SECTION 7 DISASSEMBLY AND ASSEMBLY

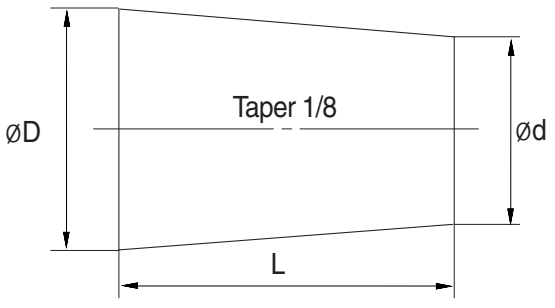
SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.

※ 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		Bolt size	Torque	
				kgf·m	lbf·ft
1	Engine	Engine mounting bolt (engine-Bracket)	M10 × 1.5	6.9±1.0	50±7.2
2		Engine mounting bolt (bracket-Frame)	M16 × 2.0	25±2.5	181±18.1
3		Radiator mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
4		Cooling fan mounting bolt	M 8 × 1.25	1.8±0.2	13±1.4
5		Coupling mounting bolt	M10 × 1.5	6.0±1.0	43.4±7.2
6	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12.3±3.0	92±22.0
7		Main control valve mounting bolt	M 8 × 1.25	2.5±0.5	18±3.6
8		Travel motor mounting bolt	M12 × 1.75	14.7±2.2	106±15.9
9		Fuel tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
10		Hydraulic oil tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
11		Turning joint mounting bolt, nut	M12 × 1.75	14.7±2.2	106±16.0
12	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
13		Swing bearing upper mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
15		Swing bearing lower mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
16		Front axle mounting bolt, nut	M16 × 2.0	29.7±4.5	215±33.0
17		Rear axle mounting bolt, nut	M16 × 2.0	29.7±4.5	215±33.0
18		Gear box mounting bolt	M14 × 2.0	19.6±2.9	142±21.0
19		Oscillating cylinder mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
20		Oscillating cylinder support bolt	M12 × 1.75	12.8±3.0	92.6±22.0
21		Wheel nut	M18 × 1.5	46.0±3.0	333±22.0
22		Front drive shaft mounting bolt, nut	M10 × 1.25	7.4±1.5	53.5±11.0
23		Rear drive shaft mounting bolt, nut	M10 × 1.25	7.4±1.5	53.5±11.0
24	Others	Counterweight mounting bolt	M20 × 2.5	57.8±6.4	418±46.3
25		Cab mounting bolt, nut	M12 × 1.75	12.8±3.0	92±22.0
26		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.1	8.5±0.7

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

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

(2) Fine thread

Bolt size	8T		10T	
	kg·m	lb·ft	kg·m	lb·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 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, 3).

(5) Disconnect pilot line hoses (4, 5, 6, 7, 8).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (9).
·Motor device weight : 23 kg (51 lb)

(7) Remove the swing motor assembly.

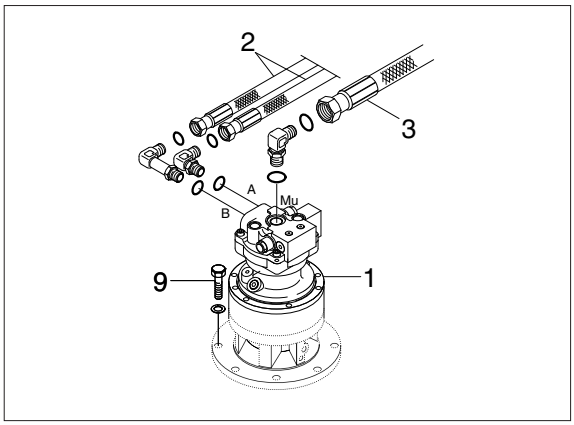
※ When removing the swing motor assembly, check that all the piping have been disconnected.

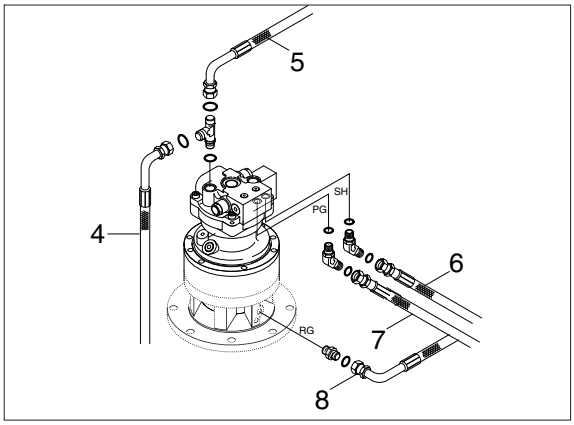
2) INSTALL

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

(2) Bleed the air from the swing motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling and check oil come out from plug.
⑤ Tighten plug fully.

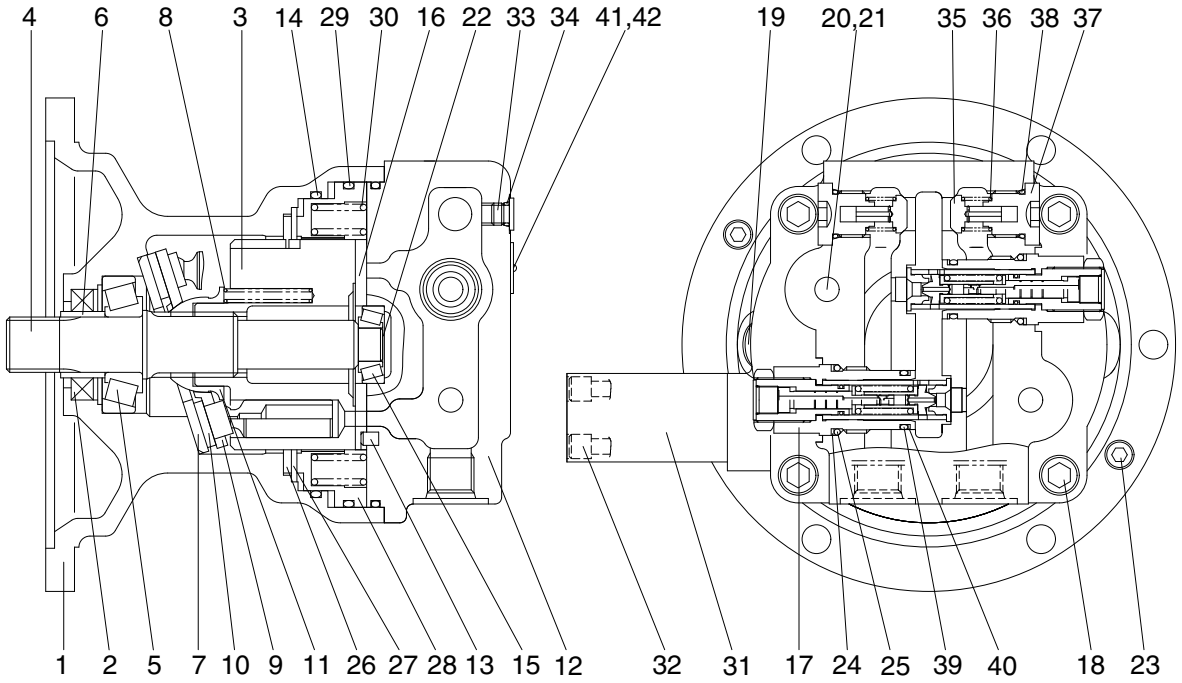
(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.





2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE

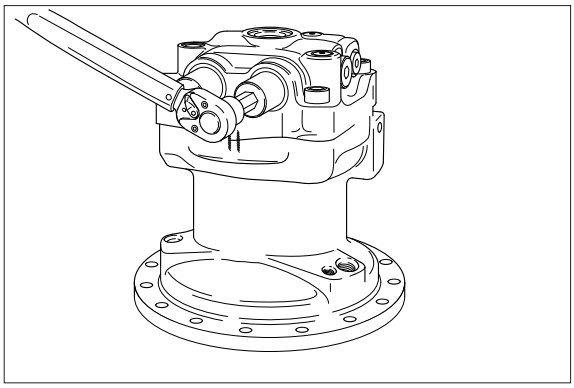


1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assy	31	Time delay valve
4	Shaft	18	Socket bolt	32	Socket bolt
5	Taper bearing	19	Plug	33	Plug
6	Bushing	20	Plug	34	O-ring
7	Shoe plate	21	O-ring	35	Valve
8	Spring	22	Shim	36	Spring
9	Set plate	23	Plug	37	Plug
10	Piston shoe assy	24	Back up ring	38	O-ring
11	Ball guide	25	O-ring	39	O-ring
12	Rear cover	26	Friction plate	40	Back up ring
13	Pin	27	Plate	41	Name plate
14	O-ring	28	Parking piston	42	Rivet

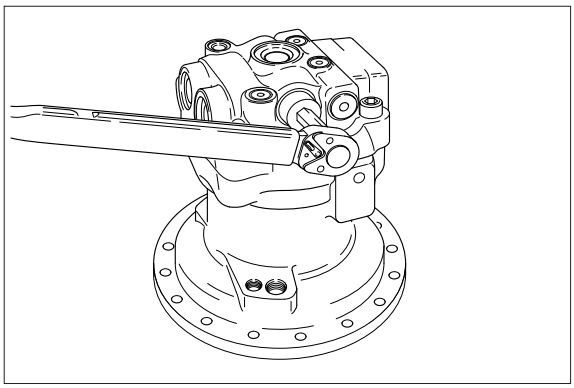
2) DISASSEMBLY

(1) Removal of relief valve assembly
Remove cap of relief valve assembly (17) with 14 ㎜ hexagonal wrench.

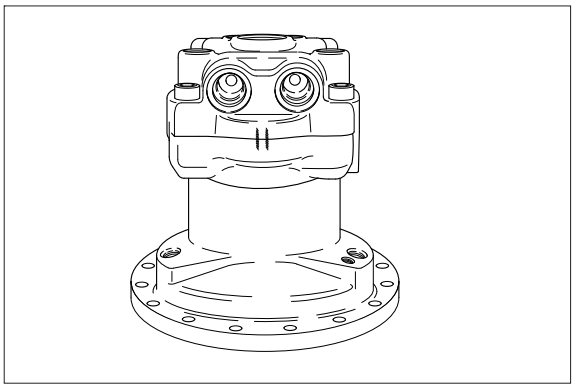
※ Assemble removed relief valve assembly (17) to original state when reassembling.



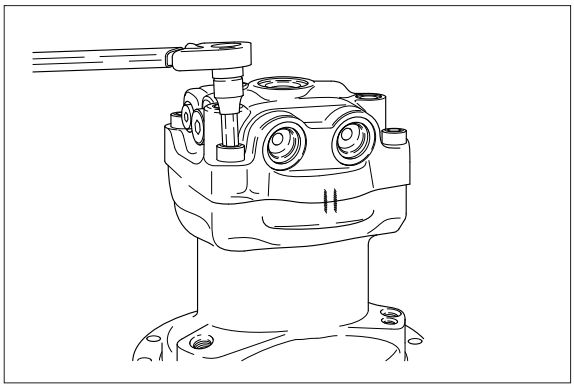
(2) Removal of make up valve and bypass valve assembly
Loosen plug (37) with 14㎜ hexagonal wrench, and remove check valve (35) and spring (36).



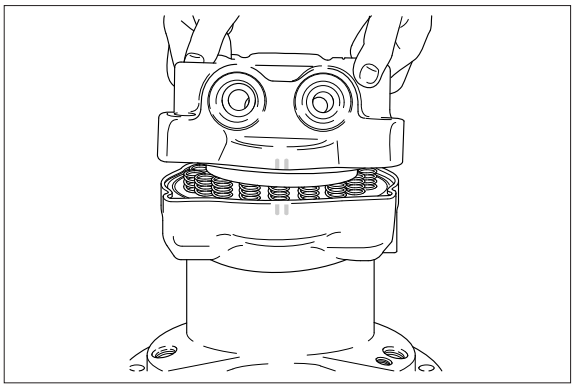
(3) Marking at swing motor
Before disassembling motor, make a matching mark between cover (12) and housing (1) for easy reassembling.



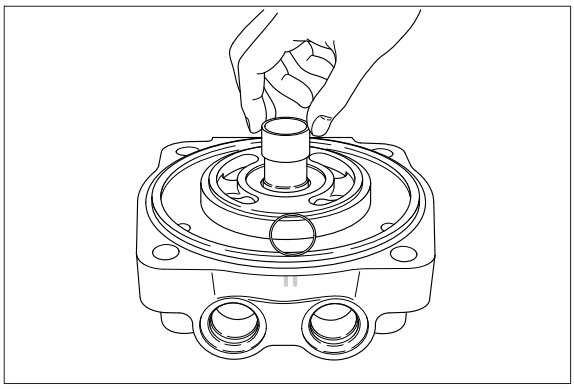
(4) Remove mounting bolts of cover
Loosen hexagon socket bolt (18) with 12 ㎜ hexagonal wrench.



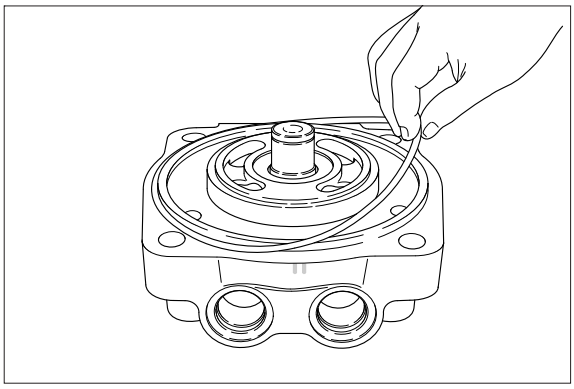
(5) Removal of cover assembly
Place shaft of motor assembly to downward and take cover (12) out.



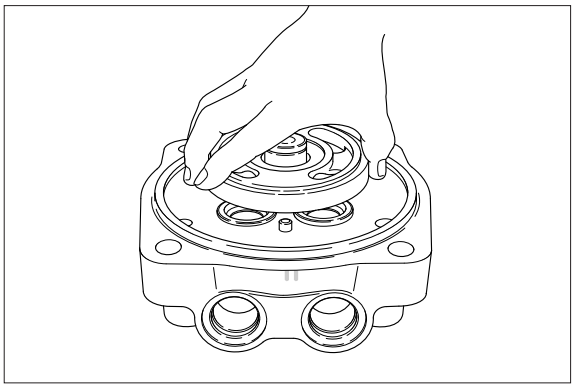
(6) Remove shim (22) remove inner race of needle bearing (15) by bearing puller.



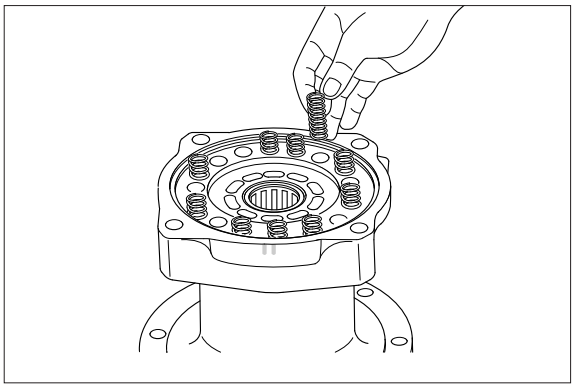
(7) Remove O-ring (29) from cover.



(8) Remove balance plate
Valve plate (16) is adhered on end surface of cylinder (3) by oil viscosity. Take off balance plate (16) with hands.
Assembling method of balance plate (16) depends on cover (12).
(band groove and round groove of high· low pressure transmission area)
Before removing, check and record location of balance plate (16) to prevent misassembling.

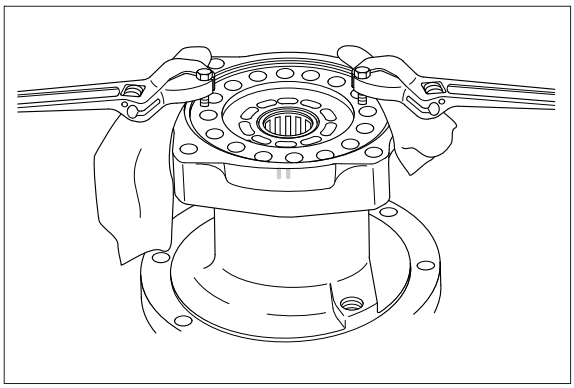


(9) Removal of spring (30, brake area)
Remove spring (30) from piston (28).
Check and record original position of each spring (30) for correct assembling.

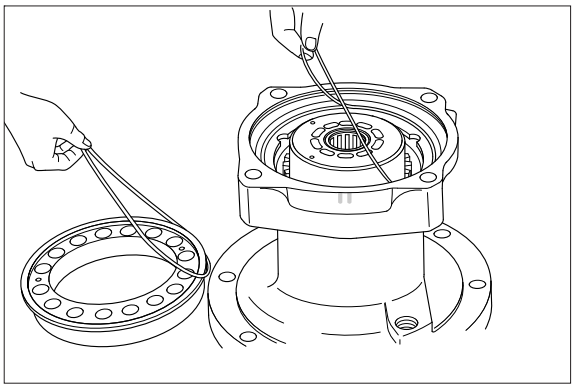


(10) Removal of brake piston

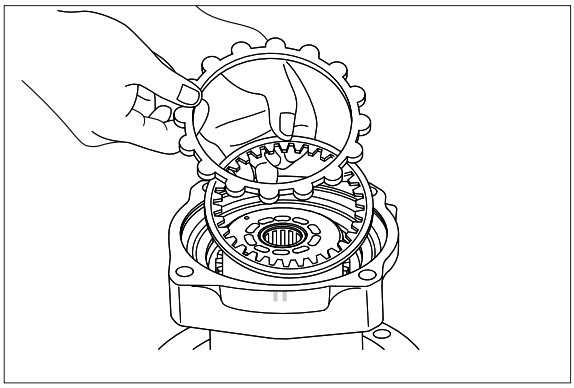
When removing piston (28) from housing (1), there is a sliding resistance against tightening of O-rings (14,29). Use tap hole on piston (28) as shown in the picture.



(11) Remove O-rings (14,29) from piston (28) and housing (1).



(12) Remove friction plate (26) and lining plate (27) from housing (1).



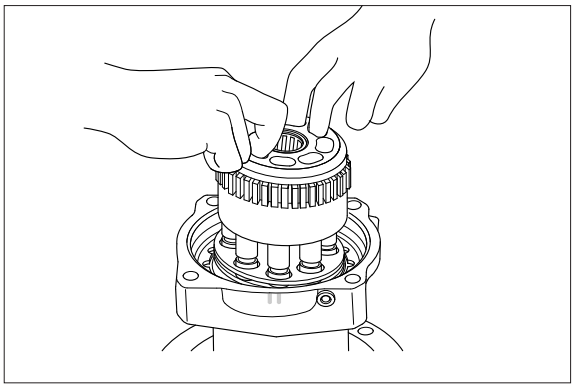
(13) Removal of cylinder assembly

Holding end of cylinder assembly (3) with hand, draw out cylinder assembly from housing.

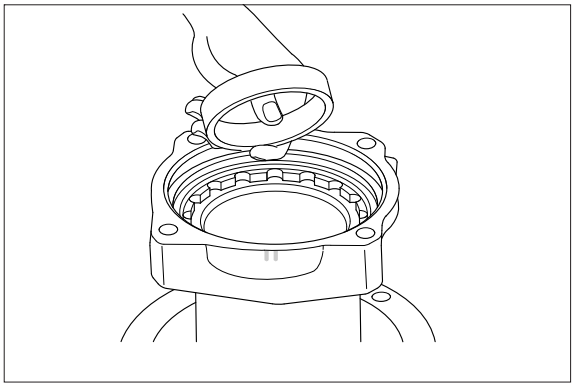
※ Oil seal (2) and outer race of taper roller bearing (15) are left inside of housing.

※ End surface of cylinder (3) is sliding face. So, protect the surface with a scrap of cloth against damage.

※ Make a matching mark on piston hole of cylinder (3) and piston assembly (10) to fit piston into the same hole when reassembling.



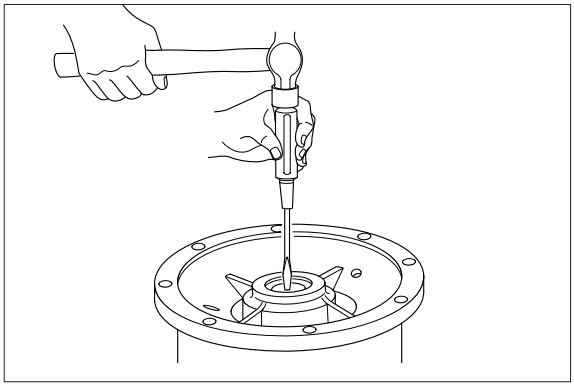
(14) Separate outer race of taper roller bearing (5) from housing.



(15) Removal of oil seal

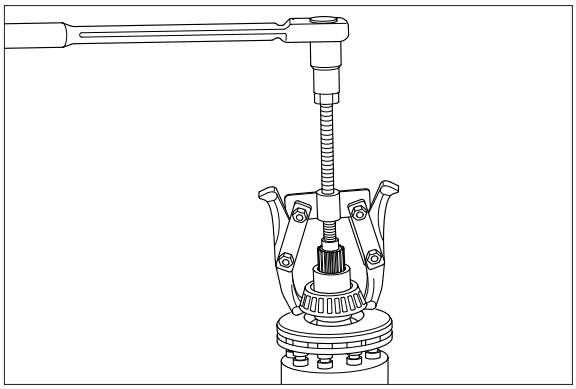
Remove oil seal (2) from housing (1) with driver and hammer.

※ Do not reuse oil seal after removal.

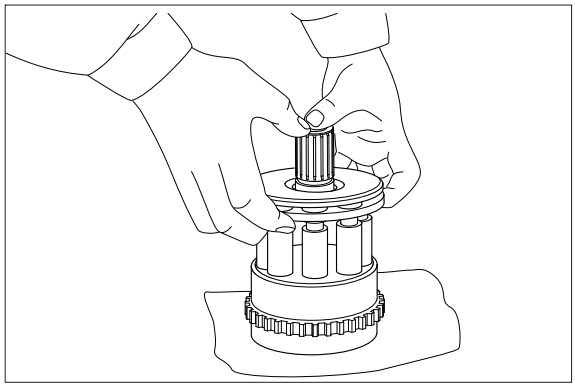


(16) Disassembly of cylinder assembly

① Removal of inner race of taper roller bearing (5).
Lift out cylinder block (3) with 2 inner race of roller bearing (5) by applying gear puller at the end of spline in the cylinder.

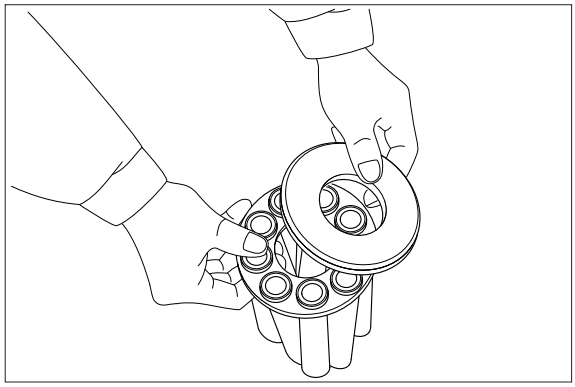


② Separate shoe plate (7), piston assembly (10), set plate (9) from cylinder block (3).

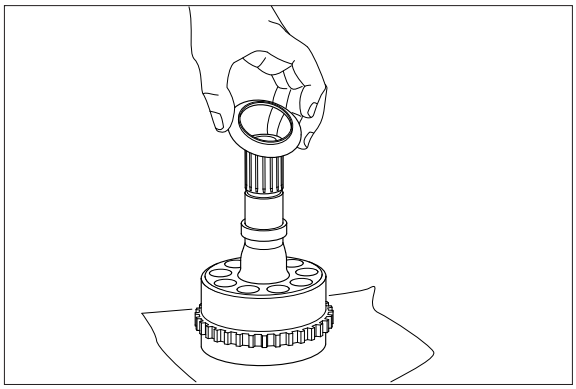


③ Get shoe plate (7) slide on sliding face of piston assembly (10) and remove it.

※ Be cautious not to damage on sliding face of cam plate.



④ Remove ball guide (11) from cylinder block (3).



This completes disassembly.

3) ASSEMBLY

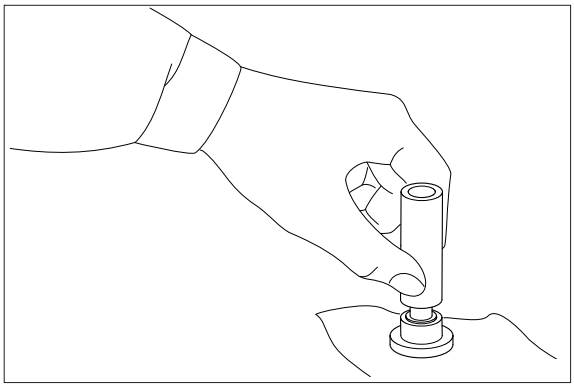
(1) Preparation

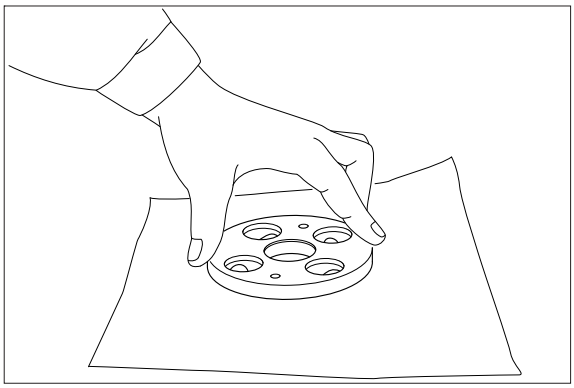
Before reassembling, perform below procedure.

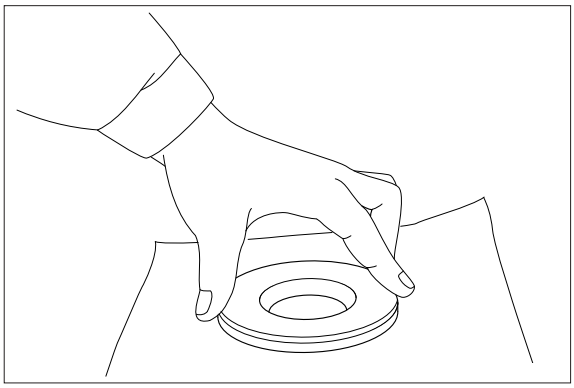
① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

② Replace seal with new one.

③ Grind sliding face of piston assembly (10), balance plate (16) and shoe plate (7) with sandpaper #2000.





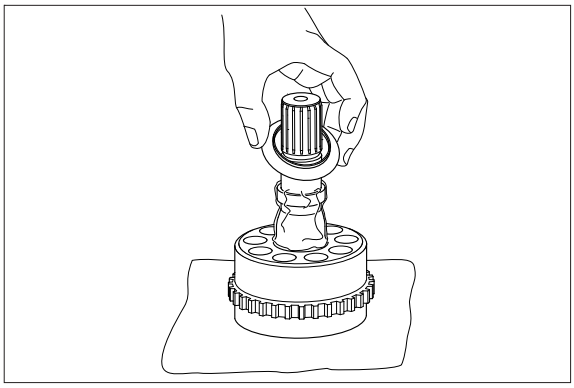


④ When assembling, lubricate with specified clean hydraulic oil.

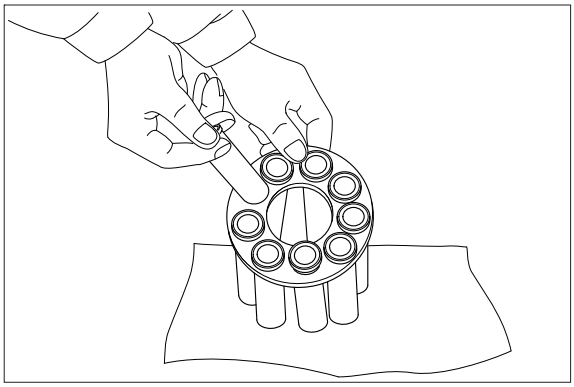
⑤ When assembling piston assembly (10) to piston hole of cylinder block (3), check matching mark between them.

(2) Cylinder assembly

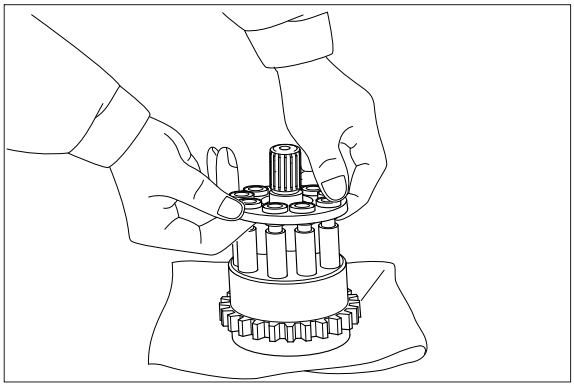
① Lubricate grease on round area (contacting area withball guide (11)) of cylinder block (3) and assemble spring (4).



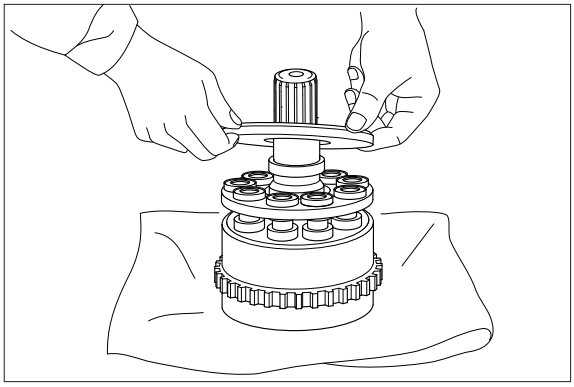
② Insert piston assembly (10) in hole of set plate (9).



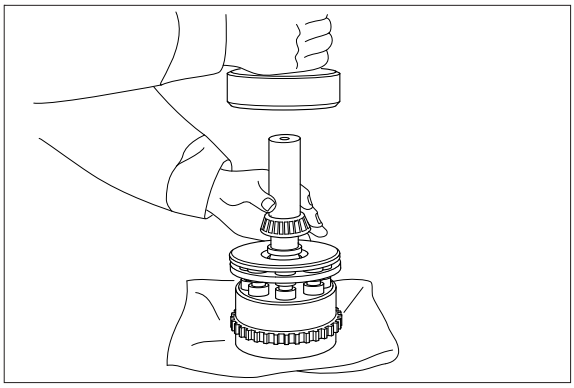
③ Assemble piston assembly (10) and set plate (9) to cylinder block (3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block (3).



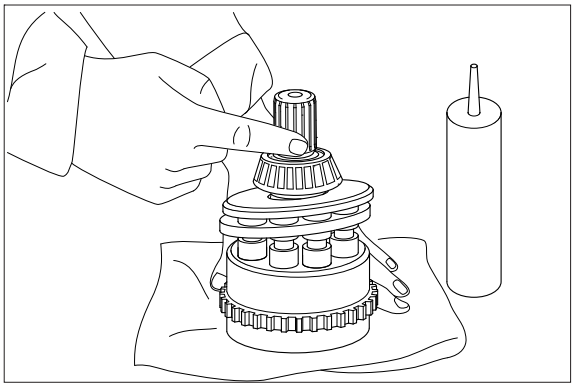
④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly (10) and assemble shoe plate (7).



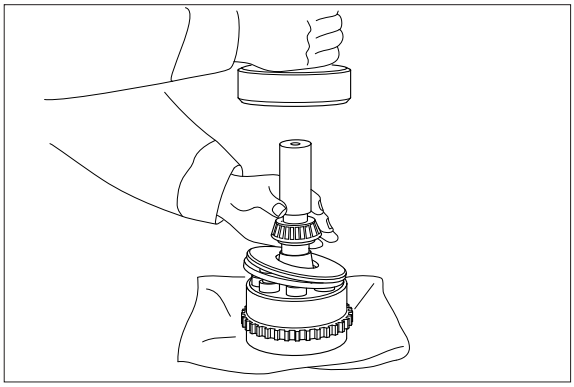
⑤ Assemble inner race of taper roller bearing (5) to cylinder block (3).



⑥ Apply loctite to bearing mounting area of inner race of cylinder block (3) lightly.



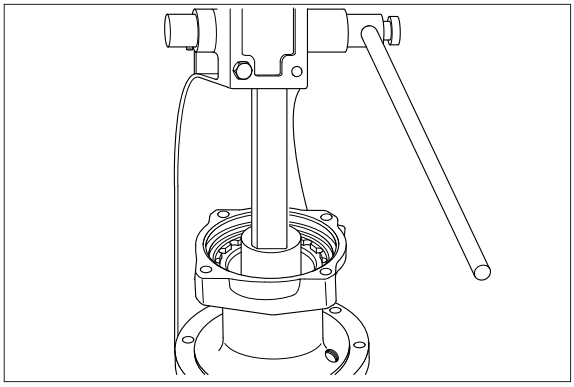
⑦ Assemble bushing (6) to cylinder block (3).



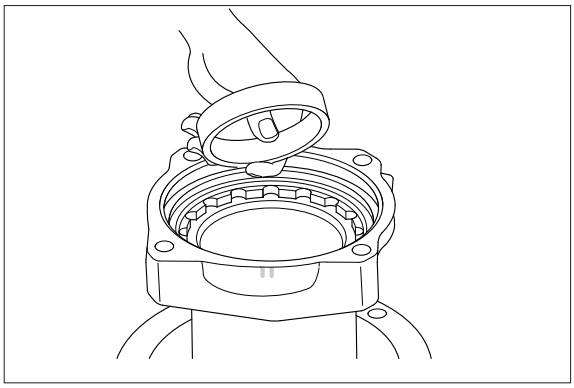
(3) Oil seal

Apply three bond of white color on outer surface of oil seal (2) and assemble and insert it.

※ Before assembling, lubricate lip of oil seal with grease.



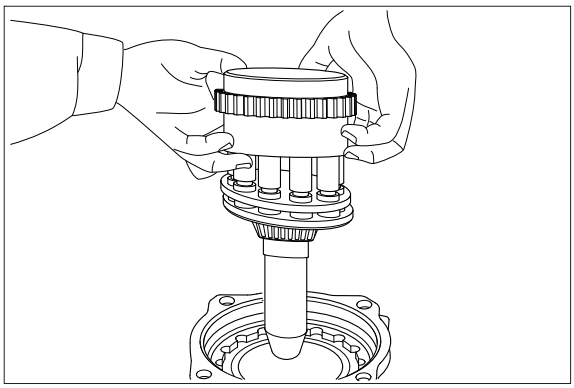
(4) Assemble outer race of taper roller bearing (5) to motor housing (1).



(5) Cylinder assembly

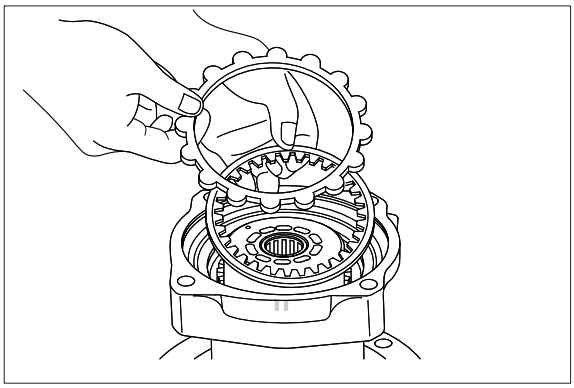
Hold end of cylinder assembly (3) with hands and assemble cylinder assembly to housing (1). Be careful to prevent damage of seal by spline of shaft.

※ When assemble cylinder assembly, spline shaft of cylinder is protruded from end of housing, therefore put pads with length 30~50 ㎜ under bottom of housing.



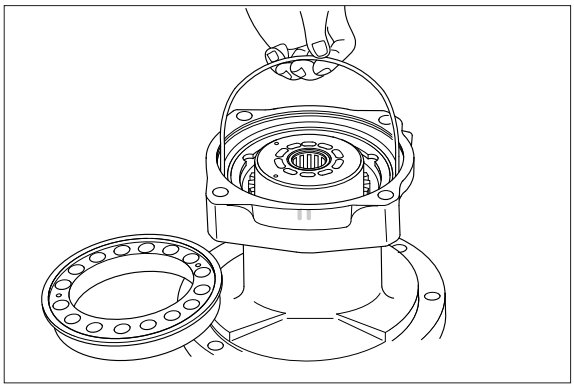
(6) Assemble friction plate (26) and lining plate (27).

※ Lubricate specified hydraulic oil on each side.



(7) Insert O-rings (14,29) into housing (1) and piston (28).

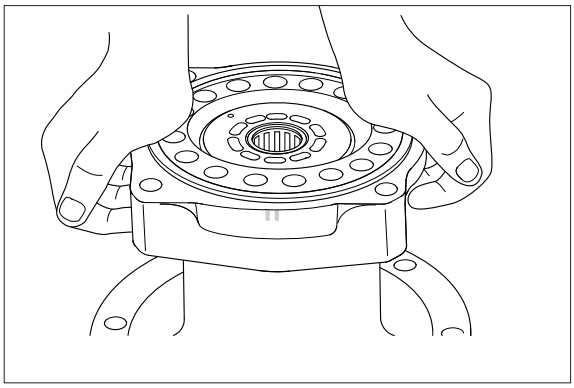
※ Lubricate O-ring with grease.



(8) Brake piston

Lubricate specified hydraulic oil on outer sliding face of piston (28) and assemble brake piston to housing (1).

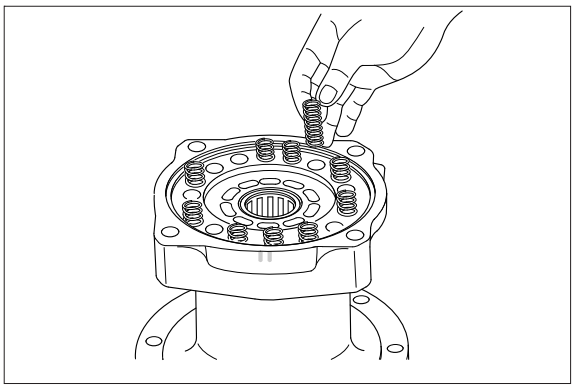
※ It is too tight to assemble piston (10) because O-rings (14,29) are fitted, therefore it is recommended to push piston (28) horizontally by hands at once.



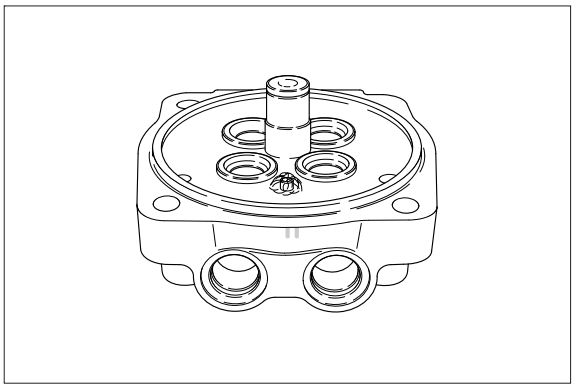
(9) Spring (30, brake unit)

Assemble spring (30) to piston (28) of brake unit.

※ Insert spring (30) into original position.



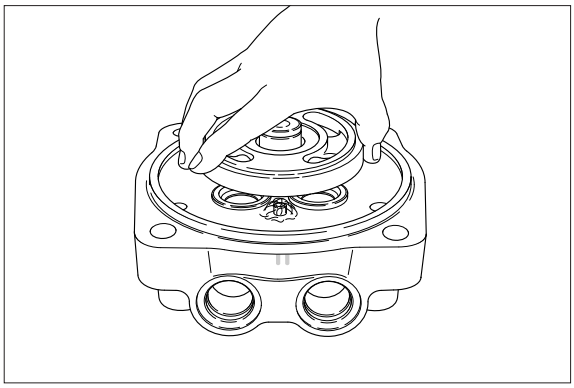
(10) Lubricate locating pin for antirotation of valve plate (16) of cover (12) with grease sufficiently and install locating pin to housing.



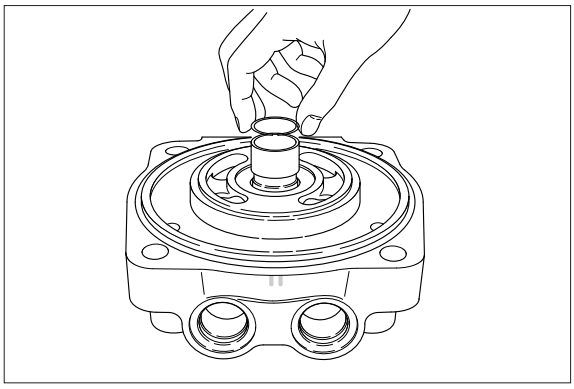
(11) Balance plate

Assemble valve plate (16) to cover (12).

※ Be cautious of assembling direction.

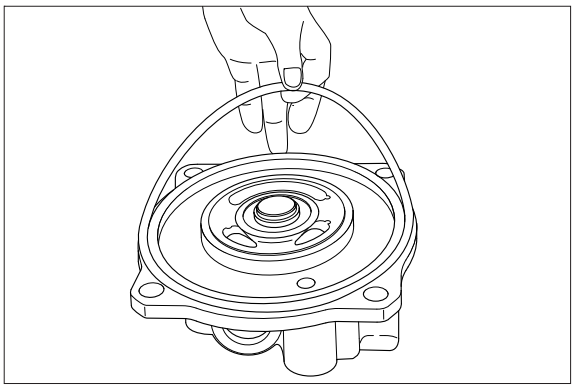


(12) Assemble inner race of needle bearing (15) and shim (22) to cover (12).

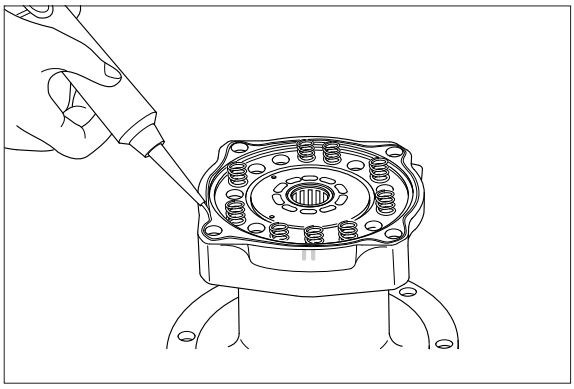


(13) Assemble O-ring (29) to cover (12).

※ Lubricate O-ring with grease.



(14) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole of cover (12).

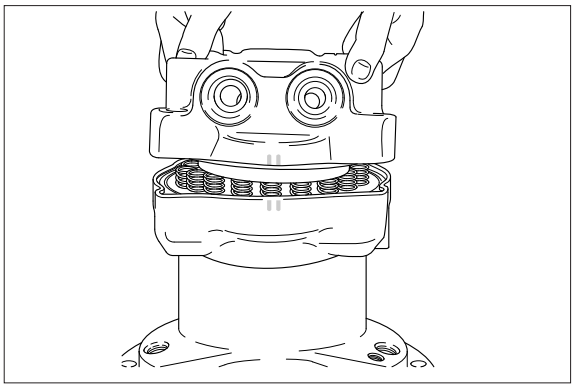


(15) Cover

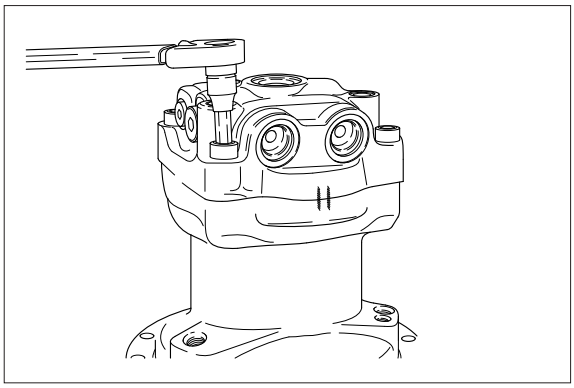
Assemble cover (12) and valve plate (16) to housing (1) lightly, holding them up with hands.

※ When assembling, be careful not to detach valve plate (16) from cover (12).

※ Fit matching marks on housing (1) and cover (12) made before disassembling.

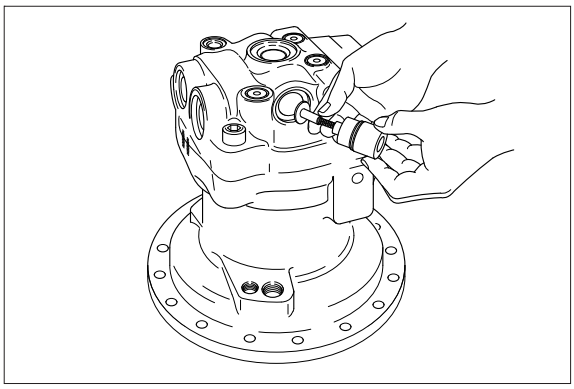


(16) Tighten cover (12) and housing (1) with 12 mm hexagonal socket bolt (18).
·Tightening torque : 16 kgf·m (116 lbf·ft)



(17) Make up valve

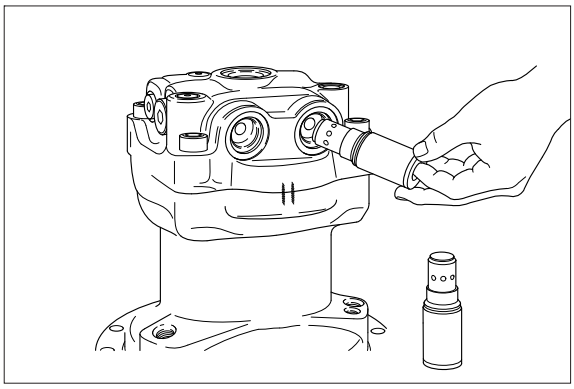
Assemble check (35) and spring (36) to cover (12) and tighten plug (37) with 14 mm hexagonal socket bolt.
·Tightening torque : 14 kgf·m (101 lbf·ft)



(18) Relief assembly

Assemble relief valve assembly (17) to cover (12) with 14 mm hexagonal socket bolt.
·Tightening torque : 8 kgf·m (58 lbf·ft)

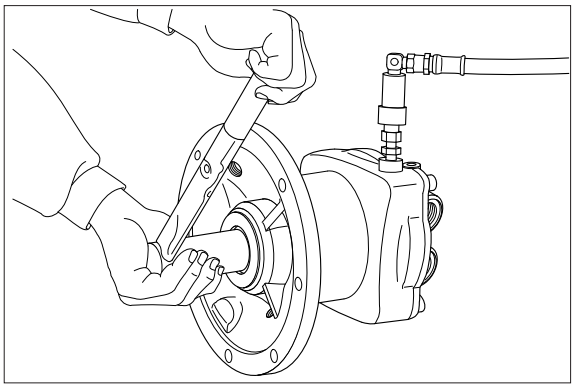
※ Be cautious of assembling method.



(19) Check of assembly

Load pilot pressure of 20 kgf/cm^2 to brake release port after opening inlet and outlet port.
Check if output shaft is rotated smoothly around torque of 0.5~1 kgf·m.
If not rotated, disassemble and check.

This completes assembly.



3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

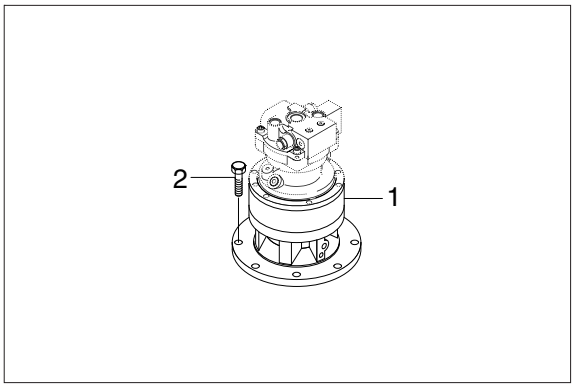
(1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.

(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
·Reduction gear device weight : 45 kg
(99 lb)

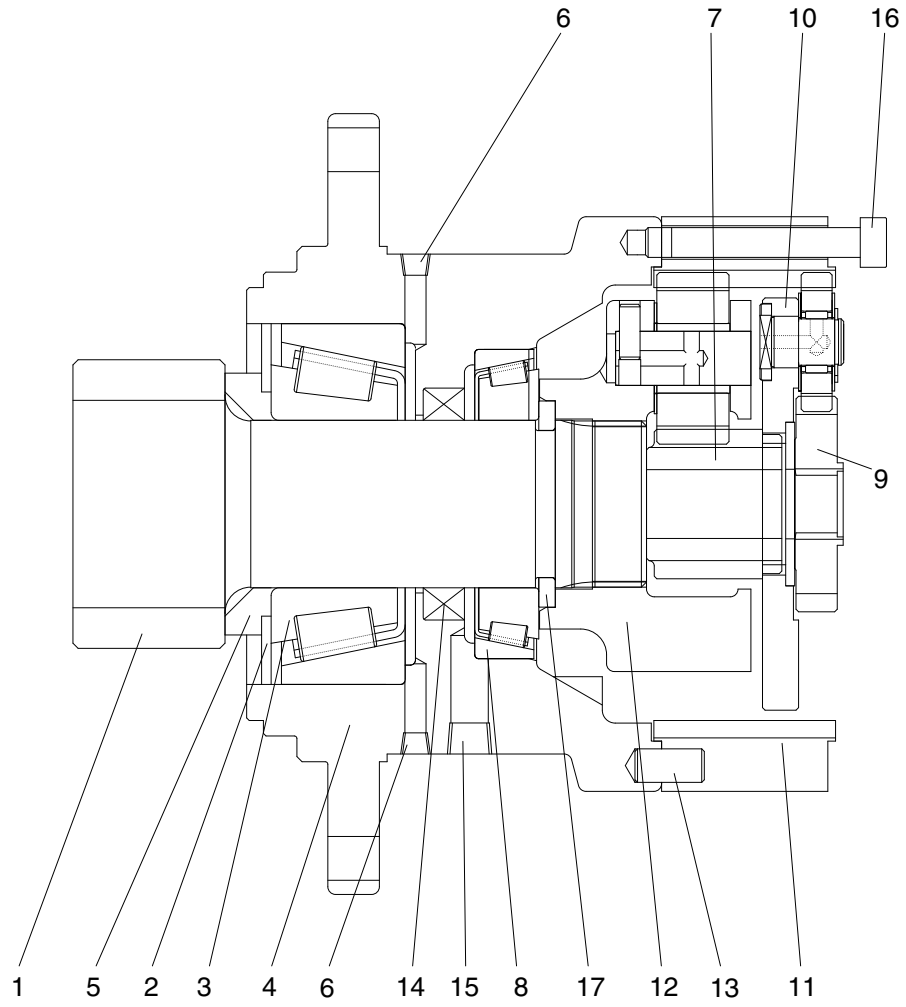
2) INSTALL

(1) Carry out installation in the reverse order to removal.
·Tightening torque : 10.5 kgf·m
(76 lbf·ft)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

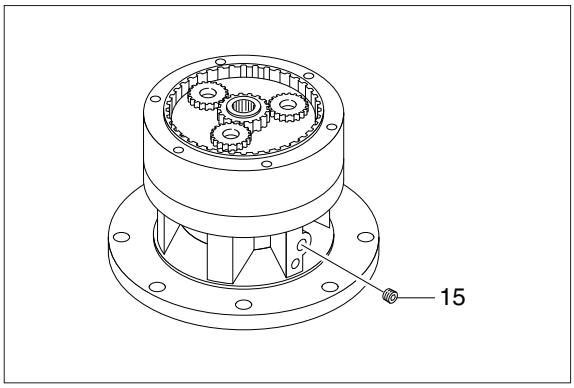
1) STRUCTURE



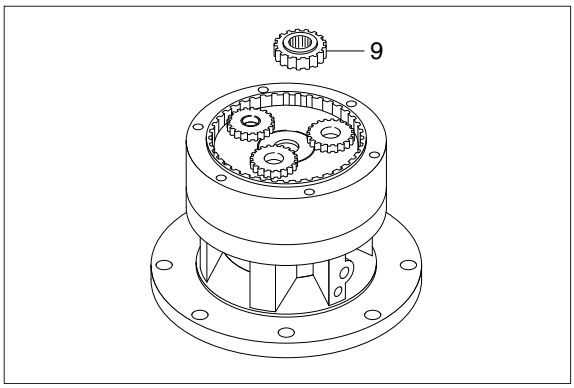
1	Pinion shaft	7	Sun gear No.2	13	Pin
2	Plate	8	Taper bearing	14	Oil seal
3	Taper bearing	9	Sun gear No.1	15	Plug
4	Case	10	Carrier assy No.1	16	Socket bolt
5	Collar No.1	11	Ring gear	17	Collar No.2
6	Plug	12	Carrier assy No.2		

2) DISASSEMBLY

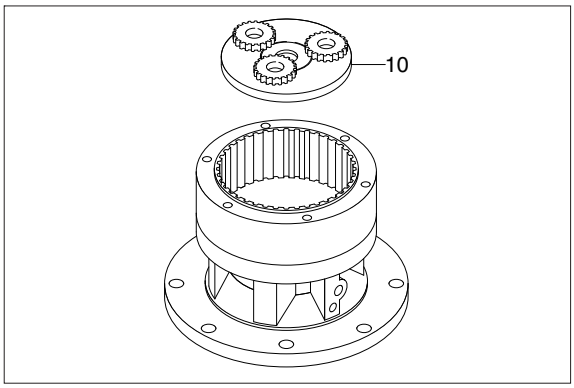
(1) Remove the plug (15) and drain out gear oil.



(2) Remove the No.1 sun gear (9).

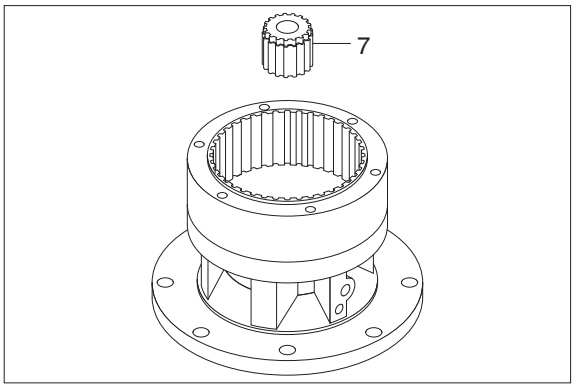


(3) Remove the No.1 carrier sub-assembly (10) using the jig.

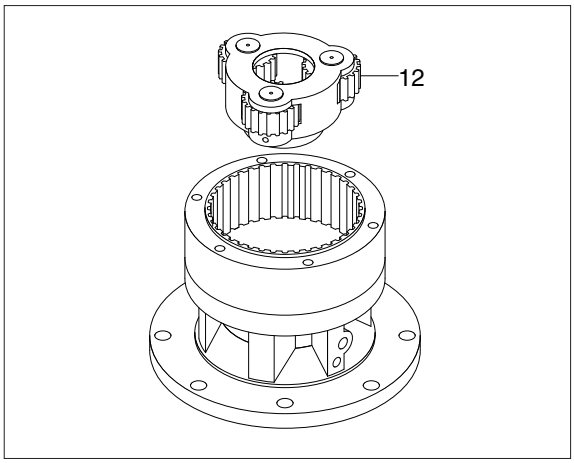


(4) Remove the No.2 sun gear (7).

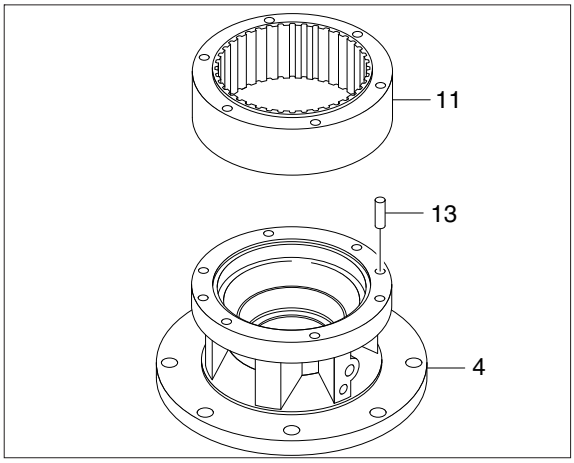
※ Pay attention to ensure the gear is not damaged during disassembling.



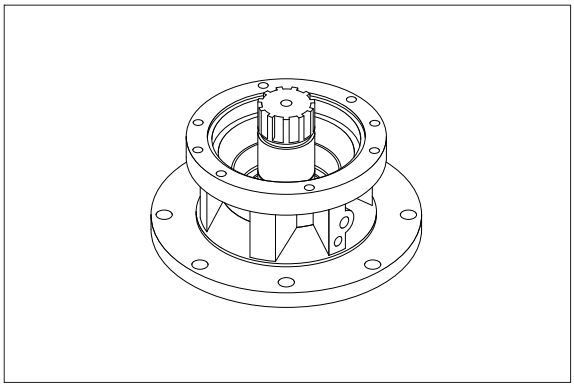
(5) Remove the No.2 carrier sub assembly (12).



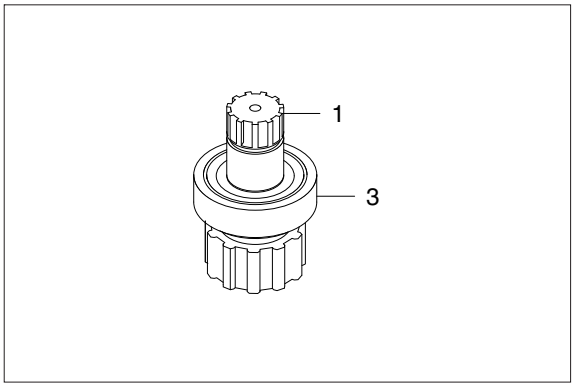
(6) Remove the ring gear by the removal groove between the ring gear (11) and casing (4) by using jig.
Full out the knock pin (13).
Do not need to remove the knock pin (13) if it is not worn or damaged.



(7) Put it on the working table with the drive shaft up.

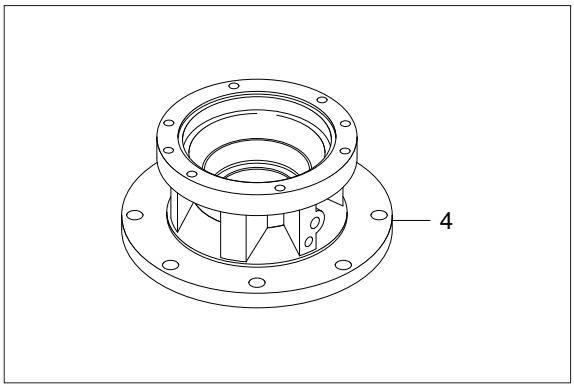


(8) Disassemble the drive shaft (1) with bearing (3) by using jig.



3) ASSEMBLING SWING REDUCTION GEAR

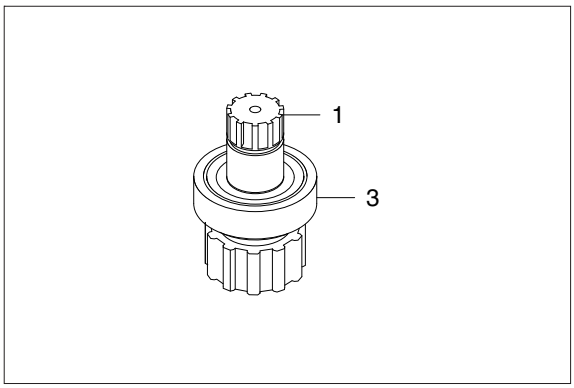
(1) Place the case (4) on the reversing machine having the flange side of the case up.



(2) Install shaft assembly (1) into case (4).

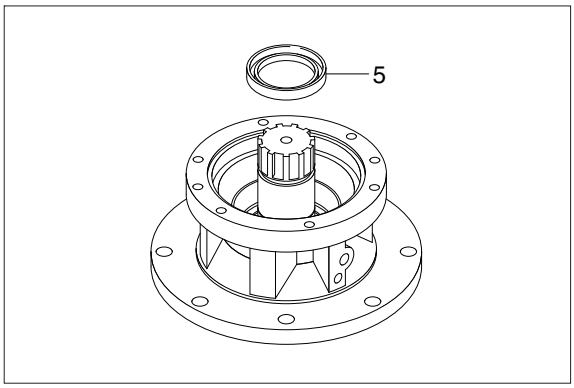
※ Be sure to clean the case before install, using washing machine with the temperature of 80˚C

※ Do not install shaft assembly by force.

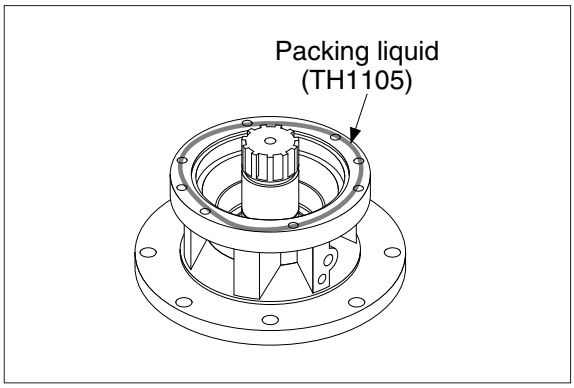


(3) Reverse case and press to insert oil seal (5) by using pressing jig after spreading grease oil around the outside ring of the seal and bearing.
Coat grease oil slightly on the lip surface to prevent any scratch when installing.

※ Be sure to check by eye that the oil seal is seated completely after being installed.



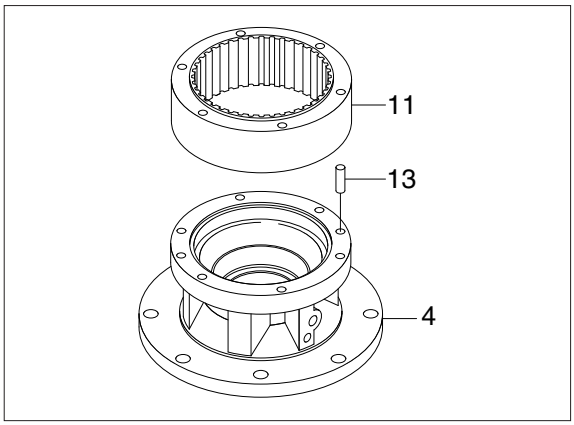
(4) Clean the assembling surface of case and spread packing liquid (TH1105) as shown in figure.



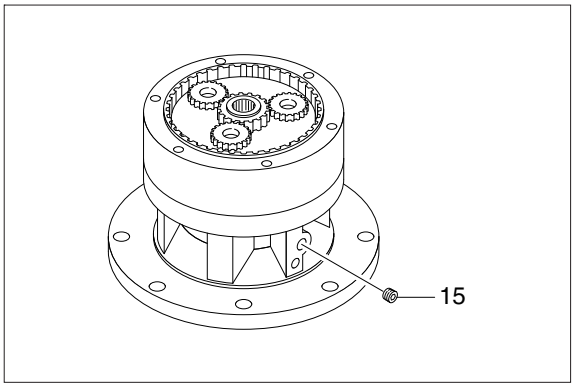
(5) Place ring gear on the case by matching it with knock pin hole.

(6) Insert 2 knock pins by using jig.

※ Be sure to check the hole location of oil gage before inserting.

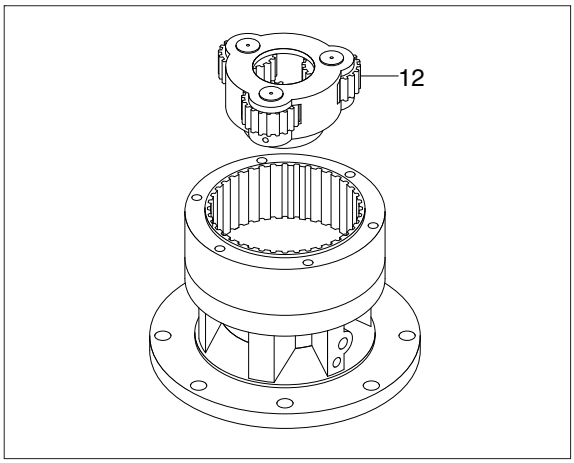


(7) Screw drain plug into drain plug (15) after winding sealing tape.



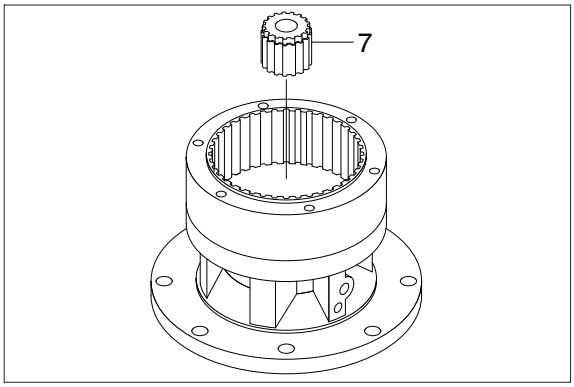
(8) Mount No.2 carrier assembly (12) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



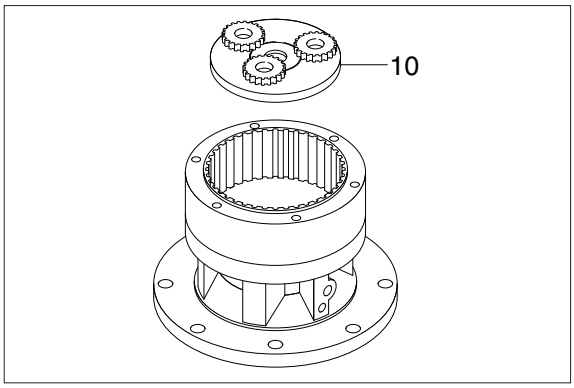
(9) Install No.2 sun gear (7).

※ Be sure to check the direction of sun gear (7) when assembling.

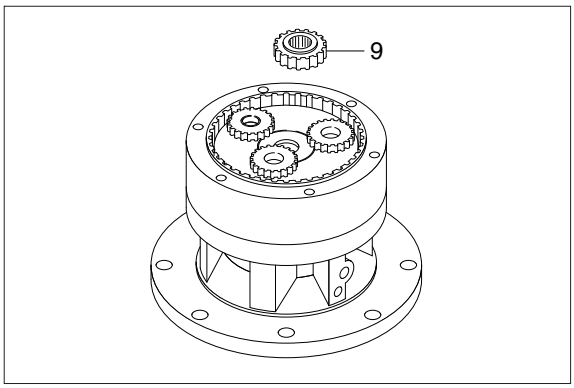


(10) Mount No.1 carrier assembly (10) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



(11) Assemble No.1 sun gear (9).



GROUP 4 TRAVEL MOTOR

1. REMOVAL AND INSTALL

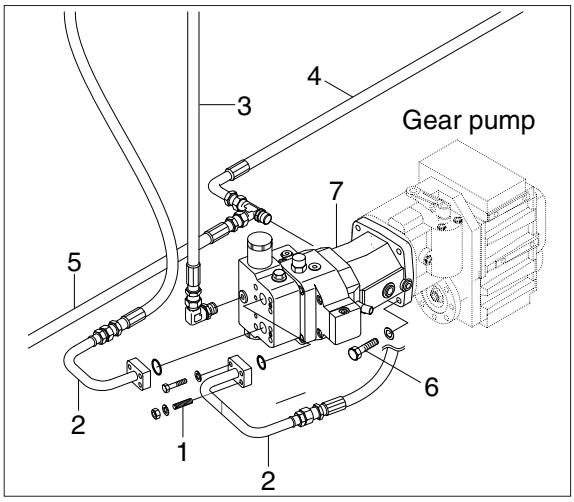
1) REMOVAL

(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 stud (1) and remove the pipe assy (2).

(5) Disconnect hoses (3,4,5).

(6) Loosen the hex bolt (6) and remove travel motor (7).
·Weight : 80 kg (180 lb)

※ When removing the travel motor assembly, check that all the hoses have been disconnected.

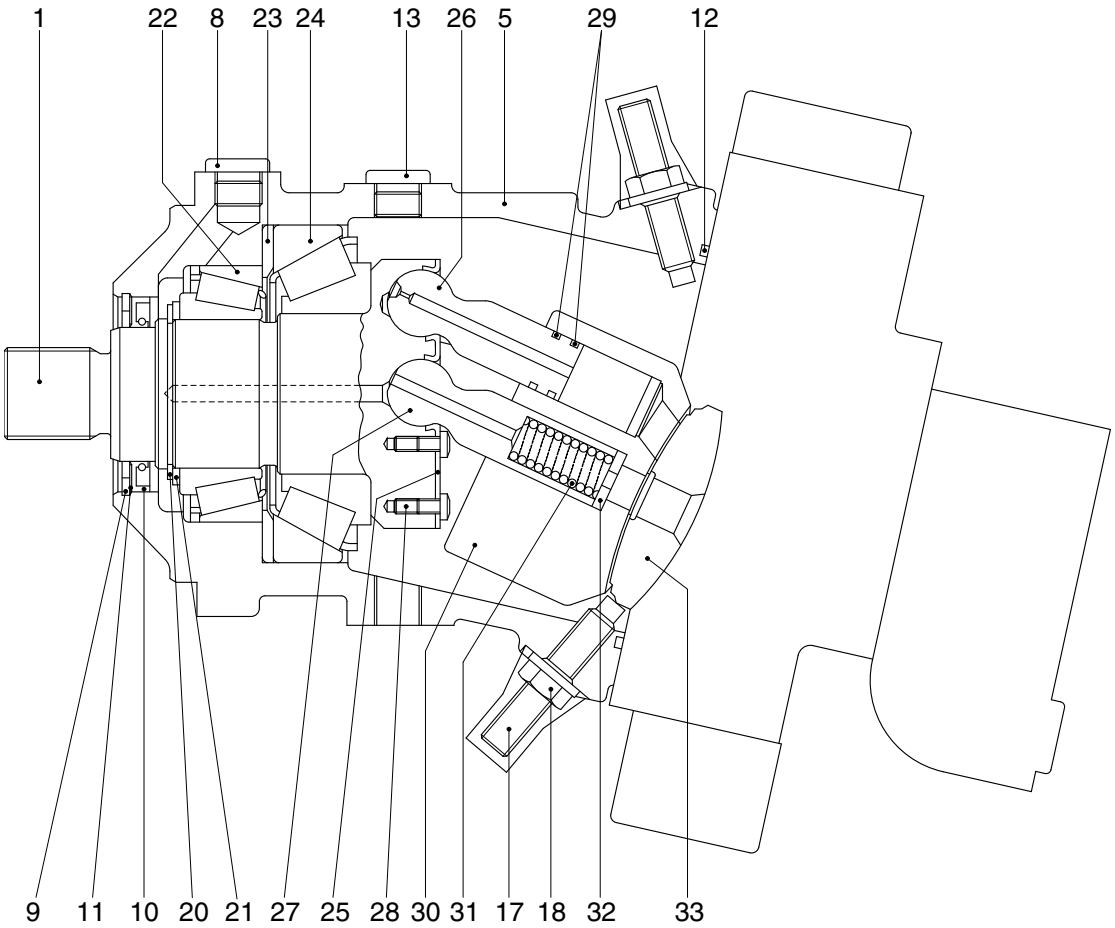
2) INSTALL

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

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

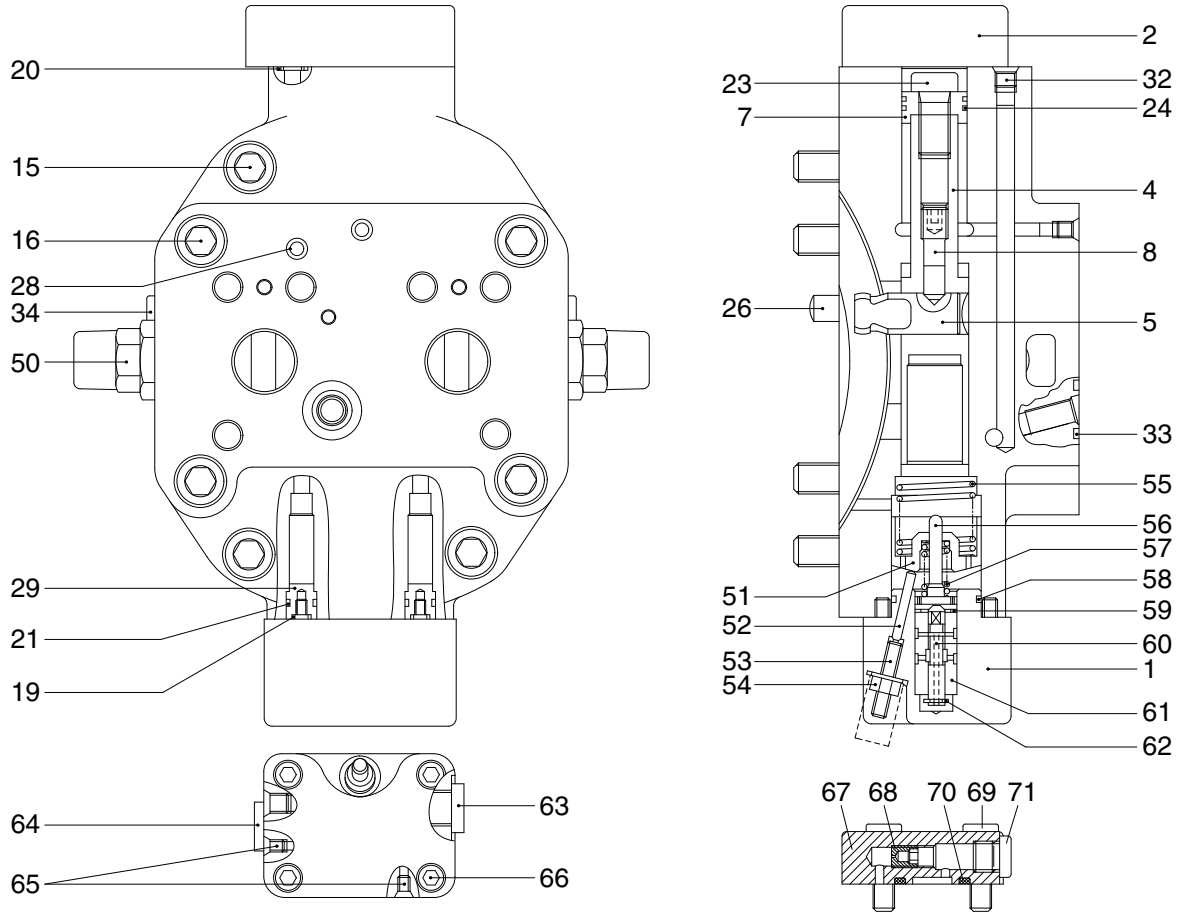
2. STRUCTURE

1) MOTOR UNIT



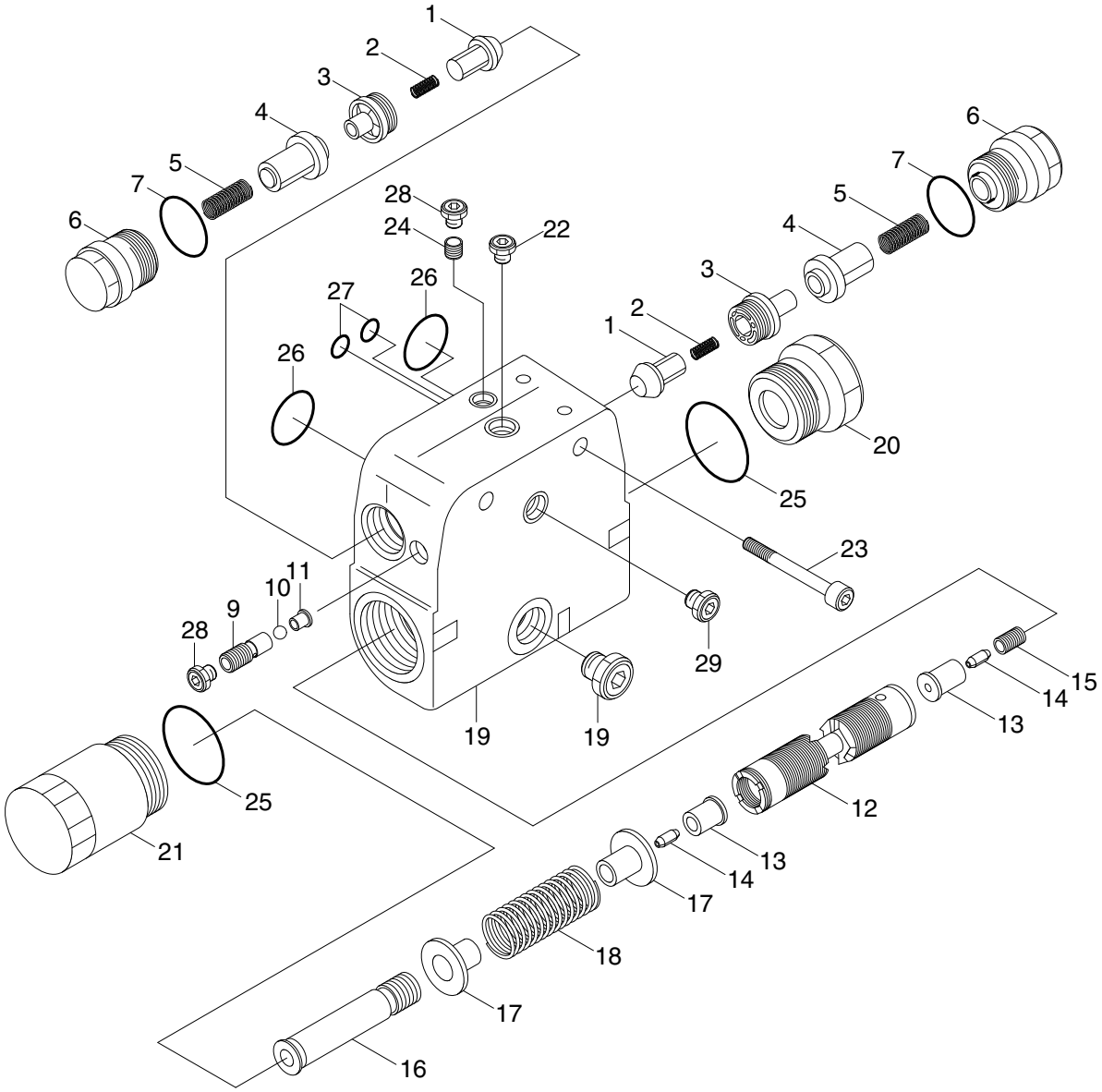
1	Drive shaft	17	Threaded pin	26	Piston
5	Housing	18	Seal lock nut	27	Center pin
8	Locking screw	20	Retaining ring	28	Pan head screw
9	Retaining ring	21	Back up plate	29	Steel sealing ring
10	Shaft seal ring	22	Taper roller bearing	30	Cylinder block
11	Back up plate	23	Shim	31	Pressure spring
12	O-ring	24	Taper roller bearing	32	Adjustment shim
13	Locking screw	25	Retaining plate	33	Control lens

2) CONTROL UNIT



1	Control housing	28	Double break off pin	59	Retaining ring
2	Cover	29	Plug	60	Control piston
4	Positioning piston	32	Double break off pin	61	Control bushing
5	Positioning trunnion	33	O-ring	62	Retaining disc
7	Piston	34	Locking screw	63	Locking screw
8	Threaded pin	50	Relief valve	64	Locking screw
15	Socket head screw	51	Adjusting bushing	65	Double break off pin
16	Socket head screw	52	Cylinder pin	66	Socket head screw
19	O-ring	53	Threaded pin	67	Cover
20	O-ring	54	Seal lock nut	68	Throttle screw
21	O-ring	55	Pressure spring	69	Socket head screw
23	Socket head screw	56	Spring collar	70	O-ring
24	Square ring	57	Pressure spring	71	Locking screw
26	Cylinder pin	58	O-ring		

3) COUNTER-BALANCE VALVE



1	Valve poppet	12	Brake piston	21	Locking screw
2	Pressure spring	13	Valve bushing	22	Locking screw
3	Poppet seat	14	Throttle pin	23	Socket screw
4	Valve poppet	15	Valve screw	24	Plug
5	Pressure spring	16	Bolt	25	O-ring
6	Locking screw	17	Spring collar	26	O-ring
7	O-ring	18	Pressure spring	27	O-ring
9	Valve screw	19	Housing	28	Locking screw
10	Ball	20	Locking screw	29	D/Break OFF pin
11	Bushing				

3. TIGHTENING TORQUE

The torques given are standard figures. Any figures specifically described in the procedure has priority.

Page	Item	Size	kgf·m	lbf·ft
8-75	8	M22 × 1.5	6.1	44
	13	M26 × 1.5	7.1	51
	18	M12	7.0	50.9
	28	M 6 × 20	1.4	10.3
8-76	15	M16 × 45	21.4	155
	23	M14 × 25	13.8	99.5
	34	M18 × 1.5	4.0	29
	53	M 6 × 30	1.4	10.3
	54	M6	1.0	7.4
	63	M14 × 1.5	3.0	22
	66	M 8 × 40	2.5	18.4
	69	M12 × 35	12.2	88.4
	71	M14 × 1.5	3.0	22

4. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) Disassembly

① Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.

② To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.

③ Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.

④ During disassembly, give a match mark to the mating surfaces of each part.

⑤ Arrange removed parts in order so that they will not become damaged or missing during disassembly.

⑥ Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

(2) Assembly

① Reassemble in a work area that is clean and free from dust and grit.

② Handle parts with bare hands to keep them free of linty contaminants.

③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.

④ Do not reuse O-ring oil seal and floating seal that were removed in disassembly.
Provide the new parts.

⑤ Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.

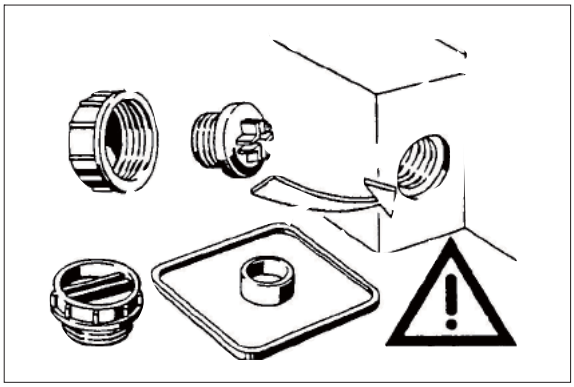
⑥ When reassembling oil motor components of motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil. (NAS class 9 or above)

⑦ Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

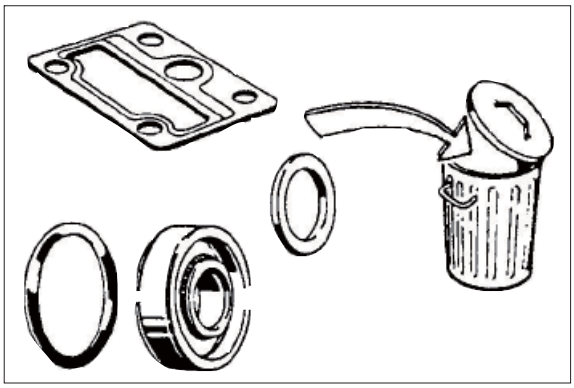
2) SEAL KITS AND COMPONENT GROUPS

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

(1) Close all ports of the hydraulic aggregates.

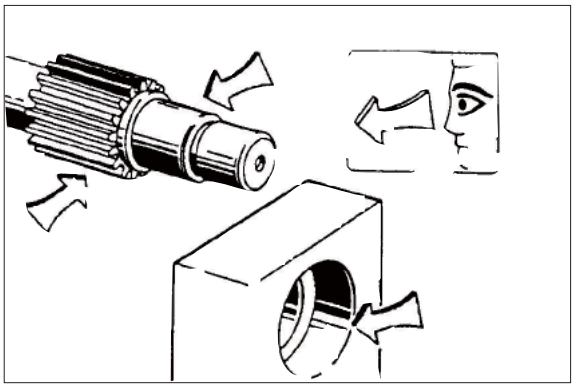


(2) Replace all seals.
Use only original hydromatik spare parts.

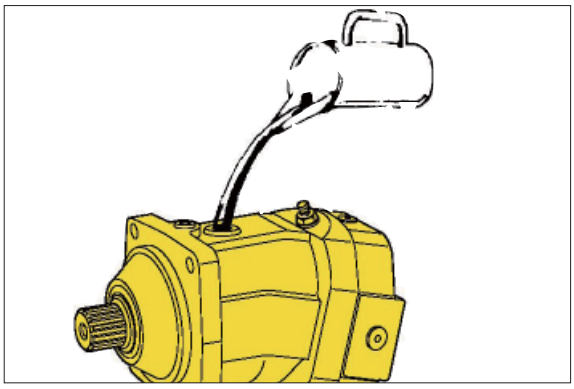


(3) Check all seal and sliding surfaces for wear.

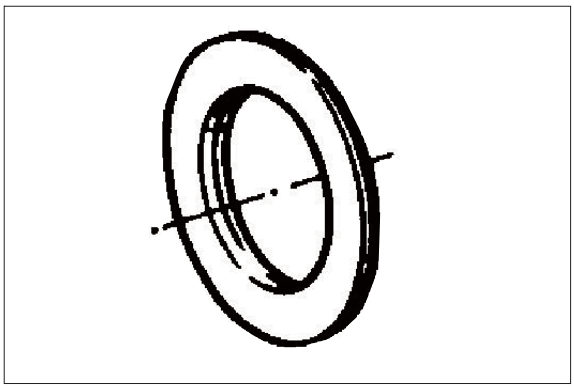
※ Rework of sealing area f.ex. with abrasive paper can damage surface.



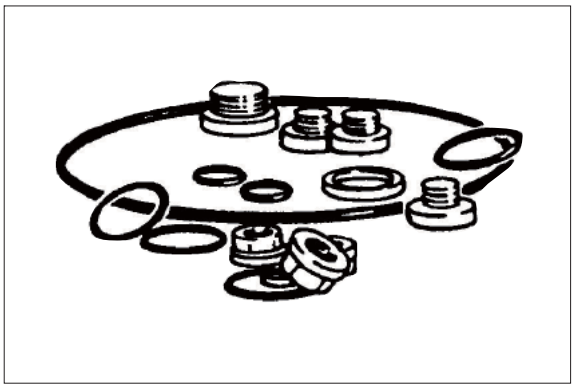
(4) Fill up hydraulic aggregates with hydraulic oil before start up.



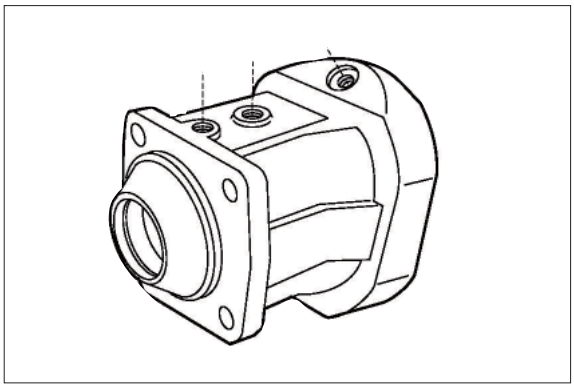
(5) Seal kit for drive shaft



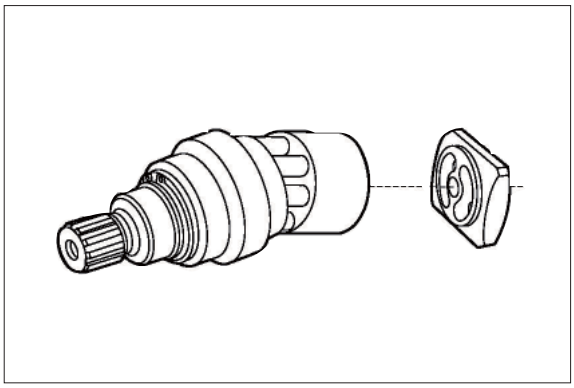
(6) External seal kit.



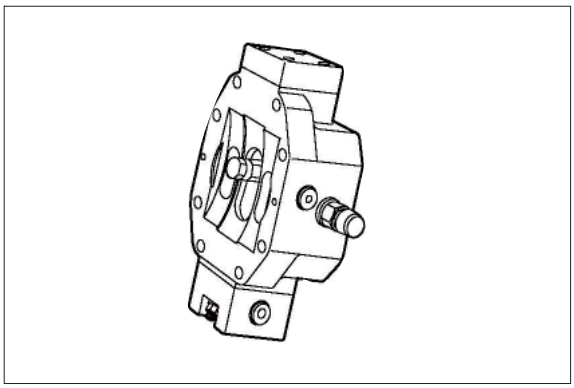
(7) Housing.



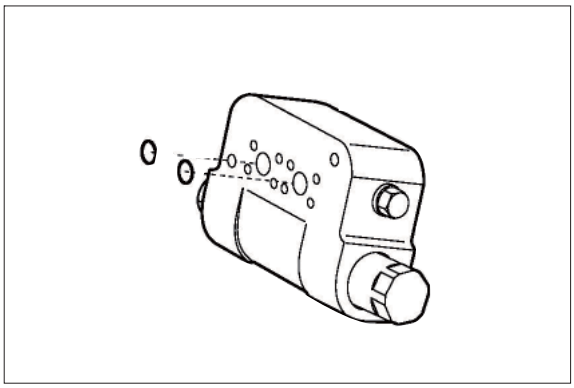
(8) Complete rotary group.



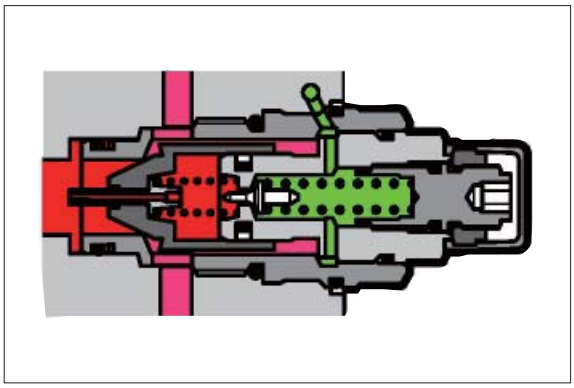
(9) Port plate with control piston.



(10) Counter balance valve.

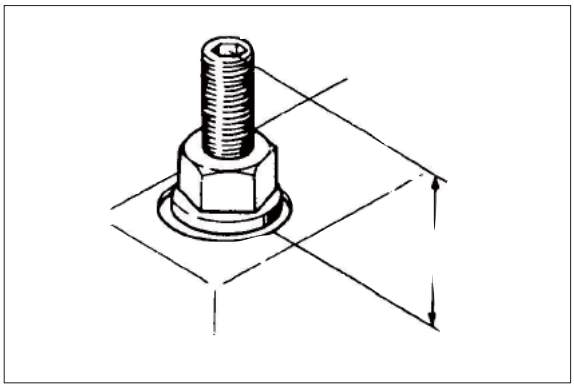


(11) Relief valve / Make up check valve.

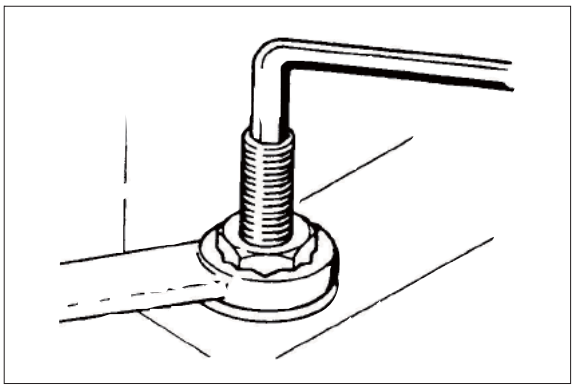


3) SEAL NUT

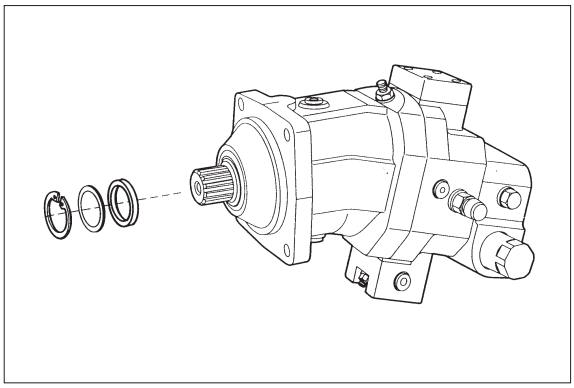
(1) Replace seal nut.
First measure and record setting height.



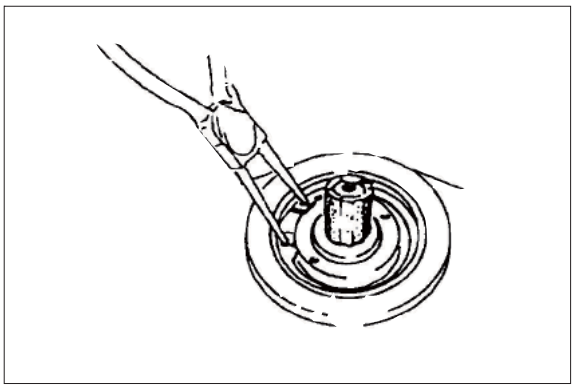
(2) When tightening, counterhold setting screw, then check setting height.



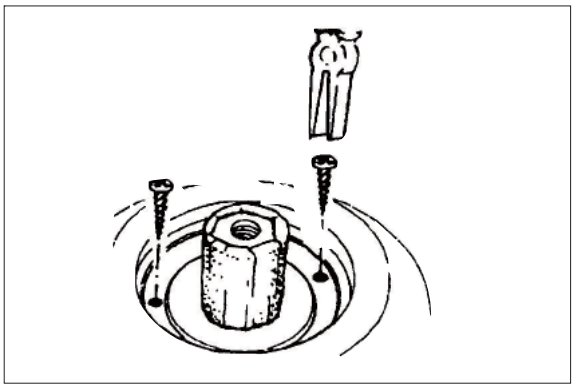
4) SEALING THE DRIVE SHAFT



(1) Protecting the drive shaft.
Remove retaining ring and shim.



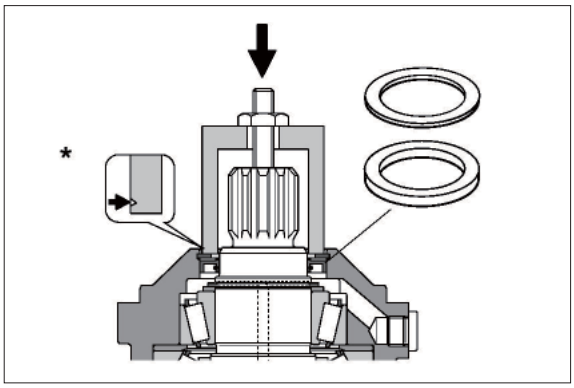
(2) Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



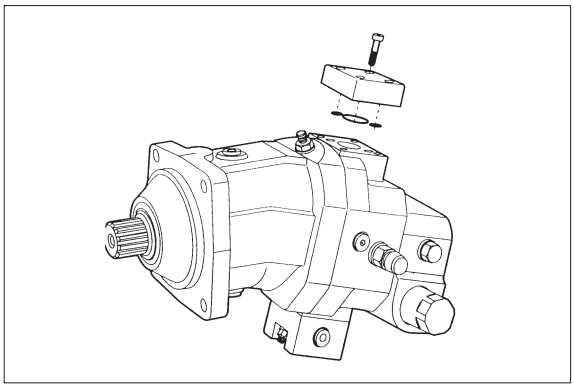
(3) Press in shaft seal and shim with bush to stop.

⚠ **Pay attention to pressing depth.**

* Mark for pressing depth.
Assemble retaining ring.

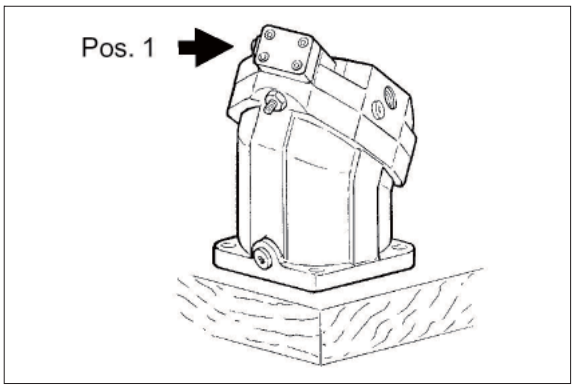


5) SEALING OF THE CONTROL PARTS



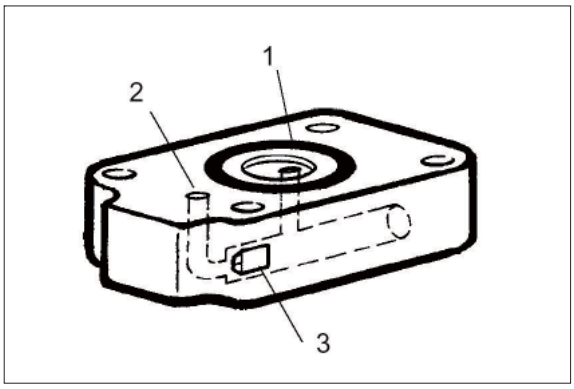
(1) Disassembly position

Remove cover 1.

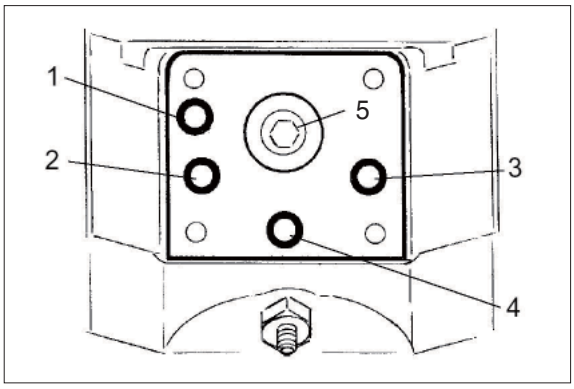


1 O-ring
2 Input flow of oil control
3 Throttle pin

※ Installation position differs according to the control components.

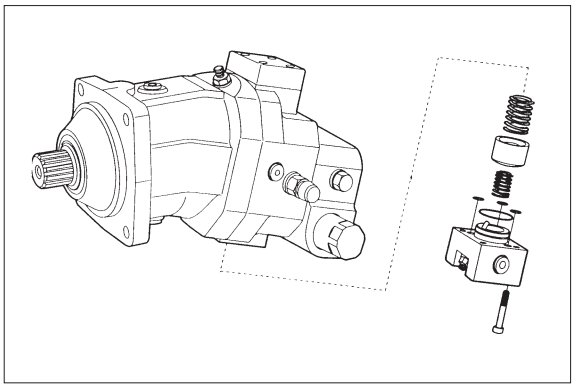


1 Input flow of oil control
2 High pressure / Low pressure
3 High pressure / Low pressure
4 Leakage oil
5 Control piston

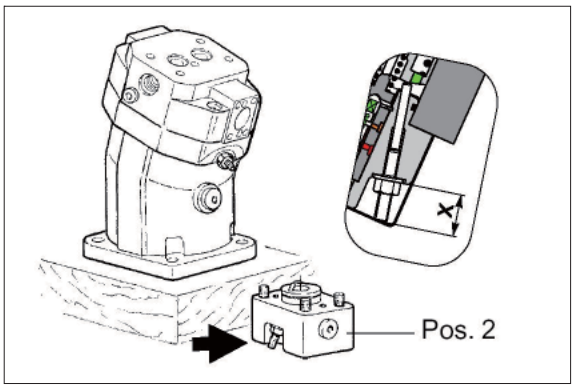


(2) Disassembly position : Remove cover 2.

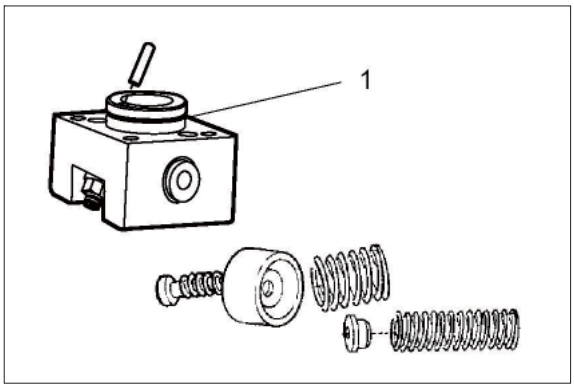
※ Attention spring load.



