

SECTION 7 DISASSEMBLY AND ASSEMBLY

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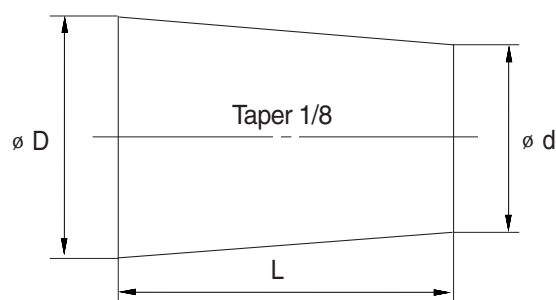
SECTION 7 DISASSEMBLY AND ASSEMBLY

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 × 1.25	7.4±1.5	53.5±11.0
2		Engine mounting bolt (bracket-frame)	M12 × 1.75	12.3±1.5	89±11.0
3		Radiator mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
4		Coupling mounting bolt	M10 × 1.5	5.15±0.25	37.2±1.8
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
6		Main control valve mounting bolt	M 8 × 1.25	3.4±0.7	24.6±5.1
7		RCV lever mounting bolt	M 6 × 1.0	1.44±0.3	10.4±2.2
8		Fuel tank mounting bolt	M10 × 1.5	6.9±1.4	50±10.1
9		Hydraulic oil tank mounting bolt	M10 × 1.5	6.9±1.4	50±10.1
10		Turning joint mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.1
11	Power train system	Swing motor mounting bolt	M14 × 2.0	21	152
12		Swing bearing upper mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
13		Swing bearing lower mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
14		Travel motor mounting bolt	M10 × 1.5	6.9±1.4	50±10.1
15		Sprocket mounting bolt	M10 × 1.5	6.9±0.7	50±5.1
16	Under carriage	Track roller mounting bolt	M12 × 1.75	12.3±1.2	89±8.7
17	Others	Counterweight mounting bolt	M20 × 2.5	57.9±8.7	432±62.9
18		Additional counterweight mounting bolt	M24 × 3.0	100±15	723±108
19		Canopy mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
20		Operator's seat mounting bolt	M 8 × 1.25	3.4±0.7	24.6±5.1

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 : 13 l

(3.4 U.S.gal)

- (5) Disconnect hoses (44) and remove connectors (24).
- (6) Disconnect pilot line hoses (12, 14, 43) and remove connectors (31, 34, 36).
- (7) Remove socket bolts (20) and disconnect pump suction tube (3).

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

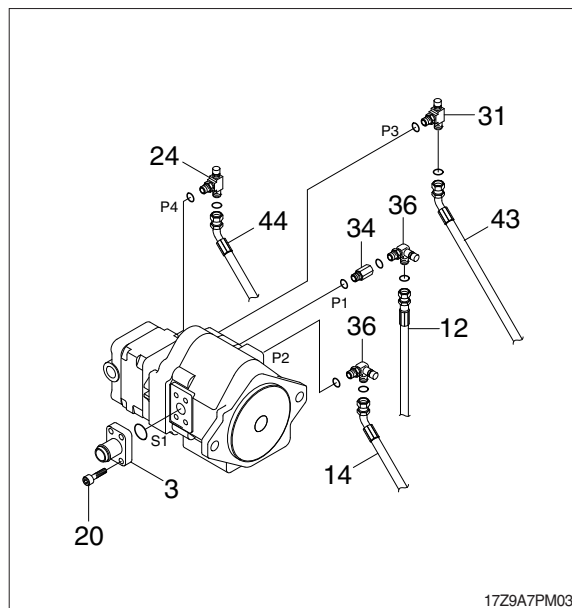
- (8) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 13 kg (29 lb)

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



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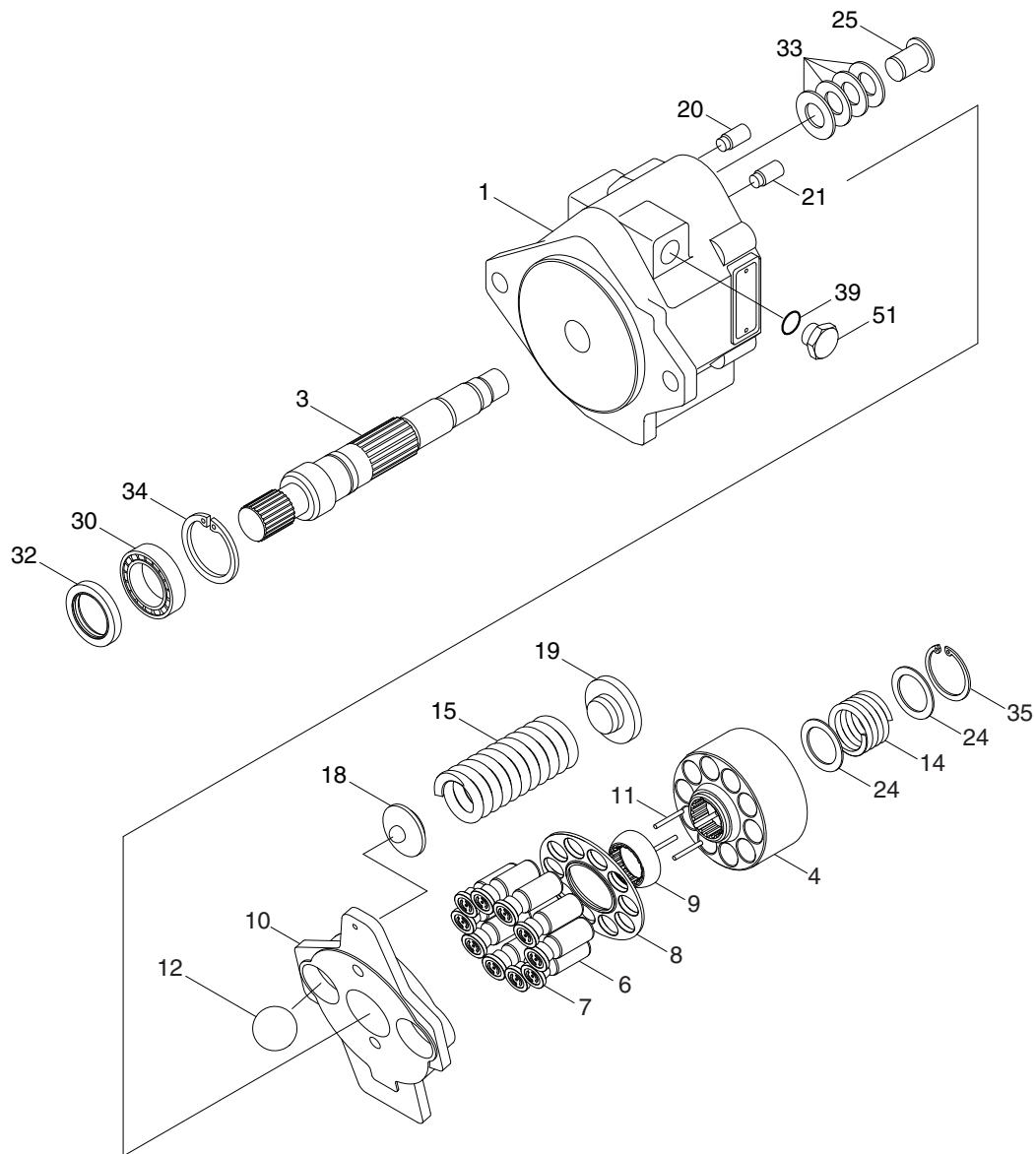
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2) INSTALL

- (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

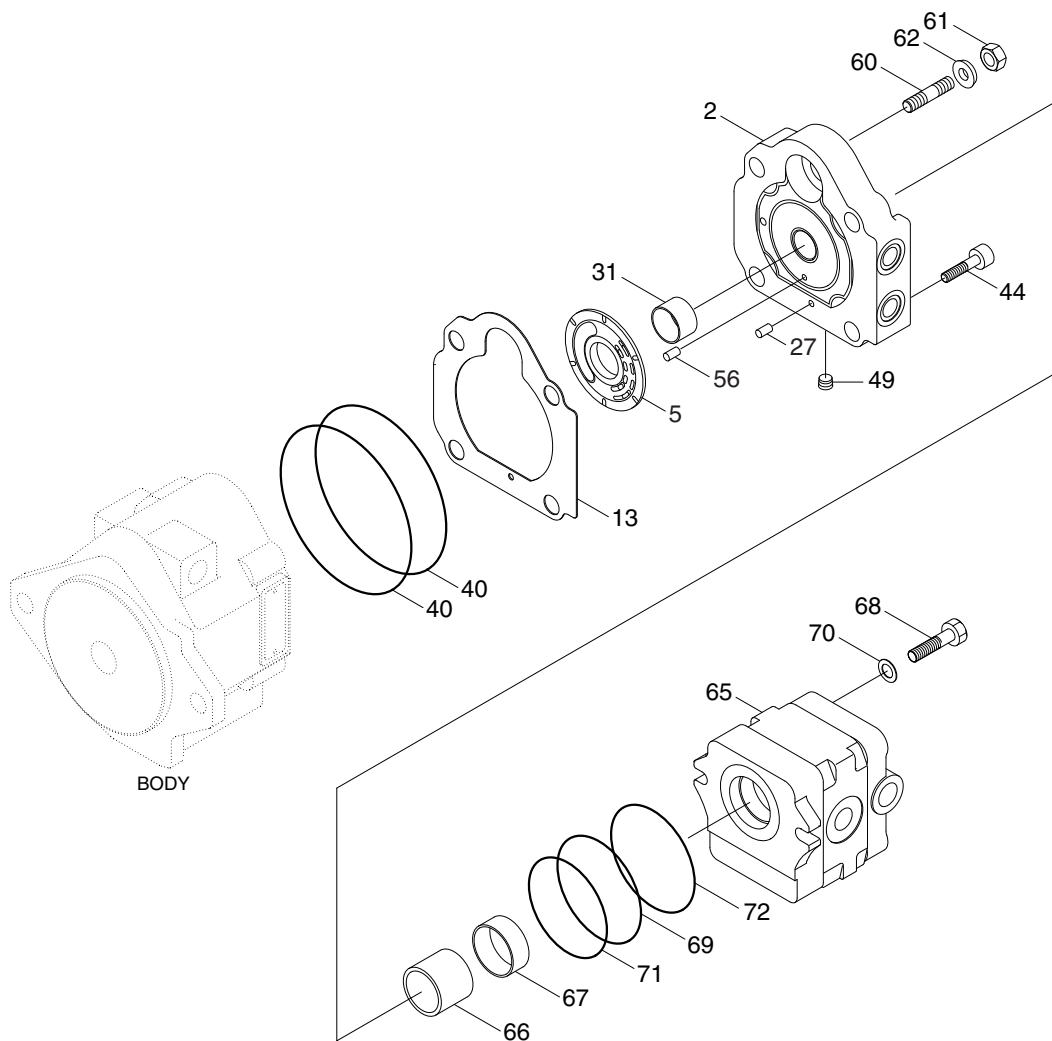
1) STRUCTURE (1/2)



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1	Body S	12	Ball	30	Ball bearing
3	Shaft	14	Spring C	32	Oil seal
4	Cylinder barrel	15	Spring T	33	Dish spring
6	Piston	18	Spring holder	34	Snap ring
7	Shoe	19	Spring guide	35	Snap ring
8	Shoe holder	20	Pin	36	Snap ring
9	Barrel holder	21	Rod G	39	O-ring
10	Swash plate	24	Retainer	51	Plug
11	Needle	25	Stopper pin A		

STRUCTURE (2/2)



2 Body H
 5 Valve plate
 13 Packing
 27 Pin
 31 Needle bearing
 40 O-ring
 44 Screw

49 Plug
 56 Spring pin
 60 Screw
 61 Nut
 62 Seal washer
 65 Gear pump
 66 Coupling

67 Collar
 68 Screw
 69 O-ring
 70 Washer
 71 O-ring
 72 O-ring

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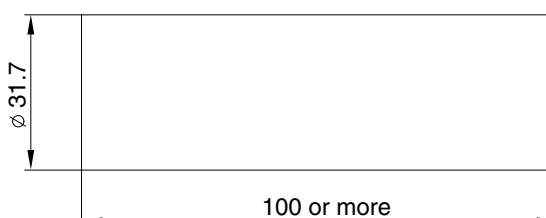
3. ASSEMBLE AND DISASSEMBLE

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	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



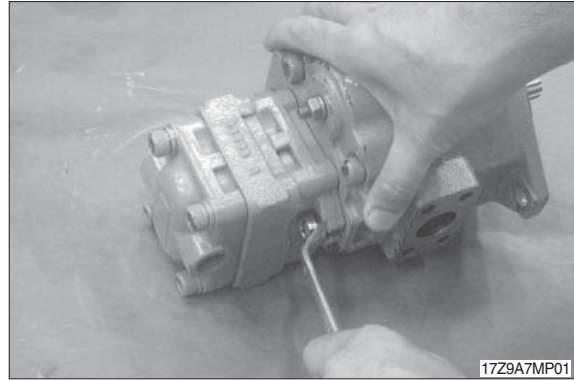
Special tooling for oil seal

3) DISASSEMBLING

(1) Disassembling of gear pump

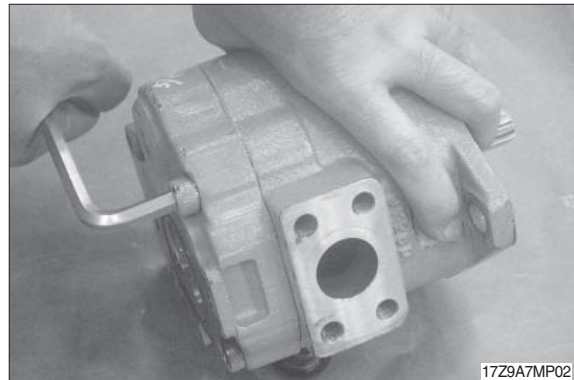
Remove two screws (68) with spanner wrench 13 mm, and after that remove two washer (70), gear pump (65), collar (67) and coupling (66).

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

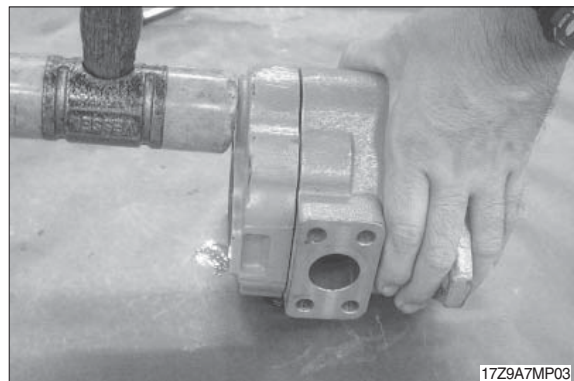


(2) Separation of body S and body H

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

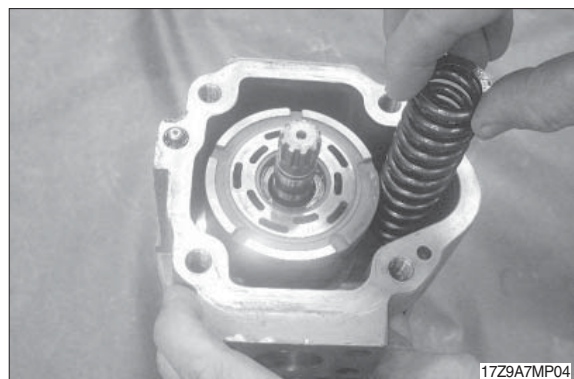


- ※ If you tap the part of inserted spring of body H with hummer softly, it is easy for separation.

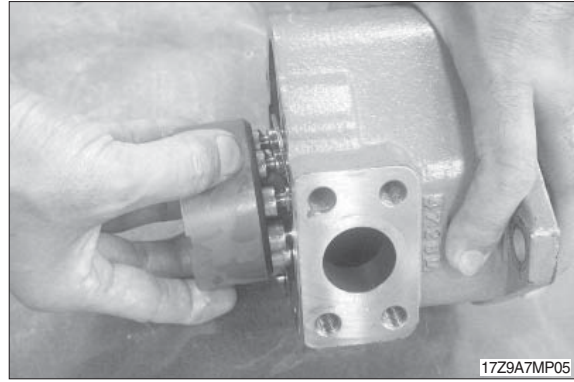


(3) Disassembling of body S kit

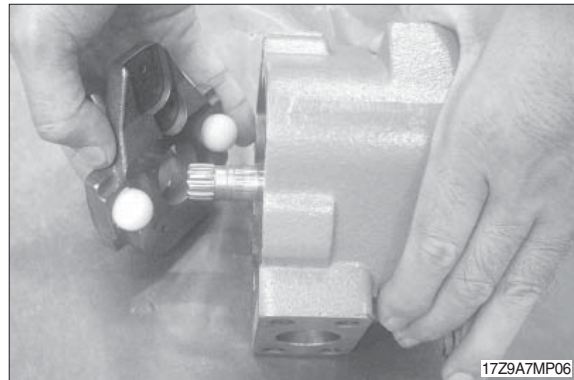
- ① Remove spring T (15) from body S kit, then take off spring holder (18).



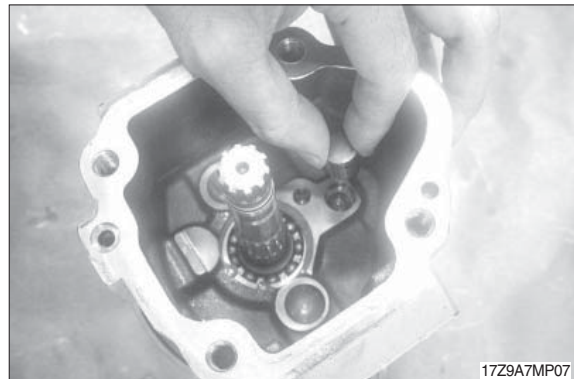
② Remove cylinder barrel kit.



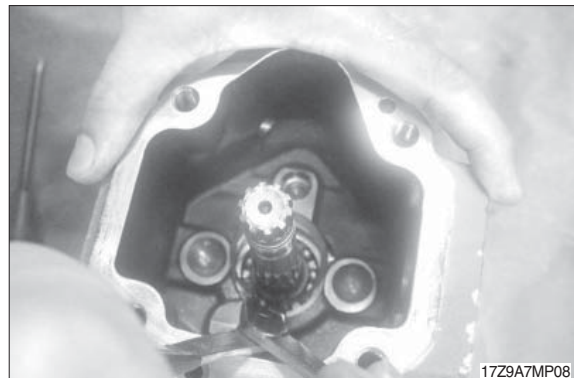
③ Remove swash plate (10) and two balls (12).



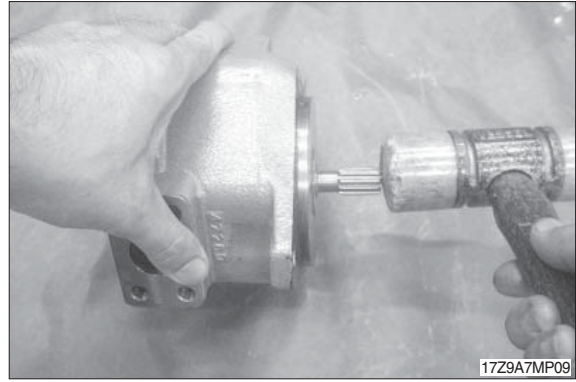
④ Remove stopper pin A (25), dish washers (33), rod G (21).



⑤ Remove snap ring (34) from body S (1).

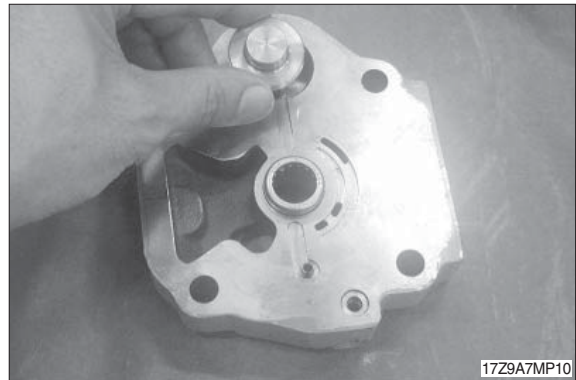


- ⑥ Tap the end of shaft (3) with hammer, then shaft with bearing (30) come off.



(4) Disassembling of body H kit

Remove spring guide (19) from body H.



4) ASSEMBLING

(1) Precautions during assembling

Reverse the above procedures for assembling.

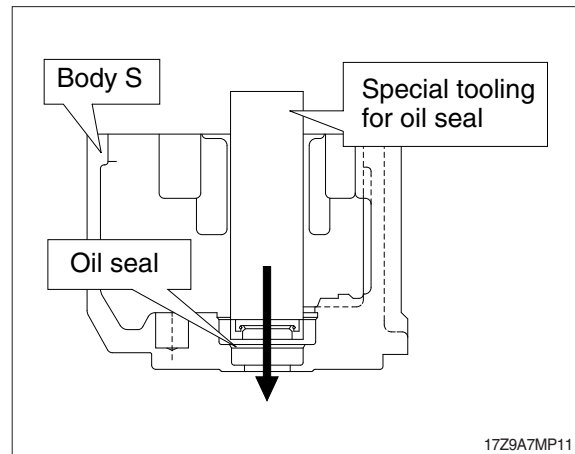
When assembling, be very careful to wash parts in clean oil, to prevent dusts and water from adhering to parts entering assemblies and not to scratch on the sliding surfaces of all parts.

- ※ 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 body S kit

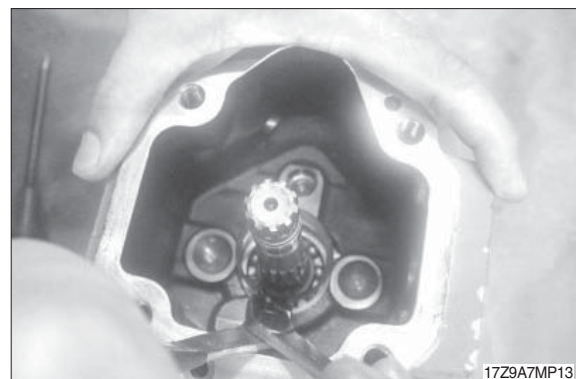
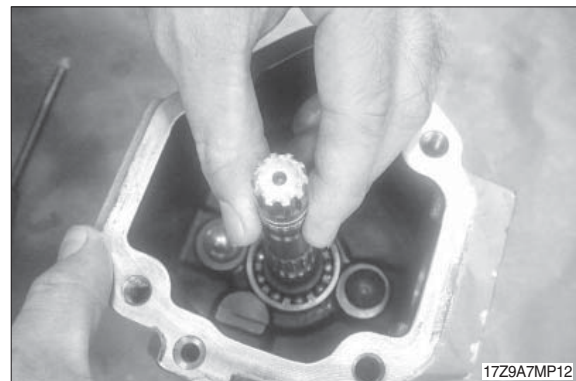
① Press-fit oil seal into body S (1).

- ※ 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 following special tooling with hammer.



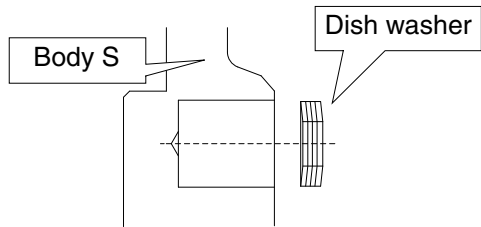
② Set shaft (3) with bearing (30) and snap ring (34) in this order into body S (1).

- ※ Pay attention not to damage the oil seal when assembling the shaft.

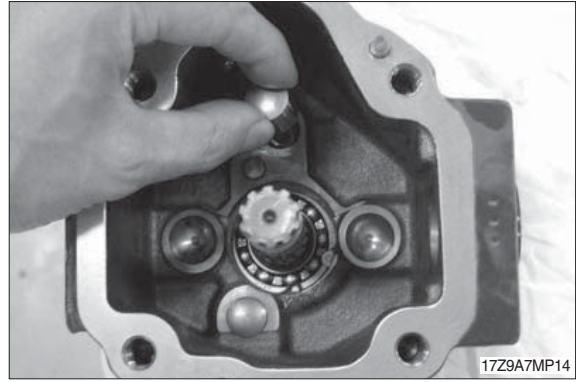


- ③ Set four dish springs (33), then set stopper pin A (25) and stopper pin B (26) into body S (1).

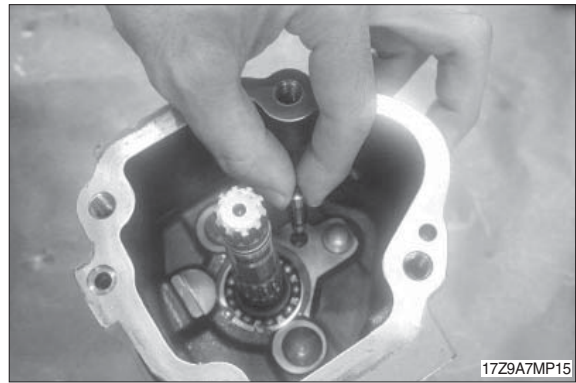
※ Pay attention to direction of the dish washer.



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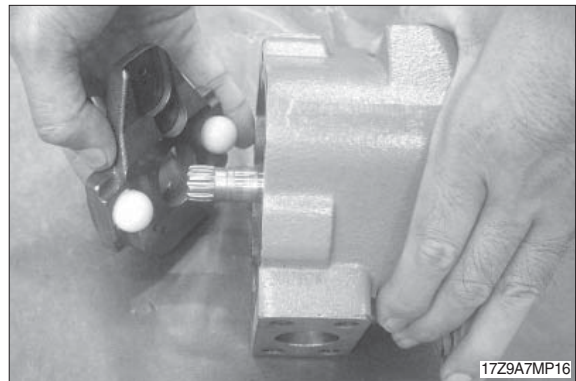


- ④ Set rod G (21) into body S (1).

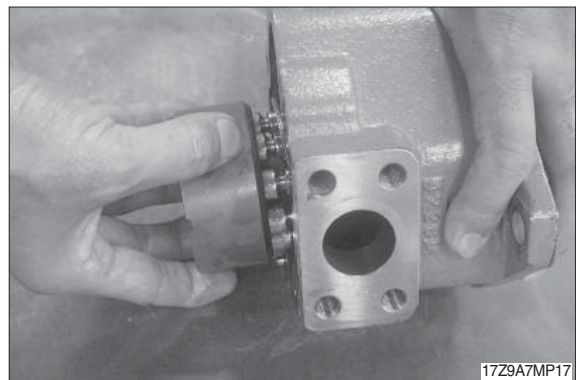


- ⑤ Put two balls (12) in the hole of swash plate (10) and install it in body S.

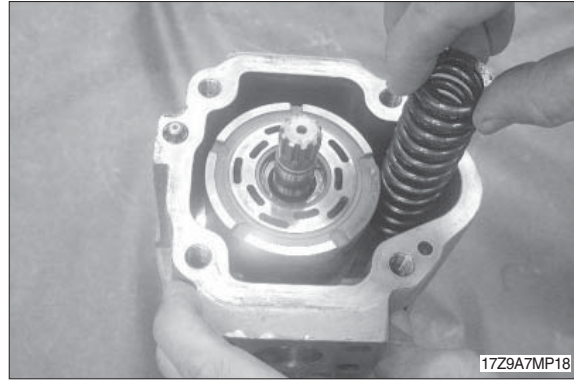
※ Apply grease on the balls if they drop out.



- ⑥ Assemble cylinder barrel kit into the body S (1).

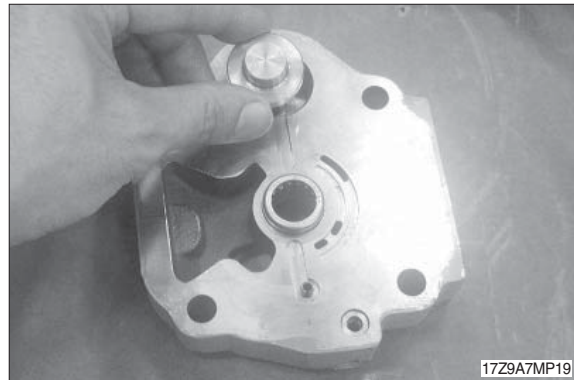


- ⑦ Set spring T (15) to spring holder (18), then set them together into the body S (1).



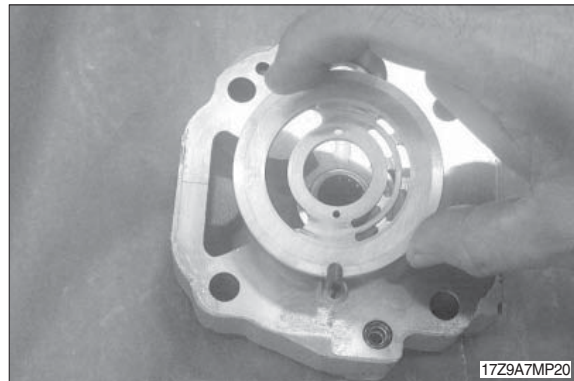
(3) Assembling of body H kit

- ① Set spring guide (19) in body H (2).



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

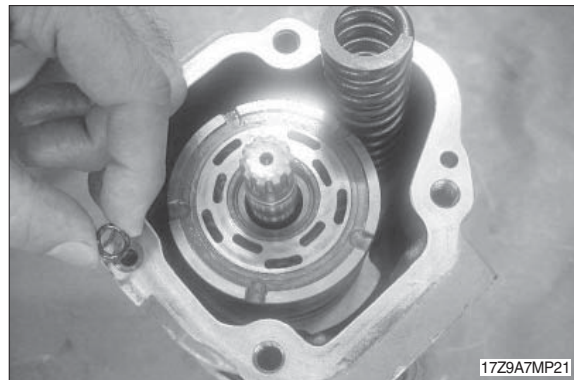
- ※ V notch copper alloy side of valve plate slides with cylinder barrel (4) and be careful not to set the valve plate to a wrong direction.



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

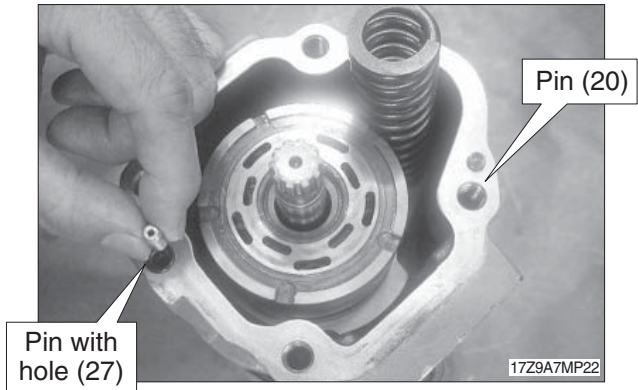
- ① Place O-ring (40) on body S.

- ※ Use new O-ring for assembling.



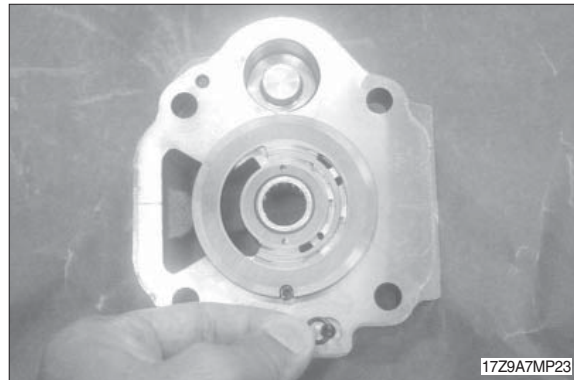
② Set pin (20) and pin (27) on body S.

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



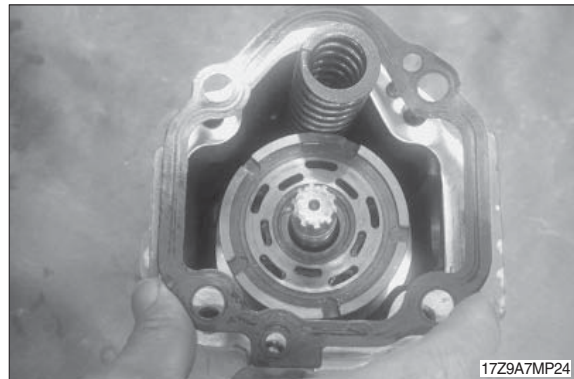
③ Place O-ring (40) on body S.

Use new O-ring for assembling.



④ Place packing (13), position it with locating pin (20) on body S.

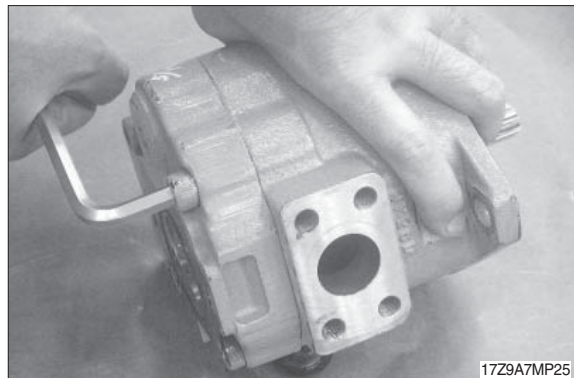
Use new gasket for assembling.



⑤ 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, M10×40) into the lower side two screw holes, after that, replace the upper side two screws (M10×65) to the regular size screws (44, M10×40) and fix them.

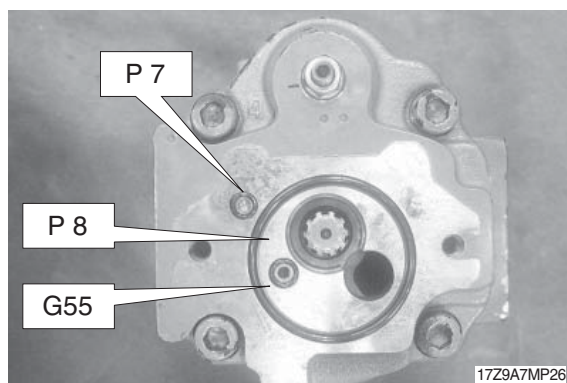
· Tightening torque : 5.2~6.6 kgf · m
(37.6~47.7 lbf · ft)



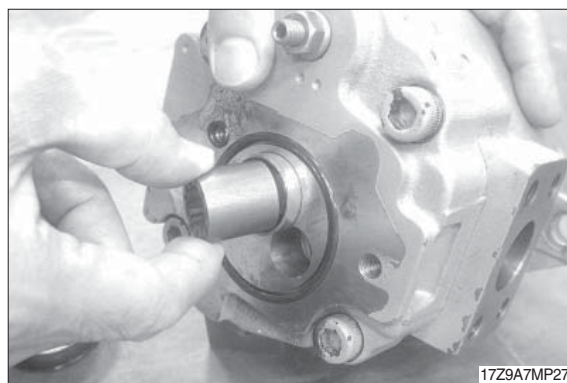
(5) Installation of gear pump kit

① Place O-ring (69, 71, 72) on the installation side of body H.

※ Use new O-ring for assembling.

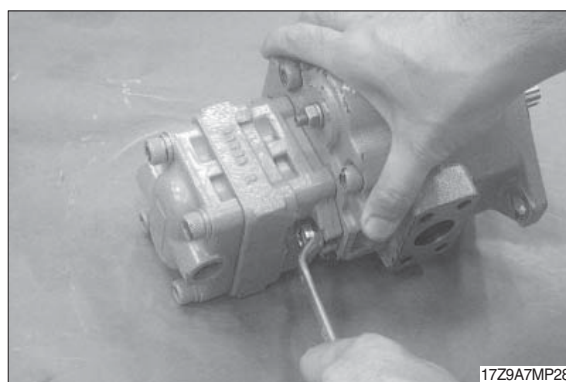


② Set collar (67), coupling (66).



③ Install gear pump kit (65) and fix it by two screws (68, M8×25) and washers (70) with spanner wrench 13 mm.

· Tightening torque : 2.0~2.4 kgf · m
(14.5~17.4 lbf · ft)



(6) Inspection of assembling

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

GROUP 4 MAIN CONTROL VALVE

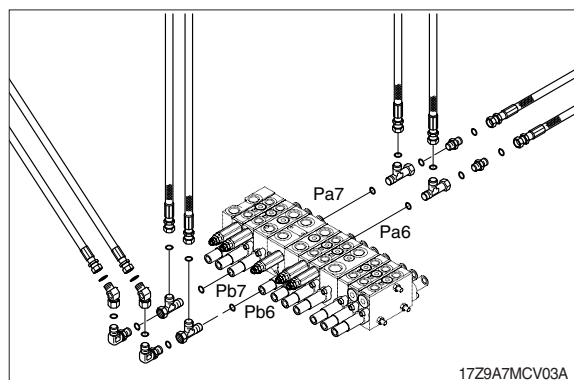
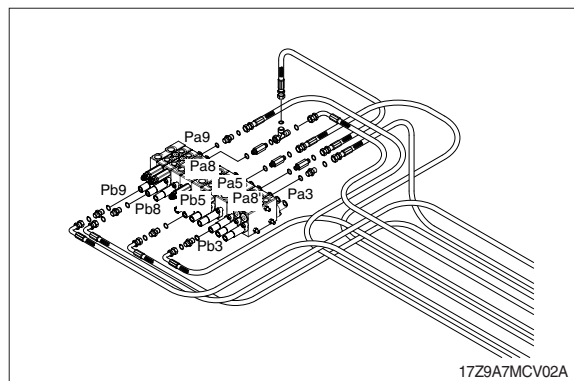
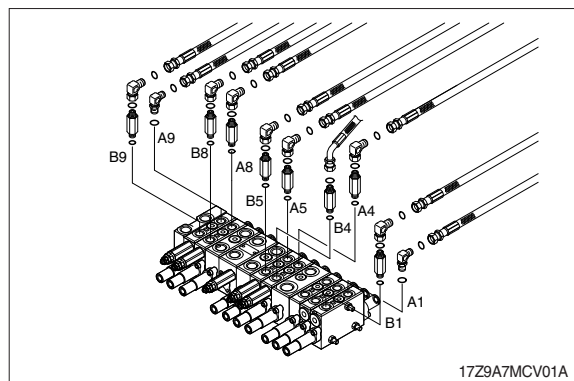
1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

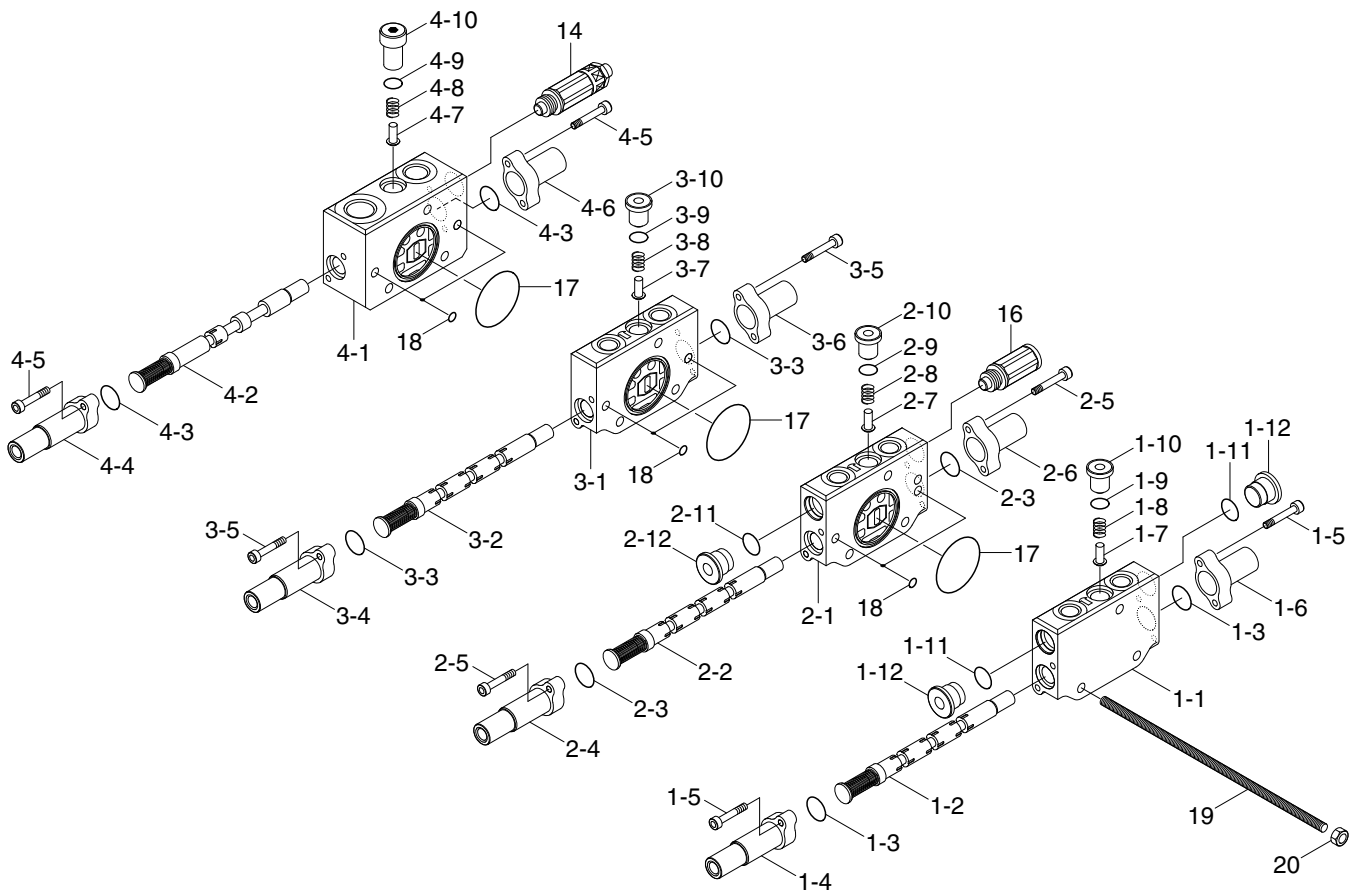
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure 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 : 14 kg (31 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.



