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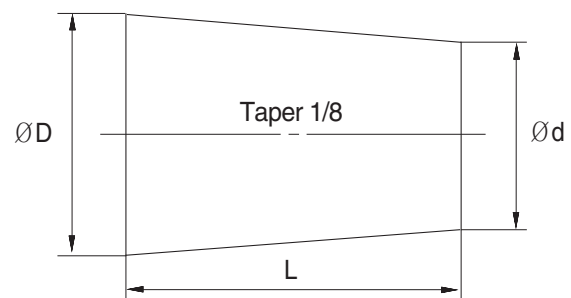
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

3. COMPLETING WORK

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

· HX480S L

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (FR, bracket)	M20 × 2.5	57.9 ± 8.0	419 ± 62.9
2		Engine mounting bolt (RR, bracket)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
3		Engine mounting bolt (frame)	M22 × 2.5	69.6 ± 7.0	503 ± 50.6
4		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1
6		Main pump housing mounting bolt	M10 × 1.5	6.7 ± 1.0	48.7 ± 7.2
7	Hydraulic system	Main pump mounting bolt	M20 × 2.5	44 ± 6.6	318 ± 47.7
8		Main control valve mounting nut	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
9		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.0	419 ± 57.9
11		Turning joint mounting bolt, nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
12	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
16		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track roller mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
19		Track tension cylinder mounting bolt	M22 × 1.5	87.2 ± 12.5	631 ± 90.4
20		Track shoe mounting bolt, nut	M24 × 3.0	140 ± 14	1012 ± 101
21		Track guard mounting bolt	M24 × 3.0	100 ± 15	723 ± 108
22	Others	Counterweight mounting bolt	M42 × 3.0	390 ± 40	2821 ± 289
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

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

· HX520S L

No.	Descriptions	Bolt size	Torque		
			kgf · m	lbf · ft	
1	Engine	Engine mounting bolt (FR, bracket)	M20 × 2.5	57.9 ± 8.0	419 ± 62.9
2		Engine mounting bolt (RR, bracket)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
3		Engine mounting bolt (frame)	M22 × 2.5	69.6 ± 7.0	503 ± 50.6
4		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1
6		Main pump housing mounting bolt	M10 × 1.5	6.7 ± 1.0	48.7 ± 7.2
7	Hydraulic system	Main pump mounting bolt	M20 × 2.5	44 ± 6.6	318 ± 47.7
8		Main control valve mounting nut	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
9		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.0	419 ± 57.9
11		Turning joint mounting bolt, nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
12	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
16		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track roller mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
19		Track tension cylinder mounting bolt	M22 × 1.5	87.2 ± 12.5	631 ± 90.4
20		Track shoe mounting bolt, nut	M24 × 3.0	140 ± 14	1012 ± 101
21		Track guard mounting bolt	M24 × 3.0	100 ± 15	723 ± 108
22		Adjustable track gauge bolt	M33 × 3.5	220 ± 20	1590 ± 145
23	Others	Counterweight mounting bolt	M42 × 3.0	390 ± 40	2821 ± 289
24		Center frame support & lower track mounting bolt	M33 × 3.5	220 ± 20	1591 ± 145
25		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
26		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

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

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~ 161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

2) PIPE AND HOSE (FLARE TYPE)

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

3) PIPE AND HOSE (ORFS TYPE)

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

4) FITTING

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

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 : 250 ℓ

- (5) Remove socket bolts (3) and disconnect block with hoses (1, 2).
- (6) Disconnect pilot line hoses (6, 7, 8, 9, 10, 11, 12, 13, 14).

- (7) Remove socket bolts (5) and disconnect pump suction tube (4).

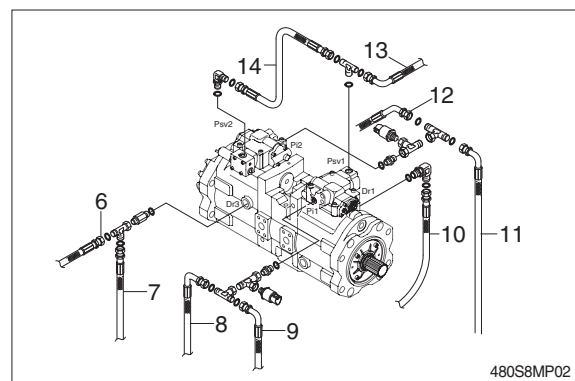
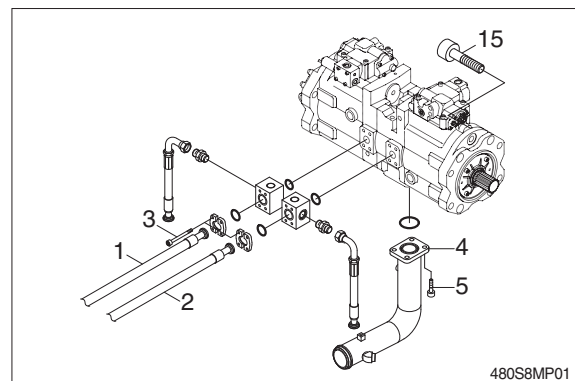
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (8) Sling the pump assembly and remove the pump mounting bolts (15).

· Weight : 190 kg (420 lb)

· Tightening torque : 69.5 ± 10.4 kgf · m
(503 ± 75.2 lbf · ft)

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

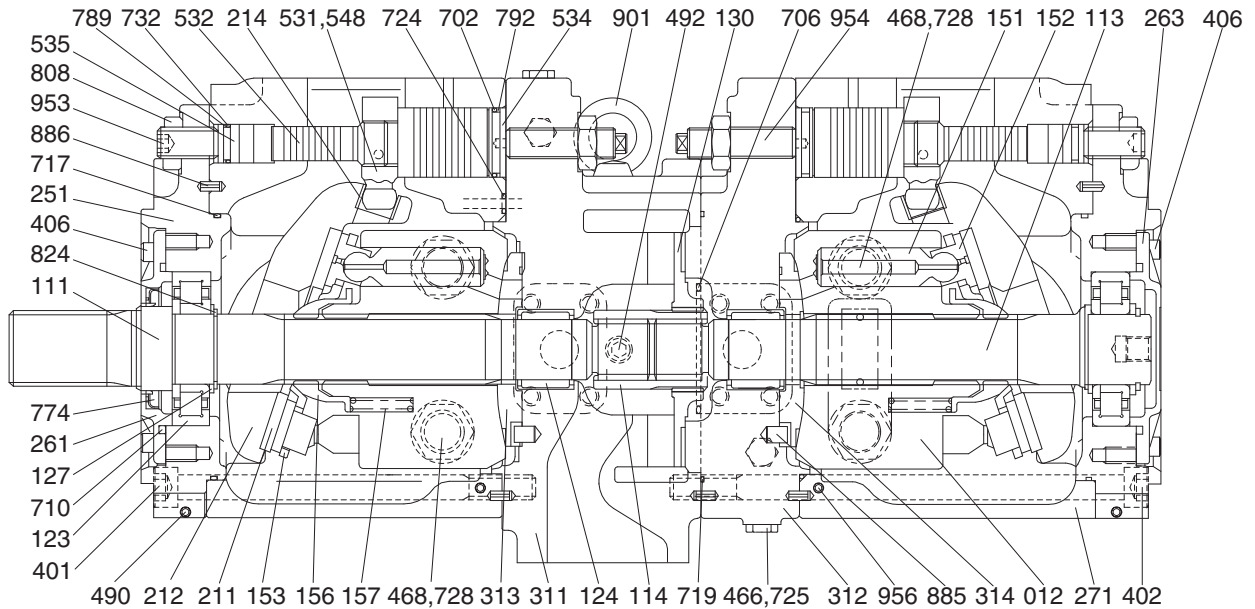


2) INSTALL

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

2. MAIN PUMP (1/2)

1) STRUCTURE



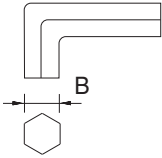

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012	Cylinder block	271	Pump casing	710	O-ring
111	Drive shaft (F)	311	Valve cover (F)	717	O-ring
113	Driven shaft (R)	312	Valve cover (R)	719	O-ring
114	Coupling	313	Valve plate (R)	724	Square ring
123	Roller bearing	314	Valve plate (L)	725	O-ring
124	Needle bearing	401	Hexagon socket bolt	728	O-ring
127	Spacer	402	Hexagon socket bolt	732	O-ring
130	Booster	406	Hexagon socket bolt	774	Oil seal
151	Piston	466	VP Plug	789	Back up ring
152	Shoe	468	VP Plug	792	Back up ring
153	Set plate	490	VP Plug	808	Hexagon head nut
156	Bushing	492	VP Plug	824	Snap ring
157	Cylinder spring	531	Tilting pin	885	Valve plate pin
211	Shoe plate	532	Servo piston	886	Spring pin
212	Swash plate	534	Stopper (L)	901	Eye bolt
214	Tilting bearing	535	Stopper (S)	953	Set screw
251	Support plate	548	Feed back pin	954	Set screw
261	Seal cover (F)	702	O-ring	956	Set screw
263	Seal cover (R)	706	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

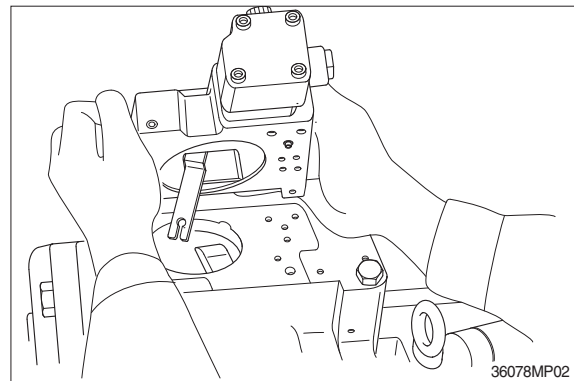
Tool name & size		Part name			
Allen wrench 	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
	8	M10	BP-3/ 8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon head bolt	Hexagon head bolt	VP plug (PF thread)	
	19	M12	M12	VP-1/4	
	24	M16	M16	-	
	27	M18	M18	VP-1/2	
	30	M20	M20	-	
	36	-	-	VP-3/4	
Adjustable angle wrench	Medium size, 1 set				
Screw driver	Minus type screw driver, Medium size, 2 sets				
Hammer	Plastic hammer, 1 set				
Pliers	For snap ring, TSR-160				
Steel bar	Steel bar of key material approx. 10 × 8 × 200				
Torque wrench	Capable of tightening with the specified torques				

(2) Tightening torque

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

3) DISASSEMBLY

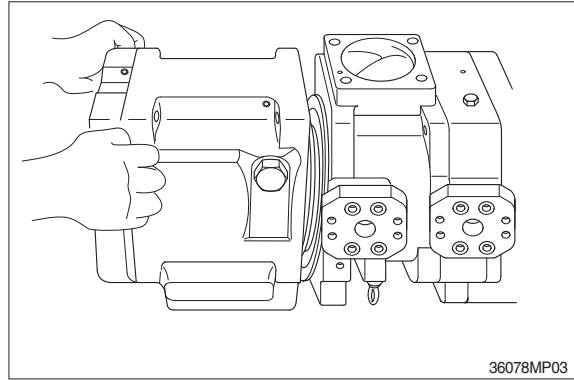
- (1) Select place suitable to disassembling.
 - ※ Select clean place.
 - ※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove drain port plug (468) and let oil out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



- (5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve cover (F, 311).
 - ※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.
- (6) Loosen hexagon socket head bolts (402) which tighten swash plate support (251), pump casing (271) and valve cover (R, 312).

(7) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing (271) from valve cover (F, 311).

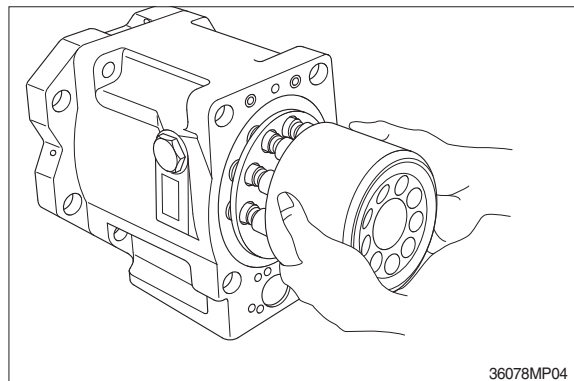
- ※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



(8) Separate valve cover (F, 311) from valve cover (R, 312) and pull out booster (130), spline coupling (114).

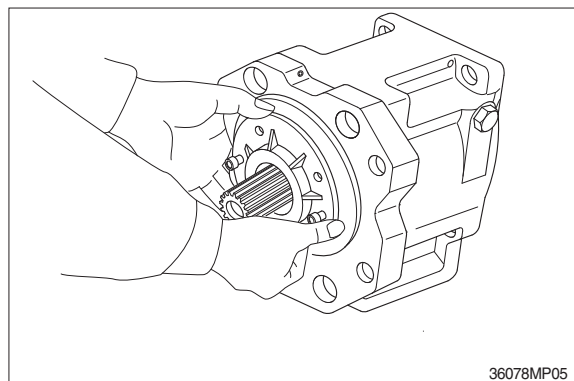
(9) Separate valve cover (R, 312) from pump casing and then pull out the cylinder block (012) of pump casing (271) straightly over drive shaft (R, 113). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

- ※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.

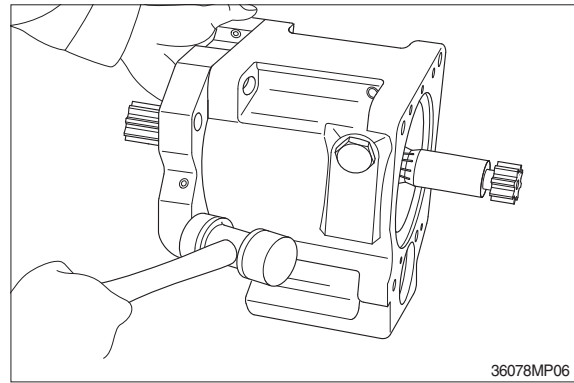


(10) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

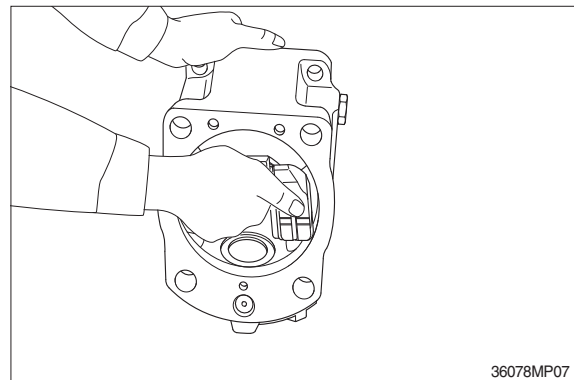
- ※ Fit bolt into pulling-out tapped hole of seal cover (F), and cover can be removed easily.
- ※ Since oil seal is fitted on seal cover (F), take care not to damage it when removing cover.



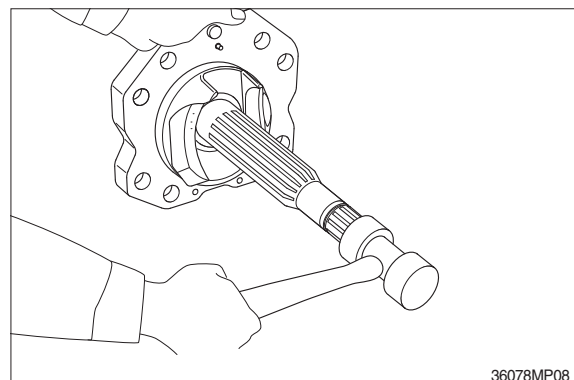
(11) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



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

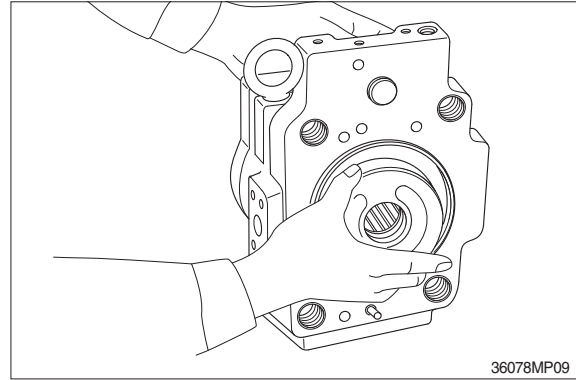


(13) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(14) Remove valve plates (313, 314) from valve cover (311, 312).

- ※ These may be removed in work 7, 9.



(15) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) from valve cover (311, 312).

- ※ In removing tilting pin, use a protector to prevent pin head from being damaged.
- ※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.
- ※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.
- ※ Do not loosen hexagon nuts of valve cover and swash plate support.
If loosened, flow setting will be changed.

(16) This is the end of disassembling procedures.

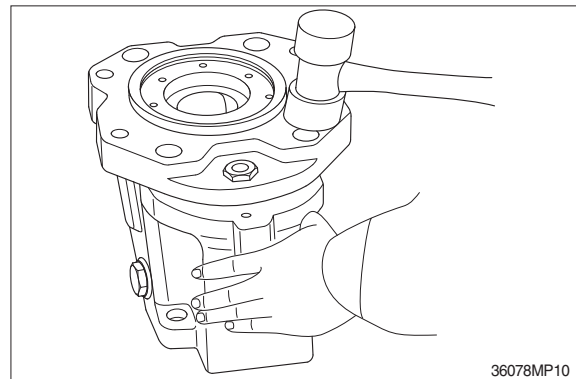
4) ASSEMBLY

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

- ① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.
- ② Clean each part fully with cleaning oil and dry it with compressed air.
- ③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.
- ④ In principle, replace seal parts, such as O-rings, oil seals, etc.
- ⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

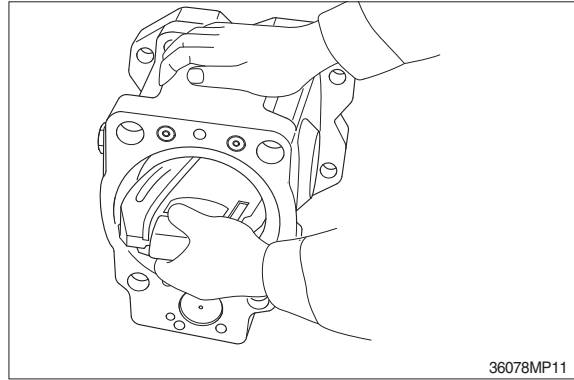
(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

- ※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.
- ※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (medium strength) to their threaded sections.



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

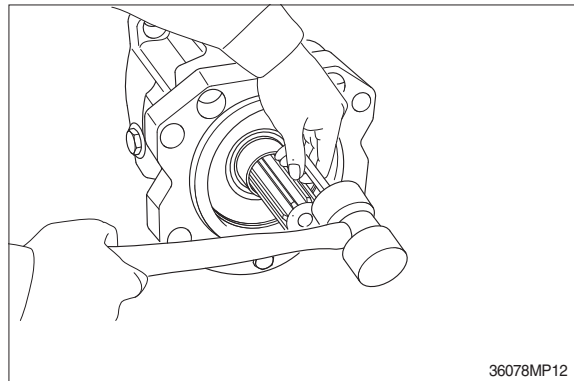
- ※ Confirm with fingers of both hands that swash plate can be removed smoothly.
- ※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



36078MP11

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

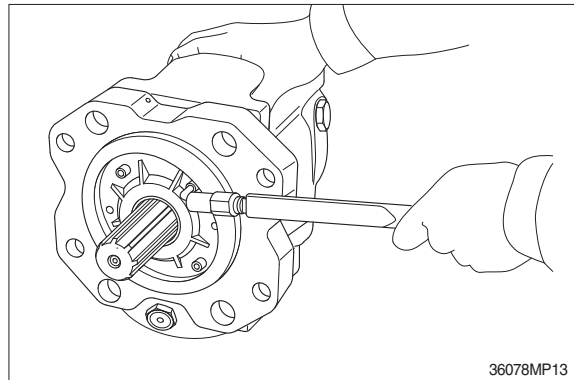
- ※ Do not tap drive shaft with hammer or so on.
- ※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.
- Fit them fully, using steel bar or so on.



36078MP12

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

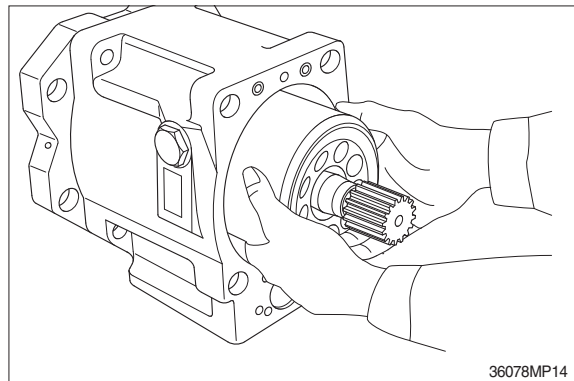
- ※ Apply grease lightly to oil seal in seal cover (F).
- ※ Assemble oil seal, taking full care not to damage it.
- ※ For tandem type pump, fit rear cover (263) and seal cover (262) similarly.



36078MP13

- (6) Assemble piston cylinder subassembly [cylinder block (012), piston subassembly (151, 152), set plate (153), spherical bushing (156) and cylinder spring (157)] .

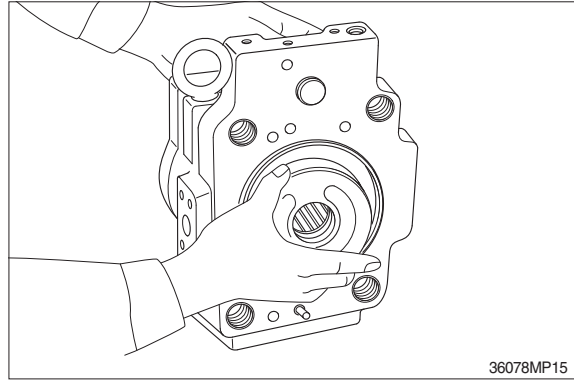
Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing (271).



36078MP14

- (7) Fit valve plate (313) to valve cover (F, 311), and fit valve plate (314) to valve cover (R, 312), entering pin into pin hole.

※ Take care not to mistake suction / delivery directions of valve plate.



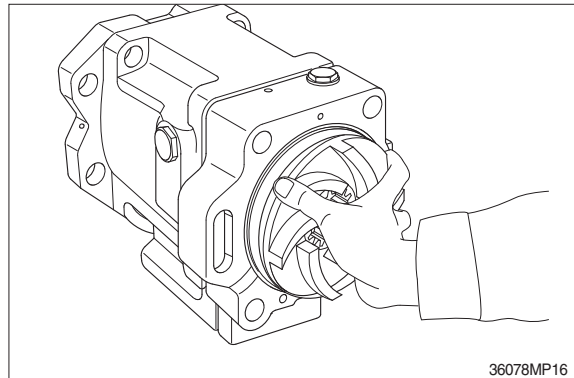
- (8) Fit valve block (R, 312) to pump casing (271) and fit spline coupling (114) and booster (130) to shaft (R, 113).

※ Take care not to mistake direction of valve cover.

Fit valve cover with regulator up and with delivery flange left, viewed from front side.

※ Take care not to mistake direction of booster (130).

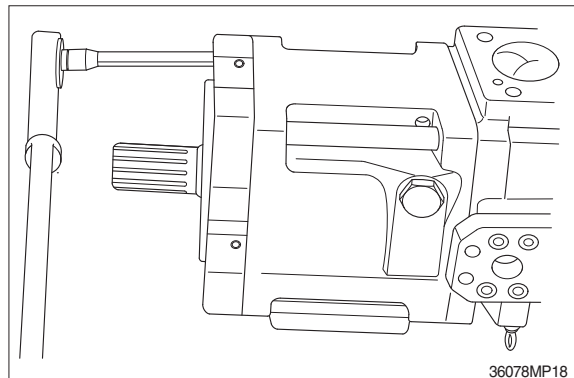
(refer to the sectional drawing)



- (9) Fit valve cover (F, 311) to valve cover (R) and tighten hexagon socket head bolts (402).

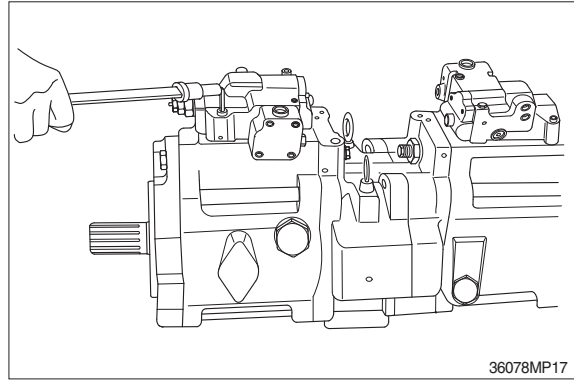
- (10) Fit pump casing (271) with shaft (F, 111) to valve cover (F, 311) and tighten hexagon socket head bolts (401).

※ Mate spline phases of shaft (F) and spline coupling, with shaft (F) been rotating.



(11) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412,413).

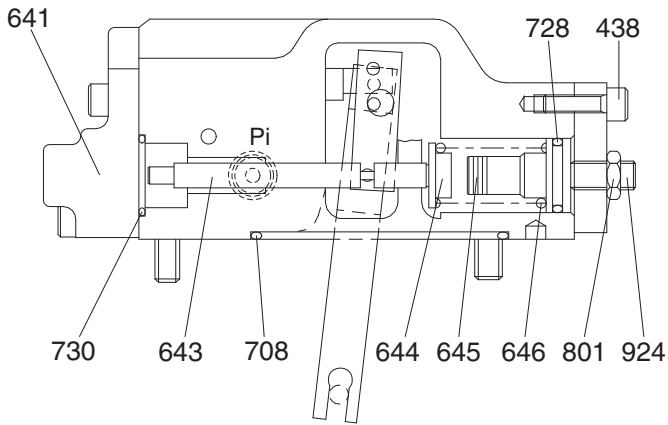
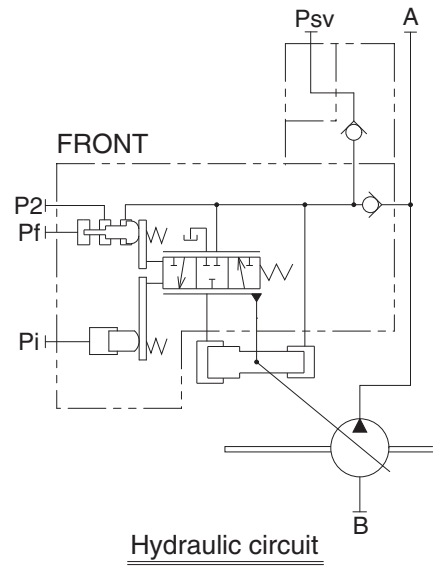
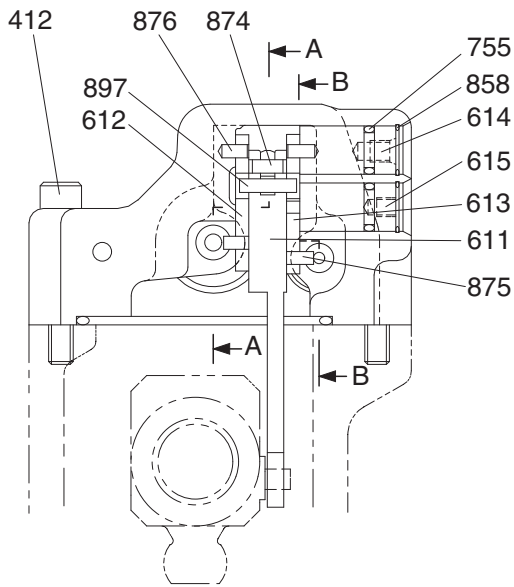
※ Take care not to mistake regulator of front pump for that of rear pump.



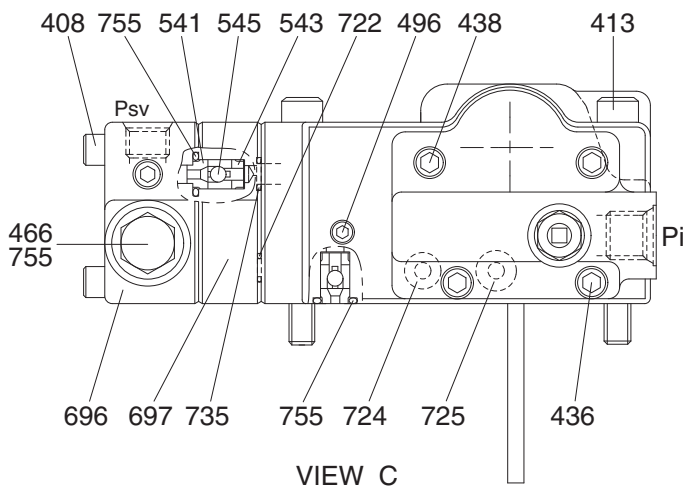
(12) Fit drain port plug (468).

This is the end of reassembling procedures.

5) REGULATOR (1/2)



SECTION B-B

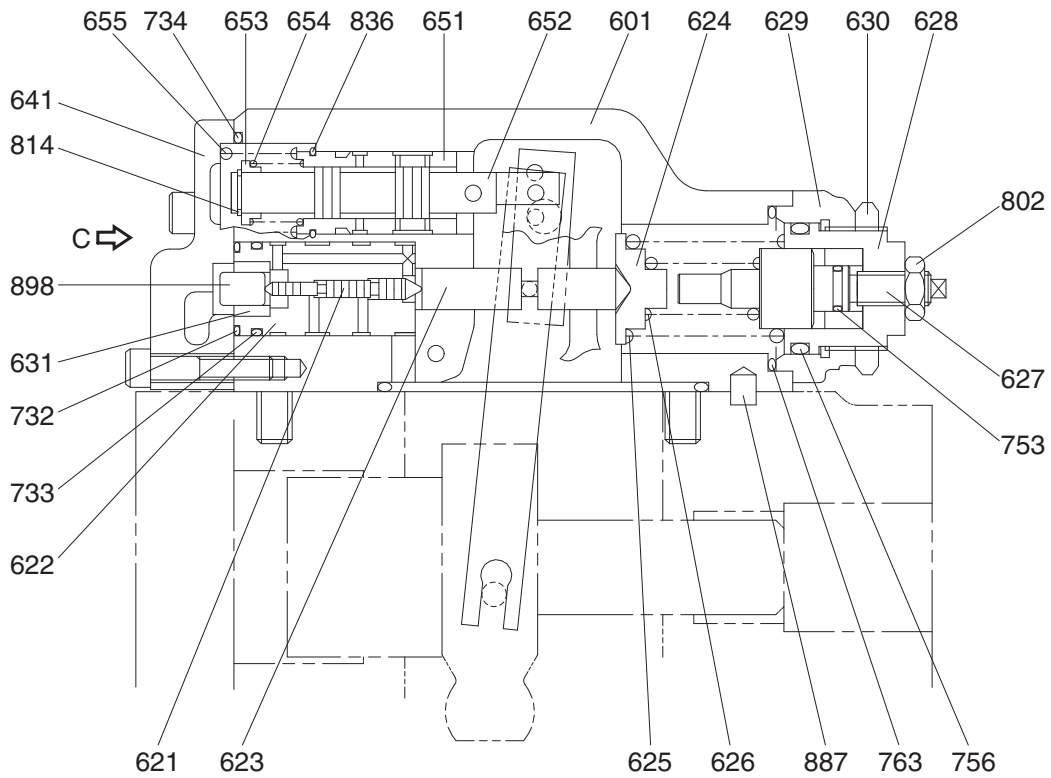


VIEW C

Port	Port name	Port size
Pi	Pilot port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 15
P2	Companion delivery port	-
Pf	Powershift port	-

48092RG01

REGULATOR(2/2)



SECTION A-A

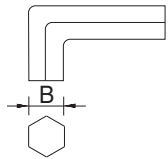

48092RG02

408 Hexagon socket screw	626 Inner spring	728 O-ring
412 Hexagon socket screw	627 Adjust stem (C)	730 O-ring
413 Hexagon socket screw	628 Adjust screw (C)	732 O-ring
436 Hexagon socket screw	629 Cover (C)	733 O-ring
438 Hexagon socket screw	630 Lock nut	734 O-ring
466 Plug	631 Sleeve, pf	735 O-ring
496 Plug	641 Pilot cover	753 O-ring
497 Plug	643 Pilot piston	755 O-ring
541 Seat	644 Spring seat (Q)	756 O-ring
543 Stopper	645 Adjust stem (Q)	763 O-ring
545 Steel ball	646 Pilot spring	801 Nut
601 Casing	651 Sleeve	802 Nut
611 Feed back lever	652 Spool	814 Snap ring
612 Lever (1)	653 Spring seat	836 Snap ring
613 Lever (2)	654 Return spring	858 Snap ring
614 Center plug	655 Set spring	874 Pin
615 Adjust plug	696 Port cover	875 Pin
621 Compensator piston	697 Check valve plate	876 Pin
622 Piston case	708 O-ring	887 Pin
623 Compensator rod	722 O-ring	897 Pin
624 Spring seat (C)	724 Square ring	898 Pin
625 Outer spring	725 O-ring	924 Set screw

6) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench	Small size, Max 36 mm				
Screw driver	Minus type screw driver, Medium size, 2 sets				
Hammer	Plastic hammer, 1 set				
Pliers	For snap ring, TSR-160				
Steel bar	4x100 mm				
Torque wrench	Capable of tightening with the specified torques				
Pincers	-				
Bolt	M4, Length : 50 mm				

(2) Tightening torque

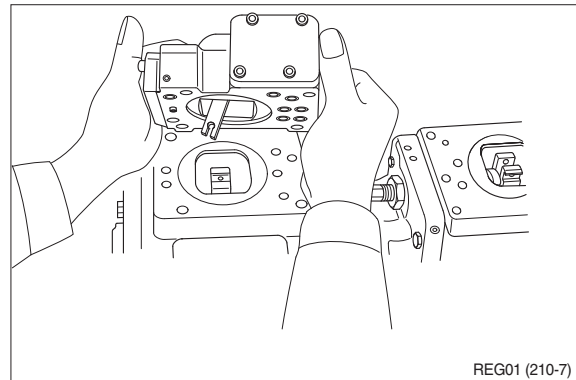
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17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

3) DISASSEMBLY

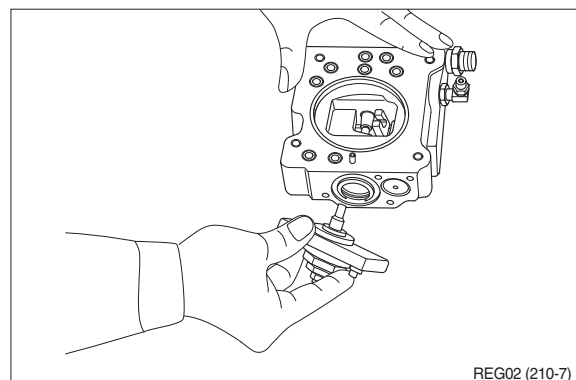
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

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

- (1) Choose a place for disassembly.
 - ※ Choose a clean place.
 - ※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.
- (2) Remove dust, rust, etc. from surfaces of regulator with clean oil.
- (3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
 - ※ Take care not to lose O-ring.

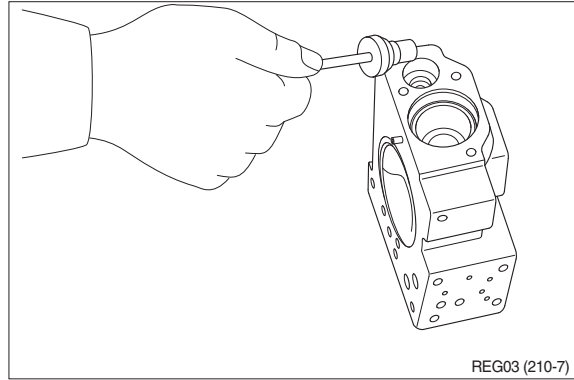


- (4) Remove hexagon socket head screw (438) and remove cover (C,629)
 - ※ Cover (C) is fitted with adjusting screw (C,QI) (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
Do not loosen these screws and nuts.
If they are loosened, adjusted pressure-flow setting will vary.

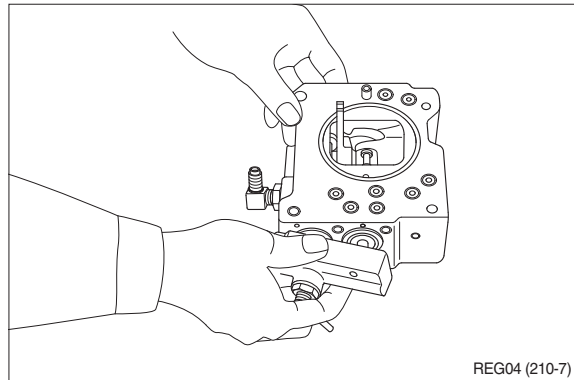


- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

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



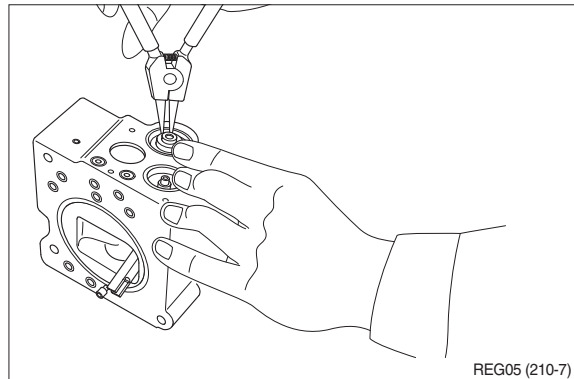
- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641). After removing pilot cover, take out set spring (655) from pilot section.



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

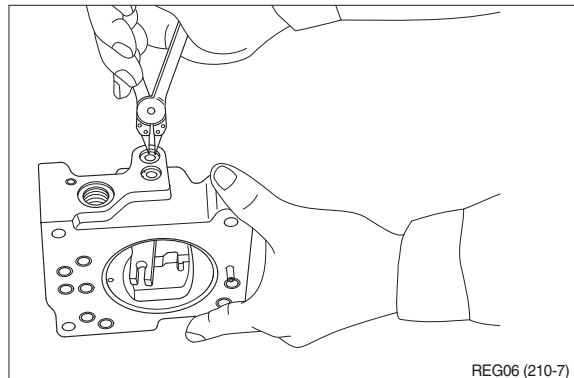
※ **Sleeve (651) is fitted with snap ring (836).**

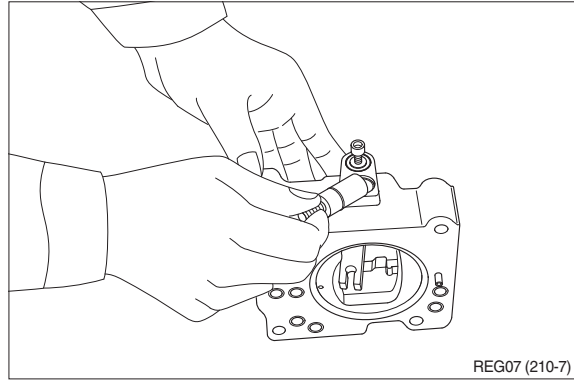
※ **When removing snap ring (814), return spring (654) may pop out. Take care not to lose it.**



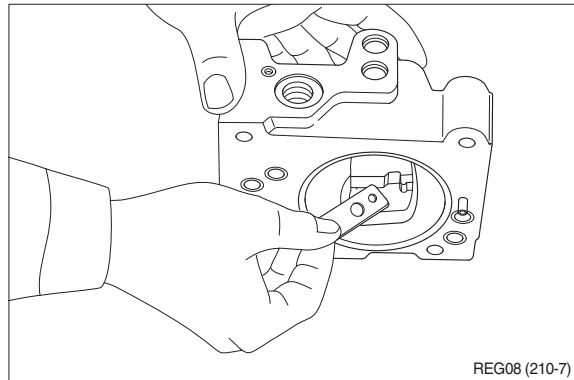
- (8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

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

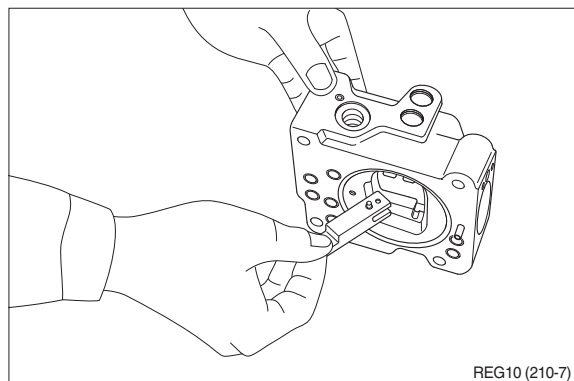
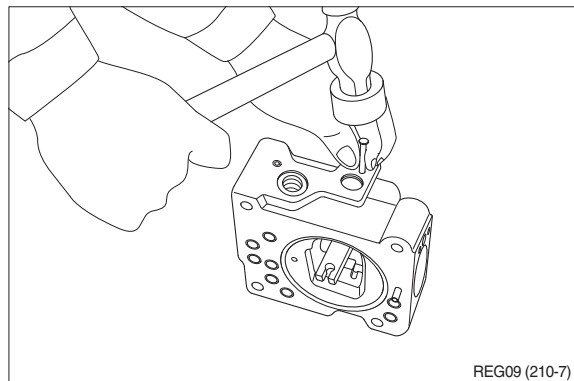




- (9) Remove lever 2 (613). Do not draw out pin (875).
※ Work will be promoted by using pincers or so on.



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



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

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

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

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

This completes disassembly.

4) ASSEMBLY

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

① Always repair parts that were scored at disassembly.

② Get replacement parts ready beforehand.

Mixing of foreign matter will cause malfunction.

Therefore, wash parts well with cleaning oil, let them dry with jet air and handle

③ them in clean place.

Always tighten bolts, plugs, etc. to their

④ specified torques.

Do not fail to coat sliding surfaces with

⑤ clean hydraulic oil before assembly.

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

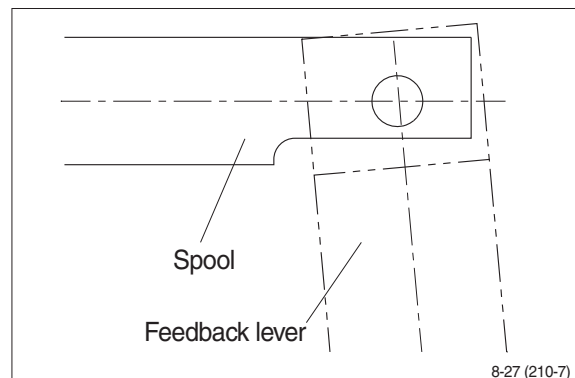
(2) Put compensating rod (623) into compensating hole of casing (601).

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

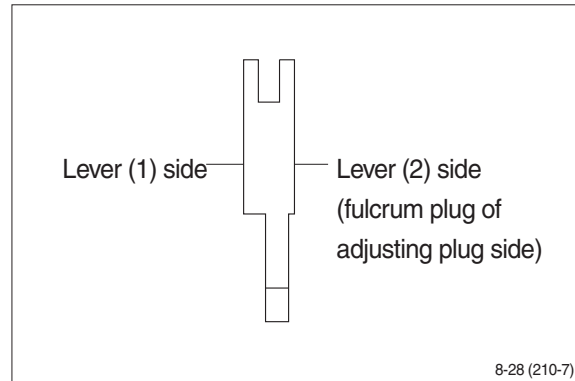
(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

※ Confirm that spool and sleeve slide smoothly in casing without binding.

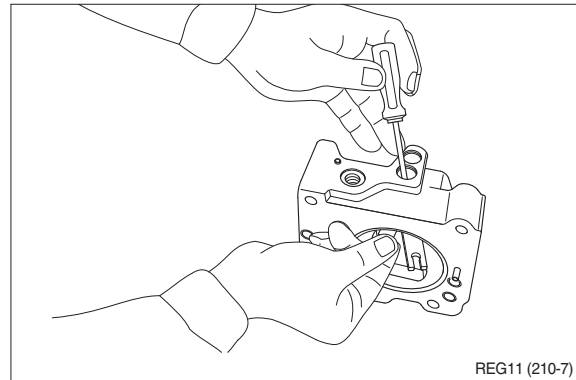
※ Pay attention to orientation of spool.



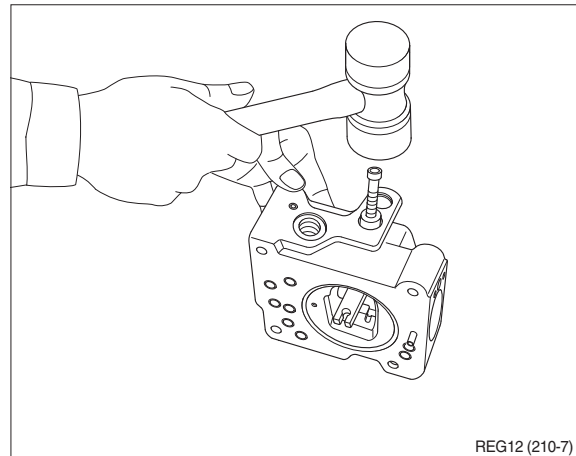
- (5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
- ※ Insert pin in feedback lever a little to ease operation.
 - ※ Take care not to mistake direction of feedback lever.



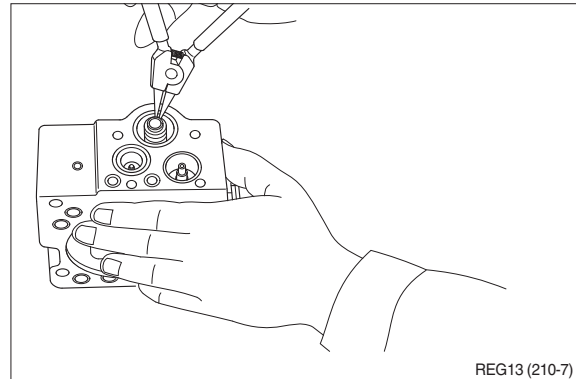
- (6) Put pilot piston (643) into pilot hole of casing.
- ※ Confirm that pilot piston slides smoothly without binding.
- (7) Put pin force-fitted in lever 2 (613) into groove of pilot piston.
Then fix lever (2).



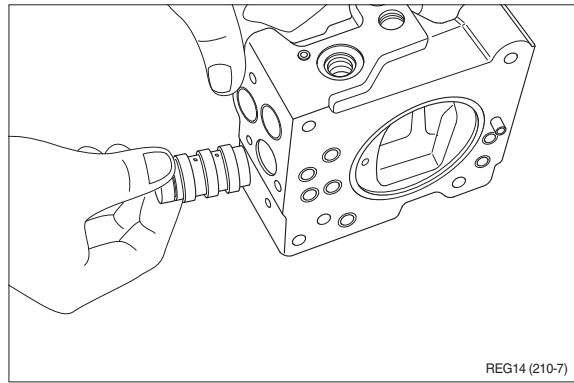
- (8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever 2.
Then fix locking ring (858).
- (9) Insert adjusting plug (615) and fit locking ring.
- ※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
- At this point in time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



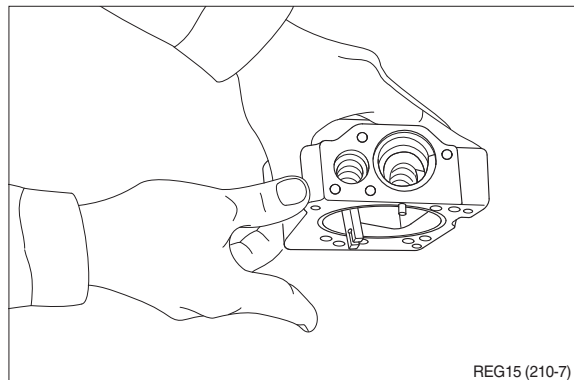
- (10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



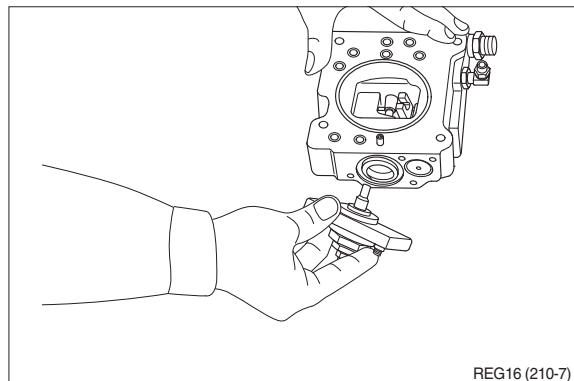
- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



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



- (13) Install cover (C, 629) fitted with adjusting screws (628, 925), adjusting ring (C, 627), lock nut (630), hexagon nut (802) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).



This completes assembly.

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

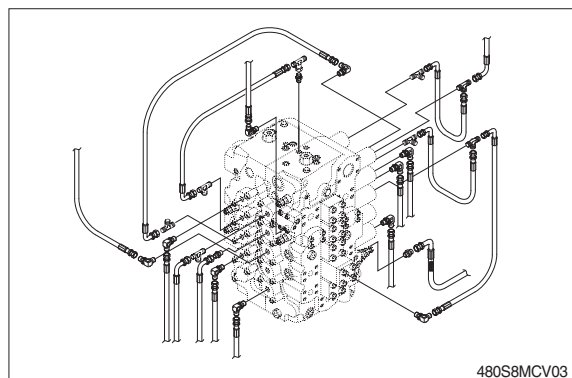
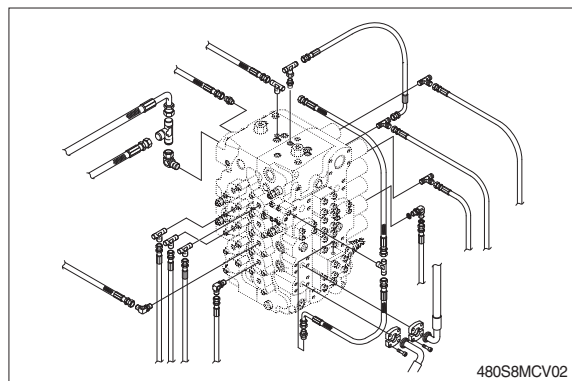
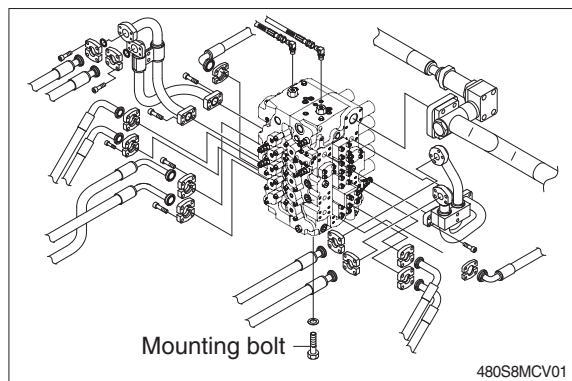
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Remove the wirings for the pressure sensor and so on.
- (5) Remove bolts and disconnect pipe.
- (6) Disconnect pilot line hoses.
- (7) Disconnect pilot piping.
- (8) Sling the control valve assembly and remove the control valve mounting bolt.
 - Weight : 420 kg (930 lb)
 - Tightening torque : $57.9 \pm 8.7 \text{ kgf} \cdot \text{m}$
($419 \pm 62.9 \text{ lbf} \cdot \text{ft}$)

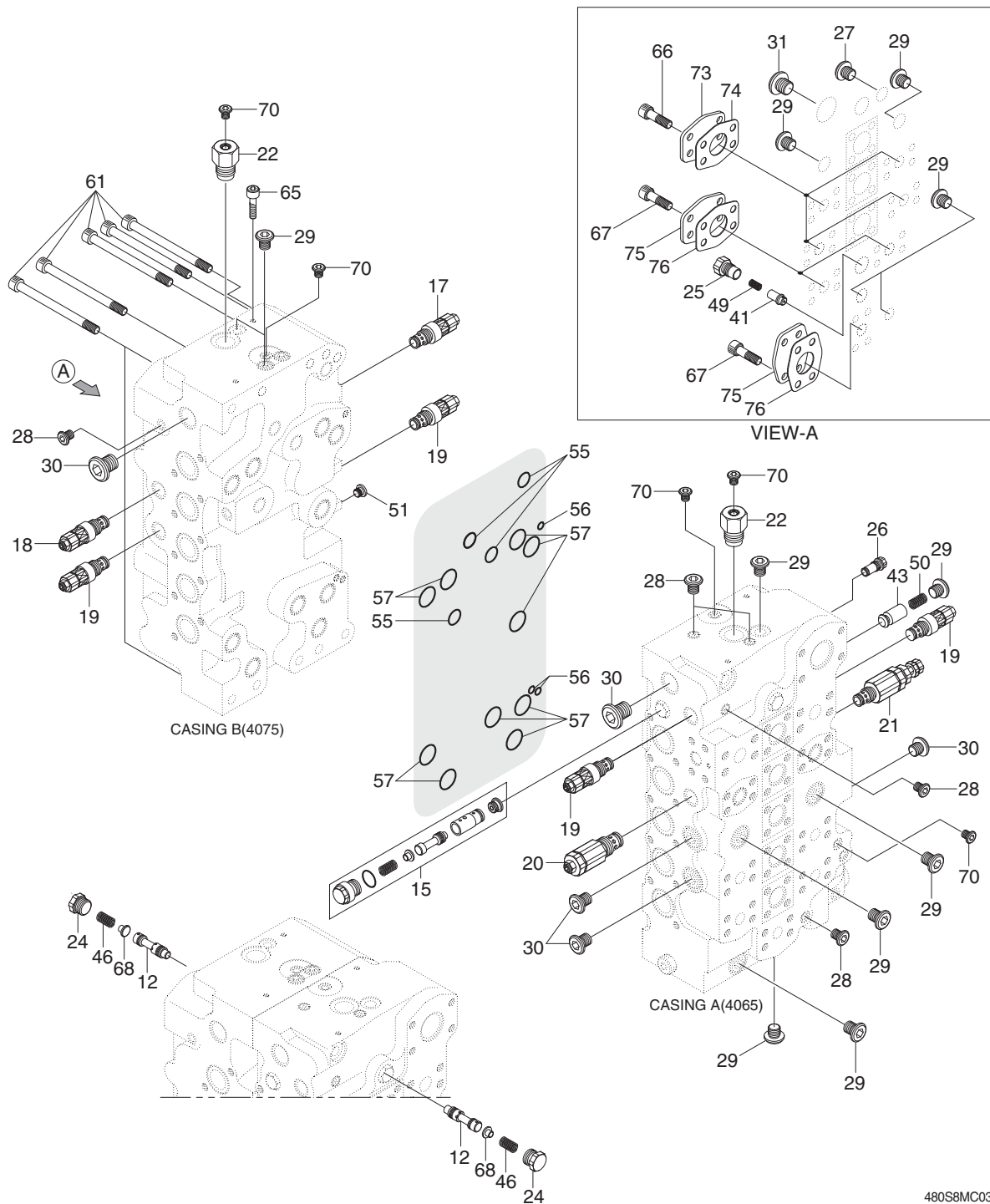
- (9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

2) INSTALL

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



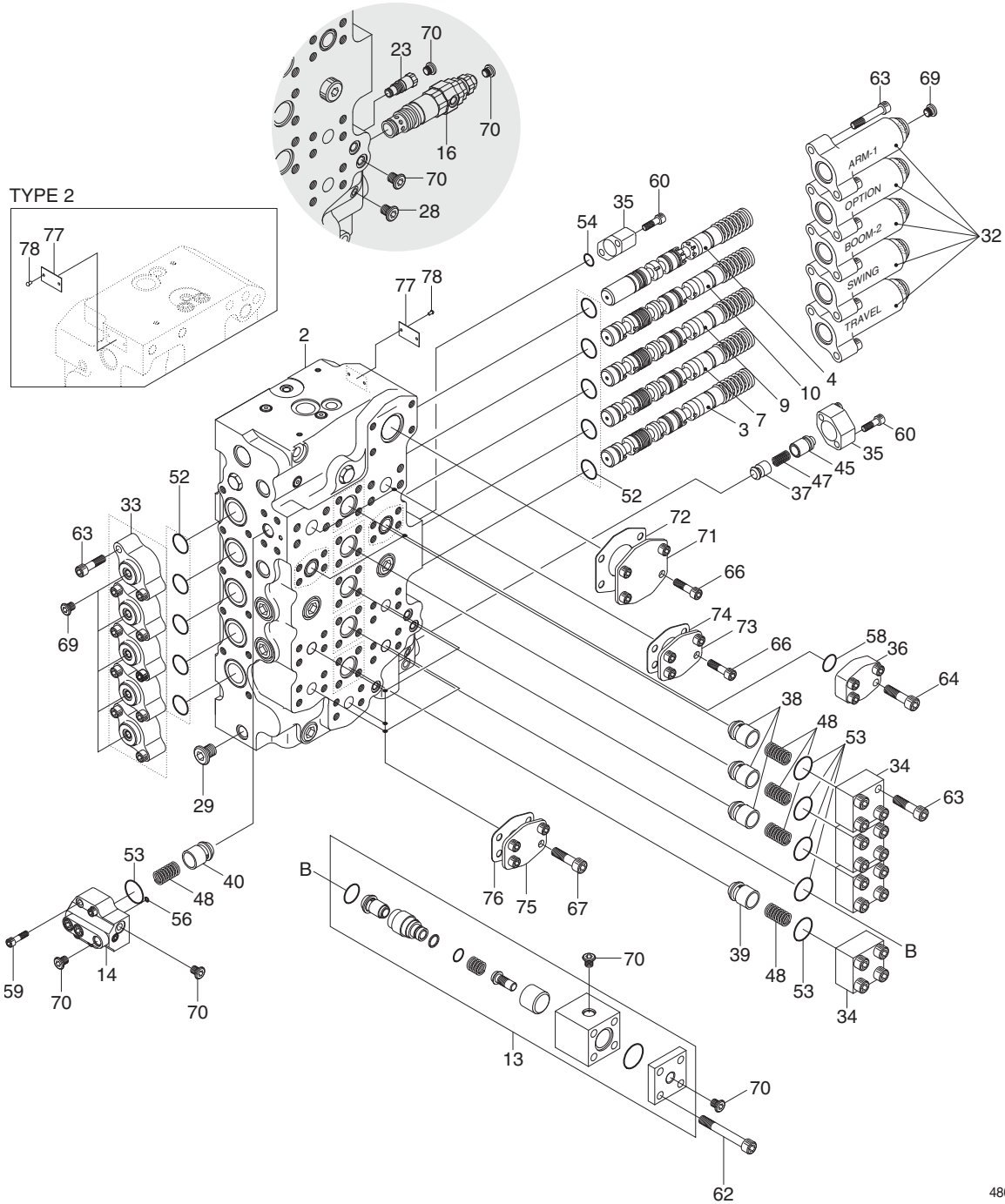
2. STRUCTURE (1/3)



- | | | | | | |
|----|------------------------|----|--------|----|------------------------|
| 12 | Bypass cut 1 spool kit | 28 | Plug | 57 | O-ring |
| 15 | Arm regen cut assy | 29 | Plug | 61 | Socket bolt |
| 17 | Port relief valve | 30 | Plug | 65 | Socket bolt |
| 18 | Port relief valve | 31 | Plug | 66 | Socket bolt |
| 19 | Port relief valve | 41 | Poppet | 67 | Socket bolt |
| 20 | Port relief valve | 43 | Poppet | 68 | Bypass cut spring seat |
| 21 | Port relief valve | 46 | Spring | 70 | Dust cap |
| 22 | Negacon relief valve | 49 | Spring | 73 | Cover |
| 24 | Bypass plug assy | 50 | Spring | 74 | Gasket |
| 25 | Plug | 51 | Plug | 75 | Cover |
| 26 | Plug | 55 | O-ring | 76 | Gasket |
| 27 | Plug | 56 | O-ring | | |

480S8MC03

STRUCTURE (2/3)