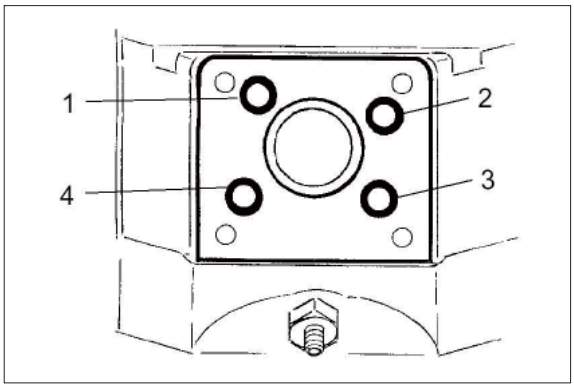
※ Dimension X : Note dimension (begin of regulation)



1 Check of O-ring

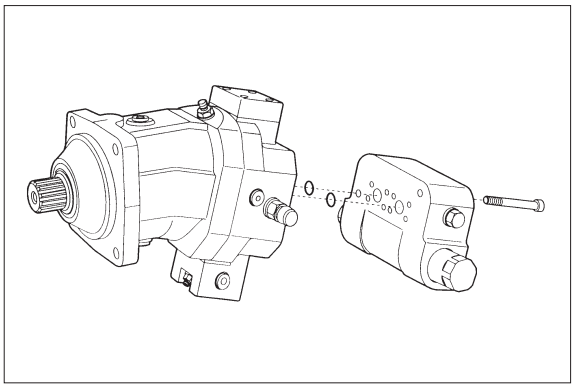


1 O-ring / High pressure-small control position side
2 O-ring / Control pressure
3 O-ring / High pressure-check valve
4 O-ring / High pressure-check valve

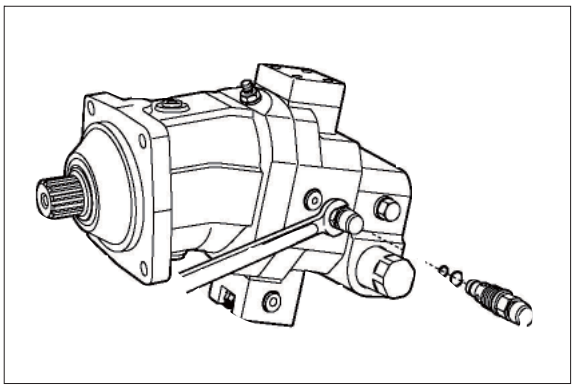


6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

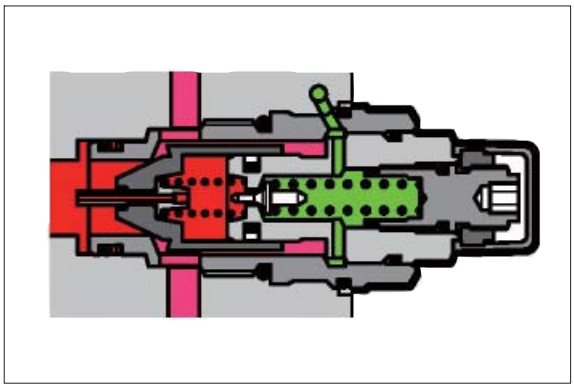
·Remove counter balance valve
·Inspect
·O-ring



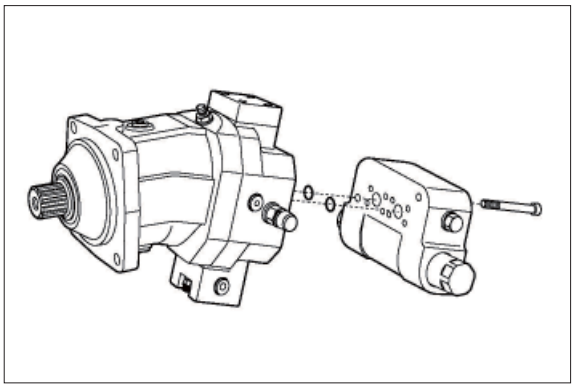
(1) Remove relief valve



(2) Inspect
O-ring



(3) Remove counter-balance valve.
Inspect
O-ring

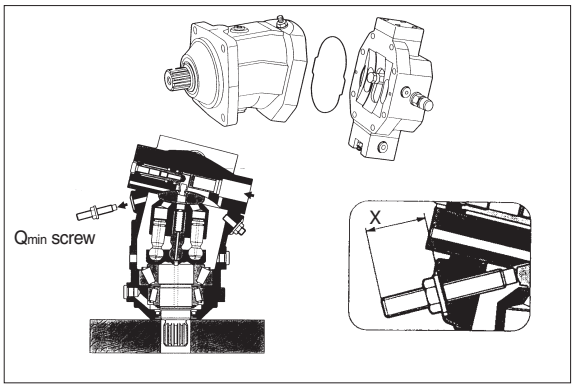


7) DISASSEMBLY OF THE PORT PLATE

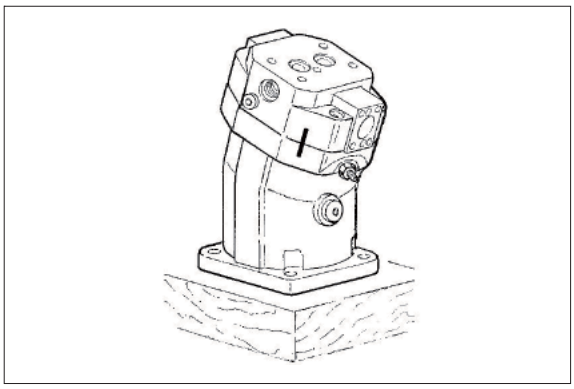
·Note dimension X

·Remove Q_{min} screw

·Swivel rotary group to zero P

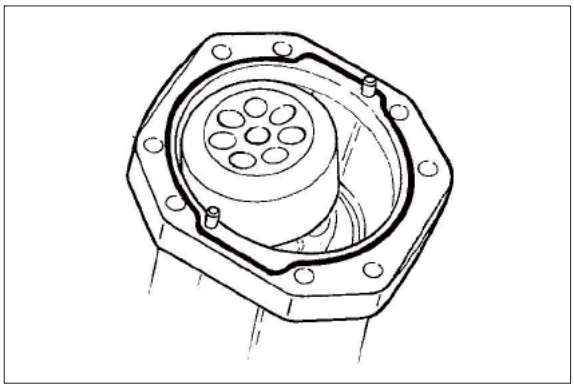


(1) Port plate.
Mark position. Loosen screws.
Removal.

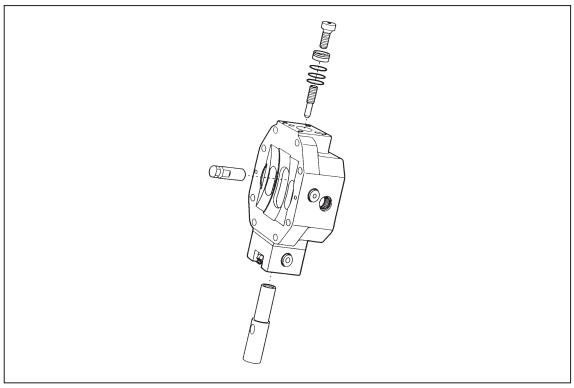


(2) Check O-ring.

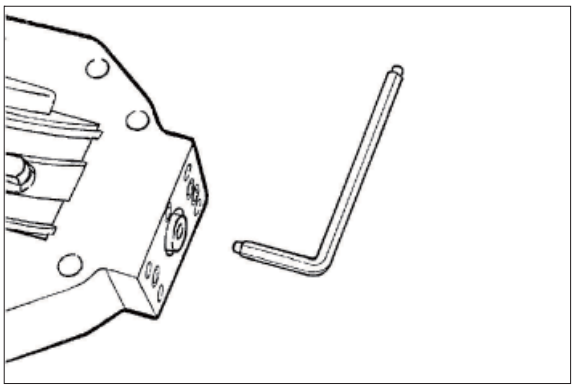
※ Stick new O-ring with some grease.
Do not swivel rotary group.
Piston rings to hang out from the cylinder boring.



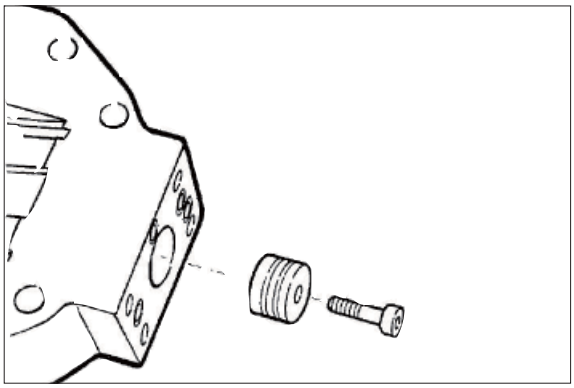
8) REMOVE OF THE POSITIONING PISTON



(1) Loosen fixing screw.
Use only socket wrench.

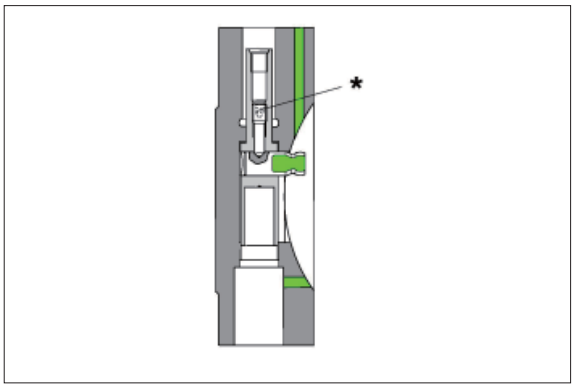


(2) Remove piston with piston ring.



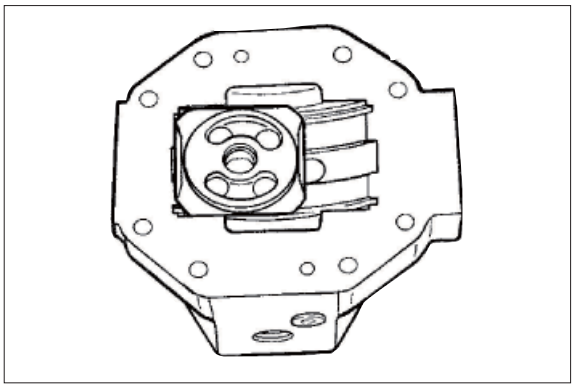
(3) Warm up fixation screw *for positioning plug via boring (screw glued-to turn out).

※ Use new screw.
Precode coating.
Note tightening torque.

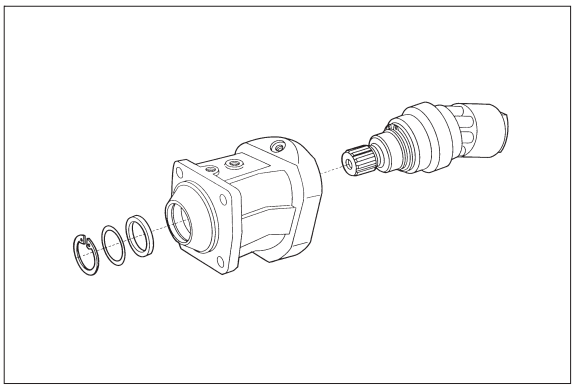


※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.

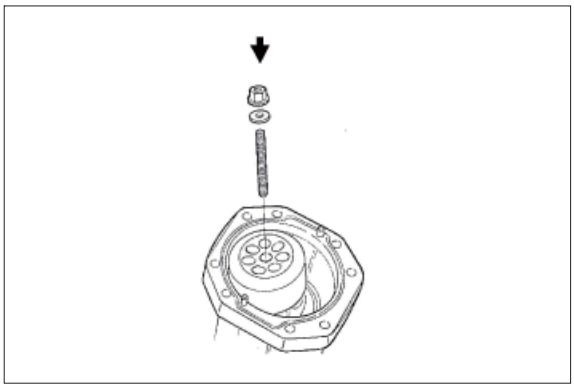
※ Rotary group vertical.



9) REMOVE ROTARY GROUP

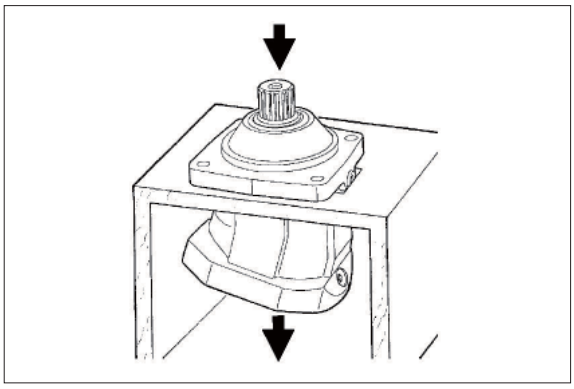


(1) Screw in threaded pin into center pin. Fix the cylinder with disc and locknut. M8×105ℓ



(2) Press out rotary group.

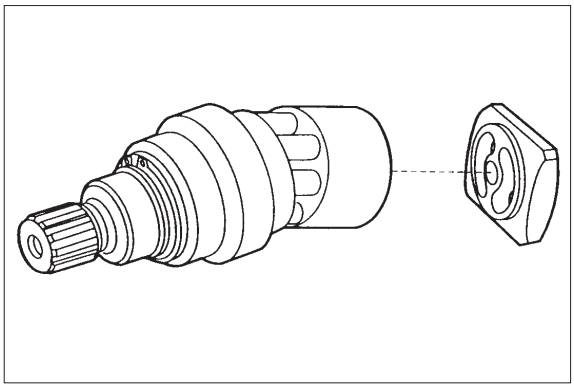
※ If the bearings are used again do not hit on the drive shaft.



10) EXCHANGING OF THE ROTARY GROUP

Complete rotary group

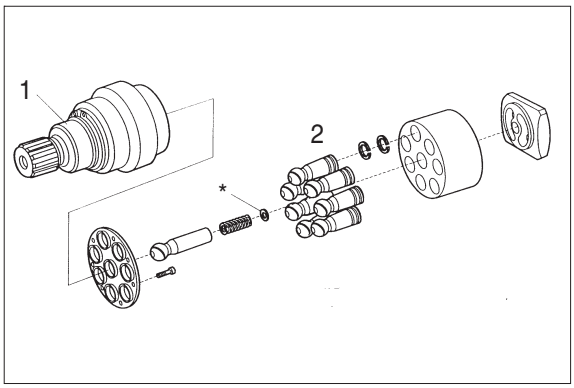
※ Setting of hydraulic part necessary.



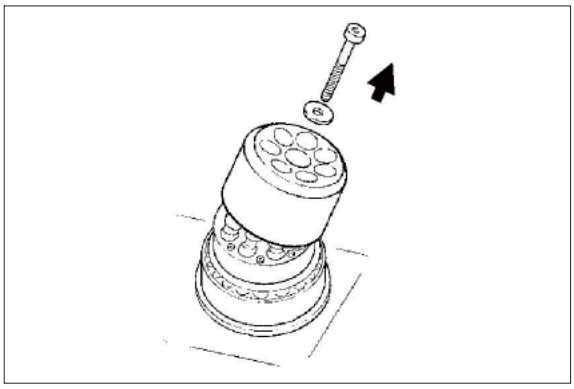
Rotary group

1 Mechanical part : Adjust drive shaft with bearing

2 Hydraulic part : Adjustment necessary

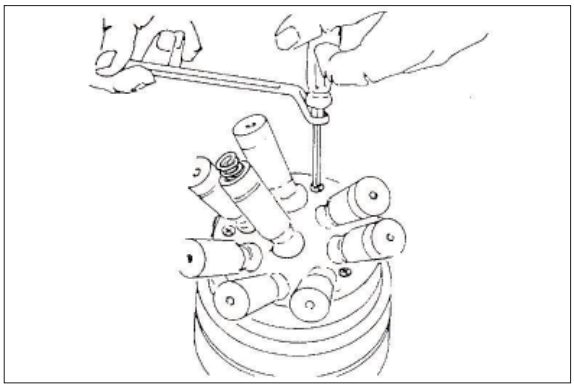


(1) Remove fixing screw (cylinder).
Remove cylinder.



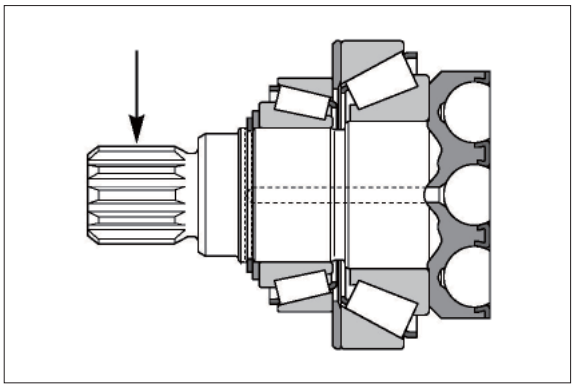
(2) Disassemble retaining plate.

※ Screws are glued.
Use Torx tools.



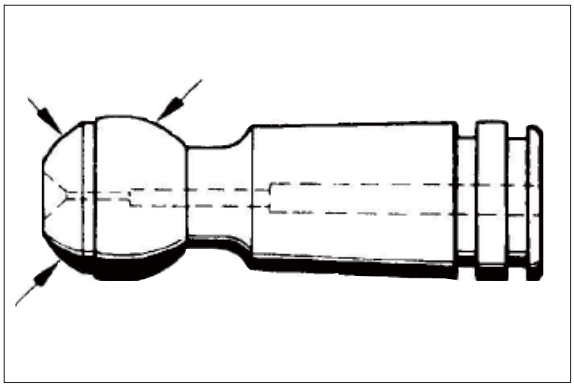
11) INSPECTION INSTRUCTIONS

(1) Free of corrosion, erosion or fretting; No damage to splines or keyways.



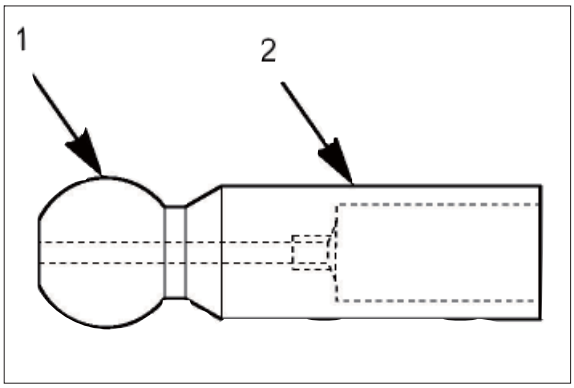
(2) Pistons

No scoring and no pittings.



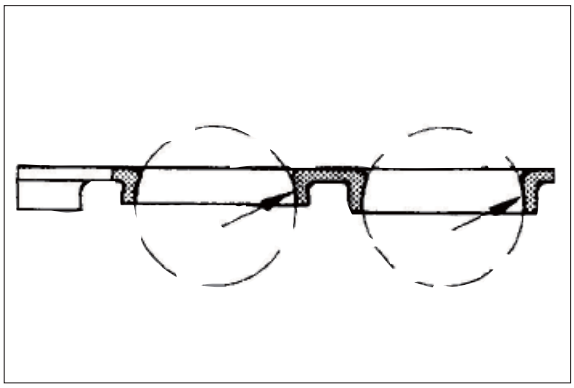
(3) Center pin

No scoring and no pittings.



(4) Retaining plate

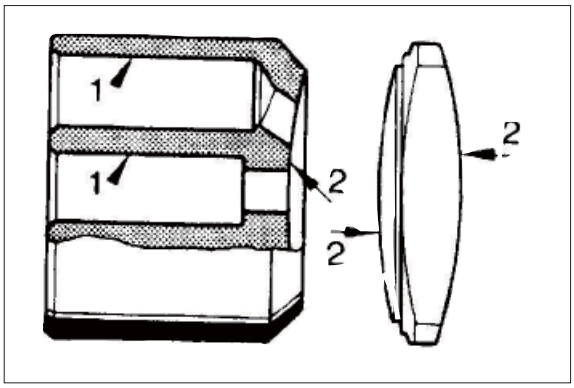
No scoring and no evidence of wear.



(5) Cylinder block / Control lens

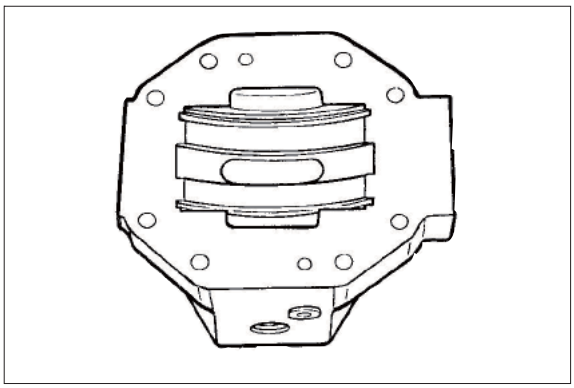
1 Bores free of scoring, no evidence of wear

2 Faces smooth and even, free of cracks and scoring



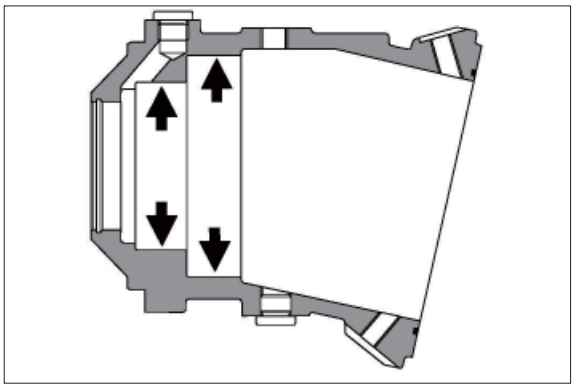
(6) Control housing

Sliding surface and side guides free of scoring and no wear.



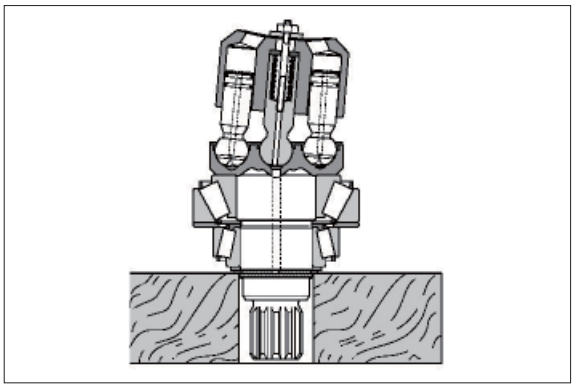
(7) Visual check

Bearing areas free of scoring and no evidence of wear.

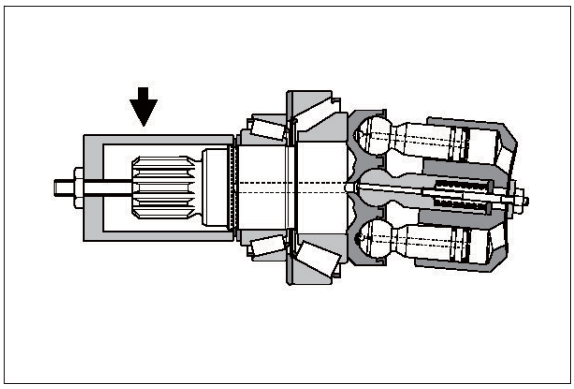


12) ROTARY GROUP ASSEMBLY

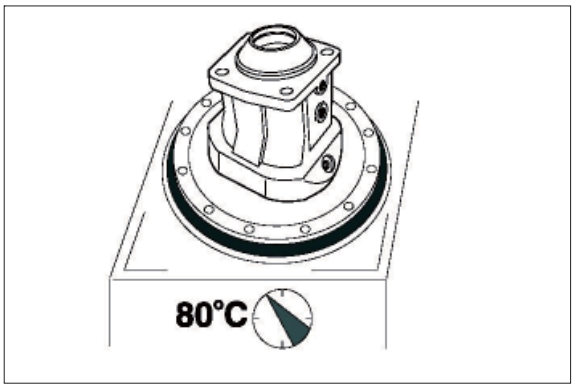
(1) Rotary group completely assembled ready for assembly.



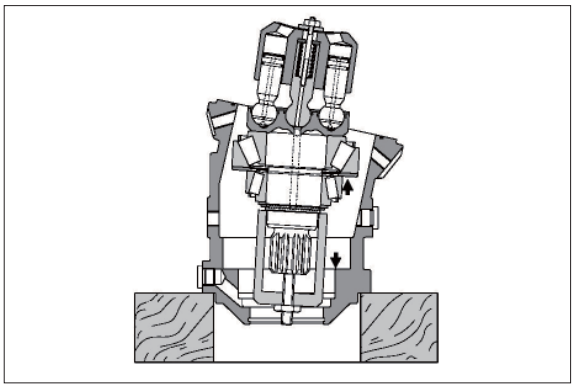
(2) Place assembly sleeve.



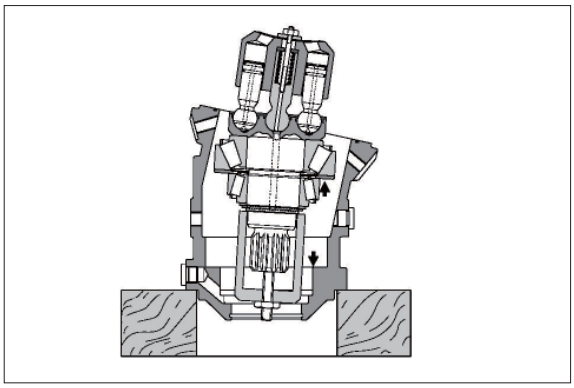
(3) Warm up housing to 80˚C.



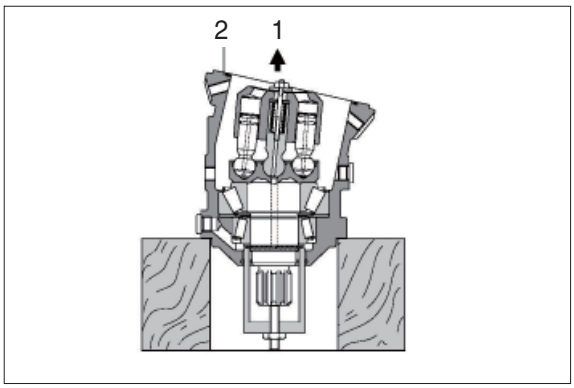
(4) Insert rotary group into housing to seat position.



(5) Insert rotary group into housing to seat position.

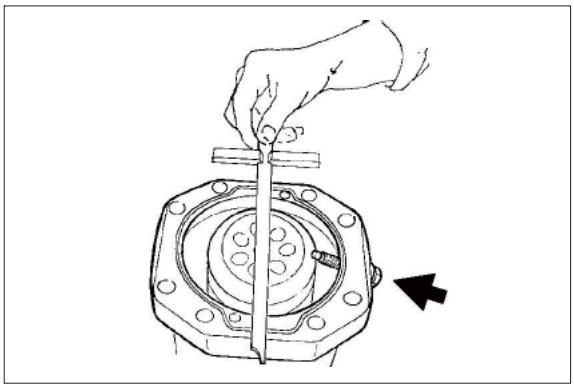


(6) Fix zero position of cylinder with Q_{max} screw.
1 Disassemble cylinder fixing screw
2 Insert O-ring

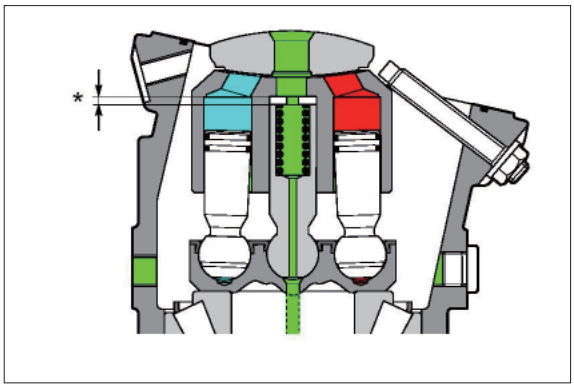


13) ROTARY GROUP ADJUSTMENT

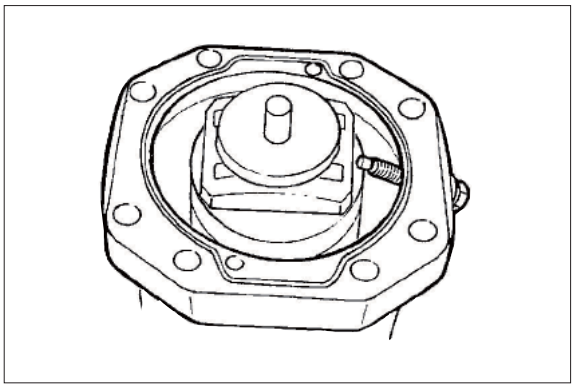
(1) Determine cylinder swivel range to max angle with screw.



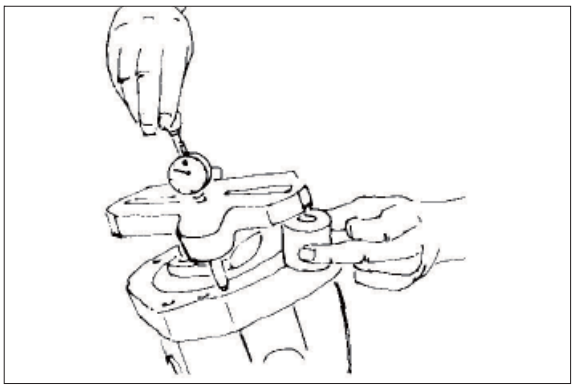
(2) * Disc



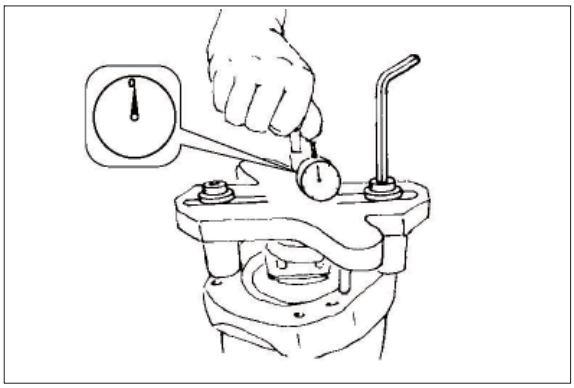
(3) Place centering disc.



(4) Mount measuring device.



(5) Check dimension X.



14) ASSEMBLY OF THE PORT PLATE

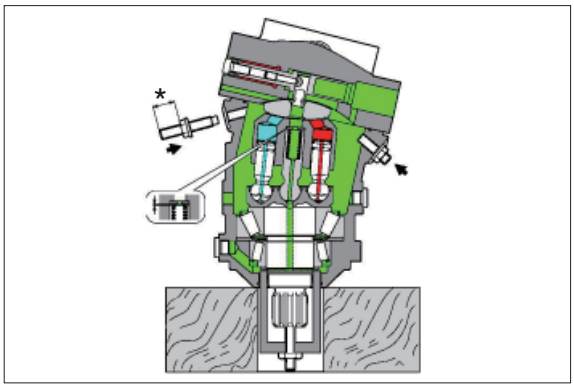
(1) Assemble port plate.

※ Take care of assembly design.
Tighten fixing screws with torque.

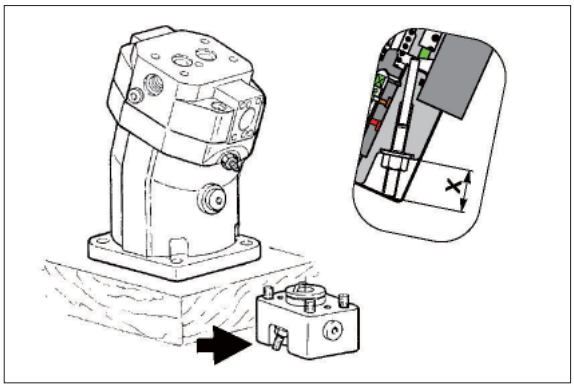
(2) Set Q_{min} screw to dimension (*).

(3) Assemble plug.

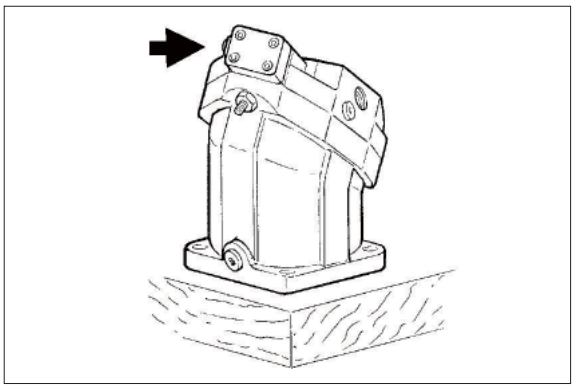
(4) Remove assembly sleeve.



(5) Assemble control components.

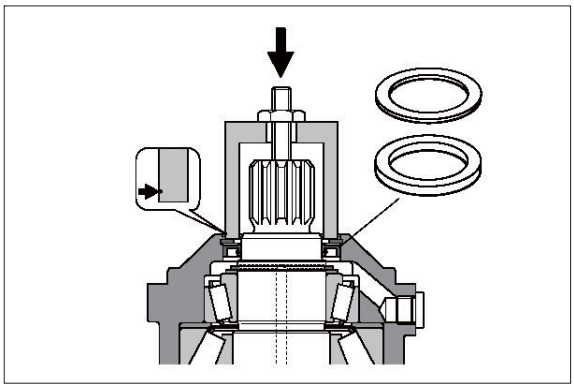


(6) Assemble cover.

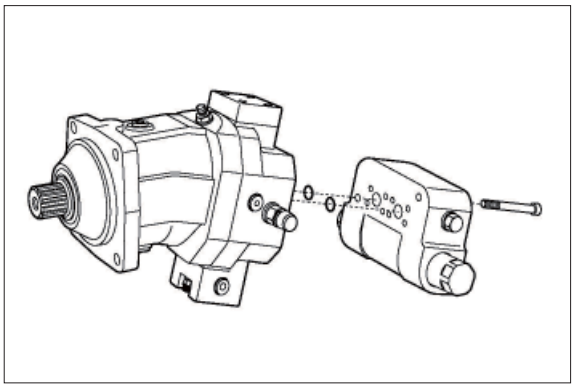


(7) Assemble shaft seal, disc and safety ring.
Press in with assembly sleeve.

※ Take care of press in depth.



(8) Assemble counter balance valve.



GROUP 5 GEAR BOX

1. REMOVAL AND INSTALL

1) REMOVAL

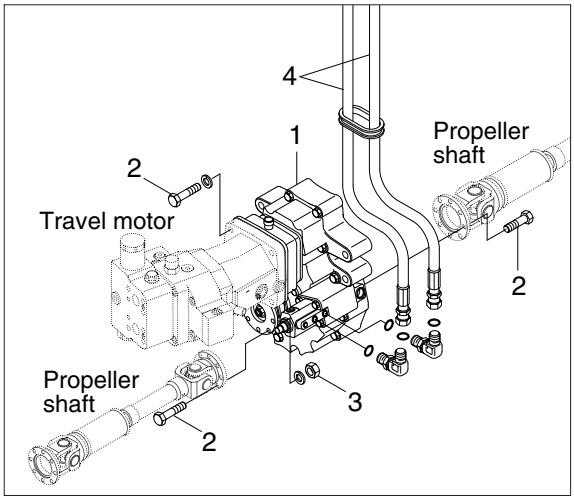
(1) Swing the work equipment 90° and lower it completely to the ground.

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

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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



(4) Remove the propeller shaft mounting nuts (3).
- Tightening torque : 7.4±1.5 kgf · m (53.5±10.8 lbf · ft)

(5) Remove the travel motor mounting bolts (2).
- Tightening torque : 14.7±2.2 kgf · m (53.5±10.8 lbf · ft)

(6) Remove the hoses (4).

※ Fit blind plugs to the disconnected hoses.

(7) Remove the mounting bolts (2), then remove the gear box (1) device assembly.
- Weight : 63 kg (140 lb)
- Tightening torque : 19.6±2.9 kgf · m (142±21 lbf · ft)

2) INSTALL

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

(2) Bleed the air from the gear box.
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. INSTRUCTIONS

The efficiency and continued operation of mechanical units depend on constant and correct maintenance and also on efficient repair work, should there be a break-down or malfunction. The instructions in this manual have been based on a complete overhaul of the unit. However, the mechanic must decide whether or not it is necessary to dismantle the individual components when only partial repair work is needed. The manual provides a quick and sure guide which, with the use of photographs and diagrams illustrating the various phases of the operations, allows to perform accurate work to take place.

Therefore all the information needed for correct disassembly, the relative check and assembly of each individual component, has been written down.

In order to remove the different unit from the vehicle, the manuals provided by the vehicle manufacturer should be consulted. In describing the following operations it is presumed that the unit has already been removed from the vehicle.

1) IMPORTANT

Throughout the phases of repair or maintenance work it is advisable to use proper equipment such as : Trestles or supporting benches, plastic or copper hammers, appropriate levers, extractor and specific spanners or wrenches. So that the work is facilitated and the working surfaces and the operators themselves are protected. Before going on to disassemble the parts itis beat to thoroughly clean the unit, removing any encrusted or accumulated greases and then drain the oil through the oil-draining plug.

2) INTRODUCTORY REMARKS

All the disassembled mechanical units should be thoroughly cleaned with appropriate products and then restored or replaced if damage, wear, cracking or seizing have occurred.

In particular, thoroughly check the state of all moving parts (bearings, gear, crown wheel and pinion, shaft) and sealing parts (O-ring, oil shield) which are subject to major stress and wear. In any case it is a disable to replace the seals every time a component is overhauled or repaired. During assembly the sealing rings must be lubricated on the sealing edge. In the case of the crown wheel and pinion, replacement of one component requires the replacement of the other one.

During assembly the prescribed pre-loading and backlash of the parts must be maintained.

3) MAINTENANCE AND REPAIR

We have compiled these instructions for maintenance and repair in order to facilitate any such work on the DANA components differential units and change units. The drawings of any special tools required for maintenance and repair work can be bought directly from us. Spare parts can be ordered either through the vehicle manufacturer or to us directly.

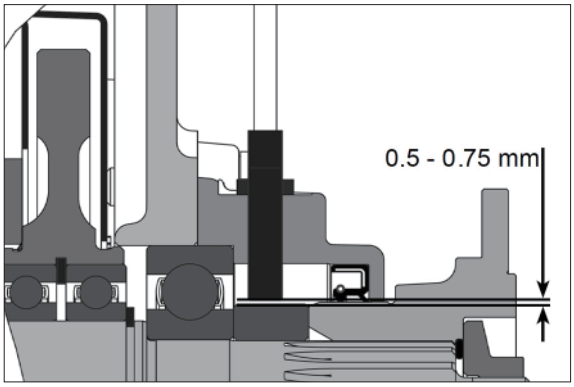
4) LUBRICANT SPECIFICATIONS

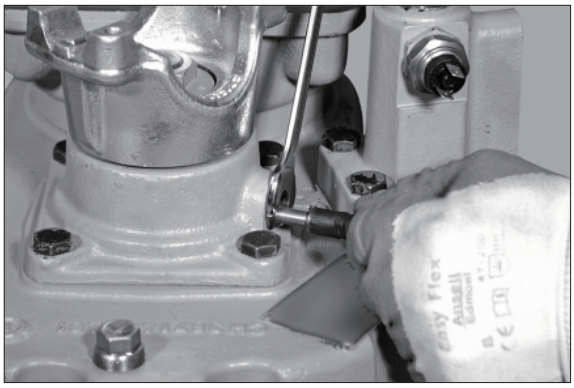
SAE 85W-90 (API GL-5)

3. COUNTER - REVOLUTION SENSOR

1) REPLACING

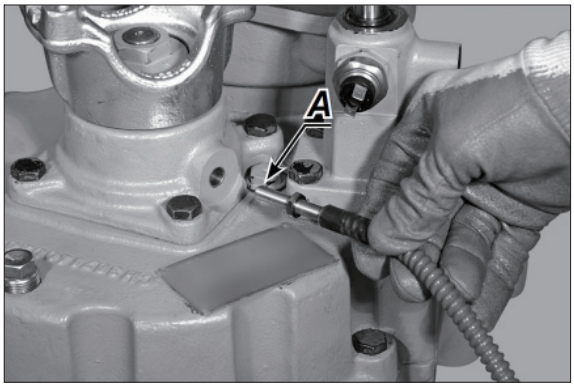
(1) Undo the sensor adjuster screw lock nut and the counter-revolution sensor.



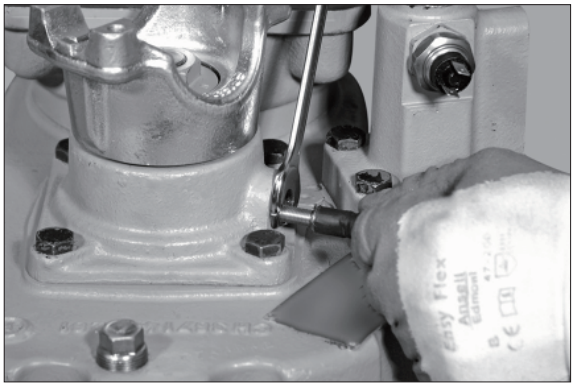


(2) Replace the counter-revolution sensor if damaged.

※ Clean the sensor reading zone “A” every oil change and every malfunctioning.

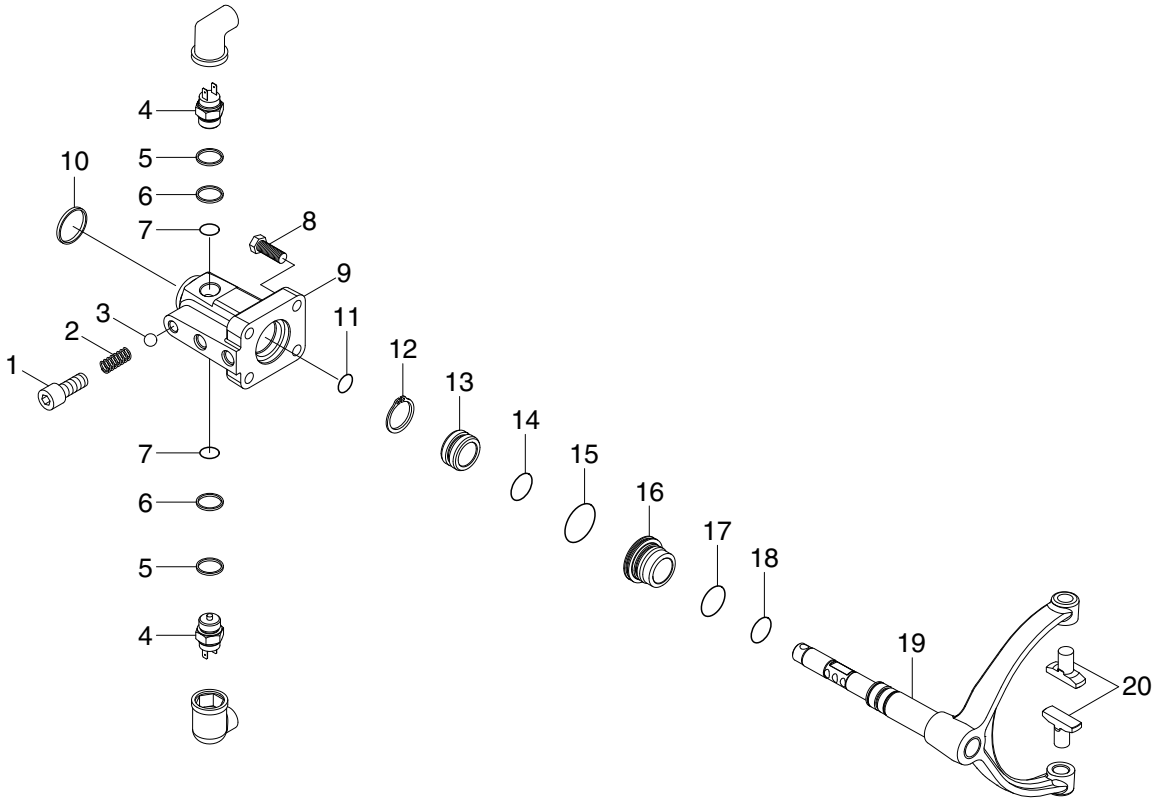


(3) Screw the counter-revolution sensor untill to the contact with the phonic end disk, then unloose the sensor 1/2 ~ 3/4 turn. Tighten the lock nuts completely.

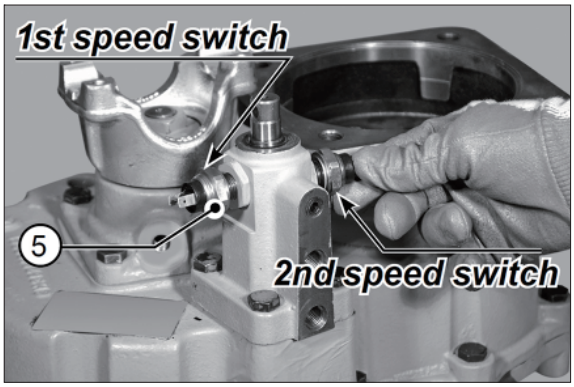


4. HYDRAULIC GEAR CONTROL

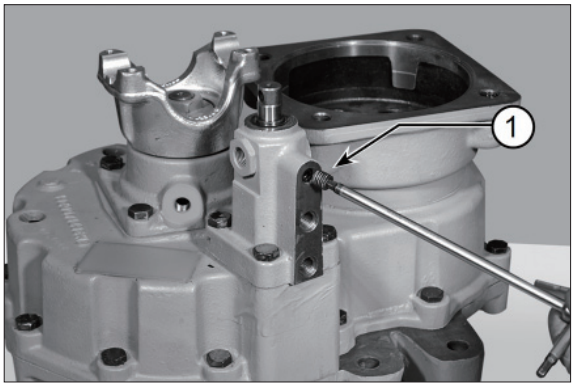
1) DISASSEMBLY



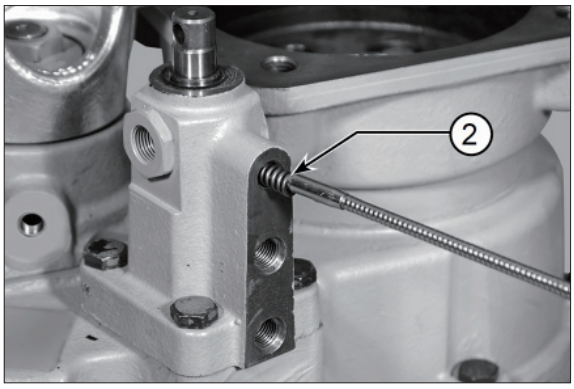
(1) Remove gear-in position switch (4), O-ring (5) and (7) and washer (7).



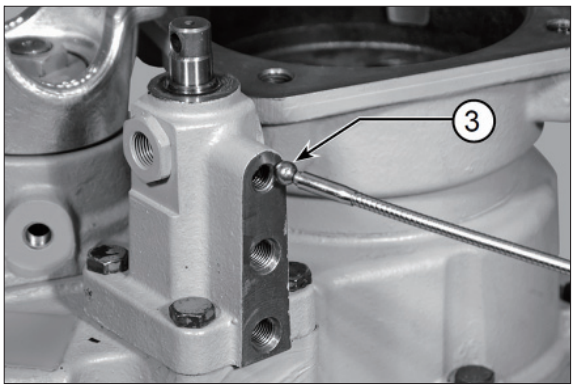
(2) Remove the cap (1) from the gear selector.



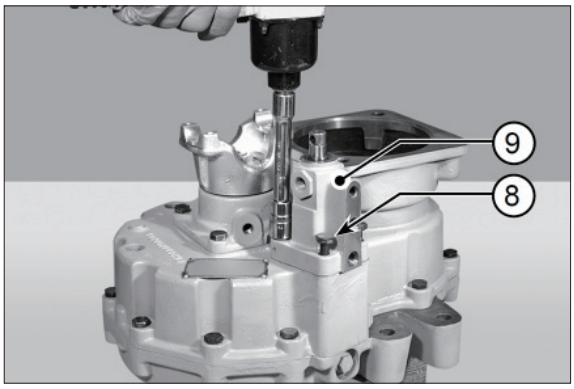
(3) Use a magnet to remove the spring (2) from the gear selector.



(4) Remove the gear selector balls (3).

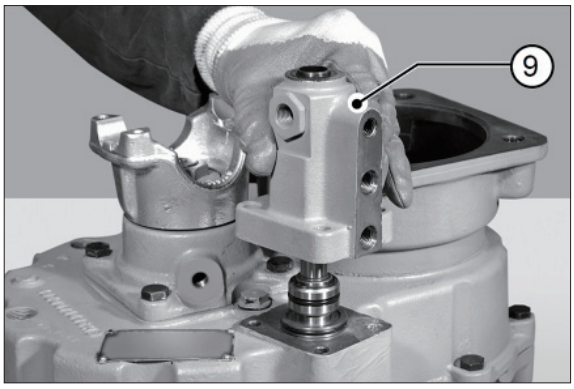


(5) Remove screws (8) on the gear control cylinder (9).

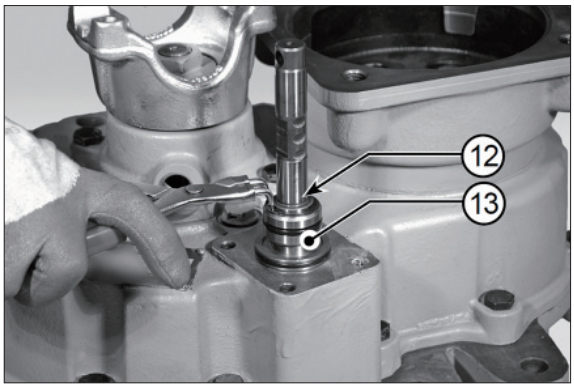


(6) Remove the gear control cylinder (9).

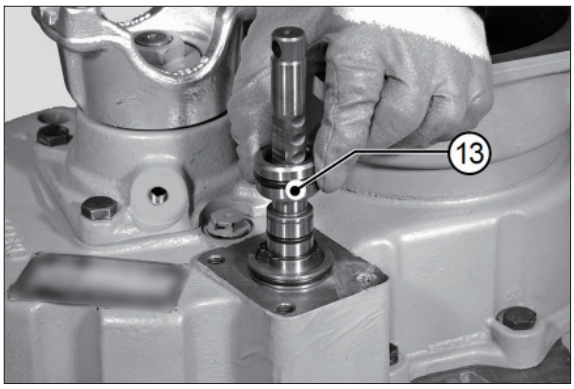
※ Carefully remove all residue of loctite from the surfaces.



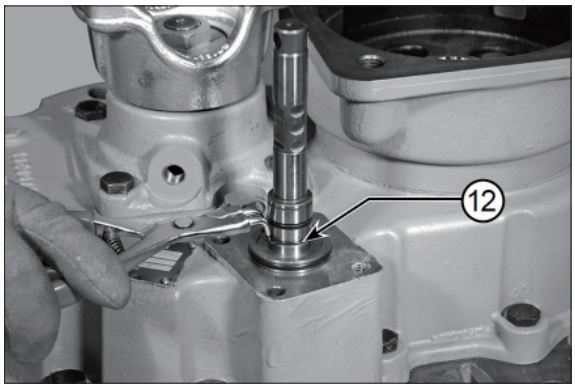
(7) Remove the snap ring (12) securing the piston (13).



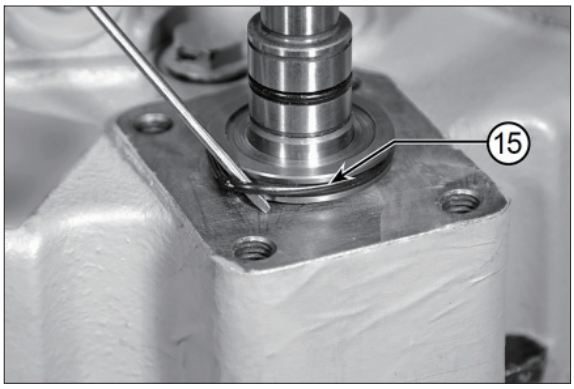
(8) Remove the piston (13), complete with seals.



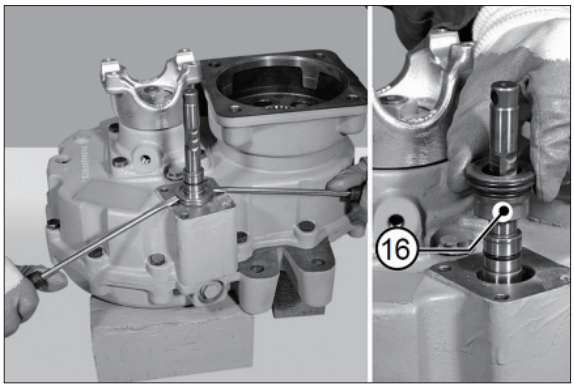
(9) Remove the snap ring (12) securing the piston (13).



(10) Remove the O-ring (15).

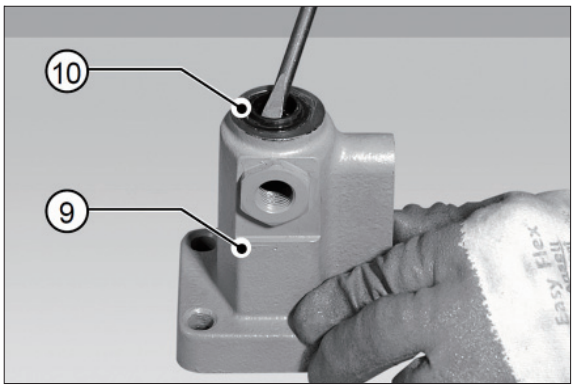


(11) Use two levers to remove the bushing (16).

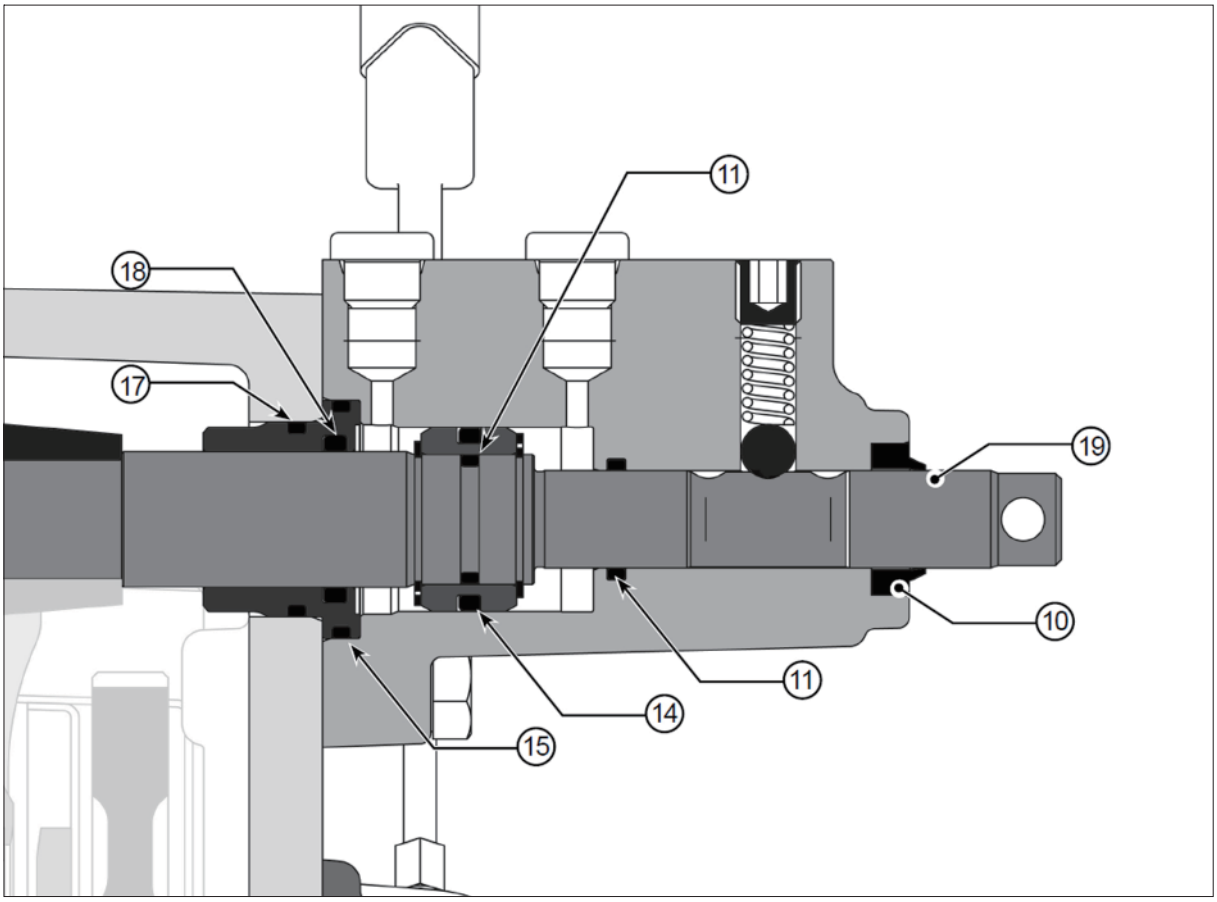


(12) Remove the dust scraper ring (10) and the rod's O-ring (11) from the gearshift cylinder (9).

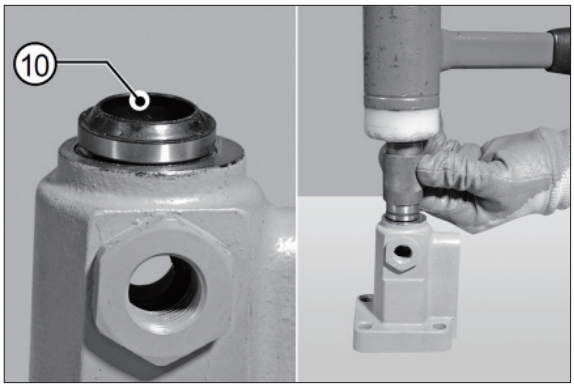
※ The O-rings and the dust scraper ring must be replaced every time the unit is disassembled.



2) ASSEMBLY

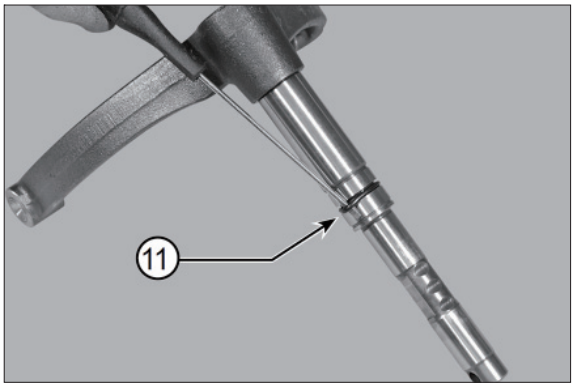


(1) Fit the rod's O-ring (11) and the dust scraper ring (10) into the cylinder.

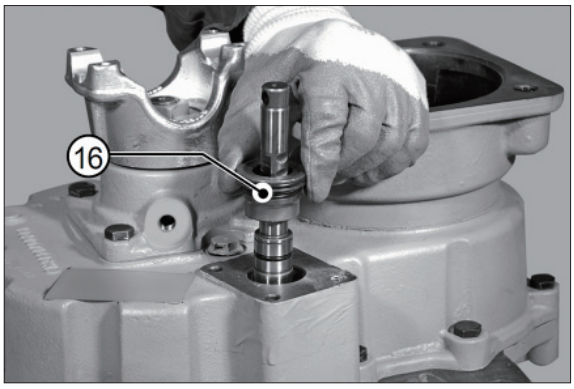


(2) Fit the new O-ring (11) on the gear selector rod (19).

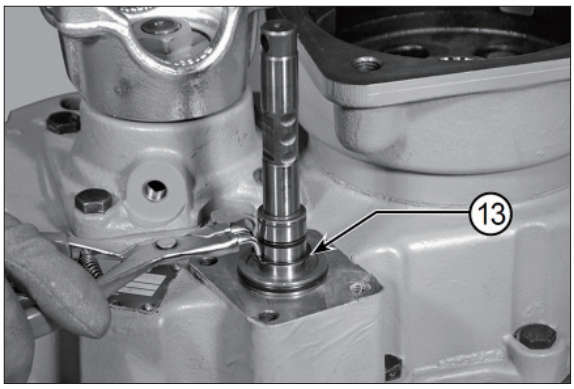
※ Lubricate before installing.



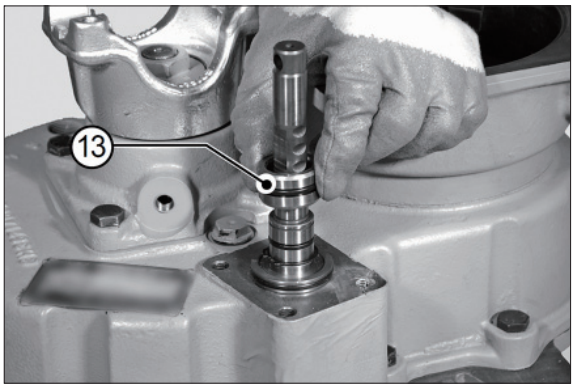
(3) Fit the O-rings (15), (17), (18) on the guide bush (16) and lubricate rings.
Fit the bush (16) onto the gear selector rod (19).



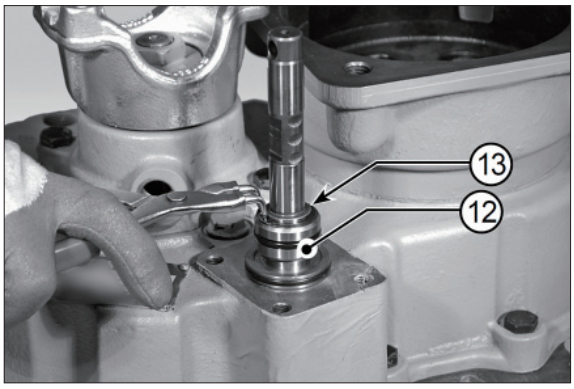
(4) Insert the snap ring (12).



(5) Fit the O-rings (11), (14) onto the piston (13) and lubricate rings.
Fit the complete piston (15) onto the gear selector rod (20) and engage it by means of the snap ring (12).

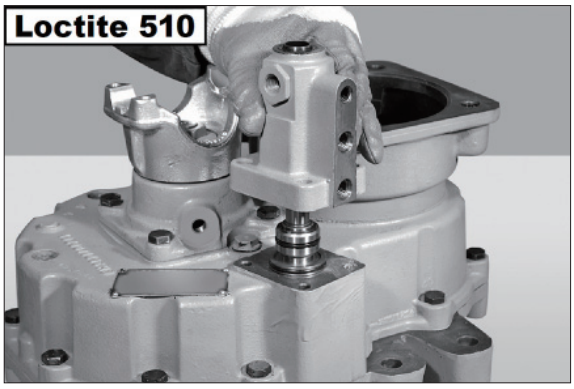


(6) Secure the piston (13) in position with the snap ring (12).

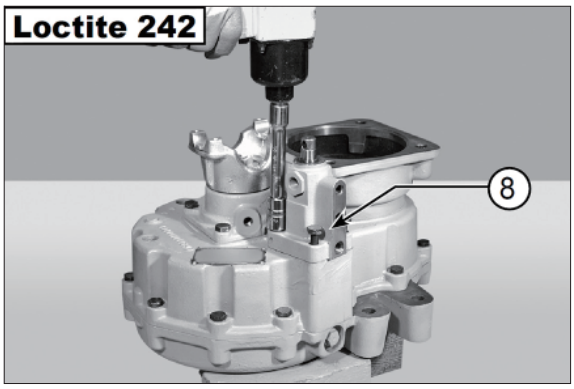


(7) Coat the coupling surface of the gearshift cylinder (9) with loctite 510; fit the cylinder on the gear selector rod (19).

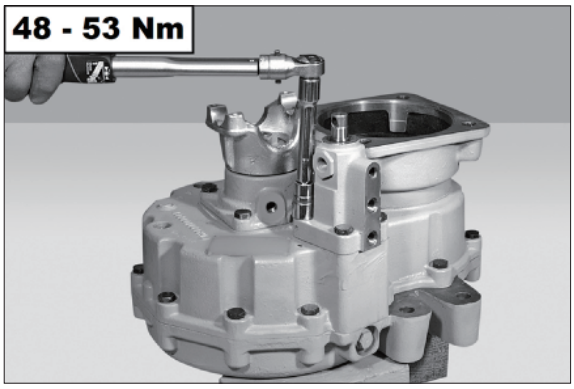
※ Make sure that the sealant forms a continuous film around the locking holes.



(8) Assembly the screws (8), spreading loctite 242 on screws.

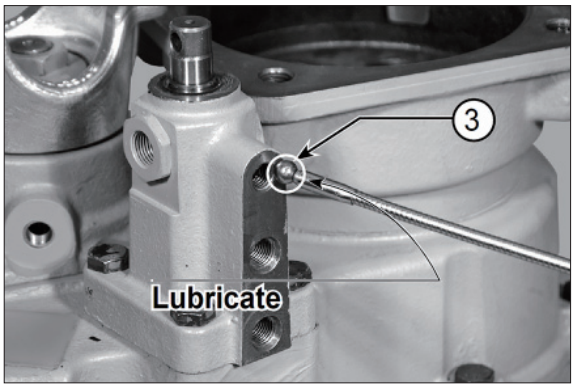


(9) Tighten screws (8) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



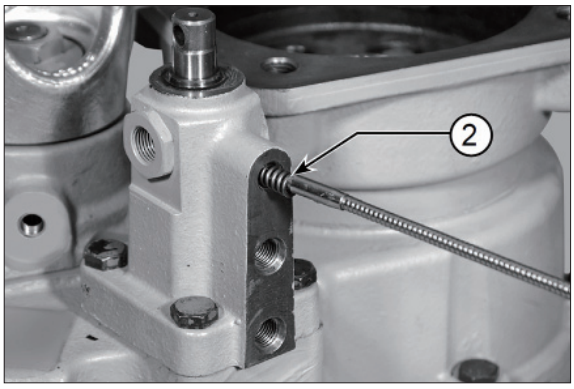
(10) Fit the gear selector balls (3).

※ Lubricate before installing.

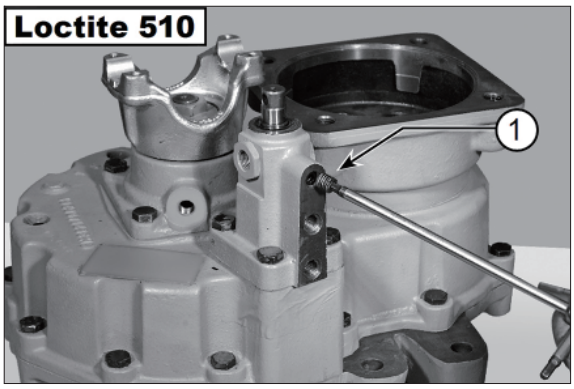


(11) Fit the gear selector springs.

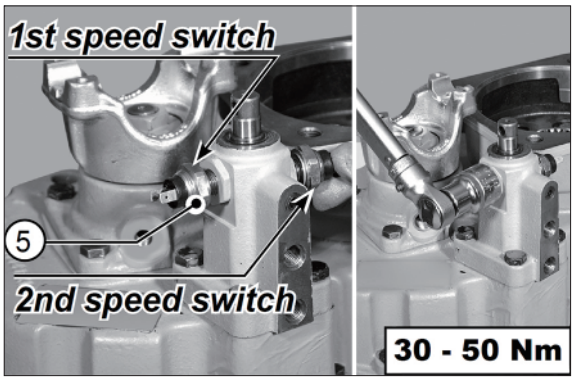
※ Replace the springs (14) if they are weakened or bent.



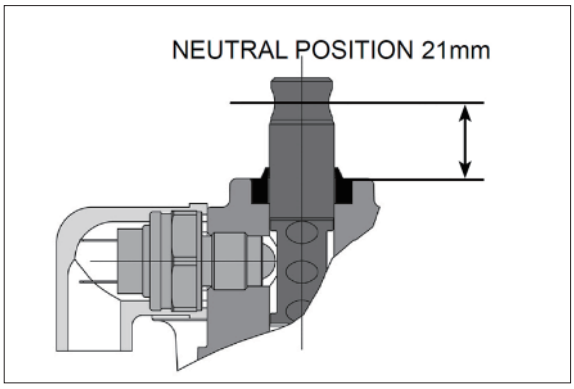
(12) Coat the dowel (1) with loctite 510 and screw it until it is level with the cylinder.



(13) Fix the gear-in position switch (4) with washer (7) and O-ring (5), (6).
Tighten with torque wrench setting of 3.57~5.09 kgf · m (25.8~36.9 lbf · ft).

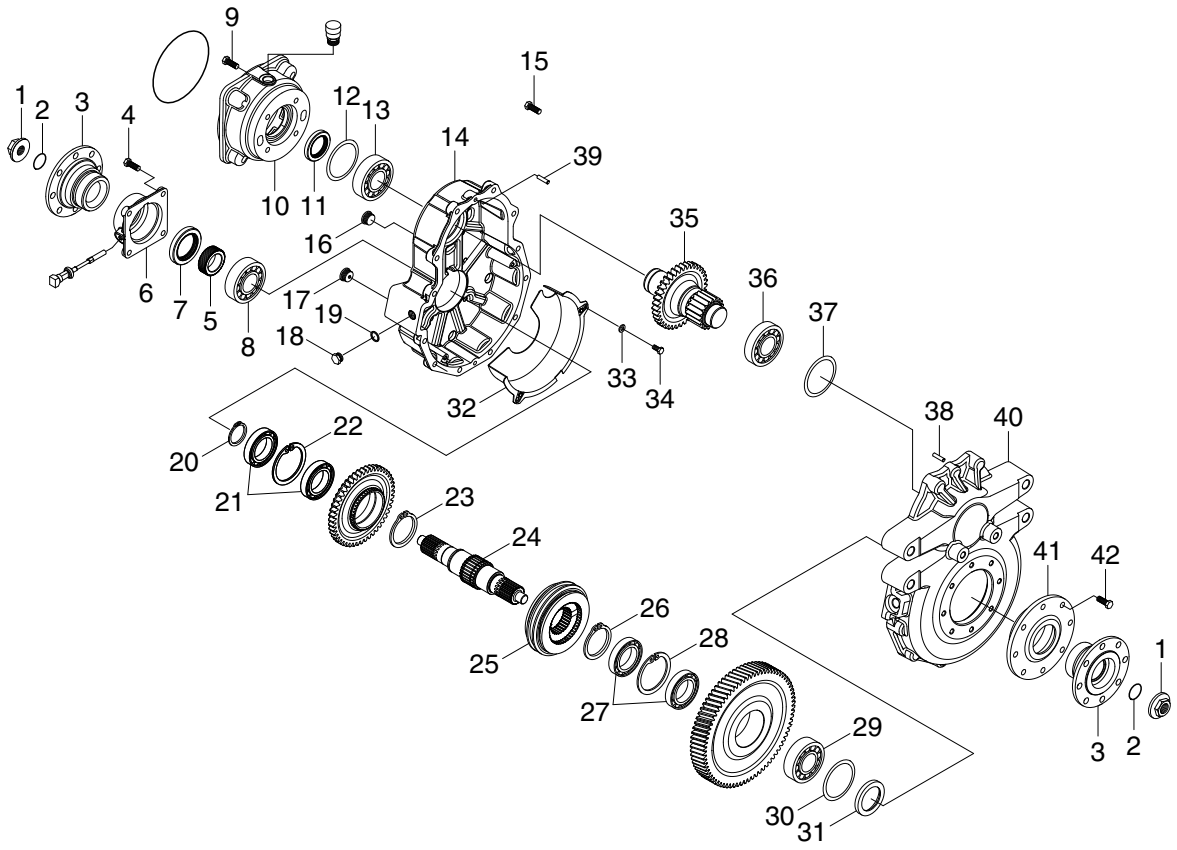


(14) Engage the 1st speed and verify with a control device (tester) that the switch 1st speed gives signal and that the switch 2nd speed is disabled.
Repeat the operation on the switch 2nd speed.

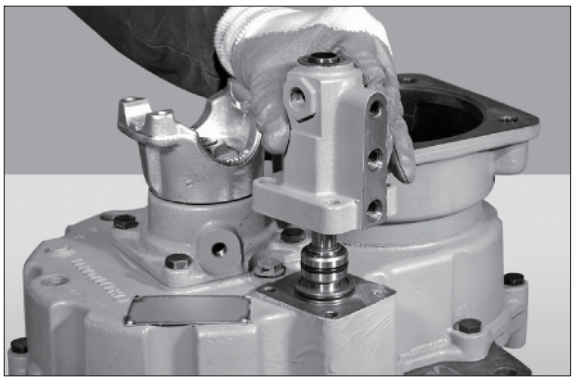


5. INTEGRATED REDUCTION GEAR

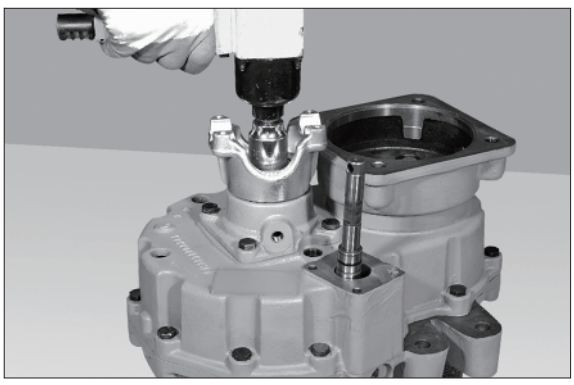
1) DISASSEMBLY



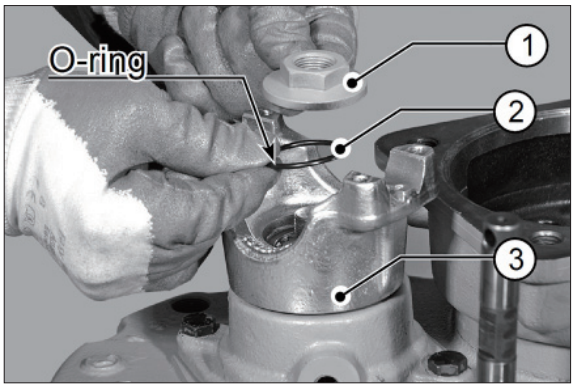
(1) Remove the gear control cylinder.
For more details, see : REMOVAL OF HYDRAULIC GEAR CONTROL



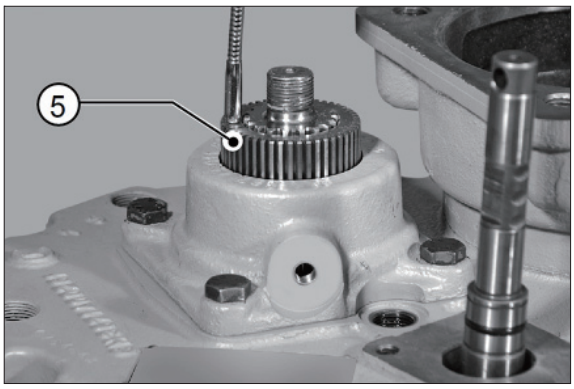
(2) Unloose the nut (1) from the flange (3).



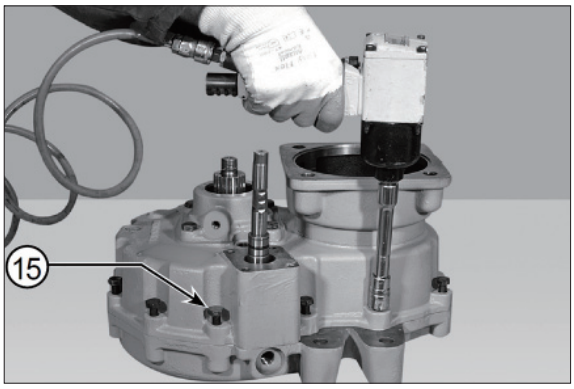
(3) Remove the nut (1) and O-ring (2) and pull out the flange (3).



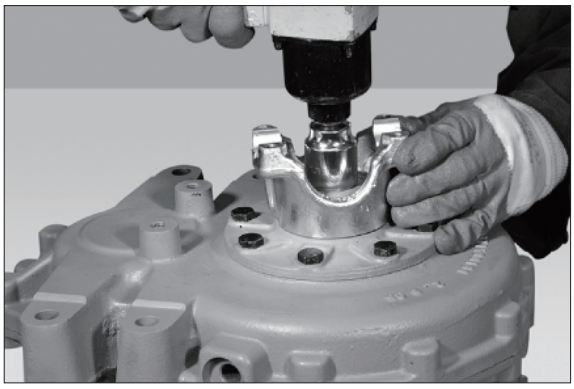
(4) Remove the phonic end disk (5).



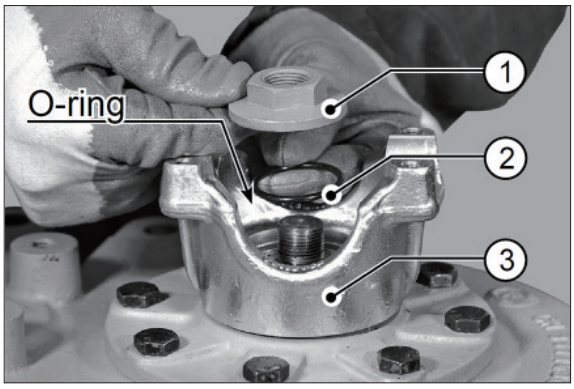
(5) Remove screws (15) of the cover (40).



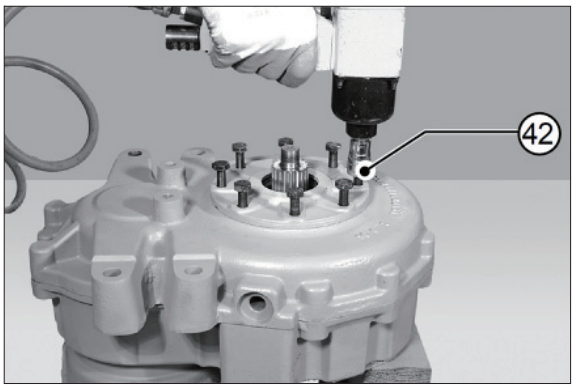
(6) Unloose the nut (10) from the flange (12).



(7) Remove the nut (1) and O-ring (2) and pull out the flange (3).

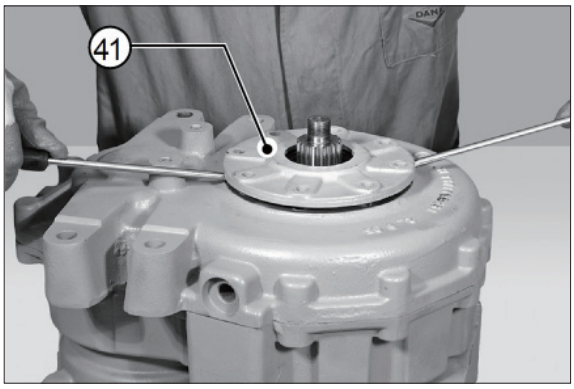


(8) Loosen and remove the check screws (42) of the cover (41).



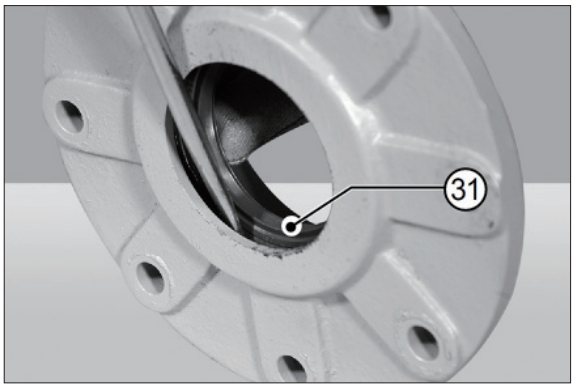
(9) Disjoin and remove the cover (41).

※ Carefully remove all residue of loctite from the surfaces.



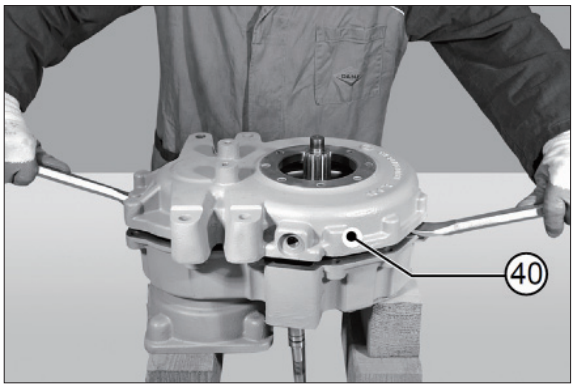
(10) Remove seal ring (31).

※ Note down direction of installation.

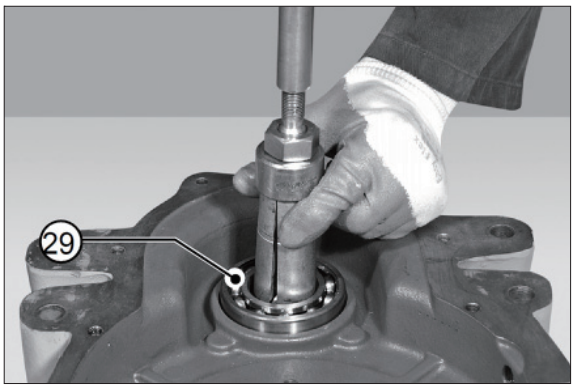


(11) Disjoin and remove the cover (40).

※ Carefully remove all residue of loctite from the surfaces.

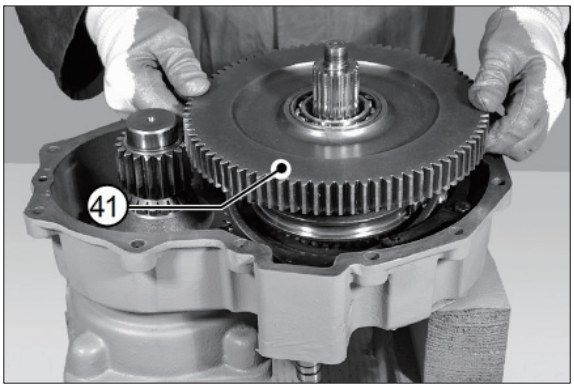


(12) Using an internal extractor, remove the bearing (29).

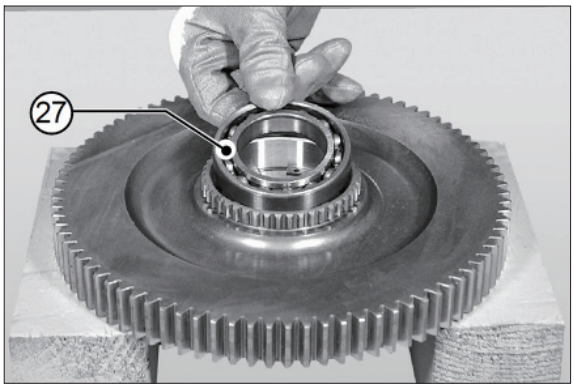


(13) Remove gear (41).

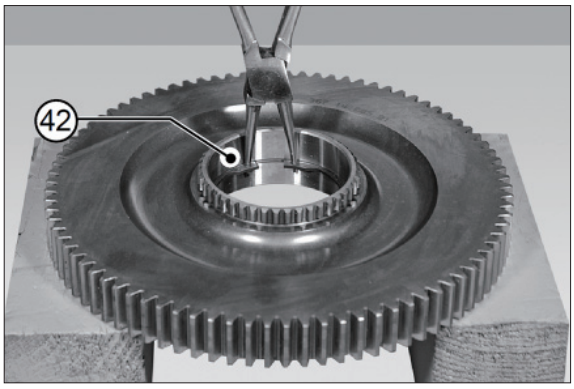
※ Note the correct mounting direction.



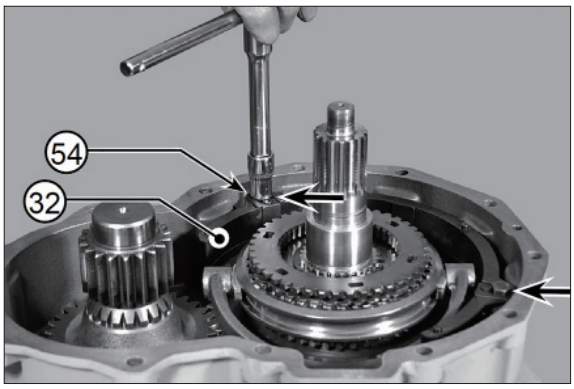
(14) Remove the bearing (27) from the gear (41).



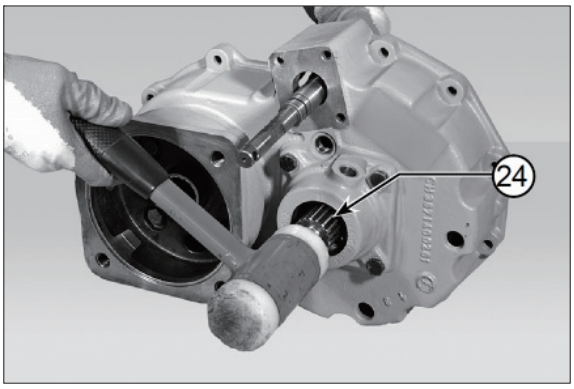
(15) Remove the snap ring (42).



(16) Remove the baffle plate (32) and retainer screws (54).

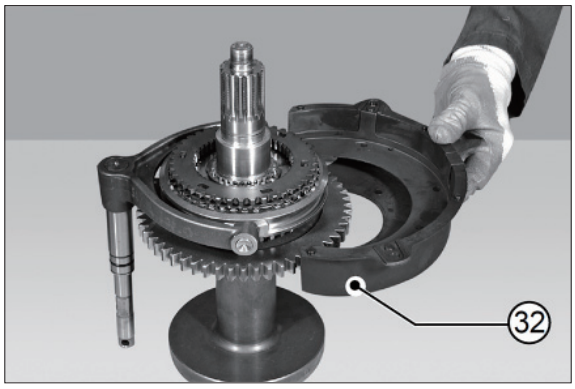


(17) Remove the lower shaft (24).



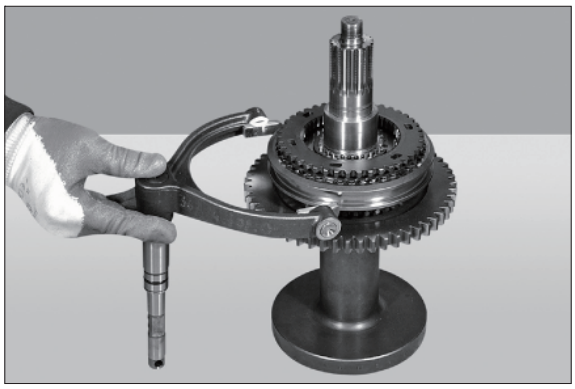
(18) Secure the lower shaft assembly to a hoist.
Remove the lower shaft assembly, complete with yoke and gearbox control rod.

(19) Remove the internal baffle plate (32).



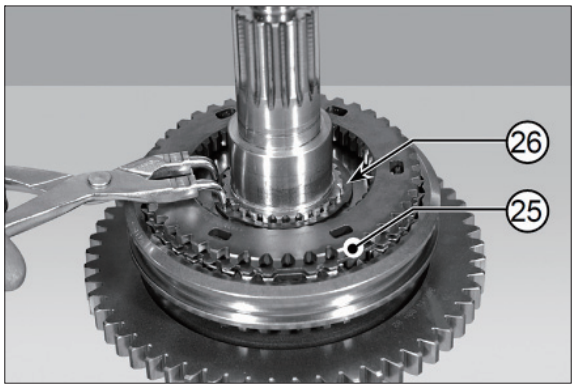
(20) Remove yoke and gearbox control rod.
Check the yoke pads for wear.

※ Replace if worn.



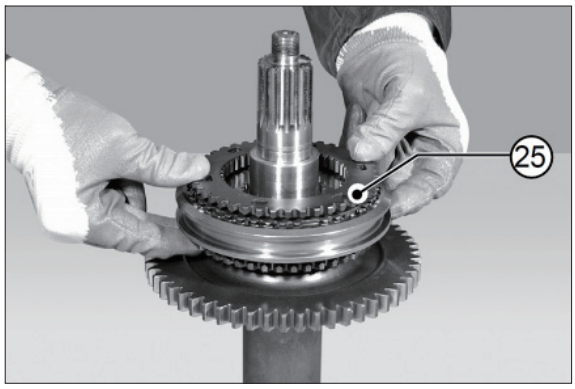
(21) Remove the snap ring (26) securing the synchroniser (25).

※ Take care not to bend the snap ring (26).



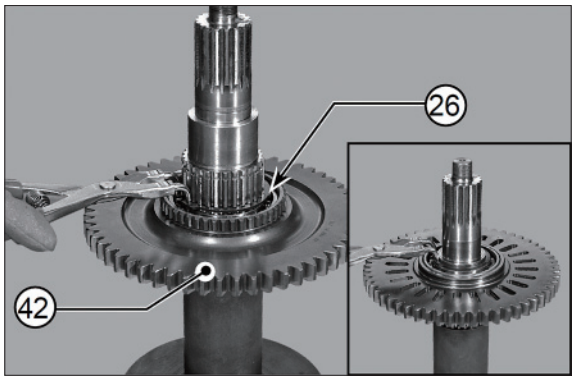
(22) Remove the complete synchroniser (25).

※ Note the correct mounting direction.



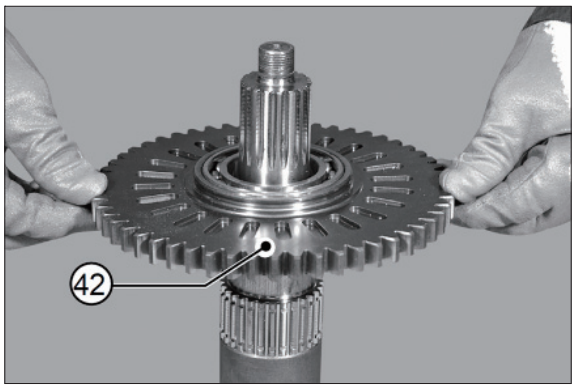
(23) Repeat the operation on both sides.
Remove the snap ring (23) securing the gear (42).

※ Take care not to bend the snap ring (23).

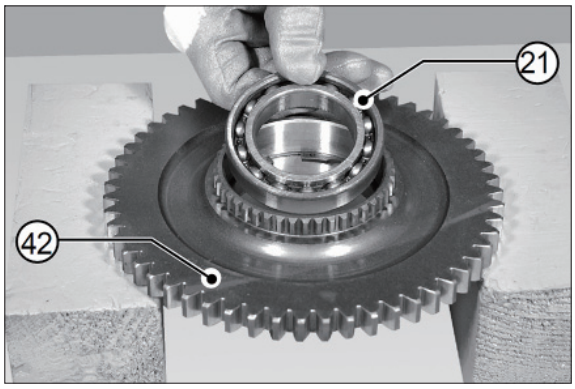


(24) Remove gear (42).

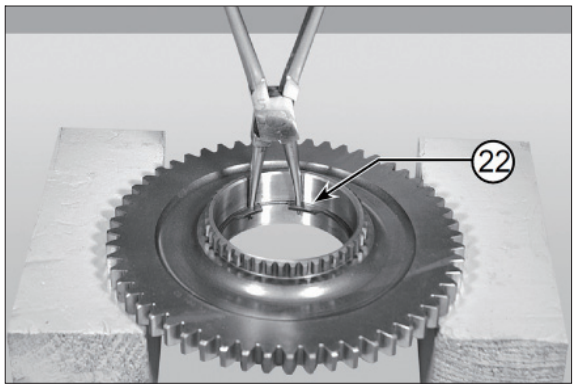
※ Note the correct mounting direction.



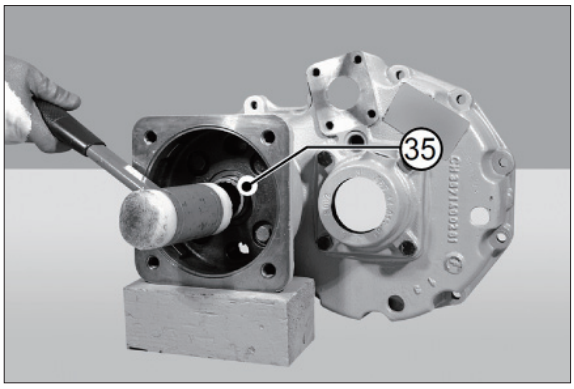
(25) Remove the bearings (21) from the gear (42).



(26) Remove the snap ring (22).

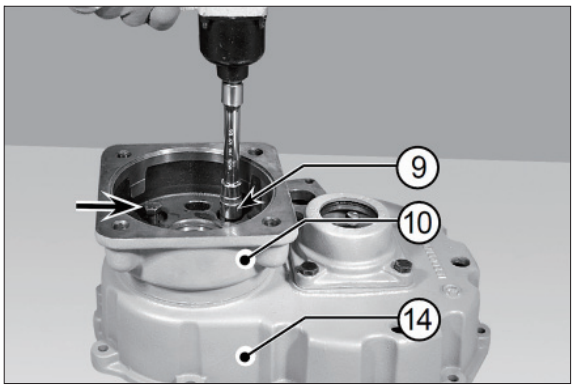


(27) Remove the upper shaft (35).



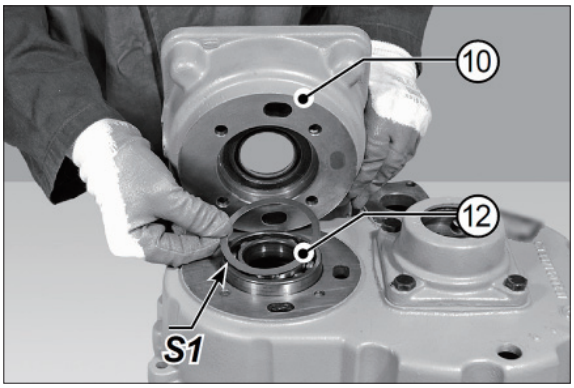
(28) Input shaft

Mark the position between the motion entrace cover (10) and reduction gear cover (14); remove screws (9) from the motion entrace cover (10).



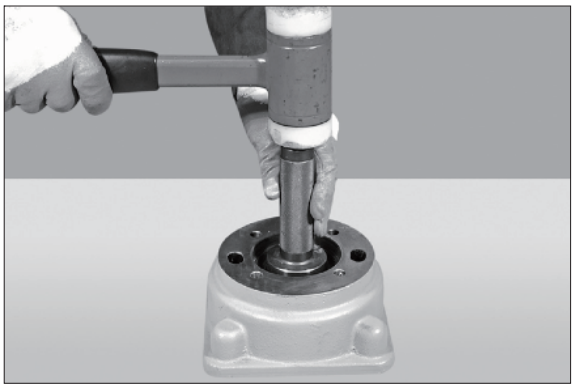
(29) Remove the cover by fixing the distance washers (12) onto the cover (10) itself.

※ Carefully remove all residue of loctite from the surfaces.

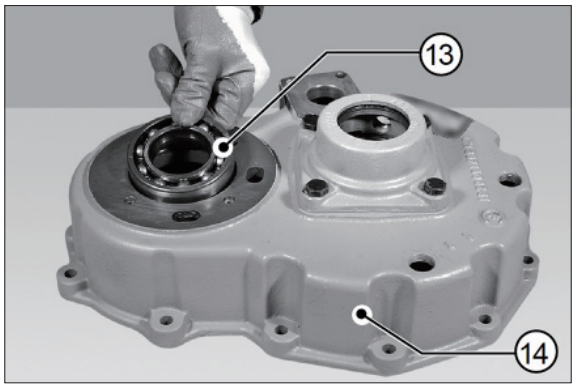


(30) Remove seal ring (11).

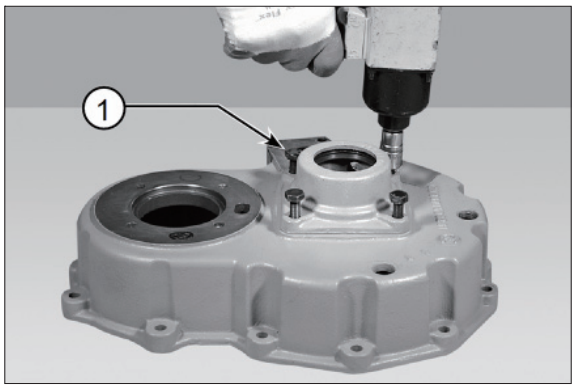
※ Note down direction of installation.



(31) Remove the bearing (13) from the cover (14).

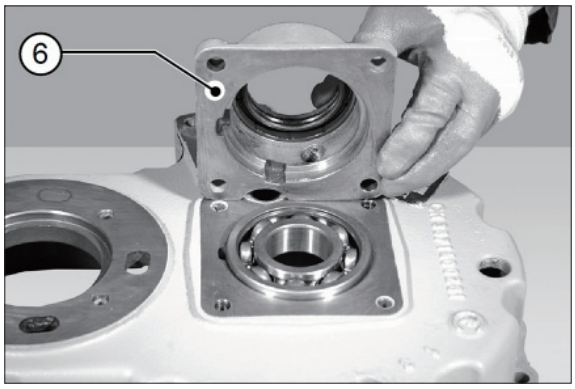


(32) Loosen and remove the check screws (4) of the cover (6).

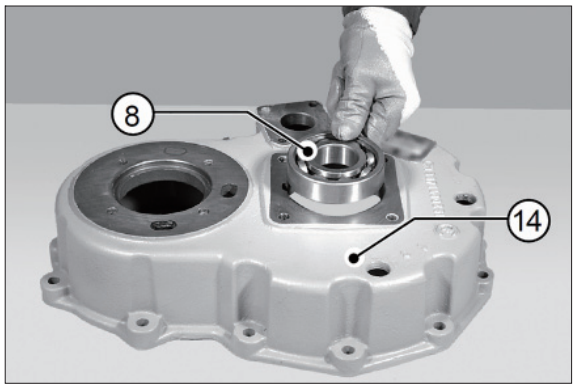


(33) Disjoin and remove the cover (6).

※ Carefully remove all residue of loctite from the surfaces.

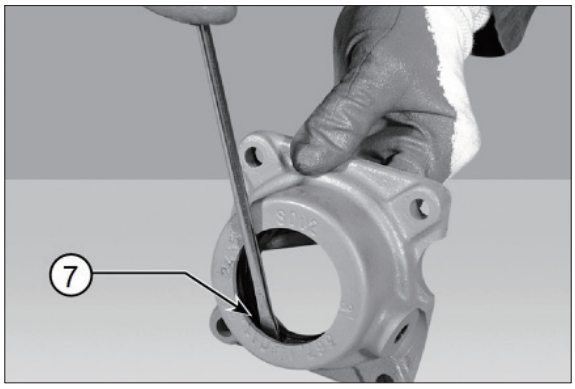


(34) Remove the bearing (8) from the cover (14).

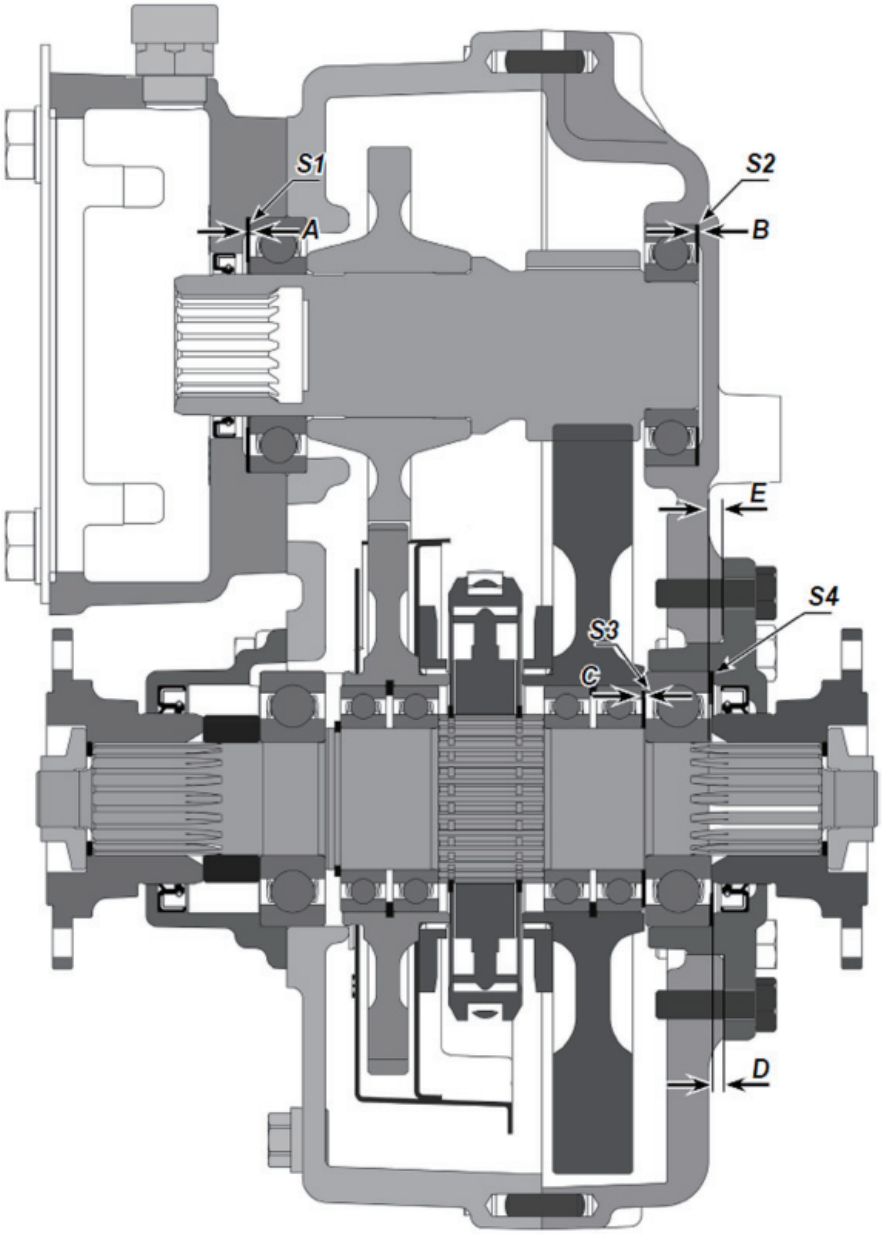


(35) Remove seal ring (7).

※ Note down direction of installation.



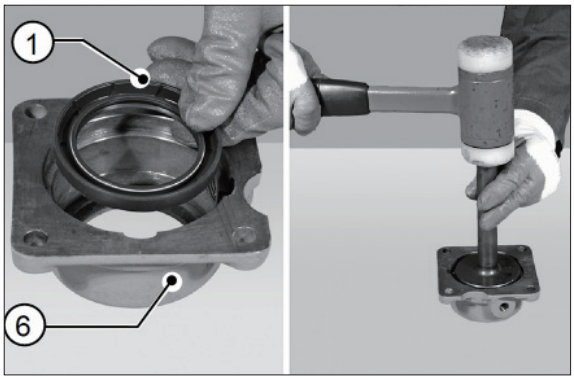
2) ASSEMBLY



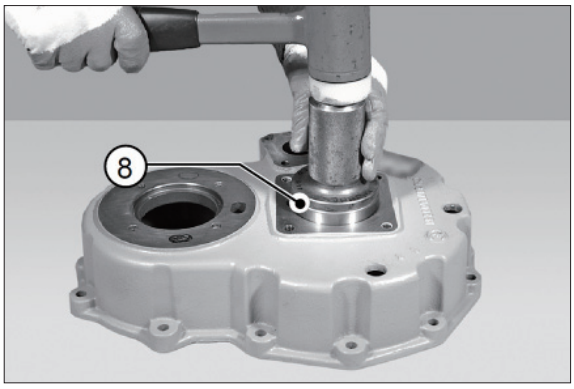
(1) Re-insert the new sealing ring (7) in the output cover (6).

※ Pay particular attention to the direction of assembly of the rings (7).

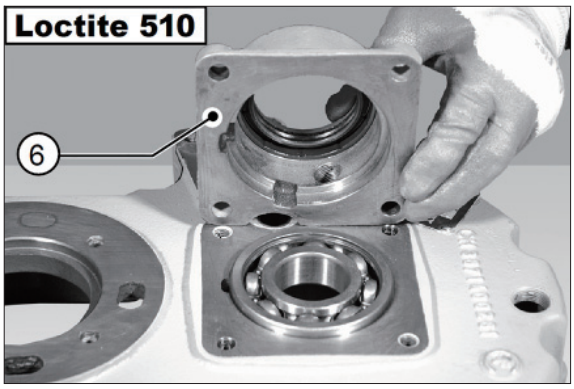
Lubricate the lip of the sealing ring with grease.



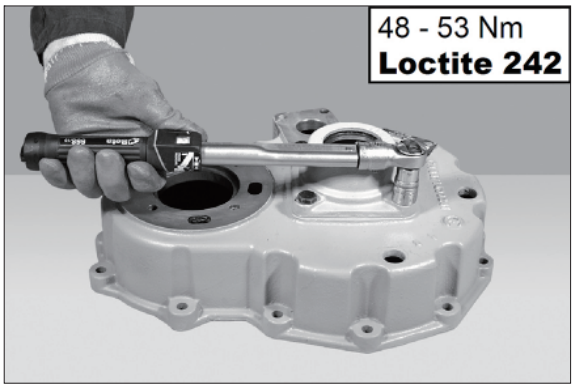
(2) Using a normal tool insert the bearing (8).



