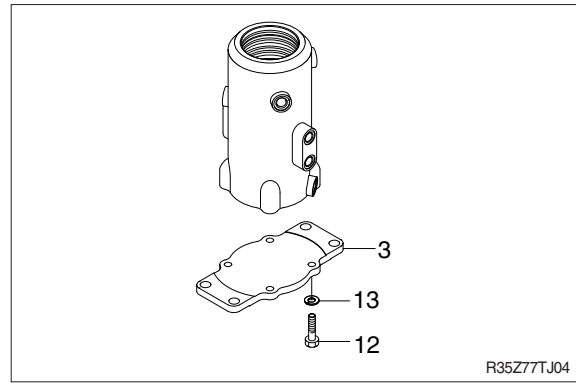


(3) Fit spacer (4) and retainer ring (9) to shaft (2).

(4) Fit O-ring (8) to hub (1).



(5) Install cover (3) to hub and tighten bolts (12).



GROUP 9 BOOM, ARM AND BUCKET CYLINDERS

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.

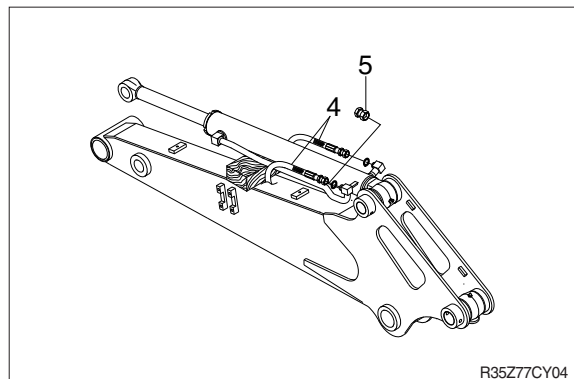
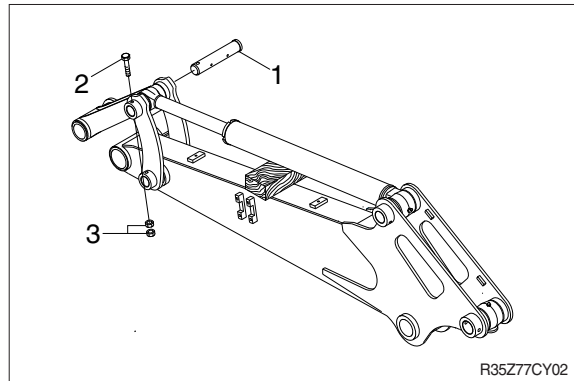
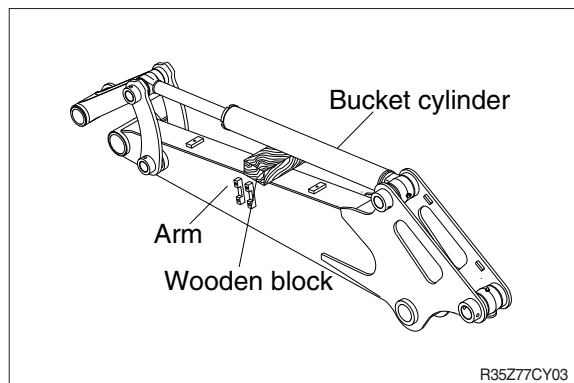
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

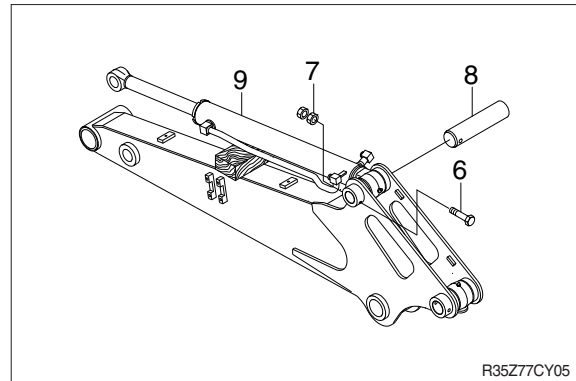
② Remove bolt (2), nut (3) and pull out pin (1).

- ※ 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 (9) and remove bolt (6) and nut (7) then pull out pin (8).
- ⑤ Remove bucket cylinder assembly (9).
 - Weight : 30 kg (70 lb)



(2) Install

- ① Carry out installation in the reverse order to removal.
- ▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**
- ※ Bleed the air from the bucket cylinder.
 - ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

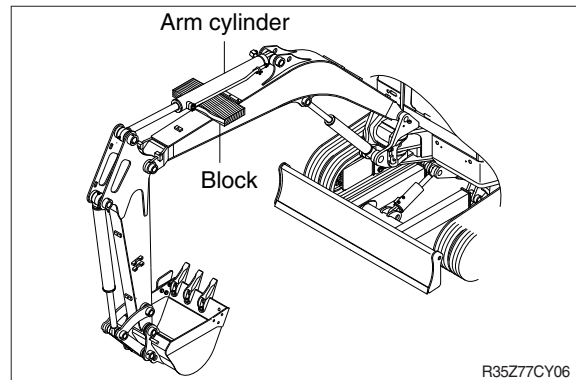
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

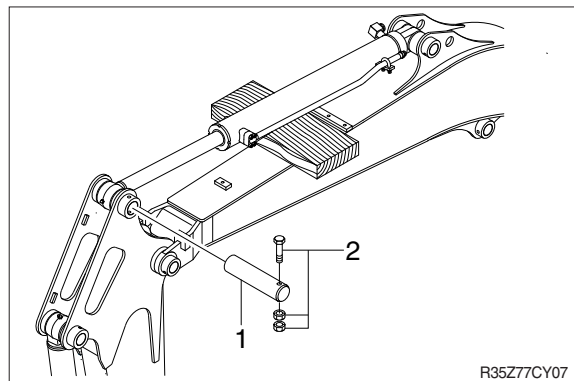
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.

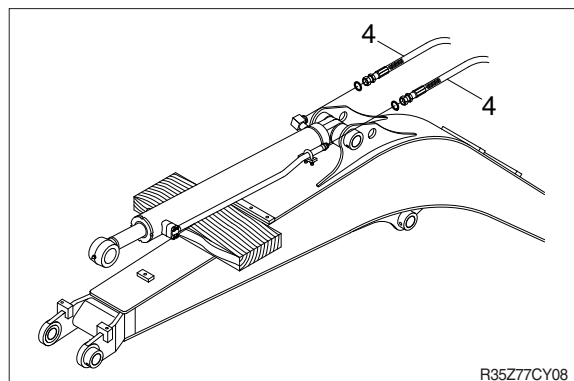


② Remove bolt and nut (2) and pull out pin (1).

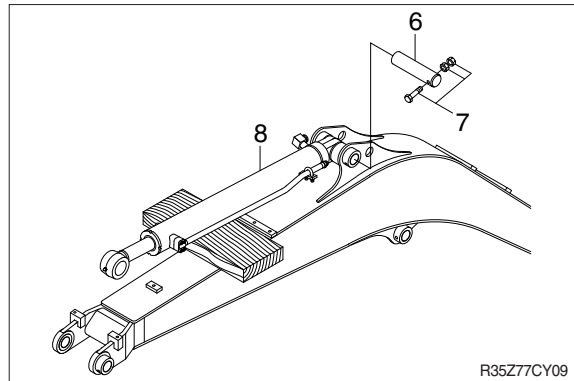
- ※ Tie the rod with wire to prevent it from coming out.



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



- ⑤ Sling arm assembly (8) and remove bolt and nut (7) then pull out pin (6).
- ⑥ Remove arm cylinder assembly (8).
 - Weight : 40 kg (90 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

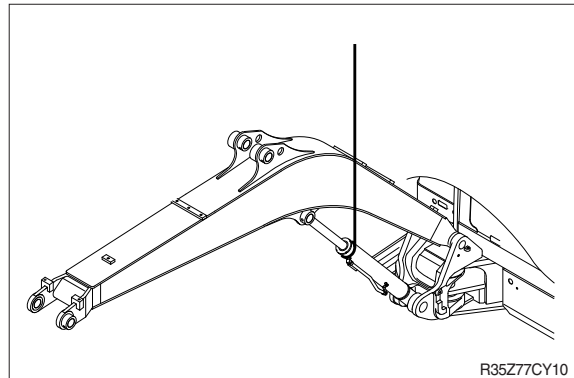
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

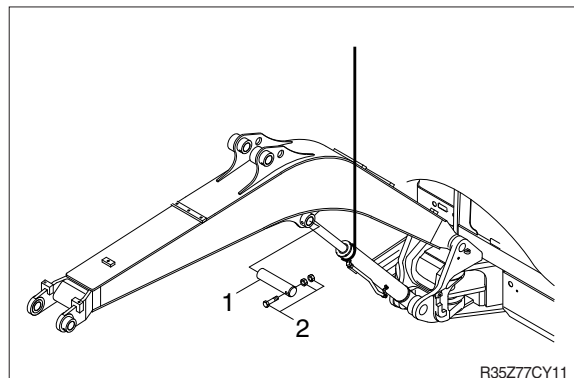
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Sling boom cylinder assembly.

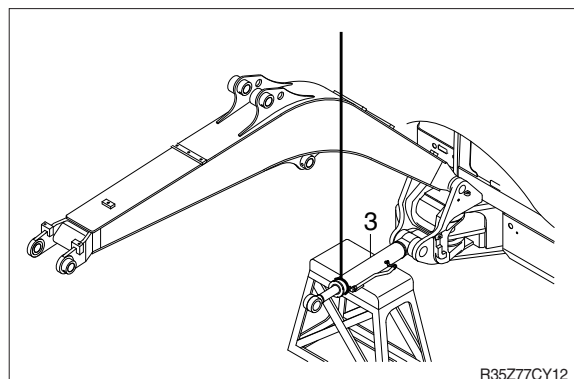


③ Remove bolt and nut (2) and pull out pin (1).

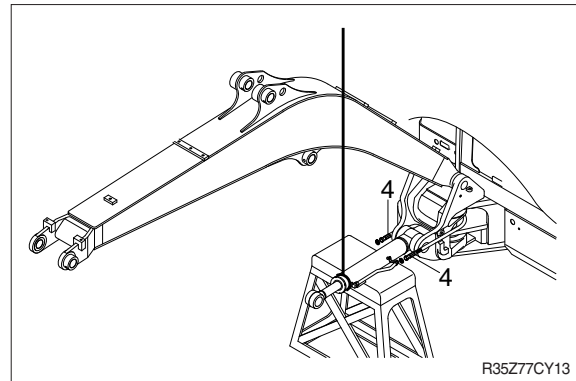
- ※ Tie the rod with wire to prevent it from coming out.



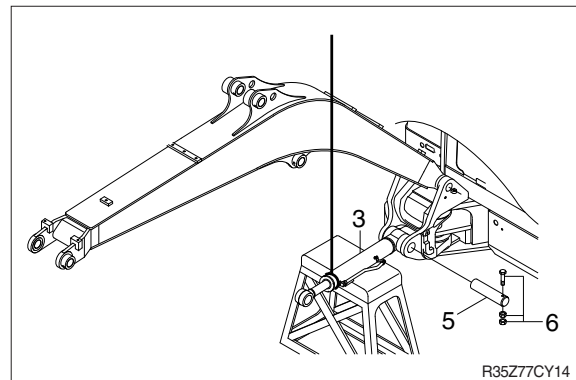
④ Lower the boom cylinder assembly (3) on a stand.



