

SECTION 7 DISASSEMBLY AND ASSEMBLY

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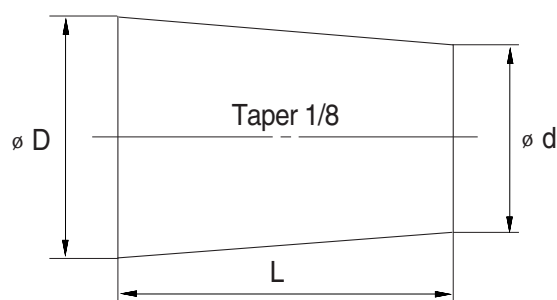
SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

- 1) Tighten all bolts and nuts (sleeve nuts) to the specified torque.
- 2) Install the hoses without twisting or interference.
- 3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- 4) Bend the cotter pin or lock plate securely.
- 5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
- 6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- 7) Clean all parts, and correct any damage, dents, burrs, or rust.
- 8) Coat rotating parts and sliding parts with engine oil.
- 9) When press fitting parts, coat the surface with antifriction compound (LM-P).
- 10) After installing snap rings, check that the snap ring is fitted securely in the ring groove (check that the snap ring moves in the direction of rotation).
- 11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- 12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
- 13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- 14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
 - (1) Start the engine and run at low idling.
 - (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100 mm before the end of the stroke.
 - (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)
 - (4) After completing this operation, raise the engine speed to the normal operating condition.
 - ※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.
 - ※ 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		Coupling mounting socket bolt	M 8 × 1.25	1.8±0.2	13±1.4
		Coupling mounting clamp socket bolt	M10 × 1.5	6.0±1.0	43.4±7.2
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12.3±3.0	92±22.0
6		Main pump housing mounting bolt	M 8 × 1.25	2.5±0.5	18±3.6
7		Main control valve mounting bolt	M12 × 1.75	14.7±2.2	106±15.9
8		Travel motor mounting bolt	M16 × 2.0	29.7±4.5	215±33
9		Fuel tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
10		Hydraulic oil tank mounting bolt	M12 × 1.75	14.7±2.2	106±16.0
11		Turning joint mounting bolt, nut			
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 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

- (4) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

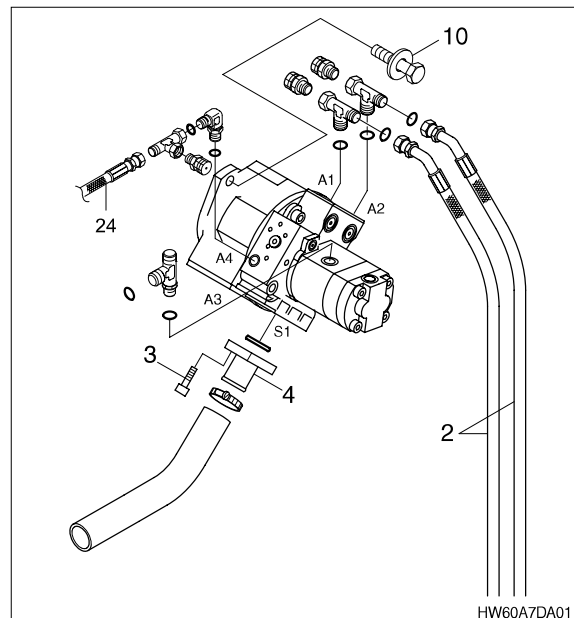
• Hydraulic tank quantity : 70 l
(18.5 U.S.gal)

- (5) Disconnect hydraulic hoses (22, 64, 65).
- (6) Remove socket bolts (83) and disconnect pump suction pipe (10).
- (7) Sling the pump assembly and remove the pump mounting bolts.

• Weight : 30 kg (70 lb)

- ※ Pull out the pump assembly from housing.

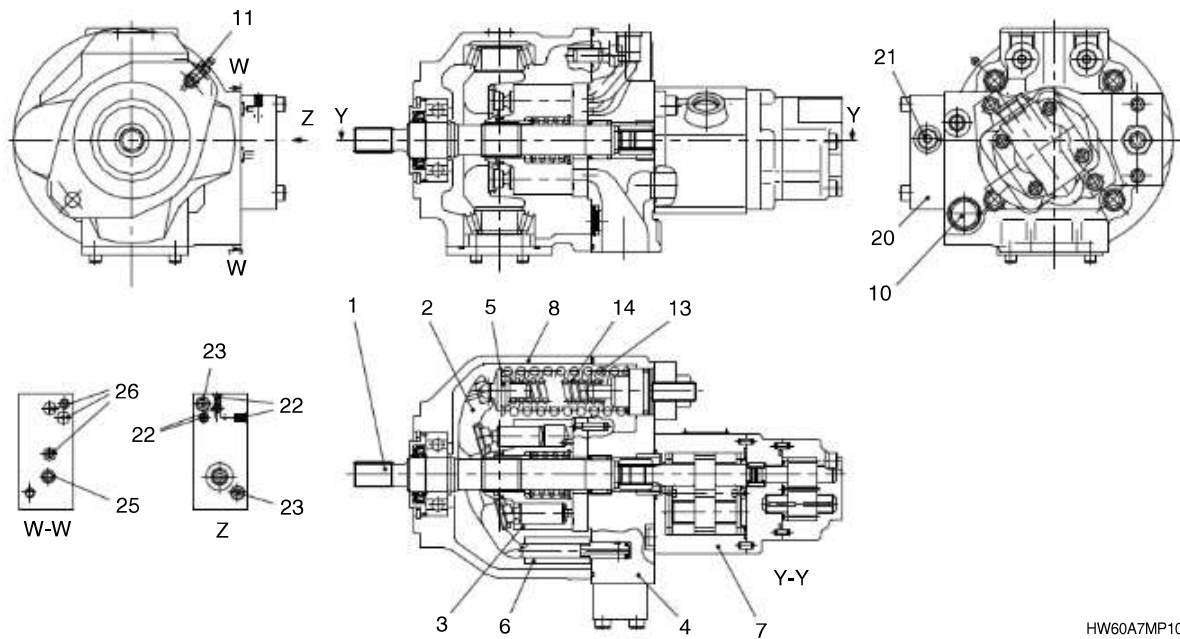
When removing the pump assembly, check that all the hoses have been disconnected.



2) INSTALL

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

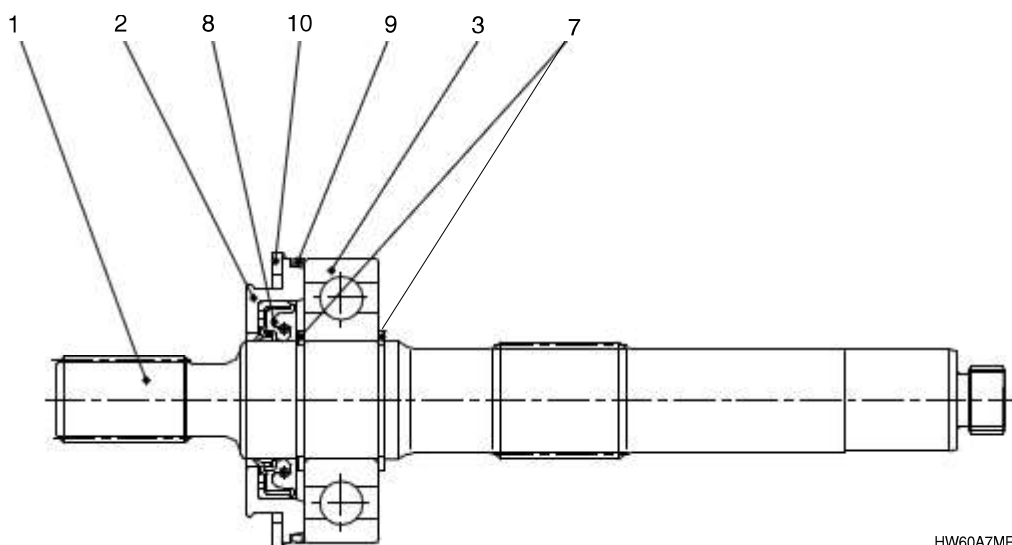
2. STRUCTURE (1/9)



HW60A7MP101

- | | | |
|------------------|-------------------|------------------------|
| 1 Shaft | 7 Gear pump | 20 Body |
| 2 Swash plate | 8 Housing | 21 Plug assy |
| 3 Rotary group | 10 Plug assy | 22 Double breakoff pin |
| 4 Port plate | 11 Air vent valve | 23 Screw-Hex Socket |
| 5 Spring seat | 13 Spring | 25 O-ring |
| 6 Control piston | 14 Spring | 26 O-ring |

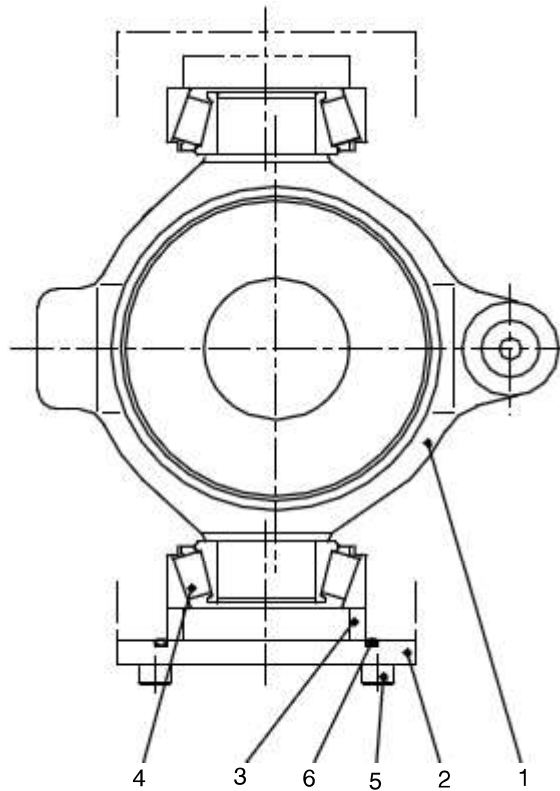
STRUCTURE (2/9)



HW60A7MP102

- | | | |
|-------------|---------------------------|----------------------------|
| 1 Shaft | 7 Retaining ring (C type) | 10 Retaining ring (C type) |
| 2 Seal case | 8 Oil seal | |
| 3 Bearing | 9 O-ring | |

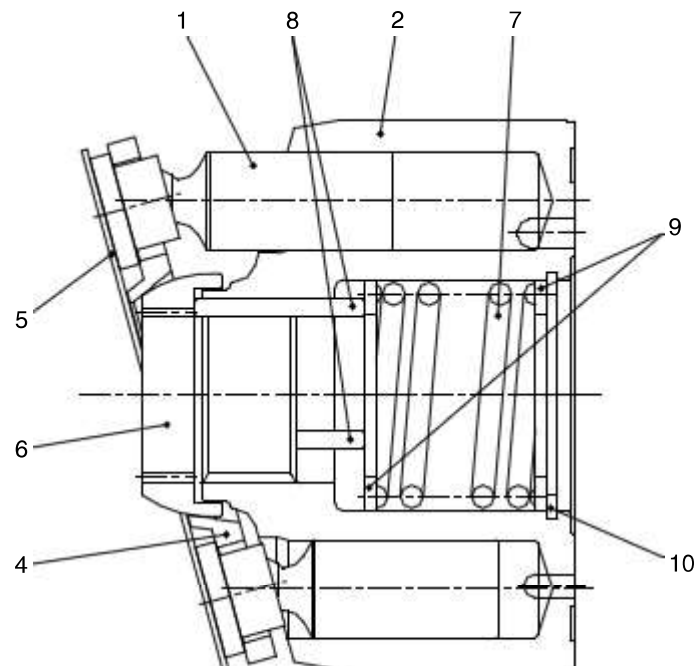
STRUCTURE (3/9)



HW60A7MP103

- | | | |
|---------------|------------------|--------------------|
| 1 Swash plate | 3 Distance piece | 5 Screw-Hex Socket |
| 2 Cover | 4 Bearing | 6 O-ring |

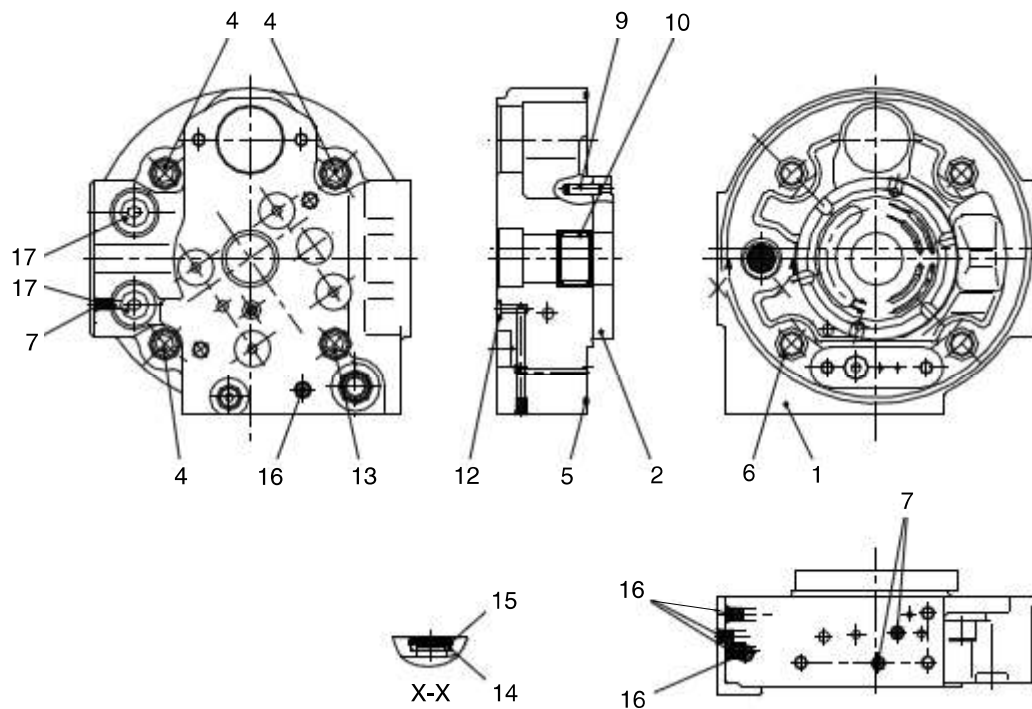
STRUCTURE (4/9)



HW60A7MP104

- | | | |
|------------------|--------------|----------------------------|
| 1 Piston | 5 Plate assy | 8 Dowel pin |
| 2 Cylinder block | 6 Guide | 9 Spring seat |
| 4 Retainer | 7 Spring | 10 Retaining ring (C type) |

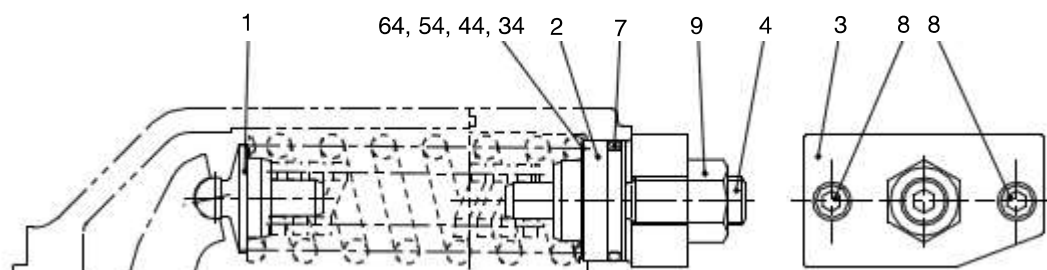
STRUCTURE (5/9)



HW60A7MP105

- | | | |
|--------------------|-----------------------|----------------------------|
| 1 Port plate | 6 O-ring | 14 Filter |
| 2 Control plate | 7 Double breakoff pin | 15 Retaining ring (C type) |
| 3 Dowel pin | 10 Bearing | 16 Double breakoff pin |
| 4 Screw-Hex Socket | 12 O-ring | 17 Plug |
| 5 O-ring | 13 Screw-Hex Socket | |

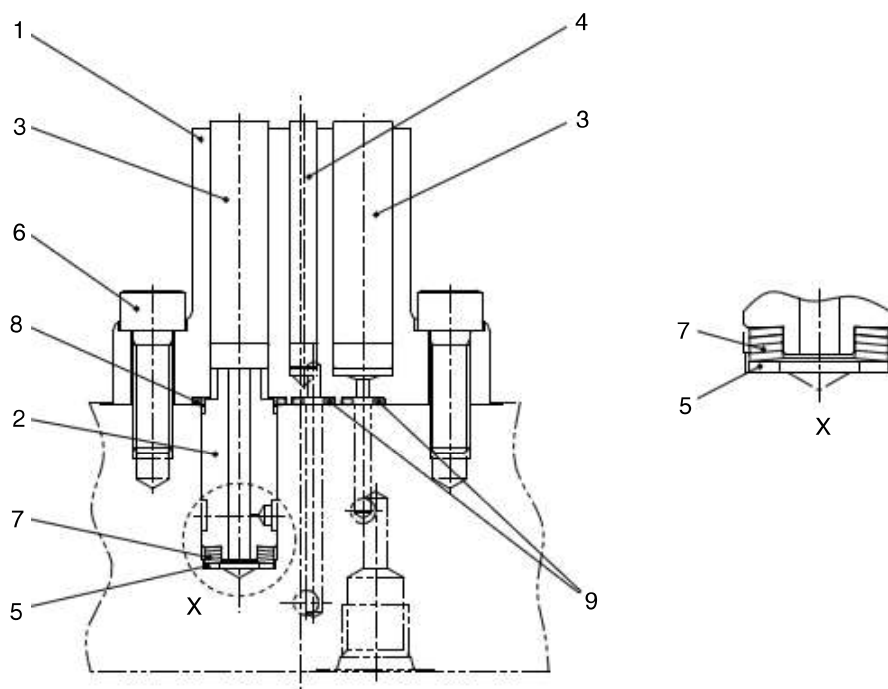
STRUCTURE (6/9)



HW60A7MP106

- | | | |
|------------------|--------------------|---------|
| 1 Spring seat | 7 O-ring | 44 Shim |
| 2 Spring seat | 8 Screw-Hex Socket | 54 Shim |
| 3 Cover | 9 Screw-Hex | 64 Shim |
| 4 Adjusted screw | 34 Shim | |

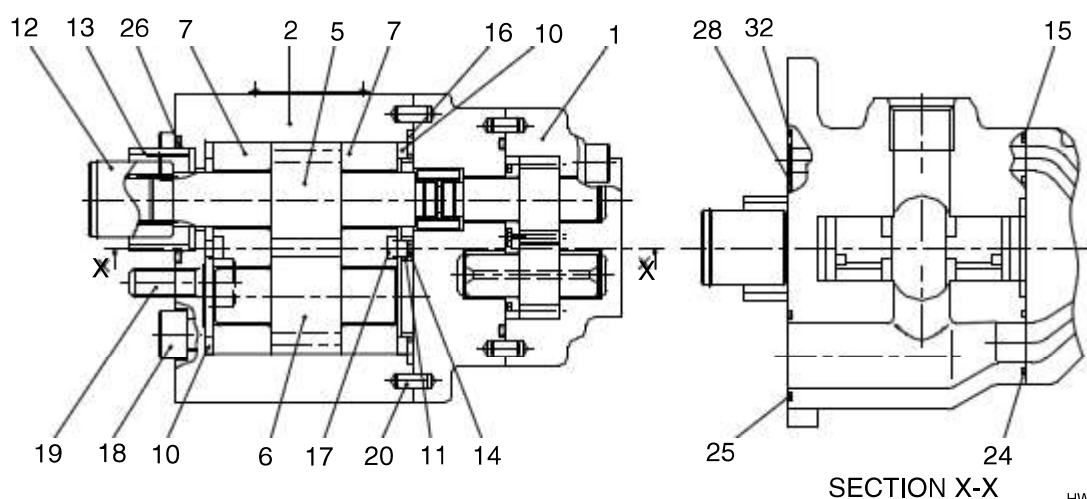
STRUCTURE (7/9)



HW60A7MP107

- | | | |
|-------------|------------------------|---------------|
| 1 Cylinder | 4 Dowel pin | 7 Disc spring |
| 2 Piston | 5 Spring seat | 8 O-ring |
| 3 Dowel pin | 6 Hex socket cap screw | 9 O-ring |

STRUCTURE (8/9)

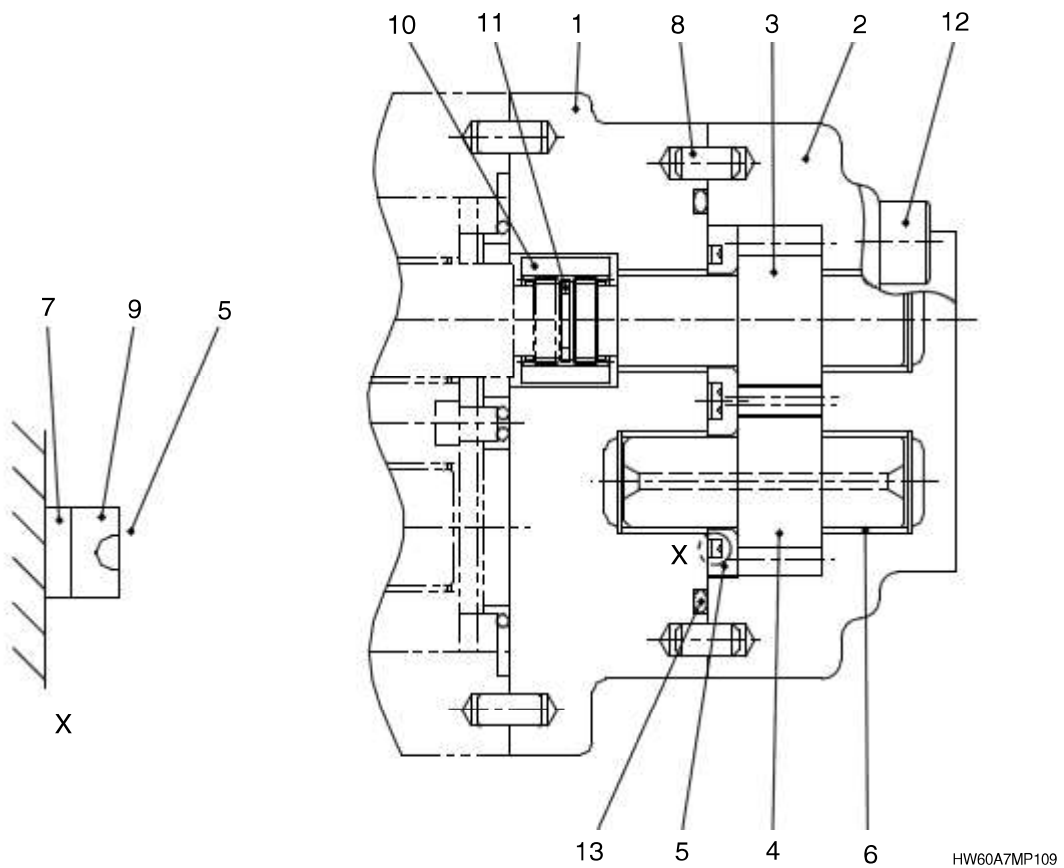


SECTION X-X

HW60A7MP108

- | | | |
|----------------|-------------------------|-------------------------|
| 1 Gear pump | 12 Coupling Assy | 19 Hex socket cap screw |
| 2 Housing | 13 Bushing | 20 Dowel pin |
| 5 Gear | 14 O-ring | 24 O-ring |
| 6 Gear | 15 O-ring | 25 O-ring |
| 7 Thrust plate | 16 Square ring | 26 O-ring |
| 10 Plate | 17 Square ring | 28 Filter |
| 11 Guide | 18 Hex socket cap screw | 32 O-ring |

STRUCTURE (9/9)



- | | | | | | |
|---|--------------|----|---------------|----|-------------------------|
| 1 | Frame | 6 | Metal | 11 | Retaining ring (C type) |
| 2 | Housing | 7 | Backup ring | 12 | Hex socket cap screw |
| 3 | Gear | 8 | Dowel pin | 13 | O-ring |
| 4 | Gear | 9 | Square ring | | |
| 5 | Thrust plate | 10 | Coupling Assy | | |

3. NECESSARY TOOLS AND JIGS

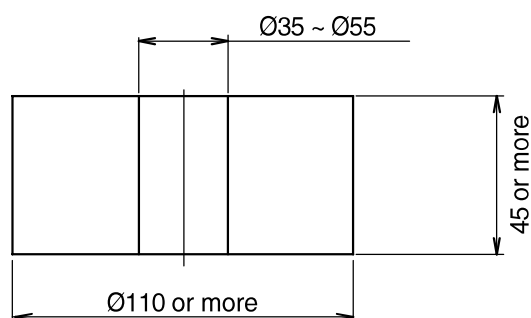
1) Tools

The followings tools and jigs are necessary to disassemble and reassemble the pump.

Name	Quantity	Size (nominal)
Hexagon socket screw key	One each	5,6,8,10
Spanner	One each	14,19,21,24
Plastic hammer	1	Medium size
Pliers for retaining ring	1	For hole (retaining ring for 72)
Pliers for retaining ring	1	For shaft (retaining ring for 30)
Standard screwdriver	2	Medium size
Torque wrench	-	Wrench which can tighten at the specified torque
Grease	Small amount	
Adhesives	Small amount	LOCTITE # 245 or # 243

2) Jigs

(1) Disassemble table

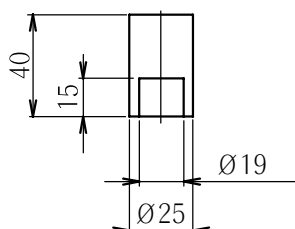


R55NM7HP01

This is a plate to stand the pump facing downward.

A square block may be used instead of the shaft and does not contact.

(2) Bearing assembling jig



R55NM7HP02

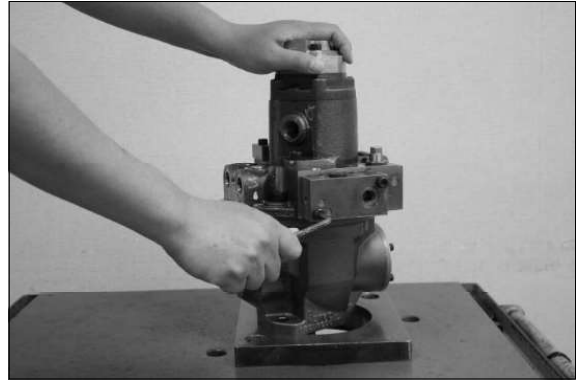
(3) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt	M 6	1.3~1.5	9.4~10.0	0.20	5
	M 8	3.0~3.6	21.7~25	0.24	6
	M12	5.6~7.0	40~50	0.31	8
	M16	10.0~12.4	72.3~90.2	0.39	10
	M18	34.0	246	0.55	14

4. DISASSEMBLY PROCEDURE

1) DISASSEMBLING THE GEARED PUMP

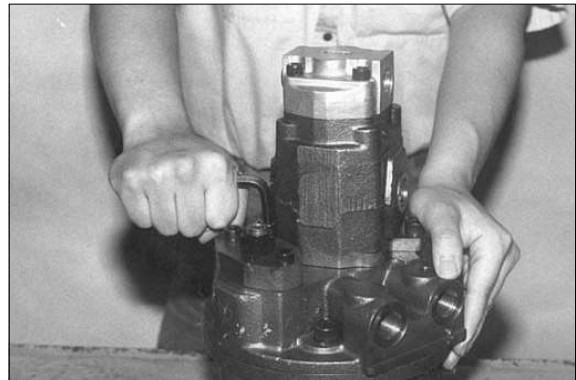
- ① Remove the hexagon socket head cap screws. (M8 × 40, 2 pieces)
Hexagon socket screw key.
(Hex. side distance : 6)
- ※ Be careful because the O-rings (at 4pieces) are provided to the body.



HW60A7MP01

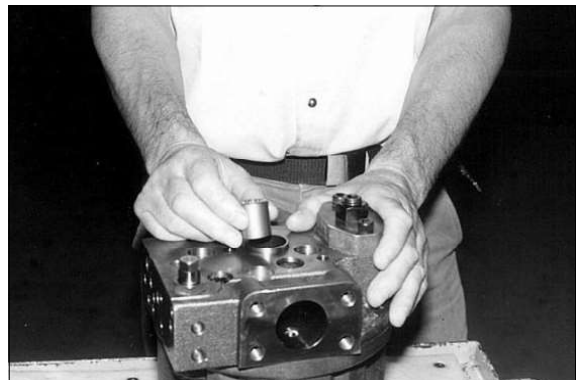
2) DISASSEMBLING THE GEAR PUMP

- ① Remove the cover.
Remove the hexagon socket head cap screws. (M10 × 25, 2 pieces)
Hexagon socket screw key.
(Hex. side distance : 8)
- ※ Be careful because the O-rings (at 3pieces) and filter are provided to the port plate.



HW60A7MP02

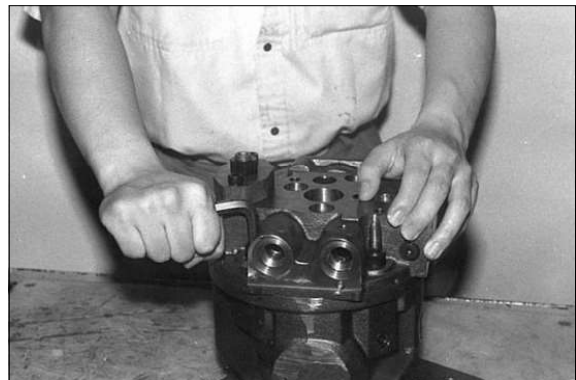
- ② Remove the coupling and bush.



HW60A7MP03

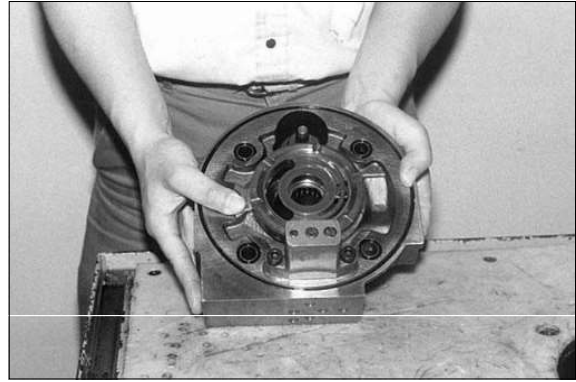
3) DISASSEMBLING THE GEAR PUMP

- (2) Removing the port plate in a horizontal condition.
Remove the hexagon socket head cap screws. (M12 × 30, 3 pieces)
(M12 × 55, 1 piece)
Hexagon socket screw key.
(Hex. side distance : 10)
- ※ Be careful because the control plate is provided to the back site.
- ※ When the plate is difficult to remove, knock lightly with a plastic hammer.
Removing the port plate.



HW60A7MP04

(2) Remove the port plate.



HW60A7MP05

(3) The removal of the control spring.
Remove two springs (inner and outer).



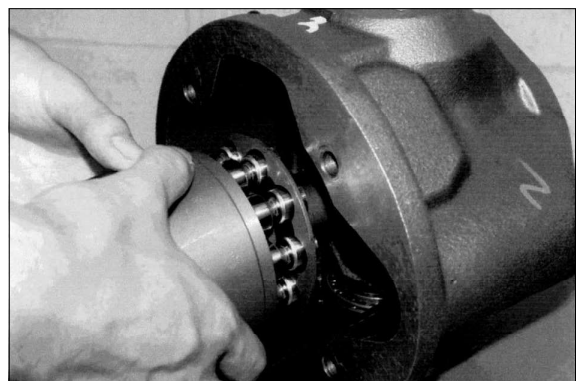
HW60A7MP06

(4) Remove the plate.



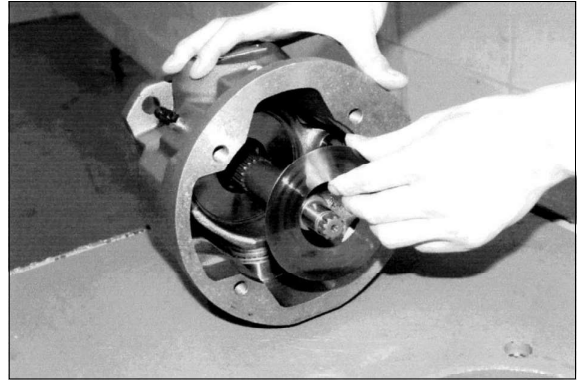
HW60A7MP07

(5) Lay the pump on the side and take out the rotary group from the shaft.



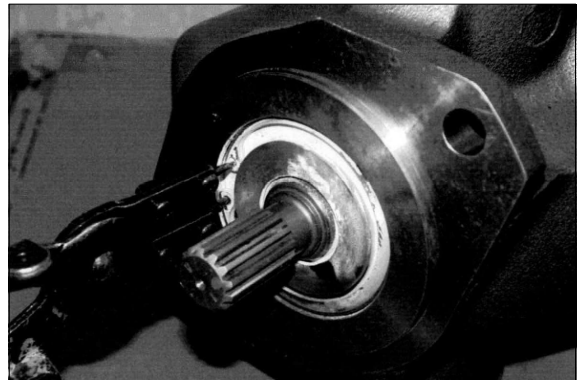
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(6) Remove the plate.



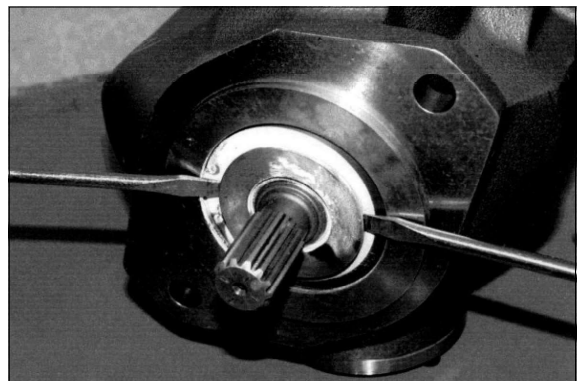
HW60A7MP09

(7) The removal of the shaft.
Remove the retaining ring (for hole: 72)



HW60A7MP10

(8) Use two standard screw-drivers to remove the oil seal case.



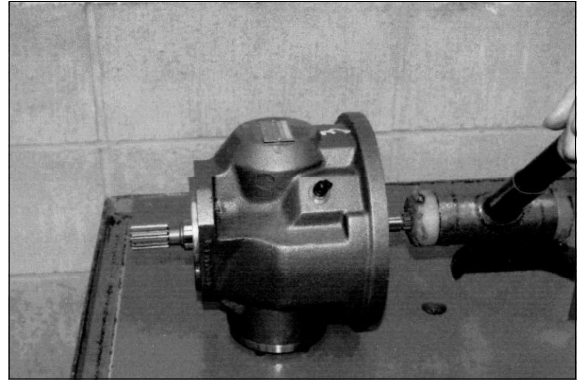
HW60A7MP11

(9) Remove the O-ring.



HW60A7MP12

- (10) Remove it while knocking the shaft rear end lifhrly with a plastic hammer.



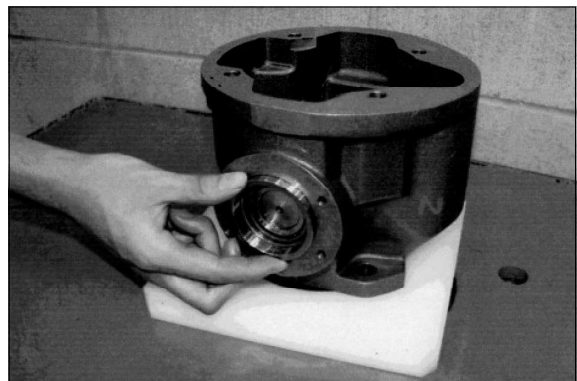
HW60A7MP13

- (11) Remove the swash plate.
Remove the hexagon socket head cap screw (M6x16, 4pieces) and plate.
hexagon socket screw key.
(Hex. side distance : 5)



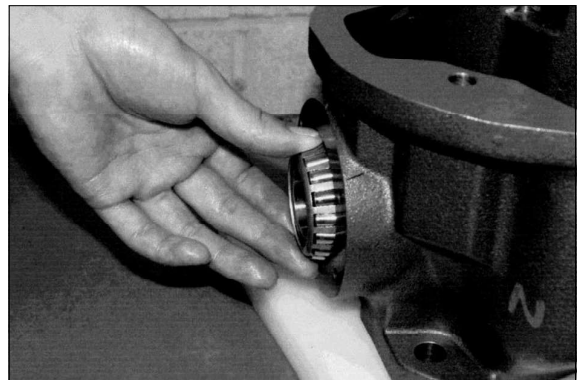
HW60A7MP14

- (12) Remove the distance piece.



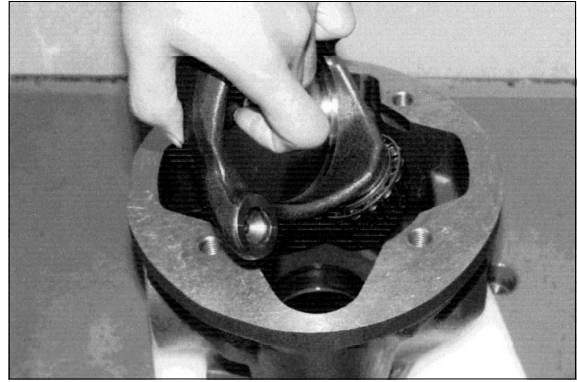
HW60A7MP15

- (13) Remove the bearing.



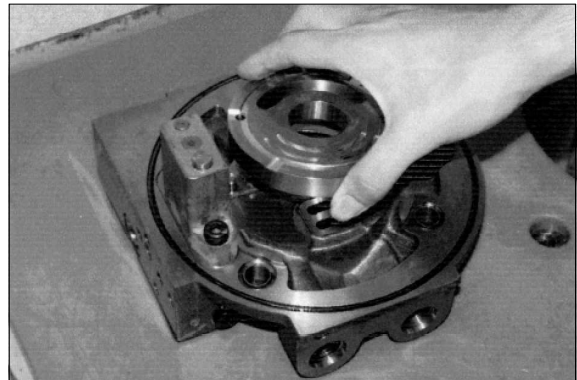
HW60A7MP16

(14) Remove the bearing.



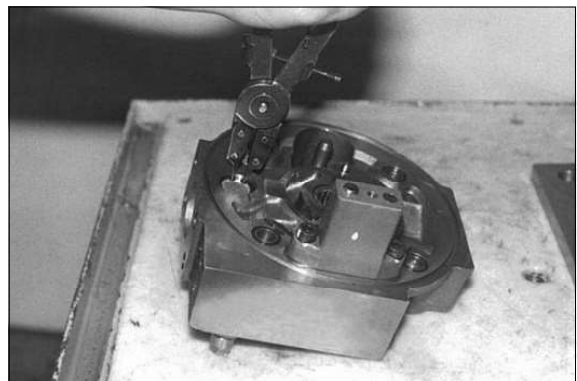
HW60A7MP17

(15) Remove the swash plate.



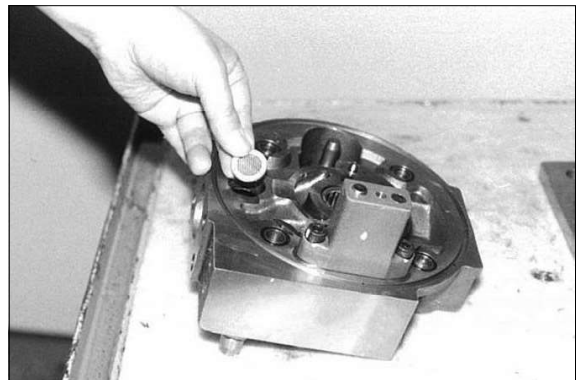
HW60A7MP18

(16) Remove the port plate.
Remove the control plate.



HW60A7MP19

(17) Remove the retaining ring (for hole: 25).



HW60A7MP20

(18) The removal of the control piston

Remove the hexagonal socket head cap screws (M8 × 25, 2pieces).

Hexagon socket screw key.

(Hex. side distance : 6)

- ※ The threaded portion of the bolt is coated with LOCTITE #245 or #243.

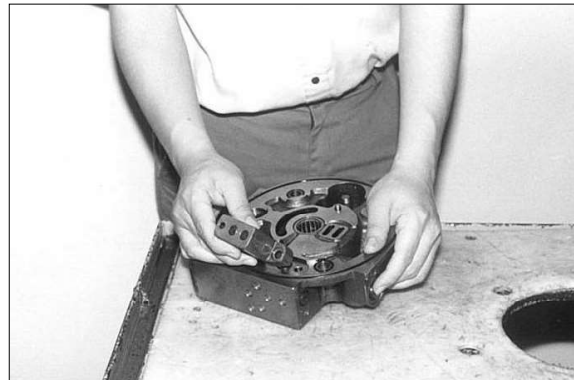
This disassembly must therefore be made only when necessary.



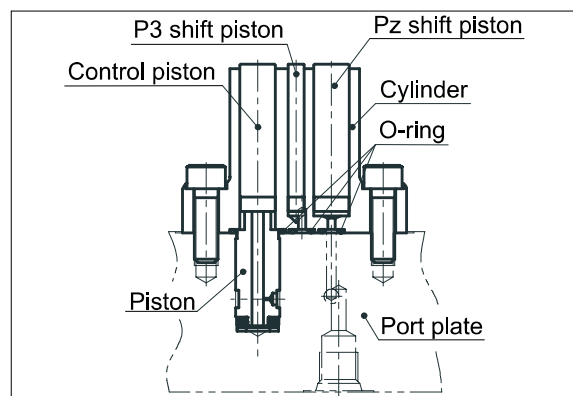
R55NM7HP23

(19) Remove the cylinder and the three pistons.

- ※ Be careful because 3 O-rings are provided to the cylinder.



HW60A7MP22



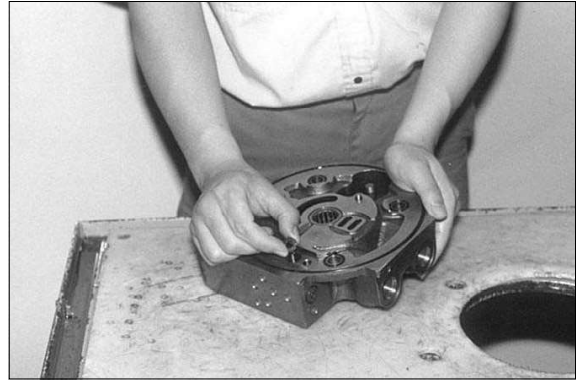
HW65AH7MP23

(20) Remove the piston.

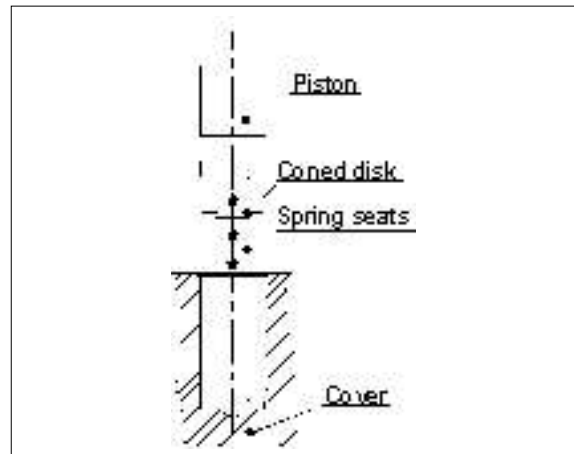


HW60A7MP24

- (21) Take out four coned disk springs and spring seats.



HW60A7MP25



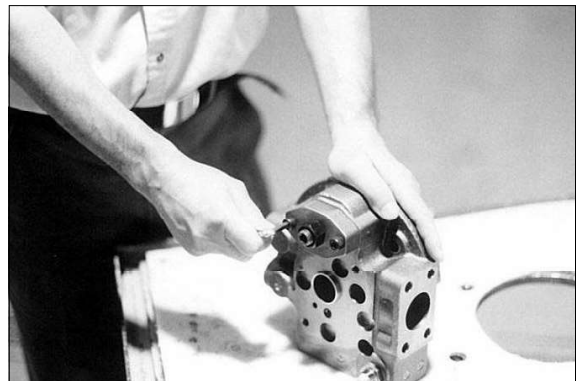
HW65AH7MP26

- (22) **The removal of the control piston**

Remove the hexagonal socket head cap screws. (M8 × 30, 2pieces).

Hexagon socket screw key.

(Hex. side distance : 6)



HW60A7MP27

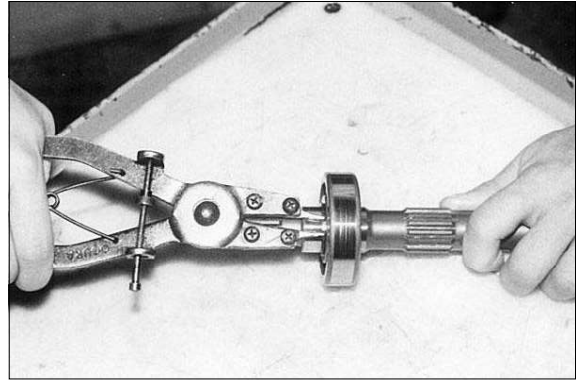
- (23) **Remove the spring seat.**



HW60A7MP28

(24) Disassembly of the shaft

Remove the bearing.
Remove the retaining ring.
(for shaft 30, 2pieces)



HW60A7MP29

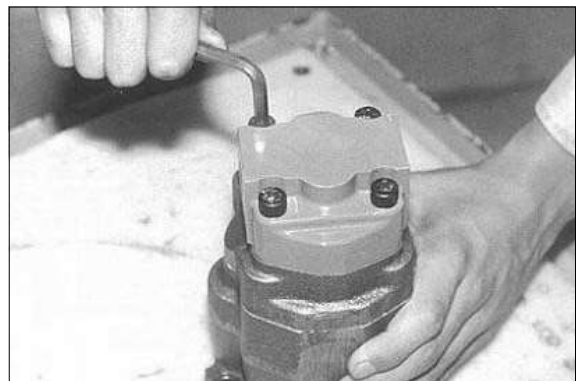
(25) Remove it while knocking the shaft end lightly with a plastic hammer.



HW60A7MP30

4) DISASSEMBLING THE GEAR PUMP (G1)

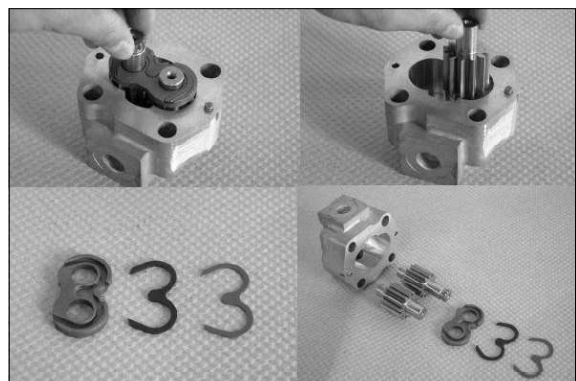
- (1) Remove the hexagon socket head cap screws. (M8 x 45, 4pieces)
Hexagonal socket screw key
(Hex. side distance : 6)



HW60A7MP31

(2) The removal of the parts

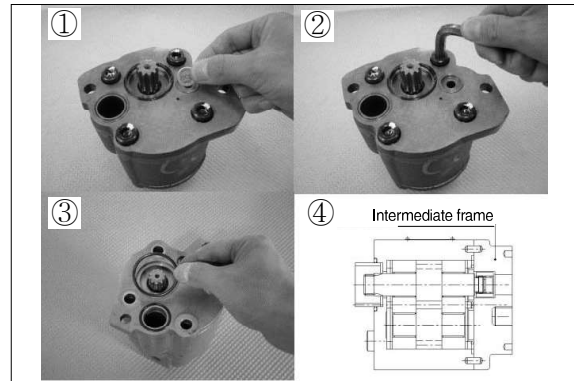
- Side plate.
- Backup ring.
- Square ring.
- Drive gear and idle gear.



HW60A7MP32

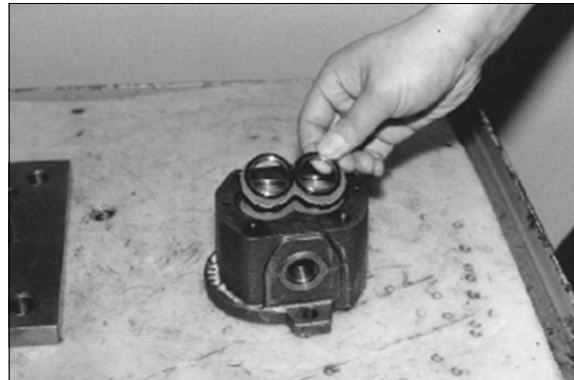
5) DISASSEMBLING THE GEAR PUMP (G1)

- (2) Remove the filter
- ① Remove the hexagon socket head cap screws.
 - Hexagon socket screw key.
(Hex. side distance : 8)
- ② Remove the O-ring.
- ③ Remove the intermediate frame.



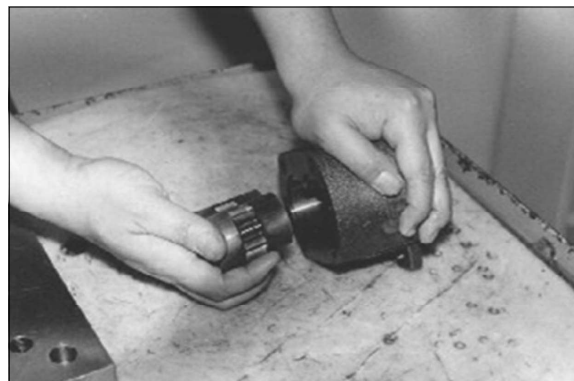
HW60A7MP33

- (2) Remove the plate, the guides, and the O-rings.



HW60A7MP34

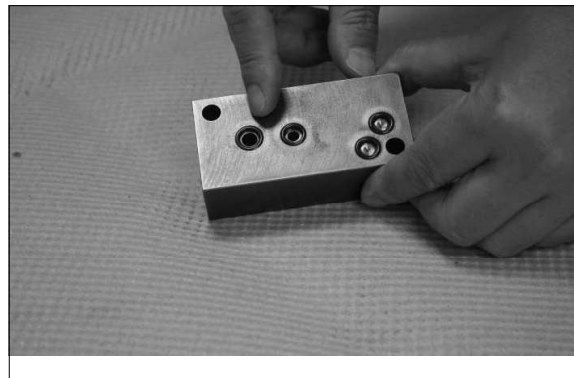
- (3) Remove the drive gear, the idle gear, and the side plate.



HW60A7MP35

6) DISASSEMBLING THE BODY.

Remove the O-rings.



HW60A7MP36

5. MAINTENANCE AND SERVICE STANDARD

Before inspection, wash the parts well and dry them completely.

Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.

Replace the seal also when any remarkable deformation and damage are found.

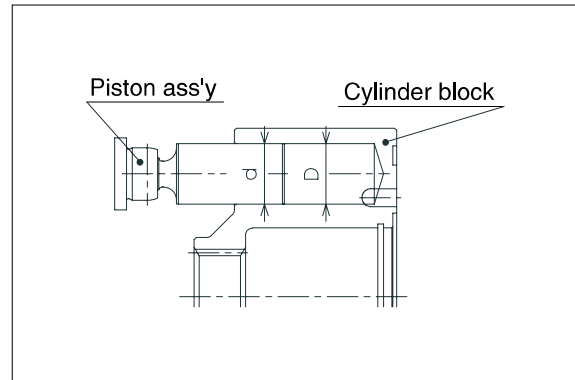
1) PISTON ASSEMBLY AND CYLINDER BLOCK

- Check the appearance visually.

No damage, scoring, abnormal wear (particularly, in the side portion) should be found.

- Check the clearance between the piston outside dia, and cylinder block inside dia.

$$D-d \leq 0.05 \text{ mm}$$

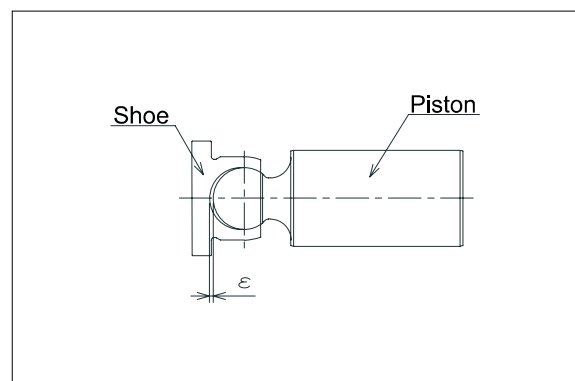


HW65AH7MP37

2) PISTON SHOE AND PISTON

- Check the axial piston shoe.

$$\varepsilon \leq 0.2 \text{ mm}$$

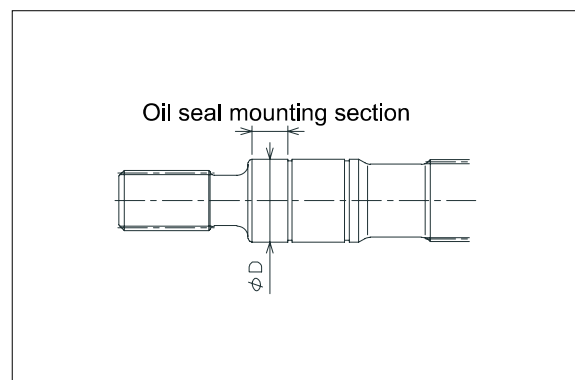


HW65AH7MP38

3) SHAFT

- Check the wear amount of the seal mounting section.

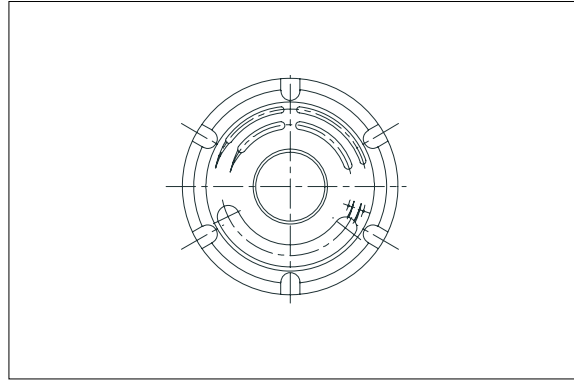
$$\text{Wear amount} \leq 0.025 \text{ mm}$$



HW65AH7MP39

4) CONTROL PLATE

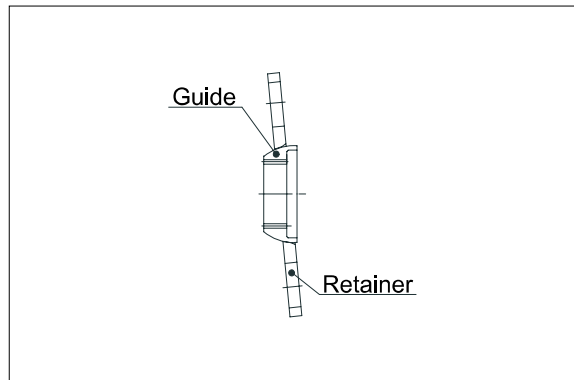
- Check the side surface for any damage.
When the damage is large, replace the plate with new one.



HW60A7MP40

5) GUIDE AND RETAINER

- Check for scouring or stepped wear.
If this can not be corrected, replace the guide and retainer as a set.
- Fine scouring or damage can be corrected with lapping.
Catty out through washing after lapping.



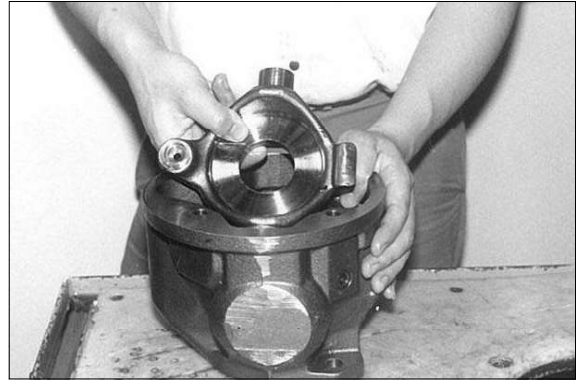
HW65AH7MP41

6.ASSEMBLING PROCEDURE

1) ASSEMBLING THE MAIN PUMP

(1) Assembling the main pump.

Assemble the hanger into the housing.



HW60A7MP50

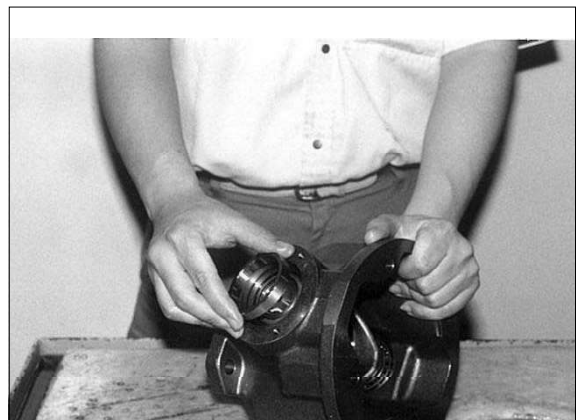
(2) Assemble the bearing.



HW60A7MP51

(3) Assemble the distance piece.

Confirm that the pre-load is 0.1 ± 0.02



HW60A7MP52

(4) Fix the plate with the hexagon socket head cap screws.

(M6 × 16, 4pieces)

- . Hexagon socket screws key.
- . (Hex. side distance : 5)

Tightening torque : 1.3~1.5 kgf·m

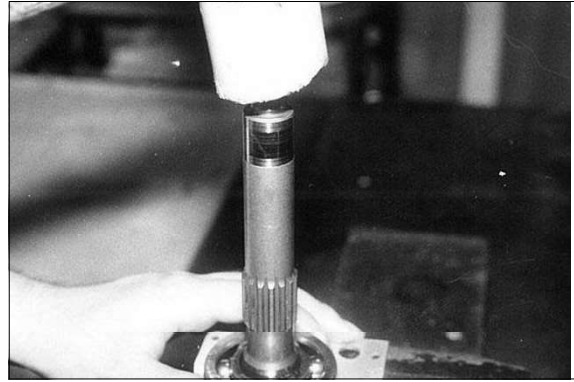


HW60A7MP53

(5) Assembling the shaft.

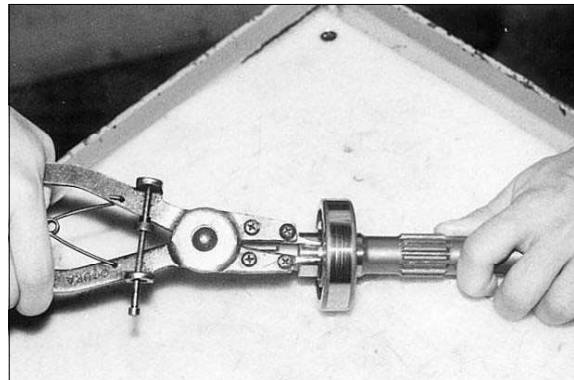
Fit the shaft into the bearing (with the bearing in the bottom) by using the press and jig.

If the press is not available, use the jig in the similar manner and drive the shaft into the bearing by knocking with a plastic hammer.



HW60A7MP54

**(6) Assemble the retaining ring.
(for shaft : 30, 2pieces)**



HW60A7MP29

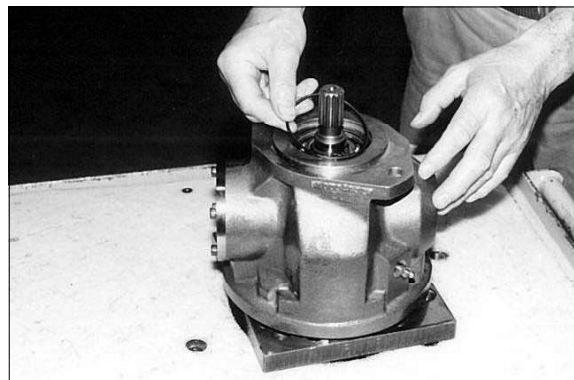
(7) Assembling the shaft.

Assemble the shaft into the housing.
Fix the bearing outer ring firmly into the housing hole.



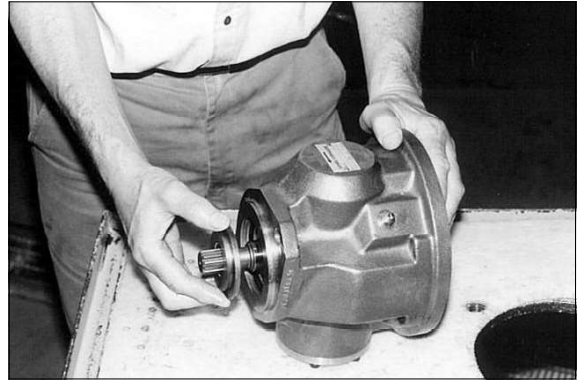
HW60A7MP56

**(8) Apply grease to the O-ring
for assembling.**



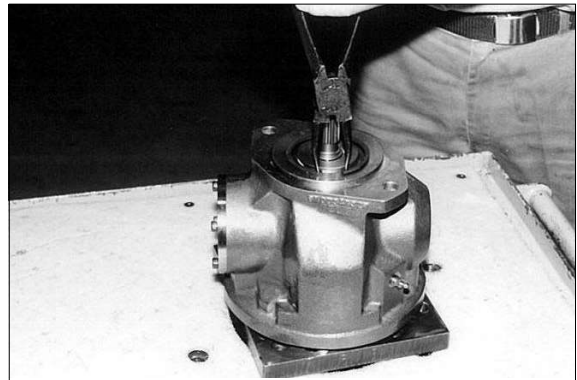
HW60A7MP57

- (9) Assemble the case with oil seal vertically without tilting.
※ Apply grease to the oil seal lip beforehand.



HW60A7MP58

- (10) Assemble the retaining ring to fix the shaft. (for hole : 72)



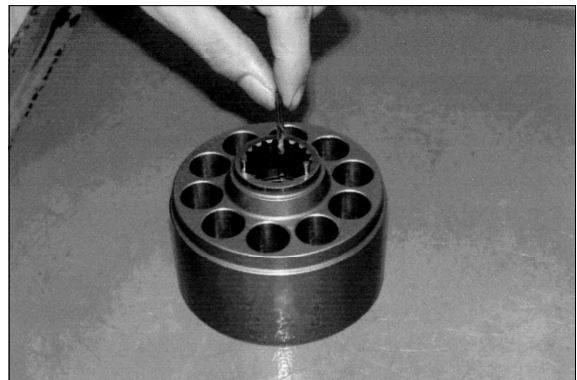
HW60A7MP59

- (11) Assemble the rotary group.
Assemble the pistons (10 pistons) into the retainer.



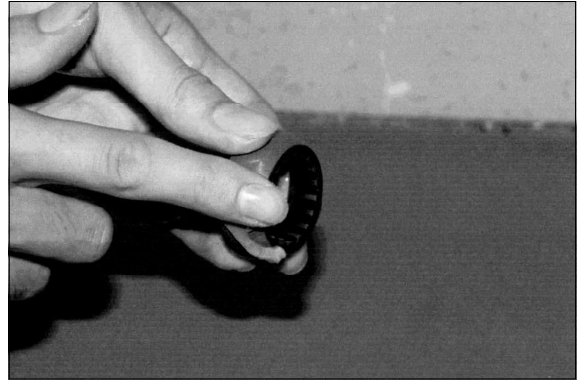
HW60A7MP60

- (12) Apply grease to 3 parallel pins and assemble them to the cylinder block.



HW60A7MP61

- (13) Apply grease to the spherical portion of the guide.



HW60A7MP62

- (14) Assemble the guide between the retainer and the cylinder block and assemble the piston into the hole of the cylinder block.

※ Apply grease to the end part of the shoes.

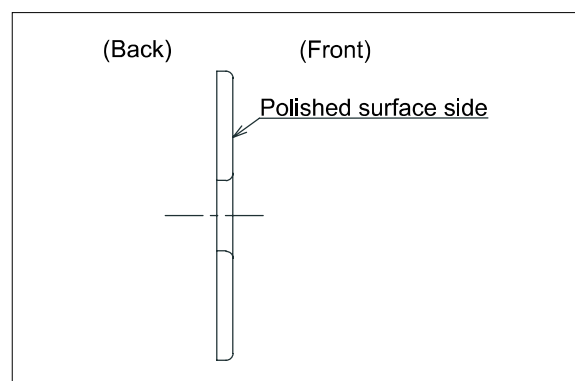


HW60A7MP63

- (15) Assemble the rotary group.
To prevent dislodgment, apply grease to the back side of the plate and assemble it to the swash plate.

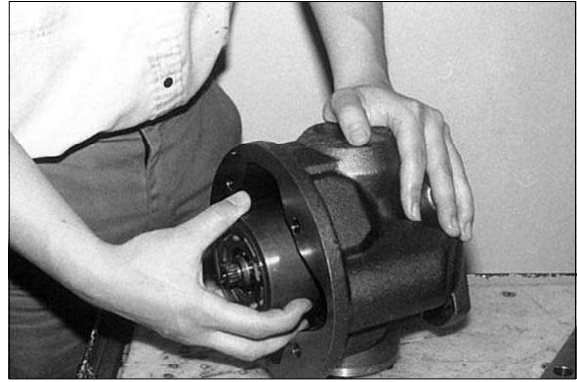


HW60A7MP64



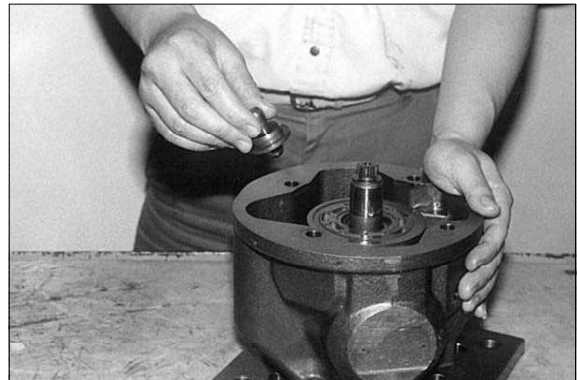
HW65AH7MP65

- (16) **Assemble the rotary group.**
Assemble the rotary group along the shaft spline.



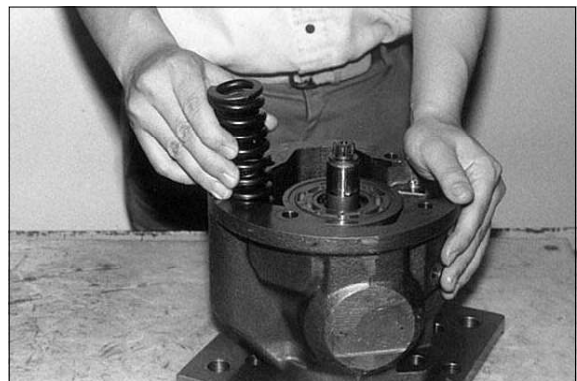
HW60A7MP66

- (17) **Apply grease to the spherical portion of the spring seat before assembling.**



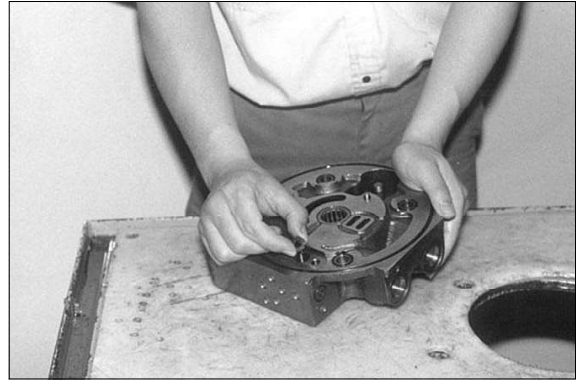
HW60A7MP67

- (18) **Assembly two springs. (inner and outer)**

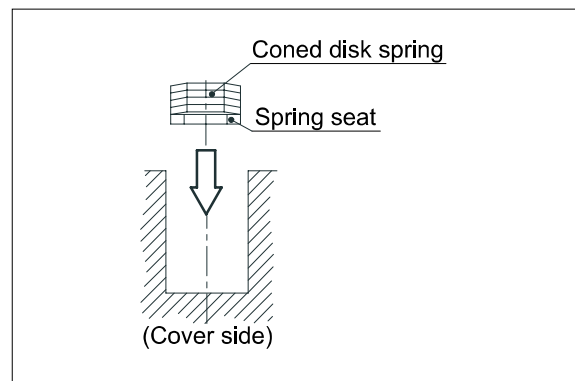


HW60A7MP68

- (19) **Assembling the port plate.**
Assemble the spring seats and coned disk springs. (4 pieces)

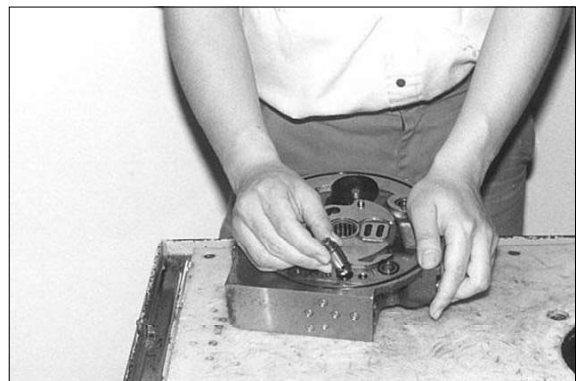


HW60A7MP25

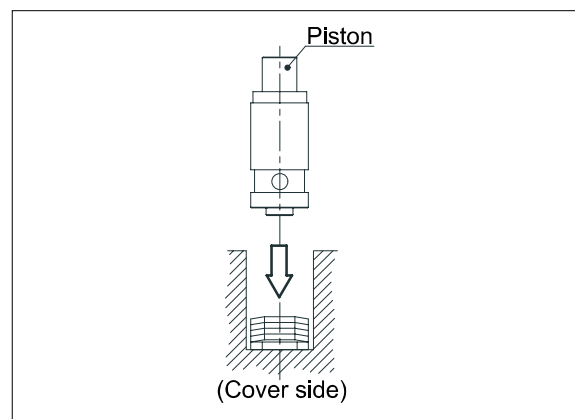


HW65AH7MP69

- (20) **Assembling the control piston.**

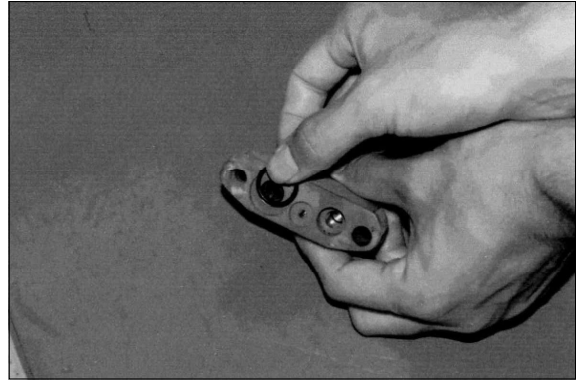


HW60A7MP24



HW65AH7MP70

- (21) Apply grease to the O-ring and assemble them to the cylinder.

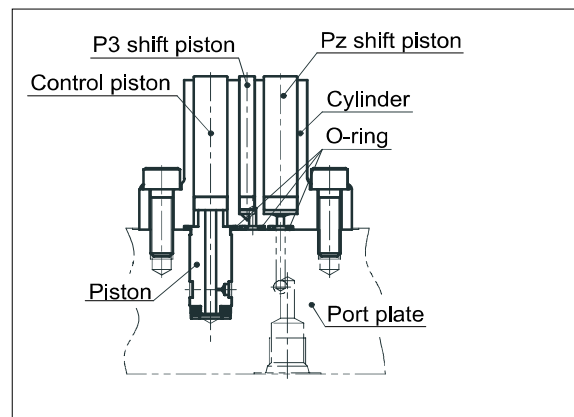


HW60A7MP71

- (22) Apply grease to 3 pistons and assemble 3 pistons into the cylinder.



HW60A7MP72



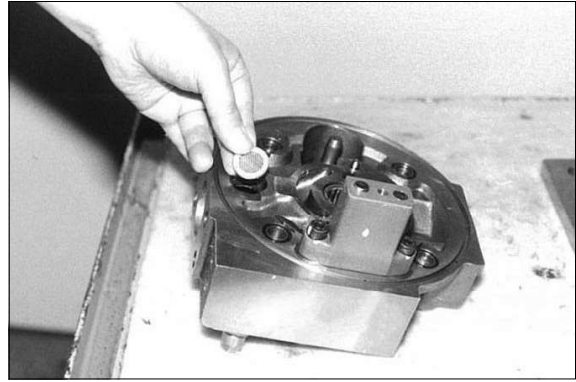
HW65AH7MP23

- (23) Fix the cylinder with the hexagon socket head cap screws.
 (M8 × 25, 2pieces)
 Hexagon socket screws key.
 (Hex. side distance : 6)
 ※ Tightening torque : 3.0~3.6 kgf·m
 Apply LOCTITE #245 (or #243) to the threaded portion of bolt.



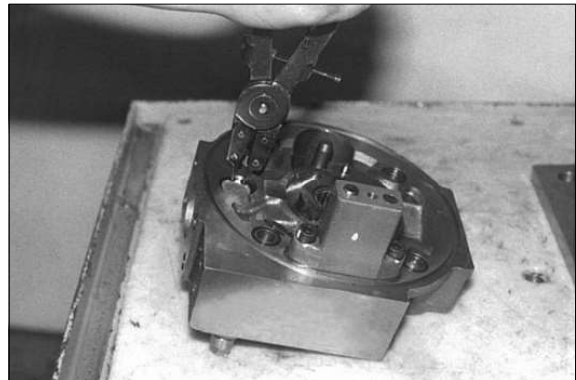
HW60A7MP21

(24) Assemble the filter to the port plate.



HW60A7MP20

(25) Assemble the retaining ring. (for hole: 25)



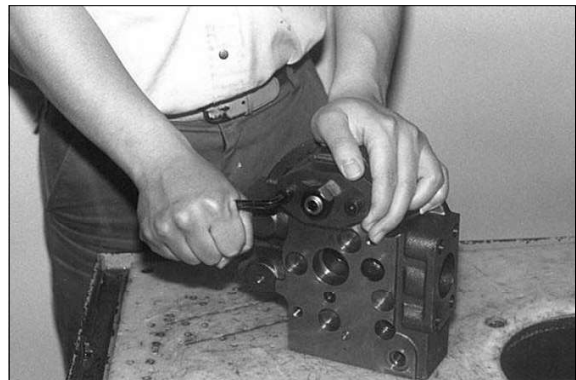
HW60A7MP19

(26) Assemble the spring seat into the port plate.



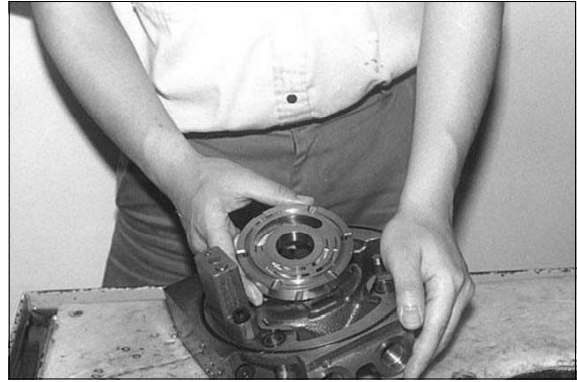
HW60A7MP19

(27) Assemble the cover of the control spring and fix it with hexagonal socket headed bolts. (M8×30, 2pieces)
· Hexagonal bar spanner
(Hex. side distance : 6)
Tightening torque : 2.9 ~ 3.5kgf · m



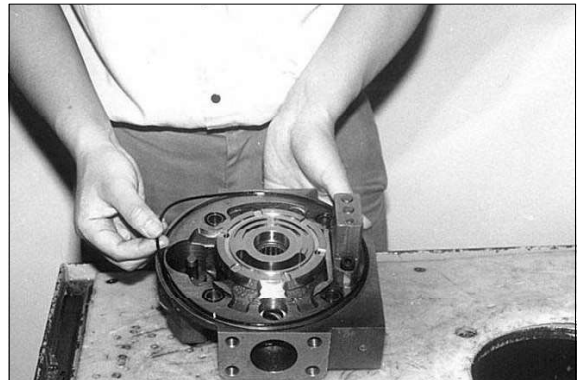
HW60A7MP74

- (28) Apply grease to the back side of the control plate, (to prevent dislodgement), and assemble it to the port plate while matching knock holes.



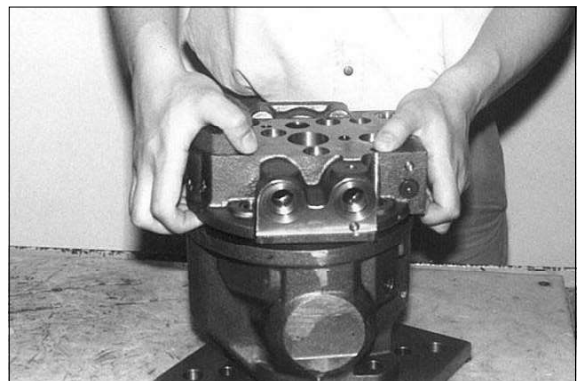
HW60A7MP75

- (29) Assemble the O-ring.



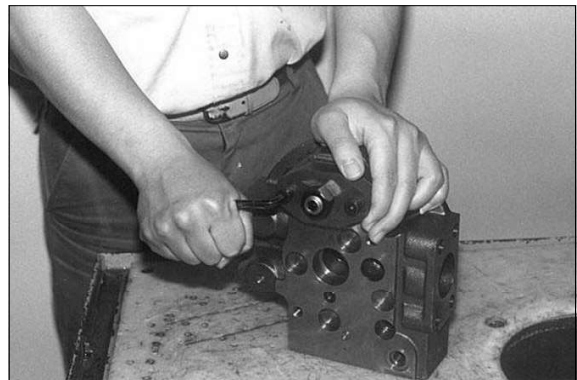
HW60A7MP76

- (30) Assemble the port plate parallel to the housing mounting surface.



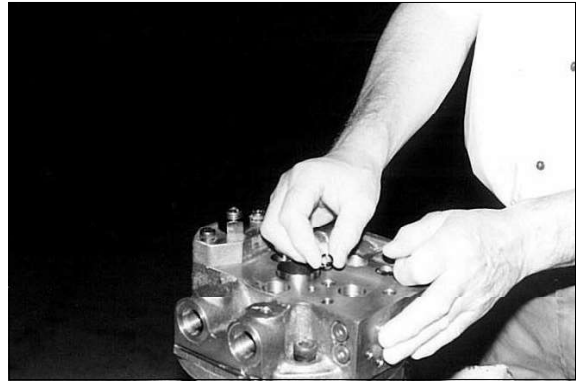
HW60A7MP77

- (31) **Fix the port plate with the hexagon socket head cap screws.**
(M12 × 30, 3pieces)
(M12 × 55, 1piece)
Hexagon bar spanner.
(Hex. side distance : 10)
Tightening torque : 10~12.4 kgf·m



HW60A7MP74

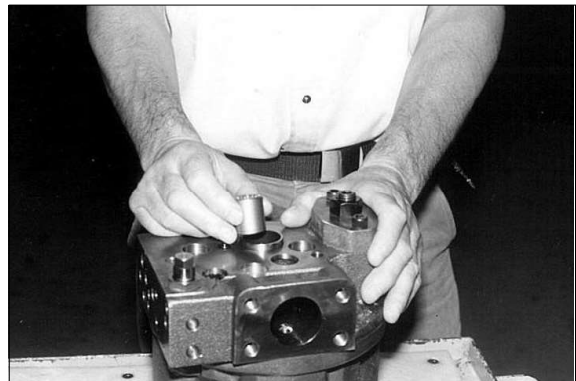
(32) Assemble the O-ring and bush.



HW60A7MP78

2) ATTACH THE GEAR PUMP

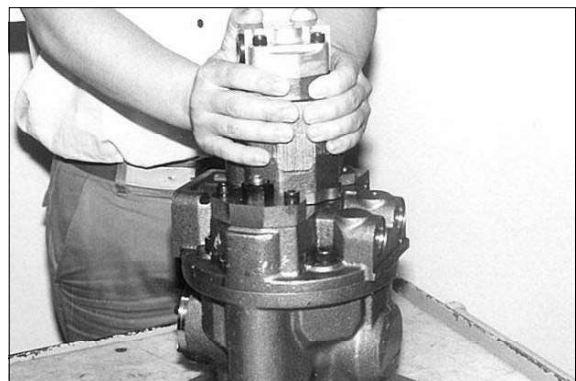
(1) Assemble the coupling to the shaft end on the main pump.



HW60A7MP79

(2) Connect the main pump and the gear pump and fix the gear pump with the hexagon socket head cap screws.

- (M10 × 25, 2pieces)
- Hexagon socket screw ke
(Hex. side distance : 8)
- Tightening torque : 5.6 ~ 7.0kgf · m

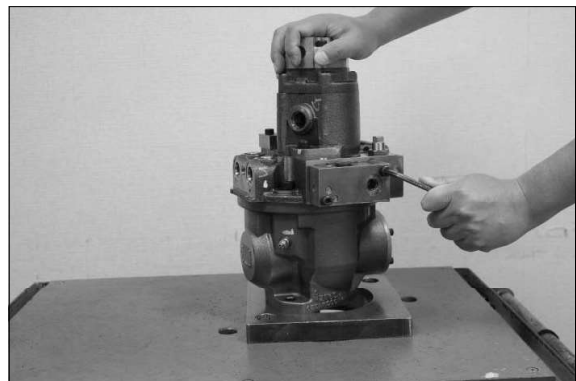


HW60A7MP80

3) ATTACH THE VALVE ASSEMBLY

Fix the body with the hexagon socket head cap screws. (M8 × 40, 2pieces)

- Hexagon socket screw key.
(Hex. side distance : 6)
- Tightening torque : 3.0 ~ 3.6kgf · m



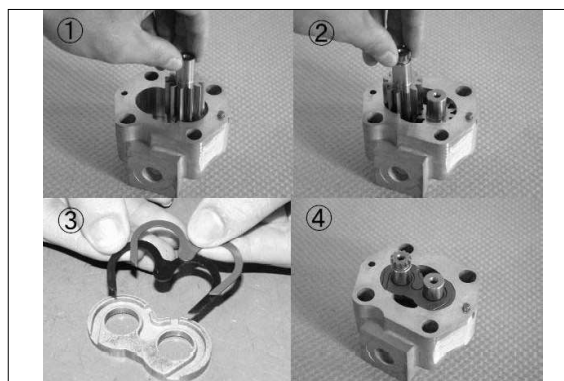
HW60A7MP81

4) ASSEMBLING THE GEAR PUMP

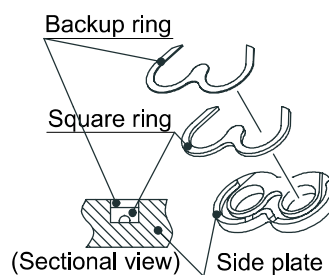
- (1) Assembling the idle and drive gear into the housing.

Assemble the side plate assy.

Apply grease to the square ring and backup ring to prevent dislodgment and assemble the min this order.



HW60A7MP82



HW65AH7MP83

- (2) Assembling the two parallel pins into the intermediate frame.



HW60A7MP84

- (3) Assemble the intermediate frame.

- ①.② Assemble the two parallel pins and O-ring.

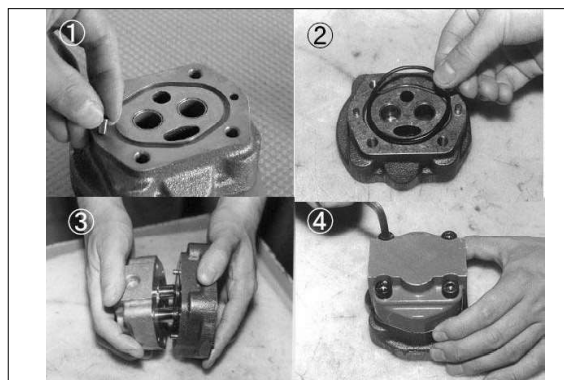
- ③.④ Fix the hexagon socket head cap screws.

(M8 × 45, 4pieces)

Hexagon socket screw key.

(Hex. side distance : 6)

Tightening torque : 3.0 kgf·m

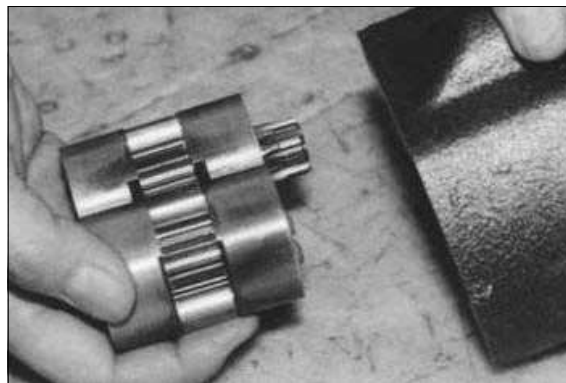


HW60A7MP85

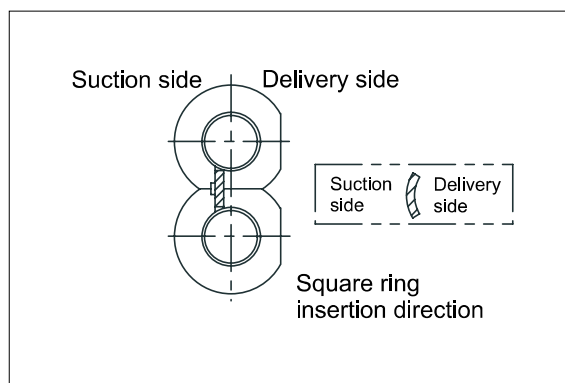
(4) ASSEMBLE THE GEAR PUMP

Assemble the square ring into the side plate.

- ※ Pay attention to the suction and delivery directions.



HW60A7MP86

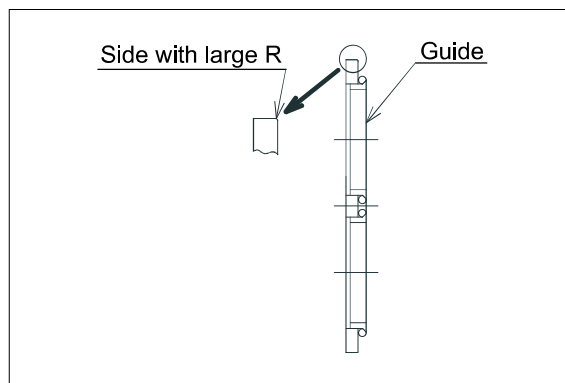


HW65AH7MP87

- (5) Insert the O-ring into the guides, then insert them into the plate.

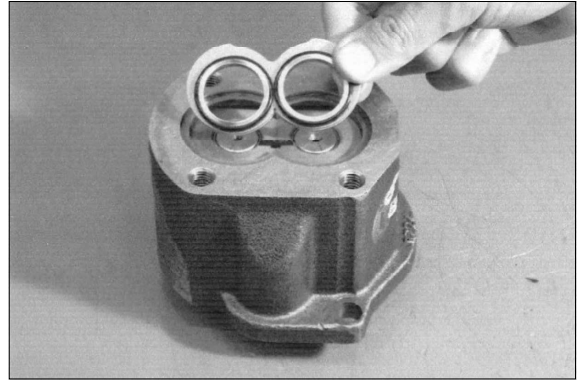


HW60A7MP88

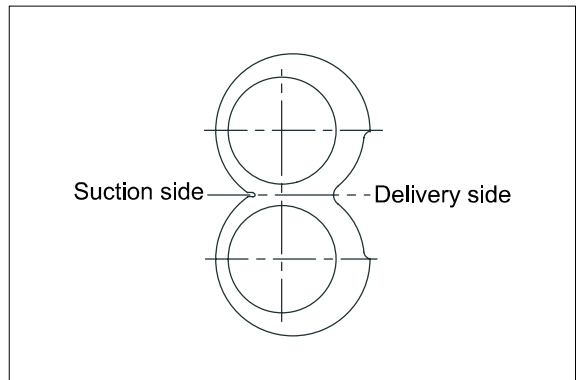


HW65AH7MP89

- (6) Assemble the plate, guides and O-rings.
※ Pay attention to the suction and delivery directions.

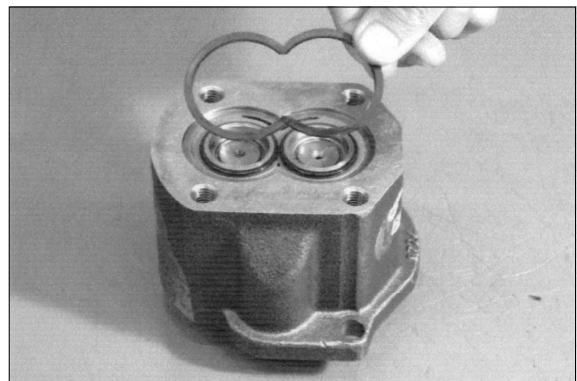


HW60A7MP90



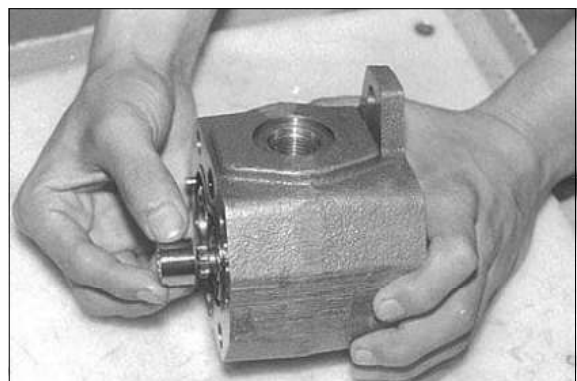
HW60A7MP91

- (7) Assemble the square ring.



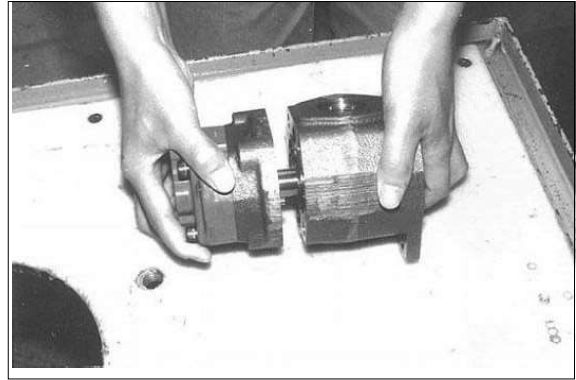
HW60A7MP92

- (8) Assemble the coupling to the drive shaft.



HW60A7MP93

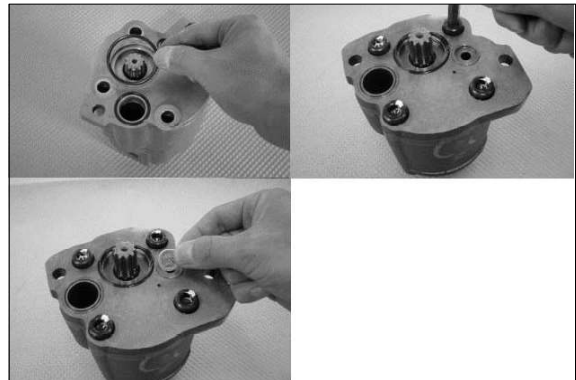
- (9) Front gear pump (GSP2) and rear gear pump (G1) are connected.



HW60A7MP94

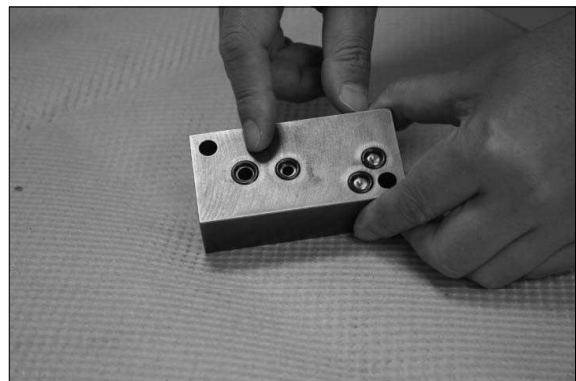
(10) ASSEMBLE THE GEAR PUMP

- ① Assemble the O-ring.
- ② Fix the hexagon socket head cap screws (M10×90, 4pieces)
 - Hexagon socket screw key.
 - (Hex. side distance : 8)
 - Tightening torque : 5.6 ~ 7.0kgf · m



HW60A7MP95

- 5) Assemble the body.
Assemble the O-ring.



HW60A7MP36

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

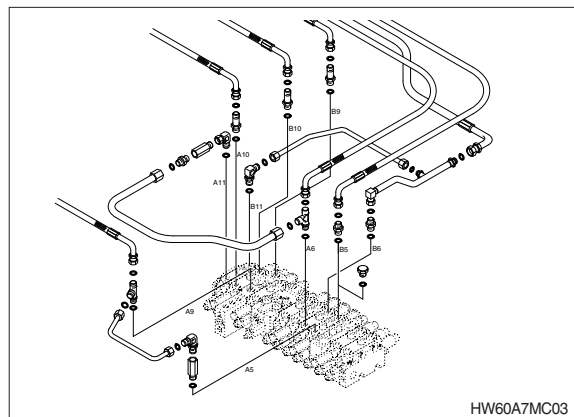
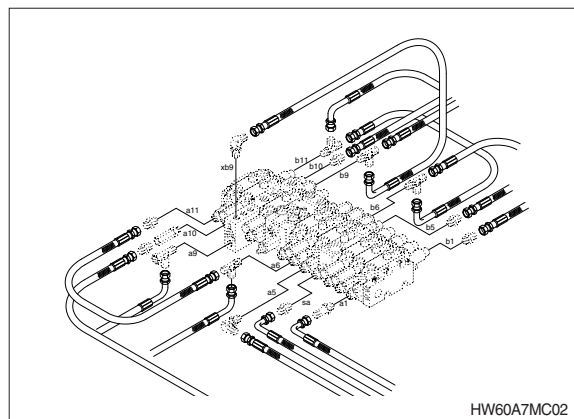
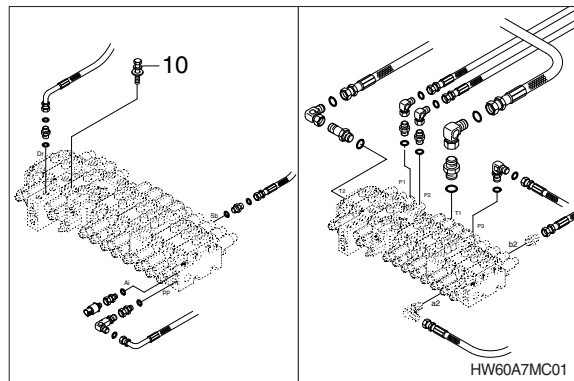
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect hydraulic hose.
- (5) Disconnect pilot line hoses.
- (6) Remove link.
- (7) Sling the control valve assembly and remove the control valve mounting bolt.
· Weight : 40 kg (90 lb)
- (8) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

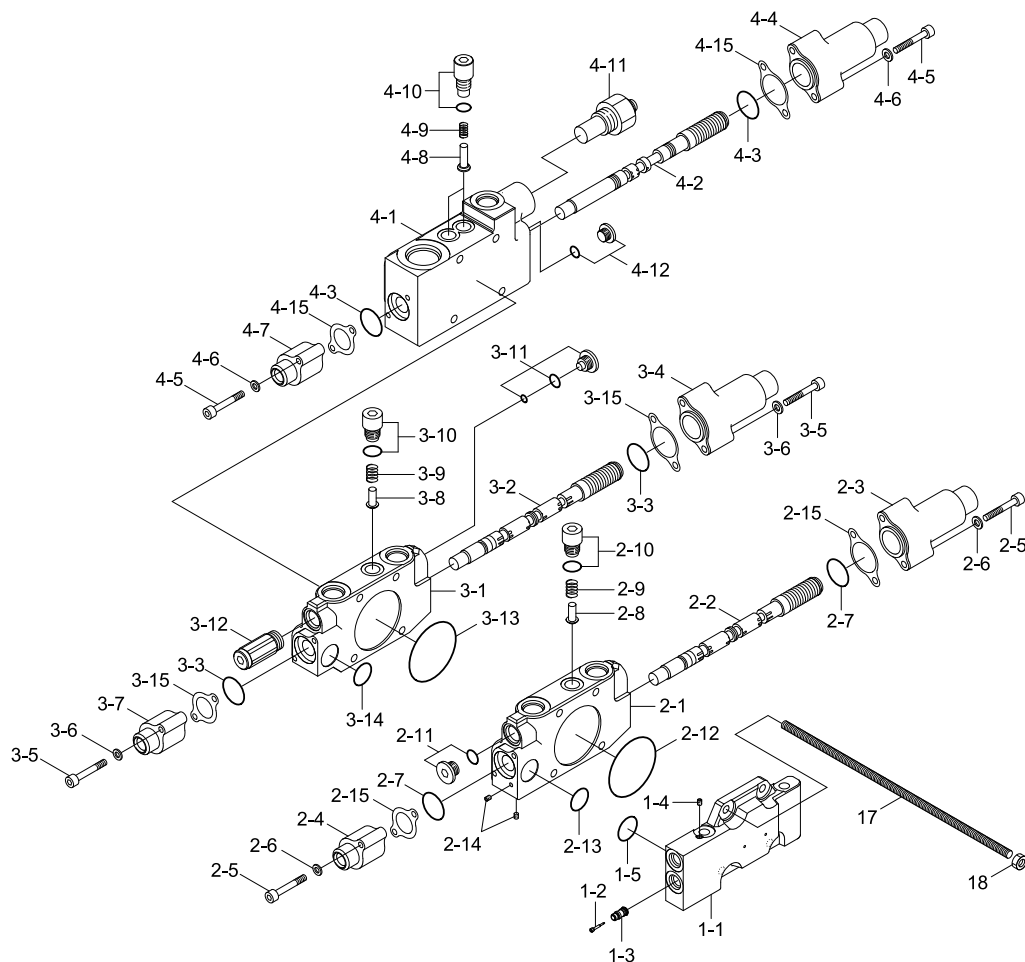
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from below items.
 - ① Cylinder (boom, arm, bucket)
 - ② Swing motor
 - ③ Travel motor

※ See each item removal and install.
- (3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



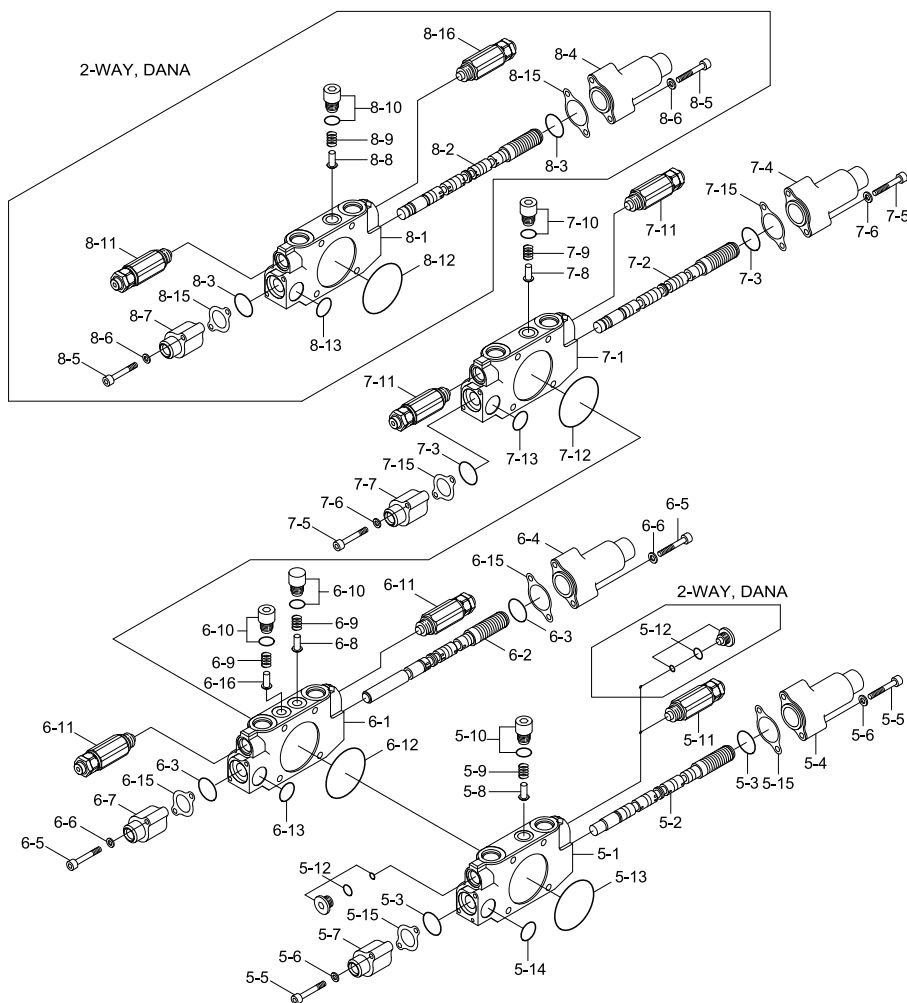
2. STRUCTURE (1/4)



HW60A2MC03

1	Cover	2-12	O-ring	3-14	O-ring
1-1	Cover	2-13	O-ring	3-15	Gasket
1-2	Orifice	2-14	Screw	4	Inlet block assy (P3)
1-3	Filter	2-15	Gasket	4-1	Work block
1-4	Screw	3	Dozer block	4-2	Select spool
1-5	O-ring	3-1	Work block	4-3	O-ring
2	Swing block assy	3-2	Dozer spool assy	4-4	Pilot cap (A)
2-1	Work block	3-3	O-ring	4-5	Wrench bolt
2-2	Spool assy-Swing	3-4	Pilot cap (A))	4-6	Plain washer
2-3	Pilot cap (A)	3-5	Wrench bolt	4-7	Pilot cap (B1)
2-4	Pilot cap (B1)	3-6	Plain washer	4-8	Check poppe
2-5	Wrench bolt	3-7	Pilot cap (B1)	4-9	Check spring
2-6	Plain washer	3-8	Check poppet	4-10	Plug
2-7	O-ring	3-9	Check spring	4-11	Main relief valve
2-8	Check poppet	3-10	Plug	4-12	Plug
2-9	Check spring	3-11	Plug	4-15	Gasket
2-10	Plug	3-12	Anti-cavitation valve	17	Tie bolt
2-11	Plug	3-13	O-ring	18	Nut

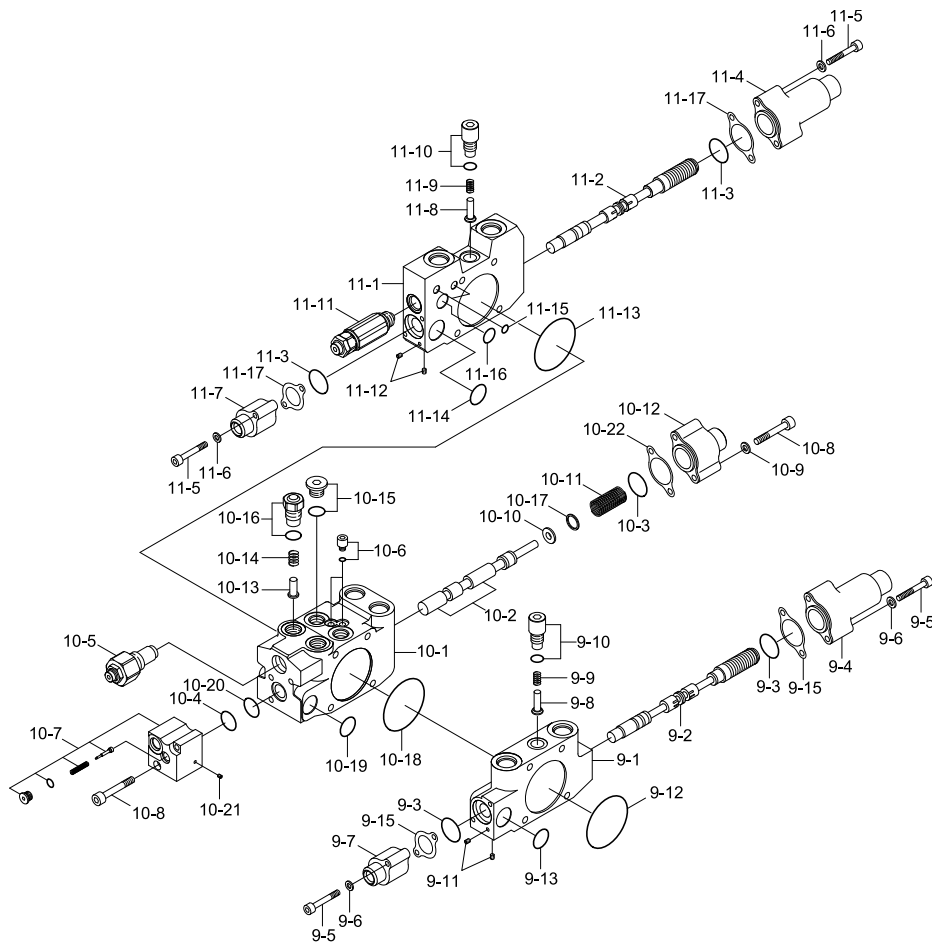
STRUCTURE (2/4)



HW60A2MC04

- | | | |
|----------------------------|----------------------------|----------------------------|
| 5 Boom 2 breaker | 6-5 Wrench bolt | 7-11 Overload relief valve |
| 5-1 Work block | 6-6 Plain washer | 7-12 O-ring |
| 5-2 Boom 2 spool assy | 6-7 Pilot cap (B1) | 7-13 O-ring |
| 5-3 O-ring | 6-8 Check poppet | 7-15 Gasket |
| 5-4 Pilot cap (A) | 6-9 Check spring | 8 Wood grab block |
| 5-5 Wrench bolt | 6-10 Plug assy | 8-1 Work block |
| 5-6 Plain washer | 6-11 Overload relief valve | 8-2 Rotator spool assy |
| 5-7 Pilot cap (B1) | 6-12 Plug assy | 8-3 O-ring |
| 5-8 Check poppet | 6-13 O-ring | 8-4 Pilot cap (A) |
| 5-9 Check spring | 6-14 O-ring | 8-5 Wrench bolt |
| 5-10 Plug assy | 6-15 Gasket | 8-6 Plain washer |
| 5-11 Overload relief valve | 7 Boom swing spool | 8-7 Pilot cap (B1) |
| 5-12 Plug assy | 7-1 Work block | 8-8 Check poppet |
| 5-13 O-ring | 7-2 Boom swing spool | 8-9 Check spring |
| 5-14 O-ring | 7-3 O-ring | 8-10 Plug assy |
| 5-15 Gasket | 7-4 Pilot cap (A) | 8-11 Overload relief valve |
| 6 Arm 1 block assy | 7-5 Wrench bolt | 8-12 O-ring |
| 6-1 Work block | 7-6 Plain washer | 8-13 O-ring |
| 6-2 Arm 1 spool assy | 7-7 Pilot cap (B1) | 8-15 Gasket |
| 6-3 O-ring | 7-8 Check poppet | 8-16 Overload relief valve |
| 6-4 Pilot cap (A1) | 7-9 Check spring | |
| | 7-10 Plug assy | |

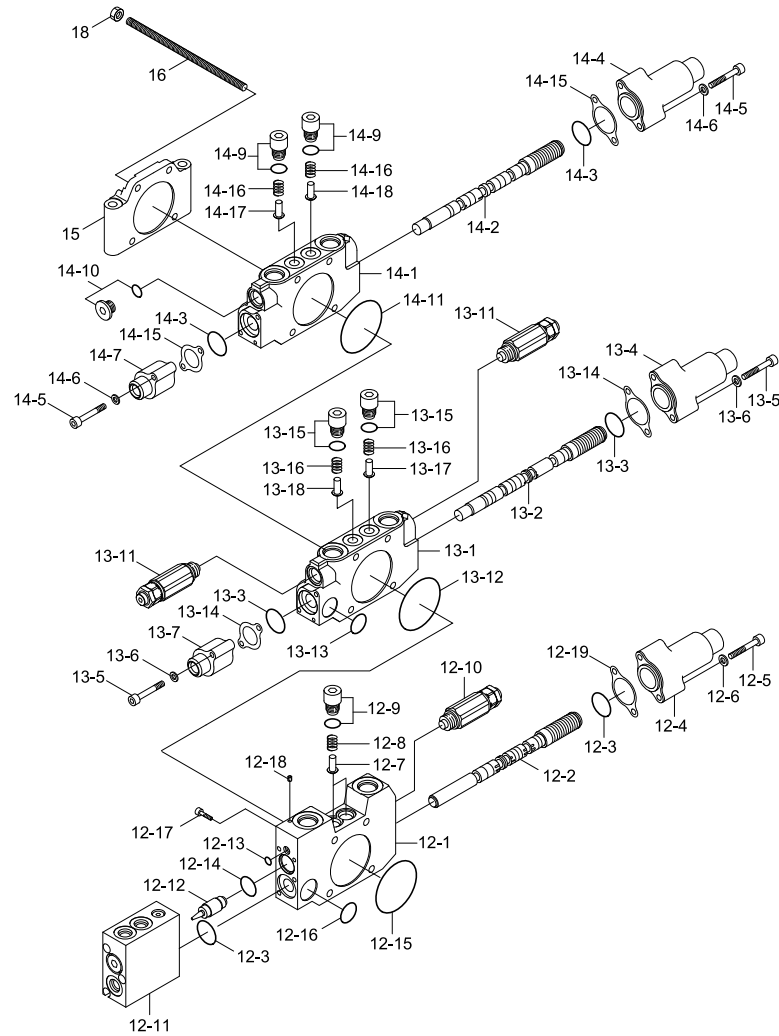
STRUCTURE (3/4)



HW60A2MC05

9	Travel block assy	10-4	O-ring	11	Travel block assy
9-1	Work block	10-5	Main relief valve	11-1	Work block
9-2	Travel spool assy	10-6	Plug	11-2	Travel spool assy
9-3	O-ring	10-7	Pilot cap (B3)	11-3	O-ring
9-4	Pilot cap (A)	10-8	Wrench bolt	11-4	Pilot cap (A)
9-5	Wrench bolt	10-9	Plain washer	11-5	Wrench bolt
9-6	Plain washer	10-10	Spring seat	11-6	Plain washer
9-7	Pilot cap (B1)	10-11	Pilot spring	11-7	Pilot cap (B1)
9-8	Check poppet	10-12	Pilot cap (B2)	11-8	Check poppet
9-9	Check spring	10-13	Check poppet	11-9	Check spring
9-10	Plug	10-14	Check spring	11-10	Plug
9-11	Screw	10-15	Plug	11-11	Overload relief valve
9-12	O-ring	10-16	Plug	11-12	Set screw
9-13	O-ring	10-17	Spring shim	11-13	O-ring
9-15	Gasket	10-18	O-ring	11-14	O-ring
10	Inlet assy	10-19	O-ring	11-15	O-ring
10-1	Work block	10-20	O-ring	11-16	O-ring
10-2	Travel spool assy	10-21	Screw	11-17	Gasket
10-3	O-ring	10-22	Gasket		

STRUCTURE



HW60A2MC06

12 Boom block assy	12-19 Gasket	14-1 Block assy
12-1 Block assy	13 Bucket block	14-2 Arm 2 spool assy
12-2 Boom spool assy	13-1 Block assy	14-3 O-ring
12-3 O-ring	13-2 Bucket spool assy	14-4 Pilot cap (A)
12-4 Pilot cap (A)	13-3 O-ring	14-5 Wrench bolt
12-5 Wrench bolt	13-4 Pilot cap (A)	14-6 Plain washer
12-6 Plain washer	13-5 Wrench bolt	14-7 Pilot cap (B1)
12-7 Check poppet	13-6 Plain washer	14-9 Plug
12-8 Check spring	13-7 Pilot cap (B1)	14-10 Gasket
12-9 Plug assy	13-11 Overload relief valve	14-11 O-ring
12-10 Overload relief valve	13-12 O-ring	14-15 Gasket
12-11 Holding valve (A)	13-13 O-ring	14-16 Check spring
12-12 Holding valve (B)	13-14 Gasket	14-17 Check poppet
12-13 O-ring	13-15 Plug assy	14-18 Check poppet
12-14 O-ring	13-16 Check spring	15 Cover
12-15 O-ring	13-17 Check poppet	16 Tie bolt
12-16 O-ring	13-18 Check poppet	18 Nut
12-17 Work block	14 Arm 2 block	
12-18 Screw		

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

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

2) TOOLS

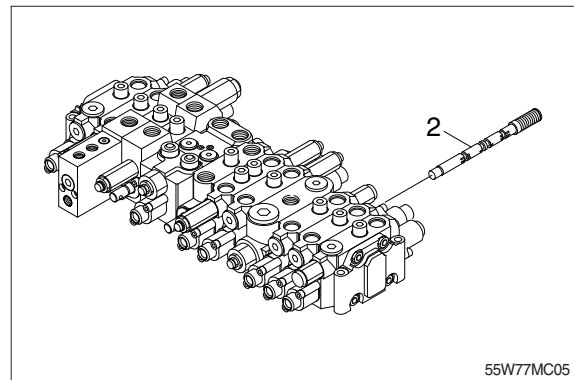
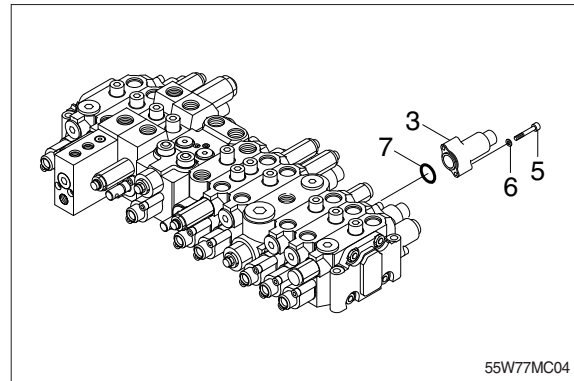
Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	5 and 6
Spanner	Each 1 piece	13, 21 and 30
Rod	1 piece	Less than 10 × 250

3) DISASSEMBLY

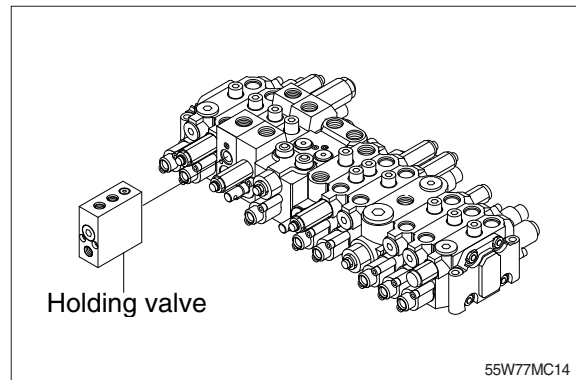
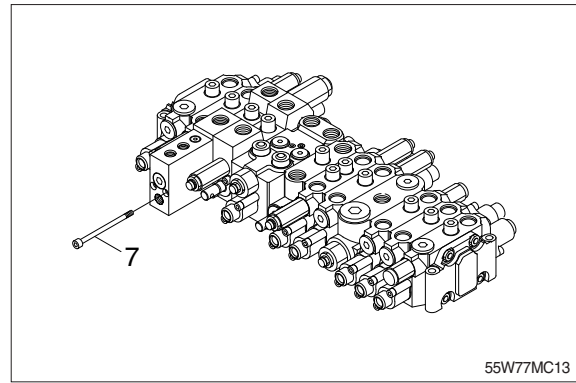
(1) Disassembly of spools

- ① Loosen hexagon socket head bolts (5) with washer (6).
(Hexagon wrench : 5 mm)
- ② Remove the pilot cover (3).
 - ※ Pay attention not to lose the O-ring (7) under the pilot cover.
- ③ Remove the spool assembly (2) from the body by hand slightly.
 - ※ When extracting each spool from its body, pay attention not to damage the body.
 - ※ When extracting each spool assembly, it must be extracted from spring side only.
 - ※ When any abnormal parts are found, replace it with completely new spool assembly.
 - ※ When disassembled, tag the components for identification so that they can be reassembled correctly.



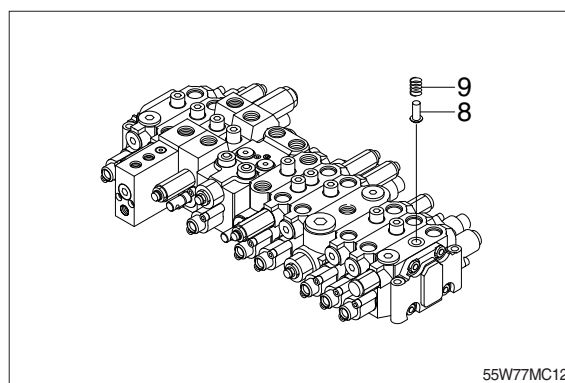
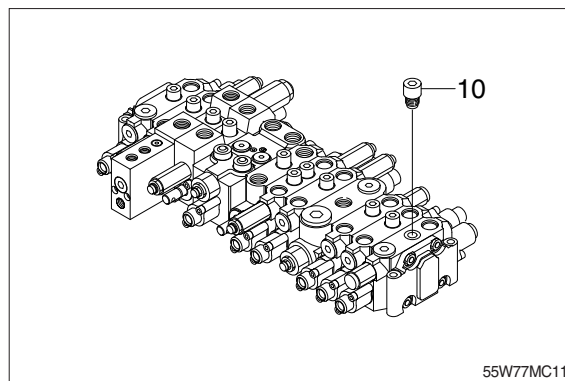
(2) Disassembly of holding valve (boom 1)

- ① Loosen hexagon socket head bolts (7).
(hexagon wrench : 5 mm)
- ② Remove the holding valve.
 - ※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
 - ※ Pay attention not to damage the "piston A" under pilot cover.
 - ※ When any abnormal parts are found, replace it with completely new holding valve assembly.
 - ※ When disassembled, tag the components for identification so that they can be reassembled correctly.



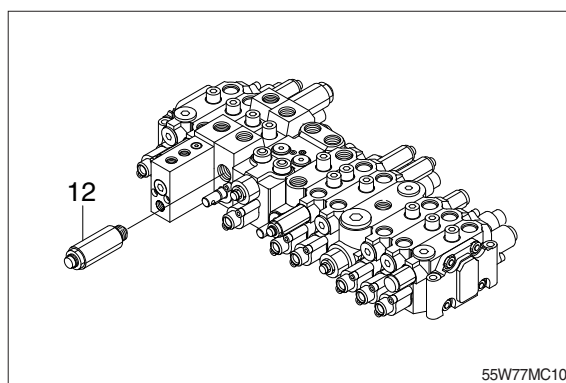
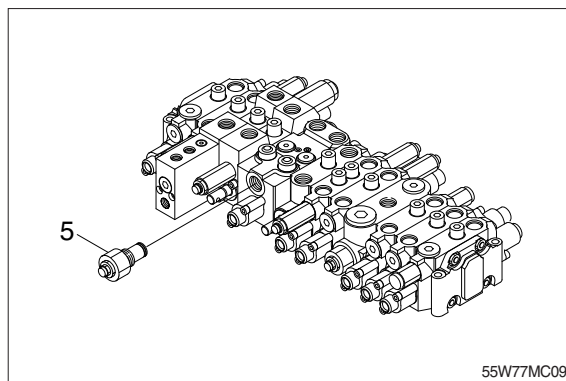
(3) Disassembly of the load check valve and the negative relief valve

- ① The load check valve
 - a. Fix the body to suitable work bench.
 - ※ Pay attention not to damage the body.
 - b. Loosen the plug (10)
(hexagon wrench : 10 mm).
 - c. Remove the spring (9) and the load check valve (8) with pincers or magnet.