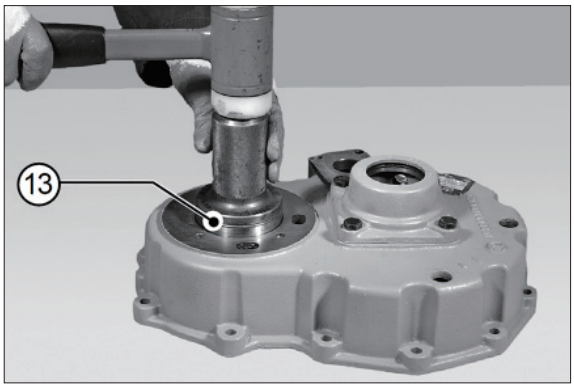
(3) Assembly the cover (16) spreading loctite 510 on planes.



(4) Assembly the screws (4) spreading loctite 242.
Tighten screws (4) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



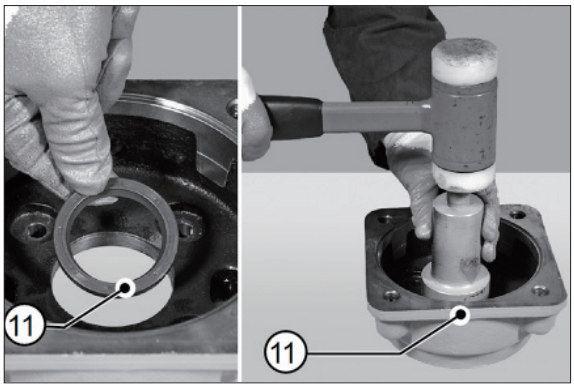
(5) Using a normal tool insert the bearing (13).



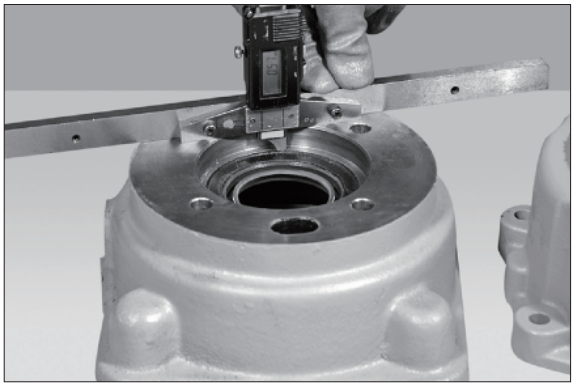
(6) Re-insert the new sealing ring (11) in the motion input cover (10).

※ Pay particular attention to the direction of assembly of the rings (11).

Lubricate the lip of the sealing ring with grease.

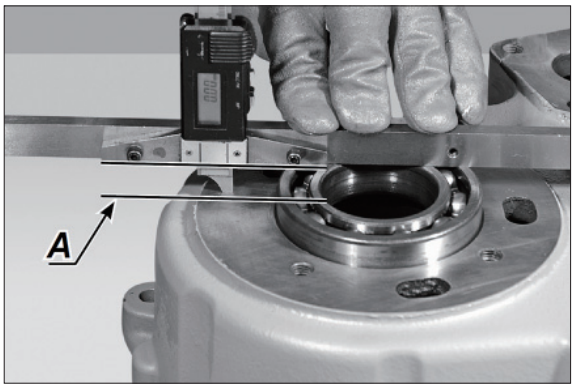


(7) Zero the depth gauge between the cover surface and bearing contact surface.



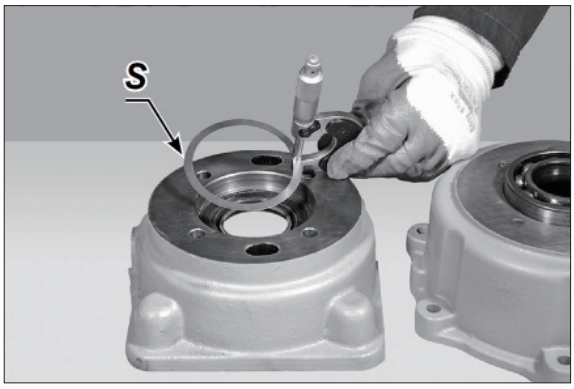
(8) Measure distance “A” between the surface and thrust block.

· Example : A = 0.50

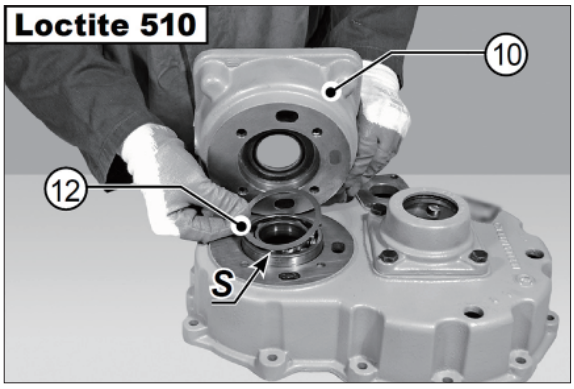


(9) Calculate thickness “S” of the shims by using this formula :
S = A - Y = S, where Y is the predefined axial backlash.
Y = backlash = 0.15 ± 0.35 mm
Example : S=A-Y=0.50-0.25=0.25 mm=S

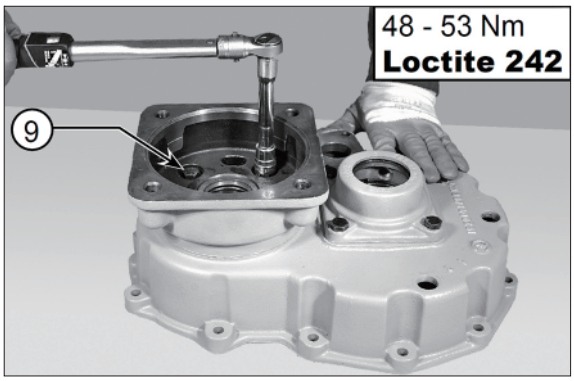
Make up the appropriate pack of shims.



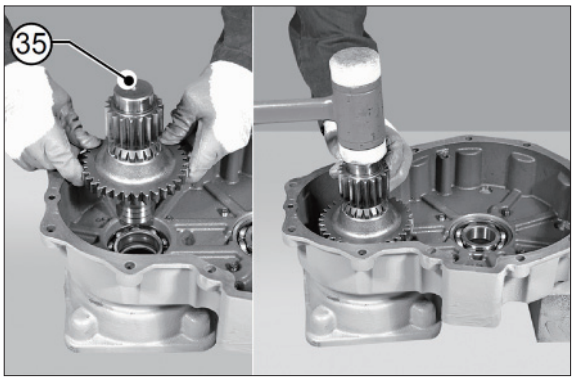
(10) Apply loctite 510 to the machined surfaces.
Assembly the cover (10) and shims (12).



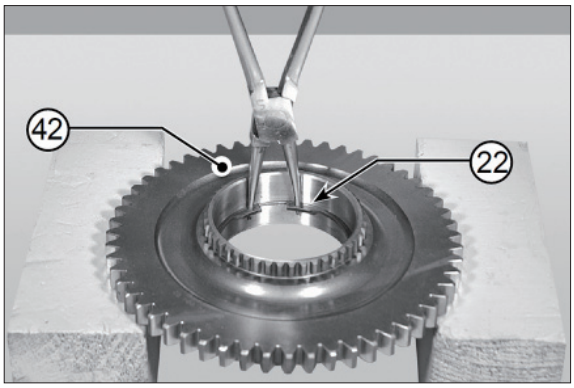
(11) Assembly the screws (9) spreading loctite 242.
Tighten screws (9) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



(12) Install the drive side shaft (35) with a plastic hammer.

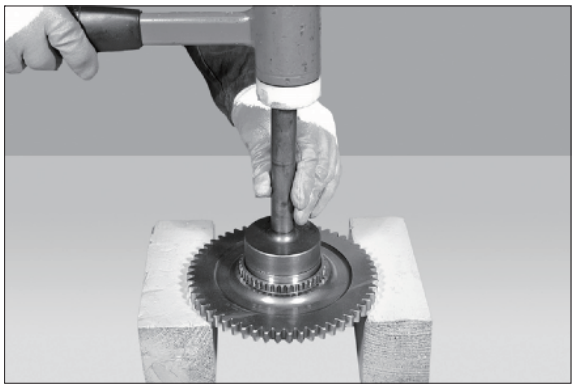


(13) Fit the snap ring (22) in the gear (42).



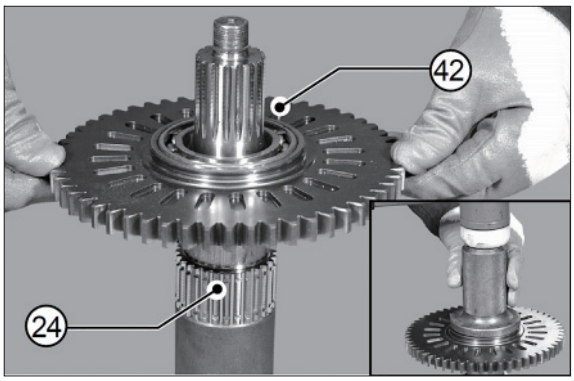
(14) Using a pusher of suitable diameter, fit the bearings (21).

※ Ensure that the bearing is seated securely.

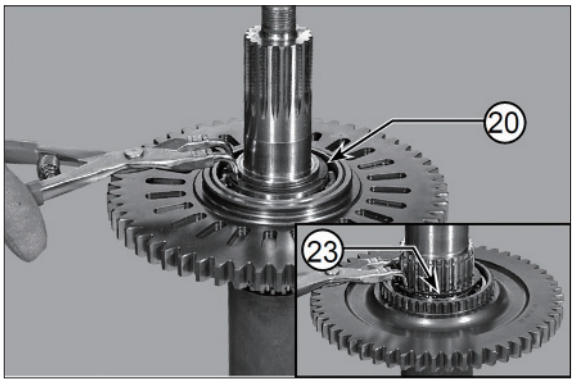


(15) Fit gear (42) onto the shaft (24).

※ Fit as originally mounted, using the markings made previously as reference.

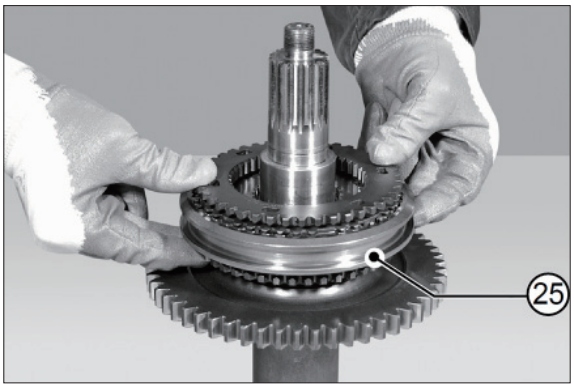


(16) Repeat the operation on both sides. Secure the gear (42) in position with the snap ring (20), (23).



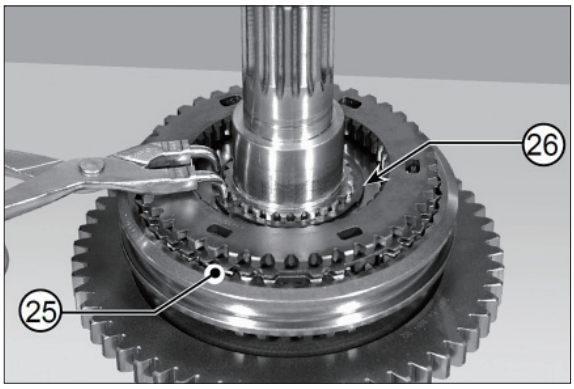
(17) Fit the complete synchroniser (25).

※ Fit as originally mounted, using the markings made previously as reference.

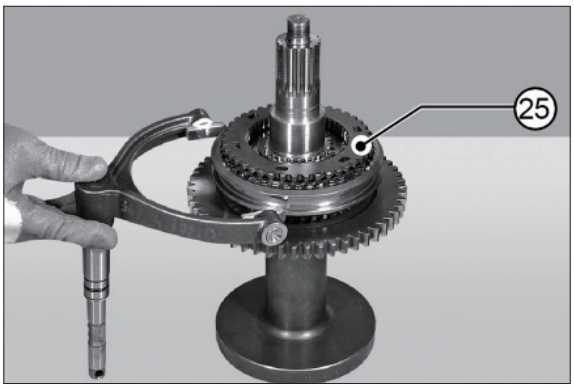


(18) Secure the synchroniser (25) in position with the snap ring (26).

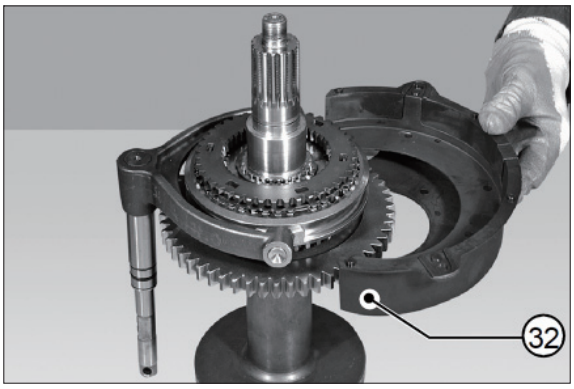
※ Check that the snap ring is seated correctly.



(19) Fit the gear selector yoke in the synchroniser (25).

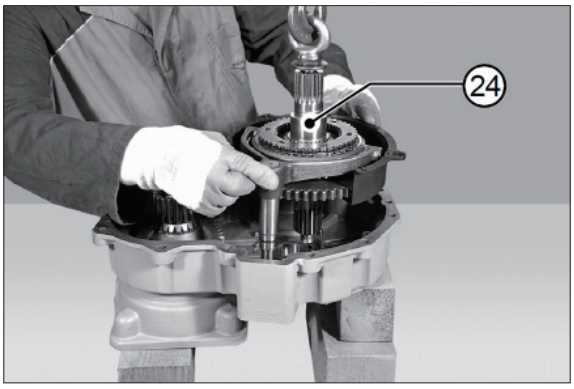


(20) Fit the internal baffle plate (32) in position.

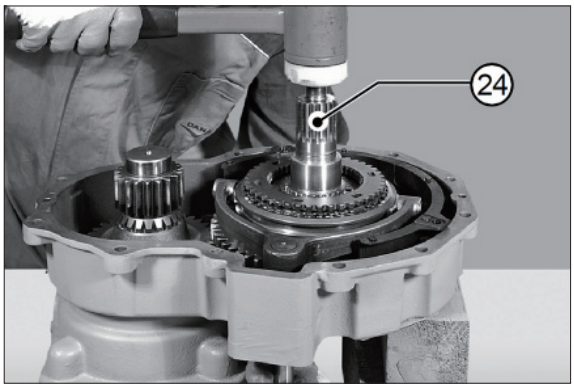


(21) Secure the lower shaft assembly (24) to a hoist.

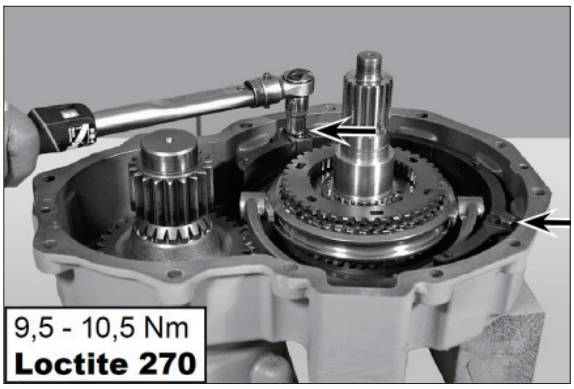
Install the lower shaft assembly (24), complete with yoke and gearbox control rod.



(22) Using a plastic hammer, install the lower shaft (24).

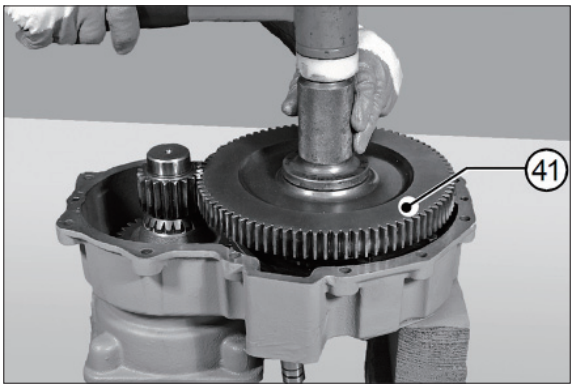


(23) Spread loctite 270 on the screws and tighten to a torque of 0.97~1.07 kgf · m (7.02~7.74 lbf · ft).

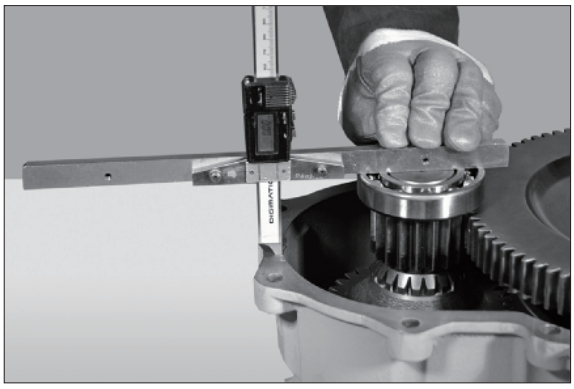


(24) Using a pusher of suitable diameter, fit gear (41) onto the shaft (24).

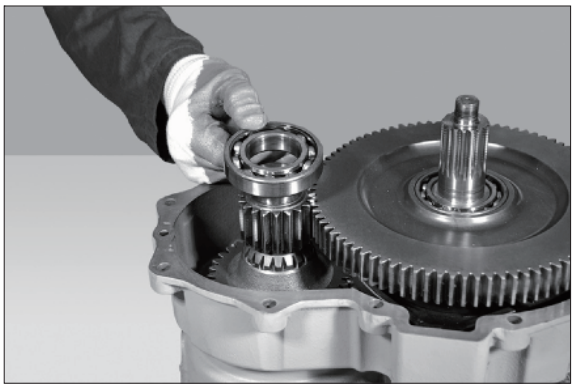
※ Fit as originally mounted, using the markings made previously as reference.



(25) By hand install the bearing on the input shaft.
Reset a digital depth gauge between cover surface and bearing.

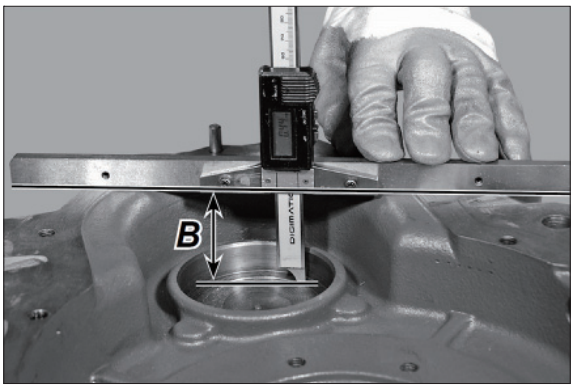


(26) Remove the bearing (75) from the input shaft (73).

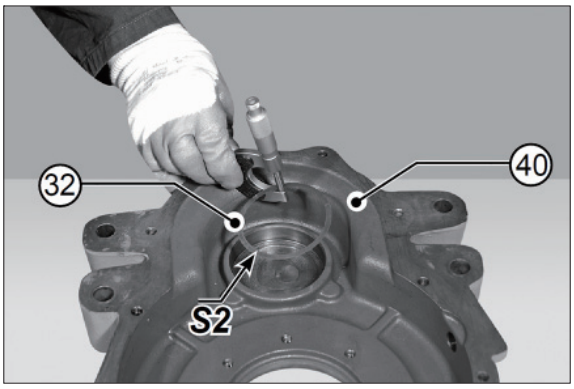


(27) Measure distance “B” between the cover surface and bearing contact surface.

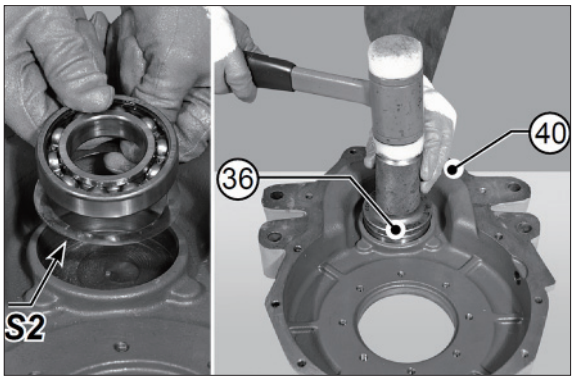
· Example : B = 0.45



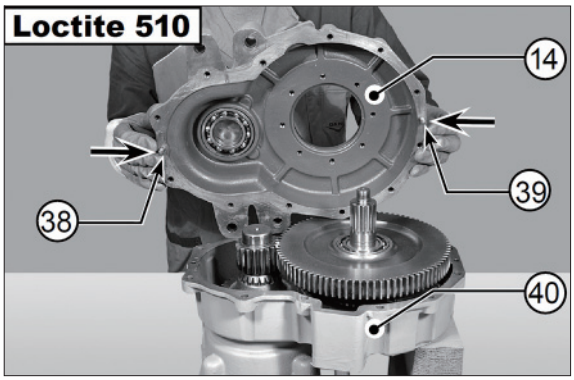
(28) Calculate thickness “S2” of the shims by using this formula :
S2 = B - Y = S2, where Y is the predefined axial backlash.
Y = backlash = 0.15 ± 0.35 mm
Example :
S2 = B-Y = 0.45 - 0.25 = 0.20 mm = S2
Make up the appropriate pack of shims.



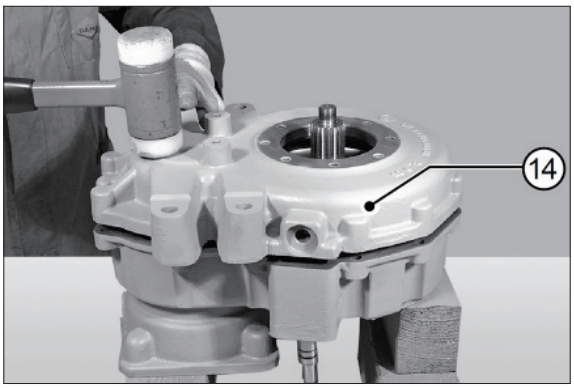
(29) Using a normal tool, push the bearing (36) and shims into its seat in the cover (40).



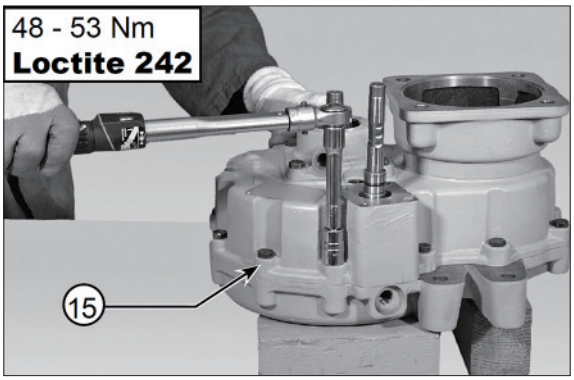
(30) Insert guide bushings (38), (39) .
Apply loctite 510 to the machined surfaces, Fit the cover (14) onto the casing (40) and align the pins (38), (39).



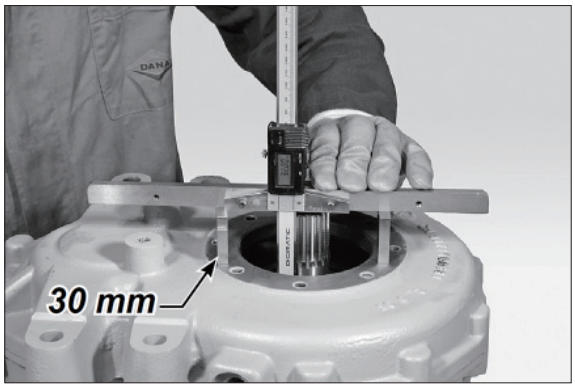
(31) Tap the cover (14) gently with a mallet to seat correctly.

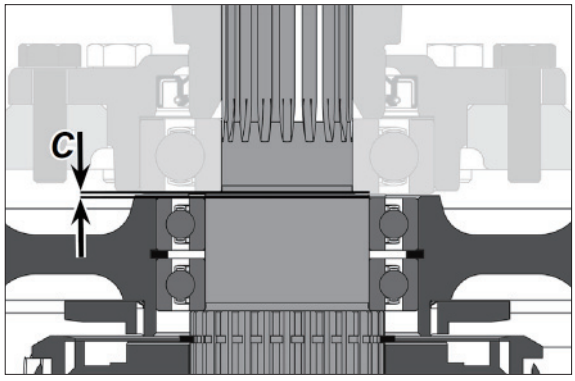


(32) Spread loctite 242 on the screws (15).
Secure in position with the screws (15), tightening to a torque of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



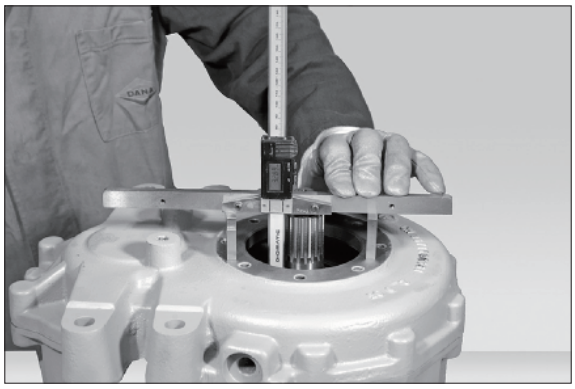
(33) Reset a centesimal digital depth gauge between calibrated blocks (whose known thickness is 30 mm) and output shaft.





(34) Measure distance “C” between the output shaft and bearing thrust block.

· Example : C = 0.45



(35) Calculate thickness “S3” of the shims by using this formula :

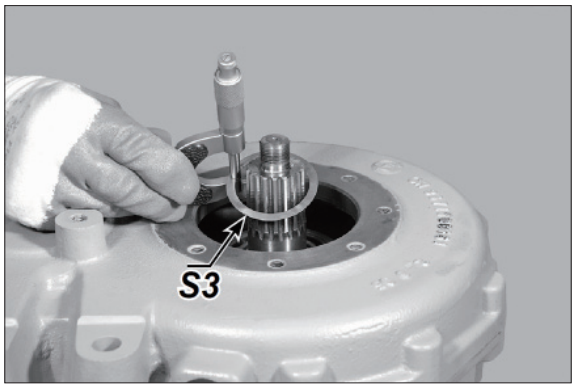
S3 = C - X = S3, where X is the predefined axial backlash.

X = backlash = 0.15 ± 0.35 mm

Example :

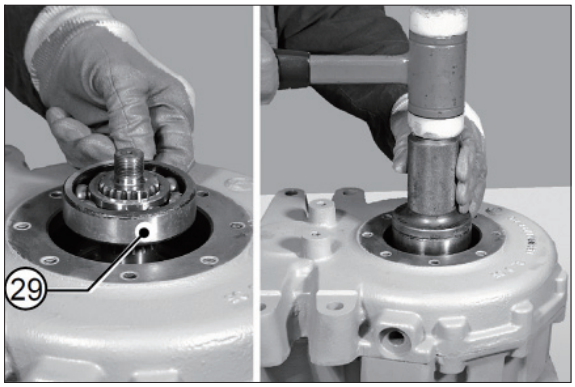
S3 = C-X = 0.45 - 0.25 = 0.20 mm = S3

Make up the appropriate pack of shims.



(36) Using a pusher of suitable diameter, fit the bearing (29) into output shaft (24).

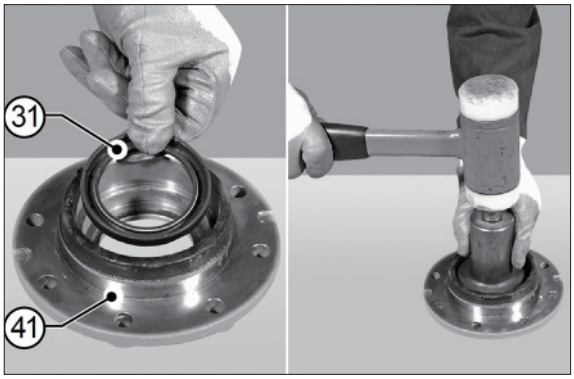
※ Ensure that the bearing is seated securely.



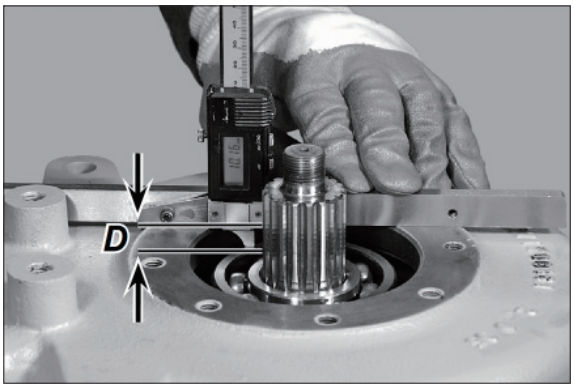
(37) Re-insert the new sealing ring (31) in the motion output cover (41).

※ Pay particular attention to the direction of assembly of the rings (31).

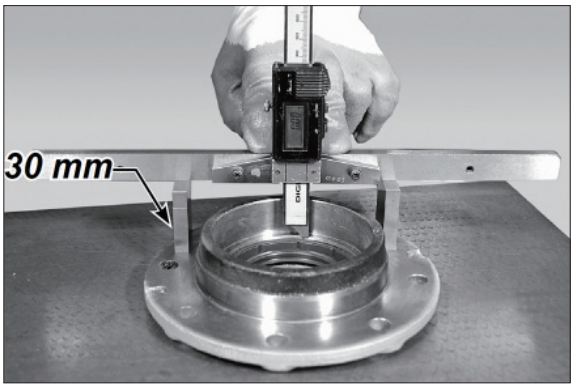
Lubricate the lip of the sealing ring with grease.



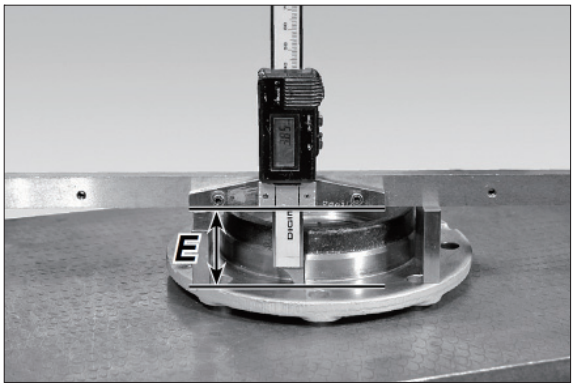
(38) Measure distance “D” between cover surface and bearing.



(39) Zero the depth gauge between calibrated blocks (whose known thickness is 30 mm) and bearing seat.

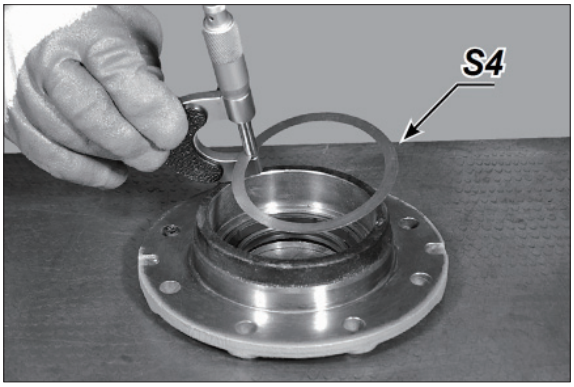


(40) Measure dimension “E” on the cover.



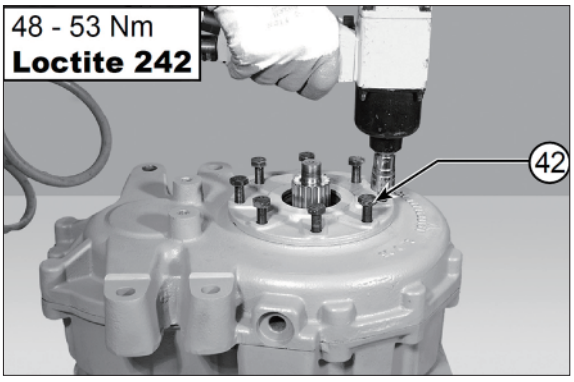
(41) Calculate thickness “S4” of the shims by using this formula :
S4 = (Dimension E - Dimension D) - X = S4, where X is the predefined axial backlash.
X = backlash = 0.15 ± 0.25 mm
Example : S4 = (E-D)-X = (3.85-3.40)-0.20 = 0.25 mm =S4

Make up the appropriate pack of shims.

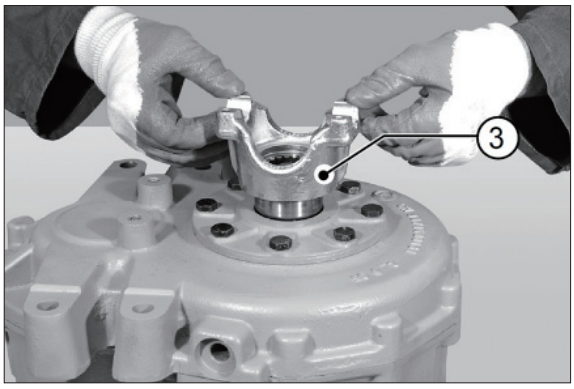


(42) Assembly the cover (41) spreading loctite 510 on planes.

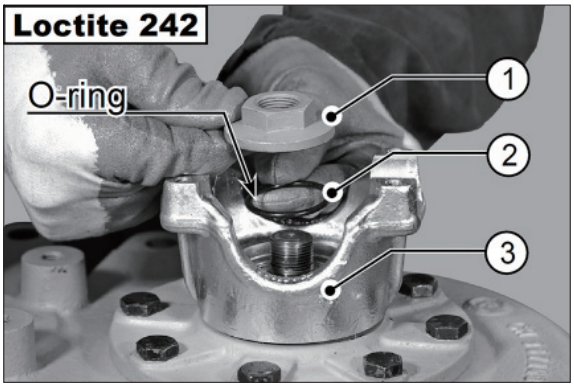
(43) Assembly the screws (42) spreading loctite 242.
Tighten screws (42) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



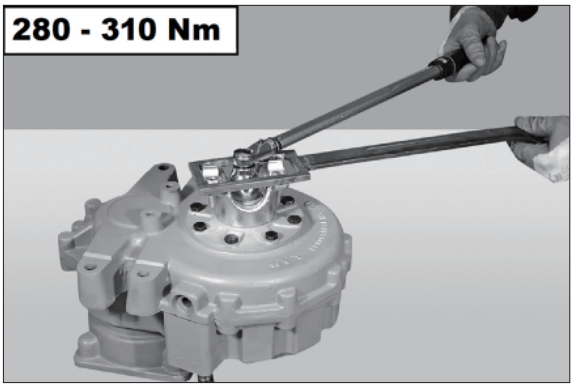
(44) Fit the flange (3) on the shaft (24), seating completely.



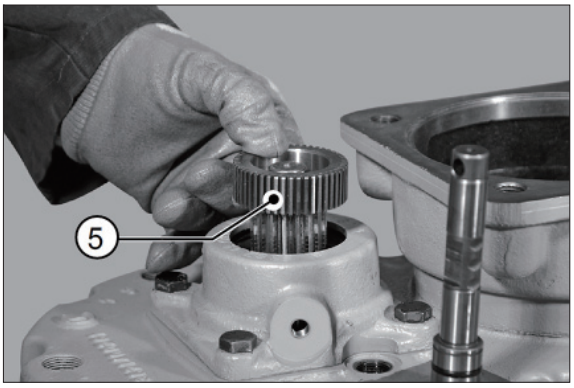
(45) Lubricate the O-ring (2) with grease and fit in the flange (3) seating.
Spread with loctite 242 the lock nut (1) and fit.



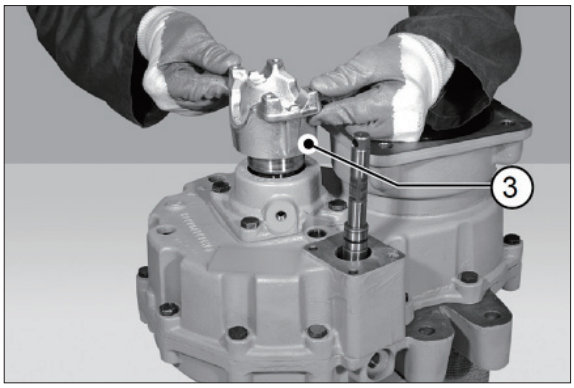
(46) Tighten the lock nut (1) to a torque of 28.6~31.6 kgf · m (207~229 lbf · ft).



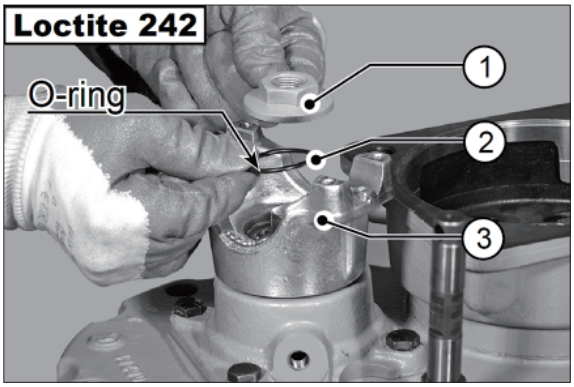
(47) Insert the phonic end disk (5).



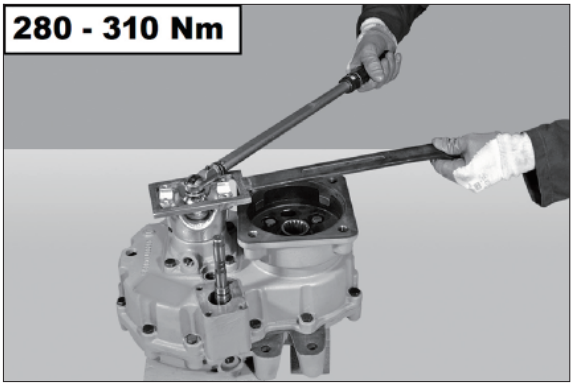
(48) Fit the flange (3) on the shaft (24), seating completely.



(49) Lubricate the O-ring (2) with grease and fit in the flange (3) seating.
Spread with loctite 242 the lock nut (1) and fit.

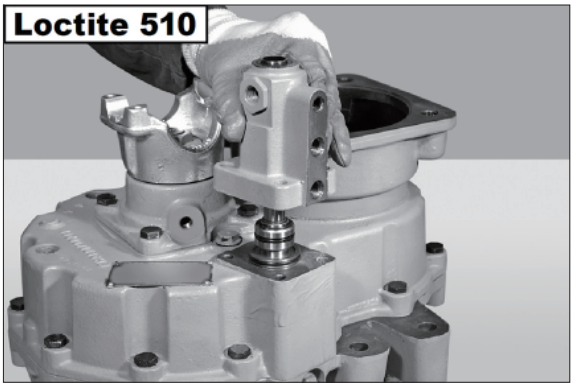


(50) Tighten the lock nut (1) to a torque of 28.6~31.6 kgf · m (207~229 lbf · ft).



(51) Coat the coupling surface of the gearshift cylinder with loctite 510 ; fit the cylinder on the gear selector rod.

※ Make sure that the sealant forms a continuous film around the locking holes.
For more details, see : INSTALLATION OF HYDRAULIC GEAR CONTROL



GROUP 6 STEERING VALVE

1. REMOVAL AND INSTALL

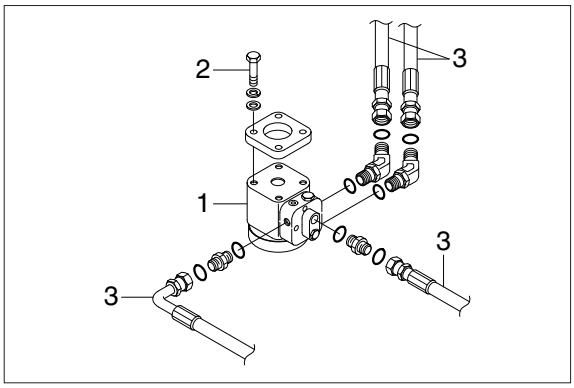
1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

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

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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



(4) Disconnect steering line hoses (3).

(5) Loosen the hexagon bolt (2) and remove the steering valve assembly (1).

· Tightening torque : 4.8 ± 0.3 kgf · m
(34.7 ± 2.2 lbf · ft)

2) INSTALL

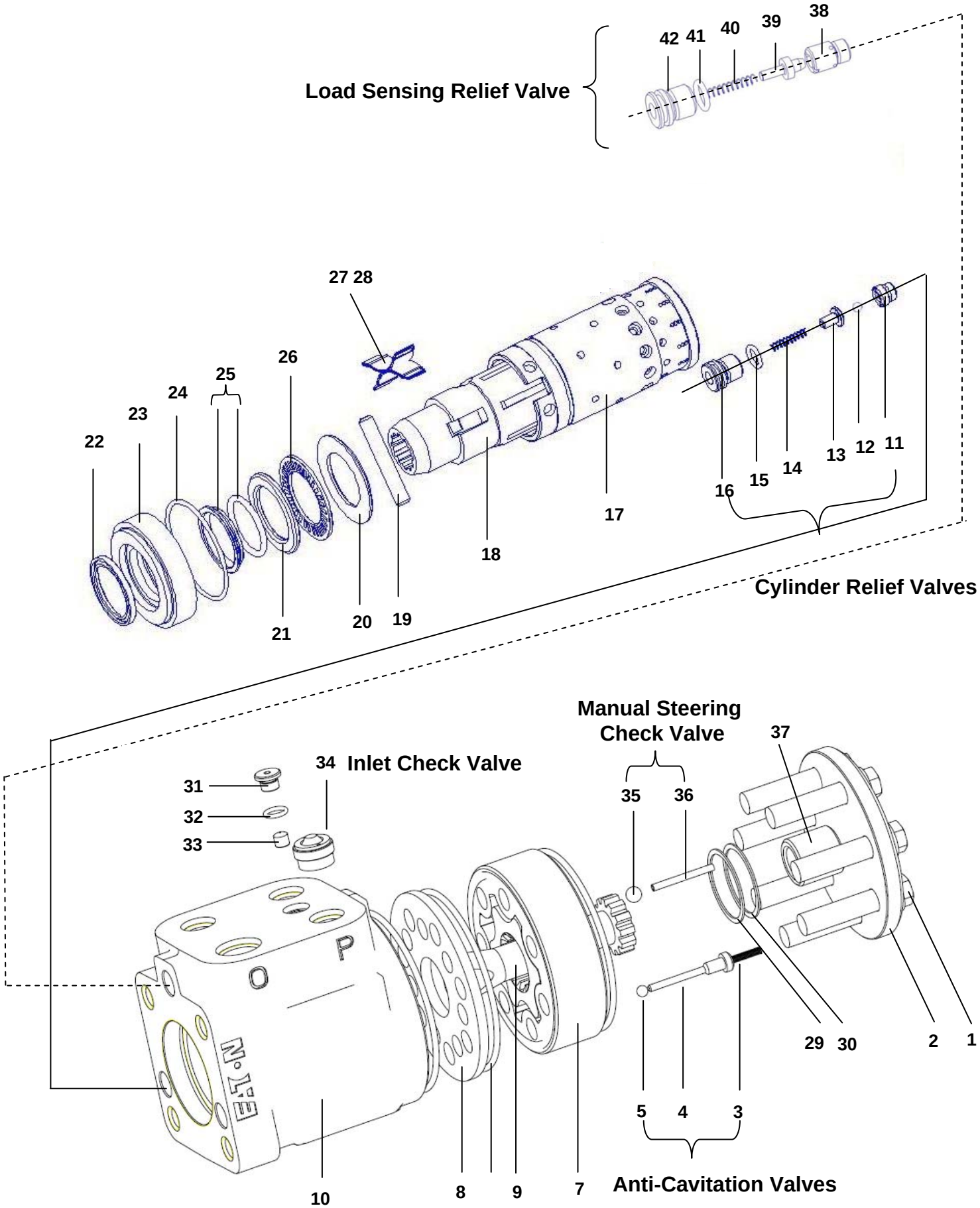
(1) Carry out installation in the reverse order to removal.

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

※ When removing the steering valve assembly, check that all the hoses have been disconnected.

2. STEERING VALVE

1) STRUCTURE



1. Cap Screw (M10)
2. End Cap
3. Spring
4. Plug
5. Ball 4mm
6. Seal, O-ring 77.5mm ID*
7. Gerotor
8. Spacer Plate
9. Drive
10. Housing
11. Valve Seat
12. Ball 5mm
13. Ball Holder
14. O-ring 7.6454mmID*
15. Spring
16. Plug
17. Sleeve
18. Spool
19. Pin
20. Bearing Race
21. Bearing Race
22. Dust Seal*
23. Gland Bushing
24. O-ring 43.2mm ID
25. Shaft Seal Kit*
26. Needle Thrust Bearing
27. Spring
28. Spacer
29. Back-up Washer*
30. Ring, Seal*
31. Plug
32. O-ring 6.07mm ID*
33. Screw, Set
34. Inlet Check Valve
35. Ball 7mm
36. Roll Pin
37. Spacer
38. Valve Set
39. Poppet
40. Spring
41. O-ring 7.6454mmID*
42. Plug

Disassembly

Cleanliness is extremely important when repairing a steering cont rol unit. Work in a clean area. Before disc onnecting lines, clean port area of unit thoroughly. Use a wire brushto remove foreign material and debris from around external joints of the unit.

Note

Although not all drawings show the unit in a vice, we recommend that you keep the unit in vice during disassembly. Follow the clamping procedures explained throughout the manual.

Meter (Gerotor) End

1. Clamp unit in vice, Gerotor end up.
   Clamp lightly on edges of port face sides (see figure). Use protective material on vice jaws. Housing distortion can result if jaws are over- tightened.
2. Remove M10 cap screws.
3. Remove end cap.
4. Remove drive Spacer(If included)
5. Remove seal from Gerotor.

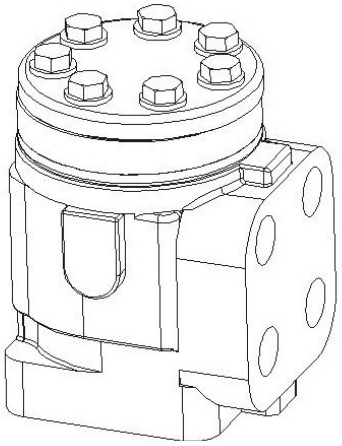


Figure 1

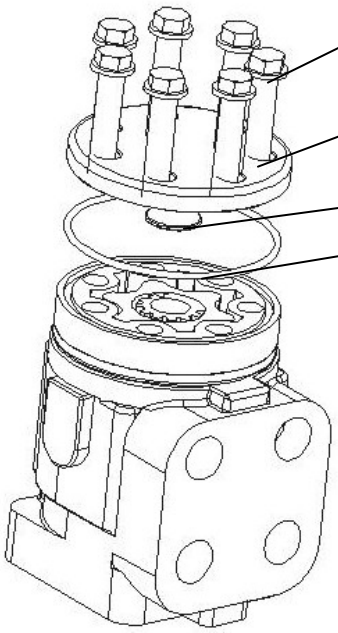


Figure 2

Disassembly

6. Remove Gerotor Set. Be careful not to drop star.
7. Remove seal .

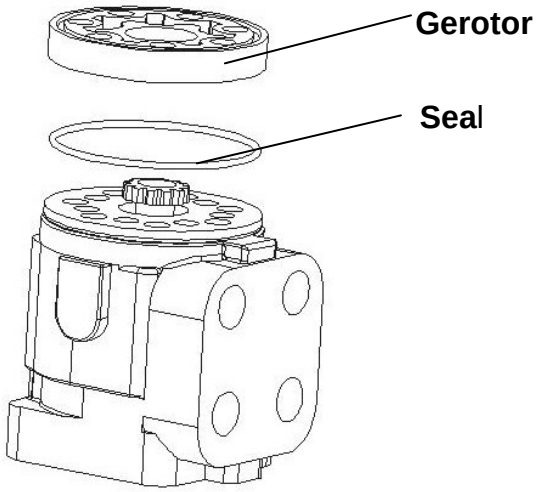


Figure 3

8. Remove drive.
9. Remove spacer plate .
10. Remove seal from housing.
11. Remove housing from vice.

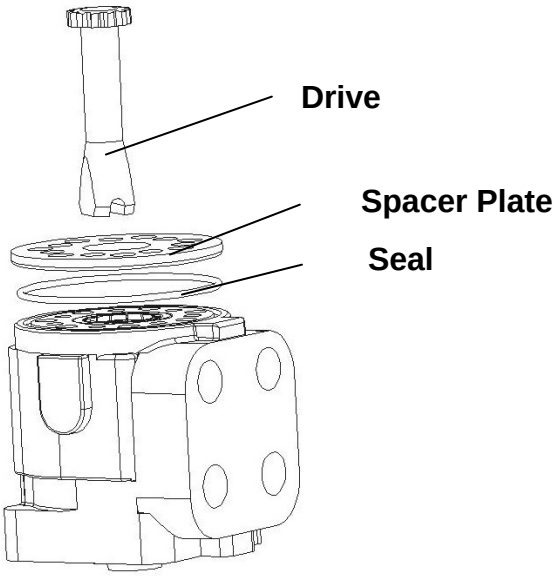


Figure 4

Disassembly

12. Carefully remove anti-cavitation check valves and manual steering check valve(roll pin and ball) from bolts holes, by tipping.

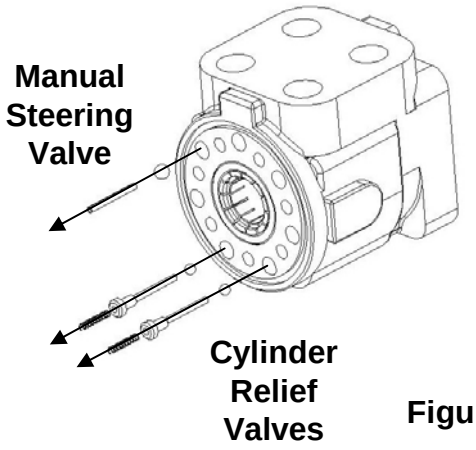


Figure 5

Note:Do not remove any valves other than manual steering check valve and anti-cavitation check valves. All other valves are factory preset and are non-serviceable

13. Carefully remove the spool-sleeve assembly from housing in upright position

Note: Do not cock spool- sleeve assembly in housing Rotate spool- sleeve assembly slowly when removing it from housing

14. Push pin from spool-sleeve assembly.

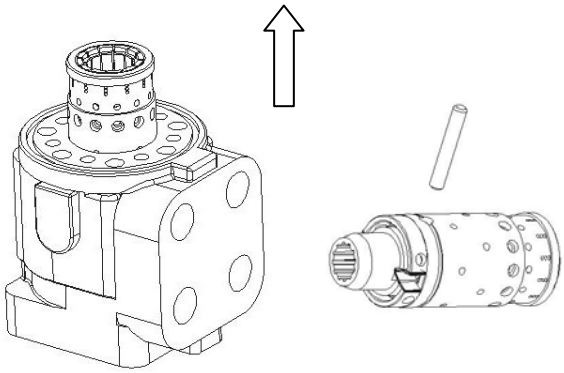


Figure 6

15. Remove the bearing race, needle thrust bearing and bearing race, step by step from the housing.

16. Remove Shaft seals from seal gland bushing.

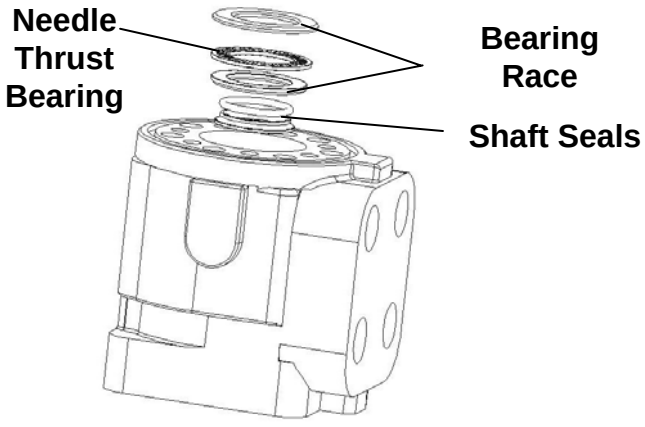


Figure 7

Disassembly

17. Push spool partially from control end of sleeve, then carefully remove centering springs from spool by hand (see figure). Low input torque unit use four centering springs and two spacers. Standard input torque unit use six centering springs.

    Make matching mark on spool and sleeve.

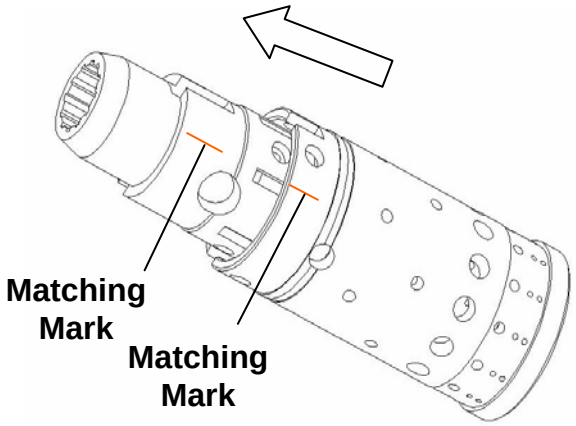


Figure 8

Note : There are different kinds of spool and sleeve set

Low torque Spring 370-000(4) and 21626-000(2)

Standard spring370-000(6)

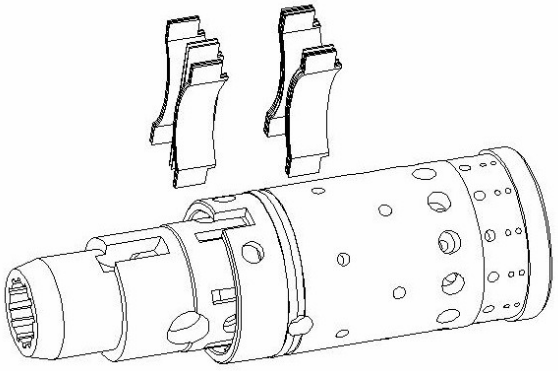


Figure 9

Reassembly

Check all mating surfaces, Replace any parts that have scratches or burrs that can cause leakage. Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper to wel because lint or other matter can get into the hydraulic system and cause damage. Do not use grit paper or file or grind these parts.

Note: Lubricate all seals with clean petroleum jelly (Vaseline). A good service policy is to replace all old seals with new seals. Do not use excessive lubricant on seals for Gerotor section.

1. Assemble spool and sleeve carefully so that spring slots line up at the same end. Rotate spool while sliding parts together.

Test for free rotation. Spool should rotate smoothly in sleeve with finger tip force applied at splined end. Align spool and sleeve by matching marks, if present. Otherwise, align spring slots in spool and sleeve and stand parts on bench

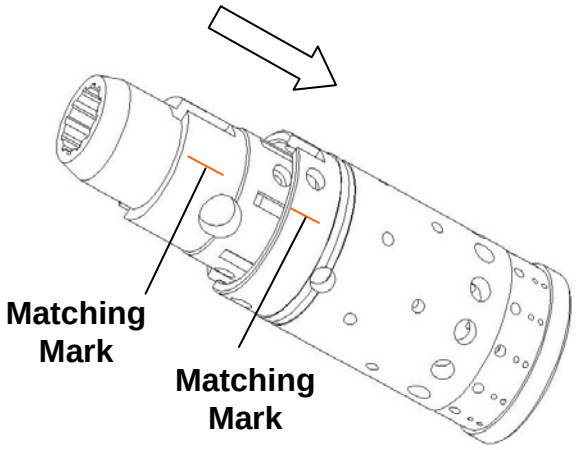


Figure 10

Reassembly

2. Centering springs for low input torque units have four arched springs with two flat spacers in the center as shown in figure.

   Centering springs for standard input torque units have six arched springs.

   Position centering springs so that the notches line up, and arched center sections are nested together. Next, with spring notches facing sleeve, insert one end of entire spring set into spring installation tool.

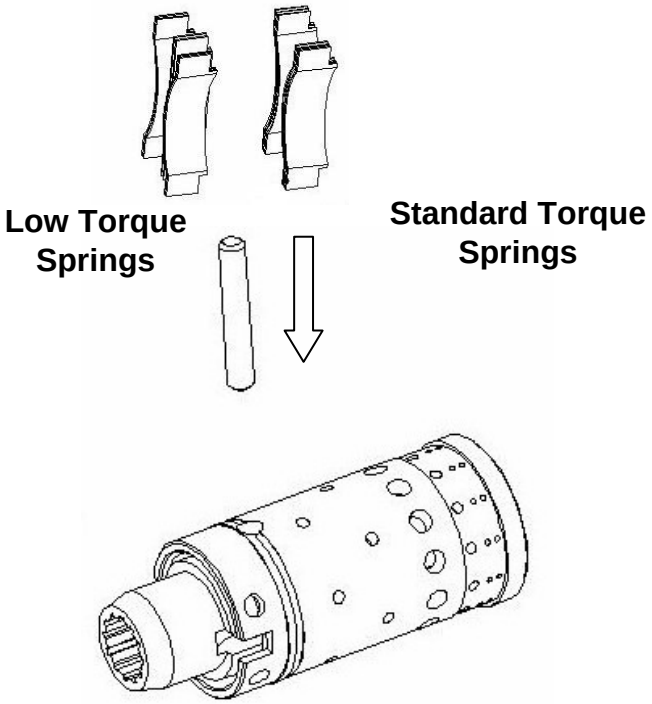


Figure 11

3. Compress extended end of spring set and push into spool-sleeve assembly. Keep pressure on spring ends while withdrawing installation tool and pushing forward on springs at same time.
4. Center spring set in spring slots. Seat springs down evenly and flush with upper surface of spool and sleeve
5. Insert pin through spool-sleeve assembly until pin is within the outside diameter of sleeve.

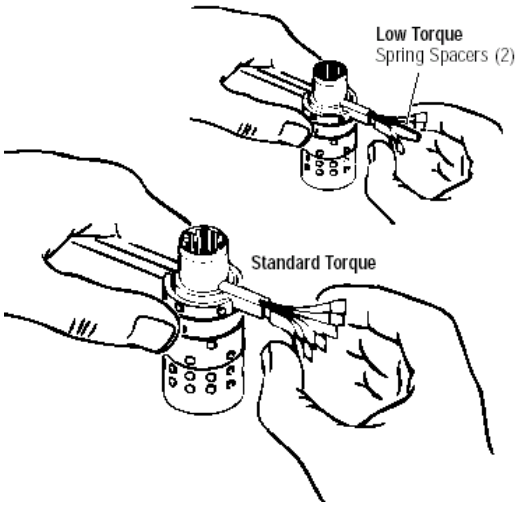


Figure 12

Reassembly

6. Lubricate seal (see parts list) before installation in seal gland bushing in housing. Use proper seal-installation tool, to make sure seal enters seal gland bushing without being cut or nicked.

   Do not use any seal that falls freely into counter-bore of seal gland bushing.

7. Install two bearing races and needle thrust bearing as shown in figure.

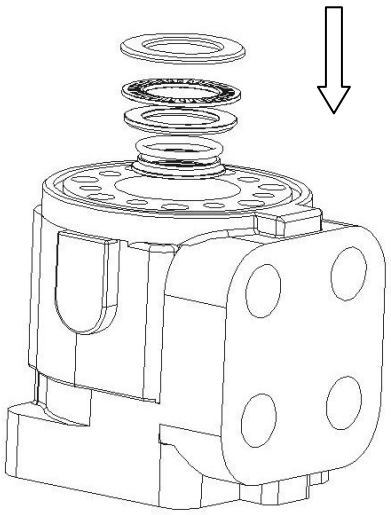


Figure 13

8. Position spool-sleeve assembly so that splined end of spool enters open end of housing first.

   Caution : While inserting spool-sleeve assembly into housing, make sure parts do not tilt out of position. Push assembly gently into place with slight rotating action, keeping pin from moving out and getting stuck in the internal groove.

   Bring spool-sleeve assembly entirely within housing bore. With spool-sleeve assembly in this flush position, check for free rotation within housing by turning assembly with fingertip force at splined end.

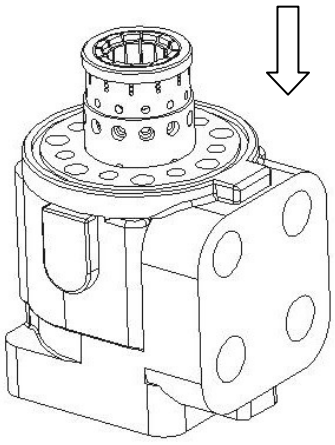


Figure 14

Reassembly

9. Clamp housing in vice, as shown in figure. Clamp lightly on edges of mounting area; do not over-tighten jaws.

   Note : Check to insure that spool and sleeve are flush or slightly below 14-hole surface of housing.

   Clean upper surface of housing by wiping with palm of clean hand. Clean each of the flat surfaces of parts in Gerotor section in a similar way just before reassembly. Do not use cloth or paper to clean surfaces.

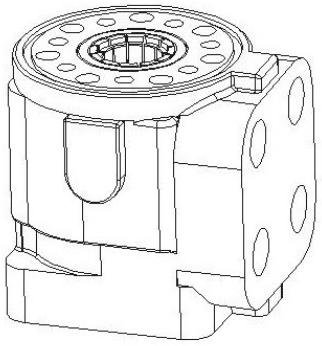


Figure 15

10. Install 77.5 ID seal in housing.
11. Install Anti-Cavitation check valves and manual steering check valve in holes, as shown in figure.
12. Install spacer plate. Align bolt holes in spacer plate with tapped holes in housing.

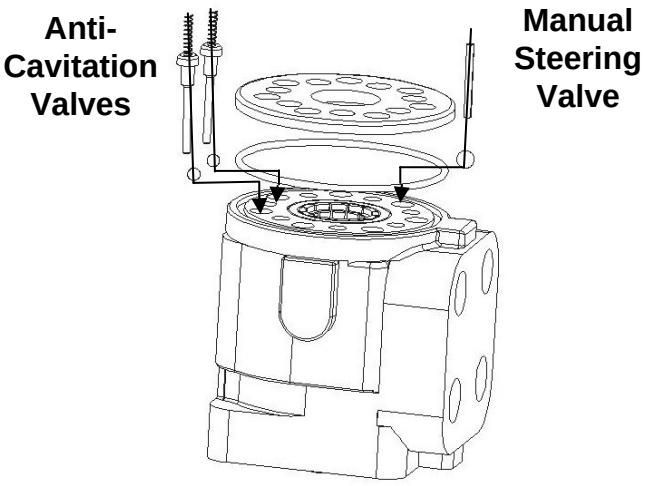


Figure 16

Reassembly

13. Rotate spool and sleeve assembly until pin is parallel with port face. Install drive, making sure drive is engaged with pin. To assure proper alignment, mark drive as shown in figure, When marking drive, note relationship of slotted end of drive to splined end of drive.
14. Lubricate and install 77.5 ID seal in Gerotor ring. The lubrication will hold seal in place.
15. Align star valleys with pin. Note parallel relationship of reference lines A,B,C and D in figure. Align bolts holes without disengaging Gerotor star from drive.

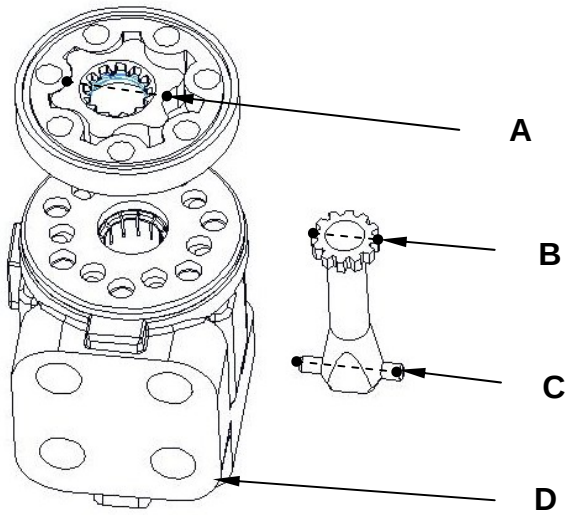


Figure 17

16. When used, install drive spacer in Gerotor star.
17. Lubricate and install 77.5 ID seal in Gerotor ring.
18. Install end cap on gerotor , aligning holes.
19. Install 7 dry cap screws in end cap. Pre-tighten screws to 17Nm, then torque screws to 35~40Nm in sequence show in figure.
20. Check for proper timing by turning the spool clockwise and feeling pressure in the “R” port.
21. Check the manual torque, the steering should turn freely.

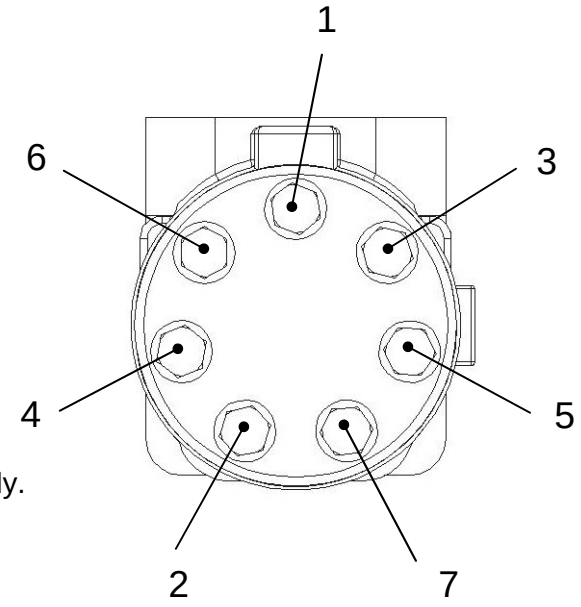


Figure 18

1. REMOVAL AXLE

1) FRONT

(1) Propeller shaft mounting nut (2, M10)
· Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)

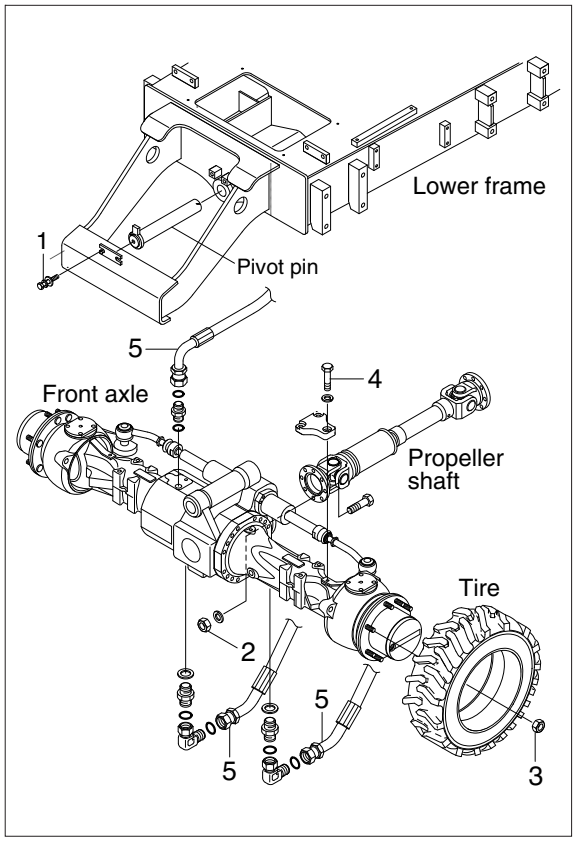
(2) Wheel nut (3, M18)
· Tightening torque : 46±3.0 kgf · m
(333±21.7 lbf · ft)

(3) Oscillating cylinder supporting mounting bolt (4, M12)
· Tightening torque : 12.8±3.0 kgf · m
(92.6±21.7 lbf · ft)

(4) Front axle mounting pin lock bolt (1, M10)
· Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)

(5) Hose assy (5)

(4) Front axle weight : 280 kg (610 lb)



2) REAR

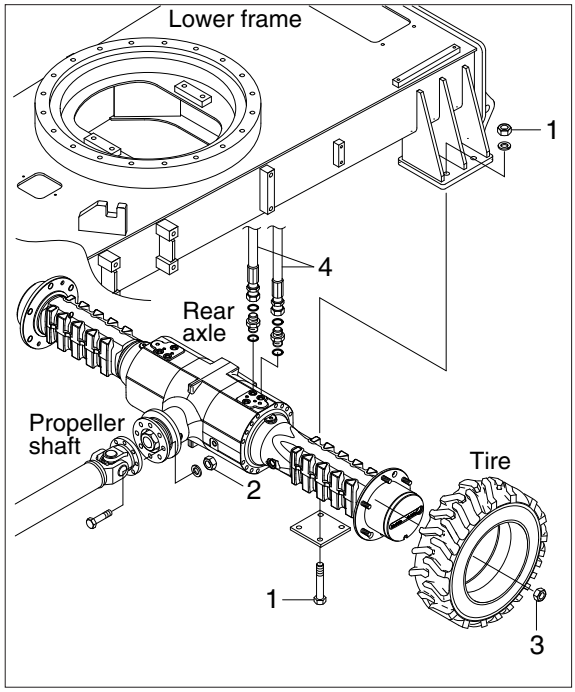
(1) Rear axle mounting bolt and nut (1, M16)
· Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)

(2) Propeller shaft mounting nut (2, M10)
· Tightening torque : 7.4±1.5 kgf · m
(53.5±10.8 lbf · ft)

(3) Wheel nut (3)
· Tightening torque : 46±3 kgf · m
(333±21.7 lbf · ft)

(4) Hose assy (4)

(5) Rear axle weight : 200 kg (440 lb)



2. GENERAL INTRODUCTIONS

1) Introduction

The efficiency and continued operation of mechanical units depends on constant and correct maintenance and also on efficient repair work should there be a break-down or malfunction.

The instructions in this manual have been made based on a complete overhaul of the unit. However the mechanic must decide whether or not it is necessary to dismantle the individual components when only partial repair work is needed.

The manual provided a quick and sure guide which, with the use of photographs and diagrams illustrating the various phases of the operations, allows accurate work to take place. Therefore all the information needed for correct disassembly, the relative checks and assembly of each individual component, has been written down.

In order to remove the differential unit from the vehicle, the manuals provided by the vehicle manufacturer should be consulted. In describing the following operations it is presumed that the unit has already been removed from the vehicle.

※ Throughout the phases of repair or maintenance work it is advisable to use proper equipment such as : trestles, or supporting benches, plastic or copper hammers, appropriate levers, extractors and specific spanners or wrenches. So that the work is facilitated and the working surfaces and the operators themselves are protected.

Before going on to disassemble the parts it is best to thoroughly clean the unit, removing any encrusted or accumulated greases and then drain the oil through the oil-draining plugs.

2) Introductory statement

All the disassembled mechanical units should be thoroughly cleaned with appropriate products and then restored or replaced if damage, wear, cracking or seizing have occurred. In particular, thoroughly check the state of all moving parts (bearing, gears, crown wheel and pinion, shafts) and sealing parts (O-ring, oil shield) which are subject to major stress and wear. In any case it is advisable to replace the seals every time a component is overhauled or repaired. During assembly the sealing rings must be lubricated on the sealing edge. In the case of the crown wheel and pinion, replacement of one requires the replacement of the other. During assembly the prescribed pre-loading and backlash of the parts must be maintained.

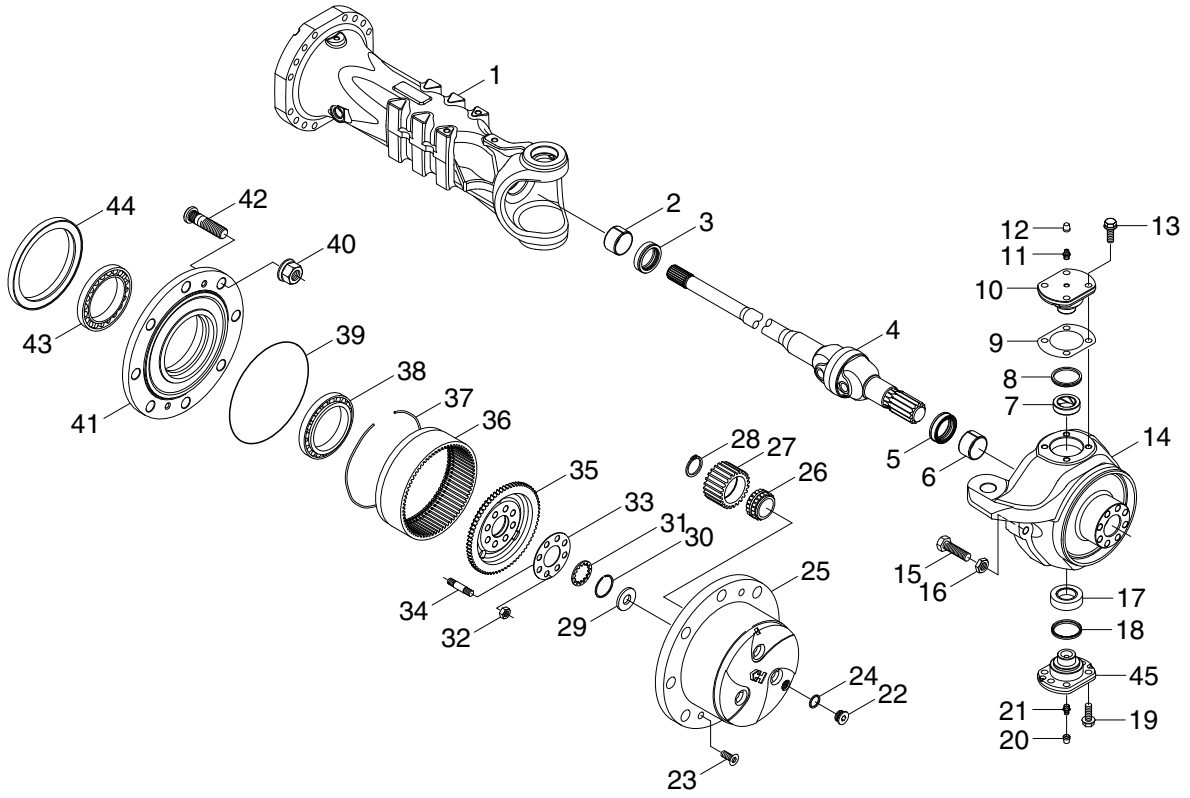
3) Maintenance and repair

We have compiled these instructions for maintenance and repair in order to facilitate any such work on the CLARK-HURTH Components differential units and gear change unit.

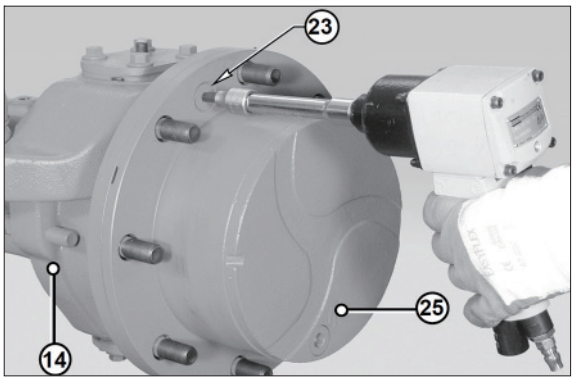
3. FRONT AXLE

1) THE PLANETARY REDUCTION AND THE COMPLETE STEERING CASE

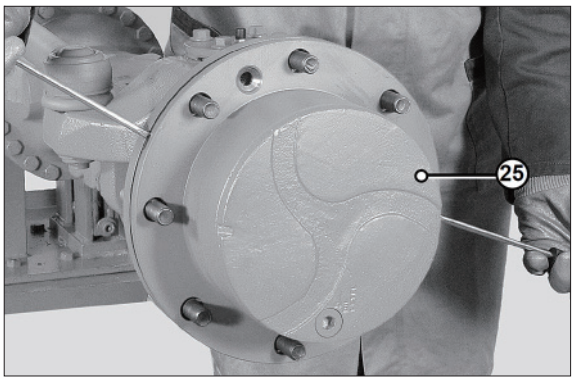
(1) Disassembly



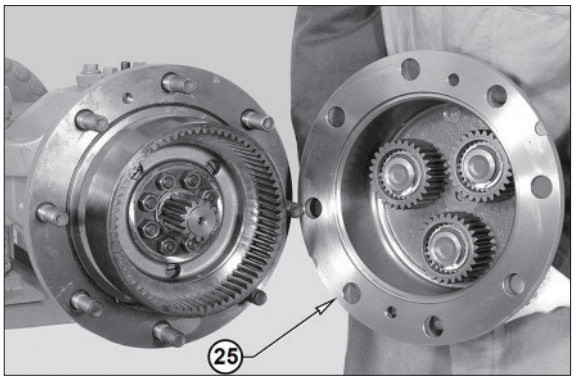
① Remove the securing screws (23) from the planetary carrier cover (25).
Disconnect the steering bars from the steering case (14).



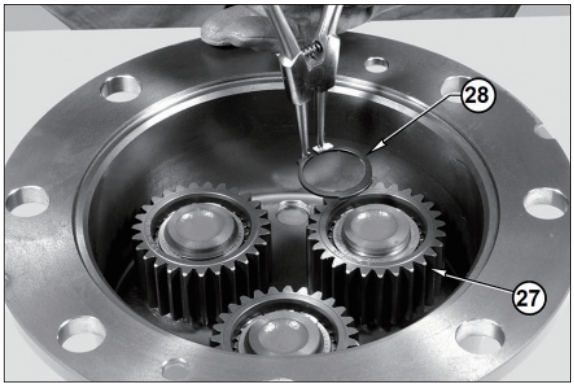
② Disjoint the planetary carrier cover (25) from the steering case by alternatively forcing a screwdriver into the appropriate slots.



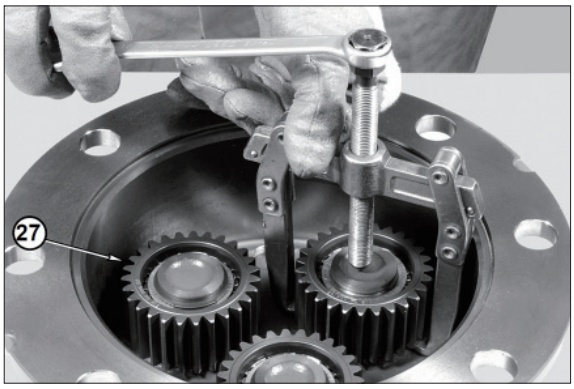
③ Remove the complete planetary carrier cover (25).



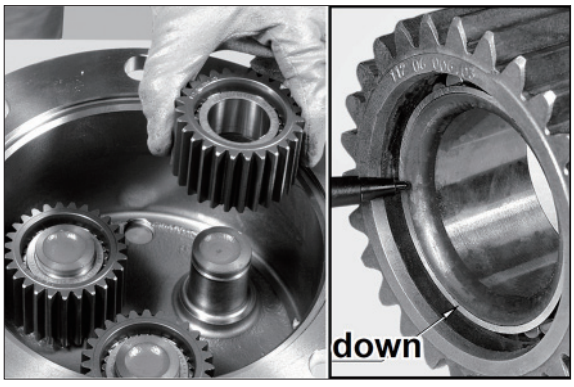
④ Remove the safety spring rings (28) of the planetary gears (27).



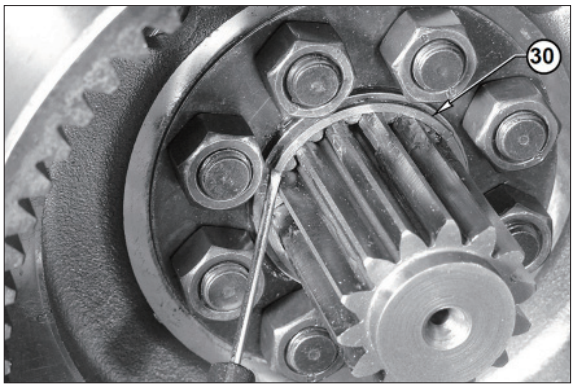
⑤ Remove the planetary gears (27).



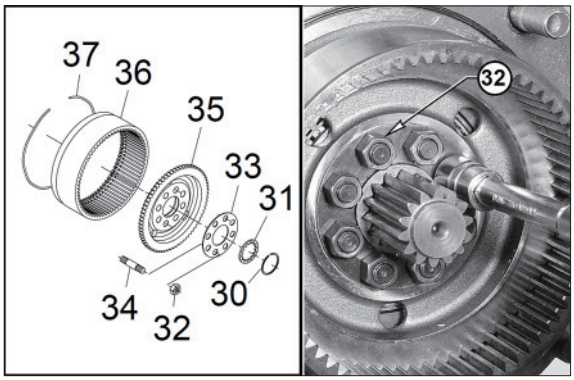
※ Note down direction of assembly of planetary gears.



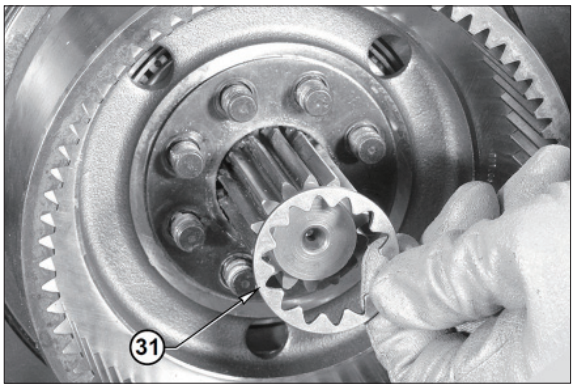
⑥ Remove the snap ring (30).



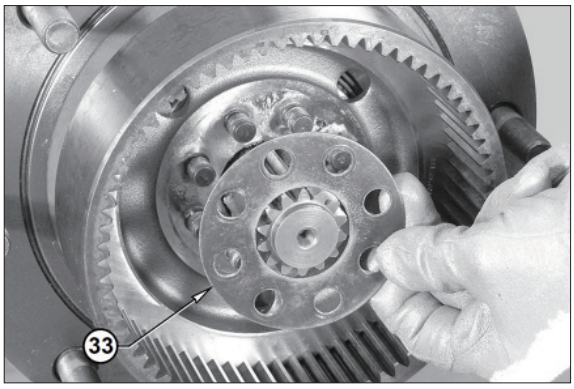
⑦ Unloose and remove the tightening nuts (32) from the crown flange (35).



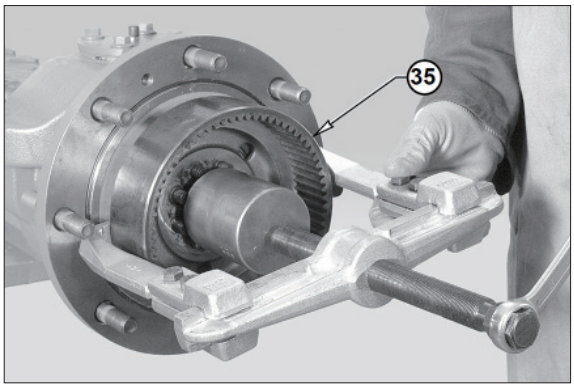
⑧ Remove the shim washer (31).

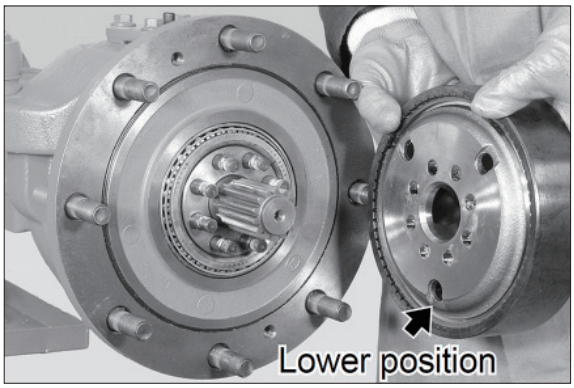


⑨ Remove the safety flange (33).



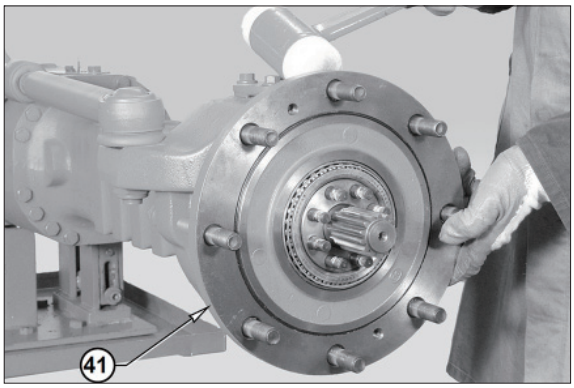
⑩ Using a puller, remove the complete crown flange (35) by acting on the stud bolts.



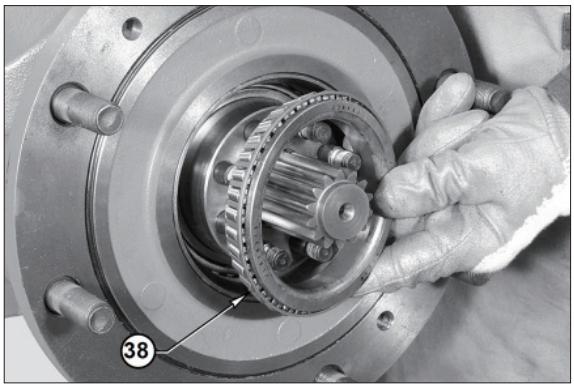


⑪ Partially extract the hub (41) using a plastic hammer.

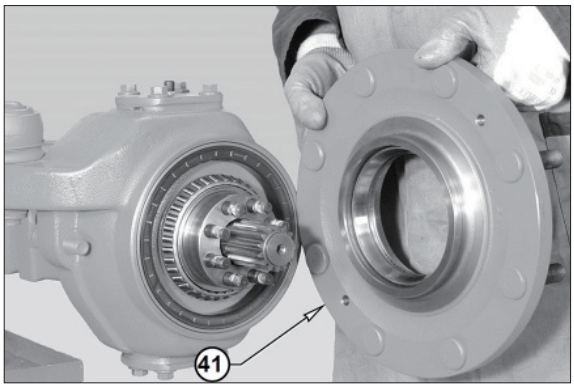
※ Alternately hammer on several equidistant points.



⑫ Remove the external bearing (38).

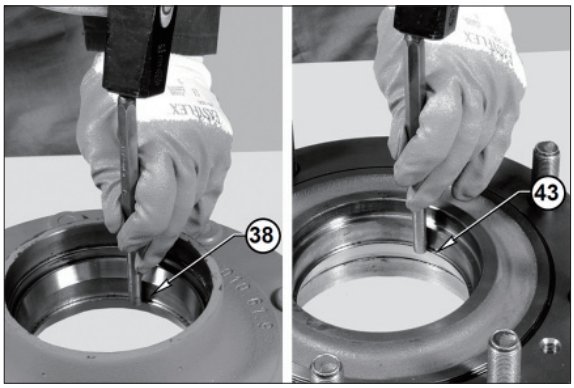


⑬ By hand remove the complete hub (41).



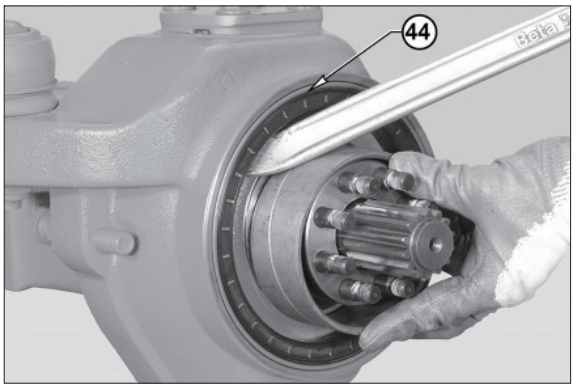
⑭ Remove the external thrust blocks of bearings, using a pindriver.

※ Hammer in an alternate sequence to prevent crawling and deformation of the thrust blocks.

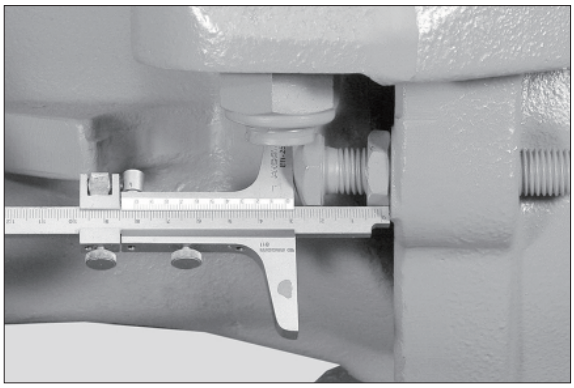


⑮ Remove the sealing ring from the steering case (44).

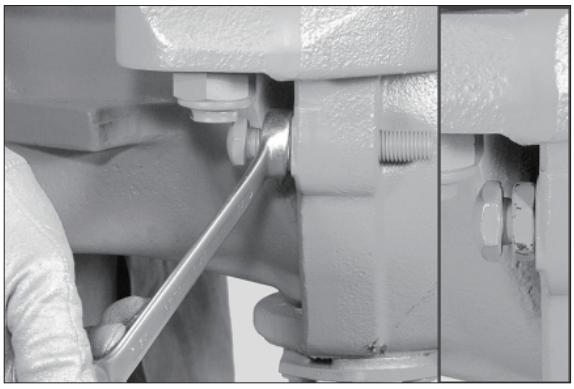
※ Pay due attention not to damage the seat of bearing.



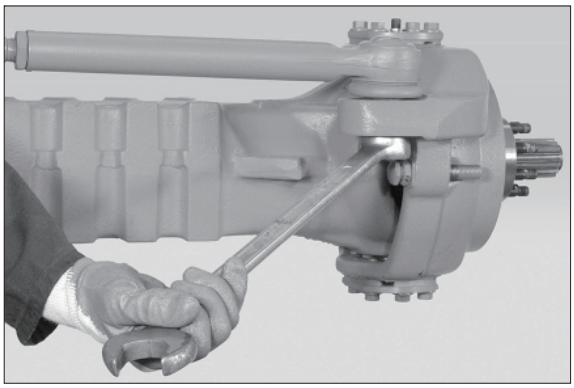
⑯ Note the measure of the screw of lock steering case.



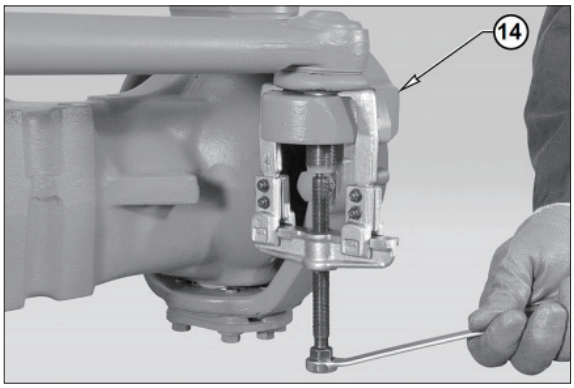
⑰ Loose the lockscrew and insert it to allow the passage of tool.



⑱ Remove the nuts that lock the articulation pins.

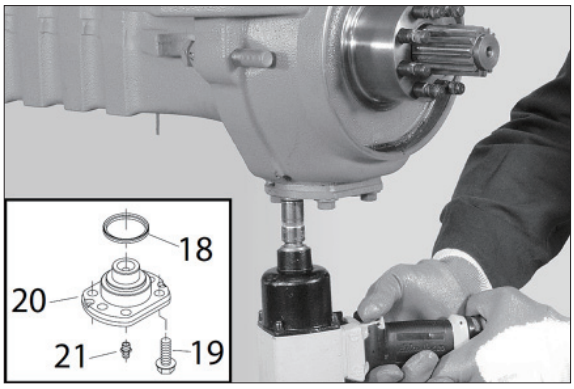


⑲ Disconnect the tapered pins of the articulation from the steering case (14) by means of a puller.

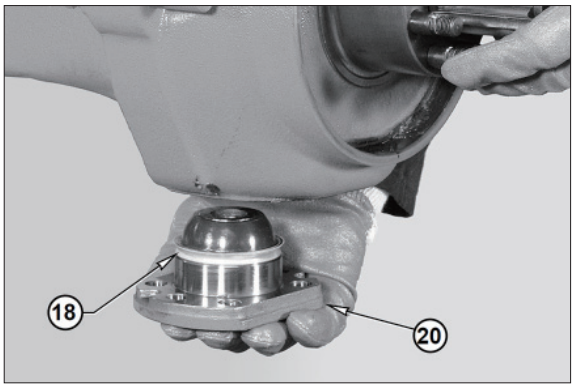


⑳ Unloose and remove the fitting screws (19) from the bottom articulation pin (20).

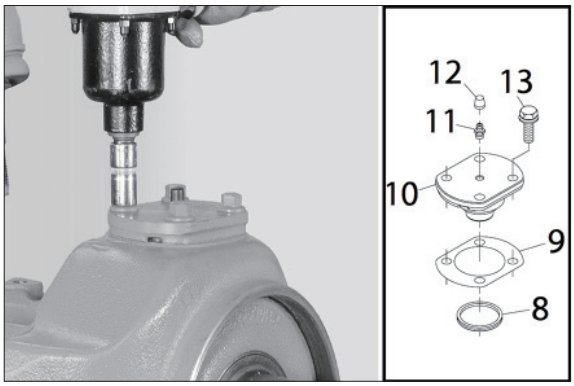
※ Screws cannot be reused.



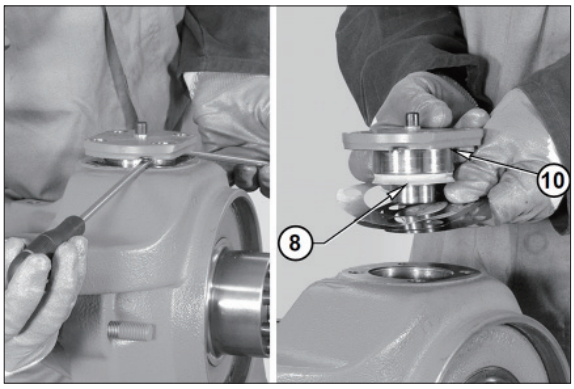
㉑ Remove the bottom articulation pin (18) complete with front sealing ring (20).



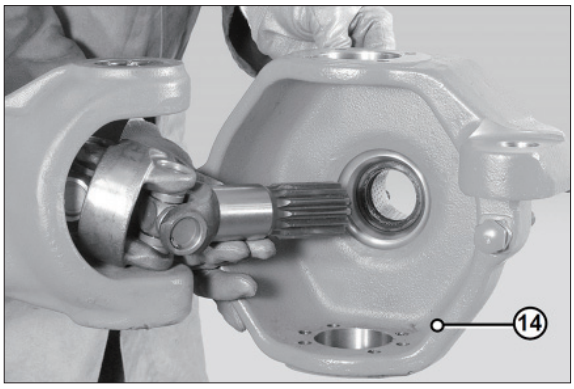
㉒ Unloose and remove the fitting screws (13) from the top articulation pin (10).



㉓ Using two levers, remove the top articulation pin (10) complete with front seal (8).
Pay attention not to damage the surfaces.

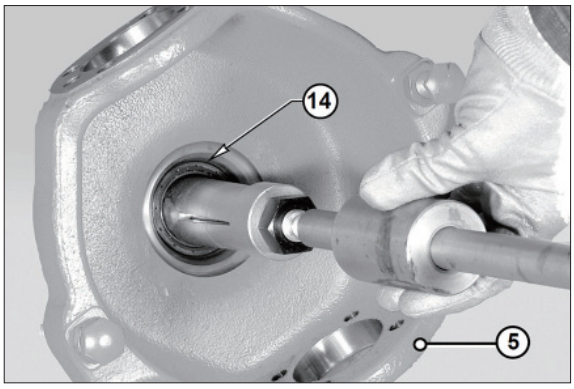


㉔ Remove the complete steering case (14).



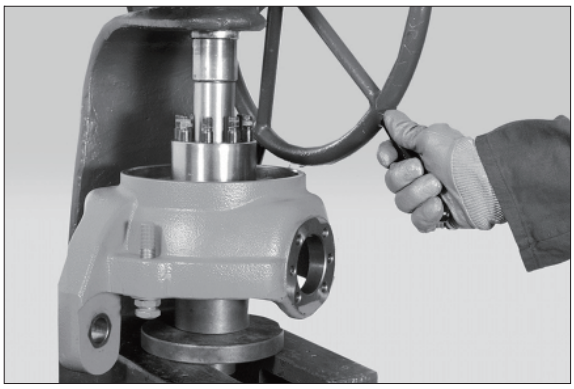
㉕ Use a puller to remove the sealing ring from the steering case (14).

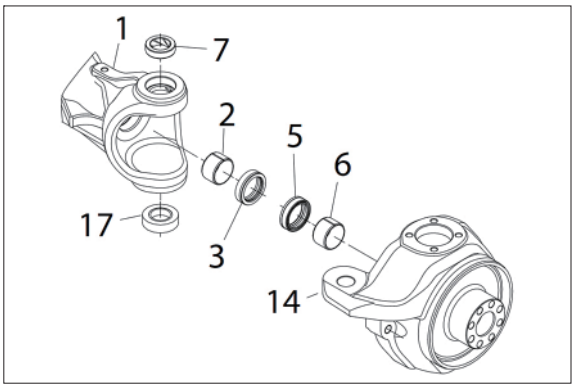
※ Note down the orientation of sealing ring (5).



㉖ Remove the bushing (6) from the steering case (14).

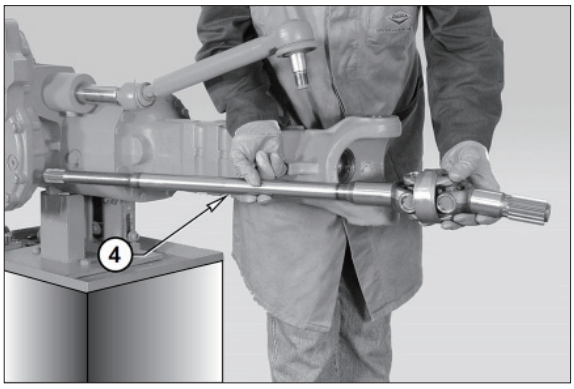
※ Note down the orientation of bushing.



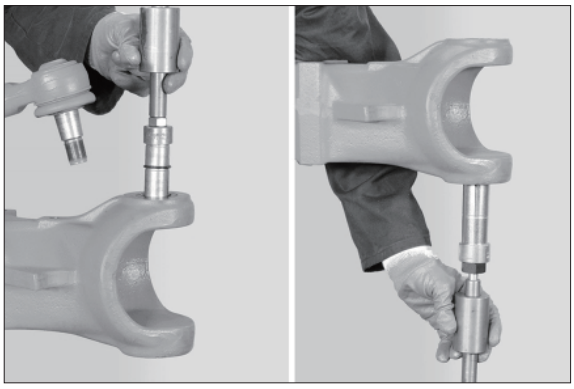


㉗ Remove the u-joint (4).

※ To remove the u-joint use, if necessary, a plastic hammer or a lever.

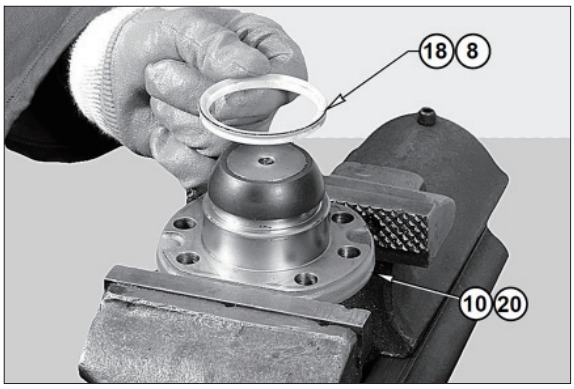


㉘ Using a puller for inner parts, remove the top bush (7) and the bottom ball-bush (17).

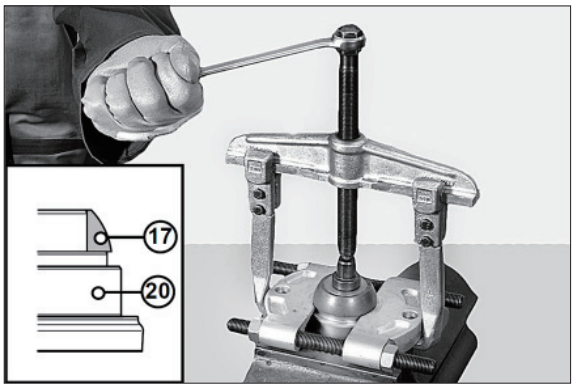


㉙ Remove the articulation pins (10) (20) and the front sealing rings (8) (18).

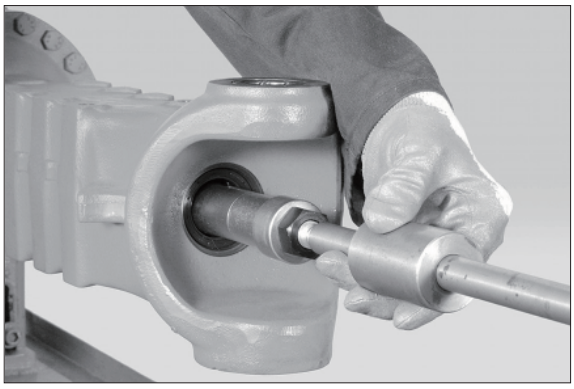
※ Note down the side for assembly.

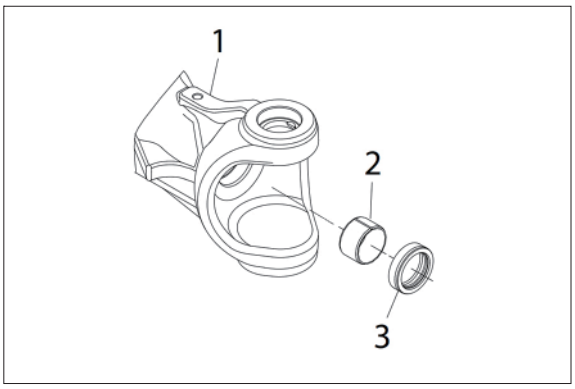


㉚ If the ball cover (17) needs replacing, remove it from the bottom articulation pin (20).