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



- ⑥ Remove bolt (6) and pull out pin (5).
⑦ Remove boom cylinder assembly (3).
· Weight : 60 kg (130 lb)



(2) Install

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

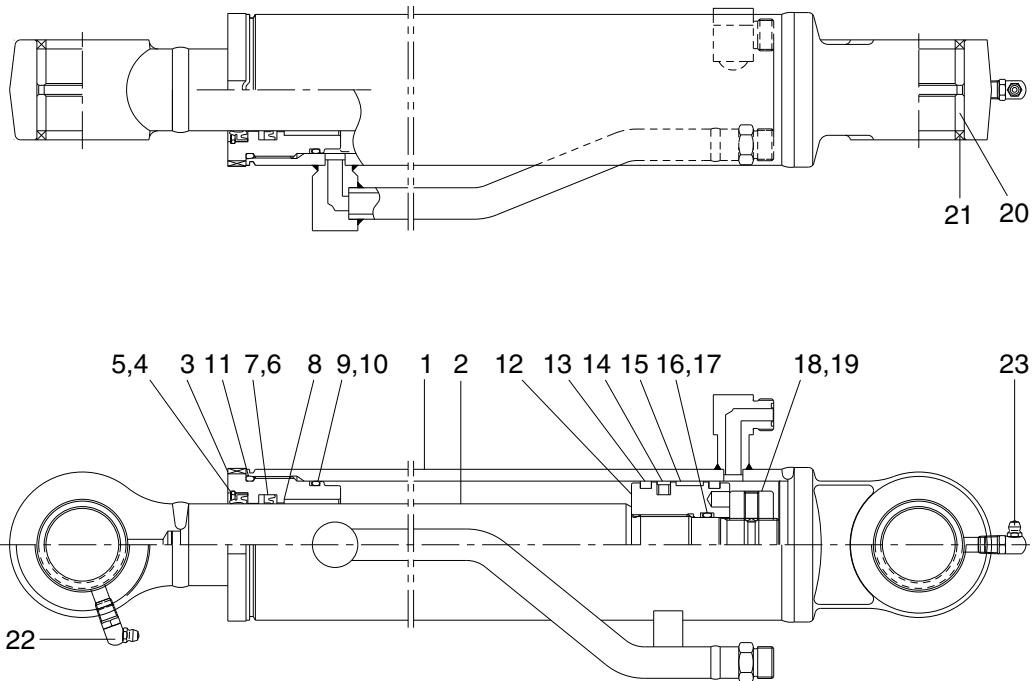
▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

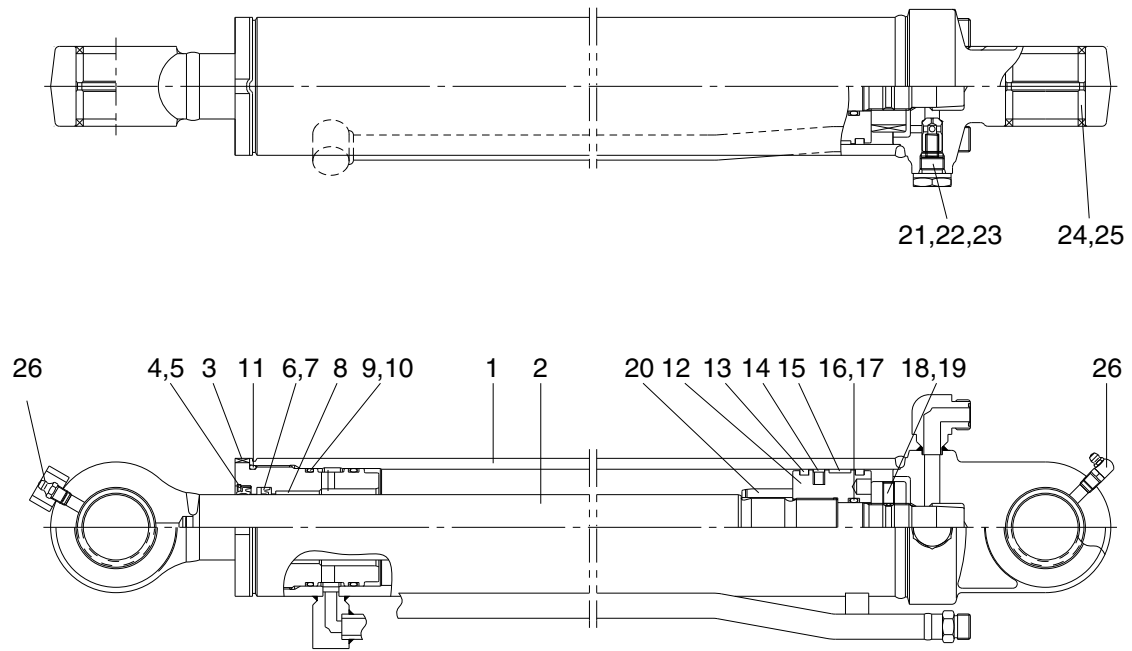
(1) Bucket cylinder



R35Z77CY15

1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Back-up ring	18	Piston nut
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Pin bushing
5	Snap ring	13	Dust ring	21	Dust seal
6	Rod seal	14	Piston seal	22	Grease nipple
7	Back-up ring	15	Wear ring	23	Grease nipple
8	DU bushing	16	O-ring		

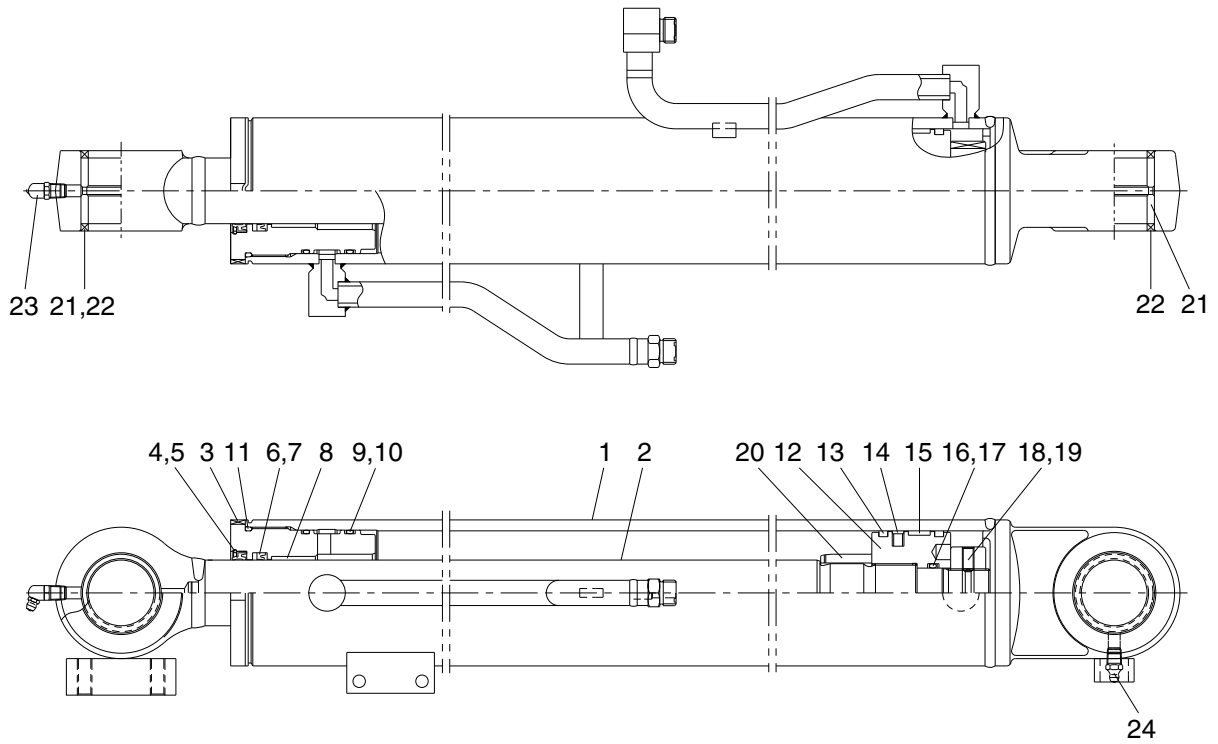
(2) Arm cylinder



R35Z97CY16

- | | | | | | |
|---|---------------|----|--------------|----|---------------|
| 1 | Tube assembly | 10 | Back-up ring | 19 | Set screw |
| 2 | Rod assembly | 11 | O-ring | 20 | Cushion ring |
| 3 | Gland | 12 | Piston | 21 | Check valve |
| 4 | Dust wiper | 13 | Dust ring | 22 | Coil spring |
| 5 | Snap ring | 14 | Piston seal | 23 | Plug |
| 6 | Rod seal | 15 | Wearing | 24 | Pin bushing |
| 7 | Back-up ring | 16 | O-ring | 25 | Dust seal |
| 8 | DU bushing | 17 | Back-up ring | 26 | Grease nipple |
| 9 | O-ring | 18 | Piston nut | | |

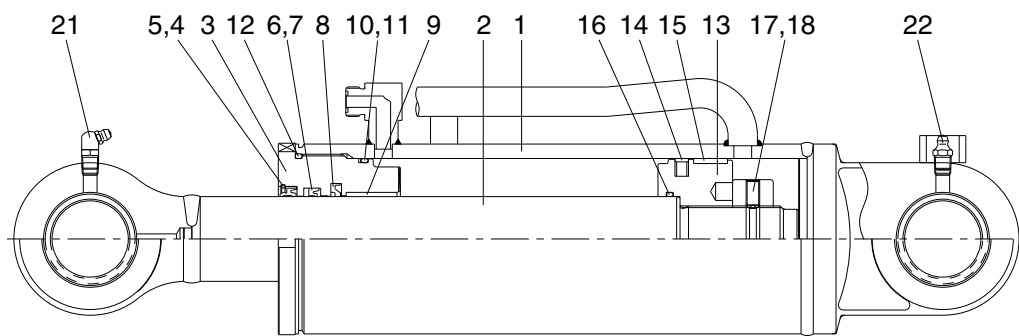
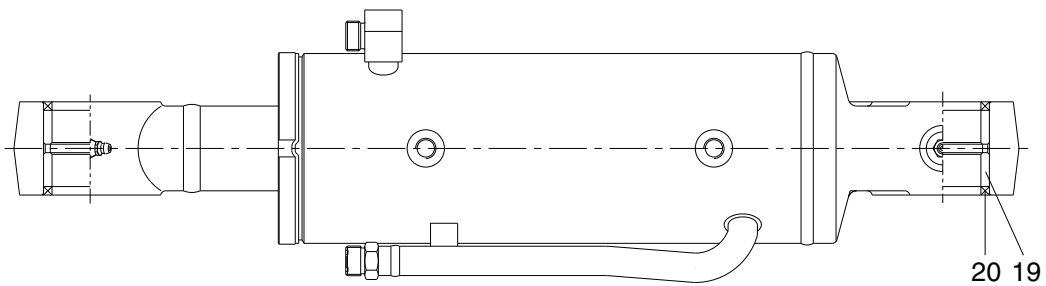
(3) Boom cylinder



R35Z77CY17

- | | | | | | |
|---|---------------|----|--------------|----|---------------|
| 1 | Tube assembly | 9 | O-ring | 17 | Back-up ring |
| 2 | Rod assembly | 10 | Back-up ring | 18 | Piston nut |
| 3 | Gland | 11 | O-ring | 19 | Set screw |
| 4 | Dust wiper | 12 | Piston | 20 | Cushion ring |
| 5 | Snap ring | 13 | Dust ring | 21 | Pin bushing |
| 6 | Rod seal | 14 | Piston seal | 22 | Dust seal |
| 7 | Back-up ring | 15 | Wear ring | 23 | Grease nipple |
| 8 | DU bushing | 16 | O-ring | 24 | Grease nipple |