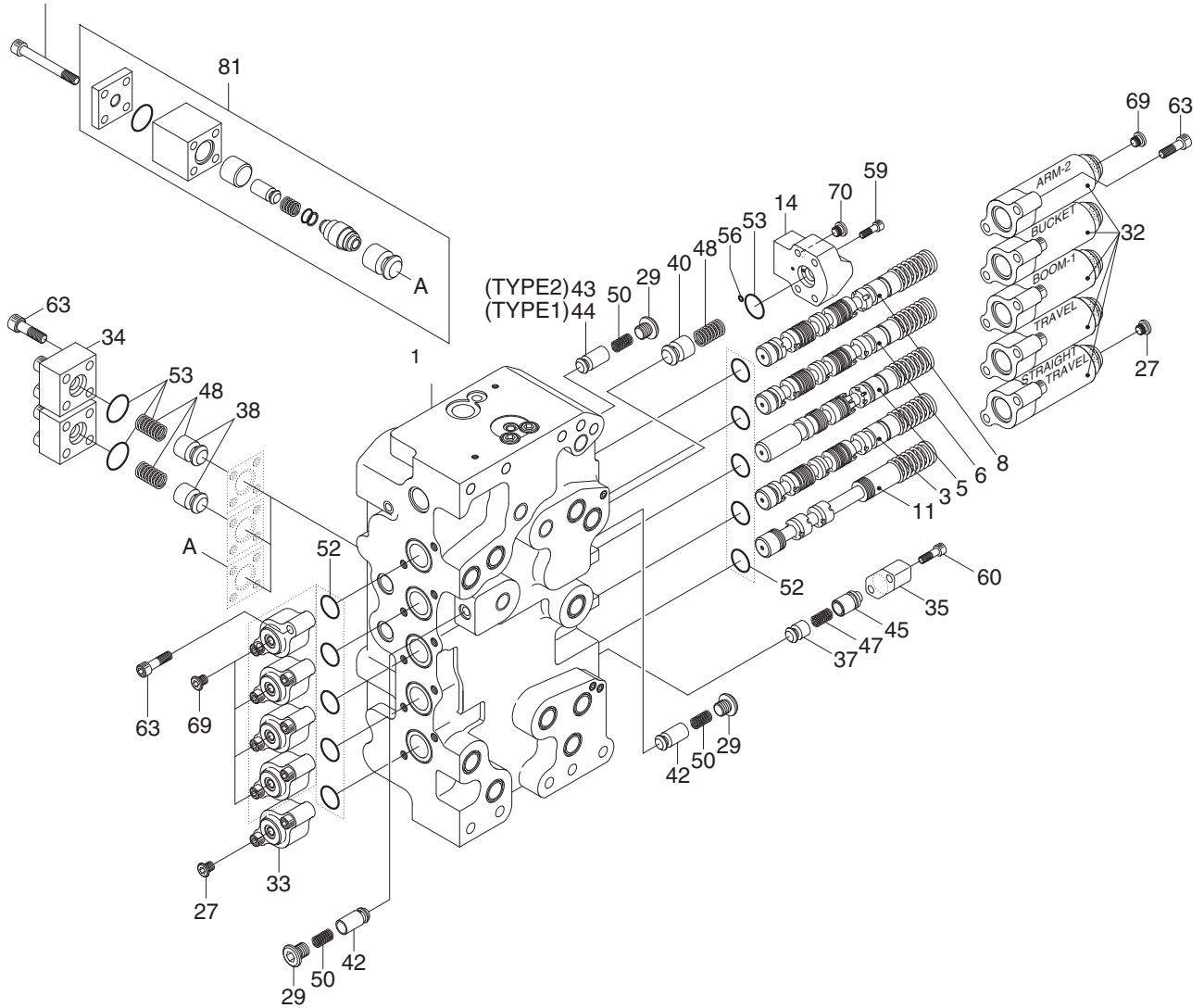
- 2 P2 housing
- 3 Travel spool kit
- 4 Arm 1 spool kit
- 7 Swing spool kit
- 9 Boom 2 spool kit
- 10 Option spool kit
- 13 Swing logic valve
- 14 Holding valve
- 16 Main relief valve
- 23 Signal plug assy
- 28 Plug
- 29 Plug
- 32 Pilot cap-large
- 33 Pilot cap-small
- 34 Load lock flange

- 35 Main relief flange
- 36 Option flange
- 37 Main relief poppet
- 38 Load check poppet
- 39 Load check poppet
- 40 Main holding poppet
- 45 Main relief spacer assy
- 47 Main relief spring
- 48 Load check spring
- 52 O-ring
- 53 O-ring
- 54 O-ring
- 56 O-ring
- 58 O-ring
- 59 Socket bolt

- 60 Socket bolt
- 62 Socket bolt
- 63 Socket bolt
- 64 Socket bolt
- 66 Socket bolt
- 67 Socket bolt
- 69 Dust cap
- 70 Dust cap
- 71 Cover
- 72 Gasket
- 73 Cover
- 74 Gasket
- 75 Cover
- 76 Gasket
- 77 Name plate
- 78 Rivet

480S8MC04

STRUCTURE (3/3)

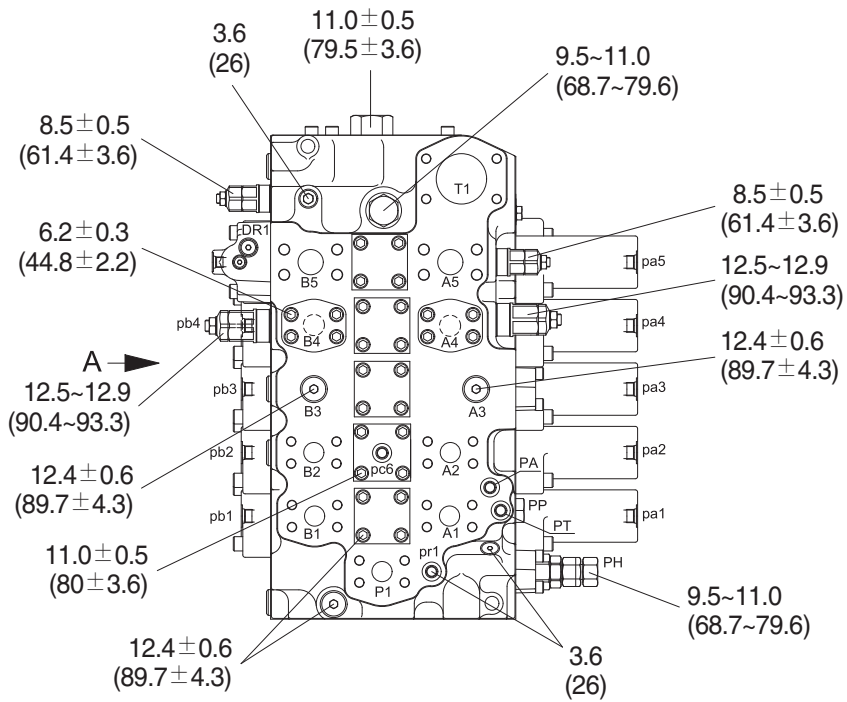
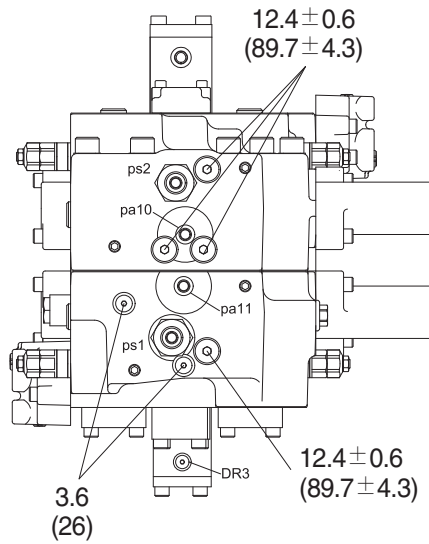


480S8MC05

- | | | | | | |
|----|---------------------------|----|-------------------------|----|------------------|
| 1 | P1 housing | 34 | Load check flange | 50 | Spring |
| 3 | Travel spool kit | 35 | Main relief flange | 52 | O-ring |
| 5 | Boom 1 spool kit | 37 | Main relief poppet | 53 | O-ring |
| 6 | Bucket spool kit | 38 | Load check poppet | 56 | O-ring |
| 8 | Arm 2 spool kit | 40 | Main H/D poppet | 59 | Socket bolt |
| 11 | Straight travel spool kit | 42 | Poppet | 60 | Socket bolt |
| 14 | Holding valve | 43 | Poppet | 62 | Socket bolt |
| 27 | Plug | 44 | Poppet | 63 | Socket bolt |
| 29 | Plug | 45 | Main relief spacer assy | 69 | Dust cap |
| 32 | Pilot cap-large | 47 | Main relief spring | 70 | Dust cap |
| 33 | Pilot cap-small | 48 | Load check spring | 81 | Boom logic valve |

3. TIGHTENING TORQUE (1/2)

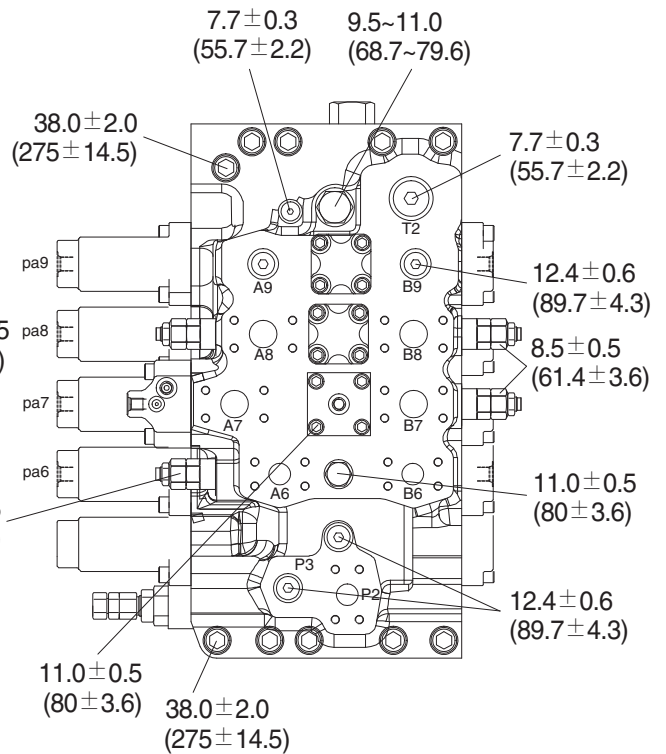
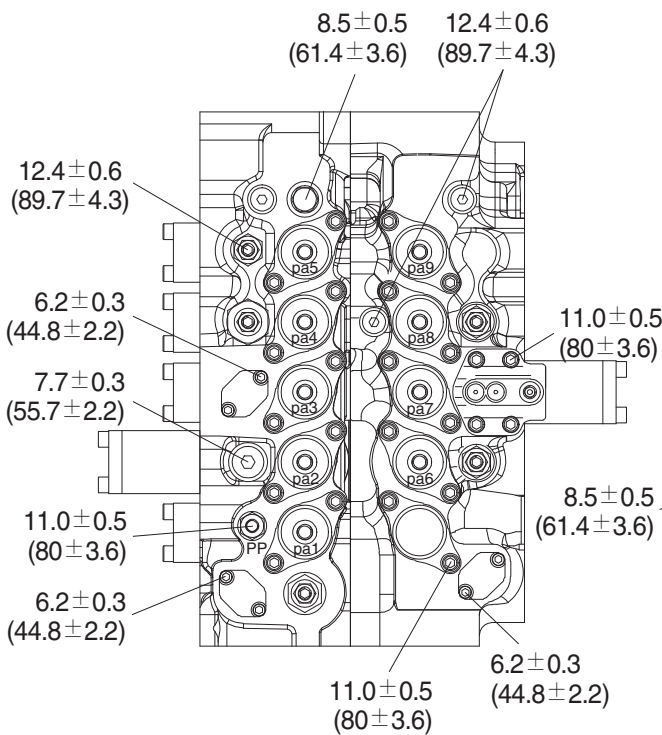
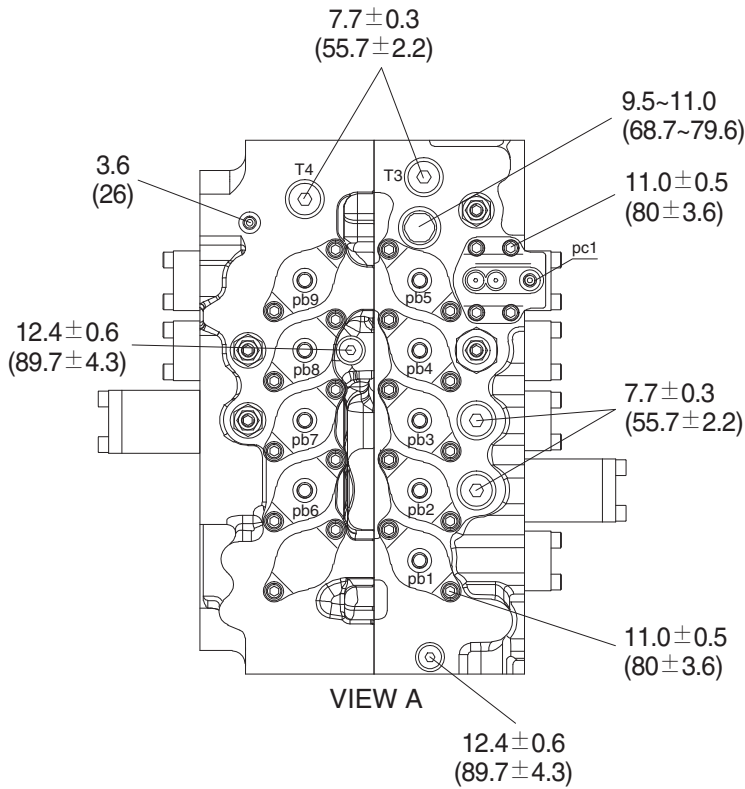
※ Unit : kgf · m (lbf · ft)



480S8MV07

TIGHTENING TORQUE (2/2)

※ Unit : kgf · m (lbf · ft)



480S8MV08

4. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.
- (2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (3) When a control valve is to be 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 the hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) DISASSEMBLY

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

(1) Place control valve on working bench

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

(2) Main spool

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



45078MC07

- ② Remove all spool (3~11) of subassembly itself from valve housing.
 - ※ Be careful not to be damaged while pulling out spools. Identify them with a tag to prevent from being mistaken at disassembly.



45078MC08

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



45078MC10

④ Spool sub assy (5).



45078MC11

⑤ Spool sub assy (4).

- ※ When disassemble the spool assembly, fix the spool with vise. On this occasion attach wood between vise blades to prevent the spool from damaging.
- ※ Heat the outer race of spool with industrial drier and then loosen easily. (Temperature : 200~250°C)



45078MC12

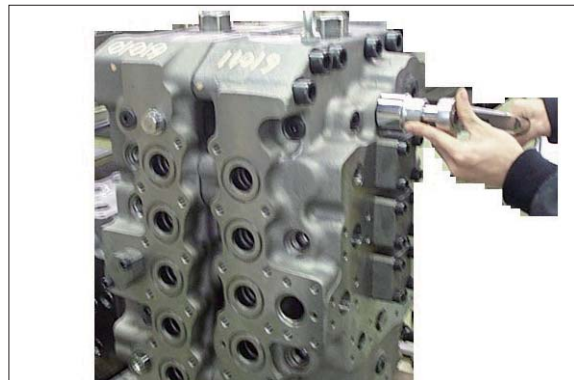
- ⑥ Loosen the socket head bolt (63) and remove the small pilot cap (33).
Pull out O-ring (14) from valve housing.



45078MC09

(3) Center bypass cut spool assy (12)

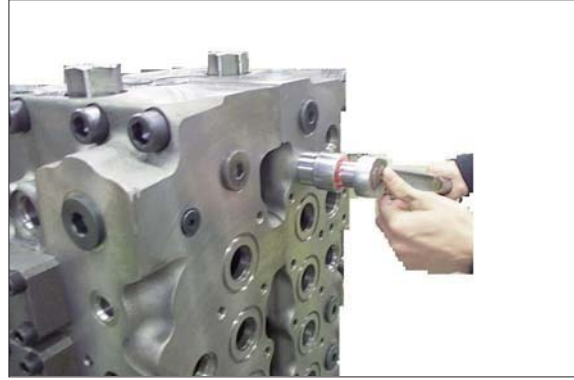
- ① Loosen the plug (24) and remove spring (46), spring seat (68) and the spool (12).



45078MC13

(4) Arm1 regeneration spool assy (15)

① Loosen the plug and pull out O-ring.



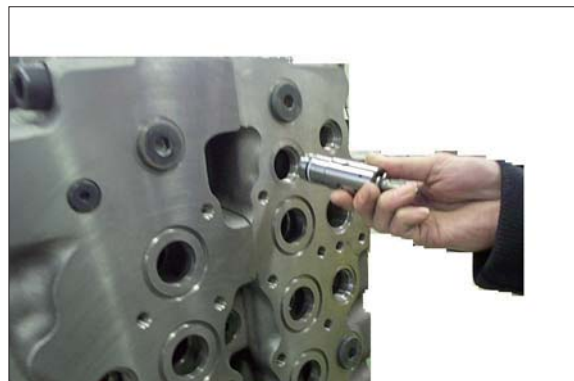
45078MC15

② Disassemble spring, spring seat and spool.



45078MC16

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



45078MC18

(5) General precautions

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

① Control valve

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

② Relief valve

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

3) ASSEMBLY

(1) General comments

- ① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures and photographs shown in the previous disassembly section.
- ② Figure in () shown after the part name in the explanation refers to the reference identity number shown on the construction figure shown in the spares section.
- ③ Cautions in assembling seal
 - a. Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
 - b. Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
 - c. Do not stretch seals so much as to deform them permanently.
 - d. In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
 - e. Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque as shown on the cross section drawings of the spares section.

(2) Main spool

- ① Apply loctite to thread of spools (3, 4, 5, 6, 7, 8, 9, 10, 11) and assemble spring seat, spring and spool end. Assemble spool end to spool after fixing spool with a vise attached wood.
※ Be careful not to applying loctite too much.
 - Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)Fit O-ring into housing and assemble spools (3, 4, 5, 6, 7, 8, 9, 10, 11) into housing.
Assemble lock cap on housing and tighten hex socket bolt.
 - Tightening torque : 11 ± 0.5 kgf · m (79.7 ± 3.7 lbf · ft)
- ② Insert poppet, spring into spool (5) and then apply loctite to thread of spool.
Fit O-ring and backup ring on the plug and then tighten plug.
Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.
 - Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)Fit O-ring into housing and assemble spool (5) into housing.
Assemble lock cap on housing and tighten hex socket bolt.
 - Tightening torque : 11 ± 0.5 kgf · m (79.7 ± 3.7 lbf · ft)
- ③ Insert poppet, spring into spool (4) and then apply loctite to thread for spool.
Fit O-ring and backup ring on the plug and then tighten plug.
Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.
 - Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)Fit O-ring into housing and assemble spool (4) into housing.
Assemble lock cap on housing and tighten hex socket bolt.
 - Tightening torque : 2.5 ± 2.7 kgf · m (18.1 ± 19.5 lbf · ft)
- ④ Assemble short cap on housing and tighten hex socket bolt.
 - Tightening torque : 11 ± 0.5 kgf · m (79.7 ± 3.7 lbf · ft)

(3) Center bypass cut spool assy (12)

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

(4) Arm1 regeneration spool assy (15)

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

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.

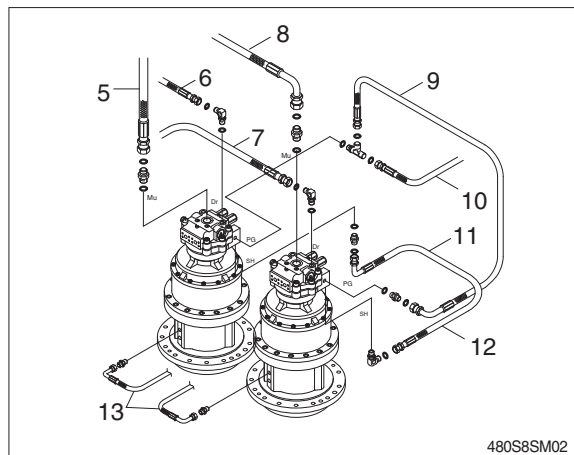
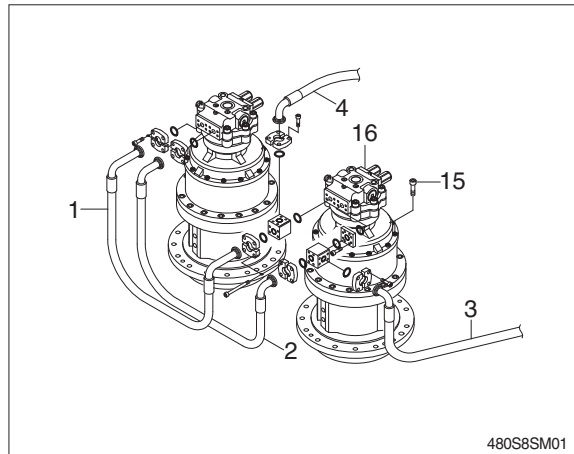
- (4) Disconnect hose assembly (1, 2, 3, 4).
- (5) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10, 11, 12, 13, 14).
- (6) Sling the swing motor assembly (16) and remove the swing motor mounting socket bolts (15).
 - Motor device weight : 61 kg (135 lb)
 - Tightening torque : $8.27 \pm 1.7 \text{ kgf} \cdot \text{m}$
($59.8 \pm 12.3 \text{ lbf} \cdot \text{ft}$)

- (7) Remove the swing motor assembly.

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

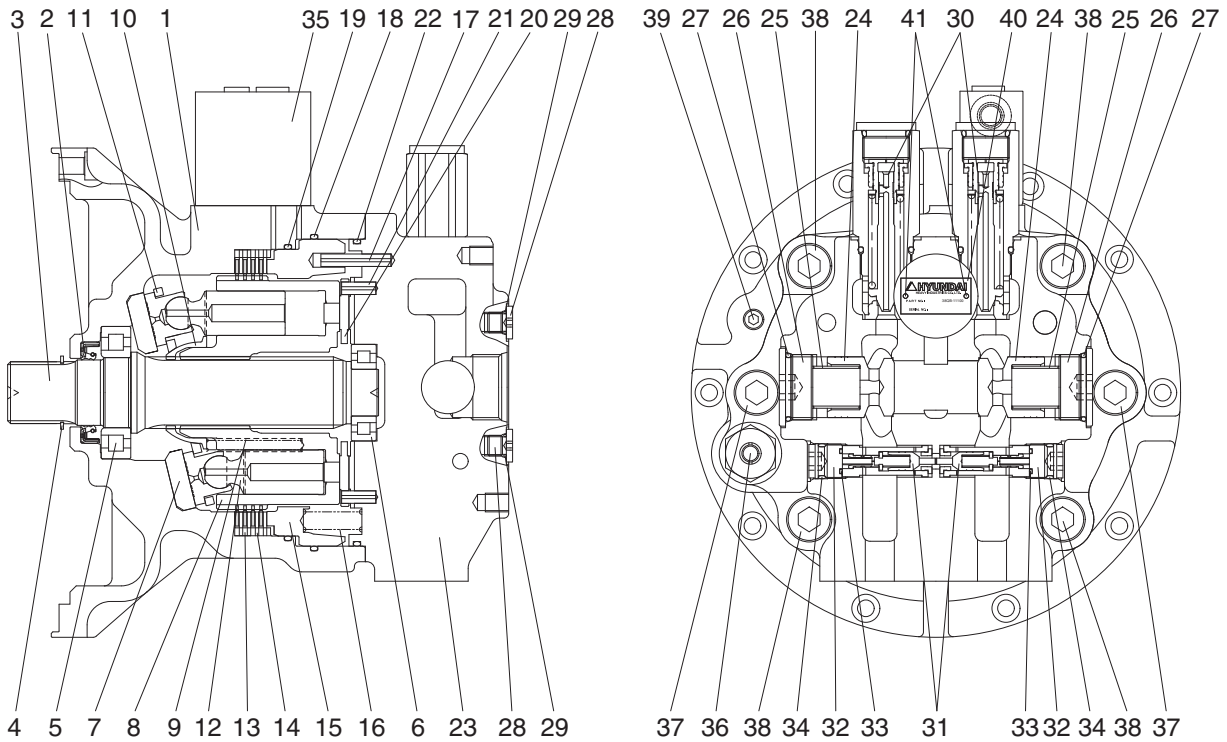
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



480S2SM02

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

2) DISASSEMBLING

(1) Disassembly the sub of a turning axis

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



480L2SM10

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



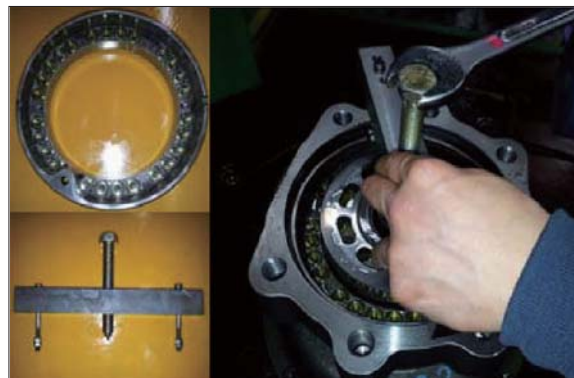
480L2SM11

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



480L2SM12

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



480L2SM13

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



480L2SM14

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



480L2SM15

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



480L2SM16

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



480L2SM17

(2) Disassemble cylinder block assy

- ① Disassemble piston assy (12) from cylinder block assy (8).



480L2SM18

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

- Ball guide × 1EA
- Spring × 9EA



480L2SM19

(3) Disassemble valve casing assy

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



480L2SM20

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



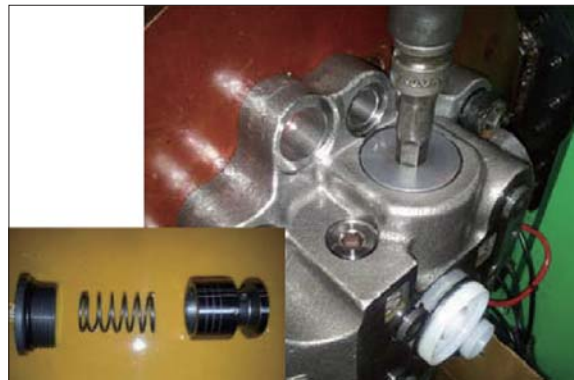
480L2SM21

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



480L2SM22

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



480L2SM23

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



480L2SM24

3) ASSEMBLING

(1) Assemble the sub of a shaft assy

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



480L2SM25

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



480L2SM26

(2) Assemble the sub of cylinder block assy

- ① Put springs (9, cylinder block) on holes of cylinder block.
 - Spring × 9EA



480L2SM27

- ② Put ball guide (10) on cylinder block (8).
 - Ball guide × 1EA



480L2SM28

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



480L2SM29

- ④ Put ② and ③ together as one.



480L2SM30

(3) Assemble the sub of valve casing assy

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



480L2SM31

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



480L2SM32

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



480L2SM33

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



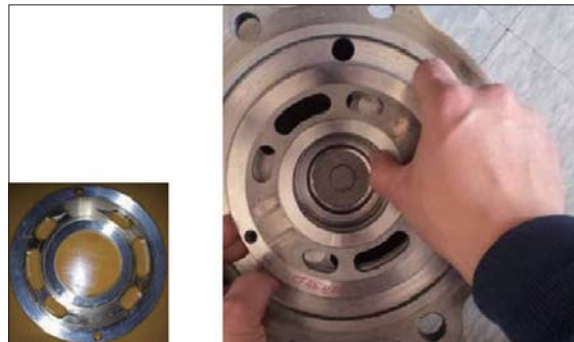
480L2SM34

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



480L2SM35

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



480L2SM36

(4) Assemble the sub of moving axis

- ① Using jig and compressing tool, assemble oil seal into casing.
· Oil seal (2) × 1EA



480L2SM37

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



480L2SM38

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

· Snap ring × 1EA



480L2SM39

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

· Swash plate × 1EA



480L2SM40

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



480L2SM41

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



480L2SM42

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



480L2SM43

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



480L2SM44

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



480L2SM45

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



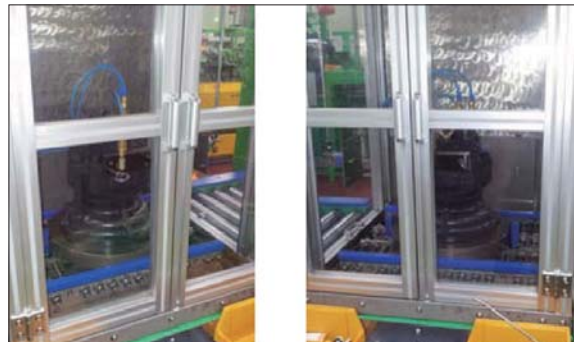
480L2SM46

- ⑪ After assembling time delay valve assy (35) into valve casing (23), tighten hex bolt (42).
- Time delay valve assy×1EA
 - Hex bolt×3EA



480L2SM47

- ⑫ Air leak test
After putting assembled swing motor into test tank, excute the air leak test for 2 min at 2k.



480L2SM48

⑬ Leakage test

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



480L2SM49

⑭ Mount test bench

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



480L2SM50

3. REMOVAL AND INSTALL OF REDUCTION GEAR

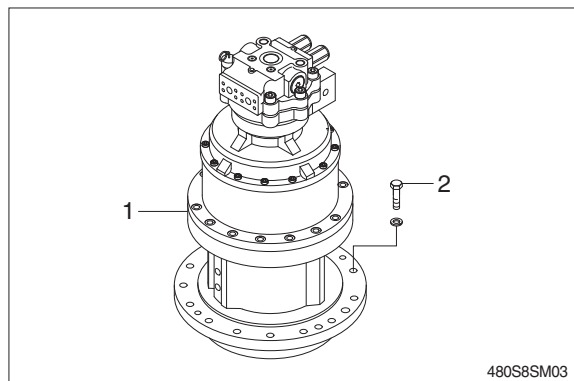
1) REMOVAL

- (1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.
- (2) Sling reduction gear assembly (1) and remove mounting bolts (2).
- (3) Remove the reduction gear assembly.
 - Reduction gear device weight : 180 kgf · m
(396 lbf · ft)



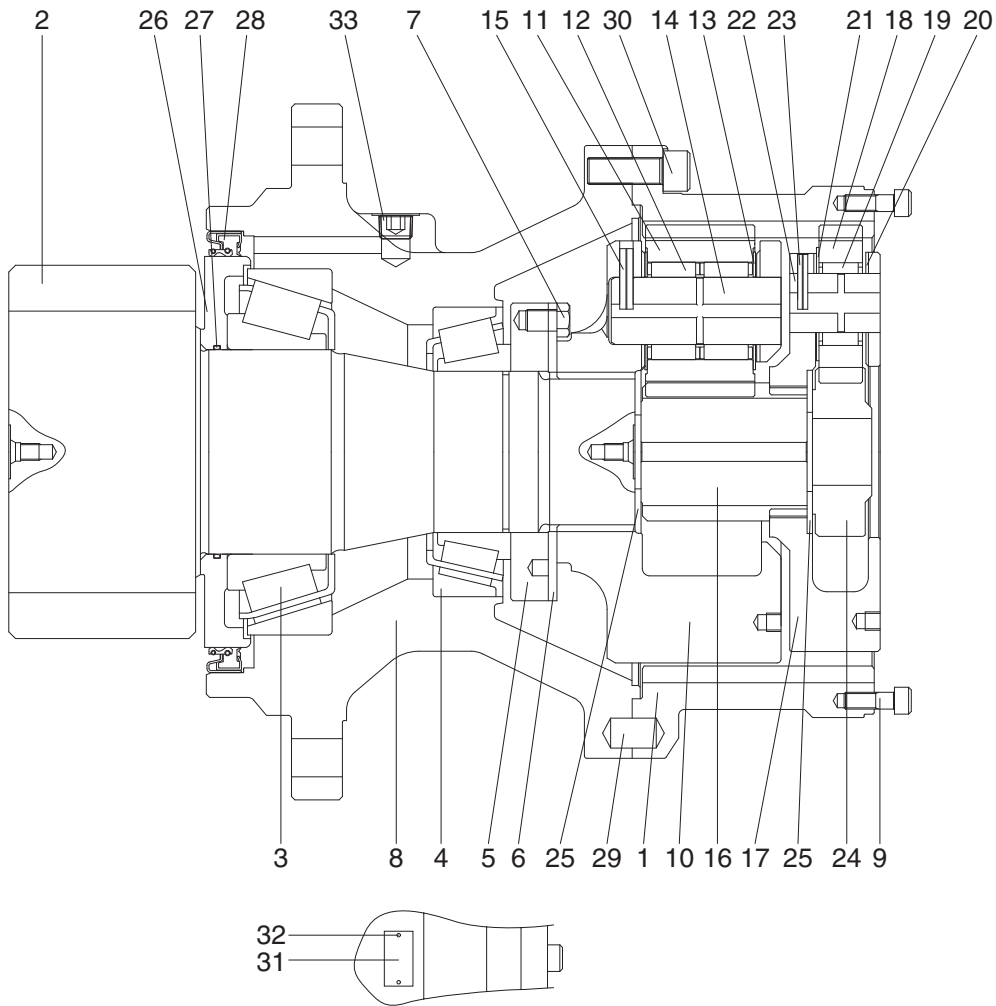
2) INSTALL

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



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



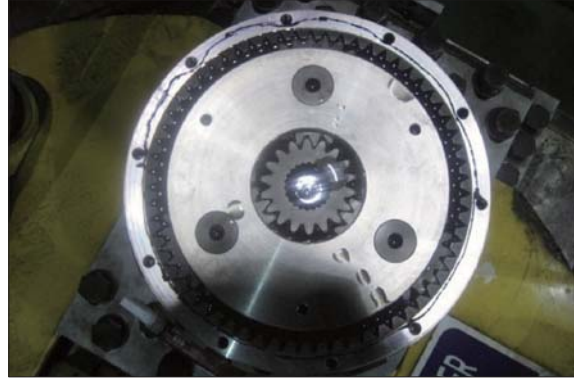
480F2SM03

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

2) PREPARATION FOR DISASSEMBLING

- (1) The reduction units removed from excavator are usually covered with mud. Wash out side of unit and dry it.
- (2) Setting reduction unit on work stand for disassembling.
- (3) Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.

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



480L2SM51

3) DISASSEMBLY

- (1) Remove every "socket bolt (M10)" that secure hydraulic motor and reduction gear.
- (2) Removing carrier sub assy & sun gear
 - ① Removing No.1 sun gear from No.1 carrier sub assy. (Be sure maintaining it vertical with ground when disassembling No.1 sun gear.)



480L2SM52

- ② Removing No.1 carrier sub assy screwing I-bolt to tab hole (M10) in No.1 carrier. (Lifting it gradually maintaining it vertical with ground.)
- ※ It's impossible to disassemble No.1 pin spring. If No.1 pin spring has problem, change whole No.1 carrier sub assy .



480L2SM53

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



480L2SM54

- ④ Removing No.2 carrier sub assy screwing I-bolt to tab hole (M10) in No.2 carrier. (Lifting it gradually maintaining it vertical with ground.)
- ※ It's impossible to disassemble No.2 pin spring. If No.2 pin spring has problem, change whole No.2 carrier sub assy.



480L2SM55

(3) Removing ring gear

After unscrewing every socket bolt (M16),
remove ring gear from casing.

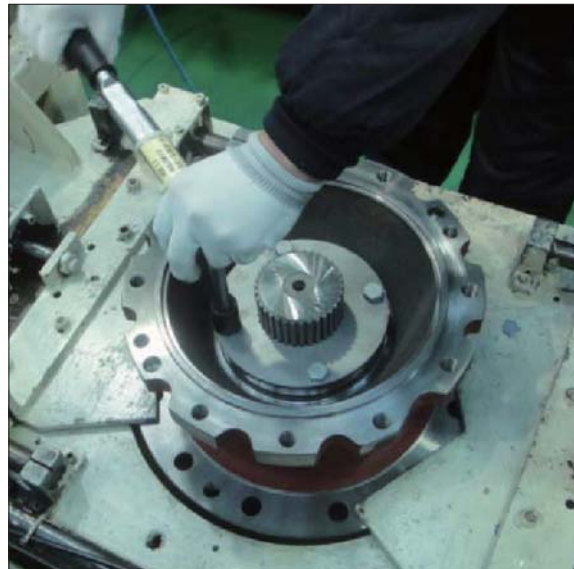
(Because of liquid gaskets between ring
gear and casing, put sharp punch
between ring gear and casing and
tapping it to remove them.)



480L2SM56

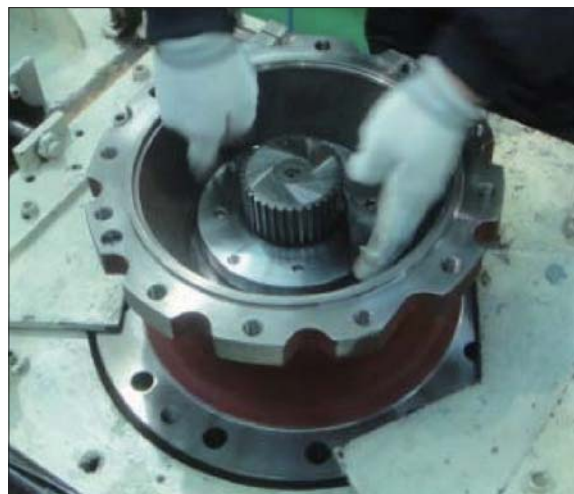
(4) Removing drive shaft sub assy

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



480L2SM57

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



480L2SM58

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



480L2SM59

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



480L2SM60



480L2SM61

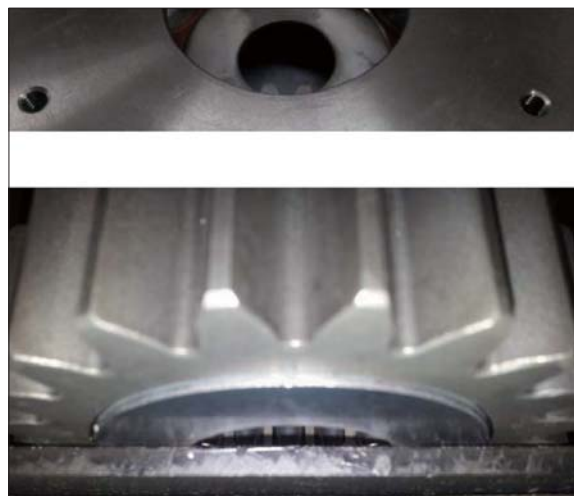
4) ASSEMBLY

(1) General notes

- ① Clean every part by kerosene and dry them in a cool and dry place.
- ② Loctite on surface must be removed by solvent.
- ③ Check every part for any abnormal.
- ④ Each hexagon socket head bolt should be used with loctite #242 applied on its threads.
- ⑤ Apply gear oil slightly on each part before assembling.
- ⑥ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.
- ⑦ Inspection before assembling.
- ⑧ **Thrust washer**
 - Check the seizure, abnormal wear or uneven wear.
 - Check the unallowable wear.
- ⑨ **Gears**
 - Check the pitting or seizure on tooth surface.
 - Check the cracks on the root of tooth.
- ⑩ **Bearing**
 - Rotate it by hands to check such noise or uneven rotation.

(2) Assembling No.1 carrier sub assy

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



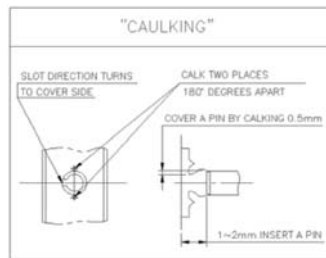
480L2SM62

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



480L2SM63

- ④ Caulk carrier holes to make No.1 pin spring settle down stably.
 (Caution : Refer to “caulking details”)
 ※ Use paint marker for marking after caulking.



480L2SM64



480L2SM65

(3) Assembling No.2 carrier sub assy

- ① Put thrust plate in firmly No.2 carrier.



480L2SM66

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



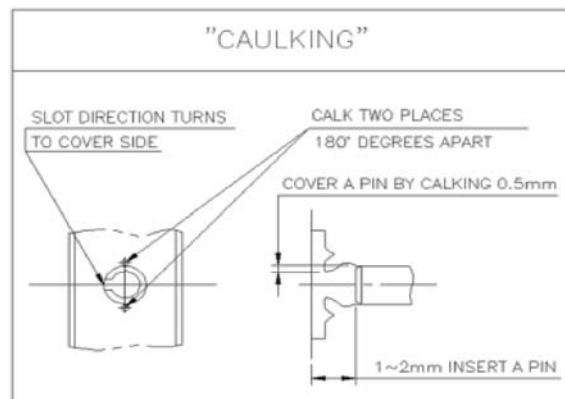
480L2SM67

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



480L2SM68

- ④ Caulk carrier holes to make No.2 pin spring settle down stably.
(Caution : Refer to “caulking details”)
※ Use paint marker for marking after caulking.



480L2SM69

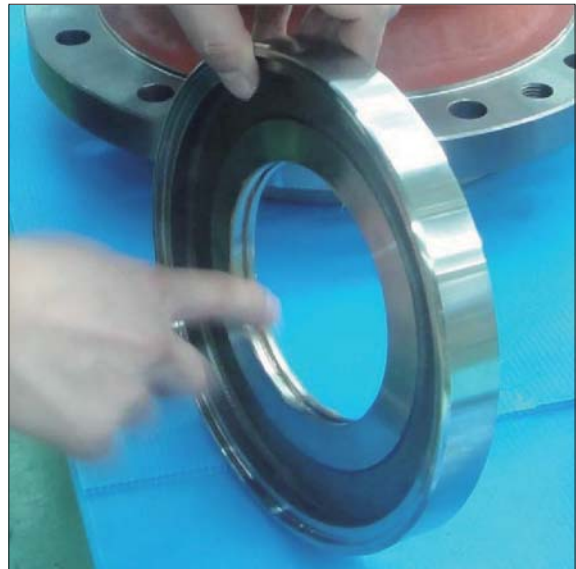
(4) Assembling pinion gear sub assy

- ① Prepare drive shaft pinion gear vertical with ground.



480L2SM70

- ② Fully apply grease (albania ep02) to sleeve's O-ring gutter.
(Be sure to maintain it vertical with ground when assembling it.)
- ③ Put O-ring into sleeve's O-ring gutter.
(Fully apply grease on O-ring.)



480L2SM71

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



480L2SM72



480L2SM73

(5) Assembling bearing cup & oil seal

- ① Put top, bottom bearing cup into casing.
(Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.)
- ※ Flip over casing to assemble oil seal.



480L2SM74



480L2SM75

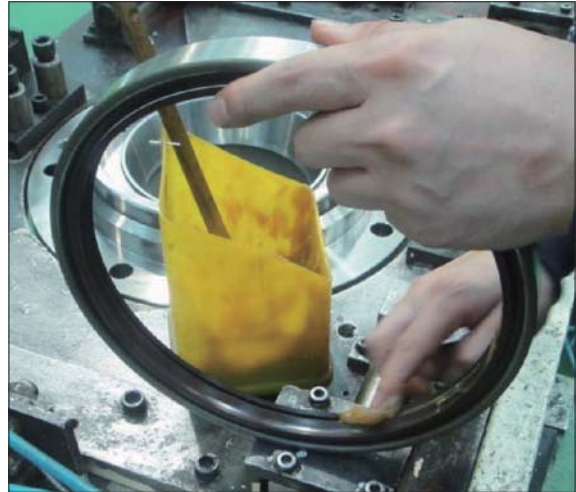
- ② Assemble oil seal to casing.
(Use special jig for pressing. Pay attention to direction of dust seal and dent.)



480L2SM76

While assembling oil seal

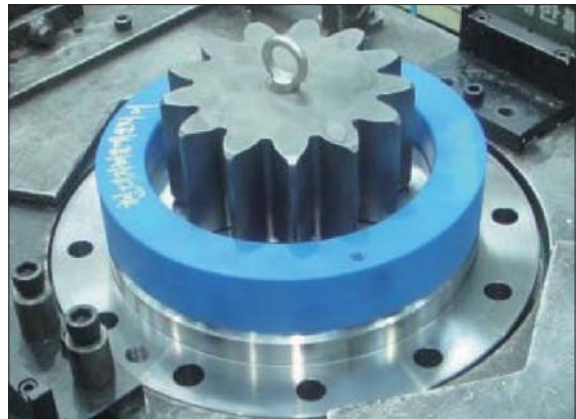
1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease in and outside of oil seal.



480L2SM77

(6) Assembling shaft sub assy & nut ring

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



480L2SM78

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



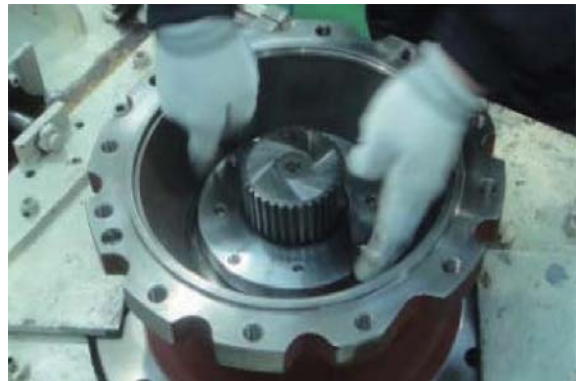
480L2SM79

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



480L2SM80

- ④ Put nut ring into drive shaft sub assy by using special jig.
· M95 / The tightening torque :
 $3.5 \pm 0.4 \text{ kgf} \cdot \text{m}$ ($25.3 \pm 2.9 \text{ lbf} \cdot \text{ft}$)
※ Apply enough loctite #242 before screwing bolts.



480L2SM81



480L2SM82

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



480L2SM83



480L2SM84

- ⑥ Screw 4 bolts (M12×16) to connect nut ring and lock plate by using torque wrench.
· 4-M12 / bolt = 12.9T
· The tightening torque :
 $8.8 \pm 0.9 \text{ kgf} \cdot \text{m}$ ($63.7 \pm 6.5 \text{ lbf} \cdot \text{ft}$)
※ Apply enough loctite #242 before screwing bolts.



480L2SM85

- ⑦ Use paint marker for checking surplus parts after assembling.

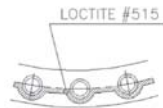


480L2SM86

(7) Assembling ring gear

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

"LOCTITE DETAIL"

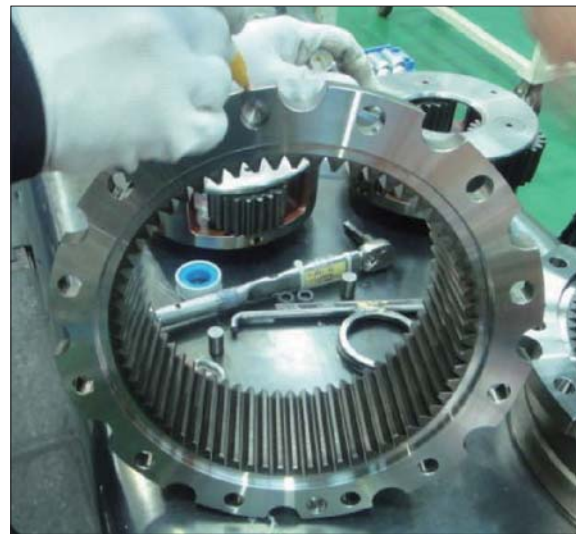


480L2SM87



480L2SM88

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



480L2SM89

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



480L2SM90

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

· 12-M16 / bolt : 12.9T

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

- ※ Apply enough loctite #242 before screwing bolts.



480L2SM91

- ⑤ Use paint marker for checking surplus parts after assembling.



480L2SM92

(8) Assembling carrier sub assy & sun gear

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



480L2SM93

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



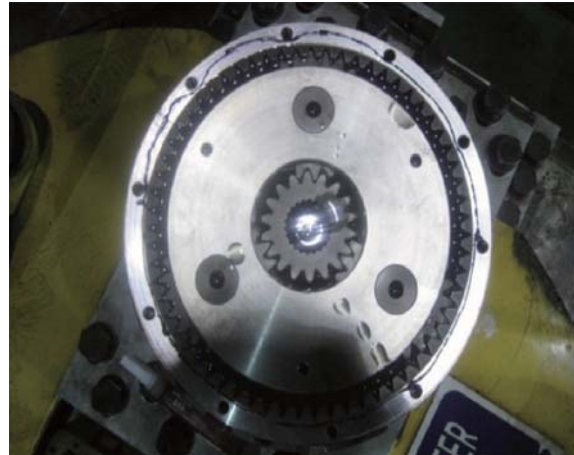
480L2SM94

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



480L2SM95

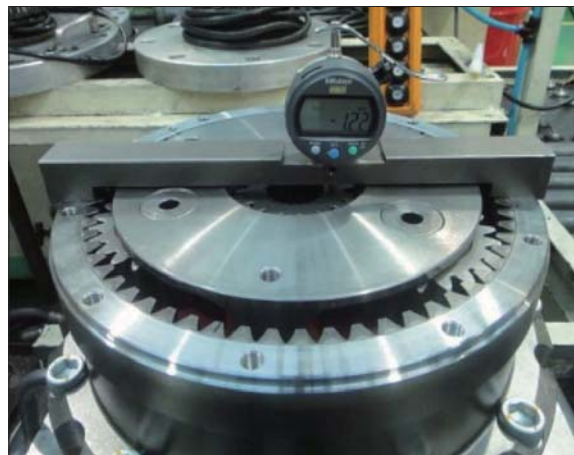
- ④ Put No.1 sun gear into No.1 carrier sub assy.
(Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.)
- ⑤ Rotate No.1 carrier sub assy by hands to check noise.



480L2SM96

(9) Measuring clearance & assembling name plate

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



480L2SM97

GROUP 6 TRAVEL DEVICE (TYPE 1, 2)

1. REMOVAL AND INSTALL

1) REMOVAL

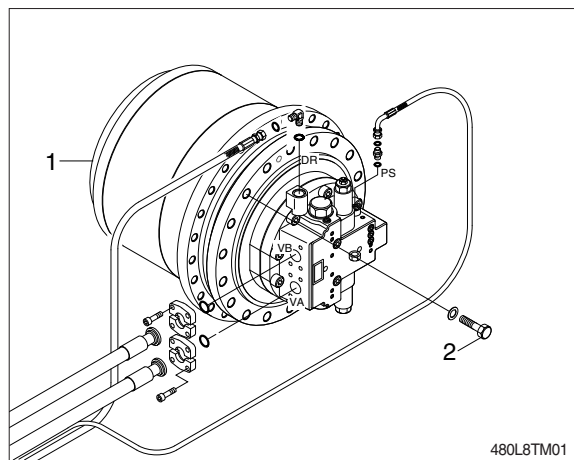
- (1) Swing the work equipment 90 ° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

- ※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.
 - (5) Remove the cover.
 - (6) Remove the hoses.
 - ※ Fit blind plugs to the disconnected hoses.
 - (7) Remove the bolts and the sprocket.
 - (8) Sling travel device assembly (1).
 - (9) Remove the mounting bolts (2), then remove the travel device assembly.
 - Weight : 632 kg (1393 lb)
 - Tightening torque : 57.9 ± 8.7 kgf · m
(419 ± 62.9 lbf · ft)



13031GE18



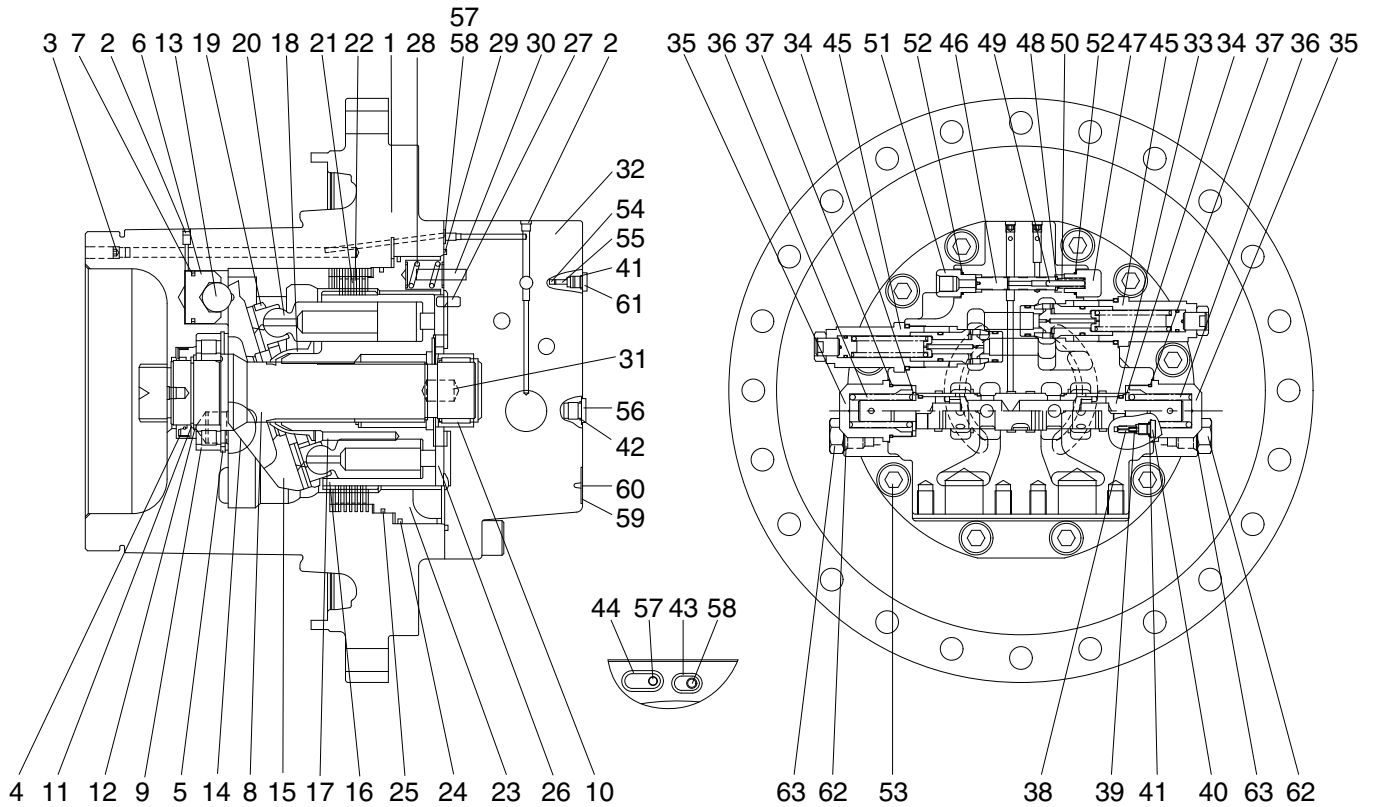
480L8TM01

2) INSTALL

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

2. TRAVEL MOTOR

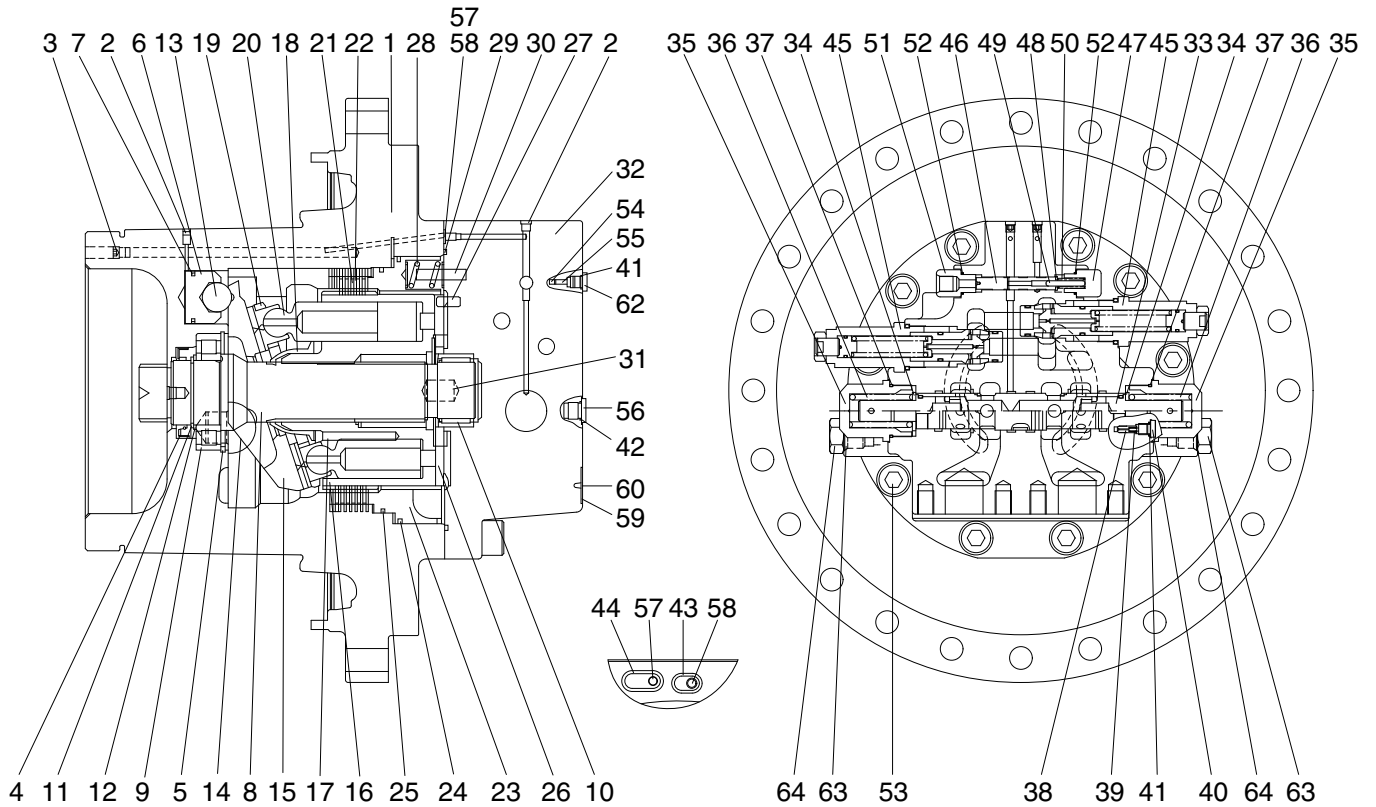
1) STRUCTURE (TYPE 1)



480A2TM02

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

STRUCTURE (TYPE 2)



480F2TM02

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

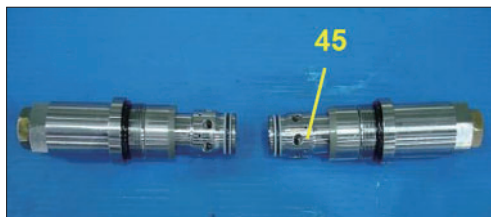
3. DISASSEMBLING OF MOTOR

1) GENERAL PRECAUTIONS

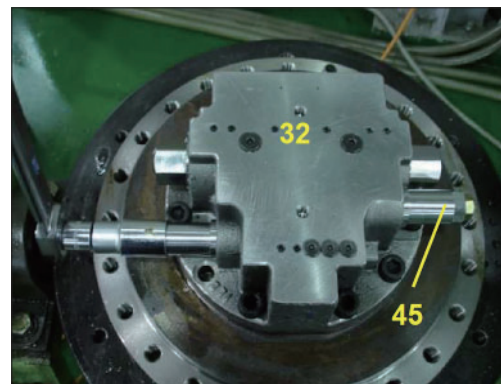
- (1) Pay attention to not damaging contact surfaces for O-rings, oil seals, etc. and contact/sliding surfaces for gears, pins, bearings, etc.
- (2) This motor can be disassembled even in a state on the reduction gear. However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.
- (3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings**.
- (4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

2) DISASSEMBLY OF REDUCTION GEAR

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

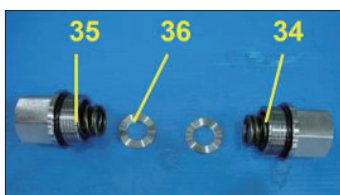


480L2TM11

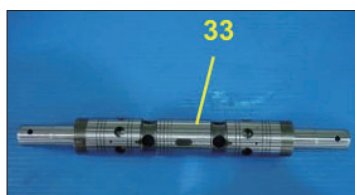


480L2TM12

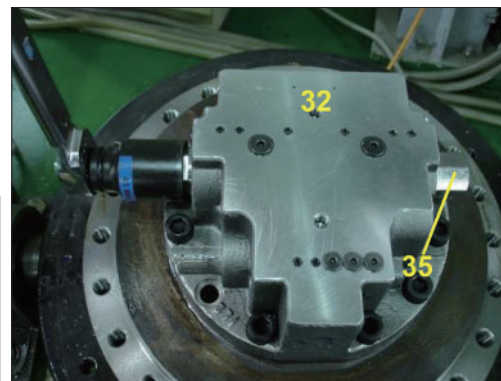
- (2) Disassemble plug (35) from rear cover (32) and then disassemble spring (36), spring seat (34), main spool kit (33) in regular sequence.