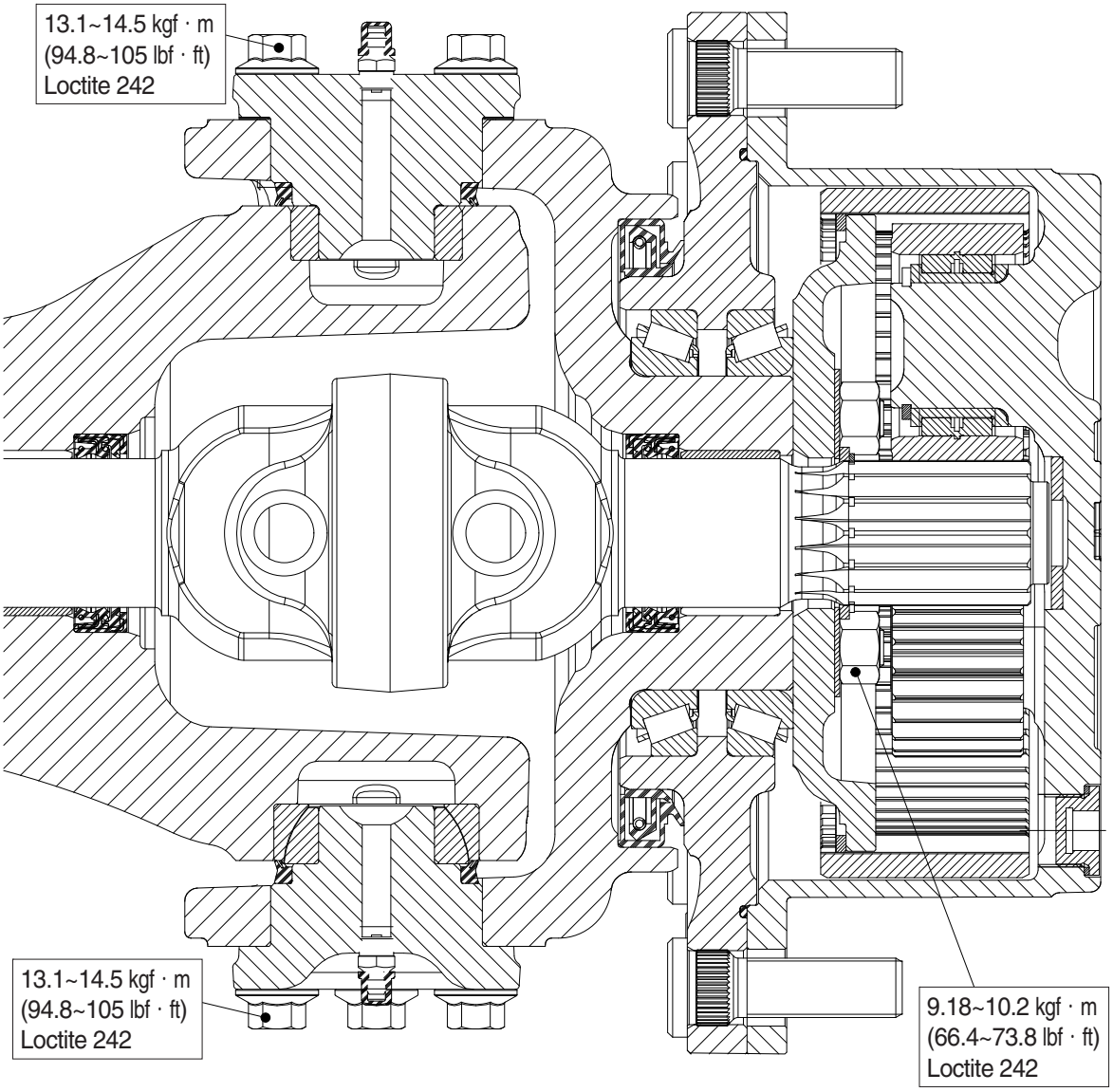


㉛ Remove seal ring (3) and the bushing (2) from the arm (1).



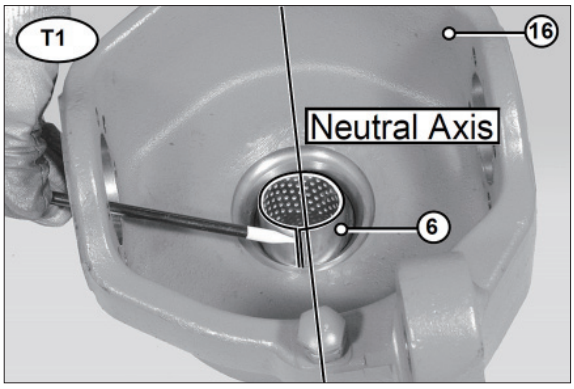


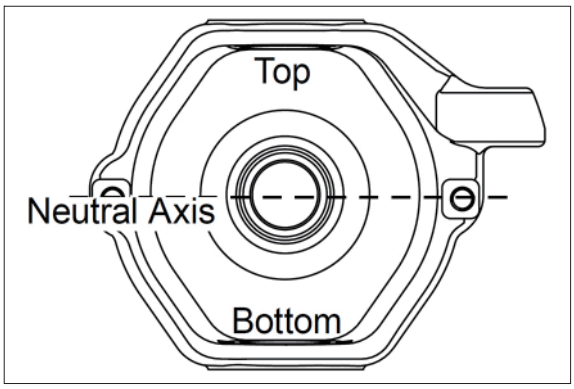
(2) Assembly



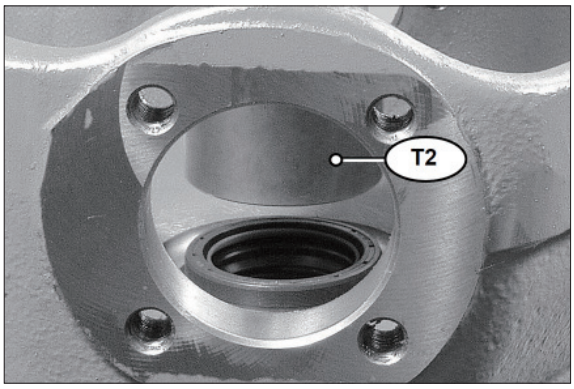
· **Continuos rolling torque** without planetary gear cover 0.71~2.04 kgf · m (5.14~14.8 lbf · ft)
· **Preload steering case** 4.08~8.16 kgf · m (29.5~59.0 lbf · ft)

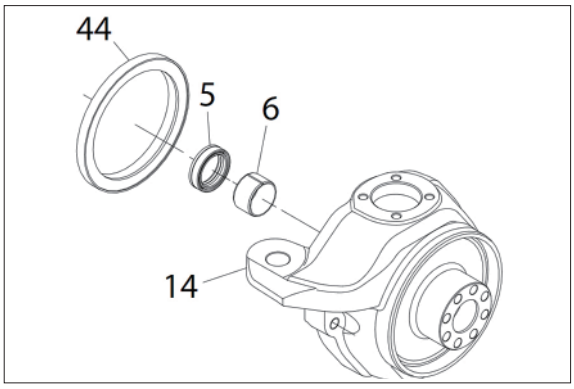
① Lubricate the bushing (6) and the seat of the steering case (14).
Install the bushing (6), using tool T1.





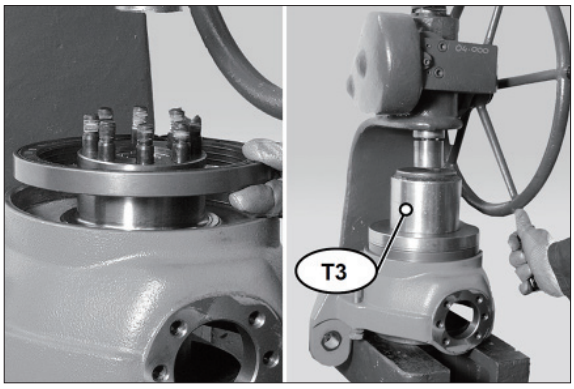
② Lubricate the outer surface of the sealing ring (5); fit them into their seat using tool T2.



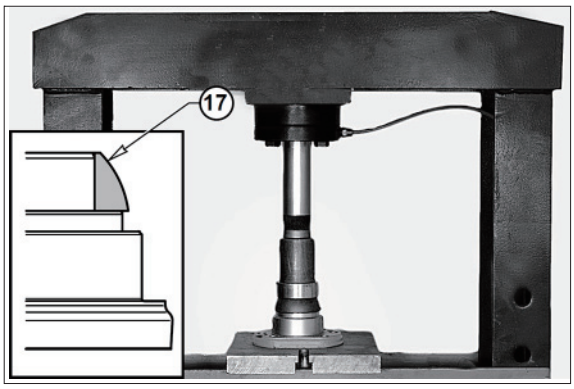


③ Using special tool T3 apply a repositionable jointing compound for seals to the outer surface of the sealing ring (44). Position the sealing ring (44) in the steering case (14).

※ Check that the ring (44) is correctly oriented.

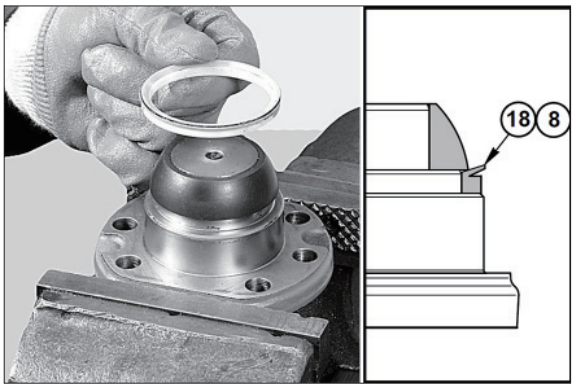


④ If the bottom articulation pin (17) has been extracted, position the pin under a press and fit the ball cover (20).

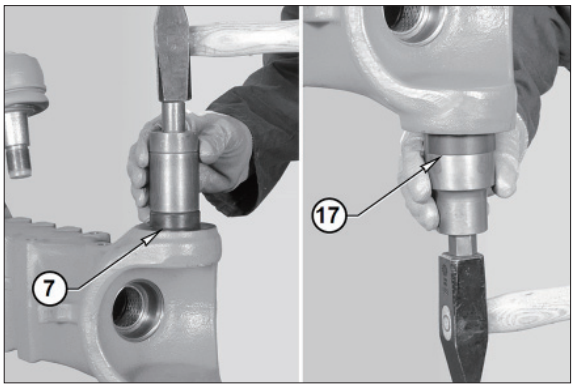


⑤ Fit the front sealing rings (18) (8) onto the articulation pins (4) and (6).

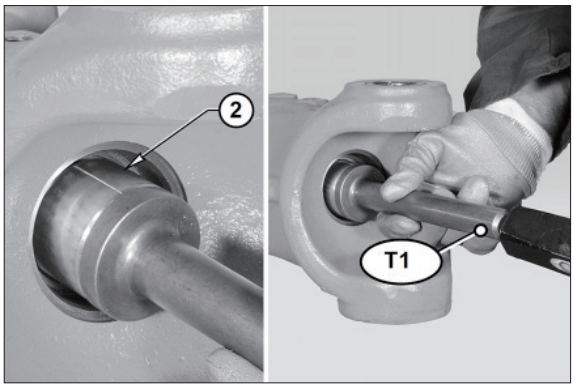
※ Carefully check that the rings are properly oriented (18) (8).



⑥ Lubricate the top bush (7) or the bottom ball bush (17) and fit them into the fulcrum holes of the arm.

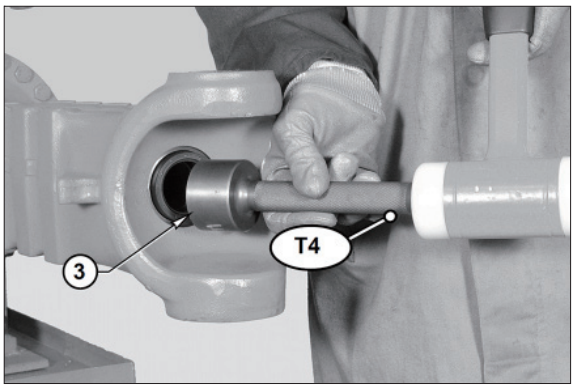


⑦ Lubricate the bushing (2) and the seat of the steering case (1).
Install the bushing (2), using tool T1.

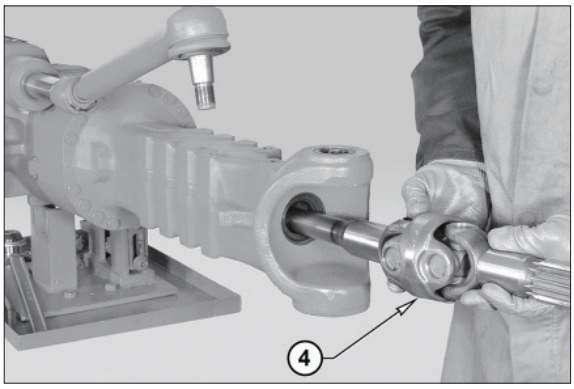


⑧ Lubricate and fit the sealing ring (3) onto tool T4 ; install the rings into the arm.

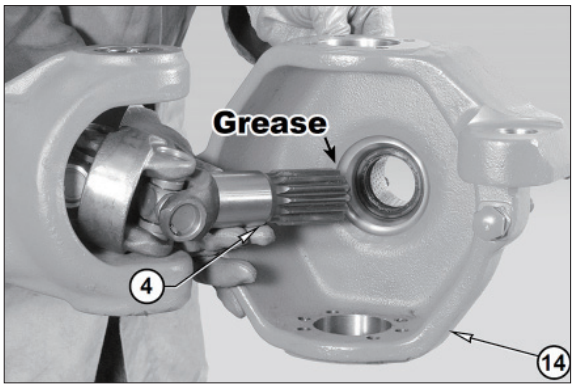
※ Pay particular attention to the direction of assembly of the rings.



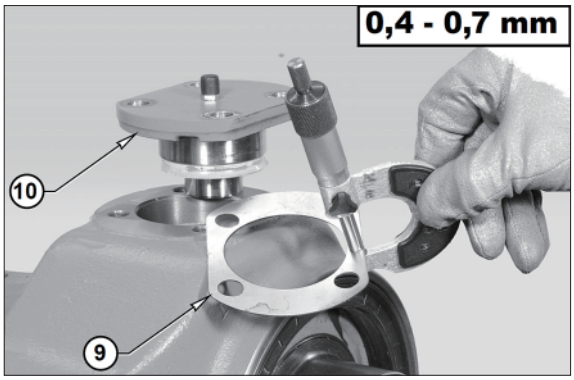
⑨ Insert the u-joint (4).



⑩ Lubricate the terminal of the u-joint (4) and install the steering case (14).
Pay due attention not to damage the dust cover rings and the sealing rings.

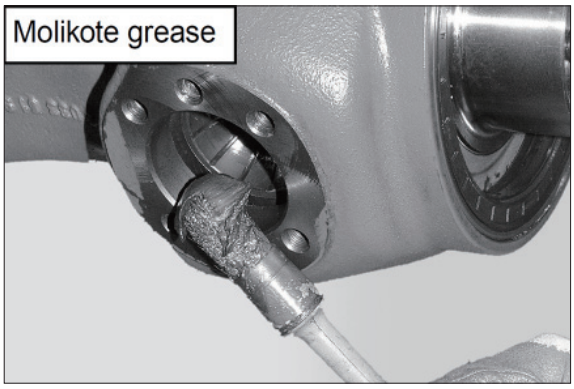


⑪ Prepare a series of shims (9) of 0.4 up to 0.7 mm.
To be assembled under the upper pin (10).

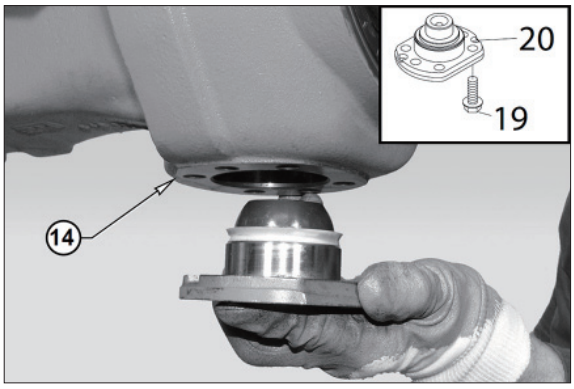


⑫ Lubricate and install the unit in the steering case.

⑬ Lubricate the steering case.

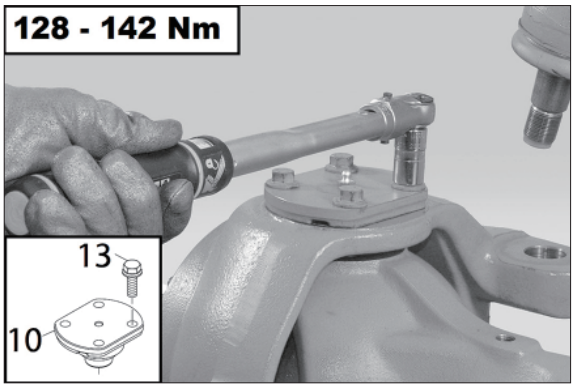


⑭ Fit the unit (20) in the steering case (14). Position the screws (19) and tightly tighten.



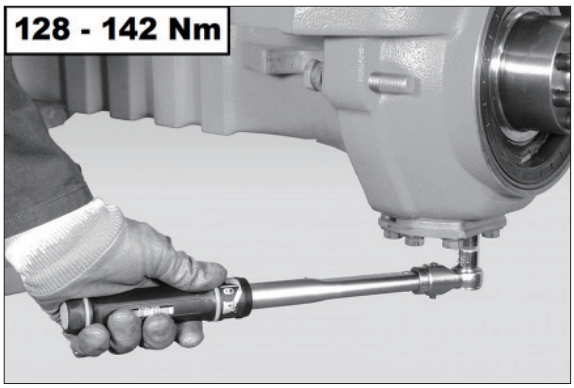
⑮ Tighten the new fitting screws (13) of top articulation pins in sequence using the cross tightening method.

· Torque wrench setting :
13.1~14.5 kgf · m (94.8~105 lbf · ft)

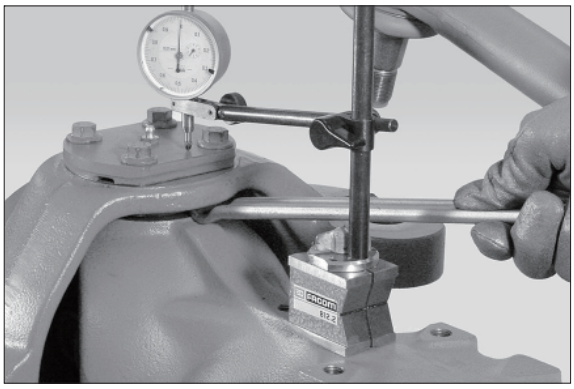


⑯ Tighten the new fitting screws (19) of bottom articulation pins in sequence using the cross tightening method.

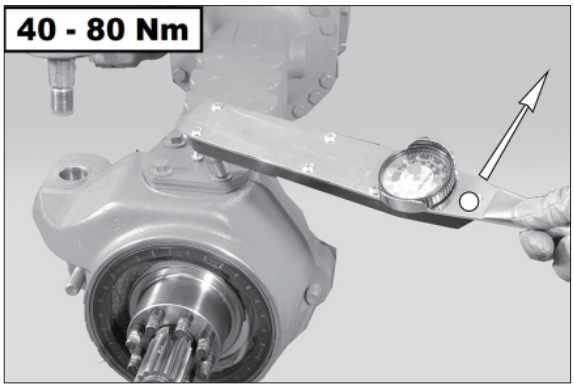
· Torque wrench setting :
13.1~14.5 kgf · m (94.8~105 lbf · ft)



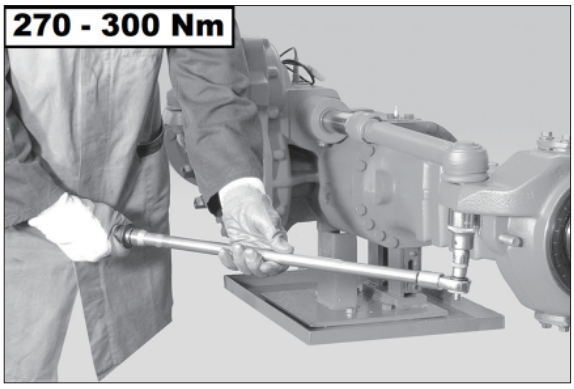
⑰ Check by means of a lever that there is no vertical gap.
In case there is any gap, determine the width and reduce it by removing shims.



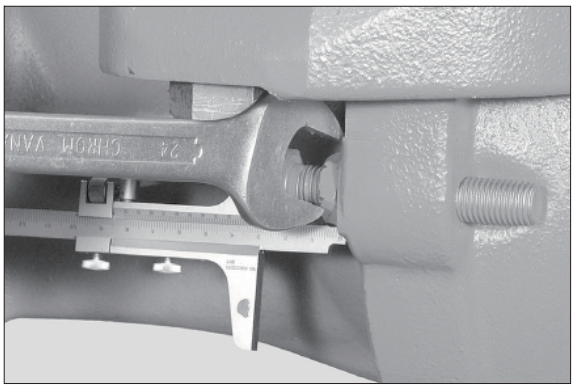
⑱ Check the torque of the pins, which has to be between 4.08 and 8.16 kgf · m.
If the preliminary measured value is too high, the shims have to be increased.



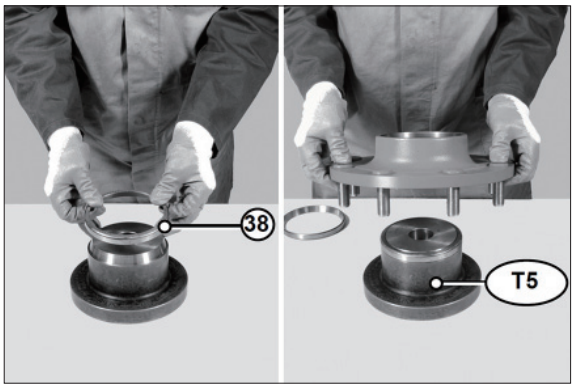
⑲ Look for the position of the notch regarding the safety cotter pin hole when the nut is finaly locked max 30.6 kgf · m (221 lbf · ft).



⑳ Bring the lockscrew to the quote at the measure previously survey.

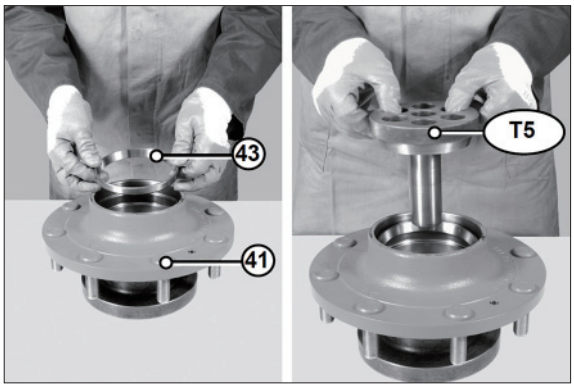


㉑ Position the lower part of tool T5 and the thrust block of the external bearing (38).



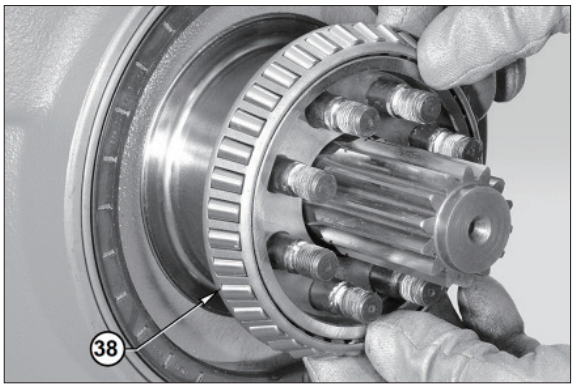
㉒ Lubricate the seats of the bearings and position the hub (41) on tool T5 ; position the thrust block of the internal bearing (43).

※ Check that the thrust block is correctly oriented.

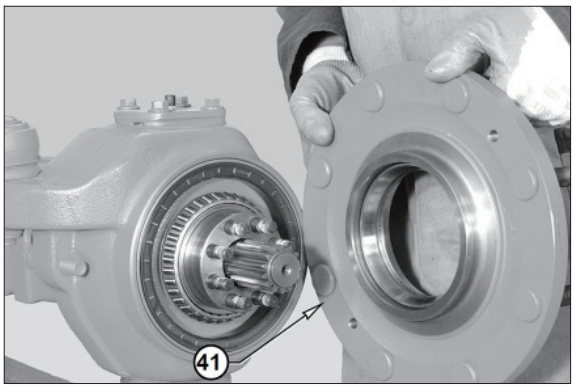


㉓ Install the external bearing (38).

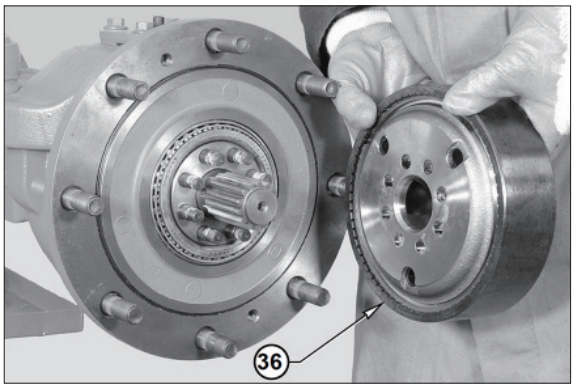
※ Move the bearing to the limit stop by hammering lightly all around the edge.



㉔ Install the wheel hub (41).

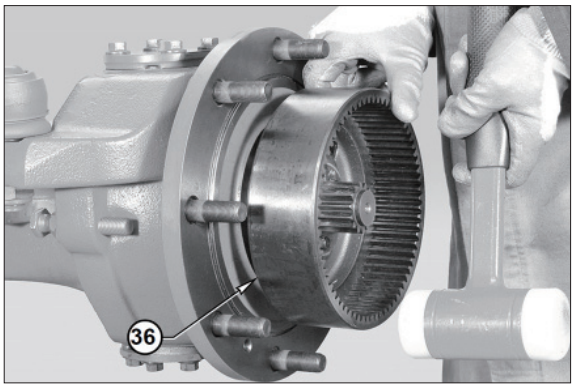


㉕ Install the crown wheel (36).

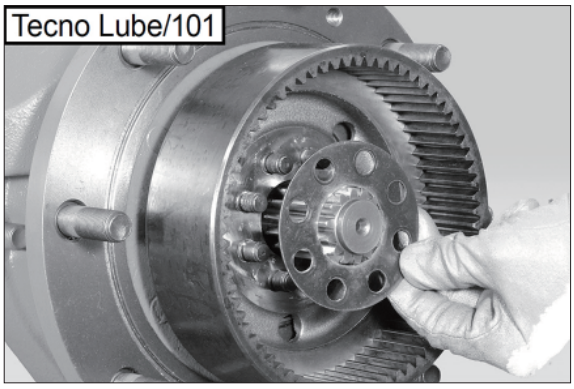


㉖ Fit the complete crown flange (36).

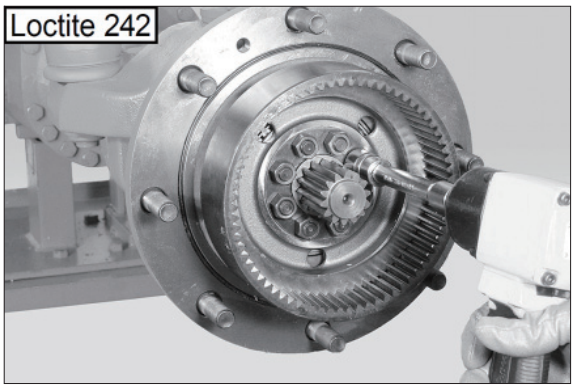
※ In order to fasten the flange (36), use a plastic hammer and alternately hammer on several equidistant points.



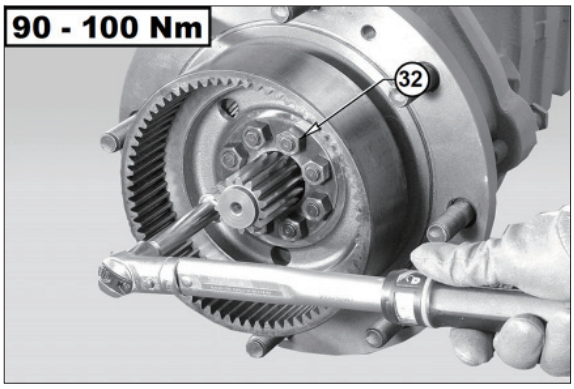
㉗ Install the security flange (33).
Grease the surface of the safety flange (33) that touches the crown wheel.



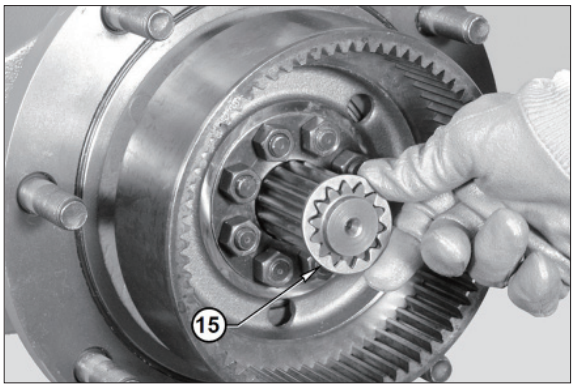
㉘ Coat the nuts (23) with loctite 242 and screw them.



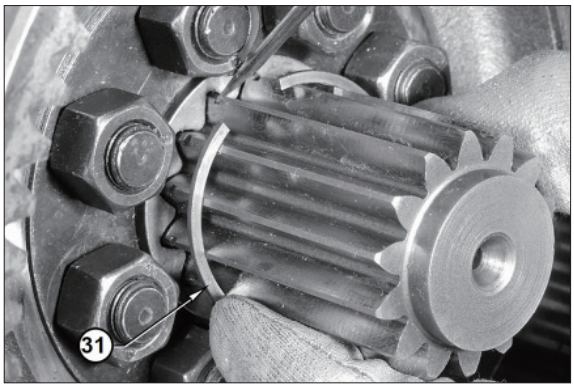
㉙ Tighten nuts (32) in two stages, using the criss-cross method.
· Initial torque wrench setting :
9.18 kgf · m (66.4 lbf · ft)
· Final torque wrench setting :
10.2 kgf · m (73.8 lbf · ft)



㉚ Install the distance piece (31).

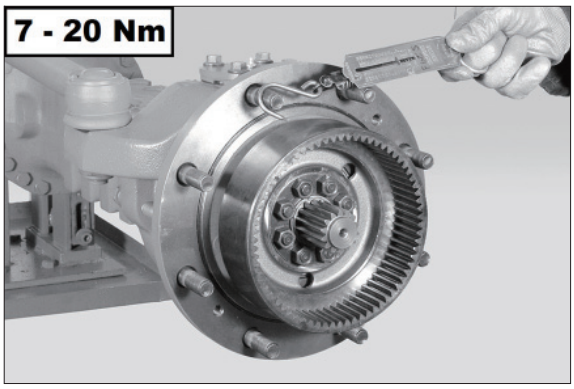


㉛ Install the snap ring (31).

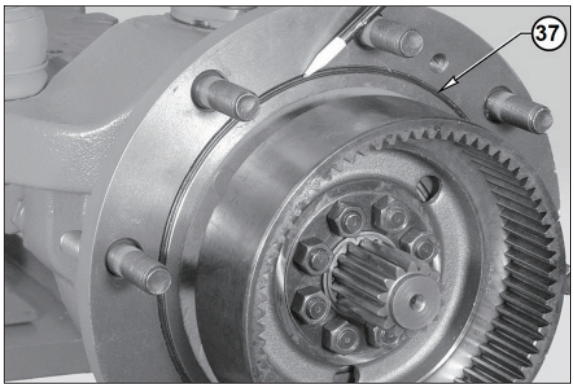


㉜ Check the continuous rolling torque on the hub.

· Torque : 0.71~2.04 kgf · m
(5.14~14.8 lbf · ft)

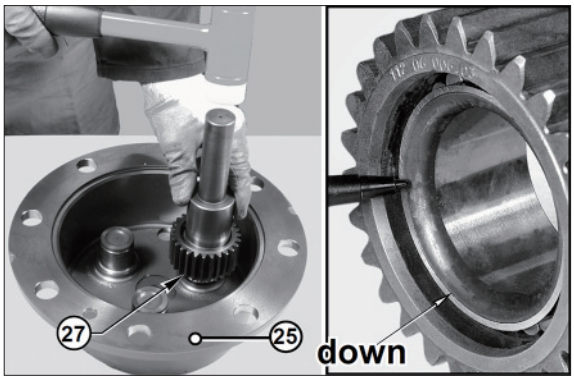


※ Check the condition and position of the O-ring (37).

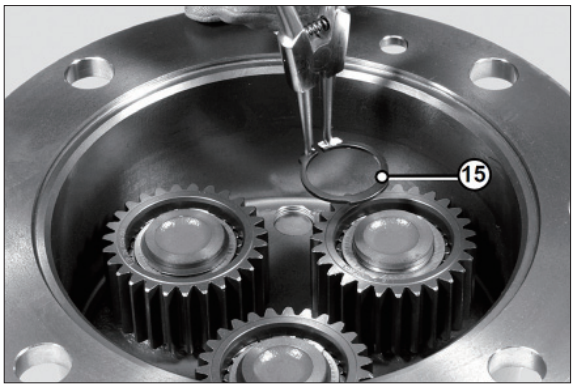


㉝ Fit the planetary gear (27) onto the planetary gear cover (25).

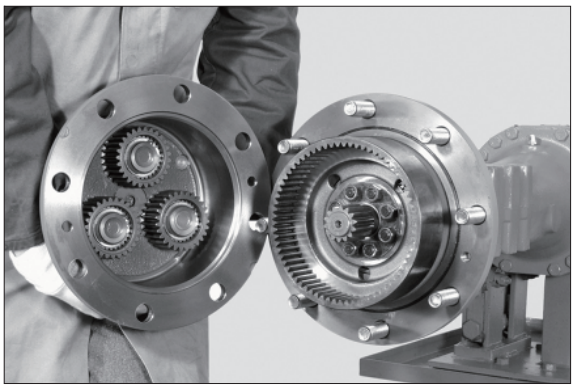
※ The jointed portion of the internal ring of the bearings must face the bottom of the pin.



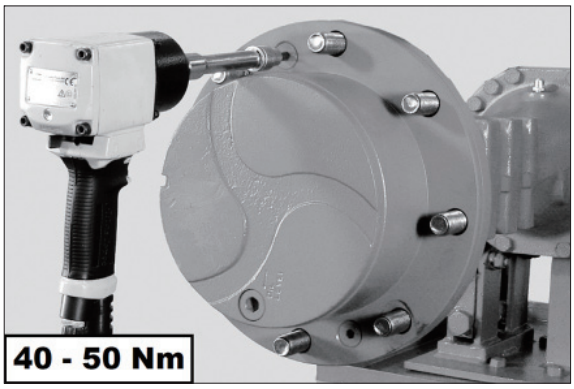
㉞ Lock into position the planetary gears (16) with the snap rings (15).



㉟ Fit the planetary gear cover (18) onto the wheel hub (4).

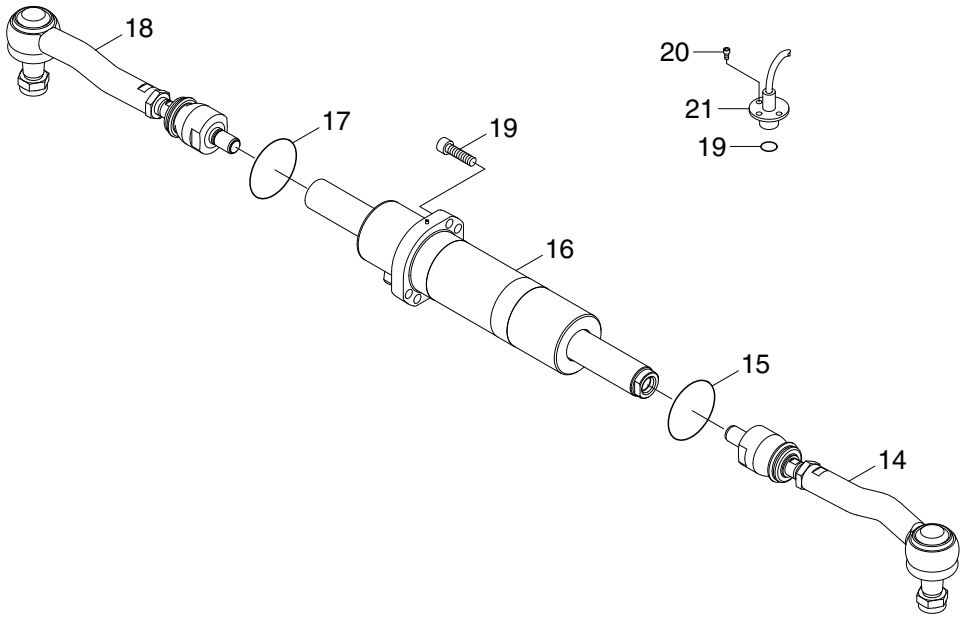


㊱ Torque wrench : 4.08~5.1 kgf · m
(29.5~36.9 lbf · ft)

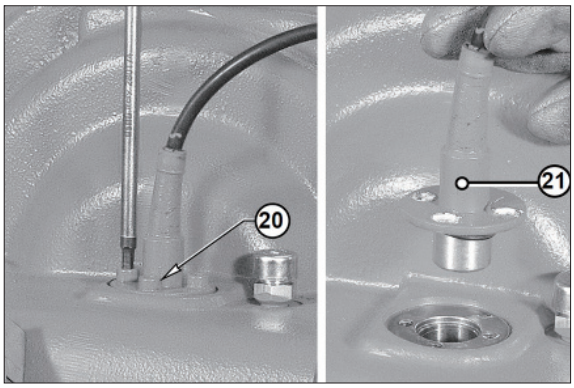


2) STEERING CYLINDER

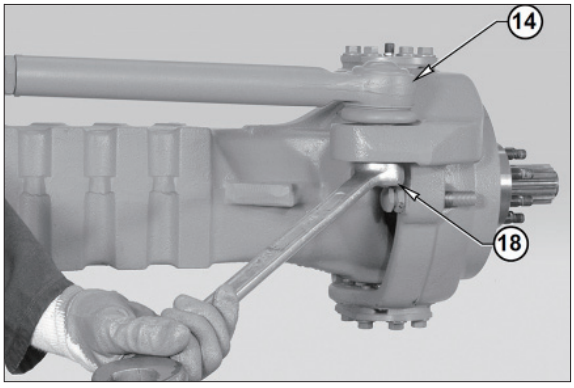
(1) Disassembly



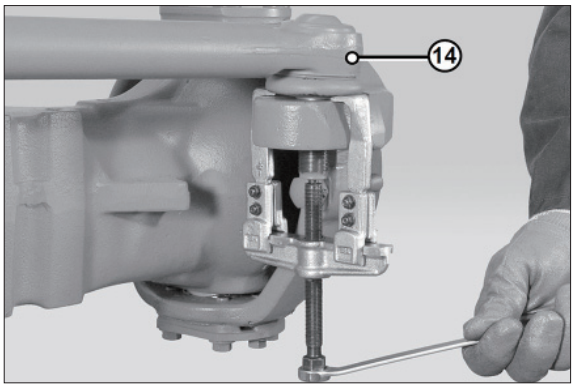
① Remove the centring sensor (21) of the steering piston.



② Remove the nuts (18) that lock the articulation pins (14).

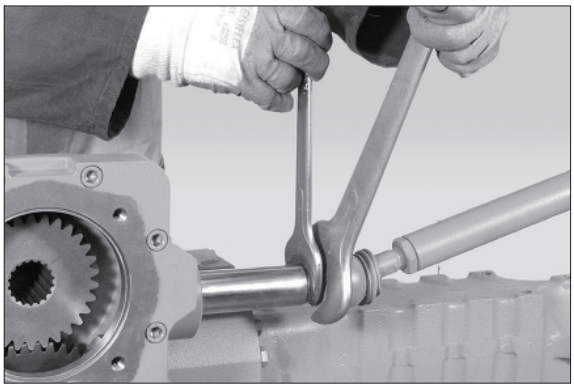


③ Disconnect the tapered pins of the articulation (14) from the steering case by means of a puller.

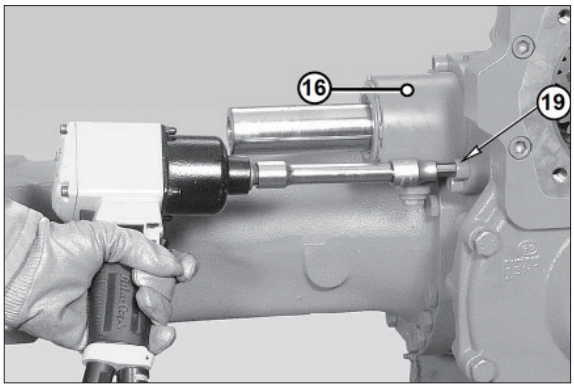


④ If the connection of the steering bars includes a safety collar, raise the border.

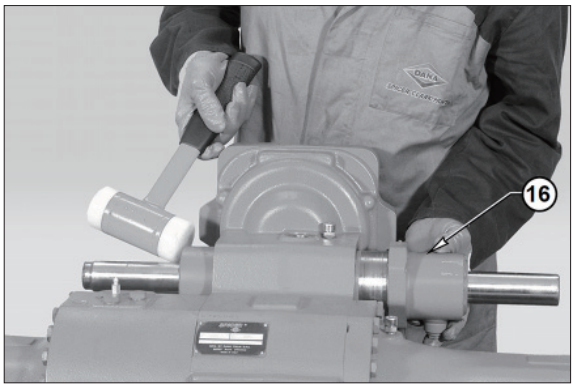
⑤ Disconnect left and right steering bars from the piston.

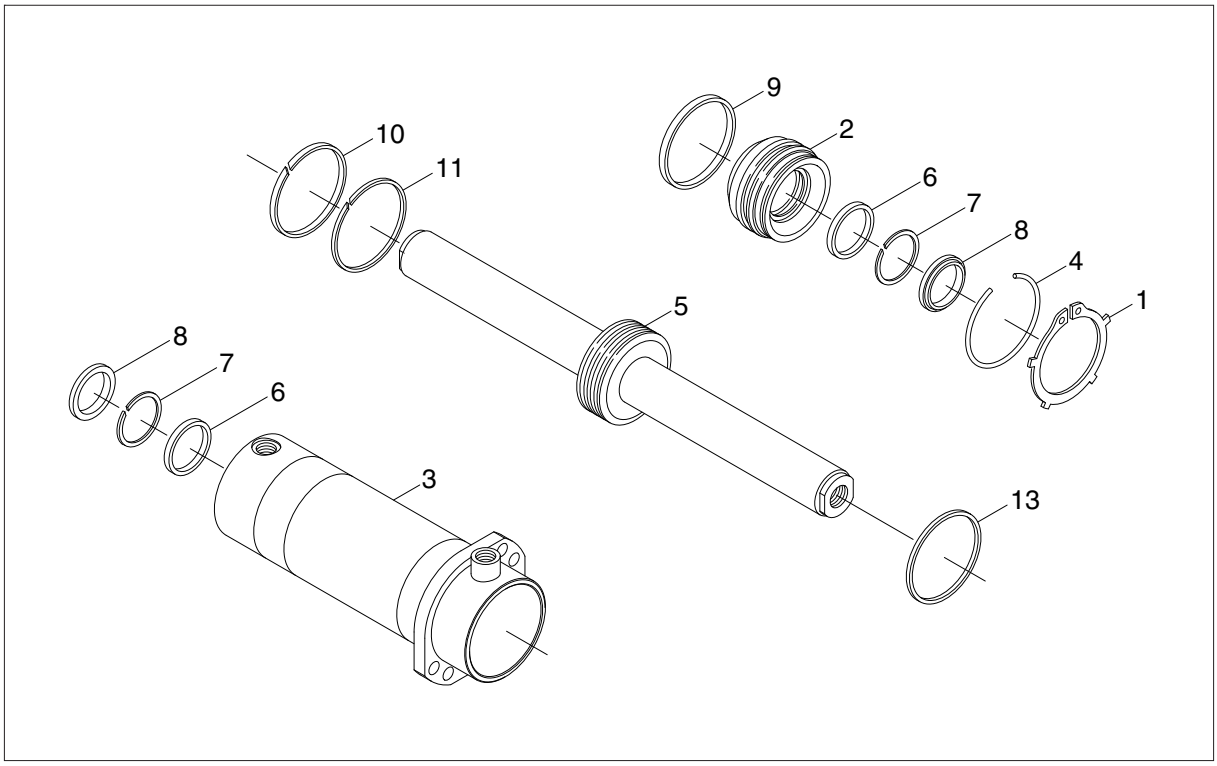


⑥ Remove the securing screws (19) from the steering cylinder (16).

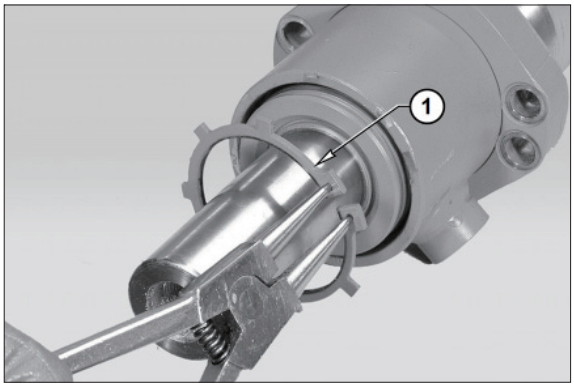


⑦ Extract the cylinder (16) using a plastic hammer.



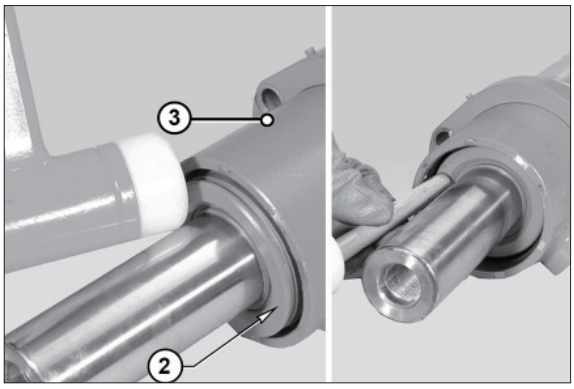


※ Before attempting to disassemble the unit, drain the oil in the cylinder chambers completely.
Using a screwdriver, remove the snap ring (1) of the cylinder head.

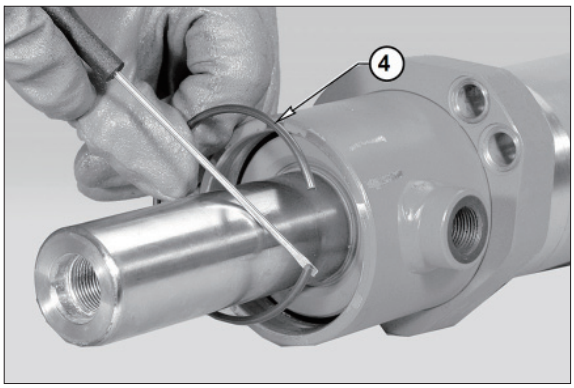


⑧ Lightly tap the cylinder head (2) with a plastic hammer so as to push it inside the cylinder (3).

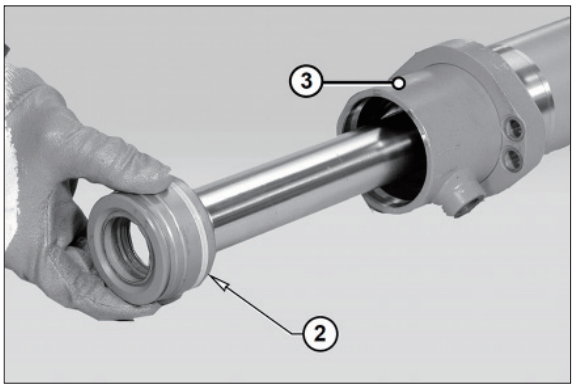
※ Insert the cylinder head so it is flush with the cylinder.



⑨ Using a punch, force the stop ring (4) located inside the cylinder (3) and extract ring using a screwdriver.



⑩ Take the cylinder unit a part by extracting the head first, followed by the piston.



※ Note down direction of installation of piston whose seal ring is oriented towards cylinder head.

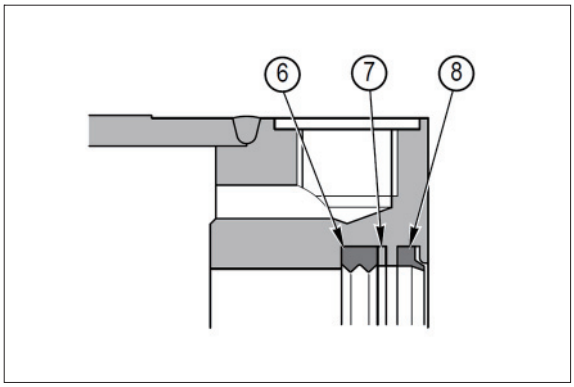
⑪ Remove all seals, anti-extrusion rings and scraper rings from head (2), cylinder (3) and piston (5).

※ All seals must be replaced every time the unit is disassembled.

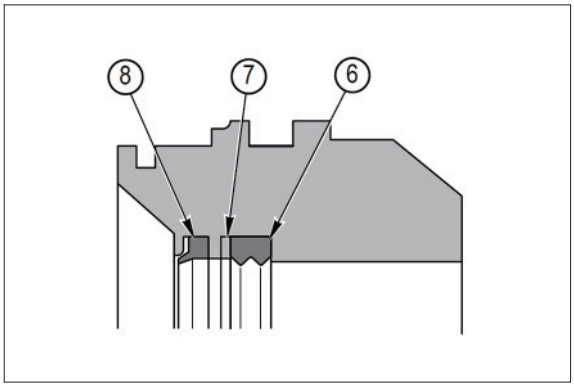
※ Particular attention must be paid not to damage the seats of both seals and piston slide.

(2) Assembly

① Grease and install the piston rod seal ring (6), rod wiper (8) and back up washer (7) into cylinder (3).



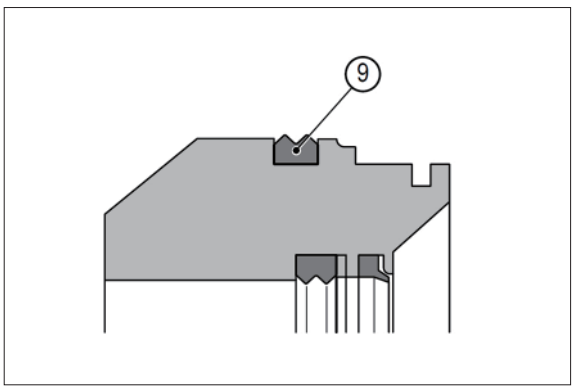
② Grease and install the piston rod seal ring (6), rod wiper (8) and anti-extrusion ring (7) into the head (2).



③ Fit seal (9) on the outside of the head (2).

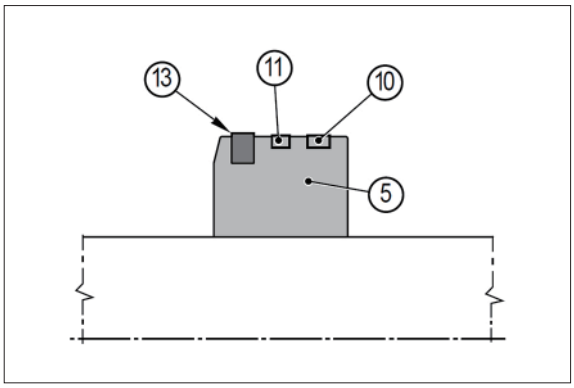
※ To ease installation, grease the outer surface of the piston

※ Do not roll the seal (9).



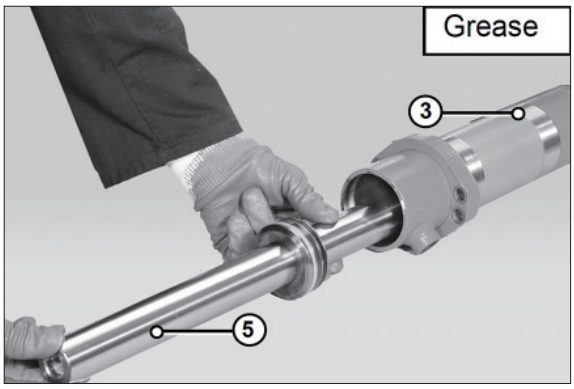
④ Prepare piston (5) by fitting it with magnetic ring (11), anti-extrusion ring (10) and piston seal (13).

※ To ease installation, lubricate with grease.

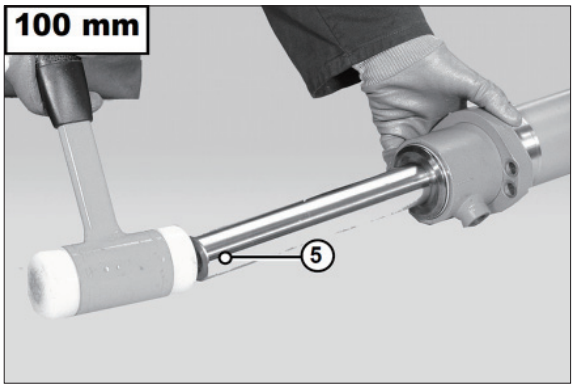


⑤ Center the shaft on the cylinder (3) so that it fits into the piston (5).

※ Apply a little grease to seals and cylinder.

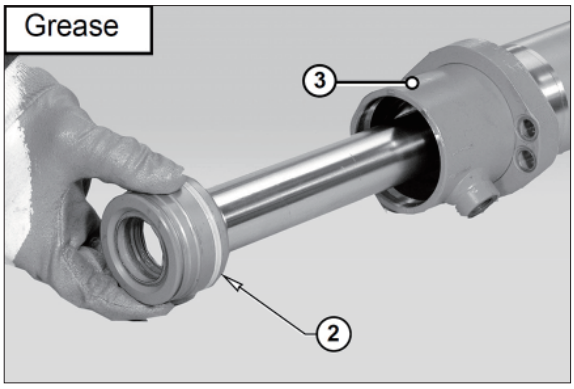


⑥ Push the piston (5) into the cylinder for 100 mm using a plastic hammer.

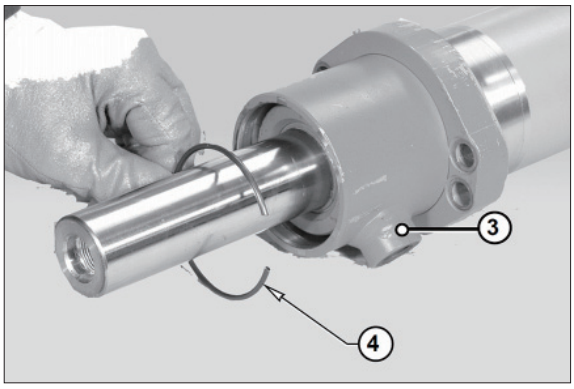


⑦ Apply grease to head (5) seals, fit the head onto the piston and push it into the cylinder (3) using a plastic hammer.

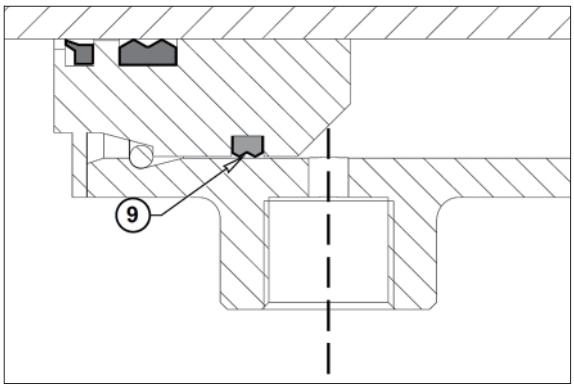
※ Insert the head as to line it up with the edge of the cylinder.



⑧ Introduce the stop ring (4) and ensure that it sets in the seat of cylinder (3).

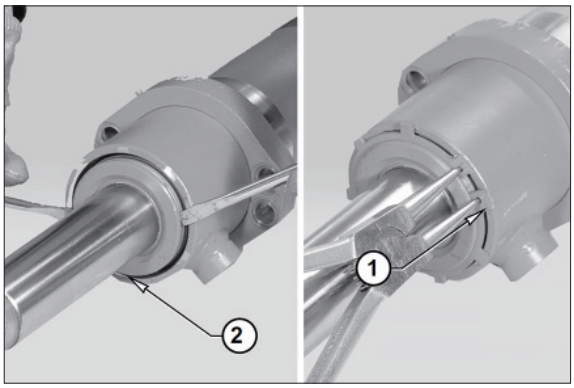


※ To insert the heading not to go beyond with the ring of gasket the hole of feeding because it could be cut.

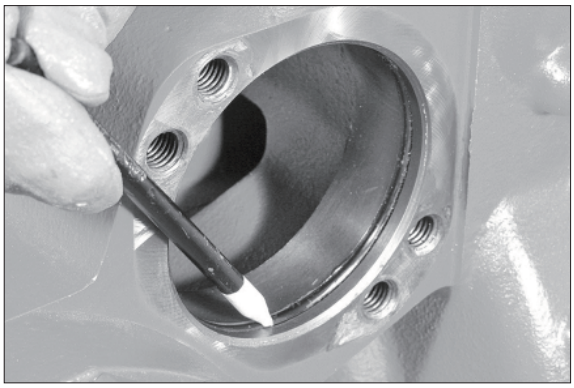


⑨ Using two screwdrivers or levers, force the head until it is seated against the stop ring (4).
Fit the snap ring (1) on the head (2).

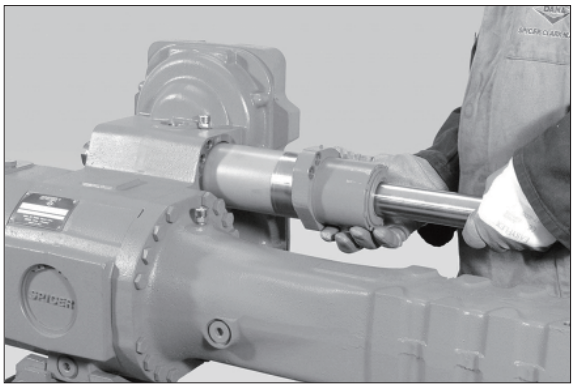
※ Make sure that the snap ring (1) is securely fastened in its seat.
If necessary, force it into its seat using a drift and a hammer.



⑩ Renew at each reassembly.

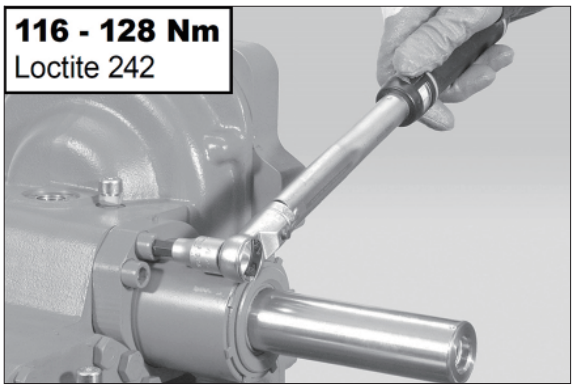


⑪ Check that the O-rings (17) (15) of the axle unit are in good condition ;
lubricate the seats of the seals and fit the steering cylinder (3).



⑫ Lock the cylinder by cross- tightening the screws (3).

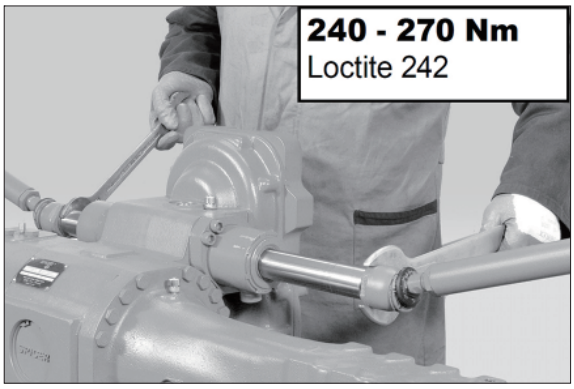
· Torque wrench setting :
11.8~13.1 kgf · m (85.3~94.8 lbf · ft)



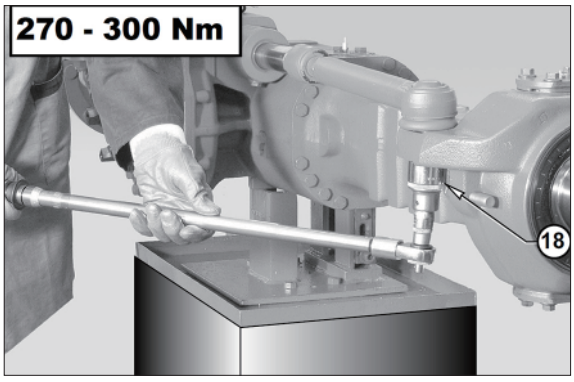
⑬ Apply loctite 242 to the thread and connect the steering bars by screwing the terminals onto the piston stem.

· Torque wrench setting :
24.5~27.5 kgf · m (177~199 lbf · ft)

※ Versions with coupling require that the rim of the articulation is riveted onto the surfaces of the piston stem.

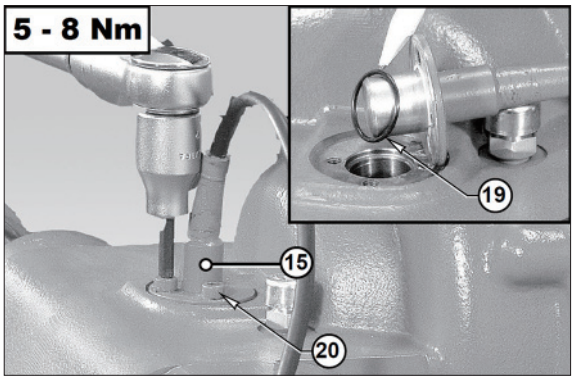


⑭ Insert the pins (18) in the steering case and lock into position using a torque wrench setting of 27.5~30.6 kgf · m (199~221 lbf · ft).



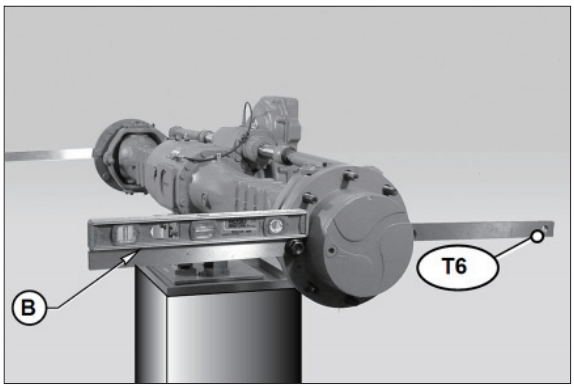
⑮ Install the proximity (21) for checking piston centring - if applicable - and tighten the screws (20).

· Torque wrench setting :
0.51~0.82 kgf · m (3.7~5.9 lbf · ft)

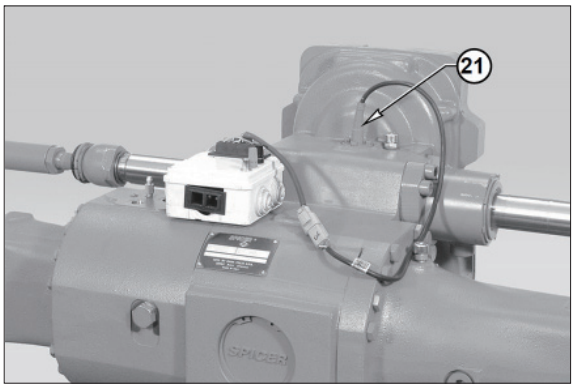


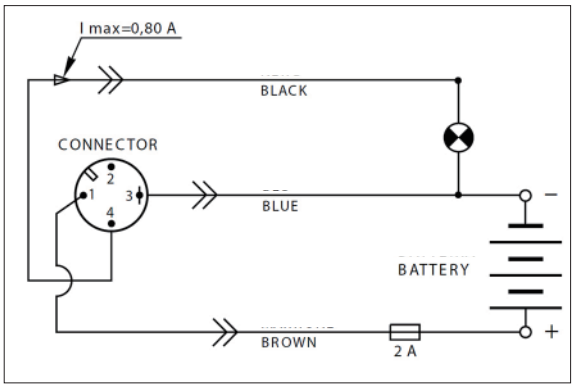
※ Eliminate the action of the negative brake, if fitted.
Apply tools T6 to the hubs and lock them.

Using a level “B”, check that tools are perfectly flat and parallel to each other.

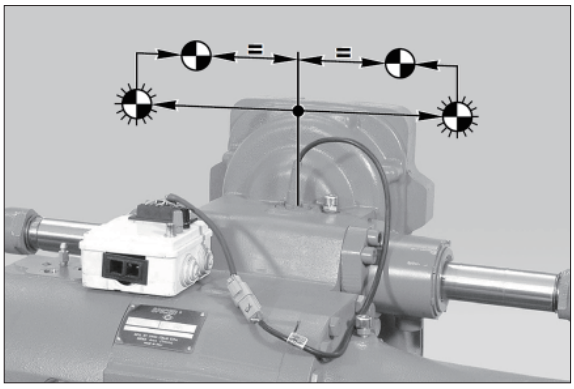


⑯ Connect the sensor (21) to the inspection device according to either diagram.



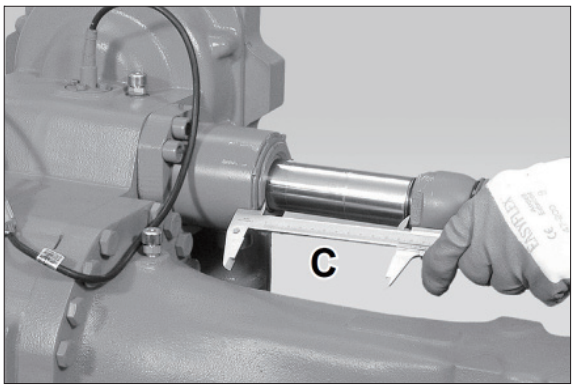


⑰ Center the piston by slowly moving it first in one direction then in the other and position it half way on the stroke, which is determined by the switching on and off of the signal lamp of the inspection device in the reversal stage.



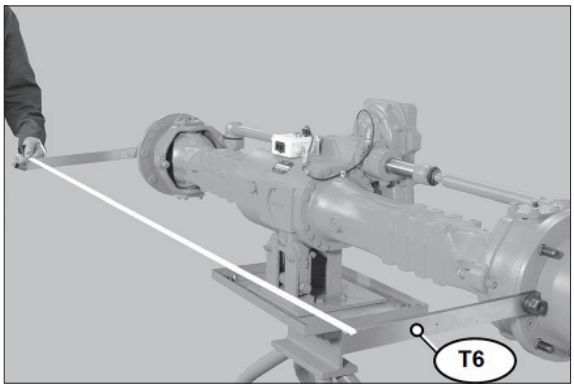
⑱ Inspect jut “C” on one side of the piston and note down the size for checking later adjustments.

※ If cylinders come without a sensor, the centering of the piston must be carried out on the basis of the maximum stroke.



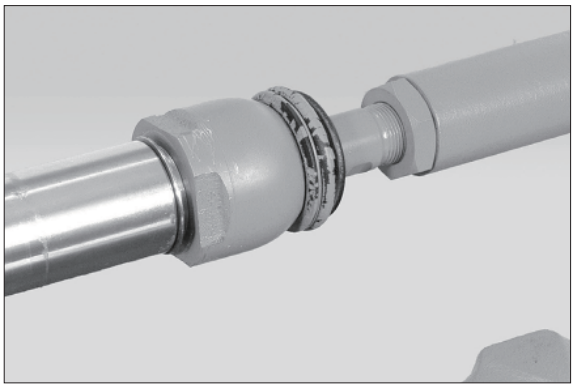
⑲ Without moving the piston, check front and rear size at the edge of tools T6.
Max. difference : 0.6-0.7 ㎜

※ In order to check the rear size, rotate the bevel pinion and check that tools T6 are flat.

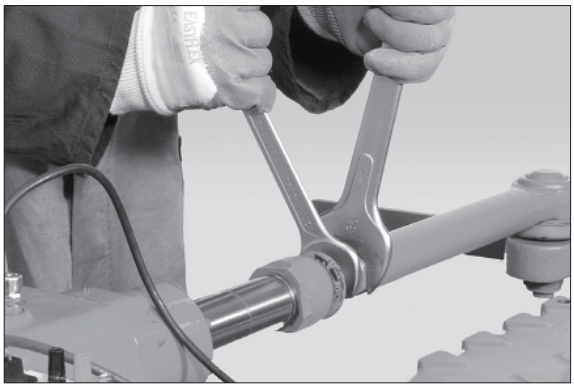


⑳ If necessary, adjust convergency without moving the centering of the piston and adjust the length of the steering bars (14).

※ With a half turn of screw, the front size is reduced by about 3 ㎜, whereas the rear one is increased by about 3 ㎜.

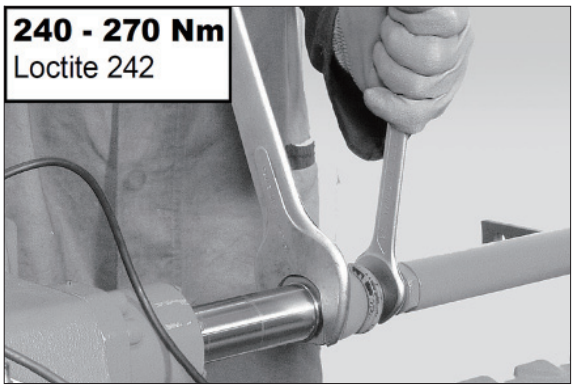


㉑ Unloose the nuts and screw them onto the ball-and-socket joints.



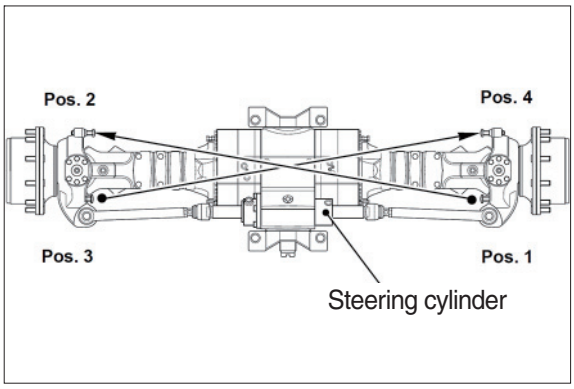
㉒ Hold the articulations still and rotate the ball-and-socket joints.
Once the convergency has been adjusted, lock the nuts.

· Torque wrench setting for nuts :
24.5~27.5 kgf · m (177~199 lbf · ft)

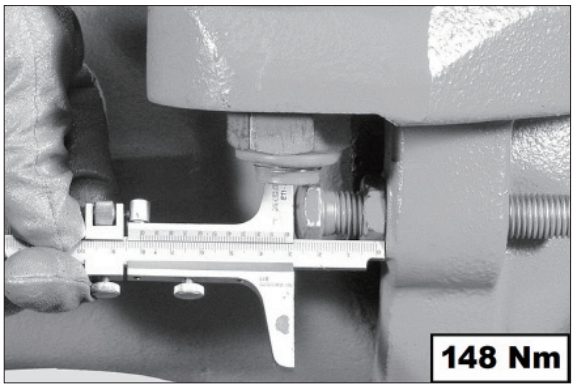


ADJUSTING THE STEERING ANGLE

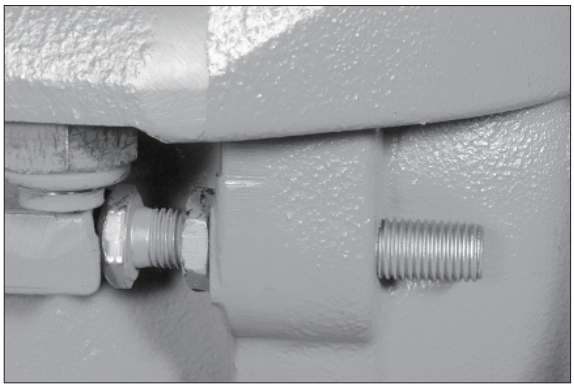
※ Perform the same operations on both sides (see diagram).
Loosen the nut of one of the adjusting screws on cylinder side.



㉓ Adjust the jutting portion of the screw according to data shown in the table (see the next page).
Lock into the position with nut tightened to max 15.1 kgf · m (109 lbf · ft).

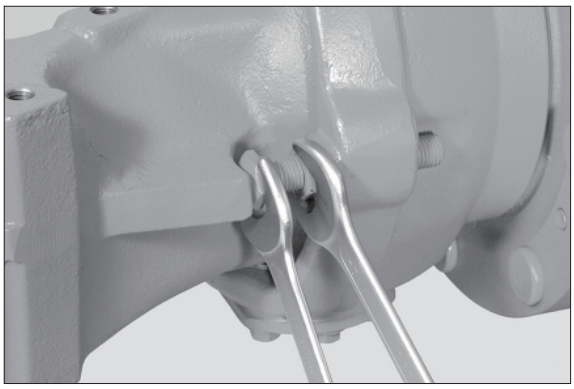


㉔ Perform one full steering operation until the adjusted screw leans against the arm stop.



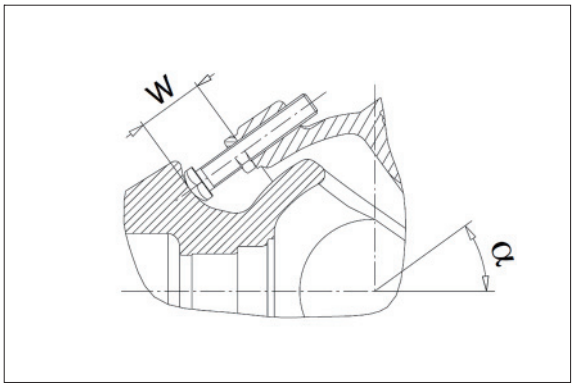
㉕ As you hold the adjusted screw in position against the arm stop, adjust the screw opposite, on non-cylinder side, until it leans against the arm stop.

※ The screws must lean against the respective arm stops all at the same time.



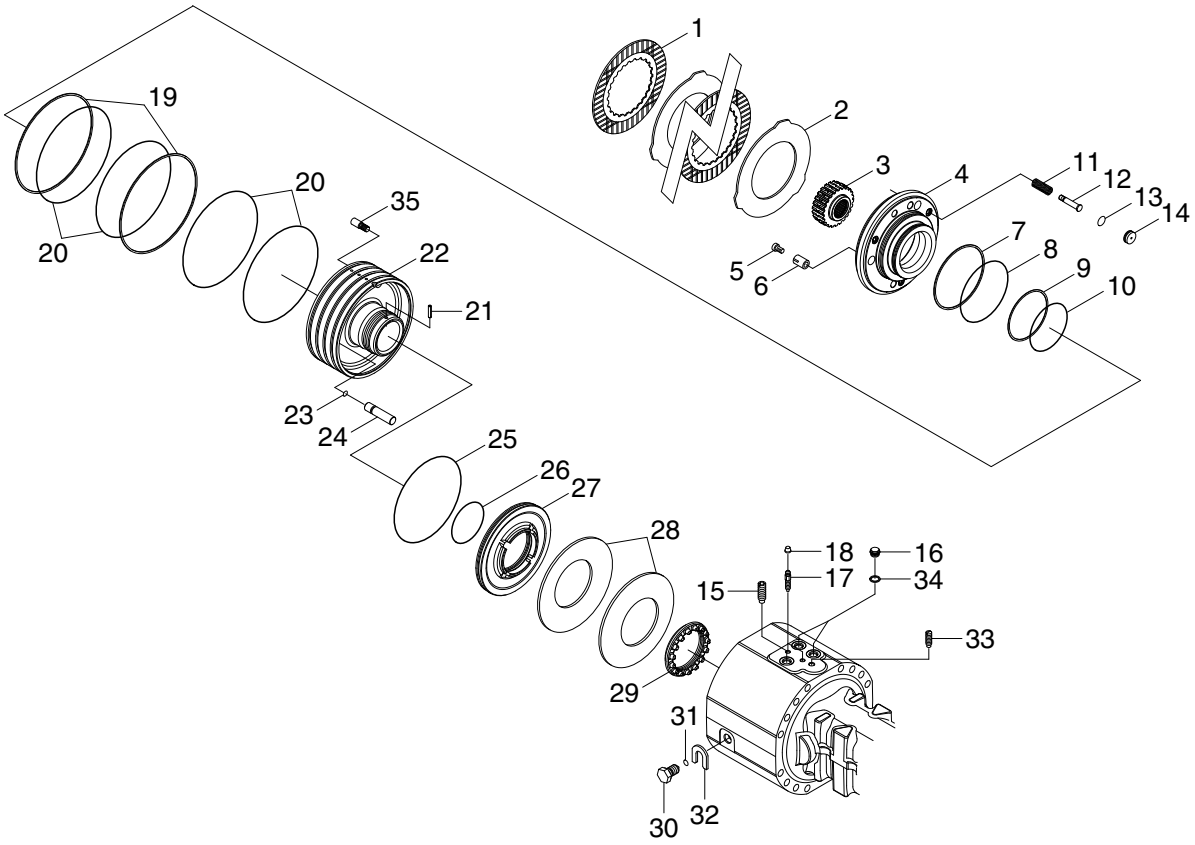
Requested steering angle : value α	25˚	27˚	30˚	32˚	35˚	36˚	40˚	42˚	45˚
Steering cases versions based on max. steering angle	Value W = Adjustment of the steering stop screw, steering cylinder side [mm]								
35˚ max angle	55.1	51.2	45.4	41.4	35.0				
45˚ max angle			57.4		47.0	44.7	35.8	31.2	24.6

※ The screws must lean against the respective arm stops all at the same time.



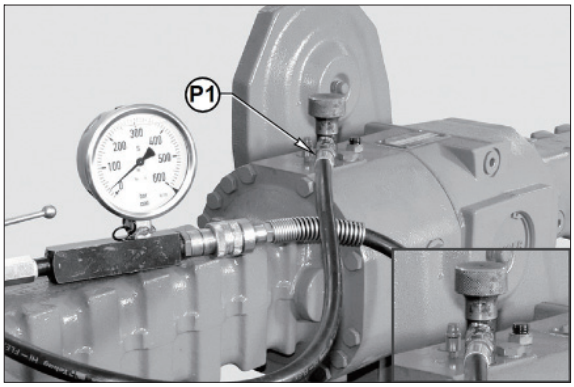
3) BRAKE : SERVICE BRAKE, NEGATIVE BRAKE

(1) Disassembly

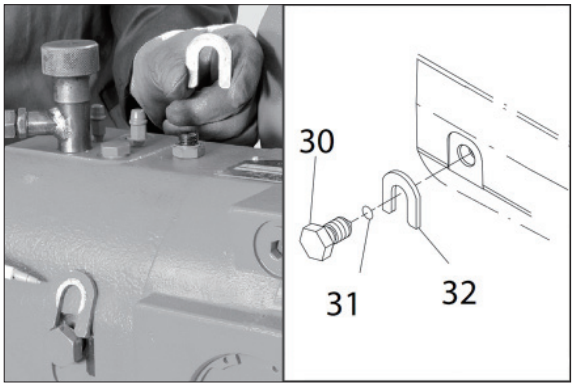


① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15±30 bar to eliminate the pressure of the belleville washers.

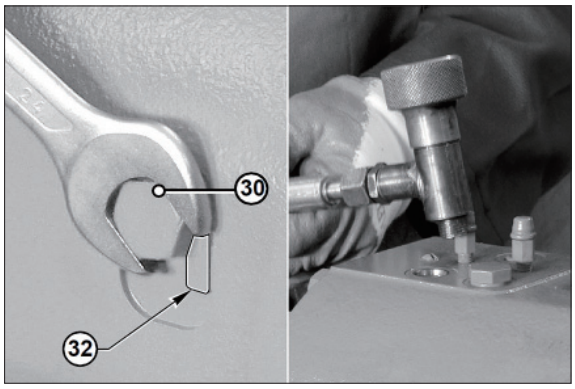
※ Perform all operations on both arms.



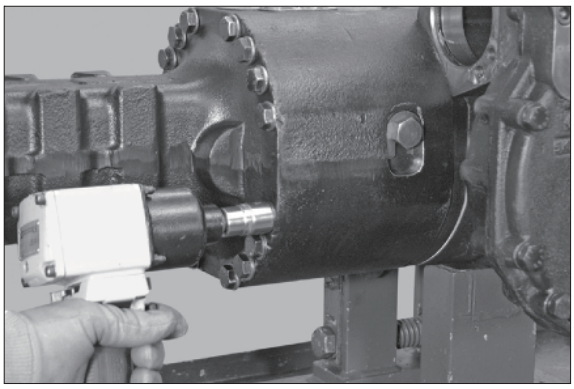
② Loosen the unlocking screws (30) and remove both stop washers (32).



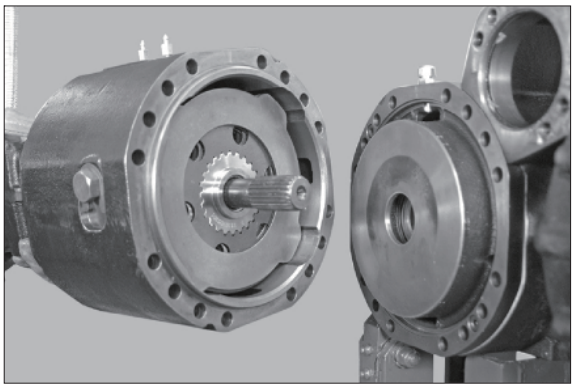
③ Insert block screws to end stroke and release pression.



④ Sling the arm to be removed and connect it to a hoist, remove screws.

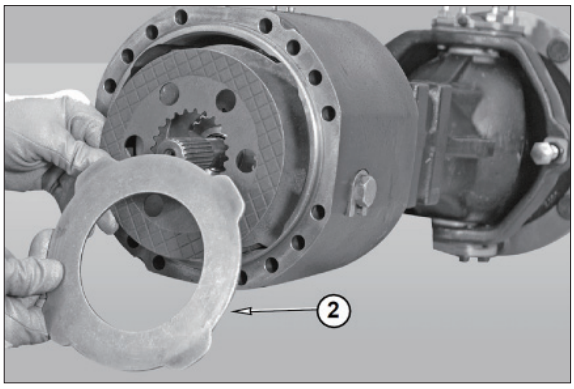


⑤ Take off the arm and lay it down vertically.

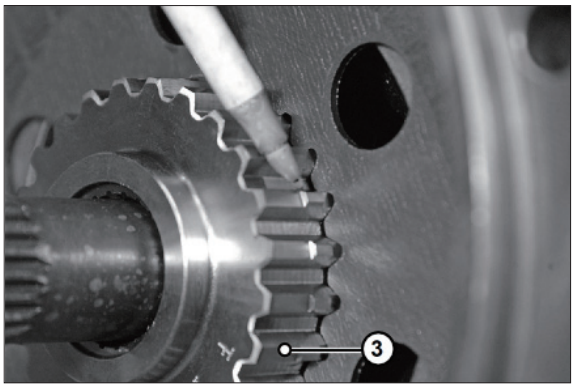


⑥ Remove the brake discs one after the other (2).

※ If they are not to be substituted, do not mix up the sequence.

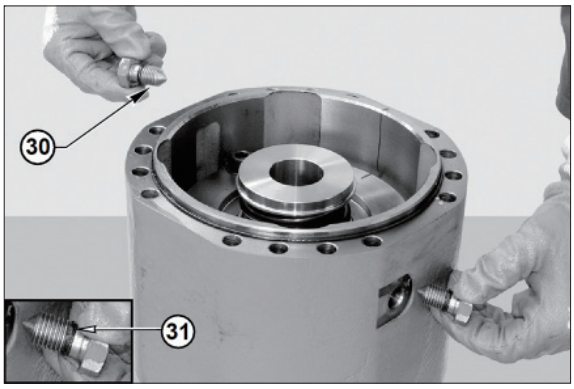


⑦ Remove the flange (3) complete with the discs.



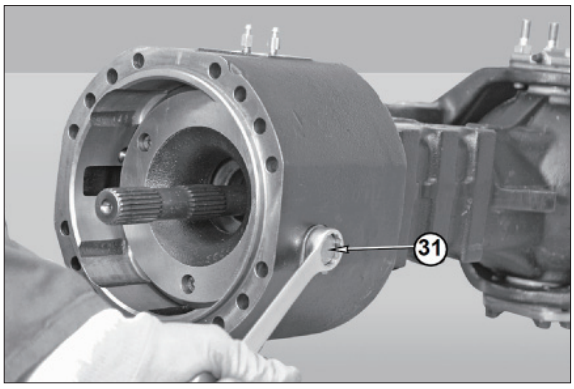
⑧ In order to keep the disc springs of the negative brake preloaded, screw down the screws with washers to the end stop.

⑨ Remove the negative brake locking screws (30).
Always exchange the O-ring (31).

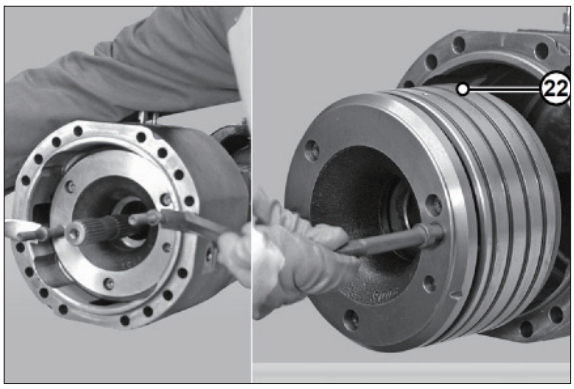


⑩ Loosen the before installed provisional screws in the same sequence and same measure.

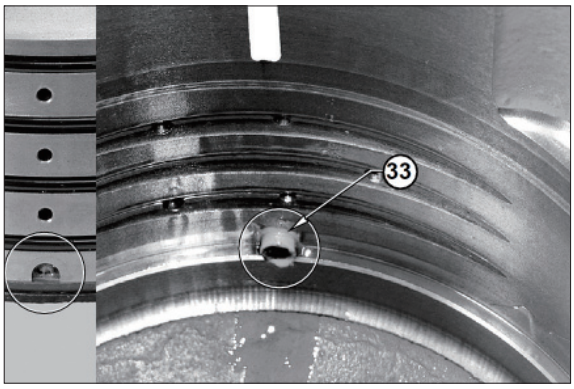
⑪ Remove the negative brake locking screws (30).
Always exchange the O-ring (31).



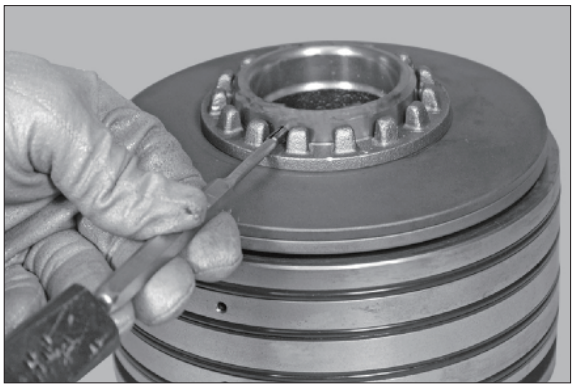
⑫ Pull out brake piston assembly module (22).



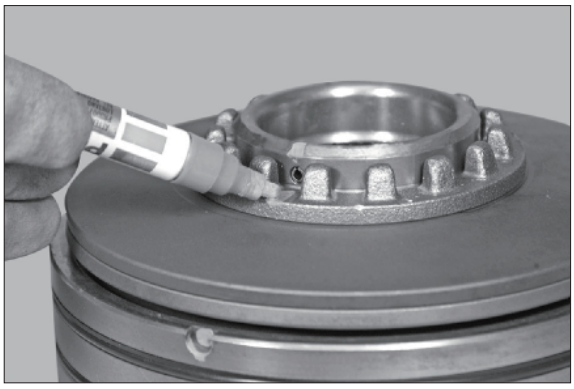
※ Check locking screw (33) of the brake piston module.



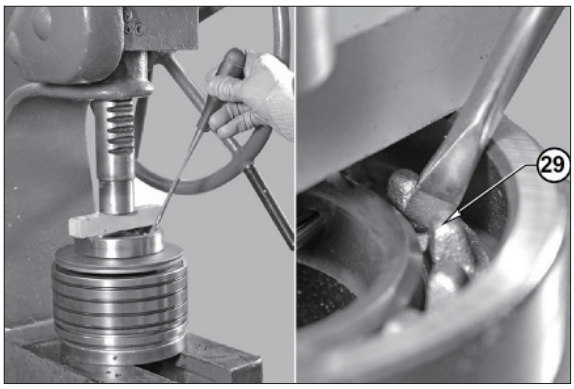
⑬ Turn upside down the brake module and with a pin driver remove the locking pin of the slotted nut.



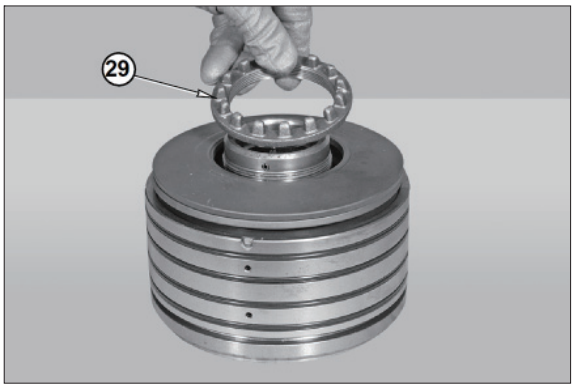
⑭ Sign the position of the slotted nut.



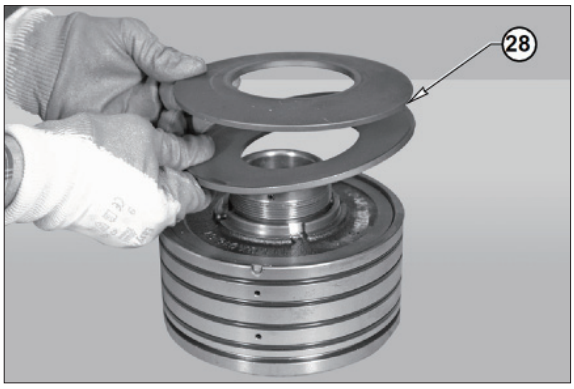
⑮ Bring the piston group below a press, compress the cup springs and loosen the metal ring.



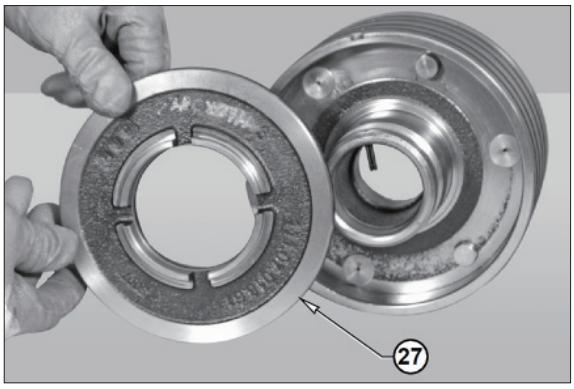
⑯ Remove nut (29).



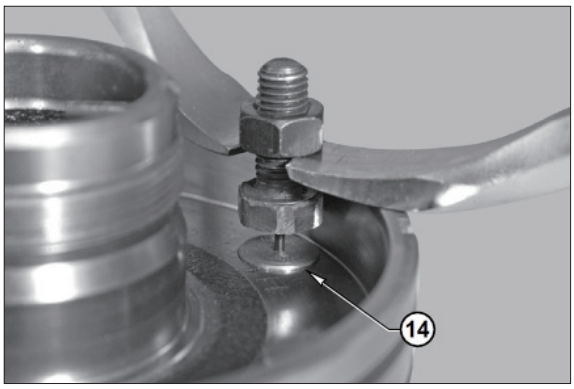
⑰ Remove the disc springs (28).



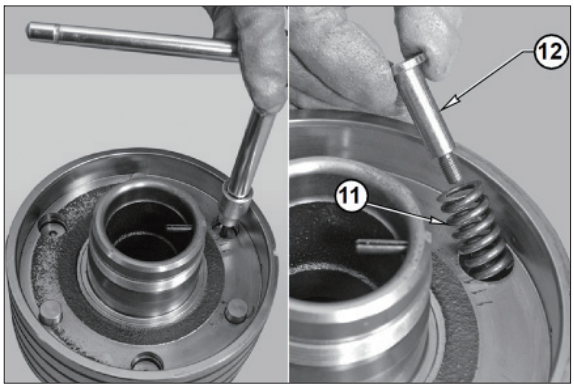
⑱ Applying air pressure, remove the piston (27) of the negative brake.



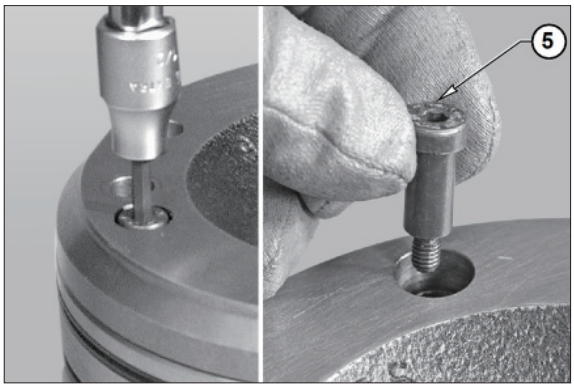
⑲ Using a new screw remove the pressure seal caps.



⑳ Remove the reversal springs (11).

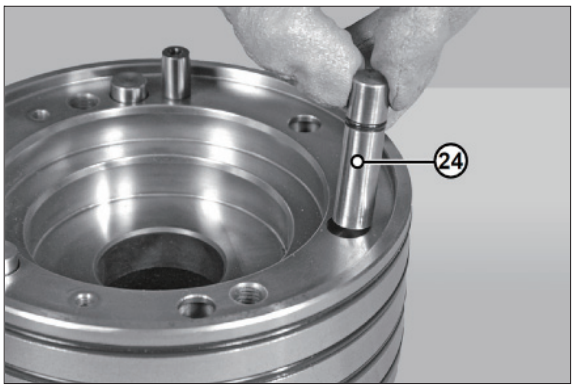


㉑ Remove the adjusting screws (5).

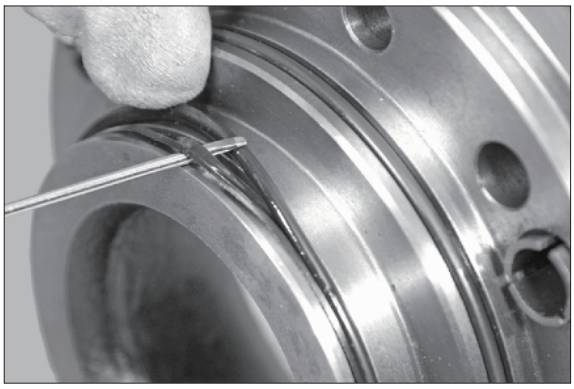


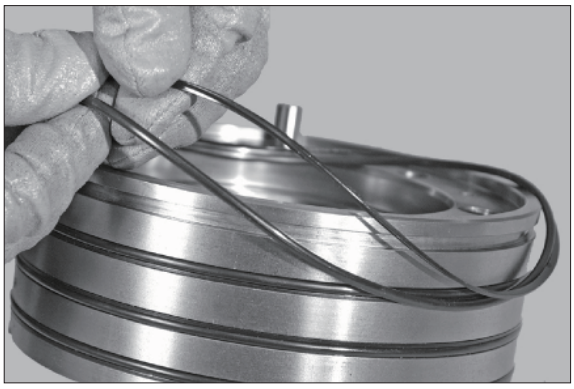
㉒ Remove the service brake piston (4).

㉓ Remove the three bolts (24).

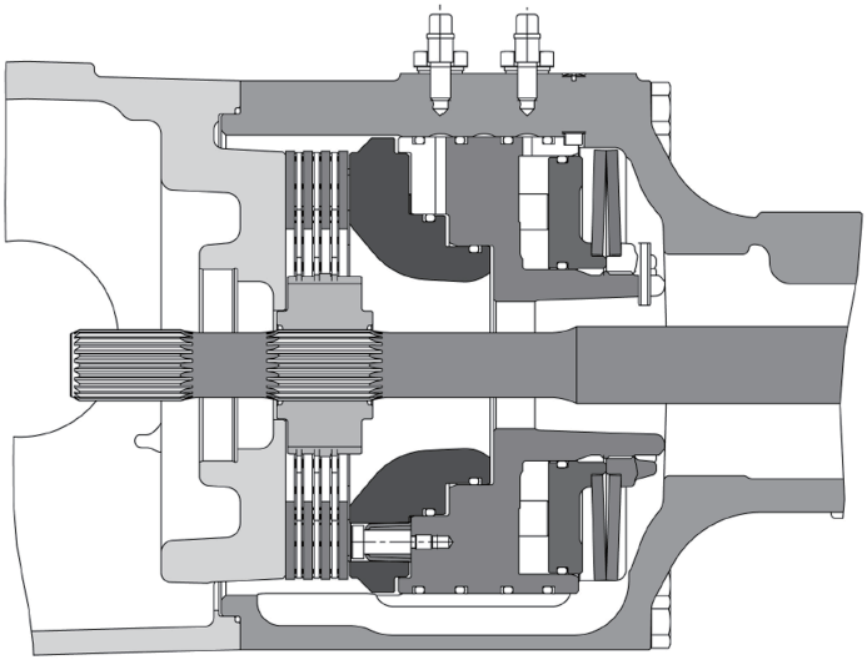


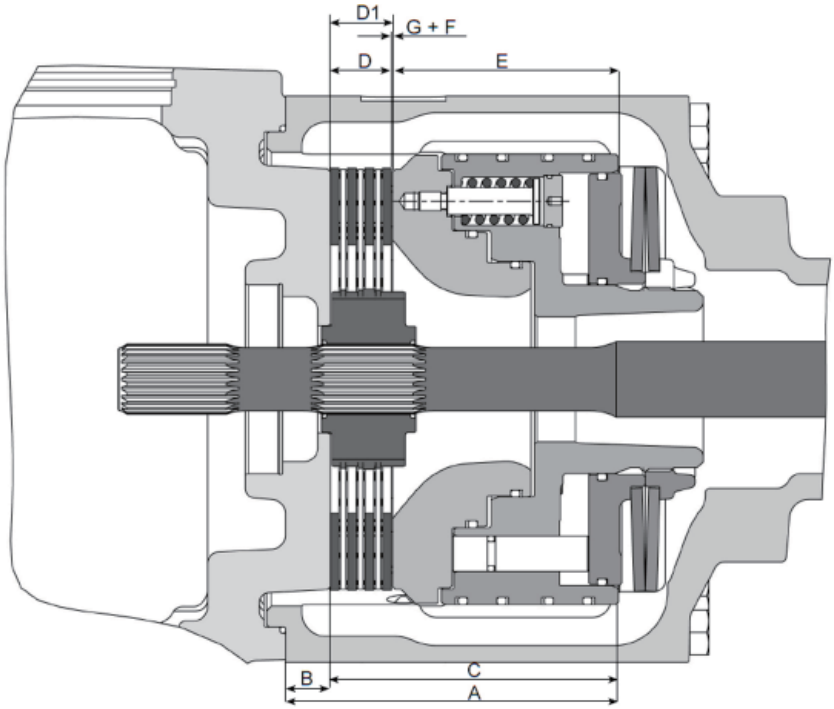
㉔ Remove the O-rings and the anti-extrusions rings from the service brake, the negative brake piston and from the piston.





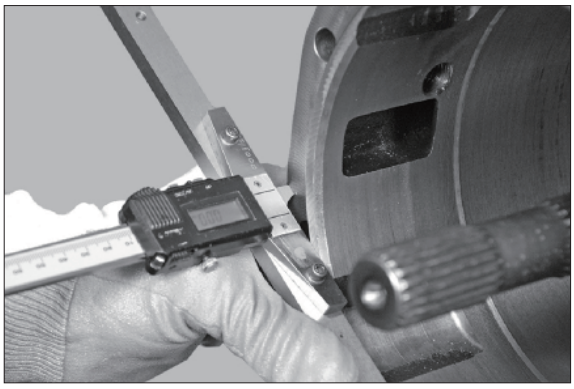
(2) Assembly



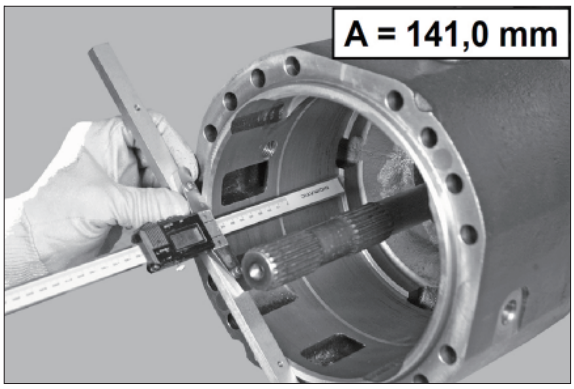


C = A - B
141.0 - 19.0 = 122 mm
C = arm quote
D1 = D + G + F
26.0 + 0.75 + 0.2 = 26.95 mm
D = tickness of discs pack
G = brake discs gap
F = fix quote
E = C - D1
122 - 26.95 = 95.05 mm
E = piston pack quote

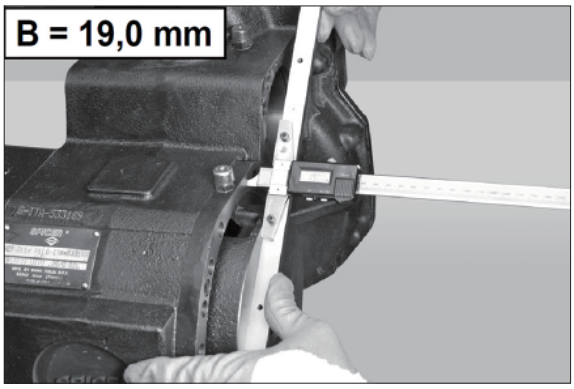
① Zero the centesimal calibre between the support plane and the centering arm.



② Then measure the distance between the arm support plane and the piston pack stop.

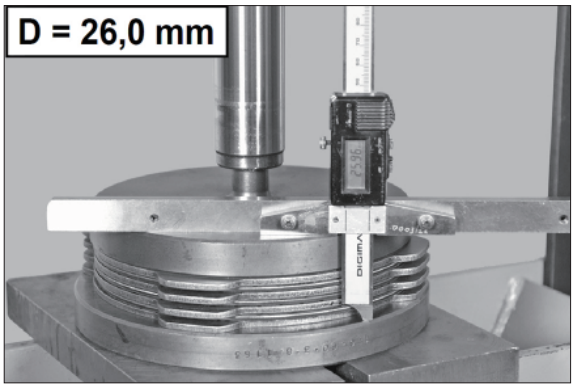


③ Measure the distance between the disk support plane and the arm support plane.
Subtract the value B from the value A to obtain the effective dimension of the arm containing the brake disks and the piston pack.



④ Bring the disk pack beneath a press, load with 1000 kg, then measure the dimension D.
Add the play G and the fixed value F (equal to 0.2 mm) to the value D.

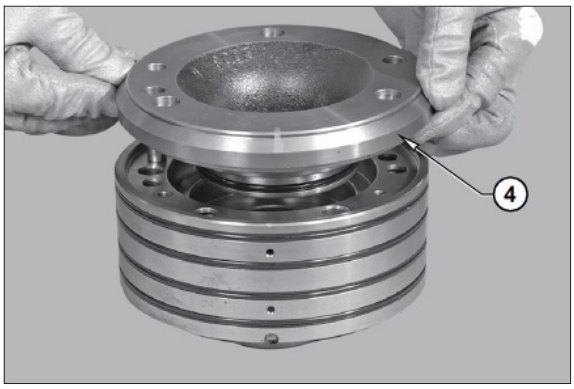
※ Do not take into account the thickness between the press piston and the disks.