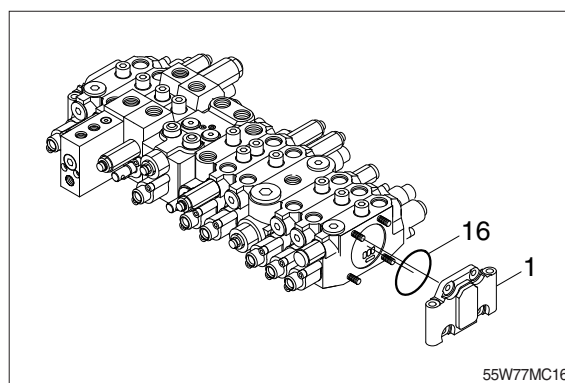
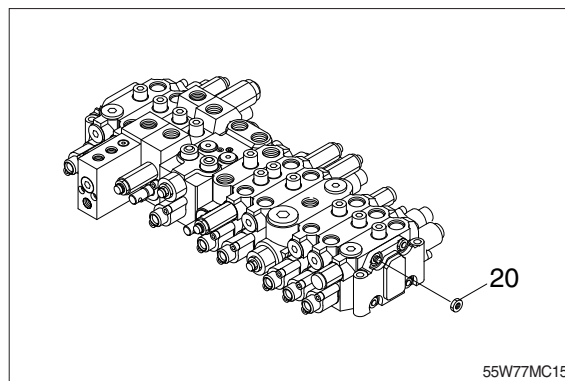
(4) Disassembly of the main and overload relief valve

- ① Fix the body to suitable work bench.
 - ② Remove the main relief valve (5).
(spanner : 30 mm)
 - ③ Remove the overload relief valve (12).
(spanner : 22 mm)
- ※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.
 - ※ Pay attention not to damage seat face.
 - ※ When any abnormal parts are found, replace it with completely new relief valve assembly.



(5) Disassembly of the block assembly

- ① Fix the body to suitable work bench.
- ② Remove the nut (20).
(spanner : 13 mm)
 - ※ The work block is assembled by two sets of tie-bolts.
- ③ Remove the end cover (1) and the work blocks.
 - ※ Do not removed the tie bolt.
 - ※ Pay attention not to lose the O-ring (16).



(6) Inspection after disassembly

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

① Control valve

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

② Relief valve

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

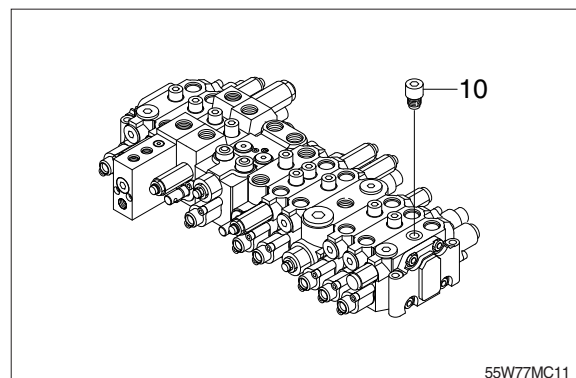
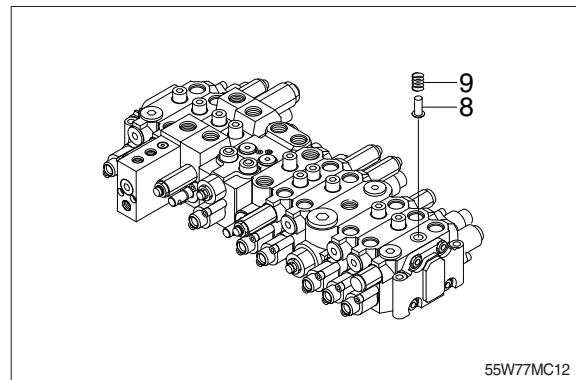
4) ASSEMBLY

(1) General precaution

- ① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures shown in the previous structure & disassembly section.
- ② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
- ③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
- ④ Do not stretch seals so much as to deform them permanently.
- ⑤ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
- ⑥ Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
- ⑦ Do not reuse removed O-rings and seals.

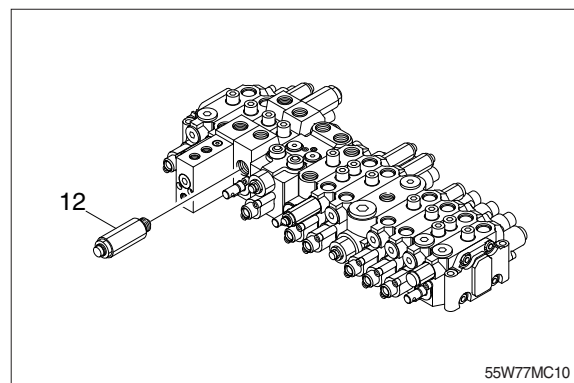
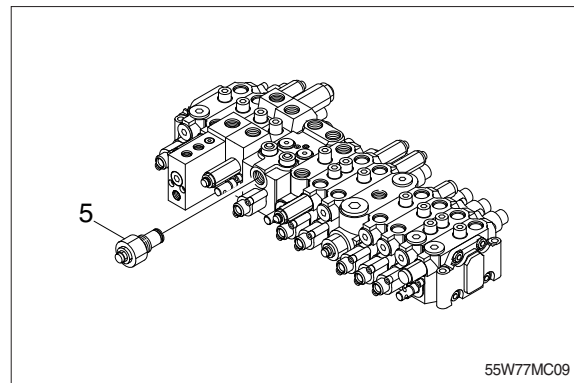
(2) Load check valve

- ① Assemble the load check valve (8) and spring (9).
- ② Put O-rings on to plug (10).
- ③ Tighten plug to the specified torque.
 - Hexagon wrench : 8 mm
 - Tightening torque : 3.7 kgf · m
(26.7 lbf · ft)



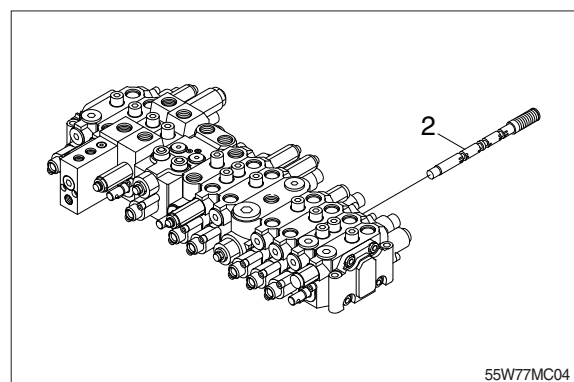
(3) Main relief, port relief valves

- ① Install the main relief valve (5).
 - Spanner : 30 mm
 - Tightening torque : 6 kgf · m (43.4 lbf · ft)
- ② Install the over load relief valve (12).
 - Spanner : 22 mm
 - Tightening torque : 4 kgf · m (28.9 lbf · ft)



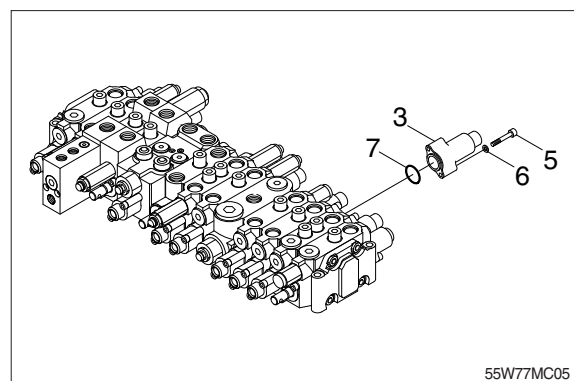
(4) Main spools

- ① Carefully insert the previously assembled spool assemblies into their respective bores within of body.
- ※ Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.



(5) Covers

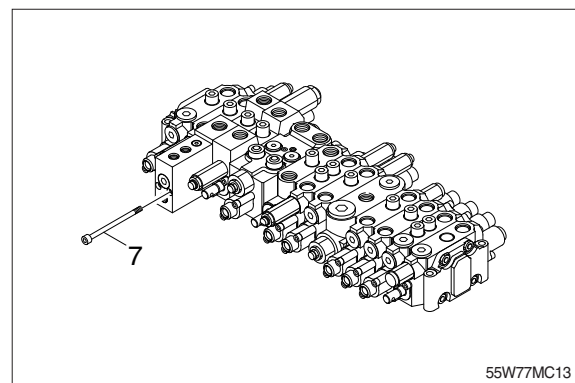
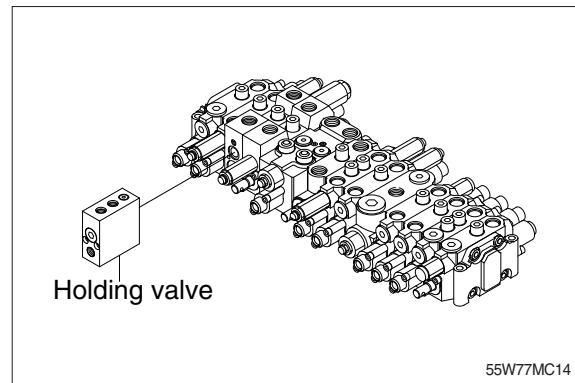
- ① Fit spool covers (3) tighten the hexagonal socket head bolts (5) to the specified torque.
- Hexagon wrench : 5 mm
 - Tightening torque : 1~1.1 kgf · m
(7.2~7.9 lbf · ft)
- ※ Confirm that O-rings (7) have been fitted.



(6) Holding valve

- ① Fit the holding valve to the body and tighten hexagon socket head bolt (7) to specified torque.

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

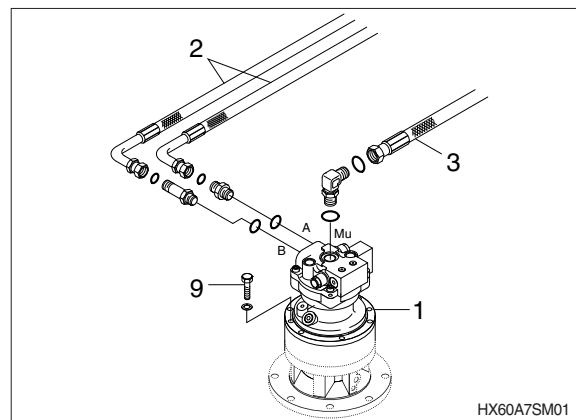


GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

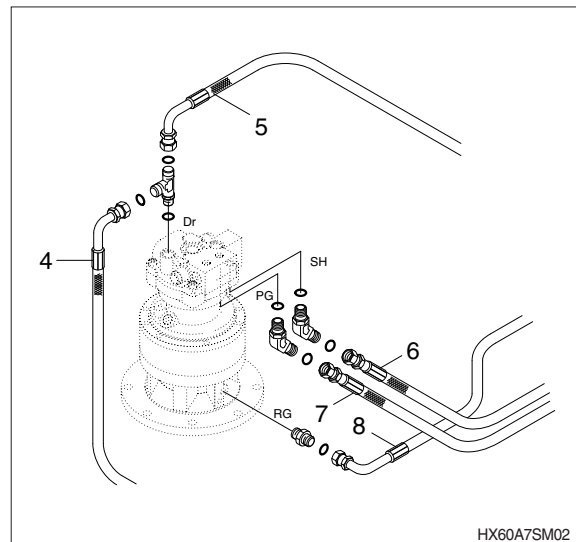
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ **Escaping fluid under pressure can penetrate the skin causing serious injury.**
 - ※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Disconnect hose assembly (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.

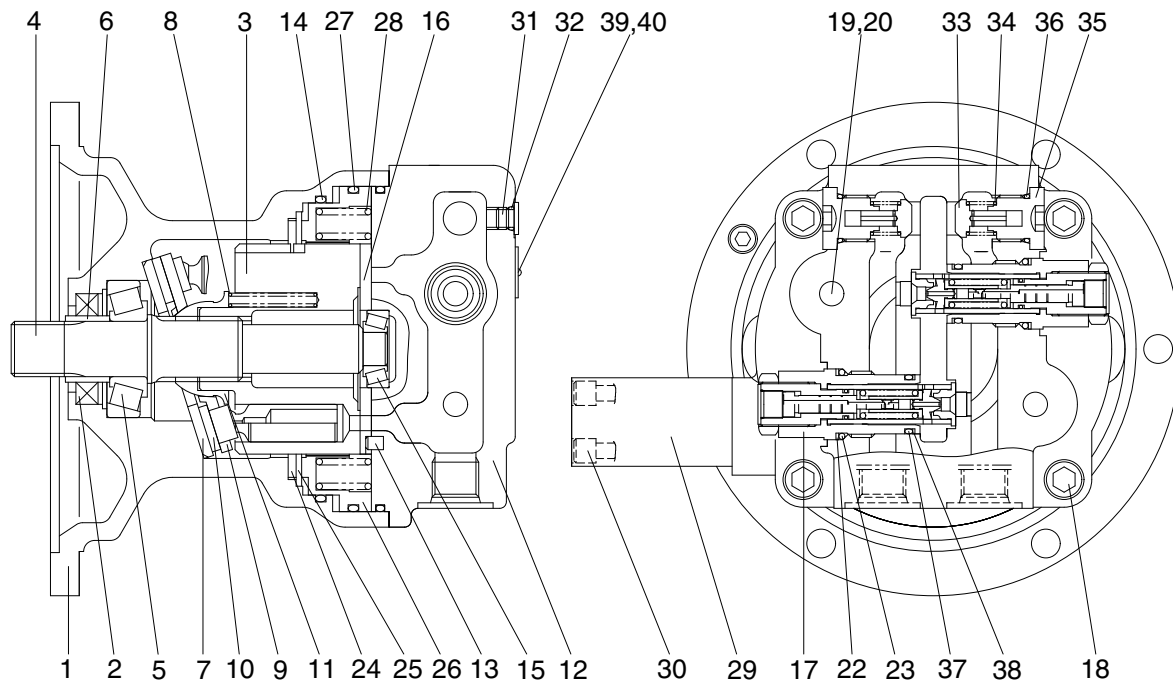
2) INSTALL

- (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

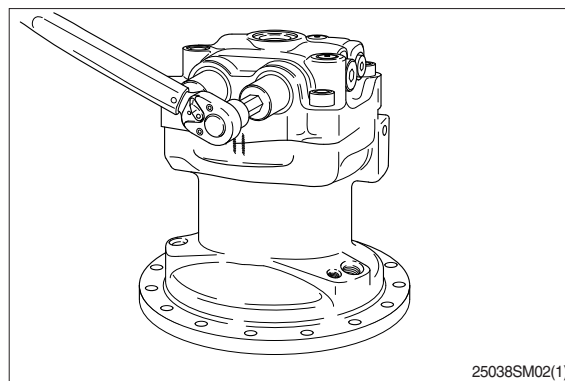


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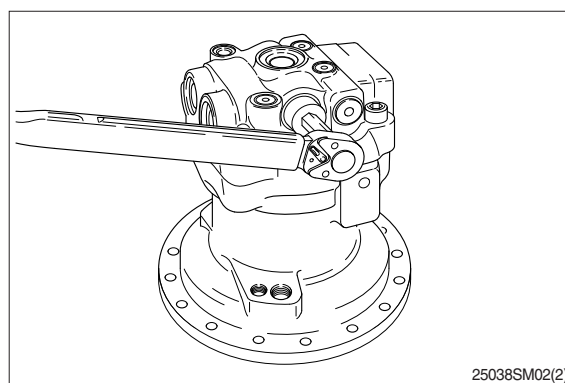
1 Body	15 Taper bearing	29 Time delay valve
2 Oil seal	16 Valve plate	30 Socket bolt
3 Cylinder block	17 Relief valve assy	31 Plug
4 Shaft	18 Socket bolt	32 O-ring
5 Taper bearing	19 Plug	33 Valve
6 Bushing	20 Plug	34 Spring
7 Swash plate	21 O-ring	35 Plug
8 Spring	22 Back up ring	36 O-ring
9 Set plate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

2) DISASSEMBLY

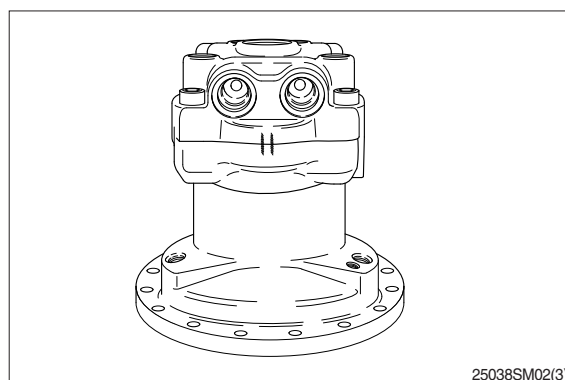
- (1) Removal of relief valve assembly
Remove cap of relief valve assembly (17) with 14 mm hexagonal wrench.
※ Assemble removed relief valve assembly (17) to original state when reassembling.



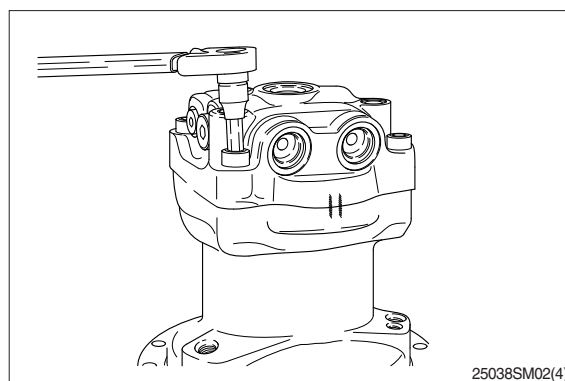
- (2) Removal of make up valve and bypass valve assembly
Loosen plug (35) with 14mm hexagonal wrench, and remove check valve (33) and spring (34).



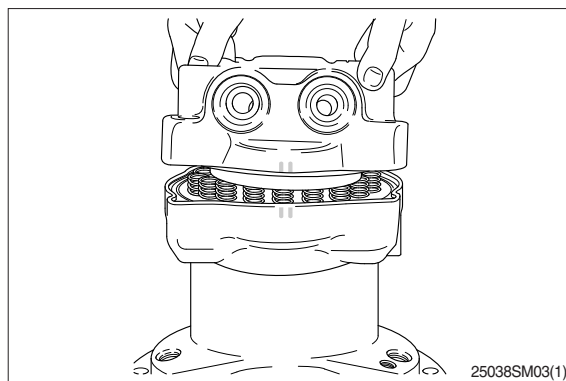
- (3) Marking at swing motor
Before disassembling motor, make a matching mark between cover (12) and housing (1) for easy reassembling.



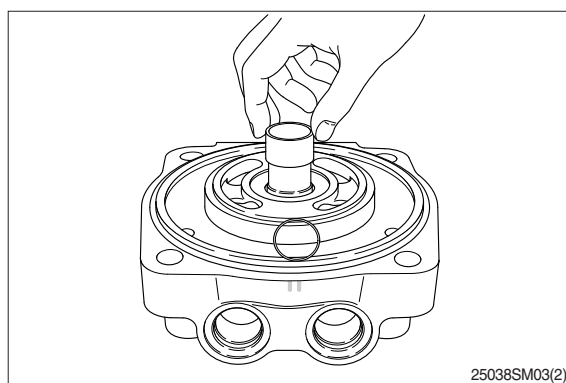
- (4) Remove mounting bolts of cover
Loosen hexagon socket bolt (18) with 12 mm hexagonal wrench.



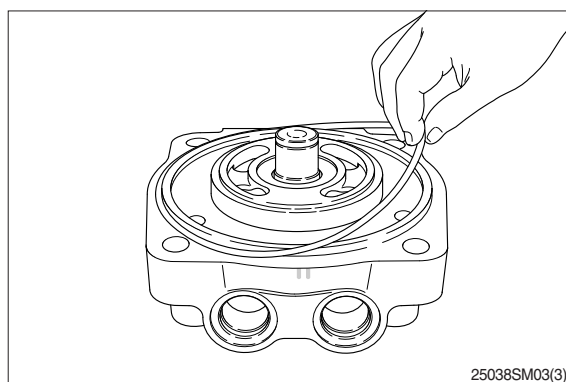
- (5) Removal of cover assembly
Place shaft of motor assembly to downward and take cover (12) out.



- (6) Remove inner race of needle bearing (15) by bearing puller.



- (7) Remove O-ring (27) from cover.



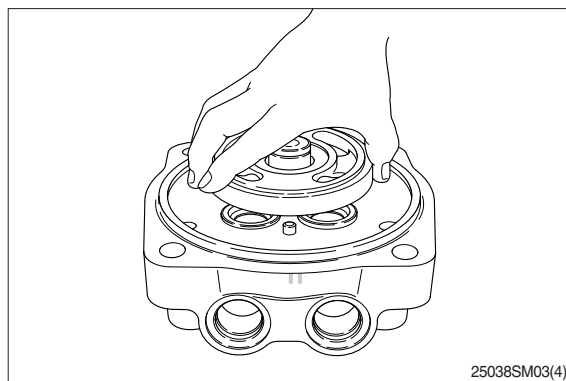
(8) Remove balance plate

Valve plate (16) is adhered on end surface of cylinder (3) by oil viscosity. Take off balance plate (16) with hands.

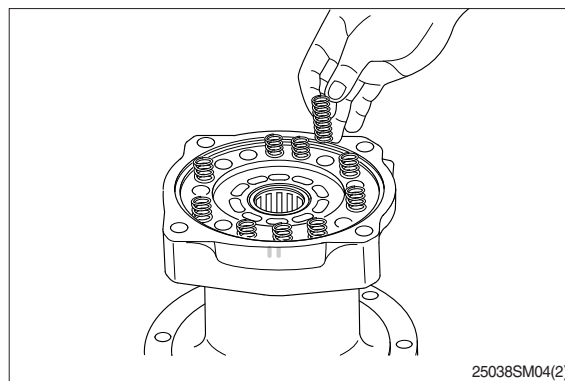
Assembling method of balance plate (16) depends on cover (12).

(band groove and round groove of high · low pressure transmission area)

Before removing, check and record location of balance plate (16) to prevent mis-assembling.

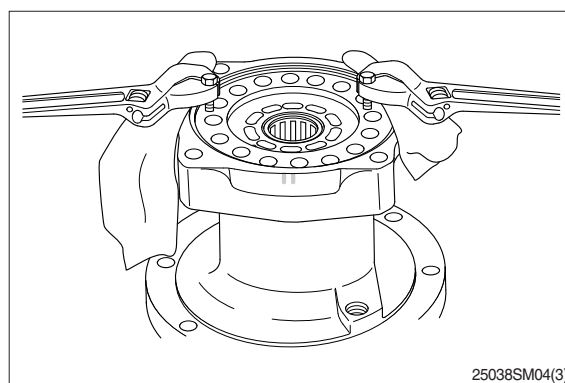


- (9) Removal of spring (28, brake area)
Remove spring (28) from piston (26).
Check and record original position of
each spring (28) for correct assembling.

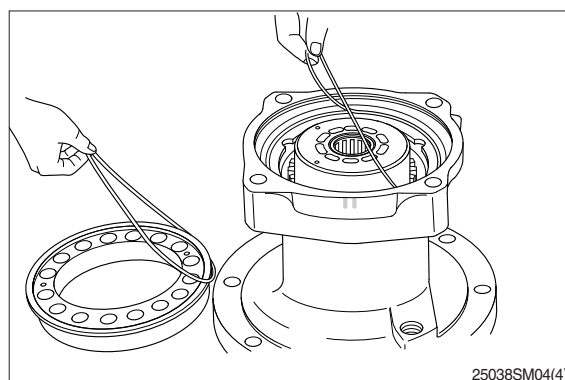


(10) Removal of brake piston

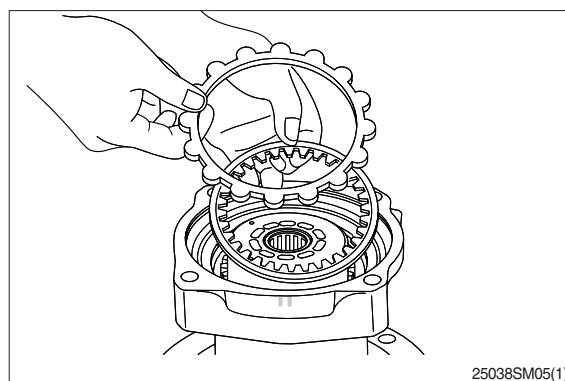
When removing piston (26) from housing (1), there is a sliding resistance against tightening of O-rings (14,27). Use tap hole on piston (26) as shown in the picture.



- (11) Remove O-rings (14,27) from piston (26) and housing (1).



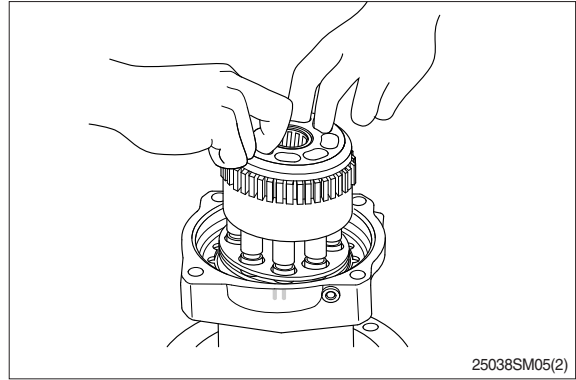
- (12) Remove friction plate (24) and lining plate (25) from housing (1).



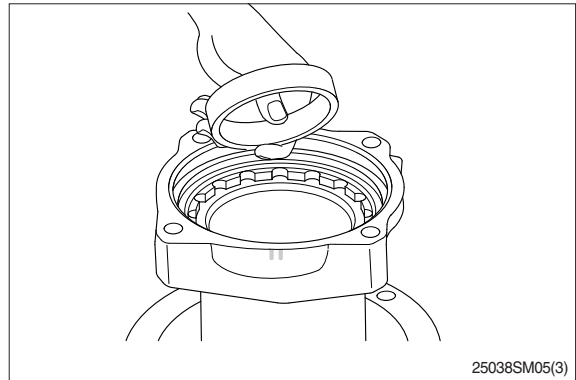
(13) Removal of cylinder assembly

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.



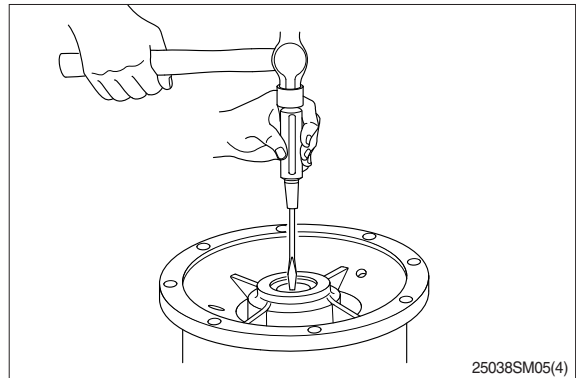
(14) Separate outer race of taper roller bearing (5) from housing.



(15) Removal of oil seal

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

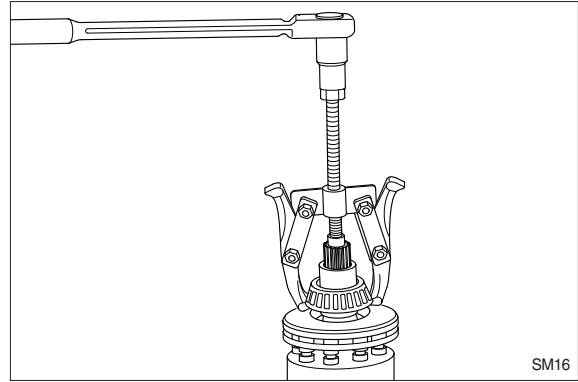
- ※ Do not reuse oil seal after removal.



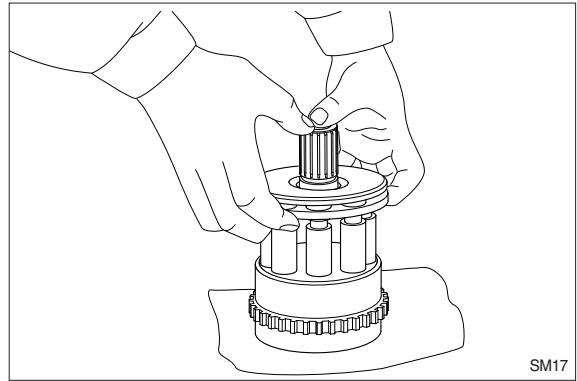
(16) Disassembly of cylinder assembly

- 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.

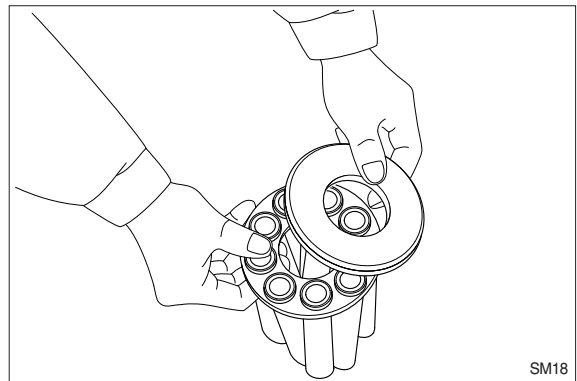


- ② Separate shoe plate (7), piston assembly (10), set plate (9) from cylinder block (3).

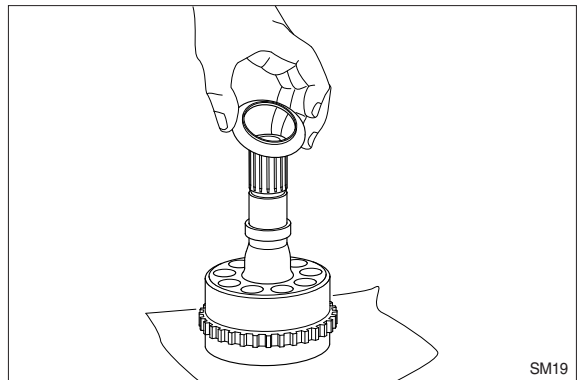


- ③ Get shoe plate (7) slide on sliding face of piston assembly (10) and remove it.

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



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



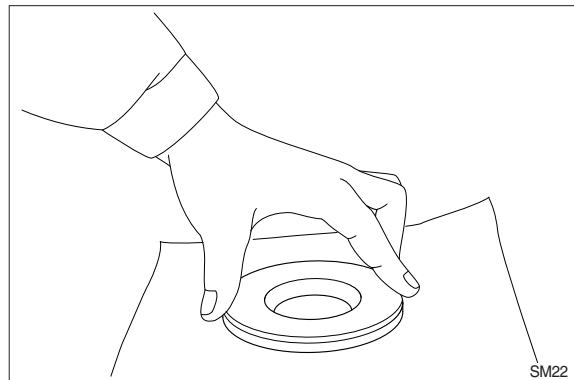
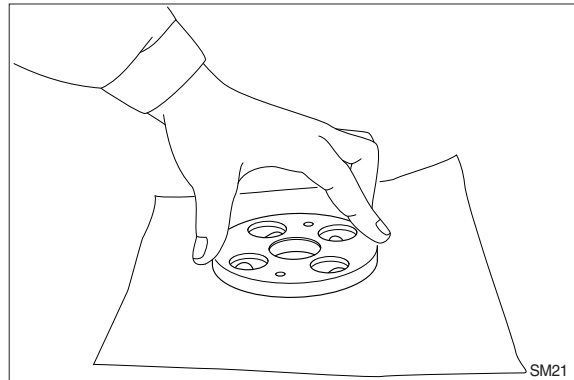
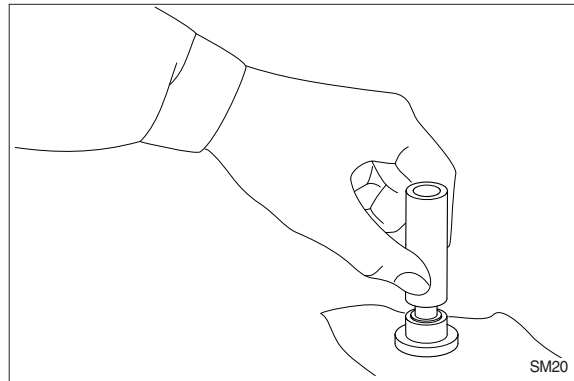
This completes disassembly.

3) ASSEMBLY

(1) Preparation

Before reassembling, perform below procedure.

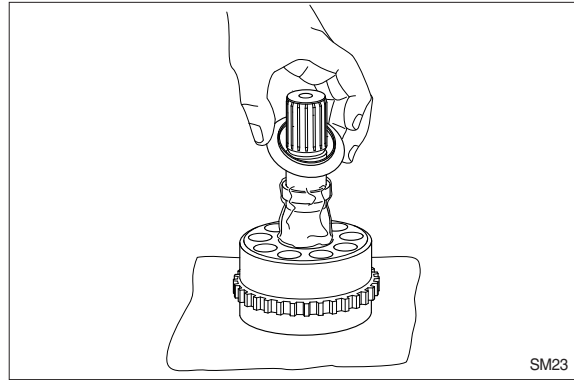
- ① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.
- ② Replace seal with new one.
- ③ Grind sliding face of piston assembly (10), balance plate (16) and shoe plate (7) with sandpaper #2000.



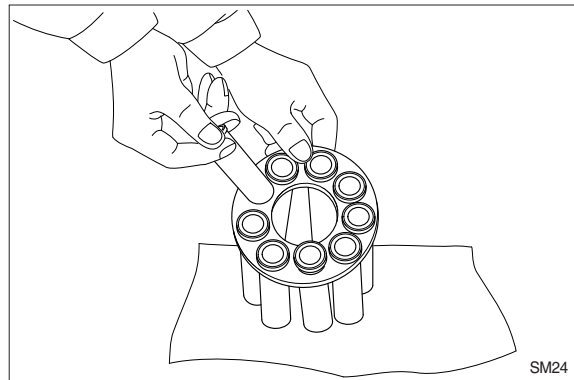
- ④ When assembling, lubricate with specified clean hydraulic oil.
- ⑤ When assembling piston assembly (10) to piston hole of cylinder block (3), check matching mark between them.

(2) Cylinder assembly

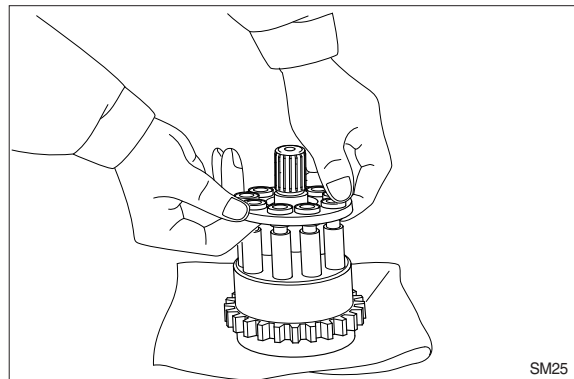
- ① Lubricate grease on round area (contacting area with ball guide (11)) of cylinder block (3) and assemble spring (4).



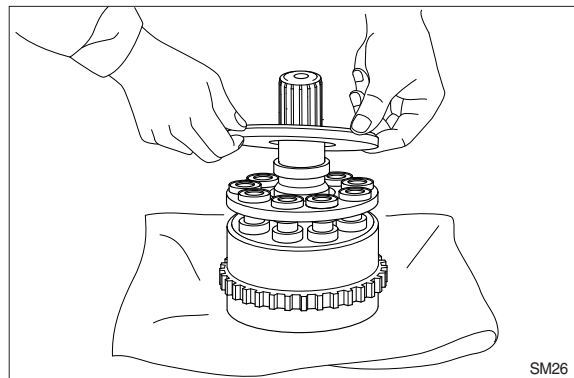
- ② Insert piston assembly (10) in hole of set plate (9).



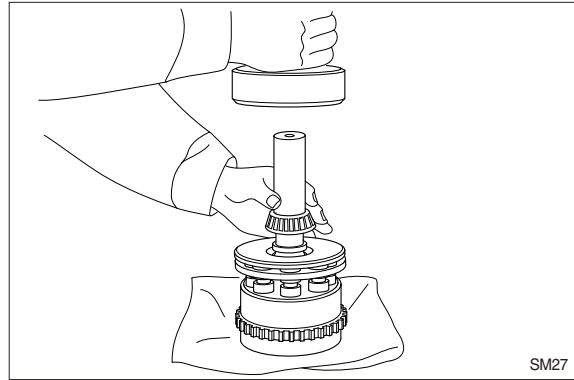
- ③ Assemble piston assembly (10) and set plate (9) to cylinder block (3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block (3).



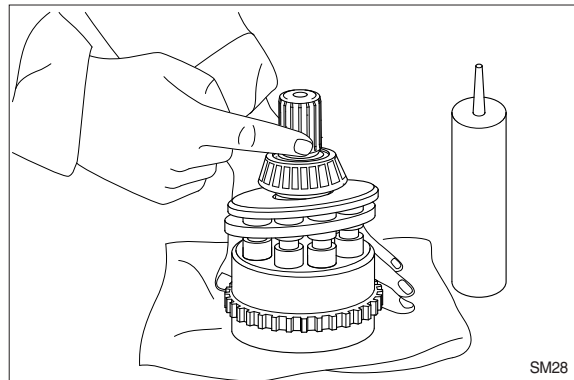
- ④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly (10) and assemble shoe plate (7).



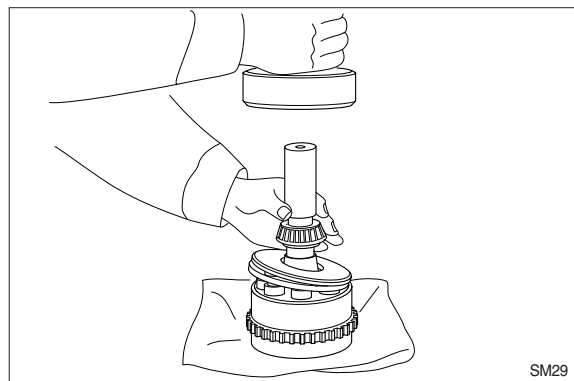
- ⑤ Assemble inner race of taper roller bearing (5) to cylinder block (3).



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



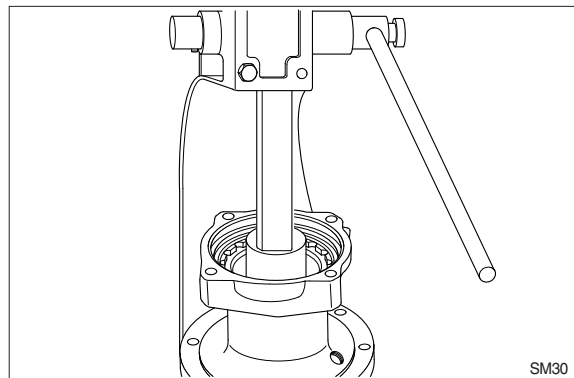
- ⑦ Assemble bushing (6) to cylinder block (3).



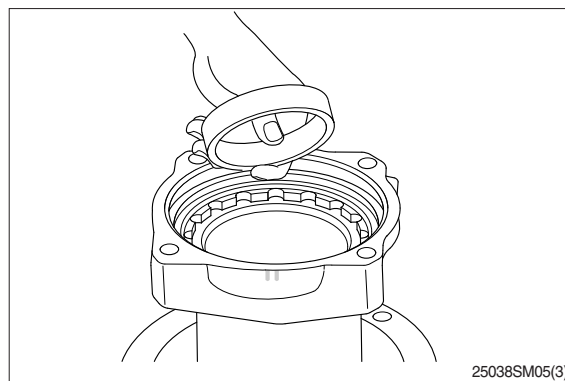
(3) Oil seal

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.



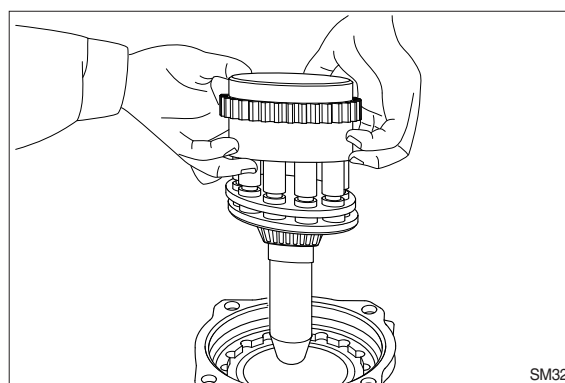
- (4) Assemble outer race of taper roller bearing (5) to motor housing (1).



(5) Cylinder assembly

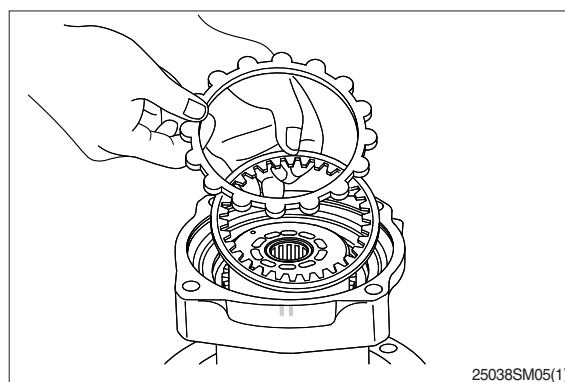
Hold end of cylinder assembly (3) with hands and assemble cylinder assembly to housing (1). Be careful to prevent damage of seal by spline of shaft.

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



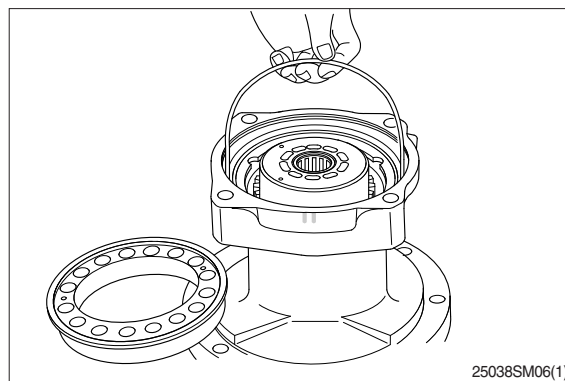
- (6) Assemble friction plate (24) and lining plate (25).

- ※ Lubricate specified hydraulic oil on each side.



- (7) Insert O-rings (14,27) into housing (1) and piston (26).

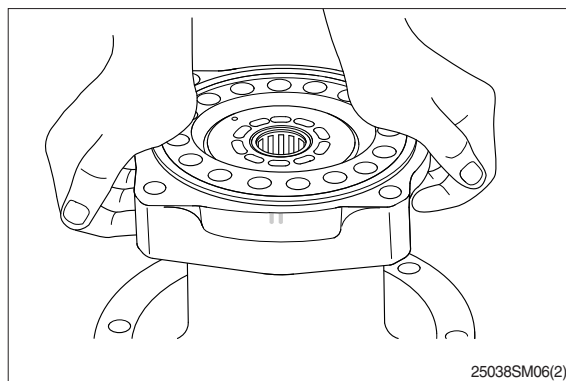
- ※ Lubricate O-ring with grease.



(8) Brake piston

Lubricate specified hydraulic oil on outer sliding face of piston (26) and assemble brake piston to housing (1).

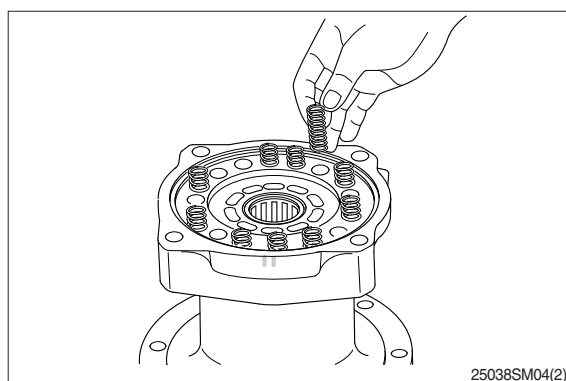
- ※ It is too tight to assemble piston (10) because O-rings (14,29) are fitted, therefore it is recommended to push piston (26) horizontally by hands at once.



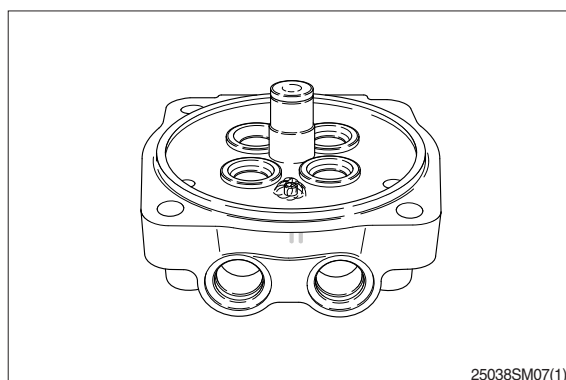
(9) Spring (28, brake unit)

Assemble spring (28) to piston (26) of brake unit.

- ※ Insert spring (28) into original position.



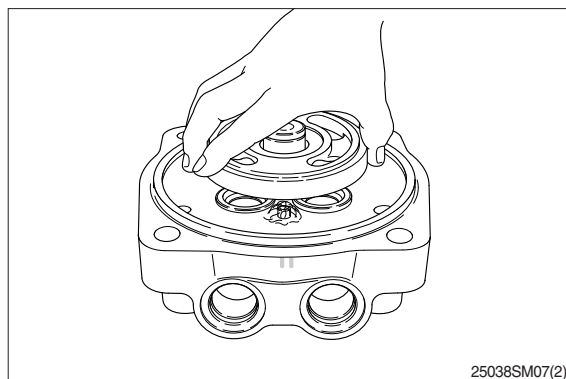
- (10) Lubricate locating pin for antirotation of valve plate (16) of cover (12) with grease sufficiently and install locating pin to housing.



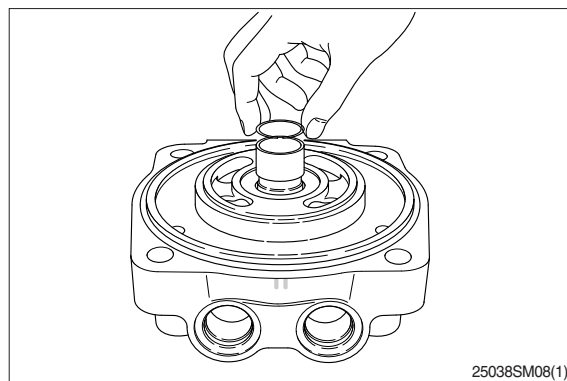
(11) Balance plate

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

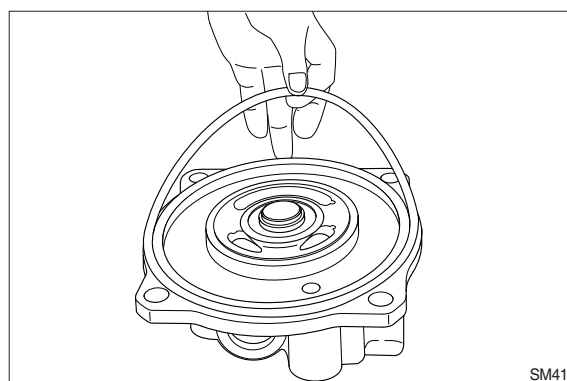
- ※ Be cautious of assembling direction.



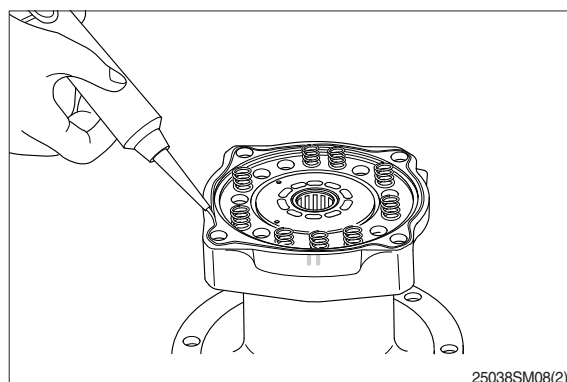
- (12) Assemble inner race of needle bearing (15) to cover (12).



- (13) Assemble O-ring (27) to cover (12).
※ Lubricate O-ring with grease.



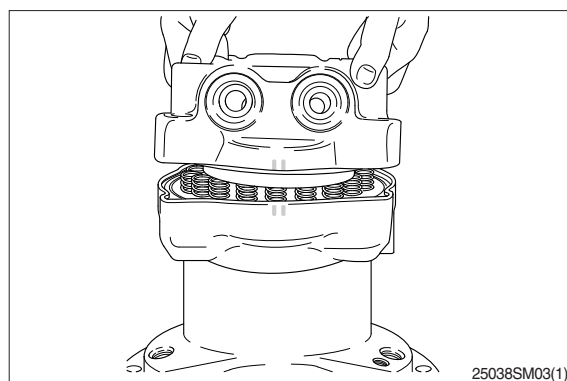
- (14) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole of cover (12).



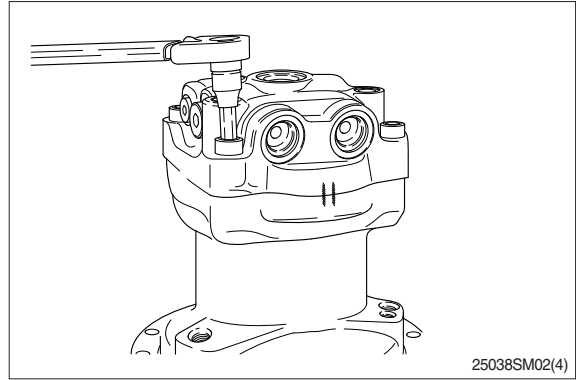
(15) Cover

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.

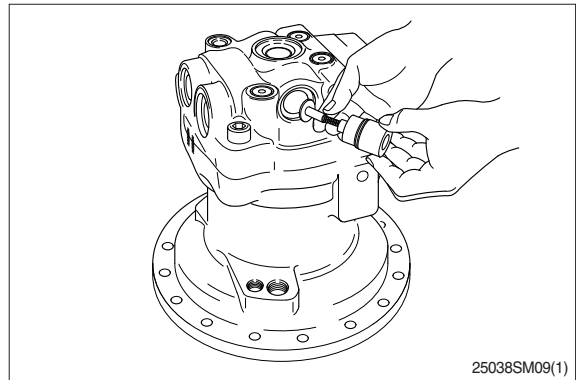


- (16) Tighten cover (12) and housing (1) with 12 mm hexagonal socket bolt (18).
- Tightening torque : 16 kgf · m (116 lbf · ft)



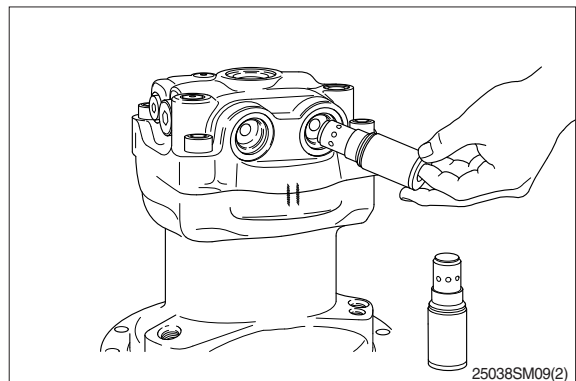
(17) Make up valve

- Assemble check (33) and spring (34) to cover (12) and tighten plug (35) with 14 mm hexagonal socket bolt.
- Tightening torque : 14 kgf · m (101 lbf · ft)



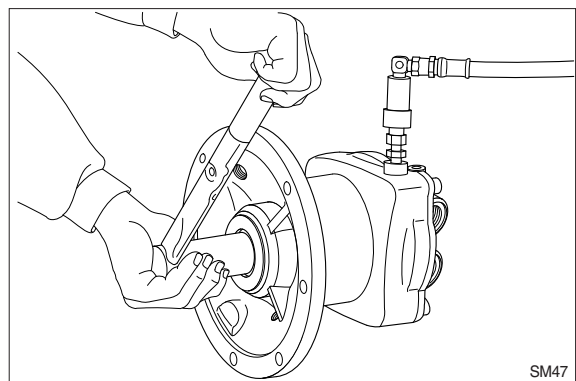
(18) Relief assembly

- 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/cm² 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

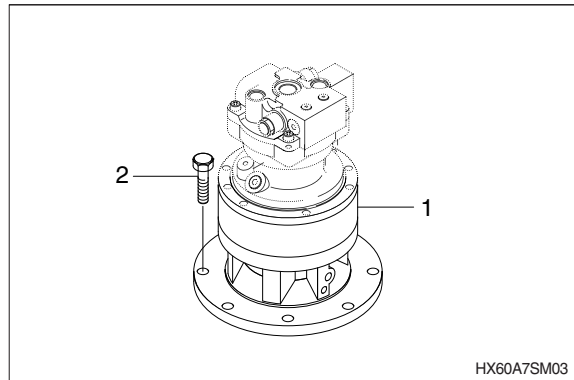
1) REMOVAL

- (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)



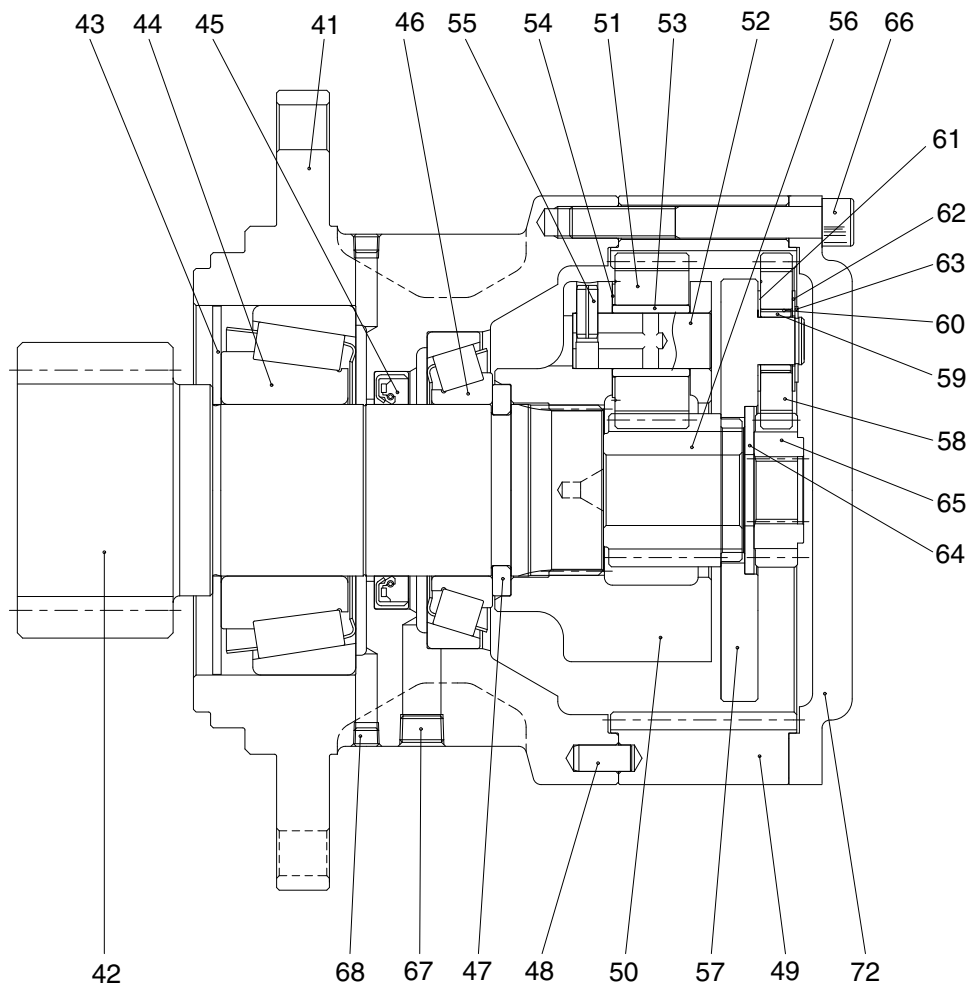
2) INSTALL

- (1) Carry out installation in the reverse order to removal.
 - Tightening torque : $29.7 \pm 4.5 \text{ kgf} \cdot \text{m}$
($215 \pm 32.5 \text{ lbf} \cdot \text{ft}$)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

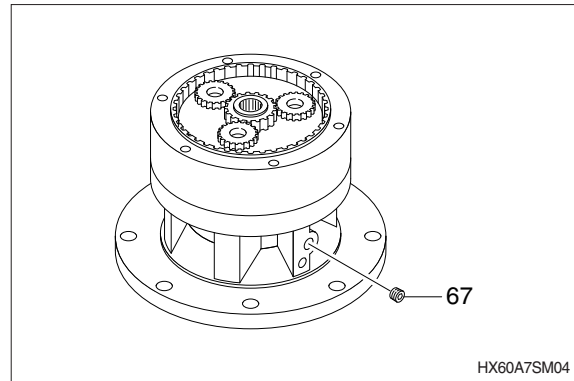


HX60A2SM02

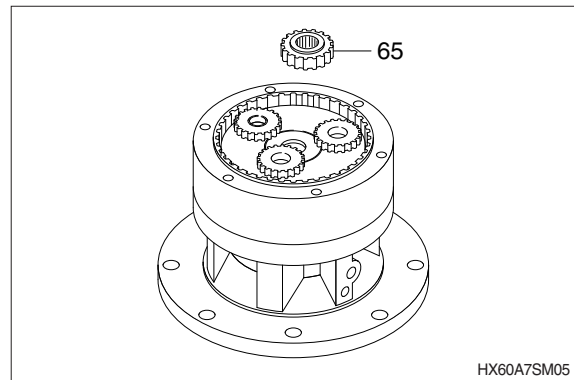
41	Case	52	Pin 2	63	Snap ring
42	Pinion gear	53	Needle roller bearing	64	Side plate
43	Bearing cover	54	Thrust washer	65	Sun gear No.1
44	Taper roller bearing	55	Spring pin	66	Wrench bolt
45	Oil seal	56	Sun gear No.2	67	Plug
46	Taper roller bearing	57	Carrier assy No.1	68	Plug
47	Lock collar	58	Planetary gear No.1	69	Level bar
48	Knock pin	59	Needle roller bearing	70	Lever pipe
49	Ring gear	60	Collar	71	Air breather
50	Carrier assy No.2	61	Thrust washer No.1	72	Cover
51	Planetary gear No.2	62	Thrust washer No.2		

2) DISASSEMBLY

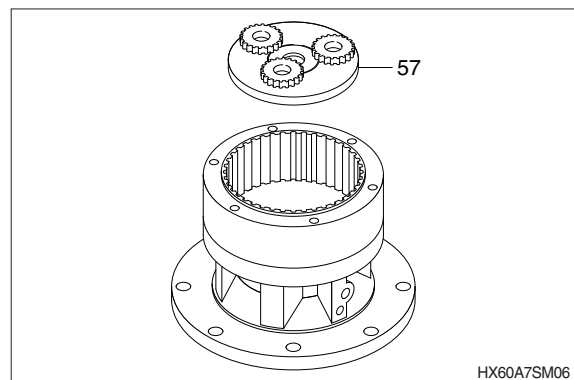
- (1) Remove the plug (67) and drain out gear oil.



- (2) Remove the No.1 sun gear (65).

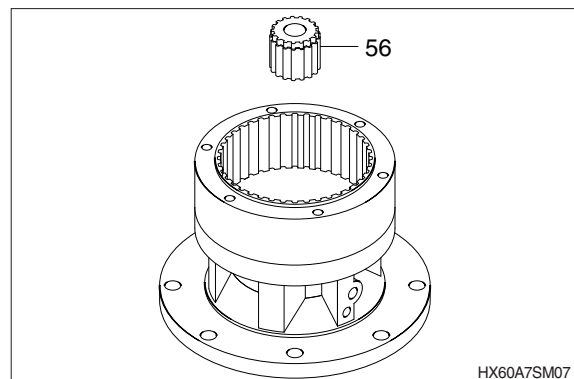


- (3) Remove the No.1 carrier sub-assembly (57) using the jig.

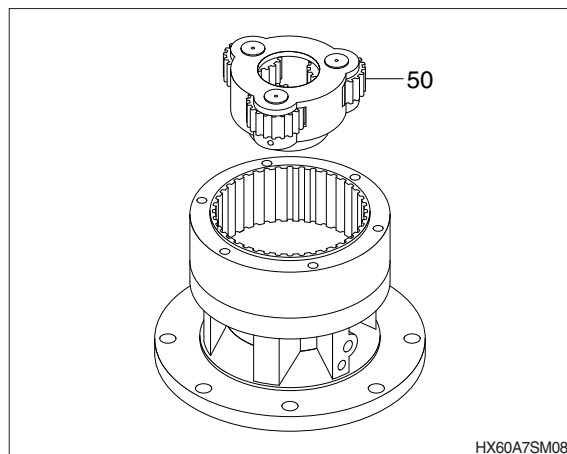


- (4) Remove the No.2 sun gear (56).

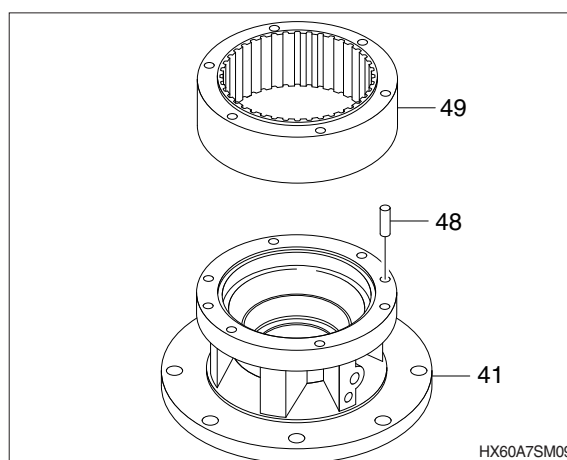
※ Pay attention to ensure the gear is not damaged during disassembling.



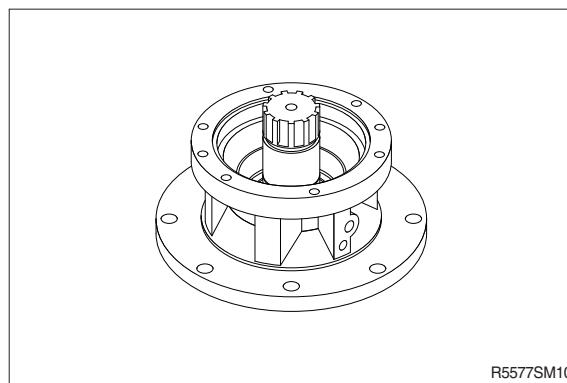
- (5) Remove the No.2 carrier sub assembly (50).



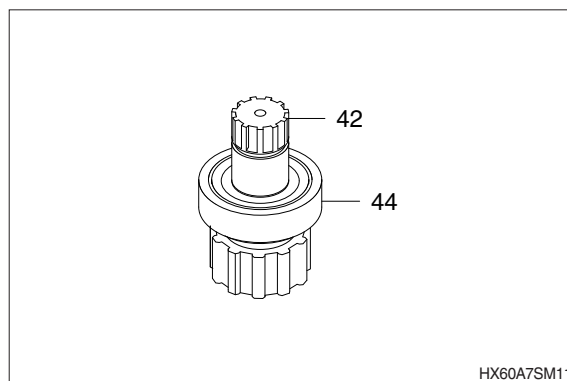
- (6) Remove the ring gear by the removal groove between the ring gear (49) and casing (41) by using jig.
Full out the knock pin (48).
Do not need to remove the knock pin (48) if it is not worn or damaged.



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

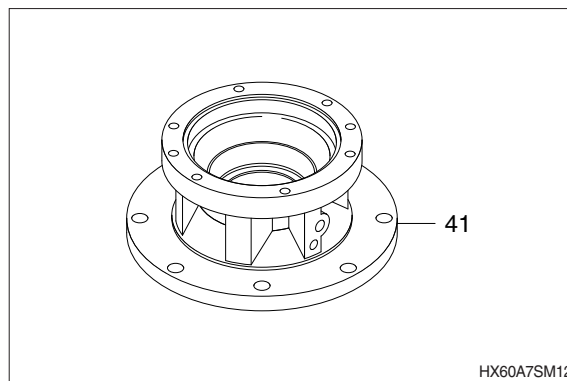


- (8) Disassemble the drive shaft (42) with bearing (44) by using jig.

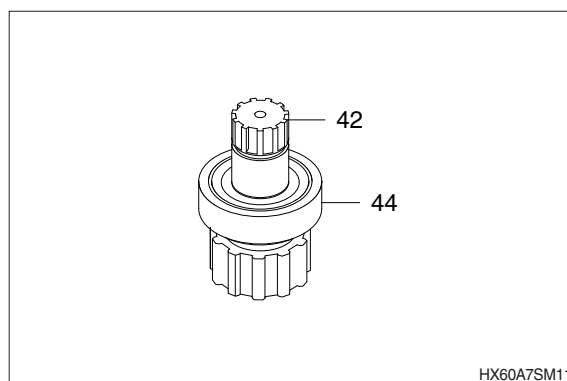


3) ASSEMBLING SWING REDUCTION GEAR

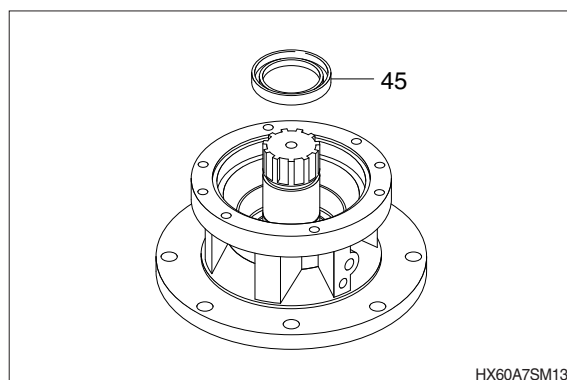
- (1) Place the case (41) on the reversing machine having the flange side of the case up.



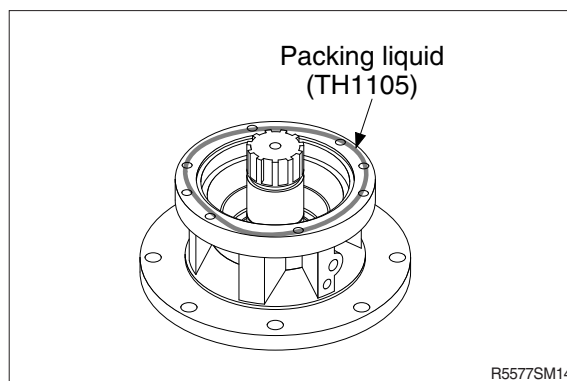
- (2) Install shaft assembly (42) into case (41).
※ Be sure to clean the case before install, using washing machine with the temperature of 80°C
※ Do not install shaft assembly by force.



- (3) Reverse case and press to insert oil seal (45) 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.



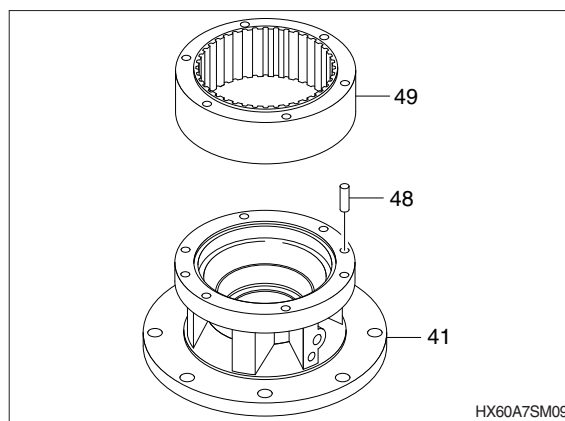
- (4) Clean the assembling surface of case and spread packing liquid (TH1105) as shown in figure.



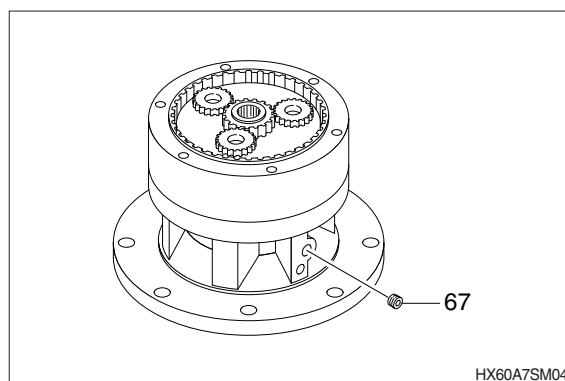
(5) Place ring gear on the case by matching it with knock pin hole.

(6) Insert 2 knock pins by using jig.

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

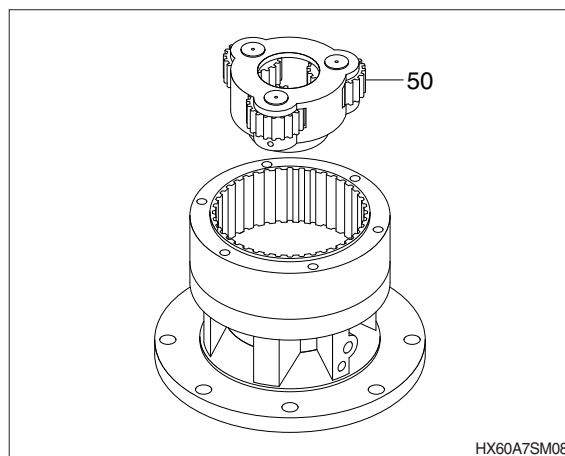


(7) Screw drain plug into drain plug (67) after winding sealing tape.



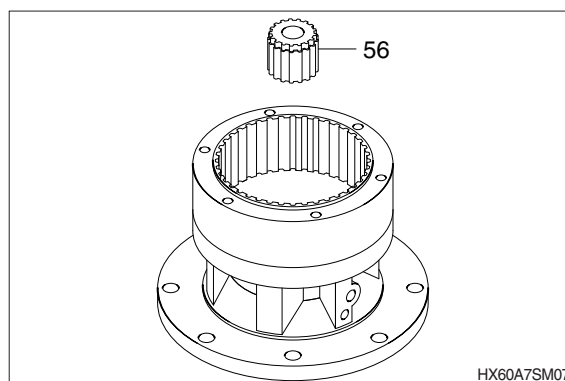
(8) Mount No.2 carrier assembly (50) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

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



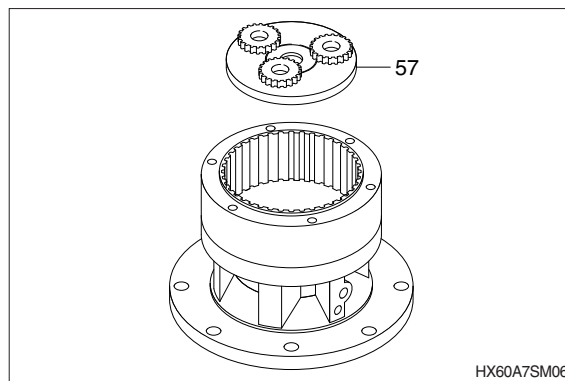
(9) Install No.2 sun gear (56).

※ Be sure to check the direction of sun gear (56) when assembling.

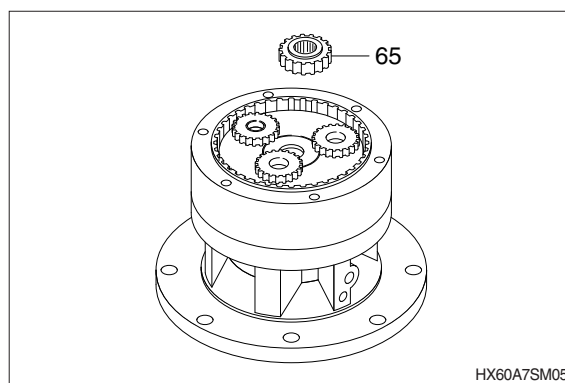


(10) Mount No.1 carrier assembly (57) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

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



(11) Assemble No.1 sun gear (65).



GROUP 6 TRAVEL MOTOR

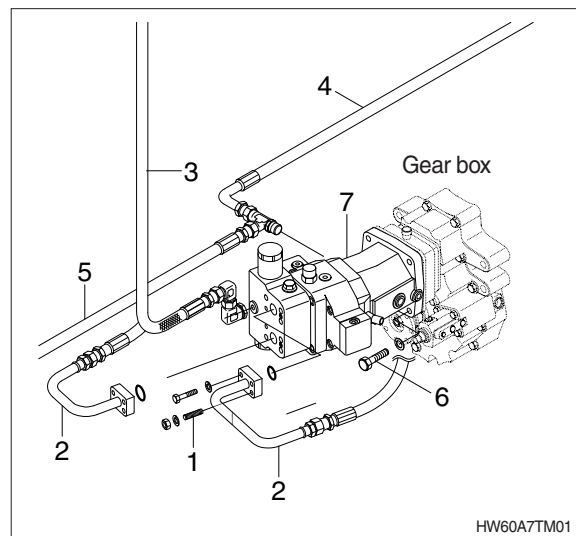
1. REMOVAL AND INSTALL

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.

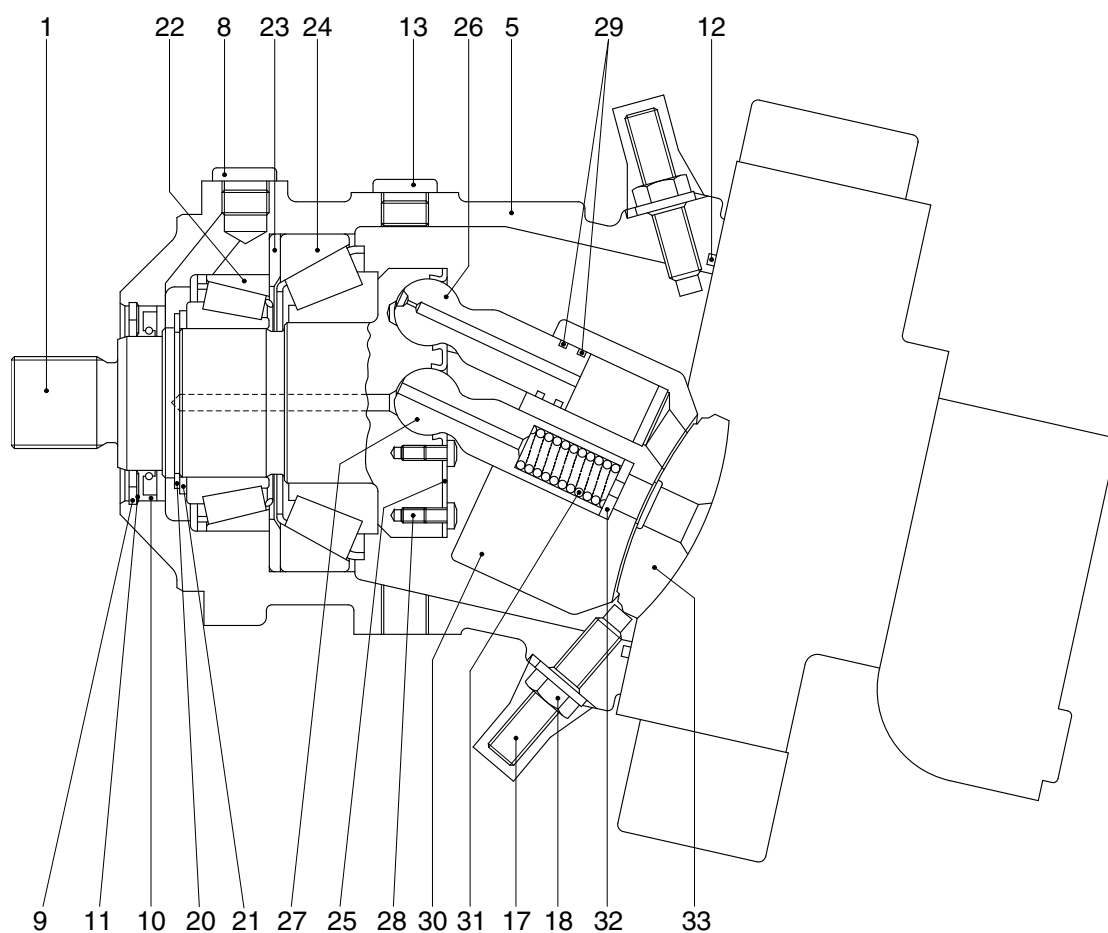


2) INSTALL

- (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

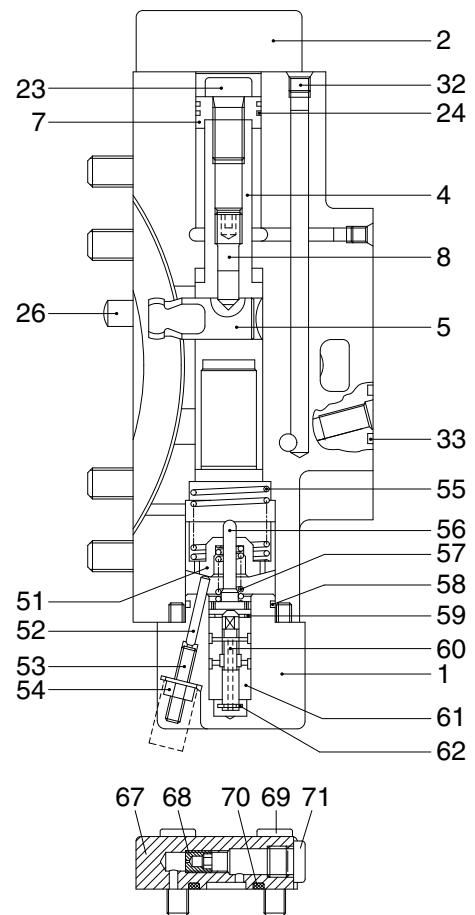
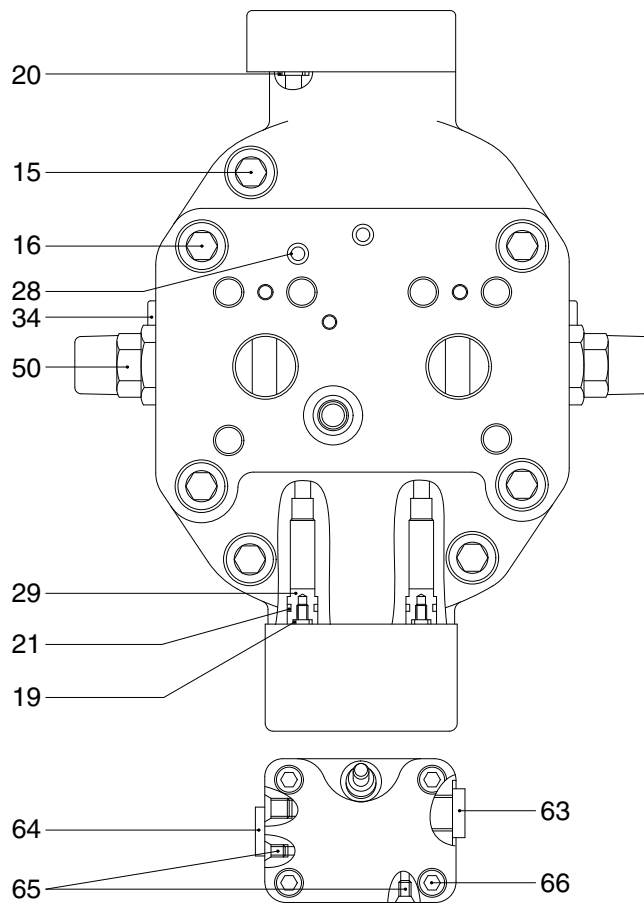
1) MOTOR UNIT



200W34TM02

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

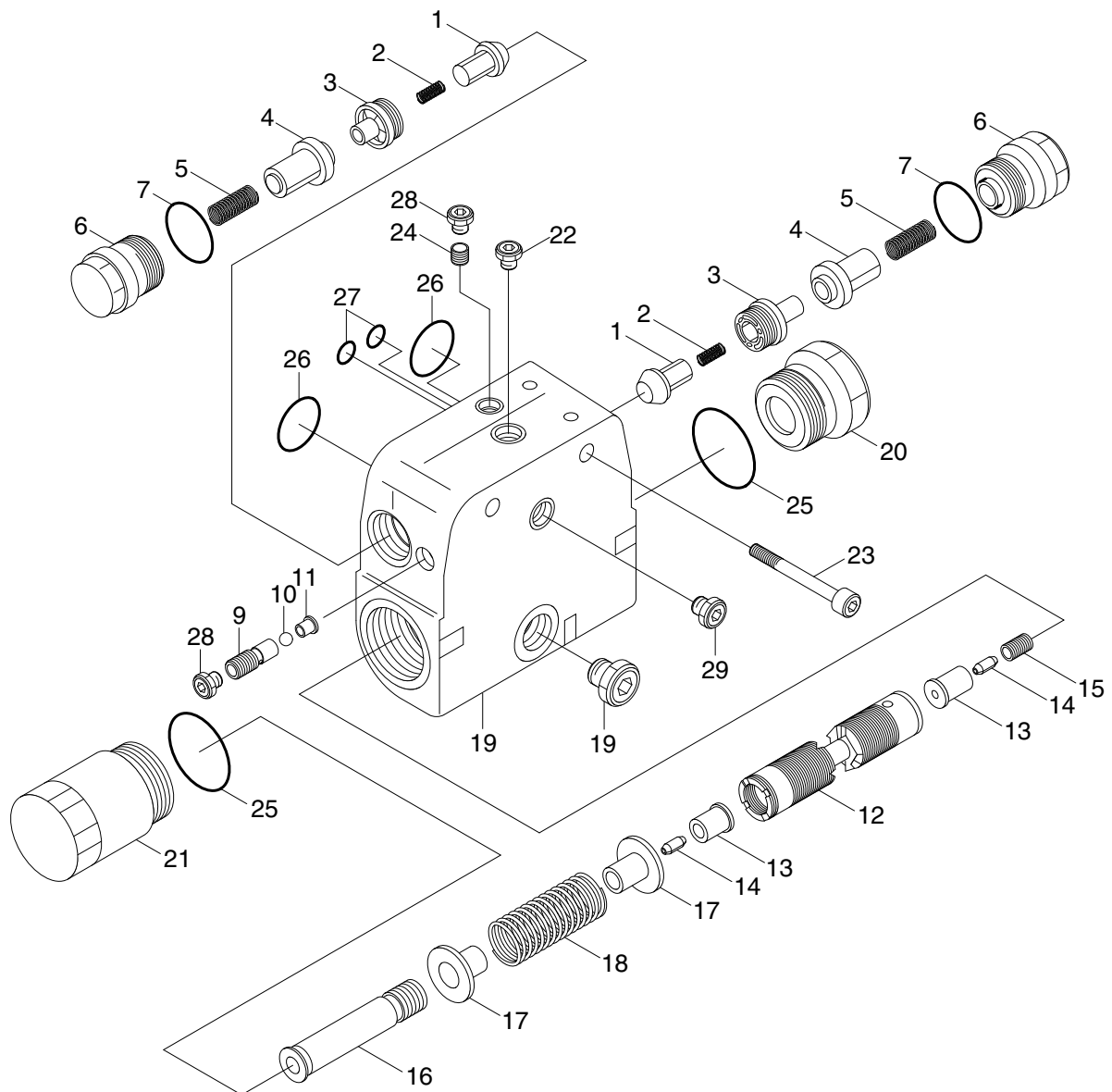
2) CONTROL UNIT



55W72TM03

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



55W77TM04

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

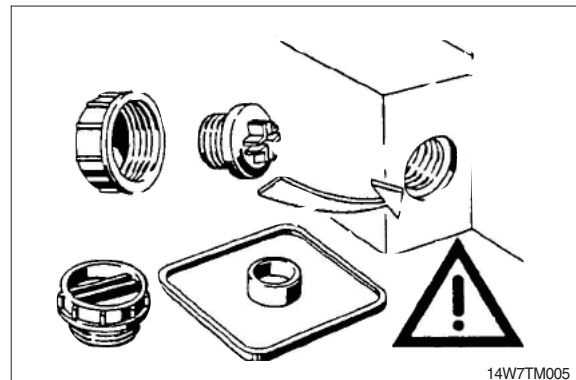
- ① Reassemble in a work area that is clean and free from dust and grit.
- ② Handle parts with bare hands to keep them free of linty contaminants.
- ③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.
- ④ Do not reuse O-ring oil seal and floating seal that were removed 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

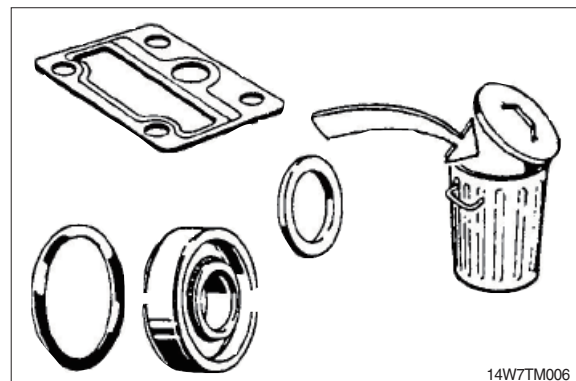
Observe the following notices when carrying out repair work at hydraulic aggregates.



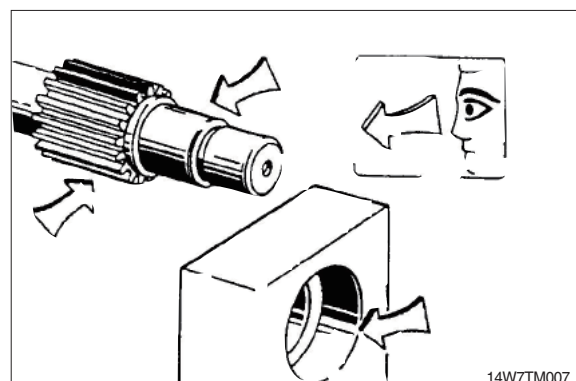
- (1) Close all ports of the hydraulic aggregates.



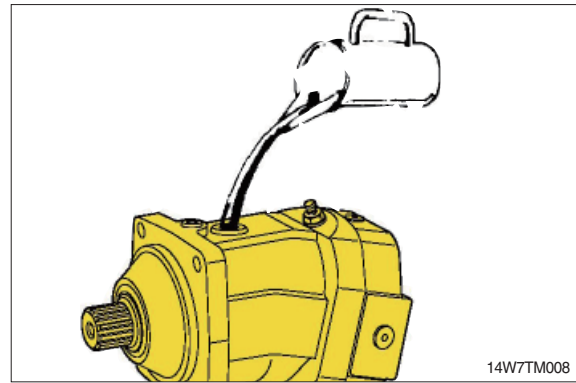
- (2) Replace all seals.
Use only original hydromatik spare parts.



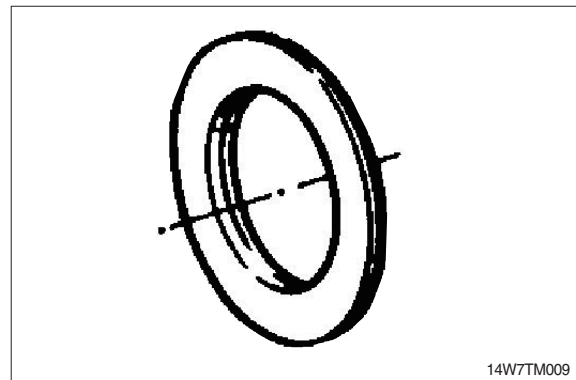
- (3) Check all seal and sliding surfaces for wear.
※ Rework of sealing area f.ex. with abrasive paper can damage surface.



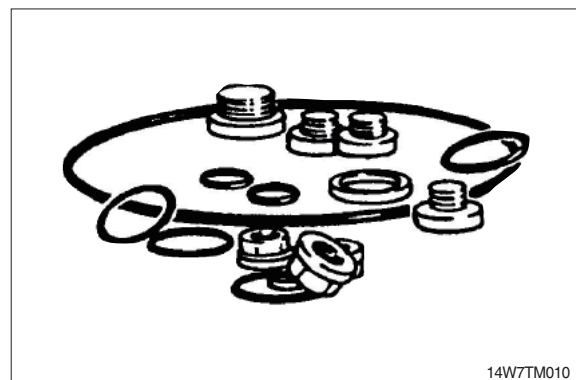
- (4) Fill up hydraulic aggregates with hydraulic oil before start up.



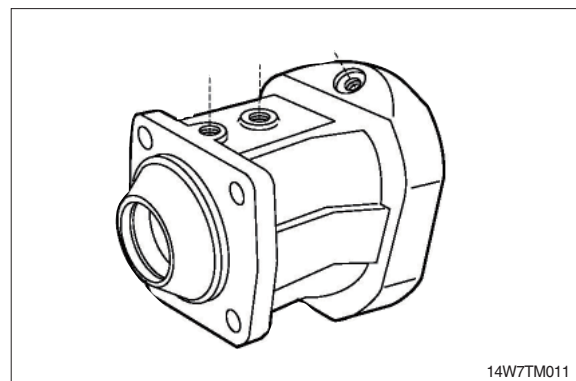
- (5) Seal kit for drive shaft



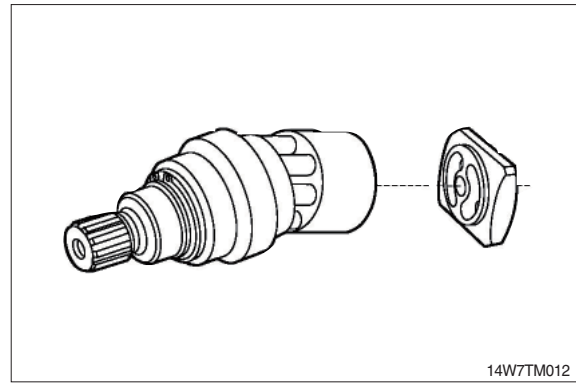
- (6) External seal kit.



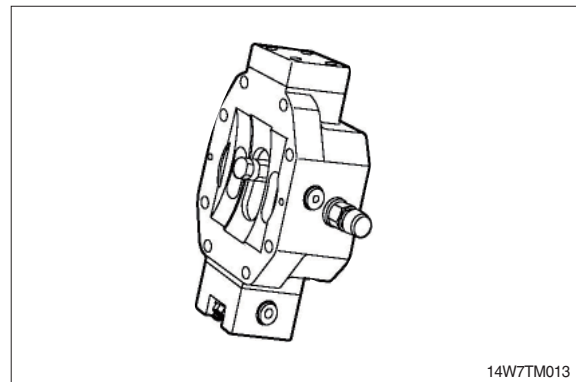
- (7) Housing.



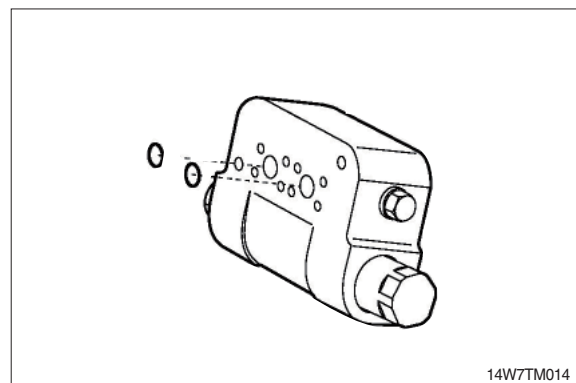
(8) Complete rotary group.



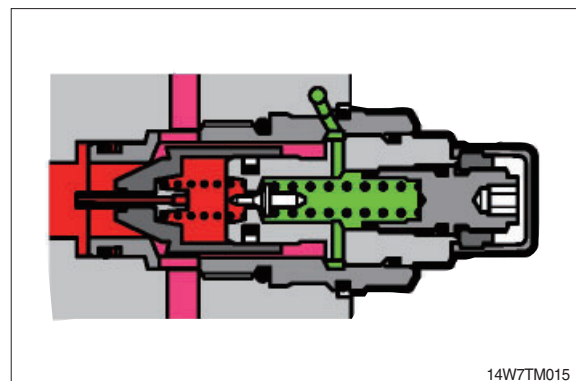
(9) Port plate with control piston.



(10) Counter balance valve.

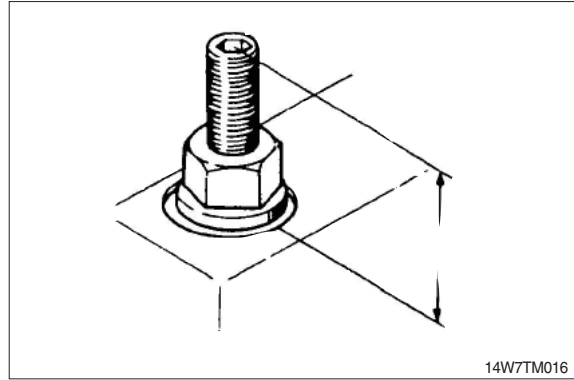


(11) Relief valve / Make up check valve.

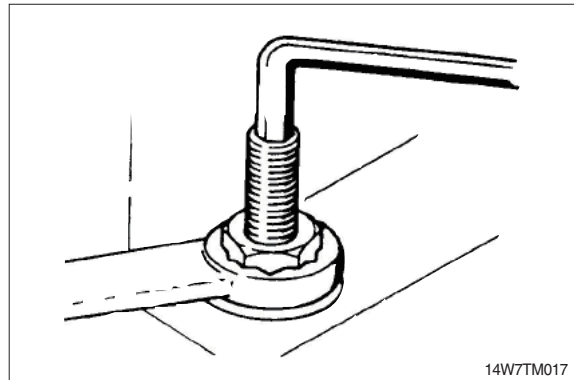


3) SEAL NUT

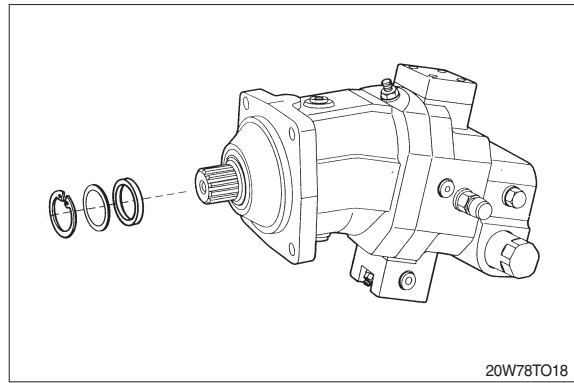
- (1) Replace seal nut.
First measure and record setting height.



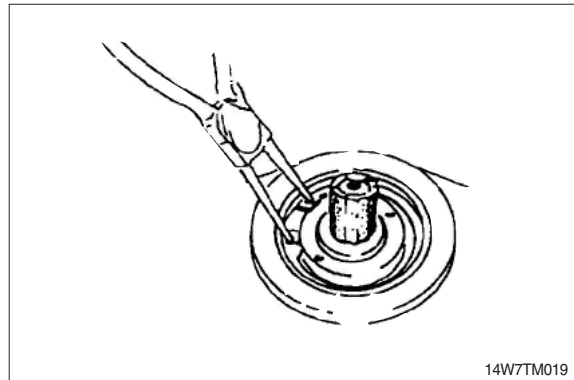
- (2) When tightening, counterhold setting screw, then check setting height.



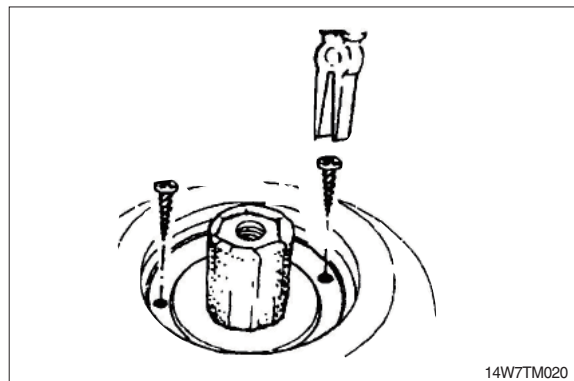
4) SEALING THE DRIVE SHAFT



- (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.

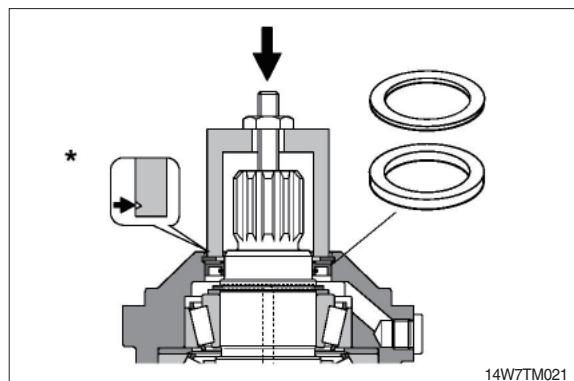


- (3) Press in shaft seal and shim with bush to
stop.

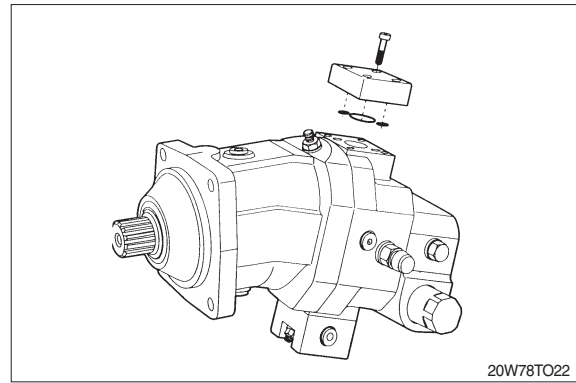
▲ Pay attention to pressing depth.

* Mark for pressing depth.

Assemble retaining ring.

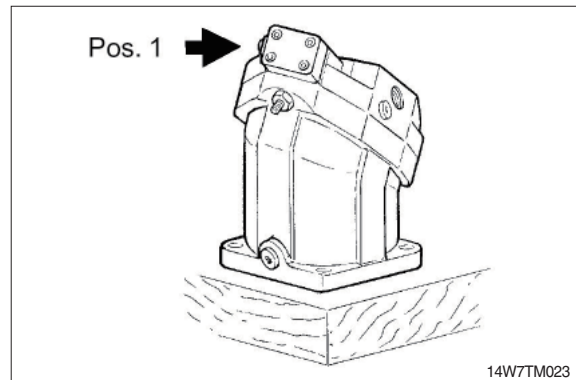


5) SEALING OF THE CONTROL PARTS



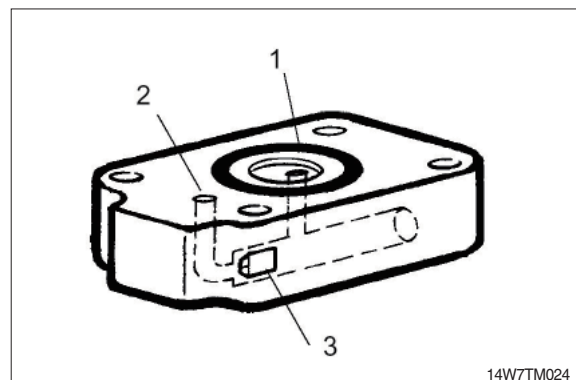
(1) Disassembly position

Remove cover 1.

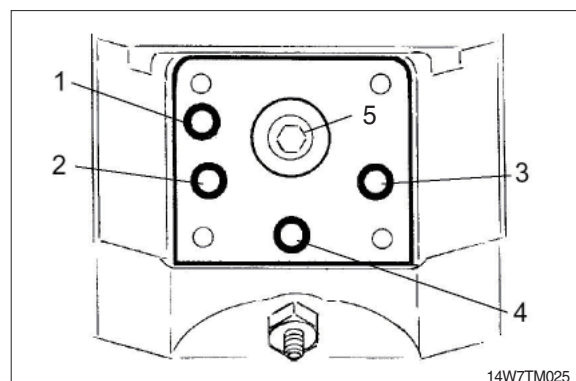


- 1 O-ring
- 2 Input flow of oil control
- 3 Throttle pin

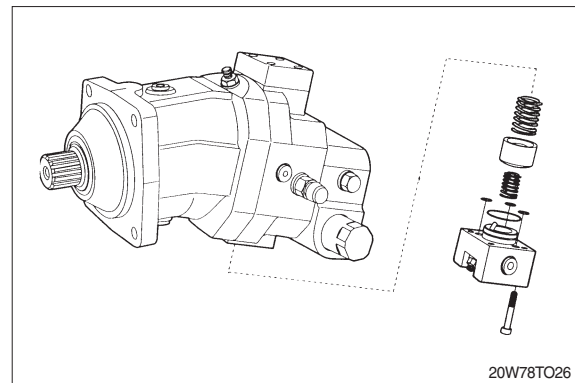
※ Installation position differs according to the control components.



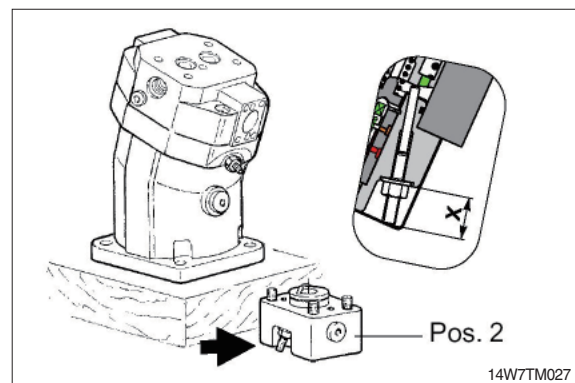
- 1 Input flow of oil control
- 2 High pressure / Low pressure
- 3 High pressure / Low pressure
- 4 Leakage oil
- 5 Control piston



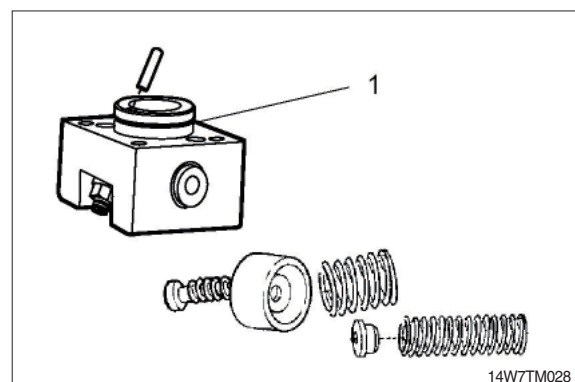
- (2) Disassembly position : Remove cover 2.
 ※ Attention spring load.



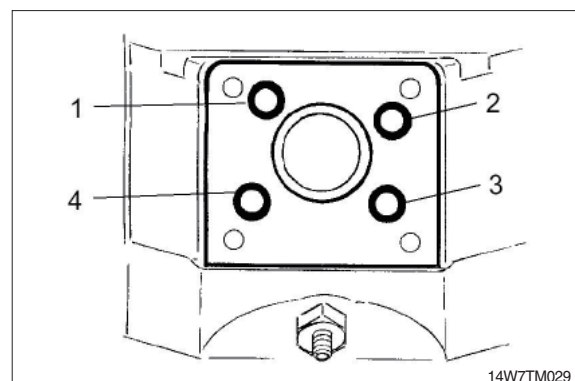
- ※ Dimension X : Note dimension (begin of regulation)



- 1 Check of O-ring

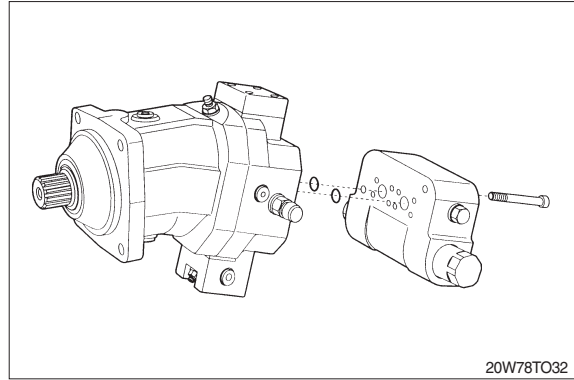


- 1 O-ring / High pressure-small control position side
 2 O-ring / Control pressure
 3 O-ring / High pressure-check valve
 4 O-ring / High pressure-check valve

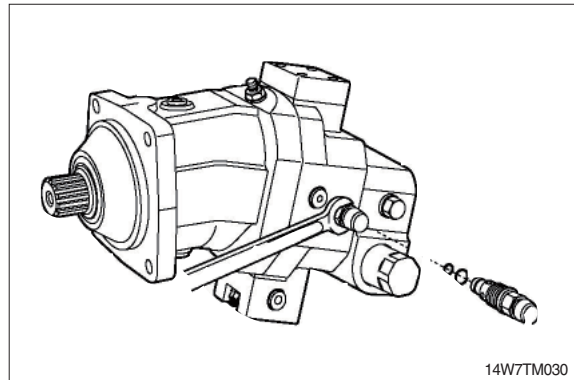


6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

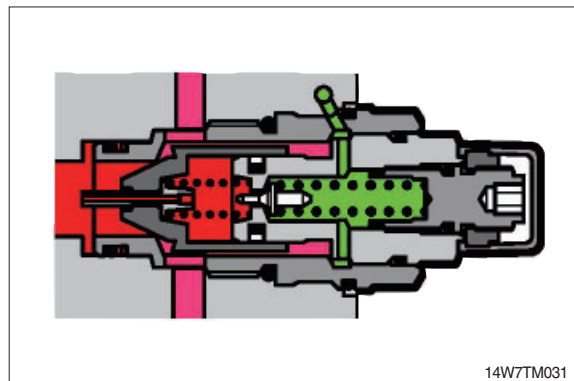
- Remove counter balance valve
- Inspect
- O-ring



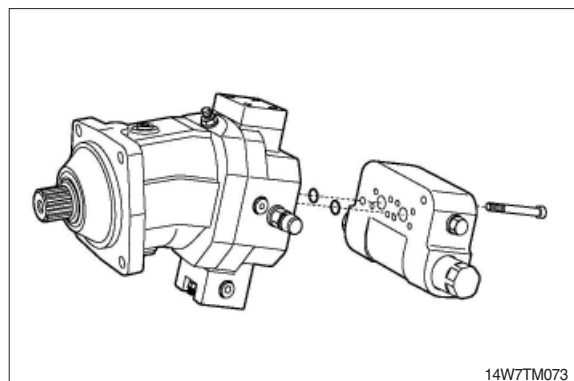
(1) Remove relief valve



(2) Inspect O-ring

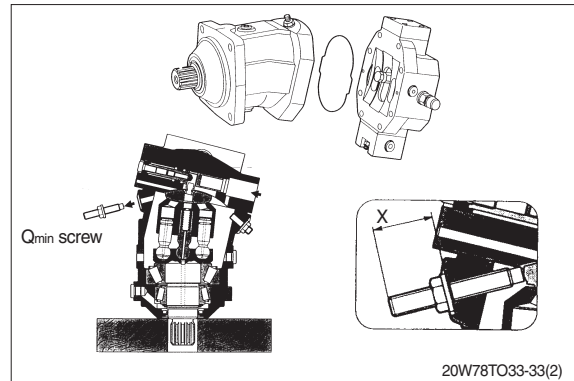


(3) Remove counter-balance valve. Inspect O-ring

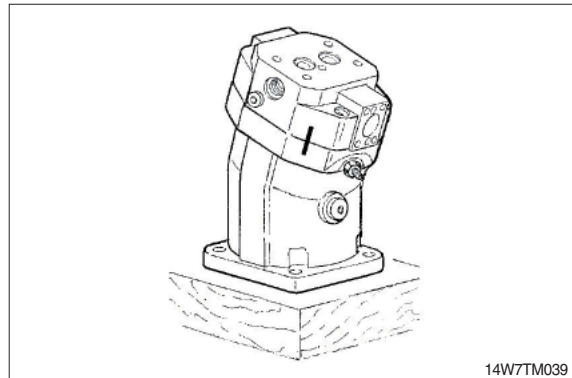


7) DISASSEMBLY OF THE PORT PLATE

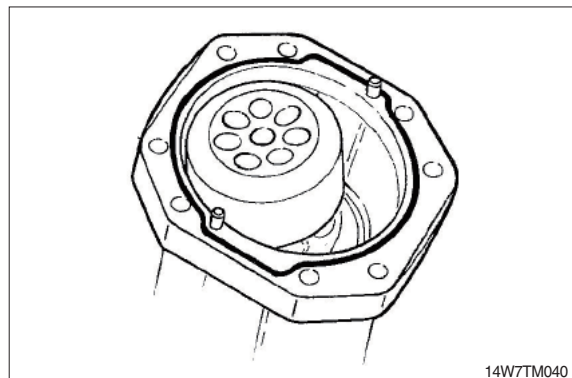
- Note dimension X
- Remove Q_{min} screw
- Swivel rotary group to zero P



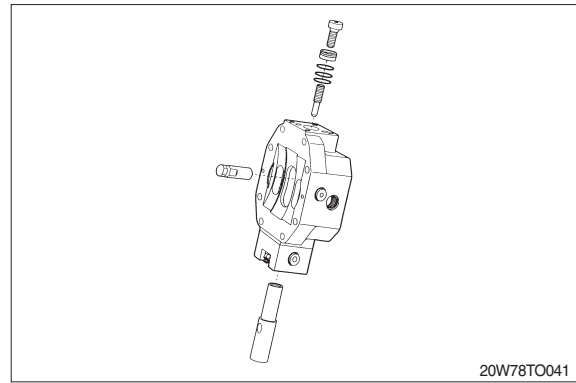
- (1) Port plate.
Mark position. Loosen screws.
Removal.



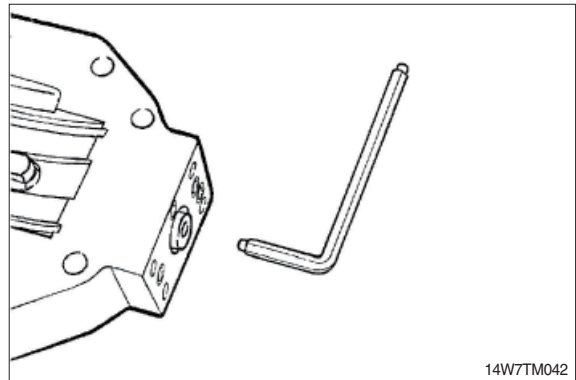
- (2) Check O-ring.
※ Stick new O-ring with some grease.
Do not swivel rotary group.
Piston rings to hang out from the cylinder boring.



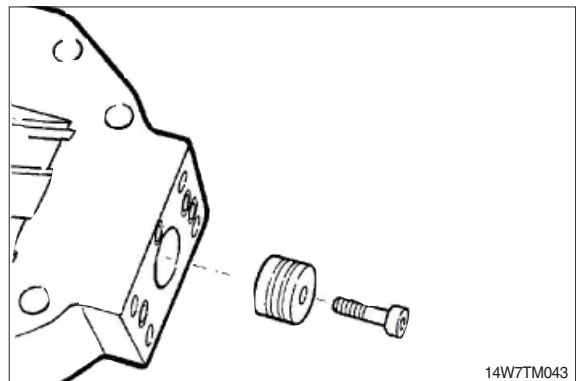
8) REMOVE OF THE POSITIONING PISTON



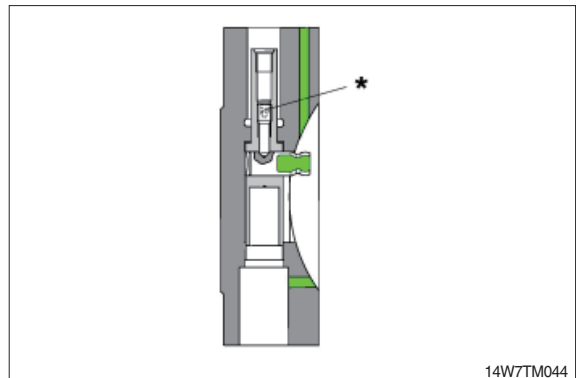
- (1) Loosen fixing screw.
Use only socket wrench.



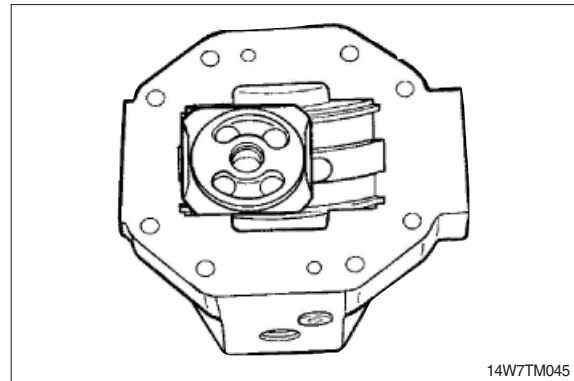
- (2) Remove piston with piston ring.



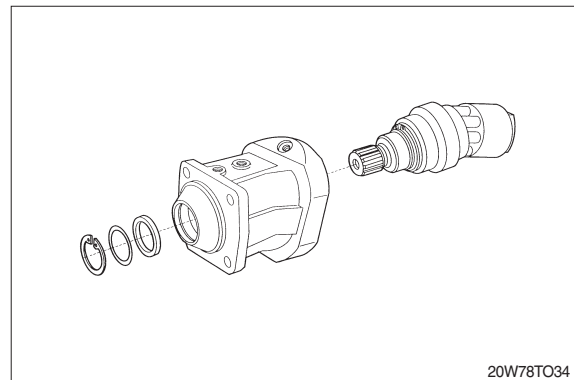
- (3) Warm up fixation screw *for positioning plug via boring (screw glued-to turn out).
※ Use new screw.
Precode coating.
Note tightening torque.



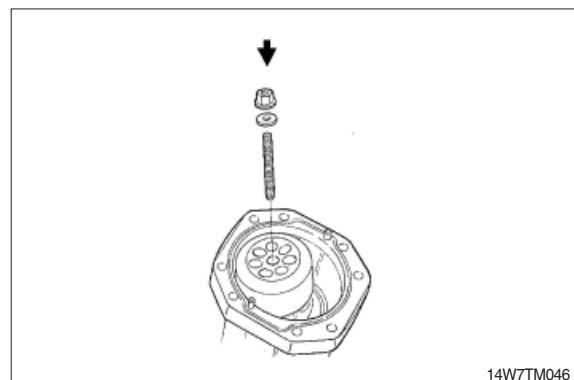
- ※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.
- ※ Rotary group vertical.



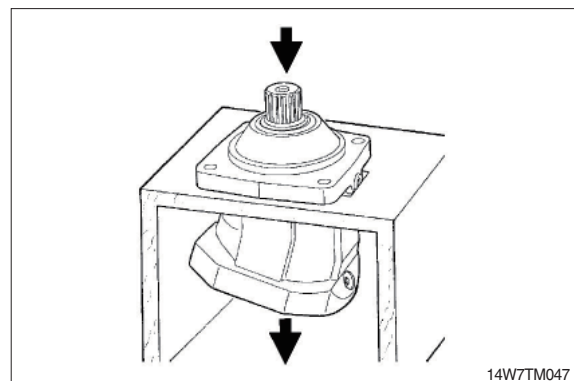
9) REMOVE ROTARY GROUP



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



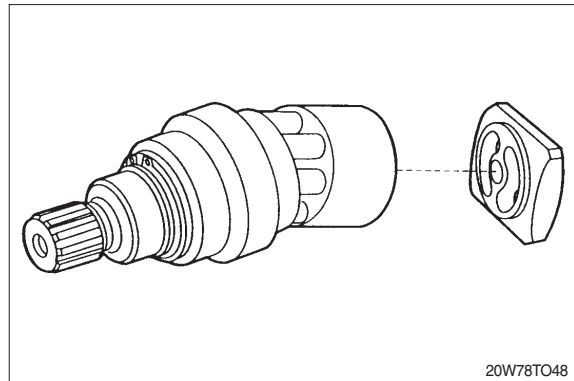
- (2) Press out rotary group.
 - ※ If the bearings are used again do not hit on the drive shaft.



10) EXCHANGING OF THE ROTARY GROUP

Complete rotary group

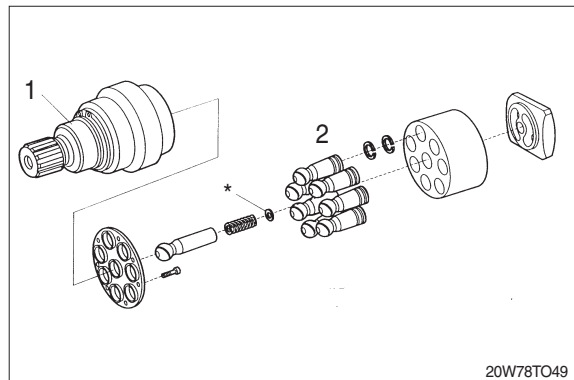
※ Setting of hydraulic part necessary.



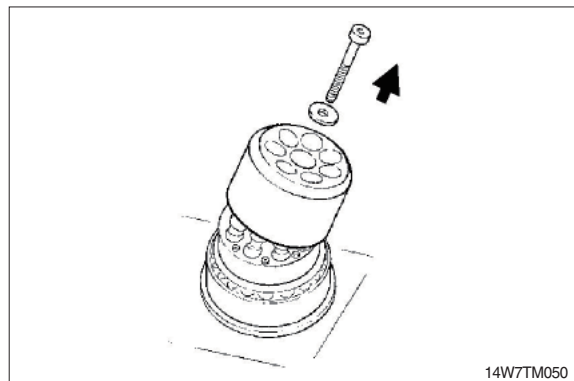
Rotary group

1 Mechanical part : Adjust drive shaft with bearing

2 Hydraulic part : Adjustment necessary



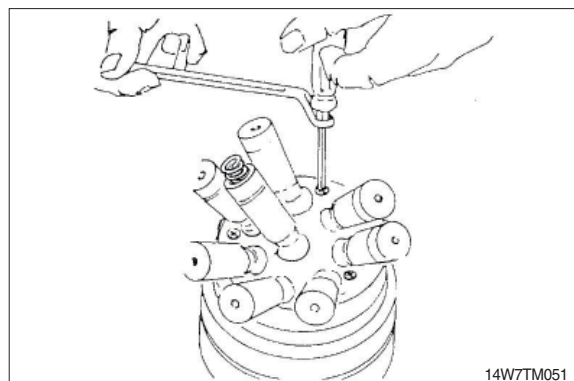
(1) Remove fixing screw (cylinder).
Remove cylinder.



(2) Disassemble retaining plate.

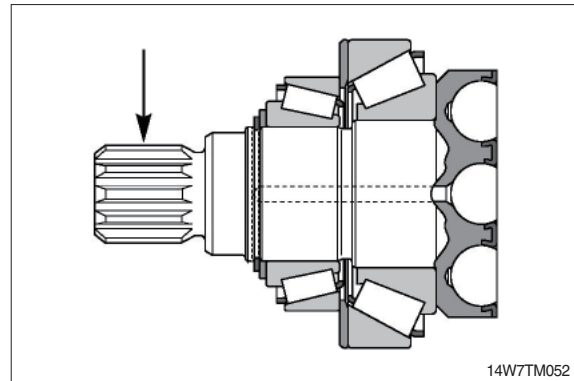
※ Screws are glued.

Use Torx tools.



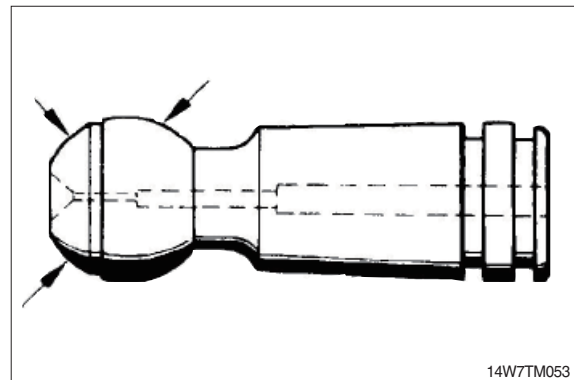
11) INSPECTION INSTRUCTIONS

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



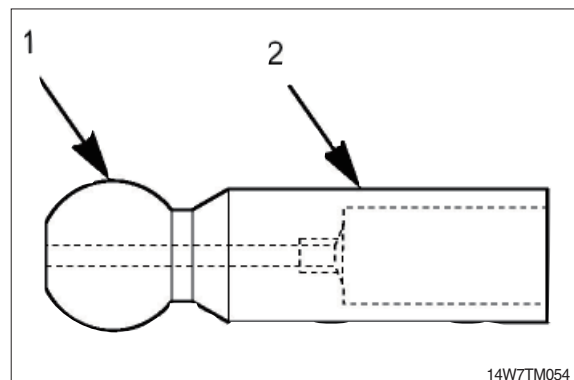
(2) Pistons

No scoring and no pittings.



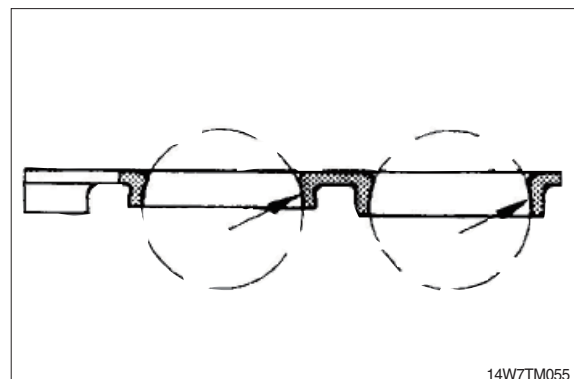
(3) Center pin

No scoring and no pittings.