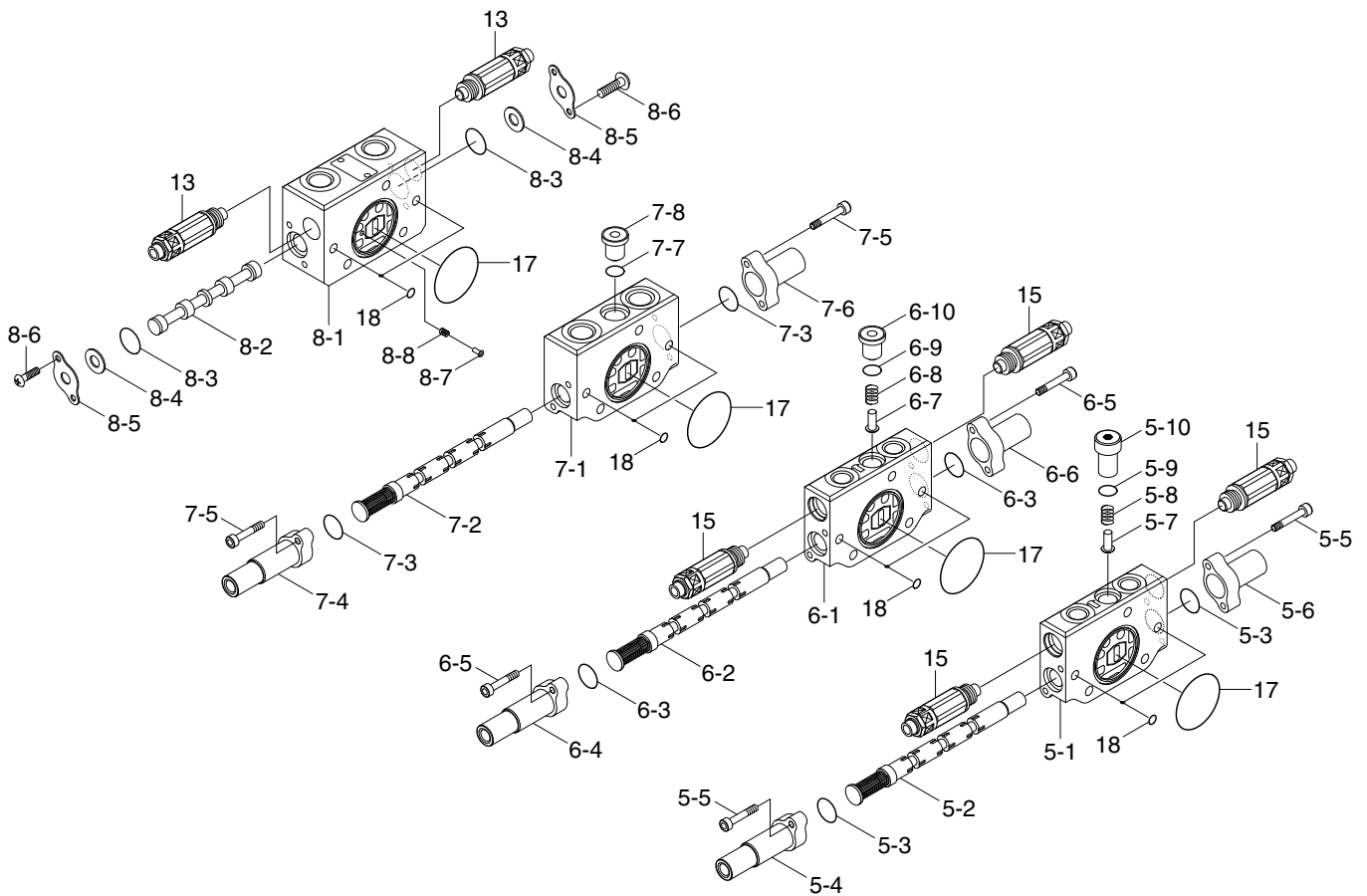
2. STRUCTURE (1/3)



17Z9A2MC02

1	Dozer work body	2-5	Bolt	3-10	Plug
1-1	Work body	2-6	Pilot cover	4	Connecting body
1-2	Spool assy	2-7	Poppet	4-1	Work body
1-3	O-ring	2-8	Spring	4-2	Spool assy
1-4	Pilot cover	2-9	O-ring	4-3	O-ring
1-5	Bolt	2-10	Plug	4-4	Pilot cover
1-6	Pilot cover	2-11	O-ring	4-5	Bolt
1-7	Poppet	2-12	Plug	4-6	Pilot cover
1-8	Spring	3	Swing work body	4-7	Poppet
1-9	O-ring	3-1	Work body	4-8	Spring
1-10	Plug	3-2	Spool assy	4-9	O-ring
1-11	O-ring	3-3	O-ring	4-10	Plug
1-12	Plug	3-4	Cover	14	Relief valve
2	Boom swing work body	3-5	Bolt	16	Anticavitation valve
2-1	Work body	3-6	Pilot cover	17	O-ring
2-2	Spool assy	3-7	Poppet	18	O-ring
2-3	O-ring	3-8	Spring	19	Tie bolt
2-4	Pilot cover	3-9	O-ring	20	Hex nut

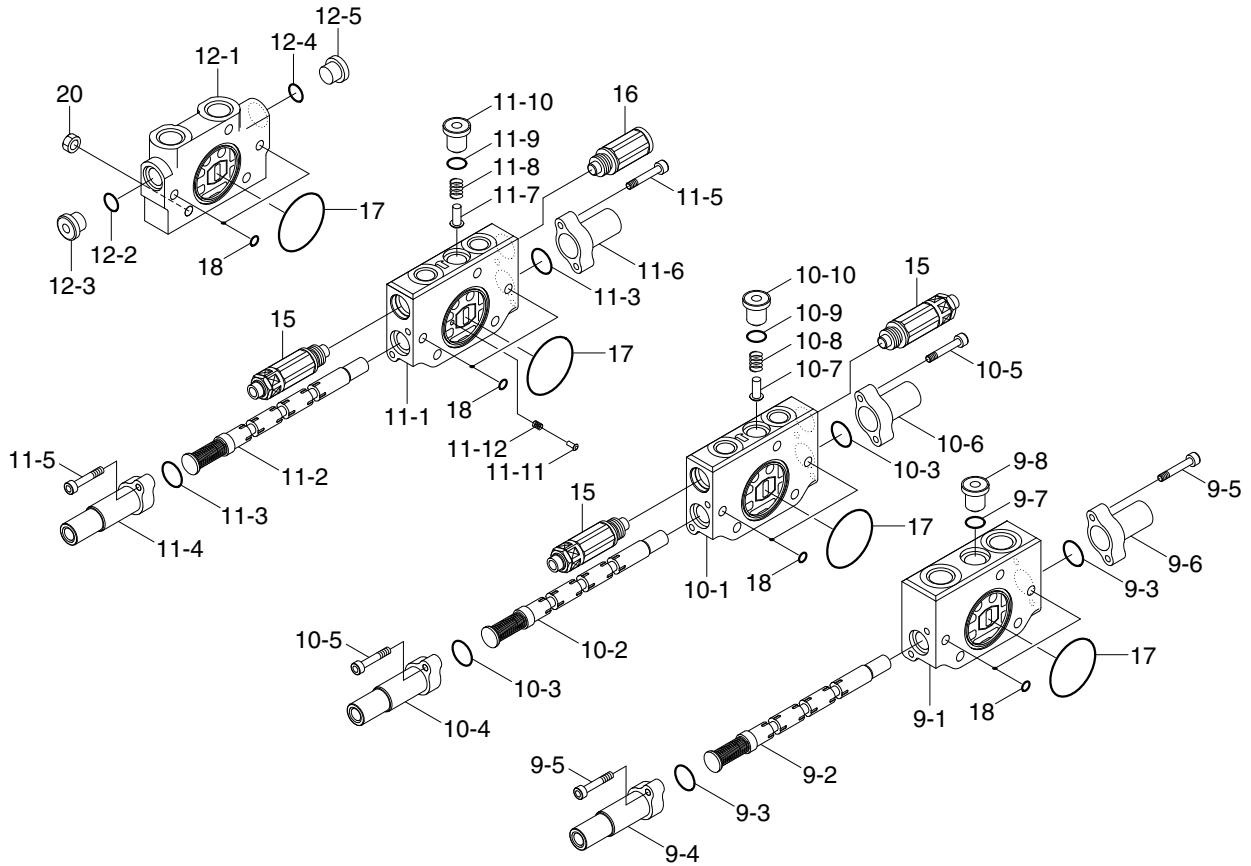
STRUCTURE (2/3)



17Z9A2MC03

5	PTO work body	6-4	Pilot cover	7-8	Plug
5-1	Work body	6-5	Bolt	8	Inlet work body
5-2	Spool assy	6-6	Pilot cover	8-1	Work body
5-3	O-ring	6-7	Poppet	8-2	Spool assy
5-4	Pilot cover	6-8	Poppet	8-3	O-ring
5-5	Bolt	6-9	O-ring	8-4	Plate
5-6	Pilot cover	6-10	Plug	8-5	Plate
5-7	Poppet	7	Travel work body	8-6	Screw
5-8	Spring	7-1	Work body	8-7	Poppet
5-9	O-ring	7-2	Spool assy	8-8	Spring
5-10	Plug	7-3	O-ring	13	Relief valve
6	Arm work body	7-4	Pilot cover	15	Overload relief valve
6-1	Work body	7-5	Bolt	17	O-ring
6-2	Spool assy	7-6	Pilot cover	18	O-ring
6-3	O-ring	7-7	O-ring		

STRUCTURE (3/3)



17Z9A2MC04

- | | | | | | |
|------|------------------|-------|------------------|------|-----------------------|
| 9 | Travel work body | 10-5 | Bolt | 11-8 | Spring |
| 9-1 | Work body | 10-6 | Pilot cover | 11-9 | O-ring |
| 9-2 | Spool assy | 10-7 | Poppet | 12 | Outlet work body |
| 9-3 | O-ring | 10-8 | Spring | 12-1 | Work body |
| 9-4 | Pilot cover | 10-9 | O-ring | 12-2 | O-ring |
| 9-5 | Bolt | 10-10 | Plug | 12-3 | Plug |
| 9-6 | Pilot cover | 11 | Bucket work body | 12-4 | O-ring |
| 9-7 | O-ring | 11-1 | Work body | 12-5 | Plug |
| 9-8 | Plug | 11-2 | Spool assy | 15 | Overload relief valve |
| 10 | Boom work body | 11-3 | O-ring | 16 | Anticavitation valve |
| 10-1 | Work body | 11-4 | Pilot cover | 17 | O-ring |
| 10-2 | Spool assy | 11-5 | Bolt | 18 | O-ring |
| 10-3 | O-ring | 11-6 | Pilot cover | 20 | Hex nut |
| 10-4 | Pilot cover | 11-7 | Poppet | | |

3. DISASSEMBLY

1) PRECAUTIONS FOR DISASSEMBLY

- (1) 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.
 - (2) Before disassembly work, prepare necessary material such as the structural drawing for control valve to fully understand the structure and others.
 - (3) When removing the control valve from the machine, put a dustproof cap on each port and then 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.
 - (4) Since there is a possibility of rust when the disassembled parts are left, apply anti-corrosive oil to the parts and seal them.
 - (5) Hold the control valve body when carrying or moving. Especially, do not hold the exposed spool after removing a pilot cover from the control valve.
 - (6) Do not hit the control valve even if it does not move smoothly.
 - (7) 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 test device.
Accordingly, when the disassembly might be possible technically but the test and/or adjustment might be impossible, do not carry out 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 becomes high temperature after operating the machine; after checking that the temperature becomes low, start the work.
 - ※ 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

(1) 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
Hexagon spanner	Each 1	4, 6 and 8 mm
Spanner	Each 1	13, 19 and 22 mm
Socket wrench	Each 1	13, 19 and 22 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	-
Screwdriver for cross	1	-
Tweezers	1	-

(2) Prepare clean wash oil, hydraulic fluid, grease, tag paper, marker pen, and others before work.

3) DISASSEMBLY OF EACH PART

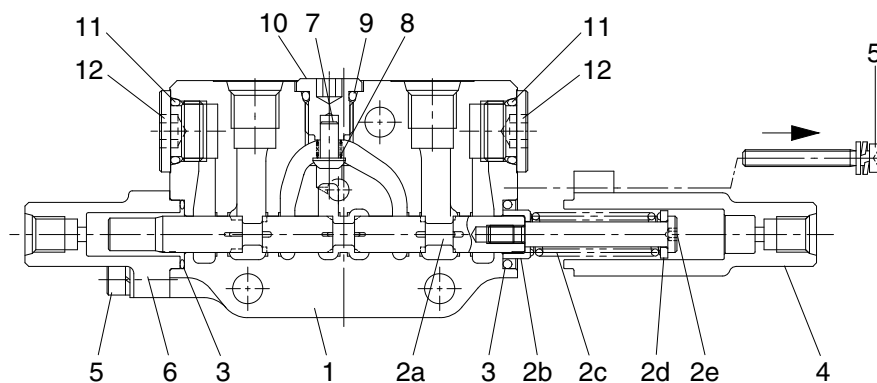
Before disassembly work, check that there is no dust on the outside of the control valve and then place it on a workbench with actuator ports facing upward.

(1) Spool draw-out procedures

Except P1, P2 inlet component

Taking the dozer spool as an example, the draw-out procedures are as follows.

- ① Remove 2 hexagonal socket head bolt with washer (5) with 4 mm hexagonal wrench.
- ② Remove pilot cover (4).
- ③ With a spring in the dozer 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 (3) is on the bottom of body side flange.



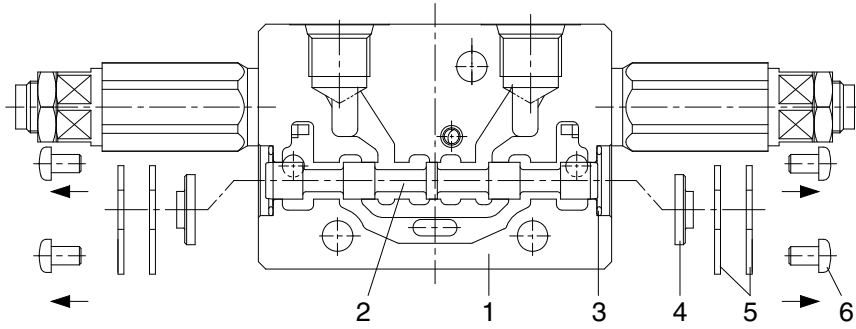
17Z9A7MCV01

1	Work body	2e	Spool end	8	Check valve spring
2	Dozer spool assy	3	O-ring	9	O-ring
2a	Dozer spool	4	Pilot cover	10	Check valve plug
2b	Spring seat	5	Hex socket head with washer	11	O-ring
2c	Spring	6	Pilot cover	12	Plug
2d	Spring seat	7	Check valve poppet		

P1, P2 inlet component

The draw-out procedures for P1, P2 inlet component spool are as follows.

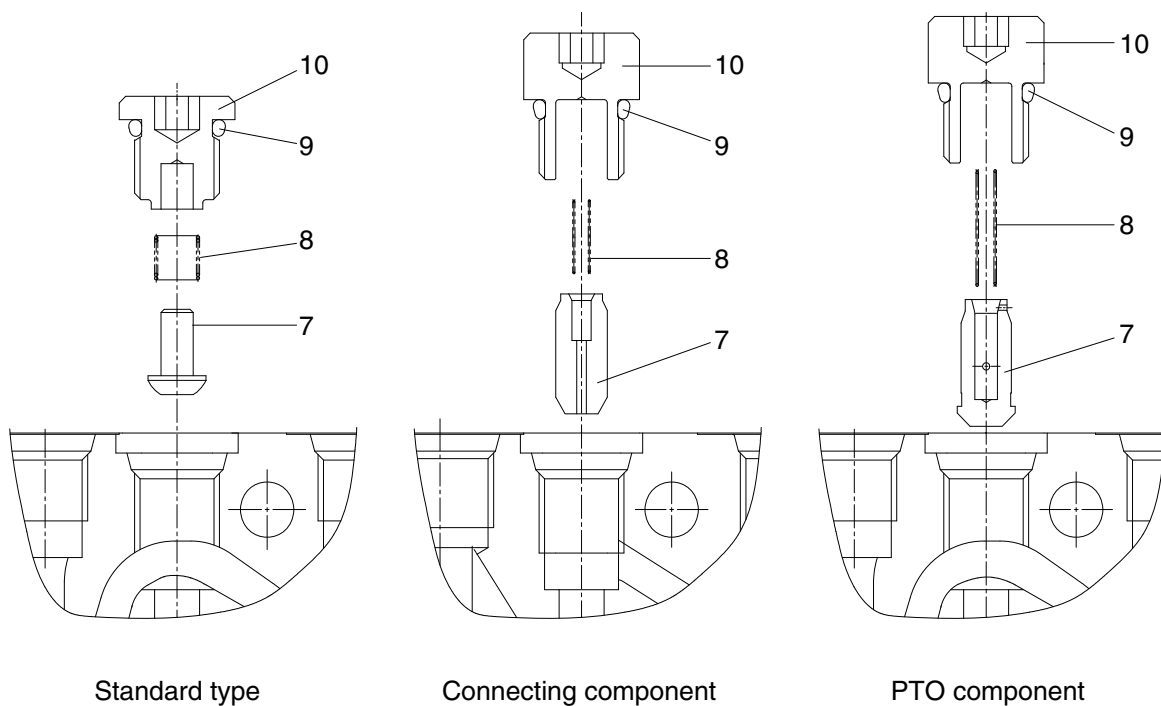
- ① Loosen and remove 2-M5 cross recessed head screws (6) by using screwdriver for cross.
- ② Remove 2-seat plates (5), and pull a seat plate (4) out by using tweezers.
- ③ A reverse-side also similarly pull out 2-seat plates (5) and a seat plate (4).
- ④ With a spool (2) exposed, pull out a spool by magnet.



17Z9A7MCV02

(2) Check valve disassembly procedures

- ① Hold the control valve body at workbench or hold it by two or more people.
- ② Loosen and remove check valve plug (10) at the center of the control valve upper surface with 6 mm hexagonal wrench.
When it is hard to loosen the plug because O-ring (9) 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 (8) and check valve (7) with tweezers or magnet.
- ④ Connecting component and PTO component are different in shape; however, they can be disassembled in the same manner.
- For travel component pull out only check valve plug (8, see page 7-22) in the same procedures since there is no check valve.



17Z9A7MCV03

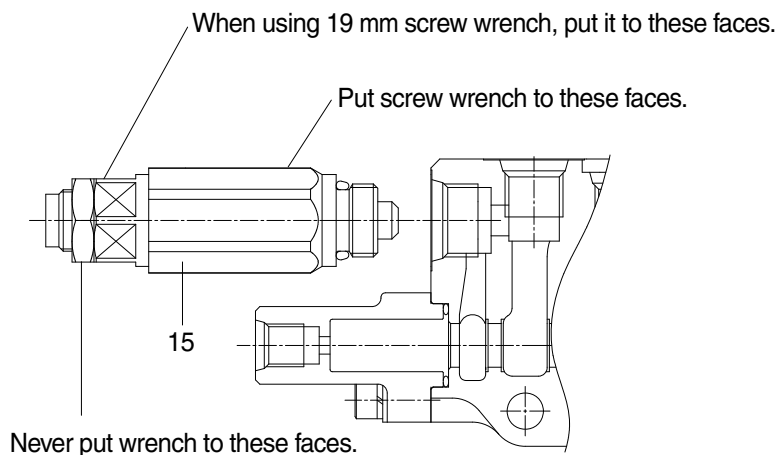
(3) Accessory valve disassembly procedures

- ※ 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 the accessory valve as assy if any malfunction occurs.

Main relief valve and overload relief valve

Taking overload relief valve in the arm section as an example, the removal procedures are as follows.

- ① Loosen and remove overload relief valve (15) by using 22 mm screw wrench or socket wrench.
 - ② Put screw wrench (or socket wrench) to 22 mm hexagonal part of pressure regulating body.
 - ③ If there is no 22 mm screw wrench (or socket wrench), it is also possible to loosen and remove by putting 19 mm screw wrench to the hexagonal part, as shown in the figure.
 - ④ The main relief valve for P1, P2 and P3 are slightly different in shape; however, they can be disassembled in the same manner.
- ※ If using 19 mm screw wrench to remove, never put it to the lock nut part.
If not, only lock nut is loosened to change the relief valve setting, which could result in the degradation in performance or damage.

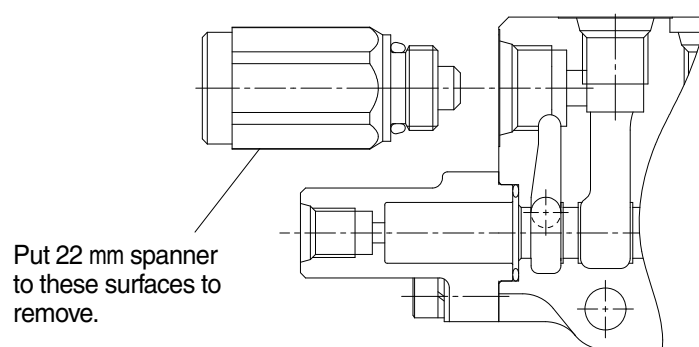


17Z9A7MCV04

Anticavitation valve

As well as overload relief valve, loosen and remove anticavitation valve by using 22 mm spanner or socket wrench.

- ※ Removing anticavitation valve causes the seat to be exposed. Flaws on the seat causes internal leakage, which makes the holding performance of actuator worse. When storing it, be careful not to damage the seat.



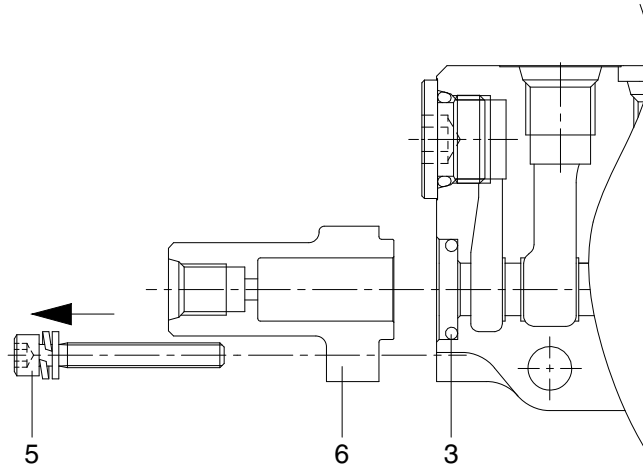
17Z9A7MCV05

(4) The other parts disassembly procedures

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

Pilot cover

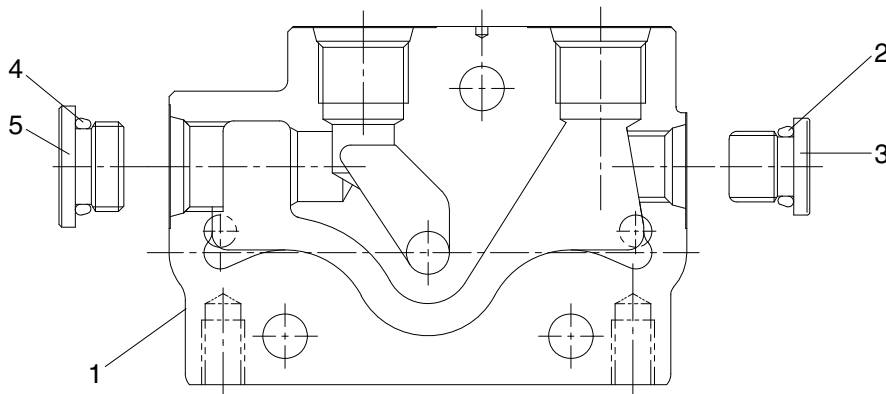
- ① Remove 2 hexagonal socket head bolt with washer (5) with 4 mm hexagonal wrench.
 - ② Remove pilot cover (6).
- Check O-ring (3) is on the bottom of body-side flange.



17Z9A7MCV06

The plug (PF3/8, PF1/4) of outlet component

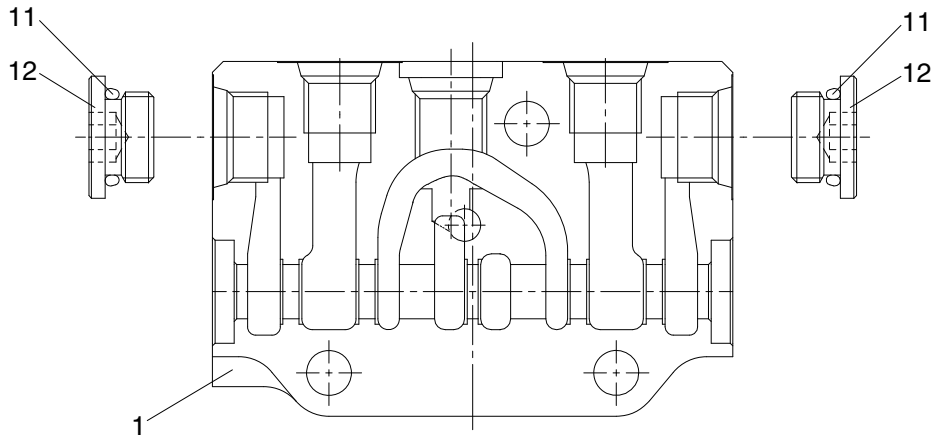
- ① Loosen plug (3) by using 6 mm hexagonal wrench to remove it from outlet body (1).
- ② Loosen plug (5) by using 8 mm hexagonal wrench to remove it from outlet body (1).



17Z9A7MCV07

The plug (PF3/8) of boom swing and dozer component

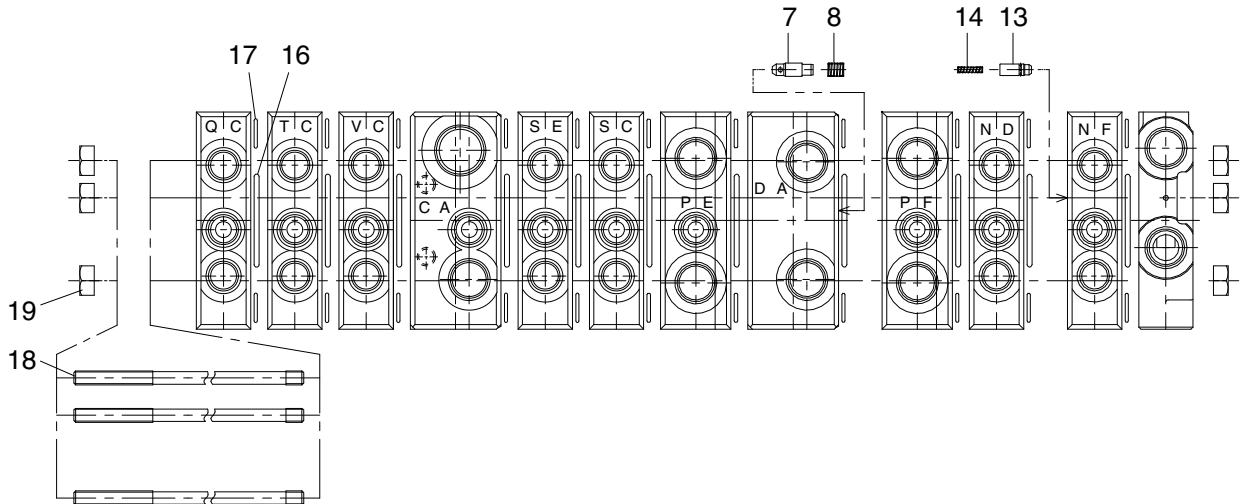
- ① Using dozer component as an example, the disassembly procedures are as follows.
- ② Remove plug (12) from the body (1) by using 8 mm hexagonal wrench to loosen.



17Z9A7MCV08

(5) Component body disassembly procedures

- ① Loosen and remove 3-M8 nuts (19) from both end faces of control valve, which are for assembling component body, by using 13 mm spanner or socket wrench.
- ② When pulling out 3-M8 tie bolts (18) from the side faces, each component body can be in individual condition. At this time, be careful not to drop or lose O-rings (16,17), poppet check valve(7,13) and spring check valve (8,14) mounted on mating surfaces of each component body.



17Z9A7MCV09

QC	Dozer	SE	PTO	PF	Travel
TC	Boom swing	SC	Arm	ND	Boom
VC	Swing	PE	Travel	NF	Bucket
CA	Connecting	DA	Inlet P1 and P2	BH	Outlet

(6) Precautions after disassembly

- ※ For the parts already removed in the work, store and/or transport them with attention on 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

The disassembly and assembly of our products are to be carried out at our factory in principle. If there is a necessity of them unavoidably, observe the following precautions and carry out the work at a factory where there are engineers with sufficient technique for hydraulic devices.

- (1) 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.
- (2) 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.
- (3) For the parts to be used in assembly, dip in fluid oil as need arises to reassemble after washing well in washing oil and being dried.
- (4) After cleaning and degreasing the surface sufficiently, apply loctite to 2 threads of the screw from the tip (Too much loctite could result in malfunction after squeezing out).
- (5) For the part to be attached or assembled with two or more bolts and nuts, fastening them evenly 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 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 restored.

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
Hexagon spanner	Each 1	4, 6 and 8 mm
Spanner	Each 1	13, 19 and 22 mm
Socket wrench	Each 1	13, 19 and 22 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	-
Screwdriver for cross	1	-
Tweezers	1	-

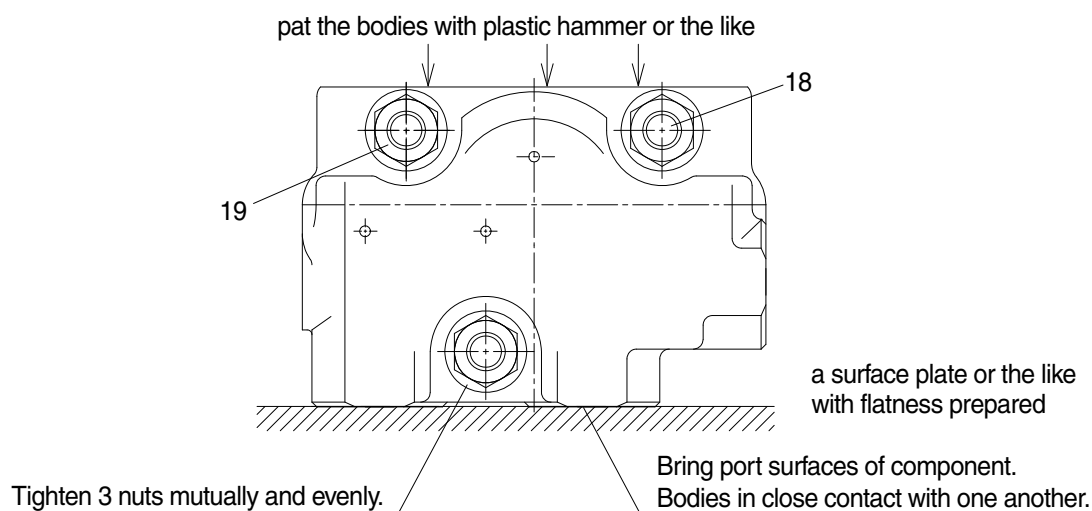
Prepare clean wash oil, hydraulic fluid, grease, tag paper, marker pen, and others before work.

4) ASSEMBLING WORK

For the fastening torque values for screws, see the page 2-6.

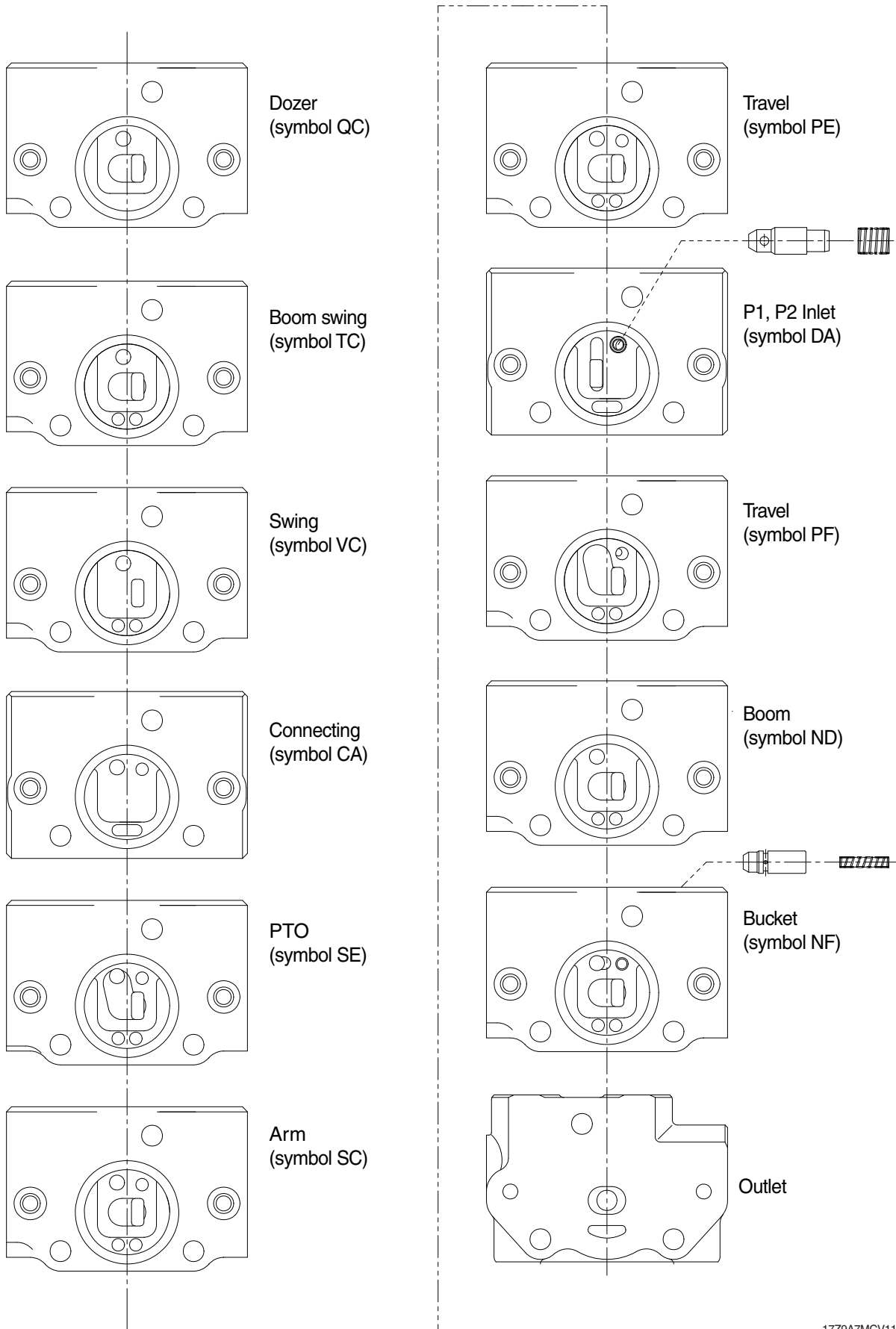
(1) Assembling body work

- ① Place component bodies with each mating surface facing up in the order of assembling.
Then, mount O-rings on mating surfaces of each component body.
However, do not apply hydraulic oil or grease to these O-rings.
(There is a possibility of mistaking them for oil leakage when oozing out from mating surfaces)
The next page shows the order of assembling component bodies and O-rings mounted on mating surfaces.
- ② On a surface plate or the like with flatness prepared, place each component body with actuator port surface facing down in the same order with the above ①.
At this time, insert it from the mating face in order of poppet check valve (7) and spring check valve (8) in P1, P2 inlet component body symbol "DA". And insert it also in the bucket component body symbol "NB" similarly in order of poppet check valve (13) and spring check valve (14).
 - ※ Then, check the mating surfaces in each component body for dust or the like and check whether O-rings shown in the delivery specifications are surely put in each groove for O-ring.
 - ※ Kinked O-rings 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.
- ③ Put 3-M8 tie bolts (18) through each component body from the side, and screw M8 nuts (19) on both ends lightly.
At this time, pat the bodies with plastic hammer or the like to align the port surface of each component body.
Then, tighten one-side nuts with the opposite side nuts fixed by 13 mm spanner.
Tighten 3-nuts equally and mutually, not all at once with specified torque.
Be careful that applying not specified torque causes the deformation of body or oil leakage.
 - Nut tightening torque : 1.4~1.5 kgf · m (10.1~10.8 lbf · ft)



Array of body

※ Do not apply hydraulic oil or grease to O-rings.