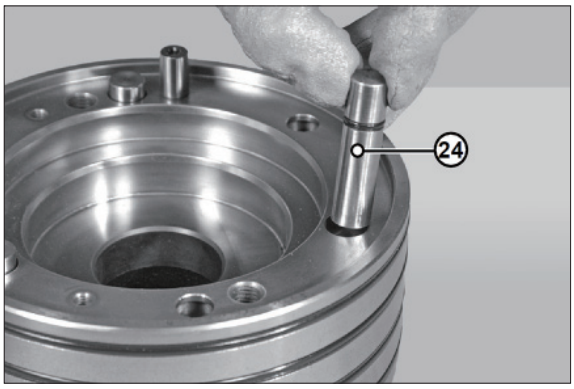
⑤ To determine the value of the piston pack, subtract value C from value D1.

C = A - B
141,0 - 19,0 = 122 mm
C= arm quote
D1 = D + G + F
26,0 + 0,75 + 0,2 = 26,95 mm
D= tickness of discs pack
G= brake discs gap
F= fix quote
E = C - D1
122 - 26,95 = 95,05 mm
E = piston pack quote

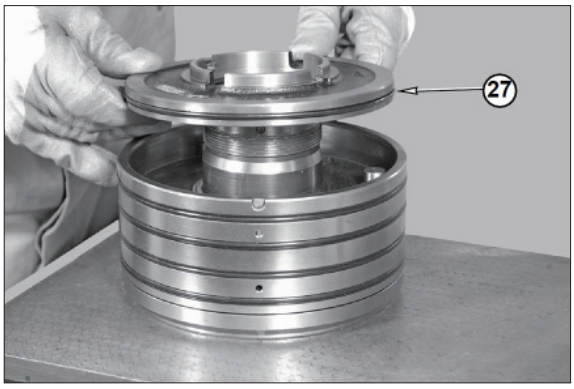
⑥ Insert the service brake piston (4) hammering alternately with a plastic hammer.



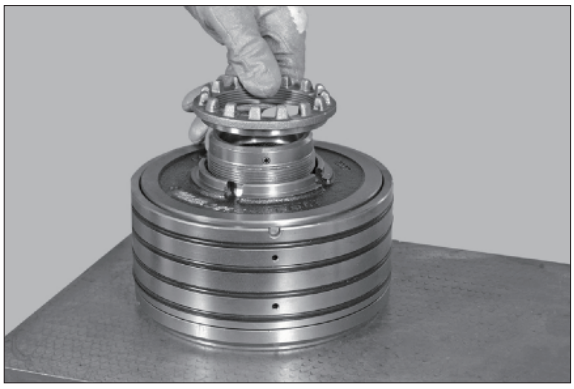
⑦ Insert the bolts (24).



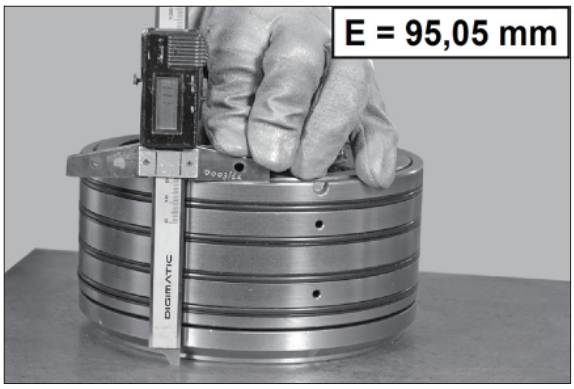
⑧ Turn upside down and insert the negative brake piston (27).



※ To determin the level “E” the slotted nut has to be operated without spring mounted.

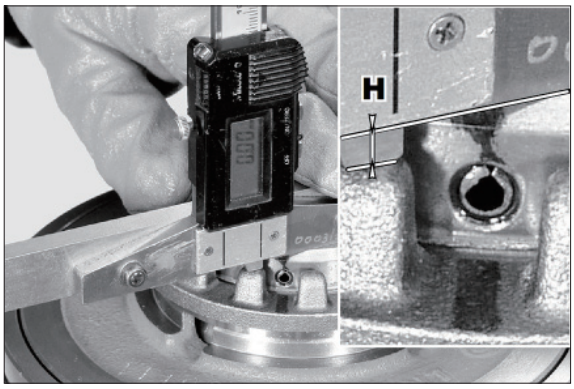


※ To define the level “E” adjust the slotted nut always to the smaller value by driving to the closer notch.

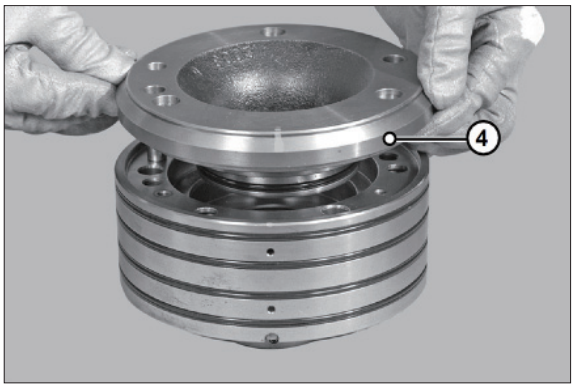


⑨ Before removing the slotted nut in order to insert the springs, note down the distance “H” from the plane to the tooth near the pin.

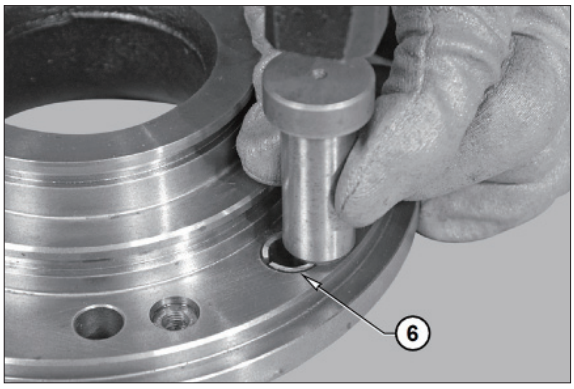
※ Sign.



⑩ Remove the service brake piston (4).

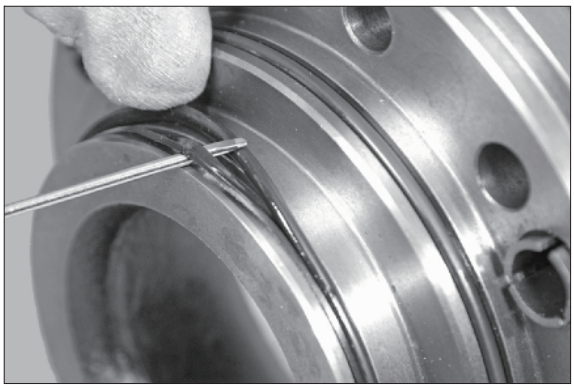


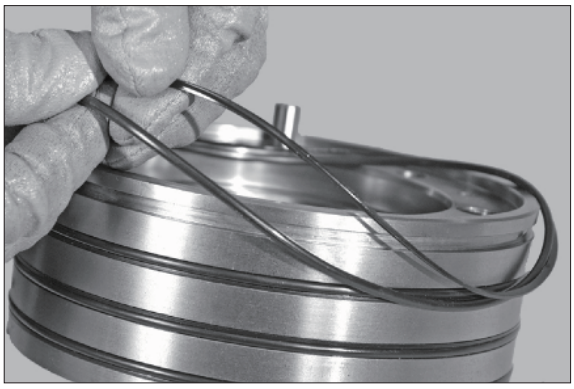
⑪ Insert the stroke automatic regulation springs (6); place them in line with the piston (4).



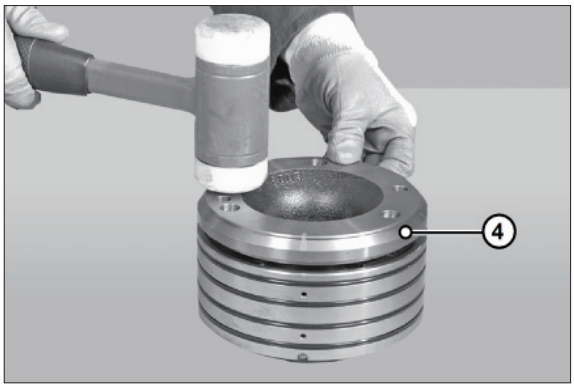
⑫ Complete the O-rings and anti-extrusion rings on all pistons.

※ The O-rings always have to be assembled from the pressure facing side.

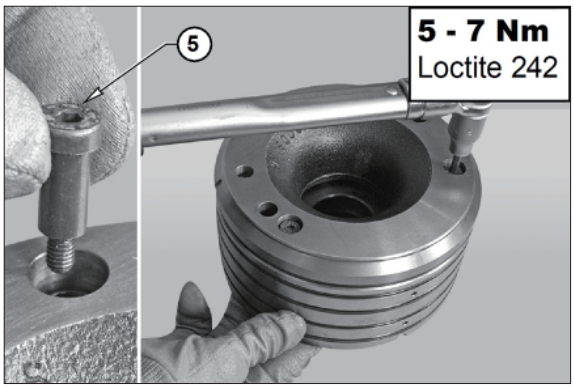




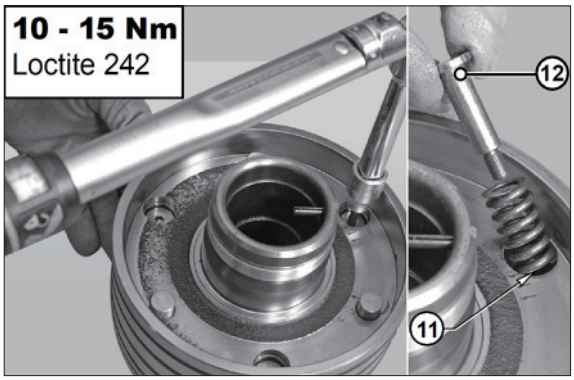
⑬ Insert the service brake piston (4) hammering alternately with a plastic hammer.



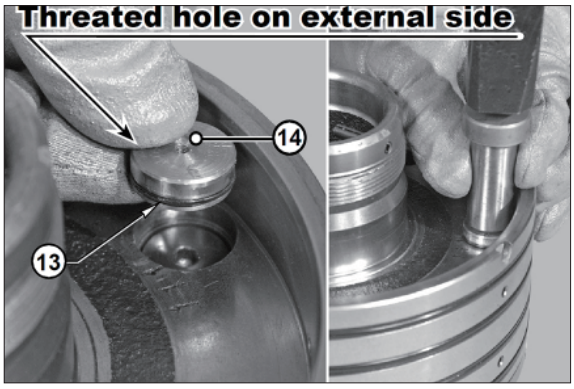
⑭ Fit the adjusting screws (5).
Apply loctite 242 to the thread.
· Torque wrench setting :
0.51~0.71 kgf · m (3.69~5.16 lbf · ft)



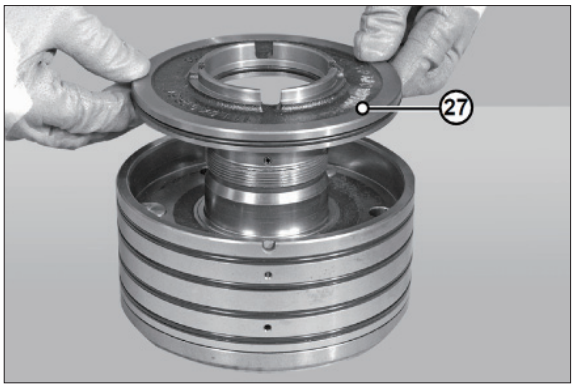
⑮ Fit the reversal springs (11) on the piston (4).
Apply loctite 242 to the thread of the adjustment screw.
Tighten with torque wrench setting of 1.02~1.53 kgf · m (7.38~11.1 lbf · ft).



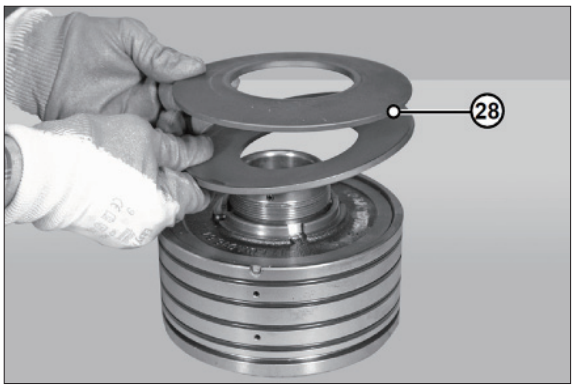
⑯ Insert the stroke end seal caps.



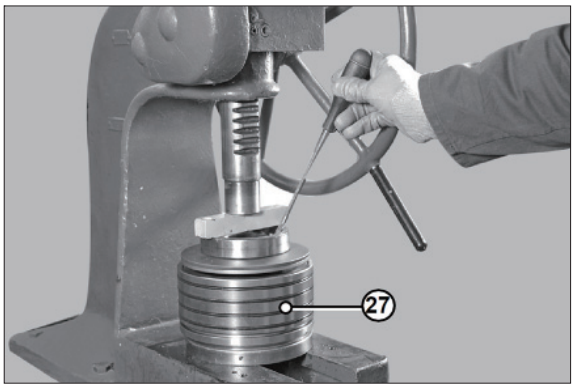
⑰ Insert the negative brake piston (27).



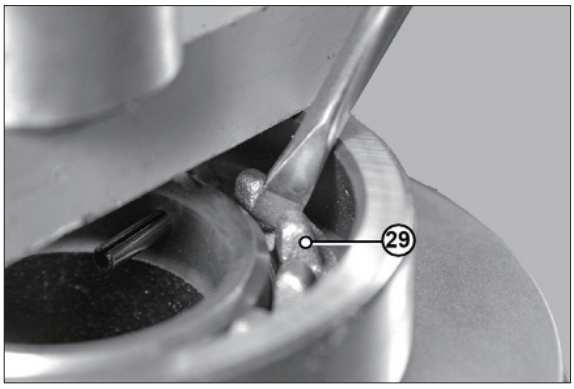
⑱ Insert the disc springs in the right position (28).



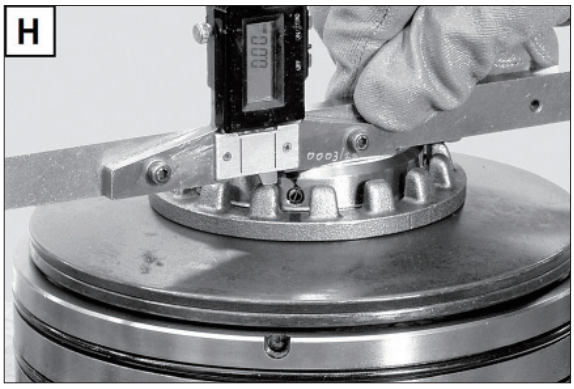
⑲ Insert at the bottom the piston of the negative brake (27) and screw up the slotted nut (29).



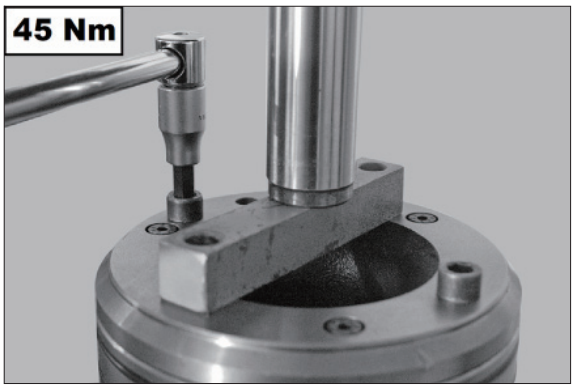
⑳ Screw down the slotted nut to the earlier determined position.



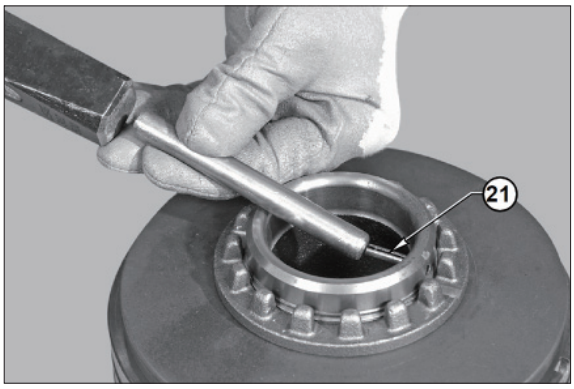
㉑ Check the earlier measured distance “H” from the plane to the tooth next to the pin.



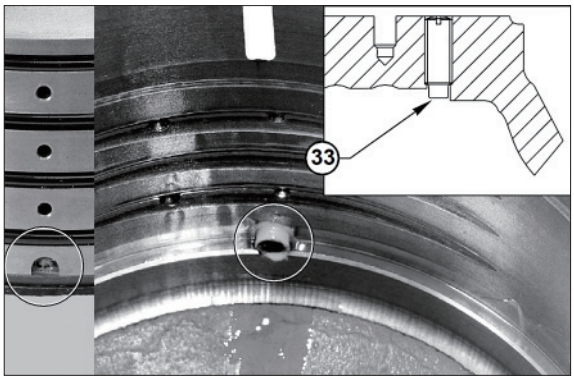
㉒ Alternately tighten with a torque wrench setting of maximum 4.59 kgf · m (33.2 lbf · ft).



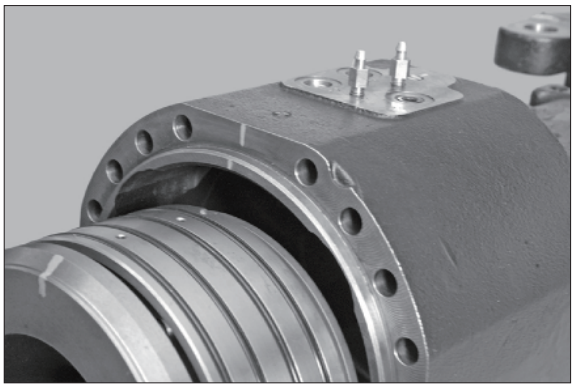
㉓ Put the pin in locking (21) position.



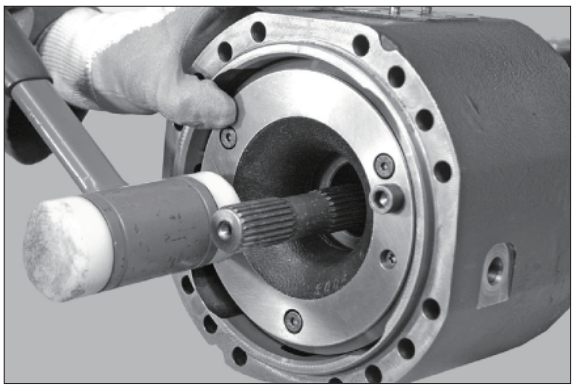
※ Check locking screw (33) of the brake piston module.



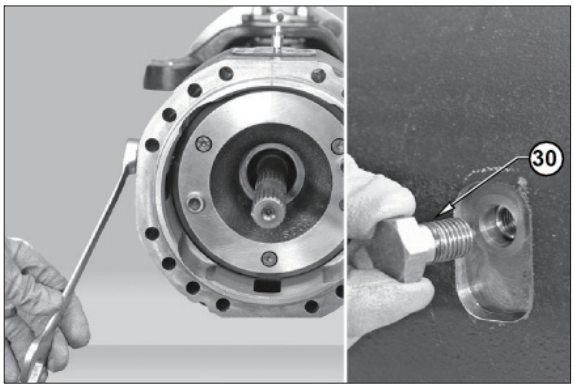
㉔ Insert the brake module facing the input holes to the top.



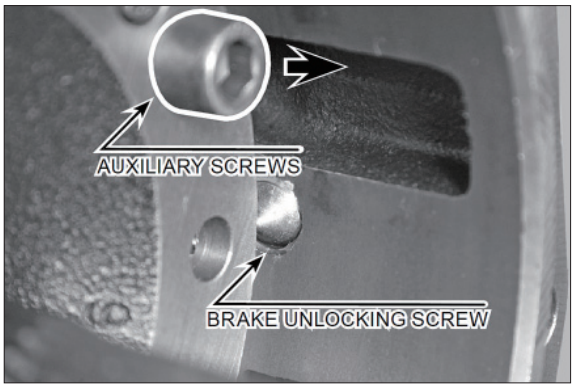
㉕ Insert the piston to the end stop by alternating light strokes and remove the screws.



㉖ Insert the negative brake unlocking screw (30) up to the end stop.

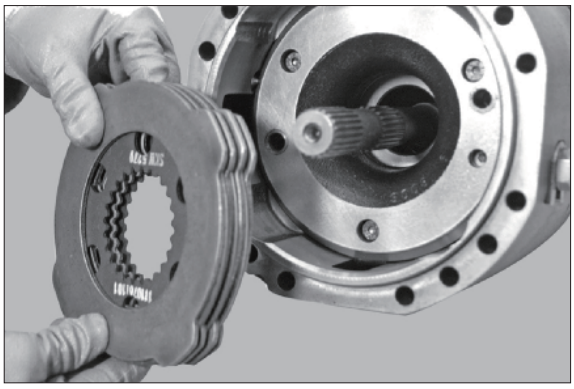


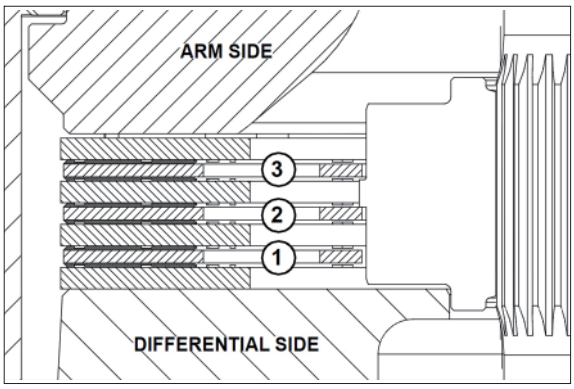
㉗ Remove the two auxiliary screws.



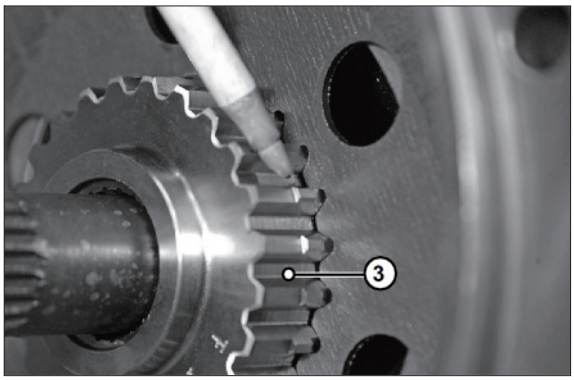
㉘ Insert the brake discs (1) (2) in the right sequence.

※ The first brake disc to be inserted must be of friction material.



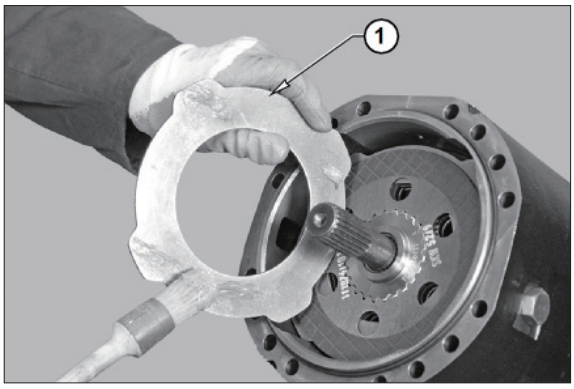


㉙ Install the flange (3) on the arm.

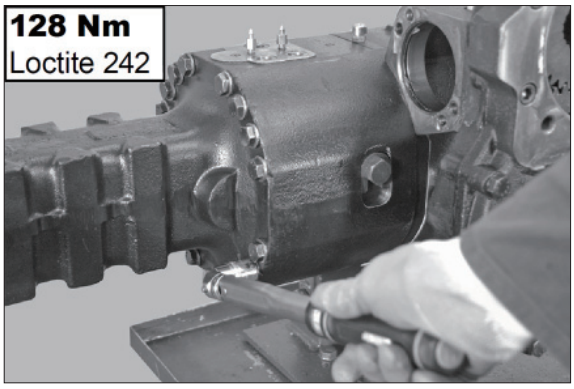


㉚ Insert the brake discs (1) (2) in the right sequence.

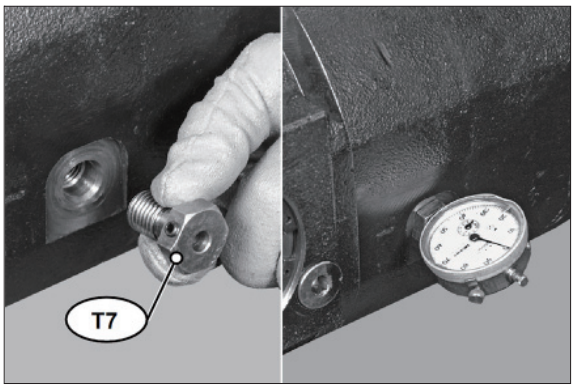
※ The last brake disc to be inserted must be of metal material.



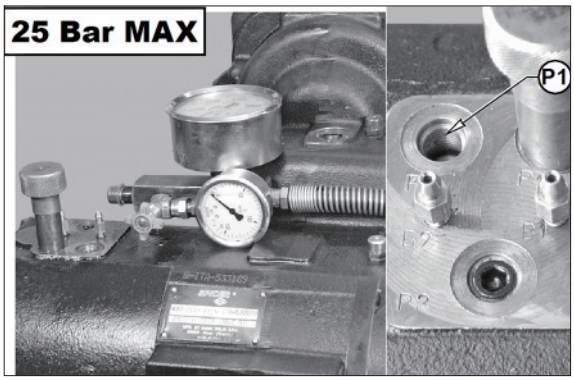
㉛ Insert the screws and tighten them alternately.



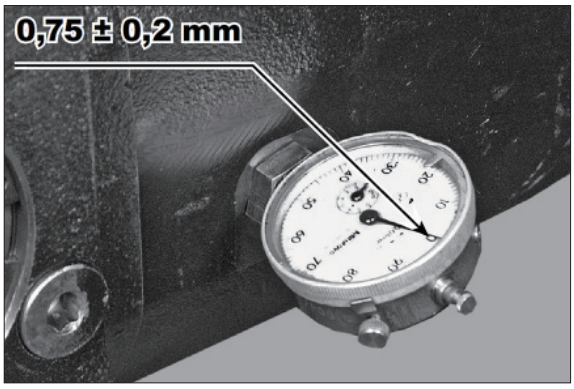
㉜ Remove the negative brake locking screws (30).
Fit the special tool T7 into the seat of the manual release of the screws, insert a comparator and pre-load it with 1 mm.



㉝ Introduce a pressure of maximum 25 bar.

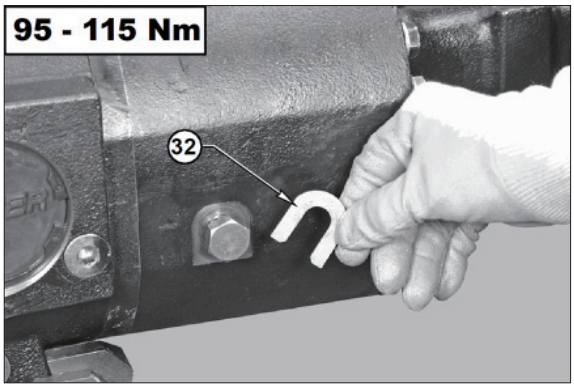


㉞ Once the pressure is inserted into the circuit the comparator must give a measurement equal to play X (0.75 mm).

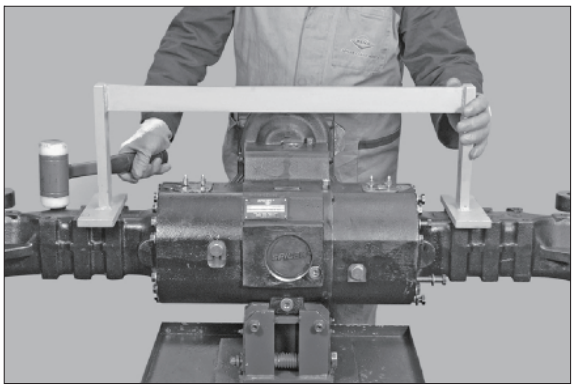


㉟ Insert the two “U”-shaped shims and tighten the screws with a torque wrench setting of 9.69~11.7 kgf · m (70.1~84.8 lbf · ft).

※ The position of the negative brake is unlocked.

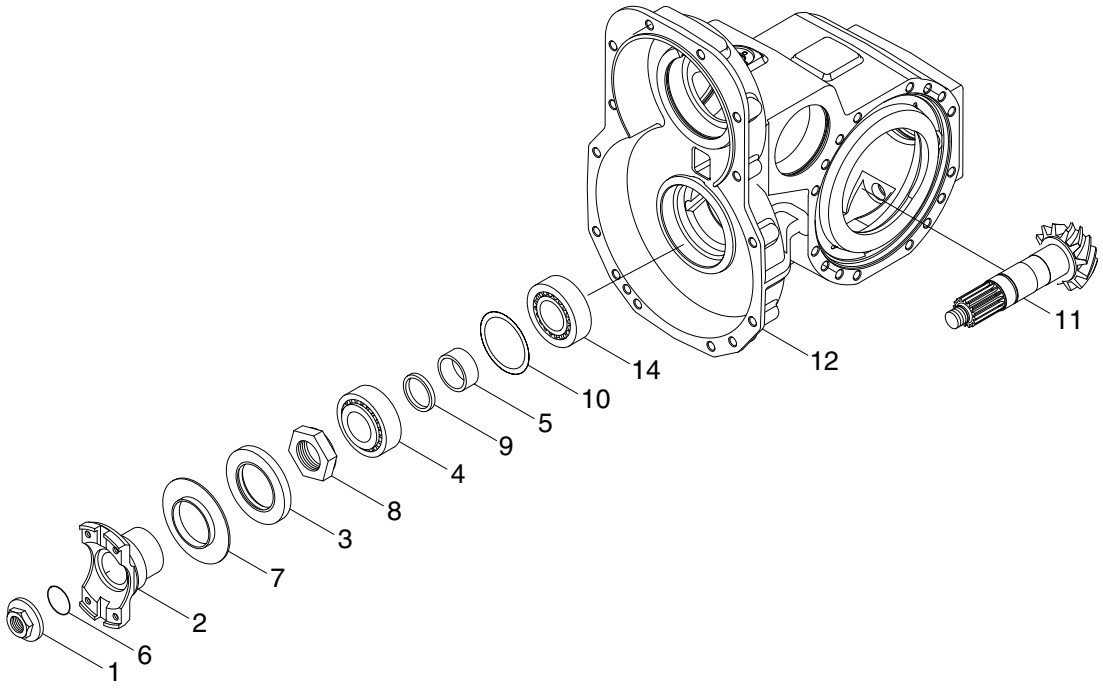


㊱ Check the flatness of the arms and finally lock the arms with the screws (4) and the washer (5) using the crosstightening method.

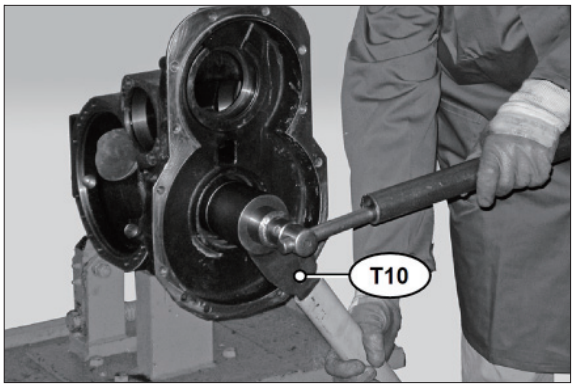


4) BEVEL PINION

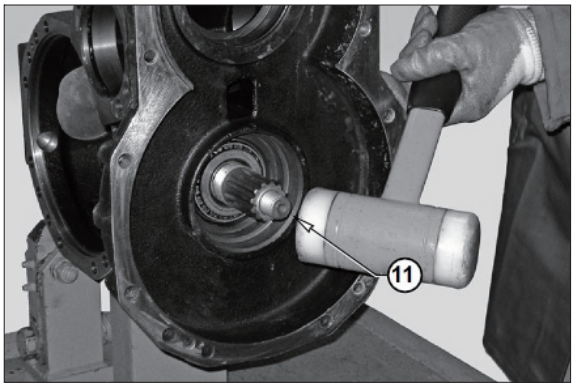
(1) Disassembly



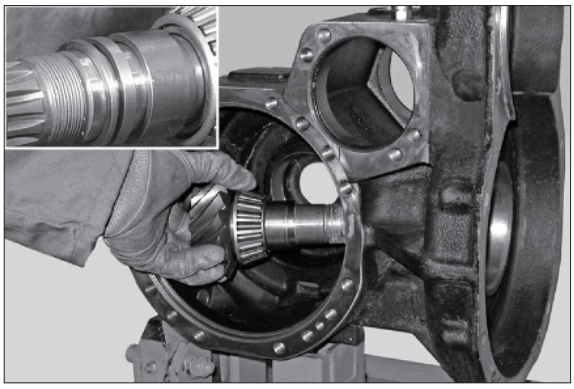
① Position tool T10, so as to avoid pinion rotation.
Unloose and remove the nut (1); also remove the O-ring (6).



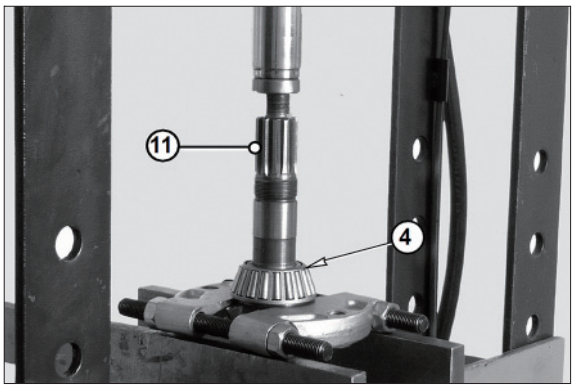
② Remove the pinion (11), shims and distance piece.



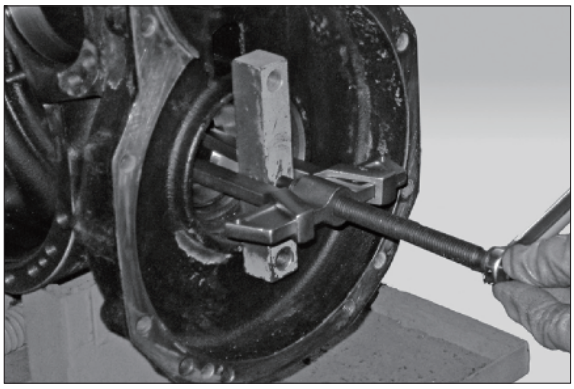
③ Refer and keep to the positions marked during disassembly.



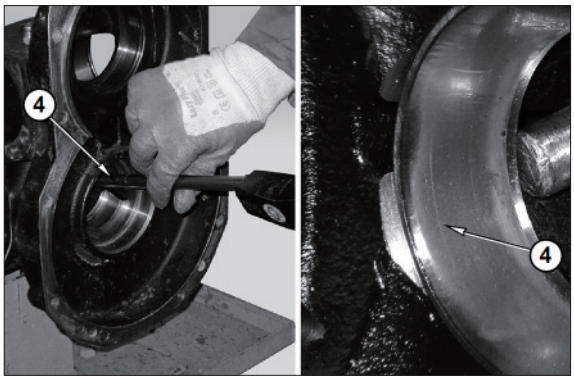
④ Using a puller and a press, remove the inner bearing (4) from the pinion (11).



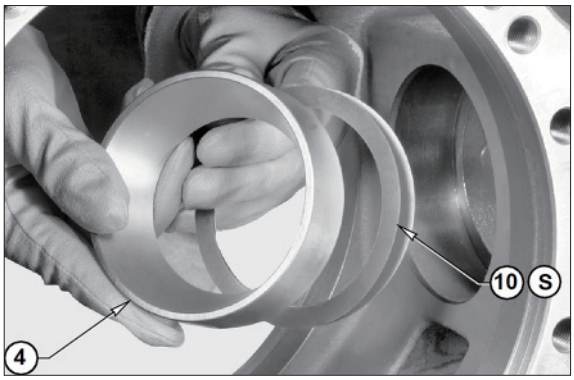
⑤ Remove the thrust block of the external bearing (14).



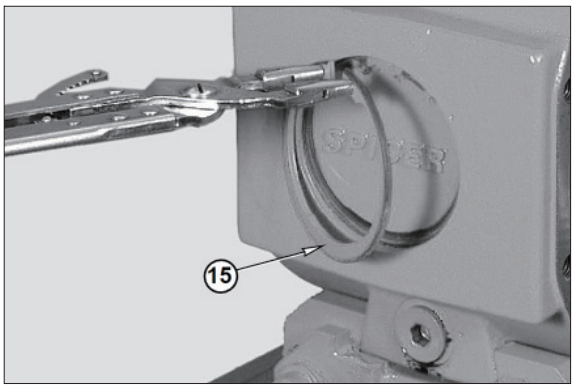
⑥ Insert a drift in the appropriate holes.



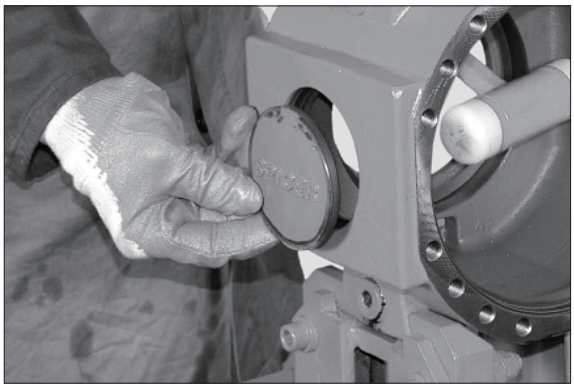
⑦ Remove the thrust block of the internal bearing (4) as well as the shim washers (10) (S).



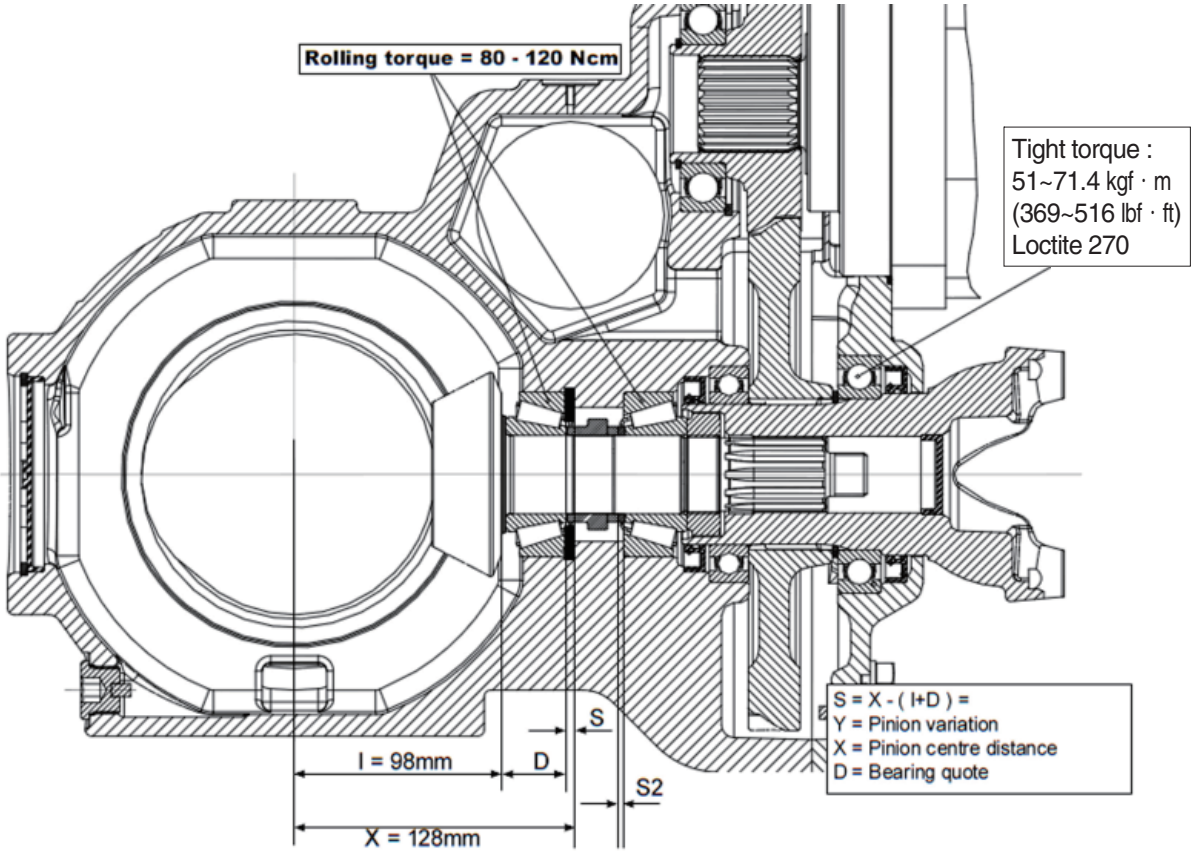
⑧ Remove the snap ring (15).



⑨ Remove the cap (14).

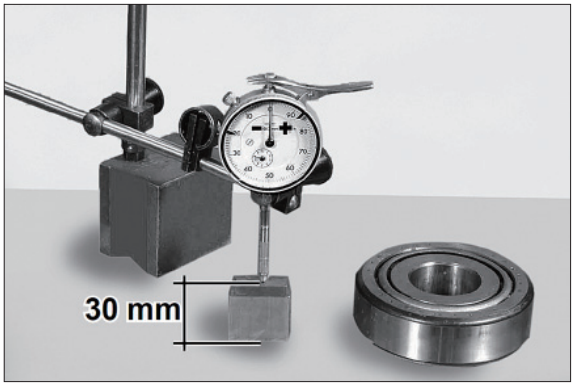


(2) Assembly



Calculating pinion center distance

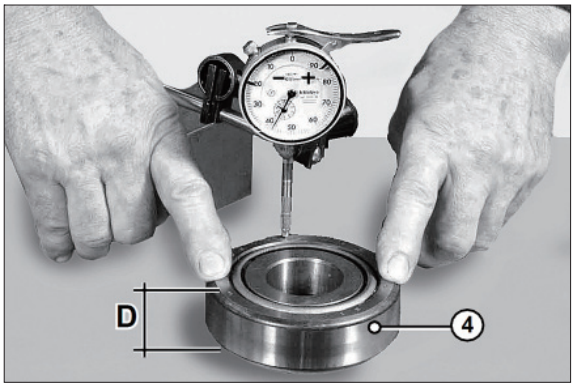
① Using a faceplate, reset a centesimal comparator “DG” on a calibrated block (whose known thickness is 30 ㎜). Preload the comparator by about 3 ㎜.



② Bring inner bearing (4), complete with thrust block, under comparator “DG”.

※ Press the thrust block centrally and carry out several measurements by rotating the thrust block.

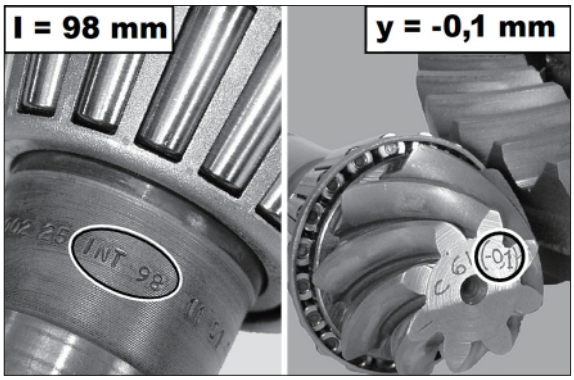
Example : 30 - 0.55 = 29.45 = “D”.



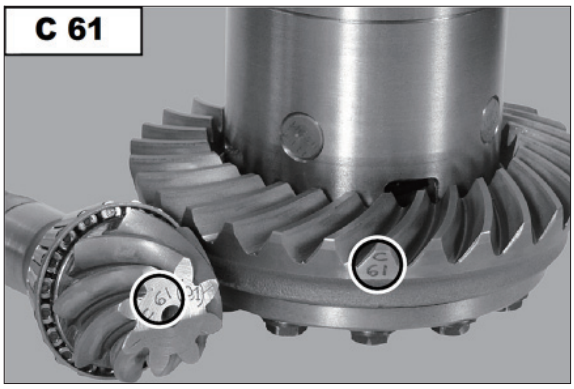
③ Check nominal dimension “I” as marked on the pinion. Add up to or subtract from “I” the variation indicated as “Y” to obtain the actual centre distance “I”.

Example : I=INT±Y=98 - 0.1=97.9 ㎜

※ C61 = Match part number

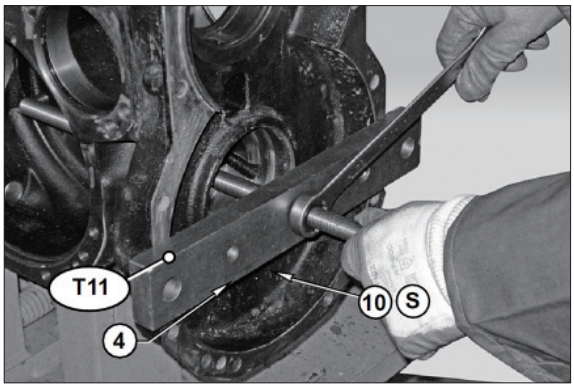


④ C61=bevel gear set matching number
(-0.1)=Y variation from the theorical I =98

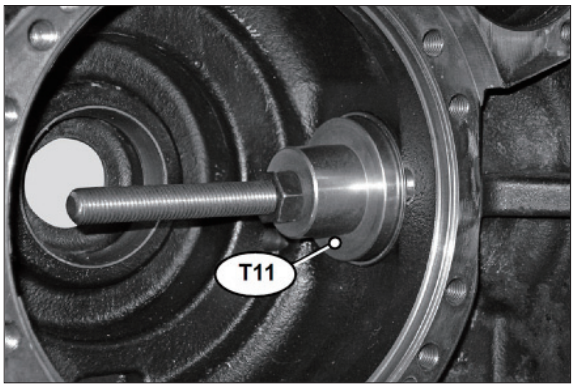


⑤ Calculate shims “S” for insertion under the thrust block of the inner bearing using the following formula :
S = X-(I+D) where : X = fixed dimension
I = actual pinion center distance
D = Total bearing thickness ;
Example :
S = 128 - (97.9+29.45) = 0.65 ㎜

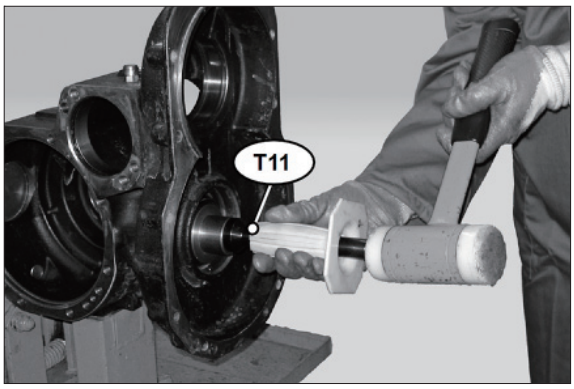
⑥ Using special tool T11.
Insert the thrust block of the bearings (4) and shims (10).



※ Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.

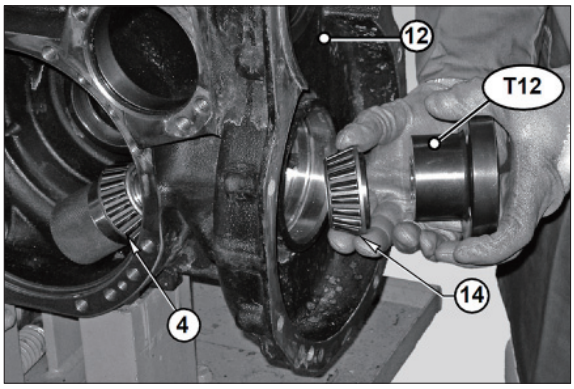


⑦ Using special tool T11.
Insert the thrust block of the bearings (4) and shims (10).

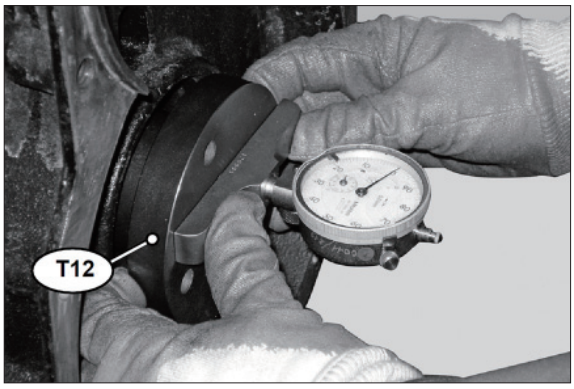


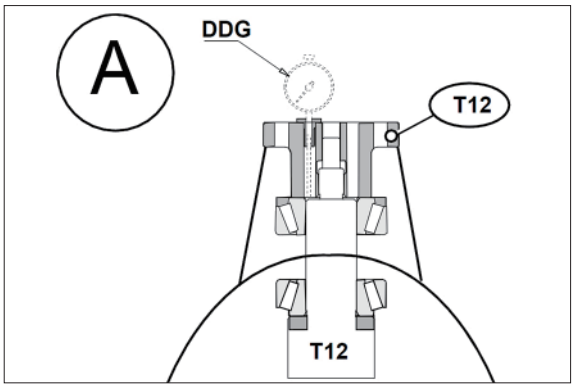
Calculating pinion bearings rolling torque

⑧ Introduce tool T12 complete with bearings (4) and (14) into the main body (12); tighten by hand until a rolling torque is definitely obtained.

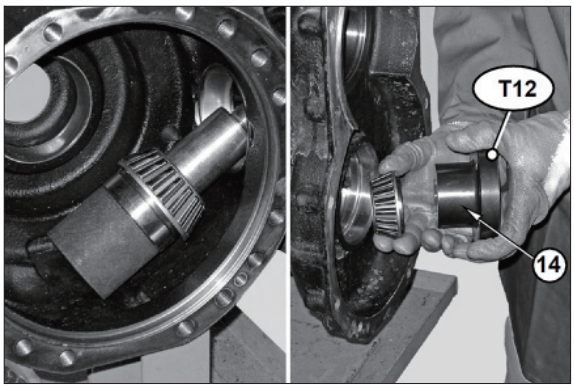


⑨ Introduce the tracer of a depth comparator “DDG” into either side hole of tool T12.
Reset the comparator with a preload of about 3 mm.



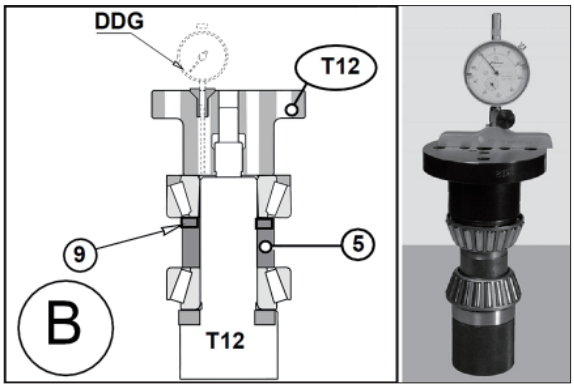


⑩ Remove the comparator and take out tool T12 and bearing kits from the main body.
Reinstall every part, also introducing a distance piece between bearings (4) and (14). Tighten the entire pack by hand.



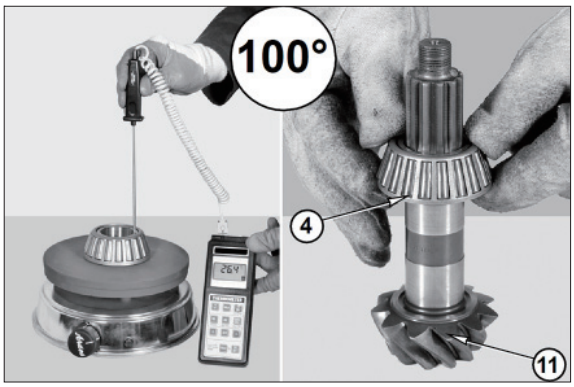
⑪ Assemble on top of the tool T12 and between the two bearings the shim (5) and the largest calibrated shim (9).

⑫ Measure the difference H using a dial gauge DDG.
・Example : H = A - B = 2.93 mm



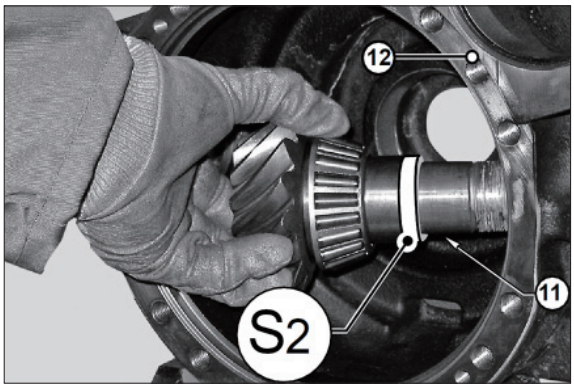
⑬ Calculate the shim S2 to be inserted.
Example : S2 = H + X1 = 3.01 ㎜
where X1 = fixed value to obtain =
0.07~0.08 ㎜

⑭ Heat the bearing to 100˚C and assemble it to the pinion shaft.



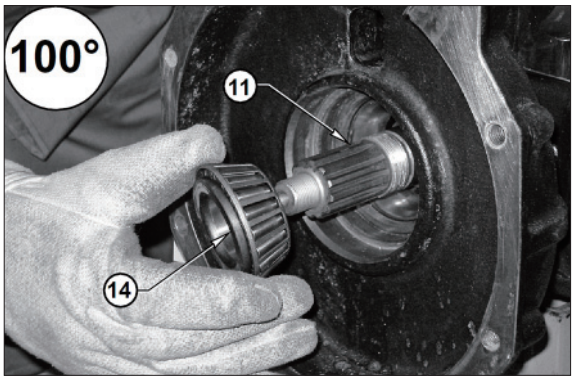
⑮ Fit the pinion (11), shim “S2” (10) and distance piece (5) (9) in the main body (12).

※ The finer shims must be placed in-between the thicker ones.

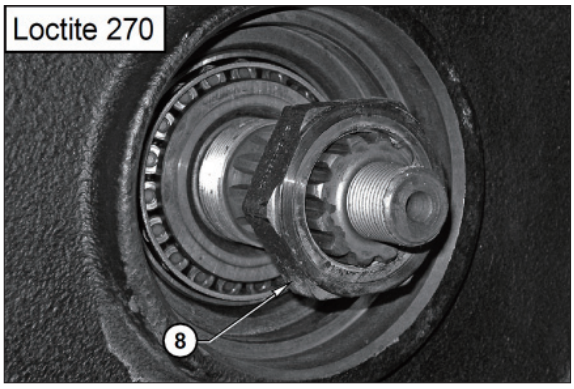


⑯ Heat the external bearing (14) to a temperature of about 100˚C and fit it on to the pinion (11) so as to complete the pack as shown in the figure.

※ Lightly lubricate bearing with SAE85W90 oil.



⑰ Apply loctite 270 to the thread of the ring nut (8) and screw the nut onto the pinion.

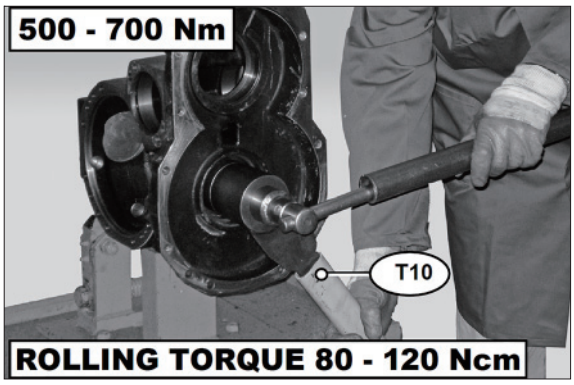


⑱ Apply onto the pinion (11) the bar-hold and with the help of a torque meter, check the torque of the pinion (11).

・Torque : 50.9~71.4 kgf · m
(368~516 lbf · ft)

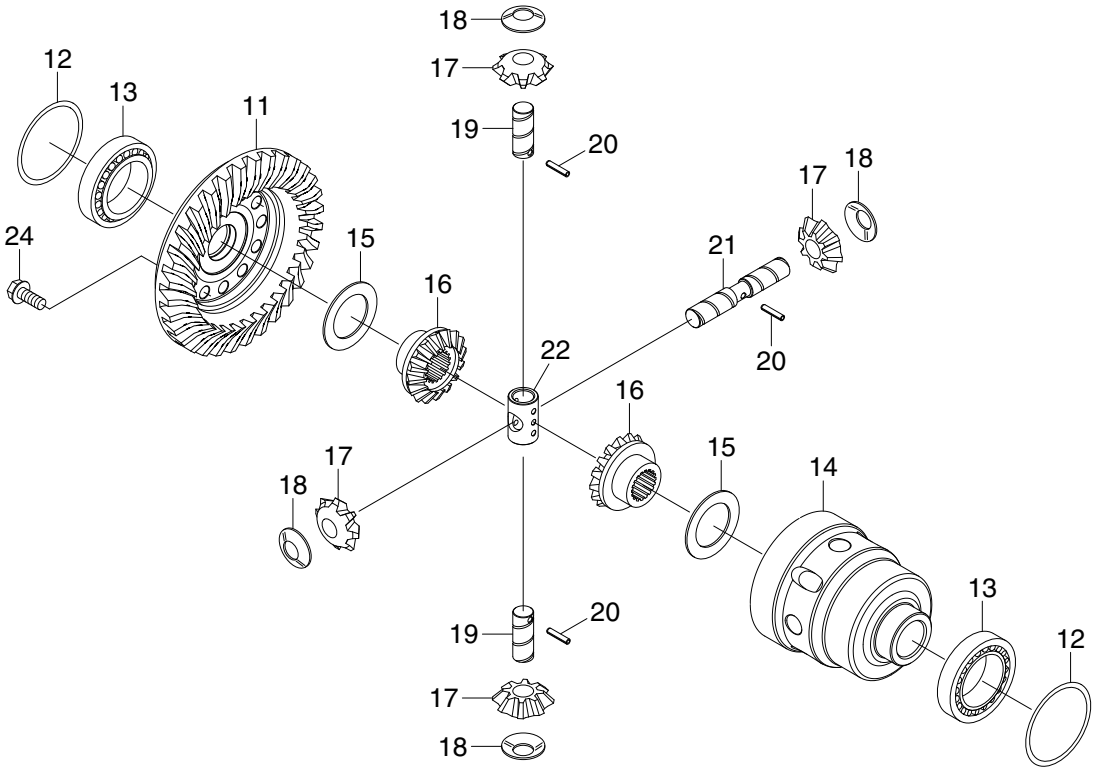
※ If torque exceeds the maximum value, then the size of shim “S1” (4) between the bearing (9) and the distance piece (3) needs to be increased. If torque does not reach the set value, increase the torque setting of the ring nut (10) in different stages to obtain a maximum value of 50.9 kgf · m (368 lbf · ft).

※ If torque does not reach the minimum value, then the size of shim “S1” (4) needs to be reduced.

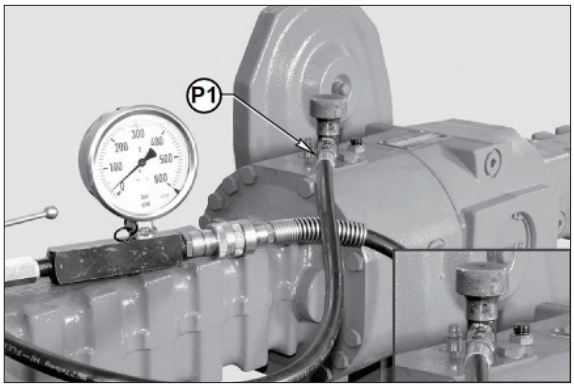


5) DIFFERENTIAL UNIT

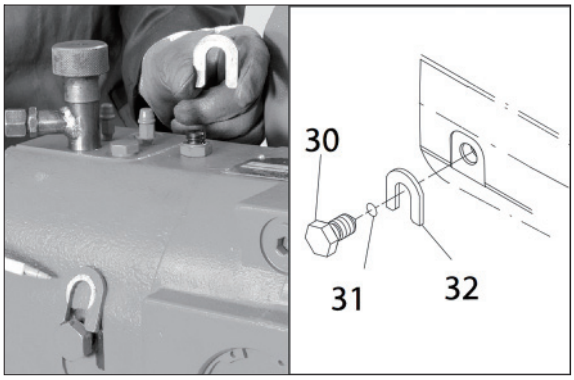
(1) Disassembly



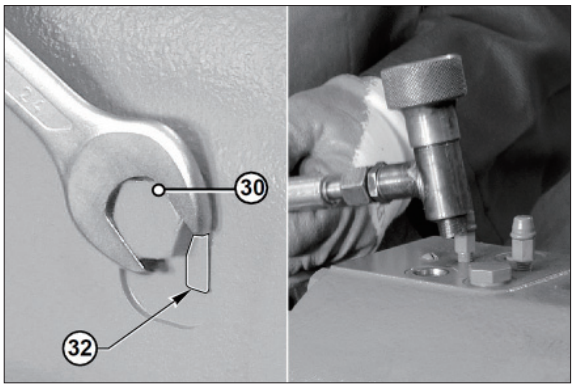
① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15±30 bar to eliminate the pressure of the belleville washers.



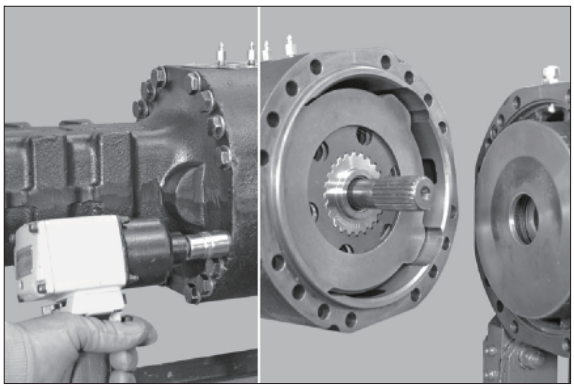
② Loosen the unlocking screws (30) and remove both stop washers (32).



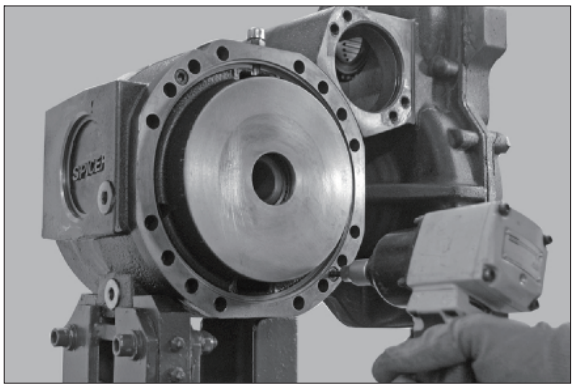
③ Insert block screws to end stroke and release pression.



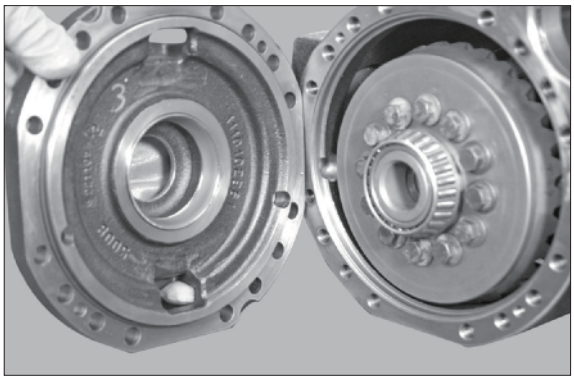
④ Remove the brake side arm and the brake discs pack.
Sling the arm to be removed and connect it to a hoist, remove screws of the crown wheel side arm.
Remove the arm together with the pack of the braking disks.
Place the arm on a bench.



⑤ Remove the fitting screws from the middle cover.

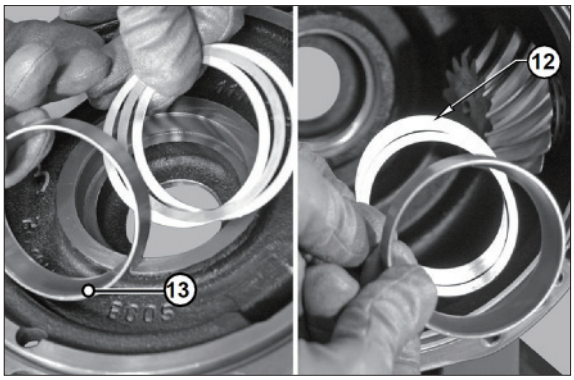


⑥ Insert a screw-driver in the opposing slots then force and remove the middle cover.

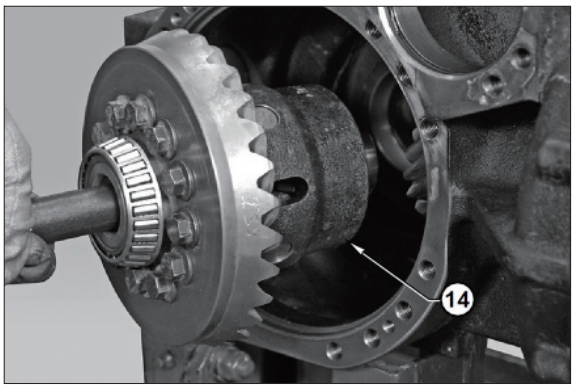


⑦ If the bearings need replacing (13), extract the external thrust blocks of the bearings (13) from middle cover and central body.

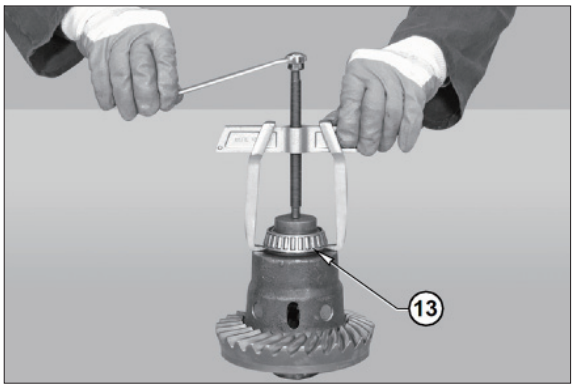
※ Accurately check the O-ring.



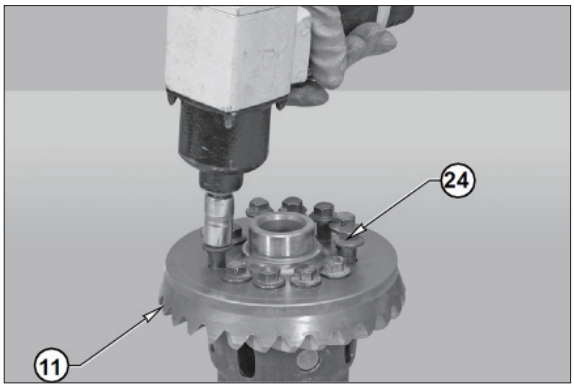
⑧ Pull out the differental (14).



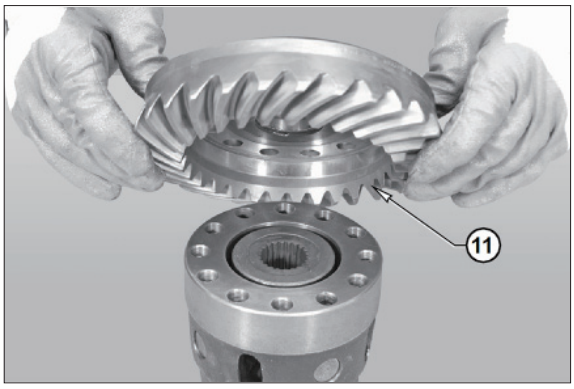
⑨ If the bearing need replacing, extract the bearing (13) from the differential carrier.



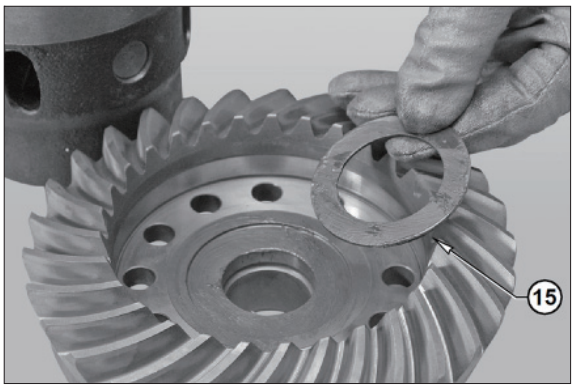
⑩ Remove fixing screws (24) of the crown wheel (11); exchange each time when removed.



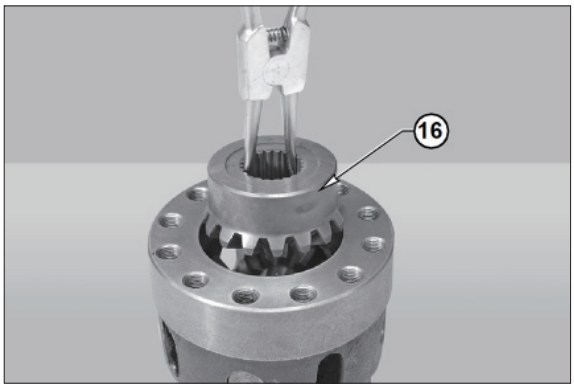
⑪ Extract the crown wheel (11).



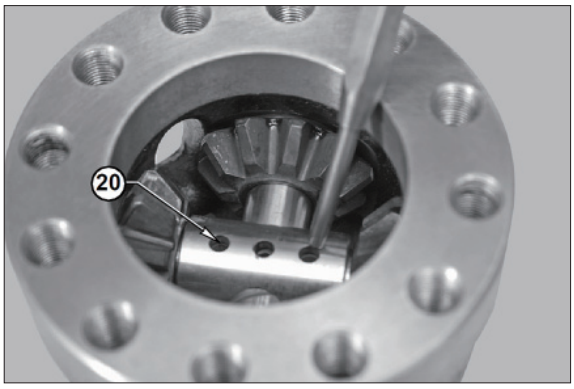
⑫ Remove the shim washer (15).



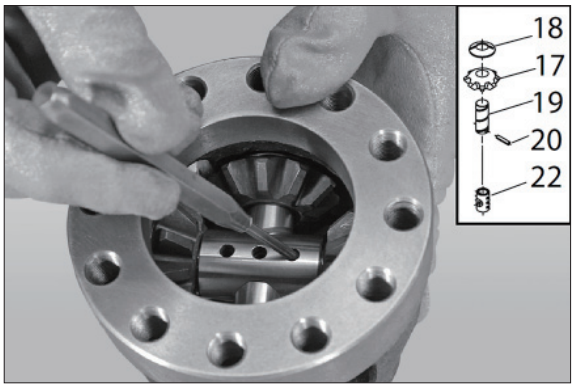
⑬ Remove the planetary gear (16).



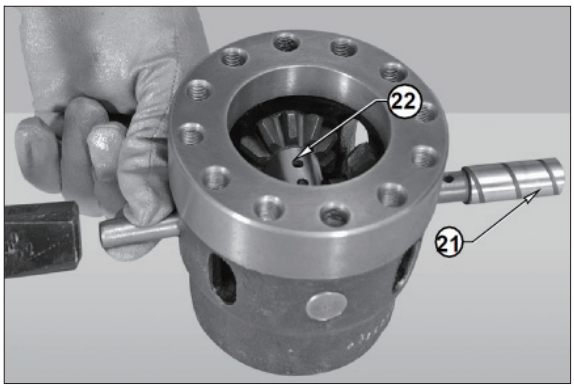
⑭ Remove the three spider blocking pins (20) by using a pin driver.



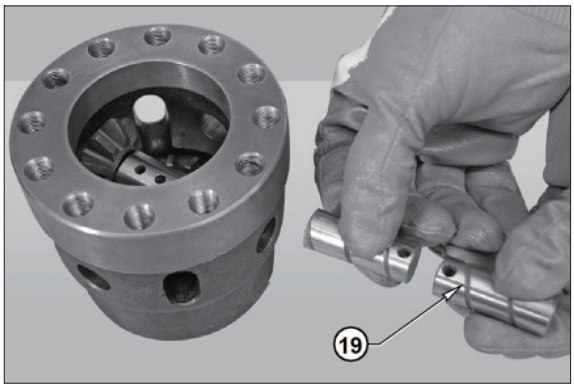
⑮ Move the two opposite mounted short bolts (19) to the outside of the box using the same pin driver.



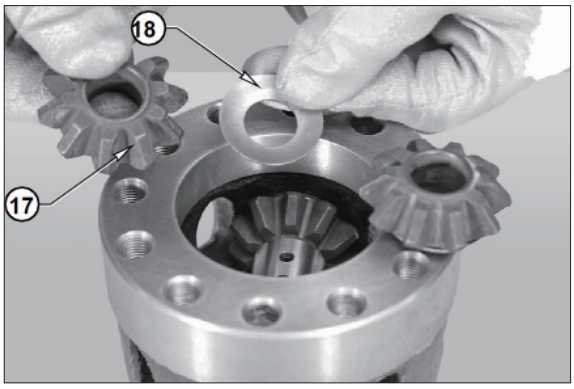
⑯ Drive out the long bolt (21) and pull out the spider (22) from the center.



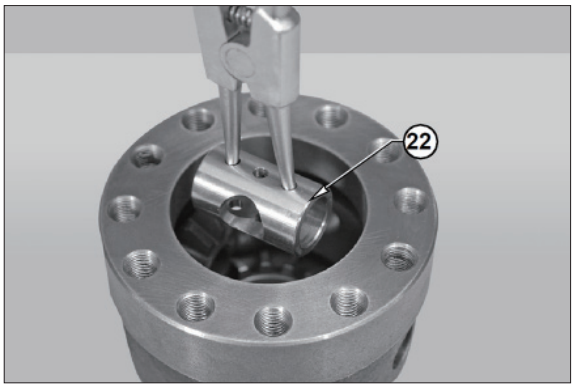
⑰ Remove the two half bolts (19), spherical washers and satellite wheels.



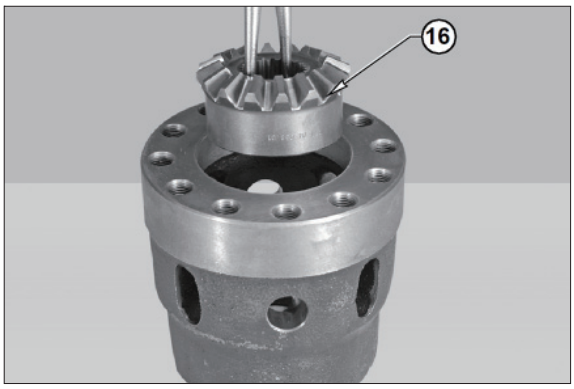
⑱ Remove long bolt, spherical washers (18) and satellite wheels (17).



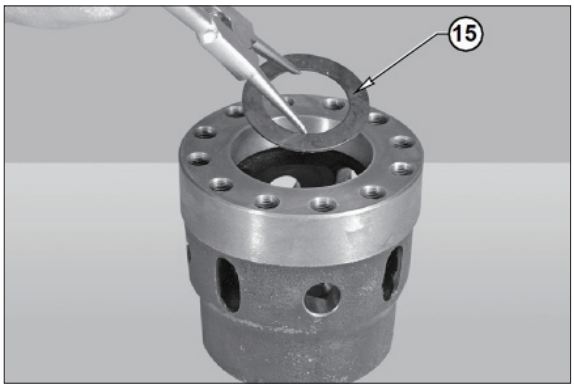
⑲ Pull out the spider (22) from the center.



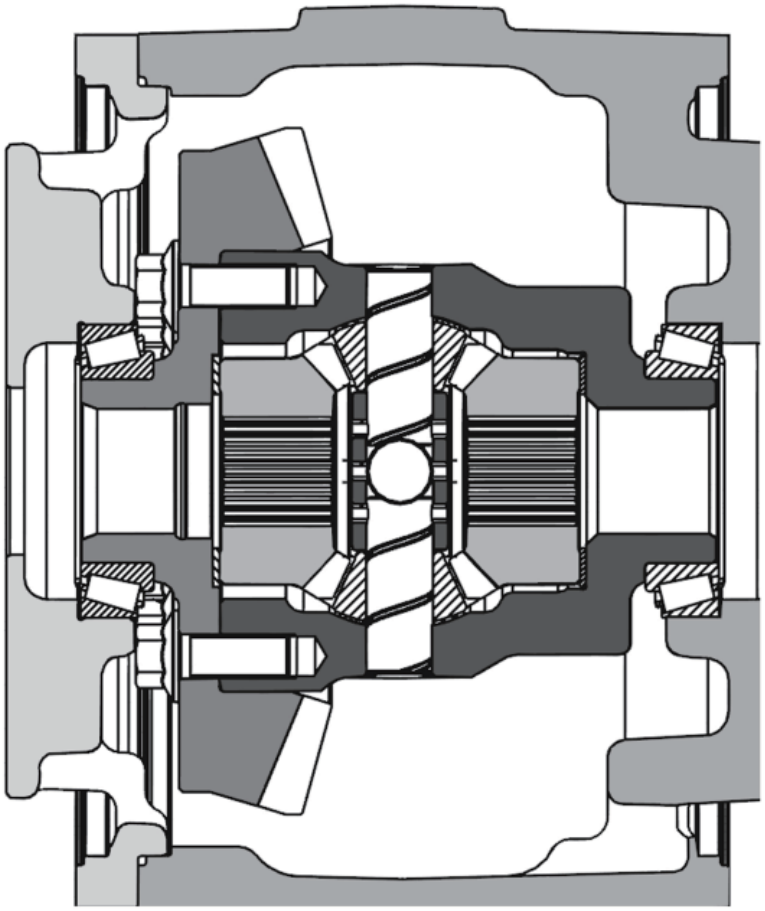
⑳ Remove the planetary gear (16).



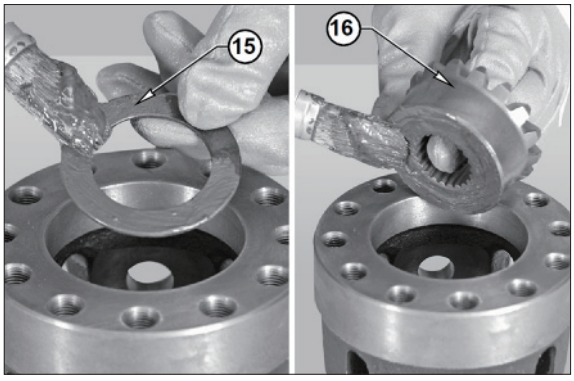
㉑ Remove the shim washer (15).

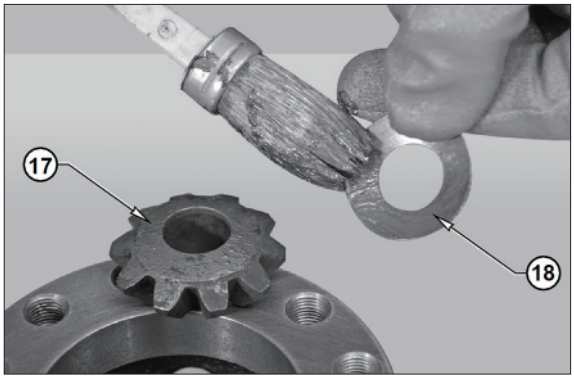


(2) Assembly

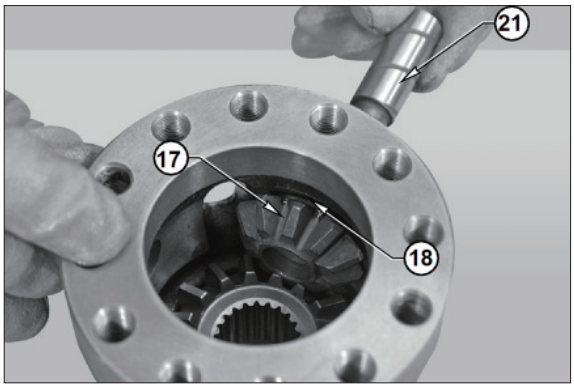


① Lubricate and insert washer (15) and plantary wheel (16).

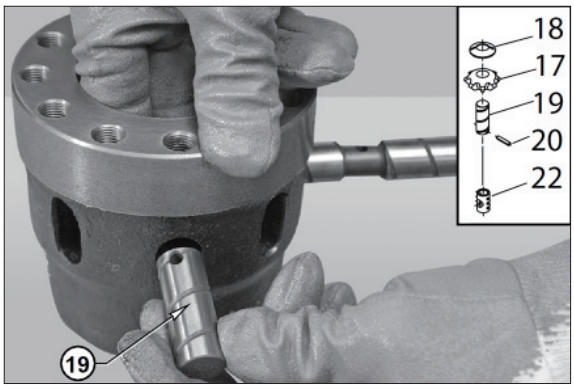




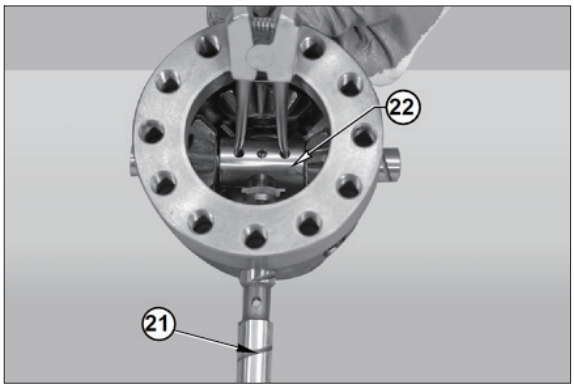
② Partially insert the long bolt (21), satellite wheels (17) and spherical washers (21).



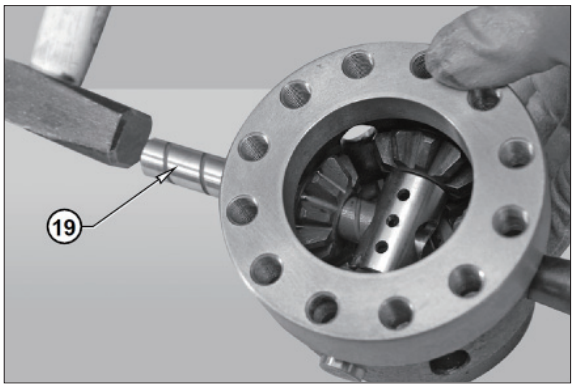
③ Insert the two half bolts (19), spherical washers (18) and satellite wheels (17).



④ Insert spider (22) and completely insert the long bolt (21).

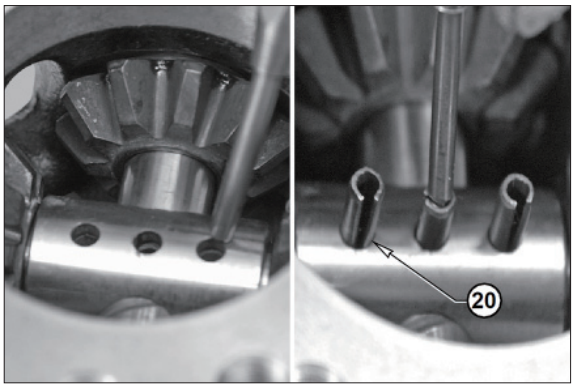


⑤ Insert completely the bolts (19).

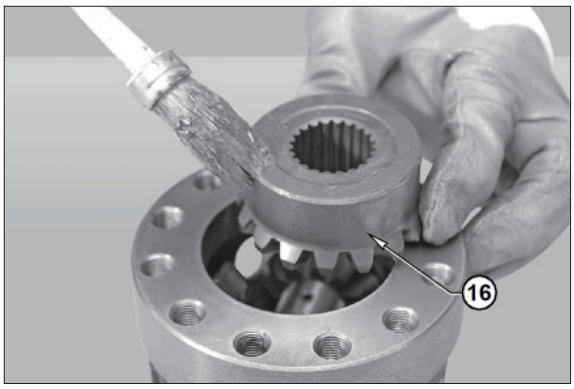


⑥ Center the pin holes and insert the 3V pins (20).

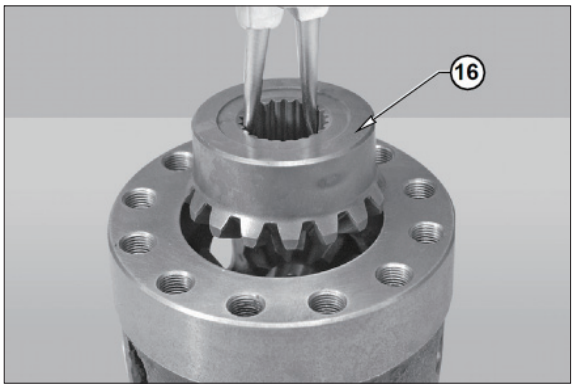
※ Check the free rotation of the satellite wheels on the bolts.



⑦ Lubricate wheel (16).

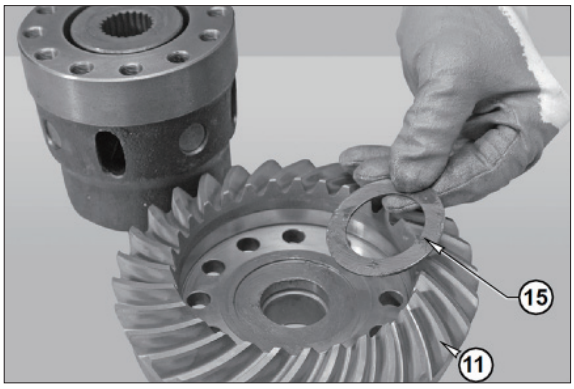


⑧ Insert planetary gear wheel (16).



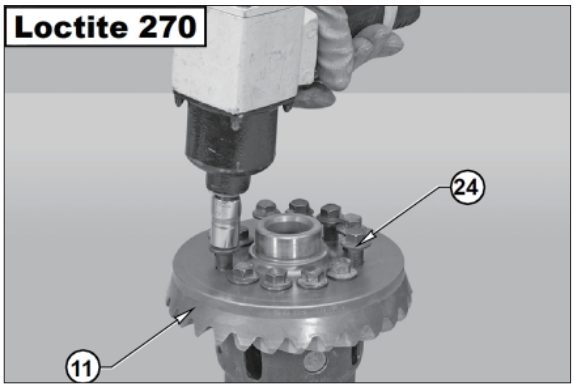
⑨ Position the shim washer (15) on the crown (11).

※ In order to hold the shim washer (15) in position, apply grease to it.



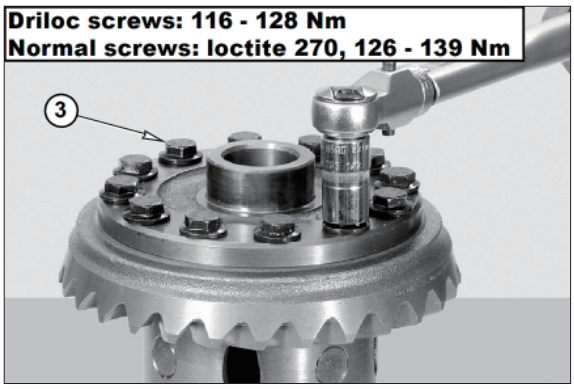
⑩ Position the crown (11) on the differential carrier and lock it with screws (24) applied with loctite 270.

※ Secure the screws using the cross-tightening method.



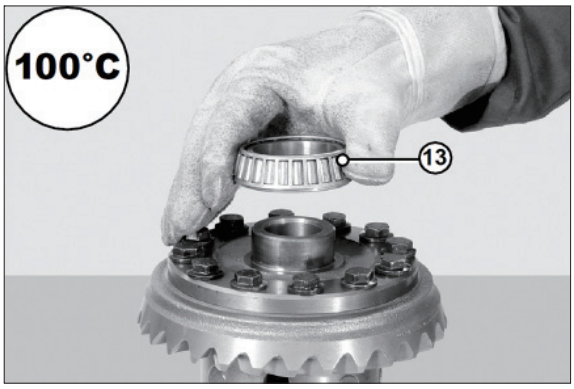
⑪ Tighten screws with a torque wrench : see table.

※ Always use new screws to fix the crown wheel. In case the screws are not thread locking pretreated, use loctite 270.



⑫ Assemble the bearing (13).

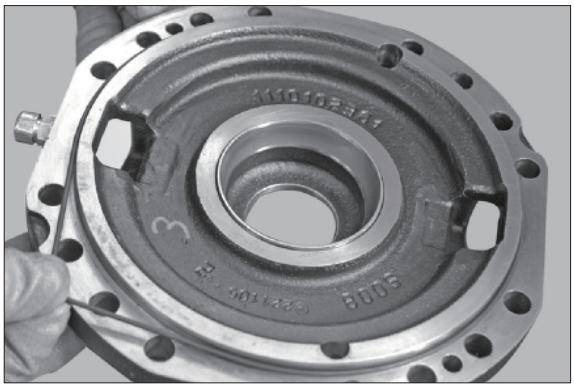
※ Heat the bearing to 100˚C before assembling.



⑬ If the bearings are replaced, insert the external thrust blocks in the middle cover and in the central body.

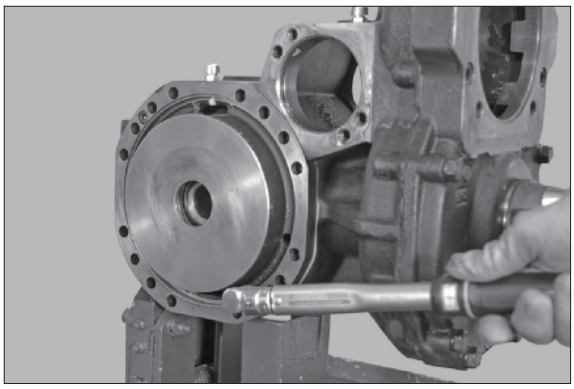
⑭ Position the differential unit in the central body with the help of a bar and fit the middle cover.

※ Thoroughly check the state of the O-ring and make sure that the cover is fitted with the oil discharge in the lower position.

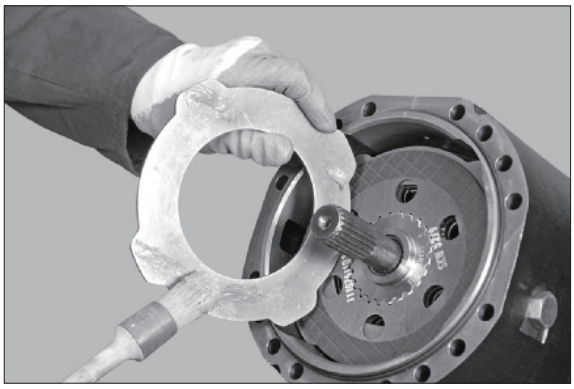


⑮ Lock the middle cover with screws.

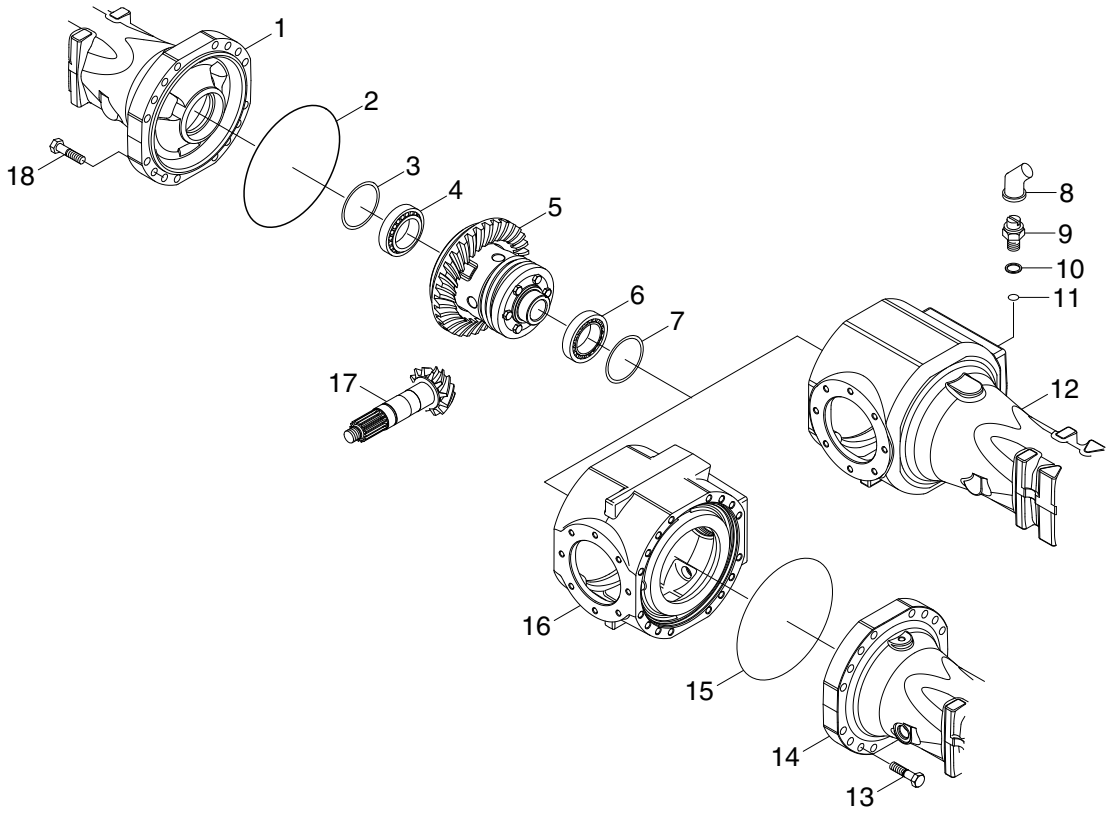
· Torque wrench setting for screw :
2.43~2.67 kgf · m (17.6~19.3 lbf · ft)



⑯ Check that the positioning of the sealing ring on the arm is intact; install the complete arm. Lock it into position using two facing screws and washers.

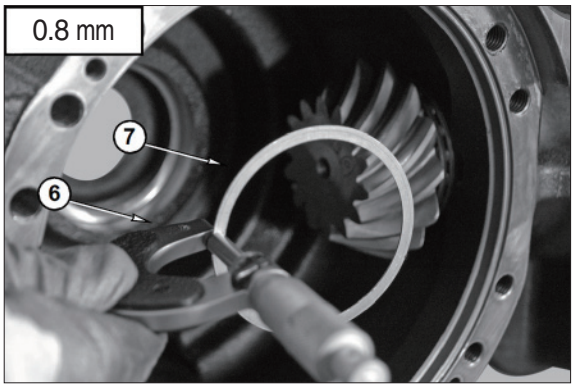


6) RING AND PINION ADJUSTING



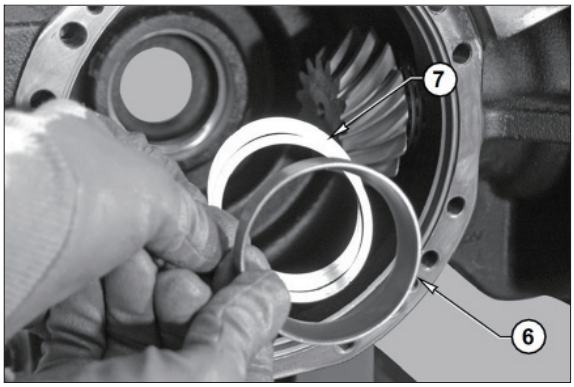
Setting of the crown wheel and pinion

(1) Insert the thrust block of the bearing (6) opposit side of the crown wheel shims (Sb) (7) of an initial thickness of about 0.8 mm.



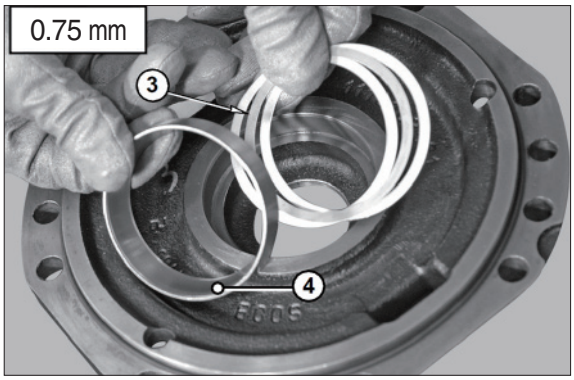
(2) Insert the thrust block (6) and the shims (Sb) (7) into the arm.

※ Check to be at end of stroke.



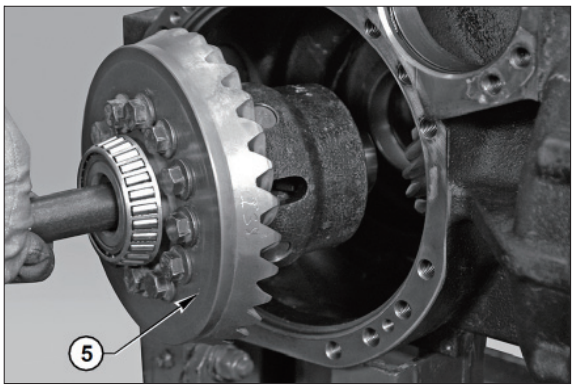
(3) Insert thrust block (4) of the bearing shims (Sc) (3) of an initial thickness of about 0.75 mm.
Insert the thrust block and the shims into the arm.

※ Check to be at end of stroke.

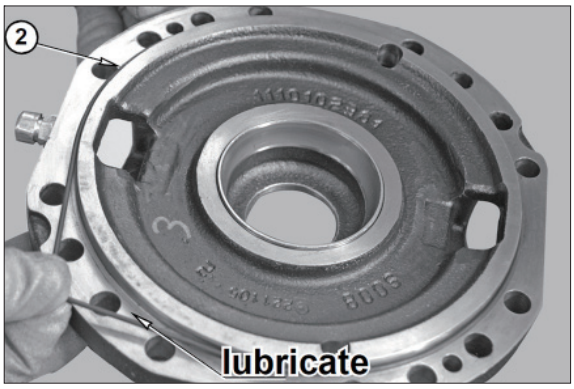


(4) Insert complete differential (5).

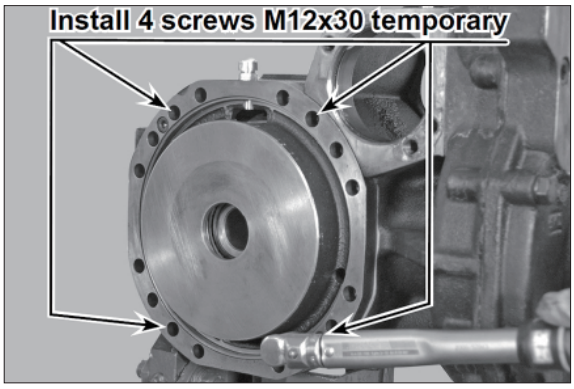
※ Do not damage the seat of the O-ring with the gearwheel.



(5) Check the O-ring (2) and grease.

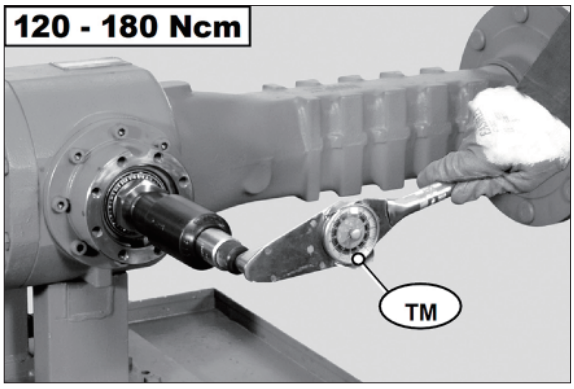


(6) Lock the middle cover (5) with screws (4).
· Torque wrench setting for screw :
2.43~2.67 kgf · m (17.6~19.3 lbf · ft)



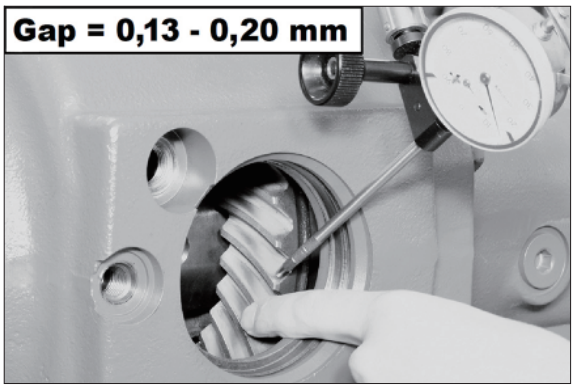
(7) Apply torque meter TM to pinion nut and check that torque will increase by 0.04~0.06 kgf · m (0.29~0.43 lbf · ft) as a result of differential bearing preload.

Example : pinion torque :
0.08~0.12 kgf · m (0.59~0.87 lbf · ft)
Pinion + differential torque :
0.12~0.18 kgf · m (0.87~1.3 lbf · ft)

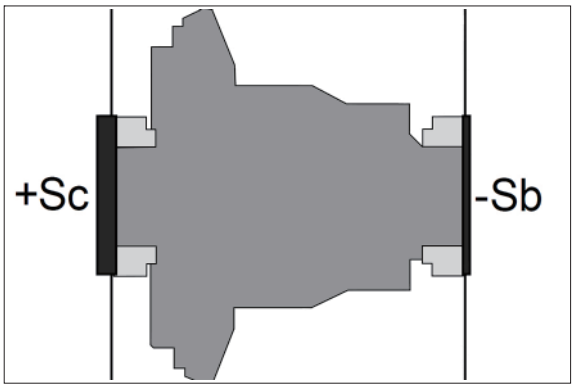


(8) Position comparator on the center of one of the crown teeth, preset it to 1 mm and reset it to zero.
Manually move the crown in both directions to check the existing clearance between pinion and crown.

