# SECTION 8 DISASSEMBLY AND ASSEMBLY

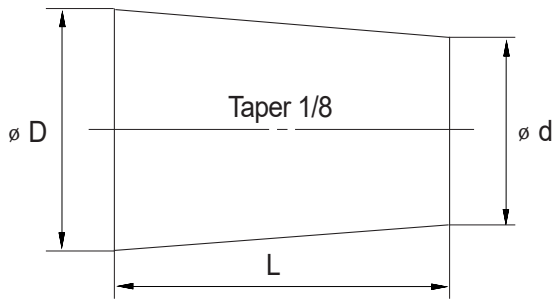
# SECTION 8 DISASSEMBLY AND ASSEMBLY

## GROUP 1 PRECAUTIONS

### 1. REMOVAL WORK

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

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



## 2. INSTALL WORK

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

(1) Start the engine and run at low idling.

(2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100㎜ 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 (bracket-frame, FR) | M20 × 2.5 | 55±3.5 | 398±25.3 |
| 2 | | Engine mounting bolt (bracket-frame, RR) | M24 × 3.0 | 90±7.0 | 651±50.6 |
| 3 | | Engine mounting bolt (engine-bracket) | M12 × 1.75 | 10.0±1.0 | 72.3±7.2 |
| 4 | | Radiator mounting bolt, nut | M16 × 2.0 | 29.7±4.5 | 215±32.5 |
| 5 | | Coupling mounting bolt | M18 × 2.5 | 32.0±1.0 | 231±7.2 |
| 6 | Hydraulic system | Main pump housing mounting bolt | M10 × 1.5 | 4.8±0.3 | 34.7±2.2 |
| 7 | | Main pump mounting bolt | M16 × 2.0 | 25.0±2.5 | 181±18.1 |
| 8 | | Main control valve mounting bolt | M12 × 1.75 | 12.2±1.3 | 88.2±9.4 |
| 9 | | Travel motor mounting bolt | M16 × 2.0 | 29.6±3.2 | 214±23.1 |
| 10 | | Fuel tank mounting bolt | M20 × 2.5 | 46±5.1 | 333±36.9 |
| 11 | | Hydraulic oil tank mounting bolt | M20 × 2.5 | 46±5.1 | 333±36.9 |
| 12 | | Turning joint mounting bolt, nut | M12 × 1.75 | 12.3±1.3 | 89±9.4 |
| 13 | Power train system | Swing motor mounting bolt | M16 × 2.0 | 29.6±3.2 | 214±23.1 |
| 14 | | Swing bearing upper mounting bolt | M18 × 2.5 | 41.3±4.5 | 299±32.5 |
| 15 | | Swing bearing lower mounting bolt | M16 × 1.5 | 31.3±3.2 | 226±23.1 |
| 16 | | Real axle mounting bolt, nut | M20 × 2.5 | 58±6.3 | 419±45.5 |
| 17 | | Transmission bracket mounting bolt | M20 × 2.5 | 58.4±6.4 | 422±46.3 |
| 18 | | Transmission mounting bolt | M20 × 2.5 | 29.7±4.5 | 215±32.5 |
| 19 | | Oscillating cylinder mounting bolt | M22 × 1.5 | 83.2±9.2 | 602±66.5 |
| 20 | | Oscillating cylinder support bolt | M12 × 1.75 | 12.3±2.5 | 88.9±18.1 |
| 21 | | Wheel nut | M22 × 1.5 | $60^{+0}_{-5}$ | $433^{+0}_{-36.2}$ |
| 22 | | Front drive shaft mounting bolt, nut | M10 × 1.0 | 5.9±0.6 | 42.7±4.3 |
| 23 | | Rear drive shaft mounting bolt, nut | M10 × 1.0 | 5.9±0.6 | 42.7±4.3 |
| 24 | Others | Counterweight mounting bolt | M27 × 3.0 | 140±15 | 1013±108 |
| 25 | | Cab mounting bolt, nut | M12 × 1.75 | 12.8±3.0 | 92.6±21.7 |
| 26 | | Operator's seat mounting bolt | M 8 × 1.25 | 4.05±0.8 | 29.3±5.8 |

※ For tightening torque of engine and hydraulic components, see each components disassembly and assembly.

## 2. TORQUE CHART

The torques given are standard figures. Any figures specifically described in this manual has priority.

### 1) BOLT AND NUT

#### (1) Coarse thread

| Bolt size | 8T | | 10T | |
|---|---|---|---|---|
| | kg · m | lb · ft | kg · m | lb · ft |
| M 6 × 1.0 | 0.9 ~ 1.3 | 6.5 ~ 9.4 | 1.1 ~ 1.7 | 8.0 ~ 12.3 |
| M 8 × 1.25 | 2.0 ~ 3.0 | 14.5 ~ 21.7 | 2.7 ~ 4.1 | 19.5 ~ 29.7 |
| M10 × 1.5 | 4.0 ~ 6.0 | 28.9 ~ 43.4 | 5.5 ~ 8.3 | 39.8 ~ 60.0 |
| M12 × 1.75 | 7.4 ~ 11.2 | 53.5 ~ 81.0 | 9.8 ~ 15.8 | 70.9 ~ 114 |
| M14 × 2.0 | 12.2 ~ 16.6 | 88.2 ~ 120 | 16.7 ~ 22.5 | 121 ~ 163 |
| M16 × 2.0 | 18.6 ~ 25.2 | 135 ~ 182 | 25.2 ~ 34.2 | 182 ~ 247 |
| M18 × 2.5 | 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 | 130.2 |
| 1" | 41 | 21 | 151.9 |
| 1-1/4" | 50 | 35 | 253.2 |

### 3) PIPE AND HOSE (ORFS type)

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

### 4) FITTING

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

## 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 : 124 ℓ (32.8 U.S. gal)

(5) Remove socket bolts (13) and disconnect hoses (1,2).

(6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10, 11).

(7) Remove socket bolts (14) and disconnect pump suction pipe (4).

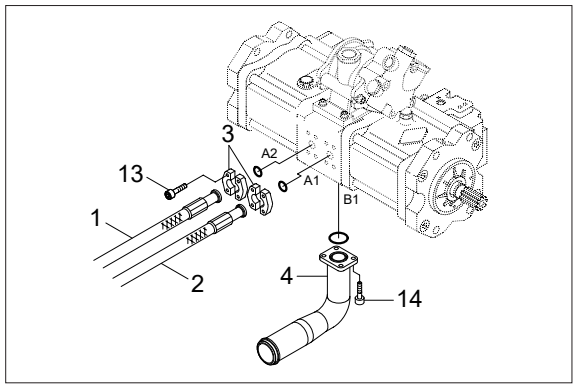
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

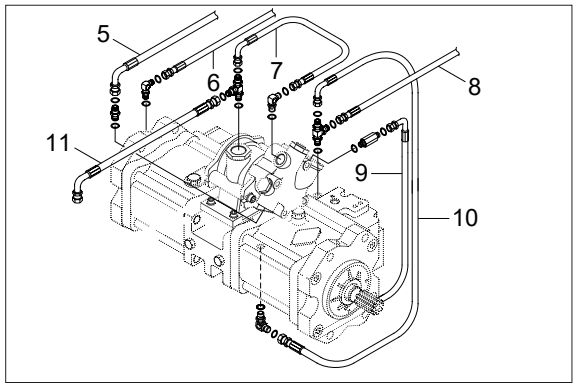
(8) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 100 ㎏ (220 ㏪)

※ Pull out the pump assembly from housing.

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

## 2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

(5) After adding oil to the hydraulic tank to the specified level.

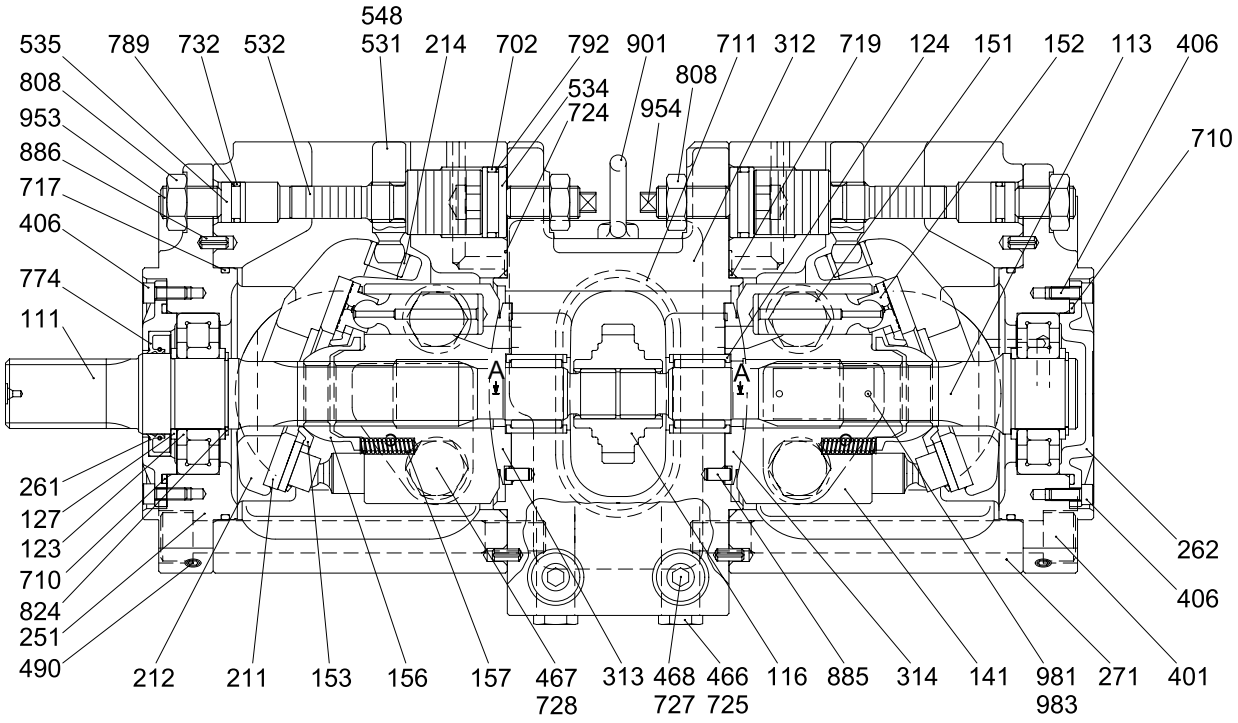
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

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

## 2. MAIN PUMP (1/2)

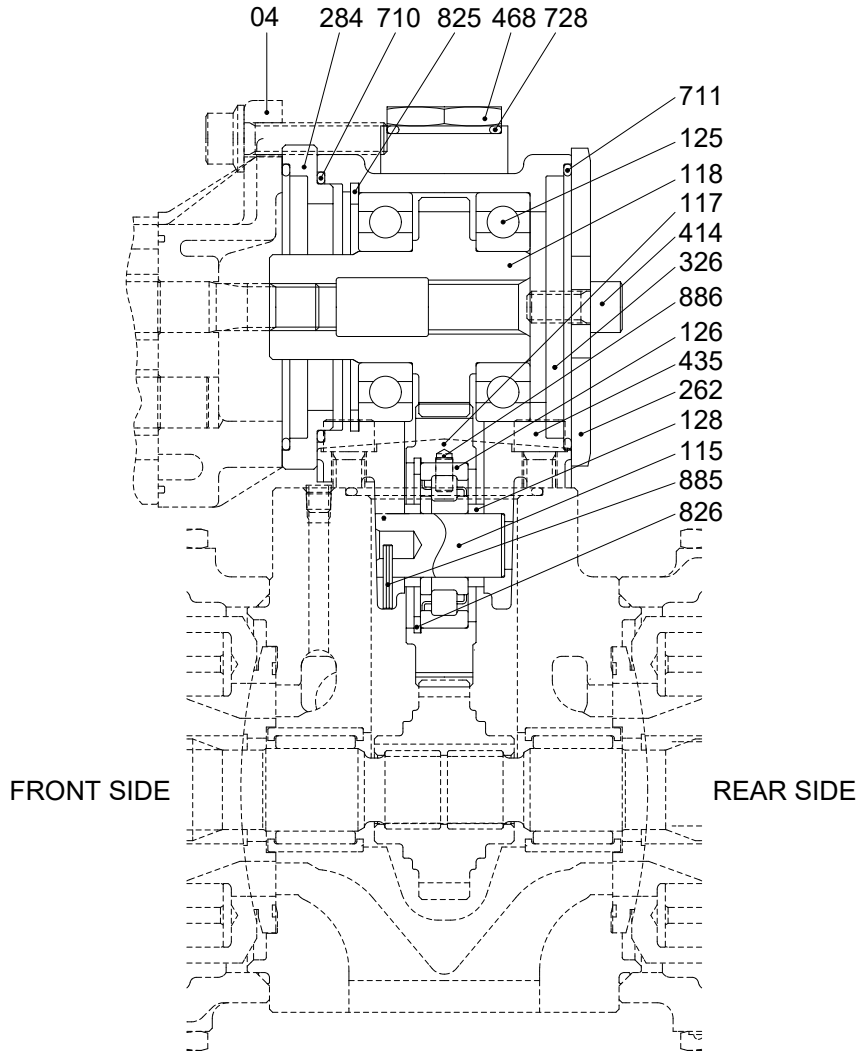
### 1) STRUCTURE




14W72SF02

| | | | | | |
|---|---|---|---|---|---|
| 111 | Drive shaft (F) | 312 | Valve block | 724 | O-ring |
| 113 | Drive shaft (R) | 313 | Valve plate (R) | 725 | O-ring |
| 116 | Gear | 314 | Valve plate (L) | 727 | O-ring |
| 123 | Roller bearing | 401 | Hexagon socket bolt | 728 | O-ring |
| 124 | Needle bearing | 406 | Hexagon socket bolt | 732 | O-ring |
| 127 | Bearing spacer | 466 | VP Plug | 774 | Oil seal |
| 141 | Cylinder block | 467 | VP Plug | 789 | Back up ring |
| 151 | Piston | 468 | VP Plug | 792 | Back up ring |
| 152 | Shoe | 490 | Plug | 808 | Hexagon head nut |
| 153 | Push-plate | 531 | Tilting pin | 824 | Snap ring |
| 156 | Bushing | 532 | Servo piston | 885 | Pin |
| 157 | Cylinder spring | 534 | Stopper (L) | 886 | Spring pin |
| 211 | Shoe plate | 535 | Stopper (S) | 901 | Eye bolt |
| 212 | Swash plate | 548 | Pin | 953 | Set screw |
| 214 | Bushing | 702 | O-ring | 954 | Set screw |
| 251 | Support | 710 | O-ring | 981 | Plate |
| 261 | Seal cover (F) | 711 | O-ring | 983 | Pin |
| 262 | Seal cover (R) | 717 | O-ring | | |
| 271 | Pump casing | 719 | O-ring | | |

## MAIN PUMP (2/2)

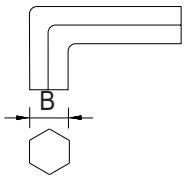
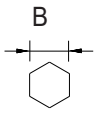



| | | | | | |
|---|---|---|---|---|---|
| 04 | Gear pump | 262 | Cover | 711 | O-ring |
| 115 | Shaft | 284 | Plate | 728 | O-ring |
| 117 | Gear No.2 | 326 | Gear case | 825 | Retainer ring |
| 118 | Gear No.3 | 414 | Screw | 826 | Retainer ring |
| 125 | Ball bearing | 435 | Hexagon socket bolt | 827 | Retainer ring |
| 126 | Roller bearing | 468 | Plug | 885 | Spring pin |
| 128 | Bearing spacer | 710 | O-ring | 886 | Pin |

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

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

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

## (2) Tightening torque

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

### 3) DISASSEMBLY

(1) Select place suitable to disassembling.

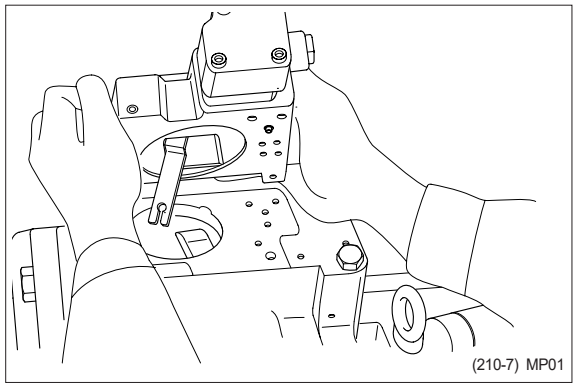
※ Select clean place.

※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.

(2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.

(3) Remove drain port plug (468) and let oil out of pump casing (front and rear pump).

(4) Remove hexagon socket head bolts (412, 413) and remove regulator.



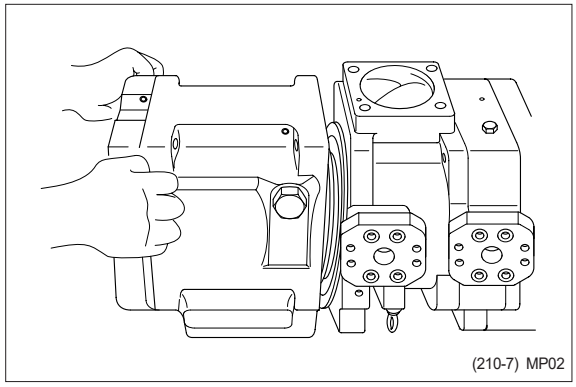
(210-7) MP01

(5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve block (312).

※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

(6) Place pump horizontally on workbench with its regulator-fitting surface down and separate pump casing (271) from valve block (312).

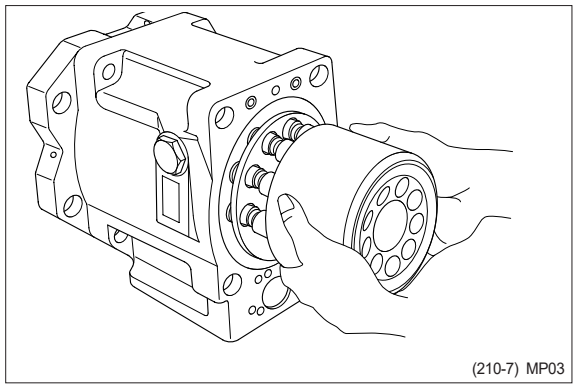
※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



(210-7) MP02

(7) Pull cylinder block (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

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

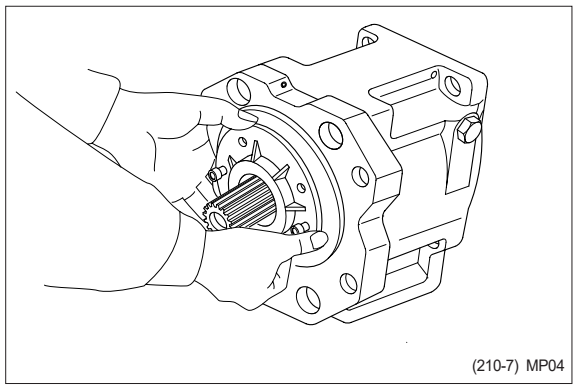


(210-7) MP03

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

※ Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

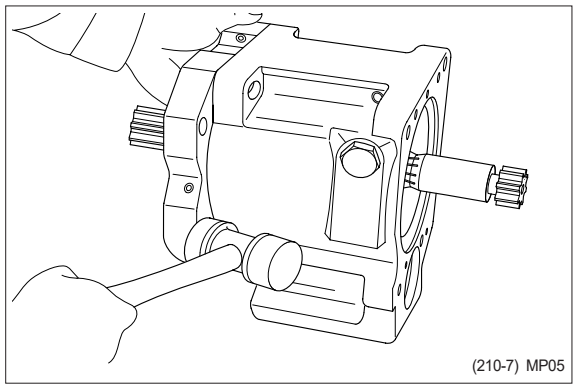
※ Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.



(210-7) MP04

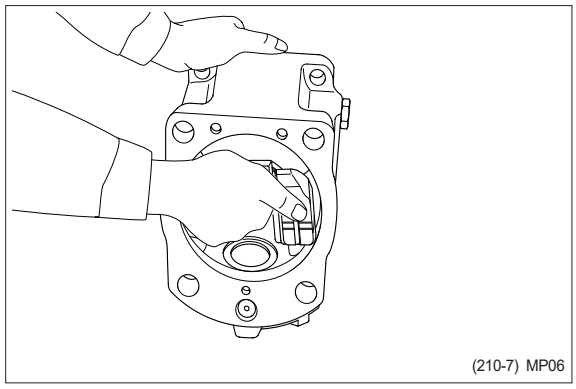
(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).
In case fitting a gear pump, first, remove gear pump.

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



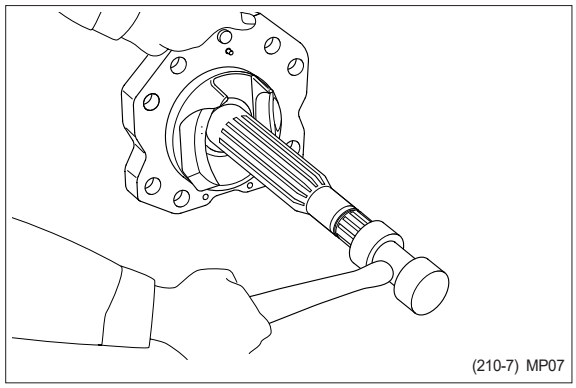
(210-7) MP05

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



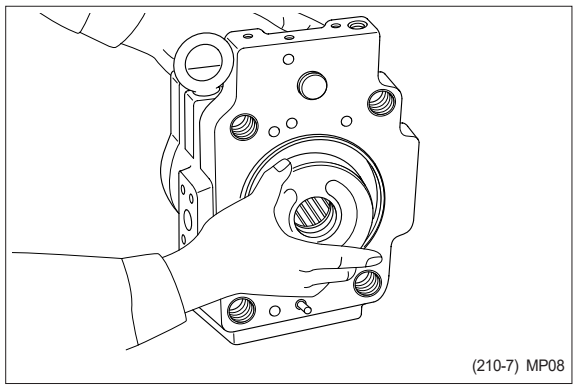
(210-7) MP06

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


(210-7) MP07

(13) Remove valve plates (313, 314) from valve block (312).

※ These may be removed in work (6).


(210-7) MP08

(14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) and splined coupling (114) from valve block (312).

※ In removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.

※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve block and swash plate support.
If loosened, flow setting will be changed.

## 4) ASSEMBLY

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

① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.

④ In principle, replace seal parts, such as O-rings, oil seals, etc.

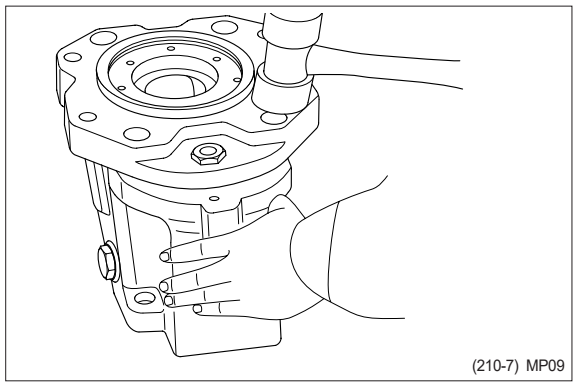
⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.

⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

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

※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.

※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (Medium strength) to their threaded sections.

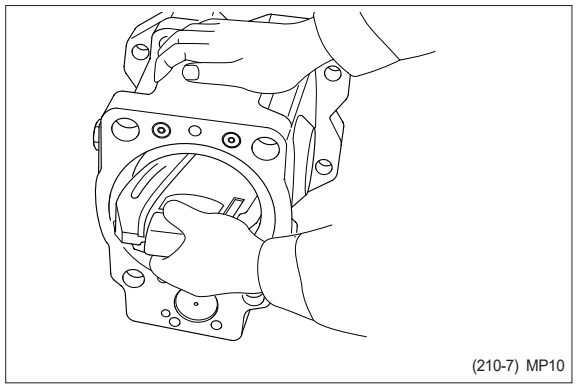


(210-7) MP09

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

※ Confirm with fingers of both hands that swash plate can be removed smoothly.

※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.

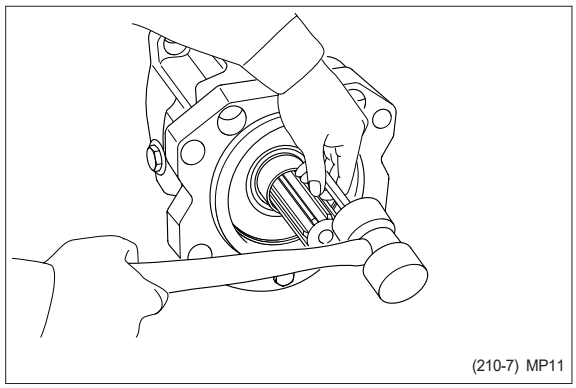


(210-7) MP10

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

※ Do not tap drive shaft with hammer or so on.

※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.
Fit them fully, using steel bar or so on.



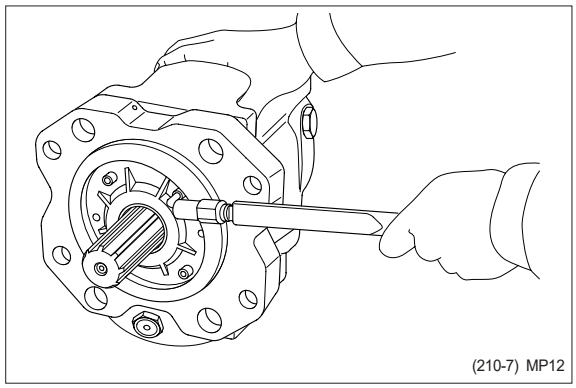
(210-7) MP11

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

※ Apply grease lightly to oil seal in seal cover (F).

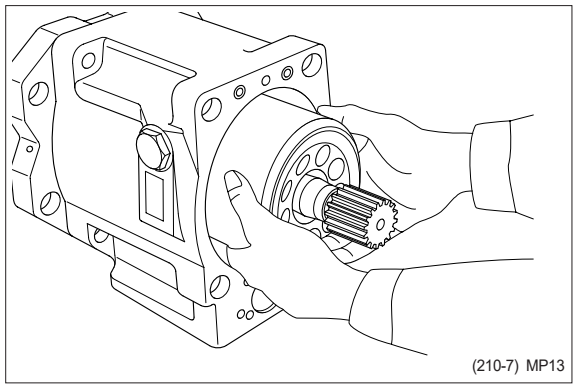
※ Assemble oil seal, taking full care not to damage it.

※ For tandem type pump, fit rear cover (263) and seal cover (262) similarly.



(210-7) MP12

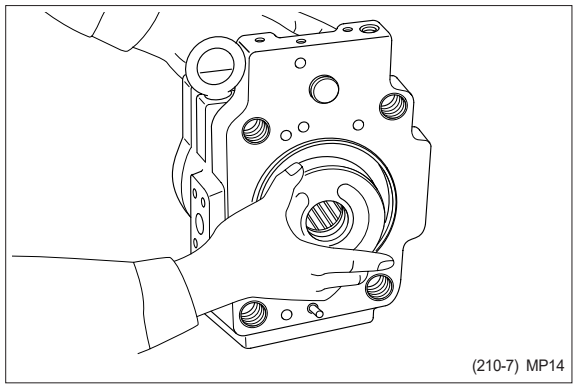
(6) Assemble piston cylinder subassembly 〔cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157)〕.
Fit spline phases of retainer and cylinder.
Then, insert piston cylinder subassembly into pump casing.



(210-7) MP13

(7) Fit valve plate (313) to valve block (312), entering pin into pin hole.

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



(210-7) MP14

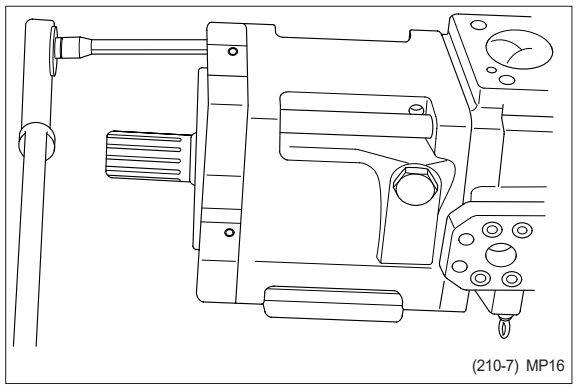
(8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).

※ At first assemble this at rear pump side, and this work will be easy.

※ Take care not to mistake direction of valve block.

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

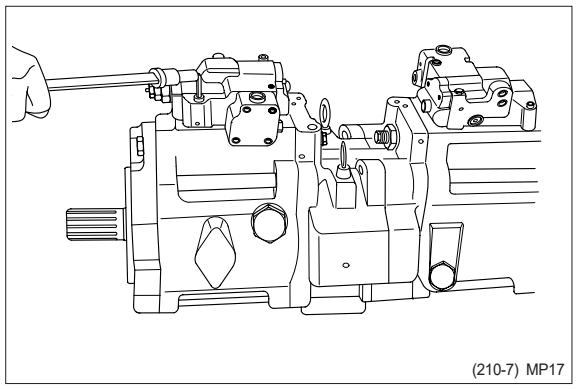
※ Counter clockwise rotation (Viewed from input shaft side) - Fit block with delivery flange right, viewed from front side.



(210-7) MP16

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

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



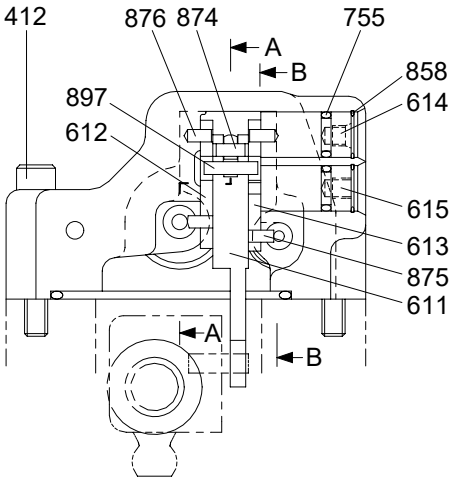
(210-7) MP17

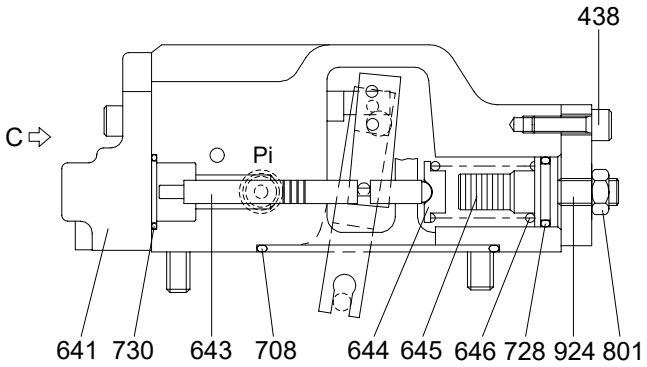
(10) Fit drain port plug (468).

This is the end of reassembling procedures.

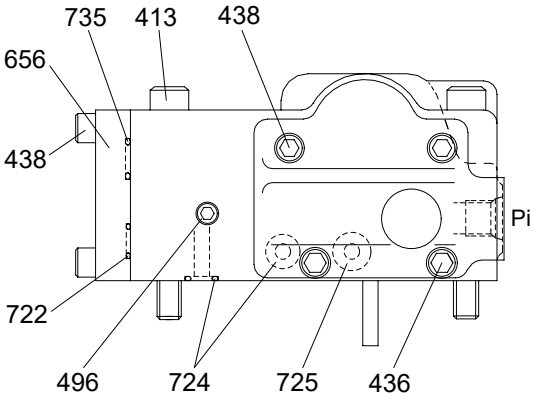
## 3. REGULATOR

### 1) STRUCTURE (1/2)

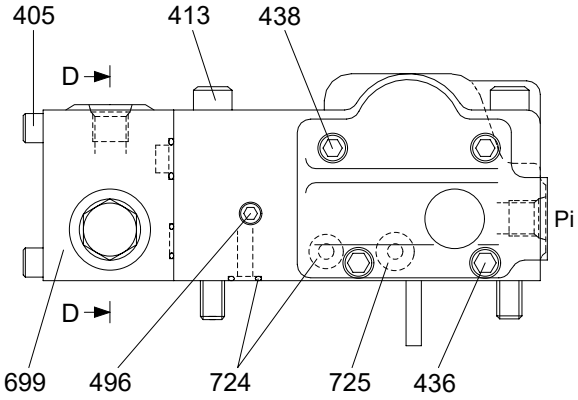


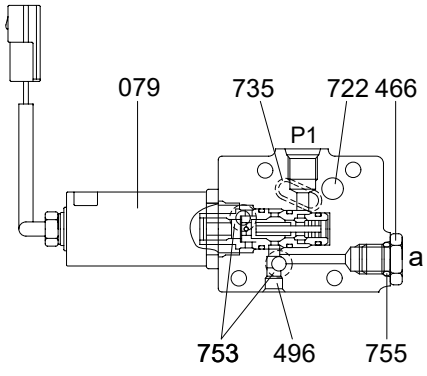

SECTION B-B



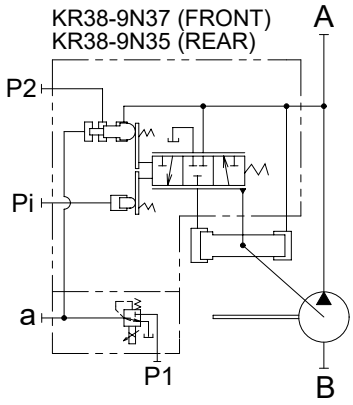

VIEW C (FRONT)



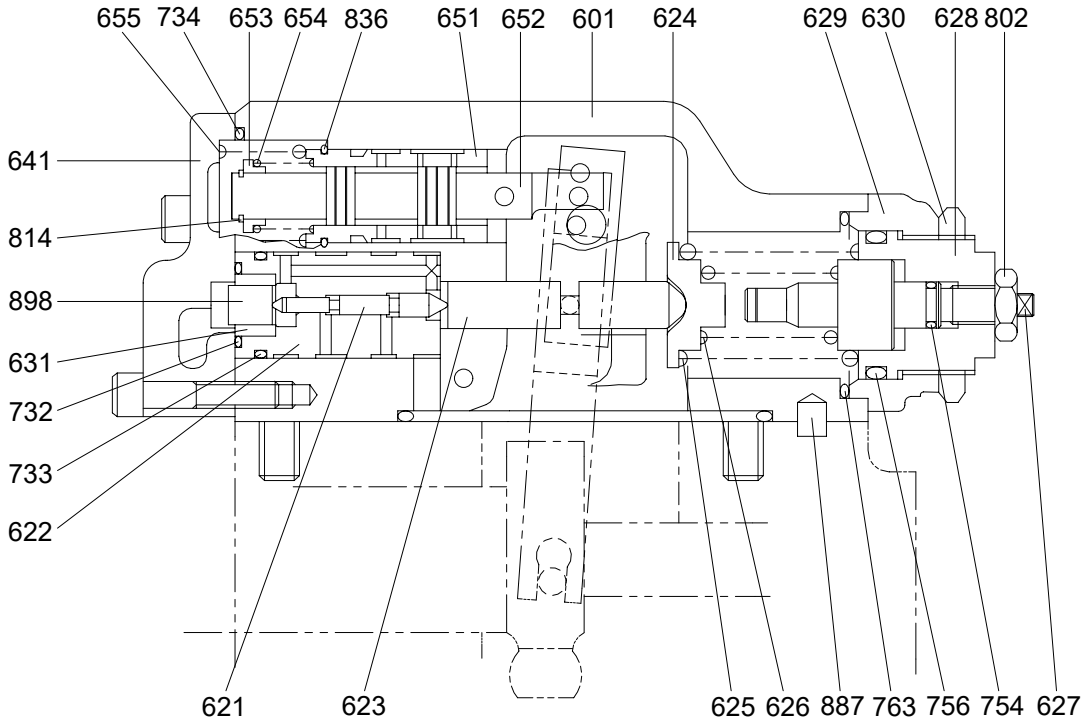

VIEW C (REAR)




SECTION D-D(REAR)



## REGULATOR (2/2)



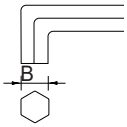

SECTION A-A

| | | | | | |
|---|---|---|---|---|---|
| 405 | Hexagon socket screw | 629 | Cover (C) | 732 | O-ring |
| 412 | Hexagon socket screw | 630 | Lock nut | 733 | O-ring |
| 413 | Hexagon socket screw | 631 | Sleeve, kf | 734 | O-ring |
| 436 | Hexagon socket screw | 641 | Pilot cover | 735 | O-ring |
| 438 | Hexagon socket screw | 643 | Pilot piston | 753 | O-ring |
| 466 | Plug | 644 | Spring seat (Q) | 754 | O-ring |
| 496 | Plug | 645 | Adjust stem (Q) | 755 | O-ring |
| 601 | Casing | 646 | Pilot spring | 756 | O-ring |
| 611 | Feed back lever | 651 | Sleeve | 763 | O-ring |
| 612 | Lever (1) | 652 | Spool | 801 | Nut |
| 613 | Lever (2) | 653 | Spring seat | 802 | Nut |
| 614 | Fulcrum plug | 654 | Return spring | 814 | Snap ring |
| 615 | Adjust plug | 655 | Set spring | 836 | Snap ring |
| 621 | Compensator piston | 656 | Block cover | 858 | Snap ring |
| 622 | Piston case | 699 | Valve casing | 874 | Pin |
| 623 | Compensator rod | 708 | O-ring | 875 | Pin |
| 624 | Spring seat (C) | 722 | O-ring | 876 | Pin |
| 625 | Outer spring | 724 | O-ring | 887 | Pin |
| 626 | Inner spring | 725 | O-ring | 897 | Pin |
| 627 | Adjust stem (C) | 728 | O-ring | 898 | Pin |
| 628 | Adjust screw (C) | 730 | O-ring | 924 | Set screw |

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

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

<table>
<tr><td colspan="2">Tool name & size</td><td colspan="5">Part name</td></tr>
<tr><td>Name</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td colspan="2">Hexagon socket head setscrew</td></tr>
<tr><td rowspan="3">Allen wrench  </td><td>4</td><td>M5</td><td>BP-1/16</td><td>-</td><td colspan="2">M 8</td></tr>
<tr><td>5</td><td>M6</td><td>BP-1/8</td><td>-</td><td colspan="2">M10</td></tr>
<tr><td>6</td><td>M8</td><td>BP-1/4</td><td>PO-1/4</td><td colspan="2">M12, M14</td></tr>
<tr><td rowspan="2">Double ring spanner, socket wrench, double (single) open end spanner  </td><td>-</td><td colspan="2">Hexagon head bolt</td><td colspan="2">Hexagon nut</td><td>VP plug (PF thread)</td></tr>
<tr><td>6</td><td colspan="2">M 8</td><td colspan="2">M 8</td><td>-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="5">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="5">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="5">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="5">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="5">4 × 100 mm</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="5">Capable of tightening with the specified torques</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="5">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="5">M4, Length : 50 mm</td></tr>
</table>

## (2) Tightening torque

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

### 3) DISASSEMBLY

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

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

(1) Choose a place for disassembly.

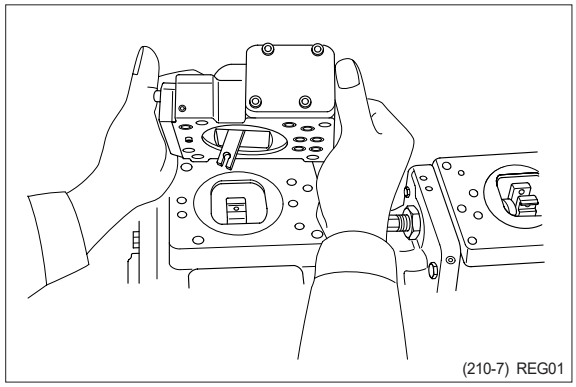
※ Choose a clean place.

※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.

(2) Remove dust, rust, etc. from surfaces of regulator with clean oil.

(3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.

※ Take care not to lose O-ring.

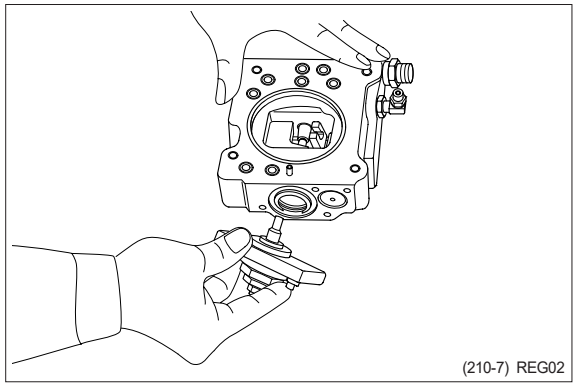


(210-7) REG01

(4) Remove hexagon socket head screw (438) and remove cover (C,629)

※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

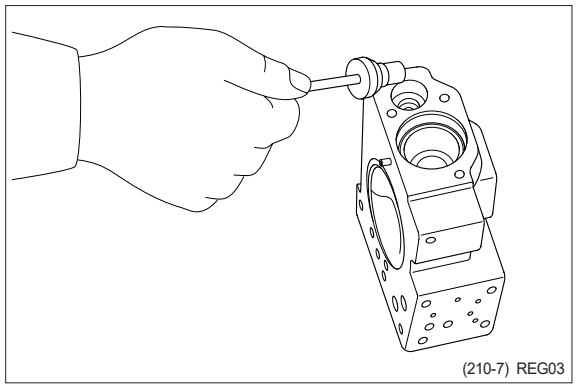
※ Do not loosen these screws and nuts. If they are loosened, adjusted pressure-flow setting will vary.



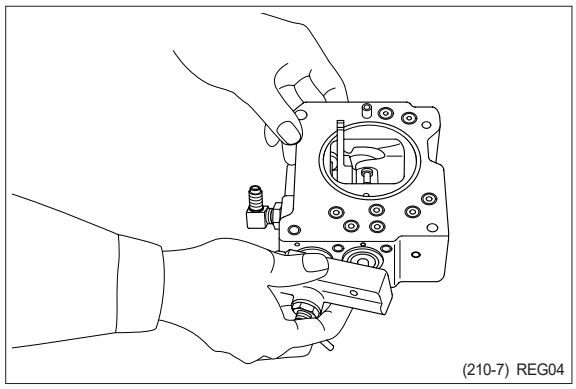
(210-7) REG02

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

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


(210-7) REG03

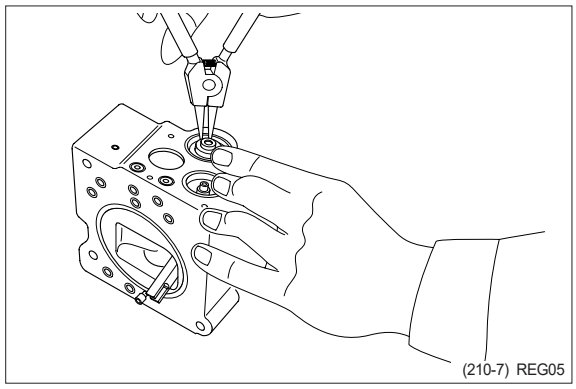
(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.


(210-7) REG04

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

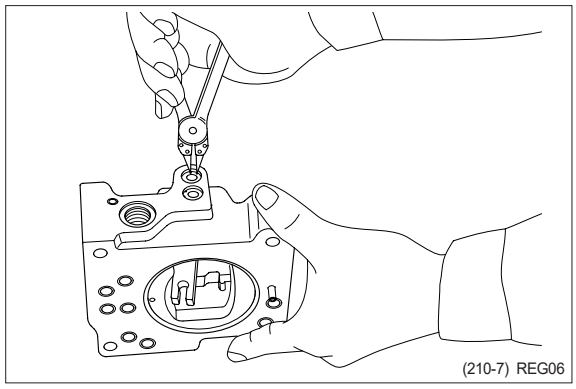
※ Sleeve (651) is fitted with snap ring (836).

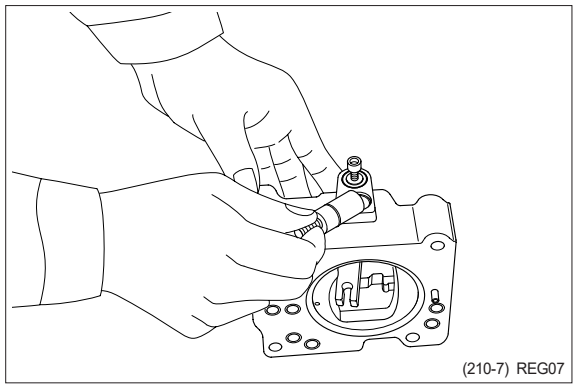
※ When removing snap ring (814), return spring (654) may pop out.
Take care not to lose it.


(210-7) REG05

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

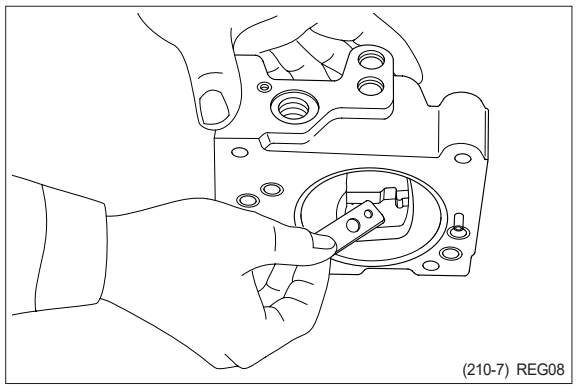
※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.


(210-7) REG06


(210-7) REG07

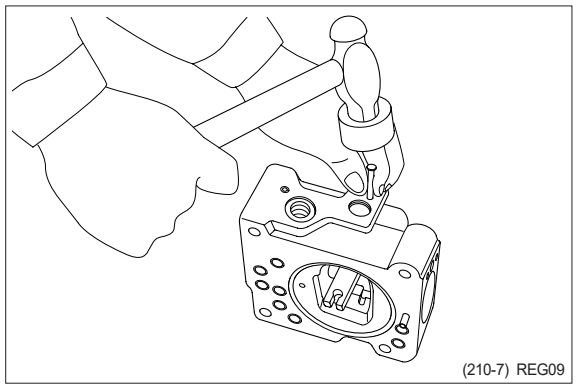
(9) Remove lever (2, 613). Do not draw out pin (875).

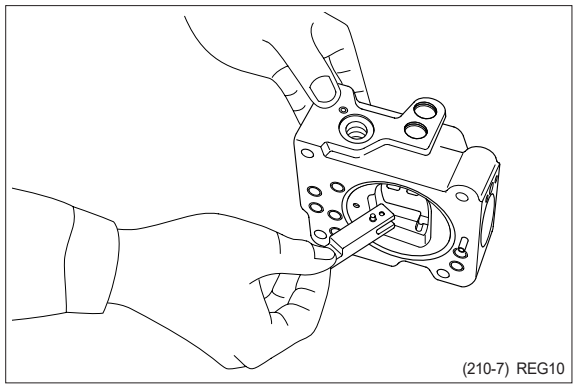
※ Work will be promoted by using pincers or so on.


(210-7) REG08

(10) Draw out pin (874) and remove feedback lever (611).

Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).


(210-7) REG09


(210-7) REG10

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

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

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

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

This completes disassembly.

## 4) ASSEMBLY

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

① Always repair parts that were scored at disassembly.

② Get replacement parts ready beforehand. Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Always tighten bolts, plugs, etc. to their specified torques.

④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.

⑤ Replace seals such as O-ring with new ones as a rule.

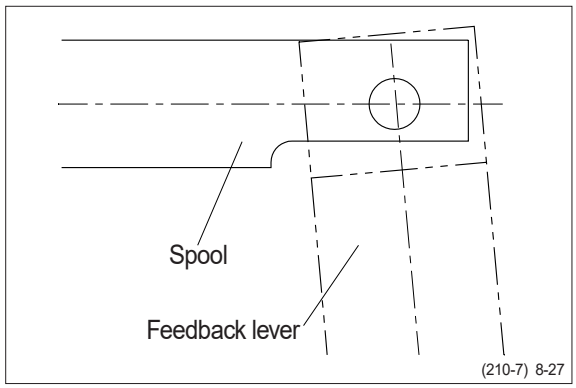
(2) Put compensating rod (623) into compensating hole of casing (601).

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

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

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

※ Pay attention to orientation of spool.

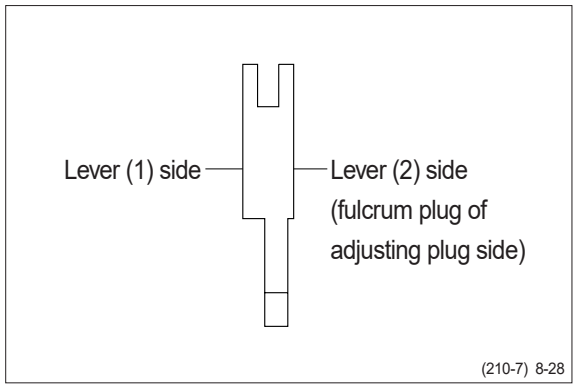


(210-7) 8-27

(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).

※ Insert pin in feedback lever a little to ease operation.

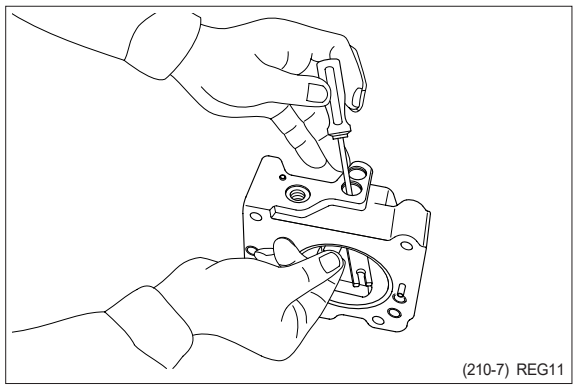
※ Take care not to mistake direction of feedback lever.




(6) Put pilot piston (643) into pilot hole of casing.

※ Confirm that pilot piston slides smoothly without binding.

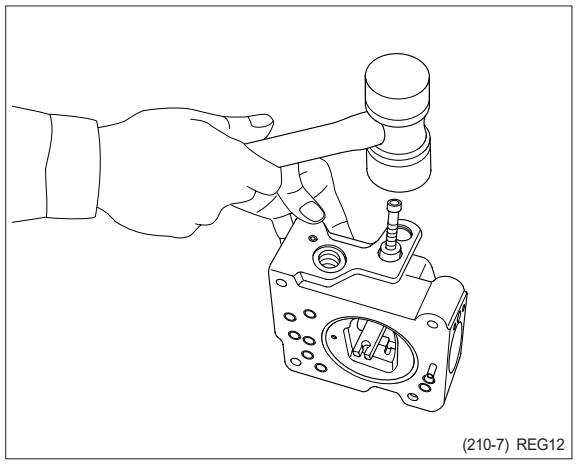
(7) Put pin force-fitted in lever (2, 613) into groove of pilot piston.
Then fix lever (2).



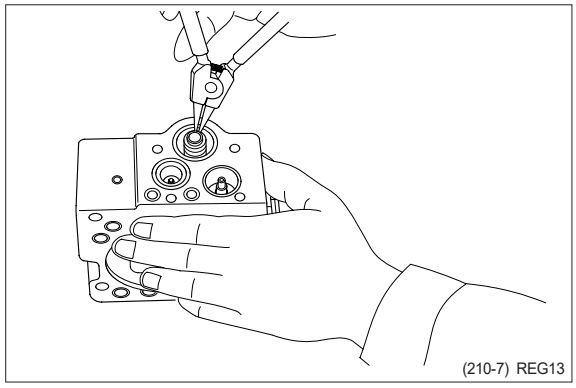

(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever (2).
Then fix locking ring (858).

(9) Insert adjusting plug (615) and fit locking ring.

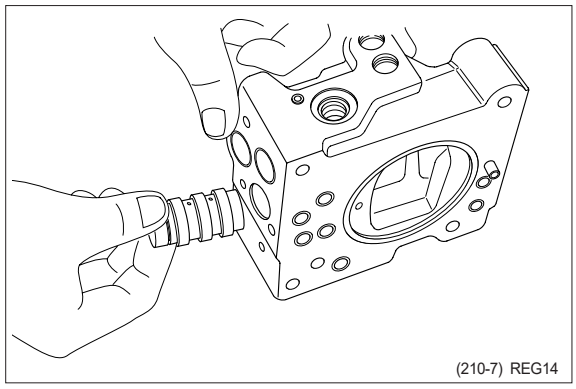
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.




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

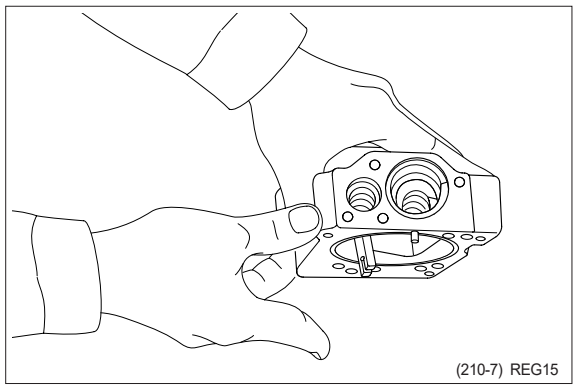


(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).


(210-7) REG14

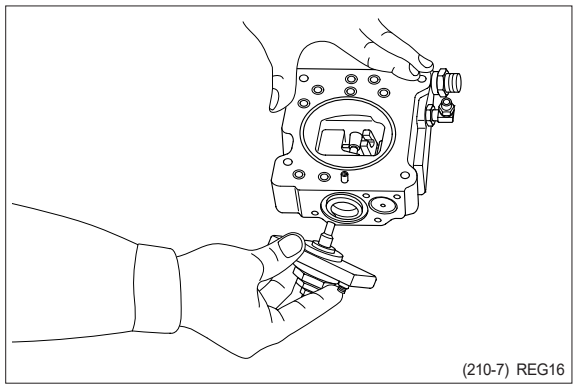
(12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole.
Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

※ When fitting spring seat, take care not to mistake direction of spring seat.


(210-7) REG15

(13) Install cover (C, 629) fitted with adjusting screws (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).

This completes assembly.


(210-7) REG16

## 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) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.
- Weight : 80kg(175lb)

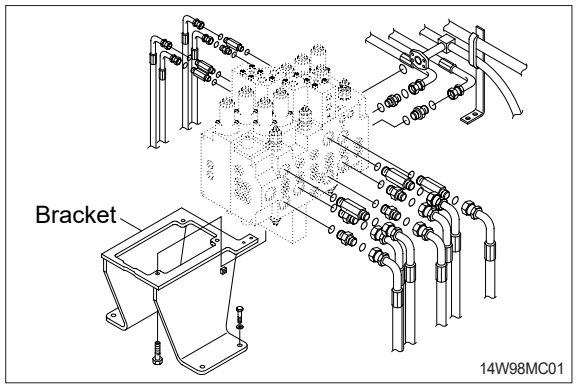
(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

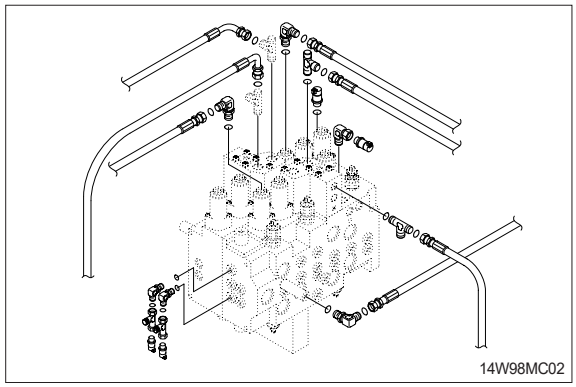
### 2) INSTALL

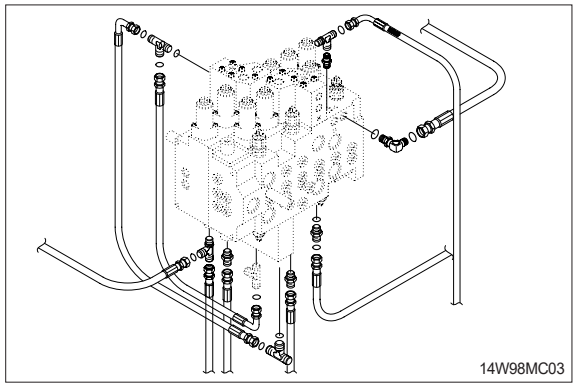
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.
① Cylinder (Boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

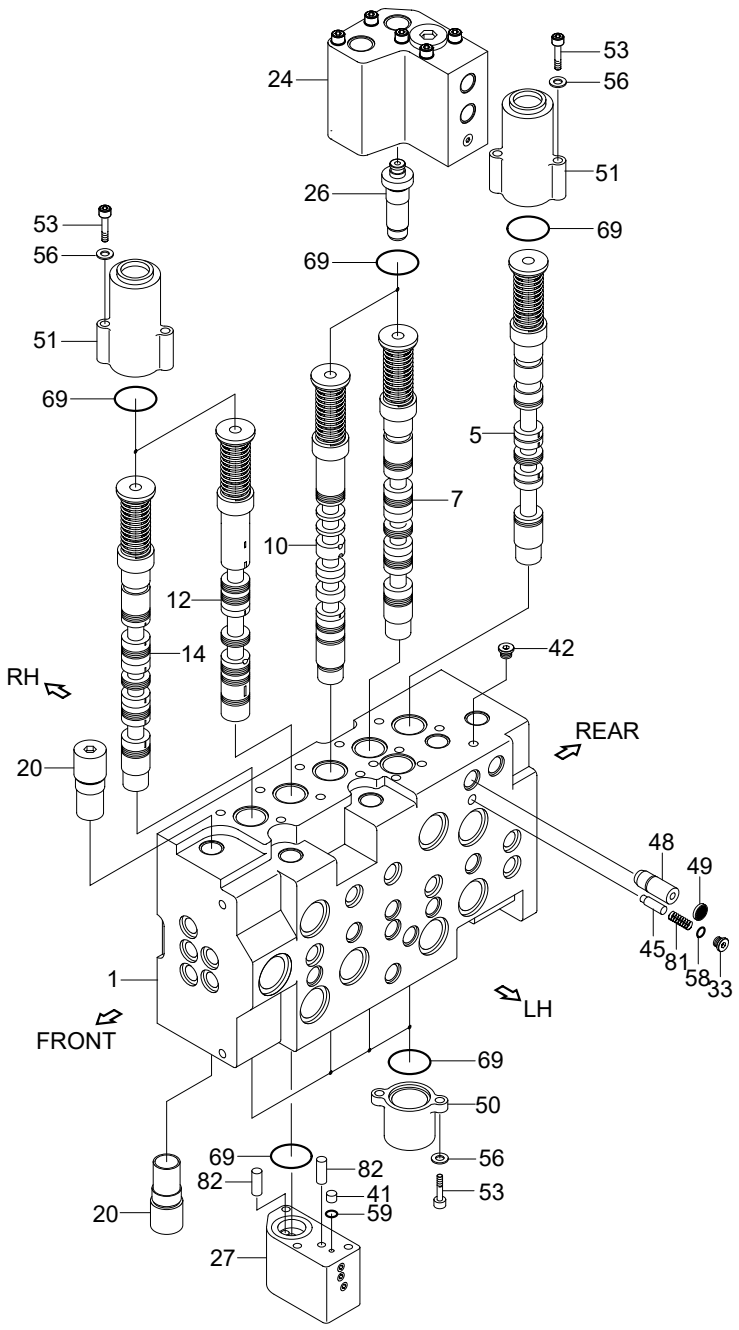
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

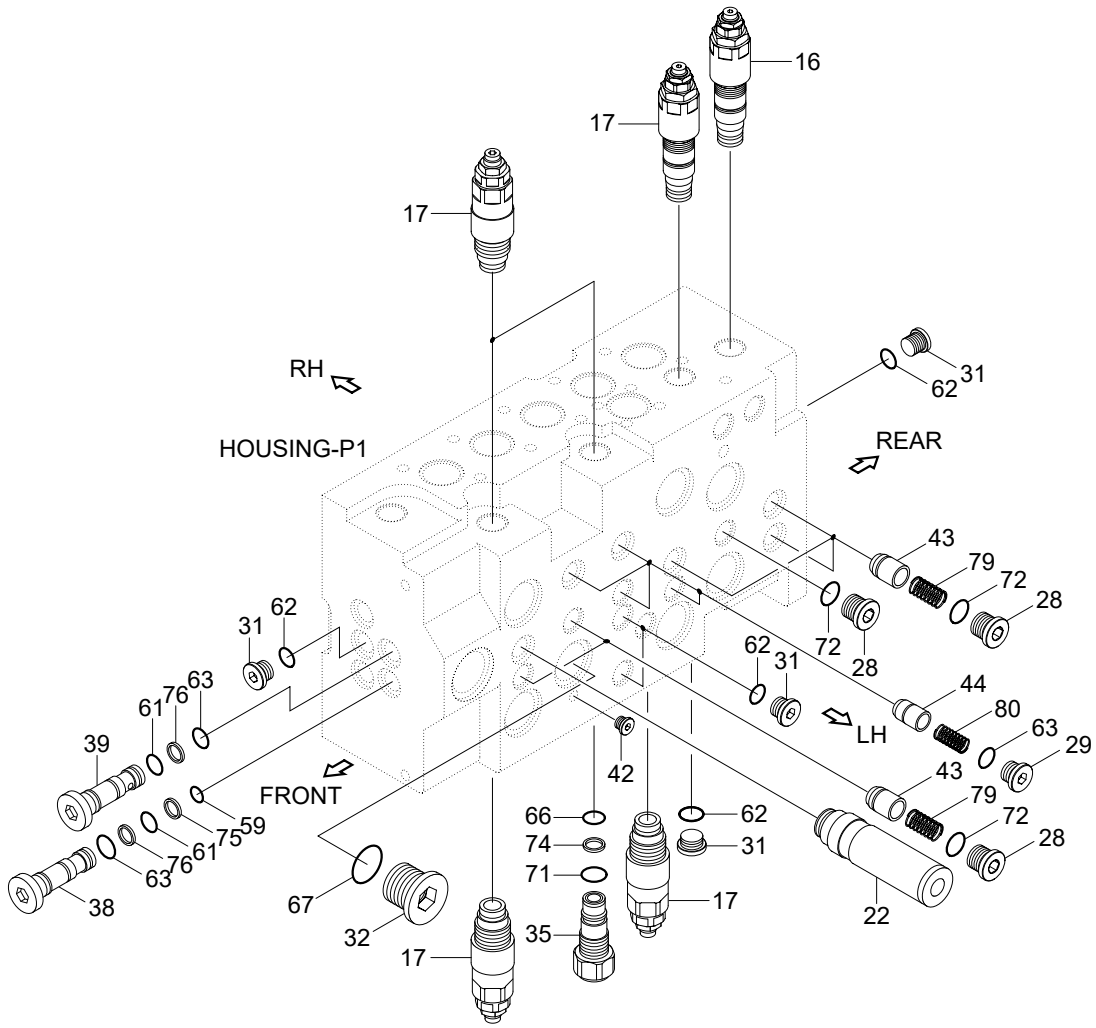
## 2. STRUCTURE (1/4)




14W98MC04

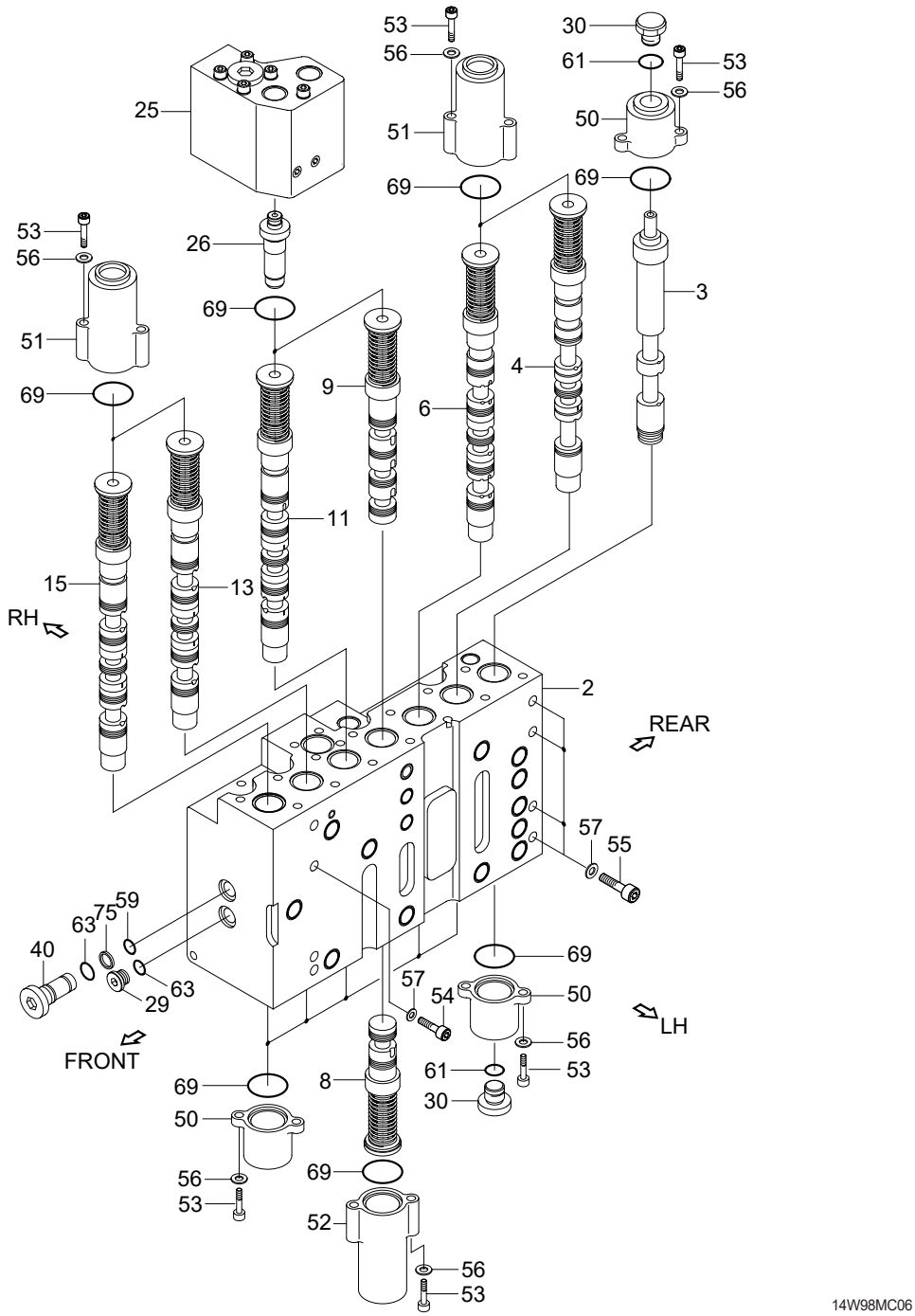
| | | | | | |
|---|---|---|---|---|---|
| 1 | Housing-P1 | 27 | Regeneration block | 53 | Socket head bolt |
| 5 | Spool assy-option C | 33 | Plug | 56 | Plain washer |
| 7 | Spool assy-boom 1 | 41 | Orifice | 58 | O-ring |
| 10 | Spool assy-arm 2 | 42 | Plug | 59 | O-ring |
| 12 | Spool assy-arm regen | 45 | Poppet | 69 | O-ring |
| 14 | Spool assy-bucket | 48 | Orifice | 81 | Spring |
| 20 | Nega con relief valve | 49 | Coin type filter | 82 | Pin-regeneration |
| 24 | Holding valve kit A1 | 50 | Pilot A cap | | |
| 26 | Lock valve kit B | 51 | Pilot B1 cap | | |

## STRUCTURE (2/4)



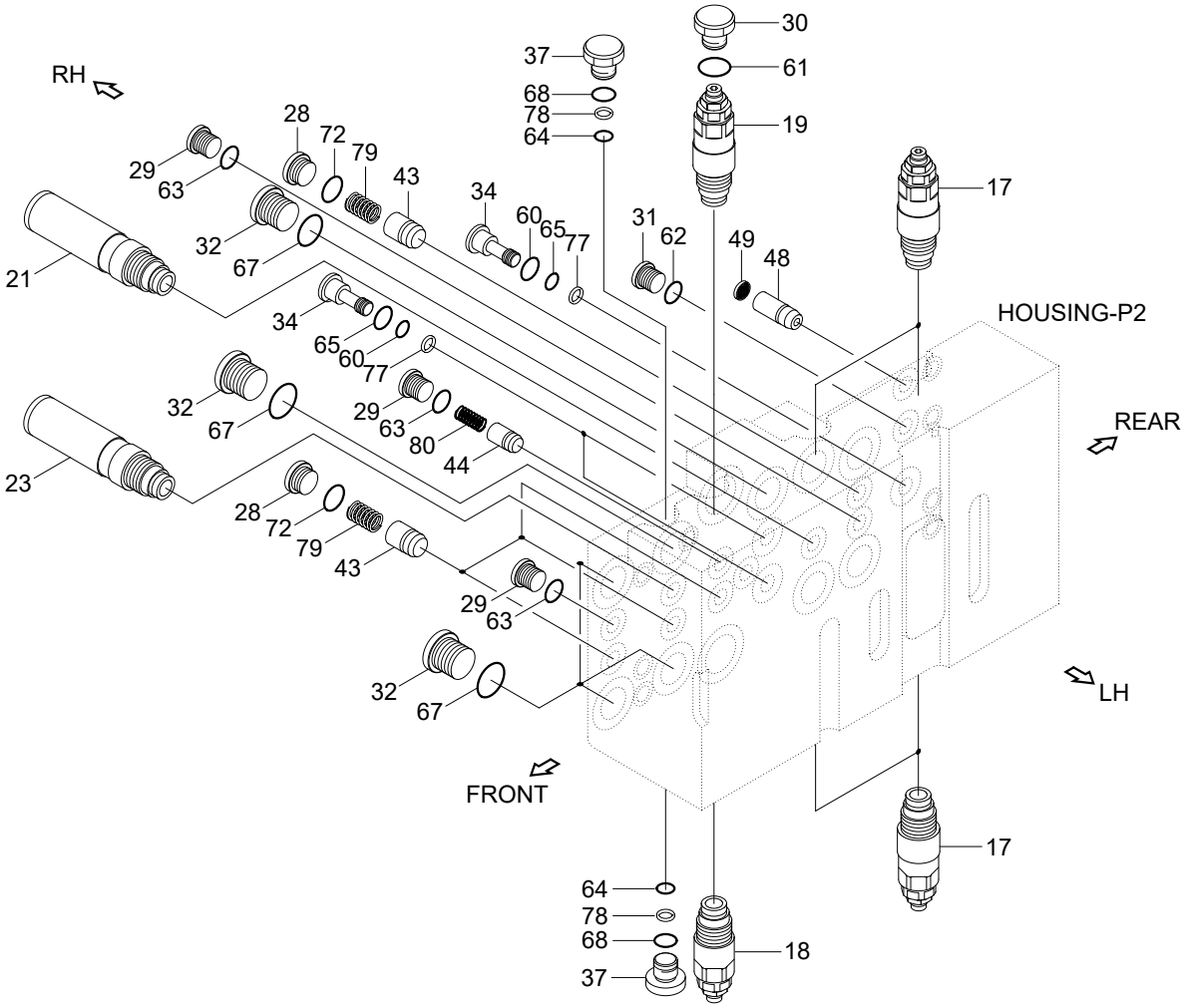

| | | | | | |
|---|---|---|---|---|---|
| 16 | Main relief valve | 39 | Plug | 67 | O-ring |
| 17 | Overload relief valve | 42 | Plug | 71 | O-ring |
| 22 | Bucket logic valve | 43 | Poppet 1 | 72 | O-ring |
| 28 | Plug | 44 | Poppet 2 | 74 | Back up ring |
| 29 | Plug | 59 | O-ring | 75 | Back up ring |
| 31 | Plug | 61 | O-ring | 76 | Back up ring |
| 32 | Plug | 62 | O-ring | 79 | Spring |
| 35 | Plug | 63 | O-ring | 80 | Spring |
| 38 | Plug | 66 | O-ring | | |

## STRUCTURE (3/4)




| | | | | | |
|---|---|---|---|---|---|
| 2 | Housing-P2 | 25 | Holding valve kit-A2 | 54 | Socket head bolt |
| 3 | Spool assy | 26 | Lock valve kit-B | 55 | Socket head bolt |
| 4 | Spool assy-travel | 29 | Plug | 56 | Plain washer |
| 6 | Spool assy-swing | 30 | Plug | 57 | Spring washer |
| 8 | Spool assy-swing priority | 40 | Plug | 59 | O-ring |
| 9 | Spool assy-boom 2 | 50 | Pilot A cap | 61 | O-ring |
| 11 | Spool assy-arm 1 | 51 | Pilot B1 cap | 63 | O-ring |
| 13 | Spool assy-option B | 52 | Pilot B2 cap | 69 | O-ring |
| 15 | Spool assy-dozer | 53 | Socket head bolt | 75 | Back up ring |

## STRUCTURE (4/4)




| | | | | | |
|---|---|---|---|---|---|
| 17 | Overload relief valve | 34 | Plug | 64 | O-ring |
| 18 | Overload relief valve | 37 | Plug | 65 | O-ring |
| 19 | Overload relief valve | 43 | Poppet 1 | 67 | O-ring |
| 21 | Swing logic valve | 44 | Poppet | 68 | O-ring |
| 23 | ON/OFF valve-option | 48 | Orifice | 72 | O-ring |
| 28 | Plug | 49 | Coin type filter | 77 | Back up ring |
| 29 | Plug | 60 | O-ring | 78 | Back up ring |
| 30 | Plug | 61 | O-ring | 79 | Spring |
| 31 | Plug | 62 | O-ring | 80 | Spring |
| 32 | Plug | 63 | O-ring | | |

## 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 remove 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 | 27 and 32 |
| Spanner | Each 1 piece | 32 (main relief valve, overload relief valve, negative relief valve)<br>26 (holding valve) |

### 3) DISASSEMBLY

#### (1) Disassembly of spools without holding valve

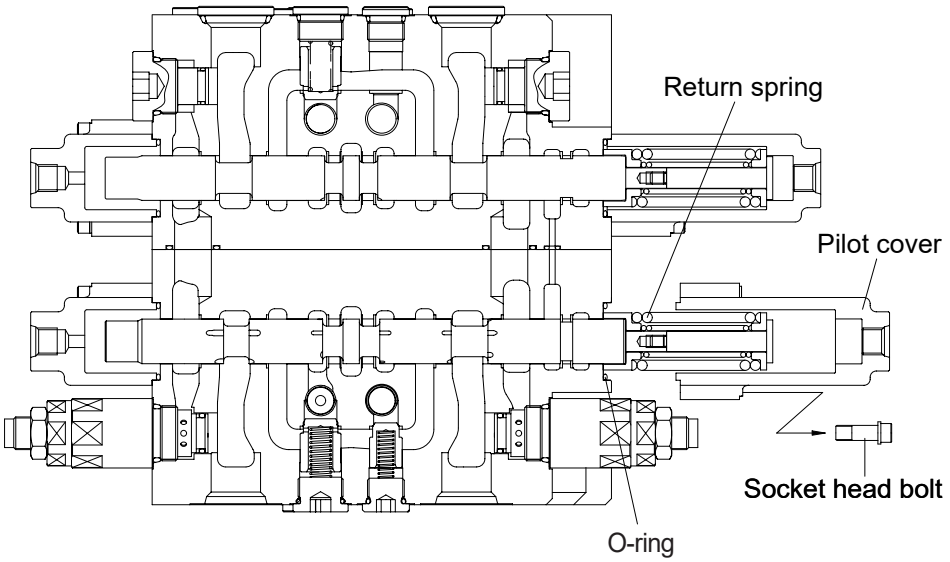
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 ㎜)

② Remove the pilot cover.

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

③ Remove the spool assembly 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 spools with holding valve** (boom 1, Arm 1 spool)

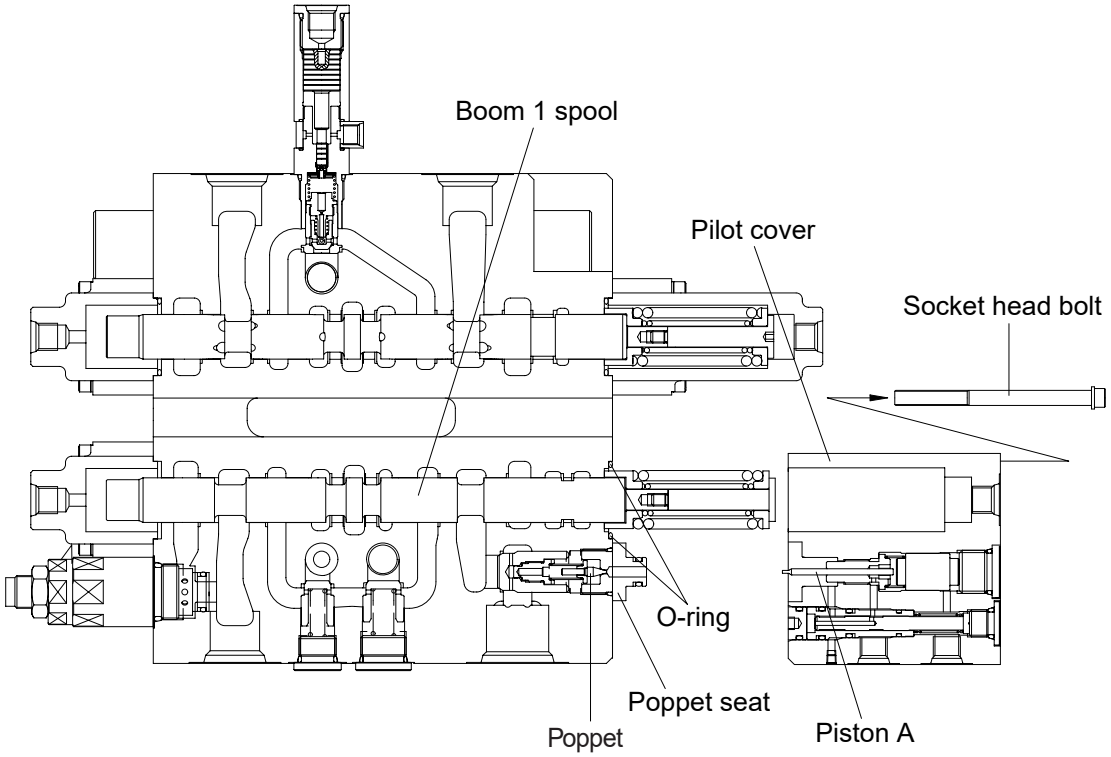
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 ㎜)

② Remove the pilot cover with internal parts.

※ 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.

③ Remove the spool assembly 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.



### (3) Disassembly of the holding valve

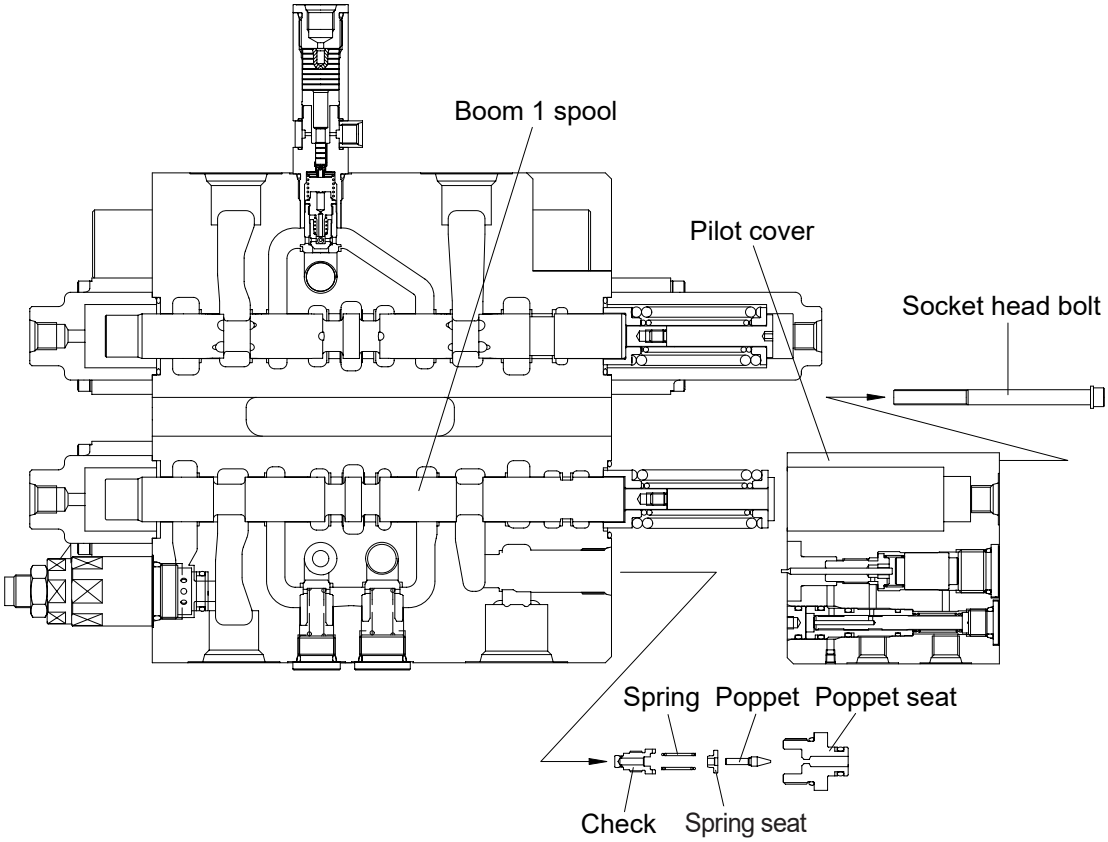
① Remove the pilot cover with the holding valve as described on previous page.

※ Do not disassembled internal parts of the pilot cover.

② Loosen the poppet seat and remove the poppet, spring seat, spring and check.
(spanner : 26 ㎜)

※ Pay attention not to lose the poppet.

※ Do not disassembled internal parts of the check.



### (4) 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.

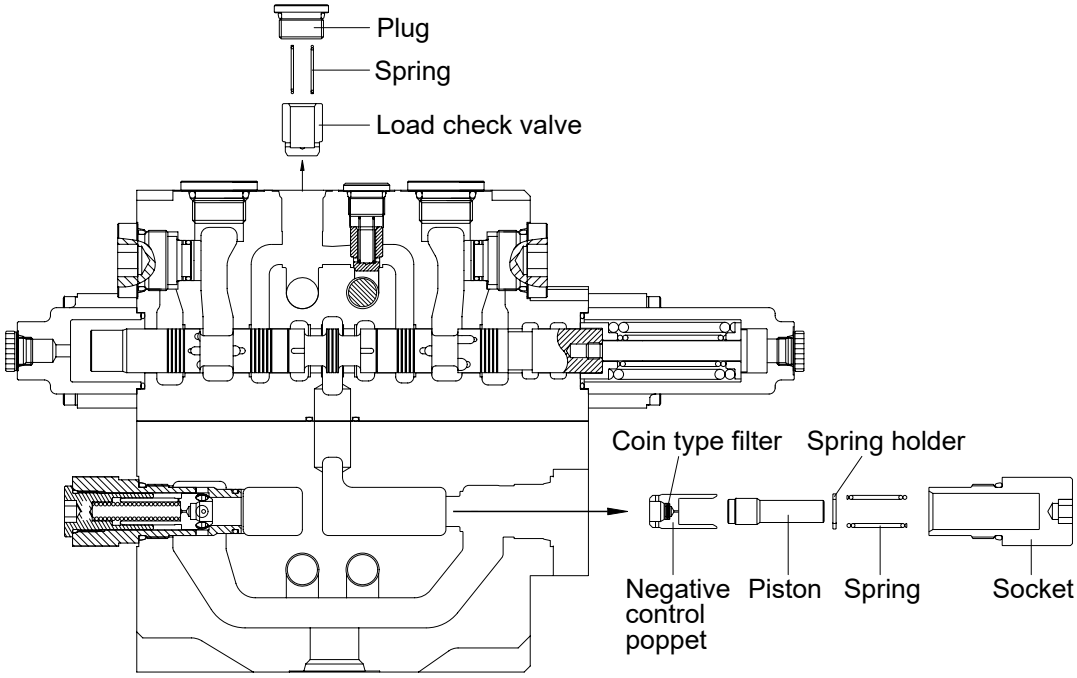
b. Loosen the plug (hexagon wrench : 10 ㎜).

c. Remove the spring and the load check valve with pincers or magnet.

② The negative relief valve

a. Loosen the socket (spanner : 32 ㎜).

b. Remove the spring, spring holder, piston and negative control poppet.



### (5) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

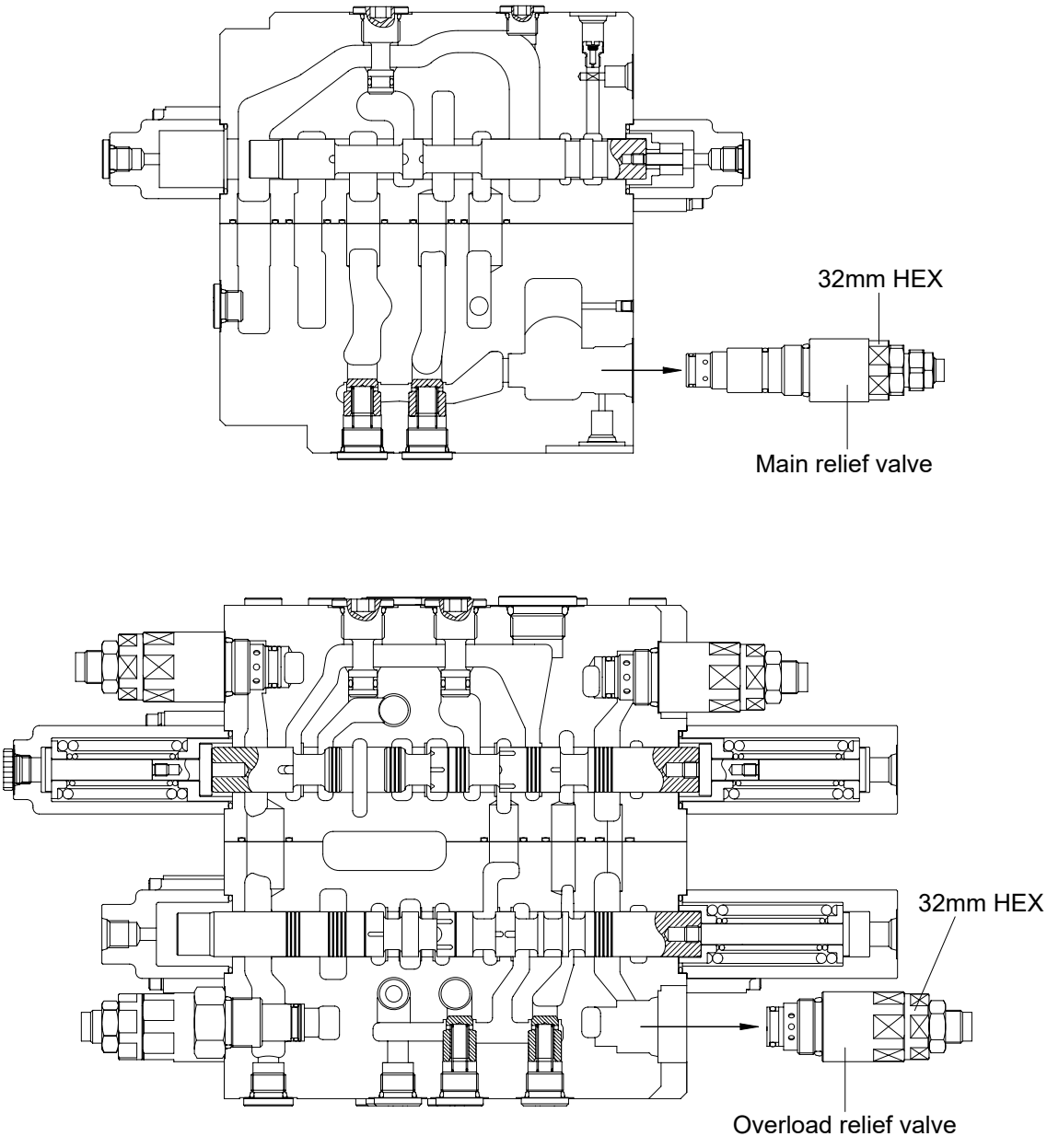
② Remove the main relief valve.
(spanner : 32 ㎜)

③ Remove the overload relief valve.
(spanner : 32 ㎜)

※ 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.




14W98MC14

### (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. Do not stretch seals so much as to deform them permanently.
④ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted
⑤ 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 and spring.
② Put O-rings on to plug.
③ Tighten plug to the specified torque.
- Hexagon wrench : 10 mm
- Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

### (3) Negative control relief valve

① Assemble the nega-con poppet, piston, spring holder and spring together into body.
② Put O-ring on to plug and tighten the latter to its specified torque.
- Hexagon wrench : 12 mm
- Tightening torque : 8~9 kgf · m (57.8~65.1 lbf · ft)

### (4) Main relief, overload relief valves

Install main relief valve, overload relief valve into the body and tighten to the specified torque.

| Component | Tools | Tightening torque | |
|---|---|---|---|
| | | kgf · m | lbf · ft |
| Main relief valve | Spanner 32 mm | 8~9 | 57.8~65.1 |
| Overload relief valve | Spanner 32 mm | 8~9 | 57.8~65.1 |

### (5) 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.

### (6) Pilot covers

① Fit spool covers to the non-spring assembly end of the spool, and tighten the hexagonal socket head bolts to the specified torque.
- Hexagon wrench : 5 mm
- Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

※ Confirm that O-rings have been fitted.

② Fit spring covers to the spring end for the spools, and tighten hexagon socket head bolts to the specified torque.
- Hexagon wrench : 5mm
- Tightening torque : 1.0~1.1 kgf·m (7.2~7.9 lbf·ft)

※ Confirm that O-rings have been fitted.

### (7) Holding valves

① Assemble the check, spring seat and poppet together into body.

② Tighten the poppet seat to the specified torque.
- Spanner : 26 mm
- Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

③ Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.

④ Tighten hexagon socket head bolt to specified torque.
- Hexagon wrench : 5mm
- Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 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).

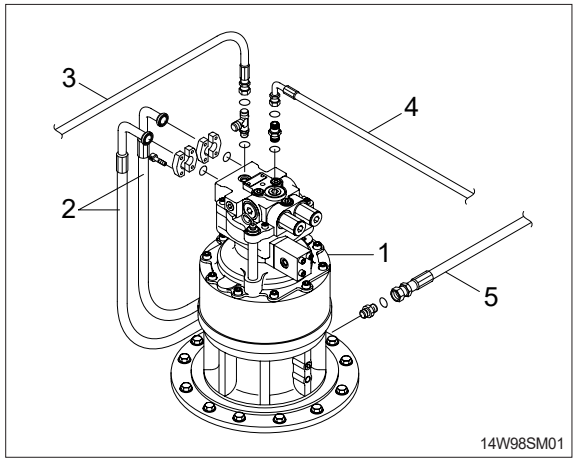
(5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 9).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (10).

· Motor device weight : 32kg (71lb)

(7) Remove the swing motor assembly.

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


### 2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

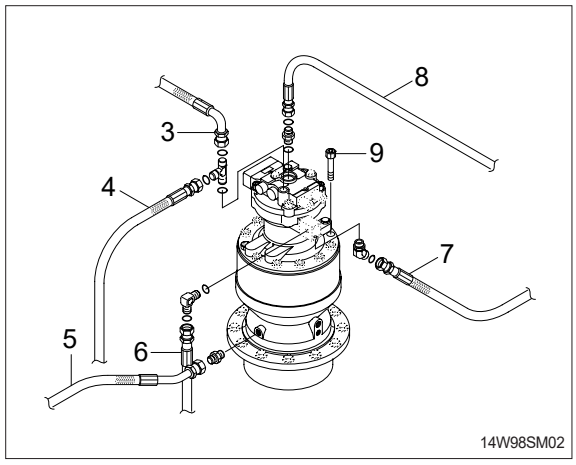
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

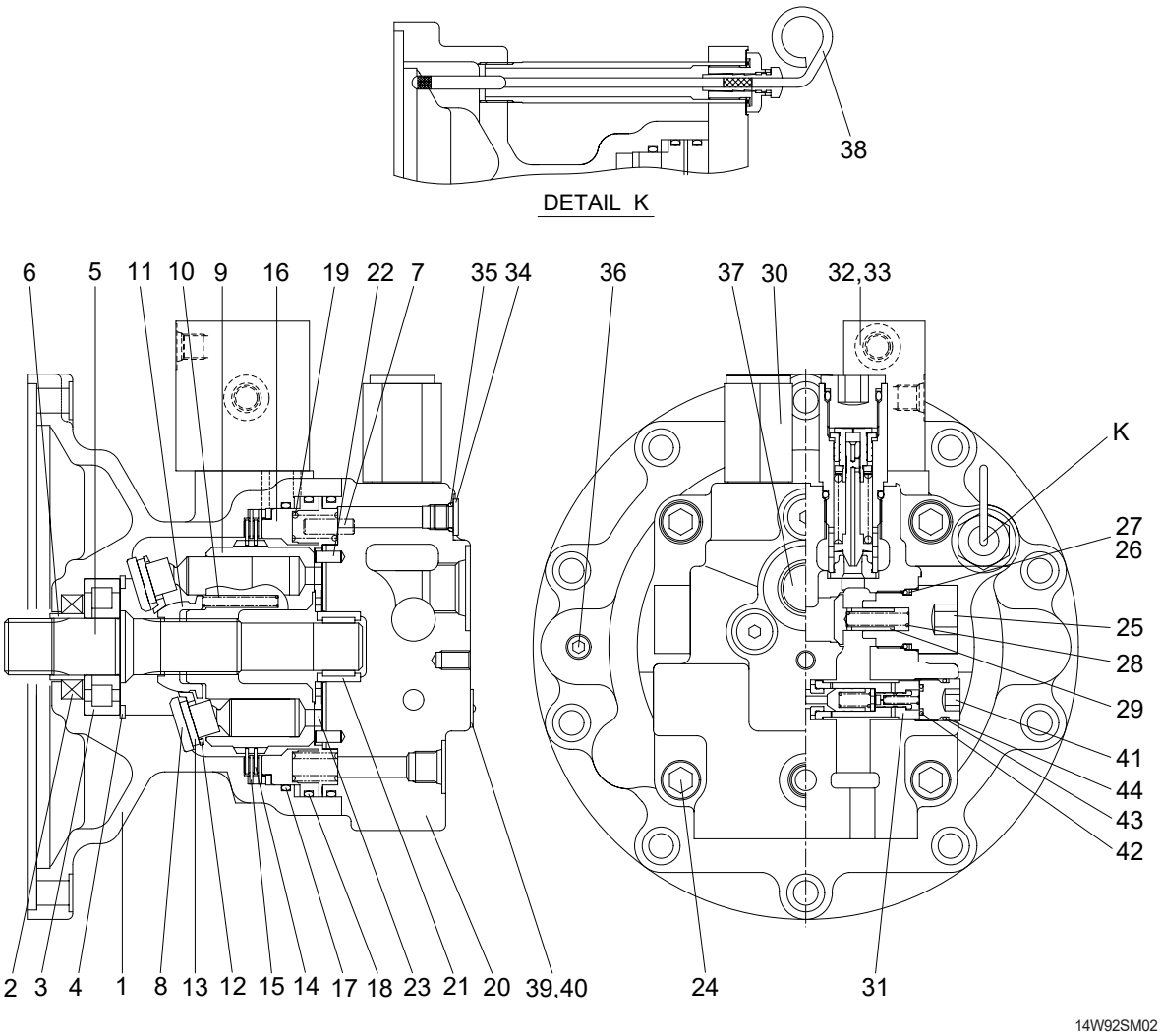
⑤ Tighten plug fully.

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



## 2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

### 1) STRUCTURE

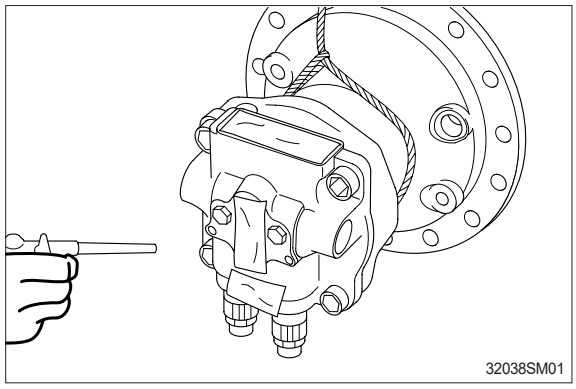



| | | | | | |
|---|---|---|---|---|---|
| 1 | Body | 16 | Brake piston | 31 | Anti-rotating valve |
| 2 | Oil seal | 17 | O-ring | 32 | Time delay valve |
| 3 | Roller bearing | 18 | O-ring | 33 | Wrench bolt |
| 4 | Snap ring | 19 | Brake spring | 34 | Plug |
| 5 | Drive shaft | 20 | Rear cover | 35 | O-ring |
| 6 | Bushing | 21 | Needle bearing | 36 | Plug |
| 7 | Pin | 22 | Pin | 37 | Plug |
| 8 | Shoe plate | 23 | Valve plate | 38 | Level gauge |
| 9 | Cylinder block | 24 | Wrench bolt | 40 | Rivet |
| 10 | Spring | 25 | Plug | 41 | Plug |
| 11 | Ball guide | 26 | Back up ring | 42 | O-ring |
| 12 | Set plate | 27 | O-ring | 43 | O-ring |
| 13 | Piston assembly | 28 | Spring | 44 | Back up ring |
| 14 | Friction plate | 29 | Check | | |
| 15 | Separate plate | 30 | Relief valve | | |

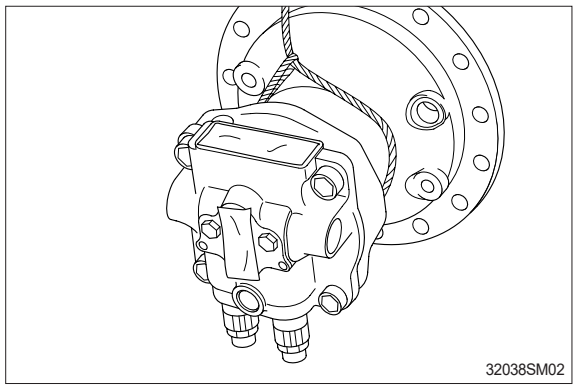
## 2) DISASSEMBLY

(1) Lift the motor out. Clean the motor in kerosene and dry with compressed air.

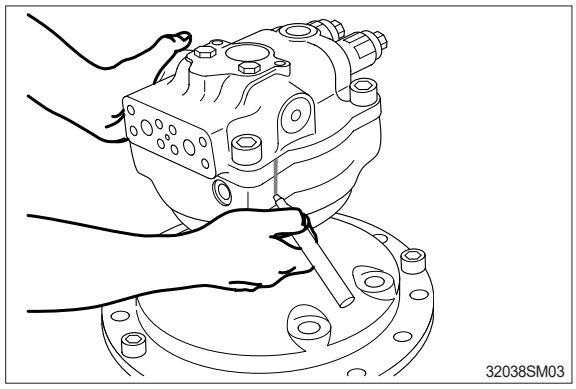
※ To avoid dust inside the motor, mask all the ports of the motor with tapes.



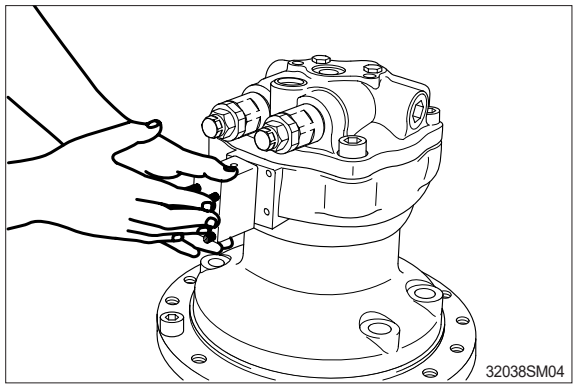

(2) Loosen the drain plug to discharge oil in the body(1).



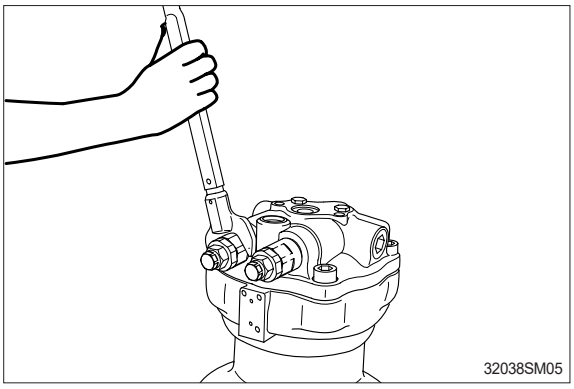

(3) Fix the drive shaft (5) on the workbench with the end of output shaft down. Put matching marks on body (1) and valve rear cover (20) for easy reassembly.




(4) Remove the valve (32).

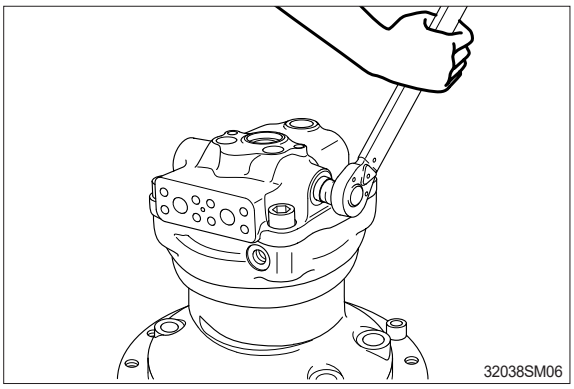


(5) Remove the relief valve (30) from rear cover (20).