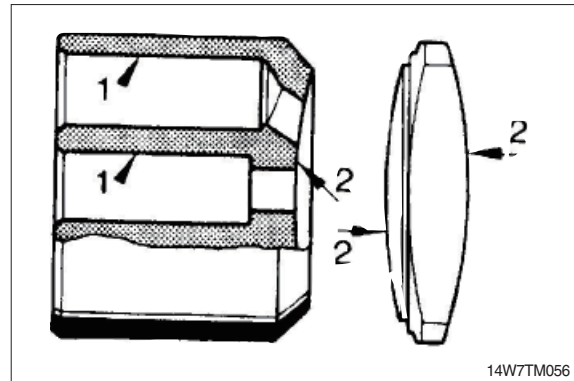
(4) Retaining plate

No scoring and no evidence of wear.



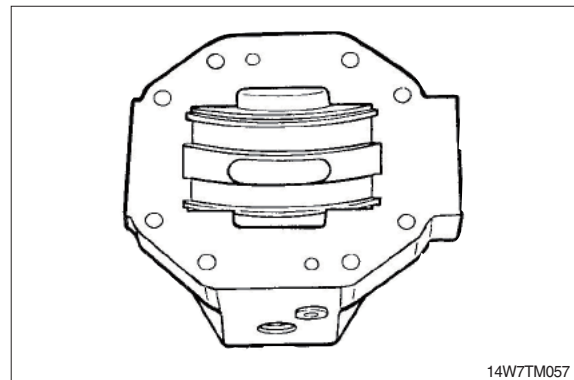
(5) Cylinder block / Control lens

- 1 Bores free of scoring, no evidence of wear
- 2 Faces smooth and even, free of cracks and scoring



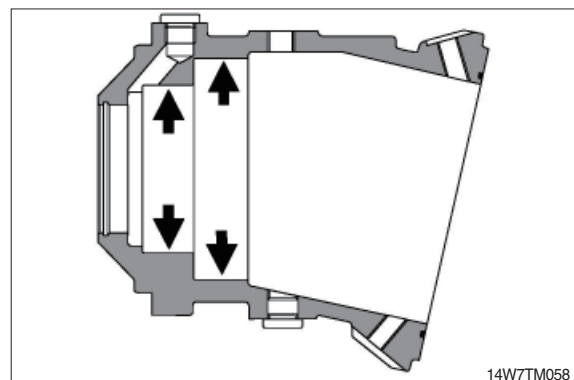
(6) Control housing

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



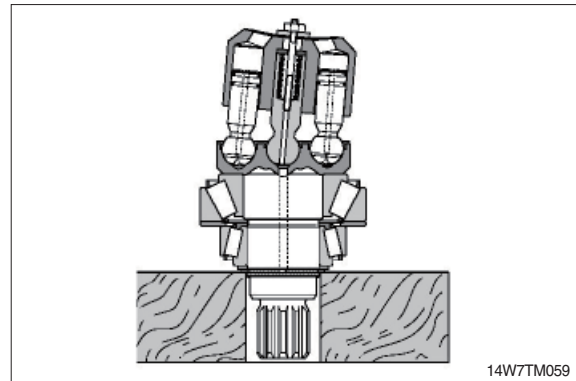
(7) Visual check

Bearing areas free of scoring and no evidence of wear.

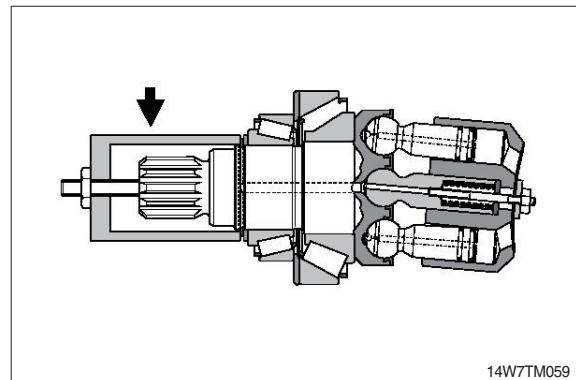


12) ROTARY GROUP ASSEMBLY

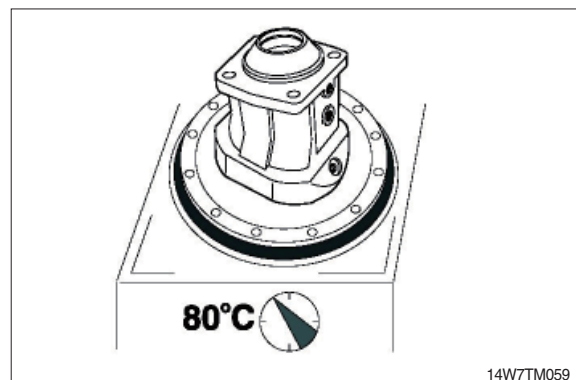
- (1) Rotary group completely assembled ready for assembly.



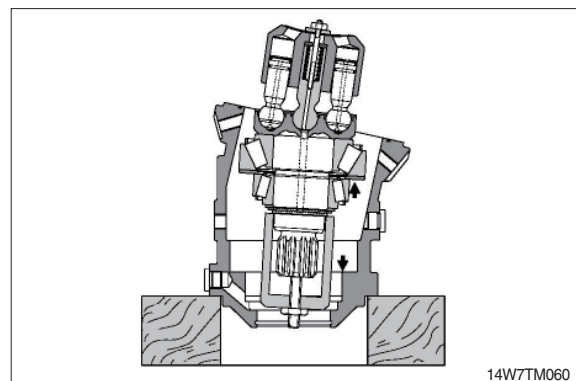
- (2) Place assembly sleeve.



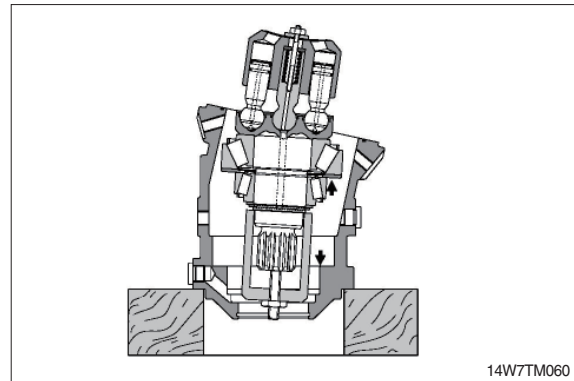
- (3) Warm up housing to 80°C.



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

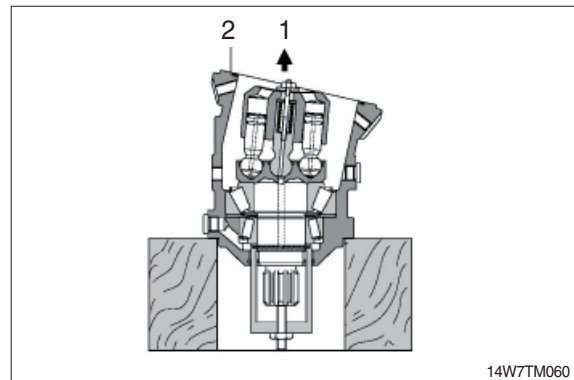


- (5) Insert rotary group into housing to seat position.



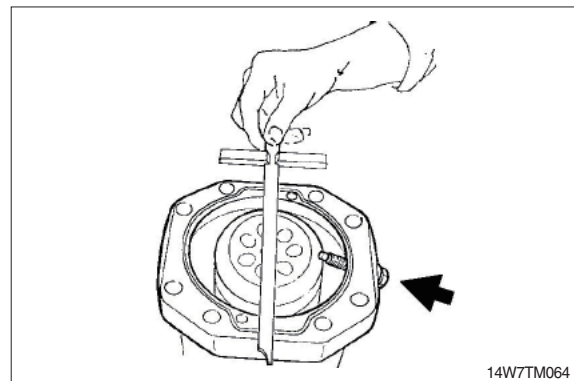
- (6) Fix zero position of cylinder with Q_{max} screw.

- 1 Disassemble cylinder fixing screw
- 2 Insert O-ring

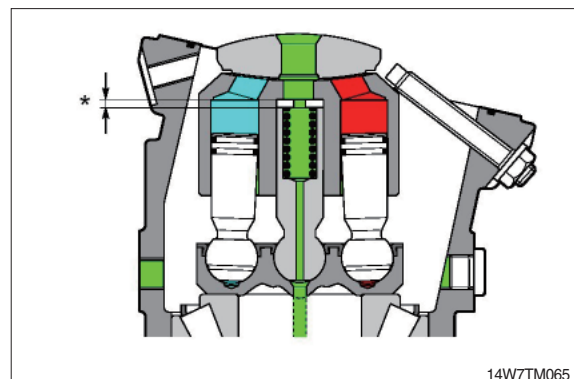


13) ROTARY GROUP ADJUSTMENT

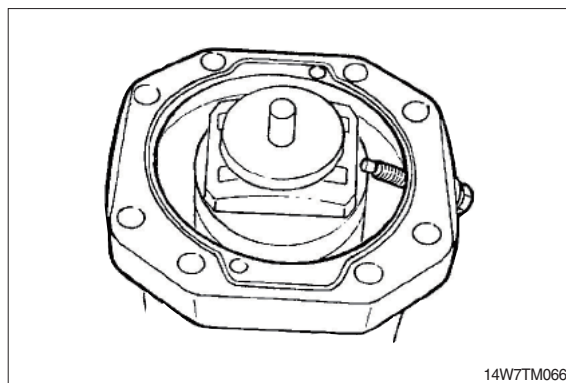
- (1) Determine cylinder swivel range to max angle with screw.



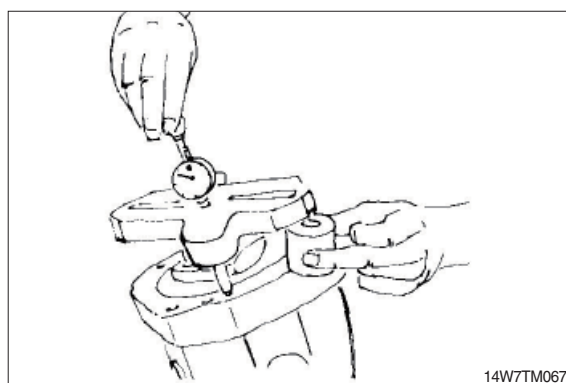
- (2) * Disc



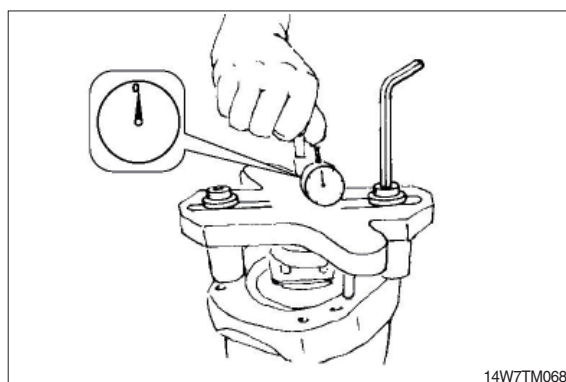
(3) Place centering disc.



(4) Mount measuring device.

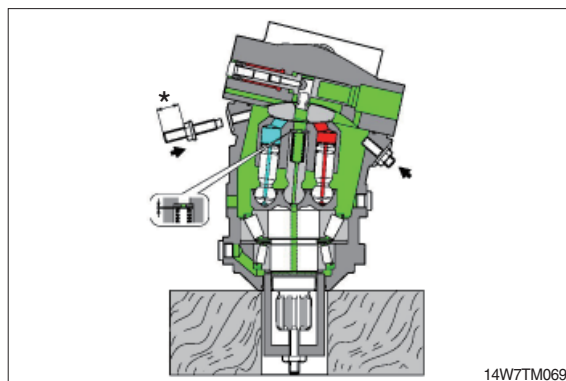


(5) Check dimension X.

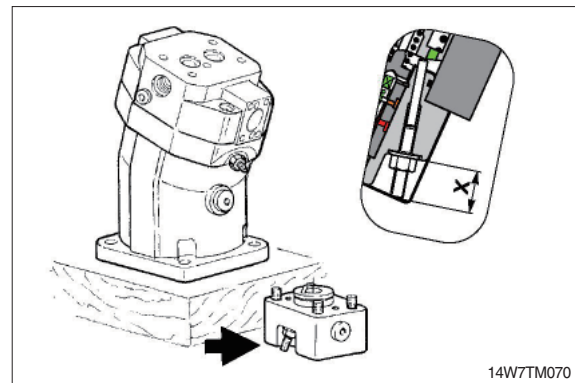


14) ASSEMBLY OF THE PORT PLATE

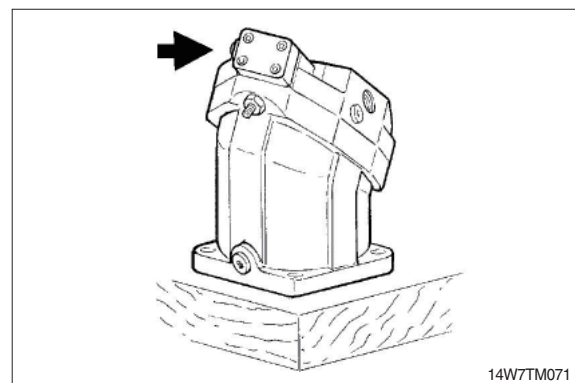
- (1) Assemble port plate.
 - ※ Take care of assembly design.
 - Tighten fixing screws with torque.
- (2) Set Q_{min} screw to dimension (*).
- (3) Assemble plug.
- (4) Remove assembly sleeve.



(5) Assemble control components.



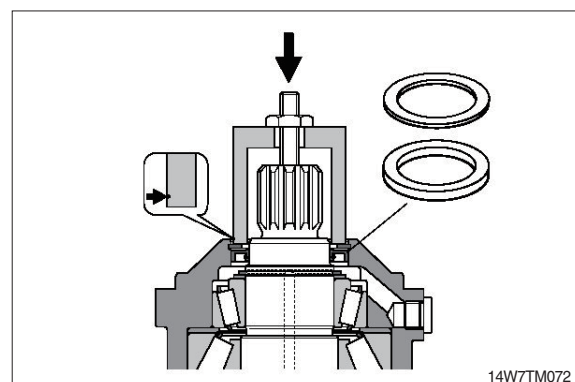
(6) Assemble cover.



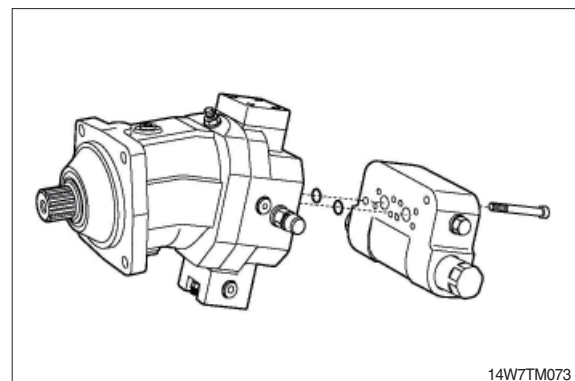
(7) Assemble shaft seal, disc and safety ring.

Press in with assembly sleeve.

※ Take care of press in depth.



(8) Assemble counter balance valve.



GROUP 7 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 : $7.4 \pm 1.5 \text{ kgf} \cdot \text{m}$
($53.5 \pm 10.8 \text{ lbf} \cdot \text{ft}$)

- (5) Remove the travel motor mounting bolts (2).

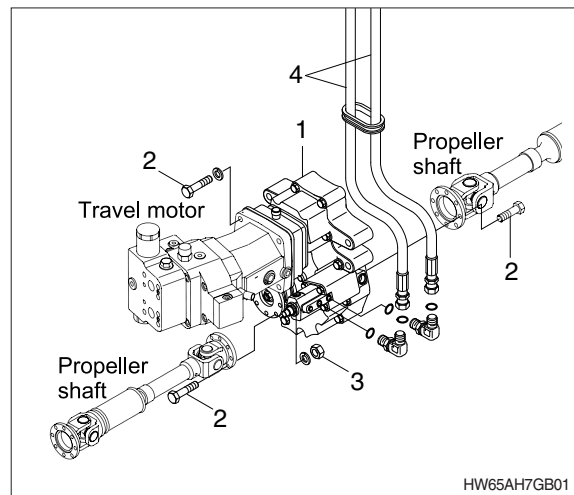
• Tightening torque : $14.7 \pm 2.2 \text{ kgf} \cdot \text{m}$
($53.5 \pm 10.8 \text{ lbf} \cdot \text{ft}$)

- (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 : $19.6 \pm 2.9 \text{ kgf} \cdot \text{m}$
($142 \pm 21 \text{ lbf} \cdot \text{ft}$)



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 it is best 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.

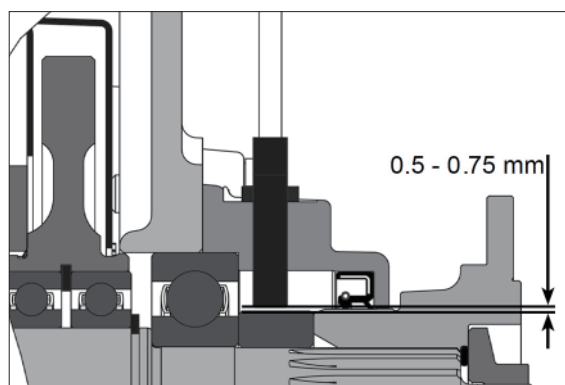
4) LUBRICANT SPECIFICATIONS

SAE 85W-90 (API GL-5)

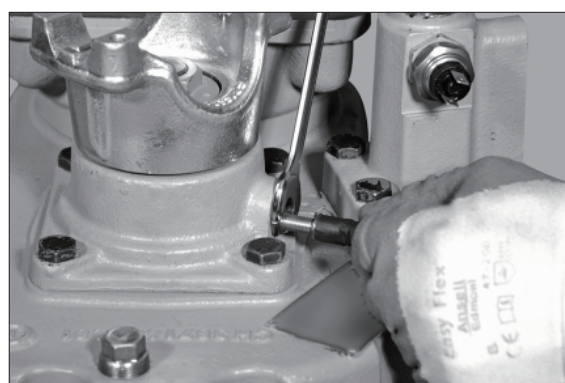
3. COUNTER - REVOLUTION SENSOR

1) REPLACING

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



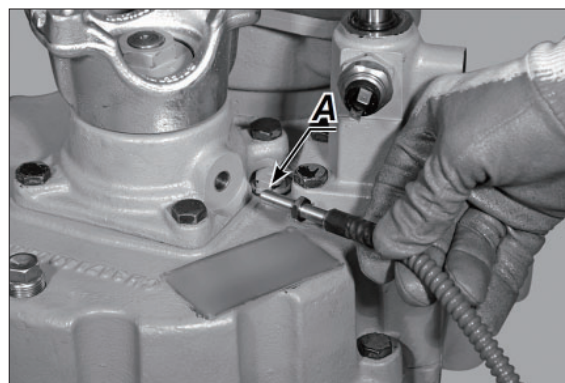
55W9NGB001



55W9NGB002

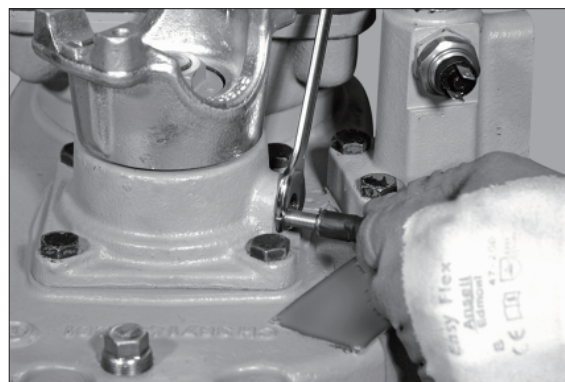
- (2) Replace the counter-revolution sensor if damaged.

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



55W9NGB003

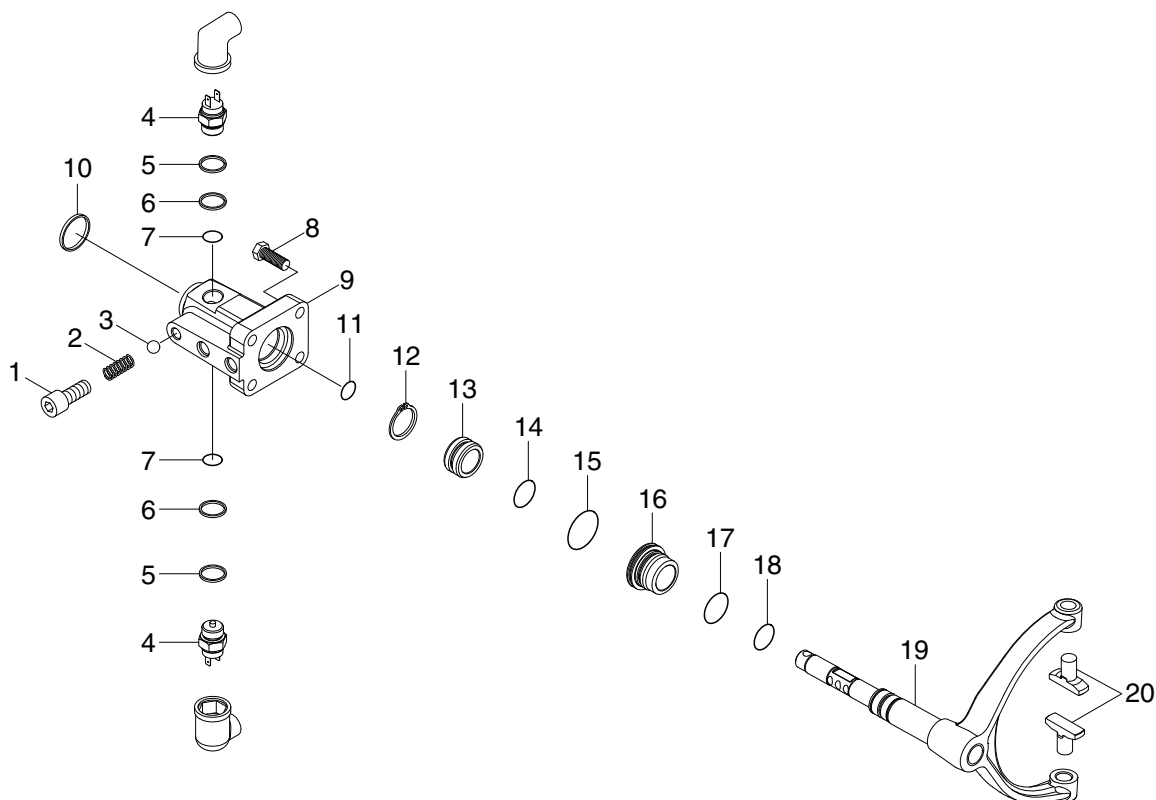
- (3) Screw the counter-revolution sensor until it contacts the phonic end disk, then loosen the sensor 1/2 ~ 3/4 turn. Tighten the lock nuts completely.



55W9NGB004

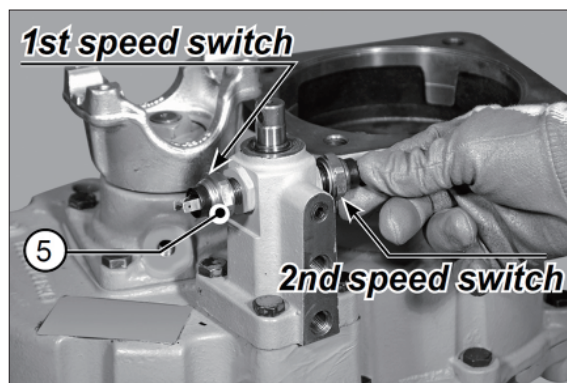
4. HYDRAULIC GEAR CONTROL

1) DISASSEMBLY



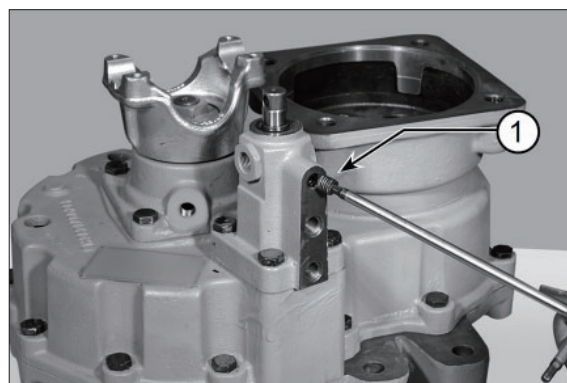
55W9NGB005

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



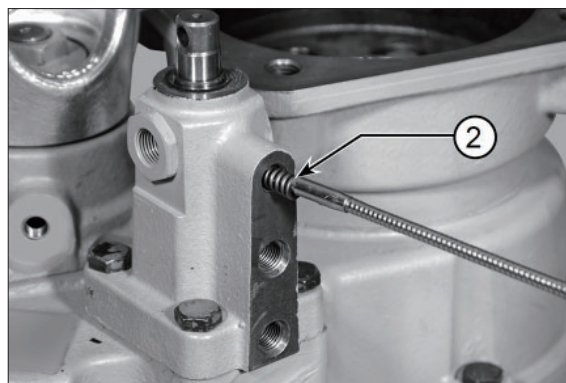
55W9NGB006

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



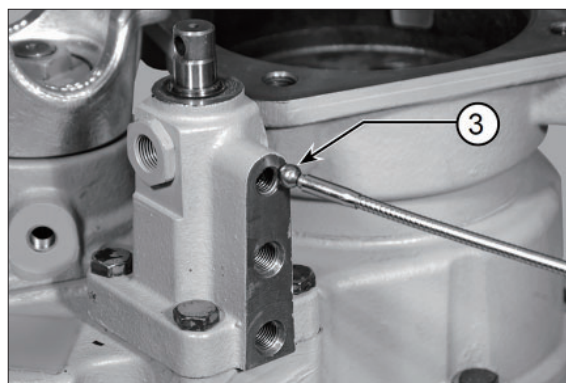
55W9NGB007

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



55W9NGB008

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



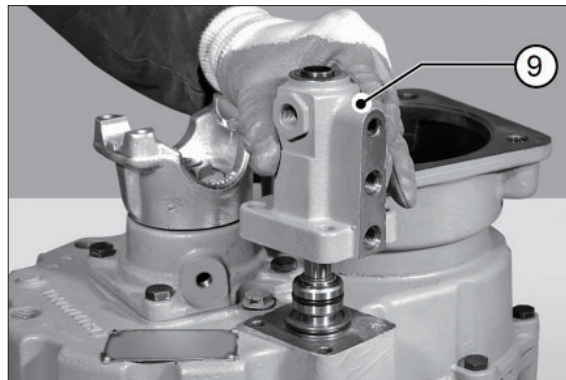
55W9NGB009

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



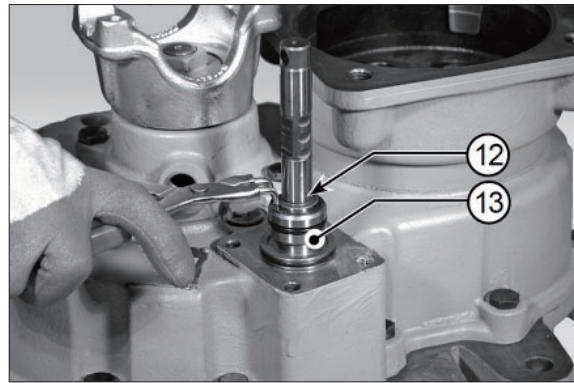
55W9NGB010

- (6) Remove the gear control cylinder (9).
- ※ Carefully remove all residue of loctite from the surfaces.



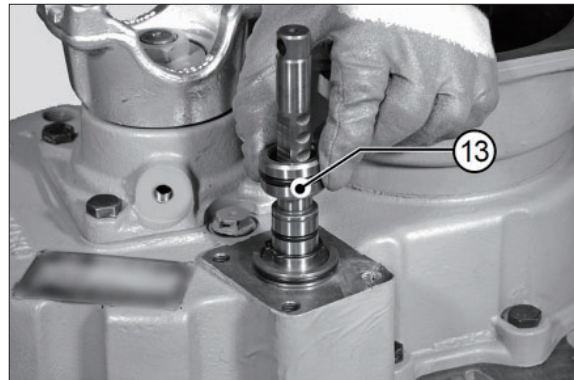
55W9NGB011

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



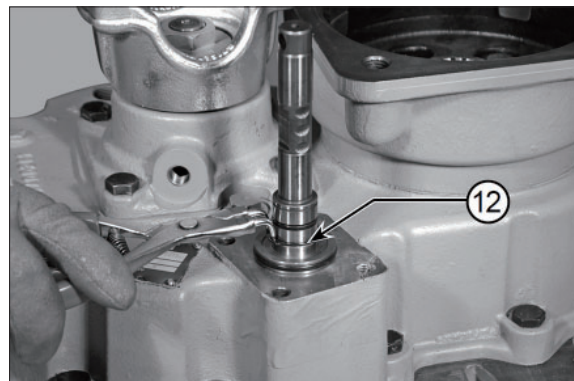
55W9NGB012

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



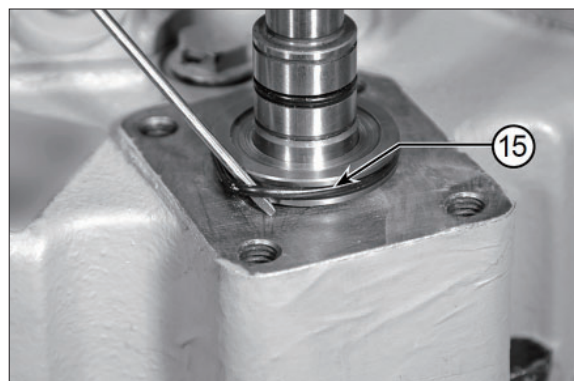
55W9NGB013

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



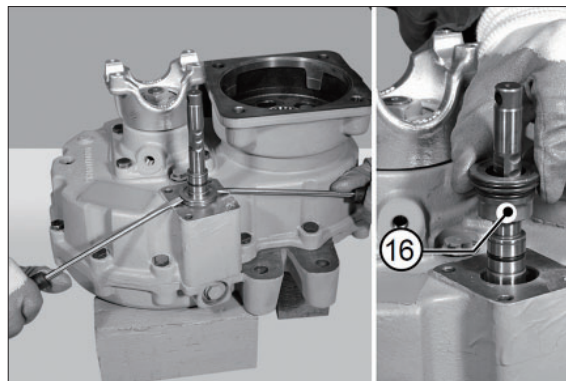
55W9NGB014

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



55W9NGB015

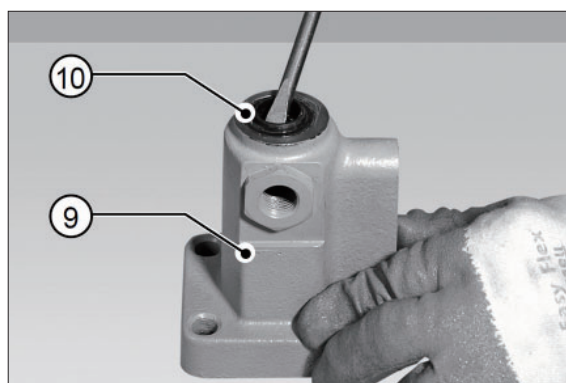
- (11) Use two levers to remove the bushing (16).



55W9NGB016

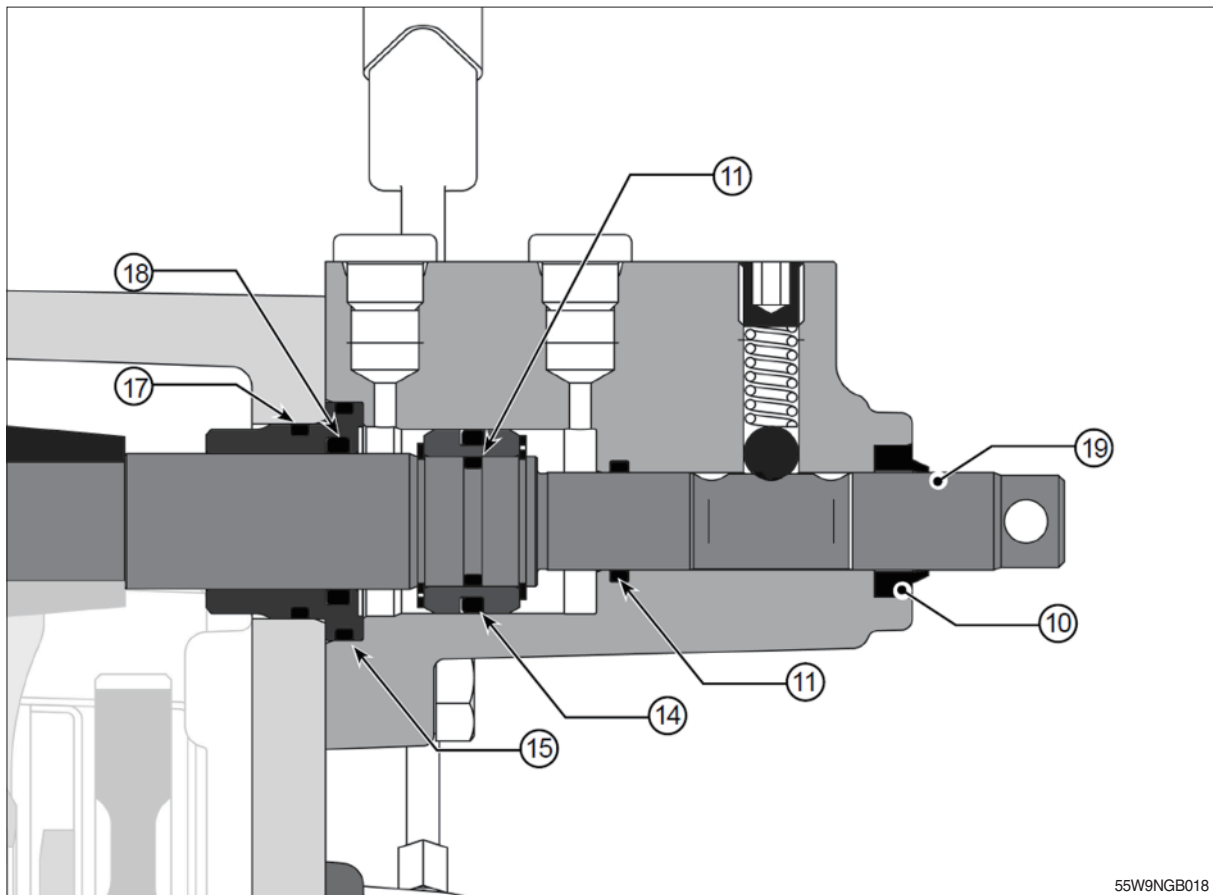
- (12) Remove the dust scraper ring (10) and the rod's O-ring (11) from the gearshift cylinder (9).

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

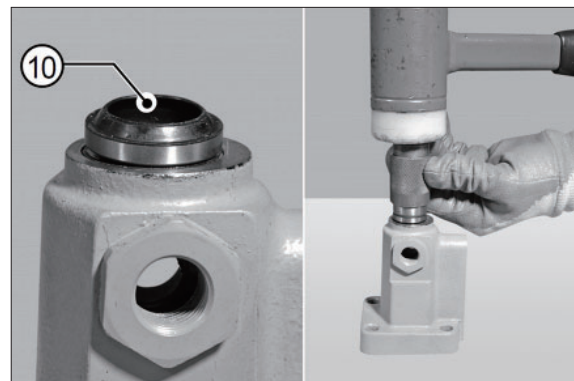


55W9NGB017

2) ASSEMBLY

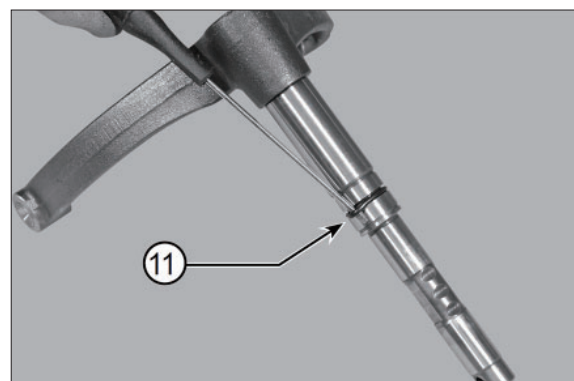


- (1) Fit the rod's O-ring (11) and the dust scraper ring (10) into the cylinder.

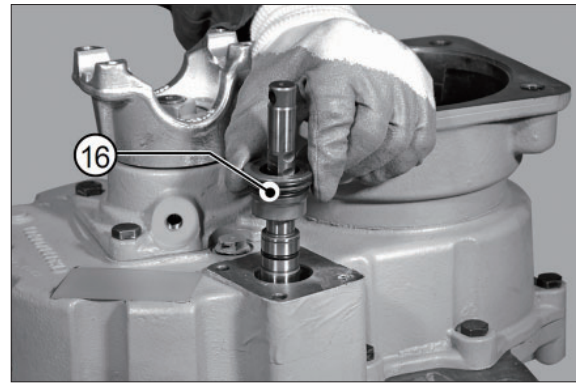


- (2) Fit the new O-ring (11) on the gear selector rod (19).

※ Lubricate before installing.

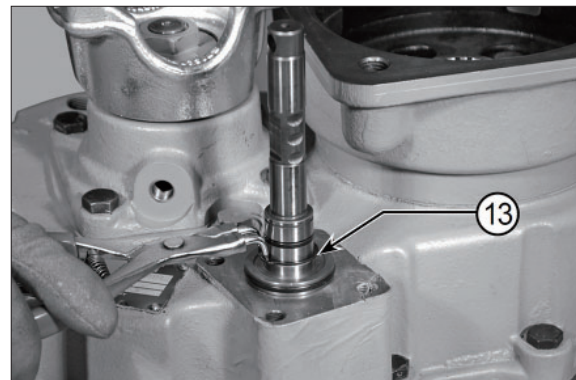


- (3) Fit the O-rings (15), (17), (18) on the guide bush (16) and lubricate rings.
Fit the bush (16) onto the gear selector rod (19).



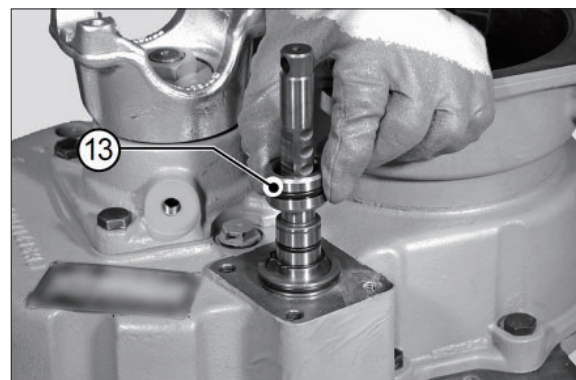
55W9NGB021

- (4) Insert the snap ring (12).



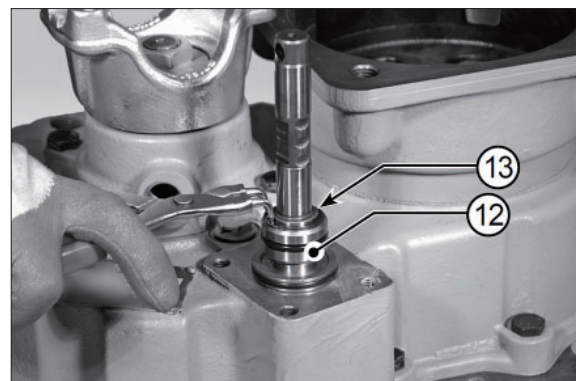
55W9NGB022

- (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).



55W9NGB023

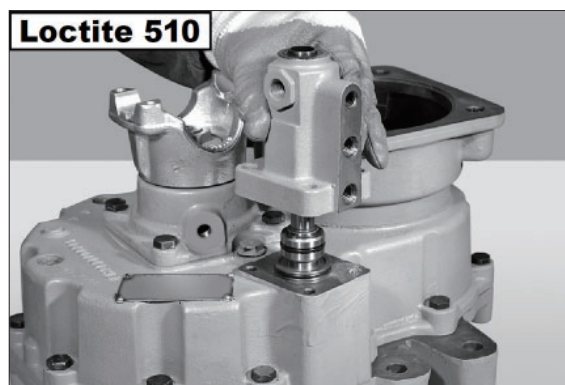
- (6) Secure the piston (13) in position with the snap ring (12).



55W9NGB024

- (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.



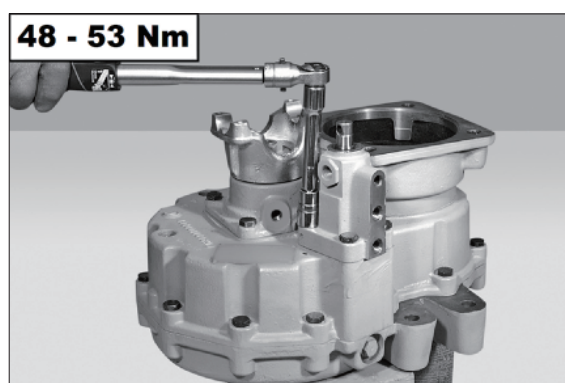
55W9NGB025

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



55W9NGB026

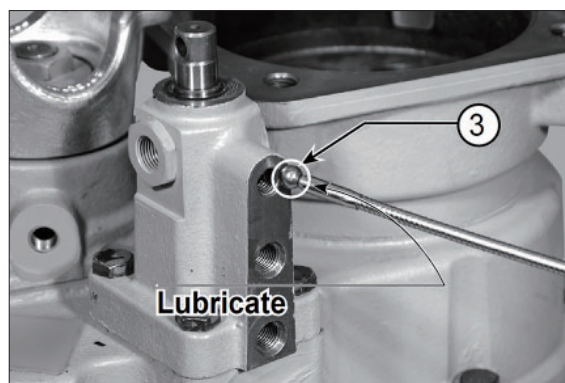
- (9) Tighten screws (8) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



55W9NGB027

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

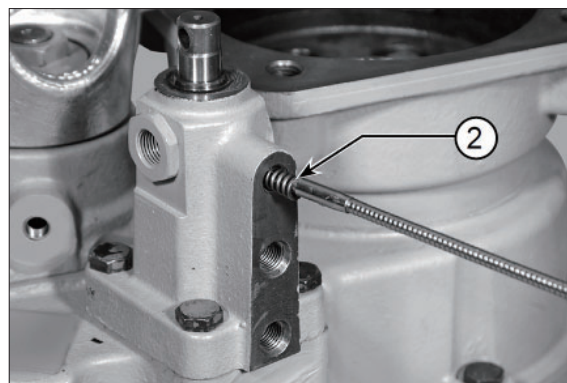
※ Lubricate before installing.



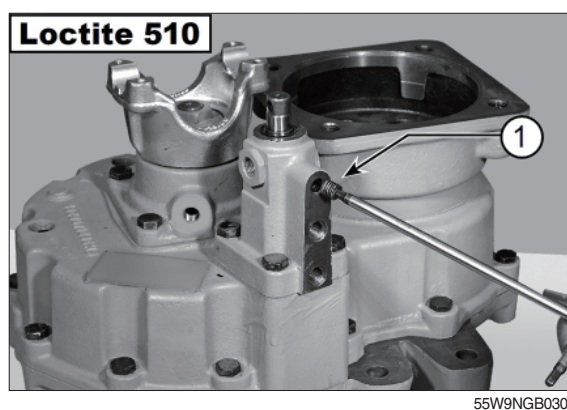
55W9NGB028

(11) Fit the gear selector springs.

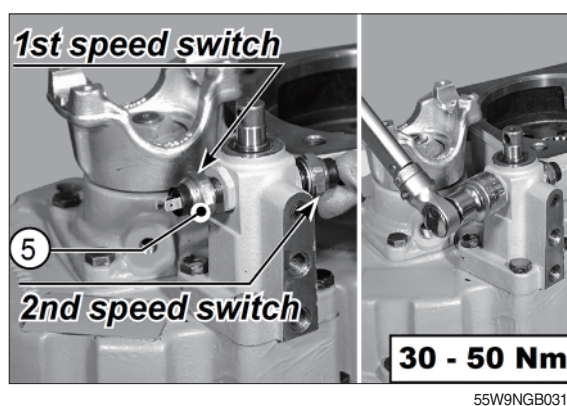
- ※ Replace the springs (14) if they are weakened or bent.



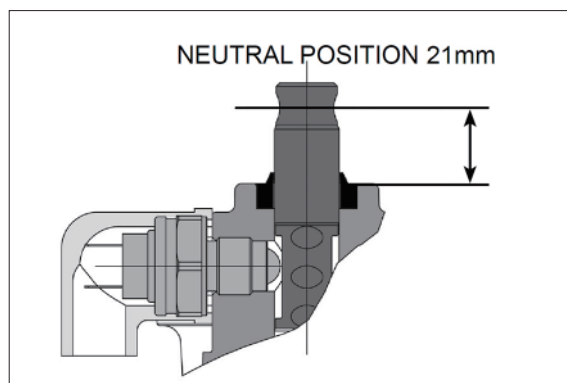
(12) Coat the dowel (1) with loctite 510 and screw it until it is level with the cylinder.



(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).



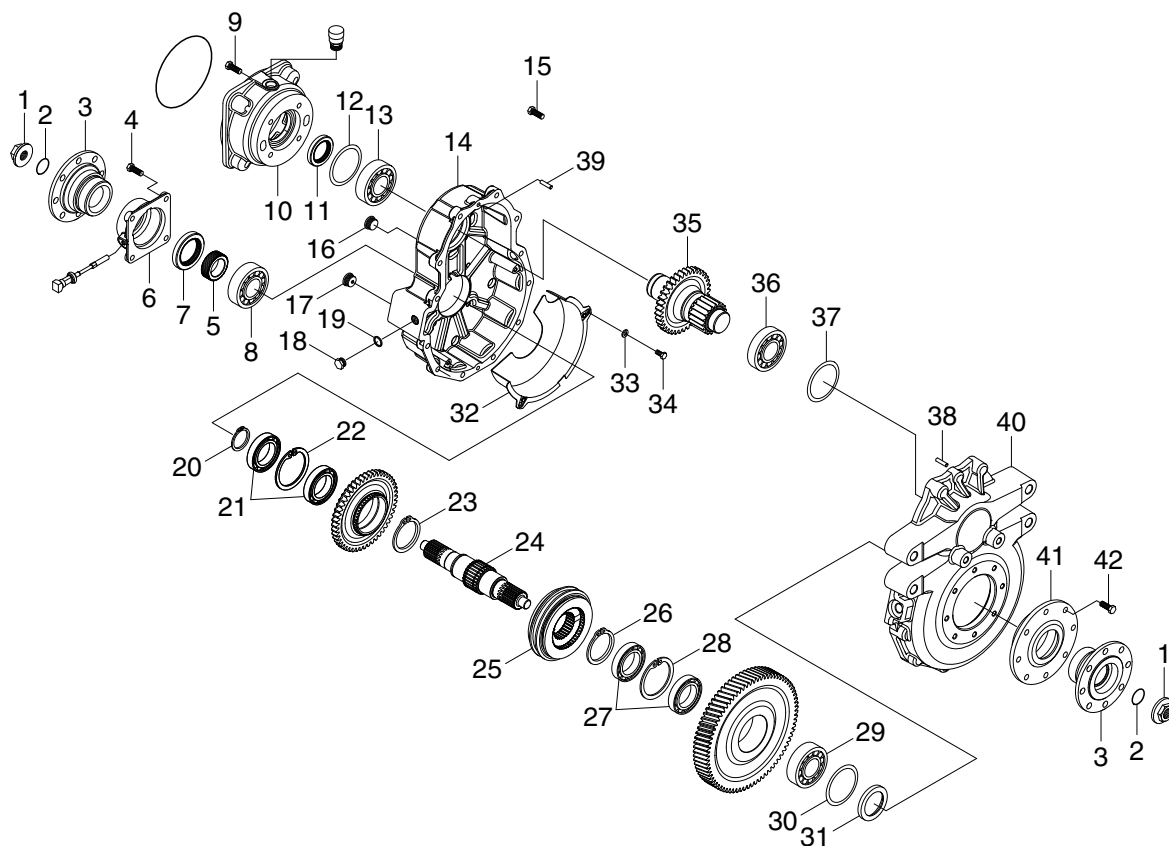
(14) Engage the 1st speed and verify with a control device (tester) that the switch 1st speed gives signal and that the switch 2nd speed is disabled. Repeat the operation on the switch 2nd speed.



55W9NGB032

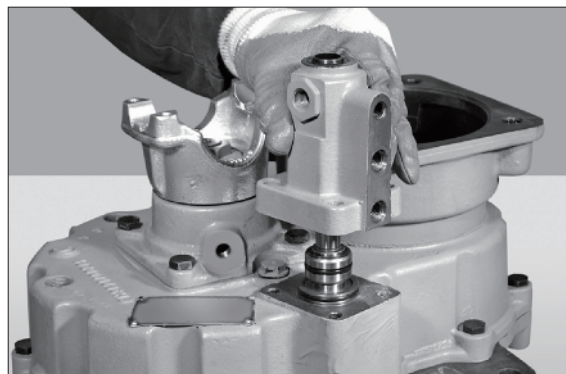
5. INTEGRATED REDUCTION GEAR

1) DISASSEMBLY



55W9NGB048

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



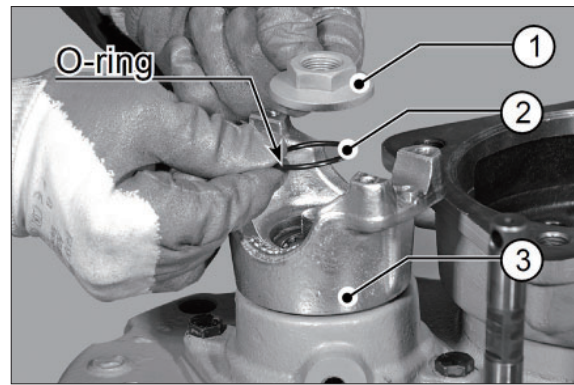
55W9NGB048-1

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



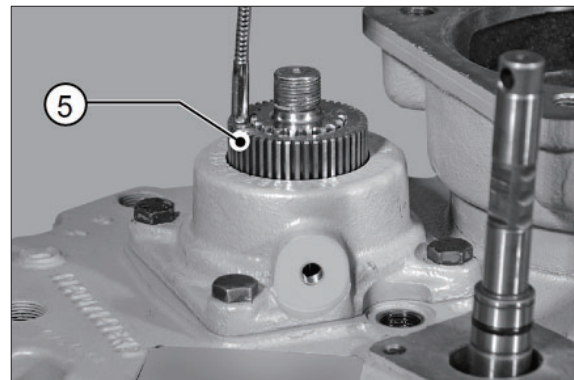
55W9NGB049

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



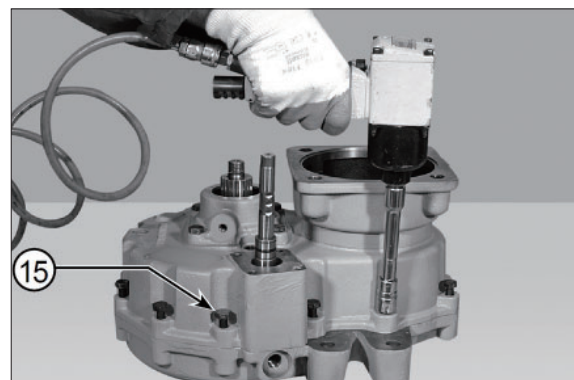
55W9NGB050

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



55W9NGB051

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



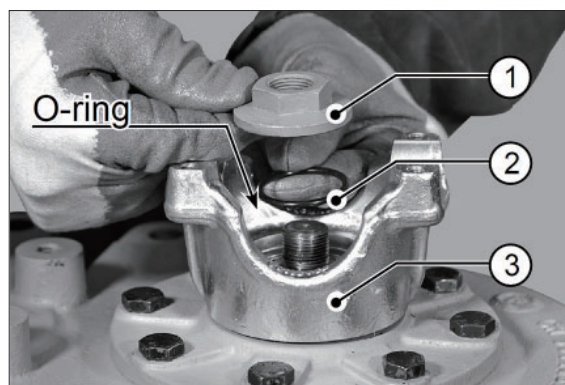
55W9NGB052

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



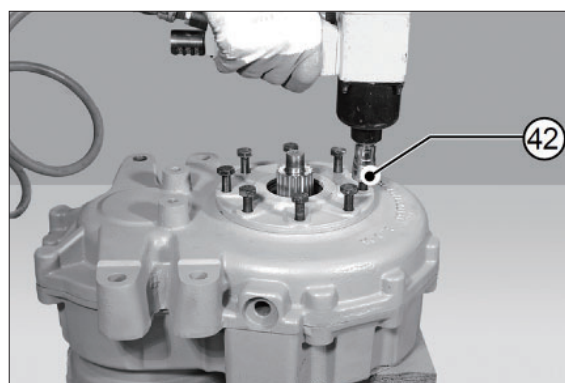
55W9NGB053

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



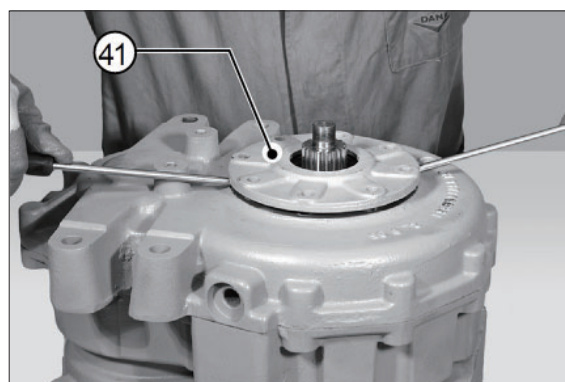
55W9NGB054

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



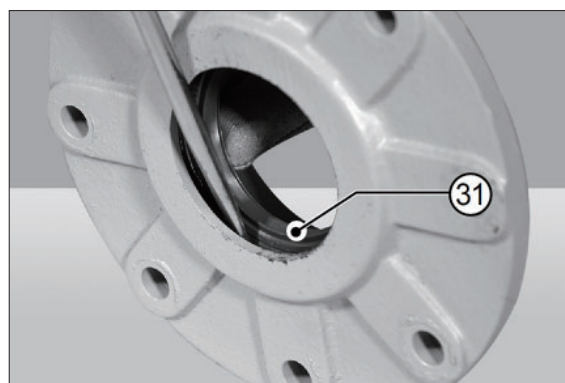
55W9NGB055

- (9) Disjoin and remove the cover (41).
※ Carefully remove all residue of loctite from the surfaces.



55W9NGB056

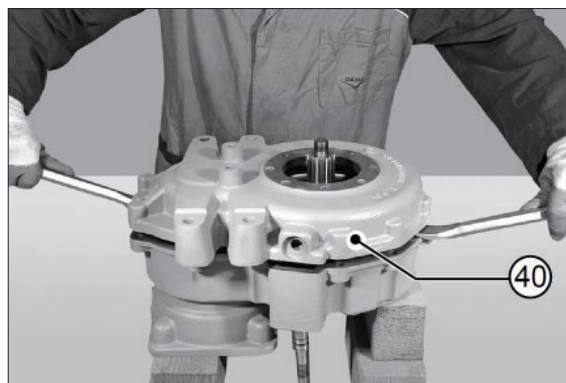
- (10) Remove seal ring (31).
※ Note down direction of installation.



55W9NGB057

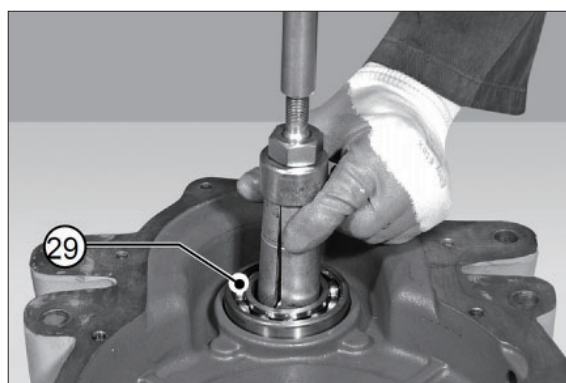
(11) Disjoin and remove the cover (40).

※ Carefully remove all residue of loctite from the surfaces.



55W9NGB058

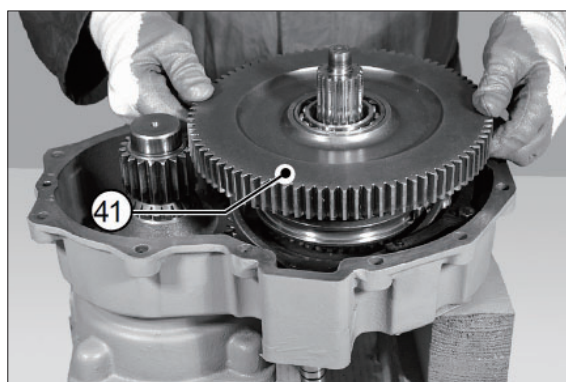
(12) Using an internal extractor, remove the bearing (29).



55W9NGB059

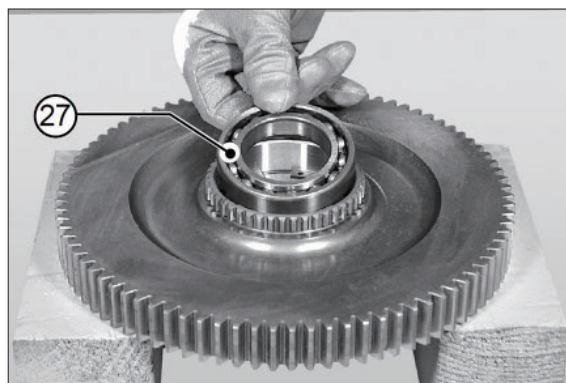
(13) Remove gear (41).

※ Note the correct mounting direction.



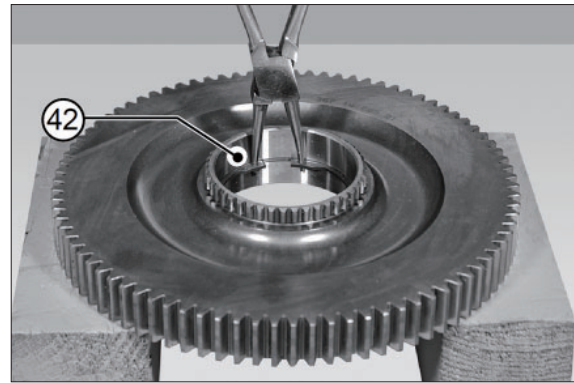
55W9NGB060

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



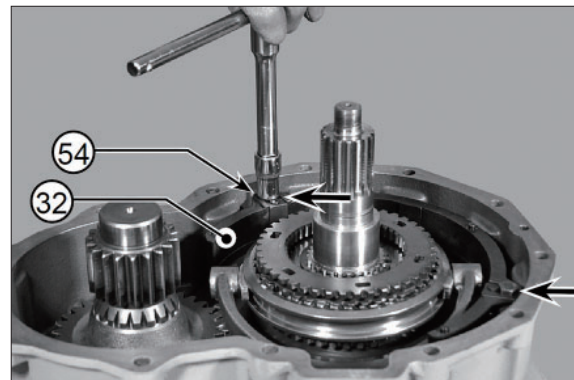
55W9NGB061

(15) Remove the snap ring (42).



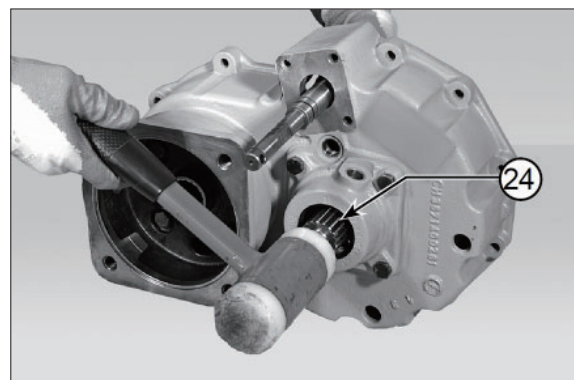
55W9NGB062

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



55W9NGB063

(17) Remove the lower shaft (24).



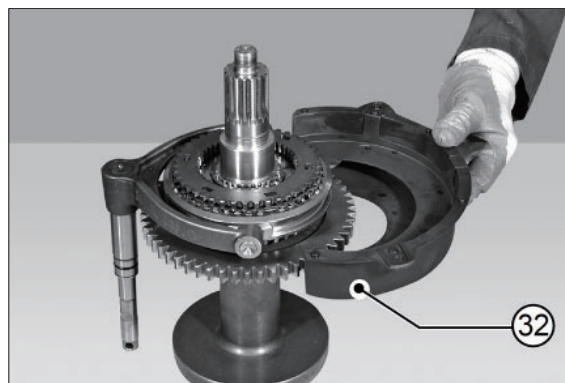
55W9NGB064

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



55W9NGB065

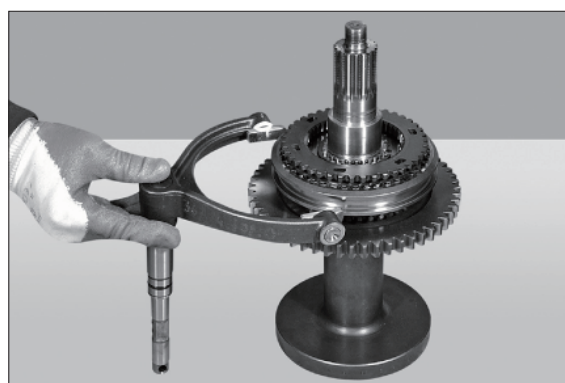
(19) Remove the internal baffle plate (32).



55W9NGB066

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

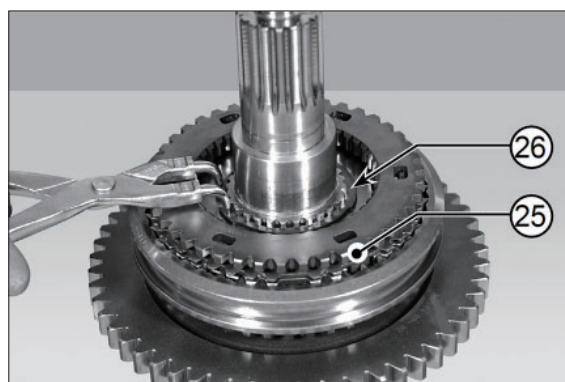
※ Replace if worn.



55W9NGB067

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

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



55W9NGB068

(22) Remove the complete synchroniser (25).

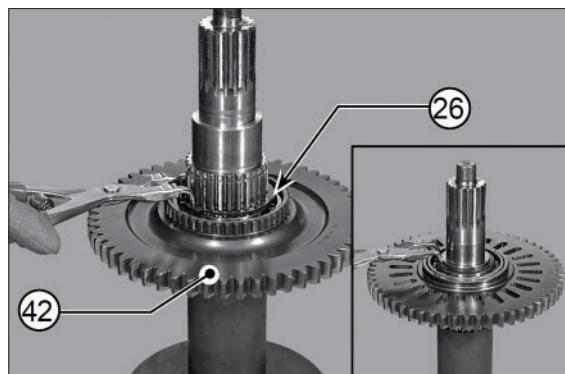
※ Note the correct mounting direction.



55W9NGB069

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

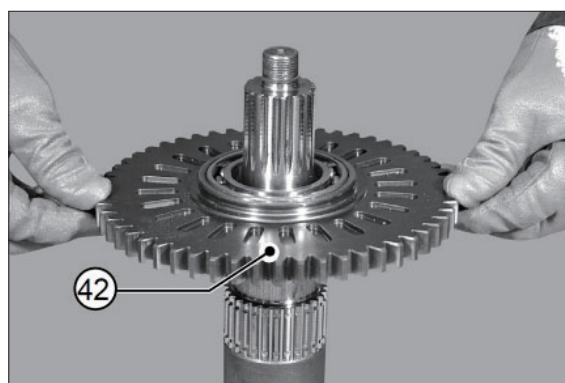
※ Take care not to bend the snap ring (23).



55W9NGB070

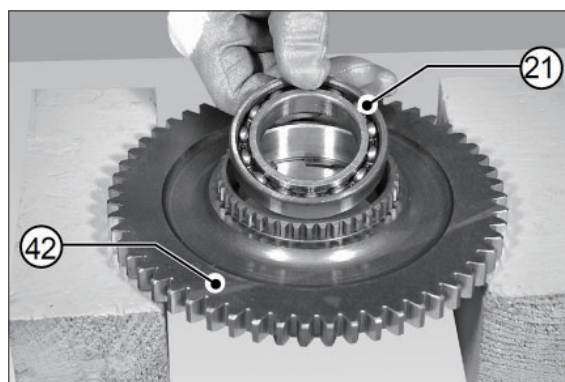
(24) Remove gear (42).

※ Note the correct mounting direction.



55W9NGB071

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



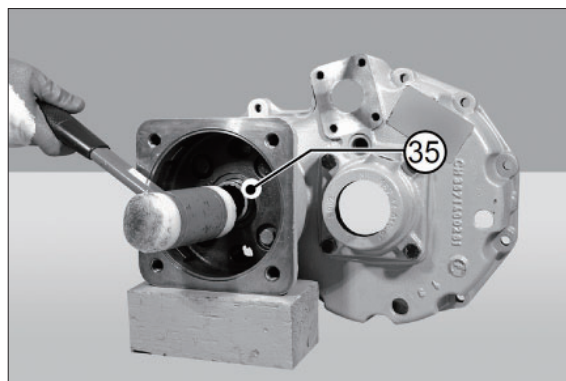
55W9NGB072

(26) Remove the snap ring (22).



55W9NGB073

(27) Remove the upper shaft (35).



55W9NGB074

(28) Input shaft

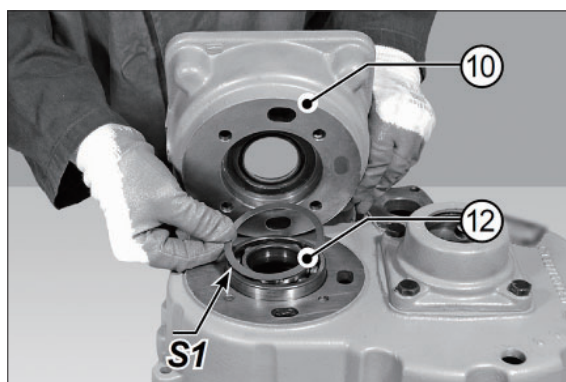
Mark the position between the motion entrance cover (10) and reduction gear cover (14); remove screws (9) from the motion entrance cover (10).



55W9NGB075

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

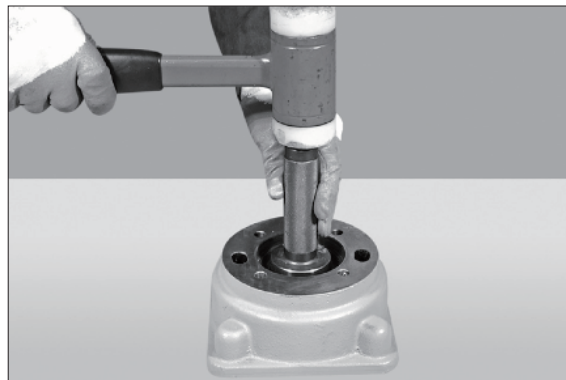
※ Carefully remove all residue of loctite from the surfaces.



55W9NGB076

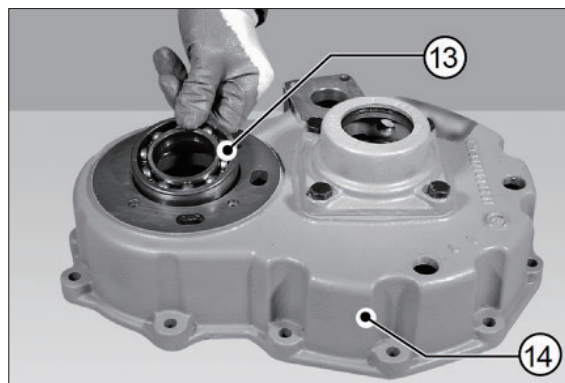
(30) Remove seal ring (11).

※ Note down direction of installation.



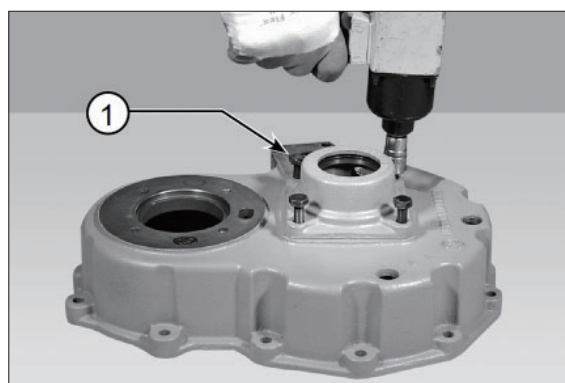
55W9NGB077

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



55W9NGB078

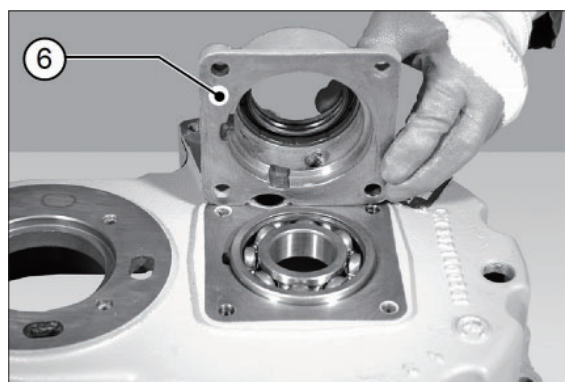
(32) Loosen and remove the check screws (4) of the cover (6).



55W9NGB079

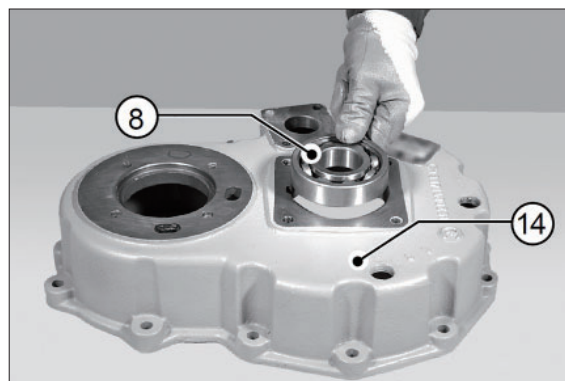
(33) Disjoin and remove the cover (6).

※ Carefully remove all residue of loctite from the surfaces.



55W9NGB080

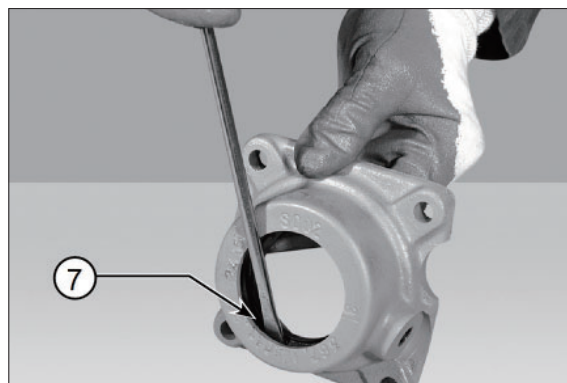
(34) Remove the bearing (8) from the cover (14).



55W9NGB081

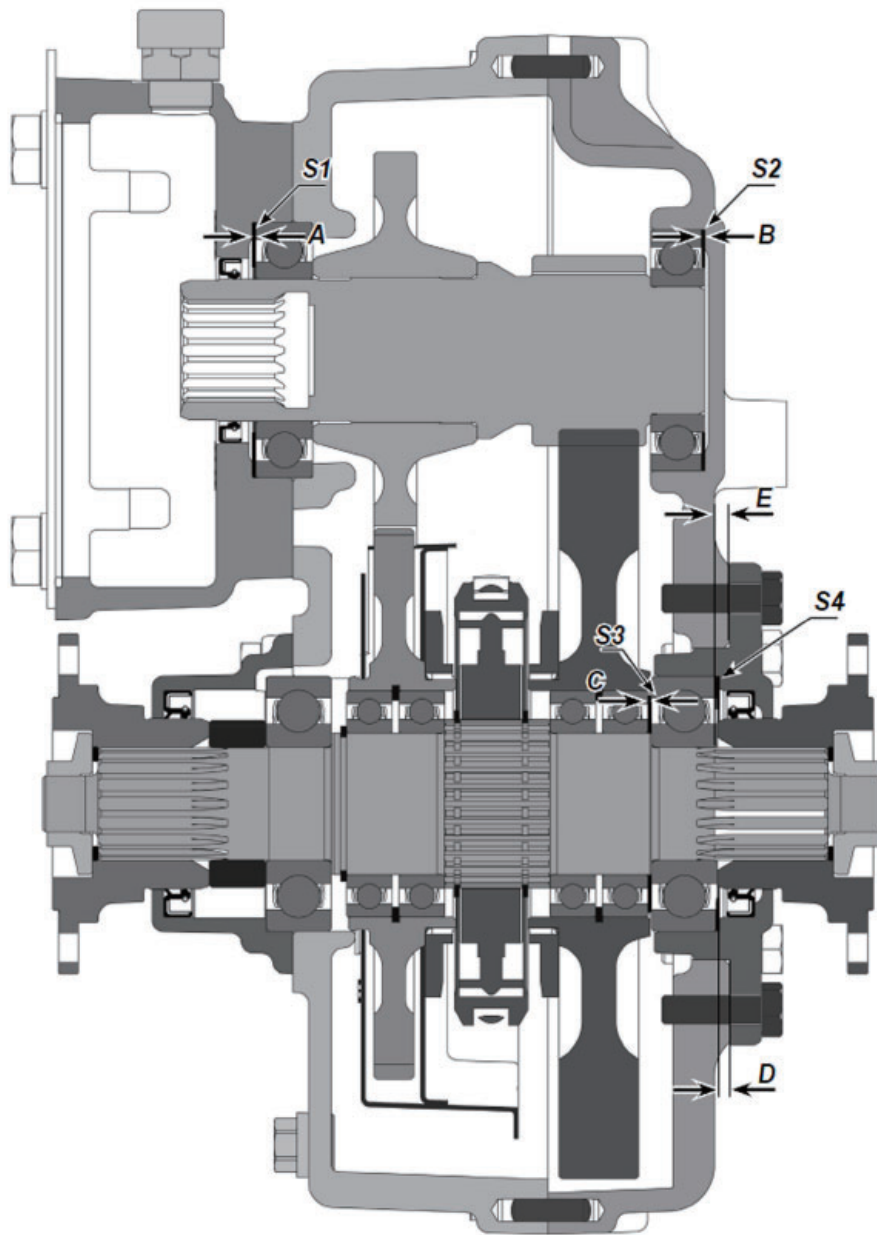
(35) Remove seal ring (7).

※ Note down direction of installation.



55W9NGB082

2) ASSEMBLY

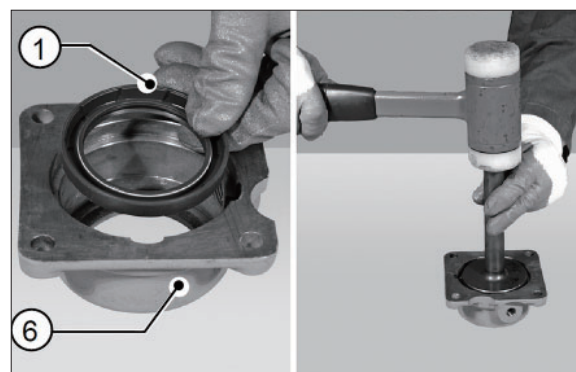


55W9NGB083

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

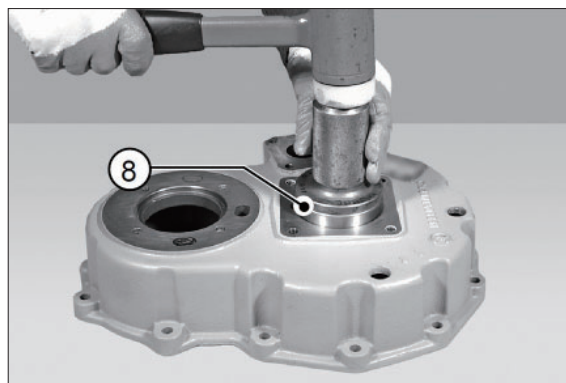
※ Pay particular attention to the direction of assembly of the rings (7).

Lubricate the lip of the sealing ring with grease.



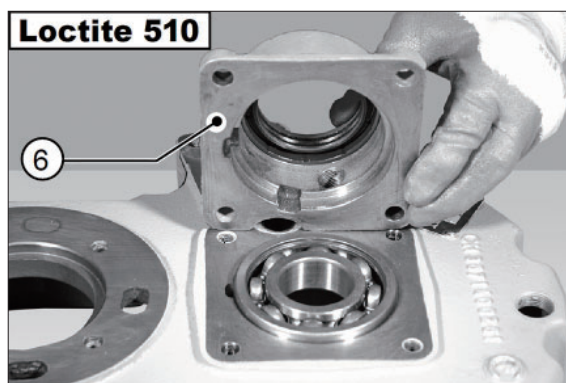
55W9NGB084

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



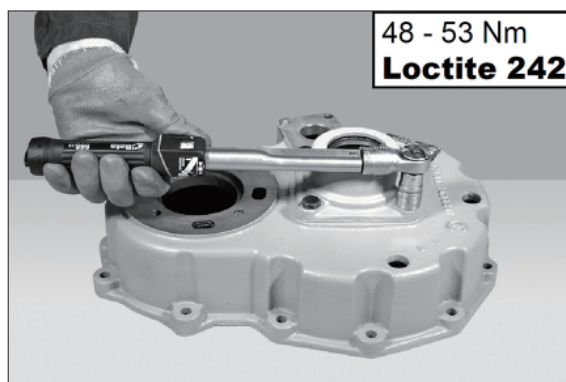
55W9NGB085

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



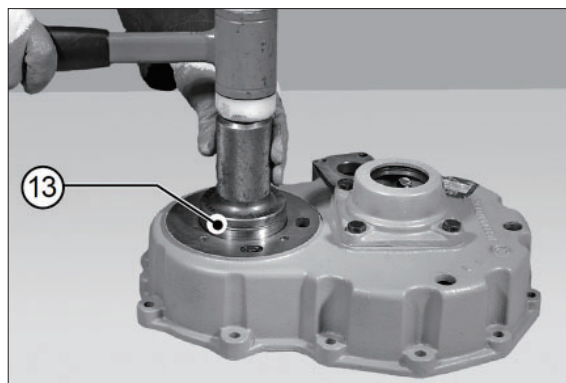
55W9NGB086

- (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).



55W9NGB087

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

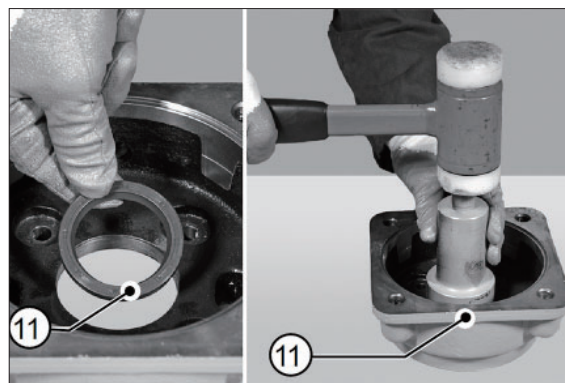


55W9NGB088

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

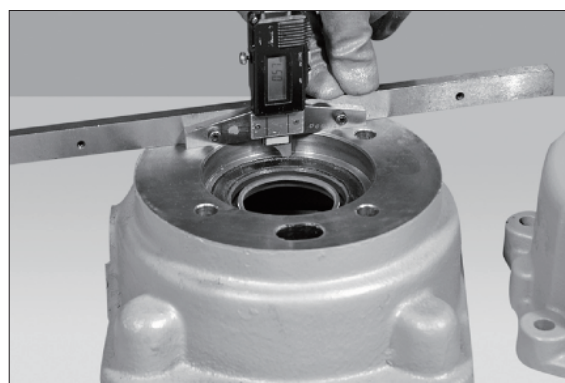
※ Pay particular attention to the direction of assembly of the rings (11).

Lubricate the lip of the sealing ring with grease.



55W9NGB089

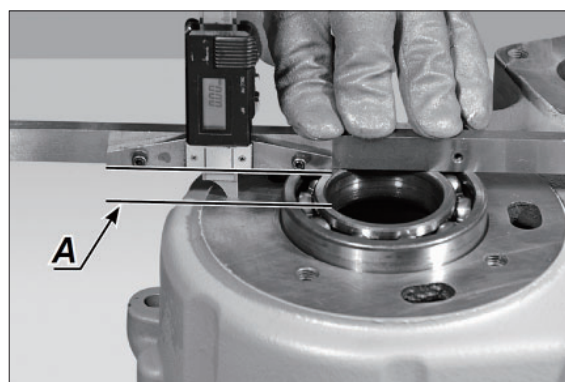
(7) Zero the depth gauge between the cover surface and bearing contact surface.



55W9NGB090

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

· Example : $A = 0.50$



55W9NGB091

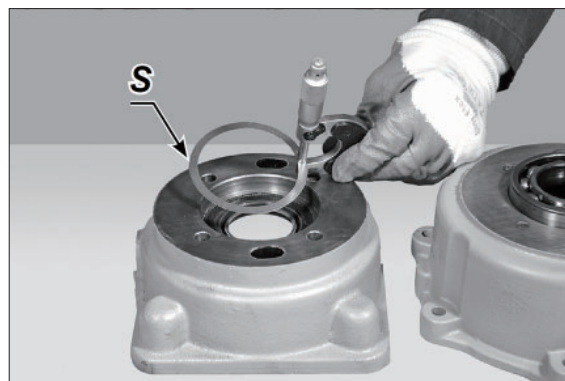
(9) Calculate thickness “S” of the shims by using this formula :

$S = A - Y = S$, where Y is the predefined axial backlash.

$Y = \text{backlash} = 0.15 \pm 0.35 \text{ mm}$

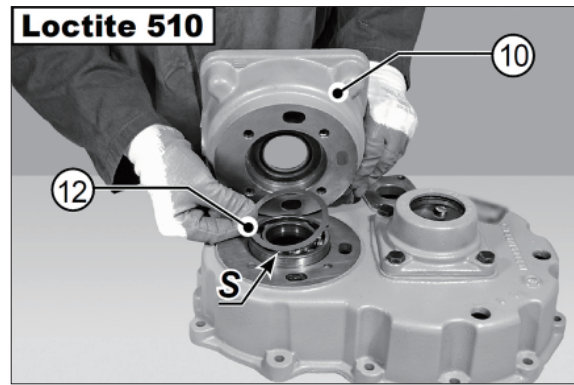
Example : $S = A - Y = 0.50 - 0.25 = 0.25 \text{ mm} = S$

Make up the appropriate pack of shims.



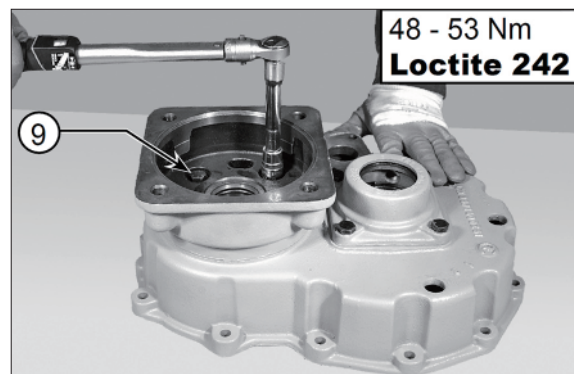
55W9NGB092

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



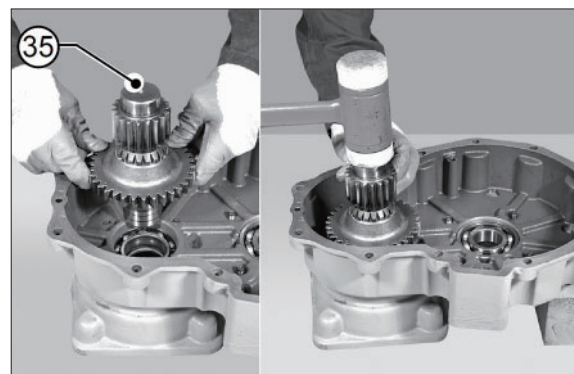
55W9NGB093

- (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).



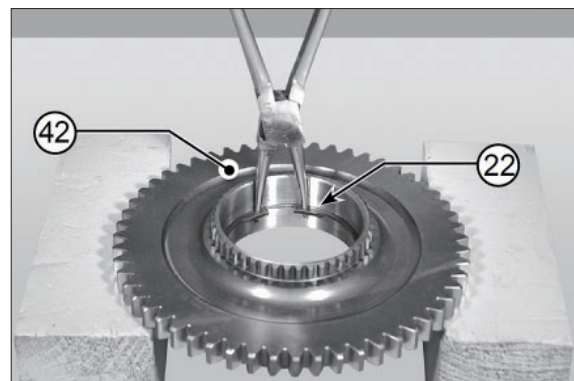
55W9NGB094

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



55W9NGB095

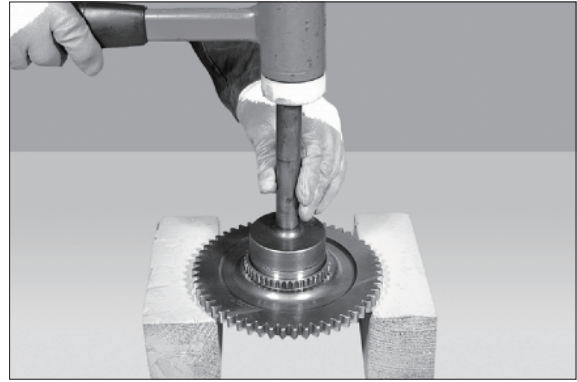
- (13) Fit the snap ring (22) in the gear (42).



55W9NGB096

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

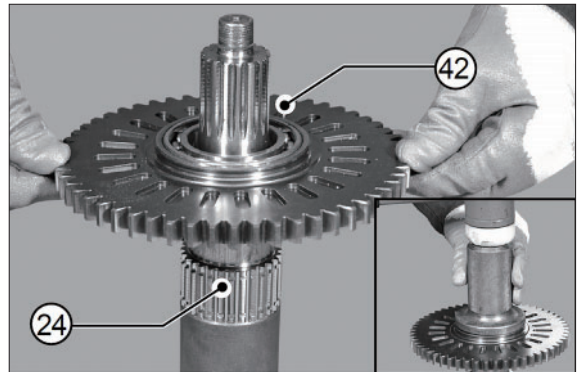
- ※ Ensure that the bearing is seated securely.



55W9NGB097

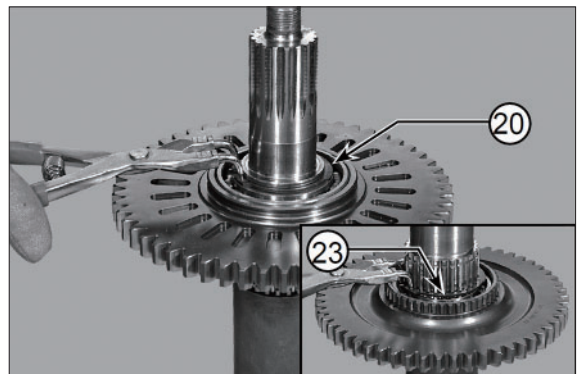
(15) Fit gear (42) onto the shaft (24).

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



55W9NGB098

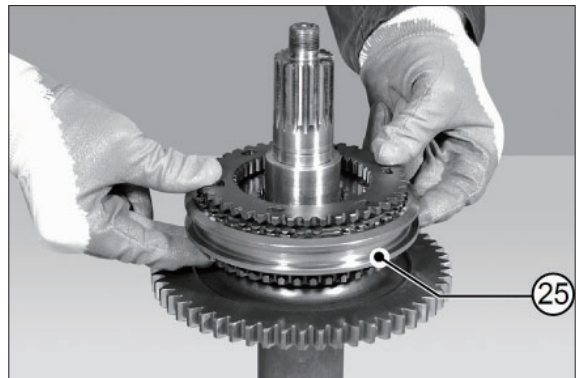
(16) Repeat the operation on both sides.
Secure the gear (42) in position with the snap ring (20), (23).



55W9NGB099

(17) Fit the complete synchroniser (25).

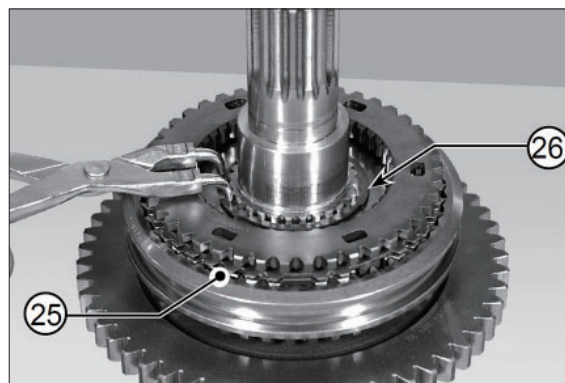
- ※ Fit as originally mounted, using the markings made previously as reference.



55W9NGB100

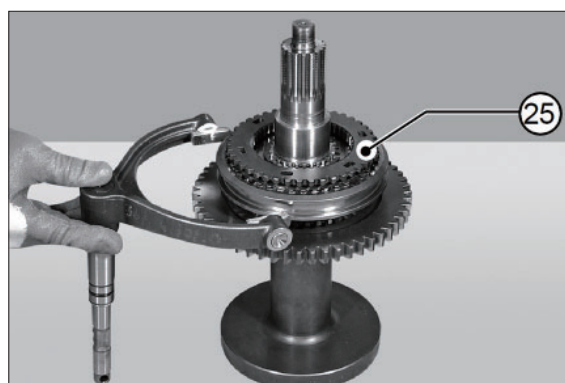
(18) Secure the synchroniser (25) in position with the snap ring (26).

※ Check that the snap ring is seated correctly.



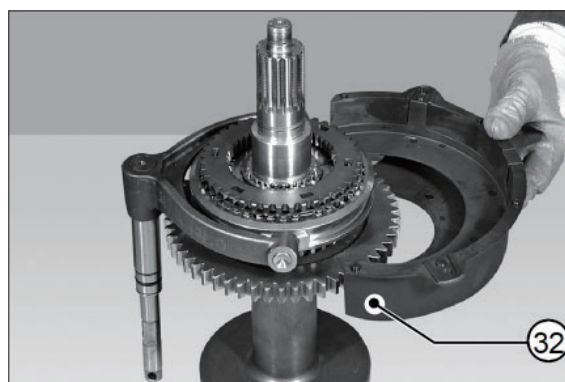
55W9NGB101

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



55W9NGB102

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



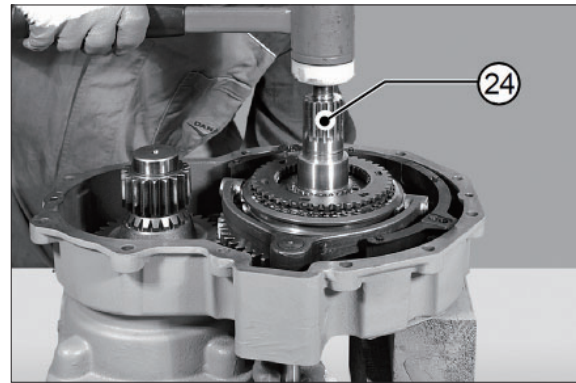
55W9NGB103

(21) Secure the lower shaft assembly (24) to a hoist.
Install the lower shaft assembly (24), complete with yoke and gearbox control rod.



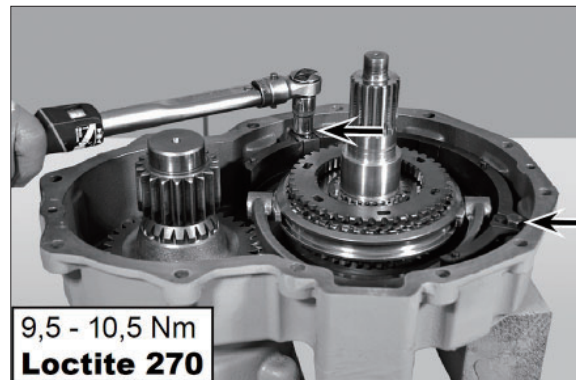
55W9NGB104

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



55W9NGB105

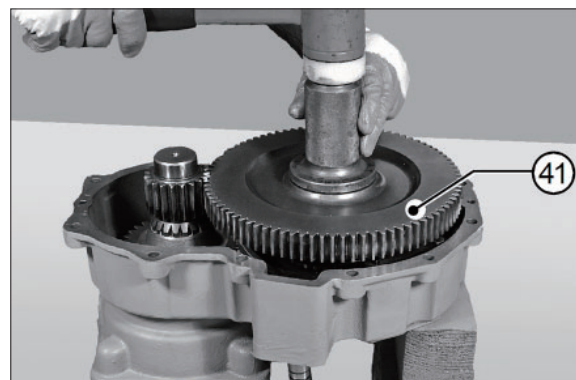
- (23) Spread loctite 270 on the screws and tighten to a torque of 0.97~1.07 kgf · m (7.02~7.74 lbf · ft).



55W9NGB106

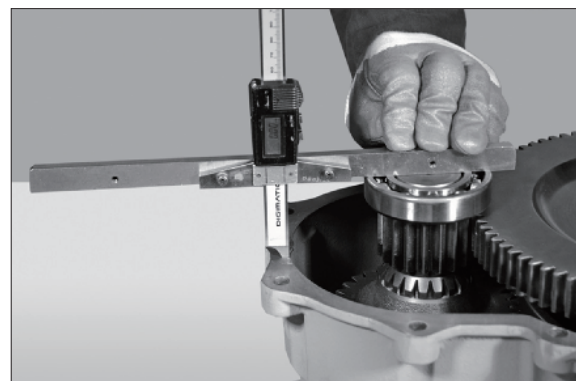
- (24) Using a pusher of suitable diameter, fit gear (41) onto the shaft (24).

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



55W9NGB107

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



55W9NGB108

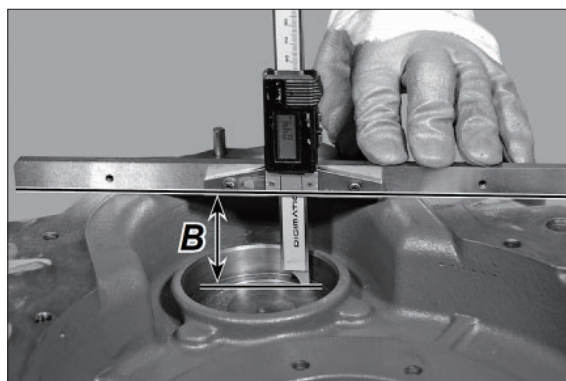
(26) Remove the bearing (75) from the input shaft (73).



55W9NGB109

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

• Example : $B = 0.45$



55W9NGB110

(28) Calculate thickness “S2” of the shims by using this formula :

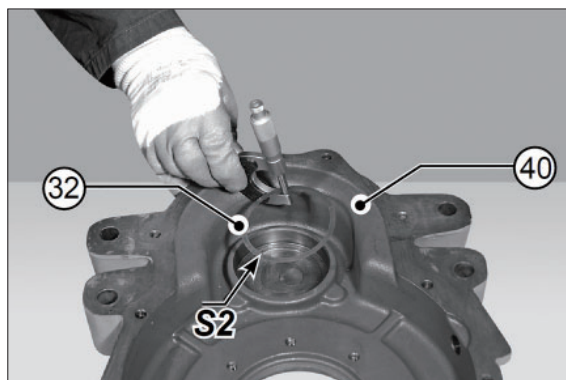
$S2 = B - Y = S2$, where Y is the predefined axial backlash.

$Y = \text{backlash} = 0.15 \pm 0.35 \text{ mm}$

Example :

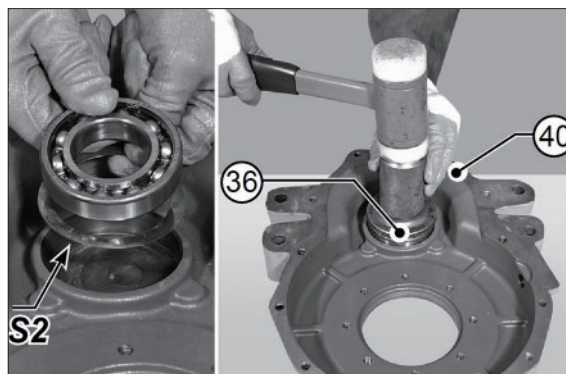
$S2 = B - Y = 0.45 - 0.25 = 0.20 \text{ mm} = S2$

Make up the appropriate pack of shims.



55W9NGB111

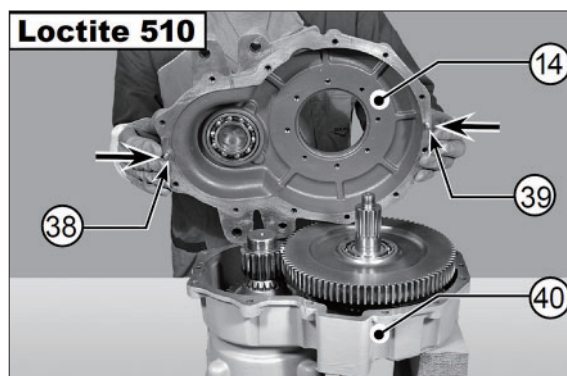
(29) Using a normal tool, push the bearing (36) and shims into its seat in the cover (40).



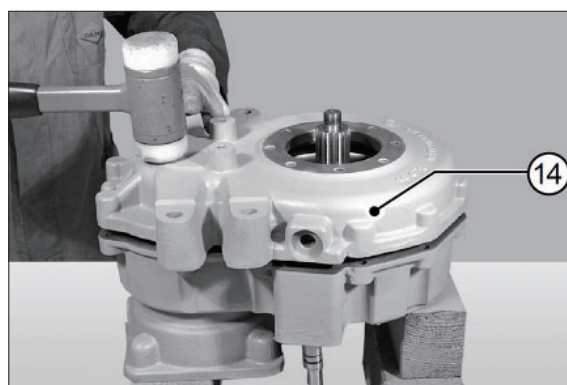
55W9NGB112

(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).

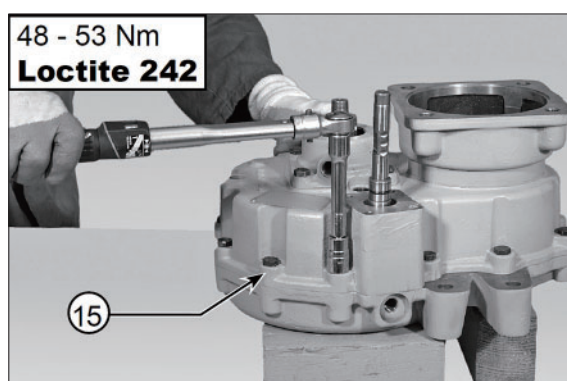


(31) Tap the cover (14) gently with a mallet to seat correctly.

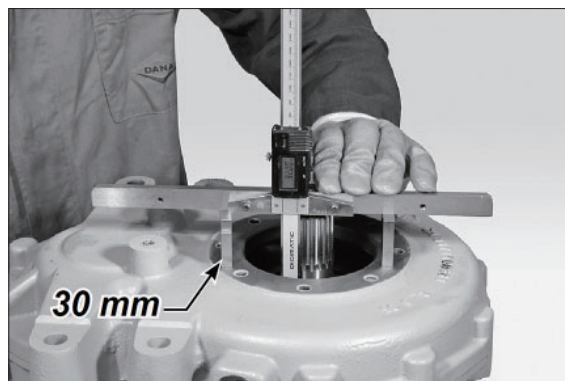


(32) Spread loctite 242 on the screws (15).

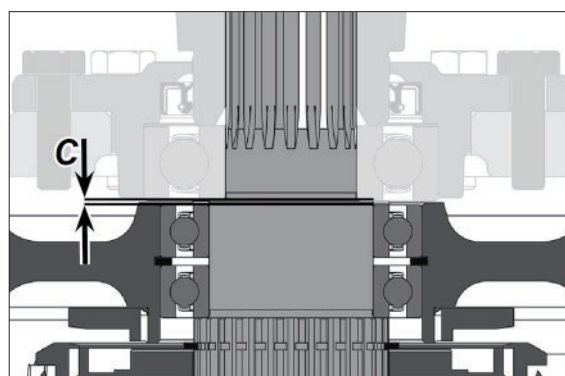
Secure in position with the screws (15), tightening to a torque of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



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



55W9NGB116



55W9NGB117

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

• Example : $C = 0.45$



55W9NGB118

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

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

$X = \text{backlash} = 0.15 \pm 0.35 \text{ mm}$

Example :

$S3 = C - X = 0.45 - 0.25 = 0.20 \text{ mm} = S3$

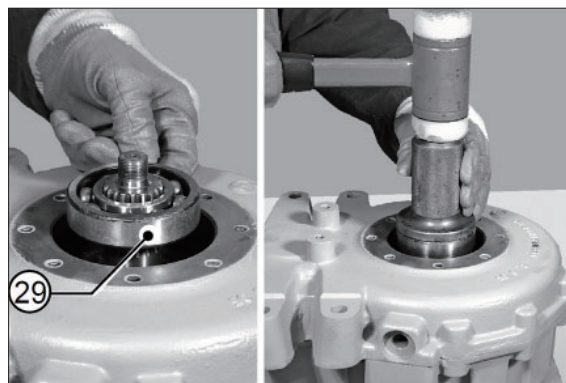
Make up the appropriate pack of shims.



55W9NGB119

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

- ※ Ensure that the bearing is seated securely.

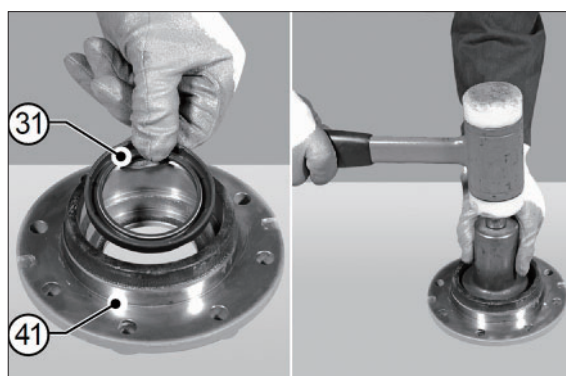


55W9NGB120

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

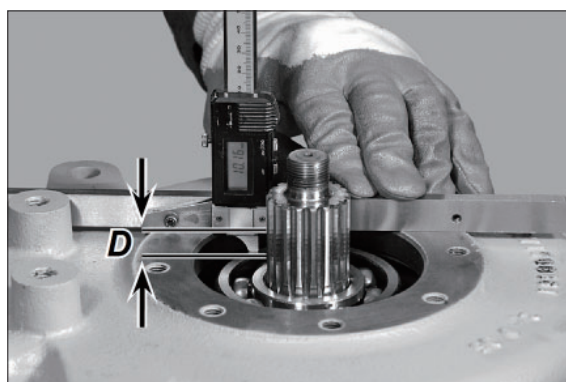
- ※ Pay particular attention to the direction of assembly of the rings (31).

Lubricate the lip of the sealing ring with grease.



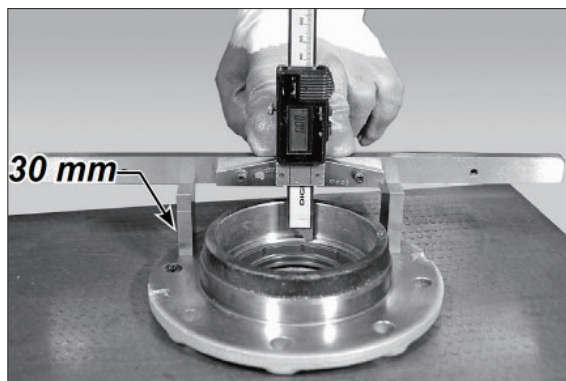
55W9NGB121

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



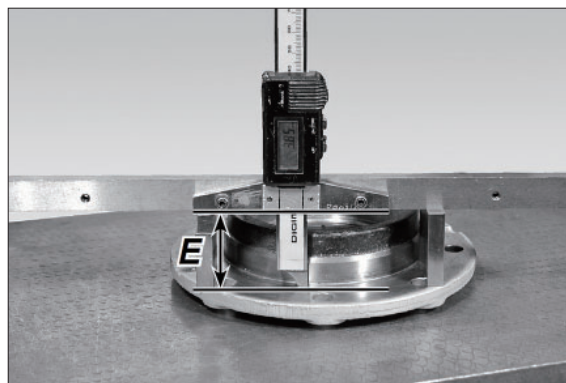
55W9NGB122

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



55W9NGB123

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



55W9NGB124

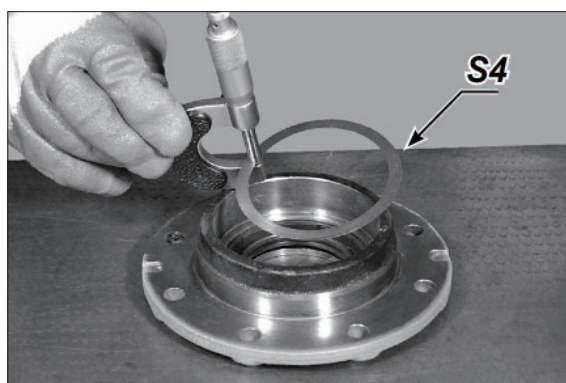
(41) Calculate thickness “S4” of the shims by using this formula :

$S4 = (\text{Dimension E} - \text{Dimension D}) - X = S4$, where X is the predefined axial backlash.

$X = \text{backlash} = 0.15 \pm 0.25 \text{ mm}$

Example : $S4 = (E-D)-X = (3.85-3.40)-0.20 = 0.25 \text{ mm} = S4$

Make up the appropriate pack of shims.



55W9NGB125

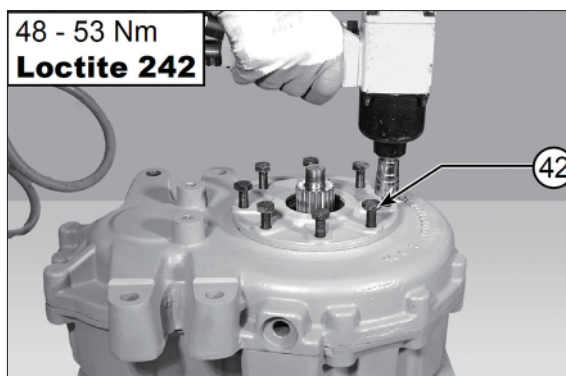
(42) Assembly the cover (41) spreading loctite 510 on planes.



55W9NGB126

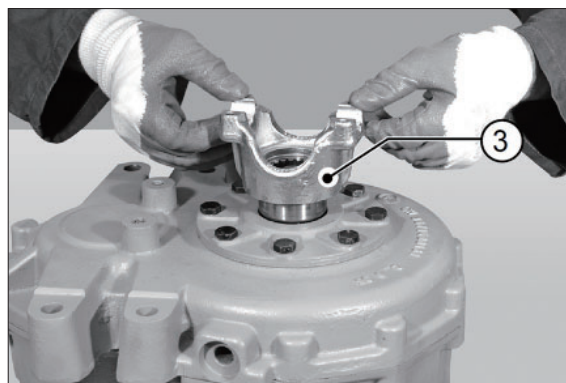
(43) Assembly the screws (42) spreading loctite 242.

Tighten screws (42) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



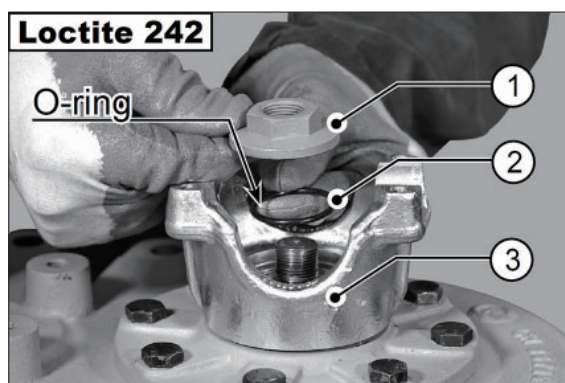
55W9NGB127

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



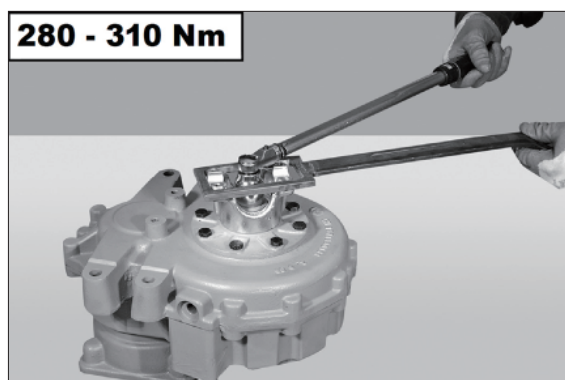
55W9NGB128

- (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.



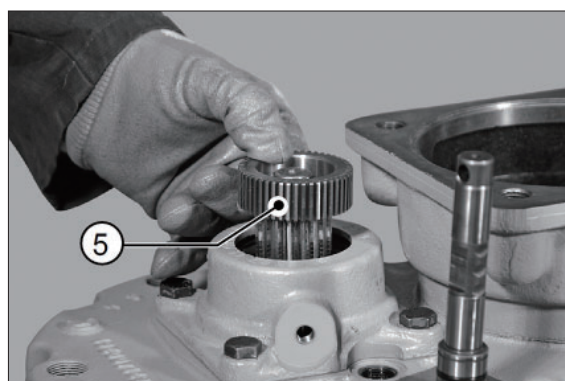
55W9NGB129

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



55W9NGB130

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



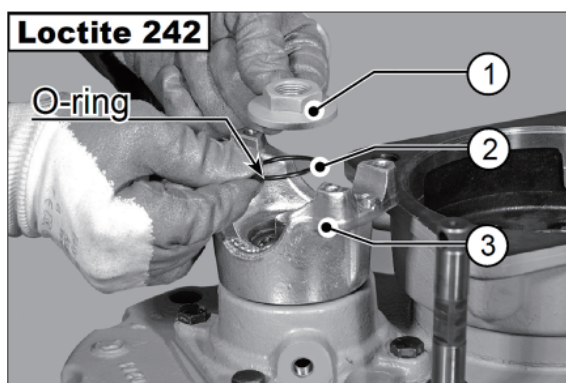
55W9NGB131

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



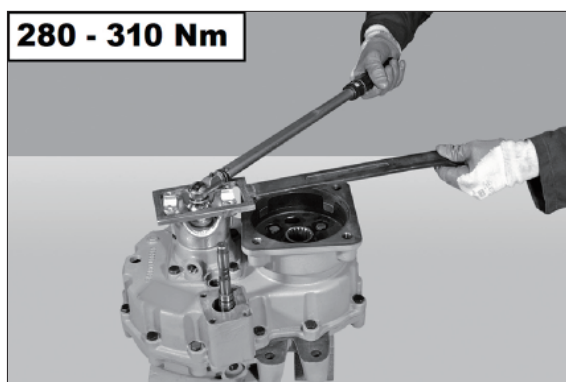
55W9NGB132

- (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.



55W9NGB133

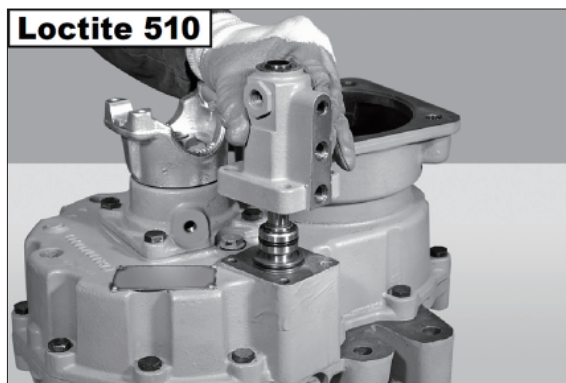
- (50) Tighten the lock nut (1) to a torque of 28.6~31.6 kgf · m (207~229 lbf · ft).



55W9NGB134

- (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



55W9NGB135

GROUP 8 STEERING VALVE

1. REMOVAL AND INSTALL

1) REMOVAL

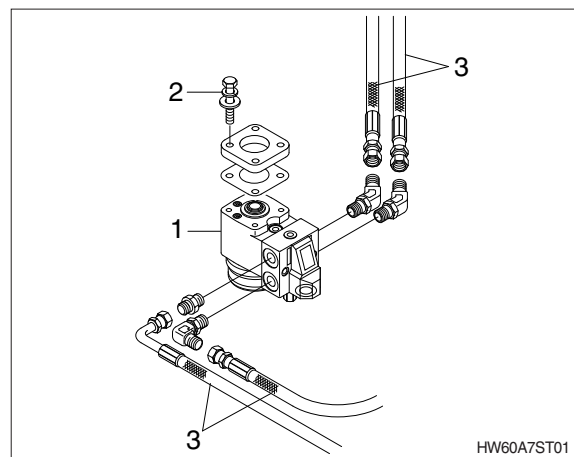
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ 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 : $4.8 \pm 0.3 \text{ kgf} \cdot \text{m}$
($34.7 \pm 2.2 \text{ lbf} \cdot \text{ft}$)

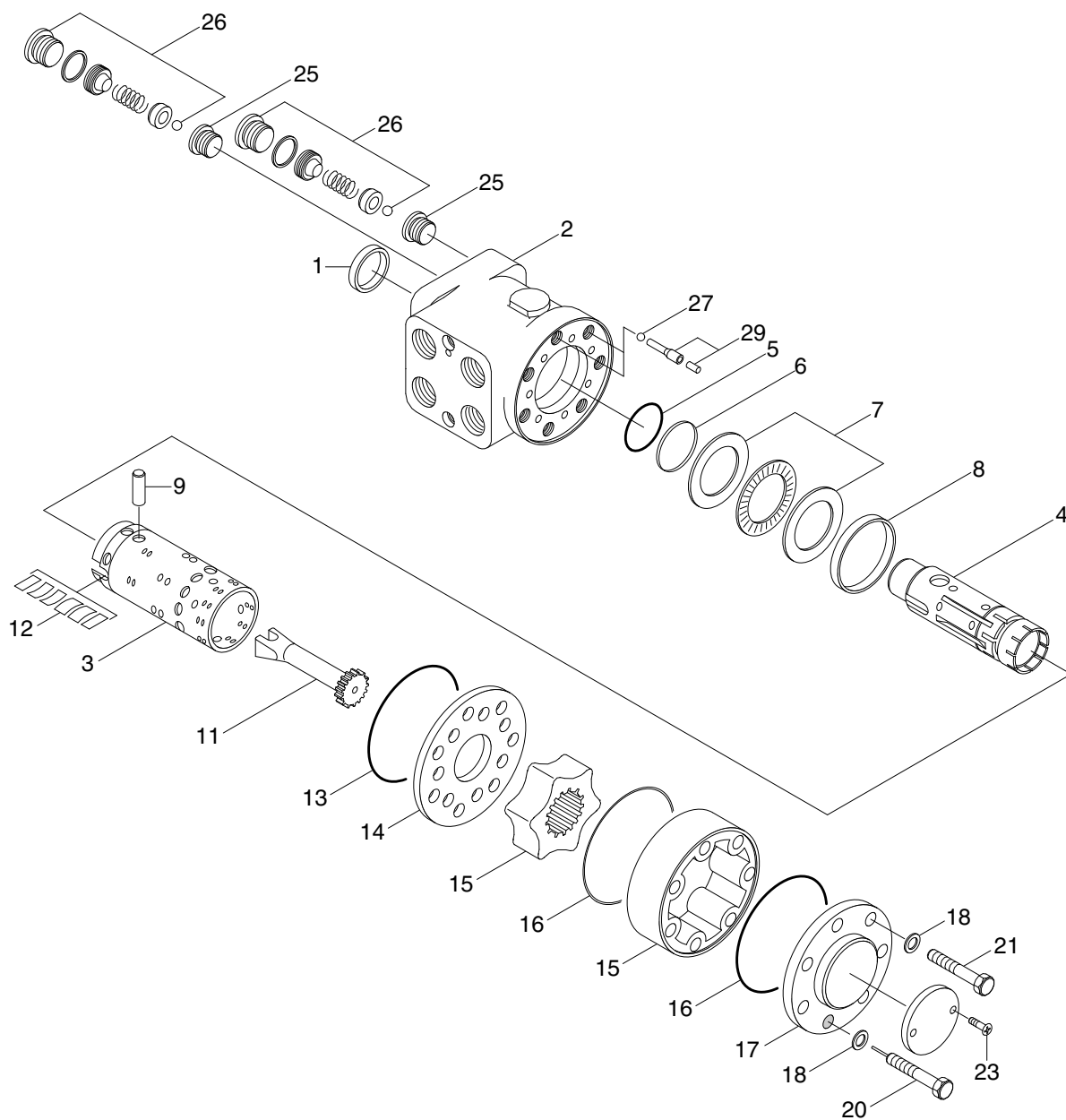
2) INSTALL

- (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

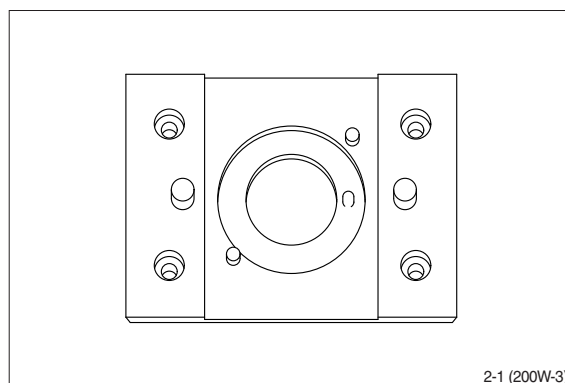


55W72ST02

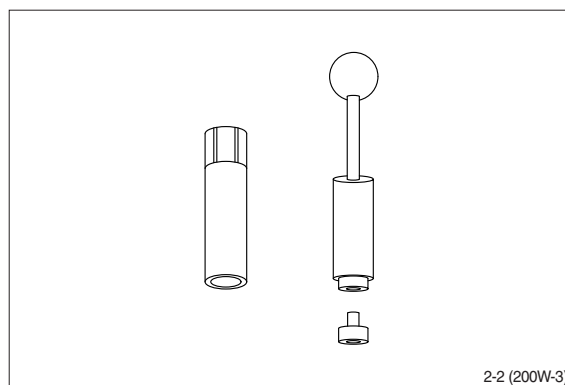
1	Dust seal ring	11	Shaft	20	Pin screw
2	Housing	12	Spring set	21	Screw
3	Sleeve	13	O-ring	22	Name plate
4	Spool	14	Distributor plate	23	Drive screw
5	O-ring	15	Gear wheel set	25	Plug
6	Kin ring	16	O-ring	26	Shock valve
7	Bearing assy	17	End cover	27	Ball
8	Ring	18	Washer	29	Suction valve pin
9	Cross pin				

2) TOOLS

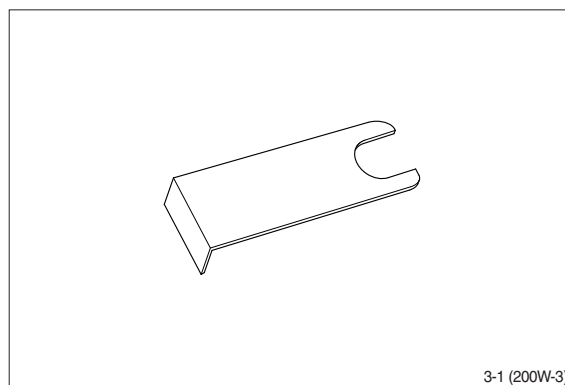
(1) Holding tool.



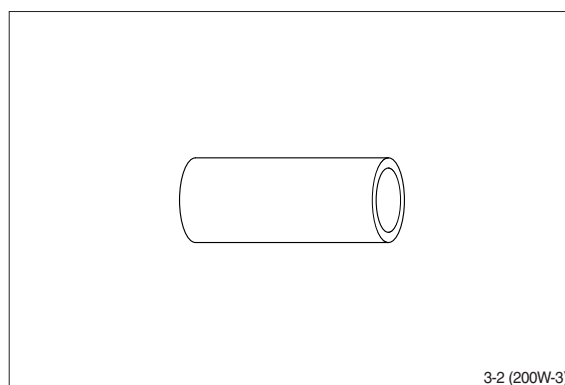
(2) Assembly tool for O-ring (5,13,16) and kin-ring (6).