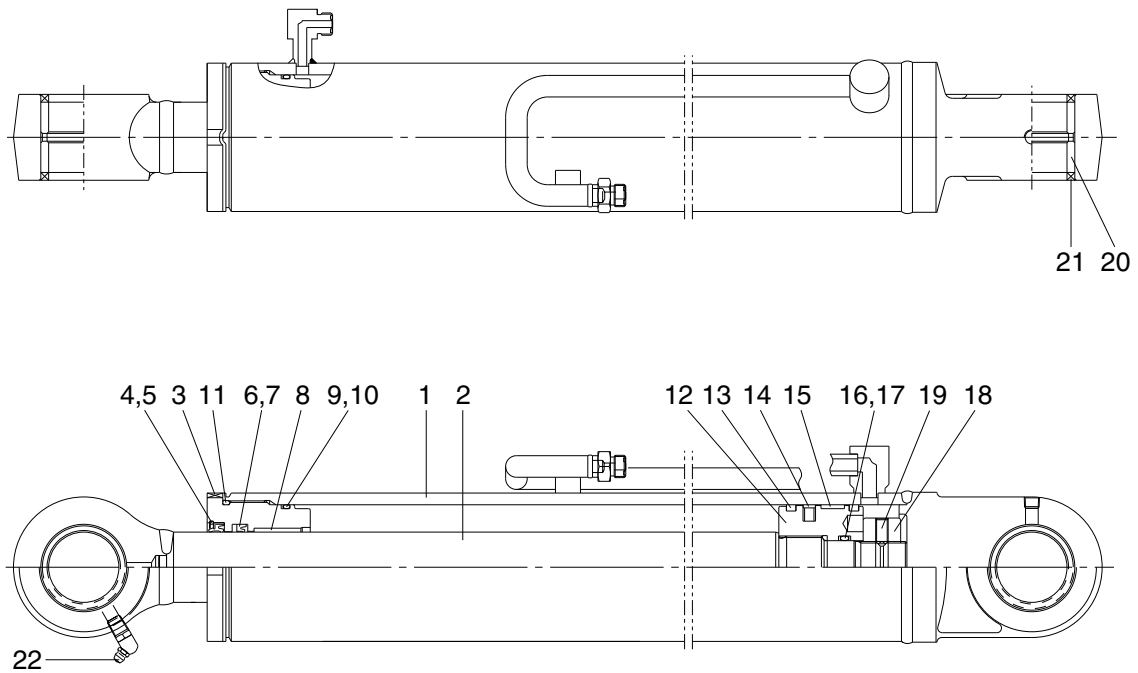
(4) Dozer cylinder



R35Z77CY18

- | | | | | | |
|---|---------------|----|--------------|----|---------------|
| 1 | Tube assembly | 8 | Buffer ring | 15 | Wear ring |
| 2 | Rod assembly | 9 | DU bushing | 17 | Piston nut |
| 3 | Gland | 10 | O-ring | 18 | Set screw |
| 4 | Dust wiper | 11 | Back-up ring | 19 | Pin bushing |
| 5 | Snap ring | 12 | O-ring | 20 | Dust seal |
| 6 | Rod seal | 13 | Piston | 21 | Grease nipple |
| 7 | Back-up ring | 14 | Piston seal | 22 | Grease nipple |

(5) Boom swing cylinder

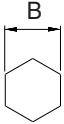


R35Z77CY19

- | | | | | | |
|---|---------------|----|--------------|----|---------------|
| 1 | Tube assembly | 9 | O-ring | 16 | O-ring |
| 2 | Rod assembly | 10 | Back-up ring | 17 | Back-up ring |
| 3 | Gland | 11 | O-ring | 18 | Piston nut |
| 4 | Dust wiper | 12 | Piston | 19 | Set screw |
| 5 | Snap ring | 13 | Dust ring | 20 | Pin bushing |
| 6 | Rod seal | 14 | Piston seal | 21 | Dust seal |
| 7 | Back-up ring | 15 | Wear ring | 22 | Grease nipple |
| 8 | DU bushing | | | | |

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	8	
	3	
Spanner	M22	
Hook spanner	Suitable size (80~120 mm)	
(-) 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	
Gland	Boom cylinder	3	M90	68±6.8	492±49
	Arm cylinder	3	M85	64±6.4	463±46
	Bucket cylinder	3	M75	56±5.6	405±41
	Dozer cylinder	3	M100	75±7.5	542±54
	Boom swing cylinder	3	M85	64±6.4	463±46
Piston	Boom cylinder	18	M33	82±8	593±59
	Arm cylinder	18	M33	82±8	593±59
	Bucket cylinder	18	M29	73±7	528±53
	Dozer cylinder	17	M39	150±15	1085±109
	Boom swing cylinder	18	M33	93±9	673±67

3) DISASSEMBLY

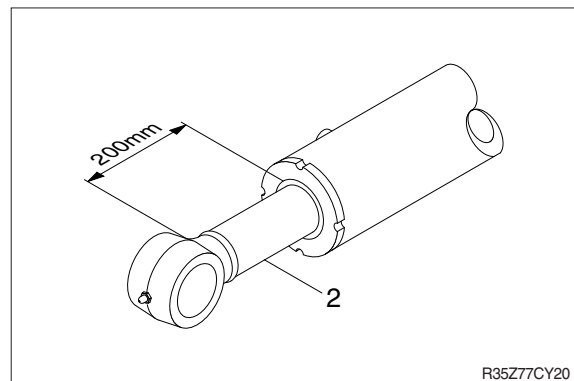
※ Procedures are based on the boom cylinder.

(1) Remove cylinder head and piston rod

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

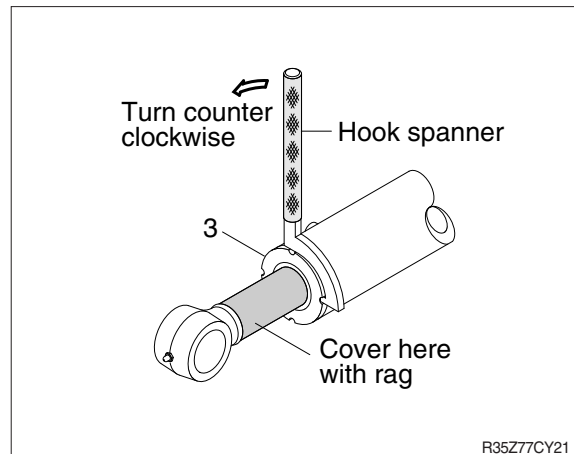
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



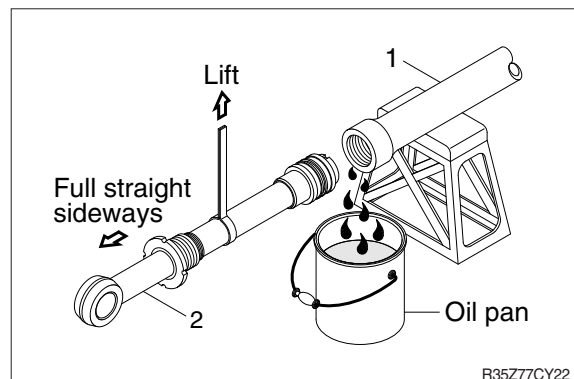
③ Loosen and remove the gland (3) by hook spanner.

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



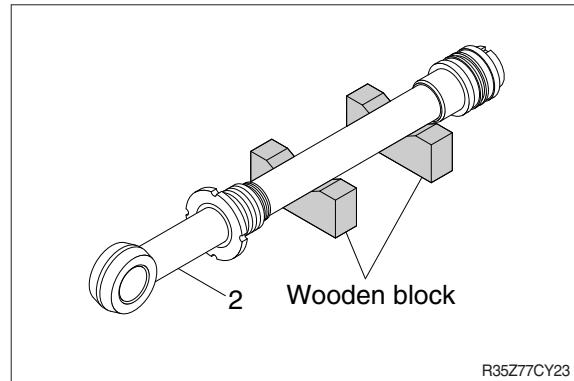
④ Draw out cylinder head and rod assembly together from tube assembly (1).

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



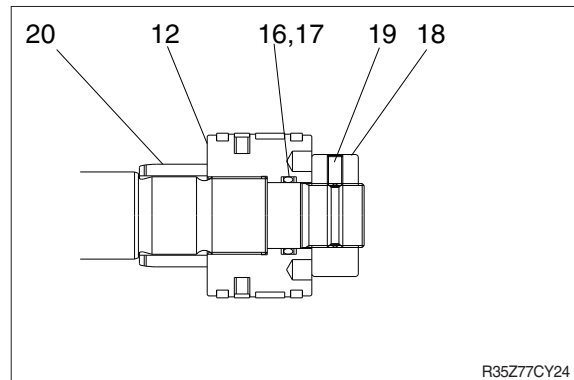
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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



(2) Remove piston and gland

- ① Remove set screw (19)
- ② Remove piston nut (18).
- ※ Since piston nut (18) is tightened to a high torque, use a hydraulic and power wrench that utilizes a hydraulic cylinder, to remove the piston nut (18).

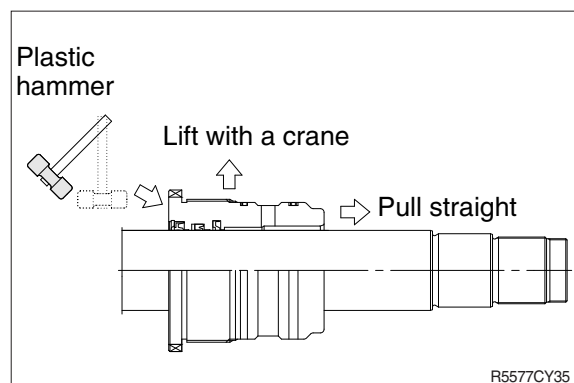


- ③ Remove piston assembly (12), back up ring (17), O-ring (10) and cushion ring (20).

- ④ Remove the gland assembly from rod assembly (2).

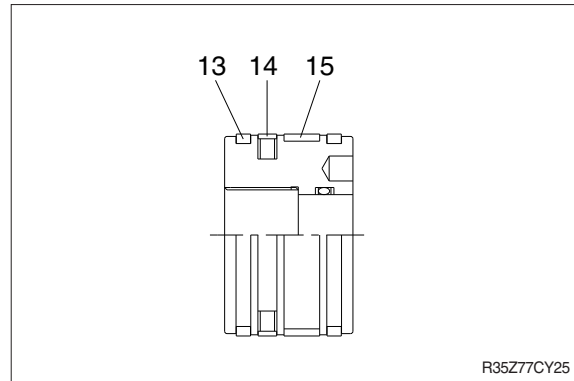
- ※ If it is too heavy to move, move it by striking the flanged part of gland with a plastic hammer.
- ※ Pull it straight with gland assembly lifted with a crane.

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



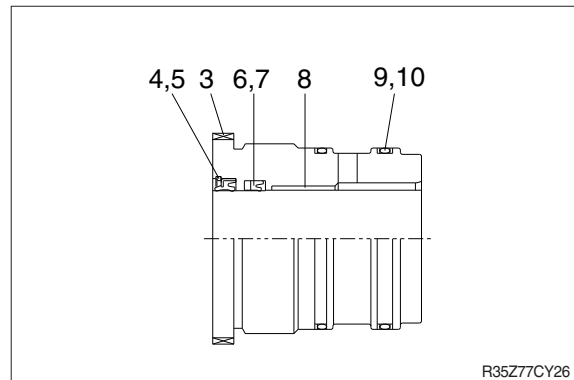
(3) Disassemble the piston assembly

- ① Remove wear ring (15).
 - ② Remove dust ring (13) and piston seal (14).
- ※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

- ① Remove back up ring (10) and O-ring (9).
 - ② Remove snap ring (5), dust wiper (4).
 - ③ Remove back up ring (7), rod seal (6).
 - ④ Remove the cushion ring (8).
- ※ Exercise care in this operation not to damage the grooves.
- ※ Do not remove seal and ring, if does not damaged.

