SECTION 8 DISASSEMBLY AND ASSEMBLY

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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.

Nominal	Dimensions					
number	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			



12) If the part is not under hydraulic pressure, the following corks can be used.

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

No		Descriptions	Polt oizo	Torque		
INO.		Descriptions	DUILSIZE	kgf ∙ m	lbf ∙ ft	
1		Engine mounting bolt, nut	M24 × 3.0	90 ± 7.0	651 ± 51	
2	Fraina	Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5	
3	Engine	Coupling mounting socket bolt	M20 × 2.5	46.5 ± 2.5	336 ± 18.1	
4		Main pump housing mounting bolt	M10 × 1.5	5.3 ± 0.5	38.3 ± 3.6	
5		Main pump mounting socket bolt	M20 $ imes$ 2.5	42 ± 4.5	304 ± 32.5	
6		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.9 ± 9.4	
7	Hydraulic system	Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9	
8	-,	Hydraulic oil tank mounting bolt	M20 $ imes$ 2.5	46 ± 5.1	333 ± 36.9	
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	88.9 ± 9.4	
10		Swing motor mounting bolt	M20 × 2.5	58.4 ± 6.4	422 ± 46.2	
11	Power	Swing bearing upper part mounting bolt	M24 × 3.0	97.8 ± 10	707 ± 72.3	
12	train	Swing bearing lower part mounting bolt	M24 \times 3.0	97.8 ± 10	707 ± 72.3	
13	system	Travel motor mounting bolt	M24 \times 3.0	84 ± 8.0	607 ± 58	
14		Sprocket mounting bolt	$M20 \times 2.5$	57 ± 6.0	412 ± 43.4	
15		Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 4.4	215 ± 31.8	
16		Track roller mounting bolt	M20 $ imes$ 2.5	57.9 ± 8.6	419 ± 62.2	
17	Under carriage	Track tension cylinder mounting bolt	M12 × 1.25	15 ± 5.0	108 ± 3.6	
18		Track shoe mounting bolt, nut	M22 × 1.5	115 ± 5.0	831 ± 36	
19		Track guard mounting bolt	M20 $ imes$ 2.5	46 ± 5.0	333 ± 36	
20		Counterweight mounting bolt	M36 × 3.0	308 ± 46	2228 ± 333	
21	Others	Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7	
22		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8	

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Daltaina	8	Т	10T		
Boil Size	kgf ⋅ m	lbf∙ft	kgf⋅m	lbf·ft	
M 6×1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6	
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7	
M10×1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60.0	
M12×1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114	
M14×2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163	
M16×2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247	
M18×2.0	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344	
M20×2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482	
M22×2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709	
M24×3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832	
M30×3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656	
M36×4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242	

(2) Fine thread

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

2) PIPE AND HOSE (FLARE TYPE)

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

3) PIPE AND HOSE (ORFS TYPE)

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

4) FITTING

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

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

- 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) Remove the wirings for the pressure sensors and so on.
- (5) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.
 - Hydraulic tank quantity : 190 *l*
- (6) Remove bolts (13) and disconnect pipe (1,2).
- (7) Disconnect pilot line hoses (4, 5, 6, 7, 8, 9, 10).
- (8) Remove bolts(12) and disconnect pump suction tube (3).
- When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (9) Sling the pump assembly and remove the pump mounting bolts.
 - · Weight : 200 kg (440 lb)
- Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.







2) INSTALL

- (1) Carry out installation in the reverse order to removal
- (2) Remove the suction strainer and clean it.
- (3) Replace the return filter with a 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) Confirmed the hydraulic oil level and check the hydraulic oil leaks or not.

2. MAIN PUMP (1/2)

1) STRUCTURE





- 04 Gear pump 111 Drive shaft (F) 113 Drive shaft (R) 114 Gear 123 Roller bearing 124 Needle bearing 127 Bearing spacer 141 Cylinder block 151 Piston 152 Shoe 153 Set plate 156 Bushing 157 Cylinder spring 211 Shoe plate 212 Swash plate
- 214 Bushing251 Swash plate support261 Seal cover (F)
- 271 Pump casing
- 312 Valve block 313 Valve plate (R) 314 Valve plate (L) 326 Cover 401 Hexagon socket bolt 406 Hexagon socket bolt 414 Hexagon socket bolt 466 VP plug 468 VP plug 490 VP plug 492 VP plug 531 Tilting pin 532 Servo piston 534 Stopper (L) 535 Stopper (S) 548 Pin 702 O-ring 710 O-ring 714 O-ring
- 717 O-ring 719 O-ring 724 O-ring 725 O-ring 728 O-ring 732 O-ring 774 Oil seal 789 Back up ring 792 Back up ring 808 Hexagon head nut 824 Snap ring 885 Pin 886 Spring pin 901 Eye bolt 953 Set screw 954 Set screw 981 Name plate 983 Pin

MAIN PUMP (2/2)



VIEW A

079	Proportional reducing valve	543	Stopper 1	545	Steel ball
541	Seat	544	Stopper 2		

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 (F		PT plug T thread)	PO plug (PF thread)		Hexagon socket head setscrew
	4	M 5	E	3P-1/16	-		M 8
	5	M 6		BP1/8	-		M10
L⊥ B ⊸++	6	M 8		BP-1/4	PO-1/4	ŀ	M12, M14
	8	M10		BP-3/ 8	PO-3/8	3	M16, M18
	17	M20, M22		BP-1	PO-1, 1 1/4,	1 1/2	-
Double ring spanner,		Hexagon head bolt		Hexagon head bolt		VP plug (PF thread)	
(single) open end spanner	19	M12		M12		VP-1/4	
	24	24 M16		M16		-	
B 	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. $10 \times 8 \times 200$					
Torque wrench		Capable of tightening with the specified torques					

(2) Tightening torque

Dorthomo	Dolt oite	Tor	que	Wrench size		
Part name	DOILSIZE	kgf ∙ m	lbf ∙ ft	in	mm	
Hexagon socket head bolt	M 5	0.7	5.1	0.16	4	
(material : SCM435)	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	115.7	0.47	12	
	M16	24.0	173.6	0.55	14	
	M18	34.0	245.9	0.55	14	
	M20	44.0	318.3	0.67	17	
PT plug (material : S45C)	PT 1/16	0.7	5.1	0.16	4	
Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/ 8	1.05	7.59	0.20	5	
	PT 1/4	1.75	12.66	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	108.5	0.55	14	
	PF 1	19.0	137.4	0.67	17	
	PF 1 1/4	27.0	195.3	0.67	17	
	PF 1 1/2	28.0	202.5	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.Remove hexagon socket head bolts (416) and remove gear pump.



- (5) Loosen hexagon socket head bolts (401) fixing swash plate support (251), pump casing (271) and valve block (312).
- (6) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing (271) from valve block (312).
- * Before bringing this surface down, spread rubber sheet on workbench without failing to prevent this surface from being damaged.



- (7) Pull cylinder (141) out of pump casing (271) straightly over drive shaft (111).
 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.
- (8) 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.
- (9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).In case of fitting a gear pump, first, remove gear pump.
- (10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.







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



(12) Tapping lightly shaft's end of drive shafts(111, 113) with plastic hammer, take out drive shafts from swash plate supports.



- (13) Remove valve plates (313, 314) from valve block (312).
- * These may be removed in work 6.



- (14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin(531) from pump casing (271), and needle bearing (124) and gear (116) from valve block (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 block and swash plate support.
 Once loosened, flow setting will be changed.

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 Section 2-3.
- ⁽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 lock-tight (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.
- (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.
- (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).
- (6) Assemble piston cylinder subassembly (Cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156) and cylinder spring (157).]
 Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.









- (7) Fit valve plate (313) to valve block (312), entering pin into pin hole.
- * Take care not to mistake suction / delivery directions of valve plate.



- (8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
- * At first assemble this at rear pump side, and this work will be easy.
- * Take care not to mistake direction of valve block.



- Clockwise rotation (viewed from input shaft side)
- * Fit block with regulator up and with delivery flange left, viewed from front side.
- (9) 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.



(10) Fit drain port plug (468).

This is the end of reassembling procedures.

3. REGULATOR

1) STRUCTURE(1/2)





REGULATOR (2/2)



412 Hexagon socket screw 413 Hexagon socket screw 436 Hexagon socket screw 438 Hexagon socket screw 496 Plug 601 Casing 611 Feed back lever 612 Lever (1) 613 Lever (2) 614 Fulcrum plug 615 Adjust plug 621 Compensator piston 622 Piston case 623 Compensator rod 624 Spring seat (C) 625 Outer spring 626 Inner spring 627 Adjust stem (C) 628 Adjust screw (C)

629 Cover (C)

630 Lock nut 631 Sleeve. pf 641 Pilot cover 643 Pilot piston 644 Spring seat (Q) 645 Adjust stem (Q) 646 Pilot spring 651 Sleeve 652 Spool 653 Spring seat 654 Return spring 655 Set spring 656 Block cover 708 O-ring 722 O-ring 724 O-ring 725 O-ring 728 O-ring 730 O-ring 732 O-ring

733 O-ring 734 O-ring 735 O-ring 753 O-ring 755 O-ring 756 O-ring 763 O-ring 801 Nut 802 Nut 814 Snap ring Snap ring 836 858 Snap ring 874 Pin 875 Pin 876 Pin 887 Pin 897 Pin 898 Pin 924 Set screw

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	В	Hexagon socket I head bolt (P		PT plug T thread)	PO pluç (PF threa	ງ ເd)	Hexagon socket head setscrew
	4	M 5	E	3P-1/16	-		M 8
	5	M 6		BP1/8	-		M10
	6	M 8	E	3P-1/4	PO-1/4		M12, M14
Socket wrench, double (single) open end .B.		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		Steel bar of key material approx. $10 \times 8 \times 200$					
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	115.7	0.47	12
PT plug (material : S45C) Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/16	0.7	5.1	0.16	4
	PT 1/ 8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.66	0.24	6
PF plug (material : S45C)	PT 1/4	3.0	21.7	0.24	6

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 not 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, 628), adjusting stem (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

Do not loosen these screws and nuts. If they are loosened, adjusted pressureflow 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 stem (Q, 645), pilot spring (646) and spring seat (644) from pilot section.
- * Adjusting stem (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 operation.