480L2TM13

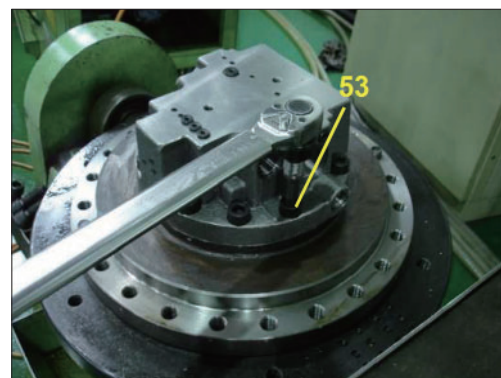


480L2TM14



480L2TM15

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



480L2TM16

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

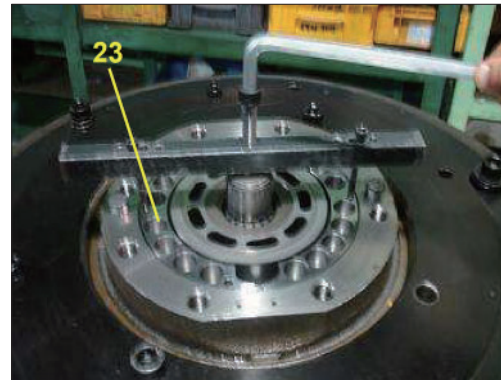


480L2TM17

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

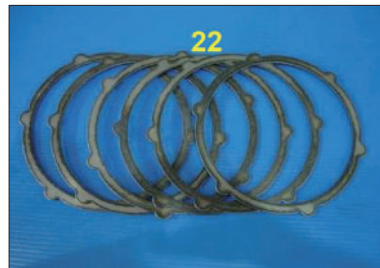


480L2TM18

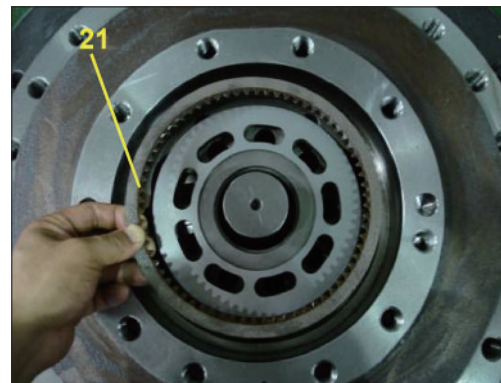


480L2TM19

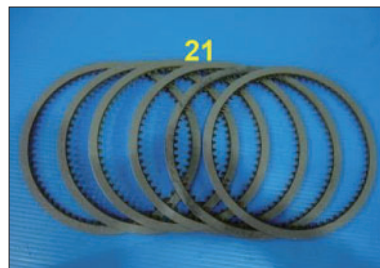
(6) Disassemble separate plate (22)-7EA, friction plate (21)-6EA



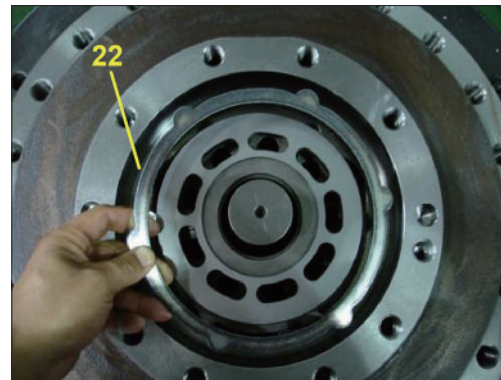
480L2TM20



480L2TM21

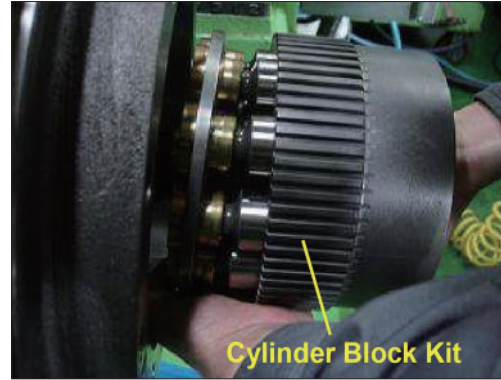


480L2TM22



480L2TM23

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



480L2TM24

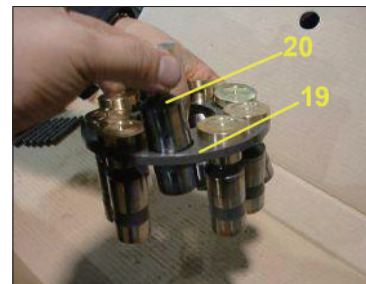
- (8) Disassemble rotary block (16), retainer plate (19), piston and shoe (20), ball guide (18), spring (17) from rotary block kit.



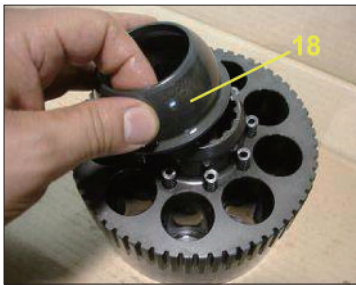
480L2TM25



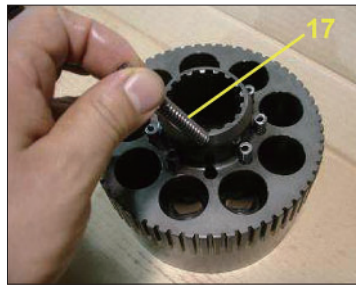
480L2TM26



480L2TM27



480L2TM28



480L2TM29

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

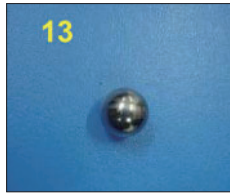


480L2TM30

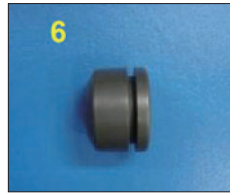


480L2TM31

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



480L2TM32

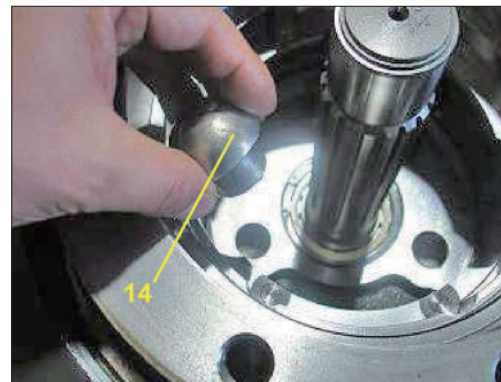


480L2TM33



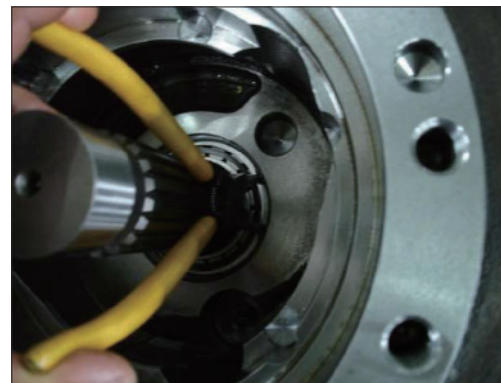
480L2TM34

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



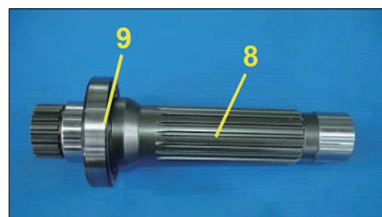
480L2TM35

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

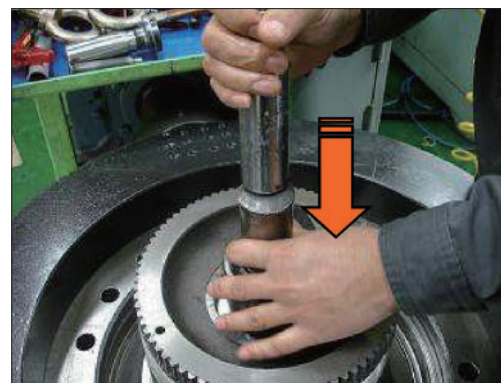


480L2TM36

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

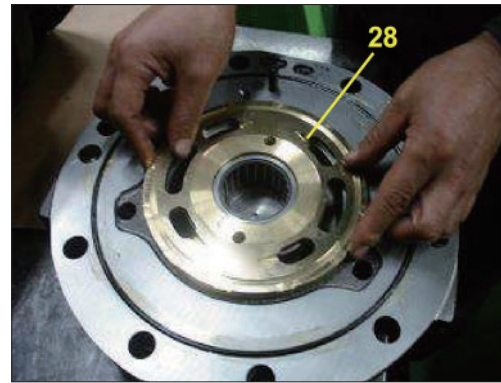


480L2TM37



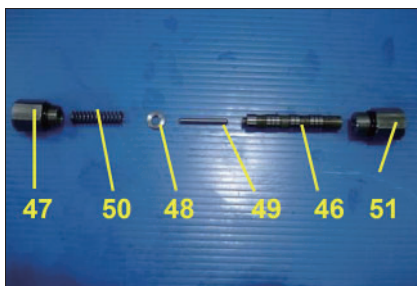
480L2TM38

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

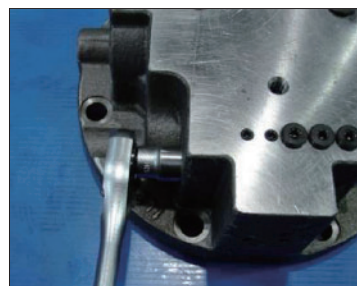


480L2TM39

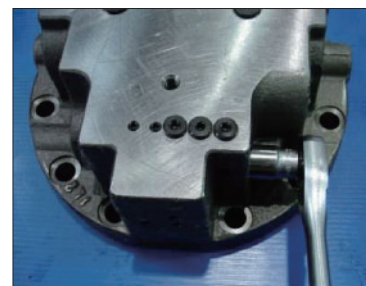
(15) Disassemble plug (47), connector (51) from rear cover (32) and then disassemble spring (50), spring seat (48), parallel pin (49), spool (46) in regular sequence.



480L2TM40

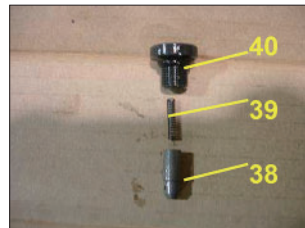


480L2TM41

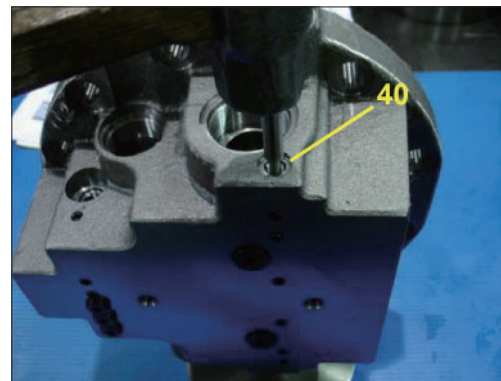


480L2TM42

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

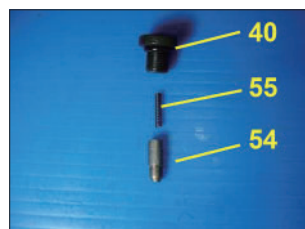


480L2TM43

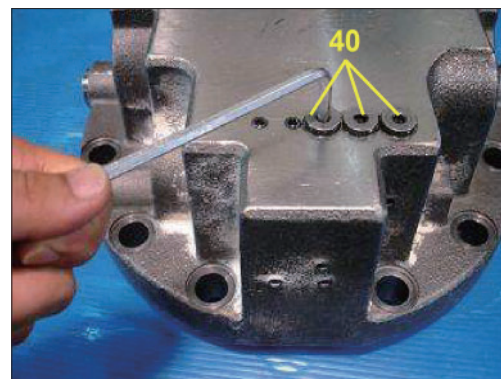


480L2TM44

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

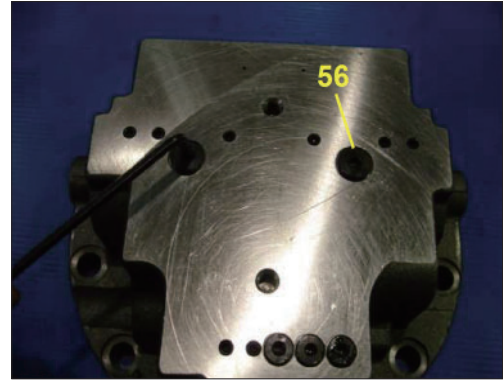


480L2TM45



480L2TM46

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

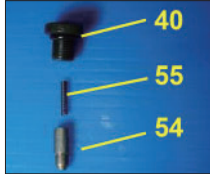


480L2TM47

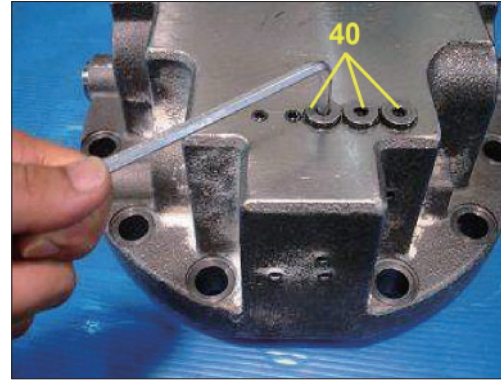
2) ASSEMBLY OF MOTOR

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

· Tightening torque : $3.0 \pm 0.3 \text{ kgf} \cdot \text{m}$
($21.7 \pm 2.2 \text{ lbf} \cdot \text{ft}$)



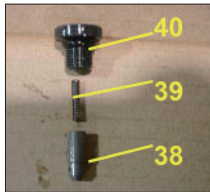
480L2TM48



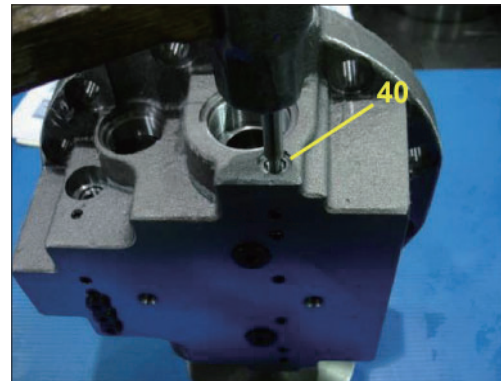
480L2TM49

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

· Tightening torque : $3.0 \pm 0.3 \text{ kgf} \cdot \text{m}$
($21.7 \pm 2.2 \text{ lbf} \cdot \text{ft}$)



480L2TM50

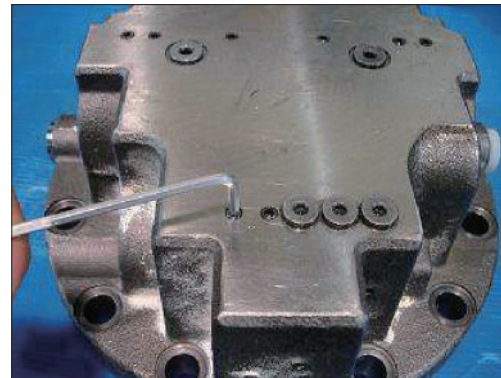


480L2TM51

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



480L2TM52



480L2TM53

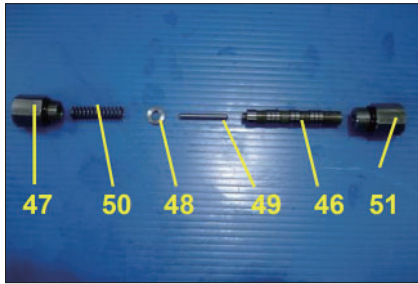
- (4) Assemble 2-PF1/4 plug (56, 61) using torque-wrench.

· Tightening torque : $4.5 \pm 0.5 \text{ kgf} \cdot \text{m}$
($32.5 \pm 3.6 \text{ lbf} \cdot \text{ft}$)

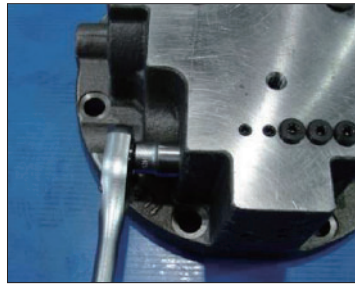


480L2TM54

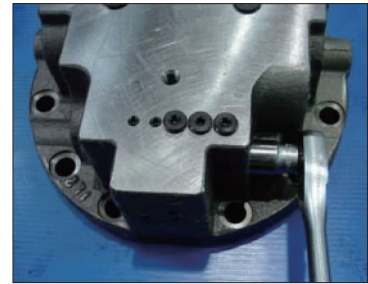
- (5) Insert spool (46), parallel pin (49), spring seat (48), spring (50) in regular sequence and then assemble plug (47), connector (51) using torque wrench.
- Tightening torque : $5.5 \pm 0.5 \text{ kgf} \cdot \text{m}$ ($40 \pm 3.6 \text{ lbf} \cdot \text{ft}$)



480L2TM55



480L2TM56



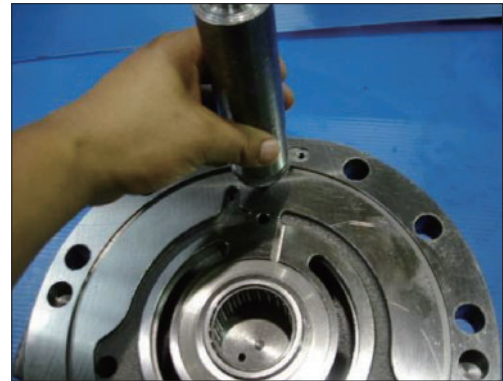
480L2TM57

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



480L2TM58

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

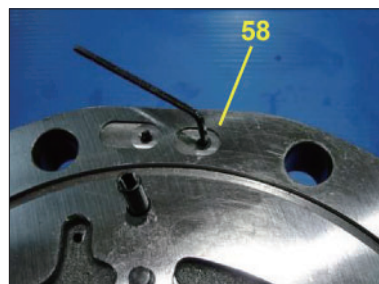


480L2TM59

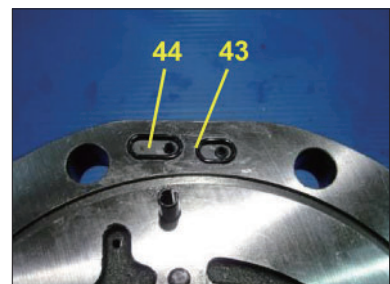
- (8) Apply loctite #242 on the restrictor (57, 58) and then assemble restrictor (57, 58), O-ring (43, 44) into rear cover (32).



480L2TM60

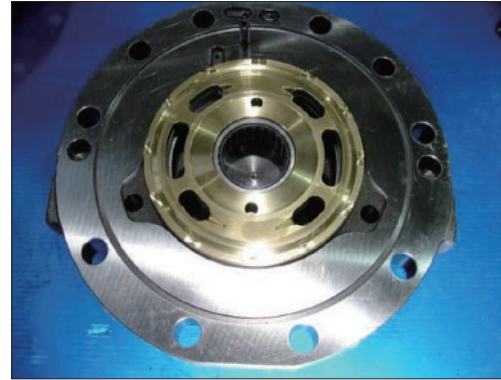


480L2TM61



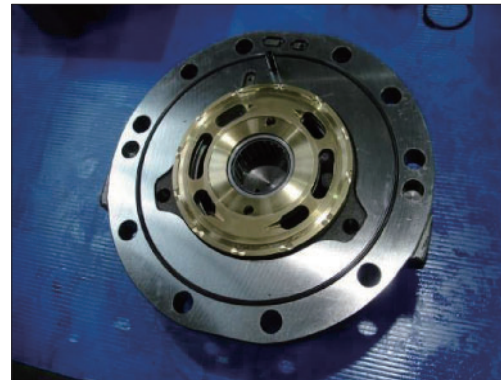
480L2TM62

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



480L2TM63

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



480L2TM64

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

- ① The temperature of the roller bearing : 100°C
* Using tool : heater.
- ② Be careful not to damage the sliding surface for the oil seal on the shaft.



480L2TM65



480L2TM66

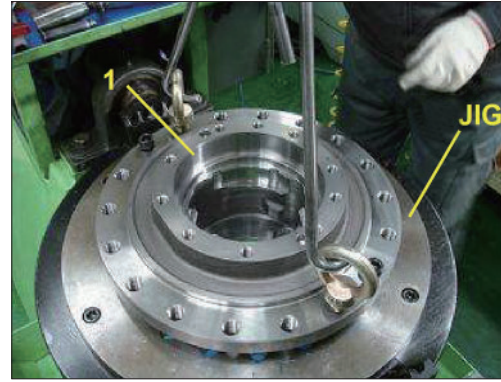


480L2TM67



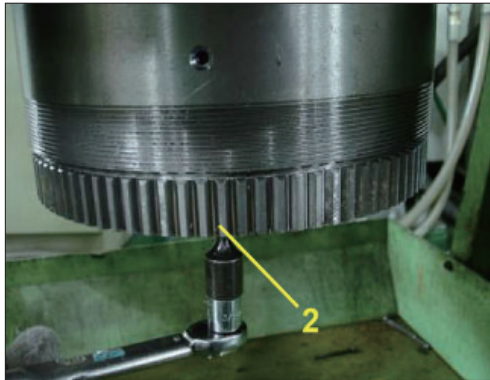
480L2TM68

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



480L2TM69

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

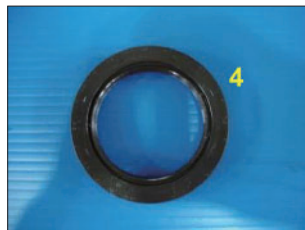


480L2TM70

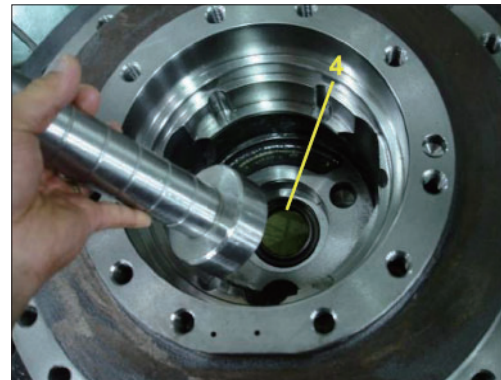


480L2TM71

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

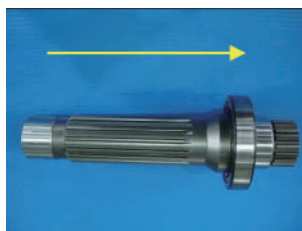


480L2TM72



480L2TM73

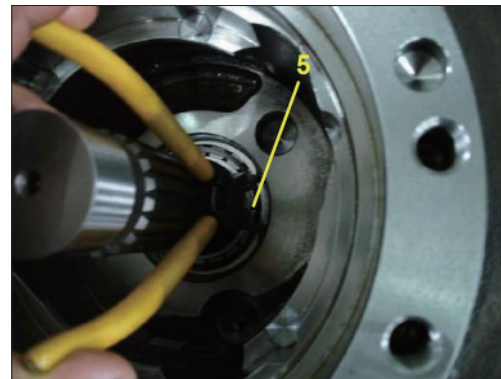
(15) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.



480L2TM74

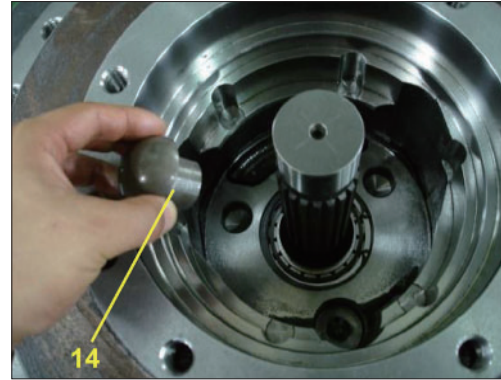


480L2TM75



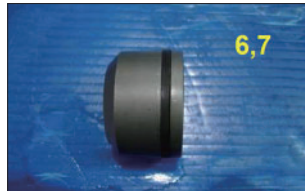
480L2TM76

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

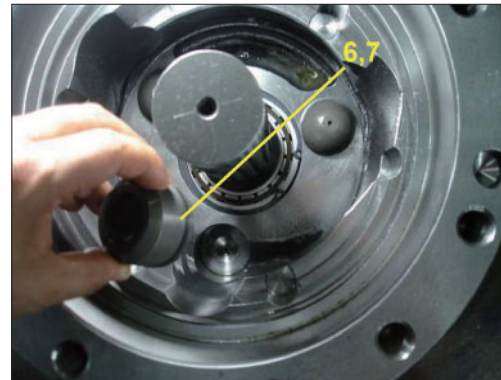


480L2TM77

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



480L2TM78

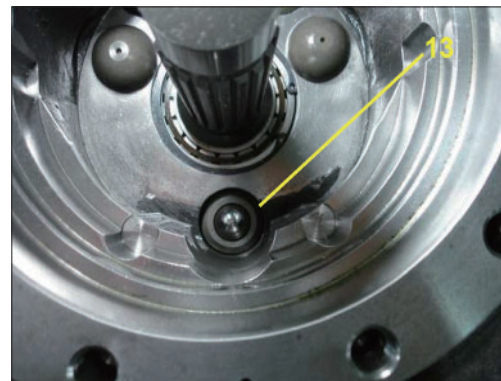


480L2TM79

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



480L2TM80

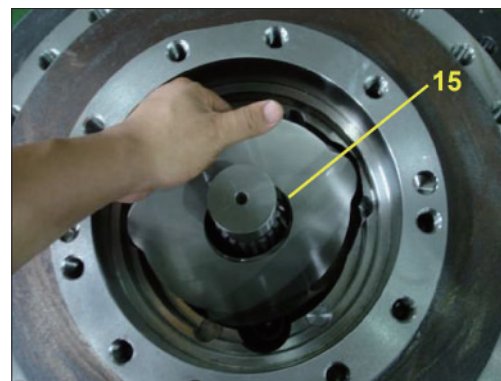


480L2TM81

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

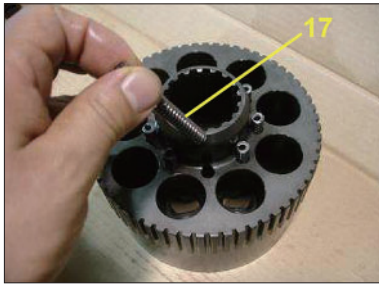


480L2TM82

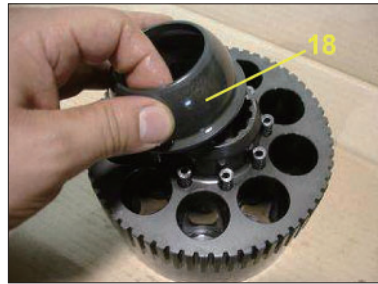


480L2TM83

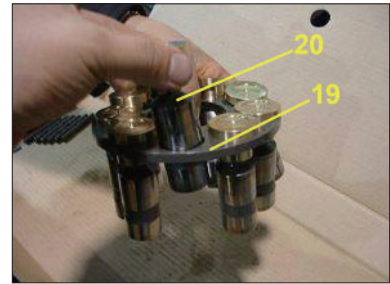
(20) Assemble spring (17), ball guide (18), retainer plate (19), piston and shoe (20) into rotary block (16) in regular sequence.



480L2TM84



480L2TM85



480L2TM86

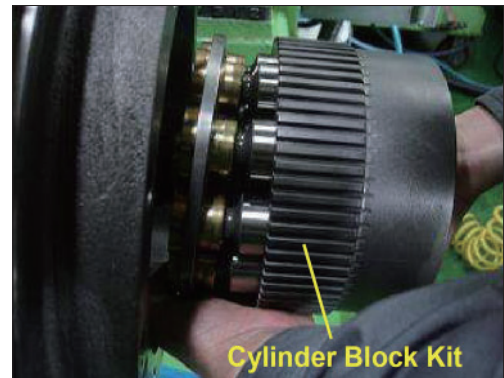


480L2TM87



480L2TM88

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

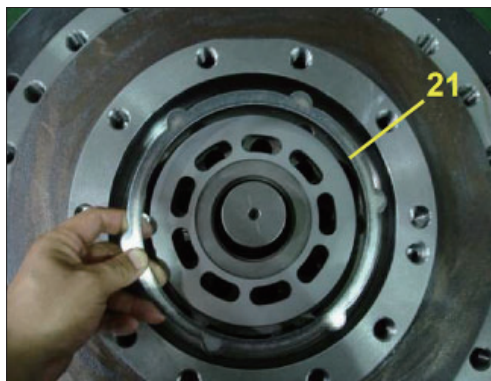


480L2TM89

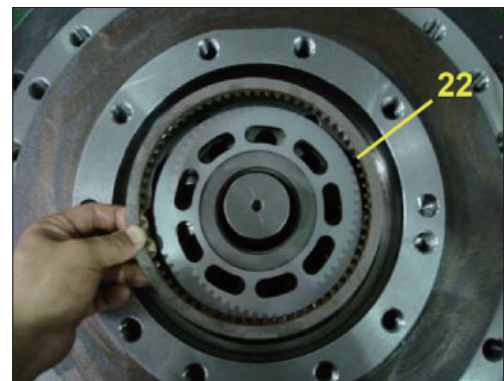
(22) Assemble separate plate (22), friction plate (21) into rotary block in regular sequence.

Friction plate : 6 EA

Separate plate : 7 EA



480L2TM90



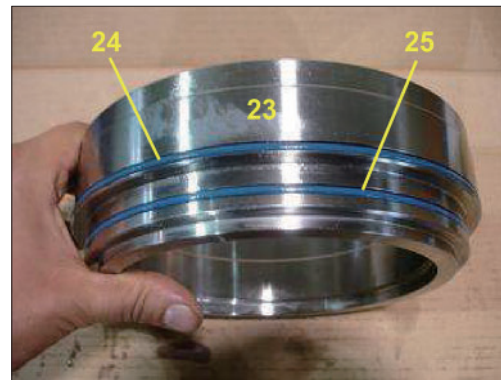
480L2TM91

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



480L2TM92

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



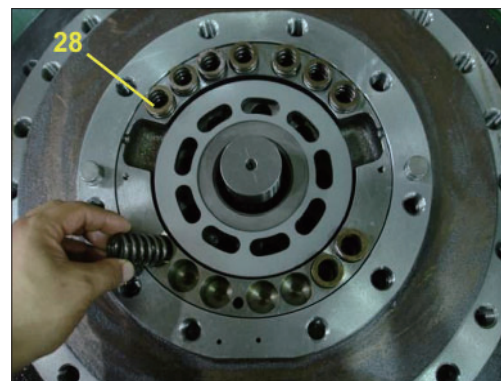
480L2TM93

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



480L2TM94

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

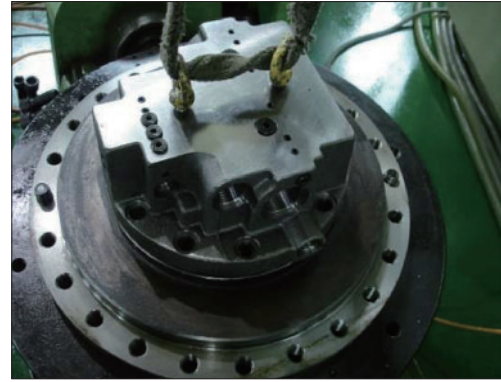


480L2TM95

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



480L2TM96



480L2TM97

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

- Tightening torque : $33 \pm 3.3 \text{ kgf} \cdot \text{m}$
($239 \pm 23.9 \text{ lbf} \cdot \text{ft}$)

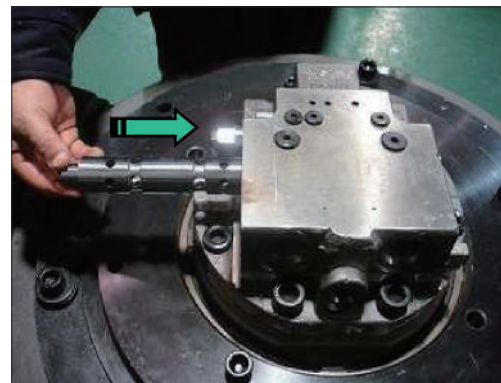


480L2TM98

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



480L2TM99



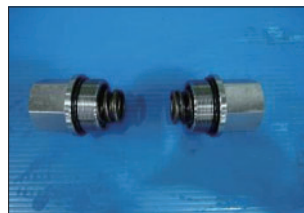
480L2TM100

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

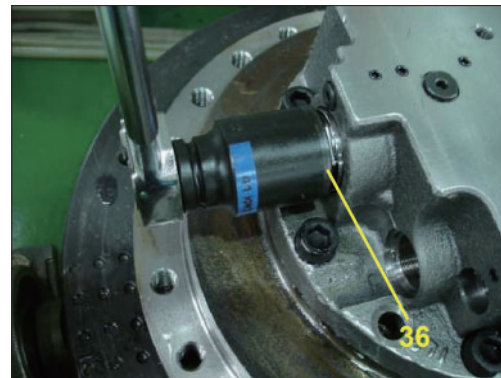
- Tightening torque : $45 \pm 4.5 \text{ kgf} \cdot \text{m}$ ($325 \pm 32.5 \text{ lbf} \cdot \text{ft}$)



480L2TM101



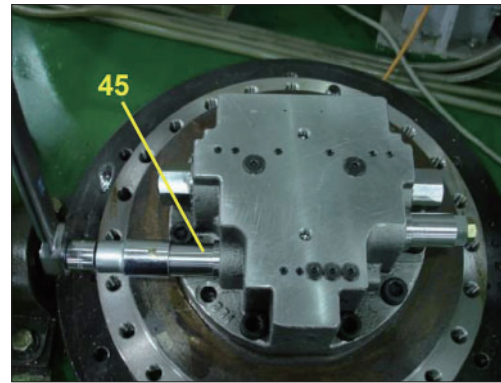
480L2TM102



480L2TM103

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

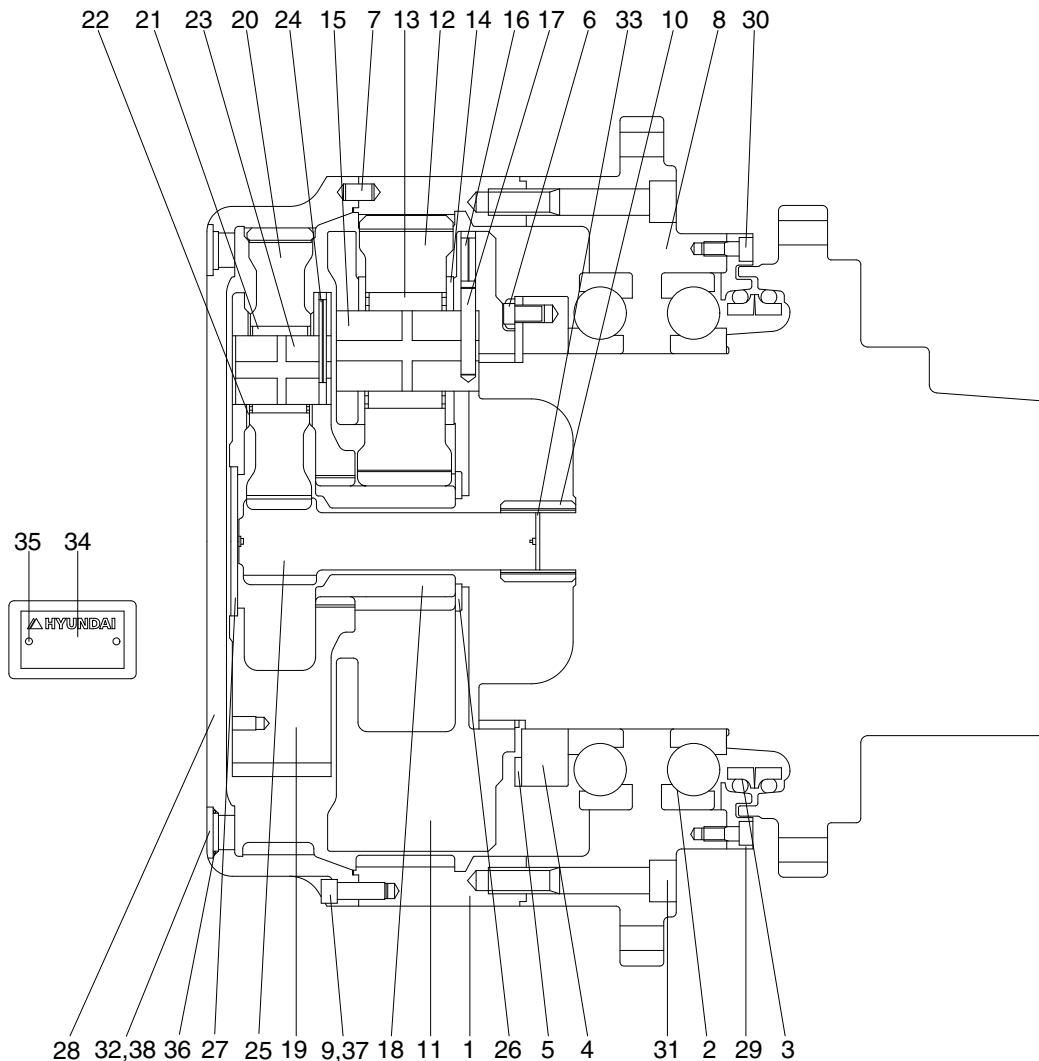
- Tightening torque : $26 \pm 2.6 \text{ kgf} \cdot \text{m}$
($188 \pm 18.8 \text{ lbf} \cdot \text{ft}$)



480L2TM104

4. TRAVEL REDUCTION GEAR

1) STRUCTURE



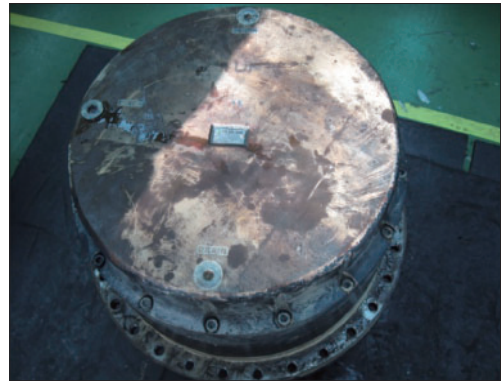
480A2TM03

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

5. DISASSEMBLY OF REDUCTION GEAR

1) READY FOR DISASSEMBLING

- (1) Reduction gear removed from machine usually covered with dirt, so clean it with cleaning liquid and dry it.
- (2) Put reduction gear on stable place with drain port down side and remove oil plug (PF3/4) to pull-out gear oil through drain port.
 - ※ When the oil is hot, there are high chance to blow out hot oil because of the pressure difference between container and out side.
- (3) Set reduction gear on work table.
- (4) Mark surface of cover, ring gear and housing for proper reassembly.



480L2TM201

2) PUT REDUCTION GEAR ON WORK TABLE TO DISASSEMBLE

- (1) Set eye bolt (M20) into M20 tap hole on housing flange. Make reduction gear cover upper direction using hoist machine.
 - ▲ **Be aware of safety. There are some chances of accidents when put down the reduction gear. Do not place the part pall on your foot.**



480L2TM202

3) COVER REMOVE

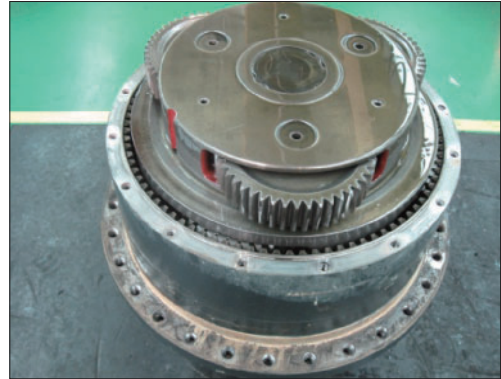
- (1) Remove 16 of bolt-hex. socket head (M12X35L) connecting cover and ring gear using torque wrench.
- (2) Using sharp tools to separate cover and ring gear. Put sharp tools into the gap between ring gear and cover and tap the tool tenderly.



480L2TM203

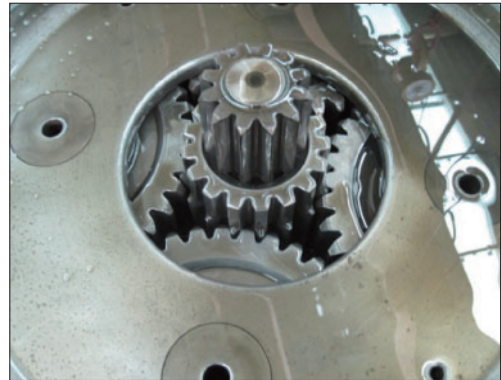
4) REMOVE THRUST PLATE AND NO.1 CARRIER SUB

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



480L2TM204

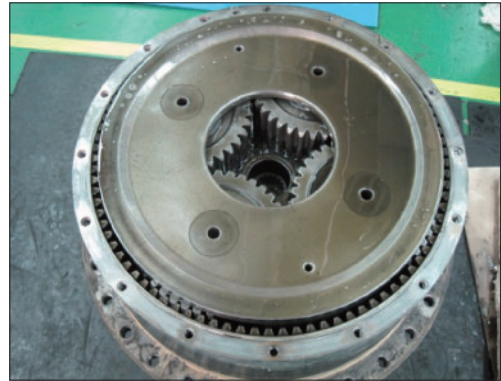
- (2) Remove No.1 sun gear from reduction gear slowly.
※ When disassemble No.1 sun gear, be sure to keep vertical against ground with No.1 sun gear.



480L2TM205

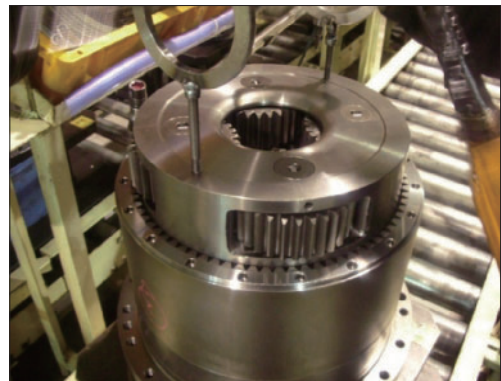
5) REMOVE NO.2 CARRIER SUB

- (1) Remove No.2 sun gear slowly.
※ When disassemble No.2 sun gear, be sure to keep vertical against ground with No.2 sun gear.



480L2TM206

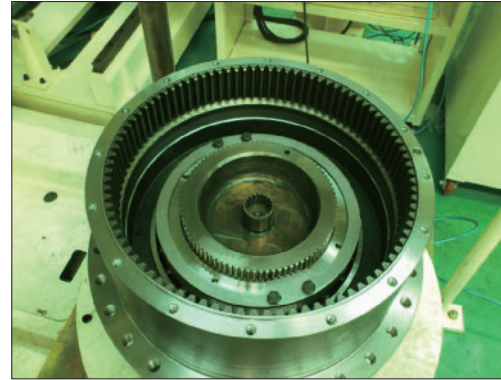
- (2) Set eye bolt (M10) in No.2 carrier assy, pull-up slowly.



480L2TM207

6) REMOVE COUPLING

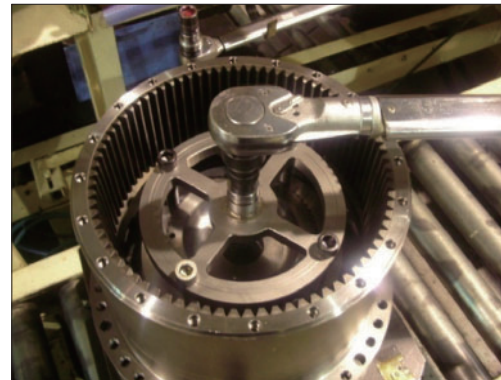
- (1) Remove coupling on motor spline.



480L2TM208

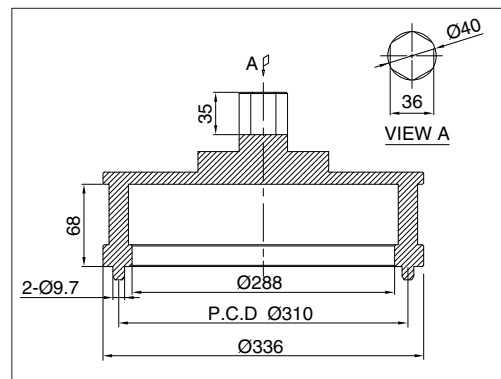
7) REMOVE RING NUT AND LOCK PLATE

- (1) Remove hex head bolt (M12 × 20L) using torque wrench which is connecting ring nut and lock plate.
- (2) Remove lock plate from motor casing spline.



480L2TM209

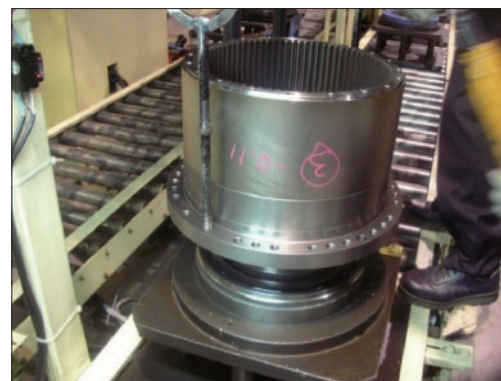
- (3) Remove ring nut using designed tools.



480L8TM03

8) DISASSEMBLE RING GEAR AND HOUSING

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



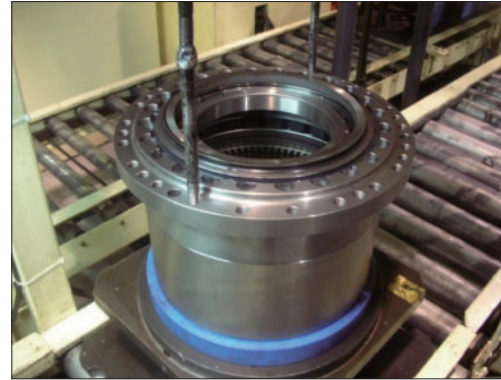
480L2TM210

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

※ Do not re-use floating seal.

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

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



480L2TM212

9) DISASSEMBLE HOUSING COMPONENTS

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

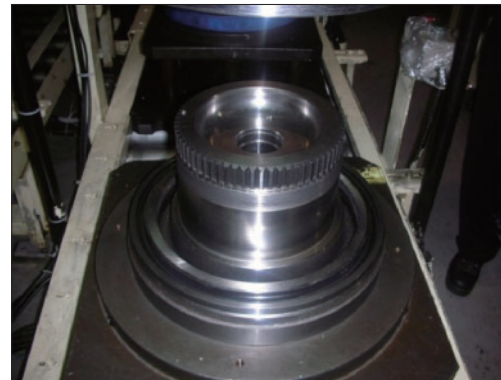


480L2TM213

10) SEPARATE MOTOR CASING AND FLOATING SEAL

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

※ Do not re-use floating seal.



480L2TM211

11) NO.1 CARRIER ASS'Y DISASSEMBLE

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



480L2TM214

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

※ Do not re-use spring pin.



480L2TM215

12) NO.2 CARRIER ASS'Y DISASSEMBLE

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

▲ Be aware of scattering of components when operator use press machine.

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

※ Do not re-use spring pin.



480L2TM216

3. ASSEMBLY OF REDUCTION GEAR

1) GENERAL PRECAUTIONS

- (1) Clean all components with kerosene and dry them in shade. Remove all loctite with solvent.
Check the components.
Apply loctite #262 on thread of bolt-hex.socket head.
Be aware of dropping of parts on foot and safety accident.
Check the quantity of all parts in advance.
- (2) Check the abnormality of thrust washer like twist or wear.
- (3) Check the surface of every gear. Whether there is pitting or crack on them.
- (4) Rolling the bearing and check the rolling condition and the noise.
- (5) Check the surface of floating seal and crack of O-ring.

2) NO.1 CARRIER ASSEMBLY

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



480L2TM217

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



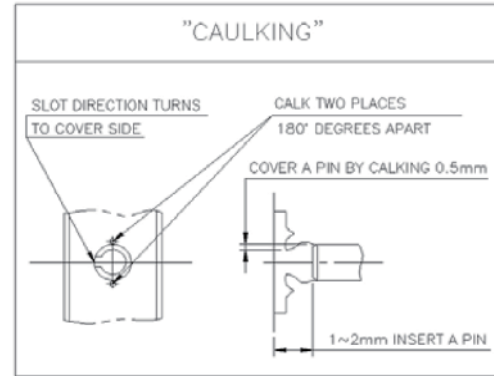
480L2TM218

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



480L2TM221

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



480L2TM219

3) NO.2 CARRIER ASSEMBLY

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

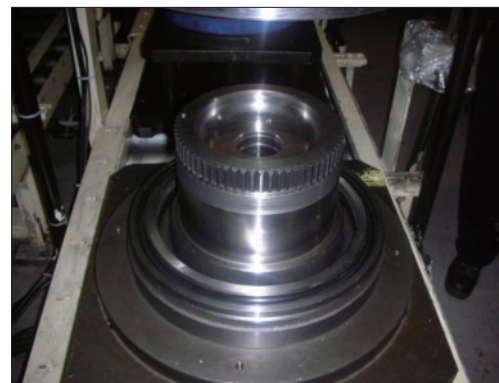


480L2TM220

4) FLOATING SEAL ASSEMBLY

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

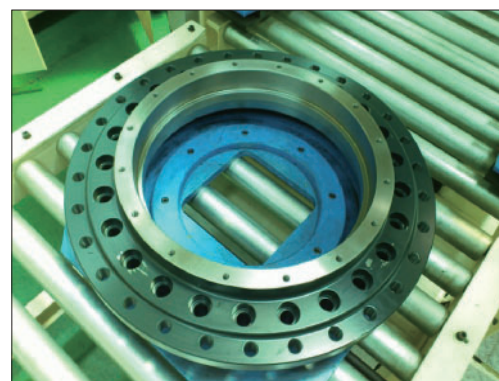
- ※ Keep the floating seal vertical against ground.



480L2TM222

5) HOUSING & MAIN BEARING ASSEMBLY

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



480L2TM224

6) SEAL COVER ASSEMBLY

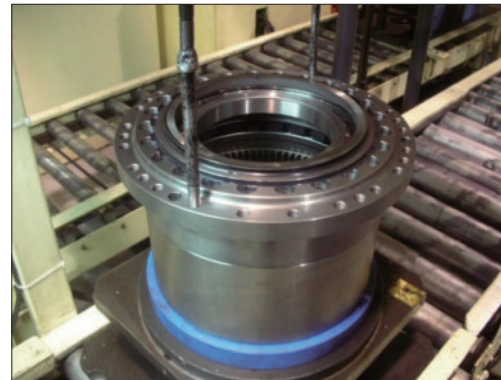
Apply three bond #1194 on contact surface of housing and seal cover, tighten hex socket head bolt (M10×25L) with designed torque 6.3 ± 0.6 kgf · m (45.6 ± 4.3 lbf · ft) using torque wrench.



480L2TM225

7) HOUSING COMPONENTS AND RING GEAR ASSEMBLY

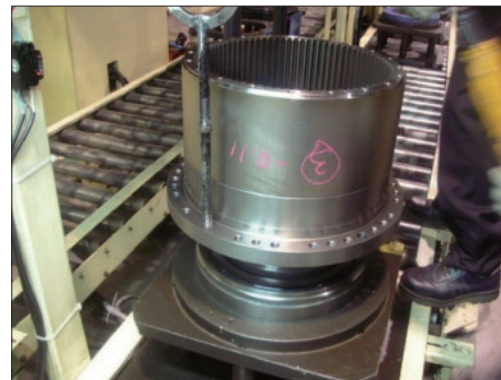
- (1) Apply three bond #1194 on the surface of ring gear and housing contact surface, tighten hex socket head bolt (M20×120L) with designed torque 53 ± 5.3 kgf · m (383 ± 38.3 lbf · ft) using torque wrench.
- (2) Wipe O-ring side of floating seal and contact surface of floating seal of seal cover with oil applied lint free towel, and press fitting floating seal into seal cover.



480L2TM223

8) MOTOR & ASSEMBLED HOUSING COMPONENTS ASSEMBLY

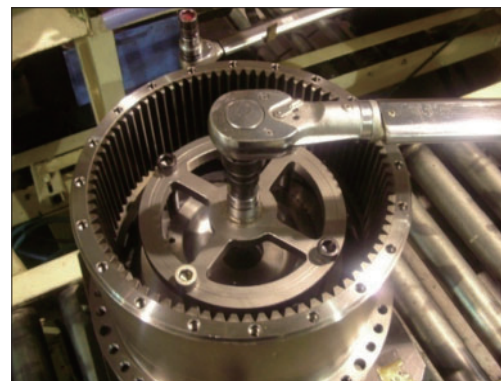
- (1) Set eye bolt (M20) in housing flange tap hole.
 - (2) Assemble assembled housing components on motor using hoist.
- ※ Be sure set eye bolt firmly to keep operator safe.



480L2TM226

9) NUT RING AND LOCK PLATE ASSEMBLY

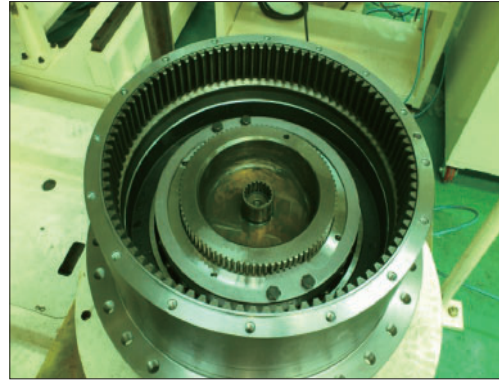
- (1) Tighten nut ring with designed torque using torque wrench.
- (2) Set lock plate along with bolt hole of nut ring and assemble them.
- (3) Tighten hex head bolt (M12×20L) with designed torque 8.8 ± 0.9 kgf · m (63.6 ± 6.5 lbf · ft).



480L2TM228

10) COUPLING ASSEMBLY

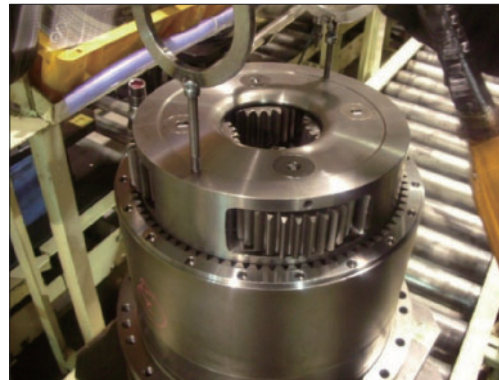
Assemble coupling with motor's spline.



480L2TM230

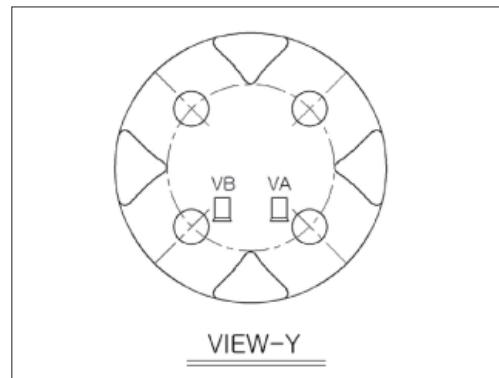
11) NO.2 CARRIER SUB ASSEMBLY

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



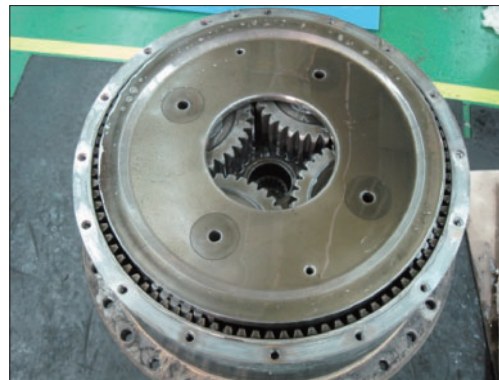
480L2TM229

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



480L2TM231

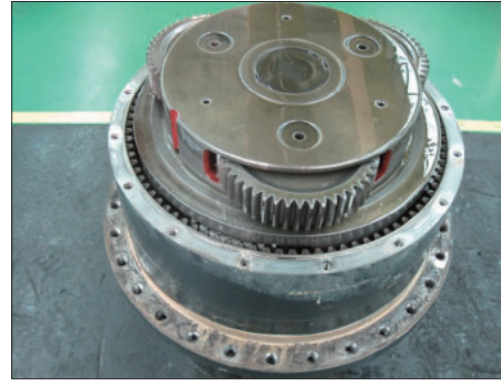
(2) Assemble No.2 sun gear into No.2 carrier assy.



480L2TM227

12) NO.1 CARRIER SUB ASSEMBLY

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



480L2TM232

13) COVER ASSEMBLY

- (1) Put parallel pin ($\varnothing 13 \times 20L$) into parallel pin hole of ring gear with rubber hammer.
- (2) Apply three bond #1194 on cover contacting surface of ring gear and assemble cover.
- (3) Tighten 16 of hex socket head bolt (M12 \times 35L) with designed torque $14.3 \pm 1.4 \text{ kgf} \cdot \text{m}$ ($103 \pm 10.1 \text{ lbf} \cdot \text{ft}$) using torque wrench.



480L2TM233

14) PUTTING GEAR OIL

- (1) Put gear oil $12 \pm 0.5L$ through drain port and check the level gage.
- (2) Tighten oil plug with torque $10 \pm 1.0 \text{ kgf} \cdot \text{m}$ ($72.3 \pm 7.2 \text{ lbf} \cdot \text{ft}$).