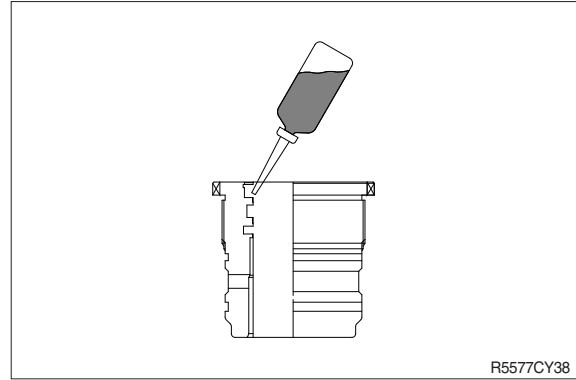


4) ASSEMBLY

(1) Assemble cylinder head assembly

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

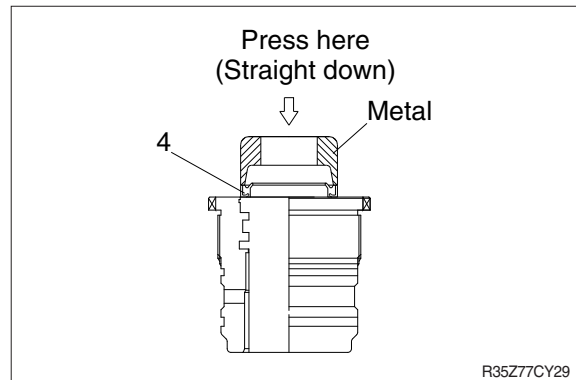
① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (4) with grease and fit dust wiper (4) to the bottom of the hole of dust seal.

At this time, press a pad metal to the metal ring of dust seal.

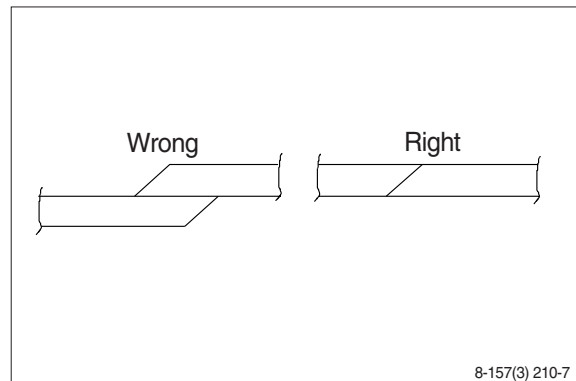
③ Fit retain ring (5) to the stop face.



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

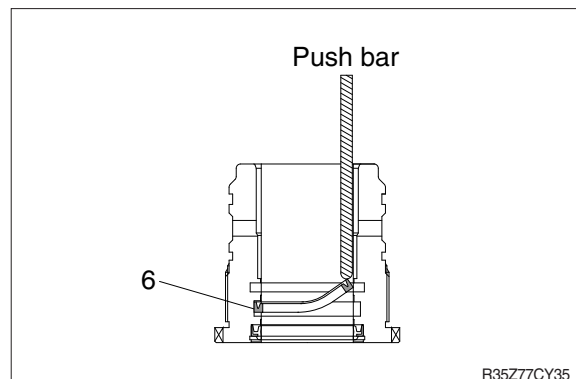
※ Coat each packing with hydraulic oil before fitting it.

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

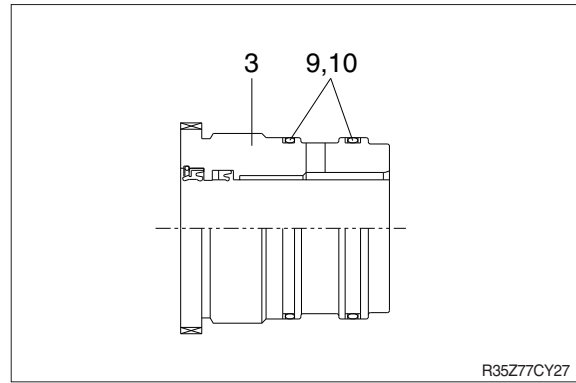


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

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

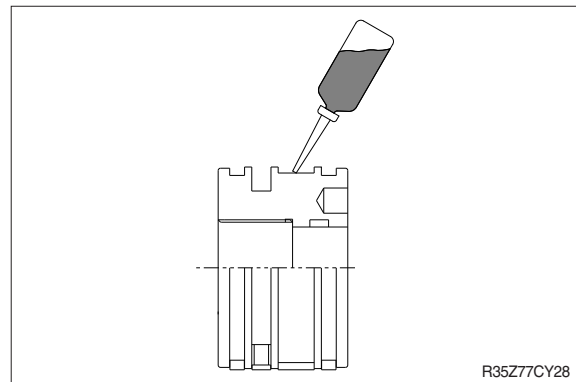


- ⑤ Fit back up ring (10) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C .
- ⑥ Fit O-ring (9) to gland (3).

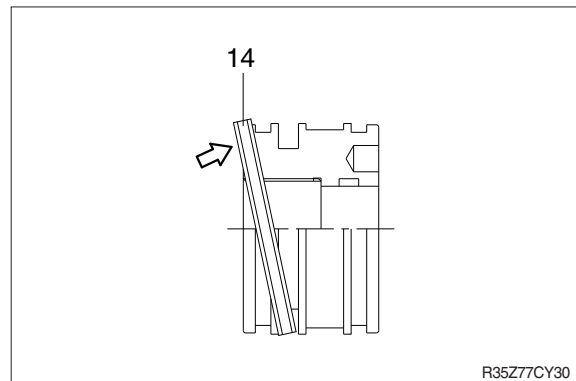


(2) Assemble piston assembly

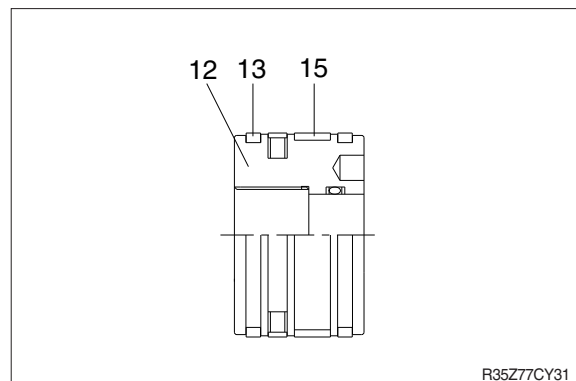
- ※ Check for scratches or rough surfaces.
If found smooth with an oil stone.
- ① Coat the outer face of piston (16) with hydraulic oil.



- ② Fit piston seal (14) 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.

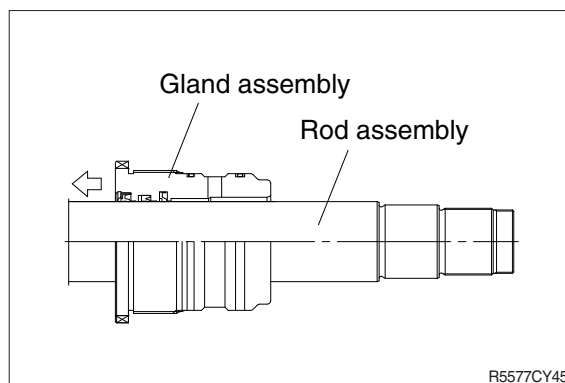


- ③ Fit wear ring (15) and dust ring (13) to piston (12).

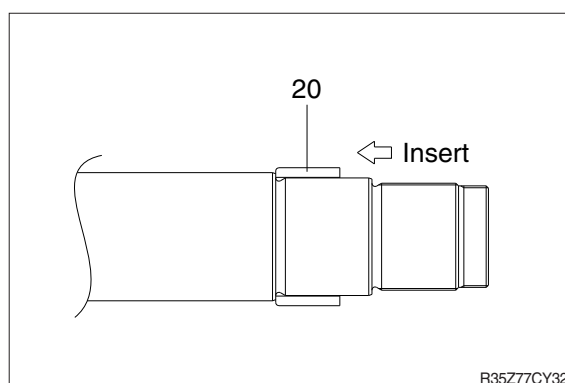


(3) Install piston and cylinder head

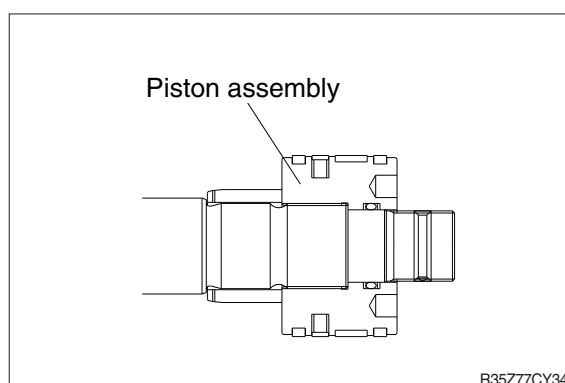
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and gland.
- ③ Insert gland assembly to rod assembly.



- ④ Insert cushion ring (20) to rod assembly.
- ※ Note that cushion ring (20) has a direction in which it should be fitted.



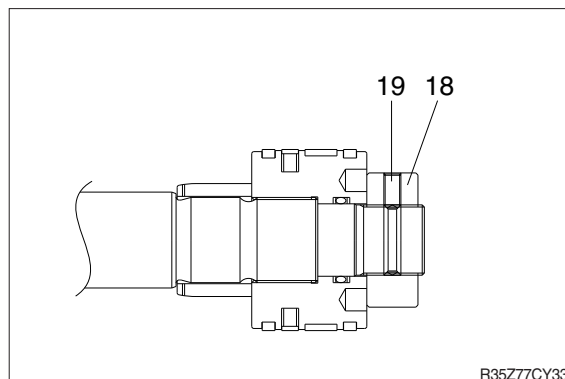
- ⑤ Fit piston assembly to rod assembly.



- ⑥ Fit piston nut (18) and set screw (19).

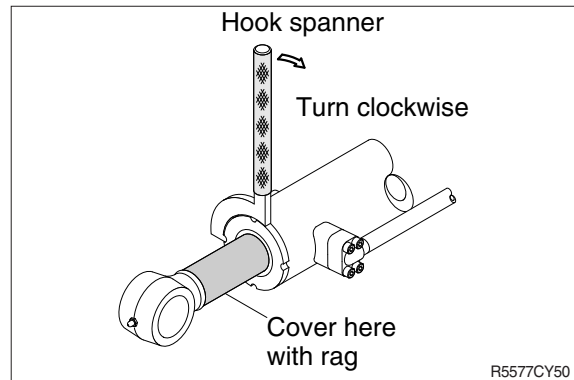
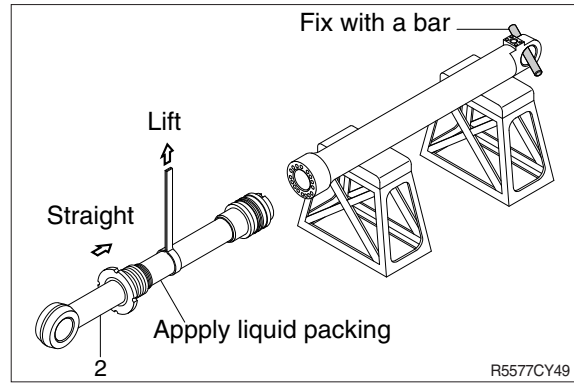
· Tightening torque :

Item		kgf · m	lbf · ft
Boom	18	82 ± 8	593 ± 59
Arm	18	82 ± 8	593 ± 59
Bucket	18	73 ± 7	528 ± 53
Dozer	17	150 ± 15	1085 ± 109
Boom swing	18	93 ± 9	673 ± 67



(3) Overall assemble

- ① Place a V-block on a rigid work bench.
Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.
- ② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.
 - ※ Be careful not to damage piston seal by thread of tube assembly.
- ③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.
 - ※ Refer to the table of tightening torque.