4) ASSEMBLY

- For assembly, reverse disassembly procedures, but pay attention to the following items.
- ① Always repair parts that were scored at disassembly.

Get replacement parts ready beforehand.

② Mixing of foreign matter will cause malfunction.

Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

- ③ Always tighten bolts, plugs, etc. to their specified torques.
- ④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.
- ⑤ 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 forcefitted 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).
- REG14
- (12) Put spring seat (644), pilot spring (646) and adjusting stem (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.
- REG15
- (13) Install cover (C, 629) fitted with adjusting screws (628), adjusting stem (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 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.
- A 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 and bracket.
 - · Weight : 220kg(485lb)
- (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 (1/4)



256 Logic poppet

261 O-ring

512 Poppet 513 Poppet

- 601 Main relief valve
- 602 Port relief valve



Plug
 Plug
 Plug
 Plug
 Plug
 Plug
 Plug
 O-ring
 O-ring
 O-ring
 O-ring

204 Cover

206	Cover
208	Cover-spool
211	Piston
258	Plug
260	Plug
264	O-ring
273	Socket screw
301	Travel, LH spool

303 Boom 1 spool

- 304 Bucket spool
- 306 Arm 2 spool
- 308 Straight travel spool
- 541 Steel ball
- 542 Spring seat
- 543 Spring
- 550 Plug
- 561 O-ring
- 602 Port relief valve

STRUCTURE (3/4)



273 Socket screw

167 O-ring

336 Bolt

975 Socket screw

STRUCTURE(4/4)



- 154 Plug
- 164 O-ring
- 202 Spring cover
- 203 Spring cover
- 204 Cover
- 205 Cover
- 261 O-ring
- 201 0-11
- 262 O-ring
- 264 O-ring
- 273 Socket screw
- 301 Travel, LH spool

- 302 Arm 1 spool
- 305 Swing spool
- 307 Boom 2 spool
- 309 Option spool
- 310 Bypass cut spool
- 311 Swing priority spool
- 313 Bypass cut spool
- bib Bypass cut spoo
- 320 Spring
- 329 Spring
- 331 Seat
- 332 Seat

- 333 Spacer bolt
- 336 Bolt
- 337 Stopper
- 339 Stopper
- 370 Spring
- 371 Spring
- 602 Port relief valve
- 604 Port relief valve assembly
- 610 Nega control relief valve

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) All hydraulic components must be worked with precision working. Then, 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 value is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the value, 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 a paper or rubber mat on the bench, and disassemble the value on it.
- (4) Support the body section carefully when carrying, transferring and so on of the control valve. Do not support the lever, exposed spool, end cover section or so on without fail.
- (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 to 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. Besides, prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

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

Name of tool	Quantity	Size (mm)	
Vice mounted on bench (soft jaws)	1 unit		
Box wrench	Each 1 piece	24, 32, 36	
Hexagon key wrench	Each 1 piece	4, 5, 6, 8, 10 and 12	
Loctite #262	1 piece	-	
Spanner	Each 1 piece	32 (main relief valve, 601) 36 (port relief valve, 603)	
3) DISASSEMBLY

The figure in () shown after the part name in the explanation sentence shows its number in the structure figures (8-31~34).

- (1) Place control valve on working bench.
- Disassemble it in clean place and pay attention not to damage flange faces and plate faces.



(2) Disassembling of main spools

- Travel (301), bucket (304), swing (305), option (308), arm 2 (306), boom 2 (307), swing priority (311).
- Loosen the hexagon the socket head bolts (273) and remove the spring cover (201, 202) and the O-ring (261).
 - \cdot Hexagon key wrench : 6 mm

- ② Pull out the spool, spring, spring seats (322), stopper (335 or 339) and spacer bolt (336) in the spool assembly condition from the casing.
- When pulling out the spool assembly from housing, pay attention not to damage the housing.



- ③ Hold the spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336) and disassemble the stopper (335 or 339) and spring seats (332).
 - · Hexagon key wrench : 10 mm

(3) Disassembling of boom 1 spool (303):

- Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).
 Hexagon key wrench : 6 mm
- Pull out the boom 1 spool (303), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).
- When pulling out the spool assembly from P2 housing (101), pay attention not to damage housing.
- ③ Hold the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).
 - · Hexagon key wrench : 10 mm
- ④ Do not disassemble the boom1 spool (303) more than these conditions.





(4) Disassembling of arm 1 spool (302):

 Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).

 \cdot Hexagon key wrench : 6 mm

- Pull out the arm 1 spool (302), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P1 housing (102).
- When pulling out the spool assembly from P1 housing(102), pay attention not to damage housing.
- ③ Hold the arm 1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).

· Hexagon key wrench : 10 mm

④ Do not disassemble the arm 1 spool (302) more than these conditions.

(5) Disassembling of travel straight spool (308):

- Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).
 - \cdot Hexagon key wrench : 6 mm
- ② Pull out the travel straight spool (308), spring (322, 323), spring seat (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).
- When pulling out the spool assembly from P2 housing (101), pay attention not to damage housing.





- ③ Hold the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336) and disassemble the spring(322, 323), spring seats(332) and stopper (335).
 · Hexagon key wrench : 10 mm
- ④ Do not disassemble the travel straight spool (308) more than these conditions.
- (6) Disassembling of bypass cut spool (310, 313):
- Loosen the hexagon socket head bolts (273), and remove the spring cover (203) and the O-ring (262).
 Hexagon key wrench : 6 mm
- ② Pull out the bypass cut spool (310, 313), spring (370, 371), spring seats (331), stopper (337) and spacer bolt (333) in the spool assembly condition from the P1 housing (102).
- When pulling out the spool assembly from P1 housing (102), pay attention not to damage housing.
- ③ Hold the bypass cut spool (310,313) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (333) and disassemble the spring (370, 371), spring seats (331) and stopper (337).

· Hexagon key wrench : 10 mm





(7) Disassembling of spool covers (204, 205, 206, 208):

- Remove the hexagon socket head bolts (273), and remove the spool cover (204, 205, 206, 208) and the O-ring (264).
 Hexagon key wrench : 6 mm
- ② In removing the bucket spool cover (206), at first loosen the plug (258) before it is removed from the P1 housing (102). After removing the bucket spring cover (206) remove the plug (551), and take out the piston (211).

 \cdot Box wrench : 32 mm



(8) Removal of main relief valve (601) port relief valves (602, 603, 604) :

 Remove the main relief valve (601) and the port relief valves (602, 603, 604) from the housing.
 Main relief valve (601) : spanner 32mm Port relief valve (602) : spanner or box wrench 32mm
 Port relief valve (603) : spanner 36mm
 Port relief valve (604) : spanner or box wrench 36mm

② Do not disassemble the relief valves more than these conditions.







(9) Removal of lock valve selector (252):

- Loosen the hexagon socket head bolts (252-171) and remove the lock valve selector (252) and the O-rings (252-161).
 Hexagon key wrench : 5 mm
- ② Do not disassemble the lock valve selector (252) more than these conditions.



- (10) Removal of negative control relief valve (610):
 - Remove the negative control relief valve (610) from the P1 housing (102).
 Box wrench : 36 mm
 - ② Do not disassemble the negative control relief valve (610) more than these conditions.



(11) Removal of arm regeneration cut valve (257):

Remove the plug (253), spring (331), spool (211), and sleeve (392) from the P1 housing (102).

 \cdot Box wrench : 36 mm



- (12) Disassembly of logic control valve (250, 251) and logic poppet (254, 256):
 - Loosen the hexagon socket head bolts (250-120, 251-120) and remove the logic control valve (250, 251) and the O-rings (250-112 and 113, 251-112 and 113).
 Hexagon key wrench : 8 mm
 - ② Pull out the logic poppet (254, 256), spring (254-106, 256-106) and spring seat (254-103, 256-103) from the housing.
 - ③ Do not disassemble the logic control valve and the logic poppet more than these condition.





(13) Disassembly of check valve :

 CP1, C2, CCb, LCb, LCo, LCk, LCa, LCAT2

Remove the plug (551) and take out the poppet (511) and the spring (521). • Hexagon key wrench : 12 mm

② CMR1, CMR2

Remove the plug (553) and take out the poppet (512) and the spring (522). • Hexagon key wrench : 10 mm



3 CRa, CRb

Remove the plug (552) and take out the poppet (513) and the spring (523). • Hexagon key wrench : 12 mm



4 CCk, CCo

Remove the plug (551) and take out poppet (514) and the spring (521). • Hexagon key wrench : 12 mm

⑤ Remove the plug (550) and take out the ball (541), spring (543) and spring seat (542).

· Hexagon key wrench : 6 mm



(14) Disassembly of flanges (209) :

Loosen the hexagon socket head bolts (971) and remove the flange (209) and the O-ring (165).

· Hexagon key wrench : 8 mm

(15) Disassembly of plate (210) :

Loosen the hexagon socket head bolts (274) and remove the plate (210) and the O-rings (165).

· Hexagon key wrench : 10 mm

(16) Disassembly of orifices for signal line :

Do not disassemble the plug (151) and orifice (156) unless required specifically.