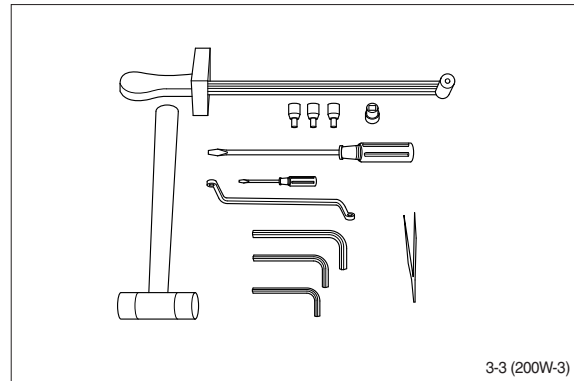
(3) Assembly tool for cardan shaft (11).



(4) Assembly tool for dust seal (1).



- (5) Torque wrench : 0~7.1 kgf · m
(0~54.4 lbf · ft).
- 13 mm socket spanner.
 - 6, 8 mm and 12 mm hexagon sockets.
 - 12 mm screwdriver.
 - 2 mm screwdriver.
 - 13 mm ring spanner.
 - 6,8 mm and 12 mm hexagon socket spanners.
 - Plastic hammer.
 - Tweezers.

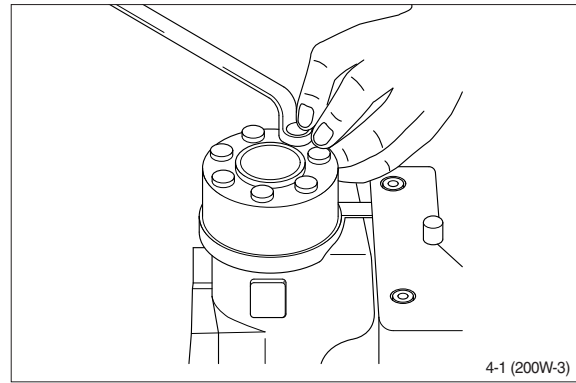


3-3 (200W-3)

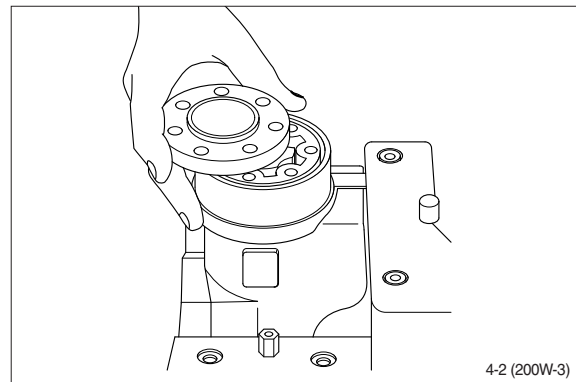
3) DISASSEMBLY

- (1) Disassemble steering column from steering valve and place the steering valve in the holding tool.

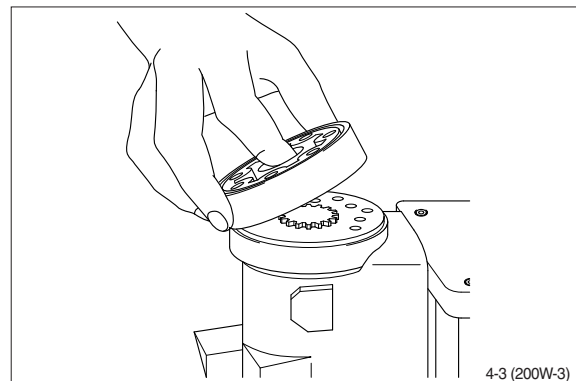
Screw out the screws in the end cover (6-off plus one special screw).



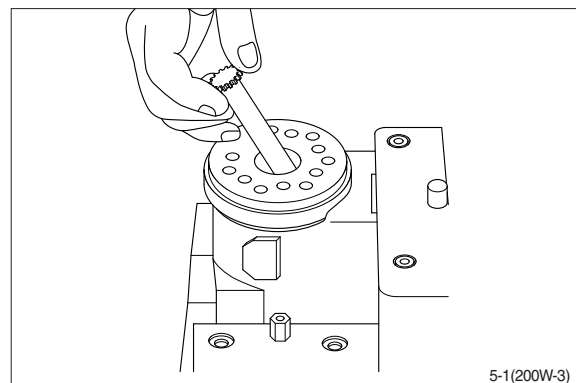
- (2) Remove the end cover, sideways.



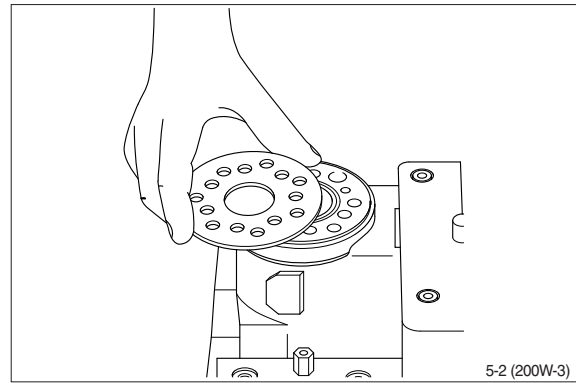
- (3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.



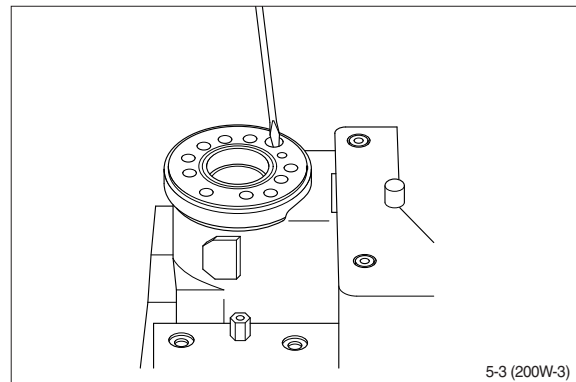
- (4) Remove cardan shaft.



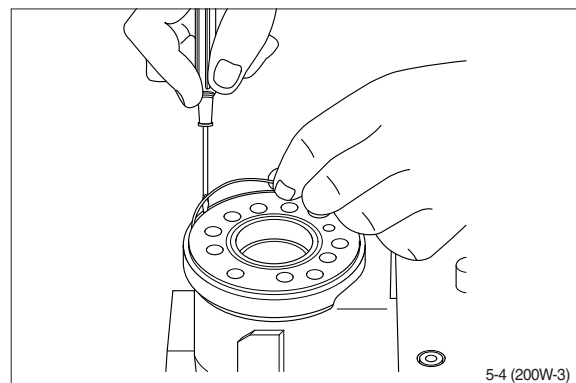
(5) Remove distributor plate.



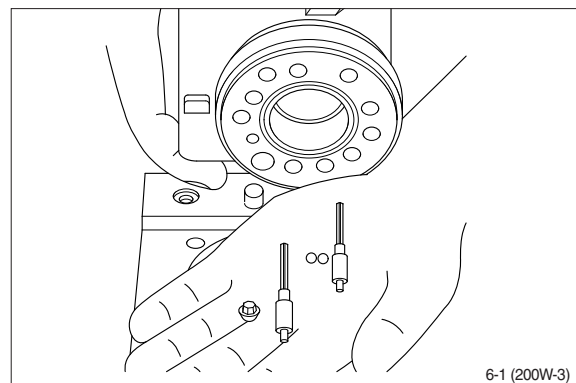
(6) Screw out the threaded bush over the check valve.



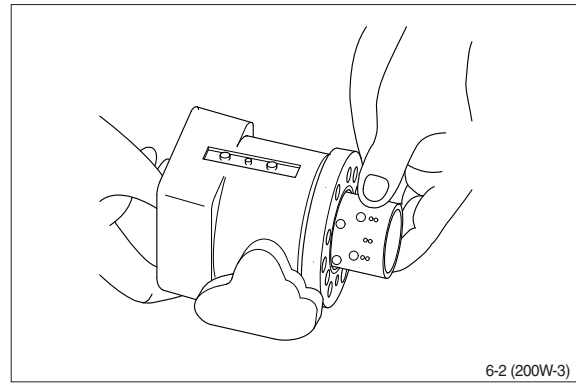
(7) Remove O-ring.



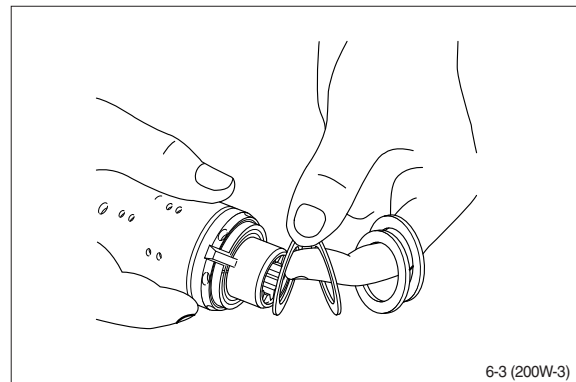
(8) Shake out the check valve ball and suction valve pins and balls.



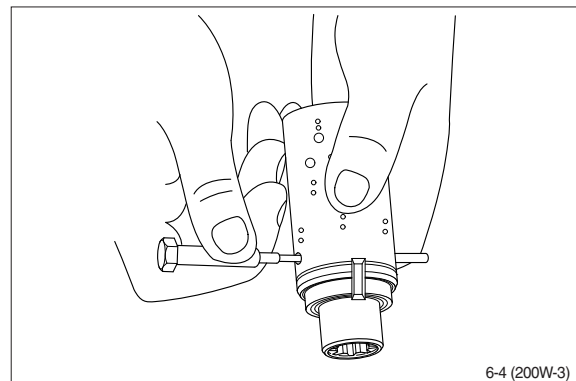
- (9) Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and needle bearing will be pushed out of the housing together.



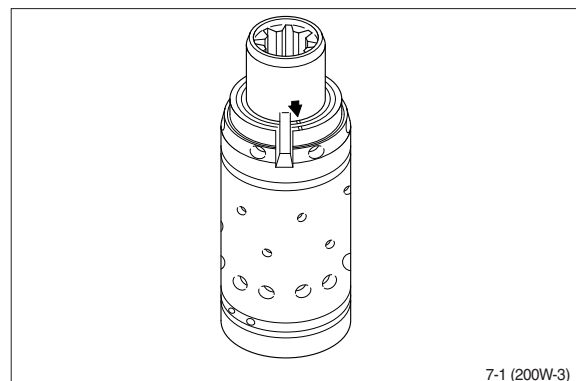
- (10) Take ring, bearing races and needle bearing from sleeve and spool. The outer (thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



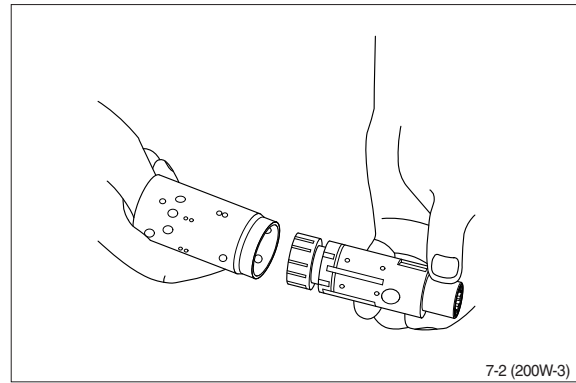
- (11) Press out the cross pin. Use the special screw from the end cover.



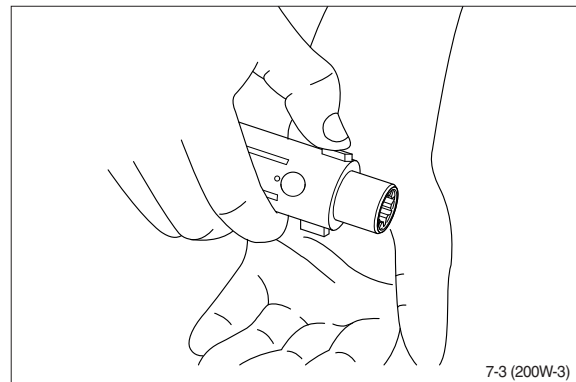
- ※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position spring as figure.
If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



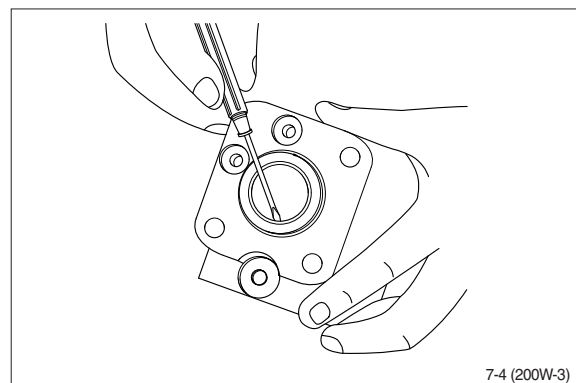
(12) Carefully press the spool out of the sleeve.



(13) Press the neutral position springs out of their slots in the spool.

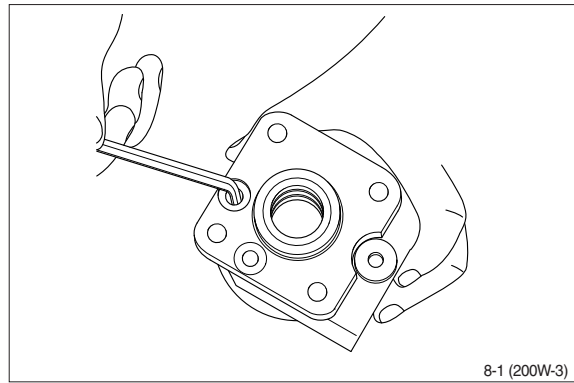


(14) Remove dust seal and O-ring/kin ring.

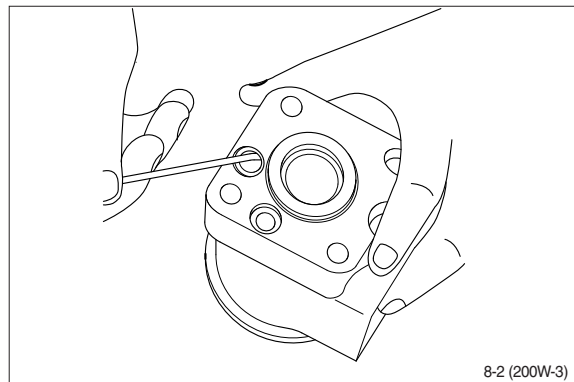


(15) Disassemble the dual shock valve

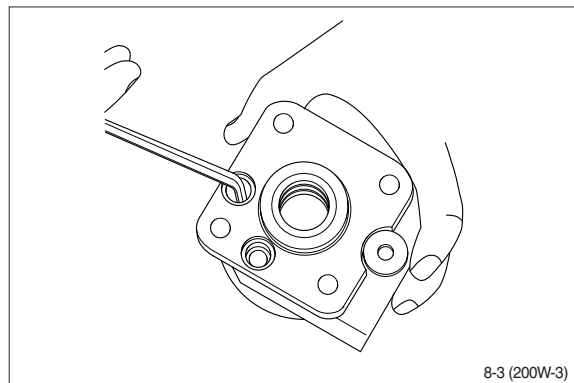
- ① Remove plugs from shock valves using a 6mm hexagon socket spanner.



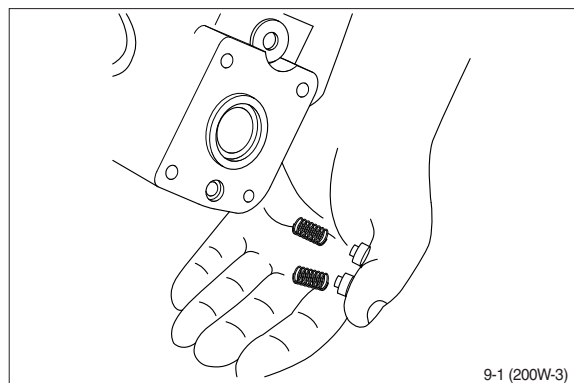
- ② Remove seal washers (2-off).



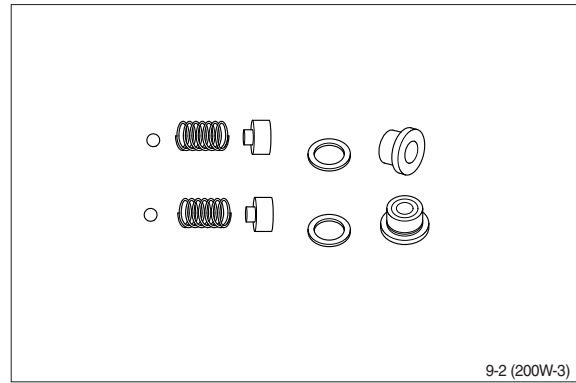
- ③ Unscrew the setting screws using a 6 mm hexagon socket spanner.



- ④ Shake out the two springs and two valve balls into your hand. The valve seats are bonded into the housing and cannot be removed.



- ⑤ The dual shock valves are now disassembled.

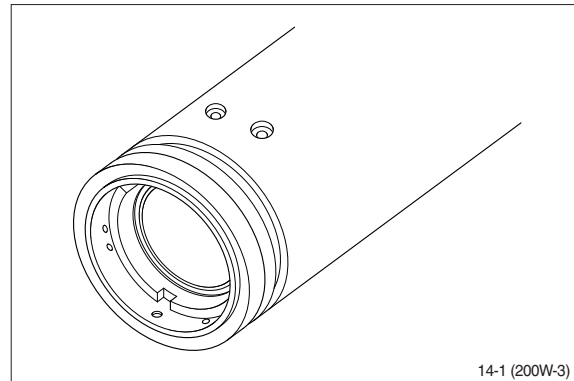


4) ASSEMBLY

(1) Assemble spool and sleeve.

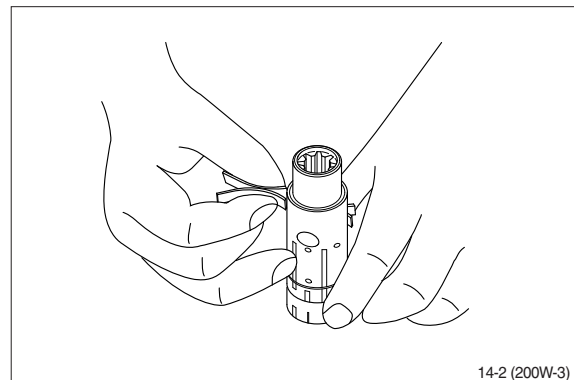
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.

Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible through the slots in the spool.

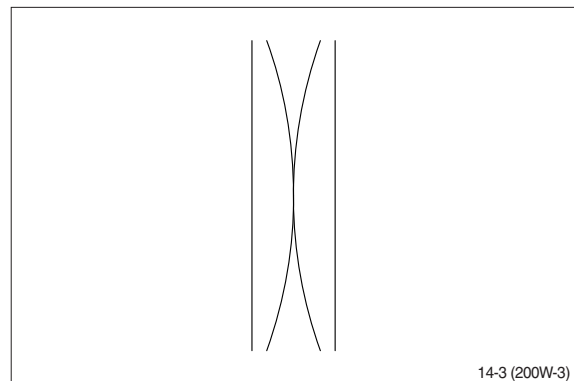


(2) Place the two flat neutral position springs in the slot.

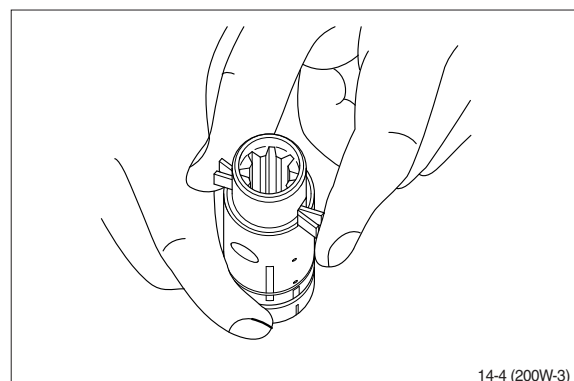
Place the curved springs between the flat ones and press them into place (see assembly pattern).



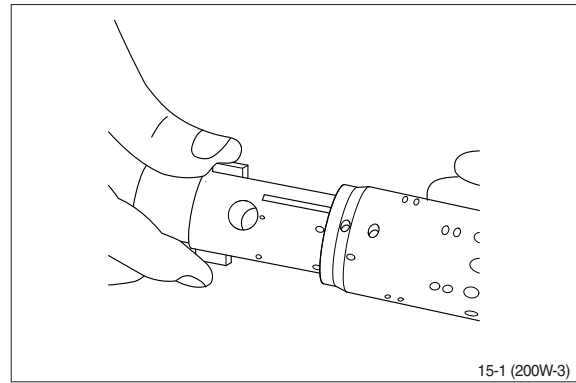
※ Assembly pattern.
Part no. : 150N4035



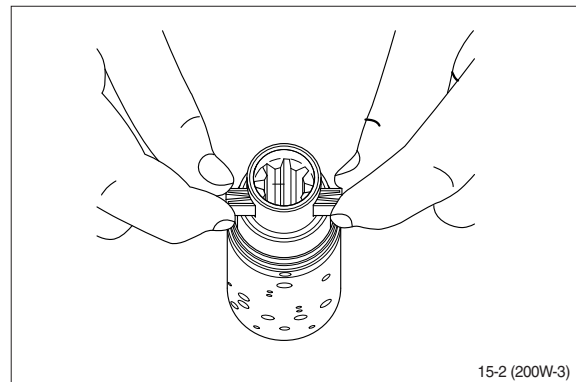
(3) Line up the spring set.



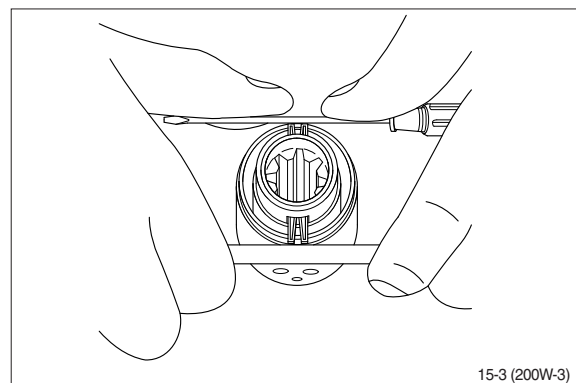
- (4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other.



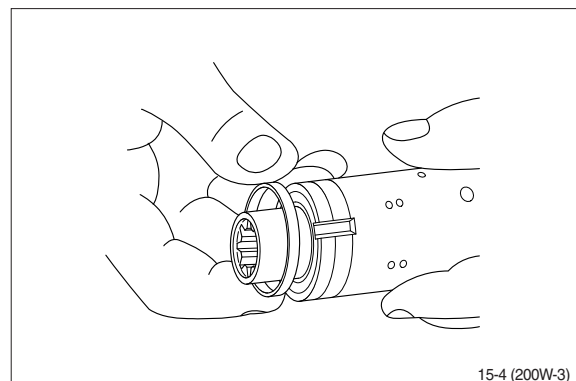
- (5) Press the springs together and push the neutral position springs into place in the sleeve.



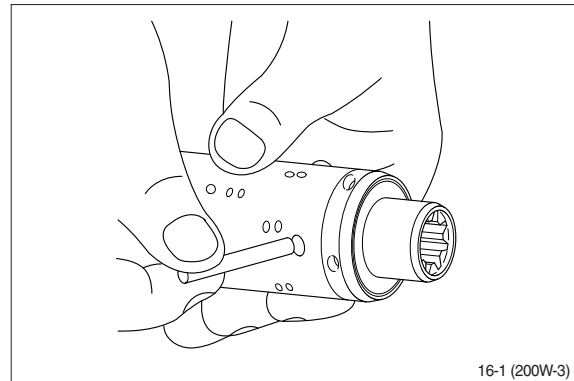
- (6) Line up the springs and center them.



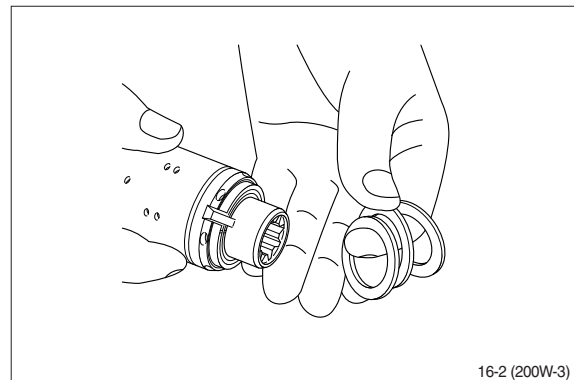
- (7) Guide the ring down over the sleeve.
※ The ring should be able to rotate free of the springs.



(8) Fit the cross pin into the spool / sleeve.

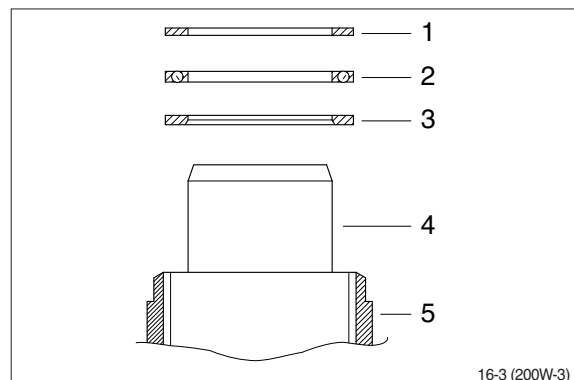


(9) Fit bearing races and needle bearing as shown on below drawing.



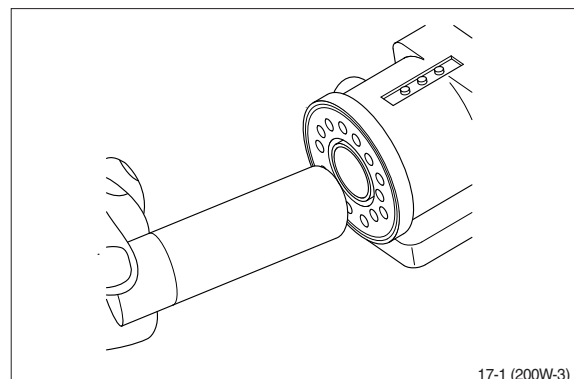
※ Assembly patted for standard bearings

- 1 Outer bearing race
- 2 Needle bearing
- 3 Inner bearing race
- 4 Spool
- 5 Sleeve

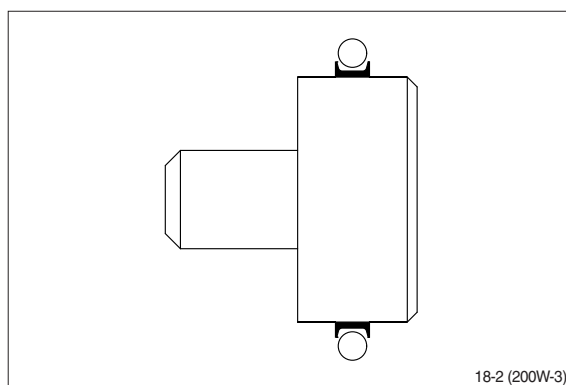
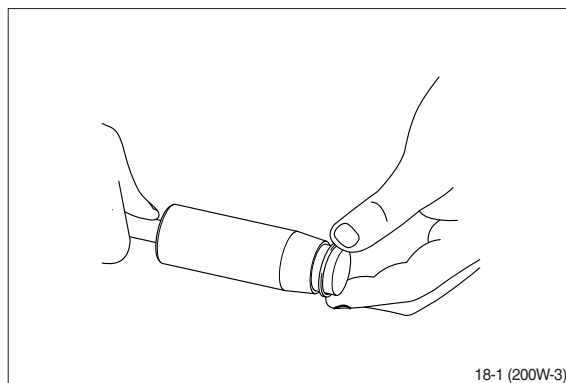


Installation instruction for O-ring/Kin-ring

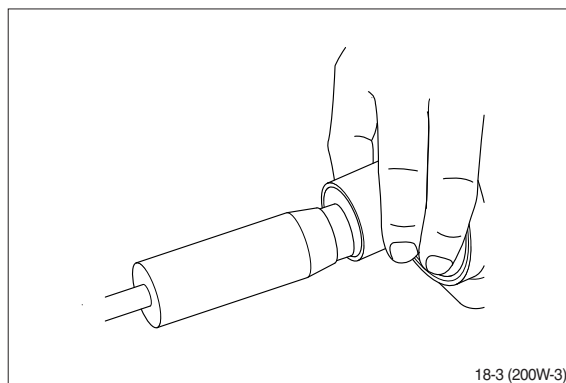
(10) Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.



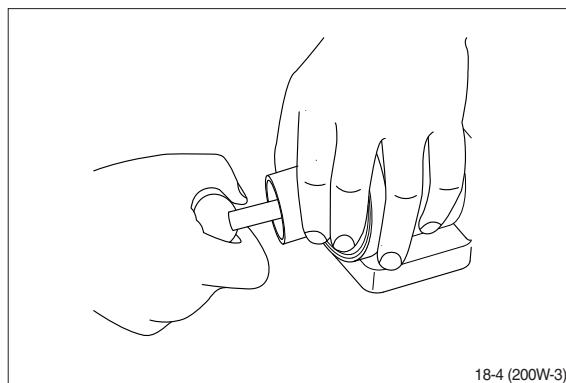
- (11) Grease O-ring and kin-ring with hydraulic oil and place them on the tool.



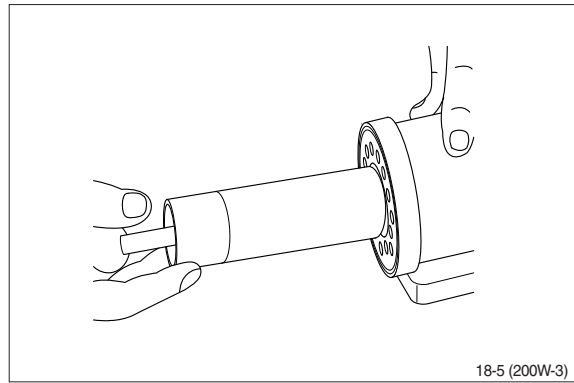
- (12) Hole the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



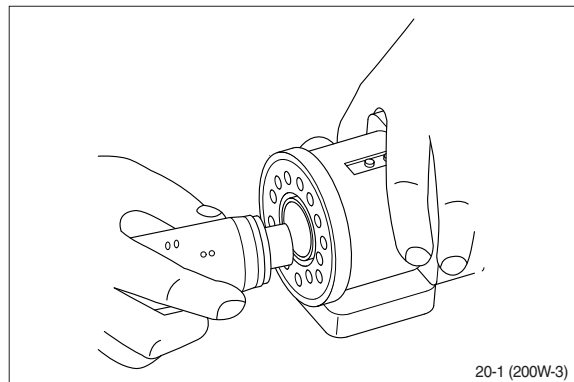
- (13) Press and turn the O-ring / kin-ring into position in the housing.



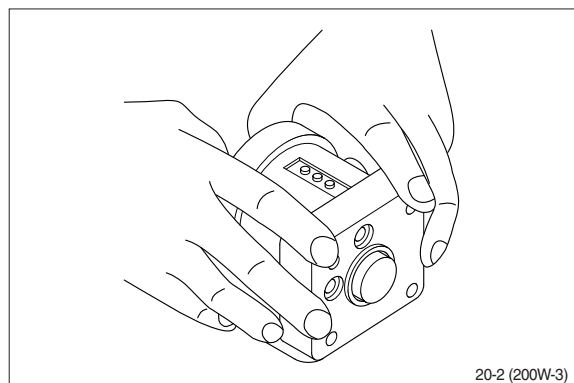
- (14) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



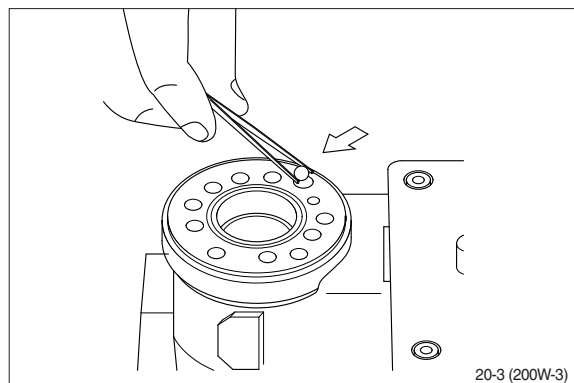
- (15) With a light turning movement, guide the spool and sleeve into the bore.
※ Fit the spool set holding the cross pin horizontal.



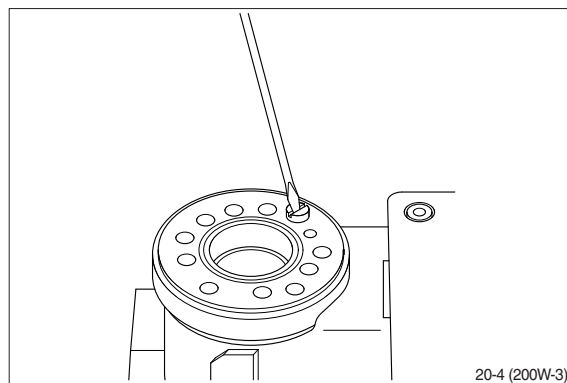
- (16) The spool set will push out the assembly tool guide. The O-ring and kin-ring are now in position.



- (17) Turn the steering unit until the bore is vertical again. Put the check valve ball into the hole indicated by the arrow.

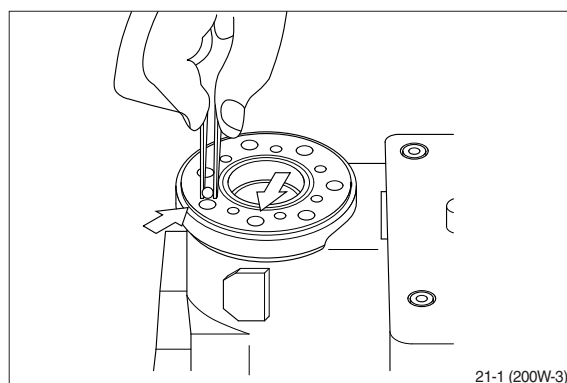


- (18) Screw the threaded bush lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

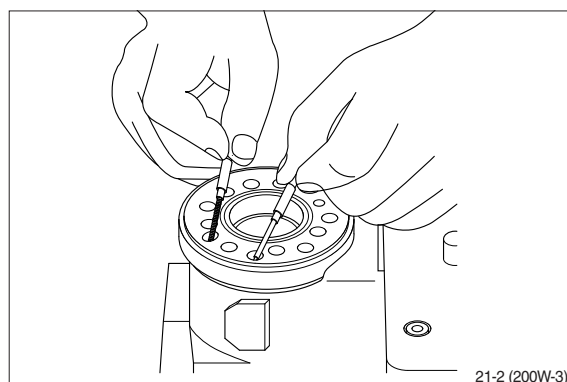


Assembly of the two suction valve

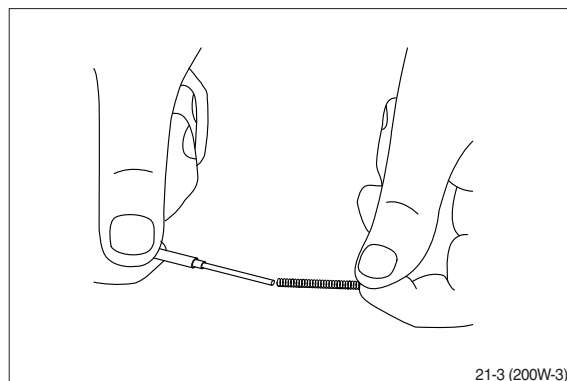
- (19) Place a ball in the two holes indicated by the arrows.



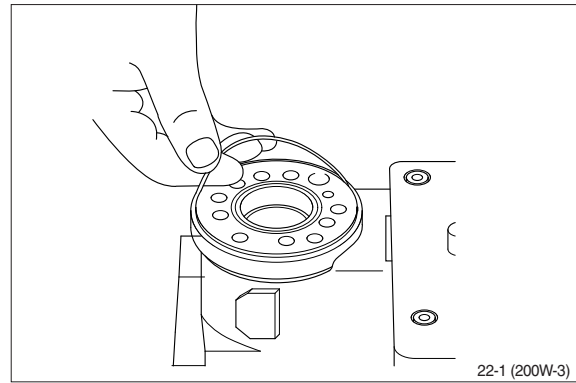
- (20) Place a pin in the same two holes.



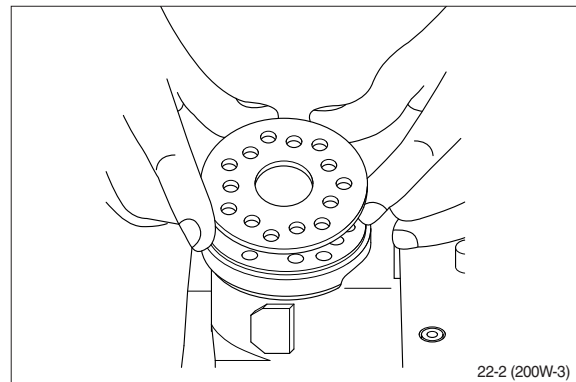
- (21) In some cases a spring has to be fitted on the pin before it is placed in the housing.



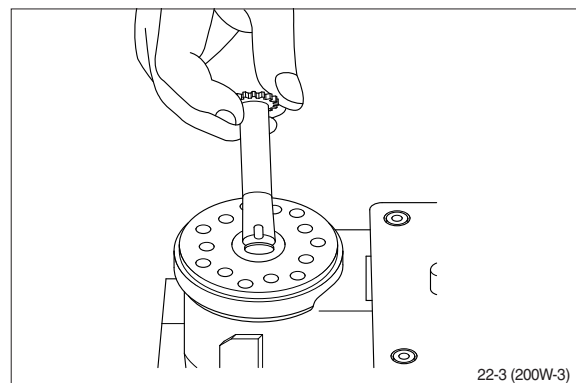
- (22) Grease the O-ring with mineral oil approx viscosity 500 cST at 20°C.



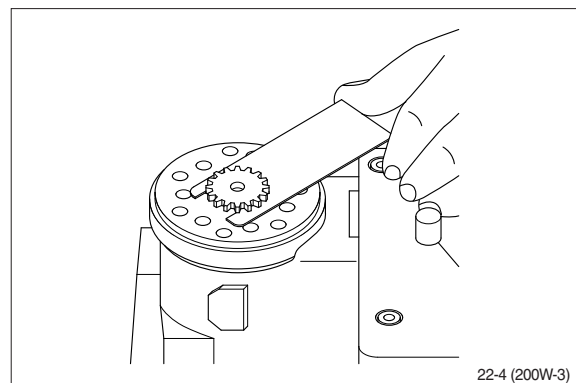
- (23) Place the distributor plate so that the channel holes match the holes in the housing.



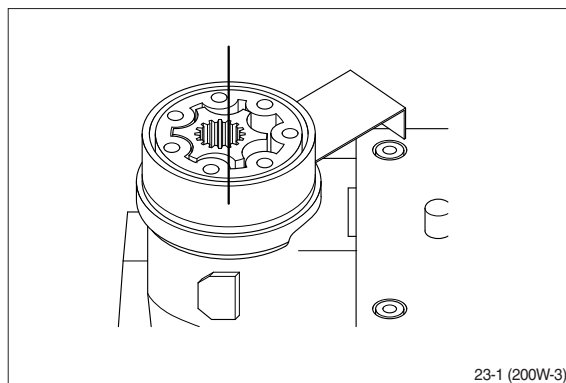
- (24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



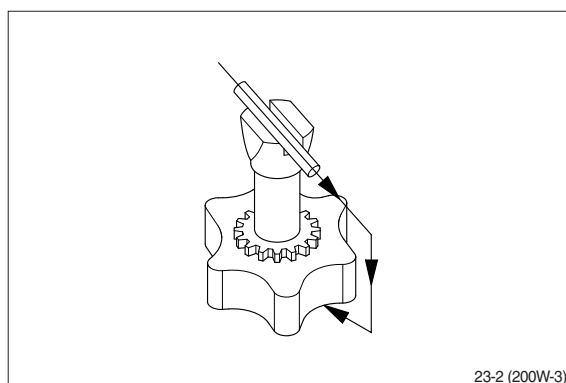
- (25) Place the cardan shaft as shown so that it is held in position by the mounting fork.



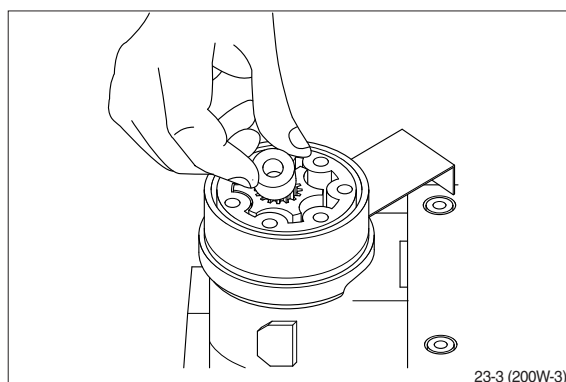
- (26) Grease the two O-rings with mineral oil approx. viscosity 500 cST at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



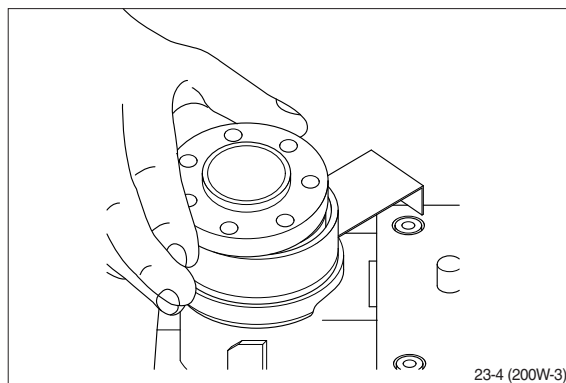
- (27) Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing.



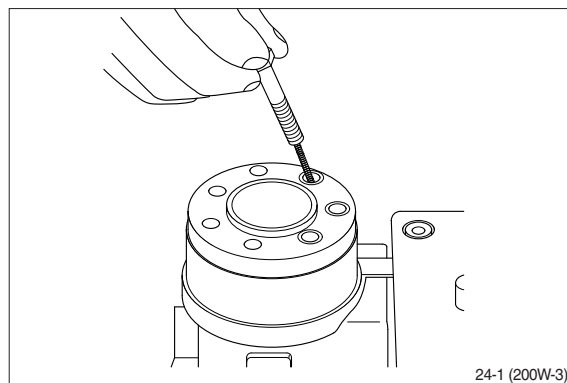
- (28) Fit the spacer, if any.



- (29) Place the end cover in position.

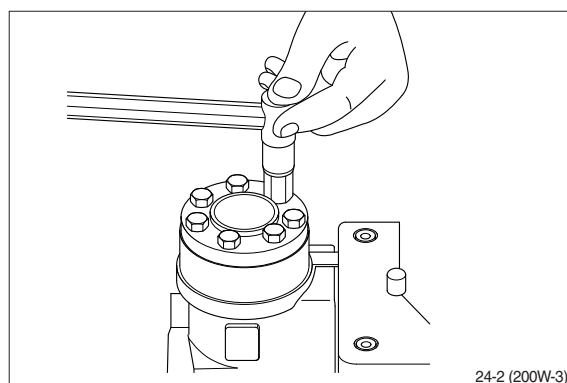


- (30) Fit the special screw with washer and place it in the hole shown.

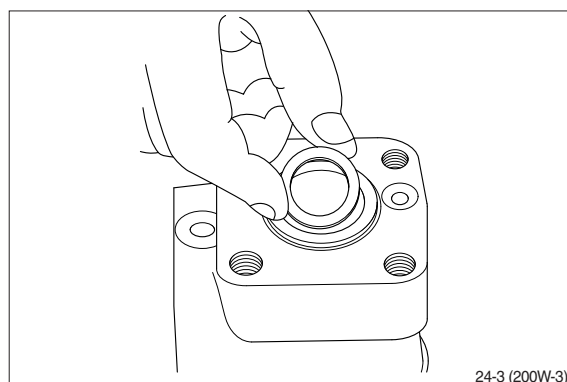


- (31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

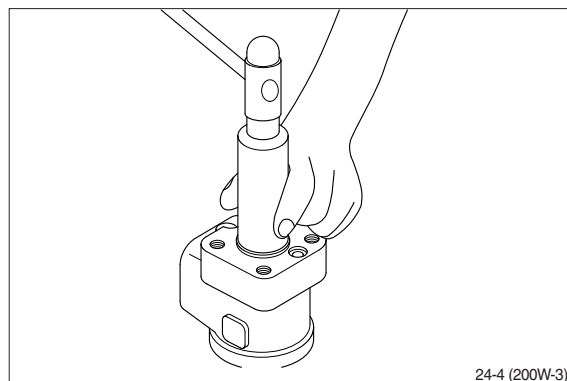
- Tightening torque : $2.3 \pm 0.6 \text{ kgf} \cdot \text{m}$
($16.6 \pm 4.3 \text{ lbf} \cdot \text{ft}$)



- (32) Place the dust seal ring in the housing.
The dust seal ring must be placed only after the pressure relief valve and shock valves have been fitted.

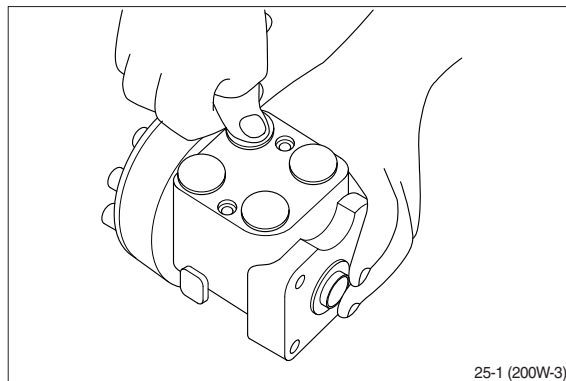


- (33) Fit the dust seal ring in the housing.



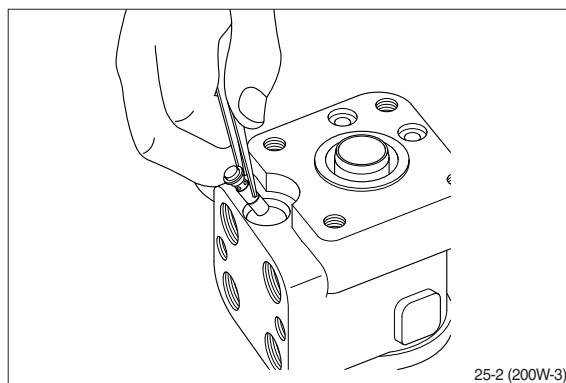
(34) Press the plastic plugs into the connection ports.

※ Do not use a hammer!

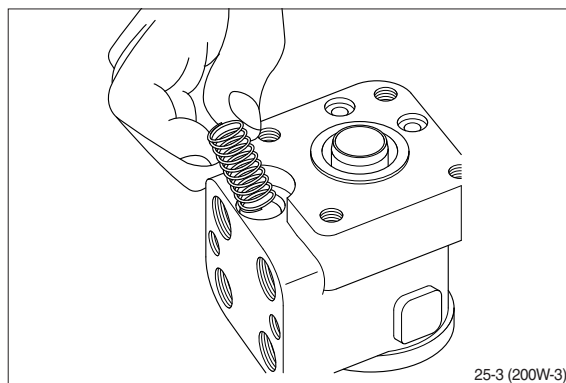


Assembly of the pressure relief valve

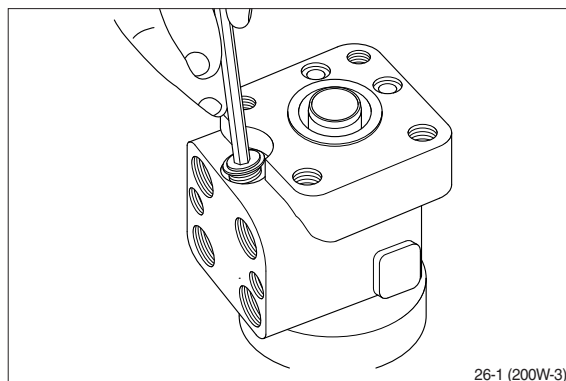
(35) Fit the piston.



(36) Fit the spring.



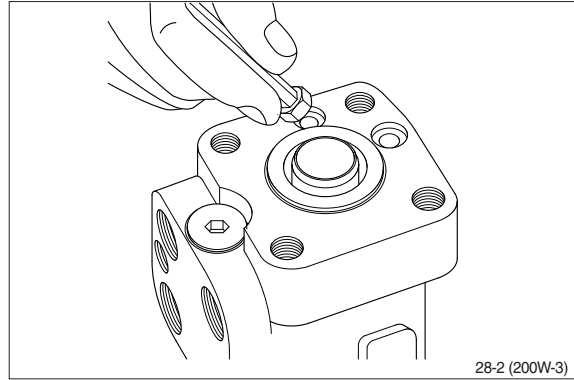
(37) Screw in the setting screw with an 8mm hexagon socket spanner. Make the pressure setting on a panel or the machine.



(38) Screw plug with seal ring into the two shock valves using a 6mm hexagon socket spanner.

- Tightening torque : 3.1 kgf · m
(22.4 lbf · ft)

Steering valve is now assembled.



1. 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.

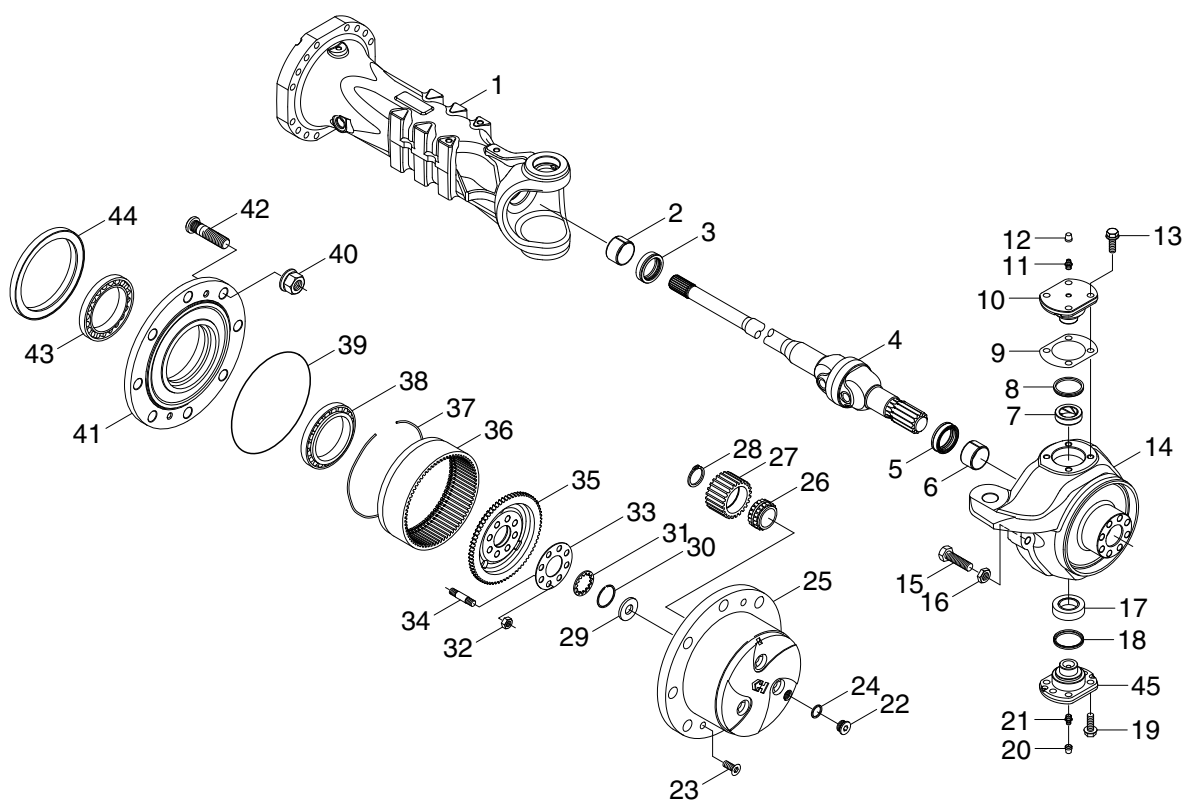
3) Maintenance and repair

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.

2. FRONT AXLE

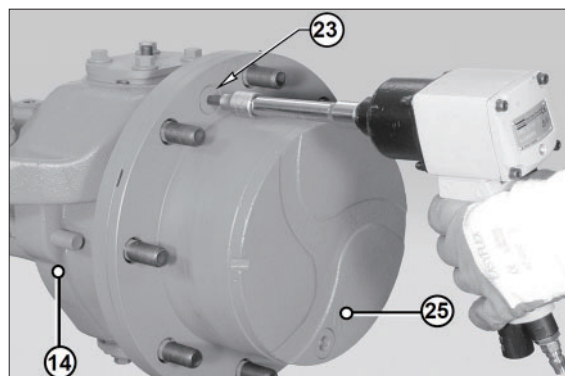
1) THE PLANETARY REDUCTION AND THE COMPLETE STEERING CASE

(1) Disassembly



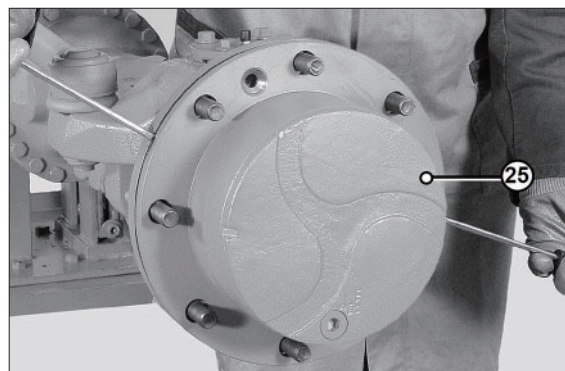
55W9NAX001

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



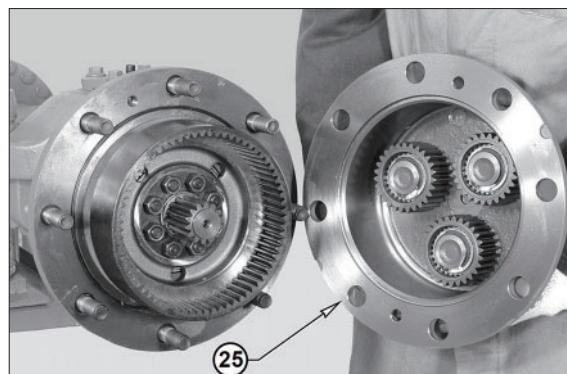
55W9NAX002

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



55W9NAX003

- ③ Remove the complete planetary carrier cover (25).



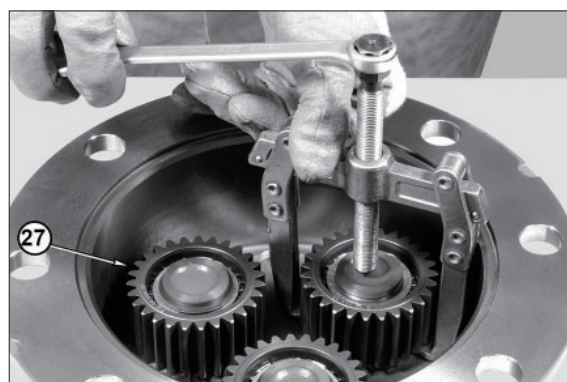
55W9NAX004

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



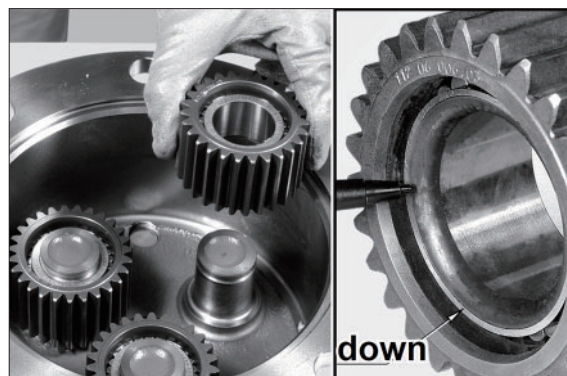
55W9NAX005

- ⑤ Remove the planetary gears (27).



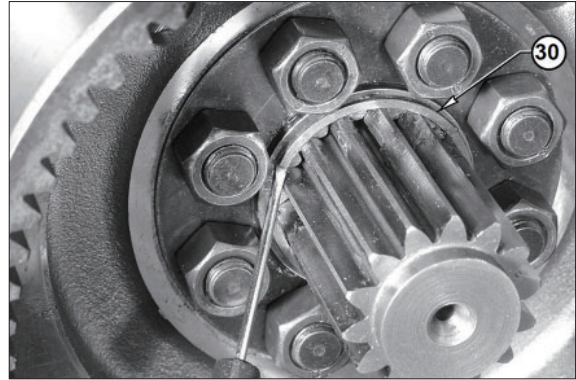
55W9NAX006

- ※ Note down direction of assembly of planetary gears.



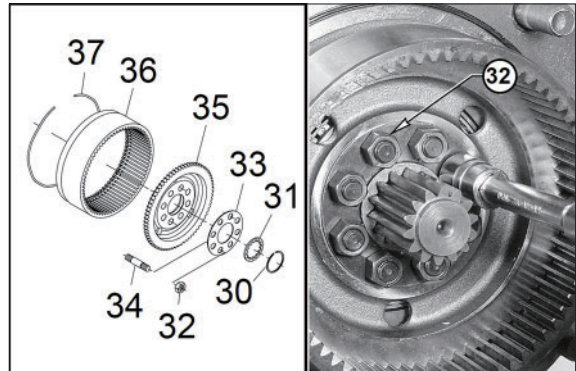
55W9NAX007

- ⑥ Remove the snap ring (30).



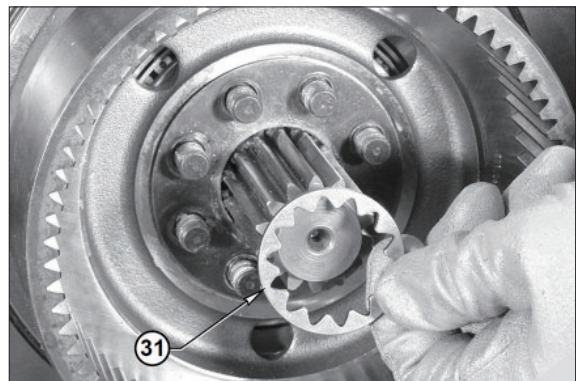
55W9NAX008

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



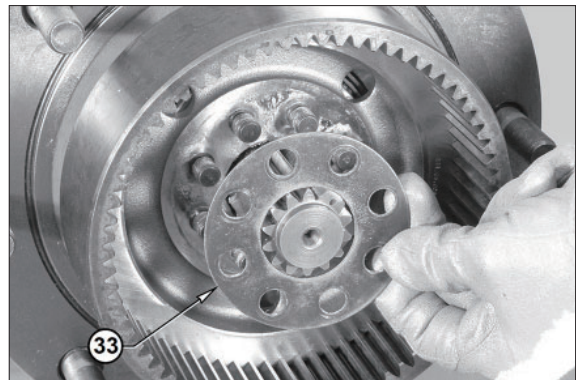
55W9NAX009

- ⑧ Remove the shim washer (31).



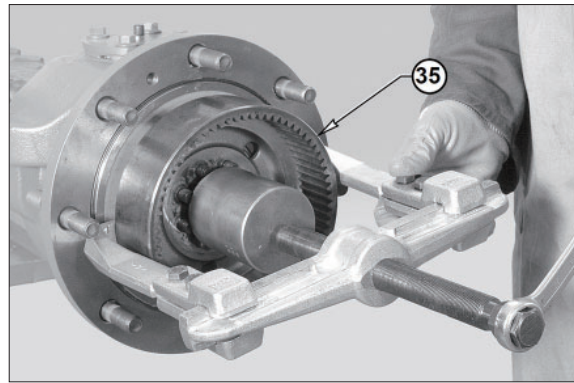
55W9NAX010

- ⑨ Remove the safety flange (33).

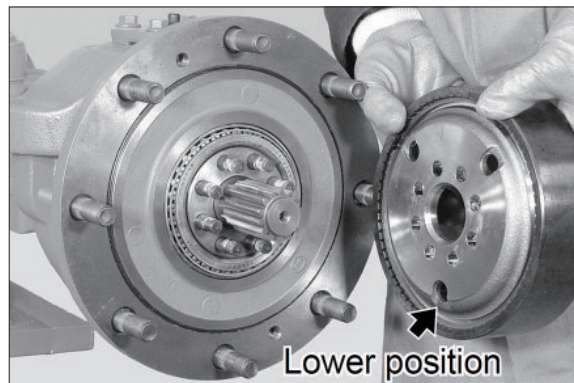


55W9NAX011

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

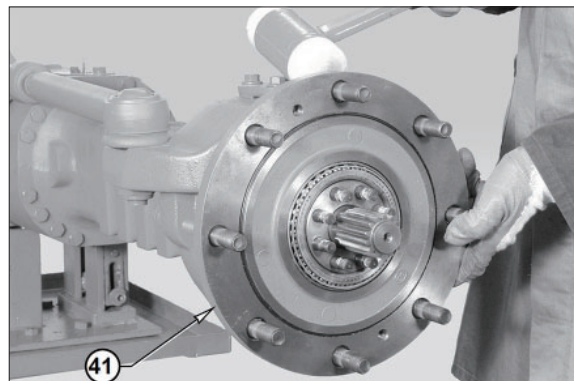


55W9NAX012



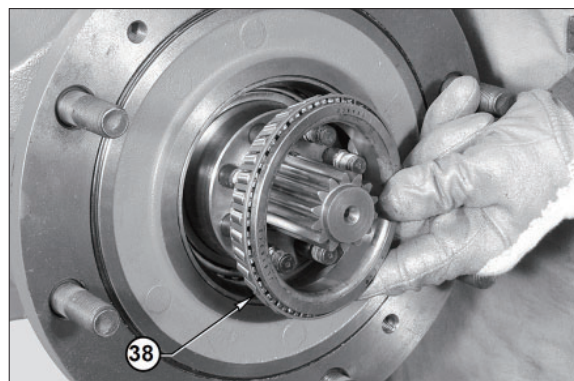
55W9NAX013

- ⑪ Partially extract the hub (41) using a plastic hammer.
- ※ Alternately hammer on several equidistant points.



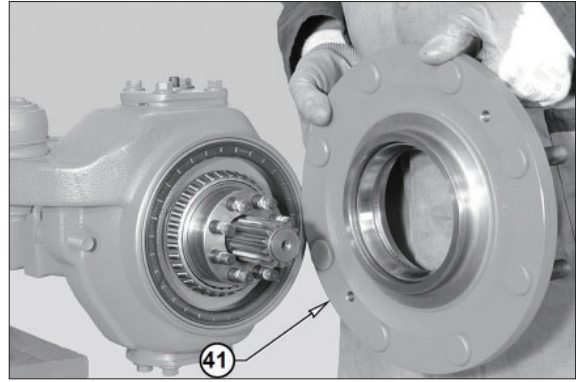
55W9NAX014

- ⑫ Remove the external bearing (38).



55W9NAX015

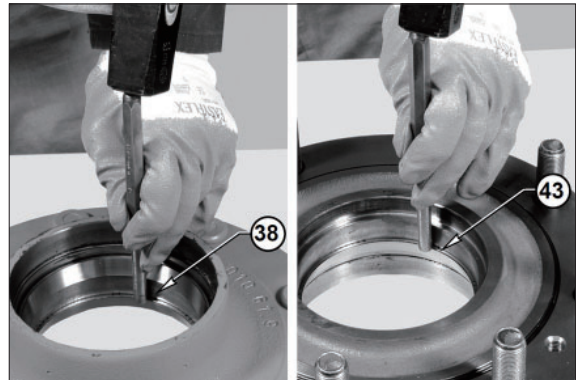
- ⑬ By hand remove the complete hub (41).



55W9NAX016

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

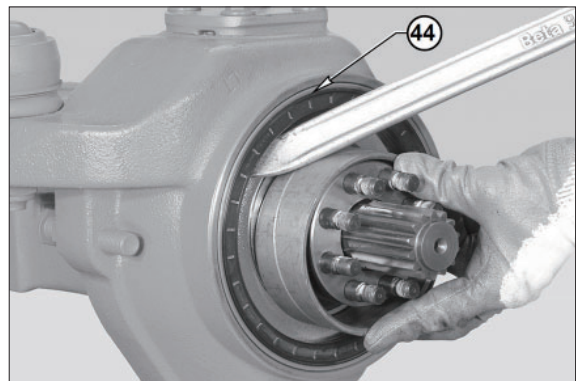
- ※ Hammer in an alternate sequence to prevent crawling and deformation of the thrust blocks.



55W9NAX017

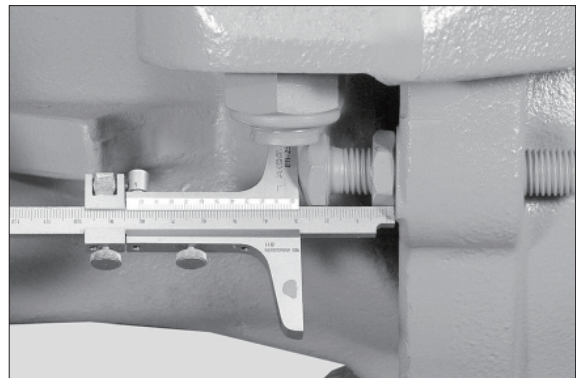
- ⑮ Remove the sealing ring from the steering case (44).

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



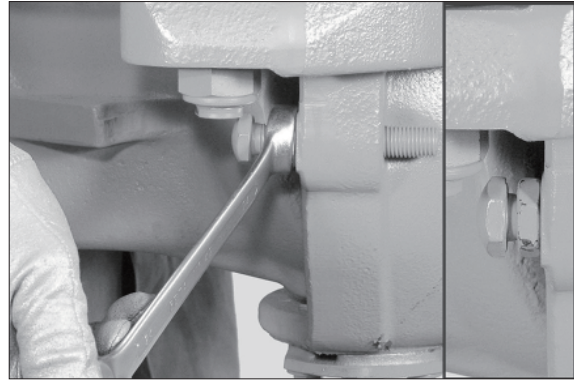
55W9NAX018

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



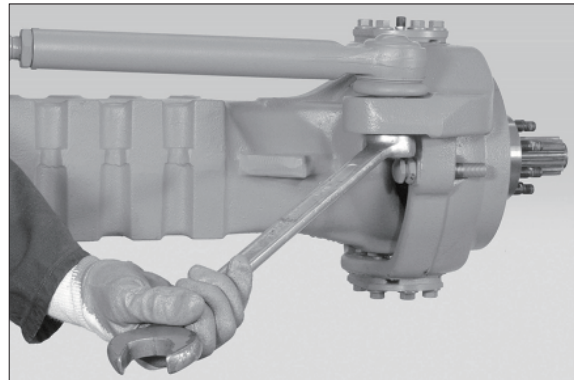
55W9NAX019

- ⑰ Loosen the lock screw and insert it to allow the passage of the tool.



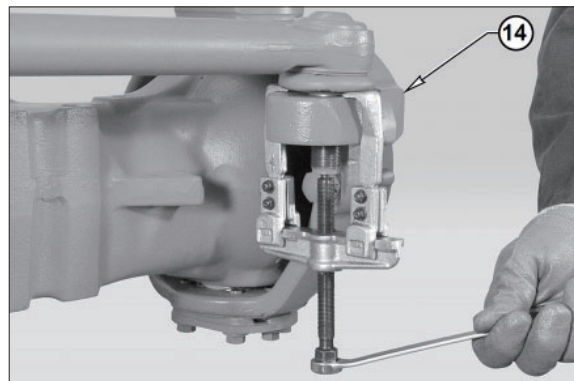
55W9NAX020

- ⑱ Remove the nuts that lock the articulation pins.



55W9NAX021

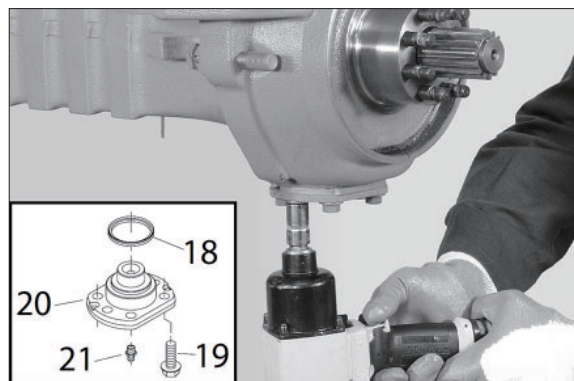
- ⑲ Disconnect the tapered pins of the articulation from the steering case (14) by means of a puller.



55W9NAX022

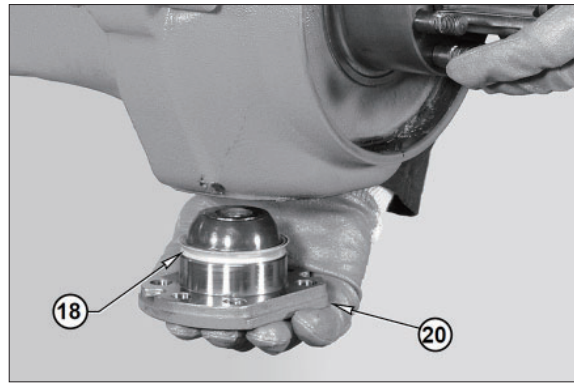
- ⑳ Unloosen and remove the fitting screws (19) from the bottom articulation pin (20).

※ Screws cannot be reused.



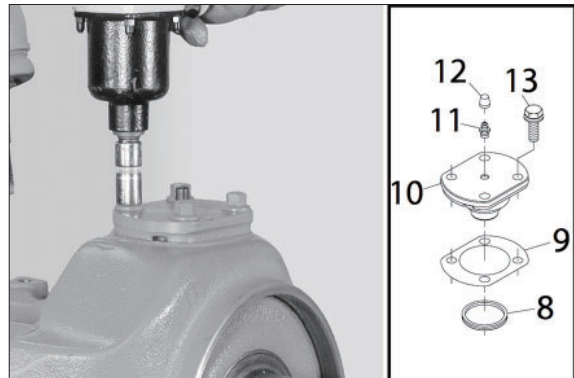
55W9NAX023

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



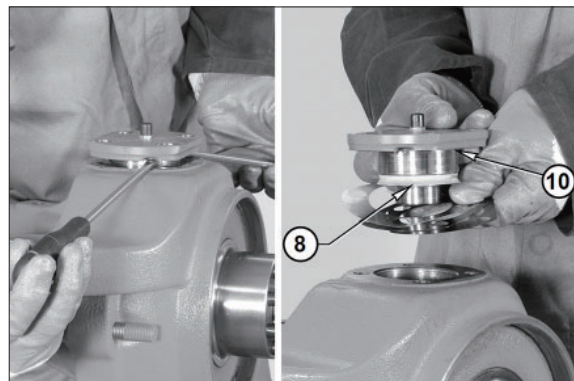
55W9NAX024

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



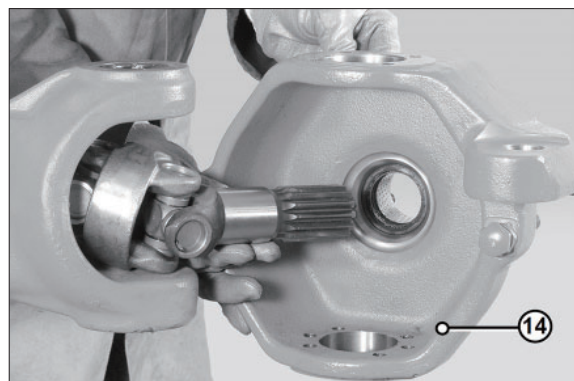
55W9NAX025

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



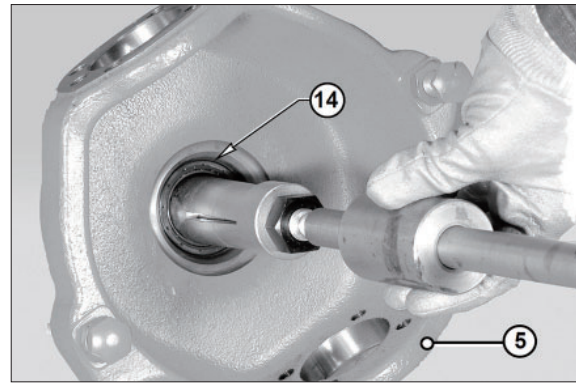
55W9NAX026

- ②④ Remove the complete steering case (14).



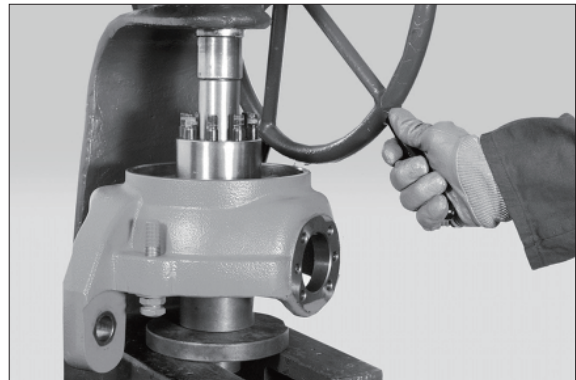
55W9NAX027

- ②⑤ Use a puller to remove the sealing ring from the steering case (14).
- ※ Note down the orientation of sealing ring (5).

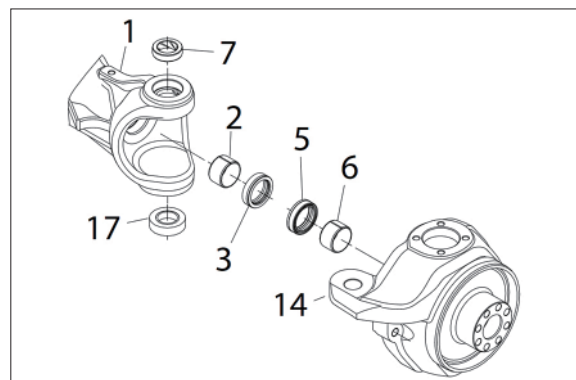


55W9NAX028

- ②⑥ Remove the bushing (6) from the steering case (14).
- ※ Note down the orientation of bushing.



55W9NAX029



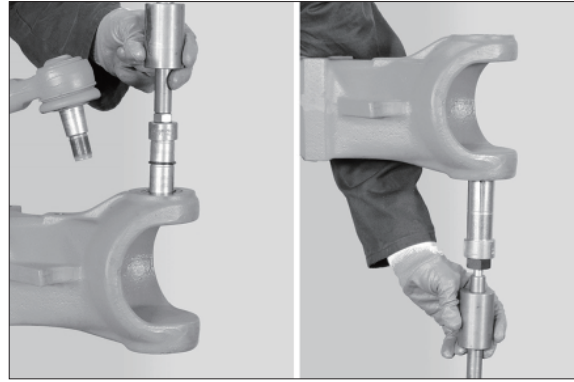
55W9NAX030

- ②⑦ Remove the u-joint (4).
- ※ To remove the u-joint use, if necessary, a plastic hammer or a lever.



55W9NAX031

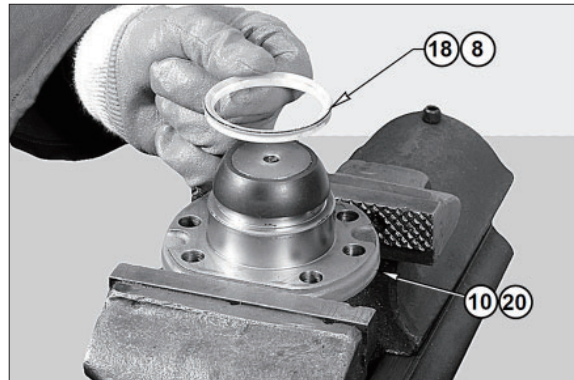
- ②⑧ Using a puller for inner parts, remove the top bush (7) and the bottom ball-bush (17).



55W9NAX032

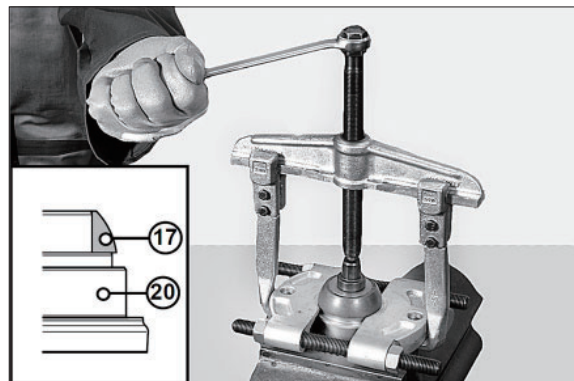
- ②⑨ Remove the articulation pins (10) (20) and the front sealing rings (8) (18).

※ Note down the side for assembly.



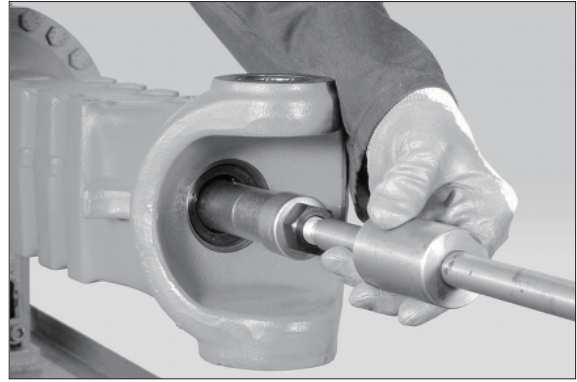
55W9NAX033

- ③⑩ If the ball cover (17) needs replacing, remove it from the bottom articulation pin (20).

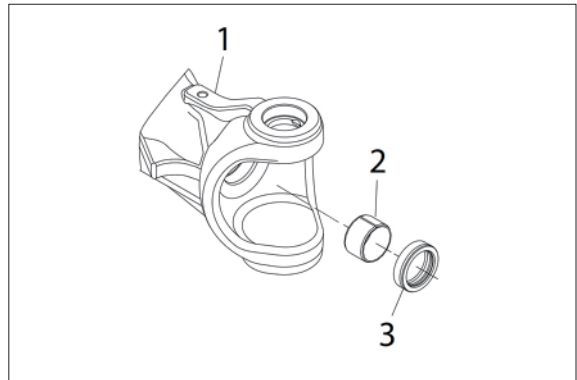


55W9NAX034

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

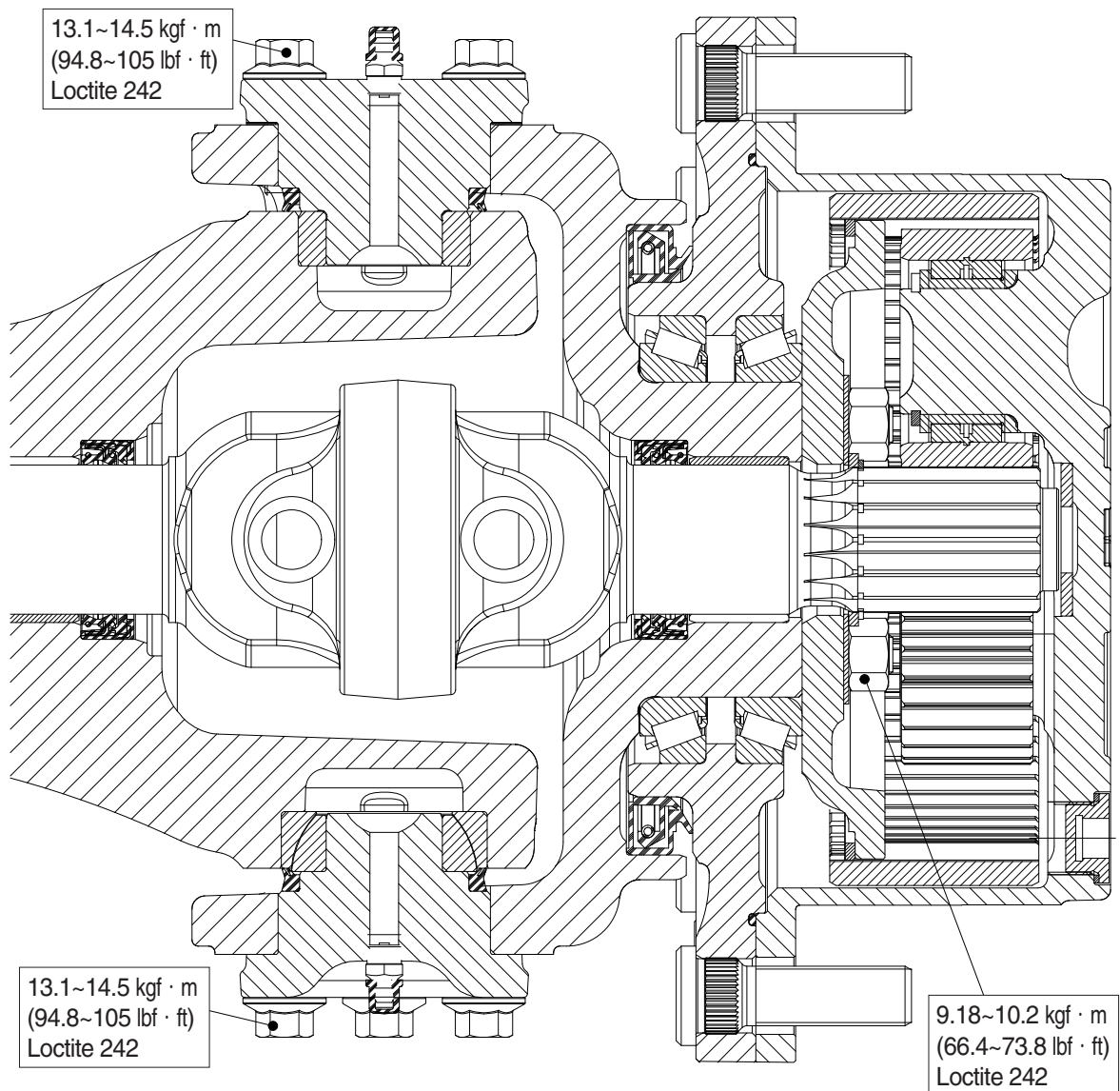


55W9NAX035



55W9NAX036

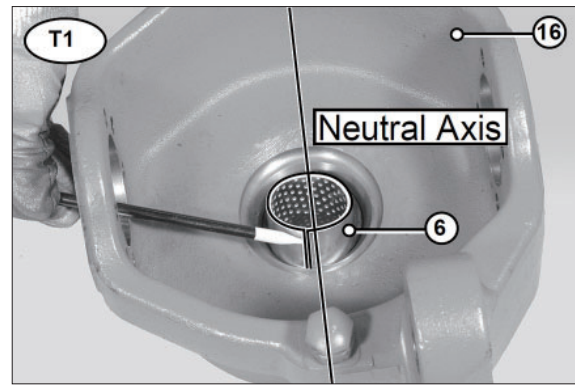
(2) Assembly



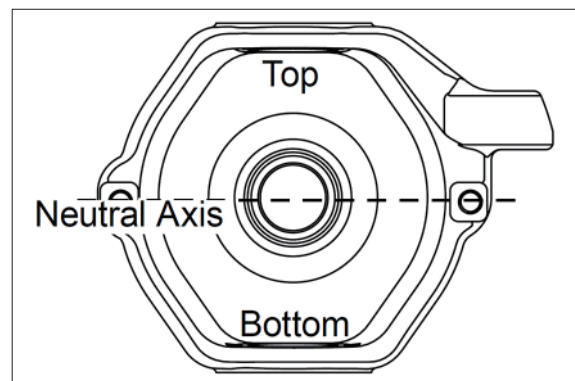
55W9NAX037

- **Continuous 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.

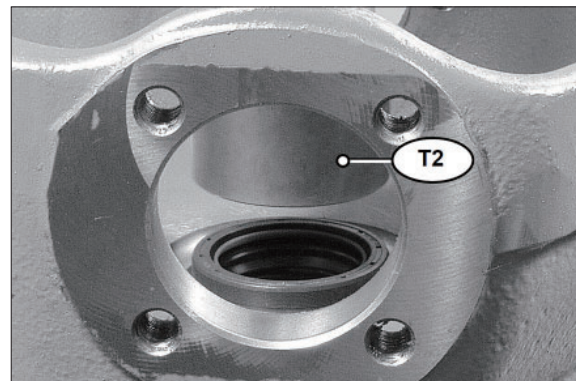


55W9NAX038

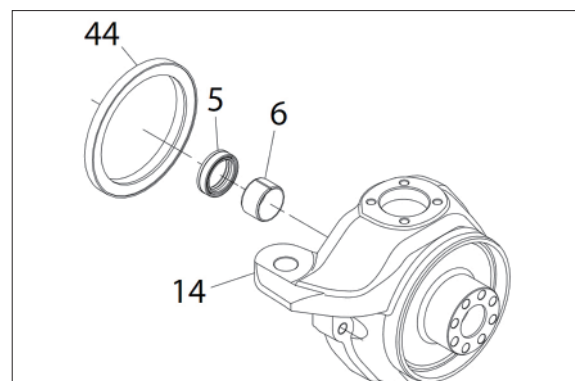


55W9NAX039

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



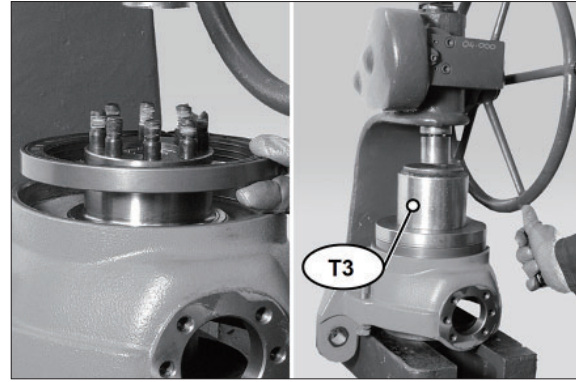
55W9NAX040



55W9NAX041

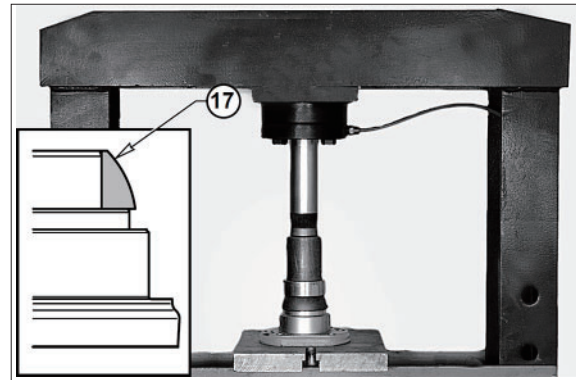
- ③ Using special tool T3 apply a repositionable jointing compound for seals to the outer surface of the sealing ring (44). Position the sealing ring (44) in the steering case (14).

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



55W9NAX042

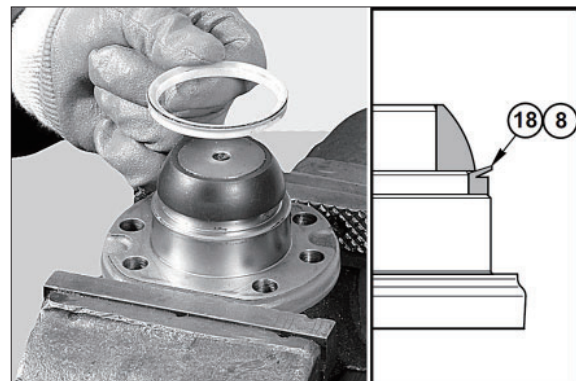
- ④ If the bottom articulation pin (17) has been extracted, position the pin under a press and fit the ball cover (20).



55W9NAX043

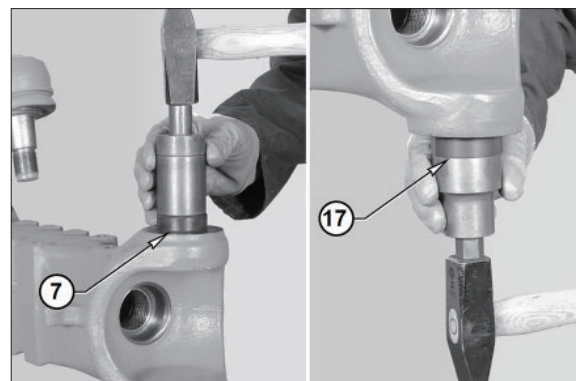
- ⑤ Fit the front sealing rings (18) (8) onto the articulation pins (4) and (6).

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



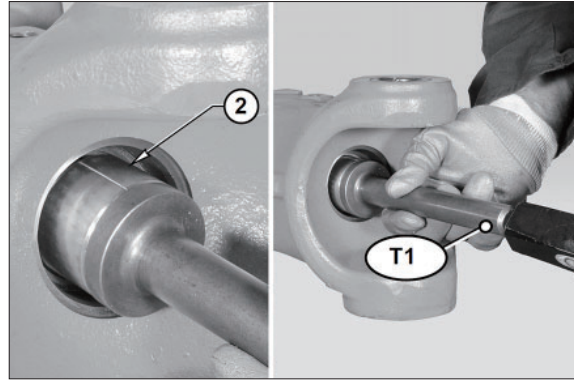
55W9NAX044

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



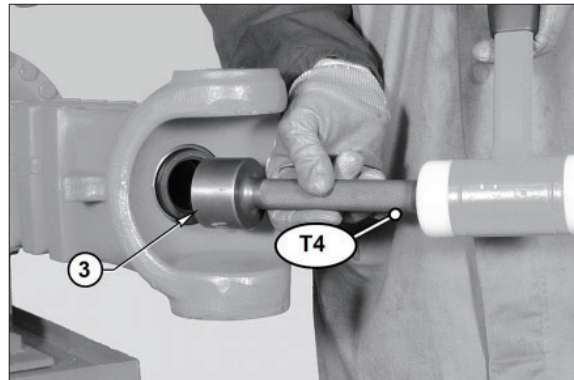
55W9NAX045

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



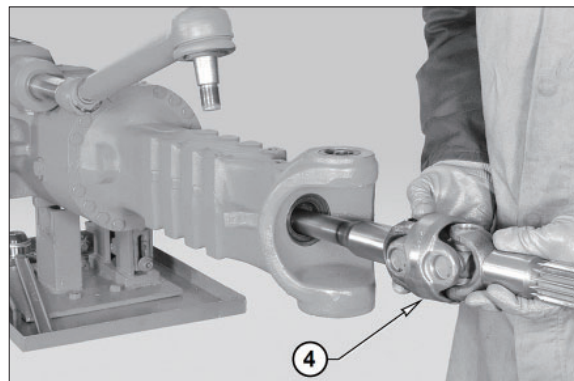
55W9NAX046

- 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.



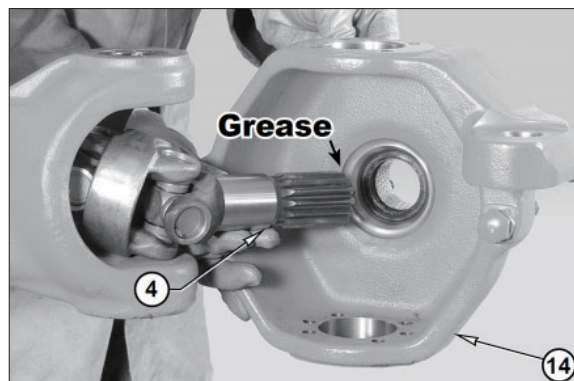
55W9NAX047

- ⑨ Insert the u-joint (4).



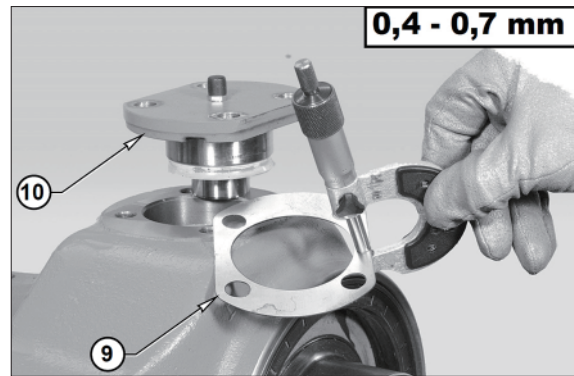
55W9NAX048

- 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.



55W9NAX049

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



55W9NAX050

- ⑫ Lubricate and install the unit in the steering case.



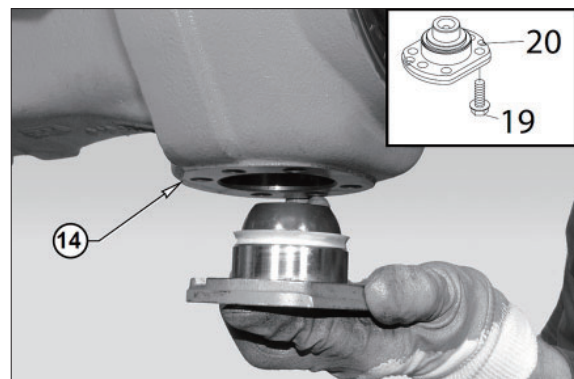
55W9NAX051

- ⑬ Lubricate the steering case.



55W9NAX052

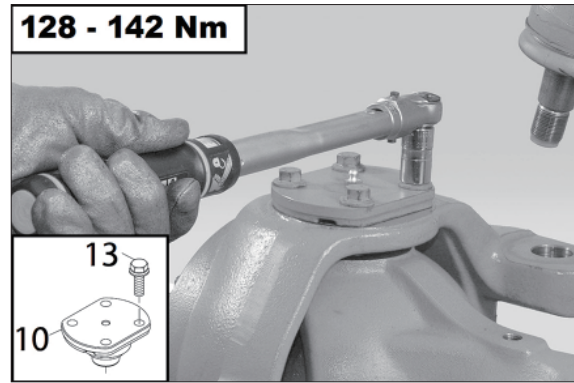
- ⑭ Fit the unit (20) in the steering case (14).
Position the screws (19) and tightly tighten.



55W9NAX053

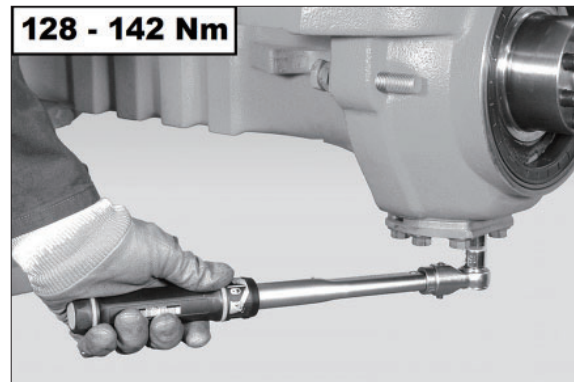
- ⑮ Tighten the new fitting screws (13) of top articulation pins in sequence using the cross tightening method.

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

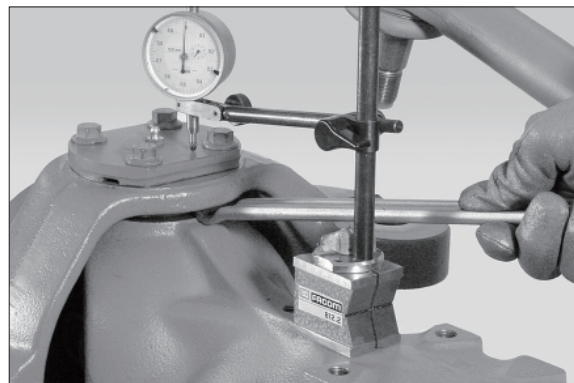


- ⑯ Tighten the new fitting screws (19) of bottom articulation pins in sequence using the cross tightening method.

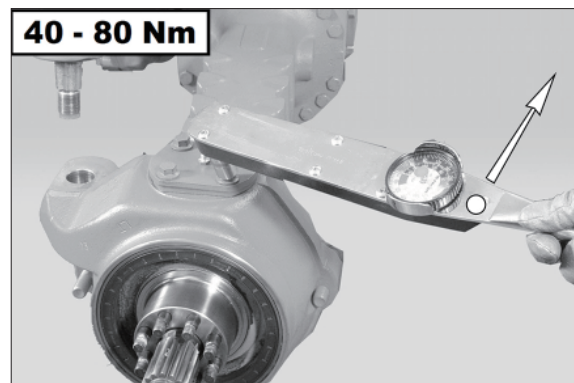
· Torque wrench setting :
13.1~14.5 kgf · m (94.8~105 lbf · ft)



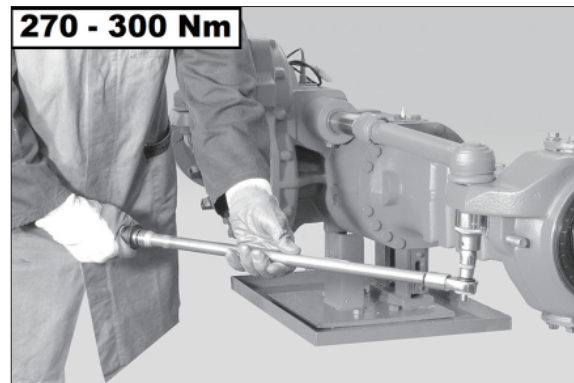
- ⑰ Check by means of a lever that there is no vertical gap.
In case there is any gap, determine the width and reduce it by removing shims.



- 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.

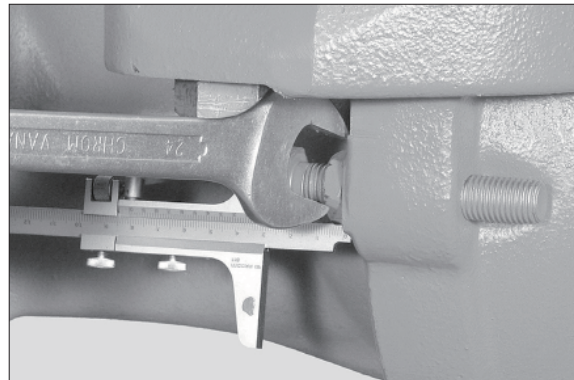


- ①⑨ Look for the position of the notch regarding the safety cotter pin hole when the nut is finally locked max 30.6 kgf · m (221 lbf · ft).



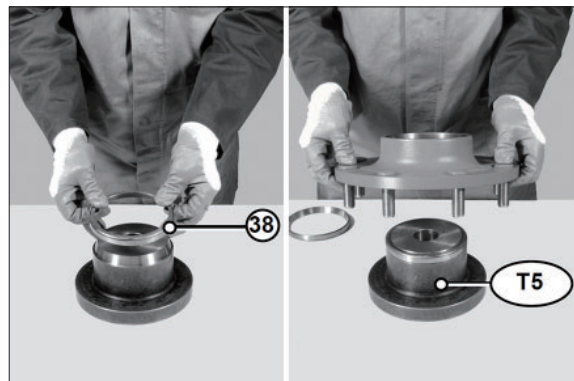
55W9NAX058

- ②⑩ Bring the lockscrew to the quote at the measure previously survey.



55W9NAX059

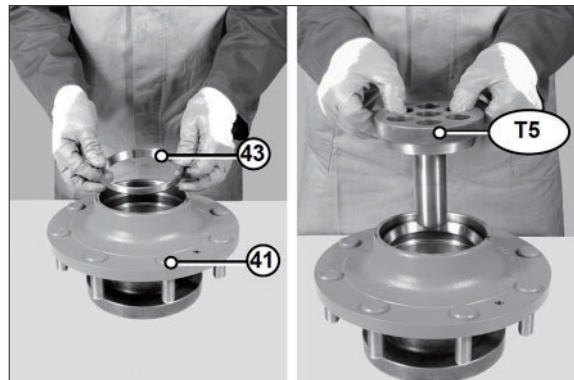
- ②⑪ Position the lower part of tool T5 and the thrust block of the external bearing (38).



55W9NAX060

- ②⑫ Lubricate the seats of the bearings and position the hub (41) on tool T5 ; position the thrust block of the internal bearing (43).

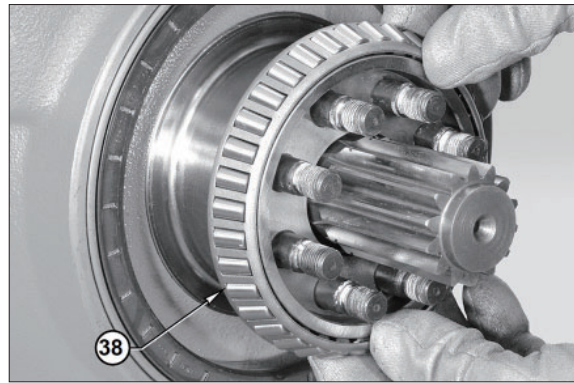
※ Check that the thrust block is correctly oriented.



55W9NAX061

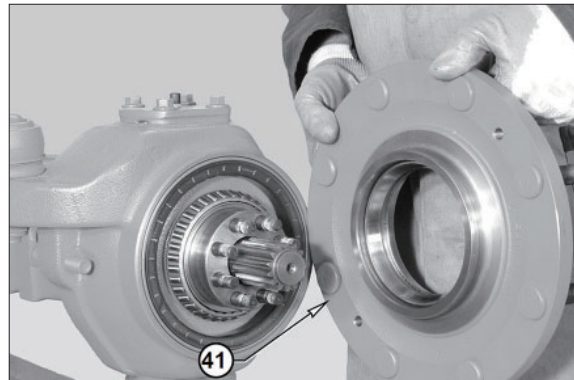
②③ Install the external bearing (38).

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



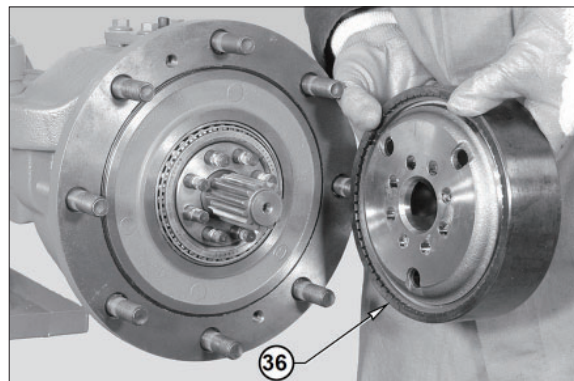
55W9NAX062

②④ Install the wheel hub (41).



55W9NAX063

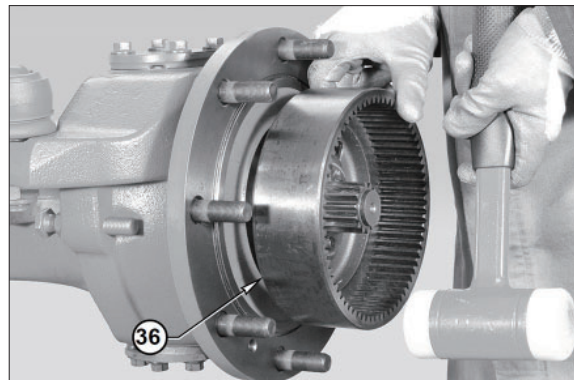
②⑤ Install the crown wheel (36).



55W9NAX064

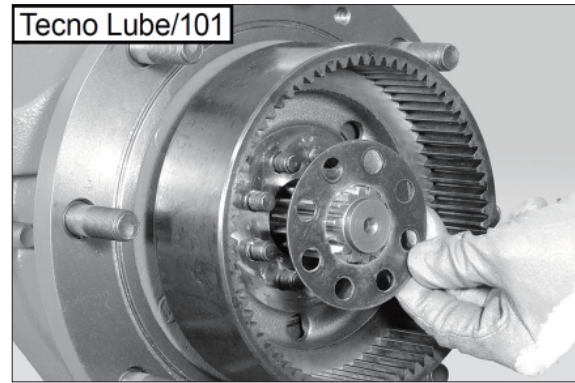
②⑥ Fit the complete crown flange (36).

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



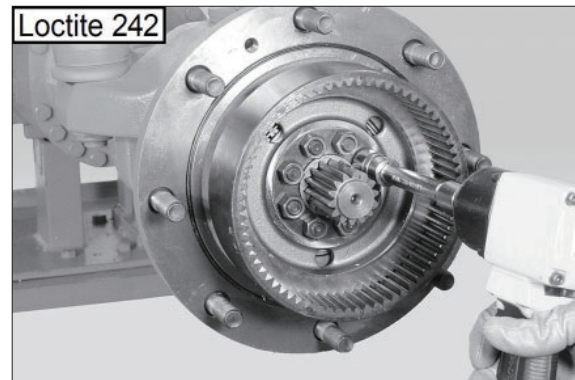
55W9NAX065

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



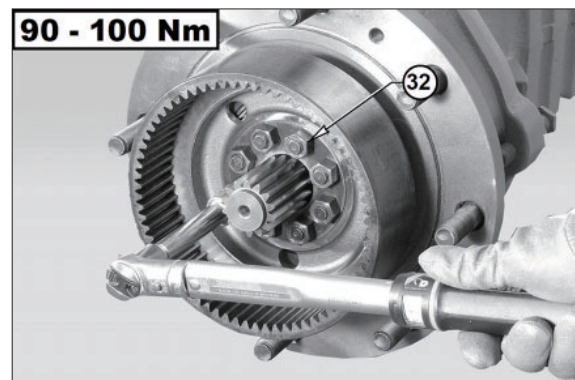
55W9NAX066

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



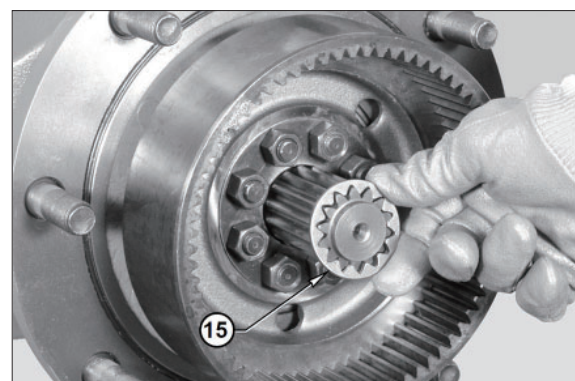
55W9NAX067

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



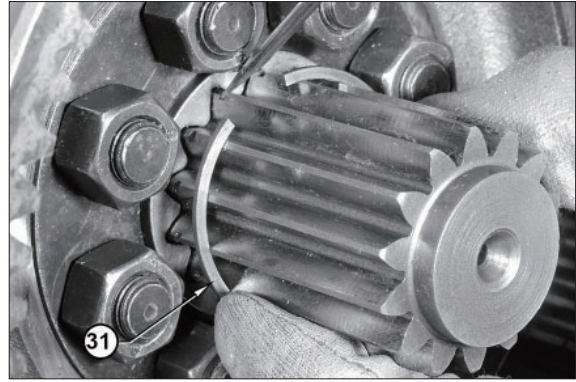
55W9NAX068

- ③⑩ Install the distance piece (31).



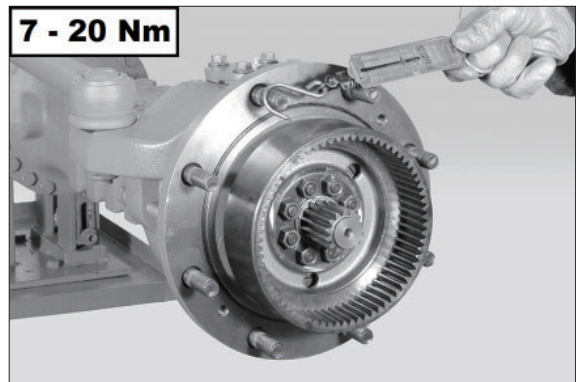
55W9NAX069

- ③① Install the snap ring (31).



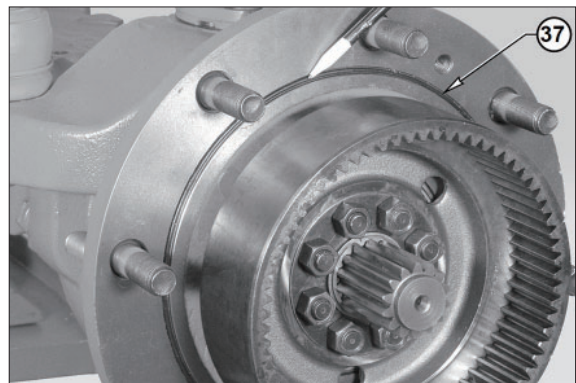
55W9NAX070

- ③② Check the continuous rolling torque on the hub.
· Torque : 0.71~2.04 kgf · m
(5.14~14.8 lbf · ft)



55W9NAX071

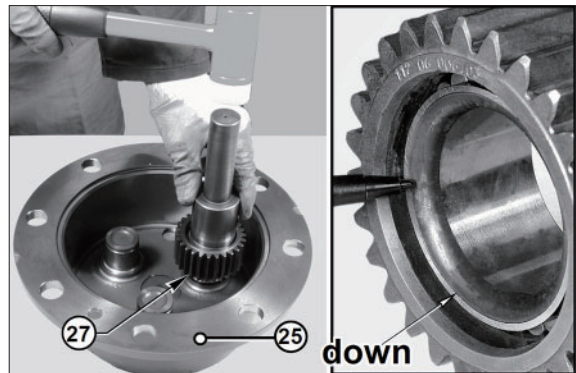
- ※ Check the condition and position of the O-ring (37).



55W9NAX072

- 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.



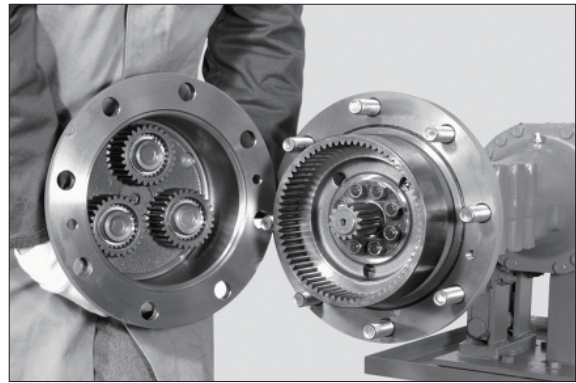
55W9NAX073

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



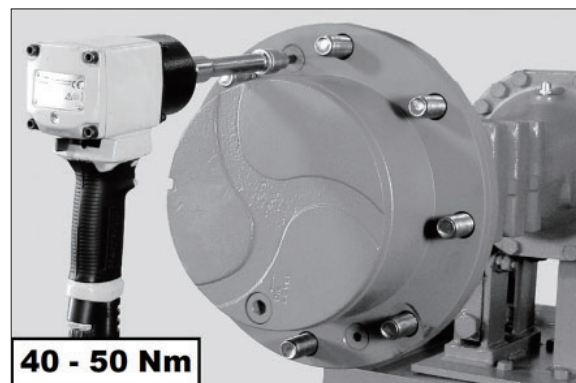
55W9NAX074

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



55W9NAX075

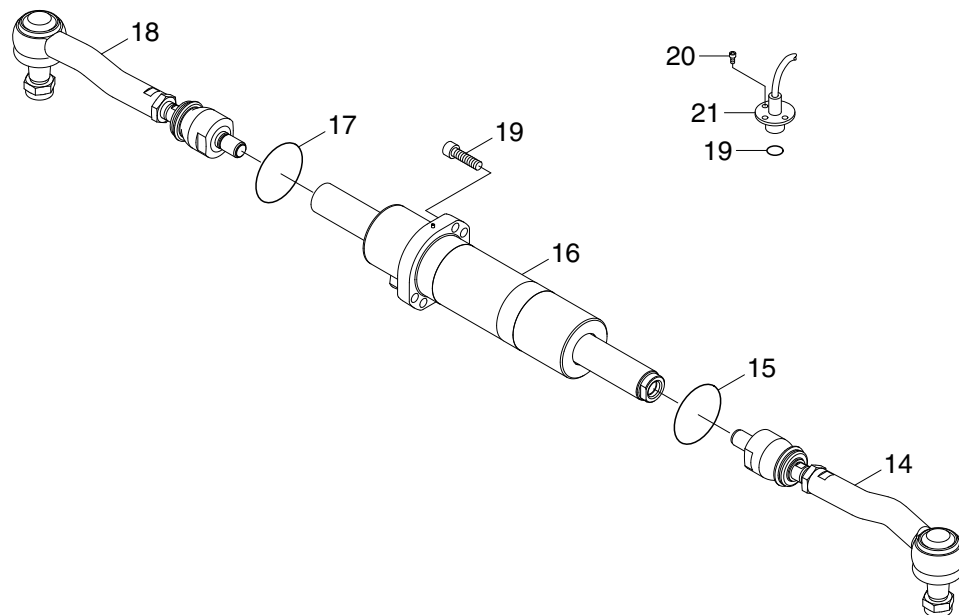
- ③⑥ Torque wrench : 4.08~5.1 kgf · m
(29.5~36.9 lbf · ft)



55W9NAX076

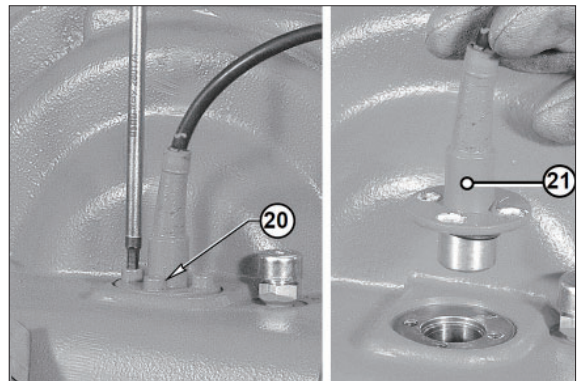
2) STEERING CYLINDER

(1) Disassembly



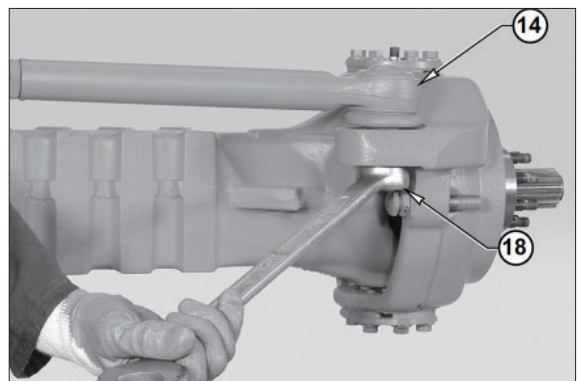
55W9NAX077

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



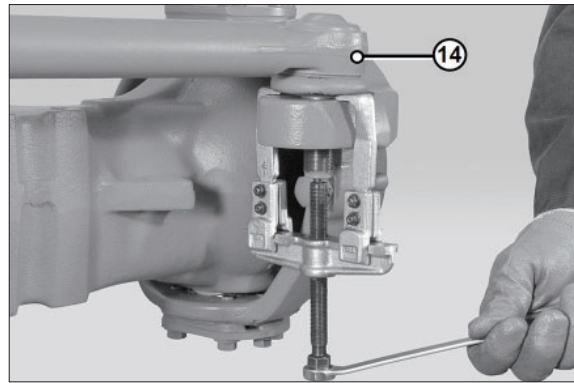
55W9NAX078

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



55W9NAX079

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



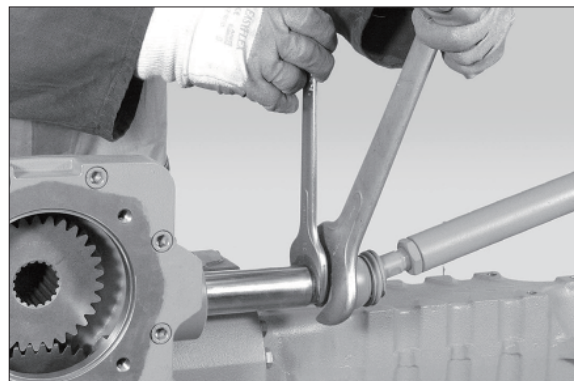
55W9NAX080

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



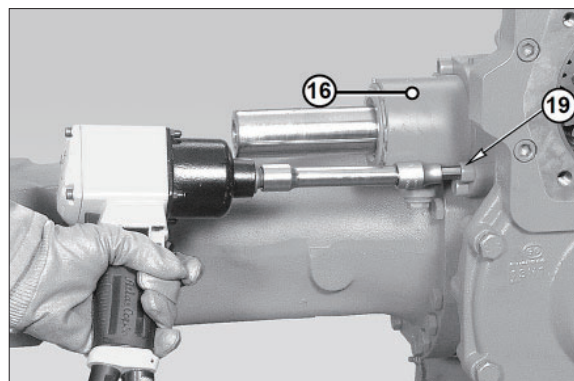
55W9NAX081

- ⑤ Disconnect left and right steering bars from the piston.



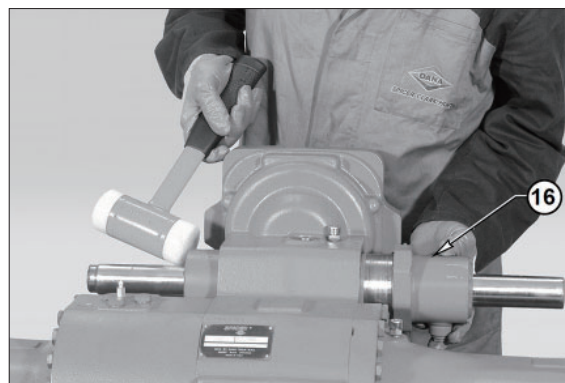
55W9NAX082

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

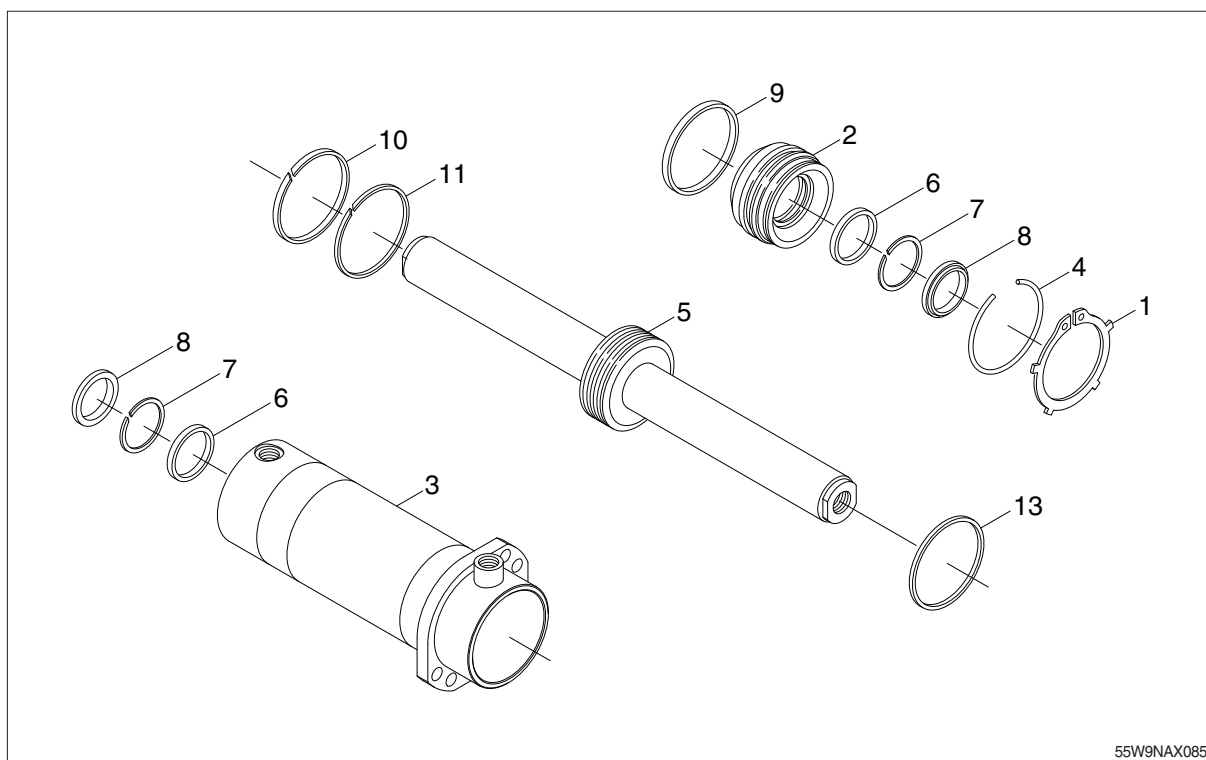


55W9NAX083

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

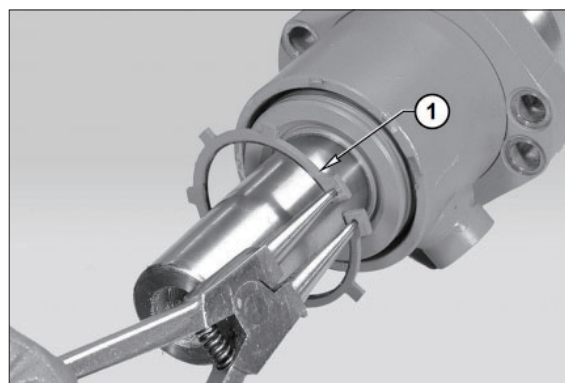


55W9NAX084



55W9NAX085

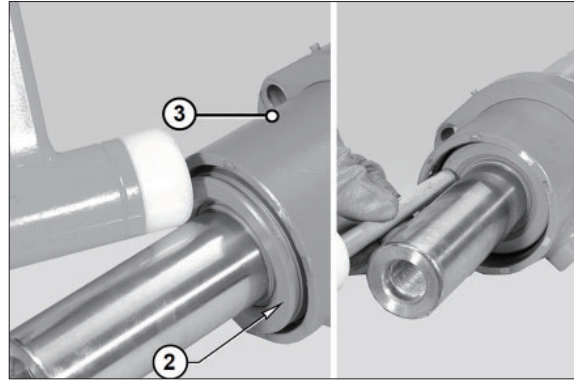
- ※ Before attempting to disassemble the unit, drain the oil in the cylinder chambers completely.
Using a screwdriver, remove the snap ring (1) of the cylinder head.



