

SECTION 7 DISASSEMBLY AND ASSEMBLY

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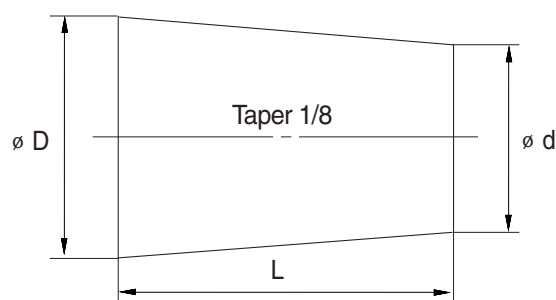
SECTION 7 DISASSEMBLY AND ASSEMBLY

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	6.5±0.7	47±5.1
2		Engine mounting bolt (bracket-frame)	M12 × 1.75	13.0±1.0	94±7.2
3		Radiator mounting bolt, nut	M 8 × 1.25	1.17±0.1	8.5±0.7
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	10±1.0	72±7.2
6		Main control valve mounting bolt	M10 × 1.5	6.9±1.4	50±10.0
7		Fuel tank mounting bolt	M10 × 1.5	6.9±1.4	50±10.0
8		Hydraulic oil tank mounting bolt	M10 × 1.5	6.9±1.4	50±10.0
9		Turning joint mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
10	Power train system	Swing motor mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
11		Swing bearing upper mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
12		Swing bearing lower mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
13		Travel motor mounting bolt	M10 × 1.5	6.9±1.4	50±10.0
14		Sprocket mounting bolt	M10 × 1.5	6.9±0.7	50±5.1
15	Under carriage	Track roller mounting bolt	M12 × 1.75	12.3±1.2	89±8.7
16	Others	Counterweight mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
17		Canopy/Cab mounting bolt, nut	M12 × 1.75	12.8±3.0	92±22.0
18		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.1	8.5±0.7

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 : 20 l

(5.3 U.S.gal)

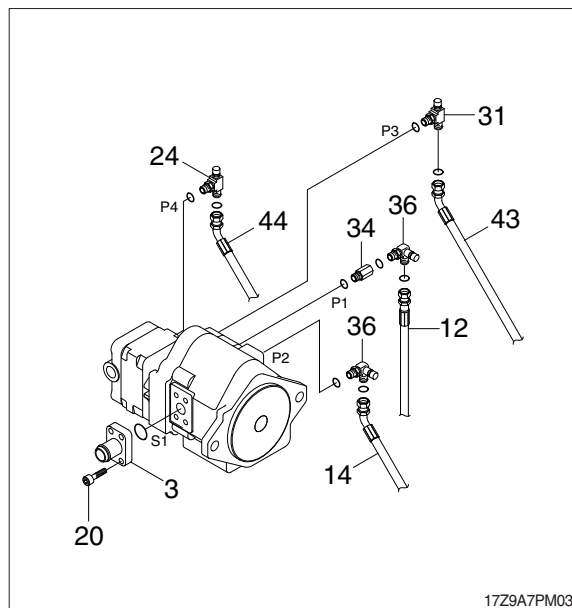
- (5) Disconnect hoses (44) and remove connectors (24).
- (6) Disconnect pilot line hoses (12, 14, 43) and remove connectors (31, 34, 36).
- (7) Remove socket bolts (20) and disconnect pump suction tube (3).

※ 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.

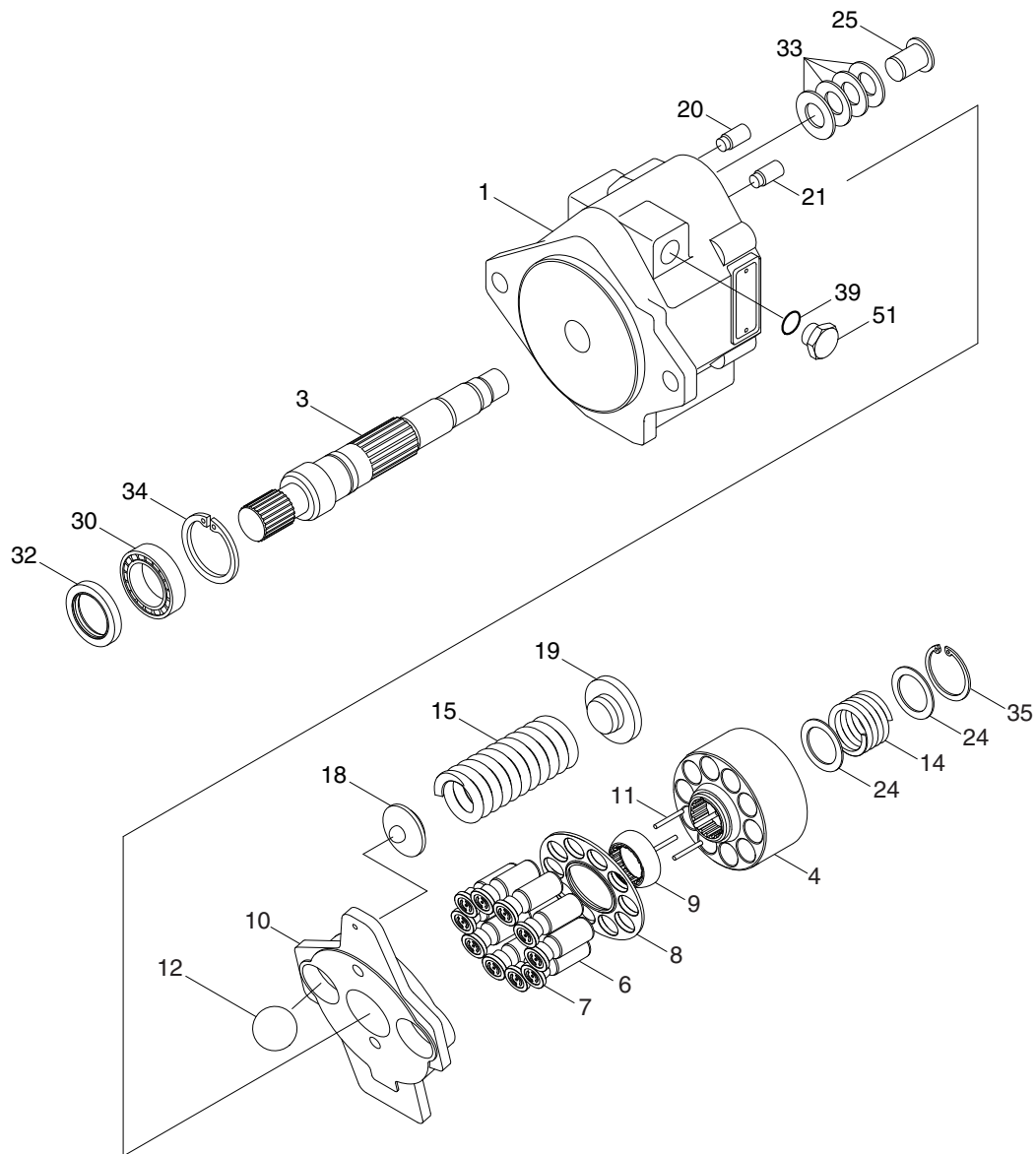


2) INSTALL

- (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

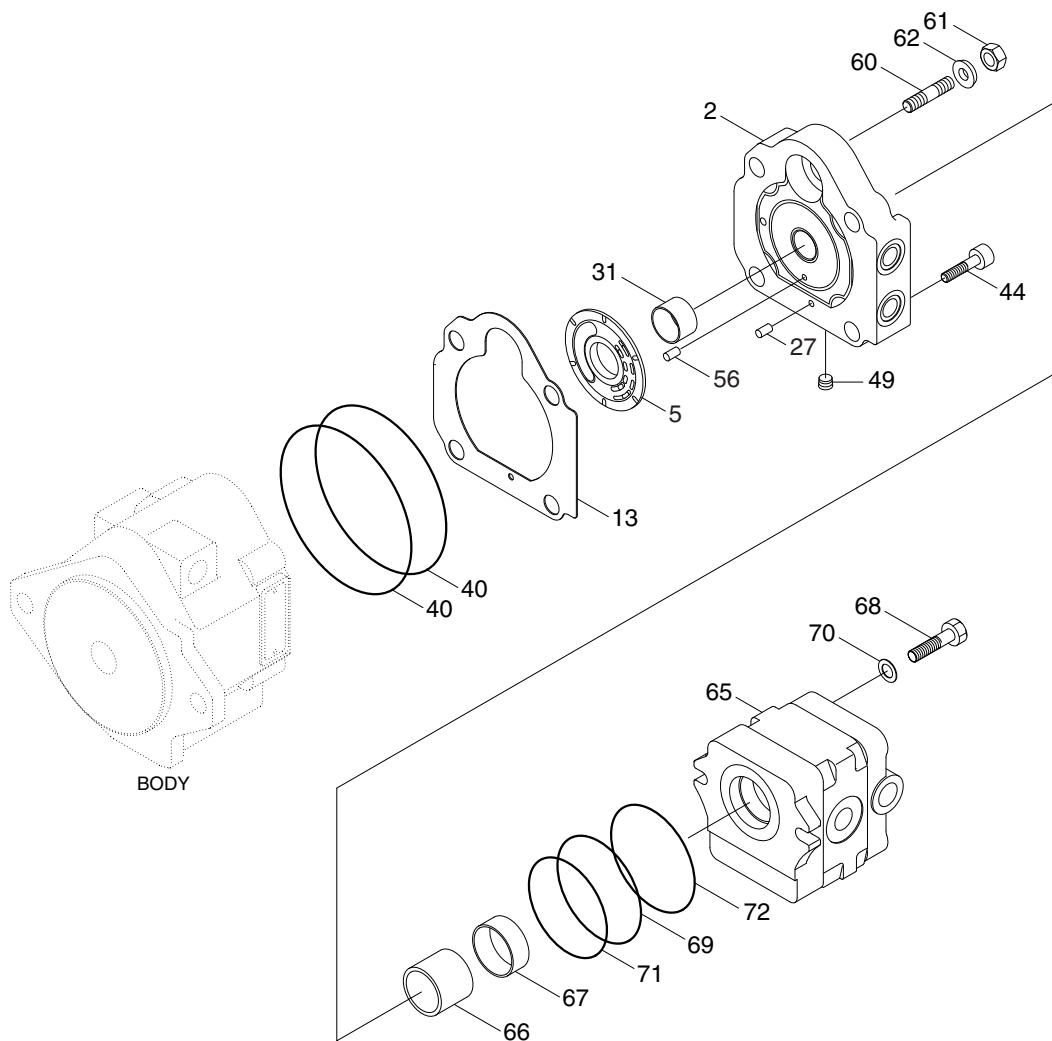
1) STRUCTURE (1/2)



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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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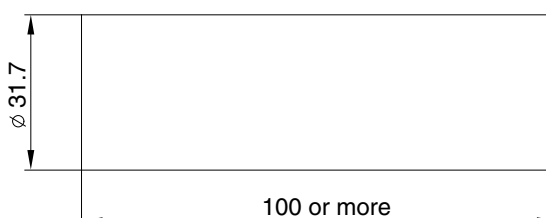
3. ASSEMBLE AND DISASSEMBLE

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



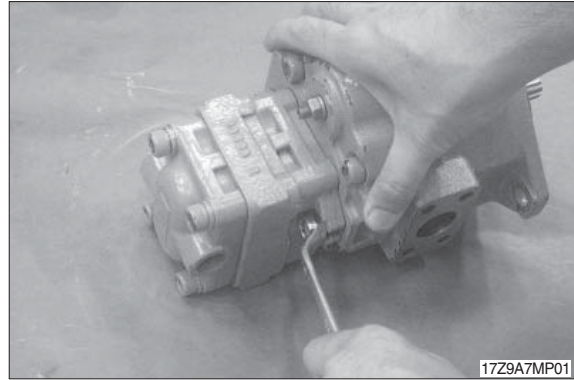
Special tooling for oil seal

3) DISASSEMBLING

(1) Disassembling of gear pump

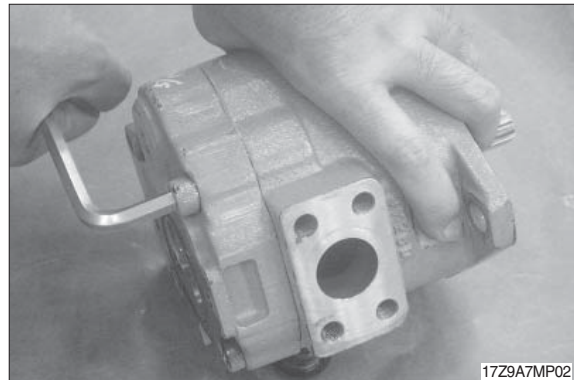
Remove two screws (68) with spanner wrench 13 mm, and after that remove two washer (70), gear pump (65), collar (67) and coupling (66).

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

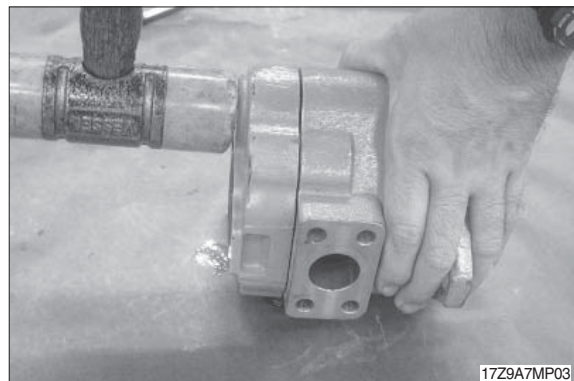


(2) Separation of body S and body H

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

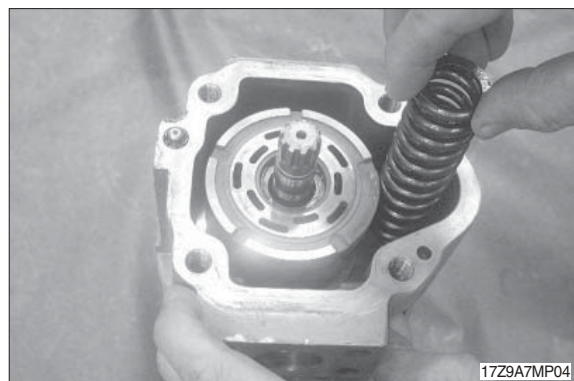


- ※ If you tap the part of inserted spring of body H with hummer softly, it is easy for separation.

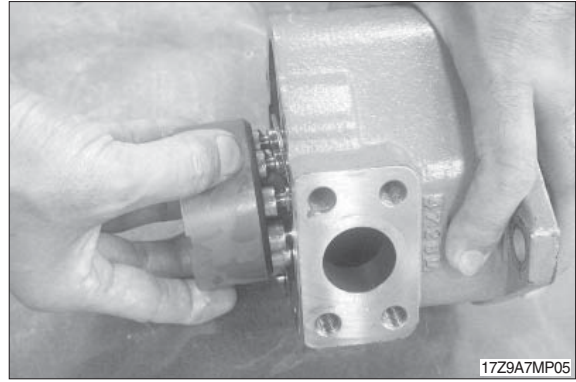


(3) Disassembling of body S kit

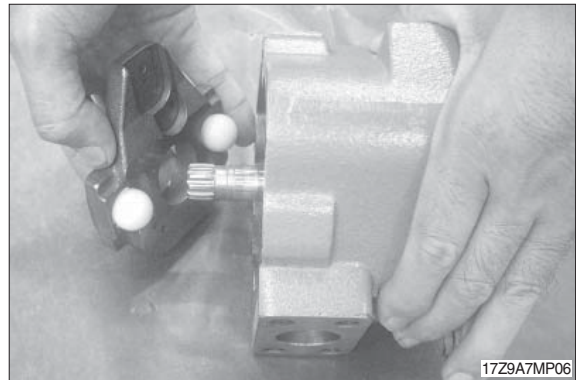
- ① Remove spring T (15) from body S kit, then take off spring holder (18).



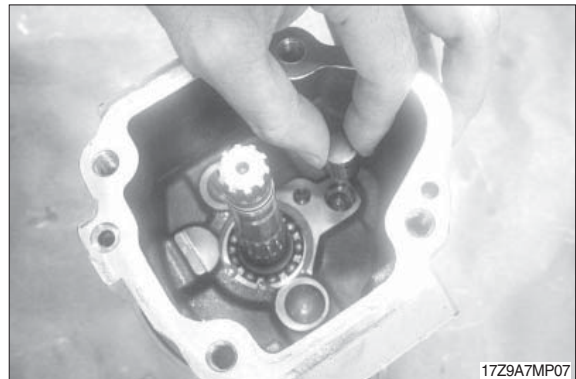
② Remove cylinder barrel kit.



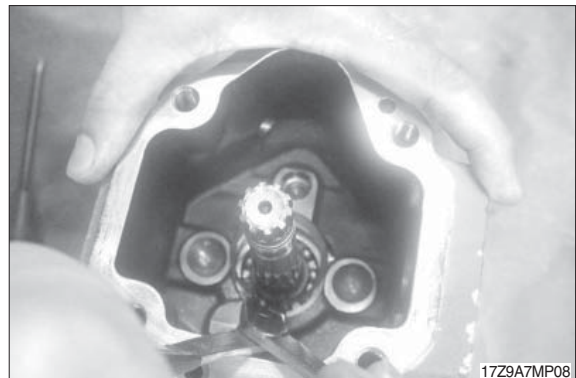
③ Remove swash plate (10) and two balls (12).



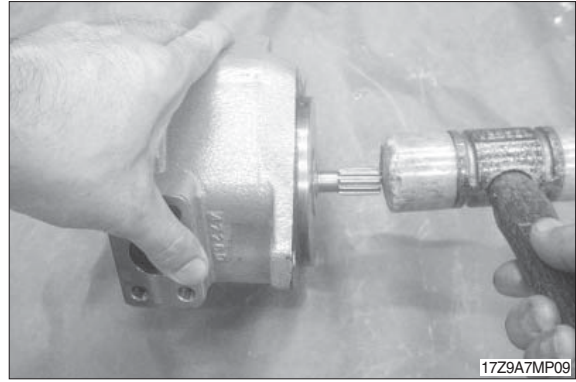
④ Remove stopper pin A (25), dish washers (33), rod G (21).



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

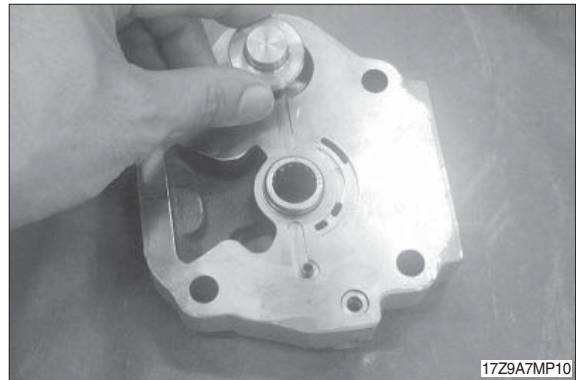


- ⑥ Tap the end of shaft (3) with hammer, then shaft with bearing (30) come off.



(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.

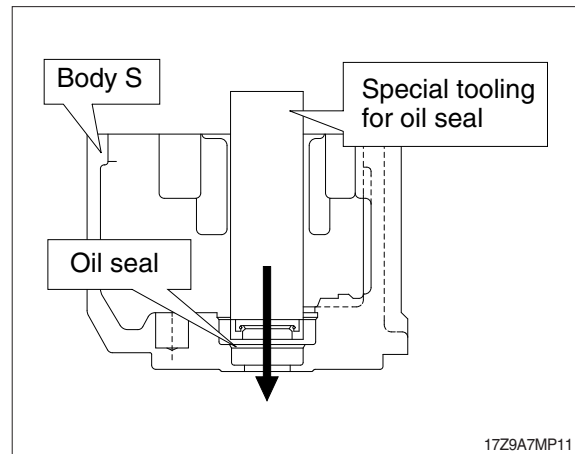
When assembling, be very careful to wash parts in clean oil, to prevent dusts and water from adhering to parts entering assemblies and not to scratch on the sliding surfaces of all parts.

- ※ 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

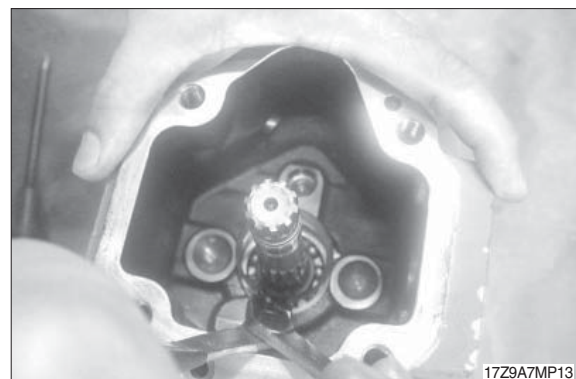
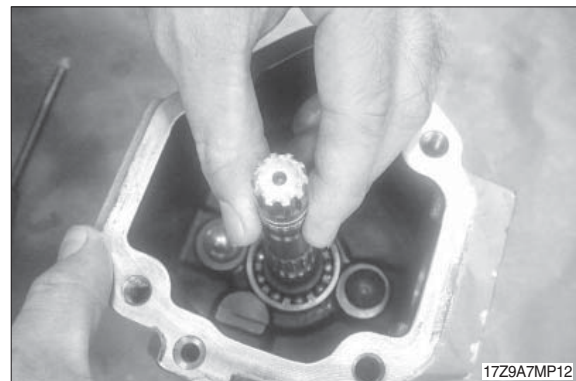
① Press-fit oil seal into body S (1).

- ※ 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.



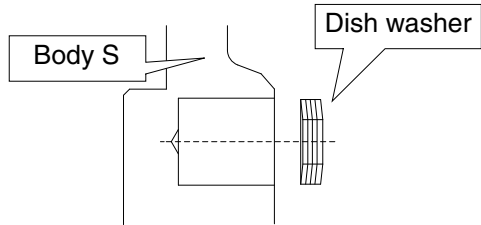
② Set shaft (3) with bearing (30) and snap ring (34) in this order into body S (1).

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

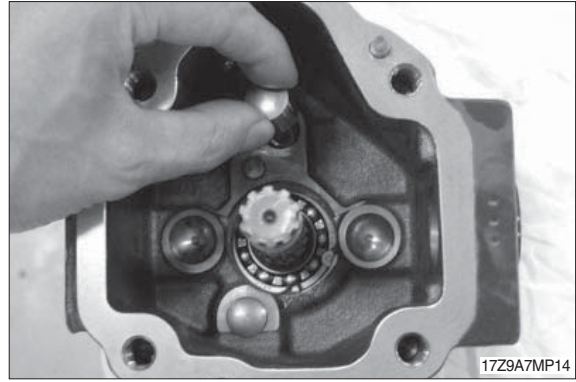


- ③ Set four dish springs (33), then set stopper pin A (25) and stopper pin B (26) into body S (1).

※ Pay attention to direction of the dish washer.

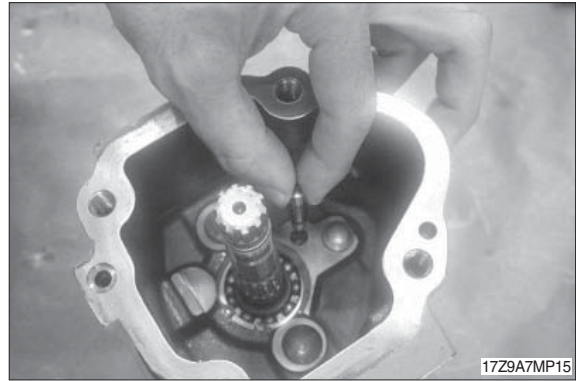


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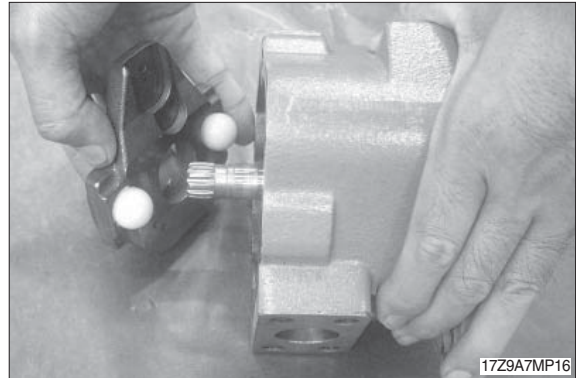
- ④ Set rod G (21) into body S (1).



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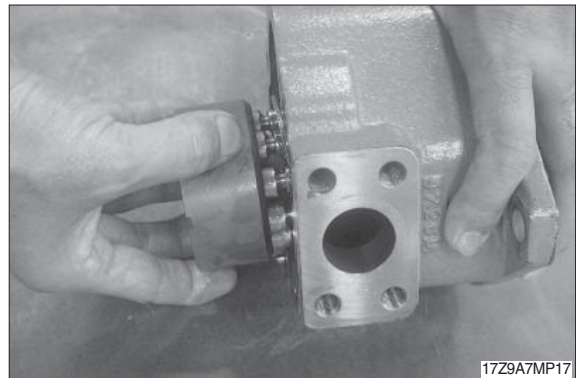
- ⑤ Put two balls (12) in the hole of swash plate (10) and install it in body S.

※ Apply grease on the balls if they drop out.



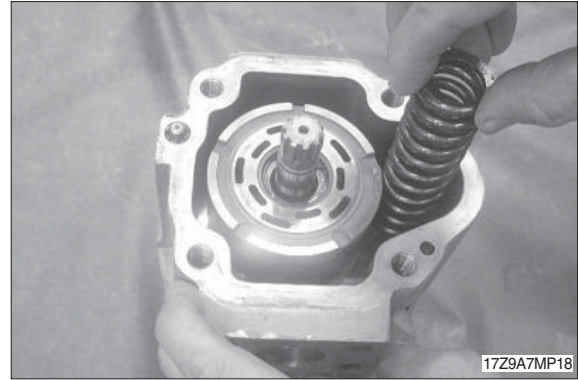
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- ⑥ Assemble cylinder barrel kit into the body S (1).



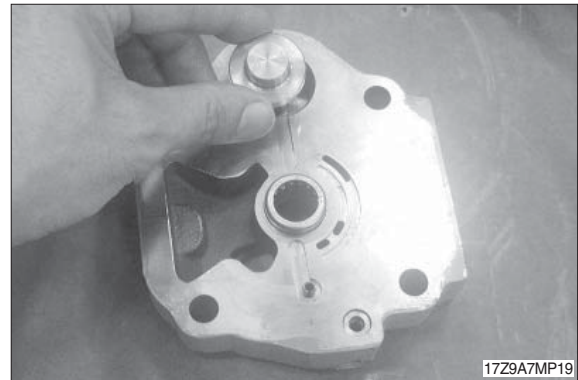
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- ⑦ Set spring T (15) to spring holder (18), then set them together into the body S (1).



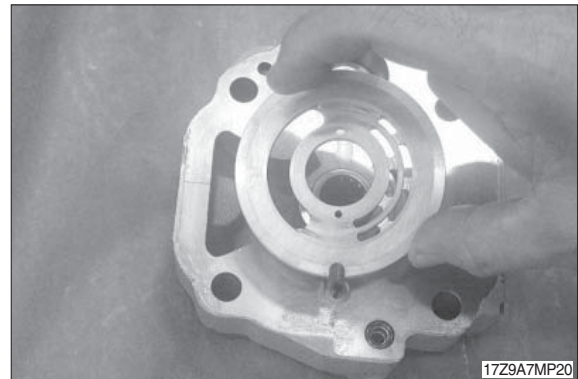
(3) Assembling of body H kit

- 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).

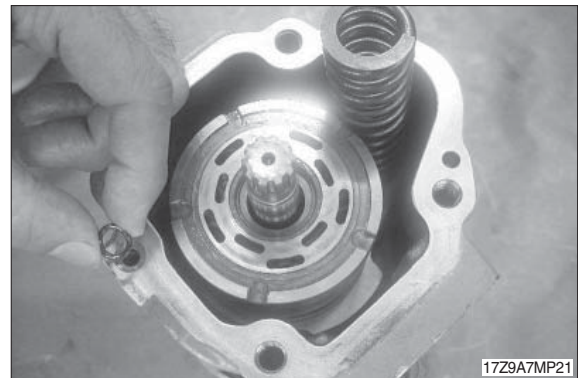
- ※ V notch copper alloy side of valve plate slides with cylinder barrel (4) and be careful not to set the valve plate to a wrong direction.



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

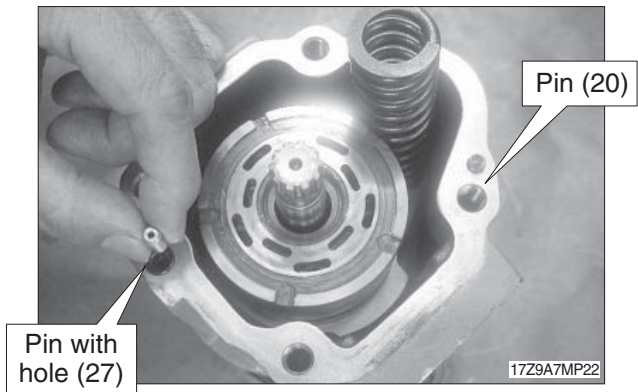
- ① Place O-ring (40) on body S.

- ※ Use new O-ring for assembling.



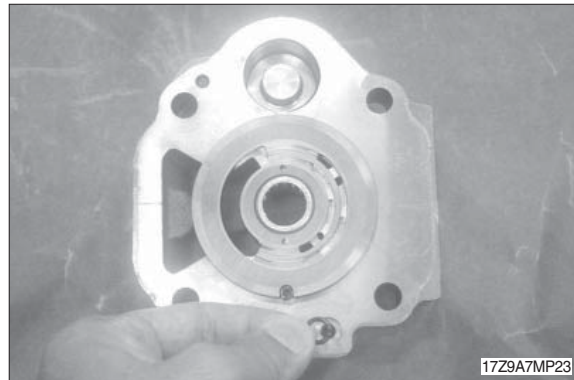
② Set pin (20) and pin (27) on body S.

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



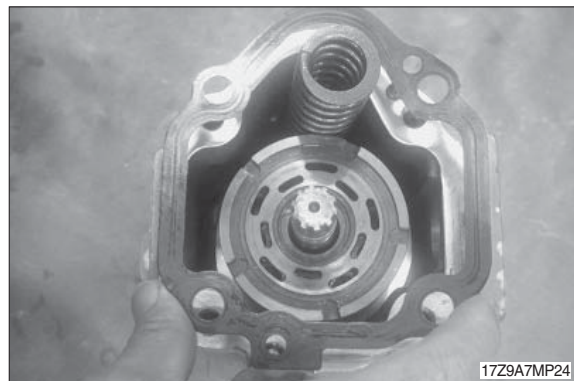
③ Place O-ring (40) on body S.

Use new O-ring for assembling.



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

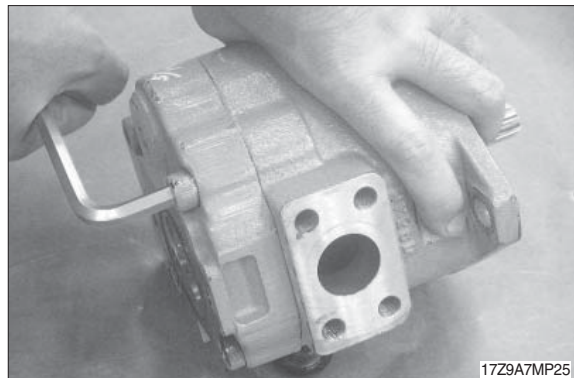
Use new gasket for assembling.



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.

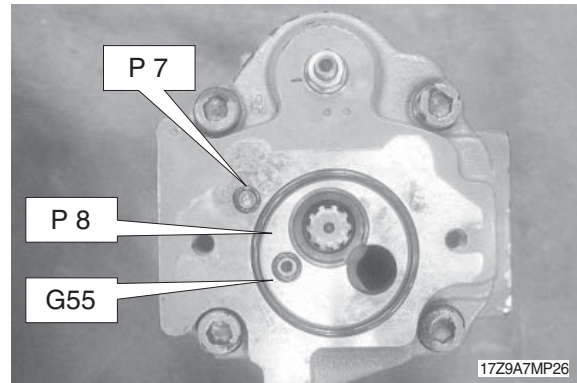
· Tightening torque : 5.2~6.6 kgf · m
(37.6~47.7 lbf · ft)



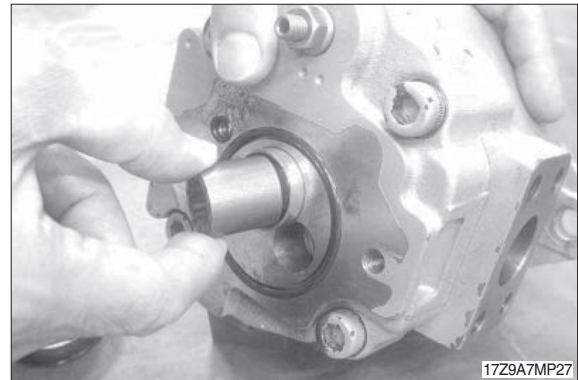
(5) Installation of gear pump kit

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

※ Use new O-ring for assembling.

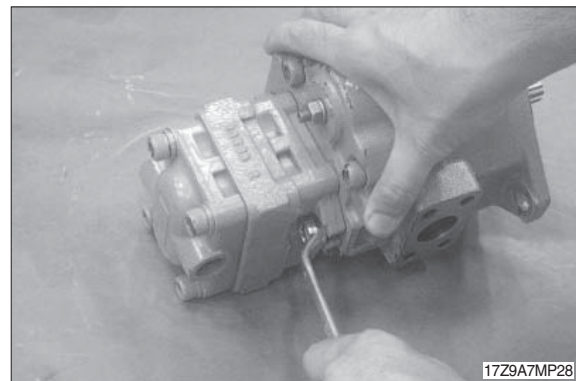


② Set collar (67), coupling (66).