(17) Disassembly of casing :

- Except when required specially, do not disassemble the tie bolts of the P1 housing.
- ② Since the plugs not described in above disassembling procedures are the blind plugs for sacrifice holes and the blind plugs for the housing sanitation, do not disassemble them as far as not required specially.



(18) Inspection after disassembling

Clean all the 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 the seal groove faces of the housing and the covers are smooth and free of dust, dent, rust etc.
- c. Correct dents and damages on check seat faces of housing, if any, by lapping.
- * Pay attention not to leave lapping agent in the housing.
- 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 its inspection procedures.
- g. Replace all the 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 are uniform 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 orifices of the main poppet and seat section are not clogged with foreign matter.
- e. Replace all O-rings with new ones.
- f. When any light damage is found in above inspections, correct it by lapping.
- g. When any abnormal part is found, replace it with a relief valve assembly.

4) ASSEMBLY

- ① In this assembling section, explanation only is shown. Refer to figures and photographs shown in disassembling section.
- ② Figure in () shown after part name in explanation sentence shows number in structure figure.
- ③ Cautions in assembling O-rings
 - a. Pay attention to keep O-rings free from defects in its forming and damages in its handling.
 - b. Apply grease, hydraulic oil or so on to O-rings and seal-fitting sections for full lubrication.
 - c. Do not stretch O-rings so much to deform them permanently.
 - d. In fitting O-ring, pay attention not to roll it into its position. In addition, twisted O-ring cannot remove its twisting naturally with ease after being fitted, and causes oil leakage.
 - e. Tighten fixing the bolts for all sections with a torque wrench to their respective tightening torque.

(1) Assembly of check valve :

- Assemble the poppets (511, 512, 513, 514) and the springs (521, 522, 523) : Put the O-rings (561) onto the plugs (551, 552). Put the O-rings (562) onto the plugs (553). Tighten the plugs (551, 552, 553) with their specified torques.
- * Use the poppets, springs and plugs in following groups.

Poppet	Spring	Plug	Reme
511	521	551	511 in
512	522	553	512 in
513	523	552	513 in
514	521	551	514 in

Remember that 511 in 8 positions 512 in 2 positions 513 in 2 positions 514 in 2 positions

Plug No.	Hexagon key wrench (mm)	Tightening torque (kgf·m)
551	12	23.5 ~ 26.5
552	12	23.5 ~ 26.5
553	10	13.3 ~ 15.3





- ② Assemble of ball (541), spring Seat (542) and spring (543) : Put the O-ring (166) onto the plug (550), and tighten the plug (550) with specified torque.
 - \cdot Hexagon key wrench : 6 mm
 - Tightening torque : 2.55 ~ 2.96 kgf·m (18.4~21.4 lbf·ft)



(2) Assembly of plate (210) :

Fit the O-rings (165) to the P1 housing (102), and tighten the hexagon socket head bolts (274) with specified torque.

Hexagon key wrench : 10 mm

 Tightening torque : 10.0 ~ 12.2 kgf·m (72.3~88.2 lbf·ft)

So turn the control valve that the plate face may be directed downward.

(3) Assembly of flange (209) :

Fit the O-rings (165) to the flange (209), and tighten the hexagon socket head bolts (971) with specified torque.

- · Hexagon key wrench : 8 mm
- Tightening torque : 5.0 ~ 6.6 kgf·m (36.2~47.7 lbf·ft)

(4) Assemble of logic control valve (250, 251):

 Put the O-ring (250-115, 251-115) onto the plug (250-111, 251-111).



- ② Assemble the spool (250-102, 251-102), spring seat (250-104, 251-104) and spring (251-105, 251-105) into the casing (250-101, 251-101) of the logic control valve, and tighten the plug (250-111, 251-111) with specified torque.
 - · Hexagon key wrench : 8 mm
 - Tightening torque : 7.0 ~ 8.1 kgf·m (50.6~58.6 lbf·ft)
- ③ Assemble the logic poppet (254; poppet, spring, spring seat) into the housing of the control valve.
- Fit the O-rings (250-112 and 113, 251-112 and 113) to the casing (250-101, 251-101) of the logic control valve, and tighten the hexagon socket head bolts (250-120, 251-120) with specified torque.
 - · Hexagon key wrench : 8 mm
 - Tightening torque : 5.0 ~ 6.6 kgf·m (36.2~47.7 lbf·ft)
- (5) Assembling of negative control relief valve (610) :

Assemble the negative control relief valve (610) into the P2 housing (101), and tighten it with specified torque.

- \cdot Box wrench : 36 mm
- Tightening torque : 7.0 ~ 8.0 kgf·m (50.6~57.9 lbf·ft)





(6) Assembly of arm regeneration cut valve (257) :

Assemble the sleeve (257-212), spool (257-211), and spring (257-231) into the P1 housing (102). Put the O-ring (265) onto the plug (257-253), and tighten with specified torque.

- Box wrench : 36 mm
- Tightening torque : 7.0 ~ 8.0 kgf·m (50.6~57.9 lbf·ft)
- (7) Assembling of lock valve selector (252) : Fit the O-rings (252-161) to the lock valve selector (252) and tighten the hexagon socket head bolts (252-171) with specified torque.
 - · Hexagon key wrench : 5 mm
 - Tightening torque : 1.0 ~ 1.4 kgf·m (7.2~10.1 lbf·ft)





(8) Assembling of main relief valve (601) and port relief valve (602, 603, 604) : Assemble the main relief valve (601) and

the port relief valves (602, 603, 604) to the housing, and tighten them with specified torque.

Item	Tool	Tightening torque (kgf·m)
Main relief valve (601)	Spanner 32	7.0 ~ 8.1
Port relief valve (602)	Spanner 32 or box wrench 32	7.0 ~ 8.1
Port relief valve (603)	Spanner 36	12.2 ~14.3
Port relief valve (604)	Spanner 36 or box wrench 36	12.2 ~14.3



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(9) Assemble of travel straight spool (308) :

- Hold the middle of the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs (322, 323) and stopper (335), and tighten the spacer bolt (336) with specified torque.
- * Before tightening the spacer bolt (336), apply loctite #262 to it.
 - · Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)
- * Pay attention not to fasten the vise excessively to the shape of the travel straight spool (308) is deformed.
- ② Insert the spool assemblies of ① items above into the P2 housing (101).
- Fit spool assemblies into P2 housing (101) carefully and slowly.
- * Do not push them forcibly without fail.







(10) Assembling of boom 1 spool (303) :

- Hold the middle of the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs (320, 321) and stopper (335), and tighten the spacer bolt (336) with specified torque.
- * Before tightening the spacer bolt (336), apply loctite #262 to it.
 - · Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m

(11.6~13.0 lbf·ft)

- * Pay attention not to fasten the vise excessively to the shape of the boom 1 spool (303) is deformed.
- Insert the spool assemblies of items ① above into the P2 housing (101).
- % Fit spool assemblies into the P2 housing (101) carefully and slowly.
- * Do not push them forcibly without fail.

(11) Assembling of arm 1 spool (302) :

- Hold the middle of the arm1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs (320, 321) and stopper (335) and tighten the spacer bolt (336) with specified torque.
- * Before tightening the spacer bolt (336), apply loctite #262 to it.
 - · Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)
- * Pay attention not to fasten the vise excessively to the shape of the arm 1 spool (302) is deformed.
- ② Insert the spool assemblies of items ① above into the P1 housing (102).
- % Fit spool assemblies into the P1 housing (102) carefully and slowly.
- * Do not push them forcibly without fail.





- (12) Assembling of main spool (travel (301), bucket (304), swing (305), option (309), arm2 (306), boom2 (307), swing priority (311)):
 - Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (332), springs and stopper (335 or 339) and tighten the spacer bolt (336) with specified torque.
 - * Before tightening the spacer bolt (336), apply loctite #262 to it.
 - · Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)
 - Pay attention not to fasten the vise excessively to the shape of the spool is deformed.
 - ② Insert the spool assemblies of Items ① above into the P2 housing (101) and P1 housing (102).
 - Fit spool assemblies into P2 housing (101) and P1 housing (102) carefully and slowly.
 - % Do not push them forcibly without fail.





(13) Assembling of bypass cut spool (310, 313) :

- Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Attach the spring seats (331), springs (370, 371) and stopper (337) and tighten the spacer bolt (333) with specified torque.
- * Before tightening the spacer bolt (333), apply loctite #262 to it.
 - Hexagon key wrench : 10 mm
 - Tightening torque : 1.6 ~ 1.8 kgf·m

(11.6~13.0 lbf·ft)

- ※ Pay attention not to fasten the vise excessively to the shape of the bypass cut spool (310, 313) is deformed.
- ② Insert the spool assemblies of Items ① above into the P1 housing (102).
- % Fit spool assemblies into the P1 housing (102) carefully and slowly.
- * Do not push them forcibly without fail.

(14) Assembling of covers :

- Fit the O-rings (264) to the spool covers (204, 205, 206, 208) to sides reverse to the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.
- * Confirm that O-rings (264) have been fitted to the spool covers (204, 205, 206, 208).
 - · Hexagon key wrench : 6 mm
 - Tightening torque : 2.5 ~ 3.5 kgf·m (18.1~25.3 lbf·ft)
- ② Bucket spool cover (206) : Assemble piston (355) into bucket spool cover (206).
 Put O-ring (561) onto plug (258) and tighten it with specified torque.
 - Box wrench : 32 mm
 - Tightening torque : 15.3 ~ 18.4 kgf·m (111~133 lbf·ft)
- ③ Fit the O-rings (261, 262) to spring covers (201, 202, 203) to the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.
- * Confirm that O-rings (261,262) have been fitted to spring covers (204, 205, 206).
 - \cdot Hexagon key wrench : 6 mm
 - Tightening torque : 2.5 ~ 3.5 kgf·m (18.1~25.3 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 (2).
- (5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).
- (6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).
 - Motor device weight : 61 kg (135 lb)
- (7) Remove the swing motor assembly.
- When removing the swing motor assembly, check that all the piping have been disconnected.