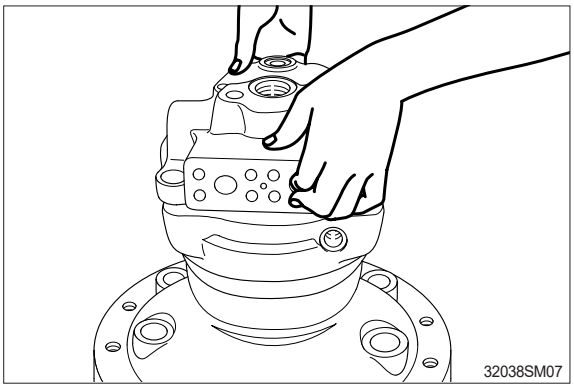



(6) Remove plug (25) from rear cover (20) and spring (28), check (29).

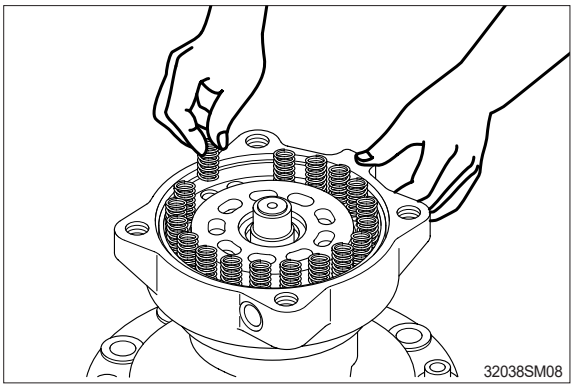
※ Be careful not to damage the check seat assembly.



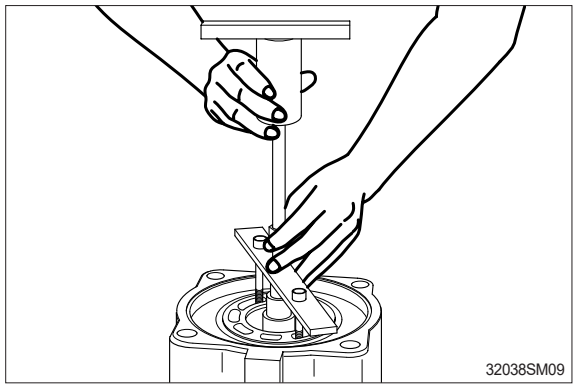

(7) Remove rear cover (20) from body (1). Then, remove the valve plate (23) from rear cover (20) with care.



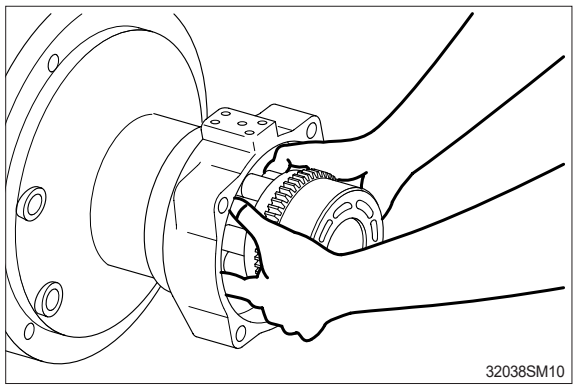

(8) Remove the brake spring (19) from brake piston (16).



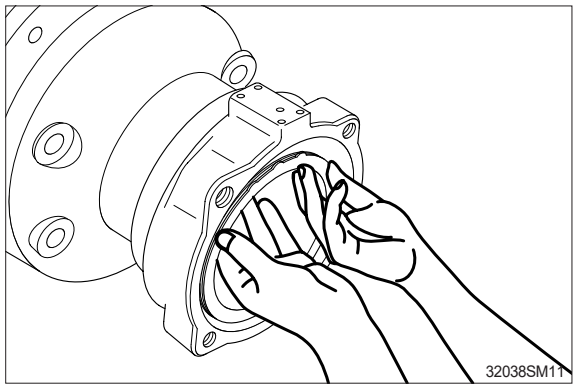
(9) Remove brake piston (16) from body (1).



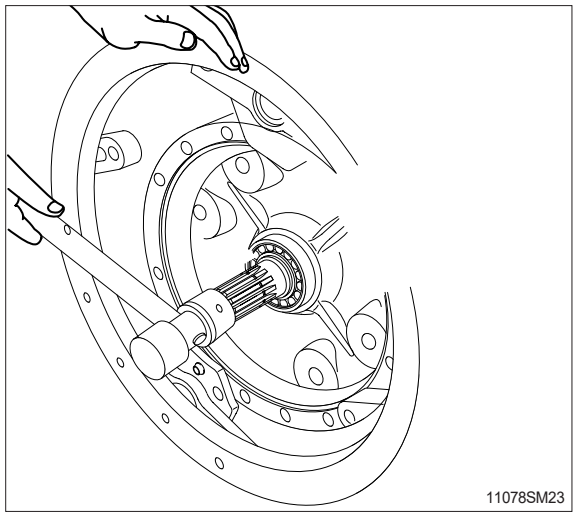

(10) Remove the cylinder (9) from the drive shaft (5) with the motor positioned horizontally. Remove ball guide (11), set plate (12), piston (13) and shoe plate (8).




(11) Remove friction plate (14) and separate plate (15) from body (1).

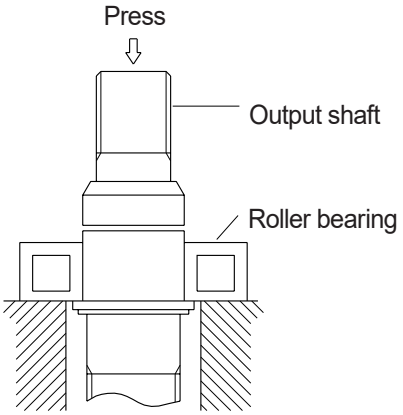


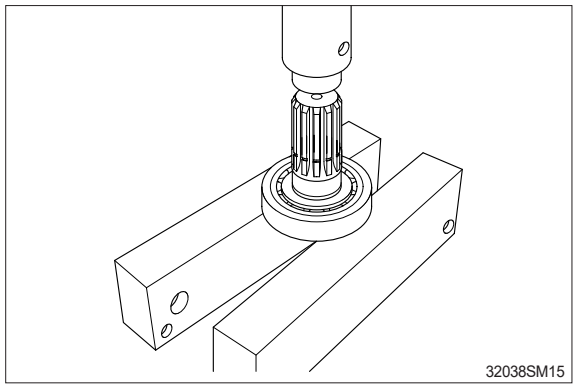

(12) Remove snap ring (4) and remove drive shaft (5) from body (1).



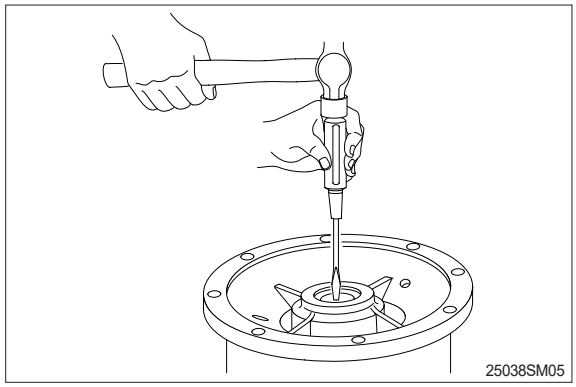
(13) Remove the cone of roller bearing (3) by press.

※ Do not reuse bearings.

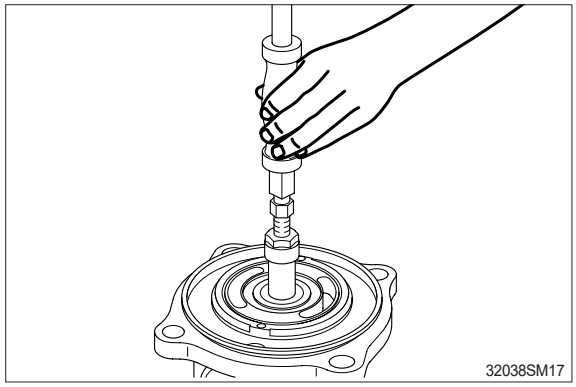


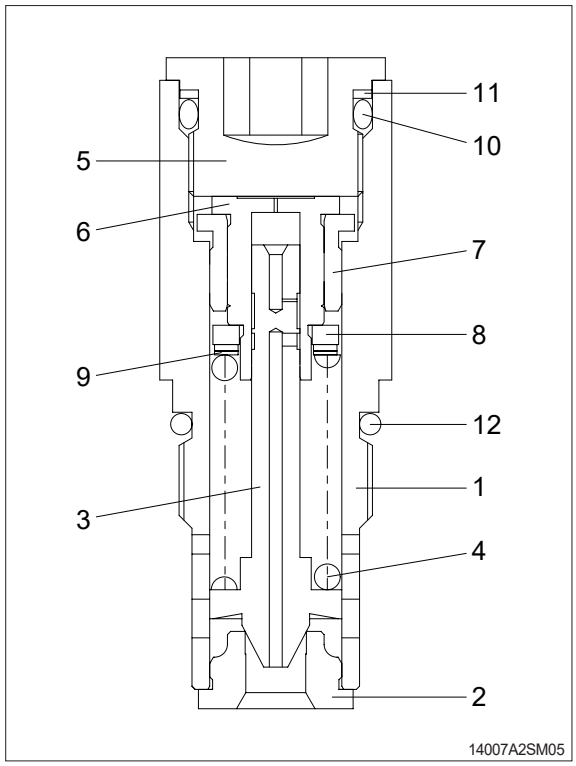

(14) Remove bushing (6) and oil seal (2) from body (1).




(15) Remove the needle bearing (21) from the rear cover (20) by using slide hammer bearing puller.



(16) When disassembling the relief valve, release the adjusting screw (5).
Remove the piston (6), spring seat (8), spring (4) and plunger (3) with the body (1) downwards.

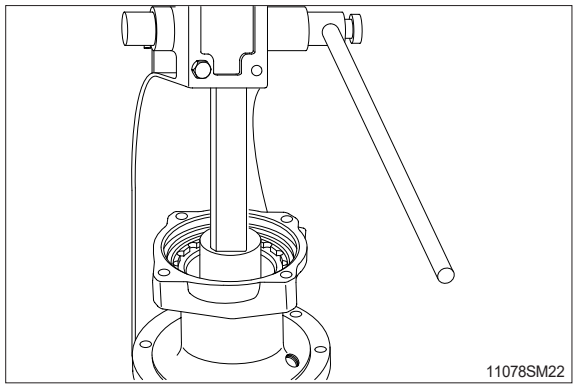



This completes disassembly.

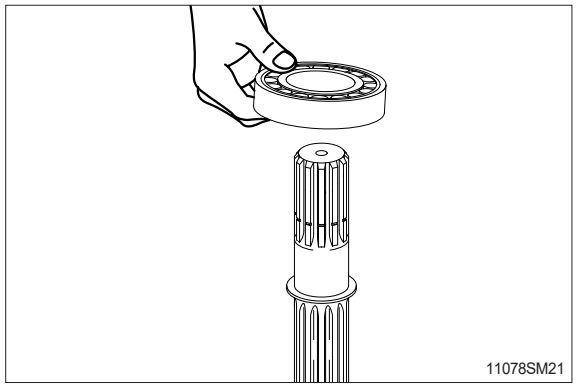
### 3) ASSEMBLY

Do the reassembly in the reverse procedure of the disassembly.

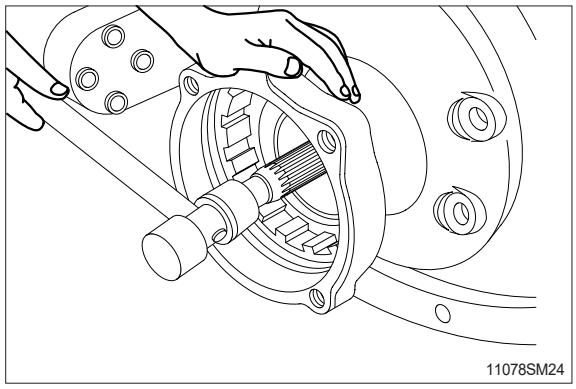
(1) Apply three bond of white color on outer surface of oil seal (2) and insert it to the body (1).



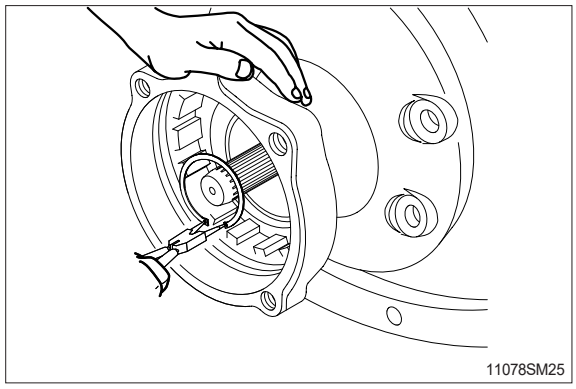

(2) Install the roller bearing (3) to the drive shaft (5).



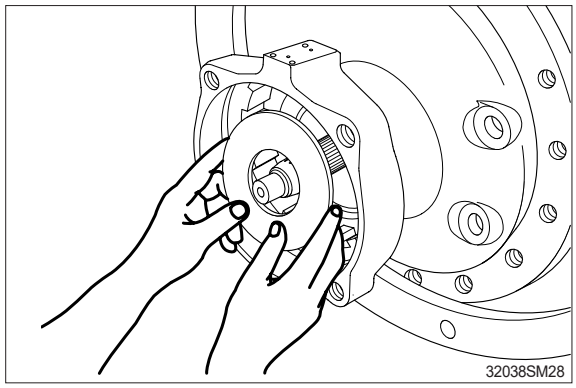

(3) Insert the drive shaft (5) into the body (1) with the plastic hammer lightly.



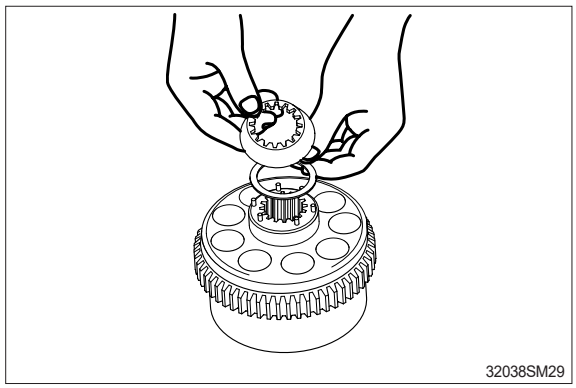

(4) Install the snap ring (4) to the body (1).



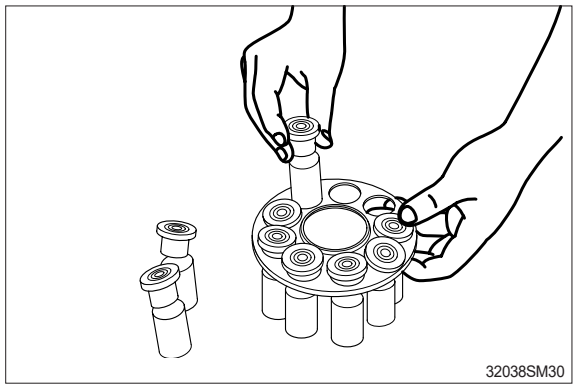
(5) Insert the shoe plate (8) with the body (1) position horizontally.



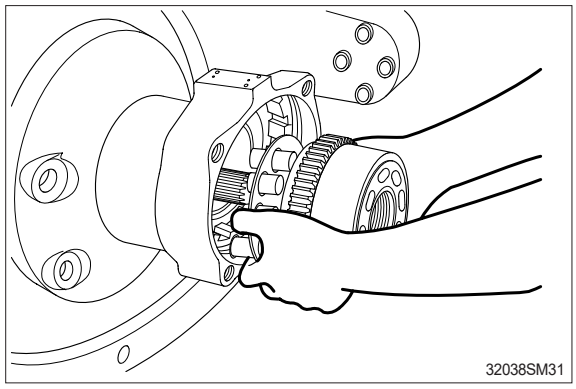

(6) Insert the ball guide (11) into the cylinder (9).



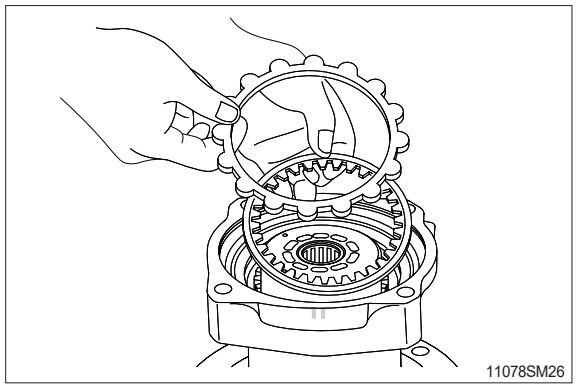

(7) Install the piston sub-assembly (13) to the set plate (12).



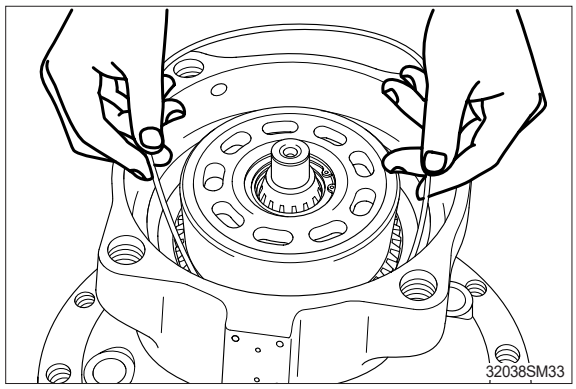

(8) Reassemble the piston assembly (9) to the body (1).



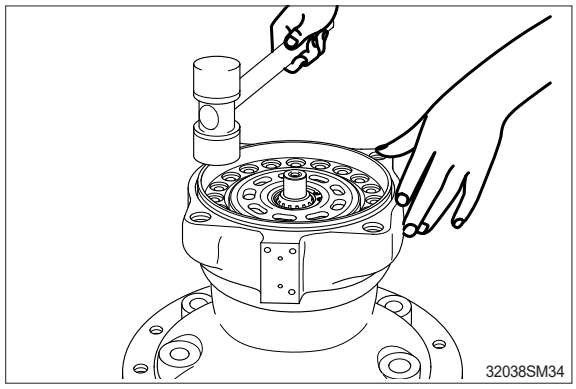
(9) Assembly friction plate (14) and separate plate (15) to the body (1).



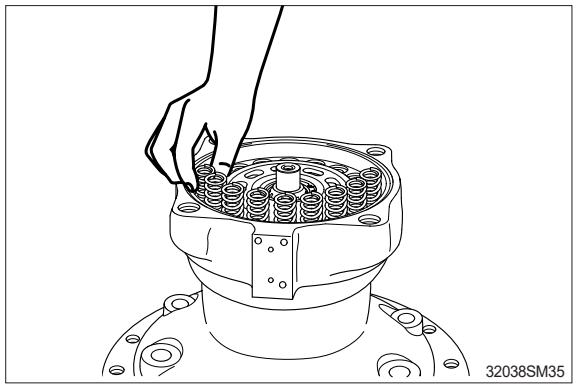

(10) Insert O-ring (17) inside the body (1).



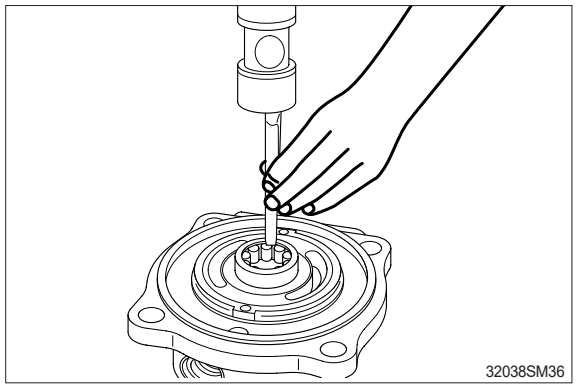

(11) Reassemble brake piston (16) to the body (1).



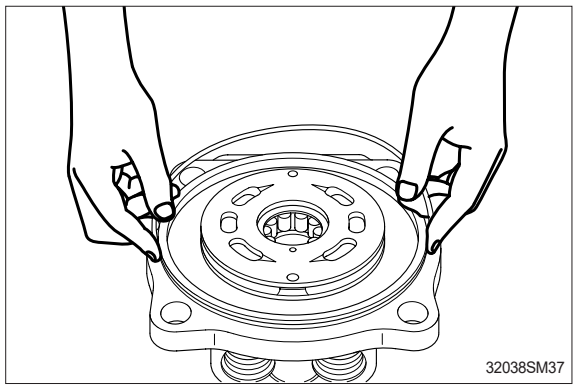

(12) Reassemble brake spring (19) to the brake piston (16).



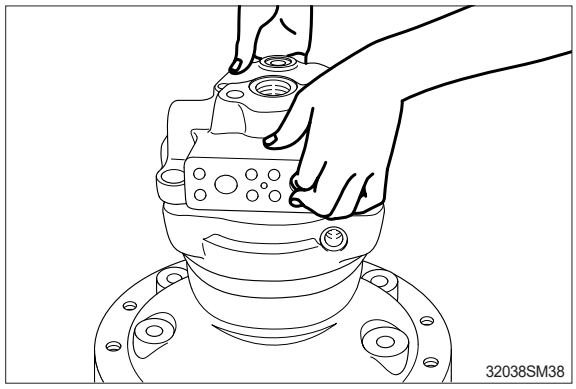
(13) When assembling the needle bearing (21), insert the needle bearing (21) into rear cover (20) by hammering.



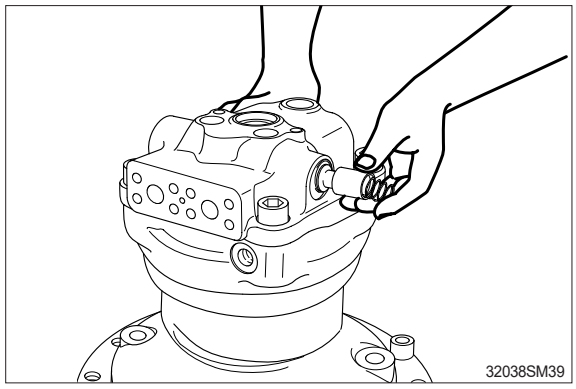

(14) Reassemble valve plate (23) to the rear cover (20) and reassemble O-ring (18).




(15) Connect the rear cover (20) with the body (1) and tighten the wrench bolt (24).

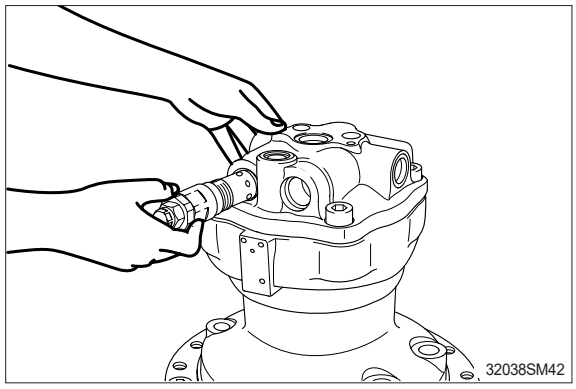



(16) Insert check (29) and spring (28) in the valve casing and install O-ring (27) and back up ring (26). Tighten plug (25) to the rear cover (20).



(17) Insert O-rings to the relief valve (30) and reassemble them to rear cover (20).

This completes assembly.



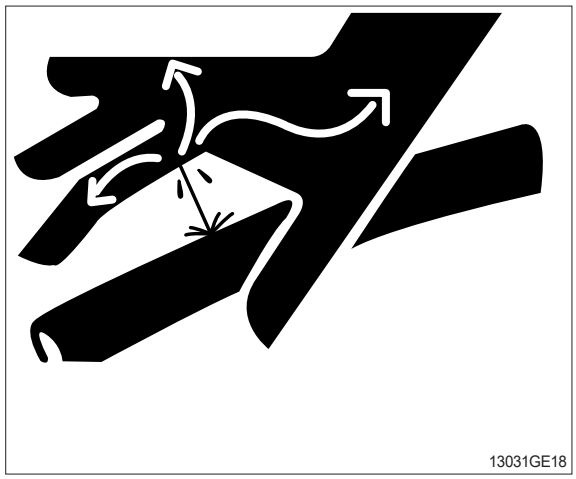
## 3. REMOVAL AND INSTALL OF REDUCTION GEAR

### 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 : 60 kg (132 lb)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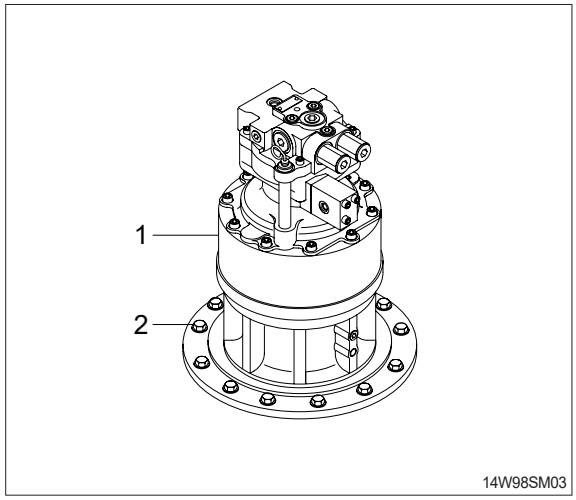
### 2) INSTALL

(1) Carry out installation in the reverse order to removal.
· Tightening torque : 29.6±3.2 kgf · m (214±23.1 lbf · ft)



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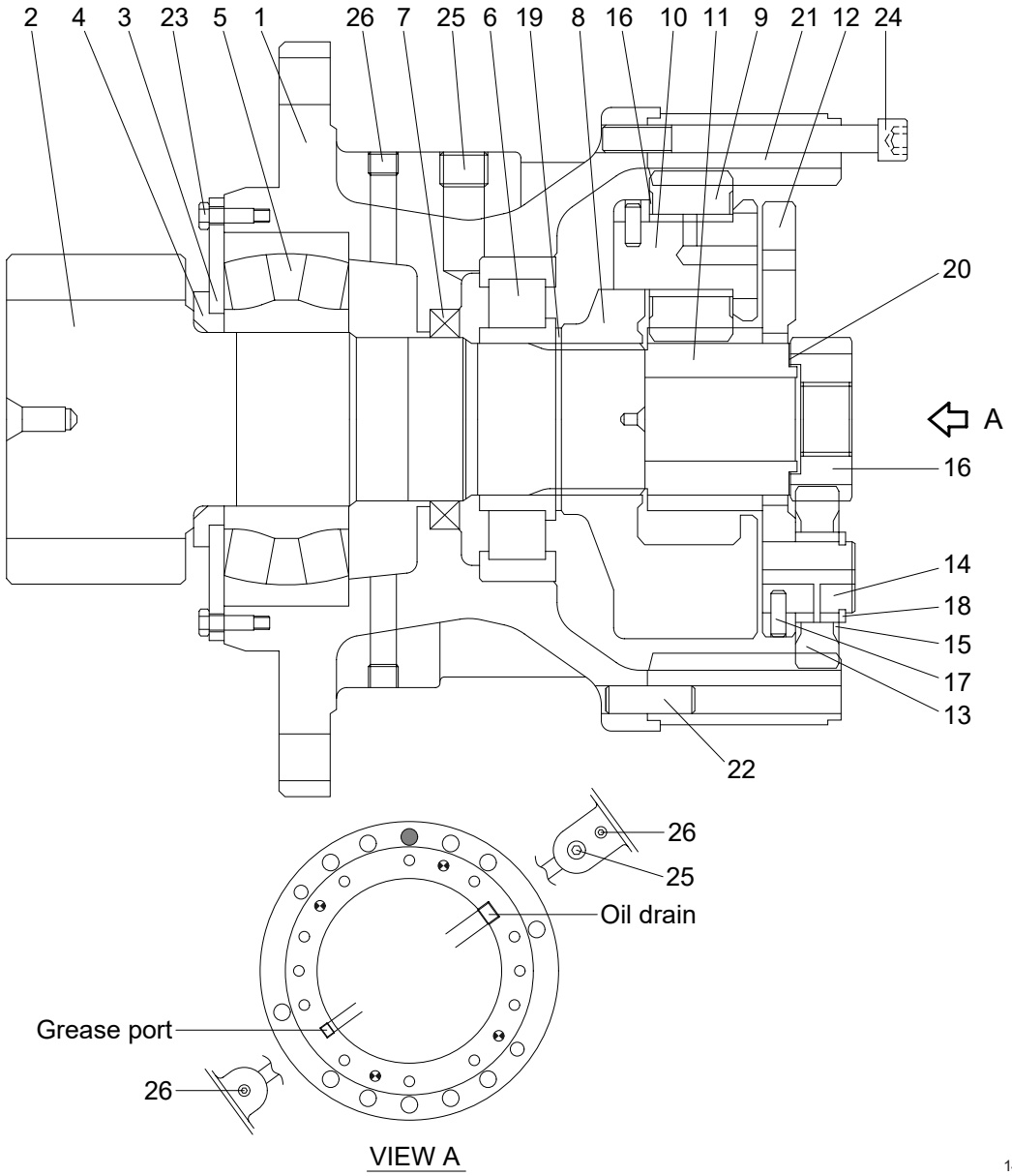
## 4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

### 1) STRUCTURE

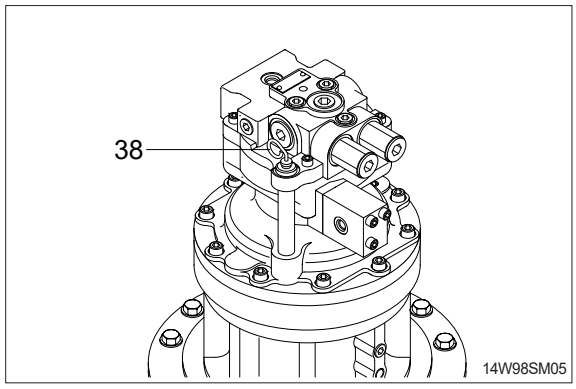



| | | | | | |
|---|---|---|---|---|---|
| 1 | Casing | 10 | Pin No.2 assembly | 19 | Stop ring |
| 2 | Drive shaft | 11 | Sun gear No. 2 | 20 | Side plate No. 1 |
| 3 | Cover plate | 12 | Carrier No. 1 | 21 | Ring gear |
| 4 | Spacer | 13 | Planet gear No. 1 | 22 | Knock pin |
| 5 | Roller bearing | 14 | Pin No.1 | 23 | Hexagonal bolt |
| 6 | Roller bearing | 15 | Thrust washer (B) | 24 | Socket head bolt |
| 7 | Oil seal | 16 | Sun gear No. 1 | 25 | Plug |
| 8 | Carrier No. 2 | 17 | Spring pin | 26 | Plug |
| 9 | Planet gear No. 2 | 18 | Stop ring | | |

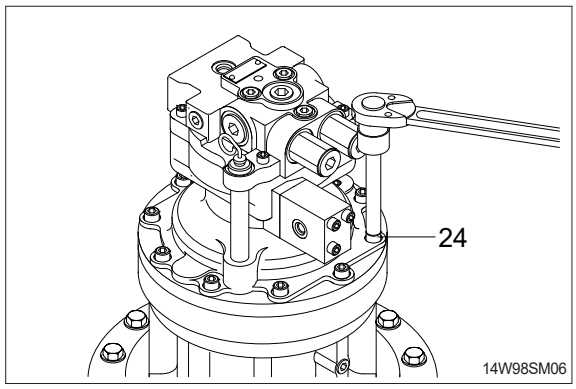
## 2) DISASSEMBLY

(1) Remove level gauge (38) from the swing motor casing.

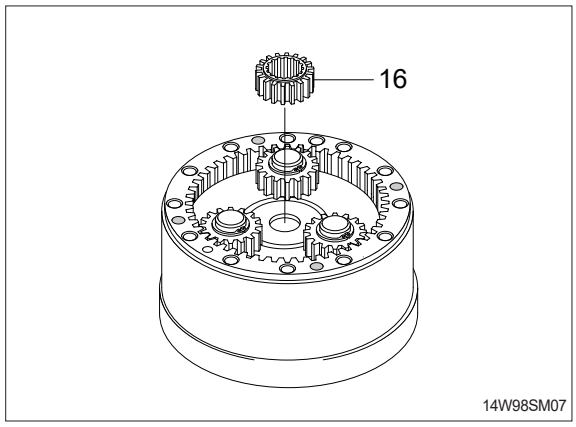
※ Pour the gear oil out of reduction gear into the clean bowl to check out the friction decrease.



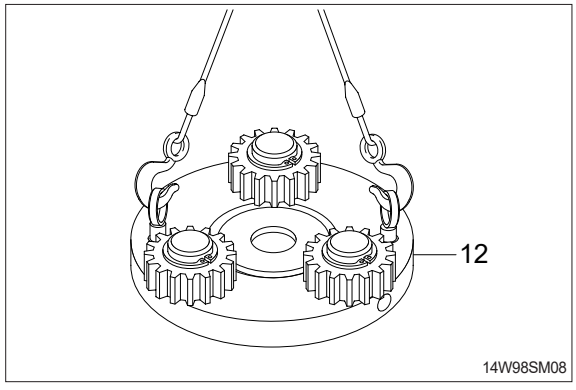

(2) Loosen the socket bolts (24) to separate swing motor from reduction gear.




(3) Remove sun gear 1 (16).




(4) Tighten two M10 eye bolts to carrier 1 (12) and lift up and remove carrier 1 (12) as subassembly.



(5) Disassembling carrier 1 (12) assembly.

① Remove stop ring (18).

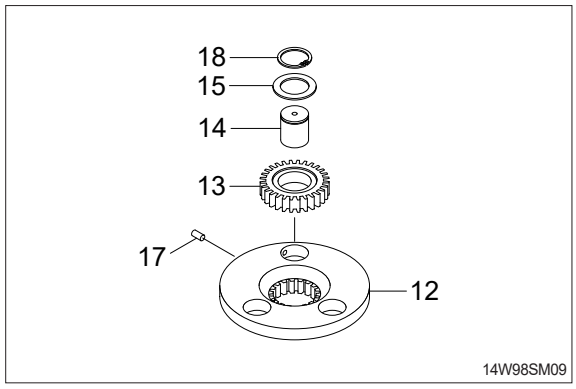
② Remove thrust washer (15) and planet gear 1(13) from the carrier 1 (12).

③ Using M8 solid drill, crush spring pin (17) so that the pin 1 (14) can be removed by hammering.

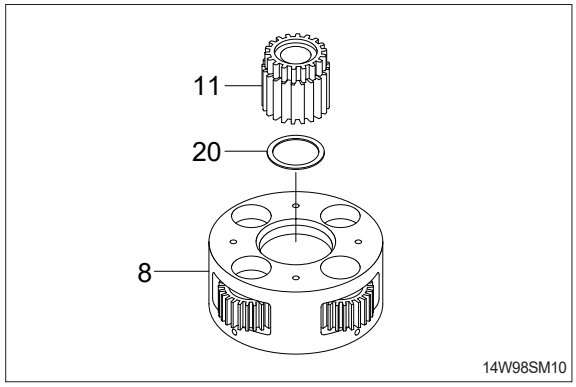
※ Do not reuse spring pin (17).

※ Do not remove pin 1 (14), carrier 1 (12) and spring pin(17) but in case of replacement.

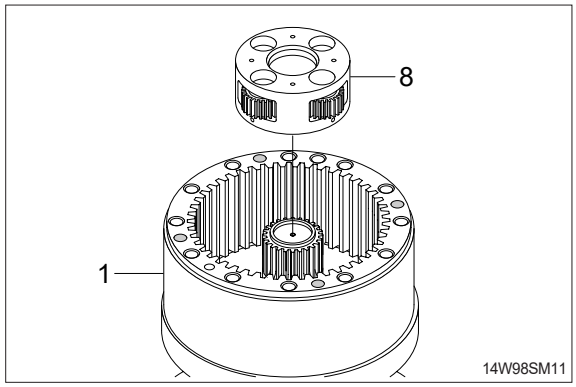
※ Put matching marks on the planet gear 1 (13) and the pin 1(14) for easy reassembly.




(6) Remove sun gear 2 (11) and side plate 1 (20) from carrier 2 (8).




(7) Remove carrier 2 (8) assembly from casing (1).



(8) Disassembling carrier 2 (8) assembly.

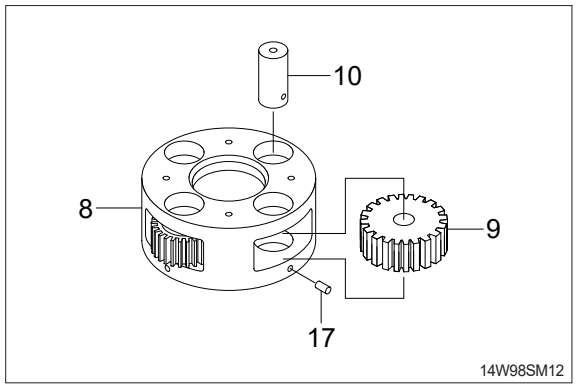
① Using M8 solid drill, crush spring pin (17) so that the pin 2 (10) can be removed.

※ Do not reuse spring pin (17).

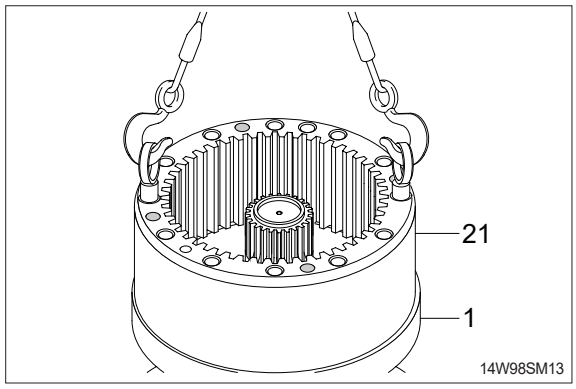
② Remove pin 2 (10) and planet gear 2 (9) from the carrier 2 (8).

※ Put matching marks on the planet gear 2 (9) and the pin 2 (17) for easy reassembly.

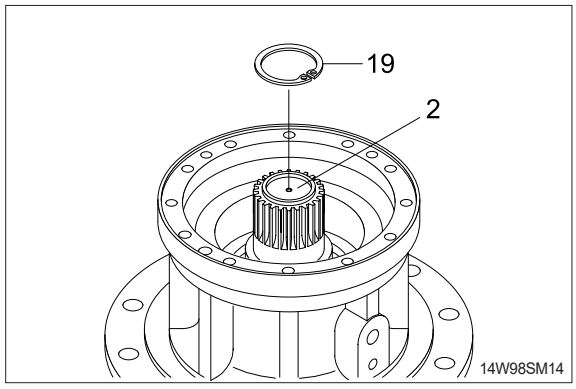
※ Do not disassemble pin 2 (10), carrier 2 (8) and spring pin (17) but in case of replacement.



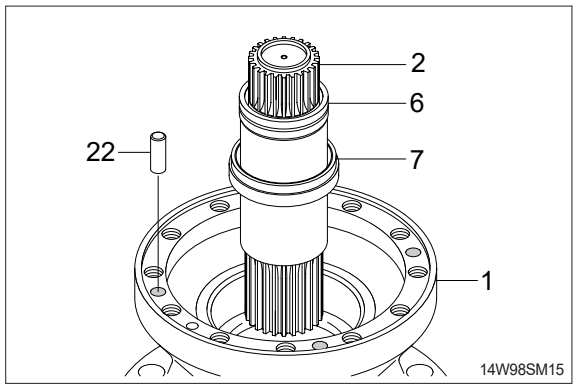

(9) Tighten two M16 eyebolt to the ring gear (21) and then lift the ring gear (21) out of casing (1).




(10) Remove stop ring (19) from the drive shaft (2).

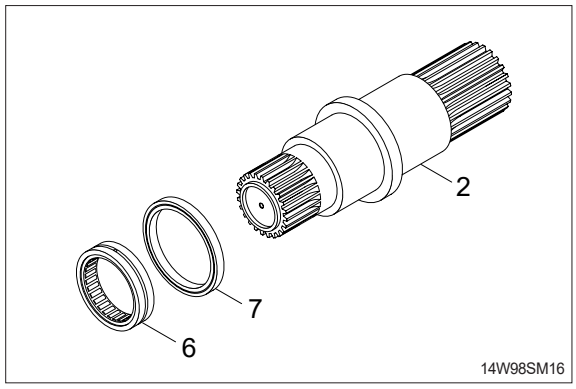



(11) Remove drive shaft (2) with roller bearing (6) and oil seal (7) assembled.
Remove knock pin (22) from the casing (1).

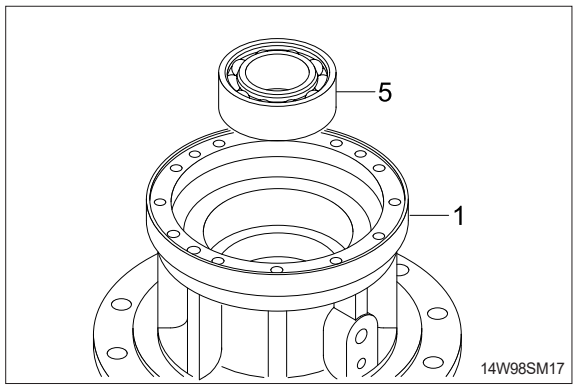


(12) Remove roller bearing (6) and oil seal (7) from the drive shaft (2).

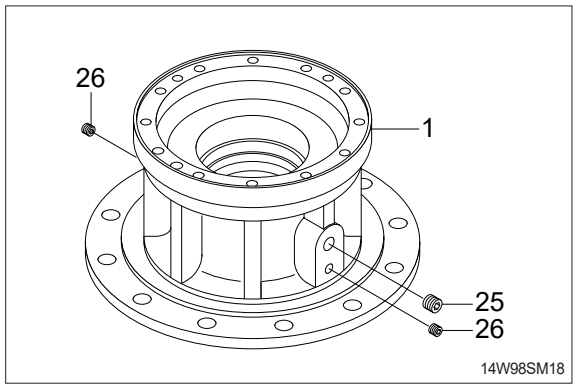
※ Do not reuse oil seal (20) once removed.




(13) Using the bearing disassembly tool, remove roller bearing (5).

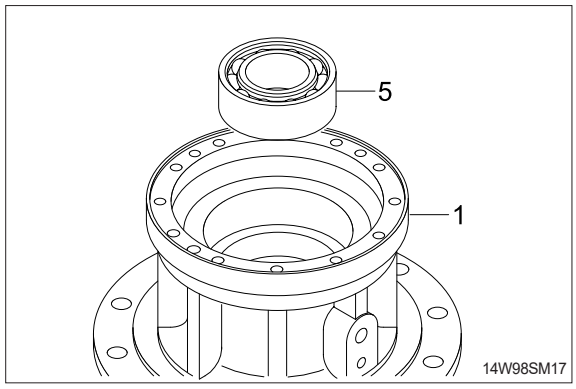



(14) Remove plugs (25, 26) from the casing (1).

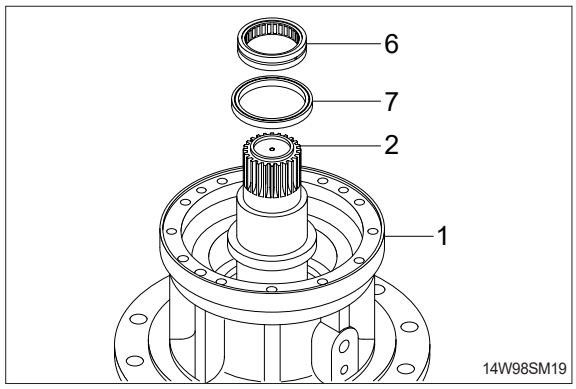


### 3) ASSEMBLY

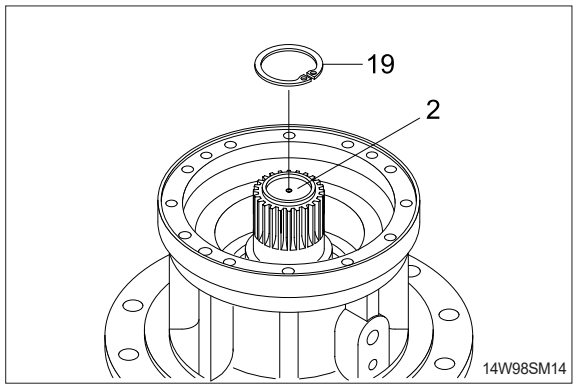
(1) Assemble roller bearing (5) inside the casing (1).




(2) Assemble the drive shaft (2) into the casing (1) and then install oil seal (7) and roller bearing (6).



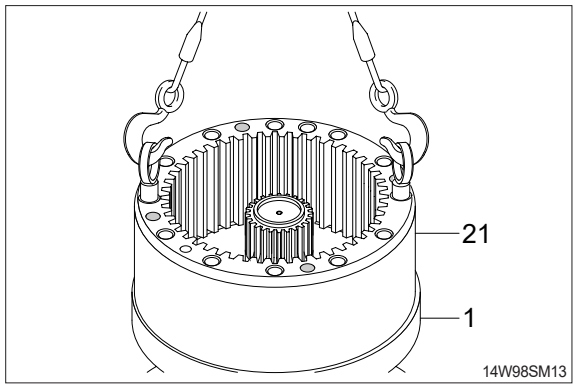

(3) Install stop ring (19) on top of drive shaft (2).




(4) Apply loctite to the tapped holes of casing (1).

(5) Tighten 2 M16 eye bolts to the ring gear (21) and lift up and then assemble it onto the casing (1).

※ Don't fail to coincide the knock pin (22) holes.



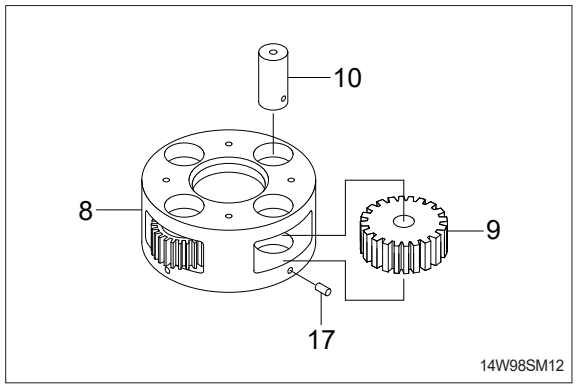
(6) Assembling carrier 2 (8) assembly.

① Install the planet gear 2 (9) inside the carrier 2 (8).

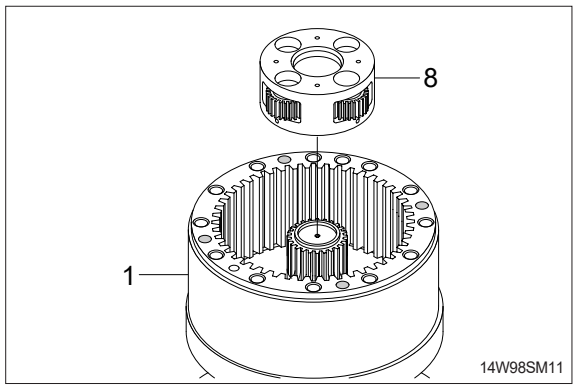
② Assemble the pin 2 (10) to the carrier 2 (8) and then press the spring pin (17) by hammering.

③ Punch 2 points of the spring pin (17) lip.

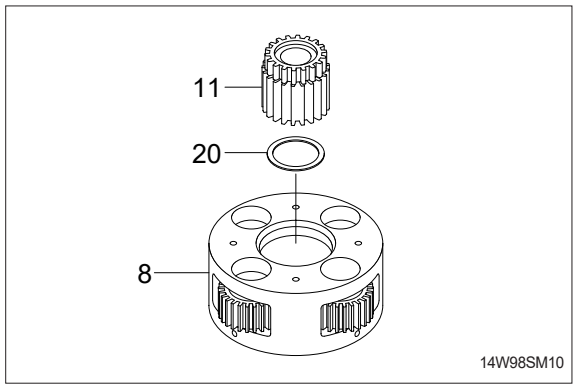
※ Take care not to mistake the matching marks of each part.




(7) Assemble carrier 2 (8) assembly correctly to the casing (1).




(8) Assemble sun gear 2 (11) and side plate 1 (20) to the center of the carrier 2 (8) assembly.



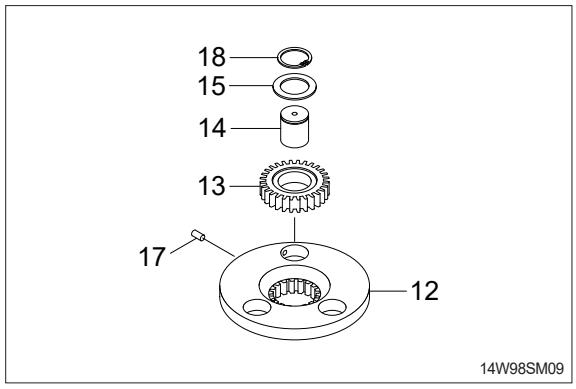

(9) Assembling carrier 1 (12) assembly.

① Assemble the pin1 (14) to the carrier 1 (12) and then press the spring pin (17) by hammering.

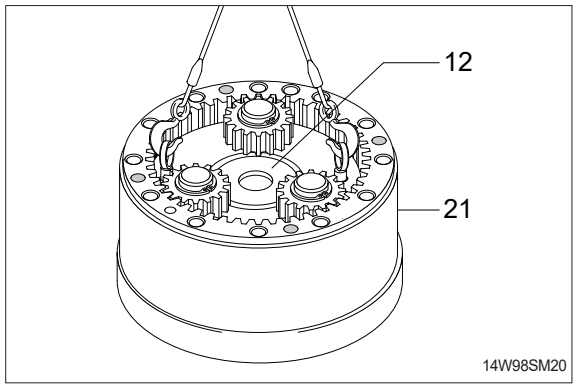
② Punch 2 points of the spring pin's (17) lip.

③ Assemble thrust washer (15), planet gear 1 (13), and then stop ring (18) to the pin 1 (11).

※ Take care not to mistake the matching marks of each part.

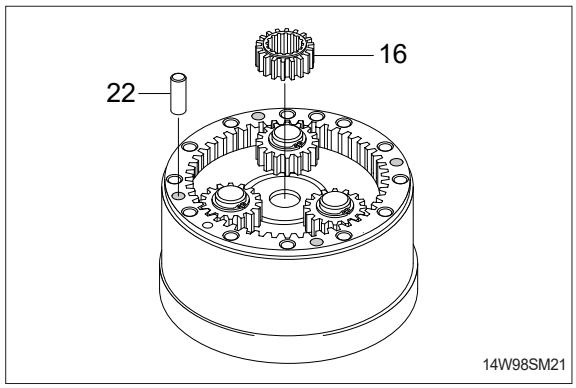


(10) Assemble carrier 1 (12) assembly into the ring gear (21).




(11) Hammer 4 knock pins (22) around the ring gear (21).

(12) Assemble sun gear 1 (16) to the drive shaft of the swing reduction gear.

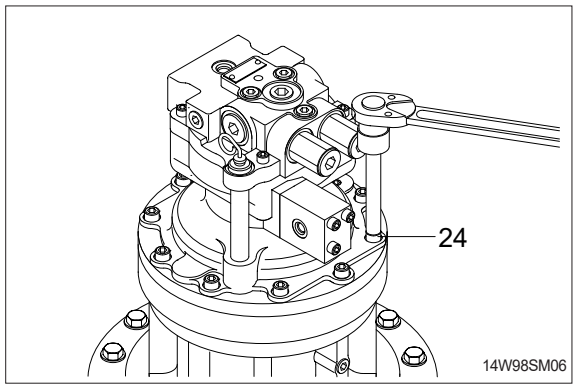



(13) Apply loctite to the tapped holes of the ring gear (21) and then mount swing motor onto the ring gear (21).

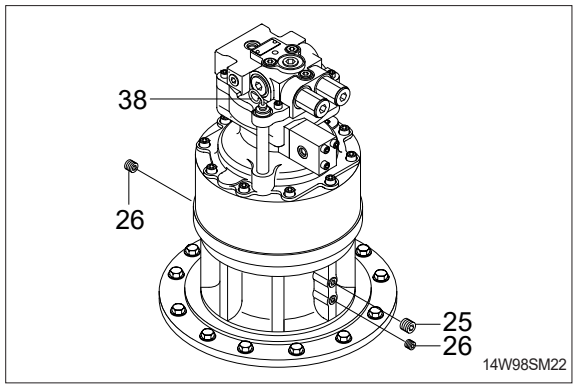
※ Don't fail to coincide the gauge bar hole.

(14) Tighten socket bolts (24) around the swing motor assembly.

· Tightening torque : 13.5 kgf · m (98 lbf · ft)




(15) Assemble plugs (25, 26) and level gauge (38).



# 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.

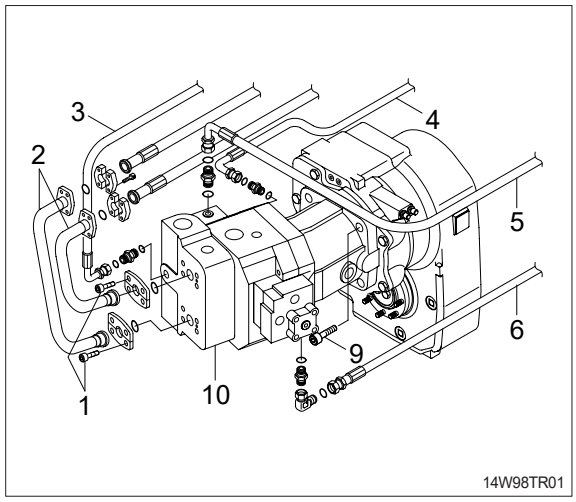
(4) Loosen the socket bolt (1) and remove the pipes (2).

(5) Disconnect hoses (3,4,5,6).

(6) Loosen the socket bolt (9) and remove travel motor (10).

· Weight : 60 kg (130 lb)

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

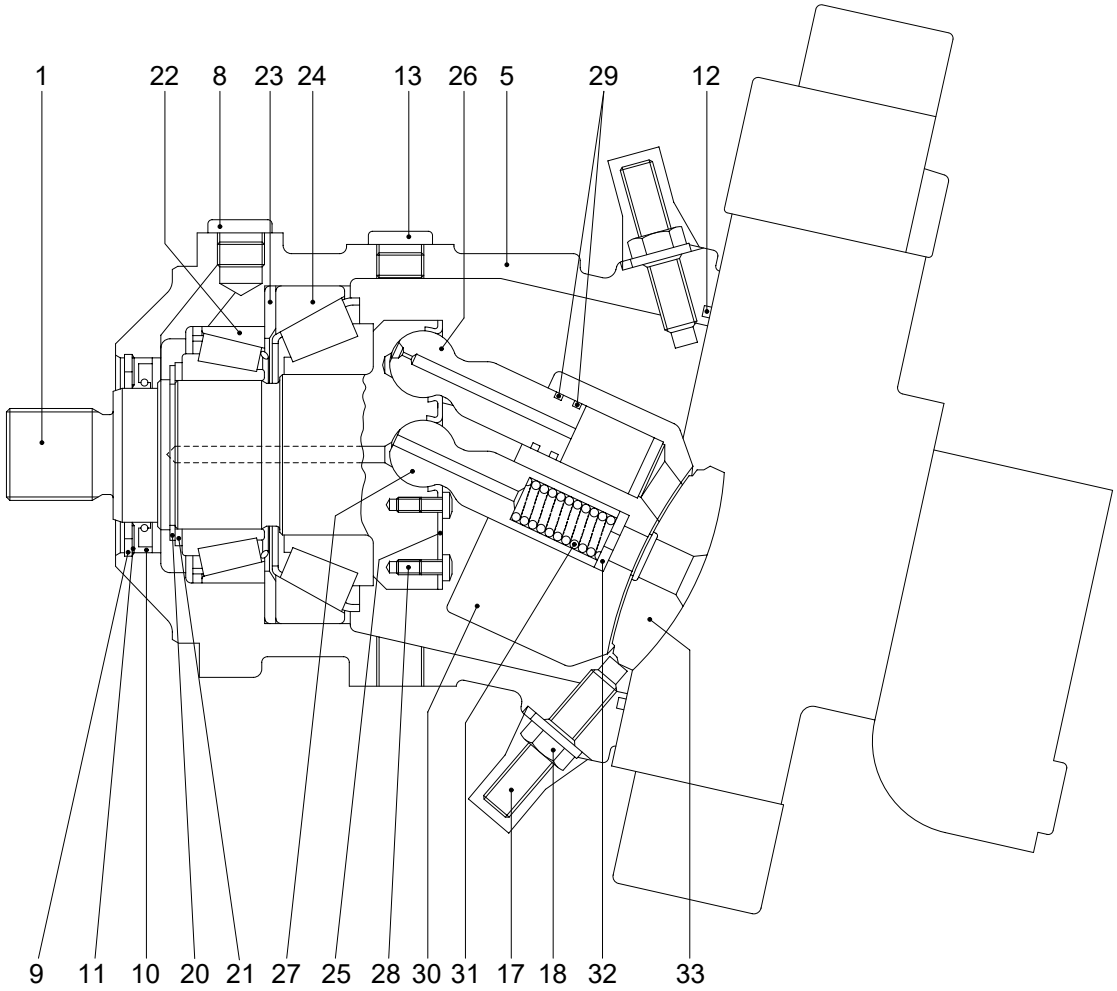

### 2) INSTALL

(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

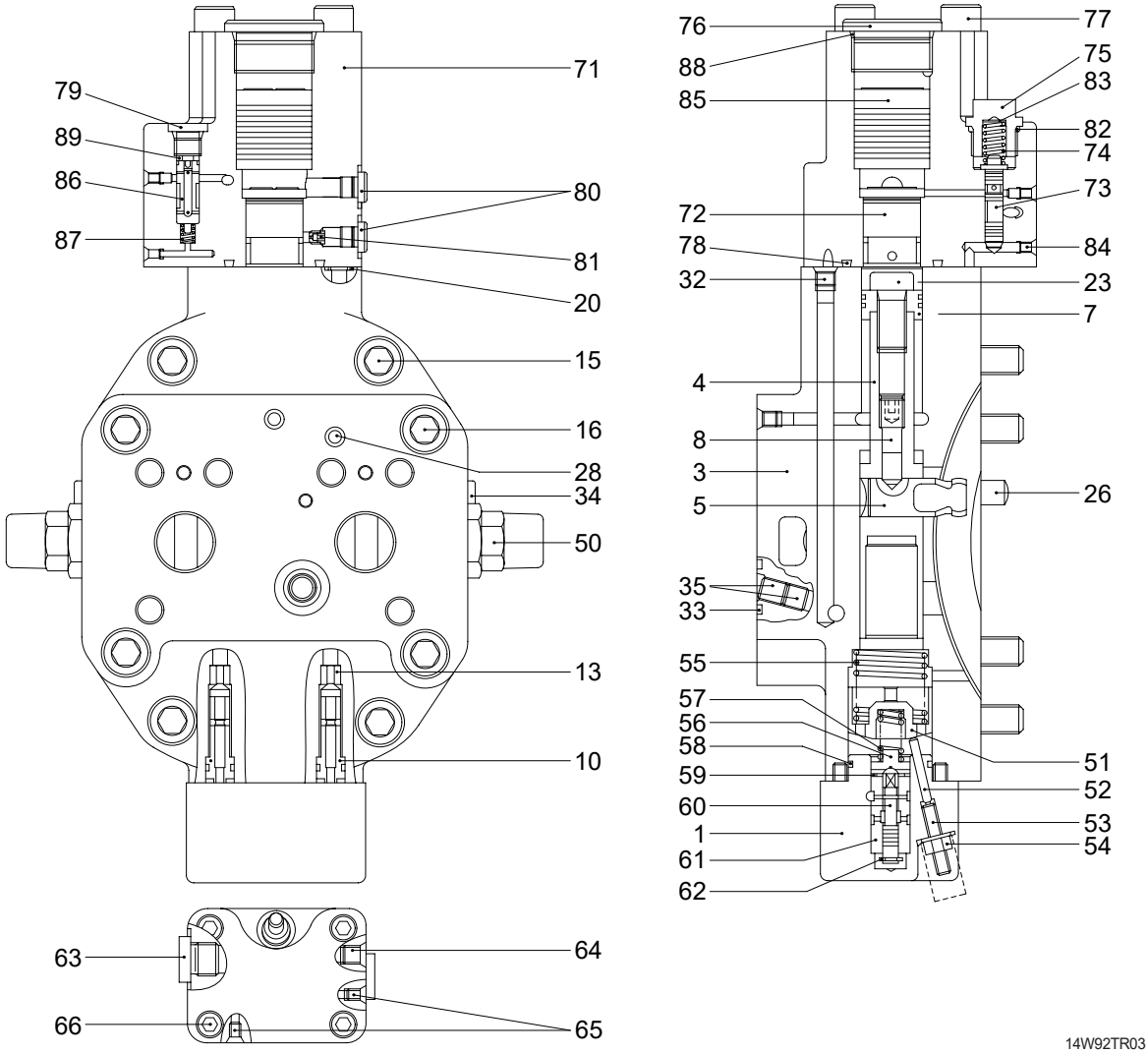
### 1) MOTOR UNIT




14W98TR02

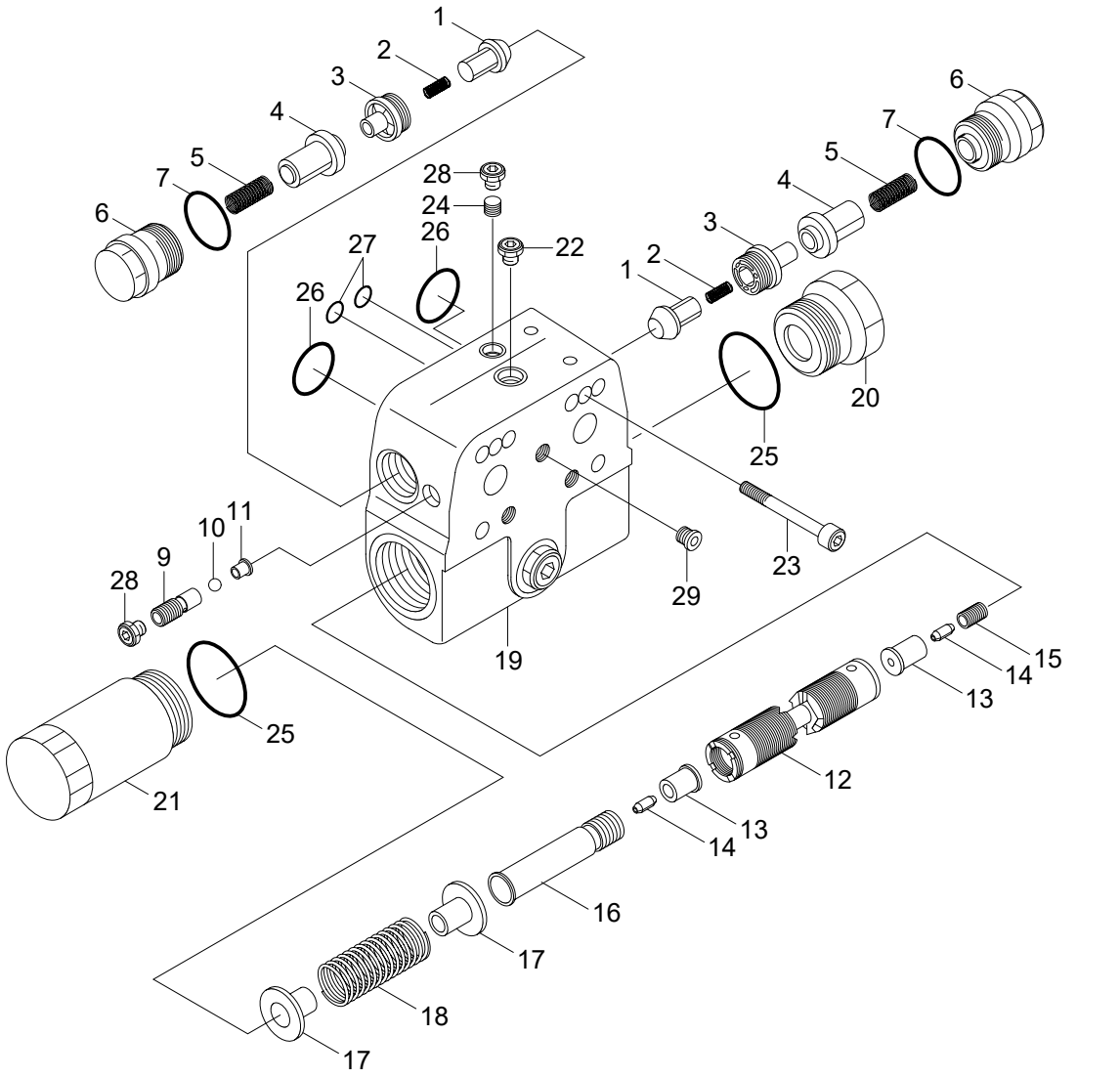
| | | | | | |
|---|---|---|---|---|---|
| 1 | Drive shaft | 17 | Threaded pin | 26 | Piston |
| 5 | Housing | 18 | Seal lock nut | 27 | Center pin |
| 8 | Locking screw | 20 | Retaining ring | 28 | Pan head screw |
| 9 | Retaining ring | 21 | Back up plate | 29 | Steel sealing ring |
| 10 | Shaft seal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

## 2) CONTROL UNIT




| | | | | | |
|---|---|---|---|---|---|
| 1 | Control housing | 50 | Relief valve | 72 | Piston |
| 2 | Stroke limiter | 51 | Adjusting bushing | 73 | Control piston |
| 3 | Port plate | 52 | Cylinder pin | 74 | Pressure spring |
| 4 | Positioning piston | 53 | Threaded pin | 75 | Locking screw |
| 5 | Positioning trunnion | 54 | Seal lock nut | 76 | Locking screw |
| 7 | Piston | 55 | Pressure spring | 77 | Socket head screw |
| 8 | Threaded pin | 56 | Spring collar | 78 | O-ring |
| 10 | Check valve | 57 | Pressure spring | 79 | Locking screw |
| 13 | Valve seat | 58 | O-ring | 80 | Locking screw |
| 15 | Socket head screw | 59 | Retaining ring | 81 | Orifice |
| 16 | Socket head screw | 60 | Control piston | 82 | O-ring |
| 20 | O-ring | 61 | Control bushing | 83 | Shim |
| 23 | Socket head screw | 62 | Retaining disc | 84 | Double break off pin |
| 26 | Cylinder pin | 63 | Locking screw | 85 | Piston |
| 28 | Double break off pin | 64 | Double break off pin | 86 | Control piston |
| 32 | Double break off pin | 65 | Double break off pin | 87 | Pressure spring |
| 33 | O-ring | 66 | Socket head screw | 88 | O-ring |
| 34 | Locking screw | 71 | Housing | 89 | Shim |

### 3) COUNTER-BALANCE VALVE




14W98TR05

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

## 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 |
|---|---|---|---|---|
| 8-66 | 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 |
| 8-67 | 76 | - | 32.6 | 236 |
| | 77 | M10 × 1.0 | 5.2 | 37.6 |
| | 78 | M12 × 1.5 | 3.6 | 25.8 |
| 8-68 | 20 | - | 66.3 | 479 |
| | 21 | - | 66.3 | 479 |

## 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.

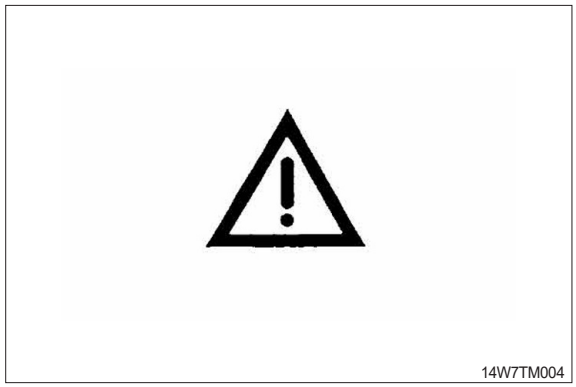
⑤ Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.

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)

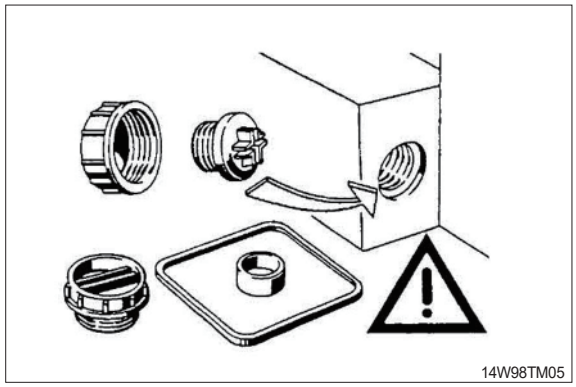
⑦ Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

## 2) SEAL KITS AND COMPONENT GROUPS

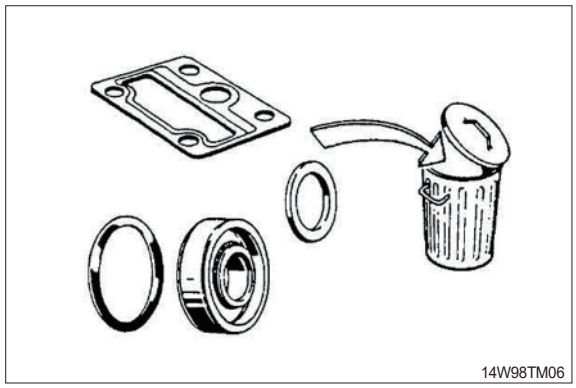
Observe the following notices when carrying out repair work at hydraulic aggregates.




(1) Close all ports of the hydraulic aggregates.

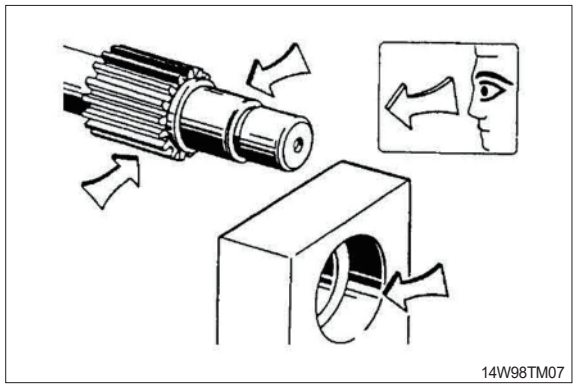



(2) Replace all seals.
Use only original spare parts.



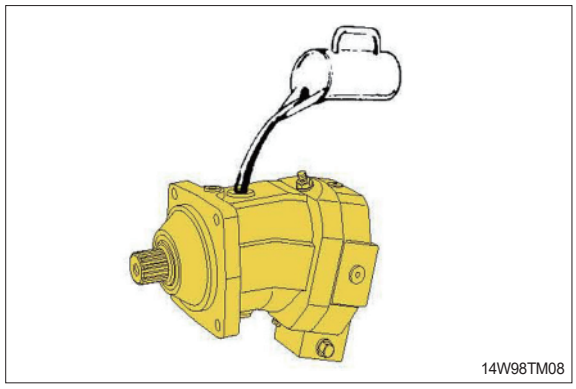

(3) Check all seal and sliding surfaces for wear.

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

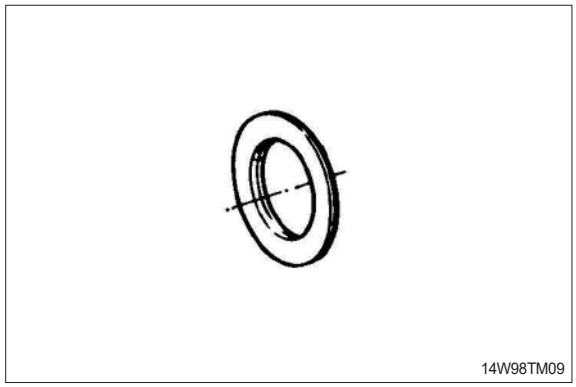


(4) Fill up hydraulic aggregates with hydraulic oil before start up.

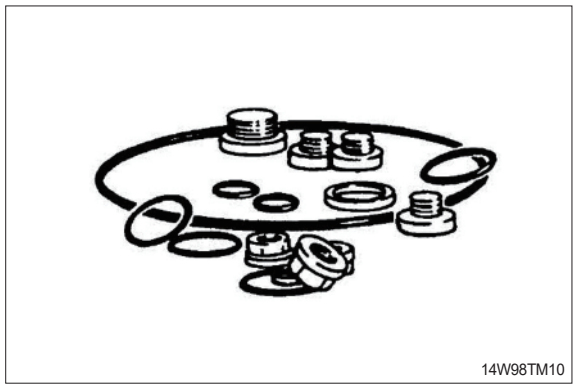
※ Without fill up bearing damage happens!



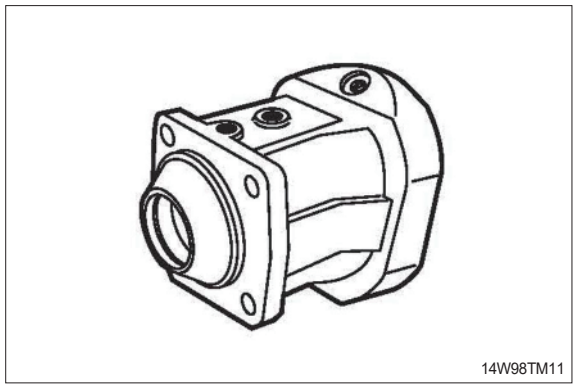

(5) Seal kit for drive shaft



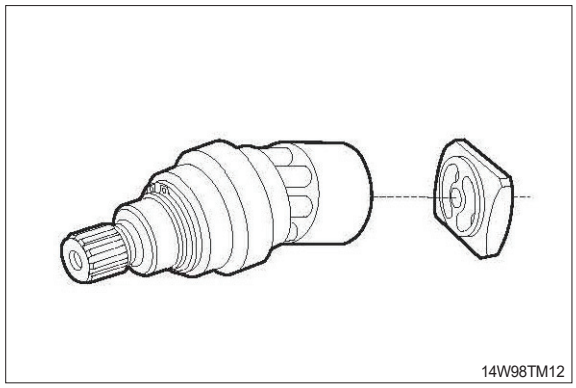

(6) External seal kit.



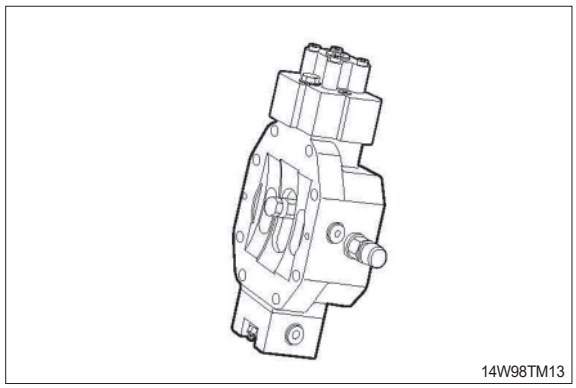

(7) Housing.



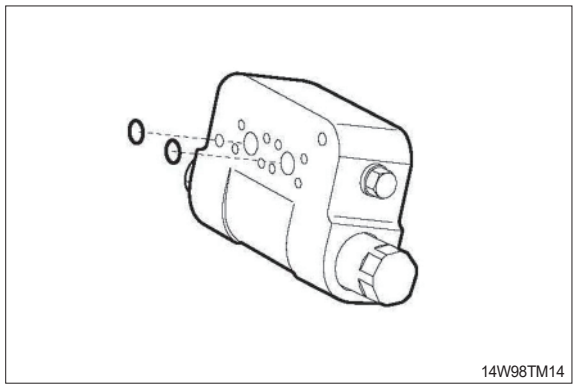
(8) Complete rotary group.



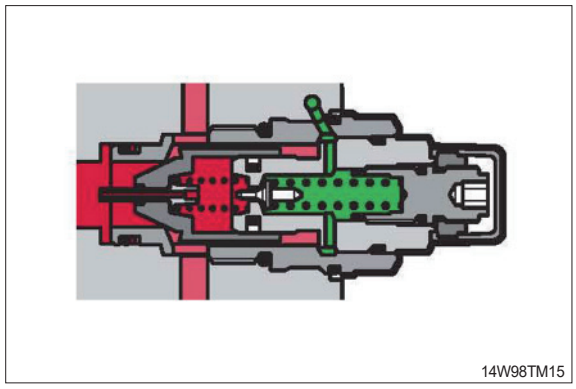

(9) Port plate with control piston.




(10) Counter balance valve.

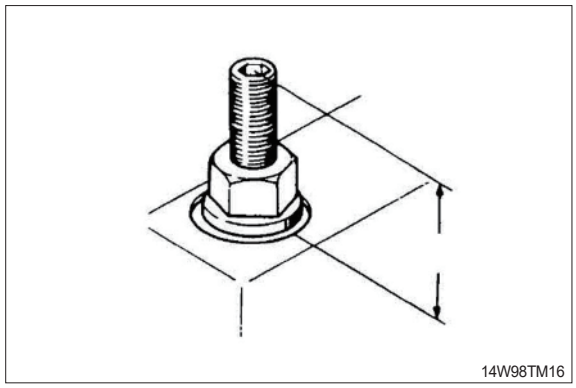



(11) Relief valve.

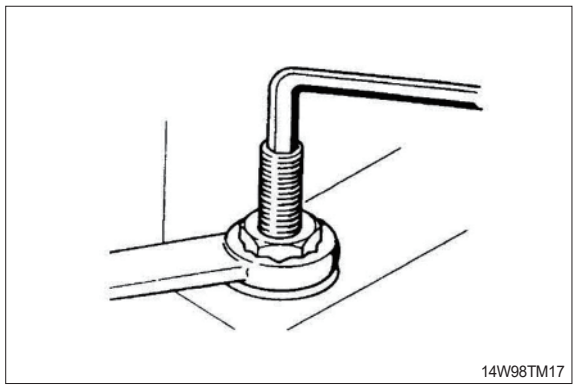


### 3) SEAL NUT

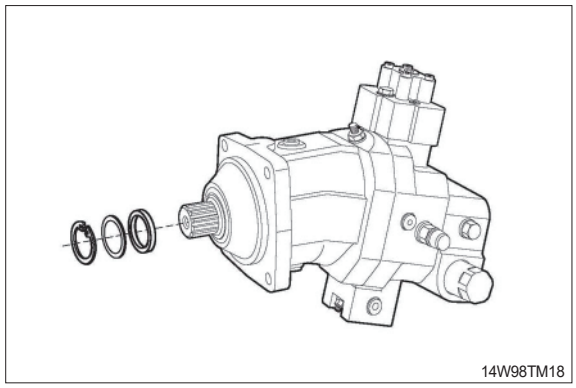
(1) Replace seal nut.
First measure and record setting height.


14W98TM16

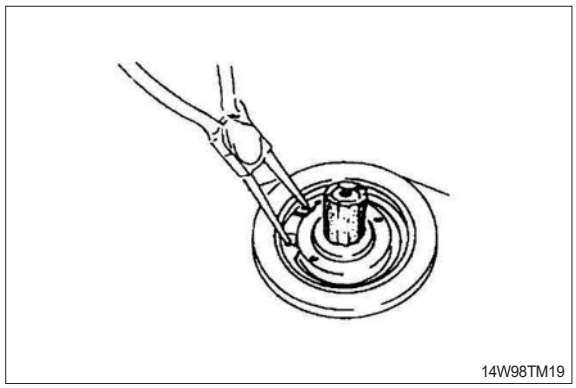
(2) When tightening, counterhold setting screw, then check setting height.


14W98TM17

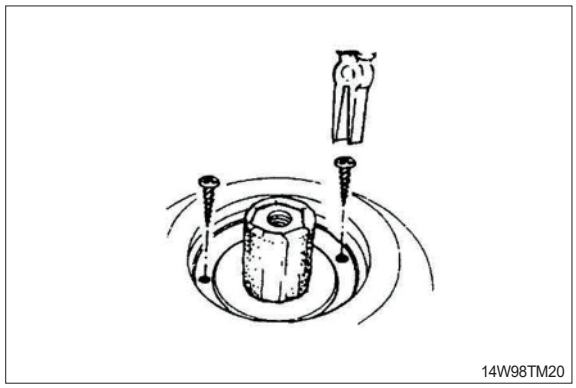
### 4) SEALING THE DRIVE SHAFT




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



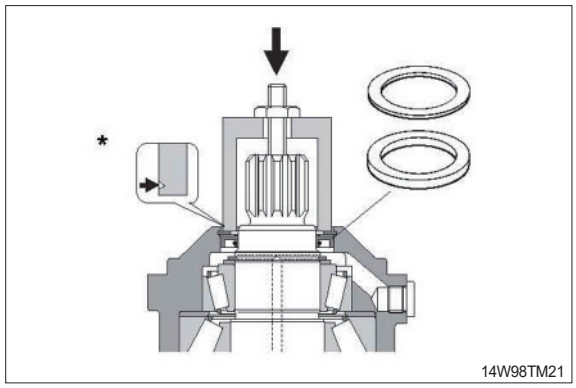

(2) Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



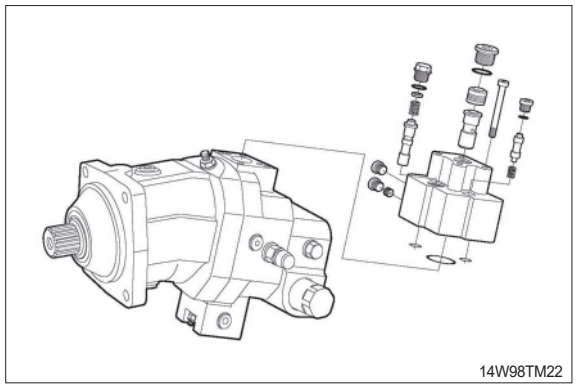

(3) Press in shaft seal and shim with bush to stop.

⚠ **Pay attention to pressing depth.**

* Mark for pressing depth.
Assemble retaining ring.

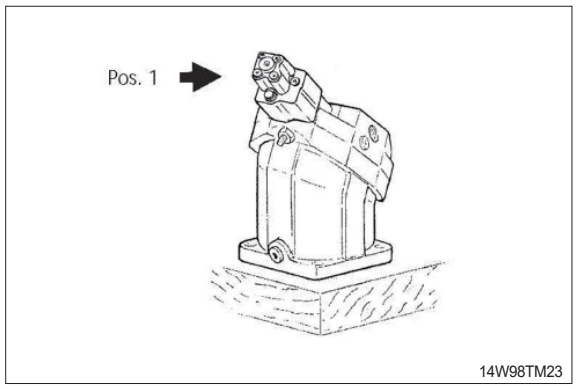


## 5) SEALING OF THE CONTROL PARTS



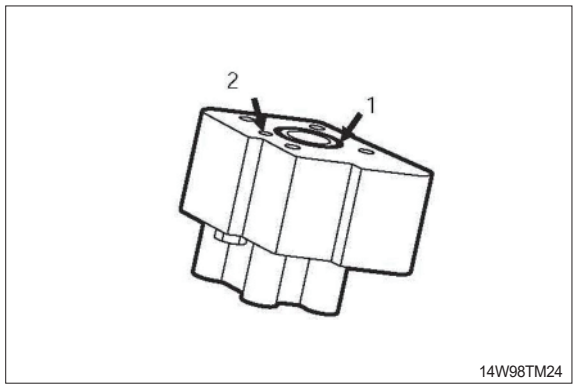

### (1) Disassembly position

Remove cover pos.1.

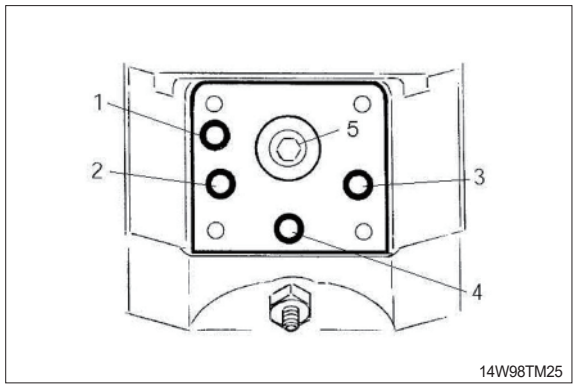



1 O-ring
2 Input flow of oil control

※ Installation position differs according to the control components.

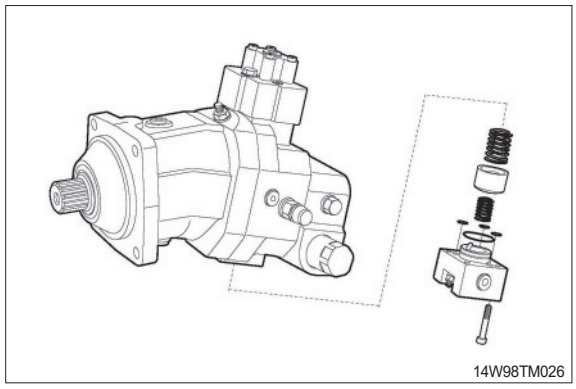



1 Input flow of oil control
2 High pressure / Low pressure
3 High pressure / Low pressure
4 Leakage oil
5 Control piston

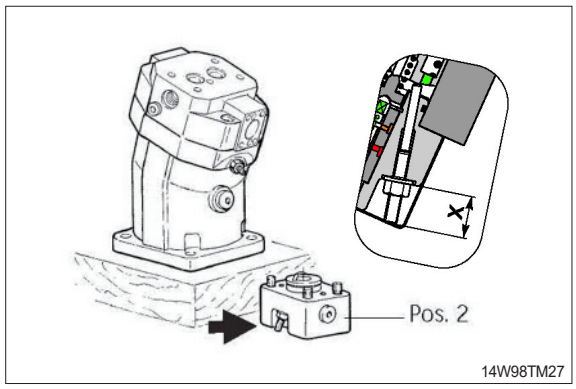


(2) Disassembly position : Remove cover 2.

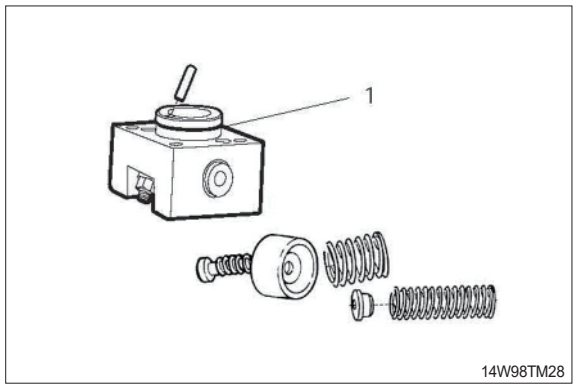
※ Attention spring load.



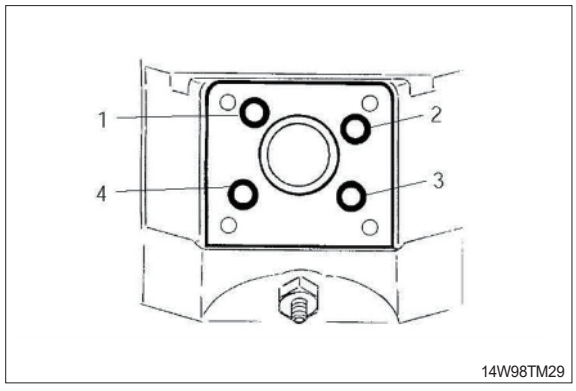

※ Dimension X : Note dimension (Begin of regulation)




1 Check of O-ring

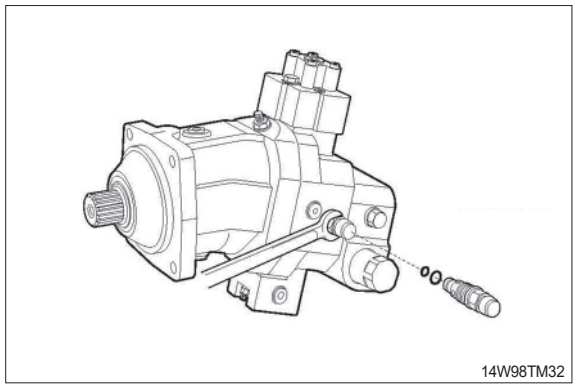



1 O-ring / High pressure-small control position side
2 O-ring / Control pressure
3 O-ring / High pressure-check valve
4 O-ring / High pressure-check valve

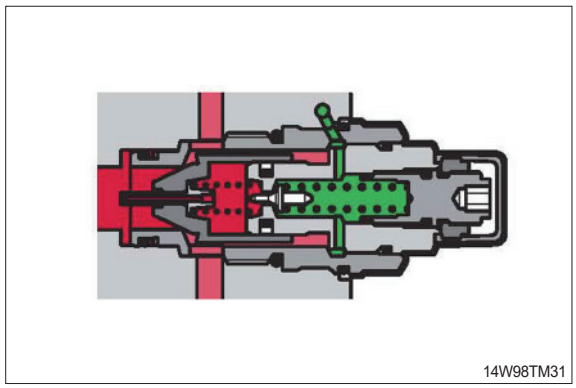


### 6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

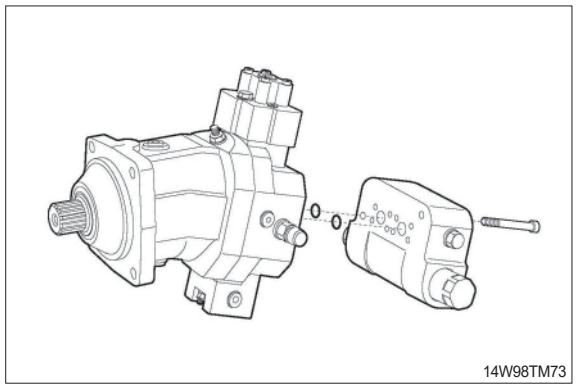
(1) Remove relief valve.




(2) Inspect
O-ring



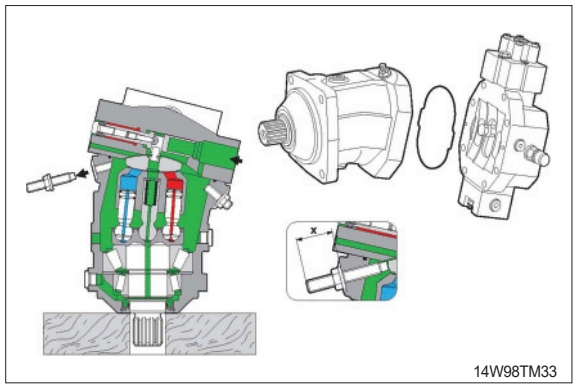

(3) Remove counter-balance valve.
Inspect
O-ring



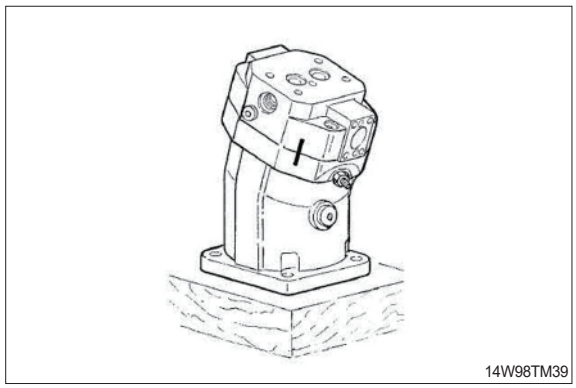
## 7) DISASSEMBLY OF THE PORT PLATE

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

※ For disassembly of the port plate, swivel always rotary group to zero position. Piston rings to hang out of the cylinder boring.

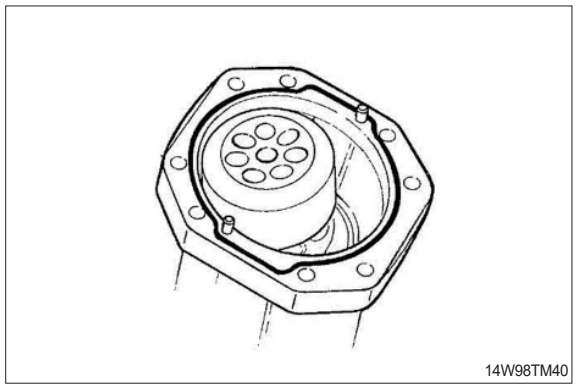



(1) Port plate.
Mark position. Loosen screws.
Removal.

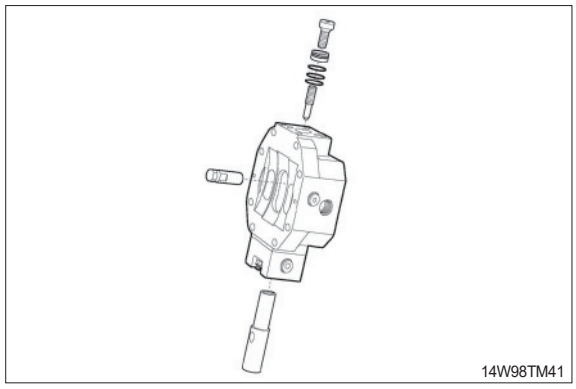



(2) Check O-ring.

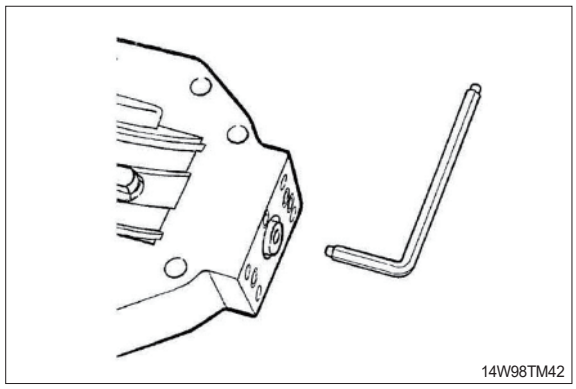
※ Stick new O-ring with some grease.
Do not swivel rotary group.
Piston rings to hang out from the cylinder boring.



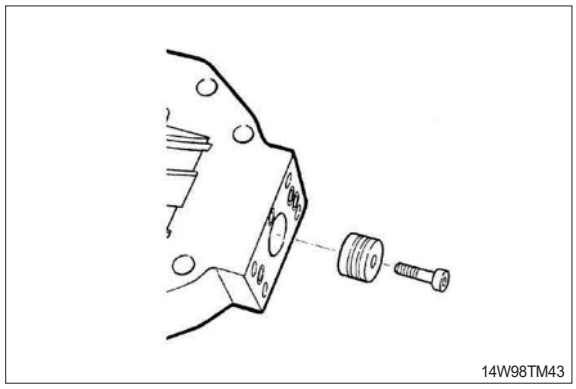
## 8) REMOVE OF THE POSITIONING PISTON




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

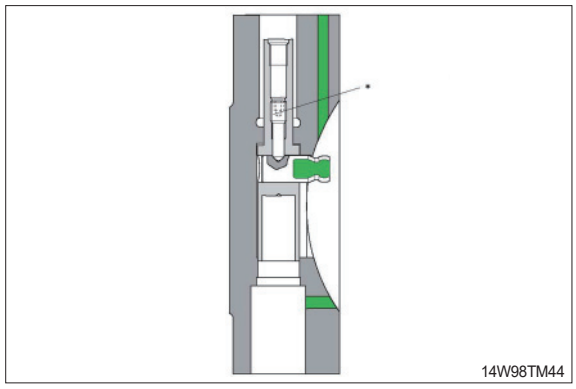



(2) Remove piston with piston ring.

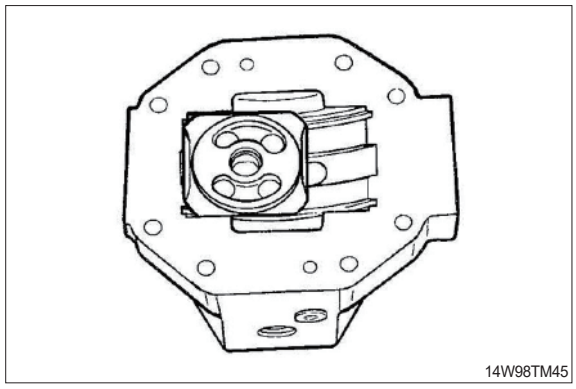



(3) Warm up fixation screw * for positioning plug via boring (screw glued-to turn out).

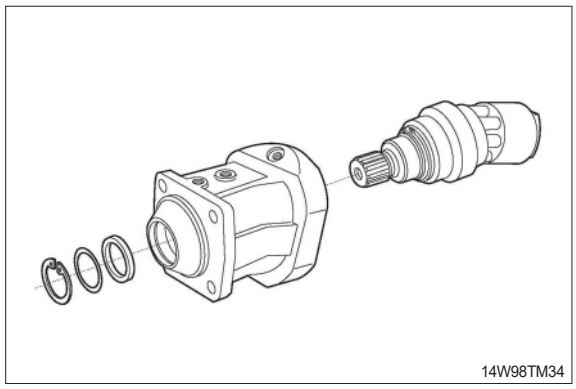
※ Use new screw.
Precote coating.
Note tightening torque.



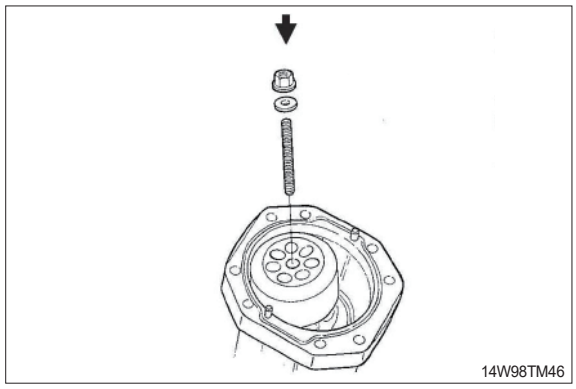
※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.
※ Rotary group vertical.


14W98TM45

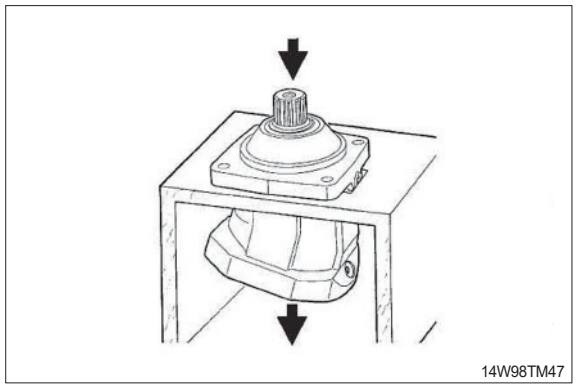
## 9) REMOVE ROTARY GROUP


14W98TM34

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

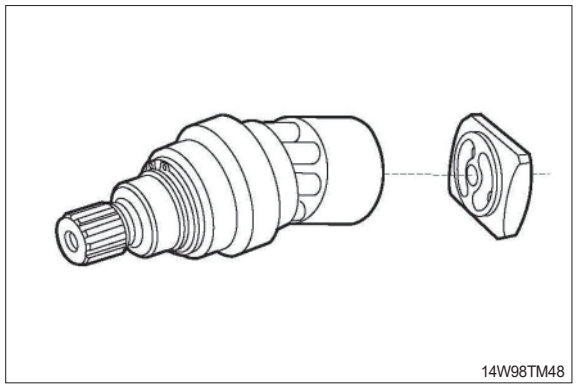

14W98TM46

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

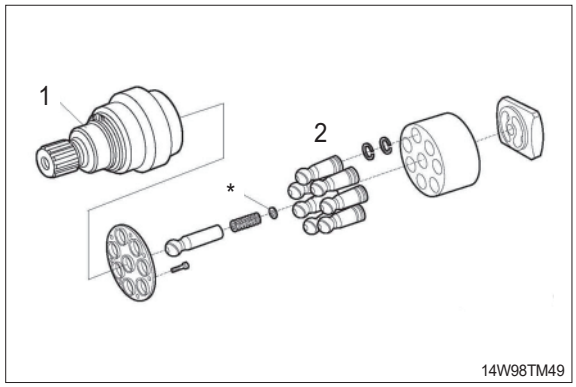

14W98TM47

## 10) EXCHANGING OF THE ROTARY GROUP

※ Complete rotary group
Setting of hydraulic part necessary.