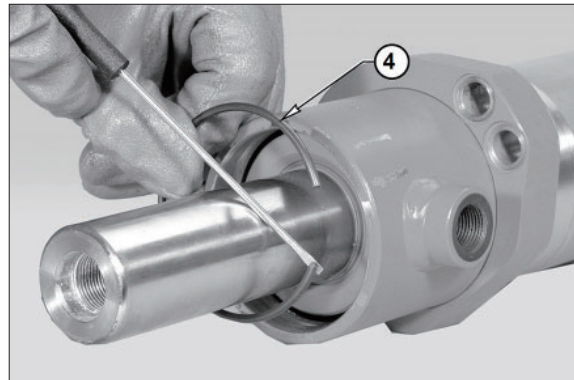
55W9NAX086

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

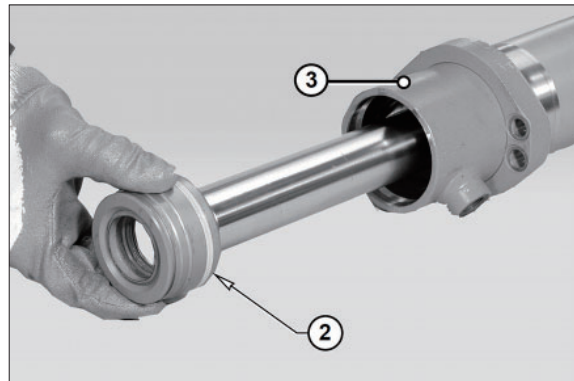
※ Insert the cylinder head so it is flush with the cylinder.



- 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.

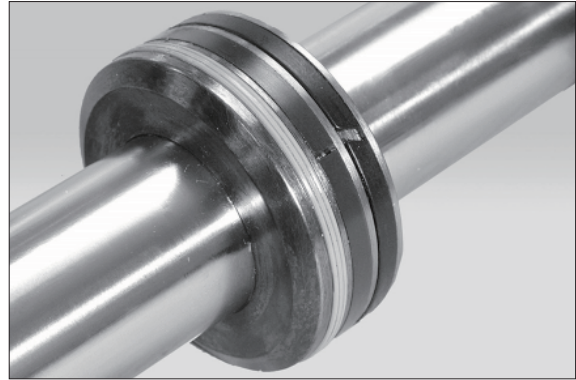


※ Note down direction of installation of piston whose seal ring is oriented towards cylinder head.



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

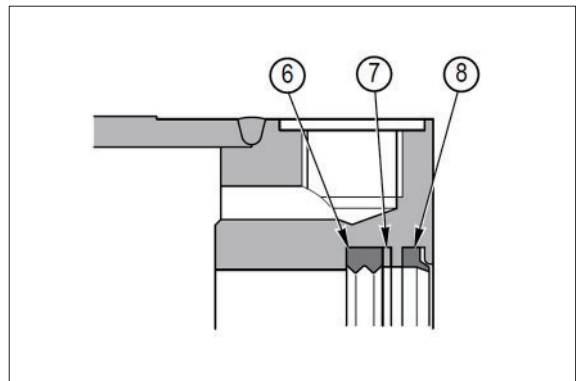
- ※ All seals must be replaced every time the unit is disassembled.
- ※ Particular attention must be paid not to damage the seats of both seals and piston slide.



55W9NAX091

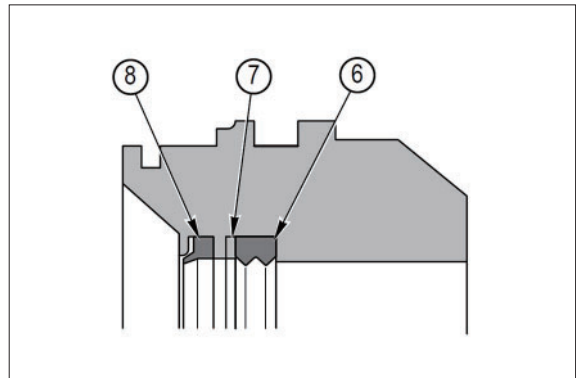
(2) Assembly

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



55W9NAX092

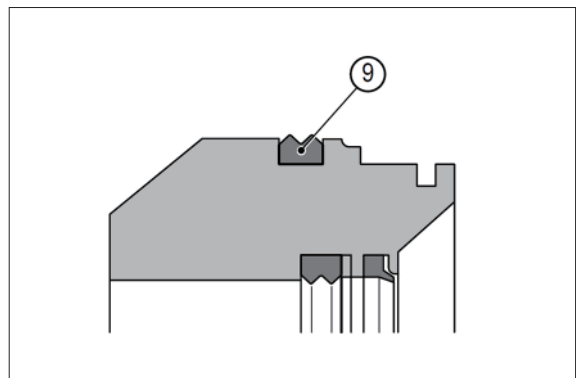
- ② Grease and install the piston rod seal ring (6), rod wiper (8) and anti-extrusion ring (7) into the head (2).



55W9NAX093

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

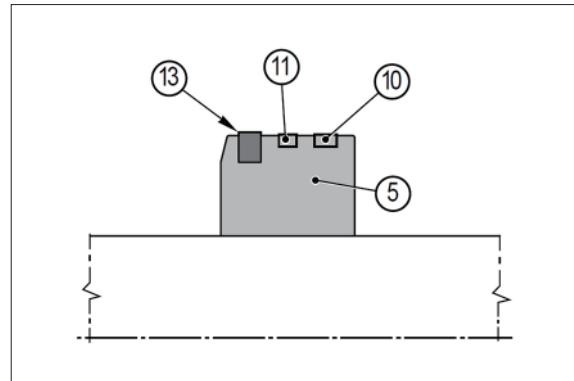
- ※ To ease installation, grease the outer surface of the piston
- ※ Do not roll the seal (9).



55W9NAX094

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

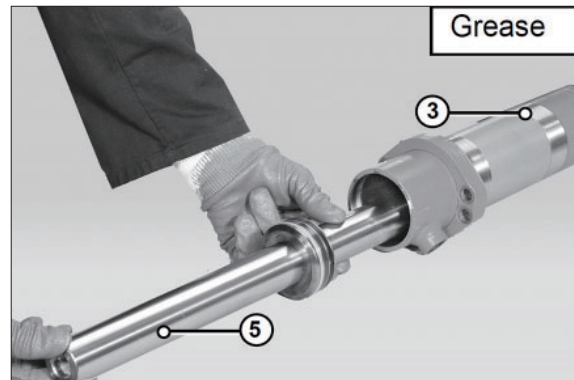
※ To ease installation, lubricate with grease.



55W9NAX095

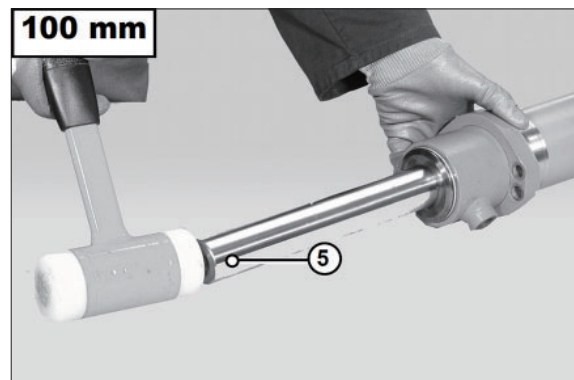
- ⑤ Center the shaft on the cylinder (3) so that it fits into the piston (5).

※ Apply a little grease to seals and cylinder.



55W9NAX096

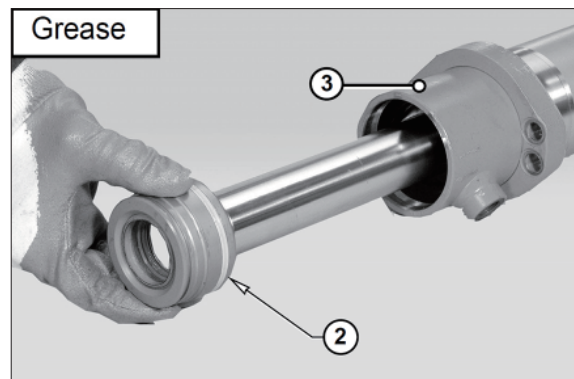
- ⑥ Push the piston (5) into the cylinder for 100 mm using a plastic hammer.



55W9NAX097

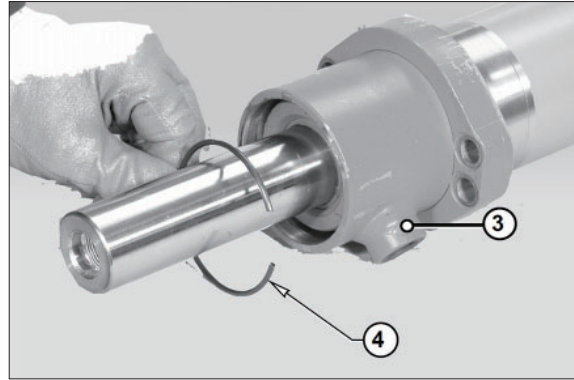
- ⑦ Apply grease to head (5) seals, fit the head onto the piston and push it into the cylinder (3) using a plastic hammer.

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



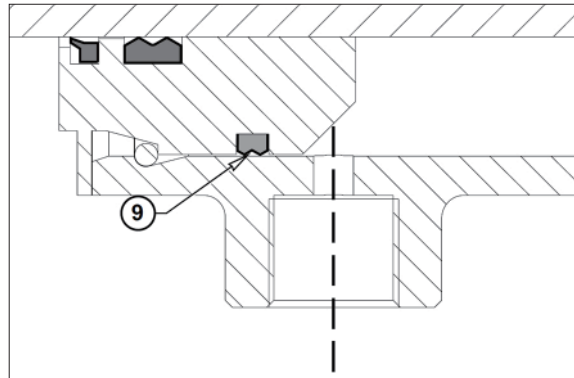
55W9NAX098

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



55W9NAX099

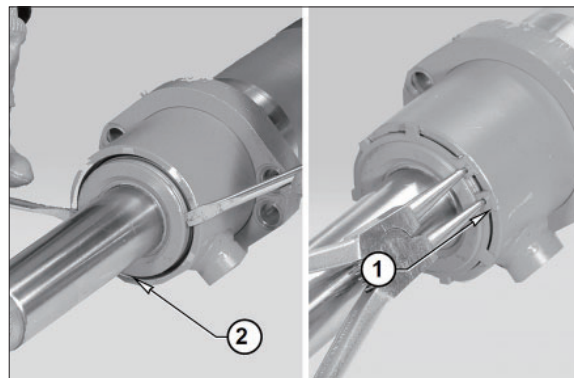
- ※ To insert the heading not to go beyond with the ring of gasket the hole of feeding because it could be cut.



55W9NAX100

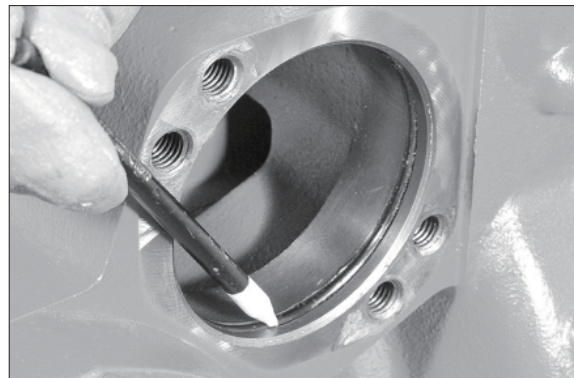
- ⑨ Using two screwdrivers or levers, force the head until it is seated against the stop ring (4).
Fit the snap ring (1) on the head (2).

- ※ 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.



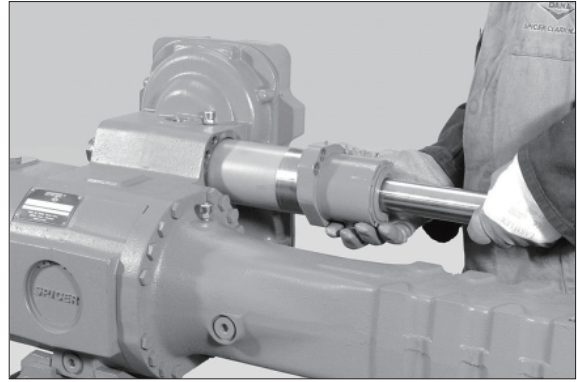
55W9NAX101

- ⑩ Renew at each reassembly.



55W9NAX102

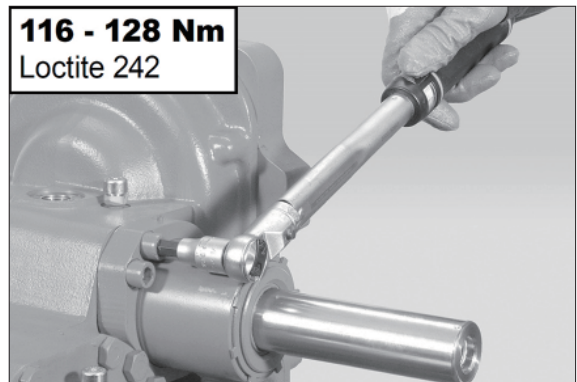
- ⑪ Check that the O-rings (17) (15) of the axle unit are in good condition ; lubricate the seats of the seals and fit the steering cylinder (3).



55W9NAX103

- 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)

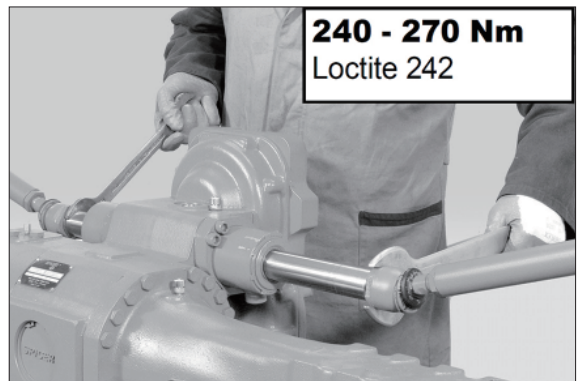


55W9NAX104

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

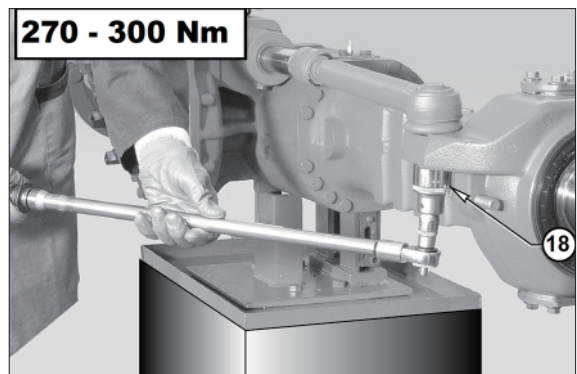
· Torque wrench setting :
24.5~27.5 kgf · m (177~199 lbf · ft)

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



55W9NAX105

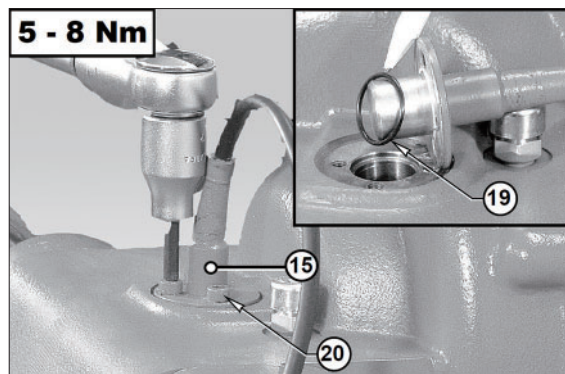
- ⑭ Insert the pins (18) in the steering case and lock into position using a torque wrench setting of 27.5~30.6 kgf · m (199~221 lbf · ft).



55W9NAX106

- 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)

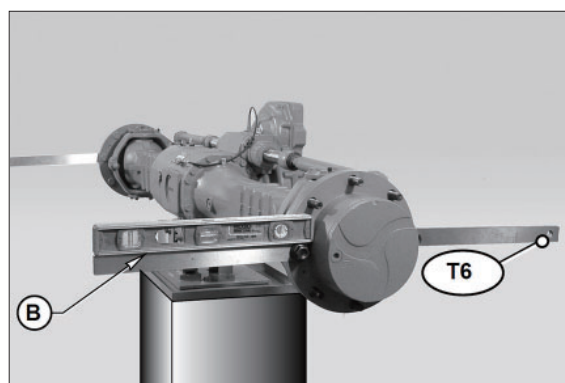


55W9NAX107

- ※ Eliminate the action of the negative brake, if fitted.

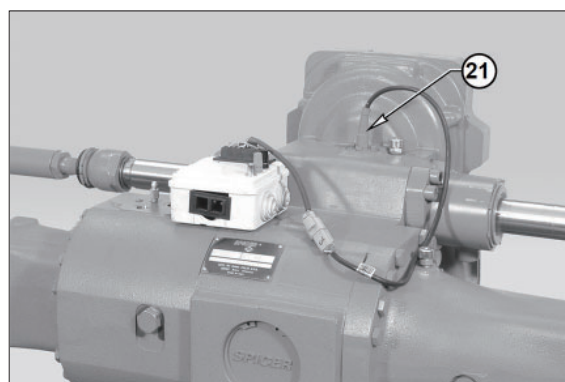
Apply tools T6 to the hubs and lock them.

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

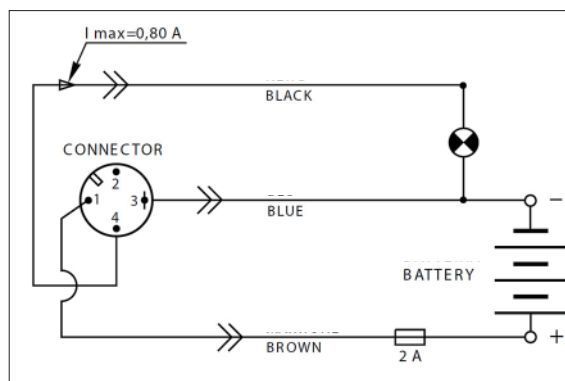


55W9NAX108

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

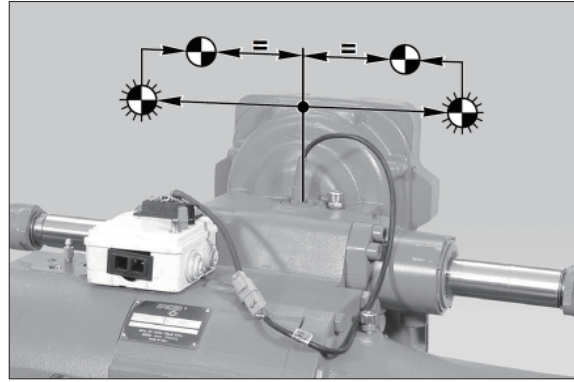


55W9NAX109



55W9NAX110

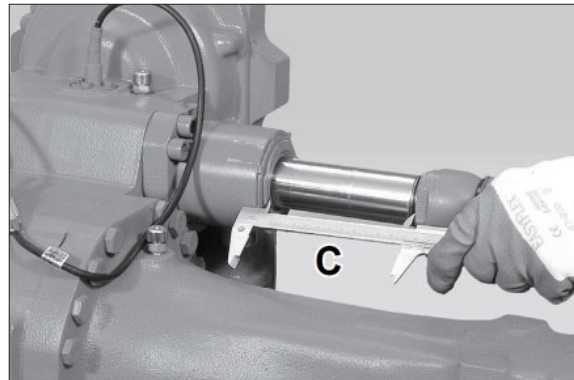
- ⑰ Center the piston by slowly moving it first in one direction then in the other and position it half way on the stroke, which is determined by the switching on and off of the signal lamp of the inspection device in the reversal stage.



55W9NAX112

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

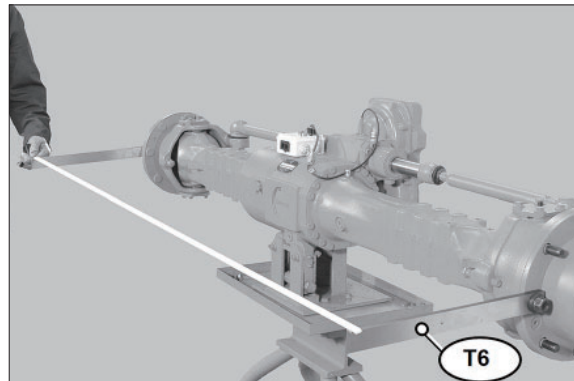
- ※ If cylinders come without a sensor, the centering of the piston must be carried out on the basis of the maximum stroke.



55W9NAX113

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

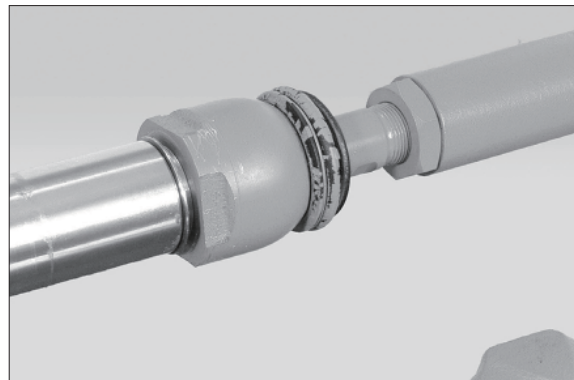
- ※ In order to check the rear size, rotate the bevel pinion and check that tools T6 are flat.



55W9NAX114

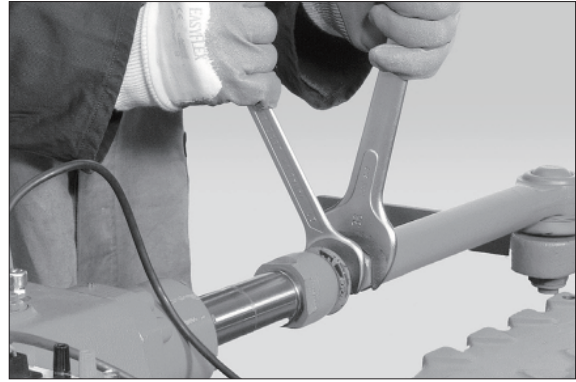
- ⑳ If necessary, adjust convergency without moving the centering of the piston and adjust the length of the steering bars (14).

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



55W9NAX115

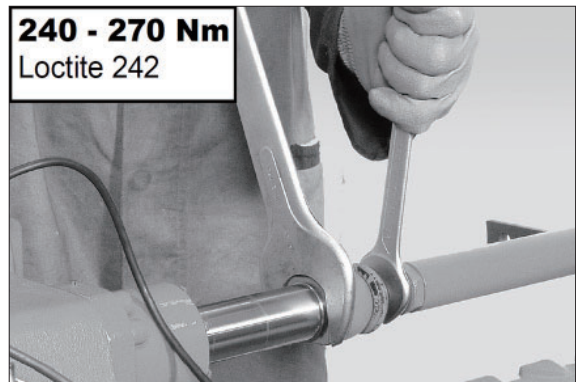
- ②① Unloose the nuts and screw them onto the ball-and-socket joints.



55W9NAX116

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

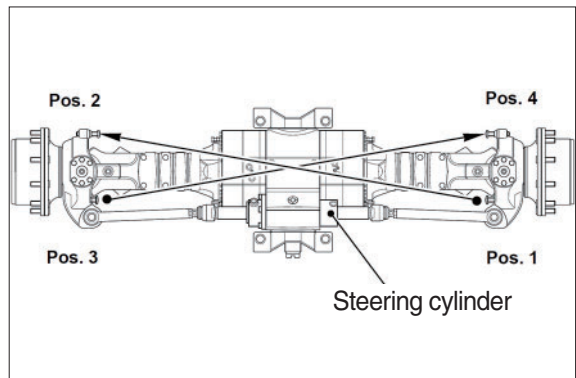
- Torque wrench setting for nuts :
24.5~27.5 kgf · m (177~199 lbf · ft)



55W9NAX117

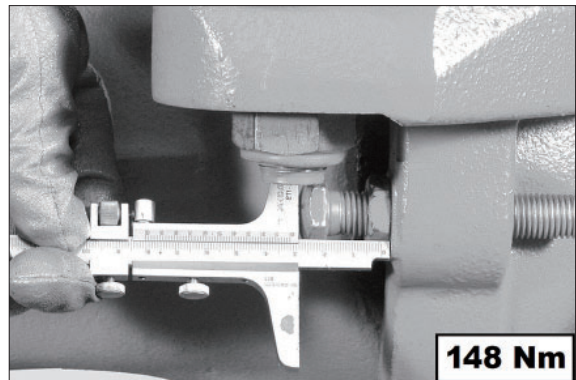
ADJUSTING THE STEERING ANGLE

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



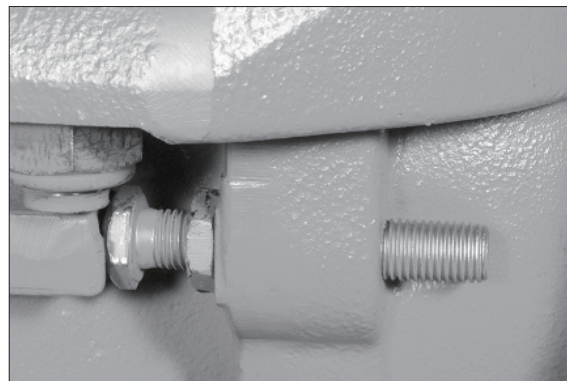
55W9NAX118

- 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).



55W9NAX119

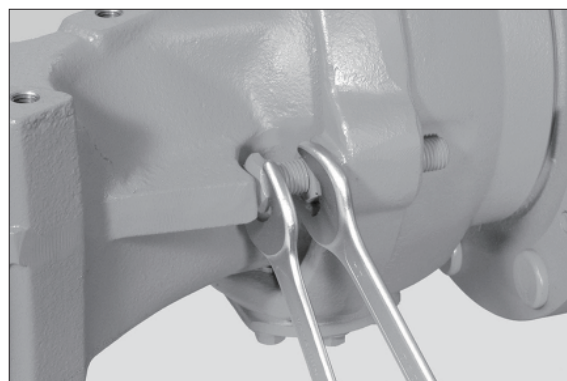
- ②④ Perform one full steering operation until the adjusted screw leans against the arm stop.



55W9NAX120

- 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.

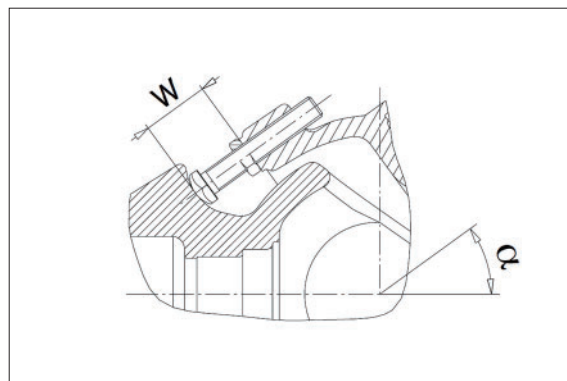
- ※ The screws must lean against the respective arm stops all at the same time.



55W9NAX121

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

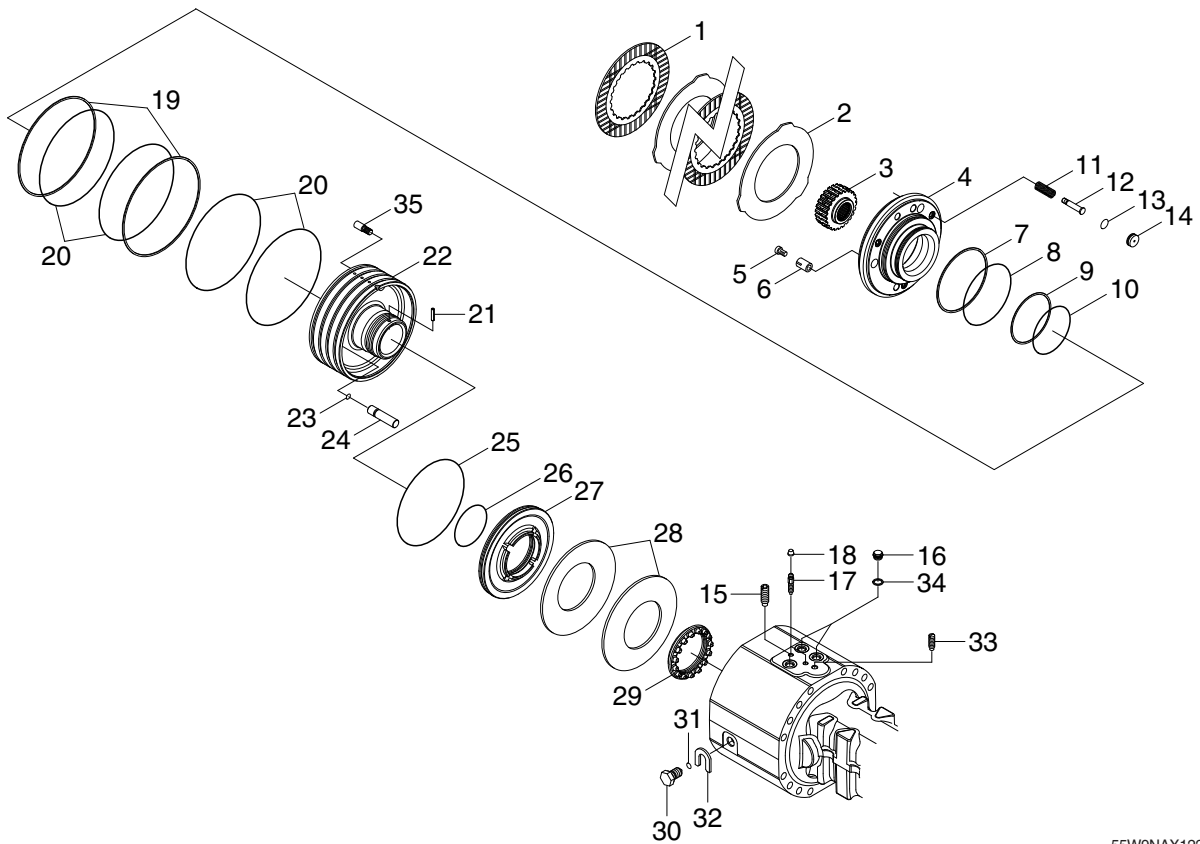
- ※ The screws must lean against the respective arm stops all at the same time.



55W9NAX121-1

3) BRAKE : SERVICE BRAKE, NEGATIVE BRAKE

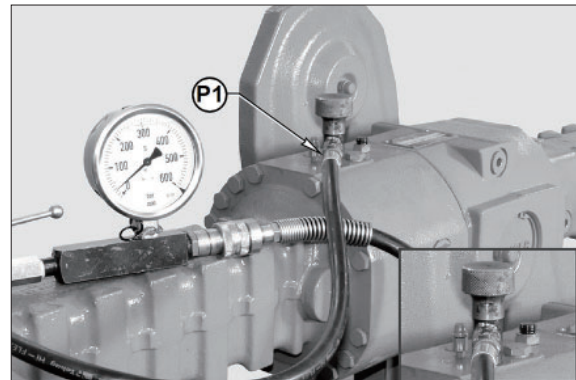
(1) Disassembly



55W9NAX122

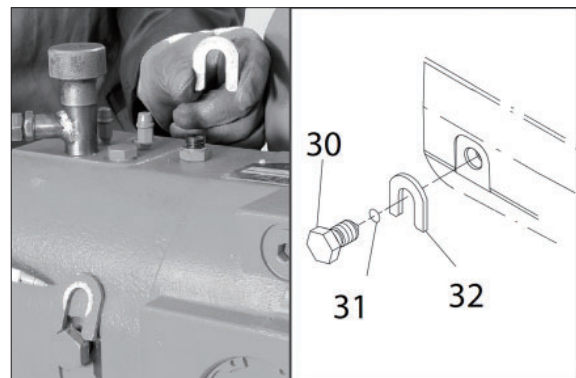
- ① Connect an external pump to the union piece "P1" of the negative brake and introduce a pressure of 15 ± 30 bar to eliminate the pressure of the belleville washers.

※ Perform all operations on both arms.



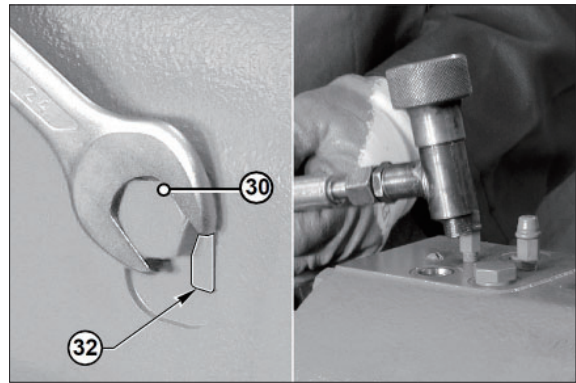
55W9NAX123

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



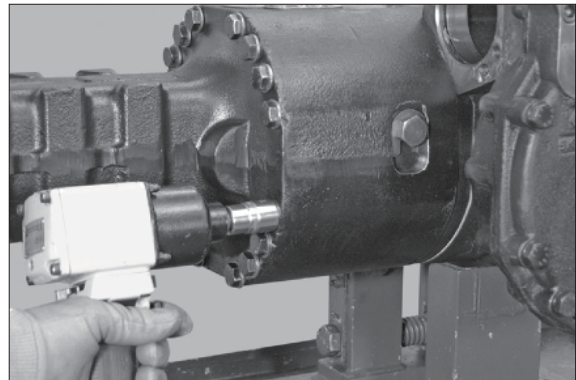
55W9NAX124

- ③ Insert block screws to end stroke and release pression.



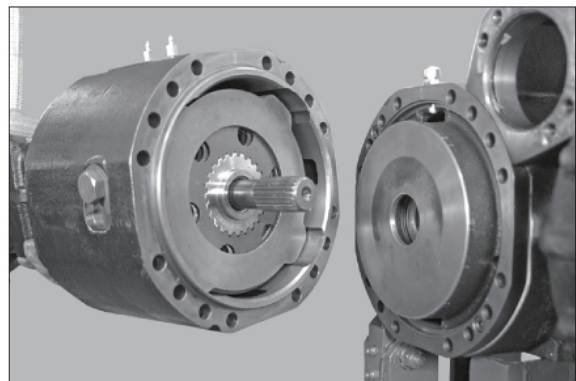
55W9NAX125

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



55W9NAX126

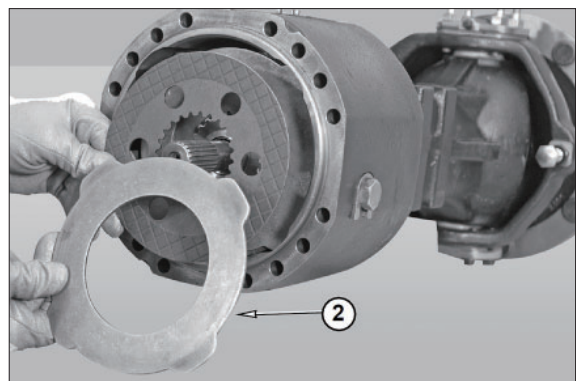
- ⑤ Take off the arm and lay it down vertically.



55W9NAX127

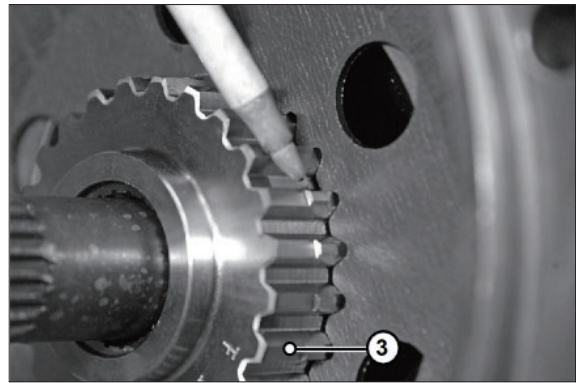
- ⑥ Remove the brake discs one after the other (2).

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



55W9NAX128

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



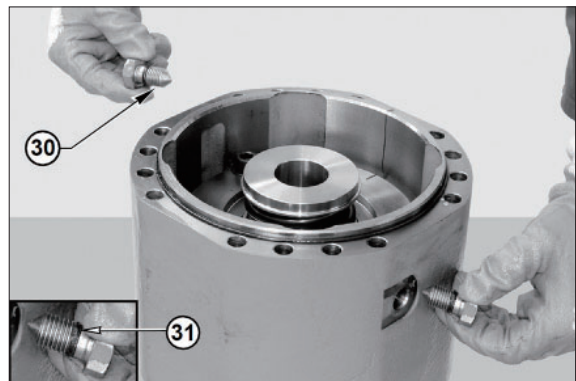
55W9NAX129

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



55W9NAX130

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



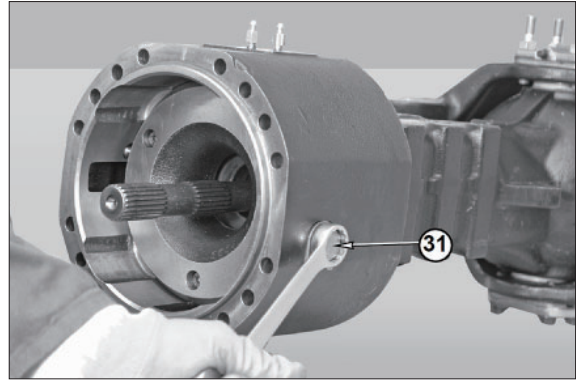
55W9NAX131

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



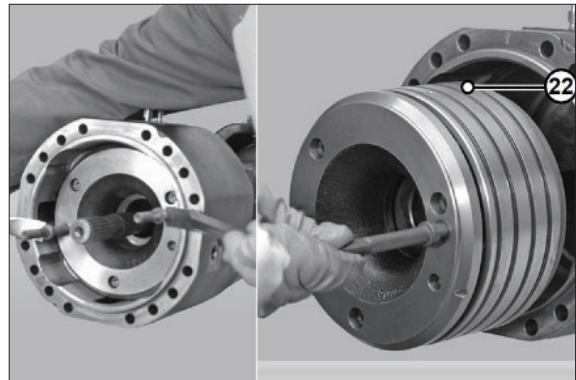
55W9NAX132

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



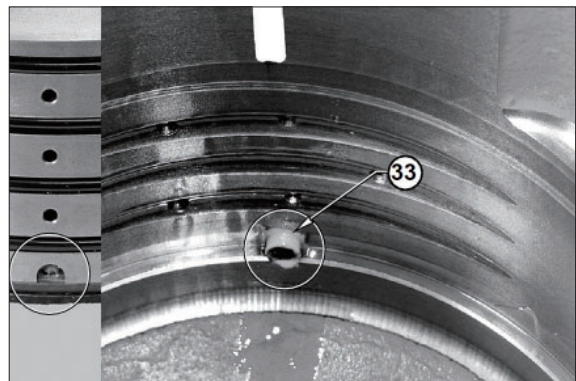
55W9NAX133

- ⑫ Pull out brake piston assembly module (22).



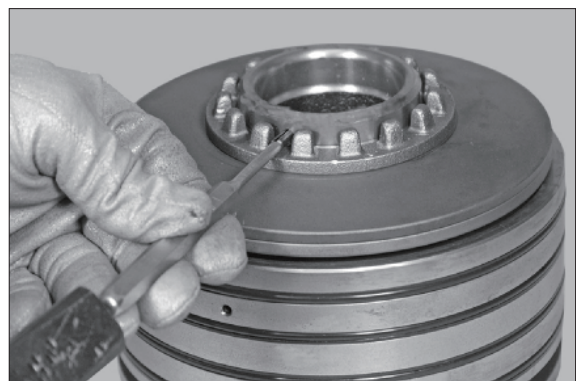
55W9NAX134

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



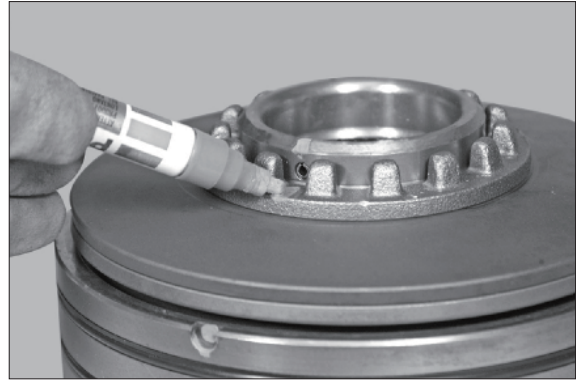
55W9NAX135

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



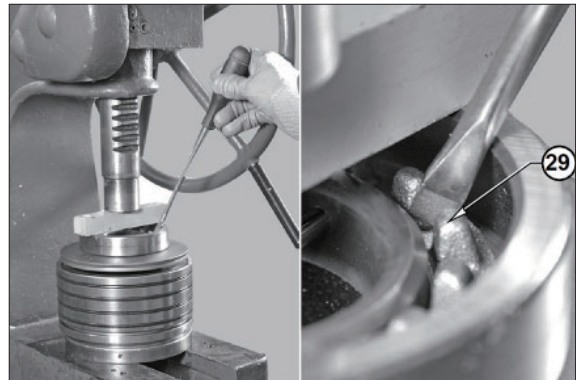
55W9NAX136

- ⑭ Sign the position of the slotted nut.



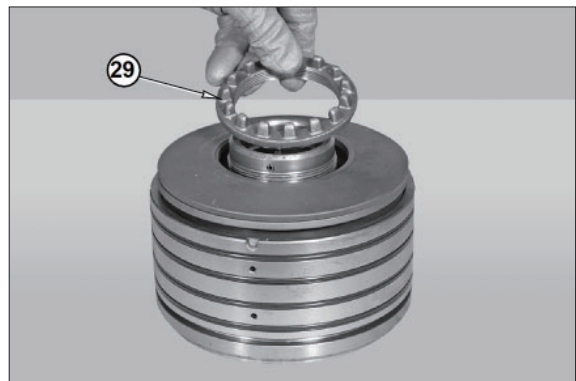
55W9NAX137

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



55W9NAX138

- ⑯ Remove nut (29).



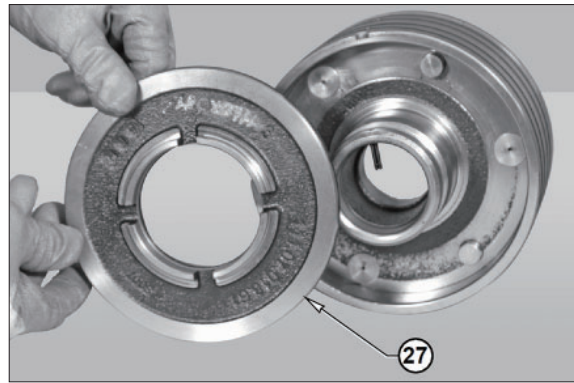
55W9NAX139

- ⑰ Remove the disc springs (28).



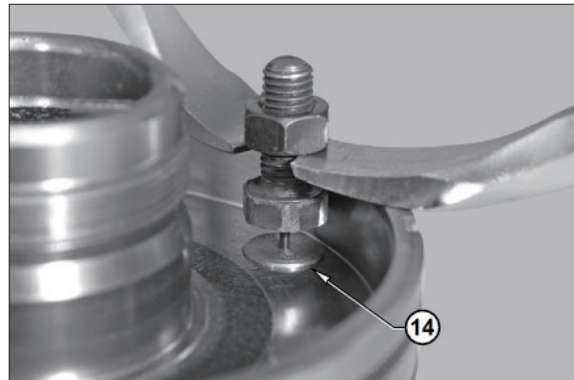
55W9NAX140

- ⑮ Applying air pressure, remove the piston (27) of the negative brake.



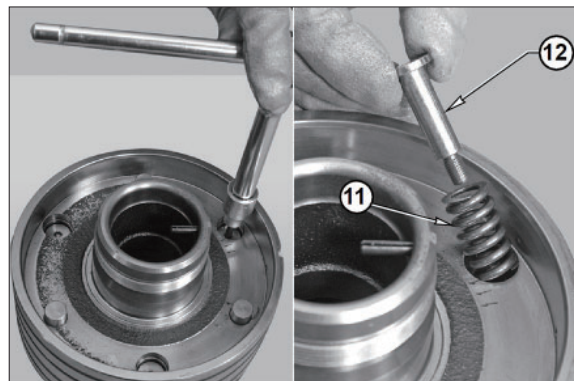
55W9NAX141

- ⑯ Using a new screw remove the pressure seal caps.



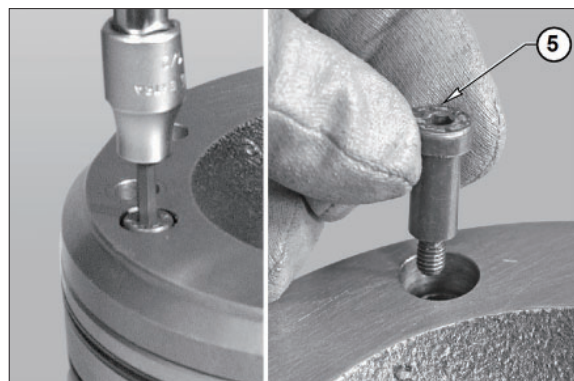
55W9NAX142

- ⑰ Remove the reversal springs (11).



55W9NAX143

- ⑱ Remove the adjusting screws (5).



55W9NAX144

- ② Remove the service brake piston (4).



55W9NAX145

- ③ Remove the three bolts (24).

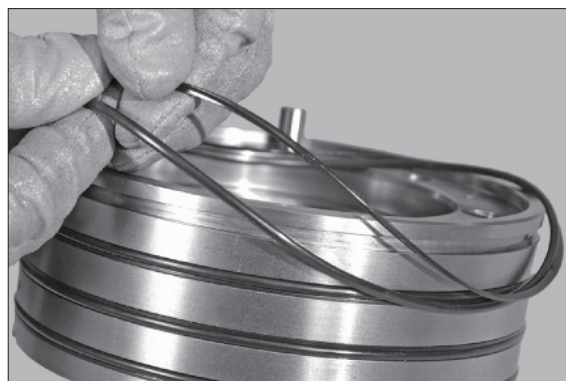


55W9NAX146

- ④ Remove the O-rings and the anti-extrusions rings from the service brake, the negative brake piston and from the piston.

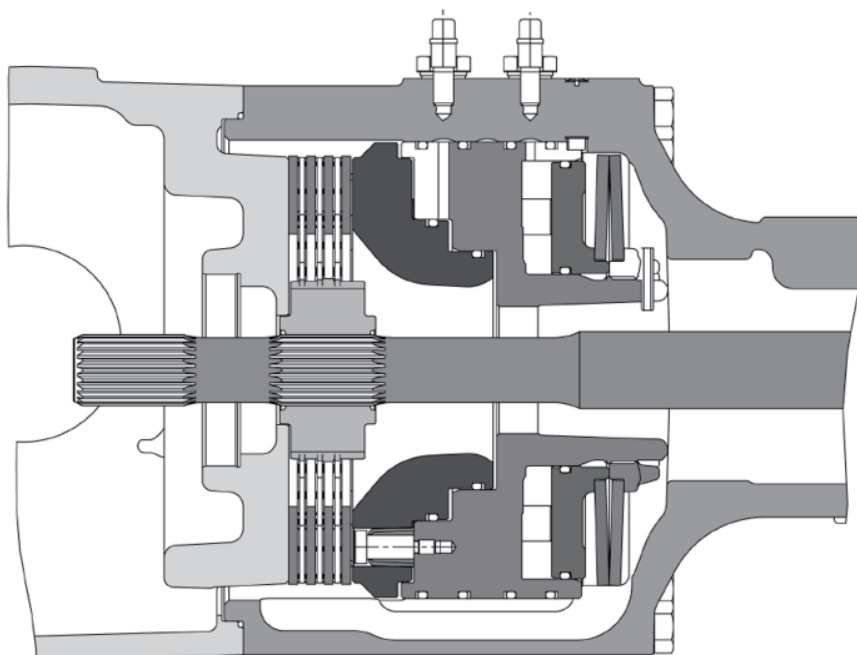


55W9NAX147



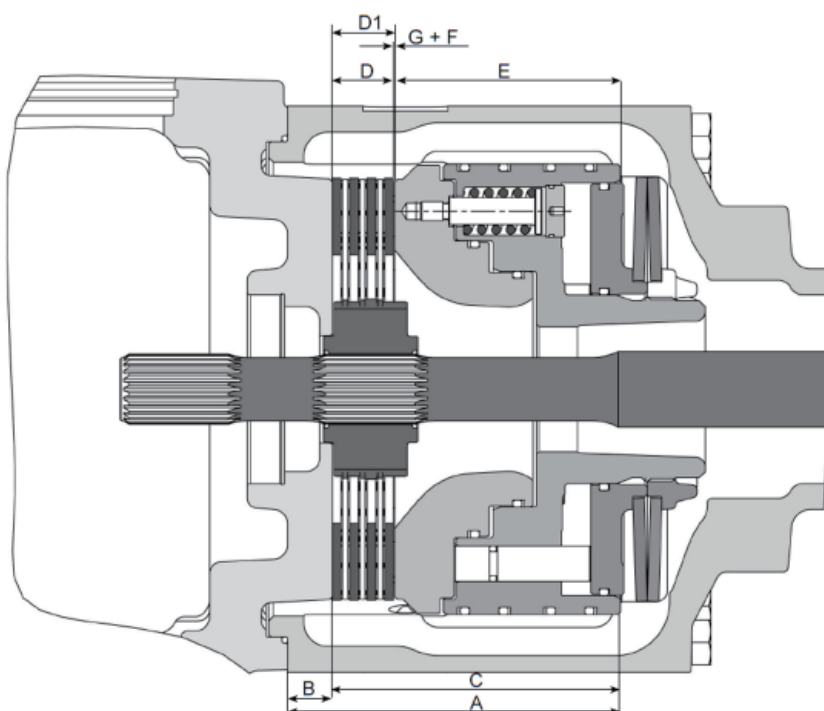
55W9NAX148

(2) Assembly



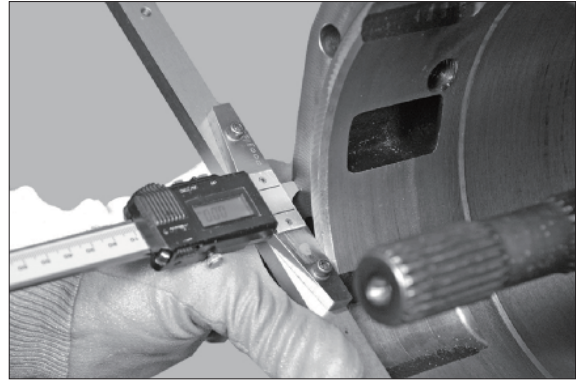
55W9NAX149

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



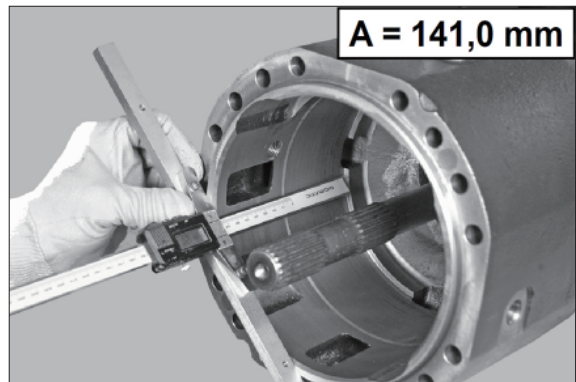
55W9NAX150

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



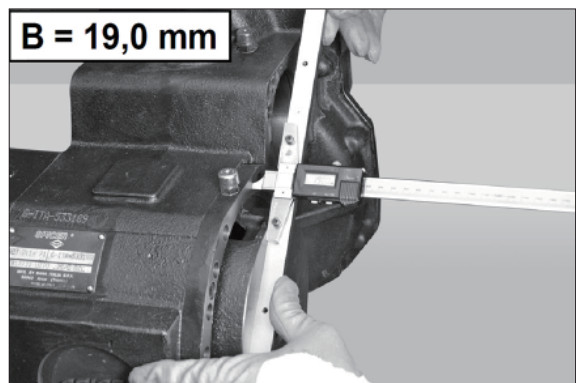
55W9NAX151

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



55W9NAX152

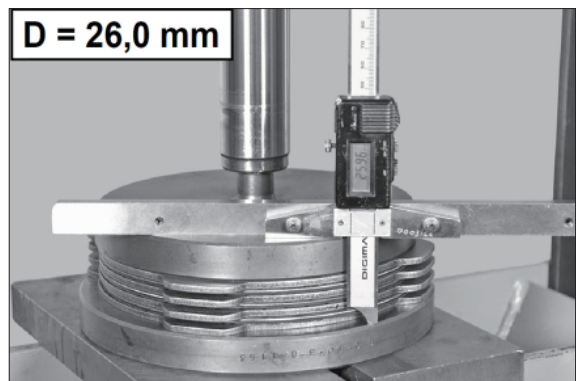
- ③ Measure the distance between the disk support plane and the arm support plane.
Subtract the value B from the value A to obtain the effective dimension of the arm containing the brake disks and the piston pack.



55W9NAX153

- 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.



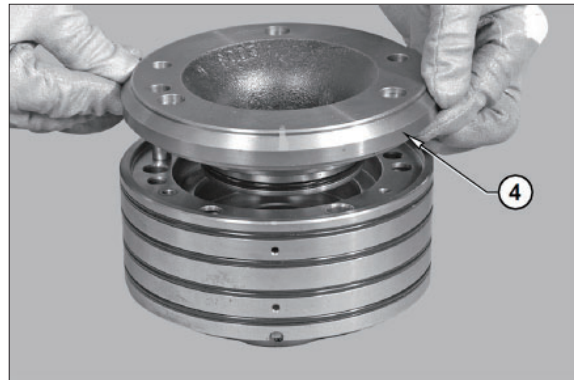
55W9NAX154

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

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

55W9NAX155

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



55W9NAX156

- ⑦ Insert the bolts (24).



55W9NAX157

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



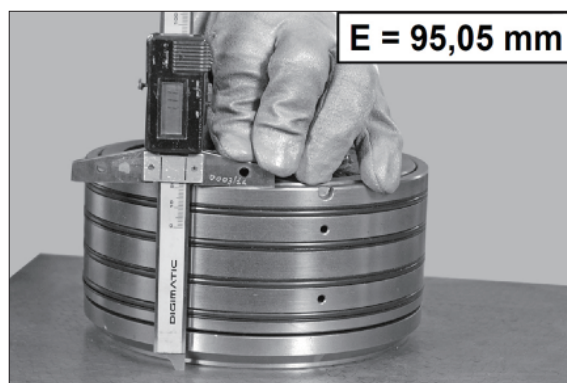
55W9NAX158

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



55W9NAX159

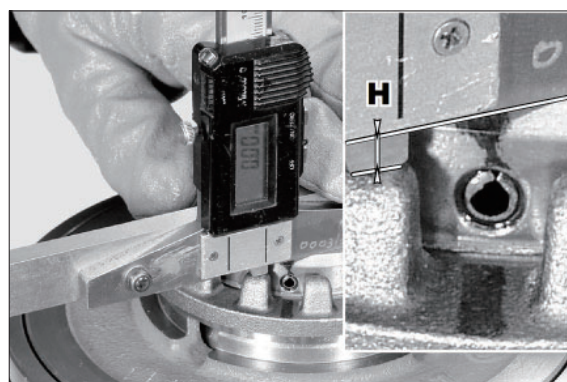
- ※ To define the level “E” adjust the slotted nut always to the smaller value by driving to the closer notch.



55W9NAX160

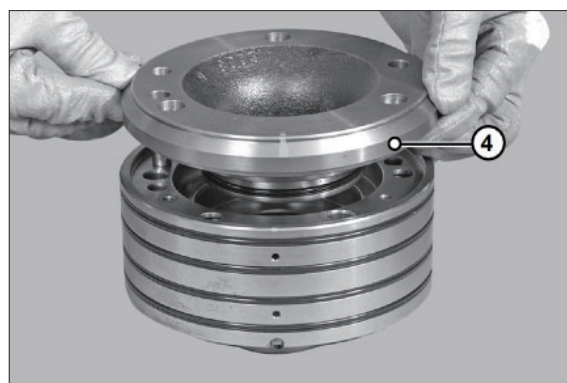
- ⑨ Before removing the slotted nut in order to insert the springs, note down the distance “H” from the plane to the tooth near the pin.

- ※ Sign.



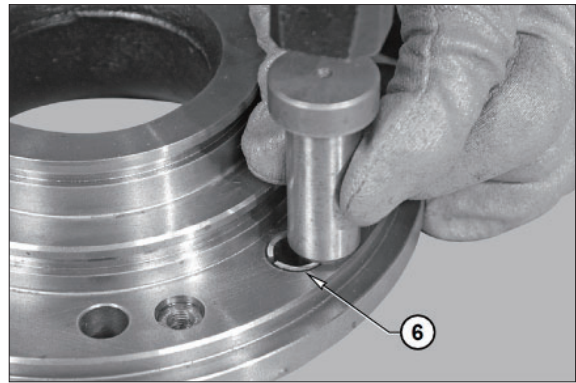
55W9NAX161

- ⑩ Remove the service brake piston (4).



55W9NAX162

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



55W9NAX163

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

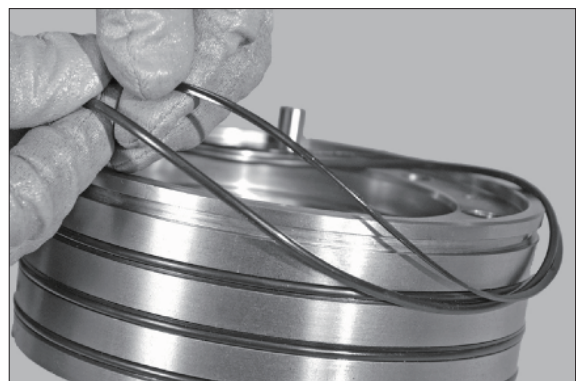
※ The O-rings always have to be assembled from the pressure facing side.



55W9NAX164

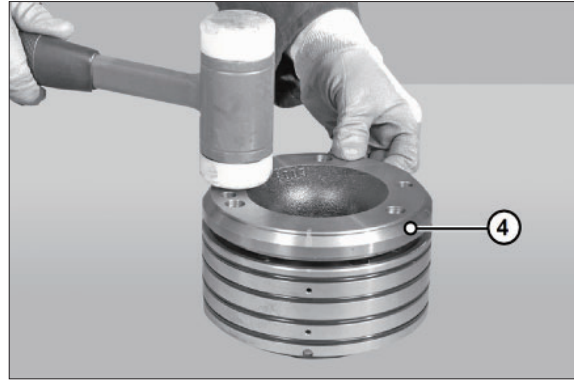


55W9NAX165



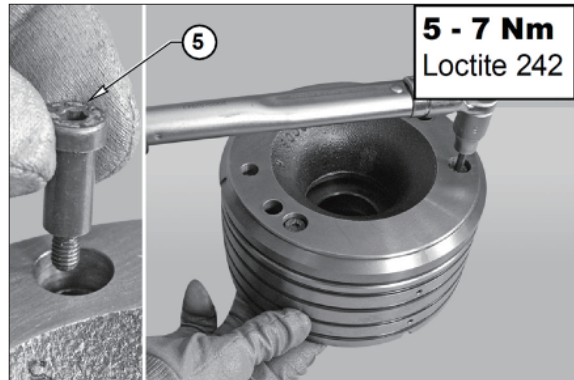
55W9NAX166

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



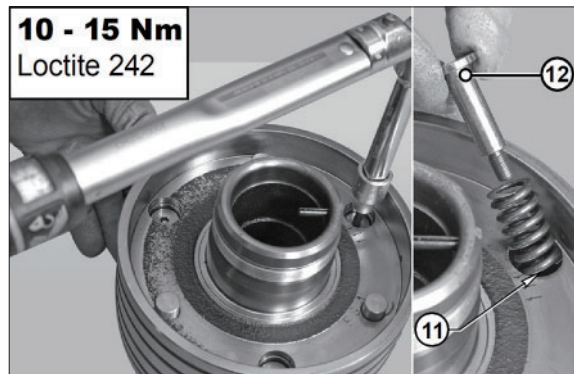
55W9NAX167

- 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)



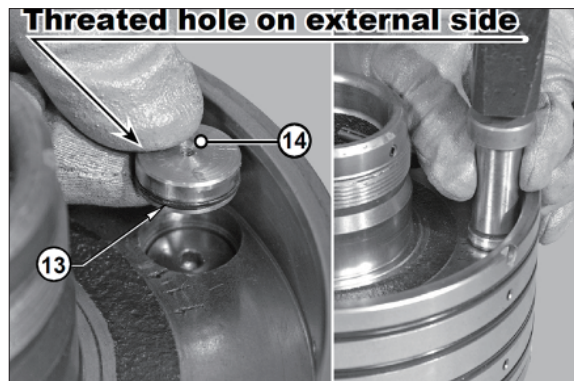
55W9NAX168

- 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).



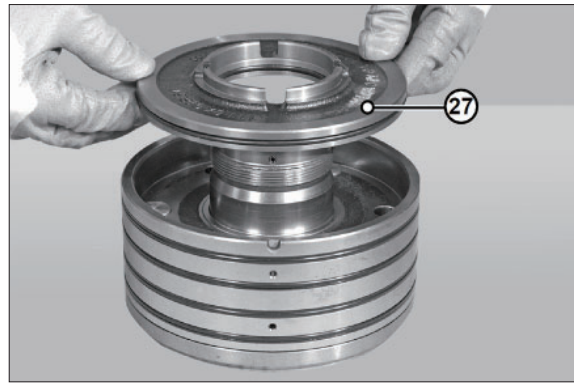
55W9NAX169

- ⑯ Insert the stroke end seal caps.



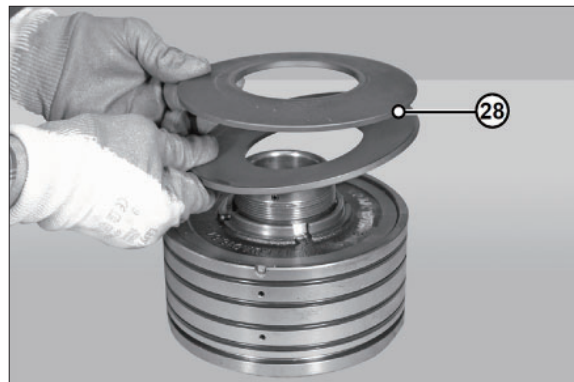
55W9NAX170

- ⑰ Insert the negative brake piston (27).



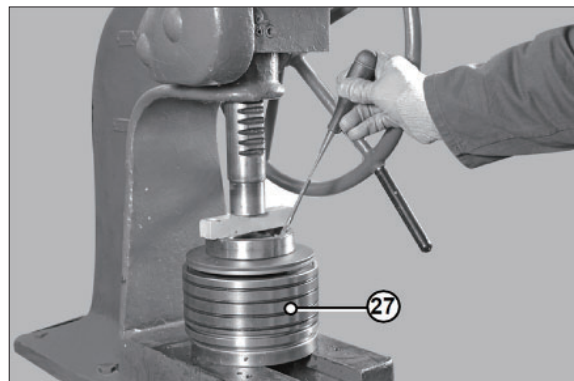
55W9NAX171

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



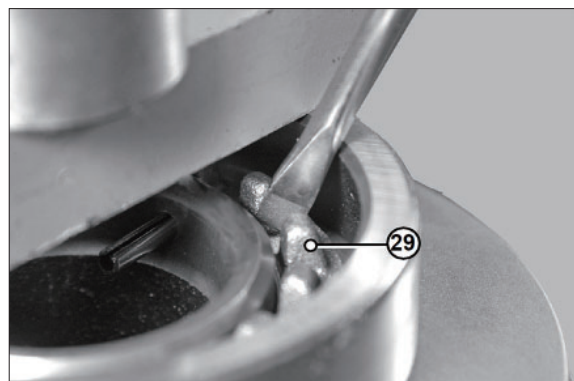
55W9NAX172

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



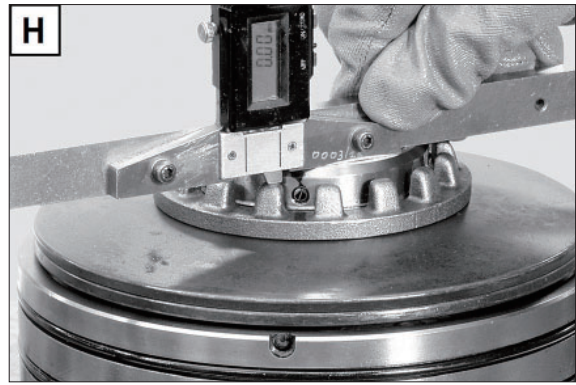
55W9NAX173

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



55W9NAX174

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



55W9NAX175

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



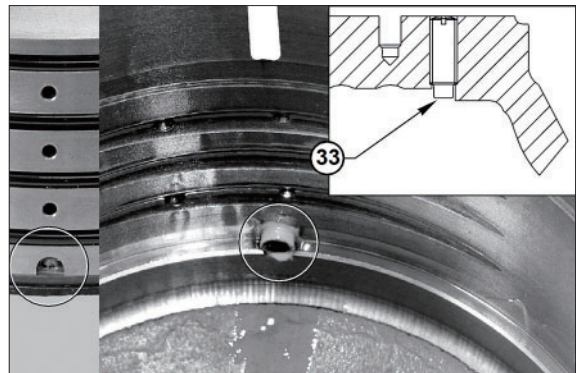
55W9NAX176

- ②③ Put the pin in locking (21) position.



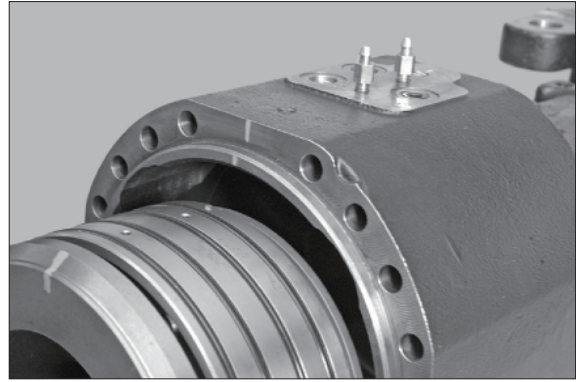
55W9NAX177

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



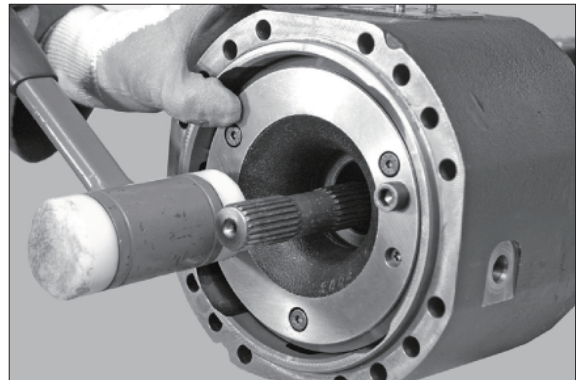
55W9NAX178

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



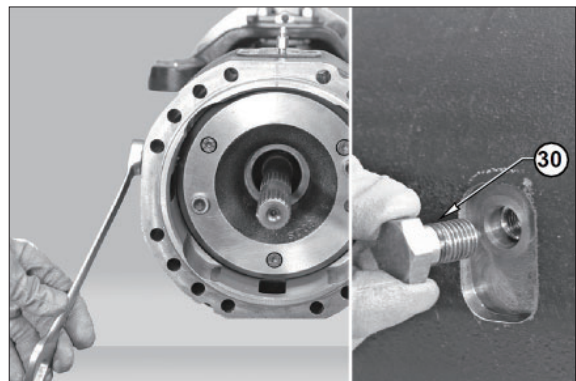
55W9NAX179

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



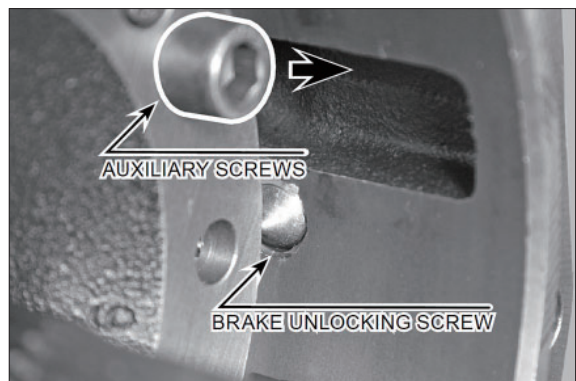
55W9NAX180

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



55W9NAX181

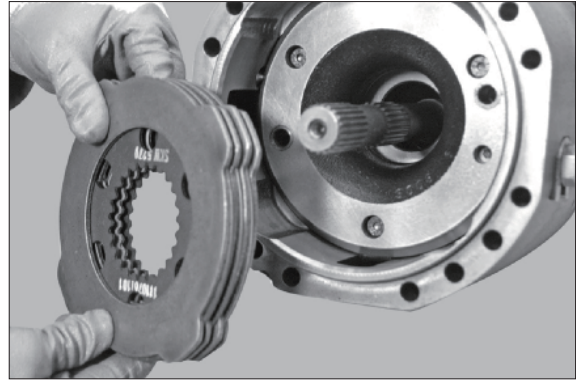
- ②⑦ Remove the two auxiliary screws.



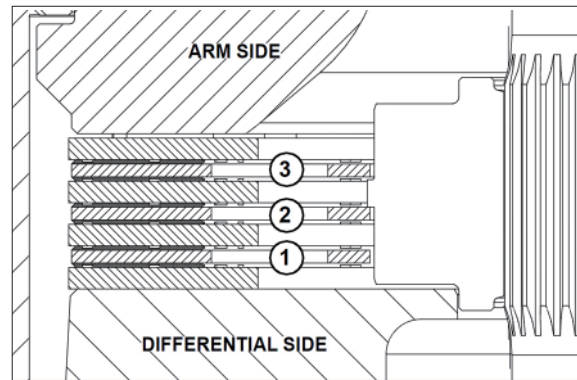
55W9NAX182

- ⑳ Insert the brake discs (1) (2) in the right sequence.

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

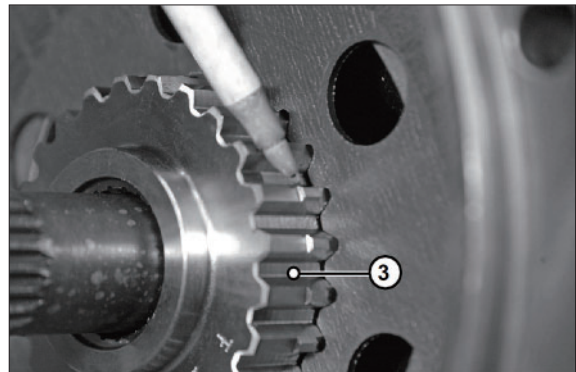


55W9NAX183



55W9NAX184

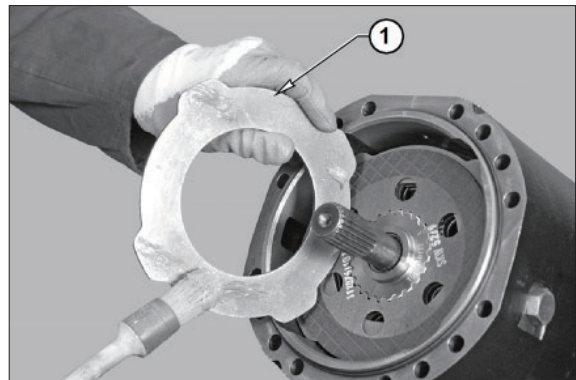
- ㉑ Install the flange (3) on the arm.



55W9NAX185

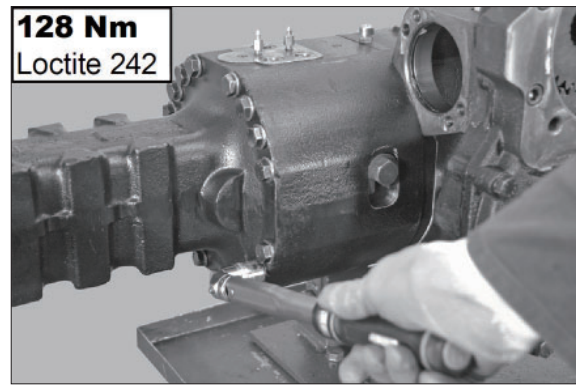
- ㉒ Insert the brake discs (1) (2) in the right sequence.

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



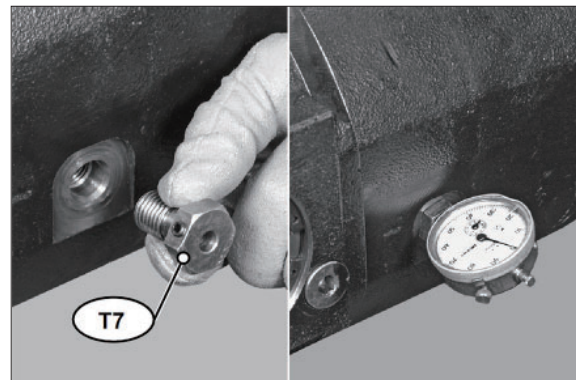
55W9NAX186

- ③① Insert the screws and tighten them alternately.



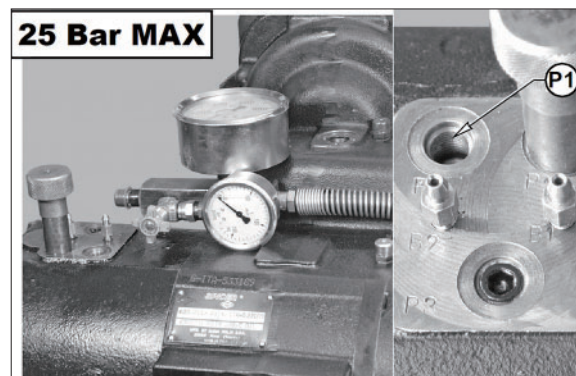
55W9NAX187

- 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.



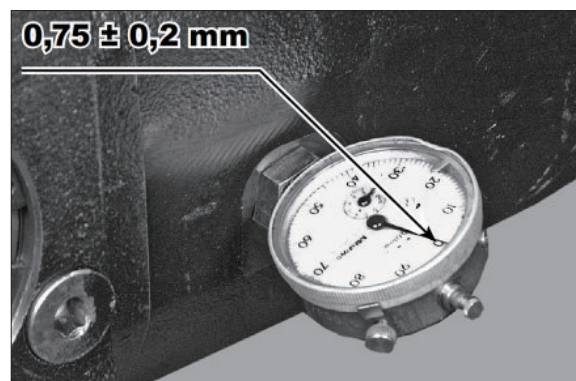
55W9NAX188

- ③③ Introduce a pressure of maximum 25 bar.



55W9NAX189

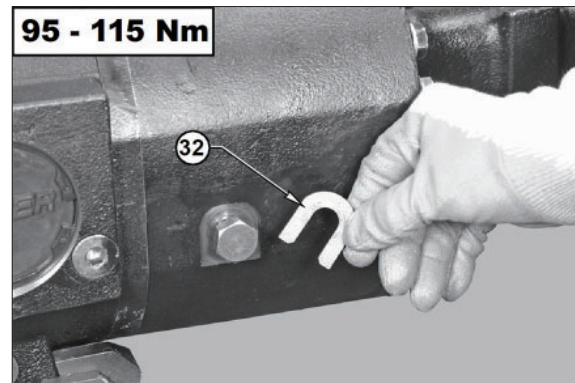
- ③④ Once the pressure is inserted into the circuit the comparator must give a measurement equal to play X (0.75 mm).



55W9NAX190

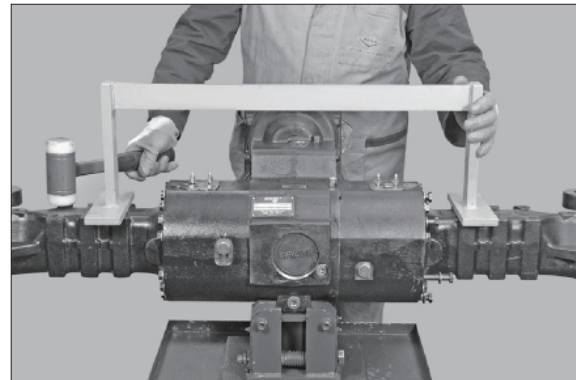
- ③⑤ Insert the two “U”-shaped shims and tighten the screws with a torque wrench setting of 9.69~11.7 kgf · m (70.1~84.8 lbf · ft).

※ The position of the negative brake is unlocked.



55W9NAX191

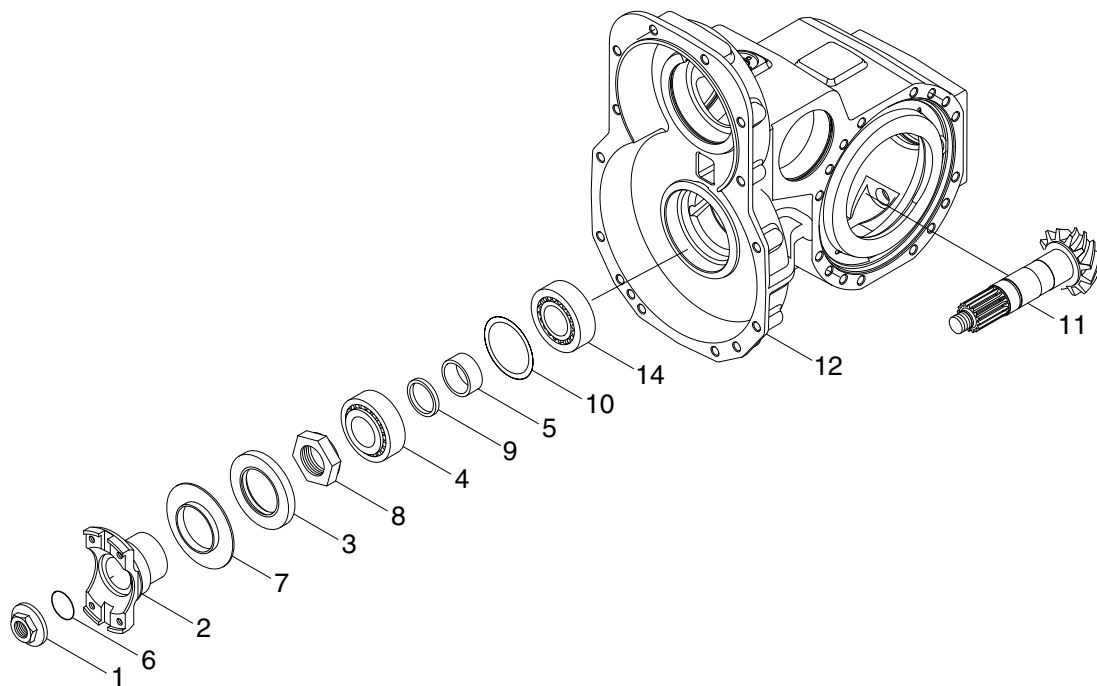
- ③⑥ Check the flatness of the arms and finally lock the arms with the screws (4) and the washer (5) using the crosstightening method.



55W9NAX192

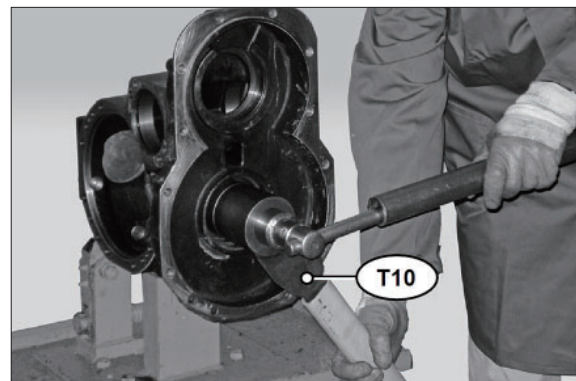
4) BEVEL PINION

(1) Disassembly



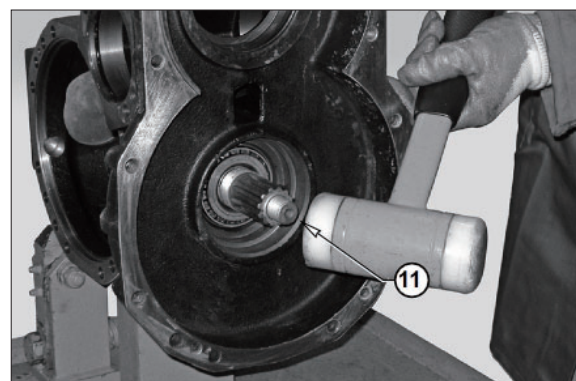
55W9NAX223

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



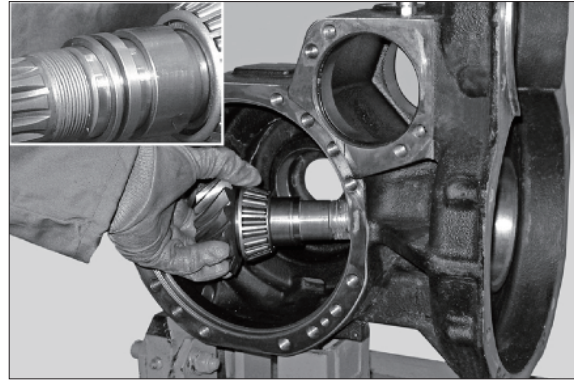
55W9NAX224

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



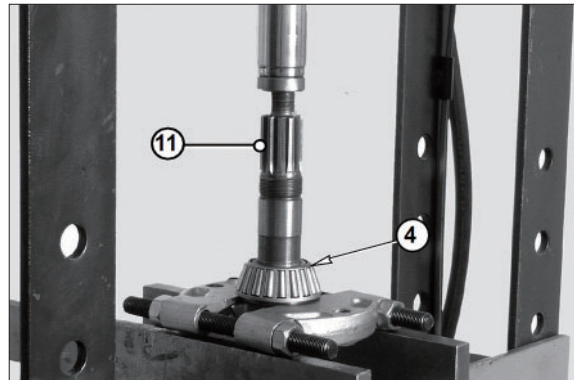
55W9NAX225

- ③ Refer and keep to the positions marked during disassembly.



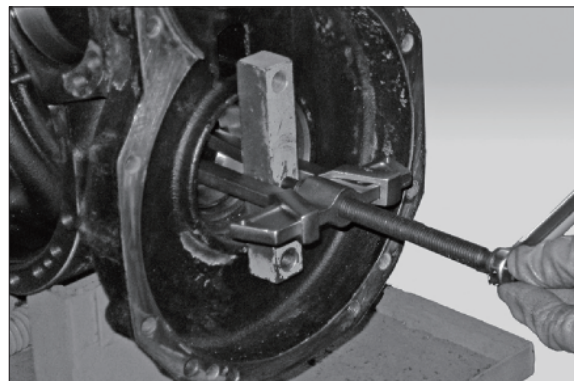
55W9NAX226

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



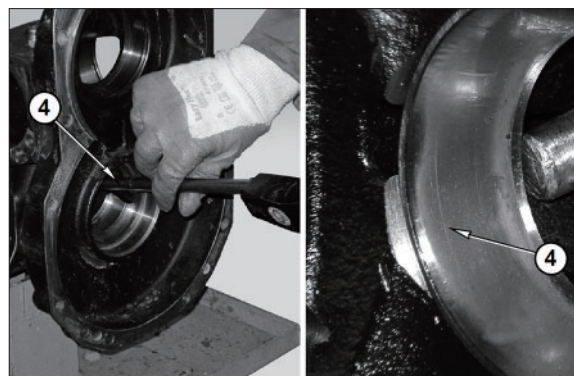
55W9NAX227

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



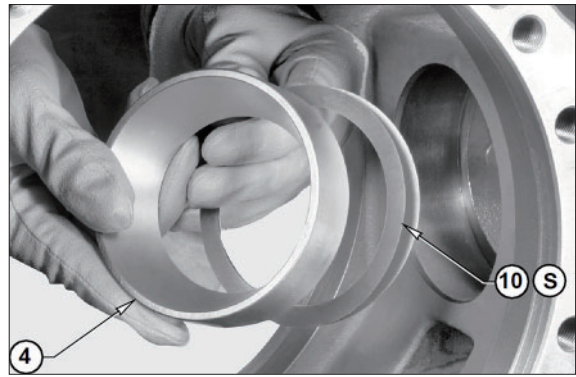
55W9NAX228

- ⑥ Insert a drift in the appropriate holes.

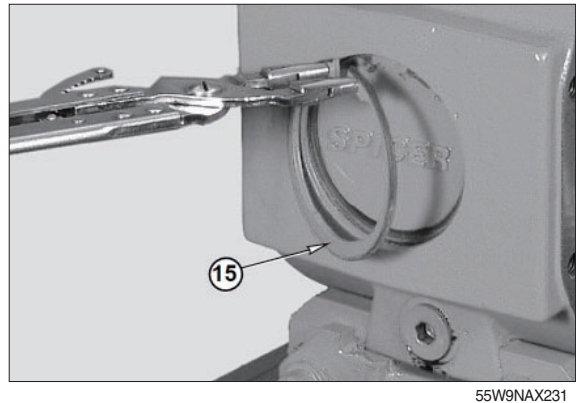


55W9NAX229

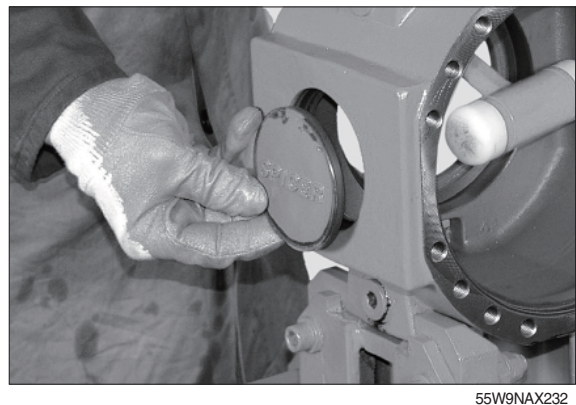
- ⑦ Remove the thrust block of the internal bearing (4) as well as the shim washers (10) (S).



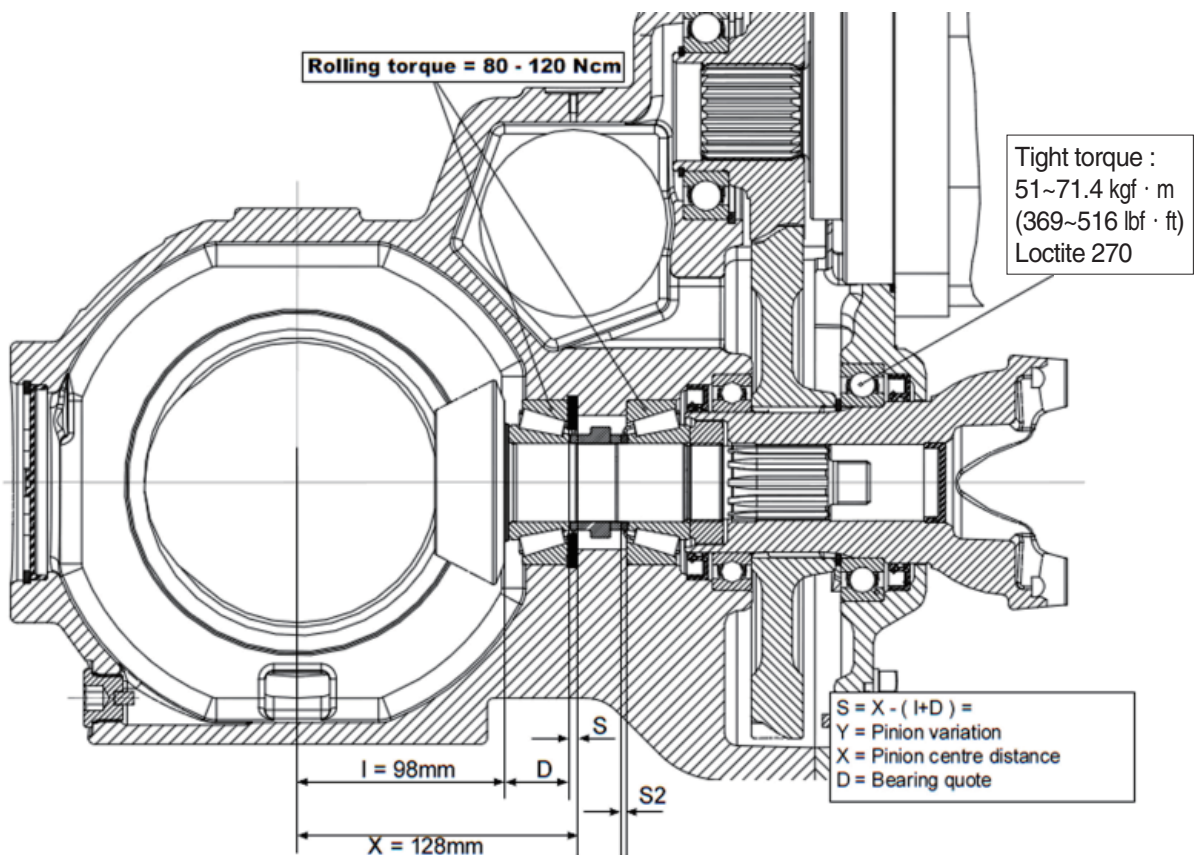
- ⑧ Remove the snap ring (15).



- ⑨ Remove the cap (14).



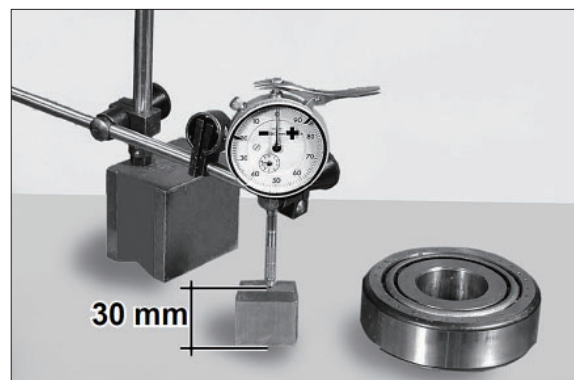
(2) Assembly



55W9NAX233

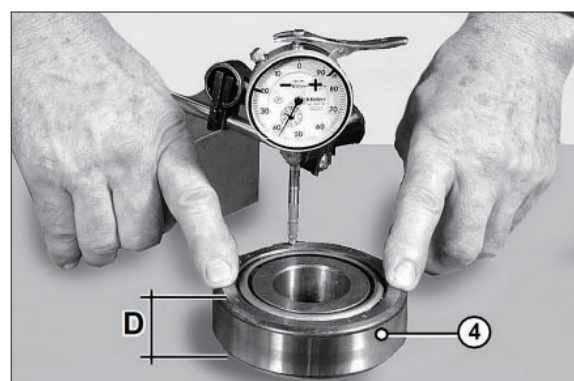
Calculating pinion center distance

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



55W9NAX234

- 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 : $30 - 0.55 = 29.45 = "D"$.

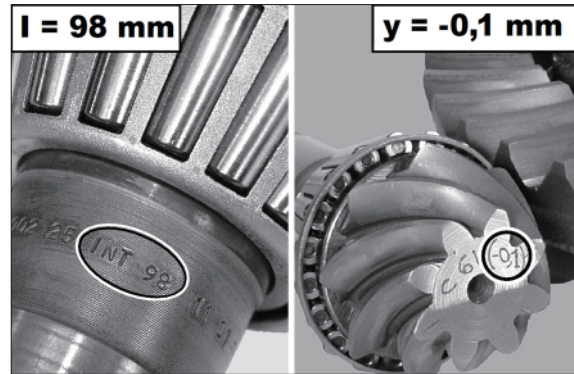


55W9NAX235

- 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”.

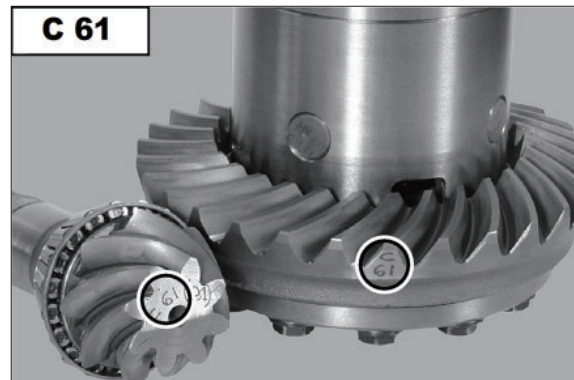
Example : $I = INT \pm Y = 98 - 0.1 = 97.9 \text{ mm}$

※ C61 = Match part number



55W9NAX236

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



55W9NAX237

- ⑤ Calculate shims “S” for insertion under the thrust block of the inner bearing using the following formula :

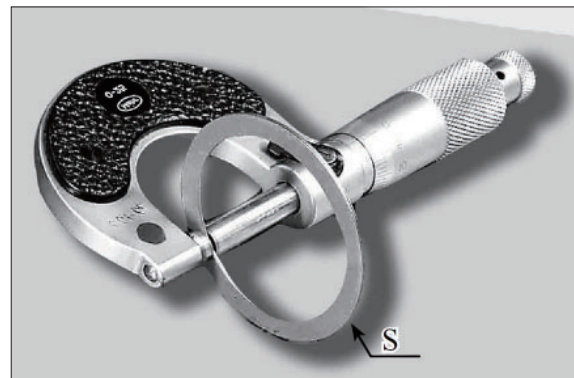
$S = X - (I + D)$ where : X = fixed dimension

I = actual pinion center distance

D = Total bearing thickness ;

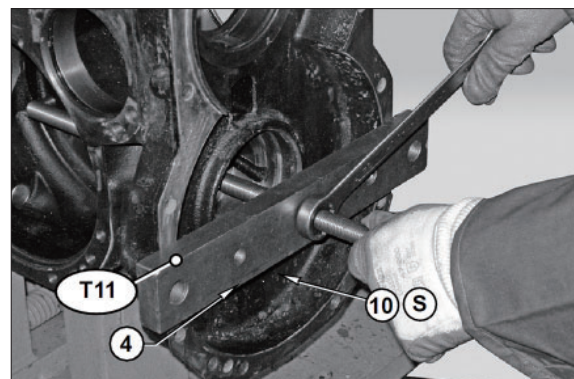
Example :

$$S = 128 - (97.9 + 29.45) = 0.65 \text{ mm}$$



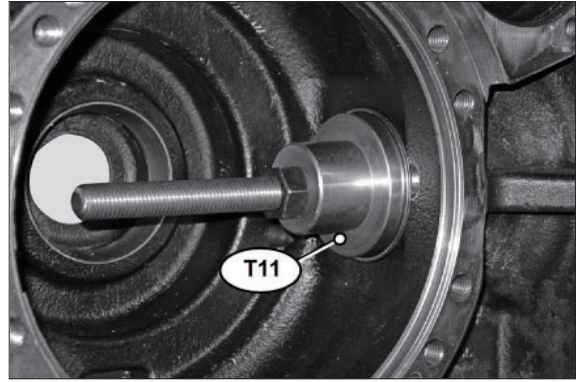
55W9NAX238

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



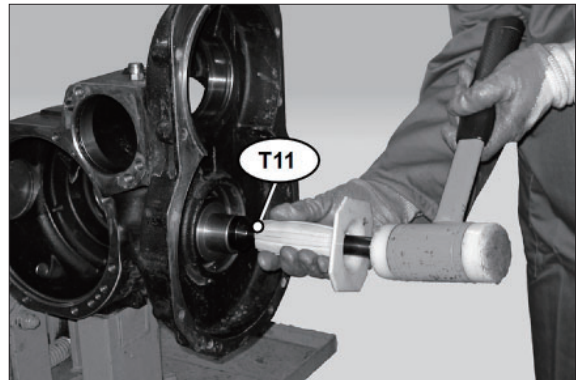
55W9NAX239

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



55W9NAX240

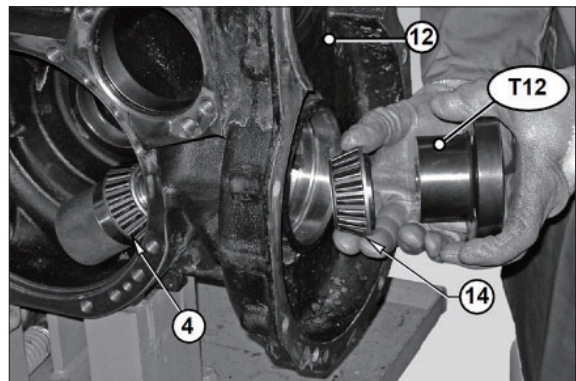
- ⑦ Using special tool T11.
Insert the thrust block of the bearings (4) and shims (10).



55W9NAX241

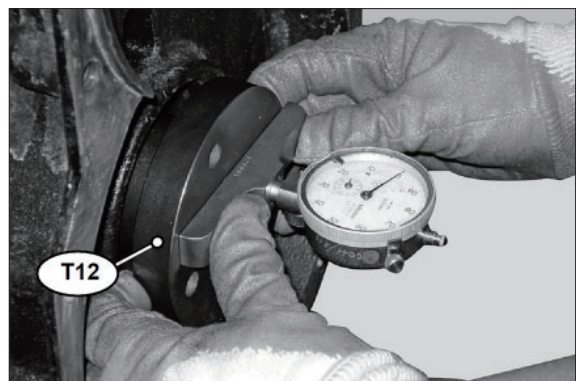
Calculating pinion bearings rolling torque

- 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.

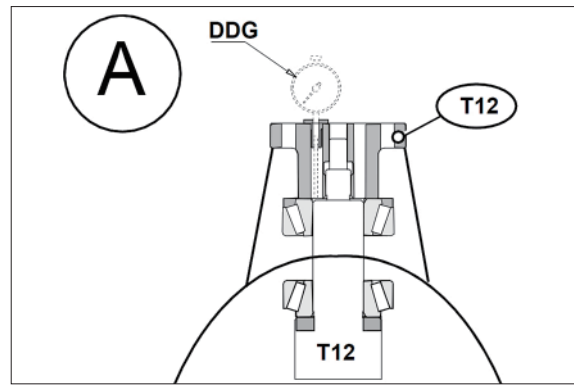


55W9NAX242

- 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.



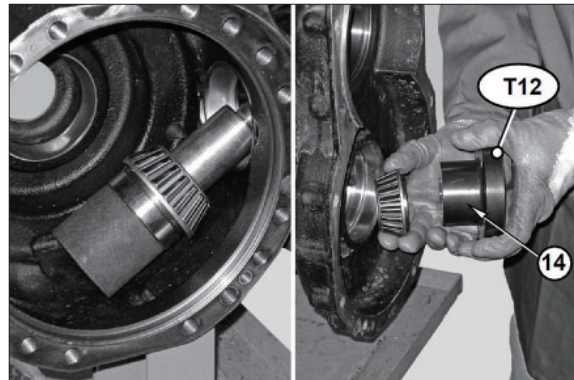
55W9NAX243



55W9NAX244

- 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.



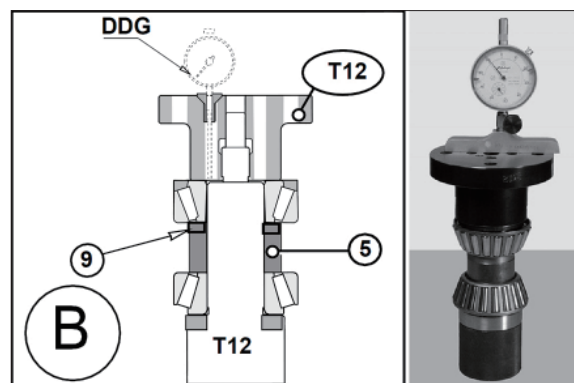
55W9NAX245

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



55W9NAX246

- ⑫ Measure the difference H using a dial gauge DDG.
- Example : $H = A - B = 2.93 \text{ mm}$



55W9NAX247

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



55W9NAX248

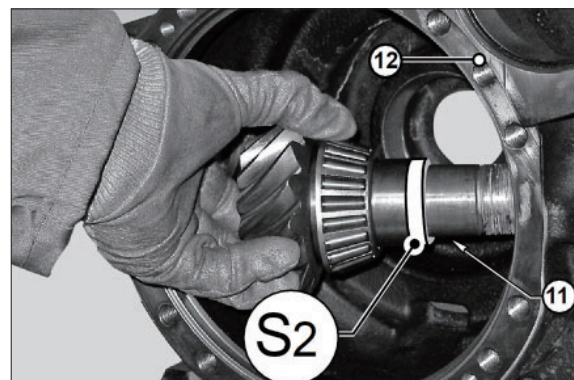
- ⑭ Heat the bearing to 100°C and assemble it to the pinion shaft.



55W9NAX249

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

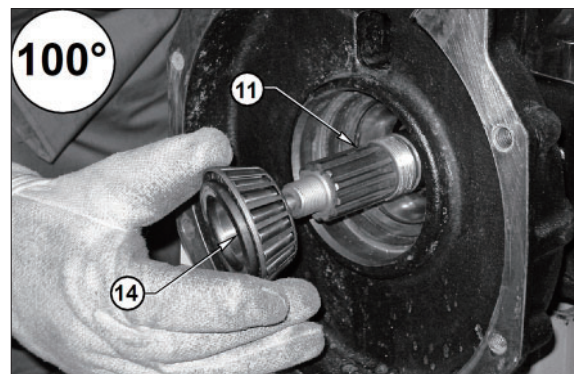
※ The finer shims must be placed in-between the thicker ones.



55W9NAX250

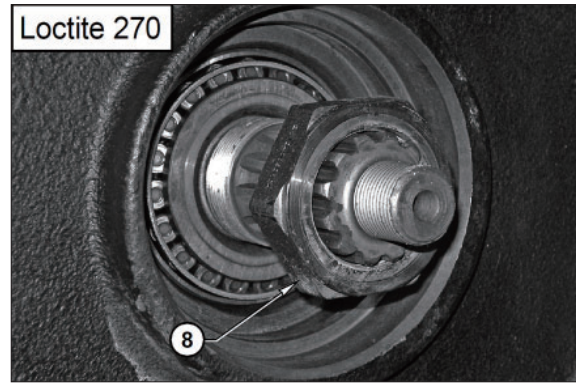
- ⑯ Heat the external bearing (14) to a temperature of about 100°C and fit it on to the pinion (11) so as to complete the pack as shown in the figure.

※ Lightly lubricate bearing with SAE85W90 oil.



55W9NAX251

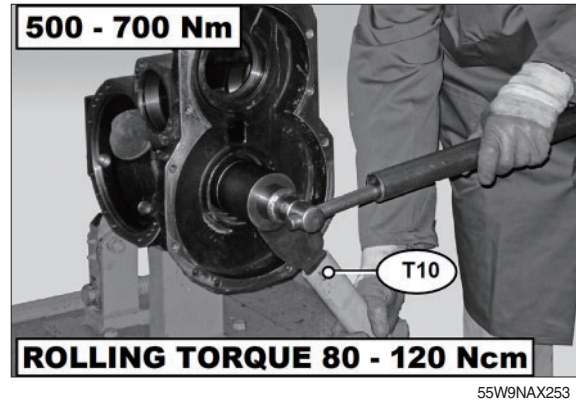
- ⑰ Apply Loctite 270 to the thread of the ring nut (8) and screw the nut onto the pinion.



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

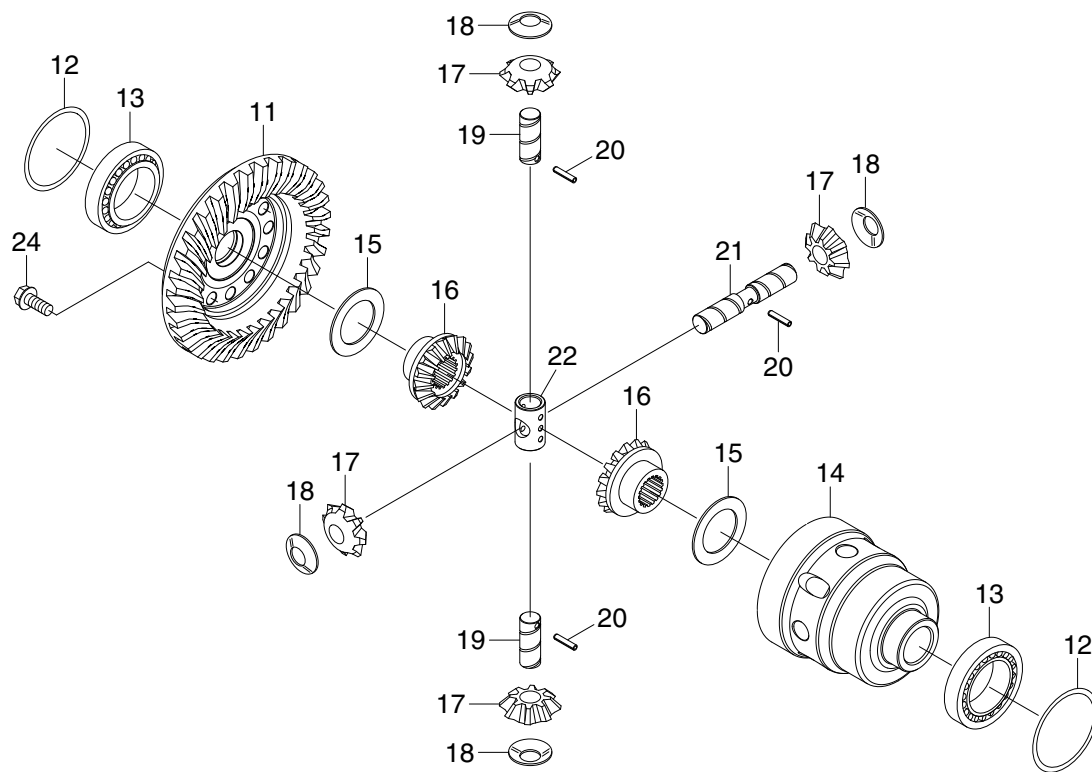
• Torque : 50.9~71.4 kgf · m
(368~516 lbf · ft)

- ※ 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.



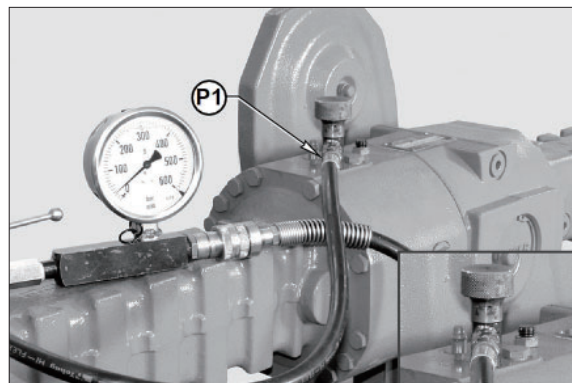
5) DIFFERENTIAL UNIT

(1) Disassembly



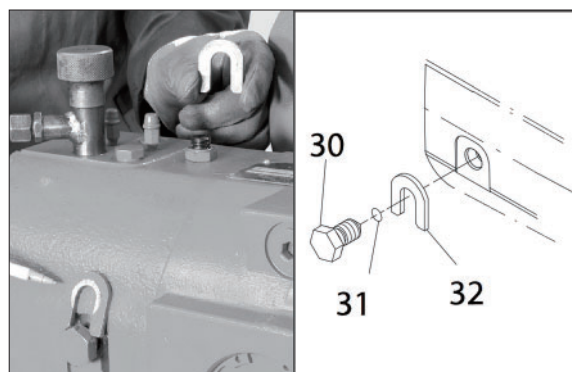
55W9NAX254

- 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.



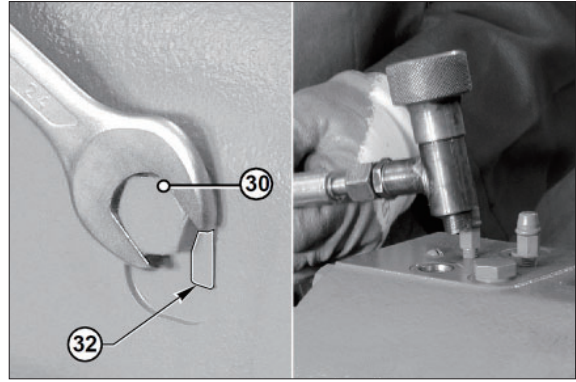
55W9NAX255

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



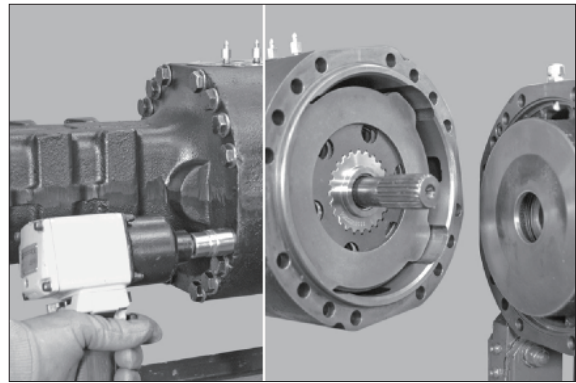
55W9NAX256

- ③ Insert block screws to end stroke and release pression.



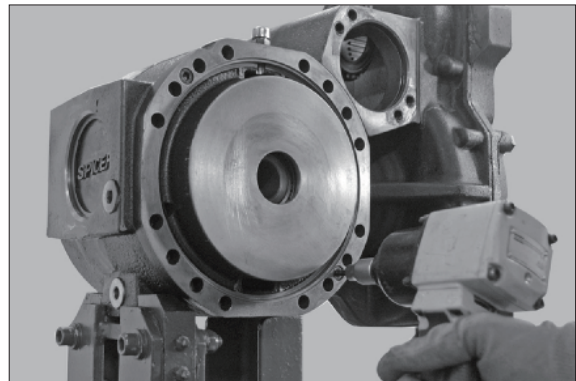
55W9NAX257

- 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.



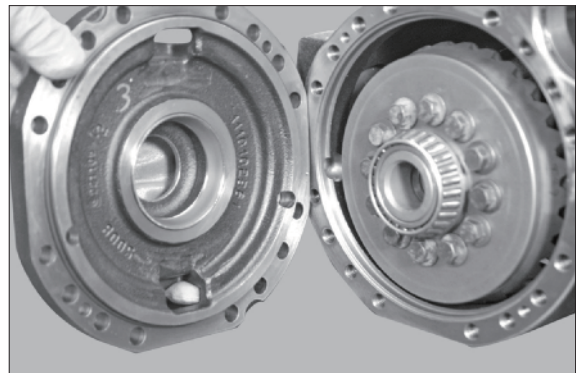
55W9NAX258

- ⑤ Remove the fitting screws from the middle cover.



55W9NAX259

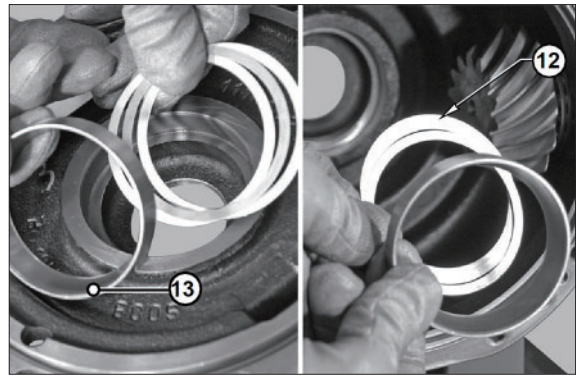
- ⑥ Insert a screw-driver in the opposing slots then force and remove the middle cover.



55W9NAX260

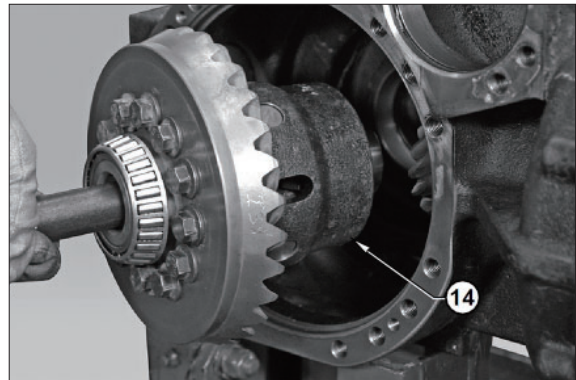
- ⑦ If the bearings need replacing (13), extract the external thrust blocks of the bearings (13) from middle cover and central body.

※ Accurately check the O-ring.



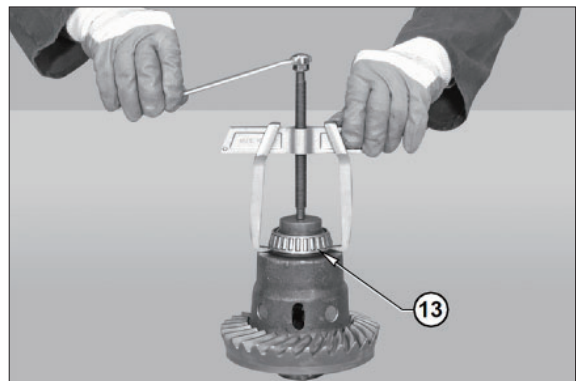
55W9NAX261

- ⑧ Pull out the differential (14).



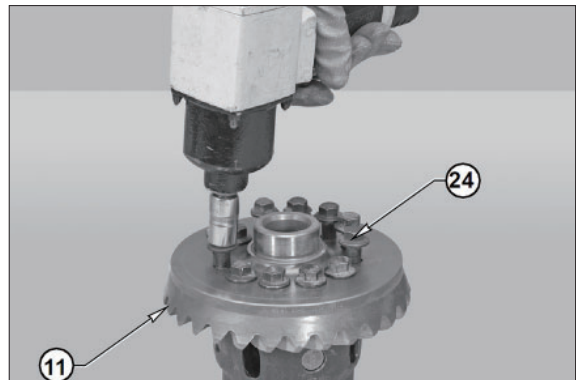
55W9NAX262

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



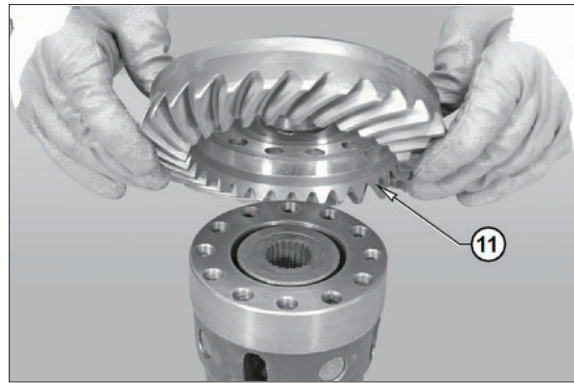
55W9NAX263

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



55W9NAX264

- ⑪ Extract the crown wheel (11).



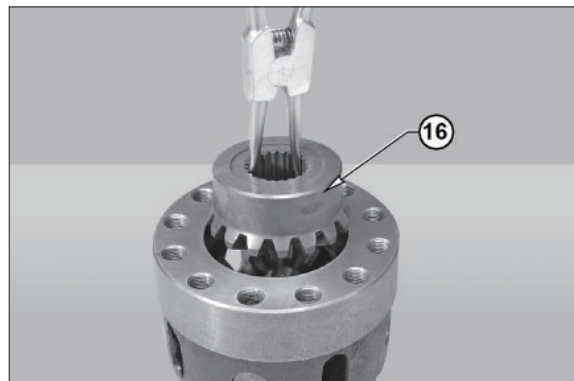
55W9NAX265

- ⑫ Remove the shim washer (15).



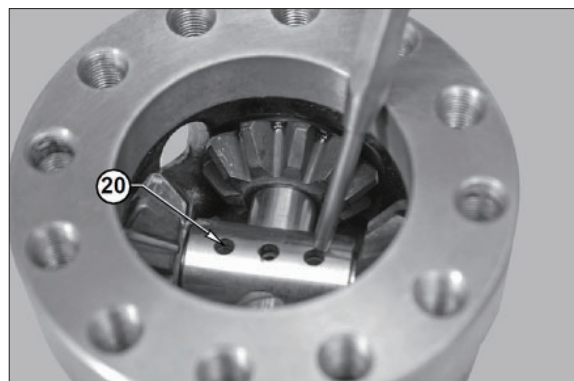
55W9NAX266

- ⑬ Remove the planetary gear (16).



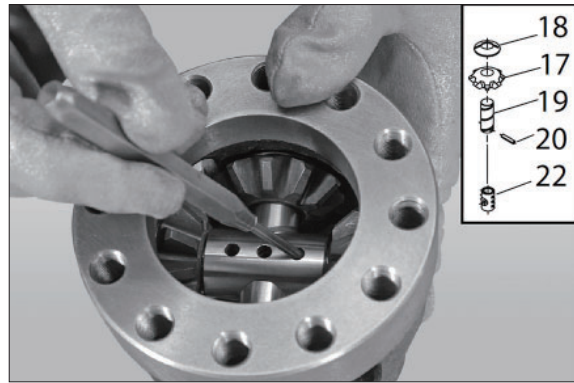
55W9NAX267

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

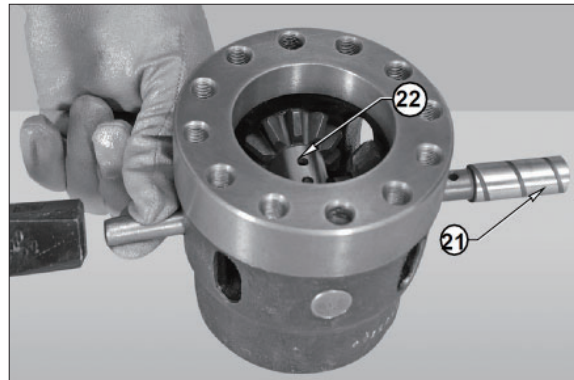


55W9NAX268

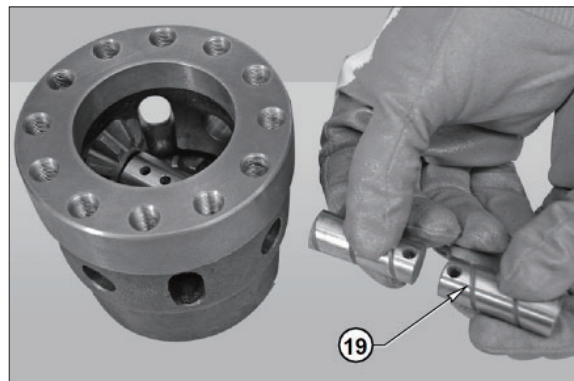
- ⑮ Move the two opposite mounted short bolts (19) to the outside of the box using the same pin driver.



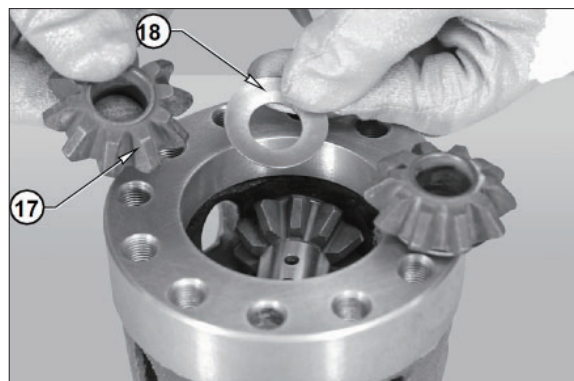
- ⑯ Drive out the long bolt (21) and pull out the spider (22) from the center.