2) INSTALL

- 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





300L2SM02

- 1 Casing
- 2 Oil seal
- 3 Shaft
- 4 Snap ring
- 5 Roller bearing
- 6 Needle bearing
- 7 Swash plate
- 8 Cylinder block
- 9 Spring
- 10 Ball guide
- 11 Retainer plate
- 12 Piston assy
- 13 Friction plate
- 14 Separate plate

- 15 Parking piston
- 16 Brake spring
- 17 Spring pin
- 18 O-ring
- 19 O-ring
- 20 Valve plate
- 21 Spring pin
- 22 O-ring
- 23 Valve casing
- 24 Check valve
- 25 Spring
- 26 Plug
- 27 O-ring
- 28 Plug

- 29 O-ring
- 30 Relief valve assy
- 31 Reactionless valve assy
- 32 Plug
- 33 O-ring
- 34 O-ring
- 35 Time delay valve assy
- 36 Level gauge
- 37 Socket bolt
- 38 Socket bolt
- 39 Plug
- 40 Name plate
- 41 Rivet
- 42 Socket bolt

2) DISASSEMBLY

(1) Disassemble drive shaft

- Unloosing socket bolt (time delay valve, 42) and disassemble time delay valve assy (35) from casing (1).
- ② Disassemble level gauge (36) from casing (1).



2209A8SM51



2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).



2209A8SM53

④ Disassemble spring (16) and using a jig, disassemble parking piston (15) from casing (1).



5 Disassemble respectively cylinder block sub (8), friction plate (13), separate plate (14) from casing (1).

⑥ Disassemble swash plate (7) from casing

(1).



2209A8SM55



2209A8SM56

- ⑦ Using a plier jig, disassemble snap ring(4) from casing (1).

2209A8SM57

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



(2) Disassemble cylinder block sub

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



2209A8SM59

- ② Disassemble ball guide (10) and spring (cylinder block, 9) from cylinder block (8).
 - · Ball guide $\times 1EA$
 - · Spring \times 9EA



2209A8SM60

(3) Disassemble valve casing sub

 Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).



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



③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and reactionless valve assy (31).



2209A8SM63

④ Using a torque wrench, disassemble check valve (24) from valve casing (23).



2209A8SM64

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



3) ASSEMBLING

(1) Assemble shaft sub

- Put roller bearing (3) on preheater and provide heat to inner race. (Temperature in conveyor : 120°C for 3~5 minutes)
- ② Using a robot machine, assemble and press preheated roller bearing (3) into shaft (5).



2209A8SM66



2209A8SM67

(2) Assemble cylinder block sub

- Assemble 9 springs (cylinder block, 9) into cylinder block (8).
 - · Spring \times 9EA



2209A8SM68

- ② Assemble ball guide (10) into cylinder block (8).
 - · Ball guide \times 1EA



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



2209A8SM70

4 Assemble parts of procedure 2 and 3.



2209A8SM71

(3) Assemble valve casing sub

- Assemble make up check valve sub Assemble check valve (24), O-ring (27), plug (26) in that order and then screw it torque wrench.
 - Make up check valve × 2EA
 - · Spring \times 2EA
 - · Plug \times 2EA
 - $\cdot \text{ O-ring} {\times} 2\text{EA}$
 - Tightening torque : $38 \pm 3.8 \text{ kgf} \cdot \text{m}$ (275±27.5 lbf $\cdot \text{ft}$)

$\ensuremath{\textcircled{}^\circ}$ Assemble reactionless valve assy

Assemble reactionless valve assy (31), plug (32), O-ring (33, 34) in that order and then screw it a torque wrench.

- Reactionless valve assy (31) × 2EA
- Plug (32) \times 2EA
- O-ring (33, 34) × 2EA
- Tightening torque : $22 \pm 1.5 \text{ kgf} \cdot \text{m}$ (159±11 lbf · ft)



2209A8SM72



2209A8SM73

- ③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).
 - Relief valve (30) × 2EA
 - Tightening torque : $18 \pm 1.8 \text{ kgf} \cdot \text{m}$ (130±13 lbf · ft)



2209A8SM74

- ④ Assemble plug (28) and O-ring (27) into valve casing (23).
 - Plug (28) × 3EA
 - O-ring (27) × 3EA
 - Tightening torque : 4.5 \pm 0.4 kgf \cdot m (32.5 \pm 2.9 lbf \cdot ft)
- 5 Assemble needle bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).
 - Needle bearing (6) \times 1EA
 - Spring pin (17, 21) \times 1EA

⑥ Apply some grease valve plate (20) and assemble it into valve casing (23).



2209A8SM76



(4) Assemble drive shaft sub

1 Using a jig, assemble oil sealing (2) into casing (1).



2209A8SM78

2 Fit shaft sub (shaft+roller bearing) into casing (1).



2209A8SM79

- ③ Using a plier jig, assemble snap ring (4) to shaft (3).
 - · Snap ring \times 1EA



2209A8SM80

- ④ Apply some grease swash plate (7) and assemble it into casing (1).
 - · Swash plate $\times 1EA$



- (5) Insert O-ring (18, 19) into casing (1).
 - O-ring (18) \times 1EA
 - O-ring (19) \times 1EA



2209A8SM82

6 Assemble cylinder block (8) into casing (1).



2209A8SM83

- ⑦ Assemble separate plate (14) and friction plate (13) 4 sets into casing (1) and fit parking piston (15) into casing (1) by a jig or a press.
 - · Separate plate \times 4EA
 - Friction plate \times 4EA
 - Parking piston × 1EA



2209A8SM84

- 8 Assemble spring (parking piston, 16) into parking piston (15).
 - Spring × 26EA



- Ift up valve casing (23) on casing (1) by a crane and assemble it with socket bolts (37, 38).
 - Tightening torque : $33 \pm 3.3 \text{ kgf} \cdot \text{m}$ (239 ± 23.9 lbf \cdot ft)



2209A8SM86

- Assemble level gauge (36) and plug (39) into casing (1).
 - Tightening torque (36) : $15 \pm 1.0 \text{ kgf} \cdot \text{m}$ (108.5 \pm 7.2 lbf \cdot ft)
 - Tightening torque (39) : 3±0.3 kgf · m (21.7±2.2 lbf · ft)



2209A8SM87

- Assemble time delay valve assy (35) into valve casing (23) with socket bolt (42).
 - \cdot Time delay valve $\times 1 \text{EA}$
 - $\cdot \; \text{Socket bolt} \! \times \! 3\text{EA}$
 - \cdot Tightening torque (42) : 1.3 \pm 0.1 kgf \cdot m (9.4 \pm 0.72 lbf \cdot ft)



2209A8SM88

② Air pressing test

Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm²).



(3) Leakage check

Place motor on a bench tester and after cleaning motor by color check No.1, paint No.3 and be sure of leakage.



2209A8SM90

(1) Mount test bench

Mounting motor a test bench, test the availability of each part.



2209A8SM91

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



- 1 Ring gear
- 2 Drive shaft
- 3 Bearing
- 4 Bearing
- 5 Thrust plate
- 6 Snap ring
- 7 Cover
- 8 Hex head bolt
- 9 Casing
- 10 O-ring
- 11 Hex socket head bolt
- 12 Carrier 2

- 13 Planetary gear 2
- 14 Needle bearing 2
- 15 Thrust washer 2
- 16 Carrier pin 2
- 17 Spring pin 2
- 18 Sun gear 2
- 19 Thrust plate 2
- 20 Carrier 1
- 21 Planetary gear 1
- 22 Needle bearing 1
- 23 Thrust washer 1
- 24 Carrier pin 1

- 25 Spring pin 1
- 26 Sun gear 1
- 27 Thrust plate 1
- 28 Sleeve
- 29 O-ring
- 30 Oil seal
- 31 Parallel pin
- 32 Hex socket head bolt
- 33 Name plate
- 34 Rivet
- 35 Plug

2) DISASSEMBLY REDUCTION GEAR

(1) Preparation

- ① The reduction gear removed from machine is usually covered with mud.
 - Wash out side of reduction gear and dry it.
- ② Setting reduction gear 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 let fall parts on your foot while lifting them.

(2) Disassemble the swing motor

① Loosen the hex wrench bolt (11, M10), and remove the swing motor.



300L8SR01

(3) Disassemble the carrier No.1 assy

 Disassemble gear-sun No.1 (26), tightening eye-bolt (M10) to screw holes for disassembly in carrier No.1 (20), then disassemble carrier No.1 assy.



300L8SR02

(4) Disassemble the carrier No.2 assy

 Disassemble gear-sun No.2 (18), tighten eye-bolt (M10) to screw holes for disassembly in carrier No.2 (12), then disassemble carrier No.2 assy.



300L8SR03

(5) Disassemble carrier No.1 assy

- ① Hold jig to spring pin No.1 (26), then tap jig with a hammer, so that place spring pin in the center of carrier pin No.1 (24).
- * Do not reuse spring pin.
- * Disassemble method of carrier No.2 assy is same.
- ② Disassemble carrier pin No.1 (24), then disassemble planetary gear No.1 (21), thrust washer No.1 (23) from the carrier No.1 (20).



300L8SR04



300L8SR05

- (6) Disassemble the ring gear (1).
- ① Separate ring gear (1) from casing (9).
- Separate casing (9) by using the groove area because loctite is spread on joining surface of ring gear (1) and casing (9) to prevent oil leakage.