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

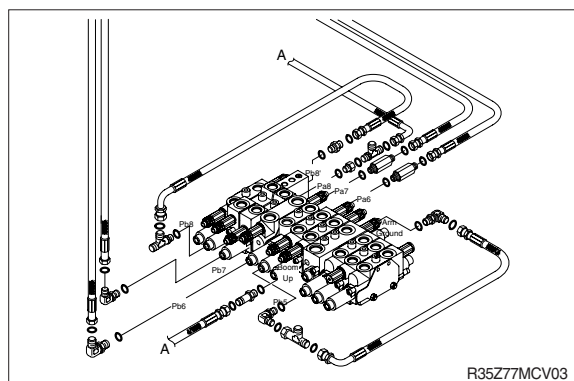
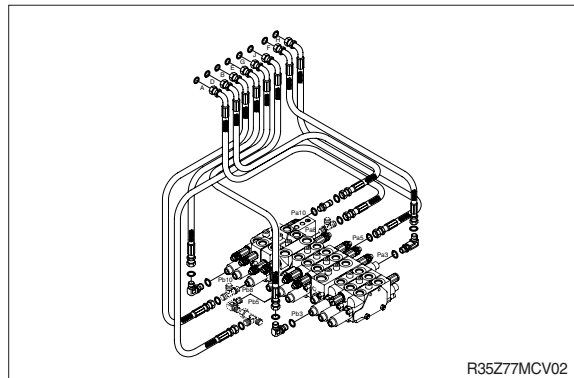
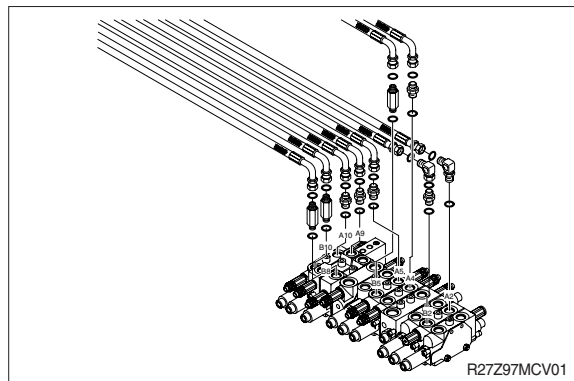
1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

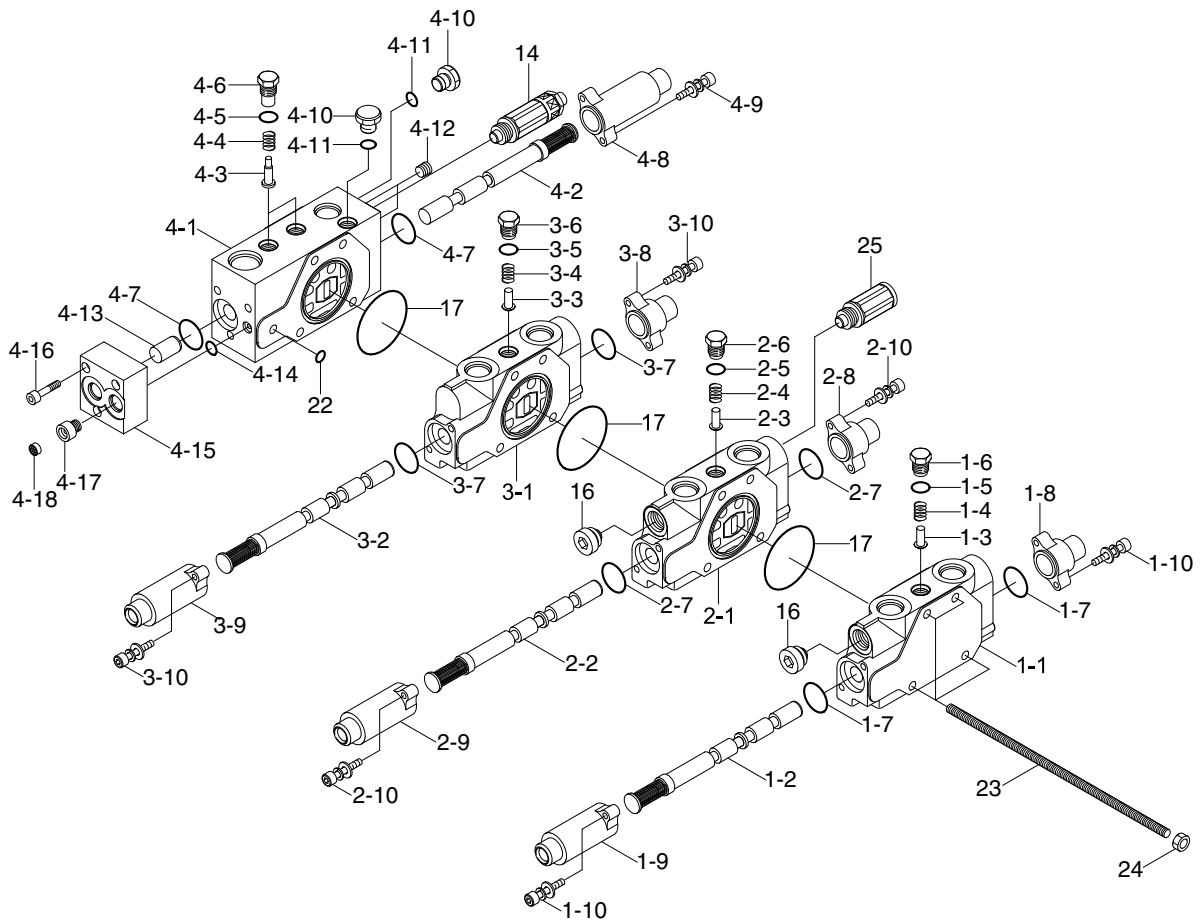
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure 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 : 25 kg (55 lb)
- (7) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

2) INSTALL

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



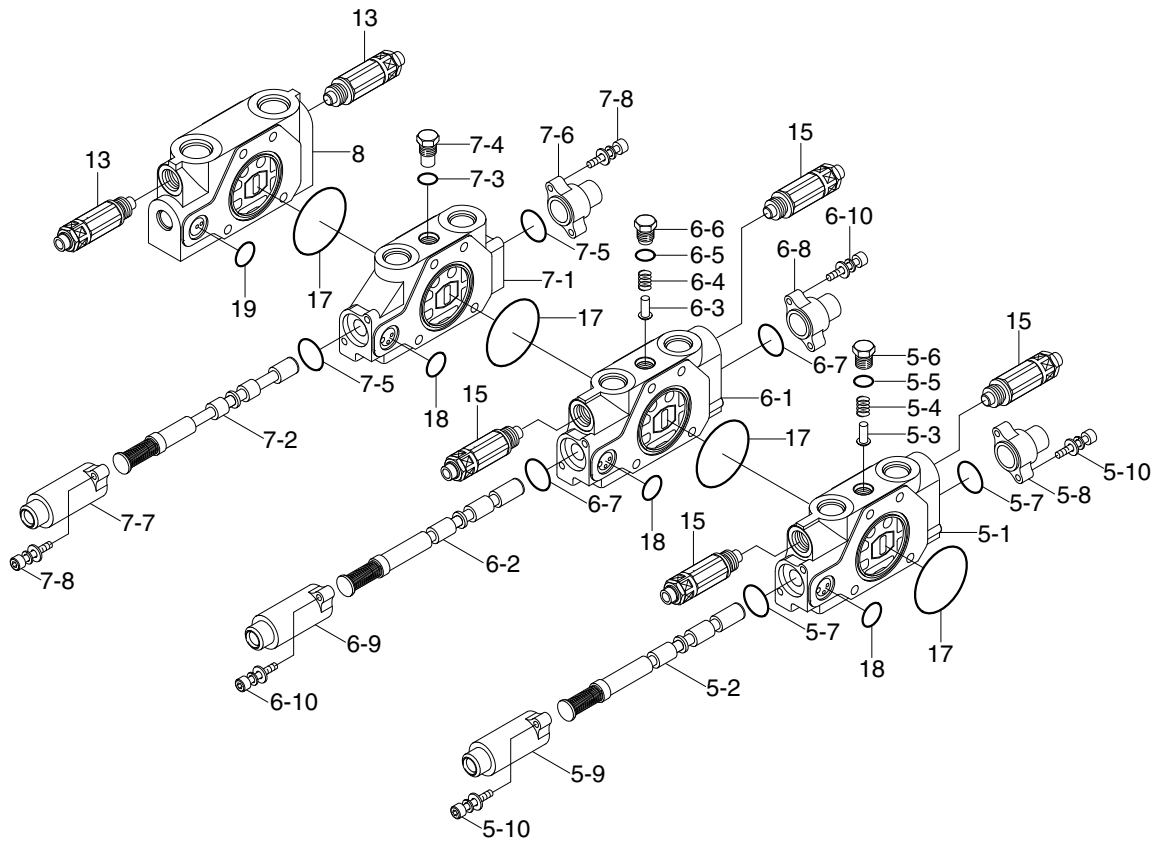
2. STRUCTURE (1/3)



1692MC02

- | | | | | | |
|------|------------------------|------|------------------------|------|------------------------|
| 1 | Dozer work block | 2-9 | Cover-pilot | 4-7 | O-ring |
| 1-1 | Body-work | 2-10 | Bolt-soc head w/washer | 4-8 | Cover-pilot |
| 1-2 | Spool assy | 3 | Swing work block | 4-9 | Bolt-soc head w/washer |
| 1-3 | Poppet | 3-1 | Body-work | 4-10 | Plug |
| 1-4 | Spring | 3-2 | Spool assy | 4-11 | O-ring |
| 1-5 | O-ring | 3-3 | Poppet | 4-12 | Plug |
| 1-6 | Plug | 3-4 | Spring | 4-13 | Piston |
| 1-7 | O-ring | 3-5 | O-ring | 4-14 | O-ring |
| 1-8 | Cover-pilot | 3-6 | Plug | 4-15 | Body-pilot |
| 1-9 | Cover-pilot | 3-7 | O-ring | 4-16 | Bolt-soc head w/washer |
| 1-10 | Bolt-soc head w/washer | 3-8 | Cover-pilot | 4-17 | Orifice |
| 2 | Boom swing work block | 3-9 | Cover-pilot | 4-18 | Filter-coin type |
| 2-1 | Body-work | 3-10 | Bolt-soc head w/washer | 14 | Relief valve |
| 2-2 | Spool assy | 4 | Connecting block | 16 | Plug |
| 2-3 | Poppet | 4-1 | Body-work | 17 | O-ring |
| 2-4 | Spring | 4-2 | Spool assy | 22 | O-ring |
| 2-5 | O-ring | 4-3 | Poppet | 23 | Bolt-tie |
| 2-6 | Plug | 4-4 | Spring | 24 | Nut-hex |
| 2-7 | O-ring | 4-5 | O-ring | 25 | Anticavitation valve |
| 2-8 | Cover-pilot | 4-6 | Plug | | |

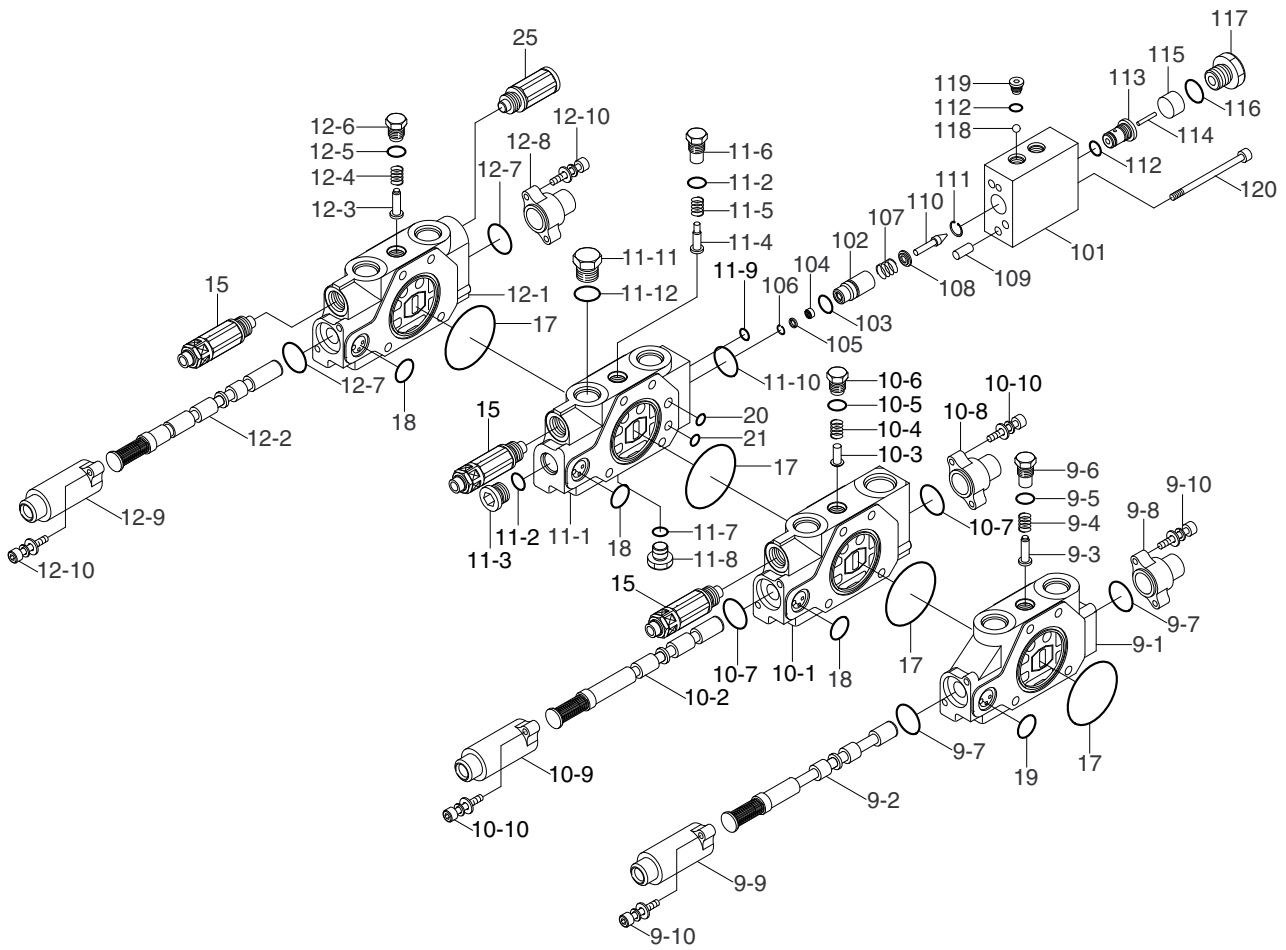
STRUCTURE (2/3)



1692MC03

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

STRUCTURE (3/3)



1692MC04

9	Travel work block	10-8	Cover-pilot	12-3	Poppet	105	Spacer
9-1	Body-work	10-9	Cover-pilot	12-4	Spring	106	Ring-retaining
9-2	Spool assy	10-10	Bolt-soc head w/washer	12-5	O-ring	107	Spring A-lock valve
9-3	Poppet	11	Boom lock valve	12-6	Plug	108	Spring seat
9-4	Spring	11-1	Body-work	12-7	O-ring	109	Pin
9-5	O-ring	11-2	O-ring	12-8	Cover-pilot	110	Poppet
9-6	Plug	11-3	Plug	12-9	Cover-pilot	111	Ring-retaining
9-7	O-ring	11-4	Poppet	12-10	Bolt-soc head w/washer	112	O-ring
9-8	Cover-pilot	11-5	Spring	15	Overload relief valve	113	Guide-piston
9-9	Cover-pilot	11-6	Plug	17	O-ring	114	Piston A1
9-10	Bolt-soc head w/washer	11-7	O-ring	18	O-ring	115	Piston B
10	Boom work block	11-8	Plug	19	O-ring	116	O-ring
10-1	Body-work	11-9	O-ring	20	O-ring	117	Connector
10-2	Spool assy	11-10	O-ring	21	O-ring	118	Ball-steel
10-3	Poppet	11-11	Plug	25	Anticavitation valve	119	Plug
10-4	Spring	11-12	O-ring	101	Cover-lock valve	120	Bolt-hex. socket head
10-5	O-ring	12	Bucket work block	102	Lock valve		
10-6	Plug	12-1	Body-work	103	Seal		
10-7	O-ring	12-2	Spool assy	104	Filter		

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

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

2) TOOLS

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

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	5 and 6
Spanner	Each 1 piece	13, 21 and 30
Rod	1 piece	Less than 10x250

3) DISASSEMBLY

(1) Disassembly of spools (pilot type)

Loosen hexagon socket head bolts (10) with washer.

(Hexagon wrench : 5 mm)

Remove the pilot cover (8).

Pay attention not to lose the O-ring (7) under the pilot cover.

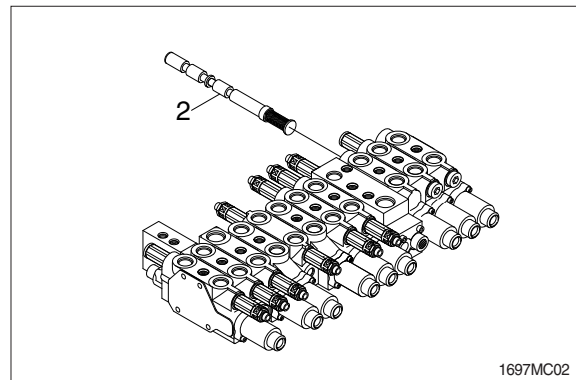
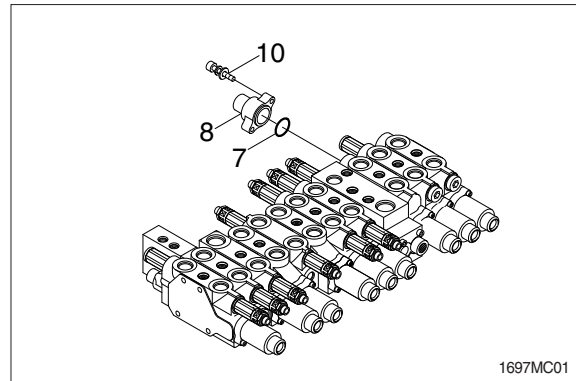
Remove the spool assembly (2) from the body by hand slightly.

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

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

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

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



(2) Disassembly of holding valve (boom 1)

Loosen hexagon socket head bolts(120).
(Hexagon wrench : 5 mm)

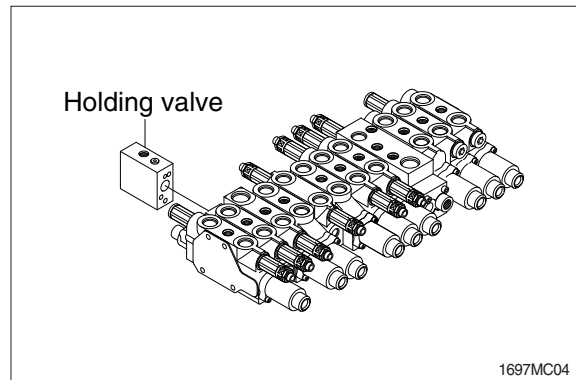
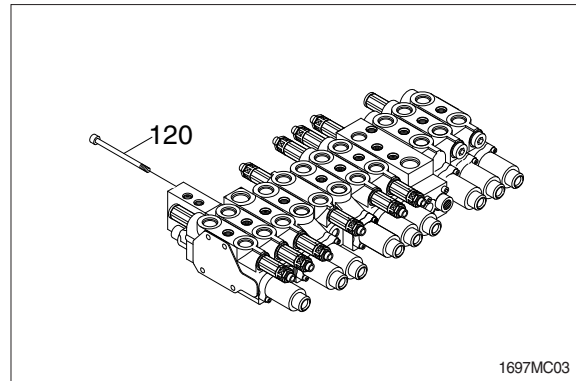
Remove the holding valve.

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

Pay attention not to damage the "piston A" under pilot cover.

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

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



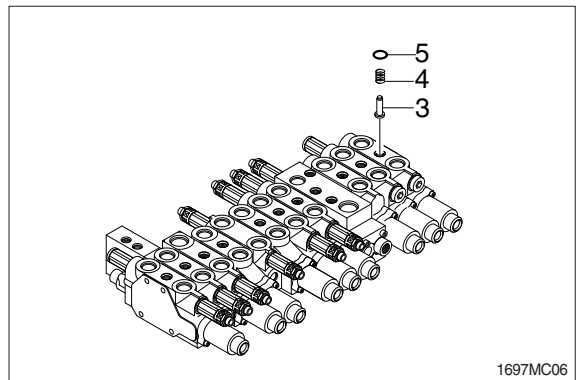
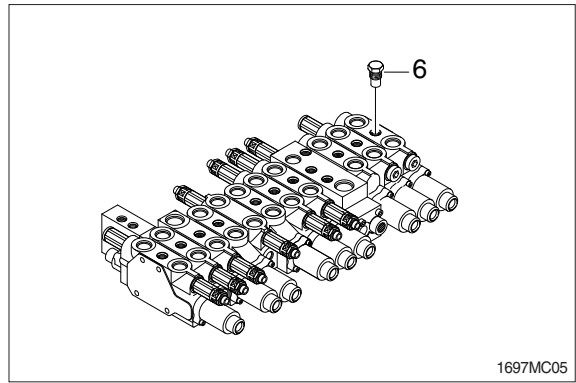
(3) Disassembly of the load check valve and the negative relief valve

The load check valve

- a. Fix the body to suitable work bench.

Pay attention not to damage the body.

- b. Loosen the plug (6)
(Hexagon wrench : 10 mm).
- c. Remove the O-ring (5), spring (4) and the load check valve (3) with pincers or magnet.



(4) Disassembly of the main and overload relief valve

Fix the body to suitable work bench.

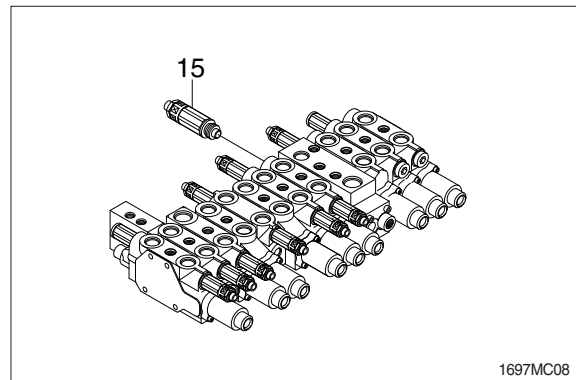
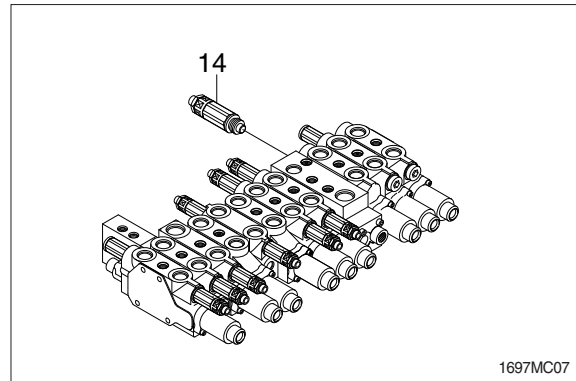
Remove the main relief valve (14).
(Spanner : 30 mm)

Remove the overload relief valve (15).
(Spanner : 22 mm)

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

Pay attention not to damage seat face.

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

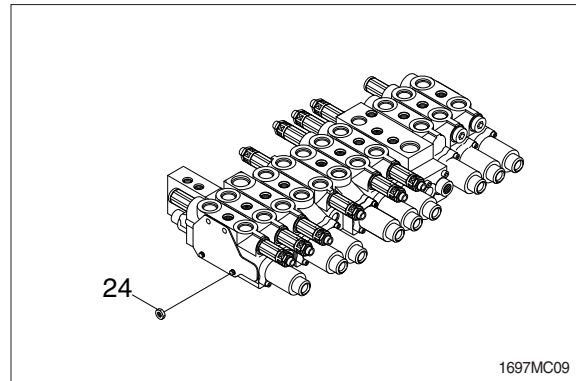


(5) Disassembly of the block assembly

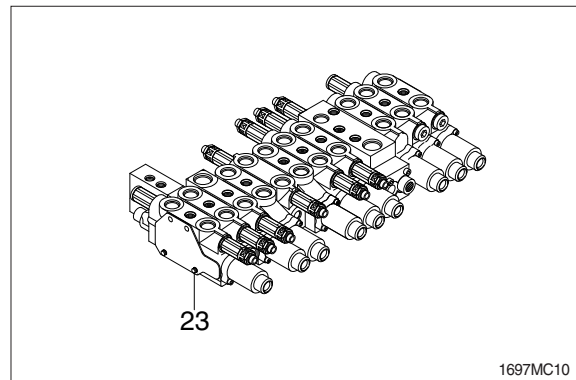
Fix the body to suitable work bench.

Remove the nut (24).

(Spanner : 13 mm)



Do not removed the tie bolt (23).



(6) Inspection after disassembly

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

Control valve

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

Relief valve

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

4) ASSEMBLY

(1) General precaution

In this assembly section, explanation only is shown.

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

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

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

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

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

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

Do not reuse removed O-rings and seals.

(2) Load check valve

Assemble the load check valve (3) and O-ring (5), spring (4).

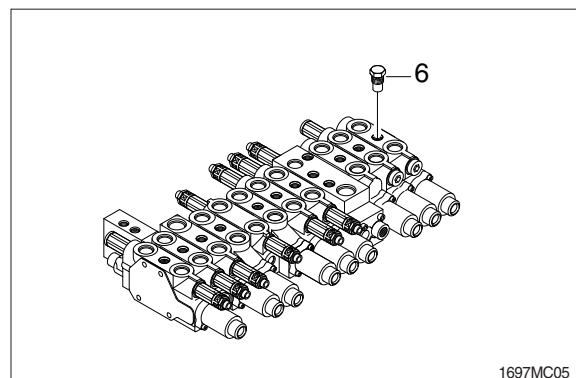
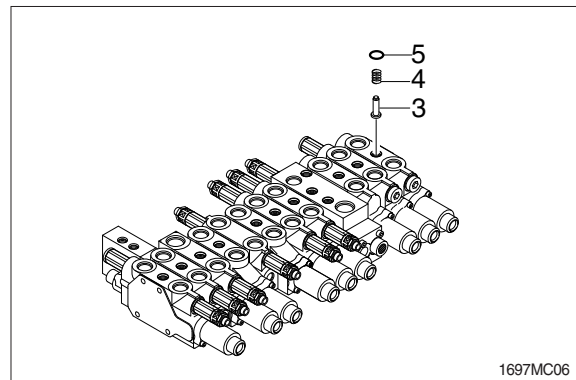
Put O-rings on to plug (6).

Tighten plug to the specified torque.

·Hexagon wrench : 8 mm

·Tightening torque : 3.7 kgf·m

(26.7 lbf·ft)



(3) Main relief, port relief valves

Install the main relief valve (14).

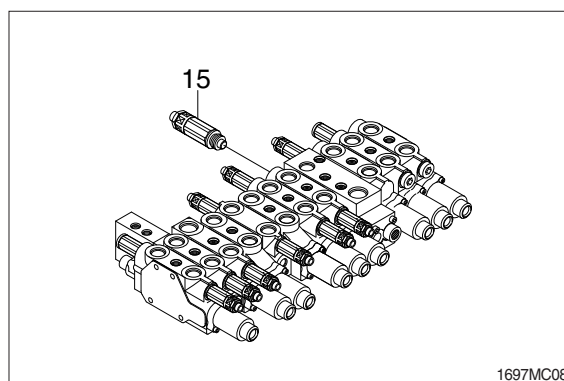
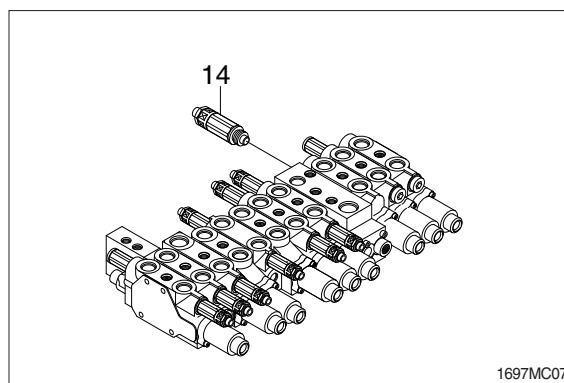
·Spanner : 30 mm

·Tightening torque : 6 kgf·m (43.4 lbf·ft)

Install the over load relief valve (15).

·Spanner : 22 mm

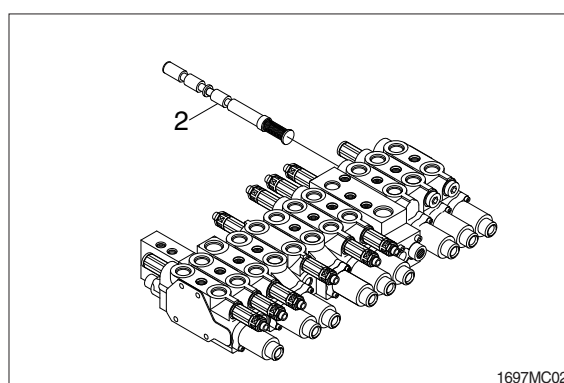
·Tightening torque : 4 kgf·m (28.9 lbf·ft)



(4) Main spools

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

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



(5) Covers of pilot type

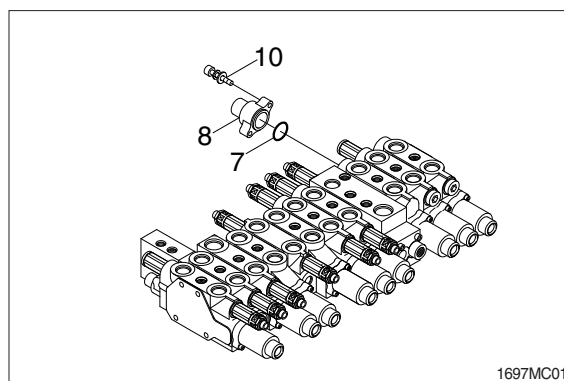
Fit spool covers (8) tighten the hexagonal socket head bolts (10) with washer to the specified torque.

·Hexagon wrench : 5mm

·Tightening torque : 1~1.1kgf·m

(7.2~7.9lbf·ft)

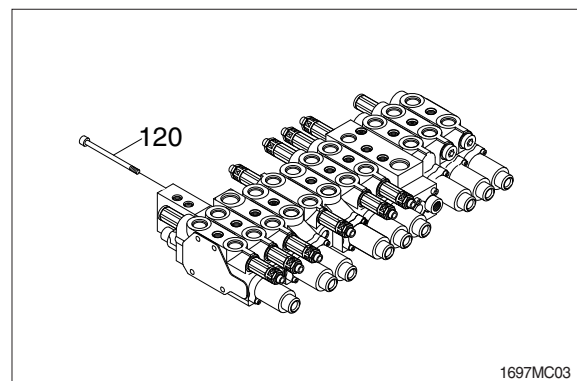
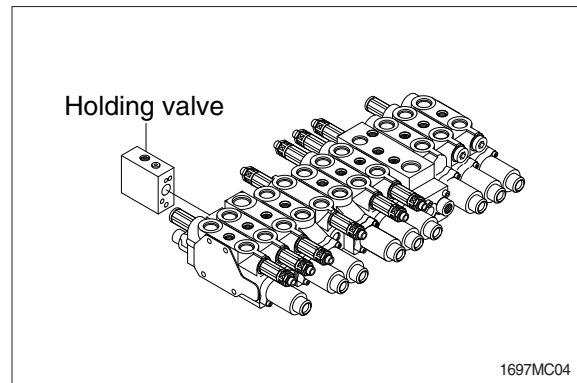
Confirm that O-rings (7) have been fitted.



(6) Holding valve

Fit the holding valve to the body and tighten hexagon socket head bolt (120) to specified torque.

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



GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

- (4) Disconnect hose assembly (59, 61, 76).
- (5) Disconnect pilot line hoses (23, 29).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (50).

Motor device weight : 23 kg (50 lb)

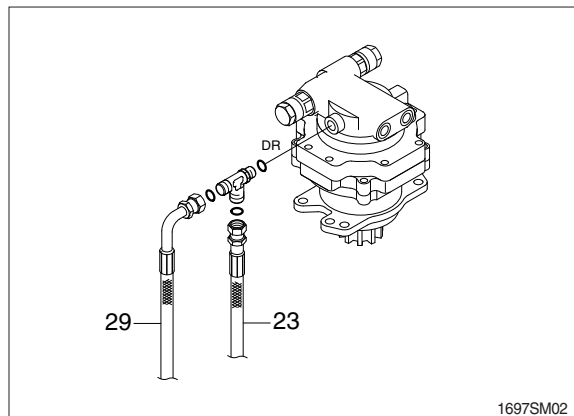
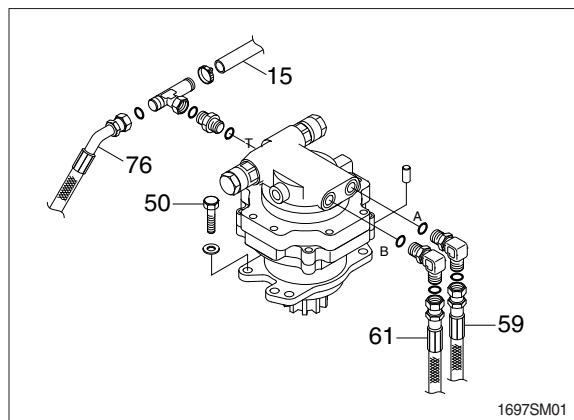
- (7) Remove the swing motor assembly.
When removing the swing motor assembly, check that all the piping have been disconnected.