TRAVEL DEVICE (TYPE 3)

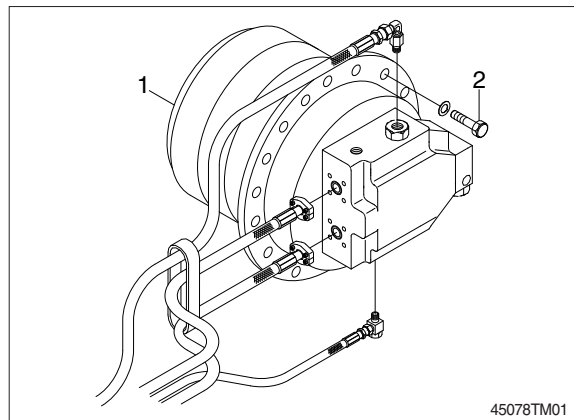
1. REMOVAL AND INSTALL

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 : 360 kg (790 lb)
 - Tightening torque : 57.9 ± 8.7 kgf · m
(419 ± 62.9 lbf · ft)

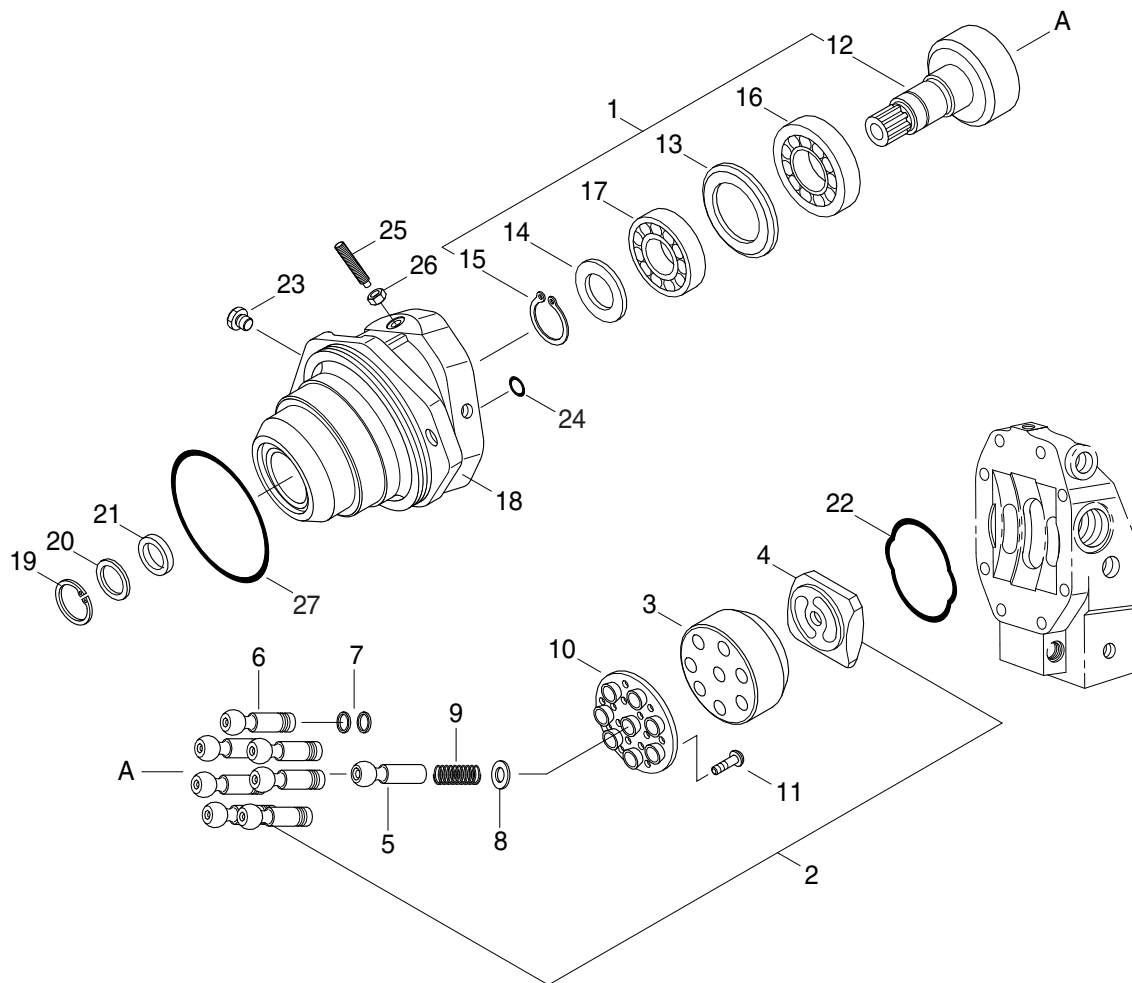


2) INSTALL

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

2. TRAVEL MOTOR (1/2)

1) STRUCTURE

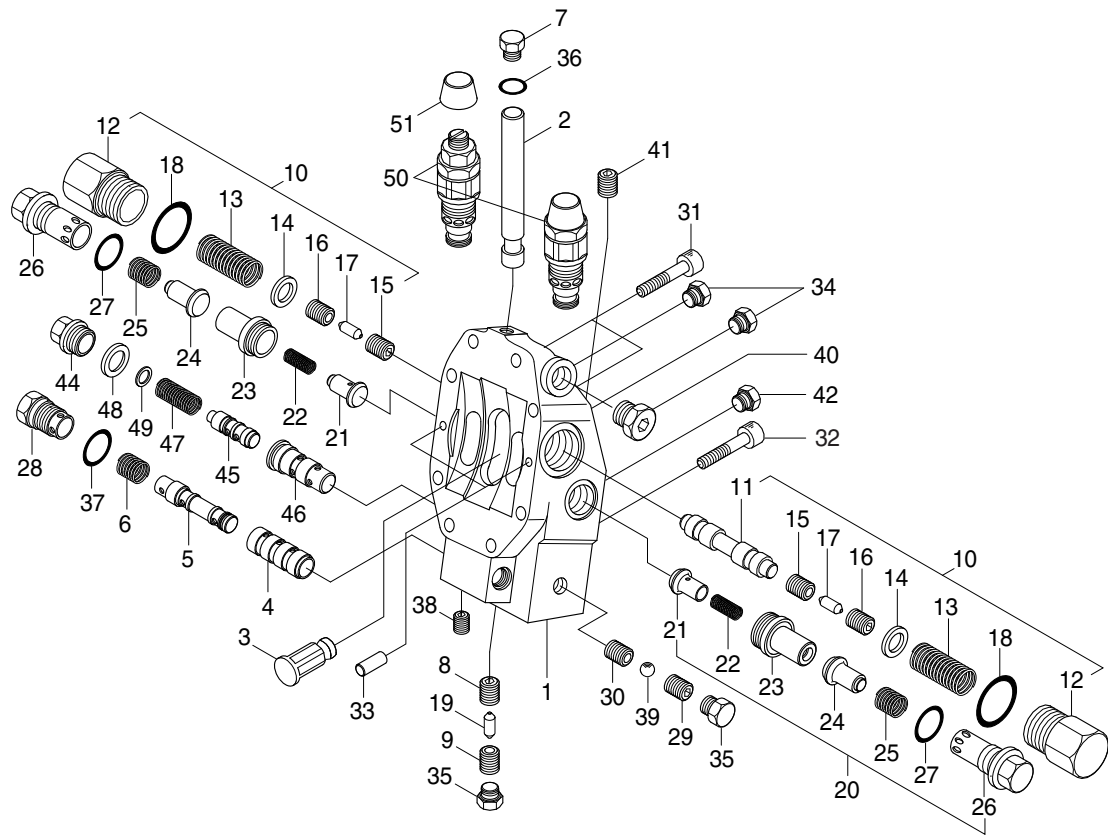


450A8TO02

1	Rotary group	10	Retainer plate	19	Retainer ring
2	Hyd section rotary	11	Screw	20	Shaft seal ring
3	Cylinder	12	Drive shaft	21	Back up plate
4	Control lens	13	Shim	22	O-ring
5	Center pin	14	Back up plate	23	Locking screw
6	Piston	15	Retainer ring	24	O-ring
7	Steel ring	16	Roller bearing	25	Threaded pin
8	Adjustment shim	17	Roller bearing	26	Seal lock nut
9	Pressure spring	18	Housing	27	O-ring

TRAVEL MOTOR (2/2)

· Control part

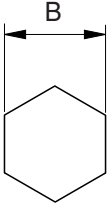


450A8TO03

- | | | | | | |
|----|-------------------|----|-----------------|----|------------------------|
| 1 | Port plate | 18 | O-ring | 35 | Locking screw |
| 2 | Position piston | 19 | Throttle pin | 36 | O-ring |
| 3 | Position turnnion | 20 | Valve | 37 | O-ring |
| 4 | Control bushing | 21 | Poppet valve | 38 | Brake off pin |
| 5 | Control piston | 22 | Pressure spring | 39 | Ball |
| 6 | Pressure spring | 23 | Seat poppet | 40 | Locking screw |
| 7 | Locking screw | 24 | Poppet valve | 41 | Brake off pin |
| 8 | Throttle screw | 25 | Pressure spring | 42 | Locking screw |
| 9 | Throttle screw | 26 | Locking screw | 43 | Pressure control valve |
| 10 | Brake valve | 27 | O-ring | 44 | Locking screw |
| 11 | Brake piston | 28 | Locking screw | 45 | Control piston |
| 12 | Locking screw | 29 | Valve screw | 46 | Control bushing |
| 13 | Pressure spring | 30 | Bushing | 47 | Pressure spring |
| 14 | Washer | 31 | Socket screw | 48 | O-ring |
| 15 | Throttle screw | 32 | Socket screw | 49 | Shim |
| 16 | Throttle screw | 33 | Cylinder pin | 50 | Relief pressure valve |
| 17 | Throttle pin | 34 | Locking screw | 51 | Cap |

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	2.5	
	4	
	6	
	8	
	10	
	14	
Socket for socket wrench, spanner	19	
Torque wrench	Capable of tightening with the specified torques.	
Pliers	-	
(-) Driver	150 mm	
Plastic and iron hammer	Wooden hammer allowed. Nominal 1 or so	
Steel rod approx	7×7×200 mm	
Monkey wrench	-	
Oil seal inserting jig	-	
Bearing pliers	-	
Seal tape	-	
Press (0.5 ton)	-	
Oil stone	-	
Bearing assembling jig	-	
Liquid packing	Loctite #577	
Screw lock	Loctite #243	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf·m	lbf·ft
Locking screw	11	M 6×20	1.0	7.4
Locking screw	13	M26×1.5	7.0	50.9
Locking nut	18	M12	7.0	50.9
Socket head screw	20, 21	M16×90	-	-
Socket head screw	22	M16×120	-	-
Locking screw	24	M14×1.5	3.0	22
Locking screw	25	M10×1	1.0	7
Locking screw	30	M27×2.0	9.1	66
Locking screw	32	M16×1.5	7.0	50.9

3) DISASSEMBLY

(1) General precautions

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

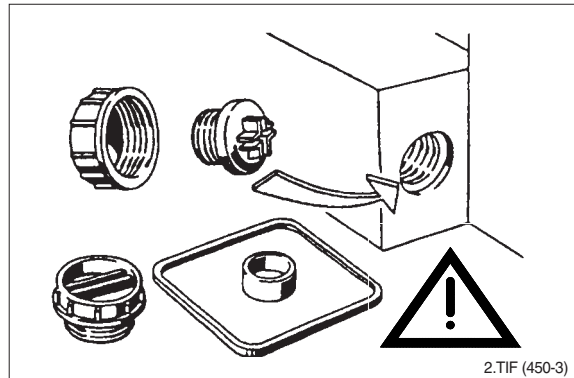
(2) Seal kit and component groups

① Attention

Observe the following notices when carrying out repair work at hydraulic aggregates!

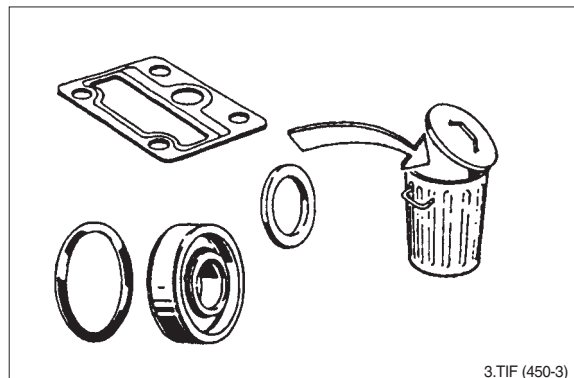


② Close all ports of the hydraulic aggregates.



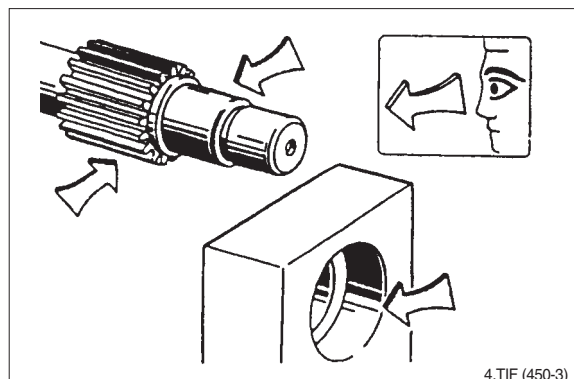
③ Replace all seals.

Use only original spare parts.

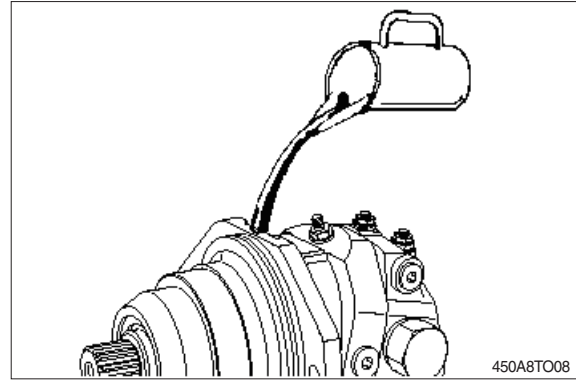


④ Check all seal and sliding surfaces for wear.

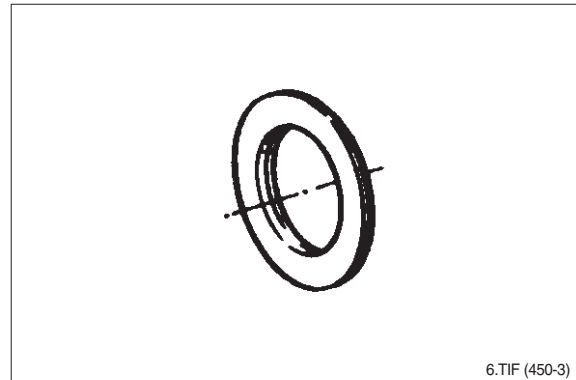
Rework of sealing area for example with abrasive paper can damage surface.



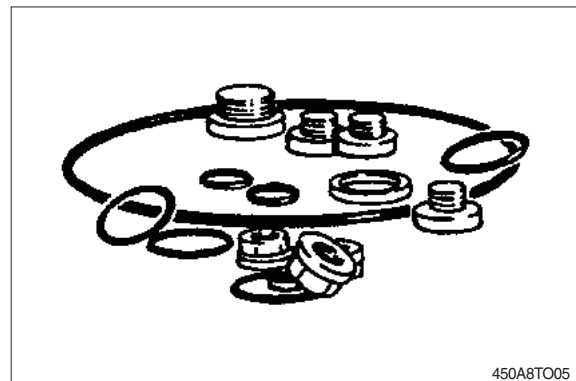
- ⑤ Fill up hydraulic aggregates with hydraulic oil before start-up.



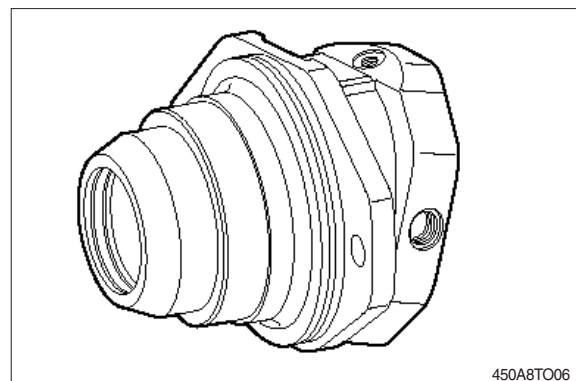
- ⑥ Seal kit for drive shaft.



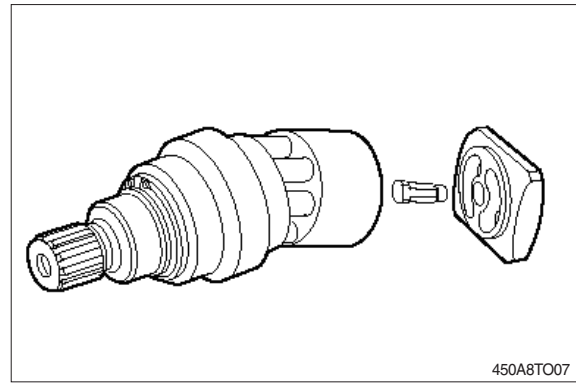
- ⑦ External seal kit.



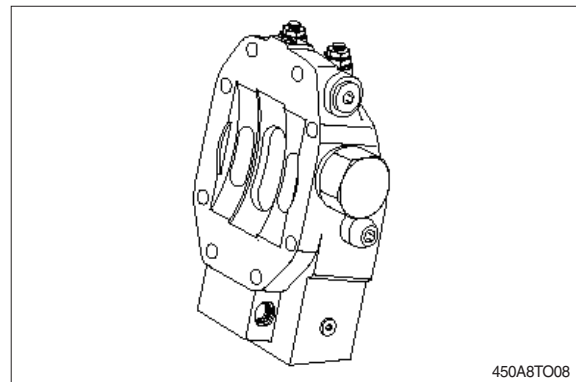
- ⑧ Housing.



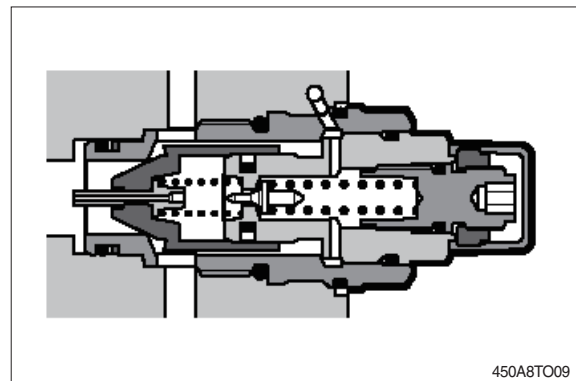
⑨ Complete rotary group.



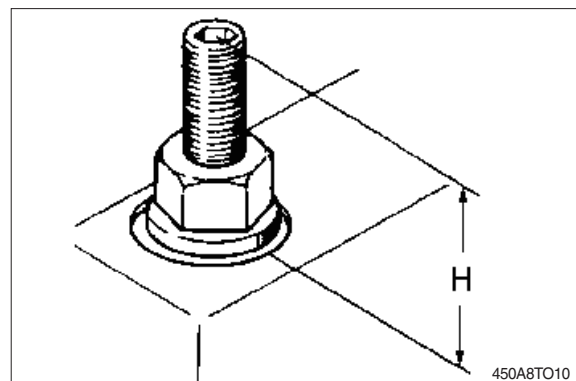
⑩ Port plate with control piston and counter-balance valve.



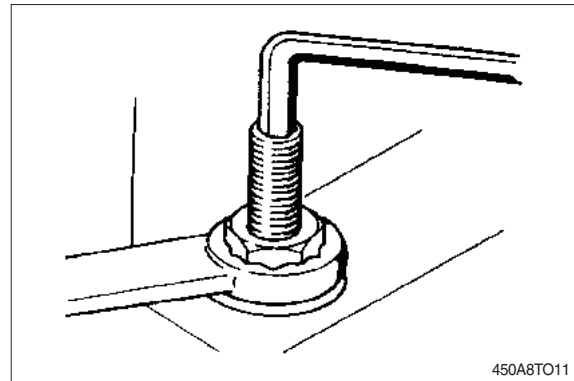
⑪ Relief valve/Make up check valve



⑫ Replace seal nut.
First measure and record setting height.

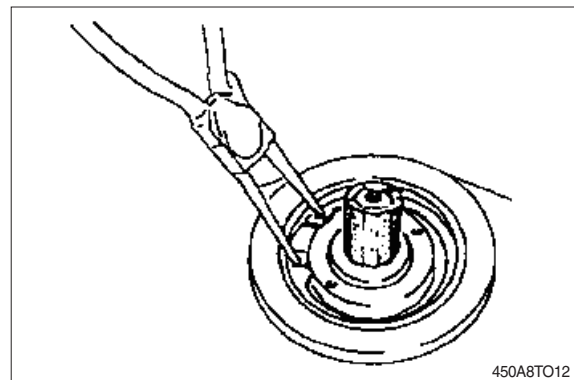


- ⑬ When tightening, counterhold setting screw, then check setting height.

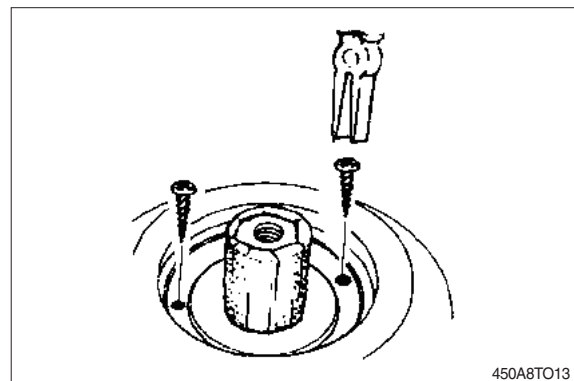


(3) Sealing the drive shaft

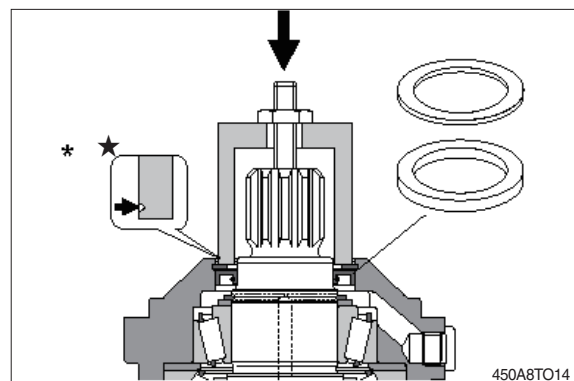
- ① Protecting the drive shaft.
Remove retaining ring and shim.



- ② Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.

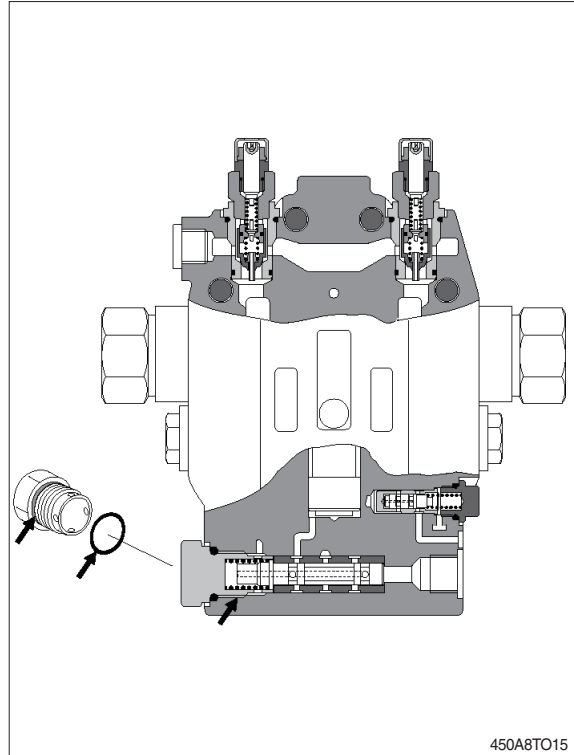


- ③ Press in shaft seal and shim with bush to stop.
※ Pay attention to pressing depth!
★ Mark for pressing depth.
Assemble retaining ring.



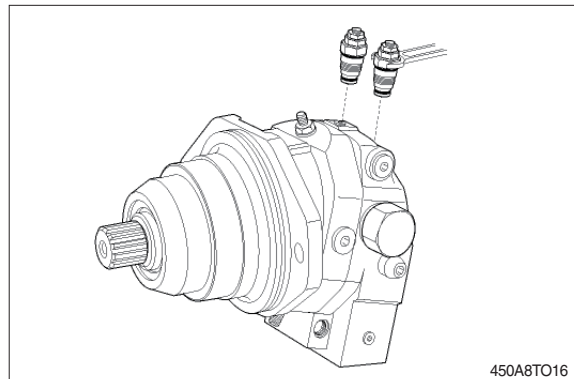
(4) Sealing of the control parts

- ① HZ-Controller
- ※ O-ring, O-ring groove, housing.

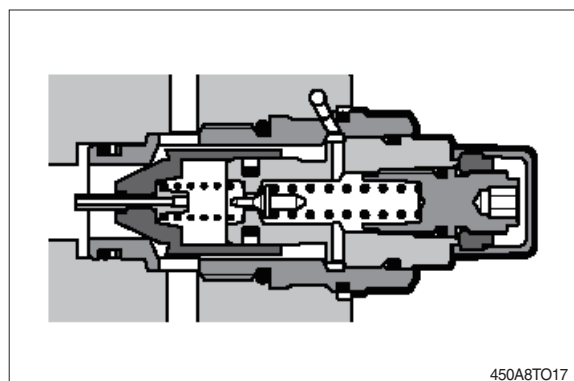


(5) Sealing of the relief valve

- ① Remove relief valve.

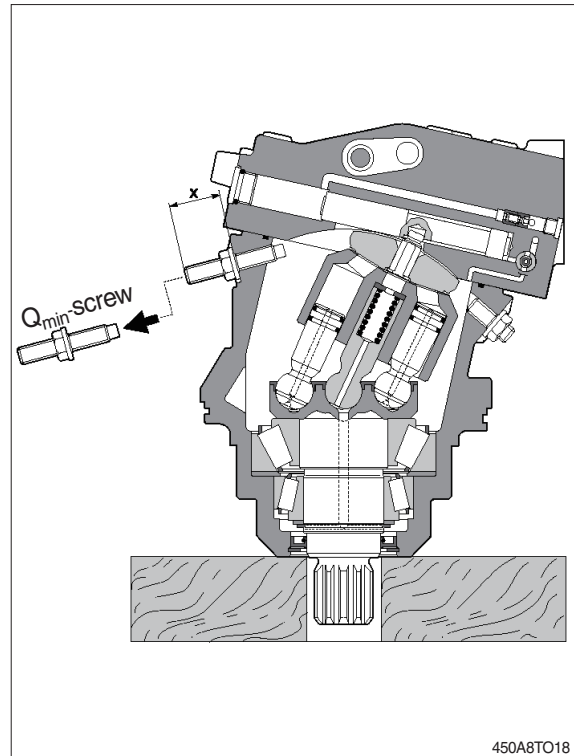


- ② Inspect O-ring.

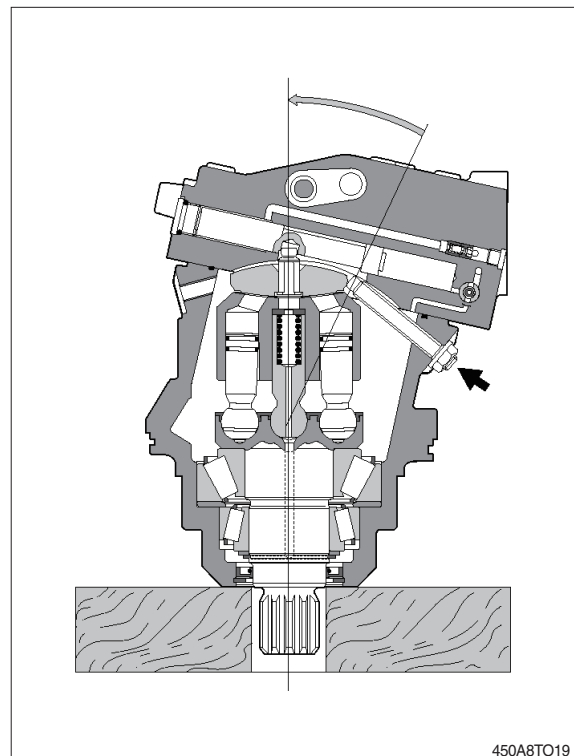


(6) Disassembly of the port plate

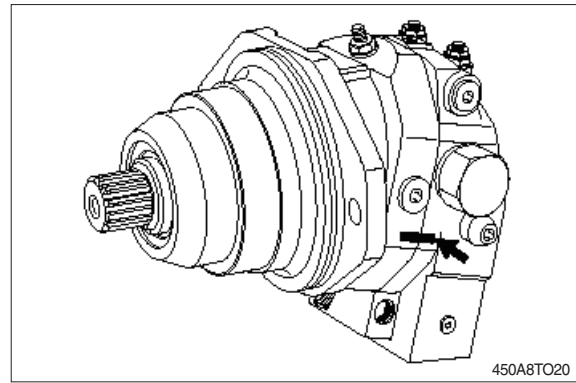
- ① Note dimension x .
Remove Q_{\min} -screw.



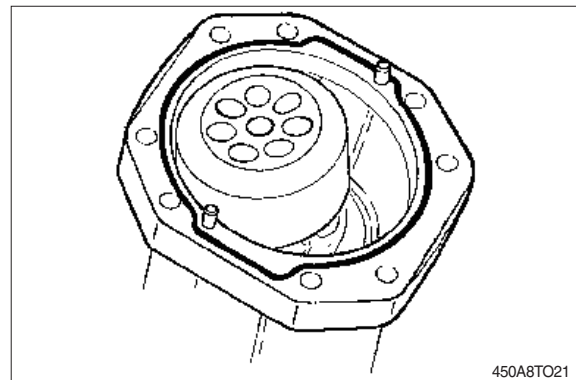
- ② For disassembly of the port plate, swivel always rotary group to zero position. Piston rings to hang out of the cylinder boring. Swivel rotary group to zero position with screw Q_{\max} .



- ③ Port plate
Mark position. Loosen screws.
Removal.

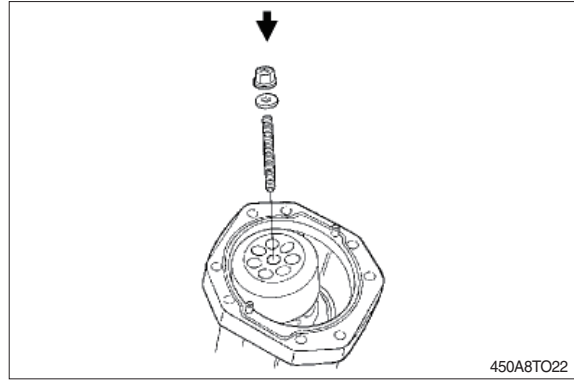


- ④ Check O-ring.
※ Stick new O-ring with some grease. Do not swivel rotary group. Piston rings to hang out from the cylinder boring.

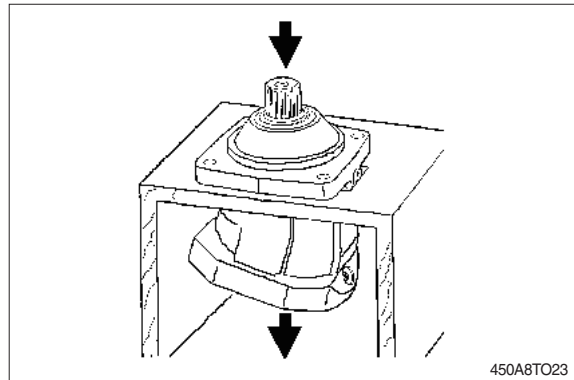


(7) Remove rotary group

- ① Screw in threaded pin into center pin.
Fix the cylinder with disc and lock nut.
Size : M8×105 mm

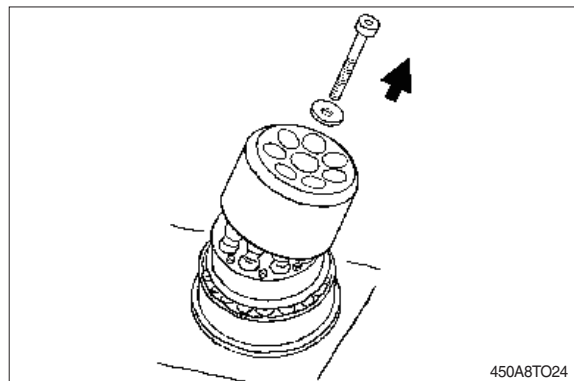


- ② Press out rotary group!
※ If the bearings are used again do not hit on the drive shaft.

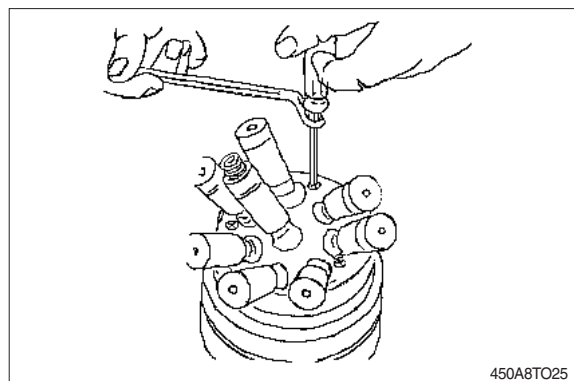


(8) Exchanging of the rotary group

- ① Remove fixing screw (cylinder).
Remove cylinder.



- ② Disassemble retaining plate.
※ Screws are glued. Use Torx-tools.



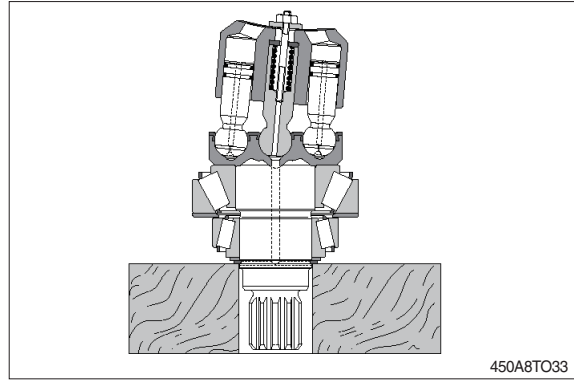
4) ASSEMBLY

(1) General precautions

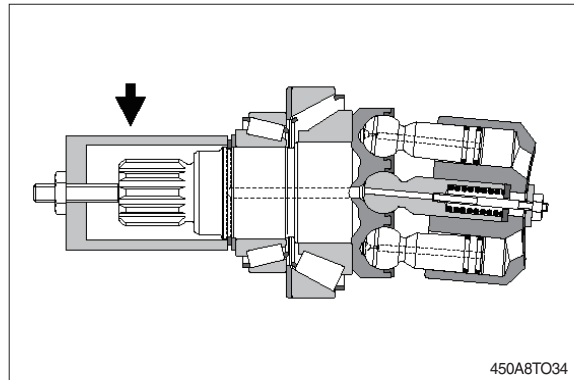
- ① Reassemble in a work area that is clean and free from dust and grit.
- ② Handle parts with bare hands to keep them free of liny contaminates.
- ③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.
- ④ Do not reuse O-rings, oil seal and floating seal that were removed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

(2) Rotary group assembly

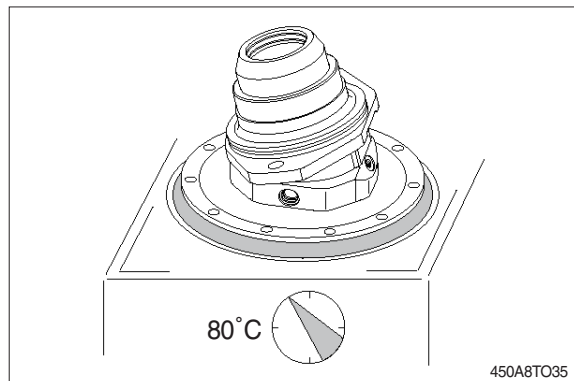
- ① Rotary group completely assembled ready for assembly.



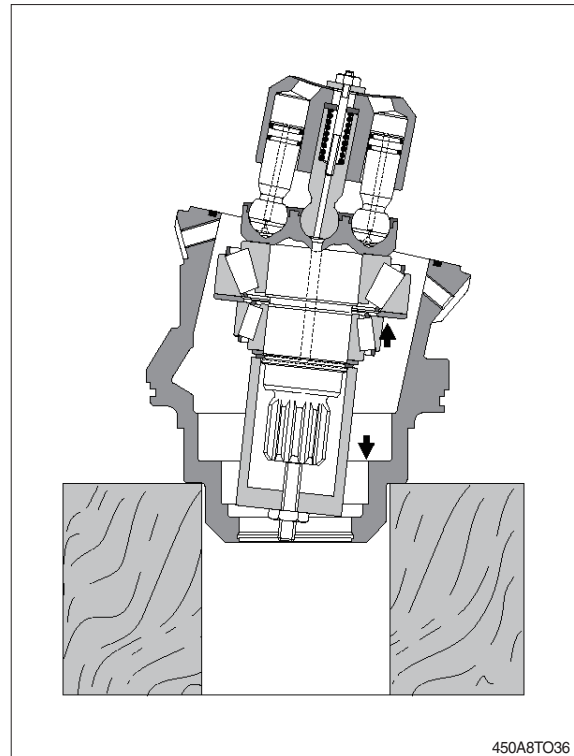
- ② Place assembly sleeve.



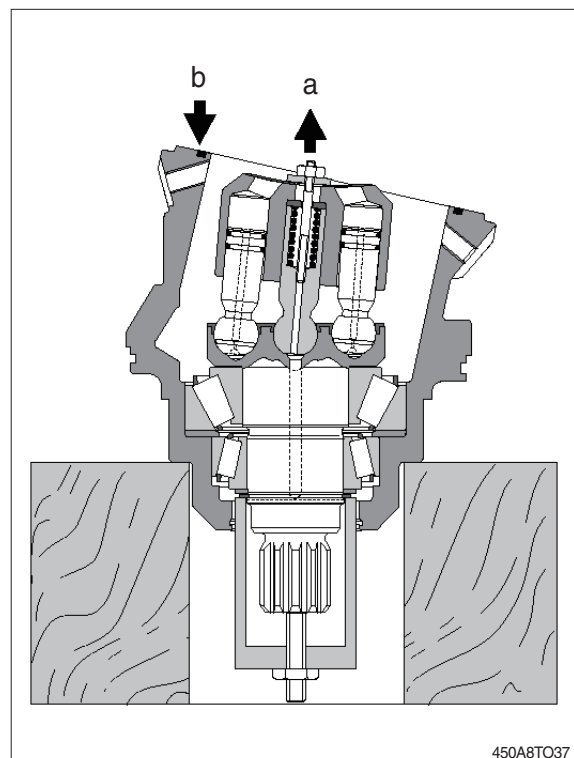
- ③ Warm up housing to 80°C.



- ④ Insert rotary group into housing to seat position.

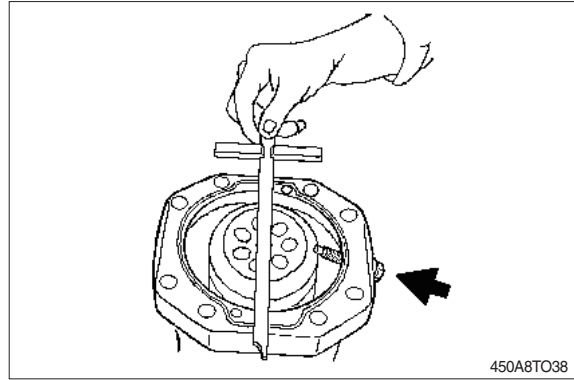


- ⑤ Fix zero position of cylinder with Q_{max} screw.
- a. Disassemble cylinder fixing screw.
 - b. Insert O-ring.

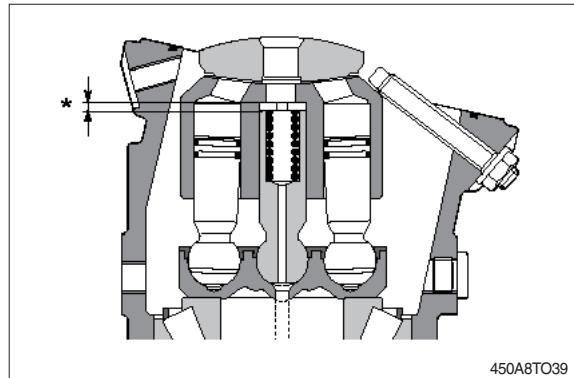


(3) Rotary group adjustment

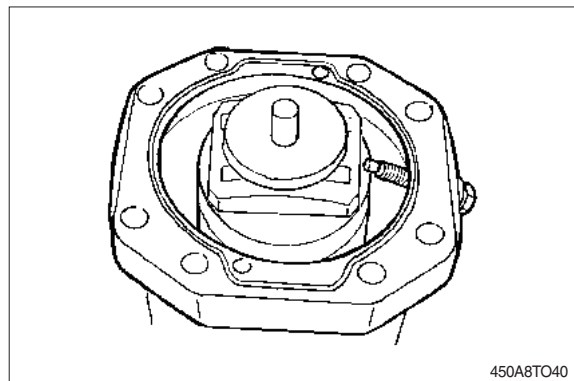
- ① Determine cylinder swivel range to max angle with screw.



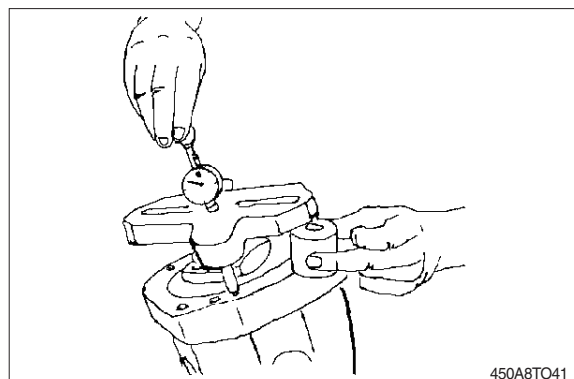
- ② *Disc



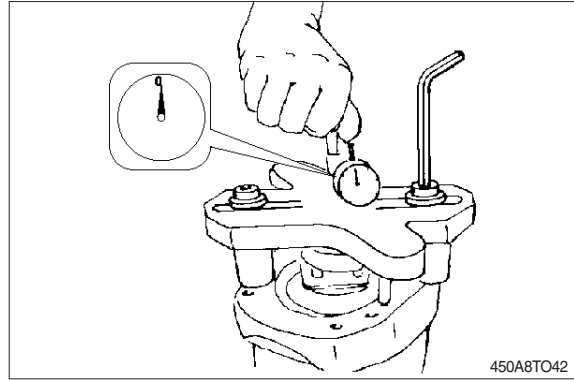
- ③ Place centering disc.



- ④ Mount measuring device.

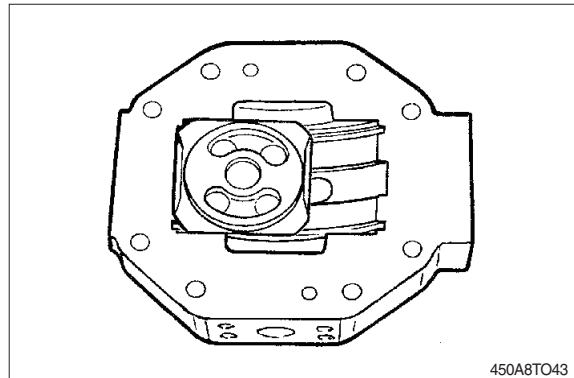


⑤ Check dimension X.



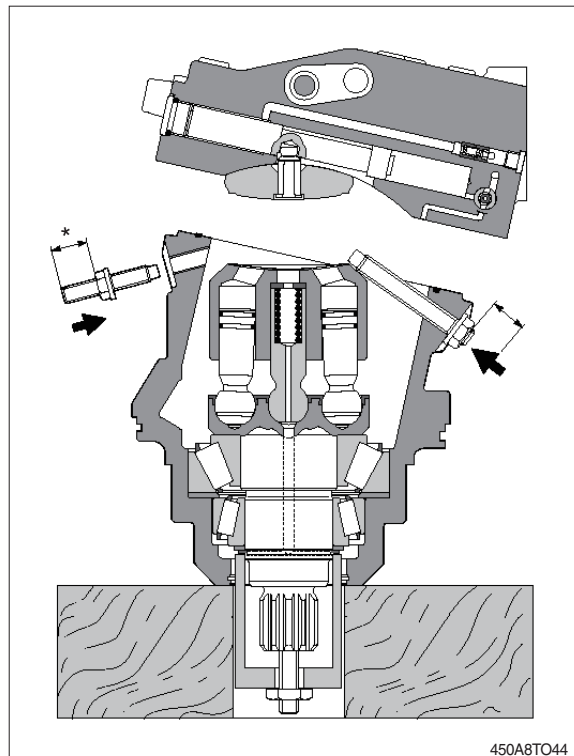
(4) Assembly of the port plate

- ※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.

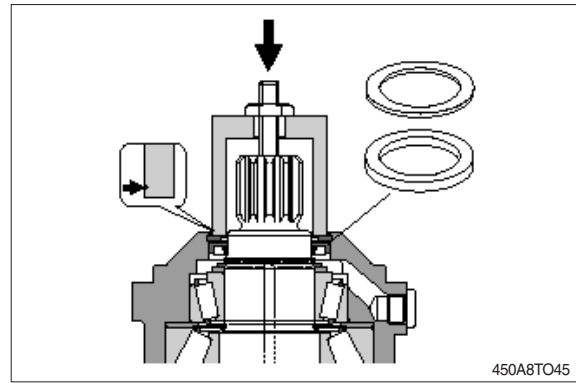


① Assembly port plate.

- ※ Take care of assembly design! Tighten fixing screws with torque.
 - Set Q_{min} -screw to dimension*.
 - Assemble plug.
 - Remove assembly sleeve.

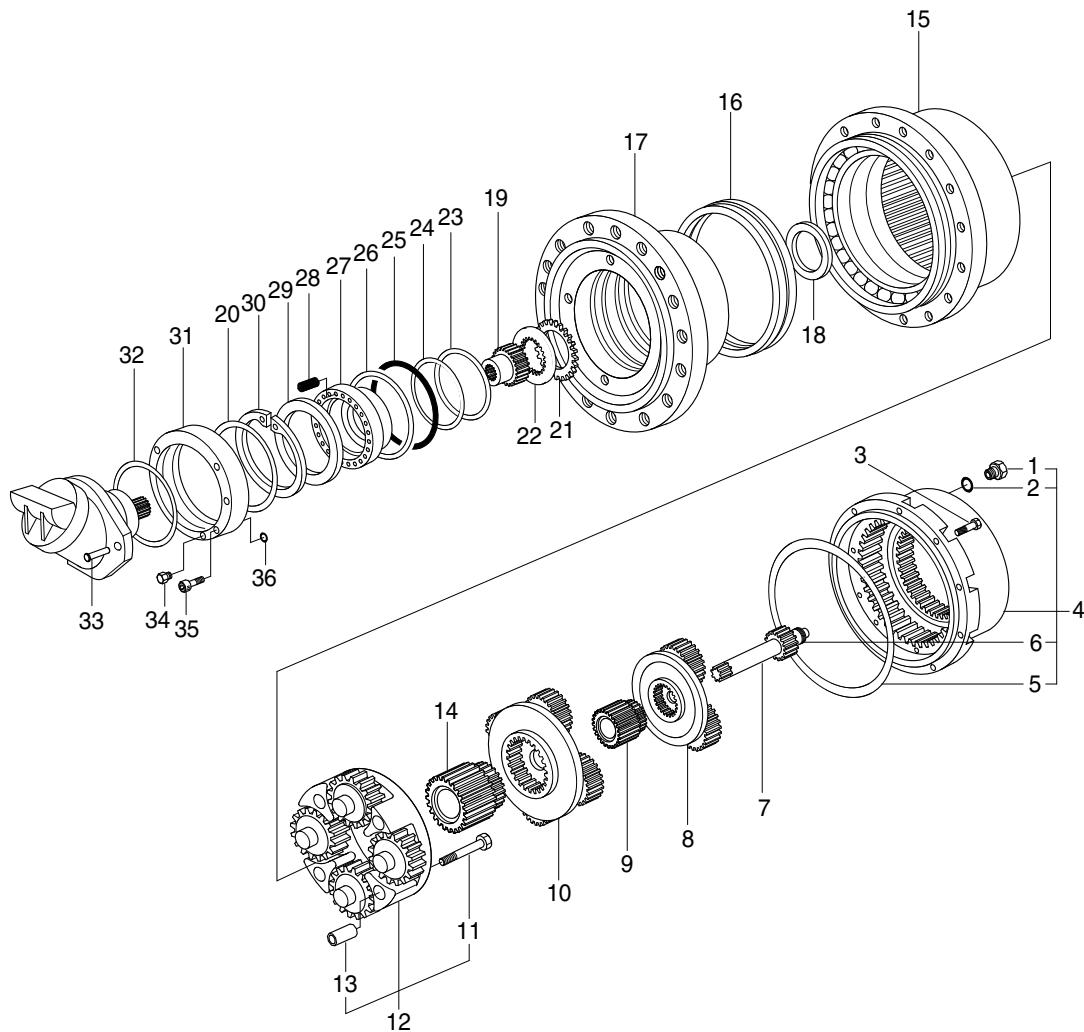


- ② Assemble shaft seal, disc and safety ring. Press-in with assembly sleeve.
※ Take care of press-in depth.



3. REDUCTION GEAR

1) STRUCTURE



450A8TR01

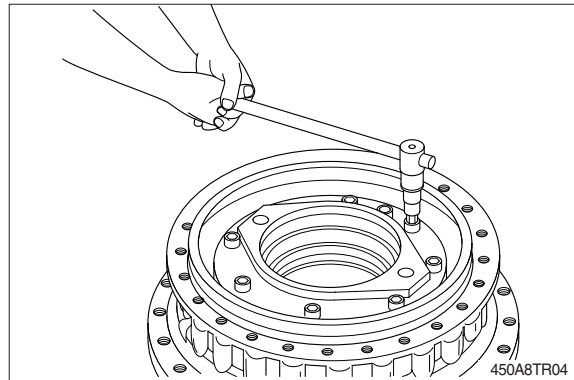
- | | | | | | |
|----|----------------------|----|---------------|----|-------------|
| 1 | Washer | 13 | Bushing | 25 | O-ring |
| 2 | Breather plug | 14 | Sun gear | 26 | Spiral ring |
| 3 | Screw | 15 | Housing | 27 | Piston |
| 4 | Cover set | 16 | Lifetime seal | 28 | Spring |
| 5 | O-ring | 17 | Hub | 29 | Spacer |
| 6 | Pad | 18 | Spacer | 30 | Circlip |
| 7 | Sun gear | 19 | Brake shaft | 31 | Flange |
| 8 | Reduction assy (1st) | 20 | O-ring | 32 | O-ring |
| 9 | Sun gear | 21 | Brake disc | 33 | Screw |
| 10 | Reduction assy (2nd) | 22 | Steel ring | 34 | Plug |
| 11 | Screw | 23 | Back up ring | 35 | Screw |
| 12 | Reduction assy (3rd) | 24 | O-ring | 36 | O-ring |

2) DISASSEMBLING

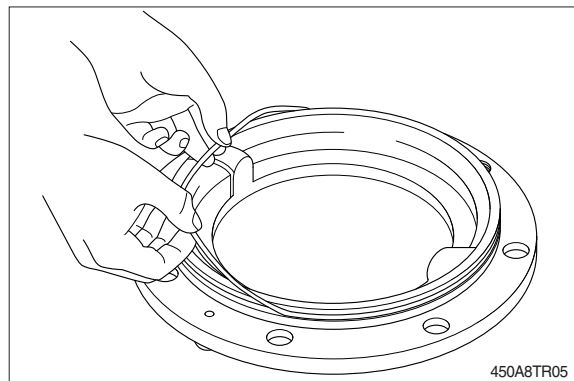
Initial inspection of the gears and the travel motor, can be made without disassembling the track and the gearmotor from the machine.

Prior to disassembling make sure that the oil is discharged, unscrew and remove the 2 screws (33), and remove the travel motor and the O-ring (32).

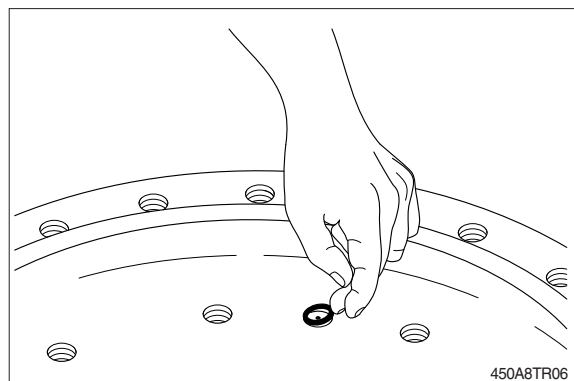
- (1) Unscrew the 8 socket head screws (3) and remove the motor flange from the flanged hub (17).



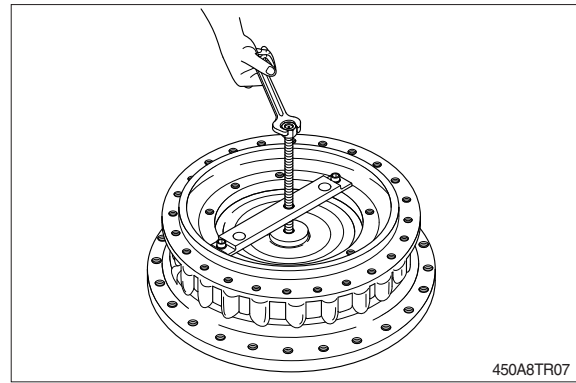
- (2) Remove the O-ring (20) from its groove in the motor flange (31).



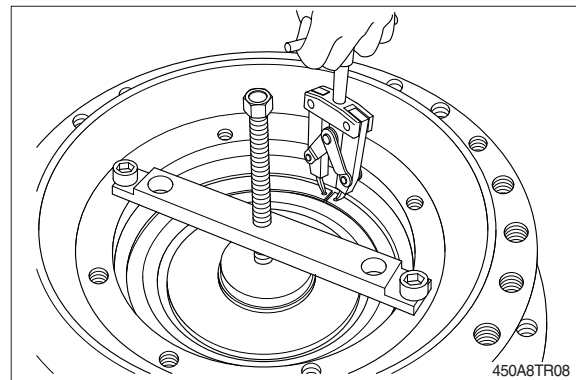
- (3) Remove the O-ring (36) from its groove in the flanged hub (17).



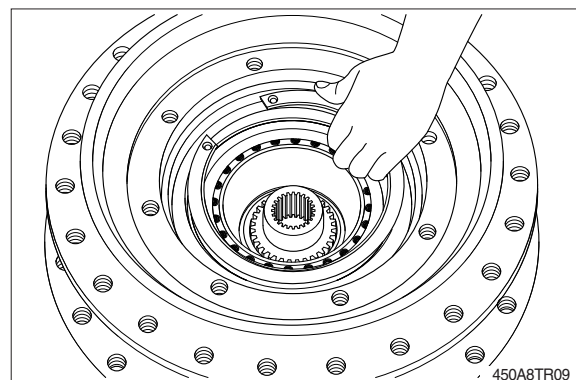
- (4) After having placed the disc on the spring retainer (29), fix the pusher on the flanged hub (17) as shown in the scheme by screwing the threaded bar, push the disc on the retainer, thus removing the force of the springs (28) on the circlip (30) and allowing its disassembling.



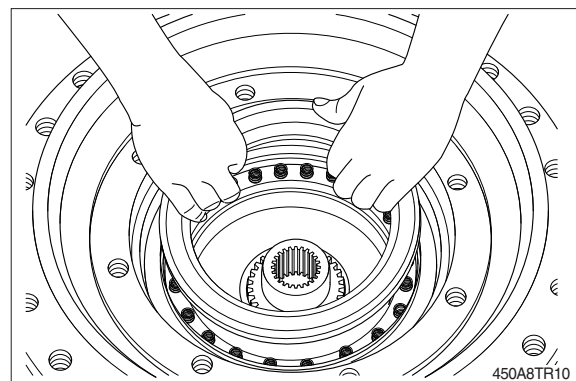
- (5) Using pliers remove the circlip (30) from its groove in the flanged hub (17).



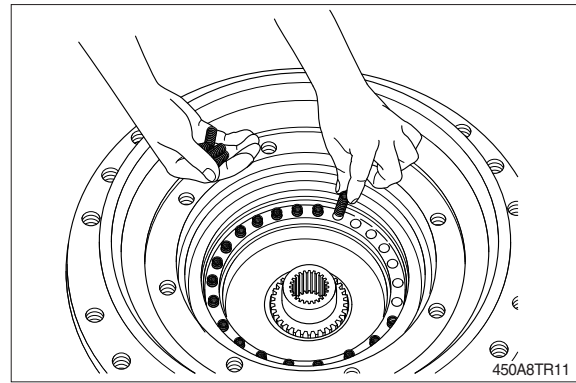
- (6) Disassemble the equipment from the flanged hub (17) and remove the circlip (30).



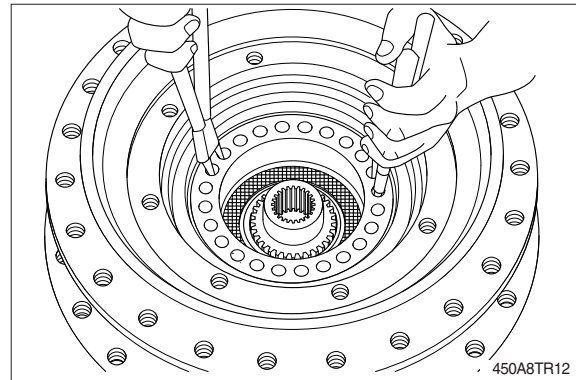
- (7) Remove the springs retainer (29).



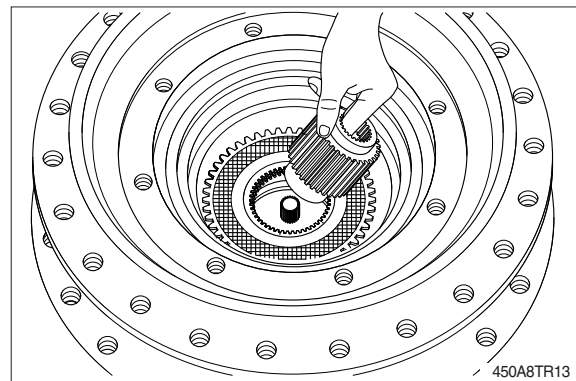
(8) Remove the springs (28) from their grooves.



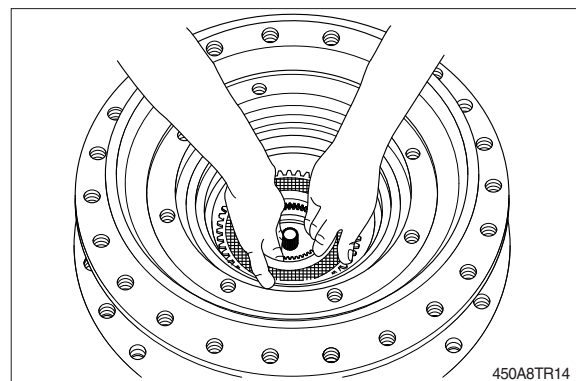
(9) Using pliers remove the brake piston (27).
※ To get it easier, pumping compressed air into the brake port hole.



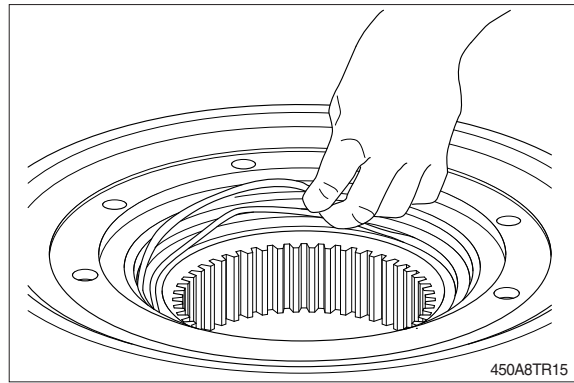
(10) Remove the brake shaft (19).



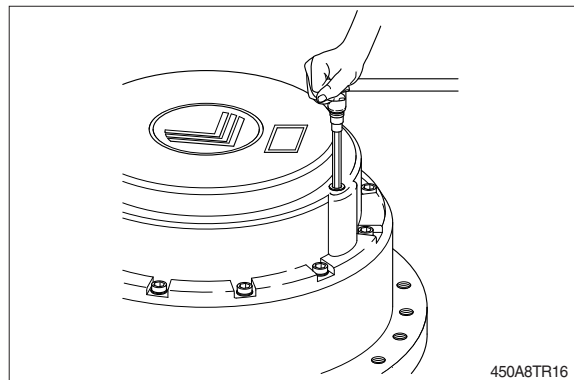
(11) Remove brake discs pack (21, 22).



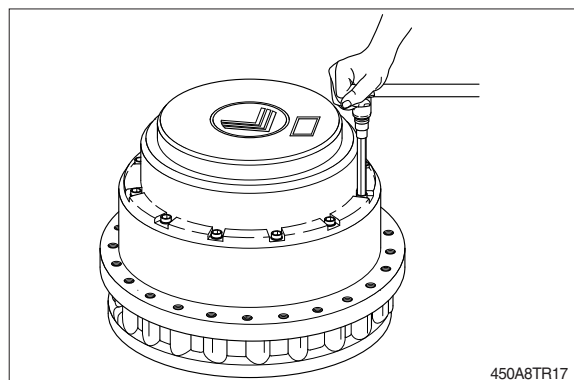
(12) Remove the O-rings (24,25) and the backup rings (23, 26) from their grooves in the flanged hub (17).



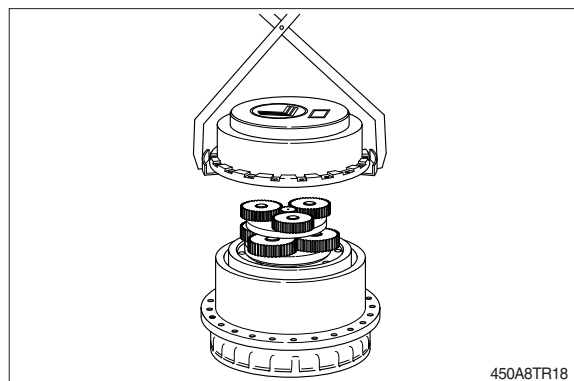
(13) Turn the gearbox around, unscrew and remove the 2 plugs (2) and the 2 washers (1) from the end cover (4).



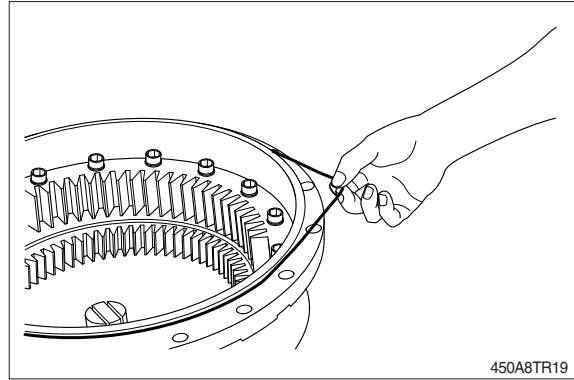
(14) Unscrew and remove the 16 socket head screws (3).



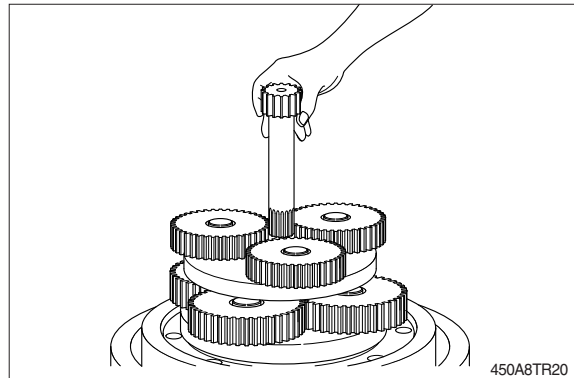
(15) By means of a puller remove the end cover (4).



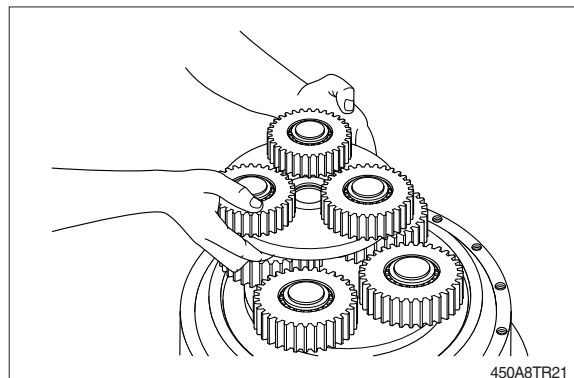
(16) Remove the O-ring (5) from its groove in the end cover (4).



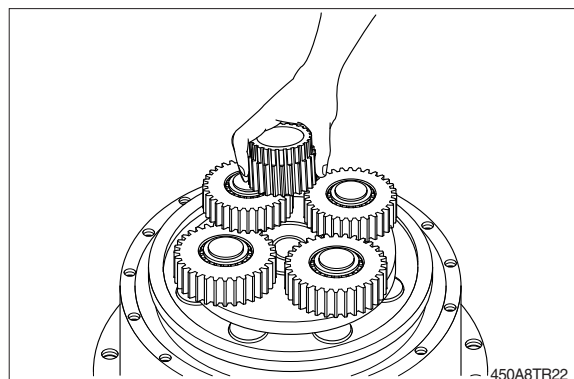
(17) Remove the 1st stage sun gear (7).



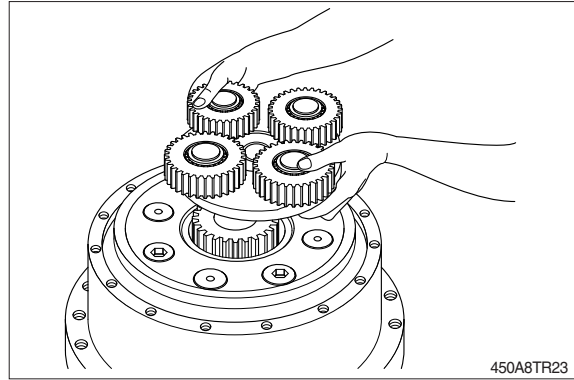
(18) Remove the 1st reduction assembly (8).



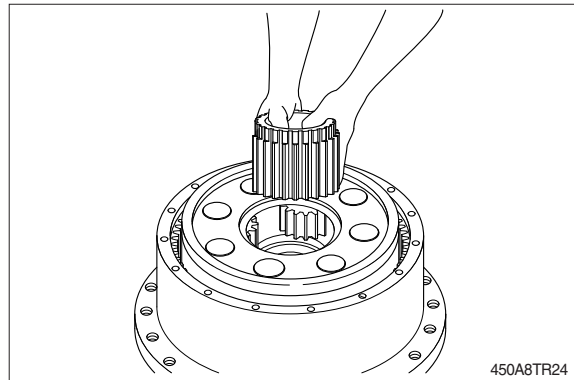
(19) Remove the 2nd stage sun gear (9).