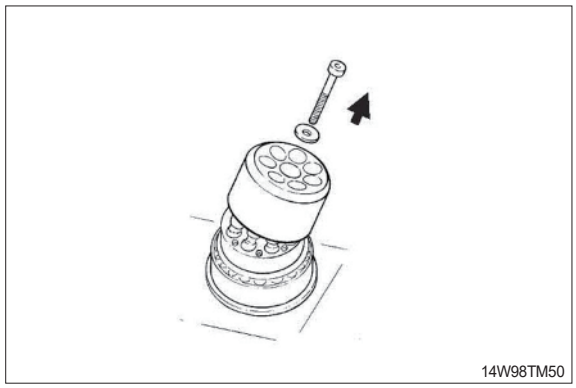

14W98TM48

Rotary group
1 Mechanical part : Adjust drive shaft with bearing
2 Hydraulic part : Adjustment necessary

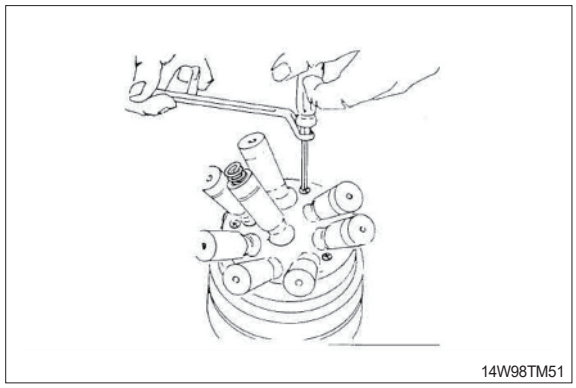


14W98TM49

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

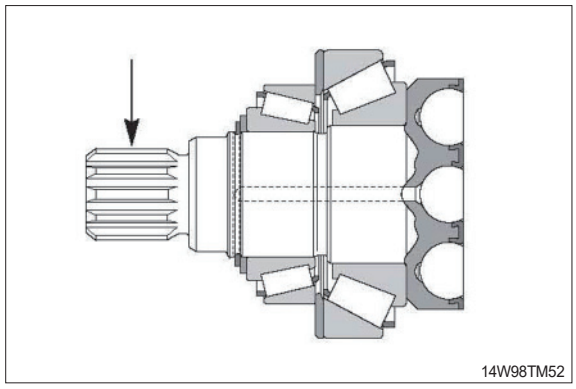

14W98TM50

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


14W98TM51

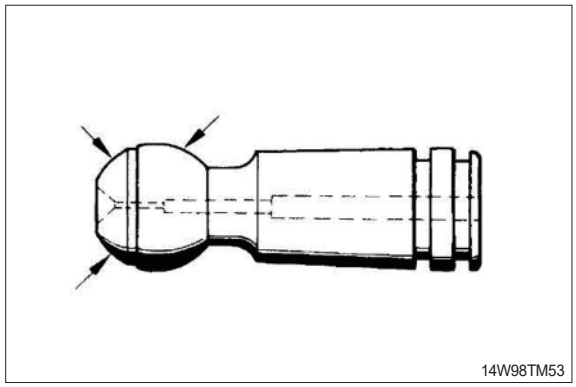
## 11) INSPECTION INSTRUCTIONS

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



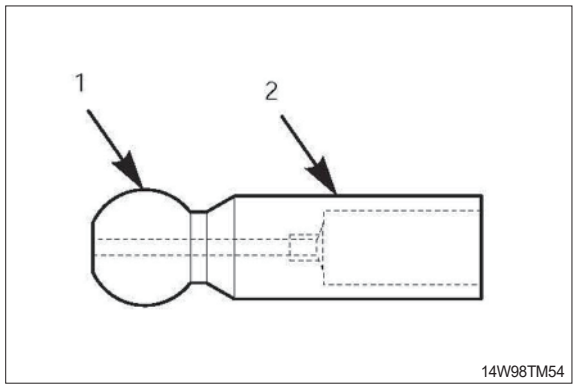

**(2) Pistons**

No scoring and no pittings.



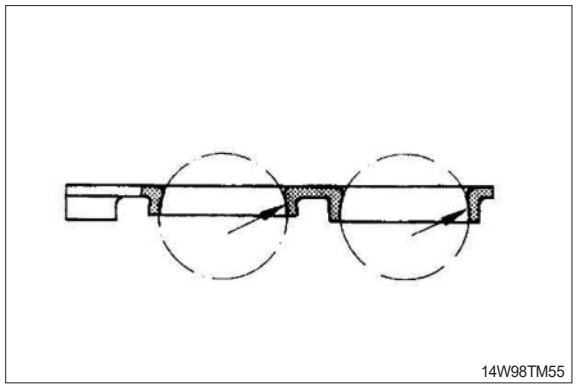

**(3) Center pin**

No scoring and no pittings.




**(4) Retaining plate**

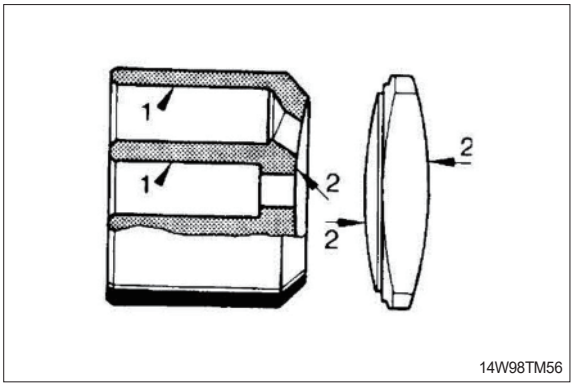
No scoring and no evidence of wear.



**(5) Cylinder block / Control lens**

1 Bores free of scoring, no evidence of wear

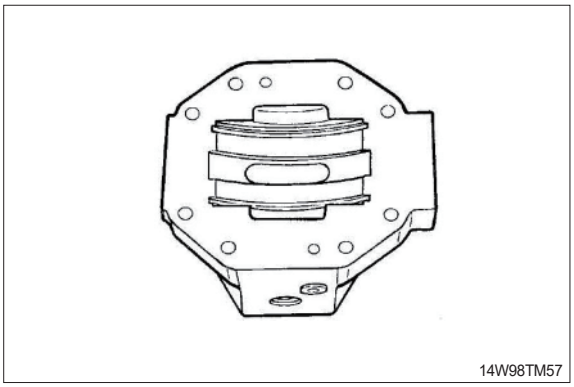
2 Faces smooth and even, free of cracks and scoring



14W98TM56

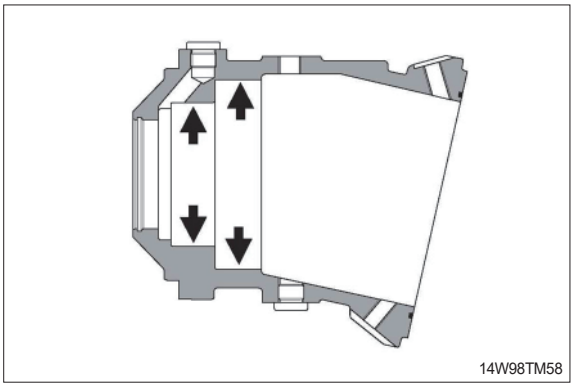
**(6) Control housing**

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


14W98TM57

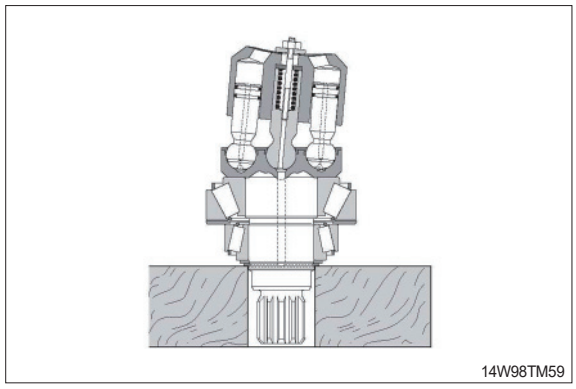
**(7) Visual check**

Bearing areas free of scoring and no evidence of wear.

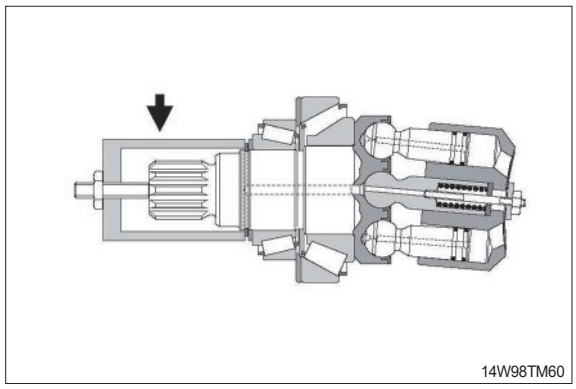

14W98TM58

## 12) ROTARY GROUP ASSEMBLY

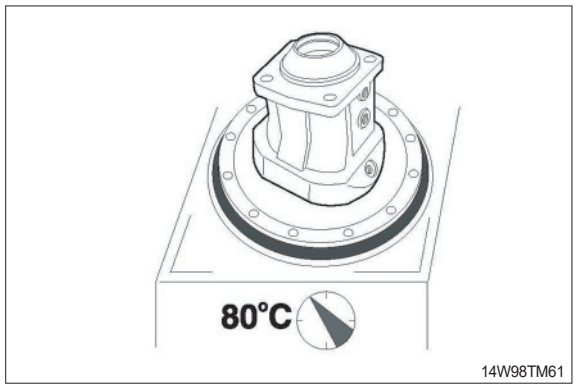
(1) Rotary group completely assembled ready for assembly.



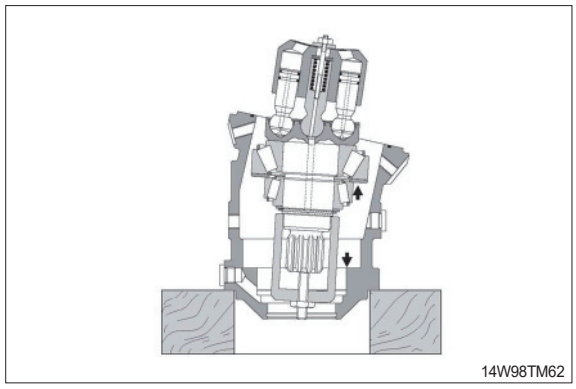

(2) Place assembly sleeve.



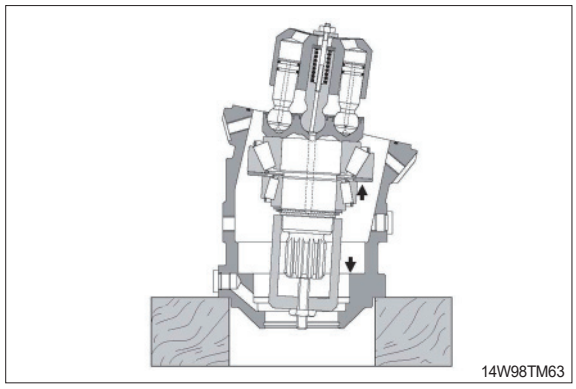

(3) Warm up housing to 80°C.



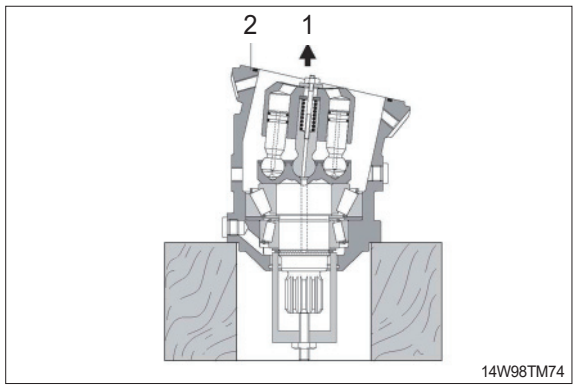

(4) Insert rotary group into housing to seat position.



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

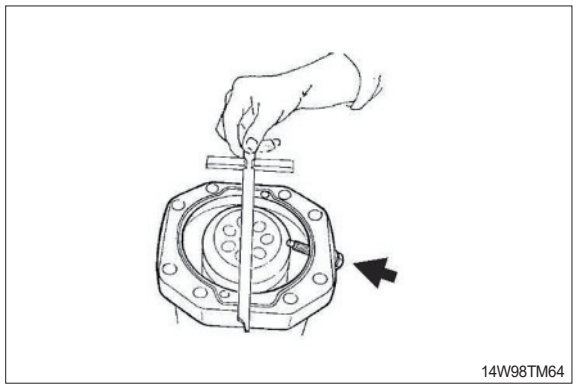



(6) Fix zero position of cylinder with $Q_{max}$ screw.
1 Disassemble cylinder fixing screw
2 Insert O-ring

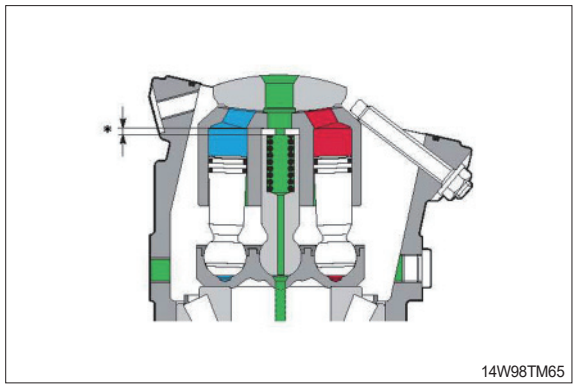



## 13) ROTARY GROUP ADJUSTMENT

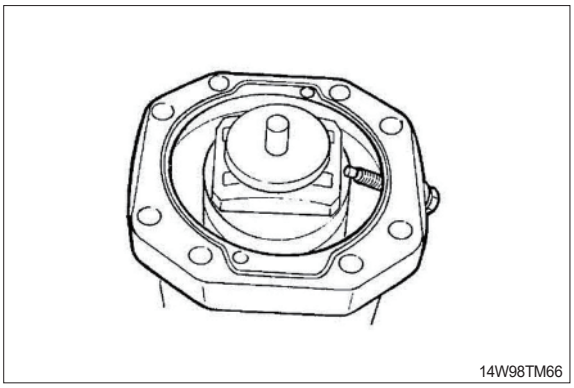
(1) Determine cylinder swivel range to max angle with screw.



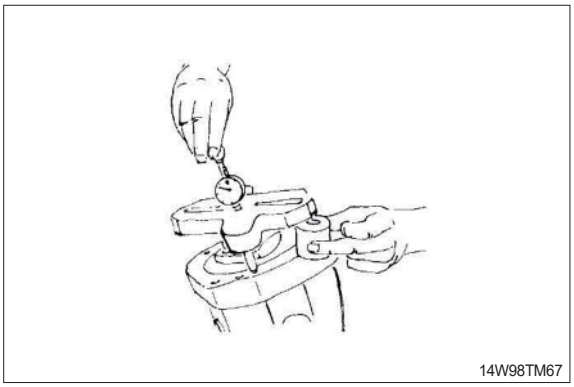

(2) * Disc



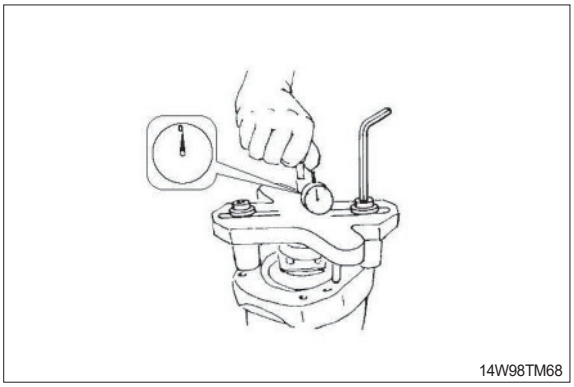
(3) Place centering disc.




(4) Mount measuring device.




(5) Check dimension X.




## 14) ASSEMBLY OF THE PORT PLATE

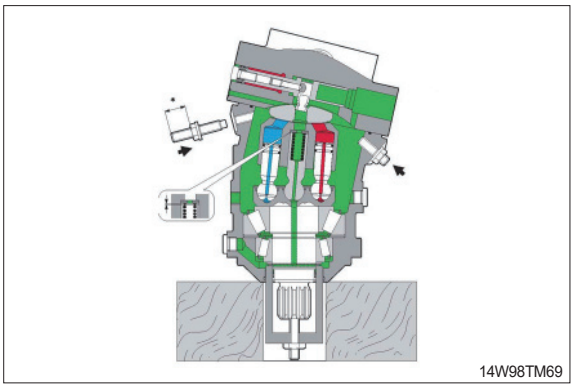
(1) Assemble port plate.

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

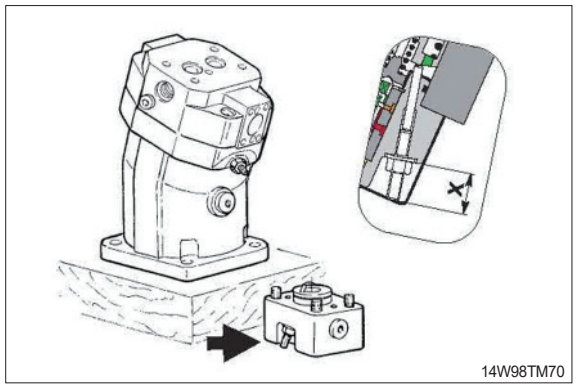
(2) Set $Q_{min}$ screw to dimension(*).

(3) Assemble plug.

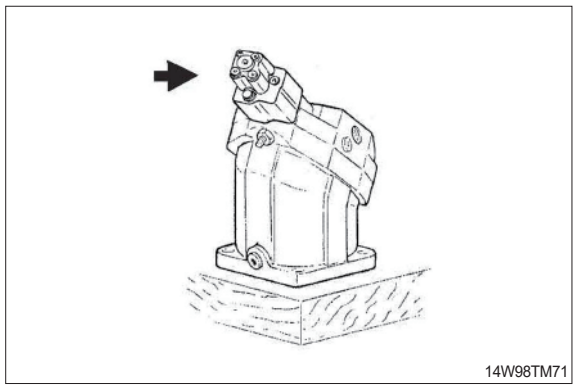
(4) Remove assembly sleeve.



(5) Assemble control components.

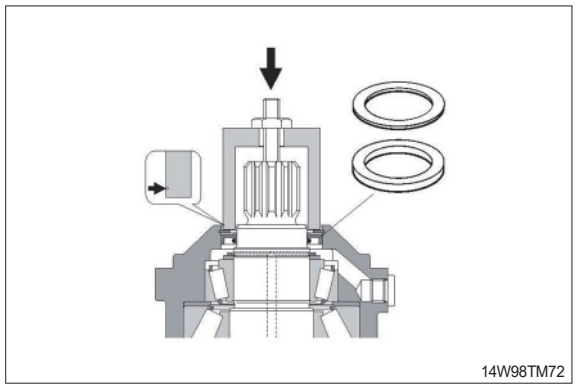



(6) Assemble cover.

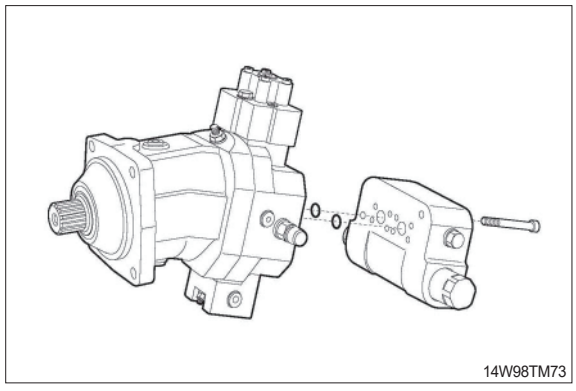



(7) Assemble shaft seal, disc and safety ring.
Press in with assembly sleeve.

※ Take care of press in depth.




(8) Assemble counter balance valve.



## 1. REMOVAL AND INSTALL

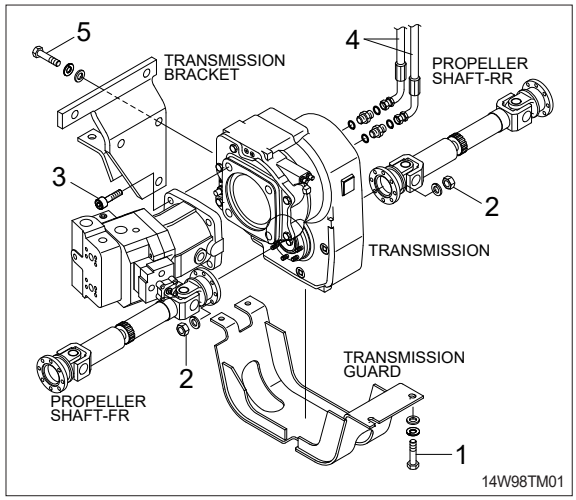
### 1) REMOVAL


(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 transmission guard plate mounting bolt (1).
(5) Remove the propeller shaft mounting nuts (2).
· Tightening torque : 5.9±0.6 kgf · m (42.7±4.3 lbf · ft)
(6) Remove the travel motor mounting bolt (3).
· Tightening torque : 29.7±4.5 kgf · m (215±32.5 lbf · ft)
(7) Remove the hoses (4).
Fit blind plugs to the disconnected hoses.
(8) Remove the mounting bolts (5), then remove the transmission device assembly.
· Weight : 140 kg (310 lb)
· Tightening torque : 58.4±6.4 kgf · m (422±46.3 lbf · ft)




### 2) INSTALL

(1) Carry out installation in the reverse order to removal.
(2) Bleed the air from the transmission.
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. GENERAL INSTRUCTIONS

### 1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by manufacturer.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore,transmission removed from the machine must be cleaned prior to open them.

(3) We assume that the special tools, specified by manufacturer, will be used.
The special tools are available from manufacturer.

(4) After the disassembly, all components must be cleaned, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100˚C.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

## 2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

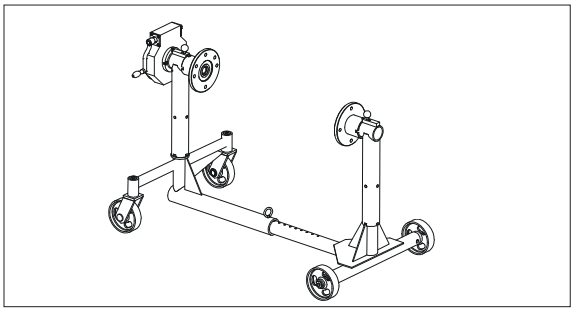
(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

## 3. SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

1) Assembly truck assy with tilting device

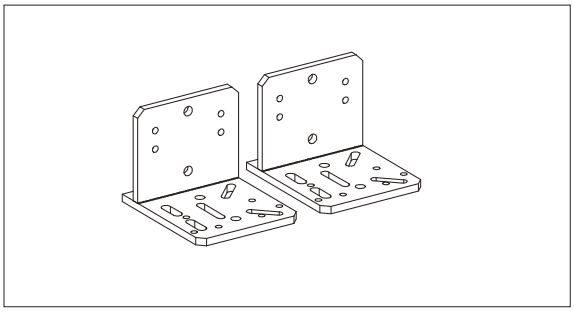
5870 350 000



14WF8TM01

2) Supporting bracket

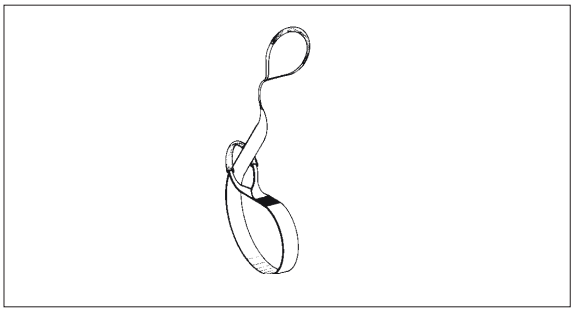
5870 350 106



14WF8TM02

3) Lifting strap

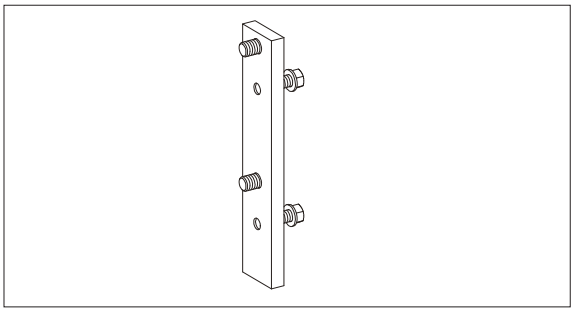
5870 281 026



14WF8TM03

4) Fixture

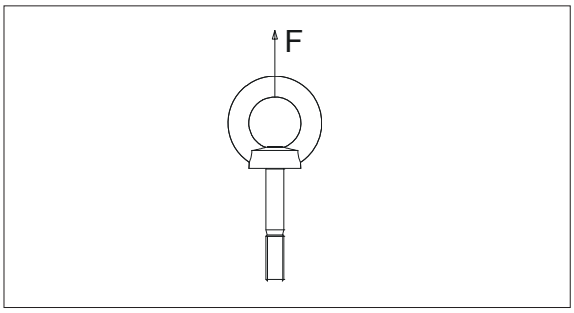
5870 350 079



14WF8TM04

5) Eye bolt assortment

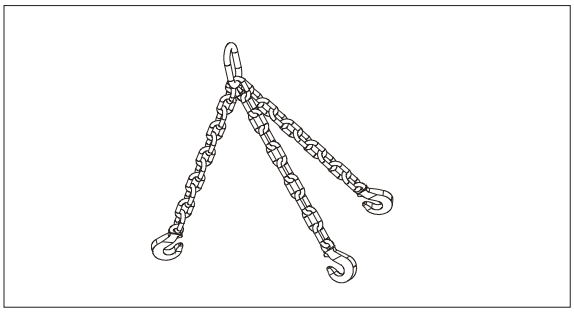
5870 204 002




14WF8TM05

6) Lifting chain

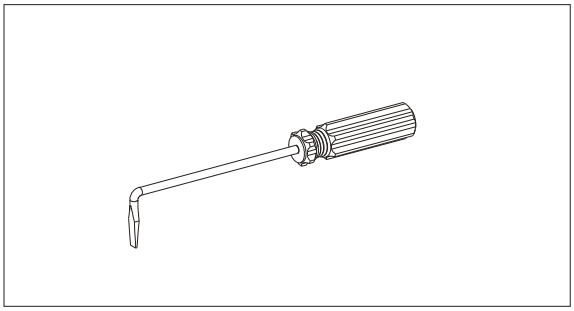
5870 221 047



14WF8TM06

7) Resetting device

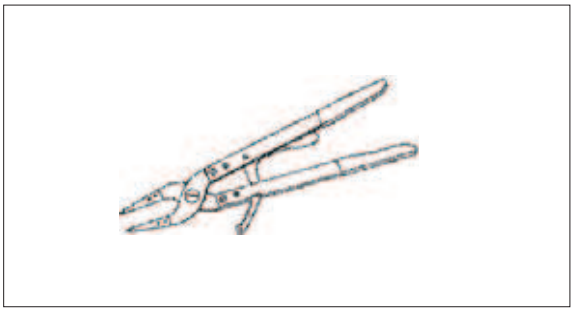
5870 400 001



14WF8TM07

8) Clamping pliers

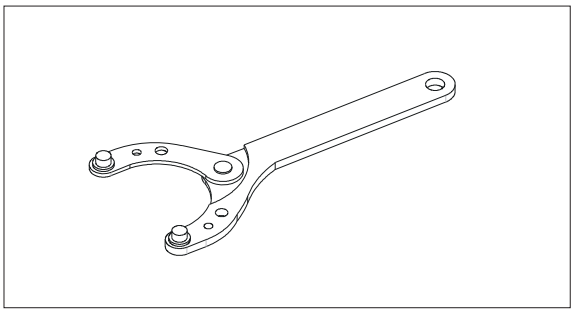
5870 900 021



14WF8TM08

9) Clamping fork

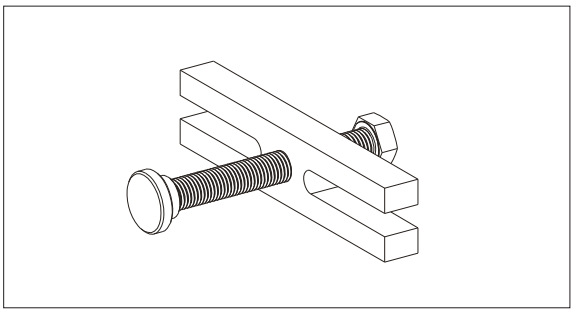
5870 240 025



14WF8TM09

10) Extractor

5870 000 017



14WF8TM10

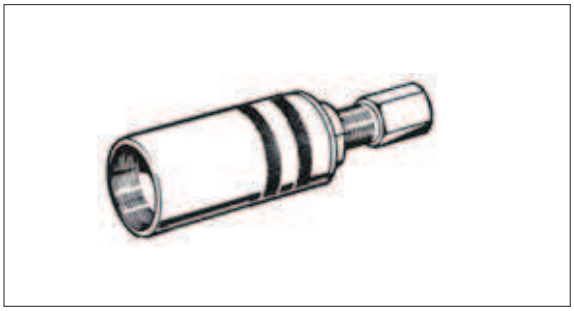
11) Rapid grip

5873 012 021

14WF8TM11

12) Basic tool

5873 002 001



14WF8TM12

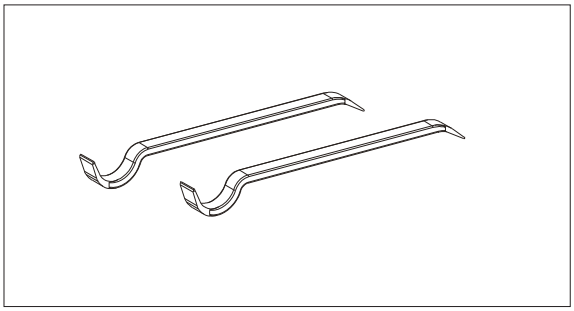
13) Cut-off device

5870 300 028

14WF8TM13

14) Assembly lever

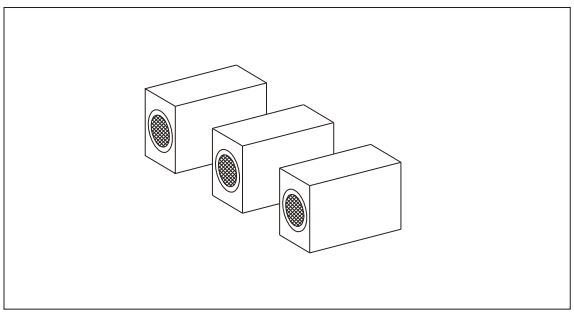
5870 345 036



14WF8TM14

15) Solenoid block

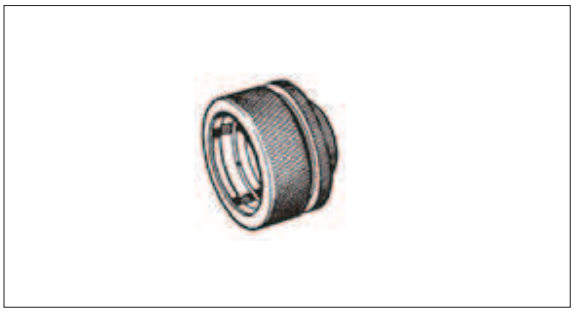
5870 450 003



14WF8TM15

16) Grab sleeve

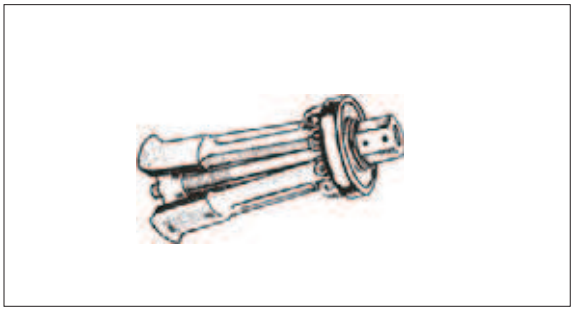
5873 001 037



14WF8TM16

17) Inner extractor

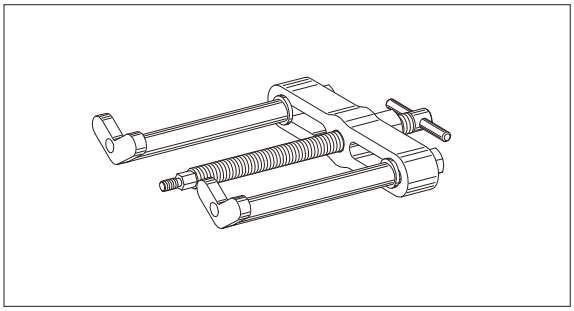
5870 300 019



14WF8TM17

18) Counter support

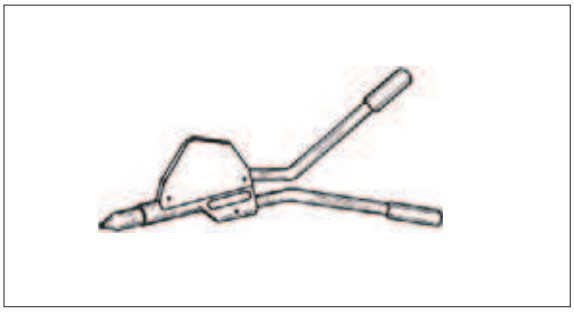
5870 300 020



14WF8TM18

19) Lever riveting tongs

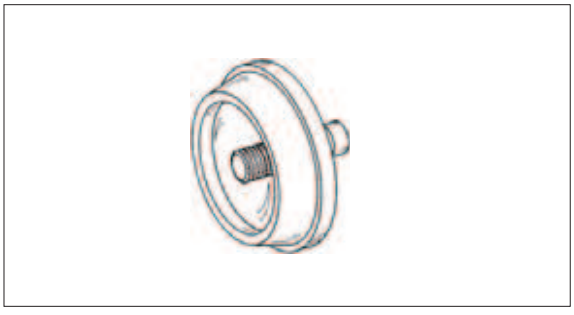
5870 320 016



14WF8TM19

20) Driver tool

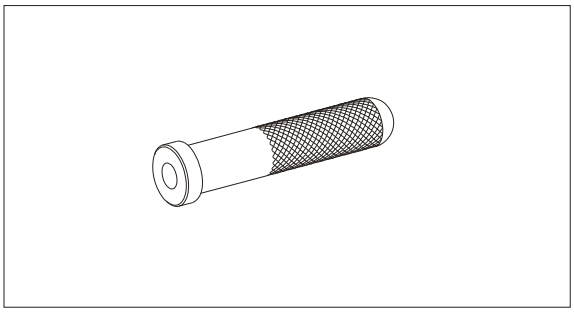
5870 058 073



14WF8TM20

21) Handle

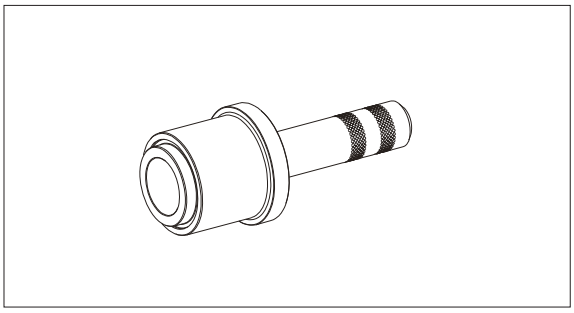
5870 260 002



14WF8TM21

22) Driver tool

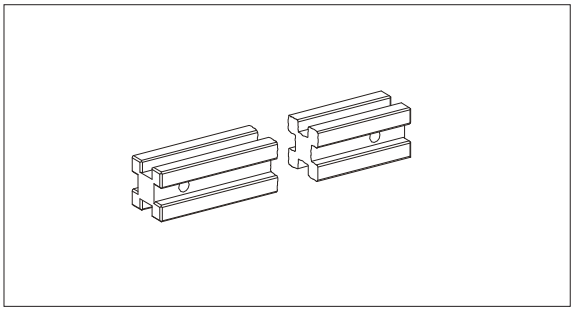
5870 048 281



14WF8TM22

23) Straightedge

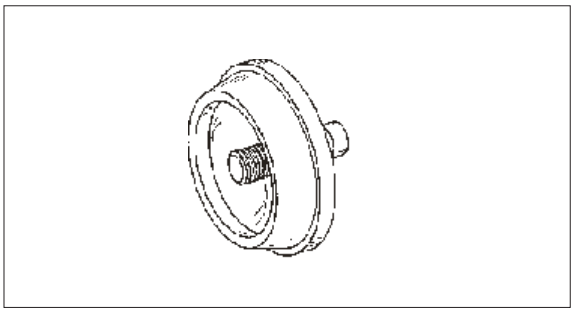
5870 200 108



14WF8TM23

24) Driver tool

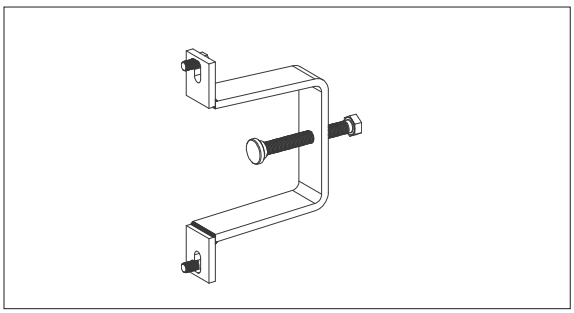
5870 058 078



14WF8TM24

25) Clamping bar

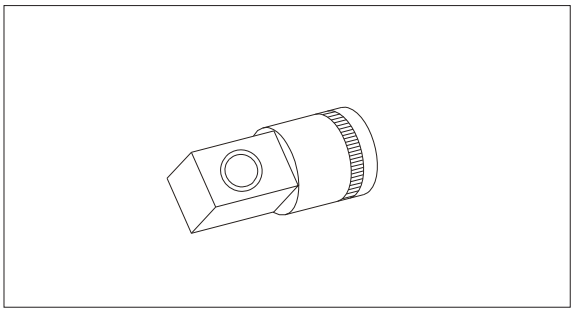
5870 654 049



14WF8TM25

26) Reduction

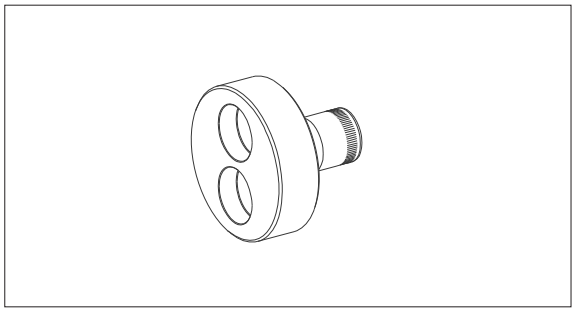
5870 656 056



14WF8TM26

27) Plug insert

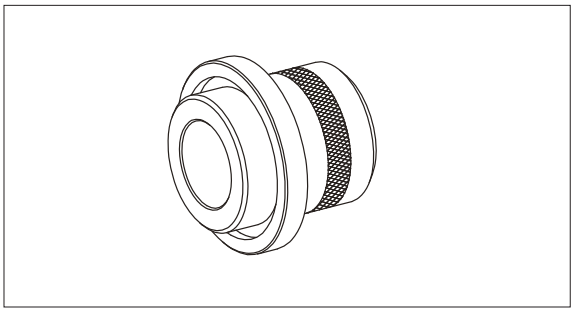
AA00 392 461



14WF8TM27

28) Driver tool

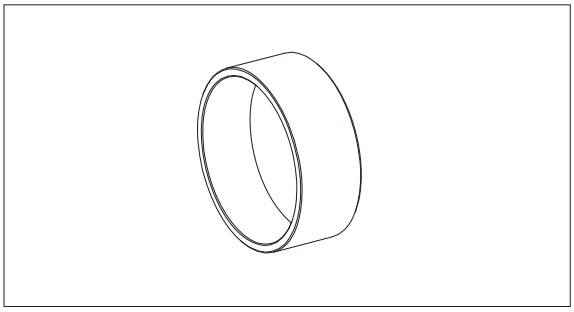
5870 048 279



14WF8TM28

29) Pressure piece

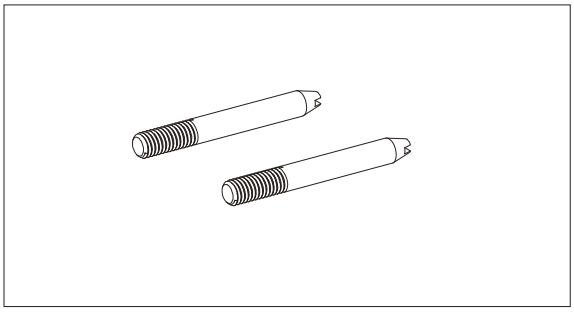
5870 506 150



14WF8TM29

30) Adjusting screws (M12)

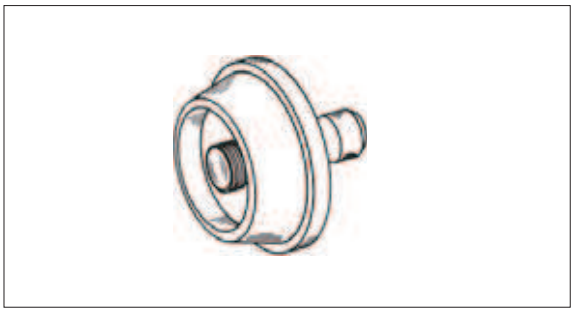
5870 204 021



14WF8TM30

31) Driver tool

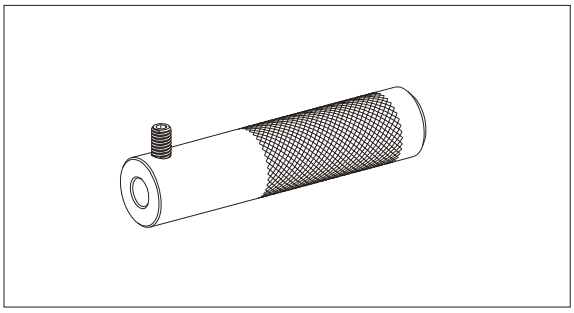
5870 058 051



14WF8TM31

32) Press-fit mandrel

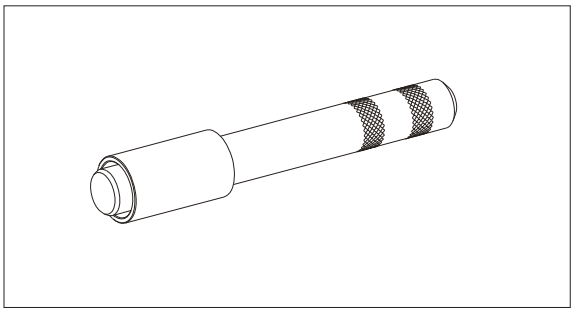
AA00 392 151



14WF8TM32

33) Driver tool

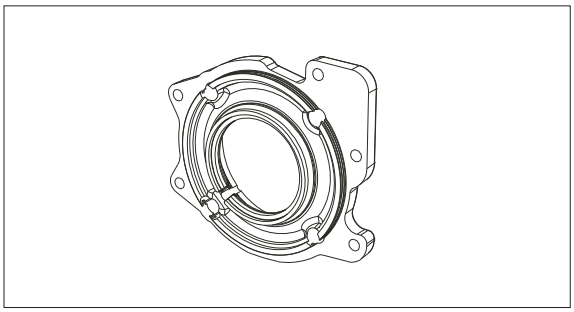
5870 048 283



14WF8TM33

34) Measuring device

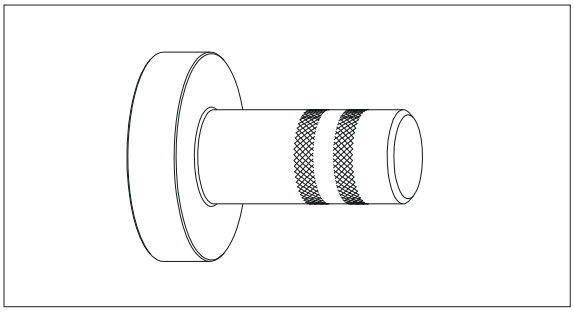
5870 200 131



14WF8TM34

35) Driver tool

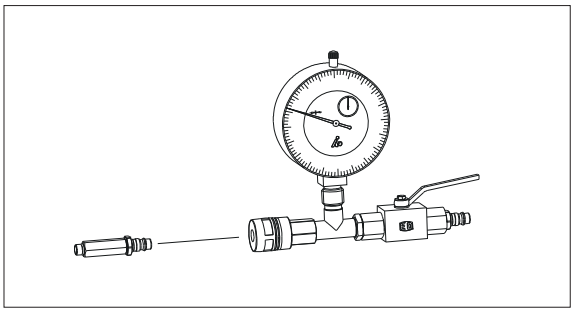
5870 506 161



14WF8TM35

36) Air connection

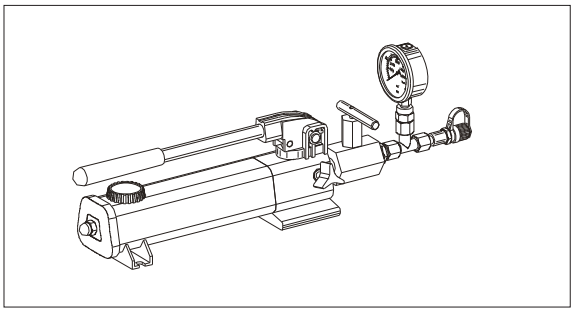
5870 505 012



14WF8TM36

37) HP pump

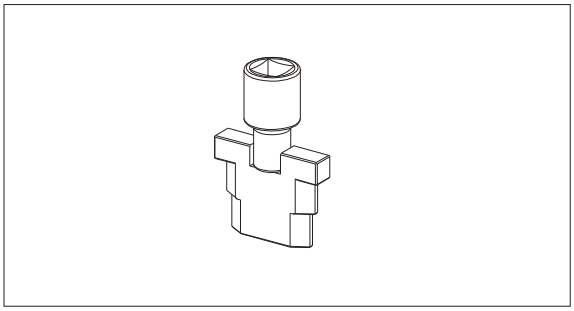
5870 287 007



14WF8TM37

38) Spline mandrel

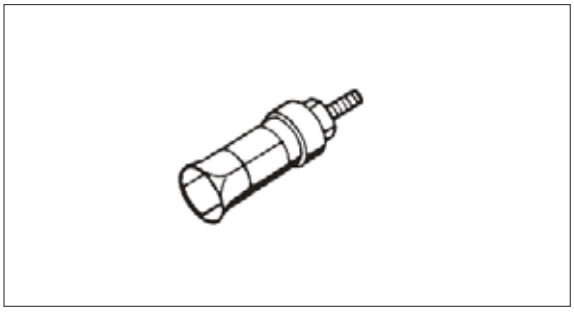
5870 510 039



14WF8TM38

39) Inner extractor

5870 300 012



14WF8TM39

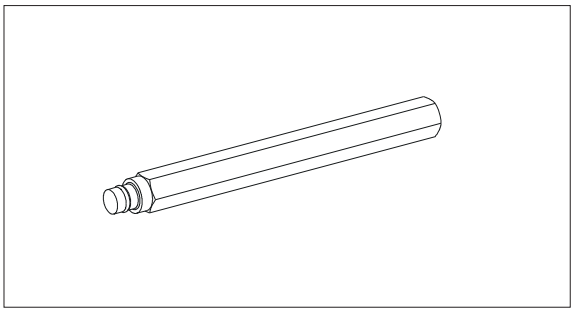
40) Counter support

5870 300 011

14WF8TM40

41) Driver tool

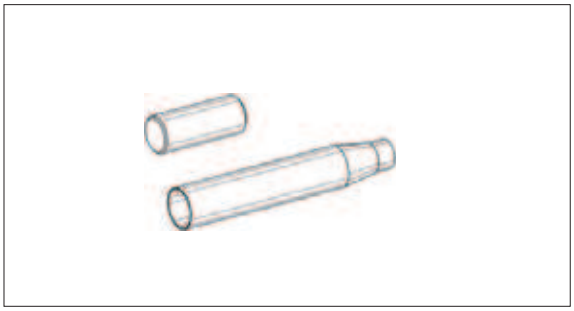
5870 705 003



14WF8TM41

42) Inner installer

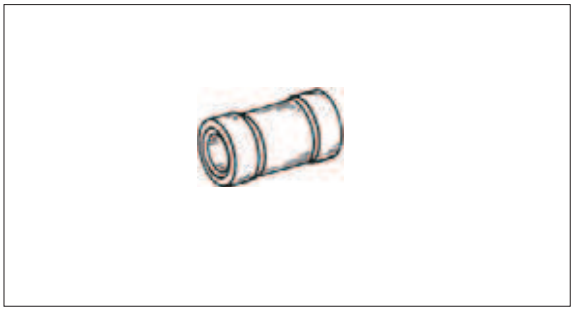
5870 651 055



14WF8TM42

43) Calibrating mandrel

5870 651 056



14WF8TM43

## 4. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

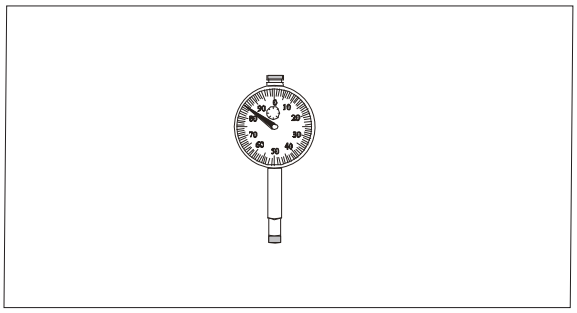
1) Magnetic stand

5870 200 055

14WF8TM44

2) Dial indicator

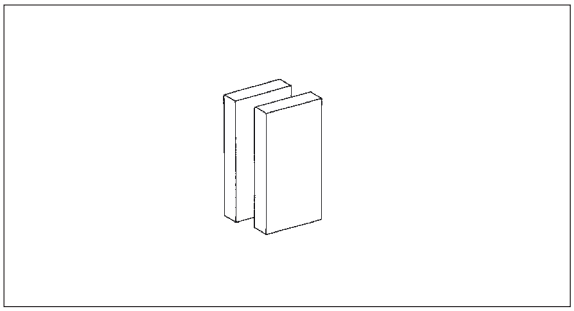
5870 200 057



14WF8TM45

3) Gauge blocks

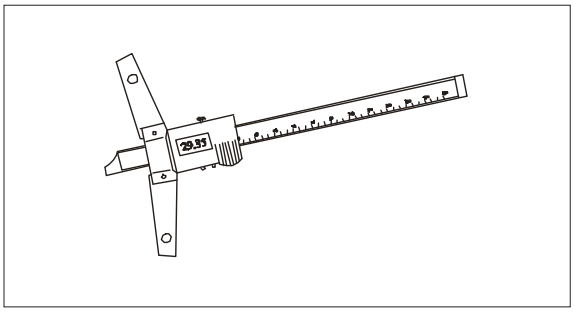
| | |
|---|---|
| 5870 200 066 | 70 mm |
| 5870 200 067 | 100 mm |



14WF8TM46

4) Digital depth gauge

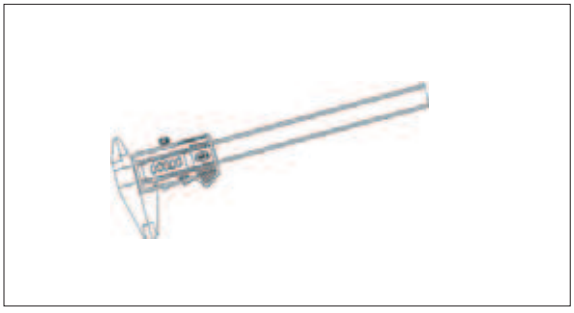
| | |
|---|---|
| 5870 200 072 | 200 mm |
| 5870 200 114 | 300 mm |



14WF8TM47

5) Digital caliper gauge

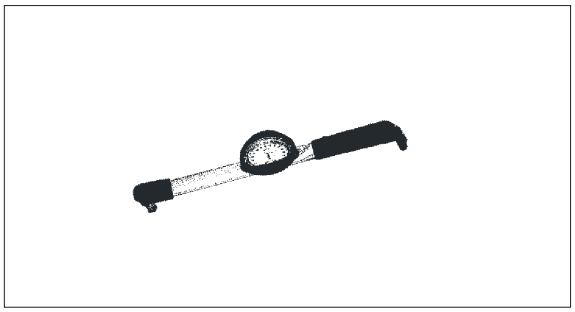
| | |
|---|---|
| 5870 200 109 | 150 mm |



14WF8TM48

6) Torque wrench

| | |
|---|---|
| 5870 203 030 | 0.6 -6.0 Nm |
| 5870 203 031 | 1.0 – 12 Nm |
| 5870 203 032 | 3.0 – 23 Nm |
| 5870 203 033 | 5.0 – 45 Nm |
| 5870 203 034 | 10 – 90 Nm |
| 5870 203 039 | 80 – 400 Nm |
| 5870 203 016 | 140 – 750 Nm |
| 5870 203 011 | 750 - 2000 Nm |

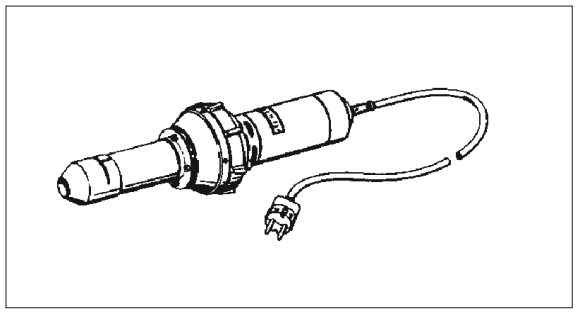


14WF8TM49

14WF8TM50

7) Hot air blower

| | |
|---|---|
| 5870 221 500 | 230 V |
| 5870 221 501 | 115 V |



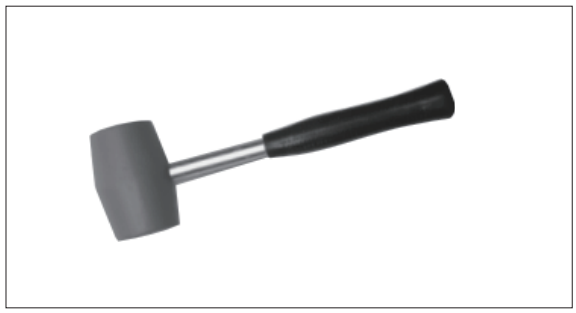
14WF8TM51

8) Plastic hammer

| | |
|---|---|
| 5870 280 004 | Ø 60 mm |

Substitute nylon insert

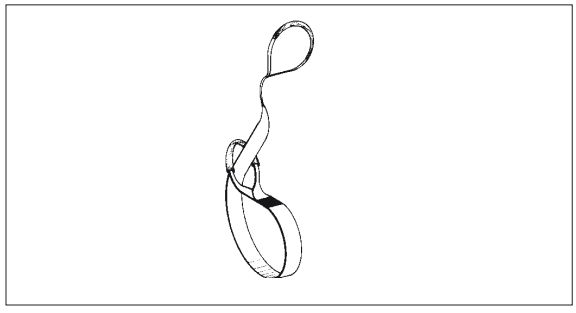
5870 280 006



14WF8TM52

9) Lifting strap

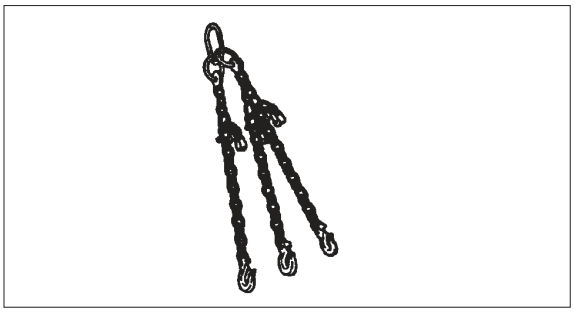
5870 281 026



14WF8TM53

10) Lifting chain

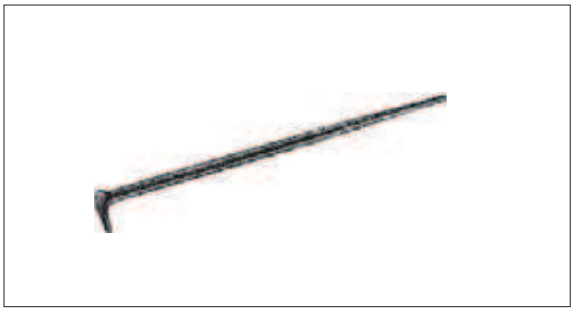
5870 281 047



14WF8TM54

11) Pry bar

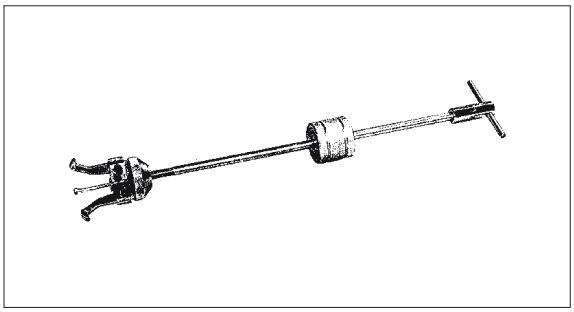
5870 345 071



14WF8TM55

12) Striker

5870 650 004



14WF8TM56

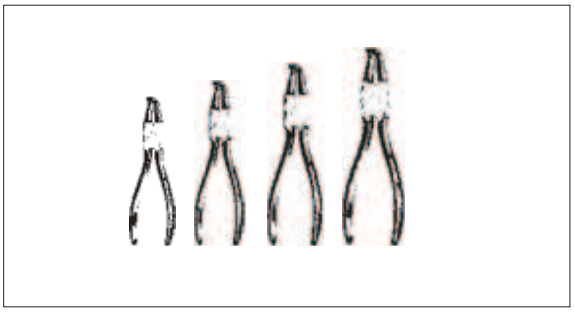
13) Set of internal pliers
I1-I2-I3-I4

5870 900 013

14WF8TM57

14) Set of internal pliers
I11-I21-I31-I41 90˚

5870 900 014



14WF8TM58

15) Set of external pliers
A1-A2-A3-A4

5870 900 015

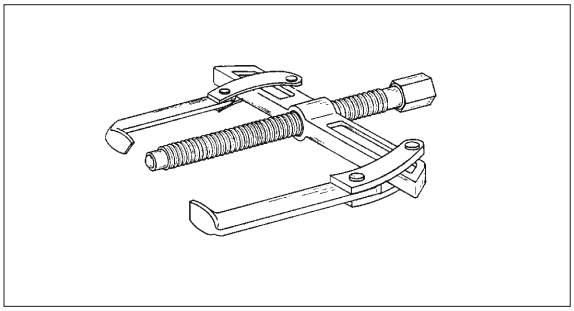
14WF8TM59

16) Set of external pliers
A01-A02-A03-A04 90°

5870 900 016

14WF8TM60

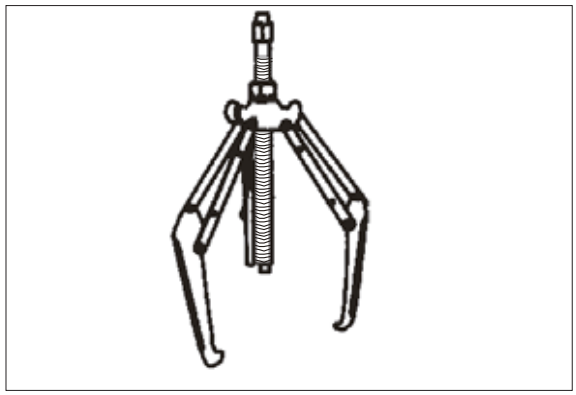
17) Two-armed puller



14WF8TM61

| | |
|---|---|
| 5870 970 001 | |
| Jaw width | 80 mm |
| Throat depth | 100 mm |
| 5870 970 002 | |
| Jaw width | 120 mm |
| Throat depth | 125 mm |
| 5870 970 003 | |
| Jaw width | 170 mm |
| Throat depth | 125 mm |
| 5870 970 004 | |
| Jaw width | 200 mm |
| Throat depth | 175 mm |
| 5870 970 006 | |
| Jaw width | 350 mm |
| Throat depth | 250 mm |
| 5870 970 007 | |
| Jaw width | 520 mm |
| Throat depth | 300 - 500 mm |
| 5870 970 026 | |
| Jaw width | 250 mm |
| Throat depth | 200 mm |
| 5870 970 028 | |
| Jaw width | 380 mm |
| Throat depth | 200 mm |

18) Three armed puller



14WF8TM62

| | |
|---|---|
| 5870 971 001 | |
| Jaw width | 85 mm |
| Throat depth | 65 mm |
| 5870 971 002 | |
| Jaw width | 130 mm |
| Throat depth | 105 mm |
| 5870 971 003 | |
| Jaw width | 230 mm |
| Throat depth | 150 mm |
| 5870 971 004 | |
| Jaw width | 295 mm |
| Throat depth | 235 mm |
| 5870 971 005 | |
| Jaw width | 390 mm |
| Throat depth | 230 mm |
| 5870 971 006 | |
| Jaw width | 640 mm |
| Throat depth | 290 mm |

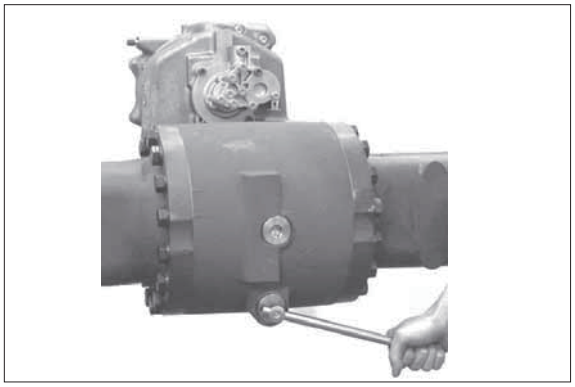
## 5. SEPARATE TRANSMISSION FROM AXLE HOUSING

(only for version Axle attachment)

1) Drain oil from axle housing – use a suitable oil reservoir.

(S) Assembly truck 5870 350 000
(S) Clamping fork 5870 350 106

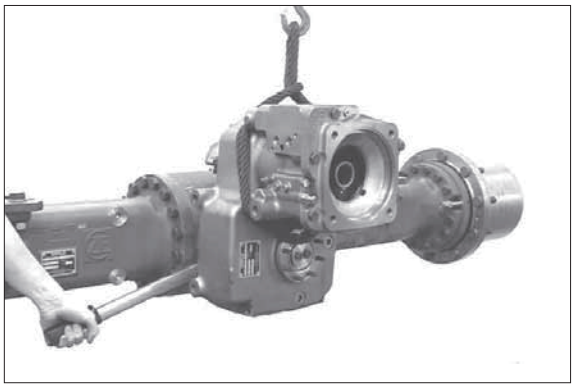
⚠ **Waste oil to be disposed of ecologically.**



14WF8TM63

2) Pick-up Transmission by means of lifting tackle, loosen threaded joint and separate complete Transmission from axle housing.

(S) Lifting strap 5870 281 026

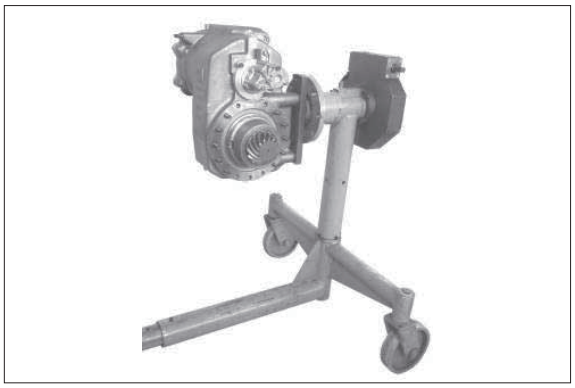


14WF8TM64

## 6. DISASSEMBLY – BRAKE / CLUTCH / PLANETARY CARRIER

1) Mount transmission to assembly truck.

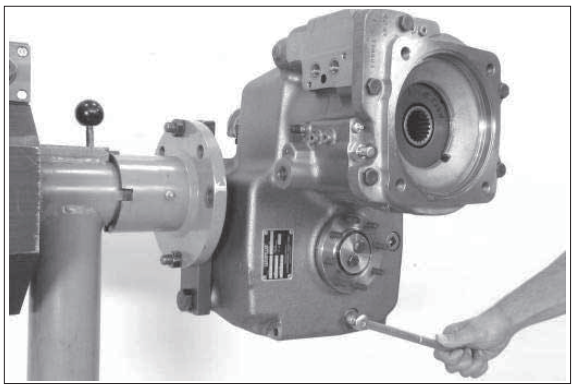
(S) Assembly truck assy. 5870 350 000
(S) Fixture 5870 350 079



14WF8TM65

2) Loosen screw plug and drain oil – use a suitable oil reservoir.

⚠ **Waste oil to be disposed of ecologically.**

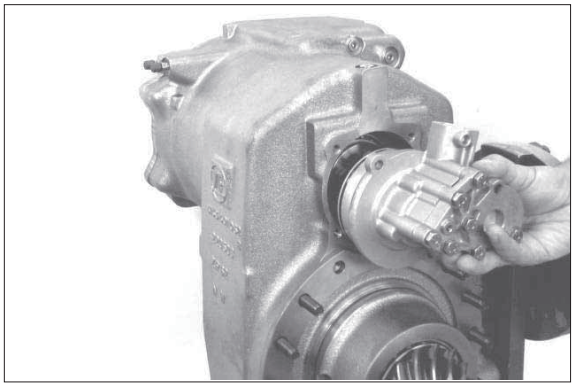


14WF8TM66

**Lubrication pump**

3) Remove lubrication pump or shift interlock (depending on version, Illustration shows version with Lubrication pump).

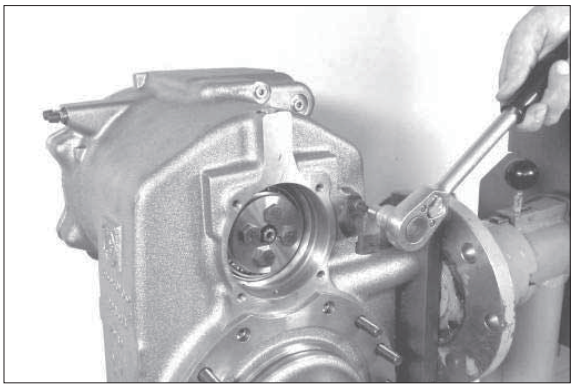
※ Complete disassembly of lubrication pump / shift interlock – see page 8-154-20.



14WF8TM67

**Speed sensor**

4) Loosen screw and pull off speed sensor.

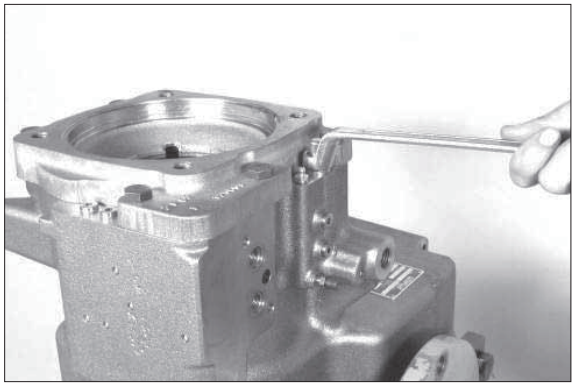


14WF8TM68

**Emergency release (Parking brake)**

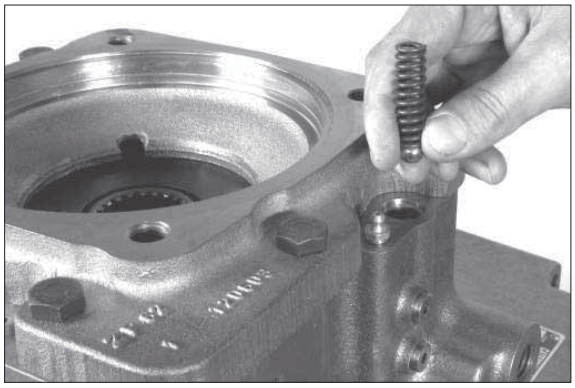
5) Remove breather.
(Illustration 14WF8TM69~14WF8TM72 shows version transmission installation position "Vertical")

※ Position of single connections or breather valves /lubrication nipples etc. as to version transmission installation position Horizontal - see 14WF8TM265.



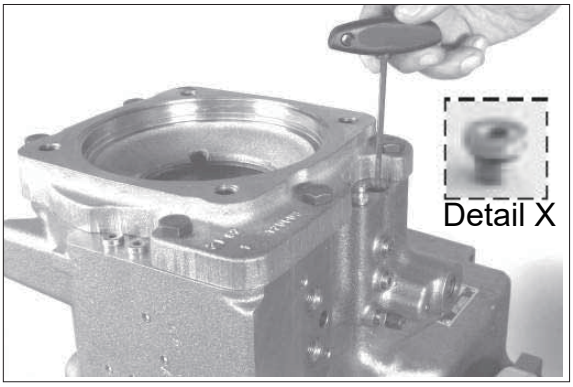
14WF8TM69

6) Remove compression spring and ball.



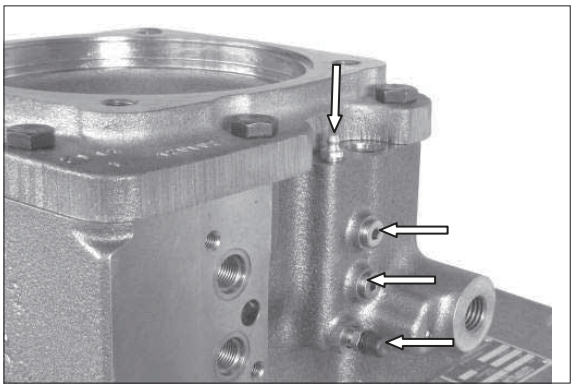
14WF8TM70

7) Remove threaded element (see Detail X) with O-ring from hole.




14WF8TM71

8) Remove lubrication nipple, both screw plugs and breather valve – see arrow.



14WF8TM72

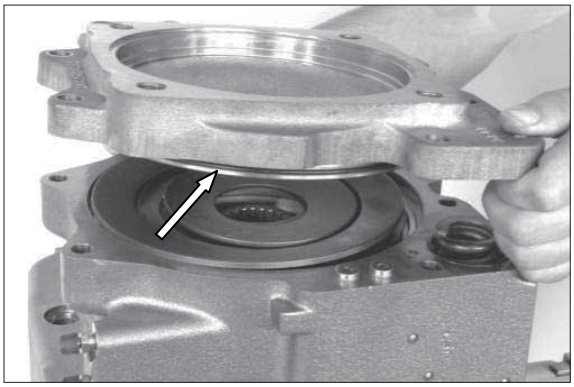
**Input housing and modulation valve**

9) Loosen threaded joint of input housing evenly.

※ Input housing is subject to cup spring and compression spring preload.

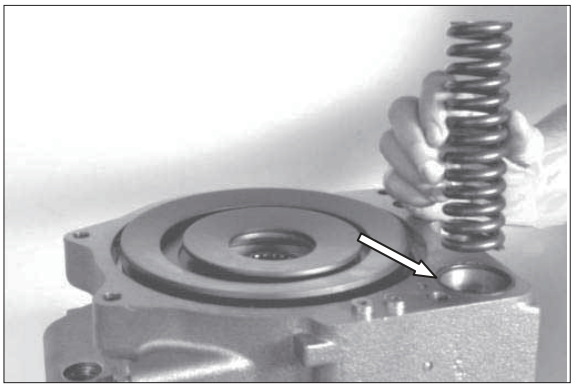
14WF8TM73

10) Take off input housing and remove O-ring (arrow).



14WF8TM74

11) Remove compression spring and O-ring (arrow).



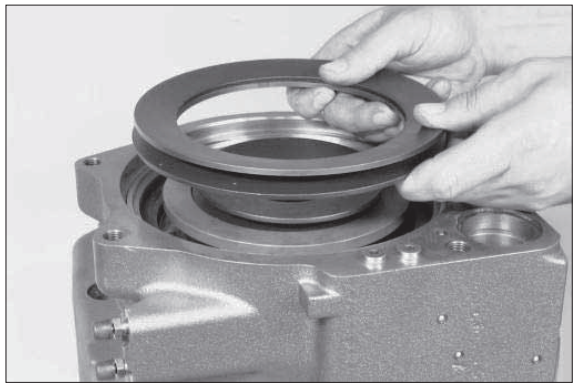
14WF8TM75

12) Pull complete piston out of hole.

14WF8TM76

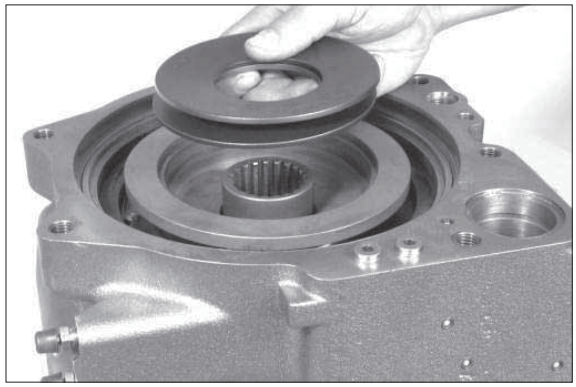
**Brake and clutch**

13) Remove cup springs from brake.



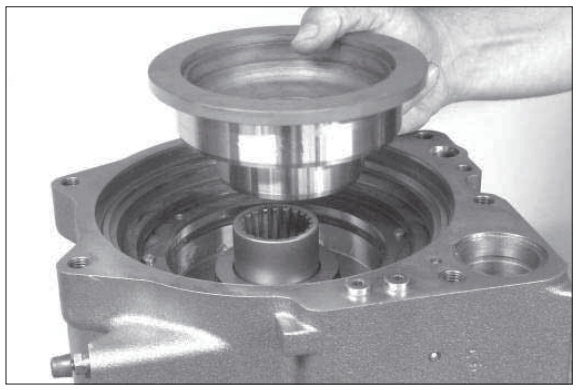
14WF8TM77

14) Remove cup springs from clutch.



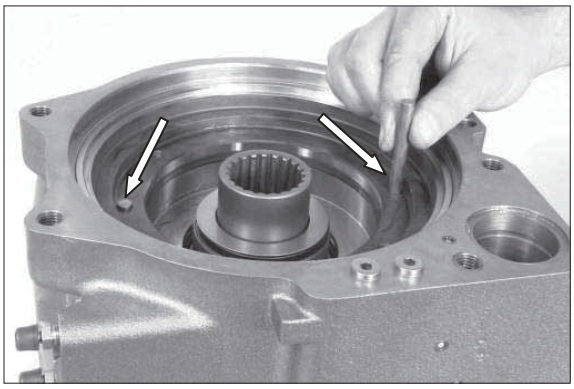
14WF8TM78

15) Remove piston.



14WF8TM79

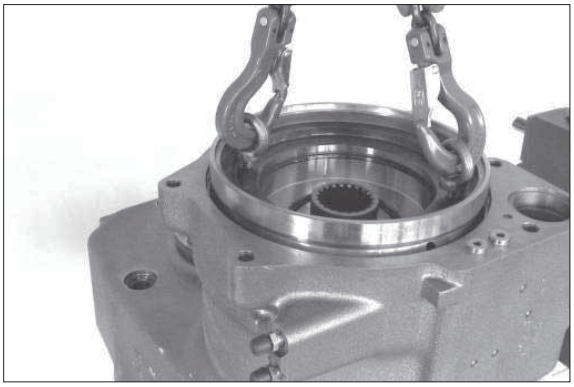
16) Pull off both cyl. pins (arrows).



14WF8TM80

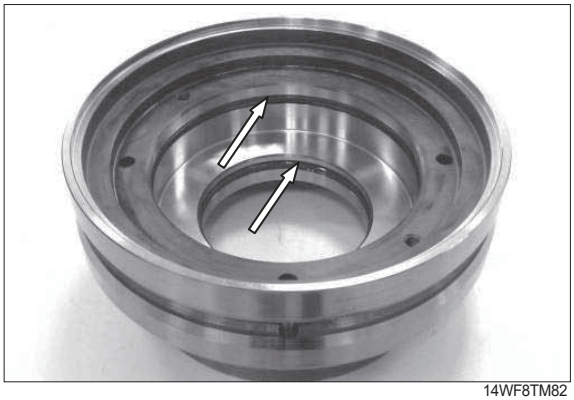
17) Attach 2 (two) eyebolts and pull piston cautiously out of housing – risk of damage.

(S) Eyebolt assortment 5870 204 002
(S) Lifting chain 5870 281 047



14WF8TM81

18) Remove both seals (arrows) from piston.

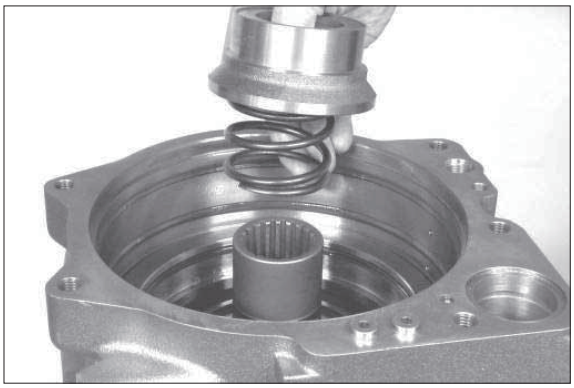


14WF8TM82

19) Remove axial roller cage with both thrust washers.

14WF8TM83

20) Remove pressure piece and compression spring.

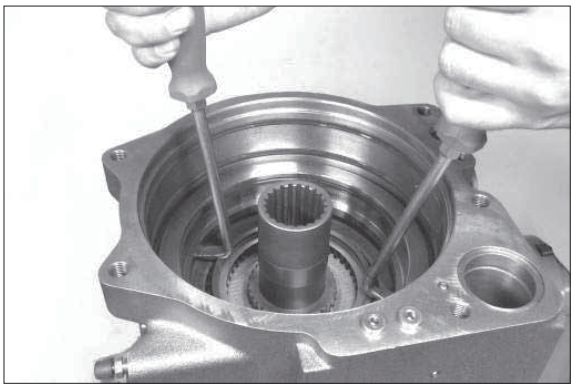


14WF8TM84

21) Remove pressure ring with ring – also see 14WF8TM86 – cautiously with lever – risk of damaging sealing surfaces.

(S) Resetting device 5870 400 001

※ Ring may also remain in housing during disassembly – disassemble ring separately.



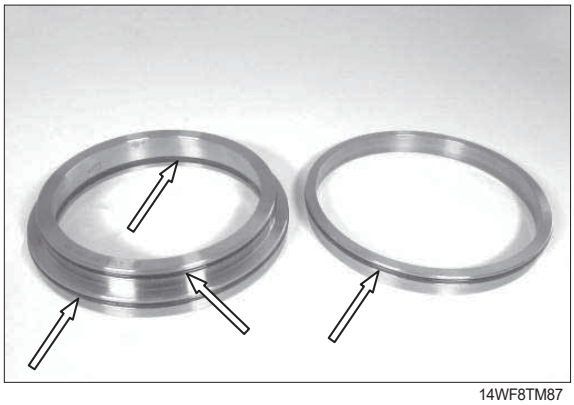
14WF8TM85

22) Remove pressure ring from ring cautiously with lever – risk of damaging sealing surfaces .

(S) Resetting device 5870 400 001

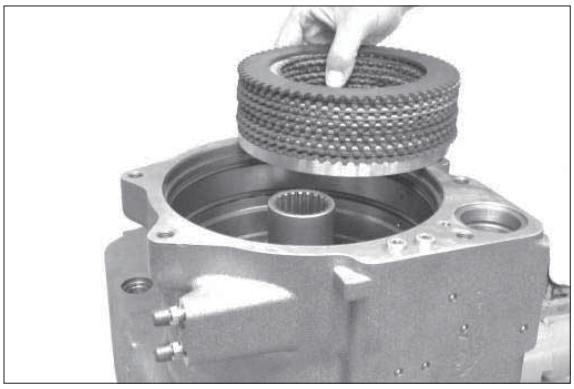
14WF8TM86

23) Remove seal and O-rings (see arrows) from pressure ring and ring.



14WF8TM87

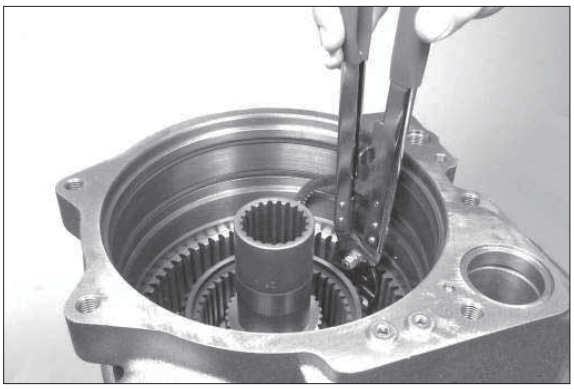
24) Take disk package of brake with end plate(s) out of housing.



14WF8TM88

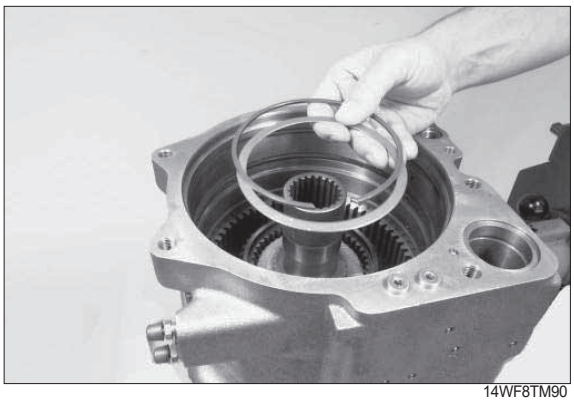
25) Disengage retaining ring.

(S) Clamping pliers 5870 900 021



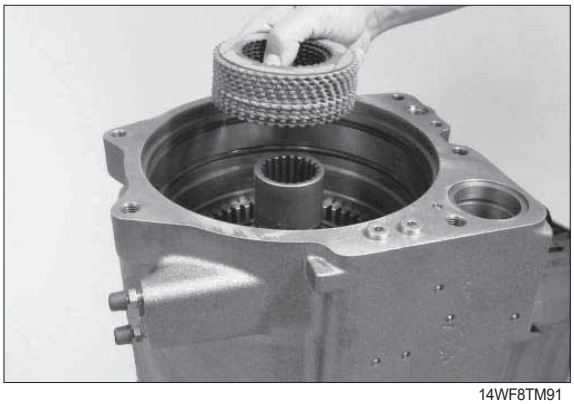
14WF8TM89

26) Remove snap ring and shim.



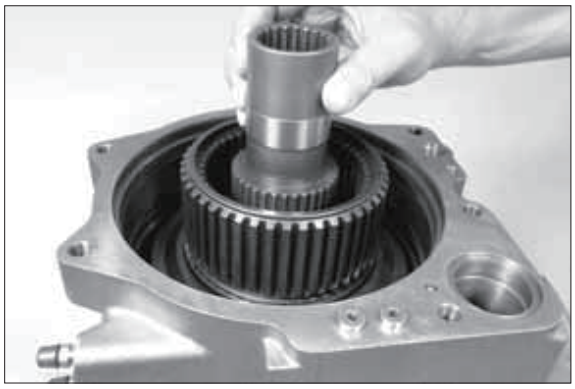
14WF8TM90

27) Take disk package of clutch with end plate(s) out of ring gear.



14WF8TM91

28) Remove cpl. input shaft with ring gear from housing.

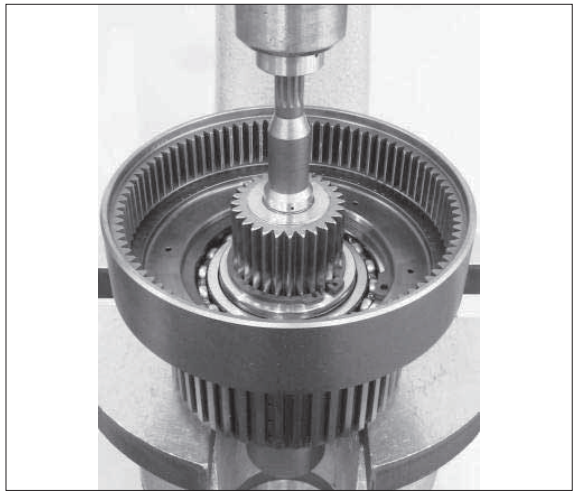


14WF8TM92

29) Unsnap retaining ring.

14WF8TM93

30) Press input shaft out of ball bearing/ring gear.



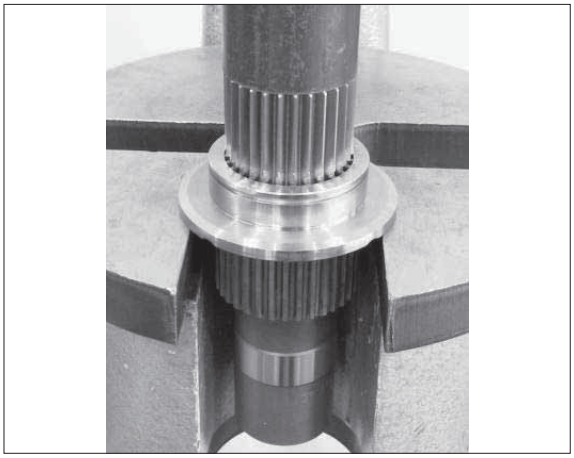
14WF8TM94

31) Unsnap retaining ring.

14WF8TM95

32) Press centering disk from input shaft.

※ In case of extreme press fit – heat centering disk.



14WF8TM96

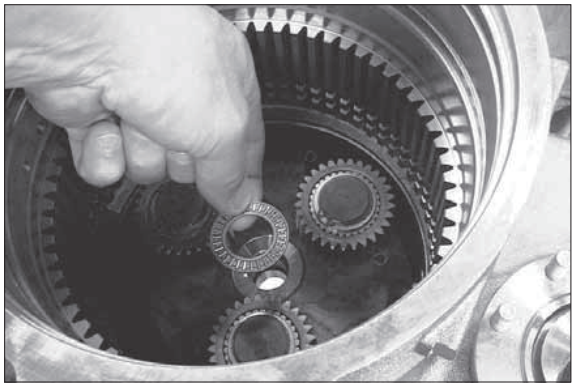
33) Unsnap retaining ring and remove ball bearing.

(S) Clamping pliers 5870 900 021

14WF8TM97

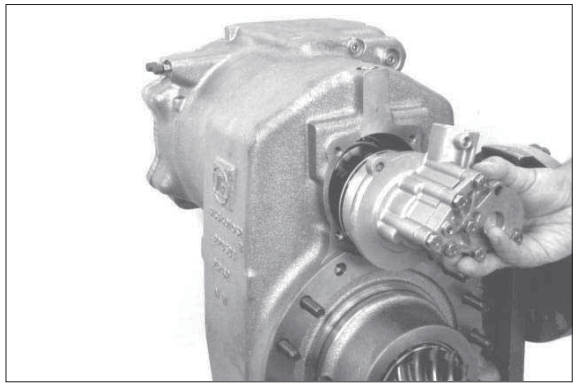
**Planetary carrier**

34) Remove axial needle cage.



14WF8TM98

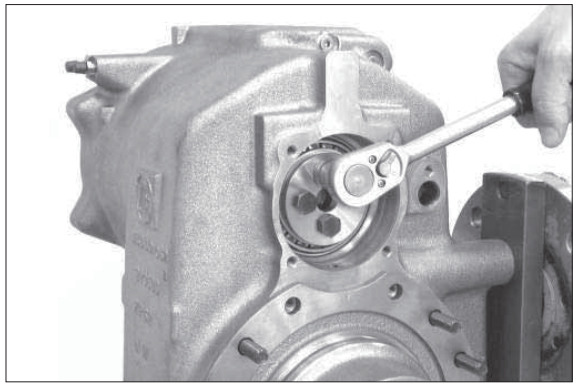
35) If not yet disassembled previously – remove lubrication pump or shift interlock (depending on version).
(Illustration shows version - Lubrication pump).



14WF8TM99

36) Loosen threaded joint and remove disk – fasten output flange by means of clamping fork.

(S) Clamping fork 5870 240 025

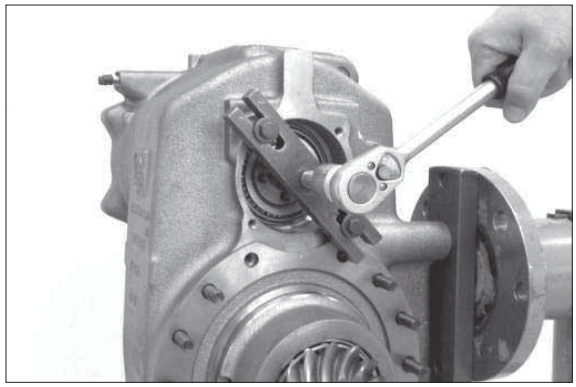


14WF8TM100

37) Press cpl. planetary carrier out of roller bearing.

(S) Extractor 5870 000 017

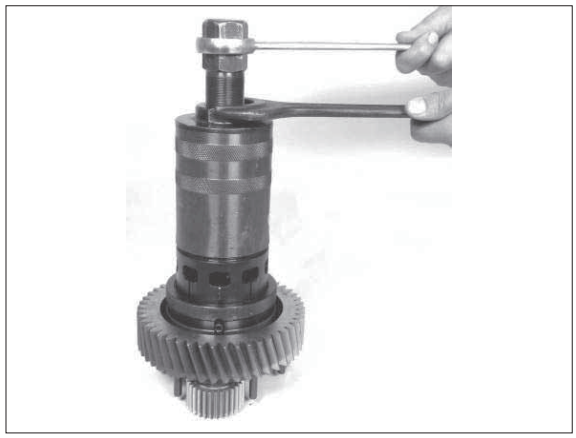
※ Pay attention to releasing planetary carrier and bearing inner ring.



14WF8TM101

38) Pull second bearing inner ring from planetary carrier.

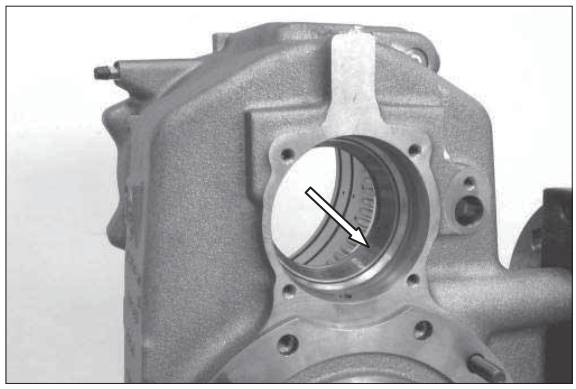
(S) Rapid grip 5873 012 021
(S) Basic tool 5873 002 001



14WF8TM102

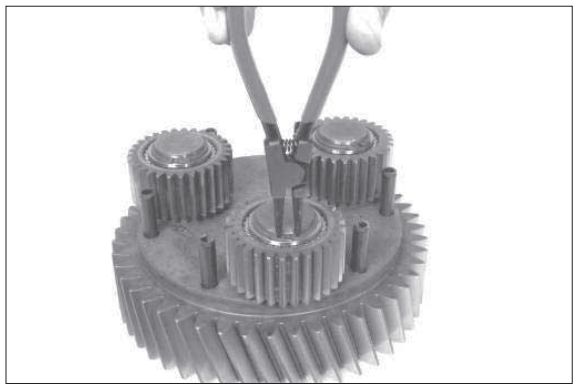
39) If required – force both bearing outer rings (arrow) out of bearing hole.

※ When reusing tapered roller bearings – pay attention to bearing allocation, i.e. respective bearing inner ring to bearing outer ring.



14WF8TM103

40) Unsnap retaining ring.

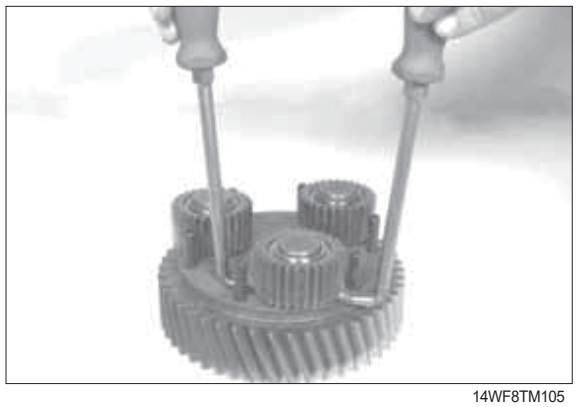


14WF8TM104

41) Lift planetary gear with resetting device – then disassemble with two armed puller .

(S) Resetting device 5870 400 001

※ If necessary, force out slotted pins (6x).

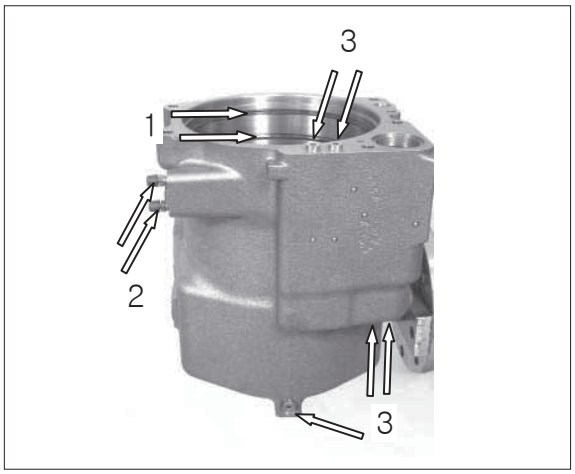


14WF8TM105

42) Remove both seals (1).

Remove breather valves (2) and all screw plugs (3) with seal and O-ring.

※ Illustration shows positions for transmission version Installation position "Vertical".

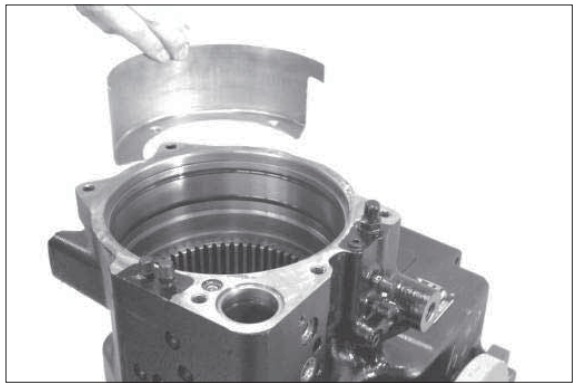



14WF8TM106

43) Only for version
Transmission installation position "Horizontal" :

Loosen countersunk screws and remove screen sheet.

※ Countersunk screws are installed with locking compound (loctite). If necessary, heat for disassembly .



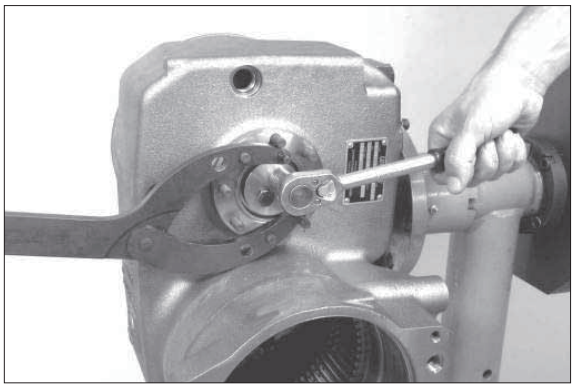
14WF8TM107

## 7. DISASSEMBLY - OUTPUT

**Version "Axle attachment"**

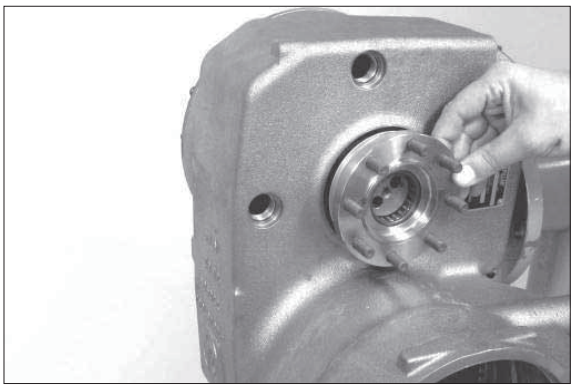
1) Loosen threaded joint, remove cover and O-ring.

※ (S) Clamping fork 5870 240 025



14WF8TM108

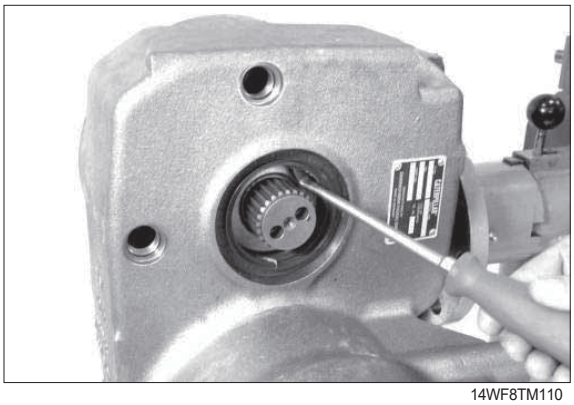
2) Pull off flange.



14WF8TM109

3) Remove shaft seal with a lever.

※ (S) Resetting device 5870 400 001

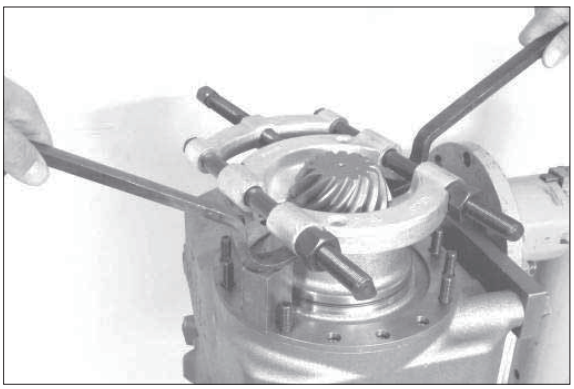


14WF8TM110

4) Fix pinion with fixture and press off.

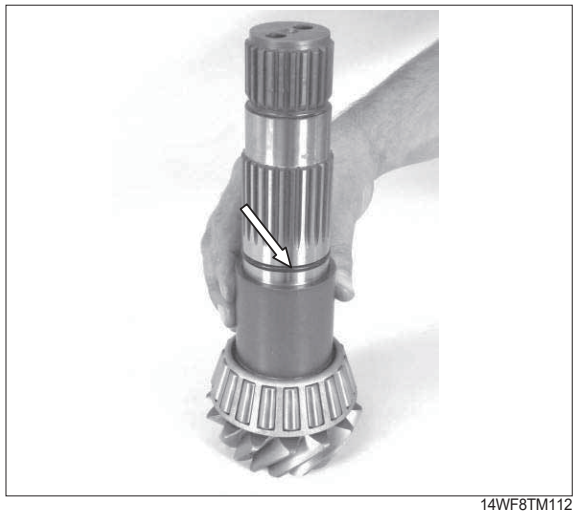
(S) Cut-off device 5870 300 028
(S) Assembly lever 5870 345 036
(S) Solenoid block 5870 450 003

※ Pay attention to releasing bearing inner ring and adjusting ring (rolling torque/pinion bearing) behind.



14WF8TM111

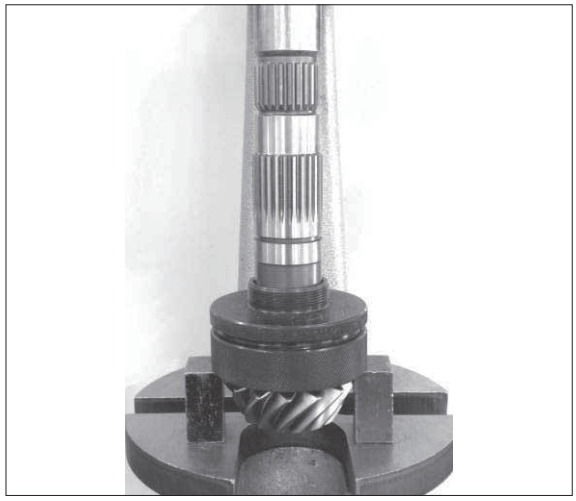
5) Remove O-ring (see arrow) and bush from pinion.



14WF8TM112

6) Press-off bearing inner ring from pinion shaft.

| | |
|---|---|
| (S) Grab sleeve | 5873 001 037 |
| (S) Solenoid block | 5870 450 003 |

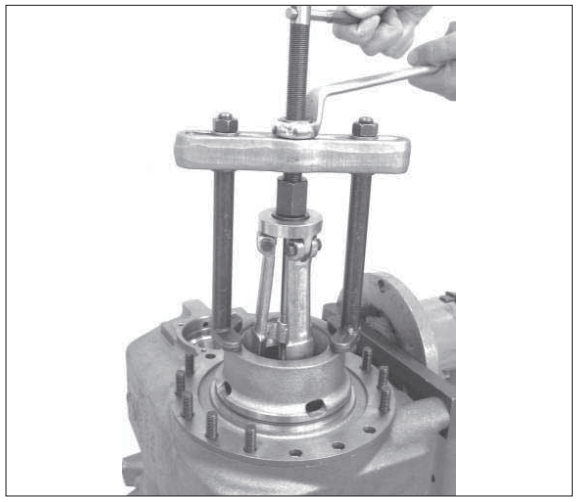


14WF8TM113

7) Pull bearing outer ring out of bearing cover.

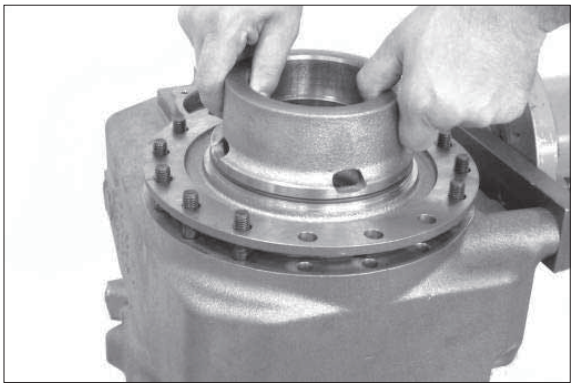
| | |
|---|---|
| (S) Inner extractor | 5870 300 019 |
| (S) Counter support | 5870 300 020 |

※ Pay attention to shim behind (pinion gap setting).



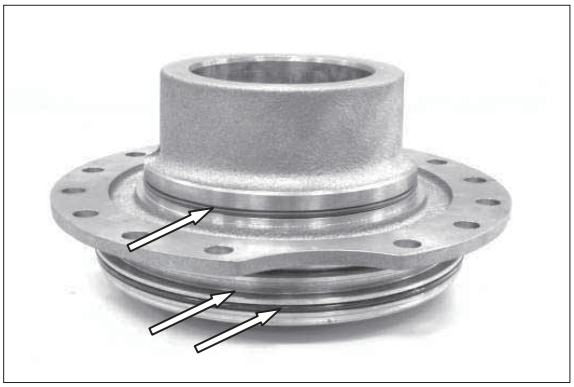
14WF8TM114

8) Pull off bearing cover.



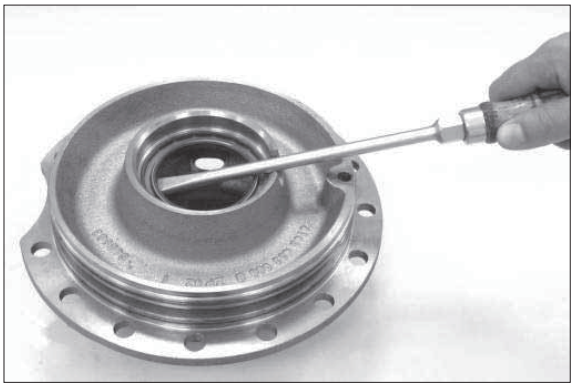
14WF8TM115

9) Remove O-rings (arrows).