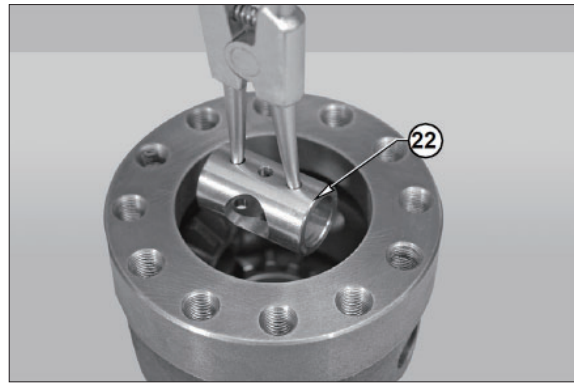
- ⑰ Remove the two half bolts (19), spherical washers and satellite wheels.



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

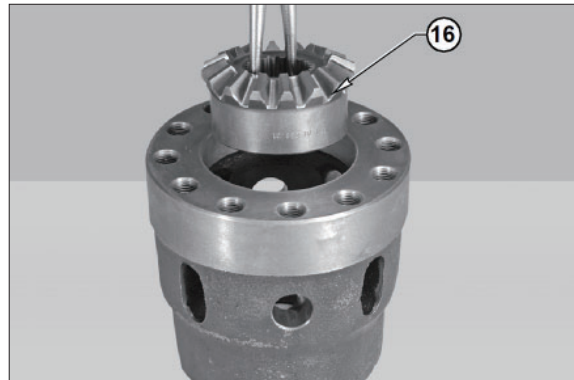


- ⑲ Pull out the spider (22) from the center.



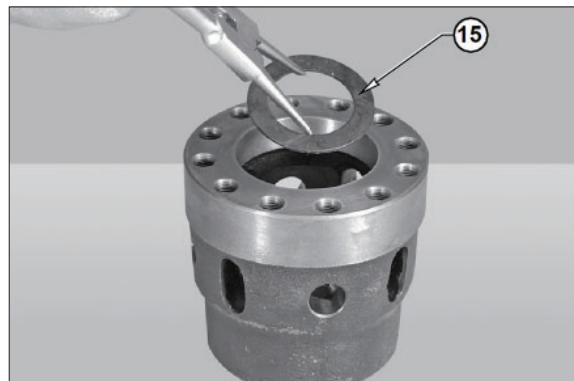
55W9NAX273

- ⑳ Remove the planetary gear (16).



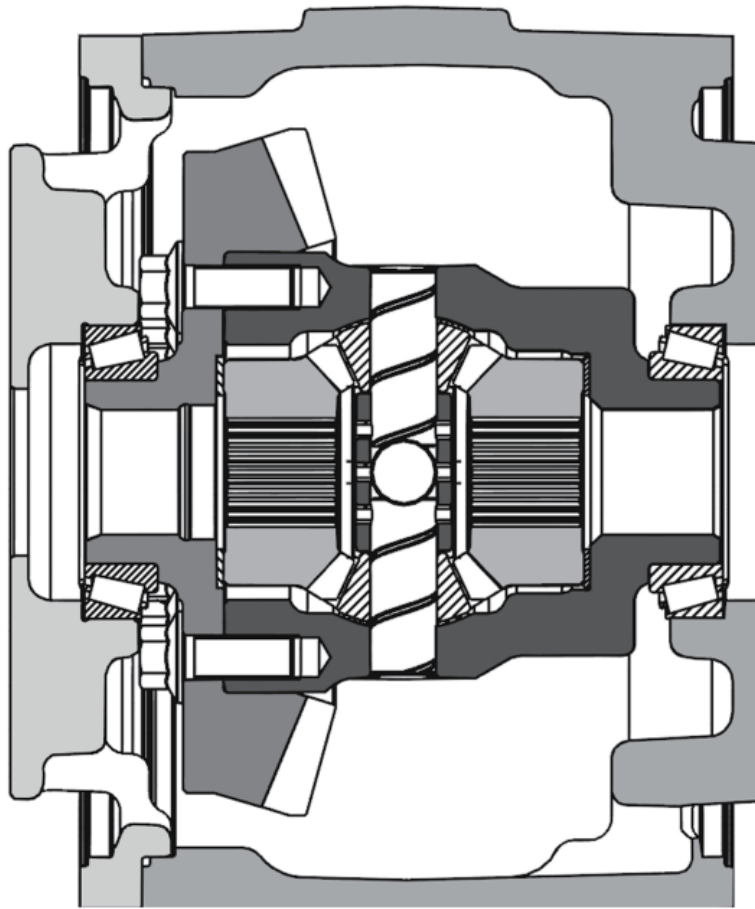
55W9NAX274

- ㉑ Remove the shim washer (15).



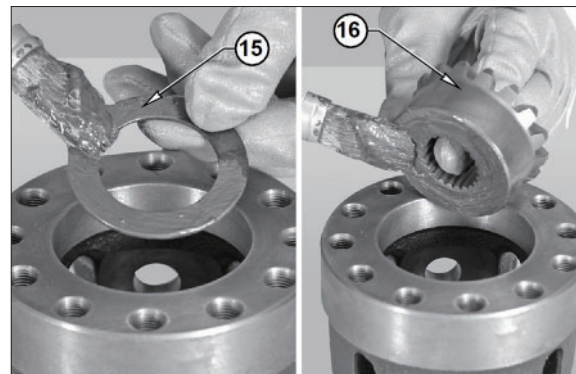
55W9NAX275

(2) Assembly



55W9NAX276

- ① Lubricate and insert washer (15) and planetary wheel (16).

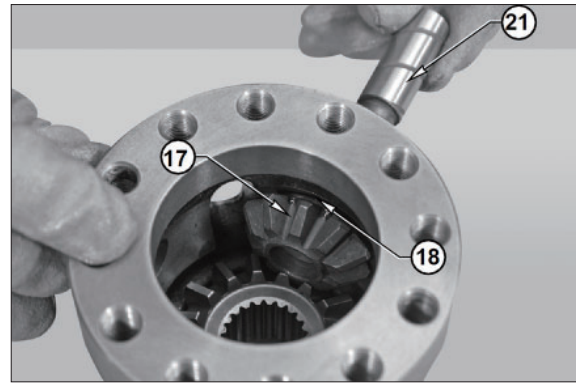


55W9NAX277



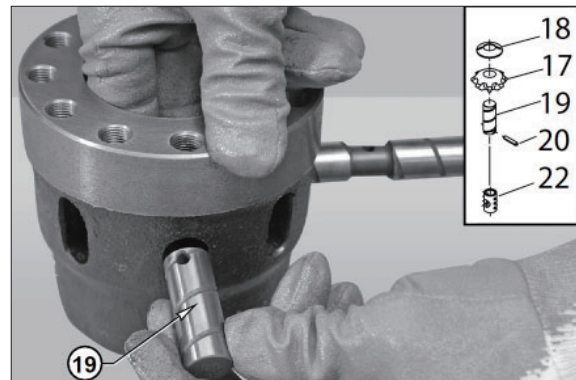
55W9NAX278

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



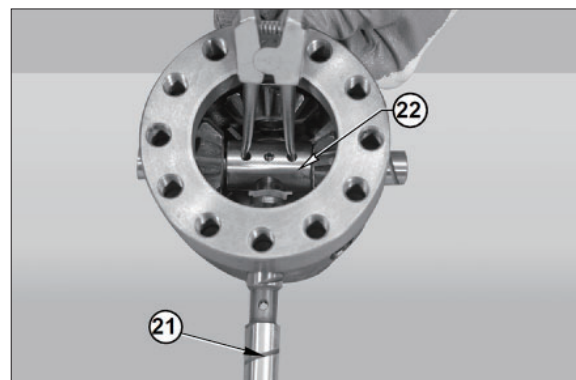
55W9NAX279

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



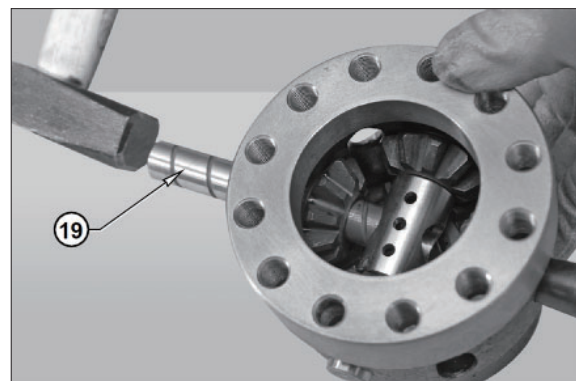
55W9NAX280

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



55W9NAX281

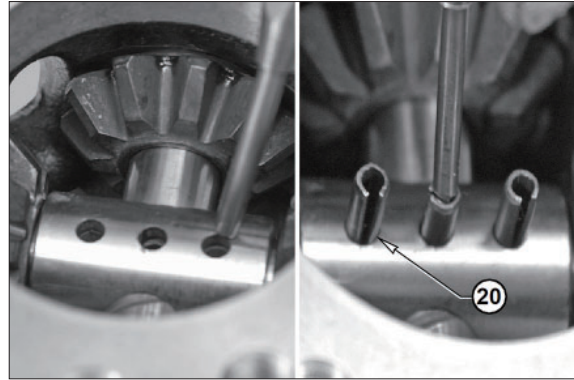
- ⑤ Insert completely the bolts (19).



55W9NAX282

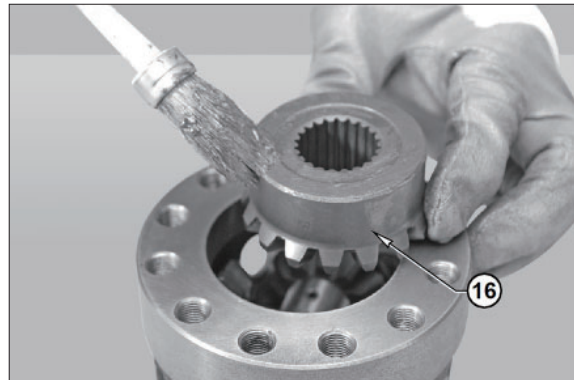
⑥ Center the pin holes and insert the 3V pins (20).

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



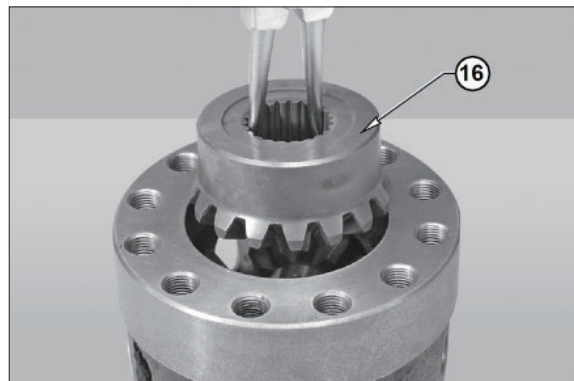
55W9NAX283

⑦ Lubricate wheel (16).



55W9NAX284

⑧ Insert planetary gear wheel (16).



55W9NAX285

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

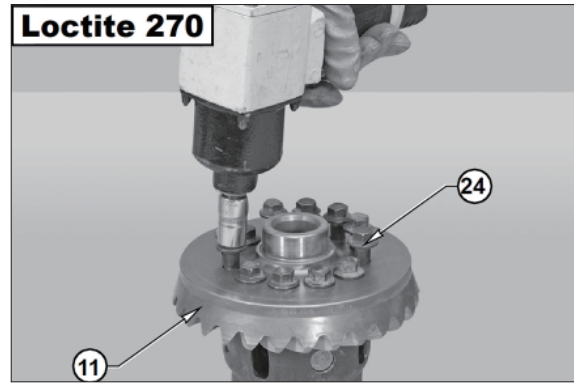
※ In order to hold the shim washer (15) in position, apply grease to it.



55W9NAX286

- 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.



55W9NAX287

- ⑪ Tighten screws with a torque wrench : see table.

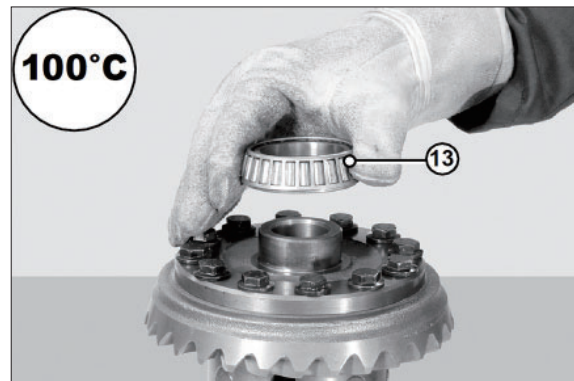
※ Always use new screws to fix the crown wheel. In case the screws are not thread locking pretreated, use loctite 270.



55W9NAX288

- ⑫ Assemble the bearing (13).

※ Heat the bearing to 100°C before assembling.



55W9NAX289

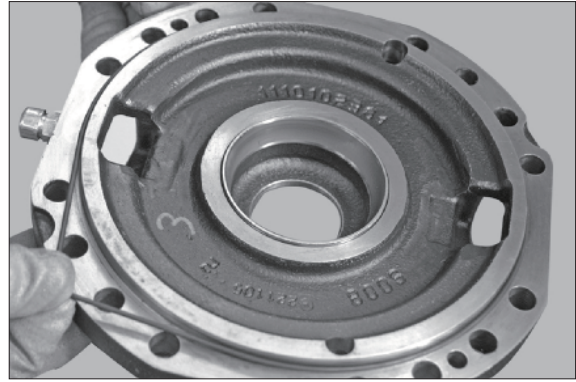
- ⑬ If the bearings are replaced, insert the external thrust blocks in the middle cover and in the central body.



55W9NAX290

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

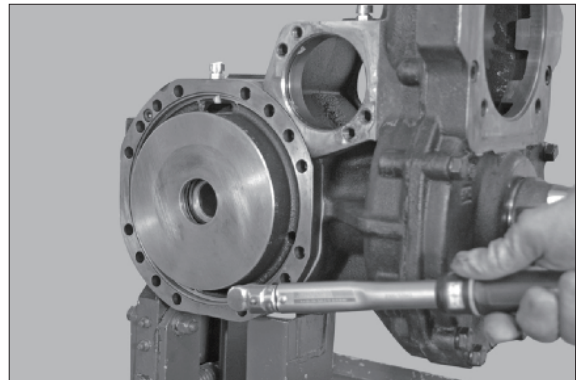
※ Thoroughly check the state of the O-ring and make sure that the cover is fitted with the oil discharge in the lower position.



55W9NAX291

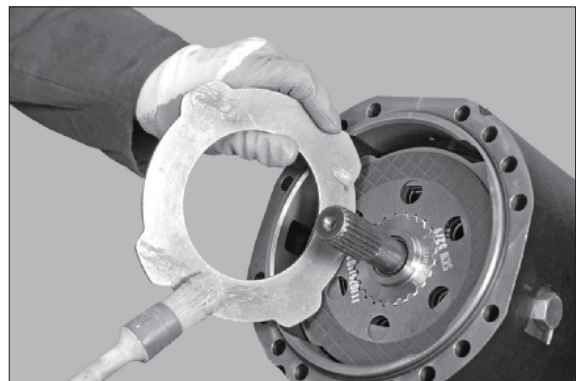
- ⑮ Lock the middle cover with screws.

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



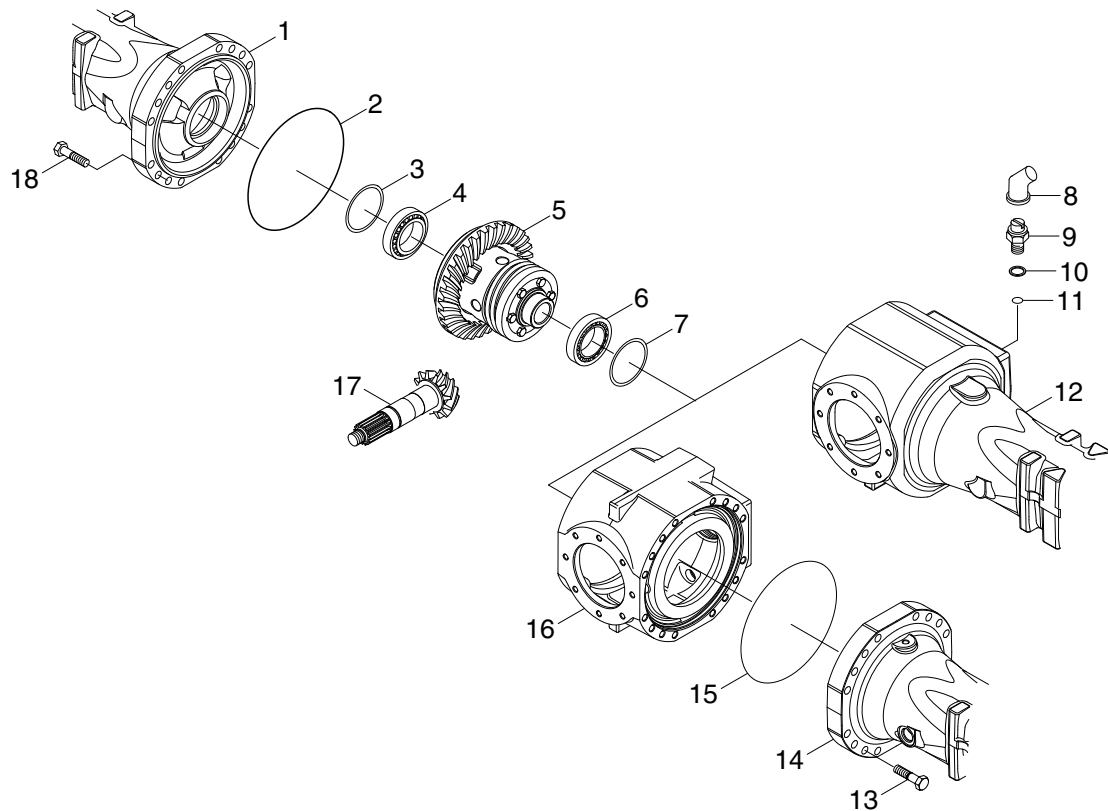
55W9NAX292

- 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.



55W9NAX293

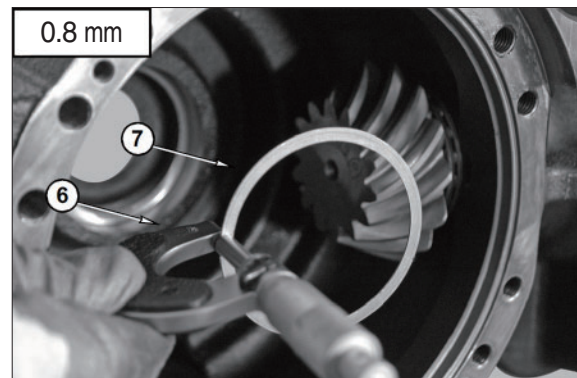
6) RING AND PINION ADJUSTING



55W9NAX294

Setting of the crown wheel and pinion

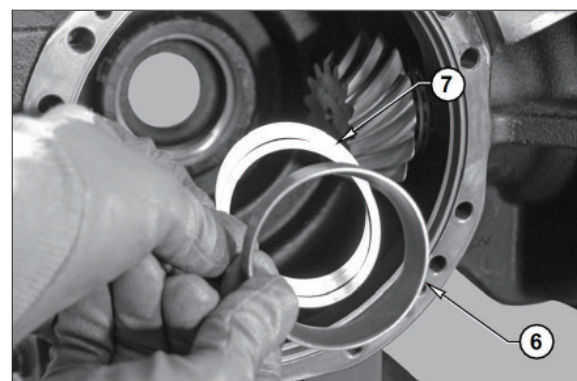
- (1) Insert the thrust block of the bearing (6) opposite side of the crown wheel shims (Sb) (7) of an initial thickness of about 0.8 mm.



55W9NAX295

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

※ Check to be at end of stroke.

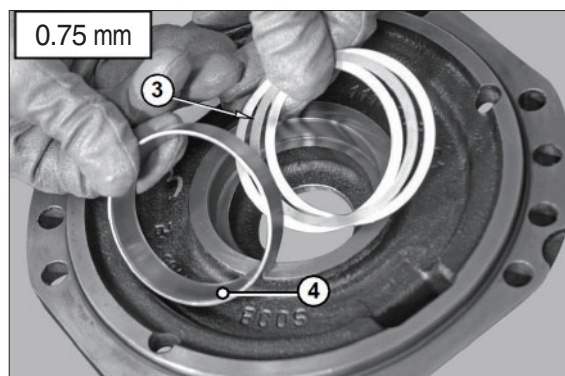


55W9NAX296

- (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.

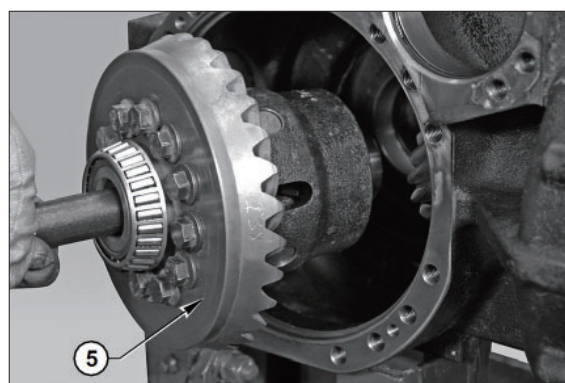
※ Check to be at end of stroke.



55W9NAX297

- (4) Insert complete differential (5).

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



55W9NAX298

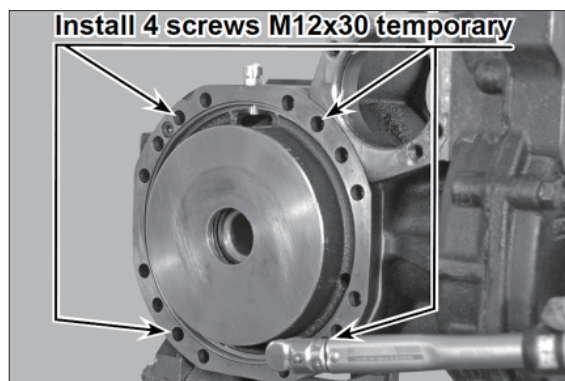
- (5) Check the O-ring (2) and grease.



55W9NAX299

- (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)



55W9NAX300

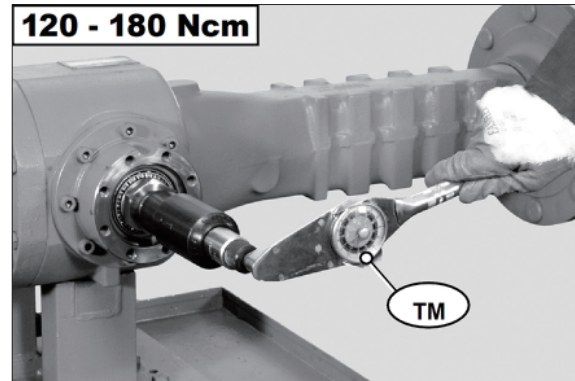
- (7) Apply torque meter TM to pinion nut and check that torque will increase by $0.04 \sim 0.06 \text{ kgf} \cdot \text{m}$ ($0.29 \sim 0.43 \text{ lbf} \cdot \text{ft}$) as a result of differential bearing preload.

Example : pinion torque :

$0.08 \sim 0.12 \text{ kgf} \cdot \text{m}$ ($0.59 \sim 0.87 \text{ lbf} \cdot \text{ft}$)

Pinion + differential torque :

$0.12 \sim 0.18 \text{ kgf} \cdot \text{m}$ ($0.87 \sim 1.3 \text{ lbf} \cdot \text{ft}$)

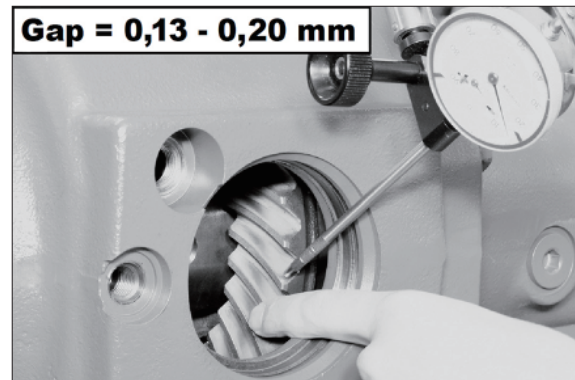


55W9NAX301

- (8) Position comparator on the center of one of the crown teeth, preset it to 1 mm and reset it to zero.

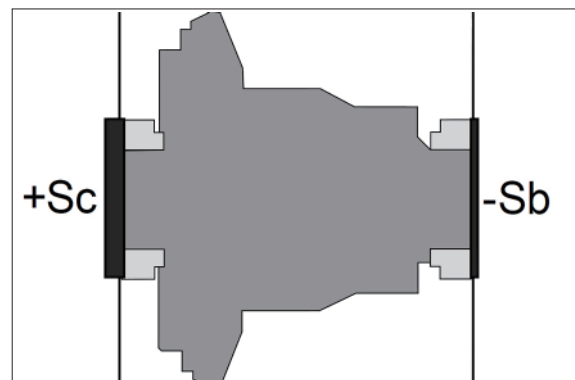
Manually move the crown in both directions to check the existing clearance between pinion and crown.

Gap = $0.13 \sim 0.20 \text{ mm}$



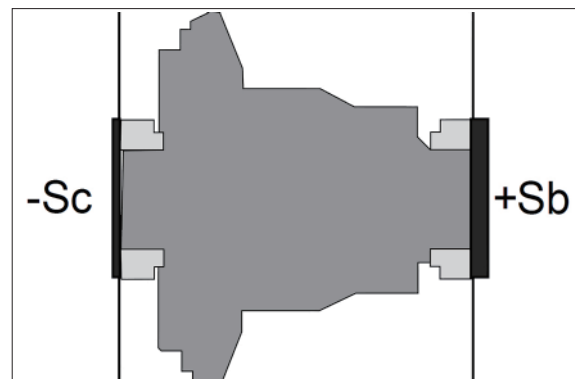
55W9NAX302

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



55W9NAX303

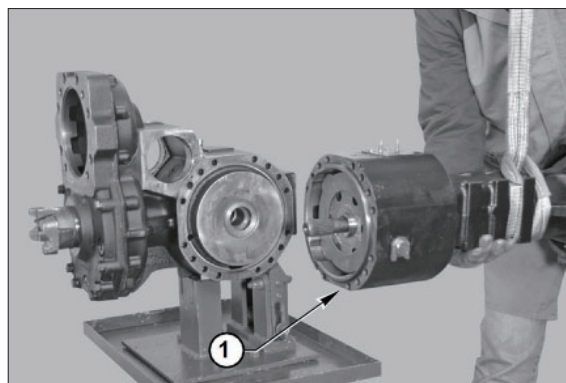
- (10) $-Sc$ (3) + Sb (7) = increase gap ring and pinion



55W9NAX304

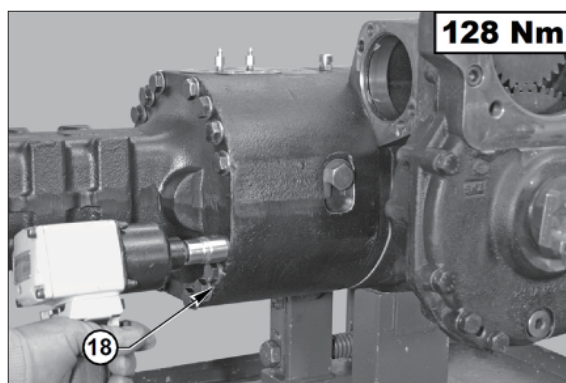
(11) Install the crown wheel side arm (1) without half-axle.

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



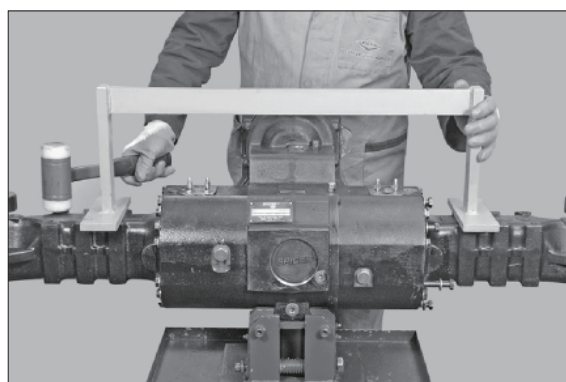
55W9NAX305

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



55W9NAX306

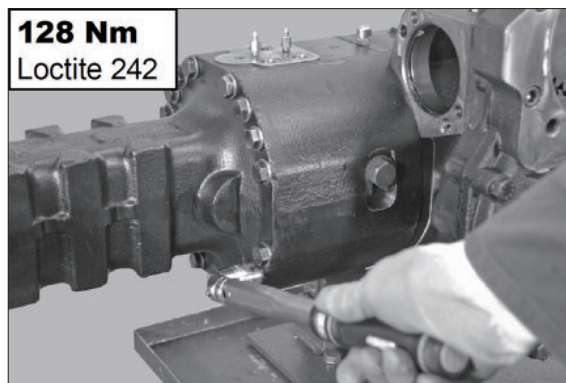
(13) Check the flatness of the arms; then lock the arms into their final position, using screws adequately coated with loctite 242.



55W9NAX308

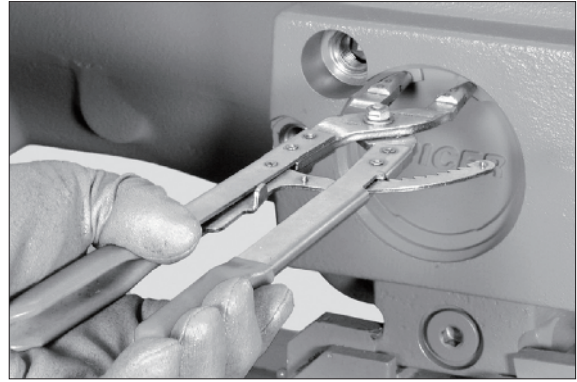
(14) Torque wrench setting :
13.1 kgf · m (94.4 lbf · ft)

※ Tighten using the criss-cross method.



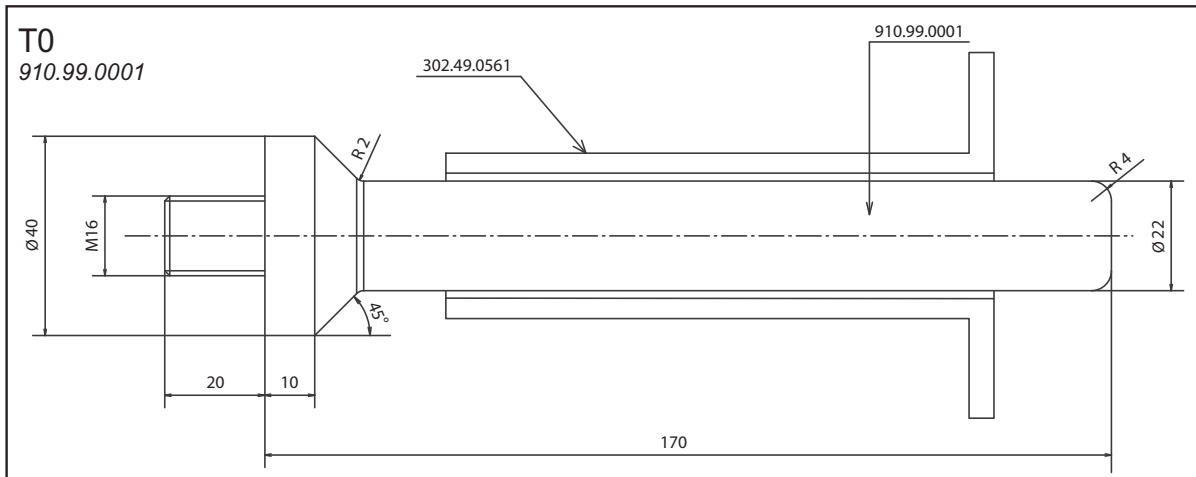
55W9NAX309

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

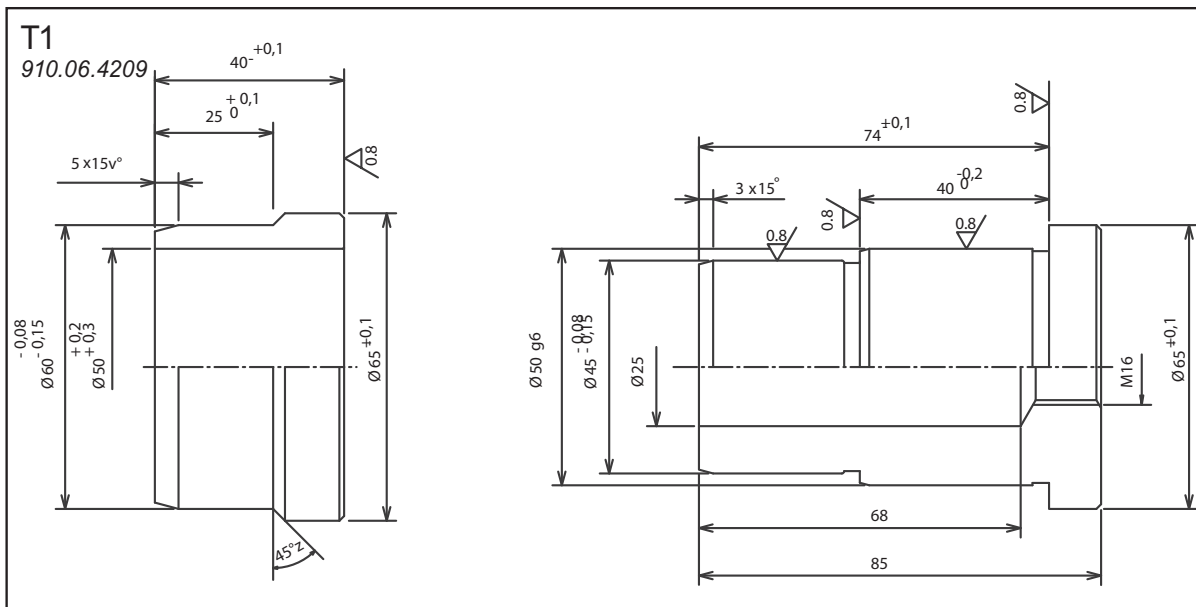


55W9NAX310

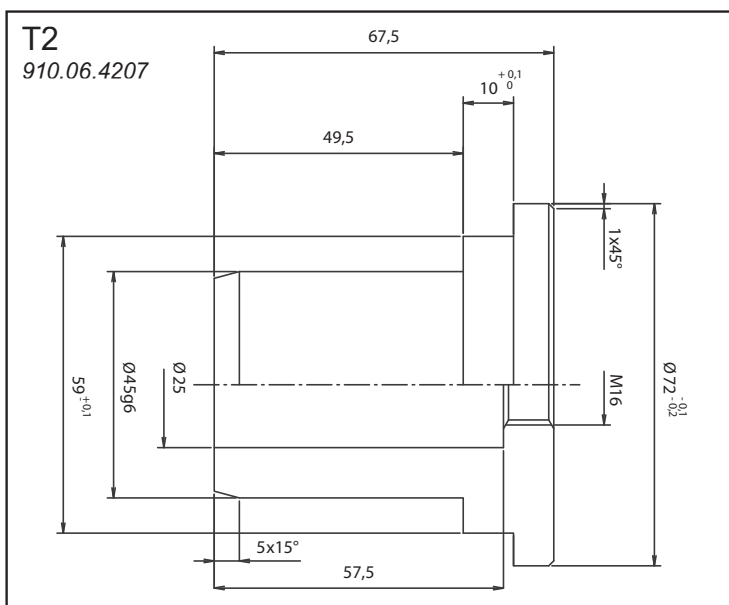
7) SPECIAL TOOLS



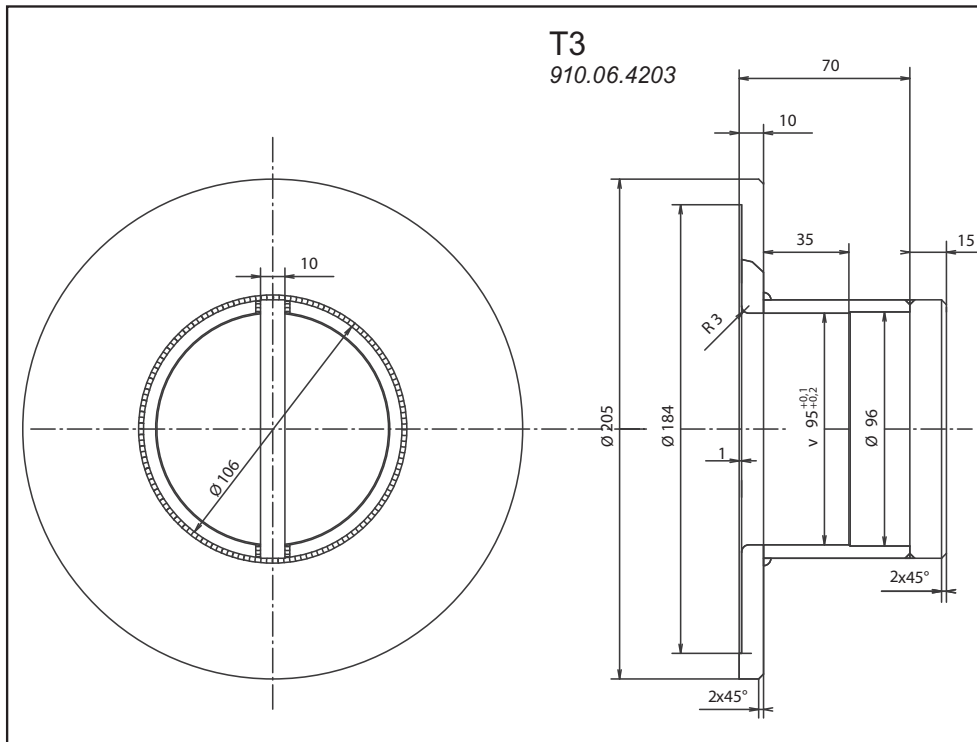
55W9NAX311-1



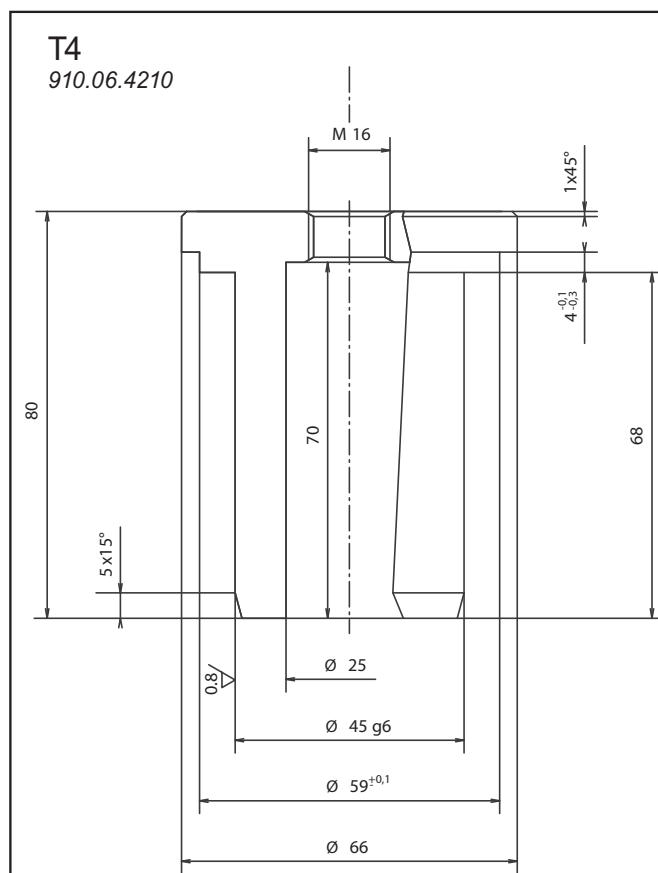
55W9NAX311-2



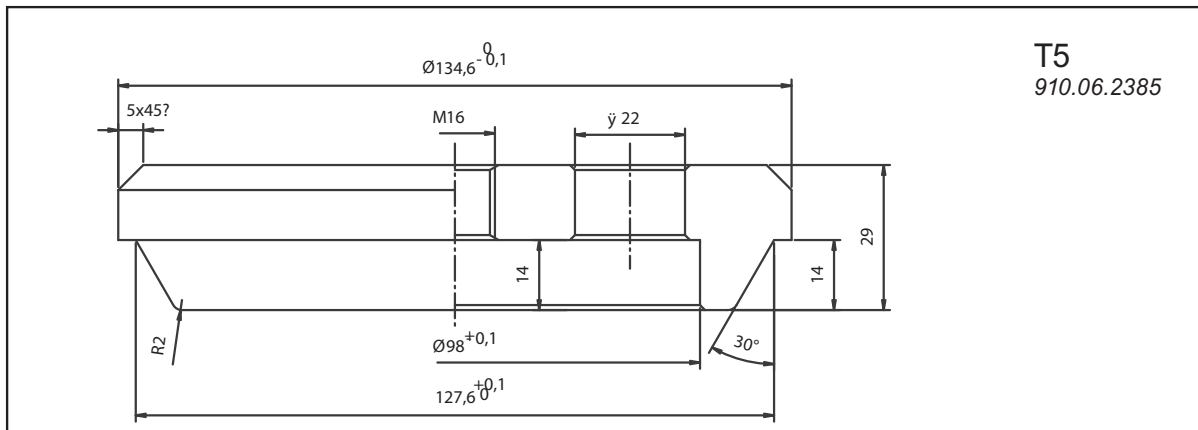
55W9NAX311-3



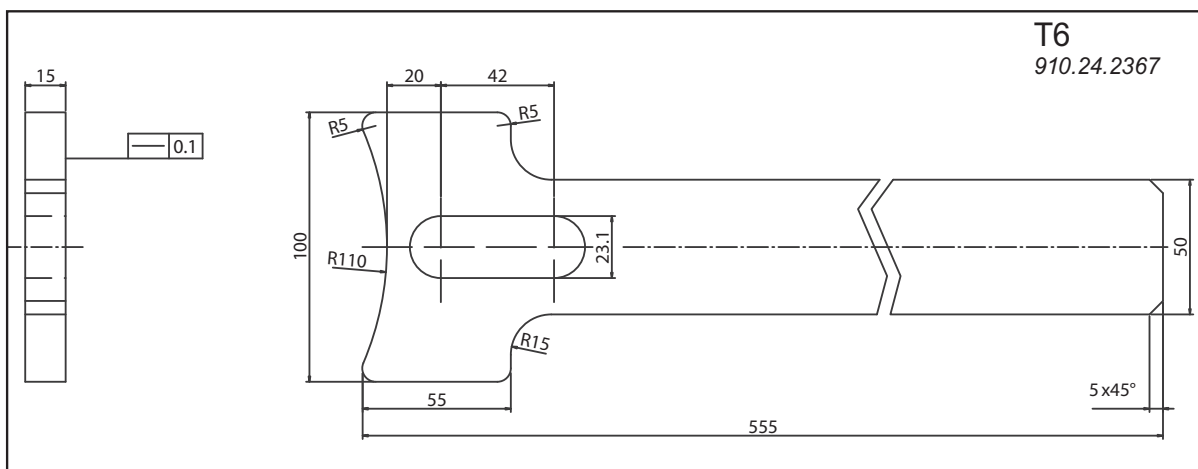
55W9NAX312-1



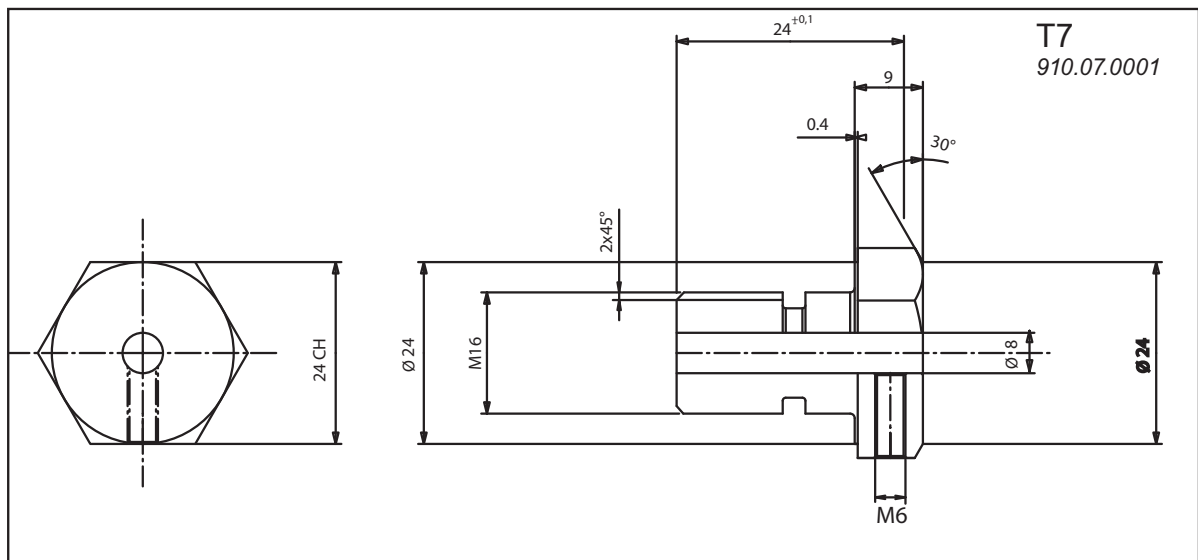
55W9NAX312-2



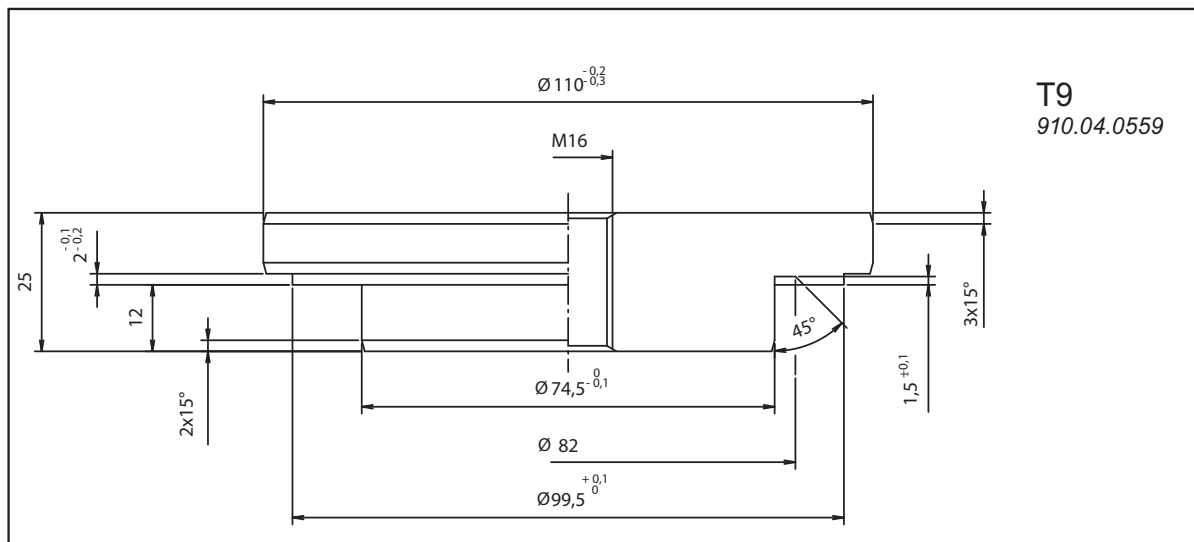
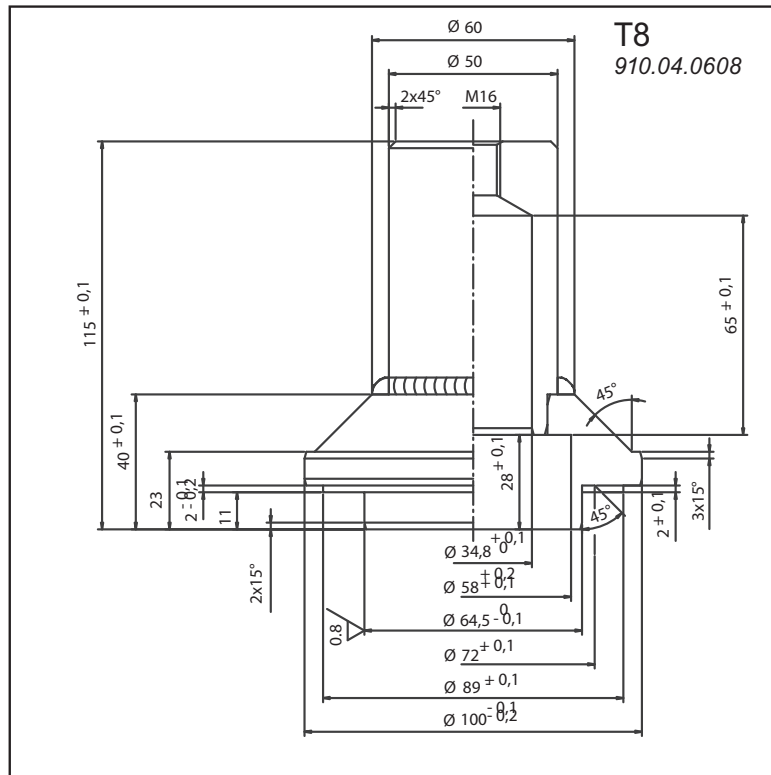
55W9NAX313-1



55W9NAX313-2

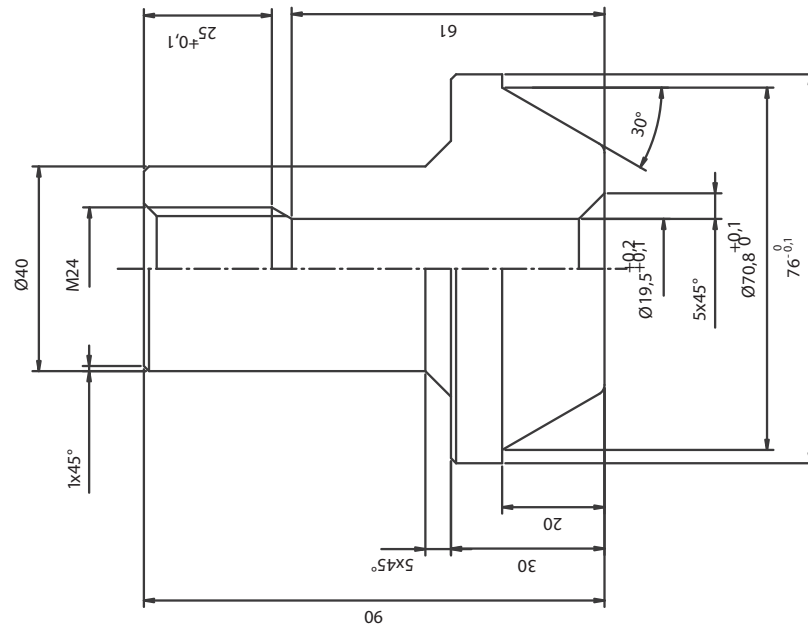


55W9NAX313-3



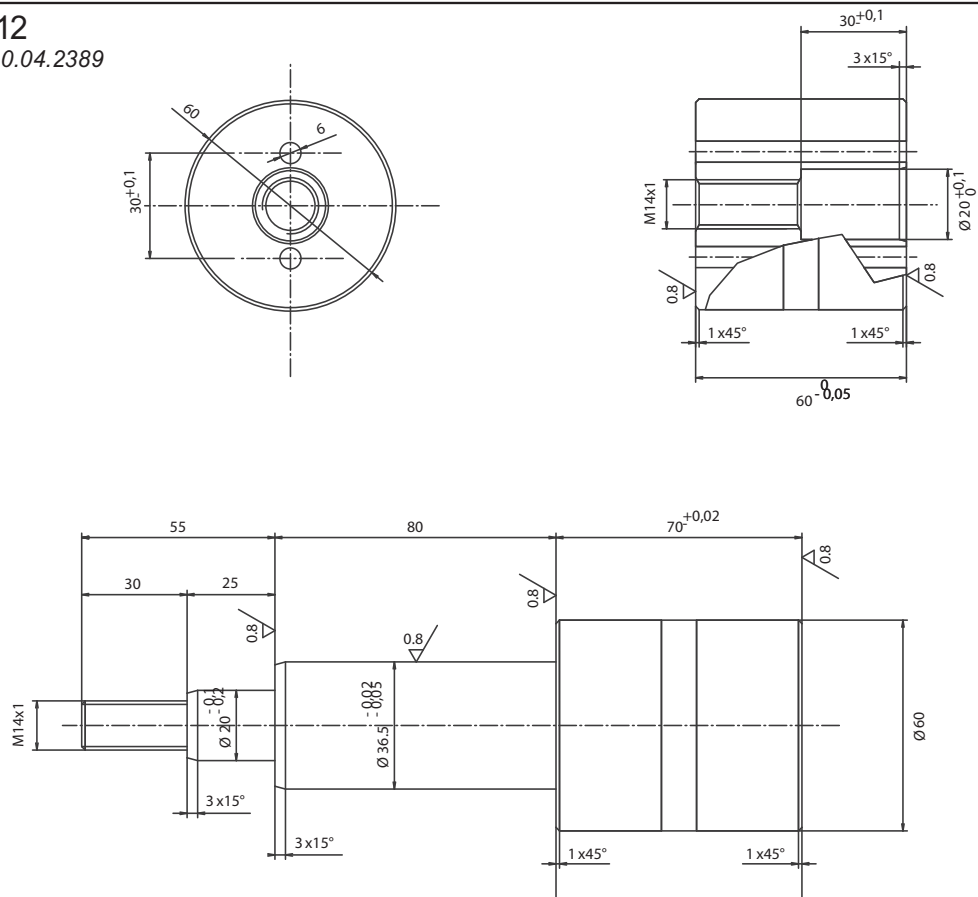


T11
910.06.4069



55W9NAX316-1

T12
910.04.2389

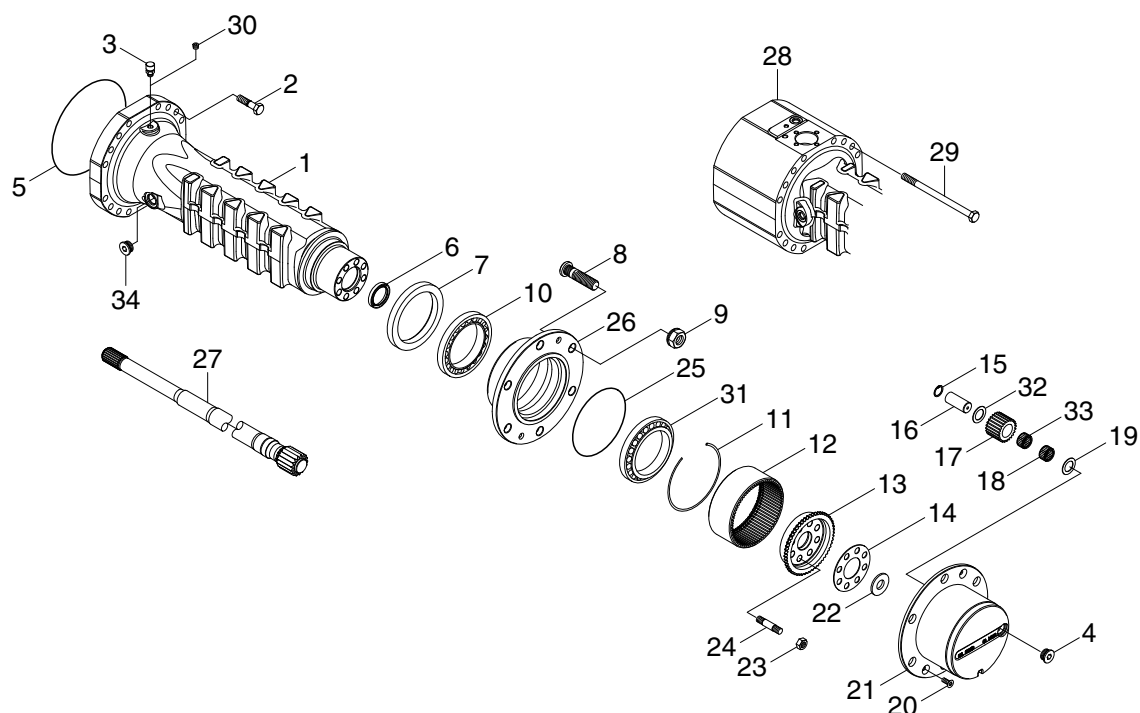


55W9NAX316-2

4. REAR AXLE

1) PLANETARY REDUCTION GEAR

(1) Assembly diagram

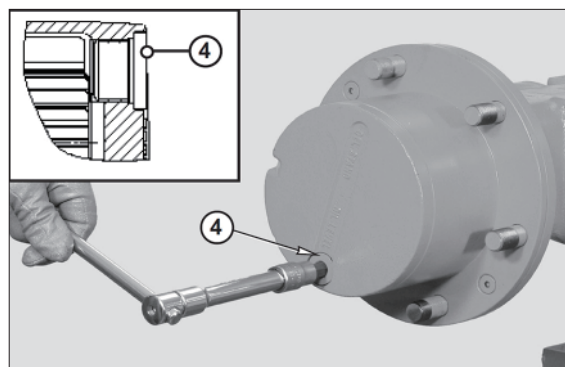


55W9NAX441

(2) Disassembly

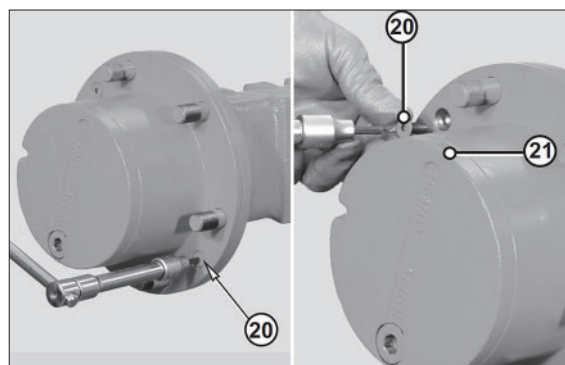
※ Perform all operations on both arms.

① Remove the oil level plug (4).



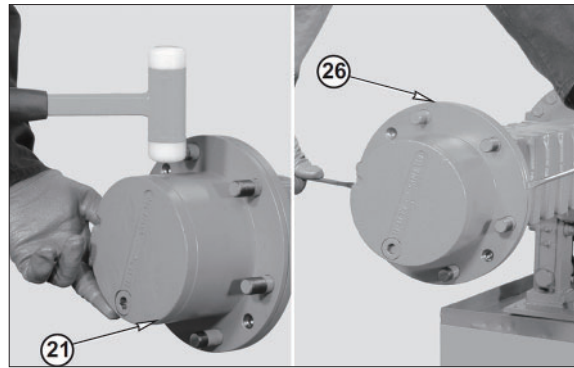
55W9NAX442

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



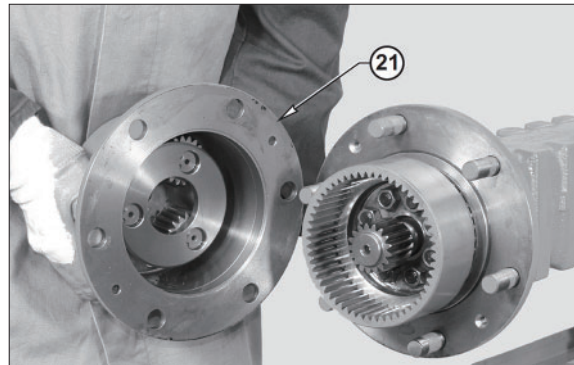
55W9NAX443

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



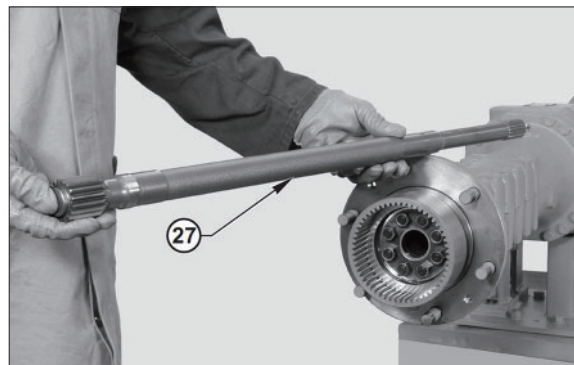
55W9NAX444

- ④ Remove the complete planetary carrier cover (21).



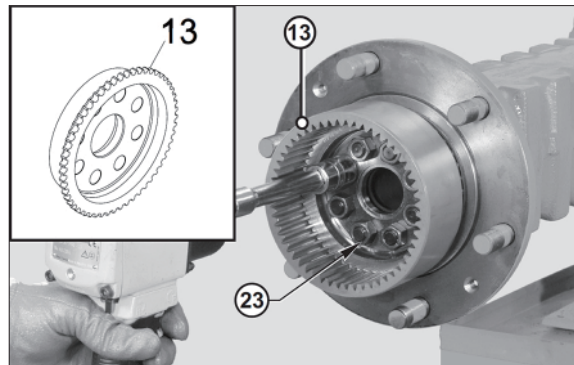
55W9NAX445

- ⑤ Remove the complete axle-shaft (27).



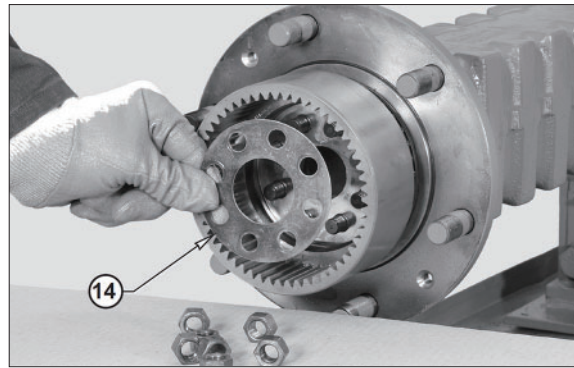
55W9NAX446

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



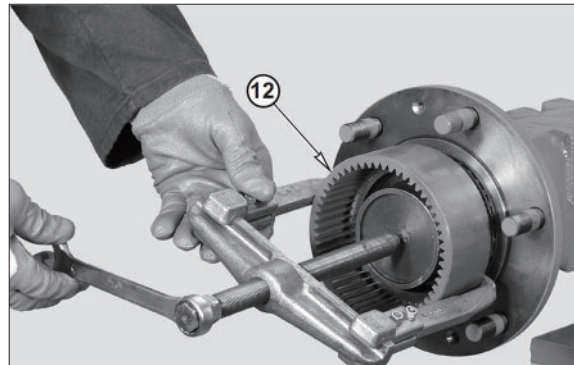
55W9NAX447

⑦ Remove the safety flange (14).



55W9NAX448

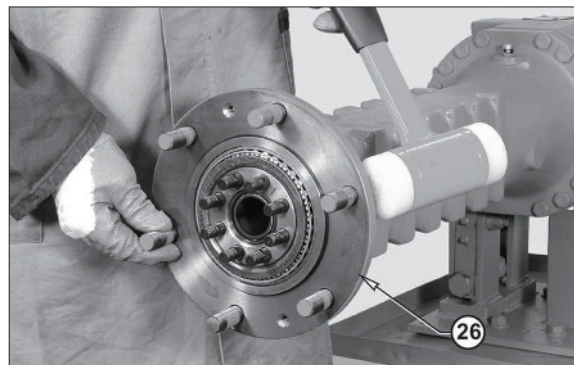
⑧ Remove the crown (12).



55W9NAX449

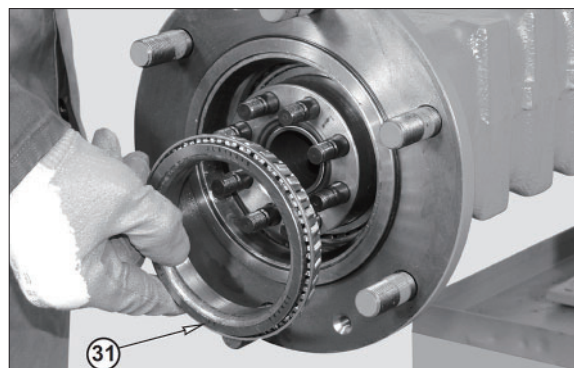
⑨ Partially extract the hub (26) using a plastic hammer.

※ Alternately hammer on several equidistant points.



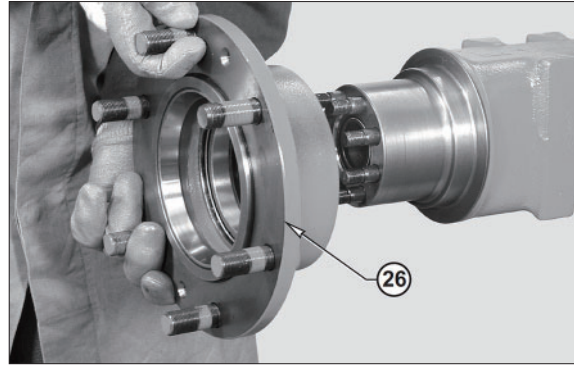
55W9NAX450

⑩ Remove the external bearing (31).



55W9NAX451

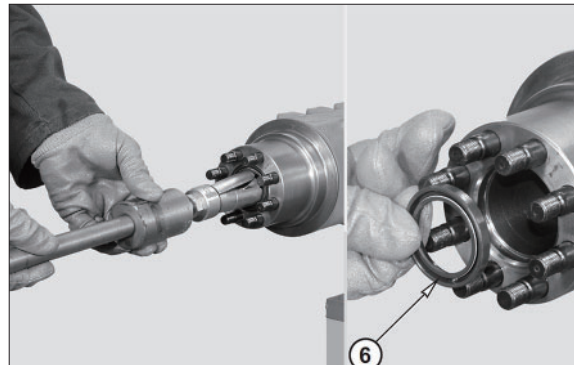
- ⑪ By hand remove complete hub (26).



55W9NAX452

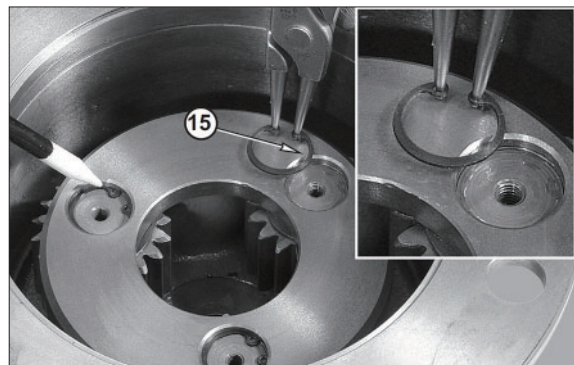
- ⑫ Using an extractor, remove the seal ring (6).

※ Note down the direction of assembly of snap ring.



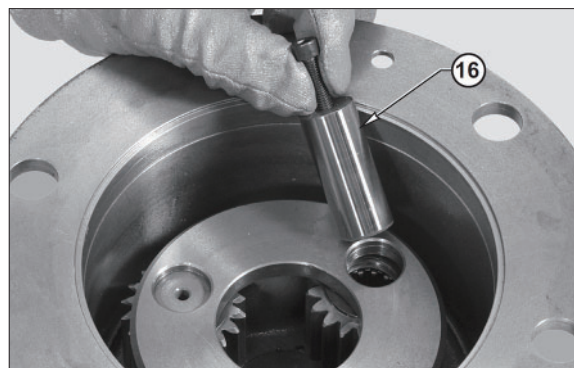
55W9NAX453

- ⑬ Remove snap ring (15).



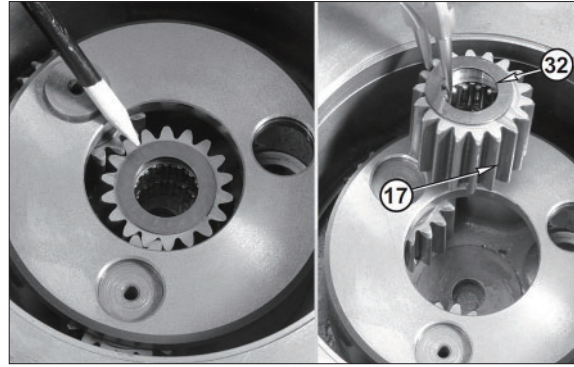
55W9NAX454

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



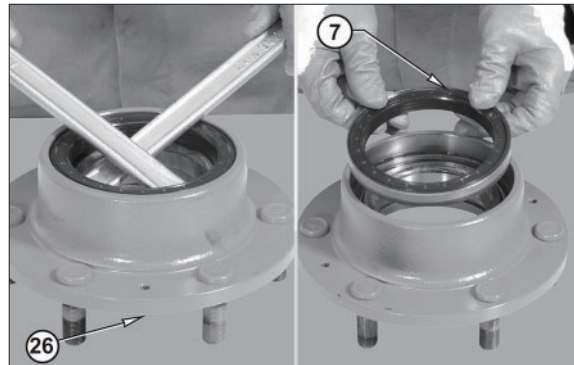
55W9NAX455

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



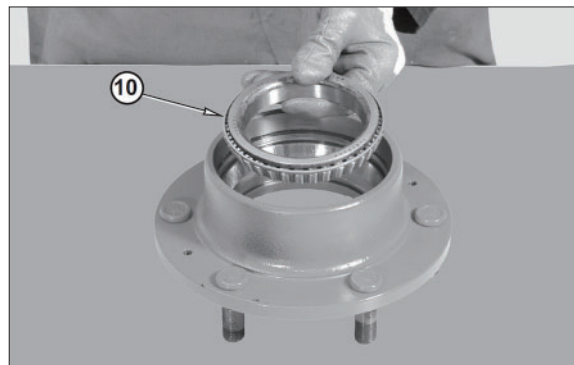
55W9NAX456

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



55W9NAX457

- ⑰ Remove the internal bearing (10).



55W9NAX458

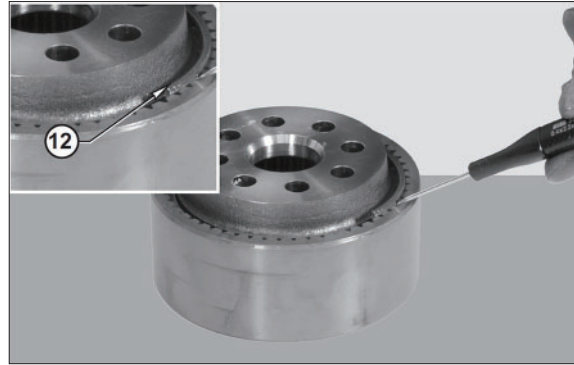
- ⑱ Remove the thrust blocks (10) (31) from the bearings and forcing a pin-driver into the appropriate slots on the hub.

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



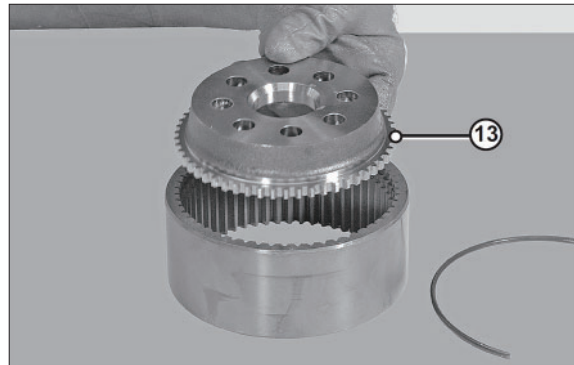
55W9NAX459

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



55W9NAX460

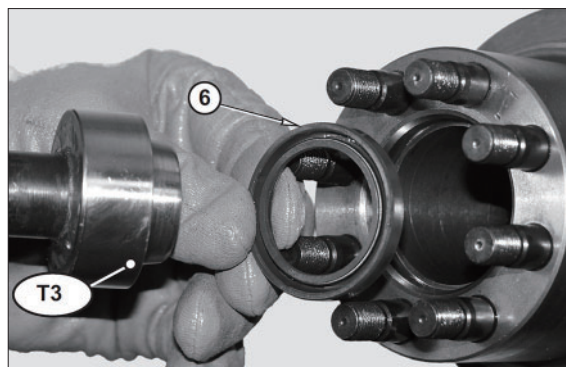
- ②⑩ Remove the crown flange (13).



55W9NAX461

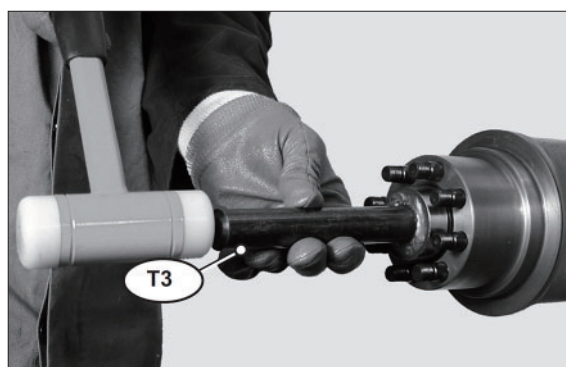
(3) ASSEMBLY

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



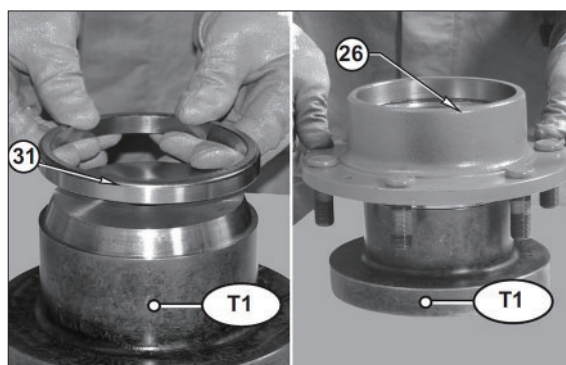
55W9NAX462

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



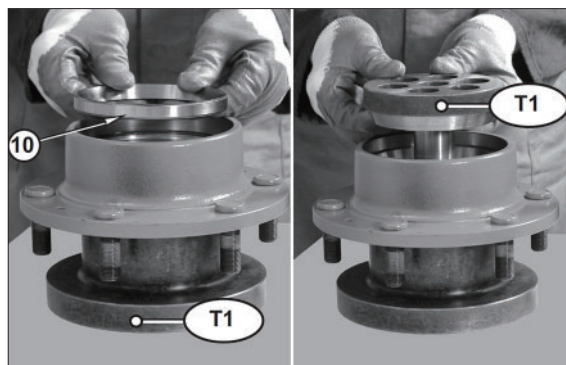
55W9NAX463

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



55W9NAX464

- 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.



55W9NAX465

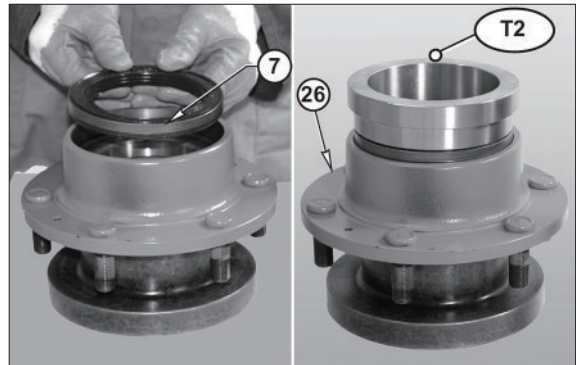
- ④ Fit the bearing (10) into the internal thrust block.



55W9NAX466

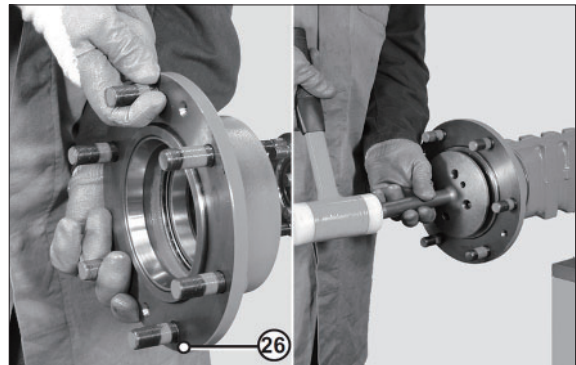
- ⑤ Using special tool T2 apply a repositionable jointing compound for seals to the outer surface of the sealing ring (7). Position the sealing ring (7) in the hub (26).

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



55W9NAX467

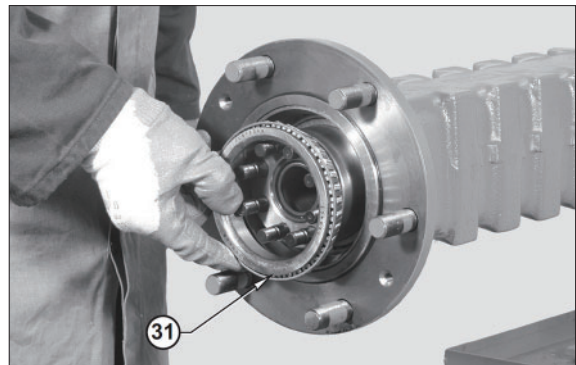
- ⑥ Install the wheel hub (26).



55W9NAX468

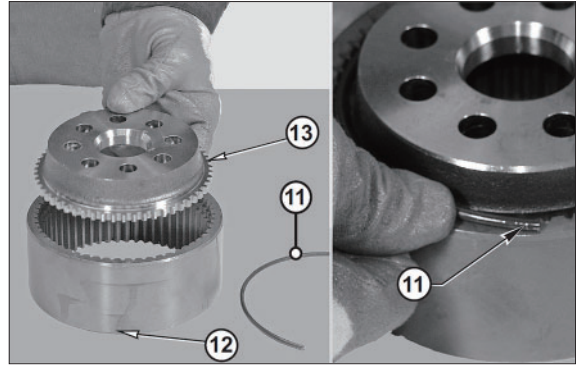
- ⑦ Install the external bearing (31).

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



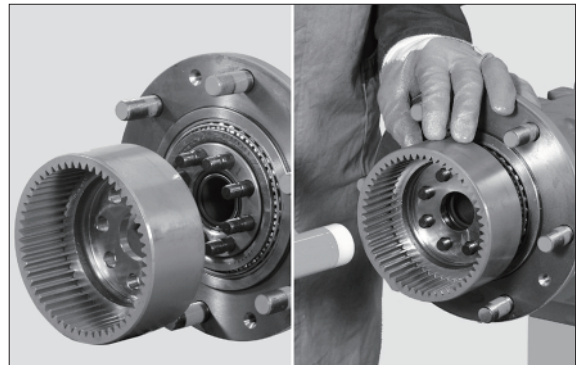
55W9NAX469

- 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).



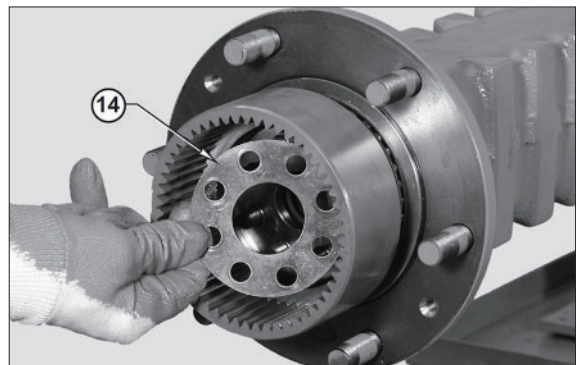
55W9NAX470

- ⑨ Fit the complete crown flange.
- ※ In order to fasten the flange, use a plastic hammer and alternately hammer on several equidistant points.



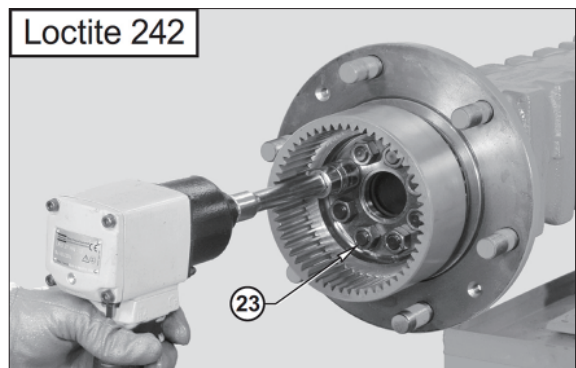
55W9NAX471

- ⑩ Install the security flange (14).



55W9NAX472

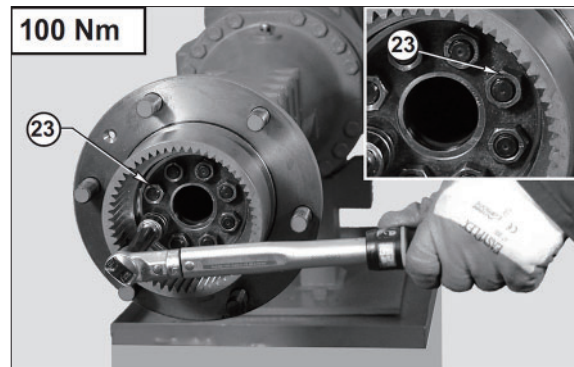
- ⑪ Coat the nuts (23) with loctite 242 and screw them.



55W9NAX473

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

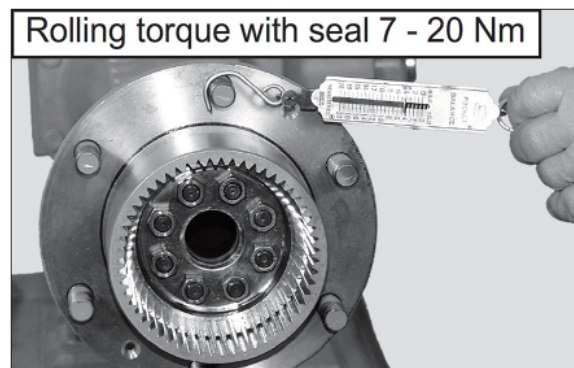
- Initial torque wrench setting :
9.18 kgf · m (66.4 lbf · ft)
- Final torque wrench setting :
10.2 kgf · m (73.8 lbf · ft)



55W9NAX474

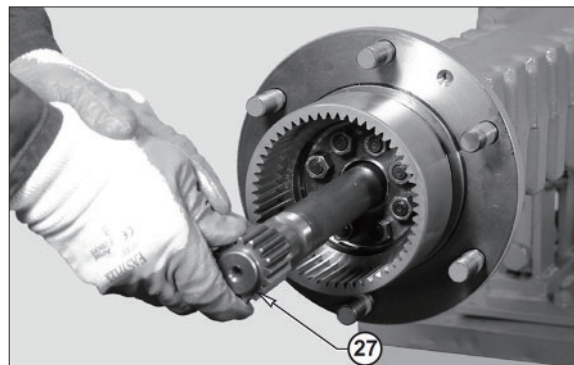
- ⑬ Check the continuous rolling torque on the hub.

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



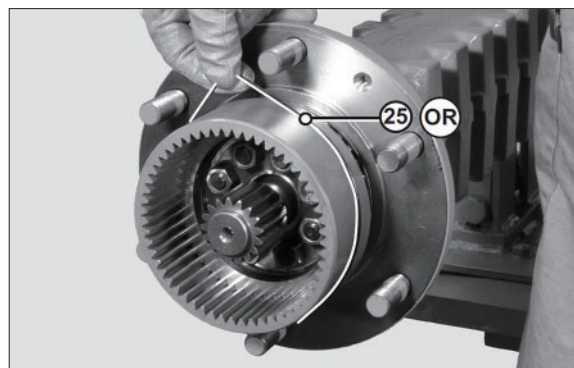
55W9NAX475

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



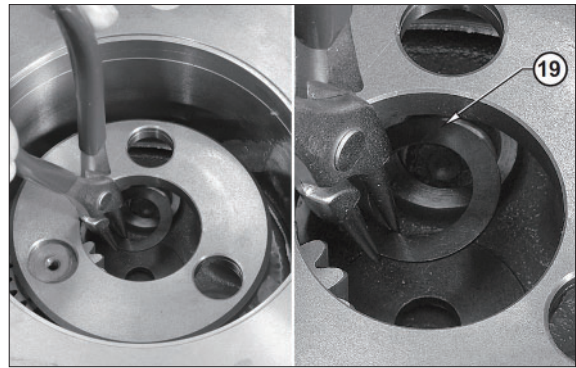
55W9NAX476

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



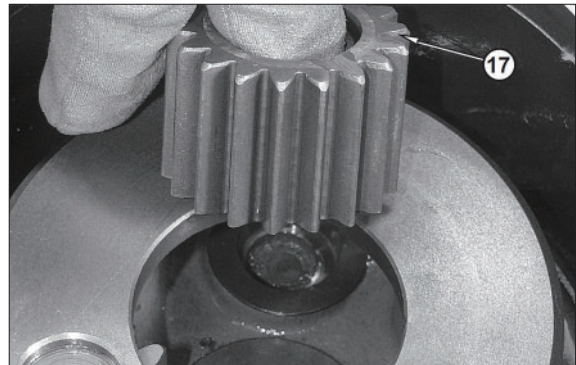
55W9NAX477

- ⑮ Install the spherical washer (19).



55W9NAX478

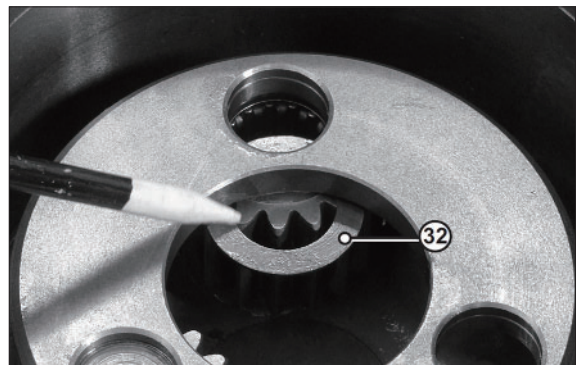
- ⑯ Install planetary gears complete with roller bearing (17).



55W9NAX479

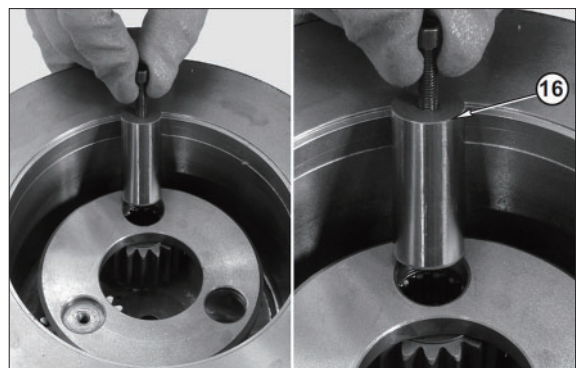
- ⑰ Install the others friction washers.

Two friction washers for every planetary gear.



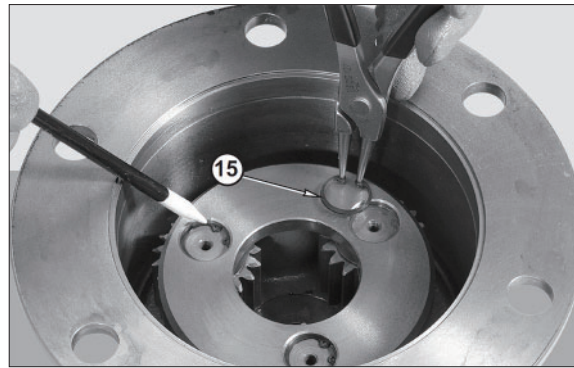
55W9NAX480

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



55W9NAX481

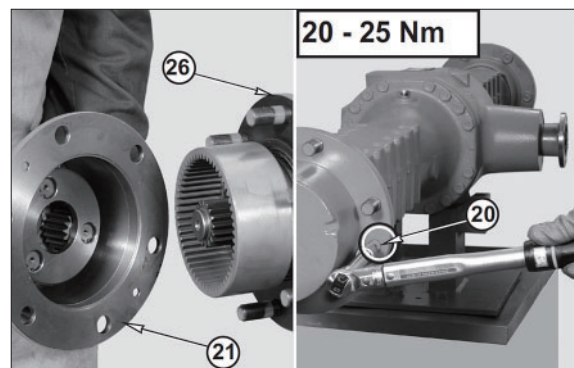
- ①⑨ Carefully check that pin is completely inserted and install the snap rings (15).



55W9NAX482

- ②⑩ Fit the planetary gear cover (21) onto the wheel hub (26).

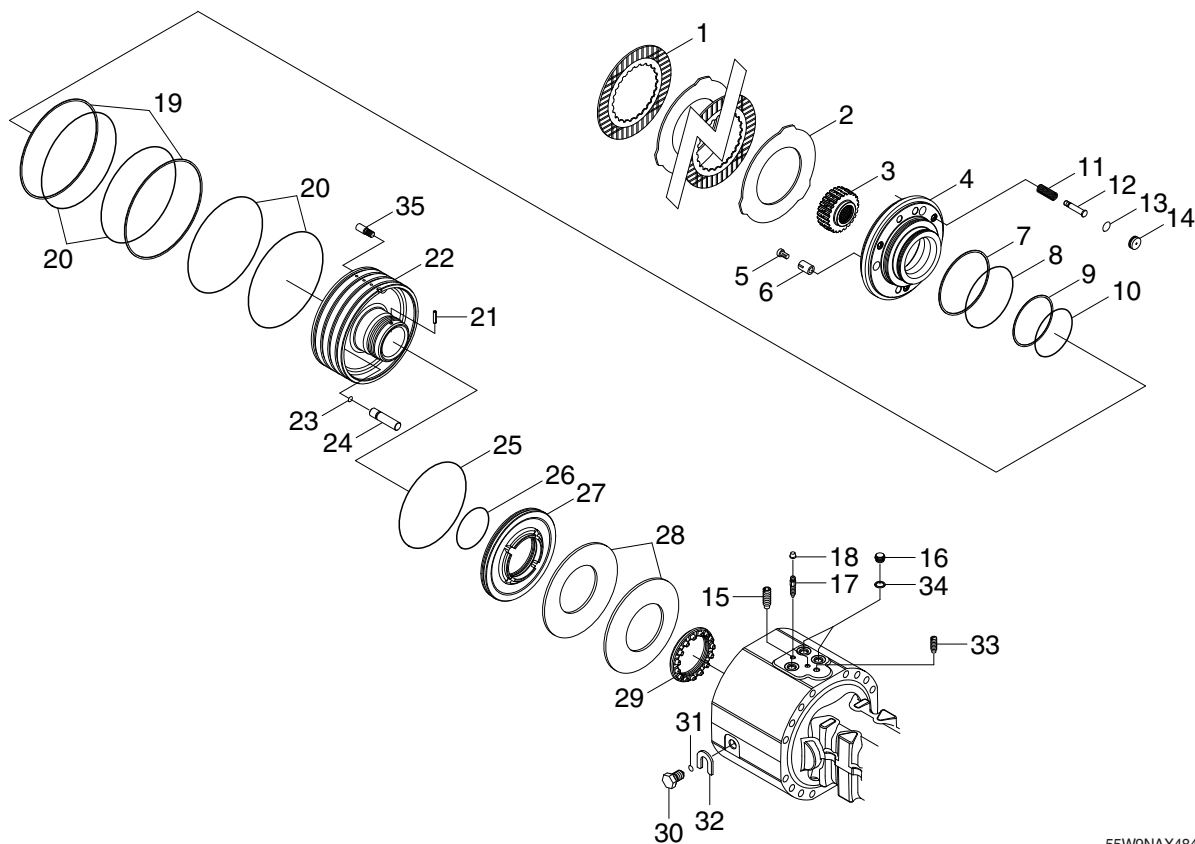
- Torque wrench : 2.04~2.55 kgf · m
(14.8~18.4 lbf · ft)



55W9NAX483

2) SERVICE AND NEGATIVE BRAKE

(1) Assembly diagram

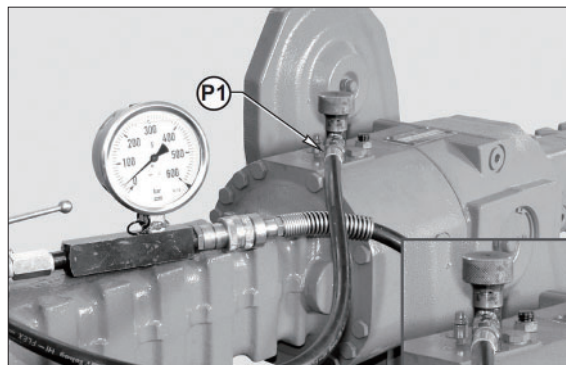


55W9NAX484

(2) Disassembly

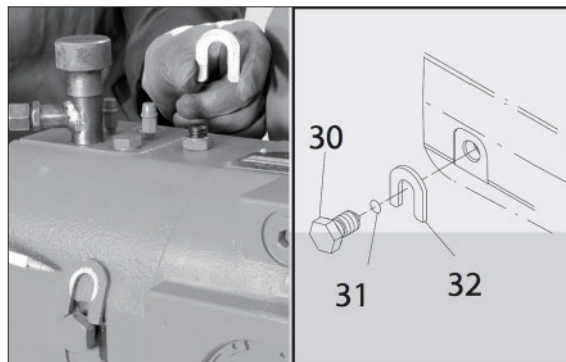
- ① Connect an external pump to the union piece "P1" of the negative brake and introduce a pressure of 15~30 bar to eliminate the pressure of the belleville washers.

※ Perform all operations on both arms.



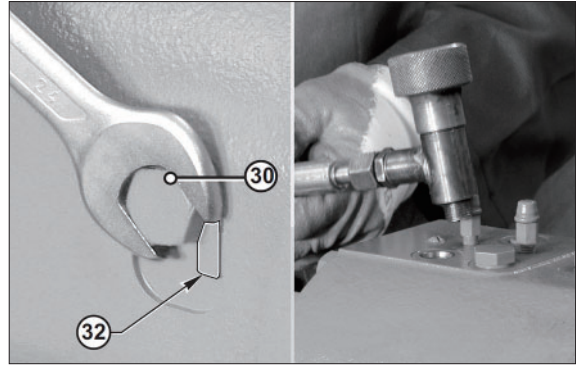
55W9NAX485

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



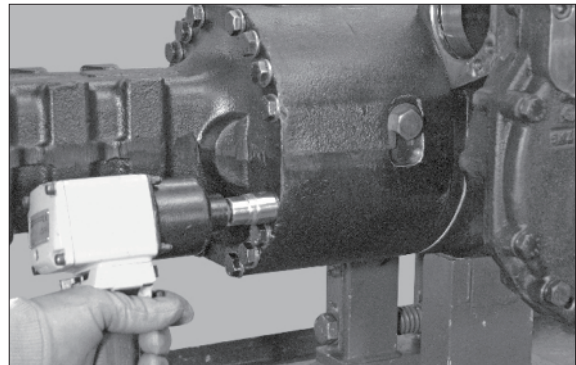
55W9NAX486

- ③ Insert block screws to end stroke and release pression.



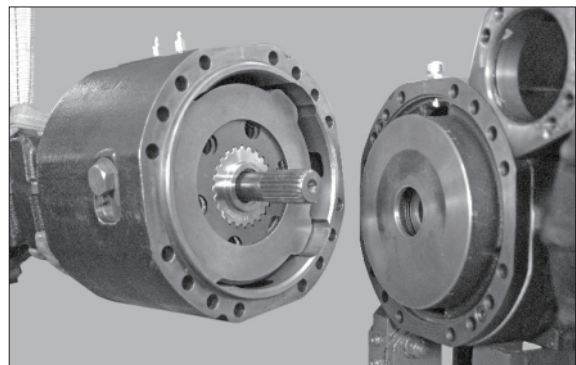
55W9NAX487

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



55W9NAX488

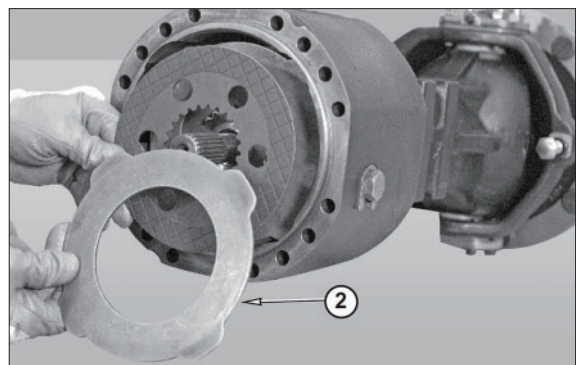
- ⑤ Take off the arm and lay it down vertically.



55W9NAX489

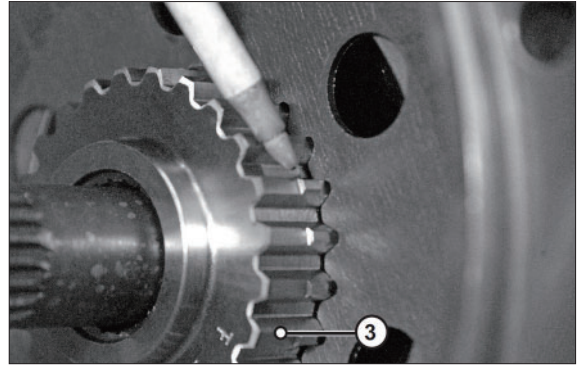
- ⑥ Remove the brake discs one after the other (2).

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



55W9NAX490

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



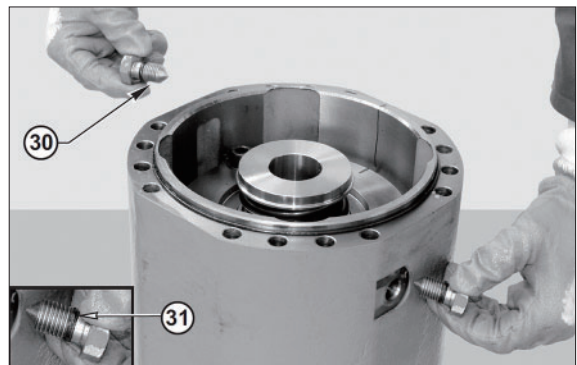
55W9NAX491

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



55W9NAX492

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



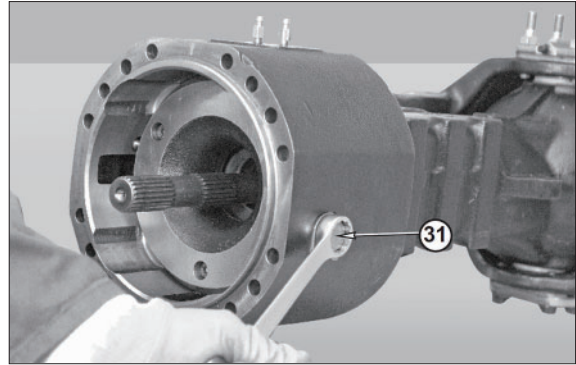
55W9NAX493

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



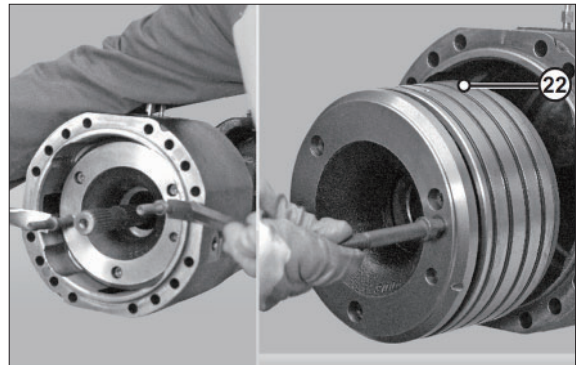
55W9NAX494

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



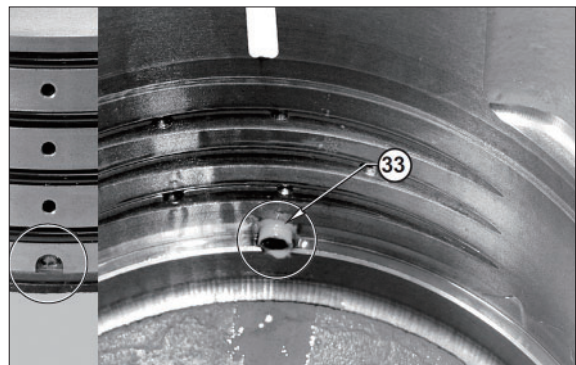
55W9NAX495

- ⑫ Pull out brake piston assembly module (22).



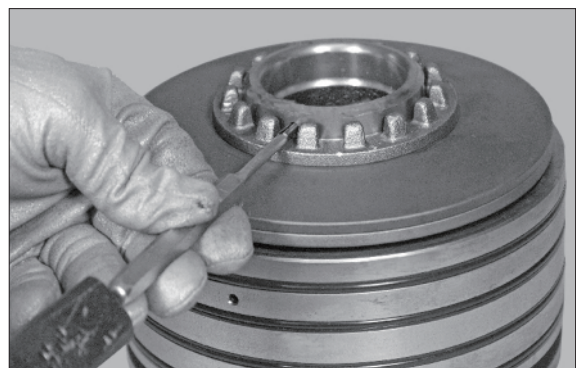
55W9NAX496

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



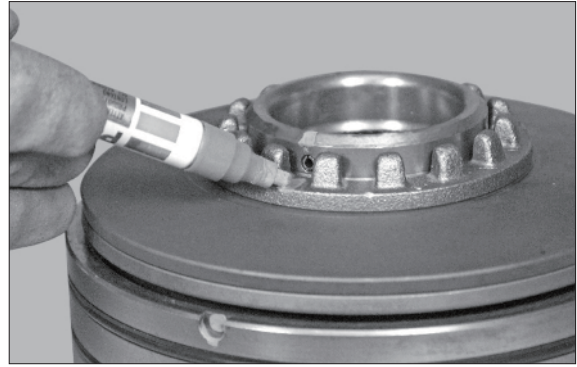
55W9NAX497

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



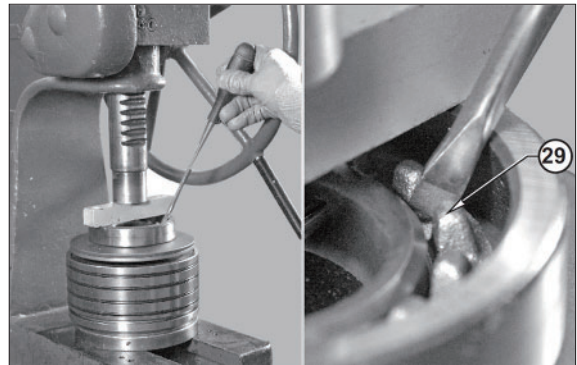
55W9NAX498

- ⑭ Sign the position of the slotted nut.



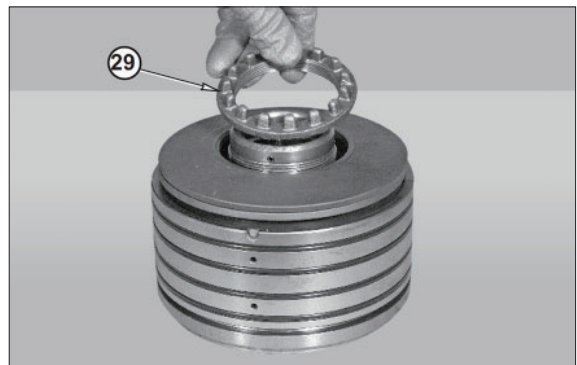
55W9NAX499

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



55W9NAX500

- ⑯ Remove nut (29).



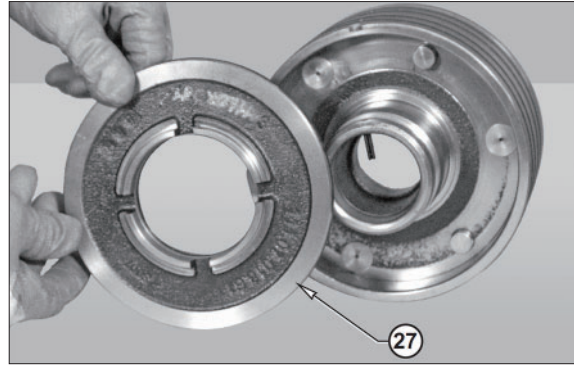
55W9NAX501

- ⑰ Remove the disc springs (28).



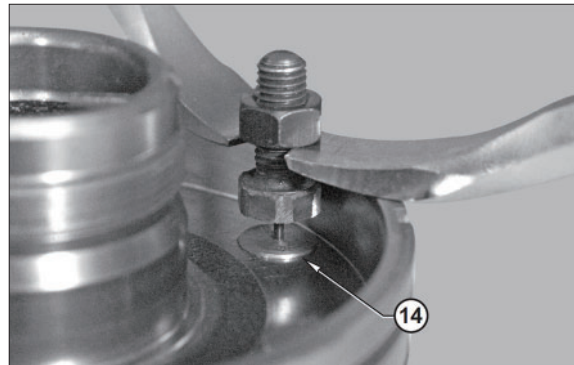
55W9NAX502

- ⑮ Applying air pressure, remove the piston (27) of the negative brake.



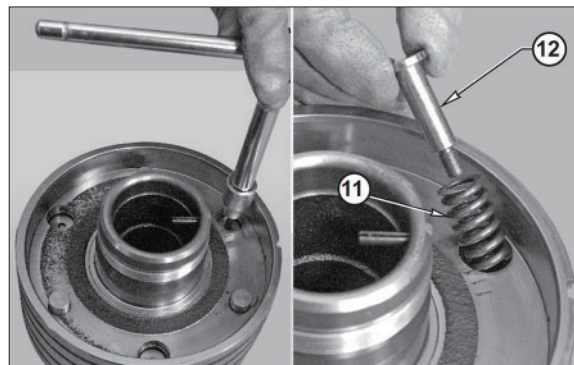
55W9NAX503

- ⑯ Using a new screw remove the pressure seal caps.



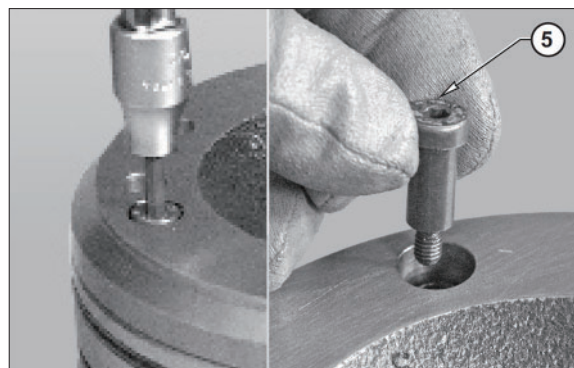
55W9NAX504

- ⑰ Remove the reversal springs (11).



55W9NAX505

- ⑱ Remove the adjusting screws (5).



55W9NAX506

- ② Remove the service brake piston (4).



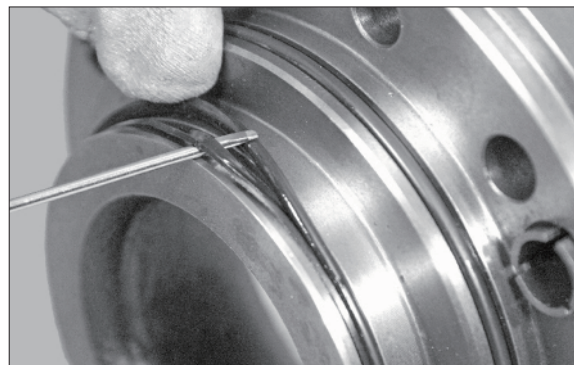
55W9NAX507

- ③ Remove the three bolts (24).



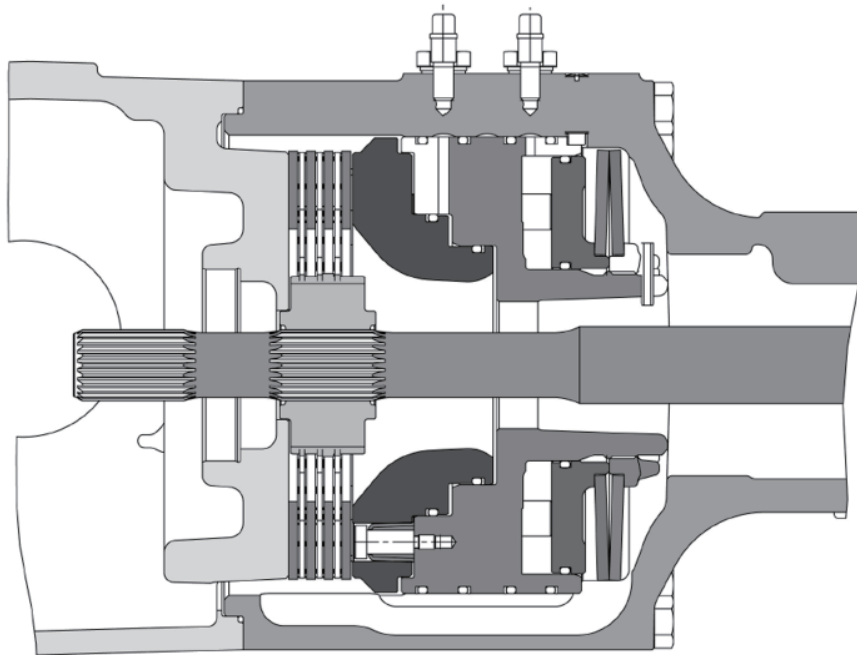
55W9NAX508

- ④ Remove the O-rings and the anti-extrusions rings from the service brake, the negative brake piston and from the piston.



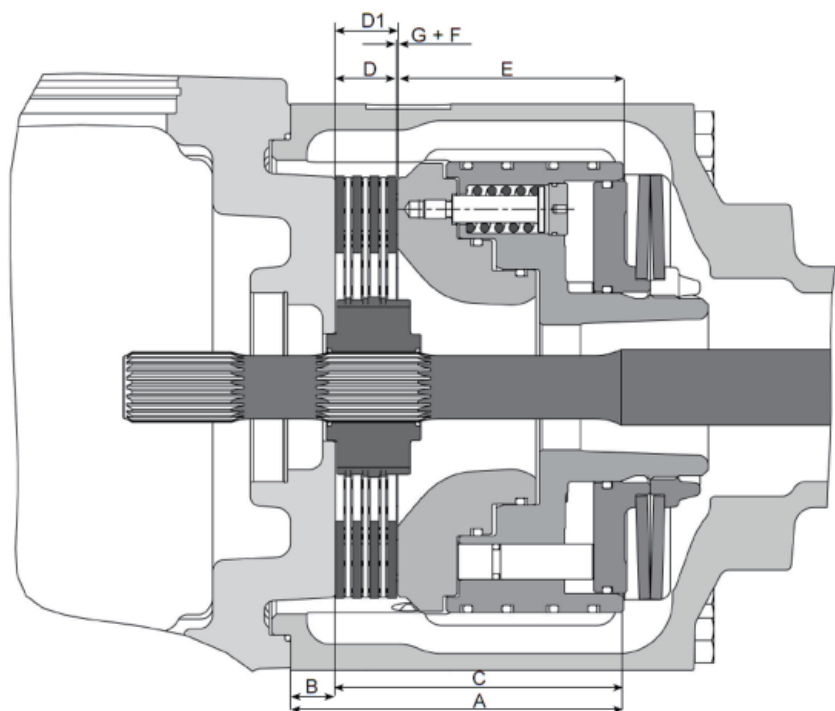
55W9NAX509

(3) Assembly



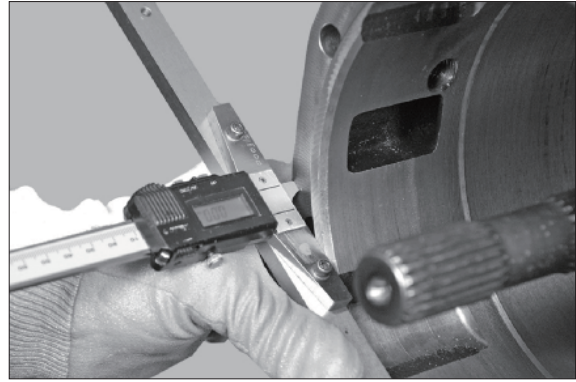
55W9NAX149

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



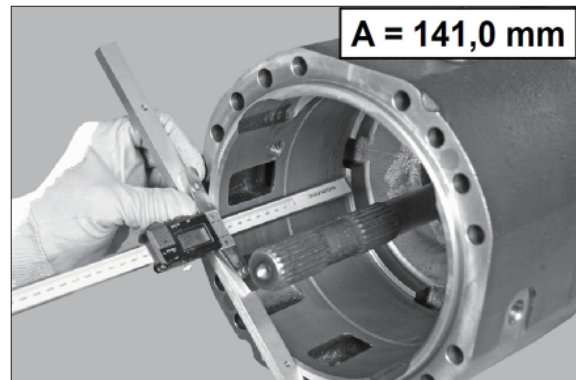
55W9NAX511

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



55W9NAX512

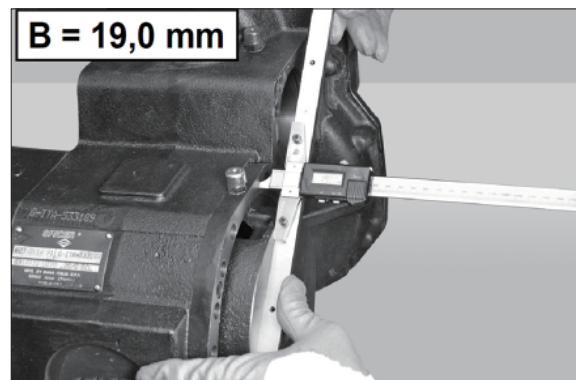
- ② Then measure the distance between the arm support plane and the piston pack stop.



55W9NAX513

- 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.

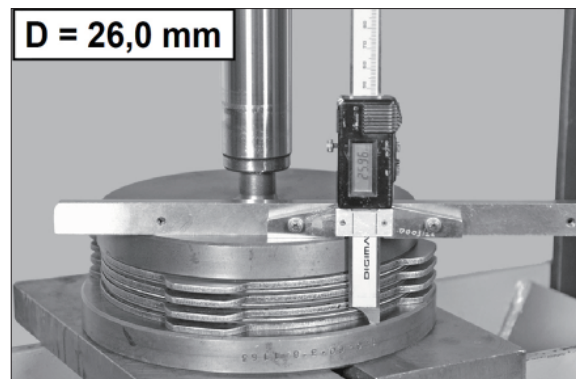


55W9NAX514

- 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.



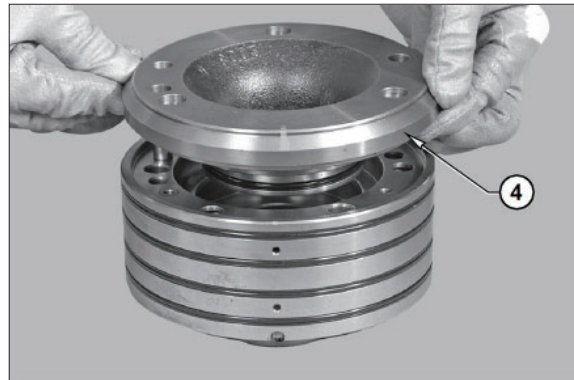
55W9NAX515

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

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

55W9NAX516

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



55W9NAX517

- ⑦ Insert the bolts (24).



55W9NAX518

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



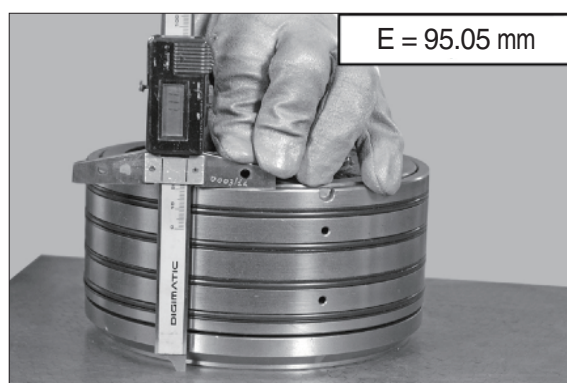
55W9NAX519

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



55W9NAX520

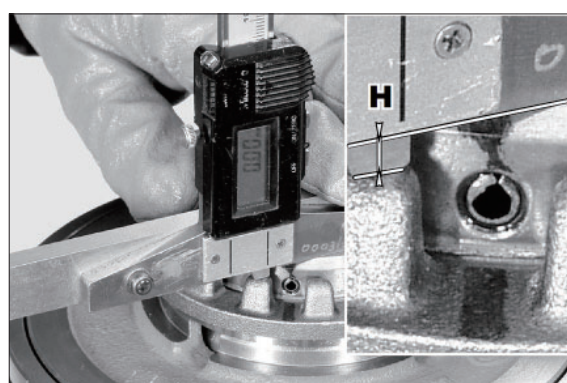
- ※ To define the level “E” adjust the slotted nut always to the smaller value by driving to the closer notch.



55W9NAX521

- 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.



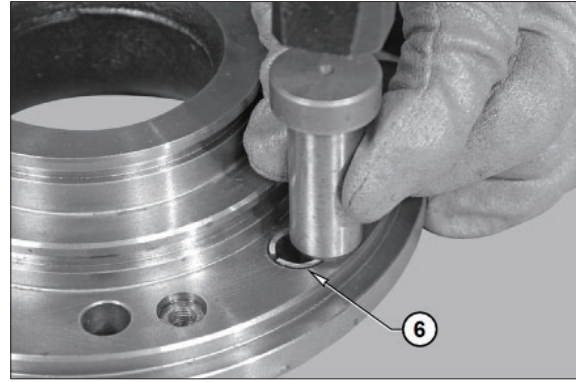
55W9NAX522

- ⑩ Remove the service brake piston (4).



55W9NAX523

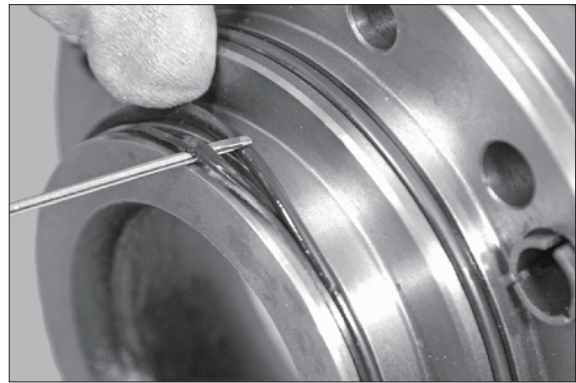
- ⑪ Insert the stroke automatic regulation springs (6); place them in line with the piston (4).



55W9NAX524

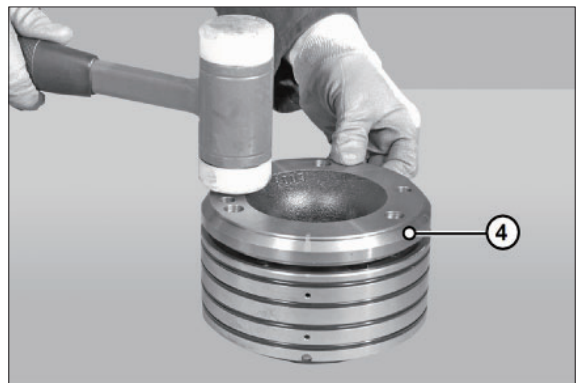
- ⑫ Complete the O-rings and anti-extrusion rings on all pistons.

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



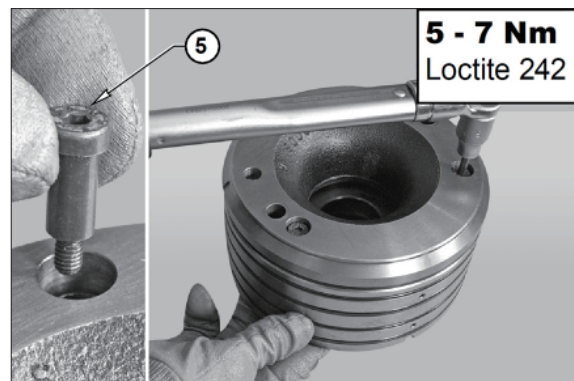
55W9NAX525

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



55W9NAX528

- 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)

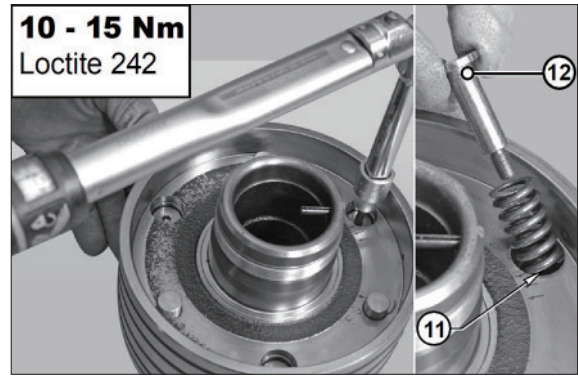


55W9NAX529

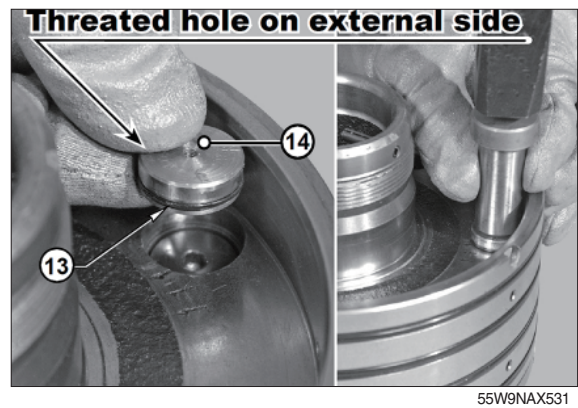
- ⑮ Fit the reversal springs (11) on the piston (4).