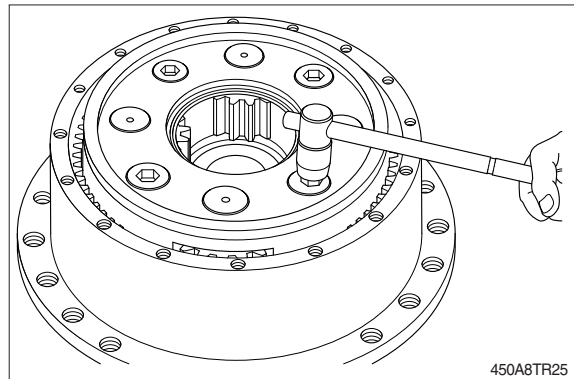
(20) Remove the 2nd reduction assembly (10).



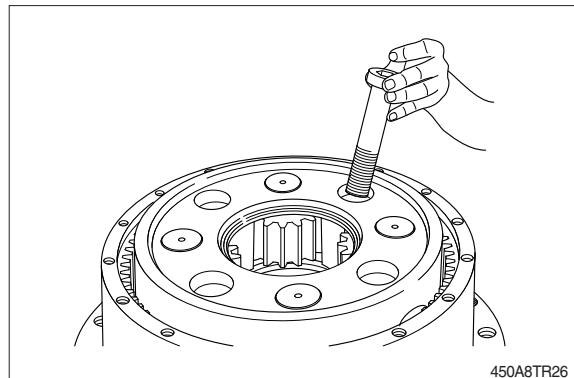
(21) Remove the 3rd stage sun gear (14).



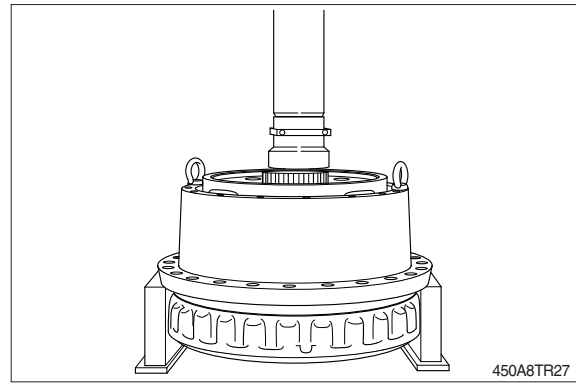
(22) Unscrew the 4 socket head screws (11),
fixing the 3rd reduction assembly (12) to
the flanged hub (17).



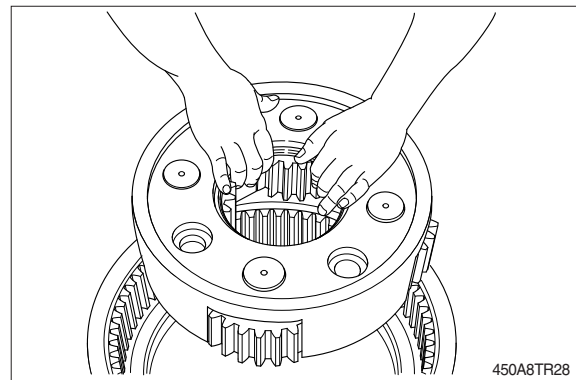
(23) Remove the 4 screws (11).



(24) Using a press and a metal stopper, remove the flanged hub (17) from the gearbox housing (14), paying attention to the eventual falling down of the main bearing's balls.

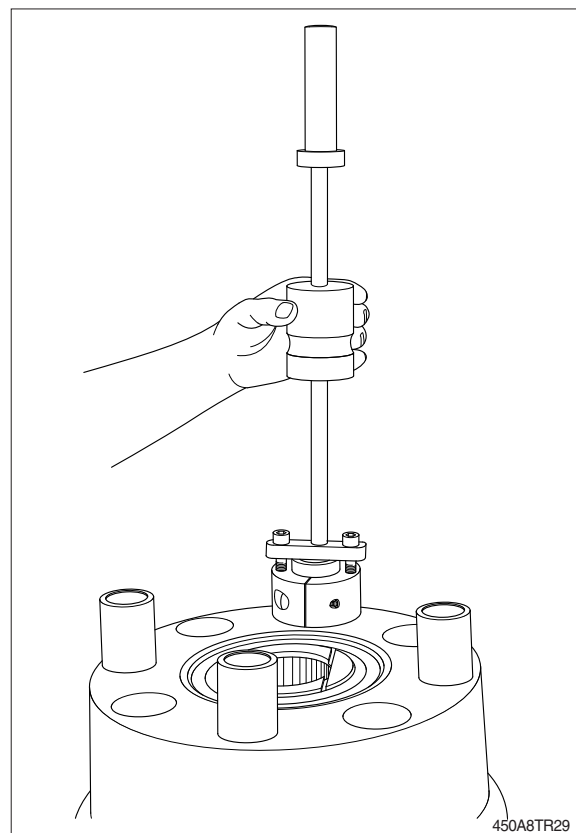


(25) Remove the 3rd reduction assembly (12) from the flanged hub (17).

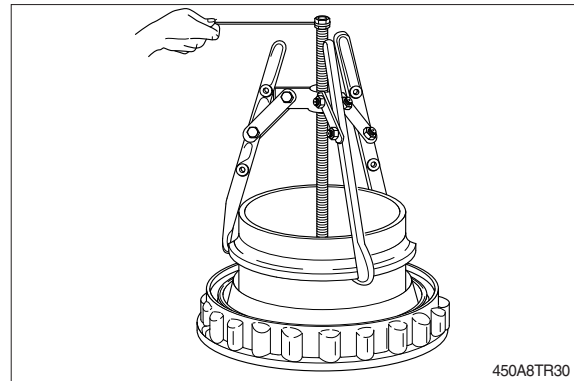


(26) Using the equipment, remove bushes (13) from the flanged hub (17).

- ※ It is possible that the planet assemblies (see reassembly (11)) remain assembled to the planet-carrier. In this case it is sufficient to push on them by means of a rubber pad or a press.
- In case the planet assemblies remain assembled to the flanged hub, it is better to use the fixture (for this operation).



(27) By means of an extractor, remove the inner race of the bearing and spacer kept on the flanged hub (17).

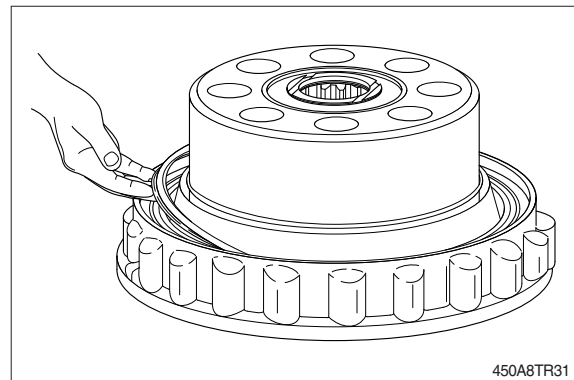


(28) Withdraw both the half-seals (16) from the flanged hub (17) and from the gearbox housing (15).

※ Lifetime seal check

In case of oil leakages, it should be necessary to check and eventually replace the lifetime seal (16), which means both the metal rings parts and the O-rings. In this case it is necessary to disassemble the gearbox from the machine.

※ The gearbox disassembly ends with the above operation: All items are now available for the necessary checks.



3) REASSEMBLY

※ For the correct assemble of gearbox please follow these basic instructions:

In case of damaged gears, for example a planetary, replace all the reduction assembly and not only the damaged gear.

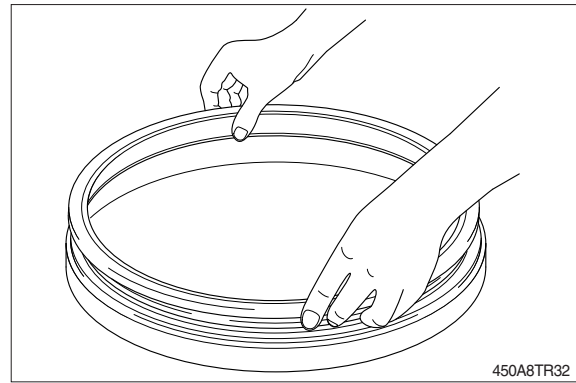
※ Before reassembling the O-ring, gaskets and the oil seals:

Concerned should be removed.

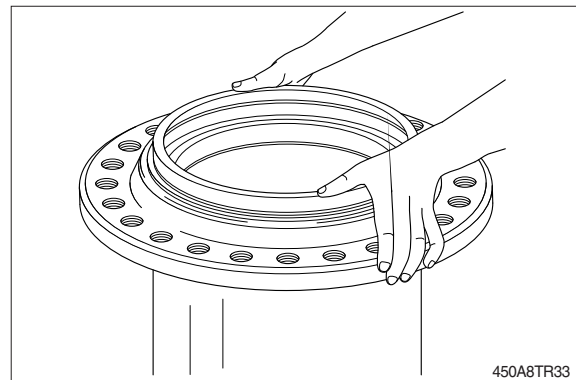
Clean with care all the housing of the seal and put some grease on the gasket before mounting.

※ Never change only one part of the lifetime seal, always the two rings together.

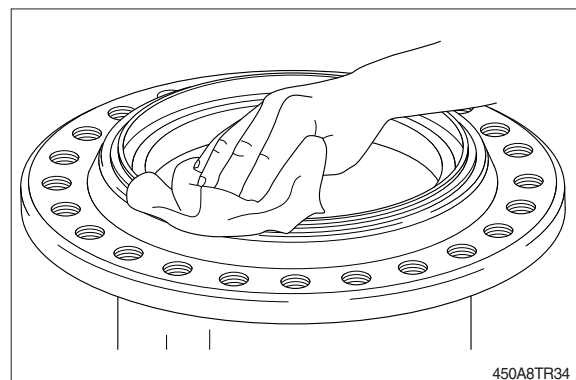
(1) Fit the half seals (16) on the tool.



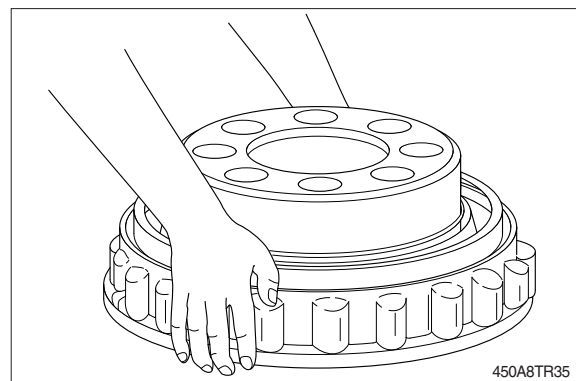
(2) Fit the half seals (16) inside the gearbox housing (15).



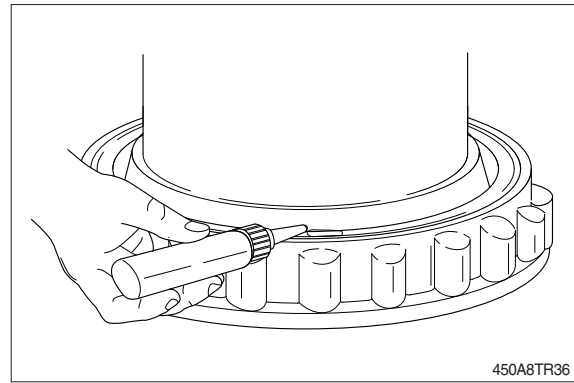
(3) Clean carefully the metallic face of the half-seal.



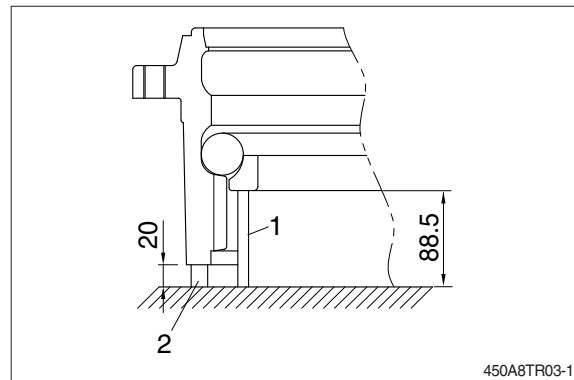
(4) Assemble, by using the same tool, the half seal (16) on the flanged hub (17).



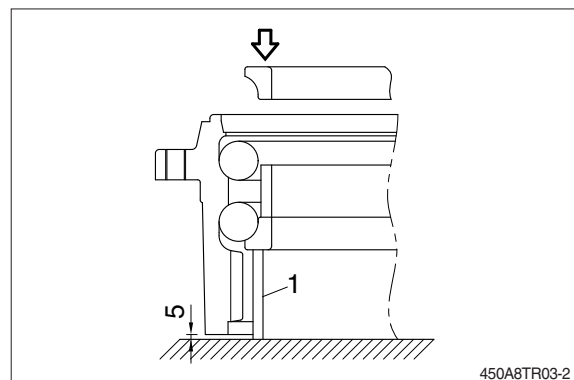
- (5) Lube the metallic face of the half seal with a thin oil film.



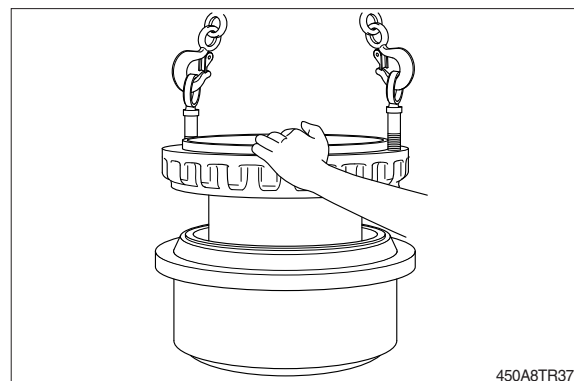
- (6) Fit on the housing the lower ball row, withstanding the ball race through the spacers 1 and 2.
Between the balls, insert the proper spacers.



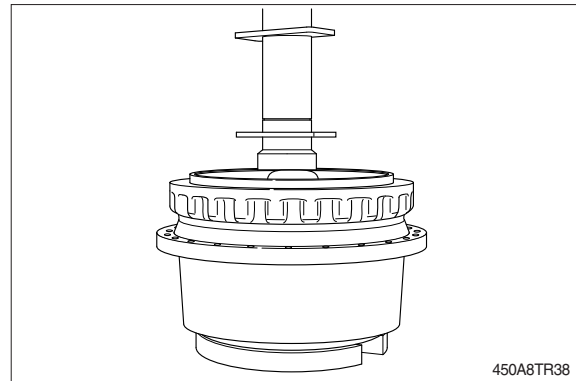
- (7) After having placed the bearing spacer fit the upper ball row.
Then place the upper inner race.



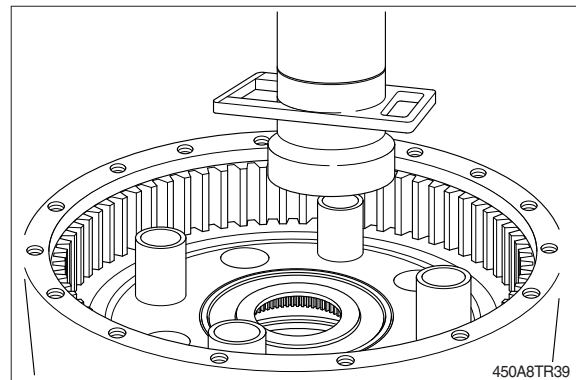
- (8) Lift the flanged hub (17) then lower it inside the gearbox housing (15).



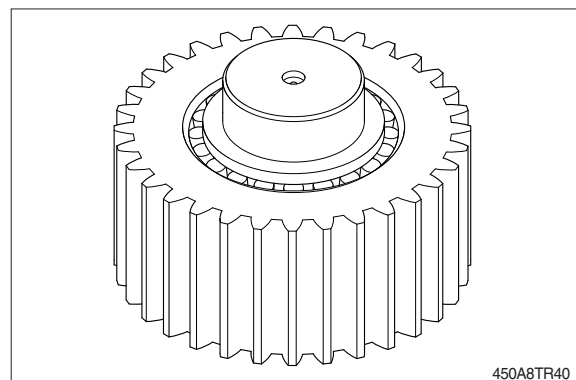
(9) Using a press and a metal stopper, push the flanged hub (17) against the shoulder on the gearbox housing (15) until assembling is complete.



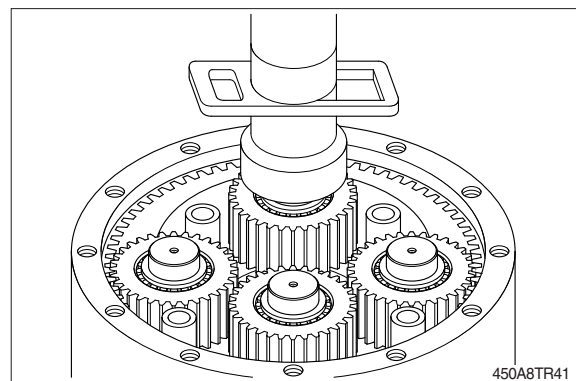
(10) Using a press, place and push the 4 bush, inside their seats on the flanged hub (17).



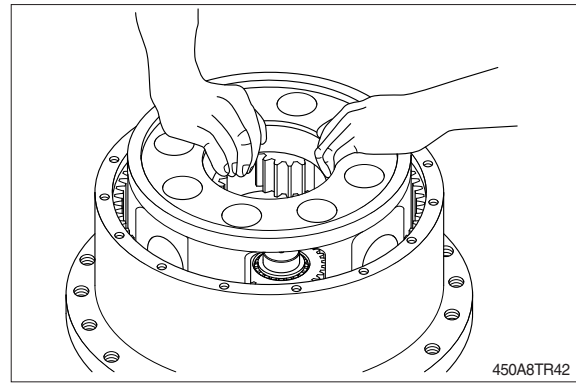
(11) View of the 3rd reduction's planet assembly.



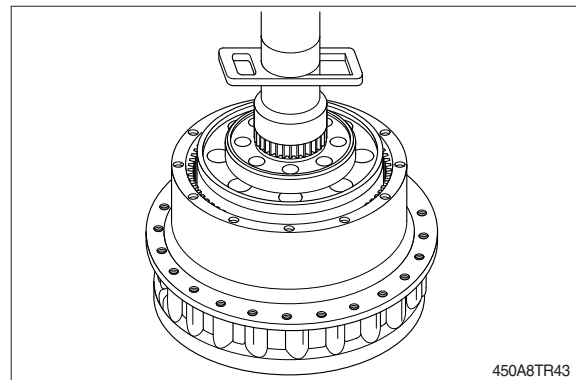
(12) Using a press push the 4 planet assemblies against the shoulder on the flanged hub (17).



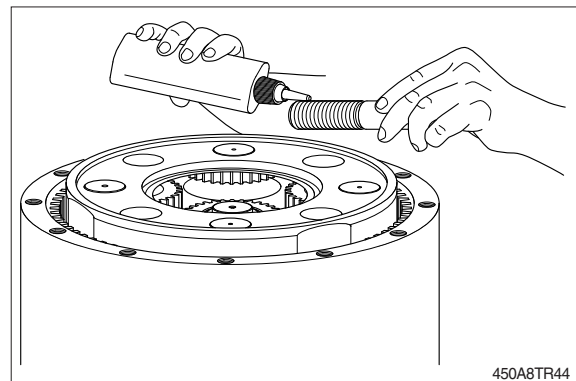
(13) Place the 3rd reduction planet carrier on the hub (17).



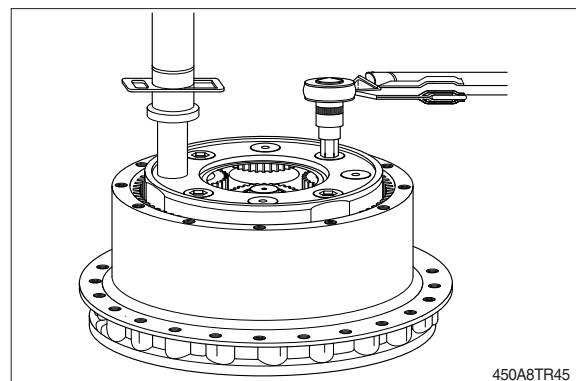
(14) Using a press push the 3rd reduction planet carrier against the shoulder on the flanged hub (17) until complete assembly.



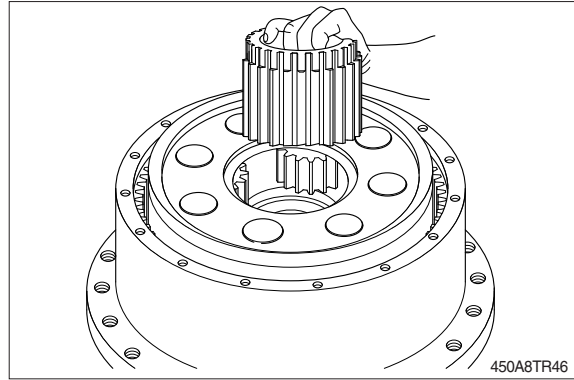
(15) Apply LOCTITE type 243 on the 4 socket head screws (11), and insert them in the thread holes.



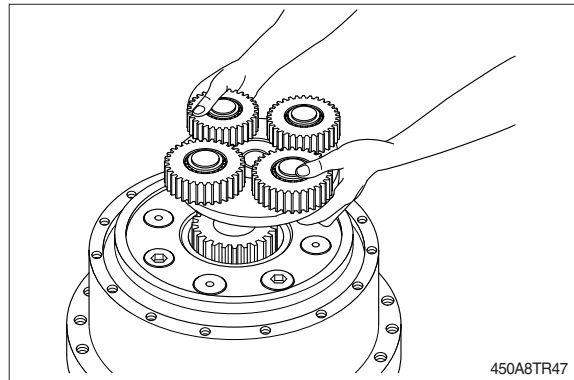
(16) Tighten the screws by a torque wrench at a torque of $153\text{kgf} \cdot \text{m}$ ($1107\text{lb} \cdot \text{ft}$), locking the gearbox acting with the press on a 3rd reduction's planet.



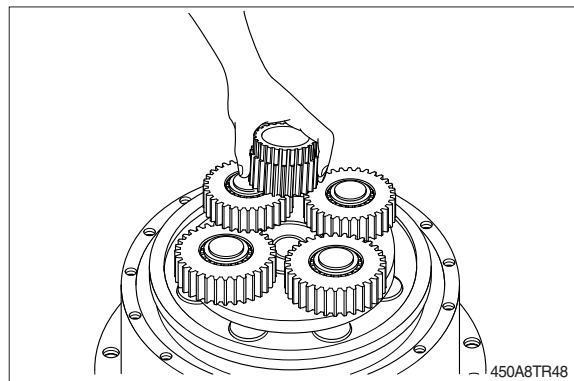
(17) Insert the 3rd stage sun gear (14).



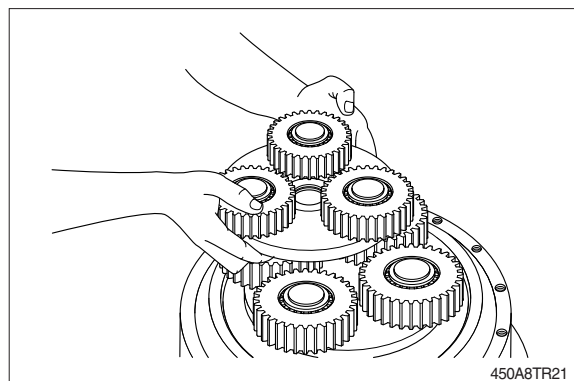
(18) Insert the 2nd reduction assembly (10).



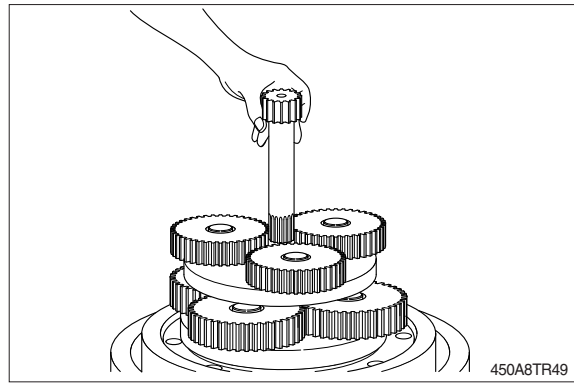
(19) Insert the 2nd stage sun gear (9).



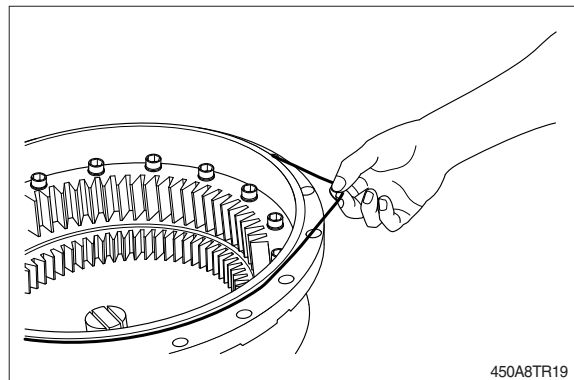
(20) Insert the 1st reduction assembly (8).



(21) Insert the 1st stage sun gear (7).

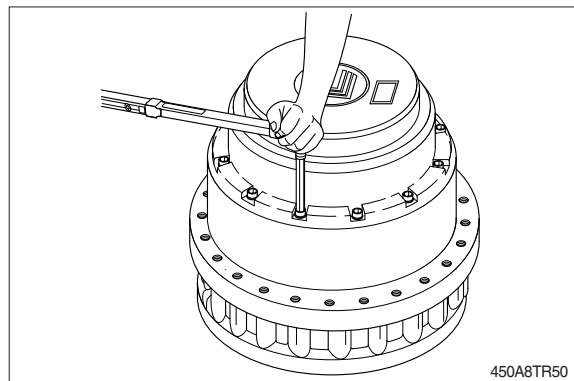


(22) Fit the O-ring (5) into its groove in the end cover (4).

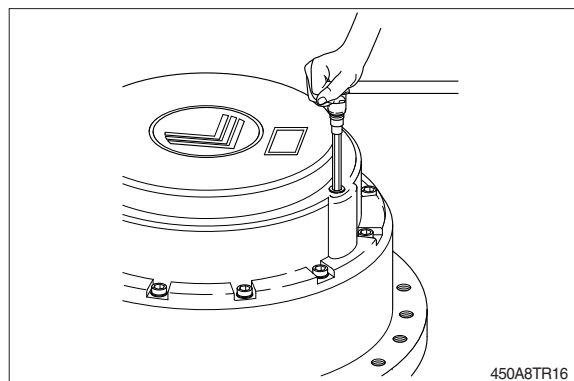


(23) Place the end cover (4) on the gearbox housing (15).

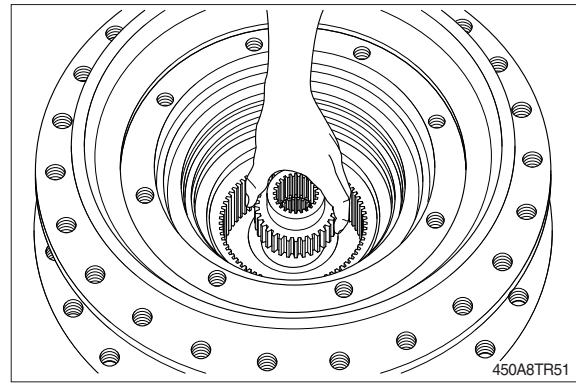
Apply LOCTITE type 243 on the 16 socket head screws (3), and tighten them by a torque wrench at a torque of 19.4 kgf · m (140 lbf · ft).



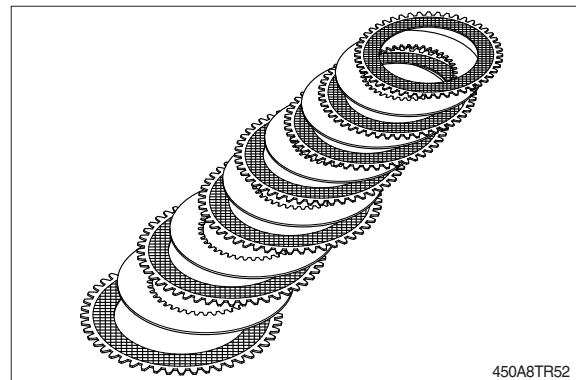
(24) Place the 2 washer (1) in their groves and tighten the 2 plugs at a torque of 6.1~8.2 kgf · m (44.1~59.3 lbf · ft).



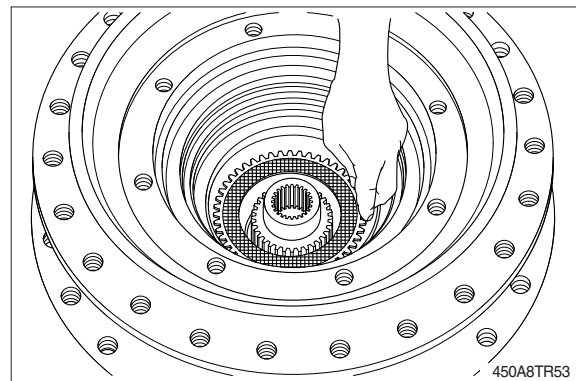
(25) Turn the gearbox around and insert the brake shaft (19).



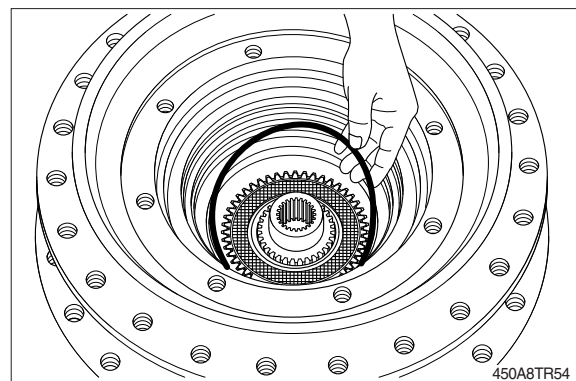
(26) View of the brake discs (21, 22).



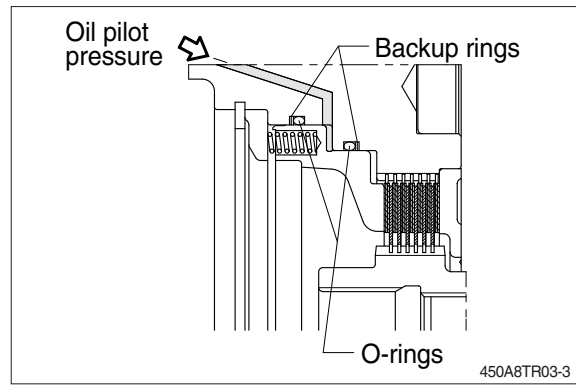
(27) Assemble the brake discs package according to the following order: Firstly insert an external toothed sintered bronze disc (21). Then insert, an internal toothed steel disc (22). Repete the operation until reaching the number of 7 bronze and 6 steel discs.



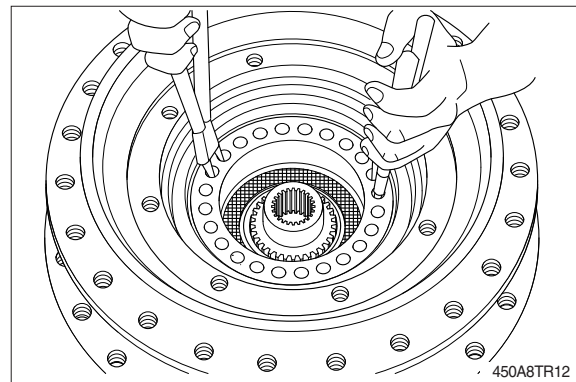
(28) Fit the backup rings (23, 26) and the O-rings (24, 25) inside the two internal grooves of the flanged hub (17, see drawing).



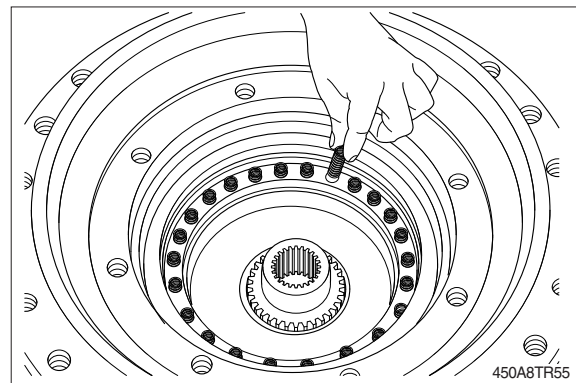
- ※ An O-ring and a backup ring must be fitted in the groove paying attention that the backup ring must always be beyond the O-ring against the oil flow.



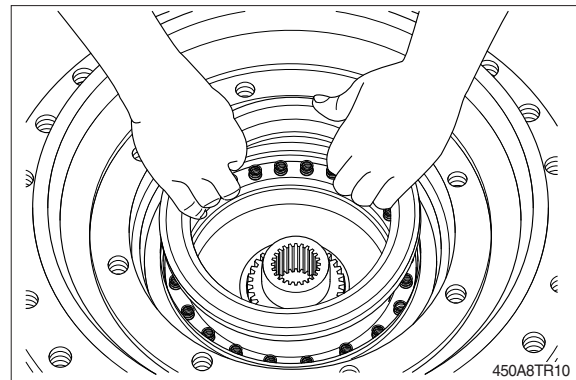
- (29) Insert the brake piston (27) inside the flanged hub (17), paying attention not to damage the seals already fitted.



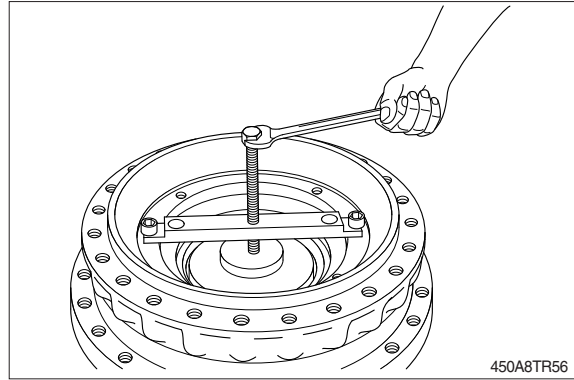
- (30) Insert the springs (28) into the grooves in the brake piston (27).



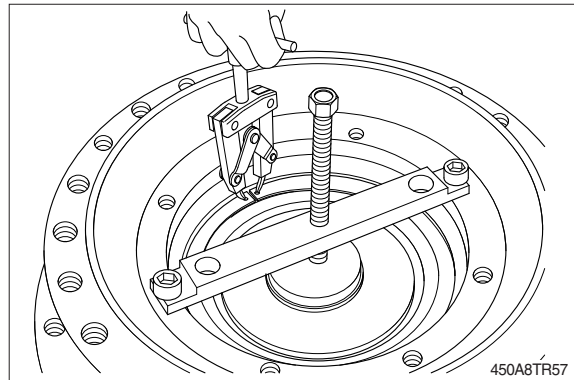
- (31) Insert the retainer disc (29).



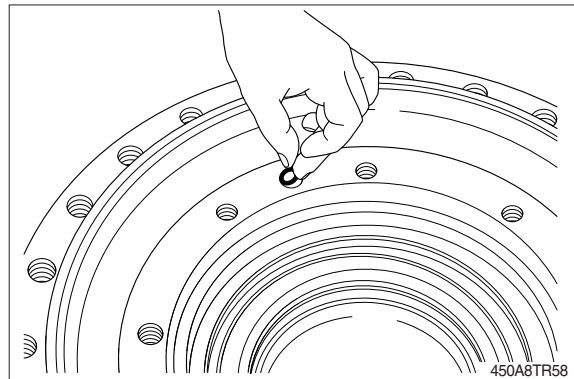
(32) Fixed the equipment to the flanged hub (17) and screw the threaded screw up the springs retainer disc (29) is lowered below the circlip seat (30).



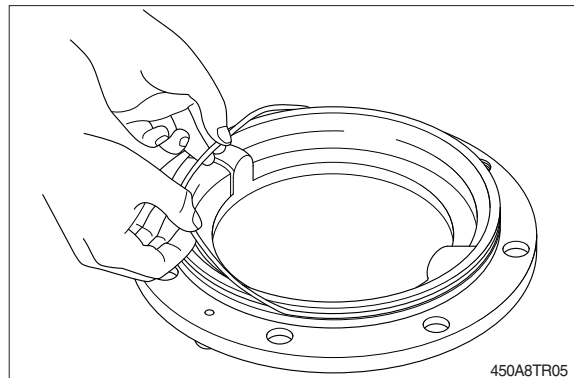
(33) By means of pliers, place the circlip (30) into its groove.



(34) Fit the O-ring (36) into its groove in the flanged hub (17).

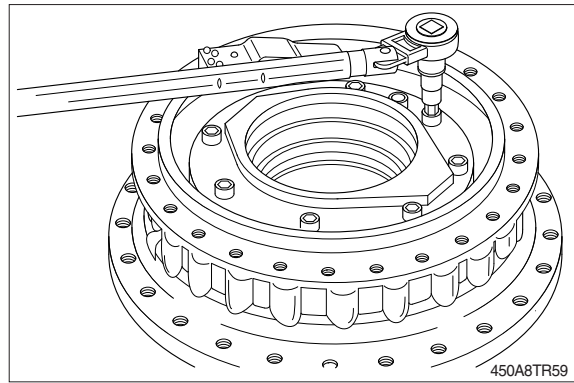


(35) Fit the O-ring (20) into the groove of the motor flange (32).



(36) Place and fix the motor flange (32) to the flanged hub (17) through 8 screws (35) tightened by a torque wrench at a torque of $21.9 \text{ kgf} \cdot \text{m}$ ($158.4 \text{ lbf} \cdot \text{ft}$).

※ After having reassembled the gearbox, fit the travel motor (taking care to include the O-ring(32), by means of 2 fixing screws(33), tightened at $42.3 \text{ kgf} \cdot \text{m}$ ($306.0 \text{ lbf} \cdot \text{ft}$). Fill the gearbox with the lubricant oil.



TRAVEL DEVICE (TYPE 4)

1. REMOVAL AND INSTALL

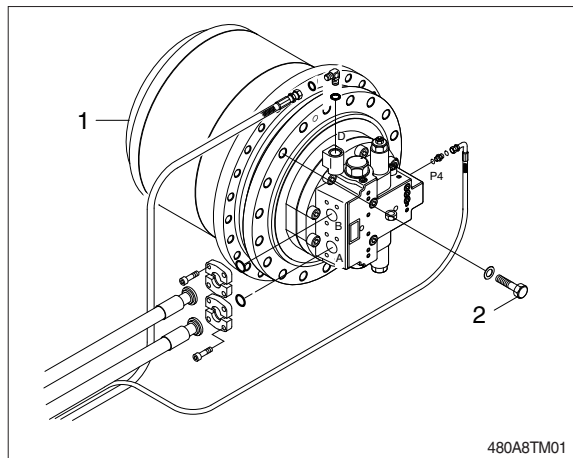
1) REMOVAL

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

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

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

- (4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.
- (5) Remove the cover.
- (6) Remove the hoses.
※ Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly (1).
- (9) Remove the mounting bolts (2), then remove the travel device assembly.
 - Weight : 632 kg (1393 lb)
 - Tightening torque : 57.9 ± 8.7 kgf · m
(419 ± 62.9 lbf · ft)

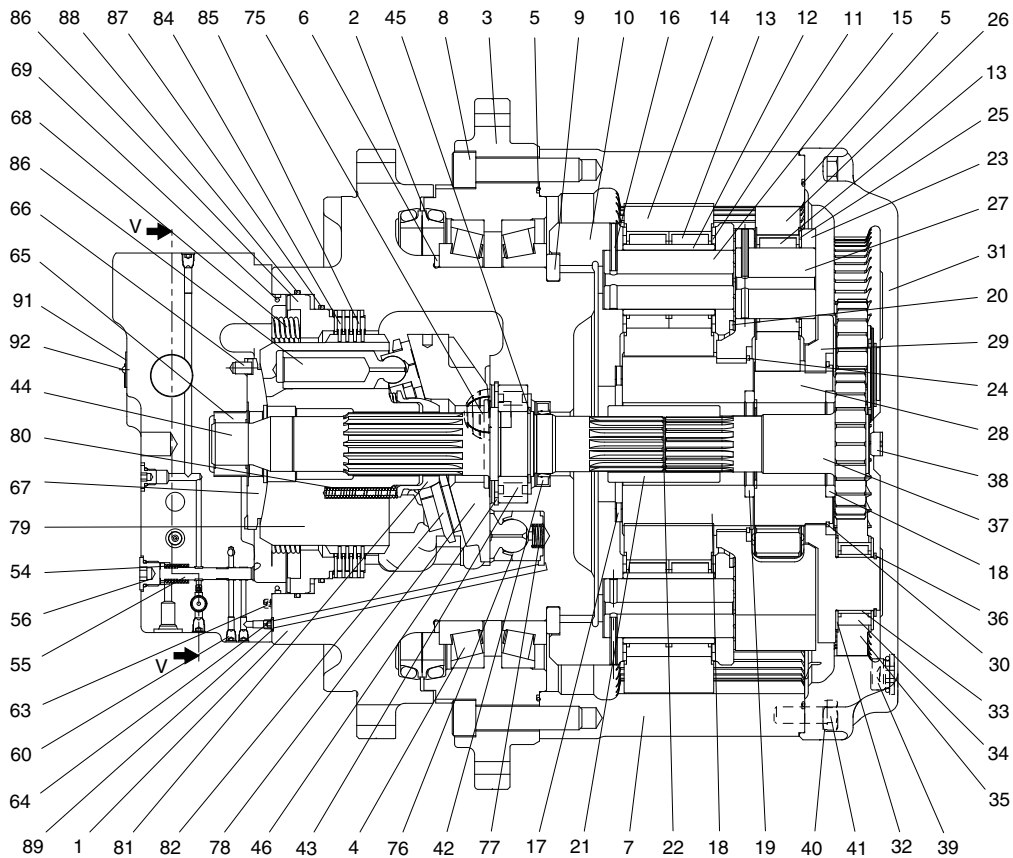


2) INSTALL

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

2. TRAVEL MOTOR

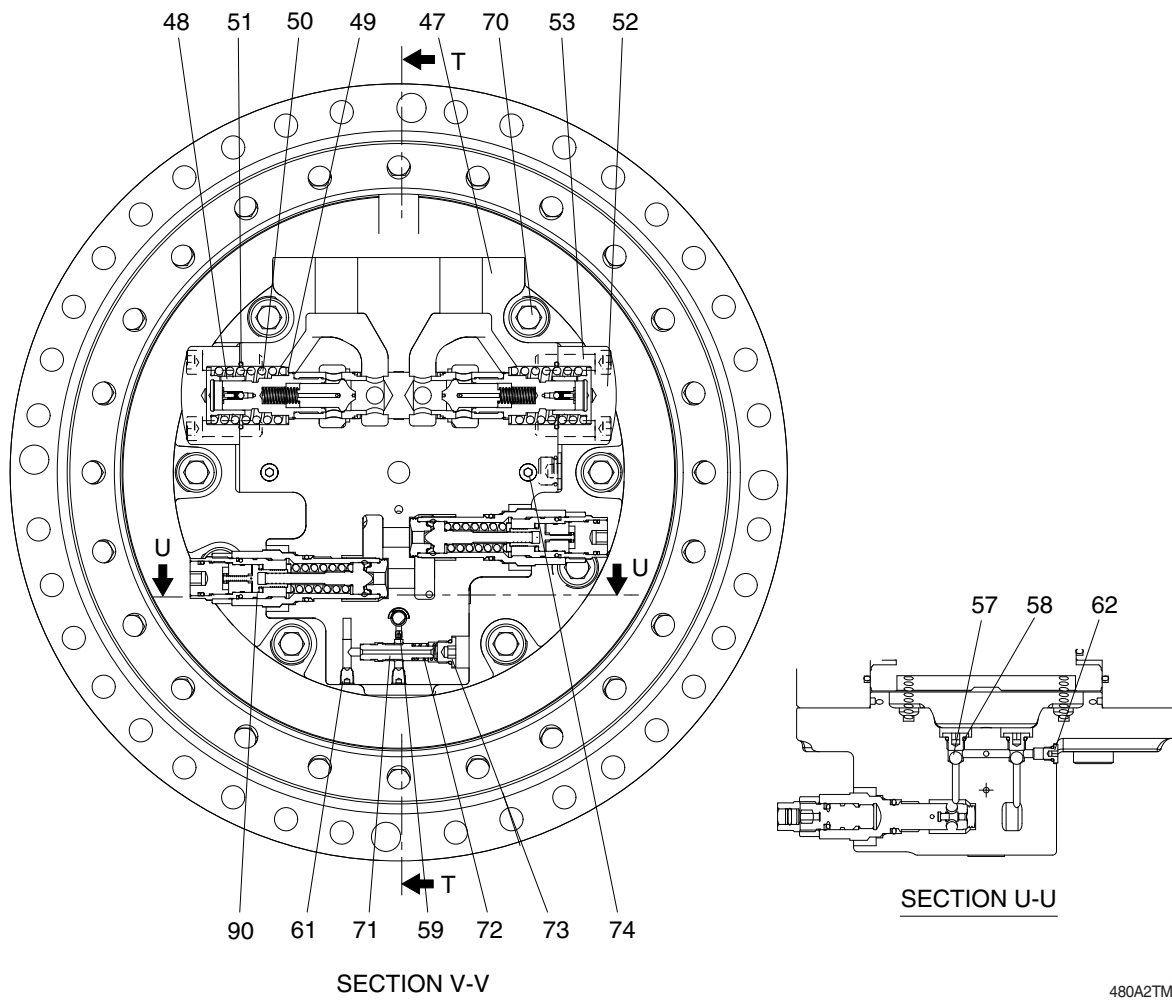
1) STRUCTURE (1/2)



480A2TM02

1	Casing	26	Planetary gear no.2	63	Orifice
2	Floating seal	27	Shaft no.2	64	Orifice
3	Hub	28	Sun gear no.2	65	Needle bearing
4	Taper roller bearing	29	Carrier no.1	66	Parallel pin
5	O-ring	30	Clip	67	Valve plate
6	Distance piece	31	Cover	68	Spring
7	Ring gear	32	Side plate	69	O-ring
8	Socket bolt	33	Ring inner	75	Pivot
9	Shim plate	34	Needle bearing	76	2 speed piston assy
10	Carrier no.3	35	Planetary gear no.1	77	2 speed piston spring
11	Thrust washer	36	Snap ring	78	Swash plate
12	Floating bushing	37	Drive gear	79	Cylinder block
13	Needle bearing	38	Thrust washer	80	Cylinder block spring
14	Planetary gear no.3	39	HS plug assy	81	Spherical bushing
15	Shaft no.3	40	Spring washer	82	Retainer plate
16	Spring pin	41	Hex bolt	83	Piston assy
17	Thrust plate	42	Shaft seal	84	Friction plate
18	Sun gear no.3	43	Roller bearing	85	Separation plate
19	Thrust ring	44	Drive shaft	86	Brake piston
20	Thrust ring	45	Snap ring	87	O-ring
21	Coupling	46	Snap ring	88	O-ring
22	Snap ring	54	2 speed spring	89	O-ring
23	Carrier no.2	55	2 speed spool	91	Name plate
24	Clip	56	HS plug assy	92	Rivet screw
25	Thrust washer	60	MW 08		

STRUCTURE (2/2)



480A2TM03

47	Valve casing	53	Socket bolt	70	Socket bolt
48	Counterbalance spool sssy	57	Steel ball	71	Reducing valve
49	CB Washer	58	HS plug assy	72	Reducing spring
50	CB main spring	59	Orifice	73	HS plug assy
51	O-ring	61	MW 10	74	PT plug
52	CB cover	62	HS plug assy	90	Relief valve

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark
Hex bit	8, 10, 17mm
Hex socket	22, 41mm
Eye bolt	M16x2
Guide pin	M20x2.5x45
Torque wrench	Capable of tightening with the specified torques.
Ball bearing assembly press-fit jig	-
Floating seal assembly jig	-
Caliper	-
Plastic hammer	-
Air gun	-
Compressed air	-

(2) Tightening torque

Item	Part name	Torque	
		kgf · m	lbf · ft
39	Plug	17.0 ± 3.0	123 ± 21.7
41	Socket bolt	10.4 ± 1.6	75.2 ± 11.6
53	Socket bolt	17.4 ± 2.5	126 ± 18.1
56	Plug	10.0 ± 2.0	72.3 ± 14.5
58	Plug	6.0 ± 1.5	43.4 ± 10.8
70	Socket bolt	50.3 ± 8.0	364 ± 57.9
90	Relief valve	18.0 ± 3.6	130 ± 26.0

4. DISASSEMBLY AND ASSEMBLY

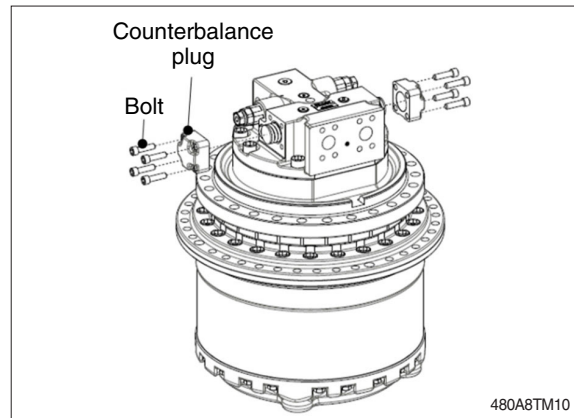
1) PRECAUTIONS

- (1) Be careful not to damage the seal contact surface of the floating seal, O-ring, shaft seal, etc. and the contact surface of the gear, pin, bearing.
- (2) When disassembling after mounted on the equipment, make sure no foreign substances enter the equipment.
- (3) Clean each part with oil sufficiently and dry it with the compressed air before assembly.
- (4) When using oil absorbent or oil mop, be careful not to scratch the parts. Clean it thoroughly with lint-free cloths before assembly.
- (5) When tightening the bolt and plug, use a torque wrench and tighten the bolt and plug to the specified tightening torque.
- (6) Use a plastic hammer to tap the non-functional parts.
- (7) replace the floating seal, O-ring, shaft seal with a new one when disassembly.
- (8) For the assembly of bearing preload/floating seal, please contact Hyundai dealer for the detailed assembly method.

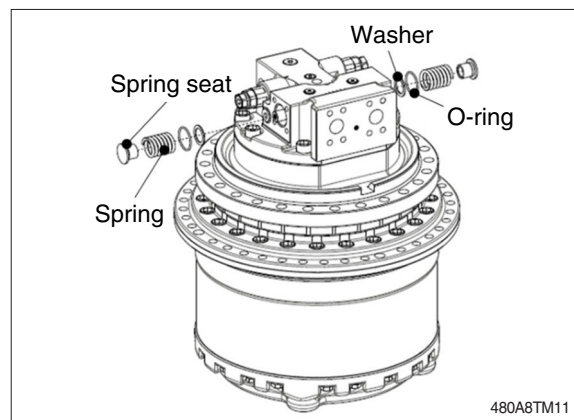
2) DISASSEMBLY

(1) Disassemble the counterbalance plug and bolt.

※ Required tools : torque wrench, hex bit 10 mm.

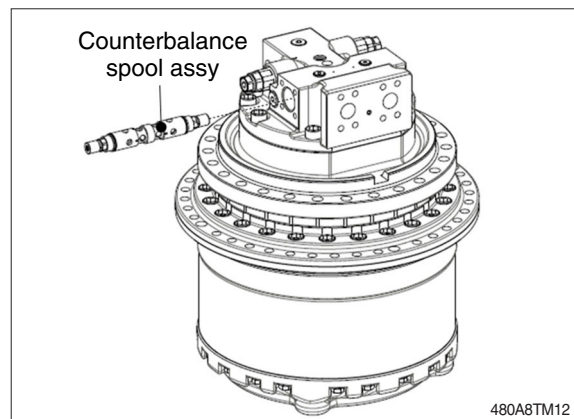


(2) Disassemble the spring, spring seat, O-ring, washer.



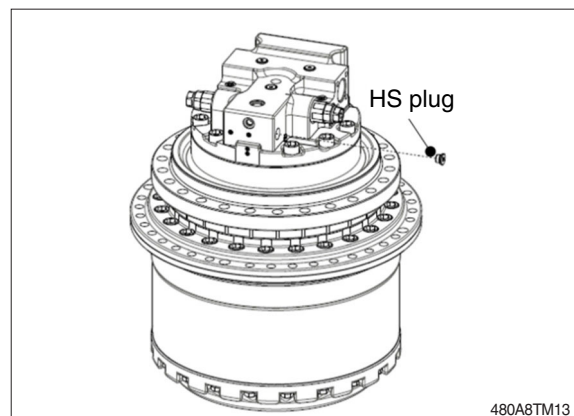
(3) Turn the counterbalance spool assy slowly to disassemble .

※ Damage caution of counterbalance spool surface.

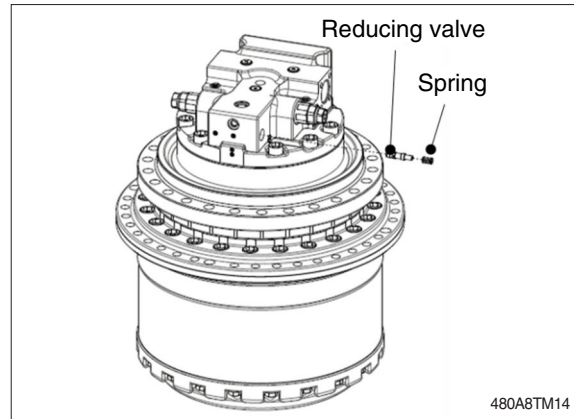


(4) Disassemble the HS plug.

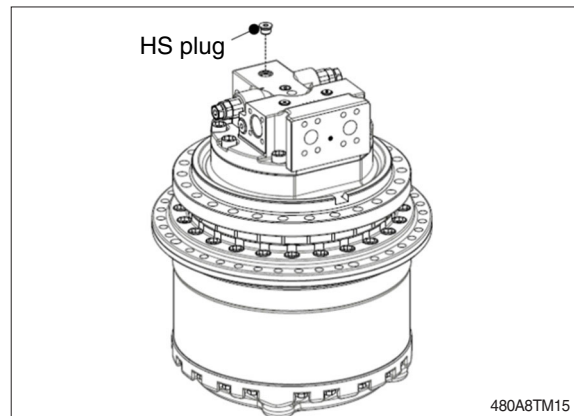
※ Required tools : torque wrench, hex bit 8 mm.



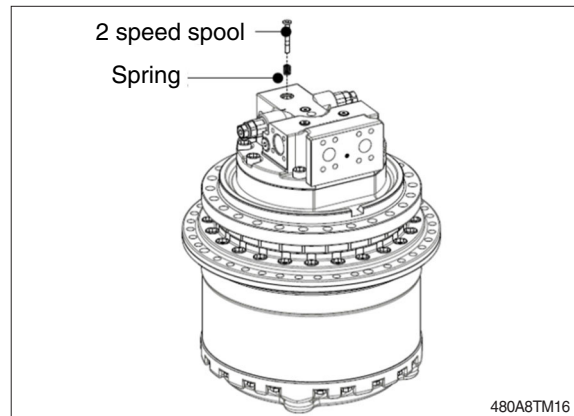
- (5) Disassemble the reducing valve, spring.
※ Damage caution of reducing valve surface.



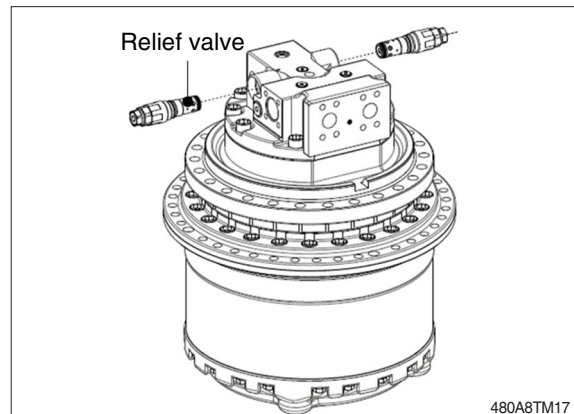
- (6) Disassemble the HS plug.
※ Required tools : torque wrench, hex bit 10 mm.



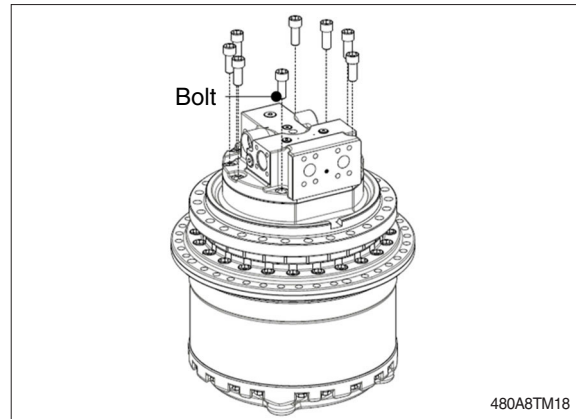
- (7) Disassemble the 2 speed spool and spring.
※ Damage caution of 2 speed spool surface.



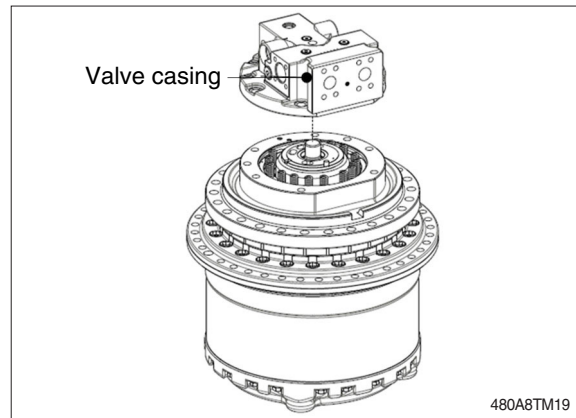
- (8) Disassemble the relief valves.
※ Required tools : torque wrench, hex socket 41 mm.



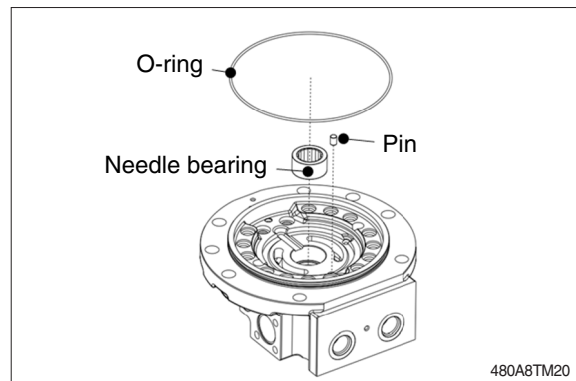
- (9) Loosen each bolt evenly to disassemble.
 ※ Required tools : torque wrench, hex bit 17 mm.



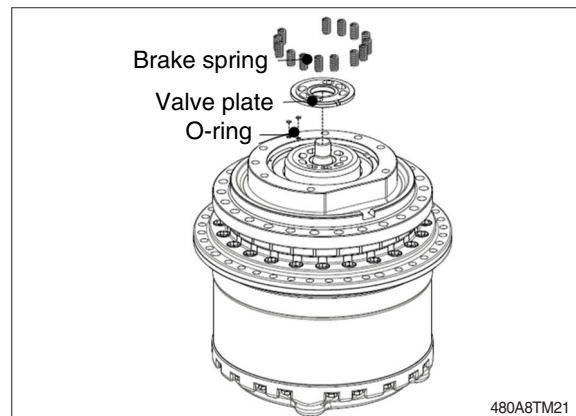
- (10) Disassemble the valve casing.



- (11) Disassemble the needle bearing, O-ring, pin.



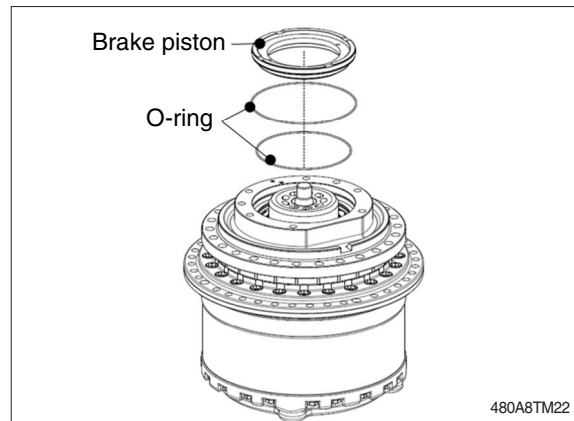
- (12) Disassemble the brake spring.
 ※ Quantity of the brake springs could be different of each model.
 Disassemble the valve plate and O-ring.



(13) Cover the top of a motor with cloths and disassembly the brake piston by blowing compressed air into the brake releasing line of the motor casing.

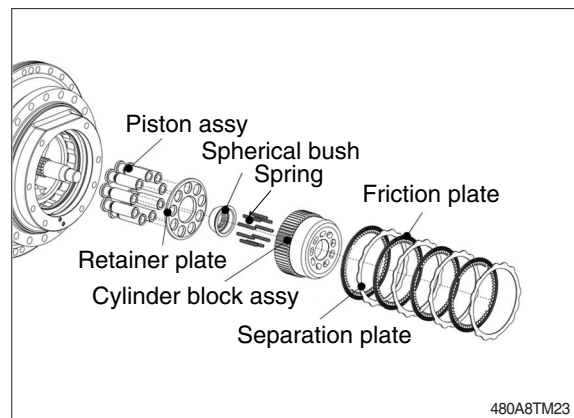
Disassemble the O-ring.