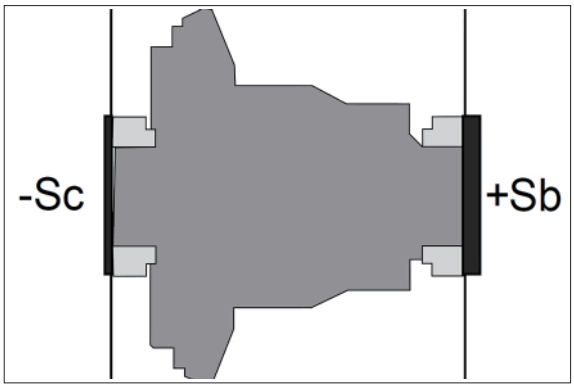
Gap = 0.13~0.20 mm



(9) + Sc (3) - Sb (7) = reduction gap ring and pinion

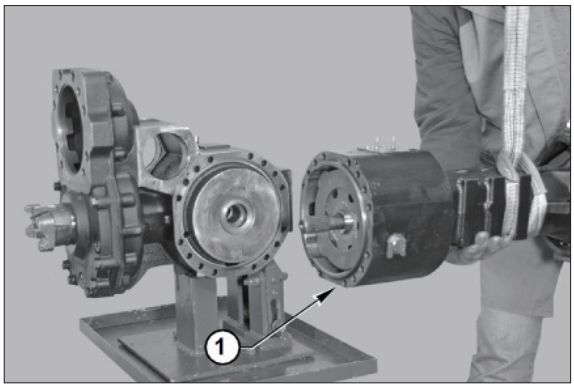


(10) - Sc (3) + Sb (7) = increase gap ring and pinion

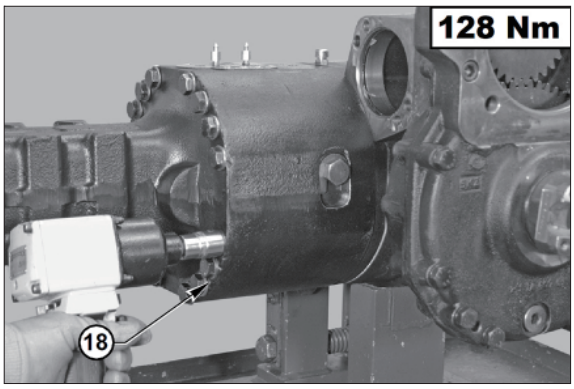


(11) Install the crown wheel side arm (1) without half-axle.

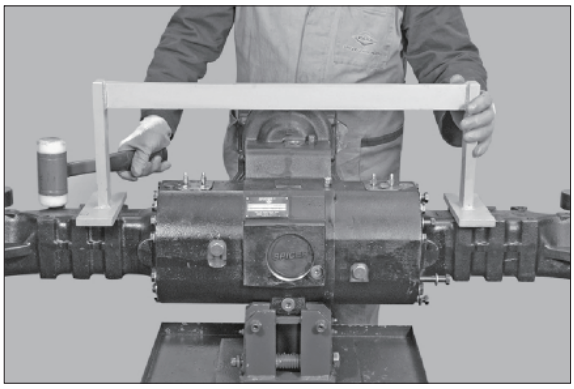
※ To check the torque of the differential, neither of both half-axles must be installed.



(12) Temporarily insert all screws of the arm (18).



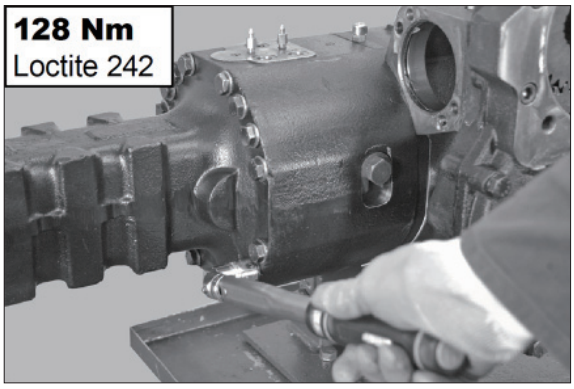
(13) Check the flatness of the arms; then lock the arms into their final position,using screws adequately coated with loctite 242.



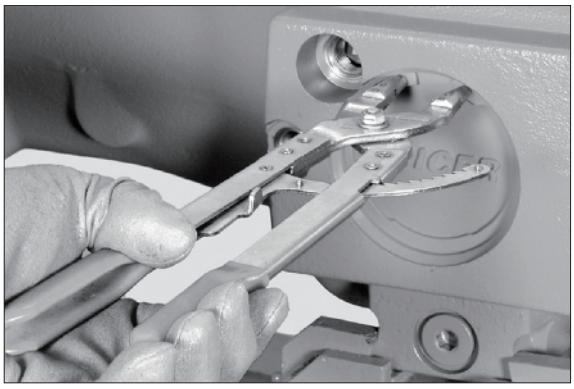
(14) Torque wrench setting :

13.1 kgf · m (94.4 lbf · ft)

※ Tighten using the criss-cross method.

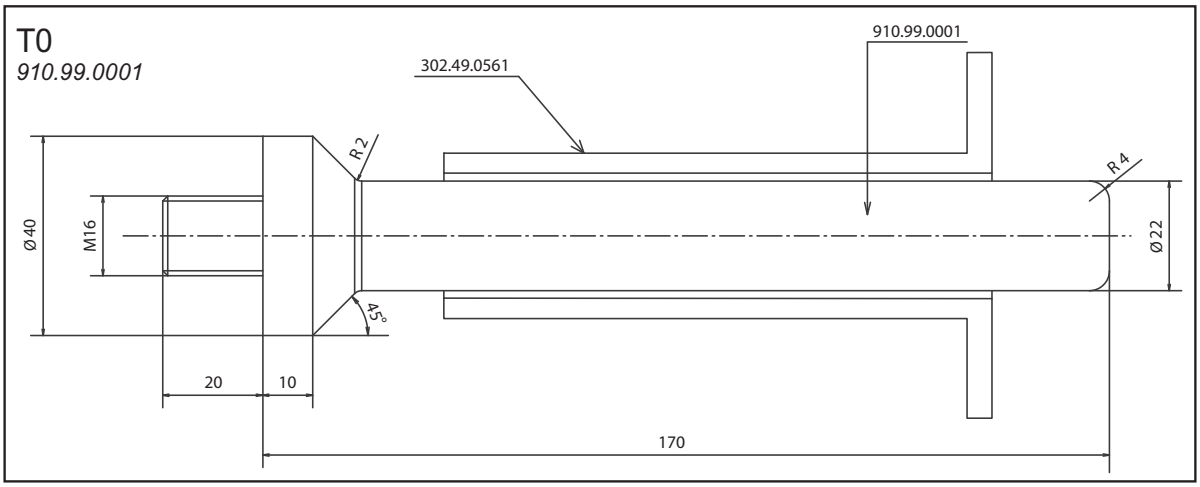


(15) Using a driver, fit the cap and position it in its seat with the snap ring.



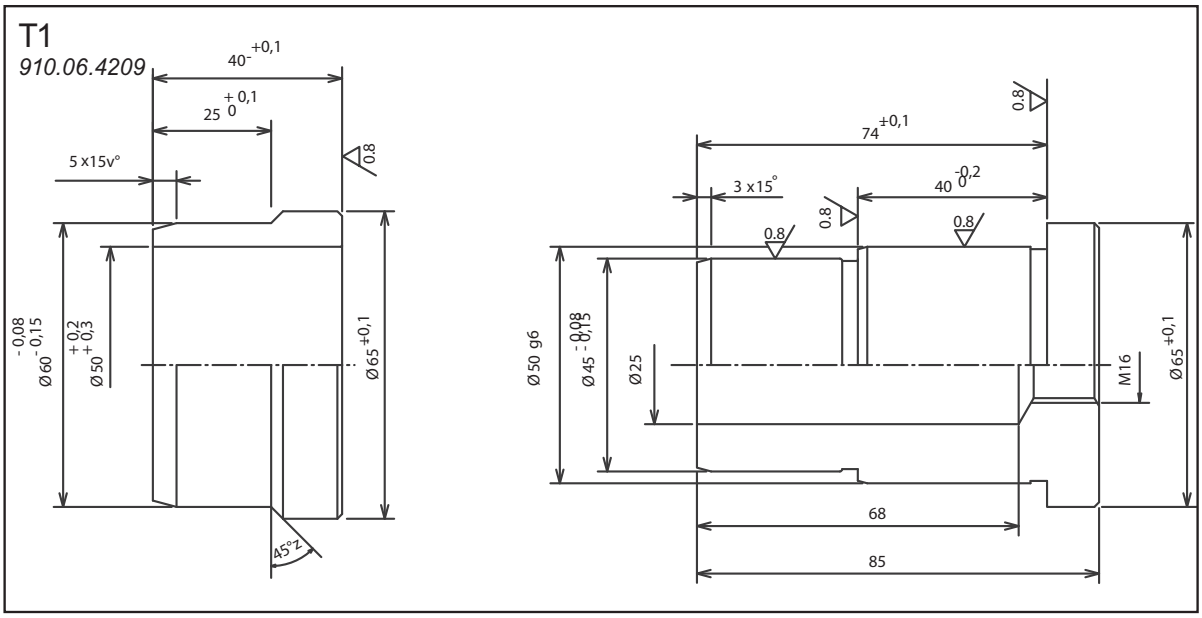
7) SPECIAL TOOLS

T0
910.99.0001

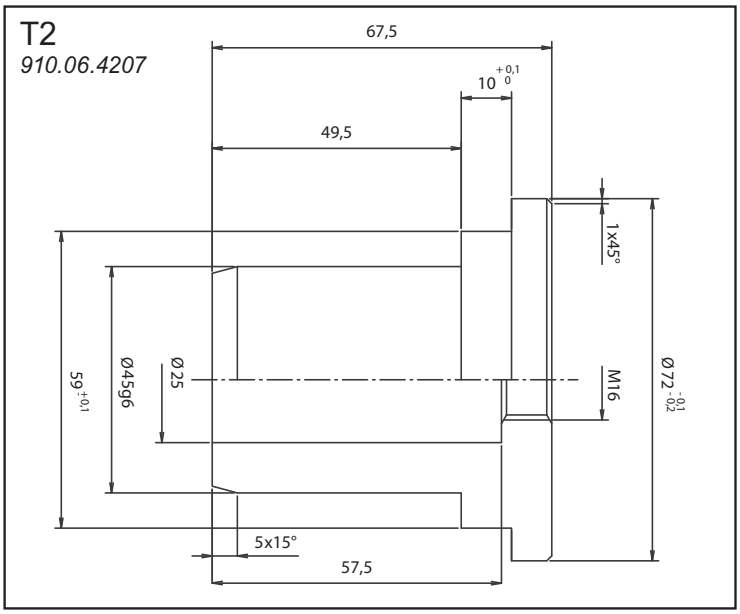


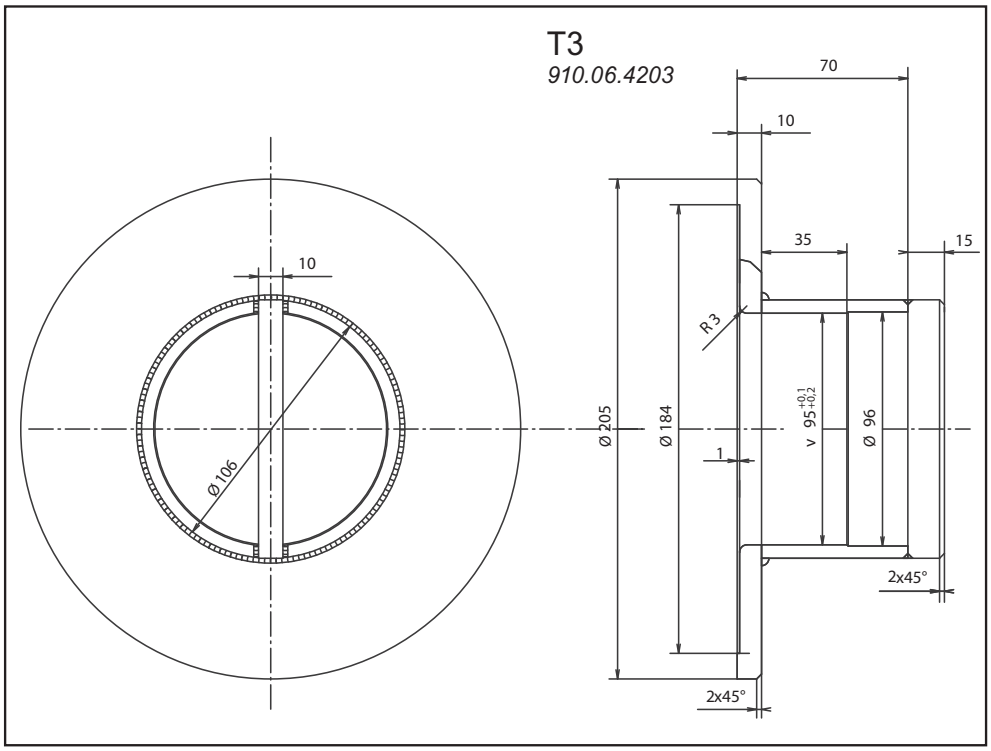
55W9NAX311-1

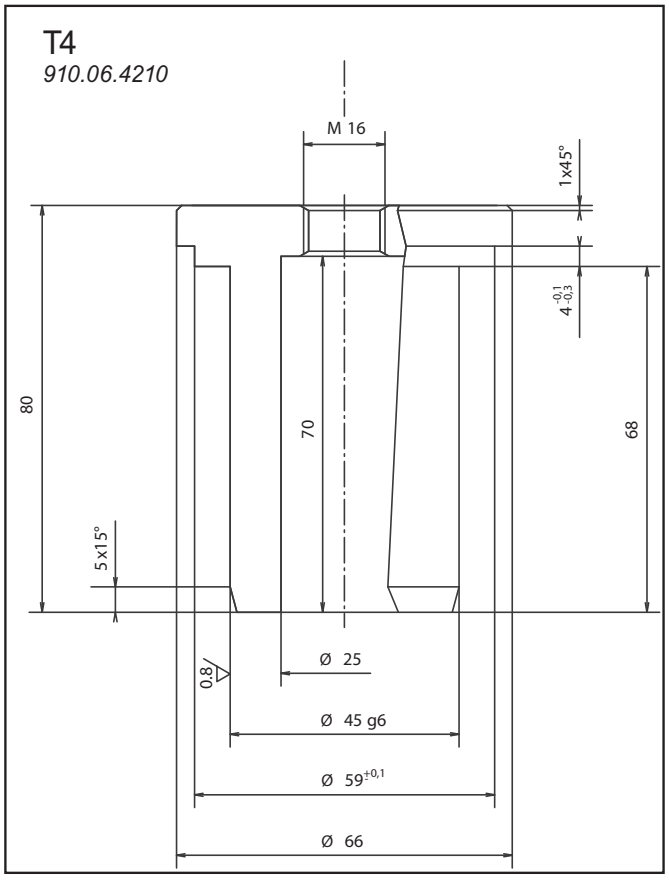
T1
910.06.4209

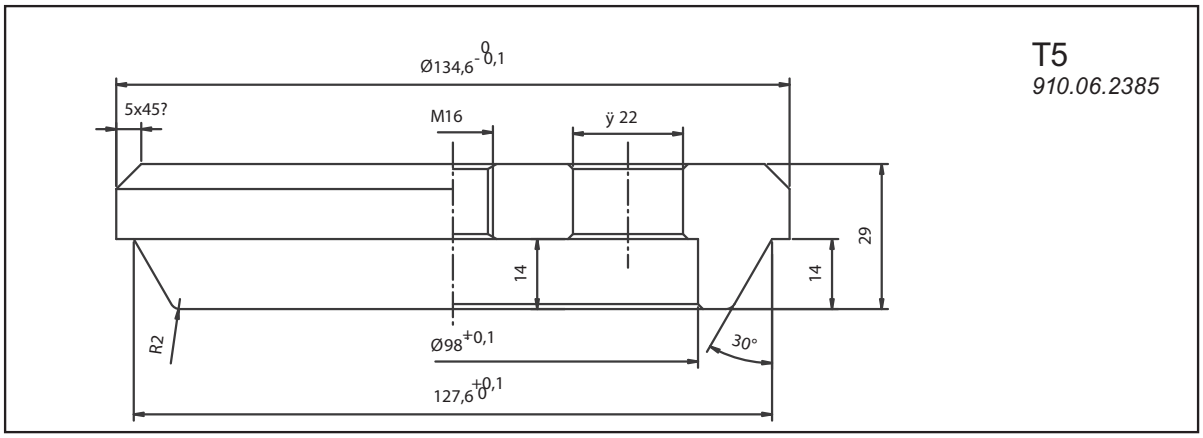


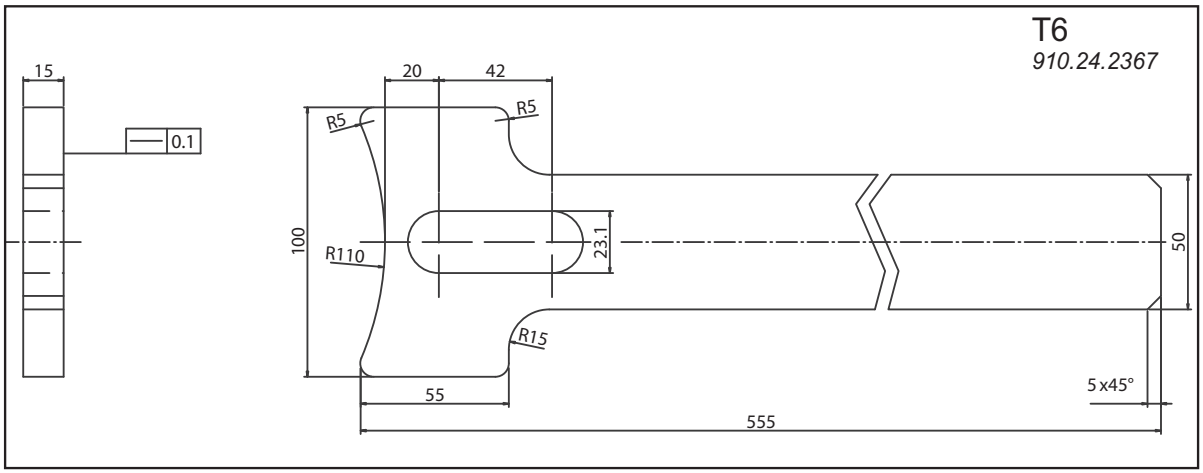
T2
910.06.4207

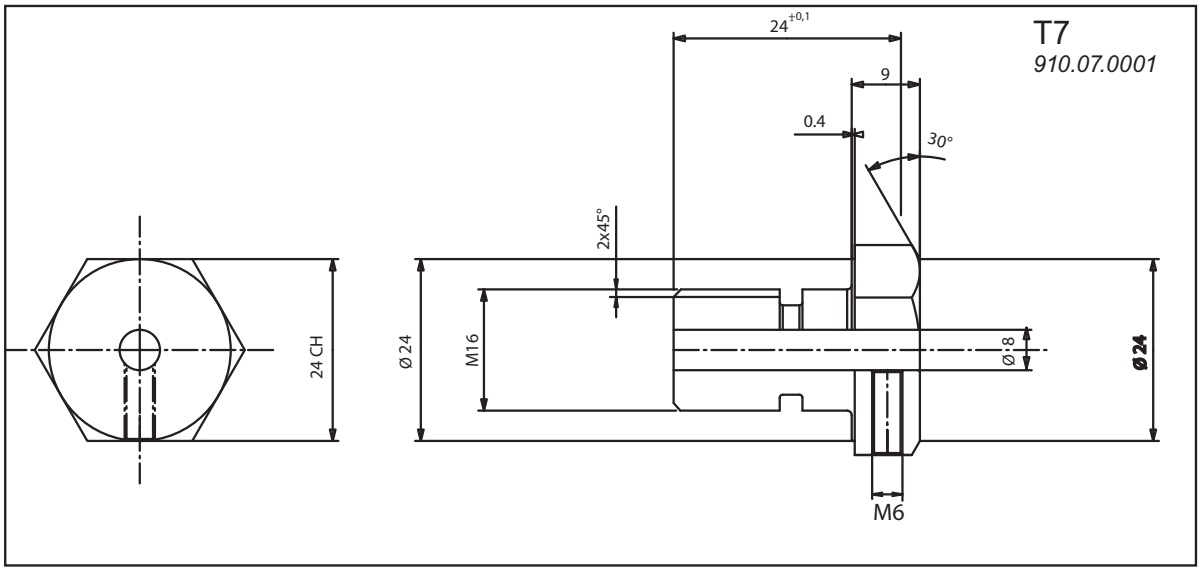


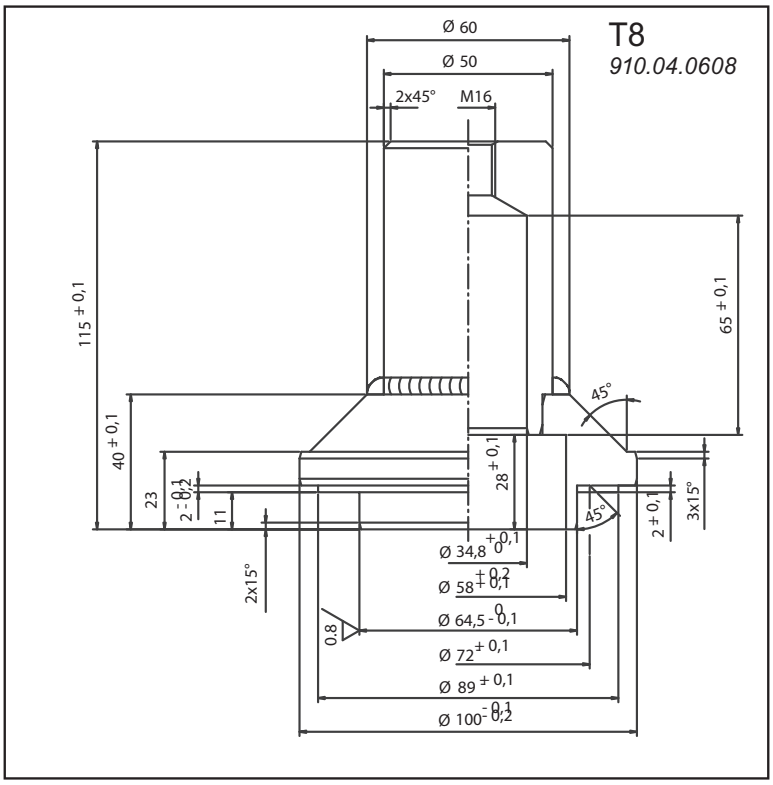

T3
910.06.4203
70
10
35
15
10
R3
Ø 205
Ø 184
v 95 +0,1 +0,2
Ø 96
1
Ø106
2x45°
2x45°

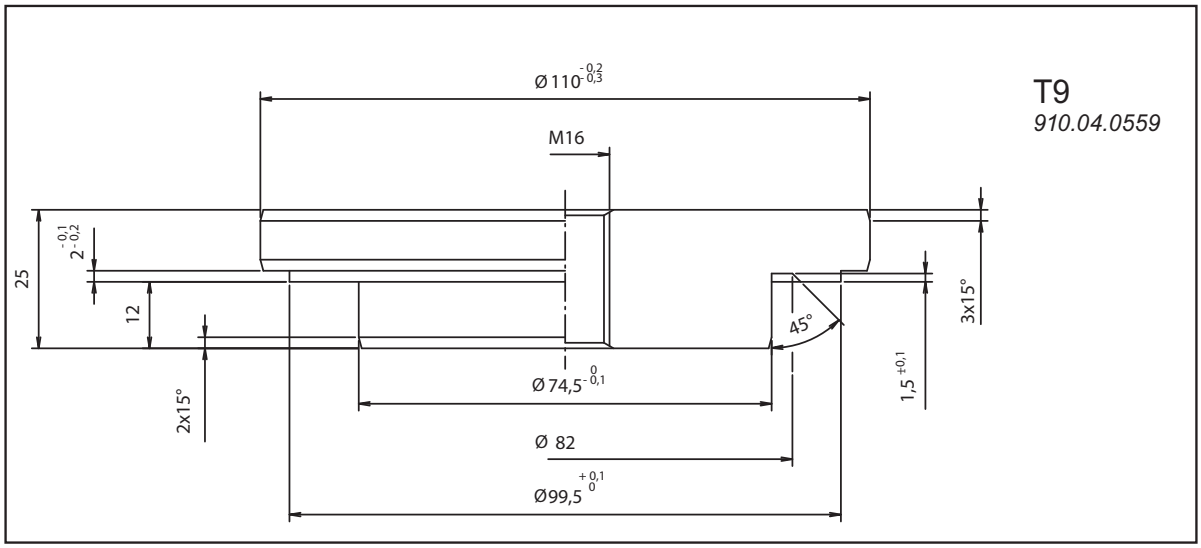

T4
910.06.4210
M 16
1x45°
4 -0,1 -0,3
80
70
68
5x15°
0.8
Ø 25
Ø 45 g6
Ø 59 ±0,1
Ø 66


T5
910.06.2385
Ø134,6 0 -0,1
5x45?
M16
ÿ 22
29
14
14
R2
Ø98 +0,1
30°
127,6 +0,1 0


T6
910.24.2367
15
0.1
20
42
R5
R5
100
R110
23.1
50
R15
55
5 x45°
555

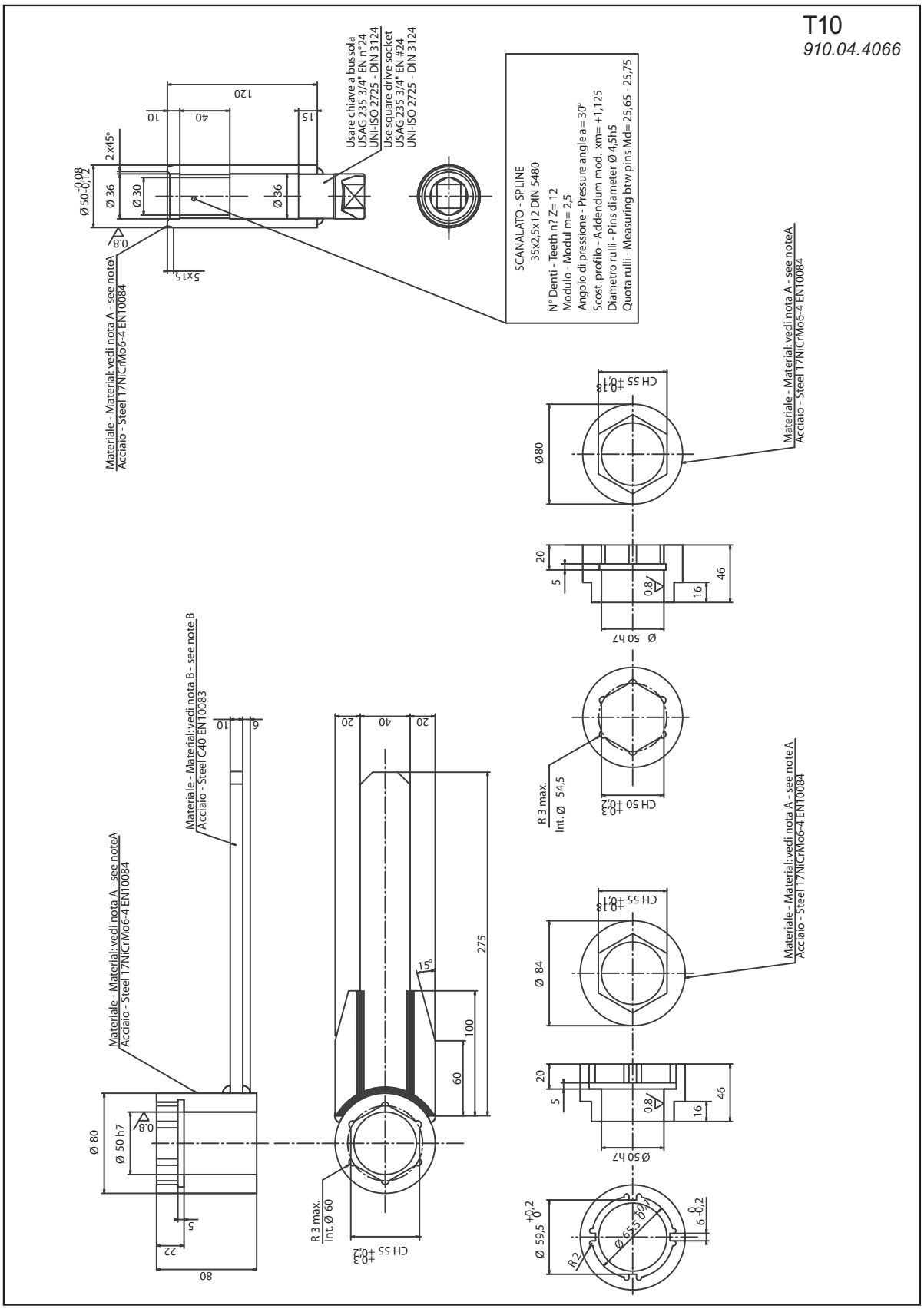

T7
910.07.0001
24 +0,1
9
0.4
30°
2x45°
24 CH
Ø 24
M16
Ø 18
Ø 24
M6


T8
910.04.0608
Ø 60
Ø 50
2x45°
M16
115 ± 0,1
65 ± 0,1
40 ± 0,1
23
2 -0,1 -0,2
11
28 ± 0,1
45°
45°
3x15°
2 ± 0,1
2x15°
Ø 34,8 +0,1 0
Ø 58 ± 0,2
Ø 64,5 ± 0,1
0.8
Ø 72 ± 0,1
Ø 89 ± 0,1
Ø 100 -0,1 -0,2


T9
910.04.0559
Ø 110 -0,2 -0,3
M16
25
2 -0,1 -0,2
12
2x15°
45°
3x15°
1,5 ±0,1
Ø 74,5 0 -0,1
Ø 82
Ø99,5 +0,1 0

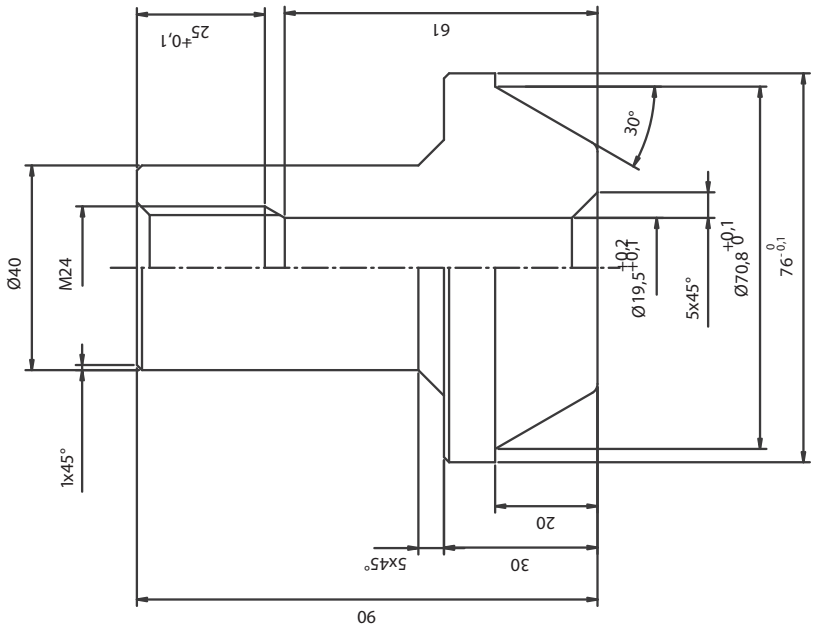
T10

910.04.4066



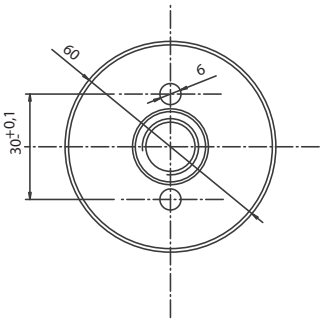
T11

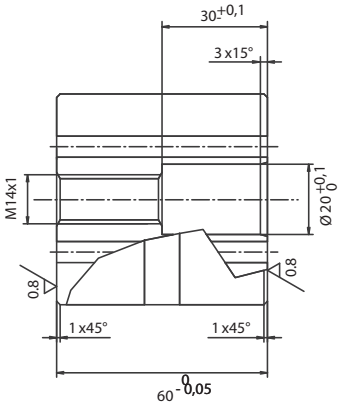
910.06.4069

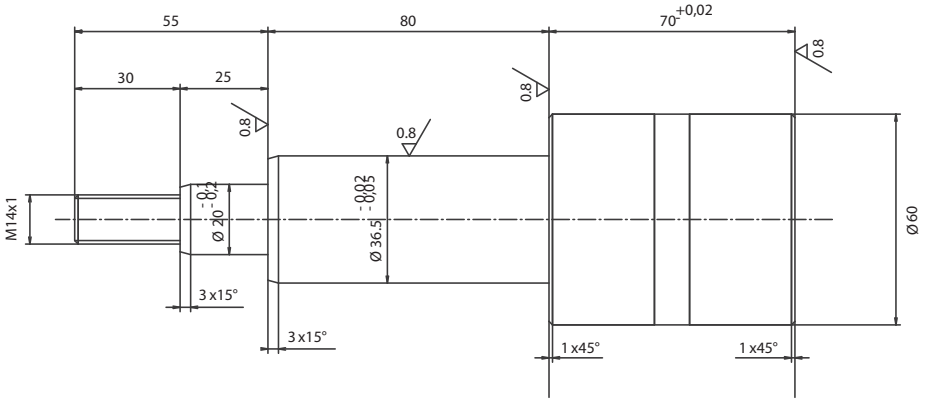


T12

910.04.2389



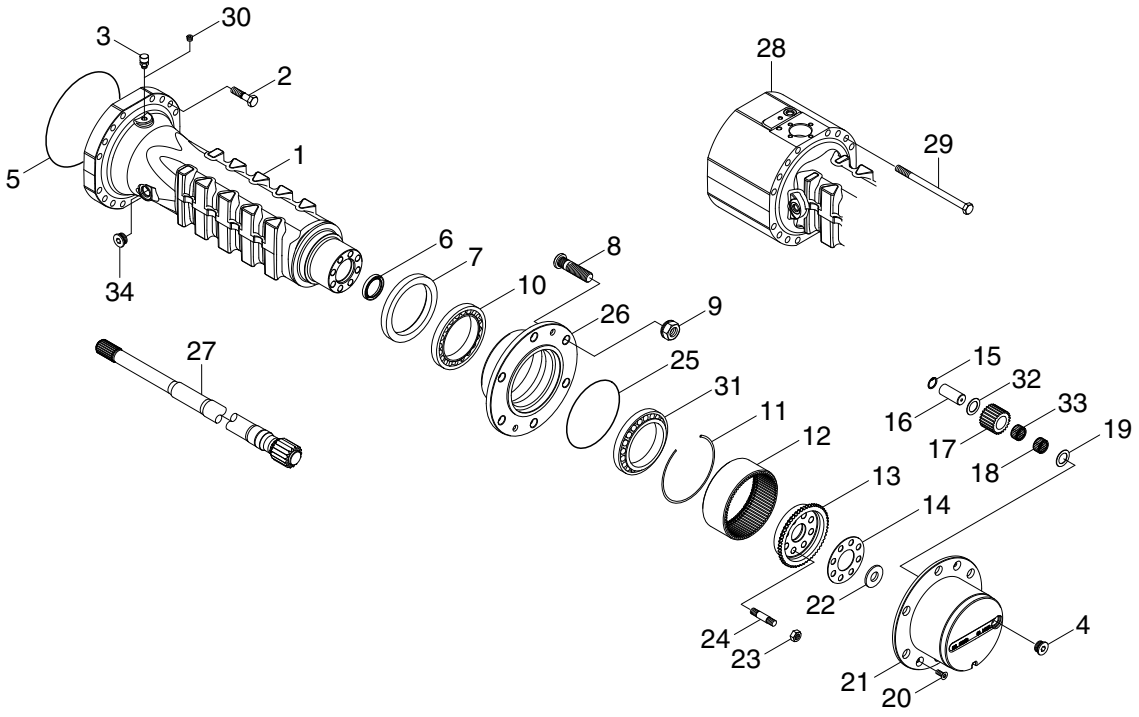




4. REAR AXLE

1) PLANETARY REDUCTION GEAR

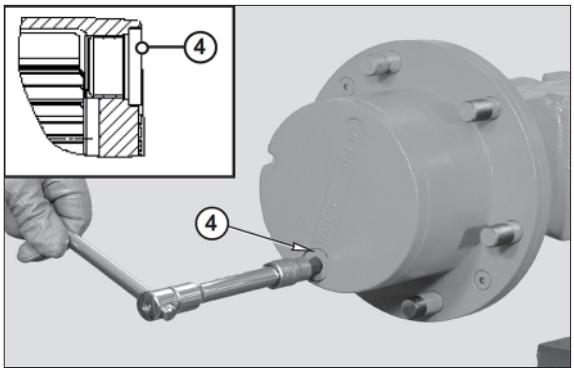
(1) Assembly diagram



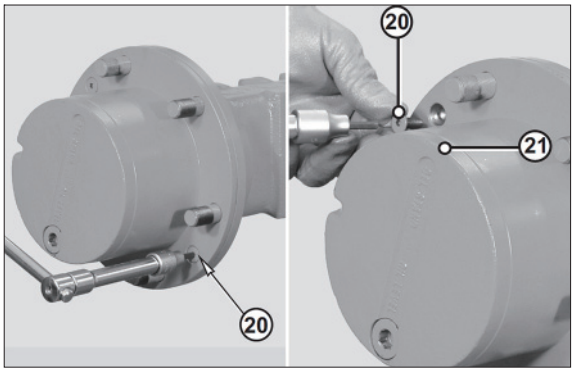
(2) Disassembly

※ Perform all operations on both arms.

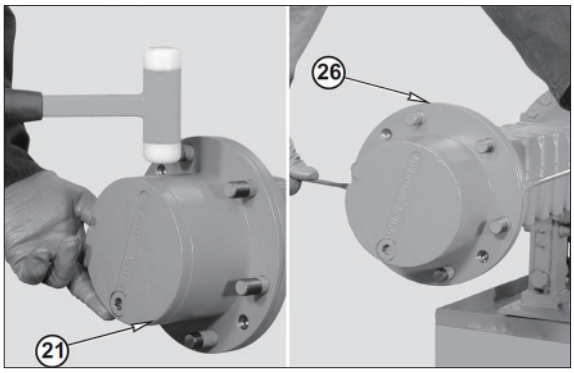
① Remove the oil level plug (4).



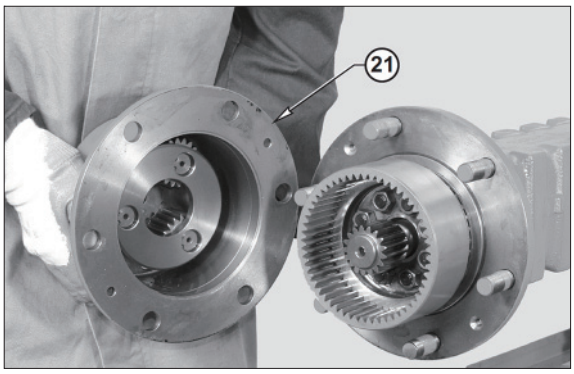
② Remove the securing screws (20) from the spider cover (21).



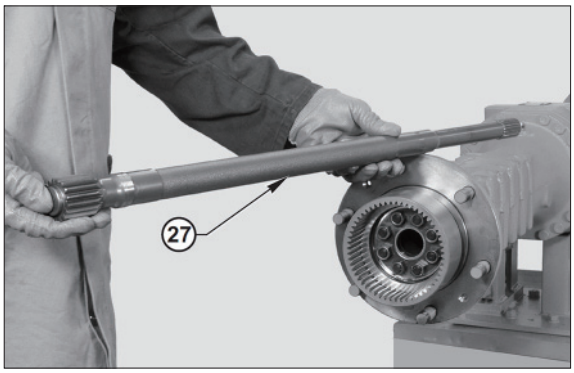
③ Disjoin the spider cover (21) from the hub (26) by alternatively forcing a screwdriver into the appropriate slots.



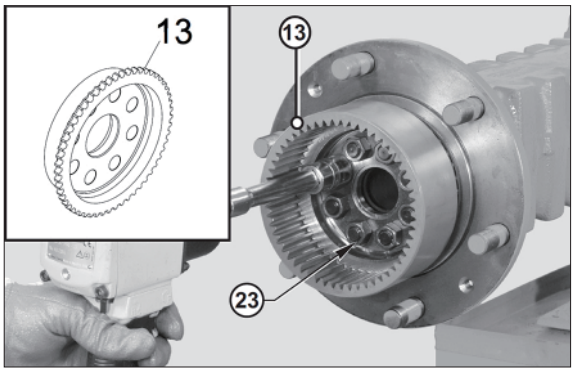
④ Remove the complete planetary carrier cover (21).



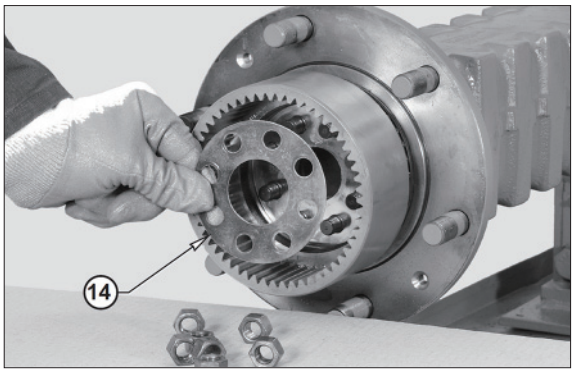
⑤ Remove the complete axle-shaft (27).



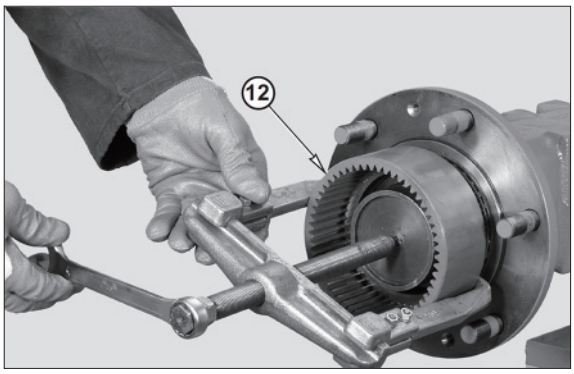
⑥ Unloose and remove the tightening nuts (23) from the crown flange (13).



⑦ Remove the safety flange (14).

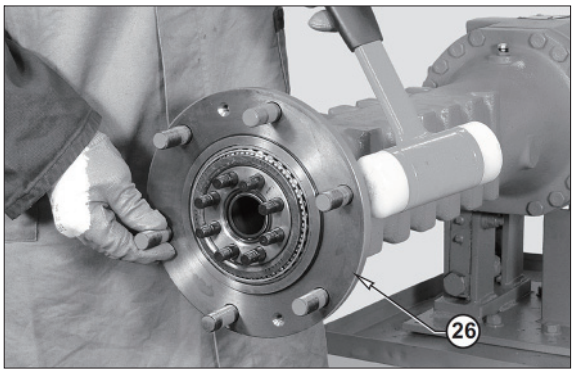


⑧ Remove the crown (12).

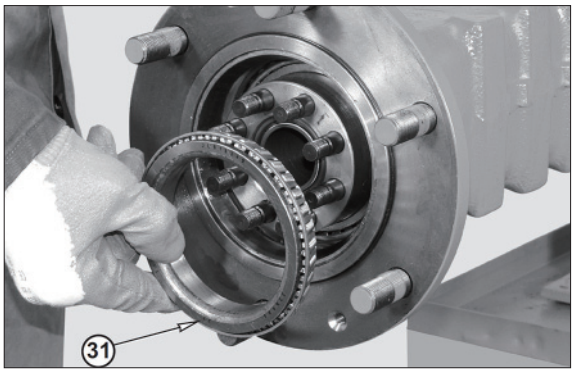


⑨ Partially extract the hub (26) using a plastic hammer.

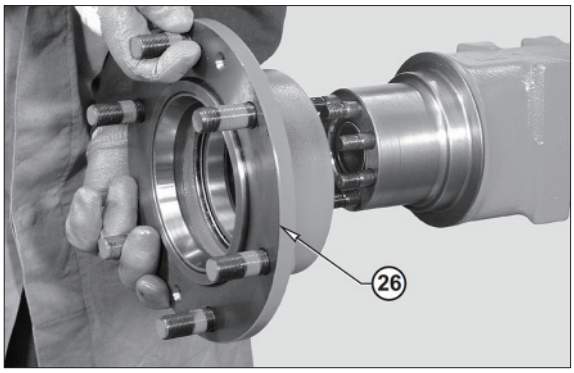
※ Alternately hammer on several equidistant points.



⑩ Remove the external bearing (31).

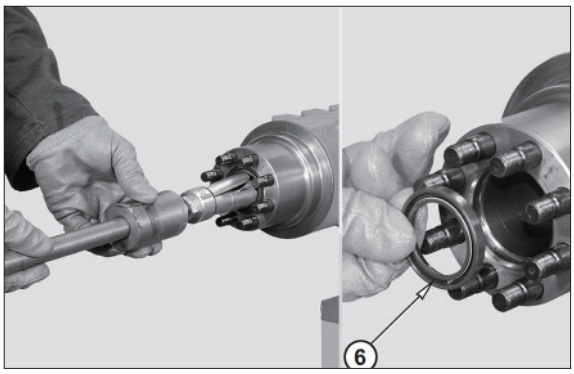


⑪ By hand remove complete hub (26).

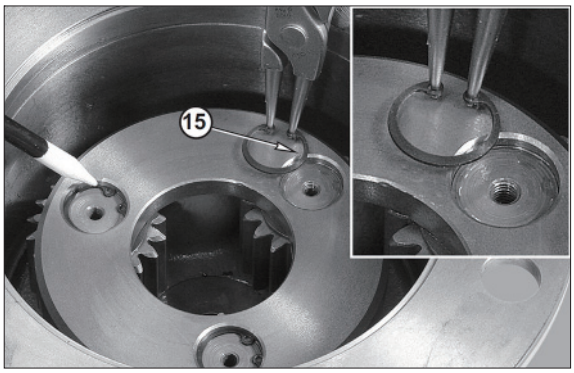


⑫ Using an extractor, remove the seal ring (6).

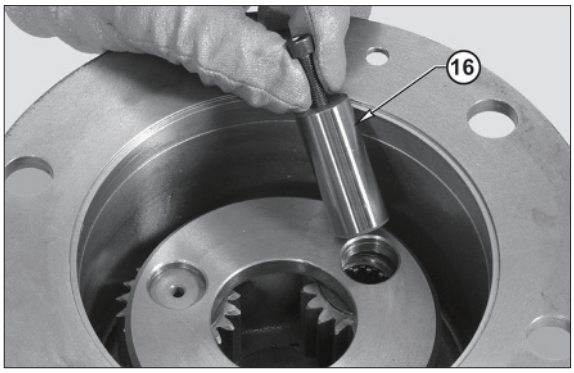
※ Note down the direction of assembly of snap ring.



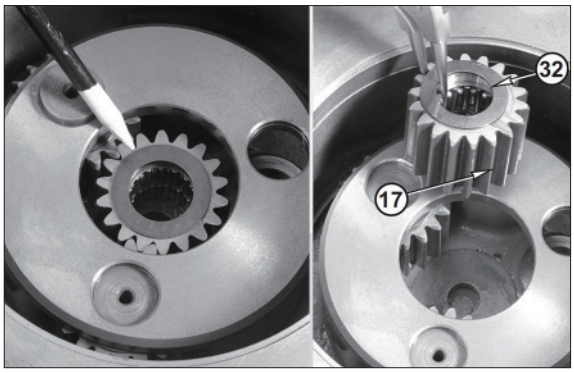
⑬ Remove snap ring (15).



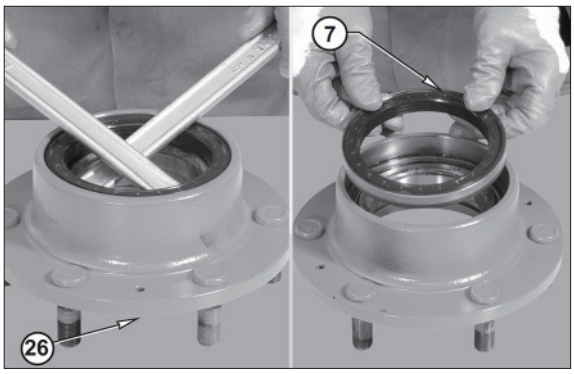
⑭ Using a screw M6 remove all bolts (16).



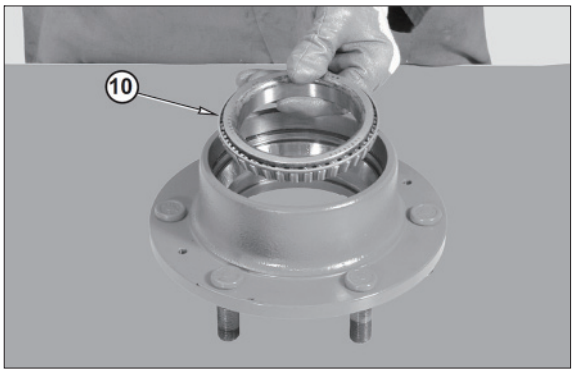
⑮ Positioning the planet wheel gear (17) in center of the spider cover and remove.



⑯ Remove the sealing ring (7) from the hub (26).

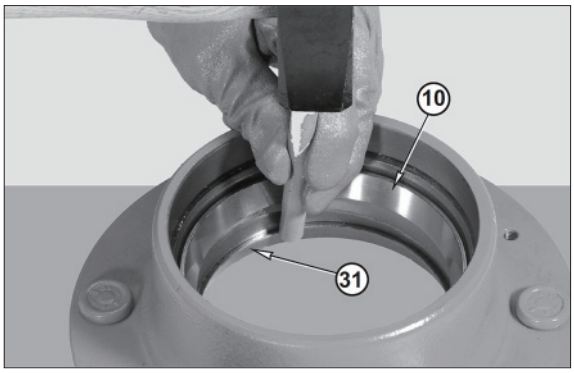


⑰ Remove the internal bearing (10).

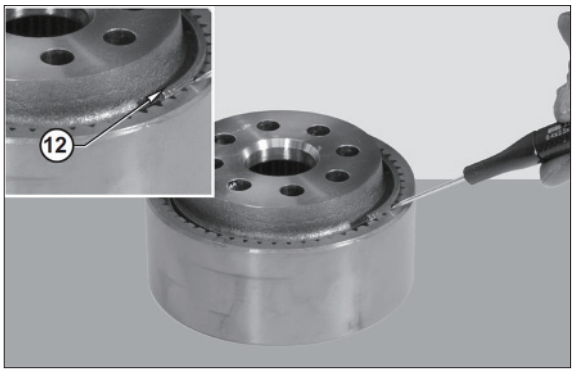


⑱ Remove the thrust blocks (10) (31) from the bearings and forcing a pin-driver into the appropriate slots on the hub.

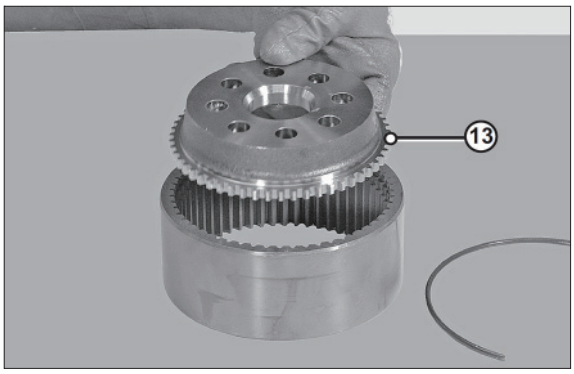
※ Hammer in an alternate way so as to avoid crawling or deformation of the thrust blocks.



⑲ Remove the snap ring (12) from the crown (13).

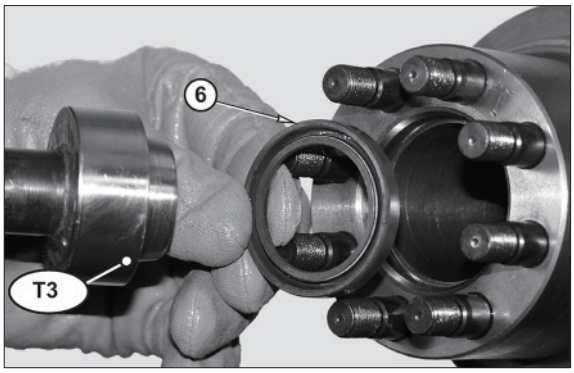


⑳ Remove the crown flange (13).

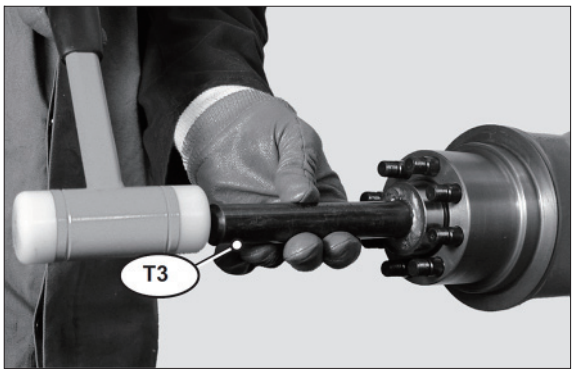


(3) ASSEMBLY

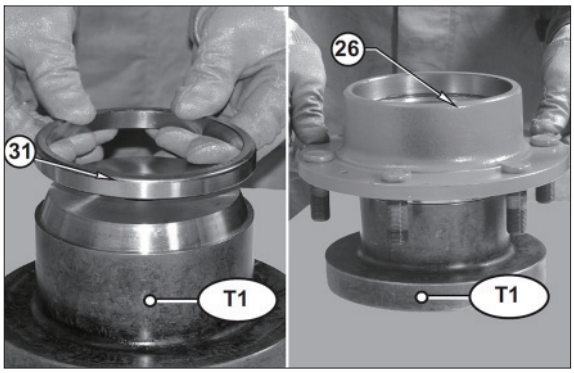
① Lubricate and fit the sealing ring (6) onto tool T3; install the rings into the arm.



※ Pay particular attention to the direction of assembly of the rings.

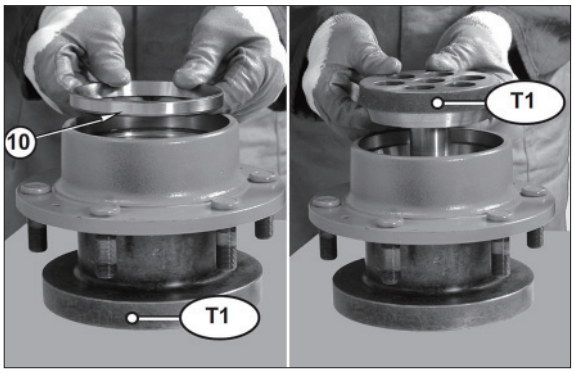


② Position the lower part of tool T1 and the thrust block of the external bearing (31).

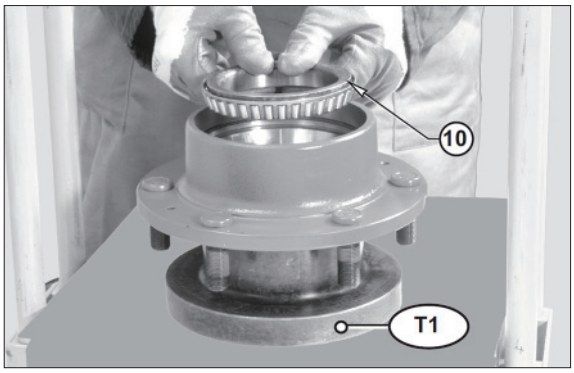


③ Lubricate the seats of the bearings and position the hub on tool T1; position the thrust block of the internal bearing (10).

Check that the thrust block is correctly oriented.

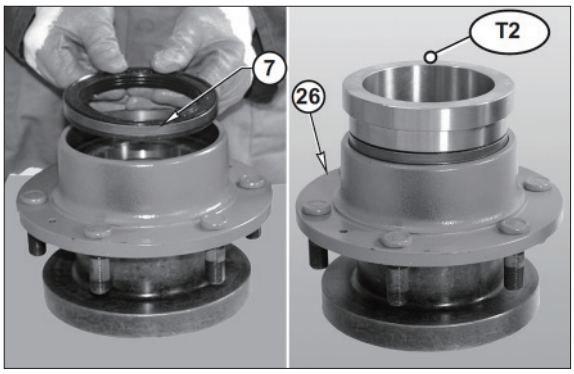


④ Fit the bearing (10) into the internal thrust block.

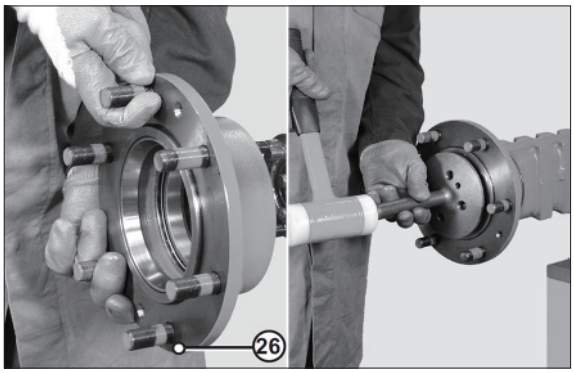


⑤ Using special tool T2 apply a repositionable jointing compound for seals to the outer surface of the sealing ring (7).
Position the sealing ring (7) in the hub (26).

※ Check that the ring (7) is correctly oriented.

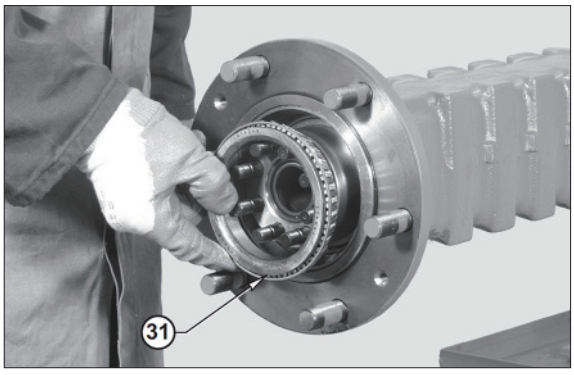


⑥ Install the wheel hub (26).



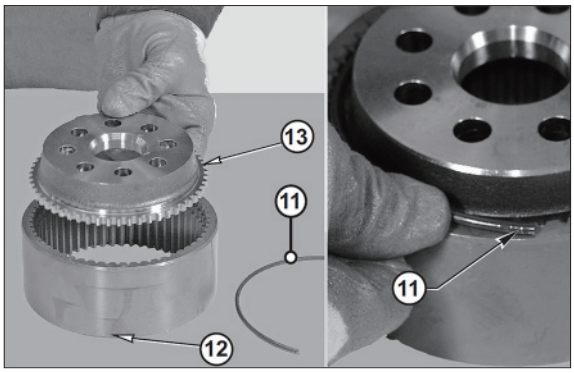
⑦ Install the external bearing (31).

※ Move the bearing to the limit stop by hammering lightly all around the edge.



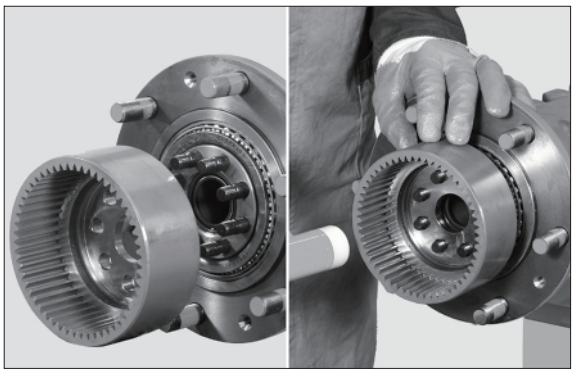
⑧ Install the crown wheel (12).
Insert the snap ring (11) in order to fix the flange (13) in the crown (12).

※ Carefully check that ring (11) is properly inserted in the slot of the crown (12).

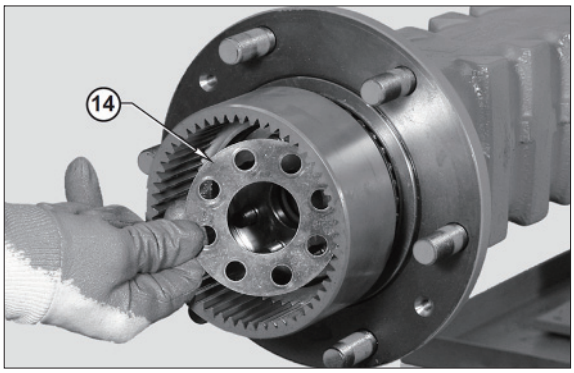


⑨ Fit the complete crown flange.

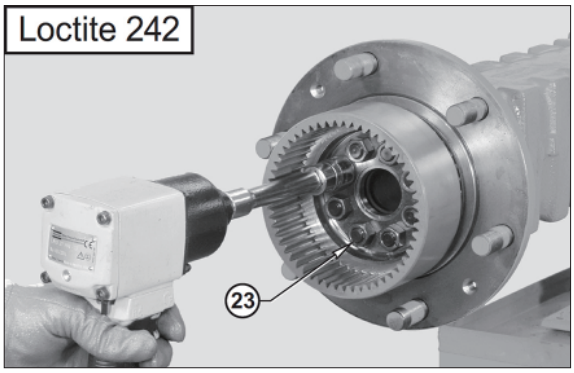
※ In order to fasten the flange, use a plastic hammer and alternately hammer on several equidistant points.



⑩ Install the security flange (14).

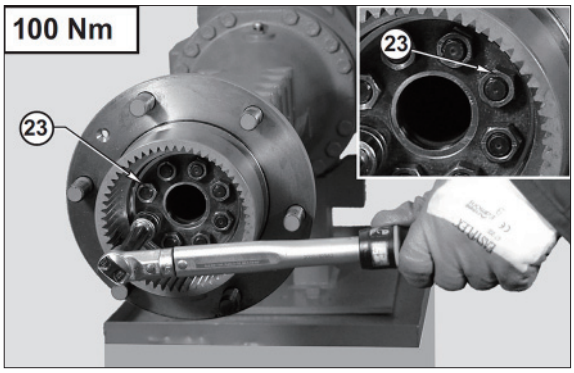


⑪ Coat the nuts (23) with loctite 242 and screw them.



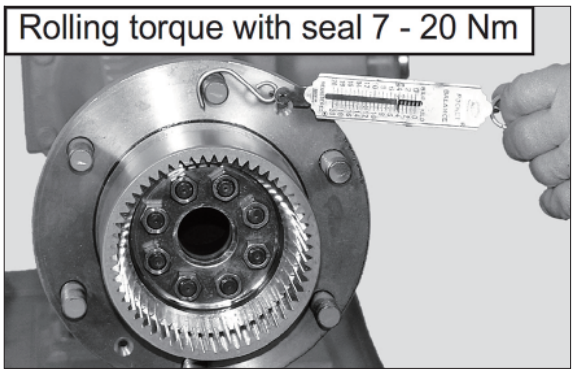
⑫ Tighten nuts (23) in two stages, using the criss-cross method.

- Initial torque wrench setting :
  9.18 kgf · m (66.4 lbf · ft)
- Final torque wrench setting :
  10.2 kgf · m (73.8 lbf · ft)

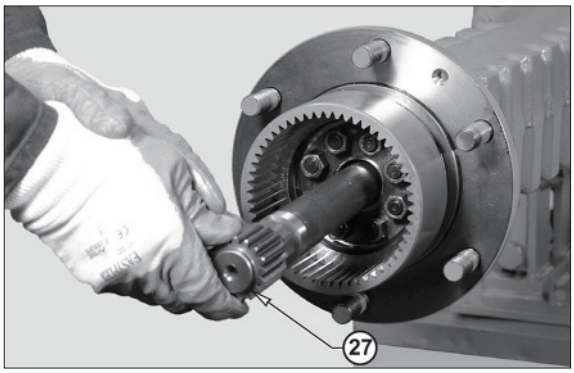


⑬ Check the continuous rolling torque on the hub.

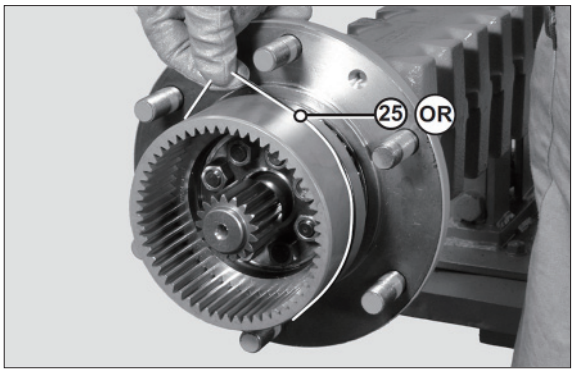
- Torque : 0.71~2.04 kgf · m
  (5.14~14.8 lbf · ft)



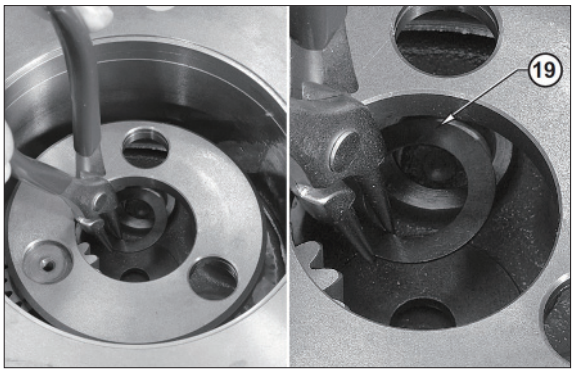
⑭ Install the axle shaft (27), making sure that it is properly inserted into braking disks and differential unit.



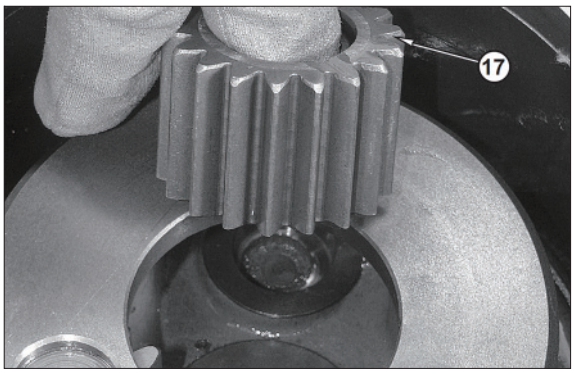
※ Check the condition and position of the O-ring (25).



⑮ Install the spherical washer (19).

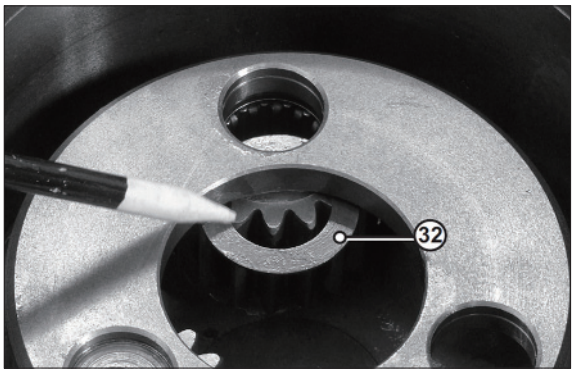


⑯ Install planetary gears complete with roller bearing (17).

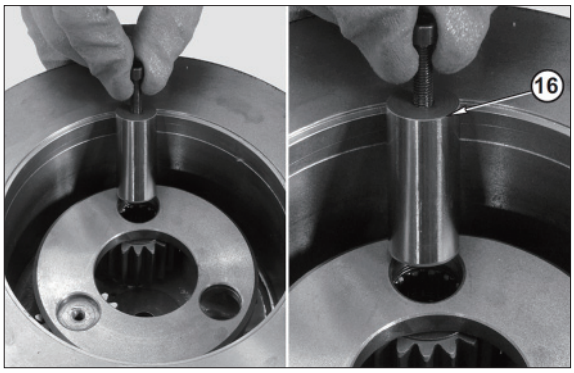


⑰ Install the others friction washers.

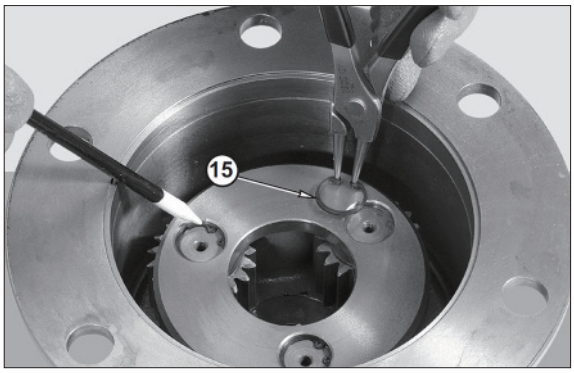
Two friction washers for every planetary gear.



⑱ Check the concentricity of the planetary gear, the seat and friction washers.
Using a screw M6 install the pin (16).

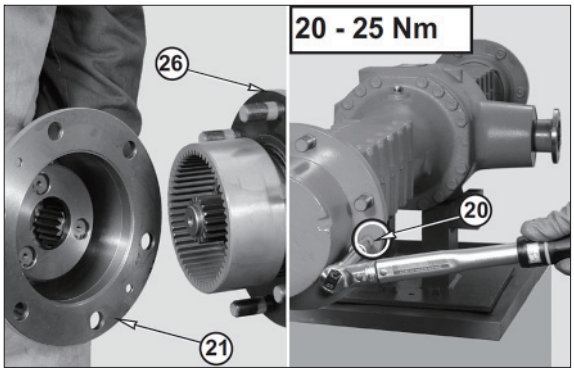


⑲ Carefully check that pin is completely inserted and install the snap rings (15).



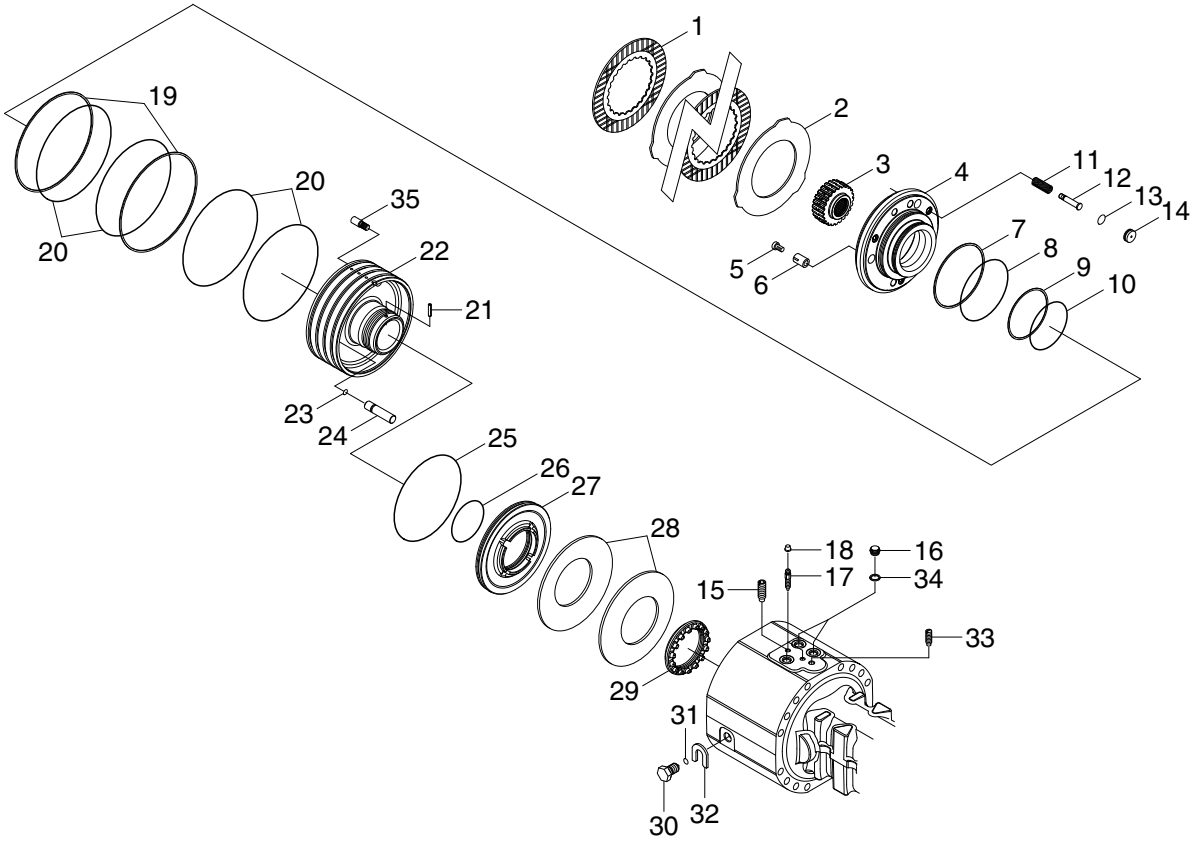
⑳ Fit the planetary gear cover (21) onto the wheel hub (26).

- Torque wrench : 2.04~2.55 kgf · m
  (14.8~18.4 lbf · ft)



2) SERVICE AND NEGATIVE BRAKE

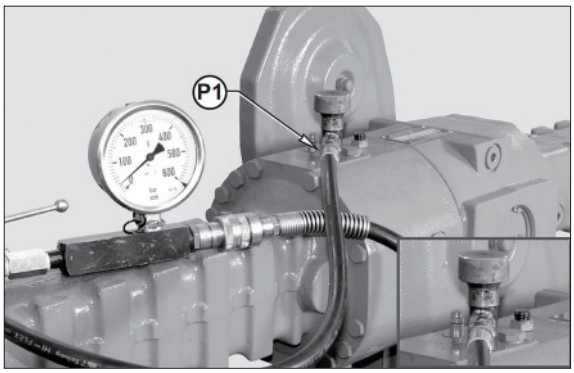
(1) Assembly diagram



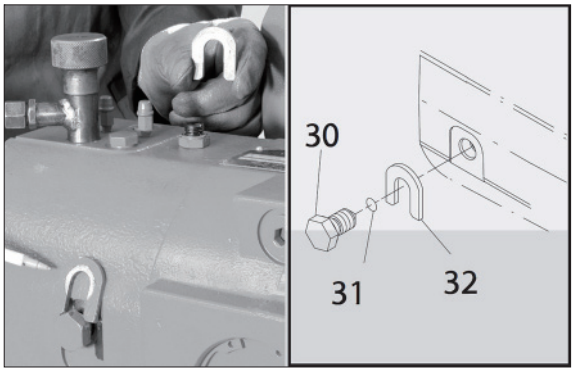
(2) Disassembly

① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15~30 bar to eliminate the pressure of the belleville washers.

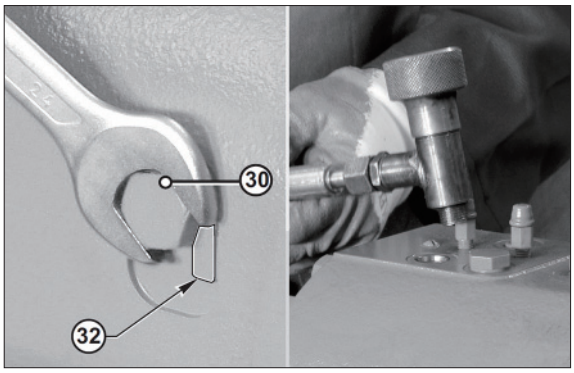
※ Perform all operations on both arms.



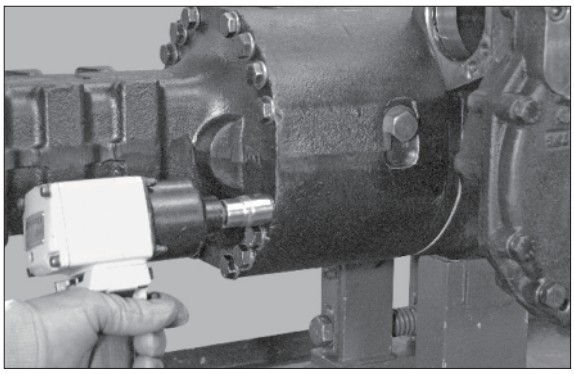
② Loosen the unlocking screws (30) and remove both stop washers (32).



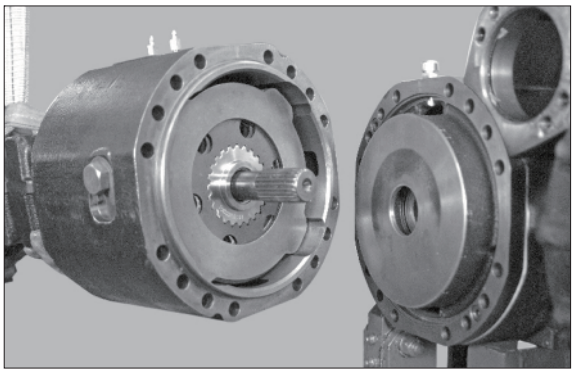
③ Insert block screws to end stroke and release pression.



④ Sling the arm to be removed and connect it to a hoist, remove screws.

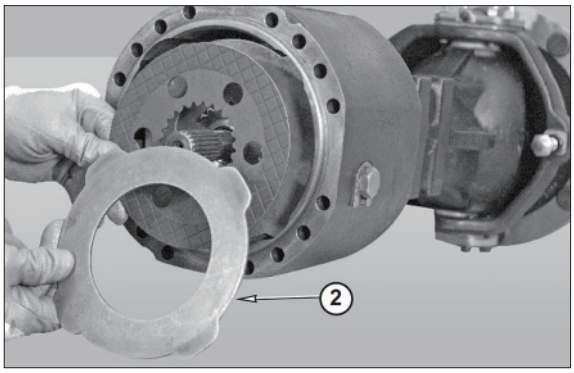


⑤ Take off the arm and lay it down vertically.

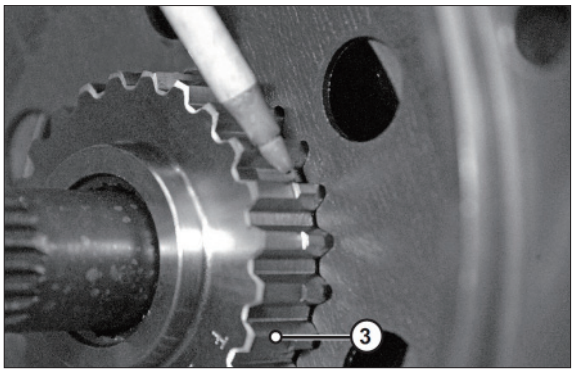


⑥ Remove the brake discs one after the other (2).

※ If they are not to be substituted, do not mix up the sequence.

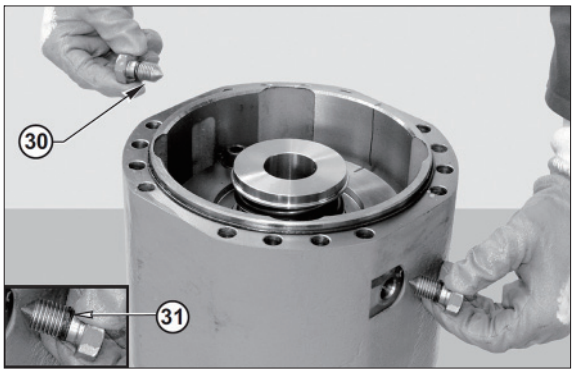


⑦ Remove the flange (3) complete with the discs.



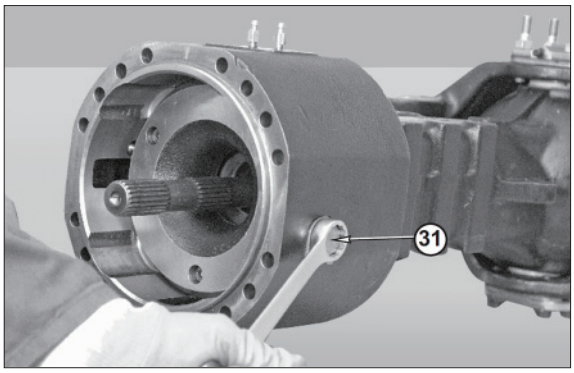
⑧ In order to keep the disc springs of the negative brake preloaded, screw down the screws with washers to the end stop.

⑨ Remove the negative brake locking screws (30).
Always exchange the O-ring (31).

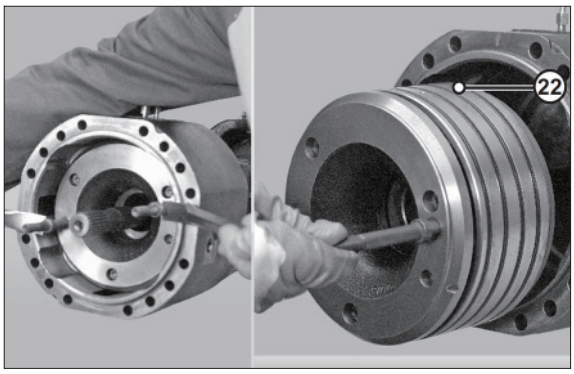


⑩ Loosen the before installed provisional screws in the same sequence and same measure.

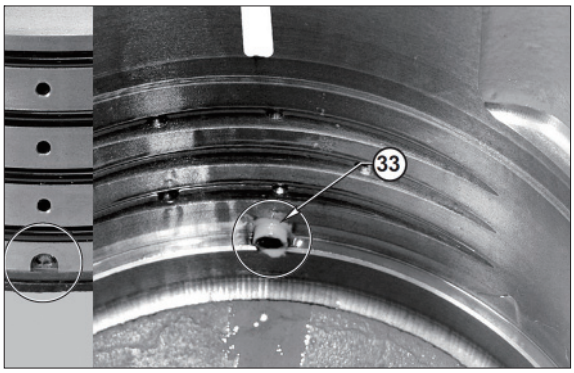
⑪ Remove the negative brake locking screws (30). Always exchange the O-ring (31).



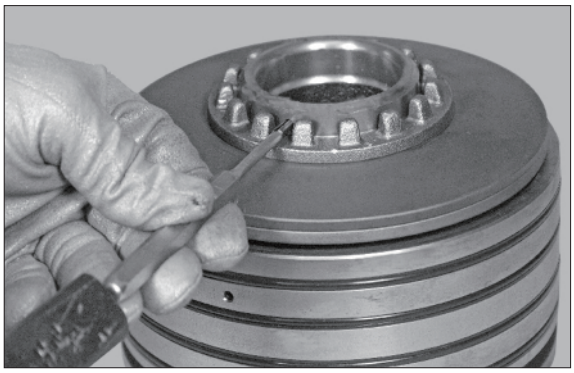
⑫ Pull out brake piston assembly module (22).



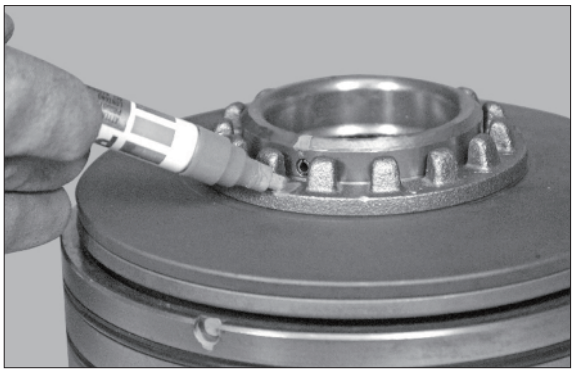
※ Check locking screw (33) of the brake piston module.



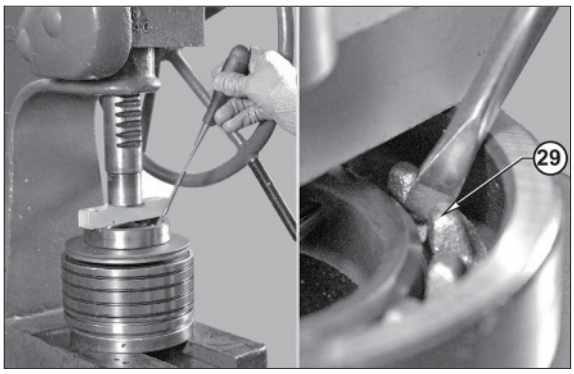
⑬ Turn upside down the brake module and with a pin driver remove the locking pin of the slotted nut.



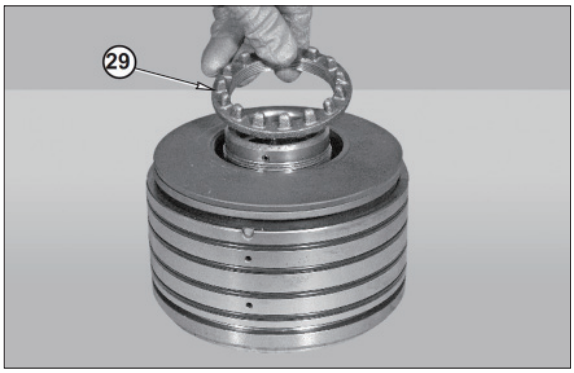
⑭ Sign the position of the slotted nut.



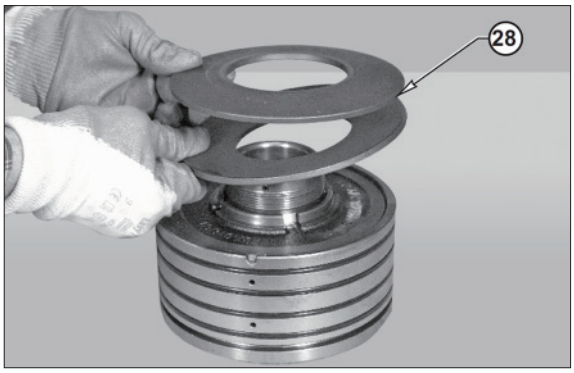
⑮ Bring the piston group below a press, compress the cup springs and loosen the metal ring.



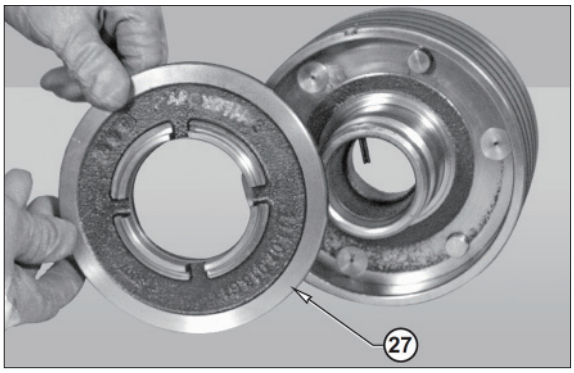
⑯ Remove nut (29).



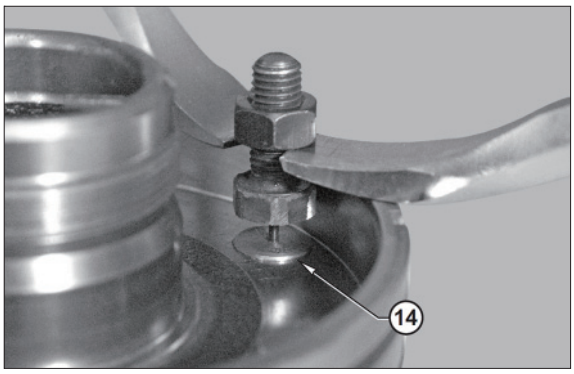
⑰ Remove the disc springs (28).



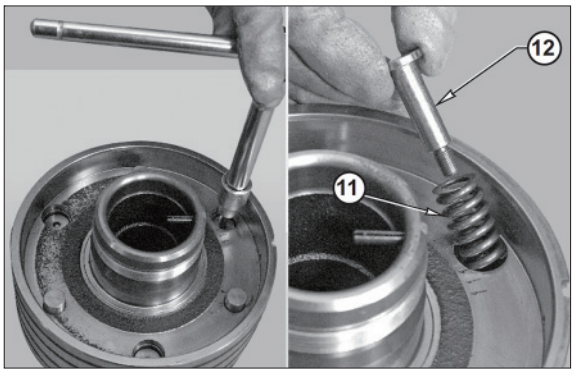
⑱ Applying air pressure, remove the piston (27) of the negative brake.



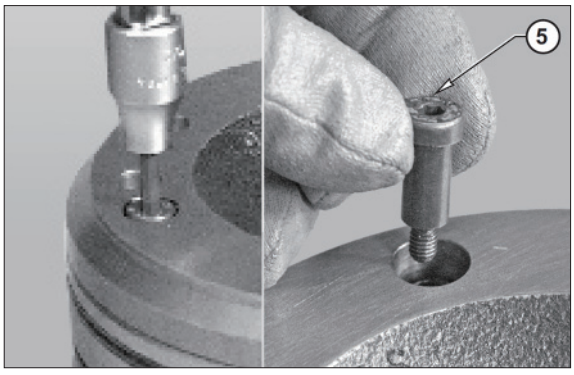
⑲ Using a new screw remove the pressure seal caps.



⑳ Remove the reversal springs (11).

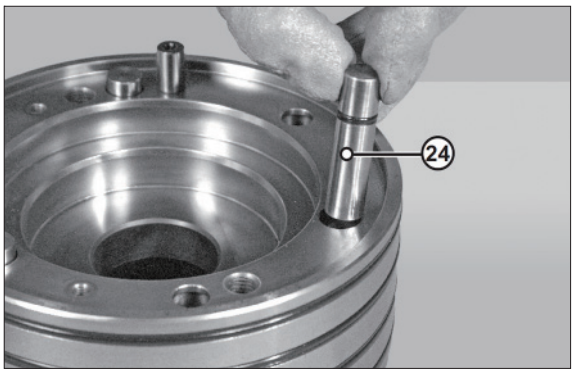


㉑ Remove the adjusting screws (5).

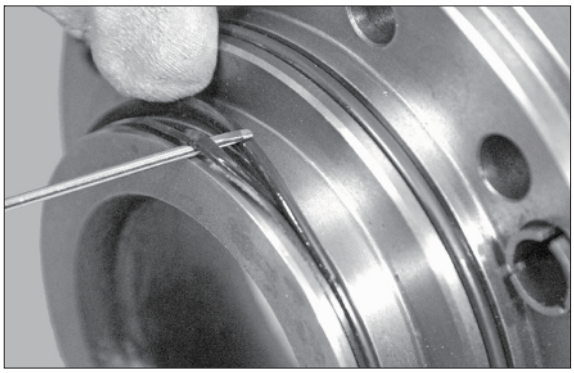


㉒ Remove the service brake piston (4).

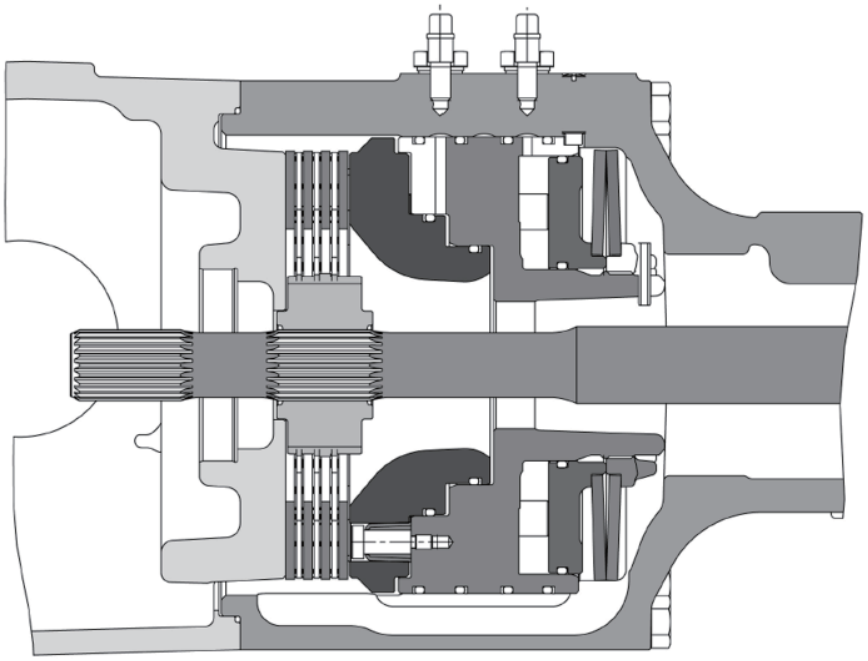
㉓ Remove the three bolts (24).

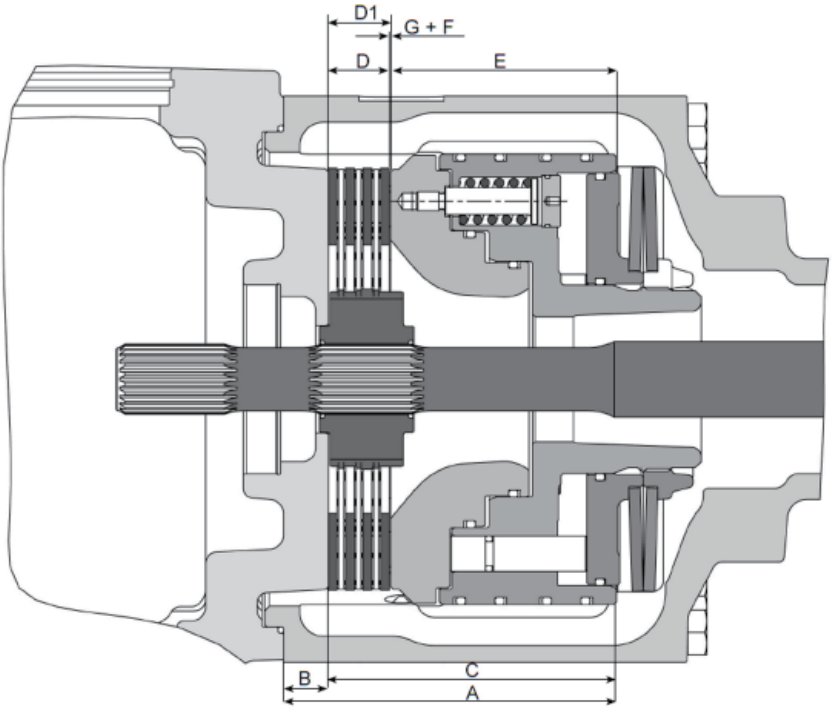


㉔ Remove the O-rings and the anti-extrusions rings from the service brake, the negative brake piston and from the piston.



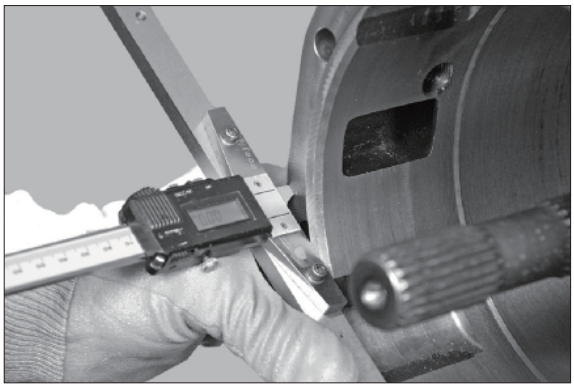
(3) Assembly



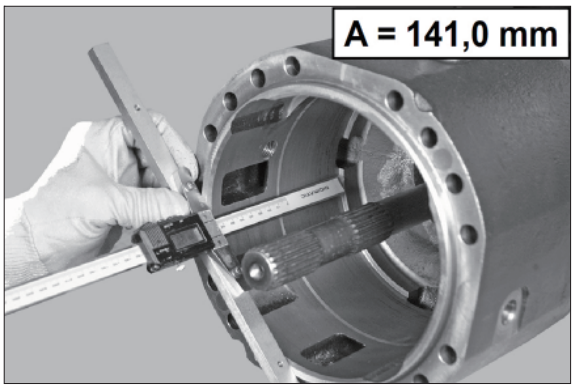


C = A - B
141.0 - 19.0 = 122 mm
C = arm quote
D1 = D + G + F
26.0 + 0.75 + 0.2 = 26.95 mm
D = tickness of discs pack
G = brake discs gap
F = fix quote
E = C - D1
122 - 26.95 = 95.05 mm
E = piston pack quote

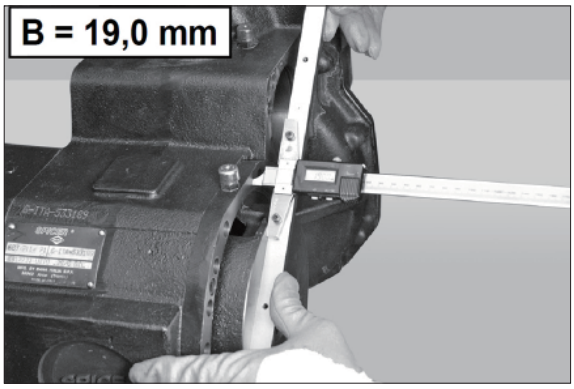
① Zero the centesimal calibre between the support plane and the centring arm.



② Then measure the distance between the arm support plane and the piston pack stop.

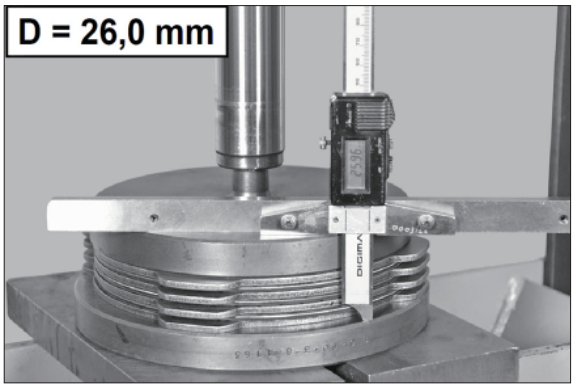


③ Measure the distance between the disk support plane and the arm support plane.
Subtract the value “B” from the value “A” to obtain the effective dimension “C” of the arm containing the brake disks and the piston pack.



④ Bring the disk pack beneath a press, load with 1000 kg, then measure the dimension “D”.
Add the play “G” and the fixed value “F” (equal to 0.2 mm) to the value “D”.

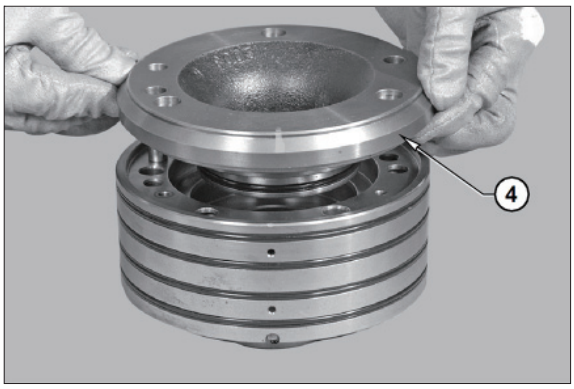
※ Do not take into account the thickness between the press piston and the disks.



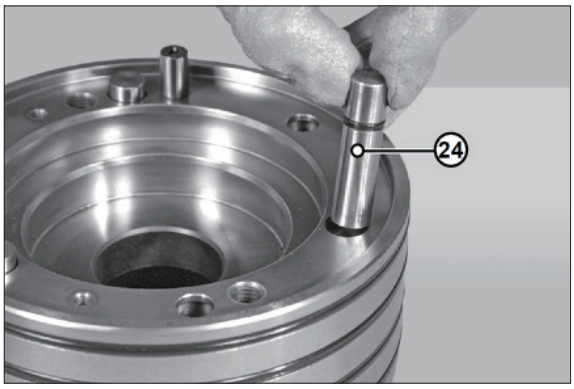
⑤ To determine the value “E” of the piston pack, subtract value “C” from value “D1”.

C = A - B
141,0 - 19,0 = 122 mm
C= arm quote
D1 = D + G + F
26,0 + 0,75 + 0,2 = 26,95 mm
D= tickness of discs pack
G= brake discs gap
F= fix quote
E = C - D1
122 - 26,95 = 95,05 mm
E = piston pack quote

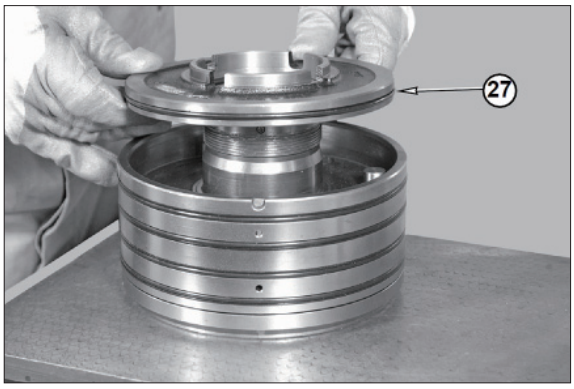
⑥ Insert the service brake piston (4) hammering alternately with a plastic hammer.



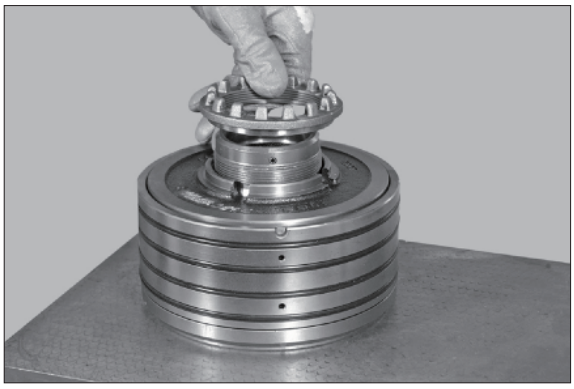
⑦ Insert the bolts (24).



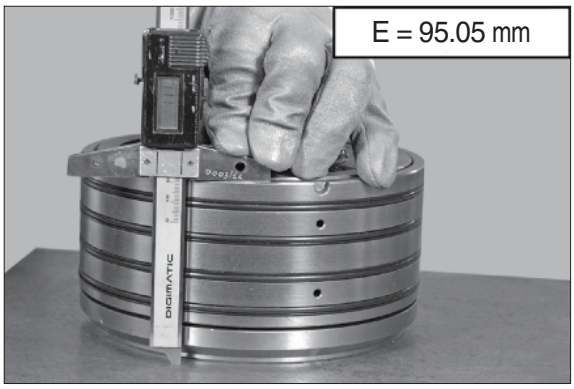
⑧ Turn upside down and insert the negative brake piston (27).



※ To determin the level “E” the slotted nut has to be operated without spring mounted.

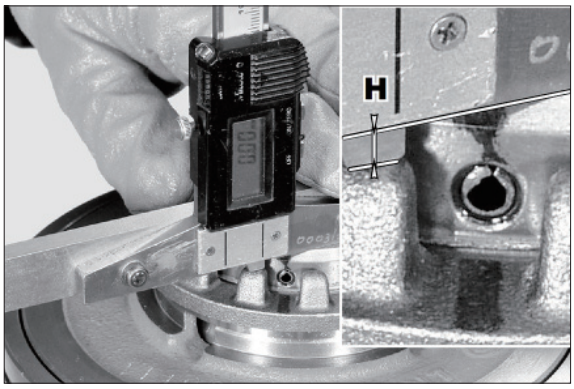


※ To define the level “E” adjust the slotted nut always to the smaller value by driving to the closer notch.

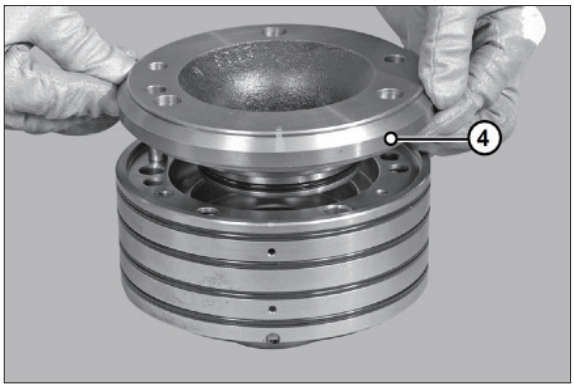


⑨ Before removing the slotted nut in order to insert the springs, note down the distance “H” from the plane to the tooth near the pin.