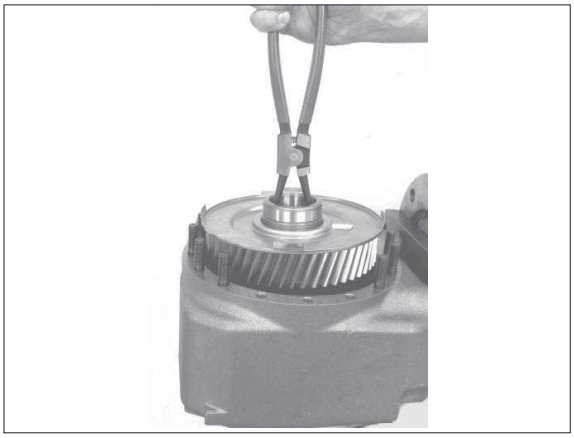
14WF8TM116

10) Remove shaft seal.



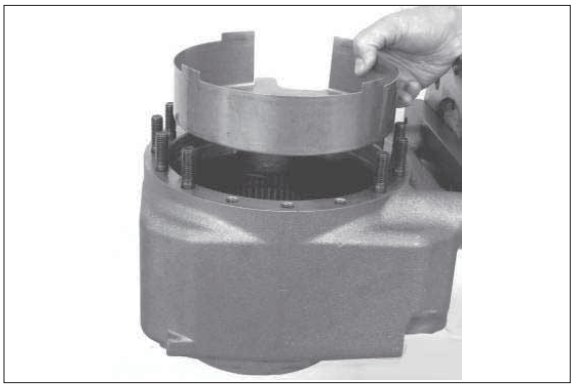
14WF8TM117

11) Lift output gear with oil screen sheet out of housing. Remove oil screen sheet from output gear.



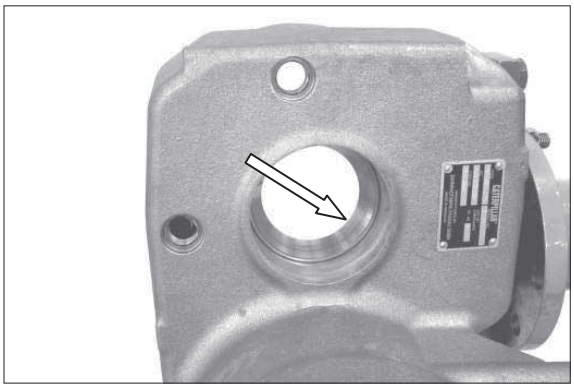
14WF8TM118

12) Remove screen sheet.



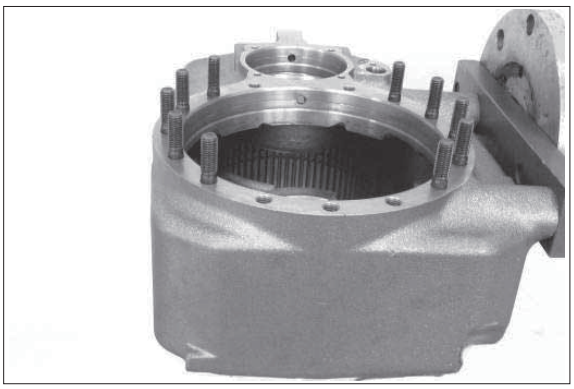
14WF8TM119

13) Disassemble bearing outer ring from housing hole (see arrow).



14WF8TM120

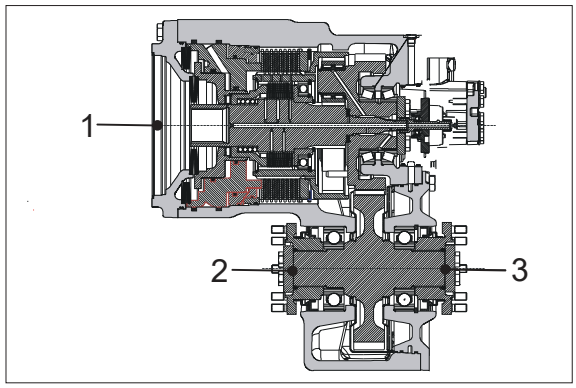
14) If necessary, remove stud bolts.



14WF8TM121

**Version "Separate installation"**

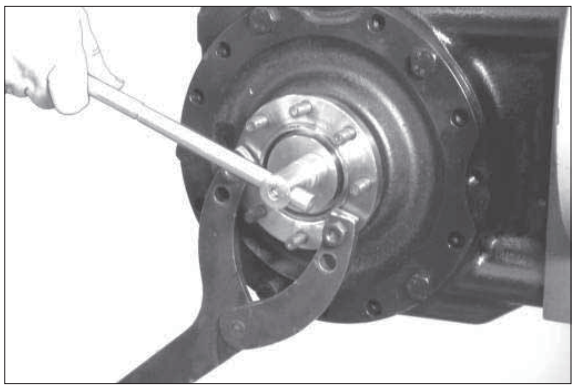
15) 1 = Input
2 = Output – front axle
3 = Output – rear axle



14WF8TM122

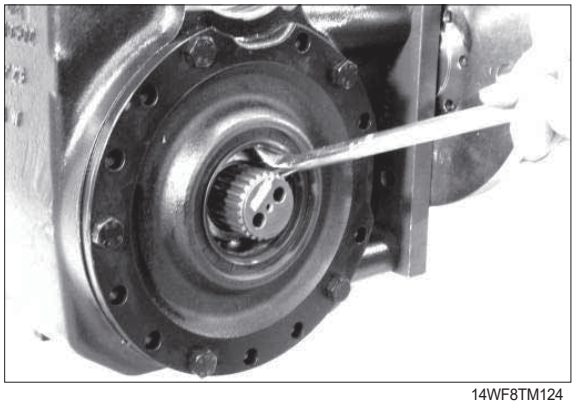
16) Use clamping fork to fix output flange. Loosen threaded joint, pull off disk, O-ring and flange.

(S) Clamping fork 5870 240 025

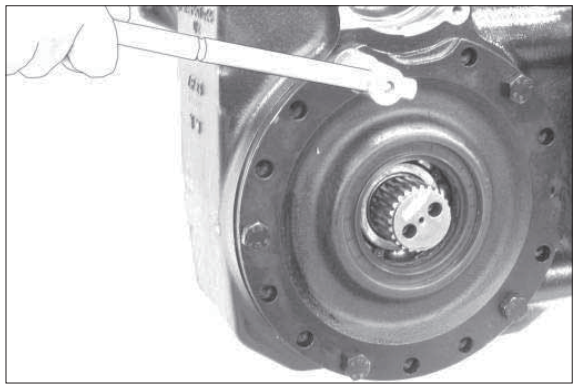

14WF8TM123

17) Remove shaft seal with a lever.

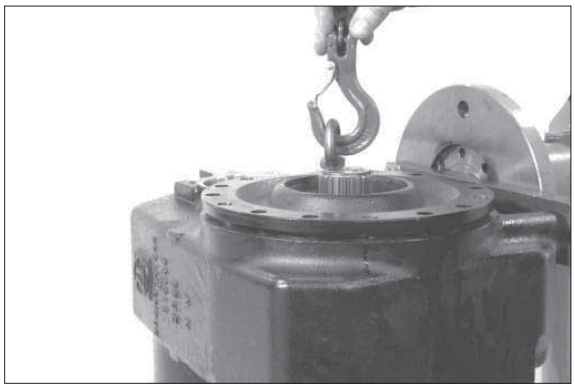
※ Disassemble second output flange and shaft seal analogously.


14WF8TM124

18) Loosen threaded joint.

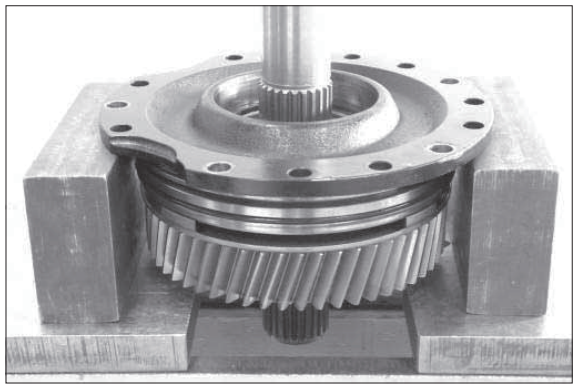

14WF8TM125

19) Use lifting tackle to separate output gear with cover from transmission housing.



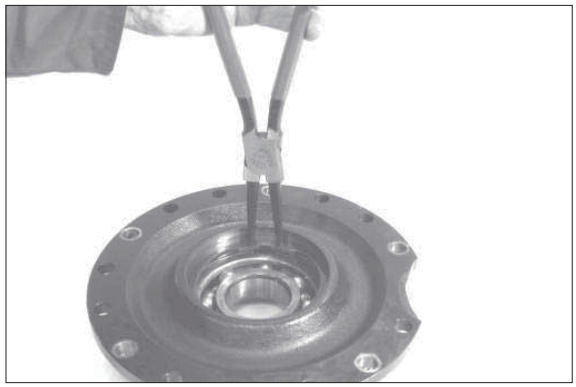
14WF8TM126

20) Press output gear out of ball bearing/cover – remove releasing oil screen sheet.



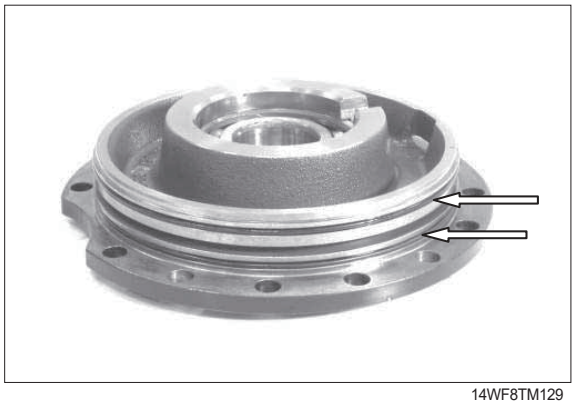
14WF8TM127

21) Unsnap retaining ring and disassemble ball bearing from cover.



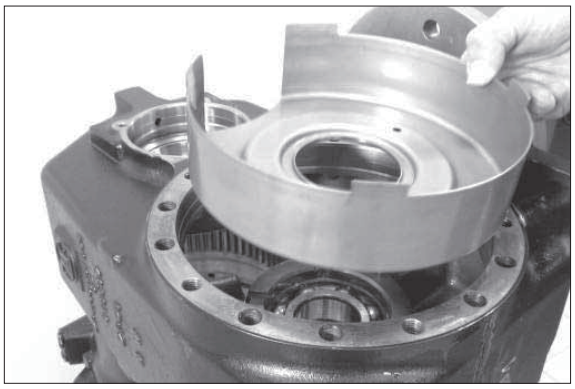
14WF8TM128

22) Remove O-rings (see arrows) from cover.



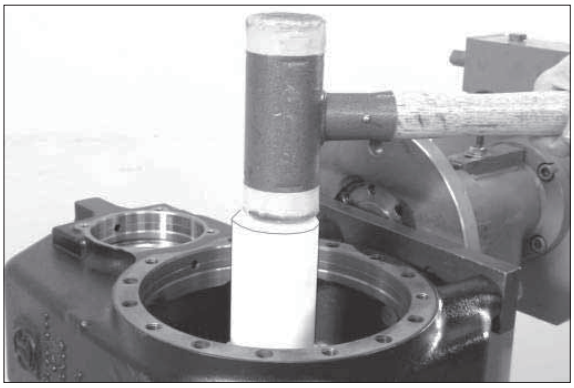
14WF8TM129

23) Remove screen sheet from transmission housing.



14WF8TM130

24) Disassemble ball bearing from housing hole.

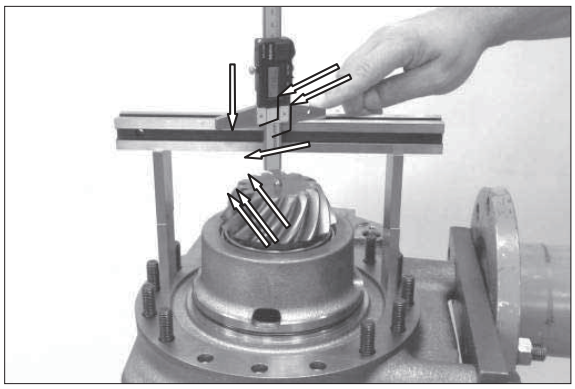


14WF8TM131

## 8. REASSEMBLY - OUTPUT

1) Seal finished holes (8x) of oil supply holes with screw plugs.

   (S) Lever riveting tongs 5870 320 016



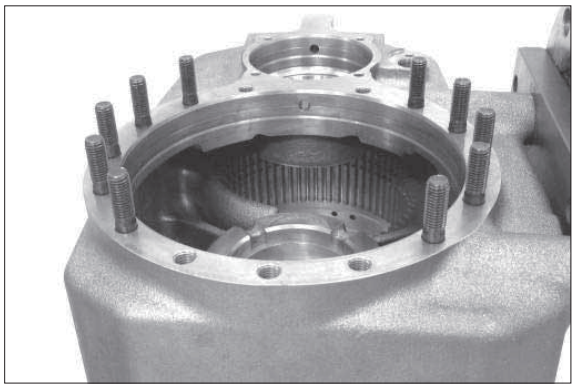
14WF8TM132

**Version "Axle attachment"**

2) Install stud bolts.

   Tightening torque $M_A$ = 27 Nm

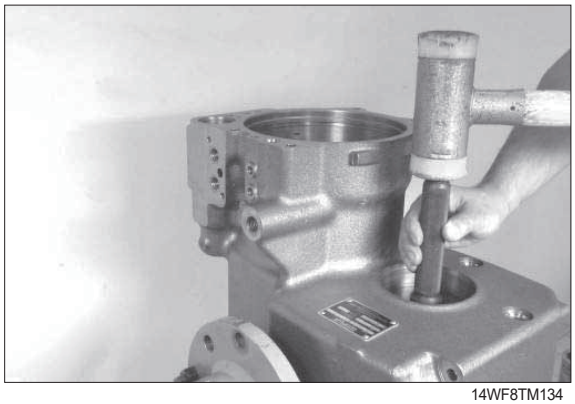
※ Pay attention to installation position.



14WF8TM133

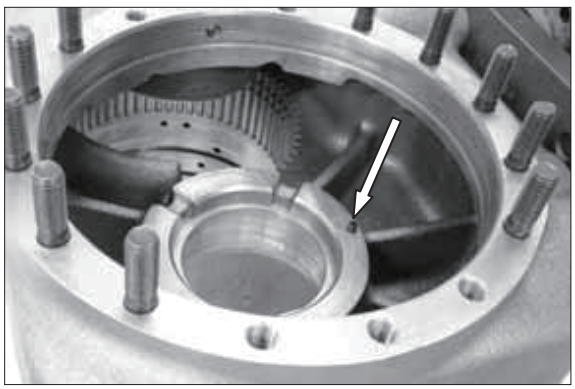
3) Install bearing outer ring until contact.

   (S) Driver tool 5870 058 073
   (S) Handle 5870 260 002



14WF8TM134

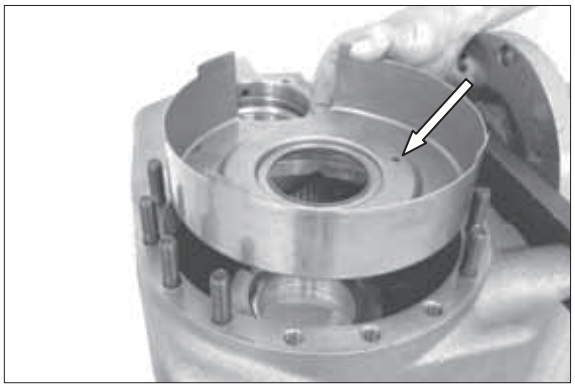
4) Insert slotted pin (see arrow) to the bottom.



14WF8TM135

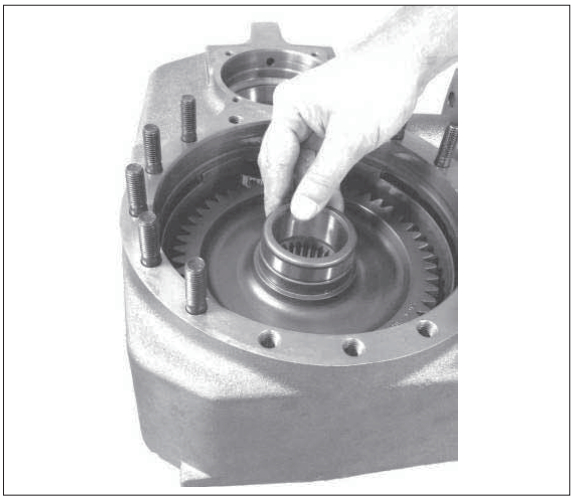
5) Position screen sheet – with slotted pin (see 14WF8TM135) into fixing hole (arrow).

※ Pay attention to installation position, slotted pin = radial fixing of screen sheet.



14WF8TM136

6) Insert output gear with the short collar showing downwards.



14WF8TM137

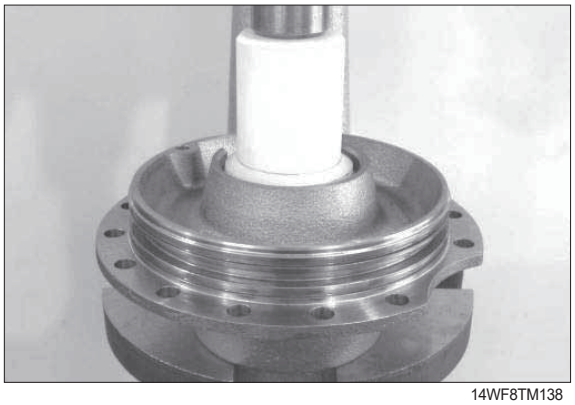
7) Press shaft seal into bearing cover.

(S) Driver tool 5870 048 281

※ For installation wet shaft seal on outer diameter with spirit.

※ Installation position of shaft seal, pay attention that seal lip is showing to oil sump (see 14WF8TM139).

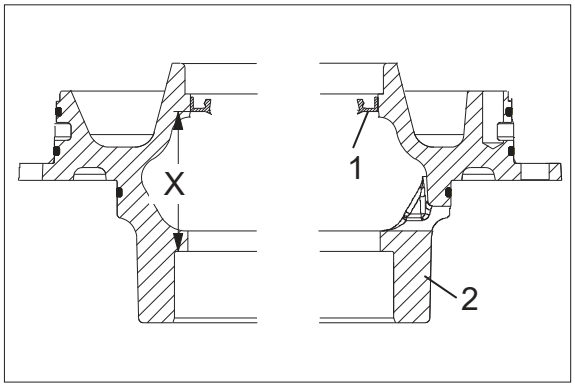
※ Use of specified driver ensures exact installation position of shaft seal.



14WF8TM138

8) 1 = Shaft seal
2 = Bearing cover

X = Installation dimension



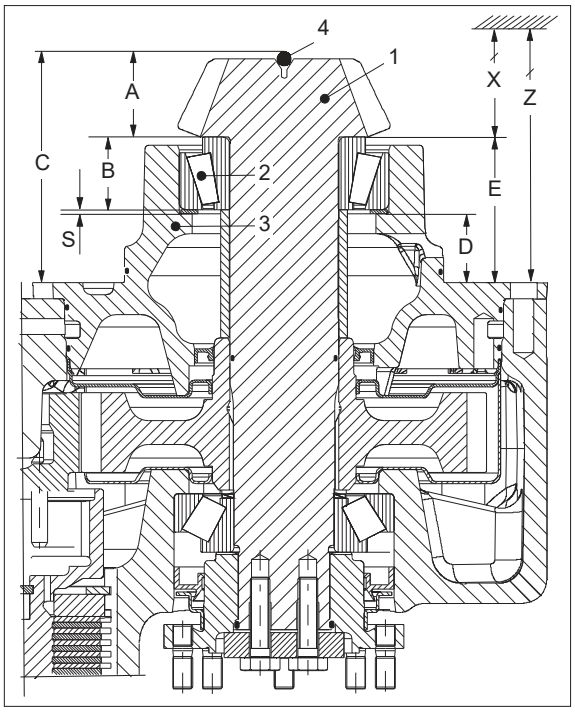

14WF8TM139

**Determine shim for pinion gap**

9) 1 = Pinion
2 = Roller bearing
3 = Bearing cover
4 = Ball (Ø = 7 mm)

A = Auxiliary dimension
B = Bearing width
C = Reference dimension
D = Contact surface/bearing cover to contact/bearing hole
E = 73.0 mm (constant value)
X = Pinion dimension (stamped into pinion)
Z = 189.0 mm
(contact surface/bearing cover to center/axle housing)

※ For correct installation and positioning of pinion, following steps must be carried out as precisely as possible .



14WF8TM140

10) Determine auxiliary dimension A.

Position ball (Ø = 7 mm) into centering hole of pinion and determine dim. A, from contact surface/pinion shoulder to ball.

Auxiliary dimension A = e.g. 42.56 mm

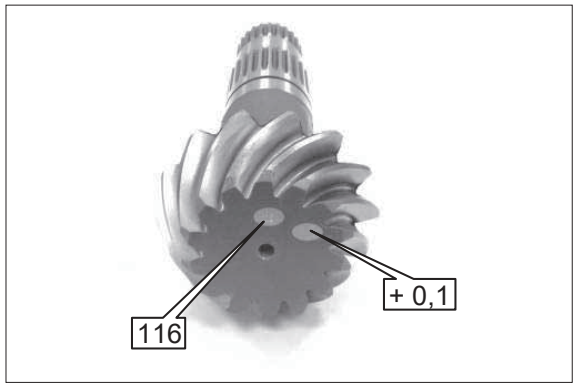
※ Auxiliary dimension A is obligatory to determine reference dimension C – on installed pinion (Fig. 14WF8TM168).

(S) Straightedge 5870 200 108


14WF8TM141

11) Read pinion dim. X on pinion (see arrow) or measure it in case of manufacturing-specific + or – deviation from pinion dim. (relating value is marked by hand on pinion e.g. + 0.1).

Pinion dim. X (without + or – deviation) = 116.0 mm
Pinion dim. X with an indicated deviation + 0.1 = 116.1 mm
Pinion dim. X with an indicated deviation - 0.1 = 115.9 mm

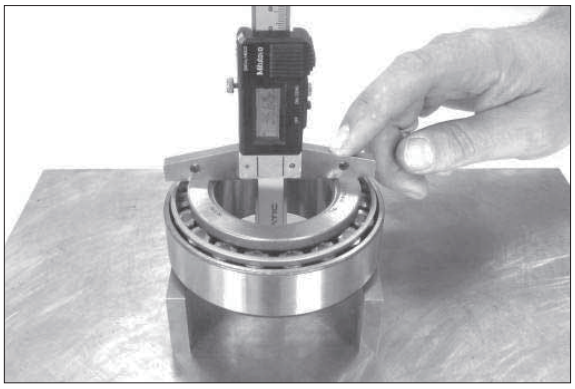


14WF8TM142

12) Determine dim. B bearing width, paying attention that rollers are seated without clearance (roller setting – rotate bearing inner ring in both directions several times).

※ Since installed roller bearing is subject to preload in installation position, deduction of empirical value of – 0.1 mm must be considered.

Dim. B = e.g. 36.65 mm - 0.1 mm → 36.55 mm

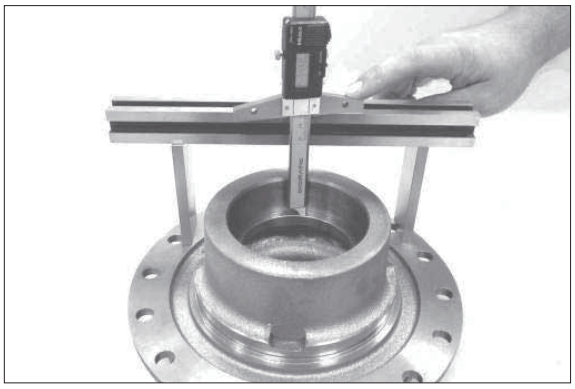


14WF8TM143

13) Determine dim. D (contact surface/bearing cover to contact/bearing hole ).

Dim. D = e.g. 35.10 mm

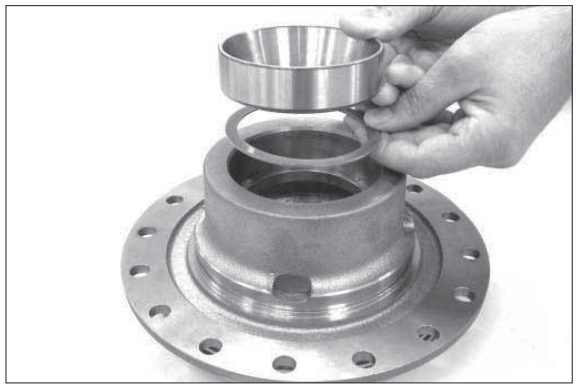
(S) Straightedge (2 sets) 5870 200 066



14WF8TM144

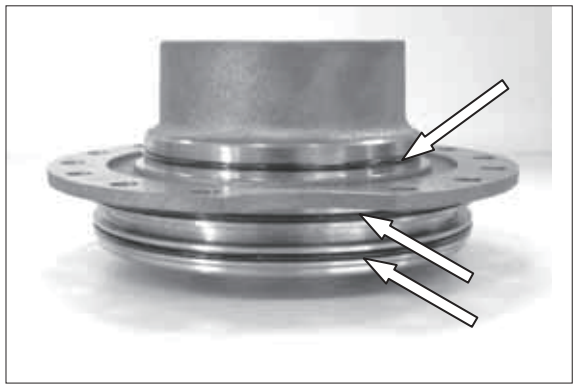
14) Insert determined shim(s) S = e.g. 1.35 mm and install bearing outer ring until contact.

(S) Driver tool 5870 058 078
(S) Handle 5870 260 002



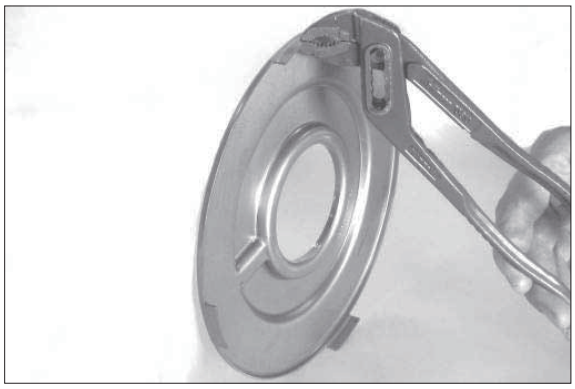
14WF8TM145

15) Oil O-rings (arrows) and insert them into annular grooves of bearing cover.



14WF8TM146

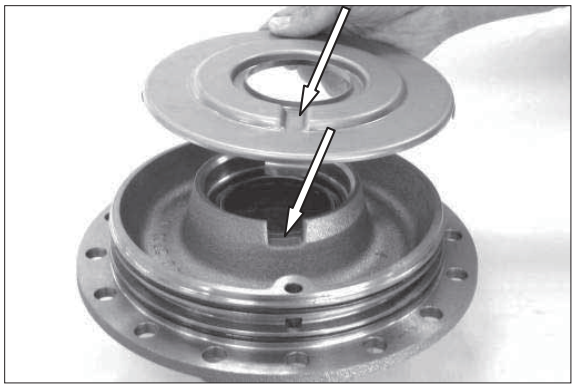
16) Bend edges of fixing straps of oil screen sheet slightly – assembly aid (sheet is fixed to bearing cover – see 14WF8TM148).



14WF8TM147

17) Mount oil screen sheet on bearing cover.

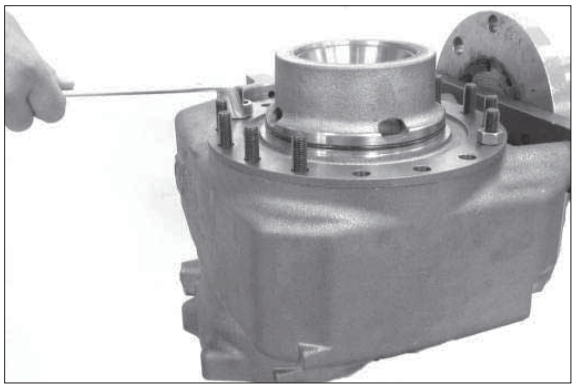
※ Pay attention to installation position – place locating tab of oil screen sheet into recess of bearing cover (see arrow).



14WF8TM148

18) Mount preassembled bearing cover and locate equally with hexagon nuts until contact. Then remove hexagon nuts again.

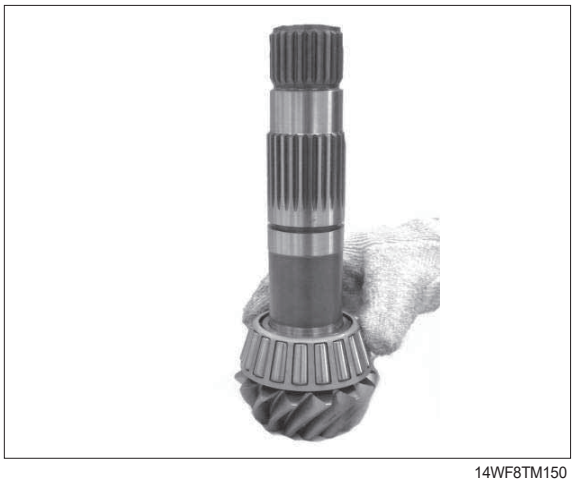
※ Oil contact face/oil screen sheet/housing (assembly aid).



14WF8TM149

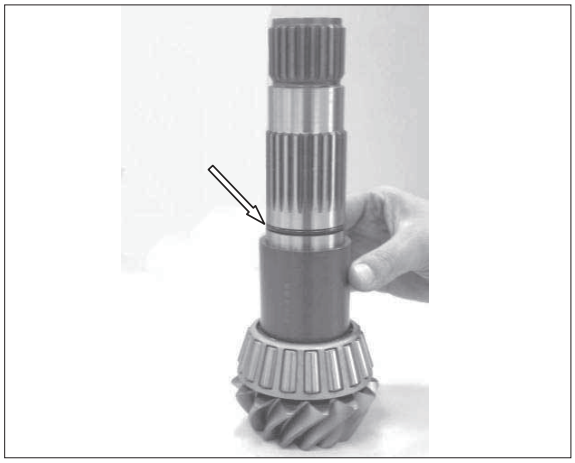
19) Install heated bearing inner ring until contact.

※ Adjust bearing inner ring after cooing down.



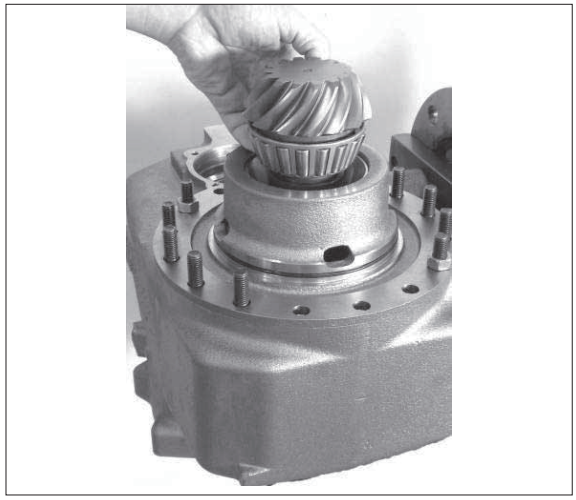
14WF8TM150

20) Mount bush, oil O-ring (arrow) and put it into annular groove.



14WF8TM151

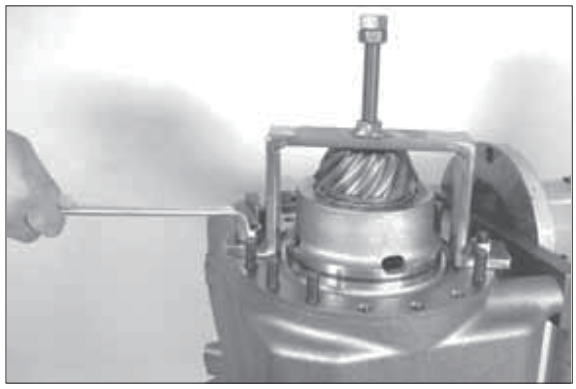
21) Mount preassembled pinion.



14WF8TM152

22) Fix pinion with clamping bar.

(S) Clamping bar 5870 654 049



14WF8TM153

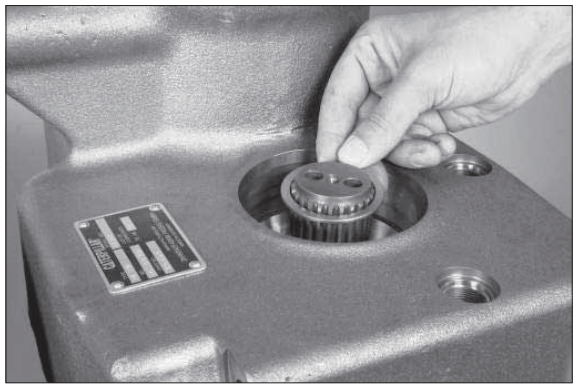
**Determine adjusting ring for rolling torque/pinion bearing :**

23) Rotate transmission by 180˚.

Mount adjusting ring (s = optional).

※ It is recommended to reinstall the adjusting ring (e.g. s = 1.35 mm) removed during disassembly, if however the required rolling torque of 1.5~4.0 Nm (without shaft seal) is not obtained – see bearing rolling torque check Fig. 14WF8TM159 – bearing rolling torque is to be corrected with an adequate adjusting ring.

※ When shaft seal is installed, try to achieve upper rolling torque value.



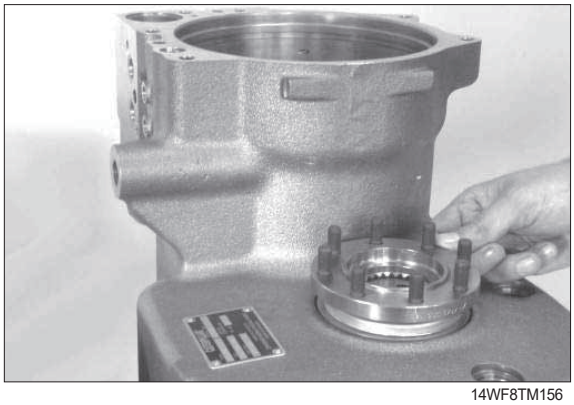
14WF8TM154

24) Insert heated bearing inner ring until contact.

※ Adjust bearing inner ring after cooling down.

14WF8TM155

25) Mount flange.

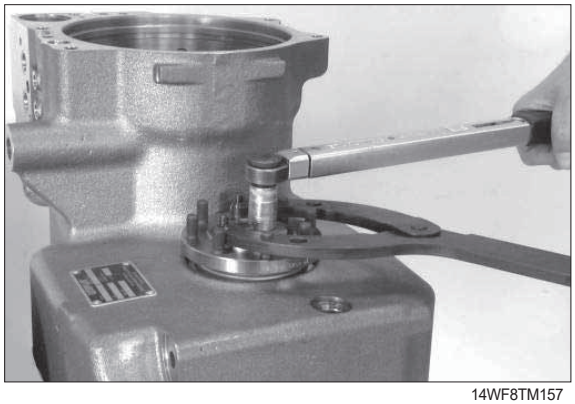


14WF8TM156

26) Place shim and fix flange with hexagon screws.

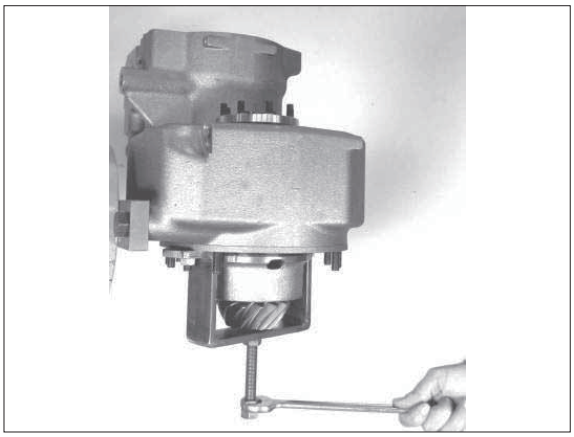
Tightening torque (M 10/10.9) $M_A$ = 68 Nm
(S) Clamping fork 5870 240 025

※ Rotate pinion – when tightening – in both directions (roller setting) several times .



14WF8TM157

27) Turn back pinion fastening / remove clamping bar.



14WF8TM158

**Check rolling torque of pinion bearing**

28) Bearing rolling torque (without shaft seal) 1.5~4.0 Nm

※ When using new roller bearings /for mounted shaft seal, try to achieve the upper value.

※ If the required rolling torque deviates, it must be corrected with an adequate adjusting ring (see 14WF8TM154).

| | |
|---|---|
| (S) Reduction ½ -¼ | 5870 656 056 |
| (S) Plug insert | AA00 392 461 |

14WF8TM159

29) Disassemble flange again.

14WF8TM160

**Shaft seal output flange**

30) Install new shaft seal.

(S) Driver tool 5870 048 279

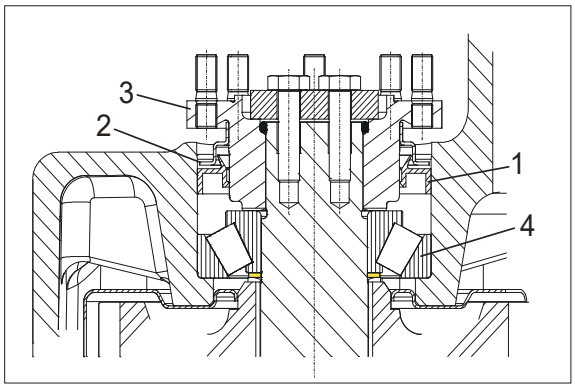
※ For reassembly wet shaft seal on outer diameter with spirit.

※ Pay attention to installation position of shaft seal, seal lip showing to oil sump (see 14WF8TM162).

※ Use of specified driver tool ensures exact installation position of shaft seal.

14WF8TM161

31) 1 = Shaft seal
2 = Metal sheet
3 = Output flange
4 = Roller bearing

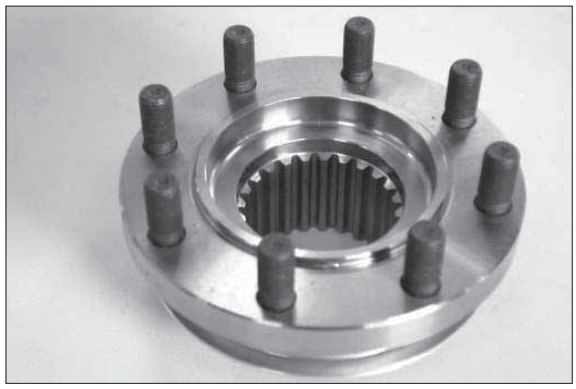



14WF8TM162

32) Install stud bolts.

Tightening torque (M10 × 1) $M_A$ = 20 Nm

※ Pay attention to installation position. Install stud bolts with short thread length into flange.

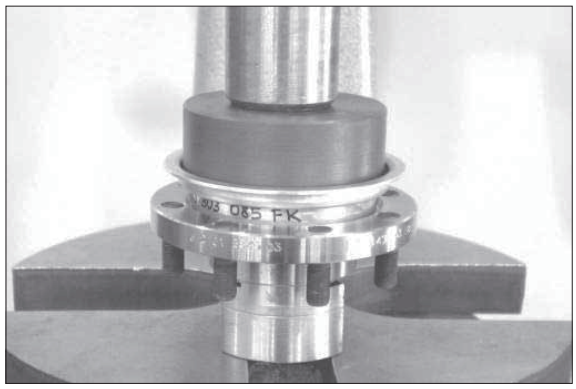


14WF8TM163

33) Install screen sheet (see 14WF8TM162).

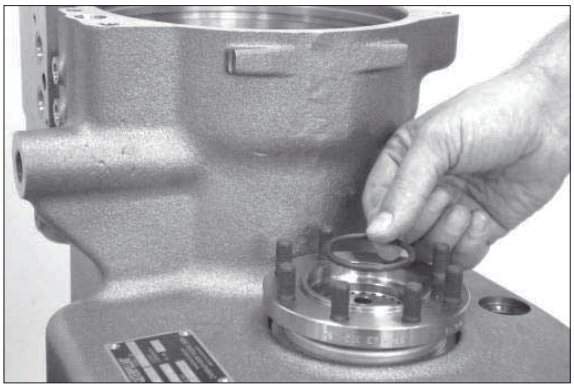
(S) Pressure piece 5870 506 150

※ Use of specified driver tool ensures exact installation position of screen sheet.



14WF8TM164

34) Mount preassembled flange and put O-ring into recess.

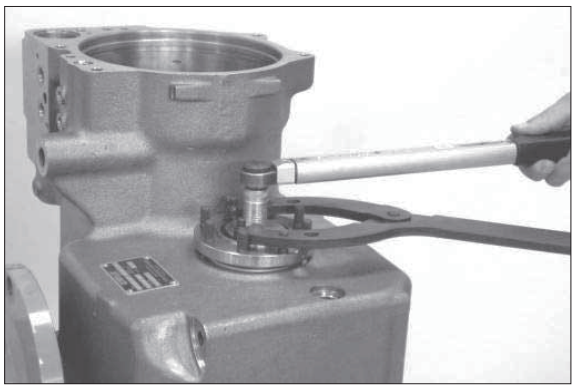


14WF8TM165

35) Place disk and fix it with hexagon screws.

Tightening torque (M 10/10.9) $M_A$ = 68 Nm

(S) Clamping fork 5870 240 025

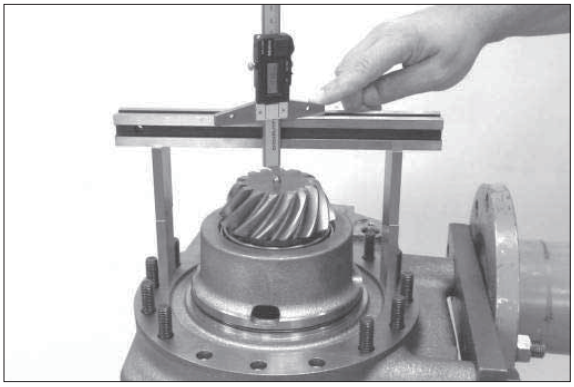


14WF8TM166

**Check pinion gap**

36) Position ball [use Ø = 7 mm → ball Ø like for determination of auxiliary dimension A into centering hole of the pinion and determine dim. C (see 14WF8TM140), from contact surface/bearing cover to ball.

(S) Straightedge 5870 200 108



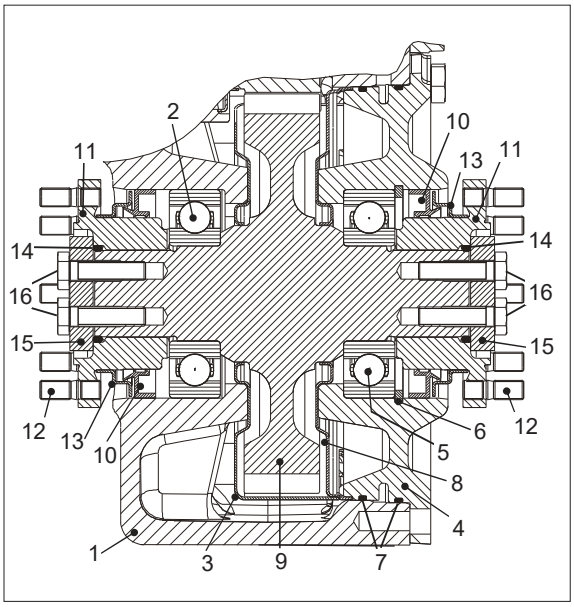
14WF8TM167

**⚠ If the constant value of dimensionE ≙ 73.00±0.05 mm**

**If the constant value of Dim. E ≙ 73.00 ±0.05 mm is not achieved, correct with an adequate shim/pinion gap (see 14WF8TM145).**

**For a correction of the shim/pinion gap, a counter correction of adjusting ring of rolling moment/ pinion gap – Fig. 14WF8TM154 must also be considered.**

37) 1 = Transmission housing
2 = Ball bearing
3 = Screen sheet
4 = Bearing cover
5 = Ball bearing
6 = Retaining ring
7 = O-ring
8 = Oil screen sheet
9 = Output gear
10 = Shaft seal
11 = Output flange
12 = Stud bolt
13 = Metal sheet
14 = O-ring
15 = Disk
16 = Hexagon screw

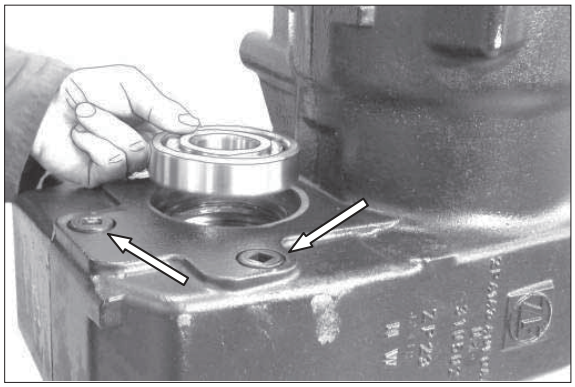


14WF8TM168

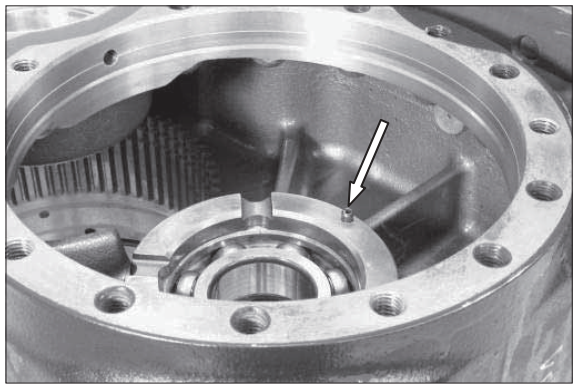
38) Provide screw plugs (see arrows) with new O-ring and install it.

Tightening torque $M_A$ = 80 Nm

※ Then insert ball bearing (2) until contact.

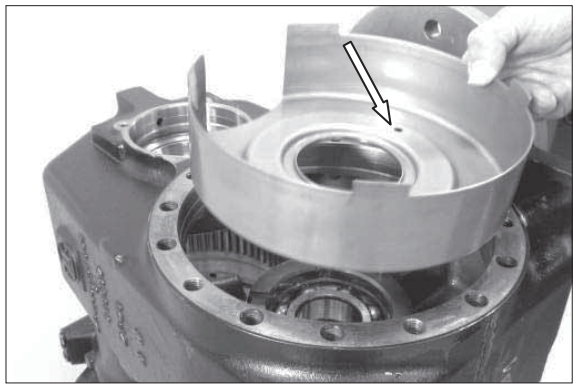

14WF8TM169

39) Rotate transmission by 180˚.
Insert slotted pin (see arrow) to the bottom.


14WF8TM170

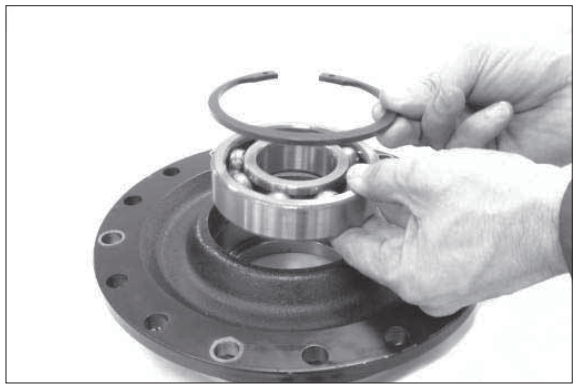
40) Position screen sheet – with slotted pin into fixing hole (arrow).

※ Observe installation position –slotted pin = radial fixing of screen sheet.



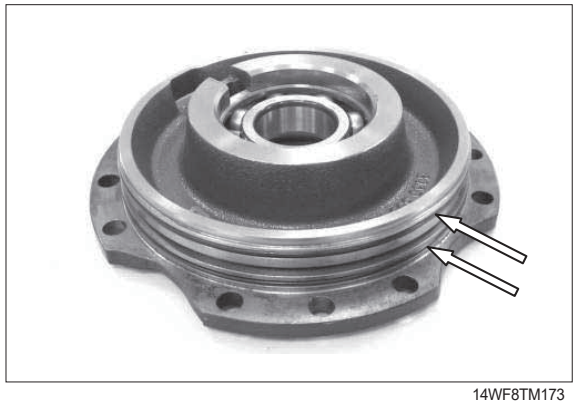
14WF8TM171

41) Insert ball bearing into cover and fix with retaining ring.



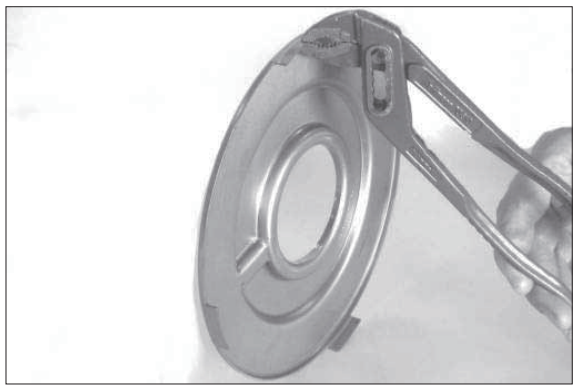
14WF8TM172

42) Oil both O-rings (arrows) and insert them into annular grooves of planetary carrier.



14WF8TM173

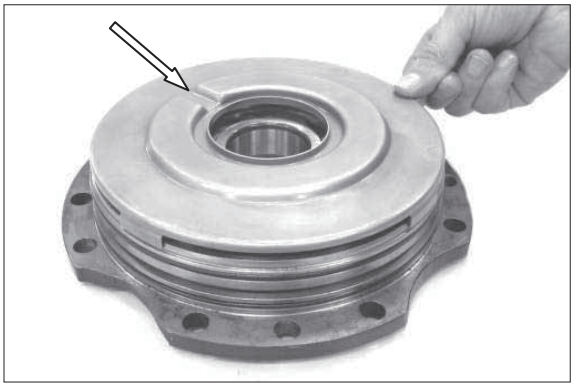
43) Bend edges of fixing straps of oil screen sheet slightly. Assembly aid screen sheet is fixed to bearing cover – see 14WF8TM176).



14WF8TM174

44) Insert oil screen sheet onto bearing cover

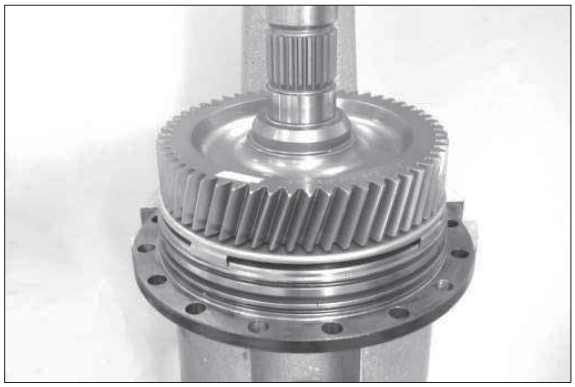
※ Observe installation position - place locating tab (see arrow) into recess of bearing cover (radial fixing).



14WF8TM175

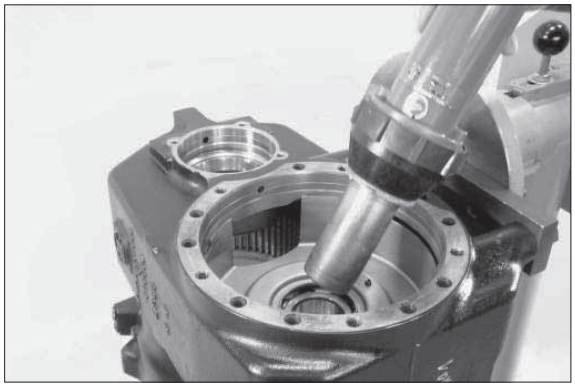
45) Press output gear into ball bearing/bearing cover.

※ Support ball bearing onto bearing inner ring.



14WF8TM176

46) Heat bearing inner ring of ball bearing.

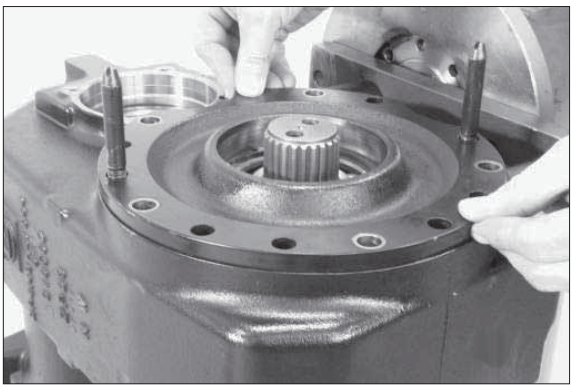


14WF8TM177

47) Attach two adjusting screws and mount preassembled bearing cover/output gear until contact.

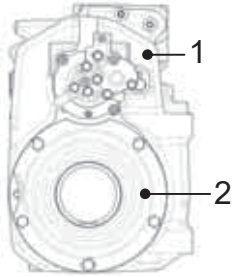
(S) Adjusting screws (M12) 5870 204 021

※ Observe installation position of bearing cover (2) in transmission (1) – transmission installation VERTICAL or HORIZONTAL - see detailed sketches below:

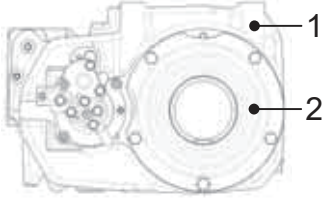


14WF8TM178

<VERTICAL>

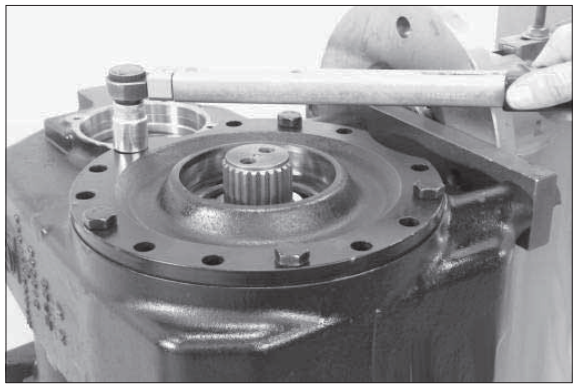



<HORIZONTAL>



48) Fix bearing cover by means of hexagon screws.

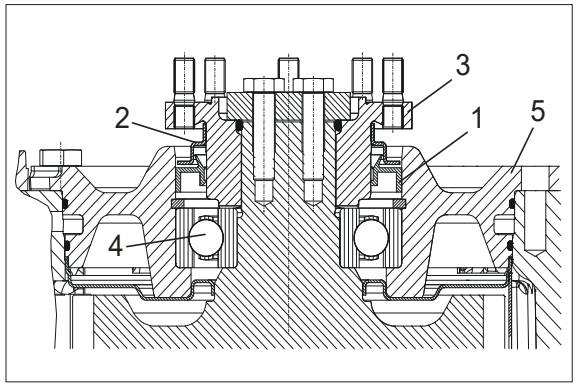
Tightening torque (M 12/8.8) $M_A$ = 80 Nm



14WF8TM181

**Shaft seal output flange**

49) 1 = Shaft seal
2 = Metal sheet
3 = Output flange
4 = Ball bearing
5 = Bearing cover

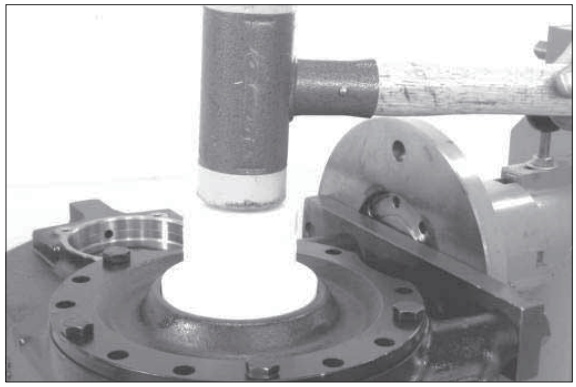



14WF8TM182

50) Install new shaft seal.

(S) Driver tool 5870 048 279

※ For reassembly wet shaft seal on outer diameter with spirit.
※ Pay attention to installation position of shaft seal, seal lip showing to oil sump.
※ Use of specified driver tool ensures exact installation position of shaft seal.

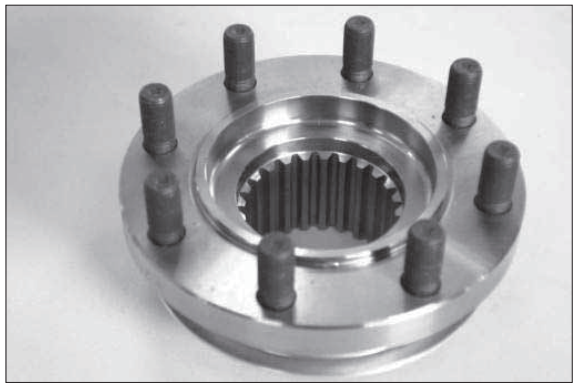


14WF8TM183

51) Install stud bolts.

Tightening torque (M10×1) $M_A$ = 20 Nm

※ Pay attention to installation position.
Install stud bolts with short thread length into flange.

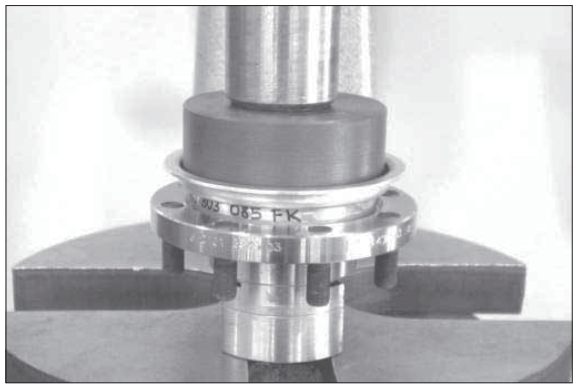


14WF8TM184

52) Install screen sheet (see 14WF8TM183).

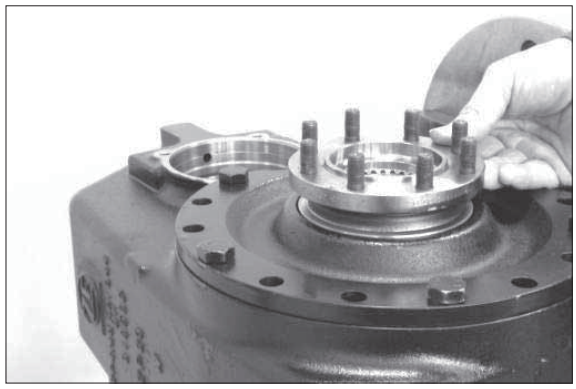
(S) Pressure piece 5870 506 150

※ Use of specified driver tool ensures exact installation position of screen sheet.



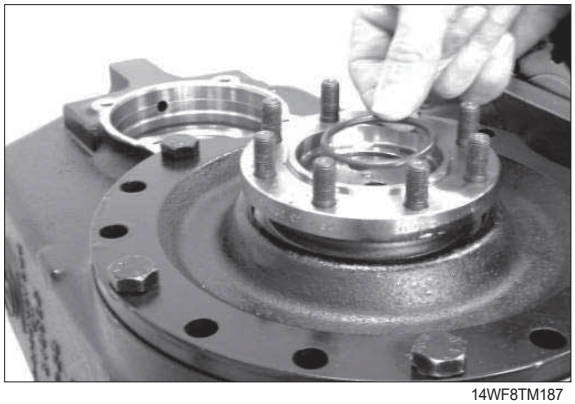
14WF8TM185

53) Install preassembled output flange.



14WF8TM186

54) Insert O-ring.

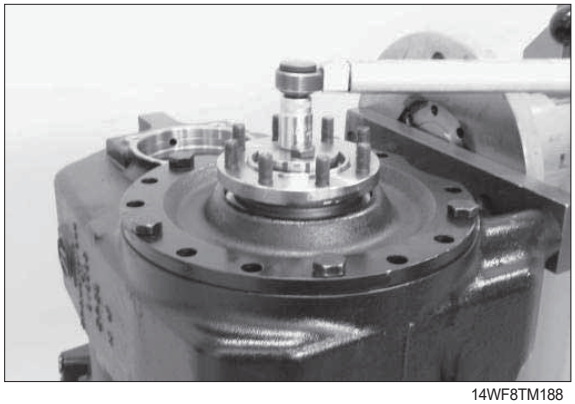


14WF8TM187

55) Position disk and fix output flange by means of hexagon screws.

Tightening torque (M10/10.9) $M_A$ = 68 Nm

※ Install second shaft seal/output flange (front axle output) analogously.



14WF8TM188

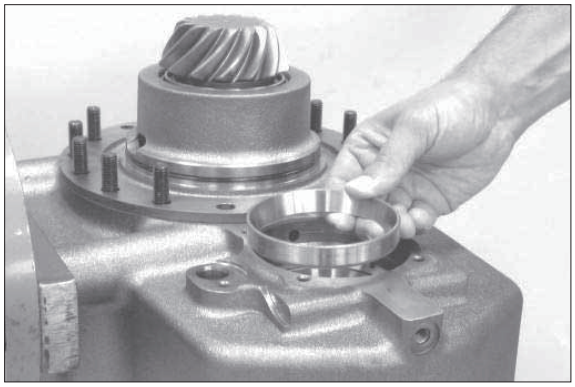
## 9.REASSEMBLY - BRAKE / CLUTCH / PLANETARY CARRIER

### Planetary carrier

1) Install bearing outer ring until contact.

| | |
|---|---|
| (S) Driver tool | 5870 058 051 |
| (S) Handle | 5870 260 002 |

※ Observe bearing allocation – bearing inner ring to bearing outer ring – also see instructions for disassembly, 14WF8TM103.

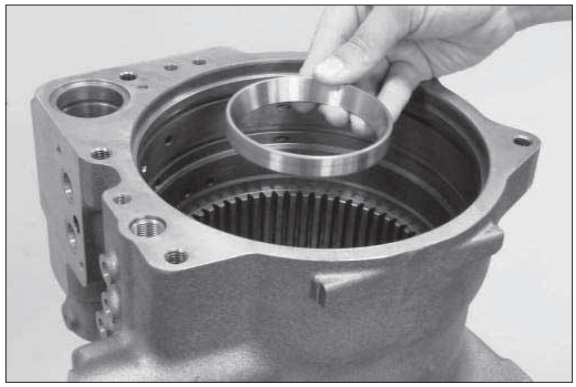


14WF8TM189

2) Rotate transmission by 180˚.
Install second bearing outer ring until contact.

| | |
|---|---|
| (S) Driver tool | 5870 058 051 |
| (S) Handle | 5870 260 002 |

※ Observe bearing allocation – bearing inner ring to bearing outer ring – also see instructions for disassembly 14WF8TM103.



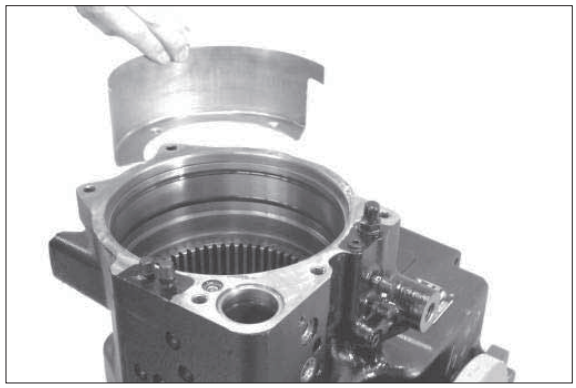
14WF8TM190

3) **Only for version transmission installation position**

※ Insert screen sheet and fasten with countersunk screws.

Tightening torque (M 6/8.8) $M_A$ = 7.4 Nm

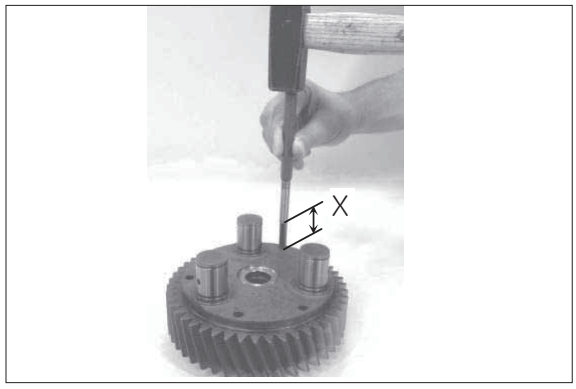
Wet countersunk screws with Loctite type no.243.



14WF8TM191

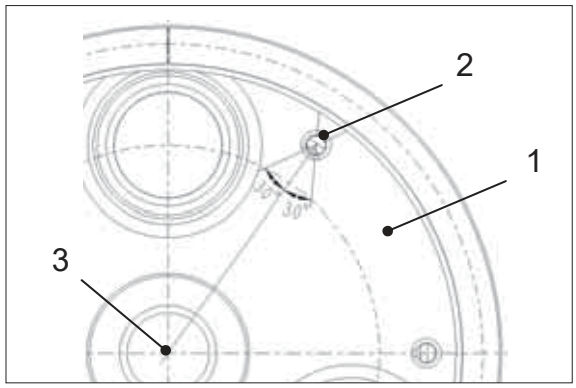
4) Install slotted pins (2) considering installation dimension X and installation position, see 14WF8TM193 (groove showing to center).

| | |
|---|---|
| (S) Press-fit mandrel | AA00 392 151 |




14WF8TM192

5) 1 = Planetary carrier
2 = Slotted pin (6x)
3 = Center (planetary carrier)

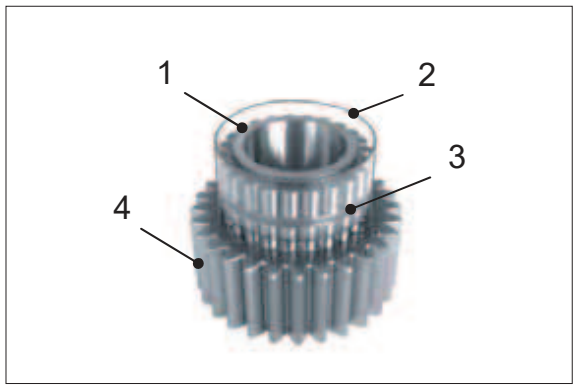


14WF8TM193

6) Insert cylindrical roller bearing into planetary gear. Press cylindrical roller bearing through packaging sleeve until snap ring engages into annular groove of planetary gear.

※ Use packaging sleeve to facilitate assembly.

1 = Cylindrical roller bearing
2 = Packaging sleeve
3 = Snap ring
4 = Planetary gear

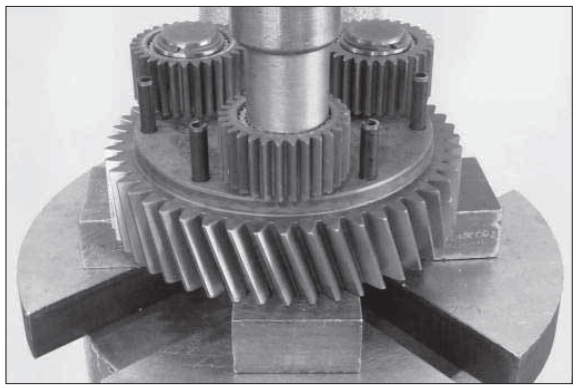


14WF8TM194

7) Press on planetary gear over bearing inner ring until contact.

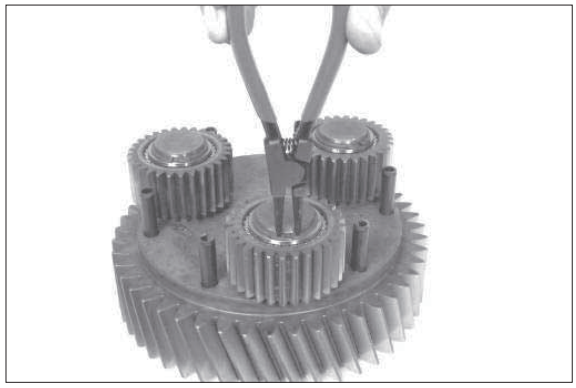
(S) Driver tool 5870 048 283

※ Install planetary gears with large radius on cylindrical roller bearing (downwards) towards planetary carrier.

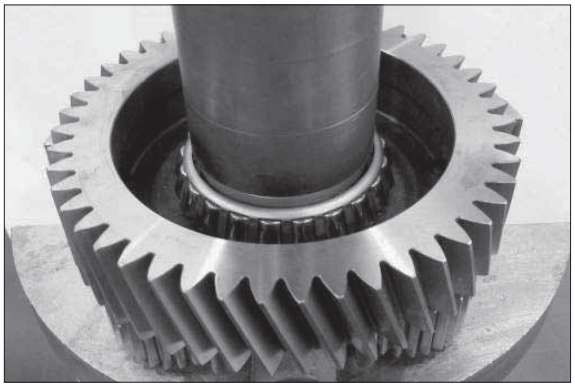

14WF8TM195

8) Engage retaining ring.

※ Adjust retaining ring until contact with groove base.

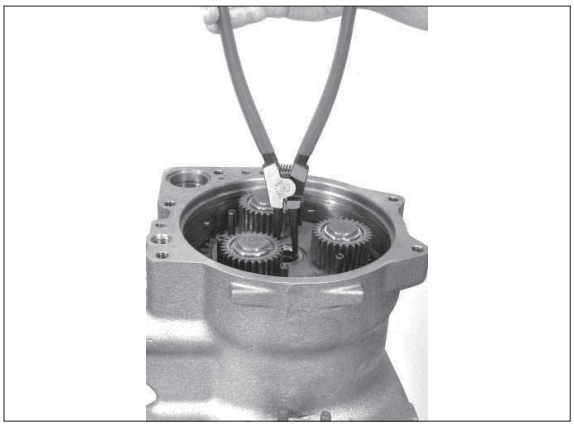

14WF8TM196

9) Press bearing inner ring onto planetary carrier until contact.



14WF8TM197

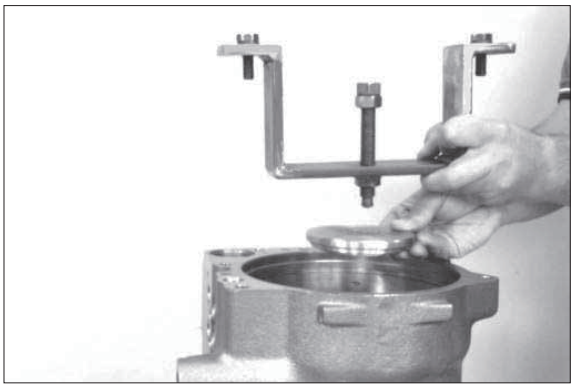
10) Insert preassembled planetary carrier.



14WF8TM198

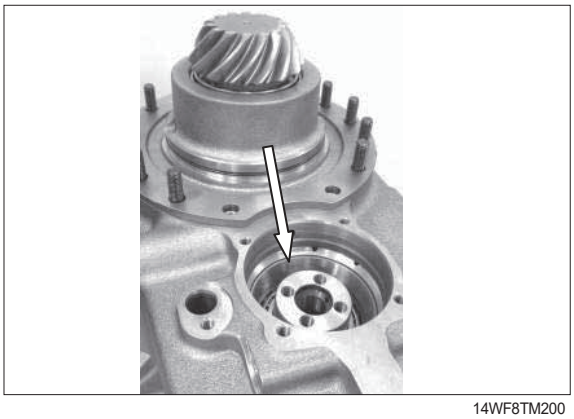
11) Fix planetary carrier with pressure plate and clamping bar.

(S) Clamping bar 5870 654 049



14WF8TM199

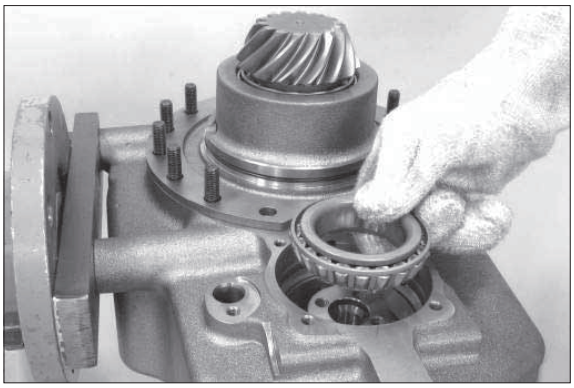
12) Rotate transmission by 180˚.
Check contact of bearing outer ring (see arrow). Reassembly of bearing outer ring, see 14WF8TM189.



14WF8TM200

13) Install heated bearing inner ring until contact.

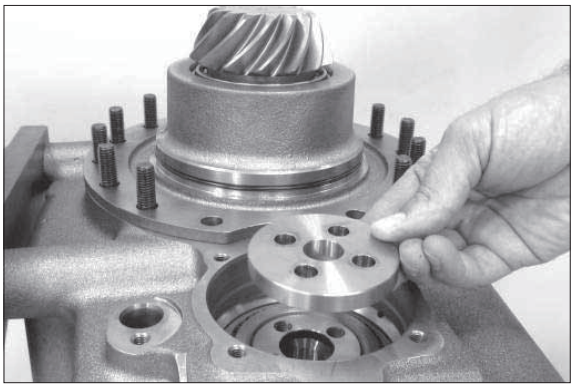
※ Adjust bearing inner ring after cooling down.



14WF8TM201

14) Position disk and manually turn in hexagon screws (fix planetary carrier).

Then remove clamping bar, see 14WF8TM199.

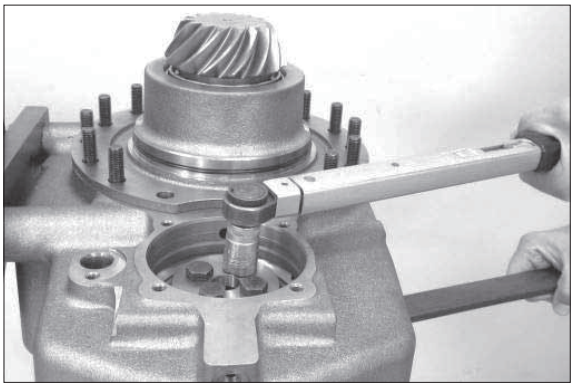


14WF8TM202

15) Fix clamping fork to output flange.
Tighten hexagon screws evenly – risk of strain.

| | |
|---|---|
| Tightening torque (M 10/10.9) | $M_A$ = 46 Nm |
| (S) Clamping fork | 5870 240 025 |

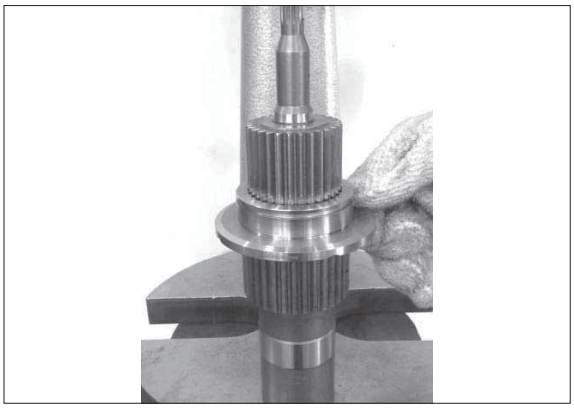
※ While tightening hexagon screws, rotate planetary carrier several times in both directions (roller setting).



14WF8TM203

**Brake and clutch**

16) Mount heated centering disk and press it until contact.



14WF8TM204

17) Fix centering disk by engaging retaining ring into annular groove of input shaft.

14WF8TM205

18) Insert ball bearing into ring gear and fasten it by engaging retaining ring into annular groove of ring gear.

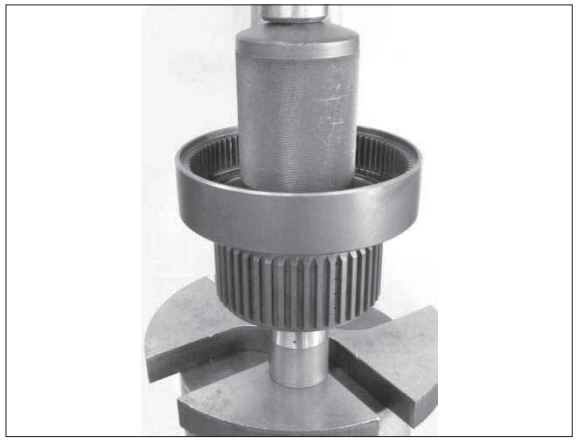
(S) Clamping pliers 5870 900 021

14WF8TM206

19) Heat bearing inner ring of ball bearing.

14WF8TM207

20) Mount preassembled ring gear to input shaft until contact.



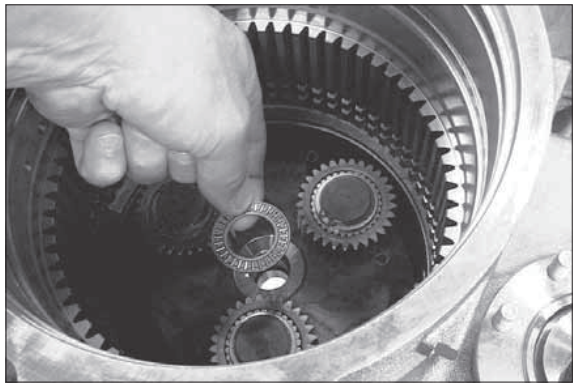
14WF8TM208

21) Engage retaining ring into annular groove of input shaft.

14WF8TM209

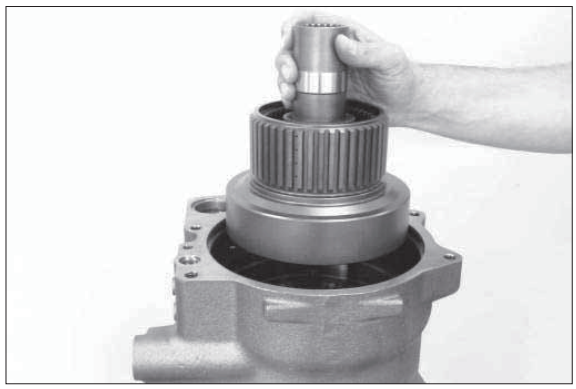
22) Rotate transmission by 180˚.
Insert axial needle cage into recess of planetary carrier.

※ Oil axial needle cage for reassembly.



14WF8TM210

23) Insert preassembled input shaft (with ring gear).

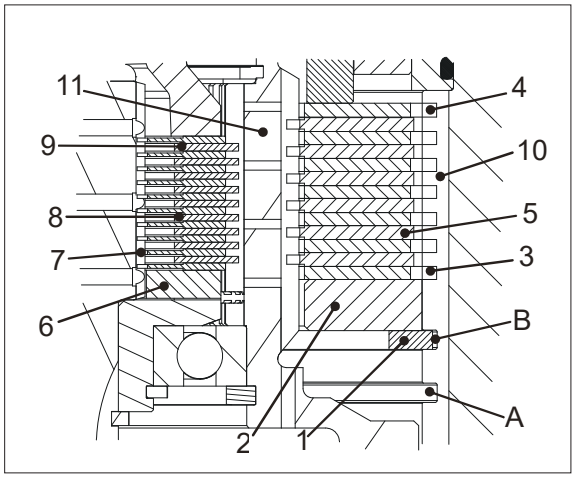


14WF8TM211

## Disk components brake and clutch

24) A = Lower annular groove (Item retaining ring-1)
B = Upper annular groove (Item retaining ring-1)

1 = Retaining ring
2 = End plate/Brake (1 pc)
3 = Outer disk/Brake (6 pcs.)
4 = Outer disk/Brake optional (1 pc)
5 = Inner disk/Brake (6 pcs.)
6 = End plate/Clutch (1 pc)
7 = Lining disk/Clutch (10 pcs.)
8 = Outer disk/Clutch (8 pcs.)
9 = Outer disk/Clutch optional (1 pc)
10 = Transmission housing
11 = Disk carrier / Ring gear



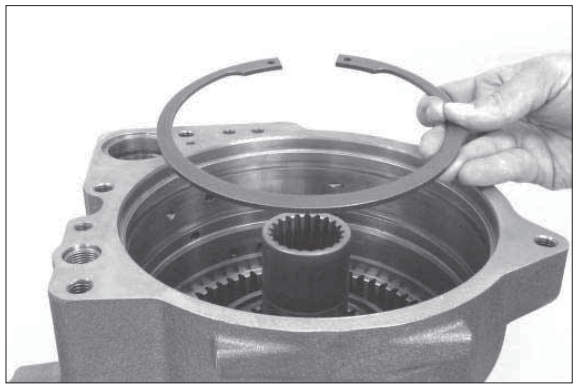
14WF8TM213

**Reassembly brake :**

25) Engage retaining ring (1) into annular groove (A).

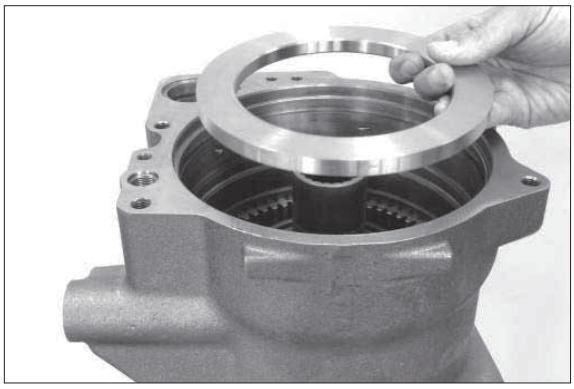
(S) Clamping pliers 5870 900 021

※ Observe installation position of retaining ring (1).



14WF8TM215

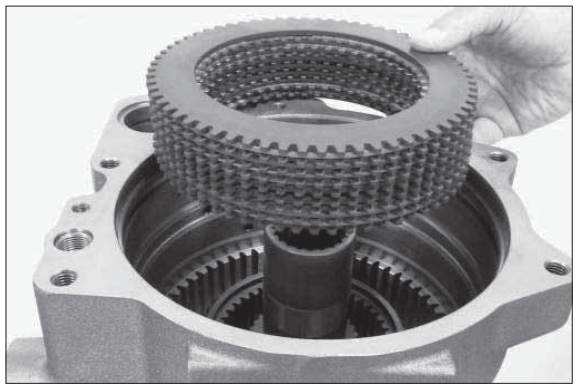
26) Insert end plate (2).



14WF8TM216

27) Insert disk package alternately, beginning with an outer disk.

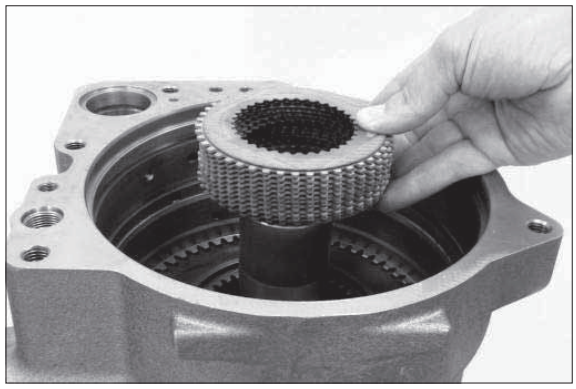
※ Position outer disk (1 pc) s = variable 2.8 ~ 3.7 mm to top of disk package (piston side). With outer disk s = variable, disk clearance/ piston stroke is adjusted - see 14WF8TM229.



14WF8TM217

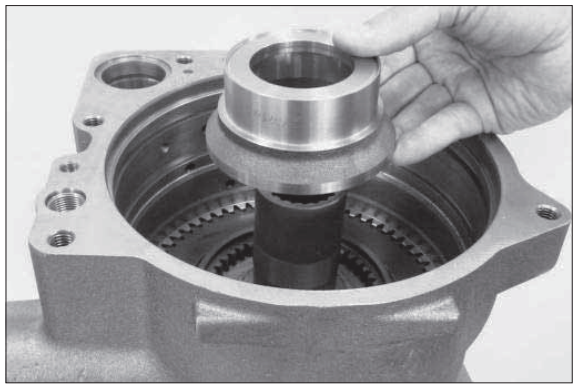
38) Insert disk package alternately, beginning with a lining disk.

※ Position outer disk (1 pc) s = variable 1.2 ~1.6 mm to top of disk package (pressure piece side).
With outer disk s = variable, disk clearance / piston stroke is adjusted – see 14WF8TM228.



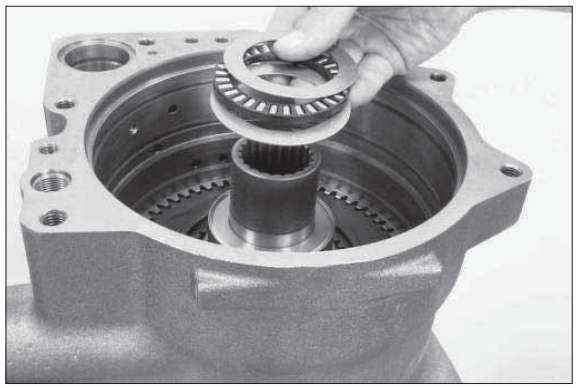
14WF8TM218

29) Mount pressure piece (without compression spring).



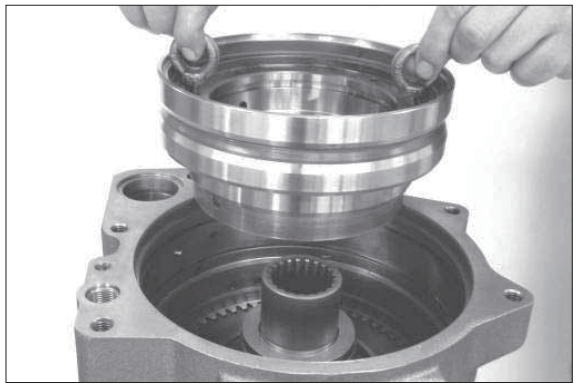
14WF8TM219

30) Oil axial roller cage and mount it with both axial washers (1x each, positioned underneath and onto axial needle cage).



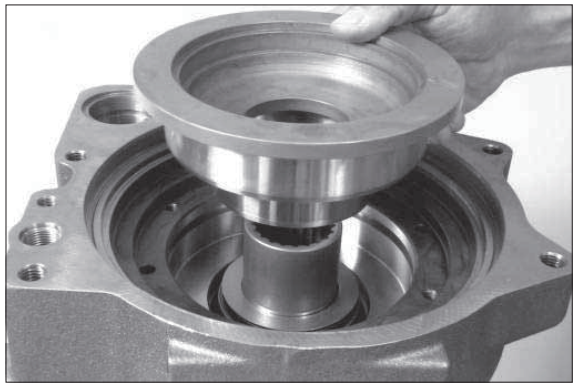
14WF8TM220

31) Insert piston (brake) – without mounted sealing elements.



14WF8TM221

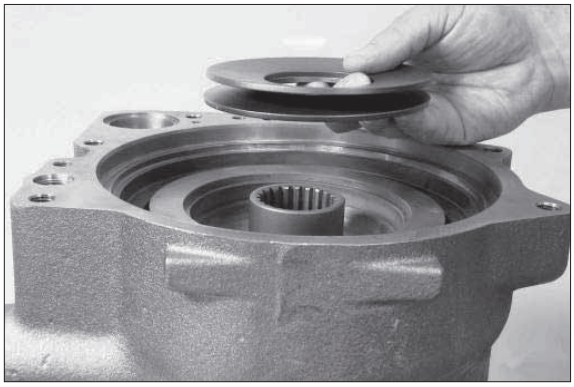
32) Insert piston (clutch) – without mounted sealing elements.



14WF8TM222

33) Insert both cup springs/clutch.

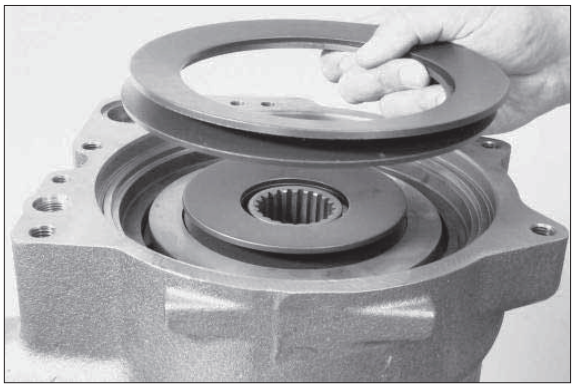
※ Fix cup springs with grease and position them centrically.
※ Observe installation position, see 14WF8TM225.



14WF8TM223

34) Insert both cup springs/brake.

※ Fix cup springs with grease and position them centrically.
※ Observe installation position, see 14WF8TM225.



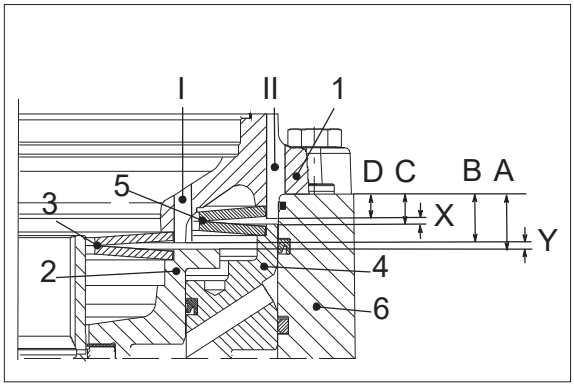
14WF8TM224

35) 1 = Measuring device
2 = Piston/clutch
3 = Cup springs/Clutch
4 = Piston/Brake
5 = Cup springs/Brake
6 = Transmission housing

I = Measuring hole (disk clearance / clutch)
II = Measuring hole (disk clearance / brake)

A = Mounting face/Housing – Front face/Piston
B = Mounting face/Housing – Piston contact/Housing
C = Mounting face/Housing – Front face/Piston
D = Mounting face/Housing – Piston contact/Housing

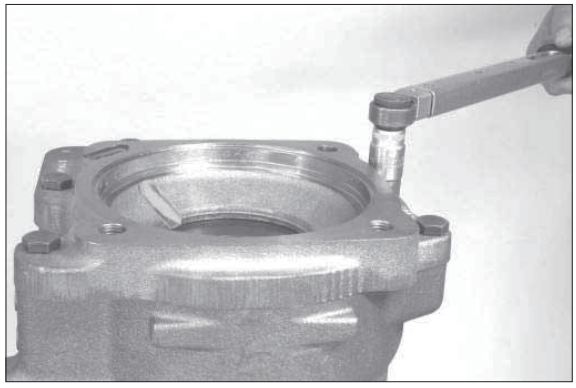
Y = Disk clearance/Clutch → 2.4 +0.3 mm (piston stroke)
X = Disk clearance/Brake → 1.8 + 0.3 mm (piston stroke)




14WF8TM225

36) Locate measuring device evenly with hexagon screws (risk of breakage) until contact.

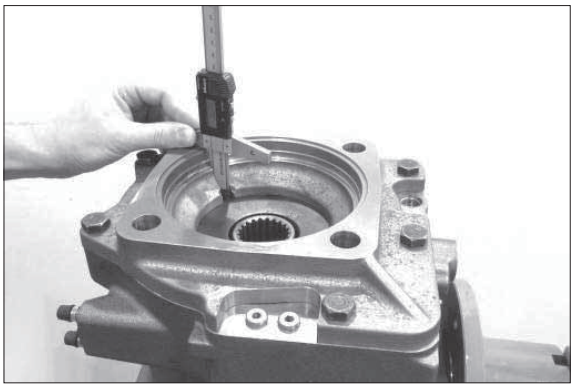
Tightening torque (M 12/8.8) $M_A$ = 80 Nm
(S) Measuring device 5870 200 131



14WF8TM226

37) Determine dim. A (Measuring hole I) from mounting face/housing to front face/piston (clutch).

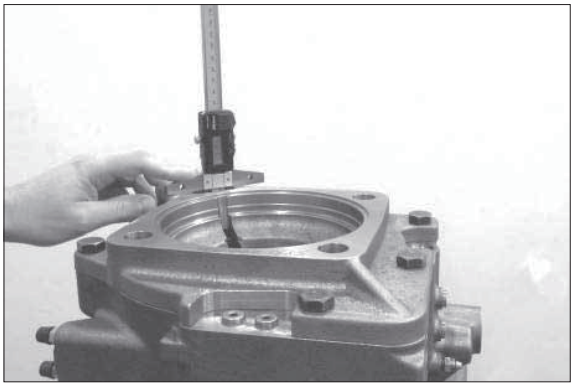
Dim. A e.g. = 22.45 mm
(S) Straightedge 5870 200 108



14WF8TM227

38) Determine Dim. C (Measuring hole II) from mounting face/housing to front face/piston (brake).

Dim. C e.g. = 11.85 mm



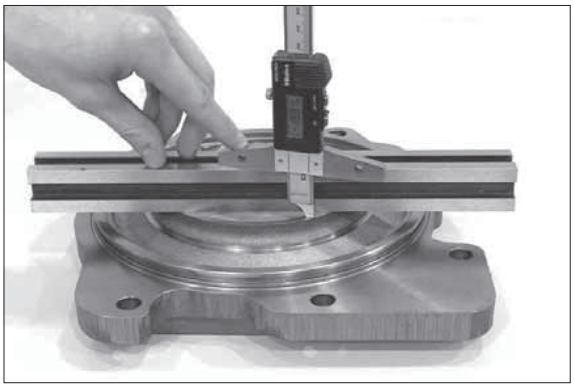
14WF8TM228

39) Determine Dim. B from mounting face/housing to clutch piston contact/housing.

Dim. B e.g. = 19.95 mm
A-B = 2.50 mm (disk clearance)

Clutch disk clearance (piston stroke) = $2.4^{+0.3}$ mm

⚠ **If the required disk clearance (piston stroke) is not obtained, correct with a suitable outer disk – see 14WF8TM218.**



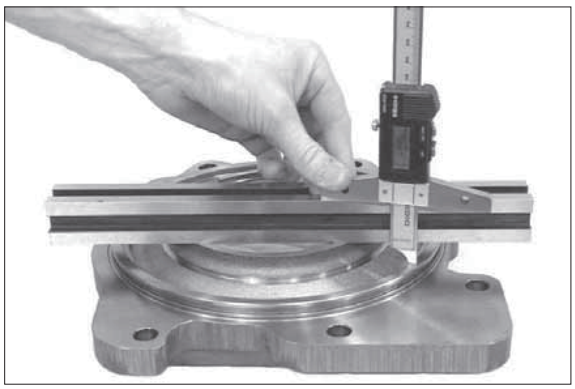
14WF8TM229

40) Determine Dim. D from mounting face/housing to brake piston contact/housing.

Dim. D e.g. = 9.95 mm
C-D = 1.90 mm (disk clearance)

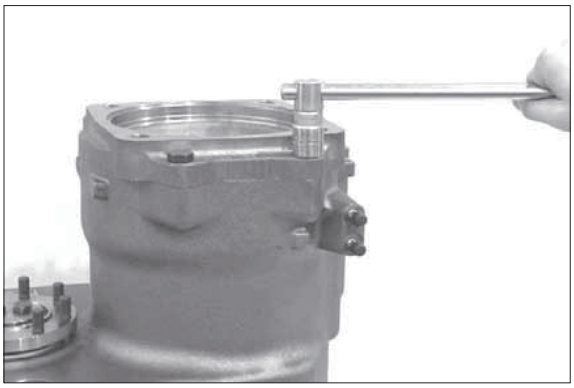
Disk clearance (piston stroke) Brake = $1.8^{+0.3}$ mm

⚠ **If the required disk clearance (piston stroke) is not obtained, correct with a suitable outer disk – see 14WF8TM217.**



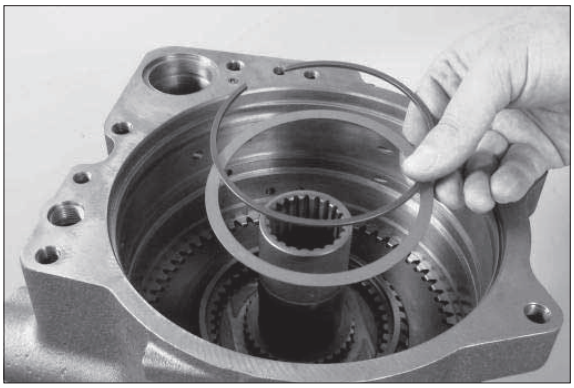
14WF8TM230

41) Remove measuring device again – loosen screws evenly.
Remove all cup springs, both pistons, axial roller cage with axial washers and pressure piece.



14WF8TM231

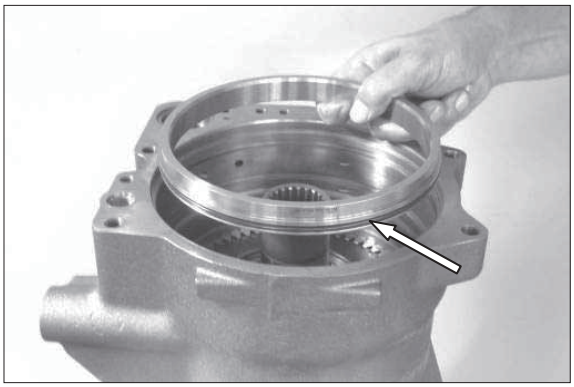
42) Insert shim into ring gear and fix by engaging snap ring into annular groove of ring gear.



14WF8TM232

43) Place O-ring (see arrow) into groove and insert ring.

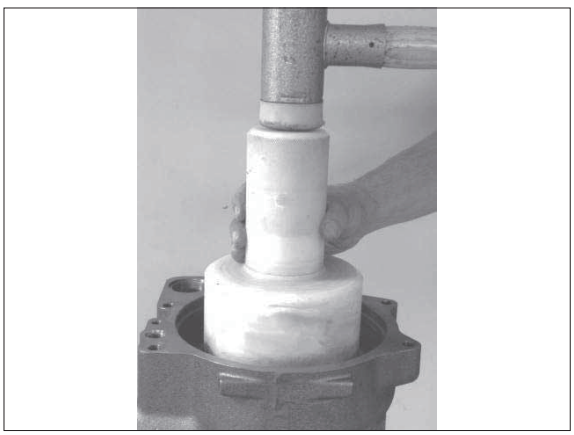
※ Oil sealing surfaces in housing and O-ring for reassembly.
※ Observe installation position



14WF8TM233

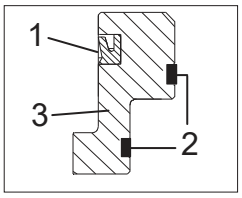
44) Mount ring with driver tool until contact.

(S) Driver tool 5870 506 161

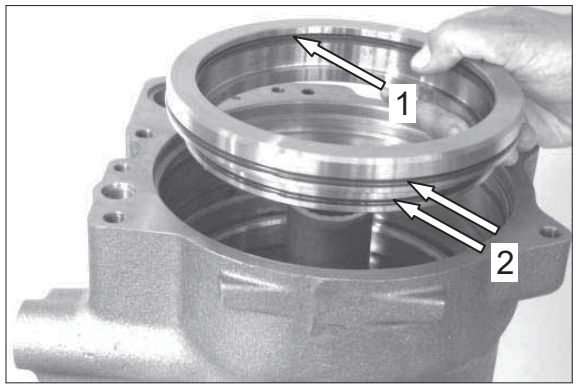


14WF8TM234

45) Oil sealing surfaces in housing and sealing elements. Insert seal (1) with sealing lip showing to oil sump – also see detail sketch.



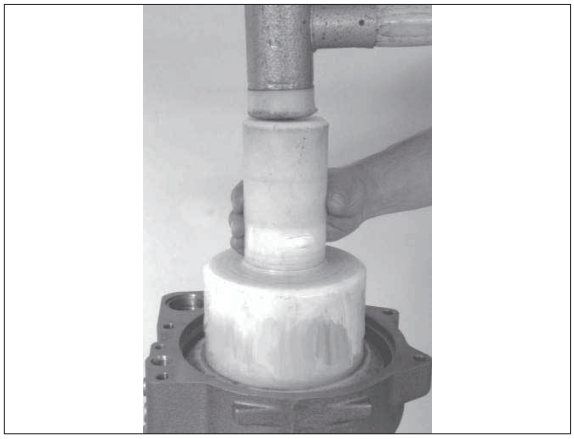

Put both O-rings (2) into annular grooves of pressure ring (3) and insert preassembled pressure ring into housing.



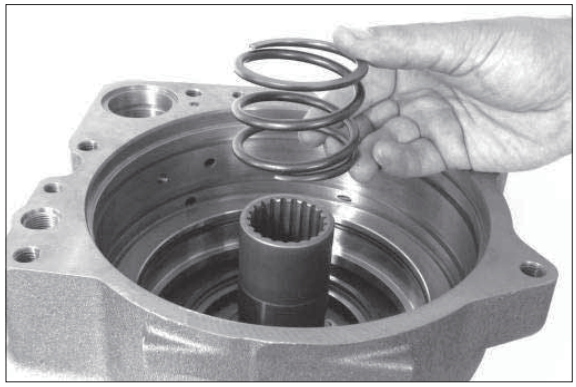
14WF8TM235

46) Bring pressure ring with driver tool into contact position.