※ Required tools : compressed air, air gun.

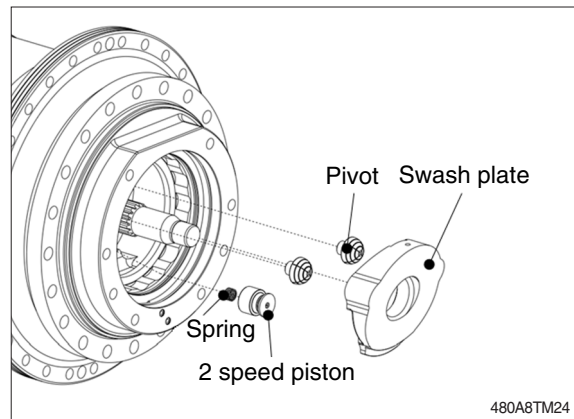


(14) Disassemble separation plate, friction plate, cylinder block assembly, spherical bush, spring, retaining plate and piston assembly.

※ Quantity of separation and friction plates could be different of each model.

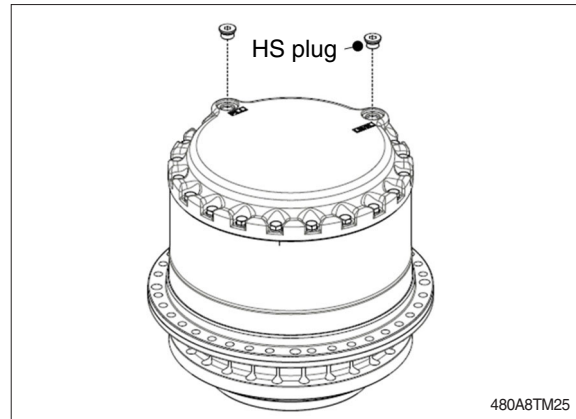


(15) Disassemble the swash plate, pivot, 2 speed piston and spring.



(16) Disassemble the HS plug and discharge the reduction gear oil.

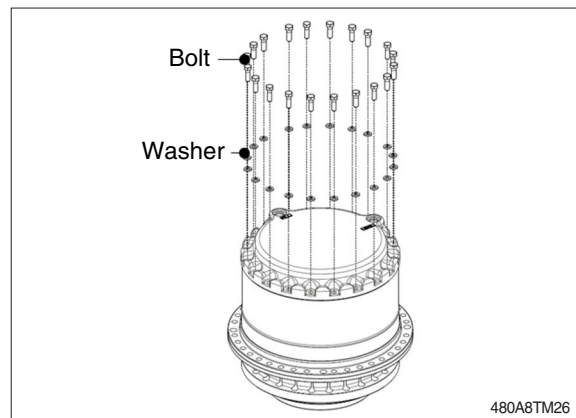
※ Required tools : torque wrench, hex bit 10 mm.



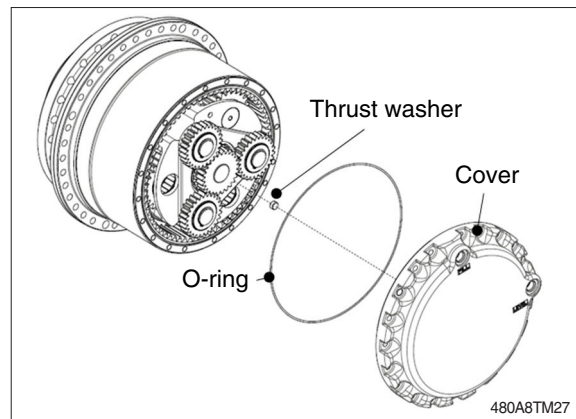
(17) Disassemble the bolt and washer.

※ Do not re-use.

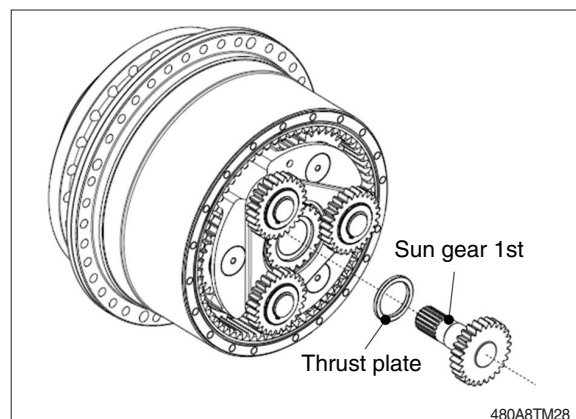
※ Required tools : torque wrench, hex socket 22 mm.



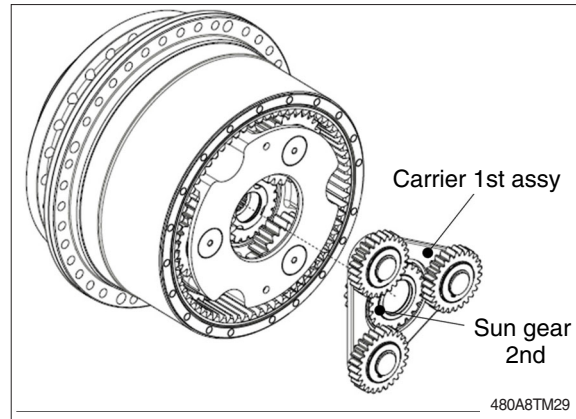
(18) Disassemble the cover, thrust washer and O-ring.



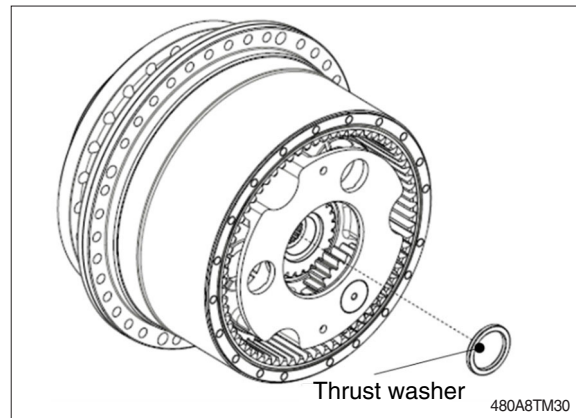
(19) Disassemble the sun gear 1st and thrust plate.



(20) Disassemble the carrier 1st assembly and sun gear 2nd.

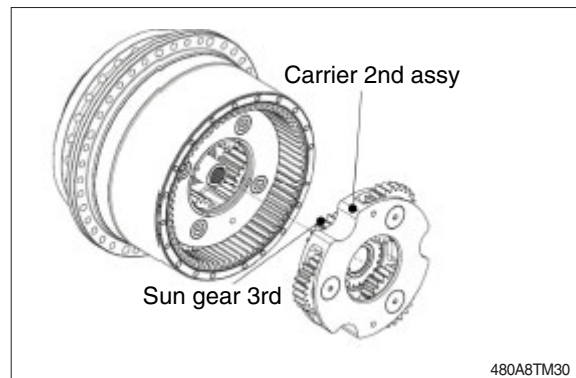


(21) Disassemble the thrust washer.

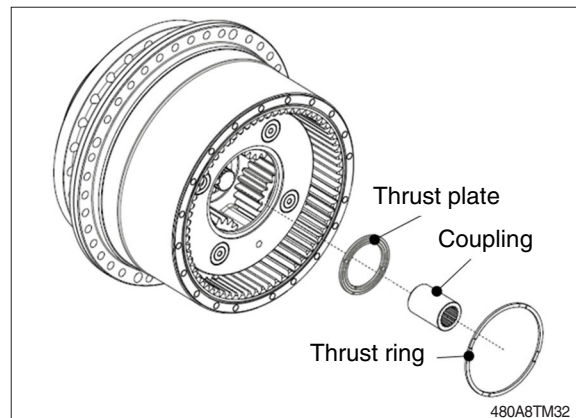


(22) Disassemble the carrier 2nd assembly and sun gear 3rd.

※ Required tools : eye bolt M16x2 (2ea)

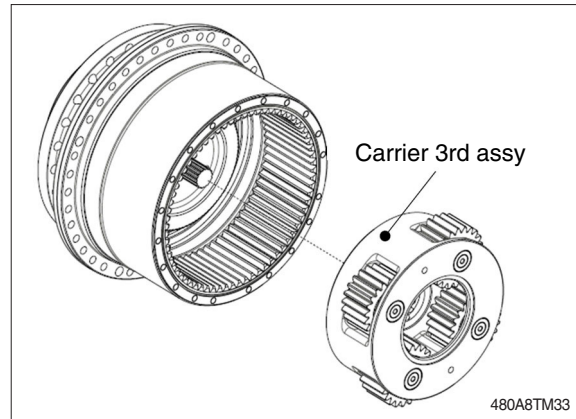


(23) Disassemble the thrust ring, coupling and thrust plate.

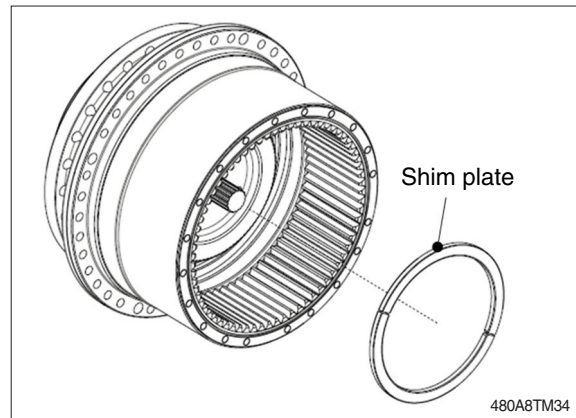


(24) Disassemble the carrier 3rd assembly.

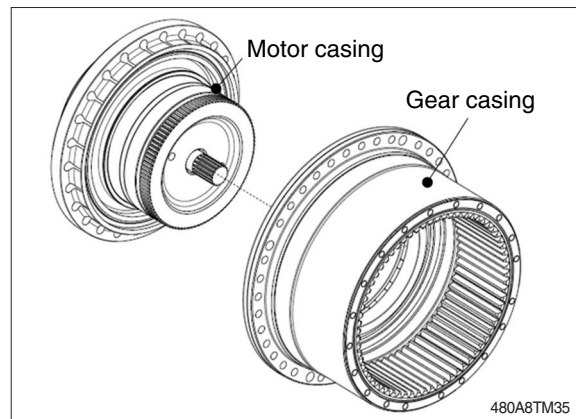
※ Required tools : eye bolt M16x2 (2ea)



(25) Disassemble the shim plate.

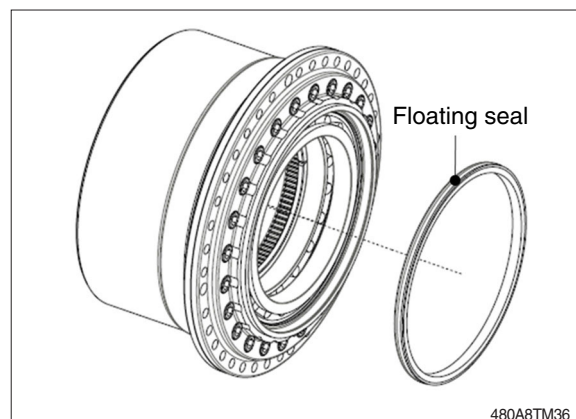


(26) Disassemble the gear casing.

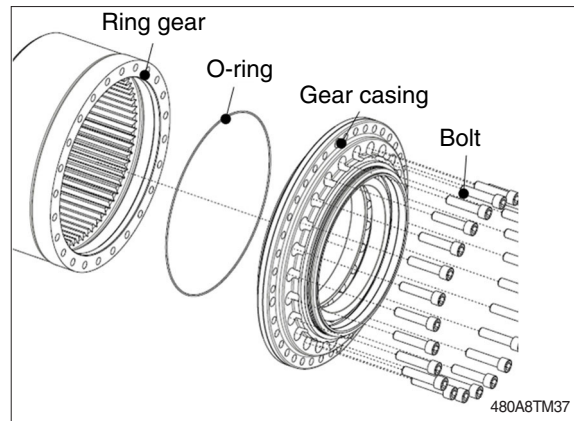


(27) Disassemble the floating seals and O-ring.

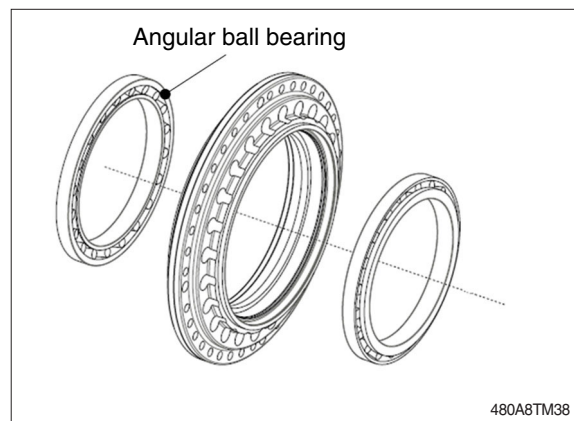
※ Damage caution of floating seal.



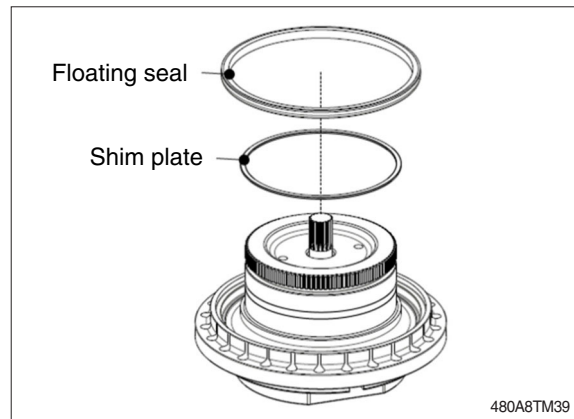
(28) Disassemble the bolt, gear casing, O-ring and ring gear.



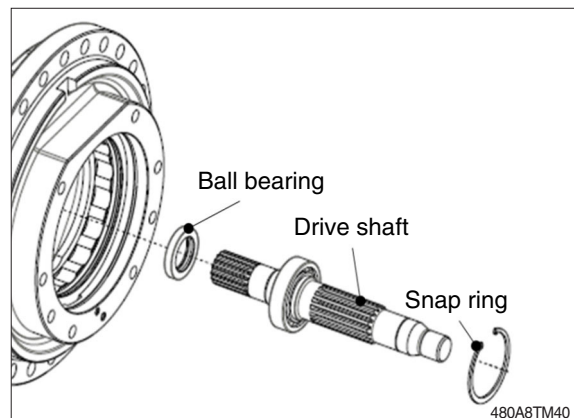
(29) Disassemble the angular ball bearing.
※ Do not disassemble if not necessary.



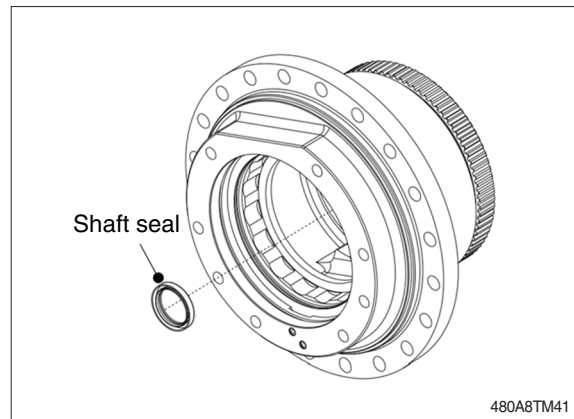
(30) Disassemble the floating seal and shim plate.
※ Damage caution of floating seal.



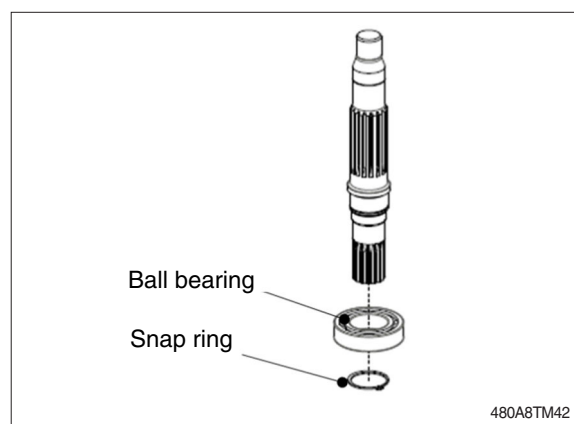
(31) Disassemble the drive shaft and ball bearing and snap ring.
※ Required tools : plier



- (32) Disassemble the shaft seal.
※ Do not re-use.



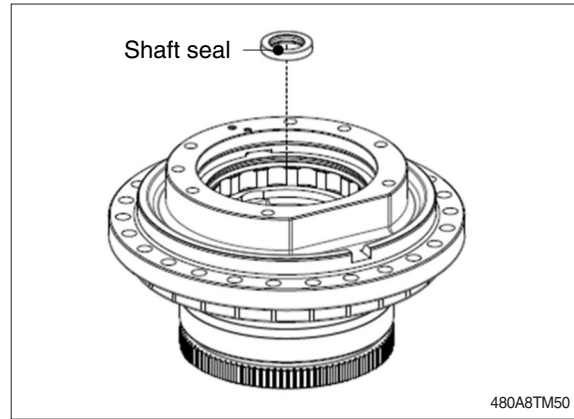
- (33) Disassemble the ball bearing and snap ring.
※ Do not disassemble if not necessary.
※ Required tools : plier



3) ASSEMBLY

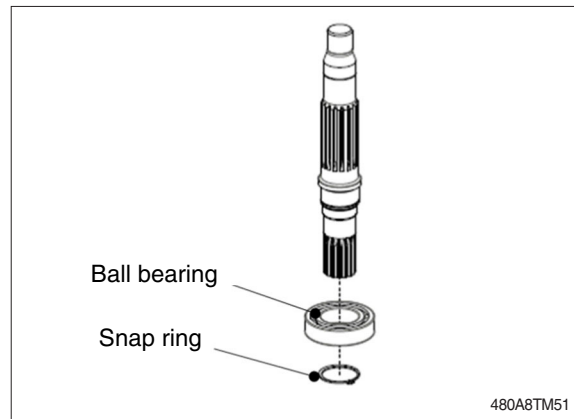
- (1) Apply a small amount of hydraulic fluid to the outer diameter of the shaft seal and assemble it to the motor casing

※ Required tools : shaft seal press-fit jig



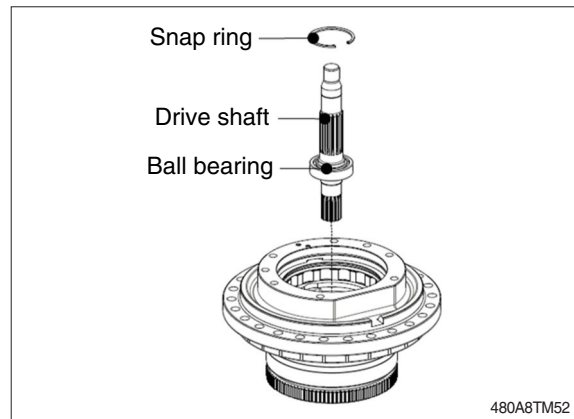
- (2) Assemble the ball bearing and snap ring to the drive shaft.

※ Required tools : ball bearing assembly press-fit jig, plier.



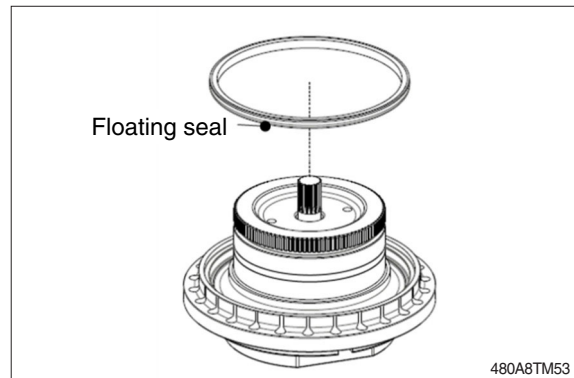
- (3) Assemble the drive shaft, ball bearing and snap ring to the motor casing.

※ Required tools : plier

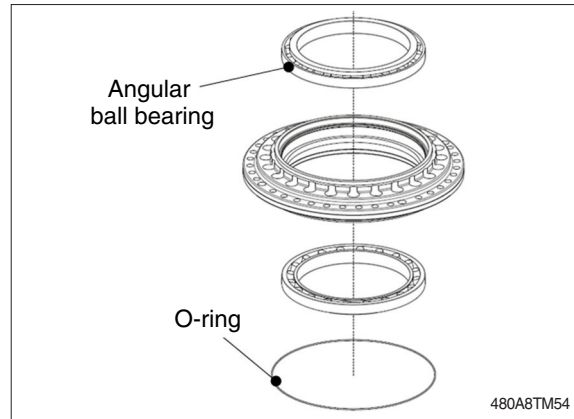


- (4) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the motor casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

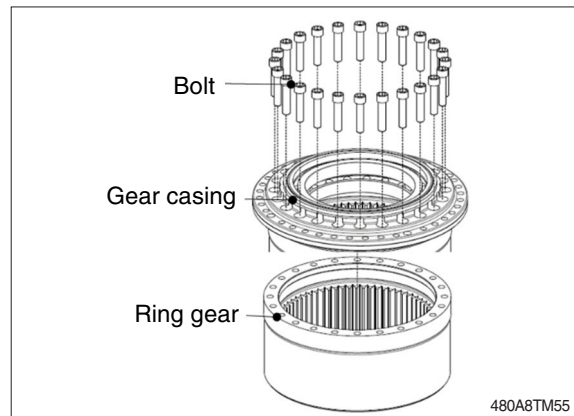
※ Required tools : floating seal assembly jig.



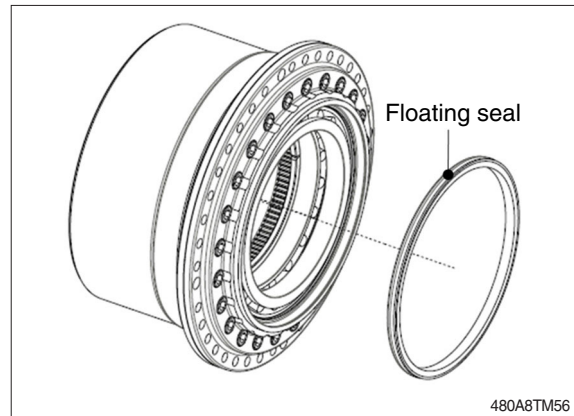
- (5) Assemble the angular ball bearing into the gear casing.
 Assemble the O-ring into the gear casing.
 ※ Required tools : angular ball bearing assembly press-fit jig.



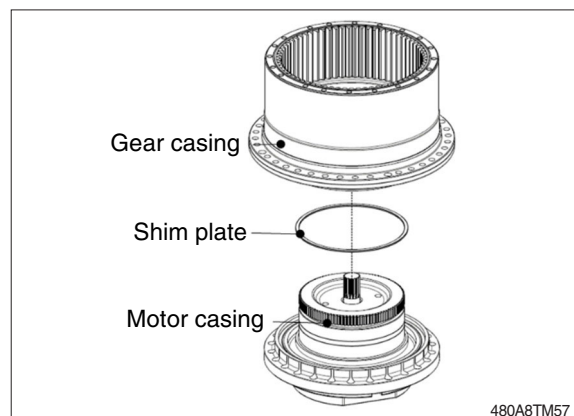
- (6) Assemble the gear casing and ring gear.
 Assemble the bolt after applying loctite 638.
 ※ Required tools : torque wrench, hex bit 17 mm.
 ※ Bolt size : M20x2.5
 ※ Tightening torque : 50.3 ± 8.0 kgf · m
 (364 ± 57.9 lbf · ft)



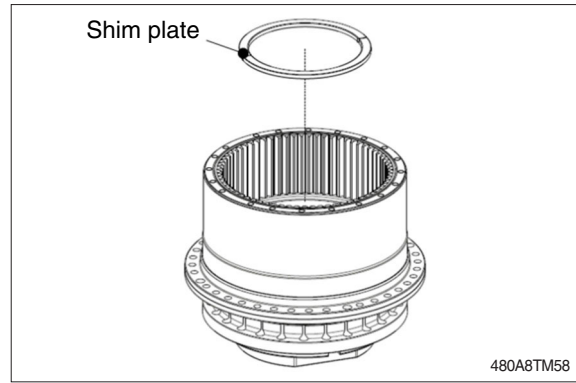
- (7) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the gear casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.
 ※ Required tools : floating seal assembly jig.



- (8) Assemble the shim plate and gear casing to motor casing.
 ※ Damage caution of floating seal.

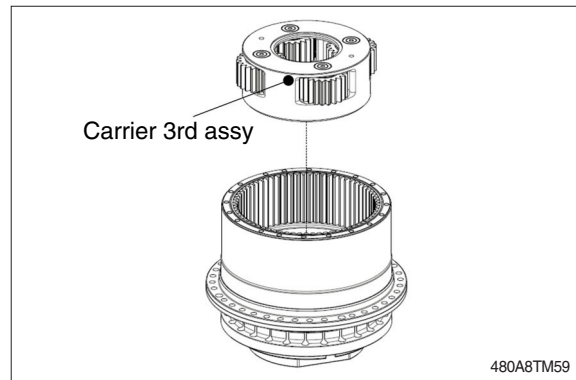


(9) Assemble the shim plate into the motor casing.

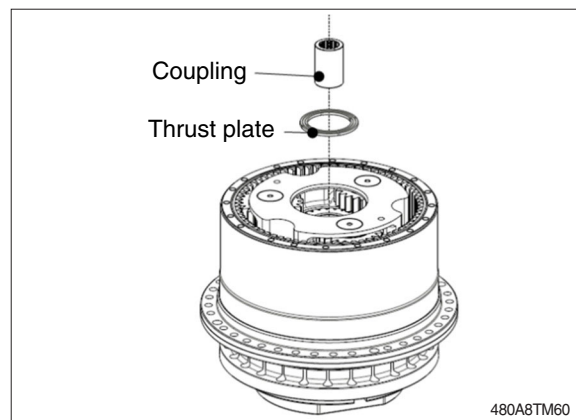


(10) Assemble the carrier 3rd assembly to gear casing.

※ Required tools : eye bolt M16x2 (2ea)

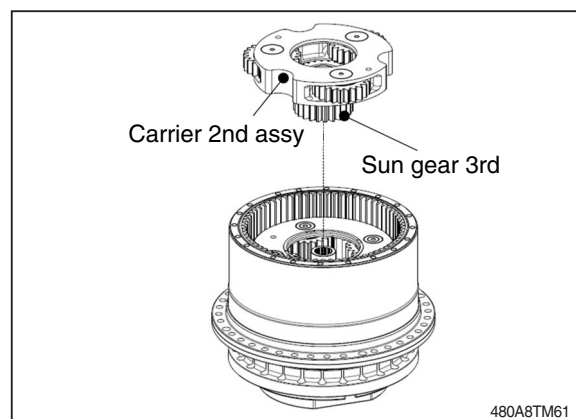


(11) Assemble the coupling and thrust plate.

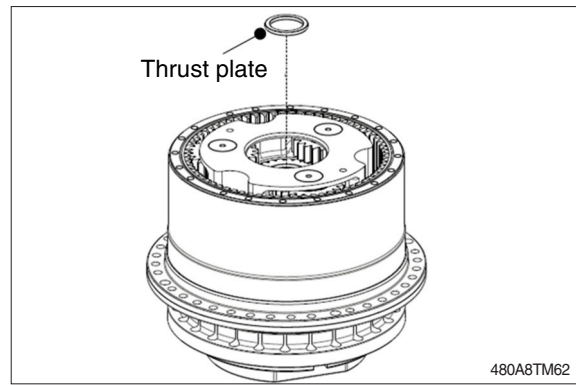


(12) Assemble the carrier 2nd assembly and sun gear 3rd to gear casing.

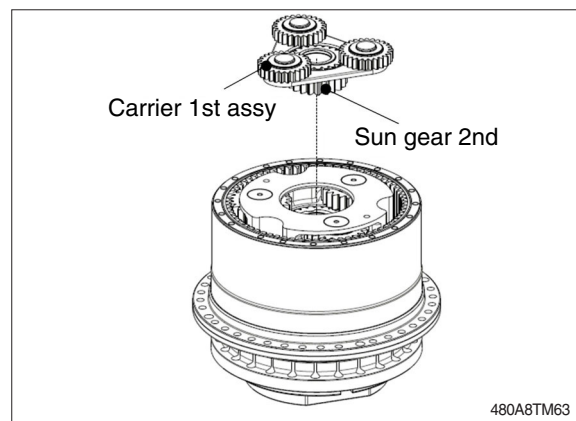
※ Required tools : eye bolt M16x2 (2ea)



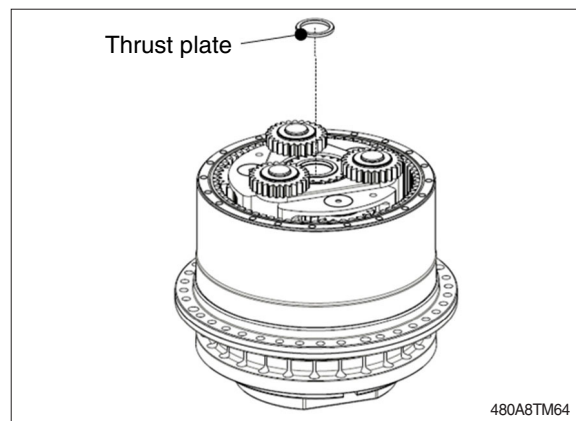
(13) Assemble the thrust plate.



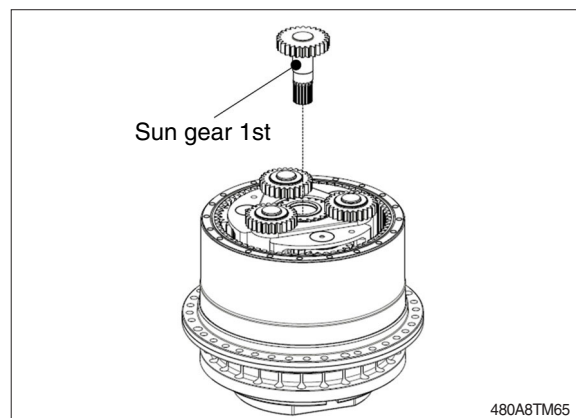
(14) Assemble the carrier no.1 assembly and sun gear 2nd.



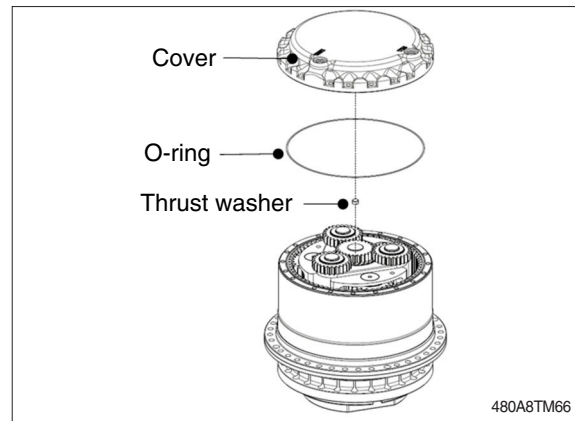
(15) Assemble the thrust plate.



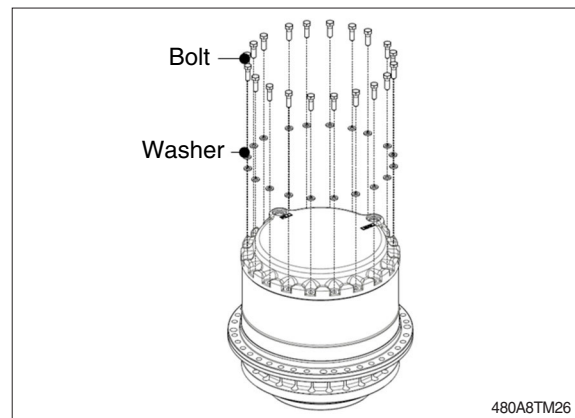
(16) Assemble the sun gear 1st.



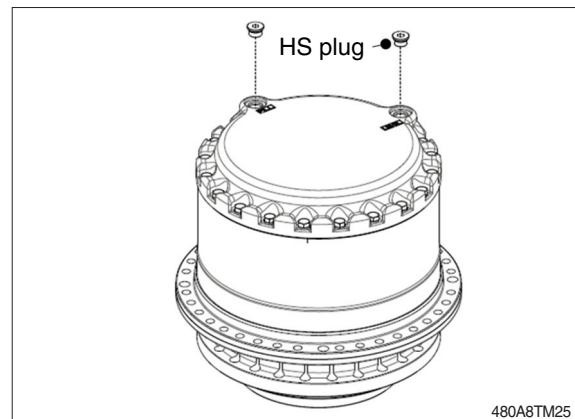
- (17) Apply grease to thrust washer and assemble it to cover.
Assemble the O-ring and cover to gear casing.



- (18) Assemble the bolt and washer.
- ※ Required tools : torque wrench, hex socket 22 mm.
 - ※ Bolt size : M14x2.0
 - ※ Tightening torque : 17.4 ± 2.5 kgf·m
(126 ± 18.1 lbf·ft)



- (19) Fill gear oil of 9 liter minimum and assemble HS plug to cover.
- ※ Required tools : torque wrench, hex bit 10 mm.
 - ※ HH plug size : G 3/4
 - ※ Tightening torque : 17.0 ± 3.0 kgf·m
(123 ± 21.7 lbf·ft)



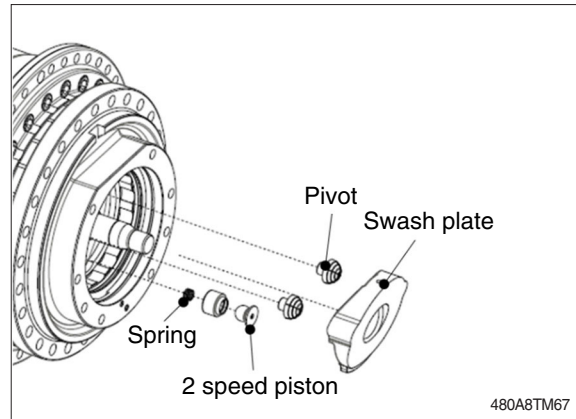
(20) Apply hydraulic fluid to the 2 speed piston outer diameter and swash plate polishing surface.

Apply grease to spring and assemble it to 2 speed piston. Assemble its to the motor casing.

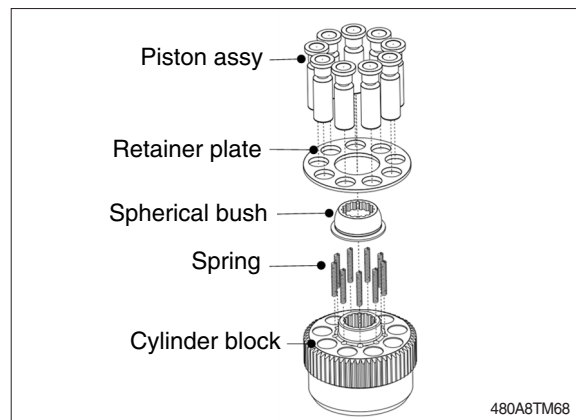
※ Check whether assembled well by pushing 2 speed piston by hand.

Assemble pivot and swash plate to motor casing.

※ Check whether assembled well by pushing 2 speed piston by hand.



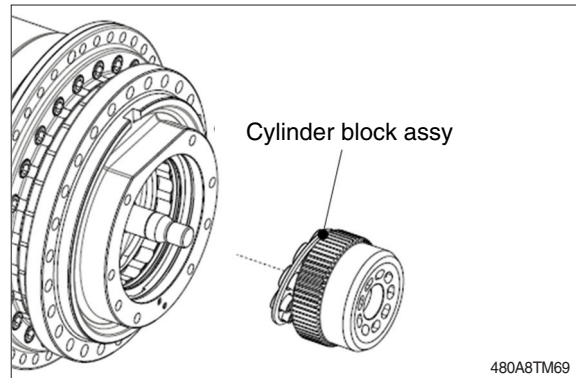
(21) Assemble the cylinder spring, cylinder block, spherical bush, retainer plate and piston assembly.



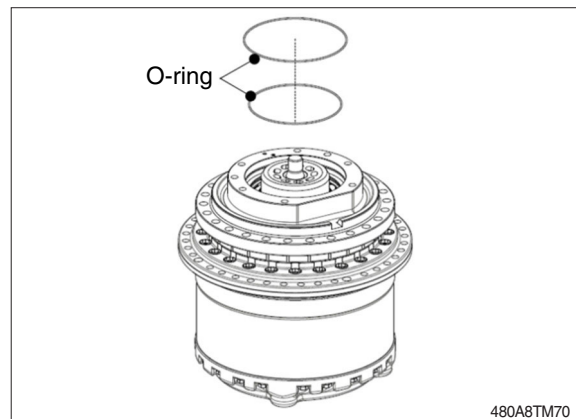
(22) Apply hydraulic fluid to the shoe.

Assemble the cylinder block assembly to drive shaft.

Apply hydraulic fluid to the cylinder block polishing surface.



(23) Assemble the O-ring to the motor casing.



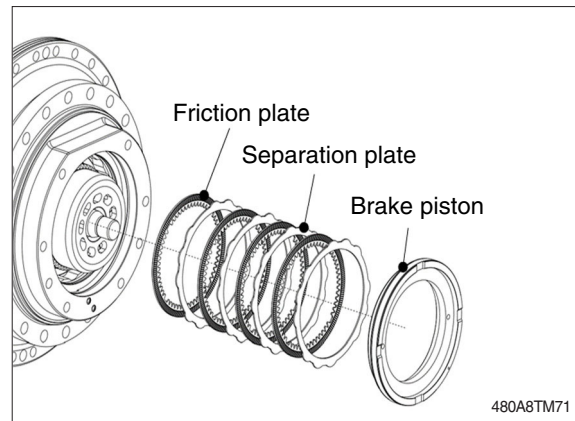
(24) Assemble the friction plate, separation plate to the motor casing in turn.

※ Be careful that the friction plate is in contact with the brake piston.

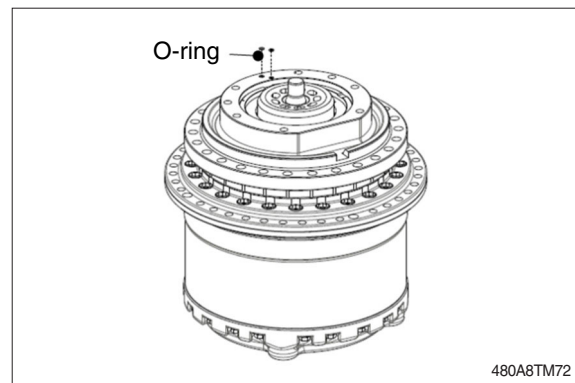
Assemble the brake piston to motor casing.

Check the brake piston is assembled completely to tap the the brake piston with a plastic hammer.

※ Quantity of friction plates and separation plates could be different of each model.



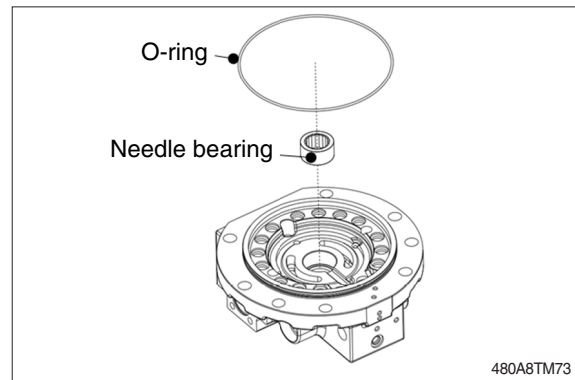
(25) Assemble the O-ring to the motor casing.



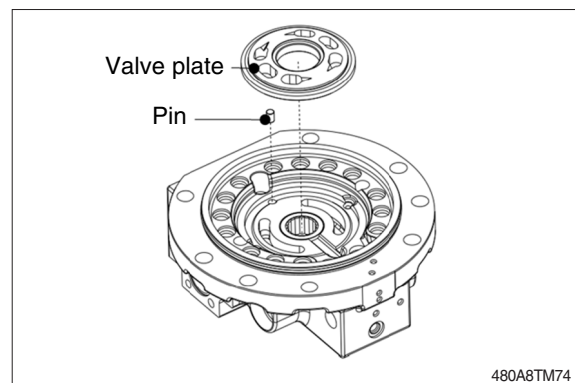
(26) Assemble the needle bearing to the valve casing.

Apply grease to the inner race of ball bearing.

Assemble the O-ring to the valve casing.

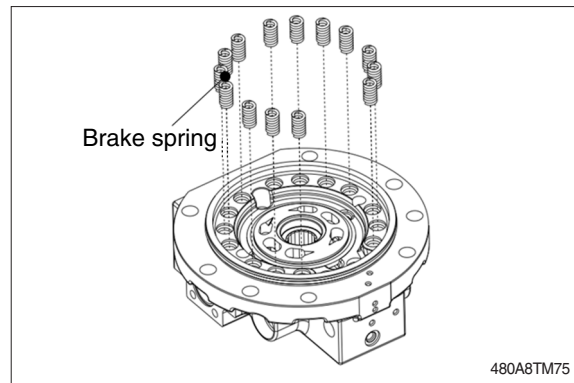


(27) Apply grease to the other side of the valve plate and assemble a valve plate and pin to valve casing.



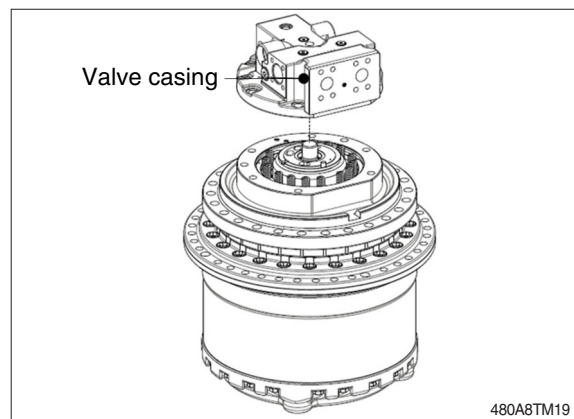
(28) Apply grease to brake spring and assemble it to the valve casing.

- ※ Quantity of brake springs could be different of each model.



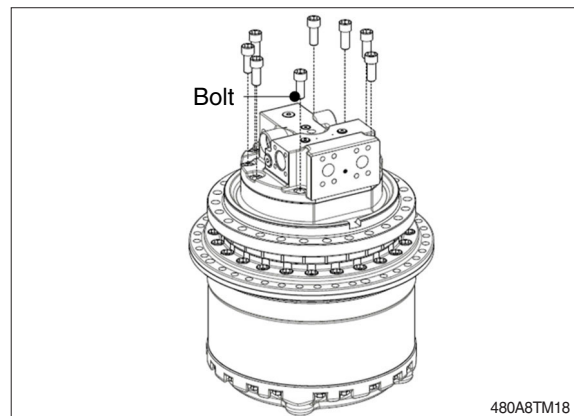
(29) Assemble the valve casing to the motor casing.

- ※ Required tools : guide pin
- ※ Guide pin size : M20x2.5x45 (total length 150 mm or more)



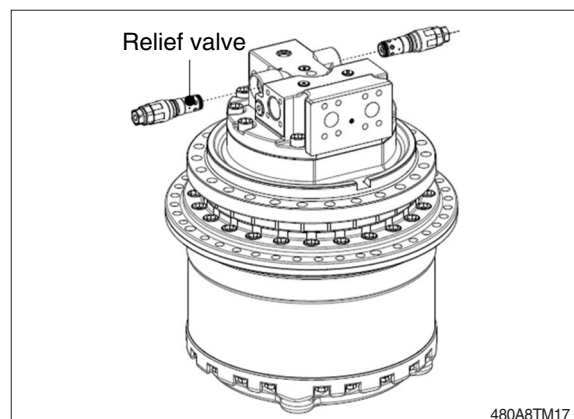
(30) Tighten each bolt evenly to assemble.

- ※ Required tools : torque wrench, hex bit 17 mm.
- ※ Bolt size : M20x2.5
- ※ Tightening torque : 50.3 ± 8.0 kgf · m
(364 ± 57.9 lbf · ft)



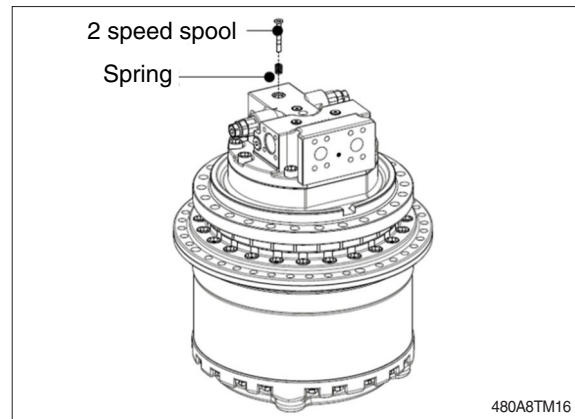
(31) Assemble the relief valve to valve casing.

- ※ Required tools : torque wrench, hex socket 41 mm.
- ※ Tap size : M33x1.5
- ※ Tightening torque : 18.0 ± 3.6 kgf · m
(130 ± 26.0 lbf · ft)



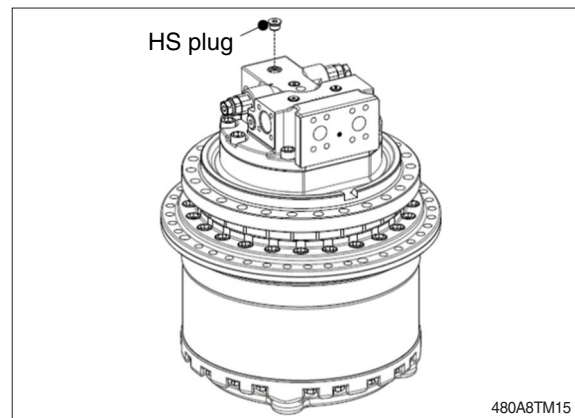
(32) Assemble the 2 speed spool, spring to valve casing.

- ※ Damage caution of 2 speed spool surface.



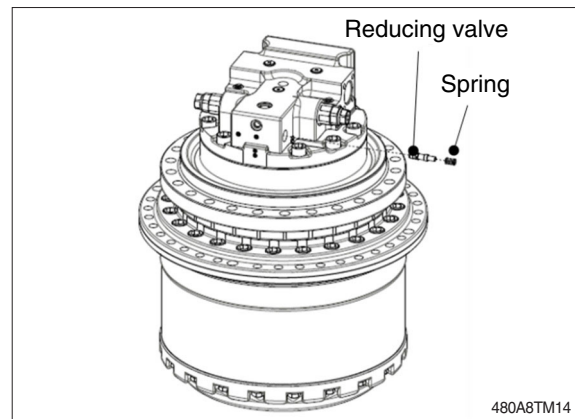
(33) Assemble the HS plug to valve casing.

- ※ Required tools : torque wrench, hex bit 10 mm.
- ※ Bolt size : G 1/2
- ※ Tightening torque : 10.0 ± 2.0 kgf·m
(72.3 ± 14.5 lbf·ft)



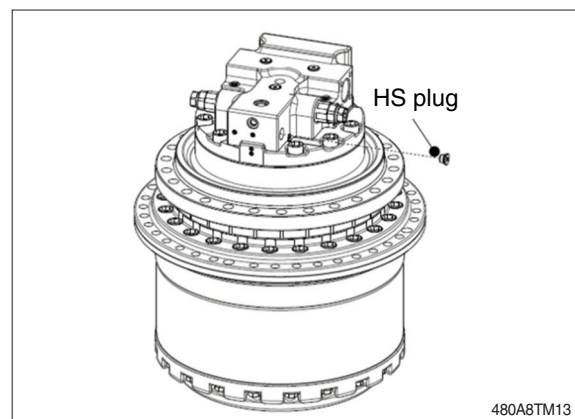
(34) Assemble the reducing valve and spring to valve casing.

- ※ Damage caution of reducing valve surface.



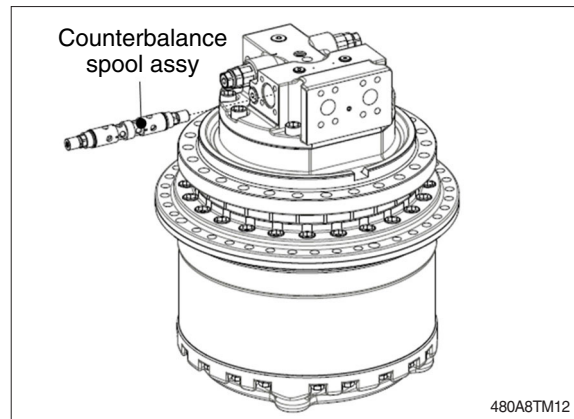
(35) Assemble the HS plug to valve casing.

- ※ Required tools : torque wrench, hex bit 8 mm.
- ※ Bolt size : G 3/8
- ※ Tightening torque : 6.0 ± 1.5 kgf·m
(43.4 ± 10.8 lbf·ft)



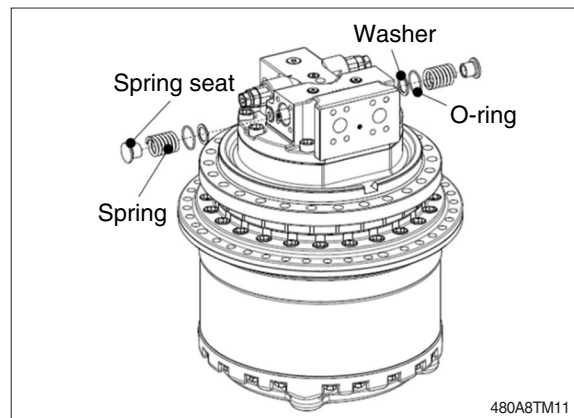
(36) Apply hydraulic fluid to counterbalance spool assy outer diameter and rotate the counterbalance spool assy slowly to assemble.

- ※ Damage caution of counterbalance spool surface.



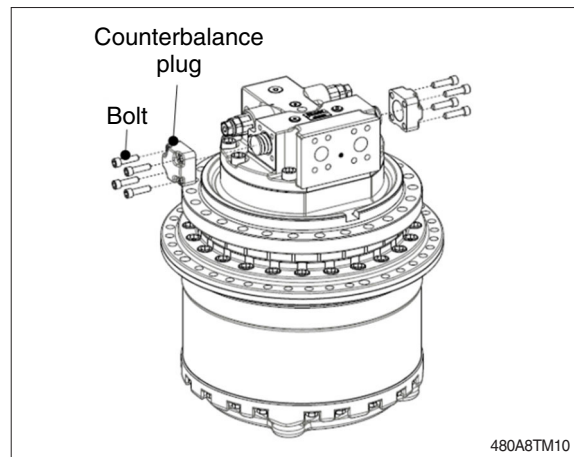
(37) Assemble the spring, spring seat, O-ring and washer to the valve casing.

- ※ Assemble the counterbalance plug and bolt to valve casing.



(38) Assemble the counterbalance plug and bolt to valve casing.

- ※ Required tools : torque wrench, hex bit 10 mm.
- ※ Bolt size : M12x1.75
- ※ Tightening torque : 10.4 ± 1.6 kgf·m
(75.2 ± 11.6 lbf·ft)



4) CHECKLIST AFTER ASSEMBLY

- (1) Supply sufficient hydraulic fluid to the hydraulic motor part, fill the reduction gear with the appropriate amount of reduction gear oil and then perform a trial run.
- (2) In a trial run, perform rotation test at low speed under no load and then a jack up test after mounted on equipment.

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

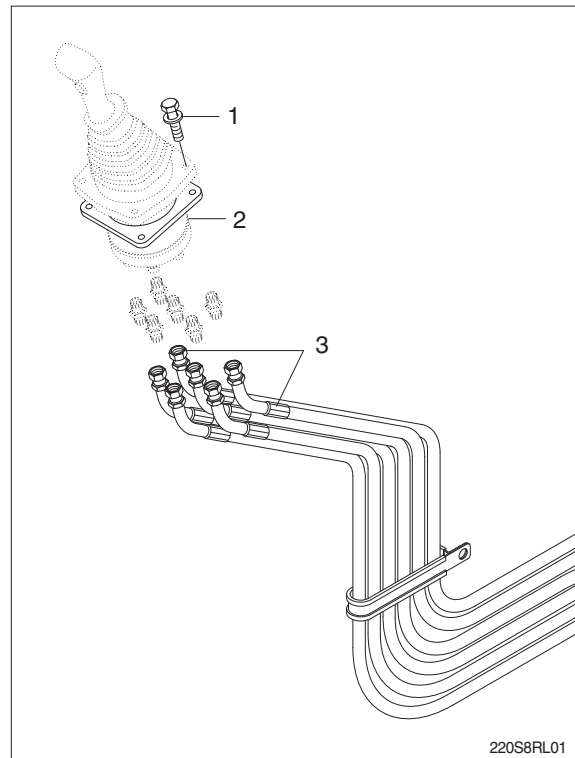
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

- (4) Loosen the socket bolt (1).
 - Tightening torque : $1.05 \pm 0.2 \text{ kgf} \cdot \text{m}$
($7.6 \pm 1.45 \text{ lbf} \cdot \text{ft}$)
 - (5) Remove the cover of the console box.
 - (6) Disconnect pilot line hoses (3).
 - (7) Remove the pilot valve assembly (2).
- ※ When removing the pilot valve assembly, check that all the hoses have been disconnected.

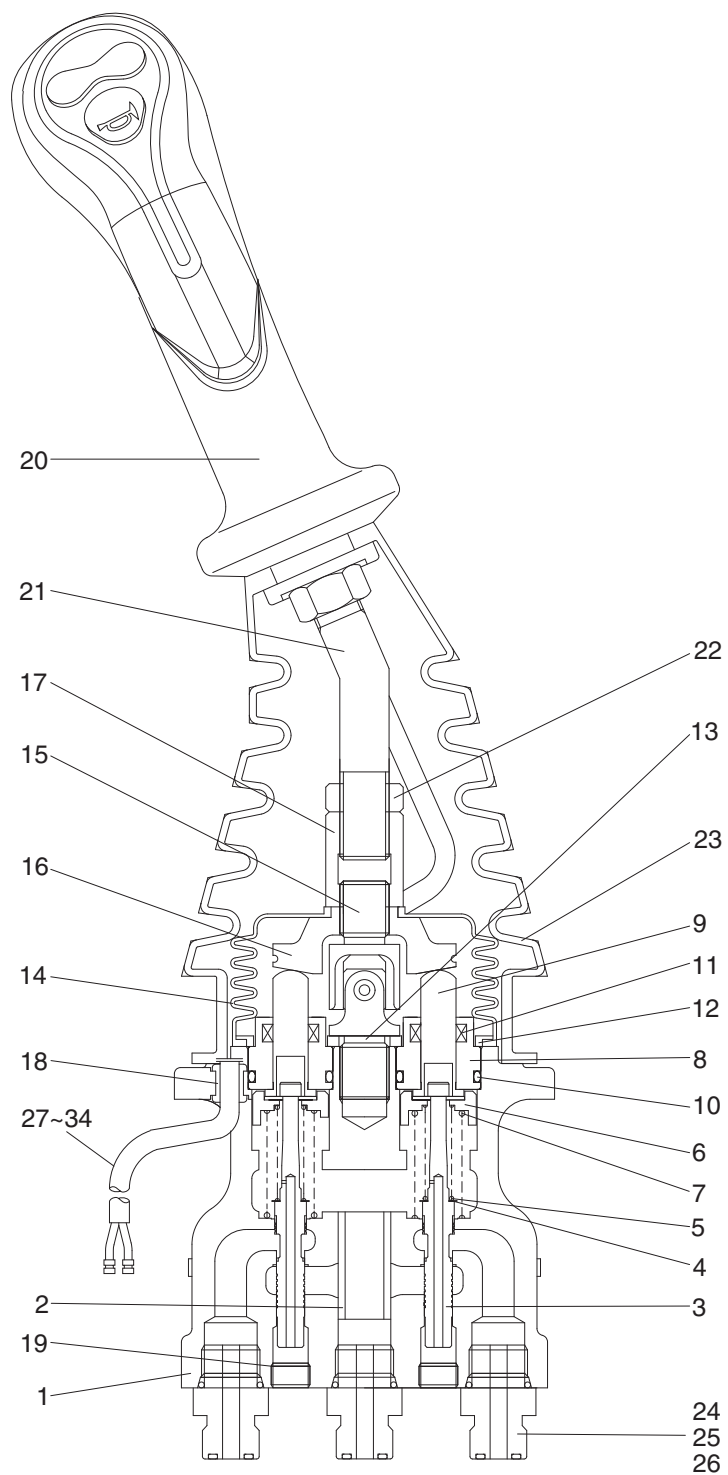
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

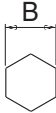


1	Case	10	O-ring	19	Plug	28	Connector
2	Bushing	11	Rod seal	20	Handle assembly	29	Connector
3	Spool	12	Plate	21	Handle bar	30	Connector
4	Shim	13	Spacer	22	Nut	31	Small guide
5	Spring	14	Boot	23	Boot	32	Connector
6	Spring seat	15	Joint assembly	24	Last guard filter	33	Big guide
7	Spring	16	Swash plate	25	Connector	34	Connector
8	Plug	17	Adjusting nut	26	Connector		
9	Push rod	18	Bushing	27	Connector		

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2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

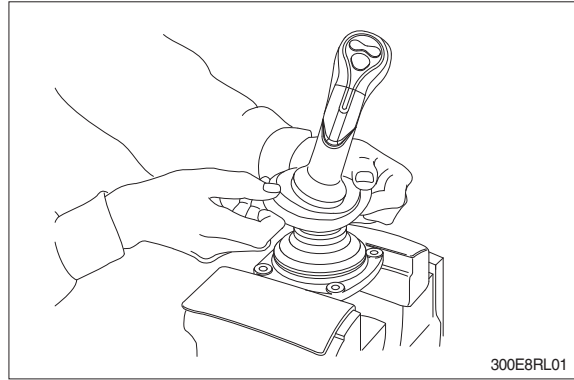
(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.5	25.3
Swash plate	16	M14	5.0±0.35	36.2±2.5
Adjusting nut	17	M14	5.0±0.35	36.2±2.5
Lock nut	22	M14	5.0±0.35	36.2±2.5

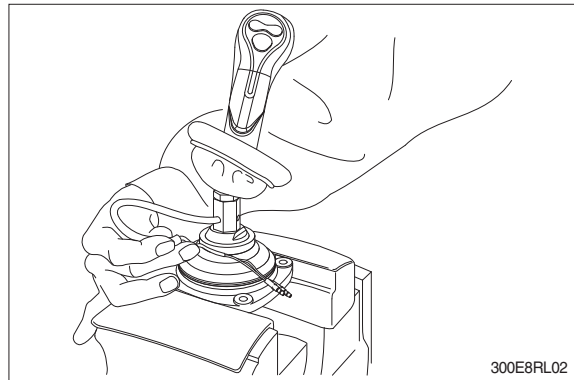
3) DISASSEMBLY

※ Procedures are based on the type L1.

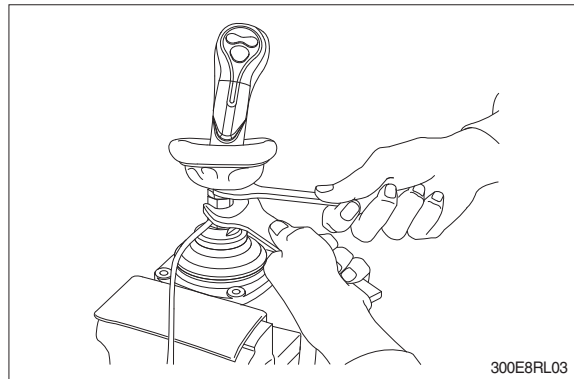
- (1) Clean pilot valve with kerosene.
 - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (23) from case (1) and take it out upwards.



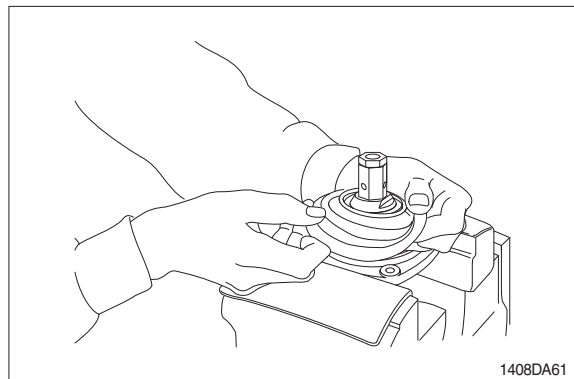
※ For valve with switch, remove cord also through hole of casing.