① Using the snapring plier, disassemble snap ring (6),then disassemble thrust plate (5).

 ② Turn casing (9) over to face pinion gear upward. Then unscrew hex.head bolt (8) 12ea by using the tool.



300L8SR06



300L8SR07



300L8SR08

- ③ Disassemble drive shaft sub assy by using the press machine.
- * The drive shaft sub assy fall all together, so becareful when removing it.



300L8SR09

- ④ Disassemble sph. roller bearing (3), cover
 (7), oil seal (30), and sleeve (28) from the drive shaft (2).
- * Do not reuse oil seal (30).



300L8SR10

(8) Separate sph. roller bearing (4) from casing(9) by using the press machine.



300L8SR11
3) ASSEMBLY REDUCTION GEAR

- (1) Even though assembly is accomplished by reversing disassembly steps, be careful of the following.
 - ① Repair the damaged part when disassembling, prepare parts for the exchange in advance.
 - 2 All parts should be cleaned with cleaner, and dried with compressed air.
 - ③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
 - ④ Replacement O-ring and oil seal with new parts is generally recommended.
 - ⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.
 - 6 When assembling bolt, spread Loctite.
- (2) Assemble drive shaft (2).
- After heating sleeve (28) for 5 minutes at 80 ~ 90°C, assemble O-ring (29).
- * Apply grease to the O-ring (29) to prevent damage.



300L8SR12

- ② Apply grease to the oil seal (30), placed on the jig and then assemble it to cover (7) by using the press machine.
- * Apply grease to oil seal lip portion.
- * Be careful of damage of oil seal.



- ③ Assemble sleeve (28) and cover (7) to drive shaft (2).
- * Be careful of the direction of cover (7), sleeve (28).
- * Be careful of damage of oil seal.

④ After heating sph. roller bearing (3) for 13 minutes at 80~90°C and doing demagnetization, then assemble it to drive shaft (2).



300L8SR14



300L8SR15

⑤ After assembling O-ring (10) on casing (9), assemble drive shaft sub assy by using a press machine.



300L8SR16

- 6 After spreading loctite #262 on hex.head bolt (8), screw them to fix casing (9) and cover (7).
- * Tightening torque : 8.8 ± 0.9 kgf \cdot m $(63.7 \pm 6.51 \text{ lbf} \cdot \text{ft})$ * Screwing when rust inhibitor is not remove.



300L8SR17



300L8SR18

- (3) Assemble sph. roller bearing (4).
- ① Assemble sph. roller bearing (4) to casing (9) by using the press machine.

- ② After assembling thrust plate (5), assemble snap ring (6) to assembly groove of drive shaft (2).
- * Assemble selected thrust plate (5) to make gap (0.1~0.3 mm) between snap ring (6) and sph. roller bearing (4).



- (4) Assemble ring gear (1).
- Spread the loctite #515 on the casing (9) with reference to the right detail view.
- * Loctite should not flow into casing (9).



- ② After press-fitting parallel pin (31) with a hammer on the casing (9). Then spreading loctite #262 on hex.head bolt (32), screw them.
- * Tightening torque : $33 \pm 3.3 \text{ kgf} \cdot \text{m}$ (239 ± 23.9 lbf \cdot ft)
- $\, \ast \,$ Screwing when rust inhibitor is not removed.



300L8SR21

(5) Assemble carrier No.1 assy

- After assembling thrust plate No.1 (27) on carrier No.1 (20), assemble thrust washer No.1 (23), planetary gear No.1 (21), then assemble carrier pin No.1 (24) by using the hammer.
- * Assembly method of carrier No.2 assy is same.



2 Assemble spring pin No.1 (25) to fix carrier No.1 (20) and spring pin No.1 (25) by using the jig.



300L8SR23

- ③ Caulking is performed on the assembled spring pin unit.
- * To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin No.1 (25).



300L8SR24

(6) Assemble carrier No.2 assy

- ① Lift pre-assembled carrier No.2 assy. Shaking it from side to side, assemble it to ring gear (1) to engage with ring gear (1). Then, press-fit it with polyurethane hammer.
- * Check caulking and rotating state before assembly.



300L8SR25

- (7) Assemble sun gear No.2 (18).
- ① Shaking sun gear No.2 (18) from side to side, assemble it to carrier No.2 assy to engage with planetary gear No.2 (13).



(8) Assemble carrier No.1 assy.

Lift carrier No.1 assy. Shaking it from side to side, assemble it to ring gear (1) to engage with ring gear (1).

* Check rotating state before assembly.



300L8SR27

- (9) Assemble sun gear No.1 (26).
- Shaking sun gear No.1 (26) from side to side, assembleit to engage planetary gear No.1 (21). Then fill with gear oil 11 liter.



GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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



SECTION A-A

1	Casing
2	Plug
3	Screw
4	Screw
5	Pin
6	Pin
7	Stopper
8	O-ring
9	Back up ring
10	Piston
11	Shaft
12	Spacer

- 12 Spacer
- 13 Roller bearing
- 14 Stop ring15 Support

16	Plate
17	Piston
18	Stopper
19	O-ring
20	Back up ring
21	Cylinder block
22	Cylinder spring
23	Spacer
24	Guide
25	Plate
26	Piston & Shoe assy
27	Plate
28	Plate
29	Brake
30	Ring

~ (
31	Ring
32	Spring
33	Valve casing
34	Needle bearing
35	O-ring
36	Pin
37	Spool
38	Screw
39	Damping check
40	Spring
41	O-ring
42	Plunger
43	Spring
44	Stopper
45	O-ring

46	Back up ring
47	Сар
48	Cap
49	Socket bolt
50	Socket bolt
51	Seat
52	Steel ball
53	Stopper
54	Plug
55	O-ring
56	Plug
57	Relief valve
58	O-ring
59	Back up ring
60	Rod

61	O-ring
62	Lock screw
63	Nut
64	Spool
65	Plug
66	O-ring
67	Valve plate
68	Spring
69	O-ring
70	Socket bolt
71	Socket bolt
72	Lock screw
73	Oil seal
74	Lock ring
82	Floating Seal

83	Housing	89-1
84	Bearing	89-2
85	Shim	89-3
86	Retainer	89-4
87	Bolt	89-5
88	Carrier No.3	89-6
88-1	Carrier No.3	89-7
88-2	Planetary gear No.3	89-8
88-3	Needle No.3	90
88-4	Thrust washer No.3	90-1
88-5	Pin No.3	90-2
88-6	Spring pin No.3	90-3
88-7	Sun gear No.3	90-4
88-8	Snap ring No.3	90-5
89	Carrier No.2	91



- Carrier No.2
- Planetary gear No.2
- Needle No.2
- Thrust washer No.2
- Pin No.2
- Spring pin No.2
- Sun gear No.2 Snap ring No.2
- Carrier No.1
- Carrier No.1
- Planetary gear No.1
- Needle bearing No.1
- Thrust washer No.1
- Pin No.1
- Sun gear No.1

- 92 Plug
- 93 Lock pin
- 94 Ring gear
- 95 Bolt
- 96 Thrust ring No.1
- 97 Cover
- 98 Thrust ring No.2
- 99 Bolt
- 100 Motor ring
- 101 Thrust ring No.3
- 103 Pad
- 105 Coupling

2) TOOL AND TIGHTENING TORQUE

(1) Tools

Name of tools	B-size	Name of part applied		
	4	Plug(2), Orifice screw(3, 4, 38)		
Hexagonal	8	Hex socket bolt(50), Lock screw(62, 72), Plug(65)		
L-Wrench	10	Hex socket bolt(49)		
	46	Hex(57)		
	19	Hp plug(54)		
Socket wrench/	24	Hex nut(63)		
spanner	27	Hp plug(56)		
Snap-ring plier(for holes, axis)		Ring stop(14), Ring lock(74)		
Solder hammer		Needle bearing(34), Pin(5, 6, 36)		
Torque wrench		Size : 500, 3000		
Jig for assembling oil seal		Oil seal(73)		

(2) Tightening torque

	Darthearea	Otomoloval	Size	Torque	
NO.	Part name	Standard		kgf ∙ m	lbf ⋅ ft
2	Plug	NPTF 1/16	4	7~11	50.63~79.5
3, 4, 38	Orifice screw	NPTF 1/16	4	7	50.63
49	Hex socket bolt	M12	10	100	723.3
50	Hex socket bolt	M10	8	67	484.6
54	Plug	PF 1/4	19	37	267.6
56	Plug	PF 1/2	27	110	795.6
57	Relief valve	HEX 46	46	170~190	1230~1374
63	Nut	M16	24	240	1736
65	Plug	PF 3/8	8	75	542.4
70, 72	Hex socket bolt	M16	14	240	1736
71	Hex socket bolt	M16	14	240	1736

2. DISASSEMBLING

1) GENERAL INSTRUCTIONS

- (1) Generally, hydraulic equipment is precisely manufactured and clearances between each parts are very narrow. Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather. Tools and kerosene to wash parts should also be clean and handled with great care.
- (2) When motor is removed from the host machine, wash around the ports sufficiently and put the plugs so that no dust and/or water may invade. Take off these plugs just before the piping works when re-attach it to the host machine.
- (3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
 Seals, O-rings, etc., if once disassembled, are not reusable.
 There are some parts that should be replaced as a subassembly.
 Consult with the parts manual in advance.
- (4) The piston can be inserted to whichever cylinder block for the initial assembling. However, their combination should not be changed if they are once used. To reuse them, put the matching mark on both pistons and cylinder block before disassembling.
- A Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

2) DISASSEMBLEING TRAVEL MOTOR

- (1) Fix a hydraulic motor on jig with four pieces of bolts (M16 \times 60L).
- When rotating jig up to 90° in disassembling and assembling, fix a motor making drain plug (56) faced to the bottom.
- (2) After disassembling drain plug (56), let an oil in a case of a motor discharged.
- * Check whether manufactured chips or metal dust are added in a drain oil.