2) INSTALL

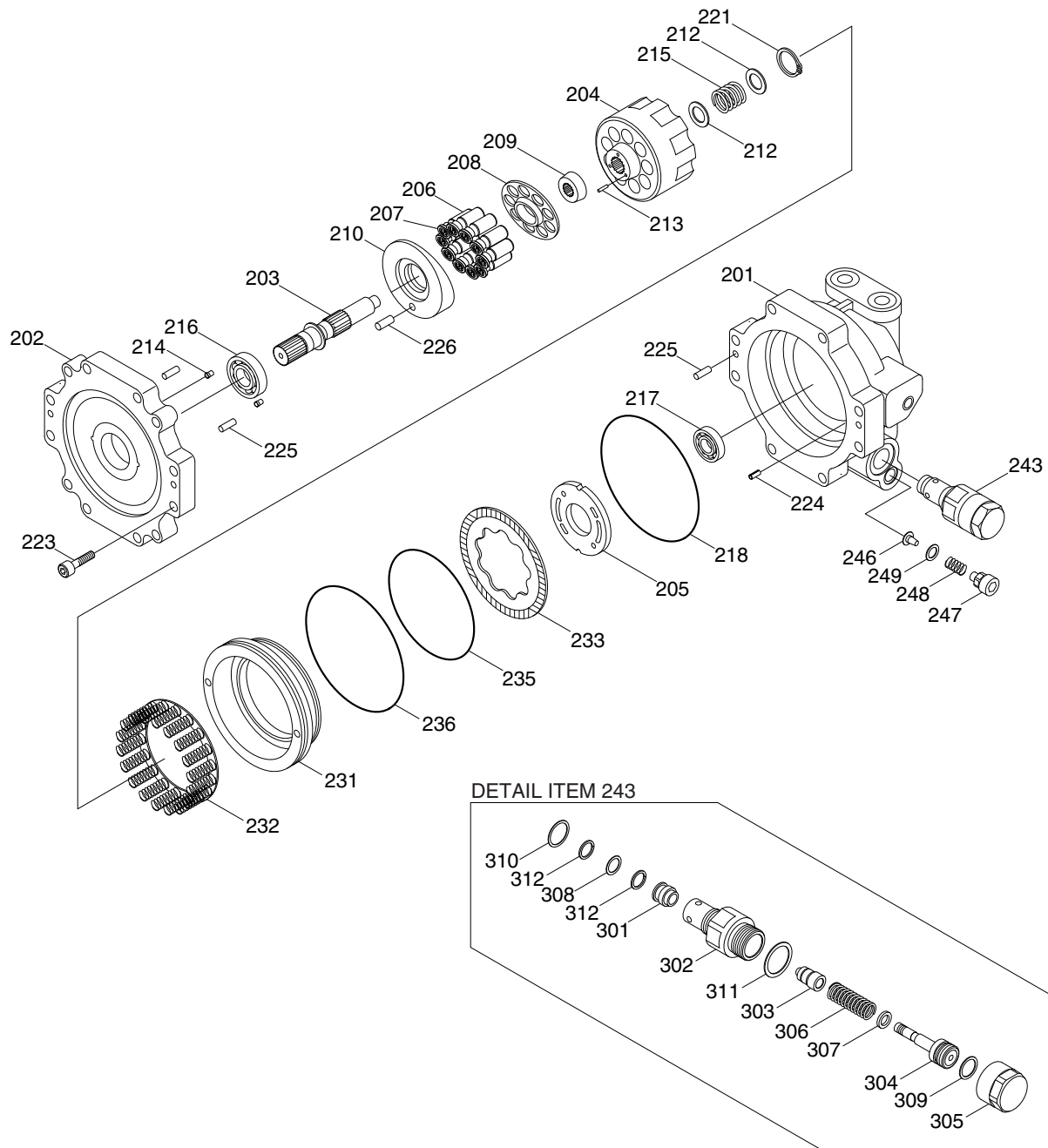
- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the swing motor.
Remove the air vent plug.
Pour in hydraulic oil until it overflows from the port.
Tighten plug lightly.
Start the engine, run at low idling and check oil come out from plug.
Tighten plug fully.
- (3)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



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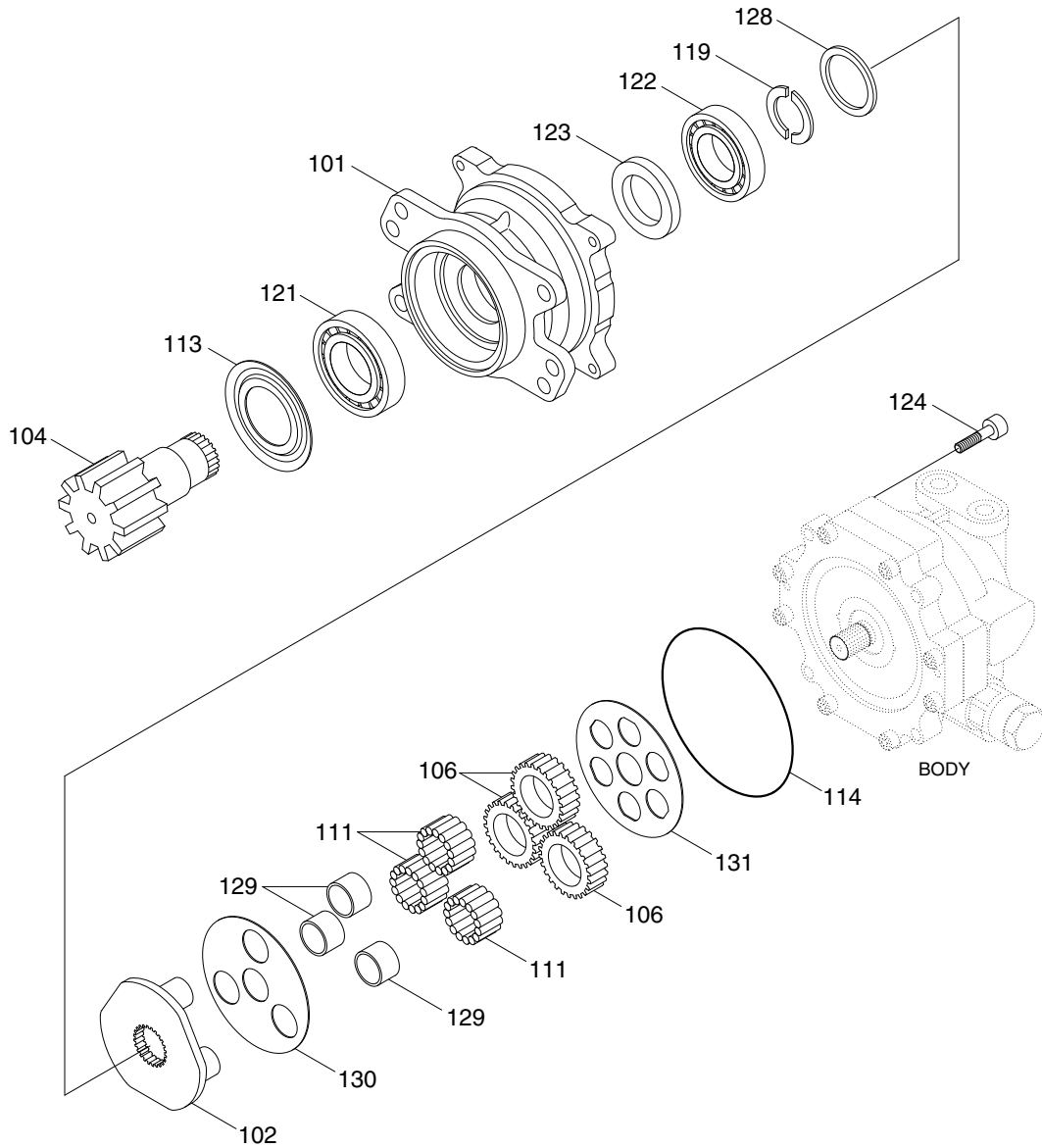
3) COMPONENTS (1/2)



1892SM06

201	Body	213	Pin	231	Brake piston	302	Retainer
202	Plate	214	Filter	232	Spring assy	303	Poppet
203	Shaft	215	Spring C	233	Disk plate	304	Piston
204	Cylinder barrel	216	Bearing	235	O-ring	305	Cap
205	Valve plate	217	Bearing	236	O-ring	306	Spring
206	Piston	218	O-ring	243	Relief valve	307	Spacer
207	Shoe	221	Snap ring	246	Check valve	308	O-ring
208	Shoe holder	223	Screw	247	Plug	309	O-ring
209	Barrel holder	224	Spring pin	248	Spring	310	O-ring
210	Swash plate	225	Pin	249	O-ring	311	O-ring
212	Retainer	226	Pin	301	Seat	312	Back up-ring

COMPONENTS (2/2)



101 Body
 102 Carrier 1
 104 Pinion shaft
 106 Gear B1
 111 Needle
 113 Seal ring

114 O-ring
 119 Preload collar
 121 Bearing
 122 Bearing
 123 Oil seal
 124 Screw

128 Ring
 129 Ring 1
 130 Thrust plate 1
 131 Thrust plate 2

1892SM08

4) GENERAL ATTENTION

Please pay attention following points.

- (1) Working should be done at the clean place and pay attention not to attach dust, paint cake and water. And prepare the clean box to put into the disassembled parts.
- (2) Before disassembling, clean up the dust which is attached to the outside of the swing motor and take out paint which is attached to the binding parts by the wire brush.
- (3) To make the original position when assembling, make a marking before disassembling.
- (4) Give special care to protect parts from damage.
- (5) Wash parts with washing oil sufficiently.
- (6) Check parts whether there is friction loss or seize and take out burr with sand paper.
- (7) Change the seals and snap rings to new ones.

2) DISASSEMBLY AND ASSEMBLY PROCEDURE

As the swing motor composes 2 blocks (hydraulic motor and reduction gear), explain each block disassembly and assembly procedure.

And please refer to the page 7-37~38.

5) TOOLS FOR DISASSEMBLY AND ASSEMBLY

No.	Tool	
1	Preset type hand torque wrench	45 N (JIS B4650)
2		90 N (JIS B4650)
4	Hexagon bar bit for above wrench	Two-plane width 6
5		Two-plane width 8
6	Single purpose type hand torque wrench	T = 15 ± 1.5 kgf · m (108 ± 10.8 lbf · ft) Two-plane 36
8	Hexagon bar wrench	Two-plane width 6
9		Two-plane width 8
10	Spanner	Two-plane width 36
11	Minus driver	Width 6~10
12	Snap ring pliers	Ø28 For hole
13	Hammer	-
14	Plastic hammer	-
15	Other	Grease
16		(Oil designated hydraulic oil)
17		Wire brush
18		Sand paper
19		Anti-loose adhesive (three bond #1305)

2. DISASSEMBLY

1) HYDRAULIC MOTOR

- (1) Loose the hexagon socket head cap bolts (124), and take out the hydraulic motor assembly from the reduction gear body.

· Tools required :
Hexagon bar wrench : 6 mm

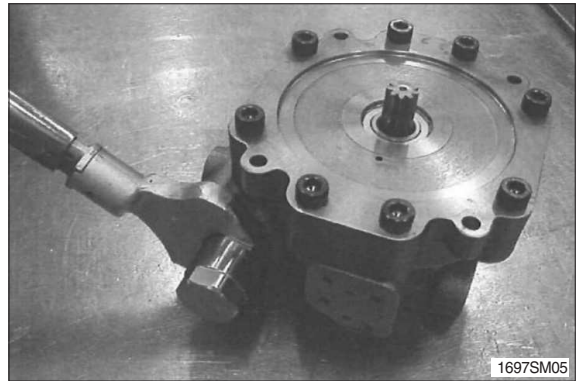
- ※ When taking out the hydraulic motor assembly from the reduction gear body, the drain port should be open.
When it is difficult to take out, insert the minus driver into the binding face to the body and take out the burr completely.



- (2) Take out the relief valve assembly.

· Tools required :
Spanner : 36 mm

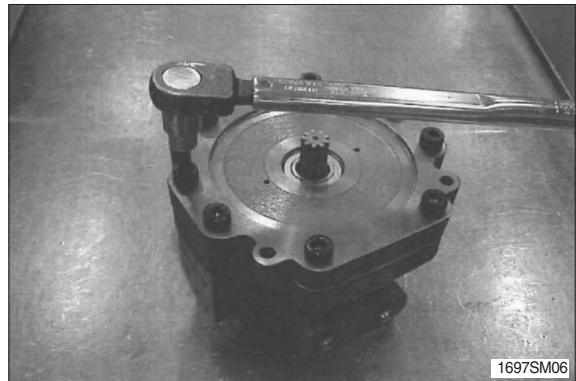
- ※ Do not disassemble the relief valve assembly, unless it is necessary.



- (3) Loose the hexagon socket head cap bolts (223), and take out the plate S (202).

· Tools required :
Hexagon bar wrench : 8 mm

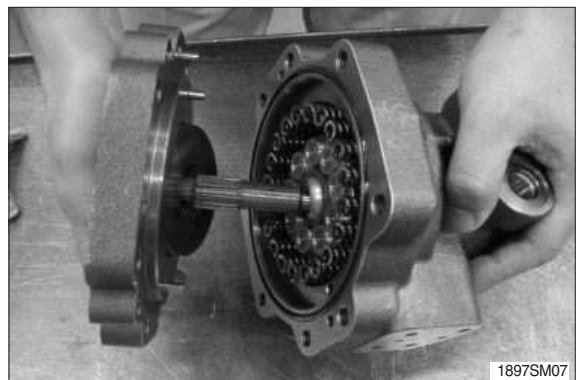
- ※ Pay attention not to drop out the swash plate (210).



- (4) Take out the swash plate (210) and the shaft kit from the plate S (202).

- ※ When it is difficult to take out the shaft, hit the opposite side slightly by the plastic hammer.

As the bearing (216) is pressed into the shaft, do not disassemble unless it is necessary to change the bearing.

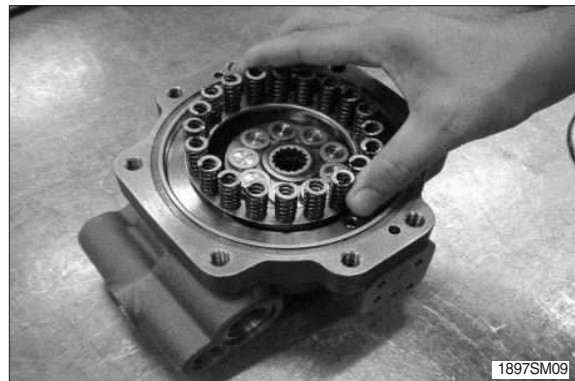


(5) Take out the filters (214) and the parallel pins (225) from the plate S (202).

- Filter (214) : 2 pcs
- Parallel pin (225) : 3 pcs

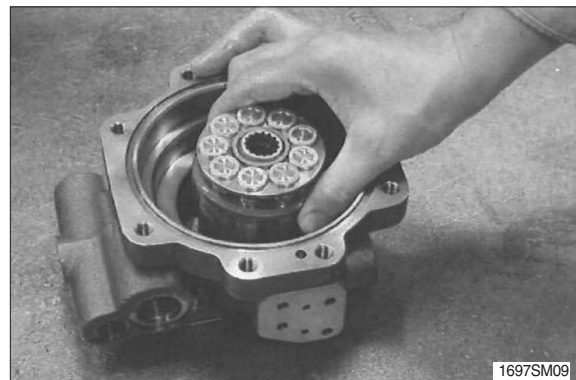


(6) Take out the O-ring (218) and the spring assembly (232) from the body H (201).

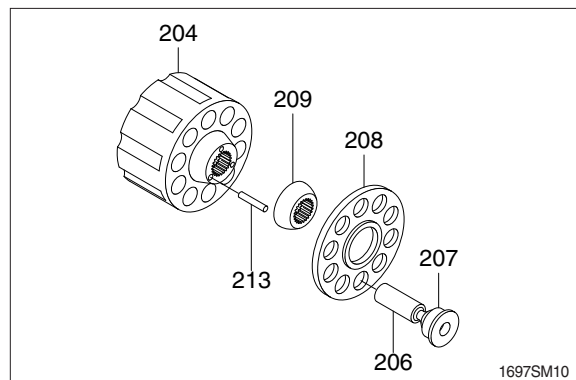


(7) Take out the cylinder barrel kit.

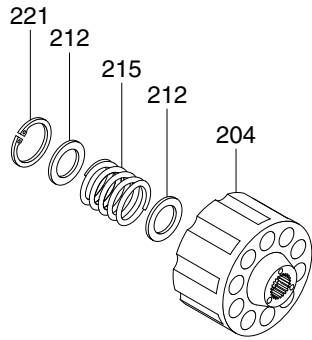
- ※ The small parts are easily dispersed, pay attention not to miss.
- The valve plate (205) is sometime attached, pay attention not to drop out.



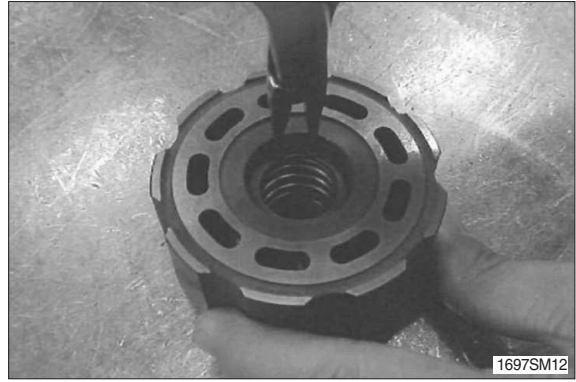
(8) Take out the piston (206) and the shoe (207) assembly, the shoe holder (208), the barrel holder (209) and the pin (213).



(9) Take out the snap ring (221), the retainer (212) and the spring C (215).

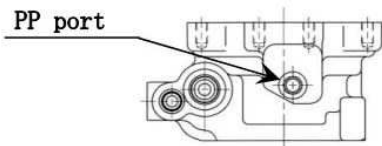


1697SM11

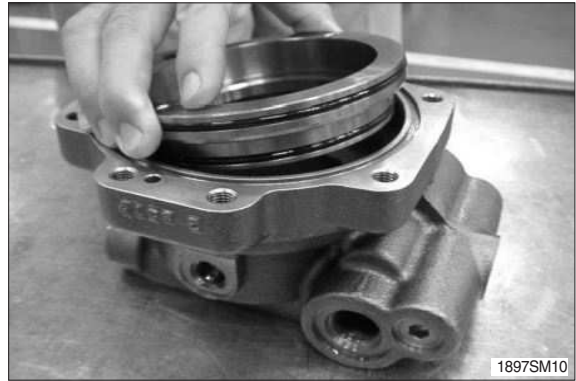


(10) Take out the brake piston (231) and the O-ring (235, 236).

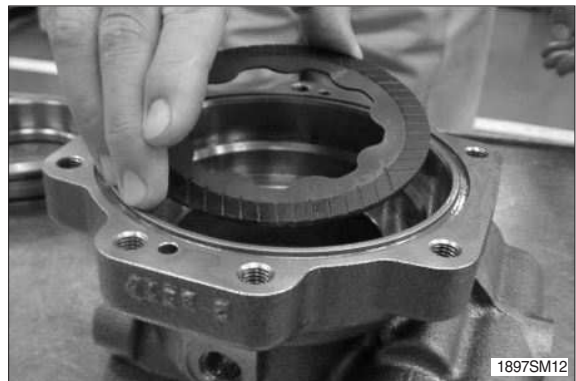
※ The brake piston is drawn out by the air blowing gradually from the PP port. Pay attention not to draw out the brake piston rapidly.



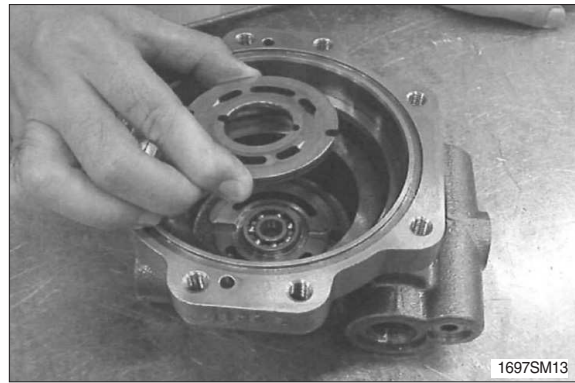
1897SM11



(11) Take out the disk plate (233).

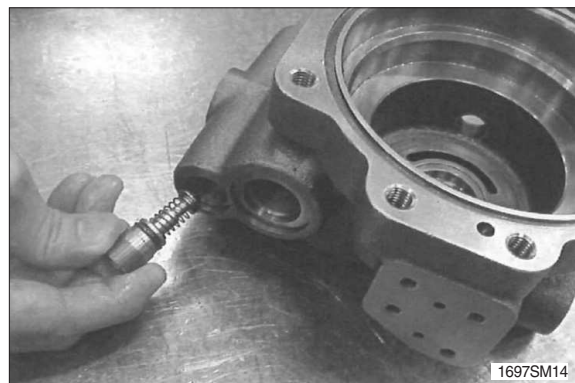


(12) Take out the valve plate (205).



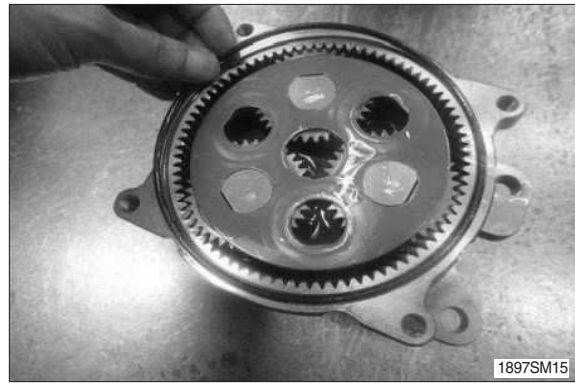
(13) Loose the plug (247), and take out the check valve (246) and the spring (248).
(2 locations)

- Tools required :
Hexagon bar wrench : 8 mm

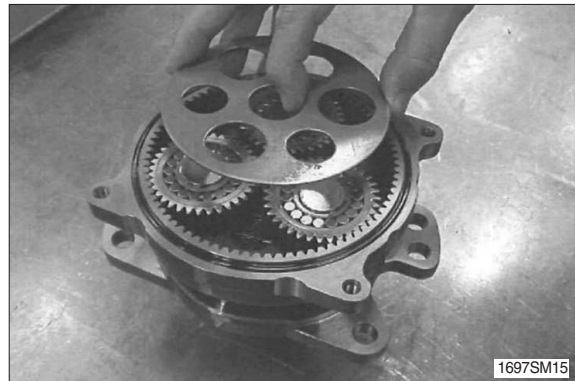


2) REDUCTION GEAR

(1) Take out the O-ring (114).



(2) Take out the thrust plate (131).



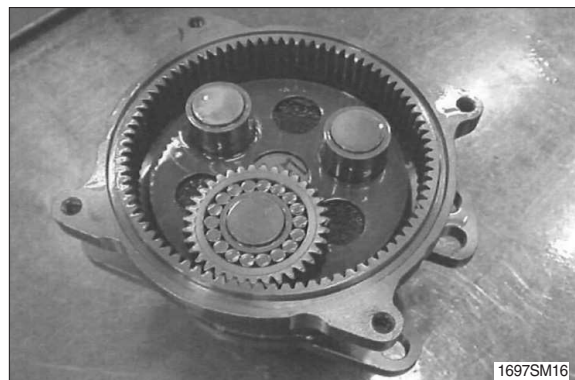
(3) Take out carrier 1 (102), the b1 gears (106), the needles (111) and the rings (129).

Needle (111) : 18 pcs / b1 gear 1pc

b1 gear (106) : 3 pcs

Ring (129) : 3 pcs

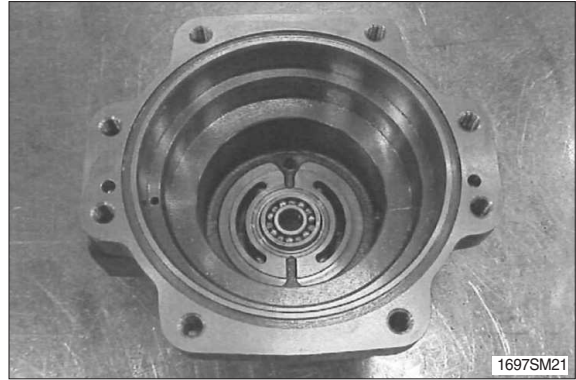
※ The small parts are easily dispersed.
Pay attention not to miss.



3. ASSEMBLY

1) HYDRAULIC MOTOR SECTION

- (1) Press-fit the bearing (217) and spring pin (224) into the body H (201).

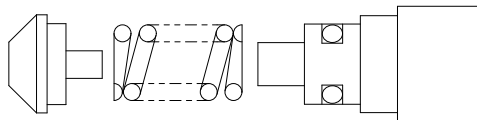
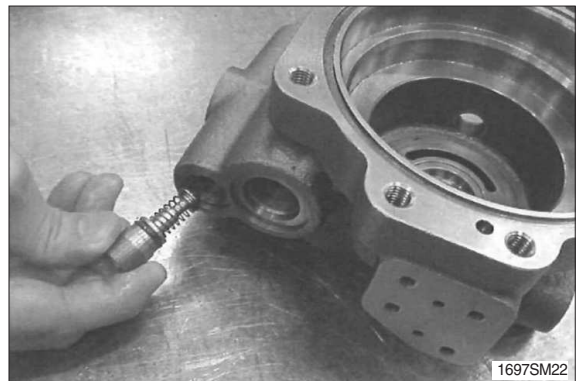


- (2) Insert the 2 check valves (246) (1 pc/side), 2 springs (248) (1 pc/side) and 2 plugs (247) (1 pc/side) with O-ring (249) in that order into the body H (201).

- Tools required :
Hexagon bar wrench : 8 mm
Torque wrench

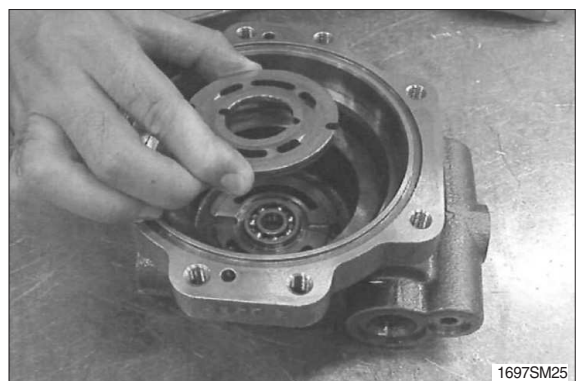
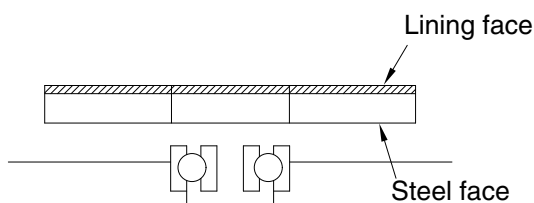
- ※ Apply grease slightly to the O-ring and assemble to pay attention not biting the seals.

- Plug tightening torque :
 $6 \pm 0.3 \text{ kgf} \cdot \text{m}$ ($43.4 \pm 2.17 \text{ lbf} \cdot \text{ft}$)

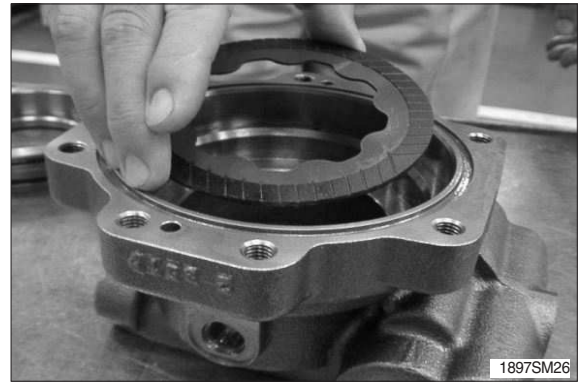


- (3) Place the valve plate (205) onto the body H.

- ※ The steel face of the valve plate should be downside and assemble.



(4) Assemble the disk plate (233).



(5) Attach the O-ring (235, 236) to the brake piston (231), and make the brake piston assembly.



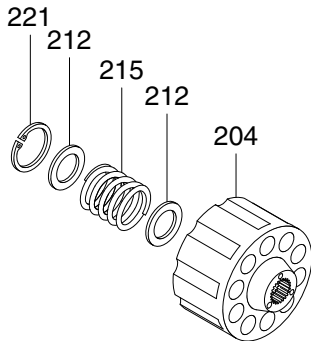
(6) Place the brake piston assembly onto the body H (201).

- ※ Set the brake piston assembly to the plate S which is attached 3 pcs of the parallel pins, and confirm there is no O-ring sticking out, flaw and dust, and assemble the brake piston assembly without inclination. In case of the brake piston assembly dropping out, apply grease to the plate S side.

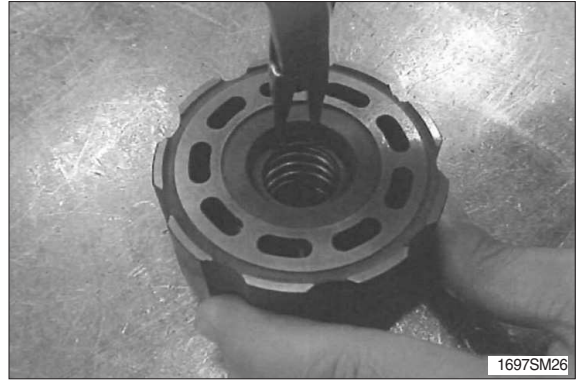
After assembled, take out the plate S. Apply grease slightly to the O-ring and assemble to pay attention not biting the seals.



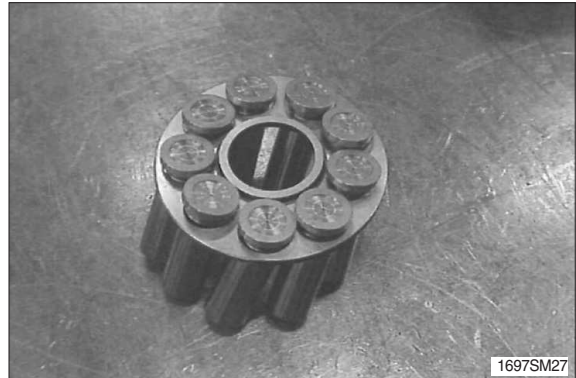
- (7) Place the retainer (212), spring C (215) and retainer (212) in that order into the cylinder barrel (204), and then secure them with the snap ring (221).



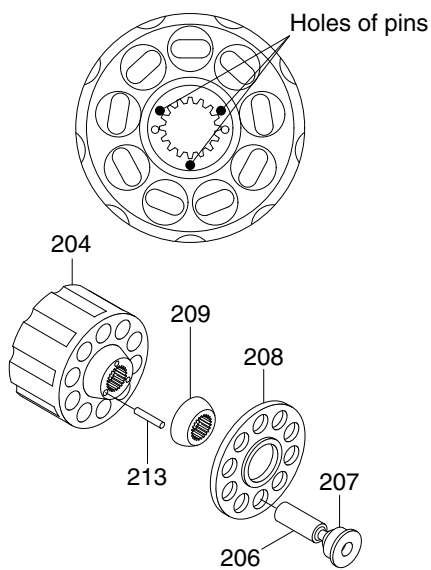
R27Z97SM38



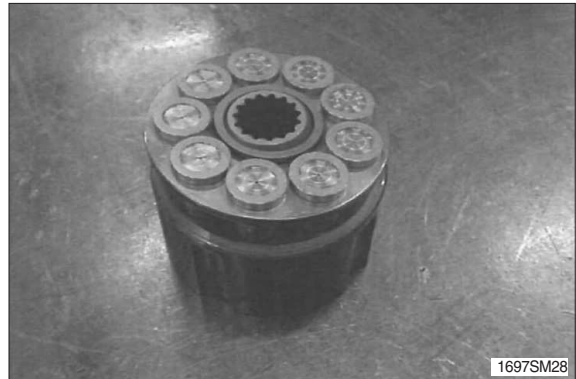
- (8) Make the shoe holder assembly which has the 9 piston-shoe (206, 207) assemblies placed on the shoe holder (208).



- (9) Place the 3 pins (213), barrel holder (209) and the shoe holder assembly onto the cylinder barrel (204) to make up a cylinder barrel assembly.



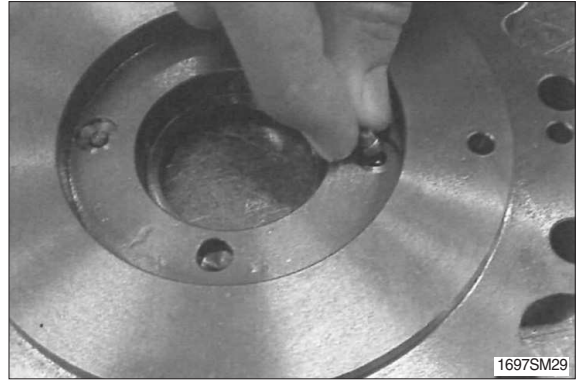
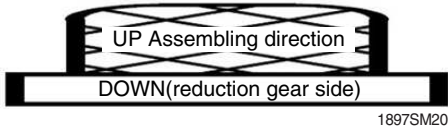
R27Z97SM41



(10) Place the filters (214) and the parallel pins (225) into the plate S.

Filter (214) : 2 pcs

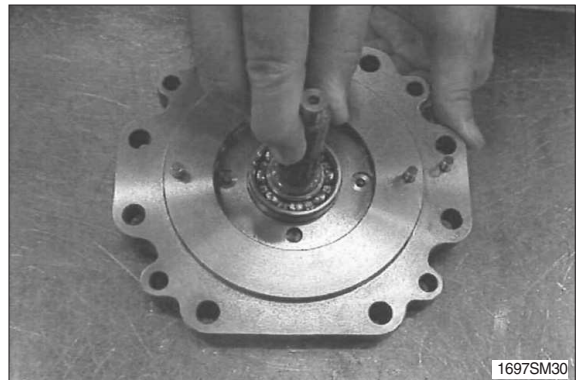
Parallel pin (225) : 3 pcs



Use a plastic hammer when it is tight.

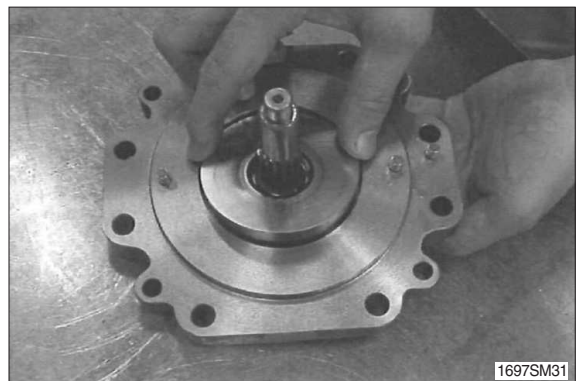
※ Pay attention height of pins are 8 mm from surface after installation.

(11) Place the shaft assembly into the plate S.



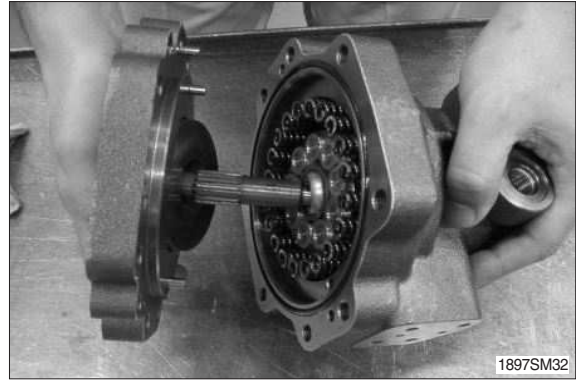
(12) Place the swash plate onto the plate S.

※ In case the swash plate drops out, apply grease to the plate S side of it.



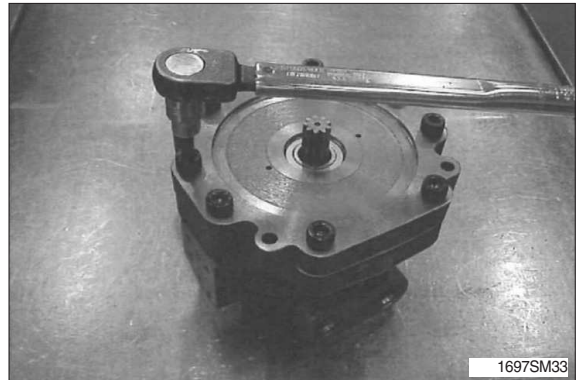
(13) Join the body H and the plate S.

- ※ Align the serration of the shaft which is assembled to the plate S to the serration of the cylinder barrel assembly which is assembled to the body H.