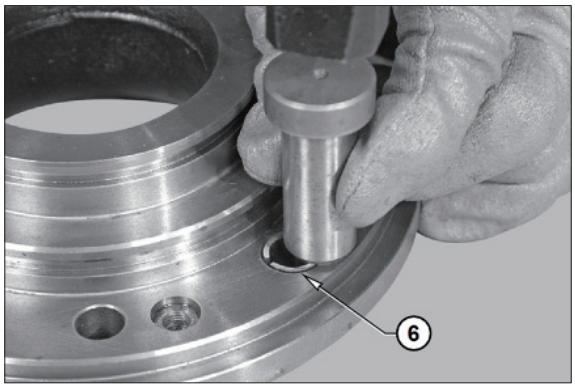
※ Sign.



⑩ Remove the service brake piston (4).

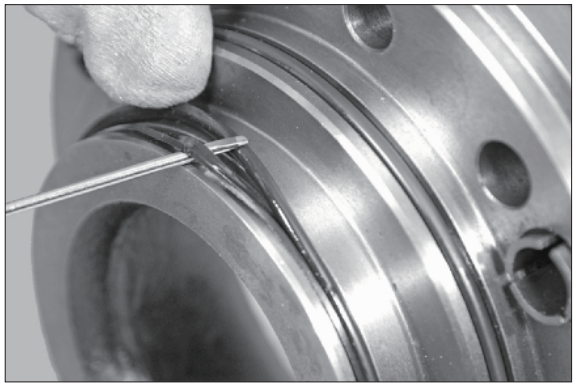


⑪ Insert the stroke automatic regulation springs (6); place them in line with the piston (4).

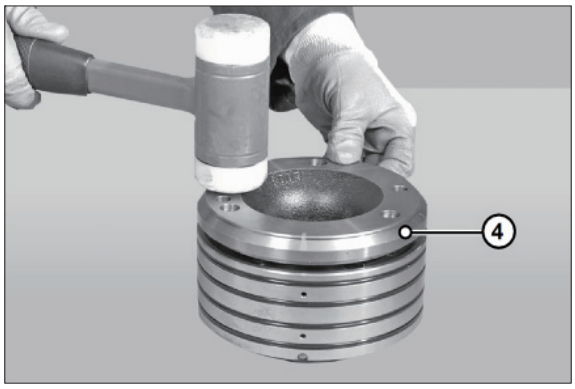


⑫ Complete the O-rings and anti-extrusion rings on all pistons.

※ The O-rings always have to be assembled from the pressure facing side.

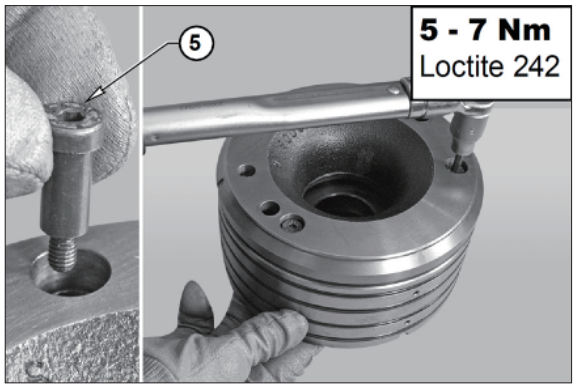


⑬ Insert the service brake piston (4) hammering alternately with a plastic hammer.

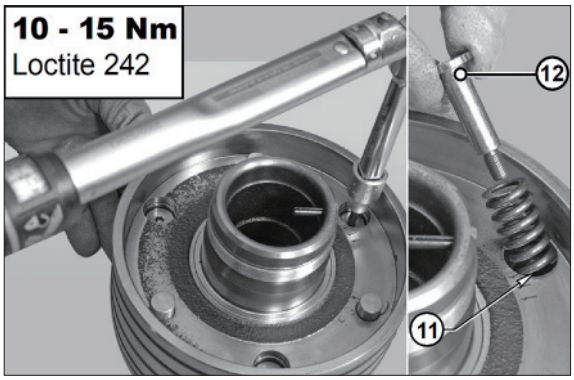


⑭ Fit the adjusting screws (5).
Apply loctite 242 to the thread.

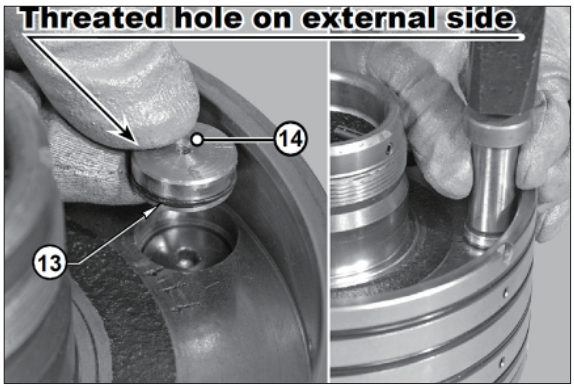
· Torque wrench setting :
0.51~0.71 kgf · m (3.69~5.16 lbf · ft)



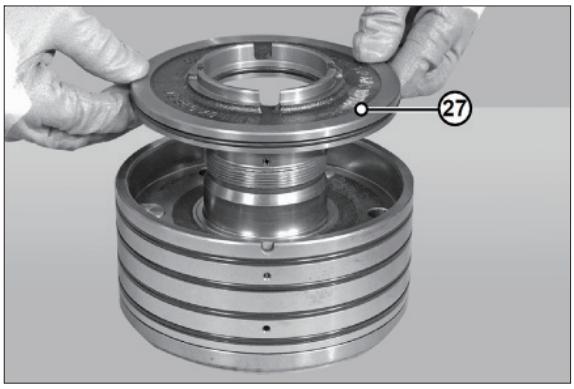
⑮ Fit the reversal springs (11) on the piston (4).
Apply loctite 242 to the thread of the adjustment screw.
Tighten with torque wrench setting of 1.02~1.53 kgf · m (7.38~11.1 lbf · ft)



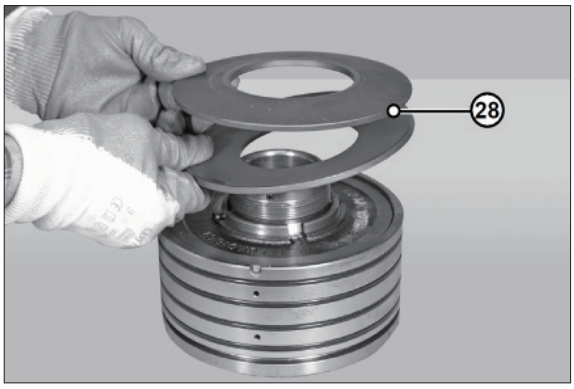
⑯ Insert the stroke end seal caps.



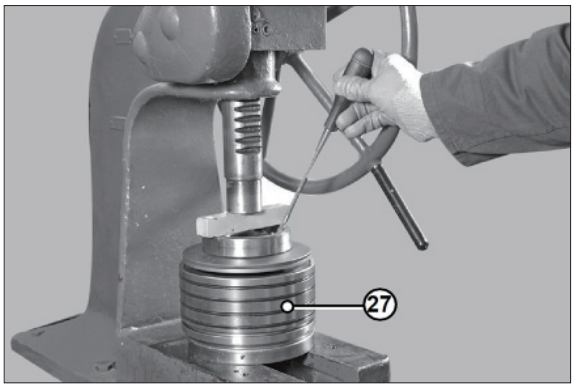
⑰ Insert the negative brake piston (27).



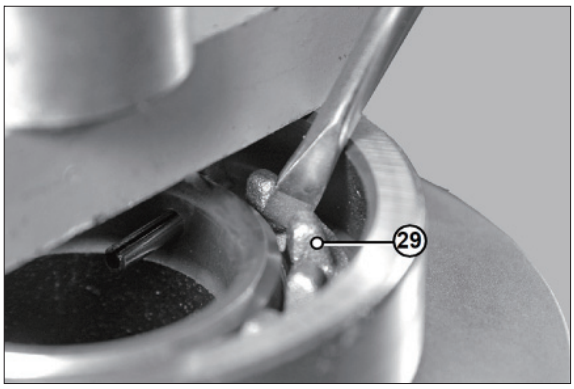
⑱ Insert the disc springs in the right position (28).



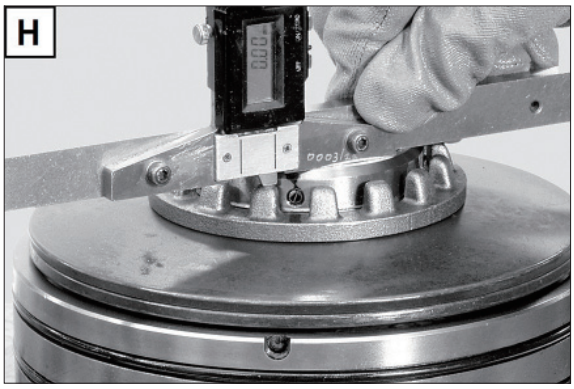
⑲ Insert at the bottom the piston of the negative brake (27) and screw up the slotted nut (29).



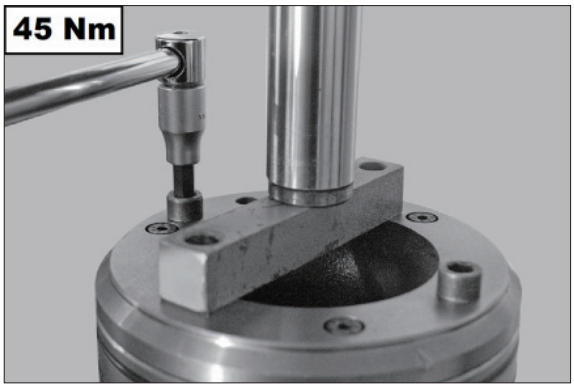
⑳ Screw down the slotted nut to the earlier determined position.



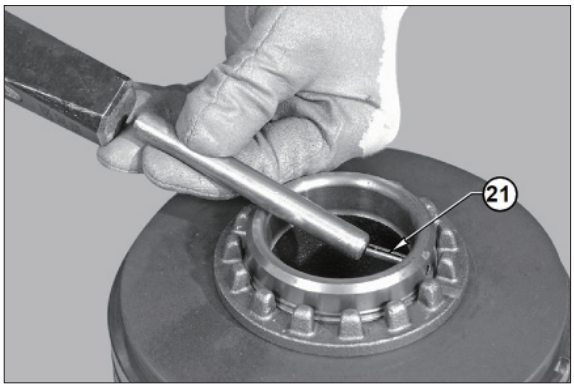
㉑ Check the earlier measured distance “H” from the plane to the tooth next to the pin.



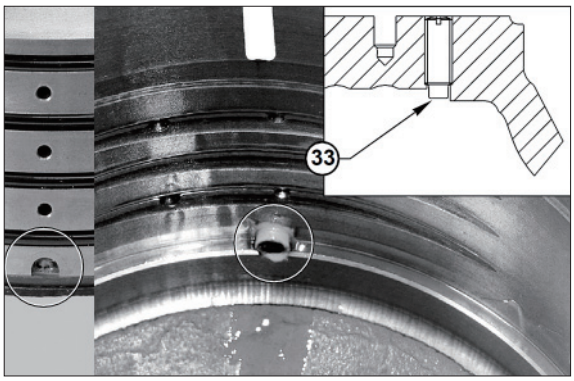
㉒ Alternately tighten with a torque wrench setting of maximum 4.59 kgf · m (33.2 lbf · ft).



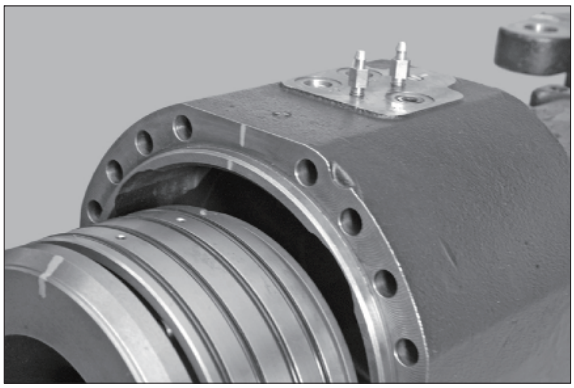
㉓ Put the pin in locking (21) position.



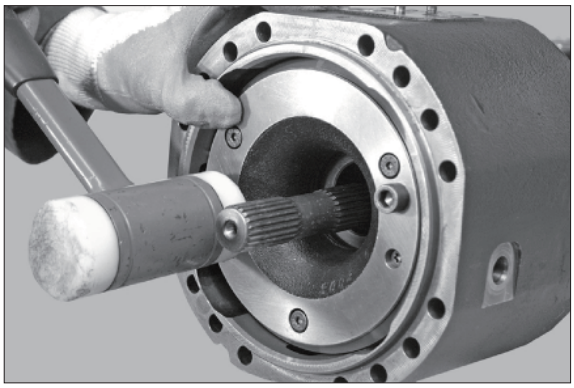
※ Check locking screw (33) of the brake piston module.



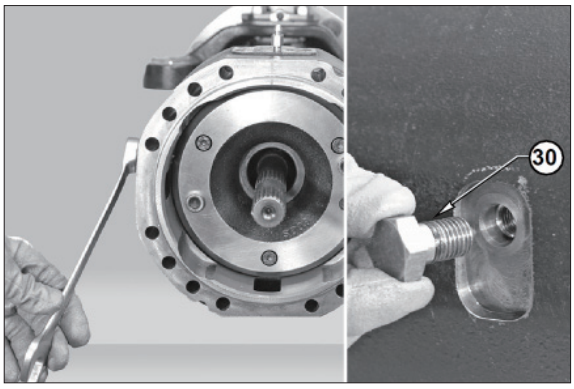
㉔ Insert the brake module facing the input holes to the top.



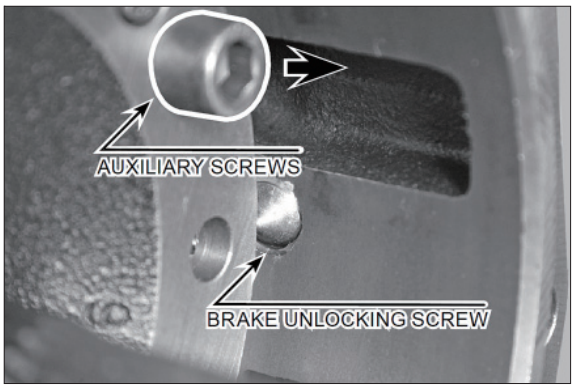
㉕ Insert the piston to the end stop by alternating light strokes and remove the screws.



㉖ Insert the negative brake unlocking screw (30) up to the end stop.

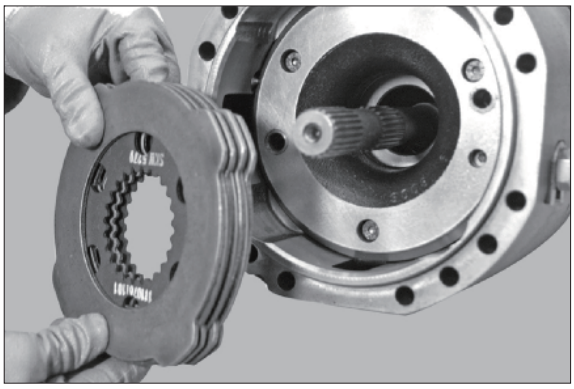


㉗ Remove the two auxiliary screws.

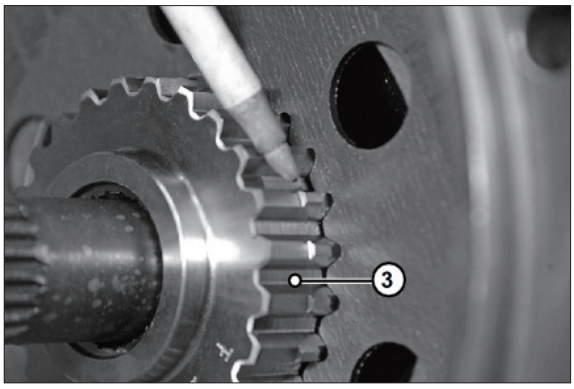


㉘ Insert the brake discs (1) (2) in the right sequence.

※ The first brake disc to be inserted must be of friction material.

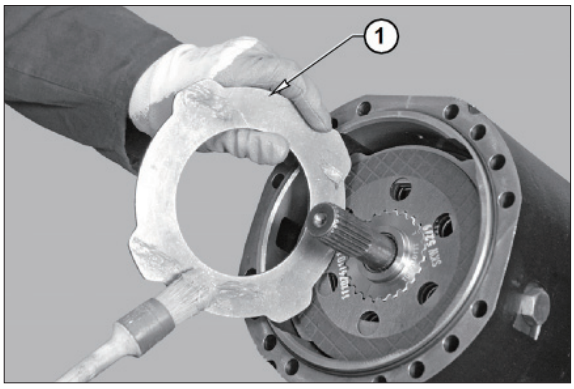


㉙ Install the flange (3) on the arm.

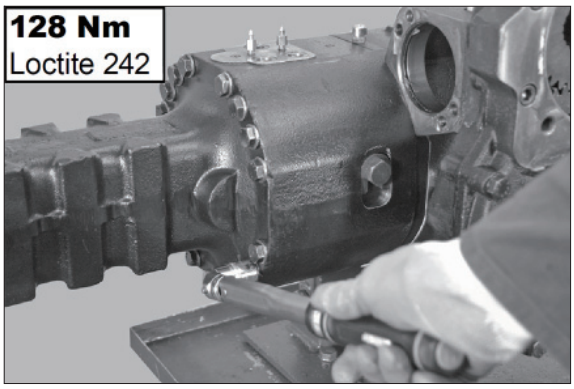


㉚ Insert the brake discs (1) (2) in the right sequence.

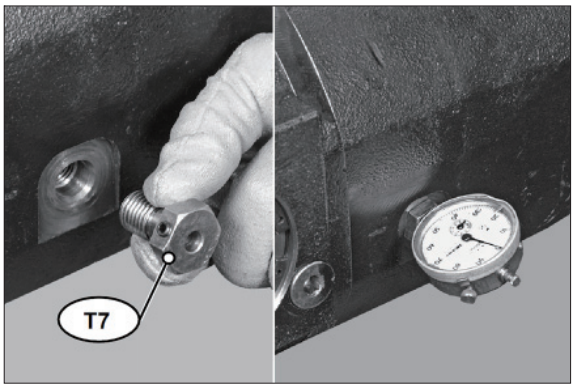
※ The last brake disc to be inserted must be of metal material.



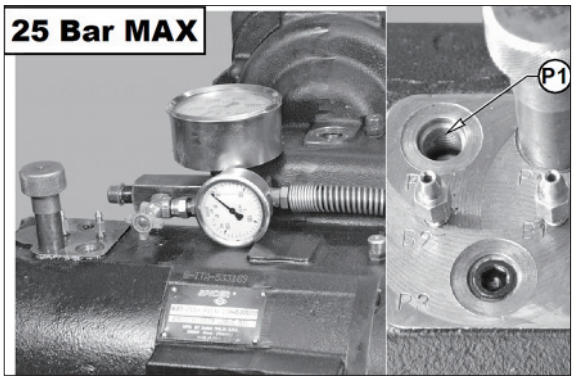
㉛ Insert the screws and tighten them alternately.



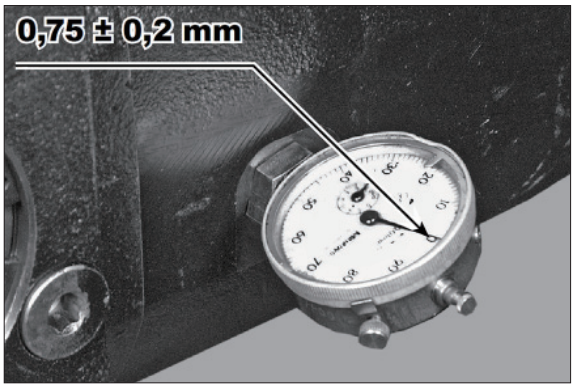
㉜ Remove the negative brake locking screws (30).
Fit the special tool T4 into the seat of the manual release of the screws, insert a comparator and pre-load it with 1 ㎜.



㉝ Introduce a pressure of maximum 25 bar.

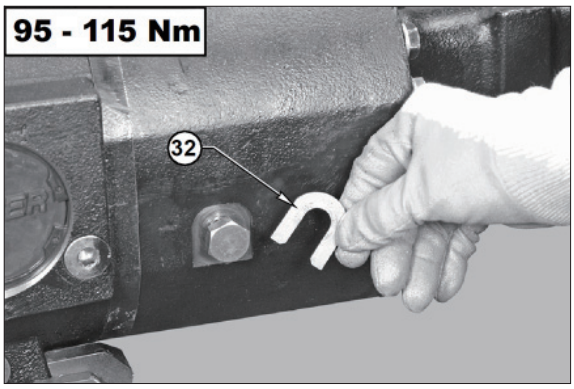


㉞ Once the pressure is inserted into the circuit the comparator must give a measurement equal to play X (0.75 ㎜).

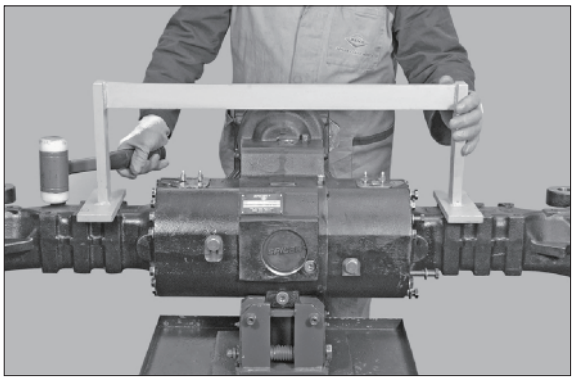


㉟ Insert the two “U”-shaped shims and tighten the screws with a torque wrench setting of 9.69~11.7 ㎏f · ㎝ (70.1~84.6 lbf · ft).

※ The position of the negative brake is unlocked.

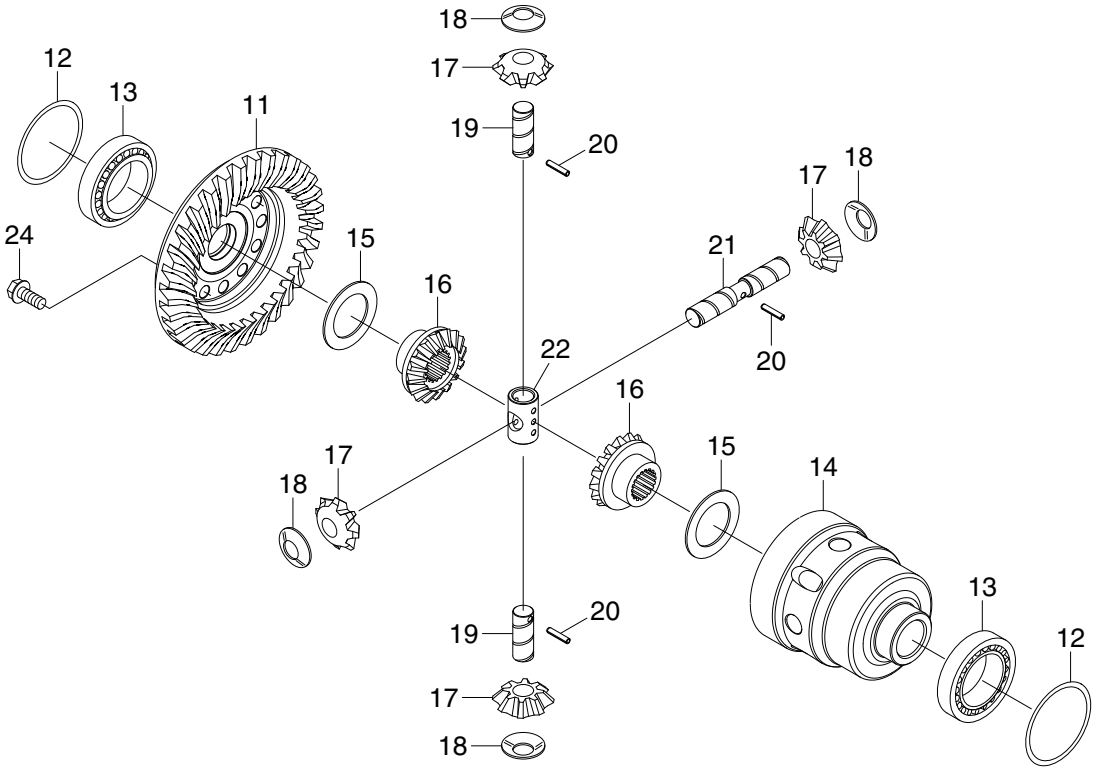


㊱ Check the flatness of the arms and finally lock the arms with the screws (4) and the washer (5) using the crosstightening method.



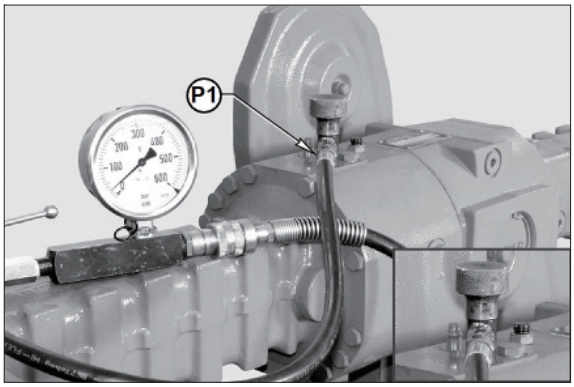
4) NORMAL DIFFERENTIAL

(1) Assembly diagram

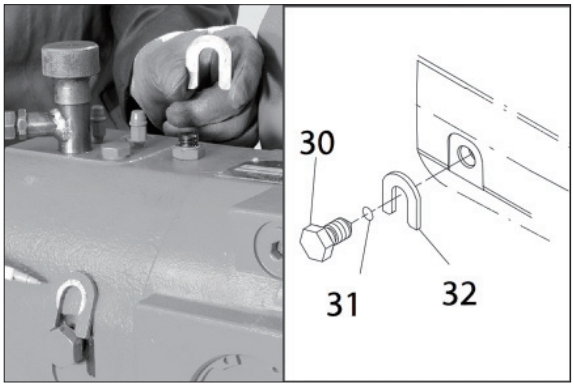


(2) DISASSEMBLY

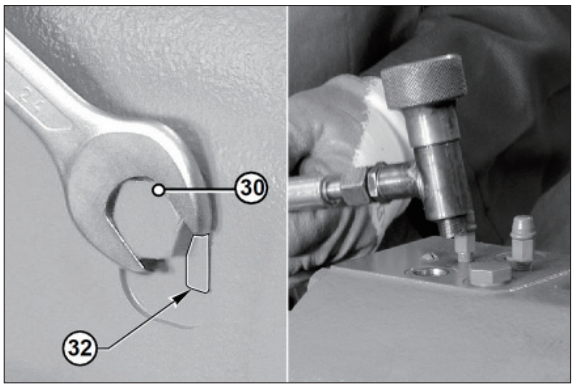
① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15~30 bar to eliminate the pressure of the belleville washers.



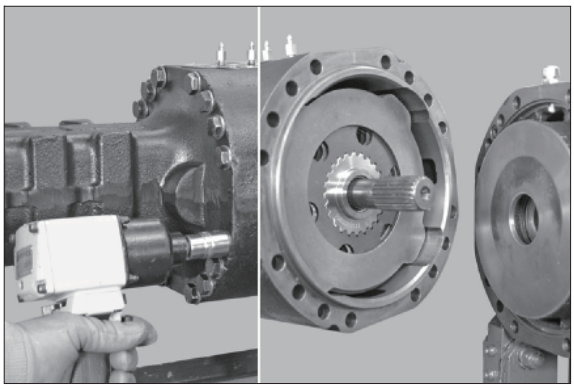
② Loosen the unlocking screws (30) and remove both stop washers (32).



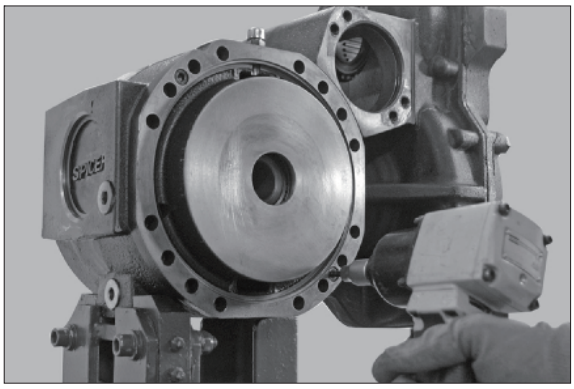
③ Insert block screws to end stroke and release pression.



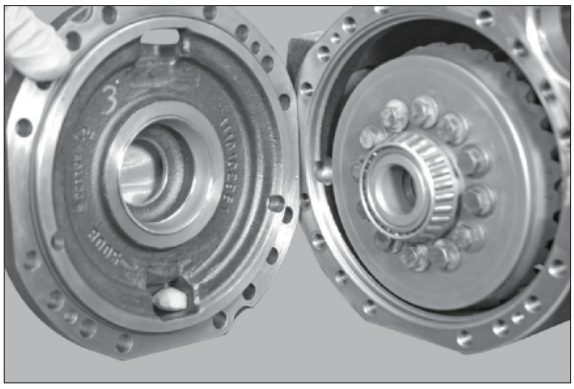
④ Remove the brake side arm and the brake discs pack.
Sling the arm to be removed and connect it to a hoist, remove screws of the crown wheel side arm.
Remove the arm together with the pack of the braking disks.
Place the arm on a bench.



⑤ Remove the fitting screws from the middle cover.

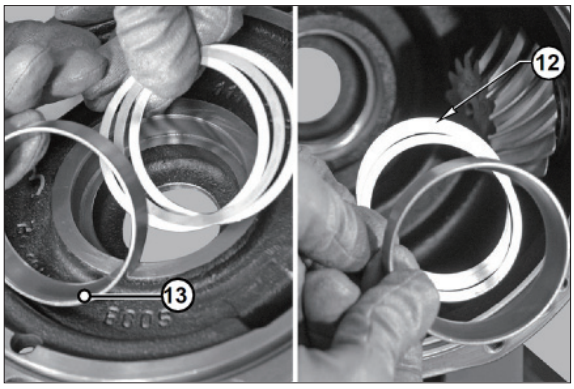


⑥ Insert a screw-driver in the opposing slots then force and remove the middle cover.

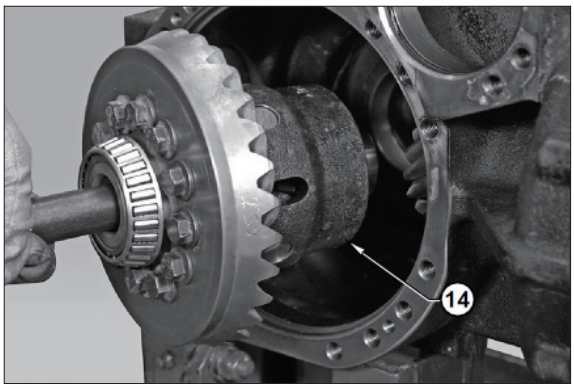


⑦ If the bearings need replacing (13), extract the external thrust blocks of the bearings (13) from middle cover and central body.

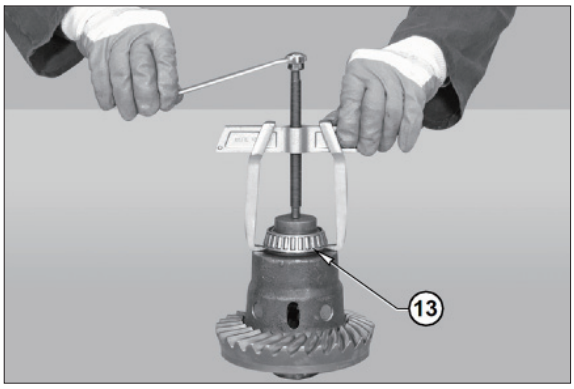
※ Accurately check the O-ring.



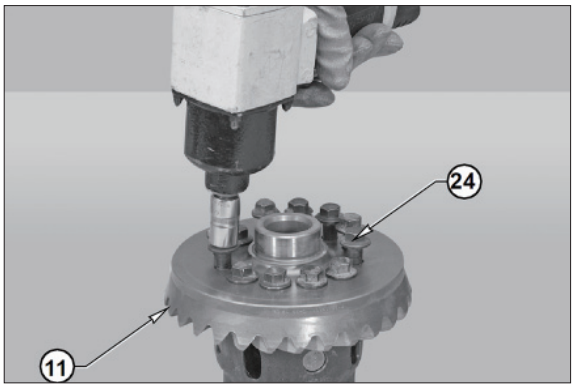
⑧ Pull out the differental (14).



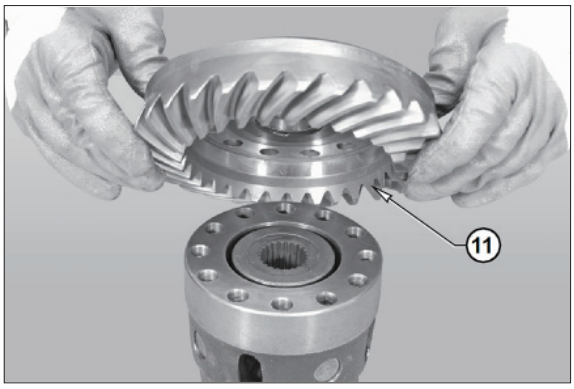
⑨ If the bearing need replacing, extract the bearing (13) from the differential carrier.



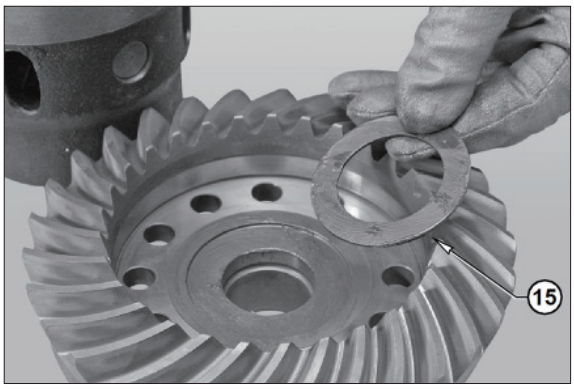
⑩ Remove fixing screws (24) of the crown wheel (11); exchange each time when removed.



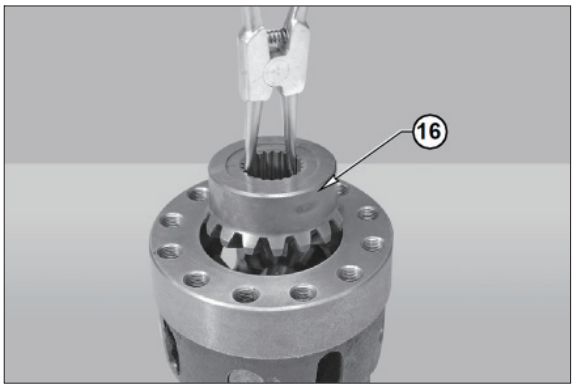
⑪ Extract the crown wheel (11).



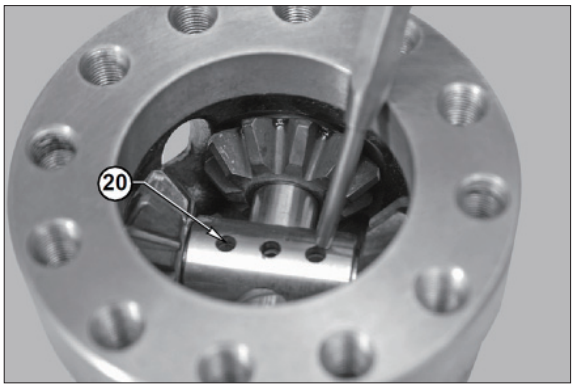
⑫ Remove the shim washer (15).



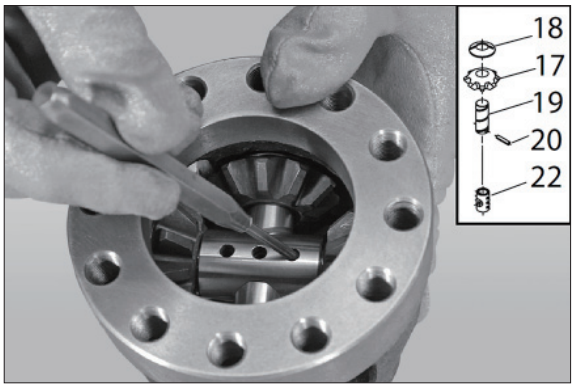
⑬ Remove the planetary gear (16).



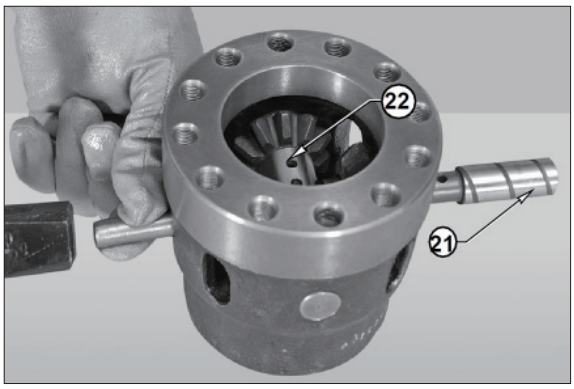
⑭ Remove the three spider blocking pins (20) by using a pin driver.



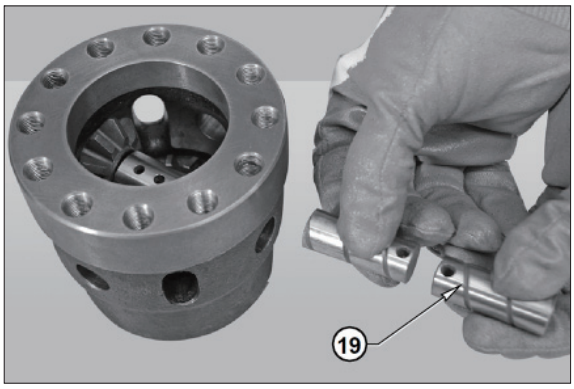
⑮ Move the two opposite mounted short bolts (19) to the outside of the box using the same pin driver.



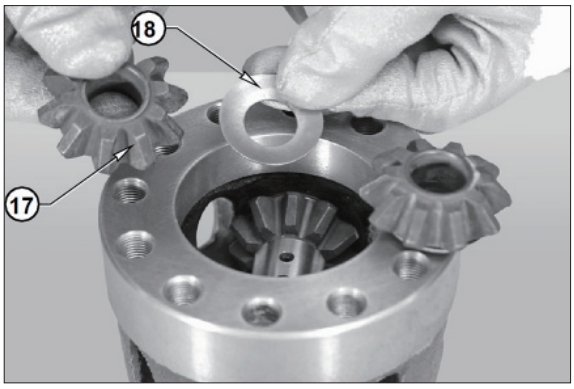
⑯ Drive out the long bolt (21) and pull out the spider (22) from the center.



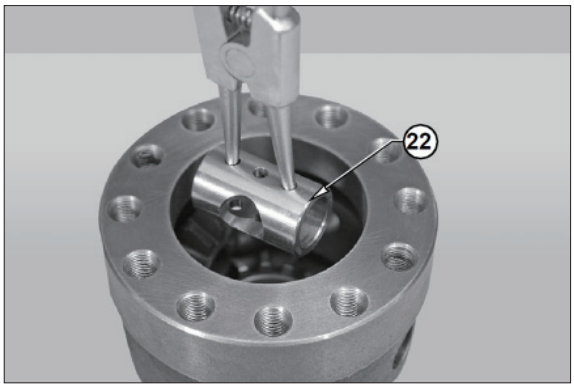
⑰ Remove the two half bolts (19), spherical washers and satellite wheels.



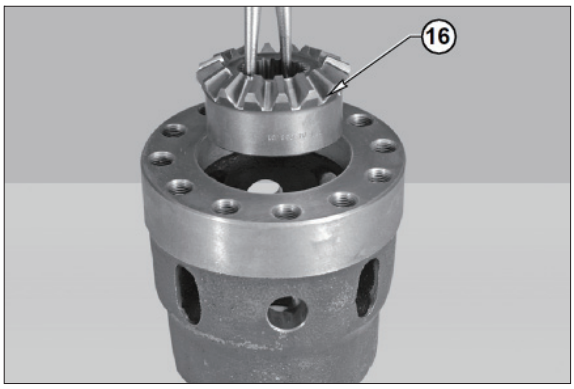
⑱ Remove long bolt, spherical washers (18) and satellite wheels (17).



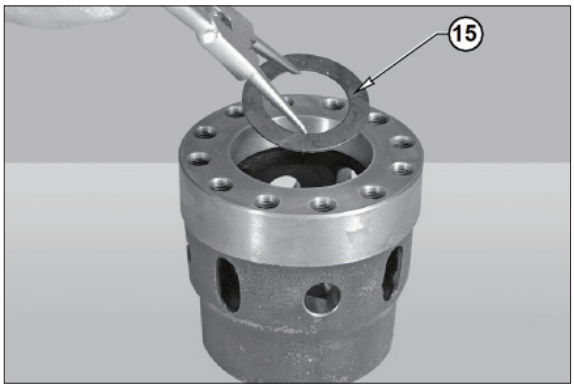
⑲ Pull out the spider (22) from the center.



⑳ Remove the planetary gear (16).

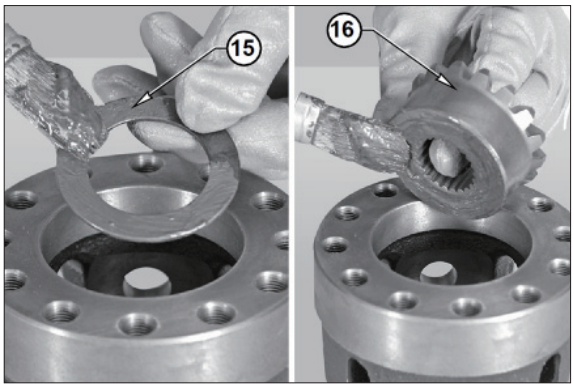


㉑ Remove the shim washer (15).

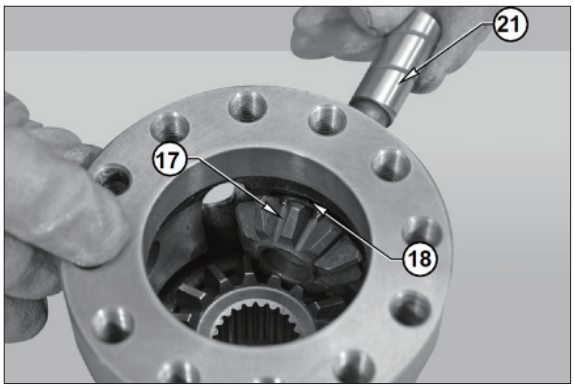


(3) ASSEMBLY

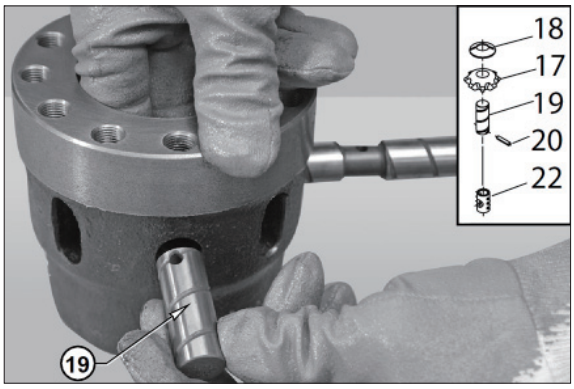
① Lubricate and insert washer (15) and plantary wheel (16).



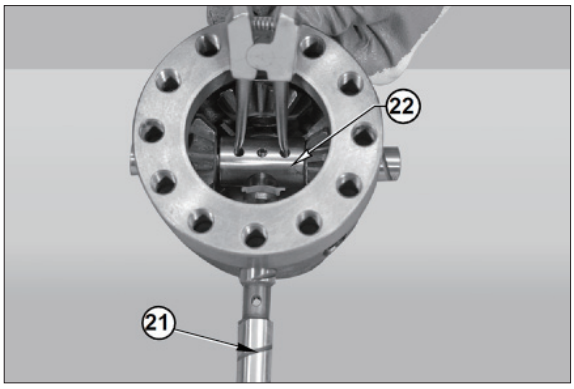
② Partially insert the long bolt (21), satellite wheels (17) and spherical washers (21).



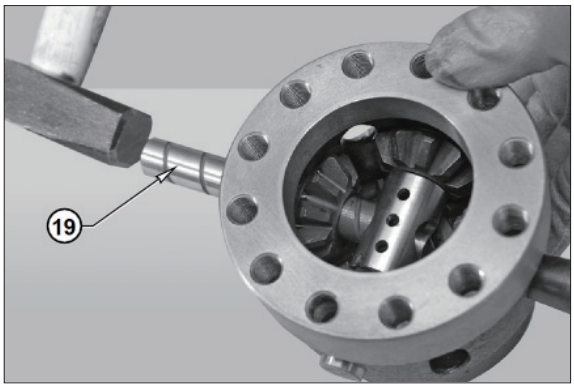
③ Insert the two half bolts (19), spherical washers (18) and satellite wheels (17).



④ Insert spider (22) and completely insert the long bolt (21).

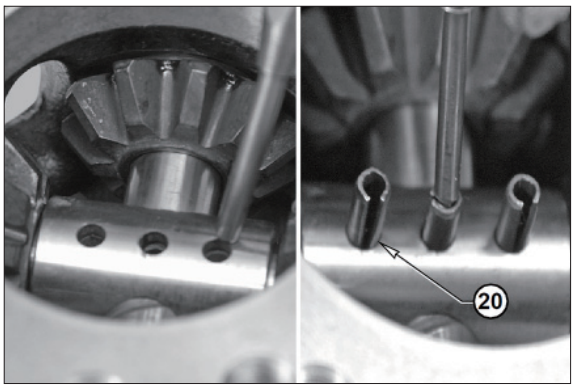


⑤ Insert completely the bolts (19).

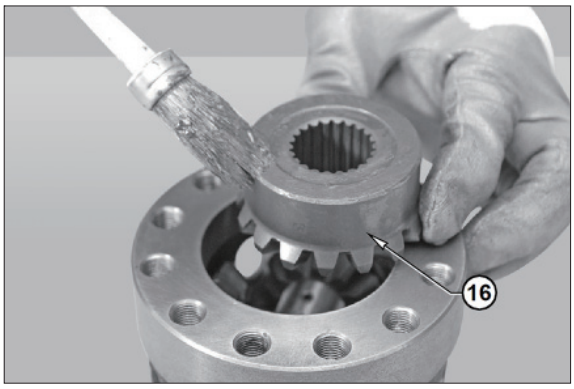


⑥ Center the pin holes and insert the 3V pins (20).

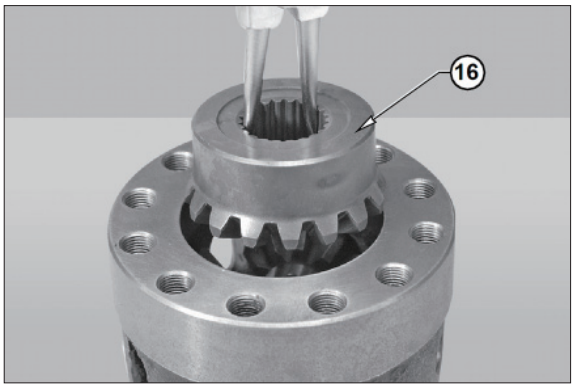
※ Check the free rotation of the satellite wheels on the bolts.



⑦ Lubricate wheel (16).

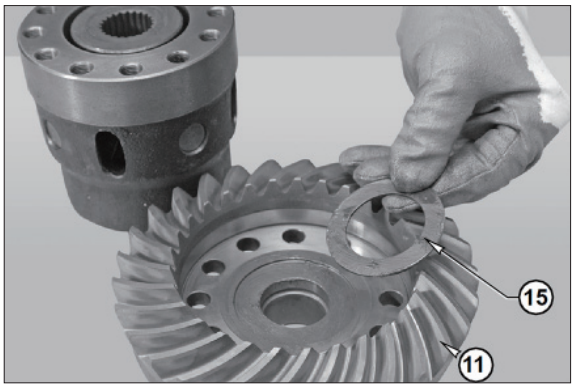


⑧ Insert planetary gear wheel (16).



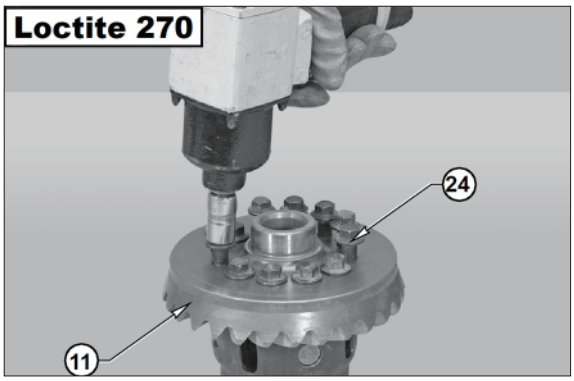
⑨ Position the shim washer (15) on the crown (11).

※ In order to hold the shim washer (15) in position, apply grease to it.



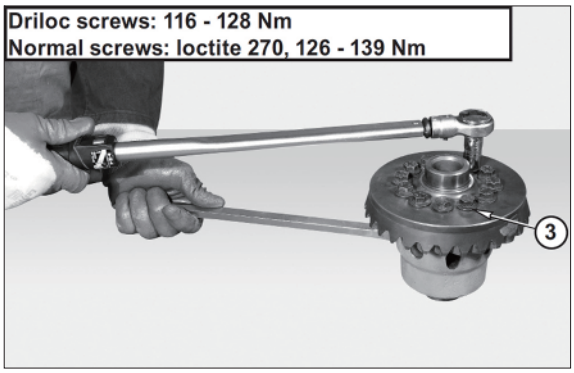
⑩ Position the crown (11) on the differential carrier and lock it with screws (24) applied with loctite 270.

※ Secure the screws using the cross-tightening method.



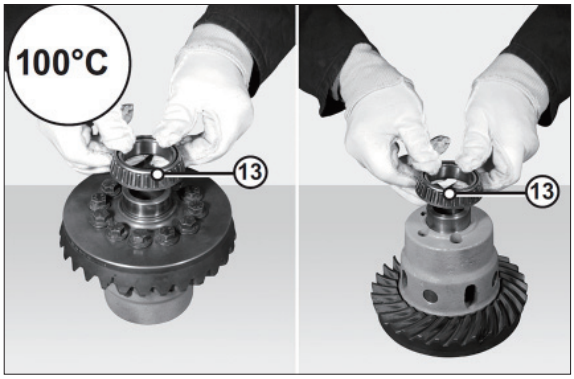
⑪ Tighten screws with a torque wrench: see table.

※ Always use new screws to fix the crown wheel. In case the screws are not thread locking pretreated, use loctite 270.



⑫ Assemble the bearing (13).

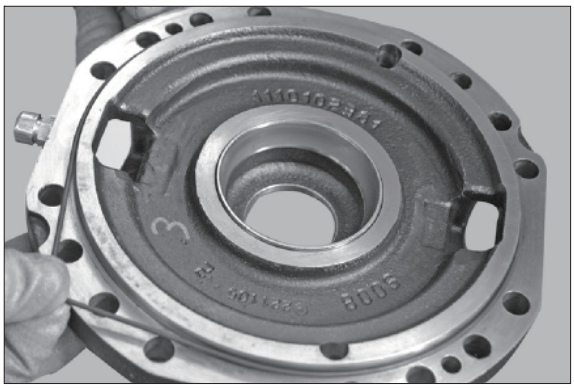
※ Heat the bearing to 100˚C before assembling.



⑬ If the bearings are replaced, insert the external thrust blocks in the middle cover and in the central body.

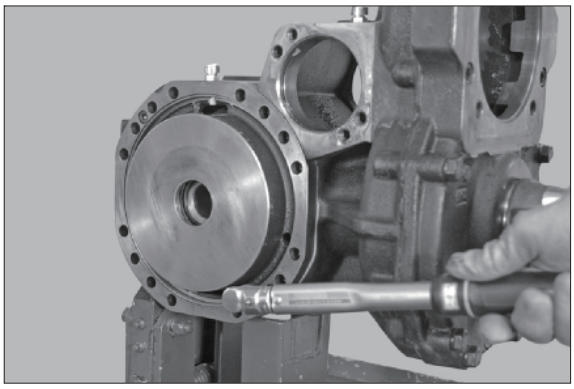
⑭ Position the differential unit in the central body with the help of a bar and fit the middle cover.

※ Thoroughly check the state of the O-ring and make sure that the cover is fitted with the oil discharge in the lower position.

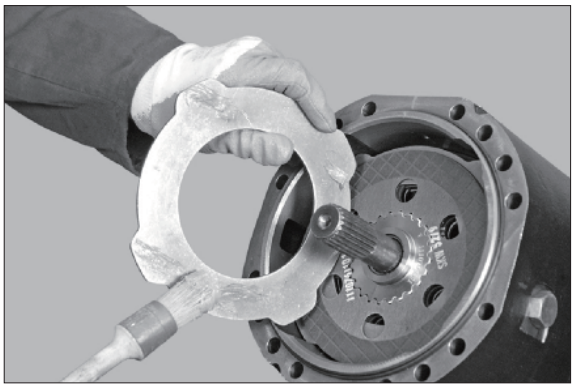


⑮ Lock the middle cover with screws.

· Torque wrench setting for screw :
2.47~2.67 kgf · m (17.9~19.3 lbf · ft)

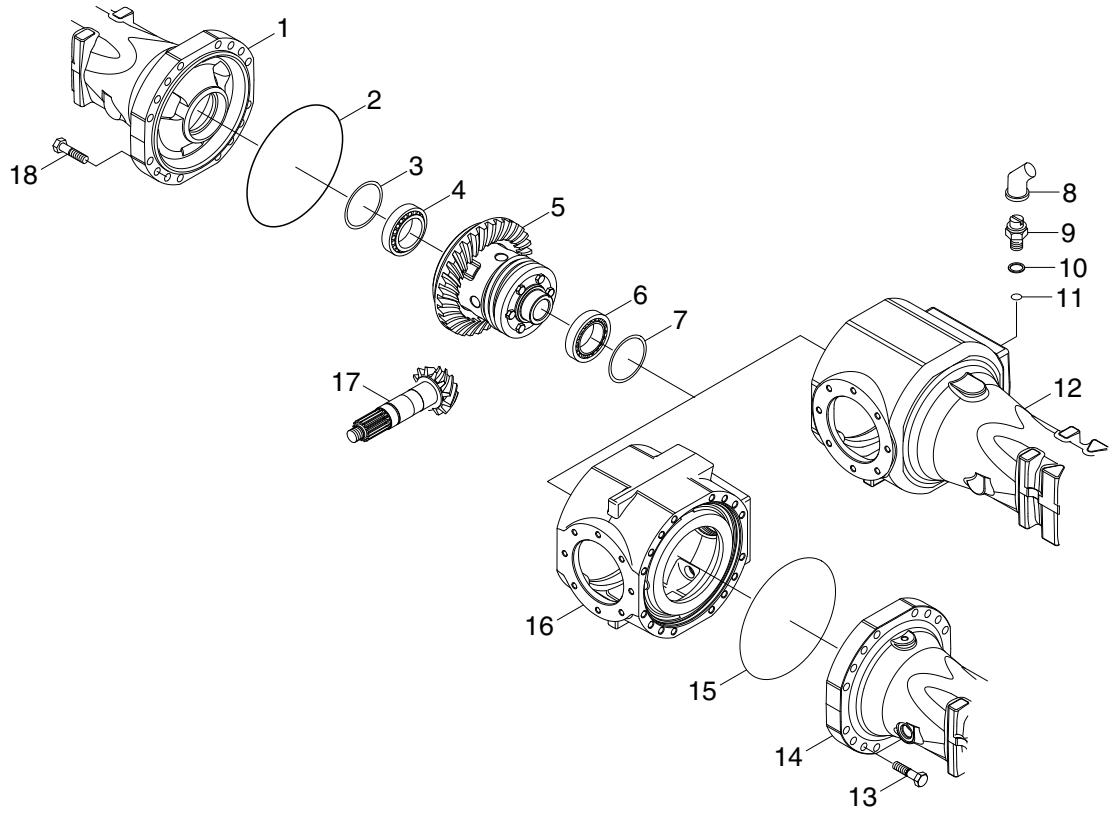


⑯ Check that the positioning of the sealing ring on the arm is intact; install the complete arm. Lock it into position using two facing screws and washers.



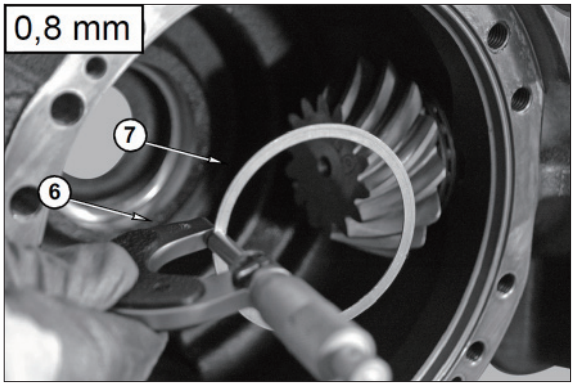
4) RING AND PINION ADJUSTING

(1) Assembly diagram



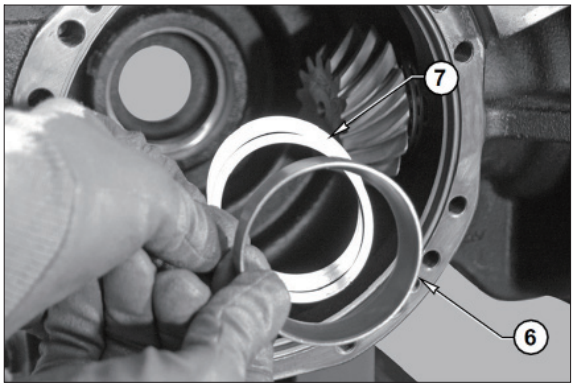
(2) Adjusting

① **Setting of the crown wheel and pinion**
Insert the thrust block of the bearing (6) opposit side of the crown wheel shims (Sb) (7) of an initial thickness of about 0.8 mm.



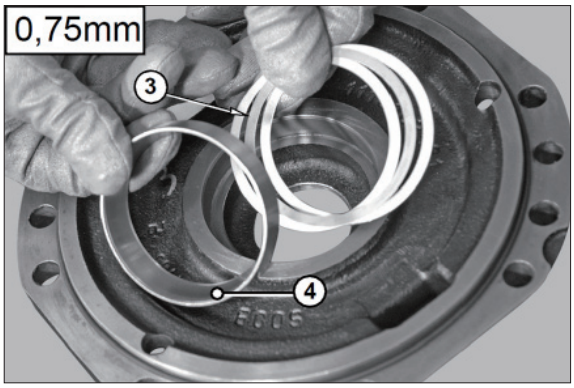
② Insert the thrust block (6) and the shims (Sb) (7) into the arm.

※ Check to be at end of stroke.



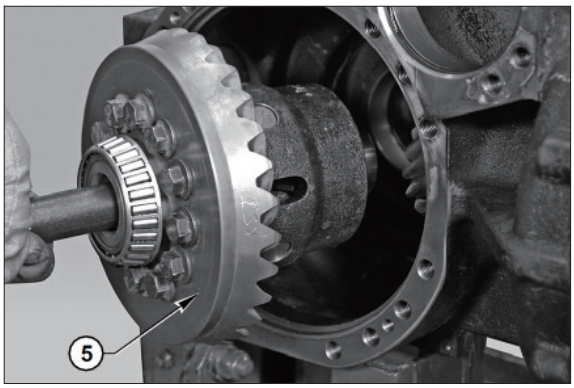
③ **Setting of the crown wheel and pinion**
Insert thrust block (4) of the bearing shims (Sc) (3) of an initial thickness of about 0.75 ㎜.
Insert the thrust block and the shims into the arm.

※ Check to be at end of stroke.

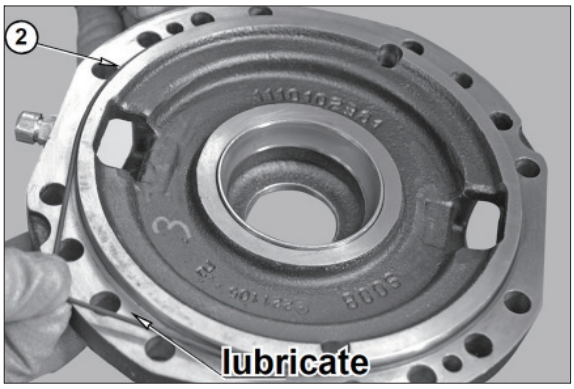


④ Insert complete differential (5).

※ Do not damage the seat of the O-ring with the gearwheel.

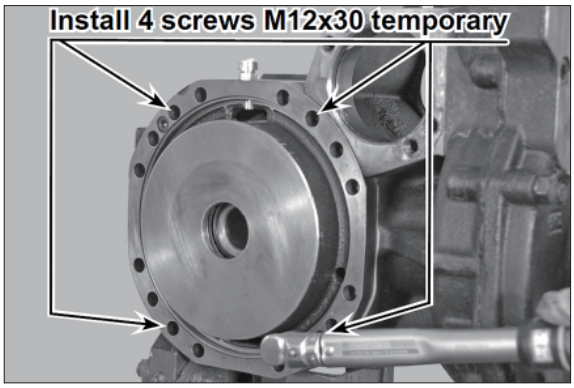


⑤ Check the O-ring (2) and grease.



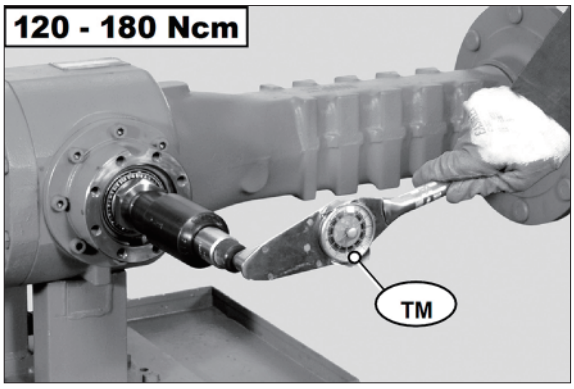
⑥ Lock the middle cover (5) with screws (4).

· Torque wrench setting for screw :
2.47~2.67 kgf · m (17.9~19.3 lbf · ft)



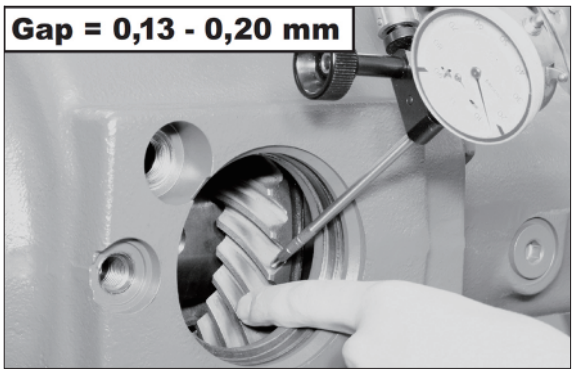
⑦ Apply torque meter TM to pinion nut and check that torque will increase by 0.04~0.06 kgf · m as a result of differential bearing preload.

· Example : pinion torque :
0.08~0.12 kgf · m (0.58~0.87 lbf · ft)
· Pinion + differential torque :
0.12~0.18 kgf · m (0.87~1.3 lbf · ft)



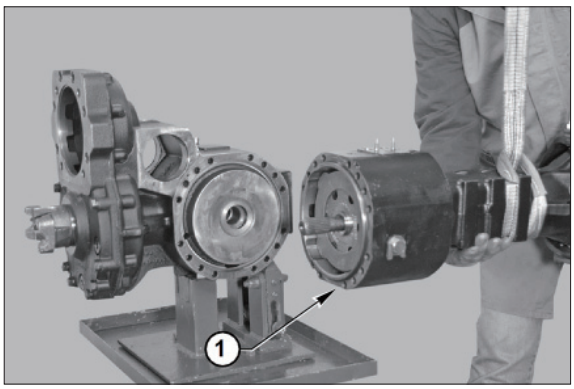
⑧ Position comparator on the center of one of the crown teeth, preset it to 1 mm and reset it to zero.
Manually move the crown in both directions to check the existing clearance between pinion and crown.

· Gap = 0.13~0.20 mm

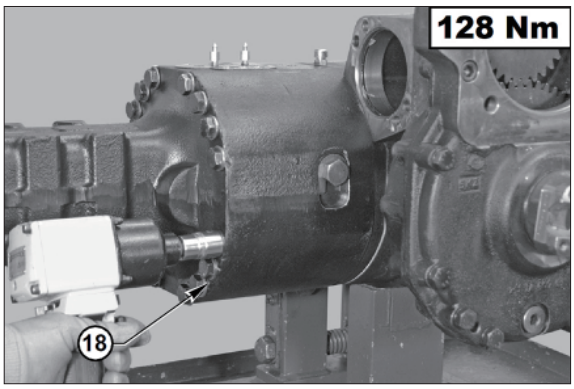


⑨ Install the crown wheel side arm (1) without half-axle.

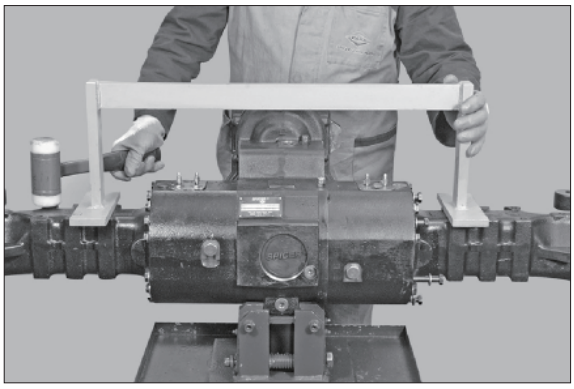
※ To check the torque of the differential, neither of both halfaxles must be installed.



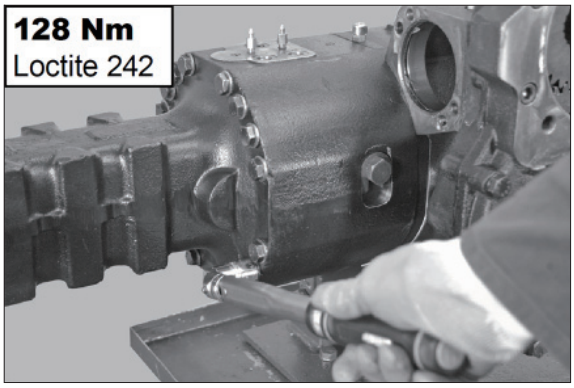
⑩ Temporarily insert all screws of the arm (18).



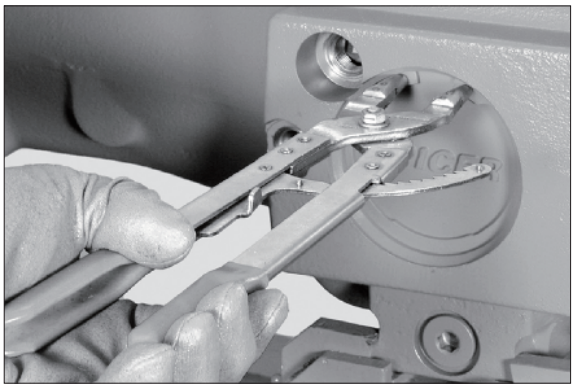
⑪ Check the flatness of the arms; then lock the arms into their final position, using screws adequately coated with loctite 242.



⑫ Torque wrench setting : 13.1 kgf · m
(94.4 lbf · ft)
Tighten using the criss-cross method.

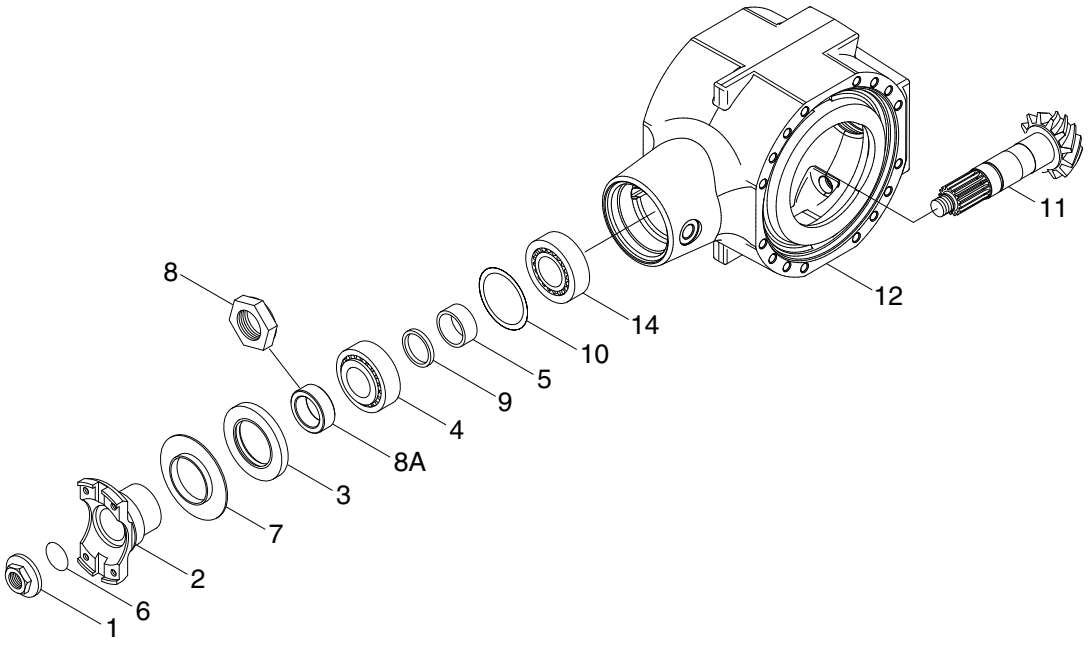


⑬ Using a driver, fit the cap and position it in its seat with the snap ring.



5) BEVEL PINION

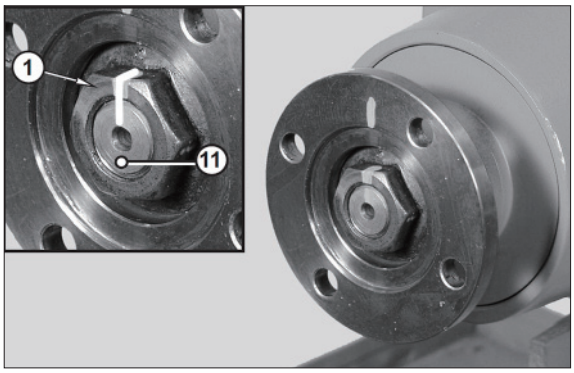
(1) Assembly diagram



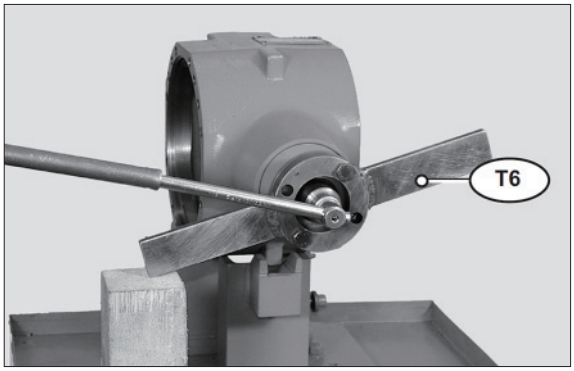
(2) Disassembly

① Make positional marks across nut (1) and pinion (11) tang; If disassembly is awkward, heat the check nut (1) of the flange (2) at 80˚C.

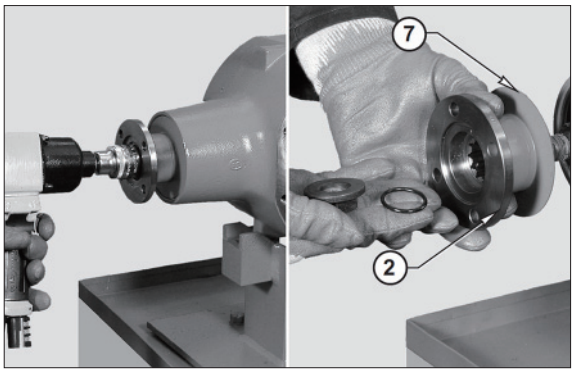
※ Heating is meant to unloose the setting of loctite on the nut (1).



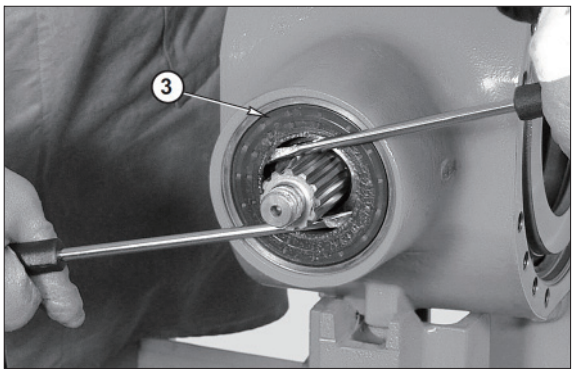
② Position tool T6, so as to avoid pinion rotation.
Unloose and remove the nut (1); also remove the O-ring (6).



③ Remove the flange (2) complete with guard (7) by means of a puller.

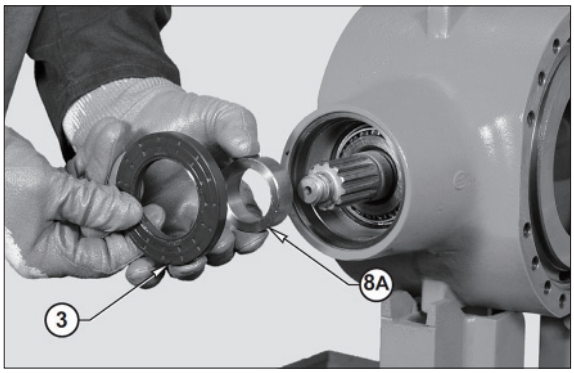


④ Remove the sealing ring (3).

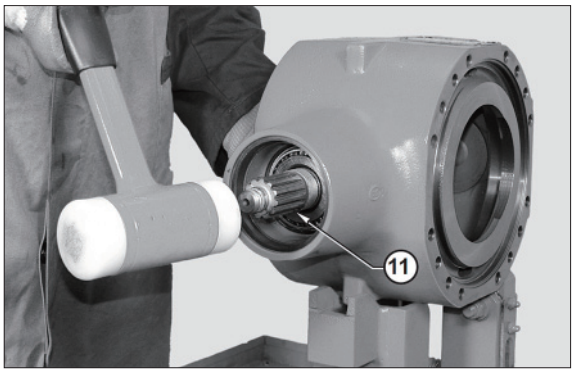


⑤ Remove the sealing ring (3) and spacer (8A).

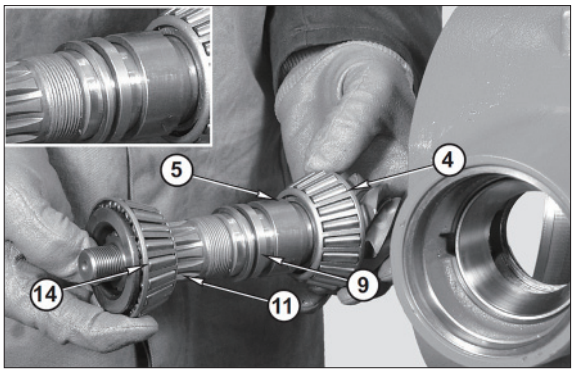
※ Sealing rings (3) must be replaced each time the unit is disassembled.



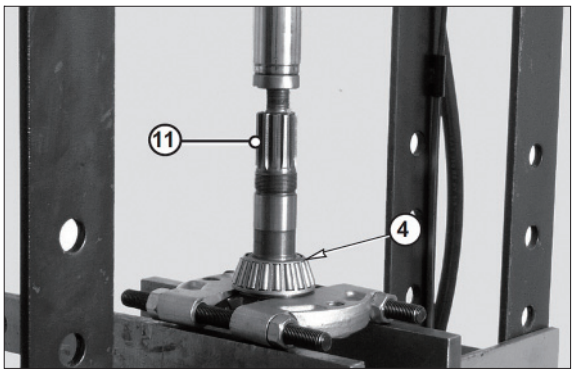
⑥ Remove the pinion (11), shims and distance piece.



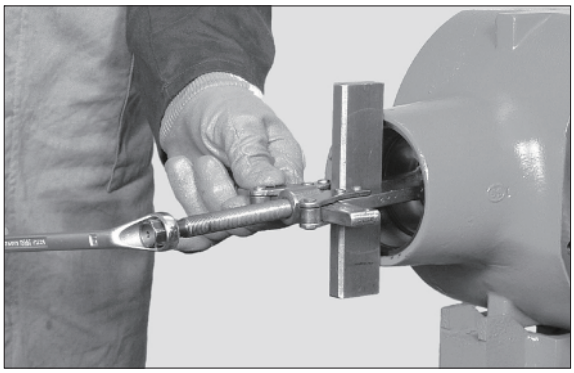
⑦ Refer and keep to the positions marked during disassembly.



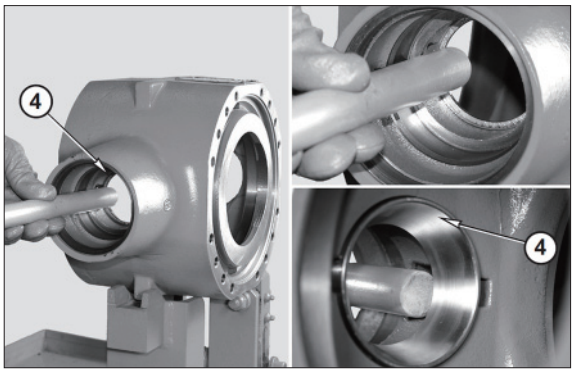
⑧ Using a puller and a press, remove the inner bearing (4) from the pinion (11).



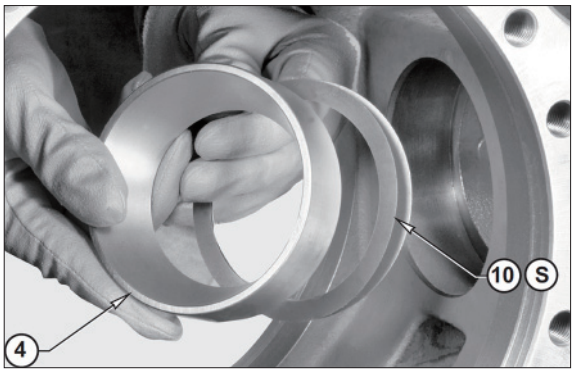
⑨ Remove the thrust block of the external bearing (14).



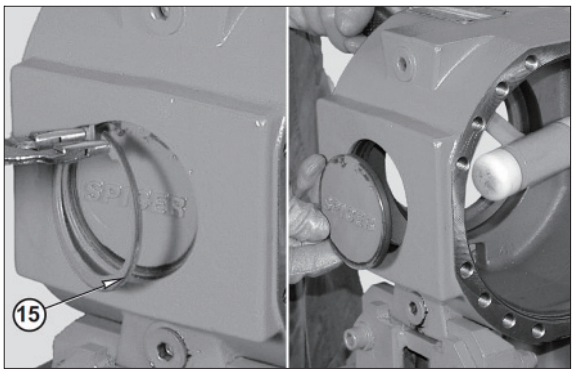
⑩ Insert a drift in the appropriate holes.



⑪ Remove the thrust block of the internal bearing (4) as well as the shim washers (10) (S).

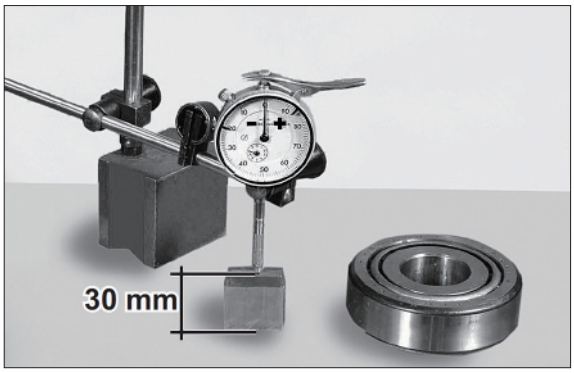


⑫ Remove the snap ring (15). Remove the cap (14).



(3) Assembly

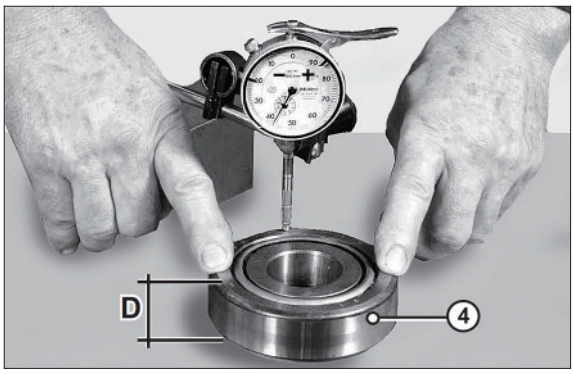
① **Calculating pinion center distance**
Using a faceplate, reset a centesimal comparator “DG” on a calibrated block (whose known thickness is 30 ㎜).
Preload the comparator by about 3 ㎜.



② Bring inner bearing (4), complete with thrust block, under comparator “DG”.

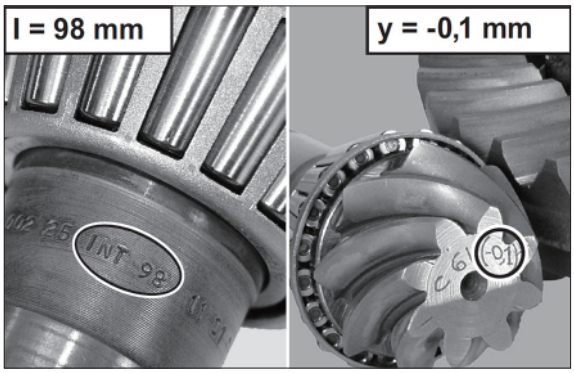
※ Press the thrust block centrally and carry out several measurements by rotating the thrust block.

· Example : 30 - 0.55 = 29.45 = “D”



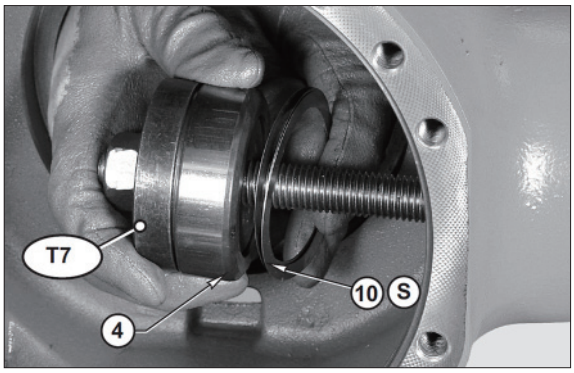
③ Check nominal dimension “I” as marked on the pinion. Add up to or subtract from “I” the variation indicated as “Y” to obtain the actual center distance “I”.

· Example : I=INT±Y=98-0.1=97.9 ㎜



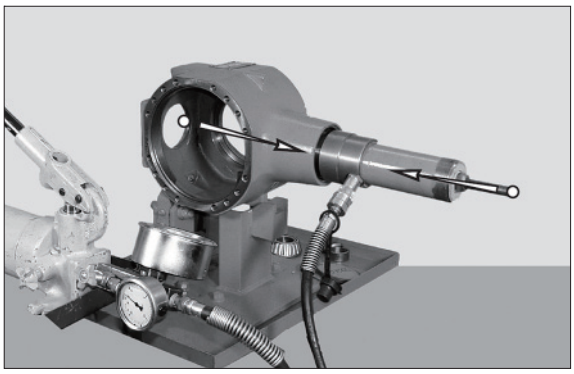
④ Calculate shims “S” for insertion under the thrust block of the inner bearing using the following formula :
S = X - (I + D) where :
X = Fixed dimension I = actual pinion center distance
D = Total bearing thickness ;
Example :
S = 128 - (97.9 + 29.45) = 0.65 ㎜

⑤ Using special tool T7.
Partially insert the thrust block of the bearings (4) and shims (10).

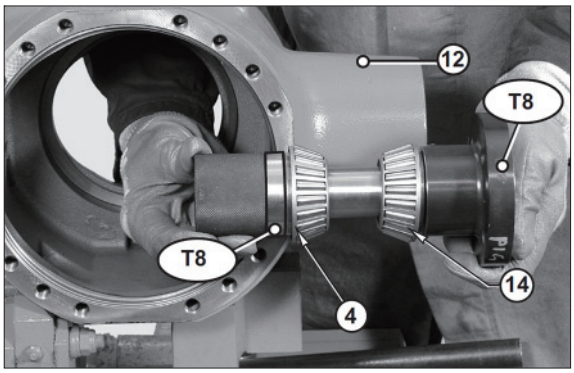


⑥ Connect the tension rod to the press and move the thrust block of bearings (4) (14) into the seats.
Disconnect the press and remove the tension rod.

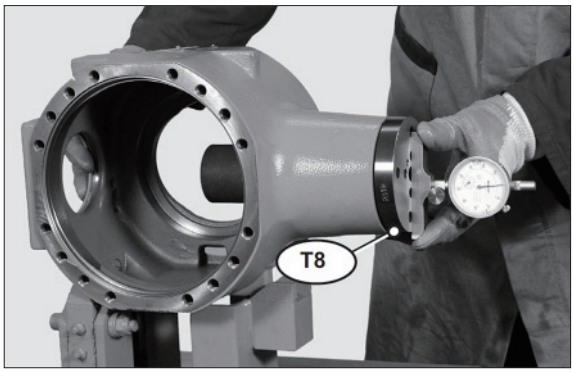
※ Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.



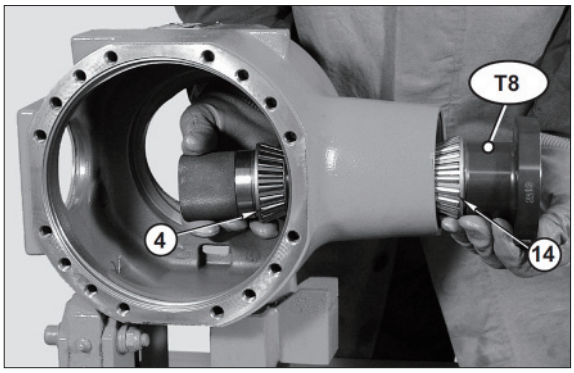
⑦ **Calculating pinion bearings rolling torque**
Introduce tool T8 complete with bearings (4) and (14) into the main body (12); tighten by hand until a rolling torque is definitely obtained.



⑧ Introduce the tracer of a depth comparator “DDG” into either side hole of tool T8.
Reset the comparator with a preload of about 3 mm.

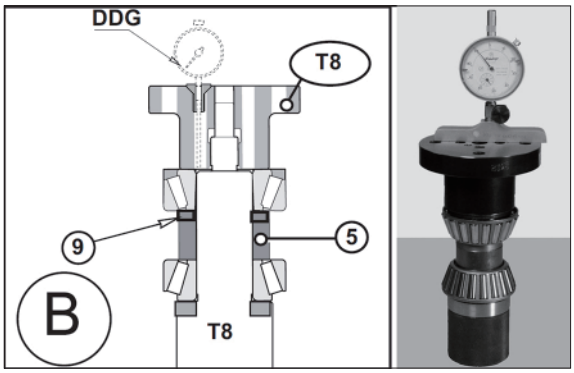


⑨ Remove the comparator and take out tool and bearing kits from the main body. Reinstall every part, also introducing a distance piece between bearings (4) and (14). Tighten the entire pack by hand.



⑩ Assemble on top of the tool T8 and between the two bearings the shim (5) and the largest calibrated shim (9).

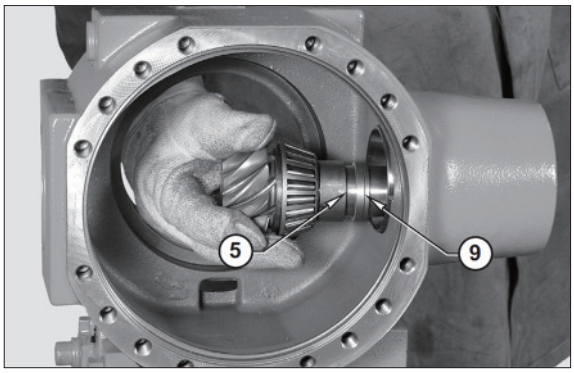
⑪ Measur the difference H using a dial gauge DDG.



⑫ Calculate the shim S2 to be inserted.
E.g. S2 = H + X = 3.01 mm where X = fixed value to obtain = 0.07~0.08 mm

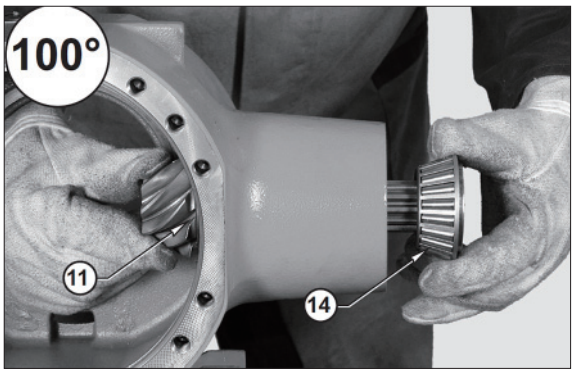
⑬ Fit the pinion (11), shim “S1” (10) and distance piece (5), (9) in the main body (12).

※ The finer shims must be placed in-between the thicker ones.



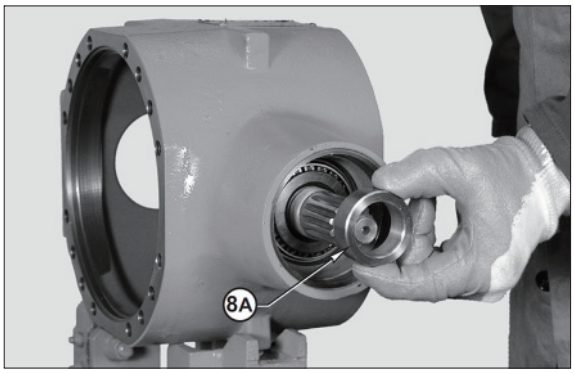
⑭ Heat the external bearing (14) to a temperature of about 100˚C and fit it on to the pinion (11) so as to complete the pack as shown in the figure.

※ Lightly lubricate bearing with SAE85W90 oil.

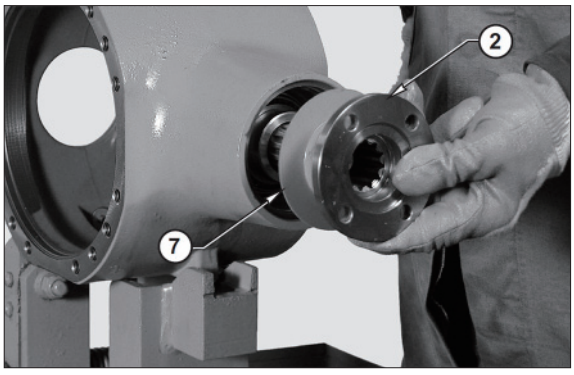


⑮ Insert the spacer (8A).

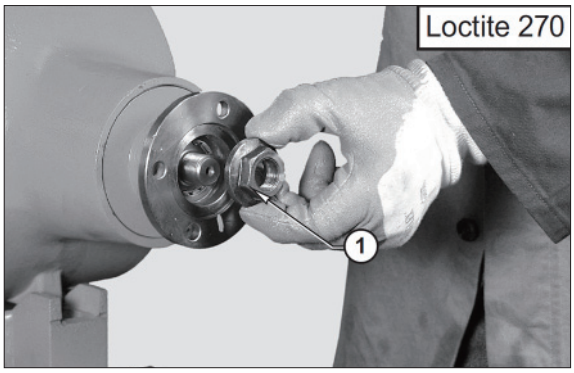
※ Check the using of the friction washers.



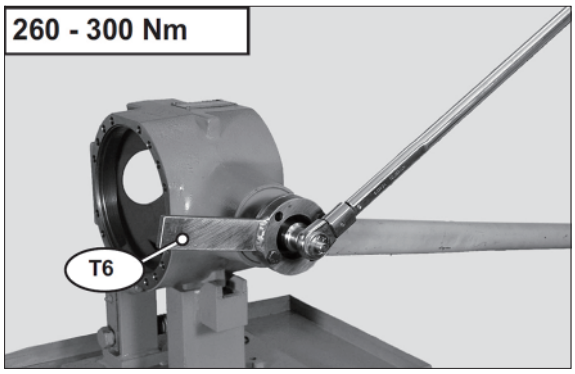
⑯ Install the flange (2) onto the pinion (11) without sealing ring.



⑰ Install the nut (1) without loctite 270.



⑱ Lock the wrench T6, rotate the pinion using a dynamometric wrench, up to a minimum required torque setting of 26.5~30.6 kgf · m (192~221 lbf · ft).

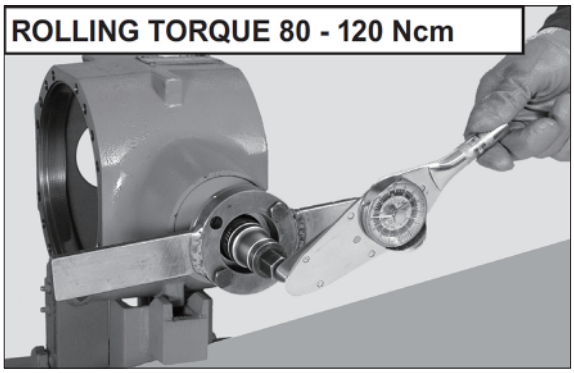


⑲ Apply onto the pinion (1) the bar-hold and with the help of a torque meter, check the torque of the pinion (1).

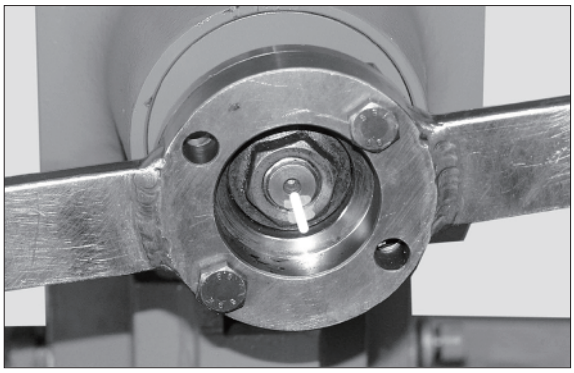
· Torque : 0.08~0.12 kgf · m
(0.58~0.87 lbf · ft)

※ If torque exceeds the maximum value, then the size of shim “S1” (4) between the bearing (9) and the distance piece (3) needs to be increased. If torque does not reach the set value, increase the torque setting of the ring nut (10) in different stages to obtain a maximum value of 51 kgf · m (369 lbf · ft).

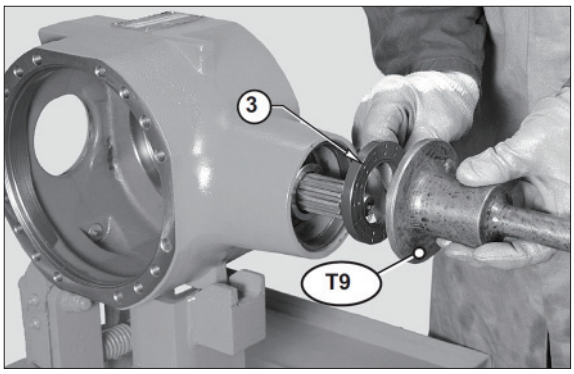
※ If torque does not reach the minimum value, then the size of shim “S1” (4) needs to be reduced. When calculating the increase or decrease in size of shim “S1”, bear in mind that a variation of shim of 0.01 mm corresponds to a variation of 0.06 kgf · m (0.44 lbf · ft) in the torque of the pinion (1).



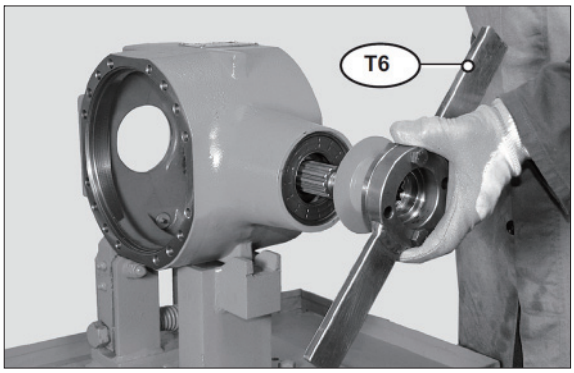
⑳ Make positional marks across nut (1) and pinion (11) tang; then remove nut and flange (2).



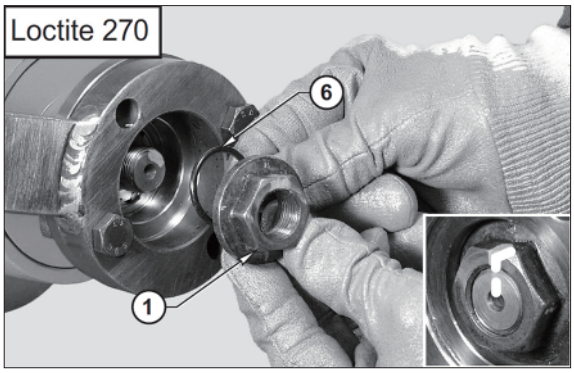
㉑ Apply Arexons rubber cement to the outer surface of the new seal ring (3) and fit ring in the main body (12) using driver T9.



㉒ Oil seal ring lips and install flange (2). Mount O-ring (6) and apply loctite 270 to pinion tang; tighten nut (1).



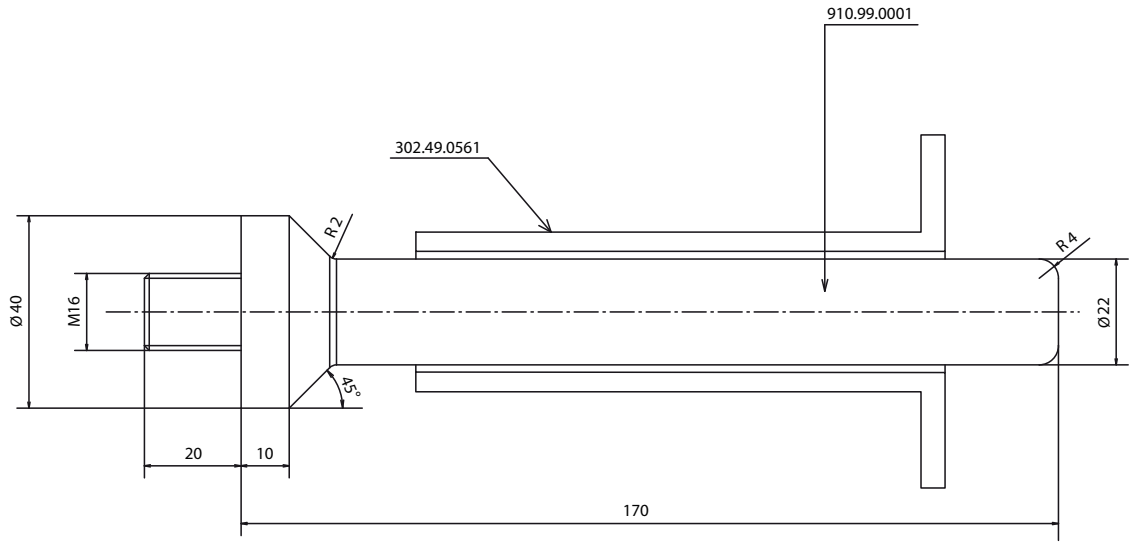
㉓ Tighten the nut until the match marks made at stage “a” line up.