(3) In order to making the out-put axis of a hydraulic motor faced upward, disassemble ring lock (74) with a plier after rotating jig up to 90° in disassembling and assembling.

(4) Disassemble hexgon socket bolts (70, 71) holding valve casing.





- (5) After detaching valve casing sub, disassemble valve plate (67).
- * In case of serious abrasion of valve plate, exchange it to a new one.



- (6) After taking brake spring (32) and then bonding two pieces of M16 bolts to brake piston (29), disassemble it pulling it upward.
- * There are 10 pieces of brake spring.

(7) First, rotate jig in disassembling and assembling up to 90°, then let a motor faced toward the horizon. then disassemble a cylinder and piston sub.a



- (8) Disassemble stopper L (18) and piston swash (17).
- * Piston swash : Use M5 bolt



(9) Disassemble swash plate (16).



(10) After put M12 into support (15), disassemble support.

(11) Disassemble piston swash (10) and stopper (7).



- (12) In order to making the turning axis (11) faced upward, put it way from shaft casing tapping the bottom of the turning axis with hammer, after rotating jig up to 90° in disassembling and assembling.
- Try to deal with roller bearing (13) without any damage.



- (13) Disassemble valve casing sub.
- * Try to deal with needle bearing (3) without any damage.
- ① Disassemble plowing road (60), automatic changeover spring (68), and automatic changeover spool (64).
- * Do not touch hexagon nut (63) for controlling the amount of an oil and lock screw (62).

If there is any abnormality on plowing spool and spring, exchange them to new ones.



- ② After unloading hexagon socket bolts (49, 50) and taking caps (47,48) away, disassemble parts of counter balance valve (37~46).
- In disassembling counter balance valve, be careful of figuring out the directions such as the right or the left of finger.
 If there is any abnormality in spool spring check, exchange it to new one.



- (14) Disassemble cylinder sub.
 - ① Disassemble set plate (25) and piston (26) sub.



⁽²⁾ Disassemble friction plate (27) and lee plate (28) in cylinder block (21).



③ Dismantle ball guide (24), spacer (23), and cylinder spring (22).



3) ASSEMBLING TRAVEL MOTOR

- (1) Assemble the sub of a turning axis.
- After assembling bearing spacer (12) into a turning axis (11), have cylinder roller bearing (13) thermal-reacted.
 - a. In the thermal reaction of cylinder roller bearing, use and induction heating apparatus and adjust the temperature as about 100°C.
 - b. Deal moisturized copper part oil seal in a turning axis without any damage of it.
- (2) Assemble ring stop (14) with a plier.
- Be careful of the direction of ring stop.
 (The direction of round is the side of bearing)





(3) Assemble valve casing sub.

① Bond seven pieces of plug (2) in valve casing (33) with standard torque.

After taping plug with seal taper and ② spread rock tight, assemble it.

• Tightening torque : 7~11 kgf • m (50.63~79.5 lbf • ft)



- (4) Compress pin (36) into.
- * Using a hammer, make the height of pin 5 mm from the a contact surface of valve plate.



(5) Assemble needle bearing (34).



- (6) Assemble seat (51), ball (52), stopper (53), and hp plug (54) with O-ring (55), respectively.
- ① Be careful of the procedure and direction of assembling seat and stopper.
 - \cdot Tightening torque : 37 kgf \cdot m (267.6 lbf \cdot ft)



- · 5sites
- \cdot Tightening torque : 37 kgf \cdot m (267.6 lbf \cdot ft)





(8) Bond orifice screw (38) on the right and left side of spool c.b (37) with a standard torque.

• Tightening torque : 7 kgf \cdot m (50.63 lbf \cdot ft)



(9) Insert hold spool c.b (37) and damper check (39) into valve casing.



- (10)Bond cap R (47) and cap L (48) with hexagon socket bolts (49, 50).
 - Remember not to exchange cap R, L each other in assembling.

Tightening torque

- \cdot M12 : 100 kgf \cdot m (item 49)
- \cdot M10 : 67 kgf \cdot m (item 50)



- (11)After fastening with torque, insert automatic plowing spool (04), spring (68) and O-ring (69).
 - \cdot Tightening torque : 75 kgf \cdot m (542.4 lbf \cdot ft)



(12)Assemble swash road (60) inserted by O-ring (61).



(13)Insert O-ring (32) into valve casing.



(14)Bond drain plug (30) inserted by O-ring
(31) with standard torque.
Tightening torque : 100 kgf · m
(723.3 lbf · ft)



(15)Assemble cylinder sub.

 Assemble cylinder spring (22), spacer (23), and spherical surface bush (24) into cylinder (21).

Set the position of spline of spherical surface bush and cylinder.



(16)Assemble friction plate (27) and separated plate (28) into cylinder.



(17)After insert piston shoe (26) into set plate(25), assemble it into cylinder.



(18)Using jig, compress oil seal (73) into shaft casing (01).



(19)Assemble the body of a motor.

- ① Bond seven piece of plug (02) in shaft casing plug with standard torque.
 - a. After taping plug with seal taper and spread rock tight, assemble it.
 Tightening torque : 7~11 kgf · m

(50.63~79.5 lbf ⋅ ft)



- (20)Using a hammer and a handle, compress pin (5, 6).
 - ① Pin (5) : Set the height as 10 mm from the contact surface of a plate supporter. - 2pieces.
 - Pin (6) : Set the height as 19 mm from the manufactured surface of shaft casing. 4pieces.



(21)Assemble sub of a turning axis.

- (22)Assemble plate supporter (15) with M12 bolt.
- * Be careful of the direction of plate supporter driven.

- (23) Assemble plate (16) into plate supporter.
 - ① Spread grease in moisturized copper part of plate.
 - O Confirm the soft movement of plate.







(24)Assemble stopper L (36) combined by plowing piston (35) and O-ring (42).



- (25)Rotating dismantling and assembling jig up to 90° make shaft from perpendicular to horizontal.
- * Be careful that plate is not segregated from plate supporter.



* Adjusting pin into holes of separated plate, assemble it.









(28)Assemble piston ring (30), piston ring 252(30) and 278 (31) into brake piston (29).



(29) Assemble brake piston into shaft casing.

* Be careful of the direction of assembling brake piston.



- * Quantity : Spring-10pieces, Holes-11pieces
- * Do not assemble on the top of brake piston.



- (31)Insert O-ring (69), after fastening orifice screw (4) with standard torque.
 - \cdot Quantity and size : (4) 2 pieces- ø 1.0

(56)1pieces-ø1.5

 \cdot Tightening torque : 7 kgf \cdot m (50.63 lbf \cdot ft)



- (32)After inserting valve plate (67) into valve casing, bond it into shaft casing with hexagon socket bolt (70).
 - ① Spread grease on the back side of valve plate, in order for valve plate to be adhered well.
 - ⁽²⁾ Use a crane in assembling it into valve plate shaft casing.
 - ⁽³⁾ Set holes, Ø 5, of valve plate heading toward the port of the inlet and outlet of valve casing.
 - ④ Spread grease in the side of plowing spool of plowing spring in order that plowing spring can not be detached.
 - Tightening torque : 240 kgf m

(1736 lbf ⋅ ft)

 \cdot Tightening torque : 180 \pm 10 kgf \cdot m (1302 \pm 72.3 lbf \cdot ft)

(33)Bond relief valve (57) with standard torque.





(34)Unloosen four pieces of bolts (M20×50L) fixing a motor and remove the motor away from jig.



3. DISASSEMBLING REDUCTION UNIT

1) Preparation for disassembling

- The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.
- (2) Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.
 - * While oil is still hot, inside of the unit may be pressurized.
 - A Take care of the hot oil gushing out of the unit when loosening the plug.

(3) Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

- 2) Setting reduction unit (or whole propelling unit) on work stand for disassembling
- (1) Remove hexagon socket head bolts (M10, 19) at 3 places from cover (17) almost equally each other, and then install eye bolts (M10).

Lift up the unit using them and place it on work stand with cover upward.

* Take great care not th pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

3) Removing cover

- (1) Remove the rest of hexagon socket head bolts(M10, 19) that secure ring gear. Loosen all the socket bolts and then, disassemble cover.
- (2) As the cover(17) is adhered to ring gear(14), dissemble ring gear (14) and cover(17) by lightly hammering slantwiseupward using sharpen punch insertedbetween the cover and ring gear.



4) Removing No.1 carrier sub assy

- (1) Remove No.1 sun gear
 - * Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.



(2) Screw three eye bolt (M10, 15) in No.1 carrier and lift up and remove No.1 carrier assy.



5) Removing No. 2 carrier sub assy

- (1) Remove No.2 sun gear
 - * Be sure to maintain it vertical with the ground when disassembling No.2 sun gear.



(2) Screw three M10 eye bolt in No.2 carrier and lift up and remove No.2 carrier assy.



6) Removing ring gear

(1) Remove hexagon socket head bolts(M14, 15) that secure ring gear and housing.



- (2) As the ring gear (14) is adhered to housing (3), disassemble ring gear (14) and housing (3) by lightly hammering slantwise upward using sharpen punch inserted between the ring gear and housing.
 - * Carefully disassembling ring gear not to make scratch on it.
- (3) Screw three eye bolt (M10) in ring gear and lift up and remove it.





7) Remove No.3 carrier sub assy

- (1) Removing No.3 sun gear
 - * Be sure to maintain it vertical with the ground when disassembling No.3 sun gear.