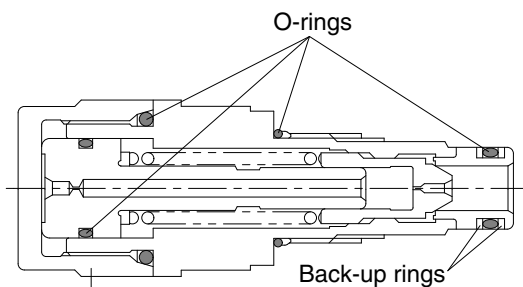
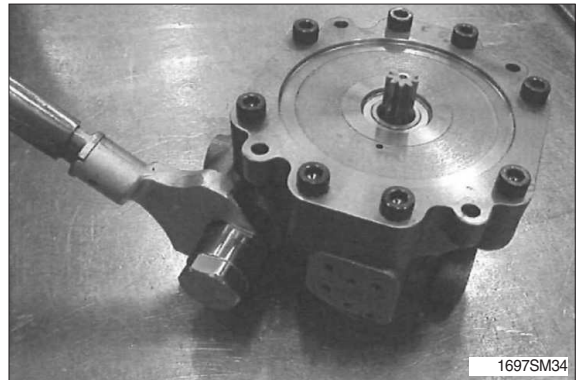
(14) Bolt the plate S (202) together with the 8 hexagon socket head cap bolts (223).

- Tools required :
Hexagon bar wrench : 8 mm
Torque wrench
- Plug tightening torque :
 $6 \pm 0.3 \text{ kgf} \cdot \text{m}$ ($43.4 \pm 2.17 \text{ lbf} \cdot \text{ft}$)



(15) Screw up the relief valve assembly.
(both side)

- Tools required :
Spanner : 36 mm
Torque wrench
- Plug tightening torque :
 $15 \pm 1.5 \text{ kgf} \cdot \text{m}$ ($108 \pm 10.8 \text{ lbf} \cdot \text{ft}$)
- ※ Once the relief valve is disassembled, replace the O-ring and the back up ring in the below, and screw the cap with the following torque.

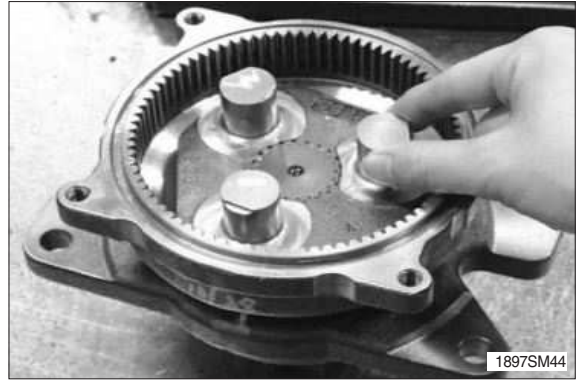


Plug tightening torque:
 $15 \pm 1.5 \text{ kgf} \cdot \text{m}$ ($108 \pm 10.8 \text{ lbf} \cdot \text{ft}$)

R27Z97SM54

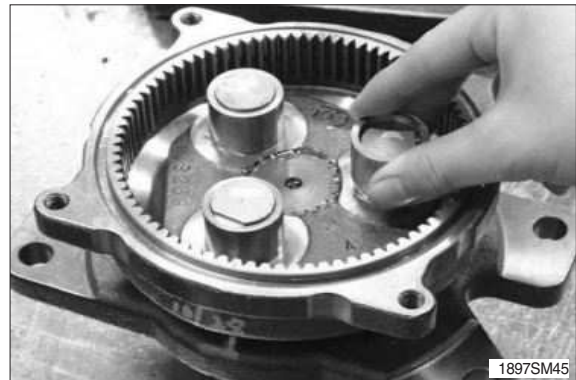
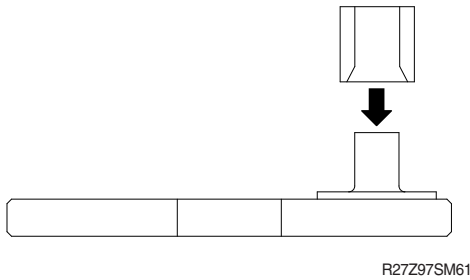
2) REDUCTION GEAR SECTION

- (1) Align the spline of the carrier 1 (102) to the pinion shaft (104) and place the carrier 1 (102) into the body.



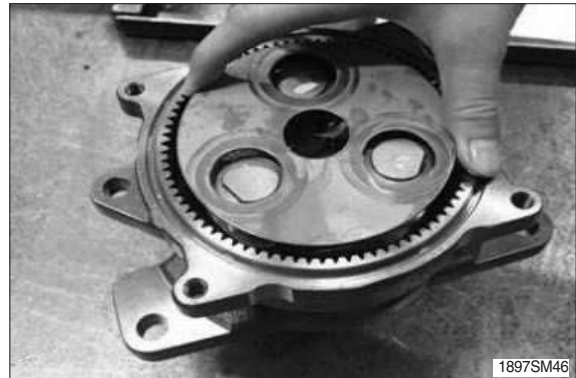
- (2) Place the 3 rings (129) (1 pc/pin) onto the 3 pins of the carrier 1 (102).

- ※ Pay attention to direction of the ring. Beveling part of the ring should be down side.



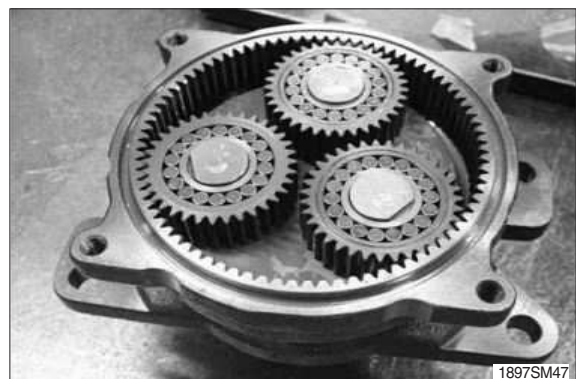
- (3) Place the thrust plate (130) onto the carrier 1.

- ※ Larger size holes are aligned to the pins.



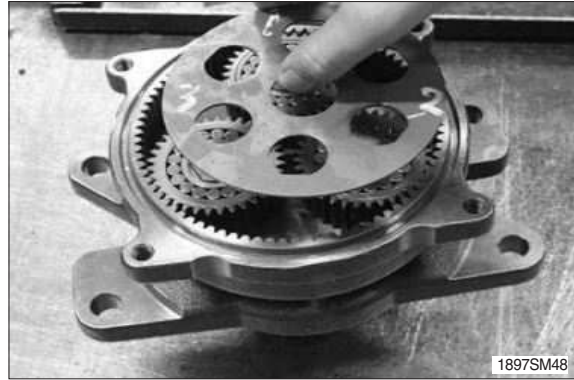
- (4) Place the 3 b1 gears (106) (1 pc/pin) and 54 needles (111) (18 pc/pin) in that order onto the 3 pins of the carrier 1.

- ※ Pay attention not to drop the needles in the body.



(5) Place the thrust plate (131) onto the carrier 1.

※ Smaller size holes are aligned to the pins.



(6) Fill the body with hydraulic oil.

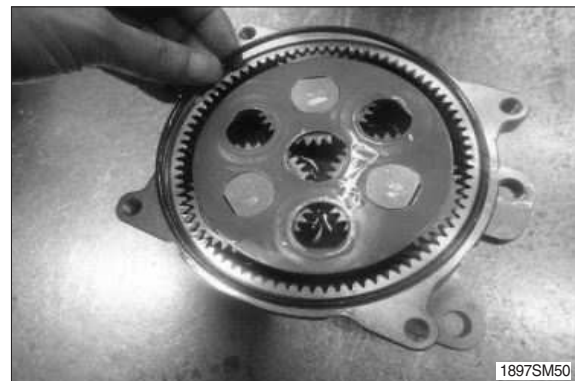
※ Oil : ISO VG 46 or equivalent

Oil amount : 3 to 4 mm below the top thrust plate

Wipe the oil off the flange surface if it is spilled.



(7) Place the O-ring (114) onto the body.



(8) Join the hydraulic motor and the body, and then bolt them together with the 4 hexagon socket head cap bolts.

· Tools required :

Hexagon bar wrench : 6 mm

Torque wrench

※ Align the shaft of the motor to the b1 gears. Apply anti-loose adhesive to the screws.

· Plug tightening torque :

$3 \pm 0.3 \text{ kgf} \cdot \text{m}$ ($21.7 \pm 2.17 \text{ lbf} \cdot \text{ft}$)



GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

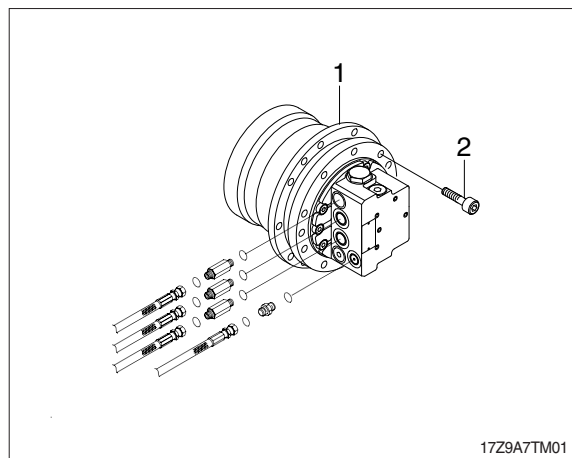
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

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

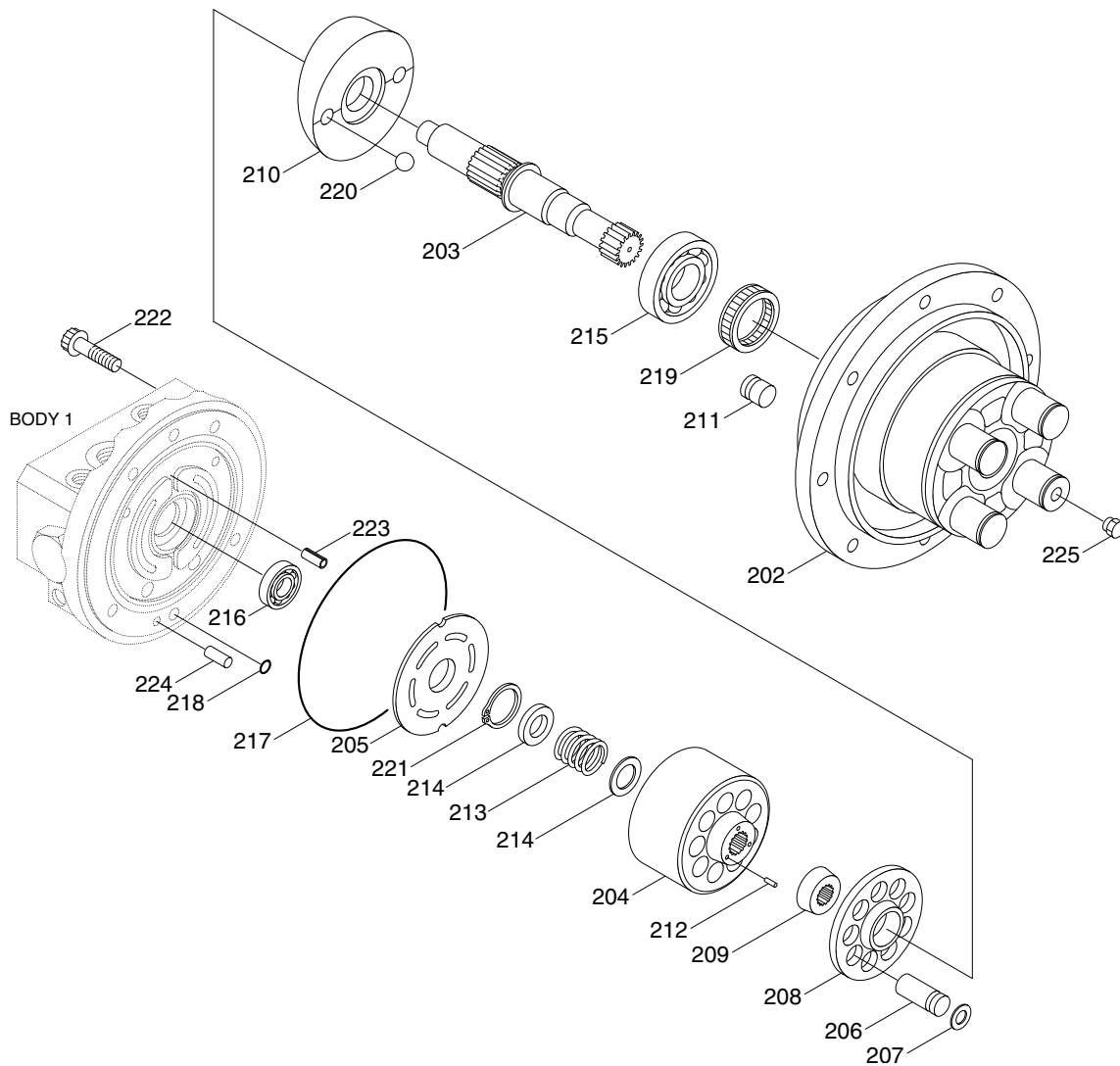
- (4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.
- (5) Remove the cover.
- (6) Remove the hose.
Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.
·Weight : 18 kg (40 lb)

2) INSTALL

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



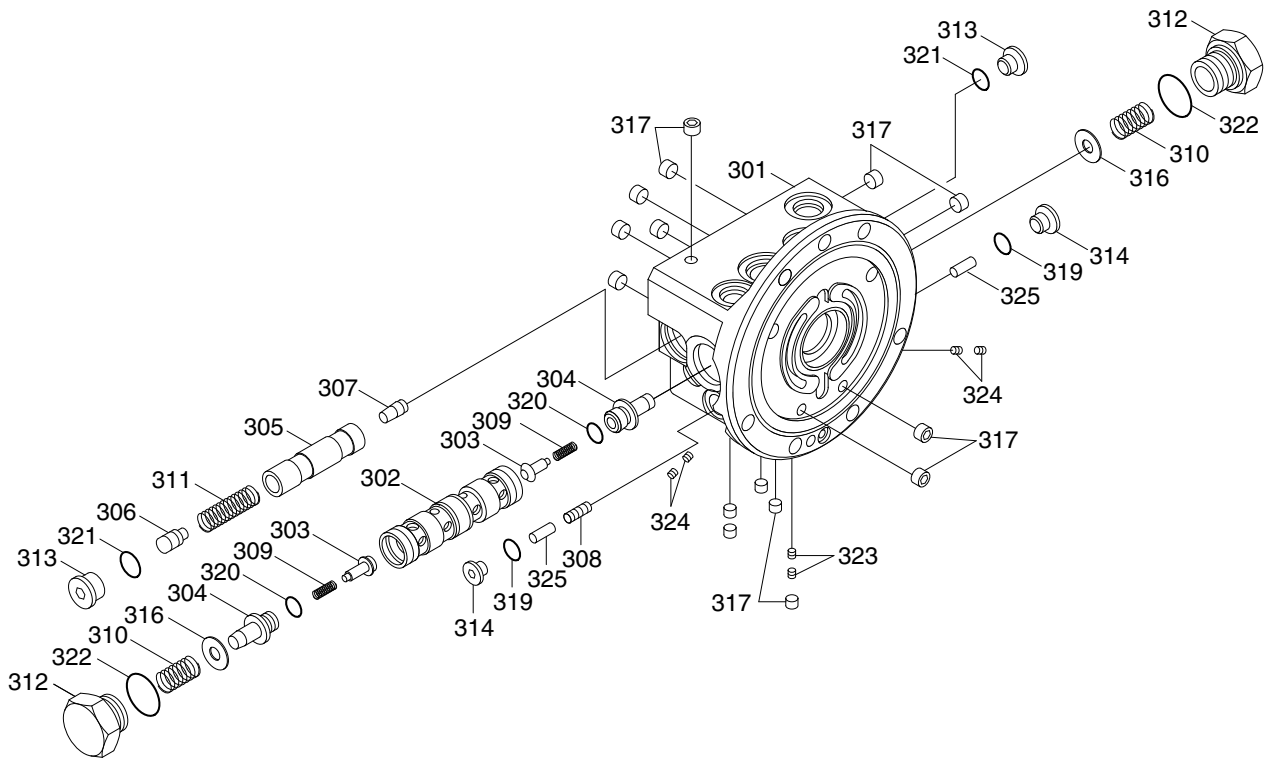
2) STRUCTURE (1/3)



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

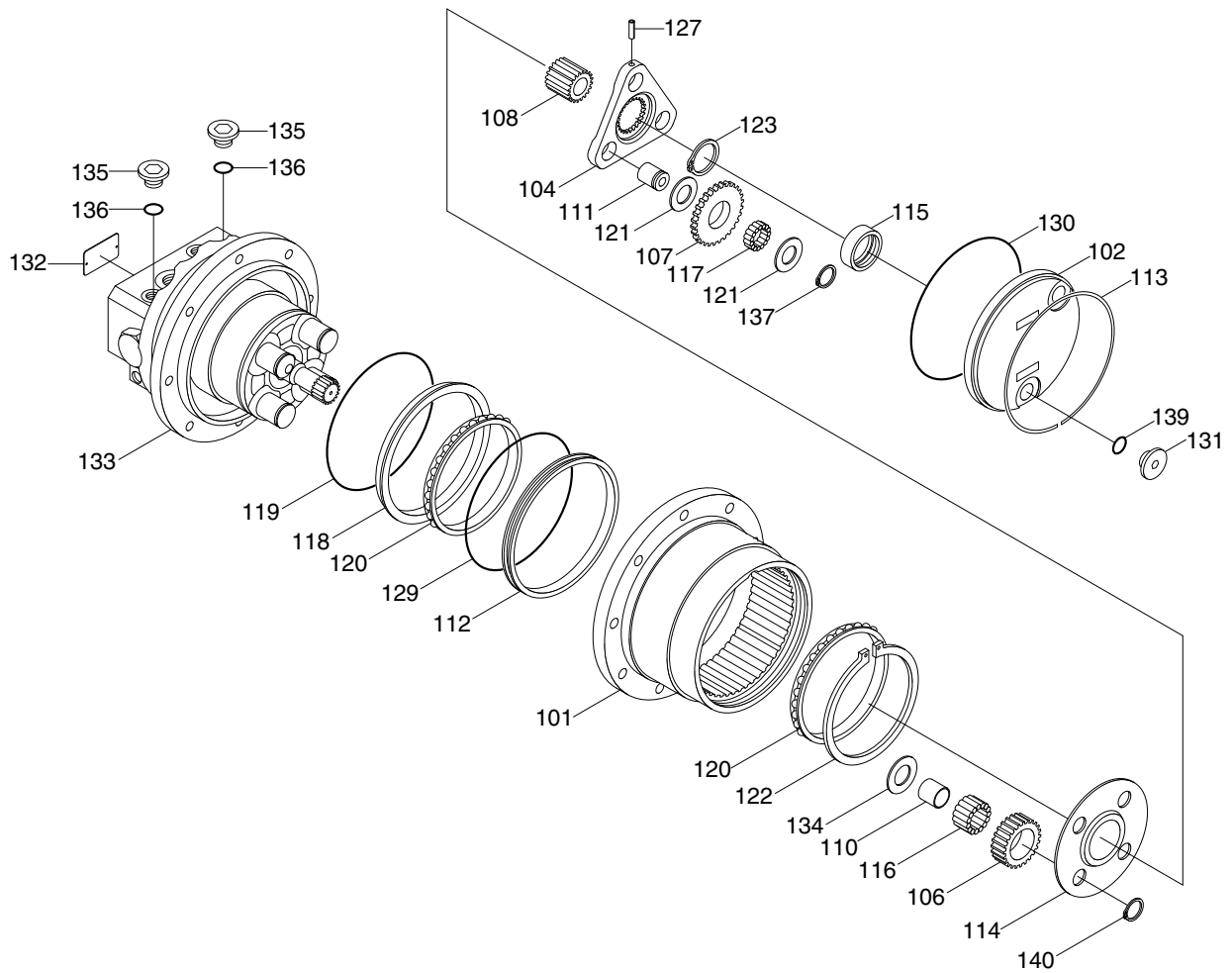
STRUCTURE (2/3)



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

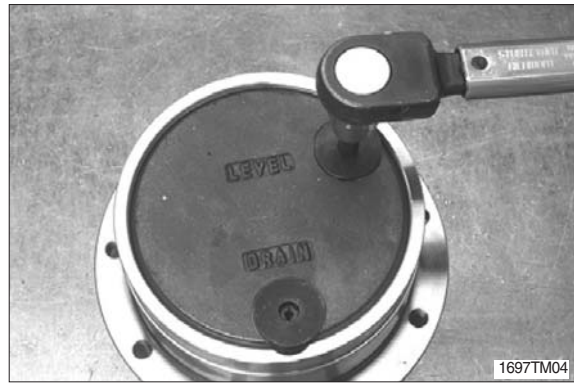
2. DISASSEMBLY

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.



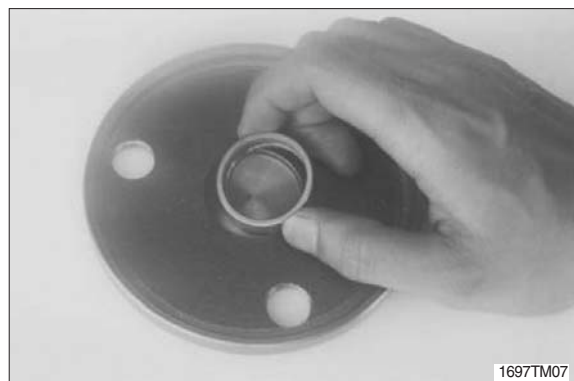
- (2) Remove the snap ring.
- ※ Put the screwdriver into the notch of the body, and then pull the snap ring.



- (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.

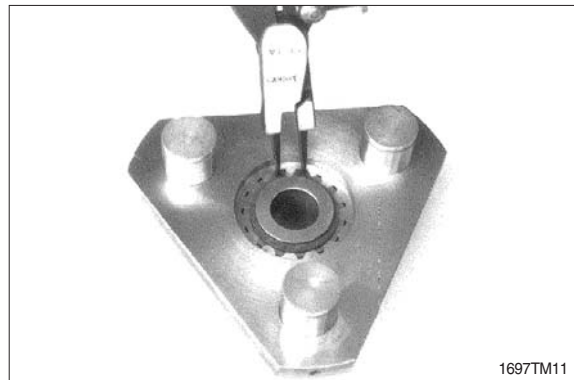


(7) Remove the three snap rings, three thrust washers, three b2 gears, thirty-nine needles and three thrust washers.

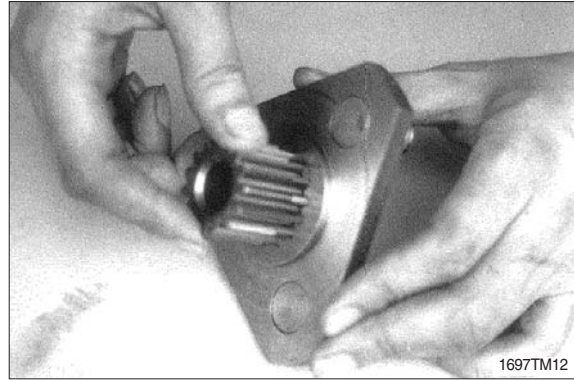
- ※ The thrust washers on both sides of the b2 gears are the same.
- ※ The b2 pins and spring pins are not able to disassemble, because they are press-fitted.
- ※ The needles are easily dispersed, pay attention not to lose.



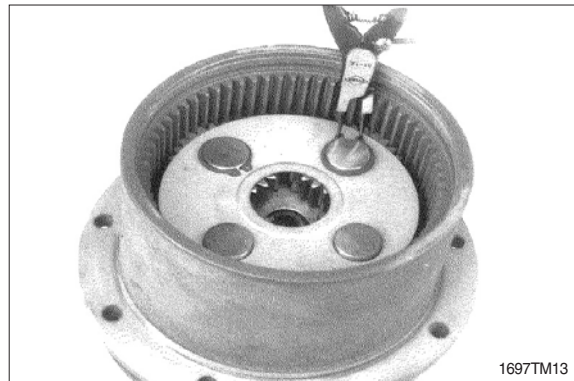
(8) Remove the snap ring from the carrier 2.



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

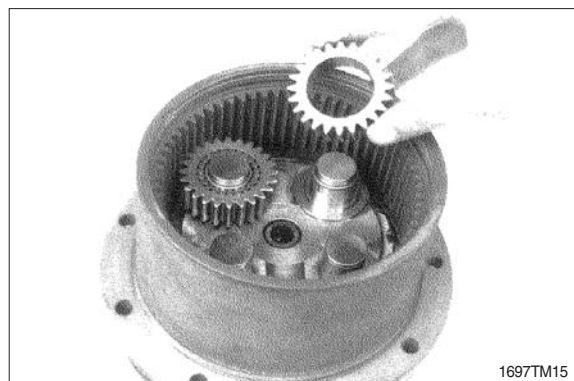
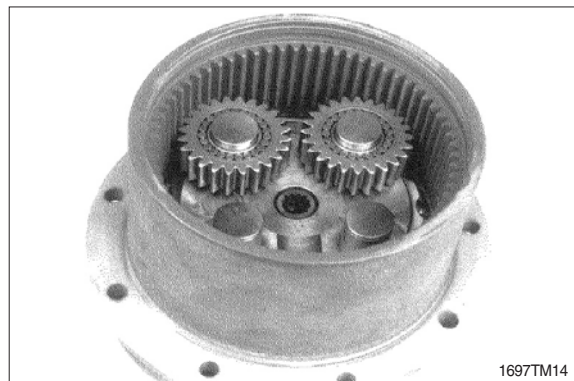


(10) Remove the four snap rings and the four thrust plates.



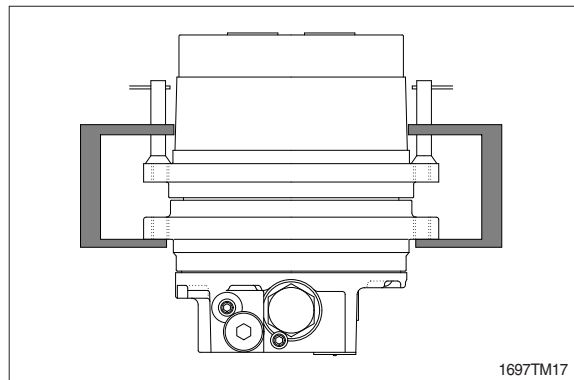
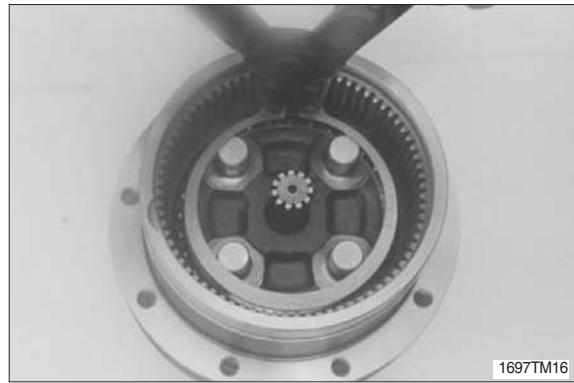
(11) Remove the four b1 gears, ninety-six needles, four thrust washers and four rings.

※ 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.

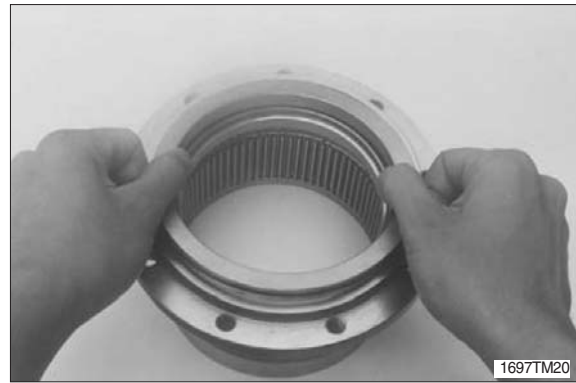


(14) Remove the iron balls with retainer from the speed reducer.

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

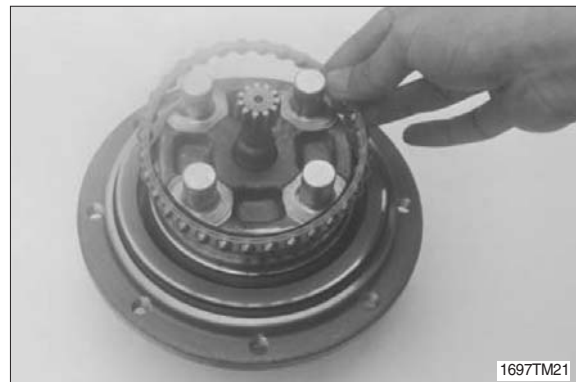


(15) Remove the seal ring from the speed reducer.



(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.

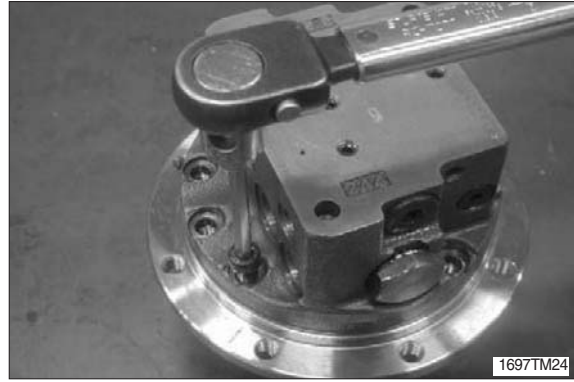


(17) Remove the floating seat with O-ring from the hydraulic motor.

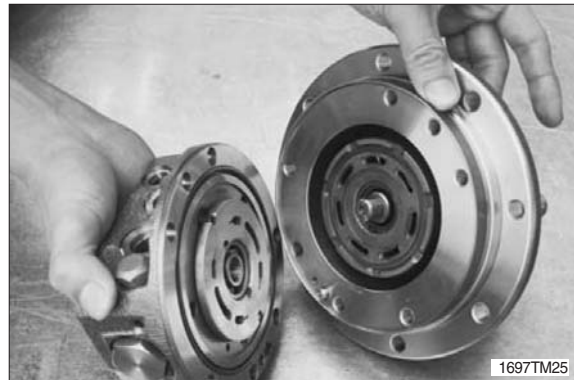


3) HYDRAULIC MOTOR SECTION

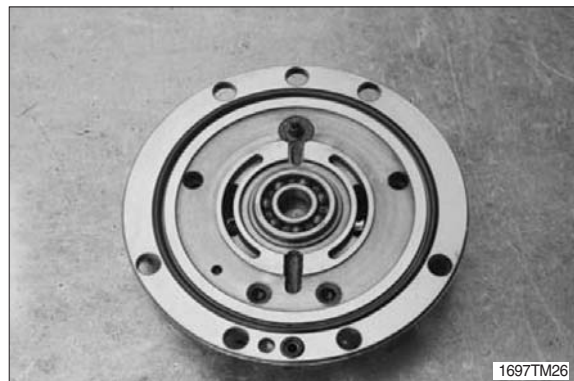
- (1) Remove the seven hexagon socket head cap bolts.
 - Hexagon size : 6 mm
- ※ If you fix the motor with a vice, protect it with aluminum plates or equivalent.



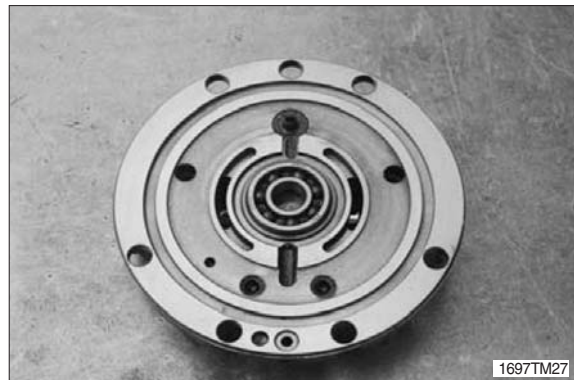
- (2) Remove the body 1 from the body 2.
- ※ Pay attention not to come off and damage the valve plate.



- (3) Remove the valve plate.

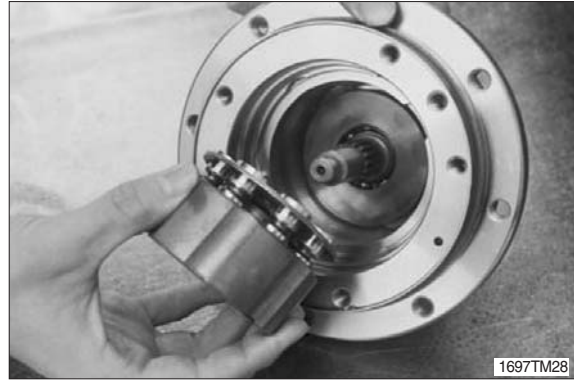


- (4) Remove the two O-rings from the body 1.
- ※ The bearing and spring pins are not able to disassemble, because they are press-fitted.

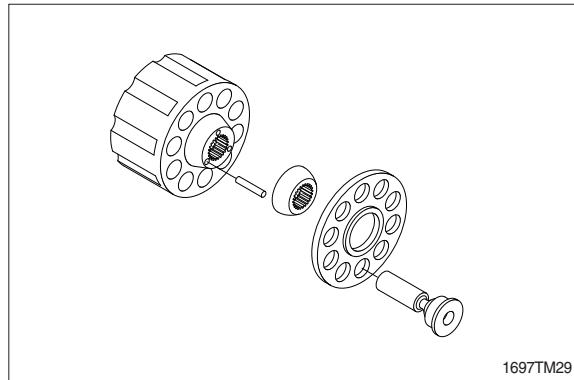


(5) Remove the cylinder barrel assembly from the body 2.

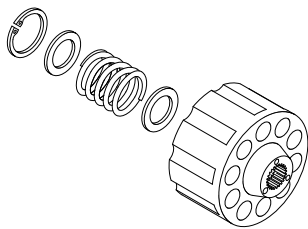
※ The small parts are easily dispersed, pay attention not to miss.



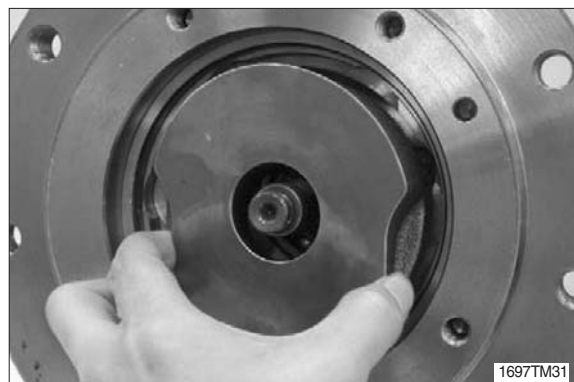
(6) Remove the seven piston-shoe assemblies, shoe holder, barrel holder, three pins.



(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.