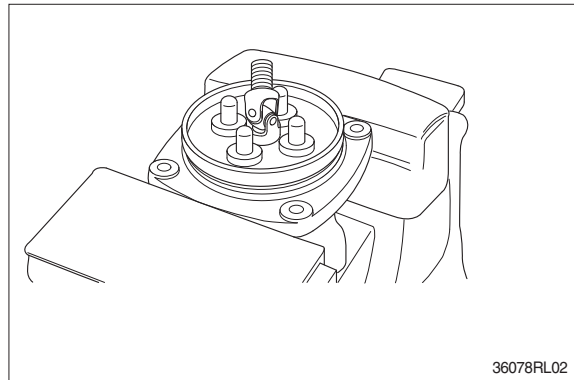
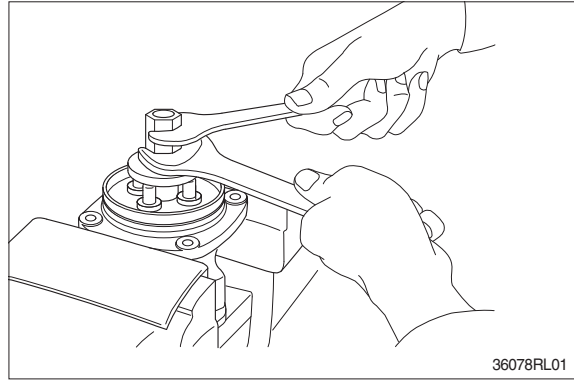
- (4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (14).

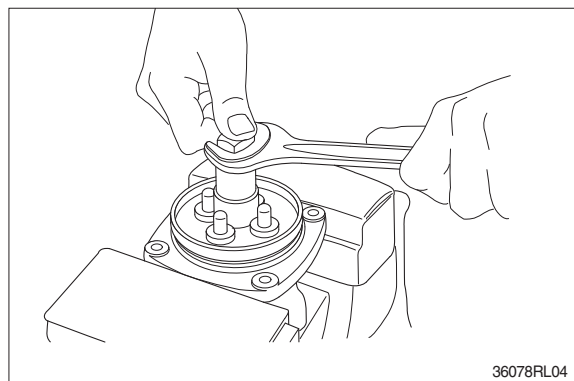
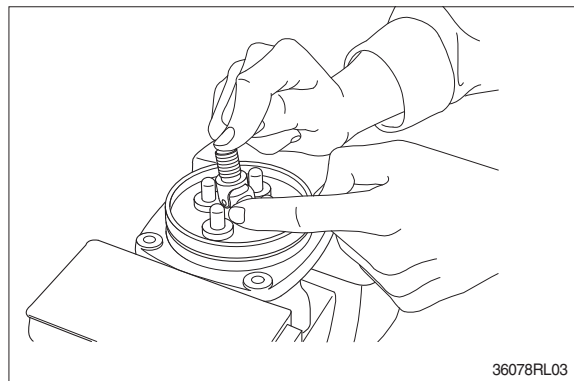


- (6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

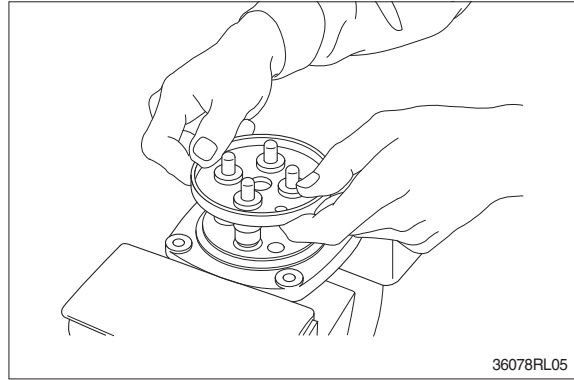


- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

- ※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint. Pay attention to this.

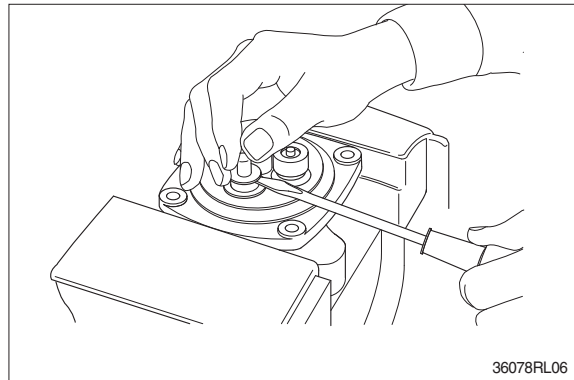


(8) Remove plate (12).



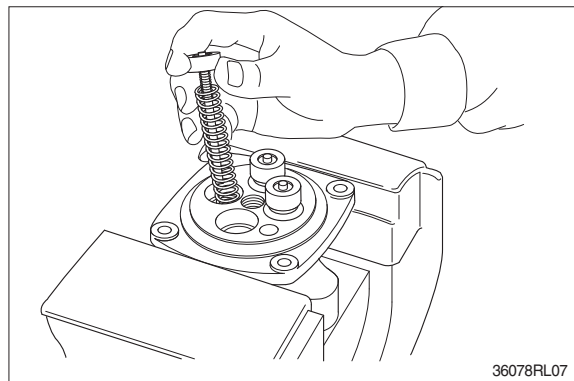
(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

- ※ Take it out with minus screwdriver. Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.
- ※ During taking out, plug may jump up due to return spring (7) force. Pay attention to this.



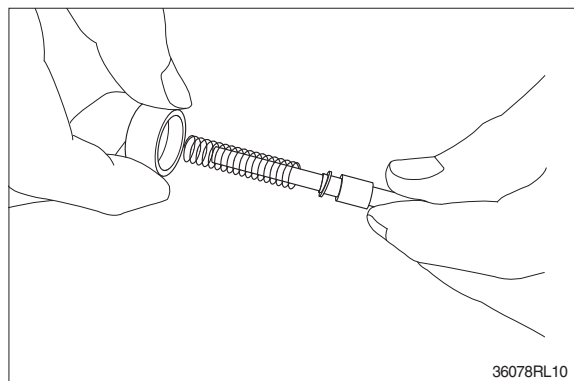
(10) Remove reducing valve subassembly and return spring (7) out of casing.

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

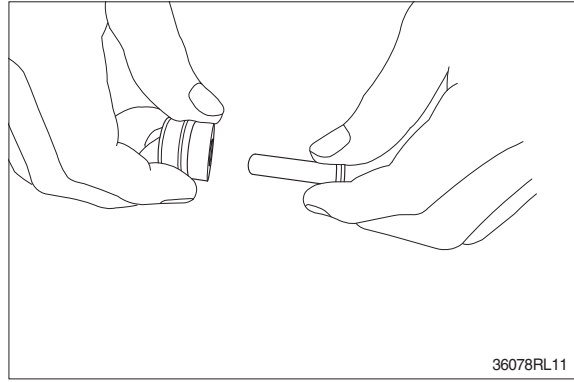


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

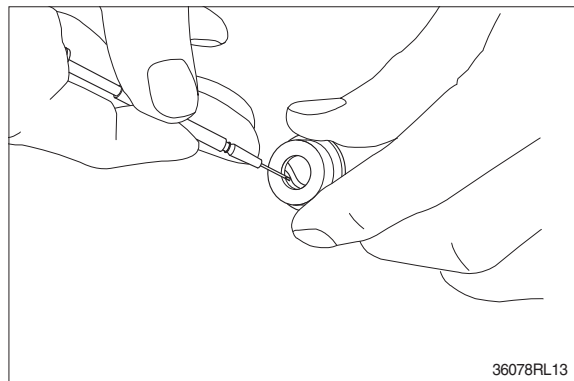
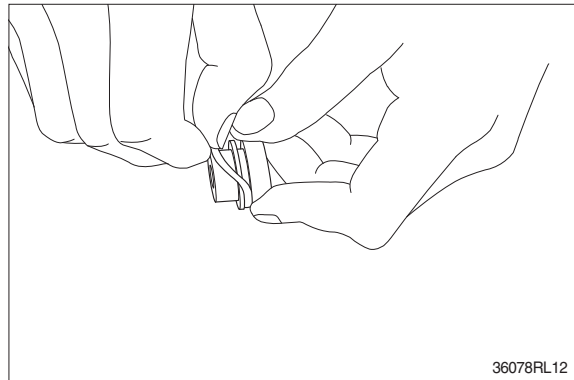
- ※ Pay attention not to damage spool surface.
- ※ Record original position of spring seat (6).
- ※ Until being assembled, they should be handled as one subassembly group.



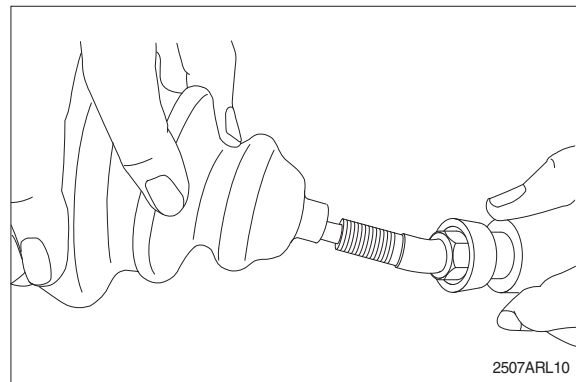
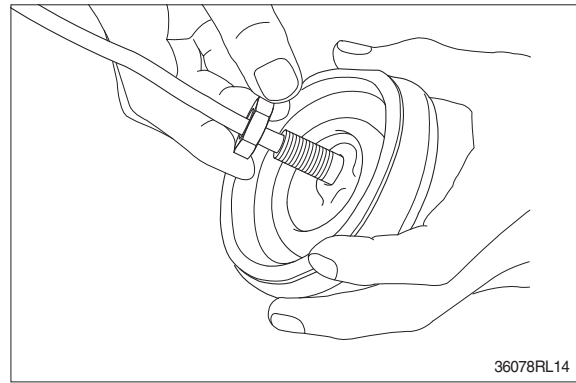
(12) Take push rod (9) out of plug (8).



(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.



(14) Remove lock nut (22) and then boot (23).



(15) Cleaning of parts

- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
 - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
 - ※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.
- ② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).
 - ※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

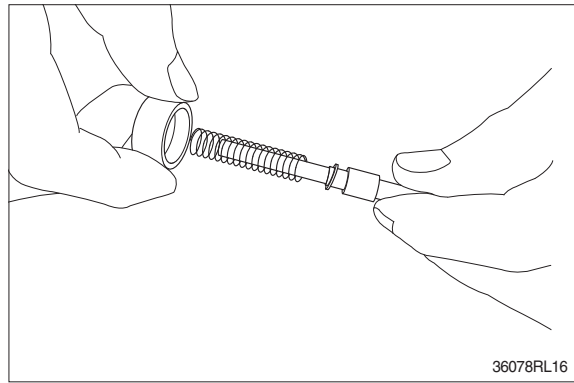
(16) Rust prevention of parts

Apply rust-preventives to all parts.

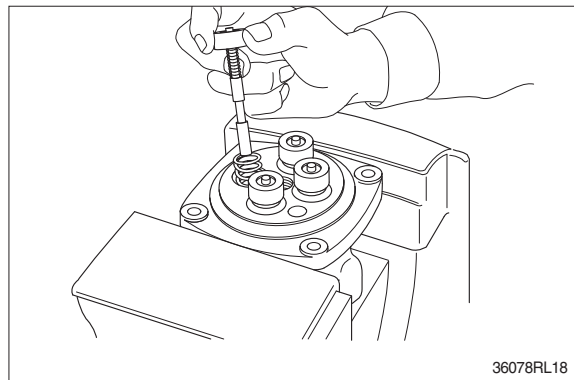
- ※ If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

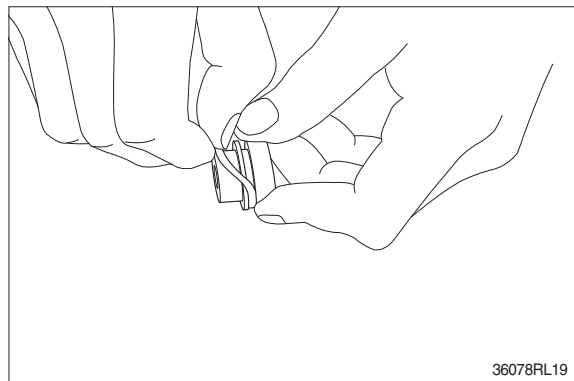
- (1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



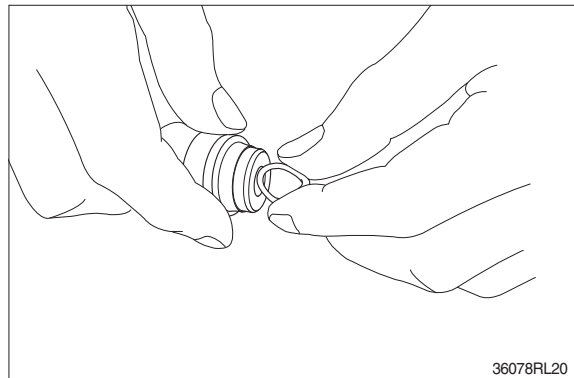
- (2) Assemble spring (7) into casing (1).
Assemble reducing valve subassembly into casing.
※ Assemble them to their original positions.



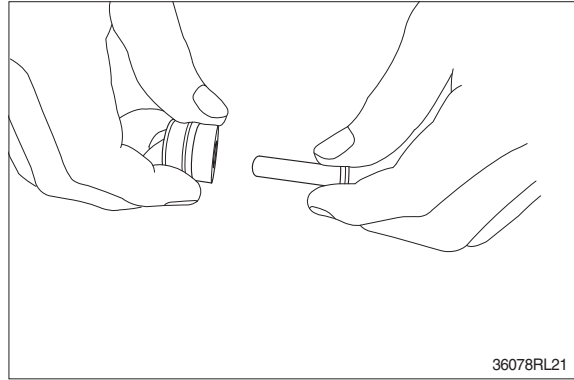
- (3) Assemble O-ring (10) onto plug (8).



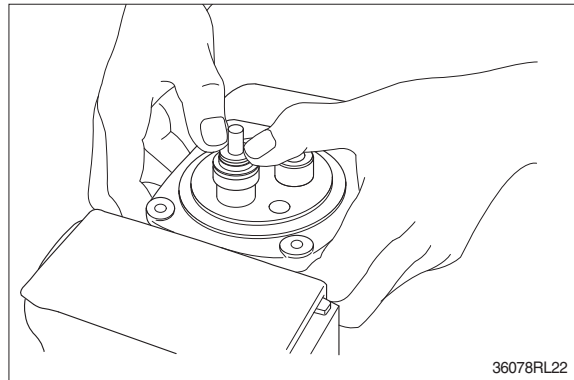
- (4) Assemble seal (11) to plug (8).
※ Assemble seal in such lip direction as shown below.



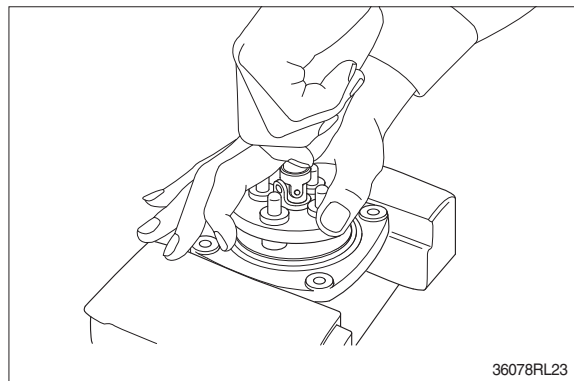
- (5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.



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

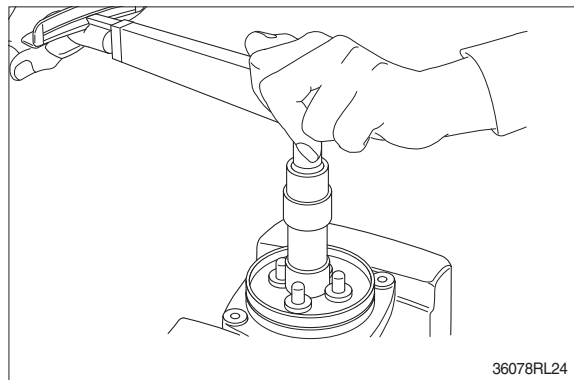


- (7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.

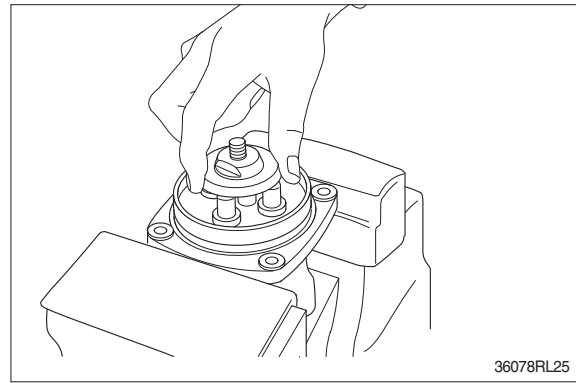


- (8) Fit plate (12).

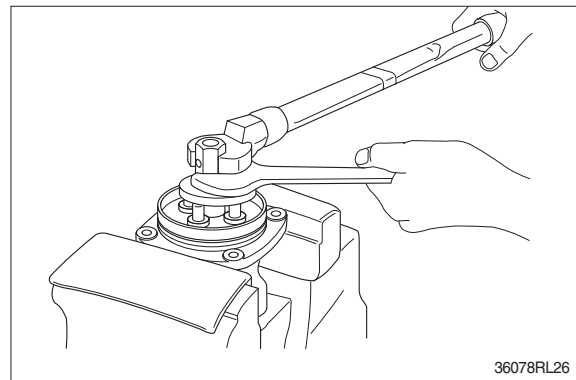
- (9) Tighten joint (15) with the specified torque to casing, utilizing jig.



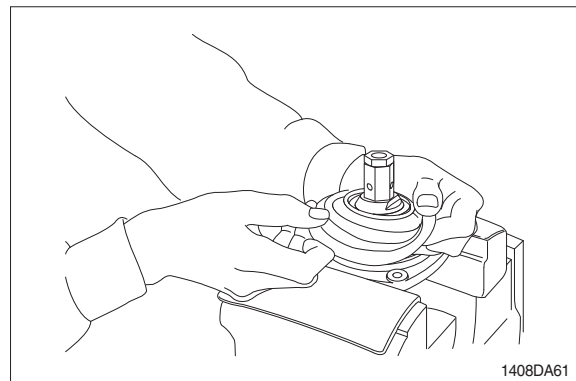
- (10) Assemble swash plate (16) to joint (15).
- ※ Screw it to position that it contacts with 4 push rods evenly.
 - ※ Do not screw it over.



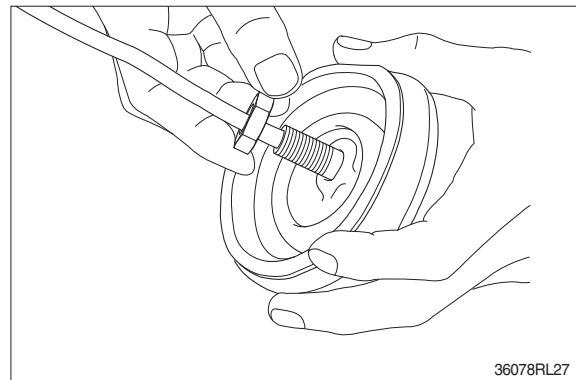
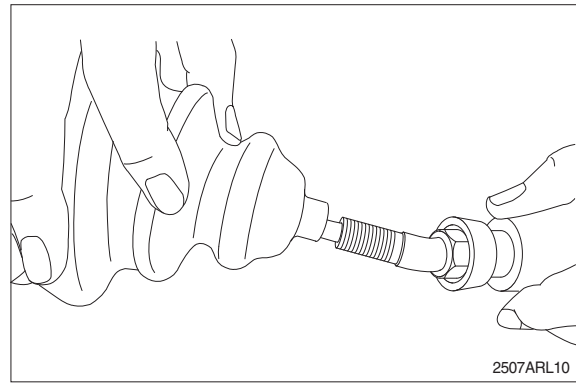
- (11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.
- ※ During tightening, do not change position of disk.



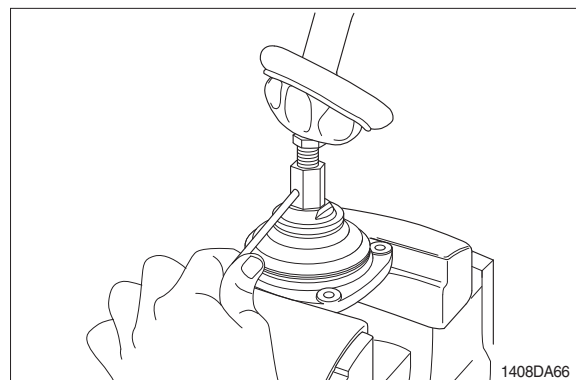
- (12) Fit boot (14) to plate.



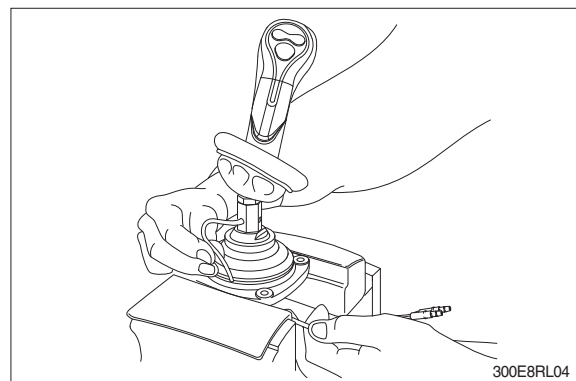
(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



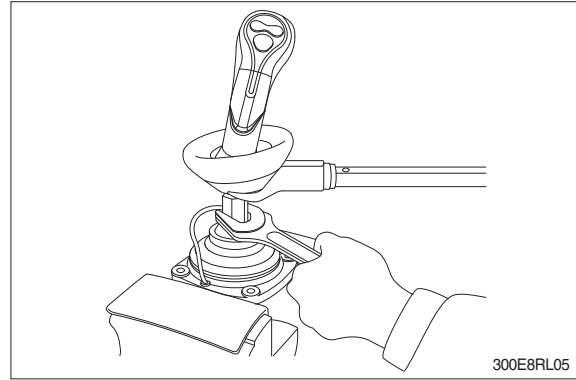
(14) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



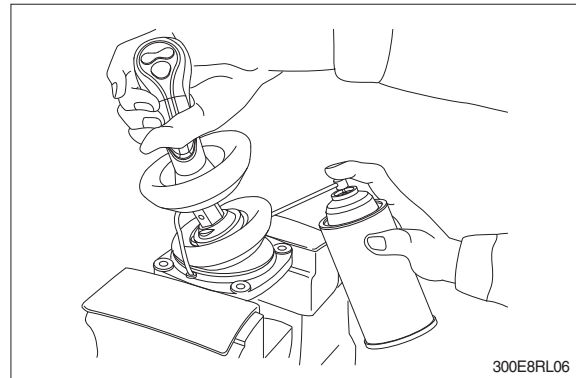
(15) Assemble bushing (18) to plate and pass cord and tube through it.
※ Provide margin necessary to operation.



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

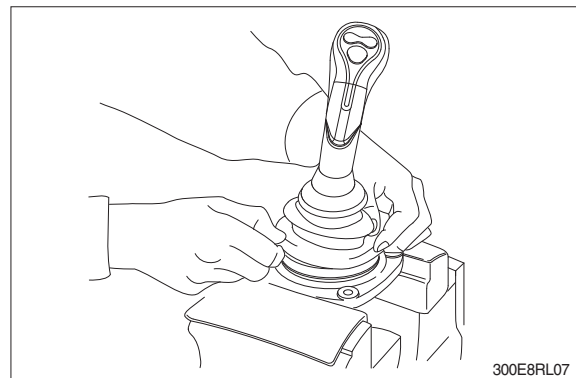


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(18) Assemble lower end of bellows to casing.

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



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

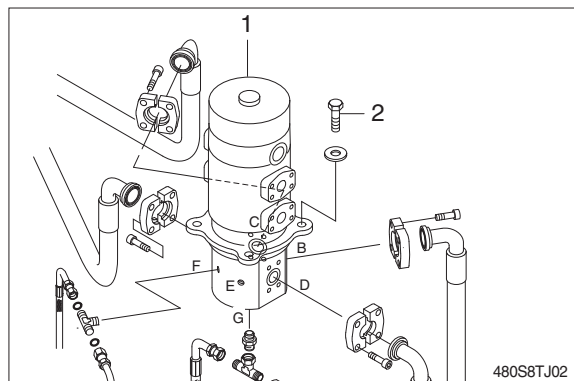
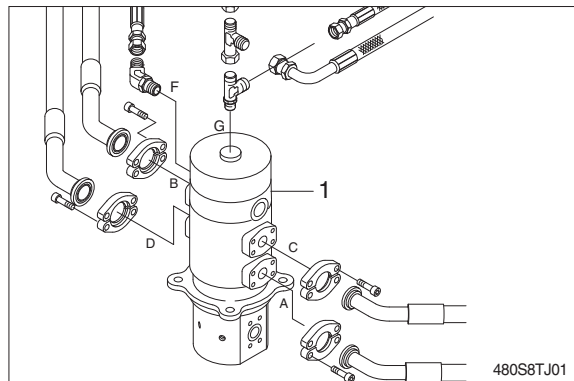
Weight : 55 kg (120 lb)

Tightening torque : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)

- (6) Remove the turning joint assembly.
※ When removing the turning joint, check that all the hoses have been disconnected.

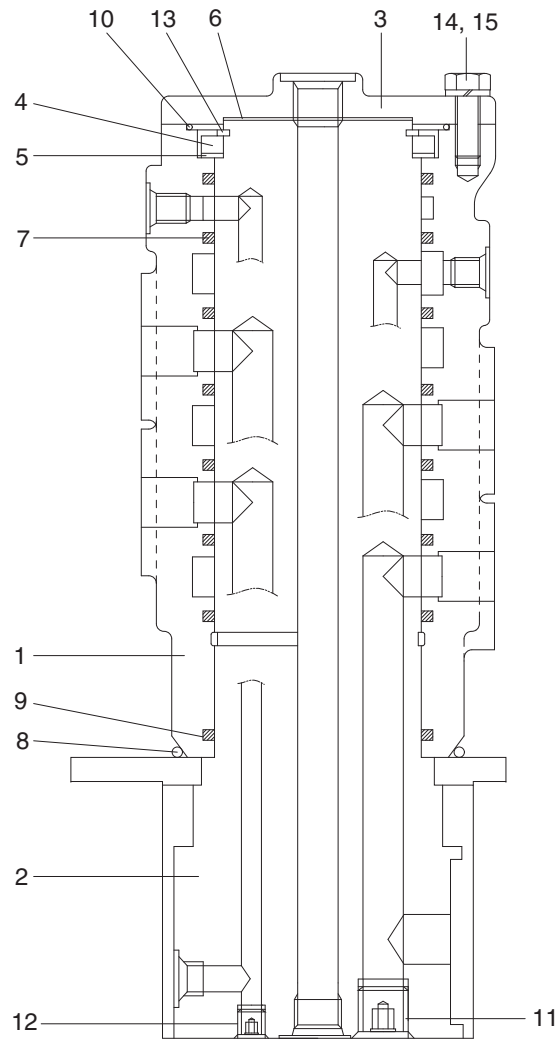
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



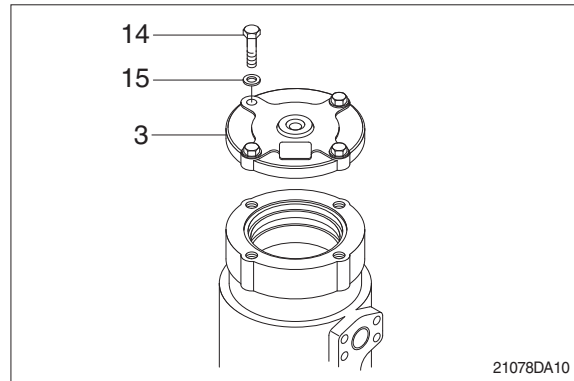
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- | | | | | | |
|---|------------|----|--------------|----|----------------|
| 1 | Hub | 6 | Shim | 11 | Plug |
| 2 | Shaft assy | 7 | Slipper seal | 12 | Plug |
| 3 | Cover | 8 | O-ring | 13 | Retaining ring |
| 4 | Spacer | 9 | O-ring | 14 | Hexagon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

2) DISASSEMBLY

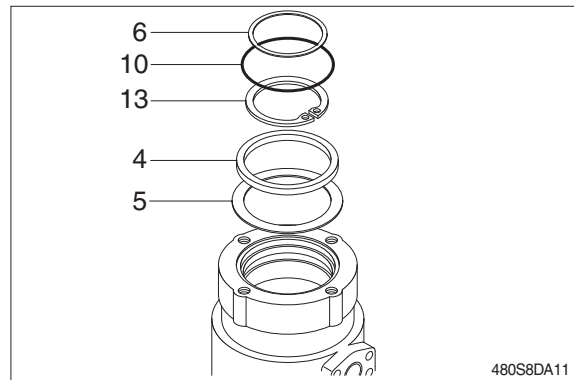
※ Before the disassembly, clean the turning joint.

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



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

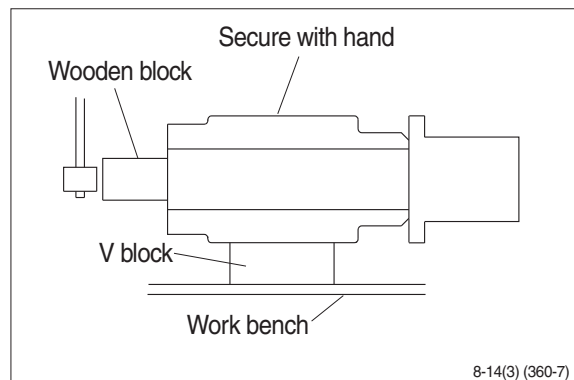
(3) Remove retainer ring (13), spacer (4) and shim (5).



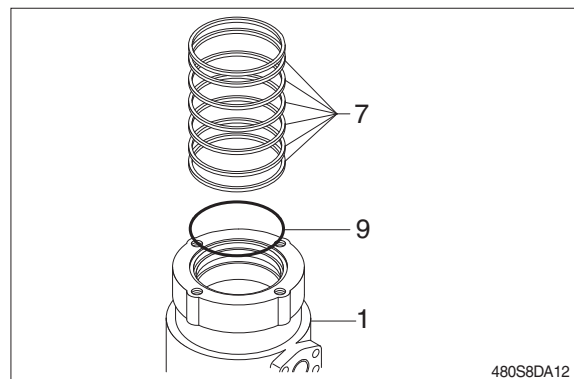
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).



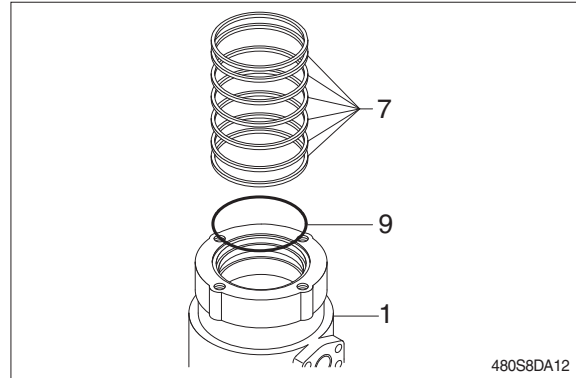
(5) Remove seven slipper seals (7) and O-ring (9) from hub (1).



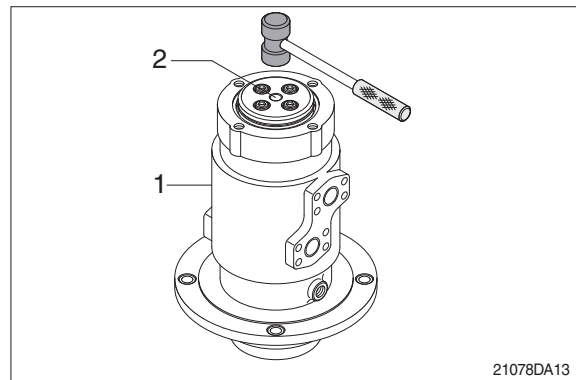
3) ASSEMBLY

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

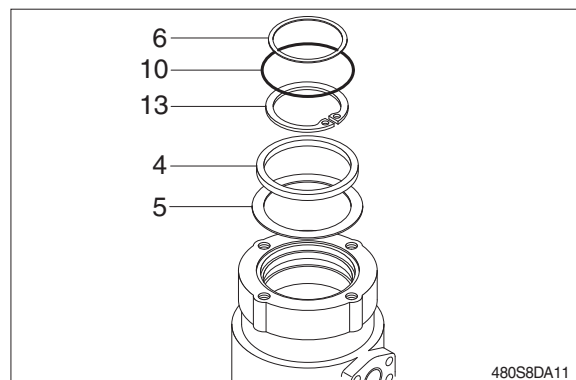
- (1) Fix seven slipper seal (7) and O-ring (9) to hub (1).
- (2) Fit O-ring (8) to shaft (2).



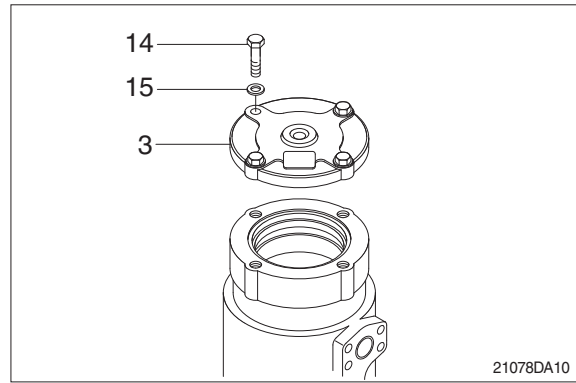
- (3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



- (4) Fit shim (5), spacer (4) and retainer ring (13) to shaft (2).
- (5) Fit O-ring (10) to hub (1).
- (6) Fit shim (6) to shaft (2).



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



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

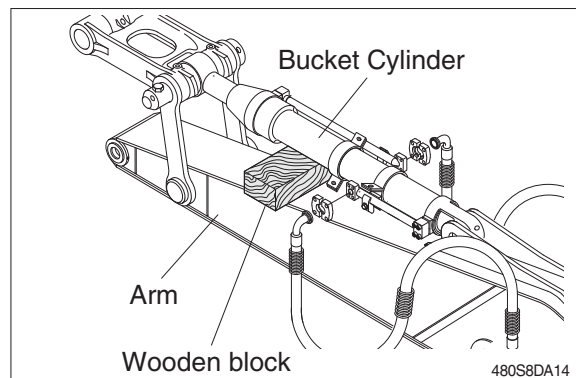
(1) Removal

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

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

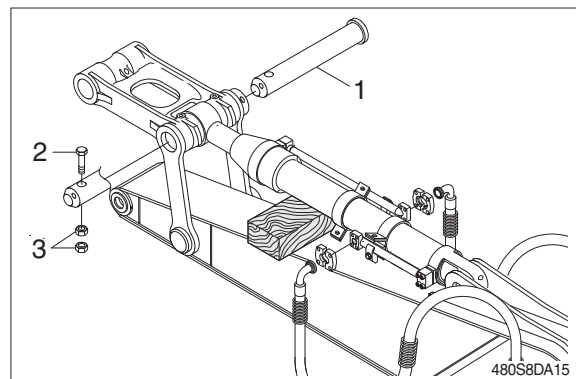
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between bucket cylinder and arm.

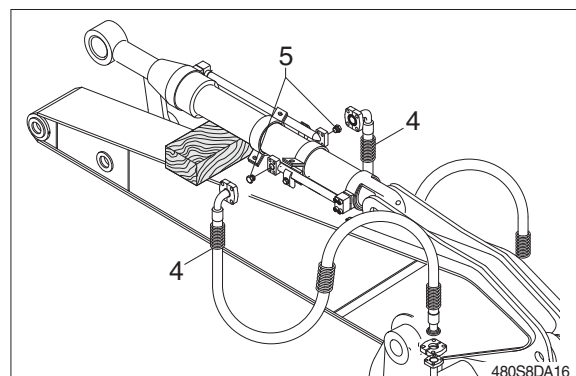


- ② Remove bolt (2), nut (3) and pull out pin (1).

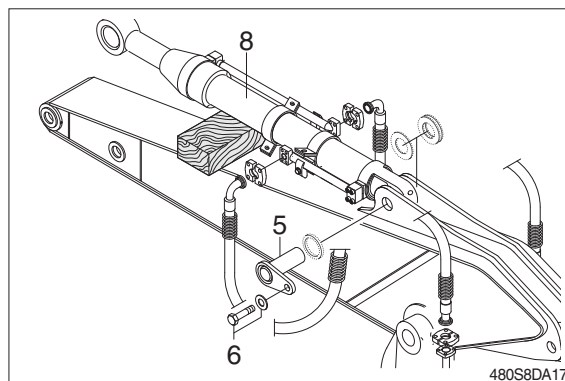
- ※ Tie the rod with wire to prevent it from coming out.



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



- ④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
- ⑤ Remove bucket cylinder assembly (8).
 - Weight : HX480S L : 370 kg (816 lb)
 - HX520S L : 400 kg (880 lb)



(2) Install

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

2) ARM CYLINDER

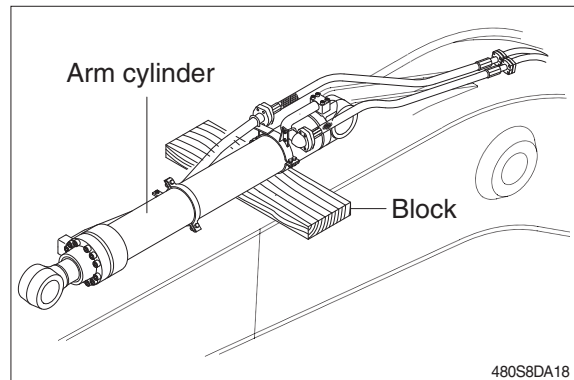
(1) Removal

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

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

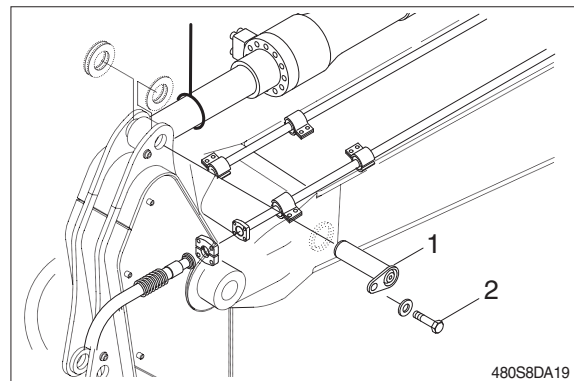
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Set block between arm cylinder and boom.



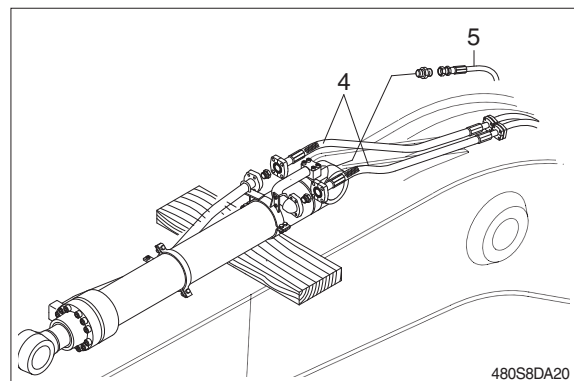
- ② Remove bolt (2) and pull out pin (1).

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

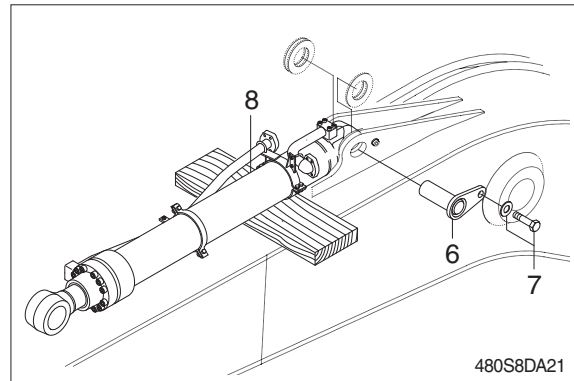


- ③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

- ④ Disconnect greasing pipings (5).



- ⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).
- ⑥ Remove arm cylinder assembly (8).
 - Weight : 600 kg (1320 lb)



(2) Install

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

3) BOOM CYLINDER

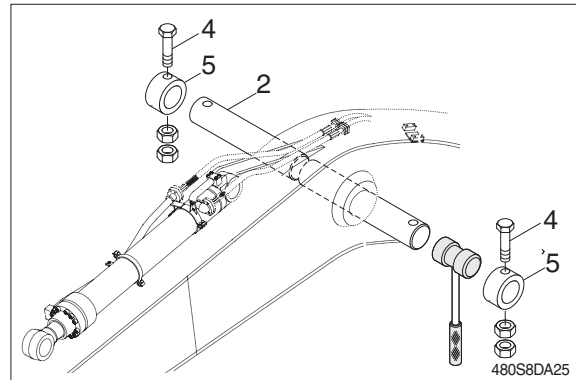
(1) Removal

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

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

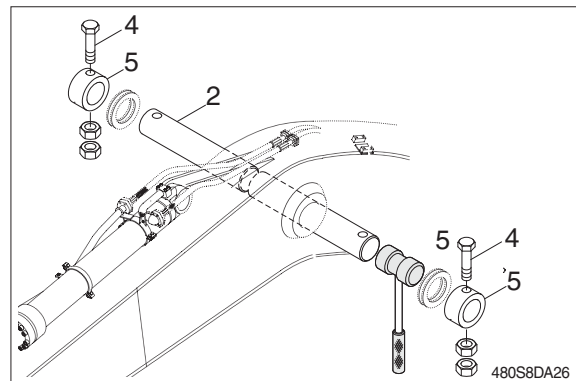
- ※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

- ① Disconnect greasing hoses (1).
- ② Sling boom cylinder assembly.

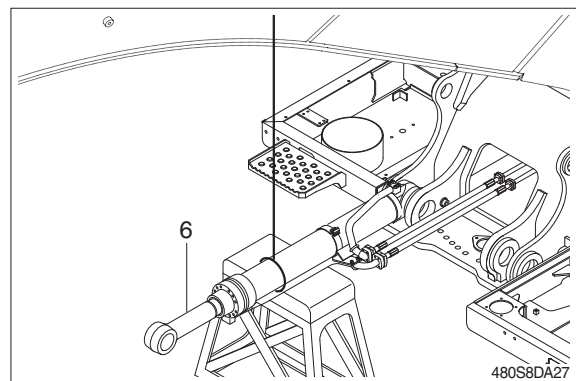


- ③ Remove bolt (4), pin stopper (5) and pull out pin (2).

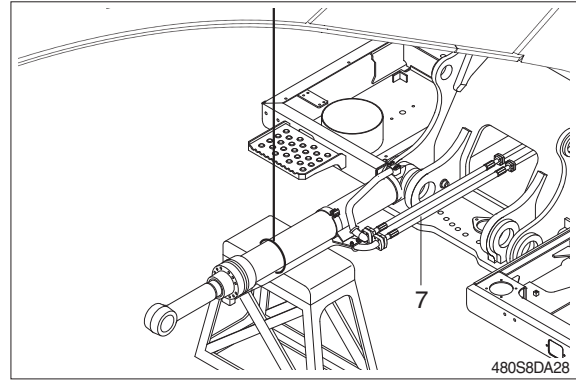
- ※ Tie the rod with wire to prevent it from coming out.



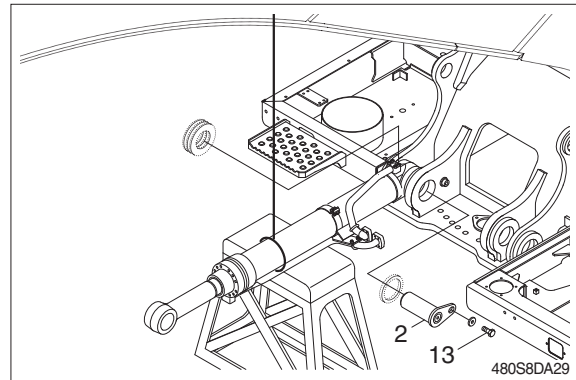
- ④ Lower the boom cylinder assembly (6) on a stand.



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



- ⑥ Remove bolt (9) and pull out pin (8).
⑦ Remove boom cylinder assembly (6).
· Weight : 435 kg (960 lb)



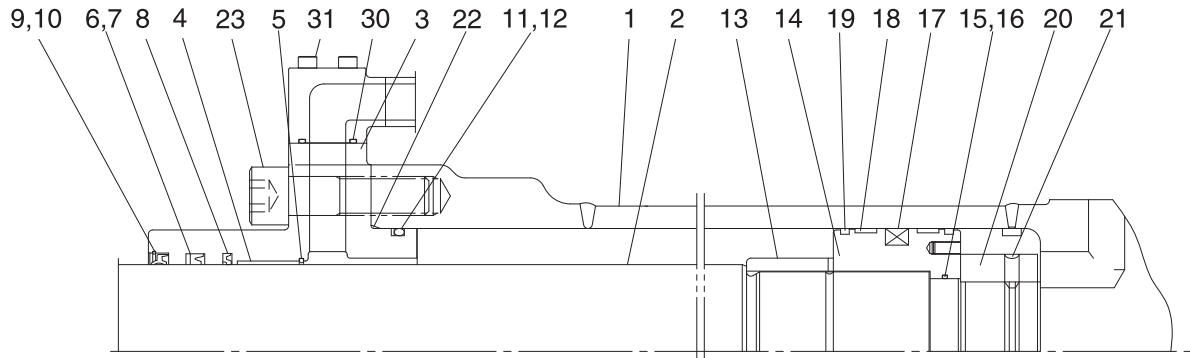
(2) Install

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

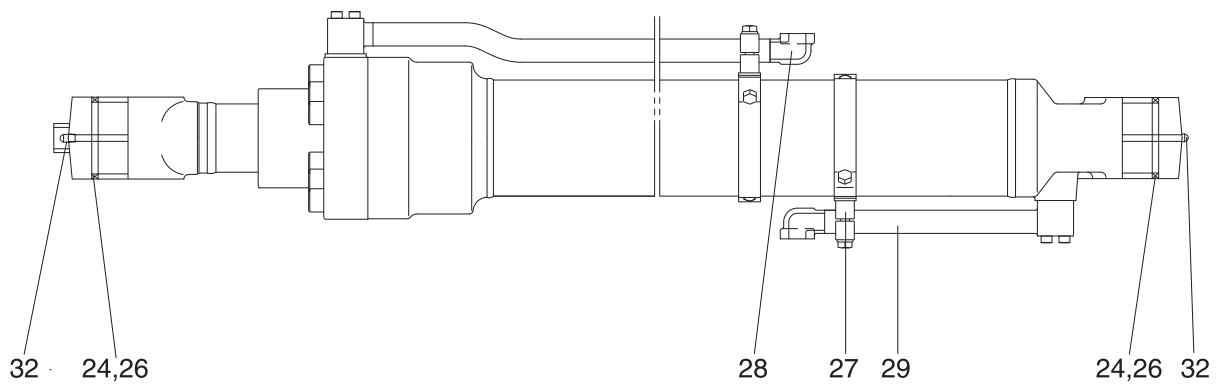
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder (HX480S L)



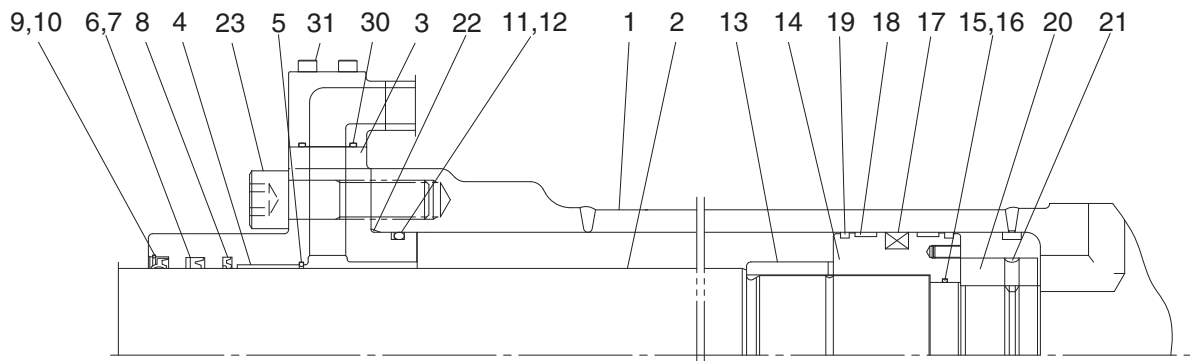
Internal detail



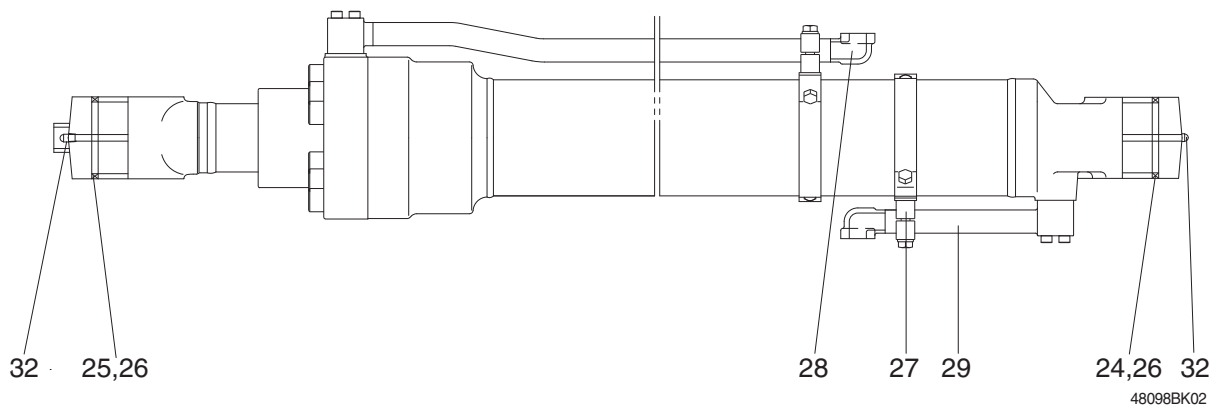
48098BK01

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

(2) Bucket cylinder (HX520S L)



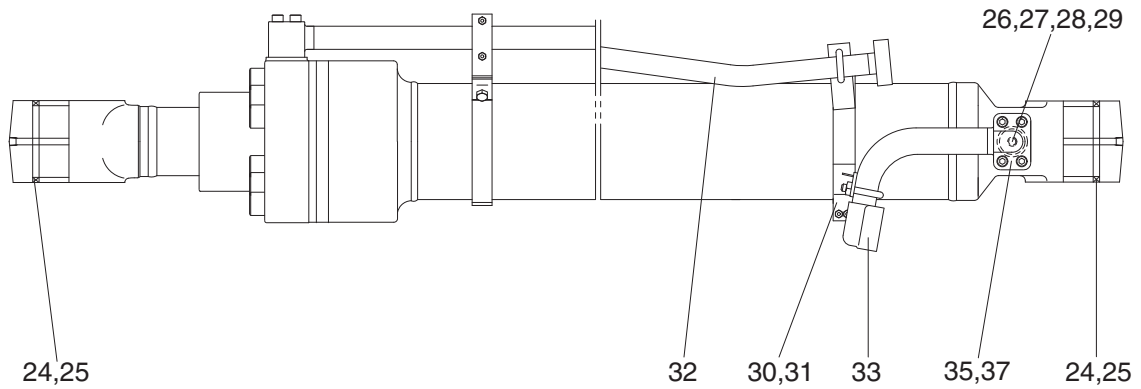
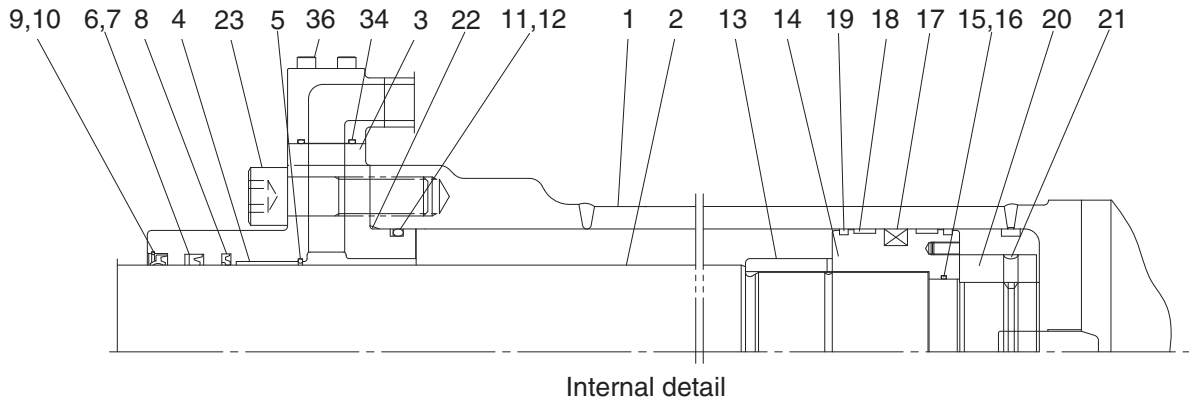
Internal detail



48098BK02

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

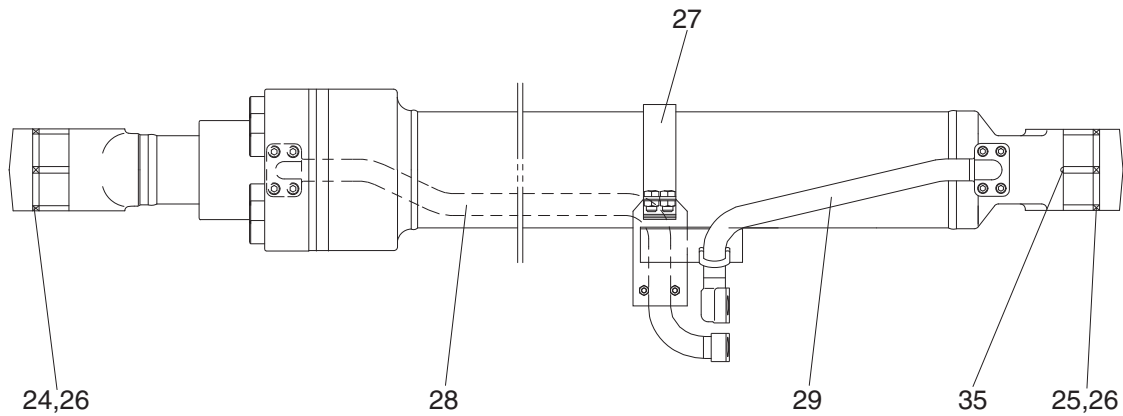
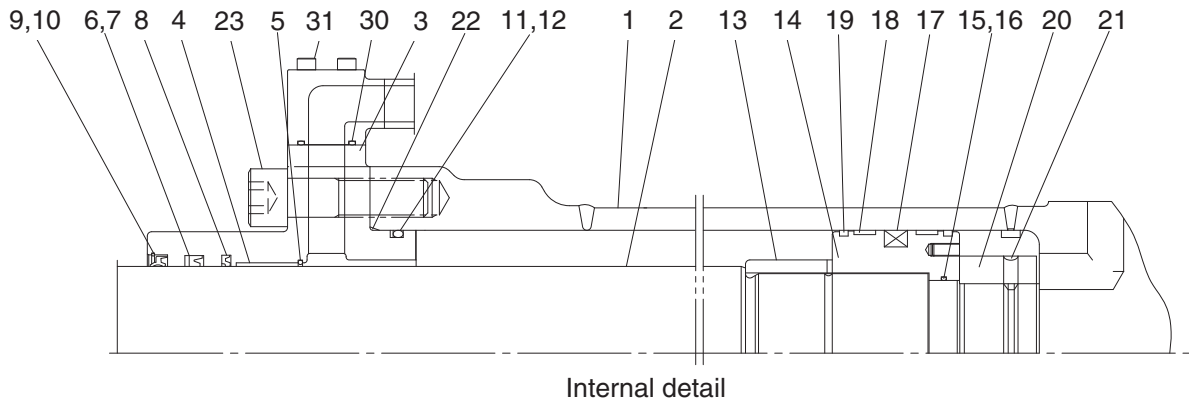
(3) Arm cylinder



480L8AM01

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

(4) Boom cylinder

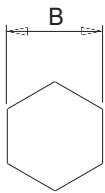


48098BQ01

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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Allen wrench	10	
	14	
	18	
	24	
	30	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Piston	Bucket cylinder	14	-	200 ± 20	1447 ± 145
	Boom cylinder	14	-	150 ± 15	1085 ± 108
	Arm cylinder	14	-	200 ± 20	1447 ± 145
Piston lock nut	Bucket cylinder	20	-	150 ± 15	1085 ± 108
	Boom cylinder	20	-	100 ± 10	723 ± 72
	Arm cylinder	20	-	150 ± 15	1085 ± 108
Socket head bolt	Bucket cylinder	23	M22	63.0 ± 6.0	456 ± 43
		31	M12	9.4 ± 1.0	67.9 ± 7.2
	Boom cylinder	23	M22	63.0 ± 6.0	456 ± 43
		31	M12	9.4 ± 1.0	67.9 ± 7.2
	Arm cylinder	23	M24	79.0 ± 8.0	571 ± 58
		36	M12	9.4 ± 1.0	67.9 ± 7.2
Socket set screw	Bucket cylinder	21	M10	5.4 ± 0.5	39.1 ± 3.6
	Boom cylinder	21	M10	5.4 ± 0.5	39.1 ± 3.6
	Arm cylinder	21	M10	5.4 ± 0.5	39.1 ± 3.6

3) DISASSEMBLY

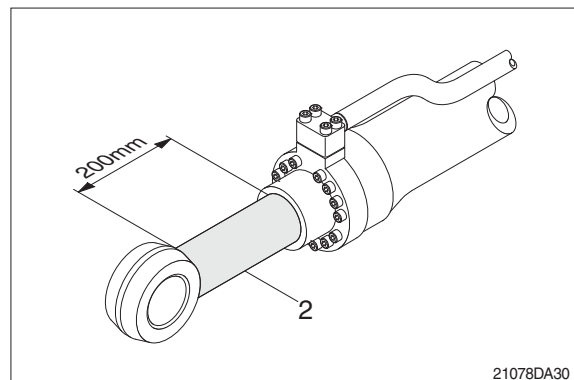
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

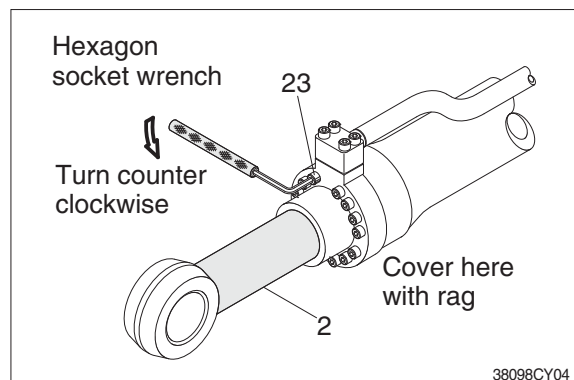
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



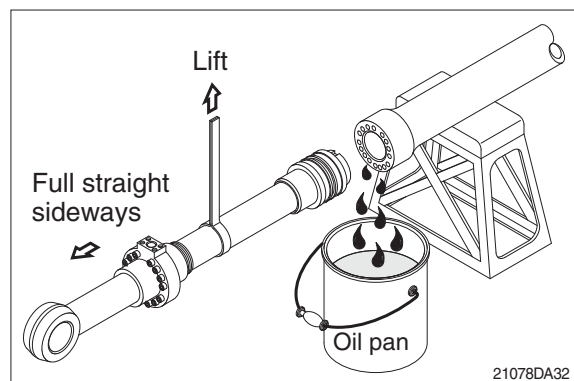
③ Loosen and remove socket bolts (23) of the gland in sequence.

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



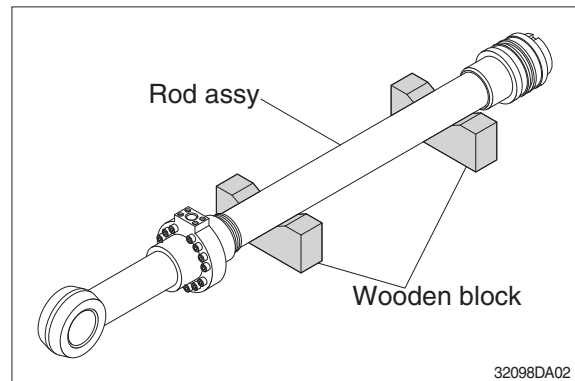
④ Draw out cylinder head and rod assembly together from tube assembly (1).

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



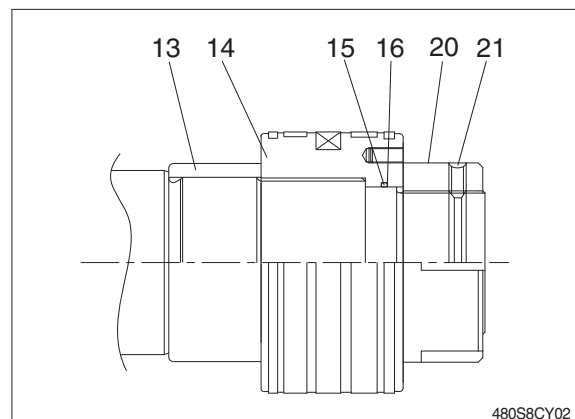
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

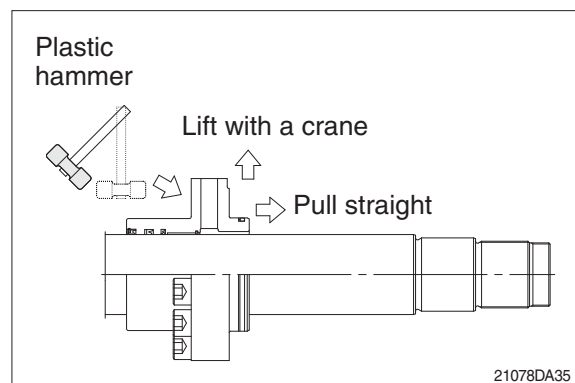


(3) Remove piston and cylinder head

- ① Loosen socket set screw (21) and remove lock nut (20).
- ※ Since lock nut (20) is tightened to a high torque use a hydraulic and power wrench that utilizes a hydraulic cylinder, to remove lock nut (20).
- ② Remove piston assembly (14), back up ring (16), and O-ring (15).