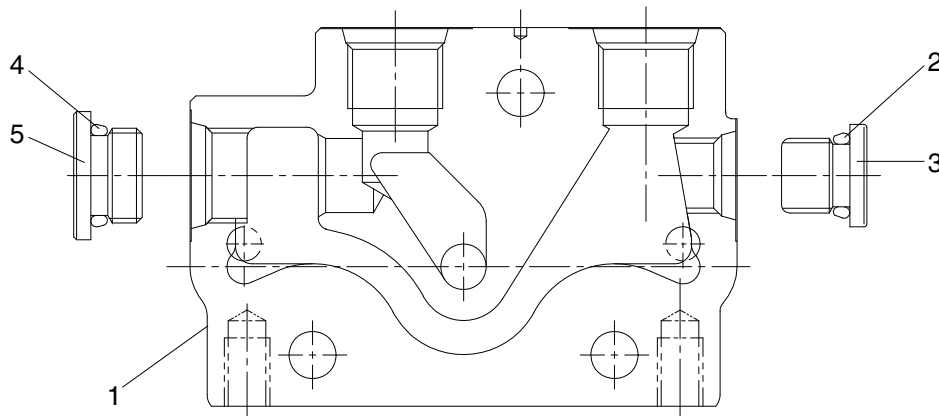
17Z9A7MCV11

(2) The other parts assembly procedures

① The plug (PF3/8, PF1/4) of outlet component

After checking that plug (3) is mounted with O-ring (2), screw the plug into outlet body (1) loosely and then tighten it with specified torque by using 6 mm hexagonal wrench.

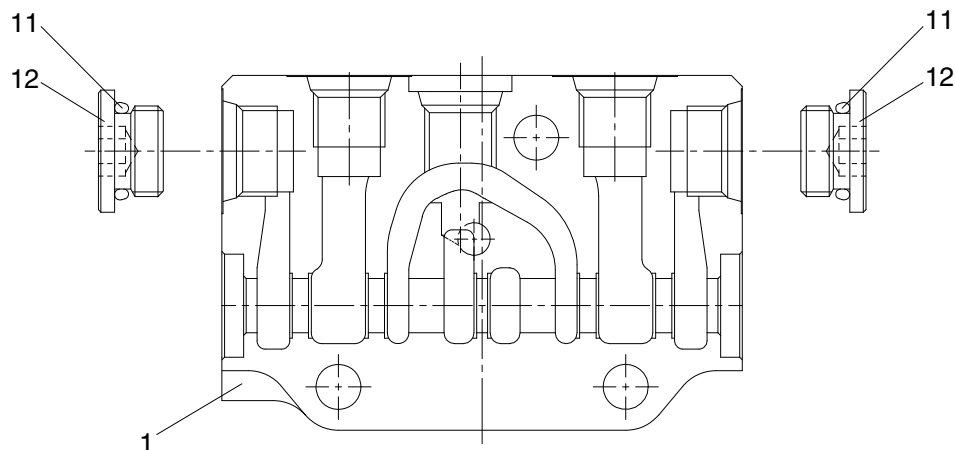
And after checking that plug (5) is mounted with O-ring (4), screw the plug into outlet body (1) loosely and then tighten it with specified torque by using 8 mm hexagonal wrench.



17Z9A7MCV12

② The plug (PF3/8) of boom swing and dozer component

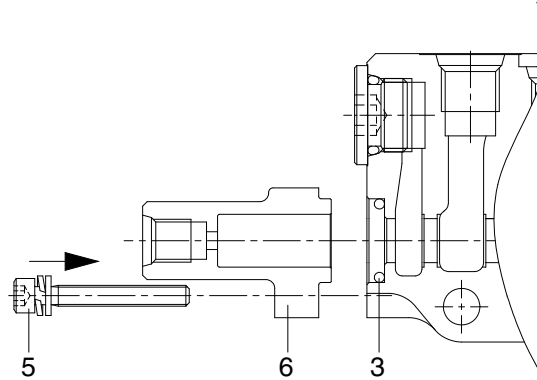
After checking that plug (12) is mounted with O-ring (11), screw the plug into component body (1) loosely and then tighten it with specified torque by using 8 mm hexagonal wrench.



17Z9A7MCV13

③ Pilot cover

- Install O-ring (3) securely on the flange bottom of the body.
- Insert pilot cover (6) into the flange of the body.
- Tighten bolt with washers (5) with specified torque by using 4 mm hexagonal wrench.



17Z9A7MCV14

(3) Accessory valve disassembly procedures

① Main relief valve and overload relief valve

Tighten main relief valve and overload relief valve by using 22 mm spanner or socket wrench.

- Put spanner (socket wrench) to 22 mm hexagonal part of pressure regulating body.

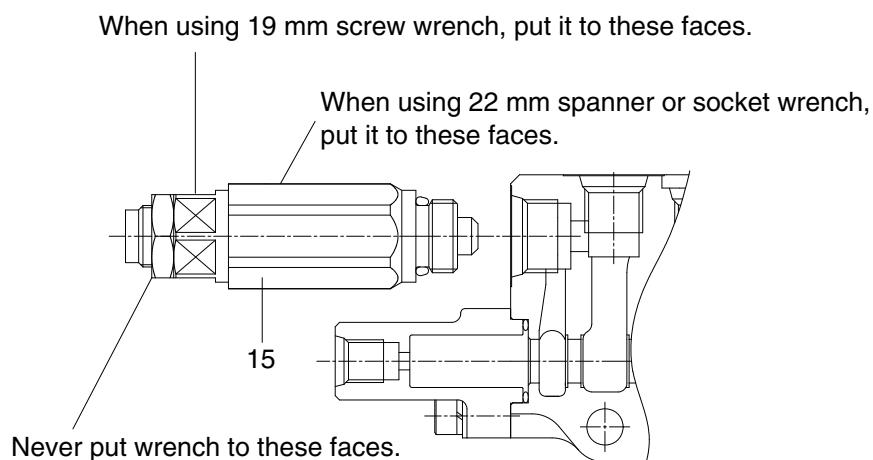
- If there is no 22 mm spanner (socket wrench), it is also possible to loosen and remove by putting 19 mm spanner to the hexagonal part as shown in the figure.

※ If using 19 mm screw wrench to remove, never put it to the lock nut part.

If not, only lock nut is loosened to change the relief valve setting, which could result in the degradation in performance or damage.

※ Before installing accessory valves (main relief valve, overload relief valve), check that there is no flaw or dust on the seat.

The presence of flaw or dust on the seat can cause internal leakage, resulting in the holding failure of actuator.



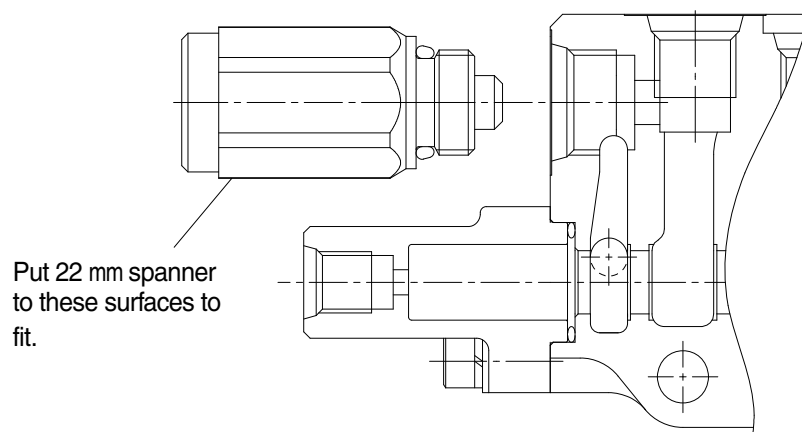
17Z9A7MCV15

② **Anticavitation valve**

As well as overload relief valve, fit anticavitation valve by using 22 mm spanner or socket wrench.

- ※ Before installing accessory valves (anticavitation valve), check that there is no flaw or dust on the seat.

The presence of flaw or dust on the seat can cause internal leakage, resulting in the holding failure of actuator.

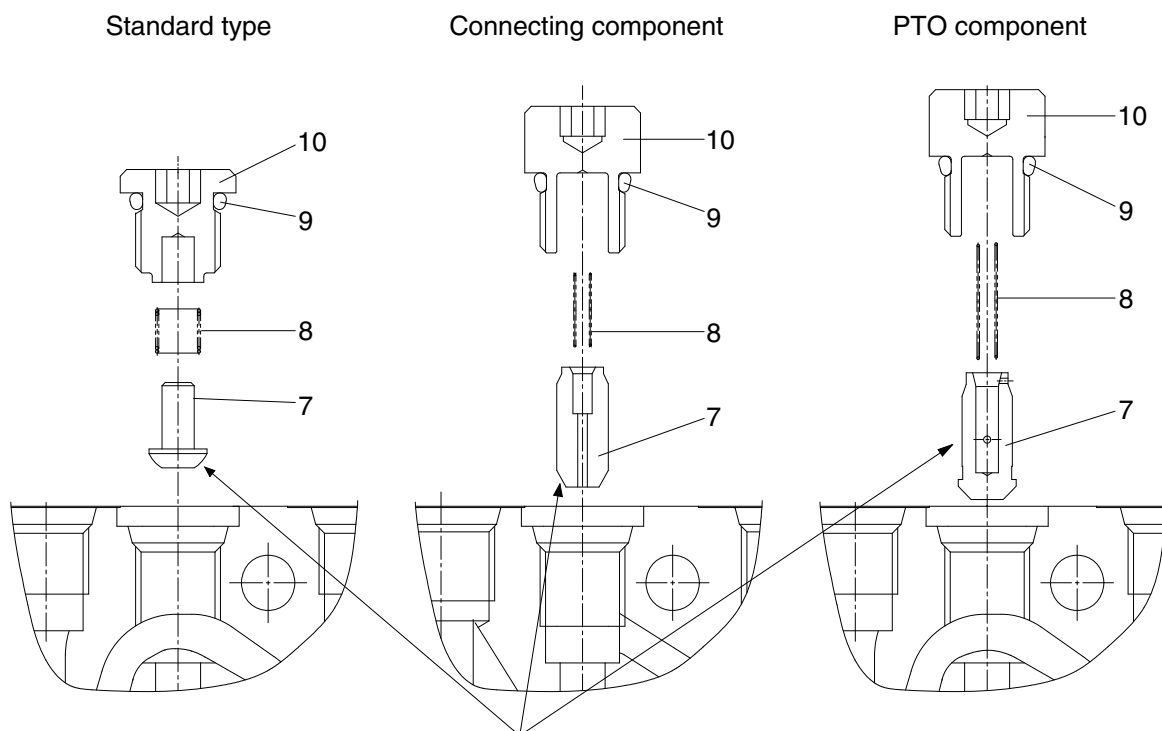


17Z9A7MCV16

(4) Check valve assembly procedures

- ① Hold the control valve body at workbench or hold it by two or more people.
- ② Insert check valve (7) with its bevel facing down vertically into the upper center of control valve's body (1). Then, insert check valve spring (8) into the body of check valve (7).
Be careful that inclined check valve (7) cannot be inserted into the hole of check valve plug (10).
(It is necessary to check that check valve is almost at the center.)
- ③ After checking that check valve plug (10) is surely mounted with O-ring (9), screw it in and tighten with specified torque by using 6 mm hexagonal wrench.
- ④ Connecting component and PTO component are different in shape; however, they can be assembled in the same manner.

Meanwhile, since track component does not have check valve nor check valve spring-check valve, the working in ② can be omitted and plug(8, see page 7 -22) is to be tightened as well.



When the check valve doesn't screw smoothly in,
discontinue screwing in.
(The check valve has the possibility of falling)

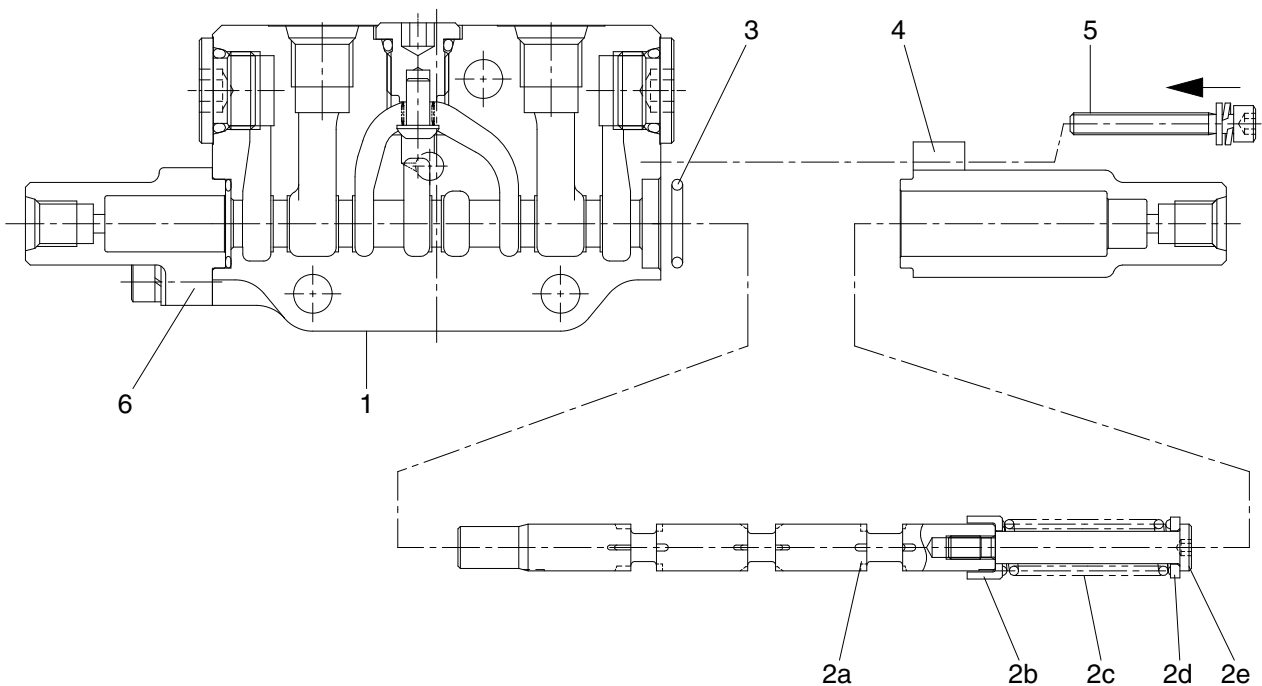
17Z9A7MCV17

(5) Spool installing procedures

Except P1, P2 inlet component

Taking the dozer spool as an example, the installing procedures are as follows.

- ① After checking whether there is no dust or the like in the spool sleeves of the body and/or spool assy and O-ring (3) is securely installed with that the flange bottom of the body, insert the dozer spool assy into spool sleeve of the body with attention on the position and direction.
- Then, apply little hydraulic fluid to spool before the insertion.
- ※ Carefully insert spool assy into the spool sleeve horizontally.
If it is hard to insert, forcible insertion could cause impressions on spool sleeves and/or spools, 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, check for any heavy movement or a feeling of catches.
- ② With pilot cover (4) being pressed in a direction from the spring side of spool assy to the flange of body, tighten bolt with washers (5) with specified torque by using 4 mm hexagonal wrench.
- ③ The other spools can be assembled in the same manner.

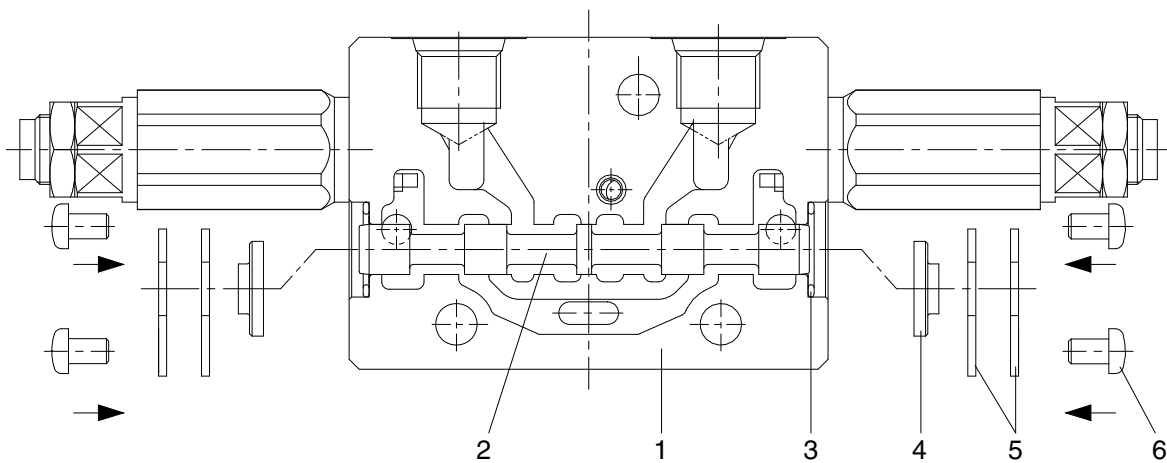


17Z9A7MCV18

P1, P2 Inlet component

The fitting procedures for P1, P2 inlet component spools are as follows.

- ① After checking whether there is dust or the like in the spool hole of spool and/or body and that the flange bottom of the body is securely installed with O-ring (3), insert the spool into spool hole of the body with attention on the position and direction.
 - The insertion direction in the spool can be inserted according to any direction because there is no right and left specification.
 - Apply little hydraulic fluid to spools before the insertion.
- ② A seat plate (4) and two seat plates (5) are installed, and tighten 2-M5 cross recessed head screws (6) with the specified torque by using screwdriver for cross.
- ③ Tighten a reverse-side with the specified torque similarly.



17Z9A7MCV19

5. PROBLEM CAUSES AND MEASURES

Since the cause of trouble occurred in hydraulic devices might be a complexity of various factors, first check whether the trouble occurs in any control valve, the other hydraulic device, or the circuit if you find any abnormality.

It is necessary to measure the pressure, flow rate, and so on of each important point.

Before disassembling even a part, follow to the above-mentioned disassembly and assembly procedures. The followings show typical trouble examples in control valves.

Phenomenon	Possible cause	Remedy
Spool's sliding movement is not smooth.	<ul style="list-style-type: none"> • Storage of foreign matter. • Oil-film shortage between spool and body due to abnormal rise of oil temperature. • Friction of spool. • Insufficient lubrication due to oil deterioration. • Set or breakage of return spring. • Bend of spool. • Distortion of valve due to fitting surface failure. • Abnormal tightening of fitting surface. • Failure in link fitting. 	<ul style="list-style-type: none"> • Disassemble, check, correct, or replace it. • Decrease oil temperature or change hydraulic oil. • Replace spool. • Change hydraulic oil and carry out flashing of circuit. • Replace spring. • Replace spool. • Loosen fitting bolts, carry out check and correction. • Retighten them with specified torque. • Inspect and correct link fitting.
Oil leakage from spool seals.	<ul style="list-style-type: none"> • Damaged or cut O-rings. • Dent or score on sliding part of spool seal. • Paint adhered on sliding part of spool seal. 	<ul style="list-style-type: none"> • Replace O-rings. • Correct or replace spool. • Remove paint with thinner or the like.
Attachment does not operate, moves slow, or outputs less power.	<ul style="list-style-type: none"> • Storage of foreign matter on the seat of relief valve or overload relief valve. • Loosened adjusting screw in relief valve or overload relief valve. • Storage of foreign matter on the seat of anticavitation valve. 	<ul style="list-style-type: none"> • Disassemble, check, and replace it. If the seat contacting with overload relief valve's body is damaged, replace body also. • Readjust with specified torque. • Disassemble, check, and replace it. If the seat contacting with overload relief valve's body is damaged, replace body also.
Even when spool position is neutral, cylinder sinks under its own weight.	<ul style="list-style-type: none"> • Damaged body or spool. • Storage of foreign matter between body and spool, or stick. • Set or breakage of check valve spring or return spring. • Storage of foreign matter on the seat of overload relief valve. • Loosened adjusting screw in overload relief valve. • Storage of foreign matter on the seat of anticavitation valve. 	<ul style="list-style-type: none"> • Replace body and/or spool. • Disassemble, check, correct, or replace it. When there is a stick, replace body and spool as a set. • Replace spring. • Disassemble, check, and replace it. If the seat contacting with overload relief valve's body is damaged, replace body also. • Readjust it with specified torque. • Disassemble, check, and replace it. If the seat contacting with anticavitation valve's body is damaged, replace body also.
When operating it upward, cylinder falls conversely.	<ul style="list-style-type: none"> • Storage of foreign matter between load check valve and component body's seat. • Stick of check valve. • Set or breakage of check valve spring. 	<ul style="list-style-type: none"> • After disassembling and cleaning, replace body if damage is serious. • Replace check valve and check valve plug as a set. • Replace spring.

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.

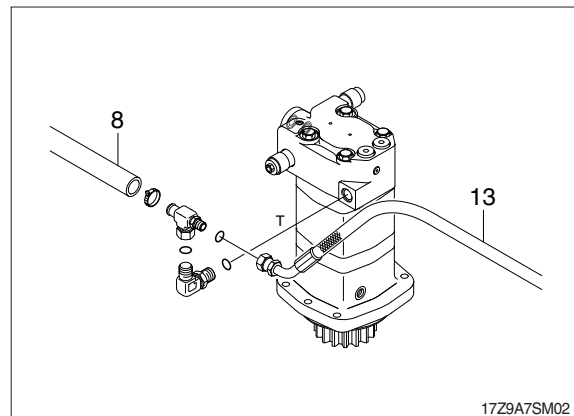
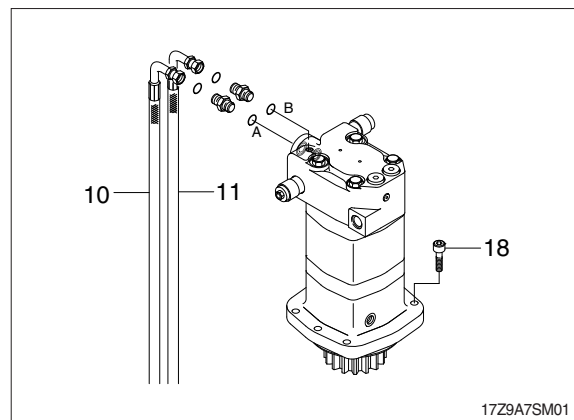
- (4) Disconnect hose assembly (8, 10, 11, 13).
- (5) Sling the swing motor assembly and remove the swing motor mounting bolts (18).

※ Motor device weight : 15 kg (33 lb)

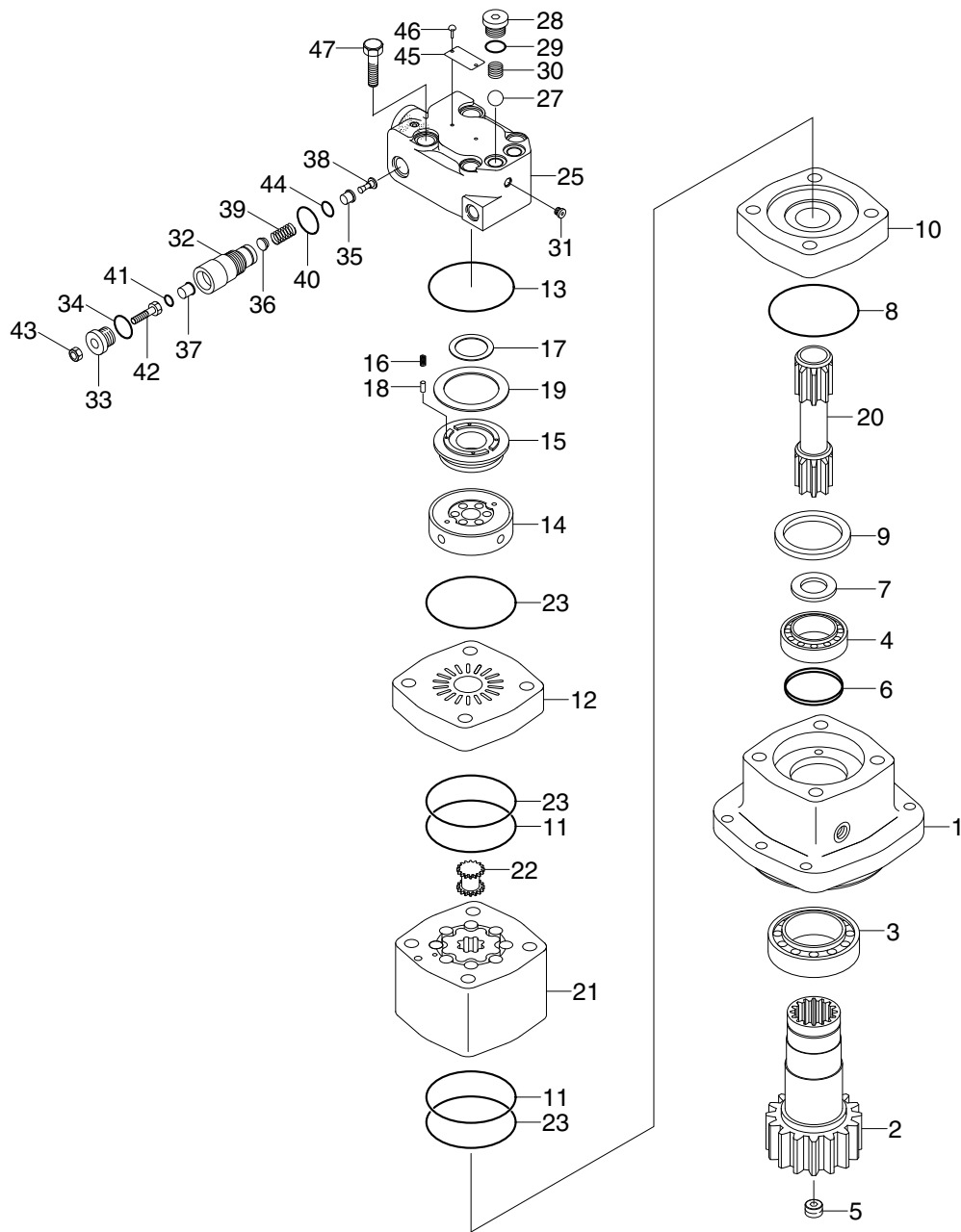
- (6) Remove the swing motor assembly.
※ When removing the swing motor assembly, check that all the piping have been disconnected.

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.



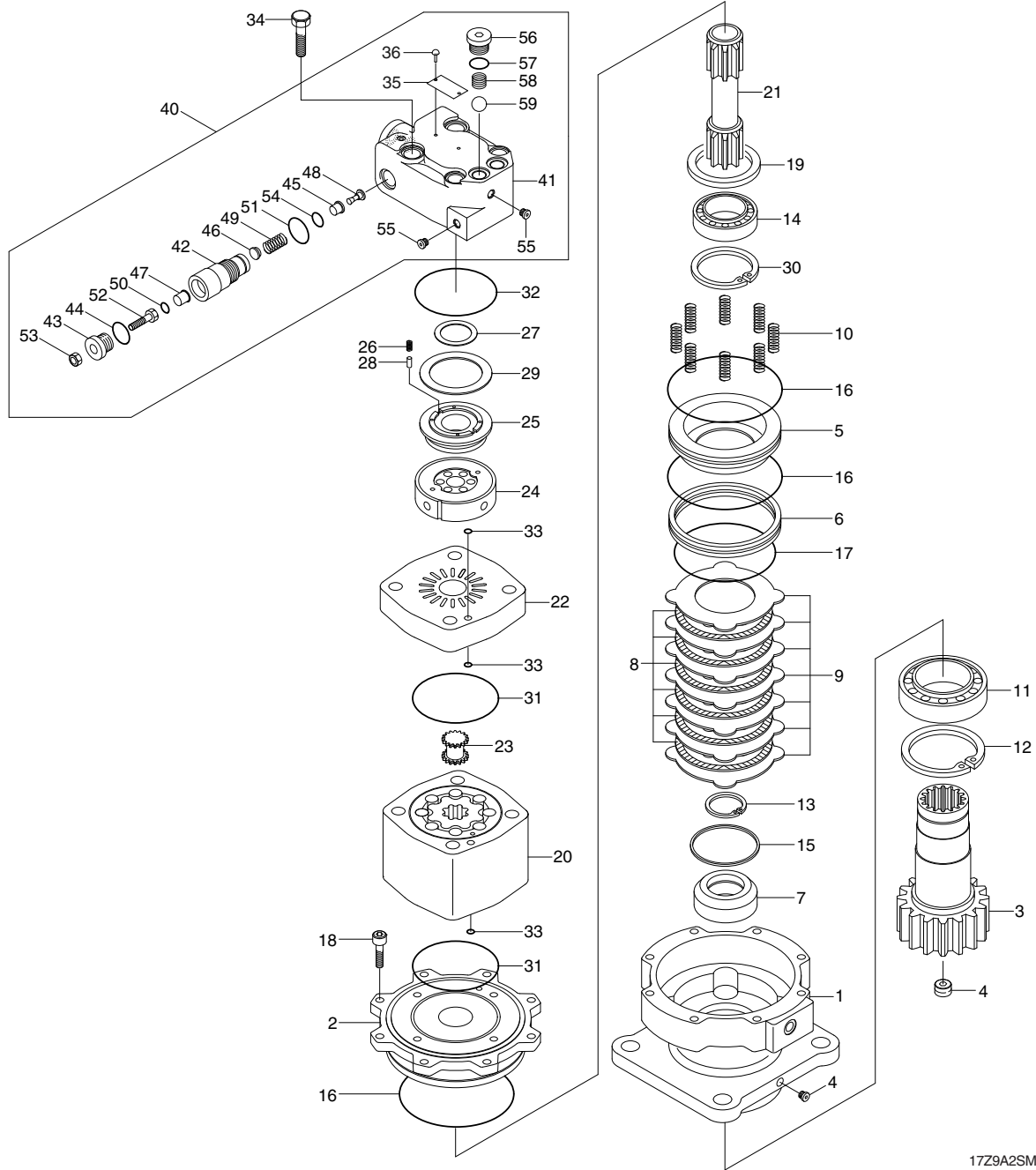
2. COMPONENTS (WITHOUT PARKING BRAKE)



17Z9A2SM02

1	Bearing housing	13	O-ring	25	Valve housing	37	Spring push
2	Pinion gear	14	Valve	26	Relief cartridge	38	Orifice plate
3	Ball bearing	15	Balancing ring	27	Steel ball	39	Spring
4	Ball bearing	16	Spring	28	Plug	40	O-ring
5	Plug	17	Inner face seal	29	O-ring	41	O-ring
6	X-ring	18	Pin	30	Spring	42	Hexagon socket set screw
7	Retaining ring	19	Outer face seal	31	Plug	43	Hexagon nut
8	O-ring	20	Drive	32	Cartridge	44	O-ring
9	Shaft face seal	21	Gerotor	33	Screw guide	45	Name plate
10	Wear plate	22	Valve drive	34	O-ring	46	Rivet
11	O-ring	23	O-ring	35	Needle valve	47	Hexagon bolt
12	Valve plate	24	Valve housing assy	36	Spring seat		

COMPONENTS (WITHOUT PARKING BRAKE)



17Z9A2SM03

- | | | | | | | | |
|-------|-----------------|-------|-----------------|-------|--------------------|-------|---------------|
| 1 | Bearing housing | 15 | X-ring | 29 | Outer face seal | 46,47 | Spring seat |
| 2 | Flange mounting | 16,17 | O-ring | 30 | Snap ring | 48 | Orifice plug |
| 3 | Pinion gear | 18 | Cap screw | 31,32 | O-ring | 49 | Spring |
| 4 | Plug | 19 | Shaft face seal | 33 | O-ring | 50 | O-ring |
| 5 | Piston | 20 | Geroler | 34 | Bolt | 51 | O-ring |
| 6 | Ring | 21 | Drive | 35 | Name plate | 52 | Hexagon screw |
| 7 | Collar | 22 | Valve plate | 36 | Rivet | 53 | Hexagon nut |
| 8 | Friction disk | 23 | Valve drive | 40 | Valve housing assy | 54 | O-ring |
| 9 | Center plate | 24 | Valve | 41 | Valve housing | 55 | Plug |
| 10 | Spring | 25 | Balancing ring | 42 | Cartridge | 56 | Plug |
| 11 | Front bearing | 26 | Spring | 43 | Screw guide | 57 | O-ring |
| 12,13 | Snap ring | 27 | Inner face seal | 44 | O-ring | 58 | Spring |
| 14 | Rear bearing | 28 | Pin | 45 | Needle valve | 59 | Ball |

3. DISASSEMBLY (WITHOUT PARKING BRAKE)

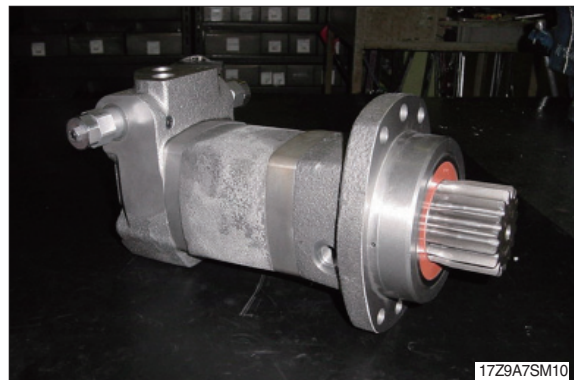
1) GENERAL PRECAUTIONS

- (1) Cleanliness is extremely important when repairing a hydraulic motor.
 - (2) Work in a clean area.
 - (3) Before disconnecting the lines, clean the port area of the motor thoroughly.
 - (4) Use a wire brush to remove foreign material and debris from around the exterior joints of the motor.
- ※ Don't disassembly the following parts if not necessary.
- Pinion gear and valve housing assembly

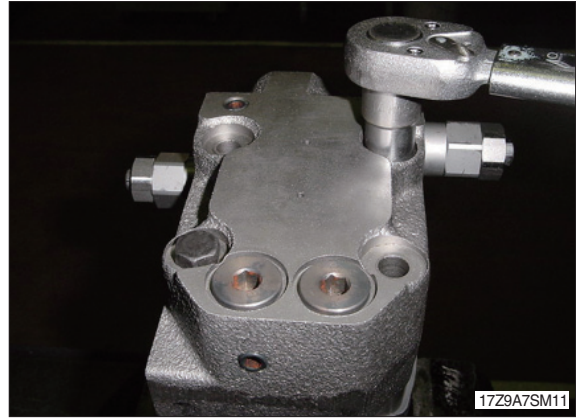
2) TOOLS

Tool name	Information
Torque wrench	Capacity 1.0~10 kgf · m (7.2~72 lbf · ft)
Socket	9/16" (or 14 mm)
Hexagon socket	5 mm, 8 mm
Snap ring pliers	-
Screwdriver	-
Plastic hammer	-
Press machine	-

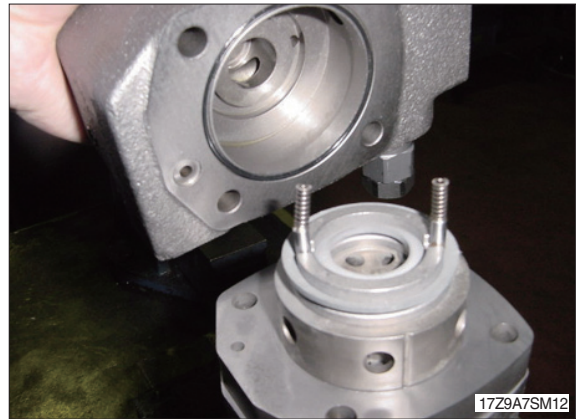
- 3) Place the motor in a vise with the valve housing part up.
Clamp across the mounting flange of the motor.



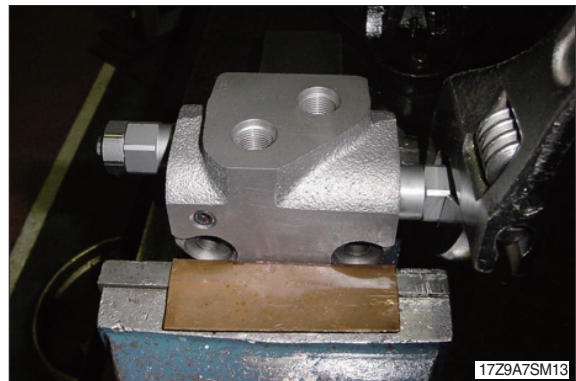
4) Remove four hexagon bolts (45) from the motor.



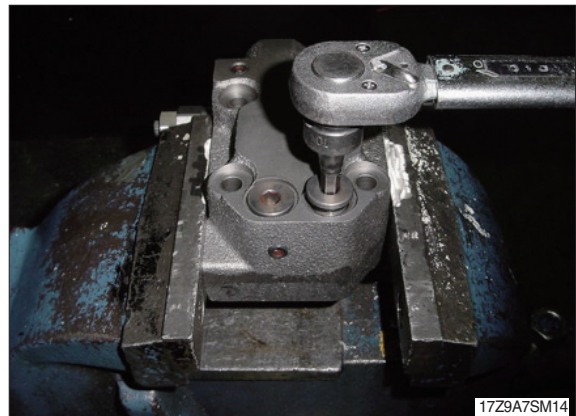
5) Remove the valve housing assembly (23), spring (15) and pin (17).



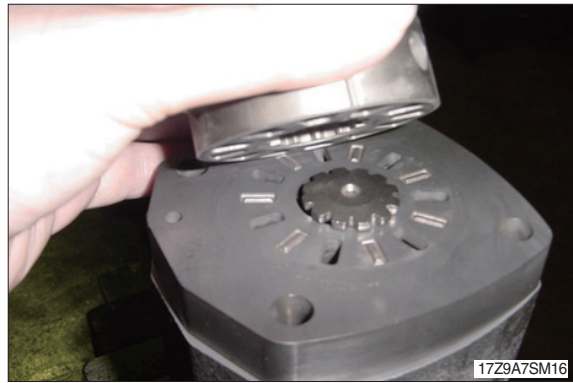
6) Don't disassembly relief cartridge (25) if not necessary.



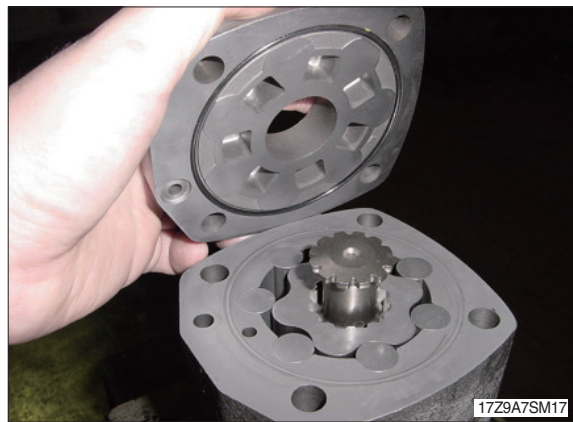
7) Don't disassembly check plug (27) if not necessary.



- 8) Balancing ring assembly, and valve (13) will remain on the valve plate (11).
Remove the balancing ring (14) and valve (13).



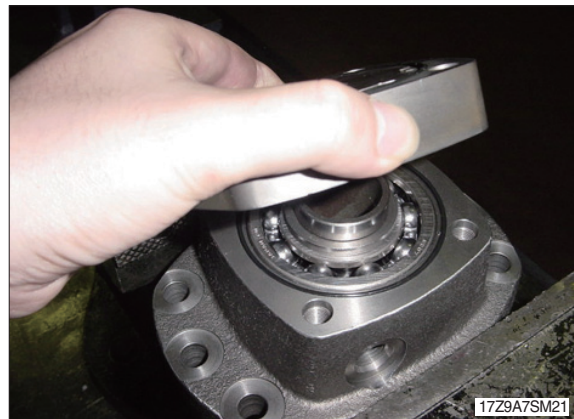
- 9) Remove the valve plate (11) and valve drive (21).



10) Remove the gerotor (20) and drive (19).