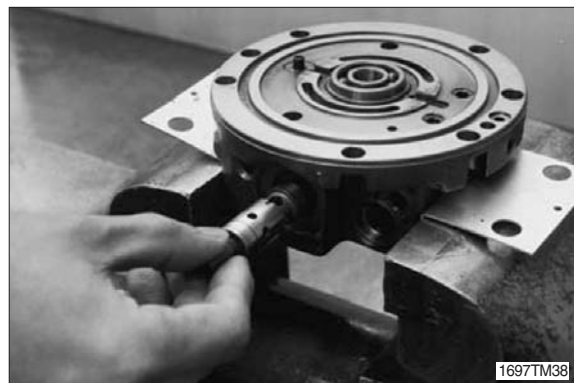
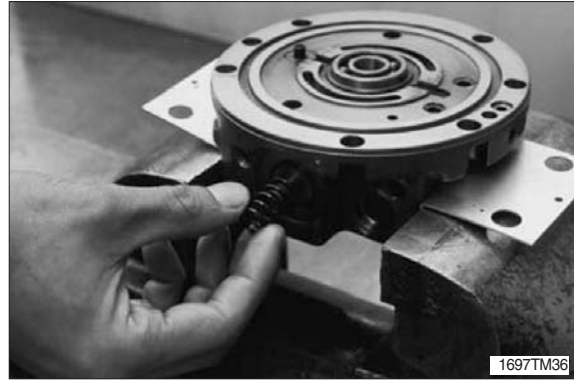
(13) Remove the two plugs with O-rings from
the body 1.

·Hexagon size : 27 mm



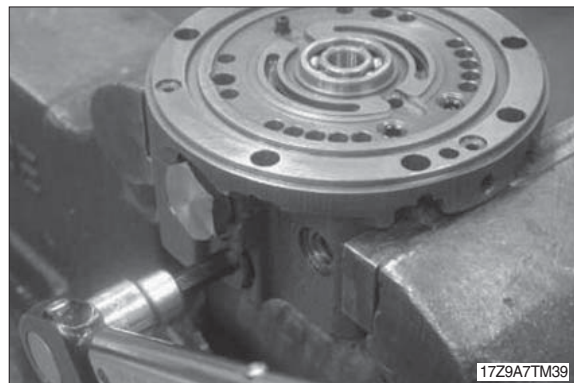
(14) Remove the two spring V2, two rings and spool assembly.

※ The spool assembly is not able to disassemble.



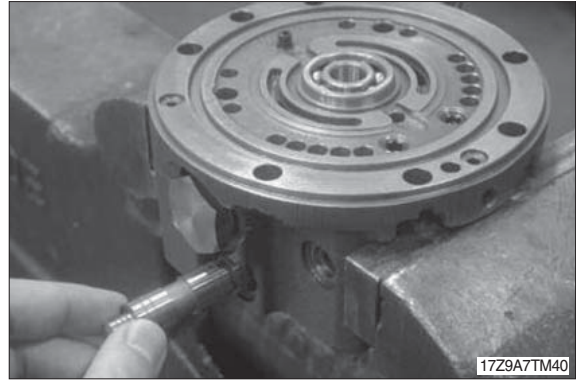
(15) Remove the two plugs with O-rings from the body 1.

·Hexagon size : 8 mm



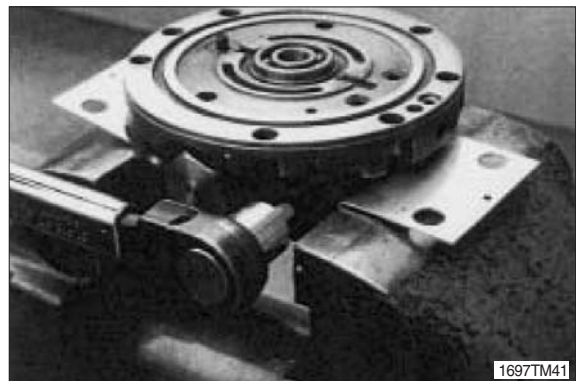
(16) Remove the spring V3, two speed spool, spool B and spool C.

※ 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



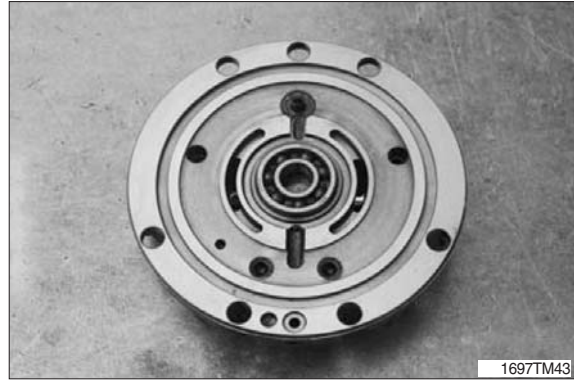
(18) Remove the two needles and shuttle spool.



3. ASSEMBLY

1) HYDRAULIC MOTOR SECTION

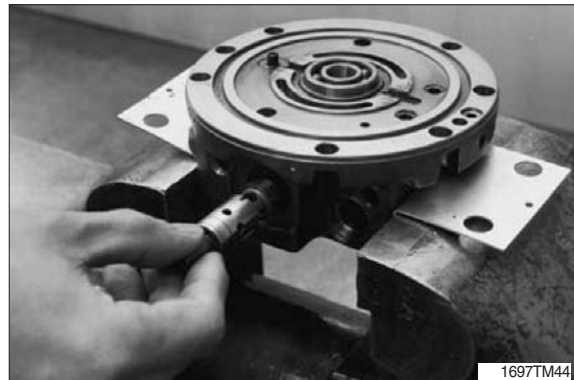
- (1) Press-fit the bearing and the spring pin into the body 1.



- (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

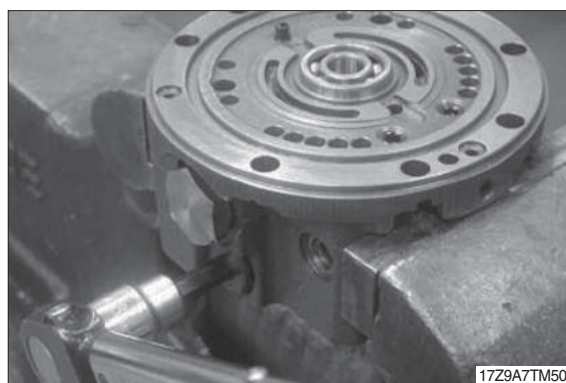
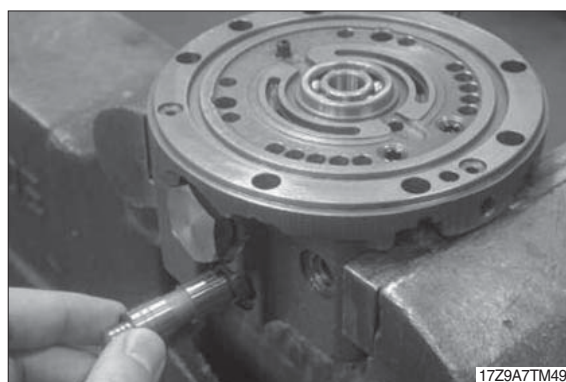




(3) Insert the spring V3, spool B and spool C into two speed spool. Insert its assembly into the body 1. Screw the two plugs (1pc/side) with two O-rings (1pc/side).

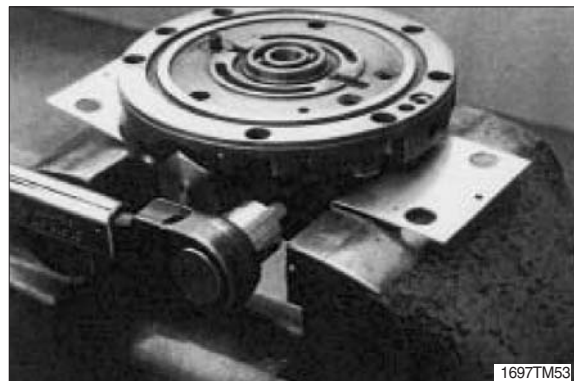
- Plugs tightening torque :
4.69~5.2 kgf · m (33.9~37.6 lbf · ft)
- Hexagon size : 8 mm

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

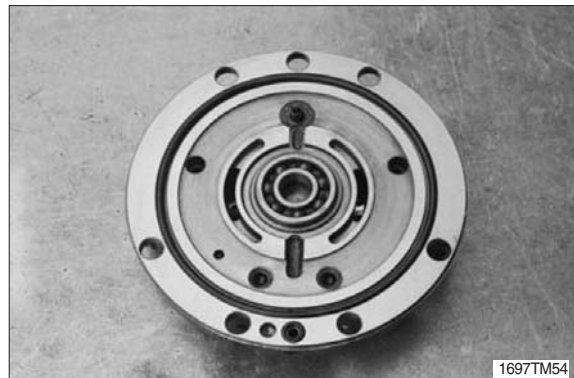


(4) Insert the shuttle spool and two needles (1pc/side) into the body 1, and then screw them in with the two plugs with O-rings (1pc/side).

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

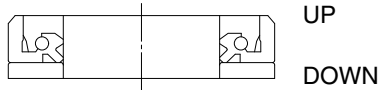


(5) Place two O-rings onto the body 1.

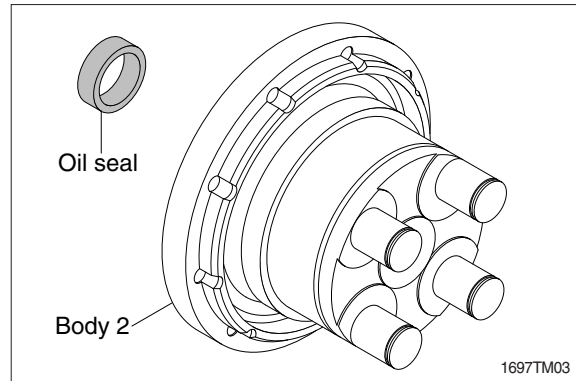


(6) Press-fit the oil seal into the body 2.

- ※ 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.

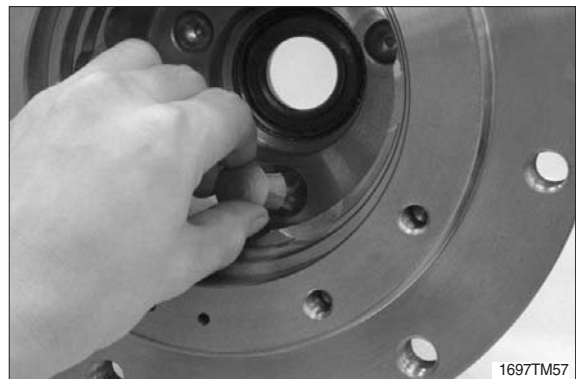


(8) Press-fit the bearing with the shaft.



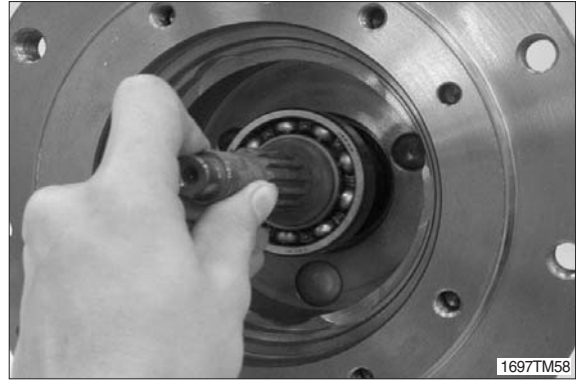
(9) Insert the control piston into the body 2.

- ※ 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).



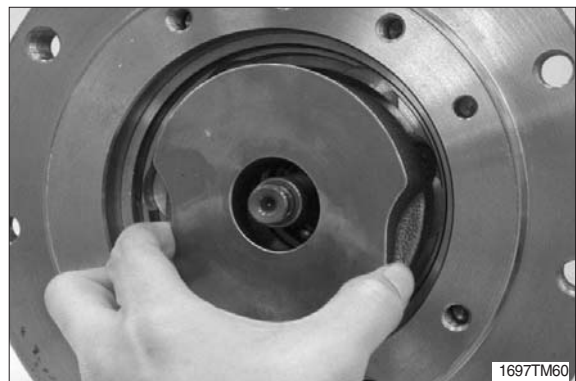
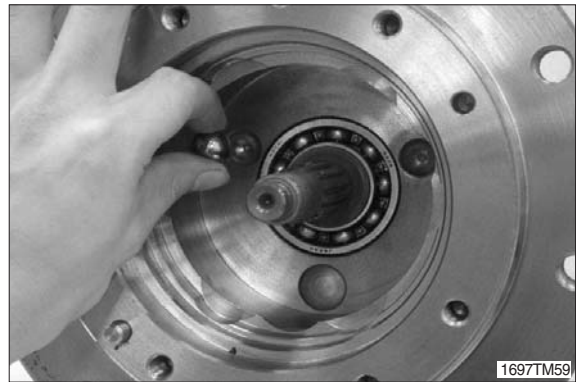
(10) Place the shaft into the body 2.

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



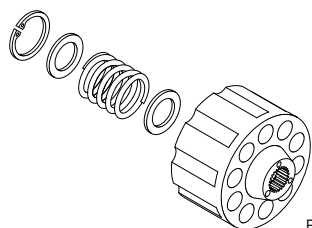
(11) Place the two balls and the swash plate onto the body 2.

- ※ 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.

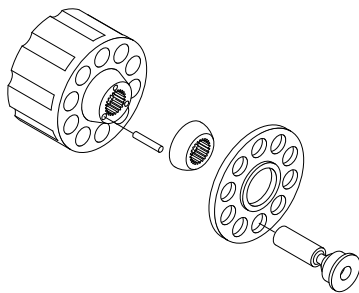
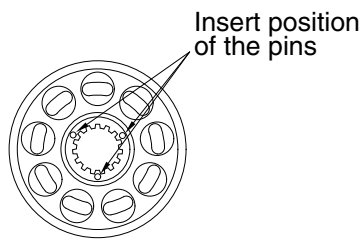


(13) Place the piston-shoe assemblies into the shoe holder.



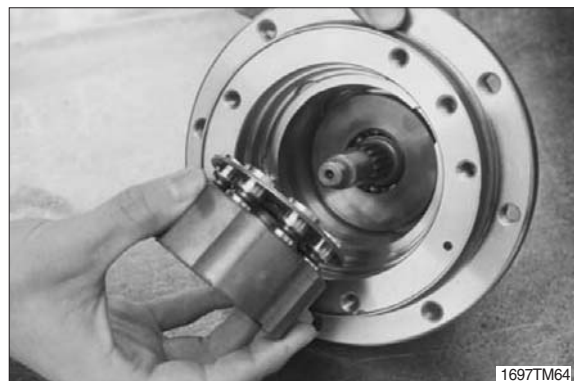
(14) Place the three pins, barrel holder and piston-shoe assemblies in that order into the cylinder barrel.

- ※ 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.

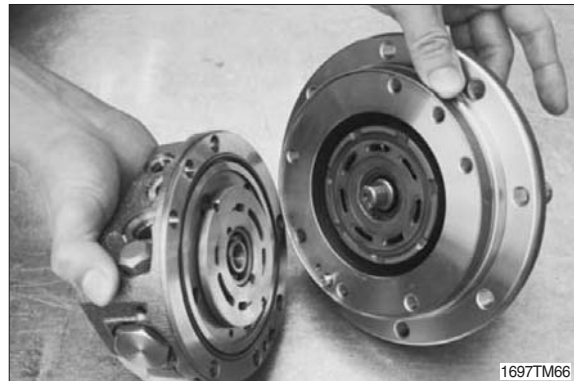
(17) Place the valve plate onto the body 1.

- ※ 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.



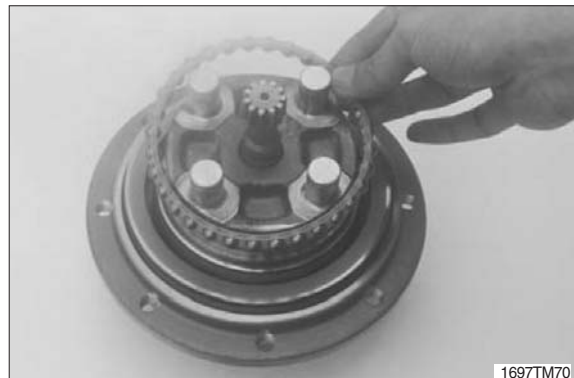
2) REDUCTION GEAR SECTION

- (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.



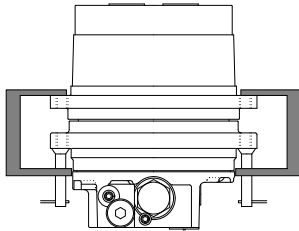
- (3) Put the seal ring with O-ring onto the body.

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

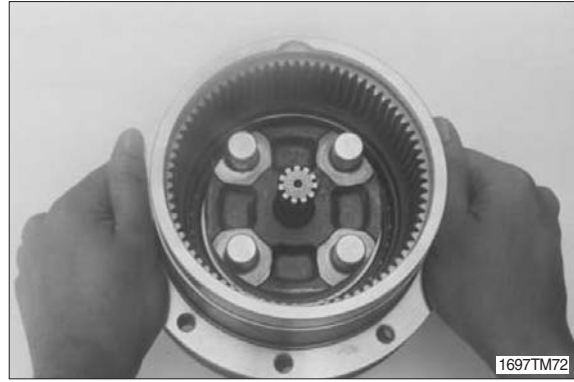


(4) Join the body to the motor.

- ※ 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.)



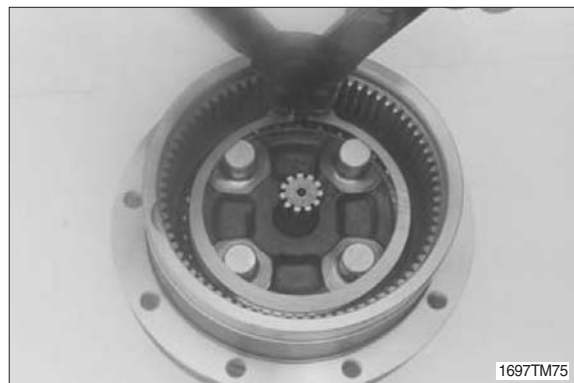
1697TM73



1697TM74

(6) Fix the bearing with the snap ring.

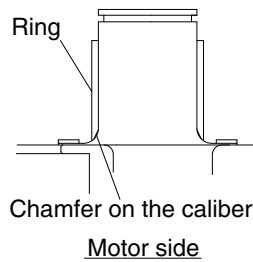
- ※ The pre-load for the bearings is adjusted by thickness of the snap ring.



1697TM75

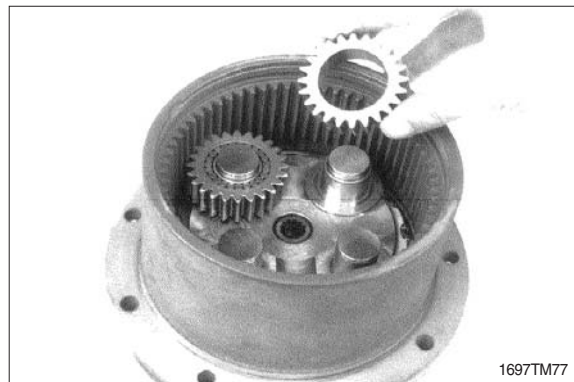
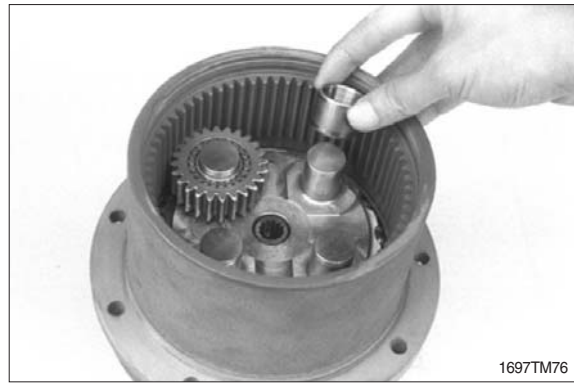
(7) Place the four rings (1pc/1pin), four thrust washers (1pc/1pin), four b1 gears (1pc/1pin) and ninety-six needles (24pcs/1pin) in that order onto the body 2.

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



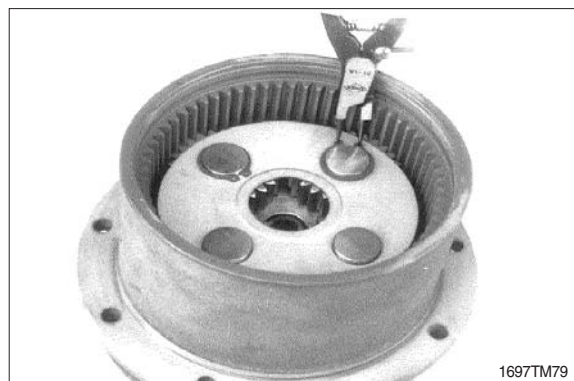
1697TM94

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

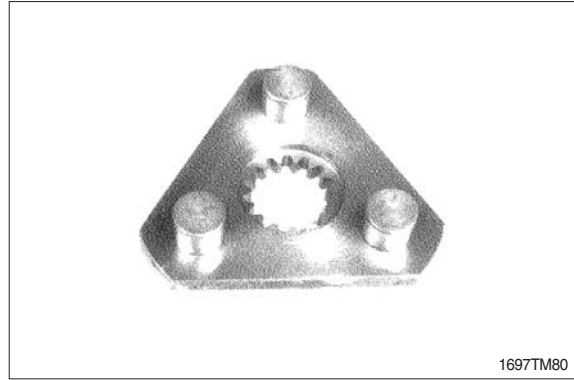


(8) Place thrust plate onto the gears and secure it with four snap rings.

- ※ 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.

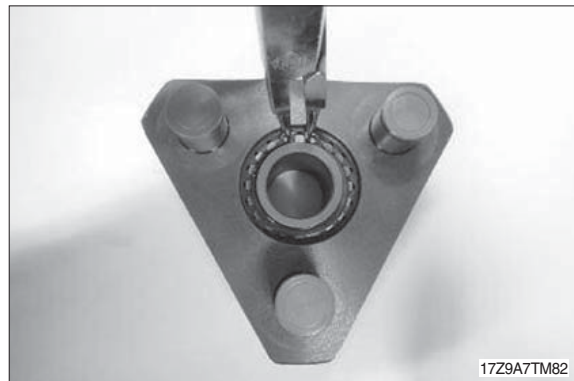
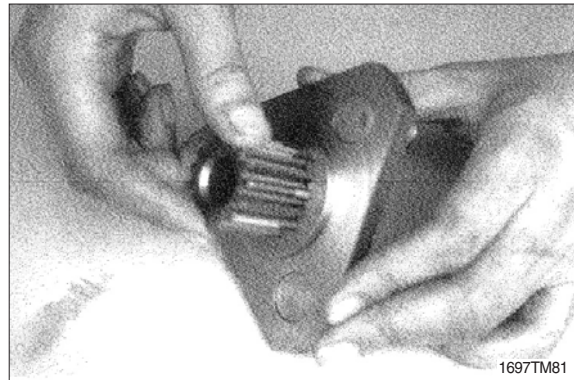


(9) Press-fit the three b2 pins and three spring pins (1pc/pin) into the carrier 2.



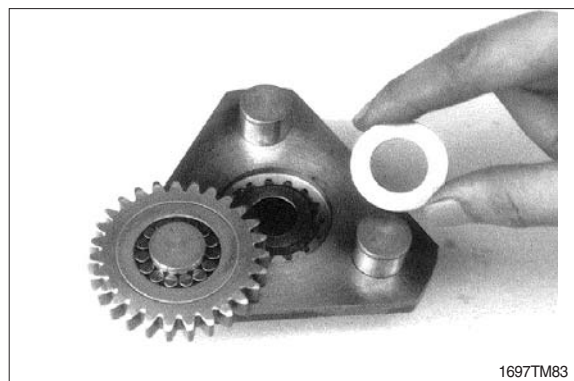
(10) Put the S1 gear to the carrier 2, and then secure them with the snap ring.

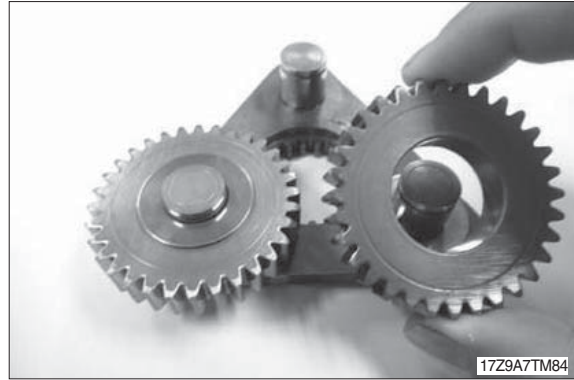
- ※ Pay attention to the direction of the snap ring. The edge side should be uppermost.
- ※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.



(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.



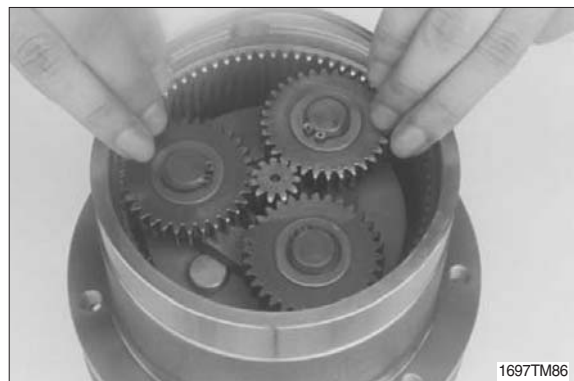


(12) Place the carrier 2 assembly into the body.



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

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



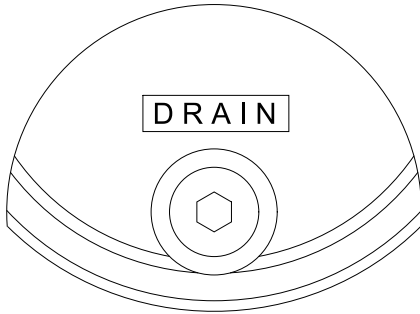
(14) Place the slide ring onto the cover.

- ※ 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

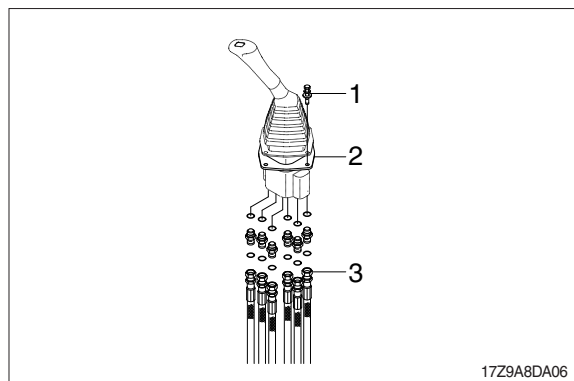
1. REMOVAL AND INSTALL

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.

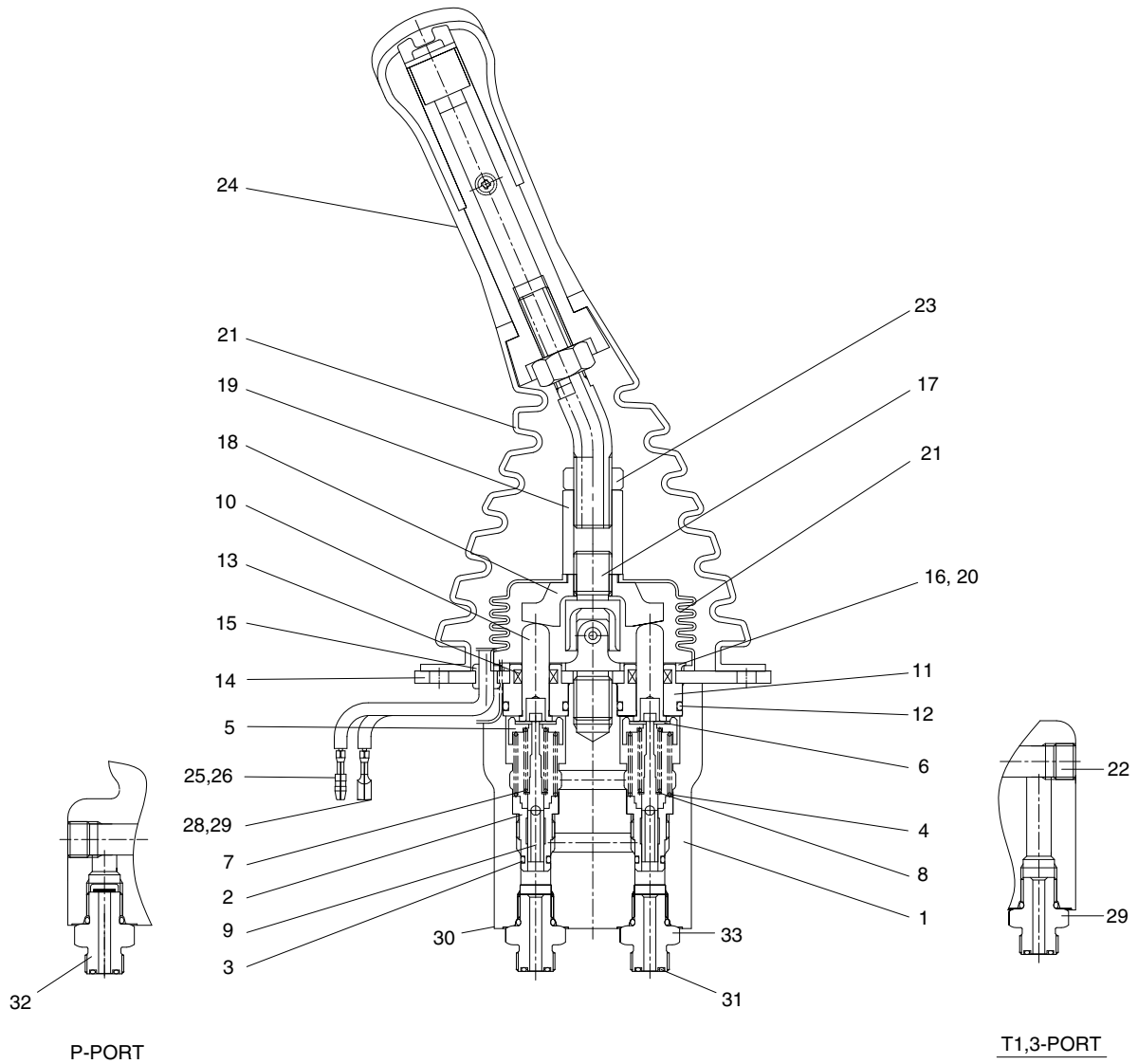


2) INSTALL

- (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. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE (STD)



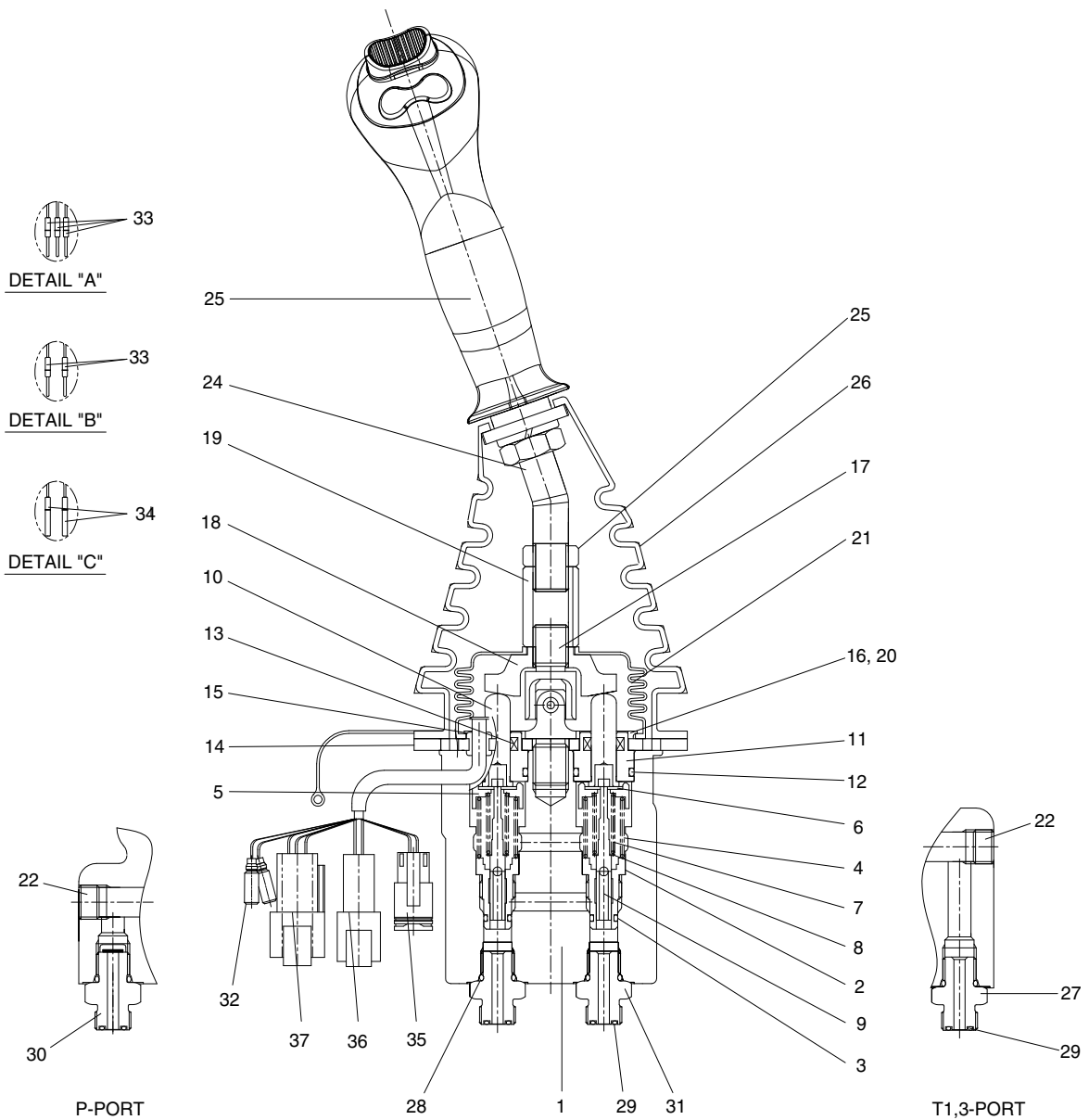
- 1 Body
- 2 Plug
- 3 O-ring
- 4 Spring
- 5 Spring seat
- 6 Stopper
- 7 Spring
- 8 Shim
- 9 Spool
- 10 Push rod
- 11 Plug

- 12 O-ring
- 13 Rod-seal
- 14 Plate (A)
- 15 Bushing
- 16 Machine screw
- 17 Joint ass'y
- 18 Swash plate
- 19 Hex nut
- 20 Plate (B)
- 21 Inner boots
- 22 Plug

- 23 Nut
- 24 Handle ass'y
- 25 Tube
- 26 Terminal
- 27 Tube
- 28 Terminal
- 29 Connector
- 30 O-ring
- 31 O-ring
- 32 Connector

18AK2RL02

STRUCTURE (PROPORTIONAL, OPT)



18AK2RL04

- | | | |
|---------------|------------------|----------------------|
| 1 Body | 12 O-ring | 23 Handle ass'y |
| 2 Plug | 13 Rod-seal | 24 Handle bar |
| 3 O-ring | 14 Plate (A) | 25 Nut |
| 4 Spring | 15 Bushing | 26 Boots |
| 5 Spring seat | 16 Machine screw | 27 Connector |
| 6 Stopper | 17 Joint ass'y | 28 O-ring |
| 7 Spring | 18 Swash plate | 29 O-ring |
| 8 Shim | 19 Hex nut | 30 Last guard filter |
| 9 Spool | 20 Plate (B) | 31 O-ring |
| 10 Push rod | 21 Inner boots | 32 Connector |
| 11 Plug | 22 Plug | |

2) TOOLS

Tool name	Information
Torque wrench	22 mm
Spanner	22 & 27 mm
Long nose plier	-
Screwdriver	-
Plastic hammer	-
L-wrench	M10

3) ASSEMBLY

- (1) Prepare the body.
Secure the product on a flat table.