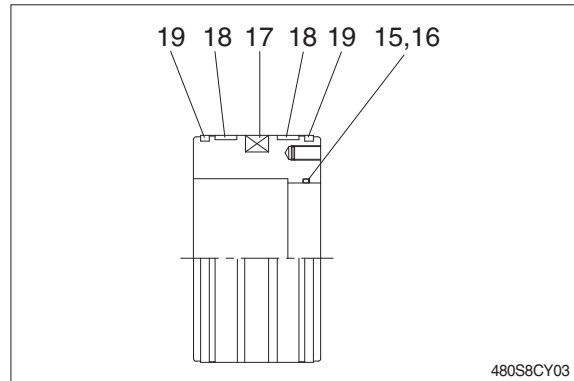


- ③ Remove the cylinder head assembly from rod assembly (2).
 - ※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
 - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of rod bushing (4) and packing (5, 6, 7, 8, 9, 10) by the threads of rod assembly (2).



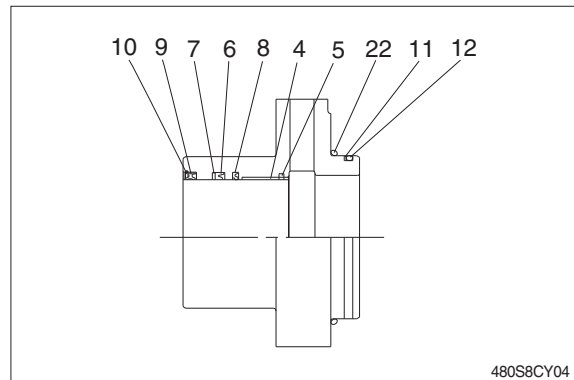
(3) Disassemble the piston assembly

- ① Remove wear ring (18).
- ② Remove dust ring (19) and piston seal (17).
- ※ Exercise care in this operation not to damage the grooves.
- ③ Remove back up ring (16) and O-ring (15).



(4) Disassemble cylinder head assembly

- ① Remove back up ring (12), O-ring (11) and O-ring (22).
- ② Remove snap ring (10), dust wiper (9).
- ③ Remove back up ring (7), rod seal (6) and buffer ring (8) and snap ring (5).
- ※ Exercise care in this operation not to damage the grooves.
- ※ Do not remove seal and ring, if does not damaged.
- ※ Do not remove bushing (4).

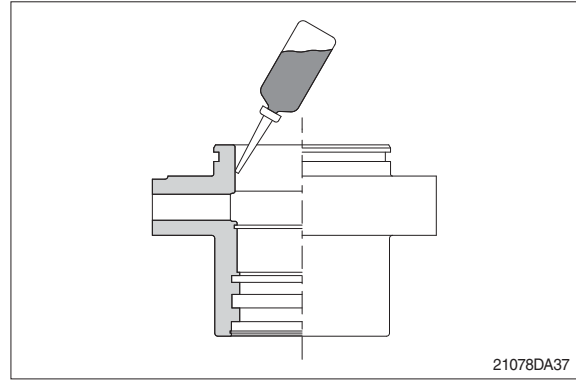


3) ASSEMBLY

(1) Assemble cylinder head assembly

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

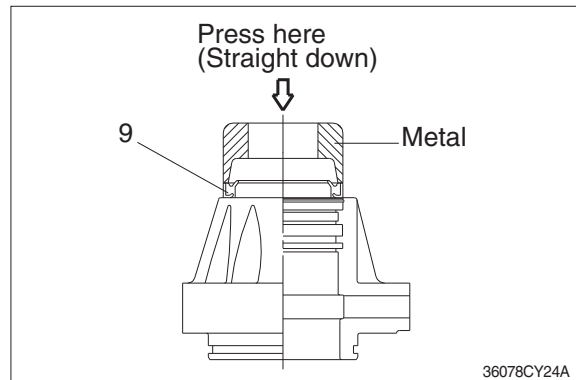
① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.

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

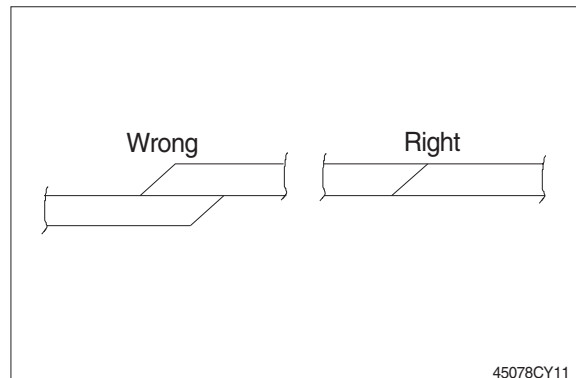
③ Fit snap ring (10) to the stop face.



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

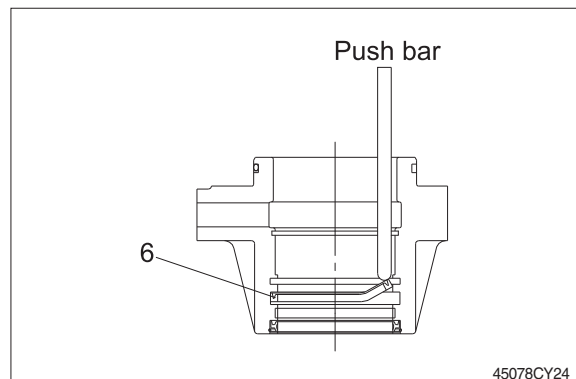
※ Coat each packing with hydraulic oil before fitting it.

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

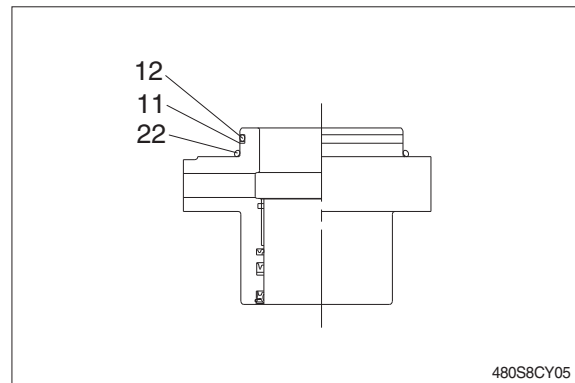


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

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

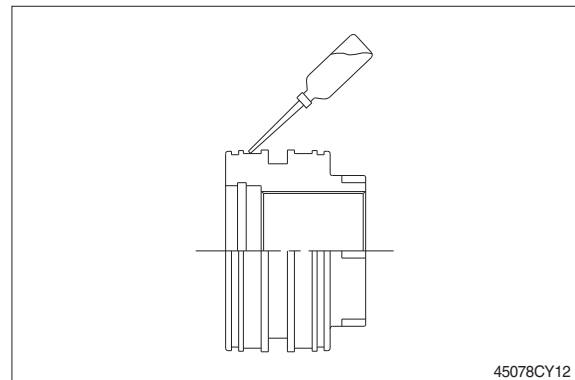


- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) and O-ring (22) to gland (3).

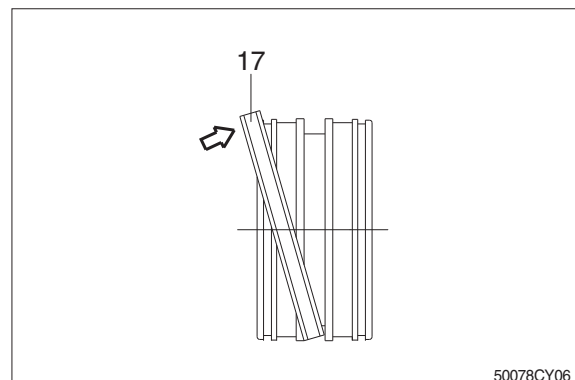


(2) Assemble piston assembly

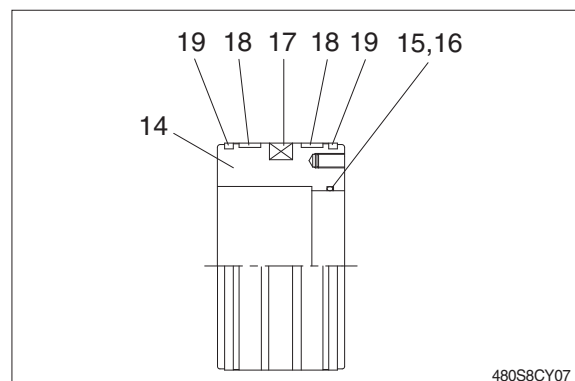
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- ② Fit piston seal (17) to piston.
- ※ Put the piston seal in the warm water of 60~100°C for more than 5 minutes.
- ※ After assembling the piston seal, press its outer diameter to fit in.

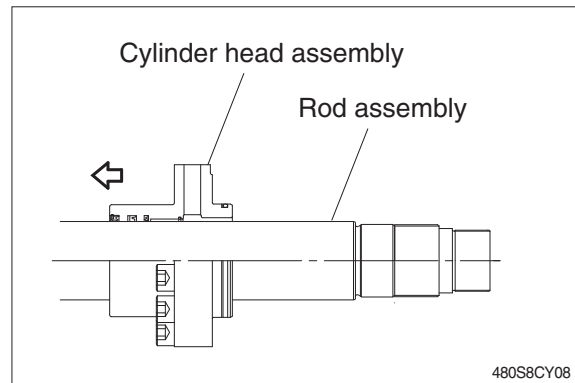


- ③ Fit wear ring (18) and dust ring (19) to piston (14).

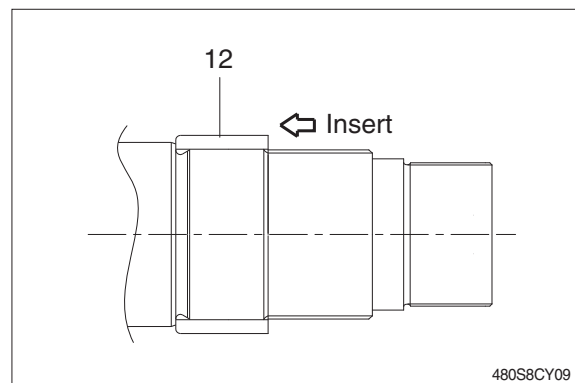


(3) Install piston and cylinder head

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

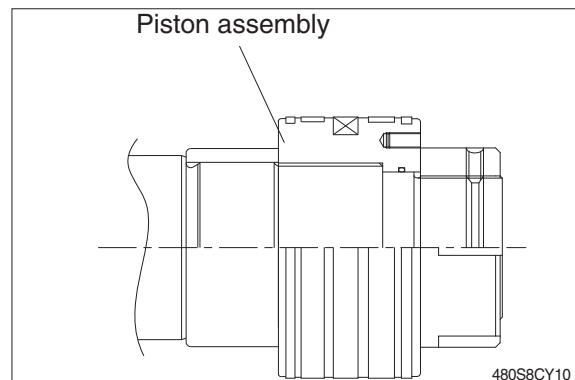


- ④ Insert cushion ring (13) to rod assembly.
- ※ Note that cushion ring (13) has a direction in which it should be fitted.



- ⑤ Fit piston assembly to rod assembly.
- Tightening torque

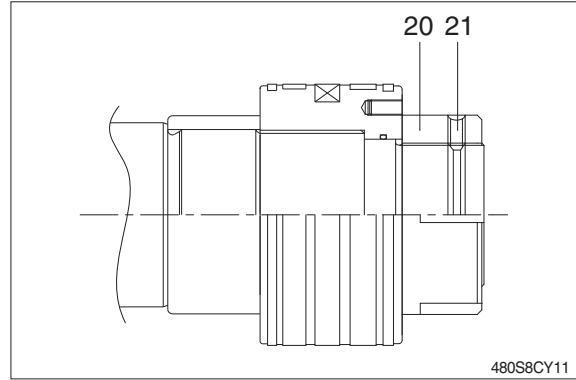
Item		kgf · m	lbf · ft
14	Bucket	200 ± 20	1447 ± 145
14	Boom	150 ± 15	1085 ± 108
14	Arm	200 ± 20	1447 ± 145



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

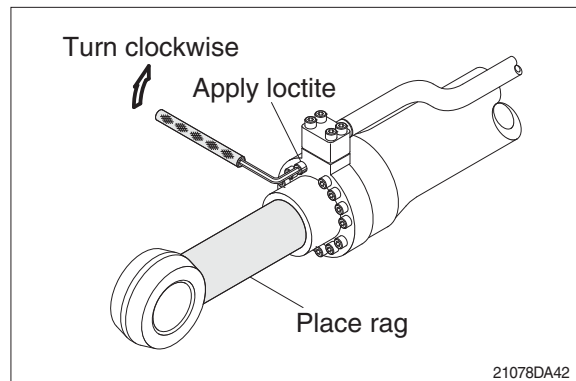
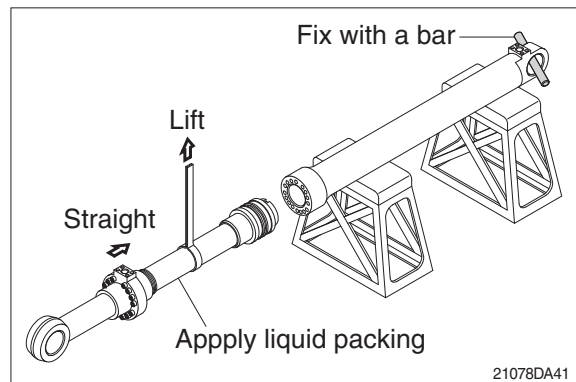
· Tightening torque :

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



(3) Overall assemble

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



GROUP 10 UNDERCARRIAGE

1. TRACK LINK

1) REMOVAL

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

(2) Loosen tension of the track link.

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

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.

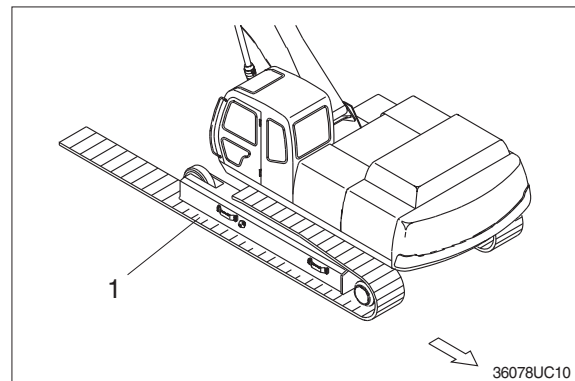
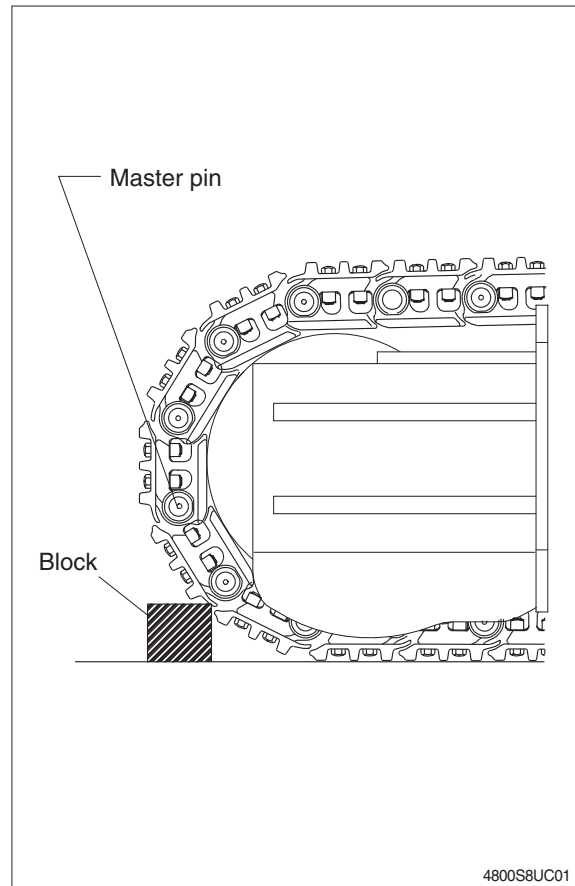
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

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

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

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

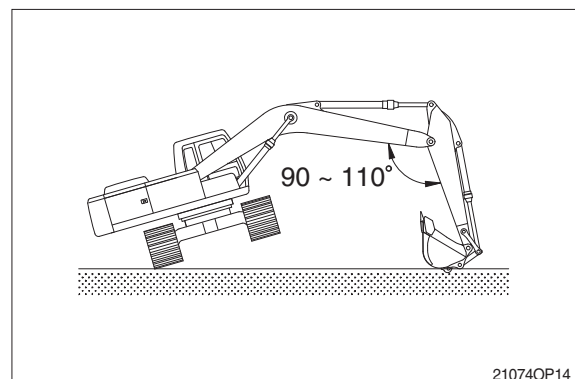
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

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

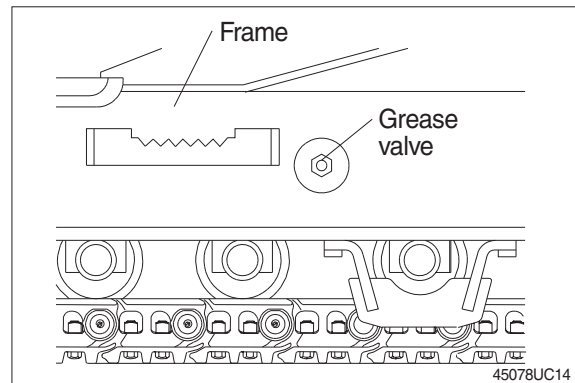
※ Adjust the tension of the track link.



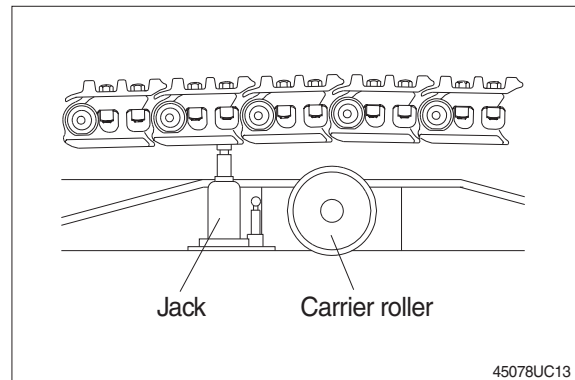
2. CARRIER ROLLER

1) REMOVAL

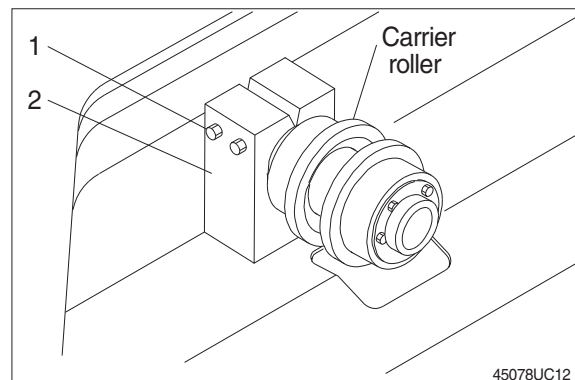
- (1) Loosen tension of the track link.



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



- (3) Loosen the lock nut (1).
- (4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.
 - Weight : 40 kg (90 lb)
 - Tightening torque : 29.7 ± 4.5 kgf · m
(215 ± 32.5 lbf · ft)



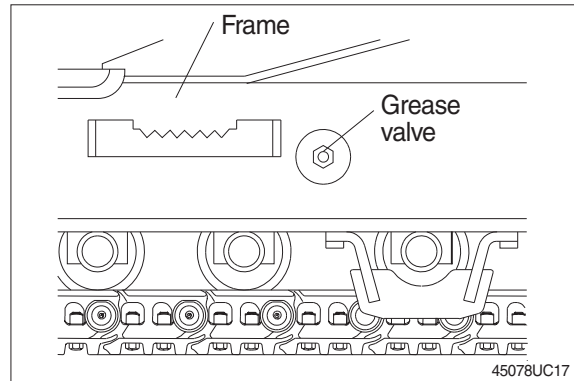
2) INSTALL

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

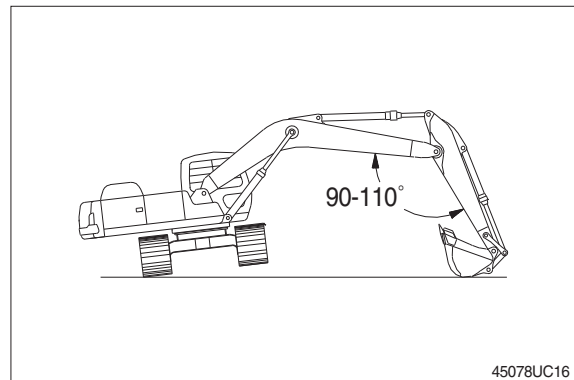
3. TRACK ROLLER

1) REMOVAL

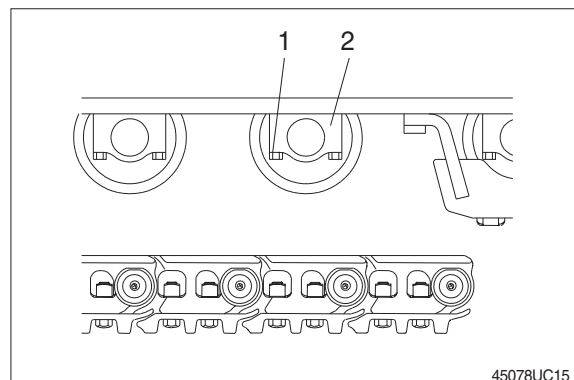
- (1) Loosen tension of the track link.



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



- (3) Remove the mounting bolt (1) and draw out the track roller (2).
 - Weight : 87 kg (190 lb)
 - Tightening torque : 100 ± 15 kgf · m
(723 ± 109 lbf · ft)



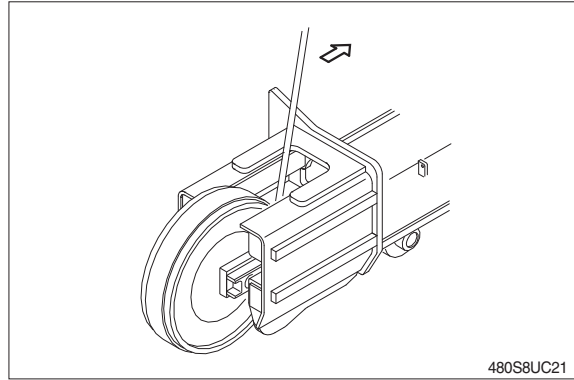
2) INSTALL

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

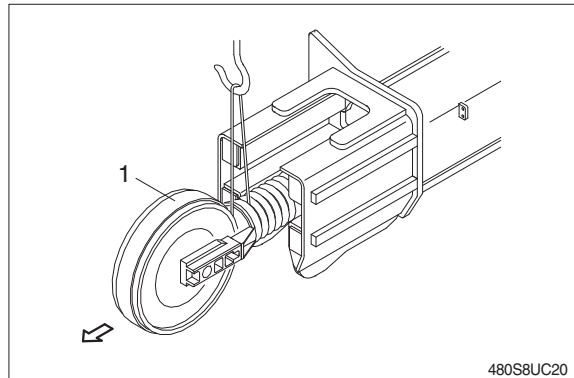
4. IDLER AND RECOIL SPRING

1) REMOVAL

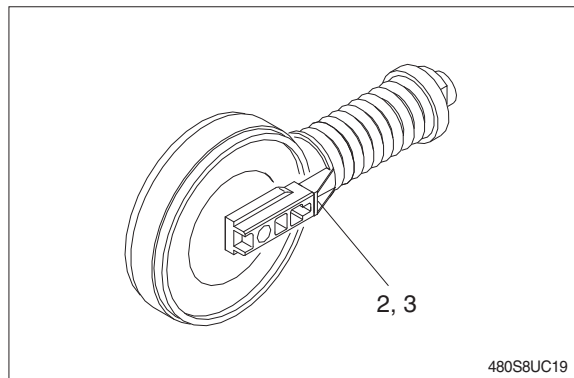
- (1) Remove the track link.
For detail, see removal of track link.



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

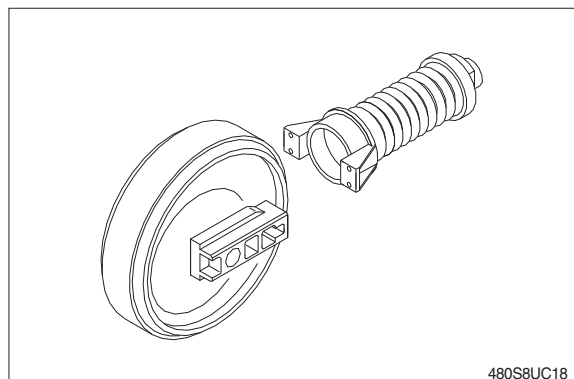


- (3) Remove the bolts (2), washers (3) and separate idler from recoil spring.
· Tightening torque : $83.2 \pm 12.5 \text{ kgf} \cdot \text{m}$
($602 \pm 90.4 \text{ lbf} \cdot \text{ft}$)



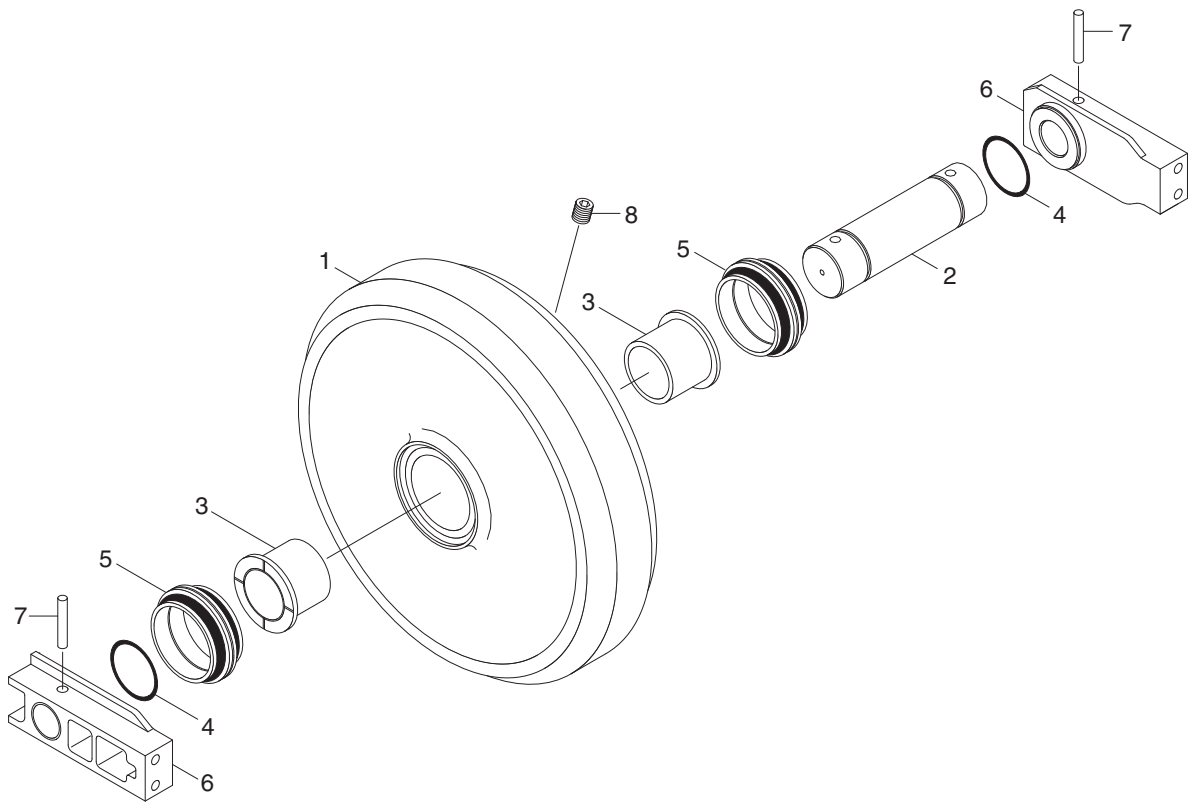
2) INSTALL

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



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



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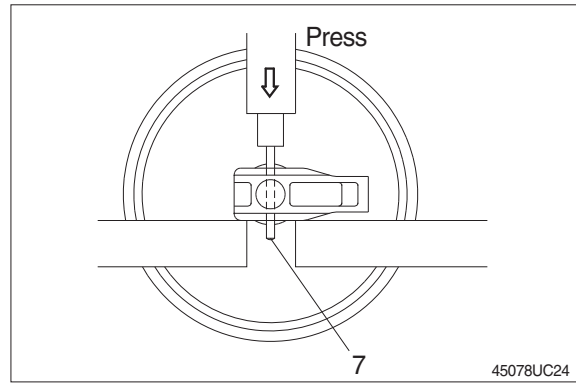
- 1 Shell
- 2 Shaft
- 3 Bushing

- 4 O-ring
- 5 Seal assembly
- 6 Bracket

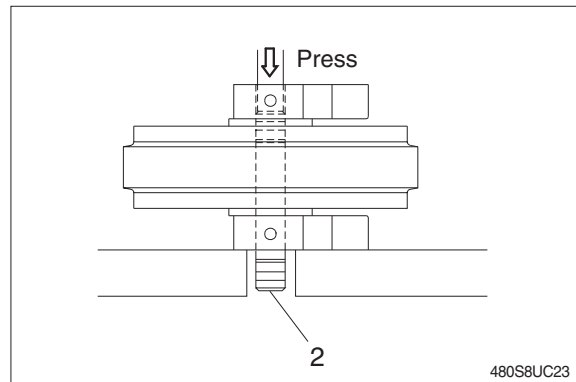
- 7 Spring pin
- 8 Plug

(2) Disassembly

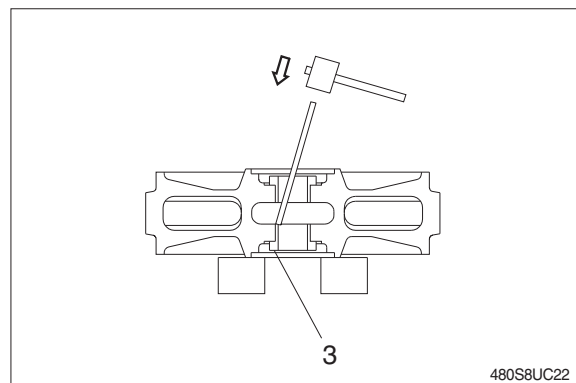
- ① Remove plug and drain oil.
- ② Draw out the spring pin (7), using a press.



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



- ⑥ Remove the bushing (3) from idler, using a special tool.
- ※ Only remove bushing if replacement is necessary.

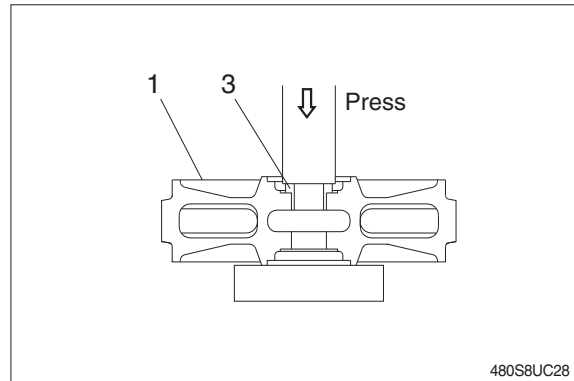


(3) Assembly

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

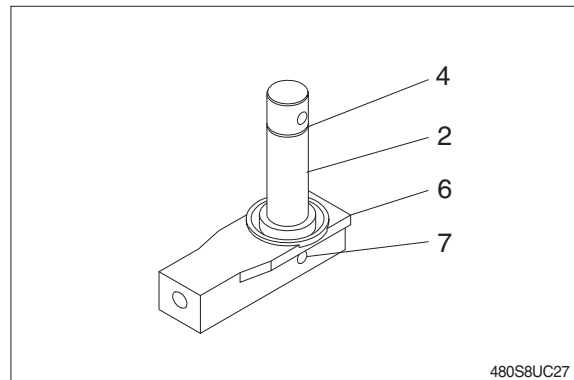
- ① Cool up bushing (3) fully by some dry ice and press it into shell (1).

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

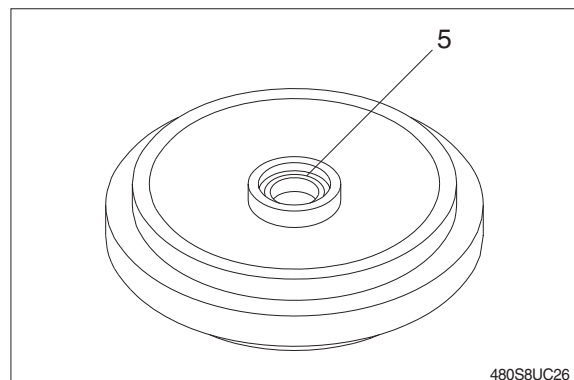


- ② Coat O-ring (4) with grease thinly, and install it to shaft (2).

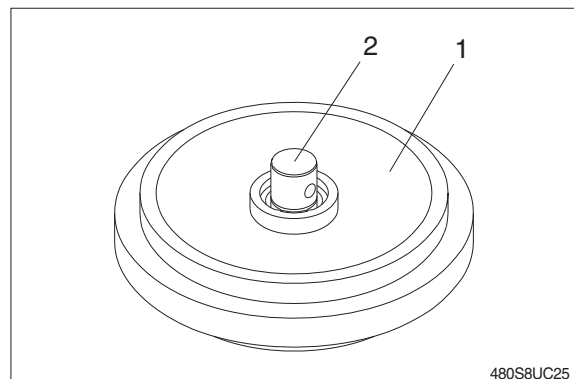
- ③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



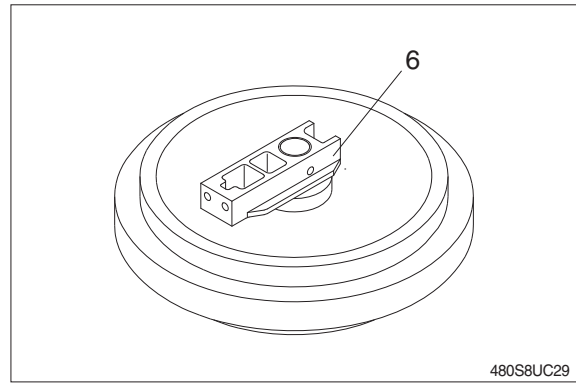
- ④ Install seal (5) to shell (1) and bracket (6).



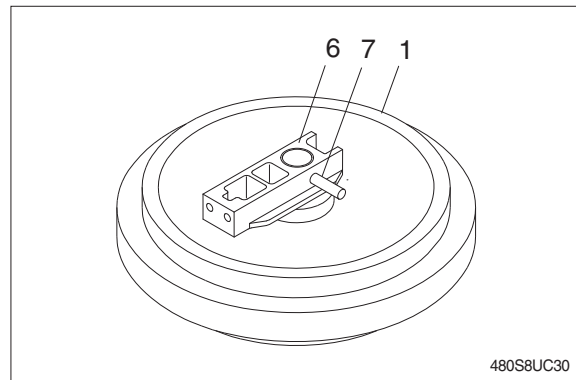
- ⑤ Install shaft (2) to shell (1).



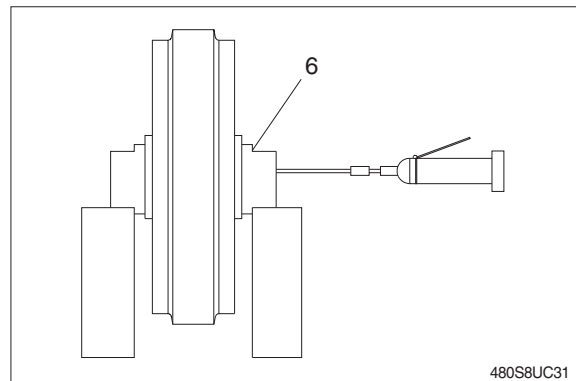
- ⑥ Install bracket (6) attached with seal (5).



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

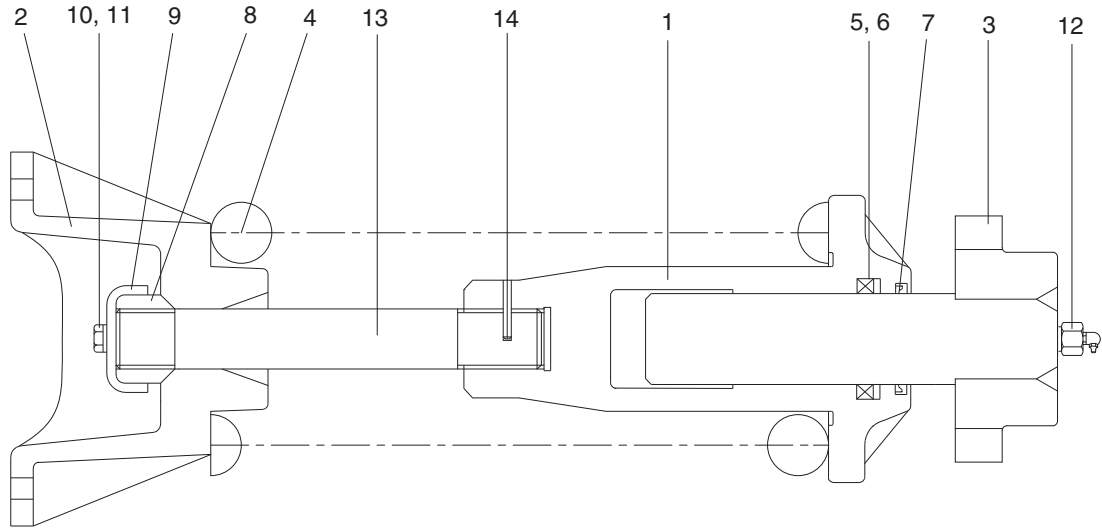


- ⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level,
and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure

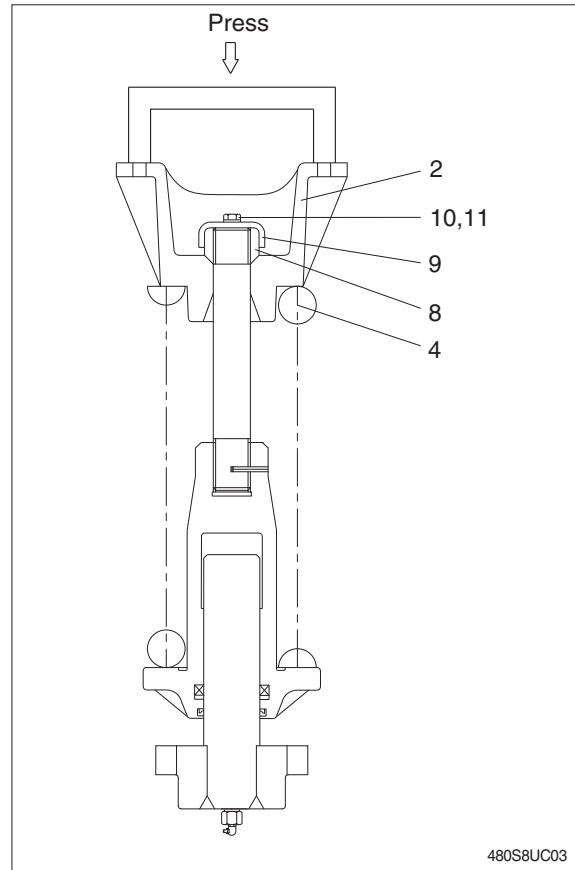


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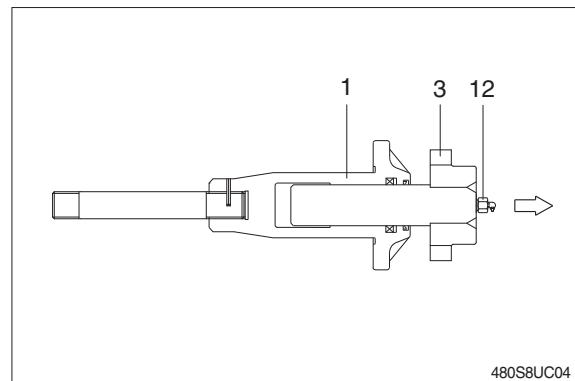
- | | | | | | |
|---|--------------|----|--------------|----|---------------|
| 1 | Body | 6 | Back up ring | 11 | Spring washer |
| 2 | Bracket | 7 | Dust seal | 12 | Grease valve |
| 3 | Rod assembly | 8 | Lock nut | 13 | Tie bar |
| 4 | Spring | 9 | Lock plate | 14 | Spring pin |
| 5 | Rod seal | 10 | Hex bolt | | |

(2) Disassembly

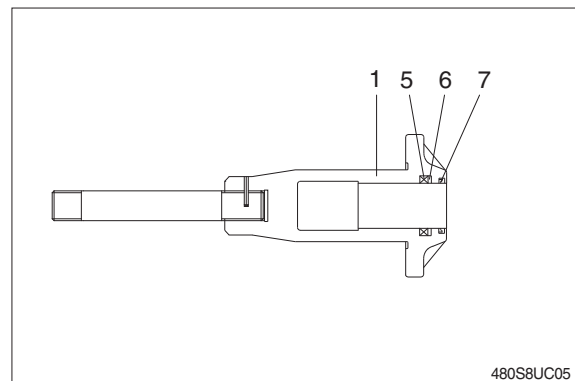
- ① Apply pressure on spring (4) with a press.
 - ※ The spring is under a large installed load. This is dangerous, so be sure to set properly.
 - Spring set load : 28840 kg (63580 lb)
- ② Remove bolt (10), spring washer (11) and lock plate (9).
- ③ Remove lock nut (8).
- ④ Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation. Lighten the press load slowly and remove bracket (2) and spring (4).



- ⑤ Remove rod (3) from body (1).
- ⑥ Remove grease valve (12) from rod (3).



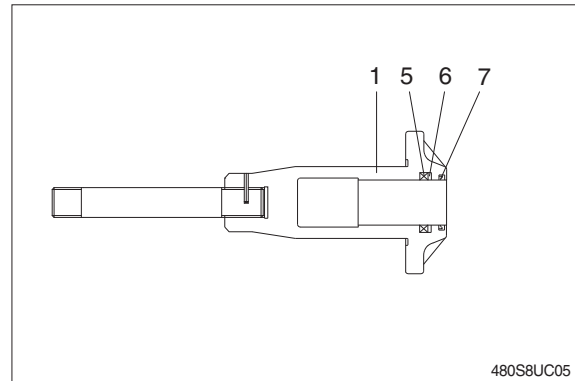
- ⑦ Remove rod seal (5), back up ring (6) and dust seal (11).



(3) Assembly

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

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



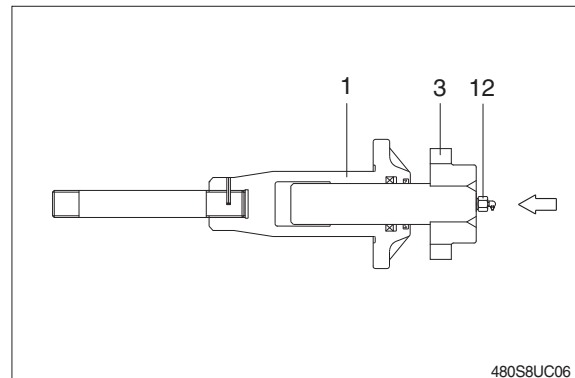
② Pour grease into body (1), then push in rod (3) by hand.

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

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

③ Fit grease valve (12) to rod (3).

· Tightening torque : $13.0 \pm 1.0 \text{ kgf} \cdot \text{m}$
($94 \pm 7.2 \text{ lbf} \cdot \text{ft}$)

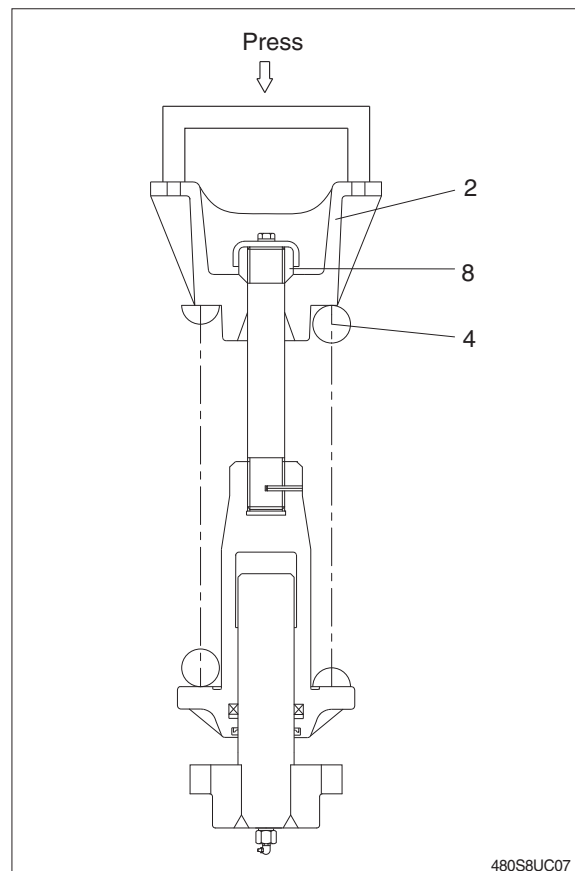


④ Install spring (4) and bracket (2) to body (1).

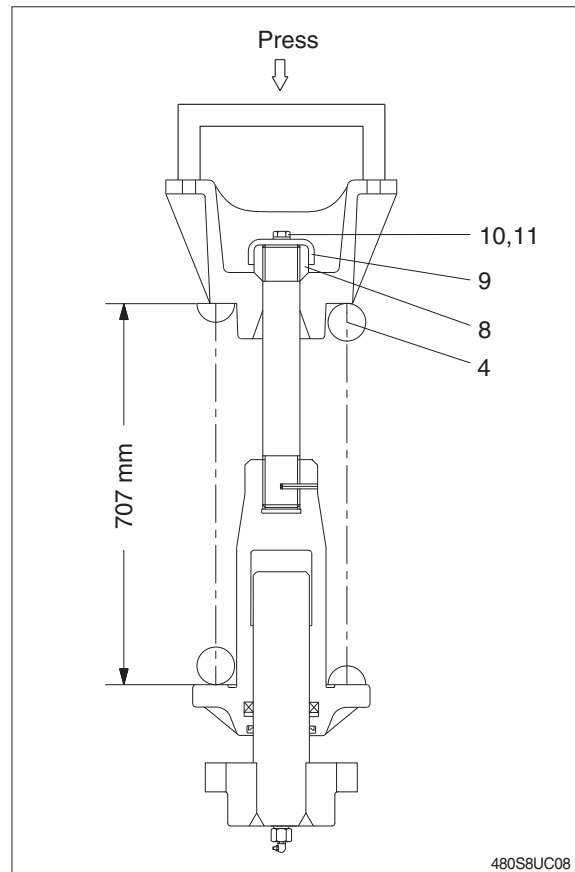
⑤ Apply pressure to spring (4) with a press and tighten lock nut (8).

※ Apply sealant before assembling.

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

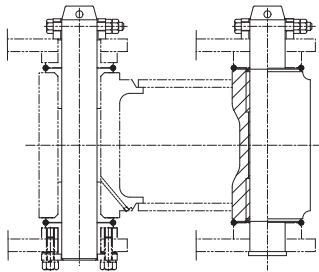
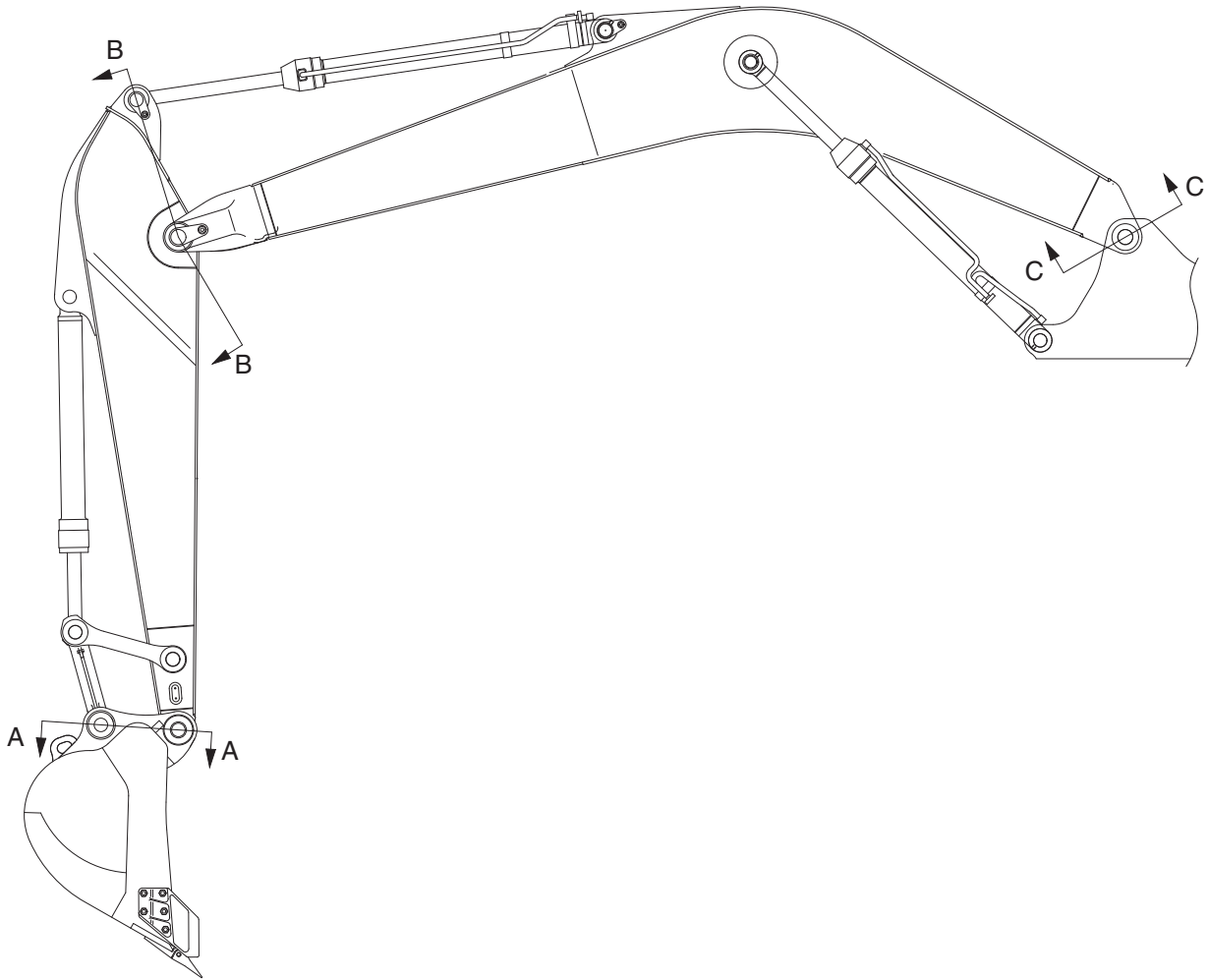


- ⑥ Lighten the press load and confirm the set length of spring (4).
- ⑦ After the setting of spring (4), install lock plate (9), spring washer (11) and bolt (10).
- Tightening torque : $21.3 \pm 3.1 \text{ kgf} \cdot \text{m}$
($152 \pm 22.4 \text{ lbf} \cdot \text{ft}$)

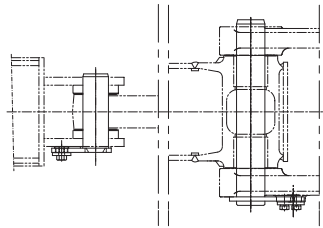


GROUP 11 WORK EQUIPMENT

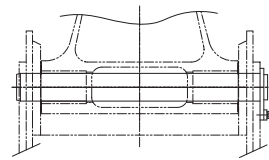
1. STRUCTURE



SECTION A



SECTION B



SECTION C

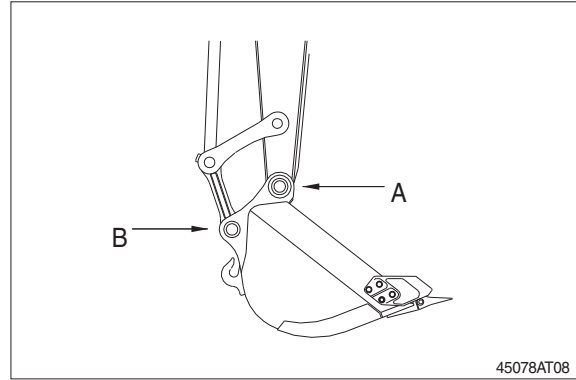
29078WE01

2. REMOVAL AND INSTALL

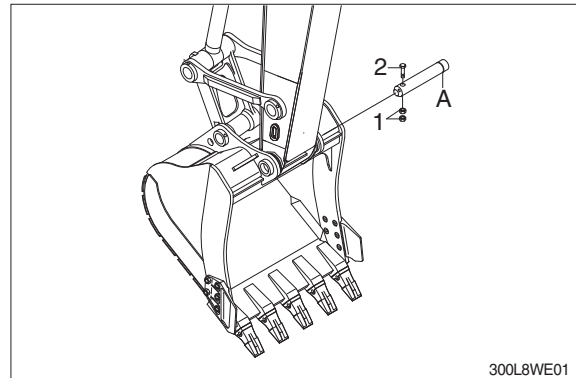
1) BUCKET ASSEMBLY

(1) Removal

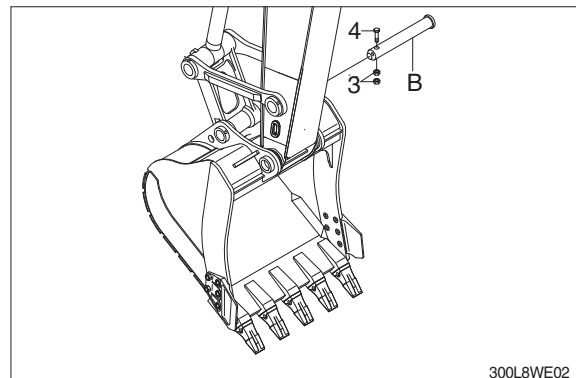
- ① Lower the work equipment completely to ground with back of bucket facing down.



- ② Remove nut (1), bolt (2) and draw out the pin (A).
 - Tightening torque (1) : $100 \pm 15 \text{ kgf} \cdot \text{m}$
($723 \pm 109 \text{ lbf} \cdot \text{ft}$)



- ③ Remove nut (3), bolt (4) and draw out the pin (B).
- Tightening torque (3) : $100 \pm 15 \text{ kgf} \cdot \text{m}$
($723 \pm 109 \text{ lbf} \cdot \text{ft}$)

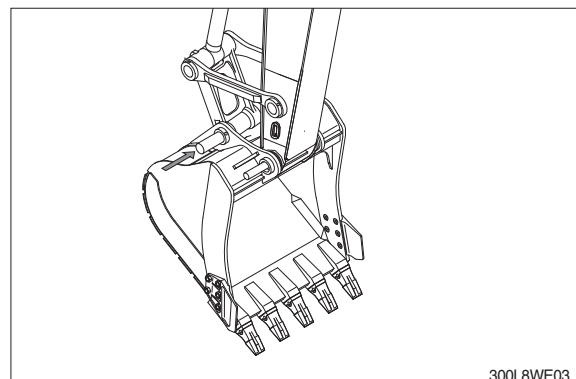


(2) Install

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

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

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



2) ARM ASSEMBLY

(1) Removal

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

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

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

② Disconnect bucket cylinder hose (1).

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

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

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

④ For details, see removal of arm cylinder assembly.

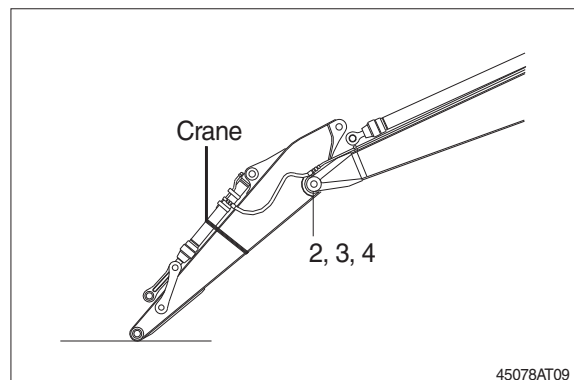
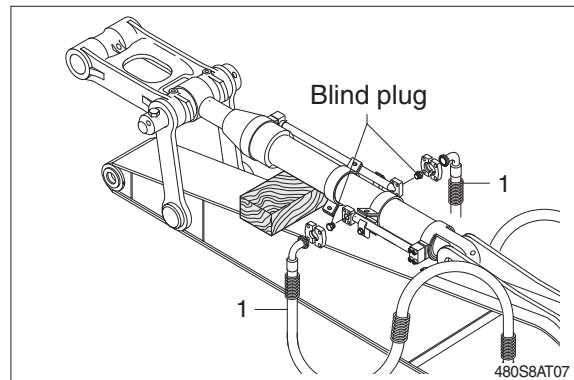
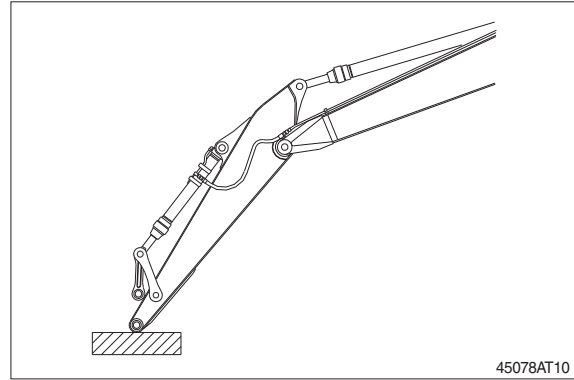
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.

· Weight : 1820 kg (4010 lb)

· Tightening torque (2) : $29.7 \pm 45 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)

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



(2) Install

① Carry out installation in the reverse order to removal.

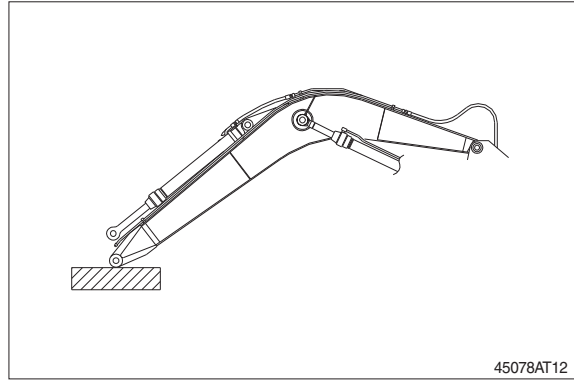
▲ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.

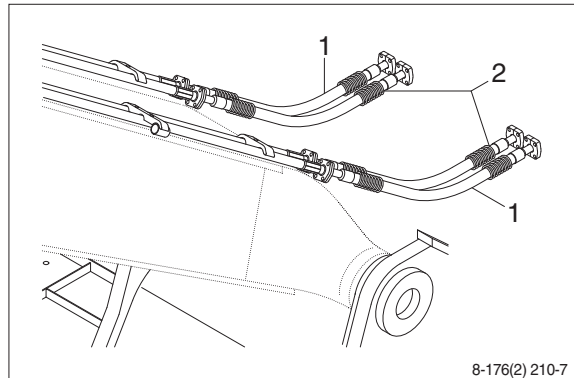
3) BOOM ASSEMBLY

(1) Removal

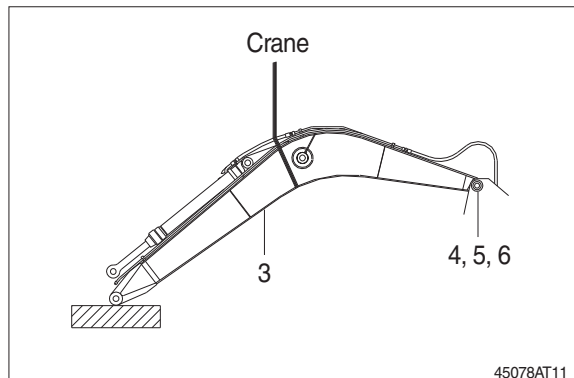
- ① Remove arm and bucket assembly.
- ② For details, see removal of arm and bucket assembly.
Remove boom cylinder assembly from boom.
For details, see removal of boom cylinder assembly.



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



- ⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight : 3570 kg (7870 lb)
· Tightening torque (4) : $59.7 \pm 8.7 \text{ kgf} \cdot \text{m}$
($419 \pm 62.9 \text{ lbf} \cdot \text{ft}$)
※ When lifting the boom assembly always lift the center of gravity.



(2) Install

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