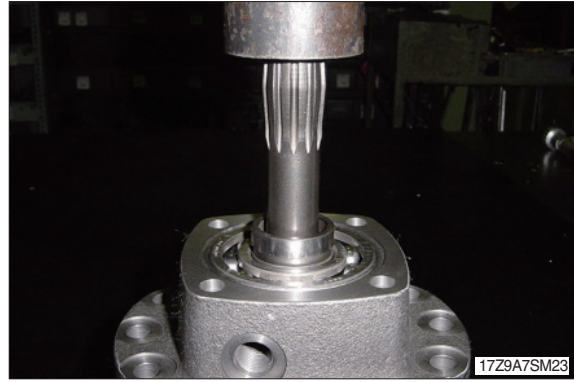
11) Remove the wear plate (10).



12) Don't disassembly pinion gear assembly if not necessary.
Remove the retaining ring (7).



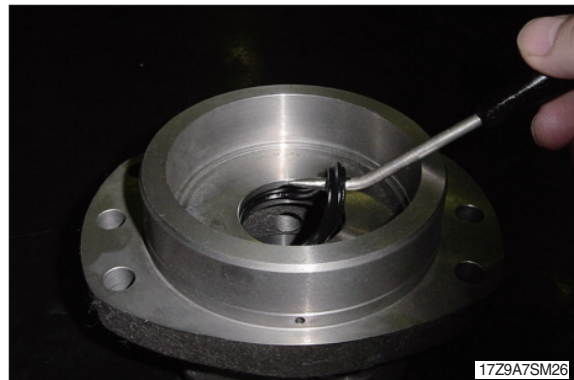
13) Remove the pinion gear shaft (2) by press machine.



14) Remove two ball bearings (3, 4).



15) Remove the X-ring (6).



4. ASSEMBLY (WITHOUT PARKING BRAKE)

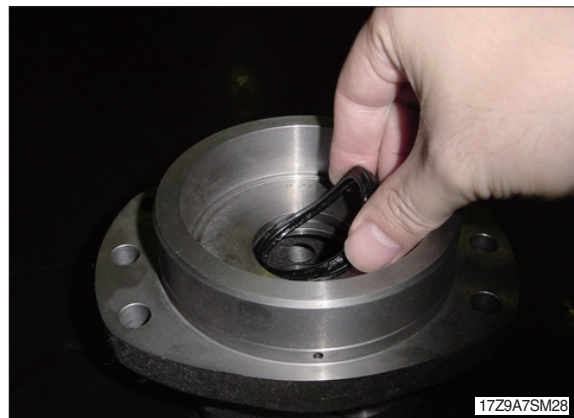
1) GENERAL PRECAUTION

- (1) Check all mating surfaces.
- (2) Replace any parts that have scratches or burrs that could cause leakage.
- (3) Clean all metal parts in clean solvent. Blow-dry with air.
- (4) Do not wipe dry with paper towel because lint or other matter can get in the hydraulic system and cause damage.
- (5) Do not file or grind motor parts.

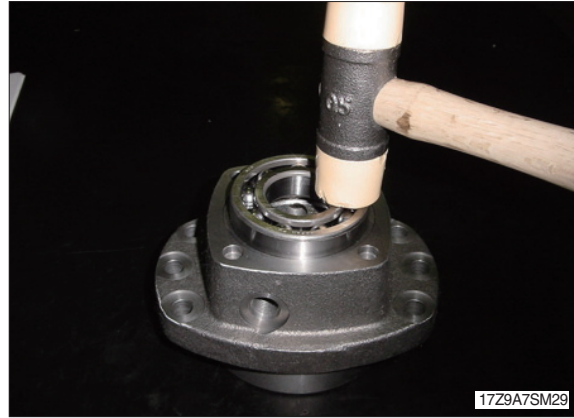
- 2) Please replace all old seals with new seals and lubricant all seals (prior to installation) with petroleum such as vaseline.



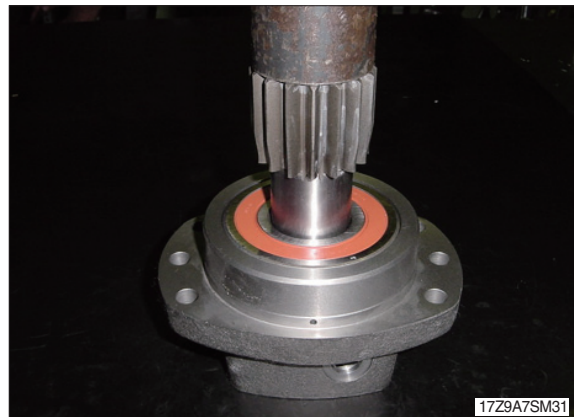
- 3) Install the X-ring (6) in the bearing housing (1).



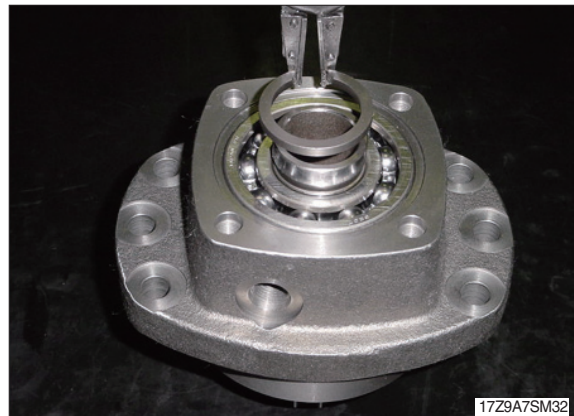
4) Install two bearings (3, 4) in the bearing housing (1).



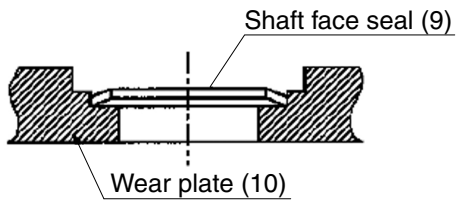
5) Install the pinion gear shaft (2) in the bearing housing (1) by press machine.



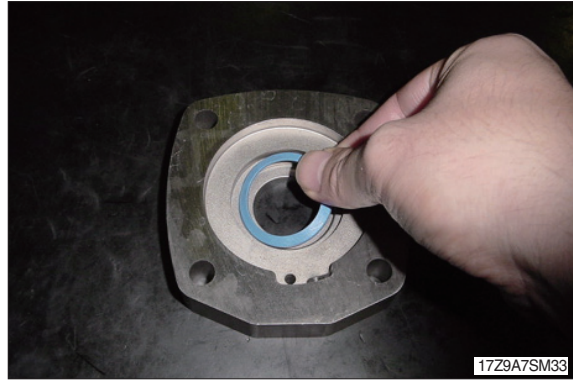
6) Install the retaining ring (7).



7) Install the shaft face seal (9) in the wear plate (10).

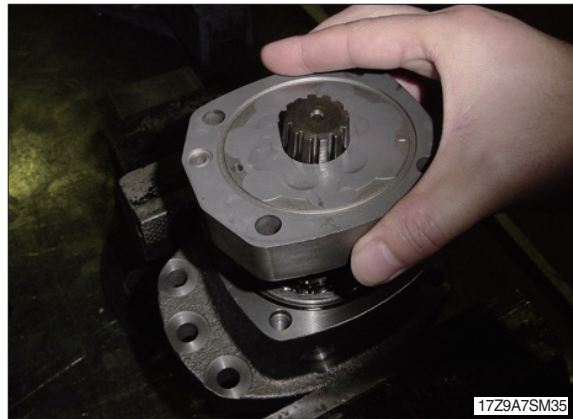


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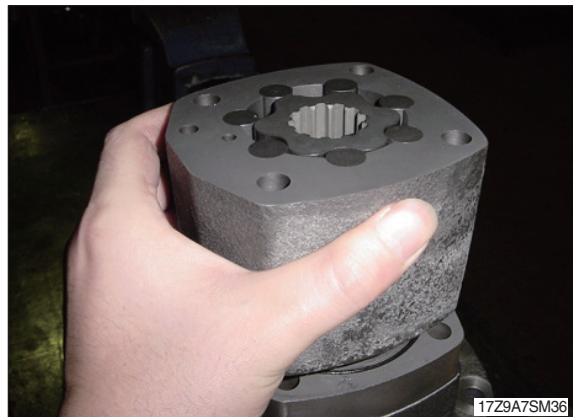
17Z9A7SM33

8) Install the O-ring (8) in the bearing housing (1).
Install the drive (19).
Install two O-rings (8, 22) in the wear plate (10).



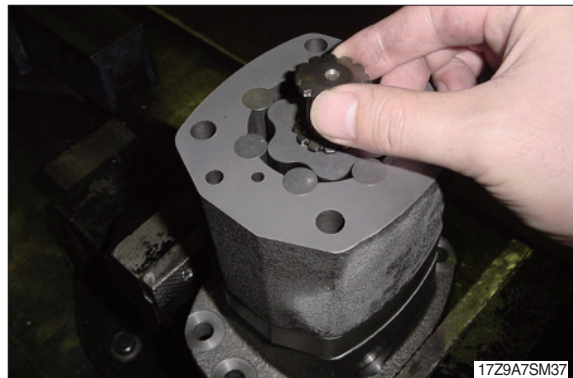
17Z9A7SM35

9) Install the gerotor (20).
Align the outline shape the gerotor with the wear plate.



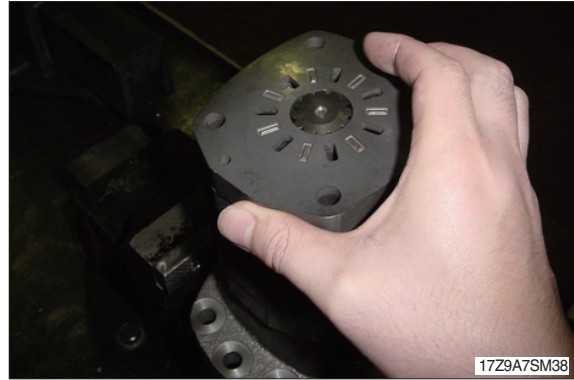
17Z9A7SM36

10) Install the valve drive (21).



17Z9A7SM37

- 11) Install the O-ring (8) in the valve plate (11).
Install the valve plate.
Align outline shape the valve plate with the gerotor.



12) Timing procedure

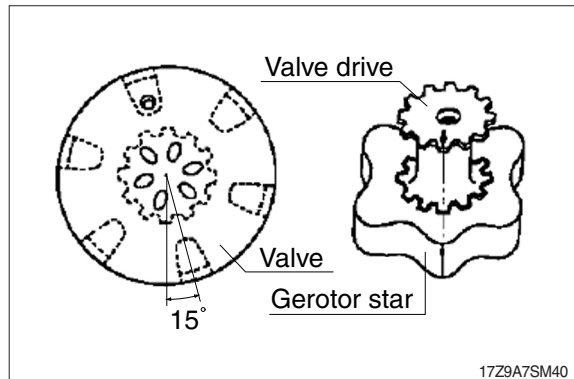
- ※ Install the valve drive and valve as shown in figure.

Install the valve (13).

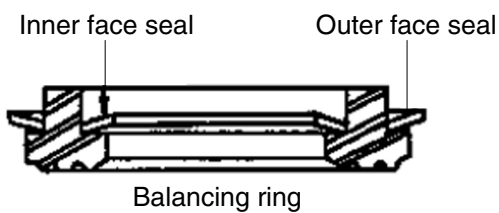


- 13) Locate the spline tooth of the valve drive and external tooth of gerotor and mark it on the spline tooth of valve drive.
Install the valve, locate to 15° right side (rotate the valve 15° ccw) side hole of the valve and marking spline tooth of valve drive.

- ※ If you mistake the valve timing, motor turns in the opposite direction. Please be careful.



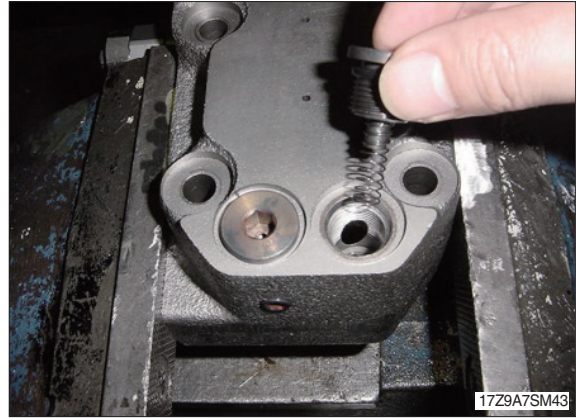
- 14) Install the inner face seal (16) and outer face seal (18) on the balancing ring.



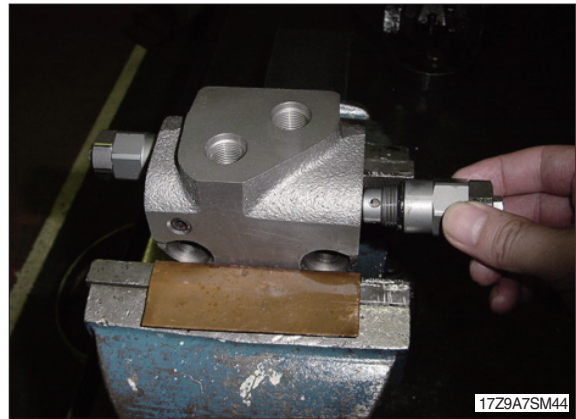
17Z9A7SM41



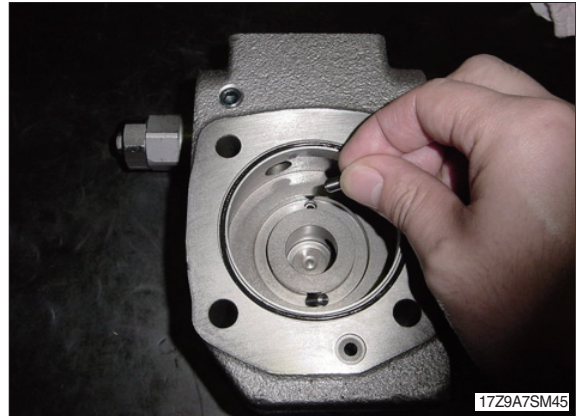
15) Install the steel ball (26), check plug (27) and spring (29) in the valve housing (24).



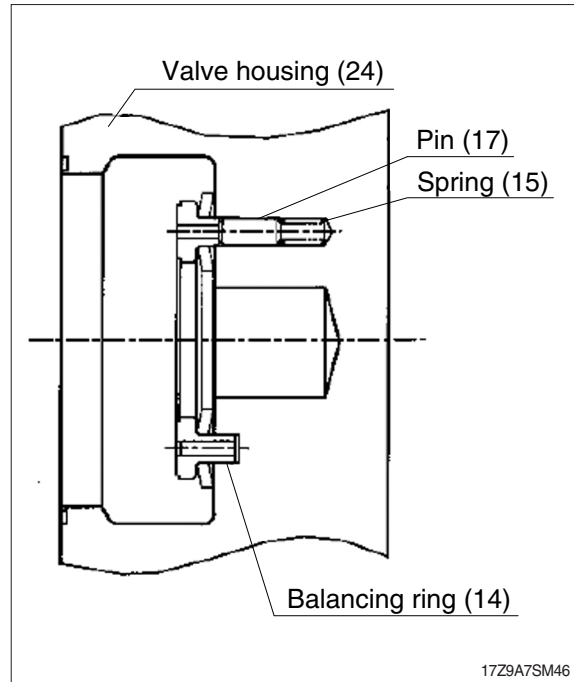
16) Install the relief cartridge (25) in the valve housing (24).



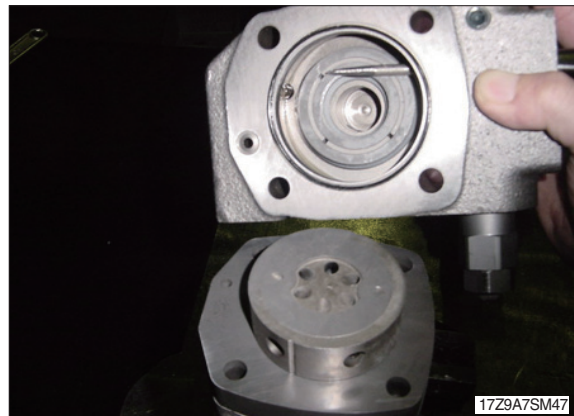
17) Install two springs (15) in the hole located in the bore of the valve housing (24).
Install two pins (17) in the same holes.



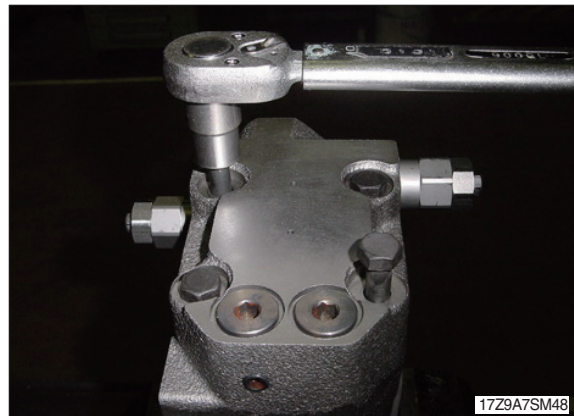
- 18) Align the pin grooves in the balancing plate with the pins in the bore of the valve housing.
Install the balancing ring (14) in the valve housing (24).



- 19) Install the O-ring (12) in the valve housing assembly (23).
Install the valve housing assembly.
Insert a screwdriver through port of valve housing to apply pressure to the side of balancing plate assembly. Hold plate in position until you install housing.



- 20) Install 4 hexagon bolts (45).
Torque all 4 bolts alternately to 5.2 kgf · m (37.6 lbf · ft).



5. DISASSEMBLY (WITH PARKING BRAKE)

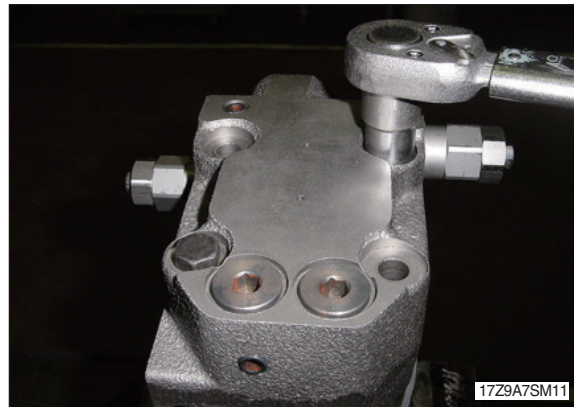
1) GENERAL PRECAUTIONS

- (1) Cleanliness is extremely important when repairing a hydraulic motor.
 - (2) Work in a clean area.
 - (3) Before disconnecting the lines, clean the port area of the motor thoroughly.
 - (4) Use a wire brush to remove foreign material and debris from around the exterior joints of the motor.
- ※ Don't disassembly the following parts if not necessary.
- Pinion gear and valve housing assembly

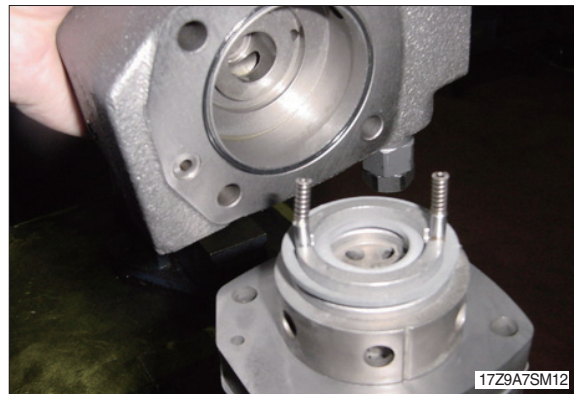
2) TOOLS

Tool name	Information
Torque wrench	Capacity 1.0~10 kgf · m (7.2~72 lbf · ft)
Socket	9/16" (or 14 mm)
Hexagon socket	5 mm, 8 mm
Snap ring pliers	-
Screwdriver	-
Plastic hammer	-
Press machine	-

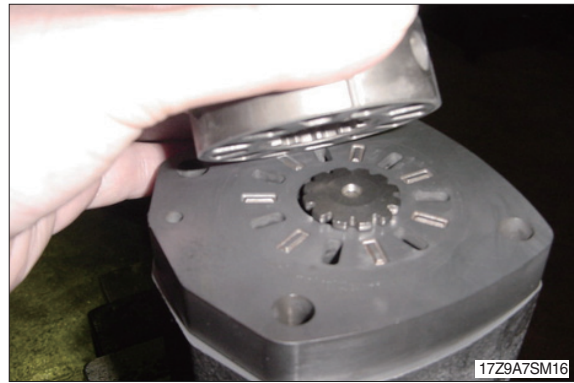
- 3) Remove 4 hexagon bolts from the motor.



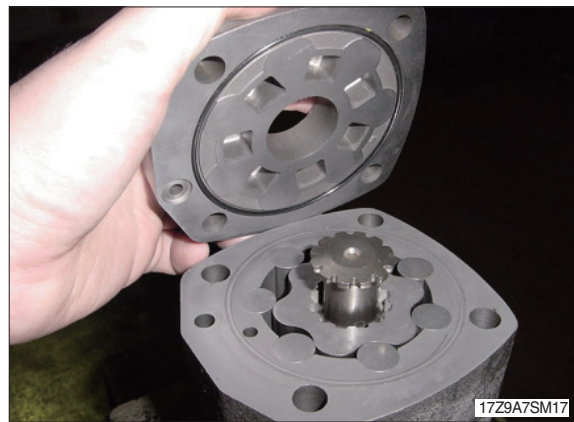
- 4) Remove the valve housing assembly.
If done carefully the spring, pin, balancing plate assembly, and valve will remain on the valve plate.



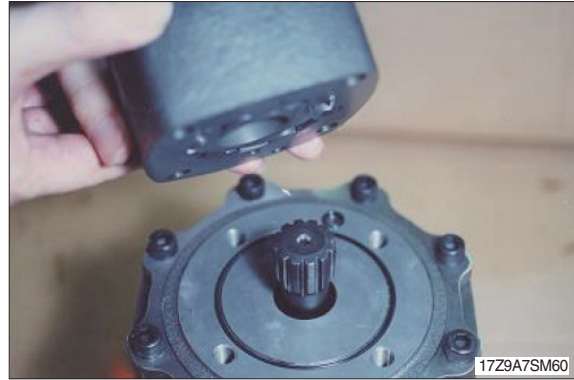
5) Remove the balancing plate and valve.



6) Remove the valve plate and valve drive.

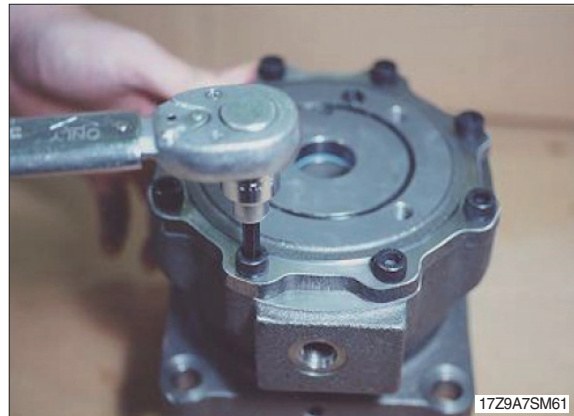


7) Remove the geroler and drive.

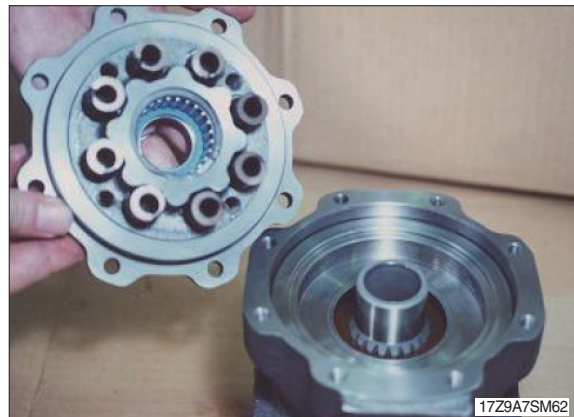


8) Disassembly of brake assembly.
Remove the screw.

※ Don't disassembly the following parts if not necessary.



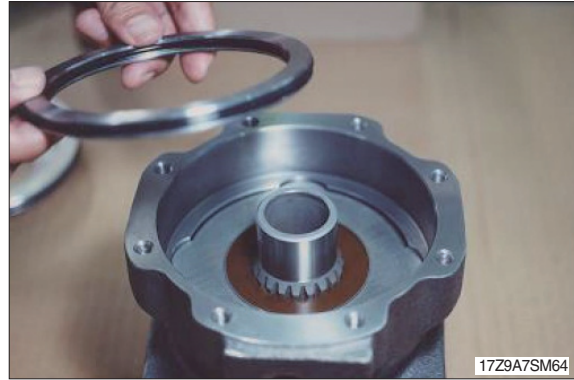
9) Remove the flange mounting and spring.



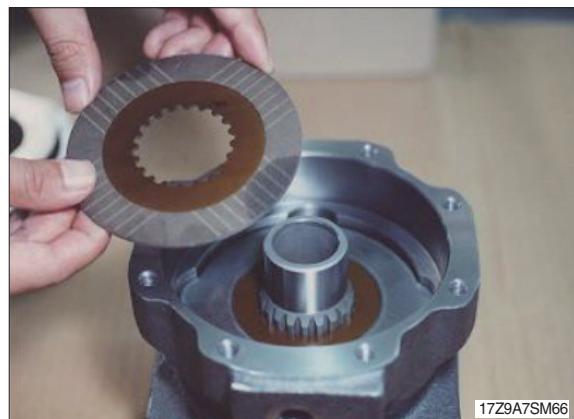
10) Remove the piston.



11) Remove the ring.



12) Remove the center plate and friction plate.



13) Remove the pinion gear assembly with press machine.
Remove the X-ring.

※ Don't disassembly the following parts if not necessary.



6. ASSEMBLY (WITH PARKING BRAKE)

1) GENERAL PRECAUTION

- (1) Check all mating surfaces.
 - (2) Replace any parts that have scratches or burrs that could cause leakage.
 - (3) Clean all metal parts in clean solvent. Blow dry with air.
 - (4) Do not wipe dry with paper towel because lint or other matter can get in the hydraulic system and cause damage.
 - (5) Do not file or grind motor parts.
- ※ Please replace all old seals with new seals and lubricant all seals (prior to installation) with petroleum such as vaseline.

- 2) Install the bearing, collar and snap ring to the pinion shaft.



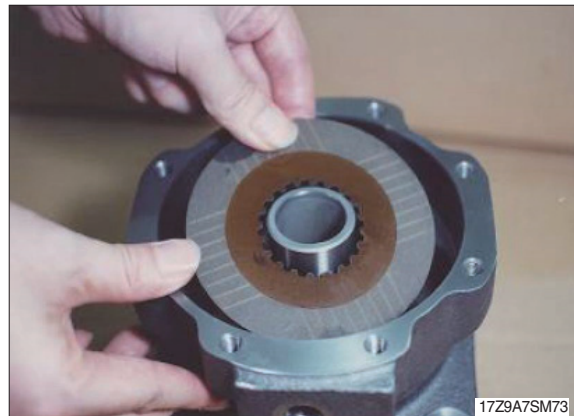
3) Install the X-ring.



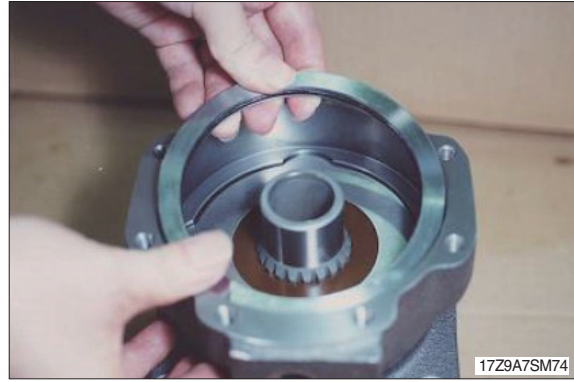
4) Install the pinion gear assembly in the bearing housing.



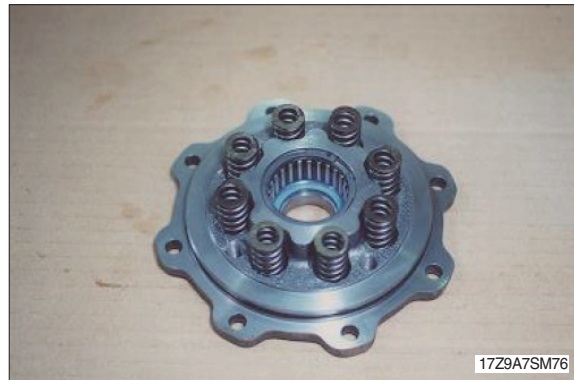
5) Install the center plate and friction plate.



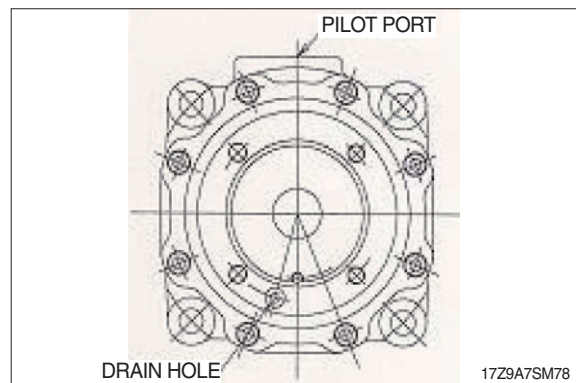
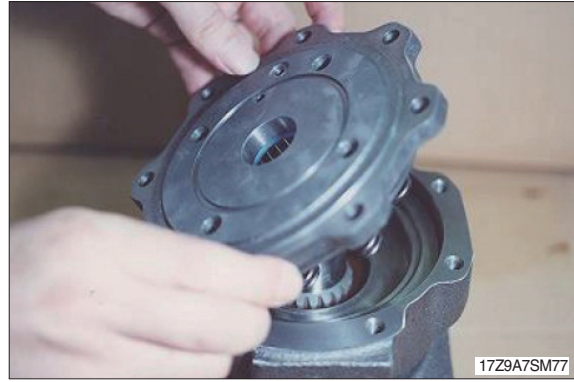
- 6) Install the ring with O-ring and piston with O-ring in the bearing housing.



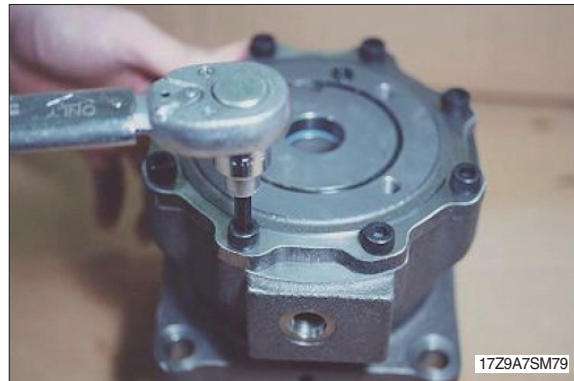
- 7) Install the shaft face seal. Bearing and snap ring in the flange mounting.
Install the spring with enough grease for fall prevention.



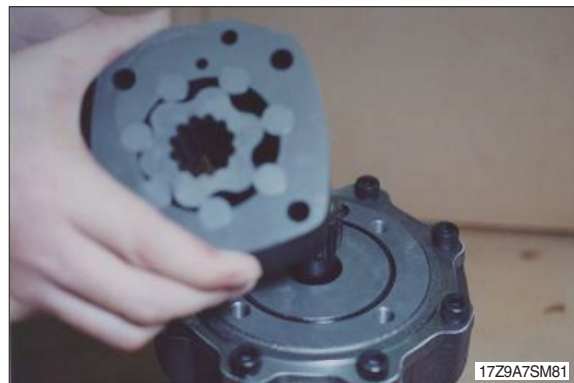
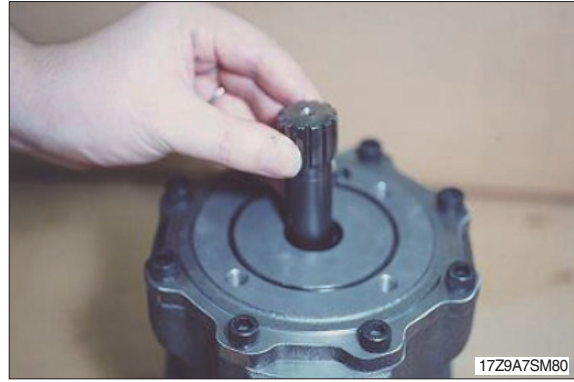
- 8) Install the flange mounting.
See below illustration relationship pilot port
to drain hole.



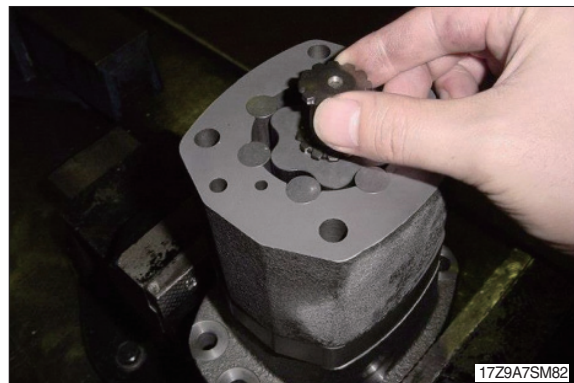
- 9) Tightening torque ; 3.47kgf · m (25.1 lbf · ft)



- 10) Install the drive and geroler.
Align the case drain hole in the geroler with the case drain hole in the flange mounting.



- 11) Install the valve drive.



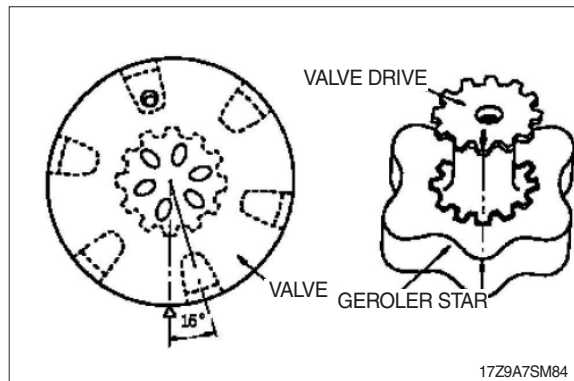
12) Install the valve plate.

Align the case drain hole in the valve plate with the case drain hole in the geroler.



13) Timing procedure.

※ Install the valve drive and valve as shown in figure.



14) Install the valve.

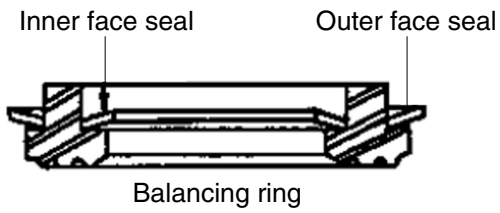
Locate the spline tooth of the valve drive and external tooth of geroler and mark it on the spline tooth of valve drive.

Install the valve, locate to 15° right side (rotate the valve 15° ccw) side hole of the valve and marking spline tooth of valve drive.

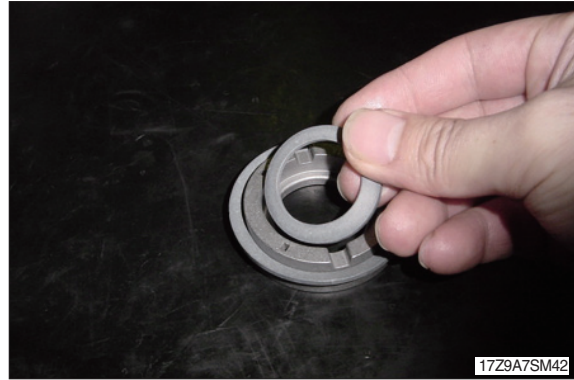
※ If you mistake the valve timing, motor turns in the opposite direction. Please be careful.



- 15) Install the inner face seal and outer face seal on the balancing plate.

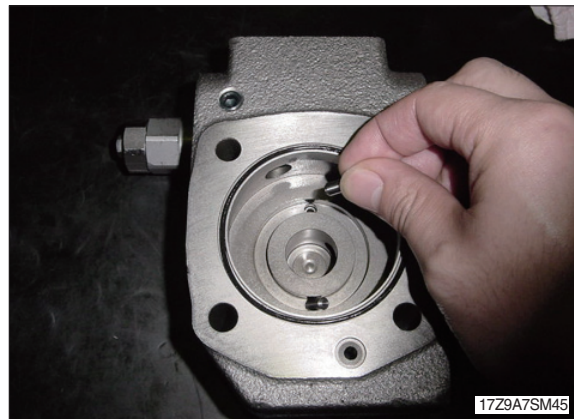


17Z9A7SM41



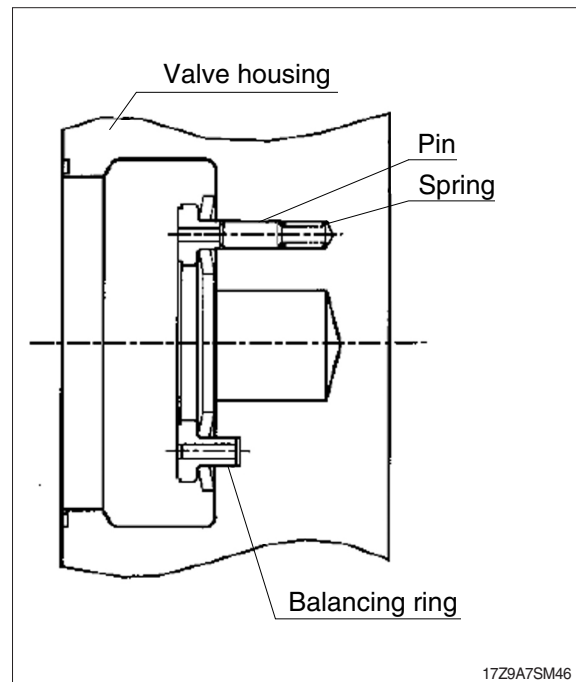
17Z9A7SM42

- 16) Install spring (in the hole located in the bore of the valve housing).
Install pin in the same holes.



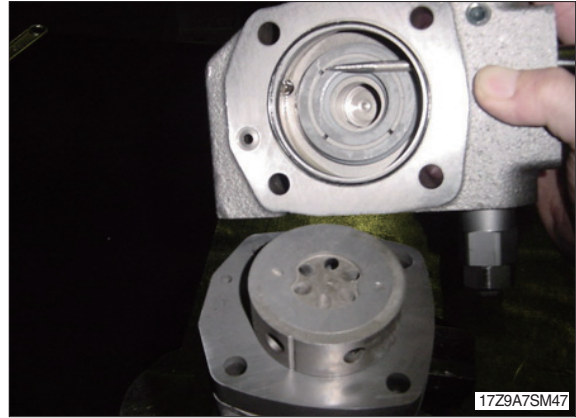
17Z9A7SM45

- 17) Align the pin grooves in the balancing plate with the pins in the bore of the valve housing.
Install the balancing plate in the valve housing.

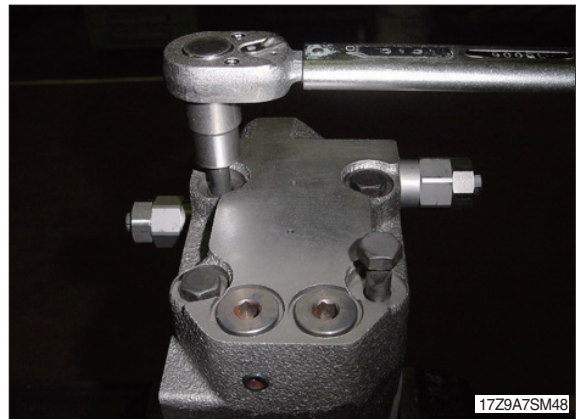


17Z9A7SM46

- 18) Install the valve housing assembly.
Insert a screw driver through port of valve housing to apply pressure to the side of balancing plate assembly.
Hold plate in position until you install housing.