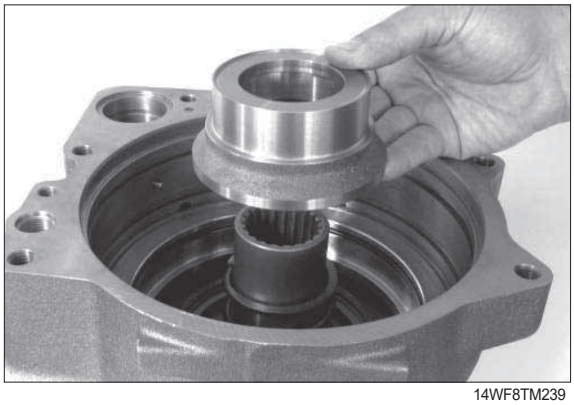
(S) Driver tool 5870 506 161


14WF8TM237

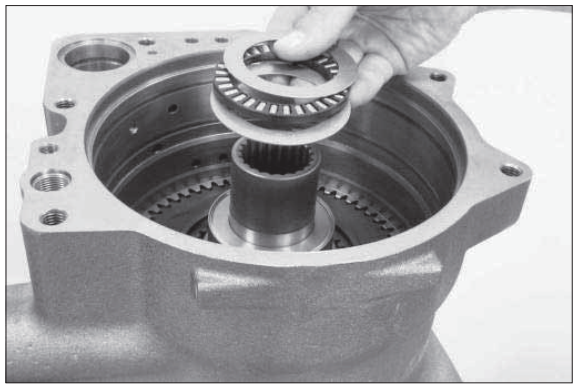
47) Insert compression spring until contact.


14WF8TM238

48) Insert pressure piece over compression spring until contact.


14WF8TM239

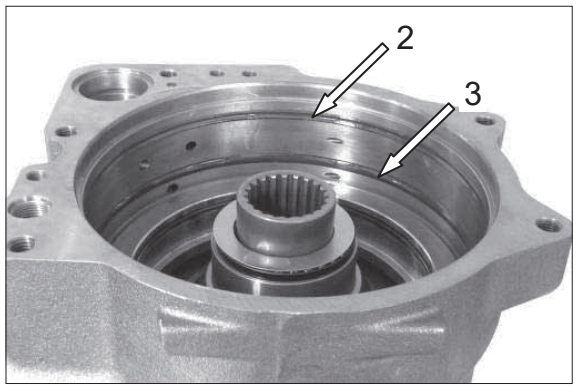
49) Oil axial roller cage and mount it with both axial washers (1x each to be positioned underneath and onto axial needle cage).



14WF8TM240

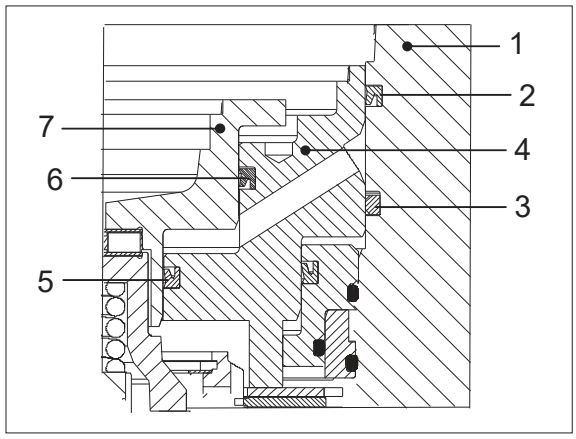
50) Insert seal (2, with sealing lip showing to oil sump) and seal (3) – see 14WF8TM242 into housing (1).

※ Oil sealing elements and sealing surfaces on piston for reassembly.




14WF8TM241

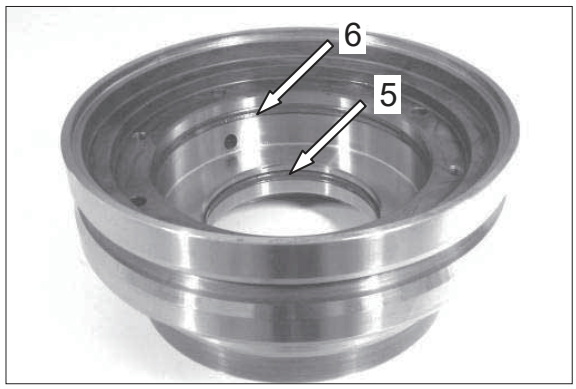
51) 1 = Housing
2 = Seal (with sealing lip)
3 = Seal
4 = Piston / Brake
5 = Seal (with sealing lip)
6 = Seal (with sealing lip)
7 = Piston / Clutch




14WF8TM242

52) Insert seals (5 and 6, see 14WF8TM247), with sealing lips showing to oil sump into piston / brake (4).

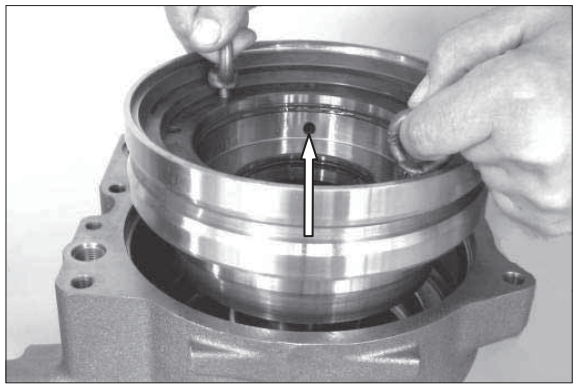
※ Oil sealing surfaces on piston and sealing elements for reassembly.




14WF8TM243

53) Insert preassembled piston/brake until contact.

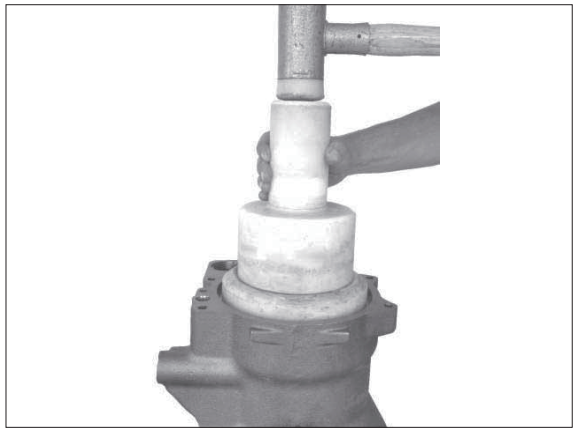
※ Position piston in such a way that oil supply hole (see arrow) is at 12.00 o'clock position.
Observe version as to transmission installation position HORIZONTAL – VERTICAL.



14WF8TM244

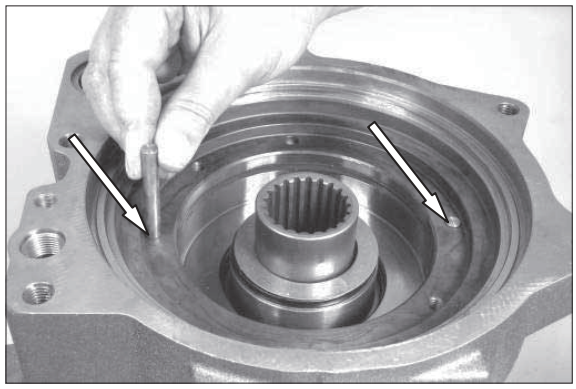
54) Use driver tool to bring piston into contact position.

(S) Driver tool 5870 506 161



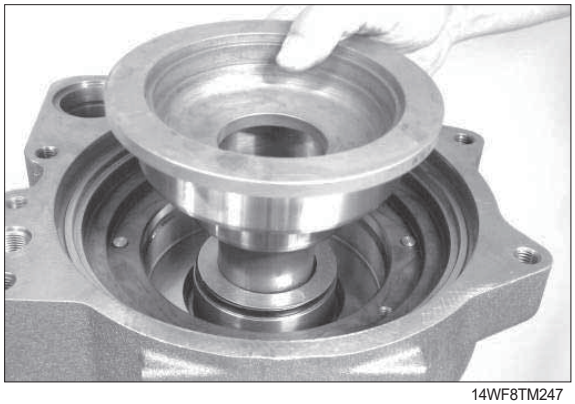
14WF8TM245

55) Insert both cyl. pins (arrow).



14WF8TM246

56) Insert piston/clutch until contact.

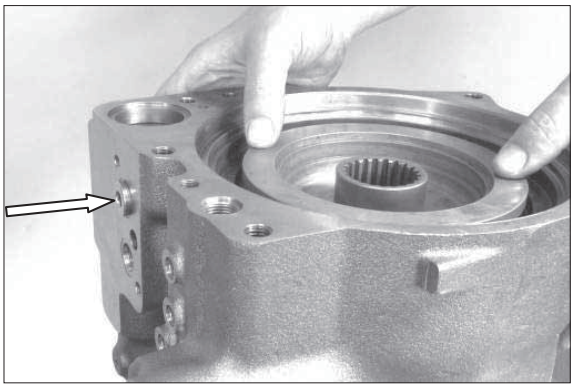


14WF8TM247

57) Press piston axially, against compression spring preload.
Provide screw plug with new O-ring and seal pressure oil supply hole (see arrow).

Tightening torque $M_A$ = 40 Nm

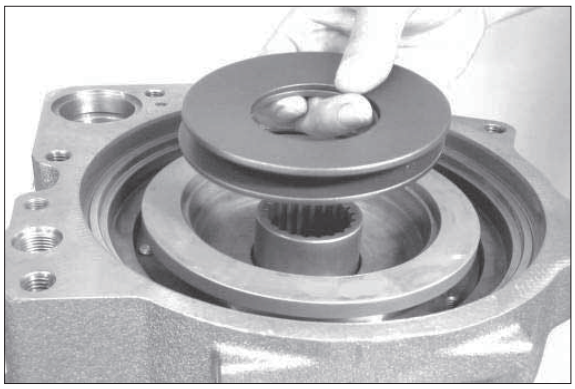
※ Axial position of piston is maintained (Facilitate assembly for installation of input housing, see 14WF8TM254~ 14WF8TM255).



14WF8TM248

58) Insert both cup springs/clutch.

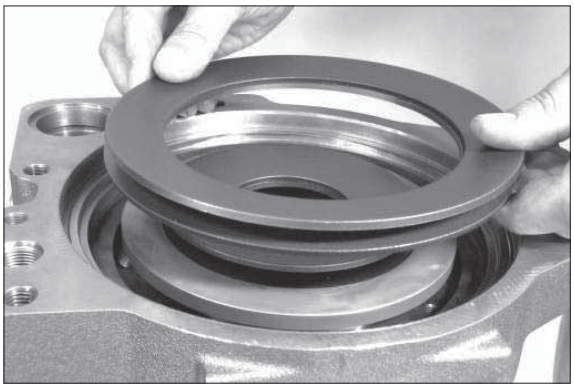
※ Observe installation position, see also 14WF8TM225.



14WF8TM249

59) Insert both cup springs/brake.

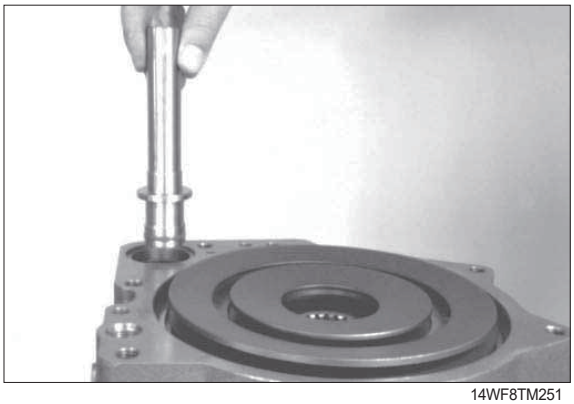
※ Observe installation position – see also 14WF8TM225.



14WF8TM250

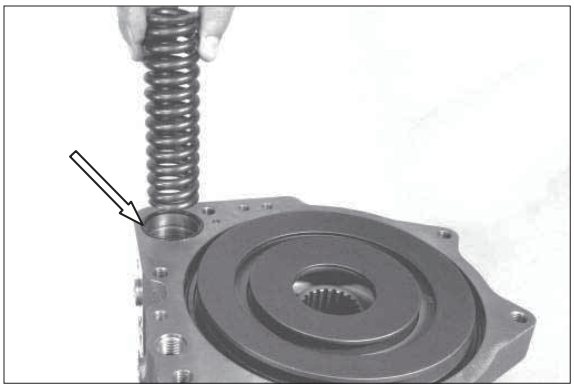
**Install modulation valve and input housing**

60) Insert piston (modulation valve cpl. – can only be replaced as unit).



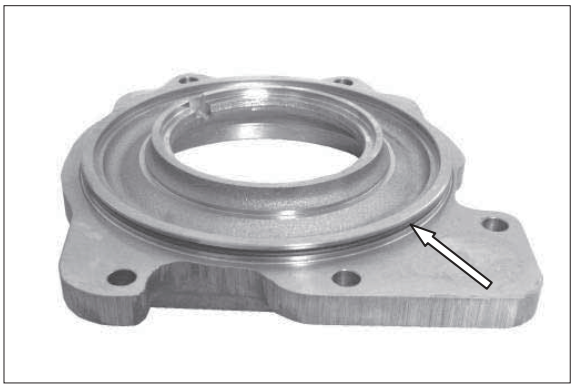
14WF8TM251

61) Place O-ring (see arrow) into annular groove of housing and insert compression spring.



14WF8TM252

62) Oil O-ring and insert it into annular groove of input housing.

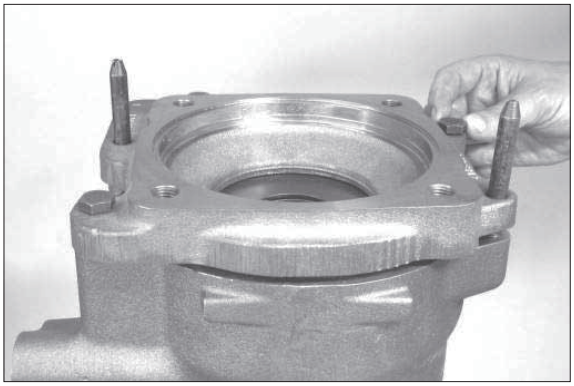


14WF8TM253

63) Insert two adjusting screws (M 12), mount input housing and fix it with hexagon screws.

(S) Adjusting screws (M12) 5870 204 021

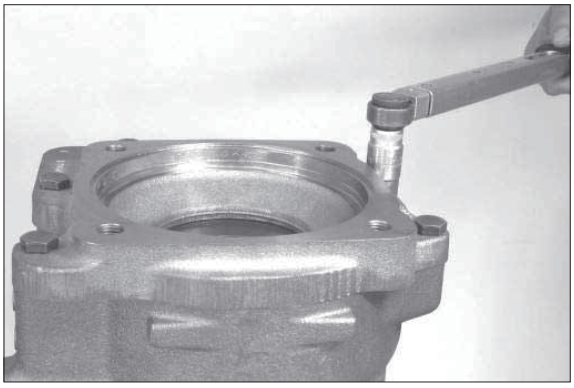
※ For installation of input housing align cup springs centrically.



14WF8TM254

64) Locate input housing evenly with hexagon screws (risk of breakage) until contact.

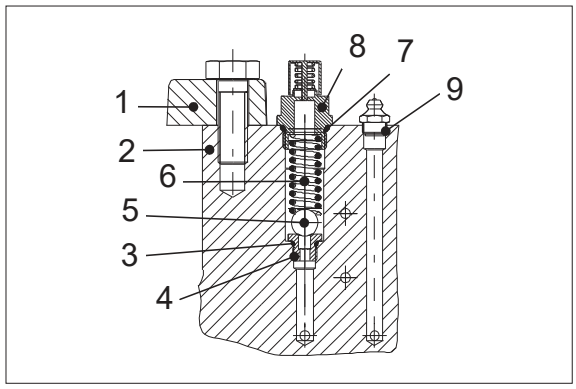
Tightening torque (M 12/8.8) $M_A$ = 80 Nm



14WF8TM255

**Emergency release (parking brake)**

65) 1 = Input housing
2 = Housing
3 = O-ring
4 = Threaded element (orifice)
5 = Ball
6 = Compression spring
7 = O-ring
8 = Breather
9 = Position of lubrication nipple for version Transmission installation position Vertical



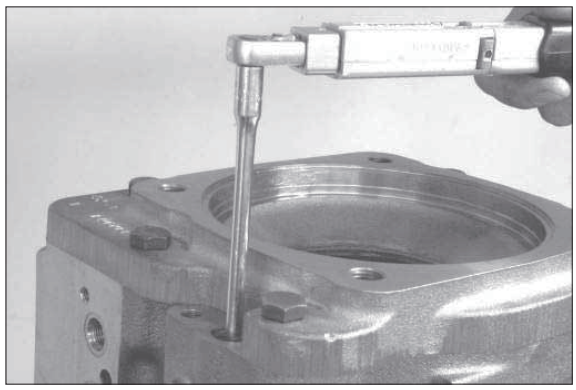
14WF8TM256

※ Position of lubrication nipple for version transmission installation position Horizontal, see 14WF8TM261.

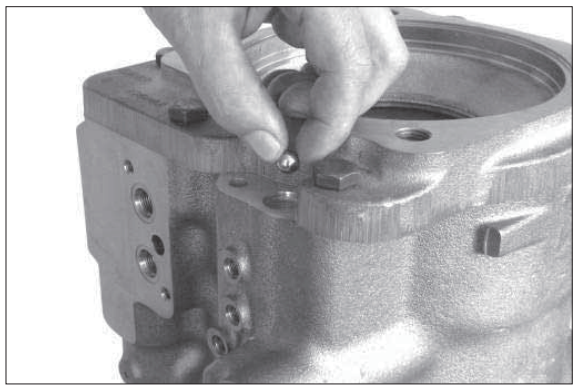
※ Remove protective cap of lubrication nipple only if emergency release is required.

66) Install threaded element (4) with new O-ring (3).

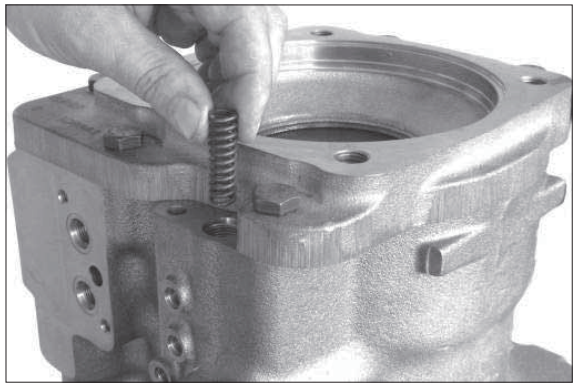
Tightening torque (M 10×1) $M_A$ = 15 Nm


14WF8TM257

67) Insert ball (5).


14WF8TM258

68) Insert compression spring (6).


14WF8TM259

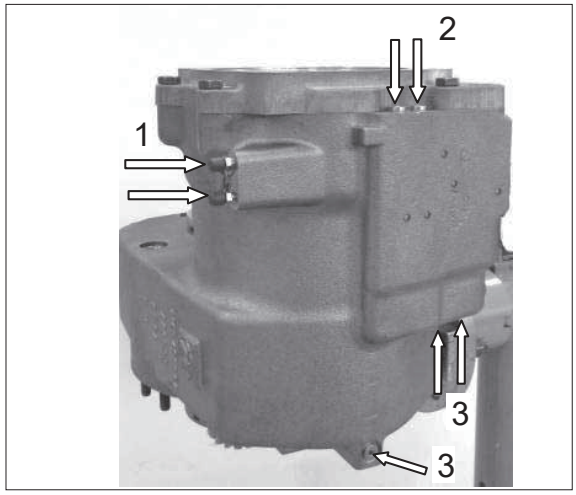
**Check emergency release for leak tightness**

69) Illustration shows version transmission installation position Vertical.

※ For version transmission installation position Horizontal connections and positions of breather valves/lubrication nipple etc. must be considered as shown on illustration of 14WF8TM261.

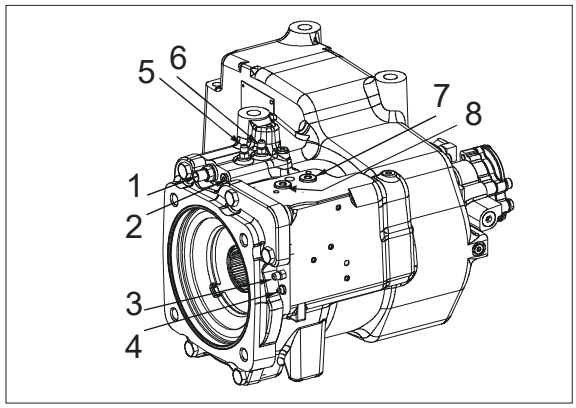
Install both breather valves (1), screw plugs (2) with new seal rings and screw plugs (3) with new O-rings.

Breather valve (M 10×1) $M_A$ = 15 Nm
Screw plug (M 10×1 with seal ring) $M_A$ = 20 Nm
Screw plug (M 10×1 with O-ring) $M_A$ = 20 Nm



14WF8TM260

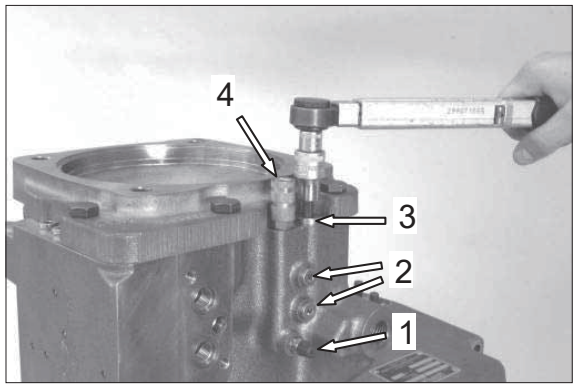
70) 1 = Breather/Pressure relief-valve
(emergency release –parking brake)
2 = Screw plug
3 = Breather valve
(emergency release – parking brake)
4 = Lubrication nipple
(emergency release – parking brake)
5 = Breather valve (multi-disk clutch)
6 = Breather valve (mulit-disk brake)
7 = Pressure oil connection – multi-disk brake
8 = Pressure oil connection – multi-disk clutch



14WF8TM261

71) Install breather valve (1), screw plugs (2), screw plug (3) with new O-ring and compressed air connection piece (4).

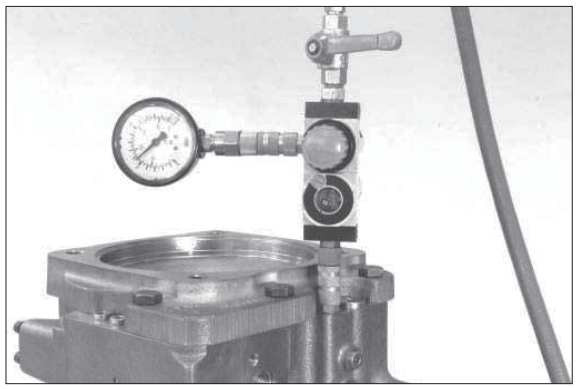
Breather valve (M 10×1) $M_A$ = 15 Nm
Screw plug (M 10×1 with O-ring) $M_A$ = 20 Nm
Screw plug (M 18×1.5 with O-ring) $M_A$ = 35 Nm
Compressed air connect. piece (M 10×1) with seal ring $M_A$ = 20 Nm



14WF8TM262

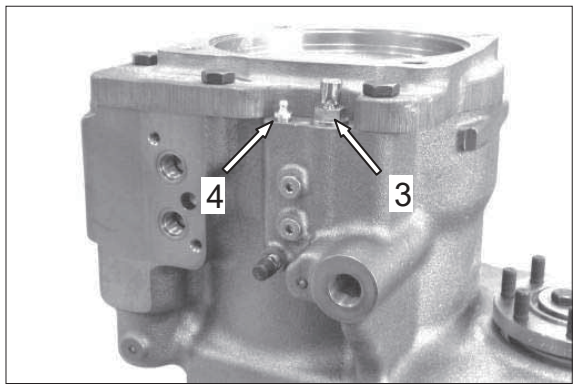
72) Pressurize emergency release with compressed air p = 5 + 1bar and close shut-off valve. During a test duration of 3 minutes no pressure drop is allowed.

(S) Air connection 5870 505 012


14WF8TM263

73) Remove screw plug and compressed air connection piece (see 14WF8TM262).
Install breather (3) with new O-ring and lubrication nipple (4).

Lubrication nipple (M 10×1) $M_A$ = 15 Nm
Breather (M 18×1.5) $M_A$ = 22 Nm



14WF8TM264

**Check multi-disk brake and clutch for leak tightness as wells as closing pressure**

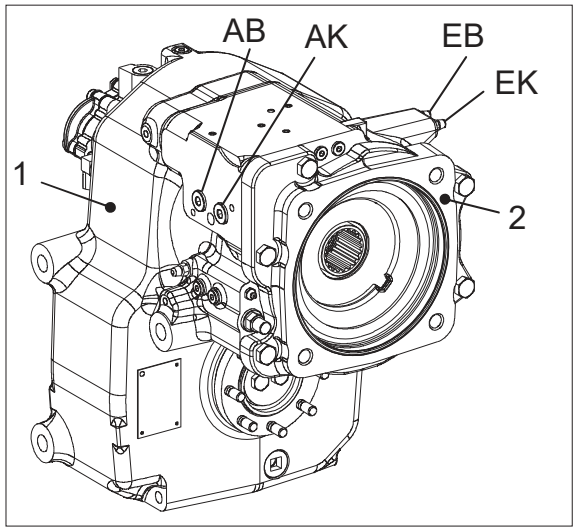
74) 1 = Transmission housing
2 = Input housing

AB = Pressure oil connection – multi-disk brake
AK = Pressure oil connection – multi-disk clutch

EB = Breather valve – multi-disk brake
EK = Breather valve – multi-disk clutch

※ Illustration shows version transmission installation position Vertical.

※ For version Transmission installation position Horizontal, connections and positions of breather valves/lubrication nipple etc. according to illustration in 14WF8TM261 must be considered.

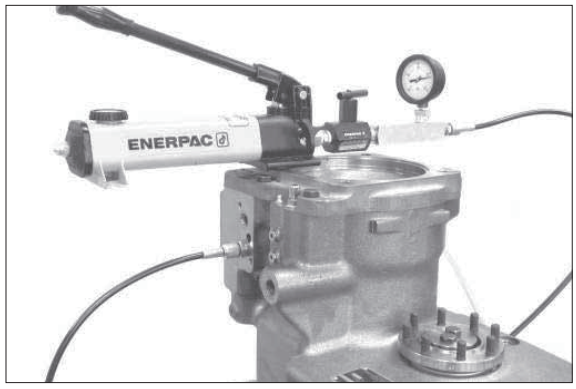


14WF8TM265

**Multi-disk brake**

75) Connect HP pump (AB – see 14WF8TM265 and 14WF8TM261) and build up pressure of p = 30 (max. 35 bar).
- Bleed pressure chamber several times. Close shut-off valve.
During a test duration of 3 minutes no measurable pressure drop is allowed.

(S) HP pump 5870 287 007



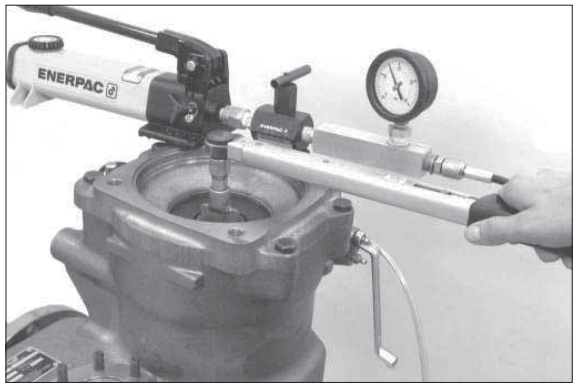
14WF8TM266

**Closing pressure test (Cup spring preloading force)**

76) When measuring closing pressure, valve block may not be attached to transmission due to by-pass function between brake and clutch.
Connection AK (see 14WF8TM265 and 14WF8TM261) open (not closed and tank connection).

Reduce pressure slowly, when pressure range 12~9 bar (closing pressure) is reached, input shaft must be locked at a tightening torque of 35 Nm.

(S) Spline mandrel 5870 510 039

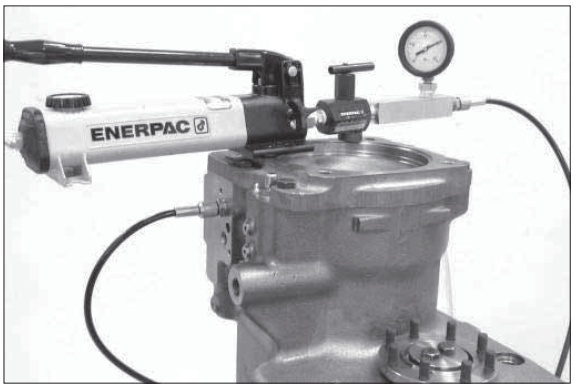


14WF8TM267

### Multi-disk clutch

77) Connect HP-pump (AK see 14WF8TM265 and 14WF8TM261), build up pressure of p = 30~max. 35 bar.
- Relieve pressure chamber several times. Close shut-off valve.
During a test duration of 3 minutes no measurable pressure drop is allowed.

(S) HP-pump 5870 287 007

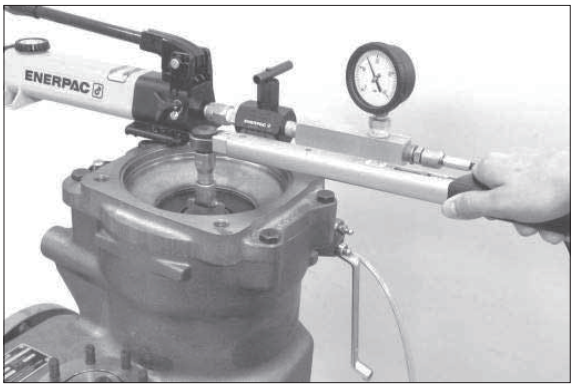


14WF8TM268

### Closing pressure test (Cup spring preloading force)

78) When measuring closing pressure, valve block (only for version with mounted valve block) may not be attached to transmission due to by-pass function between brake and clutch.
Connection AB (see 14WF8TM265 and 14WF8TM261) open (not closed and tank connection).
Reduce pressure slowly, when pressure range 17~13 bar (closing pressure) is reached, input shaft must be locked at a tightening torque of 35 Nm.

(S) Spline mandrel 5870 510 039

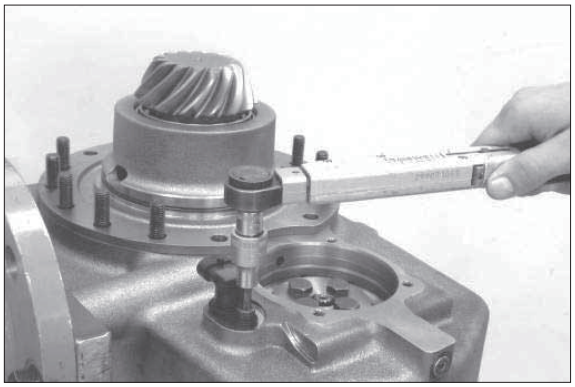


14WF8TM269

### Speed sensor

79) Install speed sensor with new O-ring.

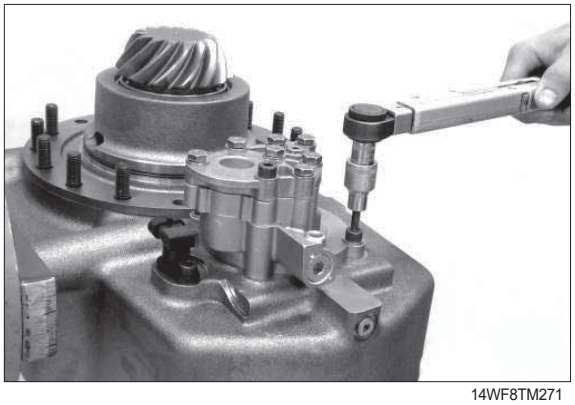
Tightening torque (M 8/8.8) $M_A$ = 23 Nm


14WF8TM270

### Lubrication pump/shift interlock

80) Install lubrication pump (with O-rings) or shift interlock – depending on version – (Illustration shows – Lubrication Pump).

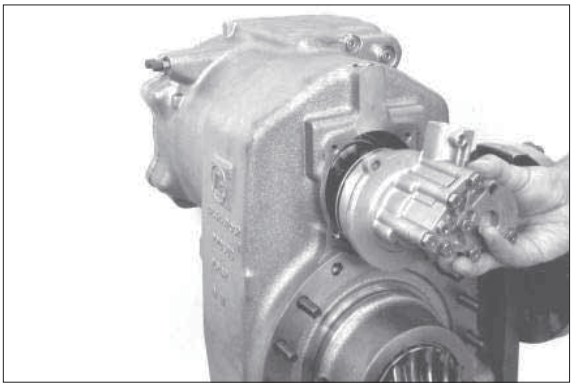
Tightening torque (M 8/10.9) $M_A$ = 23 Nm


14WF8TM271

## 10.DISASSEMBLY - LUBRICATION PUMP/ SHIFT INTERLOCK and VALVE BLOCK

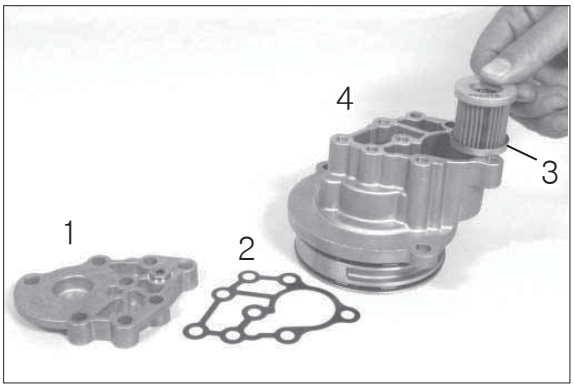
### Lubrication pump version

1) Loosen threaded joint and pull off cpl. lubrication pump.



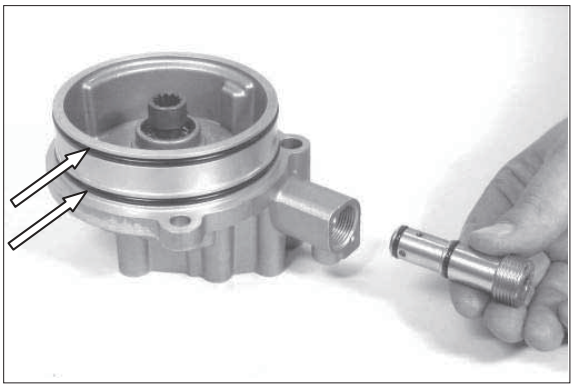
14WF8TM272

2) Loosen cover screws, remove cover (1) with seal (2) and filter (3) from housing (4).



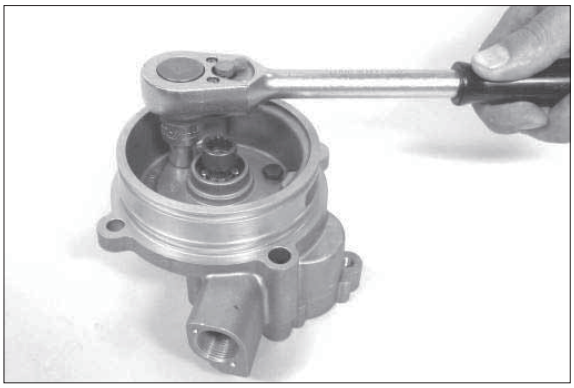

14WF8TM273

3) Remove cpl. pressure limiting valve and both O-rings (arrows).



14WF8TM274

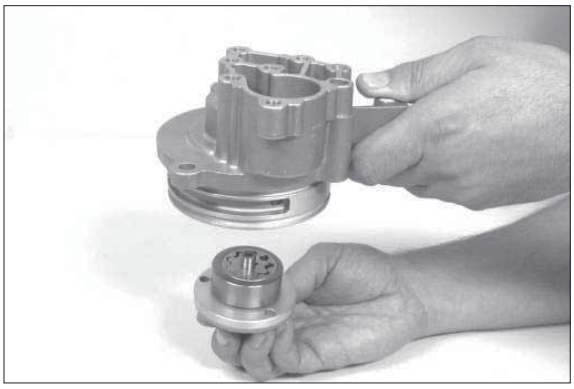
4) Keep housing in vertical position, while loosening pump cover screws.



14WF8TM275

※ Maintain contact position of pump and rotate by 180˚- disassembly aid.

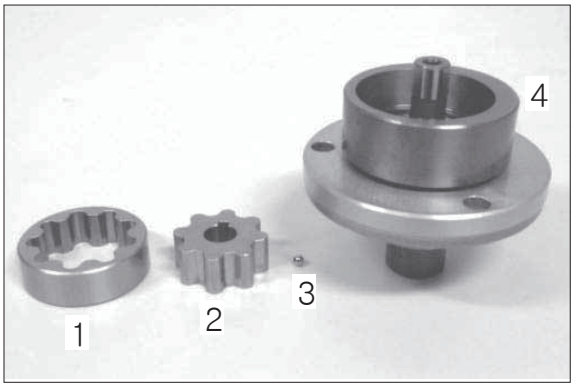
5) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs.



14WF8TM276

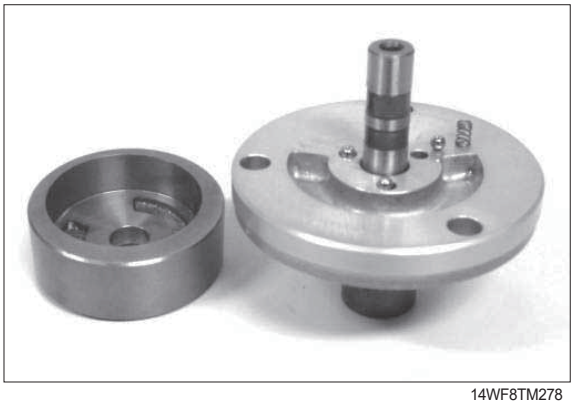
6) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



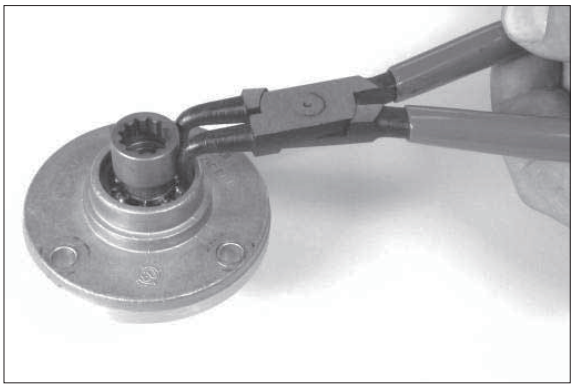

14WF8TM277

7) Remove control housing and releasing balls and compression springs (3 pcs. each).



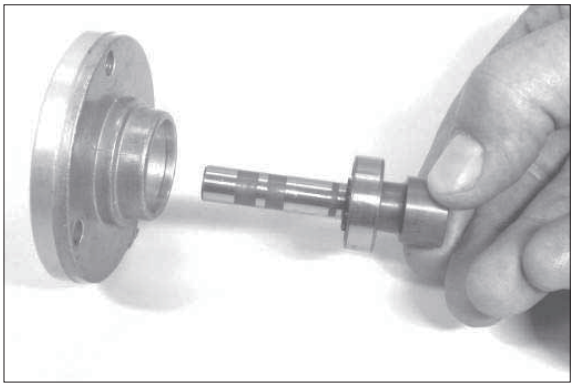
14WF8TM278

8) Unsnap retaining ring.



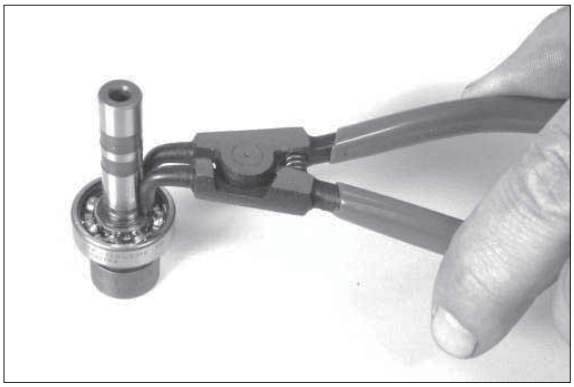
14WF8TM279

9) Pull cpl. pump shaft out of pump cover.



14WF8TM280

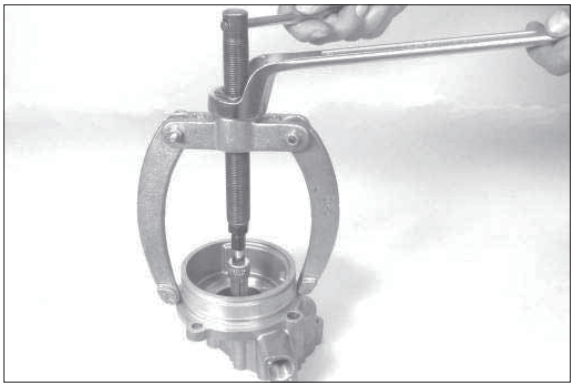
10) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM281

11) Pull needle sleeve out of housing hole.

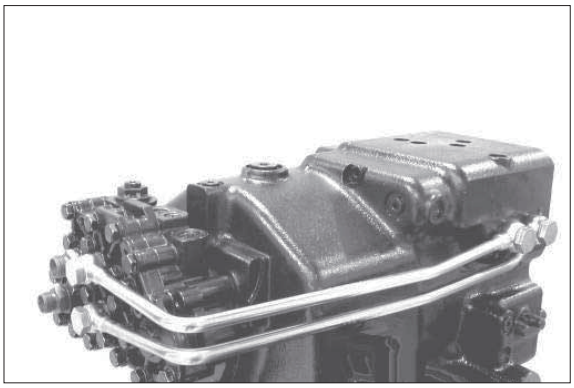
| | |
|---|---|
| (S) Inner extractor | 5870 300 012 |
| (S) Counter support | 5870 300 011 |



14WF8TM282

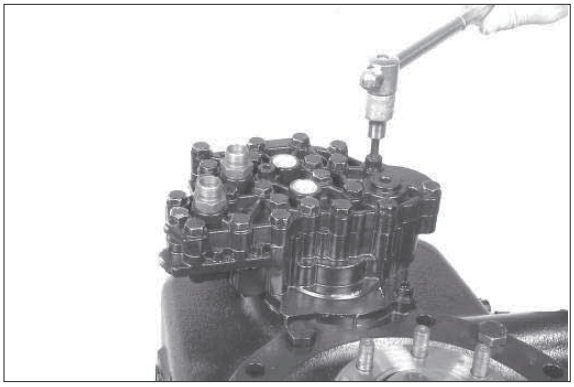
**Shift interlock version**

12) Disassemble both oil tubes.



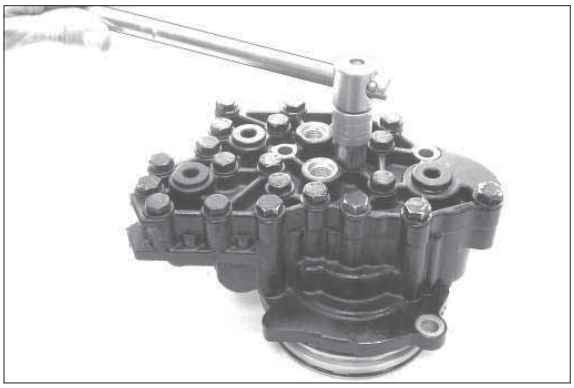
14WF8TM283

13) Loosen threaded joint of shift interlock (3 x cylindrical screws) and remove cpl. shift interlock.



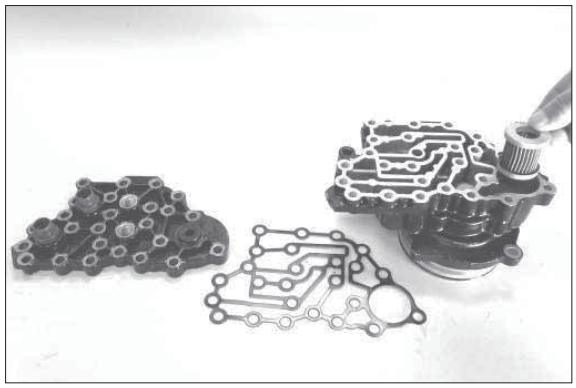
14WF8TM284

14) Loosen cover screws, remove cover and gasket (see also 14WF8TM286).



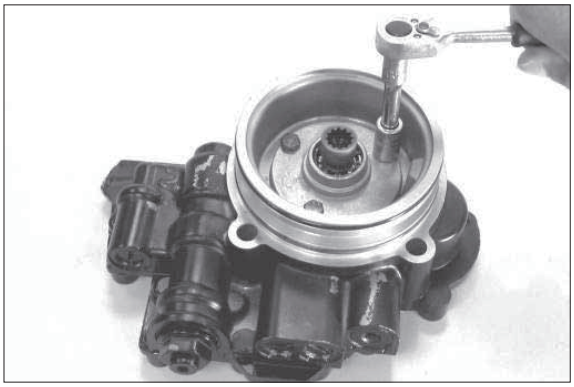
14WF8TM285

15) Take filter out of housing.



14WF8TM286

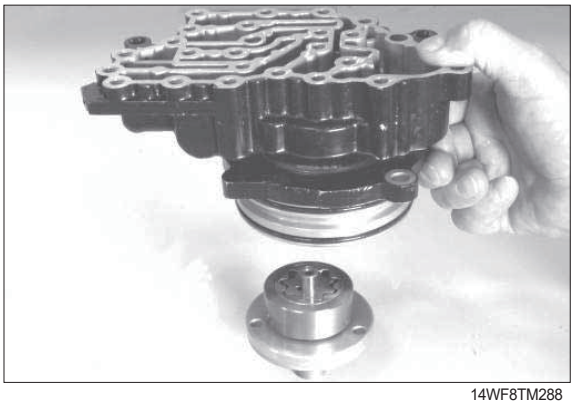
16) Loosen cover screws of pump.



14WF8TM287

※ Maintain contact position of pump and rotate it by 180˚ – disassembly aid.

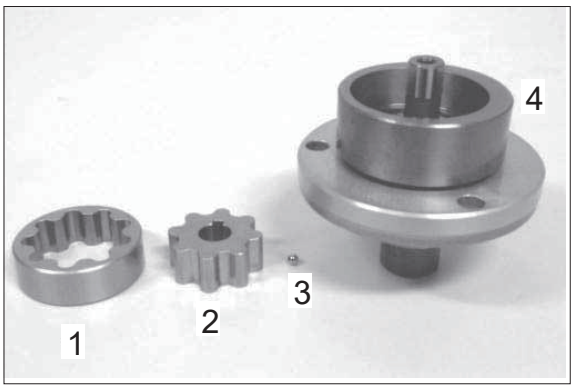
17) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs (see 14WF8TM289 and 14WF8TM290).



14WF8TM288

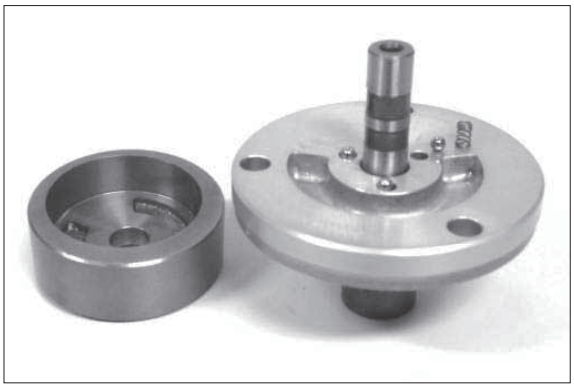
18) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



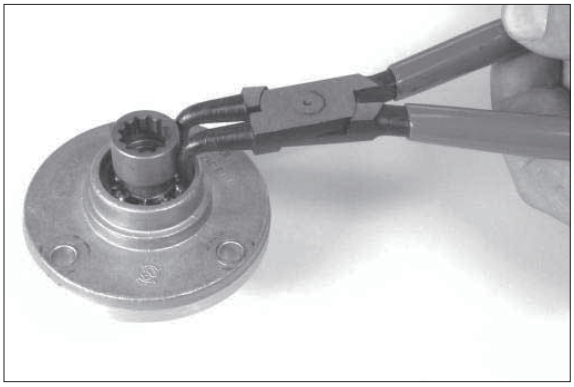

14WF8TM289

19) Remove control housing and releasing balls and compression springs (3 pcs. each).



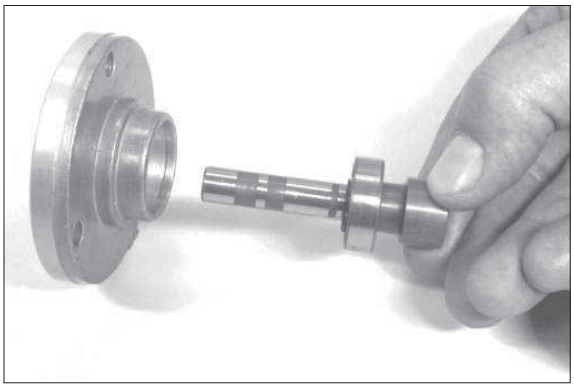
14WF8TM290

20) Unsnap retaining ring.



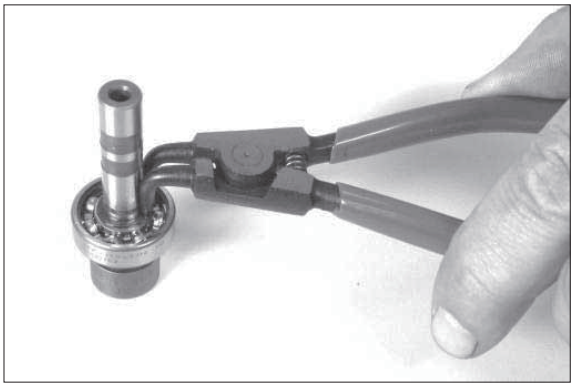
14WF8TM291

21) Pull cpl. pump shaft out of pump cover.



14WF8TM292

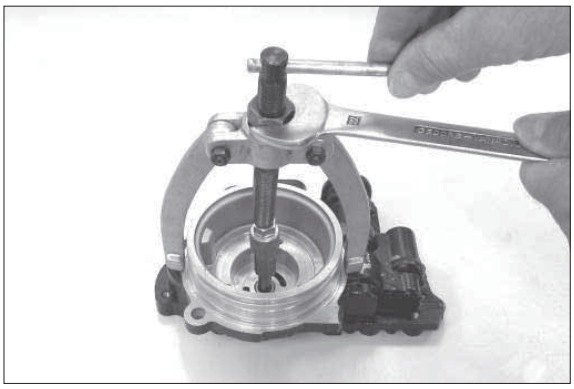
22) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM293

23) Pull needle sleeve out of housing hole.

(S) Inner extractor 5870 300 012
(S) Counter support 5870 300 011

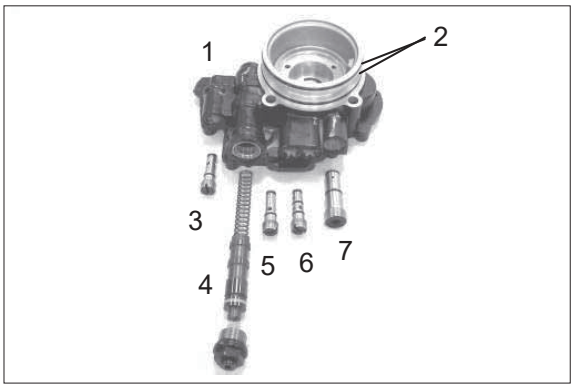


14WF8TM294

24) Remove O-rings and all single parts, remove valves.

1 = Housing
2 = O-rings
3 = Check valve (010)
4 = Shift piston
5 = Check valve (009)
6 = Check valve (008)
7 = Pressure relief valve

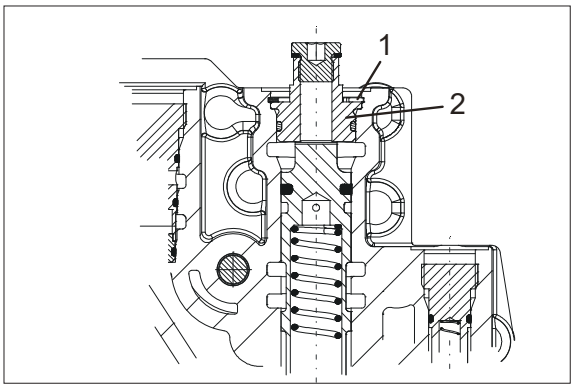
Position 4 (shift piston) shows version with screw plug.




14WF8TM295

25) In sketch 14WF8TM296 version II is shown with plug (2) and retaining ring (1).

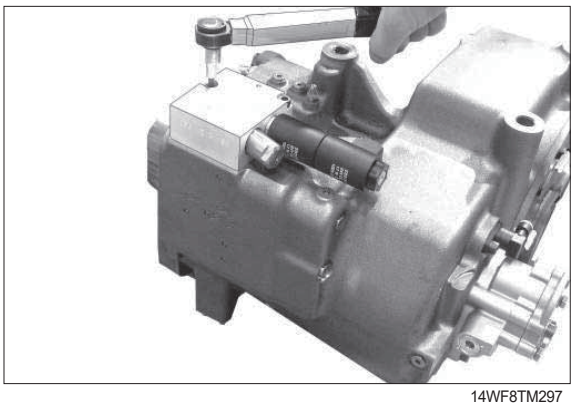
⚠ **When disengaging retaining ring – Pay attention to spring preload. Protect against movement.**




14WF8TM296

**Disassemble valve block**

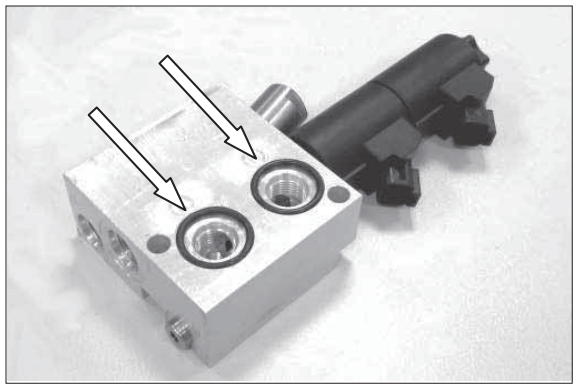
26) Loosen fixing screws and remove cpl. valve block.



14WF8TM297

27) Remove both O-rings (see arrows).

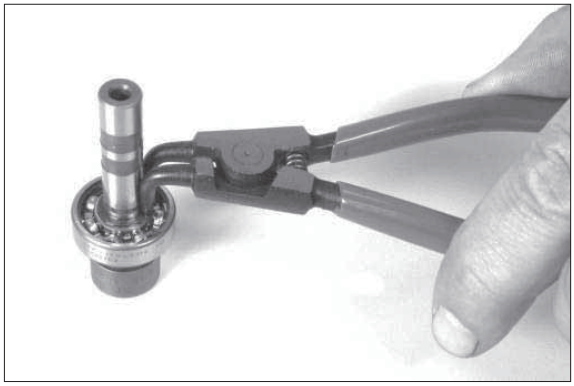
※ Do not further disassemble. Valve block may only be replaced as component.



14WF8TM298

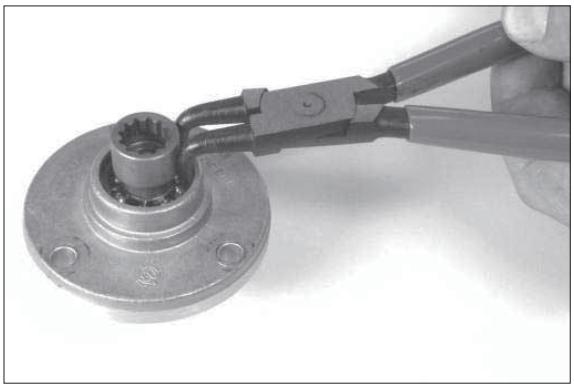
## 11. REASSEMBLY LUBRICATION PUMP

1) Mount ball bearing onto pump shaft and fix it by engaging retaining ring into annular groove of pump shaft.



14WF8TM299

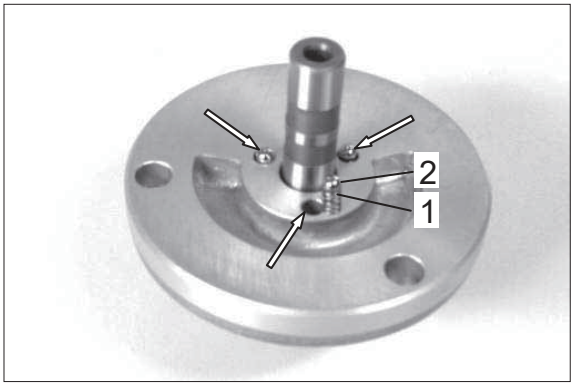
2) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.



14WF8TM300

3) Insert compression springs (1) and ball (2) into holes (see arrows - 3x).

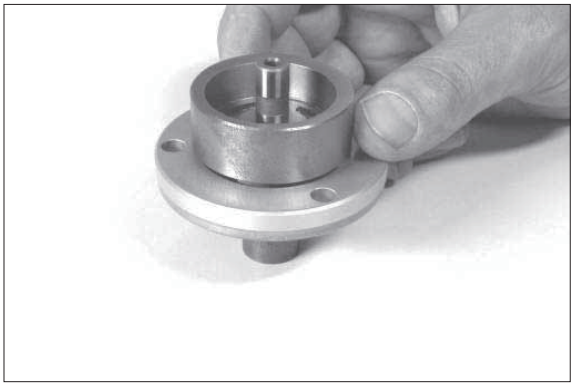
※ Keep preassembled single parts in vertical position–pay attention to position of inserted balls and compression springs (see work steps 14WF8TM301~14WF8TM307).




14WF8TM301

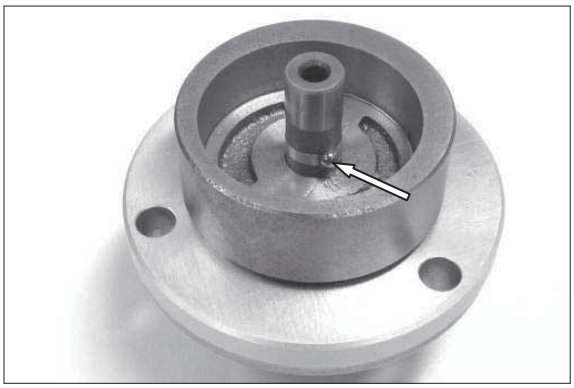
4) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



14WF8TM302

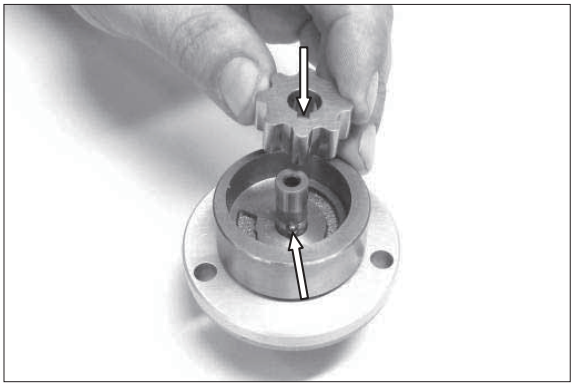
5) Position ball – (see arrow, engagement for inner rotor) with grease into countersink of pump shaft.



14WF8TM303

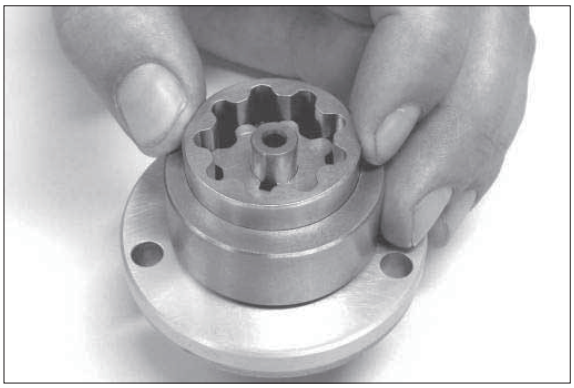
6) Mount inner rotor.

※ Place groove of inner rotor over ball (see arrows).



14WF8TM304

7) Mount outer rotor



14WF8TM305

8) Insert needle sleeve to installation dimension X into housing.

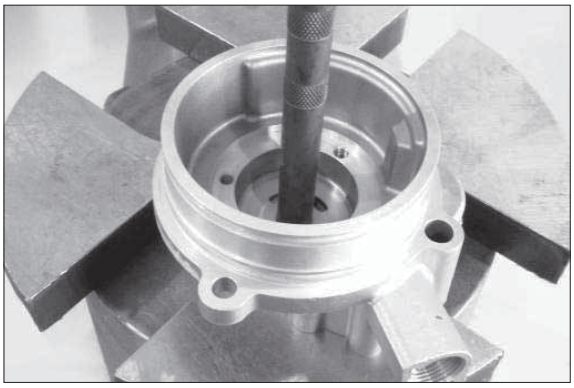
X = 0.2~0.7 mm below plane face / housing

(S) Driver tool 5870 705 003

※ Use of specified driver tool ensures exact installation position.

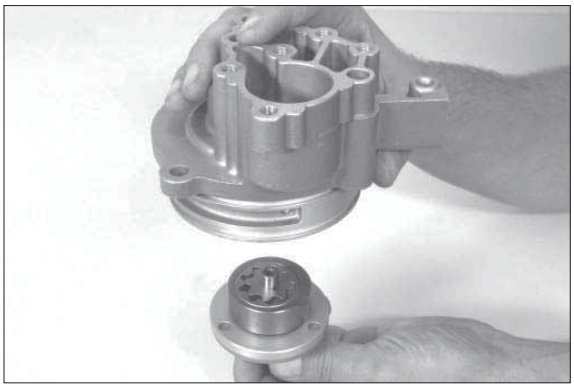
※ Insert needle sleeve with marked front face showing upwards.

※ Check opening of orifice / oil hole in housing bottom.



14WF8TM306

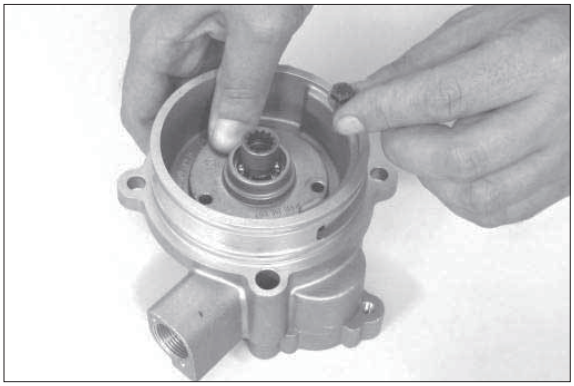
9) Maintain pump in vertical position while inserting housing with mounted needle sleeve onto preassembled pump.



14WF8TM307

10) Rotate housing by 180˚ and fix pump with hexagon screws.

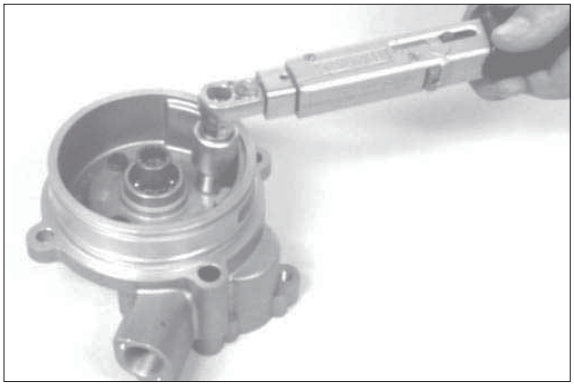
※ Maintain contact position of inserted pump.



14WF8TM308

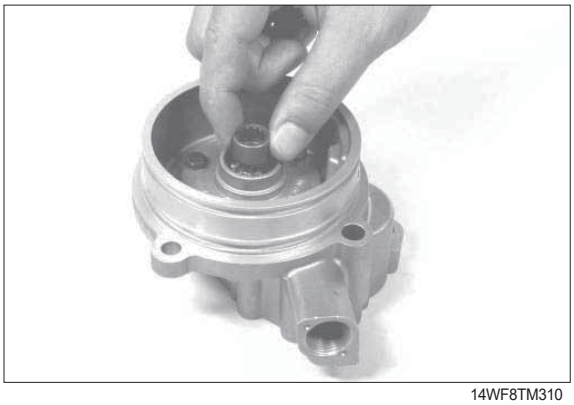
11) Fix pump.

Tightening torque (M6/8.8) $M_A$ = 9.5 Nm



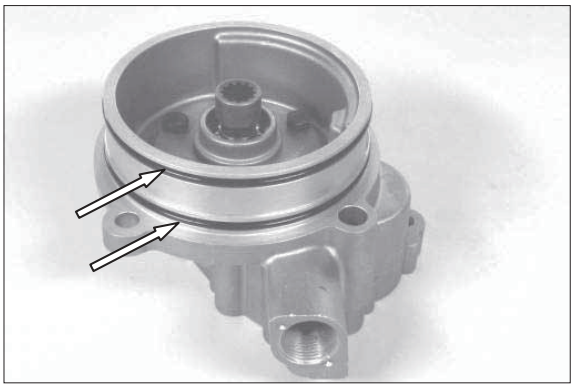
14WF8TM309

12) With counter-turning motions on pump shaft, swiveling of control housing (stop LH/RH in pump cover) is audible.



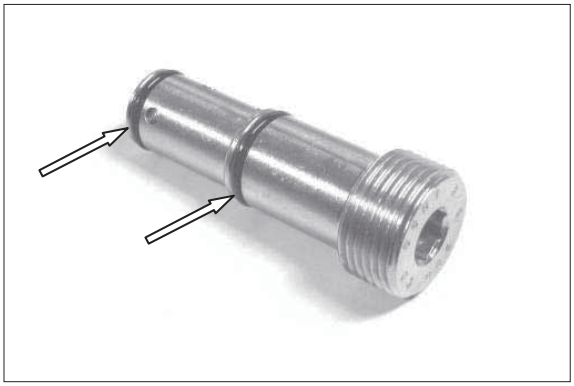
14WF8TM310

13) Oil both O-rings (arrows) and put them into annular groove of housing.



14WF8TM311

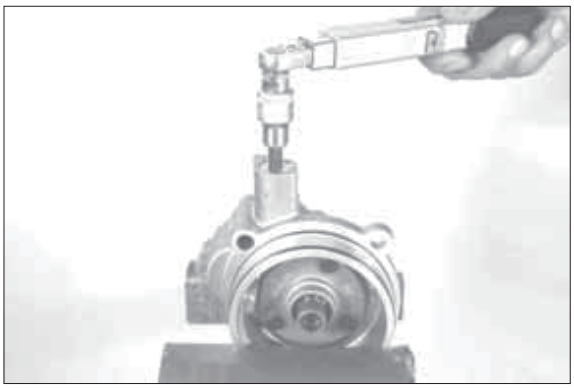
14) Insert O-rings (see arrows) into annular grooves of pressure relief valve.



14WF8TM312

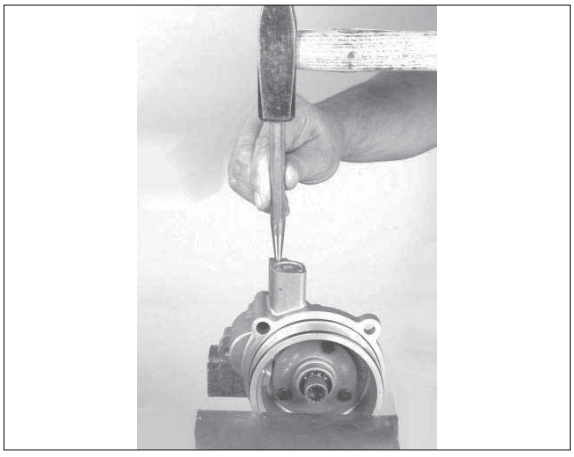
15) Mount pressure relief valve.

Tightening torque $M_A$ = 10 Nm



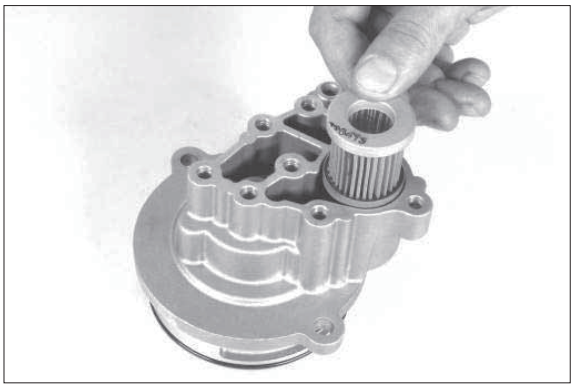
14WF8TM313

16) Secure pressure relief valve by center punch marks (2x).



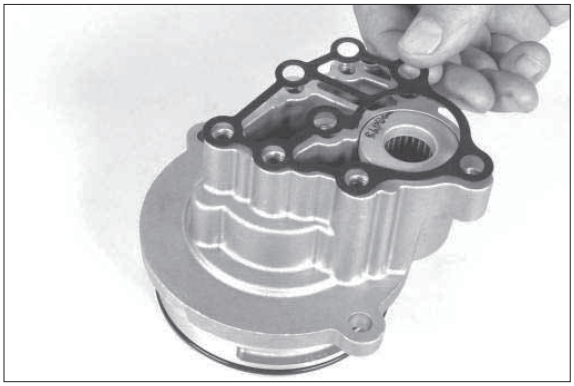
14WF8TM314

17) Insert filter.



14WF8TM315

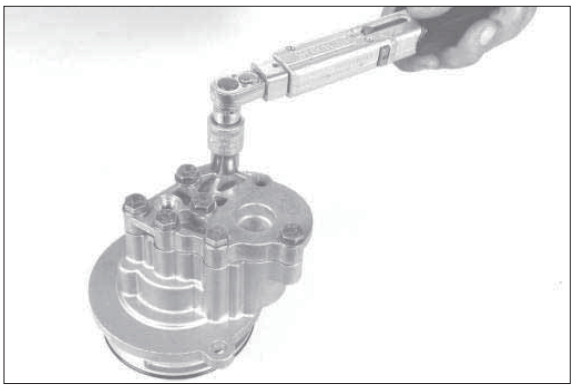
18) Place gasket.



14WF8TM316

19) Place cover and fix it with hexagon screws and disks.

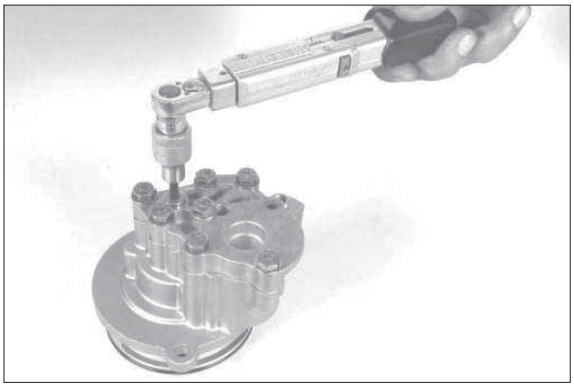
Tightening torque (M8/8.8) $M_A$ = 23 Nm



14WF8TM317

20) Insert screw plug with new O-ring.

Tightening torque (M10 × 1) $M_A$ = 15 Nm

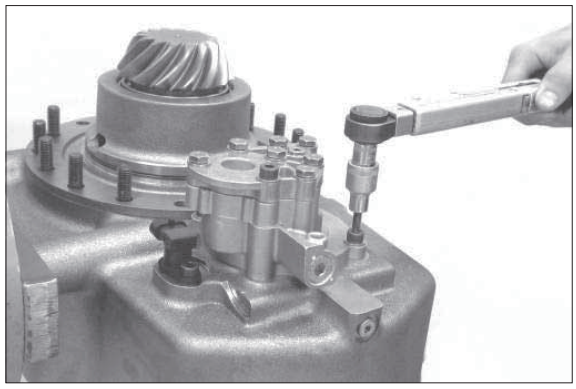


14WF8TM318

21) Mount cpl. lubrication pump and fasten it with cylindrical screws and disks.

Tightening torque (M8/10.9) $M_A$ = 23 Nm

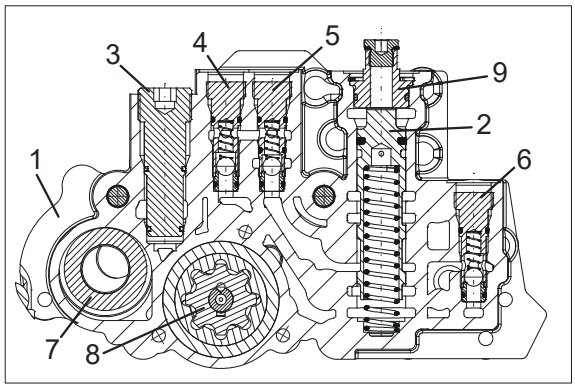
※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM319

## 12. REASSEMBLY SHIFT INTERLOCK

1) 1 = Housing
   2 = Shift piston
   3 = Pressure relief valve
   4 = Check valve (008)
   5 = Check valve (009)
   6 = Check valve (010)
   7 = Filter
   8 = Lubrication pump
   9 = Plug

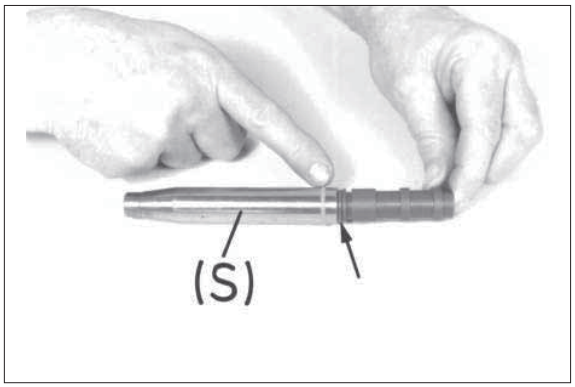


14WF8TM320

2) Put O-ring (see arrow) into annular groove of piston.
   Lead plastic ring by means of inner installer (S) over piston and position it at O-ring.

   (S) Inner installer 5870 651 055

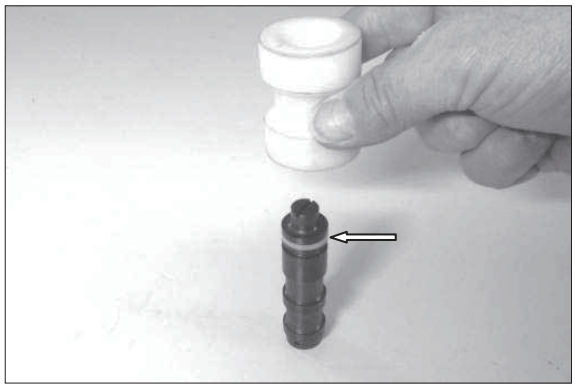
※ Seal consists of plastic ring and O-ring (see 14WF8TM321~14WF8TM322).



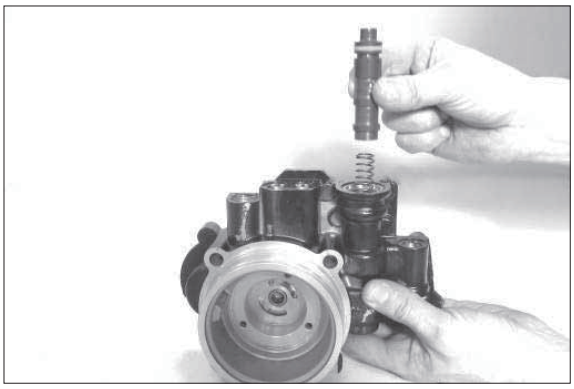
14WF8TM321

3) Center plastic ring (see arrow) with calibrating mandrel.

   (S) Calibrating mandrel 5870 651 056


14WF8TM322

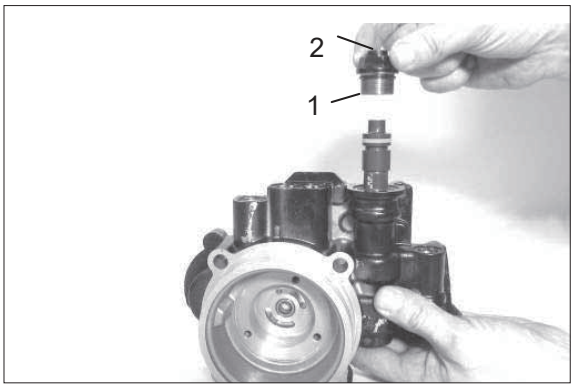
4) Insert compression spring, oil preassembled piston and install.


14WF8TM323

**Version I :**

5) Fix piston with screw plug (1- with O-ring). Install screw plug (2 – with seal ring).

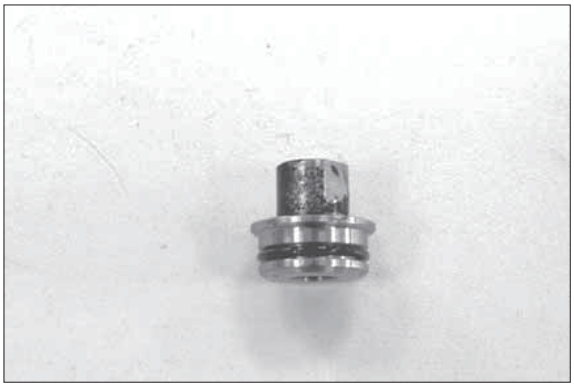
Screw plug (M24 × 1.5) $M_A$ = 50 Nm
Screw plug (M10 × 1) $M_A$ = 15 Nm



14WF8TM324

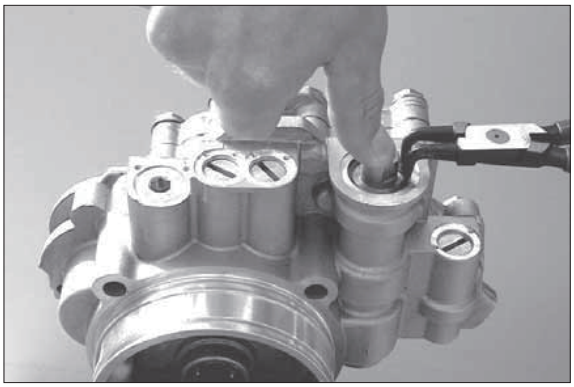
**Version II (14WF8TM325 ≈ 14WF8TM327) :**

6) Oil O-ring and insert it into annular groove of plug.


14WF8TM325

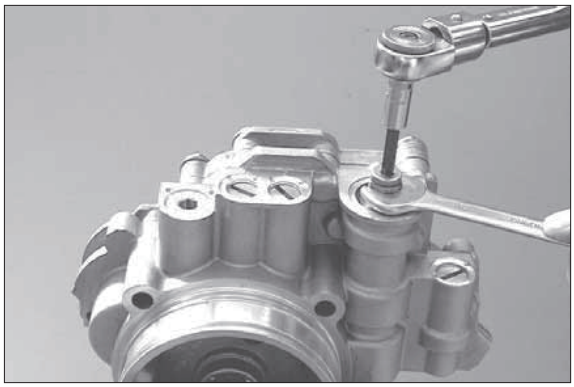
7) Fix plug by engaging retaining ring into annular groove of housing.

※ Pay attention to spring preload – protect against movement.


14WF8TM326

8) Mount screw plug with seal.

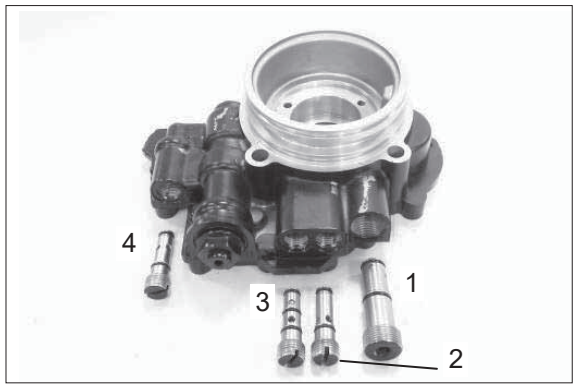
Tightening torque (M10 × 1) $M_A$ = 15 Nm


14WF8TM327

9) Install single parts according to adjacent illustration.

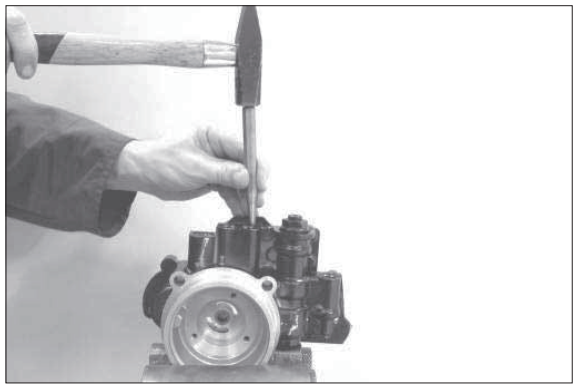
1 = Pressure relief valve cpl. $M_A$ = 10 Nm
2 = Check valve cpl. $M_A$ = 10 Nm
3 = Check valve cpl. $M_A$ = 10 Nm
4 = Check valve cpl. $M_A$ = 10 Nm

※ Observe installation position of the different check valves (see also 14WF8TM320).



14WF8TM328

10) Secure check valves and pressure relief valves with two center punch marks each.

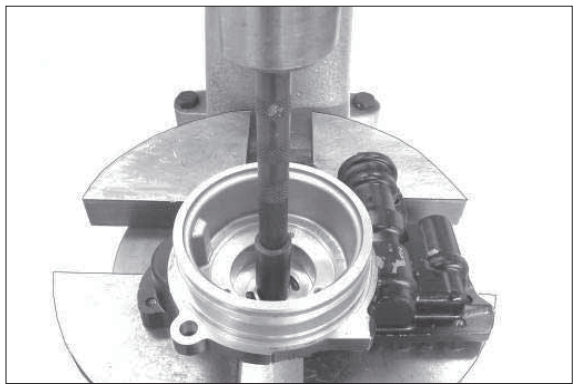

14WF8TM329

11) Insert needle sleeve to installation dimension X into housing.

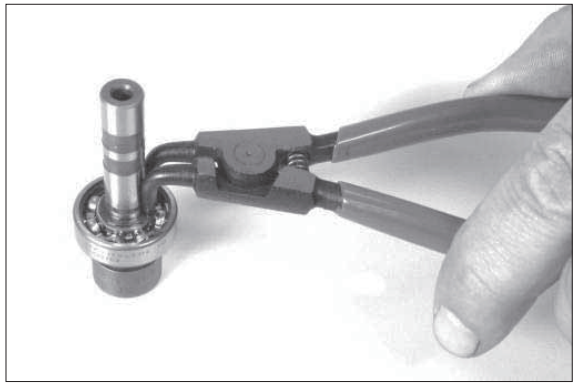
X = 0.2~0.7 mm below plane face/housing

(S) Driver tool 5870 705 003

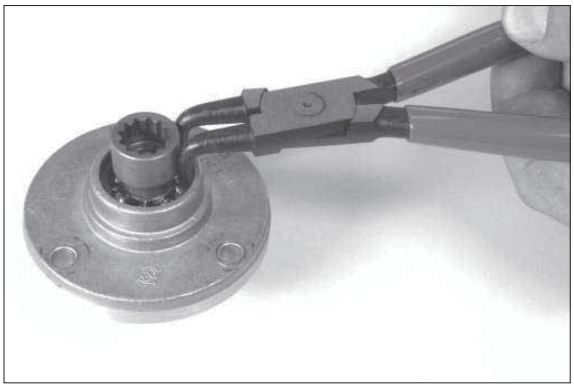
※ Use of specified driver ensures exact installation position.
※ Insert needle sleeve with marked front face showing upwards.
※ Check opening of orifice / oil hole in housing bottom.


14WF8TM330

12) Insert ball bearing onto pump shaft and fix it by engaging retaining ring into annular groove of pump shaft.


14WF8TM331

13) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.

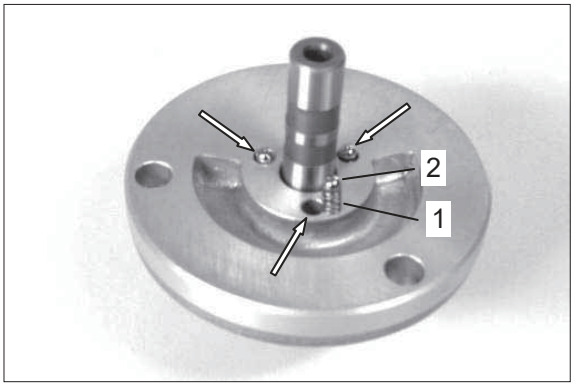


14WF8TM332

14) Insert compression springs (1) and ball (2) into holes (see arrows - 3x).

⚠ **Prior to installation, oil single parts of pump/ rotor set (control housing, inner and outer rotor) – use oil (lubrication)**

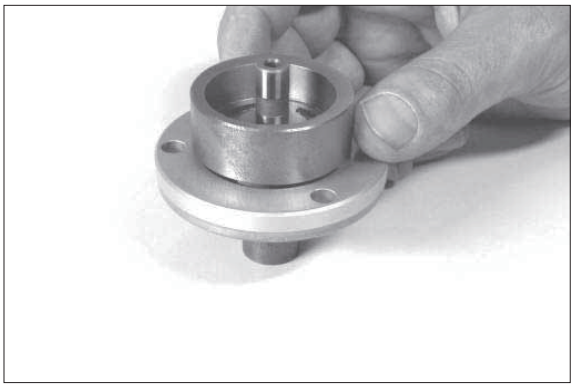
※ Keep preassembled single parts in vertical position – pay attention to position of inserted balls and compression springs (see work steps 14WF8TM333 ~14WF8TM338).




14WF8TM333

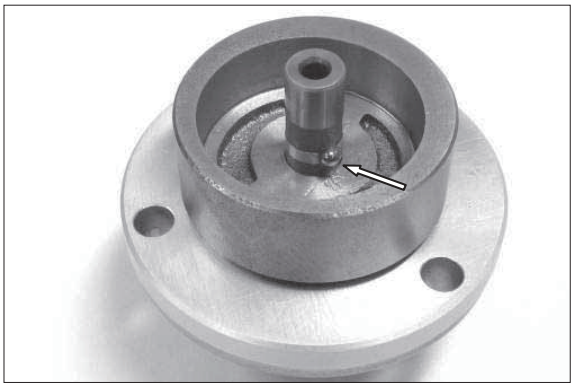
15) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



14WF8TM334

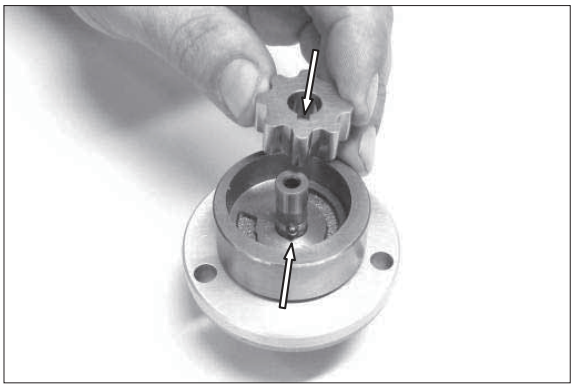
16) Position ball – (see arrow –engagement for inner rotor) with grease into countersink of pump shaft



14WF8TM335

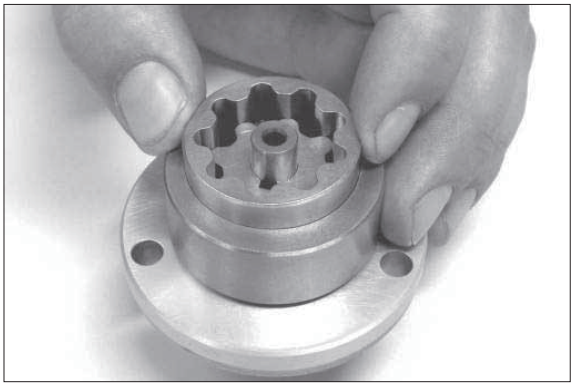
17) Mount inner rotor.

※ Place groove of inner rotor over ball (see arrows).



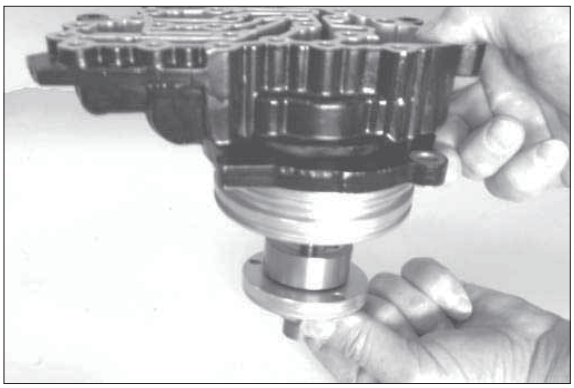
14WF8TM336

18) Mount outer rotor.



14WF8TM337

19) Maintain pump in vertical position while inserting housing with mounted needle sleeve onto preassembled pump.

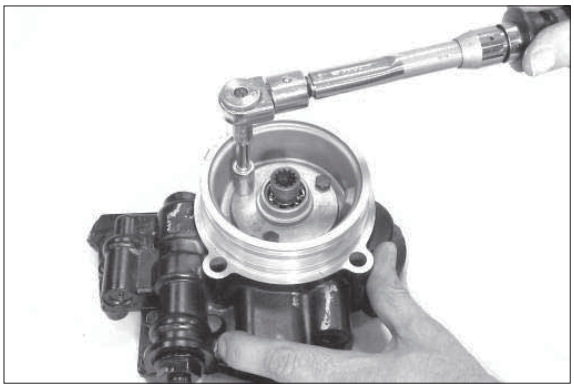


14WF8TM338

20) Rotate housing by 180˚ and fix pump with hexagon screws.

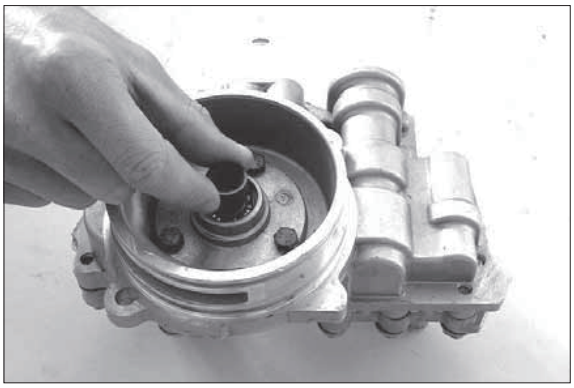
Tightening torque (M6/8.8) $M_A$ = 9.5 Nm

※ Maintain contact position of inserted pump.



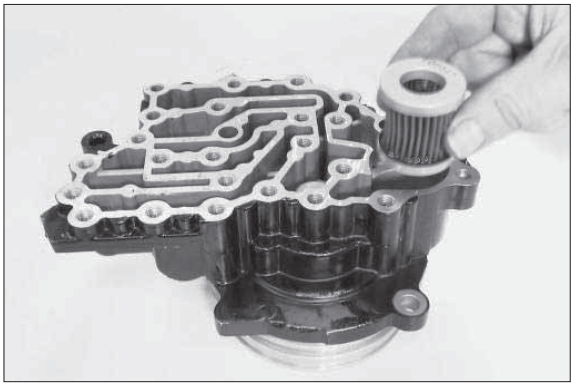
14WF8TM339

21) With counter-turning motions on pump shaft, swiveling of control housing (stop LH/ RH in pump cover) is audible.



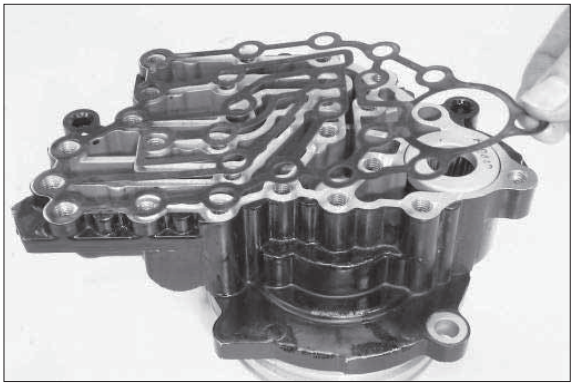
14WF8TM340

22) Insert screen filter.



14WF8TM341

23) Place gasket.

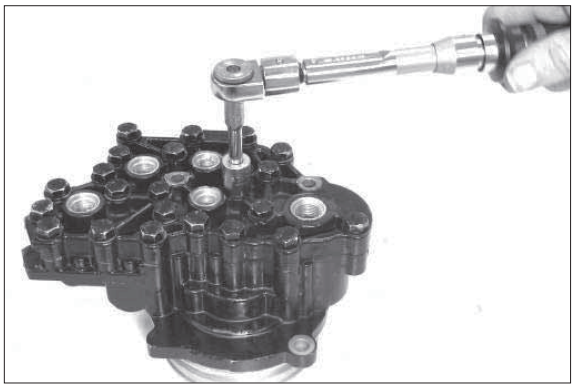


14WF8TM342

24) Place cover and fix with hexagon screws and disks.

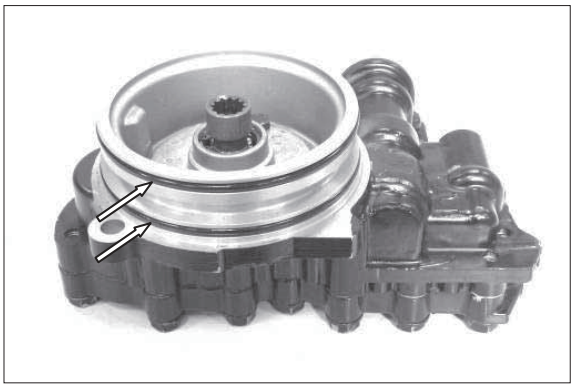
Tightening torque (M8/8.8) $M_A$ = 23 Nm

※ Pay attention to different screw length.



14WF8TM343

25) Oil both O-rings (arrows) and put them into annular groove of housing.

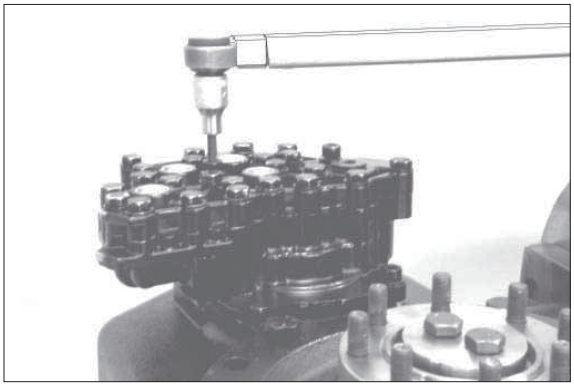


14WF8TM344

26) Insert cpl. shift interlock and fix with cylindrical screws with disks.

Tightening torque (M8/10.9) $M_A$ = 23 Nm

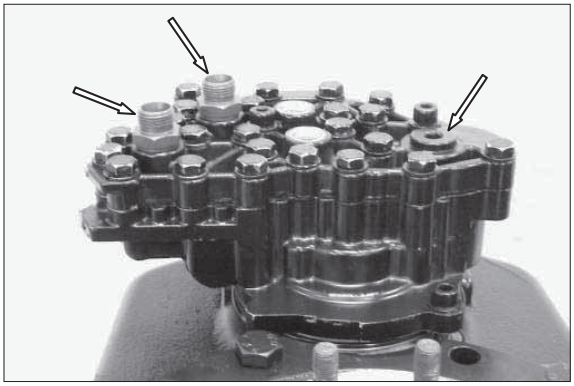
※ Pay attention to different screw length.



14WF8TM345

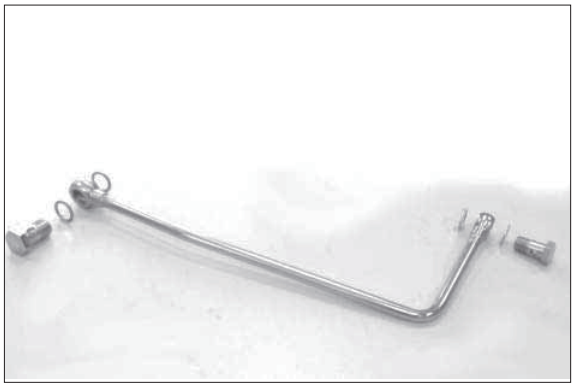
27) Install both screw-in sleeves and screw plug (see arrow) with O-rings.

Screw-in sleeve (M 16×1.5) $M_A$ = 30 Nm
Screw plug (M 18×1.5) $M_A$ = 35 Nm



14WF8TM346

28) 1 = Oil tube
2 = Hollow screw (M16×1.5)
3 = Seal ring
4 = Hollow screw (M14×1.5)
5 = Seal ring

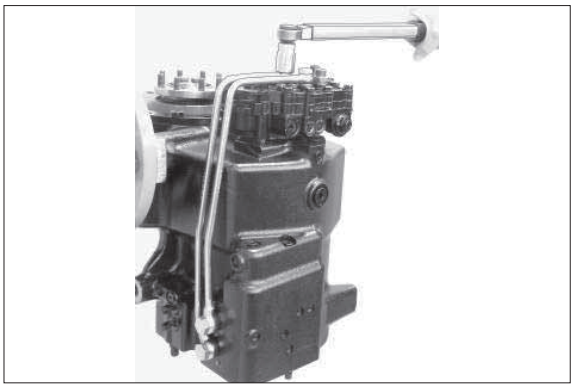


14WF8TM347

29) Mount oil tubes.

Hollow screw (M14 × 1.5) $M_A$ = 40 Nm
Hollow screw (M16 × 1.5) $M_A$ = 40 Nm

※ Prior to putting the unit into operation, observe the specifications and regulations.

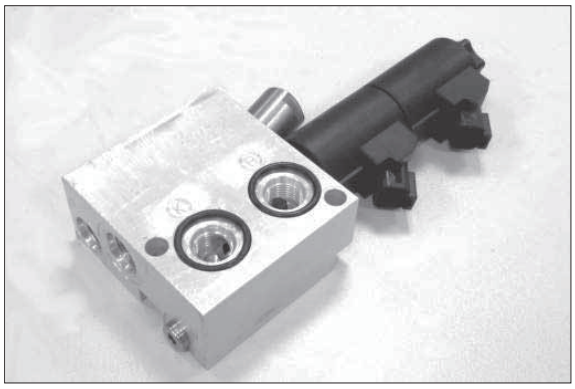


14WF8TM3428

## 13. VALVE BLOCK (shifting low gear – high gear)

1) Insert O-rings (see arrows) into countersinks of valve block.

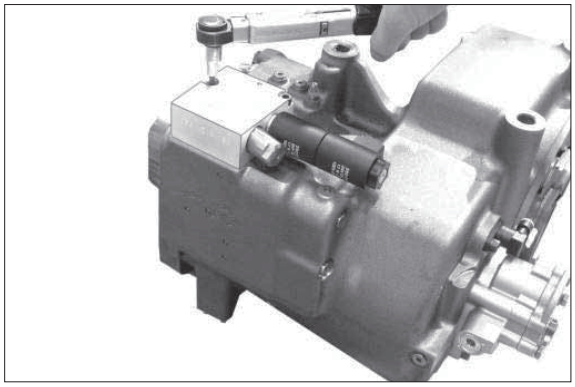
※ Use grease as assembly aid.



14WF8TM349

2) Fix cpl. valve block with cylindrical screws.

Tightening torque (M8/10.9) $M_A$ = 23 Nm

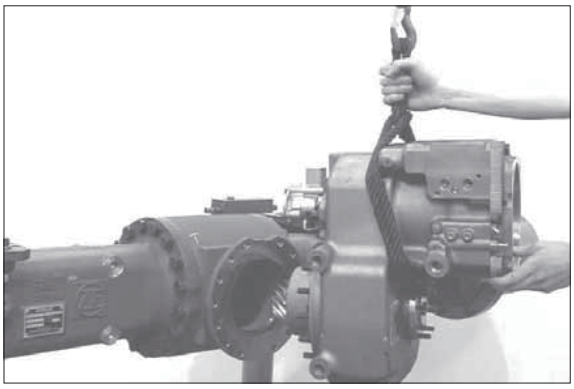


14WF8TM350

## 14. Mount TRANSMISSION to AXLE (only for version axle attachment)

1) Position complete transmission to axle.

(S) Lifting strap 5870 281 026

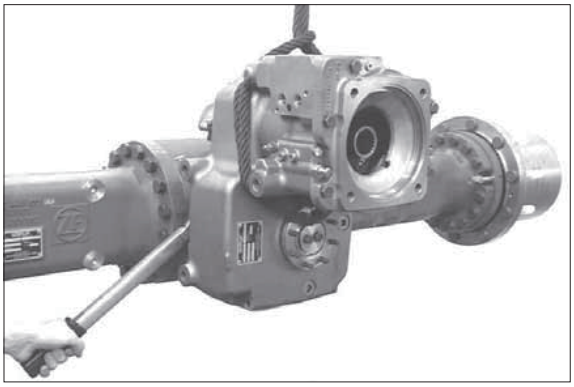


14WF8TM351

2) Fix transmission to axle with hexagon screws and nuts.