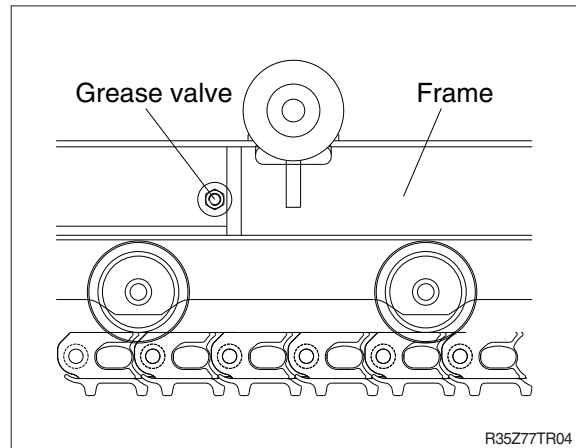


GROUP 10 UNDERCARRIAGE

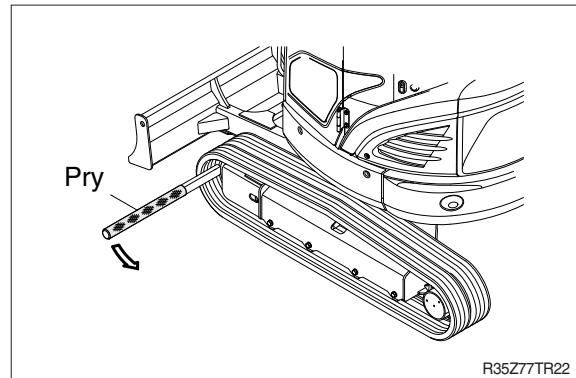
1. RUBBER TRACK

1) REMOVAL

- (1) Loosen tension of the rubber track.
 - ※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

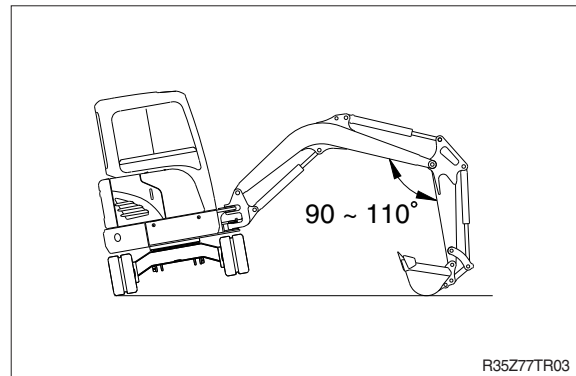


- (2) Remove the rubber track from lower frame using pry.



2) INSTALL

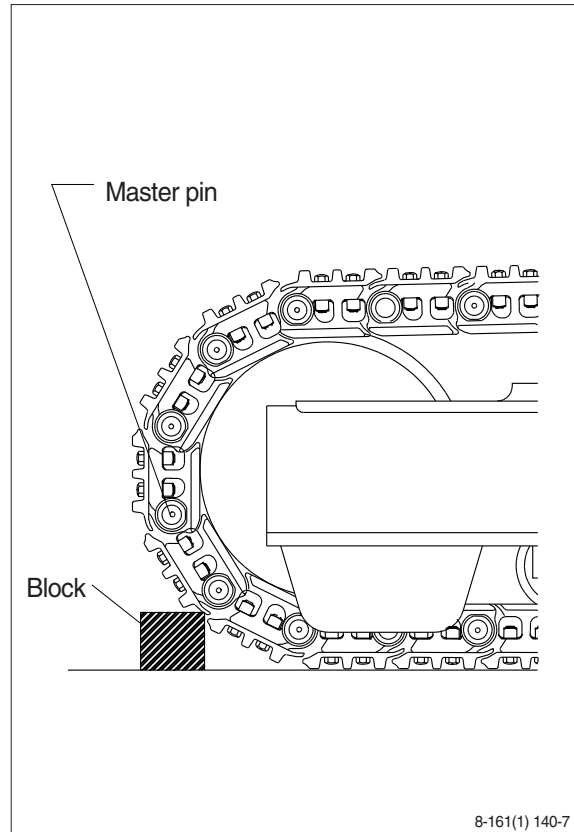
- (1) Carry out installation in the reverse order to removal.
 - ※ Adjust the tension of the rubber track.



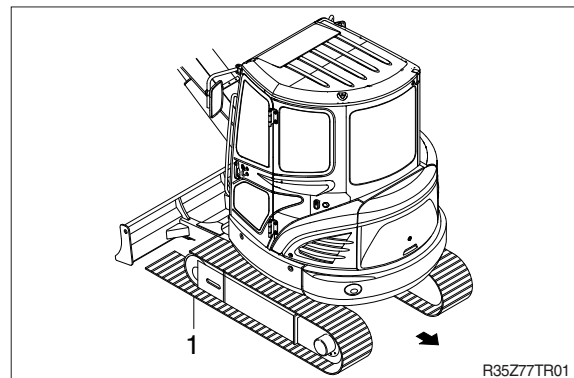
2. TRACK LINK

1) REMOVAL

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

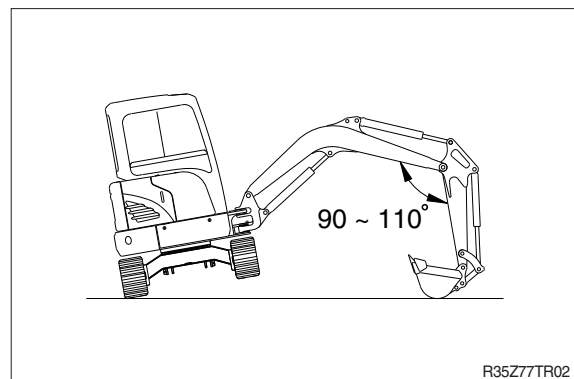


- (4) Move the machine slowly in reverse, and lay out track link assembly (1).
 - ※ Jack up the machine and put wooden block under the machine.
 - ※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

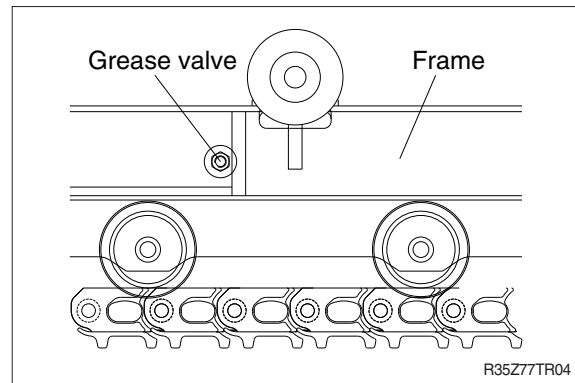
- (1) Carry out installation in the reverse order to removal.
 - ※ Adjust the tension of the track link.



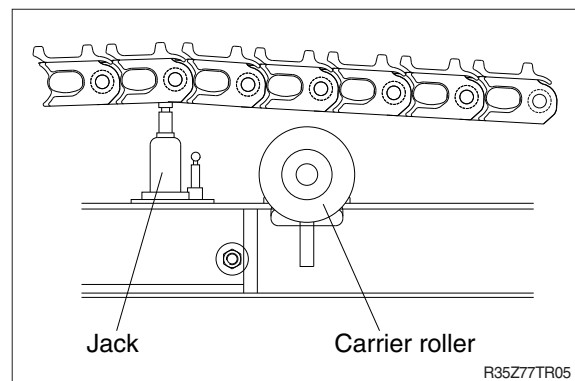
3. CARRIER ROLLER

1) REMOVAL

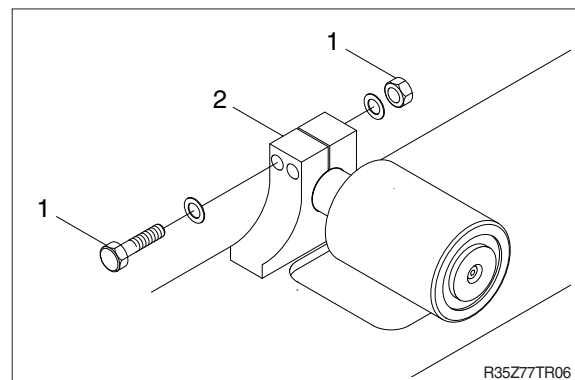
- (1) Loosen tension of the track link.



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



- (3) Loosen the bolt and nut (1)
- (4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.
 - Weight : 7 kg (15 lb)



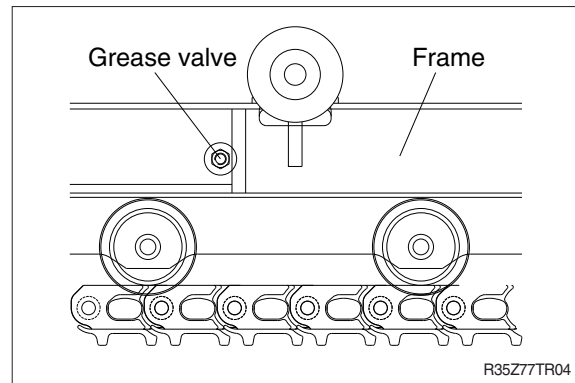
2) INSTALL

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

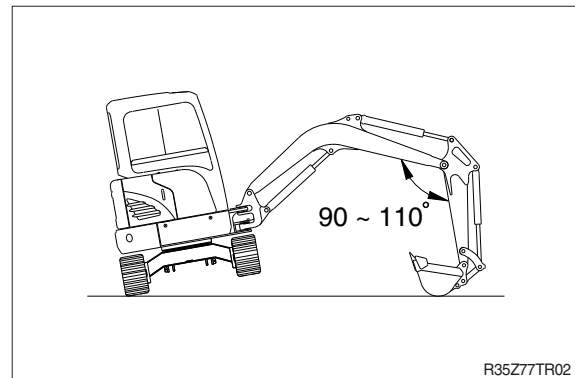
4. TRACK ROLLER

1) REMOVAL

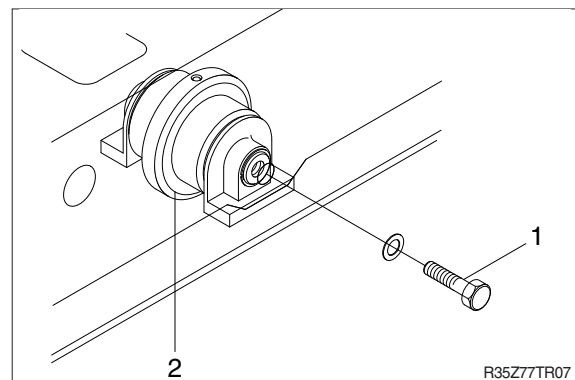
- (1) Loosen tension of the rubber track.