- 19) Install 4 hexagon bolts.
Torque all 4 bolts alternately to 5.2 kgf · m
(37.6 lbf · ft).



GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

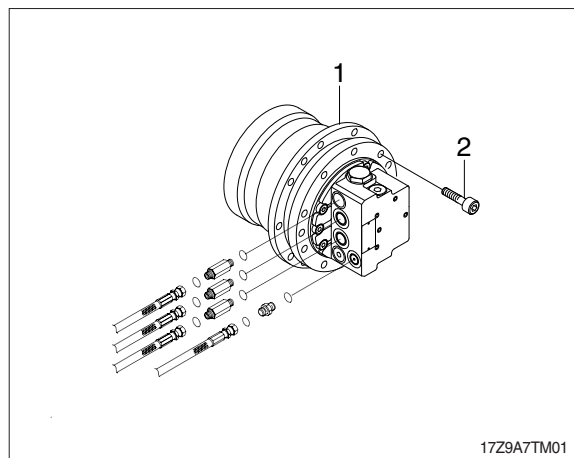
- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ 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 : 18 kg (40 lb)



13031GE18

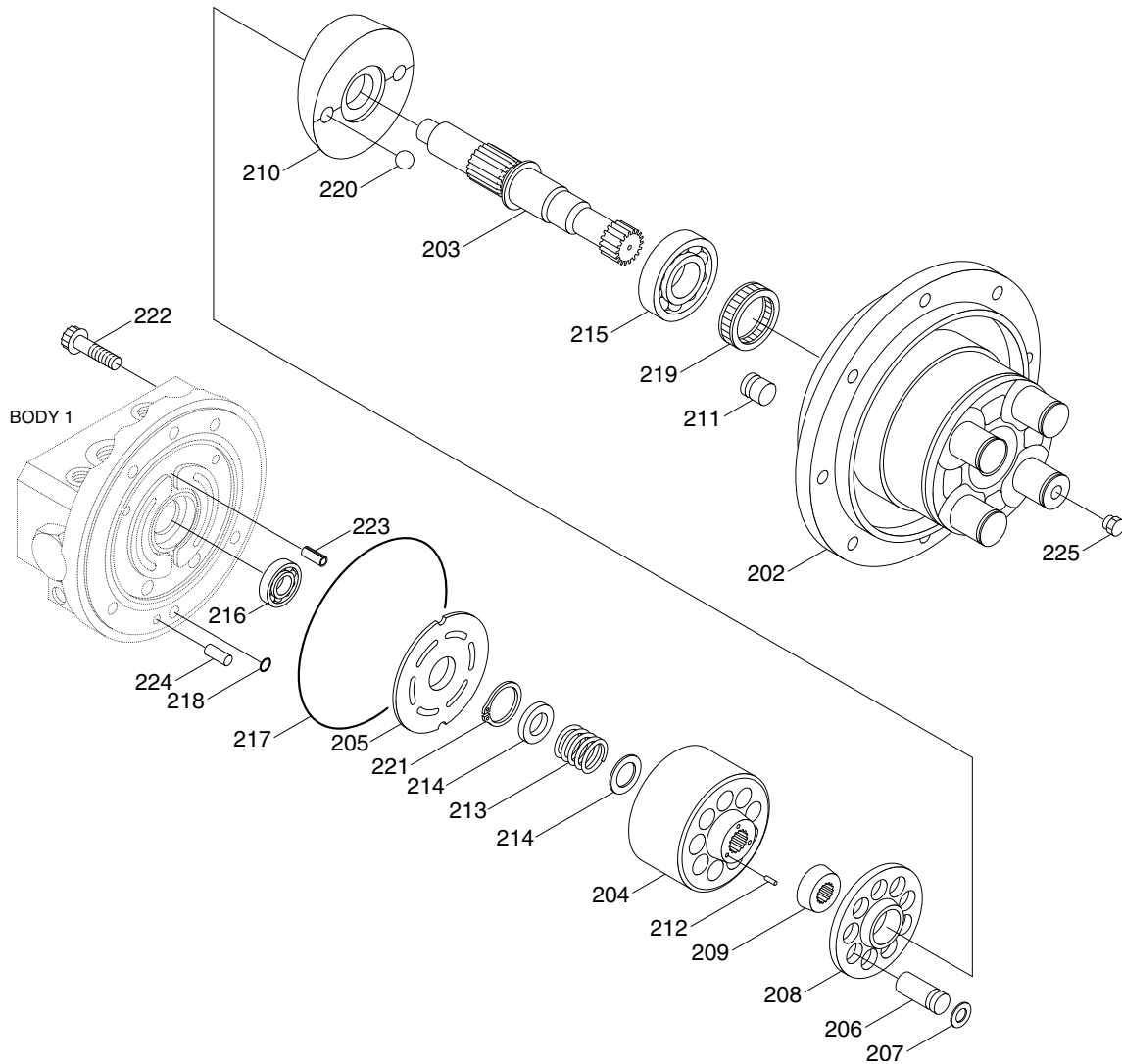


17Z9A7TM01

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.

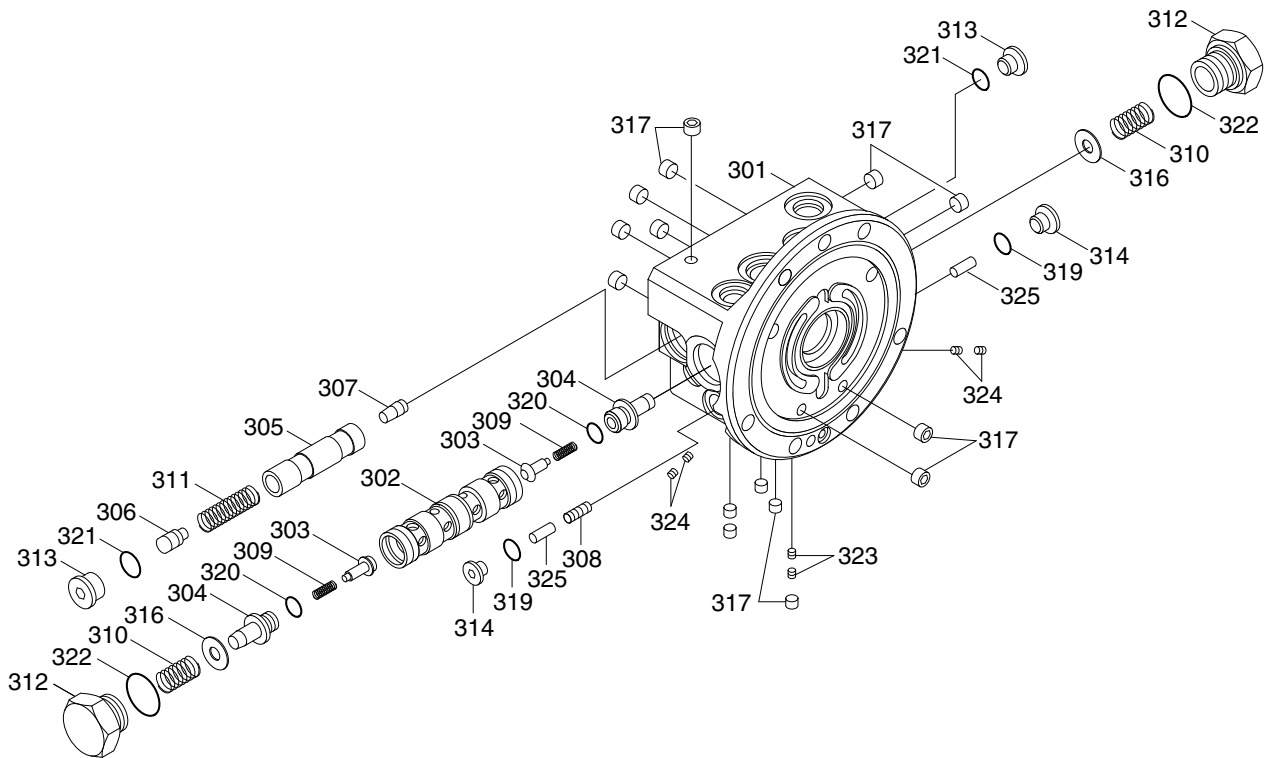
2) STRUCTURE (1/3)



1692TM02

202	Body 2	210	Swash plate	218	O-ring
203	Shaft	211	Control piston	219	Oil seal
204	Cylinder barrel	212	Pin	220	Ball
205	Valve plate	213	Spring C	221	Snap ring
206	Piston	214	Retainer	222	Screw
207	Shoe	215	Bearing	223	Spring pin
208	Shoe holder	216	Bearing	224	Pin
209	Barrel holder	217	O-ring	225	Plug

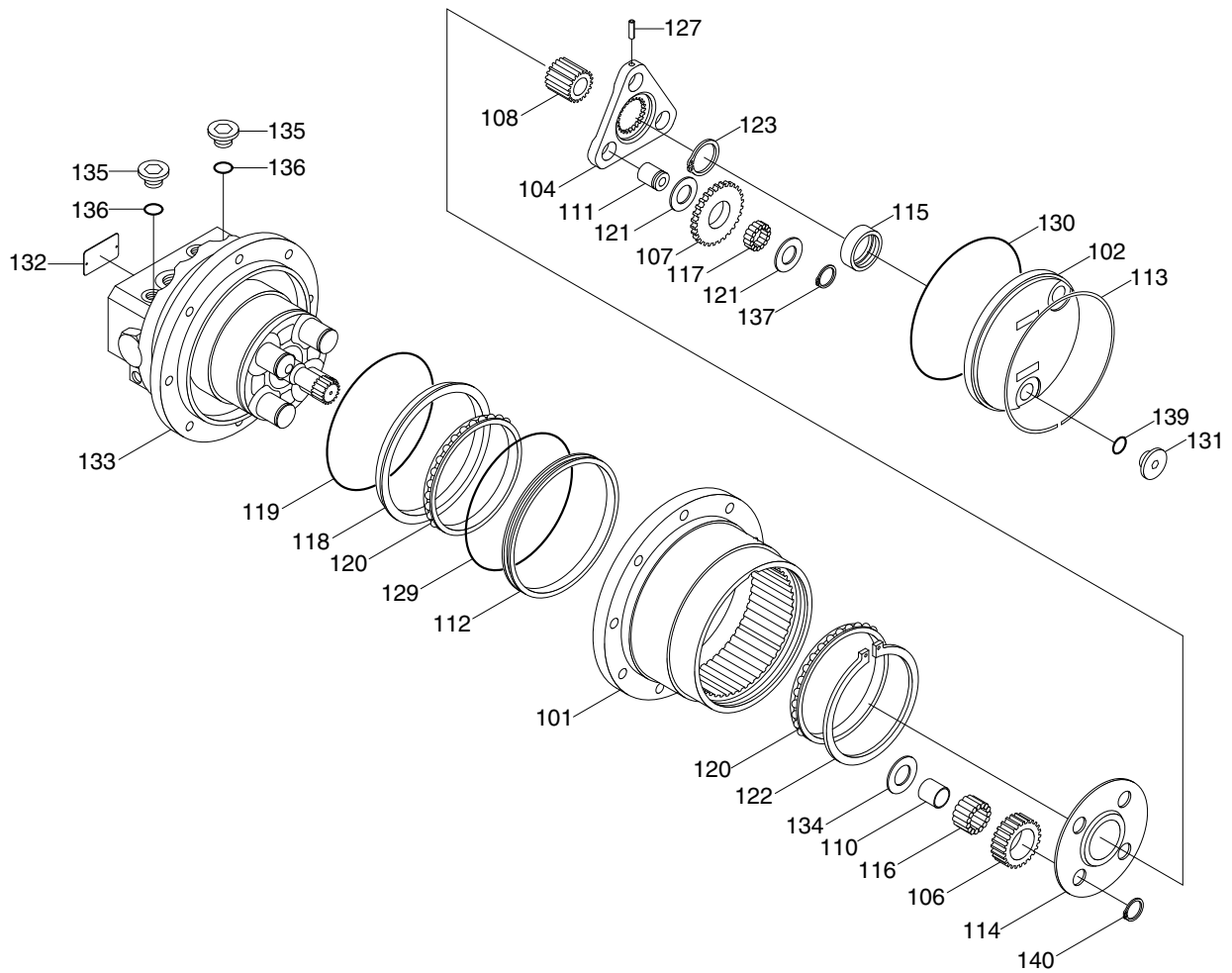
STRUCTURE (2/3)



17Z9A2TM03

301	Body 1	309	Spring V1	319	O-ring
302	Spool	310	Spring V2	320	O-ring
303	Check valve	311	Spring V3	321	O-ring
304	Spring guide	312	Plug	322	O-ring
305	Spool	313	Plug	323	Choke
306	Spool-B	314	Ring	324	Choke
307	Spool-C	316	Plug	325	Pin
308	Shuttle spool	317	Plug		

STRUCTURE (3/3)



1692TM04

101	Body	113	Snap ring	121	Thrust washer	134	Thrust washer
102	Cover	114	Thrust plate	122	Snap ring	135	Plug
104	Carrier 2	115	Slide ring	123	Snap ring	136	O-ring
106	Gear B1	116	Needle	127	Spring pin	137	Snap ring
107	Gear B2	117	Needle	129	O-ring	139	O-ring
108	Gear S1	118	Floating seat (Incl 119)	130	O-ring	140	Snap ring
110	Ring	119	O-ring	131	Plug		
111	Pin B2	120	Bearing	132	Name plate		
112	Seal ring			133	Hydraulic motor		

3) MAINTENANCE INSTRUCTION

(1) Necessary tool to assemble

Tool name	Information
Torque wrench	12 N, 90 N and 180 N
Hexagon socket	Hexagon size : 5 mm, 6 mm and 8 mm
Socket wrenches	Hexagon size : 27 mm
Hexagon socket wrenches	Hexagon size : 5 mm, 6 mm and 8 mm
Screwdriver	Width : 6~10 mm
Snap ring pliers	∅ 24 mm for hole ∅ 15 mm, ∅ 18 mm, ∅ 26 mm, ∅ 90 mm for shaft
Plastic hammer	-
Others	Grease, Oil, Sand paper and C-clamps

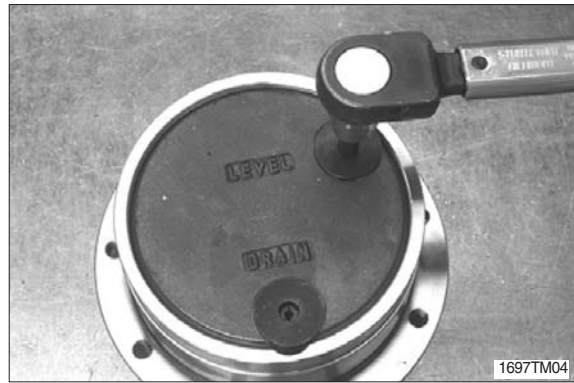
2. DISASSEMBLY

1) GENERAL PRECAUTIONS

- (1) Work at the clean area, and pay attention to clean each part from rubbish, piece of paint and prepare the clean case for disassembled parts.
- (2) Remove the rubbish from the outside of the track motor before disassembling, and remove of paint by wiring brush.
- (3) Put a mark on each part before disassembling for keeping the correct position at assembling.
- (4) Handle disassembled parts with special care.
- (5) Clean each part with cleaning solvents.
- (6) Check disassembled parts with no damage, and removes any burrs.
- (7) Use the new seal parts and snap rings.
- (8) The press-fitting parts (for example, bearing and pin) can not be disassembled.

2) REDUCTION GEAR SECTION

- (1) Remove the two plugs (PF3/8).
 - Hexagon size : 8 mm
- ※ Remove the plug of "LEVEL" side first.



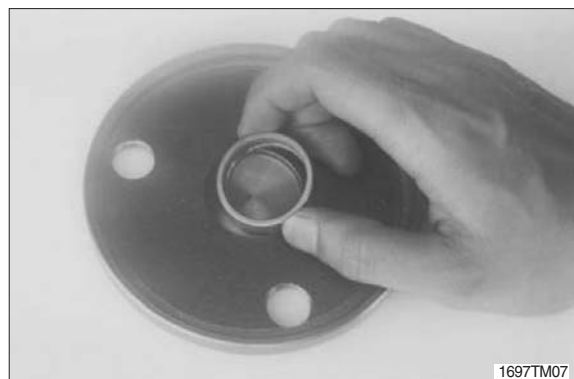
- (2) Remove the snap ring.
- ※ Put the screwdriver into the notch of the body, and then pull the snap ring.



- (3) Remove the cover.



- (4) Remove the slide ring from the cover.



(5) Remove the O-ring from the body.



(6) Remove the carrier 2 kit from the body.

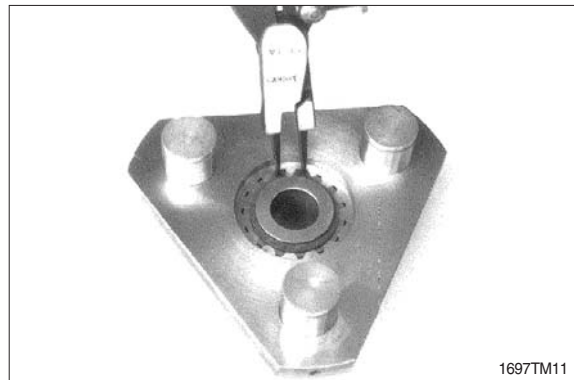


(7) Remove the three snap rings, three thrust washers, three b2 gears, thirty-nine needles and three thrust washers.

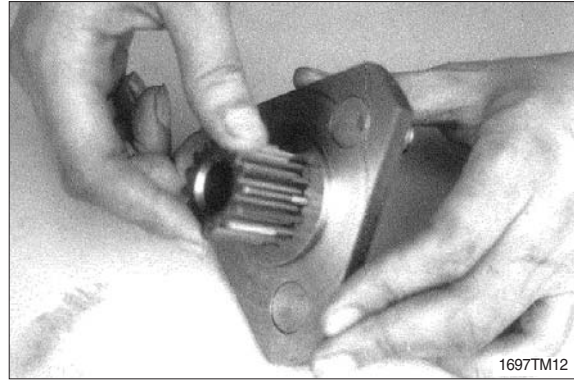
- ※ The thrust washers on both sides of the b2 gears are the same.
- ※ The b2 pins and spring pins are not able to disassemble, because they are press-fitted.
- ※ The needles are easily dispersed, pay attention not to lose.



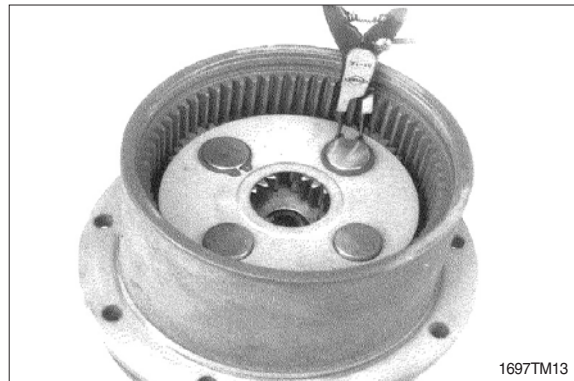
(8) Remove the snap ring from the carrier 2.



(9) Remove the s1 gear from the carrier 2.

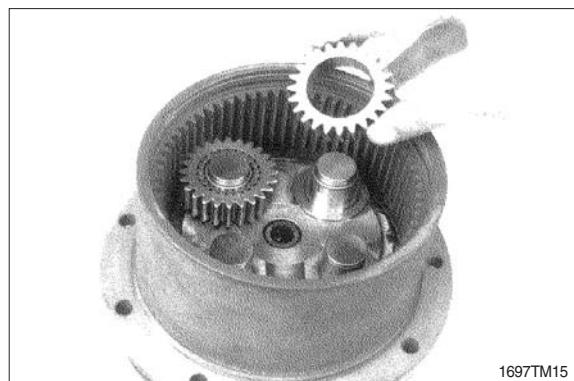
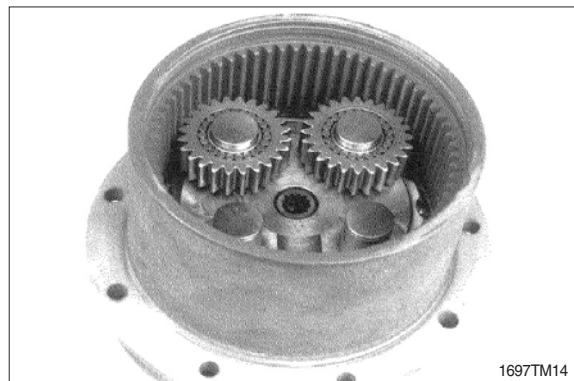


(10) Remove the four snap rings and the four thrust plates.



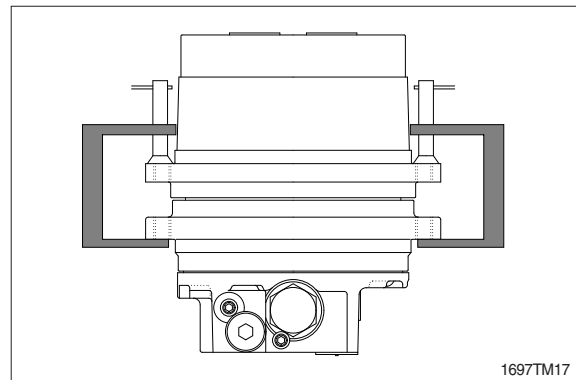
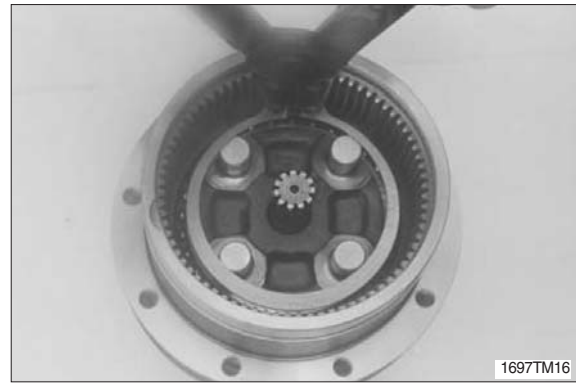
(11) Remove the four b1 gears, ninety-six needles, four thrust washers and four rings.

※ The needles are easily dispersed, pay attention not to lose.



(12) Remove the snap ring.

- ※ Tighten the speed reducer flange and the motor flange with C-clamps or a hydraulic press (see the illustration) to make it easy.



(13) Remove the speed reducer with the iron balls with retainer and the internal ring of bearing.

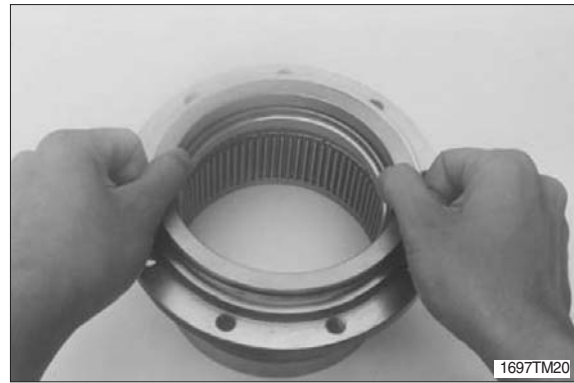


(14) Remove the iron balls with retainer from the speed reducer.

- ※ Pay attention not to lose the balls from retainer.

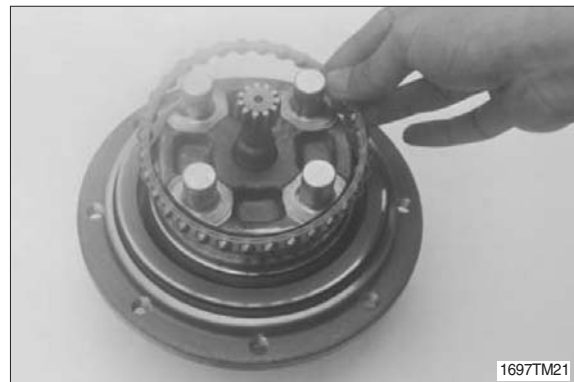


(15) Remove the seal ring from the speed reducer.



(16) Remove the iron balls with retainer and the internal ring of bearing from the hydraulic motor.

※ Pay attention not to lose the balls from retainer.

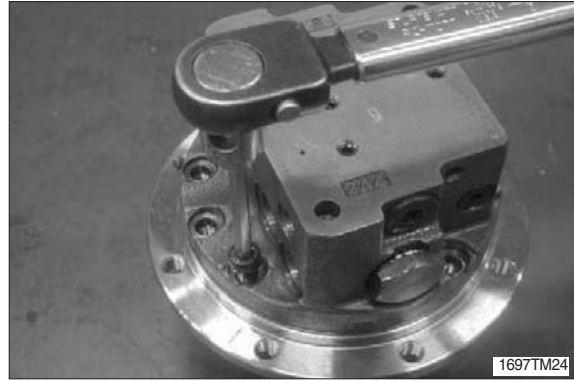


(17) Remove the floating seat with O-ring from the hydraulic motor.

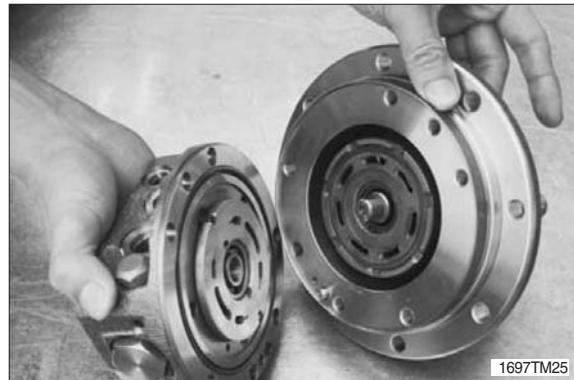


3) HYDRAULIC MOTOR SECTION

- (1) Remove the seven hexagon socket head cap bolts.
 - Hexagon size : 6 mm
- ※ If you fix the motor with a vice, protect it with aluminum plates or equivalent.



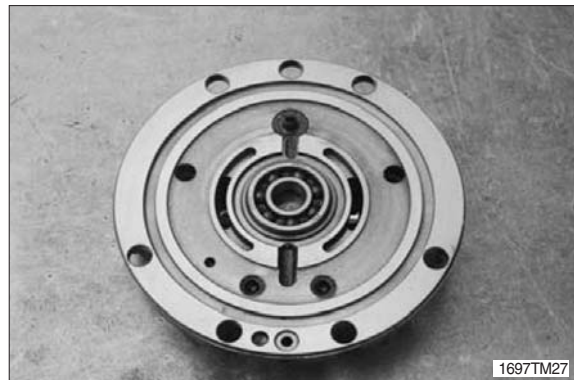
- (2) Remove the body 1 from the body 2.
- ※ Pay attention not to come off and damage the valve plate.



- (3) Remove the valve plate.

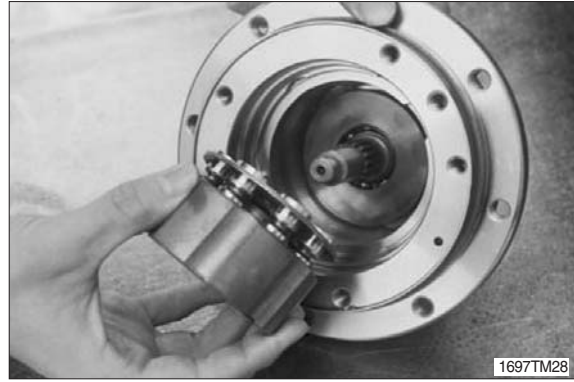


- (4) Remove the two O-rings from the body 1.
- ※ The bearing and spring pins are not able to disassemble, because they are press-fitted.

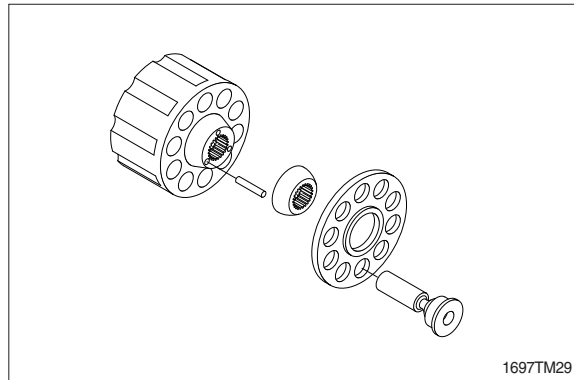


(5) Remove the cylinder barrel assembly from the body 2.

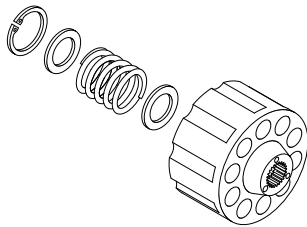
※ The small parts are easily dispersed, pay attention not to miss.



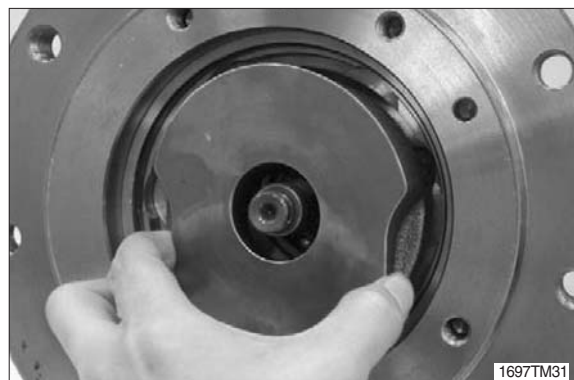
(6) Remove the seven piston-shoe assemblies, shoe holder, barrel holder, three pins.



(7) Remove the snap ring, retainer, spring-C and retainer.



(8) Remove the swash plate and two balls from the body 2.



(9) Remove the shaft from the body 2.

※ The bearing is not able to disassemble,
because they are press-fitted.



(10) Remove the control piston from the body 2.



(11) Remove the oil seal from the body 2.

(12) Remove the pin from the body 2.



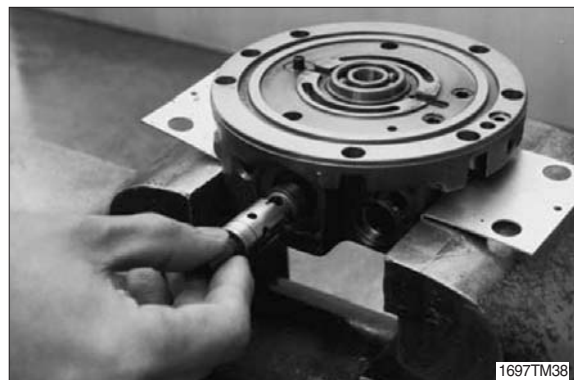
(13) Remove the two plugs with O-rings from
the body 1.

• Hexagon size : 27 mm



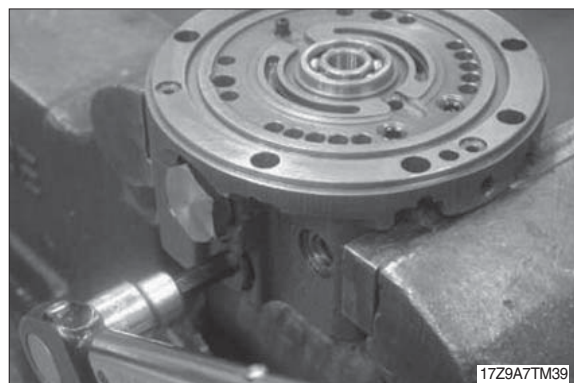
(14) Remove the two spring V2, two rings and spool assembly.

※ The spool assembly is not able to disassemble.



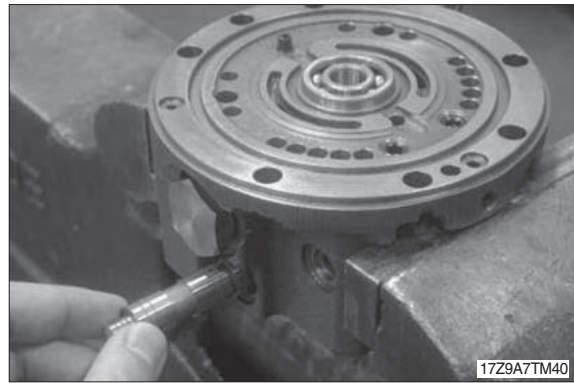
(15) Remove the two plugs with O-rings from the body 1.

· Hexagon size : 8 mm



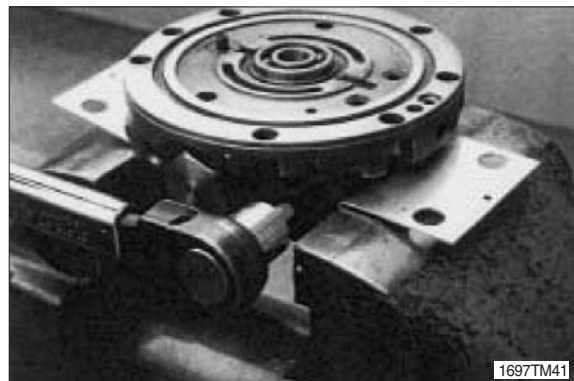
(16) Remove the spring V3, two speed spool, spool B and spool C.

※ The small parts are easily dispersed, pay attention not to miss.



(17) Remove the two plugs with O-ring from the body 1.

· Hexagon size : 5 mm



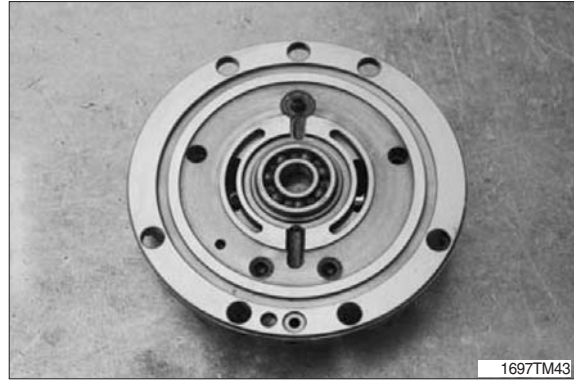
(18) Remove the two needles and shuttle spool.



3. ASSEMBLY

1) HYDRAULIC MOTOR SECTION

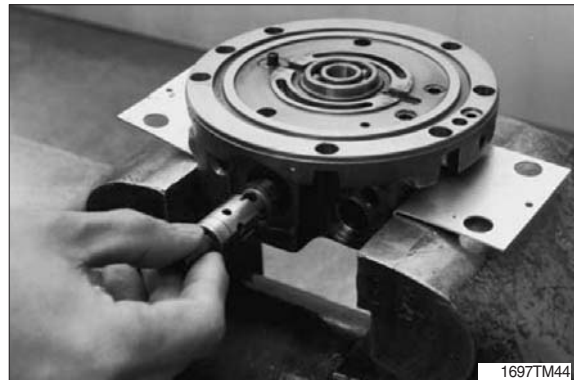
- (1) Press-fit the bearing and the spring pin into the body 1.



- (2) Insert the spool assembly, two rings (1pc/side) and two springs (1pc/side) in that order into the body 1, and then screw the two plugs (1pc/side) with two O-rings (1pc/side).

※ The spool assembly is not able to disassemble.

- Plugs tightening torque (both sides) :
13~17 kgf · m (94~123 lbf · ft)
- Hexagon size : 27 mm

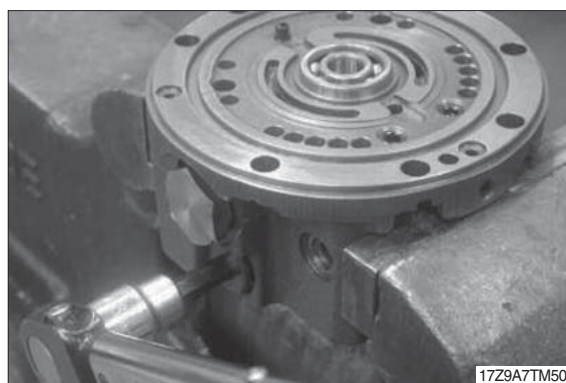
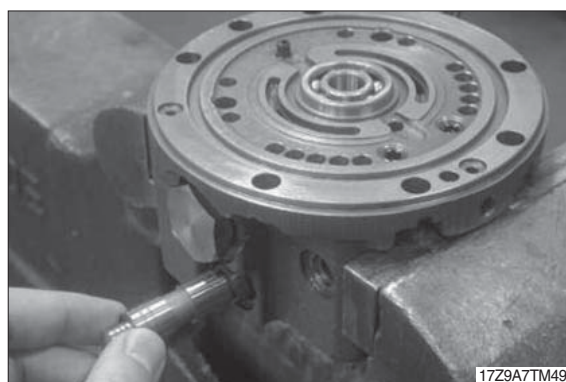
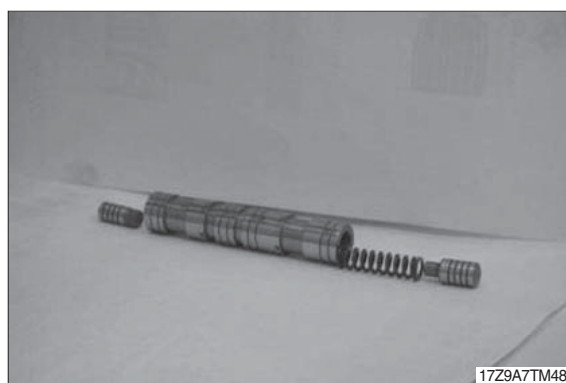




(3) Insert the spring V3, spool B and spool C into two speed spool. Insert its assembly into the body 1. Screw the two plugs (1pc/side) with two O-rings (1pc/side).

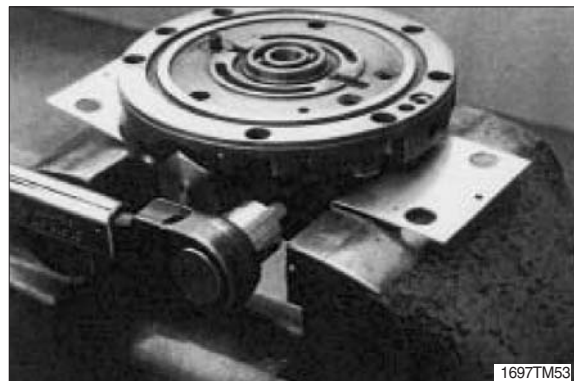
- Plugs tightening torque :
4.69~5.2 kgf · m (33.9~37.6 lbf · ft)
- Hexagon size : 8 mm

※ Pay attention to the direction of the spool.
(See drawings for the direction, page 7-58~60).

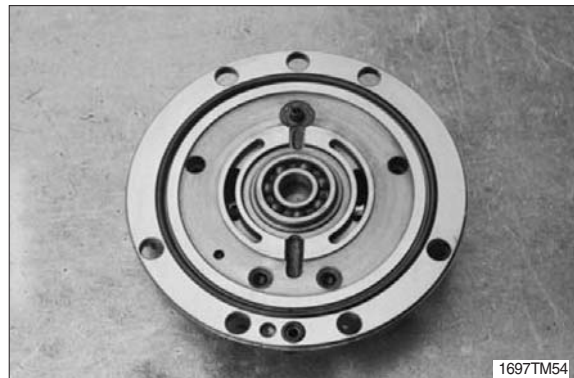


(4) Insert the shuttle spool and two needles (1pc/side) into the body 1, and then screw them in with the two plugs with O-rings (1pc/side).