Tightening torque (M12/8.8) $M_A$ = 79 Nm

※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM352

## 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.

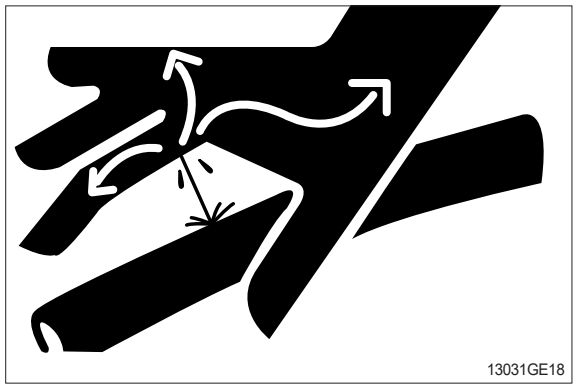
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

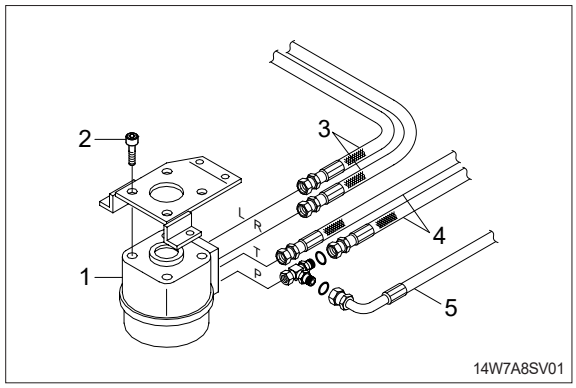
⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

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

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

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




### 2) INSTALL

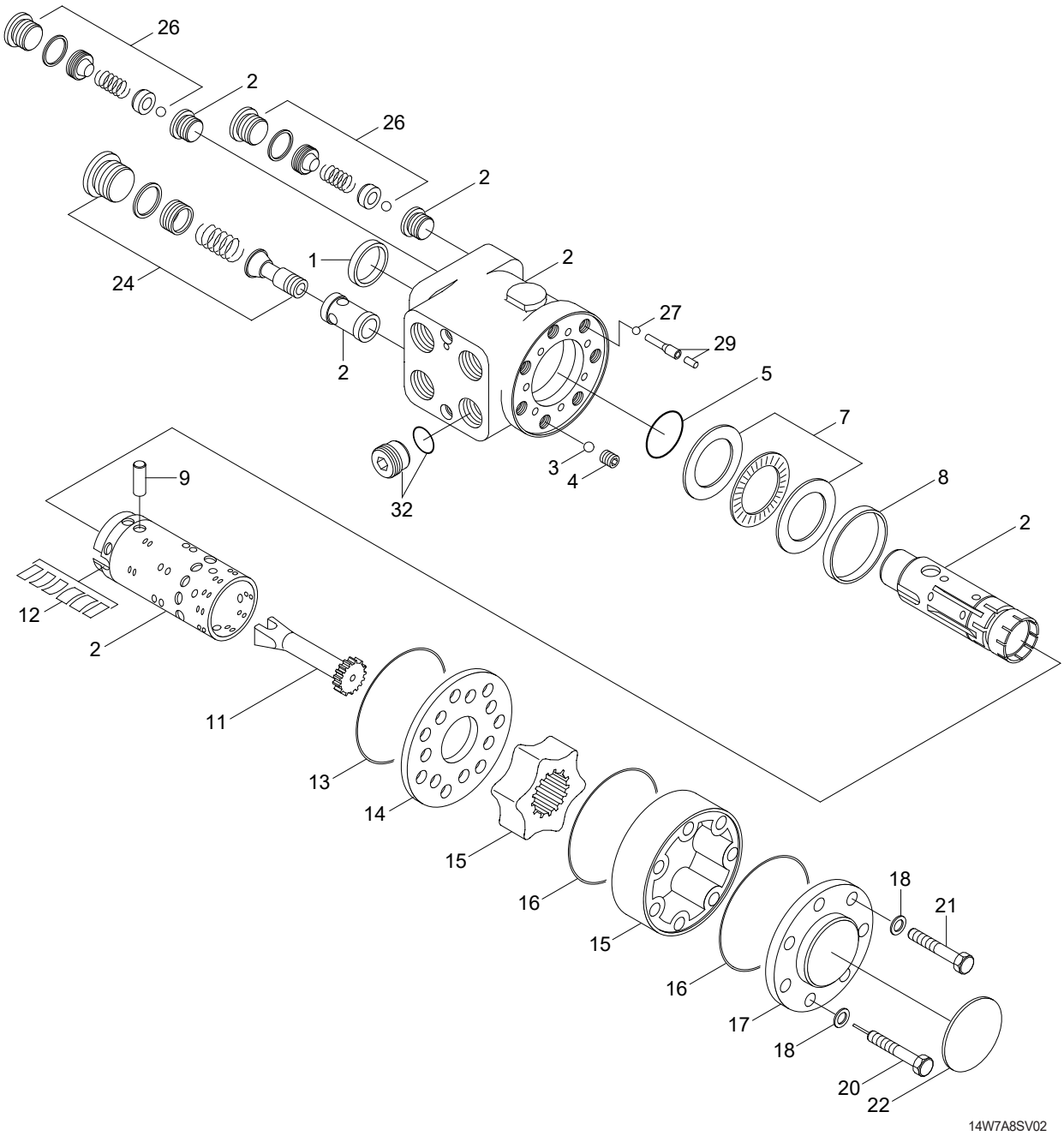
(1) Carry out installation in the reverse order to removal.

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

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

## 2. STEERING VALVE

### 1) STRUCTURE

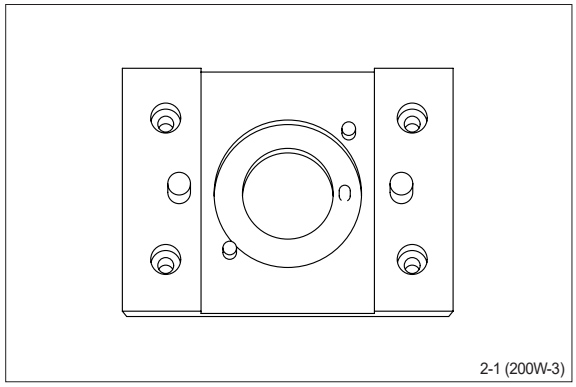



| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust seal ring | 11 | Cardan shaft | 20 | Pin screw |
| 2 | *Housing, spool, sleeve | 12 | Spring set | 21 | Screw |
| 3 | Ball | 13 | O-ring | 22 | Name plate |
| 4 | Bushing | 14 | Distributor plate | 24 | Relief valve assy |
| 5 | O-ring | 15 | Gear wheel set | 26 | Shock valve |
| 7 | Bearing assy | 16 | O-ring | 27 | Ball |
| 8 | Ring | 17 | End cover | 29 | W/pin bushing |
| 9 | Cross pin | 18 | Washer | 32 | Check valve |

* Housing, spool and sleeve (check valve and the seats for relief and dual shock valves are loctited).

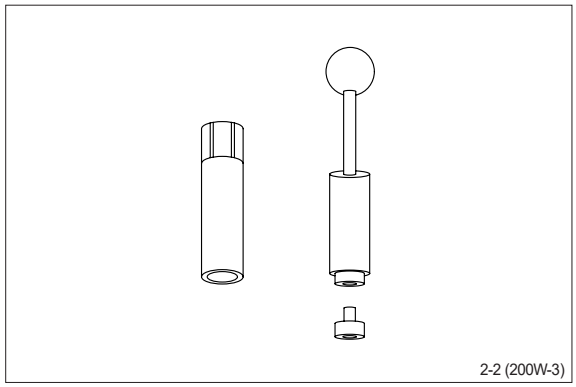
## 2) TOOLS

(1) Holding tool.



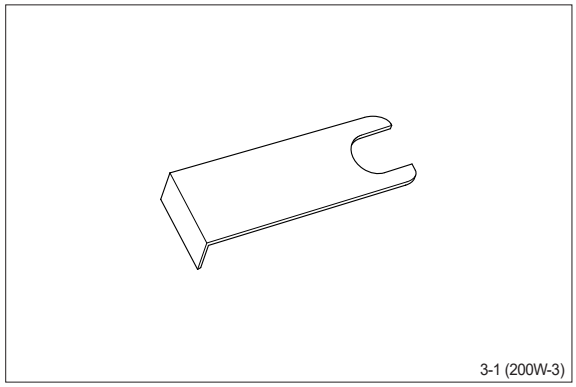
2-1 (200W-3)

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



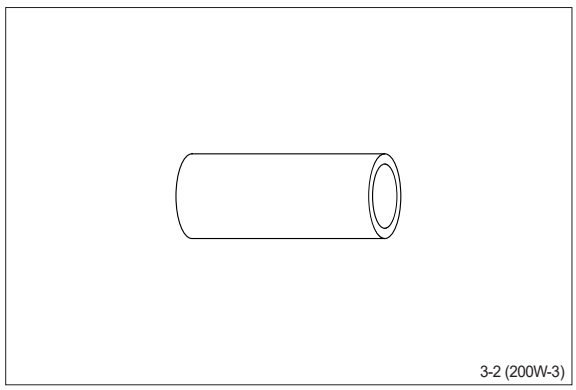
2-2 (200W-3)

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



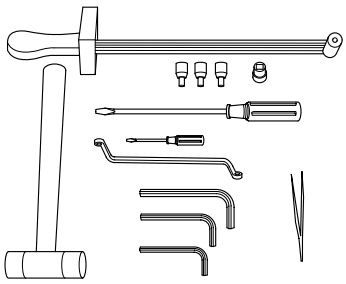
3-1 (200W-3)

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



3-2 (200W-3)

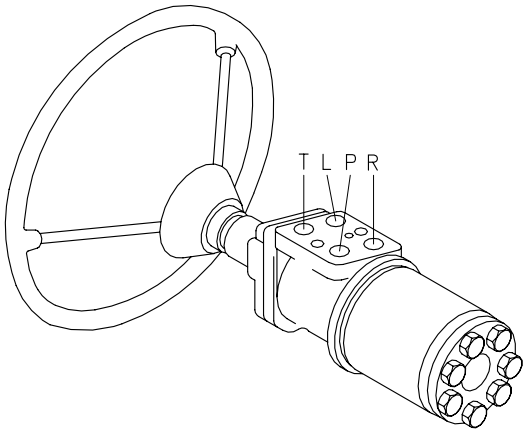
(5) Torque wrench : 0~7.1 kgf · m
(0~54.4 lbf · ft)
13 mm socket spanner.
6, 8 mm and 12 mm hexagon sockets.
12 mm screwdriver.
2 mm screwdriver.
13 mm ring spanner.
6,8 mm and 12 mm hexagon socket spanners.
Plastic hammer.
Tweezers.



3-3 (200W-3)

### 3) TIGHTENING TORQUE AND HYDRAULIC CONNECTIONS

#### (1) Hydraulic connections




L : Left port
R : Right port
T : Tank
P : Pump

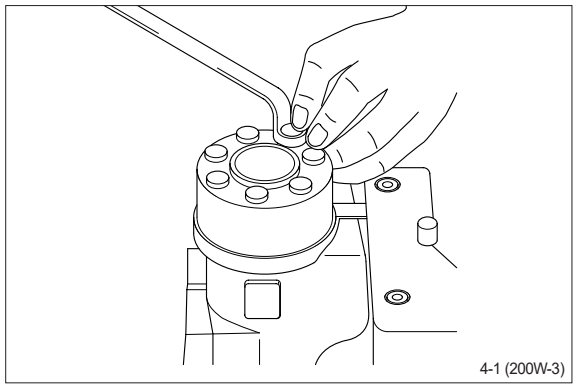
17038SV03

#### (2) Tightening torque

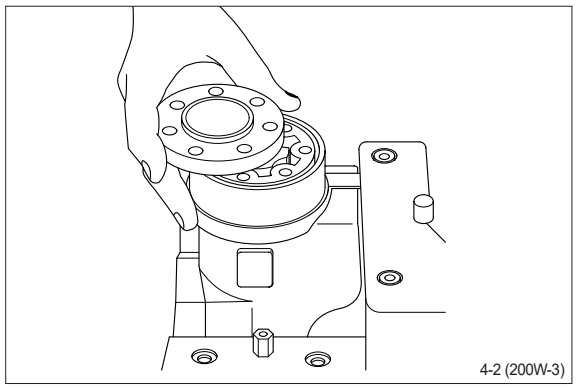
| Screwed connection | Max. tightening torque kgf · m (lbf · ft) | | | |
|---|---|---|---|---|
| | With cutting edge | With copper washer | With aluminum washer | With O-ring |
| 1.4 BSP.F | 4.1 (29.7) | 2.0 (14.5) | 3.1 (22.4) | - |
| 3/8 BSP.F | 6.1 (44.1) | 2.0 (14.5) | 5.1 (36.9) | - |
| 1/2 BSP.F | 10.2 (73.8) | 3.1 (22.4) | 8.2 (59.3) | - |
| 7/16-20 UNF | - | - | - | 2.0 (14.5) |
| 3/4-16 UNF | - | - | - | 6.1 (44.1) |
| M12 × 1.5 | 4.1 (29.7) | 2.0 (14.5) | 3.1 (22.4) | 2.0 (14.5) |
| M18 × 1.5 | 7.1 (51.4) | 2.0 (14.5) | 5.1 (36.9) | 5.1 (36.9) |
| M22 × 1.5 | 10.2 (73.8) | 3.1 (22.4) | 8.2 (59.3) | 7.1 (51.4) |

## 4) DISASSEMBLY

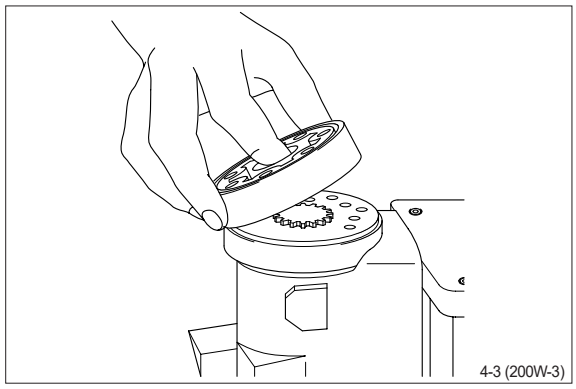
(1) Dissemble steering column from steering valve and place the steering valve in the holding tool.
Screw out the screws in the end cover (6-off plus one special screw).


4-1 (200W-3)

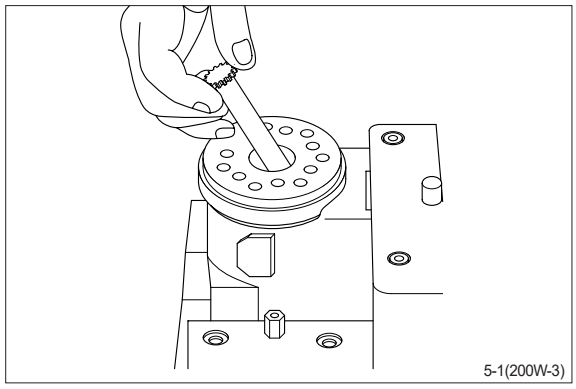
(2) Remove the end cover, sideways.


4-2 (200W-3)

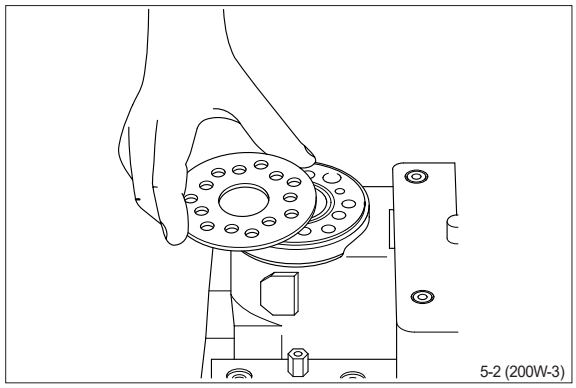
(3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.


4-3 (200W-3)

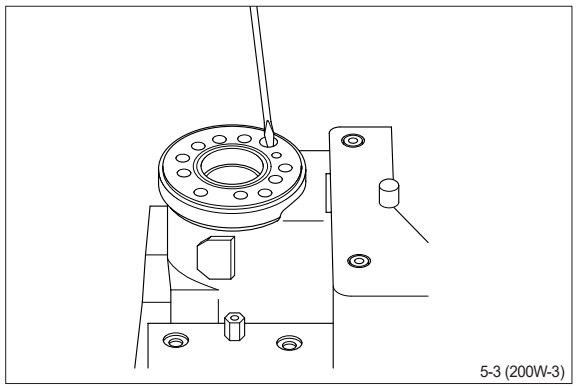
(4) Remove cardan shaft.


5-1(200W-3)

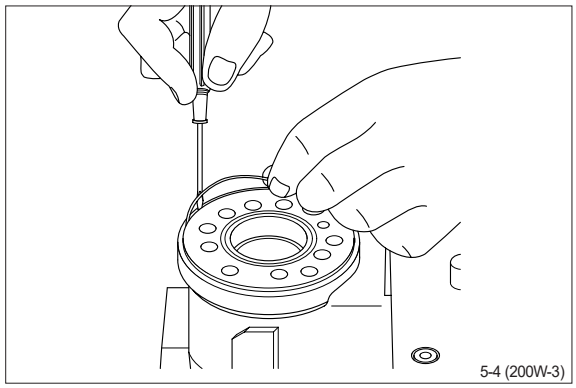
(5) Remove distributor plate.


5-2 (200W-3)

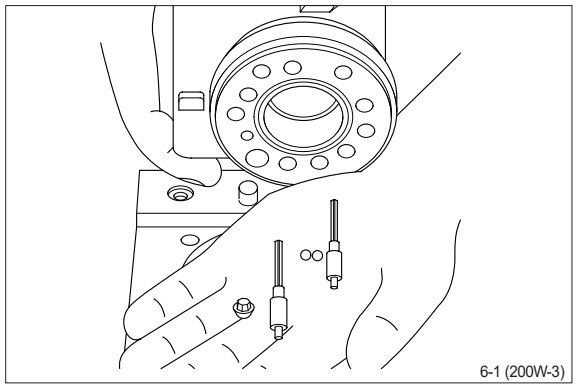
(6) Screw out the threaded bushing over the check valve.


5-3 (200W-3)

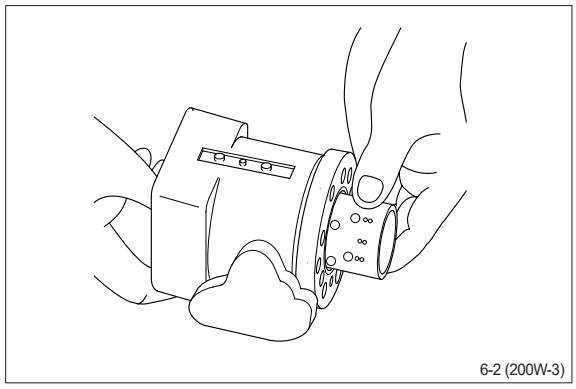
(7) Remove O-ring.


5-4 (200W-3)

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

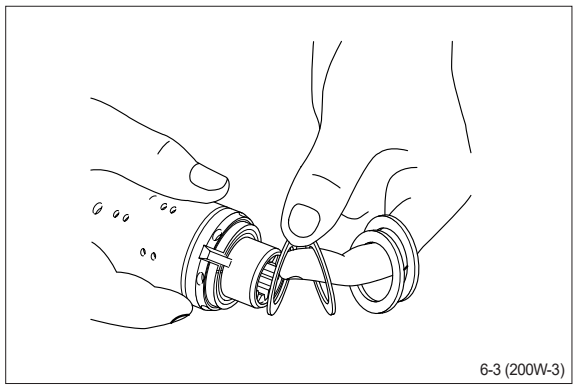

6-1 (200W-3)

(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.



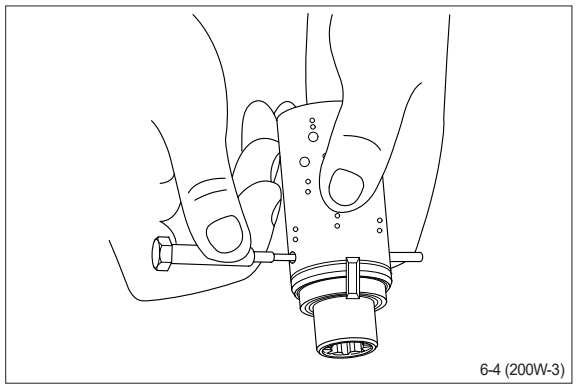
6-2 (200W-3)

(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.



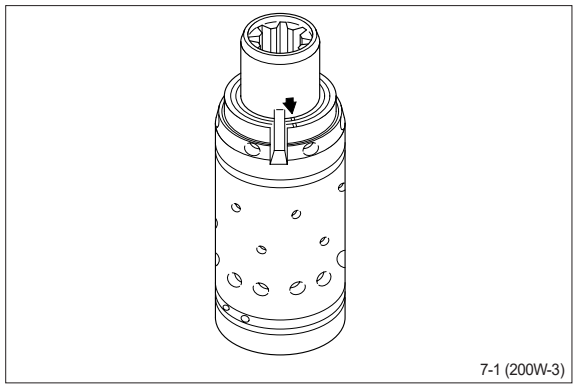
6-3 (200W-3)

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



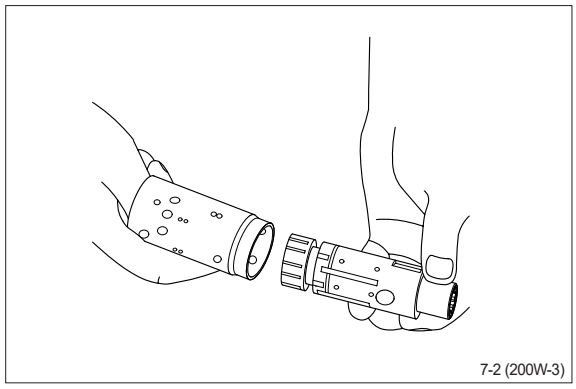
6-4 (200W-3)

※ 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.



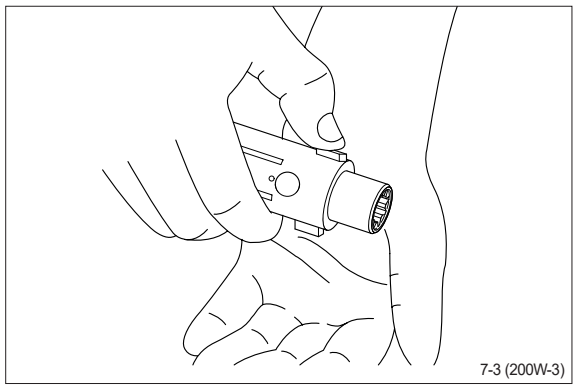
7-1 (200W-3)

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



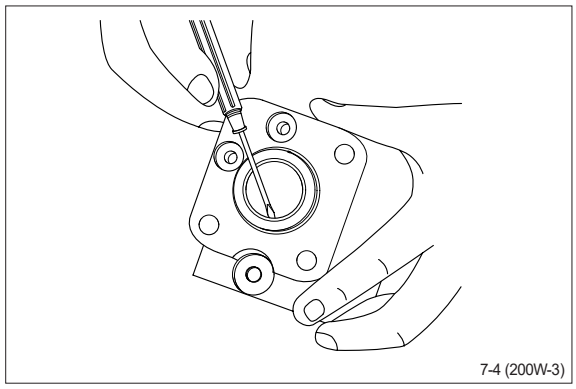
7-2 (200W-3)

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



7-3 (200W-3)

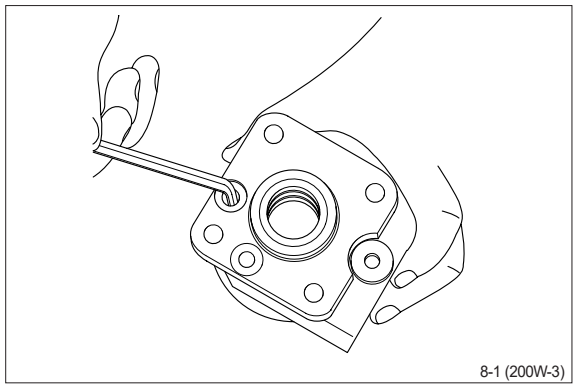
(14) Remove dust seal and O-ring.



7-4 (200W-3)

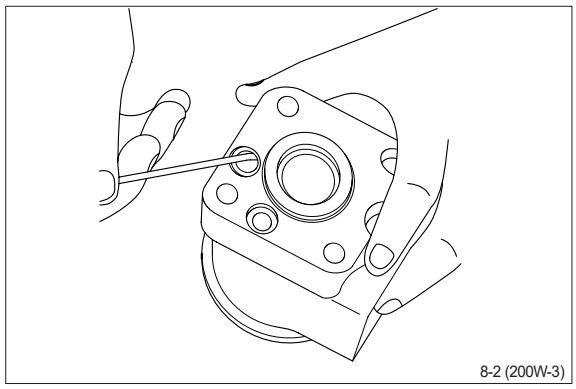
### (15) Disassemble the dual shock valve

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



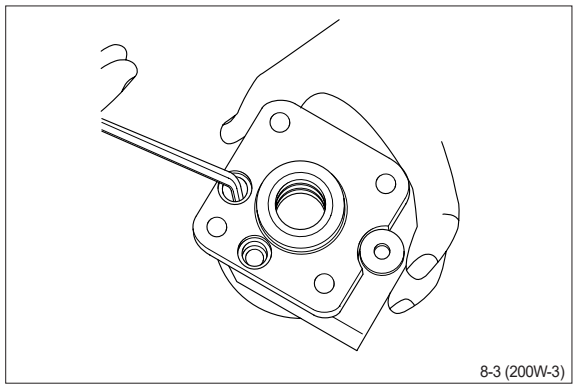
8-1 (200W-3)

② Remove seal washers (2-off).



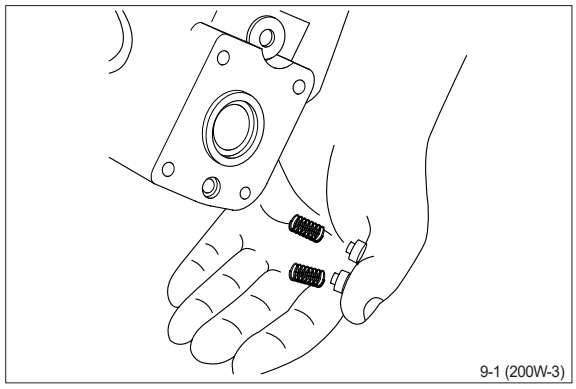
8-2 (200W-3)

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



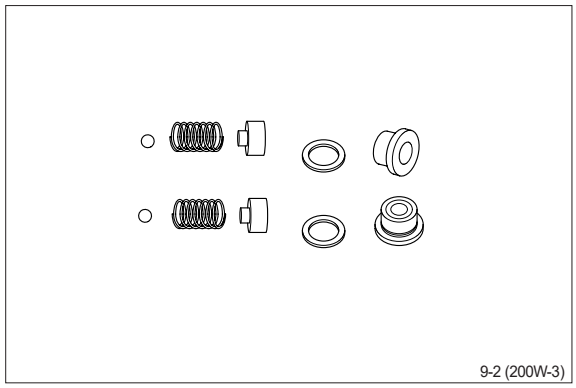
8-3 (200W-3)

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.



9-1 (200W-3)

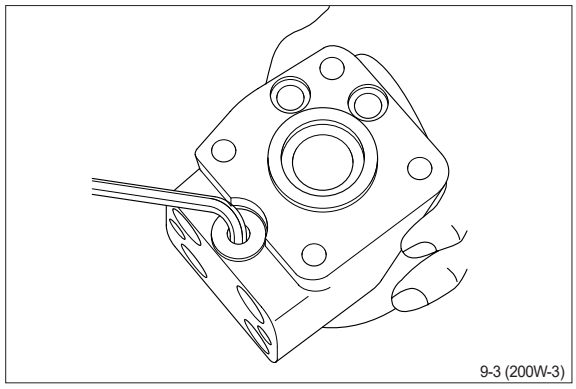
⑤ The dual shock valves are now disassembled.



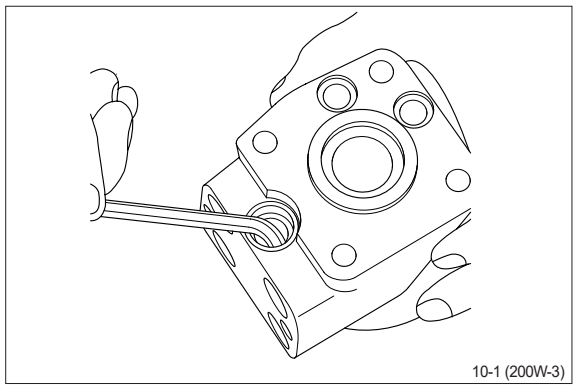
9-2 (200W-3)

**(16) Disassemble the pressure relief valve** (cartridge)

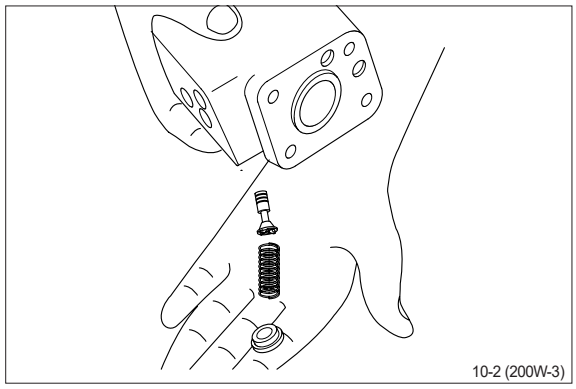
① Screw out the plug using an 8 mm hexagon socket spanner. Remove seal washers.


9-3 (200W-3)

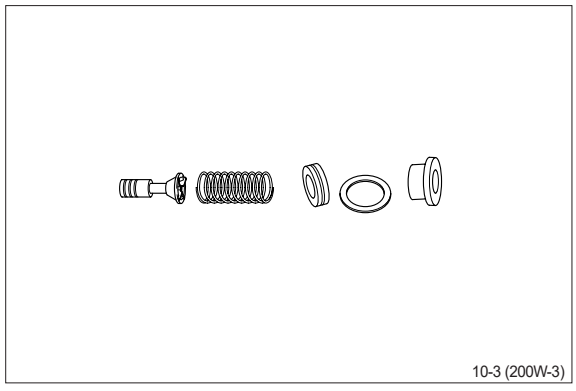
② Unscrew the setting screw using an 8mm hexagon socket spanner.


10-1 (200W-3)

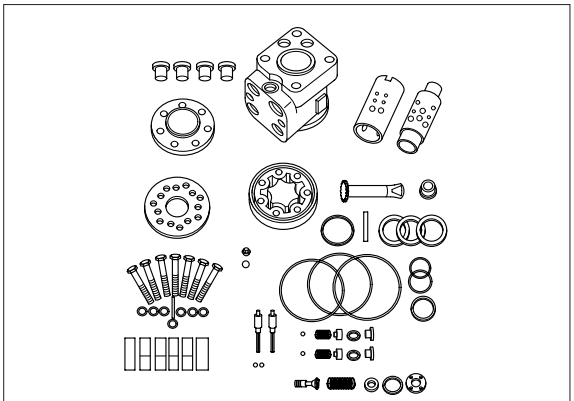
③ Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.


10-2 (200W-3)

④ The pressure relief valve is now disassembled.


10-3 (200W-3)

⑤ The steering valve is now completely disassembled.



12-1 (200W-3)

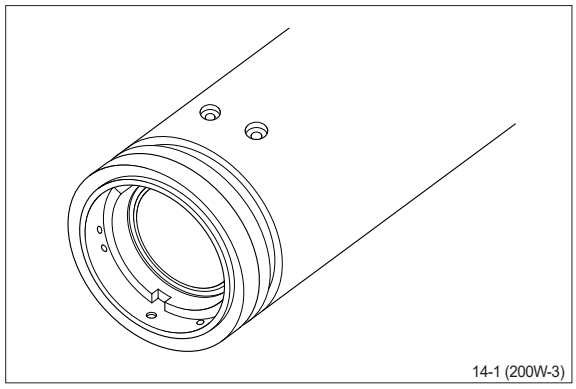
※ **Cleaning**
Clean all parts carefully in shellsol K or the like.

※ **Inspection and replacement**
Replace all seals and washers. Check all parts carefully and make any replacements necessary.

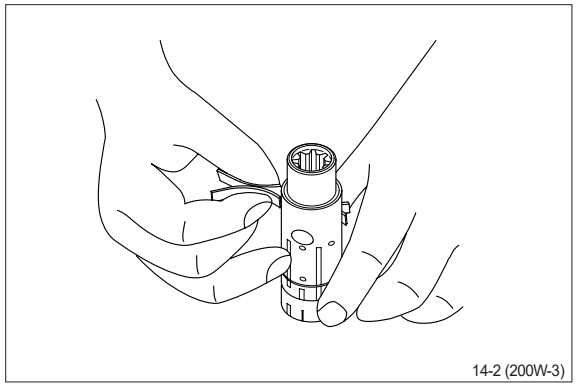
※ **Lubrication**
Before assembly, lubricate all parts with hydraulic oil.

## 5) ASSEMBLY

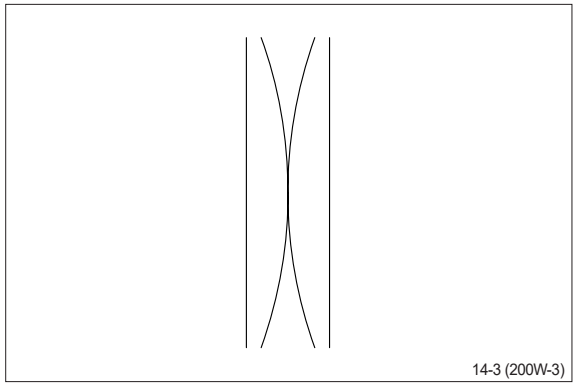
(1) Assemble spool and sleeve.
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.
Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible through the slots in the spool.


14-1 (200W-3)

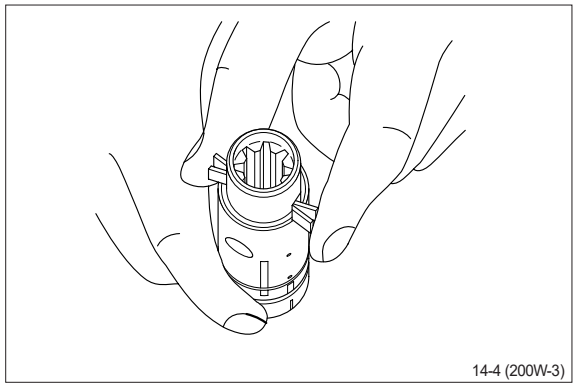
(2) Place the two flat neutral position springs in the slot.
Place the curved springs between the flat ones and press them into place (see assembly pattern).


14-2 (200W-3)

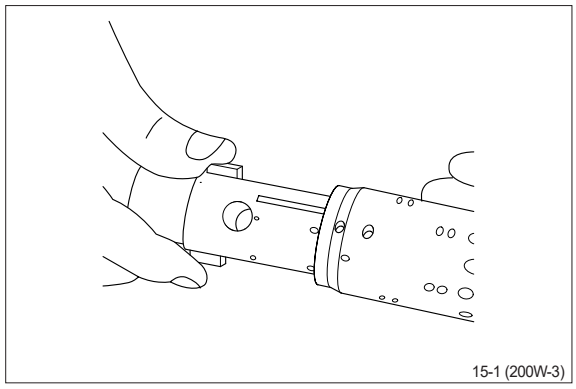
※ Assembly pattern.
· Part no : 150N4035


14-3 (200W-3)

(3) Line up the spring set.

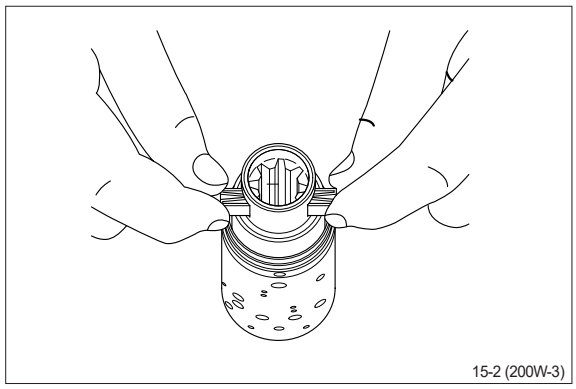

14-4 (200W-3)

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



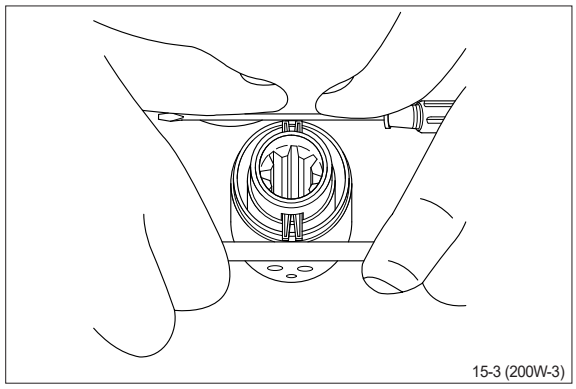
15-1 (200W-3)

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



15-2 (200W-3)

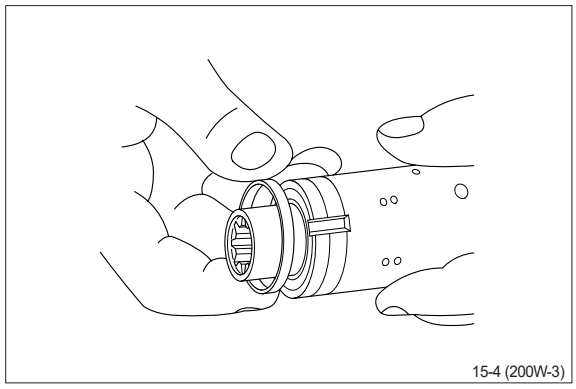
(6) Line up the springs and center them.



15-3 (200W-3)

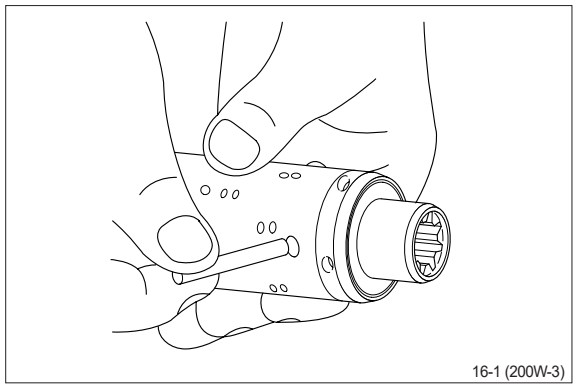
(7) Guide the ring down over the sleeve.

※ The ring should be able to rotate free of the springs.



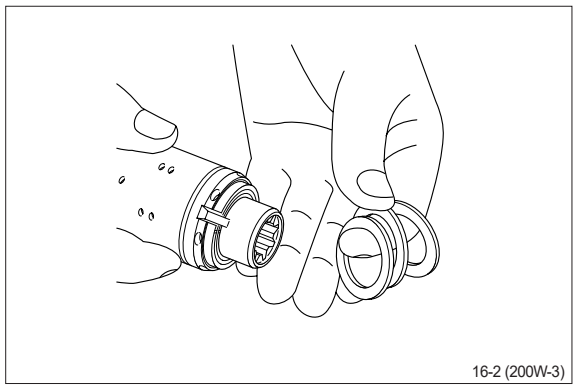
15-4 (200W-3)

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



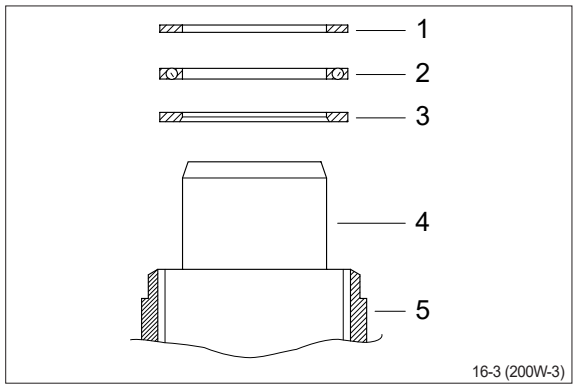
16-1 (200W-3)

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



16-2 (200W-3)

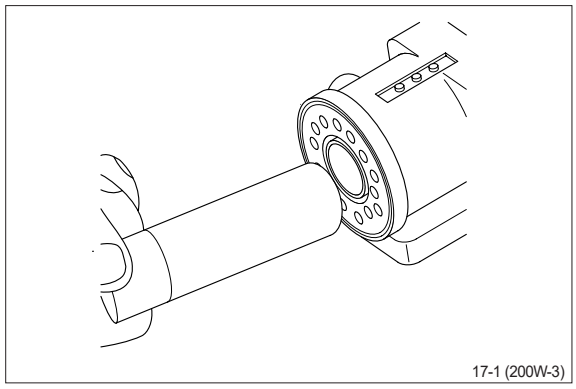
※ Assembly patted for standard bearings
1 Outer bearing race
2 Needle bearing
3 Inner bearing race
4 Spool
5 Sleeve




16-3 (200W-3)

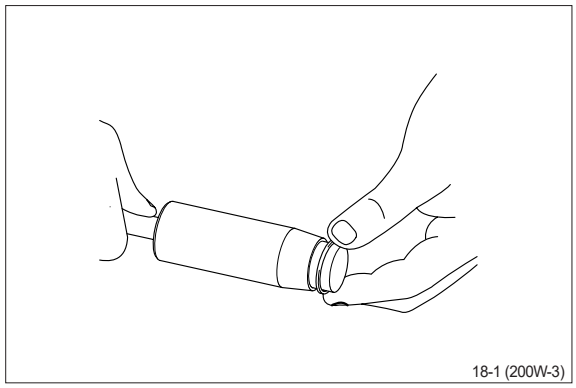
Installation instruction for O-ring

(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.

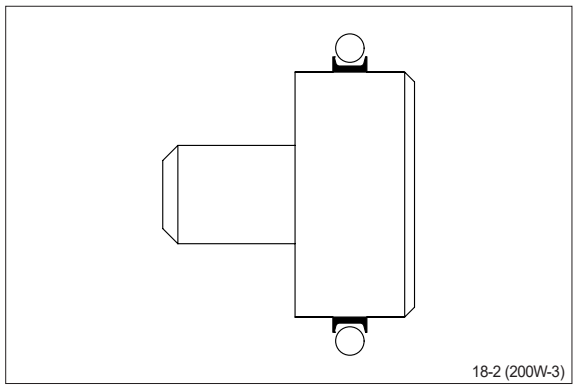


17-1 (200W-3)

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

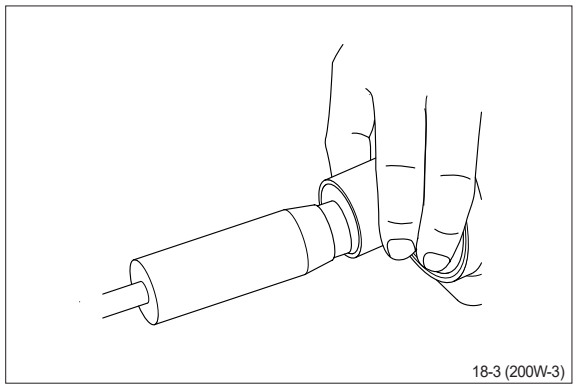


18-1 (200W-3)



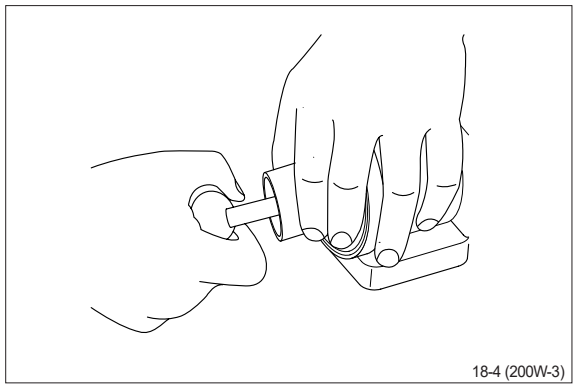
18-2 (200W-3)

(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.



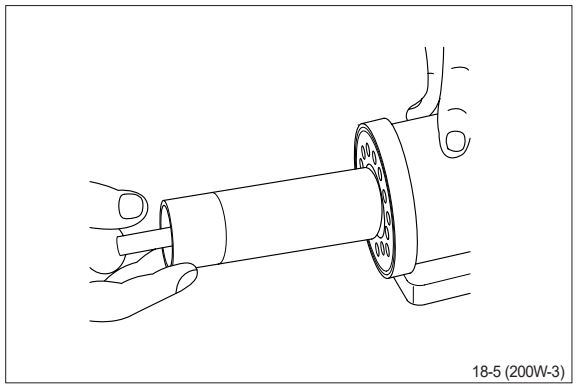
18-3 (200W-3)

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



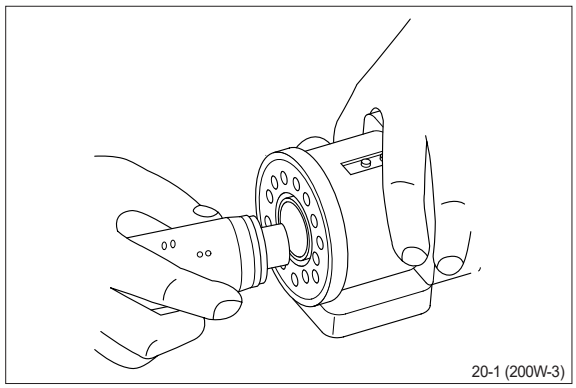
18-4 (200W-3)

(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.

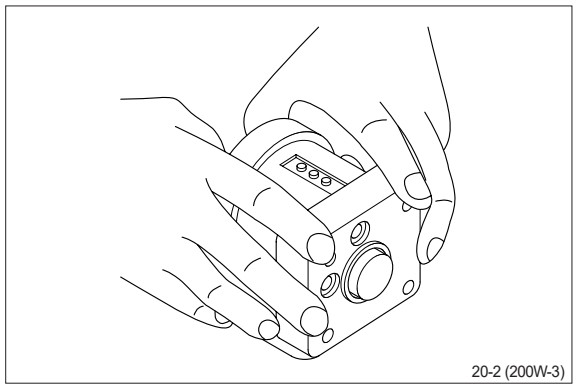

18-5 (200W-3)

(15) With a light turning movement, guide the spool and sleeve into the bore.

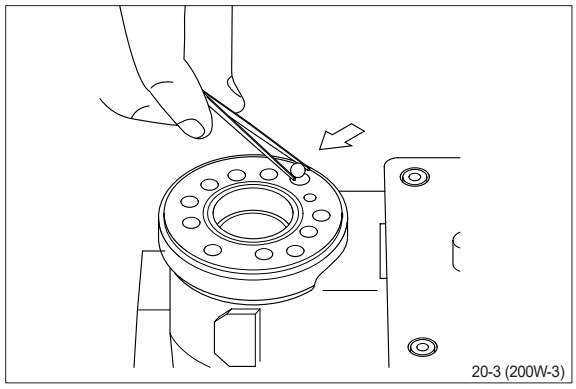
※ Fit the spool set holding the cross pin horizontal.


20-1 (200W-3)

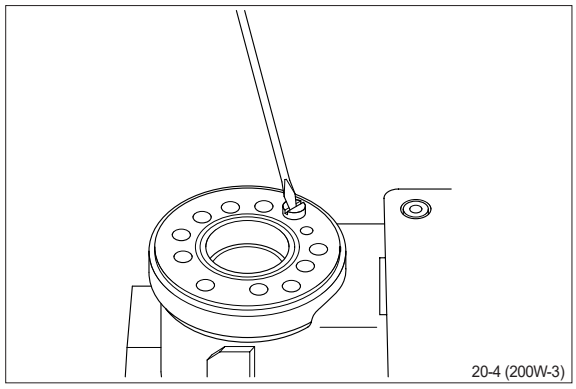
(16) The spool set will push out the assembly tool guide. The O-ring is now in position.


20-2 (200W-3)

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

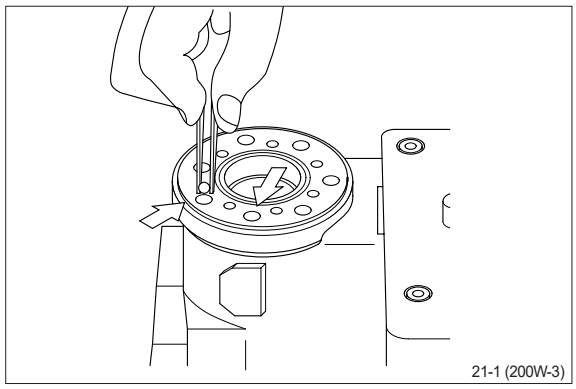

20-3 (200W-3)

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

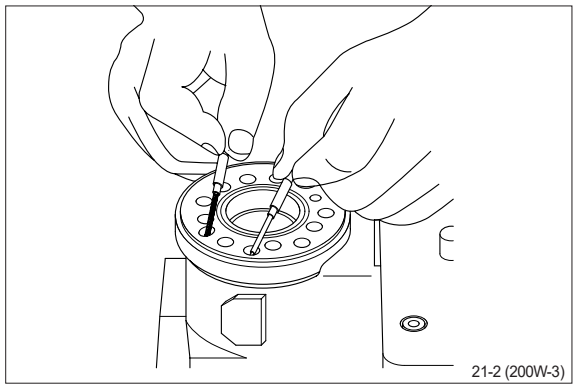



**Assembly of the two suction valve**

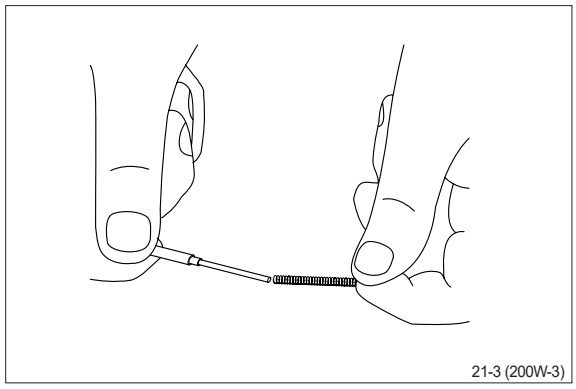
(19) Place a ball in the two holes indicated by the arrows.



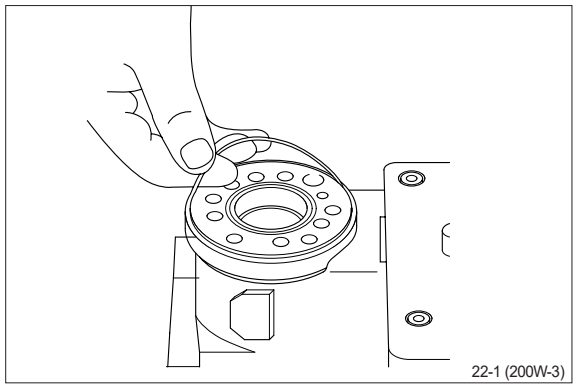

(20) Place a pin in the same two holes.



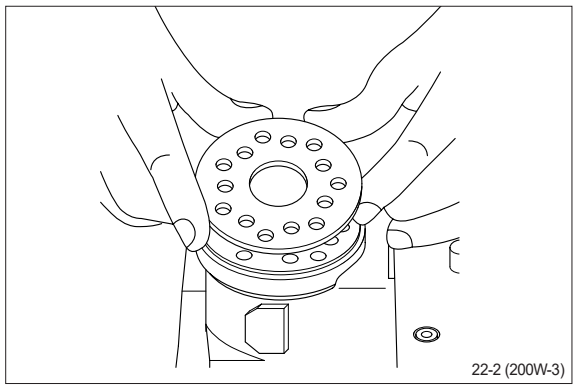

(21) In some cases a spring has to be fitted on the pin before it is placed in the housing.



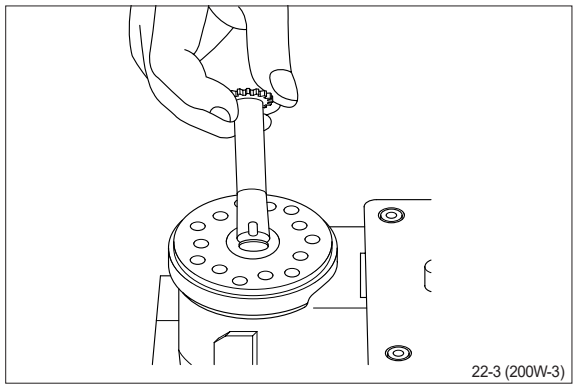
(22) Grease the O-ring with mineral oil approx viscosity 500 cST at 20°C.


22-1 (200W-3)

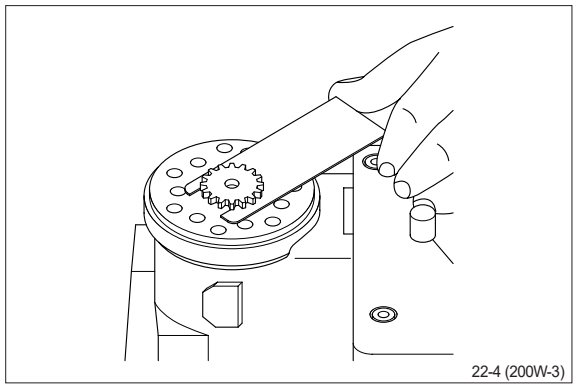
(23) Place the distributor plate so that the channel holes match the holes in the housing.


22-2 (200W-3)

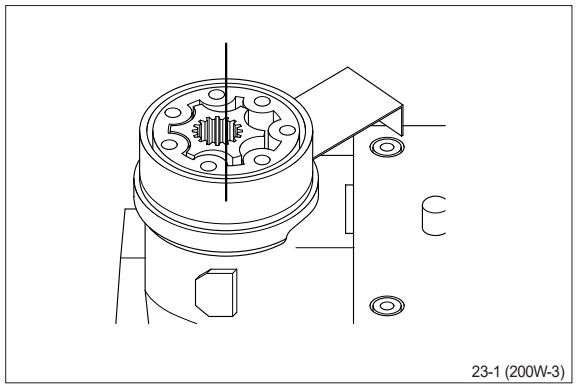
(24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.


22-3 (200W-3)

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

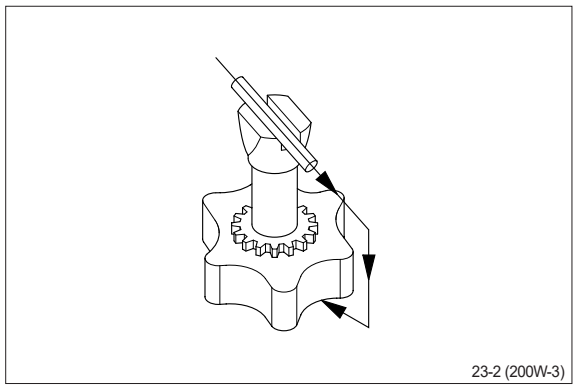

22-4 (200W-3)

(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.



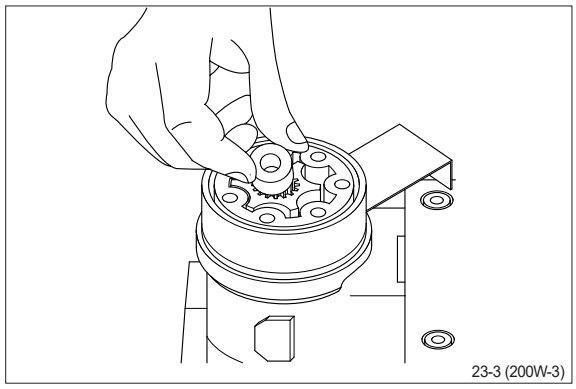
23-1 (200W-3)

(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.



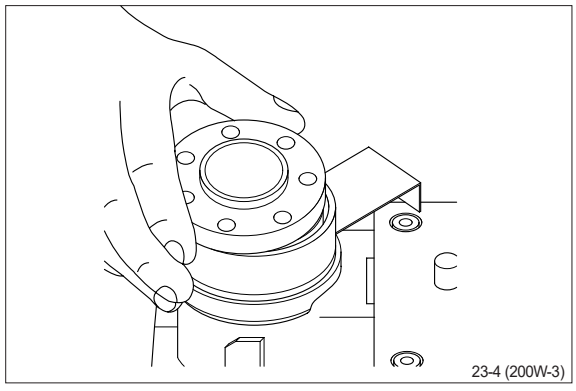
23-2 (200W-3)

(28) Fit the spacer, if any.



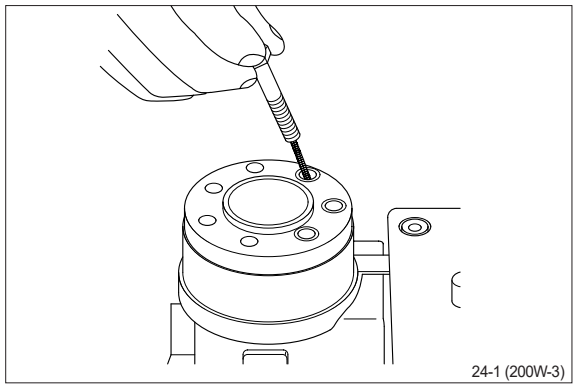
23-3 (200W-3)

(29) Place the end cover in position.



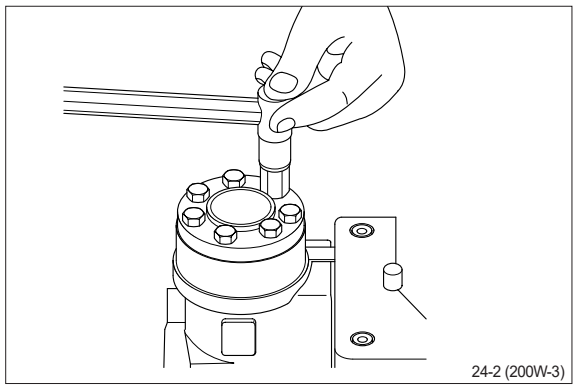
23-4 (200W-3)

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

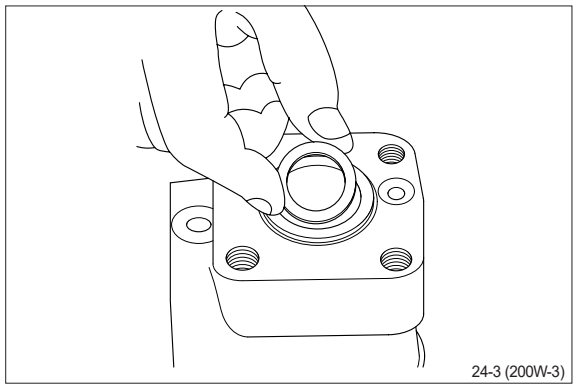

24-1 (200W-3)

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

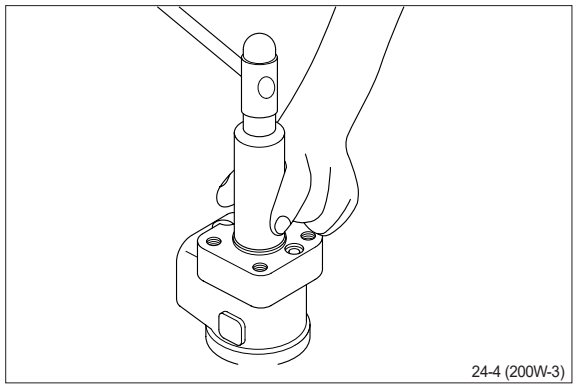
· Tightening torque : 3.0 ± 0.6 kgf · m
(22.4 ± 4.3 lbf · ft)


24-2 (200W-3)

(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.

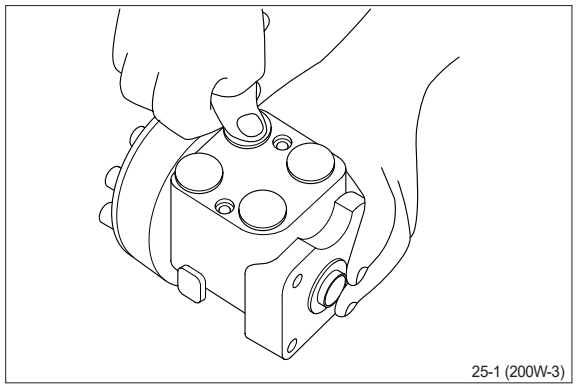

24-3 (200W-3)

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


24-4 (200W-3)

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

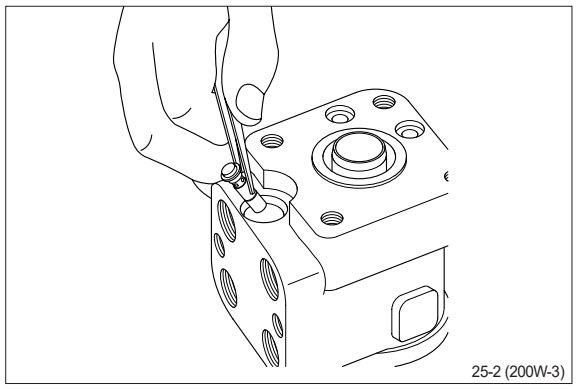
※ Do not use a hammer!



25-1 (200W-3)

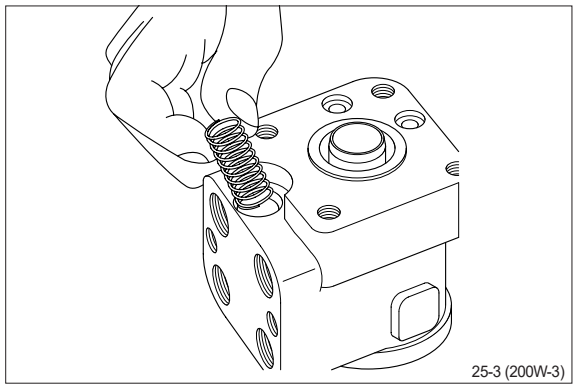
**Assembly of the pressure relief valve**

(35) Fit the piston.



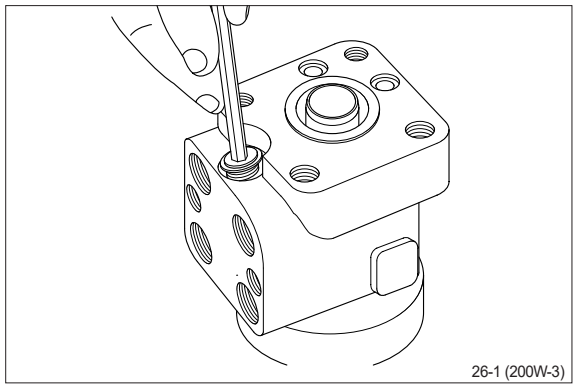
25-2 (200W-3)

(36) Fit the spring.



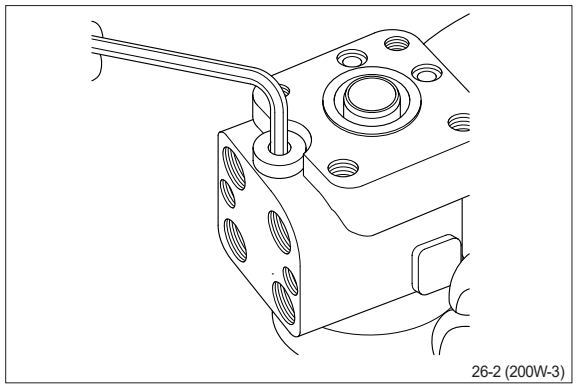
25-3 (200W-3)

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



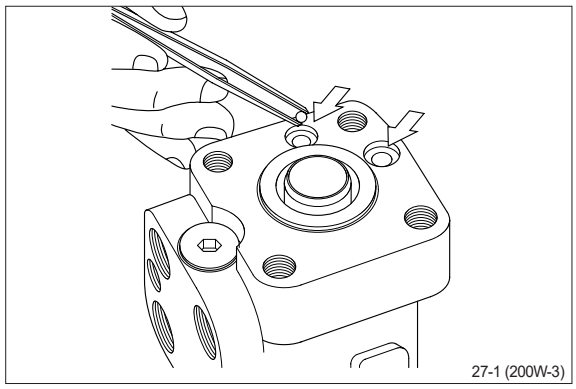
26-1 (200W-3)

(38) Screw plug with dust seal into the housing using an 8㎜ hexagon socket spanner.
・Tightening torque : 5.1±1.0 kgf・m
(36.9±7.2 lbf・ft)

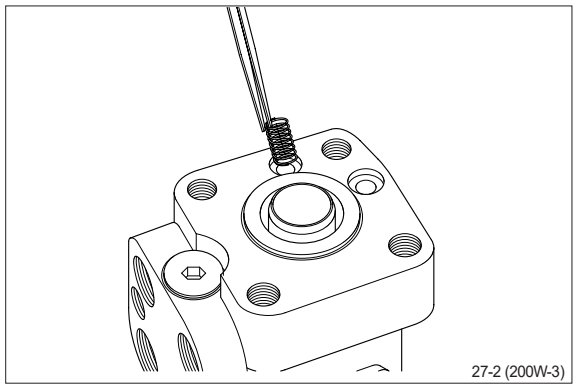

26-2 (200W-3)

**Assembly of the dual shock valve**

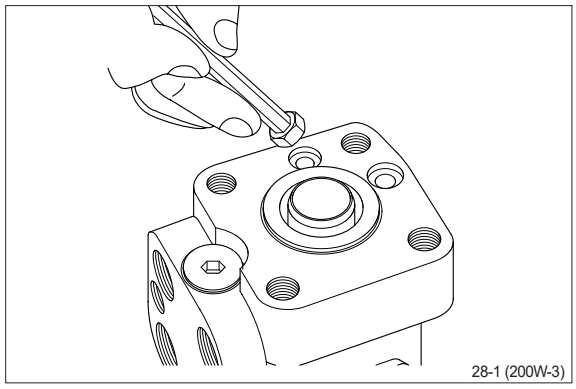
(39) Put a ball in the two holes indicated by the arrows.


27-1 (200W-3)

(40) Place springs and valve cones over the two balls.

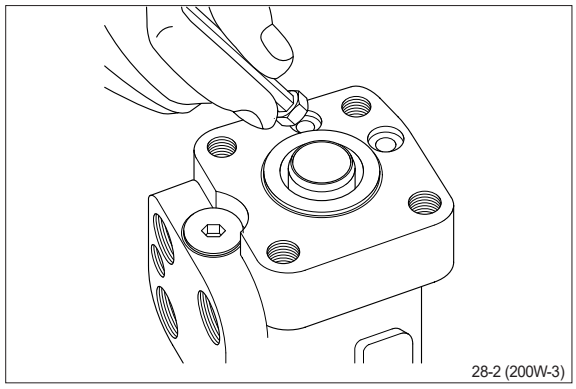

27-2 (200W-3)

(41) Screw in the two setting screws using a 6㎜ hexagon socket spanner. Make the pressure setting on a panel or the machine.


28-1 (200W-3)

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

· Tightening torque : 3.1 ㎏f · m
(22.4 lbf · ft)

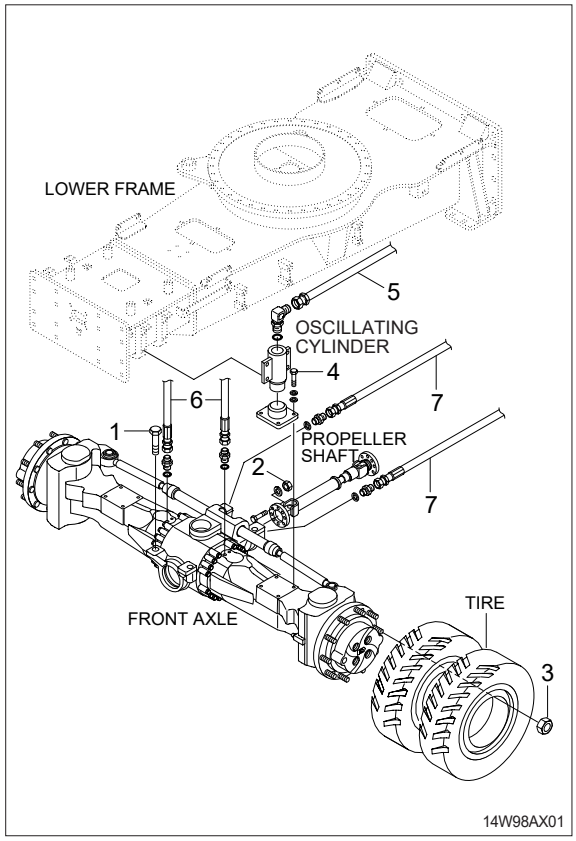

28-2 (200W-3)

Steering valve is now assembled.

## A. FRONT AND REAR AXLE (up to #0073)

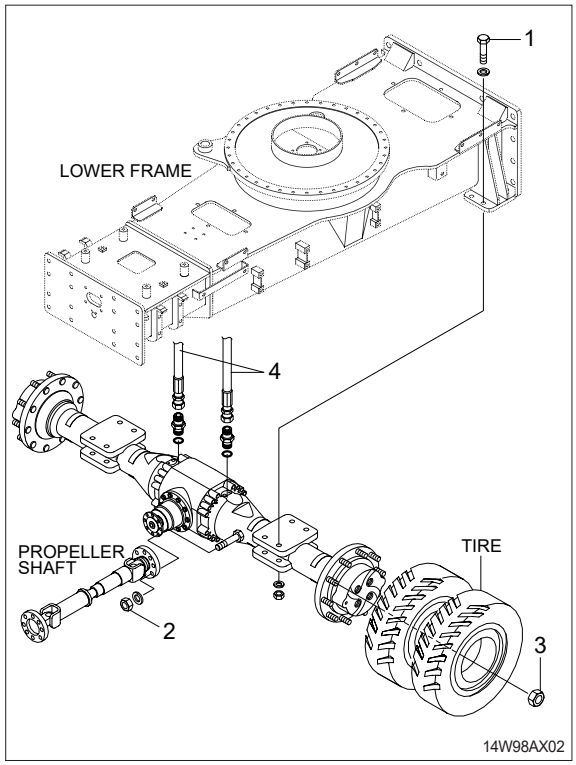
### 1. REMOVAL FRONT AXLE

1) Front axle mounting bolt (1, M22)
   · Tightening torque : 83.2±9.2 kgf · m
   (602±66.5 lbf · ft)
2) Propeller shaft mounting nut (1, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)
3) Wheel nut (2, M22)
   · Tightening torque : 60 $^{+0}_{-5}$ kgf · m
   (433 $^{+0}_{-36.2}$ lbf · ft)
4) Oscillating cylinder supporting mounting bolt (3, M12)
   · Tightening torque : 12.3±2.5 kgf · m
   (88.9±18.1 lbf · ft)
5) Pipe assy (4)
6) Hose assy (5)
7) Front axle weight : 520 kg (1150 lb)




### 2. REMOVAL REAR AXLE

1) Rear axle mounting bolt and nut (1, M20)
   · Tightening torque : 58±6.3 kgf · m
   (419±45.5 lbf · ft)
2) Propeller shaft mounting nut (2, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)
3) Wheel nut (3)
   · Tightening torque : 60 $^{+0}_{-5}$ kgf · m
   (433 $^{+0}_{-36.2}$ lbf · ft)
4) Hose assy (4)
5) Rear axle weight : 480 kg (1060 lb)



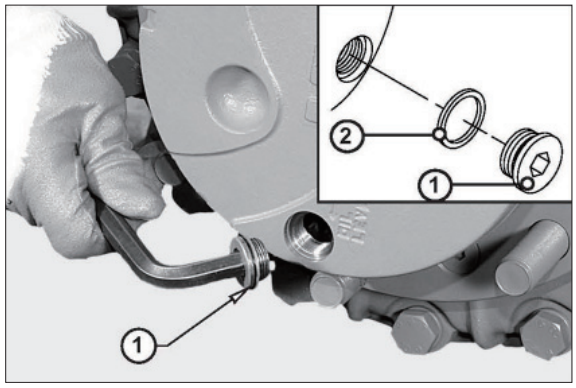
## 3. GENERAL INSTRUCTIONS

1) During all operations described in this manual, the axle should be fastened onto a trestle, while the other parts mentioned should rest on supporting benches.
2) When removing one of the arms, an anti-tilting safety trestle should be placed under the other arm.
3) When working on an arm that is fitted on the machine, make sure that the supporting trestles are correctly positioned and that the machine is locked lengthways.
4) Do not admit any other person inside the work area; mark off the area, hang warning signs and remove the ignition key from the machine.
5) Use only clean, quality tools; discard all worn, damaged, low-quality or improvised wrenches and tools. Ensure that all dynamometric wrenches have been checked and calibrated.
6) Always wear gloves and non-slip rubber shoes when performing repair work.
7) Should you stain a surface with oil, remove marks straight away.
8) Dispose of all lubricants, seals, rags and solvents once work has been completed. Treat them as special waste and dispose of them according to the relative law provisions obtaining in the country where the axles are being overhauled.
9) Make sure that only weak solvents are used for cleaning purposes; avoid using turpentine, dilutants and toluol-, xylol- based or similar solvents; use light solvents such as kerosene, mineral spirits or water-based, environment friendly solvents.
10) For the sake of clarity, the parts that do not normally need to be removed have not been reproduced in some of the diagrams.
11) The terms RIGHT and LEFT in this manual refer to the position of the operator facing the axle from the side opposite the drive.
12) After repair work has been completed, accurately touch up any coated part that may have been damaged.

## 4. THE PLANETARY REDUCTION AND AXLE SHAFT

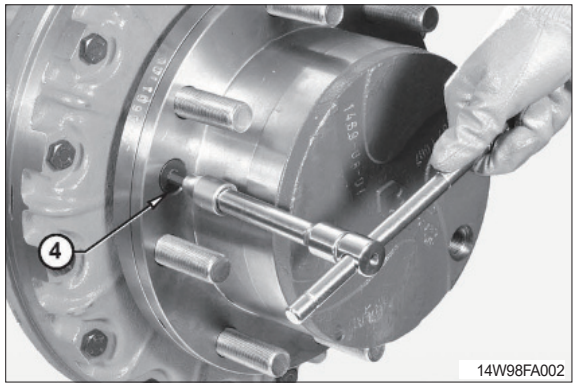
### 1) DISASSEMBLE

(1) Remove oil-level plug (1) and oil.



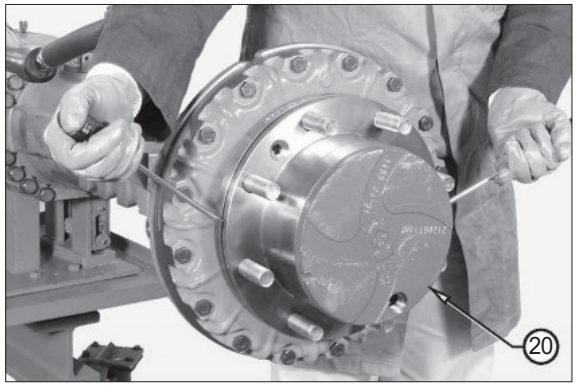
14W98FA001

(2) Remove the securing screws (4) from the planetary carrier cover.



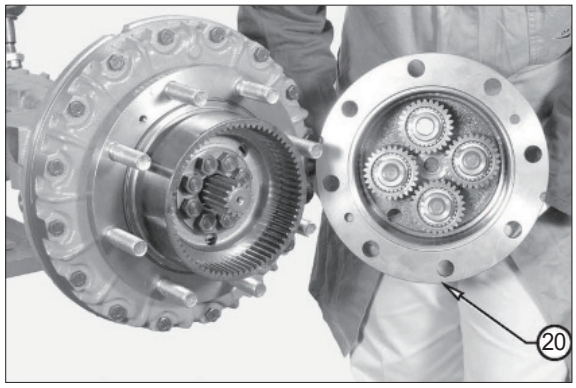
14W98FA002

(3) Disjoint the planetary carrier cover (20) by alternatively forcing a screwdriver into the appropriate slots.



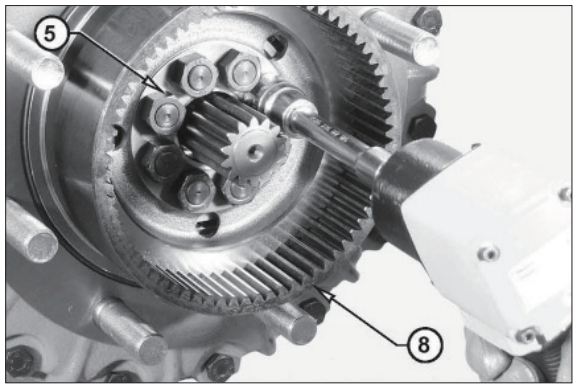
14W98FA003

(4) Remove the complete planetary carrier cover (20) .



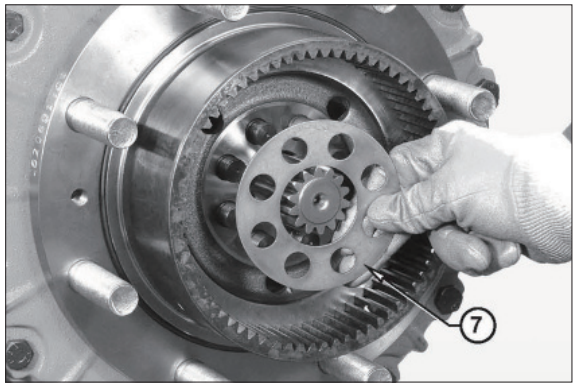
14W98FA004

(5) Unloose and remove the tightening nuts (5) from the crown flange (8).



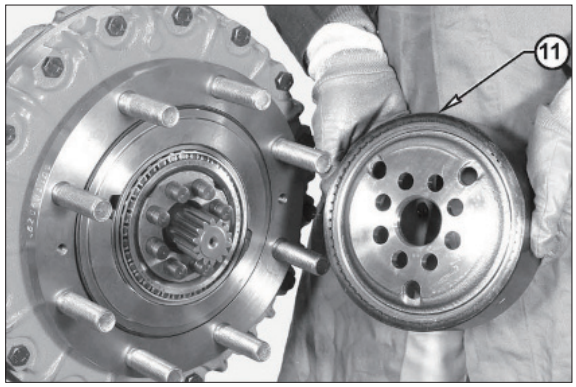
14W98FA005

(6) Remove the safety flange (7).



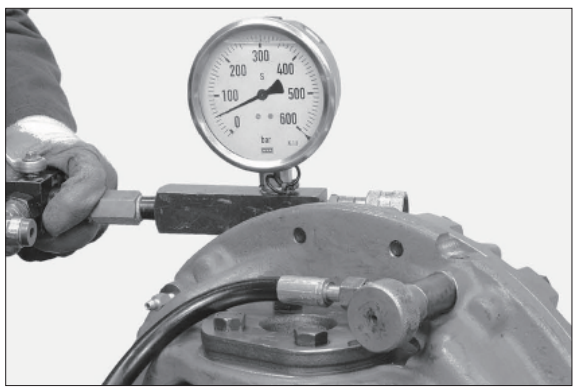
14W98FA006

(7) Using a puller, remove the complete crown flange (11) by acting on the stud bolts.



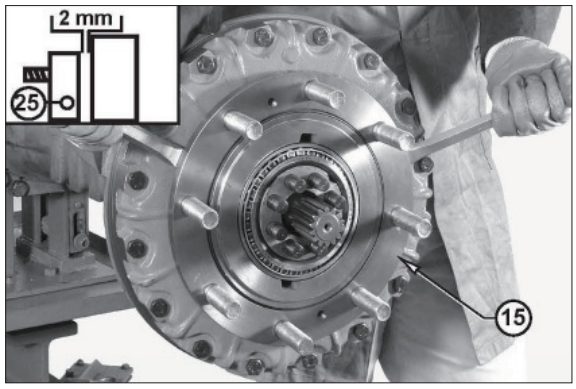
14W98FA007

(8) Engage break circuit pressure at min. 7 bar to block the break discs in position.



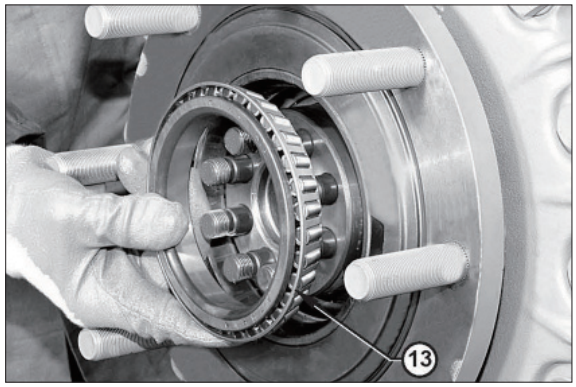
14W98FA008

(9) Using two levers, by hand disjoin the complete hub (15).



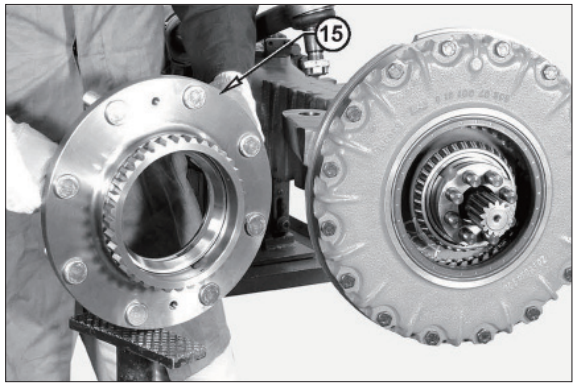

14W98FA009

(10) Remove the external bearing (13).



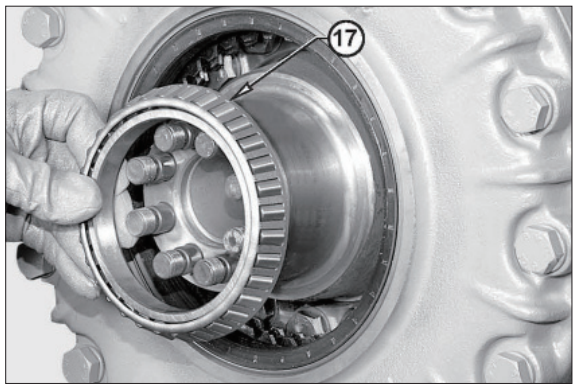

14W98FA010

(11) Extract the hub (15).



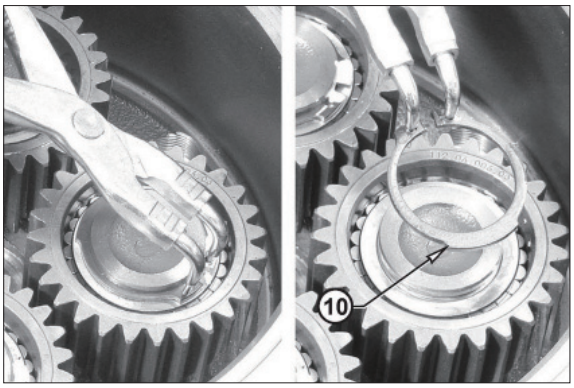

14W98FA011

(12) Remove the internal bearing (17).



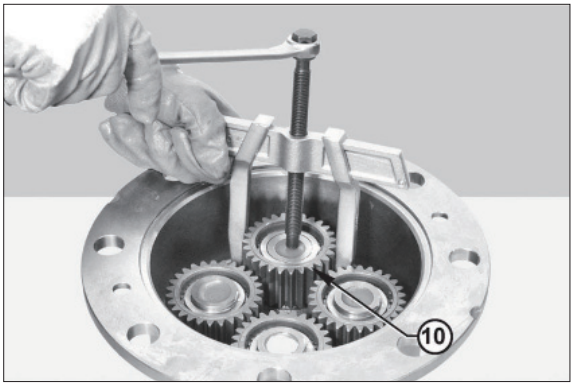

14W98FA012

(13) Remove the snap rings (10).



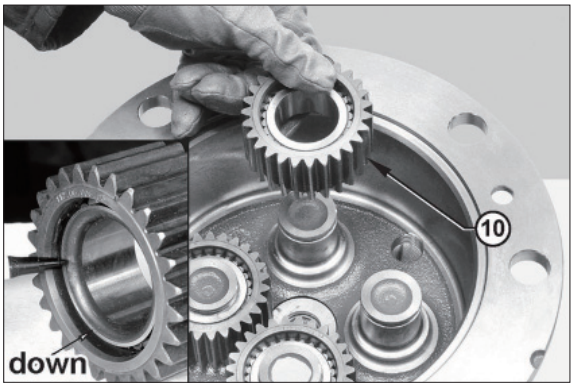

14W98FA013

(14) With the help of an puller, remove the planet wheel gears (10).



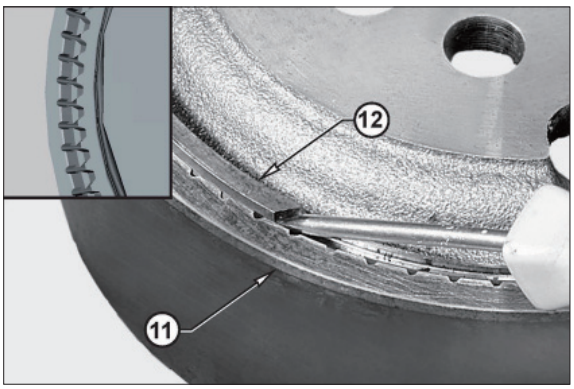

14W98FA014

※ Note down the assembly side of planet wheels.



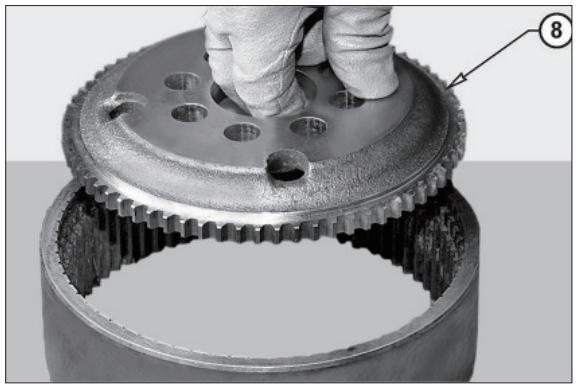

14W98FA015

(15) Remove the snap ring (12) from the crown (11).




14W98FA016

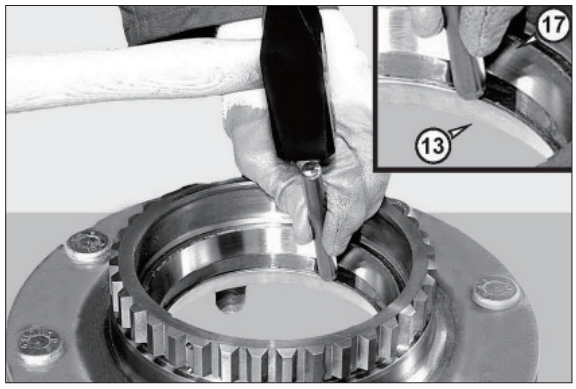
(16) Remove the crown flange (8).




14W98FA017

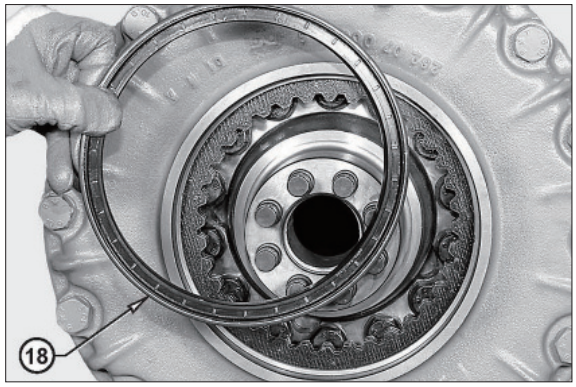
(17) Remove the thrust blocks (13, 17) from the bearings forcing a pin driver into the appropriate slots on the hub (15).

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

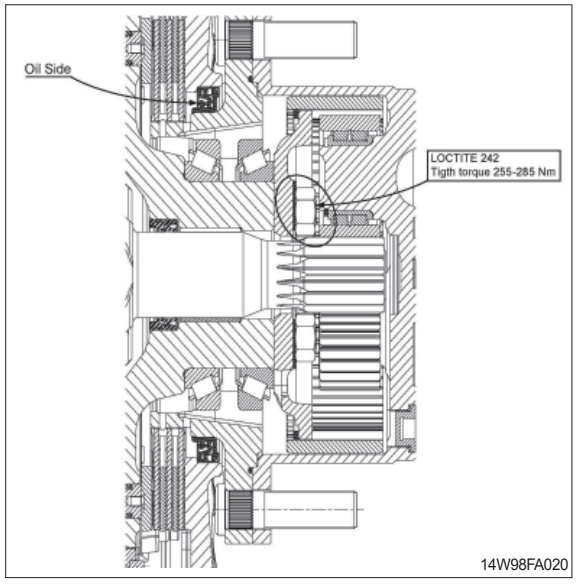



14W98FA018

(18) Remove the sealing ring (18) from the hub.
Note down the assembly sequence.



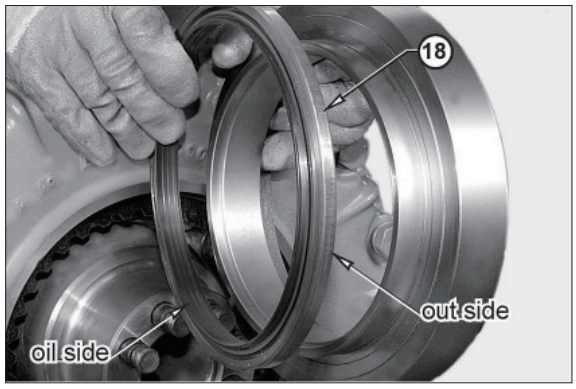

14W98FA019




14W98FA020

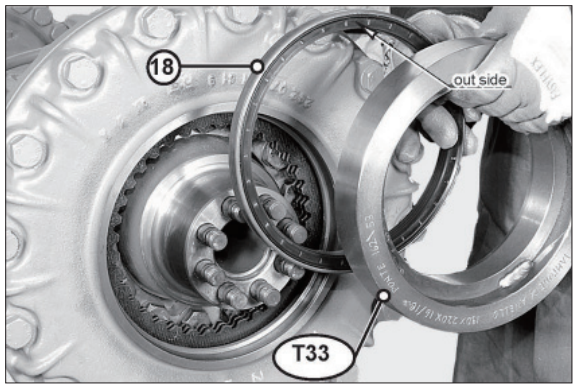
## 2) ASSEMBLE

(1) Check that the ring (18) is correctly oriented.



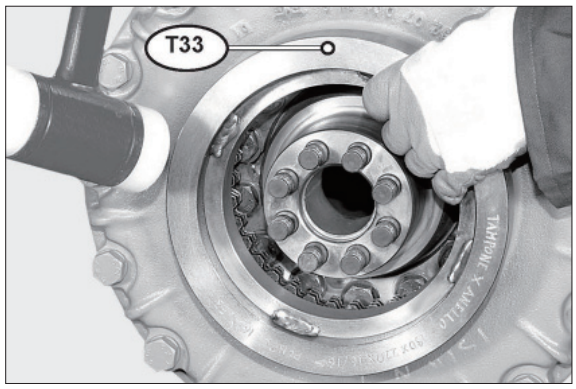

14W98FA021

(2) Apply a sealant for removable seals to the outer surface of the sealing ring (18). Position the sealing ring (18) in the hub.

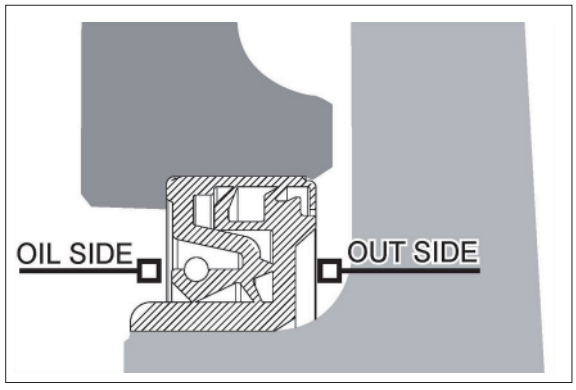



14W98FA022

(3) Assist the insertion of the sealing ring by lightly hammering around the edge with a plastic hammer.

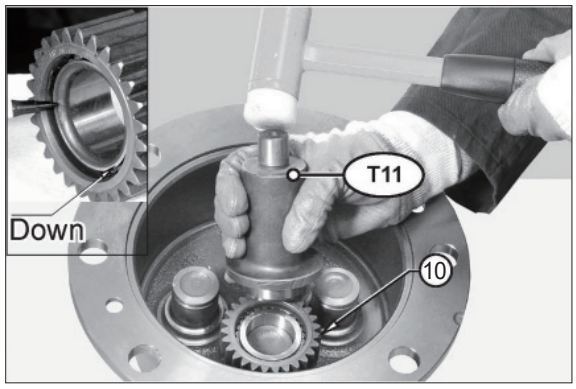



14W98FA023



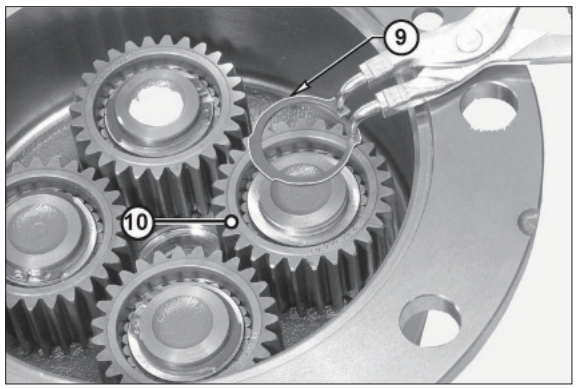

14W98FA024

(4) With the help of tool T11, insert the planet wheel gears (10) into the cover (4). Accurately check the orientation.




14W98FA025

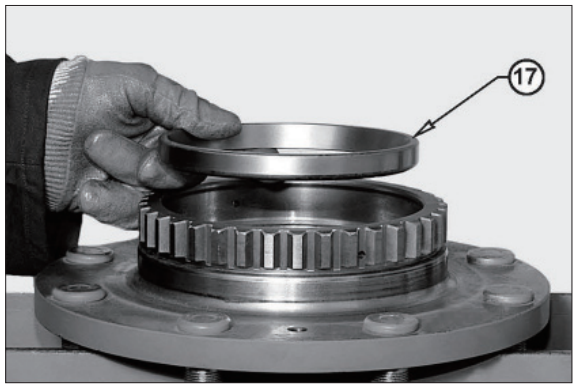
(5) Lock the gears (10) into position by fitting the snap rings (9).




14W98FA026

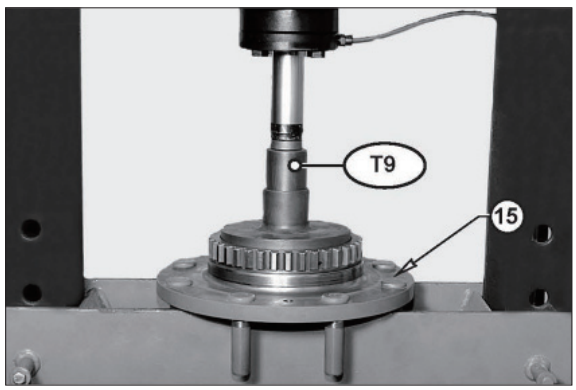
(6) Position the thrust block of the internal bearing (17).

※ Check that the thrust block is correctly oriented.




14W98FA027

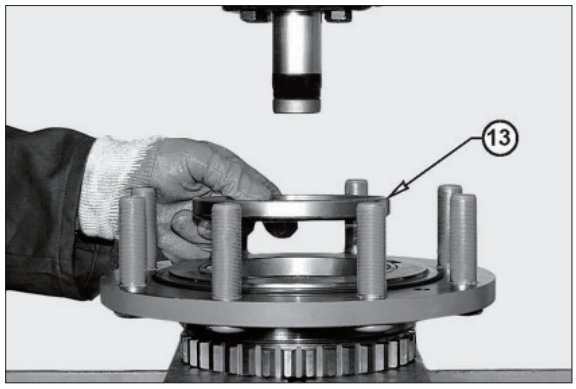
(7) Position the upper part of tool T9 and press the thrust block into the hub (15) all the way down.




14W98FA028

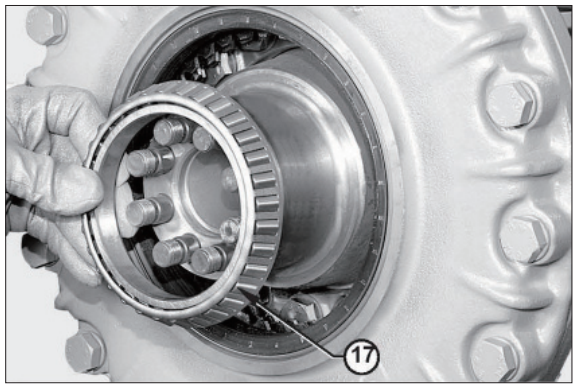
(8) Position the thrust block of the external bearing (13).

※ Check that the thrust block is correctly oriented.



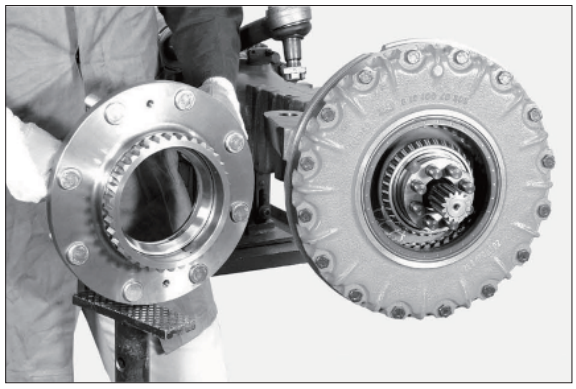

14W98FA029

(9) Install the internal bearing (17).



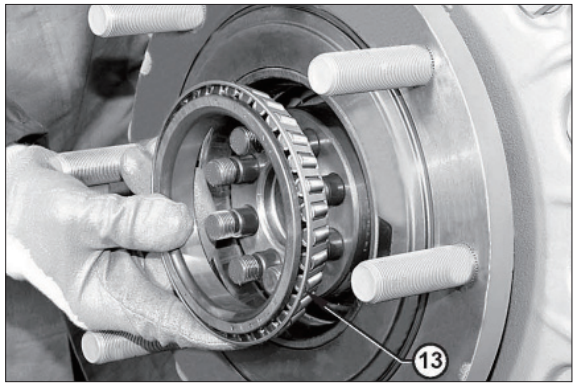

14W98FA030

(10) Install the hub (15).

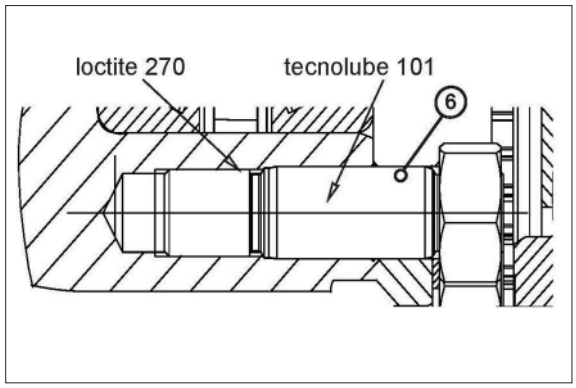


14W98FA031

(11) Install the external bearing (13).

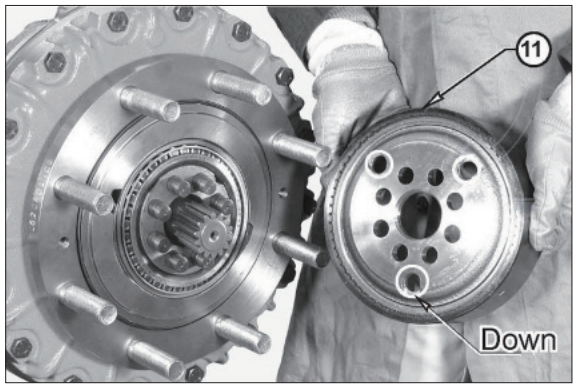



14W98FA032



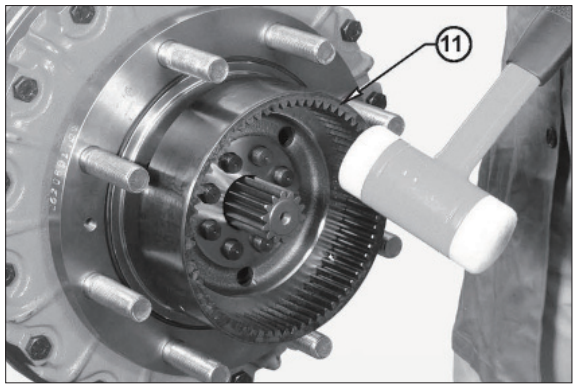

14W98FA033

(12) Fit the complete crown flange (11).



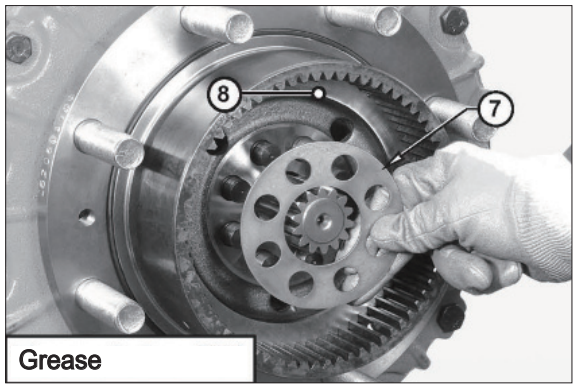

14W98FA034

※ In order to fasten the flange (11), use a plastic hammer and alternately hammer on several equidistant points.




14W98FA035

(13) Apply grease to the surface of the safety flange (7) which touches the crown flange (8).
Fit the safety flange (7).

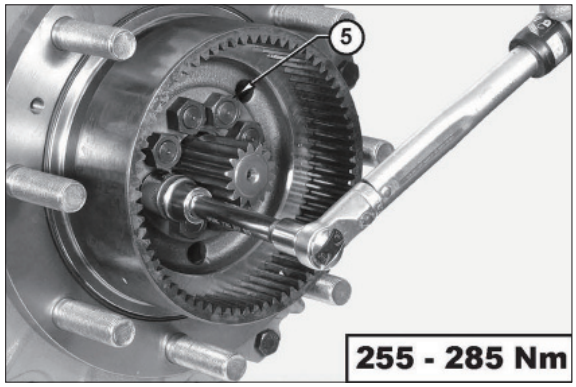



14W98FA036

(14) Apply loctite 242 to the studs and fit in the nuts (5).