- (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 : 11.5 kg (25 lb)



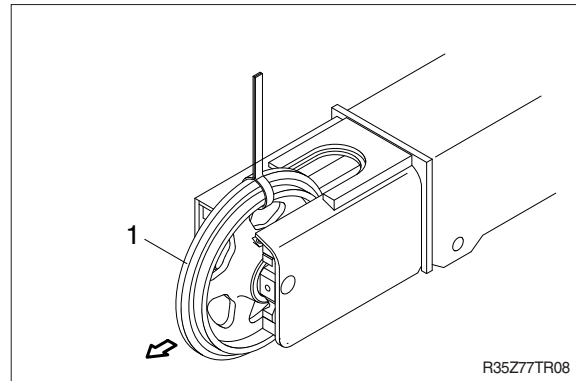
2) INSTALL

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

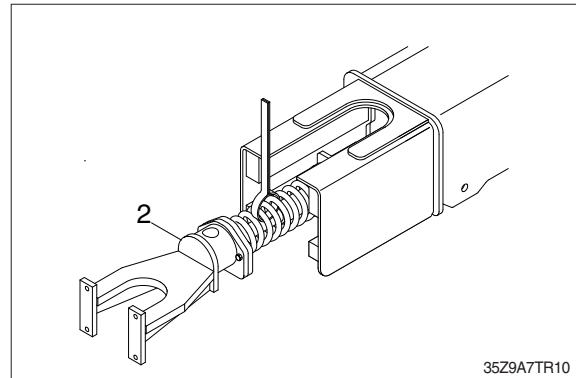
5. IDLER AND RECOIL SPRING

1) REMOVAL

- (1) Remove the track link.
For detail, see **removal of track link**.
- (2) Sling the idler (1) and pull out idler and recoil spring assembly from track frame, using a pry.
 - Weight : 58.3 kg (129 lb)

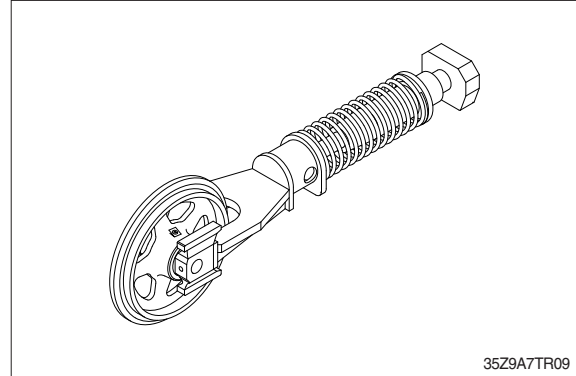


- (3) Pull out yoke and recoil spring assembly (2) from track frame, using a pry.
 - Weight : 36 kg (79 lb)



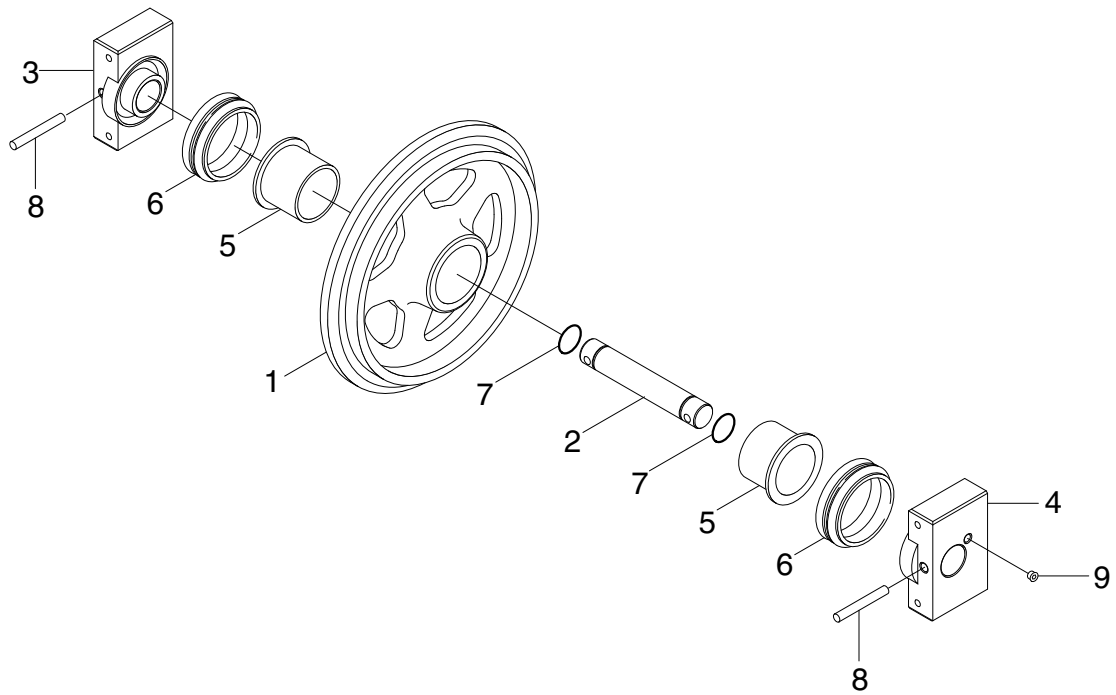
2) INSTALL

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



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



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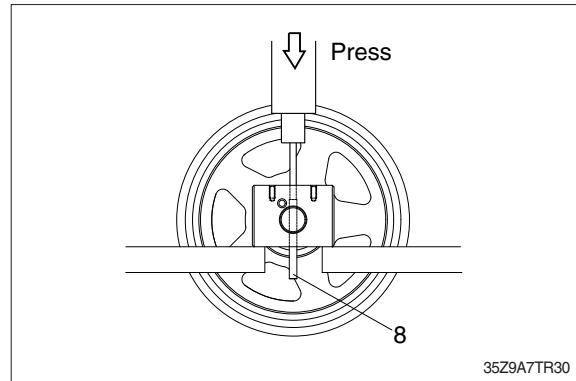
- 1 Idler shell
- 2 Shaft
- 3 Collar-LH

- 4 Collar-RH
- 5 Bushing
- 6 Seal assembly

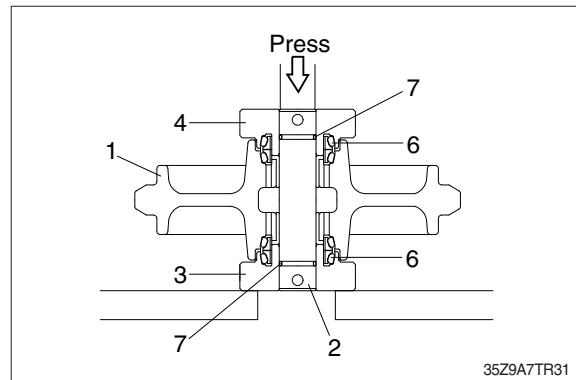
- 7 O-ring
- 8 Spring pin
- 9 Plug

(2) Disassembly

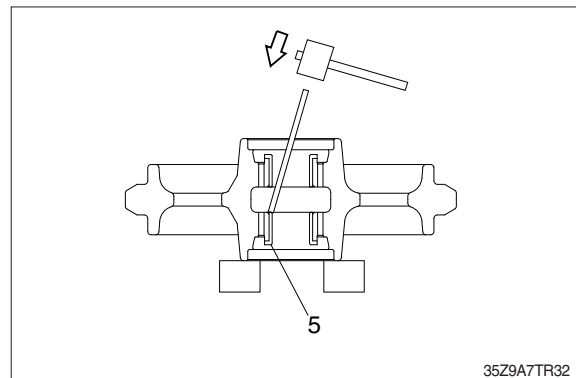
- ① Remove plug (9) and drain oil.
- ② Draw out the spring pin (8), using a press.



- ③ Pull out the shaft (2) with a press.
- ④ Remove seal (6) from idler shell (1) and collar (3,4).
- ⑤ Remove O-ring (7) from shaft.



- ⑥ Remove the bushing (5) from idler, using a special tool.
- ※ Only remove bushing if replacement is necessary.

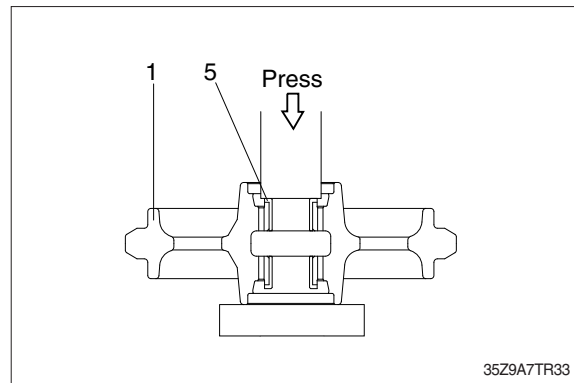


(3) Assembly

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

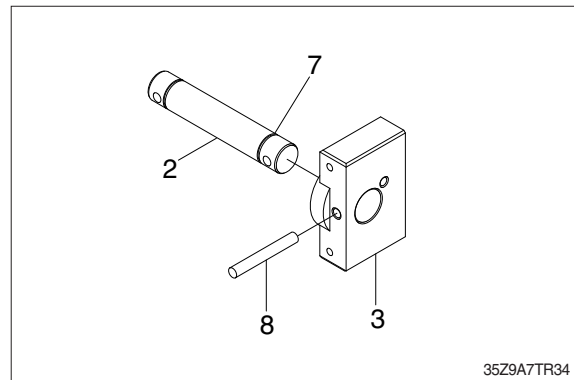
- ① Cool up bushing (5) fully by some dry ice and press it into idler shell (1).

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

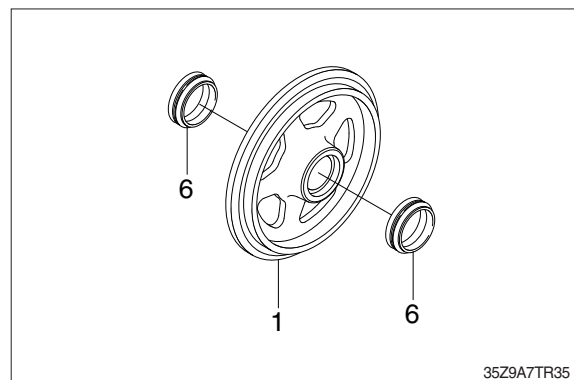


- ② Coat O-ring (7) with grease thinly, and install it to shaft (2).

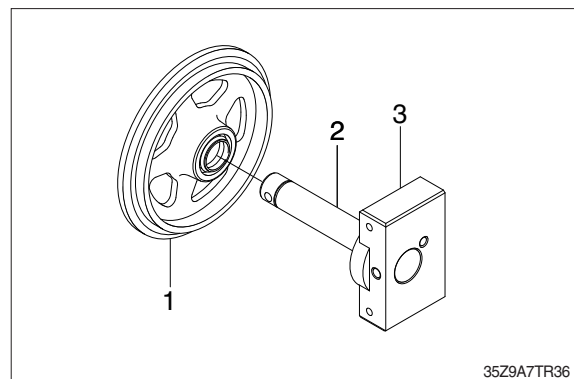
- ③ Insert shaft (2) into collar (3) and drive in the spring pin (8).



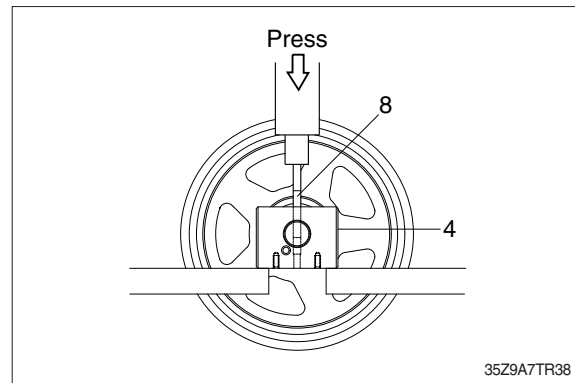
- ④ Install seal (6) to idler shell (1).



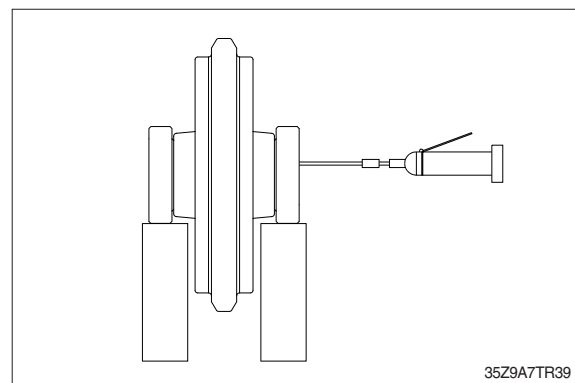
- ⑤ Install shaft (2) and collar (3) to idler shell (1).



- ⑥ Lay collar (4) on its side. Knock in the spring pin (8) with a hammer.