- Plugs tightening torque :
1.2~1.8 kgf · m
(8.7~13.0 lbf · ft, both sides)
- Hexagon size : 5 mm

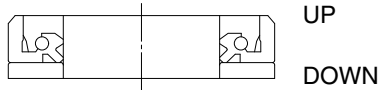


(5) Place two O-rings onto the body 1.

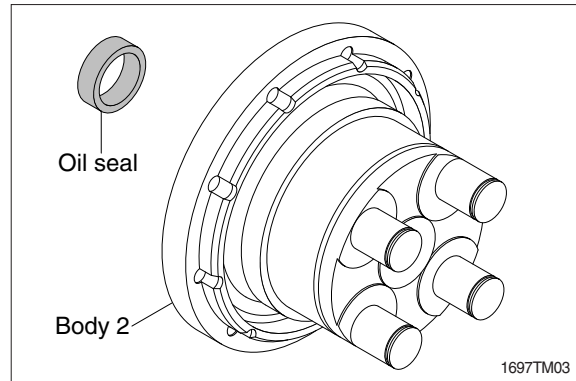


(6) Press-fit the oil seal into the body 2.

- ※ Apply grease to the periphery of the oil seal.
- ※ Pay attention to the direction of the oil seal, and do not slant it.



R27Z97TM52



(7) Place the pin into the body 2.



(8) Press-fit the bearing with the shaft.



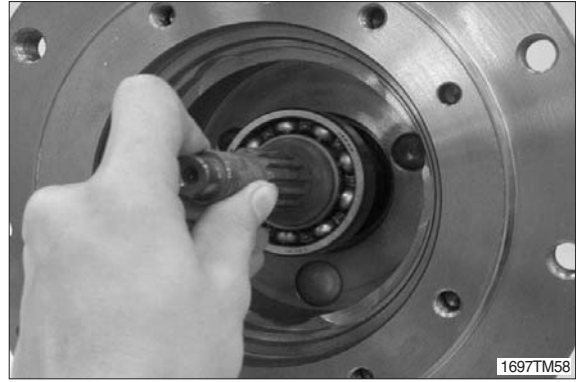
(9) Insert the control piston into the body 2.

- ※ Pay attention to the direction of the control piston.
- ※ Assemble the control piston, which shoe surface should be upper side (see drawings for the direction, page 7-58~60).



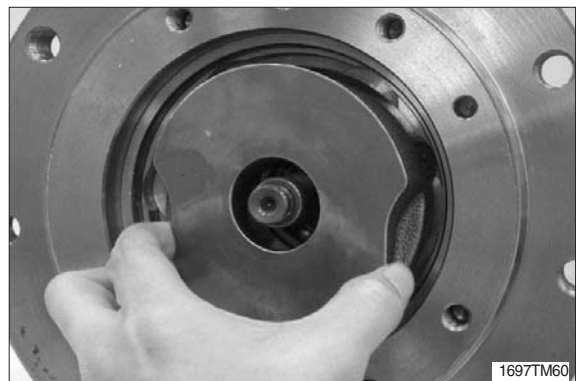
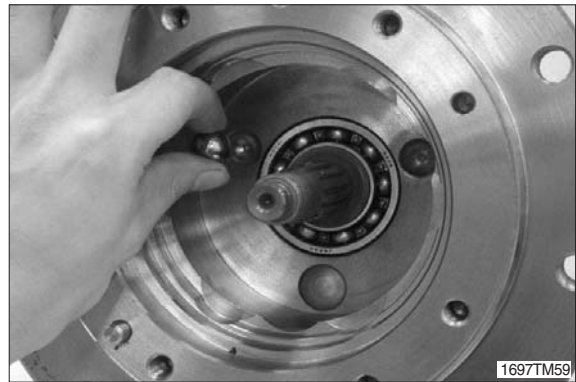
(10) Place the shaft into the body 2.

- ※ Pay attention not to damage the oil seal with the shaft.
- A oil which damaged should be replaced.



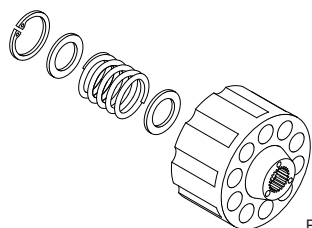
(11) Place the two balls and the swash plate onto the body 2.

- ※ Apply oil to the working face of the swash plate.
- ※ In case the swash plate drops out, apply grease to the back of it.



(12) Place the retainer, spring C and retainer in that order into the cylinder barrel, and then secure them with the snap ring.

- ※ Pay attention to the direction of the snap ring. The edge side should be uppermost.

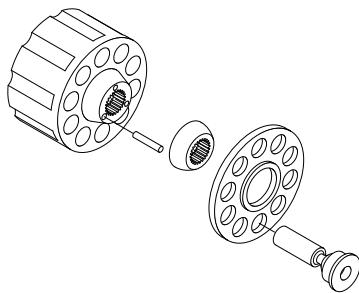
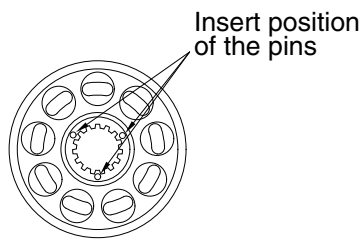


(13) Place the piston-shoe assemblies into the shoe holder.



(14) Place the three pins, barrel holder and piston-shoe assemblies in that order into the cylinder barrel.

- ※ Apply oil to the inside of the cylinders, then lower the pistons into the cylinder barrel.
- ※ Pay attention to the order of pins, barrel holder and piston-shoe assemblies.
(See drawing for the order, page 7-58~60)



(15) Insert the cylinder barrel assembly into the body 2 so that the shoes contact the swash plate.

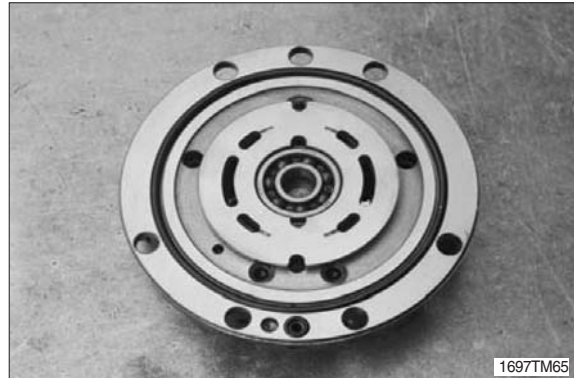
- ※ The small parts are easily dispersed, pay attention not to lose.



(16) Fill the body 2 with 0.1ℓ hydraulic oil for lubrication.

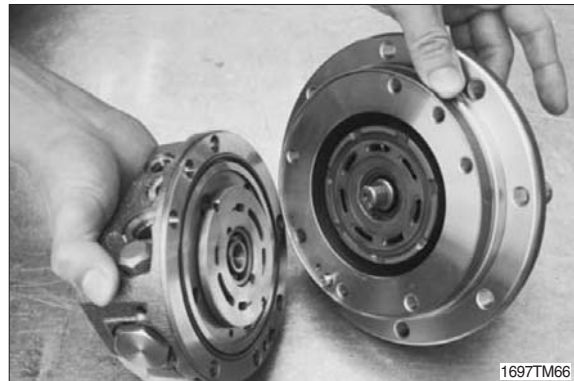
(17) Place the valve plate onto the body 1.

- ※ The copper face of the valve plate should be uppermost.
- ※ Apply oil to the copper face of the valve plate.
- ※ In case the valve plate drops out, apply grease to the steel face of it.



(18) Join the body 1 to the body 2.

- ※ The small parts are easily dispersed, pay attention not to miss.



(19) Bolt them with seven hexagon socket head cap bolts.

- Bolt tightening torque :
2.9~3.1 kgf · m (21.0~22.4 lbf · ft)
- Hexagon size : 6 mm

- ※ If you fix the motor with a vice, protect it with aluminum plates or equivalent.



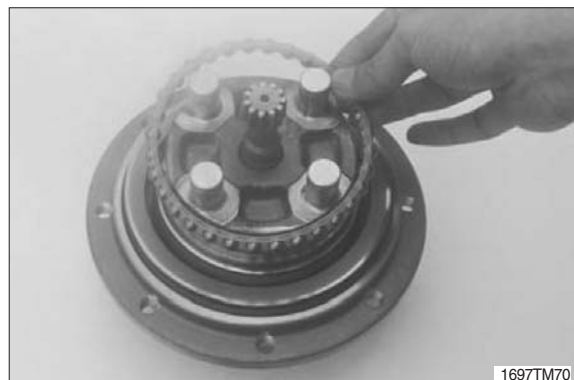
2) REDUCTION GEAR SECTION

- (1) Place the floating seal with O-ring into the hydraulic motor.



- (2) Place inner ring, retainer with balls of the bearing in that order, onto the hydraulic motor.

- ※ Pay attention to the direction of the inner ring and the retainer.
(See drawings for the direction, page 7-58~60)
- ※ Pay attention not to disassemble the balls from the retainer.



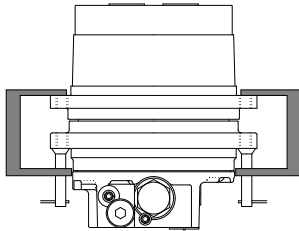
- (3) Put the seal ring with O-ring onto the body.

- ※ Apply grease to the O-ring to make it easy, and then wipe grease from the seal surface.



(4) Join the body to the motor.

- ※ Wipe grease from the seal surface.
- ※ Tighten the speed reducer flange and the motor flange with C-cramps or a hydraulic press.



1697TM95



1697TM72

(5) Place retainer with balls, inner ring of the bearing in that order onto the hydraulic motor.

- ※ Pay attention to the direction of the inner ring and the retainer.
- ※ Pay attention not to disassemble the balls from retainer.
(See drawing for the direction.)



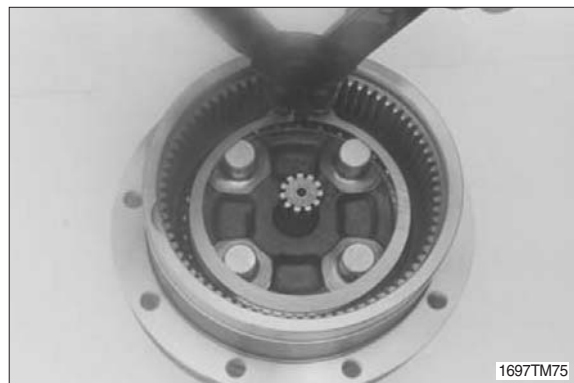
1697TM73



1697TM74

(6) Fix the bearing with the snap ring.

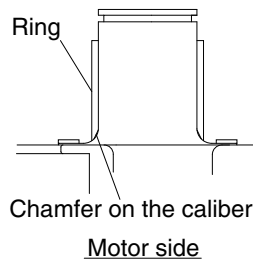
- ※ The pre-load for the bearings is adjusted by thickness of the snap ring.



1697TM75

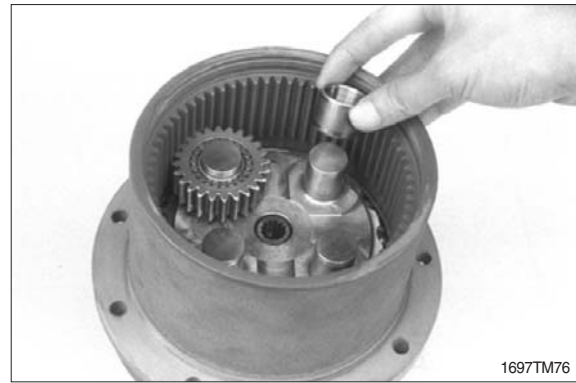
(7) Place the four rings (1pc/1pin), four thrust washers (1pc/1pin), four b1 gears (1pc/1pin) and ninety-six needles (24pcs/1pin) in that order onto the body 2.

- ※ Pay attention to the direction of the ring. The chamfer on the caliber of the ring direction is motor side.

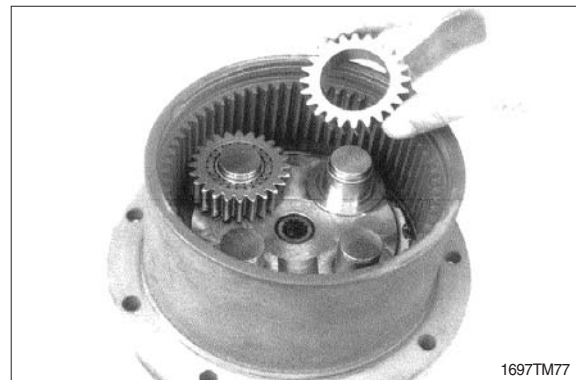


1697TM94

- ※ The needles are easily dispersed, pay attention not to lose.



1697TM76



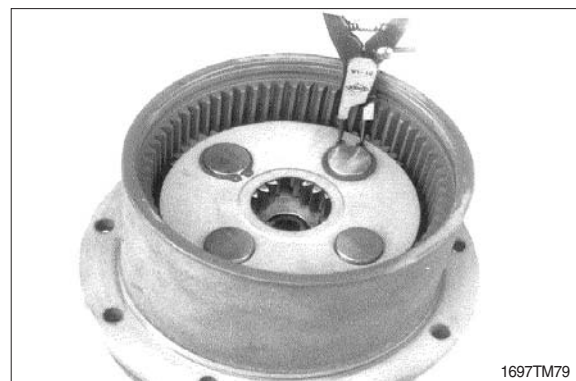
1697TM77



1697TM78

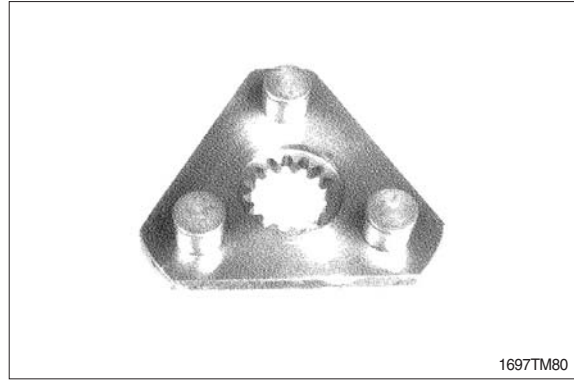
(8) Place thrust plate onto the gears and secure it with four snap rings.

- ※ Pay attention to the direction of the thrust plate. The convex side should be uppermost. (see drawings for the direction, page 7-58~60).
- ※ Pay attention to the direction of the snap ring. The edge side should be uppermost.
- ※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.



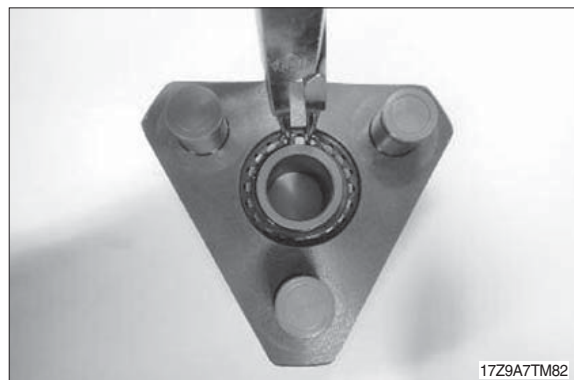
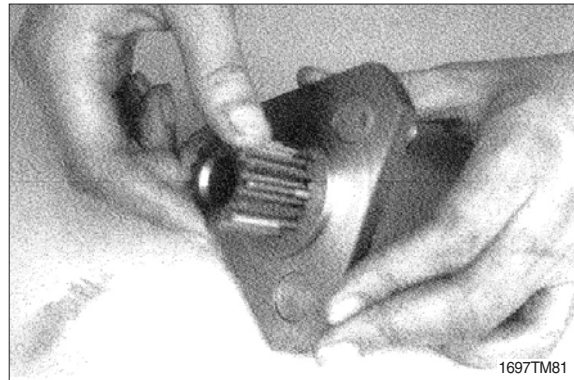
1697TM79

(9) Press-fit the three b2 pins and three spring pins (1pc/pin) into the carrier 2.



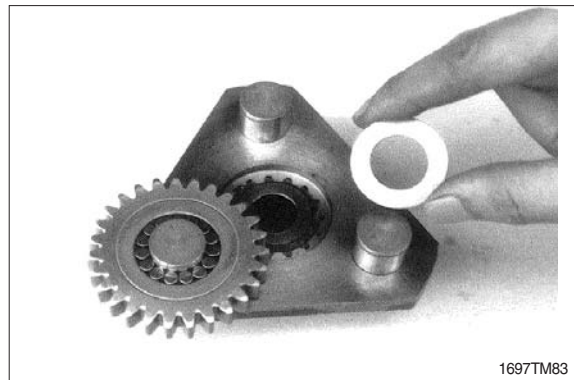
(10) Put the S1 gear to the carrier 2, and then secure them with the snap ring.

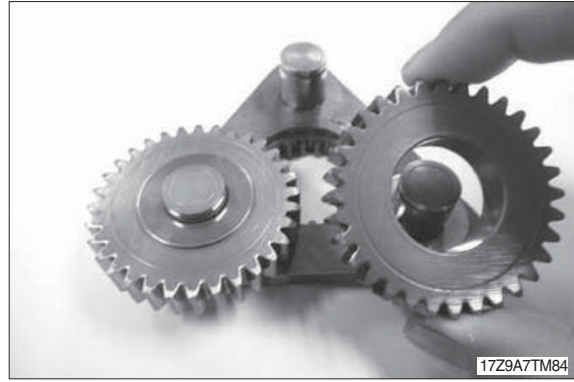
- ※ Pay attention to the direction of the snap ring. The edge side should be uppermost.
- ※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.



(11) Place the three thrust washers (1pc/1pin), three b2 gears (1pc/1pin), thirty-nine needles (13pcs/1pin) and the three thrust washers (1pc/1pin), in that order the carrier 2 and secure them with the three snap rings.

- ※ Pay attention to the direction of the snap ring. The edge side should be uppermost.
- ※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.





(12) Place the carrier 2 assembly into the body.



(13) Place the O-ring to the body.

- ※ Apply grease to the O-ring.
- ※ Pay attention not the rubbish in the O-ring groove.



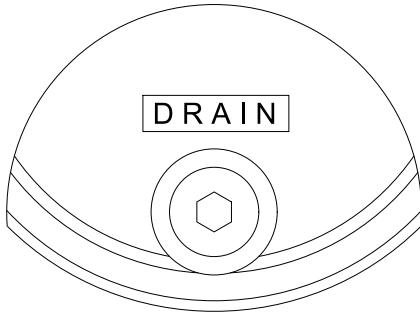
(14) Place the slide ring onto the cover.

- ※ Apply grease to the slide ring to prevent it dropping out.



(15) Fill 0.33 ℓ gear oil in the body and insert cover.

- ※ Pay attention not to damage the O-ring.
- ※ The "DRAIN" side tapped hole should be aligned with notches of the body.



1697TM89



(16) Put the snap ring into the groove of the body to secure the cover.

- ※ Put the flat blade-flared tip screwdriver to the end of the snap ring, and tap it in the direction of the circumference.



(17) Screw the two plugs (size : PF3/8) with O-rings (1pc/plug) to the cover.

- Plug tightening torque (PF3/8) :
4.69~5.2 kgf · m (33.9~37.6 lbf · ft)
- Hexagon size : 8 mm (PF3/8)

※ Screw the plug of "DRAIN" side first.



GROUP 7 RCV LEVER

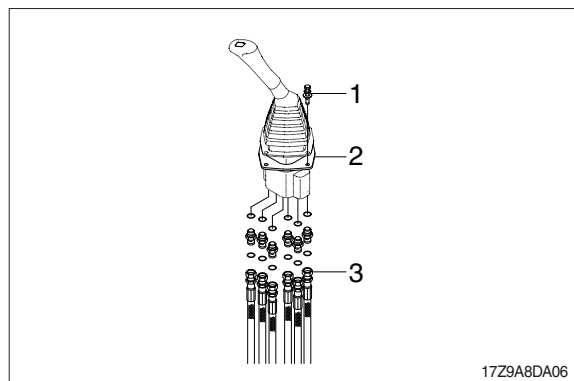
1. REMOVAL AND INSTALL

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.

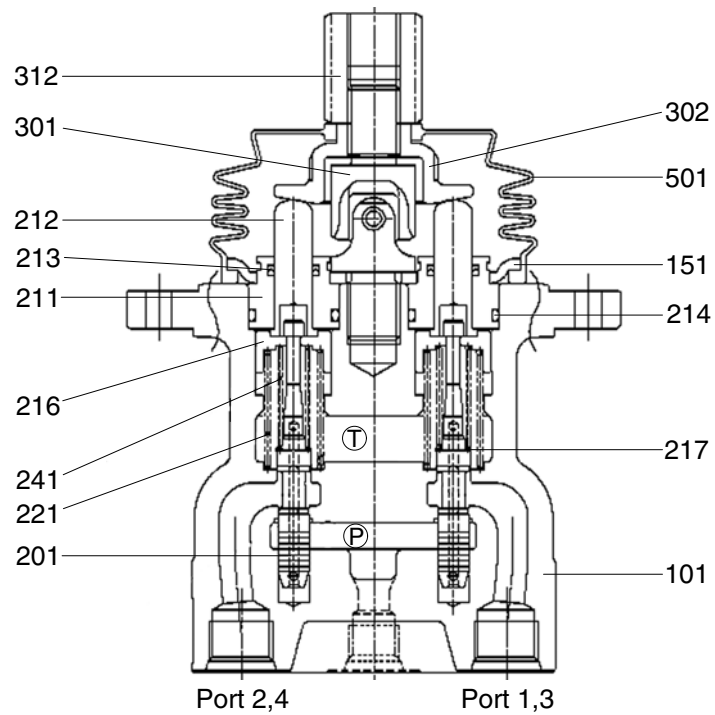
- (4) Loosen the socket bolt(1).
 - (5) Remove the cover of the console box.
 - (6) Disconnect pilot line hoses(3).
 - (7) Remove the pilot valve assembly(2).
- ※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



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. 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

3. 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 mishandling. 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.

15) 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.

4. ASSEMBLY

※ The surface of the spool (201) and the spring seat (216) can be damaged by mishandling. 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).



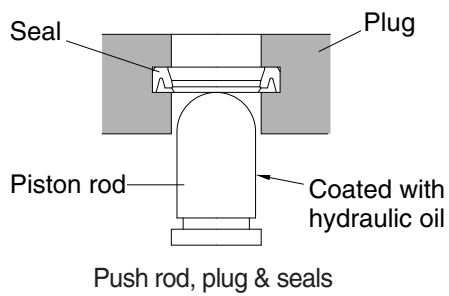
5) Fit the seal (213) into the plug (211).

※ 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.



17Z9A7RCV32



▲ 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.

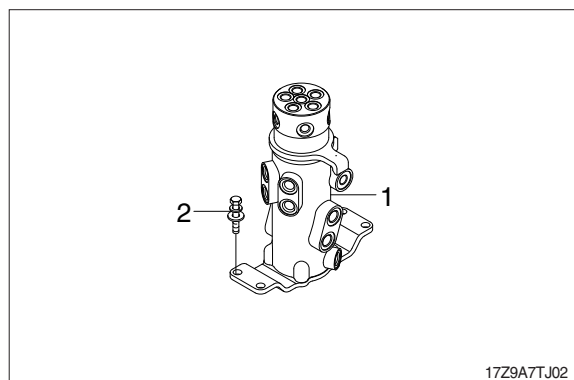
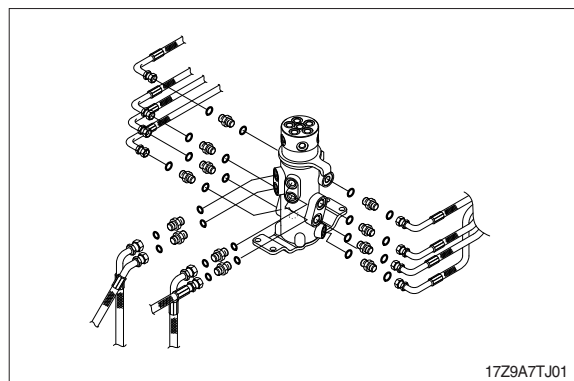
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

※ 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 : 14 kg (31 lb)
 - Tightening torque : 6.9 ± 1.4 kgf · m
(49.9 ± 10.1 lbf · ft)
 - (6) Remove the turning joint assembly.
- ※ When removing the turning joint, check that all the hoses have been disconnected.

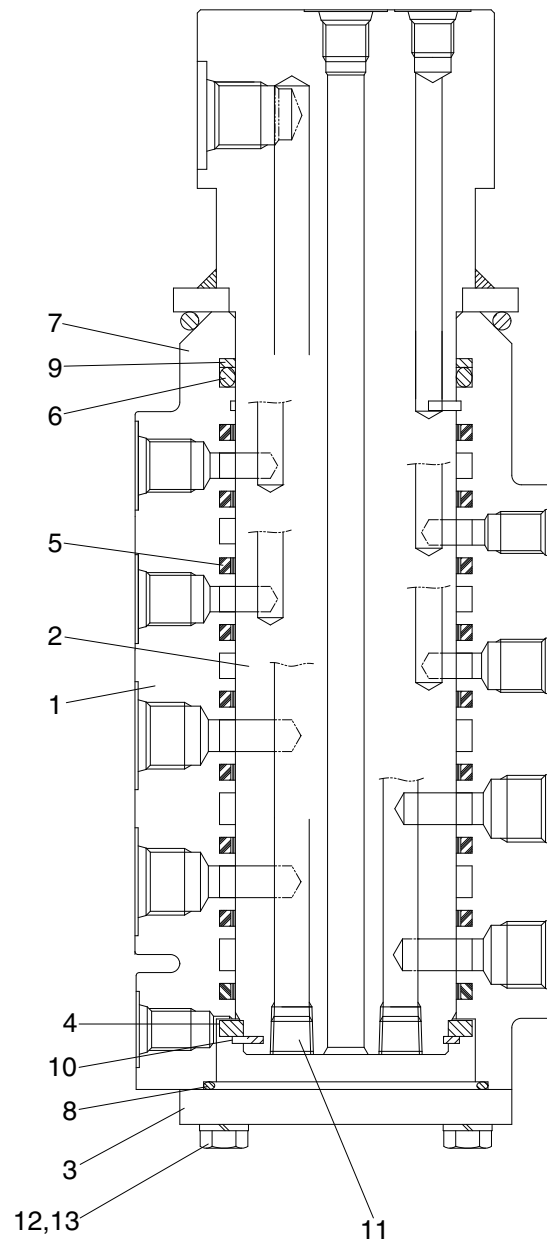
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



- 1 Hub
- 2 Shaft
- 3 Cover
- 4 Spacer
- 5 Slipper seal

- 6 O-ring
- 7 O-ring
- 8 O-ring
- 9 Back-up ring
- 10 Retainer ring

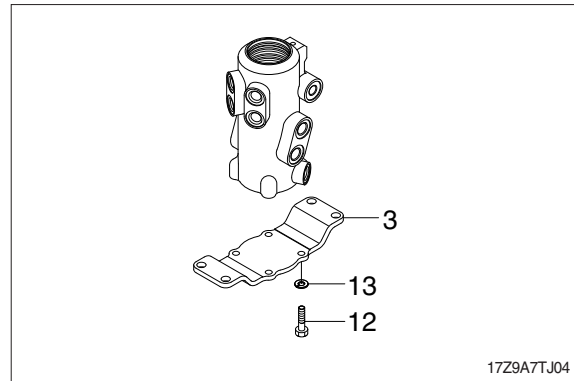
- 11 Plug
- 12 Hexagon bolt
- 13 Spring washer

1697TJ02

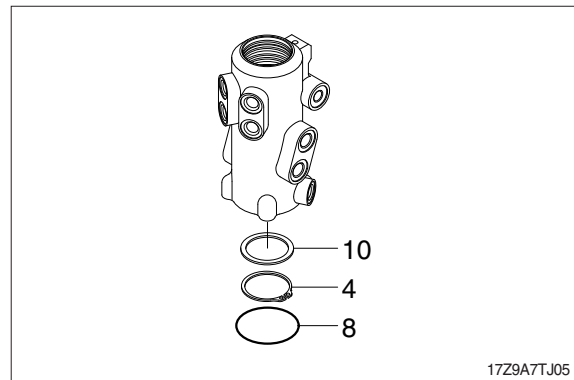
2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

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

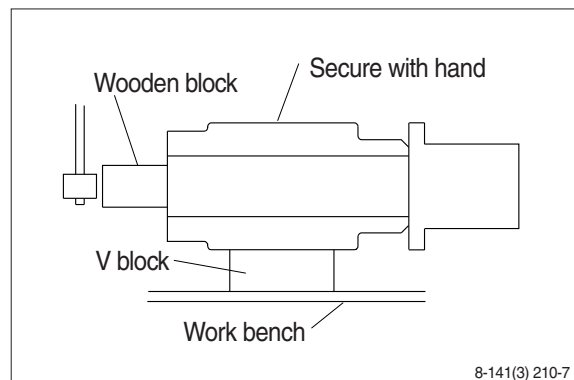


- (2) Remove O-ring (8).
- (3) Remove retainer ring (10) and spacer (4).

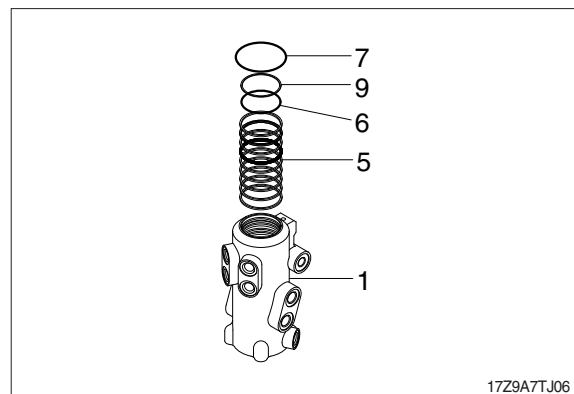


- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).



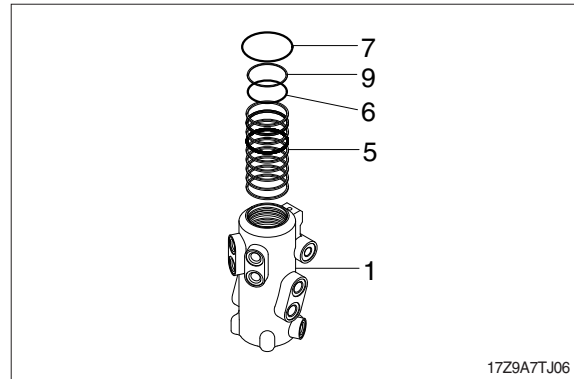
- (5) Remove nine slipper seals (5), O-ring (7), back-up ring (9), and O-ring (6) from hub (1).



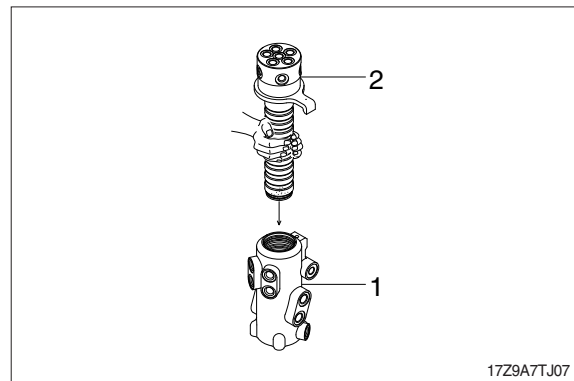
3) ASSEMBLY

- ※ 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 nine slipper seal (5) and O-ring (7), back-up ring (9) and O-ring (6) to hub (1).

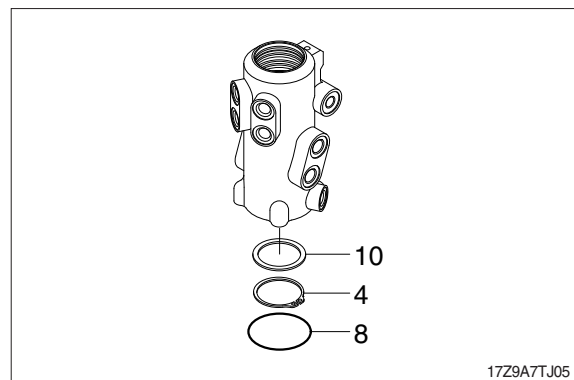


(2) Set hub (1) on block, install shaft (2) into hub (1) by hand.

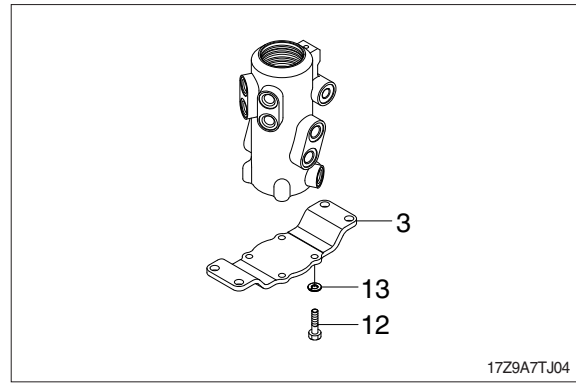


(3) Fit spacer (4) and retainer ring (10) to shaft (2).

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



(5) Install cover (3) to hub, tighten bolts (12) with washer (13).



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.

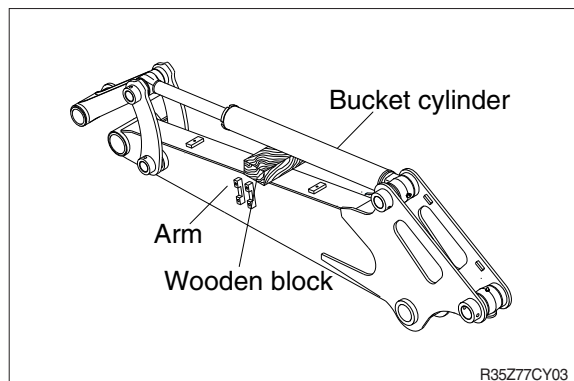
② Remove bolt (2), nut (3) and pull out pin (1).

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

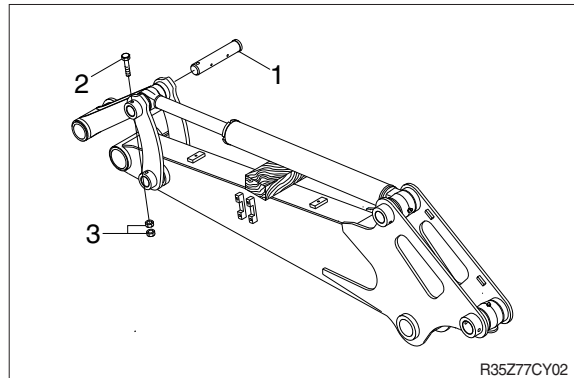
③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



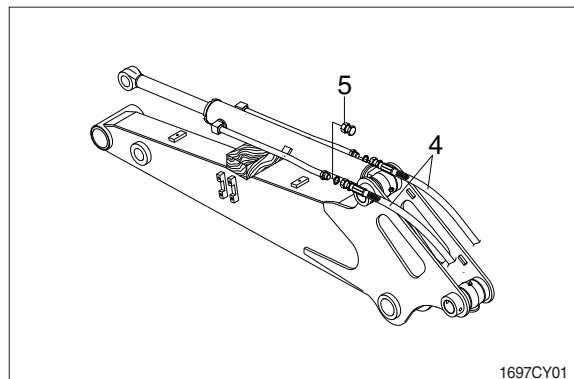
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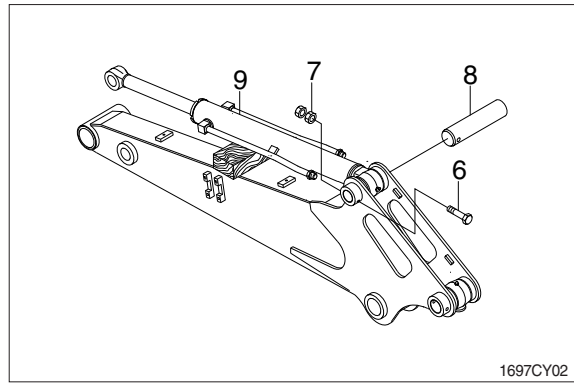


R35Z77CY02



1697CY01

- 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 : 11 kg (24 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

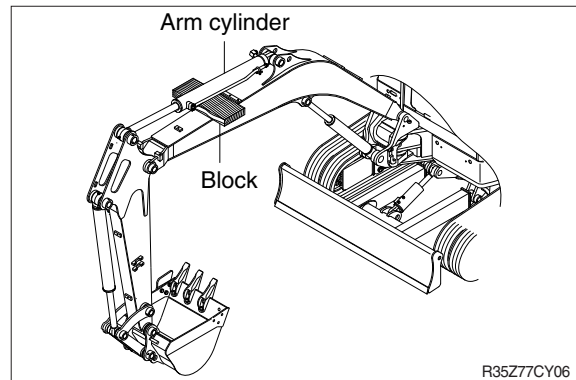
(1) Removal

- ※ 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.

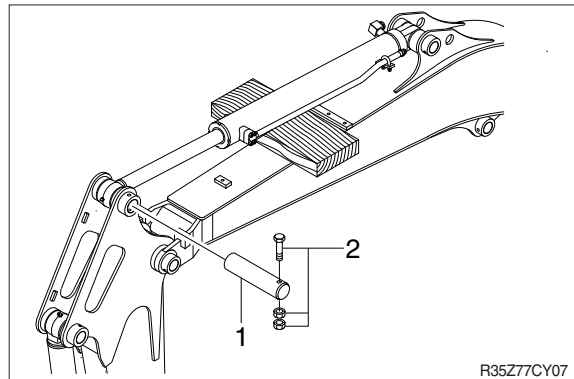
▲ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

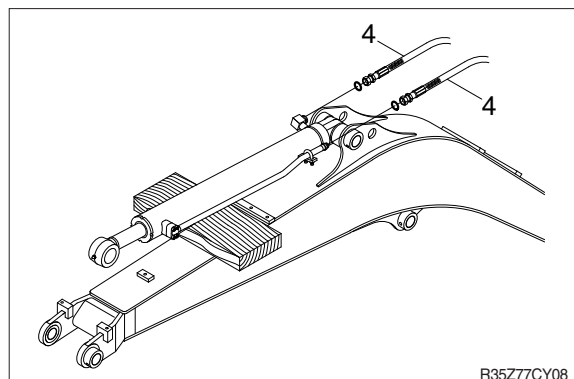
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.
- ① Set block between arm cylinder and boom.



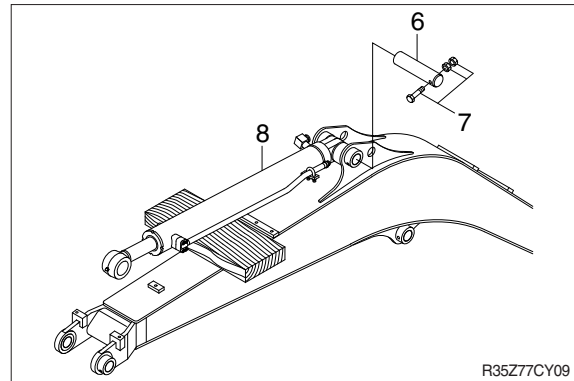
- ② Remove bolt and nut (2) and pull out pin (1).
- ※ Tie the rod with wire to prevent it from coming out.