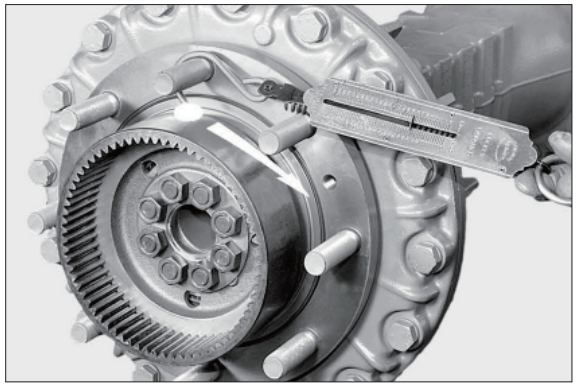

14W98FA037

(15) Cross tighten the nuts (5) in two stages.
Initial torque wrench setting : 120 Nm
Final torque wrench setting : 255~285 Nm



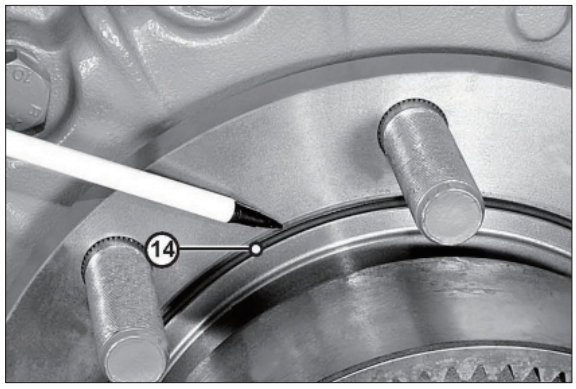

14W98FA038

(16) Check the continuous rolling torque on the hub.
Torque 10~30 Nm.



14W98FA039

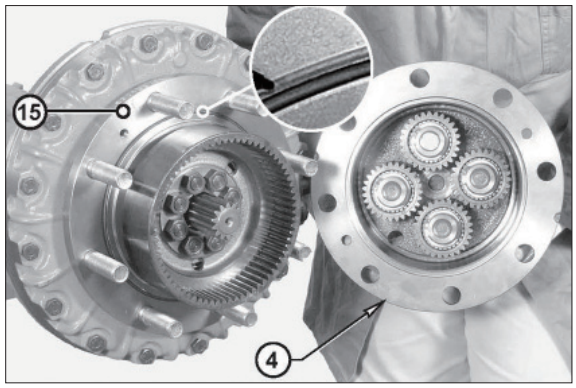
(17) In order to facilitate assembly, apply grease on the O-ring (14).




14W98FA040

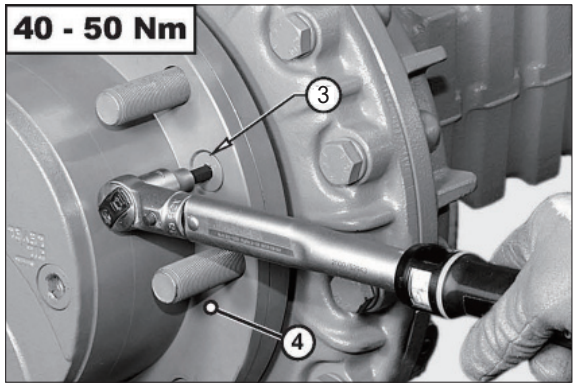
(18) Fit the planetary carrier cover (4) onto the hub (15).

※ Check that the O-ring is in good condition and in position.




14W98FA041

(19) Lock the planetary carrier cover (4) by tightening the screws (3).
Torque wrench setting for screws: 40~50 Nm

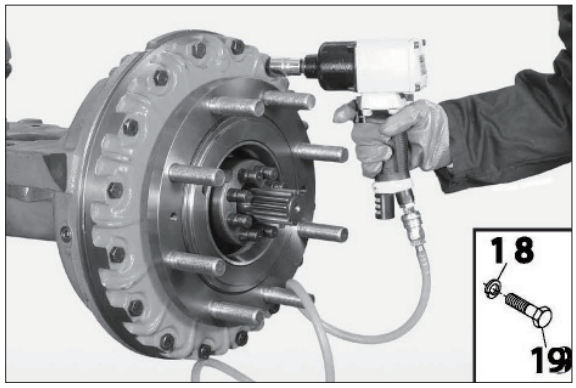



14W98FA042

## 5. CHECKING WEAR AND REPLACING THE BRAKING DISKS

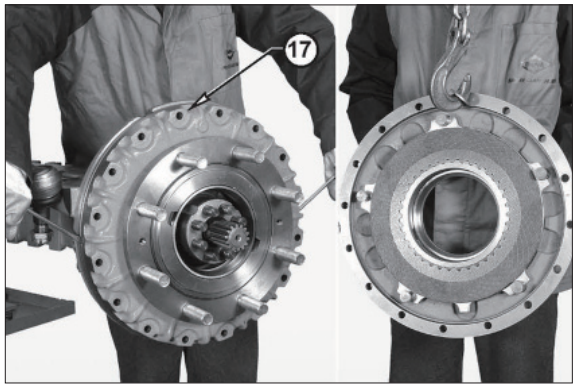
### 1) DISASSEMBLE THE BRAKING UNIT

(1) Remove fix in screws (19).



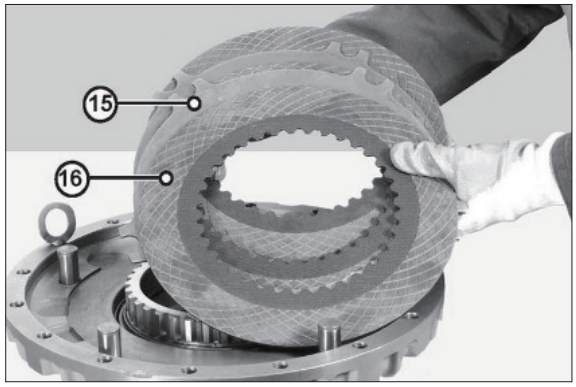

14W98FA043

(2) Disjoin the cover (17) from the hub by alternatively forcing a screwdriver into the appropriate slots.



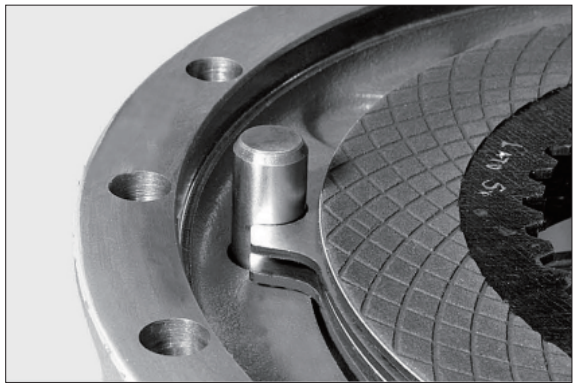

14W98FA044

(3) Remove the braking disks (15, 16) and note down their order of assembly.



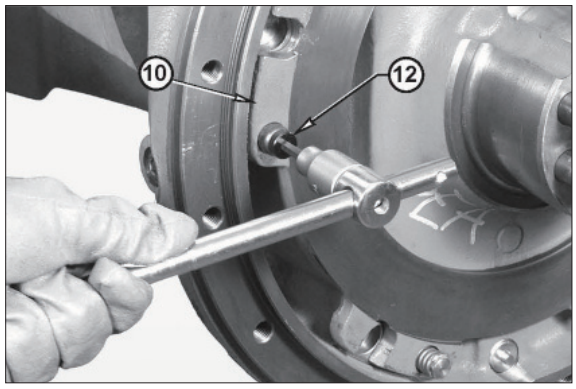

14W98FA045

(4) If the disks do not need replacing, avoid switching their position.



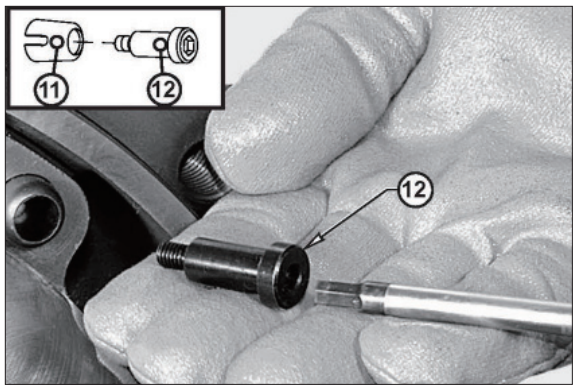
14W98FA046

(5) Remove the pin screws (12) of the counter plate (10).



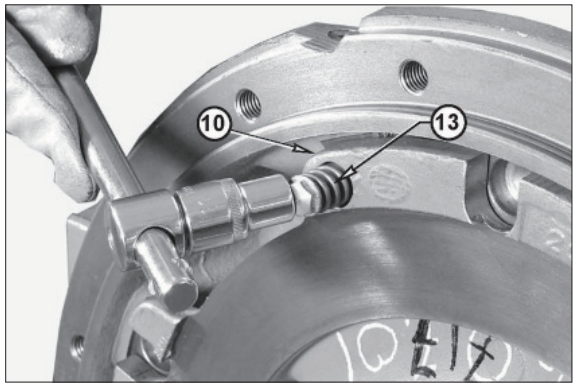

14W98FA047

※ If the screws are to be replaced, note down the different colours for the different brake gap.



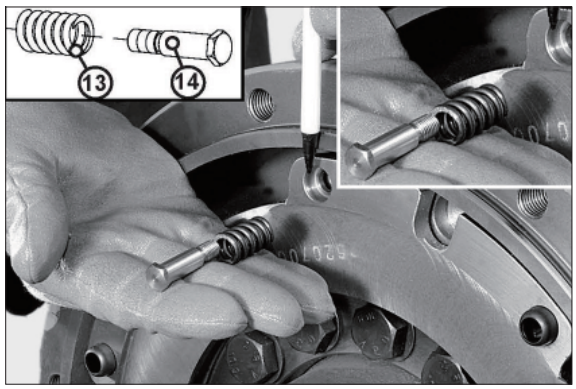

14W98FA048

(6) Remove the reversal springs (13) from counter plate (10).




14W98FA049

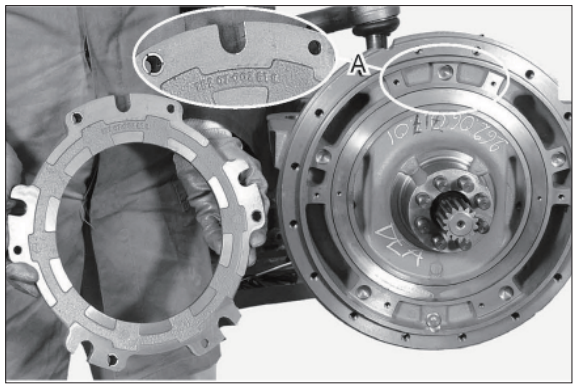
※ If the springs (13) are weak or deformed they must be replaced.




14W98FA050

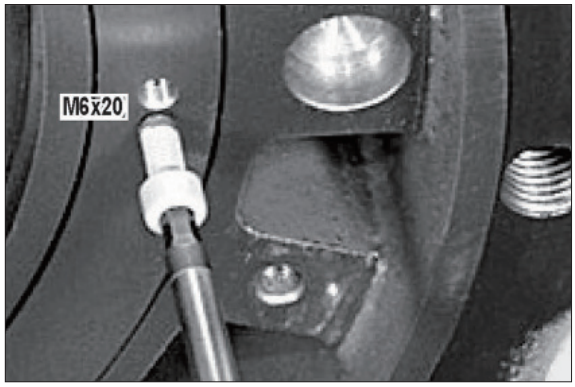
(7) Remove the intermediate plate (10).

※ Note down the direction the montage (A).



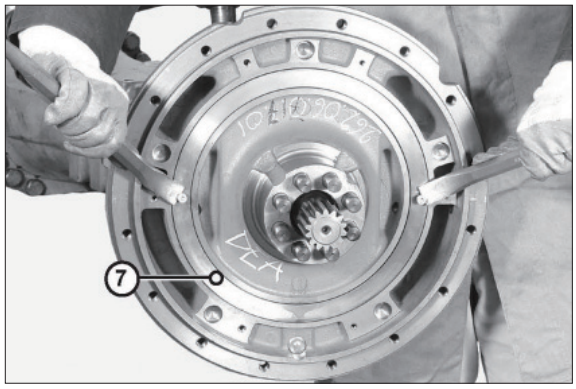

14W98FA051

(8) Tighten two screws M6 × 20 on the piston.



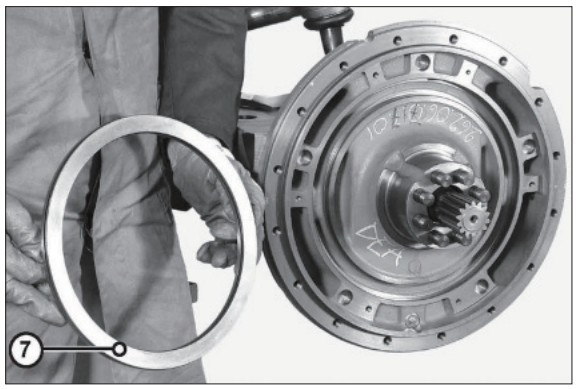

14W98FA052

(9) Using two levers, remove the piston (7).



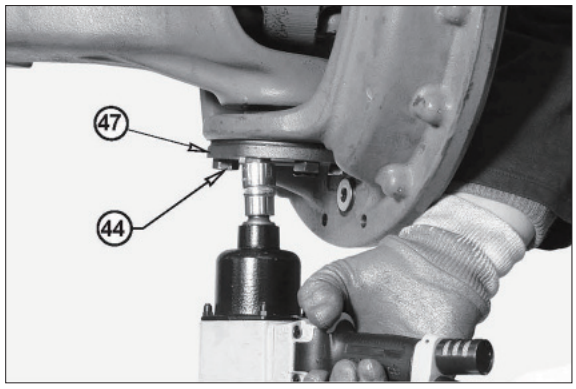

14W98FA053

※ Note down the side for assembly.



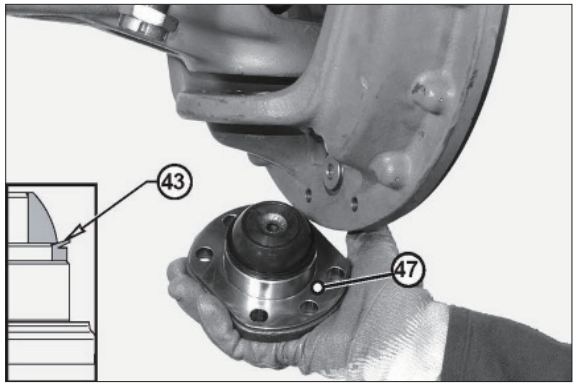

14W98FA054

(10) Unloose and remove the screws (44) from the articulation pin (47).



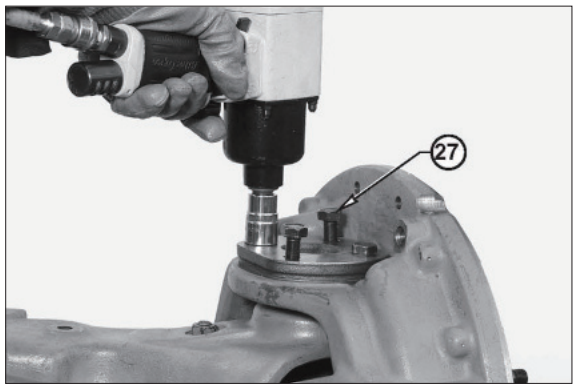

14W98FA055

(11) Remove the bottom articulation pin (47) complete with front sealing ring (43).




14W98FA056

(12) Unloose and remove the screws (27) from the articulation pin (26).

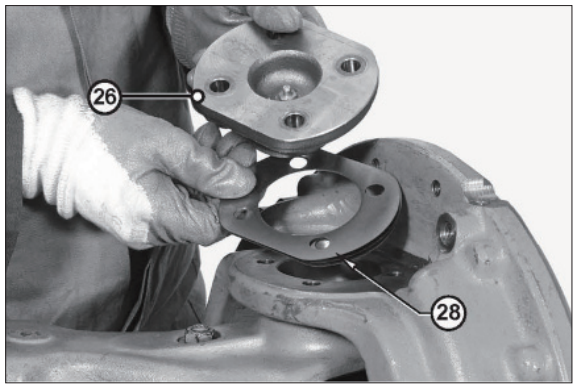



14W98FA057

(13) Using two levers, remove the top articulation pin (26) complete with front seal (29).

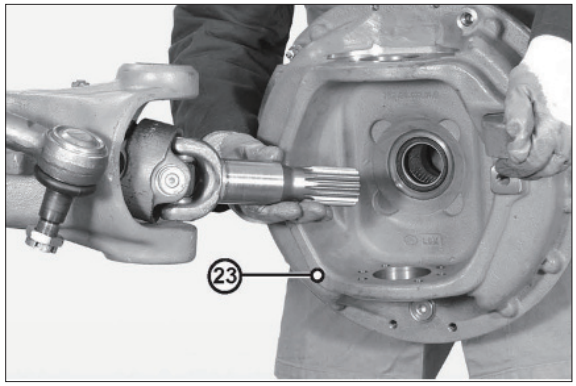
※ Pay attention not to damage the surfaces.


14W98FA058




14W98FA059

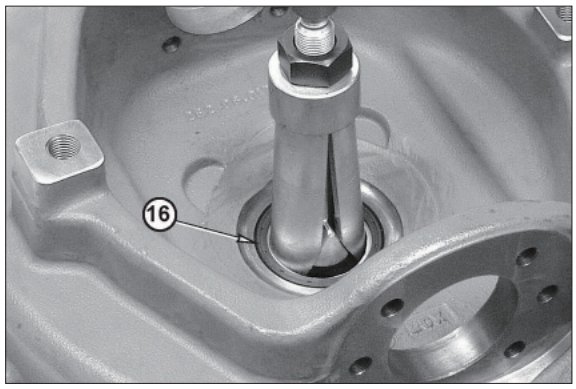
(14) Remove the complete steering case (23).




14W98FA060

(15) Using a puller, take off the sealing ring (16) from the steering case.

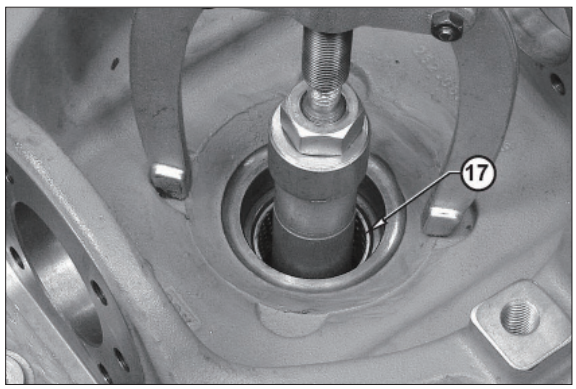
※ Note down the orientations of the sealing rings (16).




14W98FA061

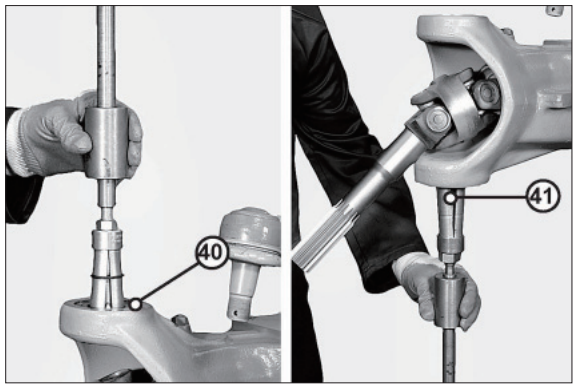
(16) Using a puller, take off the bush (17) from the steering case.

※ Note down the orientations.




14W98FA062

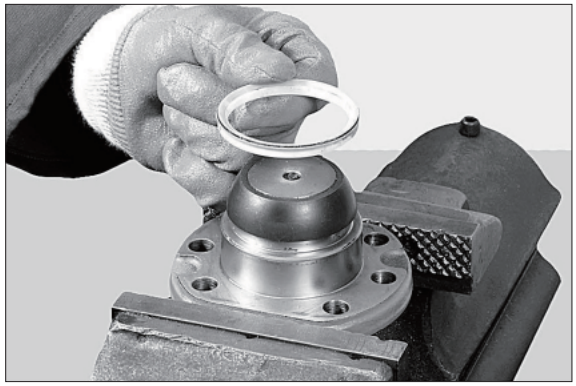
(17) Using a puller for inner parts, remove the top bush (40) and the bottom ball-bush (41).




14W98FA063

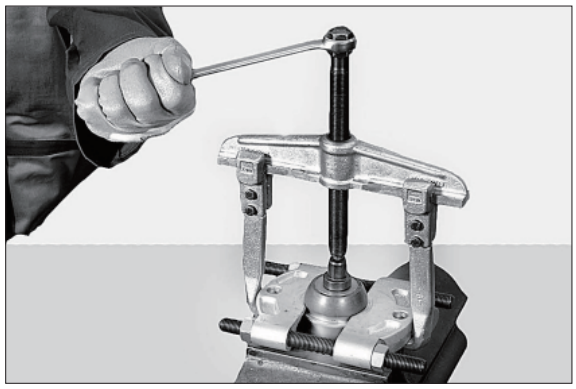
(18) Remove the articulation pins (41) and the front sealing rings (43).

※ Note down the side for assembly.

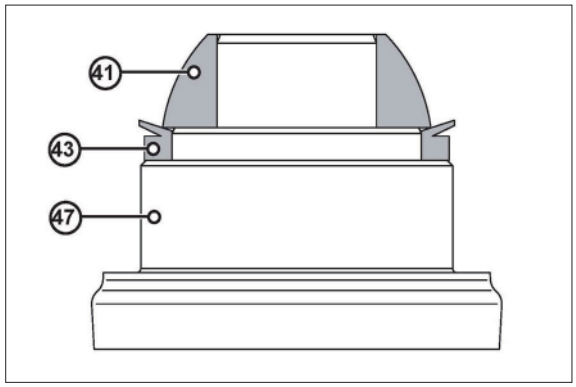


14W98FA064

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



14W98FA065



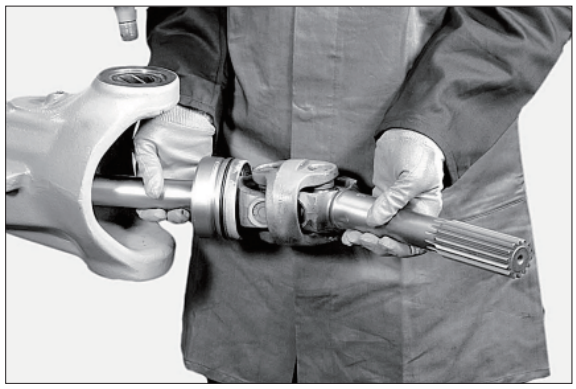

14W98FA066

(20) Unloose and remove the top and bottom check nuts from the dowels.
Remove top and bottom check dowels from the flange or bushing.

14W98FA067

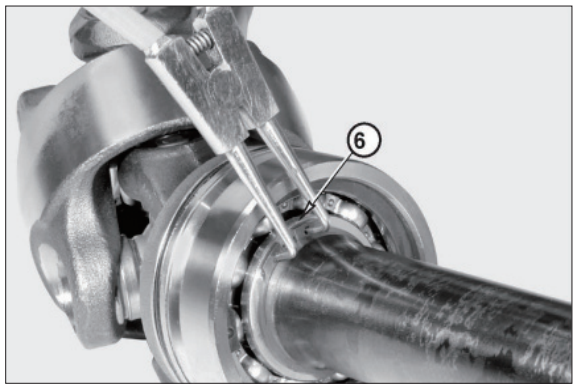
(21) Remove the U-joint.

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



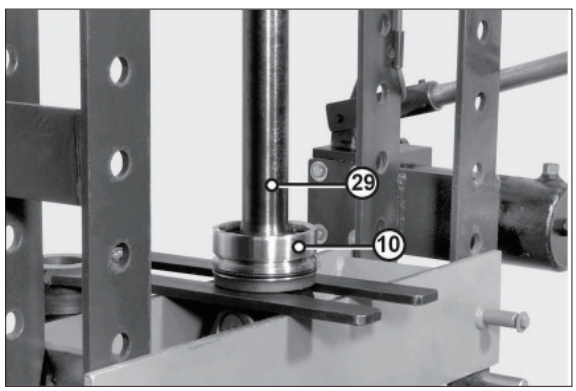
14W98FA068

(22) Remove the snap ring (6) from the bearing.




14W98FA069

(23) Position the entire U-joint (29) under a press and remove the complete bush (10).



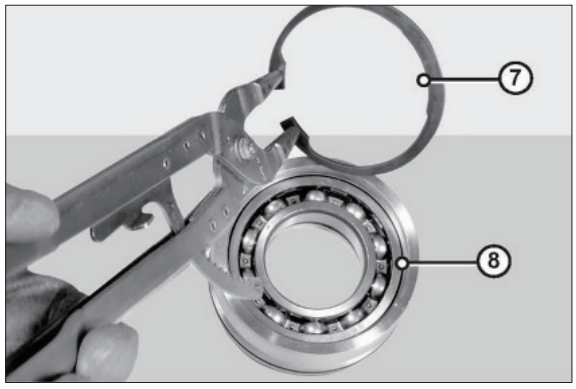

14W98FA070

## 6. UNIVERSAL-JOINT

※ Front axle only

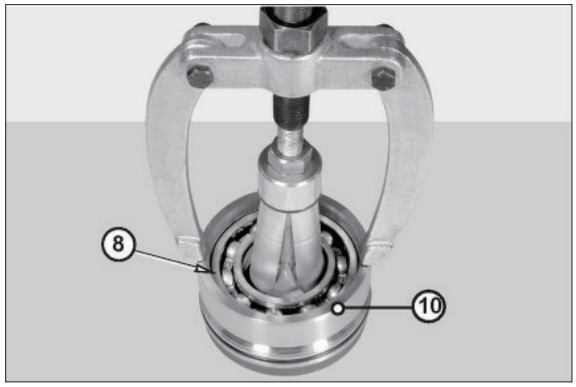
### 1) REMOVE THE U-JOINT

(1) Remove the snap ring (7) from the bearing (8).




14W98FA071

(2) Use a puller to remove the bearing (8) and by using a tool remove the sealing ring.




14W98FA072

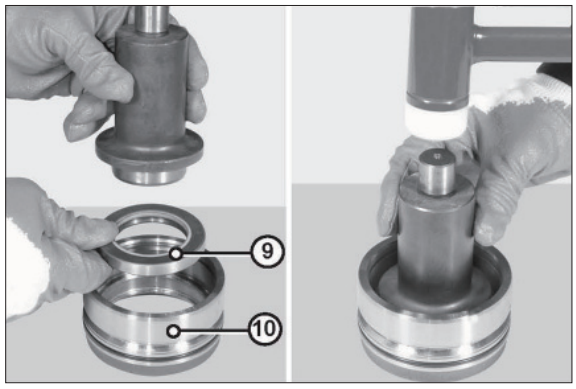
## 7. STEERING CASE

※ Front axle only

### 1) INSTALL THE COMPLETE STEERING CASE

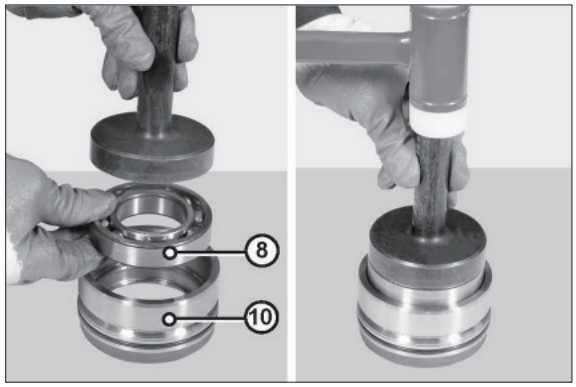
(1) Using tools T3, insert the sealing ring (9) in the bush (10).

※ Carefully check the assembly side of the seal.



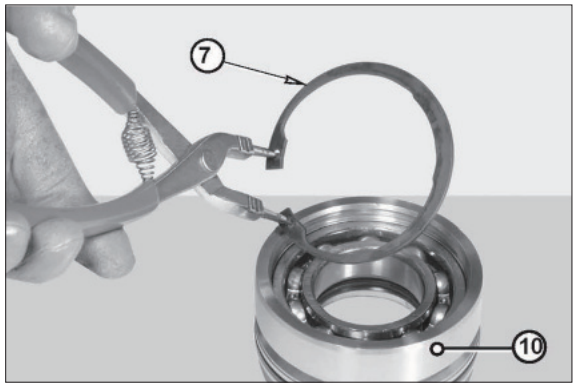

14W98FA073

(2) Using tools T4, insert the bearing (8) in the bush (10).



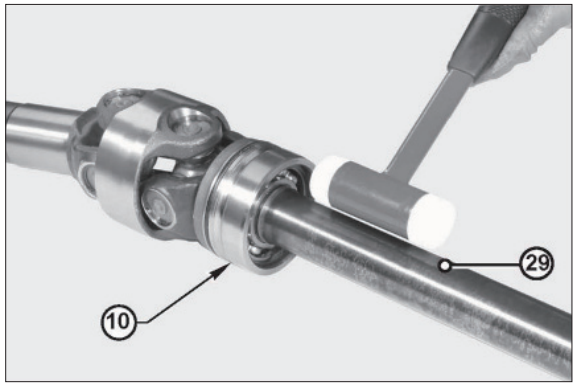

14W98FA074

(3) Fit the snap ring (7) on the bearing (10).



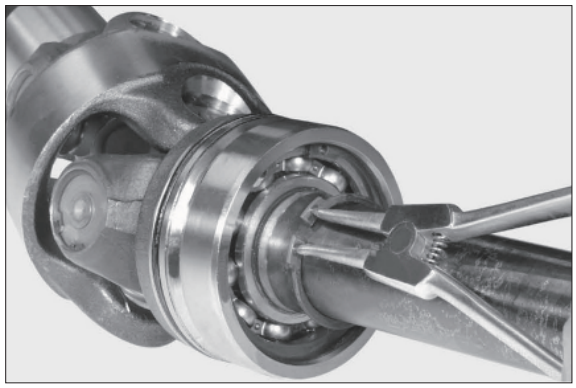

14W98FA075

(4) Fit the flange (10) onto the U-joint (29).

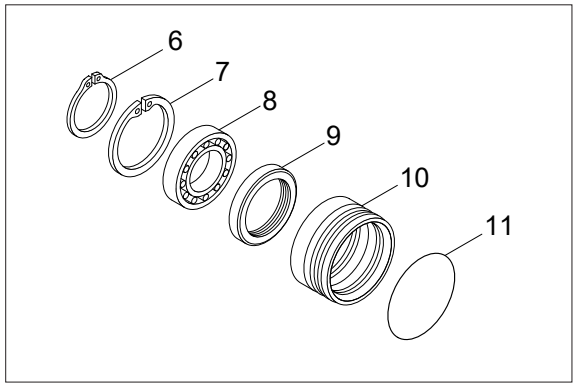



14W98FA076

(5) Fit the snap ring (6) of the bearing (8).



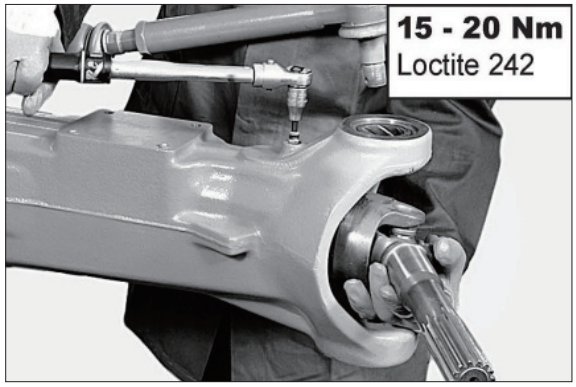
14W98FA077



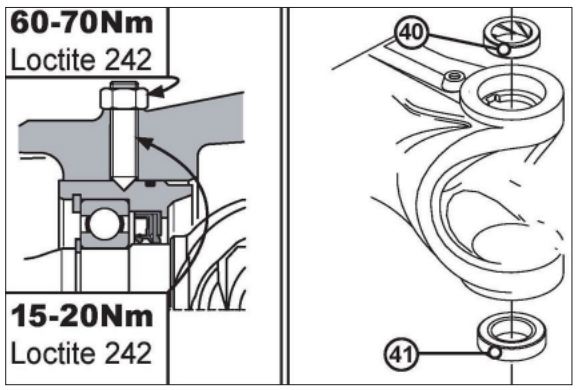

14W98FA078

(6) Insert the U-joint and tighten the top and bottom dowels.
· Torque wrench setting : 15~20 Nm.

※ For U-joint coming with a bush, center the point of the check dowels in the slot.

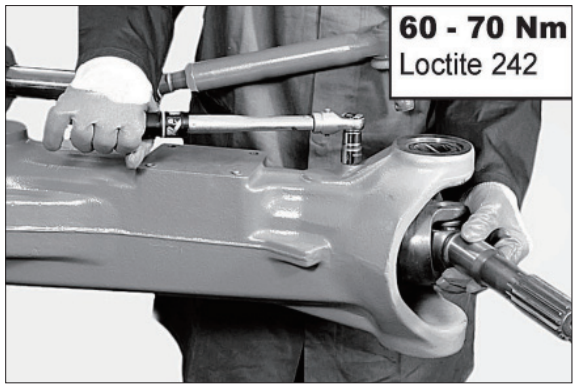



14W98FA079



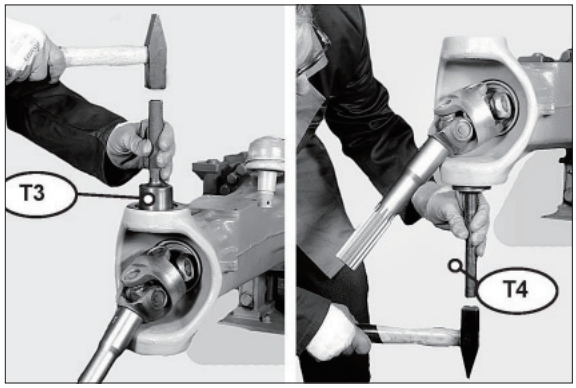

14W98FA080

(7) Screw the check nuts of the dowels and lock them using a dynamometric wrench.
· Torque wrench setting : 60~70 Nm



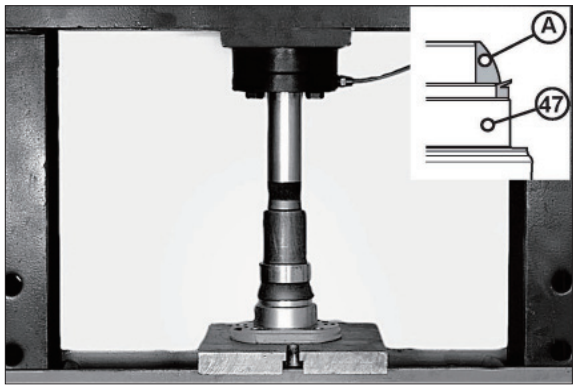
14W98FA081

(8) Lubricate the top bush (7) or the bottom ball bush (10) and fit them into the fulcrum holes of the arm.
Use tools T3 and T4.



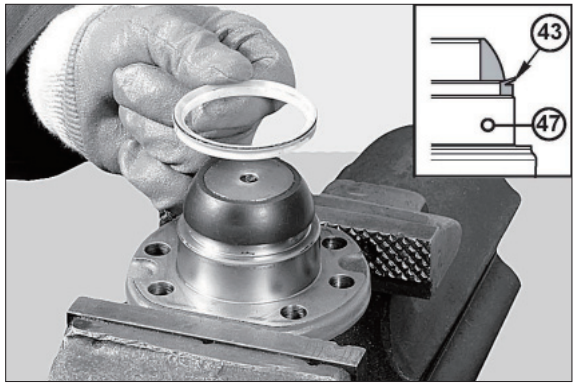
14W98FA082

(9) If the bottom articulation pin (47) has been extracted, position the pin under a press and fit the ball cover A.



14W98FA083

(10) Fit the front sealing ring (43) onto the articulation pin (47).
※ Carefully check that the rings are properly oriented.

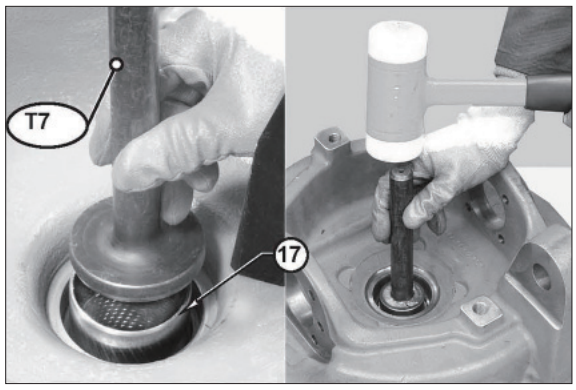


14W98FA084

## 8. BRAKING UNITS

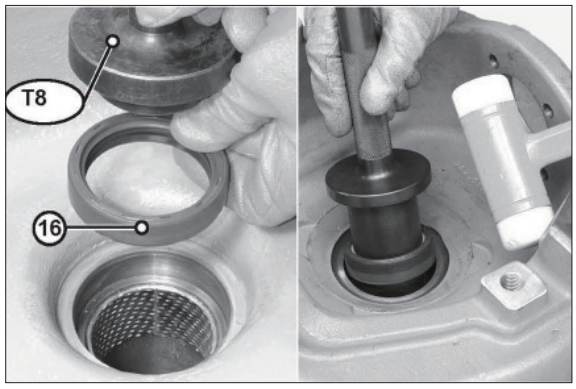
### 1) ASSEMBLE THE BRAKING UNITS

(1) Using tool T7, lubricate and assemble bearing (17).




14W98FA085

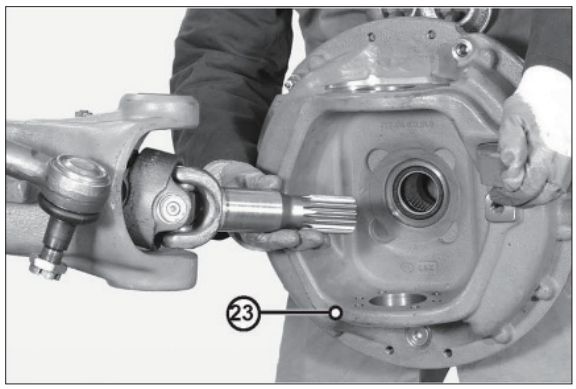
(2) Lubricate the outer surface of the sealing ring (16) and assemble it into it's position by using the tool T8.




14W98FA086

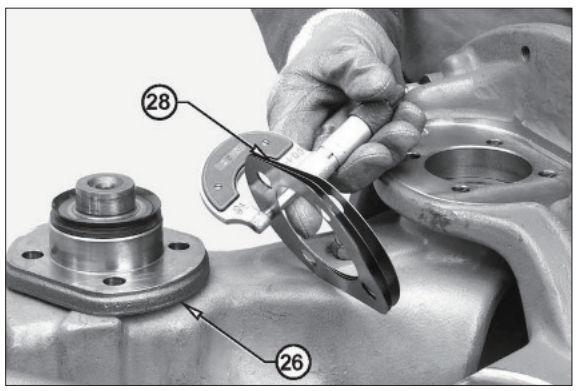
(3) Lubricate the terminal of the U-joint and install the steering case (23).

※ Pay attention don't damage the dust cover rings and the sealing rings.



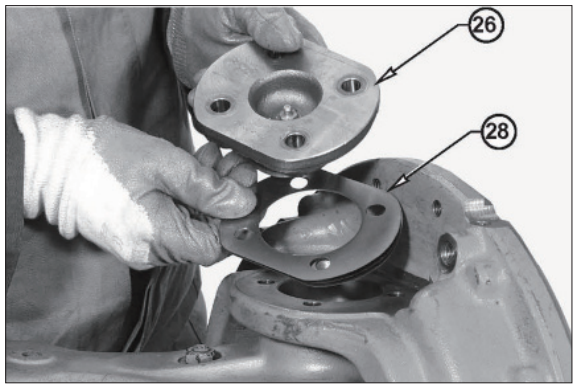

14W98FA087

(4) Prepare a series of shims (28) of 0.4 up to 0.7 mm.
To be assembled under the upper pin (26).



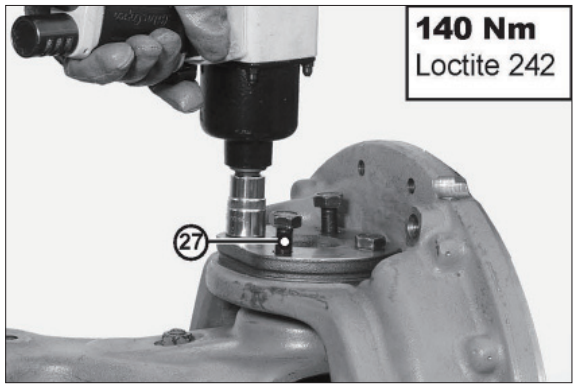

14W98FA088

(5) Lubricate and install the unit in the steering case.



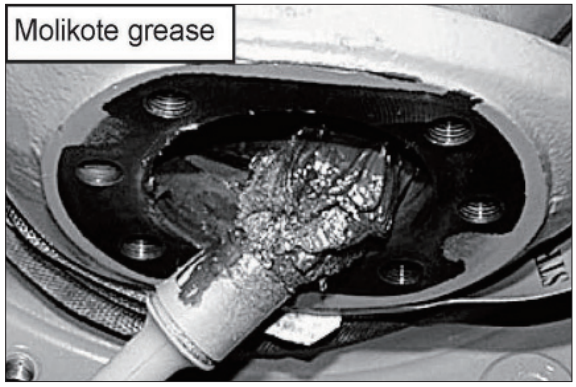

14W98FA089

(6) Tighten the new fittin screws (27) of top articulation pins in sequence using the cross tightening method.
· Torque wrench setting : 140 Nm



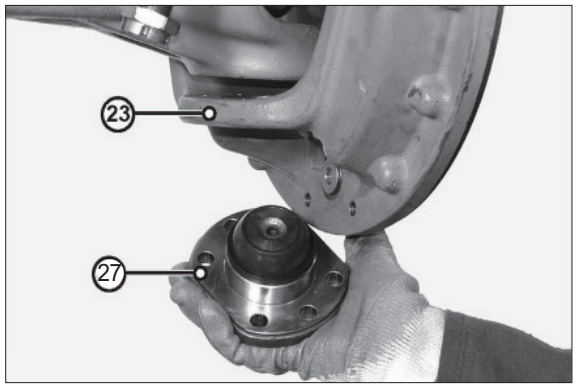

14W98FA090

(7) Lubricate the steering case.




14W98FA091

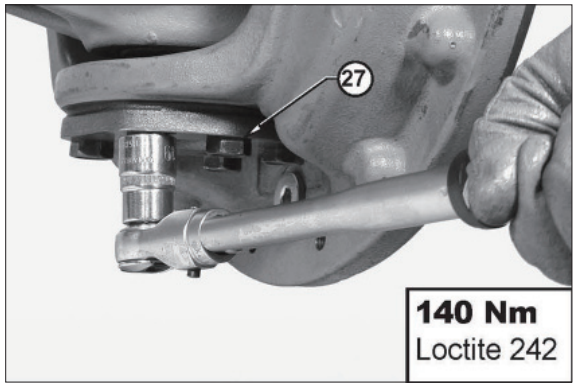
(8) Fit the unit (43) in the steering case (23). Position the screws (27) and tightly tighten.




14W98FA092

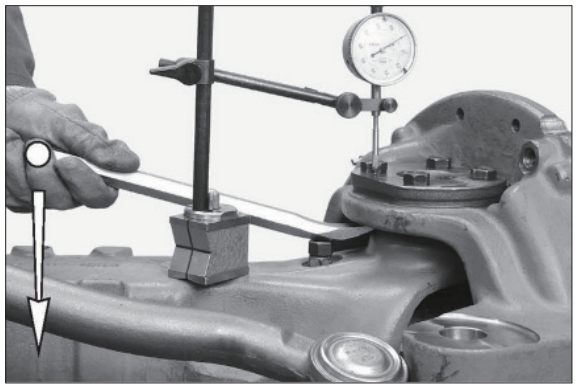
14W98FA093

(9) Tighten the new screws (27) of bottom articulation pins in sequence using the cross tightening method.
· Torque wrench setting : 140 Nm



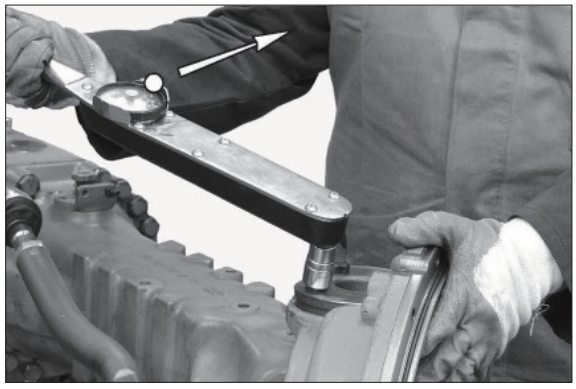

14W98FA094

(10) 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.



14W98FA095

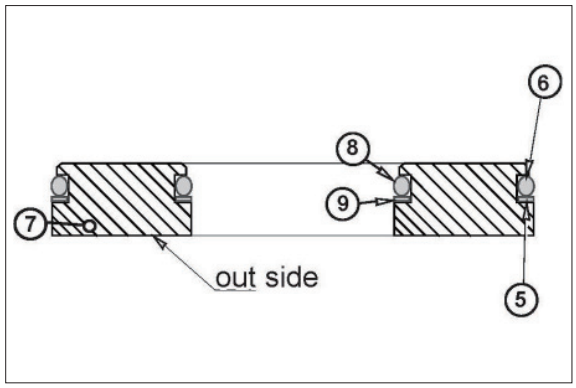
(11) Check the torque of the pins, which has to be between 40 and 80 Nm.
If the preliminary measured value is too high, the shims have to be increased.



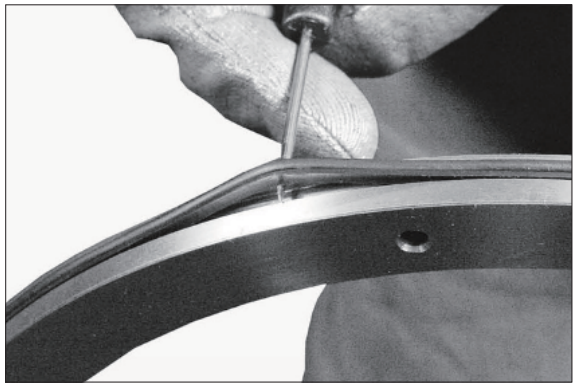
14W98FA096

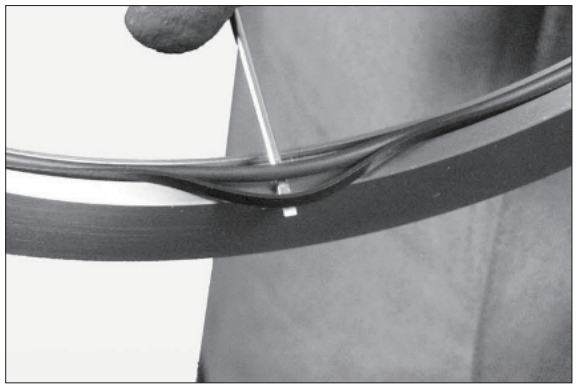
(12) Accurately clean the piston (9) and the seats of slide and seal.
Replace the O-rings (5) and (8) and the back up rings (6) and (9) ; make sure that the assembly side is correct.

※ Accurately check the positioning of the back up rings (6) and (9).



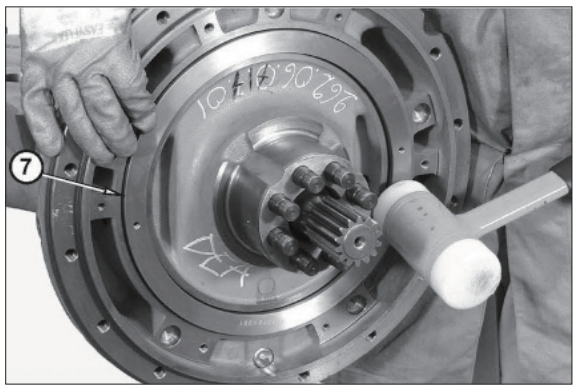
14W98FA097


14W98FA098


14W98FA099

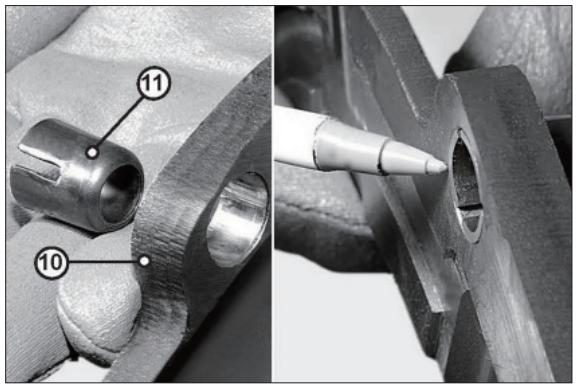
(13) Insert the piston (7).

※ Check that the O-ring (5, 8) and back-up rings are in good condition and in position.



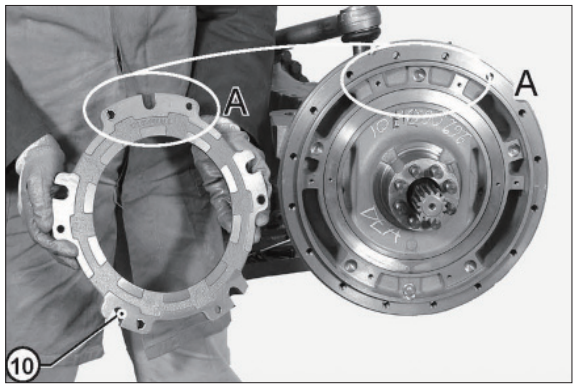
14W98FA100

(14) Before installing the intermediate disk, insert the stroke automatic regulation springs (11) ; place them in line with the intermediate disk (10).



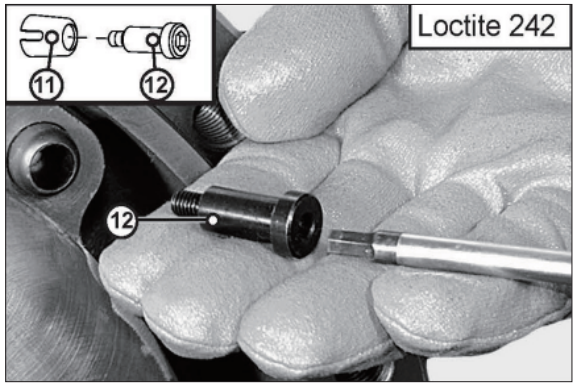

14W98FA101

(15) Install the intermediate disk (10) with the sign position (A).



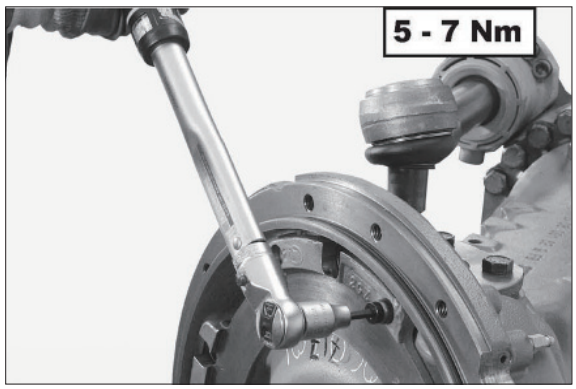

14W98FA102

(16) Apply loctite 270 to the thread, fit the pin screws (12).



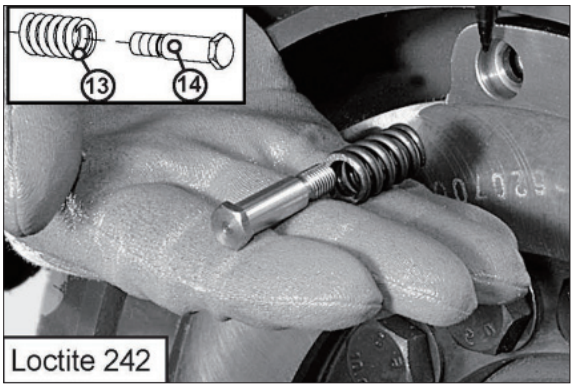

14W98FA103

(17) Use a torque wrench setting of 5~7 Nm.



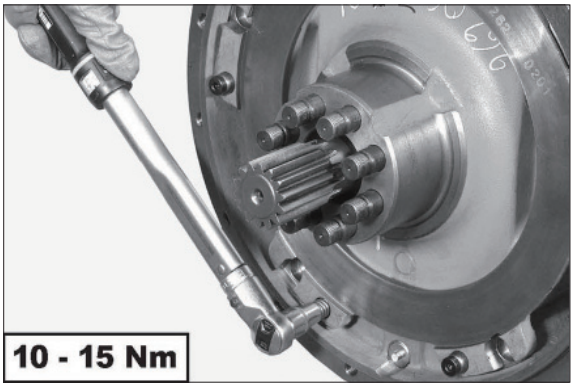

14W98FA104

(18) Apply loctite 270 to the thread, fit the pin screws (14).



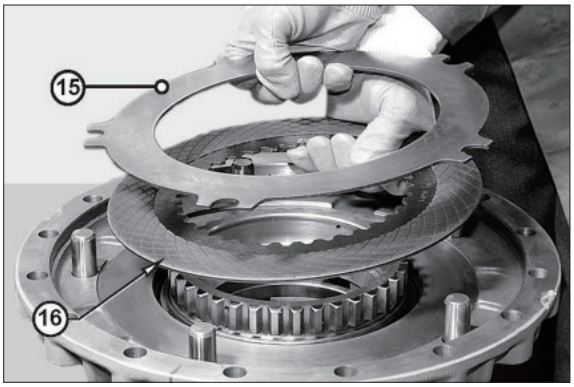

14W98FA105

(19) Use a torque wrench setting of 10-15 Nm.

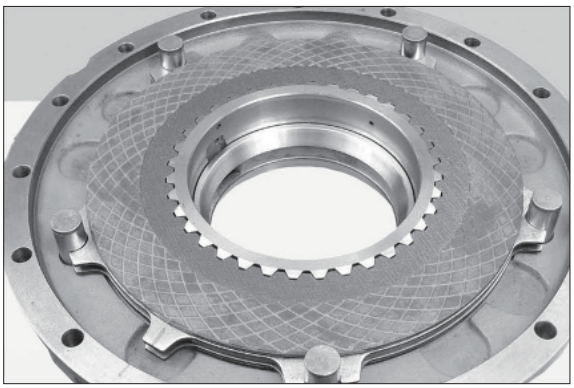



14W98FA106

(20) Slightly lubricate the braking disks (15 ,16).
Fit the braking disks (15, 16) in the arm following the correct sequence.

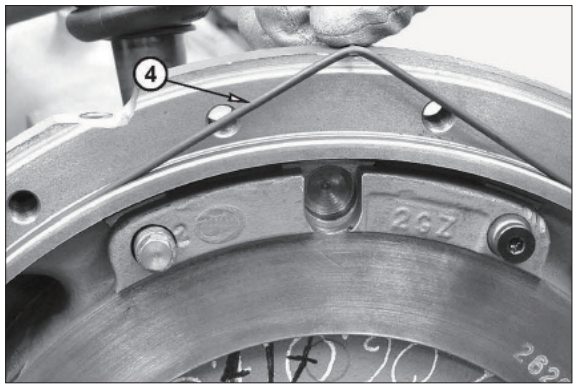



14W98FA107



14W98FA108

(21) Install a new O-ring (4).

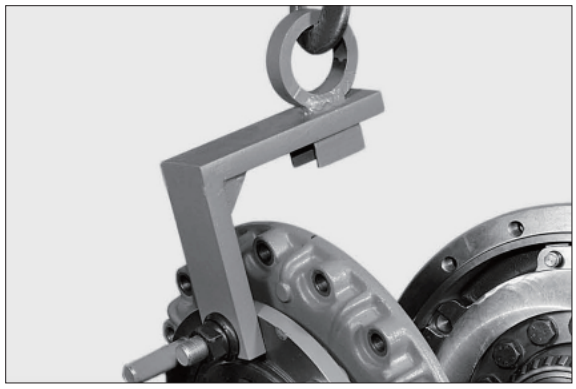



14W98FA109

(22) Install internal bearing.

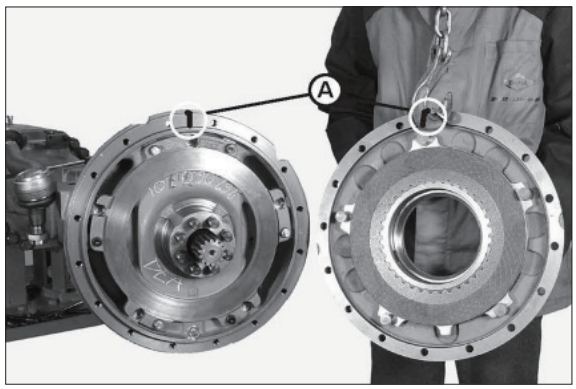
14W98FA110

(23) Before install the cover, secure them onto an appropriate tool.



14W98FA111

(24) Install the cover and hub complete with braking disks with the sign position (A).

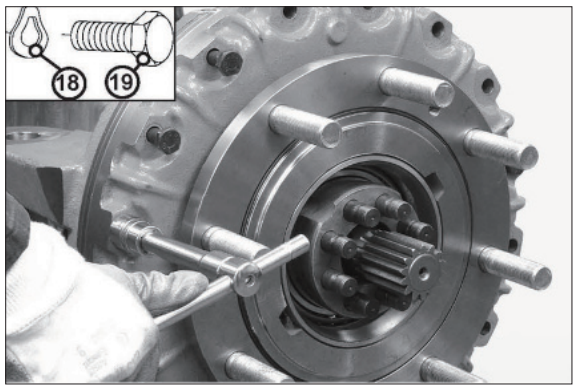



14W98FA112

(25) Slowly install for don't drop the brake disks (15, 16).

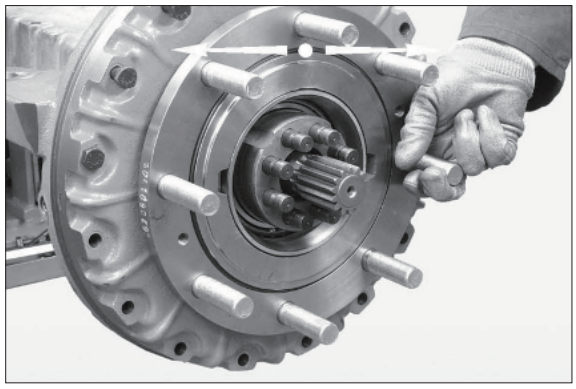

14W98FA113

(26) Turning two screws alternately until the cover is well set, fix the assembly.



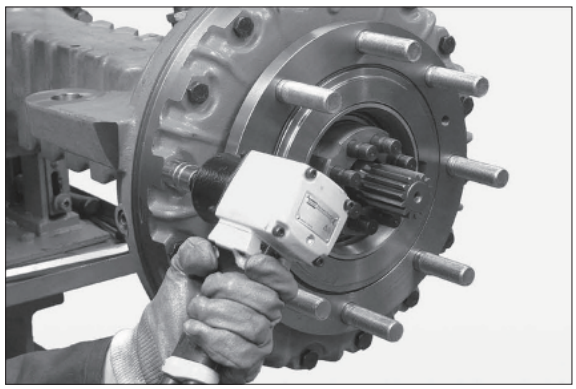

14W98FA114

※ Turn the hub and control the free motion. If it blocks, repeat the operation.



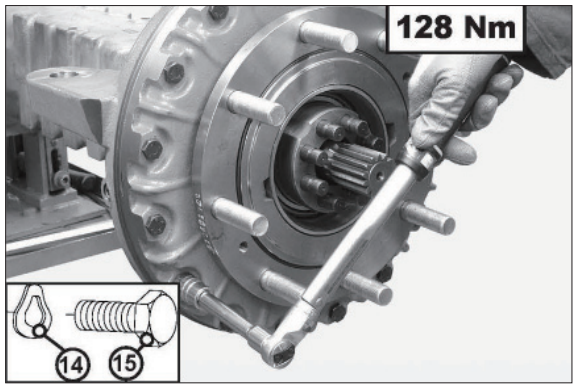
14W98FA115

(27) Screw.



14W98FA116

(28) Lock the screws (14, 15) crosswise with a torque wrench setting of 128 Nm.



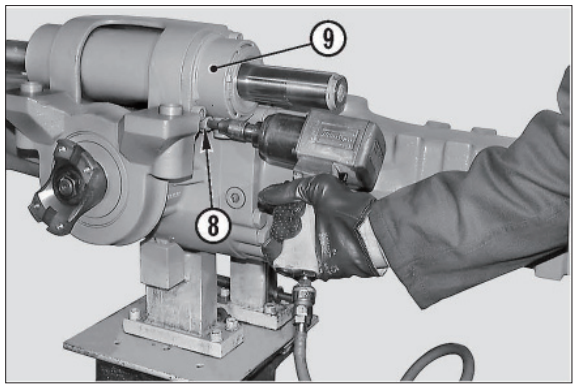

14W98FA117

## 9. THE STEERING CYLINDER

※ Front axle only

### 1) REMOVAL

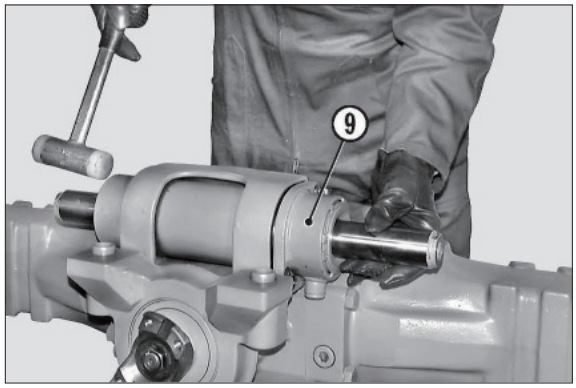
(1) Remove the securing screws (8) from the steering cylinder (9).




14W98FA118

(2) Extract the cylinder (9) using a plastic hammer.

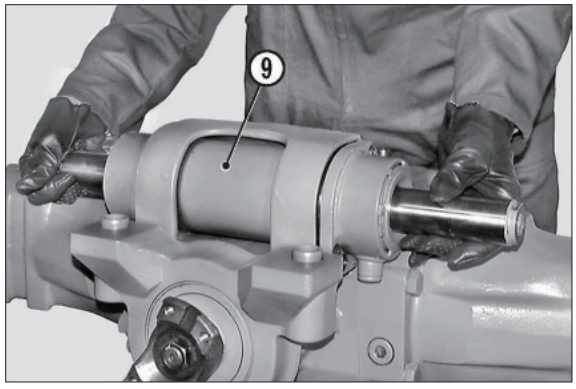
※ For cylinder disassembly, refer to "HOW TO DISASSEMBLE THE STEERING CYLINDER."




14W98FA119

### 2) INSTALLATION

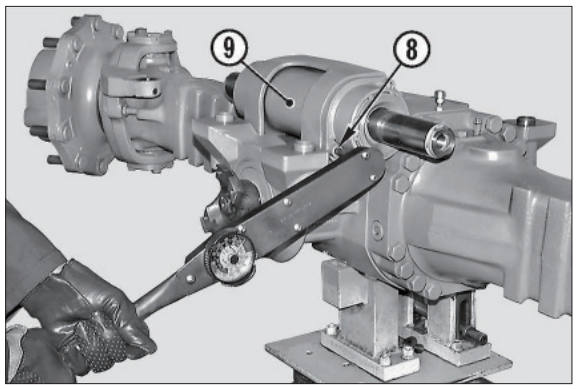
(1) Check that the O-rings (15) of this axle unit are in good condition ; lubricate the seats of the seals (15) and fit the steering cylinder (9) into ins seat.




14W98FA120

(2) Lock the cylinder by cross-tightening the screws (8).

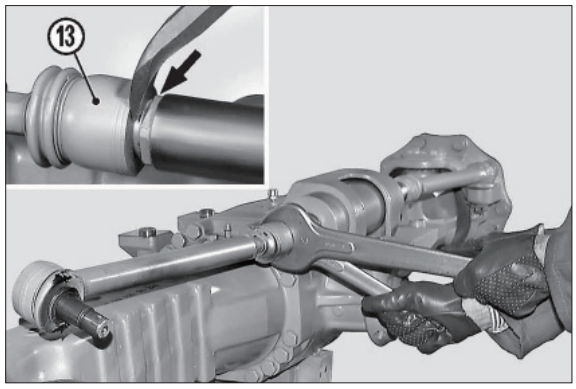
· Torque wrench setting : 116~128 Nm.




14W98FA121

(3) Apply loctite 242 to the thread and connect the steering bars by screwing the terminals onto the piston stem.
· Torque wrench setting : 240~270 Nm

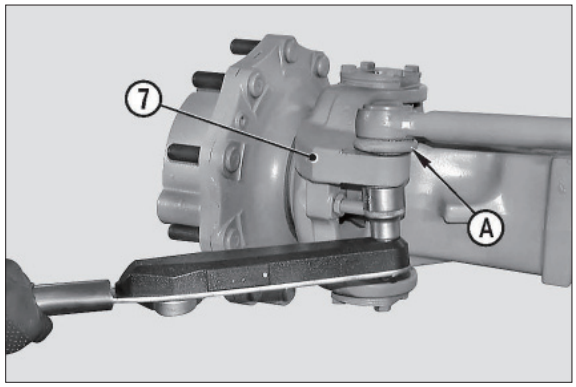
※ Versions with coupling require that the rim of the articulation (13) is riveted onto the surfaces of the piston stem.



14W98FA122

(4) Insert the pins (4) in the steering case (7) and lock into position using a torque wrench setting of 260-290 Nm.
Find the position of the notching in relation to the hole of the cotter pins and tighten the nut (6) further.

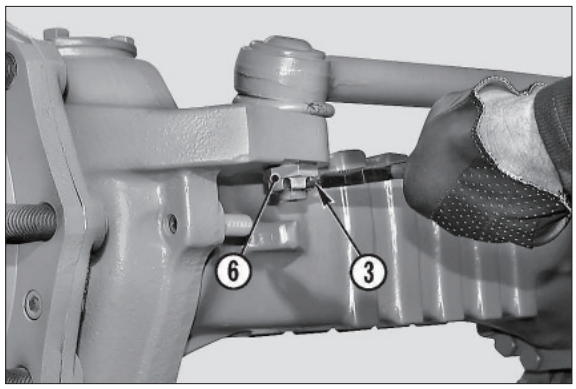
※ Check that rubber guards (A) are intact.



14W98FA123

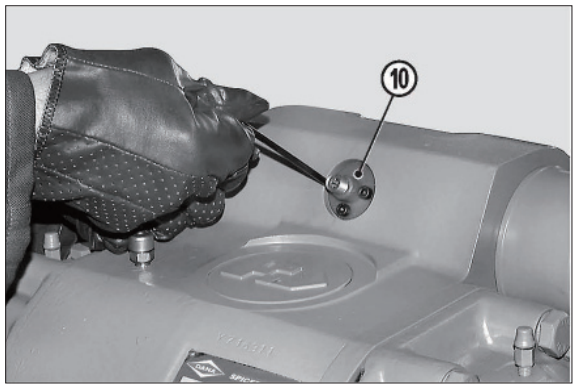
(5) Insert the cotter pins (3) and bend the safety stems.

※ Use new cotter pins.



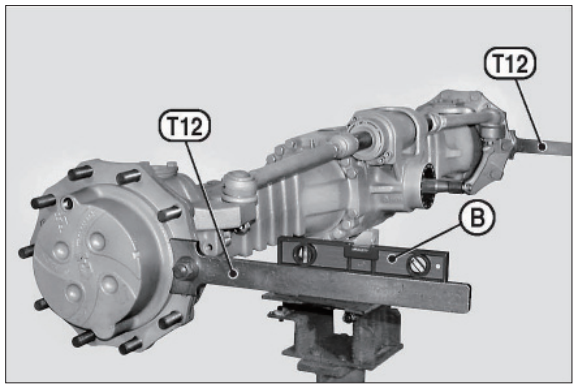
14W98FA124

(6) Install the proximity (1) for checking piston centering - if applicable and tighten the screw (10).
· Torque wrench setting : 5~6 Nm



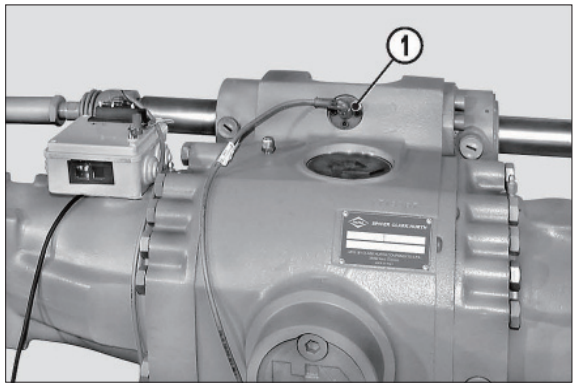
14W98FA125

※ Eliminate the action of the negative brake, if fitted. Apply tools T12 to the hubs and lock them.
Using a level "B", check that tools are perfectly flat and parallel to each other.



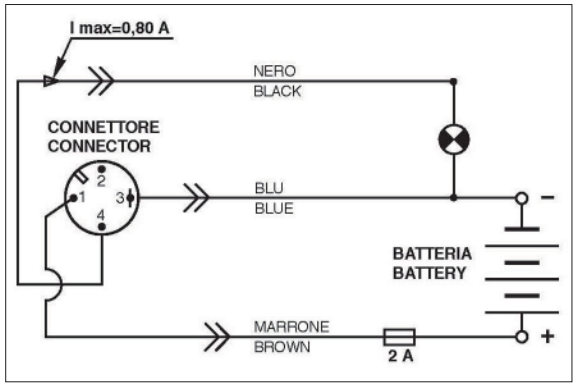
14W98FA126

(7) Connect the sensor (1) to the inspection device according to either diagram.



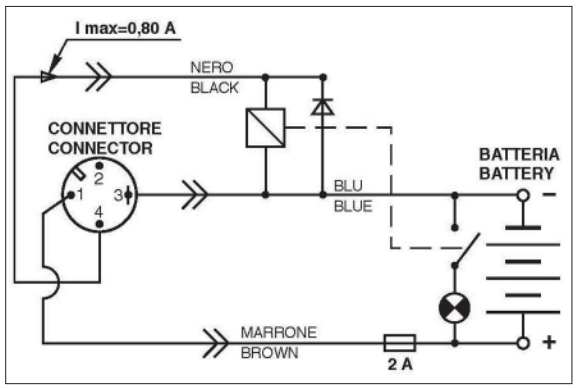
14W98FA127

(8) Sensor connection card, STANDARD version.



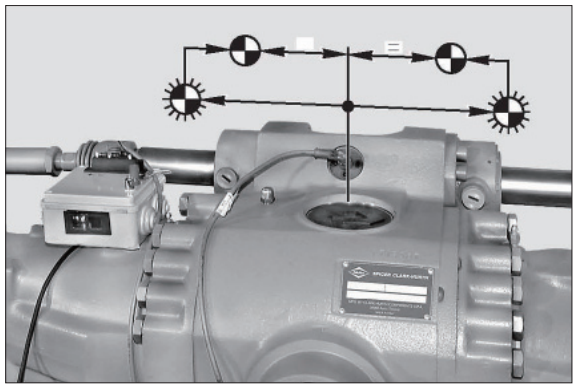
14W98FA128

(9) Sensor connection card, OPTIONAL version.



14W98FA129

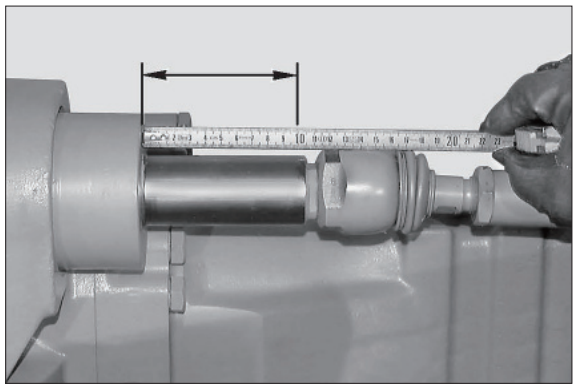
(10) Center the piston by slowly moving it first in one direction then in the other position if half way on the stroke, which is determined by the switching on and off of the signal lamp of the inspection device in the reversal stage.



14W98FA130

(11) Inspect jut "C" in one side of the piston and note down the size for checking later adjustment.

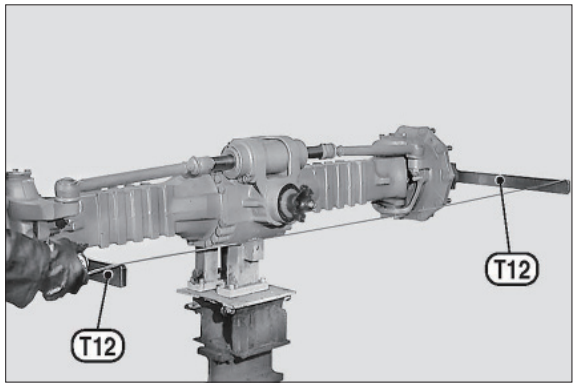
※ If cylinder come without a sensor, the centering of the piston must be carried out on the basis of the maximum stroke.



14W98FA131

(12) Without moving the piston, check front and rear size at the edge of tools T12.

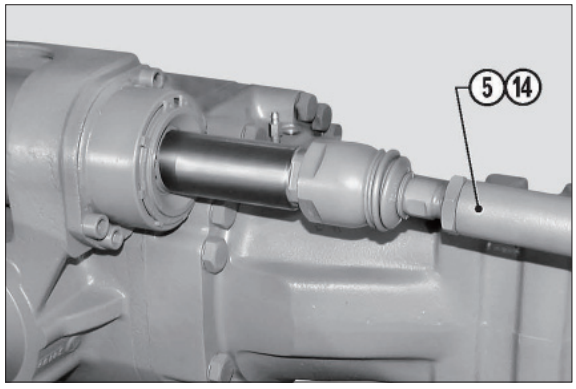
※ In order to check the rear size, rotate the bevel pinion and check that tools T12 are flat.




14W98FA132

(13) If necessary, adjust convergency without moving the centering of the piston and adjust the length of the steering bars (5) or (14).

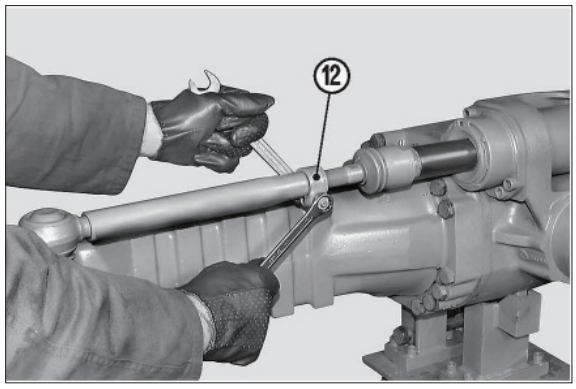
※ With a half turn of screw, the front size is reduced by about 3 mm, whereas the rear one is increased by about 3 mm.




14W98FA133

### (14) CONVERGENCY ADJUST ON UNITS WITH COLLAR

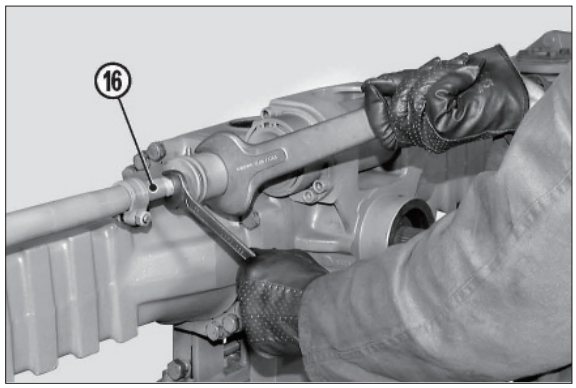
① Unloose the nuts on the collars (12).




14W98FA134

② Rotate the ball-socket joints (16) until convergency has been obtained.
Check that articulations move easily and lock the collars (12).

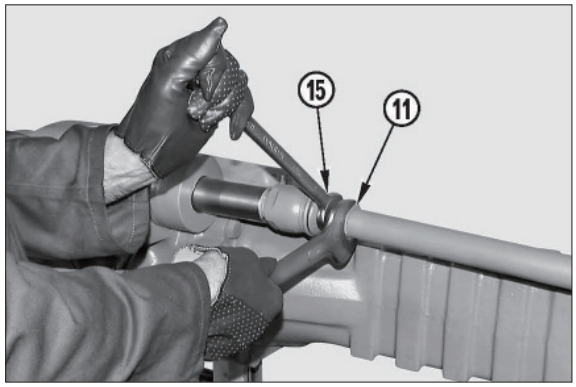
· Torque wrench setting for nuts :
42~52 Nm.




14W98FA135

### (15) CONVERGENCY ADJUSTMENT ON ALTERNATOR VERSIONS

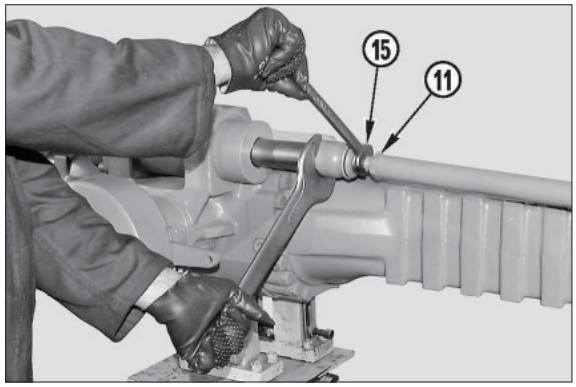
① Unloose the nuts (11) and screw them onto the ball-and-socket joints (15).




14W98FA136

② Hold the articulations still and rotate the ball-and-socket joints (15). Once the convergency has been adjusted, lock the nuts (11).

· Torque wrench setting for nuts :
298-328 Nm

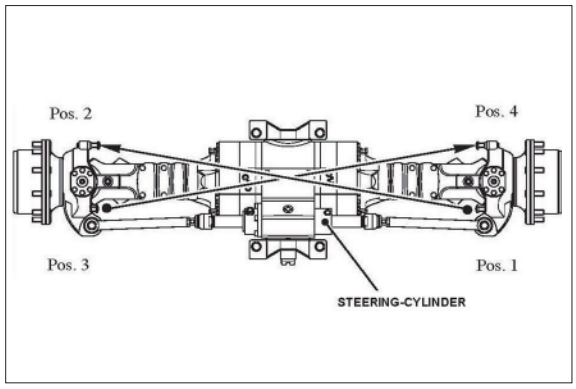



14W98FA137

## (16) ADJUSTMENT THE STEERING ANGLE

※ Form the same operations on both sides see diagram.

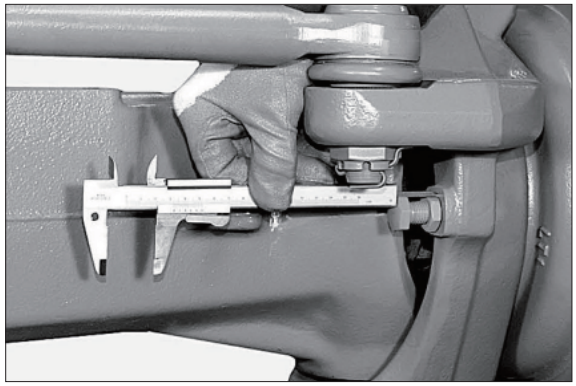
① Loosen the nut of one of the adjusting screw on cylinder side.




14W98FA138

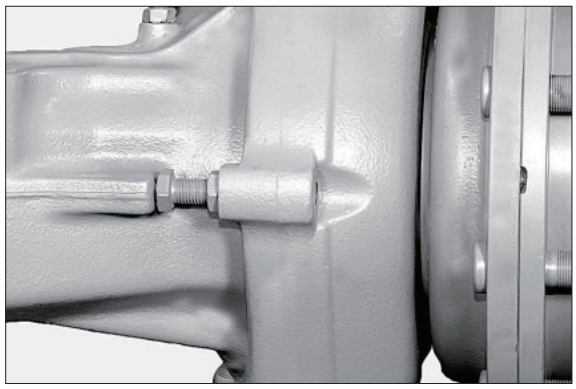
② Adjust the jutting portion of the screw according to data shown in the table.
Lock into the position with nut tightening to max 148 Nm.

| Steering angle | 43° | 45° | 35° | 55° | 40° | 40° |
|---|---|---|---|---|---|---|
| Distance (mm) | 58.5 | 53.5 | 51.6 | 23.8 | 36.6 | 38.2 |



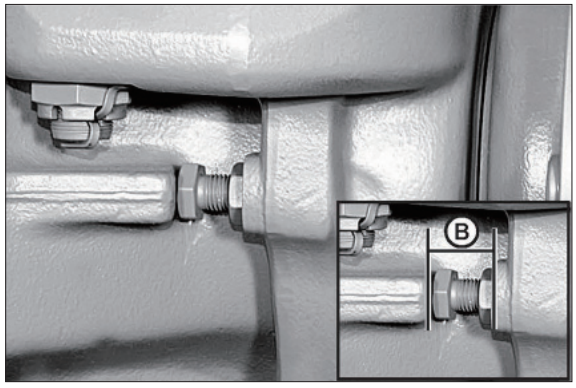
14W98FA139

③ Perform one full steering operation until the adjusted screw leans against the arm stop.



14W98FA140

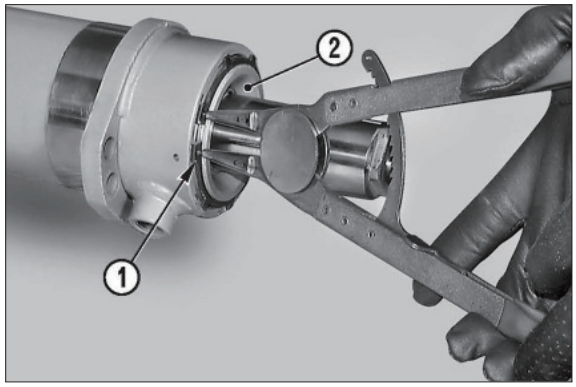
④ Adjust the jutting portion.




14W98FA141

### 3) DISASSEMBLE THE STEERING CYLINDER

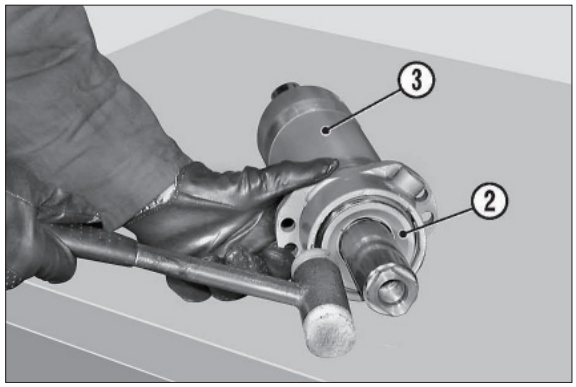
(1) Remove the snap ring (1) from the cylinder head (2).




14W98FA142

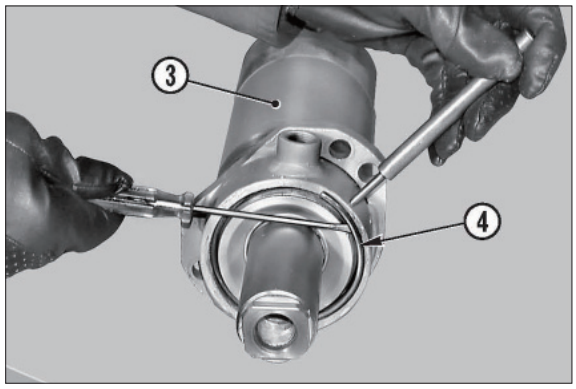
(2) With the help of a plastic hammer, push the head (2) inside the cylinder (3).

※ The head should line up with the edge of the cylinder.



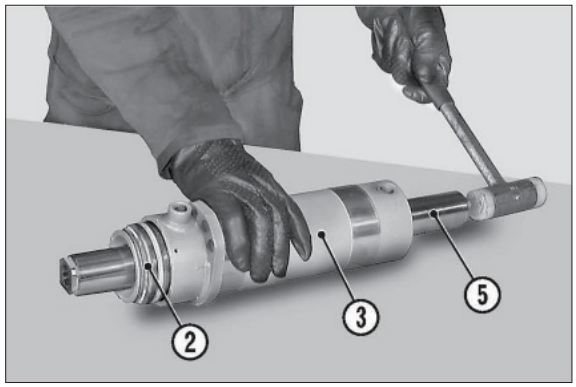

14W98FA143

(3) With the help of a dirty, apply pressure to the stop ring (4) that is placed inside the cylinder (3) and extract the ring using a screwdriver.




14W98FA144

(4) Hammer the piston (5) in the rear head (2) using a plastic hammer.
Continue hammering until the head (2) is ejected from the cylinder (3).




14W98FA145

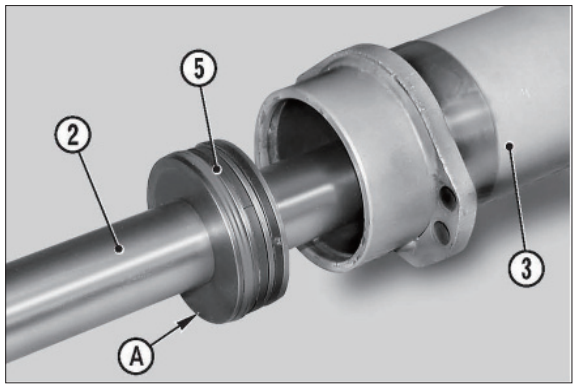
(5) Disassemble the cylinder unit (3) by extracting first the head (2), then the piston (5).

※ Note down the assembly side of the piston (5). The bevelled part "A" of the piston is oriented towards the head (2).

(6) 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 seals of both seals and piston side.

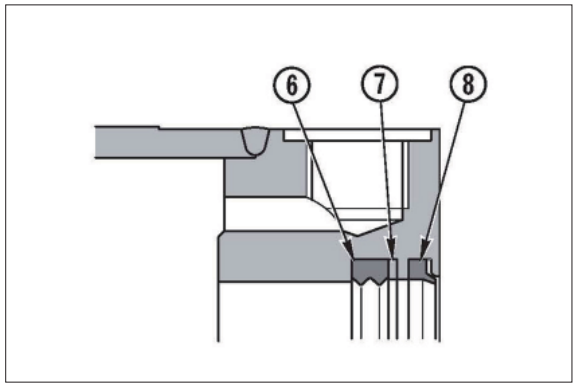


14W98FA146

### 4) ASSEMBLE THE STEERING CYLINDER

(1) After applying grease, install the sealing ring (6) of the shaft, the anti-extrusion ring (7) and the scraper ring (8) inside the cylinder (3).

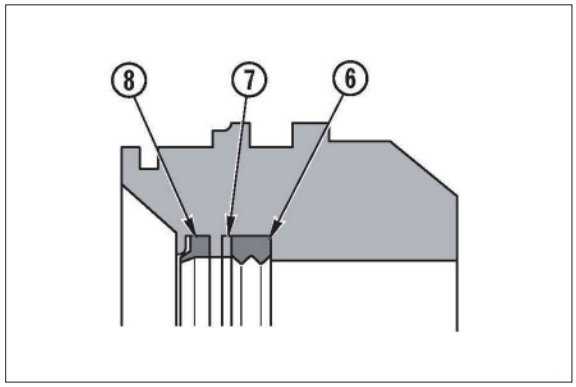
※ Thoroughly check that position of the anti-extrusion ring (7) is correct.



14W98FA148

(2) After applying grease, install the sealing ring (6) of the shaft, the anti-extrusion ring (7) and the scraper ring (8) in the head (2).

※ Thoroughly check that positioning of the anti-extrusion (7) ring is correct.

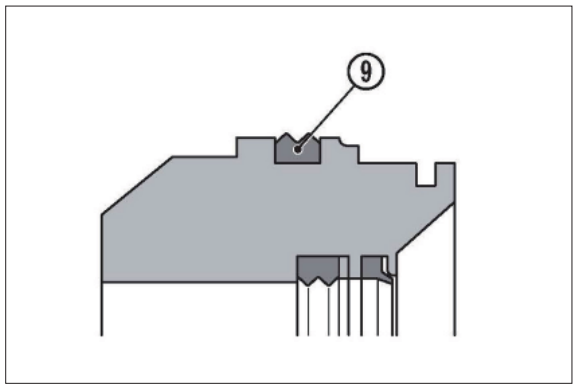


14W98FA149

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

※ In order to facilitate assembly, apply grease to the outer surface of the piston.

※ Do not roll the seal (9) up.

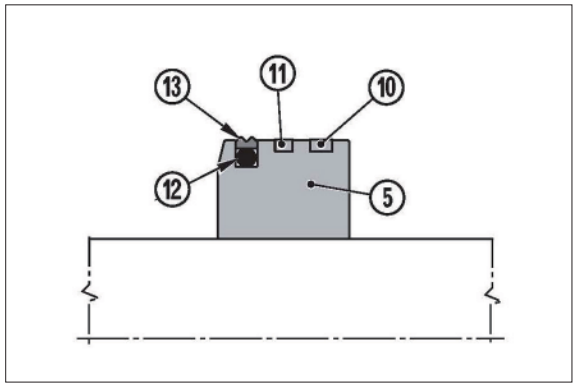


14W98FA150

(4) Prepare the piston (5) by fitting it with the guide ring (10), the magnetic ring (11), the O-ring (12) and the seal (13).

※ In order to facilitate assembly, apply grease.

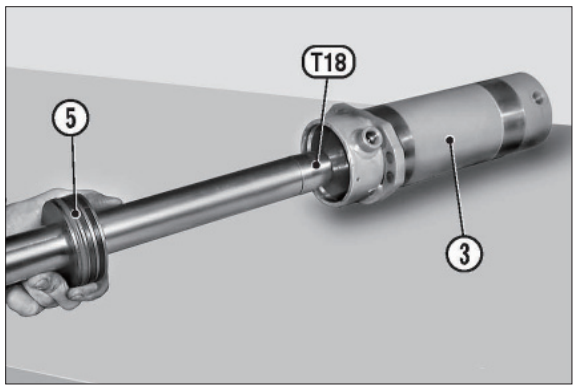
※ If a centering sensor is not fitted, then the magnetic ring (11) should be replaced by another guide ring (10).




14W98FA151

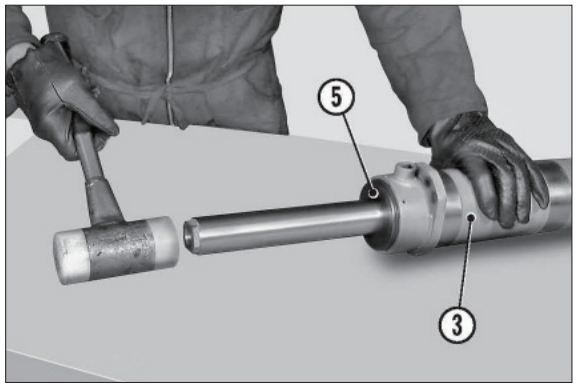
(5) Apply tool T18 to the shaft on the opposite side of the head (2) and center it on the cylinder (3) so that of fits into the piston (5).

※ Apply a little grease to seals and cylinder.



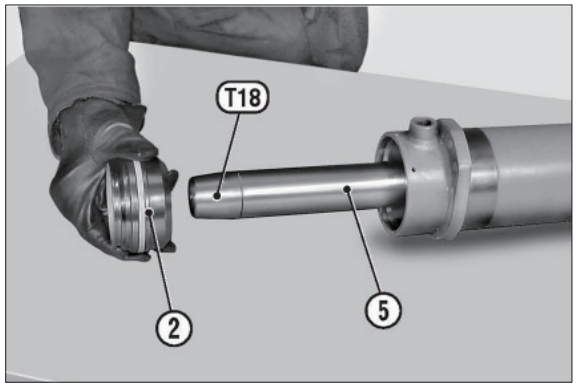

14W98FA152

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




14W98FA153

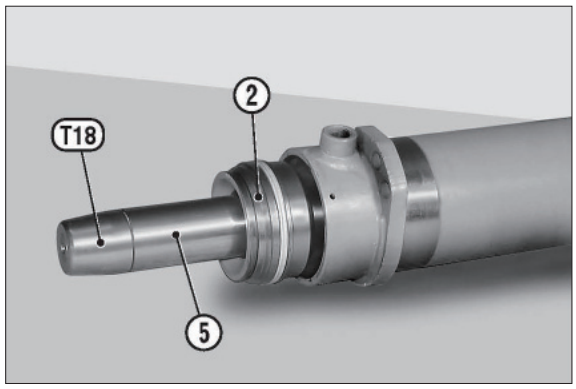
(7) Remove tool T18 and apply of to the opposite side of the piston (5).




14W98FA154

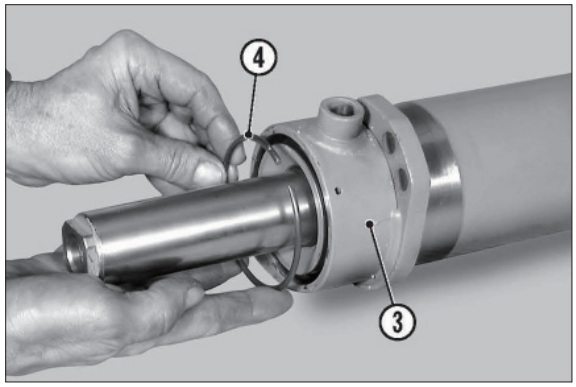
(8) Apply grease to head (2) seals, fit the head onto the piston and push it into the cylinder (3) using a plastic hammer.

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



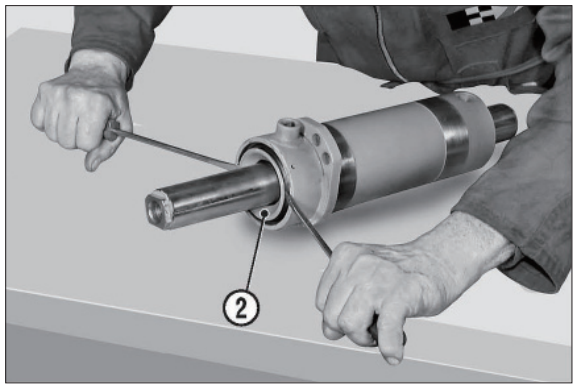

14W98FA155

(9) Insert the stop ring (4) ensuring that it fits into the seat of the cylinder (3).




14W98FA156

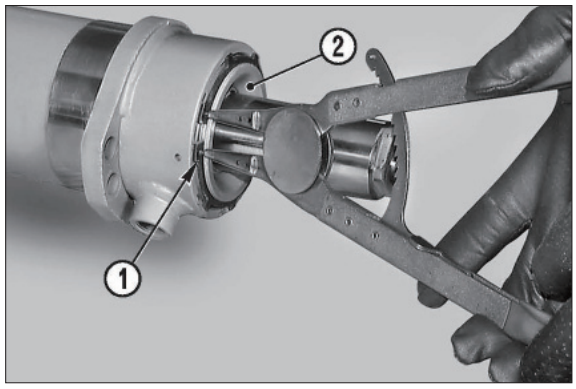
(10) Apply pressure to the head using two screwdrivers or levers until the head is fastened onto the stop ring (4).




14W98FA157

(11) 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.

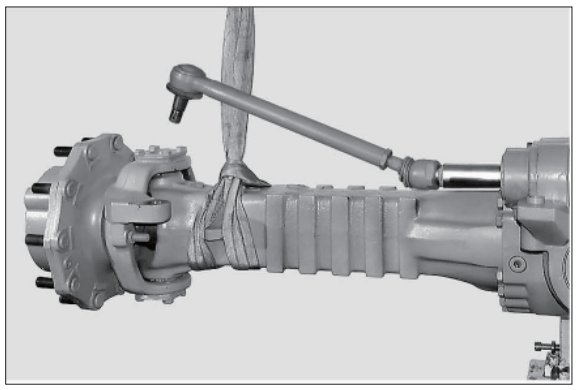



14W98FA158

## 10. THE BEVEL PINION

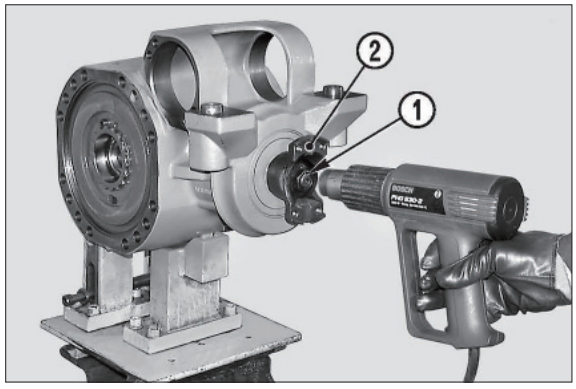
### 1) REMOVE THE BEVEL PINION

(1) Remove the complete arms and the differential unit.
For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS" and "REMOVING THE DIFFERENTIAL UNIT".



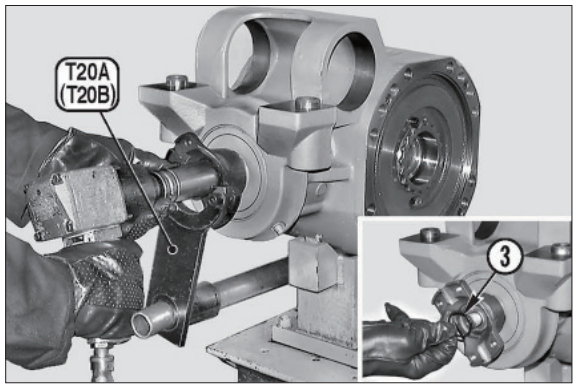
14W98FA159

(2) If disassembly is awkward, heat the check nut (1) of the flange (2) at 80°C.



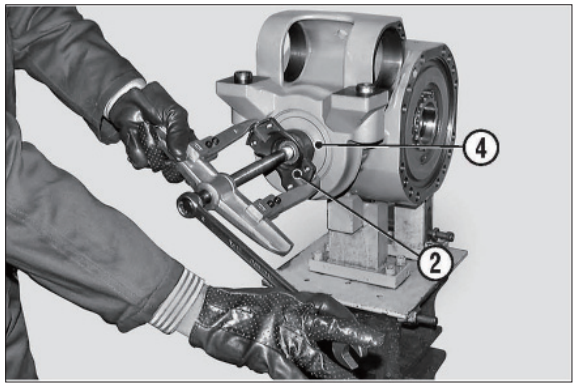

14W98FA160

(3) Position tool T20A (or T20B), so as to avoid pinion rotation. Unloose and remove the nut (1) ; also remove the O-ring (3).



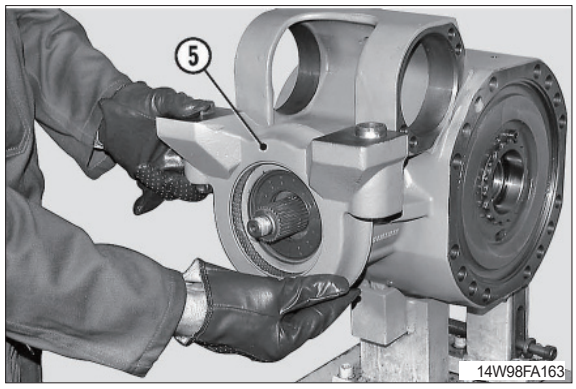

14W98FA161

(4) Remove the flange (2) complete with guard (4) by means of a puller.




14W98FA162

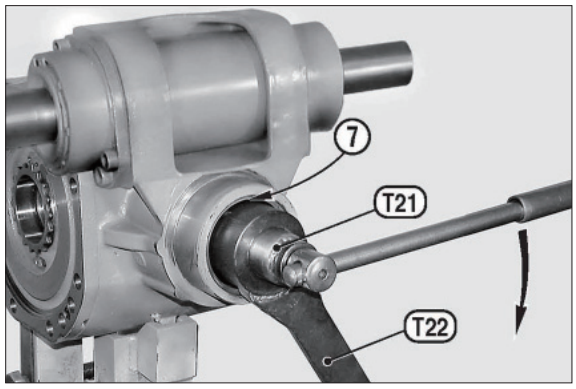
(5) Remove the swinging support (5).




(6) Remove the sealing ring (6).

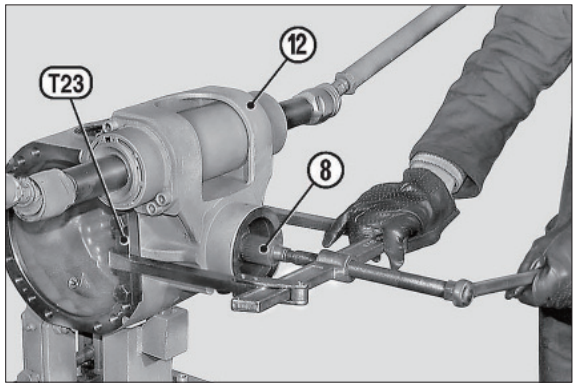

(7) Position wrench T22 onto the ring nut (7) and apply bar hold T21 to the pinion (8). Stop wrench T22 and rotate the pinion so as to release and remove the ring nut (7)

※ If disassembly proves awkward, weld the ring nut at approx 80°C.

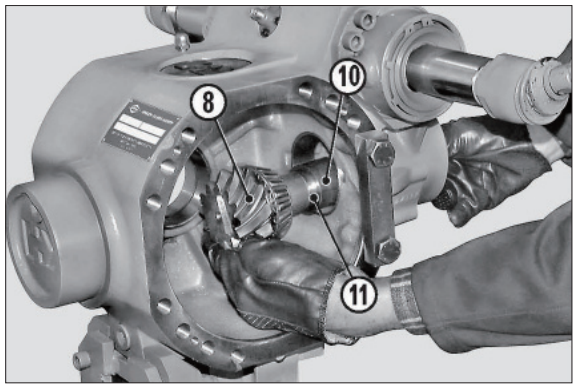



(8) Apply blocks T23 and, with the help of a puller, extract the pinion (8) complete with the internal bearing (9), the distance piece (10) and shims (11).