- #3 Carrier assy
- (2) Screw three eye bolt (M10) in No.3 carrier and lift up and remove No.3 carrier assy.





9) Remove motor ring

(1) Remove motor ring using hand.



10) Removing retainer & shim

- (1) Remove hexagon socket (M12) head bolts that retainer and motor.
- (2) Remove retainer & shim.



11) Removing housing sub assy

(1) Screw eye bolt (M14) in housing and lift up housing assembly including angular bearing and floating seal.

12) Removing floating seal

(1) Lift up a piece of floating seal of motor side.



13) Dissembling housing assembly

- (1) After turning housing, lift up a piece of floating seal from housing and then remove it.
- * Don't disassemble angular bearing.



14) Dissembling No.1 carrier

- (1) Remove thrust ring (16) from carrier.
- (2) Knock spring pin (89-6) fully into No.1 pin (90-5).
- (3) Remove planetary, thrust washer, No.1 pin, bearing from carrier.

15) Disassembling No.2,3 carrier

(1) Disassemble (14) carriers, using the same method for No.1 carrier assembly.



6. ASSEMBLING REDUCTION GEAR

- General precautions

Clean every part by kerosene and dry them by air blow.

Surfaces to be applied by locktite must be decreased by solvent.

Check every part for any abnormals.

Each hexagon socket head bolt should be used with locktite No. 242 applied on its threads.

Apply gear oil slightly on each part before assembling.

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

Inspection before reassembling

Thrust washer

- \cdot Check if there are seizure, abnormal wear or uneven wear.
- \cdot Check if wear is over the allowable limit.

Gears

- \cdot Check if there are pitting or seizure on the tooth surface.
- \cdot Check if there are cracks on the root of tooth by die check.

Bearings

 \cdot Rotate by hand to see if there are something unusual such as noise or uneven rotation.

Floating seal

· Check flaw or score on sliding surface or on O-rings.

1) Assembling No.1 carrier

- (1) Put No.1 carrier (90-1) on a flat place.
- (2) Install No.1 needle bearing (90-3) into No.1 planetary gear (90-2), put 2 ea of No.1 thrust washer (90-4) on both sides of bearing, and then install it into carrier.
- (3) Install No.1 pin (90-5) into No.1 carrier where the holes for No.1 pin (90-5) are to be in line with those of No.1 carrier, and then, install spring pins into the holes.
- (4) Caulk carrier holes as shown on the picture.
- (5) Assembly ring thrust (96) into carrier.







2) Assembling No.2 carrier

- (1) Make No.2 planetary gear (89-2) vertical, assemble 8-9 ea of No.2 needle (89-3), and then, assemble the remaining No.2 needle by use of the assembly jig for No.2 pin (89-5).
- (2) Remove out the assembly jig for No.2 pin and assemble 2 ea of No.2 thrust washer (89-4) into No.2 carrier (89-1).
- (3) Insert No.2 pin (89-5) into carrier where the holes of No.2 pin (89-5) are in line with those of carrier.
- (4) Hammer spring pin (89-6) to insert into carrier hole and No.2 pin hole, and then, caulk. Assemble 2 sets using the same method.
- (5) Assemble ring thrust (98) into carrier.

3) Assembling No.3 carrier

(1) Assemble 4 sets, using the same method for assembly of No.2 carrier.





4) Installing floating seal

- (1) Assemble floating seal into motor by use of pressing jig.
- (2) Grease the contact parts for floating seal which is assembled into motor.





5) Assembling housing

- (1) Heat housing at 60~70°C while clearing it out and then, assemble bearing.
- (2) Assemble floating seal into housing by use of pressing jig as shown on the picture.
- * Be sure to maintain it vertical with the ground when assembling bearing and floating seal.





6) Installing housing assembly

- (1) Install 2 ea of eye bolt (M14) into housing assembly.
- (2) Assemble housing into motor by use of hoist and eye bolt.
- * Be sure to tighten eye bolt deep enough.



7) Installing main bearing

- (1) Heat main bearing at 60~70°C and then, install.
- * Be sure to maintain it vertical with the ground when assembling bearing.



8) Installing retainer (86) and shim (85)

- (1) Measure clearance between main bearing and retainer by use of jig to decide the thickness of shim and select and appropriate shim, and then, assemble retainer.
- (2) Apply locktite (#242) on hexagon socket head bolt (M12), and then, bolt.





9) Installing motor ring

(1) Insert motor ring into motor to install.



10) Installing coupling

(1) Install coupling on spline of the motor.



11) Installing No.3 carrier sub assy

- (1) Install eye bolt(M10) on No.3 carrier assembly.
- (2) Lift No.3 carrier assembly and then, assemble it into reducer.
- * Match it vertical with the spline of the motor and the, slowly lower.



12) Installing ring gear

- (1) Apply three bond #1104 (Locktite #515) on housing for ring gear without gap.
- (2) Insert lock pin into housing hole.
- (3) Install eye bolt (M12) on the tap for cover of ring gear.
- (4) Lift ring gear and then, assemble into housing.
- (5) Apply locktite to hexagon socket bolt(M14) and then, bolt, having appropriate torque.






13) Installing No.3 sun gear (88-7)

- (1)Install snap ring (88-8) in No.3 sun gear(88-7) by use if snap ring flier.
- (2) Install No.3 sun gear on the spline of No.3 carrier, matching teeth of them.





14) Installing No.2 carrier sub assy

- ⁽¹⁾Install eye bolt (M10) on No.2 carrier assembly.
- ⁽²⁾ Lift No.2 carrier assembly and then, slowly put it down on ring gear.
- (3) Rotate planetary gear by hands and install in ring gear.



15) Installing No.2 sun gear (89-7)

- (1) Install snap ring (89-8) on No.2 sun gear (89-7) by use of snap ring flier.
- (2) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.





16) Installing No.1 carrier sub assy

- (1) Install eye bolt (M10) on No.1 carrier assembly.
- (2) Lift No.1 carrier assembly and then, put it down on ring gear slowly.
- (3) Rotate planetary gear by hands to install on ring gear, matching their teeth.

17) Installing No.1 sun gear (91)

- Put down No.1 sun gear on No.1 carrier, maintaining it vertical with spline of coupling.
- (2) Install No.1 sun gear on No.1 planetary gear, matching their teeth.



18) Installing cover (97)

- (1) Beat pad with plastic hammer, and press it into the center of cover.
- (2) Apply three bond #104 (locktite #515) on the ring gear for without gap.
- (3) Put cover on ring gear, apply locktite (#242) in hexagon socket head bolt (M10), and then, bolt.
- (4) Fill gear oil (8L) into drain port.
- (5) Apply sealing tape (teflon) on PT3/4 plug and then, bolt.





GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- (4) Loosen the socket bolt (1).
- (5) Remove the cover of the console box.
- (6) Disconnect pilot line hoses (3).
- (7) Remove the pilot valve assembly (2).
- When removing the pilot valve assembly, check that all the hoses have been disconnected.

2) INSTALL

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





2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



1	Case	8	Stopper
2	Plug	9	Push rod
3	Bushing	10	Spring
4	Spool	11	Push rod
5	Shim	12	Spring
6	Spring	13	Spring seat

- 7 Spring seat
- Spring seat 13 14 Plug

- 15 O-ring 16 Rod seal 17 Plate Boot
- 18
- 19 Joint assembly 20
- Swash plate 21 Adjusting nut
 - 28 Bushing

22 Lock nut

Nut

Boot

Handle assembly

Handle bar

Spring pin

23

24

25

26

27

8-112

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark		
Allen wrench	S B		
Snanner	2		
Opanner	7		
(+) Driver	Length 150		
(-) Driver	Width 4~5		
Torque wrench	Capable of tightening with the specified torques		

(2) Tightening torque

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

3) DISASSEMBLY

- (1) Clean pilot valve with kerosene.
- * Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (26) from case (1) and take it out upwards.
- * For valve with switch, remove cord also through hole of casing.





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



(5) Remove the boot (18).



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





- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).
- When return spring (10) is strong in force, plate (17), plug (14) and push rod (11) will come up on loosening joint.
 Pay attention to this.





(8) Remove plate (17).



- (9) When return spring (10) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.
- * Take it out with minus screwdriver. Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.
- During taking out, plug may jump up due to return spring (10) force.
 Pay attention to this.
- (10) Remove reducing valve subassembly and return spring (10) out of casing.
- * Record relative position of reducing valve subassembly and return springs.





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



- (12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.
- * Pay attention not to damage spool surface.
- * Record original position of spring seat (7).
- Do not push down spring seat more than 6mm.



- (13) Separate spool (4), spring seat (7), spring(6) and shim (5) individually.
- * Until being assembled, they should be handled as one subassembly group.



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



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

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





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





(16) Cleaning of parts

- Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
- If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
- If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.

Therefore, control cleanliness of kerosene fully.

- ② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).
- Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

(17) Rust prevention of parts

Apply rust-preventives to all parts.

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

4) ASSEMBLY

- (1) Tighten hexagon socket head plug (2) to the specified torque.
- * Tighten two bolts alternately and slowly.

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





- (3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.
- Assemble stopper (8) so that its sharp edge side will be caught by head of spool.
 Do not push down spring seat more than 6mm.
- (4) Assemble spring (10) into casing (1).Assemble reducing valve subassembly into casing.
- * Assemble them to their original positions.





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



- (6) Assemble seal (16) to plug (14).
- * Assemble seal in such lip direction as shown below.



- (7) Assemble push rod (11) to plug (14).
- $\ast~$ Apply working oil on push-rod surface.



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



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



(10) Fit plate (17).

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



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

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



- (13) Assemble adjusting nut (21), apply spanner to width across flat of plate (20) to fix it, and tighten adjusting nut to the specified torque.
- * During tightening, do not change position of disk.