6) SPECIAL TOOLS

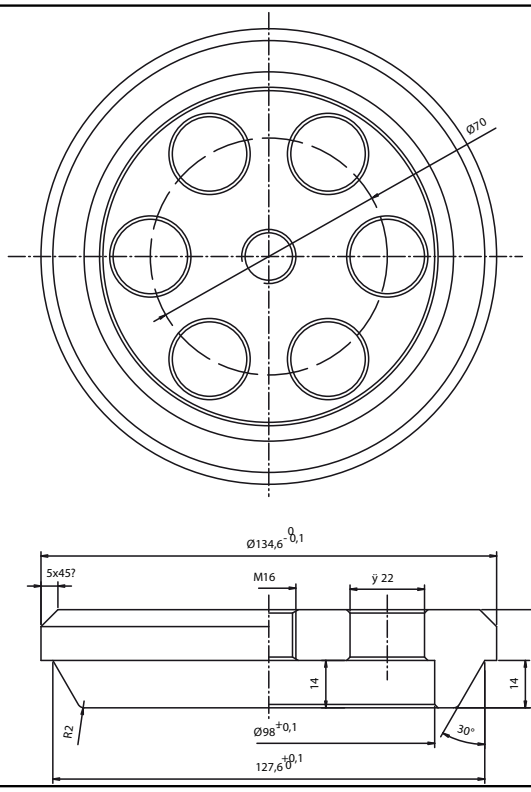
T0

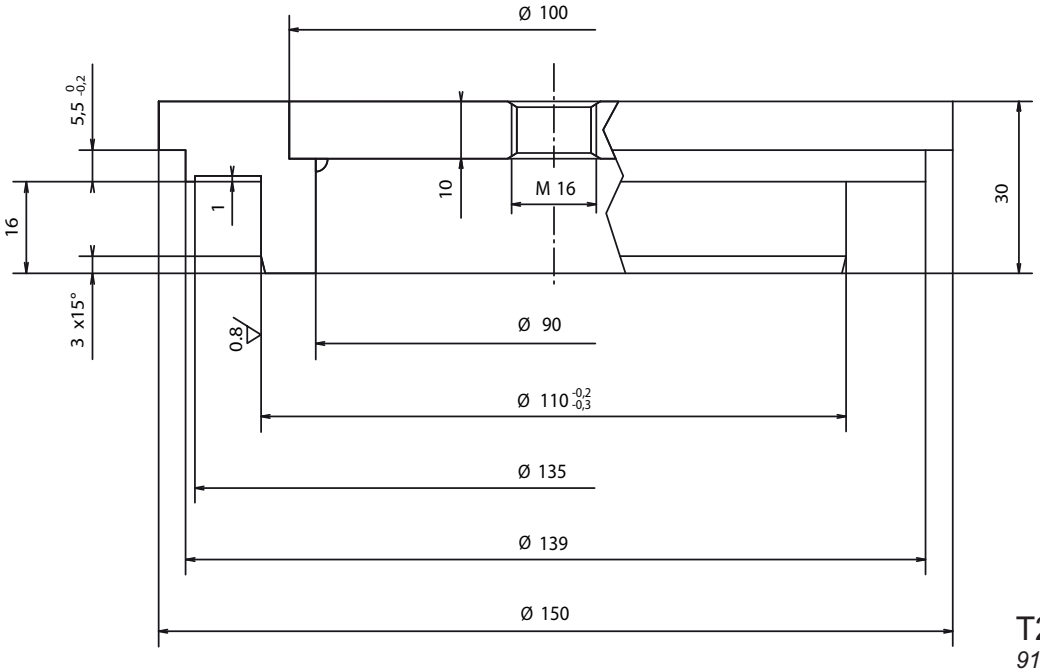
910.99.0001



T1

910.06.2385



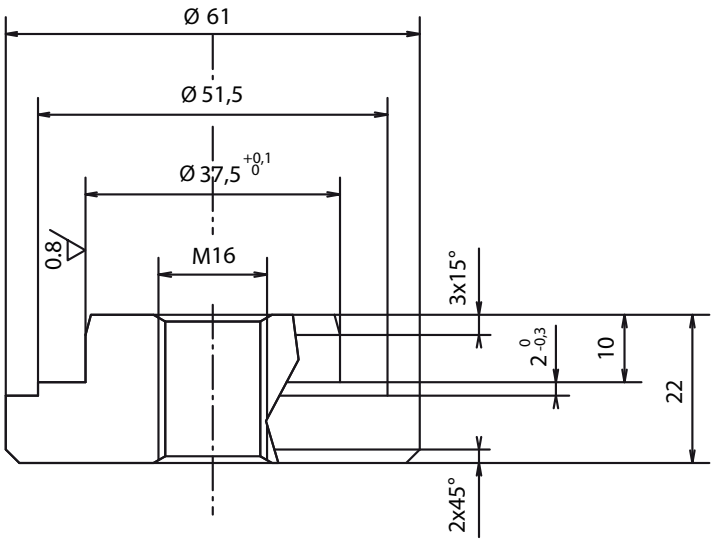


T2

910.06.0456

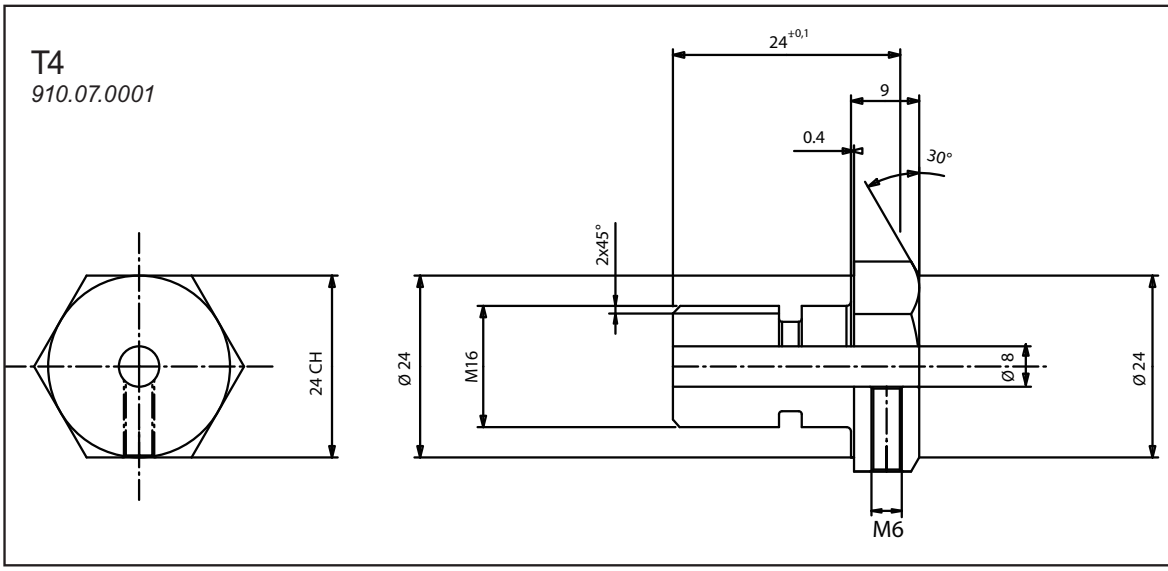
T3

910.06.4088



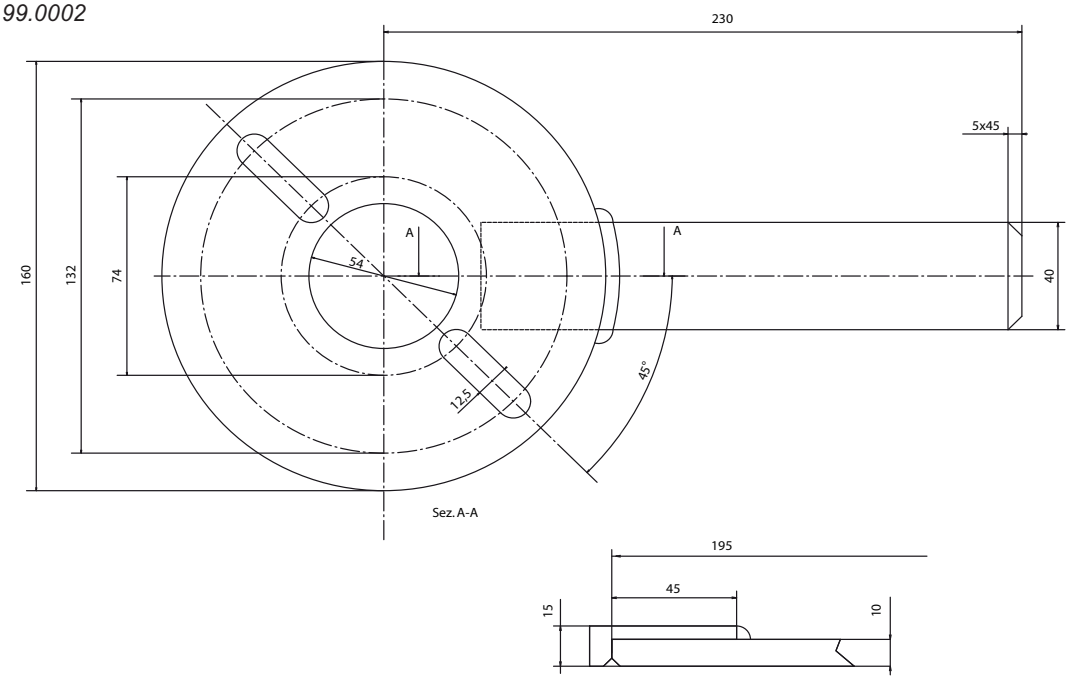
T4

910.07.0001



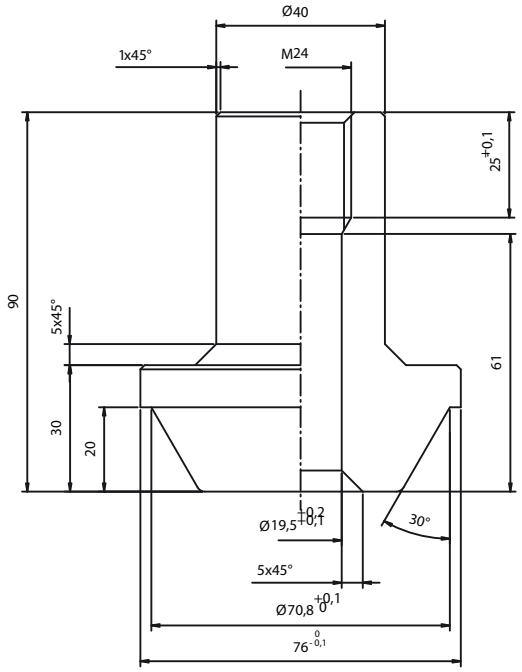
T6

910.99.0002



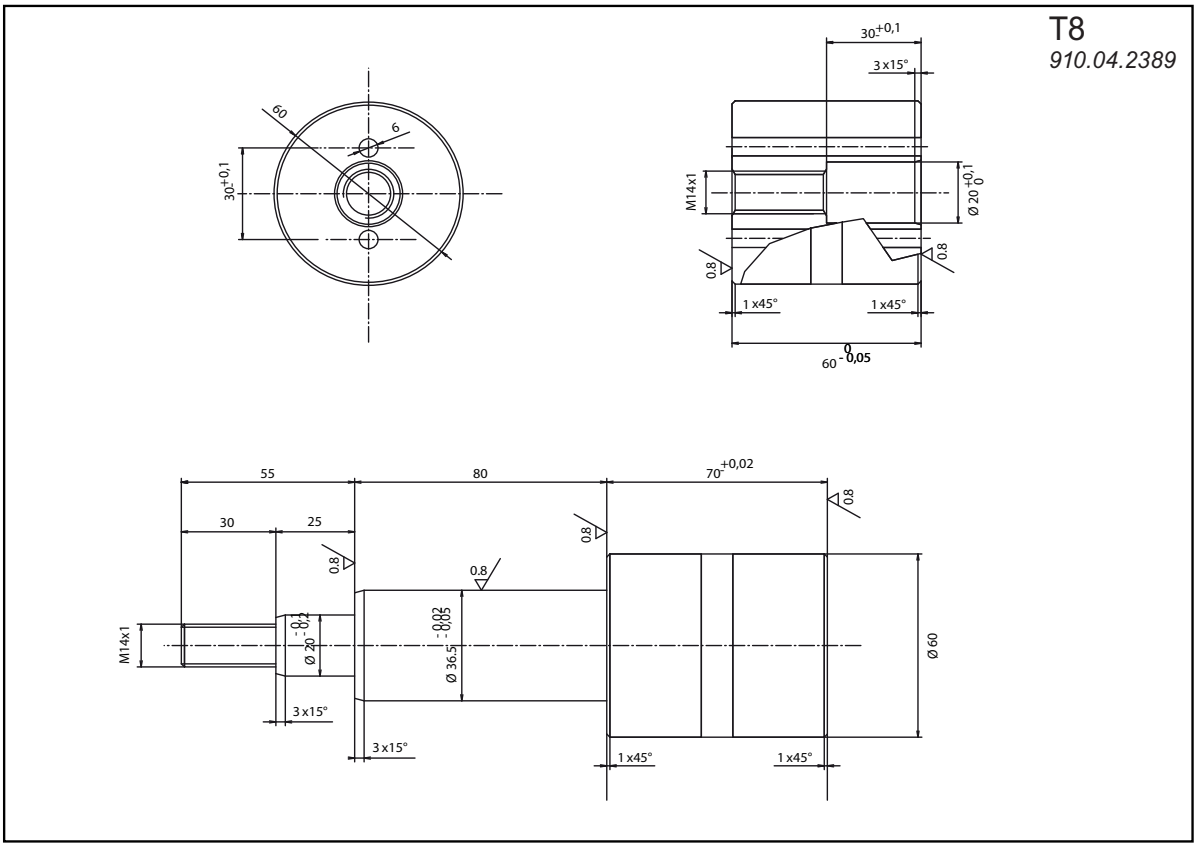
T7

910.06.4069



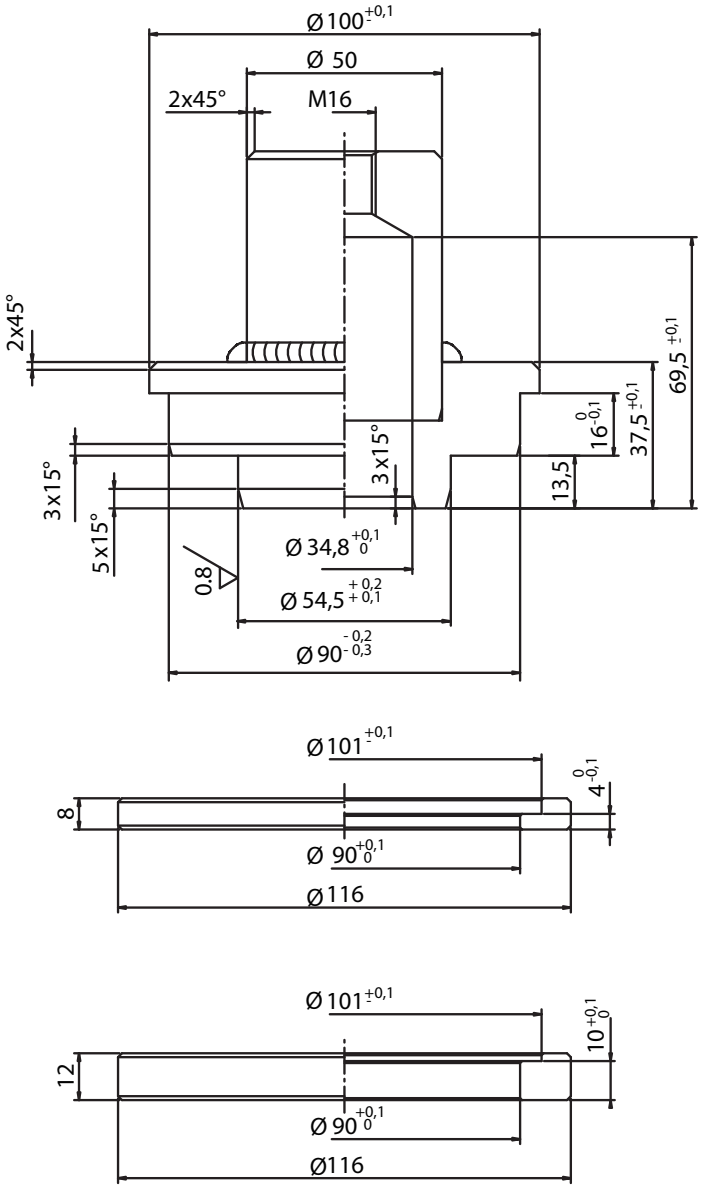
T8

910.04.2389



T9

910.04.4214

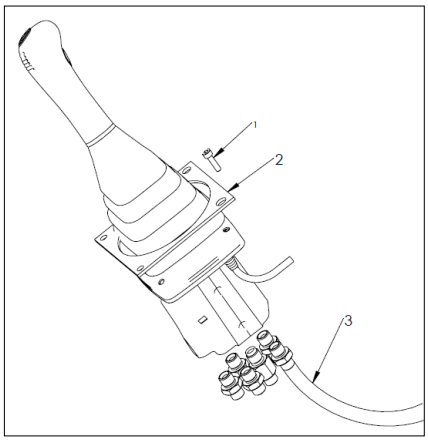


GROUP 8 RCV LEVER

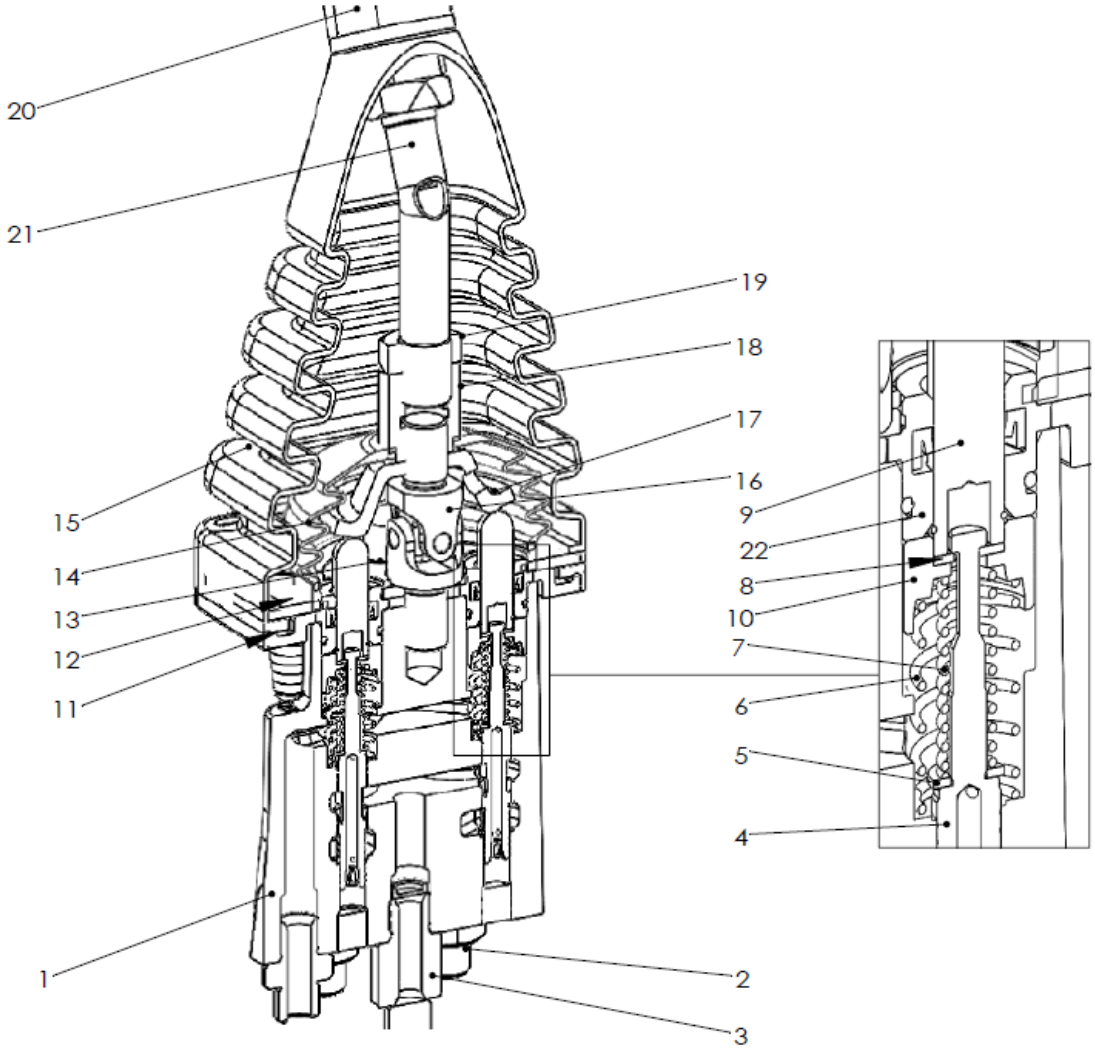
1. REMOVAL AND INSTALL

- 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.
  4) Loosen the socket bolt(1).
  5) Remove the cover of the console box(2).
  6) Disconnect pilot line hoses(3).
  7) Remove the pilot valve assembly

- 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.



- **STRUCTURE**



1 Body	2 Shortadaptor	3 Long adaptor	4 Spool
5 Spring seat	6 Return spring	7 Reduce spring	8 Lock Washer
9 Bullet	10 Guider ring	11 Fixing flange	12 Press flange
13 Circle flange	14 In rubber bellow	15 Rubber bellow	16 Cardon Joint
17 Selector	18 Link nut	19 Lock nut	20 Handle
21 Bent joint	22 Piston		

- TOOLS

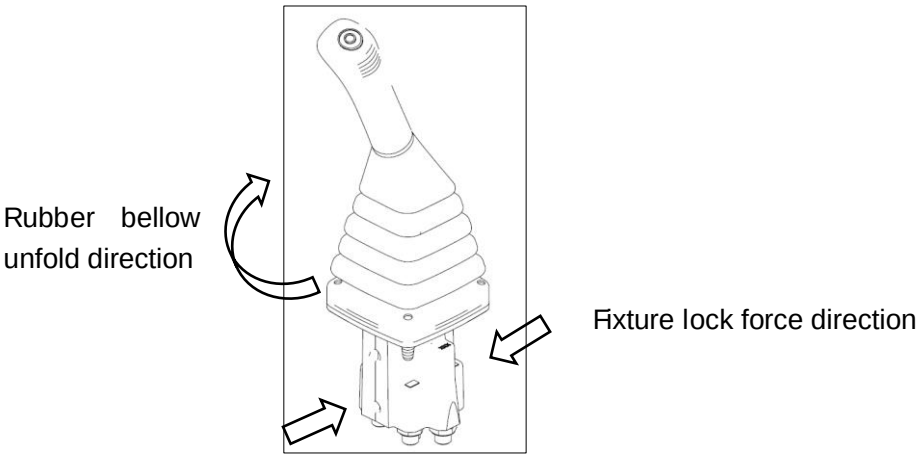
1) Allen wrench: Hex.4 mm
2) Spanner: Hex22mm; 18mm;

- TighteningTorque

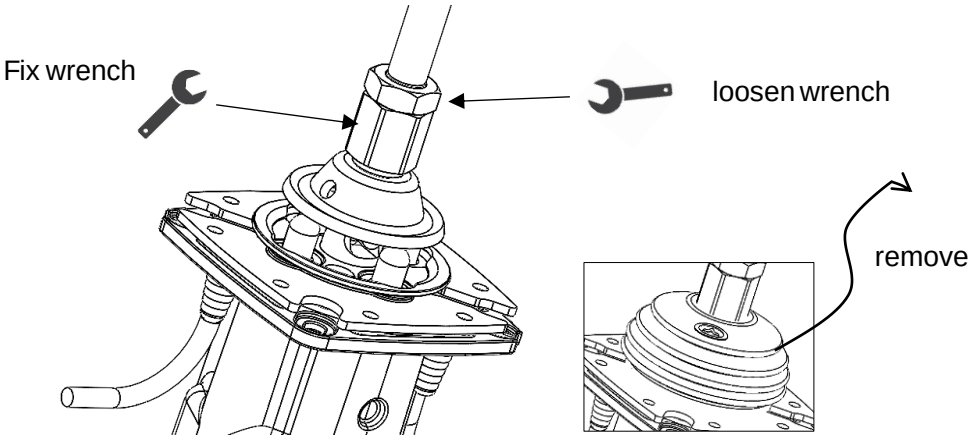
Part name	Item number	Tool size	Torque
Cardon Joint	16	18mm	24Nm
Link nut	18	22mm	24Nm
Lock nut	19	22mm	24Nm
adaptor	2, 3	19mm	24Nm

- **DISASSEMBLY**

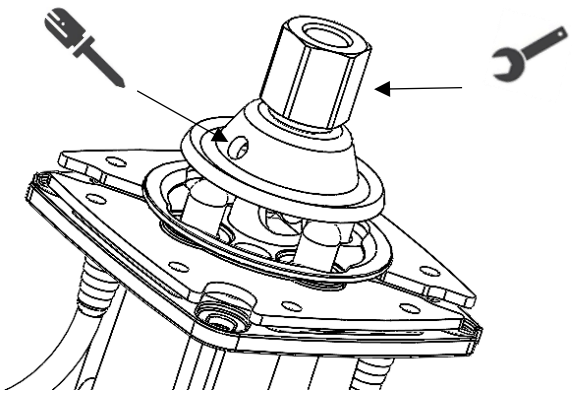
1) Fixing the joysticks on available Fixture or Bench vice Be attention to protect the body by covering closes or soft rubber
2) Loosening the rubber bellow and unfold it



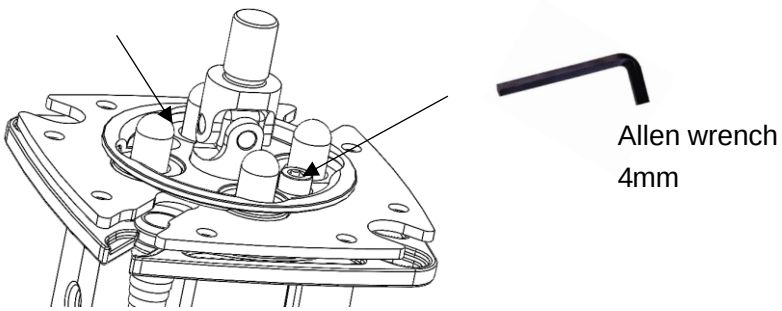
3) Remove the circle rubber bellow (14) and after to the handle kits(20), to use one wrench fix the Link nut(18), and another wrench to loosen lock nut(19)



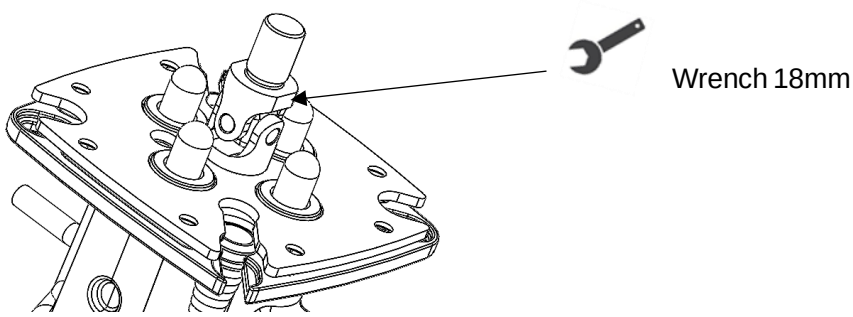
4) Remove the link nut(18), it need an auxiliary Pin or screwdriver to insert the hole on the selector(17), the loosen the link nut(18). And after to remove the Selector(17) by the screwdriver too



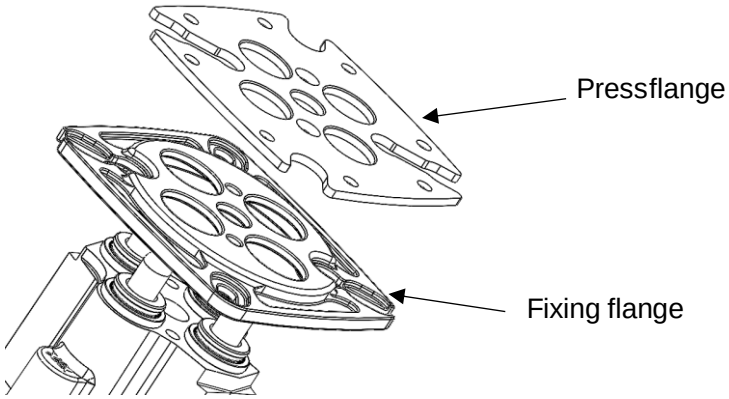
5) To disassembly the circle flange(13), to use hex 4 mm Allen wrench loosen the fix screw on this flange



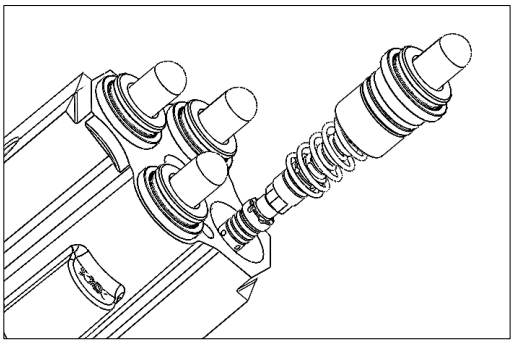
6) To disassembly Cardon Joint (16)



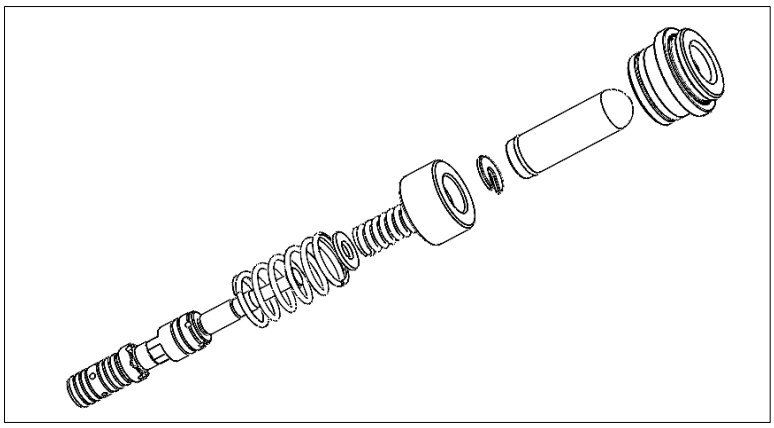
7) Remove the press flange(12) and fixing flange (11)



8) Disassembly the pilot curve kits the four kits is the same composition



9) Disassembly the curve kits, the seal will not be separated to repair, and it need to replaced with piston together as the relative parts list



10) Cleaning the internal parts

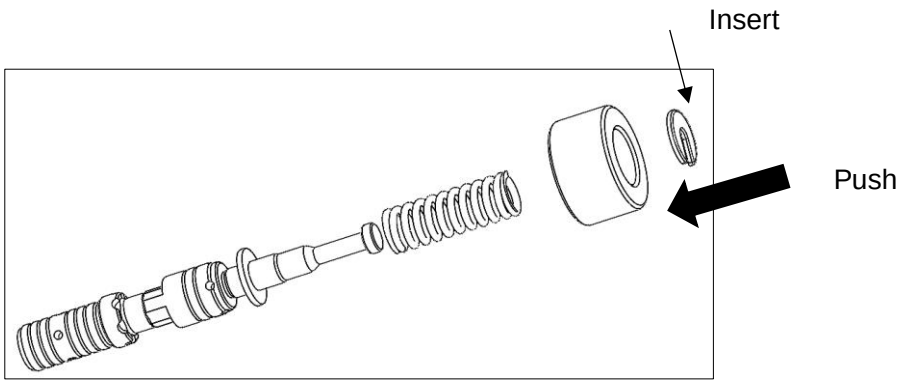
i) Put all parts in rough cleaning vessel filled with kerosene and clean them, this is a basic cleaning process

ii) Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides, this is the best cleaning process

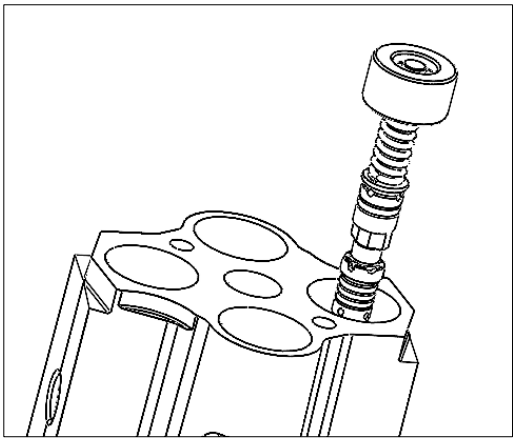
iii) It's not to recommend to remove the rusty and instead of to change new parts if it's serious

- **ASSEMBLY**

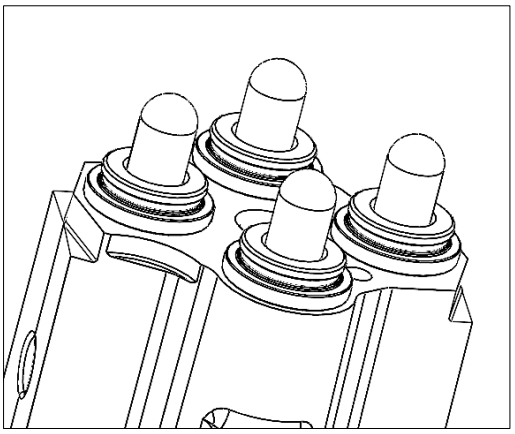
1) The curve kits assembly, to follow below view sequence to assembly these parts, and push the guider ring(10), and then inert the lock ring(8), make the curve be a whole kits



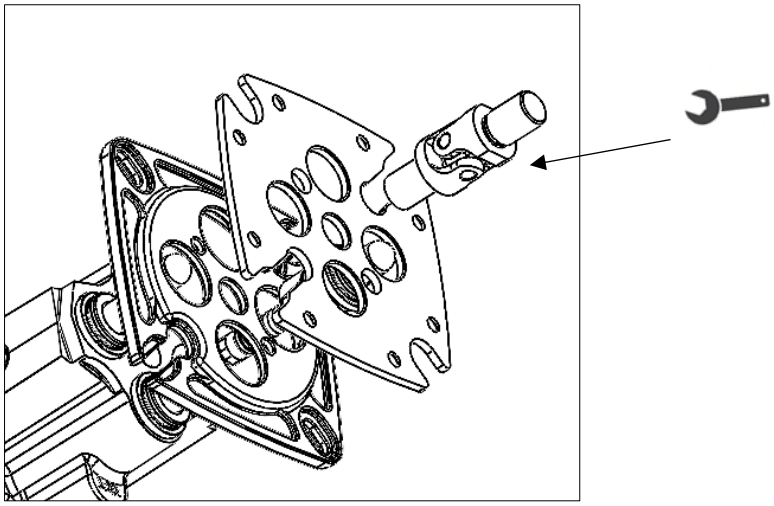
2) To put all kits in the body cavity



3) Put the piston(22) and bullet(9)



4) Put Fix flange(11) and pressflange(12), then lock it byCardon Joint(16)



5) The next assembly procedure will be a opposite operation of disassembly

6) Inject volatile rust-preventives through allports and then put blind plugs in ports.

GROUP 9 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

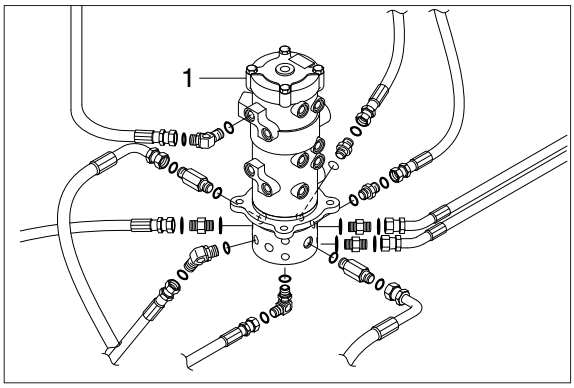
(1) Lower the work equipment to the ground and stop the engine.

(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.



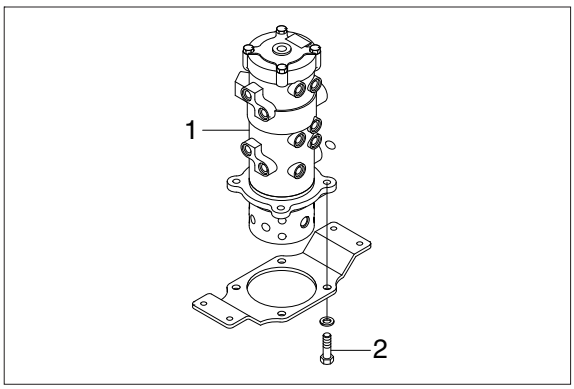
(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
- Weight : 30 kg (70 lb)
- Tightening torque : 14.7± 2.2 kgf · m (106± 15.9 lbf · ft)

(6) Remove the turning joint assembly.

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

2) INSTALL



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

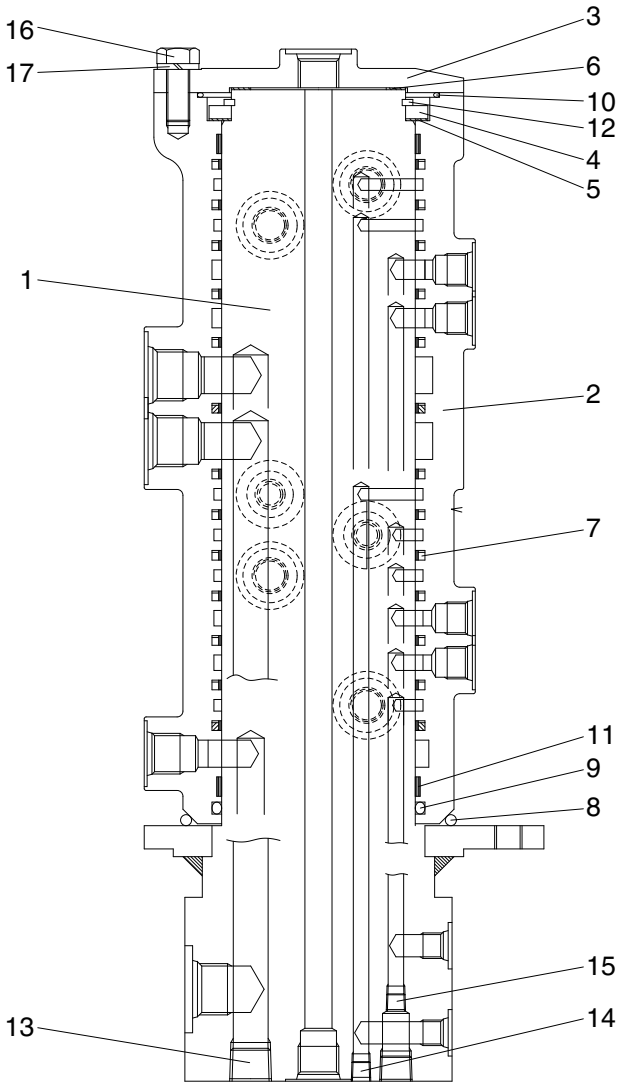
※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

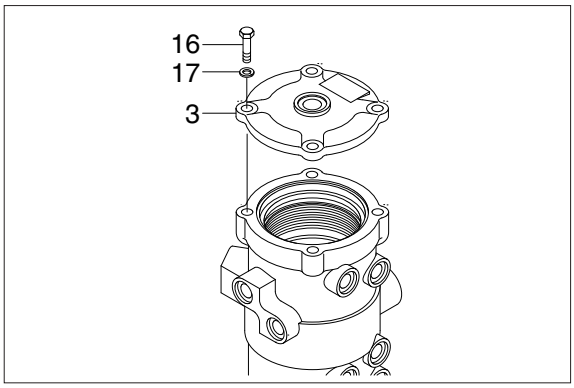


1	Shaft	7	Slipper seal	13	Plug
2	Hub	8	O-ring	14	Plug
3	Cover	9	O-ring	15	Plug
4	Spacer	10	O-ring	16	Hexagon bolt
5	Shim	11	Wear ring	17	Spring washer
6	Shim	12	Retainer ring		

2) DISASSEMBLY

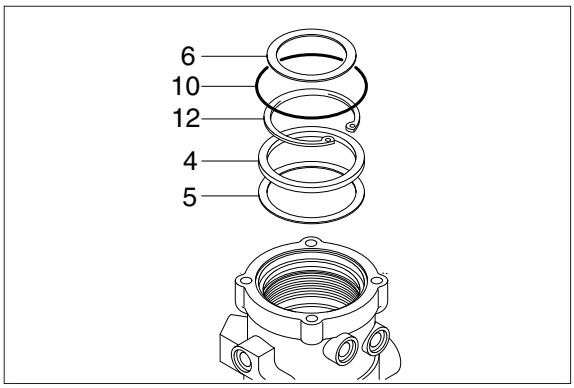
※ Before the disassembly, clean the turning joint.

(1) Loosen the bolts (16), washer (17) and remove cover (3).



(2) Remove shim (6) and O-ring (7).

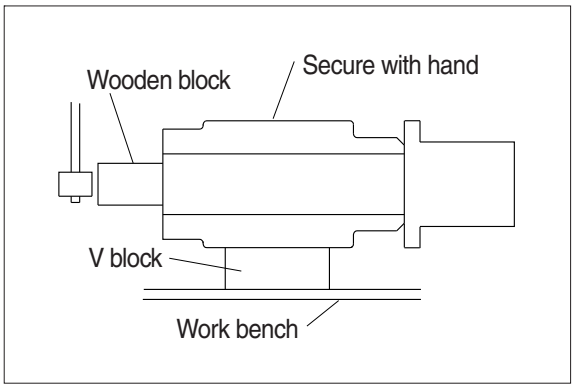
(3) Remove retainer ring (12), spacer (4) and shim (5).



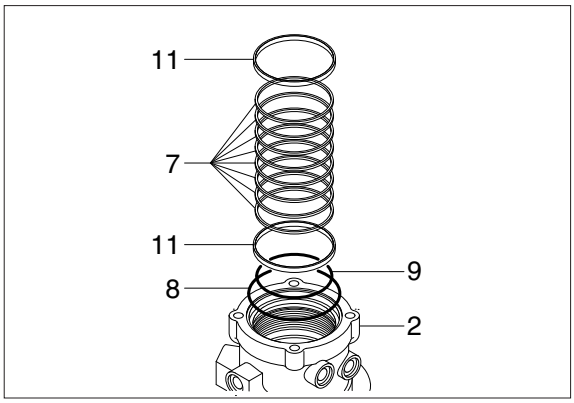
(4) Place hub (2) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

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

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



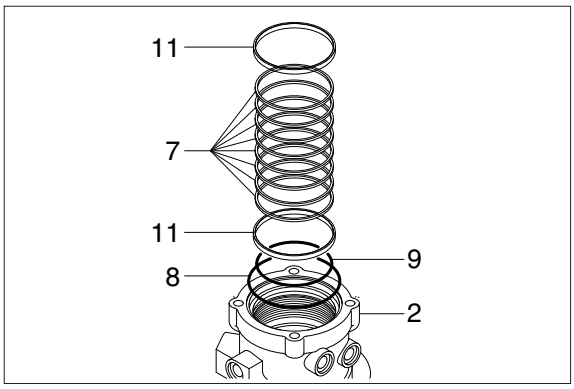
(5) Remove wear rings (11), thirteen slipper seals (7) and O-rings (8, 9) from hub (2).



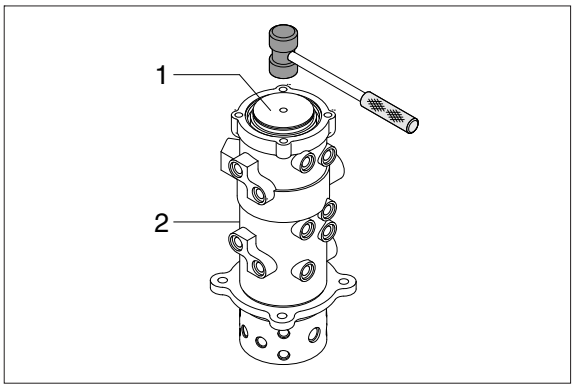
3) ASSEMBLY

※ 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 wear rings (11), thirteen slipper seals (7) and O-rings (8, 9) to hub (2).

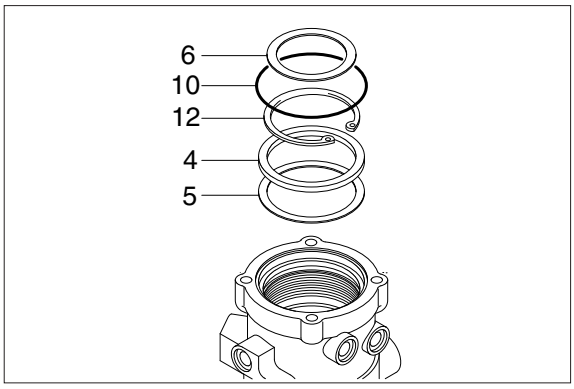


(2) Set shaft (1) on block, tap hub (2) with a plastic hammer to install.

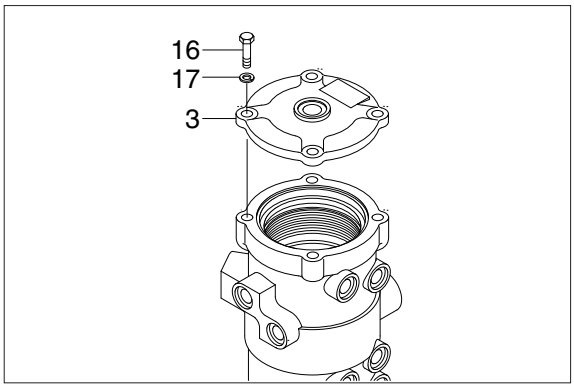


(3) Fit shim (5), spacer (4) and retainer ring (12) to shaft (11).

(4) Fit O-ring (7) to hub (2).



(5) Install cover (3) to hub (2) and tighten bolts (16) with washer (13).



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

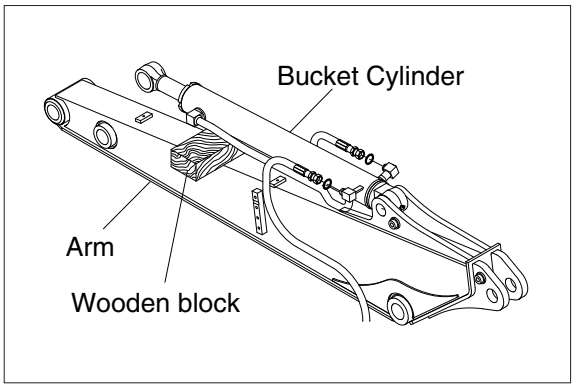
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank. Escaping fluid under pressure can penetrate the skin causing serious injury.**

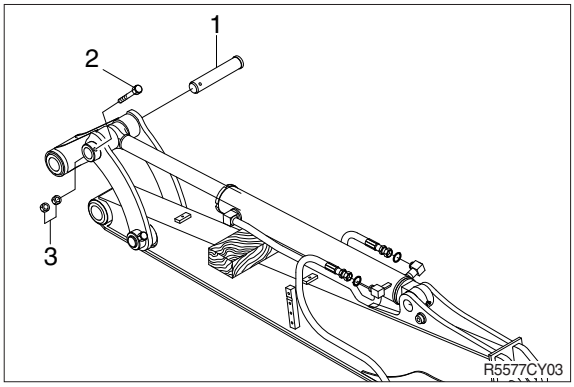
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

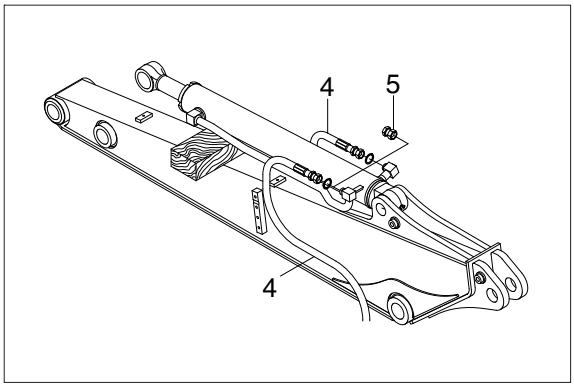


② Remove bolt (2), nut (3) and pull out pin (1).

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



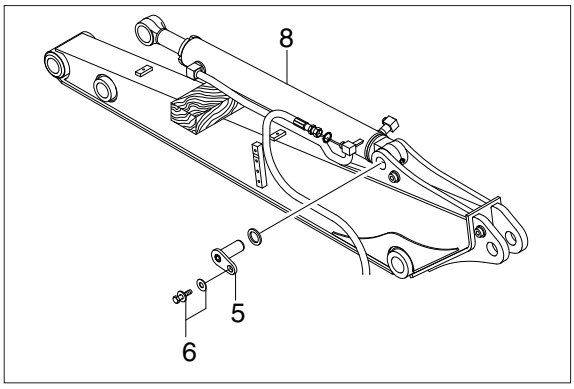
③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : 30 kg (70 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the bucket cylinder.

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

2) ARM CYLINDER

(1) Removal

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

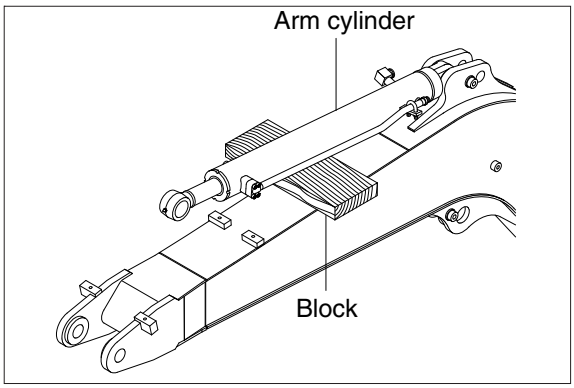
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

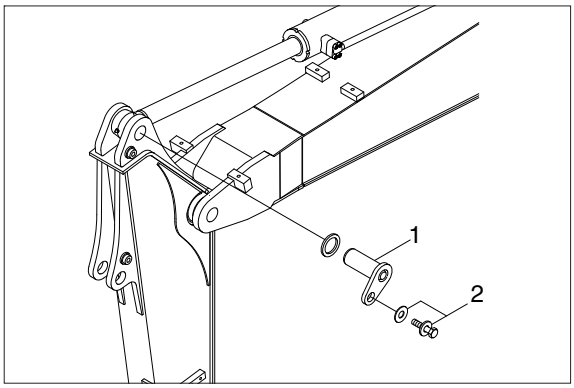
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



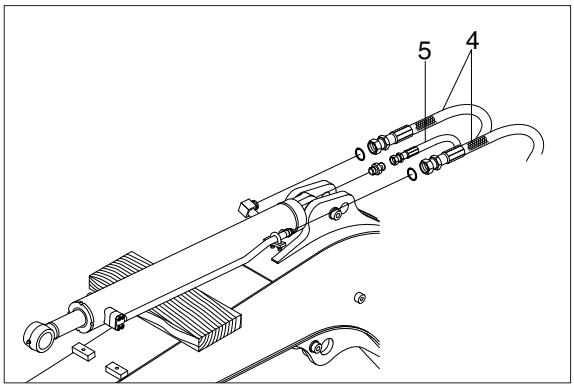
② Remove bolt (2) and pull out pin (1).

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



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

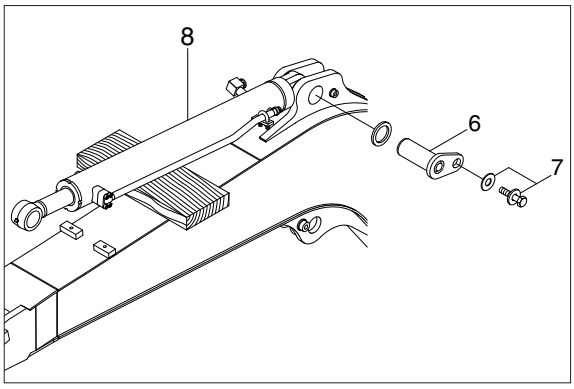
④ Disconnect greasing pipings (5).



⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

・Weight : 50 kg (110 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the arm cylinder.

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

3) BOOM CYLINDER

(1) Removal

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

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

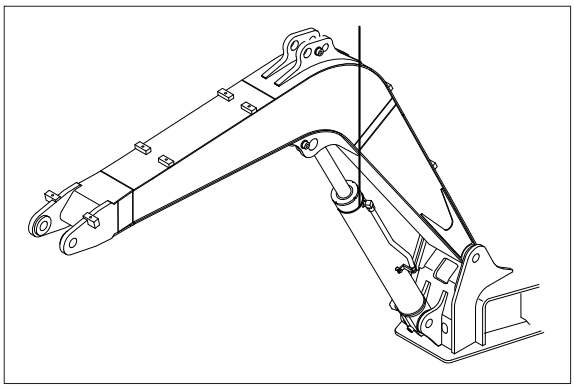
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

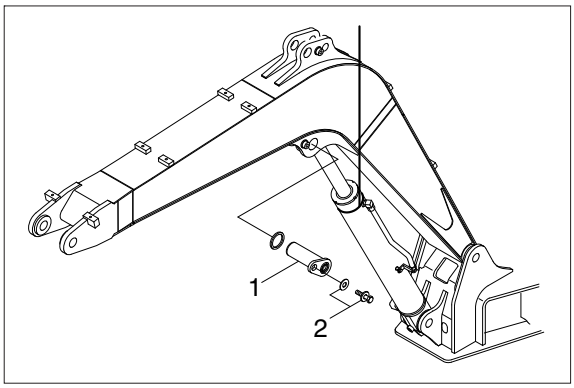
① Disconnet greasing hoses.

② Sling boom cylinder assembly.

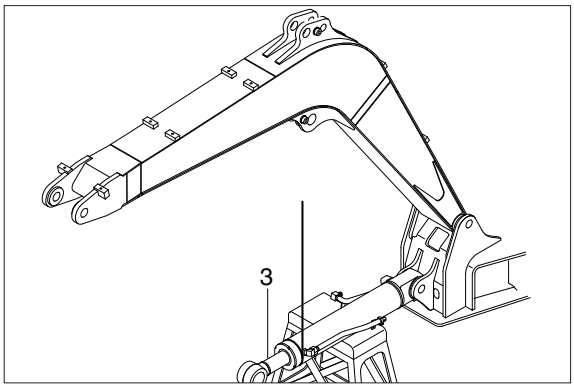


③ Remove bolt (2) and pull out pin (1).

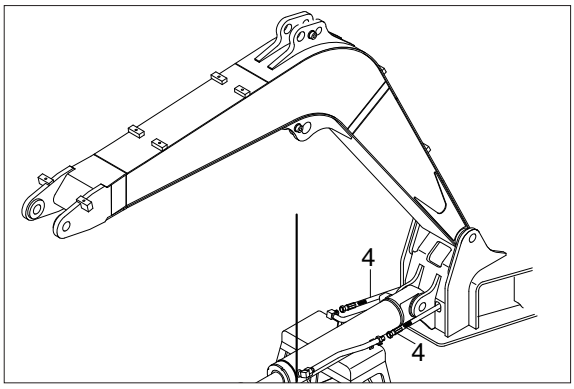
※ Tie the rod with wire to prevent it from coming out.



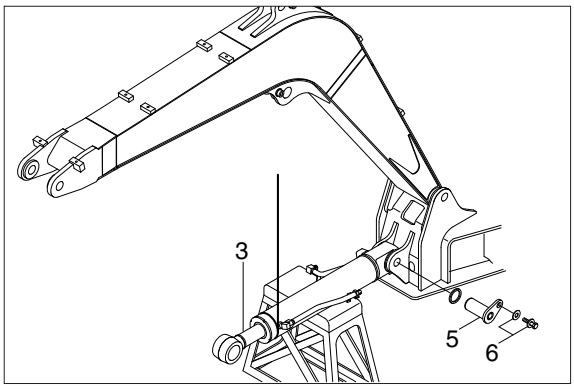
④ Lower the boom cylinder assembly (3) on a stand.



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



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



(2) Install

① Carry out installation in the reverse order to removal.

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

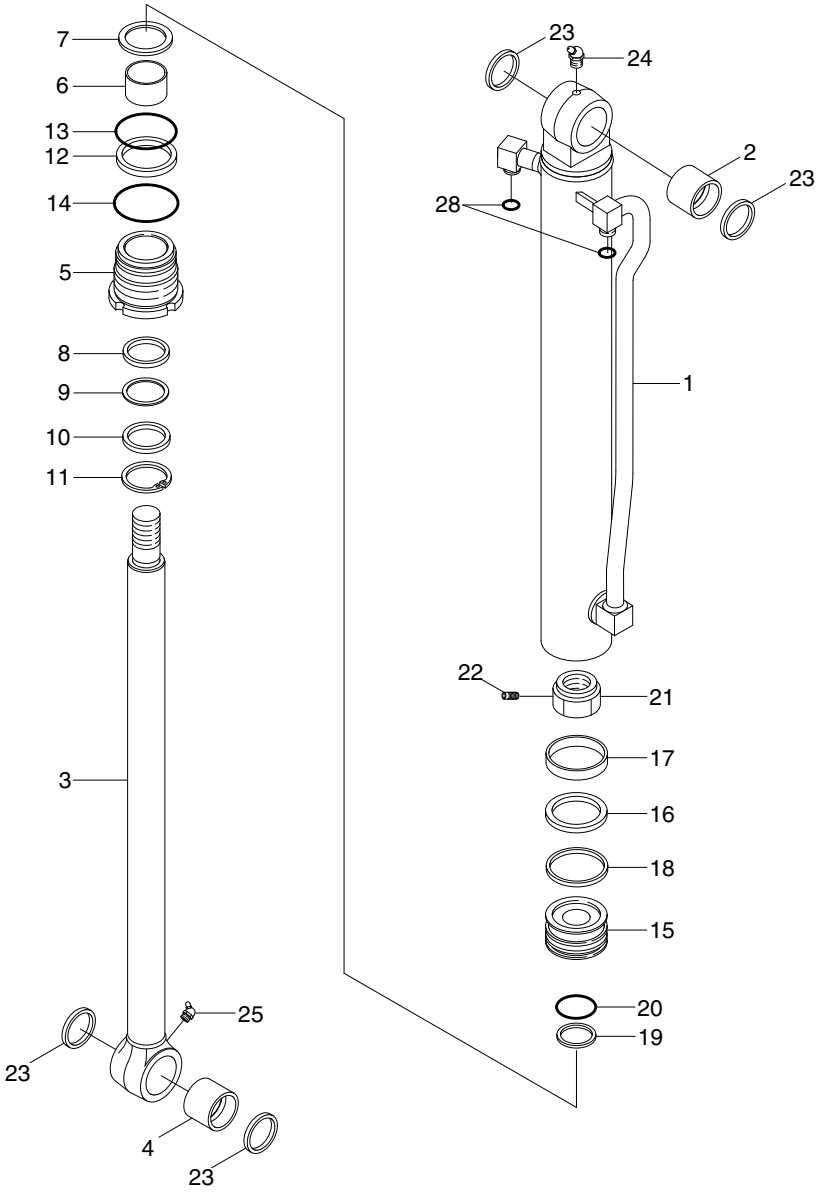
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

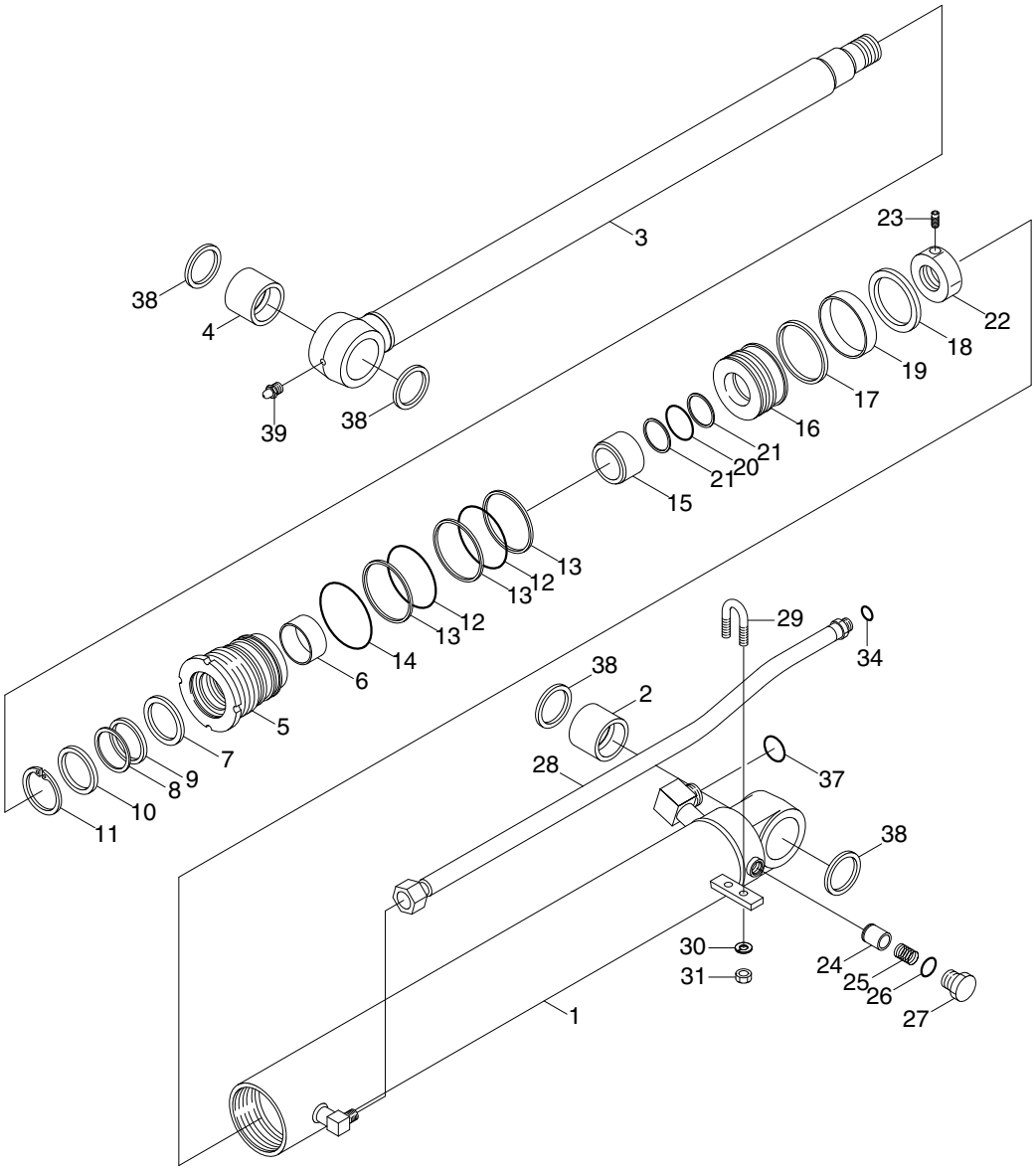
1) STRUCTURE

(1) Bucket cylinder



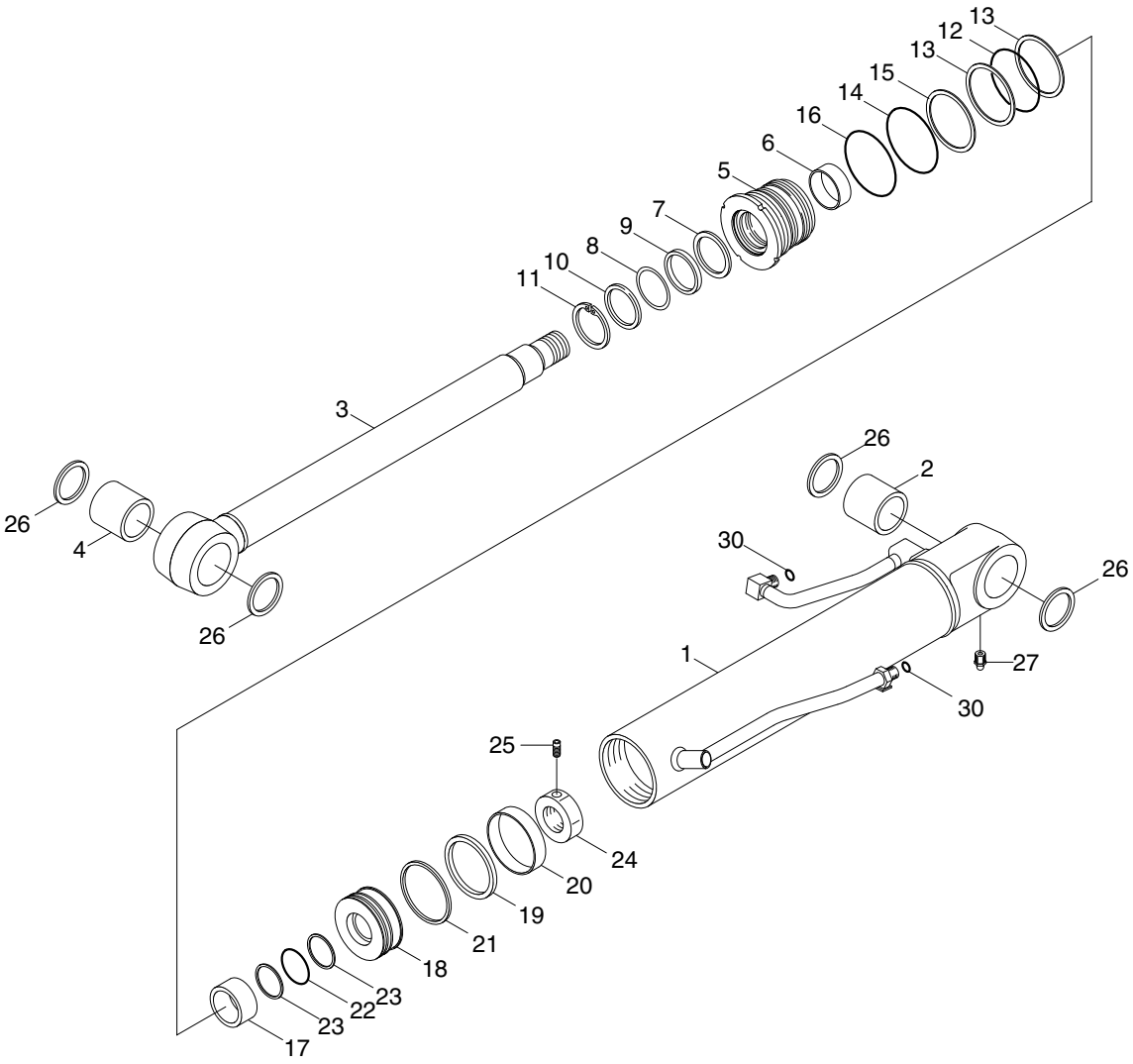
1	Tube assembly	11	Retaining ring	21	Dust ring
2	Bushing	12	O-ring	22	O-ring
3	Bushing	13	Back-up ring	23	Back-up ring
4	Du bushing	14	O-ring	24	Piston nut
5	Rod cover	15	Back-up ring	25	Set screw
6	Rod bushing	16	O-ring	26	Dust seal
7	Buffer ring	17	Cushion ring	27	Grease nipple
8	U-packing	18	Piston	30	O-ring
9	Back-up ring	19	Piston seal		
10	Dust seal	20	Wear ring		

(2) Arm cylinder



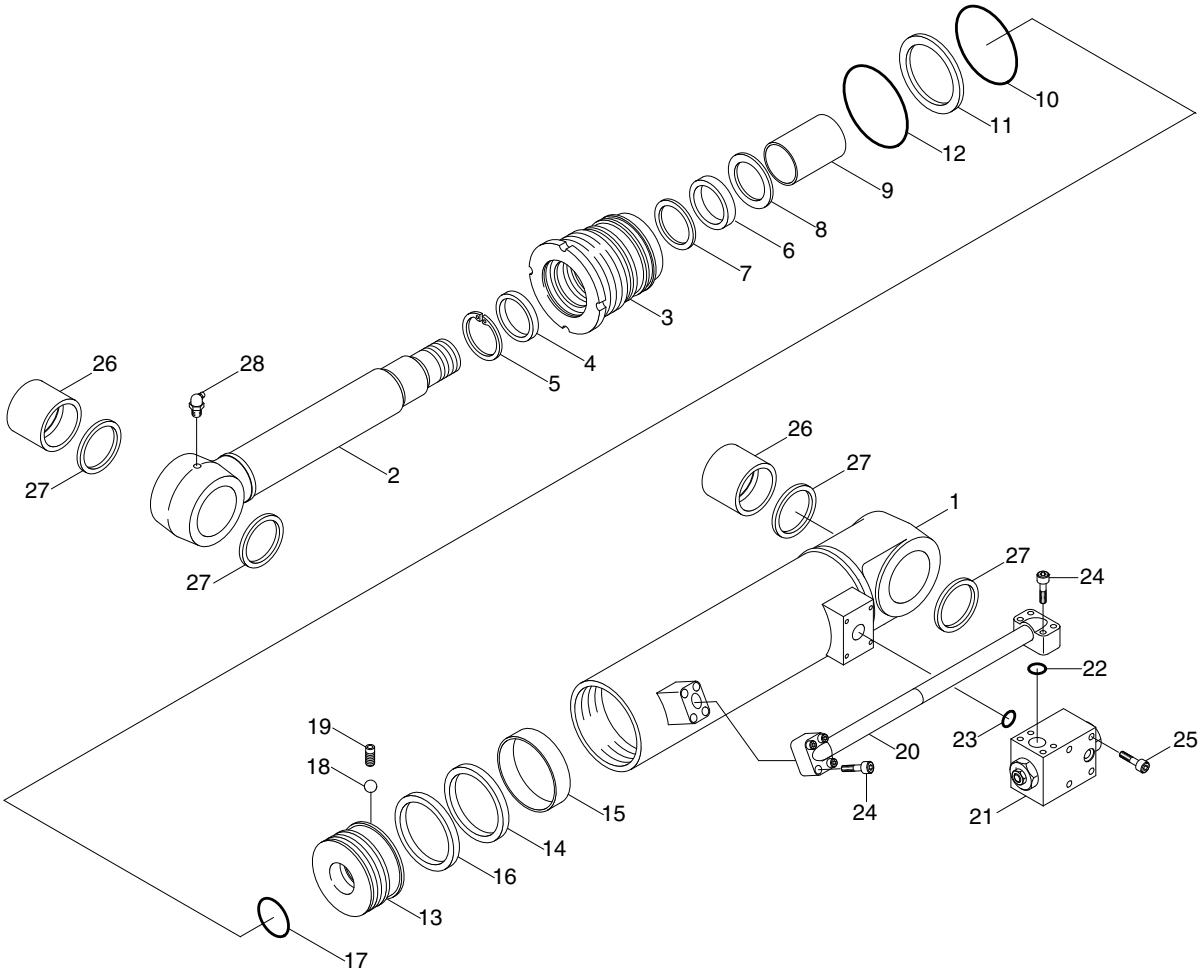
1	Tube assembly	9	DU bushing	17	O-ring
2	Rod assembly	10	O-ring	18	Back-up ring
3	Gland	11	Back-up ring	19	Steel ball
4	Dust wiper	12	O-ring	20	Set screw
5	Retaining ring	13	Piston	21	Bushing
6	Rod seal	14	Piston seal	22	Dust seal
7	Back-up ring	15	Dust ring	23	Grease nipple
8	Buffer ring	16	Wear ring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

(3) Boom cylinder



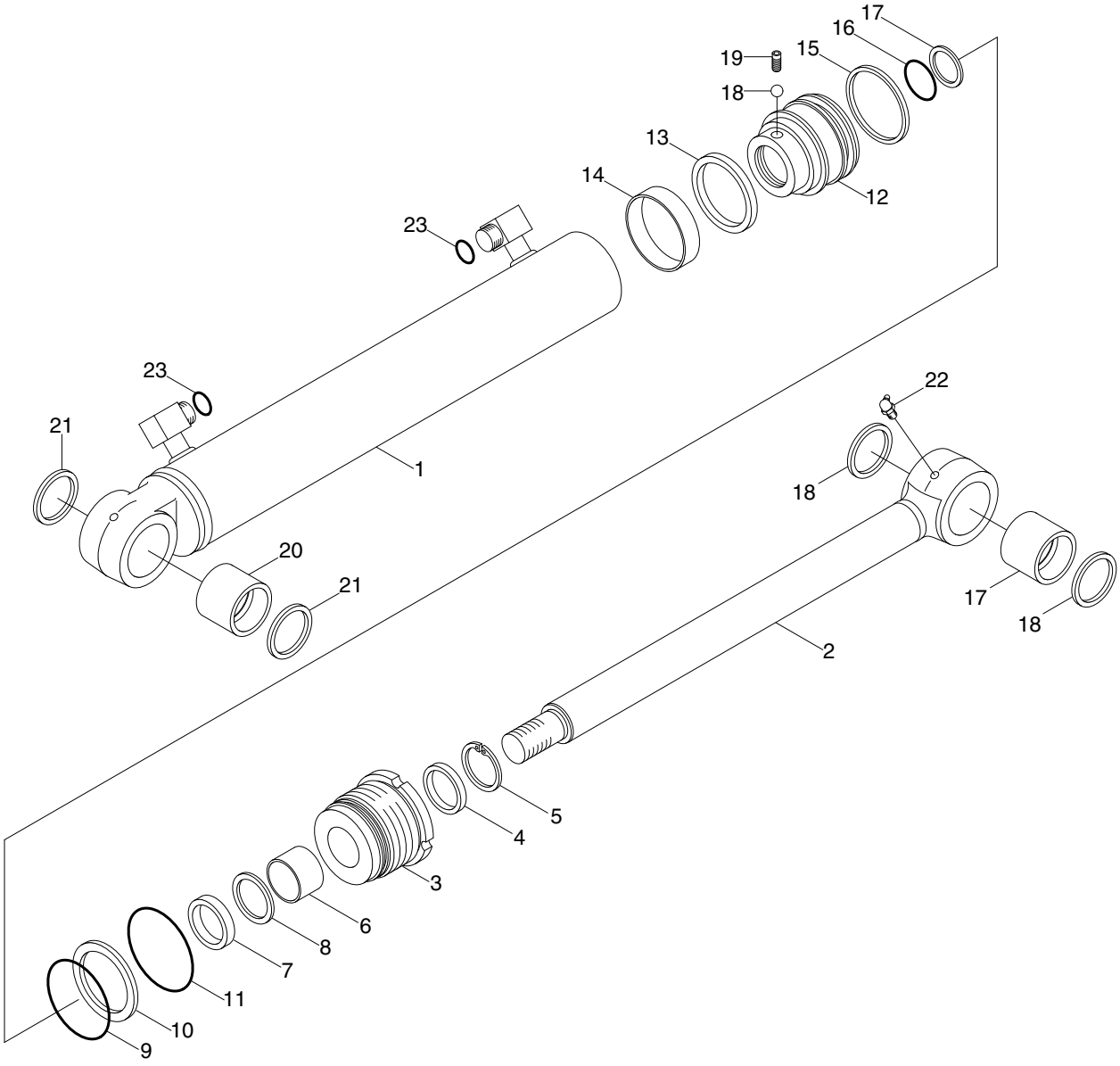
1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Buck-up ring	18	Steel ball
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Pin bushing
5	Retaining ring	13	Piston seal	21	Dust seal
6	DU bushing	14	Wear ring	22	Grease nipple
7	Rod seal	15	Dust ring	23	O-ring
8	Buck-up ring	16	O-ring		

(4) Dozer cylinder



1	Tube assembly	11	Buck-up ring	21	Check valve
2	Rod assembly	12	O-ring	22	O-ring
3	Gland	13	Piston	23	O-ring
5	Retaining ring	14	Piston seal	24	Socket head bolt
6	Rod seal	15	Wear ring	25	Socket head bolt
7	Buck-up ring	16	Dust ring	26	Pin bushing
4	Dust wiper	17	O-ring	27	Dust seal
8	Buffer ring	18	Steel ball	28	Grease nipple
9	DU bushing	19	Set screw		
10	O-ring	20	Pipe assembly (R)		

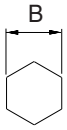
(5) Boom swing cylinder



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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name	Specification	
Allen wrench	8	
	10	
Spanner	M22	
Hook spanner	Suitable size	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Gland	Boom cylinder	5	M115	70±9.7	506±70
	Arm cylinder	5	M95	70±8.7	506±63
	Bucket cylinder	5	M85	75±7.5	540±54
	Dozer cylinder	3	M105	70±7.0	506±51
	Boom swing cylinder	3	M100	70±7.0	506±51
Lock nut	Boom cylinder	22	M45	75±7.5	540±5.4
	Arm cylinder	21	M39	75±7.5	540±5.4
	Bucket cylinder	19	M36	75±7.5	540±5.4
	Dozer cylinder	13	M39	97.5±9.8	705±71
	Boom swing cylinder	16	M39	97.5±9.8	705±71

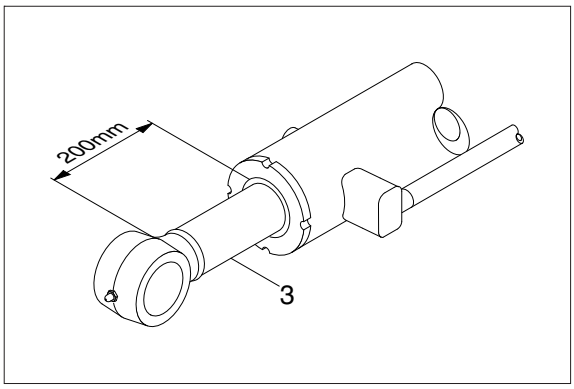
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

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

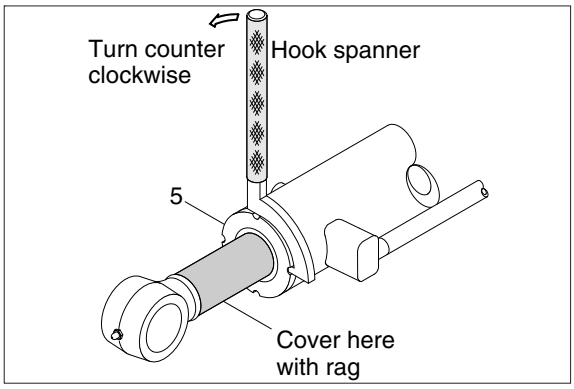
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (3) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



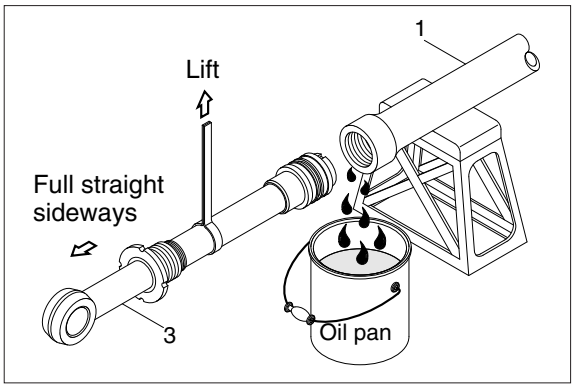
③ Remove rod cover (5) by hook spanner.

※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly (3) together from tube assembly (1).

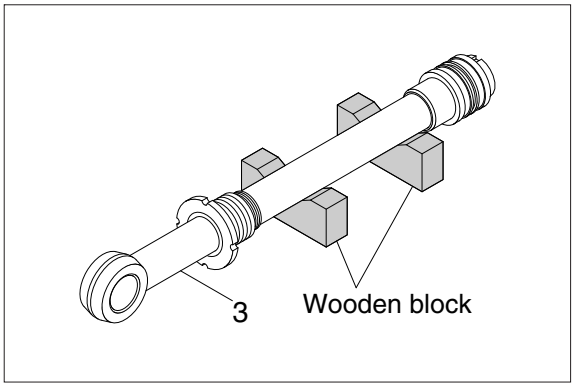
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



Note that the plated surface of rod assembly (3) 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.

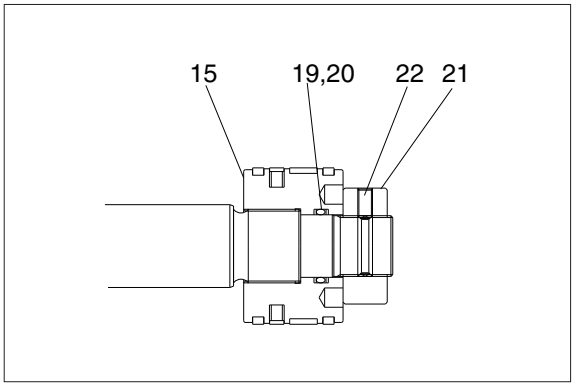


(2) Remove piston and rod cover

① Loosen set screw (22) and remove piston nut (21).

※ Since piston nut (21) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the piston nut (21).

② Remove piston assembly (15), back up ring (19), and O-ring (20).

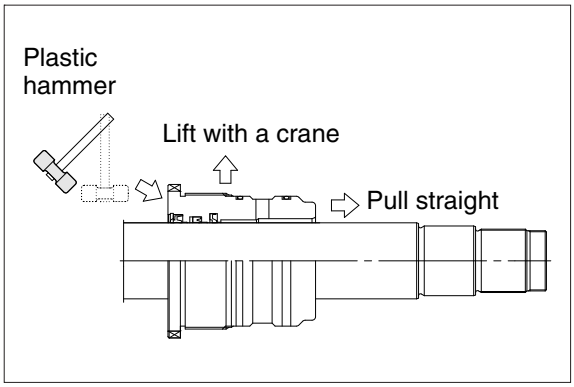


③ Remove the rod cover from rod assembly (3).

※ If it is too heavy to move, move it by striking the flanged part of gland 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 Du bushing (6) and packing (8, 9, 10, 11, 12, 13, 14) by the threads of rod assembly (3).

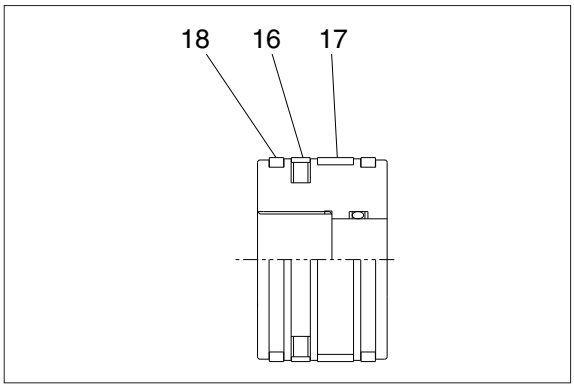


(3) Disassemble the piston assembly

① Remove wear ring (17).

② Remove dust ring (18) and piston seal (16).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

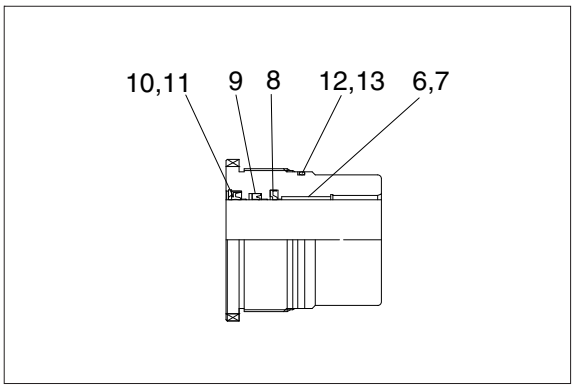
① Remove back up ring (12) and O-ring (13).

② Remove snap ring (11), dust wiper (10).

③ Remove U-packing (9) and buffer seal (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

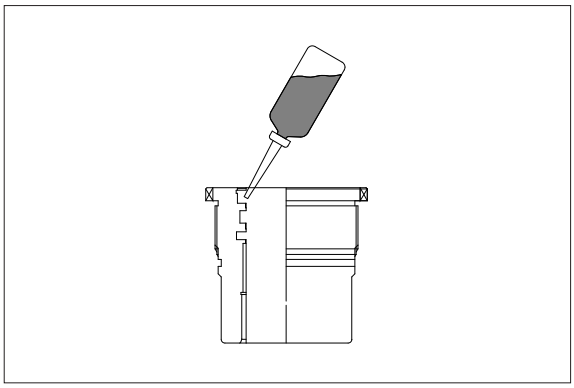


4) ASSEMBLY

(1) Assemble cylinder head assembly

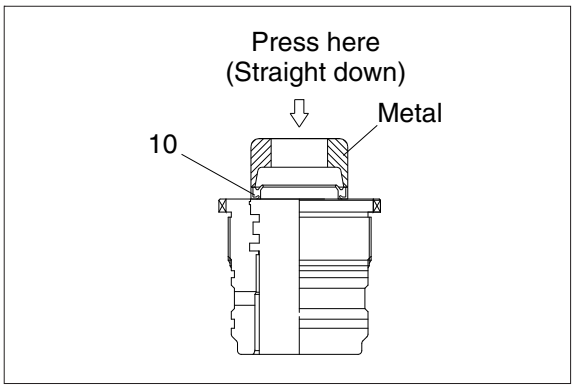
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of rod cover (5) with hydraulic oil.



② Coat dust wiper (10) with grease and fit dust wiper (10) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

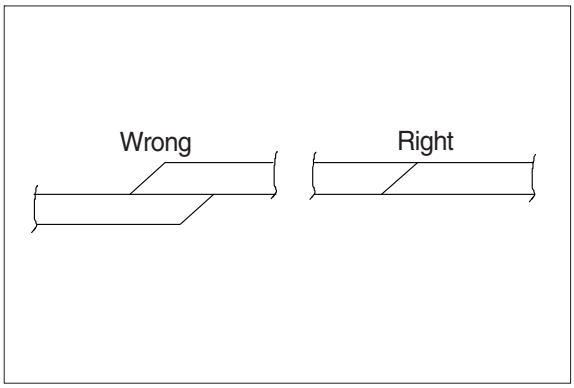
③ Fit snap ring (11) to the stop face.



④ Fit U-packing (9) and buffer seal (8) to corresponding grooves, in that order.

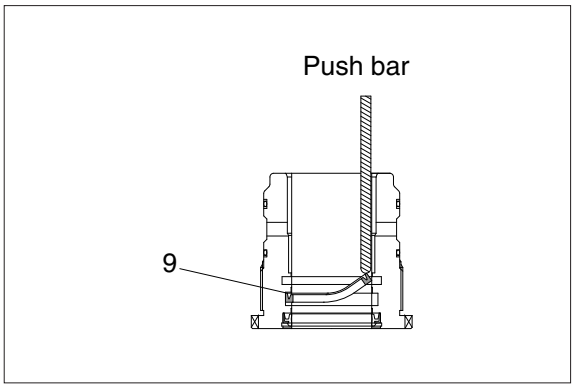
※ Coat each packing with hydraulic oil before fitting it.

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



※ U-packing (9) has its own fitting direction. Therefore, confirm it before fitting them.

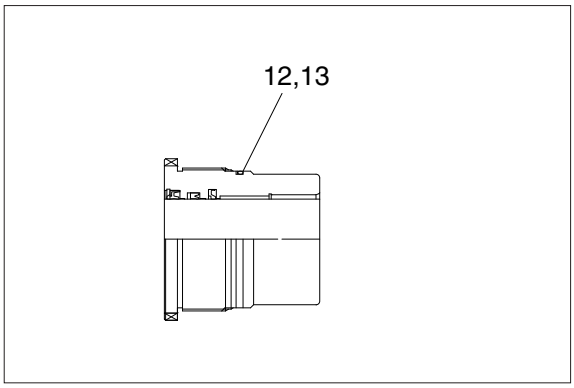
※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to rod cover (5).

※ Put the backup ring in the warm water of 30~50˚C .

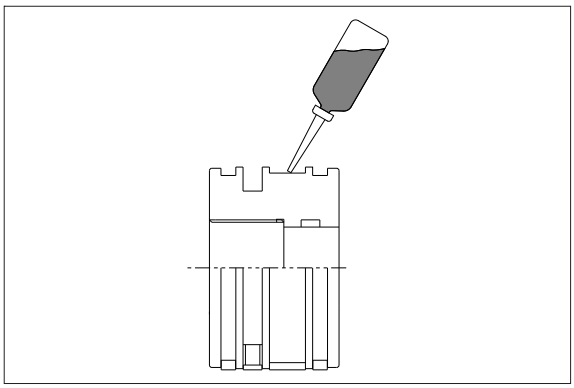
⑥ Fit O-ring (13) to rod cover (5).



(2) Assemble piston assembly

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

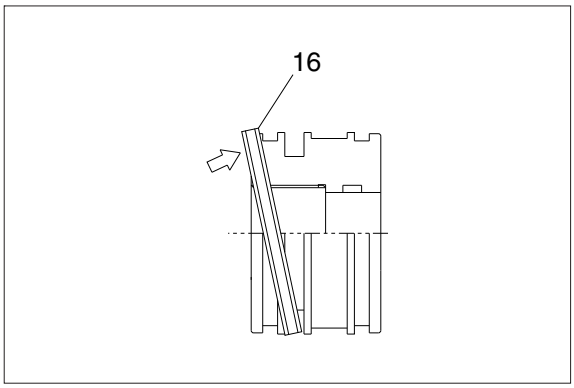
① Coat the outer face of piston (15) with hydraulic oil.



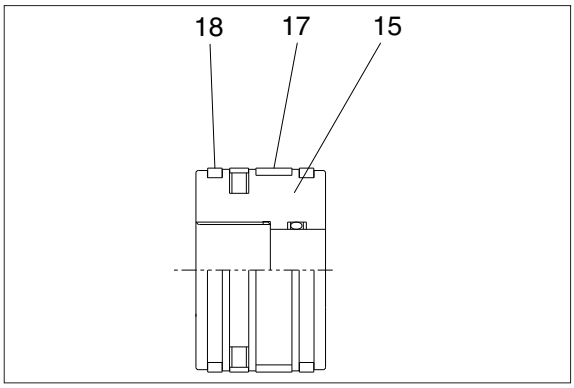
② Fit piston seal (16) to piston.

※ 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 (17) and dust ring (18) to piston (15).

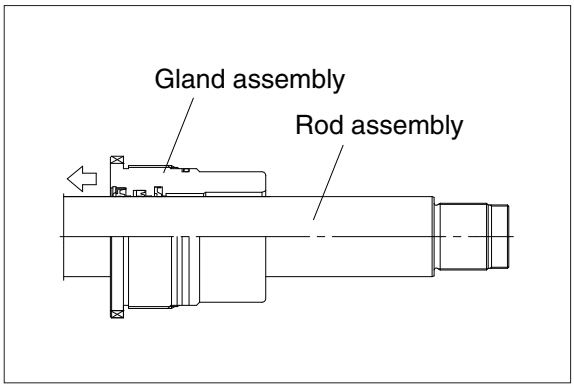


(3) Install piston and cylinder head

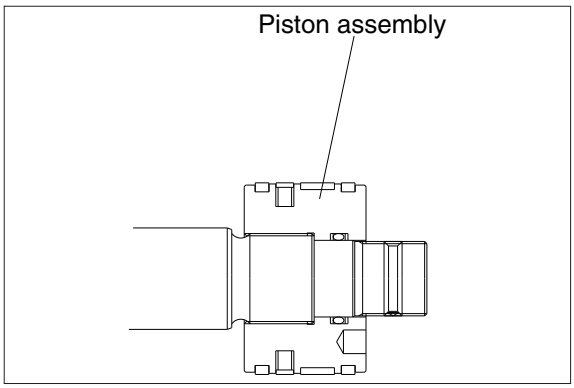
① Fix the rod assembly to the work bench.

② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



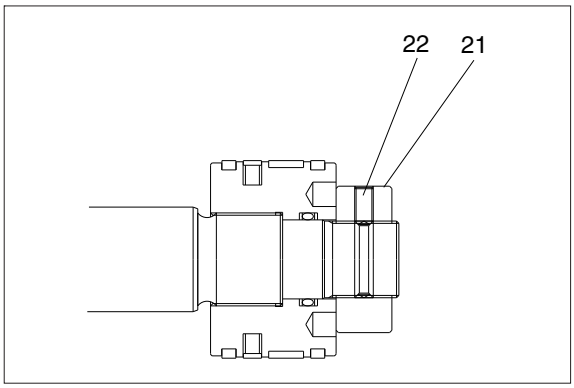
④ Fit piston assembly to rod assembly.



⑤ Fit piston nut (21) and tighten the set screw (22).

· Tightening torque :

Item		kgf · m	lbf · ft
Boom	22	75±7.5	540±54
Arm	21	75±7.5	540±54
Bucket	19	75±7.5	540±54
Dozer	16	97.5±9.8	705±71
Boom swing	16	97.5±9.8	705±71



(4) Overall assemble

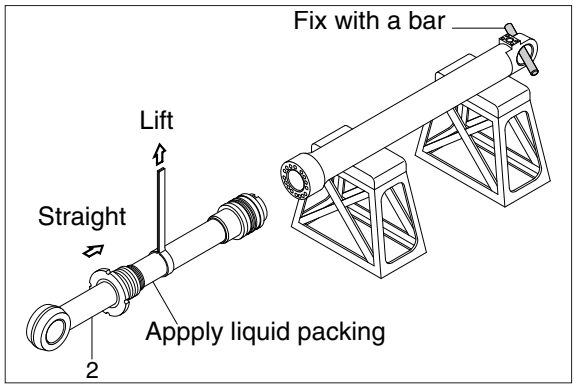
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

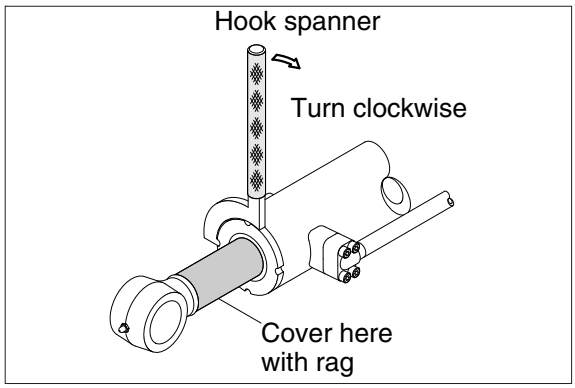
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

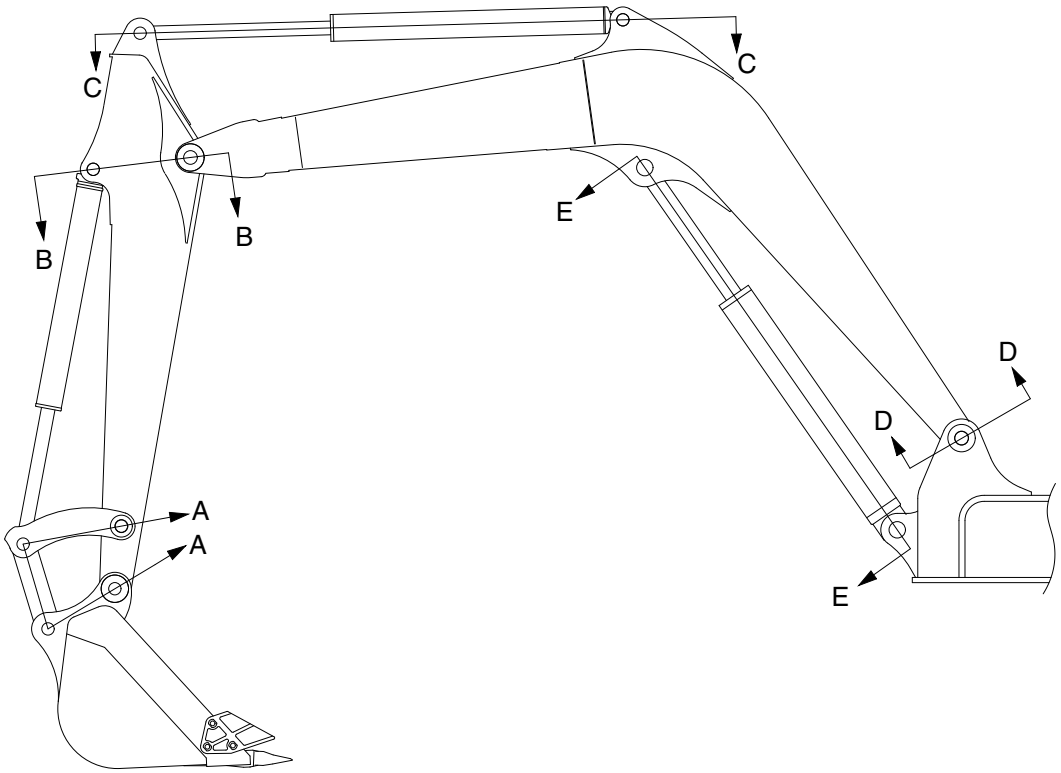
※ Refer to the table of tightening torque.

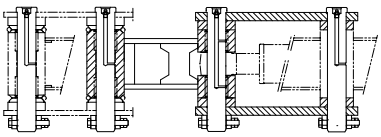




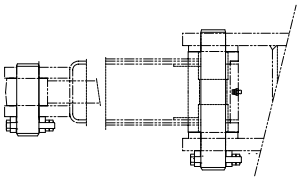
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

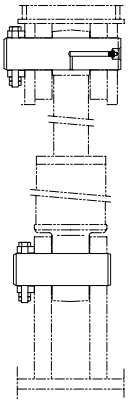




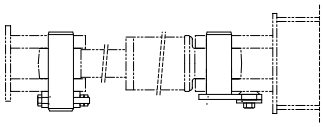
SECTION A-A



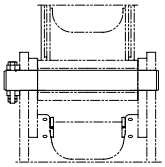
SECTION B-B



SECTION E-E



SECTION C-C



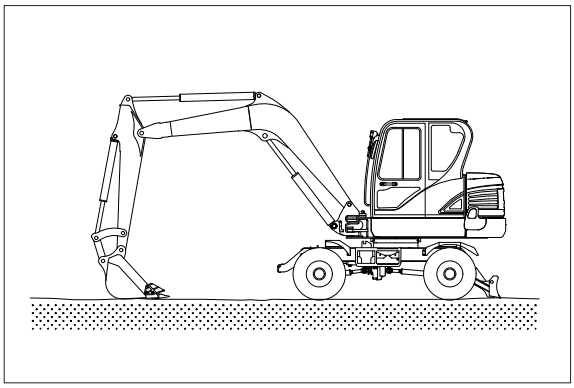
SECTION D-D

2. REMOVAL AND INSTALL

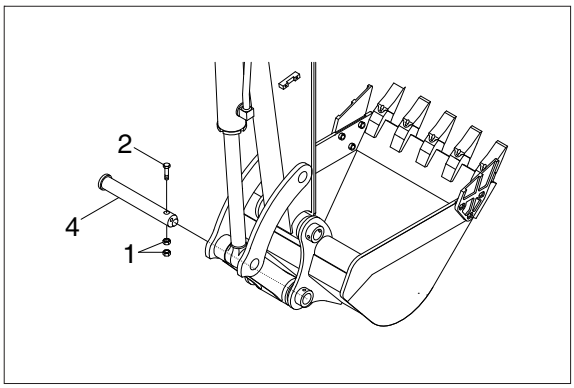
1) BUCKET ASSEMBLY

(1) Removal

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

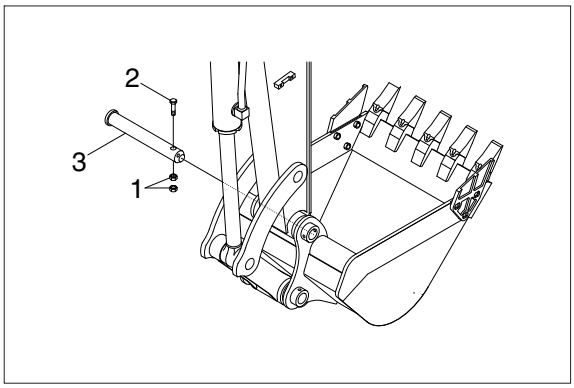


② Remove nut (1), bolt (2) and draw out the pin (4).



③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.

· Weight : 170 kg (370 lb)

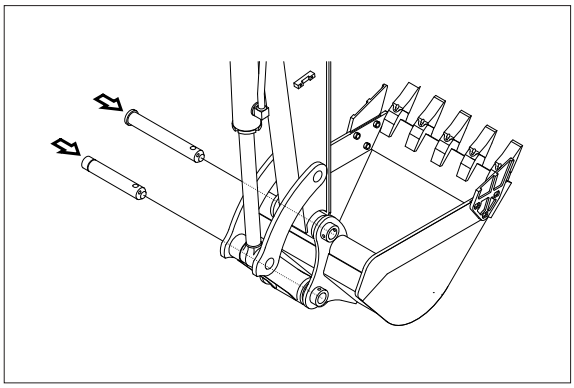


(2) Install

① Carry out installation in the reverse order to removal.

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

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



2) ARM ASSEMBLY

(1) Removal

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

⚠ Escaping fluid under pressure can penetrated the skin causing serious injury.

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

② Disconnect bucket cylinder hose (4).

⚠ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

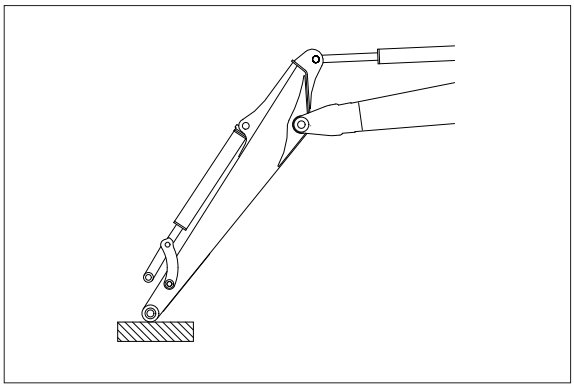
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

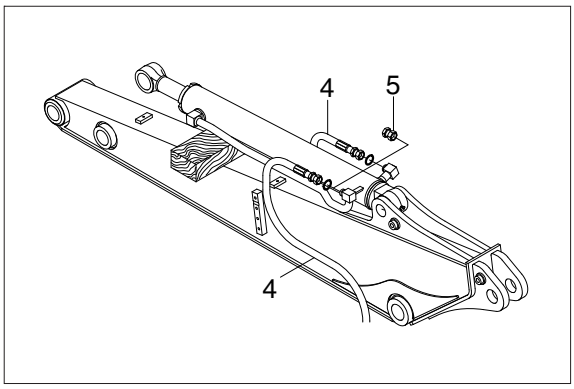
※ Tie the rod with wire to prevent it from coming out.

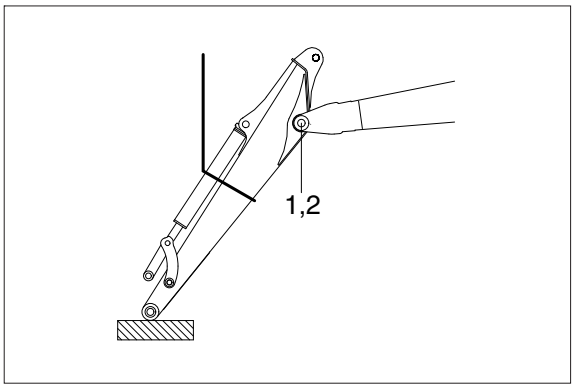
④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.
· Weight : 210 kg (470 lb)

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







(2) Install

① Carry out installation in the reverse order to removal.

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

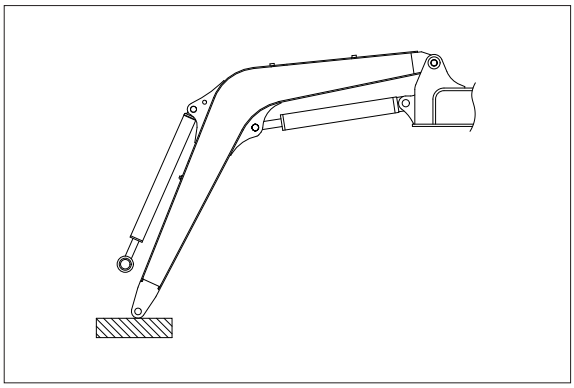
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

① Remove arm and bucket assembly.

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

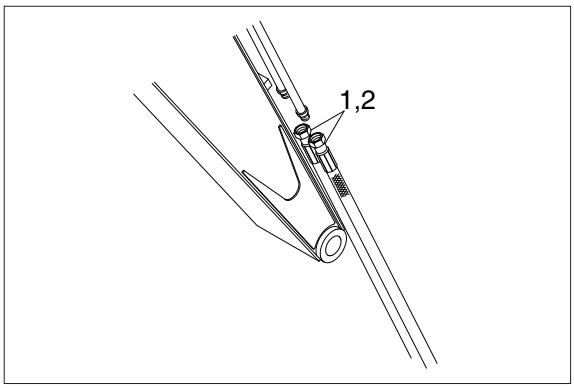


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

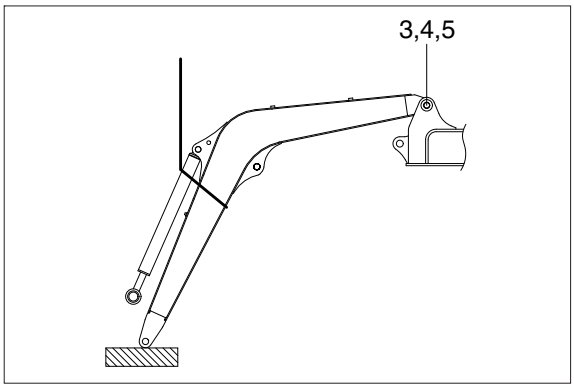
⚠ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight : 310 kg (680 lb)

※ When lifting the boom assembly always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the cylinder.