- (2) Insert greased plugs into the respective ports.
Insert the spring while making sure that it is as close to the center as possible.



- (3) Assemble plug.
10mm torque wrench, direction of assembly: clockwise
- Tightening torque : 3kgf·m (21.7 lbf·ft)



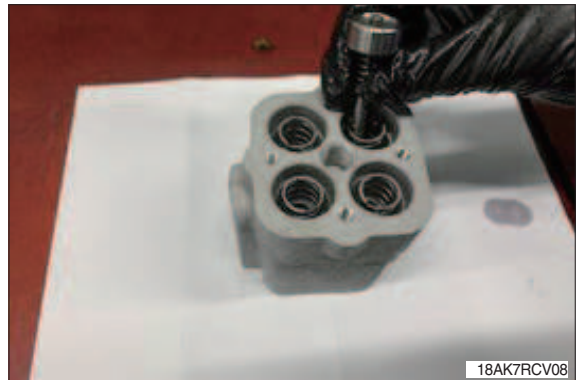
- (4) Insert the op spring into the respective ports.



- (5) Assemble the spool kit.
Assemble the spool, spring, spring seat, shim and stopper as shown in the photo.



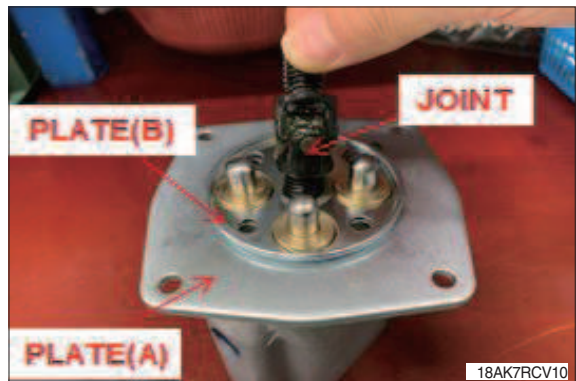
- (6) Assemble the spool kit to the respective ports.



- (7) Place the plug kit over the spool kit.
Align the spool head part with the push rod hole.



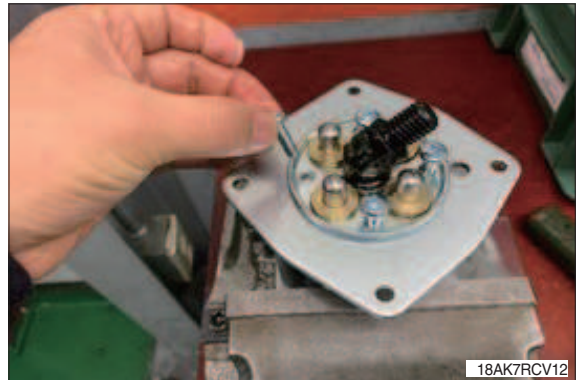
- (8) Place plate(B) over plate(A) and assemble the joint with the wire hole facing toward port P.
Assemble the joint clockwise while pressing the plate.



- (9) Assemble the joint assy.
-Tightening torque : 3kgf·m (21.7 lbf·ft)
Direction of assembly: clockwise
Lightly tap with a hammer in all four compass directions while making sure not to scratch the product, so that the plug can be inserted at the same time.



- (10) Insert screws into the four holes.



- (11) Fasten the screws with an electric driver.
(Direction of assembly): clockwise



- (12) Apply grease to the joint assy and push rod.
Grease spec: combi ep no.1 or equivalent

Apply grease to the rotating part of the joint and the upper surface of push rod.



- (13) Assemble the swash plate.
Assemble the swash plate and push rod along the contact surface, and make sure that the push rod is not pressed.
Direction of assembly: clockwise.



- (14) Assemble the hex nut.
Direction of assembly: clockwise.



- (15) Assemble the hex nut with the torque wrench.
- Tightening torque : 8kgf-m (57.9 lbf-ft)
Direction of assembly of upper torque wrench: clockwise.



- (16) Assemble the inner boots.
Insert the boots between the plate and body.



(17) Assemble the handle kit and fasten with a torque wrench.

-Tightening torque : 6kgf·m (43.4 lbf·ft)

When assembling, fasten according to the direction of the handle.

Assembly direction of the upper torque wrench: clockwise.



STD



PROPORTIONAL, OPT

(18) Insert wire into the bushing hole.

After inserting the wire, secure it with a cable tie.



(19) Insert the terminal into the respective wire.



18AK7RCV21

STD

Insert the terminal into the respective wire.

SWITCH NUMBER	CONNECTOR SPECIFICATION	WIRE COLOR
1	DT06-2S-EP05	GRAY
2	DT04-2P-E005	BLACK
3	JIS D 5403 CB104	BLUE
(PUSH BUTTON SWITCH)		
SWITCH NUMBER	CONNECTOR SPECIFICATION	WIRE COLOR
4	DT04-3P-E004-1	RED
4	DT04-3P-E004-2	PURPLE
4	DT04-3P-E004-3	WHITE
(PROPORTIONAL SWITCH)		



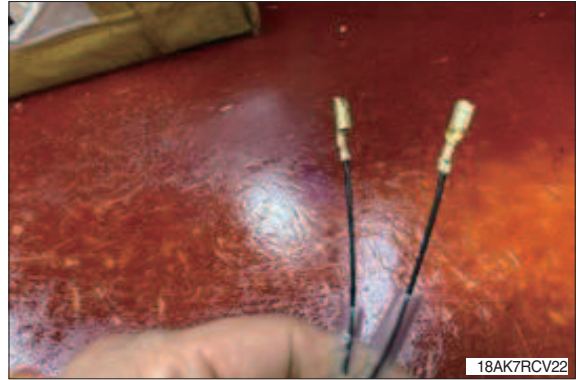
18AK7RCV26



18AK7RCV27

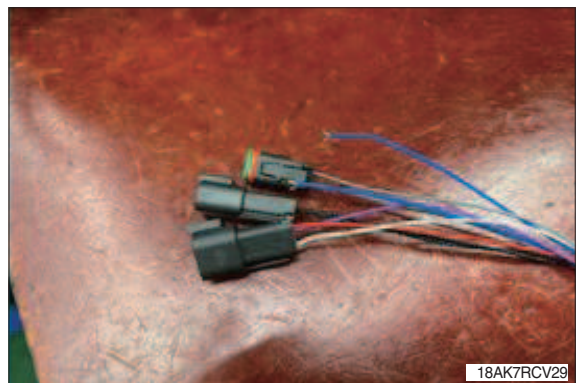
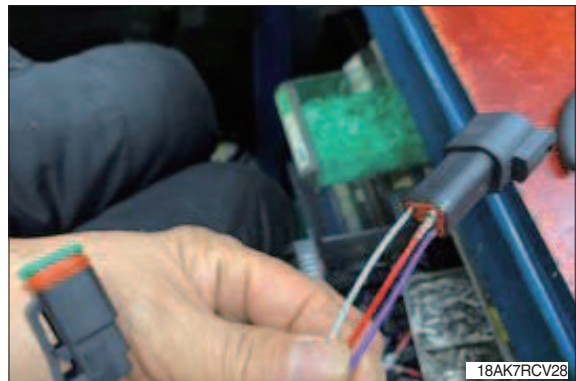
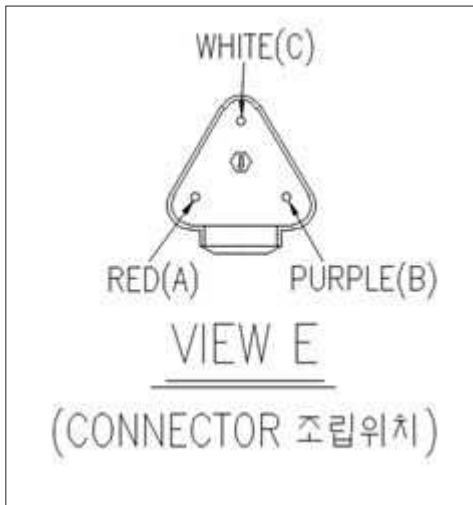
PROPORTIONAL, OPT

(20) Insert the female and male terminals.



STD

Insert the wire into the connector.



PROPORTIONAL, OPT

- (21) Check the final status.
Check the exterior parts for irregularities
as well as the connector specifications.



STD



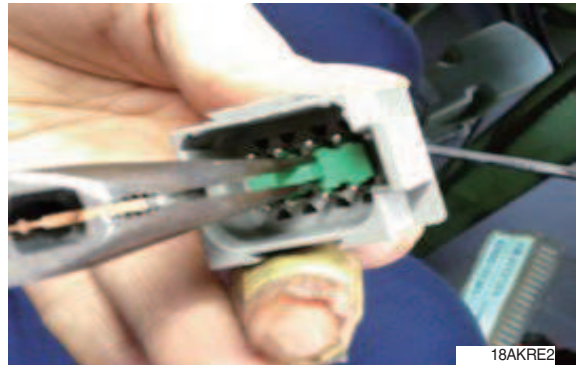
PROPORTIONAL, OPT

4) DISASSEMBLY

- (1) 1. Prepare the joystick product.
Fix the product on a flat table.



- (2) Disassemble the guide from the connector.



- (3) Disassemble the wire from the connector.

Force the terminal holder to the opposite side and fix it.



- (4) Pull out the terminal wire by moving the holder to the opposite side.



(5) Pull out the wire from the bushing hole.



(6) Disassemble the handle kit from the hex nut.
Disassembly direction: counterclockwise.



(7) Disassemble the inner boots.



(8) Disassemble the hex nut.
Disassembly direction: counterclockwise



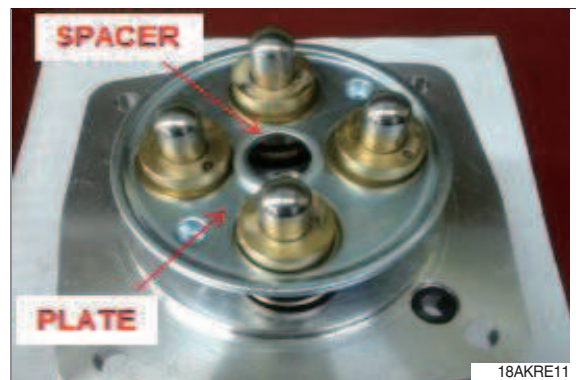
- (9) Disassemble the swash plate.
Disassembly direction: counterclockwise.



- (10) Disassemble the joint assy.
Disassembly direction: counterclockwise.



- (11) Disassemble the plate and spacer.



- (12) Disassemble the plug kit from each port.

Fix the plug side using pliers and then force in the upper direction. take care not to damage the plug side.



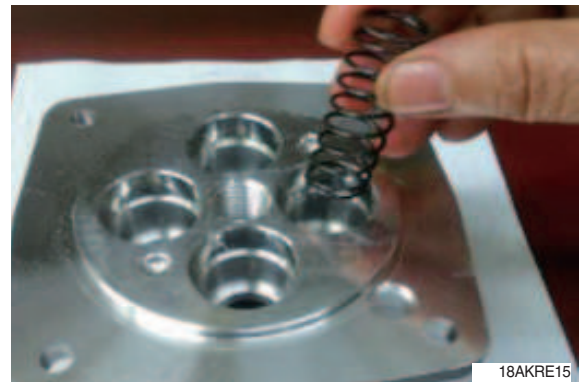
- (13) Disassemble the bushing.
Extract the bushing using a screwdriver.



- (14) Extract the spool kit from the body.



- (15) Extract the op spring from the body.



- (16) Check the final parts.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

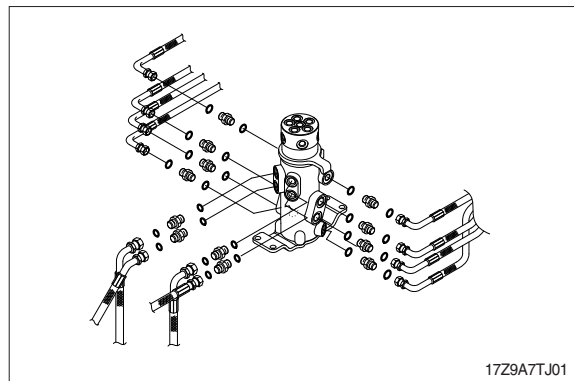
1) REMOVAL

- (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.

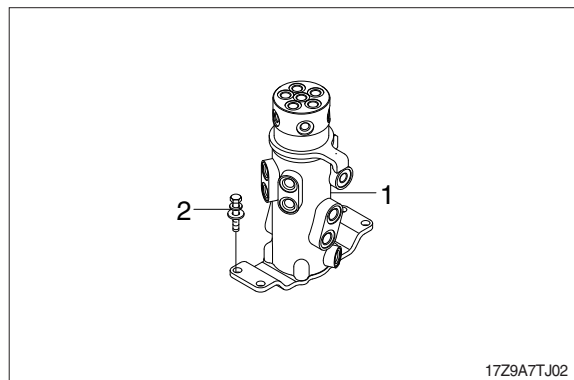
When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (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



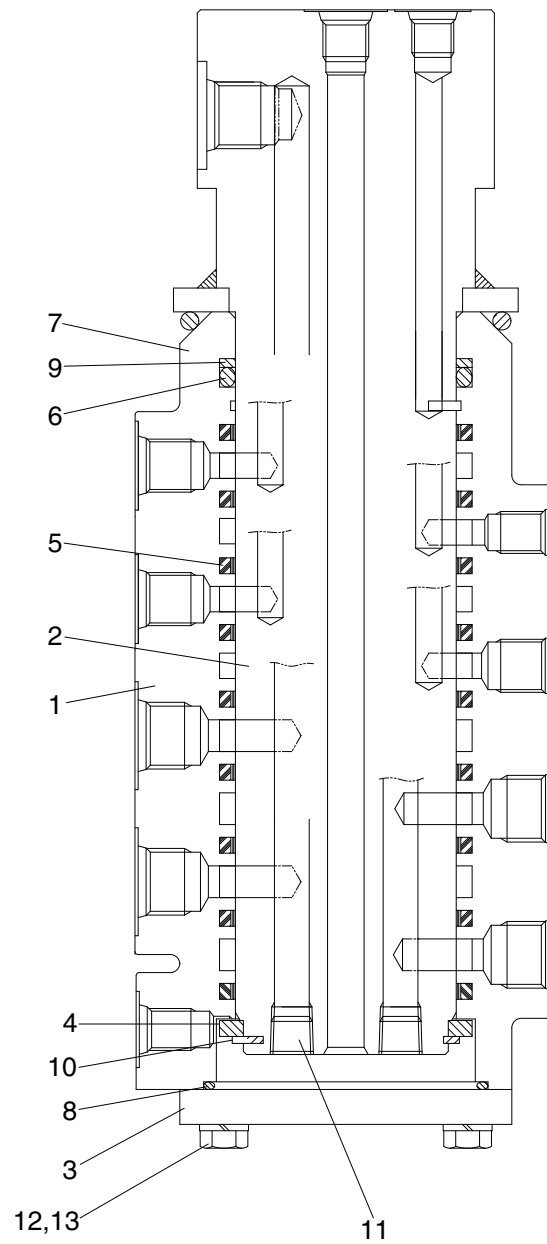
2) INSTALL

- (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

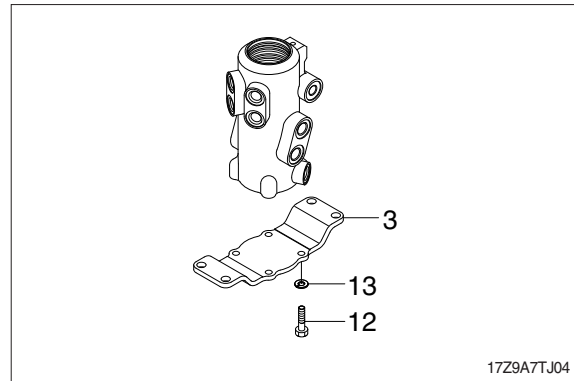
- 11 Plug
- 12 Hexagon bolt
- 13 Spring washer

1697TJ02

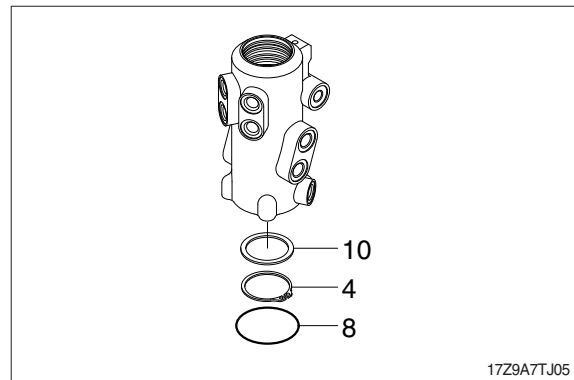
2) DISASSEMBLY

Before the disassembly, clean the turning joint.

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

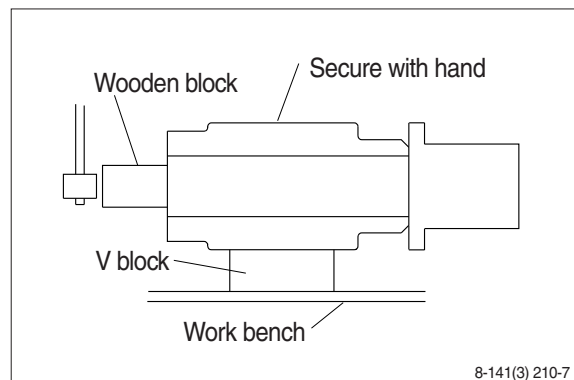


- (2) Remove O-ring (8).
- (3) Remove retainer ring (10) and spacer (4).

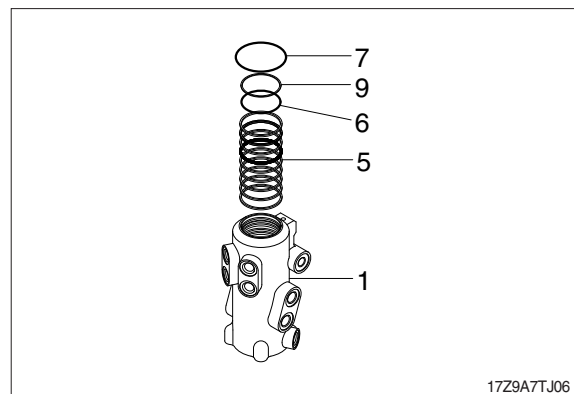


- (4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

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).



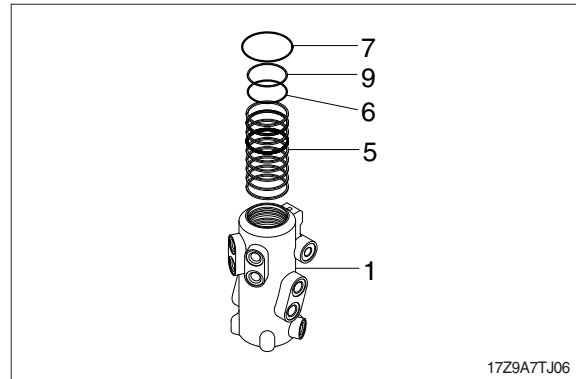
3) ASSEMBLY

Clean all parts.

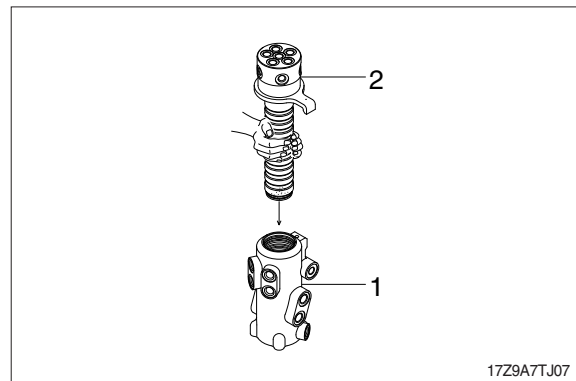
As a general rule, replace oil seals and O-ring.

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).

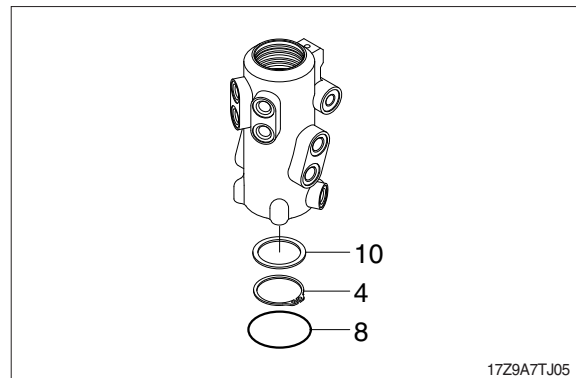


- (2) Set hub (1) on block, install shaft (2) into hub (1) by hand.

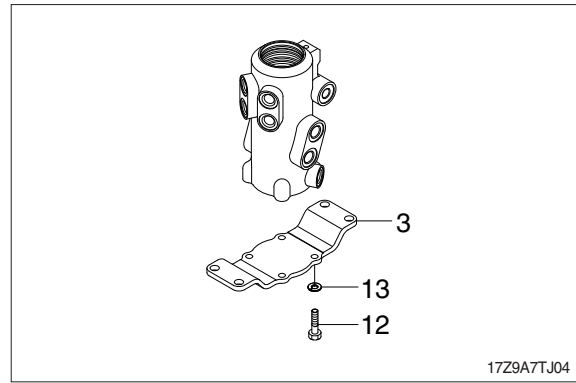


- (3) Fit spacer (4) and retainer ring (10) to shaft (2).

- (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.

Set block between bucket cylinder and arm.

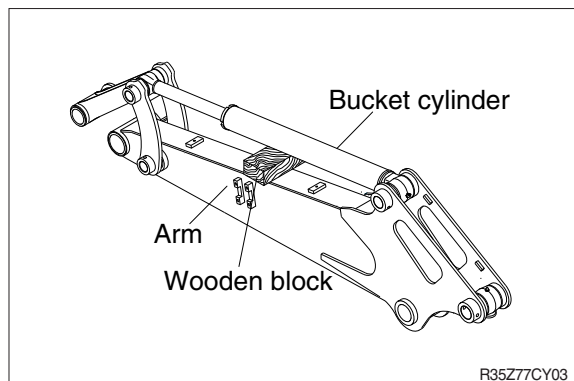
Remove bolt (2), nut (3) and pull out pin (1).

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

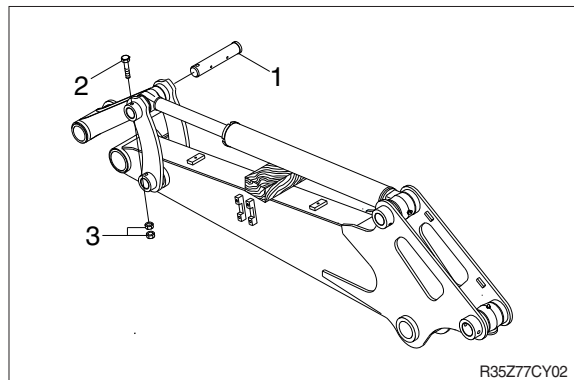
Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



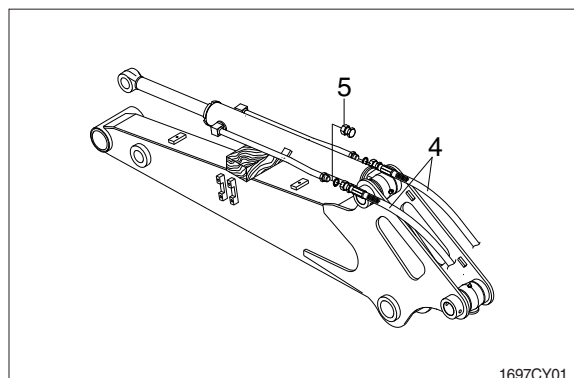
13031GE18



R35Z77CY03



R35Z77CY02

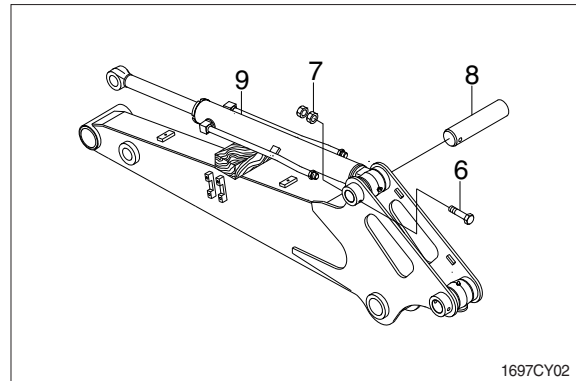


1697CY01

Sling bucket cylinder assembly (9) and remove bolt (6) and nut (7) then pull out pin (8).

Remove bucket cylinder assembly (9).

·Weight : 11 kg (24 lb)



(2) Install

Carry out installation in the reverse order to removal.

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

Bleed the air from the bucket cylinder.

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

2) ARM CYLINDER

(1) Removal

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

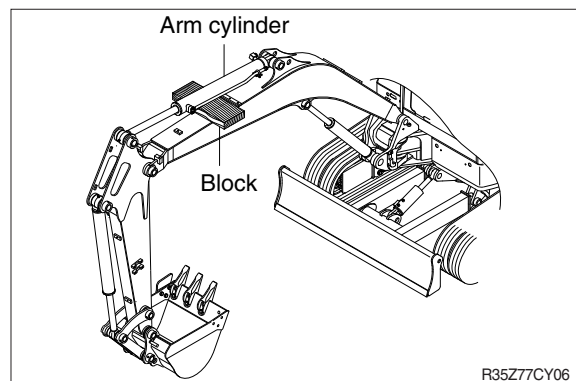
Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

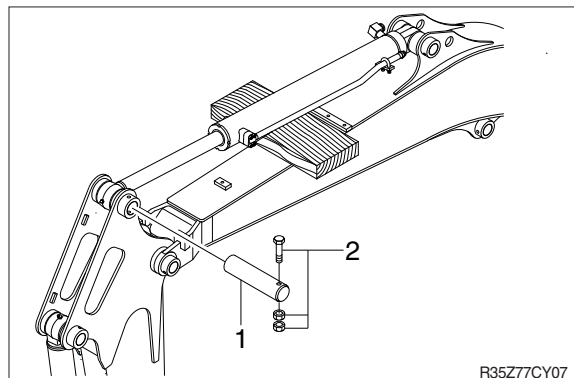
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

Set block between arm cylinder and boom.

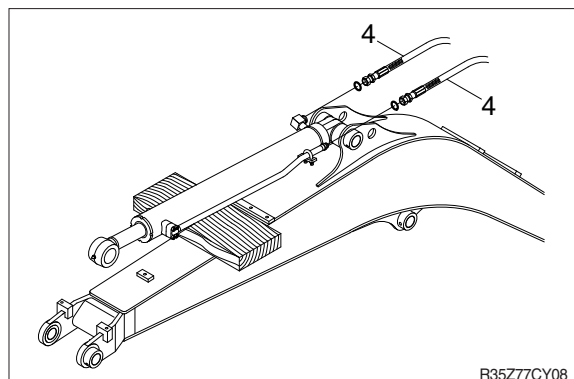


Remove bolt and nut (2) and pull out pin (1).

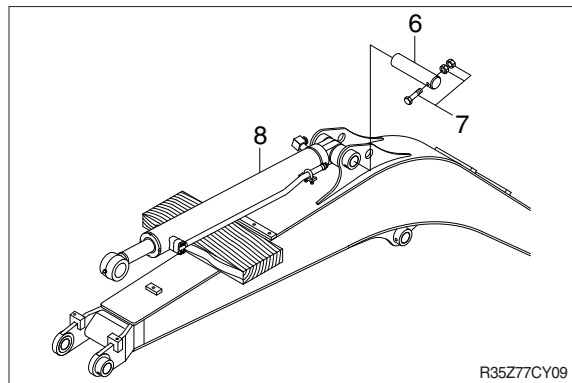
Tie the rod with wire to prevent it from coming out.



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



Sling arm assembly (8) and remove bolt and nut (7) then pull out pin (6).
Remove arm cylinder assembly (8).
·Weight : 15 kg (33 lb)



(2) Install

Carry out installation in the reverse order to removal.

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

Bleed the air from the arm cylinder.

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

3) BOOM CYLINDER

(1) Removal

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

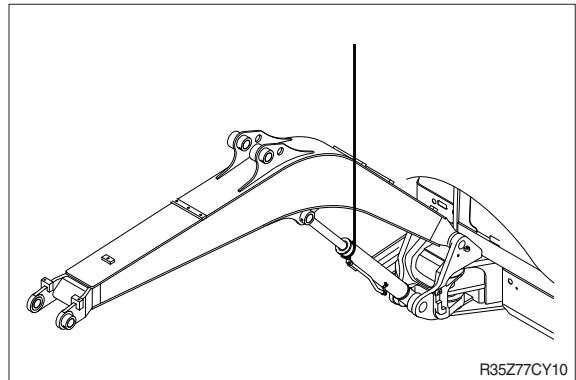
Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

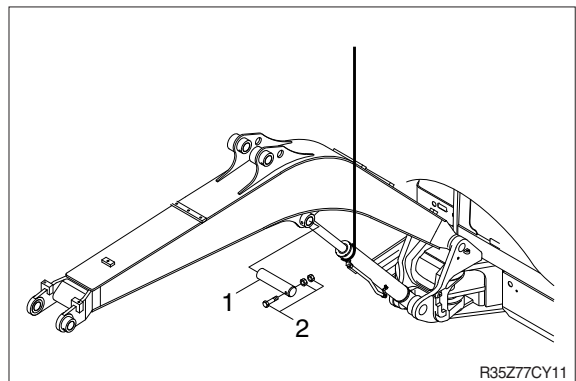
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

Sling boom cylinder assembly.

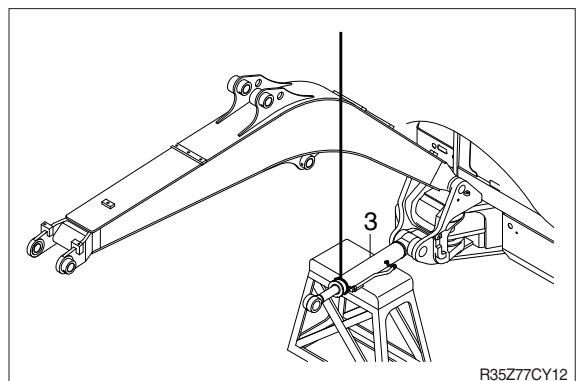


Remove bolt and nut (2) and pull out pin (1).

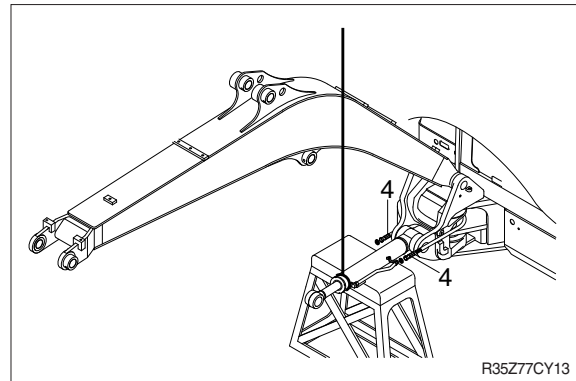
Tie the rod with wire to prevent it from coming out.



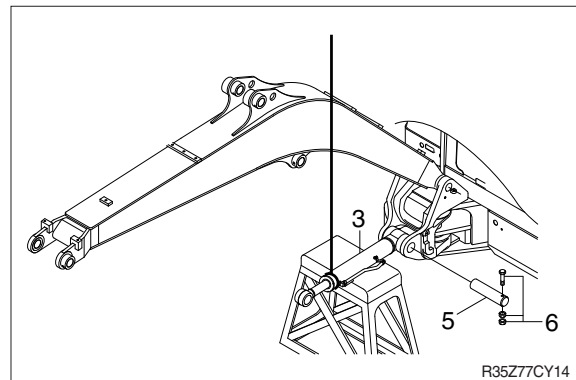
Lower the boom cylinder assembly (3) on a stand.



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



Remove bolt (6) and pull out pin (5).
Remove boom cylinder assembly (3).
·Weight : 17 kg (37 lb)



(2) Install

Carry out installation in the reverse order to removal.