(14) Fit boot (18) to plate.



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





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



- (17) Assemble bushing (27) to plate and pass cord and tube through it.
- * Provide margin necessary to operation.



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





- (20) Assemble lower end of bellows to casing.
- (21) 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 : $12.3 \pm 1.3 \text{ kgf} \cdot \text{m}$ ($89 \pm 9.4 \text{ lbf} \cdot \text{ft}$)
- (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



Hub 1

Shim 6

- 2 Shaft
- 3 Cover
- Spacer 4
- 5 Shim

- Slipper seal 7
- O-ring 8
- 9 O-ring
- 10 O-ring

- Wear ring 11
- Retainer ring 12
- Plug 13
- Hexagon bolt 14
- 15 Spring washer

2) DISASSEMBLY

- * Before the disassembly, clean the turning joint.
- (1) Remove bolts (14), washer (15) and cover(3).



6 10

12

4 5

- (2) Remove shim (6) and O-ring (10).
- (3) Remove retainer ring (12), spacer (4) and shim (5).



- * Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.
- * Put a fitting mark on hub (1) and shaft (2).
- (5) Remove six slipper seals (7) and O-ring(9), two wear ring (11) 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), two wear ring (11) 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 (12) to shaft (2).
- (5) Fit O-ring (10) to hub (1).
- (6) Fit shim (6) to shaft (2).





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.
- A 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 : 220 kg (485 lb)



(2) Install

- ① Carry out installation in the reverse order to removal.
- A 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 : 360 kg (790 lb)



(2) Install

- Carry out installation in the reverse order to removal.
- A 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).
- 0 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.





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



- 6 Remove bolt (9) and pull out pin (8).
- O Remove boom cylinder assembly (6).
 - Weight : 300 kg (660 lb)



(2) Install

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder



- 1 Tube assembly
- 2 Rod assembly
- 3 Gland
- 4 DD2 bushing
- 5 Snap ring
- 6 Rod seal
- 7 Back up ring
- 8 Buffer ring
- 9 Dust wiper
- 10 Snap ring
- 11 O-ring

- 12 Back up ring
- 13 Cushion ring
- 14 Piston
- 15 Piston seal
- 16 Wear ring
- 17 Dust ring
- 18 O-ring
- 19 Back up ring
- 20 Lock nut
- 21 Hexagon socket set screw
- $\ 22 \ O-ring$

- 23 Hexagon socket head bol
- 24 Pin bushing
- 25 Pin bushing
- 26 Dust seal
- 27 Band assembly
- 28 Pipe assembly
- 29 Pipe assembly
- 30 O-ring
- 31 Hexagon socket head bolt





- 1 Tube assembly
- 2 Rod assembly
- 3 Gland
- 4 DD2 bushing
- 5 Snap ring
- 6 Rod seal
- 7 Back up ring
- 8 Buffer ring
- 9 Dust wiper
- 10 Snap ring
- 11 O-ring
- 12 Back up ring

- 13 Cushion ring
- 14 Piston
- 15 Piston seal
- 16 Wear ring
- 17 Dust ring
- 18 O-ring
- 19 Back up ring
- 20 Lock nut
- 21 Hexagon socket set screw
- 22 O-ring
- 23 Hexagon socket head bolt
- 24 Pin bushing

- 25 Dust seal
- 26 Check valve
- 27 Coil spring
- 28 O-ring
- 29 Plug
- 30 Band assembly
- 31 Band assembly
- 32 Pipe assembly
- 33 O-ring
- 34 Hexagon socket head bolt



Internal detail



- 1 Tube assembly
- 2 Rod assembly
- 3 Gland
- 4 DD2 bushing
- 5 Snap ring
- 6 Rod seal
- 7 Back up ring
- 8 Buffer ring
- 9 Dust wiper
- 10 Snap ring

- 11 O-ring
- 12 Back up ring
- 13 Cushion ring
- 14 Piston
- 15 Piston seal
- 16 Wear ring
- 17 Dust ring
- 18 O-ring
- 19 Back up ring
- 20 Lock nut

- 21 Hexagon socket set screw
- 22 O-ring
- 23 Hexagon socket head bolt
- 24 Pin bushing
- 25 Dust seal
- 26 Band assembly
- 27 Pipe assembly
- 28 Pipe assembly
- 29 O-ring
- 30 Hexagon socket head bolt

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools	Remark		
	6		
Allon wronch	8 B		
Allen wienen	14		
	17		
Spappar	7		
Spanner	8		
(-) Driver	Small and large sizes		
Torque wrench	Capable of tightening with the specified torques		

(2) Tightening torque

Part name		ltem	Size	Torque	
				kgf ∙ m	lbf ∙ ft
	Bucket cylinder	23	M18	32.0±3.0	232±21.7
Socket head bolt	Boom cylinder	23	M12	46.0±5.0	333±7.2
	Arm cylinder	23	M22	63.0±6.0	457±43.4
	Bucket cylinder	31	M12	9.4±1.0	68.0±7.2
Socket head bolt	Boom cylinder	30	M12	9.4±1.0	68.0±7.2
	Arm cylinder	34	M12	9.4±1.0	68.0±7.2
	Bucket cylinder	20	-	$100\!\pm\!10.0$	723±72.3
Lock nut	Boom cylinder	20	-	$100\!\pm\!10.0$	723±72.3
	Arm cylinder	20	-	$150\!\pm\!15.0$	1085±108
	Bucket cylinder	14	-	$150\!\pm\!15.0$	1085±108
Piston	Boom cylinder	14	-	150±15.0	1085±108
	Arm cylinder	14	-	200±20.0	1447±145

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 (7.1 in). 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.



(2) Remove piston and cylinder head

- ① Loosen sochet set screw (21) and remove lock nut (20).
- Since lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock nut (20).
- ② Remove piston assembly (14), back up ring (19), and O-ring (18).
- 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 (16).
- ② Remove dust ring (17) and piston seal (15).
- * Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

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



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.

 \bigcirc Fit snap ring (10) to the stop face.



- ④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.
- * Coat each packing with hydraulic oil before fitting it.
- Insert the backup ring until one side of it is inserted into groove.



- Rod seal (6) has its own fitting direction.
 Therefore, confirm it before fitting them.
- Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.


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



(2) Assemble piston assembly

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



- ② Fit piston seal (15) 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 (16) and dust ring (17) to piston (14).



(3) Install piston and cylinder head

- 1 Tix 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 : 100 ± 10.0 kgf • m (723±72.3 lbf • ft)



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

 \cdot Tightening torque :

Item		kgf ∙ m	lbf ∙ ft
Bucket	20	100±10	723.3±72.3
Boom	21	$5.4 {\pm} 0.5$	391 ± 3.6
Arm	21	150 ± 15	$1085\!\pm\!108$
	22	5.4±0.5	39.1±3.6



(3) Overall assemble

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

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



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



2) INSTALL

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



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.
 - \cdot Weight : 48 kg (88 lb)



2) INSTALL

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

3. TRACK ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



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



(3) Remove the mounting bolt (1) and draw out the track roller (2).Weight : 54 kg (119lb)



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.
 - \cdot Weight : 457 kg (1010 lb)







2) INSTALL

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



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



- 1 Shell
- 2 Bushing
- 3 Shaft

- 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.



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



- ⑥ Remove the bushing (2) from idler, using a special tool.
- * Only remove bushing if replacement is necessity.



(3) Assembly

- * Before assembly, clean the parts.
- * Coat the sliding surfaces of all parts with oil.
- Cool up bushing (2) fully by some dry ice and press it into shell (1).

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

- ② Coat O-ring (4) with grease thinly, and install it to shaft (3).
- ③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).





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



5 Install shaft (3) to shell (1).



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



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



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



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



- 1 Body
- 2 Tie bar
- 3 Spring
- 4 Bracket
- 5 Lock nut

- 6 Lock plate
- 7 Bolt
- 8 Spring washer
- 9 Rod seal
- 10 Back up ring
- 11 Dust seal
- 12 Rod assembly
- 13 Grease valve
- 14 Stopper tube
- 15 Spring pin

(2) Disassembly

- ① Apply pressure on spring (3) with a press.
- * The spring is under a large installed load. This is dangerous, so be sure to set properly.

·Spring set load : 19012 kg (41826 lb)

- ② Remove bolt (7), spring washer (8) and lock plate (6).
- ③ Remove lock nut (5).

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

④ Lighten the press load slowly and remove bracket (4) and spring (3).



- 5 Remove rod (12) from body (1).
- 6 Remove grease value (13) from rod (12).



⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



(3) Assembly

- Install dust seal (11), back up ring (10) and rod seal (9) to body (1).
- When installing dust seal (11) and rod seal (9), take full care so as not to damage the lip.



② Pour grease into body (1), then push in rod (12) 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 (13) to rod (12).
 Tightening torque : 13.0±1.0 kgf ⋅ m (94±7.2 lbf ⋅ ft)
- ④ Install spring (3) and bracket (4) to body (1).
- ⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).
- * 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 (3).
- ⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).



GROUP 11 WORK EQUIPMENT

1. STRUCTURE



2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

(1) Removal

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



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



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



(2) Install

- Carry out installation in the reverse order to removal.
- A 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.
- A Escaping fluid under pressure can penetrated the skin causing serious injury.
- 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 : 1160 kg (2560 lb)
- When lifting the arm assembly, always lift the center of gravity.







(2) Install

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

3) BOOM CYLINDER

(1) Removal

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

For details, see **removal of arm cylinder** assembly.

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





- (6) Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
 Weight : 2540 kg (5600 lb)
- When lifting the boom assembly always lift the center of gravity.



(2) Install

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