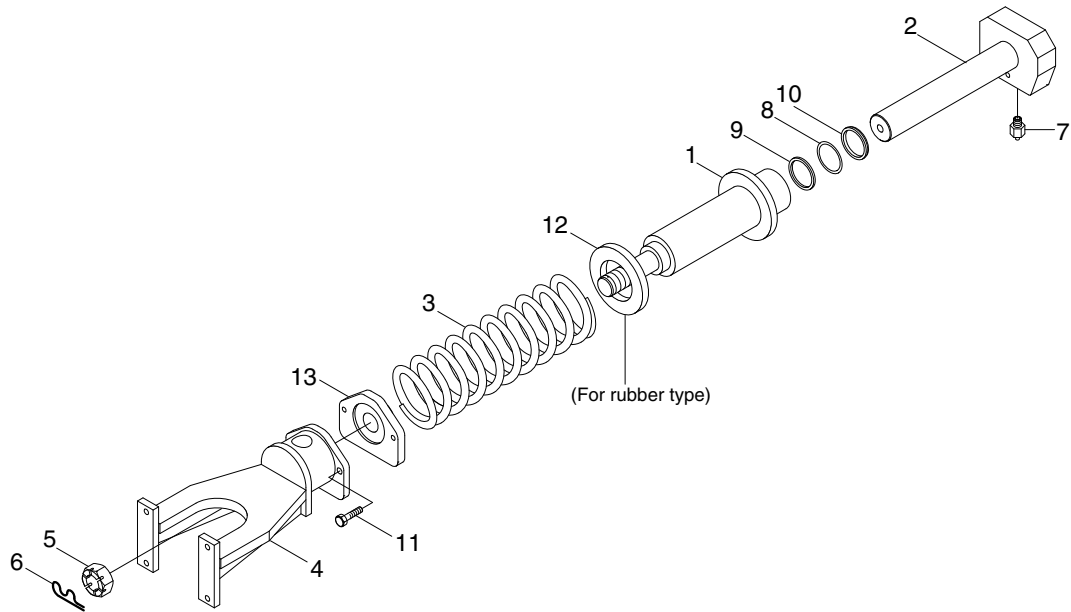


- ⑦ Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure

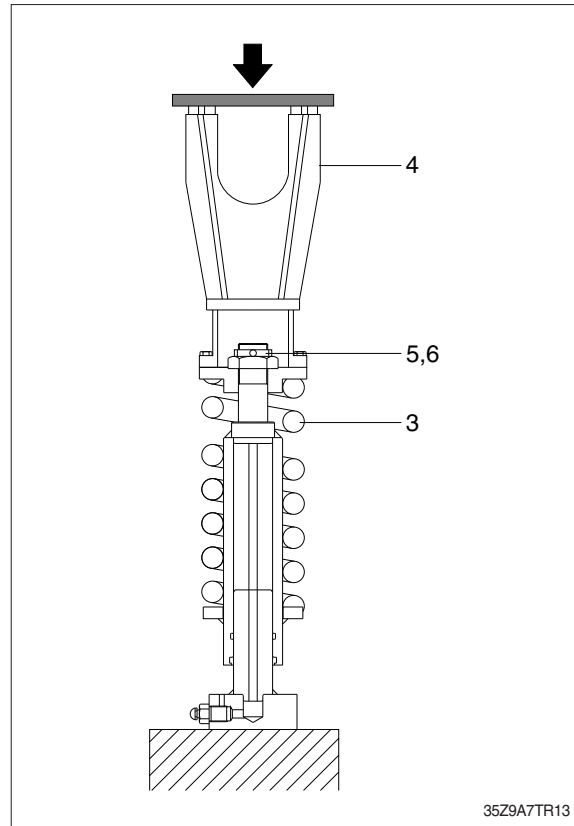


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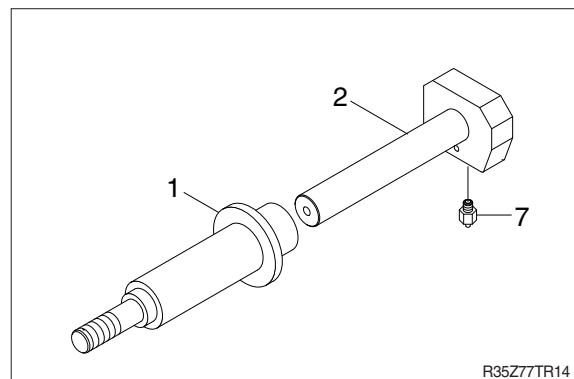
- | | | | | | |
|---|----------------|----|--------------|----|----------------------|
| 1 | Body assy | 6 | Split pin | 11 | Bolt |
| 2 | Rod assy | 7 | Grease valve | 12 | Spacer (rubber type) |
| 3 | Tension spring | 8 | O-ring | 13 | Cap |
| 4 | Yoke | 9 | Back-up ring | | |
| 5 | Nut | 10 | Packing | | |

(2) Disassembly

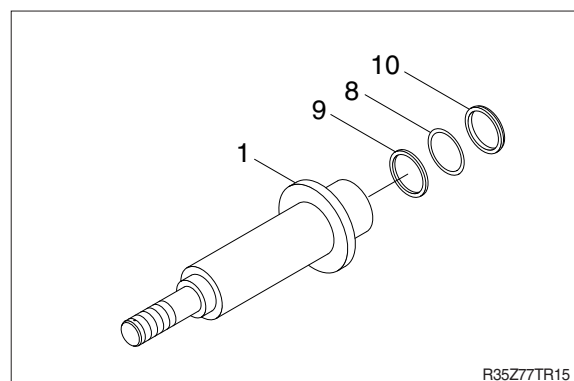
- ① Apply pressure on yoke (4) with a press.
 - ※ The spring is under a large installed load. This is dangerous, so be sure to set properly.
 - Spring set load : 2700 kg (6000 lb)
- ② Remove split pin (6) and nut (5).
- ③ Lighten the press load slowly and remove cap (4) and spring (3).



- ⑤ Remove rod (2) from body (1).
- ⑥ Remove grease valve (7) from rod (2).

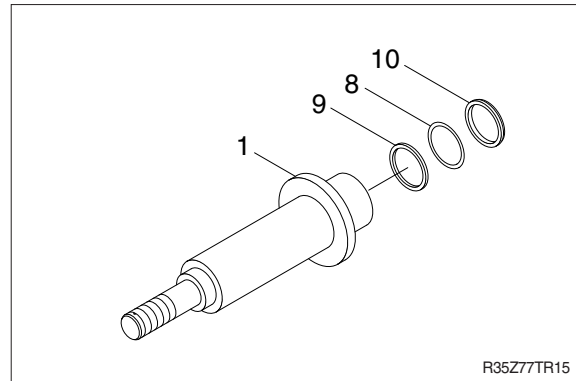


- ⑦ Remove packing (10), back-up ring (9) and O-ring (8) from body (1).



(3) Assembly

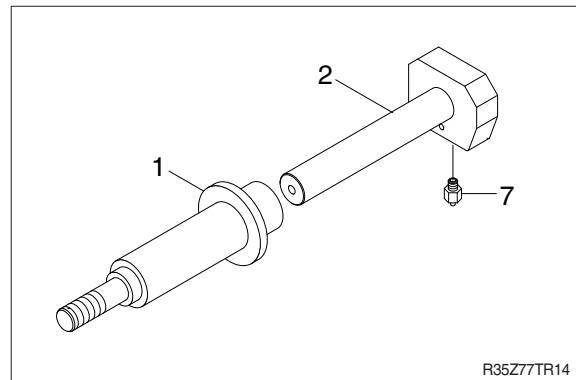
- ① Install O-ring (8), back-up ring (9), and packing (10) body (1).



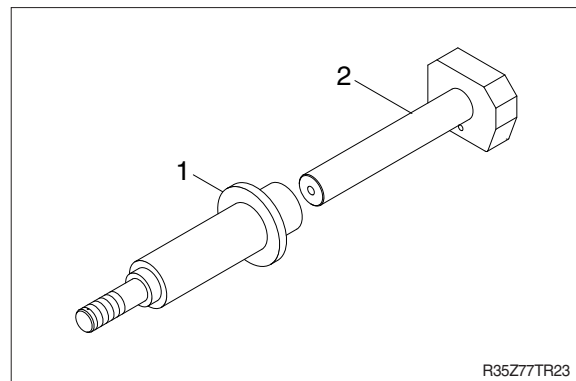
- ② Pour grease into body (1), then push in rod (2) by hand.

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

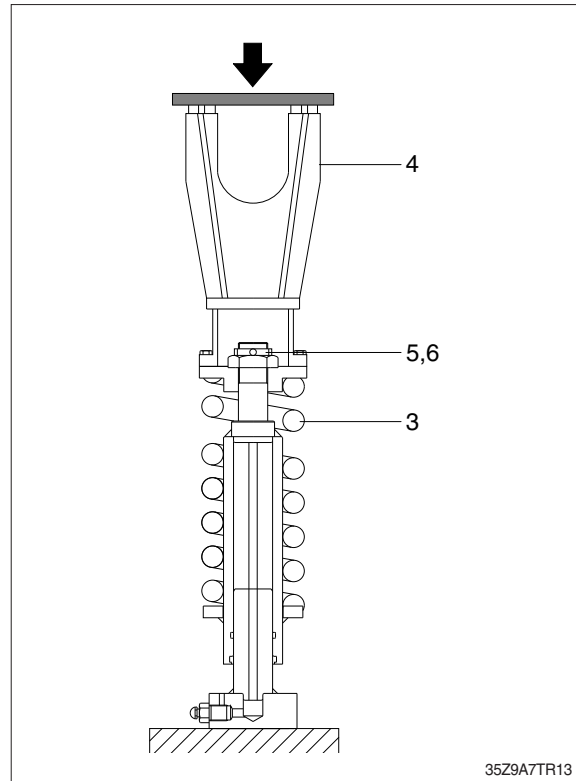
- ※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.
- ③ Fit grease valve(7) to rod(2).
 - Tightening torque : $10 \pm 0.5 \text{ kgf} \cdot \text{m}$
($72.4 \pm 3.6 \text{ lbf} \cdot \text{ft}$)



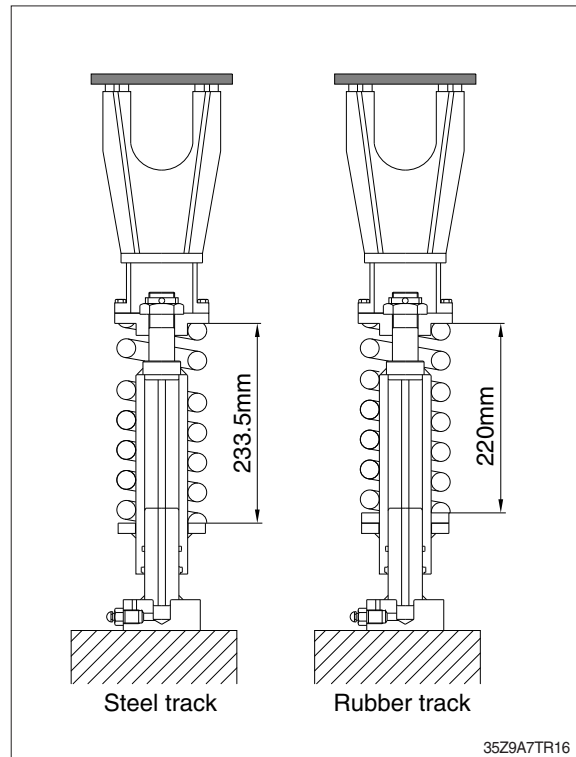
- ④ Install rod (2) to body (1).



- ⑤ Install spring (3) and yoke (4) to body (1).
- ⑥ Apply pressure to spring (3) with a press and tighten nut (5).
- ※ During the operation, pay attention specially to prevent the press from slipping out.
- ⑦ Tighten nut (5) and insert split pin (6).