Apply loctite 242 to the thread of the adjustment screw.

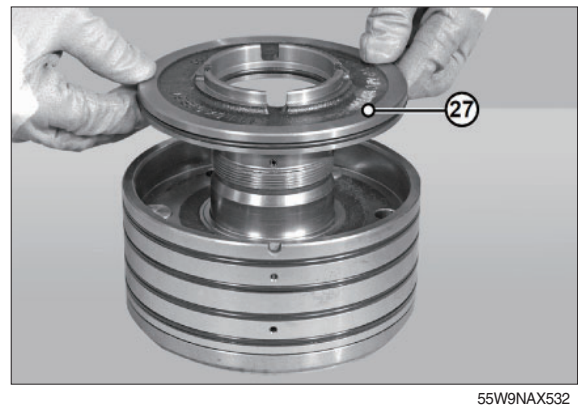
Tighten with torque wrench setting of 1.02~1.53 kgf · m (7.38~11.1 lbf · ft)



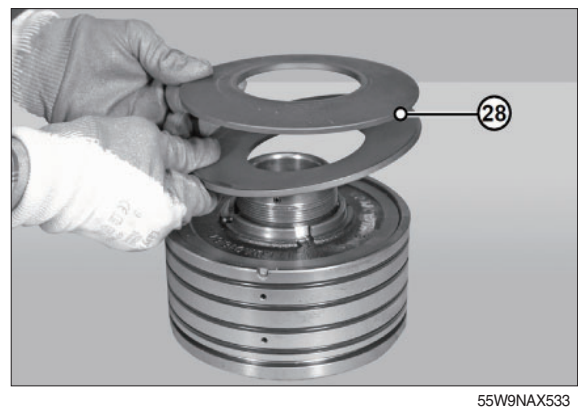
- ⑯ Insert the stroke end seal caps.



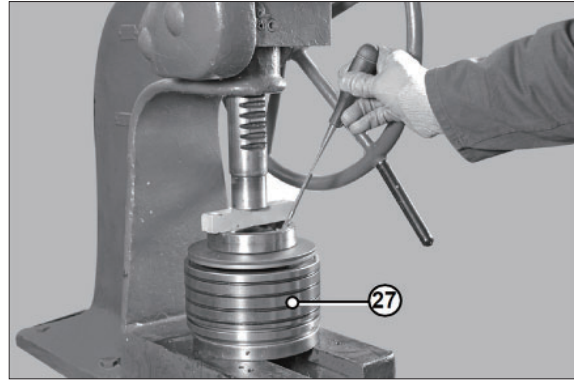
- ⑰ Insert the negative brake piston (27).



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

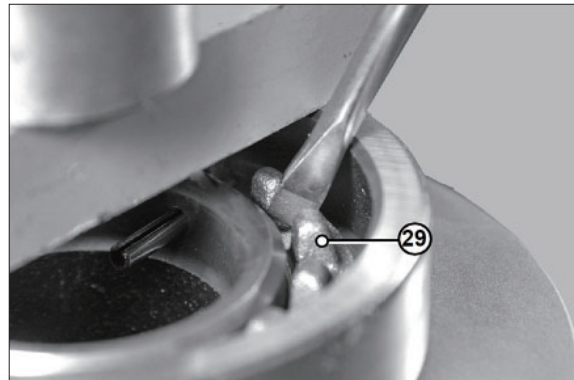


- ⑰ Insert at the bottom the piston of the negative brake (27) and screw up the slotted nut (29).



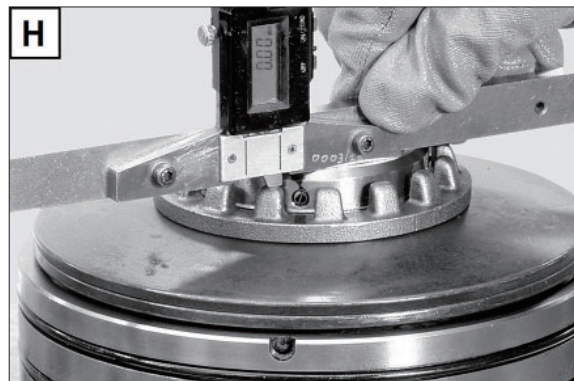
55W9NAX534

- ⑱ Screw down the slotted nut to the earlier determined position.



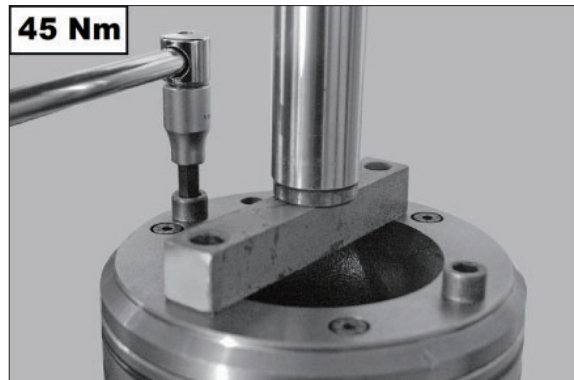
55W9NAX535

- ⑲ Check the earlier measured distance "H" from the plane to the tooth next to the pin.



55W9NAX536

- ⑳ Alternately tighten with a torque wrench setting of maximum 4.59 kgf · m (33.2 lbf · ft).



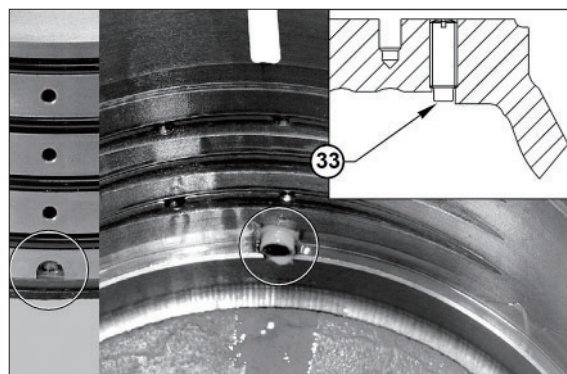
55W9NAX537

- ②③ Put the pin in locking (21) position.



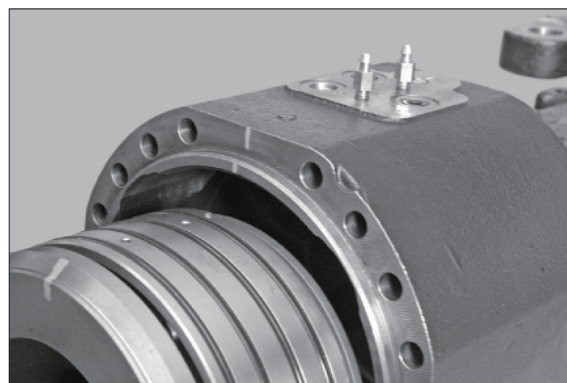
55W9NAX538

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



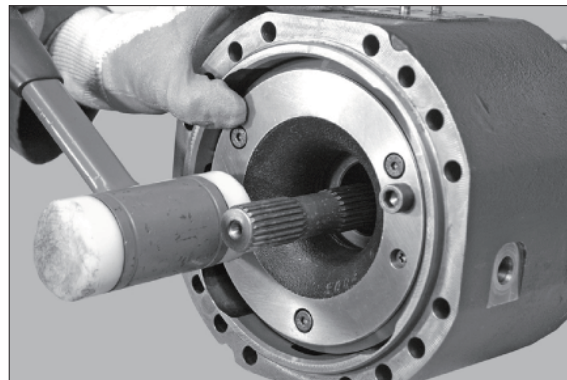
55W9NAX539

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



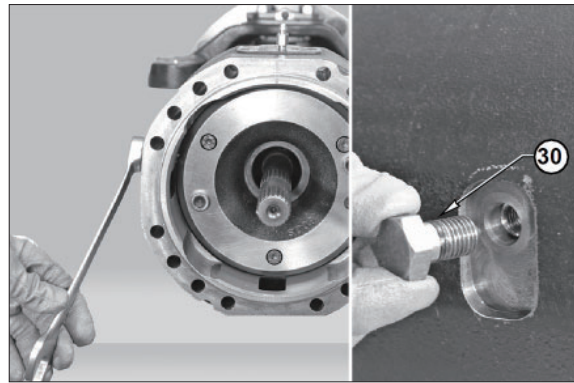
55W9NAX540

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



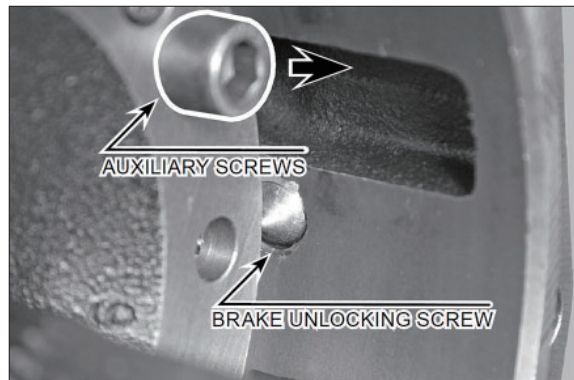
55W9NAX541

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



55W9NAX542

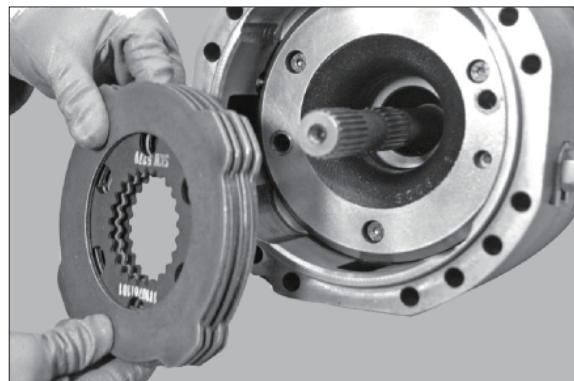
- ②⑦ Remove the two auxiliary screws.



55W9NAX543

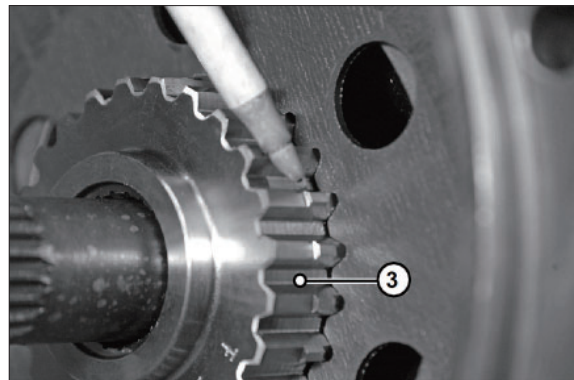
- ②⑧ Insert the brake discs (1) (2) in the right sequence.

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



55W9NAX544

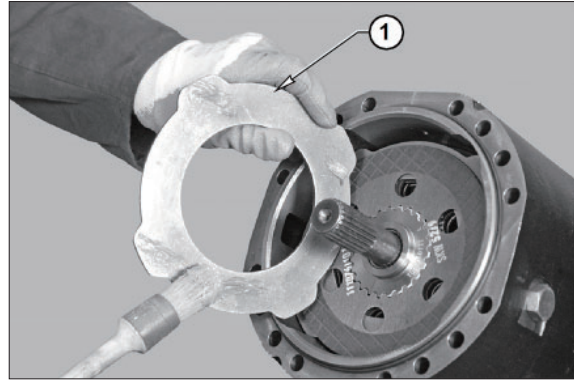
- ②⑨ Install the flange (3) on the arm.



55W9NAX545

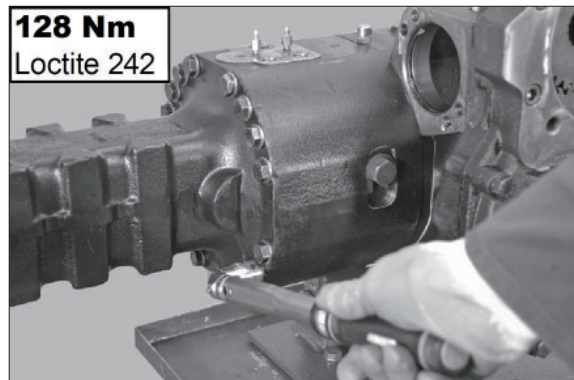
- ③⑩ Insert the brake discs (1) (2) in the right sequence.

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



55W9NAX546

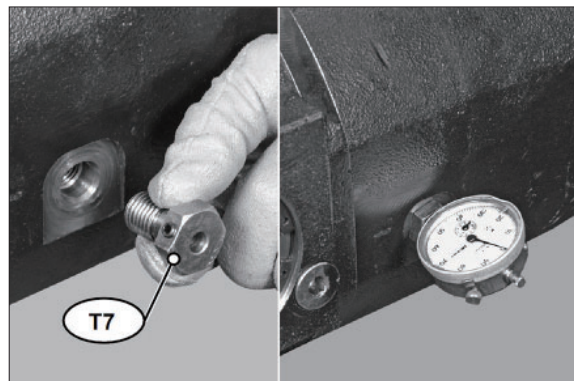
- ③⑪ Insert the screws and tighten them alternately.



55W9NAX547

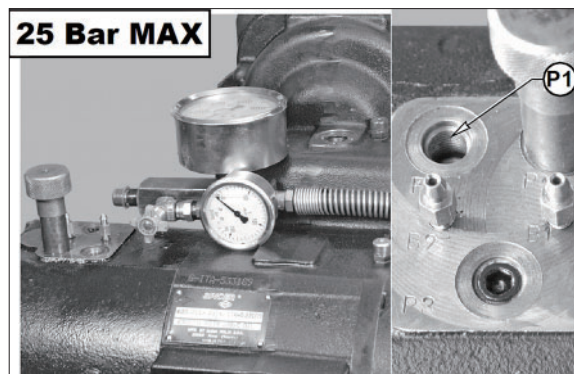
- ③⑫ Remove the negative brake locking screws (30).

Fit the special tool T4 into the seat of the manual release of the screws, insert a comparator and pre-load it with 1 mm.



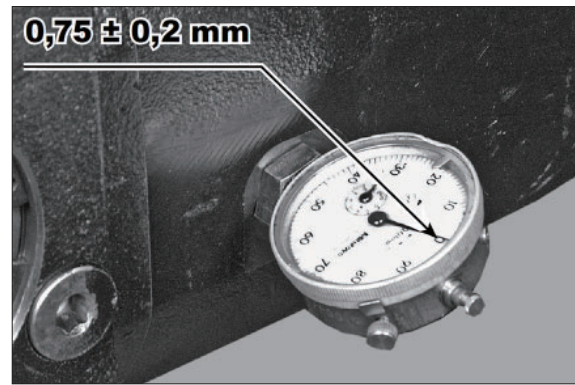
55W9NAX548

- ③⑬ Introduce a pressure of maximum 25 bar.



55W9NAX549

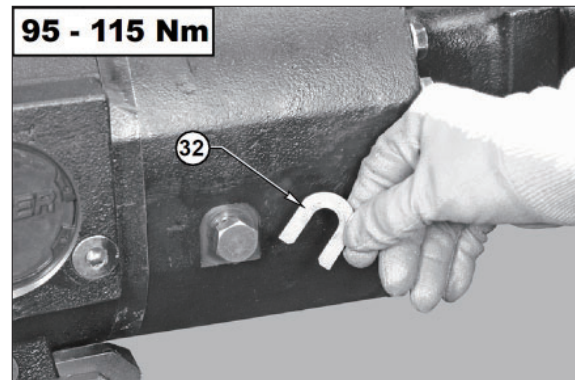
- ③④ Once the pressure is inserted into the circuit the comparator must give a measurement equal to play X (0.75 mm).



55W9NAX550

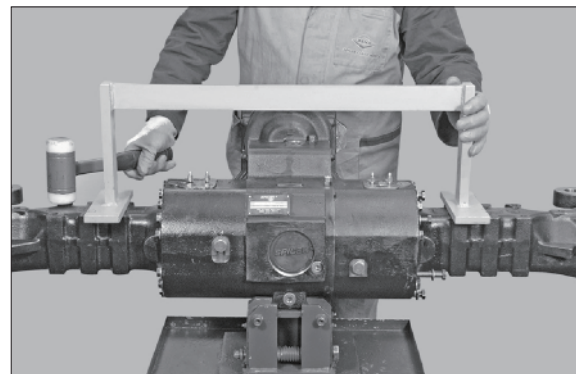
- ③⑤ Insert the two “U”-shaped shims and tighten the screws with a torque wrench setting of 9.69~11.7 kgf · m (70.1~84.6 lbf · ft).

※ The position of the negative brake is unlocked.



55W9NAX551

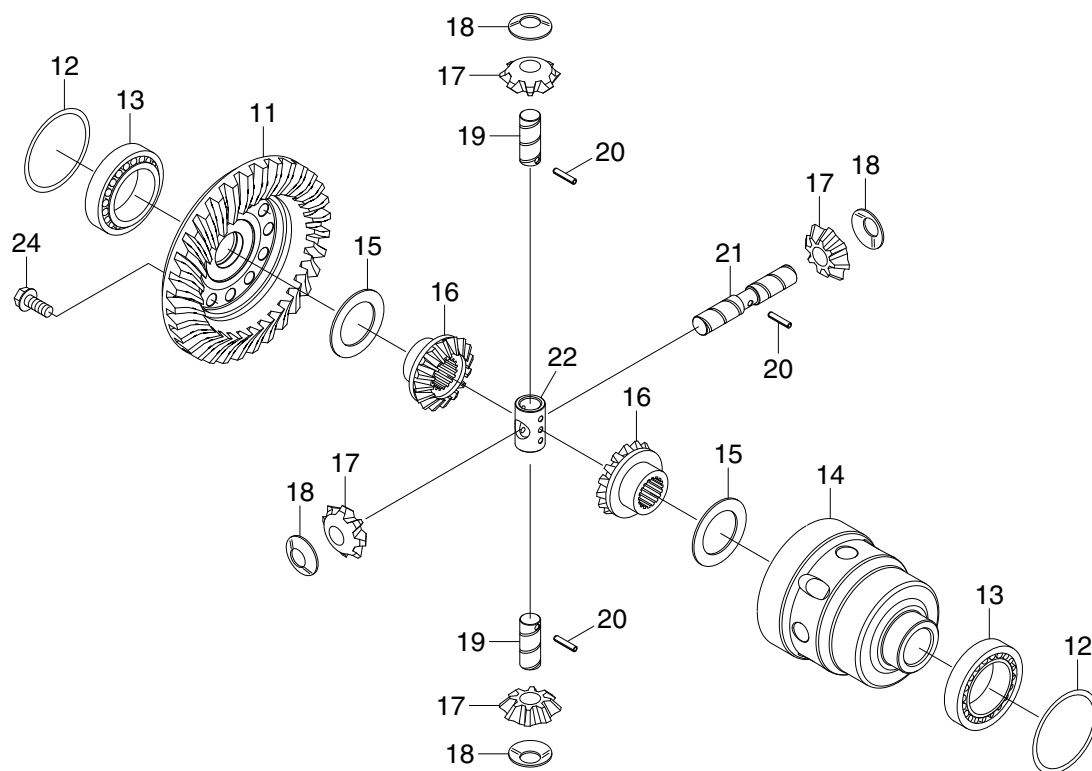
- ③⑥ Check the flatness of the arms and finally lock the arms with the screws (4) and the washer (5) using the crosstightening method.



55W9NAX552

4) NORMAL DIFFERENTIAL

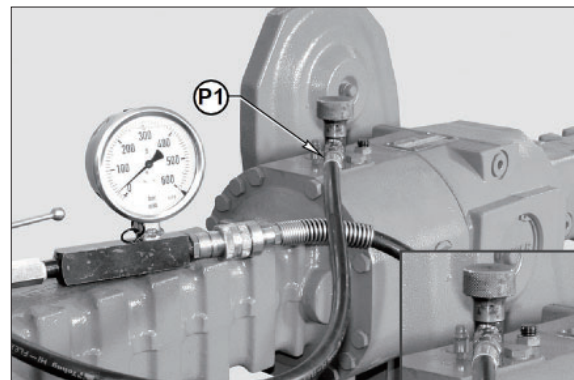
(1) Assembly diagram



55W9NAX553

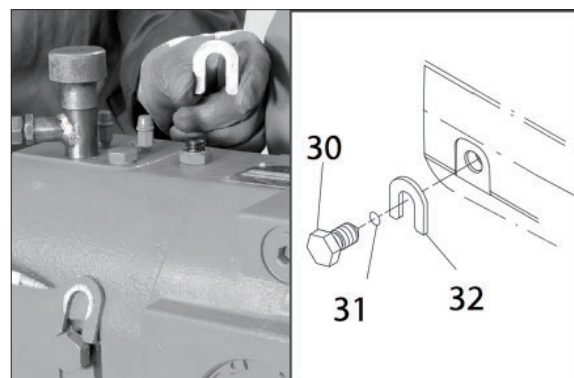
(2) DISASSEMBLY

- 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.



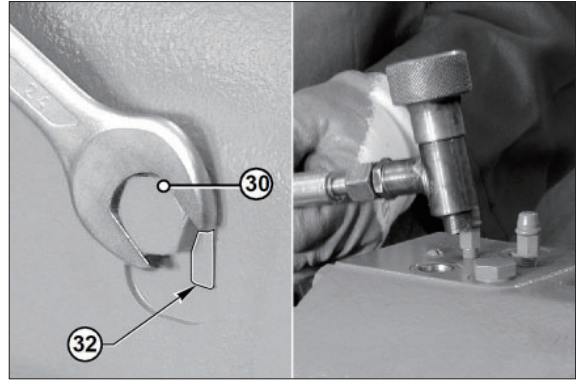
55W9NAX554

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



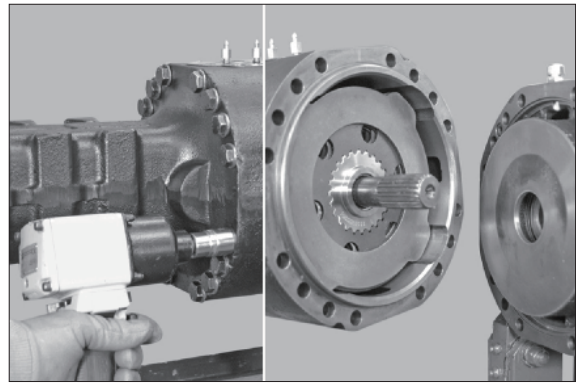
55W9NAX555

- ③ Insert block screws to end stroke and release pression.



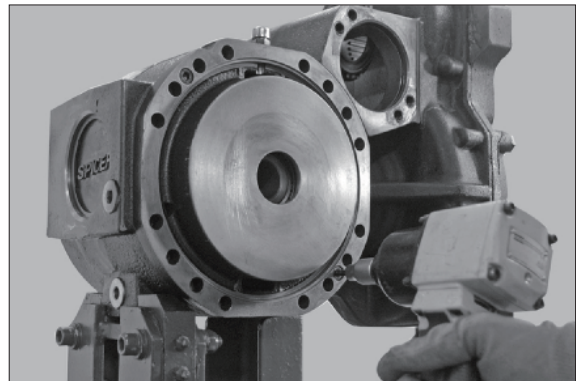
55W9NAX556

- 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.



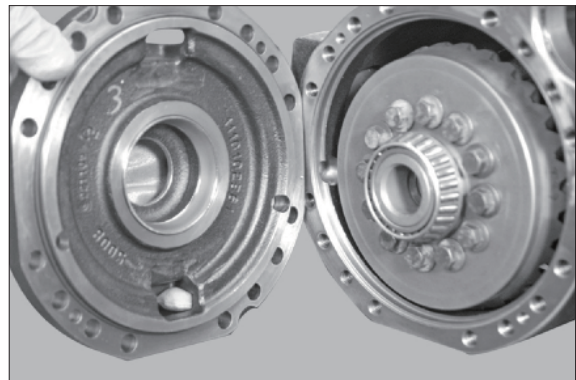
55W9NAX557

- ⑤ Remove the fitting screws from the middle cover.



55W9NAX558

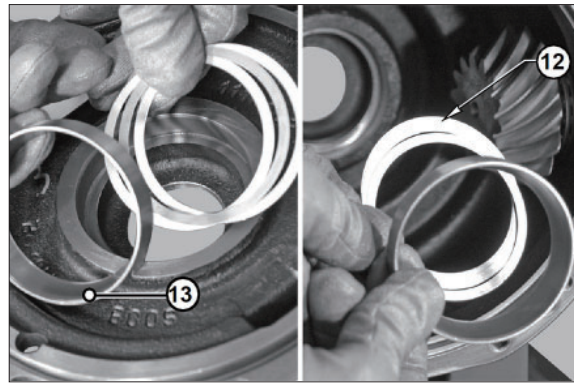
- ⑥ Insert a screw-driver in the opposing slots then force and remove the middle cover.



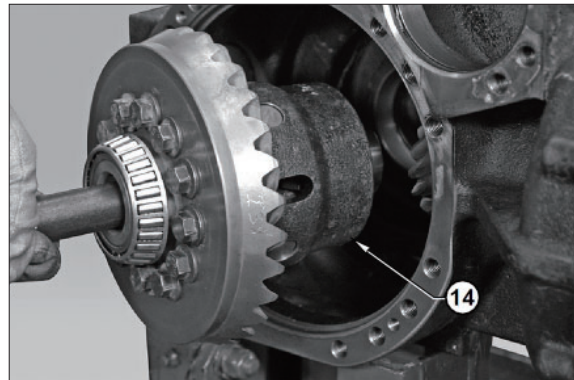
55W9NAX559

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

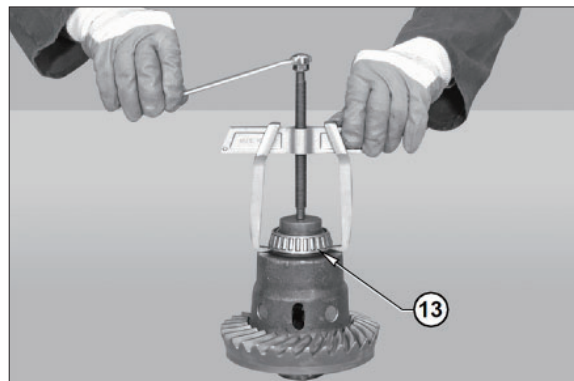
※ Accurately check the O-ring.



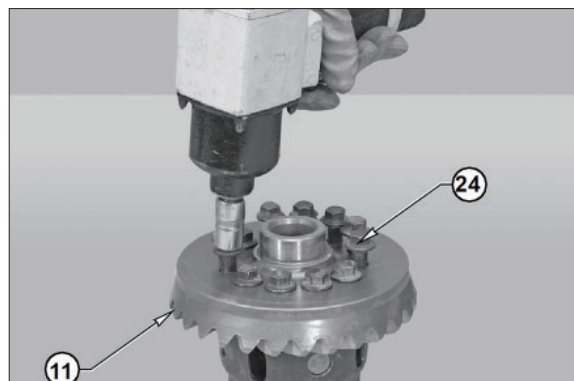
- ⑧ Pull out the differential (14).



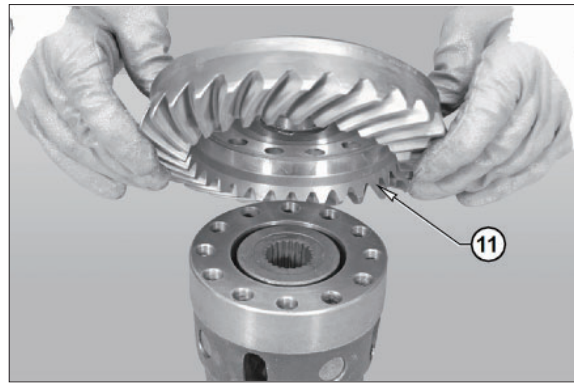
- ⑨ If the bearing need replacing, extract the bearing (13) from the differential carrier.



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



- ⑪ Extract the crown wheel (11).



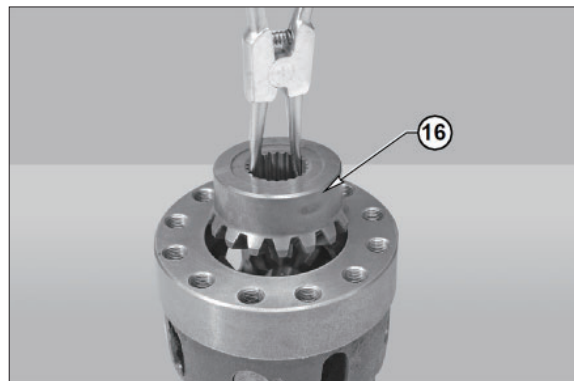
55W9NAX564

- ⑫ Remove the shim washer (15).



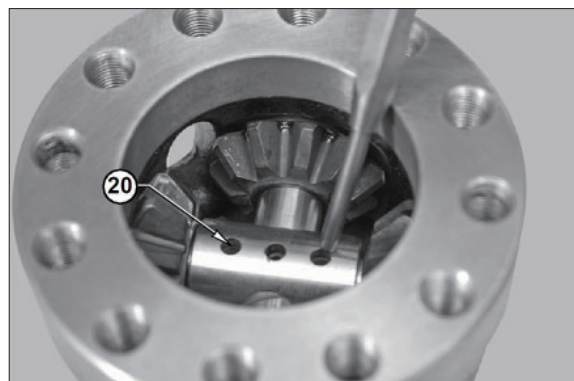
55W9NAX565

- ⑬ Remove the planetary gear (16).



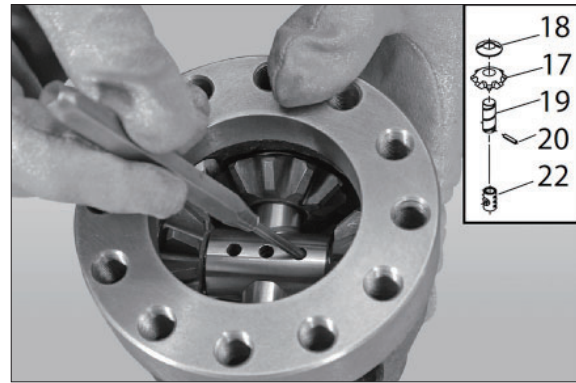
55W9NAX566

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

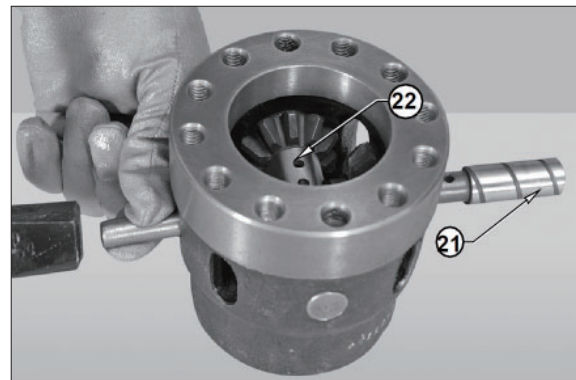


55W9NAX567

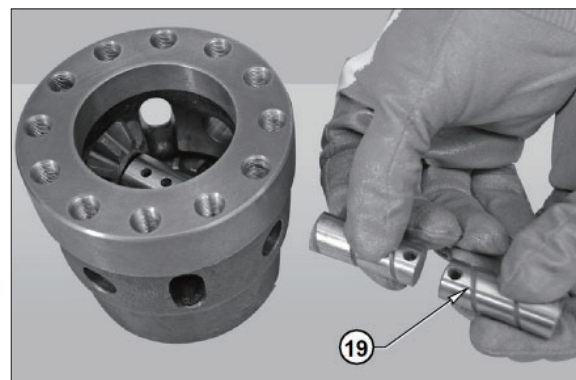
- ⑮ Move the two opposite mounted short bolts (19) to the outside of the box using the same pin driver.



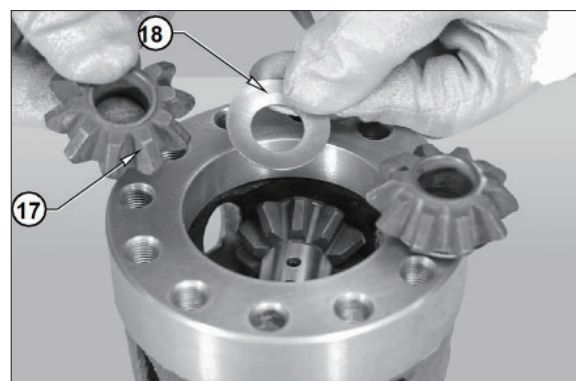
- ⑯ Drive out the long bolt (21) and pull out the spider (22) from the center.



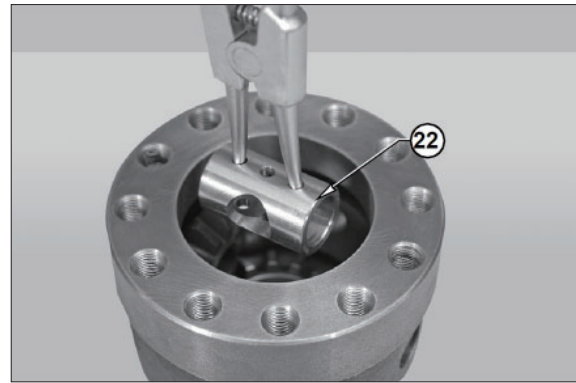
- ⑰ Remove the two half bolts (19), spherical washers and satellite wheels.



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

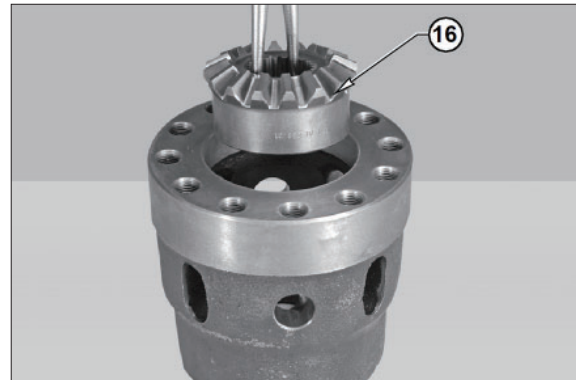


- ①⑨ Pull out the spider (22) from the center.



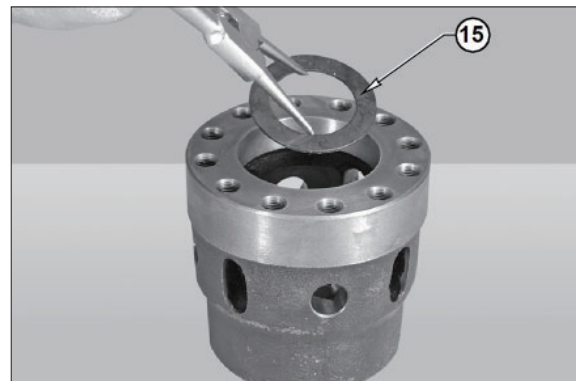
55W9NAX572

- ②⑩ Remove the planetary gear (16).



55W9NAX573

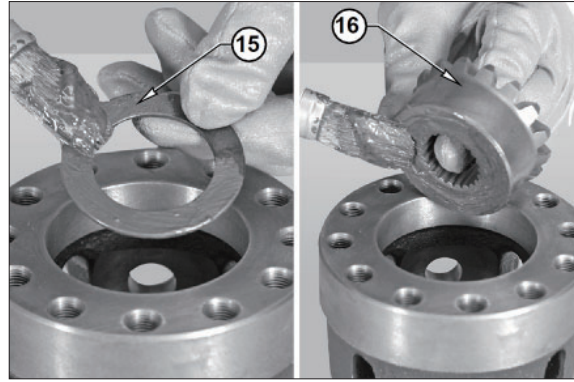
- ②⑪ Remove the shim washer (15).



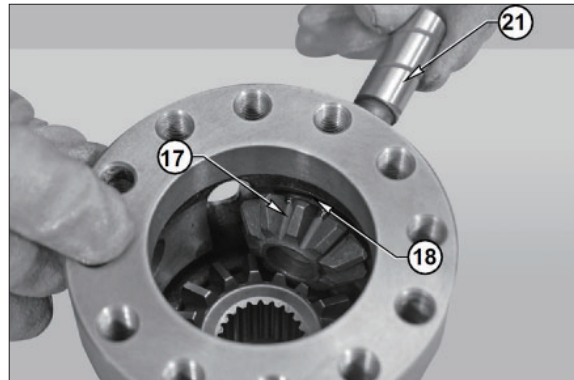
55W9NAX574

(3) ASSEMBLY

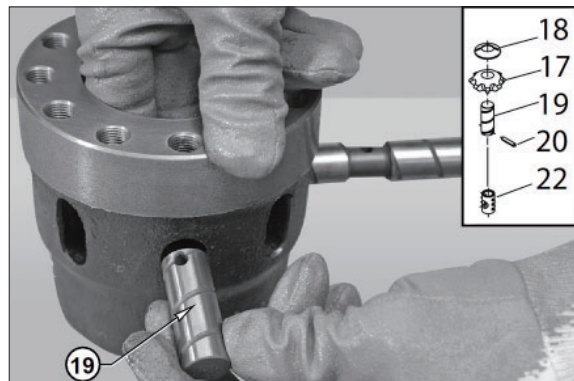
- ① Lubricate and insert washer (15) and planetary wheel (16).



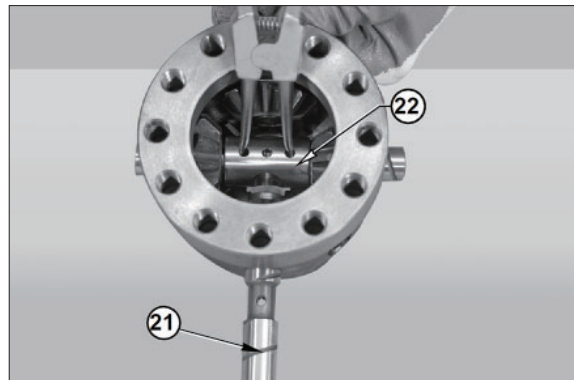
- ② Partially insert the long bolt (21), satellite wheels (17) and spherical washers (21).



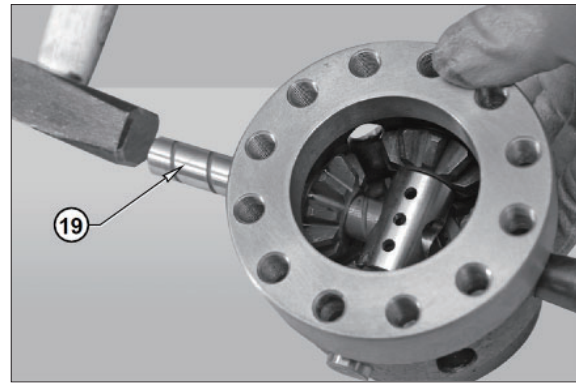
- ③ Insert the two half bolts (19), spherical washers (18) and satellite wheels (17).



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



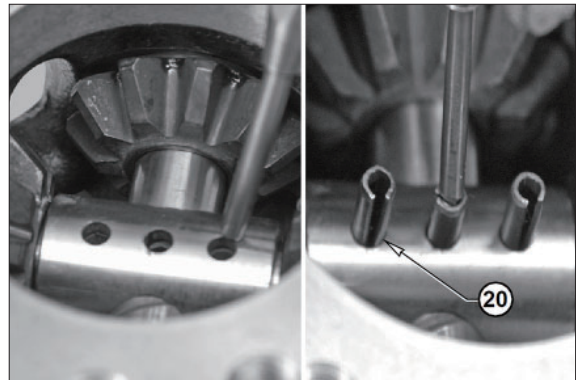
- ⑤ Insert completely the bolts (19).



55W9NAX581

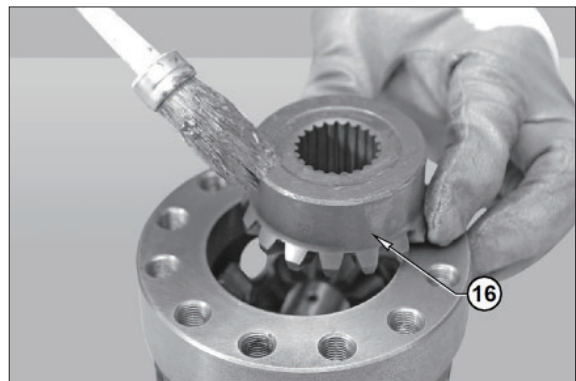
- ⑥ Center the pin holes and insert the 3V pins (20).

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



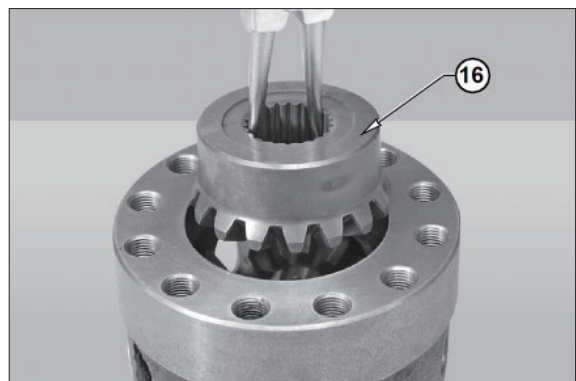
55W9NAX582

- ⑦ Lubricate wheel (16).



55W9NAX583

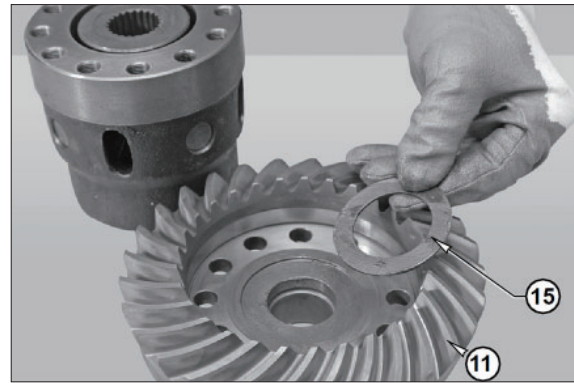
- ⑧ Insert planetary gear wheel (16).



55W9NAX584

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

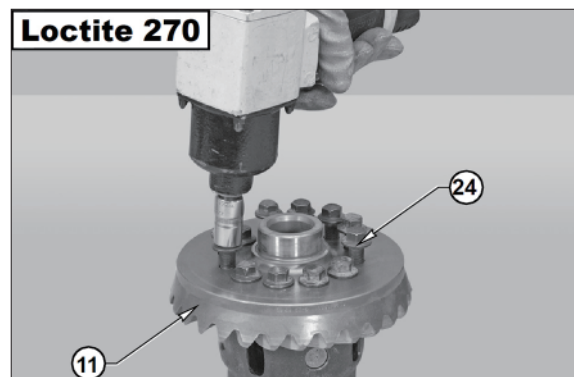
※ In order to hold the shim washer (15) in position, apply grease to it.



55W9NAX585

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

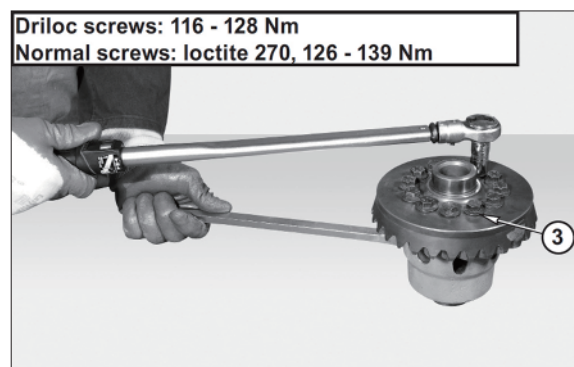
※ Secure the screws using the cross-tightening method.



55W9NAX586

- ⑪ Tighten screws with a torque wrench: see table.

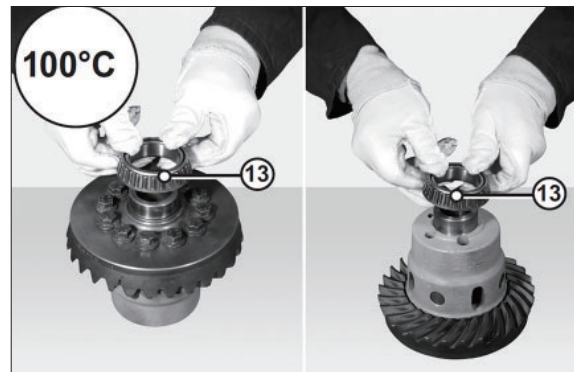
※ Always use new screws to fix the crown wheel. In case the screws are not thread locking pretreated, use loctite 270.



55W9NAX587

- ⑫ Assemble the bearing (13).

※ Heat the bearing to 100°C before assembling.



55W9NAX588

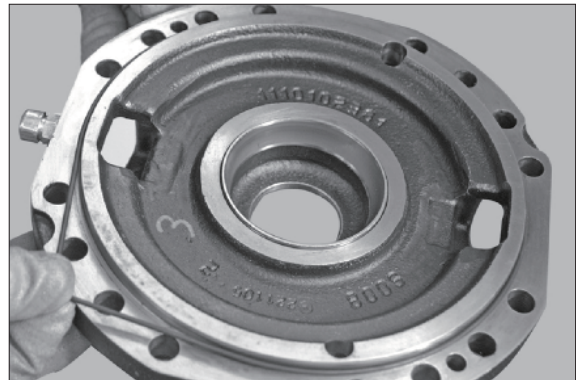
- ⑬ If the bearings are replaced, insert the external thrust blocks in the middle cover and in the central body.



55W9NAX589

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

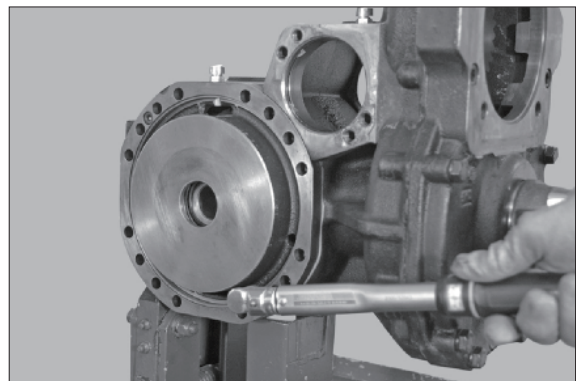
- ※ Thoroughly check the state of the O-ring and make sure that the cover is fitted with the oil discharge in the lower position.



55W9NAX590

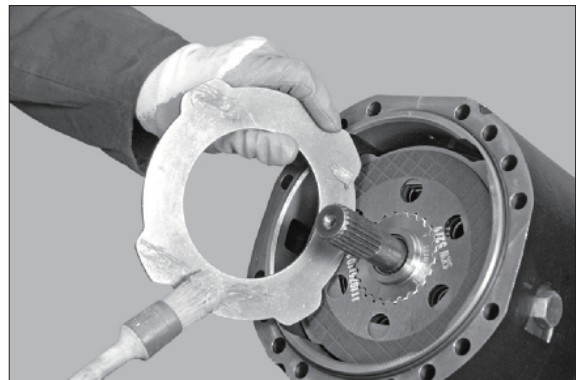
- ⑮ Lock the middle cover with screws.

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



55W9NAX591

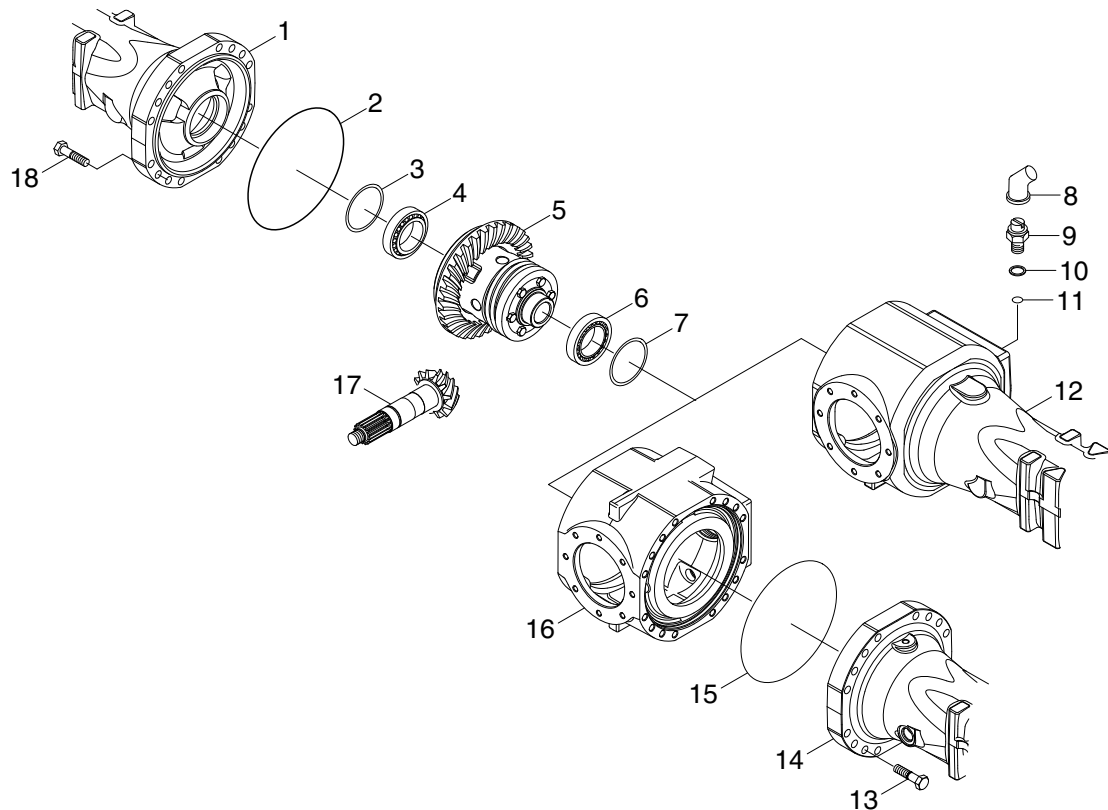
- ⑯ Check that the positioning of the sealing ring on the arm is intact; install the complete arm. Lock it into position using two facing screws and washers.



55W9NAX592

4) RING AND PINION ADJUSTING

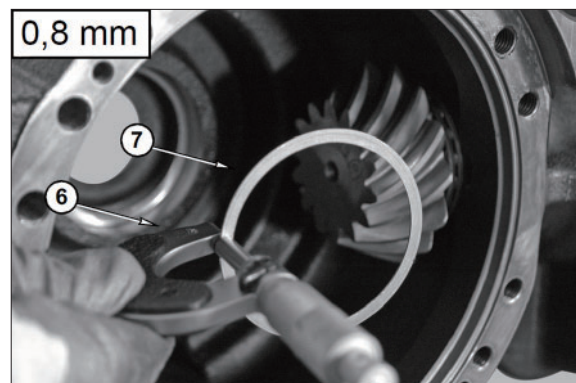
(1) Assembly diagram



55W9NAX593

(2) Adjusting

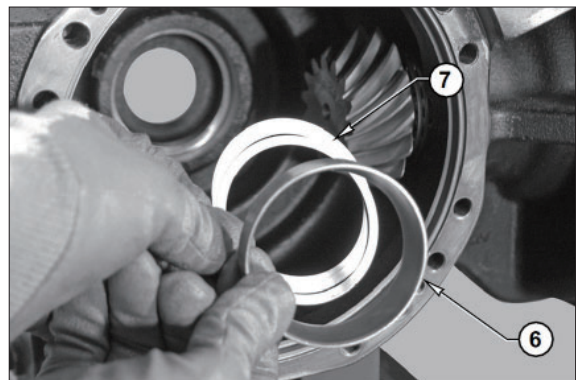
- ① **Setting of the crown wheel and pinion**
Insert the thrust block of the bearing (6) opposite side of the crown wheel shims (Sb) (7) of an initial thickness of about 0.8 mm.



55W9NAX595

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

※ Check to be at end of stroke.

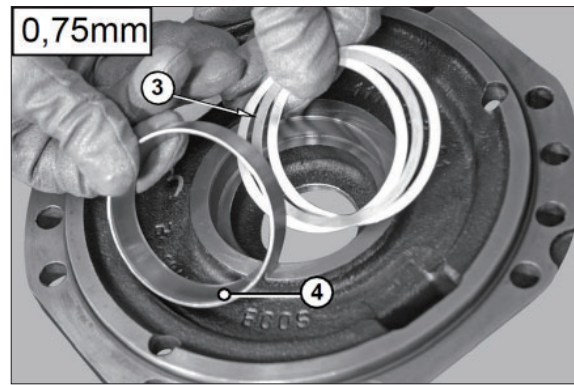


55W9NAX596

- 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 mm.

Insert the thrust block and the shims into the arm.

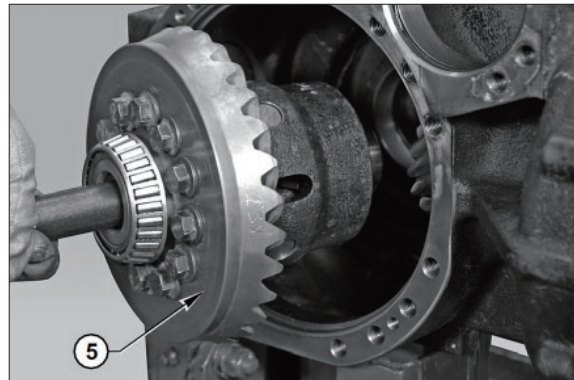
※ Check to be at end of stroke.



55W9NAX597

- ④ Insert complete differential (5).

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



55W9NAX598

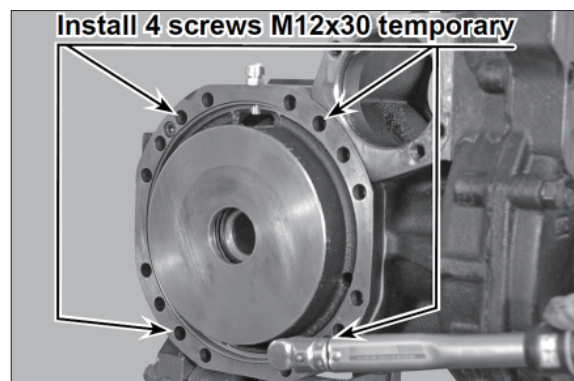
- ⑤ Check the O-ring (2) and grease.



55W9NAX599

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

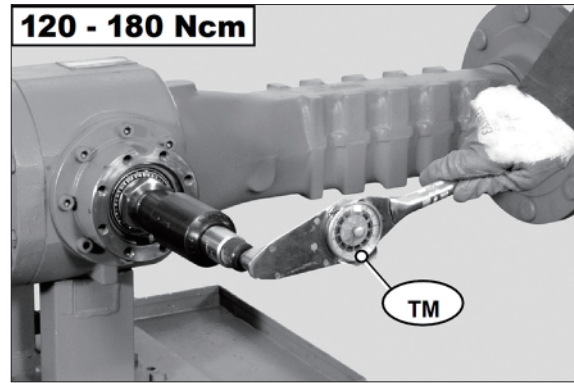
· Torque wrench setting for screw :
2.47~2.67 kgf · m (17.9~19.3 lbf · ft)



55W9NAX600

- ⑦ Apply torque meter TM to pinion nut and check that torque will increase by $0.04 \sim 0.06 \text{ kgf} \cdot \text{m}$ as a result of differential bearing preload.

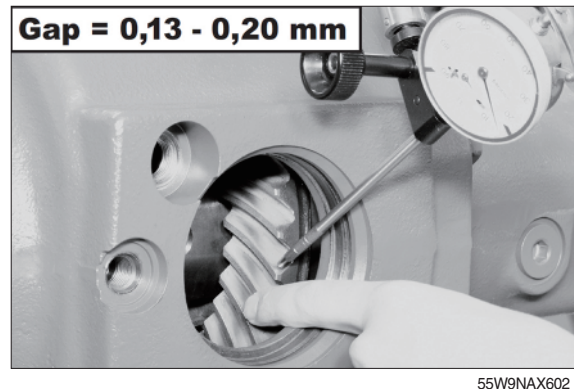
- Example : pinion torque :
 $0.08 \sim 0.12 \text{ kgf} \cdot \text{m}$ ($0.58 \sim 0.87 \text{ lbf} \cdot \text{ft}$)
- Pinion + differential torque :
 $0.12 \sim 0.18 \text{ kgf} \cdot \text{m}$ ($0.87 \sim 1.3 \text{ lbf} \cdot \text{ft}$)



- ⑧ Position comparator on the center of one of the crown teeth, preset it to 1 mm and reset it to zero.

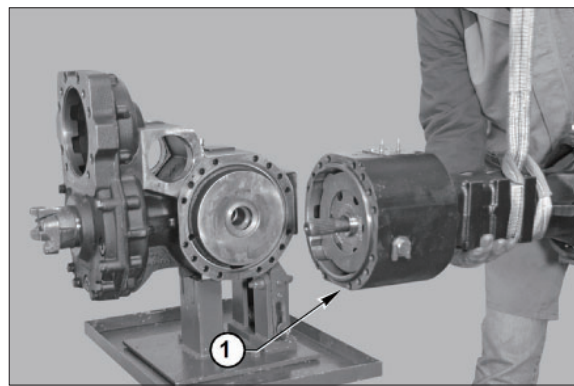
Manually move the crown in both directions to check the existing clearance between pinion and crown.

- Gap = $0.13 \sim 0.20 \text{ mm}$

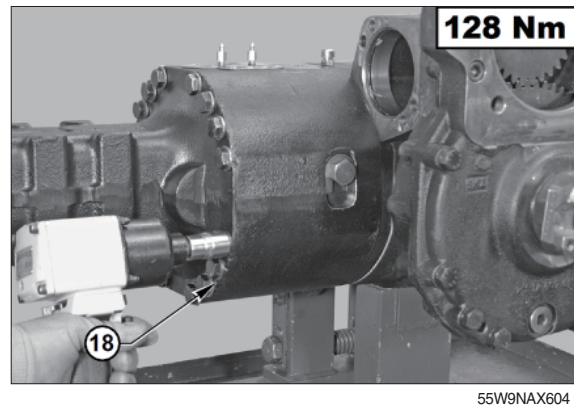


- ⑨ Install the crown wheel side arm (1) without half-axle.

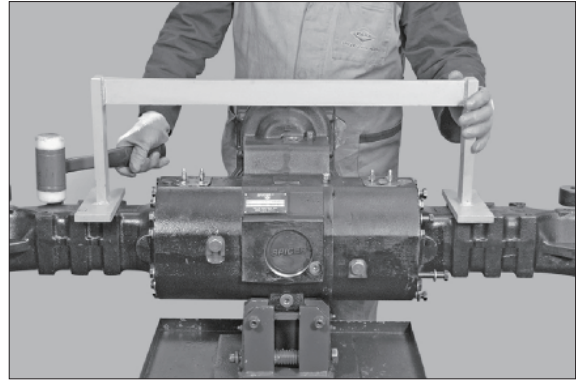
- ※ To check the torque of the differential, neither of both halfaxles must be installed.



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

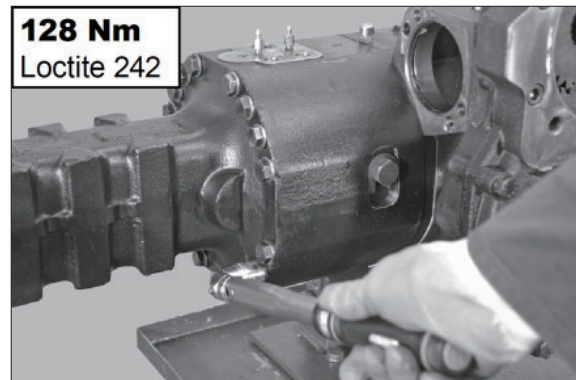


- ⑪ Check the flatness of the arms; then lock the arms into their final position, using screws adequately coated with loctite 242.



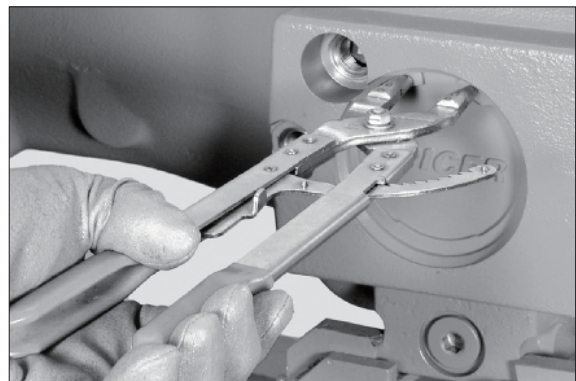
55W9NAX605

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



55W9NAX606

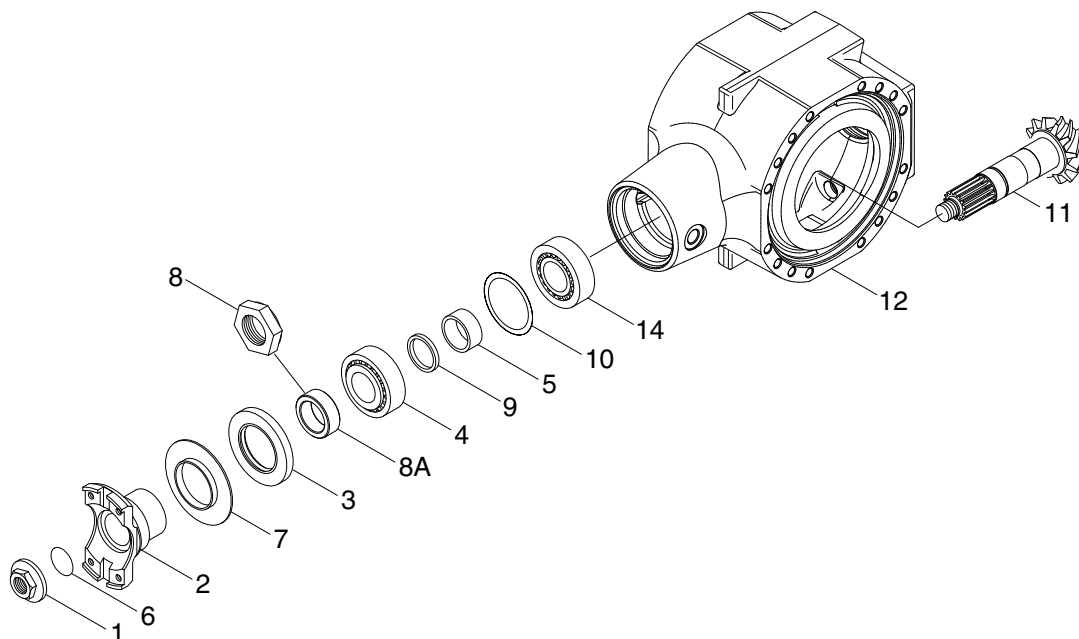
- ⑬ Using a driver, fit the cap and position it in its seat with the snap ring.



55W9NAX607

5) BEVEL PINION

(1) Assembly diagram

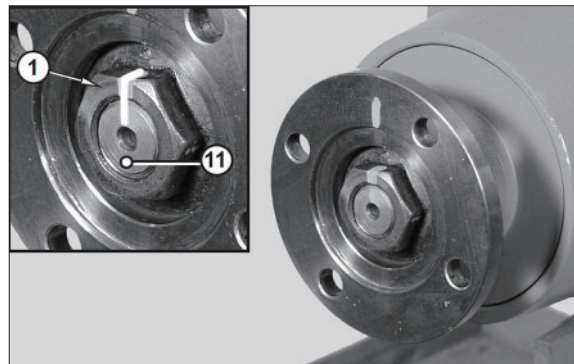


55W9NAX637

(2) Disassembly

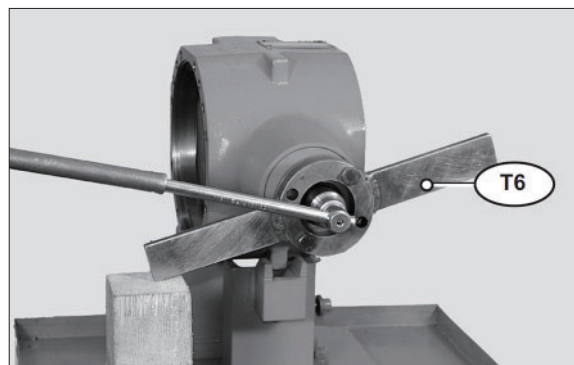
- ① Make positional marks across nut (1) and pinion (11) tang; If disassembly is awkward, heat the check nut (1) of the flange (2) at 80°C.

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



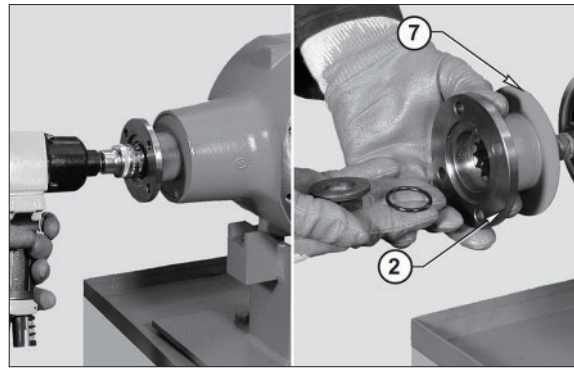
55W9NAX638

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



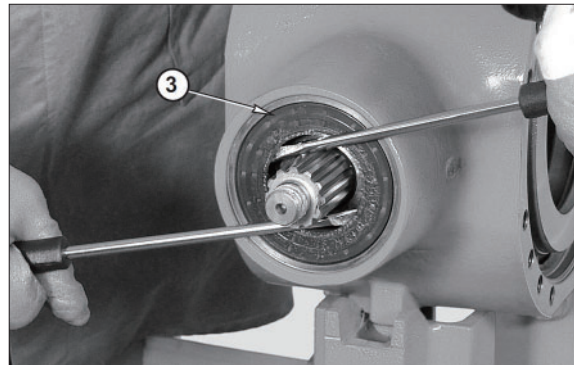
55W9NAX639

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



55W9NAX640

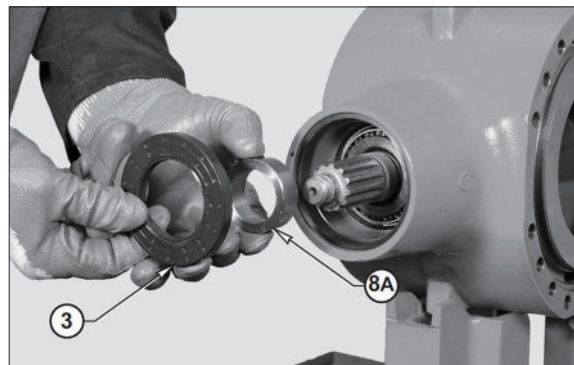
- ④ Remove the sealing ring (3).



55W9NAX641

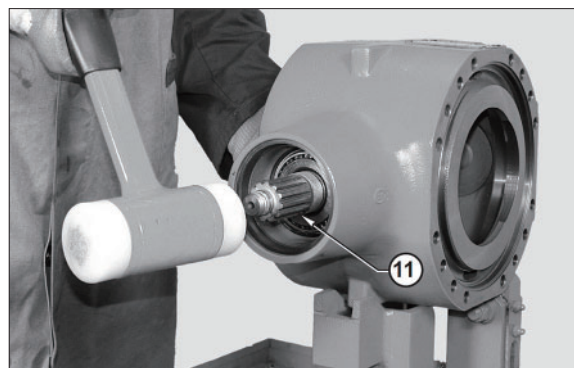
- ⑤ Remove the sealing ring (3) and spacer (8A).

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



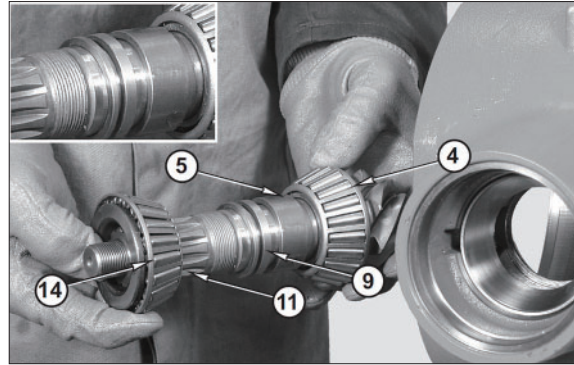
55W9NAX642

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



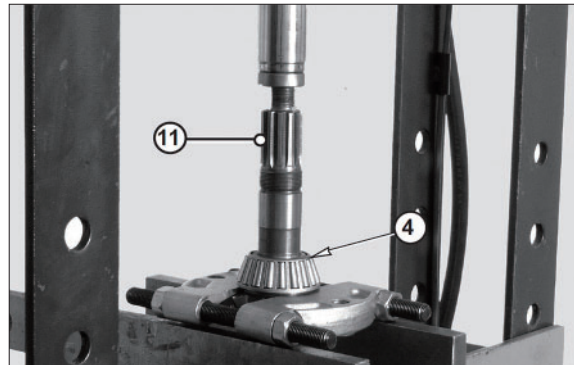
55W9NAX643

- ⑦ Refer and keep to the positions marked during disassembly.



55W9NAX644

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



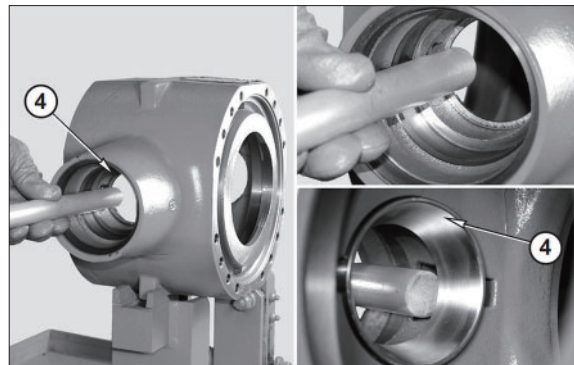
55W9NAX645

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



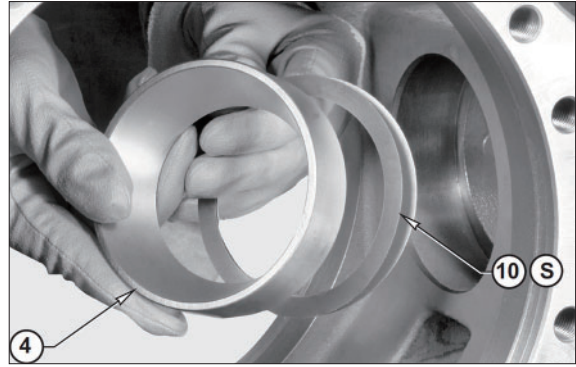
55W9NAX646

- ⑩ Insert a drift in the appropriate holes.



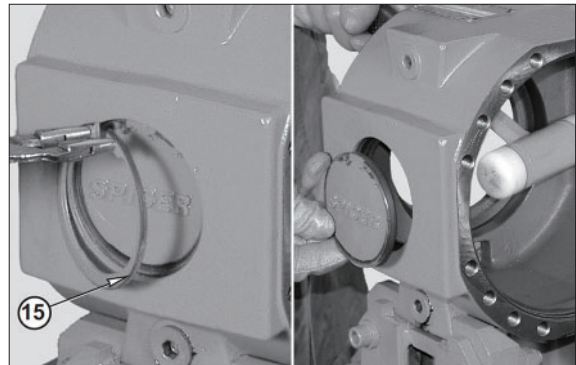
55W9NAX647

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



55W9NAX648

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

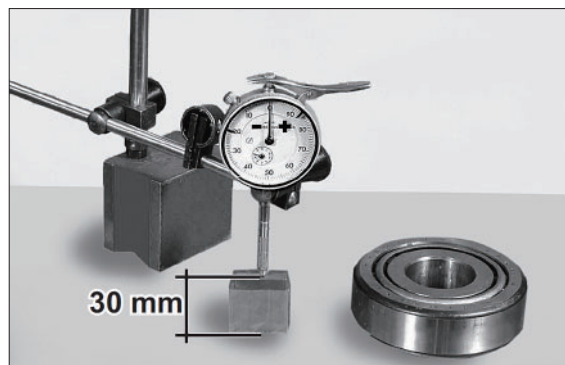


55W9NAX649

(3) Assembly

① Calculating pinion center distance

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

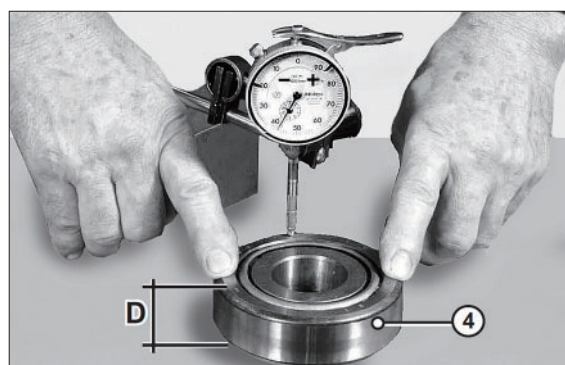


55W9NAX650

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.

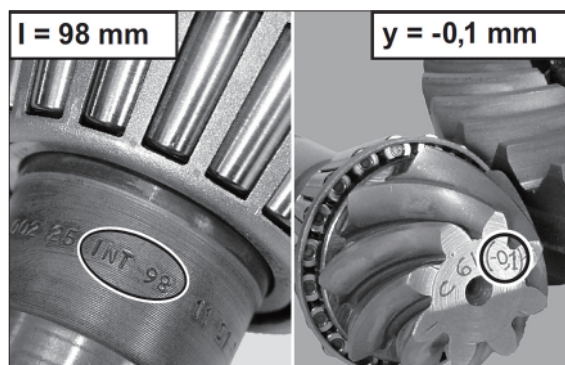
· Example : $30 - 0.55 = 29.45 = "D"$



55W9NAX651

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

· Example : $l = INT \pm Y = 98 - 0.1 = 97.9 \text{ mm}$



55W9NAX652

④ Calculate shims “S” for insertion under the thrust block of the inner bearing using the following formula :

$S = X - (l + D)$ where :

X = Fixed dimension
l = actual pinion center distance

D = Total bearing thickness ;

Example :

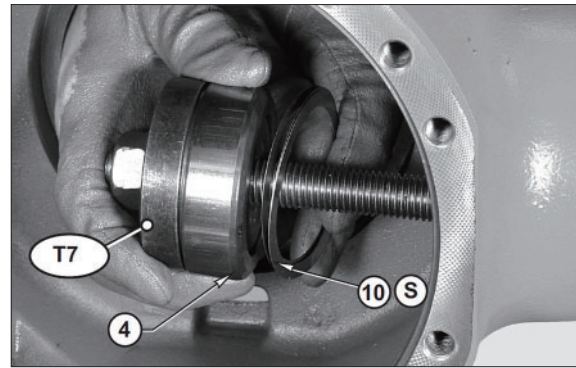
$S = 128 - (97.9 + 29.45) = 0.65 \text{ mm}$



55W9NAX653

⑤ Using special tool T7.

Partially insert the thrust block of the bearings (4) and shims (10).

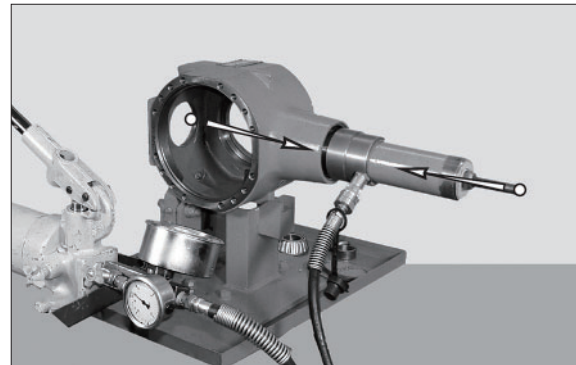


55W9NAX654

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.

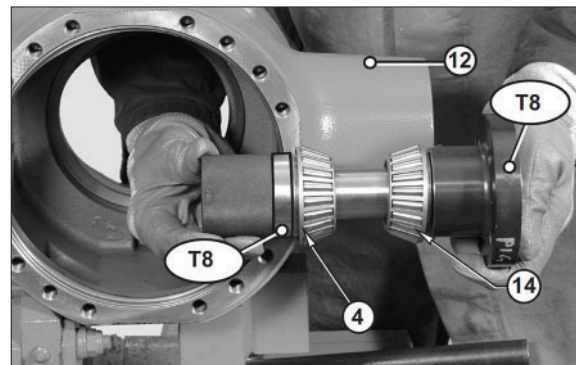
※ Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.



55W9NAX655

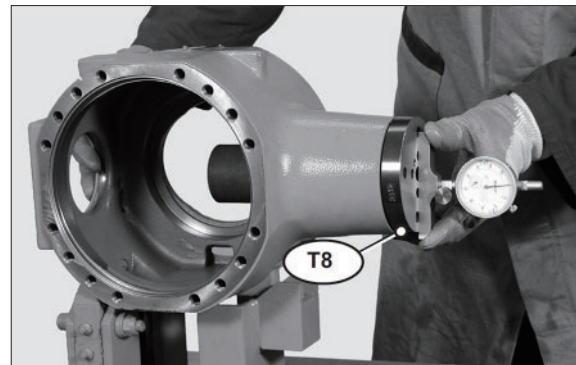
⑦ **Calculating pinion bearings rolling torque**

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



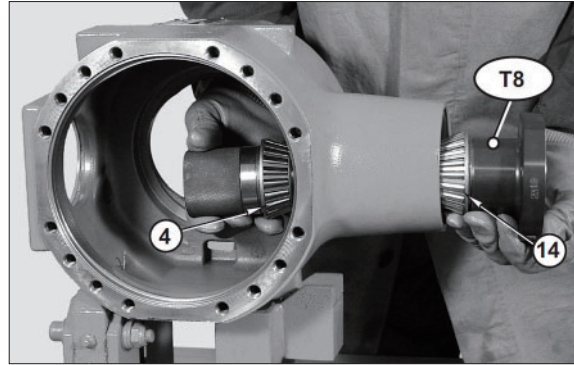
55W9NAX656

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.



55W9NAX657

- 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.



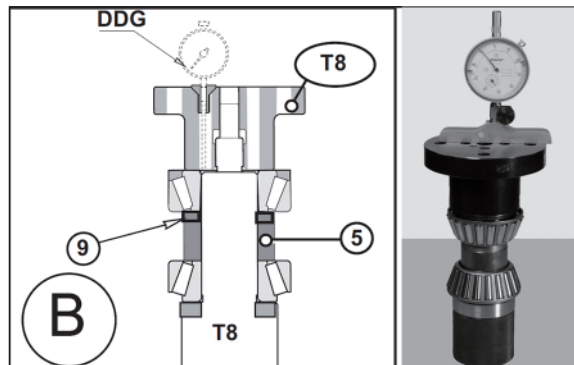
55W9NAX658

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



55W9NAX659

- ⑪ Measur the difference H using a dial gauge DDG.



55W9NAX660

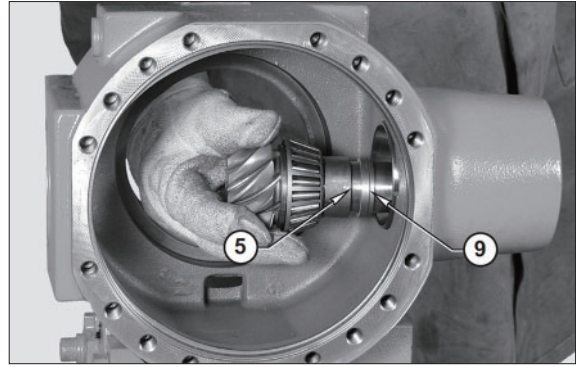
- ⑫ Calculate the shim S2 to be inserted.
E.g. $S2 = H + X = 3.01 \text{ mm}$ where $X =$
fixed value to obtain $= 0.07 \sim 0.08 \text{ mm}$



55W9NAX661

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

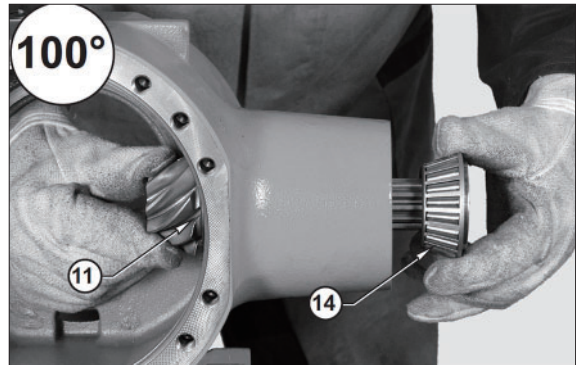
※ The finer shims must be placed in-between the thicker ones.



55W9NAX662

- 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.

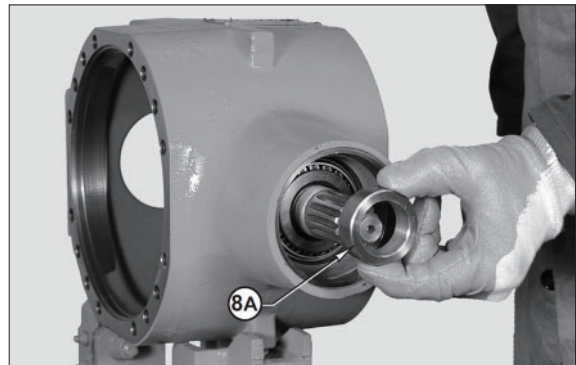
※ Lightly lubricate bearing with SAE85W90 oil.



55W9NAX663

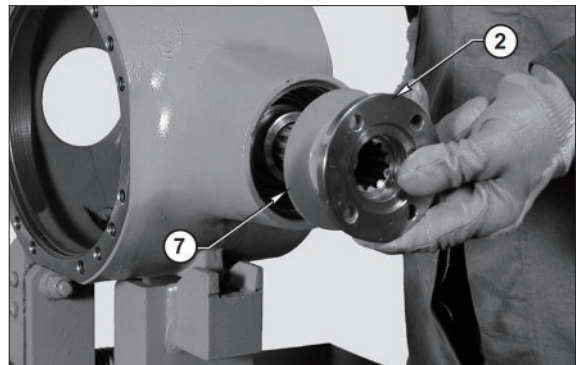
- ⑮ Insert the spacer (8A).

※ Check the using of the friction washers.



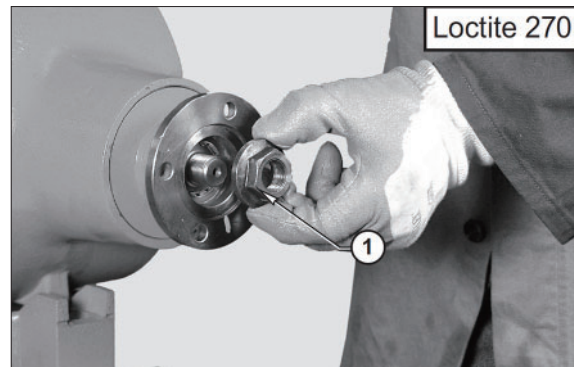
55W9NAX664

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



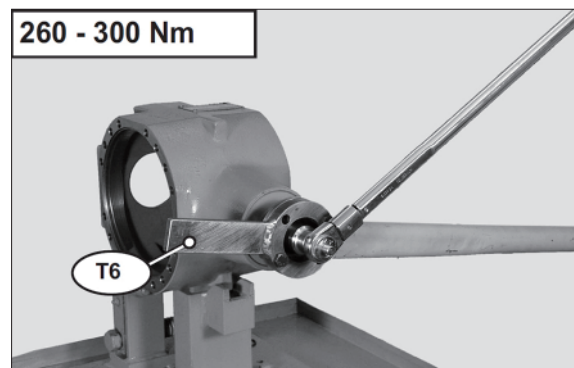
55W9NAX665

- ⑰ Install the nut (1) without loctite 270.



55W9NAX666

- 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).

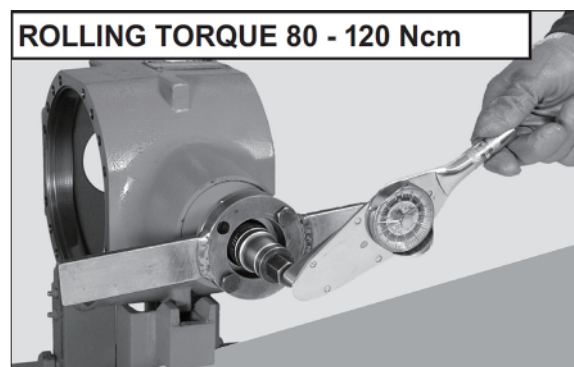


55W9NAX667

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

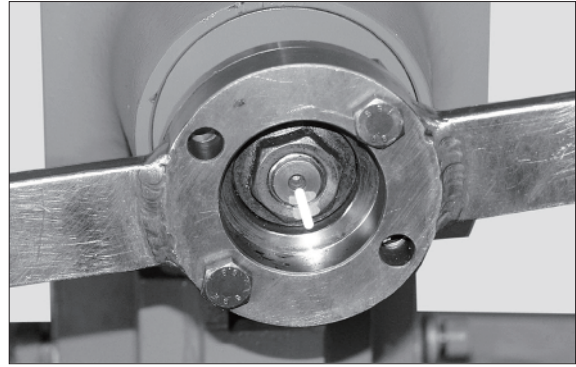
• Torque : 0.08~0.12 kgf · m
(0.58~0.87 lbf · ft)

- ※ 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).



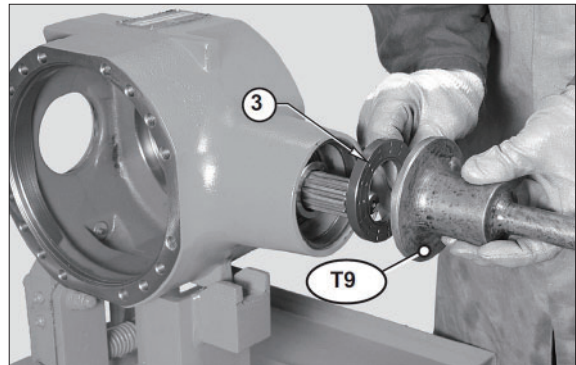
55W9NAX668

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



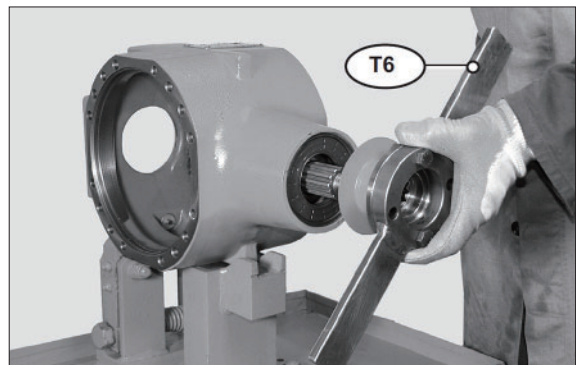
55W9NAX669

- ② 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.



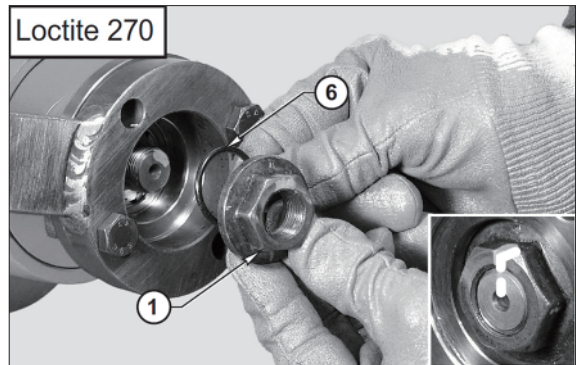
55W9NAX670

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



55W9NAX671

- ② Tighten the nut until the match marks made at stage "a" line up.

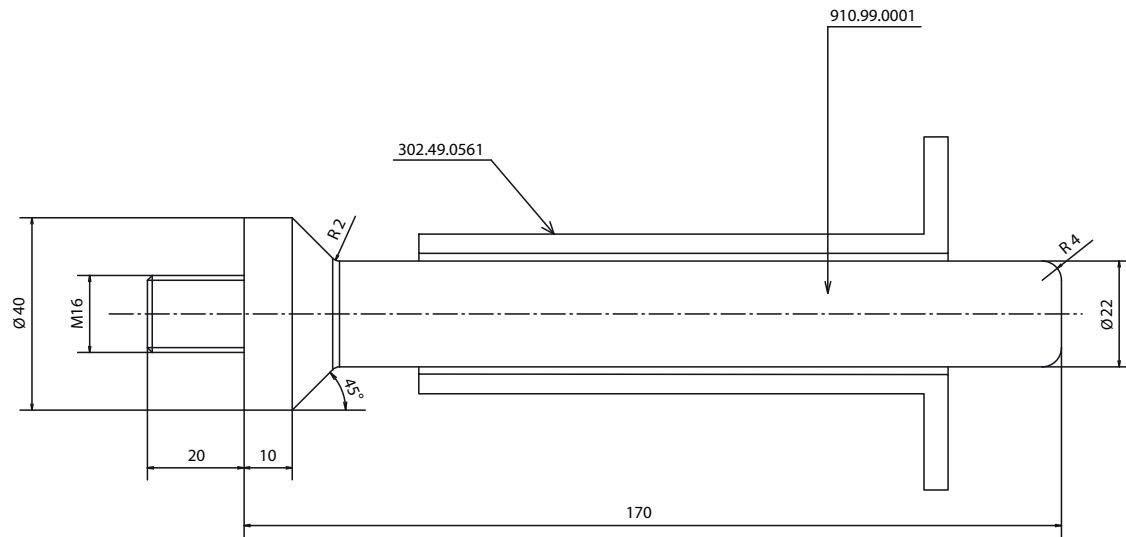


55W9NAX672

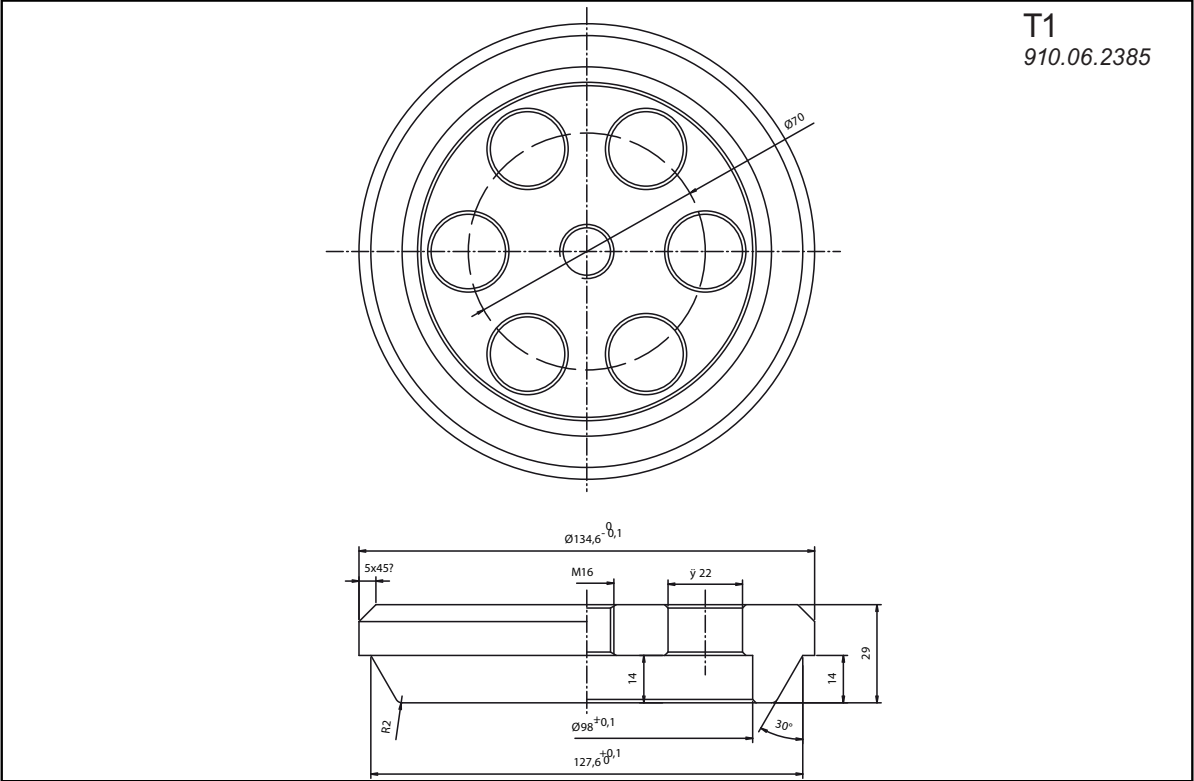
6) SPECIAL TOOLS

T0

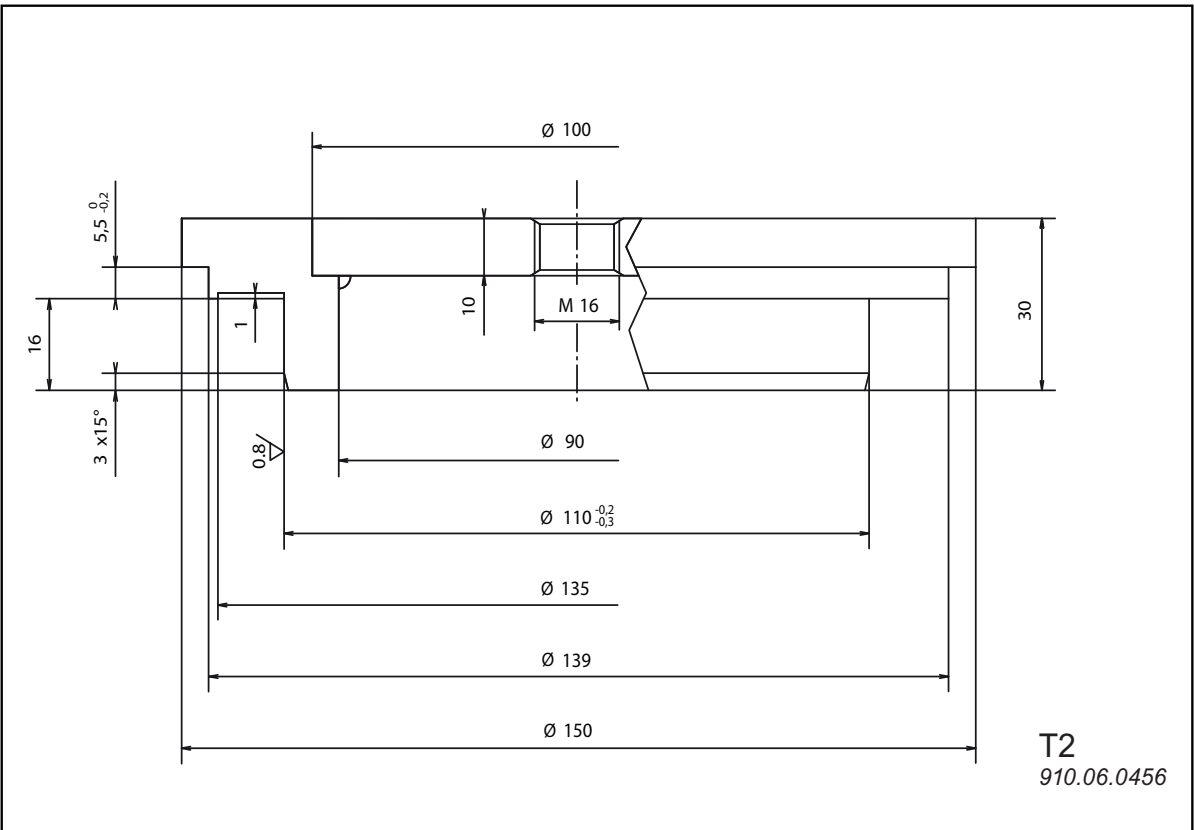
910.99.0001



55W9NAX673



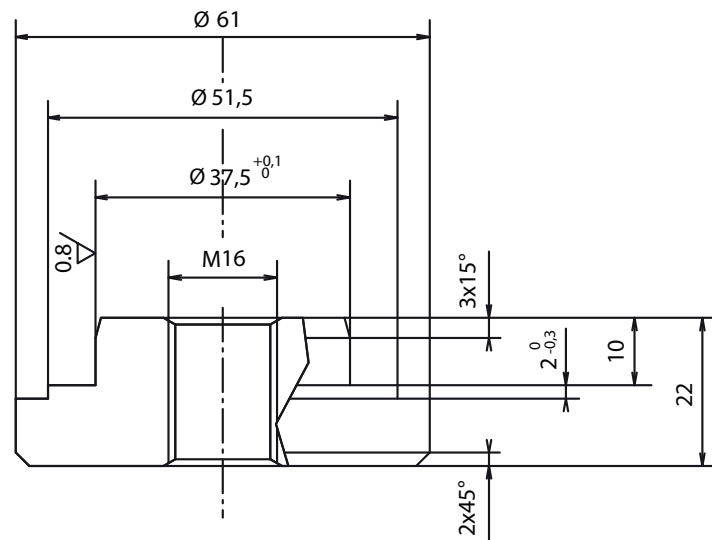
55W9NAX674-1



55W9NAX674-2

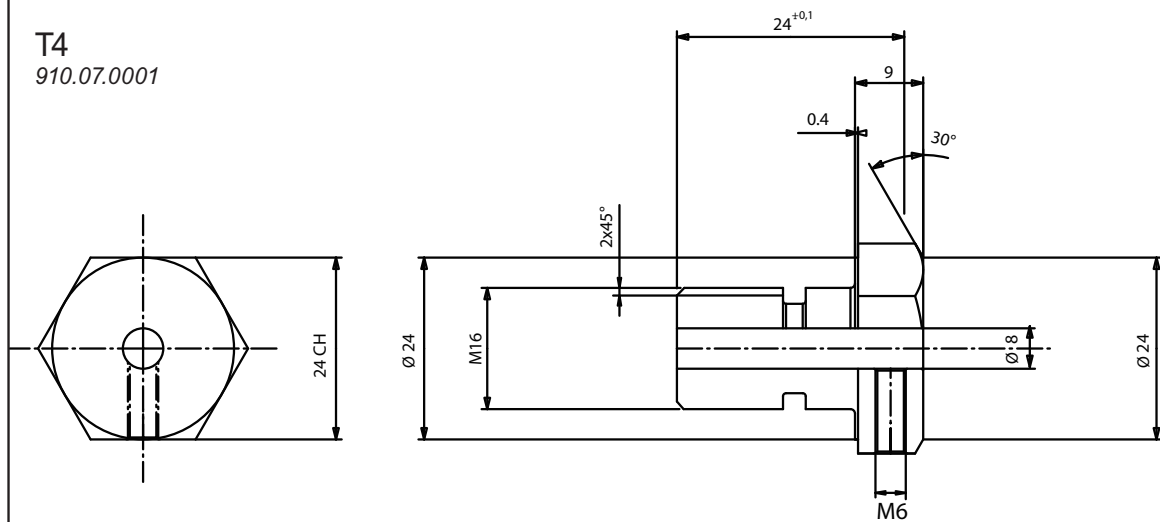
T3

910.06.4088



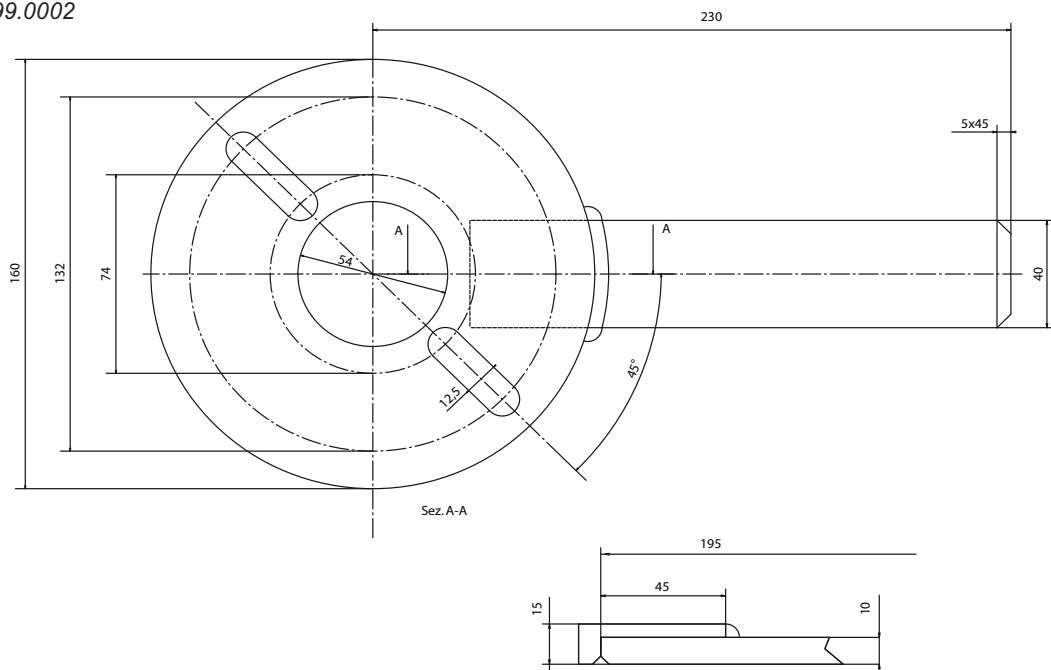
T4

910.07.0001

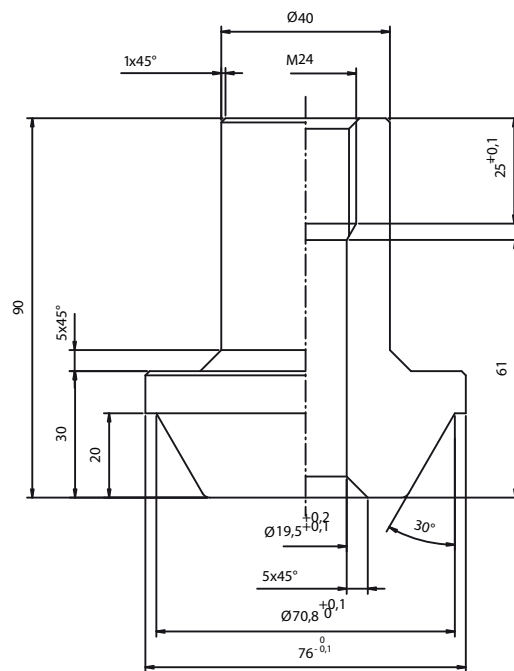


55W9NAX675

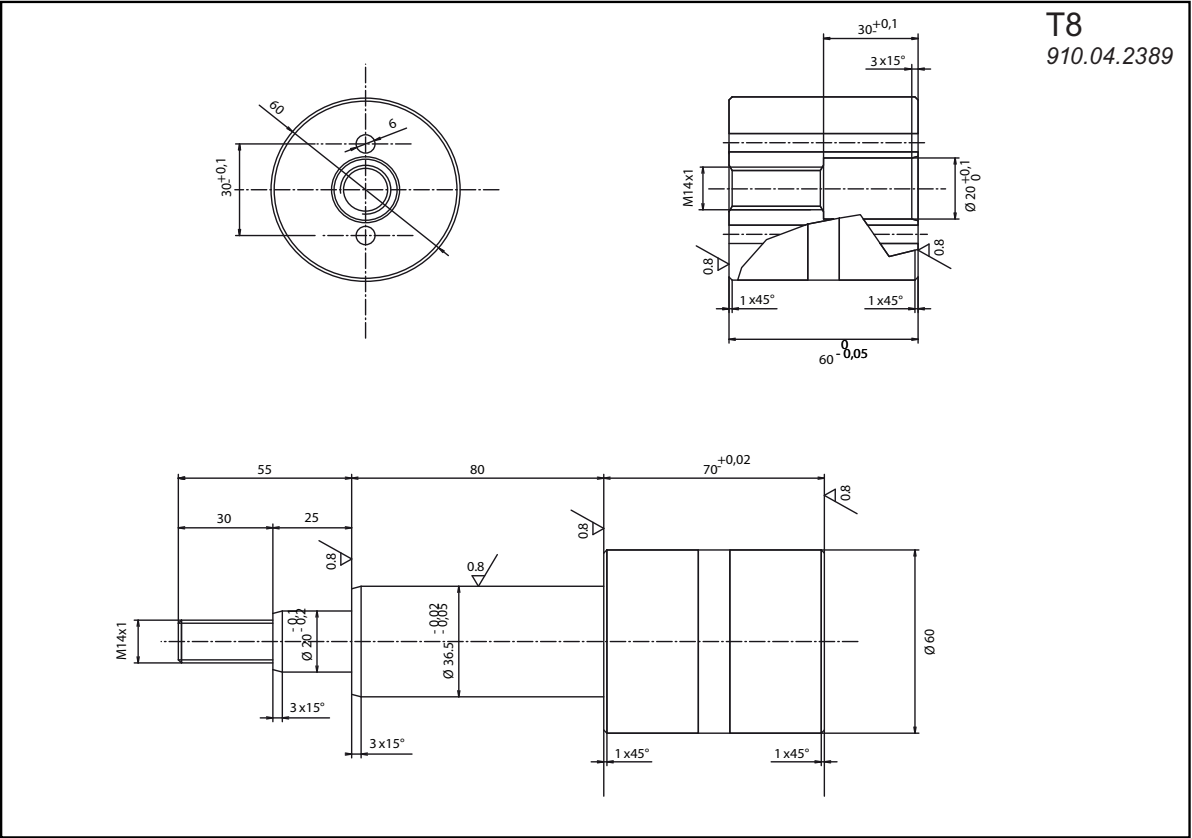
T6
910.99.0002



T7
910.06.4069



55W9NAX676



55W9NAX677

T9
910.04.4214

Technical drawing of a mechanical assembly (T9) showing a cross-section and two side views. The cross-section shows a central shaft with a diameter of $\varnothing 34,8^{+0,1}_0$, surrounded by a housing with a bore of $\varnothing 54,5^{+0,2}_{+0,1}$. The housing has an outer diameter of $\varnothing 90^{-0,2}_{-0,3}$. The shaft has a length of $69,5^{+0,1}$. The housing has a total length of $101^{\pm 0,1}$. The shaft has a diameter of $\varnothing 101^{\pm 0,1}$. The housing has a bore of $\varnothing 90^{+0,1}_0$. The shaft has a diameter of $\varnothing 116$. The housing has a bore of $\varnothing 90^{+0,1}_0$. The shaft has a diameter of $\varnothing 101^{\pm 0,1}$. The housing has a bore of $\varnothing 90^{+0,1}_0$. The shaft has a diameter of $\varnothing 116$. The housing has a bore of $\varnothing 90^{+0,1}_0$.

7-300

GROUP 10 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

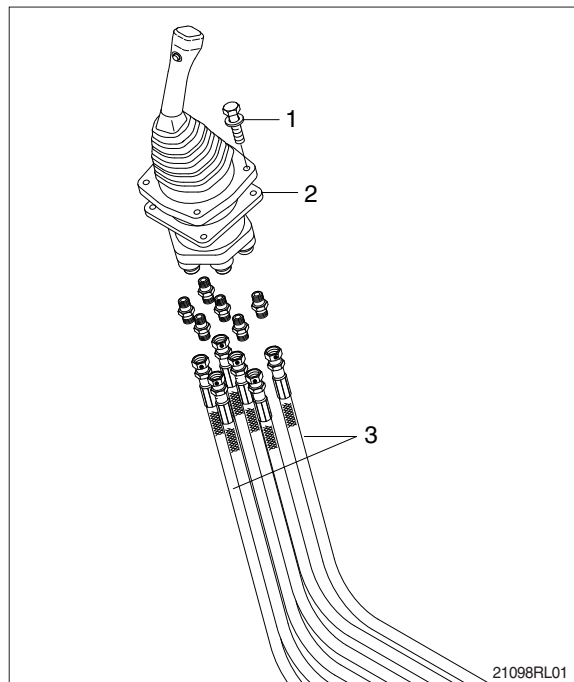
- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

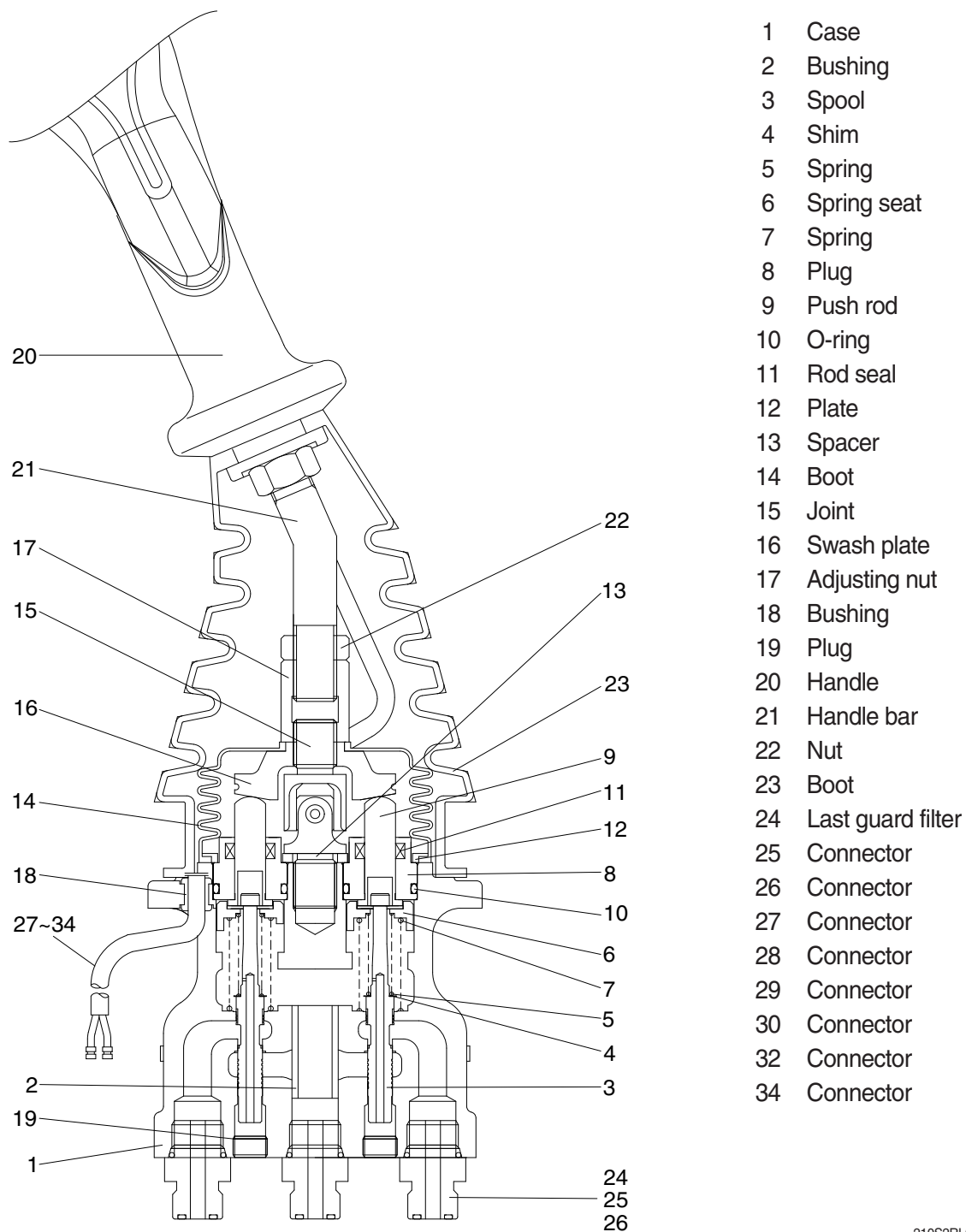
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

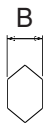
1) STRUCTURE



210S2RL06AK

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

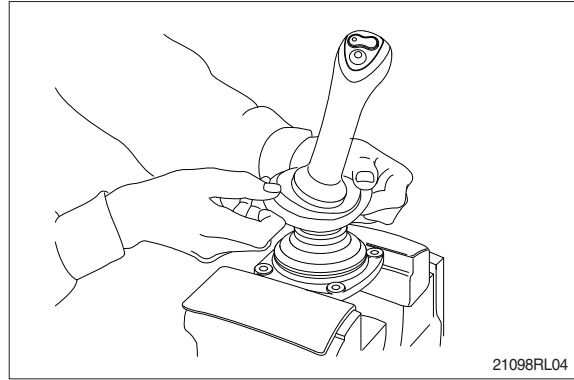
Tool name	Remark	
Allen wrench	6	
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

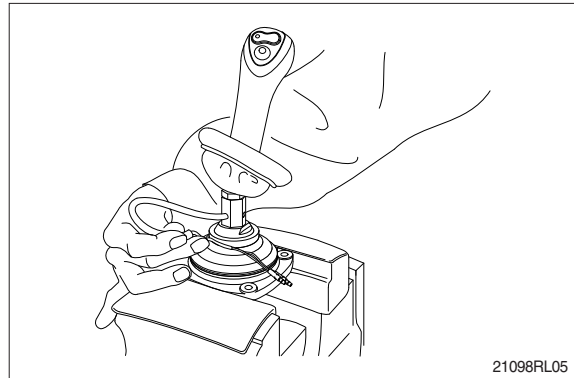
Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.5	25.3
Swash plate	16	M14	7.0±0.40	51.8±2.9
Adjusting nut	17	M14	7.0±0.40	51.8±2.9
Lock nut	22	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

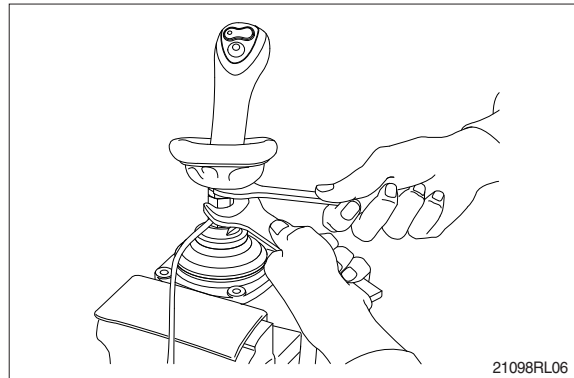
- (1) Clean pilot valve with kerosene.
 - ※ Put blind plugs into all ports
- (2) Fix pilot valve in a vise with copper (or lead) sheets.
- (3) Remove end of boot (23) from case (1) and take it out upwards.



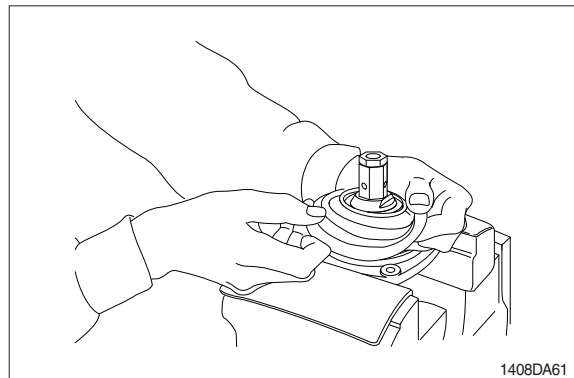
- ※ For valve with switch, remove cord also through hole of casing.



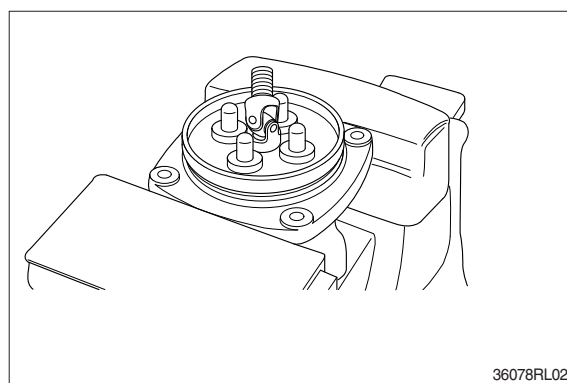
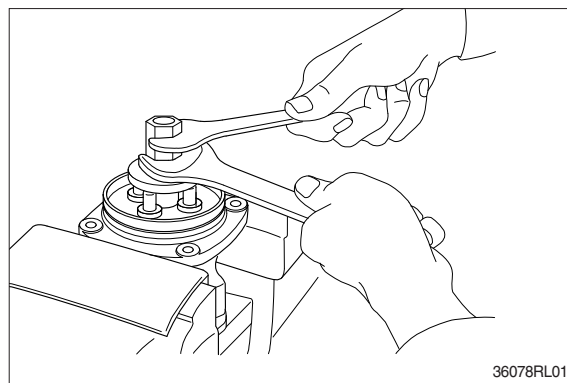
- (4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



- (5) Remove the boot (14).

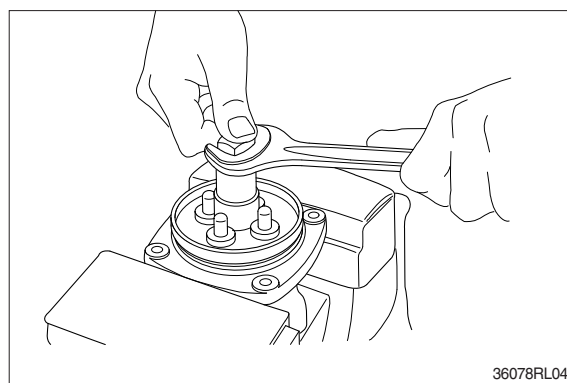
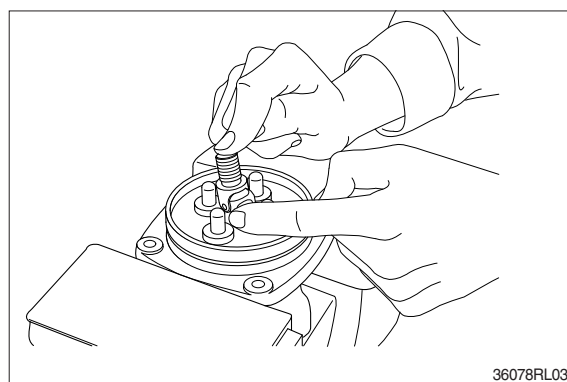


- (6) Loosen adjusting nut (17) and plate (16) with spanners on them respectively, and remove them.

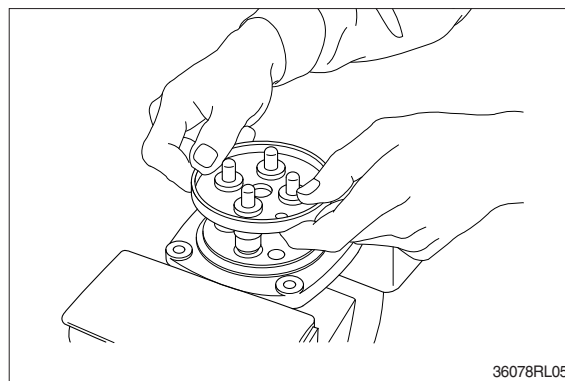


- (7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

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



(8) Remove plate (12).



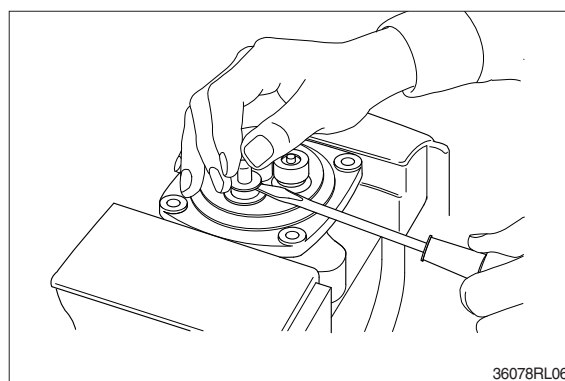
(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

※ Take it out with minus screwdriver.

Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

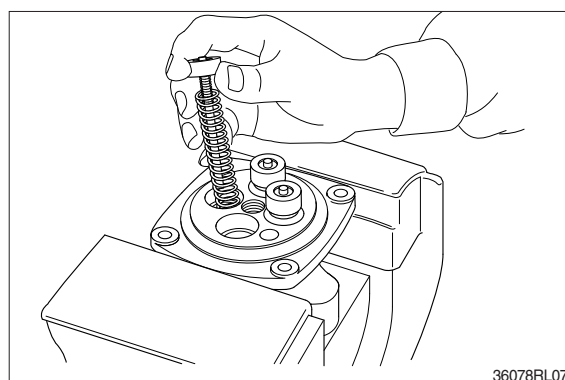
※ During taking out, plug may jump up due to return spring (7) force.