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

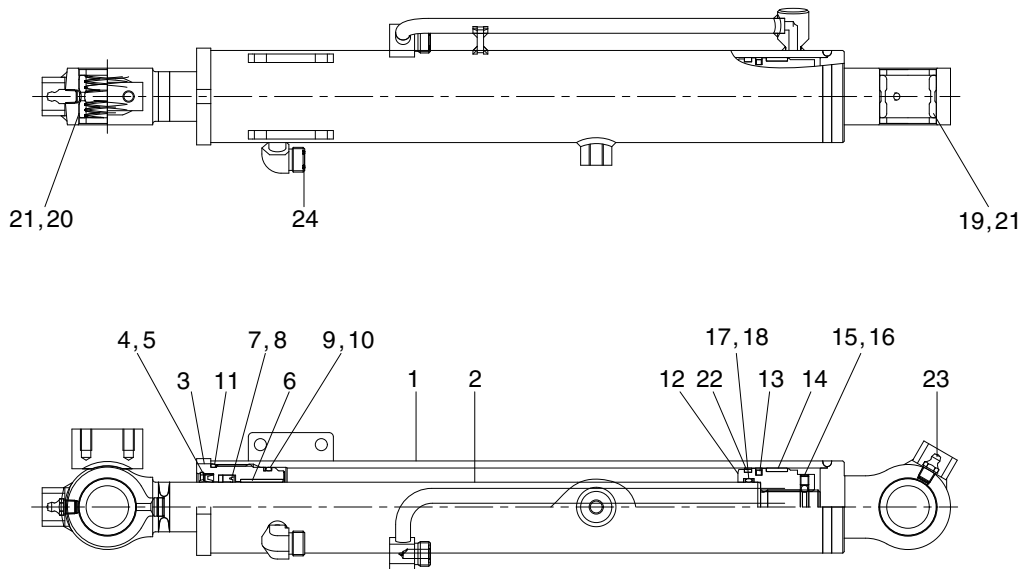
Bleed the air from the boom cylinder.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

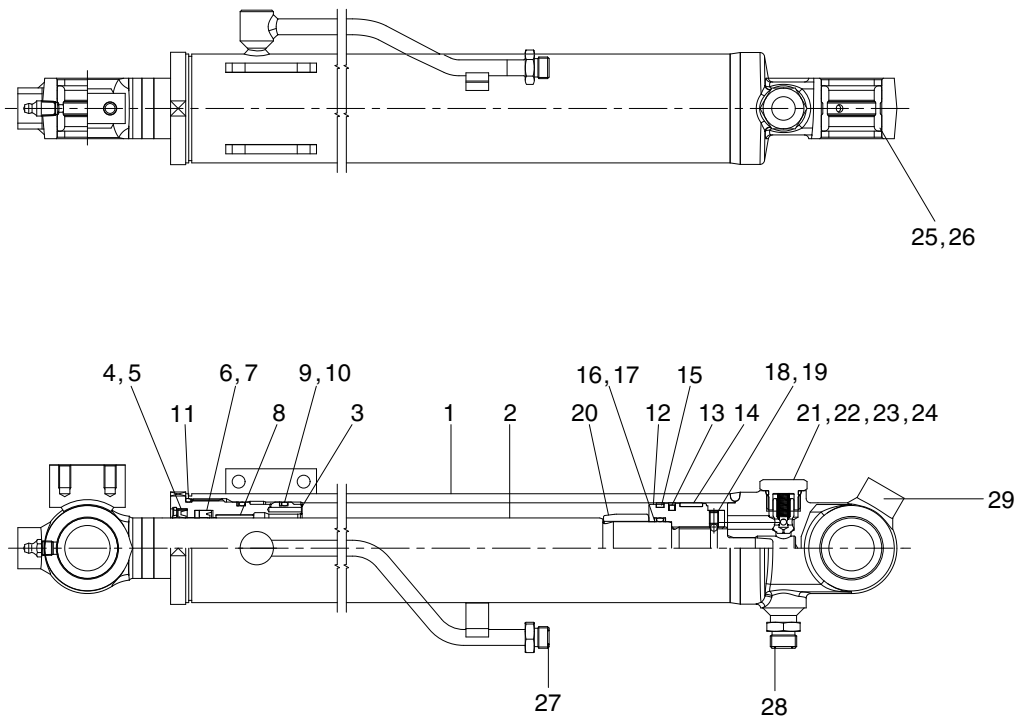
(1) Bucket cylinder



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

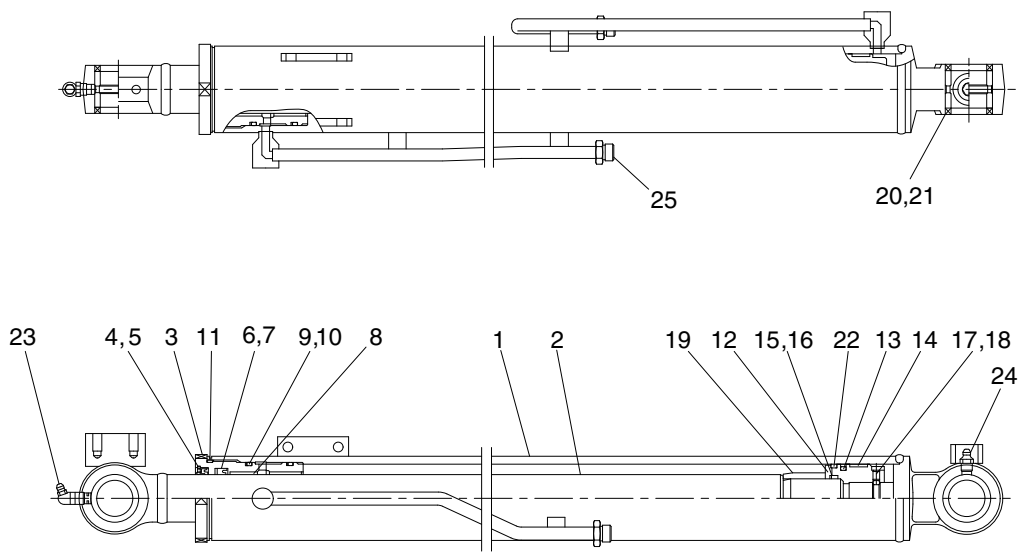
(2) Arm cylinder



17Z9A7CY04

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		

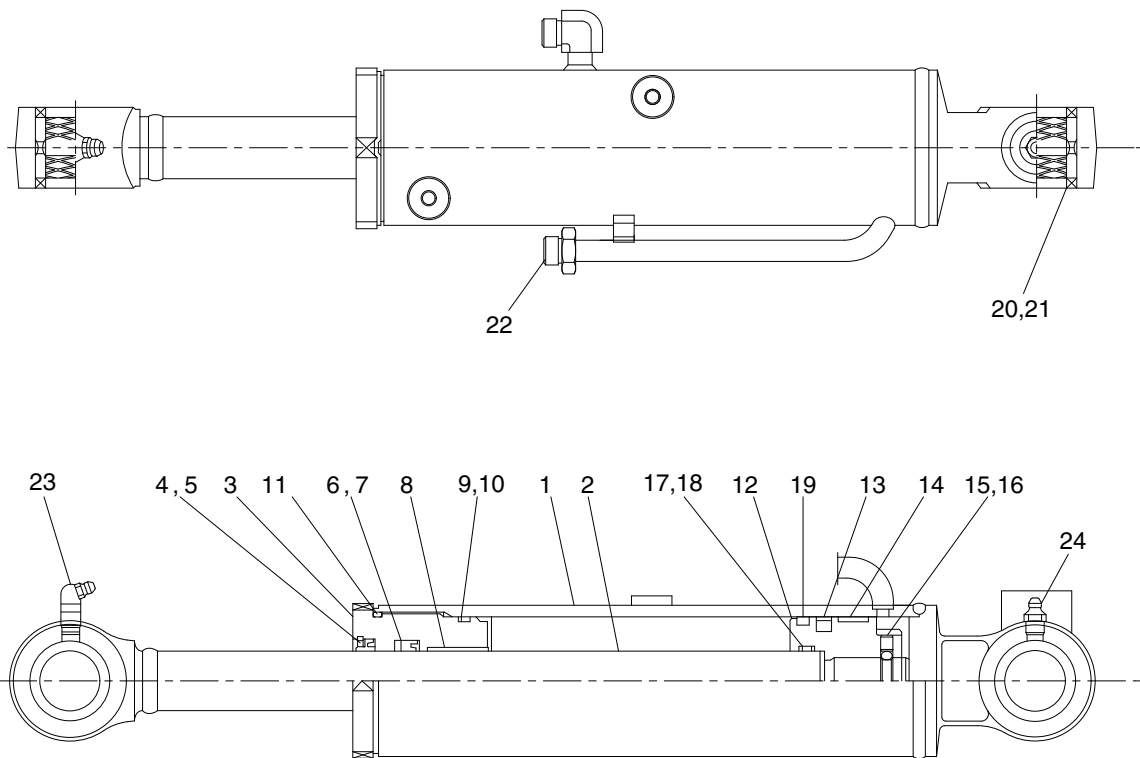
(3) Boom cylinder



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 | | |

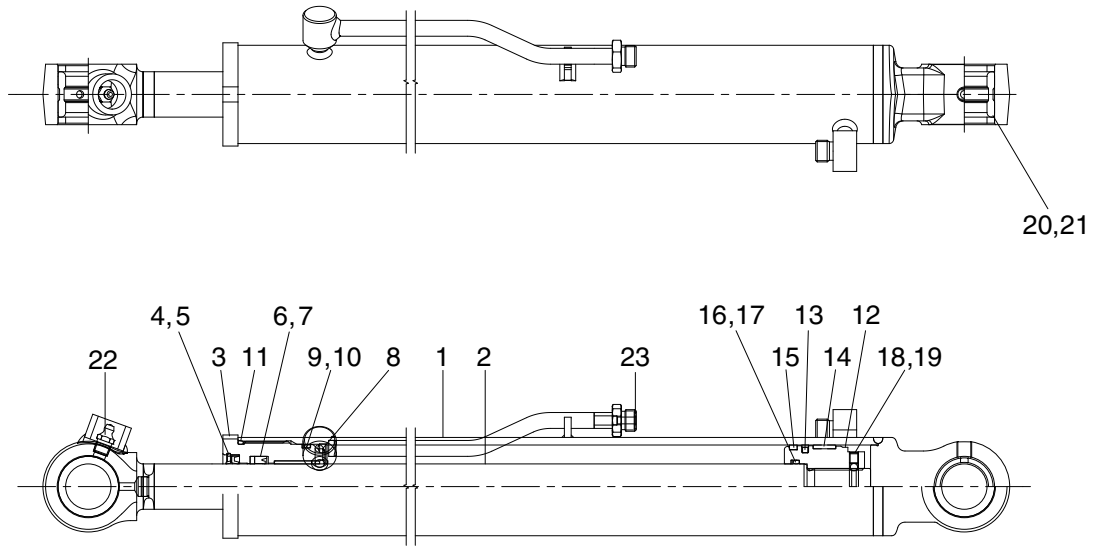
(4) Dozer cylinder



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 |

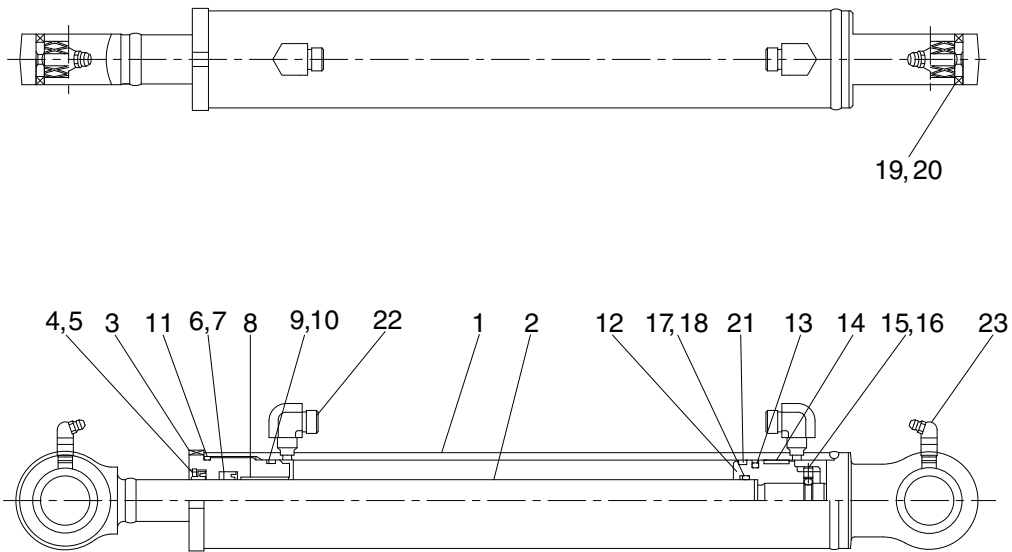
(5) Boom swing cylinder



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

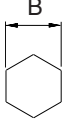


1697CY21

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

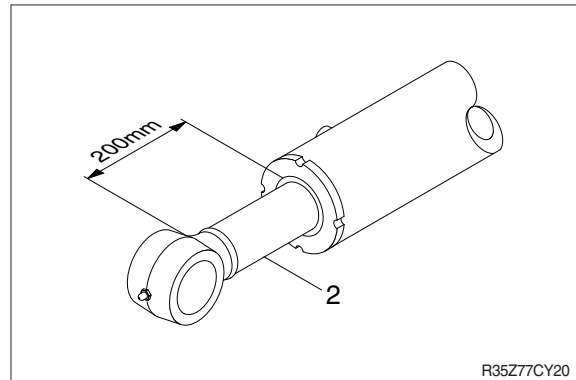
Part name	Item	Size	Torque		
			kgf·m	lbf·ft	
Gland	Boom cylinder	3	M65	52±5.0	376±36.2
	Arm cylinder	3	M65	52±5.0	376±36.2
	Bucket cylinder	3	M60	48±5.0	347±36.2
	Dozer cylinder	3	M70	56±5.0	405±36.2
	Boom swing cylinder	3	M60	48±4.8	347±34.7
	Extension cylinder	3	M60	48±4.8	347±34.7
Piston	Boom cylinder	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

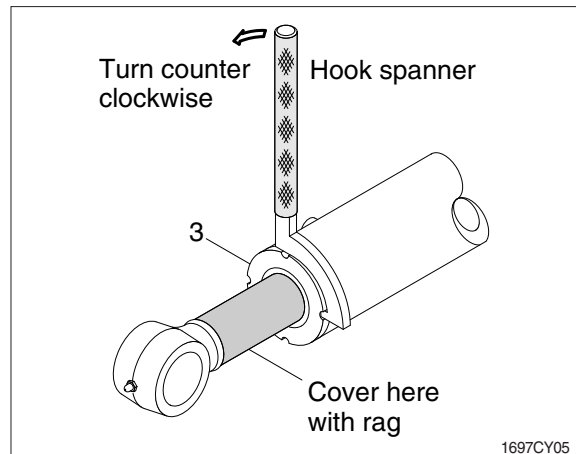
Procedures are based on the boom cylinder.

- (1) Remove cylinder head and piston rod
Hold the clevis section of the tube in a vise.
Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

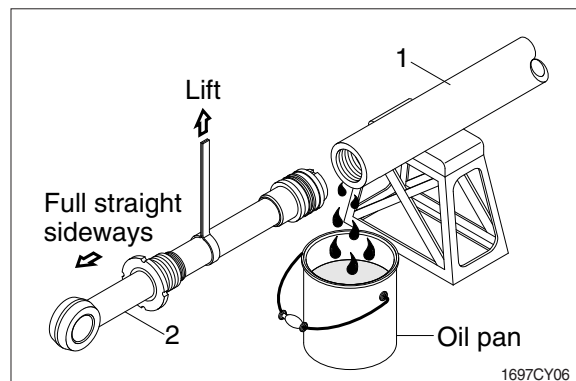
Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



- 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.

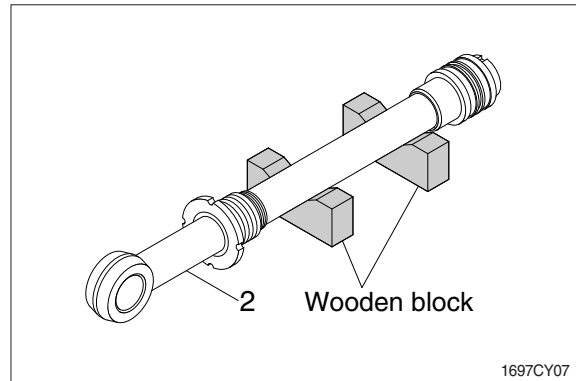


- Draw out cylinder head and rod assembly together from tube assembly (1).
Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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

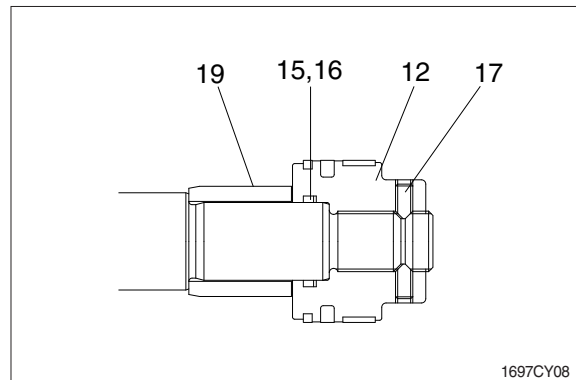
Place the removed rod assembly (2) on a wooden V-block that is set level.
Cover a V-block with soft rag.



(2) Remove piston and gland

Remove set screw (17).

Remove piston assembly (12), back up ring (16), O-ring (15) and cushion ring (19).

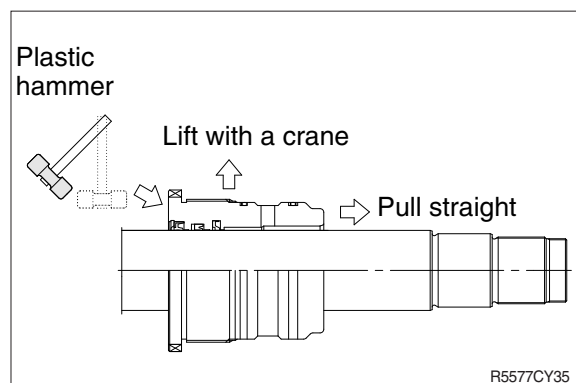


Remove the gland assembly from rod assembly (2).

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).

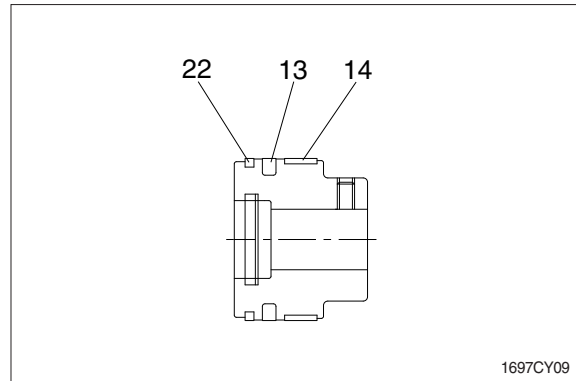


(3) Disassemble the piston assembly

Remove wear ring (14).

Remove dust ring (22) and piston seal (13).

Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

Remove back-up ring (10) and O-ring (9).

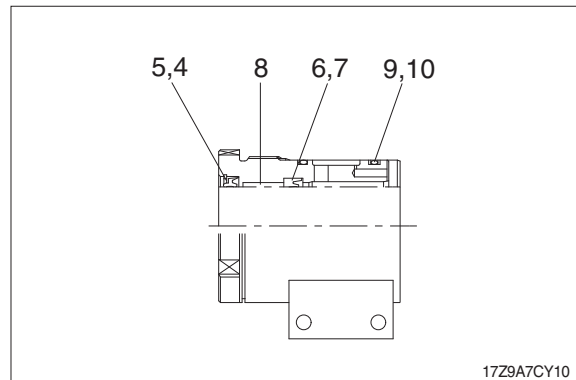
Remove retaining ring (5), dust wiper (4).

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

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.

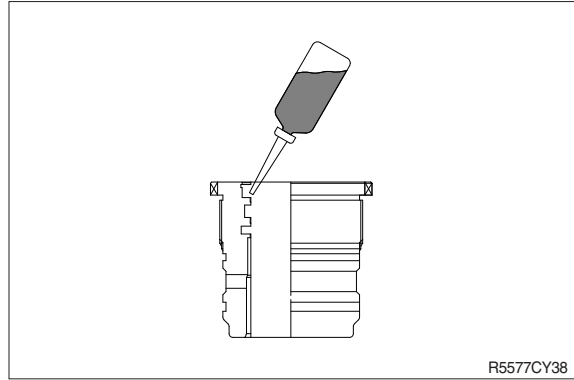


4) ASSEMBLY

(1) Assemble cylinder head assembly

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

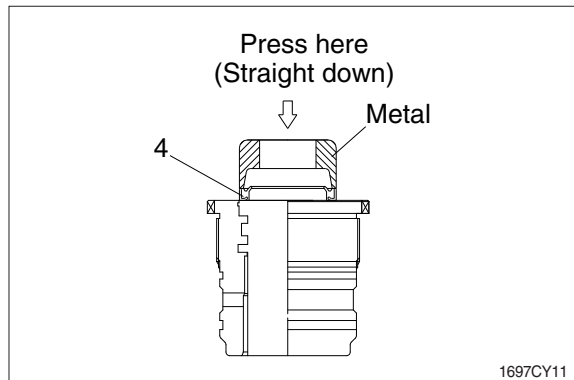
Coat the inner face of gland (3) with hydraulic oil.



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.

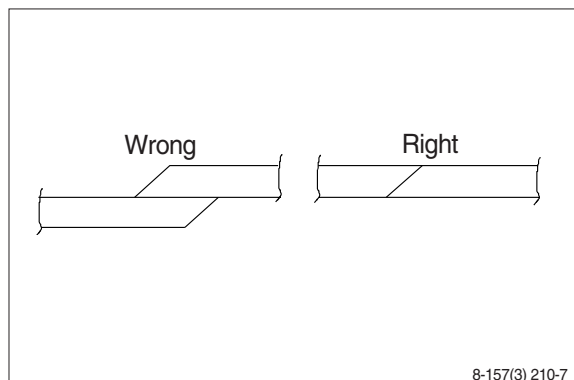
Fit retain ring (5) to the stop face.



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

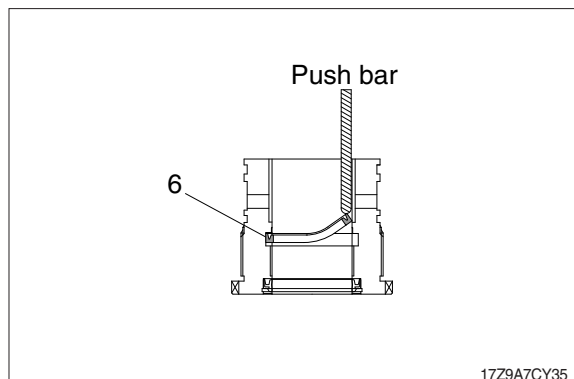
Coat each packing with hydraulic oil before fitting it.

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

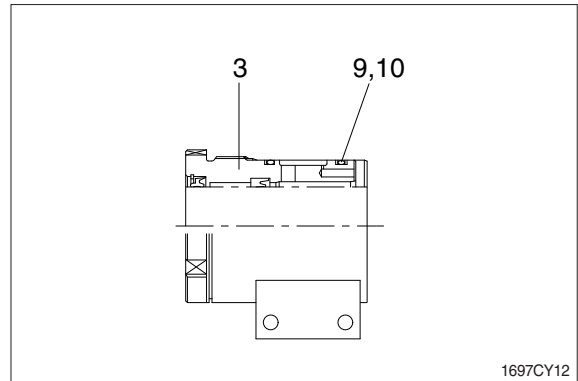


Rod seal (6) has its own fitting direction.

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.

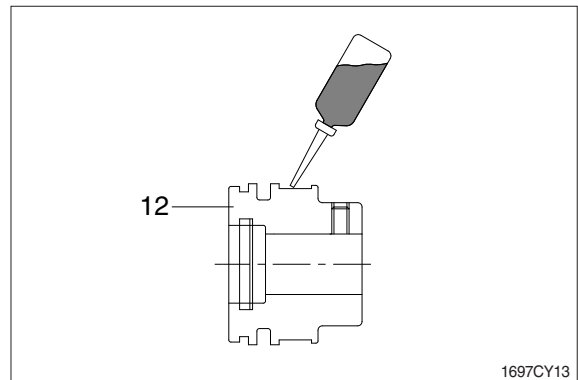


Fit back up ring (10) to gland (3).
Put the backup ring in the warm water of
30~50°C .
Fit O-ring (9) to gland (3).

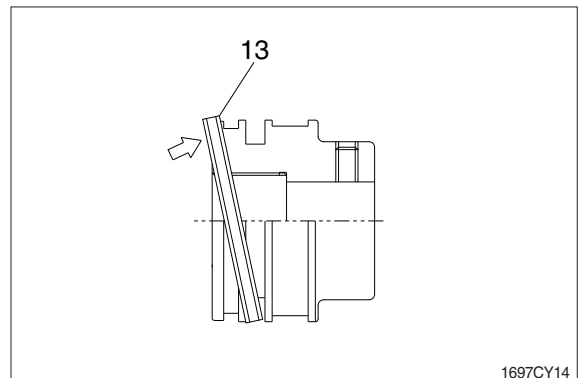


(2) Assemble piston assembly

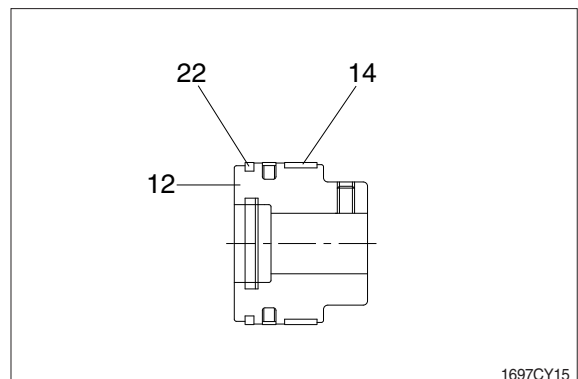
Check for scratches or rough surfaces.
If found smooth with an oil stone.
Coat the outer face of piston (12) with
hydraulic oil.



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.

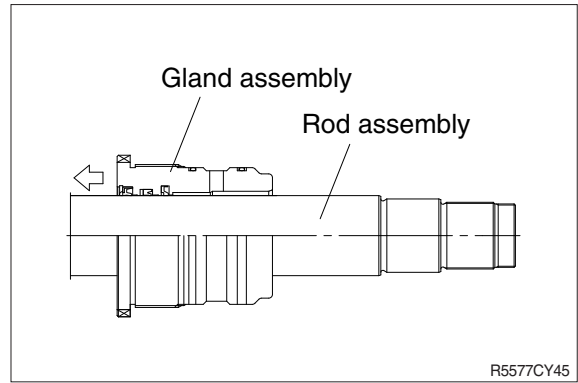


Fit wear ring (14) and dust ring (22) to
piston (12).

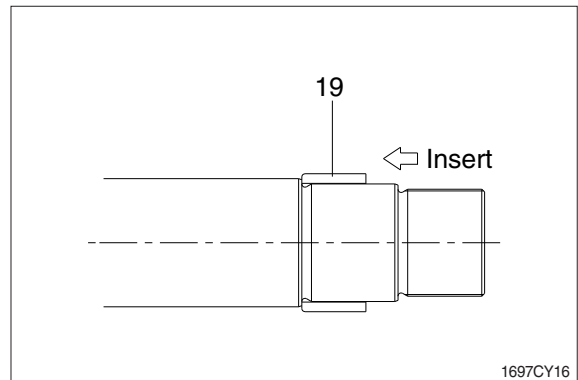


(3) Install piston and cylinder head

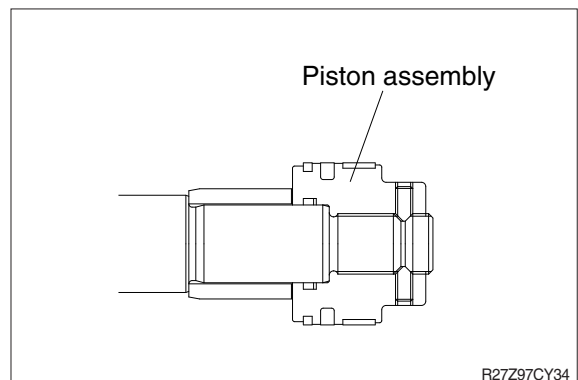
Fix the rod assembly to the work bench.
Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and gland.
Insert gland assembly to rod assembly.



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



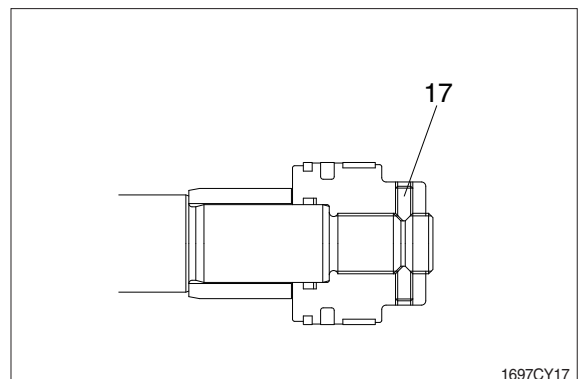
Fit piston assembly to rod assembly.



Fit set screw (17).

·Tightening torque :

2 ± 0.2 kgf·m (14.5 ± 1.45 lbf·ft)



(3) Overall assemble

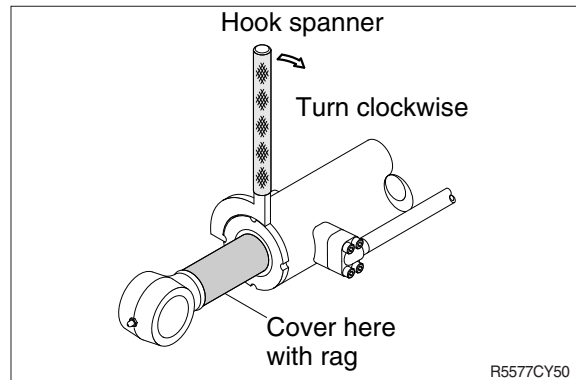
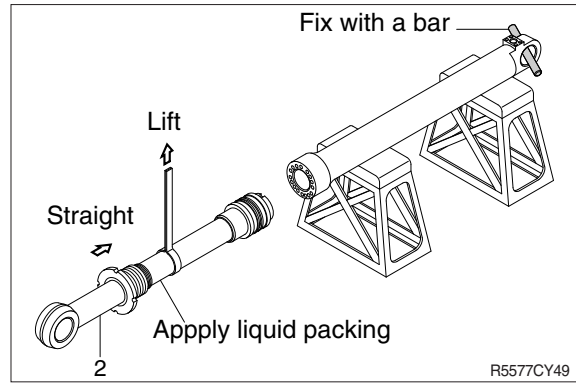
Place a V-block on a rigid work bench.
Mount the tube assembly (1) on it and
fix the assembly by passing a bar
through the clevis pin hole to lock the
assembly.

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

Be careful not to damage piston seal
(13) by thread of tube assembly (1).

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.

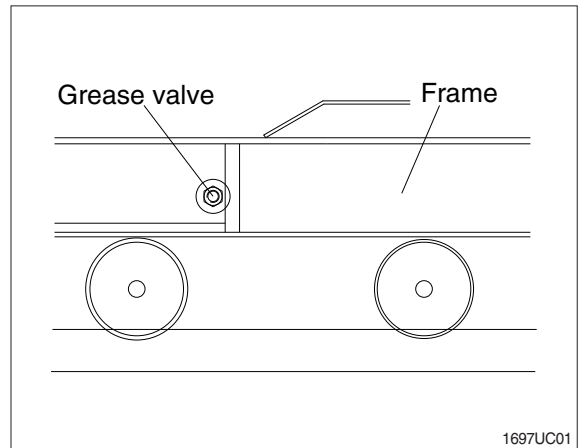


GROUP 10 UNDERCARRIAGE

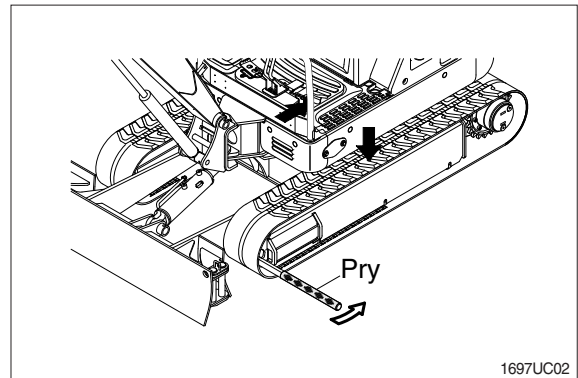
1. RUBBER TRACK

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.

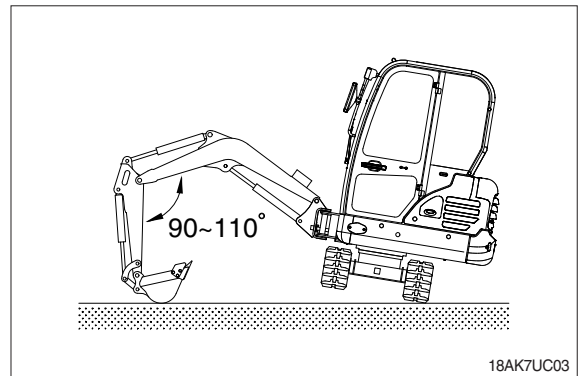


- (2) Remove the rubber track from lower frame using pry.



2) INSTALL

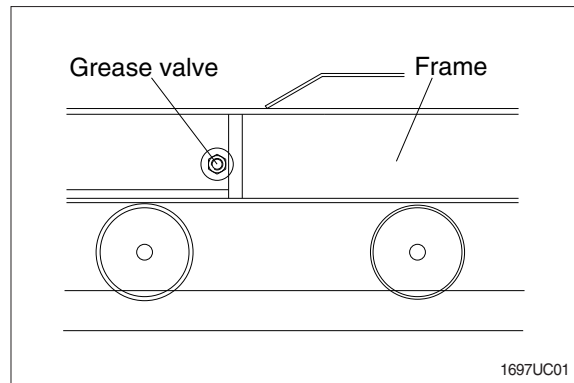
- (1) Carry out installation in the reverse order to removal.
Adjust the tension of the rubber track.



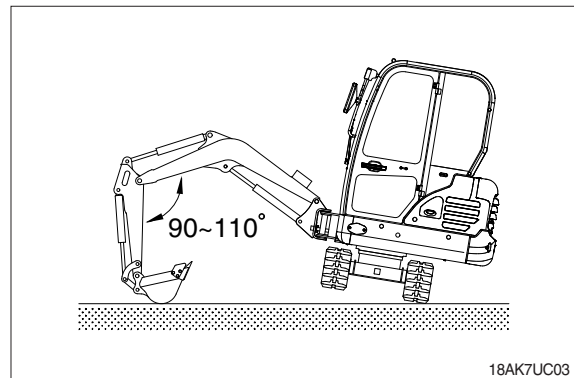
2. TRACK ROLLER

1) REMOVAL

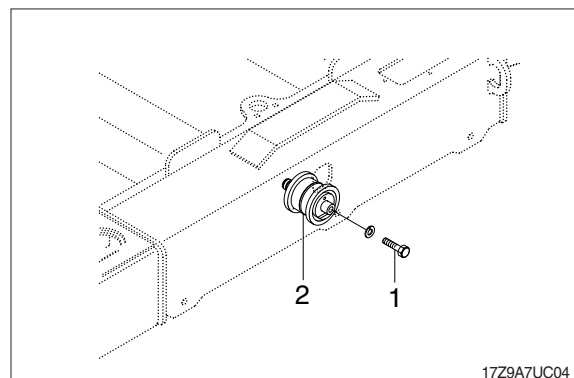
- (1) Loosen tension of the rubber track.