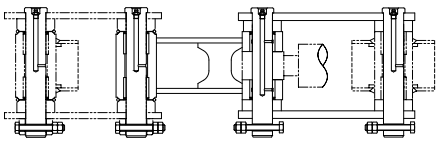
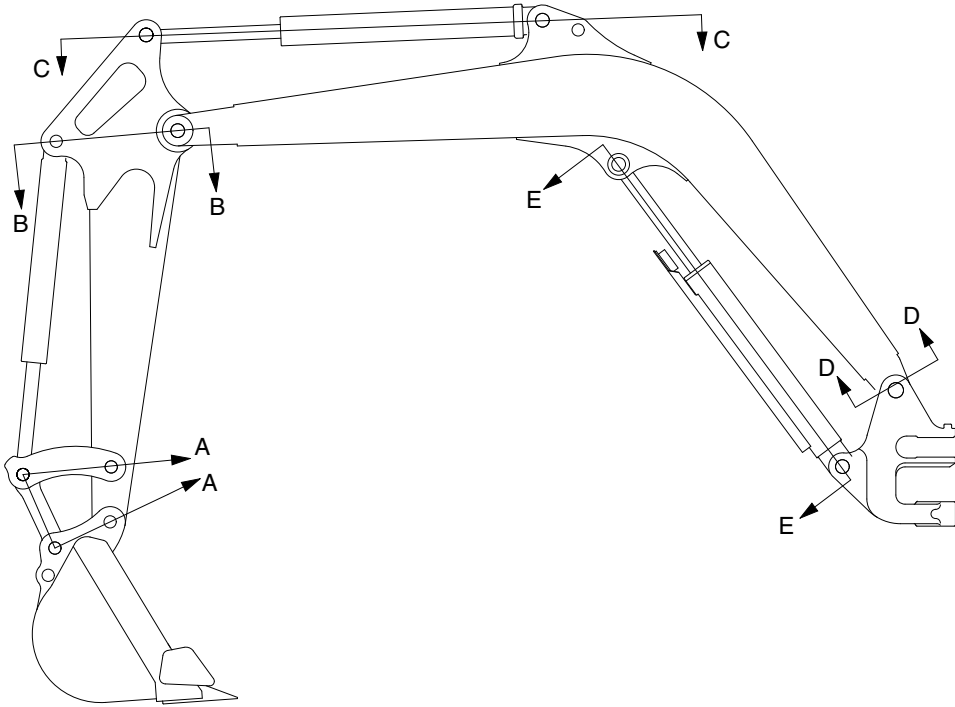


- ⑧ Lighten the press load and confirm the set length of spring (2).
- Spring length (steel track) : 233.5 mm
- Spring length (rubber track) : 220 mm

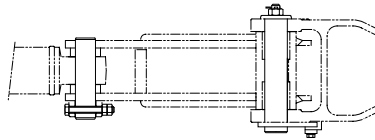


GROUP 11 WORK EQUIPMENT

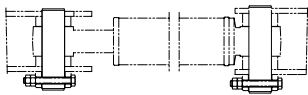
1. STRUCTURE



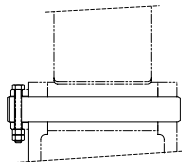
SECTION A-A



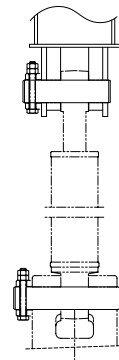
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

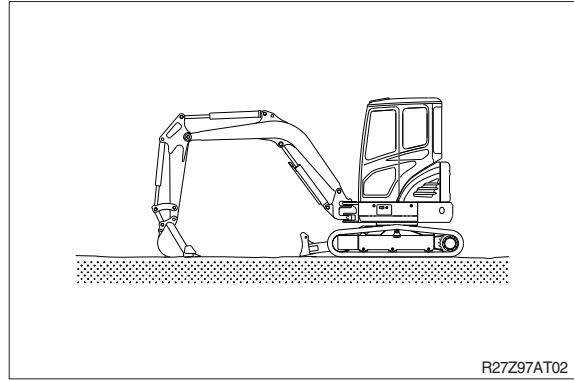
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2. REMOVAL AND INSTALL

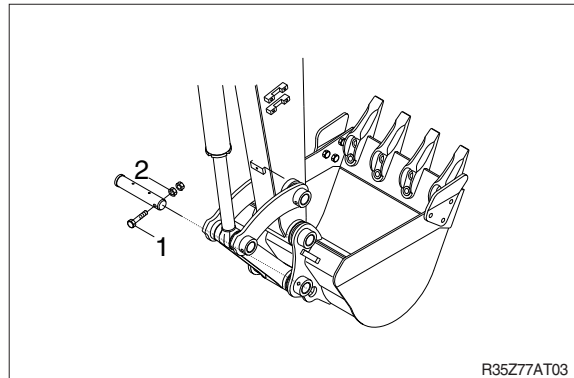
1) BUCKET ASSEMBLY

(1) Removal

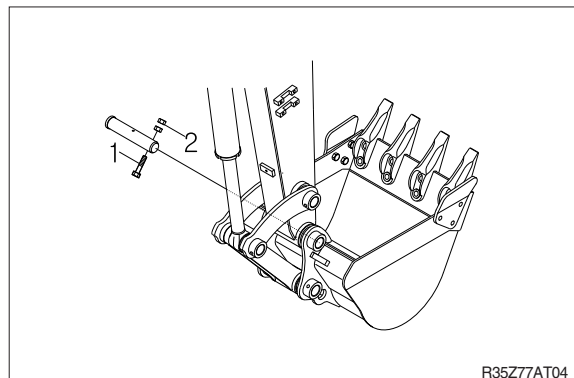
- ① Lower the work equipment completely to ground with back of bucket facing down.



- ② Remove nut (1), bolt (2) and draw out the pin (4).



- ③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly (0.11 m³).
 - Weight : 80 kg (180 lb)

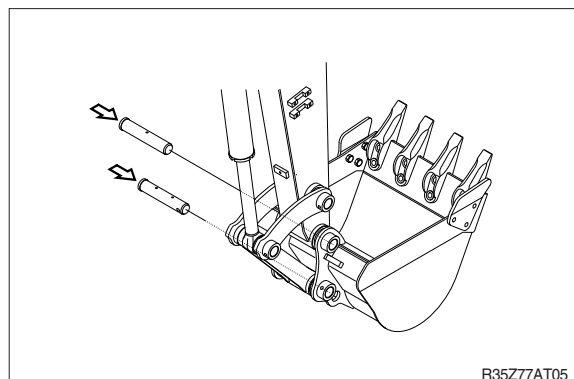


(2) Install

- 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.

- ※ Adjust the bucket clearance.
For detail, see operator's manual.



2) ARM ASSEMBLY

(1) Removal

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

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

① Remove bucket assembly.

For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (4).

▲ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurring 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.

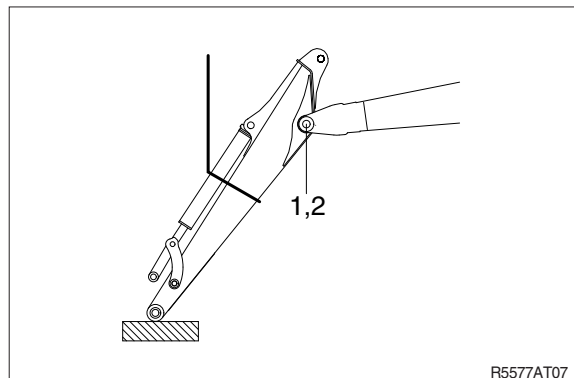
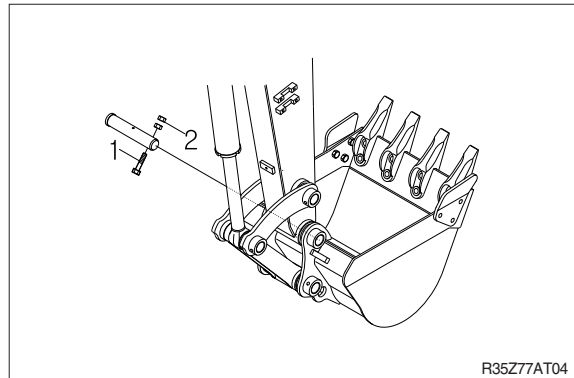
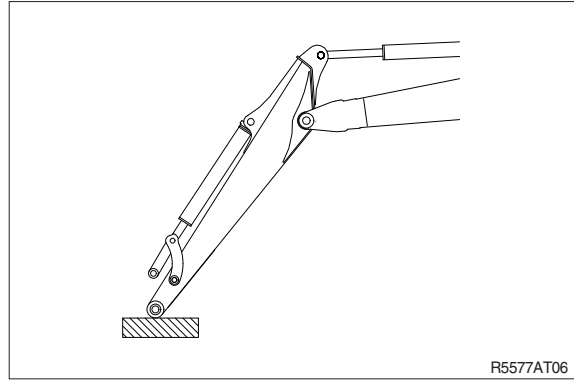
④ For details, see removal of arm cylinder assembly.

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

⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly (1.3 m).

· Weight : 80 kg (180 lb)

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



(2) Install

① Carry out installation in the reverse order to removal.

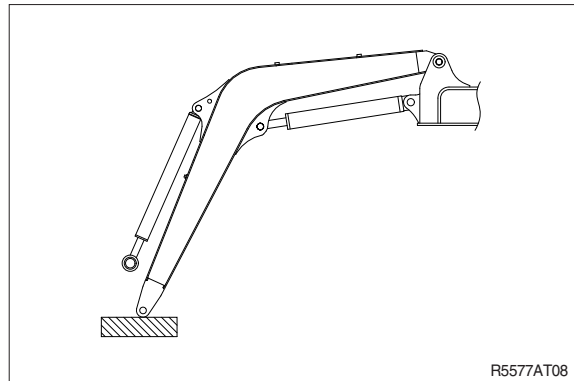
▲ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.

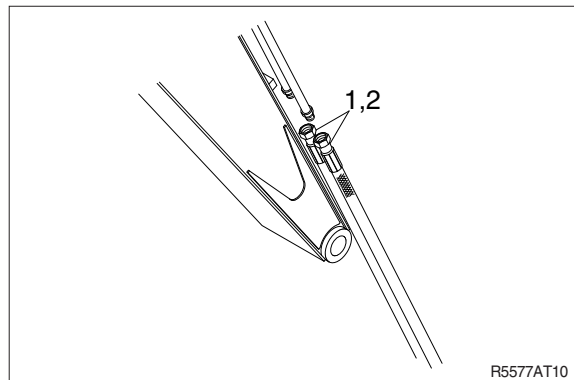
3) BOOM CYLINDER

(1) Removal

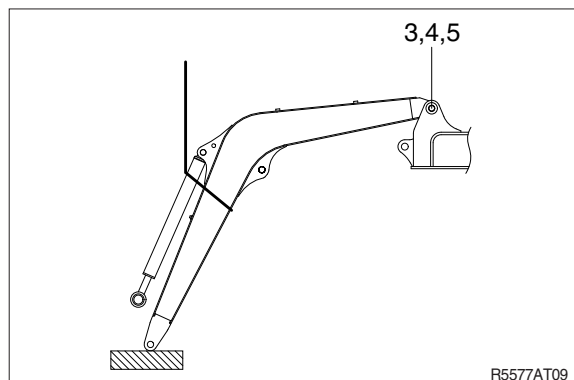
- ① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.
- ② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



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



- ⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly (2.5 m).
· Weight : 140 kg (310 lb)
※ When lifting the boom assembly always lift the center of gravity.



(2) Install

- ① Carry out installation in the reverse order to removal.
- ▲ When lifting the arm assembly, always lift the center of gravity.
- ※ Bleed the air from the cylinder.