Pay attention to this.



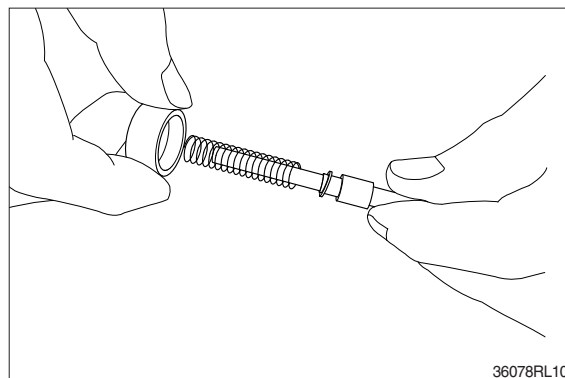
(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs (7).

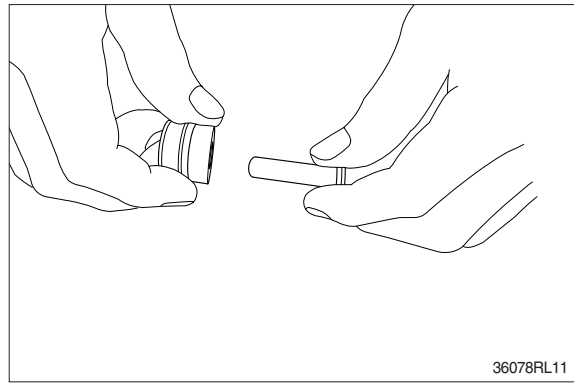


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

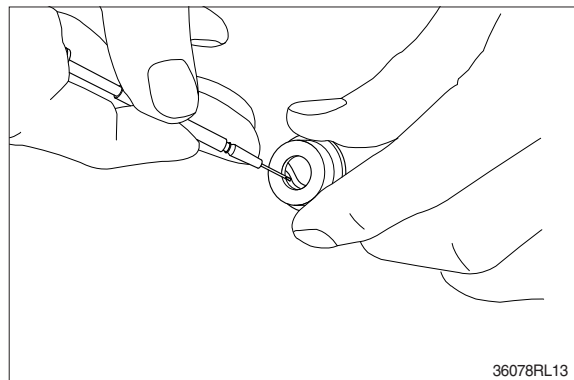
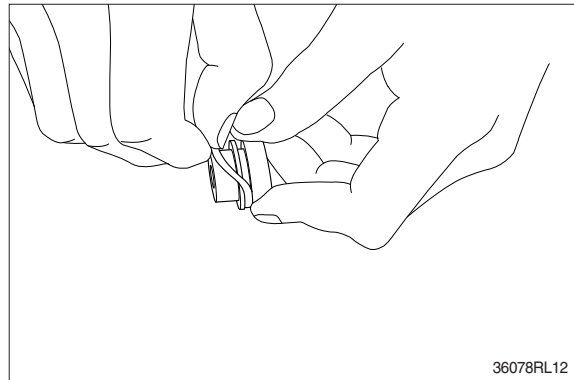
※ Until being assembled, they should be handled as one subassembly group.



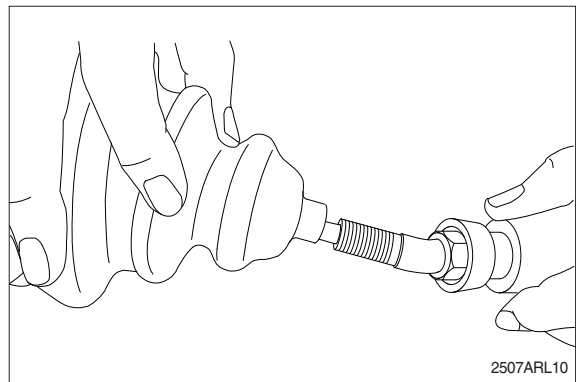
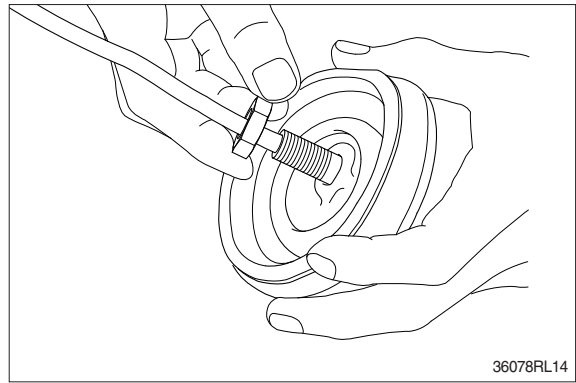
(12) Take push rod (8) out of plug (9).



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



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



(15) Cleaning of parts

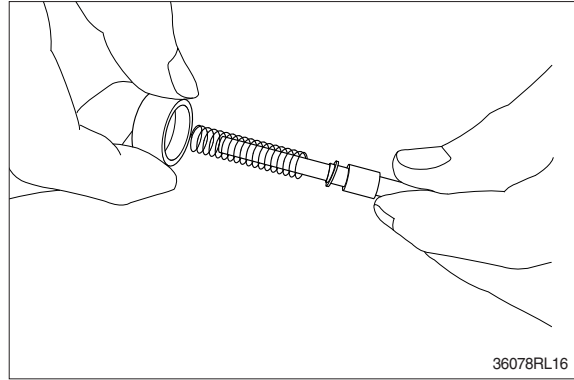
- ① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).
 - ※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.
 - ※ If this kerosene is polluted, parts will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

(16) Rust prevention of parts.

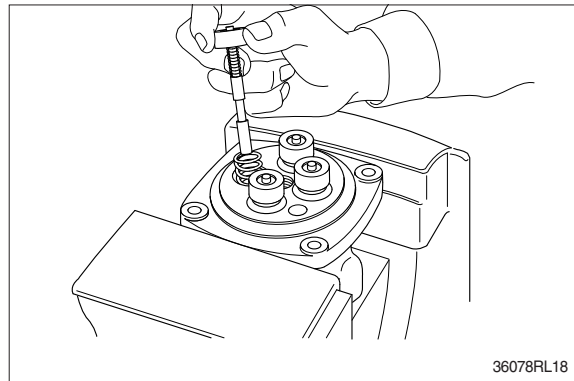
- Apply rust-preventives to all parts.
- ※ If left as they are after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

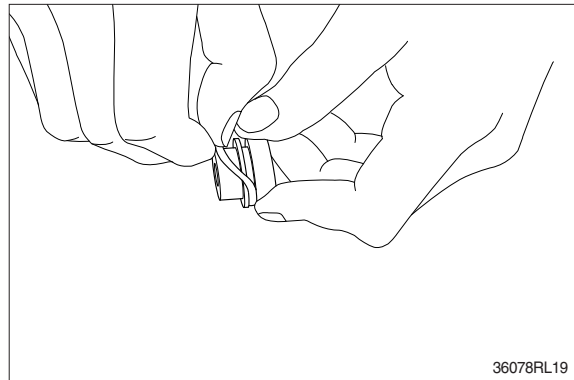
- (1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



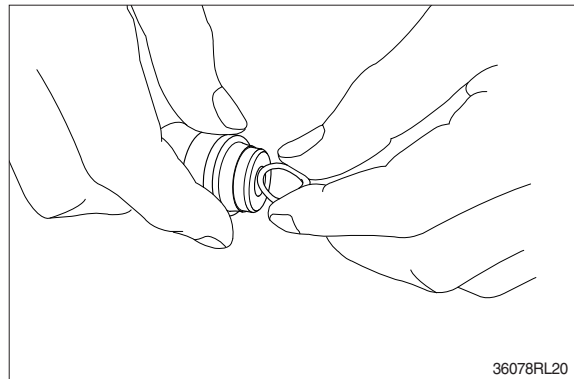
- (2) Assemble spring (7) into casing (1).
Assemble reducing valve subassembly into casing.
※ Assemble them to their original positions.



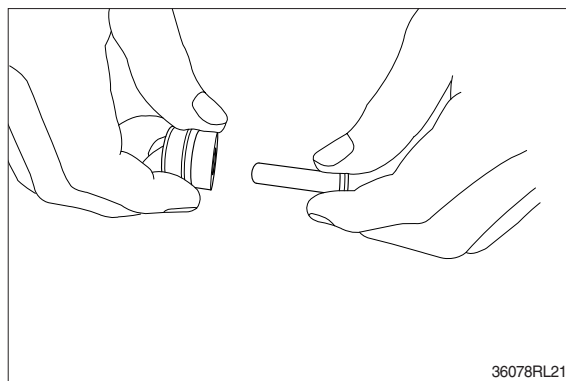
- (3) Assemble O-ring (8) onto plug (10).



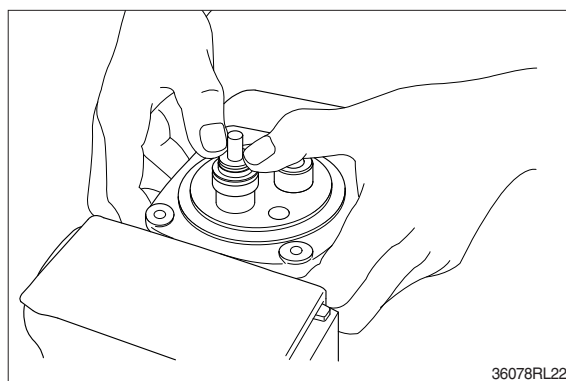
- (4) Assemble seal (11) to plug (8).
※ Assemble seal in such lip direction as shown below.



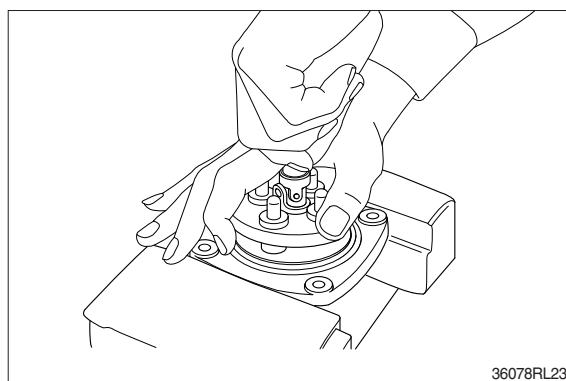
- (5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.



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

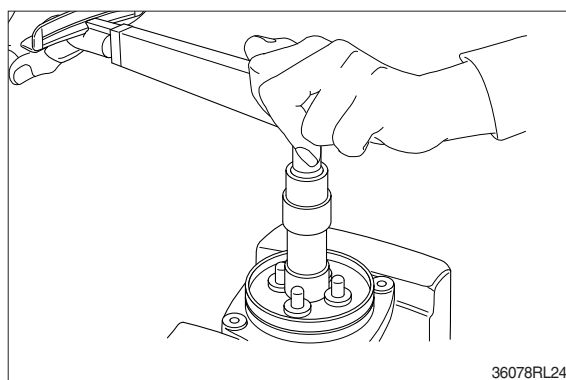


- (7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



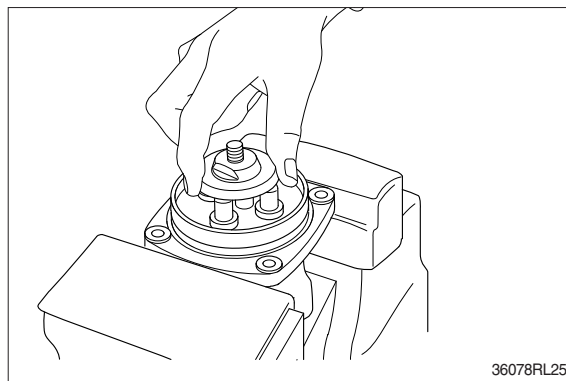
- (8) Fit plate (12).

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



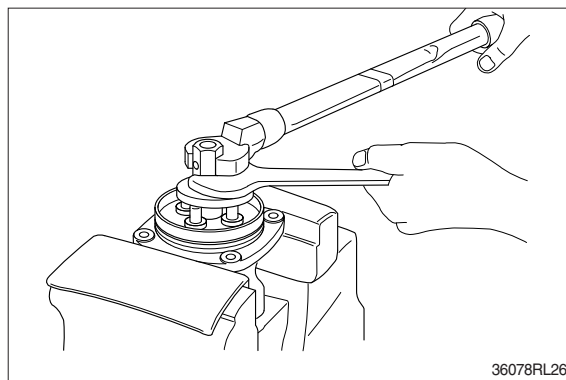
(10) Assemble plate (16) to joint (15).

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

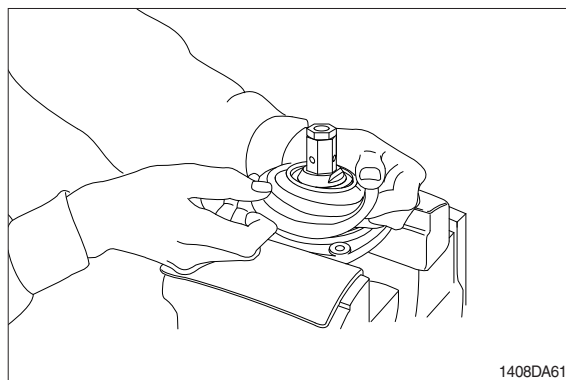


(11) Assemble adjusting nut (17), apply spanner to width across flat of swash plate (16) to fix it, and tighten adjusting nut to the specified torque.

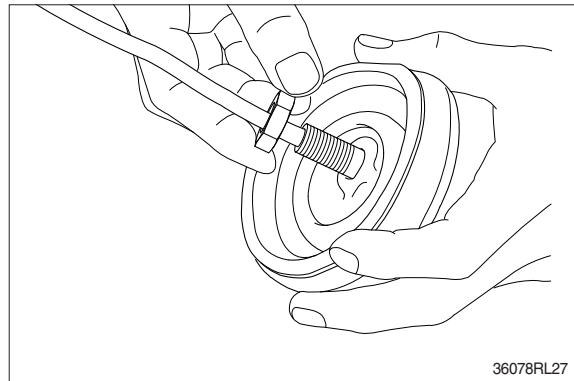
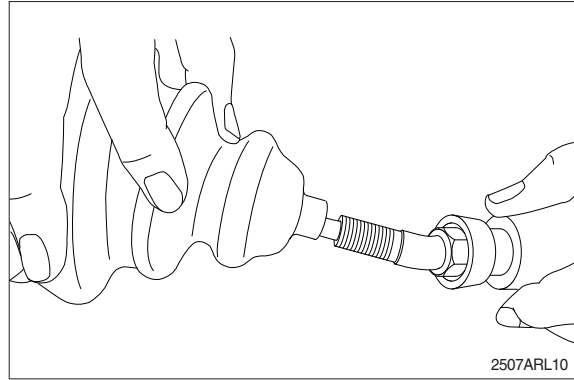
- ※ During tightening, do not change position of disk.



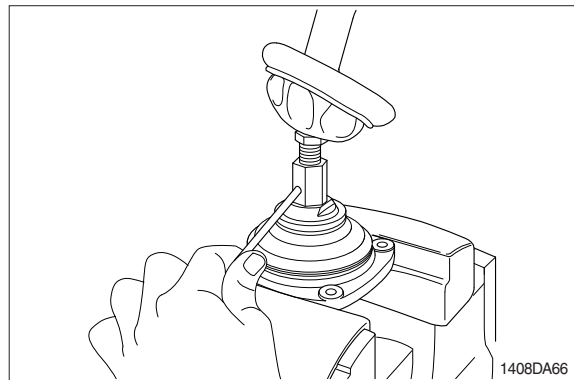
(12) Fit boot (14) to plate.



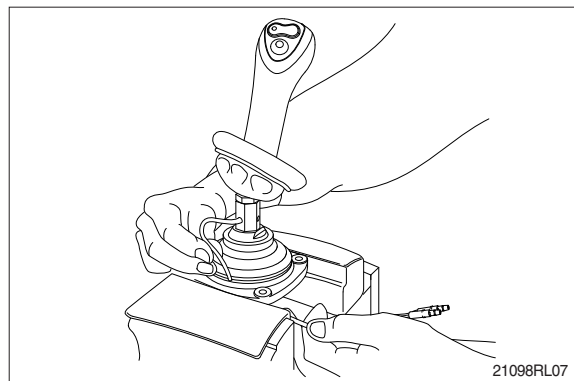
- (13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



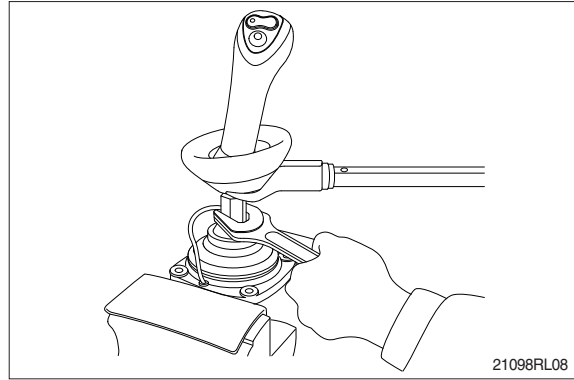
- (14) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



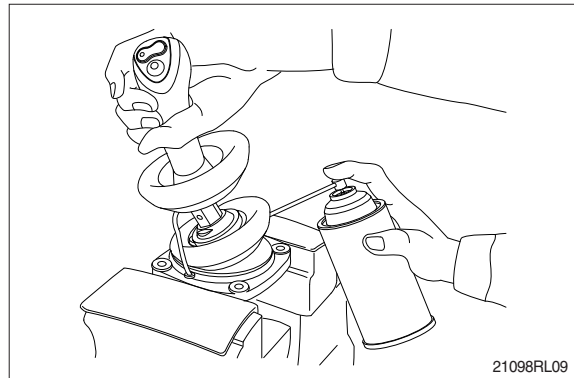
- (15) Assemble bushing (18) to plate and pass cord and tube through it.
※ Provide margin necessary to operation.



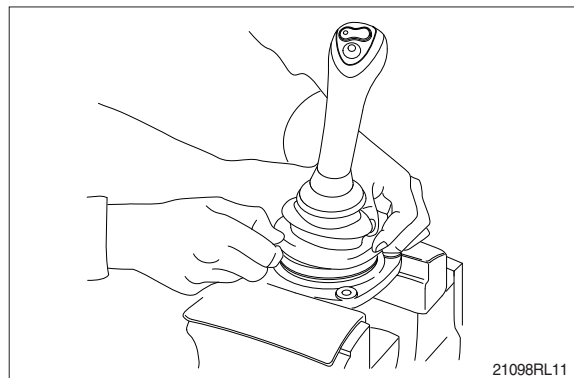
- (16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



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



- (18) Assemble lower end of bellows to casing.
(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 11 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.

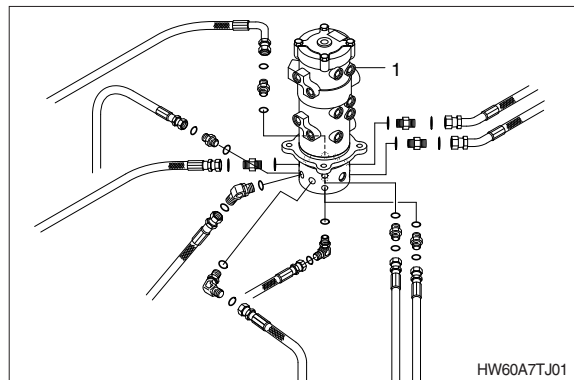
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

※ 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 : $14.7 \pm 2.2 \text{ kgf} \cdot \text{m}$
($106 \pm 15.9 \text{ lbf} \cdot \text{ft}$)

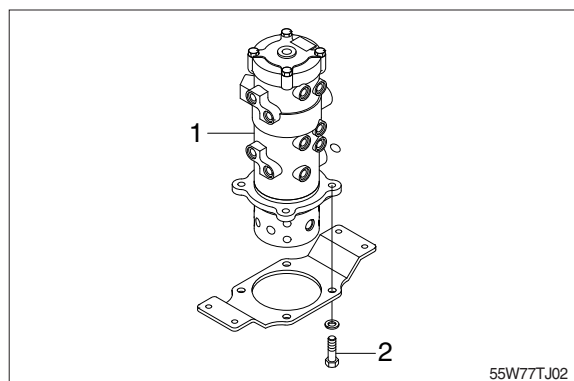
- (6) Remove the turning joint assembly.

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



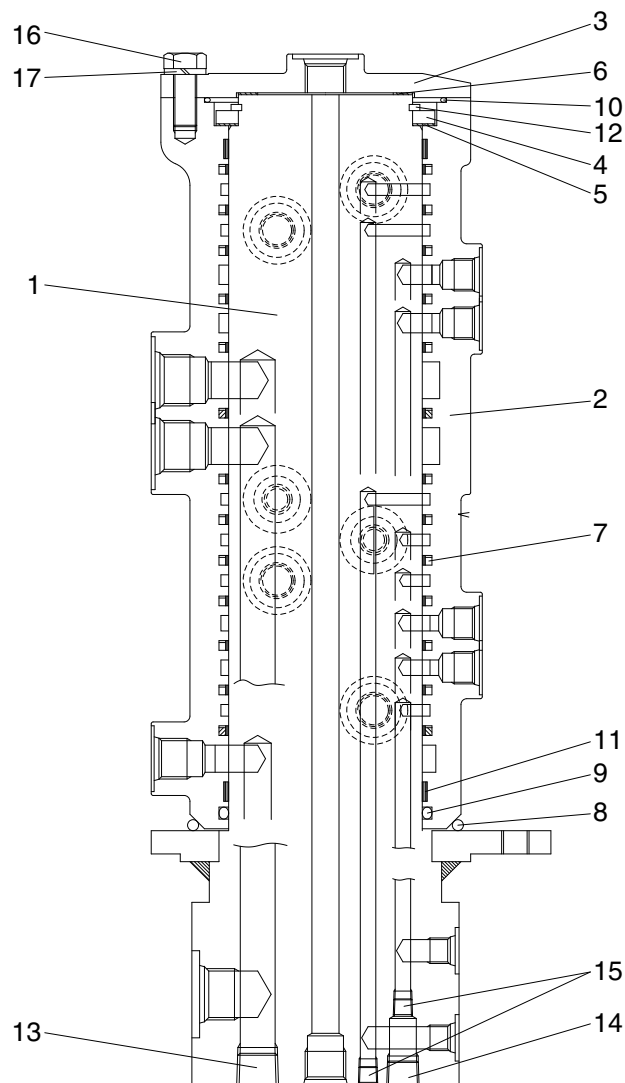
2) INSTALL

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



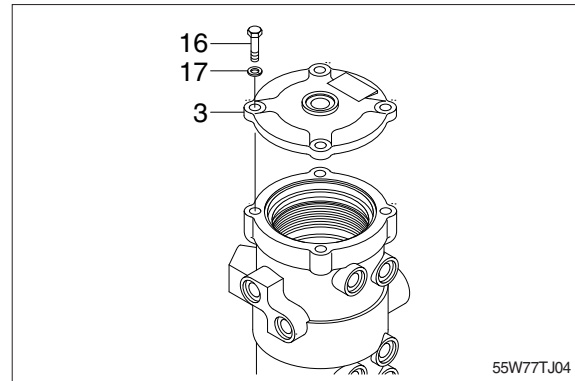
HW60A7TJ03

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

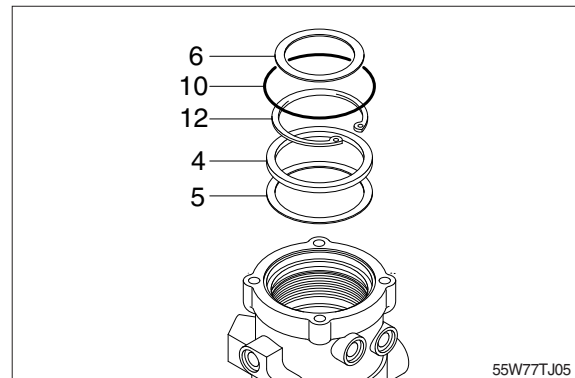
※ Before the disassembly, clean the turning joint.

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



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

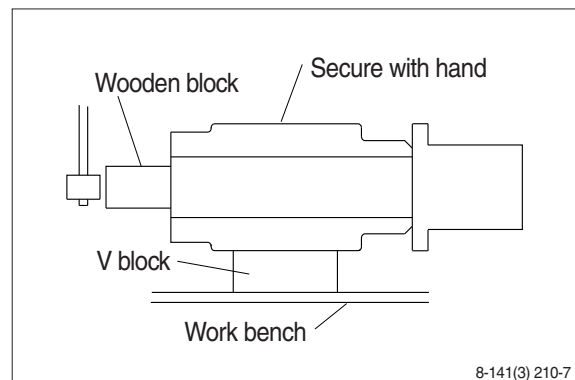
- (3) Remove retainer ring (12), spacer (4) and shim (5).



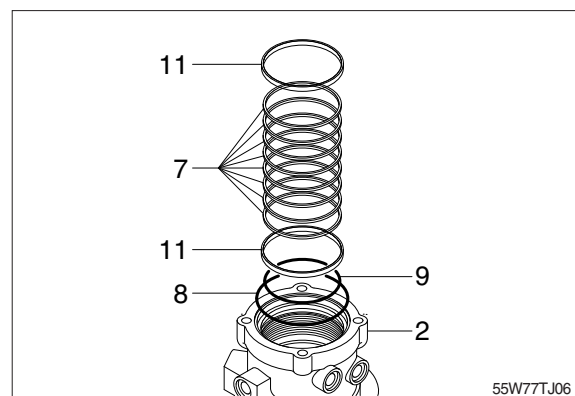
- (4) Place hub (2) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

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

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



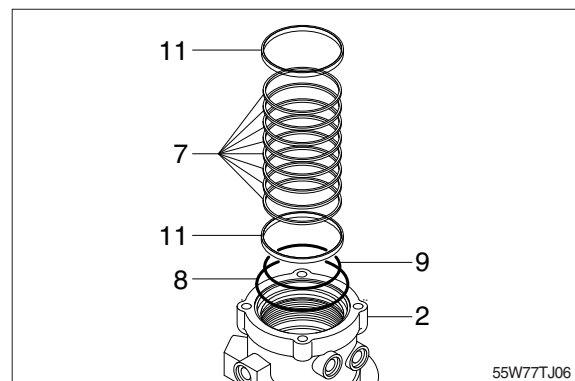
- (5) Remove wear rings (11), thirteen slipper seals (7) and O-rings (8, 9) from hub (2).



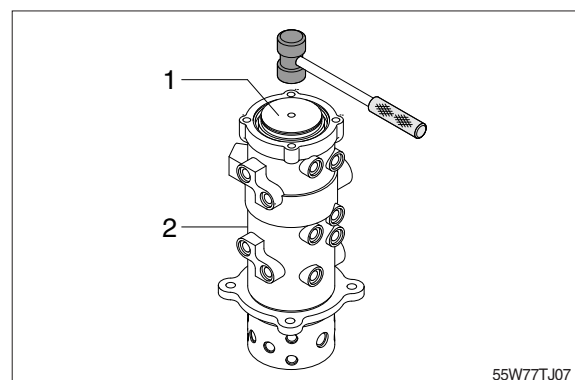
3) ASSEMBLY

- ※ 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).

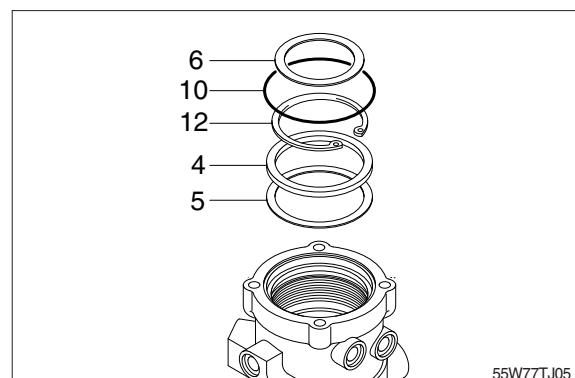


- (2) Set shaft (1) on block, tap hub (2) with a plastic hammer to install.

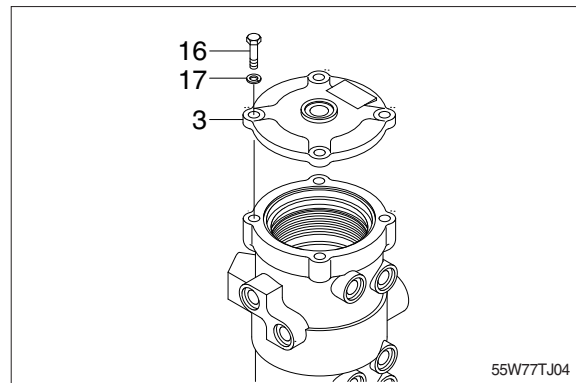


- (3) Fit shim (5), spacer (4) and retainer ring (12) to shaft (11).

- (4) Fit O-ring (7) to hub (2).



- (5) Install cover (3) to hub (2) and tighten bolts (16) with washer (13).



GROUP 12 BOOM, ARM AND BUCKET CYLINDERS

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

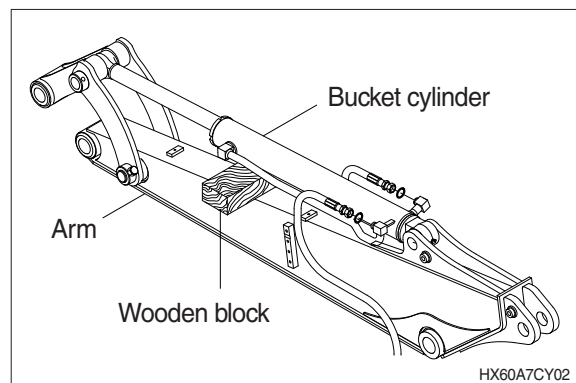
(1) Removal

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

▲ Loosen the breather slowly to release the pressure inside the hydraulic tank. Escaping fluid under pressure can penetrate the skin causing serious injury.

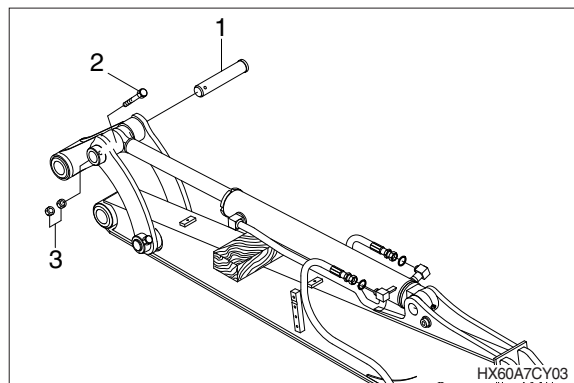
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

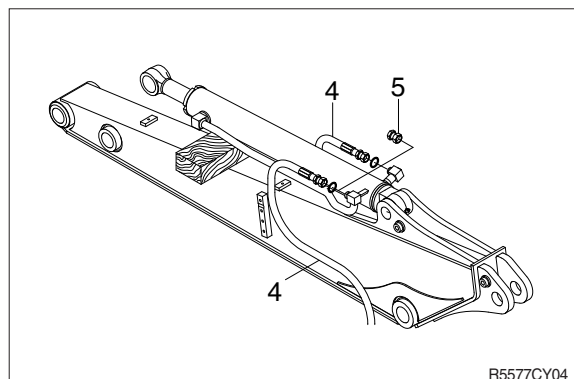


② Remove bolt (2), nut (3) and pull out pin (1).

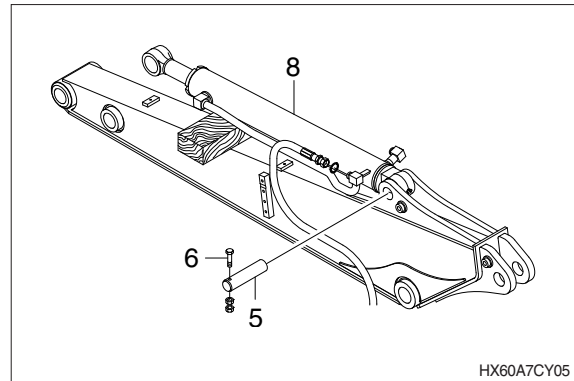
- ※ Tie the rod with wire to prevent it from coming out.



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



- ④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
- ⑤ Remove bucket cylinder assembly (8).
 - Weight : 34 kg (75 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

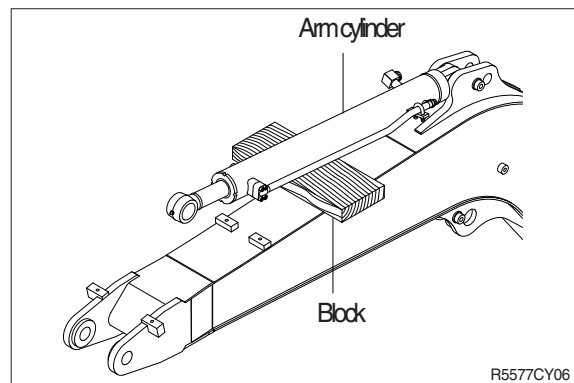
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

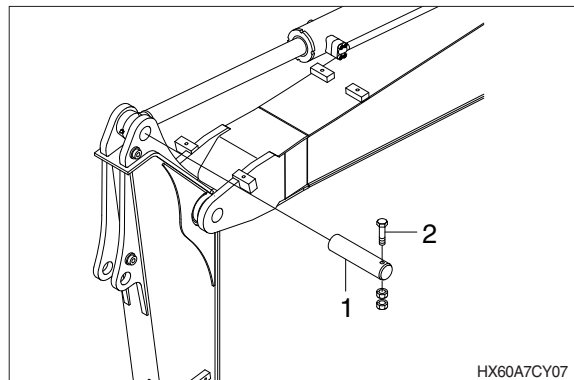
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



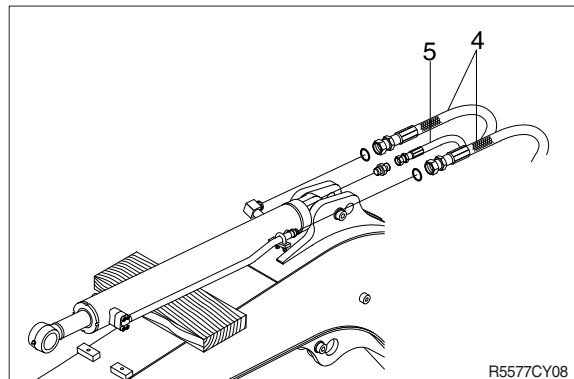
② Remove bolt (2) and pull out pin (1).

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

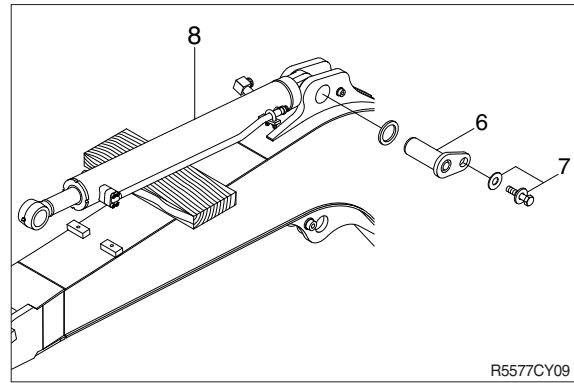


③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

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 : 56 kg (153 lb)



(2) Install

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

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

- ※ Bleed the air from the arm cylinder.
- ※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

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

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

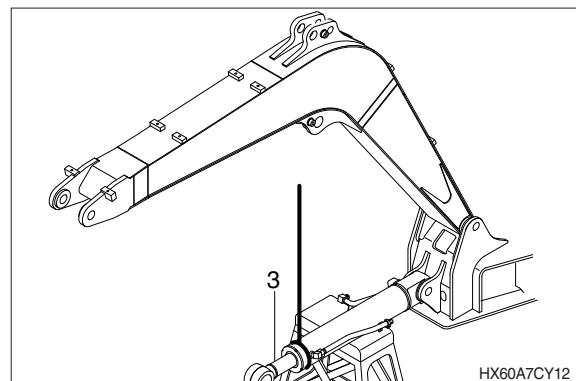
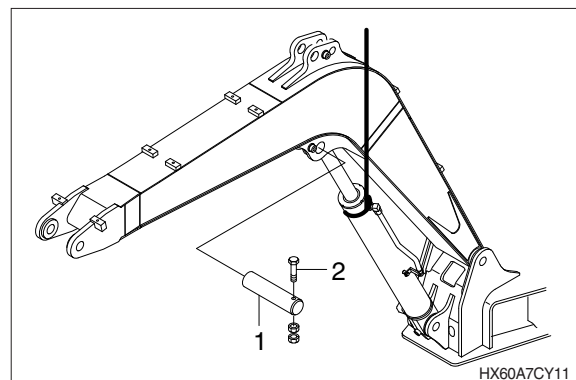
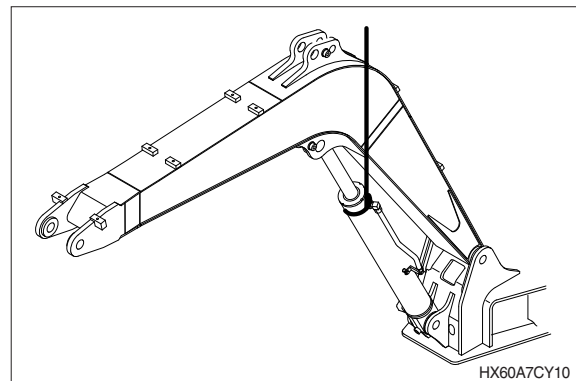
▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

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

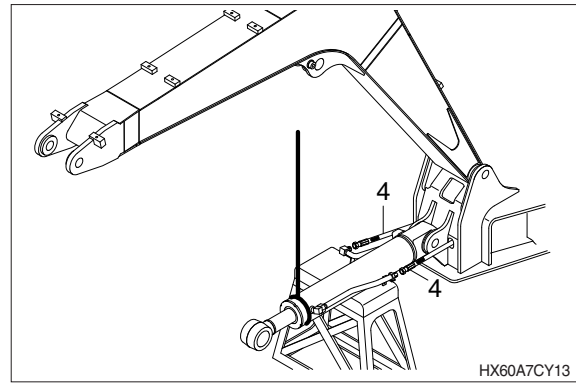
- ① Disconnect greasing hoses.
- ② Sling boom cylinder assembly.

- ③ Remove bolt (2) and pull out pin (1).
- ※ Tie the rod with wire to prevent it from coming out.

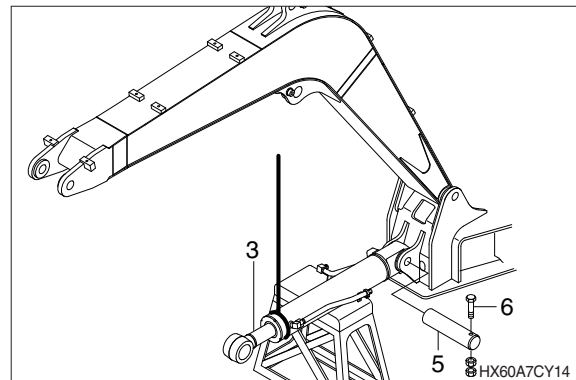
- ④ Lower the boom cylinder assembly (3) on a stand.



- 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 : 64 kg (141 lb)



(2) Install

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

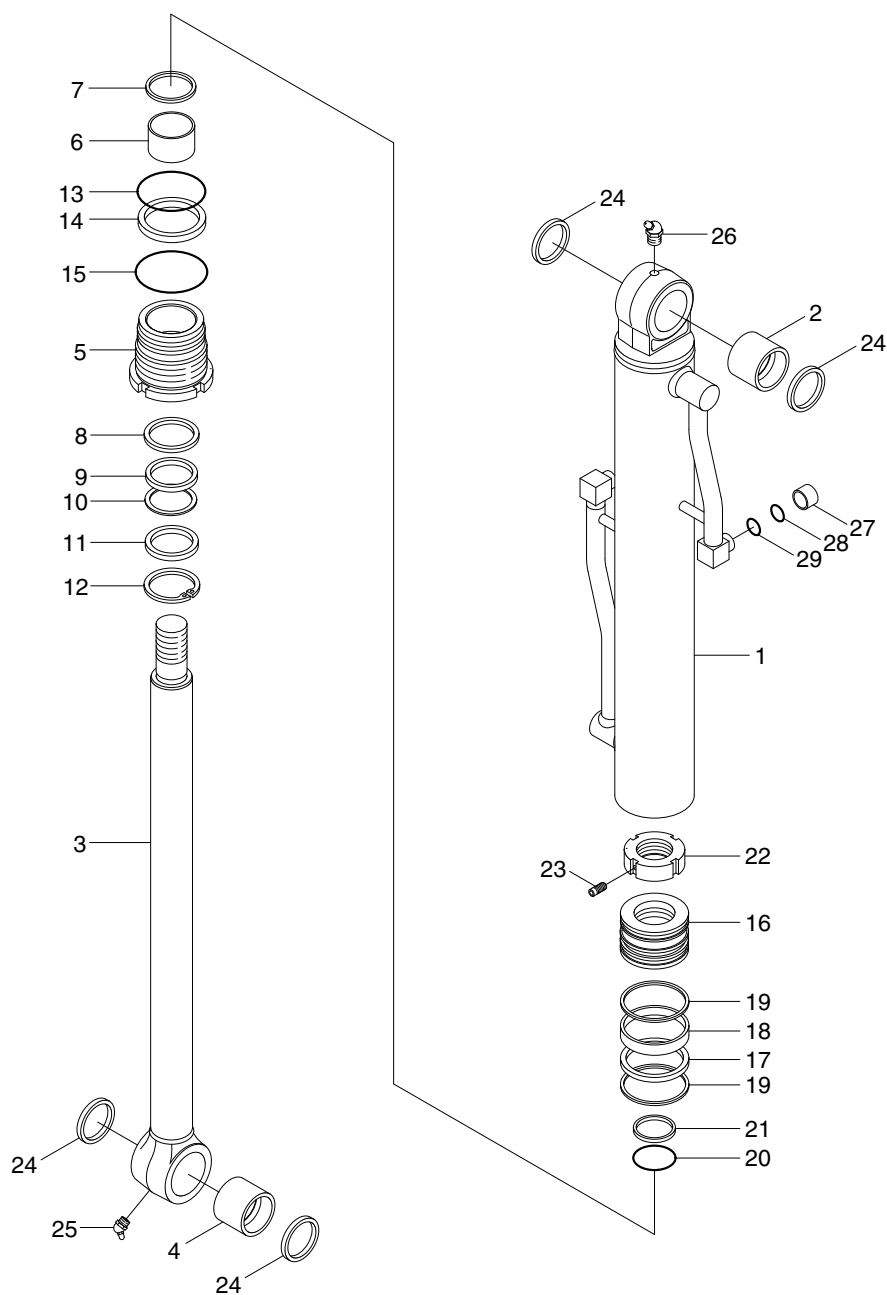
▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

- ※ Bleed the air from the boom cylinder.
- ※ Confirmed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

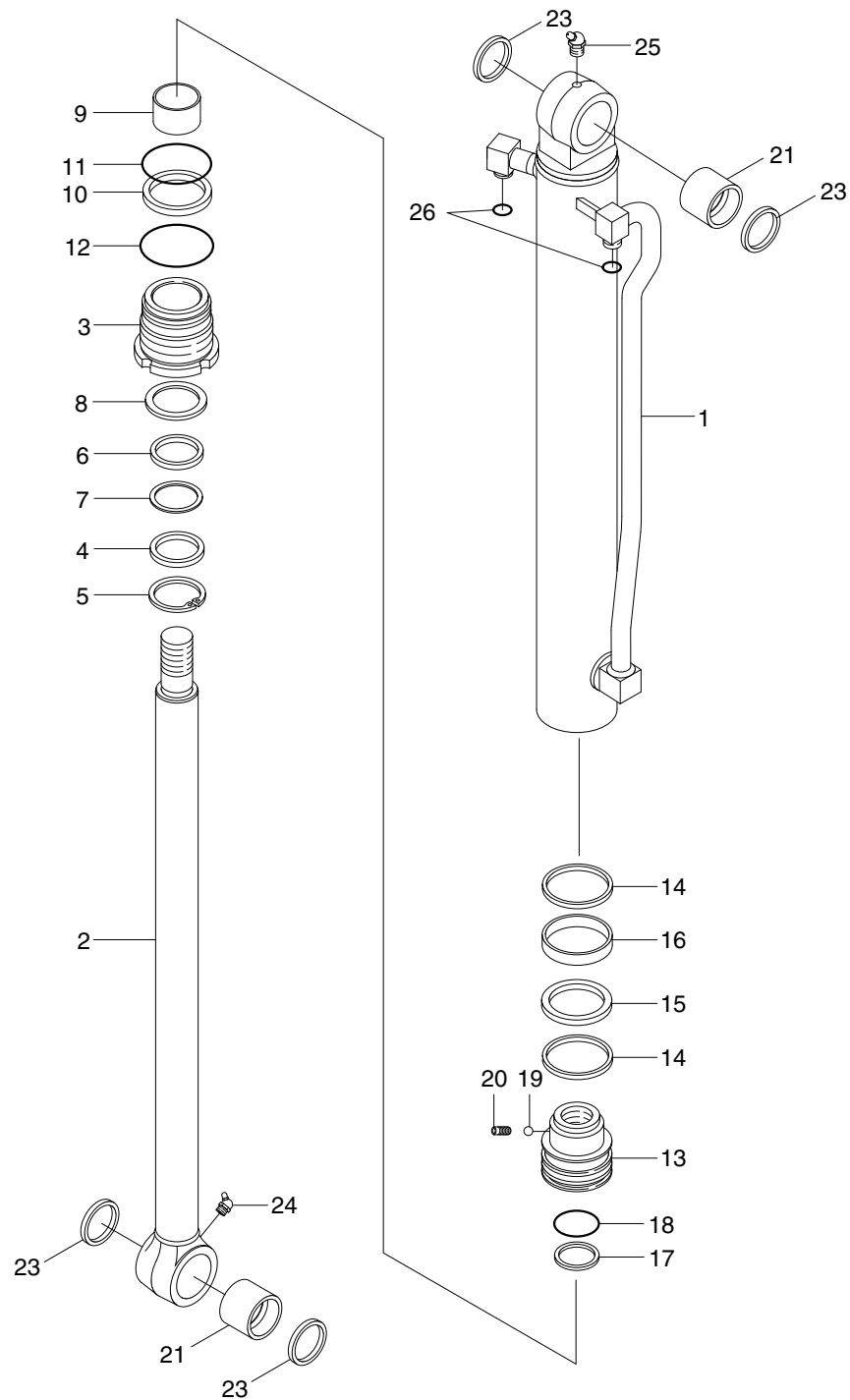
(1) Bucket cylinder (DY POWER)



HX60A7CY22

- | | | |
|------------------|-------------------|------------------|
| 1 Tube assembly | 11 Dust seal | 21 Back-up ring |
| 2 Bushing | 12 Retaining ring | 22 Piston nut |
| 3 Rod | 13 O-ring | 23 Set screw |
| 4 Bushing | 14 Back-up ring | 24 Dust seal |
| 5 Rod cover | 15 O-ring | 25 Grease nipple |
| 6 Rod bushing | 16 Piston | 26 Grease nipple |
| 7 Retaining ring | 17 Piston seal | 27 Dust cap |
| 8 Buffer seal | 18 Wear ring | 28 O-ring |
| 9 U-packing | 19 Dust ring | 29 O-ring |
| 10 Back-up ring | 20 O-ring | |

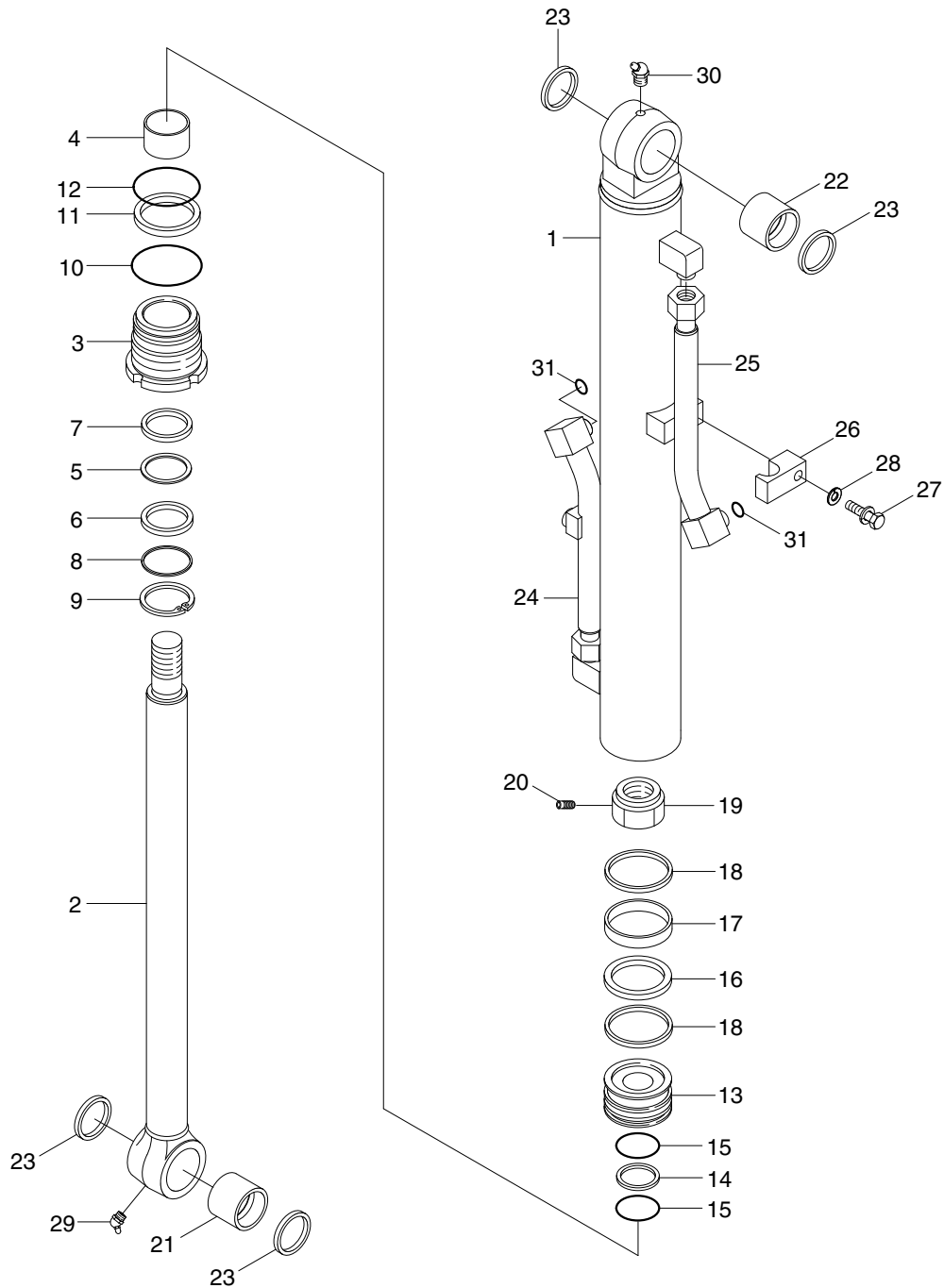
Bucket cylinder (SH PAC)



HX60A7CY23

- | | | | | | |
|---|----------------|----|--------------|----|----------------|
| 1 | Tube assembly | 10 | O-ring | 18 | Back-up ring |
| 2 | Piston rod | 11 | Back-up ring | 19 | Steel ball |
| 3 | Gland | 12 | O-ring | 20 | Set screw |
| 4 | Dust seal | 13 | Piston | 21 | Dimple bushing |
| 5 | Retaining ring | 14 | Dust ring | 22 | Dust seal |
| 6 | Rod seal | 15 | Piston seal | 23 | Dust seal |
| 7 | Back-up ring | 16 | Wear ring | 24 | Grease nipple |
| 8 | Buffer ring | 17 | O-ring | 25 | Grease nipple |
| 9 | Dry bearing | | | 26 | O-ring |

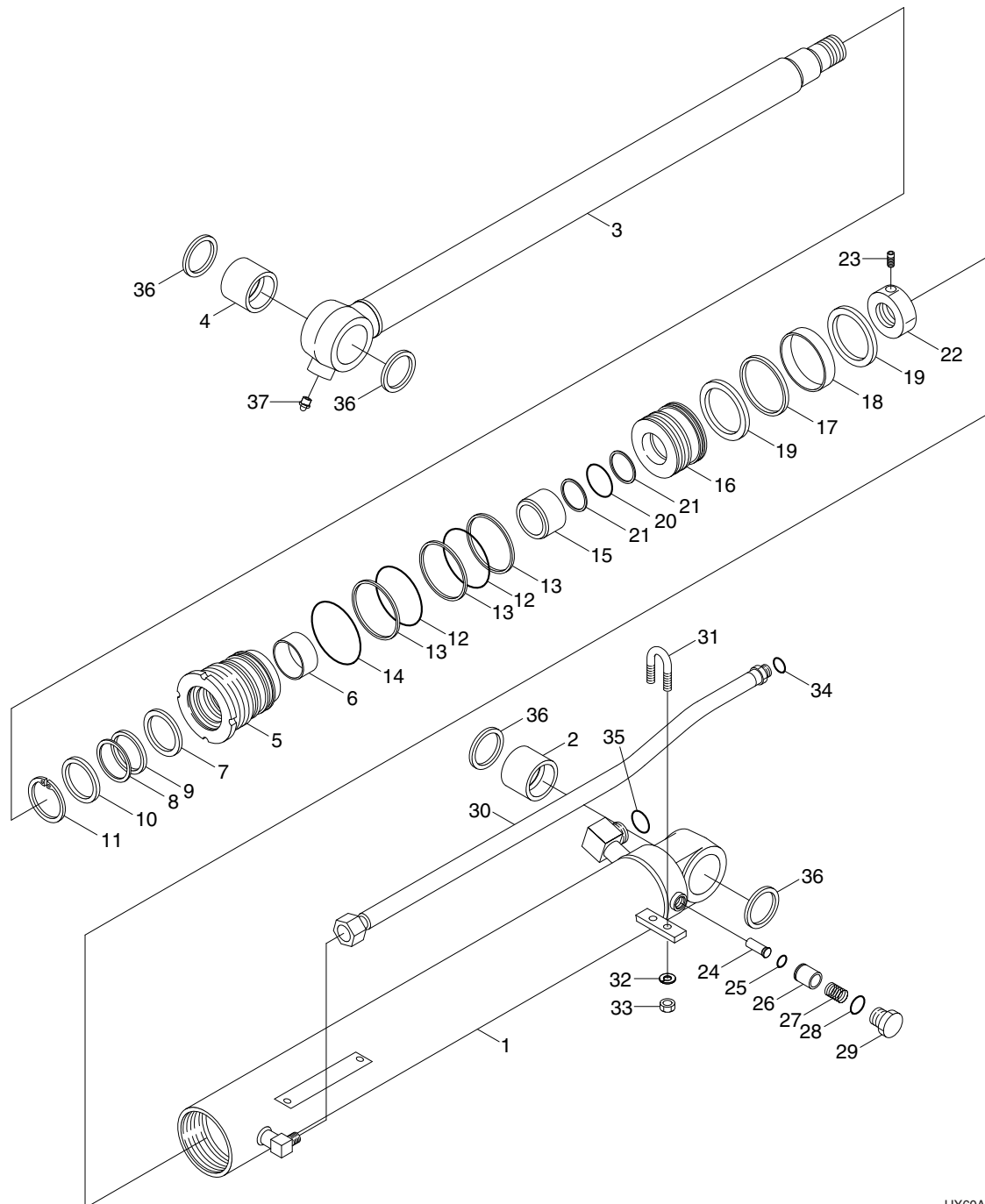
Bucket cylinder (CHANGZHOU)



HX60A7CY24

- | | | | | | |
|----|---------------|----|--------------|----|-------------------|
| 1 | Tube assembly | 11 | O-ring | 21 | Dimple bushing |
| 2 | Rod assembly | 12 | Back-up ring | 22 | Dust seal |
| 3 | Gland | 13 | Piston | 23 | Pipe assl (R) |
| 4 | DU bushing | 14 | O-ring | 24 | Pipe assl (B) |
| 5 | Rod seal | 15 | Back-up ring | 25 | Pipe clamp |
| 6 | Back-up ring | 16 | Piston seal | 26 | Hexagon head bolt |
| 7 | Buffer ring | 17 | Wear ring | 27 | Spring washer |
| 8 | Dust wiper | 18 | Dust ring | 28 | Grease nipple |
| 9 | Snap ring | 19 | Lock nut | 29 | O-ring |
| 10 | O-ring | 20 | Socket screw | | |

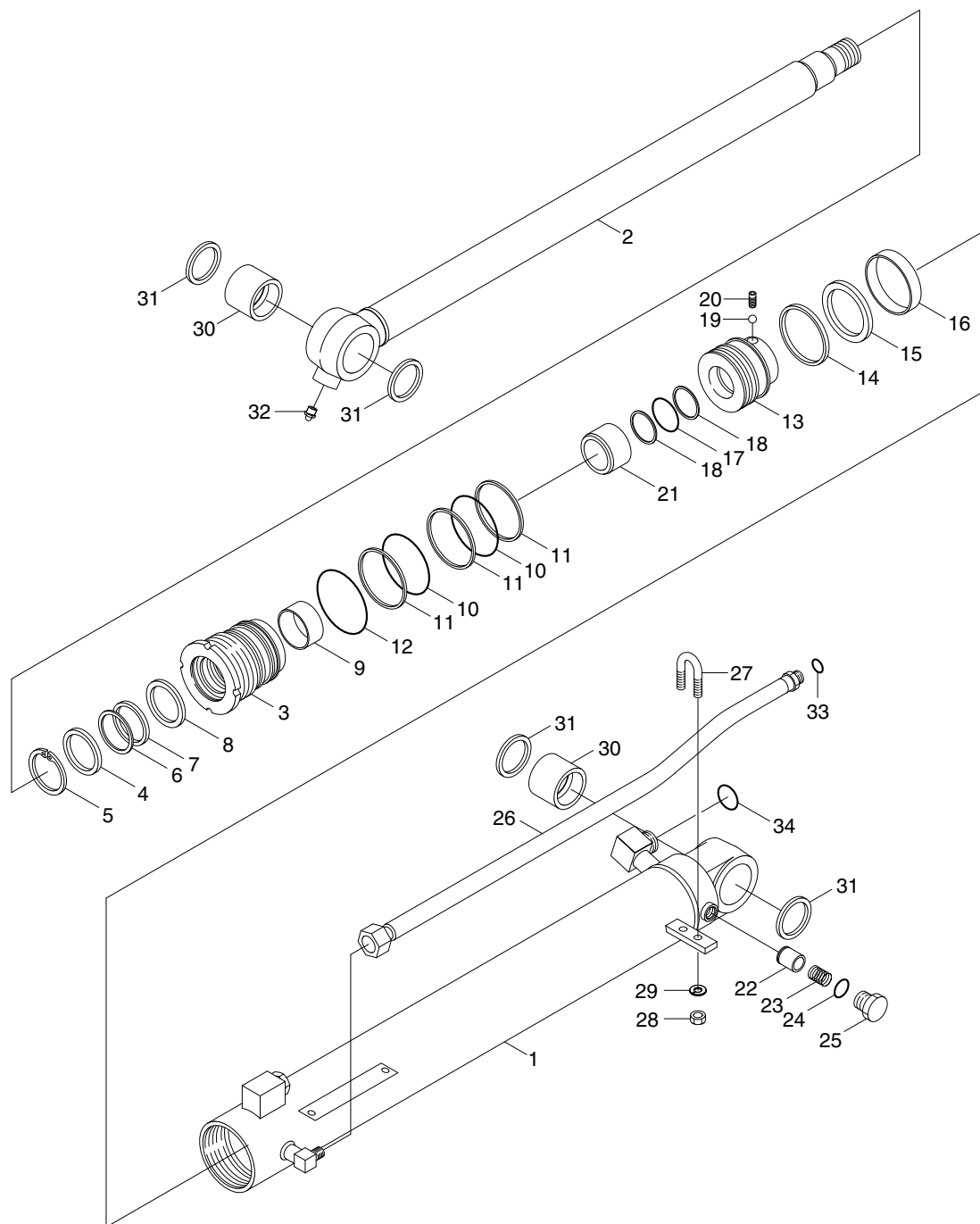
(2) Arm cylinder (DY POWER)



HX60A7CY25

- | | | | | | |
|----|----------------|----|-----------------|----|-------------------|
| 1 | Tube assembly | 14 | O-ring | 26 | Check valve |
| 2 | Bushing | 15 | Cushion ring | 27 | Spring |
| 3 | Rod | 16 | Piston | 28 | Spring support |
| 4 | Bushing | 17 | Piston seal | 29 | Hexagon head poug |
| 5 | Rod cover | 18 | Wear ring | 30 | Pipe |
| 6 | Rod bushing | 19 | Dust ring | 31 | U bolt |
| 7 | Buffer seal | 20 | O-ring | 32 | Spring washer |
| 8 | U-packing | 21 | Back-up ring | 33 | Hexagon head nut |
| 9 | Back-up ring | 22 | Piston nut | 34 | O-ring |
| 10 | Dust seal | 23 | Set screw | 35 | O-ring |
| 11 | Retaining ring | 24 | Cushion plunger | 36 | Dust seal |
| 12 | O-ring | 25 | Pause ring | 37 | Grease nipple |
| 13 | Back-up ring | | | | |

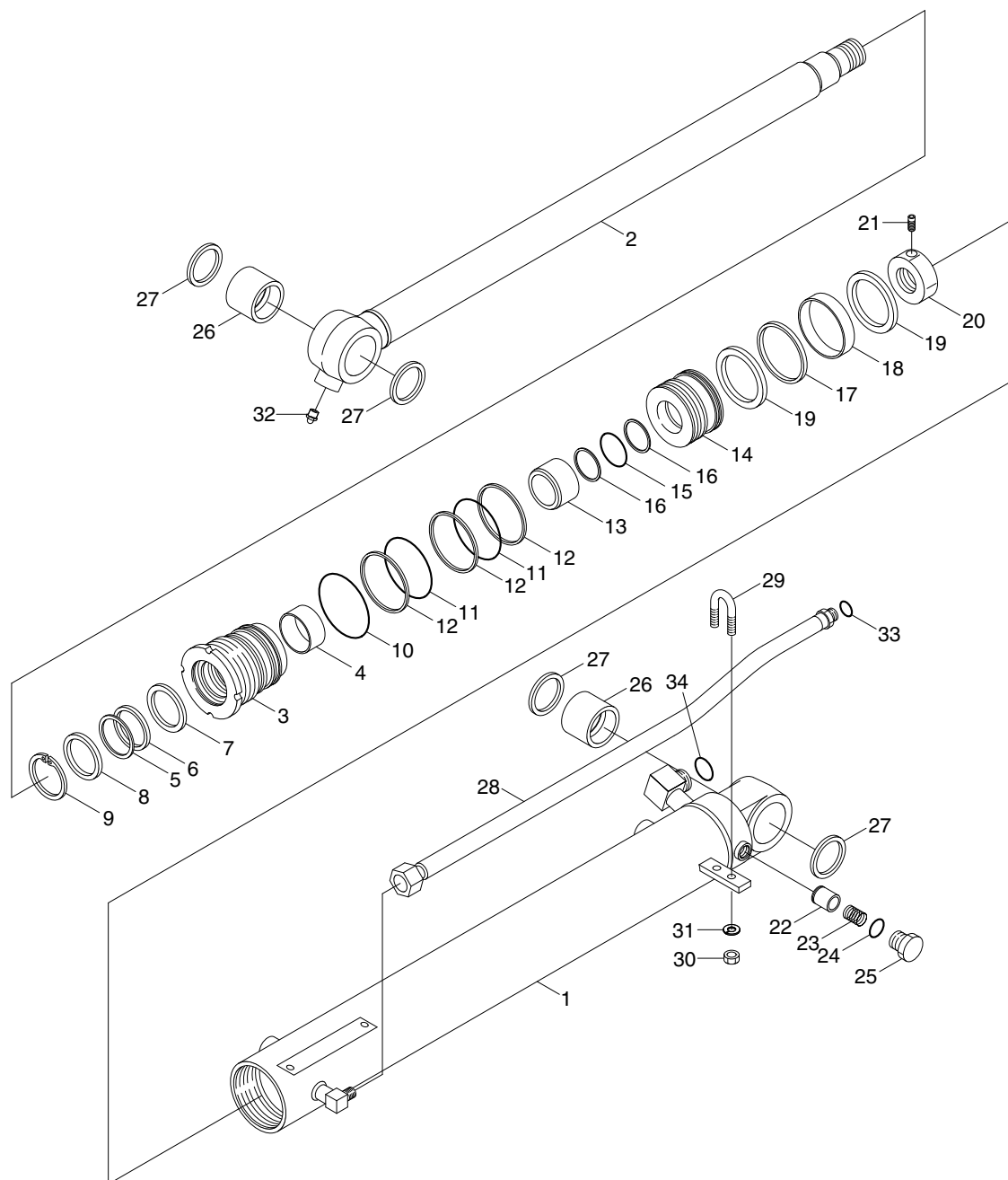
Arm cylinder (SH PAC)



HX60A7CY26

- | | | | | | |
|----|----------------|----|---------------|----|-------------------|
| 1 | Tube assembly | 13 | Piston | 24 | O-ring |
| 2 | Piston rod | 14 | Dust rung | 25 | Plug |
| 3 | Gland | 15 | Piston seal | 26 | Pipe |
| 4 | Dust seal | 16 | Wear ring | 27 | Hexagon head bolt |
| 5 | Retaining ring | 17 | O-ring | 30 | Nut |
| 6 | Rod seal | 18 | Back-up ring | 31 | Spring washer |
| 7 | Back-up ring | 19 | Steel ball | 30 | Pin bushing |
| 8 | Buffer ring | 20 | Set screw | 31 | Dust |
| 9 | Bushing | 21 | Cushion ring | 32 | Grease nipple |
| 10 | O-ring | 22 | Valve | 33 | O-ring |
| 11 | Back-up ring | 23 | Coiled spring | 34 | O-ring |
| 12 | O-ring | | | | |

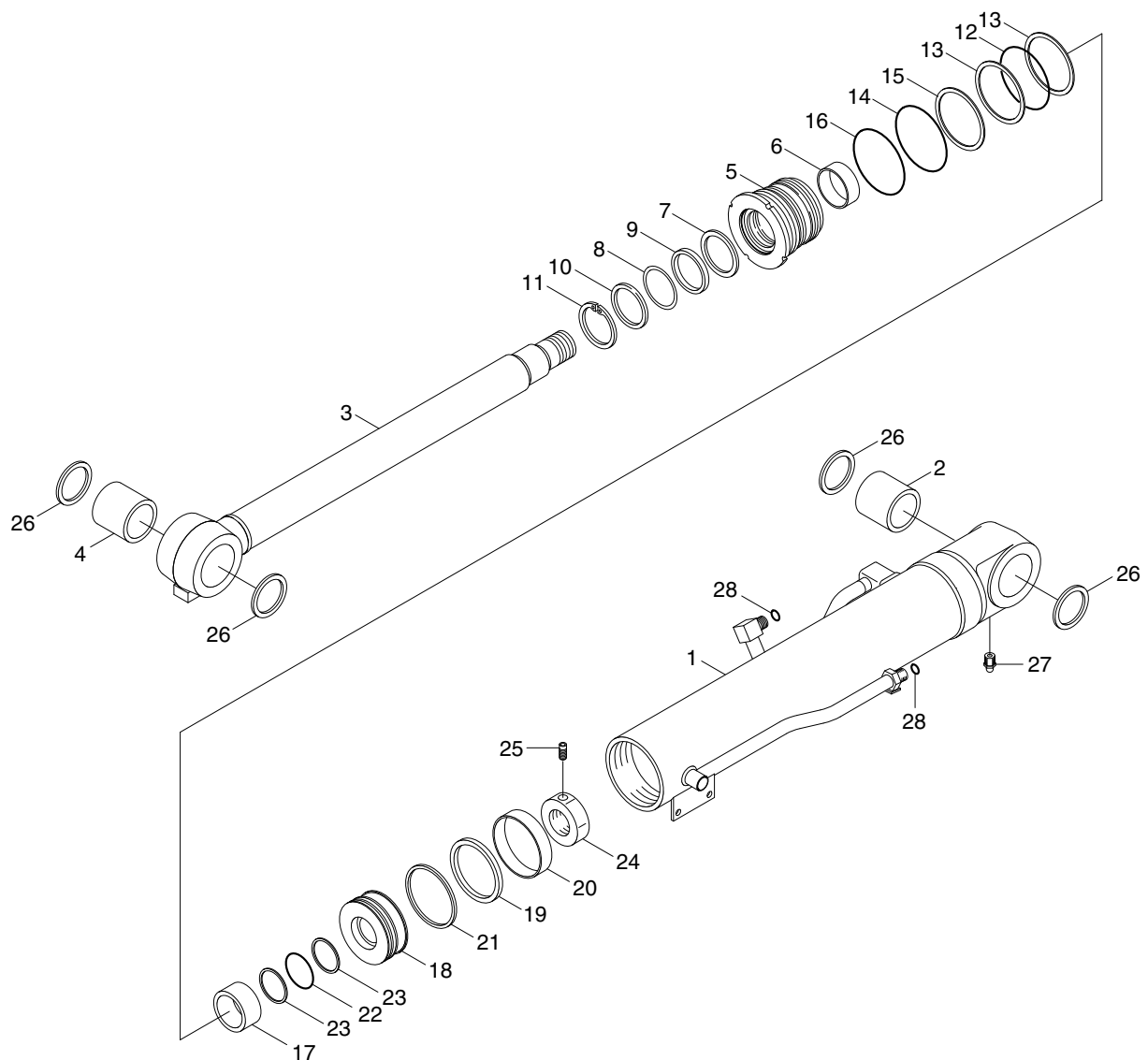
Arm cylinder (CHANGZHOU)



HX60A7CY27

- | | | |
|-----------------|-----------------|----------------------|
| 1 Tube assembly | 13 Cushion ring | 25 Plug |
| 2 Rod | 14 Piston | 26 Pin bushing |
| 3 Gland | 15 O-ring | 27 Dust seal |
| 4 DU bushing | 16 Back-up ring | 28 Pipe (R) |
| 5 Rod seal | 17 Piston seal | 29 Hexagon head bolt |
| 6 Back-up ring | 18 Wear ring | 30 Hexagon head nut |
| 7 Buffer ring | 19 Dust ring | 31 Spring washer |
| 8 Dust wiper | 20 Lock nut | 32 Grease nipple |
| 9 Snap ring | 21 Socket screw | 33 O-ring |
| 10 O-ring | 22 Valve | 34 O-ring |
| 11 O-ring | 23 Coiled sprin | |
| 12 Back-up ring | 24 O-ring | |

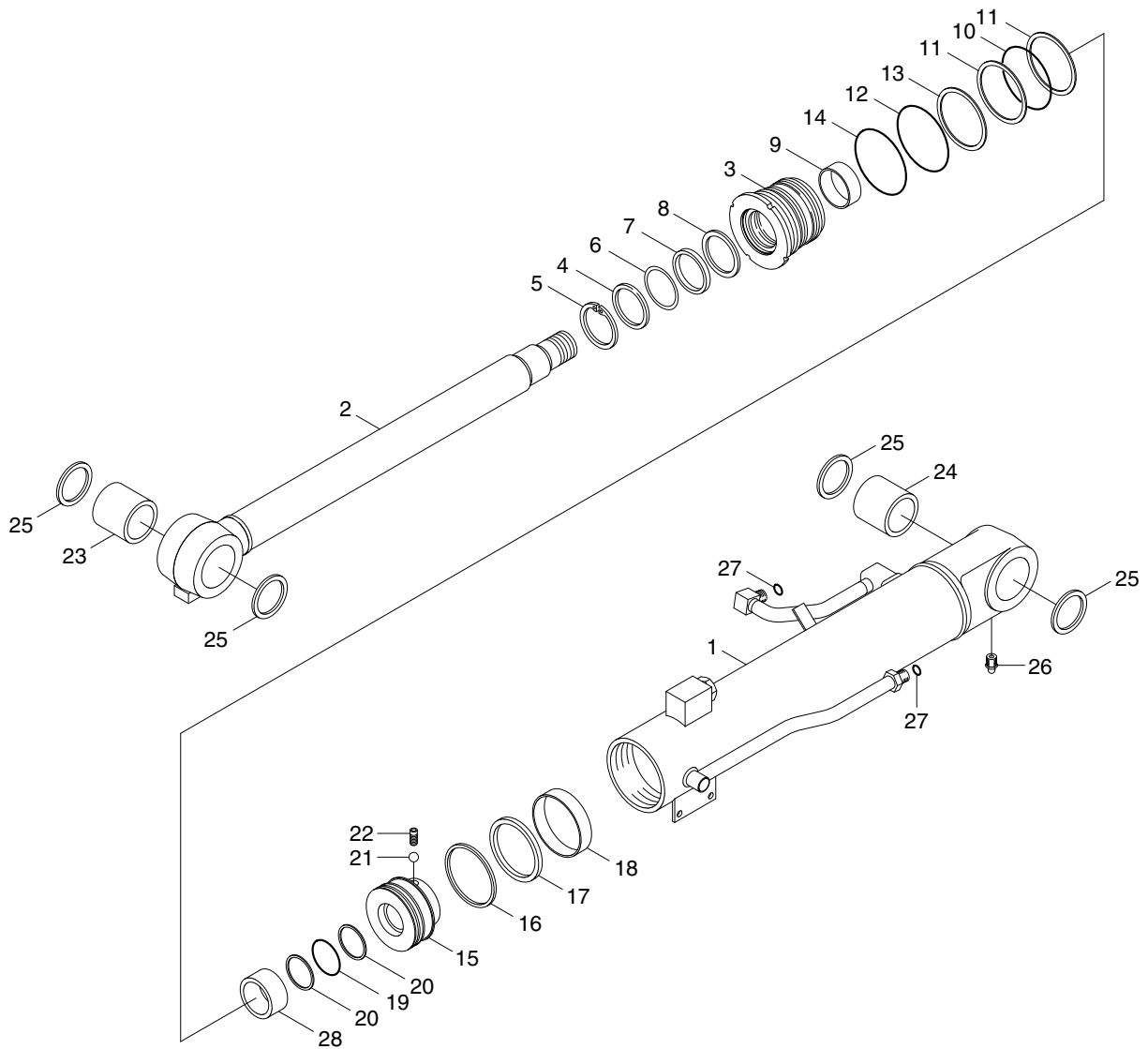
(3) Boom cylinder (DY POWER)



HX60A7CY28

- | | | |
|-----------------|-------------------|------------------|
| 1 Tube assembly | 11 Retaining ring | 20 Wear ring |
| 2 Bushing | 12 O-ring | 21 Dust ring |
| 3 Rod assembly | 13 Back-up ring | 22 O-ring |
| 4 Bushing | 14 O-ring | 23 Back-up ring |
| 5 Rod cover | 15 Back-up ring | 24 Piston nut |
| 6 Rod bushing | 16 O-ring | 25 Set screw |
| 7 Buffer seal | 17 Cushion ring | 26 Dust wiper |
| 8 U-packing | 18 Piston | 27 Grease nipple |
| 9 Back-up ring | 19 Piston seal | 28 O-ring |
| 10 Dust wiper | | |

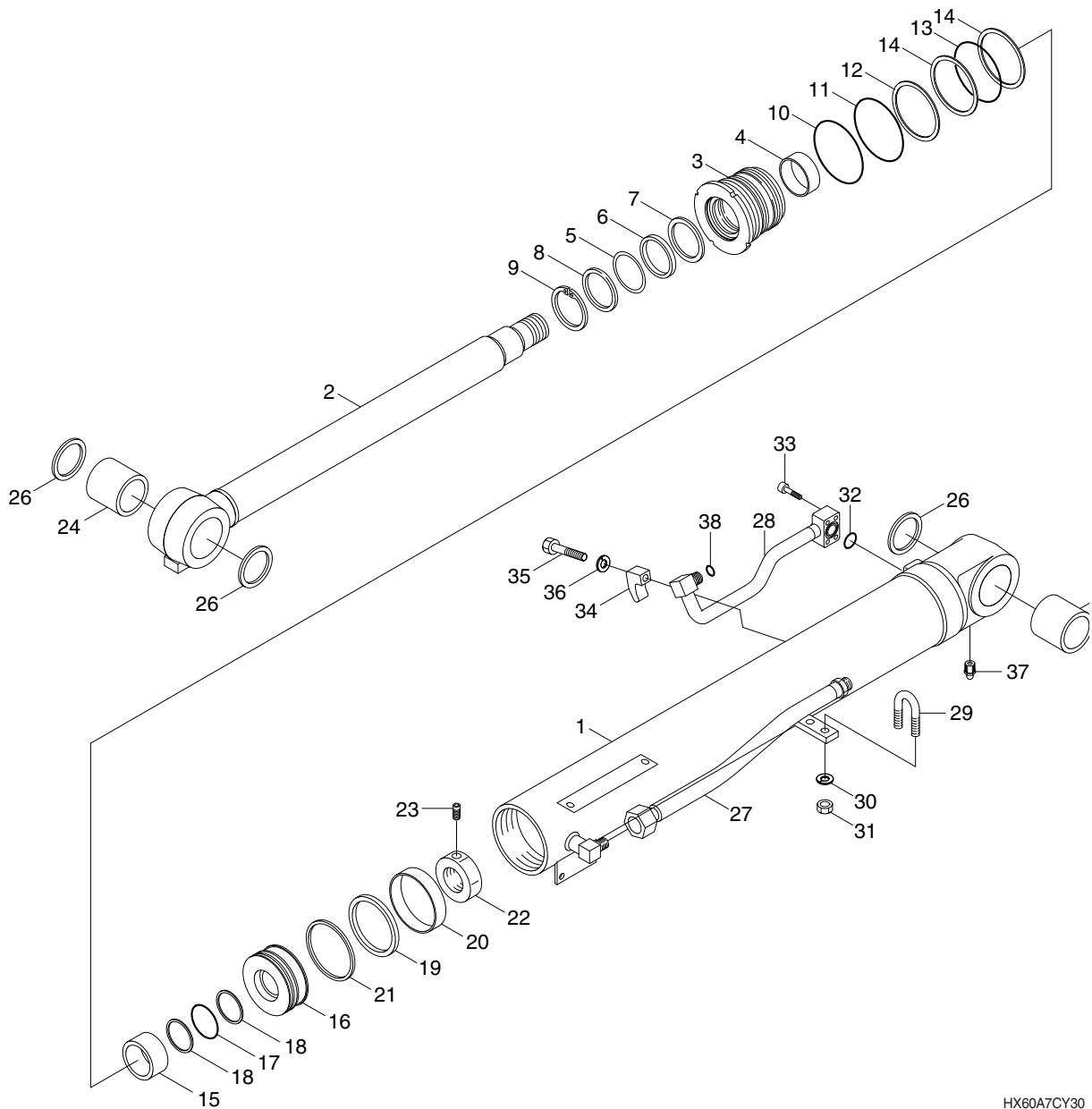
Boom cylinder (SH PAC)



HX60A7CY29

- | | | | | | |
|----|----------------|----|--------------|----|-------------------|
| 1 | Tube assembly | 11 | Back-up ring | 20 | Back-up ring |
| 2 | Piston rod | 12 | O-ring | 21 | Steel ball |
| 3 | Gland | 13 | Wear ring | 22 | Hexagon head bolt |
| 4 | Dust seal | 14 | O-ring | 23 | Pin bushing |
| 5 | Retaining ring | 15 | Piston | 24 | Pin bushing |
| 6 | Rod seal | 16 | Dust rung | 25 | Dust seal |
| 7 | Back-up ring | 17 | Piston seal | 26 | Grease nipple |
| 8 | Buffer ring | 18 | Back-up ring | 27 | O-ring |
| 9 | Bushing | 19 | O-ring | 28 | Cushion ring |
| 10 | O-ring | | | | |

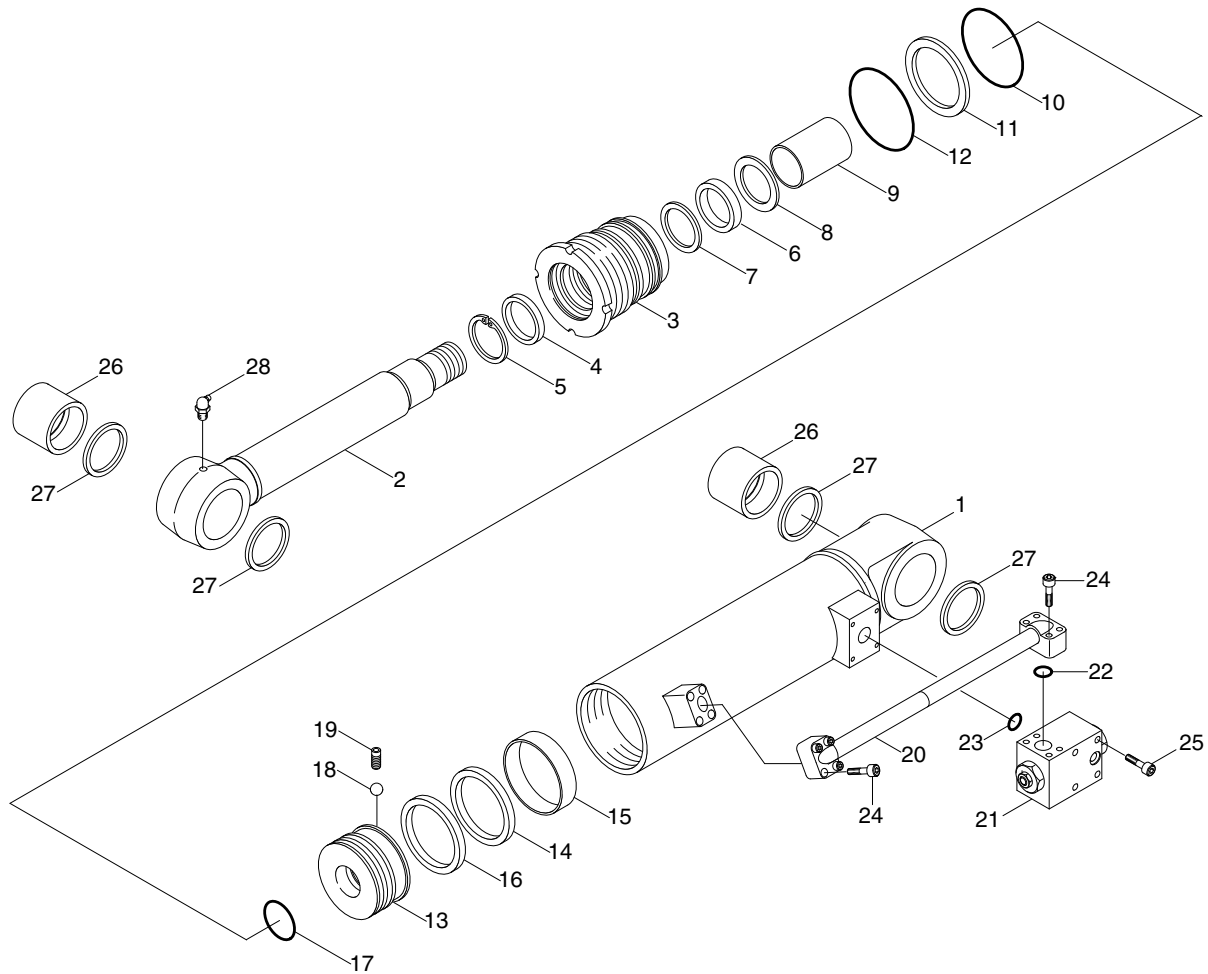
Boom cylinder (CHANGZHOU)



HX60A7CY30

- | | | |
|-----------------|-----------------|----------------------|
| 1 Tube assembly | 13 O-ring | 26 Dust seal |
| 2 Rod | 14 Back-up ring | 27 Pipe (R) |
| 3 Gland | 15 Cushion ring | 28 Pipe (B) |
| 4 DU bushing | 16 Piston | 29 U bolt |
| 5 Rod seal | 17 O-ring | 30 Spring washer |
| 6 Back-up ring | 18 Back-up ring | 31 Hexagon head nut |
| 7 Buffer ring | 19 Piston seal | 34 Pipe clamp |
| 8 Dust wiper | 20 Wear ring | 35 Hexagon head bolt |
| 9 Snap ring | 21 Dust ring | 36 Spring washer |
| 10 O-ring | 22 Lock nut | 37 Grease nipple |
| 11 O-ring | 23 Socket screw | 38 O-ring |
| 12 Back-up ring | 24 Dimpling | |

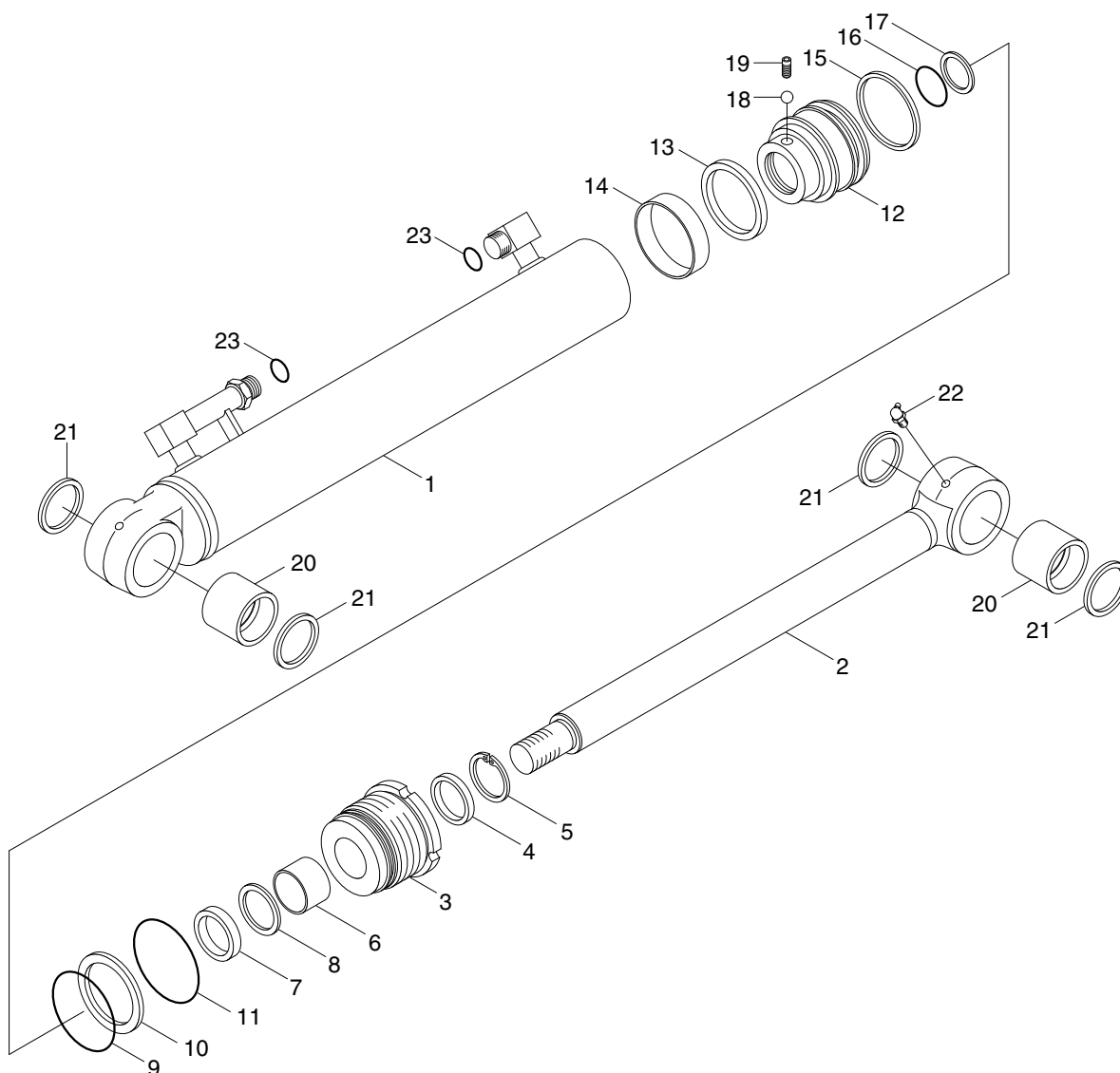
(4) Dozer cylinder



55W97CY01

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

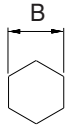


HW607CY25

- | | | | | | |
|---|----------------|----|--------------|----|---------------|
| 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
Rod cover (Gland)	Boom cylinder★ ¹	5	M115	70±7.0	506±51
	Boom cylinder★ ²	3	M115	95±9.5	686±70
	Boom cylinder★ ³	3	M115	70±7.0	506±51
	Arm cylinder★ ¹	5	M95	70±7.0	506±51
	Arm cylinder★ ²	3	M95	76±7.6	550±56
	Arm cylinder★ ³	3	M95	70±7.0	506±51
	Bucket cylinder★ ¹	5	M85	75±7.5	540±5.4
	Bucket cylinder★ ²	3	M85	70±7.0	506±51
	Bucket cylinder★ ³	3	M85	70±7.0	506±51
	Dozer cylinder	3	M115	95±9.5	686±70
Piston nut	Boom cylinder★ ¹	24	M42	75±7.5	540±5.4
	Boom cylinder★ ³	22	-	75±7.5	540±5.4
	Arm cylinder★ ¹	22	M39	75±7.5	540±5.4
	Arm cylinder★ ³	20	-	75±7.5	540±5.4
	Bucket cylinder★ ¹	22	M36	75±7.5	540±5.4
	Bucket cylinder★ ³	19	M36	75±7.5	540±5.4
Piston	Boom cylinder★ ¹	18	M52	50±5.0	361±36
	Boom cylinder★ ²	15	M45	113±11.3	817±83
	Boom cylinder★ ³	16	-	50±5.0	361±36
	Arm cylinder★ ¹	16	M39	50±5.0	361±36
	Arm cylinder★ ²	13	M39	97.5±9.8	705±71
	Arm cylinder★ ³	14	-	50±5.0	361±36
	Bucket cylinder★ ¹	16	M48	50±5.0	361±36
	Bucket cylinder★ ²	13	M36	90±9.0	650±66
	Bucket cylinder★ ³	13	M48	50±5.0	361±36
	Dozer cylinder	13	M45	113±11.3	817±83

★1 : DY POWER

★2 : SHPAC

★3 : CHANGZHOU

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Set screw	Boom cylinder★1★4	25	M8	1.5	10.8
	Boom cylinder★2	22	M8	1.7±0.2	12.3±1.4
	Boom cylinder★3	23	M8	2.7±0.3	19.5±2.2
	Arm cylinder★1★4	23	M8	1.5	10.8
	Arm cylinder★2	20	M8	1.7±0.2	12.3±1.4
	Arm cylinder★3	21	M8	2.7±0.3	19.5±2.2
	Bucket cylinder★1★4	23	M8	1.5	10.8
	Bucket cylinder★2★5	20	M8	1.7±0.2	12.3±1.4
	Bucket cylinder★3 ★5	20	M8	2.7±0.3	19.5±2.2

★1 : DY POWER

★2 : SHPAC

★3 : CHANGZHOU

★4 : Apply loctite #242 on the thread of bolt.

★5 : on the thread of bolt.

3) DISASSEMBLY

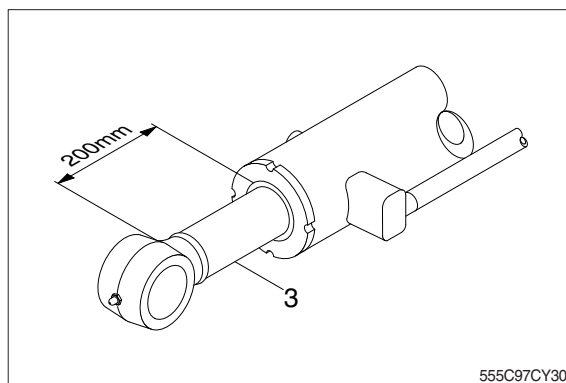
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder (DY POWER type).

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

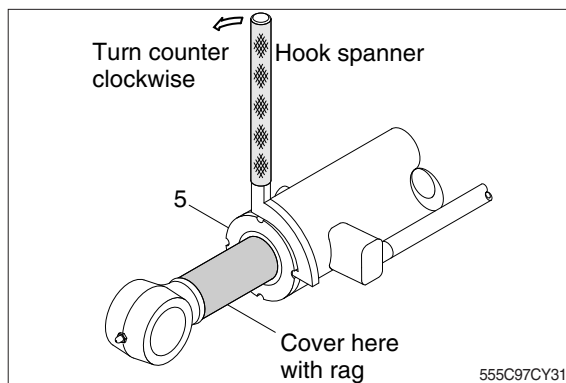
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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.



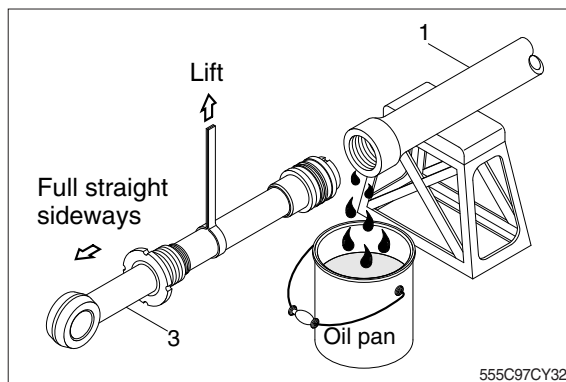
③ Remove rod cover (5) by hook spanner.

※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



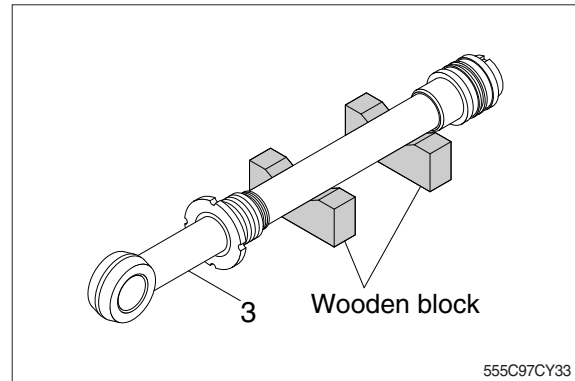
④ Draw out cylinder head and rod assembly (3) together from tube assembly (1).

※ 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.



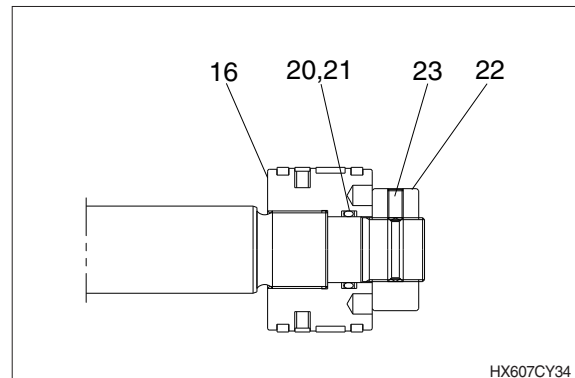
Note that the plated surface of rod assembly (3) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

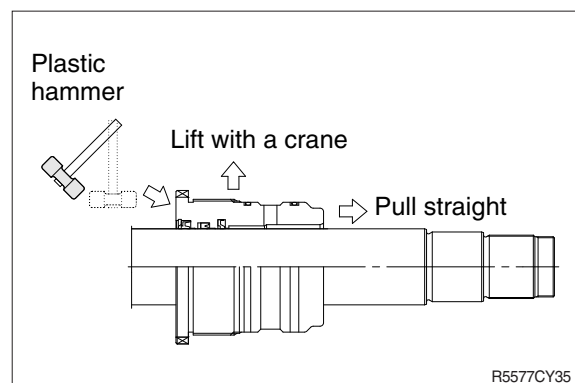


(2) Remove piston and rod cover

- ① Loosen set screw (23) and remove piston nut (22).
- ※ Since piston nut (22) is tightened to a high torque, use a hydraulic and power wrench that utilizes a hydraulic cylinder, to remove the piston nut (22).
- ② Remove piston assembly (16), back up ring (21), and O-ring (20).

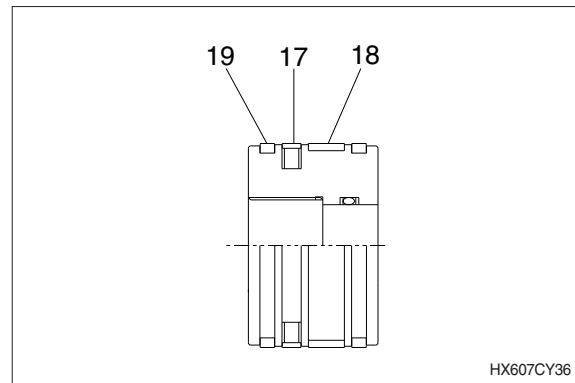


- ③ Remove the rod cover from rod assembly (3).
 - ※ If it is too heavy to move, move it by striking the flanged part of gland with a plastic hammer.
 - ※ Pull it straight with cylinder head assembly lifted with a crane.
- Exercise care so as not to damage the lip of Du bushing (6) and packing (8, 9, 10, 11, 12, 13, 14) by the threads of rod assembly (3).



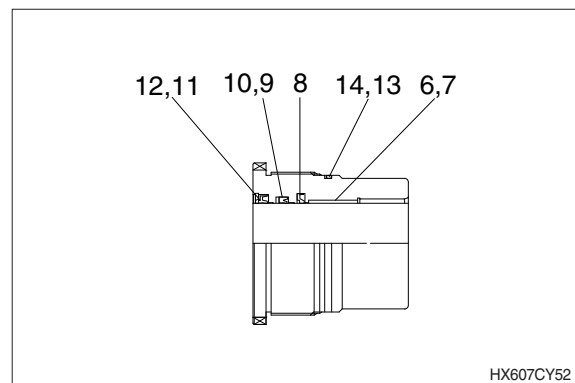
(3) Disassemble the piston assembly

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



(4) Disassemble gland assembly

- ① Remove back up ring (14) and O-ring (13).
 - ② Remove retaining ring (12), dust seal (11).
 - 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.

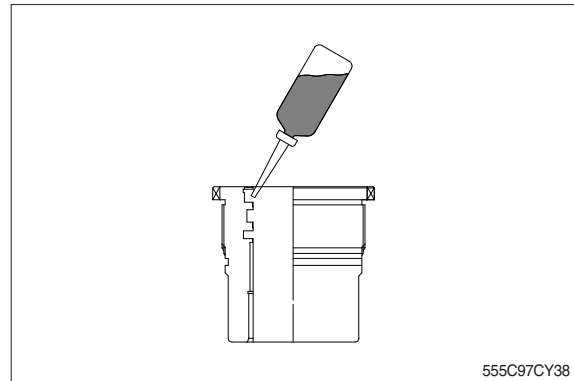


4) ASSEMBLY

(1) Assemble cylinder head assembly

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

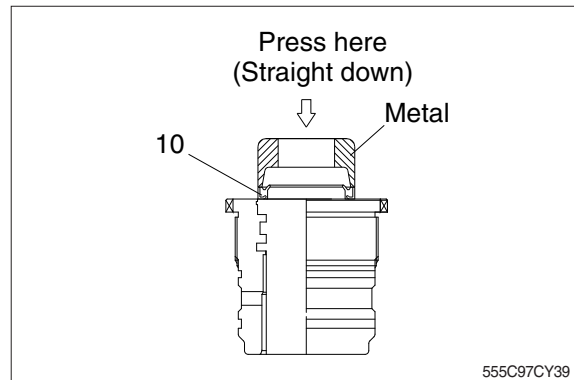
- ① Coat the inner face of rod cover (5) with hydraulic oil.



- ② Coat dust seal (11) with grease and fit dust seal (11) to the bottom of the hole of dust seal.

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

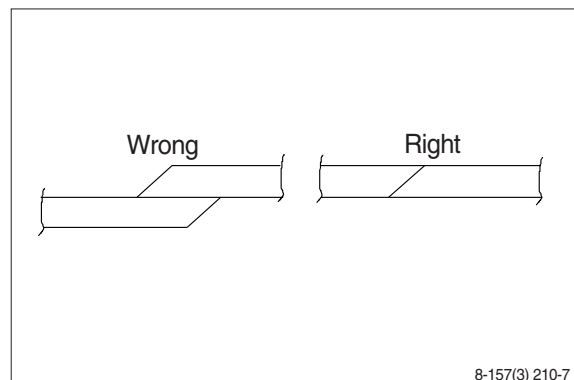
- ③ Fit snap ring (12) to the stop face.



- ④ Fit U-packing (9) and buffer seal (8) to corresponding grooves, in that order.

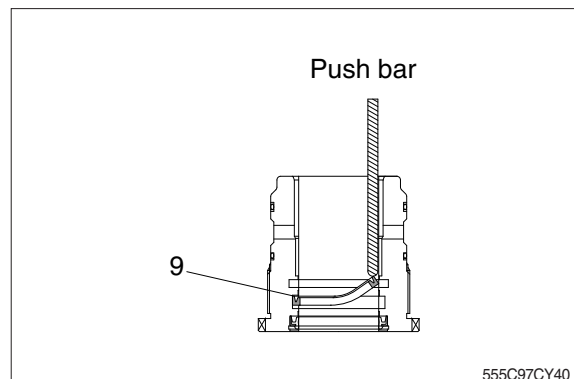
- ※ Coat each packing with hydraulic oil before fitting it.

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

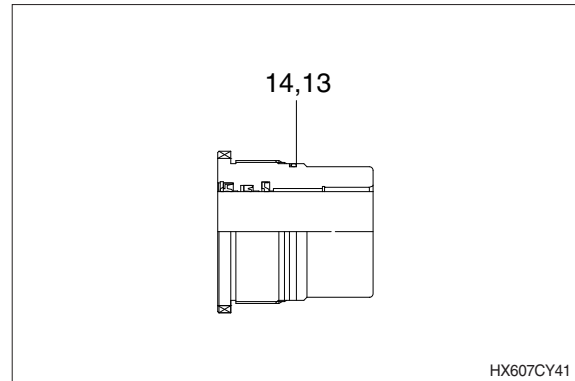


- ※ U-packing (9) has its own fitting direction. Therefore, confirm it before fitting them.

- ※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.

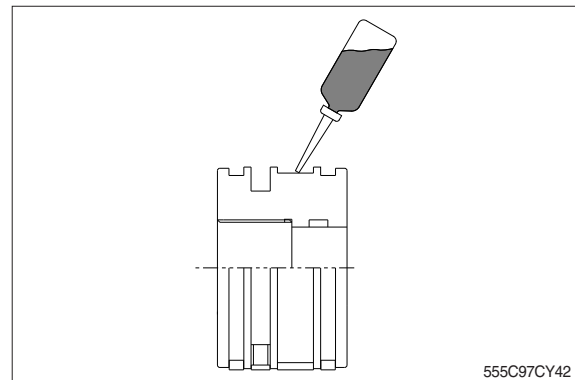


- ⑤ Fit back up ring (14) to rod cover (5).
- ※ Put the backup ring in the warm water of 30~50°C .
- ⑥ Fit O-ring (13) to rod cover (5).

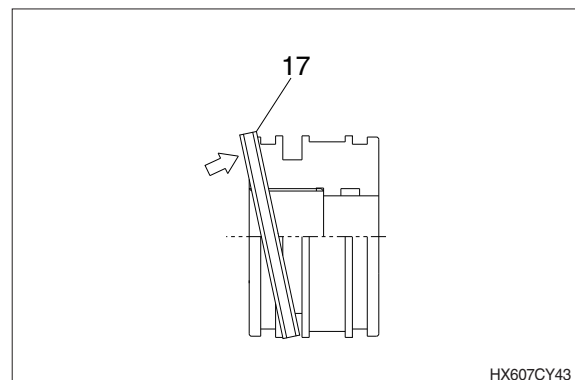


(2) Assemble piston assembly

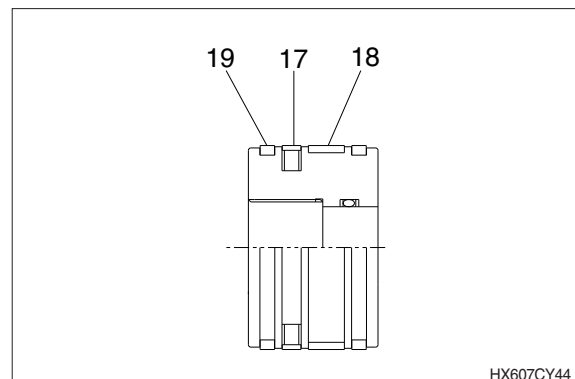
- ※ Check for scratches or rough surfaces.
If found smooth with an oil stone.
- ① Coat the outer face of piston (16) with hydraulic oil.



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

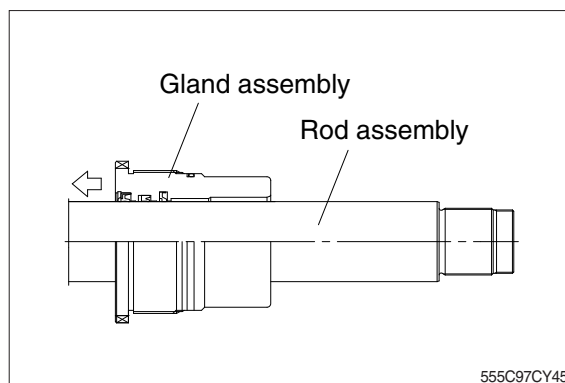


- ③ Fit wear ring (18) and dust ring (19) to piston (15).

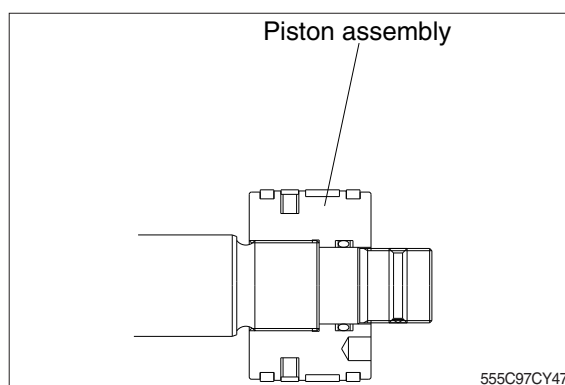


(3) Install piston and cylinder head

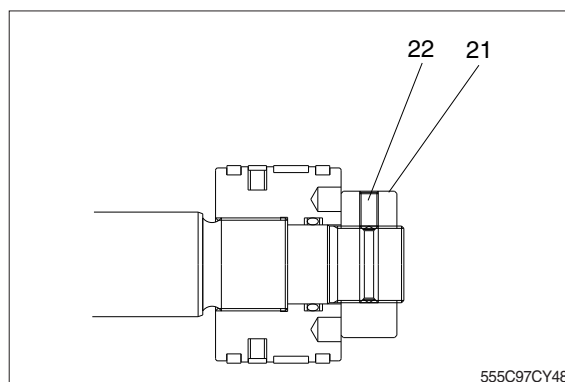
- ① Fix the rod assembly to the work bench.
- ② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and cylinder head.
- ③ Insert cylinder head assembly to rod assembly.



- ④ Fit piston assembly to rod assembly.
 - Tightening torque : 50 ± 5 kgf·m

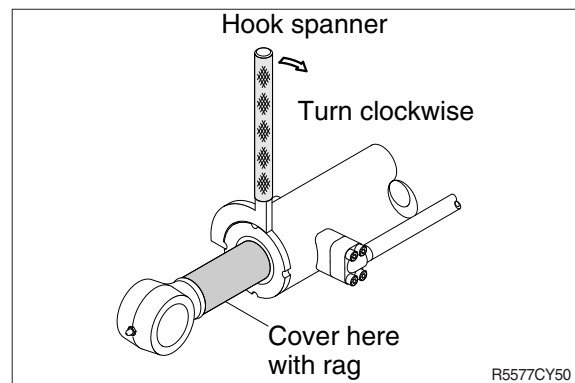
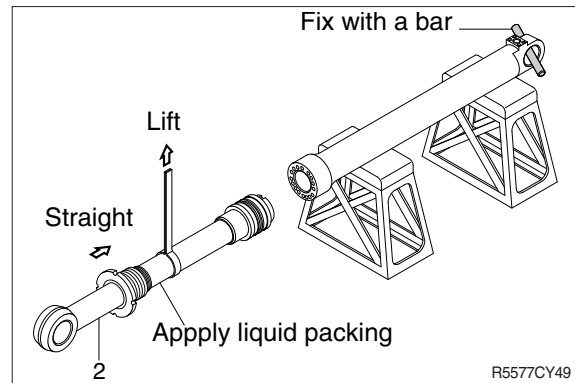


- ⑤ Fit piston nut (22) and tighten the set screw (23).
 - Tightening torque :
 - Piston nut (21) : 75 ± 7.5 kgf·m
 - Set screw (22) : 1.5 kgf·m



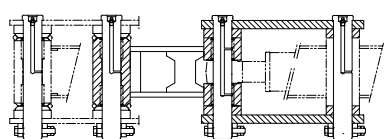
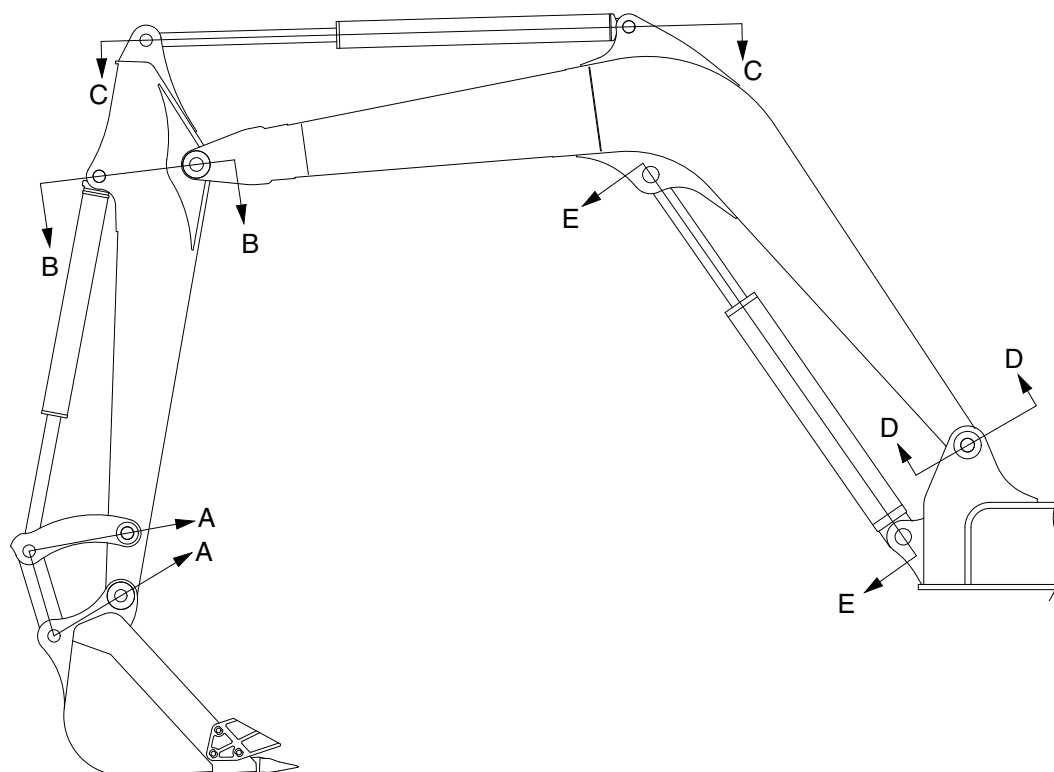
(4) Overall assemble

- 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.

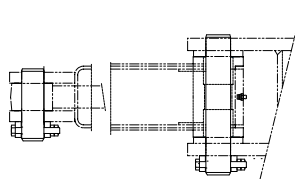


GROUP 13 WORK EQUIPMENT

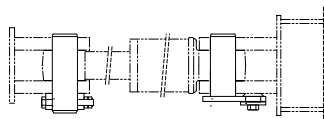
1. STRUCTURE



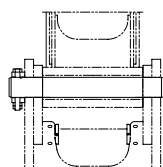
SECTION A-A



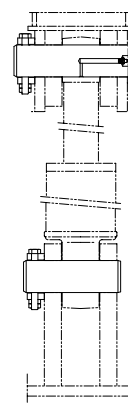
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

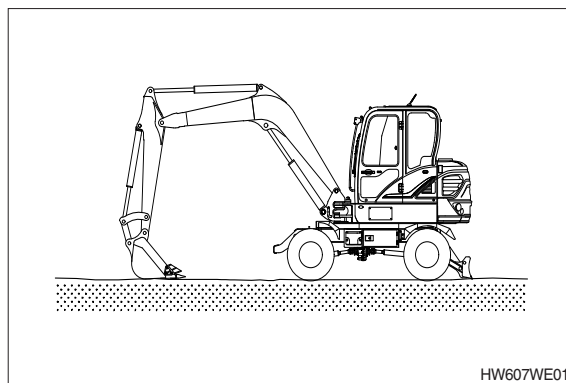
R5577AT01

2. REMOVAL AND INSTALL

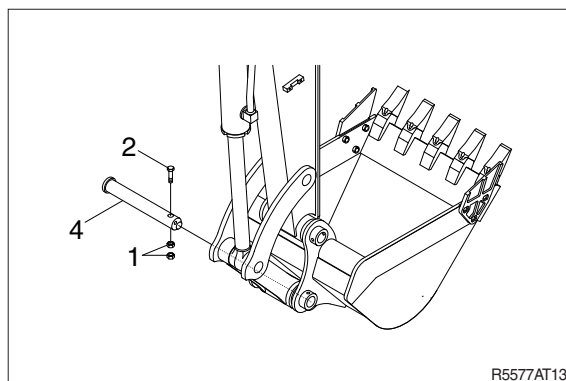
1) BUCKET ASSEMBLY

(1) Removal

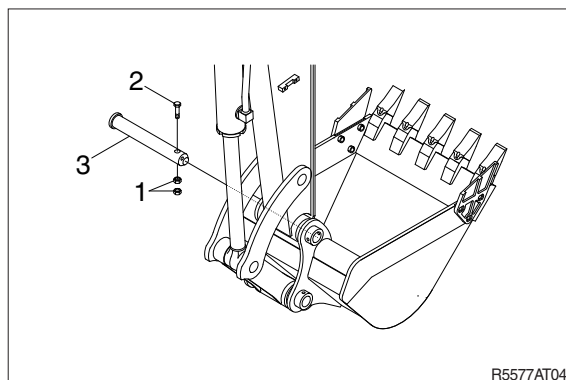
- ① Lower the work equipment completely to ground with back of bucket facing down.



- 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)

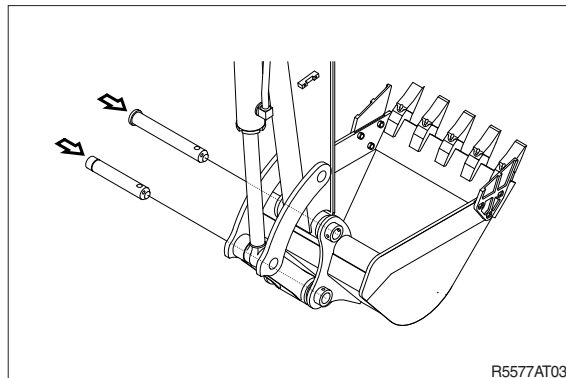


(2) Install

- 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 penetrate the skin causing serious injury.

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

- ② Disconnect bucket cylinder hose (4).

▲ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

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

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

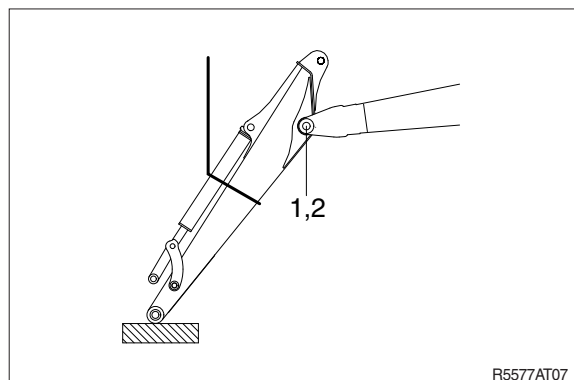
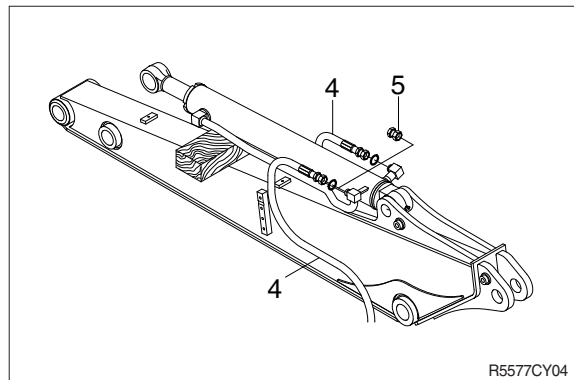
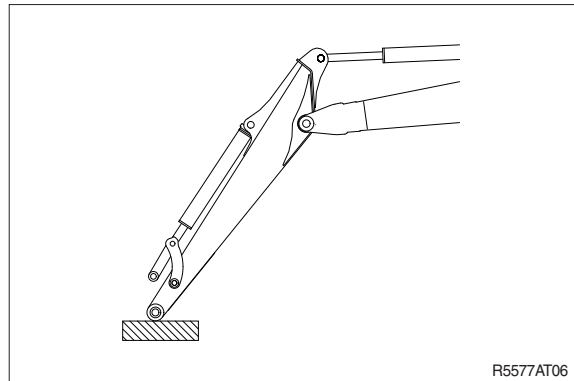
- ④ For details, see removal of arm cylinder assembly.

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

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

· Weight : 205 kg (455 lb)

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



(2) Install

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

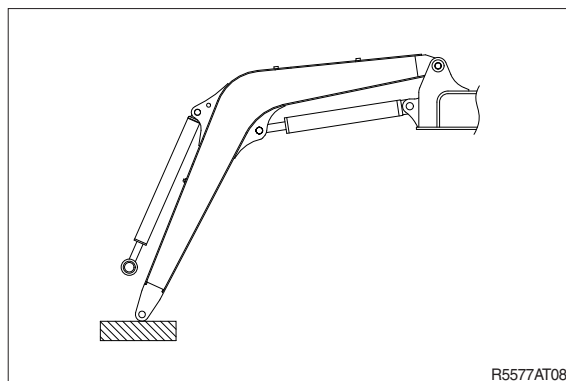
- ※ When lifting the arm assembly, always lift the center of gravity.

- ※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

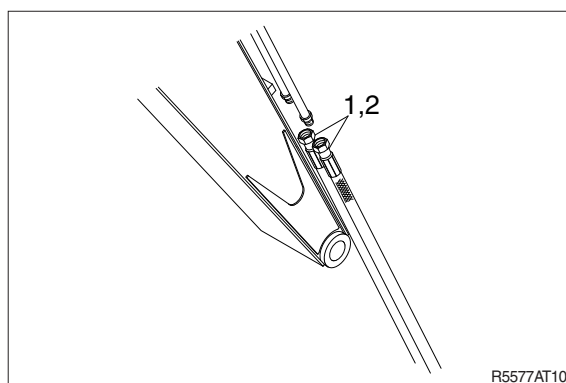
- ① Remove arm and bucket assembly.
- ② For details, see removal of arm and bucket assembly.
Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



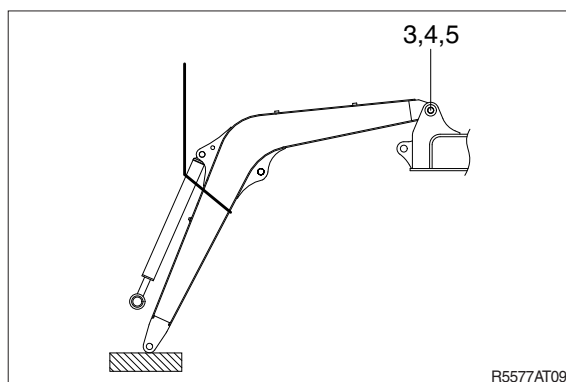
- ③ Disconnect head lamp wiring.
- ④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

▲ 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 (695 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.