- (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)



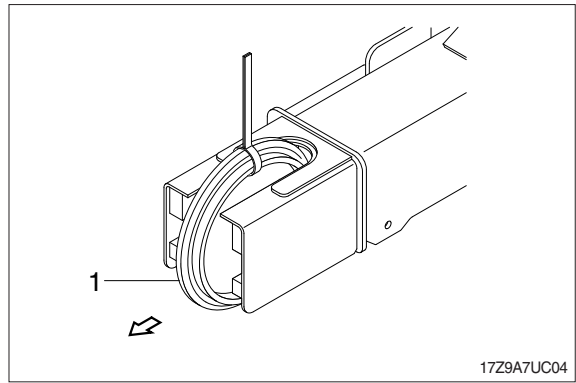
2) INSTALL

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

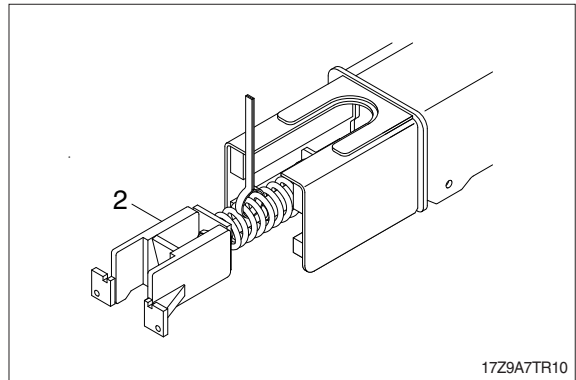
3. IDLER AND RECOIL SPRING

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)

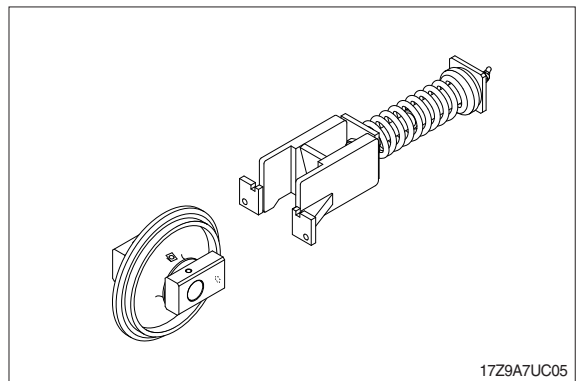


- (3) Pull out yoke and spring weld assembly from track frame, using a pry.
·Weight : 11 kg (24 lb)



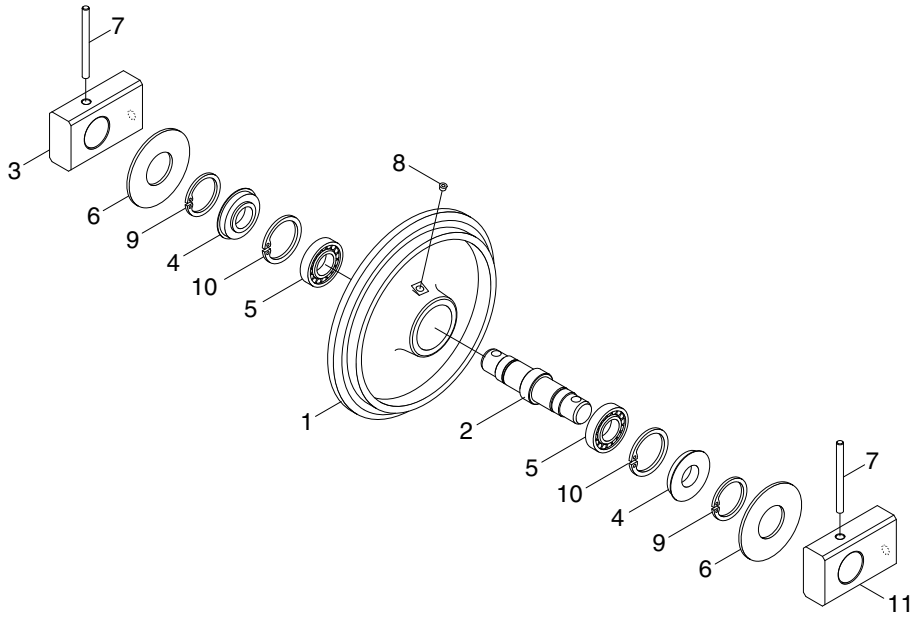
2) INSTALL

- (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



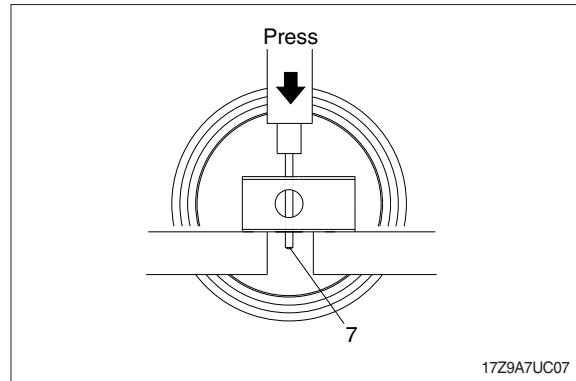
17Z9A7UC06

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

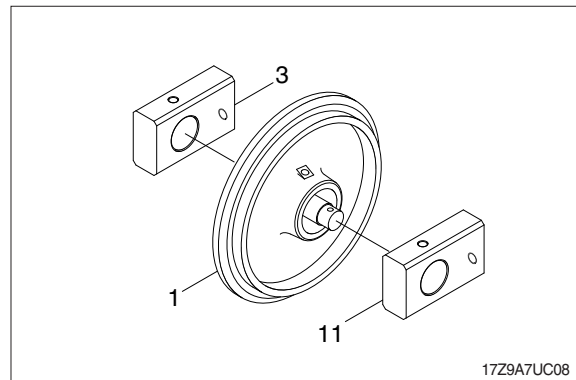
(2) Disassembly

Remove plug and drain oil.

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



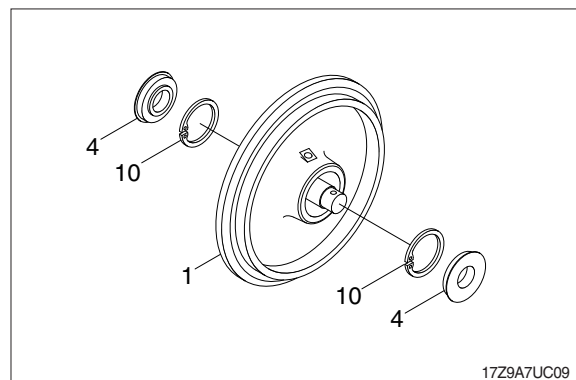
Remove collar (3, 11) from shaft.



Remove seal assembly (4) from shell (1) by pry.

Do not reuse seal assembly after removal.

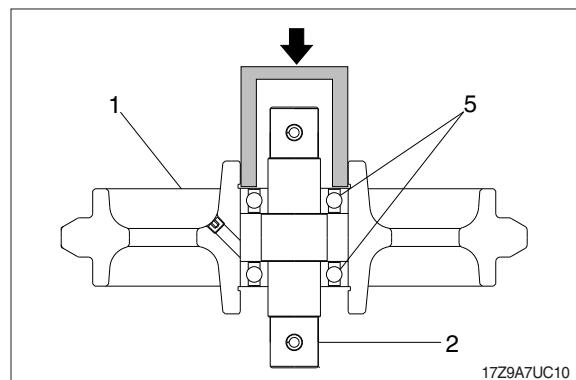
Remove snap ring (10) from shell (1)



Draw out the ball bearing (5) with shaft (2) using press.

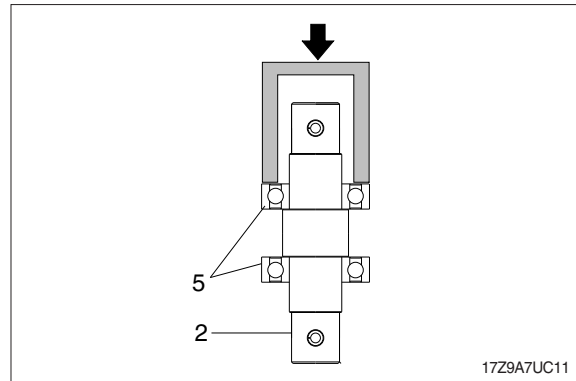
Remove the ball bearing (5) from shaft, using a special tool.

Only remove ball bearing if replacement is necessary.

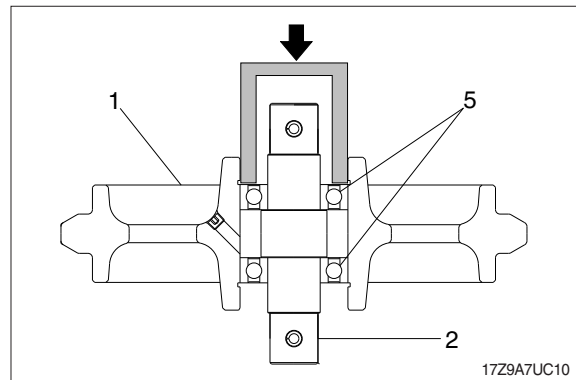


(3) Assembly

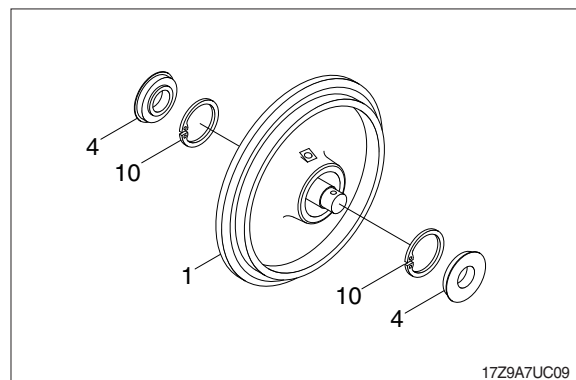
Before assembly, clean the parts.
Coat the sliding surfaces of all parts with oil.
Do not press it at the normal temperature, assemble ball bearing (5) to shaft (2) by press.



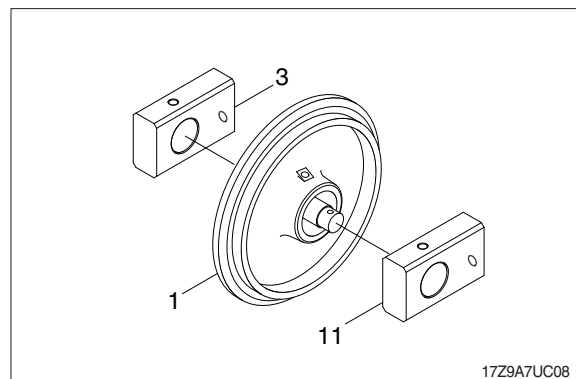
Insert shaft (2) with ball bearing (5) assembly to shell (1).



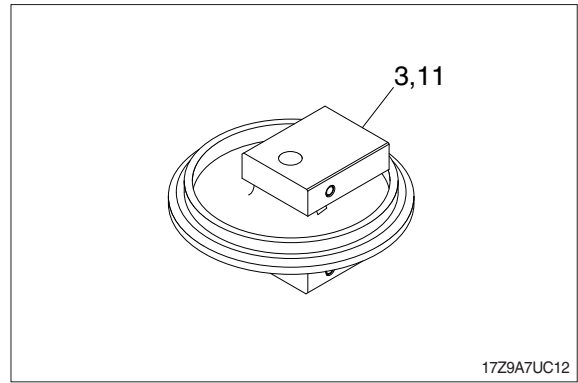
Assemble snap ring (10) and seal assembly (4).



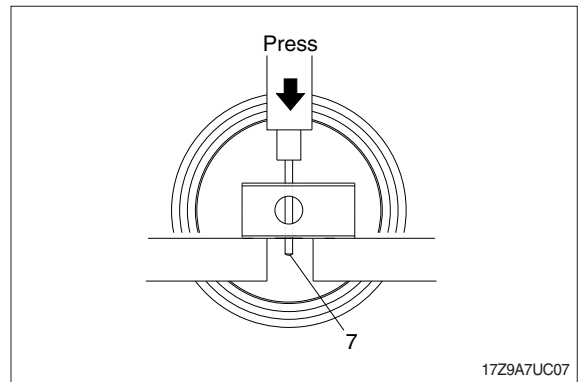
Assemble collar (3, 11) to shell (1).



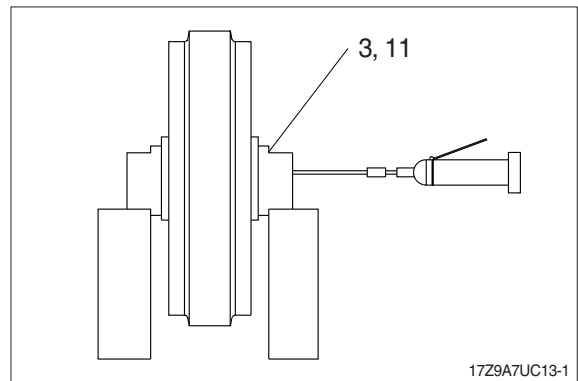
Install collar (3, 11) attached with seal (4).



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

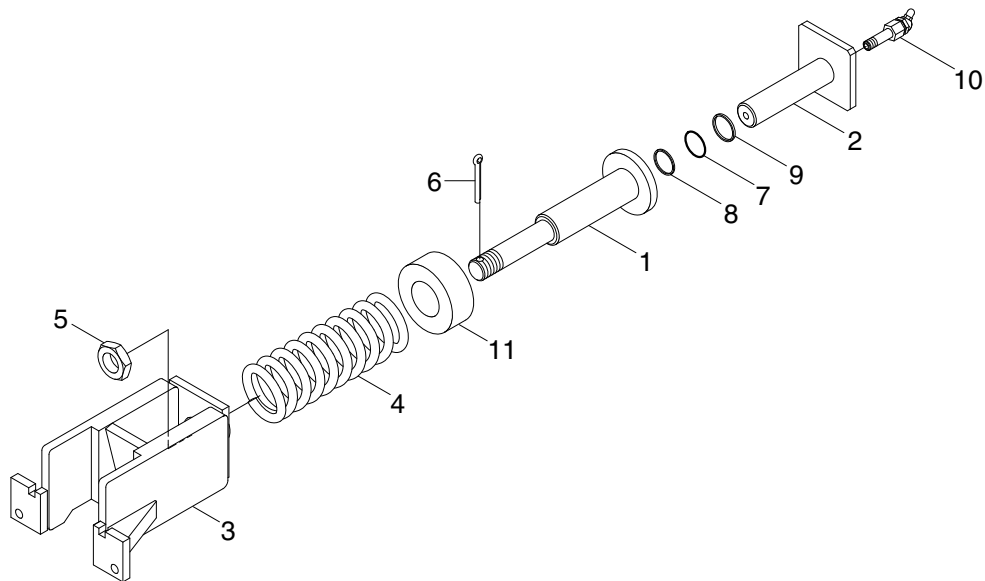


Lay collar (3, 11) on its side.
Supply engine oil to the specified level,
and tighten plug.



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

Apply pressure on bracket (3) with a press.

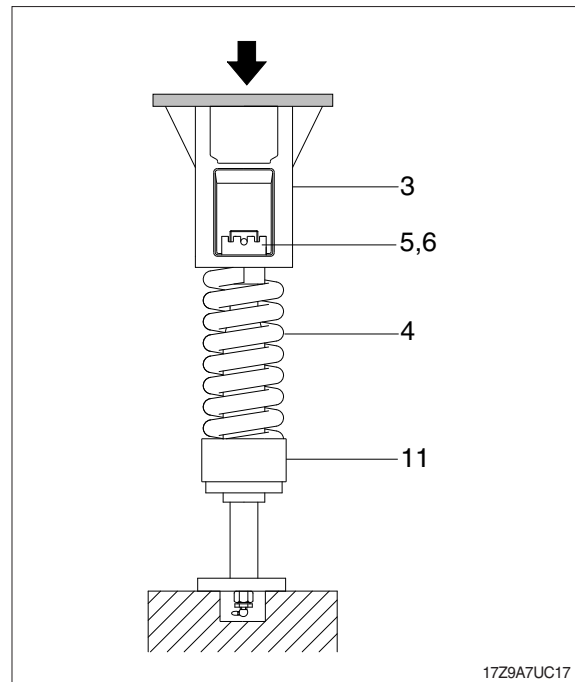
The spring is under a large installed load. This is dangerous, so be sure to set properly.

·Spring set load : 1785 kg (3940 lb)

Remove split pin (6) and nut (5).

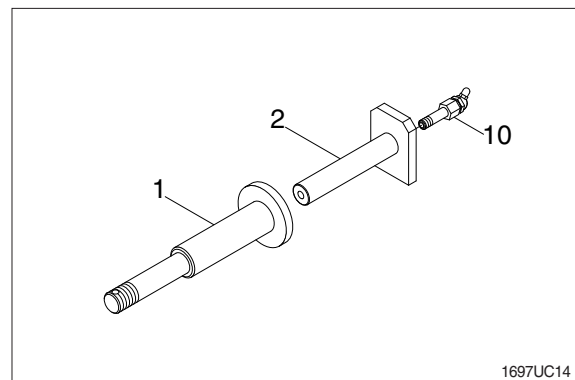
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

Lighten the press load slowly and remove bracket (6) and spring (4).

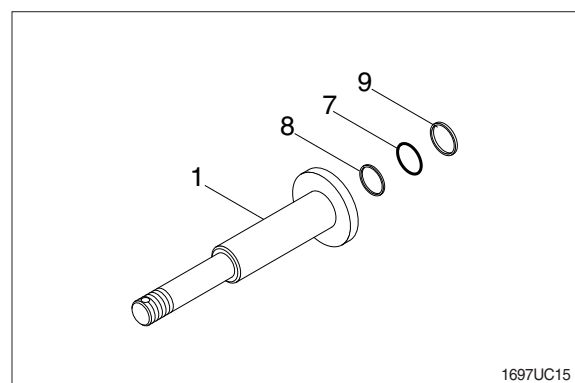


Remove piston rod (2) from cylinder (1).

Remove grease valve (10) from piston rod (1).

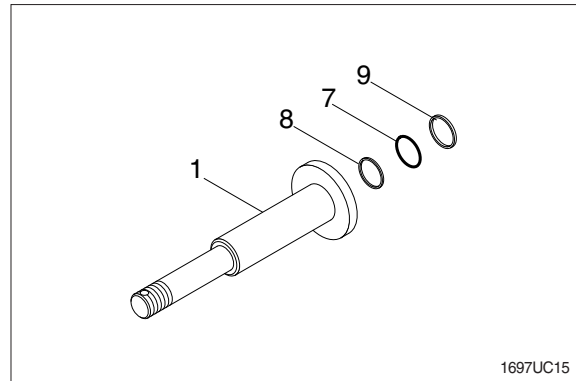


Remove packing (9), back-up ring (8) and O-ring (7) from cylinder (1).



(3) Assembly

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



Pour grease into cylinder (1), then push in piston rod (2) by hand.

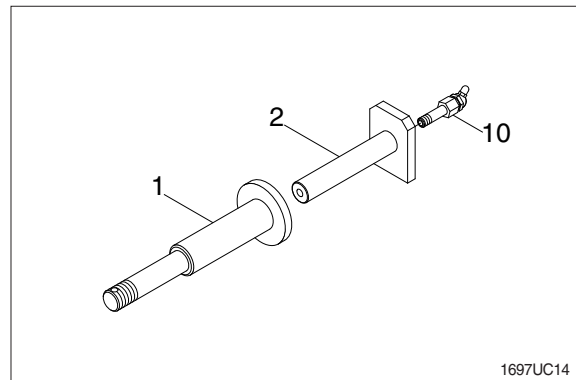
After take grease out of grease valve mounting hole, let air out.

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

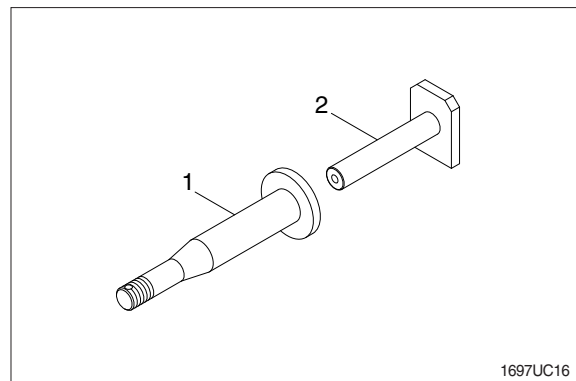
Fit grease valve (10) to piston rod (2).

·Tightening torque : 10 ± 0.5 kgf·m

(72.4 ± 3.6 lbf·ft)



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

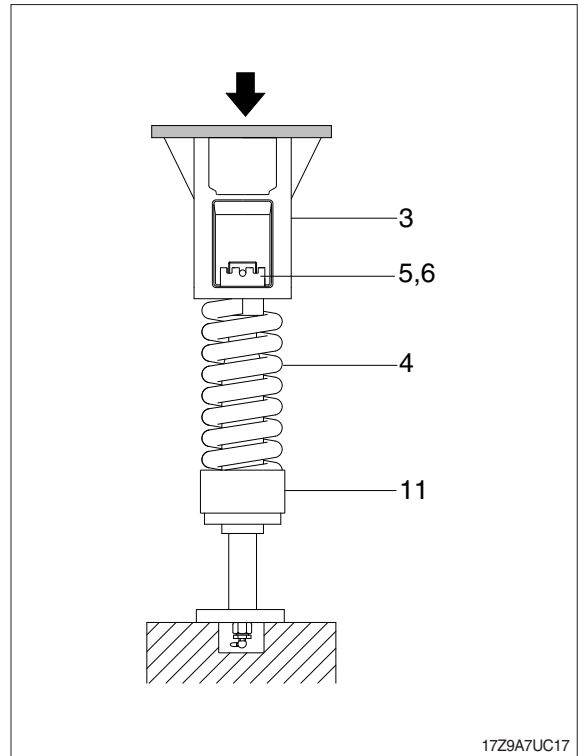


Install spring (4) and spacer (11) to cylinder (1).

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

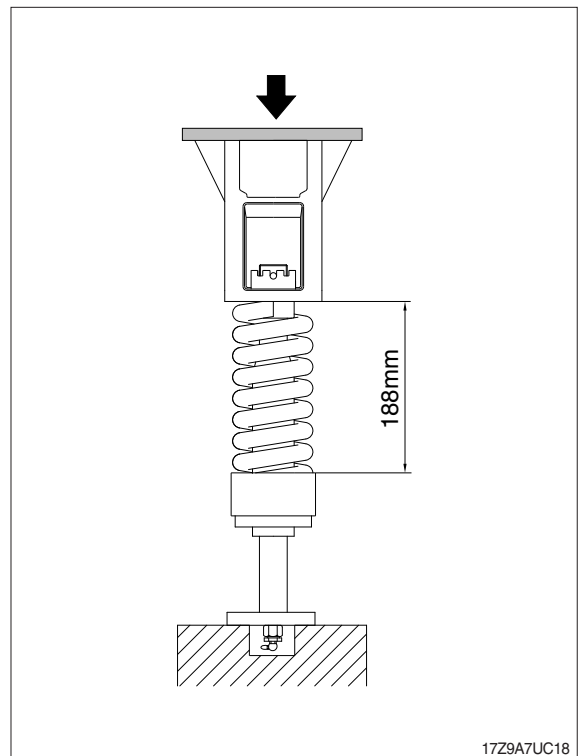
During the operation, pay attention specially to prevent the press from slipping out.

Tighten nut (5) and insert split pin (6).



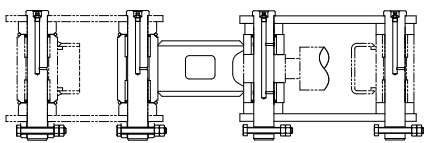
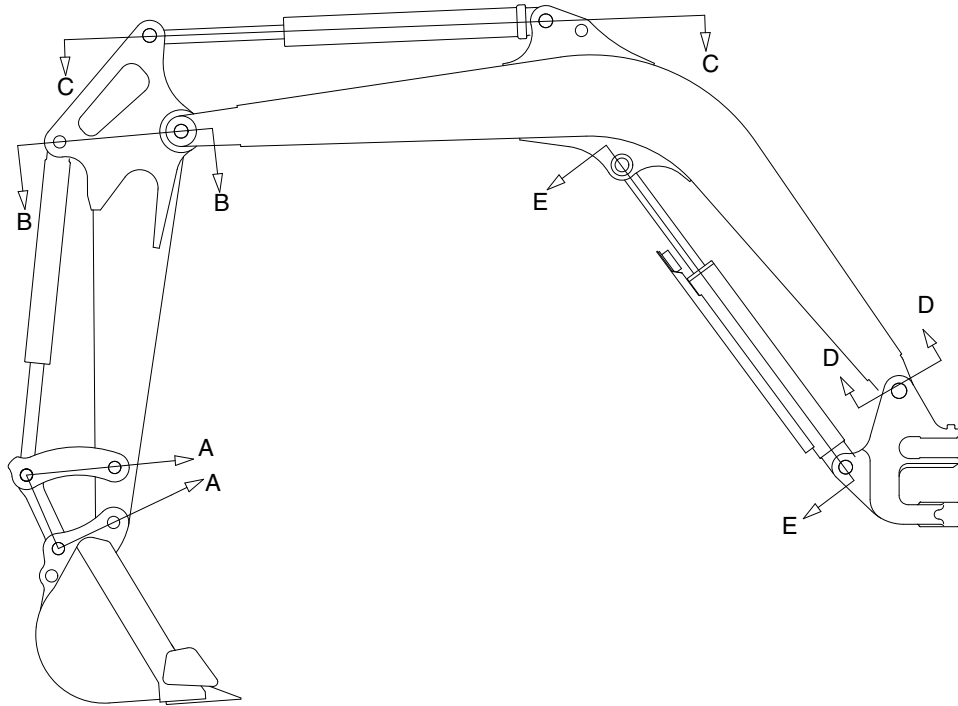
Lighten the press load and confirm the set length of spring (4).

·Spring length : 188 mm (7.4")

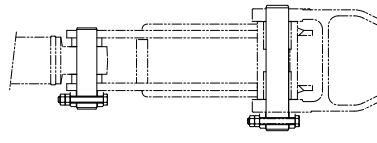


GROUP 11 WORK EQUIPMENT

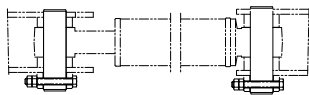
1. STRUCTURE



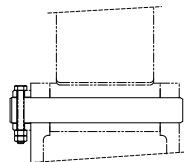
SECTION A-A



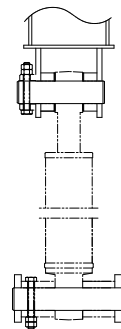
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

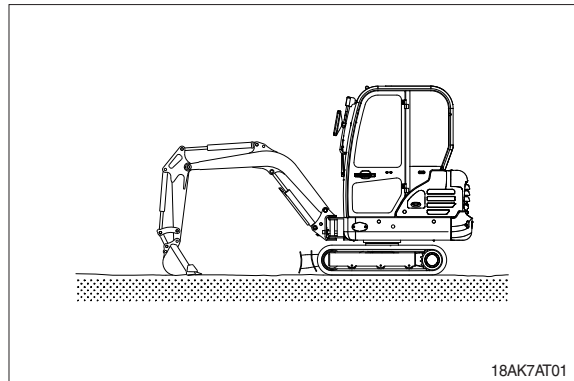
1697AT01

2. REMOVAL AND INSTALL

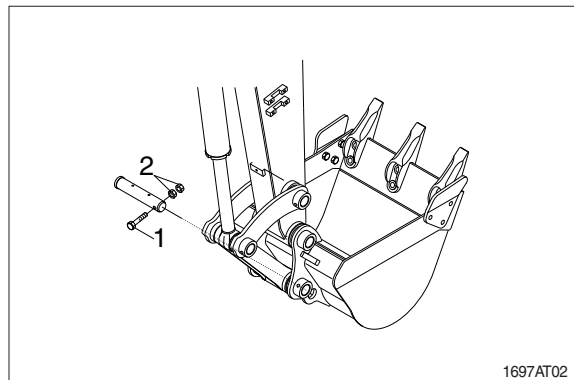
1) BUCKET ASSEMBLY

(1) Removal

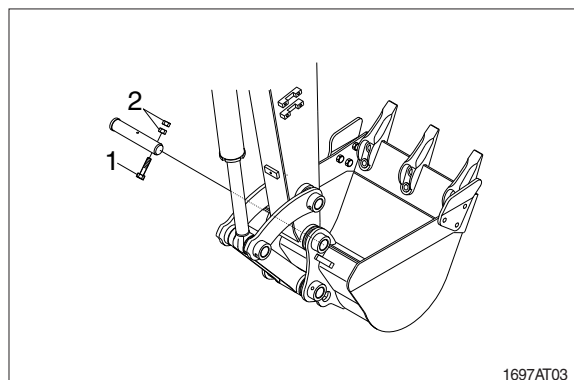
Lower the work equipment completely to ground with back of bucket facing down.



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



Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.
·Weight : 43 kg (95 lb)



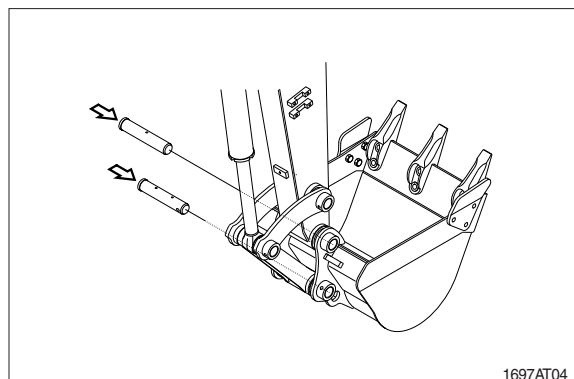
(2) Install

Carry out installation in the reverse order to removal.

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

Adjust the bucket clearance.

For detail, see 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.**

Remove bucket assembly.

For details, see removal of bucket assembly.

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.**

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

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

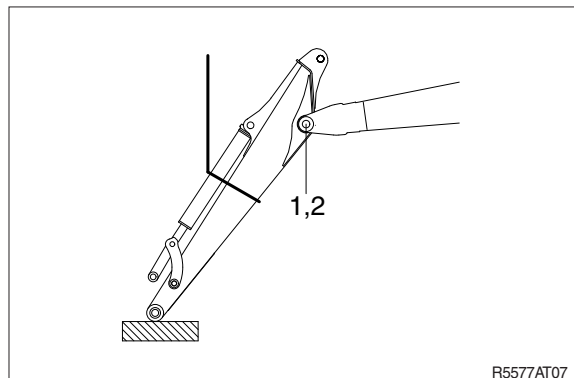
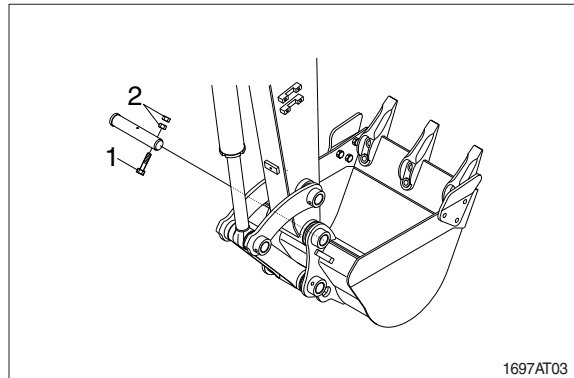
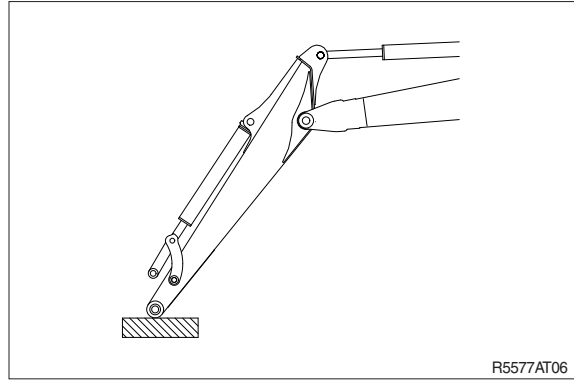
For details, see removal of arm cylinder assembly.

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

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

·Weight : 37 kg (82 lb)

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



(2) Install

Carry out installation in the reverse order to removal.

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

Bleed the air from the cylinder.

3) BOOM CYLINDER

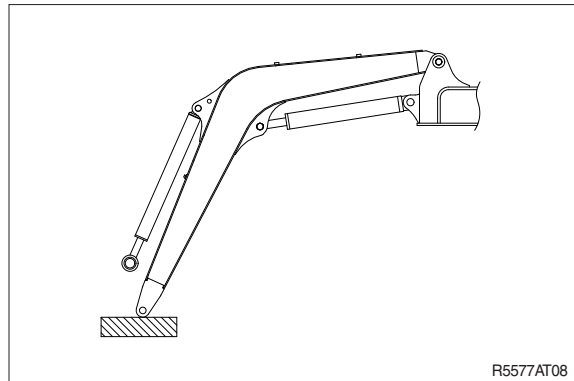
(1) Removal

Remove arm and bucket assembly.

For details, see removal of arm and bucket assembly.

Remove boom cylinder assembly from boom.

For details, see removal of arm cylinder assembly.

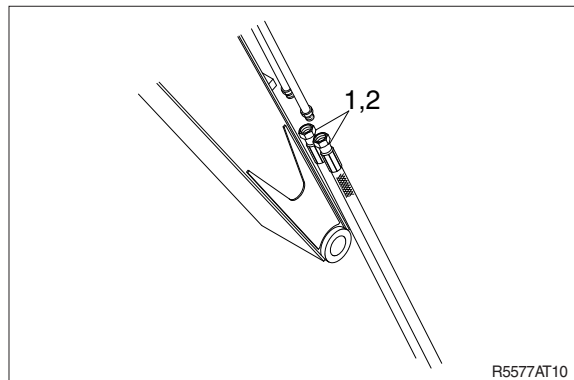


Disconnect head lamp wiring.

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

When the hose are disconnected, oil may spurt out.

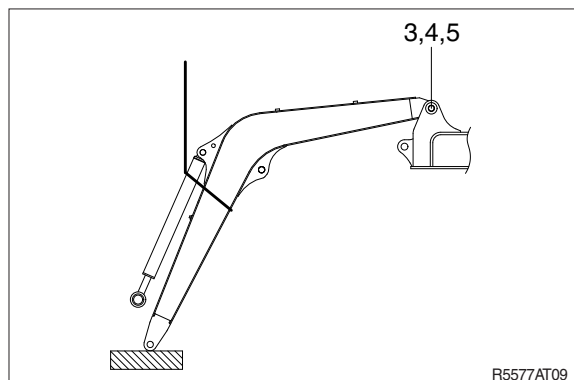
Sling boom assembly (3).



Remove bolt (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

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.