- 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 : 15 kg (33 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

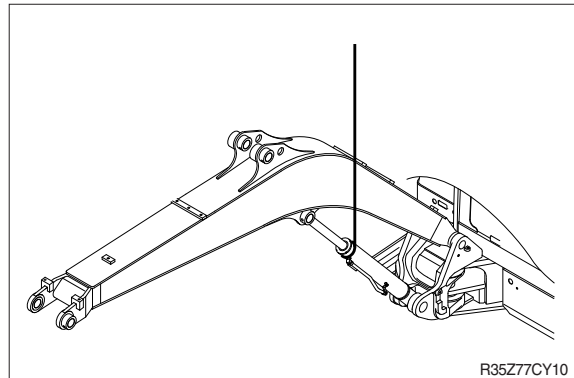
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

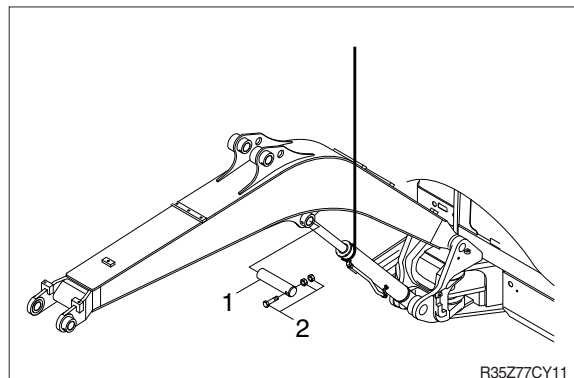
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Sling boom cylinder assembly.

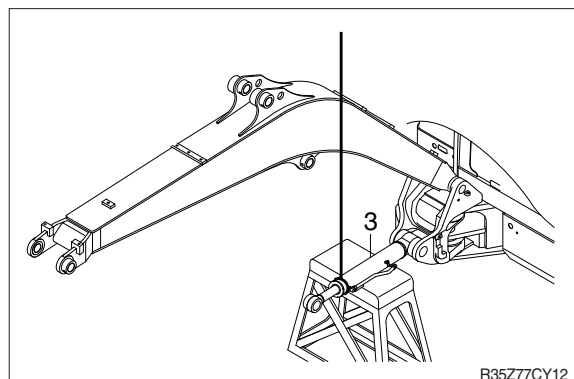


③ Remove bolt and nut (2) and pull out pin (1).

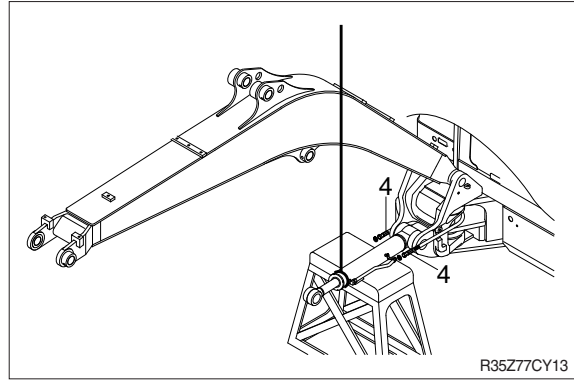
- ※ Tie the rod with wire to prevent it from coming out.



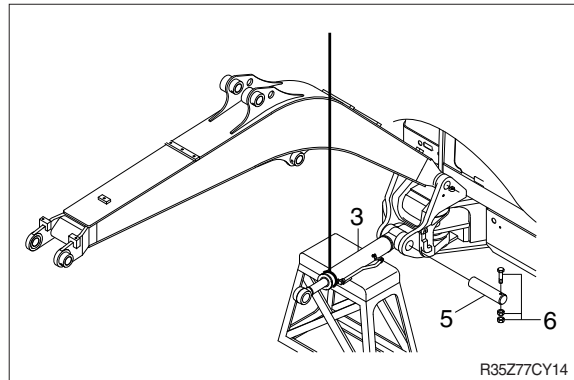
④ Lower the boom cylinder assembly (3) on a stand.



- 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 : 17 kg (37 lb)



(2) Install

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

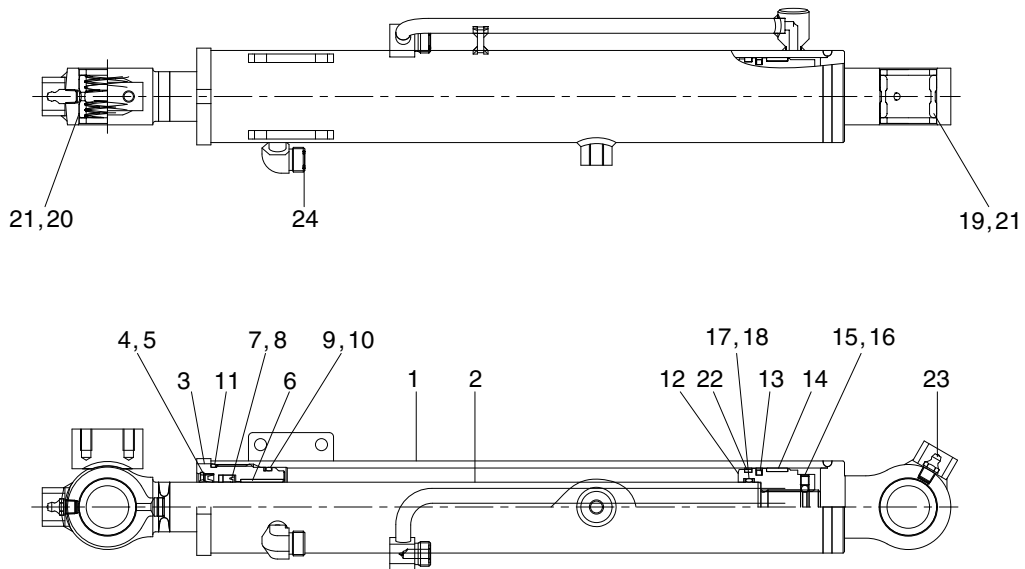
▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

- ※ 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

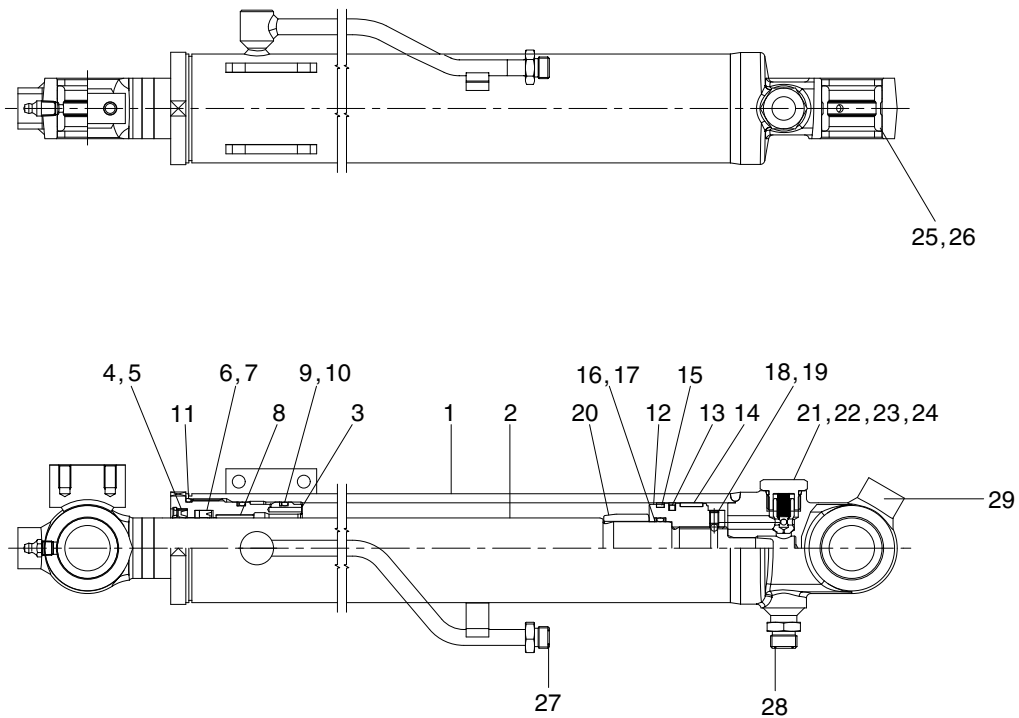
(1) Bucket cylinder



17Z9A7CY03

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

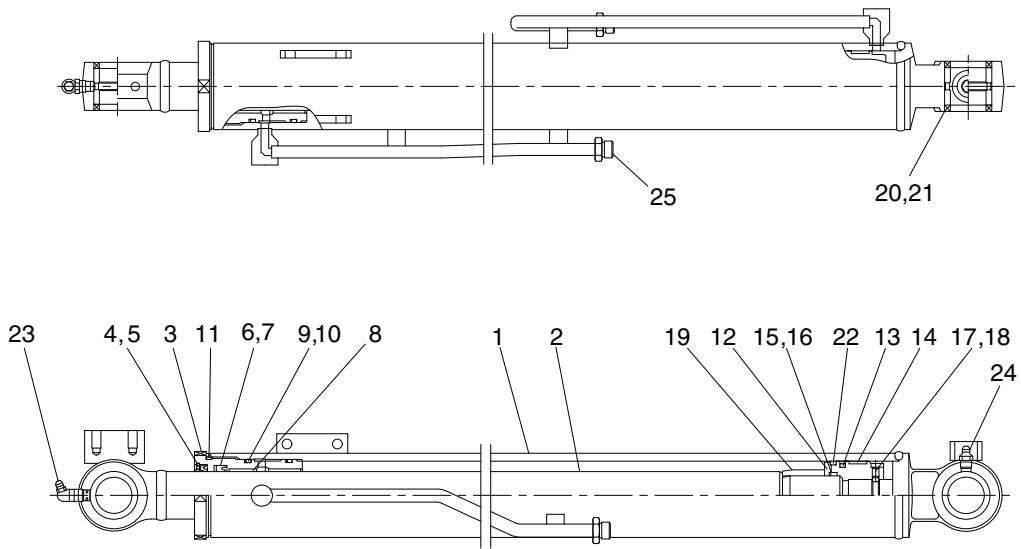
(2) Arm cylinder



1	Tube assembly	11	O-ring	21	Check valve
2	Rod assembly	12	Piston	22	Spring
3	Gland	13	Piston seal	23	Plug
4	Dust wiper	14	Wear ring	24	O-ring
5	Retaining ring	15	Dust ring	25	Pin bushing
6	Rod seal	16	O-ring	26	Dust seal
7	Back-up ring	17	Back up ring	27	O-ring
8	Bushing	18	Steel ball	28	O-ring
9	O-ring	19	Set screw	29	Grease nipple
10	Back-up ring	20	Cushion ring		

17Z9A7CY04

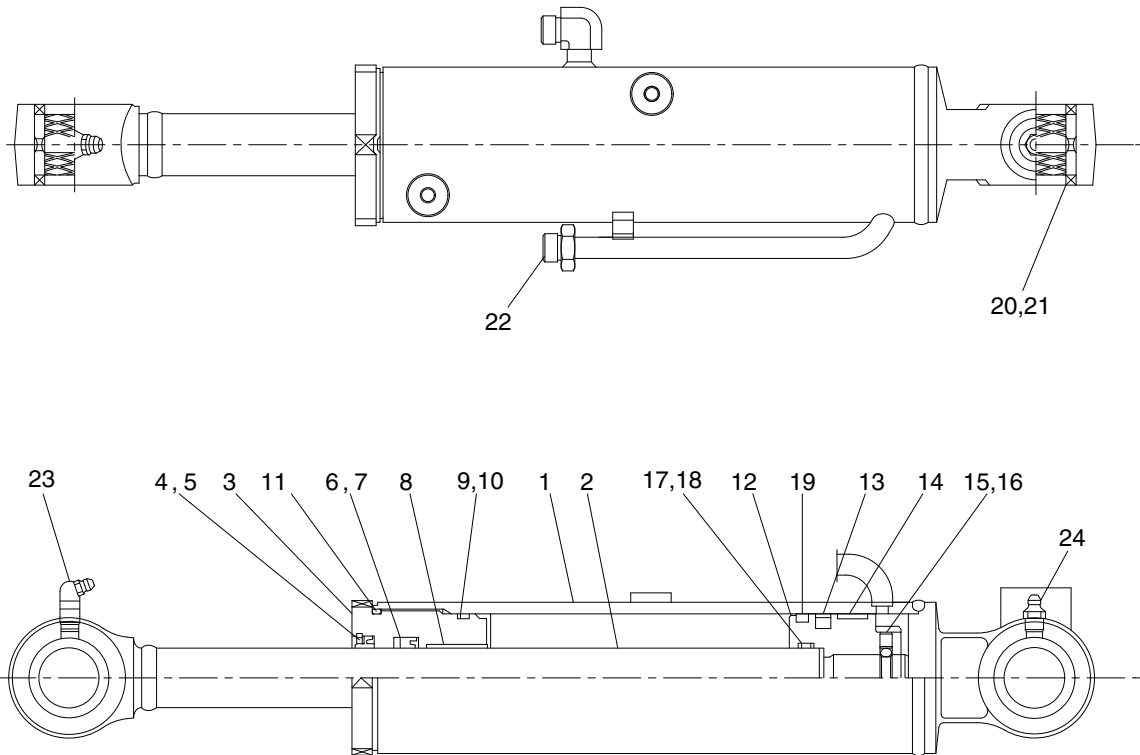
(3) Boom cylinder



17Z9A7CY18

- | | | | | | |
|---|----------------|----|--------------|----|---------------|
| 1 | Tube assembly | 10 | Back-up ring | 19 | Cushion ring |
| 2 | Rod assembly | 11 | O-ring | 20 | Pin bushing |
| 3 | Gland | 12 | Piston | 21 | Dust seal |
| 4 | Dust wiper | 13 | Piston seal | 22 | Dust ring |
| 5 | Retaining ring | 14 | Wear ring | 23 | Grease nipple |
| 6 | Rod seal | 15 | O-ring | 24 | Grease nipple |
| 7 | Back-up ring | 16 | Back up ring | 25 | O-ring |
| 8 | Bushing | 17 | Set screw | | |
| 9 | O-ring | 18 | Steel ball | | |

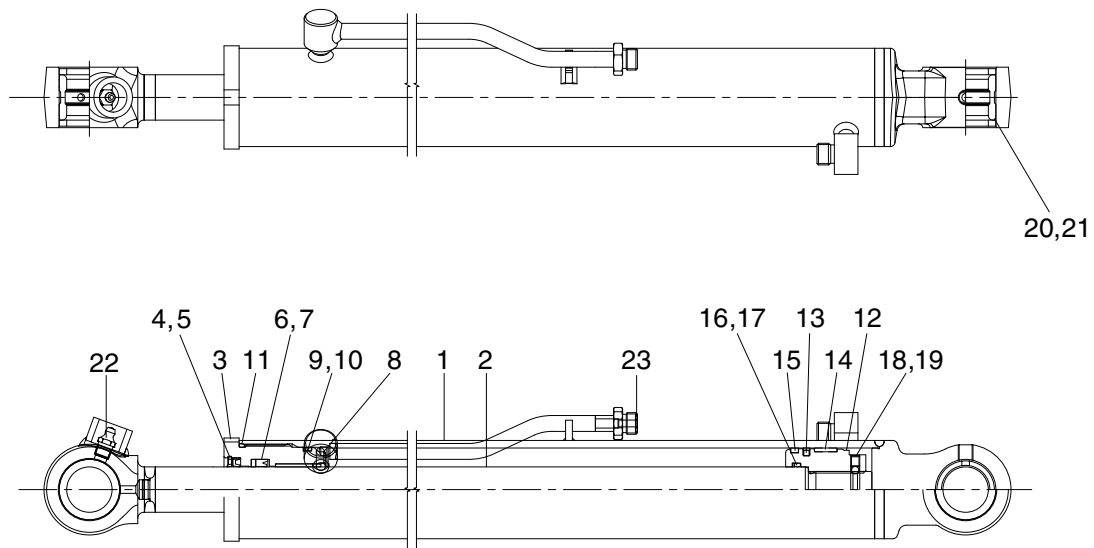
(4) Dozer cylinder



17Z9A7CY19

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

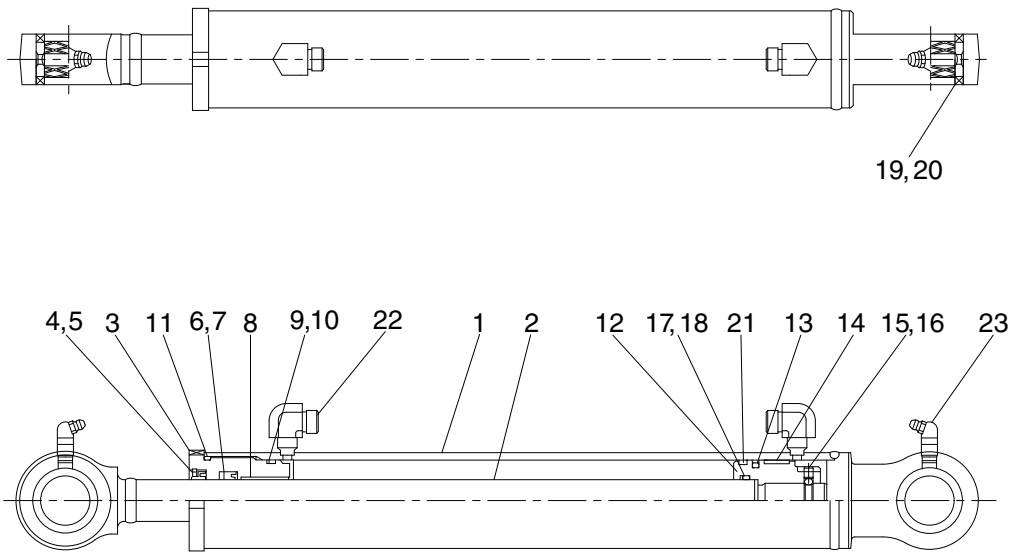
(5) Boom swing cylinder



17Z9A7CY20

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

(6) Extension cylinder

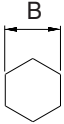


1697CY21

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

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	M65	52 ± 5.0	376 ± 36.2
	Arm cylinder	3	M65	52 ± 5.0	376 ± 36.2
	Bucket cylinder	3	M60	48 ± 5.0	347 ± 36.2
	Dozer cylinder	3	M70	56 ± 5.0	405 ± 36.2
	Boom swing cylinder	3	M60	48 ± 4.8	347 ± 34.7
	Extension cylinder	3	M60	48 ± 4.8	347 ± 34.7
Piston	Boom cylinder	12	M28	70 ± 7.0	506 ± 50.6
	Arm cylinder	12	M28	70 ± 7.0	506 ± 50.6
	Bucket cylinder	12	M24	60 ± 6.0	434 ± 43.4
	Dozer cylinder	12	M24	60 ± 6.0	434 ± 43.4
	Boom swing cylinder	12	M24	60 ± 6.0	434 ± 43.4
	Extension cylinder	12	M24	60 ± 6.0	434 ± 43.4
Set screw	Boom cylinder	17	M6	2 ± 0.2	14.5 ± 1.45
	Arm cylinder	19	M6	2 ± 0.2	14.5 ± 1.45
	Bucket cylinder	15	M6	2 ± 0.2	14.5 ± 1.45
	Dozer cylinder	15	M6	2 ± 0.2	14.5 ± 1.45
	Boom swing cylinder	18	M6	2 ± 0.2	14.5 ± 1.45
	Extension cylinder	15	M6	2 ± 0.2	14.5 ± 1.45

3) DISASSEMBLY

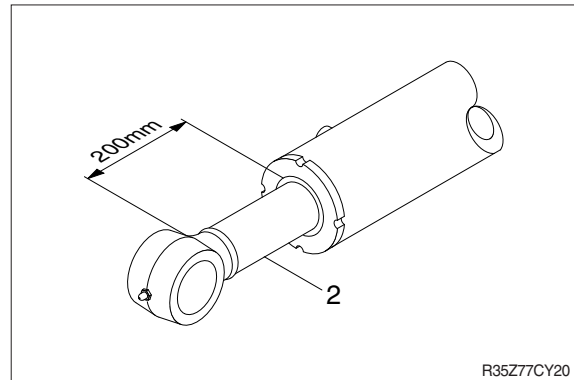
※ Procedures are based on the boom cylinder.

(1) Remove cylinder head and piston rod

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

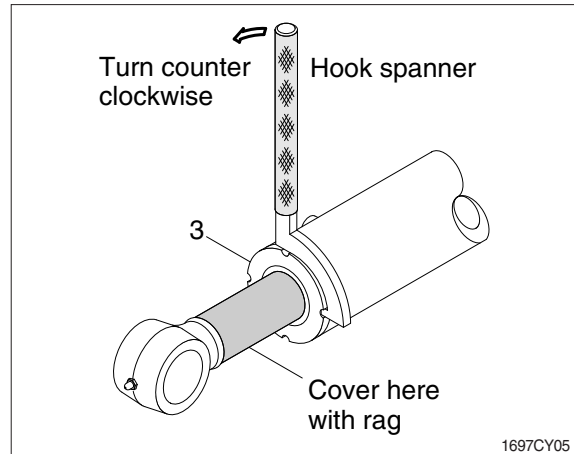
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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.



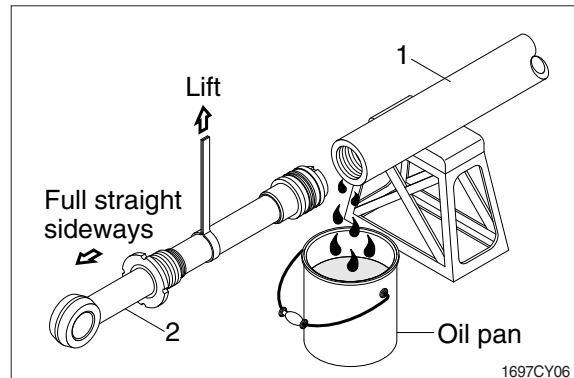
③ Loosen and remove the gland (3) by hook spanner.

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



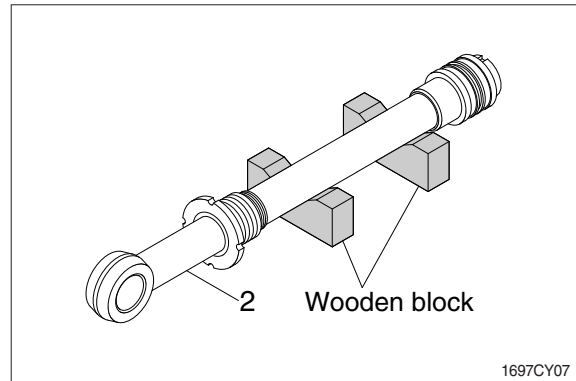
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ 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.



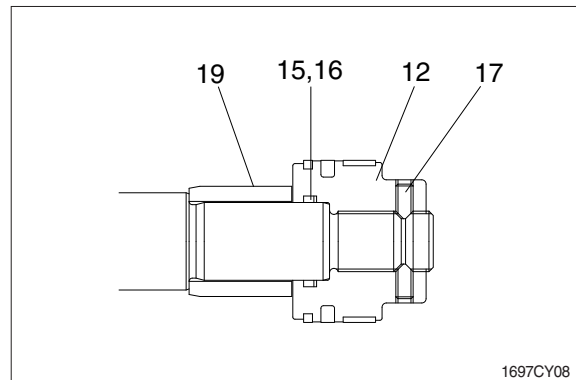
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

- ⑤ Place the removed rod assembly (2) on a wooden V-block that is set level.
- ※ Cover a V-block with soft rag.

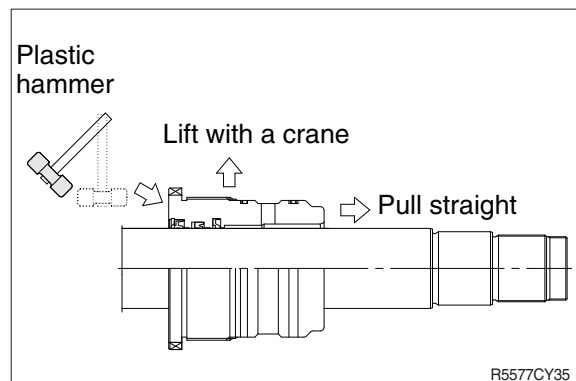


(2) Remove piston and gland

- ① Remove set screw (17).
- ② Remove piston assembly (12), back up ring (16), O-ring (15) and cushion ring (19).

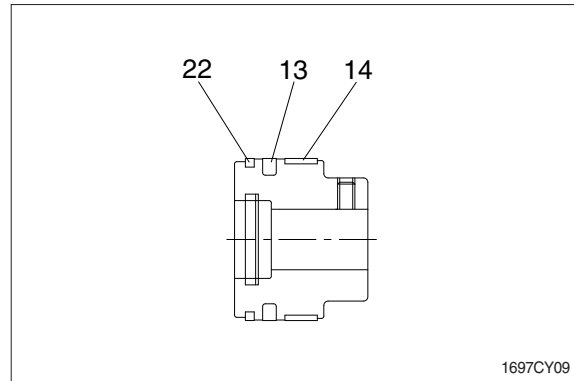


- ④ Remove the gland assembly from rod assembly (2).
 - ※ If it is too heavy to move, move it by striking the flanged part of gland with a plastic hammer.
 - ※ Pull it straight with gland assembly lifted with a crane.
- Exercise care so as not to damage the lip of packing (7, 8, 9, 10, 11) by the threads of rod assembly (2).



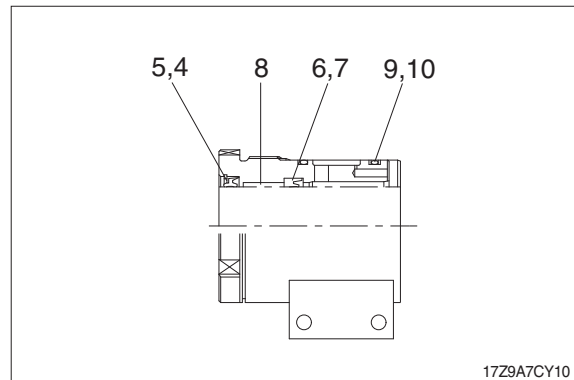
(3) Disassemble the piston assembly

- ① Remove wear ring (14).
 - ② Remove dust ring (22) and piston seal (13).
- ※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

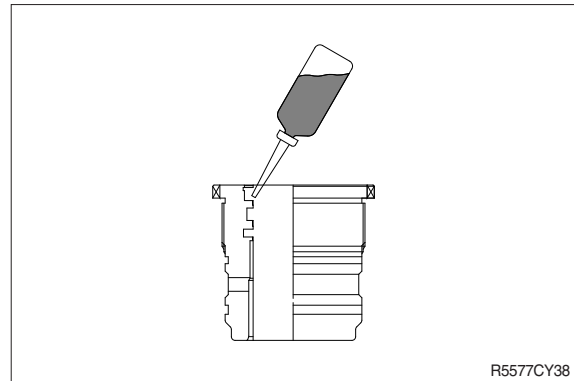
- ① Remove back-up ring (10) and O-ring (9).
 - ② Remove retaining ring (5), dust wiper (4).
 - ③ Remove back up ring (7), rod seal (6).
 - ④ Remove the dry bushing (8).
- ※ Exercise care in this operation not to damage the grooves.
- ※ Do not remove seal and ring, if does not damaged.



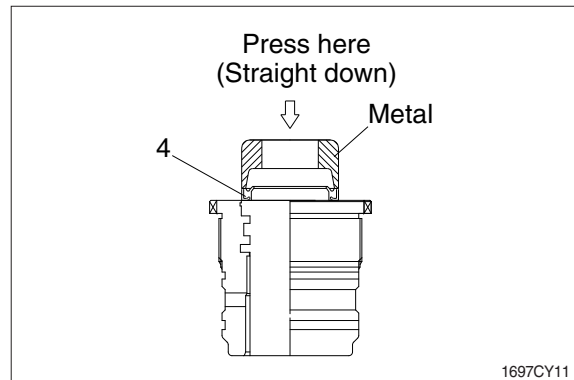
4) ASSEMBLY

(1) Assemble cylinder head assembly

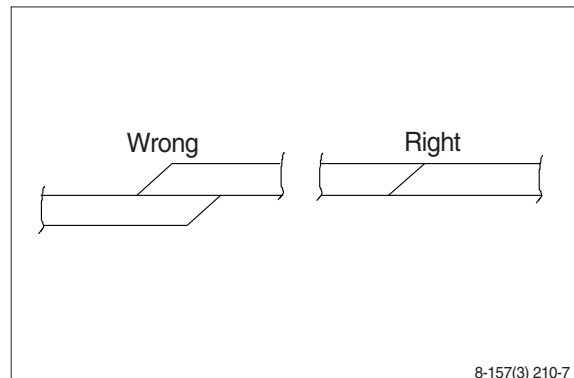
- ※ Check for scratches or rough surfaces if found smooth with an oil stone.
- ① Coat the inner face of gland (3) with hydraulic oil.



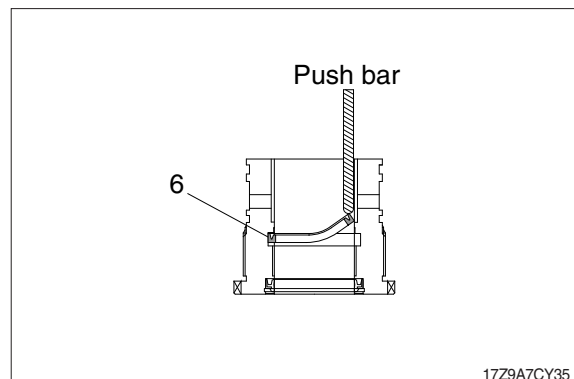
- ② Coat dust wiper (4) with grease and fit dust wiper (4) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.
- ③ Fit retain ring (5) to the stop face.



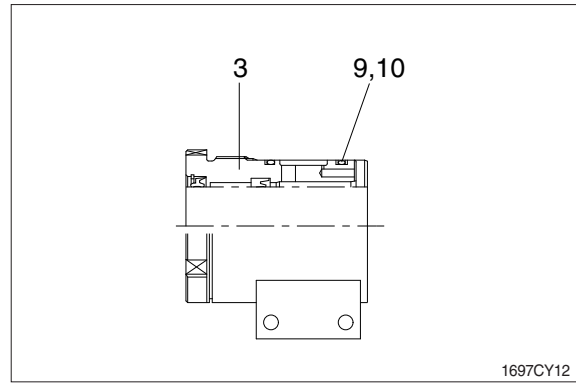
- ④ Fit back up ring (7), rod seal (6) to corresponding grooves, in that order.
 - ※ Coat each packing with hydraulic oil before fitting it.
 - ※ Insert the backup ring until one side of it is inserted into groove.



- ※ 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.

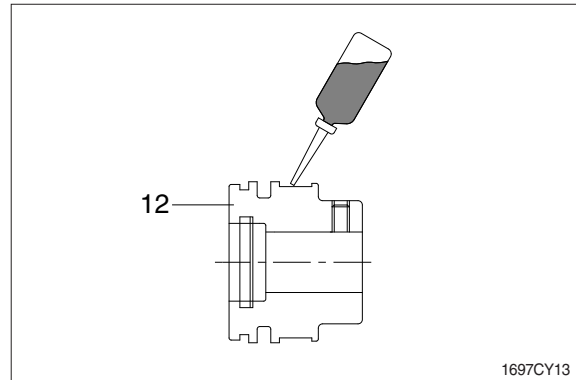


- ⑤ Fit back up ring (10) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C .
- ⑥ Fit O-ring (9) to gland (3).

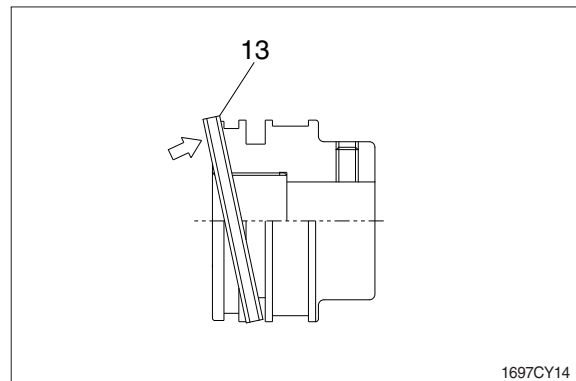


(2) Assemble piston assembly

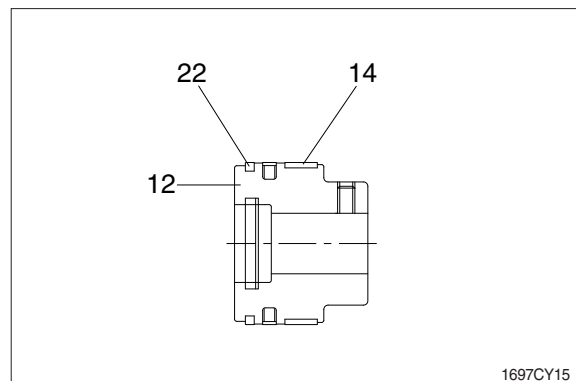
- ※ Check for scratches or rough surfaces.
If found smooth with an oil stone.
- ① Coat the outer face of piston (12) with hydraulic oil.



- ② Fit piston seal (13) 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.

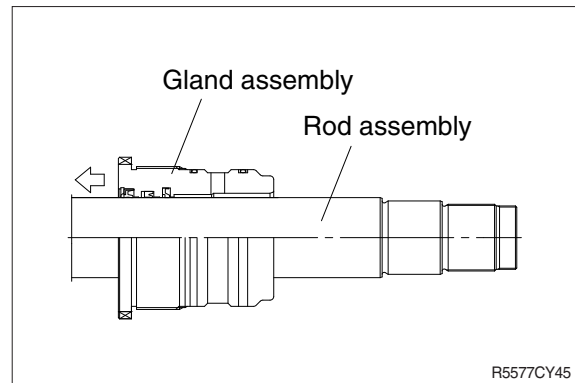


- ③ Fit wear ring (14) and dust ring (22) to piston (12).

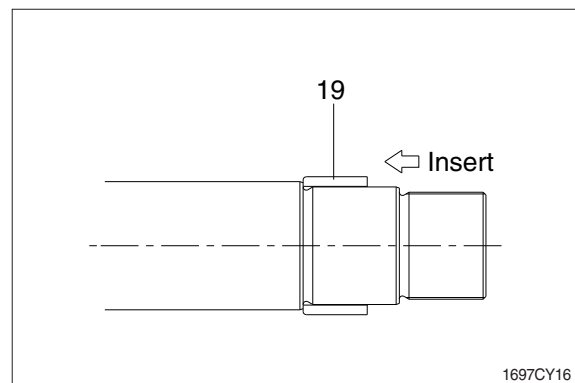


(3) Install piston and cylinder head

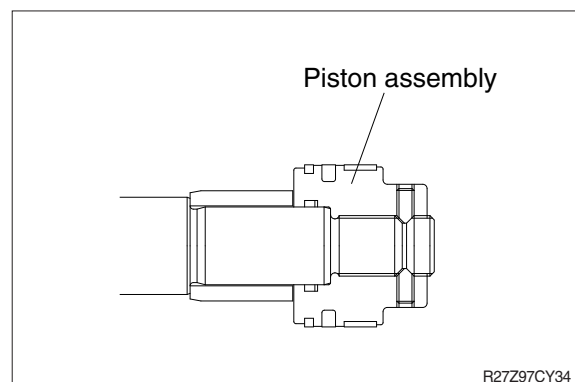
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and gland.
- ③ Insert gland assembly to rod assembly.



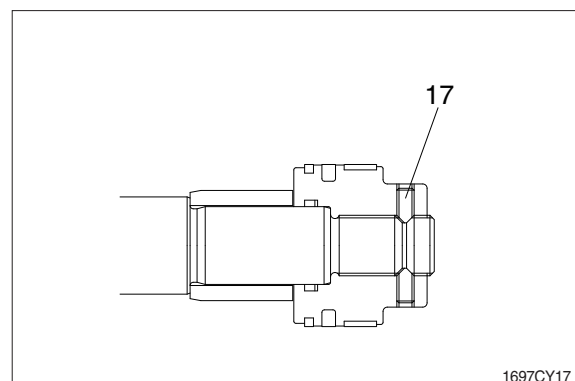
- ④ Insert cushion ring (19) to rod assembly.
※ Note that cushion ring (19) has a direction in which it should be fitted.



- ⑤ Fit piston assembly to rod assembly.

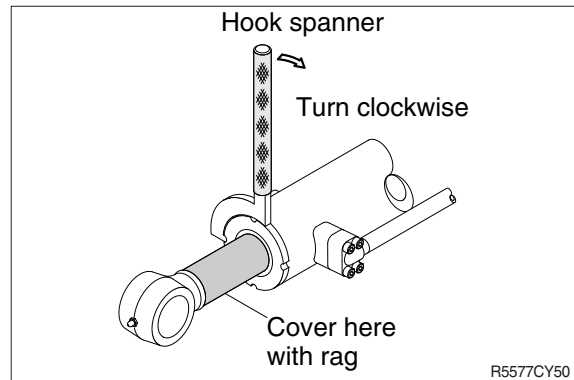
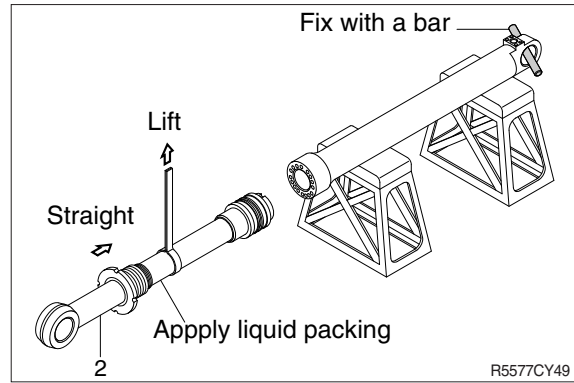


- ⑥ Fit set screw (17).
· Tightening torque :
 $2 \pm 0.2 \text{ kgf} \cdot \text{m}$ ($14.5 \pm 1.45 \text{ lbf} \cdot \text{ft}$)



(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 (2) with a crane.
 - ※ Be careful not to damage piston seal (13) by thread of tube assembly (1).
- 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.

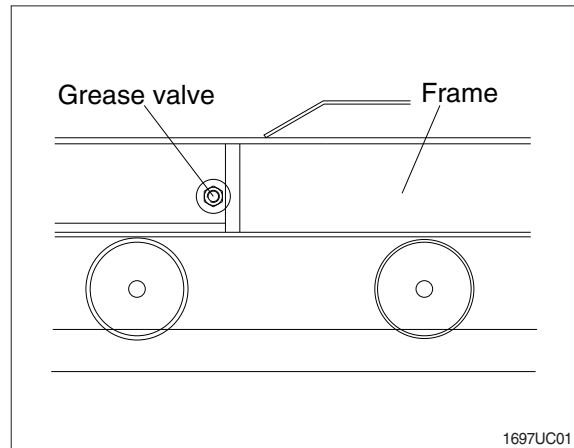


GROUP 10 UNDERCARRIAGE

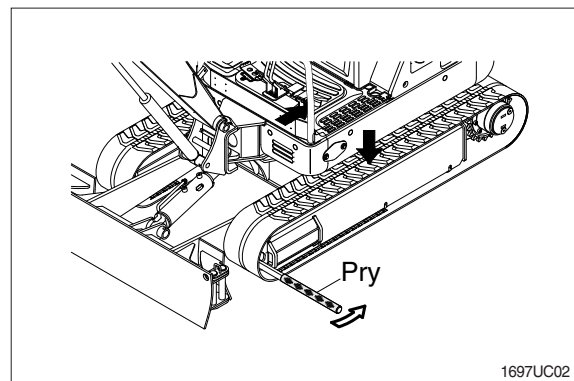
1. RUBBER TRACK

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.

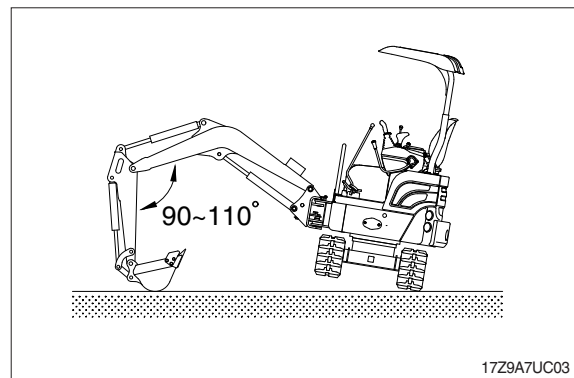


- (2) Remove the rubber track from lower frame using pry.



2) INSTALL

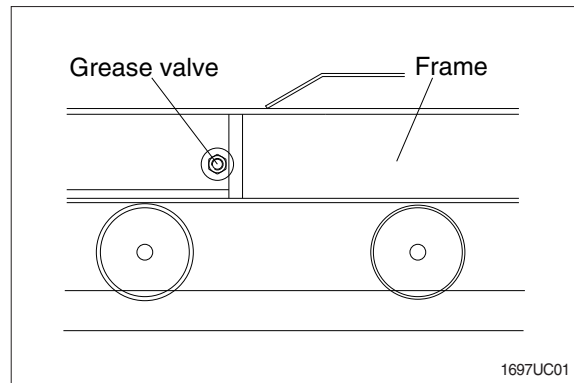
- (1) Carry out installation in the reverse order to removal.
 - ※ Adjust the tension of the rubber track.



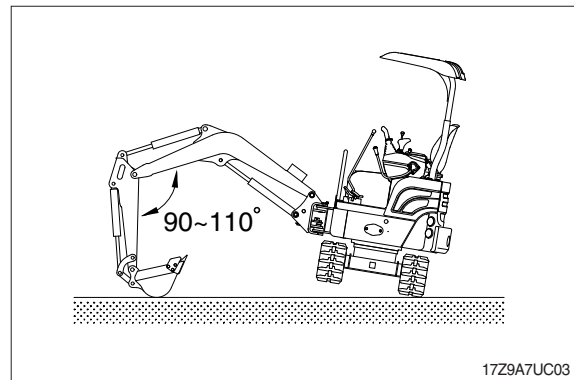
2. TRACK ROLLER

1) REMOVAL

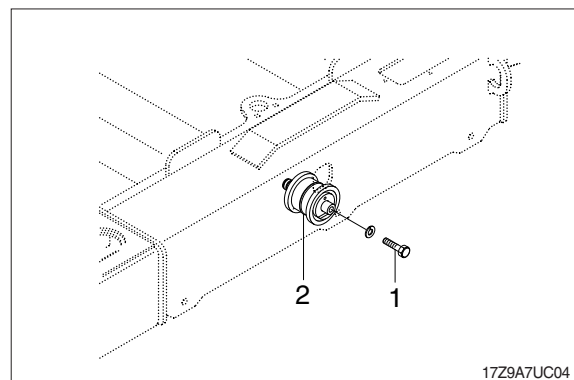
- (1) Loosen tension of the rubber track.



- (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 : 3 kg (7 lb)
 - Tightening torque : 12.3 ± 1.2 kgf · m
(89 ± 8.7 lbf · ft)



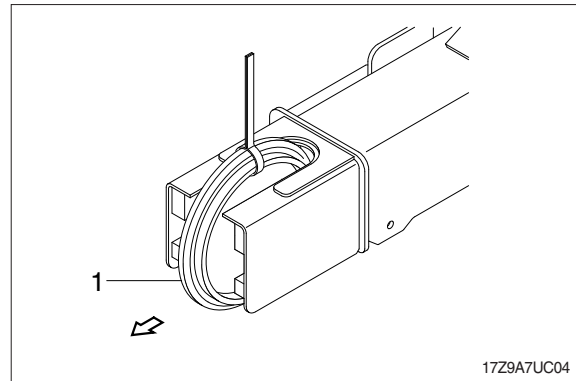
2) INSTALL

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

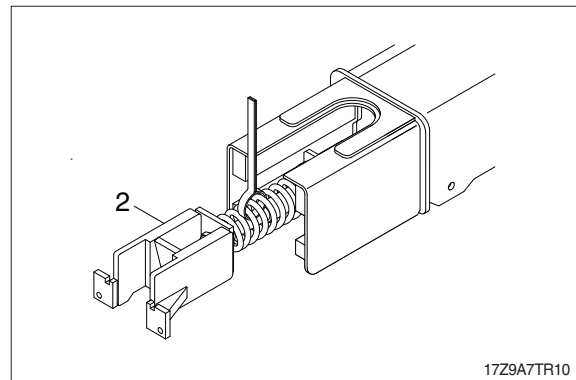
3. IDLER AND RECOIL SPRING

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 : 15 kg (33 lb)

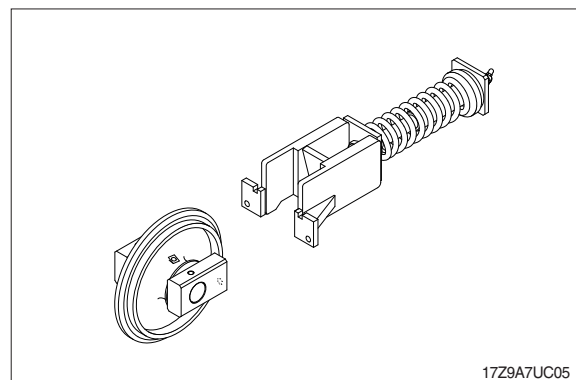


- (3) Pull out yoke and spring weld assembly from track frame, using a pry.
 - Weight : 11 kg (24 lb)



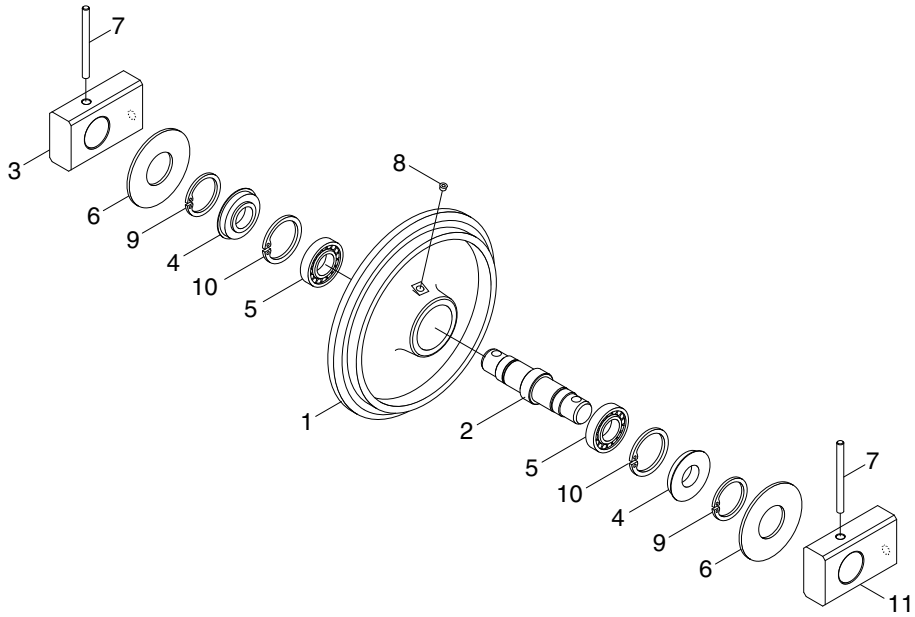
2) INSTALL

- (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

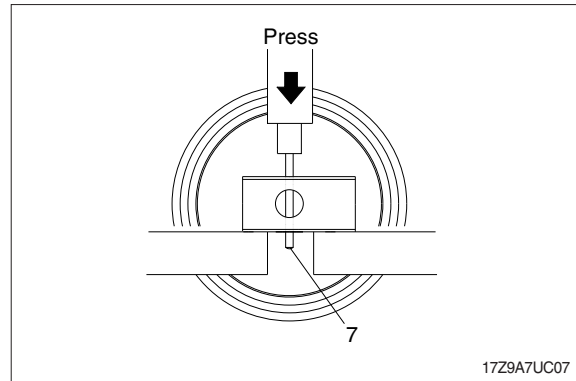


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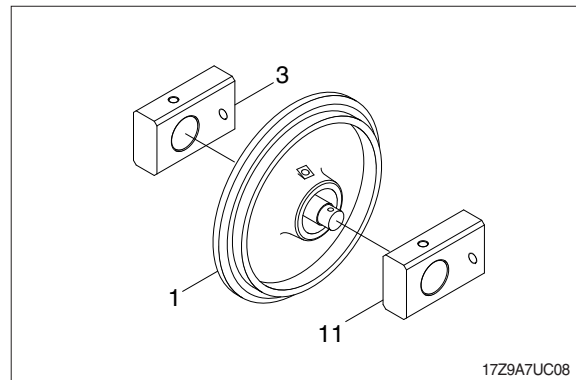
- | | | | | | |
|---|-----------|---|--------------|----|-----------|
| 1 | Shell | 5 | Ball bearing | 9 | Snap ring |
| 2 | Shaft | 6 | Plate | 10 | Snap ring |
| 3 | Collar-LH | 7 | Spring pin | 11 | Collar-RH |
| 4 | Oil seal | 8 | Plug | | |

(2) Disassembly

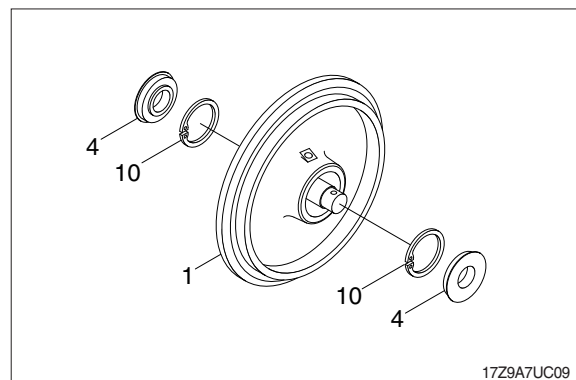
- ① Remove plug and drain oil.
- ② Draw out the spring pin (7), using a press.



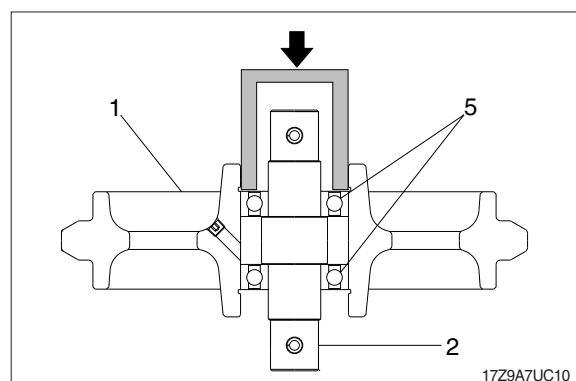
- ③ Remove collar (3, 11) from shaft.



- ④ Remove seal assembly (4) from shell (1) by pry.
- ※ Do not reuse seal assembly after removal.
- ⑤ Remove snap ring (10) from shell (1)

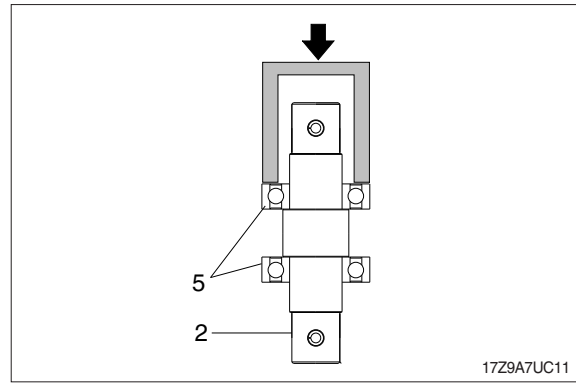


- ⑥ Draw out the ball bearing (5) with shaft (2) using press.
- ⑦ Remove the ball bearing (5) from shaft, using a special tool.
- ※ Only remove ball bearing if replacement is necessary.

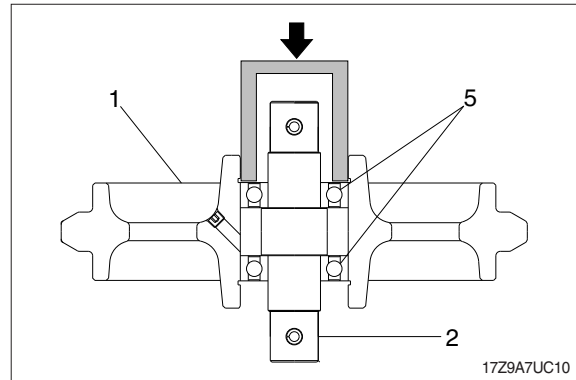


(3) Assembly

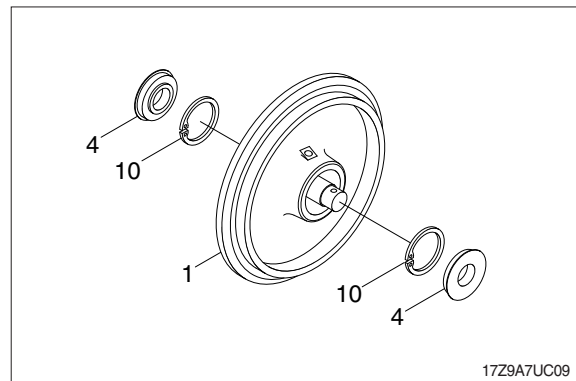
- ※ Before assembly, clean the parts.
- ※ Coat the sliding surfaces of all parts with oil.
- ① Do not press it at the normal temperature, assemble ball bearing (5) to shaft (2) by press.



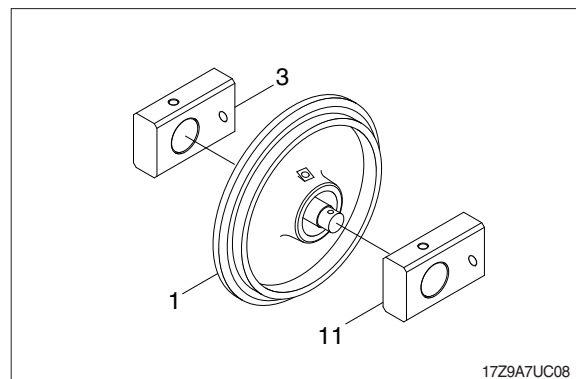
- ② Insert shaft (2) with ball bearing (5) assembly to shell (1).



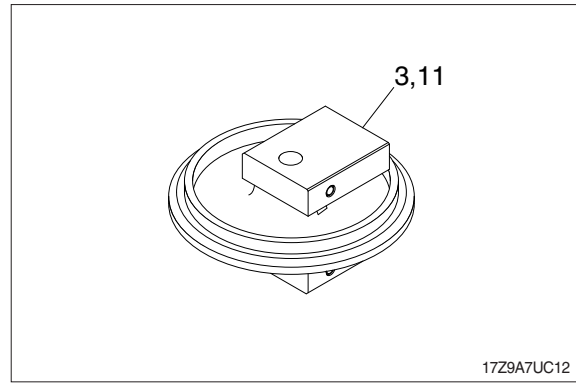
- ③ Assemble snap ring (10) and seal assembly (4).



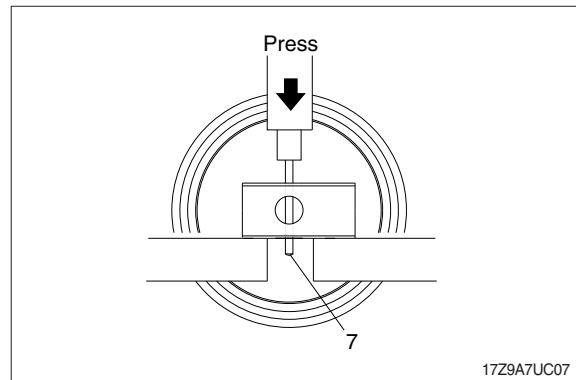
- ④ Assemble collar (3, 11) to shell (1).



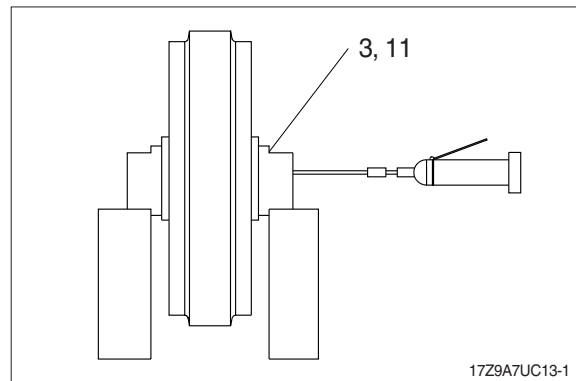
- ⑤ Install collar (3, 11) attached with seal (4).



- ⑥ Knock in the spring pin (7) with a hammer.

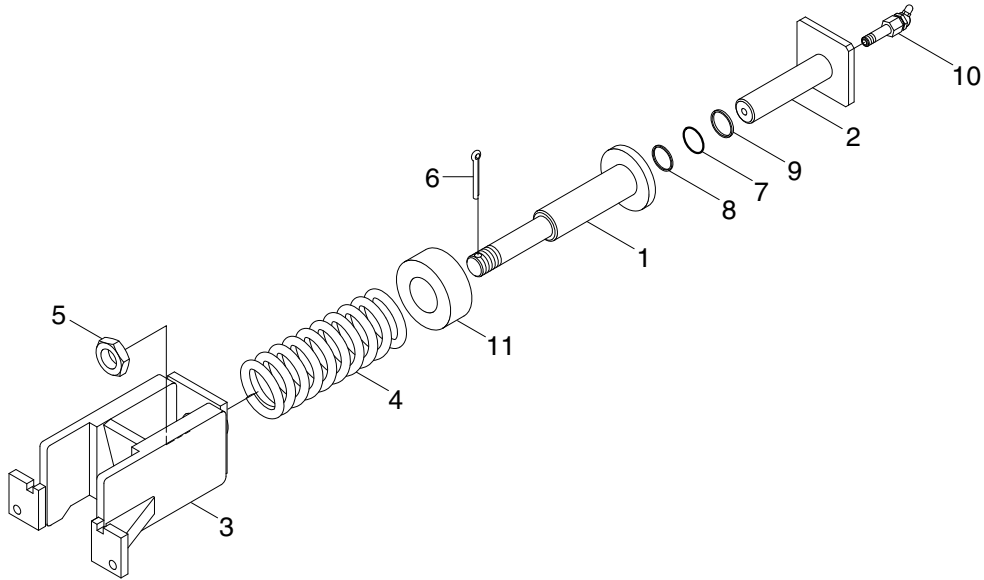


- ⑦ Lay collar (3, 11) on its side.
Supply engine oil to the specified level,
and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure

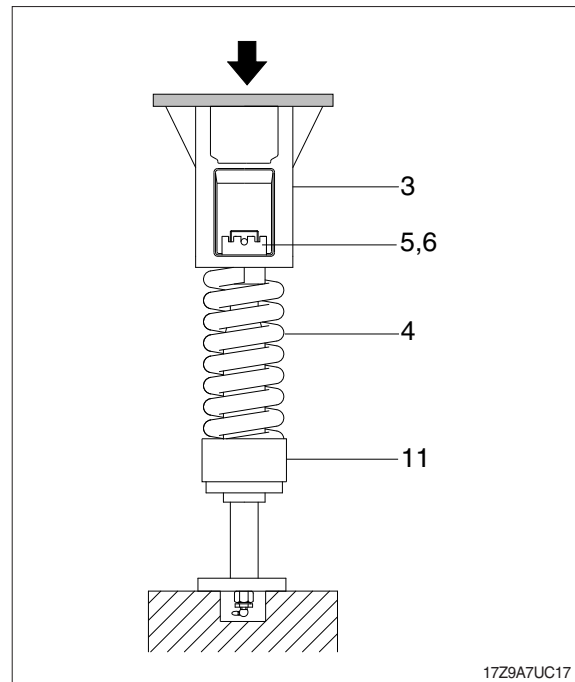


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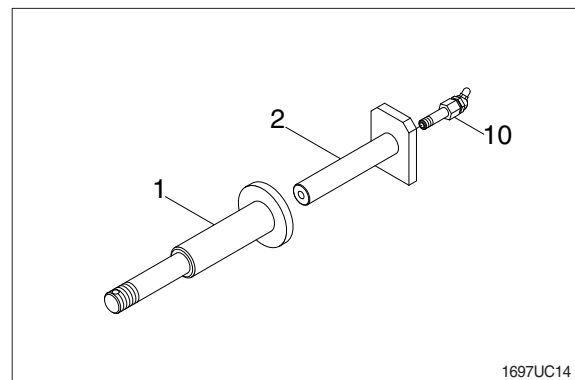
- | | | | | | |
|---|------------|---|--------------|----|------------|
| 1 | Cylinder | 5 | Castle nut | 9 | Packing |
| 2 | Piston rod | 6 | Split pin | 10 | Valve assy |
| 3 | Bracket | 7 | O-ring | 11 | Spacer |
| 4 | Spring | 8 | Back-up ring | | |

(2) Disassembly

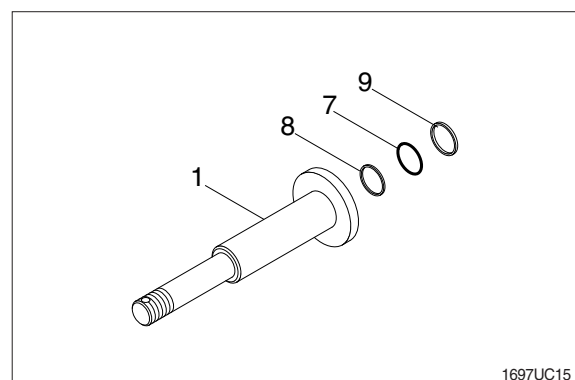
- ① Apply pressure on bracket (3) with a press.
The spring is under a large installed load. This is dangerous, so be sure to set properly.
 - Spring set load : 1785 kg (3940 lb)
- ※ Remove split pin (6) and nut (5).
- ② Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.
- ③ Lighten the press load slowly and remove bracket (6) and spring (4).



- ⑤ Remove piston rod (2) from cylinder (1).
- ⑥ Remove grease valve (10) from piston rod (1).

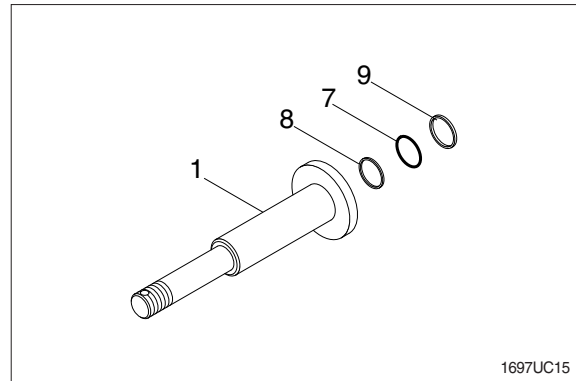


- ⑦ Remove packing (9), back-up ring (8) and O-ring (7) from cylinder (1).

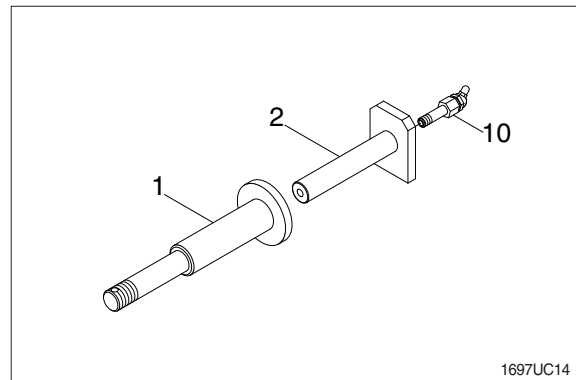


(3) Assembly

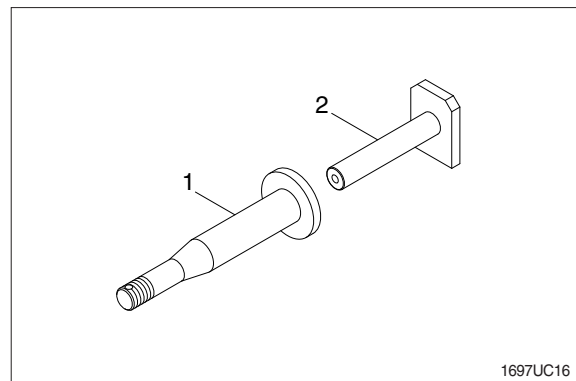
- ① Install O-ring (7), back-up ring (8), and packing (9) cylinder (1).



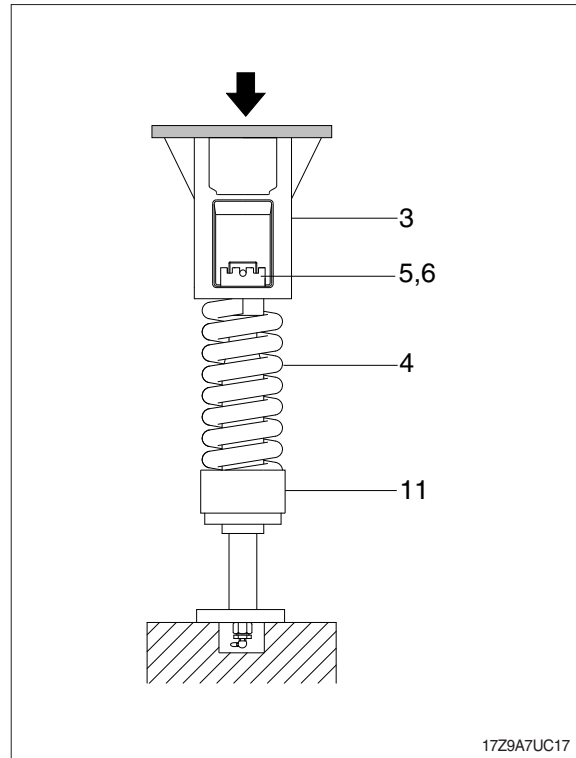
- ② Pour grease into cylinder (1), then push in piston rod (2) by hand.
After take grease out of grease valve mounting hole, let air out.
※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.
- ③ Fit grease valve (10) to piston rod (2).
 - Tightening torque : $10 \pm 0.5 \text{ kgf} \cdot \text{m}$
($72.4 \pm 3.6 \text{ lbf} \cdot \text{ft}$)



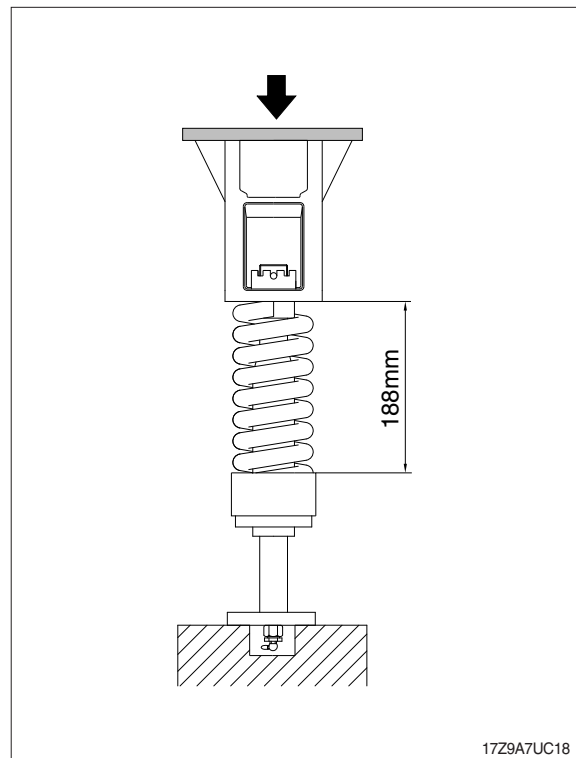
- ④ Install piston rod (2) to cylinder (1).



- ⑤ Install spring (4) and spacer (11) to cylinder (1).
- ⑥ Apply pressure to bracket (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).

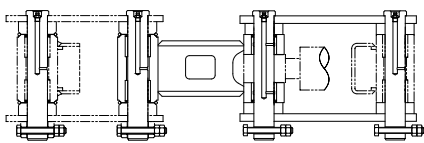
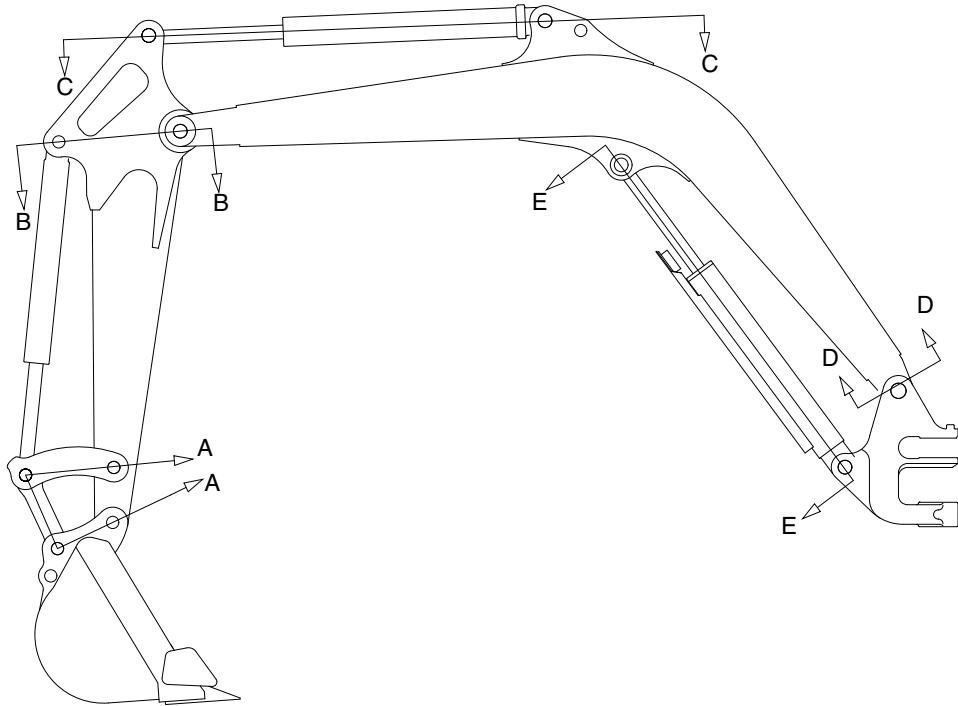


- ⑧ Lighten the press load and confirm the set length of spring (4).
 - Spring length : 188 mm (7.4")

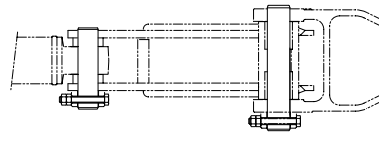


GROUP 11 WORK EQUIPMENT

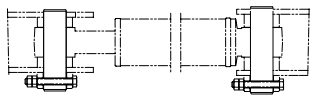
1. STRUCTURE



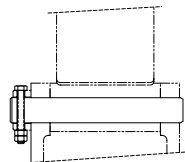
SECTION A-A



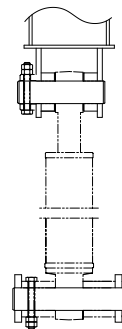
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

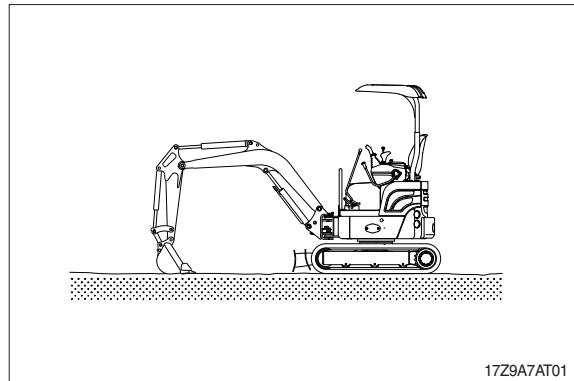
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2. REMOVAL AND INSTALL

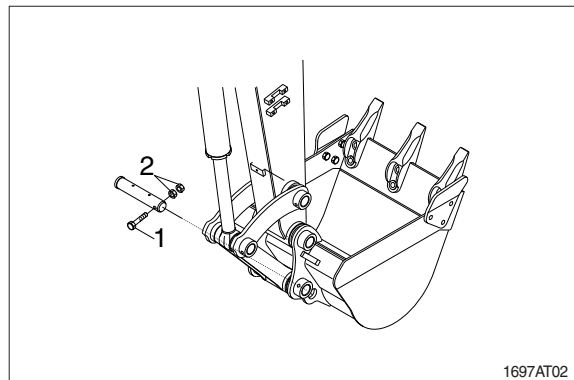
1) BUCKET ASSEMBLY

(1) Removal

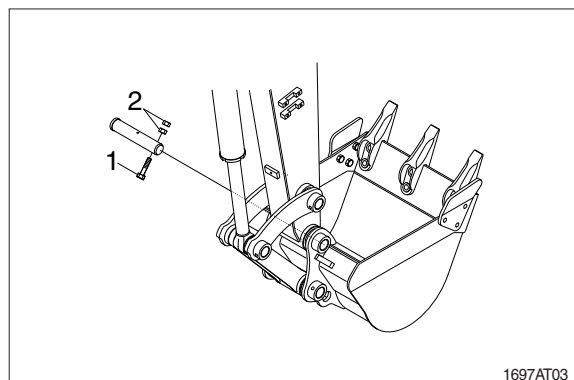
- ① Lower the work equipment completely to ground with back of bucket facing down.



- 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.
· Weight : 40 kg (90 lb)

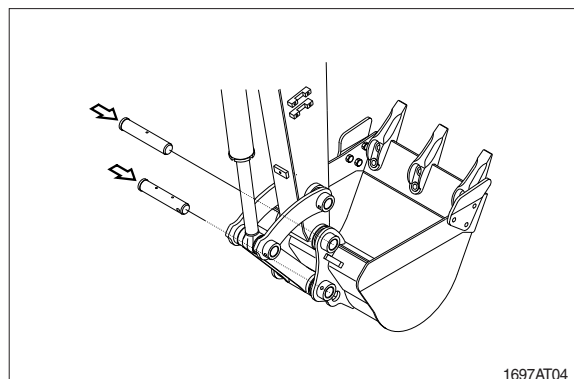


(2) Install

- 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.

- ※ 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 spurting out when the engine is started.

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

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

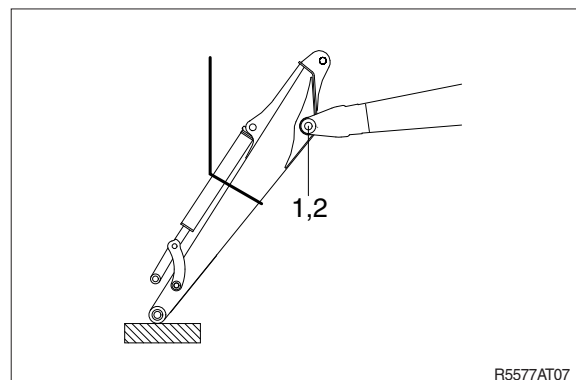
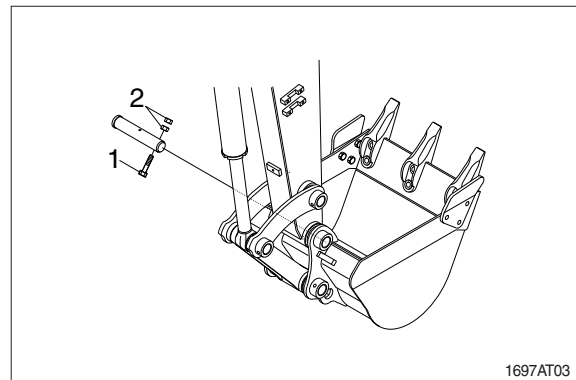
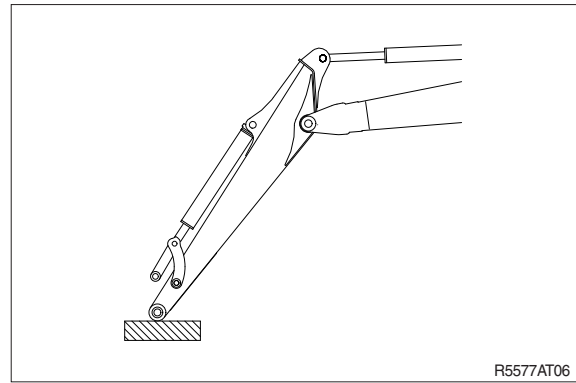
④ For details, see removal of arm cylinder assembly.

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

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

· Weight : 35 kg (77 lb)

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



(2) Install

① Carry out installation in the reverse order to removal.

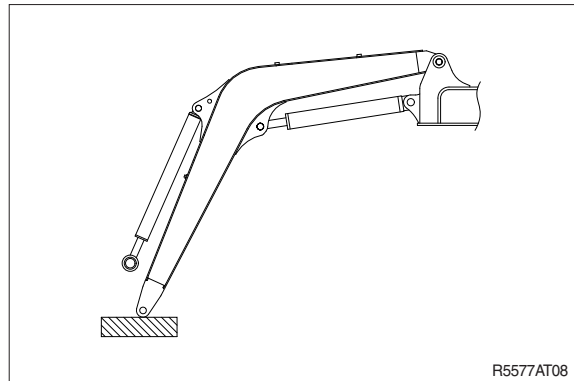
▲ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.

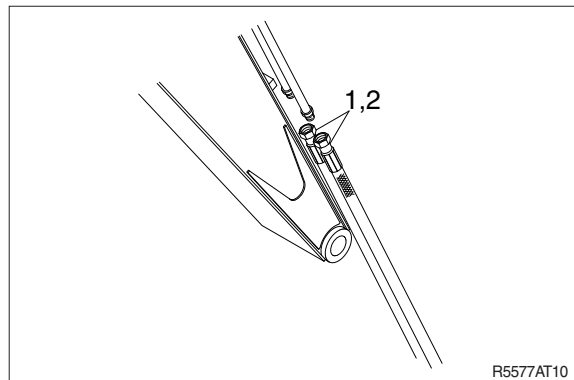
3) BOOM CYLINDER

(1) Removal

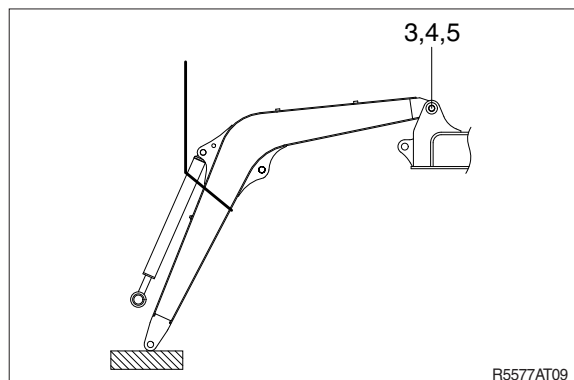
- ① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.
- ② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



- 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.
· Weight : 70 kg (154 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.