※ The thrust blocks of the bearing remain in the central body (12).

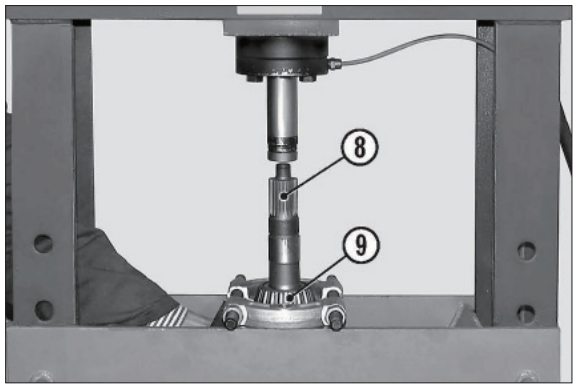


(9) Remove the pinion (8), shims (11) and distance piece (10).



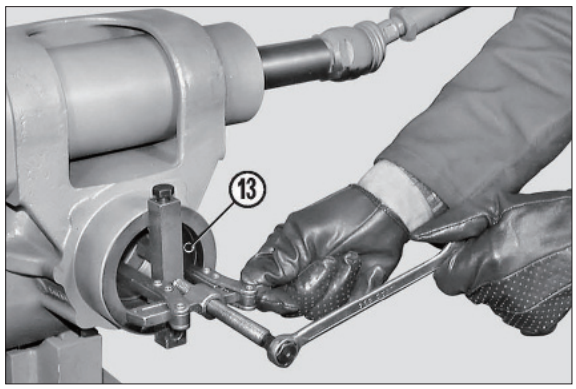

14W98FA167

(10) Using a puller and a press, remove the inner bearing (9) from the pinion (8).



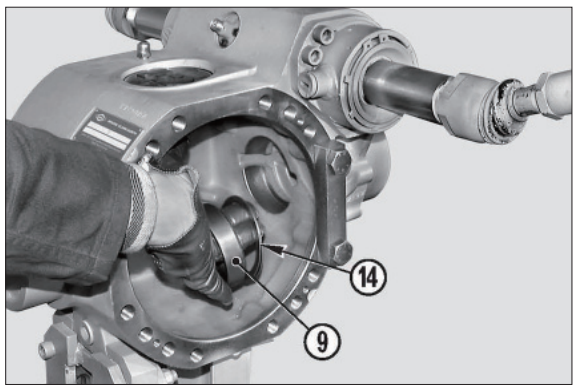

14W98FA168

(11) Remove the thrust block of the external bearing (13).




14W98FA169

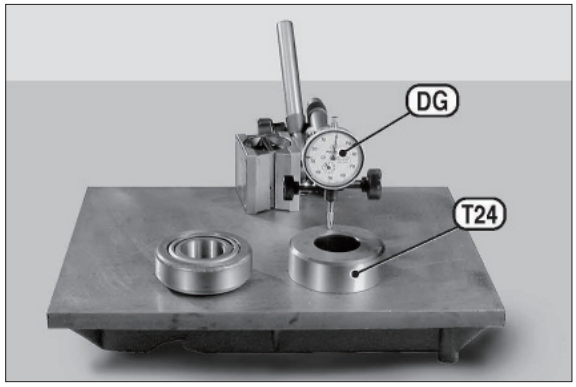
(12) Insert a drift in the appropriate holes and remove the thrust block of the internal bearing (9) as well as the shim washers (14).




14W98FA170

## 2) INSTALL AND ADJUST THE BEVEL PINION

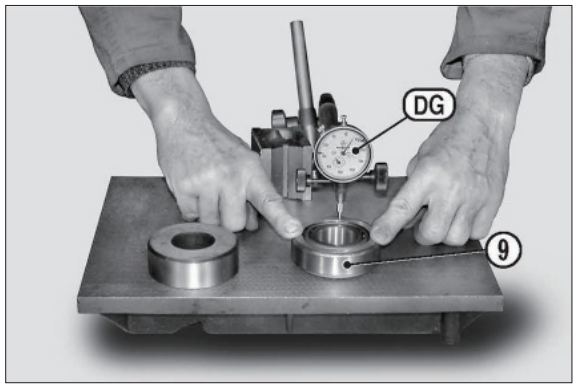
(1) Using a surface plate, reset a centesimal comparator "DG" and place it on the measurement ring T24 (with a thickness of 30.2 ㎜).
Preset the comparator to approx 2 ㎜.



14W98FA171

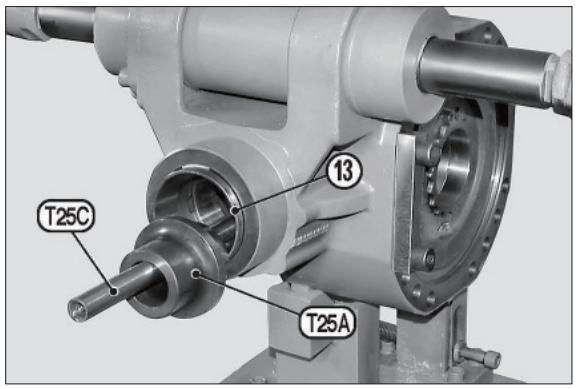
(2) Bring the internal bearing (9), complete with its thrust block, under the comparator "DG".
Determine overall thickness "D" of the bearing checking the discrepancy between this size and the size of the measurement ring.

※ Press the thrust block in the center and take several measurements while rotating the thrust block.



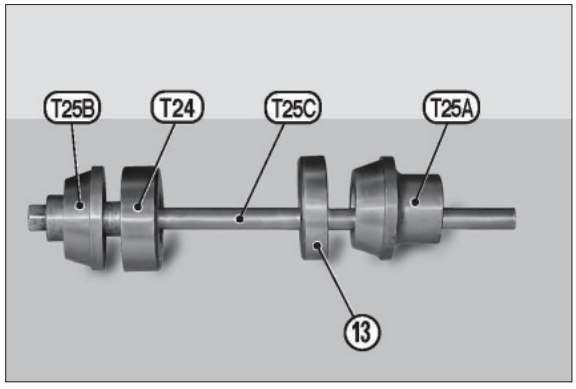
14W98FA172

(3) Partially insert the thrust block of the external bearing (13).



14W98FA173

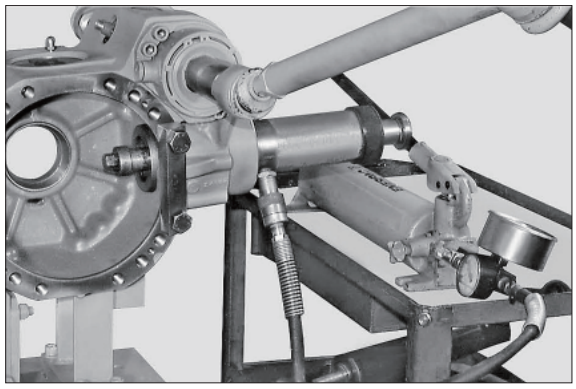
(4) Install tension rod T25C, measurement ring T24 and front guide tool T25A on the thrust block of the external bearing (13).



14W98FA174

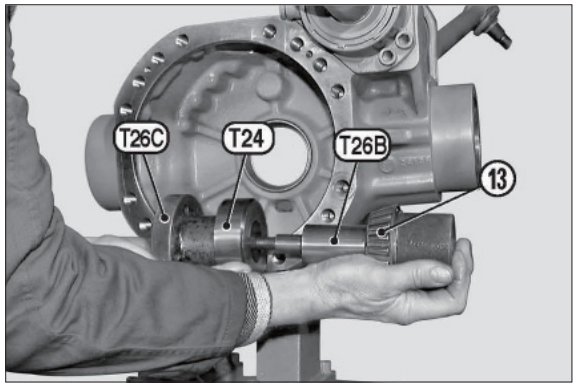
(5) Connect the tension rod to the press and move the thrust block of the external bearing (13) into its seat.
Disconnect the press and remove the tension rod.

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



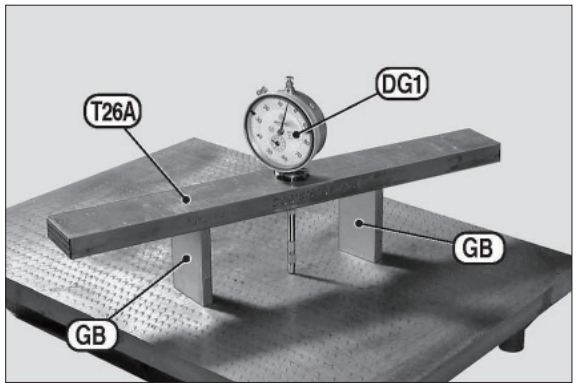
14W98FA175

(6) Insert tool T26B complete with external bearing (13), measurement ring T24 and gauged ring nut T26C.
Manually tighten.



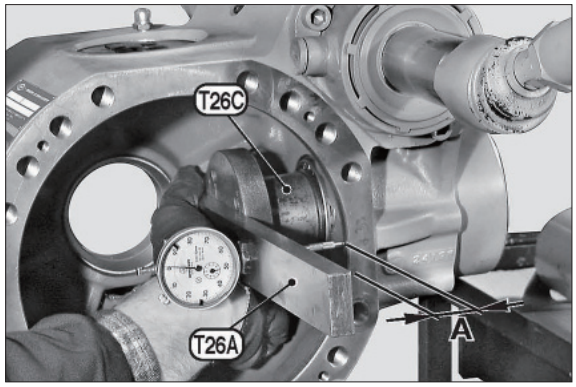

14W98FA176

(7) Fit a centesimal comparator "DG1" with long stem into bar T26A ; when the bar rests on two size-blocks "GB" of 57 mm , rest the comparator.
Preset the comparator to approx. 2 mm and reset.



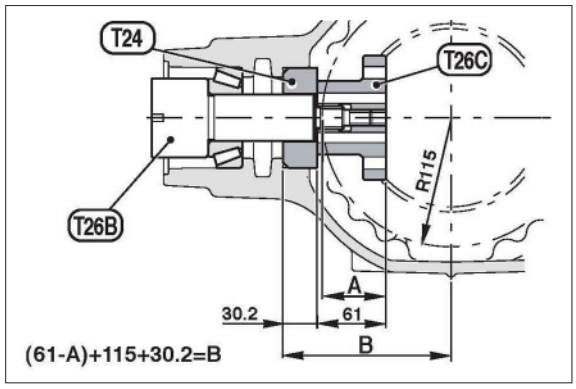

14W98FA177

(8) Lay bar T26A on gauge nut T26C and take the size "A" at about 57 mm corresponding to the maximum diameter of arms centering.



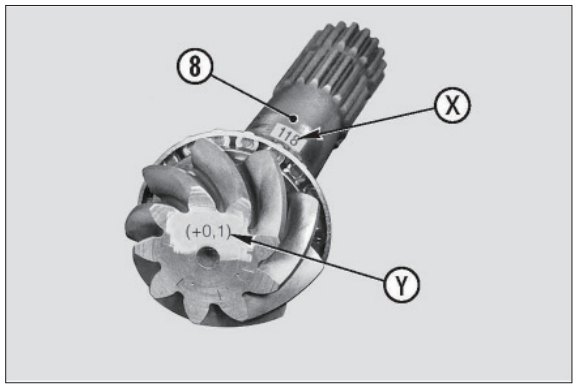

14W98FA178

(9) Calculate size "B" which will be the first useful value for calculating the size of the shims (14) that are to be inserted under the thrust block of the internal bearing (9).



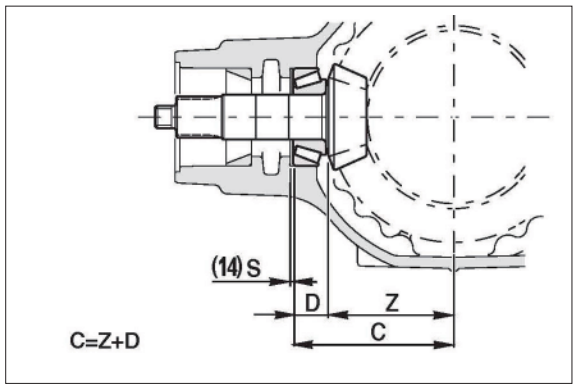

14W98FA179

(10) Check the nominal size (X) marked on the pinion and add or subtract the indicated variation (Y) so as to obtain size "Z".
e.g. : Z =118 + 0.1 = 118.1
Z = 118 - 0.2 = 117.8



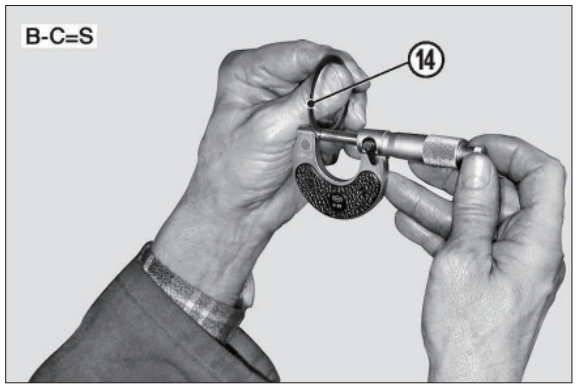

14W98FA180

(11) Calculate size "C" which represents the second value for calculating the size of the shims "S" that are to be placed under the thrust block of the internal bearing (9).




14W98FA181

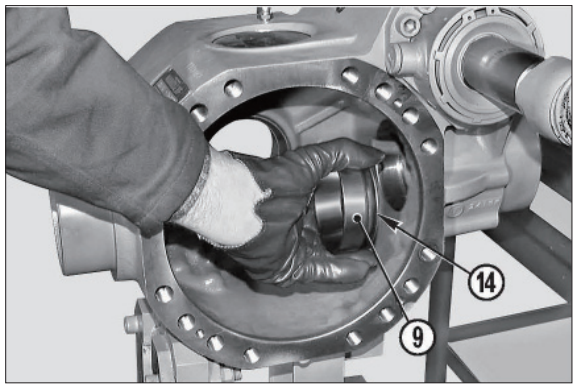
(12) Calculate the difference between sizes "B" and "C" so as to obtain the size "S" of the shim (14) that will go under the thrust block of the internal bearing (9).




14W98FA182

(13) Insert shim "S" (14) and the thrust block of the internal bearing (9) in the central body.

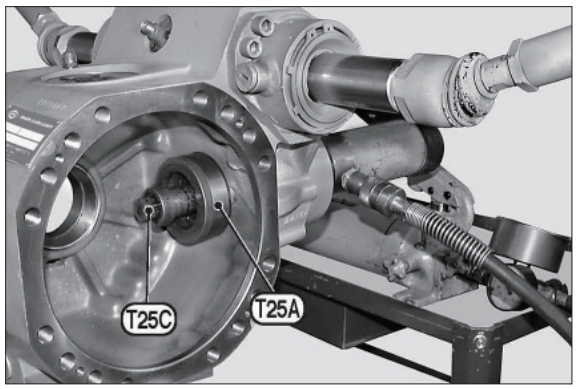
※ To hold shim "S" (14) in position, apply grease.




14W98FA183

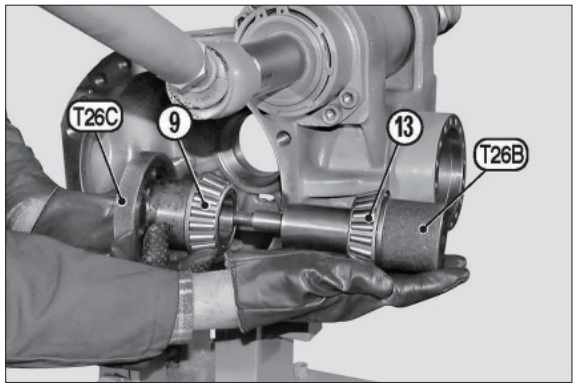
(14) Position tool T25A and tension rod T25C. Connect the tension rod to the press, fasten the thrust block and then remove the tools.

※ Before going on the next stage, make sure that the thrust block has been completely inserted.



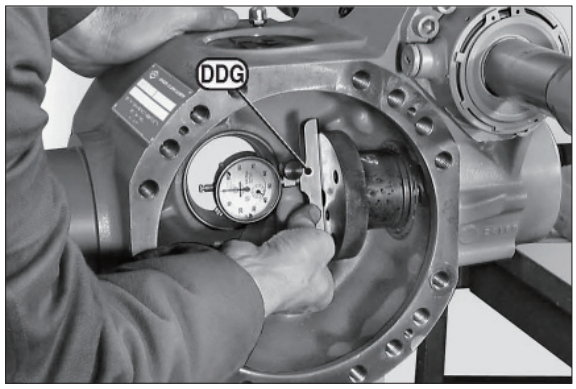

14W98FA184

(15) Position tools T26C and T26B complete with tapered bearing (9) and (13) ; manually tighten until a rolling torque has been obtained.



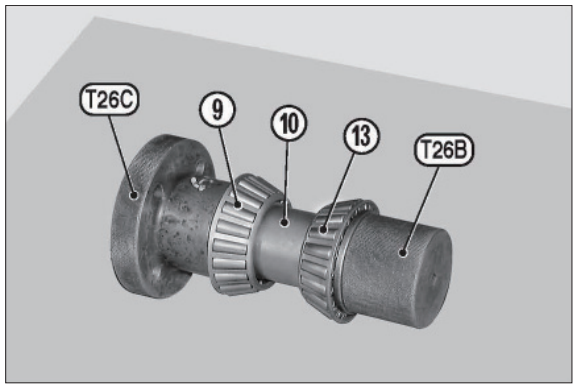

14W98FA185

(16) Insert the stem of a depth comparator "DDG" in either side hole of tool T26C ; reset the comparator with a presetting of approx. 3 mm.



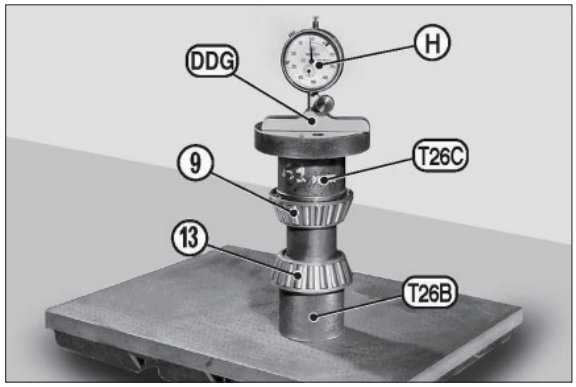

14W98FA186

(17) Remove the comparator and release tools and bearing from the central body. Re-install all and insert the distance piece (10) between bearings (9) and (13) ; manually tighten until a rolling torque has been obtained.



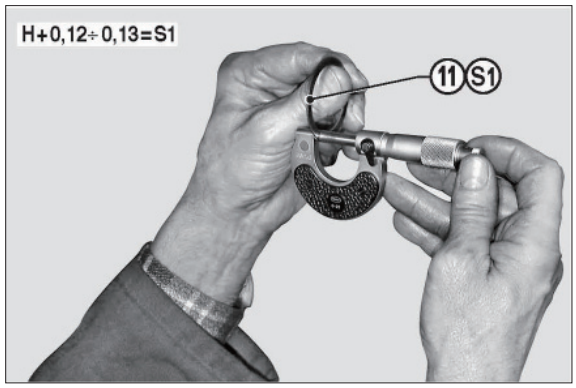

14W98FA187

(18) Insert the stem of a depth comparator "DDG" into tool T26B-T26C and measure variation "H" in relation to the zero setting performed back at point d.



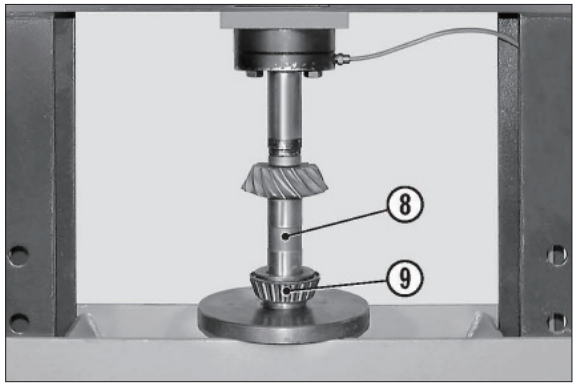

14W98FA188

(19) The variation is to be added to a set value of 0.12-0.13 mm., so as to obtain the size of shim "S1" (11) which will be inserted between the external bearing (13) and the distance piece (10) and subsequently, to determine the preload for the bearings.




14W98FA189

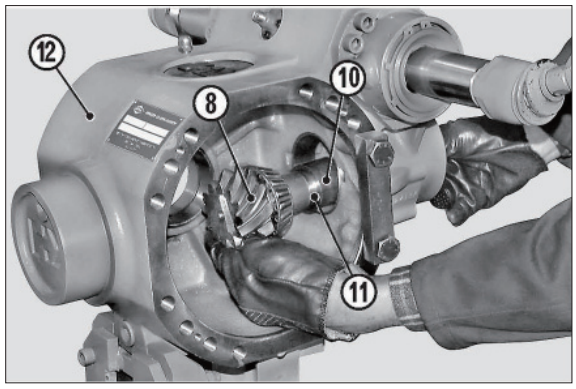
(20) Position the internal bearing (9) and the pinion (8) under a press ; force the bearing onto the pinion.




14W98FA190

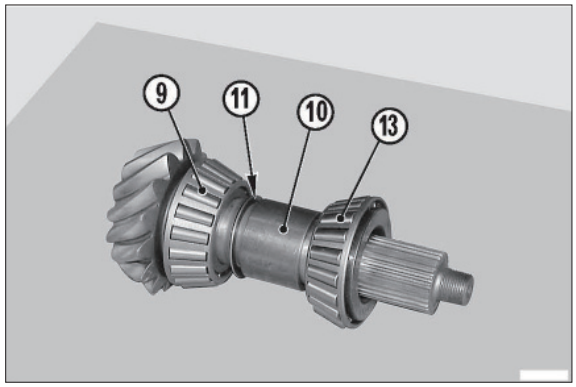
(21) Fit the pinion (8), shim "S1" (11) and distance piece (10) in the main body (12).

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



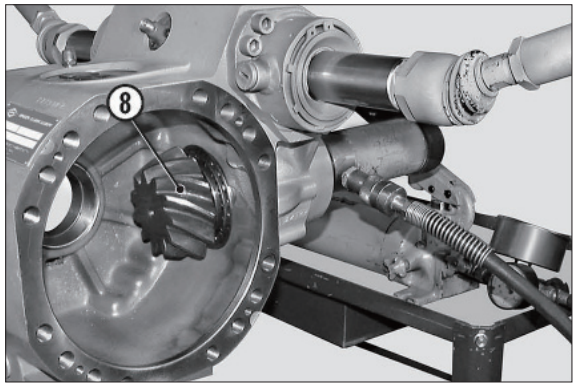

14W98FA191

(22) Insert the external bearing (13) in the central body in order to complete the pack arranged as in the figure.



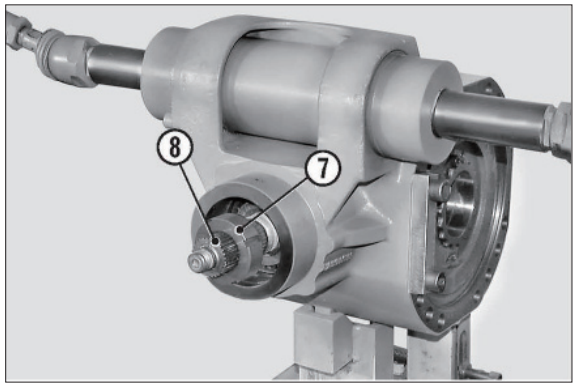

14W98FA192

(23) Connect the pinion (8) to the tie rod T28A and T28B ; connect the tie rod T28C (see special tools) to the press and block.



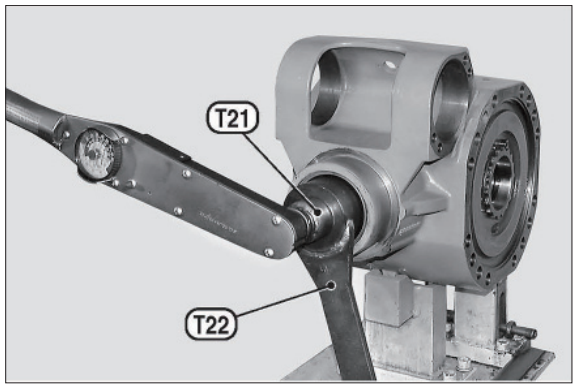

14W98FA193

(24) Apply loctite 242 to the thread of the ring nut (7) and screw the nut onto the pinion (8).




14W98FA194

(25) Apply special wrench T22 to the ring nut (7) and bar-hold T21 to the pinion (8).
Lock the wrench T22 and rotate the pinion using a dynamometric wrench, up to a minimum required torque setting of 500 Nm.



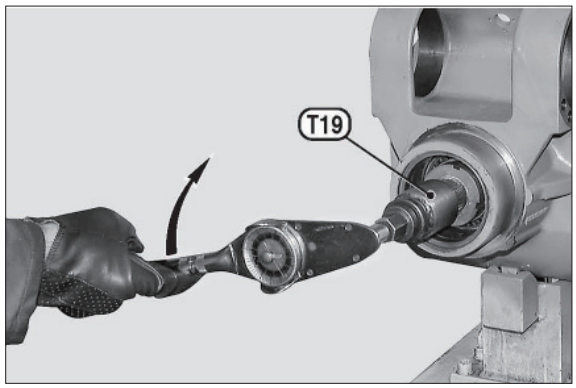
14W98FA195

(26) Apply onto the pinion (8) the bar-hold and with the help of a torque meter, check the torque of the pinion (8).
Torque : 120-170Ncm

※ If torque exceed the maximum value, then the size of shim "S1" (11) between the bearing (13) and the distance piece (10) needs to be increased.

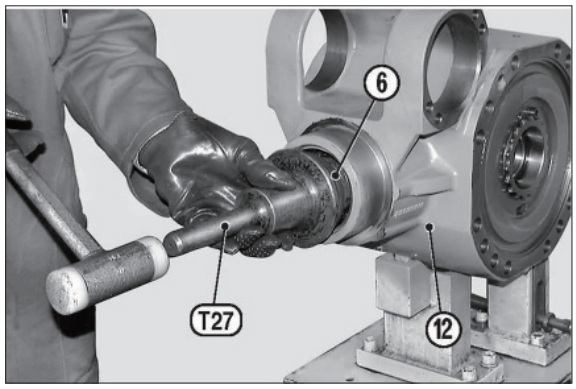
※ If torque does not reach the set value, increase the torque setting of the ring nut (7) in differential stages to obtain a maximum value of 570 Nm.
If torque does not reach the minimum value, then the size of shim "S1" (11) needs to be reduced.

※ When calculating the increase or decrease in size of shim "S1", bear in mind that a variation of shim (11) of 0.01 mm corresponds to a variation of 60 Ncm in the torque of the pinion (8).



14W98FA196

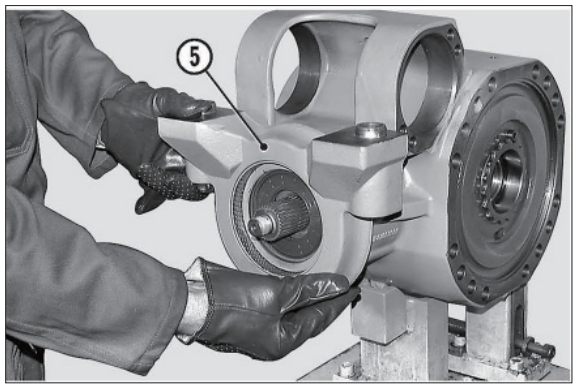
(27) Lubricate the outer surface of the new sealing ring (6) and fit it onto the central body (12) using tool T27.



14W98FA197

(28) Install the swing support (5).

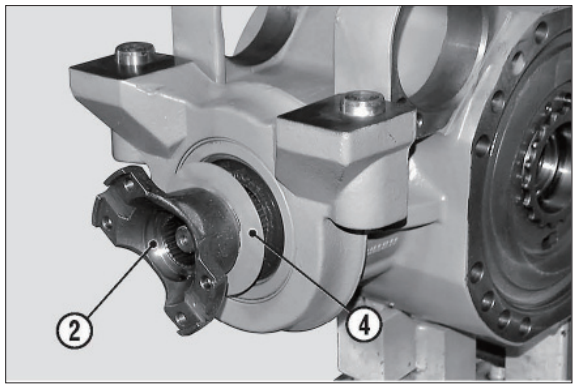
※ Check that it is properly oriented.




14W98FA198

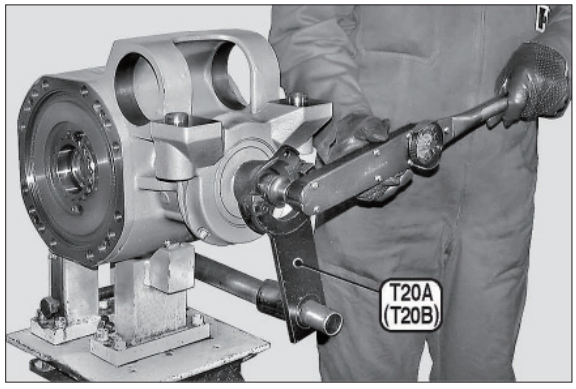
(29) Fit the flange (2) complete with the guard (4) and fasten it.
For keying the flange (2), use a plastic hammer if necessary.

※ Make sure that the guard (4) is securely fastened onto the flange and that it is not deformed.



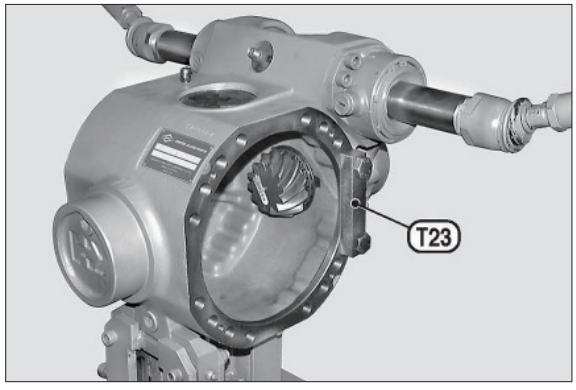

14W98FA199

(30) Apply loctite 242 to the threaded part of the pinion (8).
Position tool T20A (or T20B) and fasten it in order to avoid rotation.
Insert O-ring (3) and the nut (1) and tighten it using a dynamometric wrench.
· Torque wrench setting : 280-310 Nm




14W98FA200

(31) Remove blocks T23 (used for extracting the pinion) and re-install the arms.
For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS."

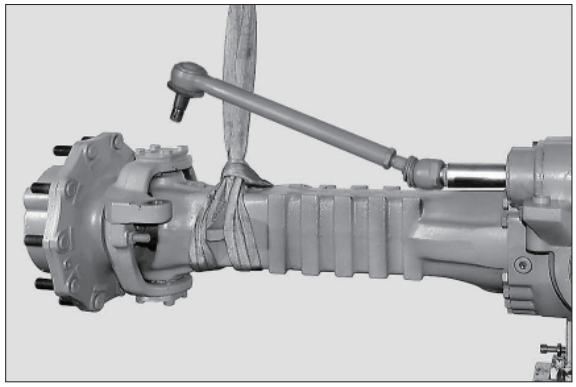



14W98FA201

## 11. THE DIFFERENTIAL UNIT

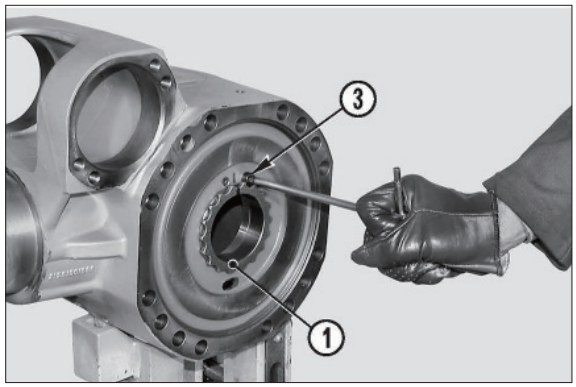
### 1) REMOVE AND DISASSEMBLE THE DIFFERENTIAL UNIT

(1) Remove the complete arms.
For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS".



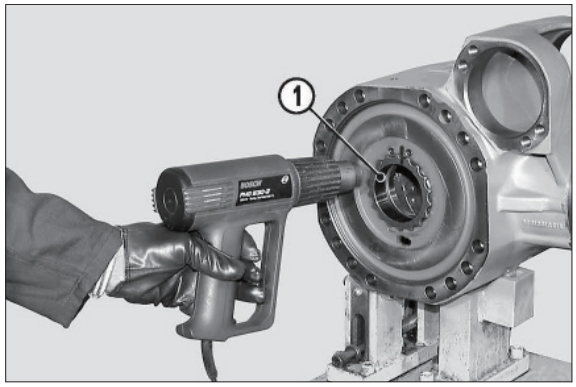
14W98FA202

(2) Make the position of the ring nuts (1).
Remove the screws (3) from the ring nuts (1).



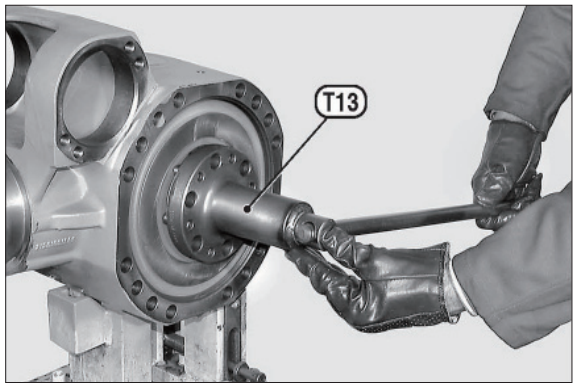

14W98FA203

(3) Uniformly heat the ring nuts (1) up to a temperature of 80°C.



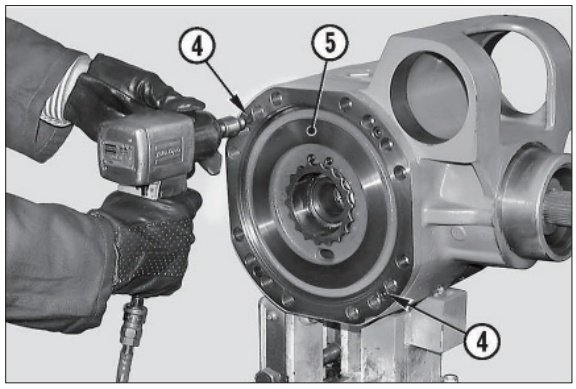

14W98FA204

(4) Apply tool T13 and remove the ring nuts.
※ Accurately clean the threaded portions on ring nuts of body and cover.




14W98FA205

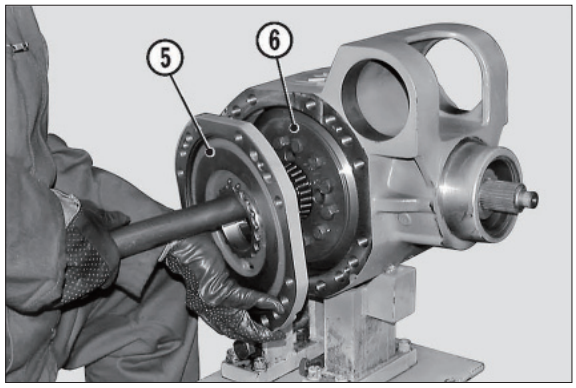
(5) Remove the fittin screws (4) from the middle cover (5).




14W98FA206

(6) Insert a screw-driver in the opposing slots then force and remove the middle cover (5) and the complete differential unit (6).

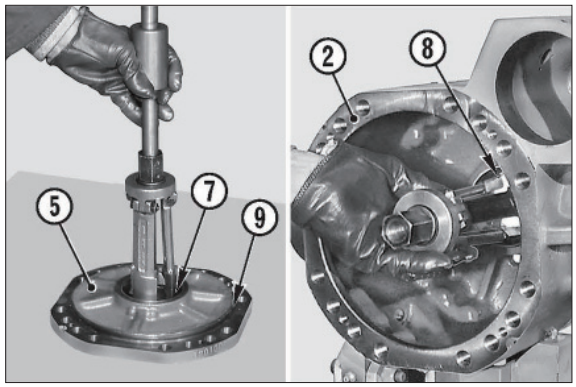
※ Support the pieces using a rod.




14W98FA207

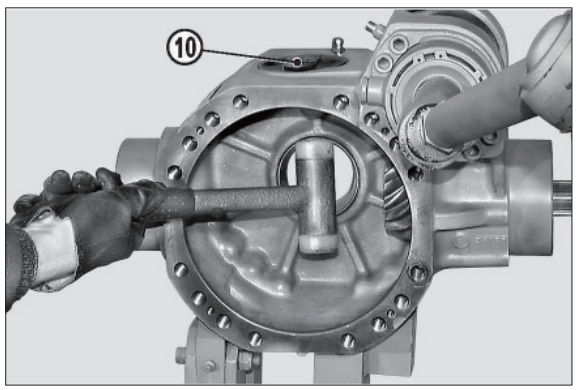
(7) If the bearing need replacing, extract the external thrust blocks of the bearing (7) and (8) from middle cover (5) and central body (2).

※ Accurately check the O-ring (9).



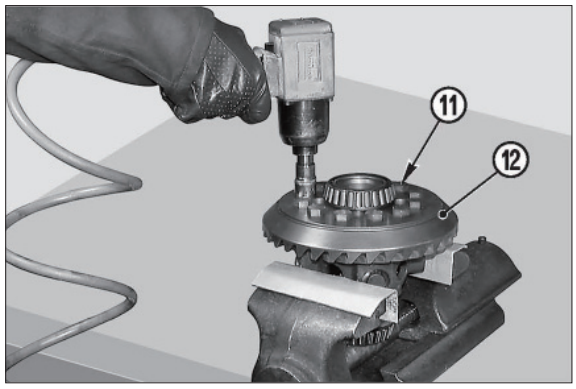

14W98FA208

(8) Remove the top plug (10).



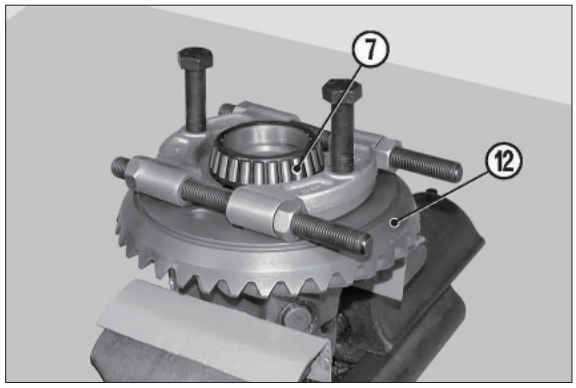

14W98FA209

(9) Remove the screw (11) from the crown (12).



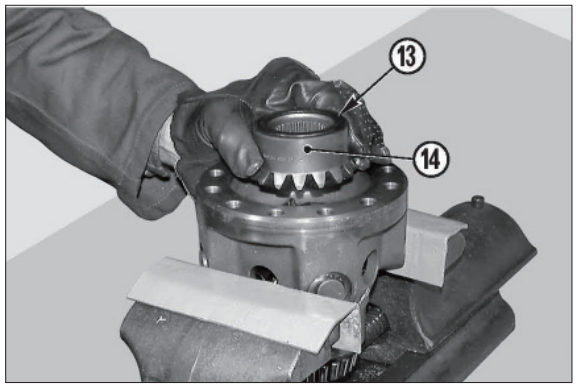

14W98FA210

(10) If the bearing need replacing, extract the bearing (7) and remove the crown (12).



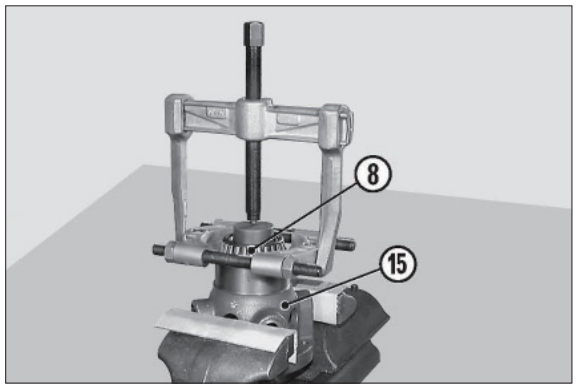

14W98FA211

(11) Remove the shim washer (13) and the planetary gear (14).



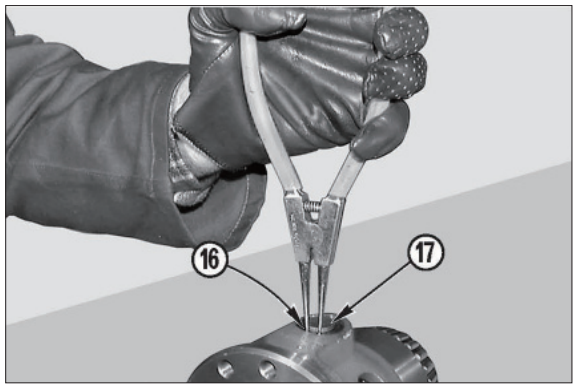

14W98FA212

(12) If the bearing need replacing, extract the bearing (8) from the differential carrier (15).



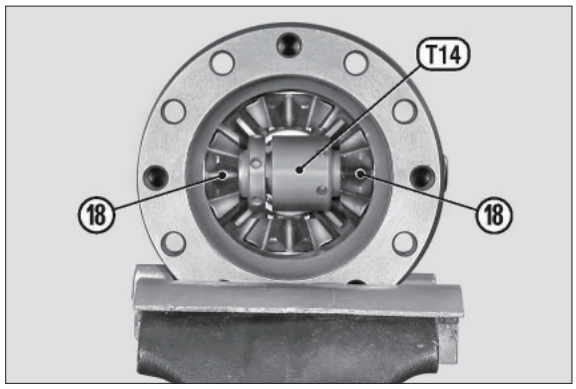

14W98FA213

(13) Remove the snap rings (16) from the two pins (17) of the planet wheel gears (18).




14W98FA214

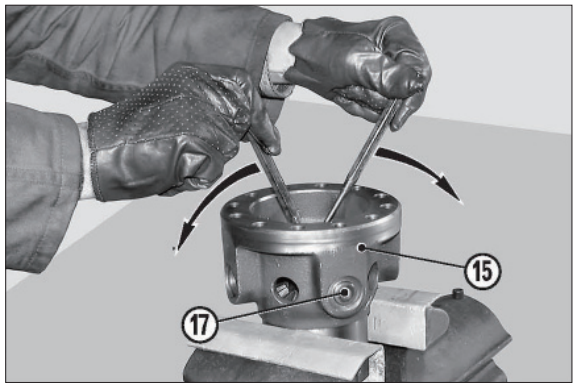
(14) Insert tool T14 between the planet wheel gears (18).




14W98FA215

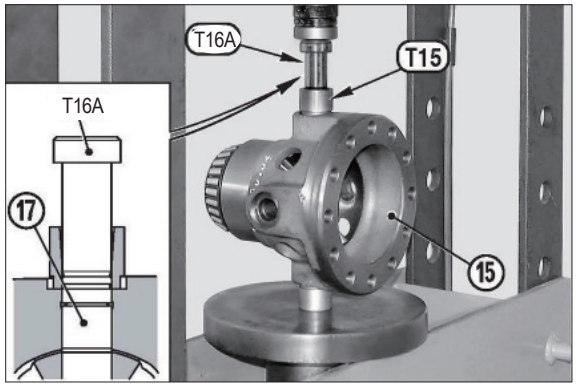
(15) Force tool T14 in-between the planet wheel gears (18) using two pin-drivers.

※ Make sure that tool T14 is perfectly lined up with the pins (17) when locked.




14W98FA216

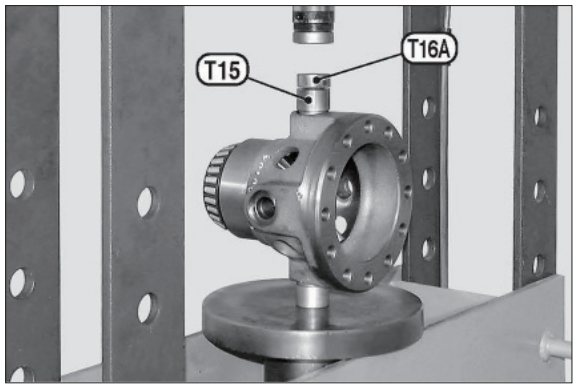
(16) Place the differential carrier (15) under a press, position bush T15 and insert gudgeon T16A. Press T16A pin to limit position.




14W98FA217

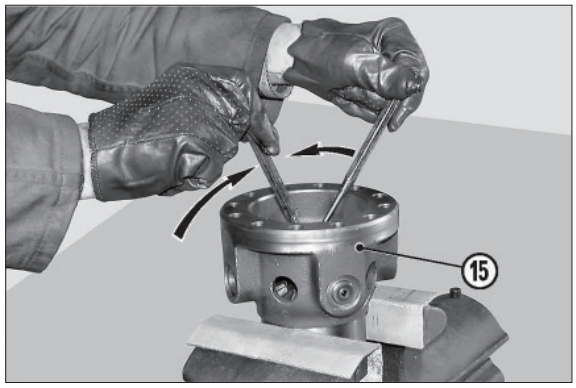
(17) Remove gudgeon T16A and bush T15.

※ In this condition the tool T14 contains pin (17)



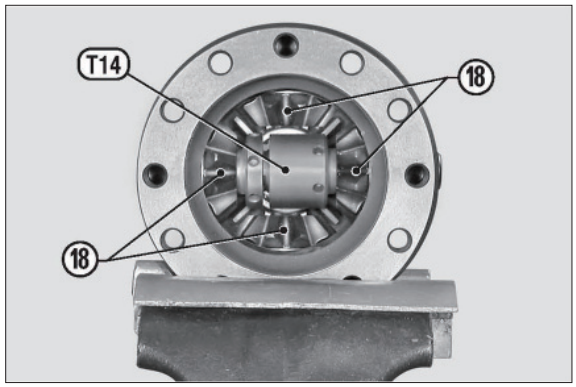

14W98FA218

(18) Remove tool T14 together with the pin (17) of the planet wheel.



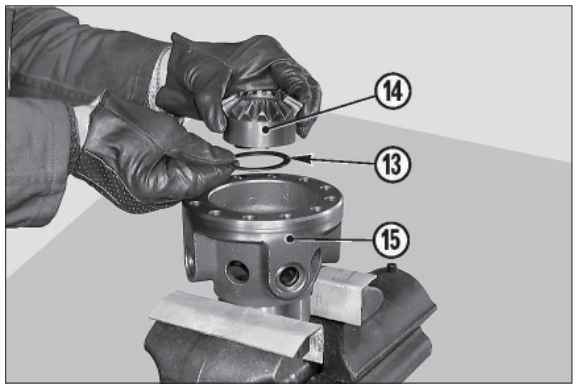

14W98FA219

(19) Leave the released planetary gear in position and again lock tool T14.
Repeat the operations for the extraction of the 2nd planet wheel (17).
Repeat the operations for all other pins.




14W98FA220

(20) Remove tool T14 and remove the last two planet wheel gears (18), the 2nd differential unit gear (14) and the relative shim washer (13) from the differential carrier.

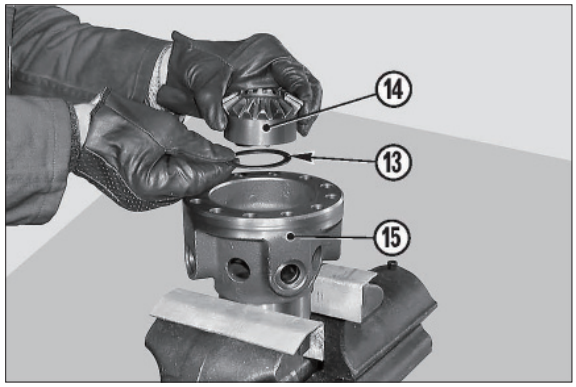



14W98FA221

## 2) ASSEMBLE AND INSTALL THE DIFFERENTIAL UNIT

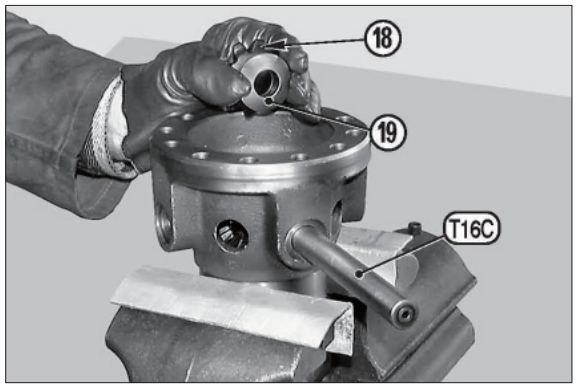
### · ASSEMBLING

(1) Insert the shim washer (13) and the planetary gear (14) in the differential carrier (15).



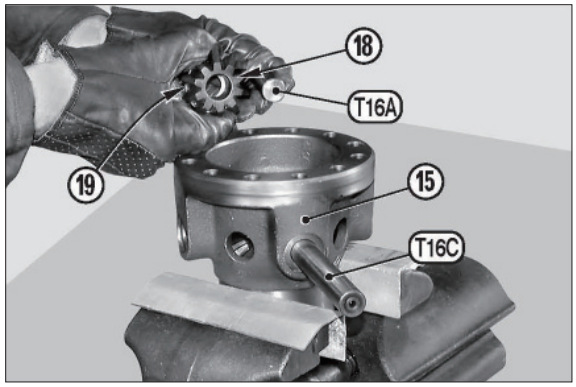

14W98FA222

(2) Position the shim washer (19) and the first planet wheel gear (18).
Hold them in position using bar T16C.



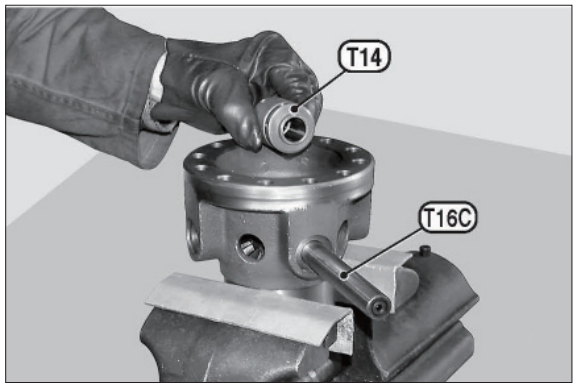

14W98FA223

(3) With the help of gudgeon T16A, position the second planet wheel gear (18) and the relative shim, washer (19).



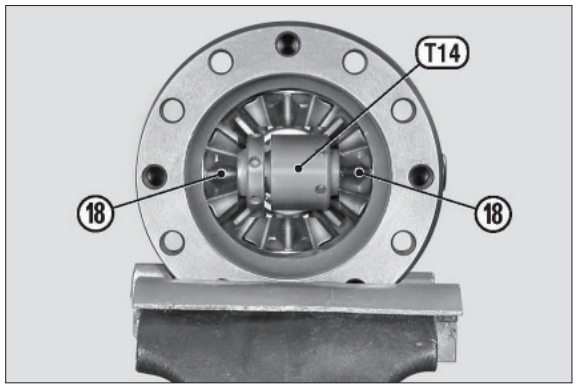

14W98FA224

(4) Insert tool T14 between the two planetary gears (18). Line up the entire unit by pushing bar T16C all the way down until gudgeon T16A is ejected.



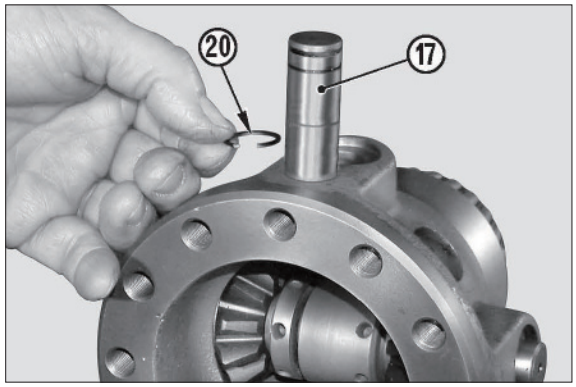

14W98FA225

(5) Lock tool T14 behind the planet wheel gears (18). After locking, remove bar T16C.



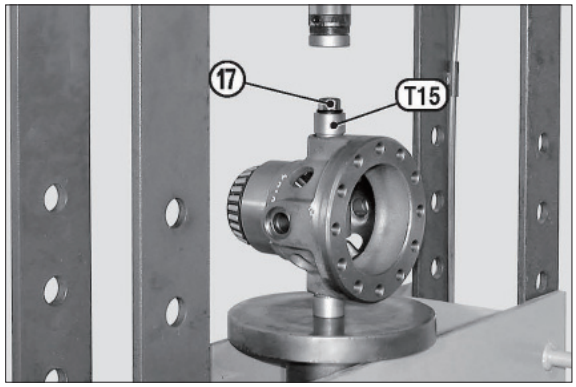
14W98FA226

(6) Fit the snap rings (20) onto the pins (17).



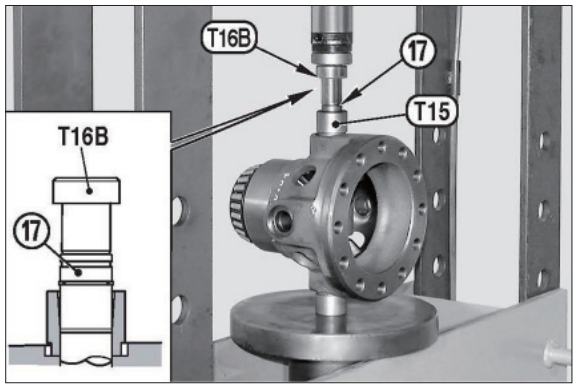
14W98FA227

(7) Place the differential carrier (15) under the press, position bush T15 and insert the planet wheel pin (17).



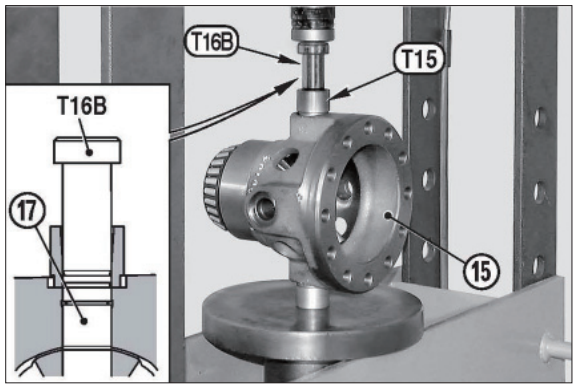
14W98FA228

(8) Put gudgeon T16B on top if the planet wheel pin (17).



14W98FA229

(9) Press T16B pin all the way down.

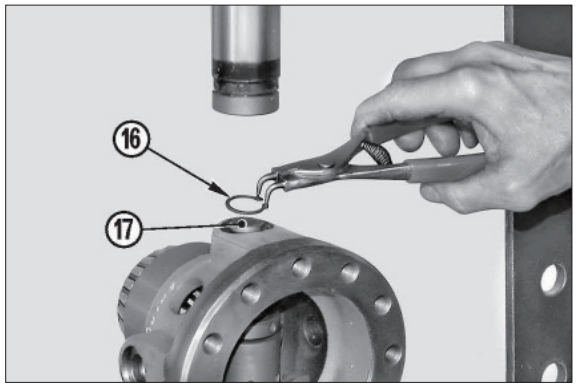


14W98FA230

(10) Remove gudgeon T16B, bush T15 and fit the snap ring (16) on the pin (17).

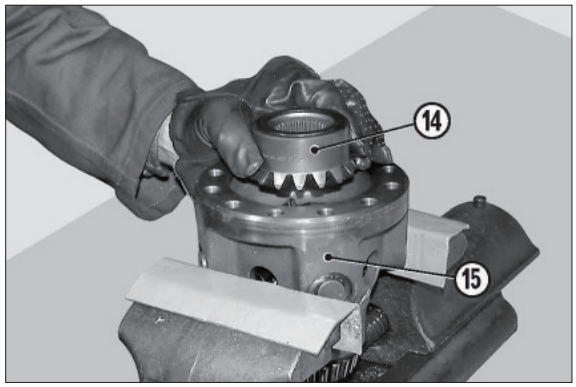
※ Make sure that the snap ring centers the seat and that it sets on the surface of the differential carrier.

Repeat the operations on the other planet wheel pin or planet wheel axle.



14W98FA231

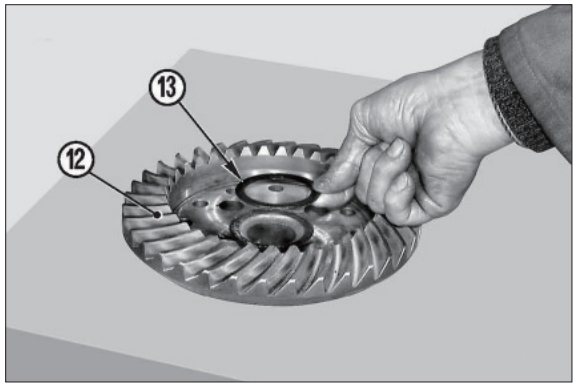
(11) Position the second planetary gear (14) in the differential carrier (15).



14W98FA232

(12) Position the shim washer (13) on the crown (12).

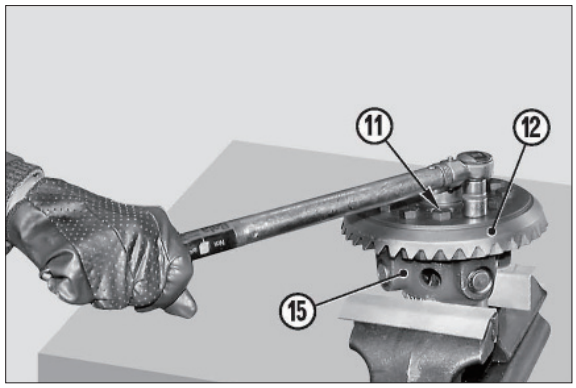
※ In order to hold the shim washer (13) in position, apply grease to it.



14W98FA233

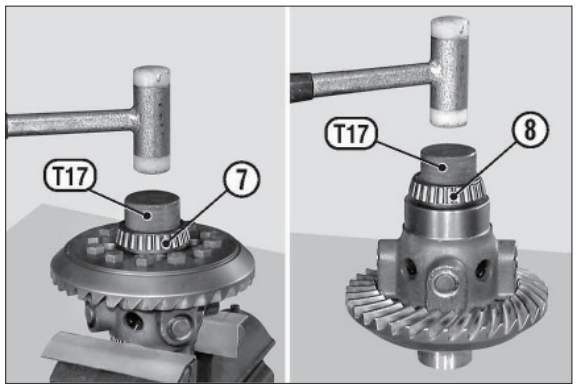
(13) Position the crown (12) in the differential carrier (15) and lock it with screws (11) applied with loctite 242.
Torque wrench setting for screws : 128-142 Nm

※ Secure the screws using the cross-tightening method.



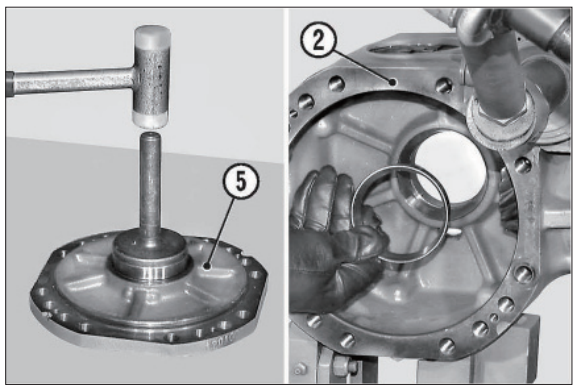
14W98FA234

(14) Install the bearings (7) and (8) using tool T17.



14W98FA235

(15) If the bearings are replaced, insert the external thrust blocks in the middle cover (5) and in the central body (2).

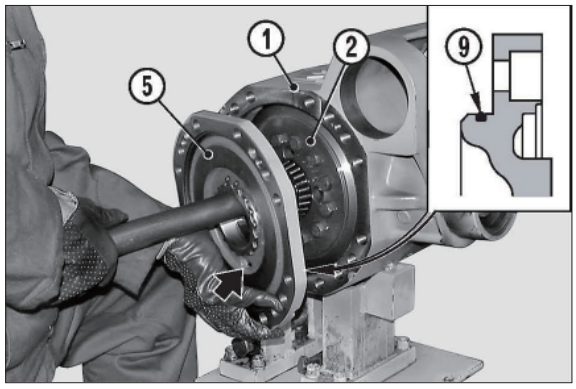


14W98FA236

· INSTALLING

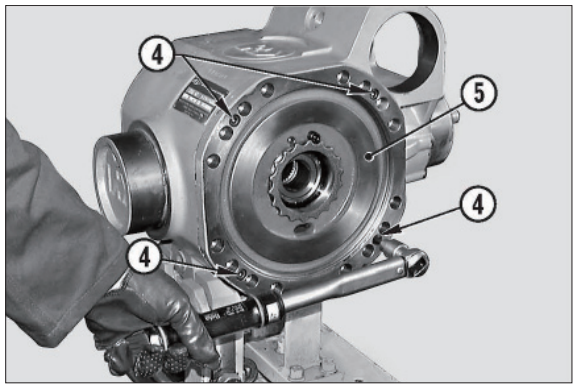
(16) Position the differential unit (6) in the central body (2) with the help of a bar and fit the middle cover (5).

※ Thoroughly check the state of the O-ring (9) and make sure that the cover is fitted with the oil discharge in the lower position.



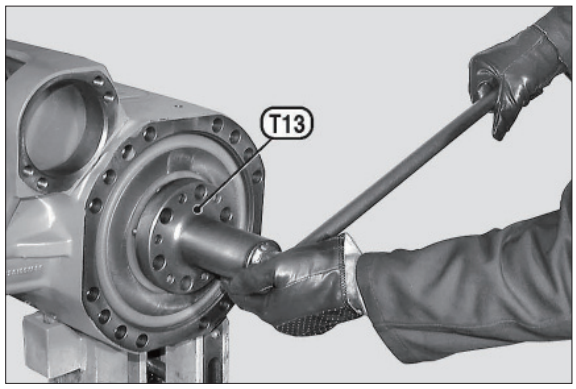
14W98FA237

(17) Lock the middle cover (5) with screws (4).
· Torque wrench setting for screw :
23.8 - 26.2 Nm



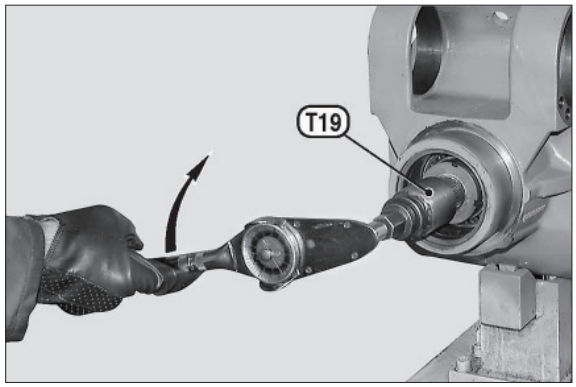
14W98FA238

(18) Tighten ring nuts on the crown side until clearance between pinion and crown is zero, then lock the crown ; go back 1/4～1/2 turn.
※ It the ring nuts (1) are removed, spread them with loctite 242.



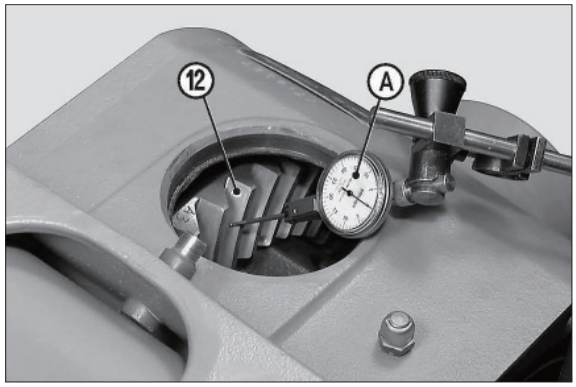
14W98FA239

(19) Pre-set the bearing by means of the ring nut situated on the opposite side of the crown, so as to increase pinion torque up to 140～210 Ncm.
※ If bearings are not new, check the static torque ; if bearing are new, check the continuous torque.



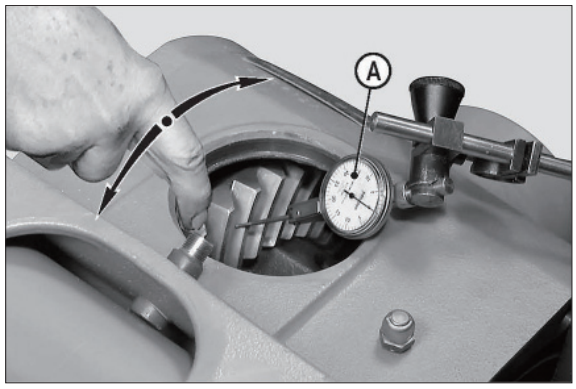
14W98FA240

(20) Introduce a comparator with rotary key "A" through the top plug hole (10).
Position the comparator on the center of one of the teeth of the crown (12), pre-set it to 1 mm and reset it.



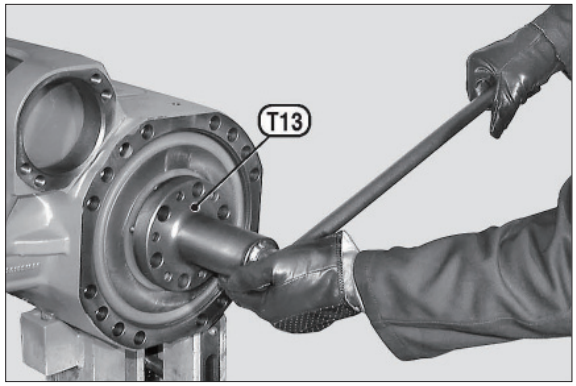
14W98FA241

(21) Manually move the crown (12) in both directions in order to check the existing backlash between the pinion and the crown.




14W98FA242

(22) Adjust the backlash between the pinion and the crown by unloosing one of the ring nuts (1) and tightening the opposite to compensate.
Normal backlash : see table.



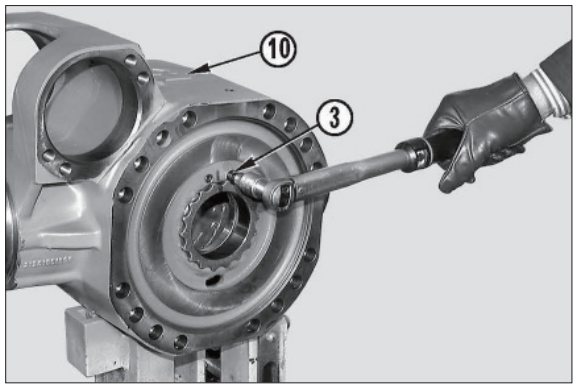

14W98FA243

※ Differential between MIN and MAX clearance for whole circumference should not exceed 0.09 mm.

TABLE

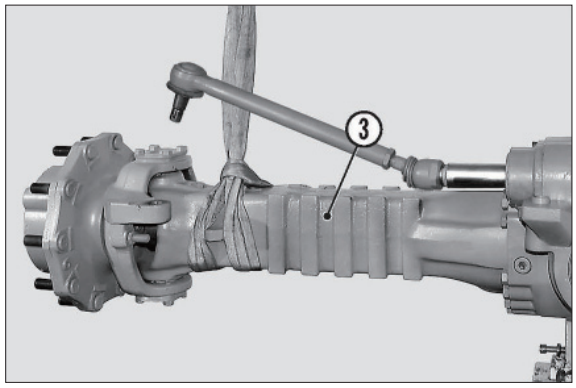
| Ratio | Clearance | |
|---|---|---|
| | Min. | Max. |
| 9:34 | 0.18 | 0.23 |
| 9:35 | 0.13 | 0.18 |
| 11:31 | 0.20 | 0.28 |
| 11:35 | 0.13 | 0.18 |
| 12:35 | 0.13 | 0.18 |
| 12:41 | 0.15 | 0.20 |
| 14:32 | 0.18 | 0.23 |
| 14:36 | 0.15 | 0.20 |
| 14:41 | 0.15 | 0.20 |
| 15:32 | 0.18 | 0.23 |
| 15:47 | 0.13 | 0.18 |

(23) Apply loctite 242 to the screws (3), fit them into one of the two holes and tighten.
· Torque wrench setting : 23.8 - 26.2 Nm
Fit the top plug (10) after applying repositionable jointing compound for seals to the rims.



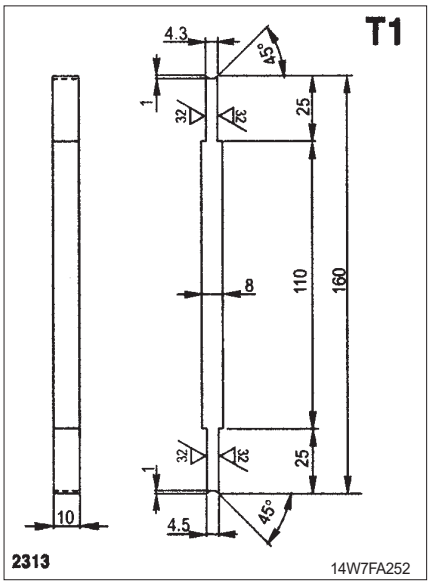
14W98FA244

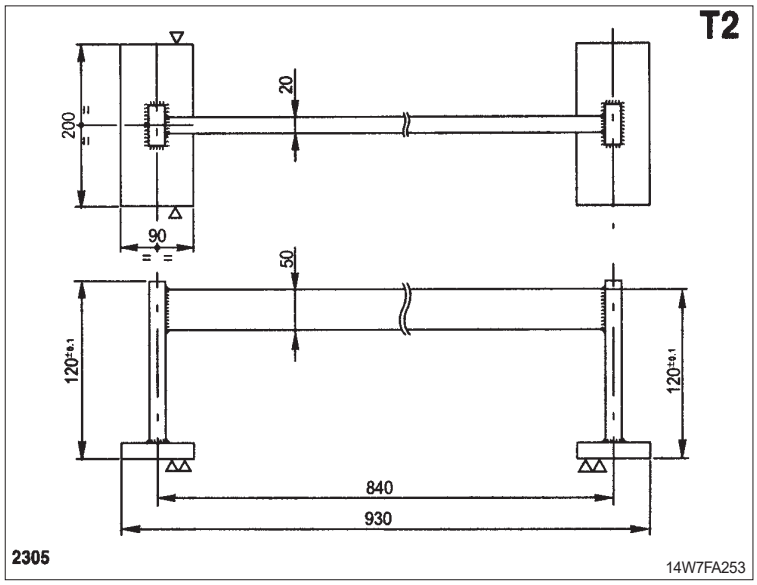
(24) Re-install the complete arms.
For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS".

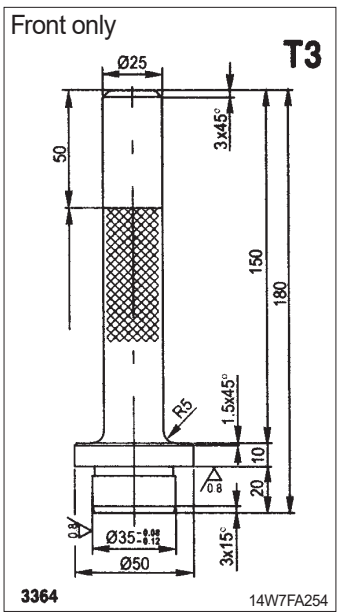


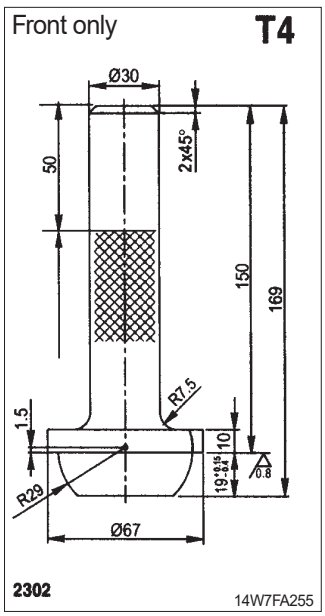
14W98FA245

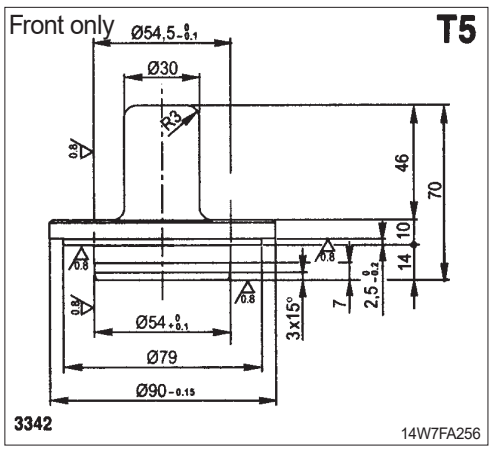
## 12. SPECIAL TOOLS

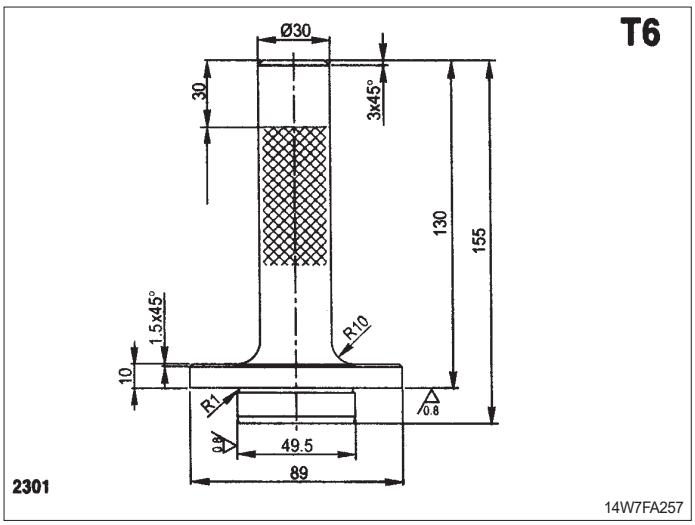


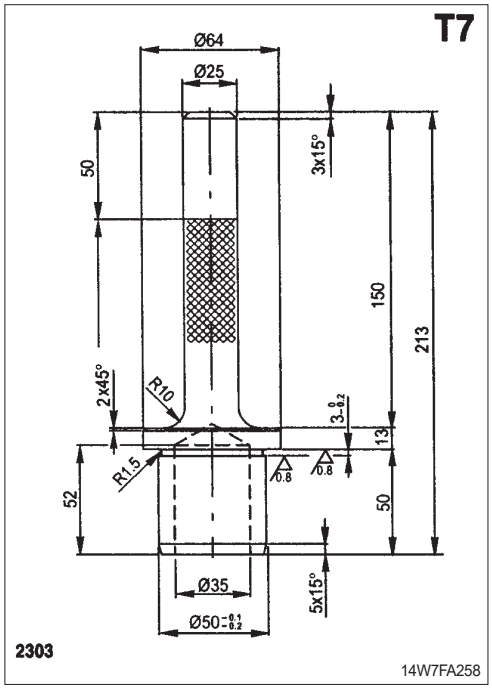



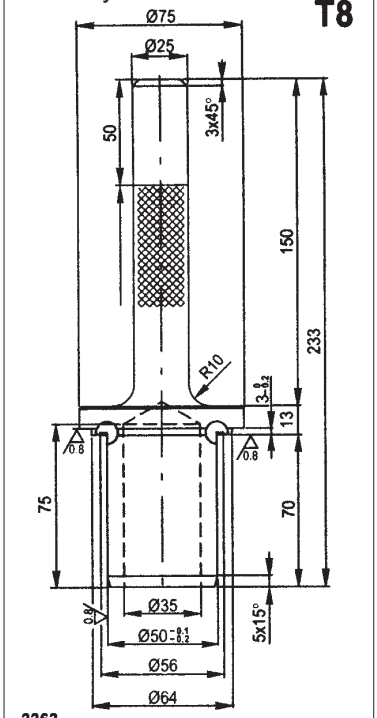



Front only

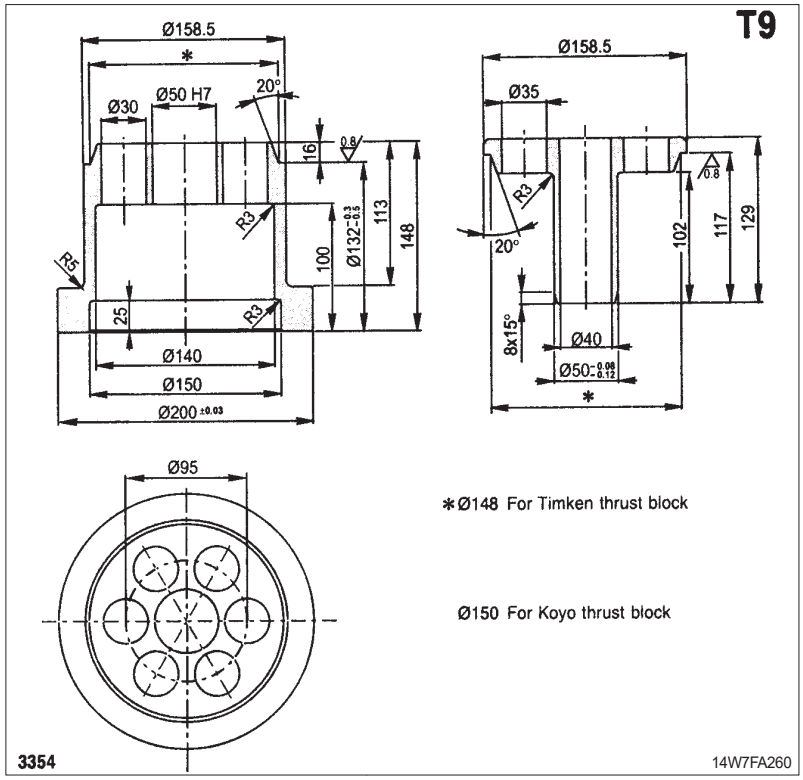
## T8




3363

14W7FA259

## T9



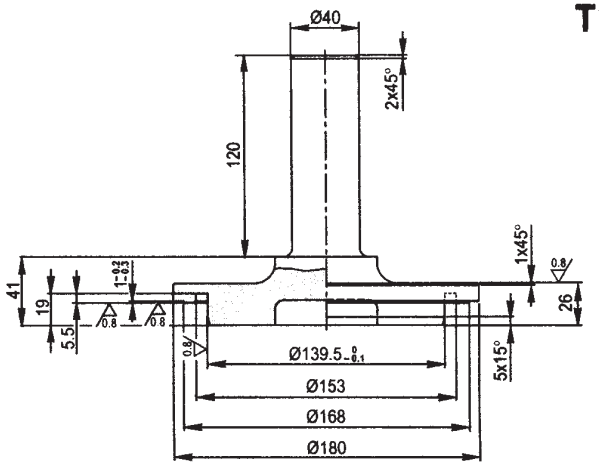

*Ø148 For Timken thrust block

Ø150 For Koyo thrust block

3354

14W7FA260

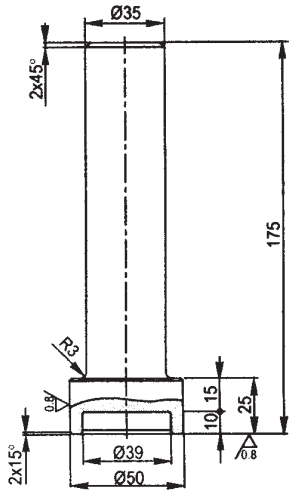
## T10




3502

14W7FA261

## T11

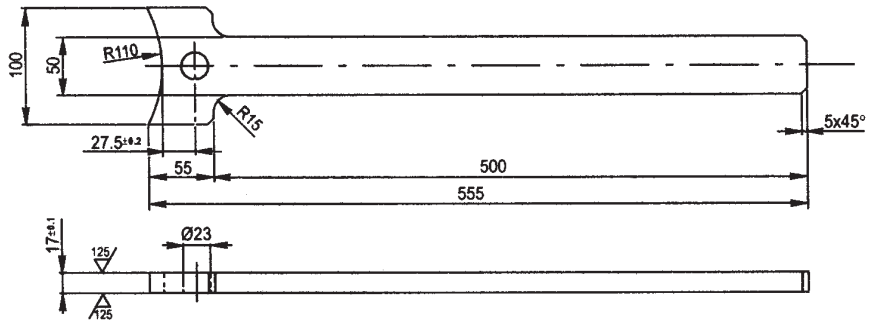



2304

14W7FA262

Front only

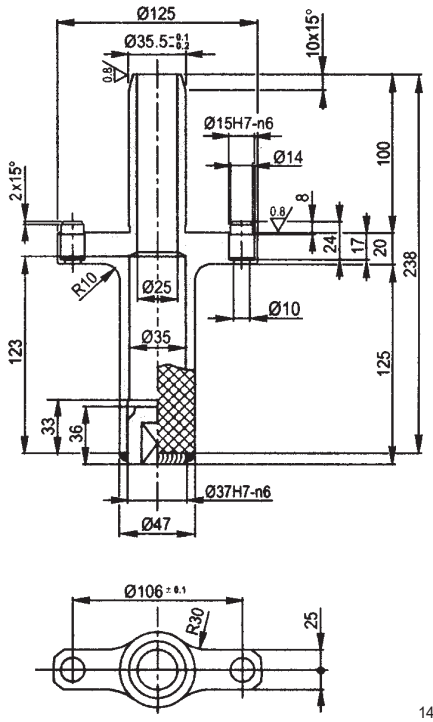
## T12




1867

14W7FA263

## T13




3333

14W7FA264

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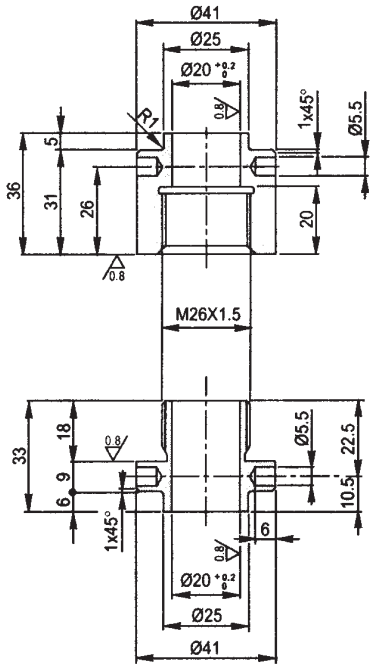


3708

14W7FA265

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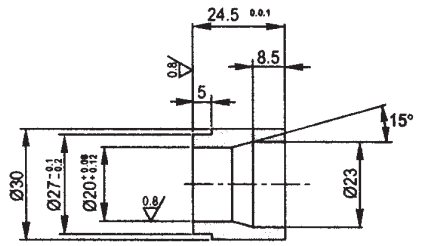


3424

14W7FA266

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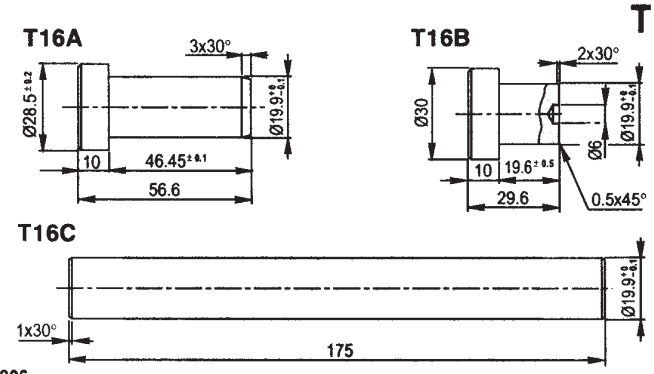


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14W7FA267

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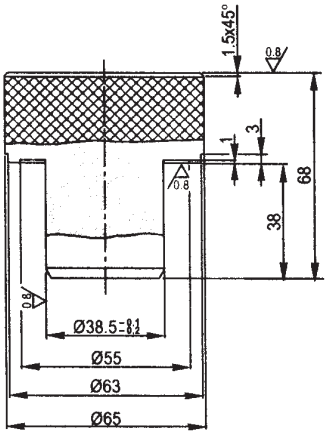
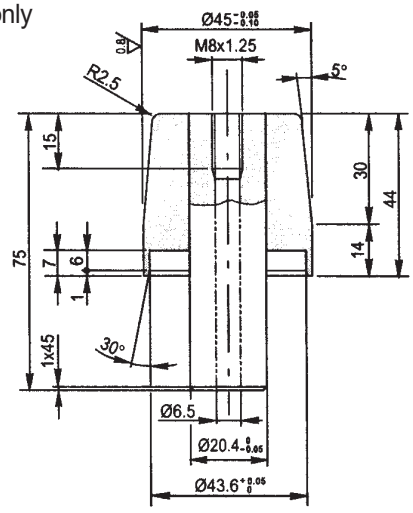



3332

14W7FA268

## T18

Front only

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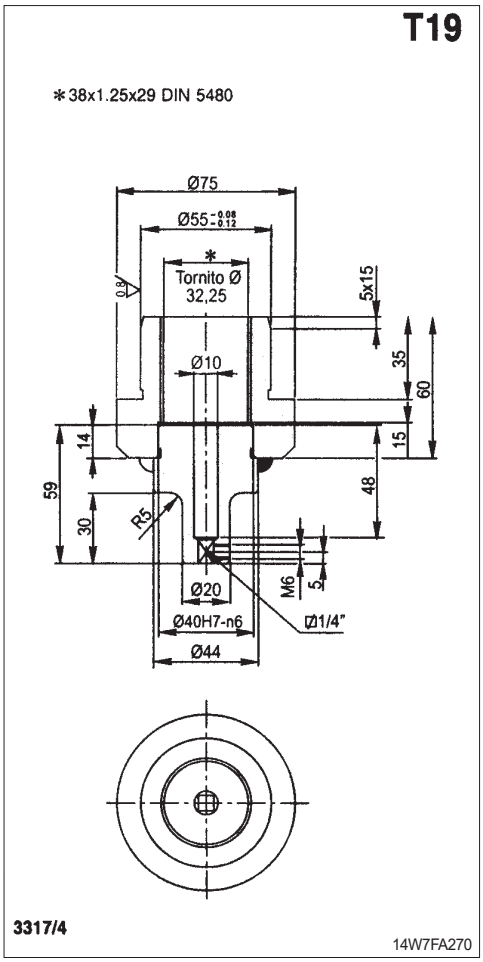
T19
*38x1.25x29 DIN 5480
Ø75
Ø55
Tornito Ø 32,25
5x15
Ø10
35
60
14
15
59
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30
R5
Ø20
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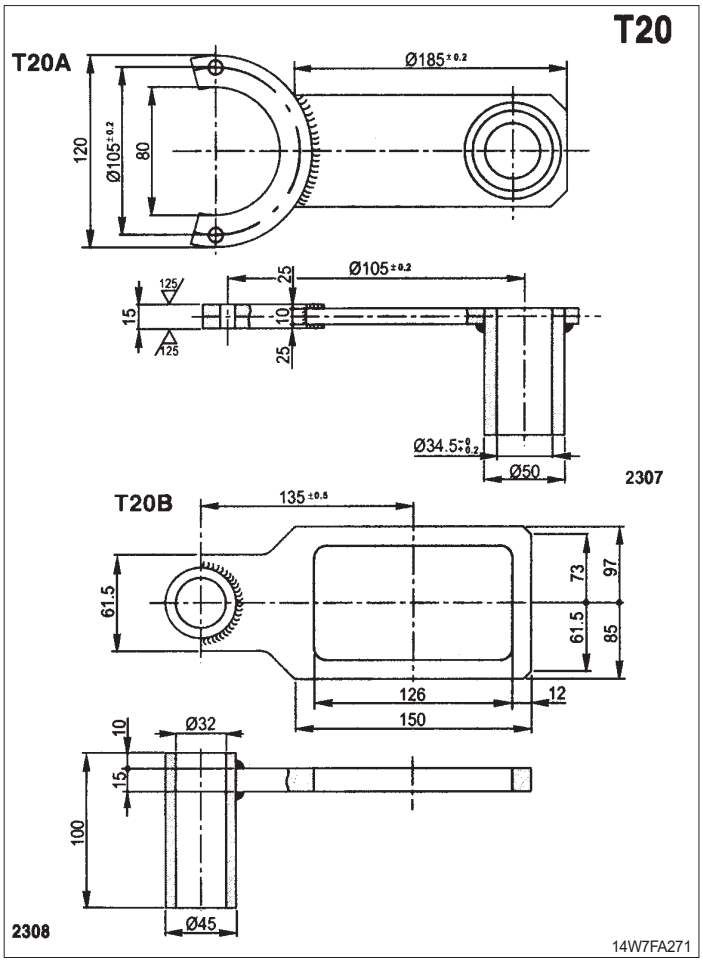
5
Ø40H7-n6
Ø1/4"
Ø44
3317/4
14W7FA270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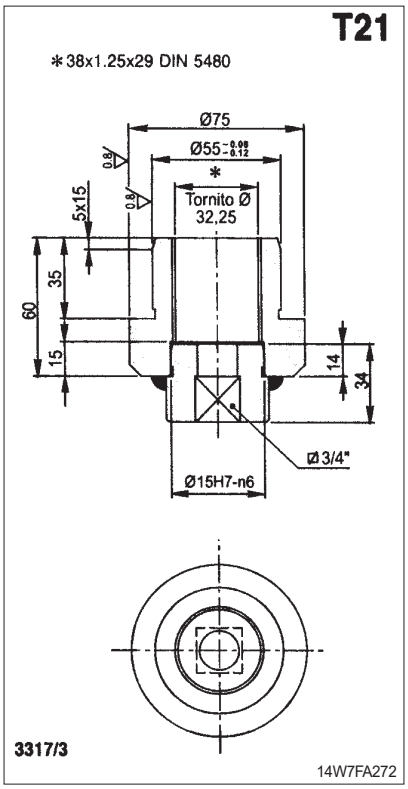
14W7FA271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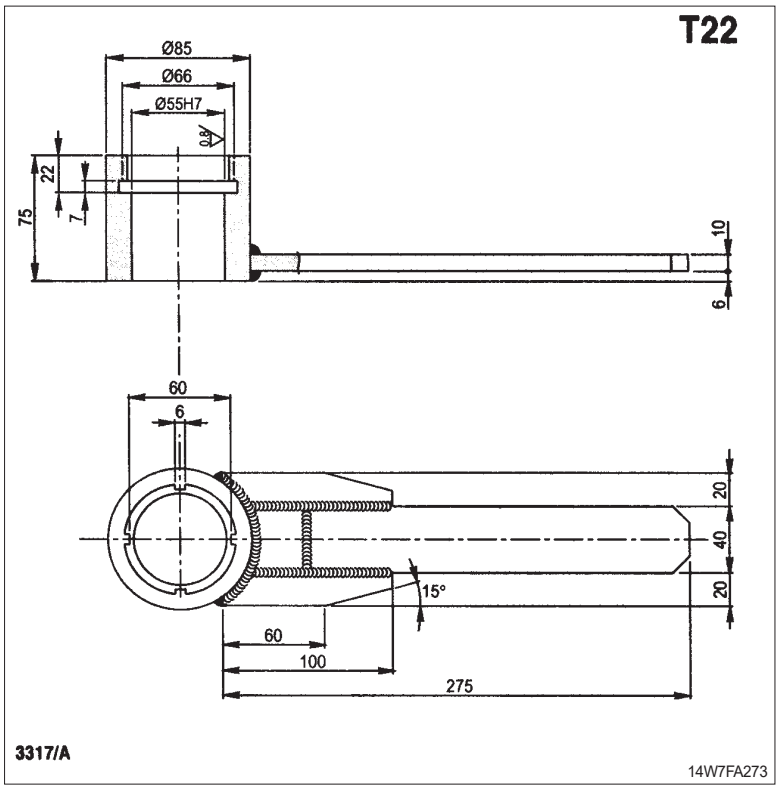
Ø3/4"
Ø15H7-n6
3317/3
14W7FA272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3317/A
14W7FA273

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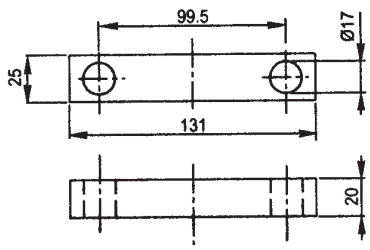
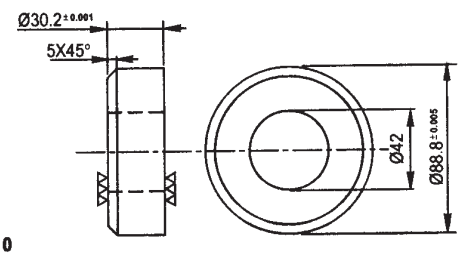



2309

14W7FA274

## T24

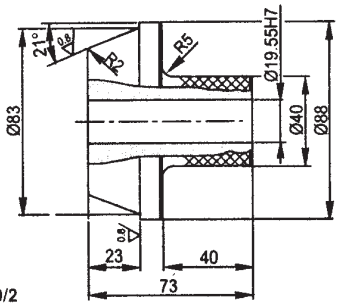



2310

14W7FA275

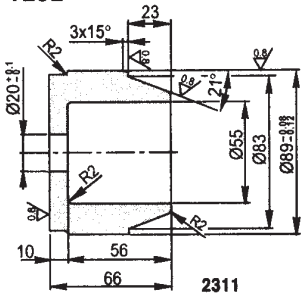
## T25

### T25A

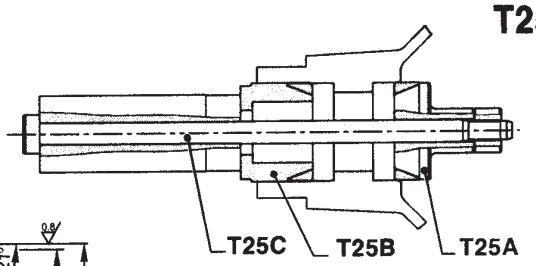



3329/2

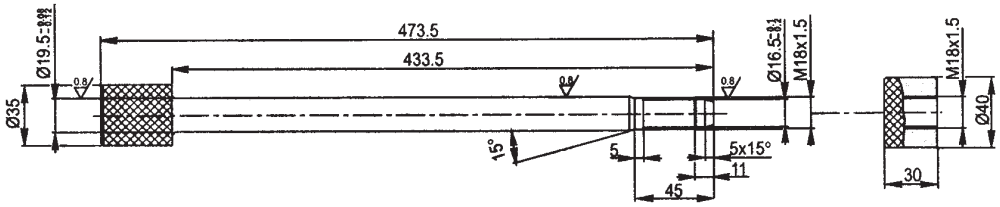
### T25B




2311




### T25C

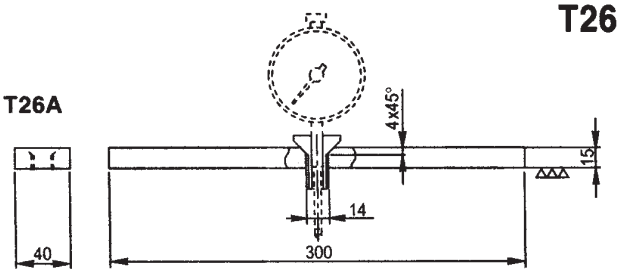



3329/3

14W7FA276

## T26

### T26A

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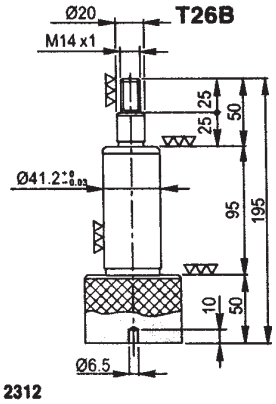
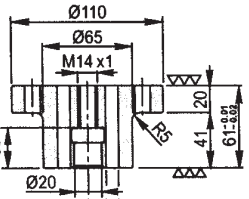
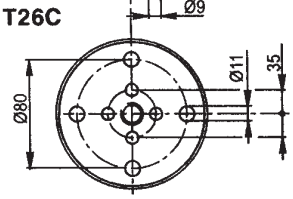


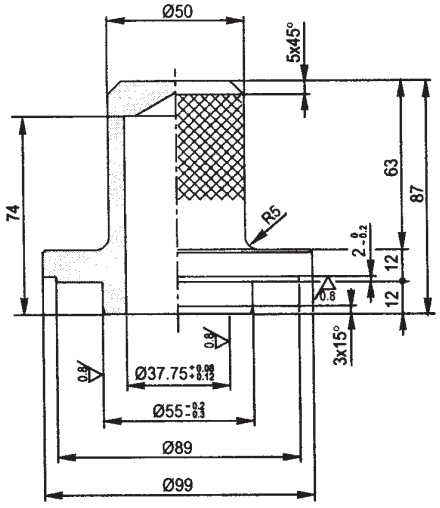

### T26C




2312

14W7FA277

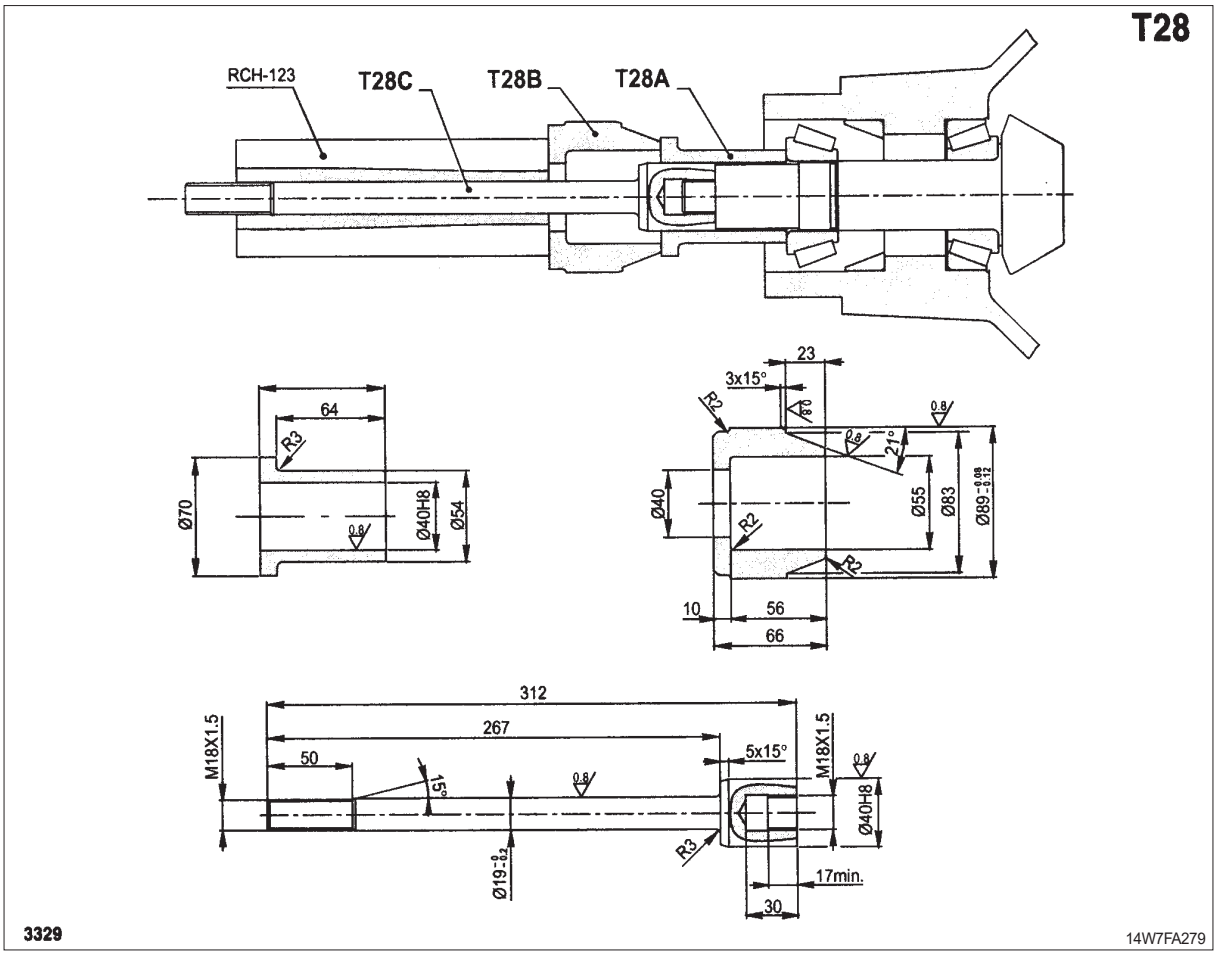
## T27




3327

14W7FA278

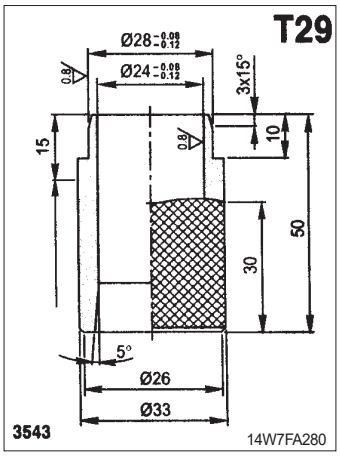
## T28




3329

14W7FA279

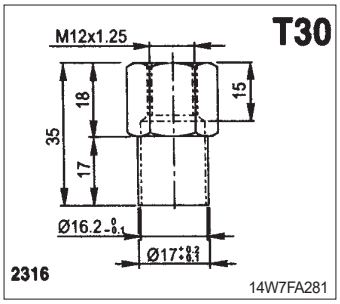
## T29




3543

14W7FA280

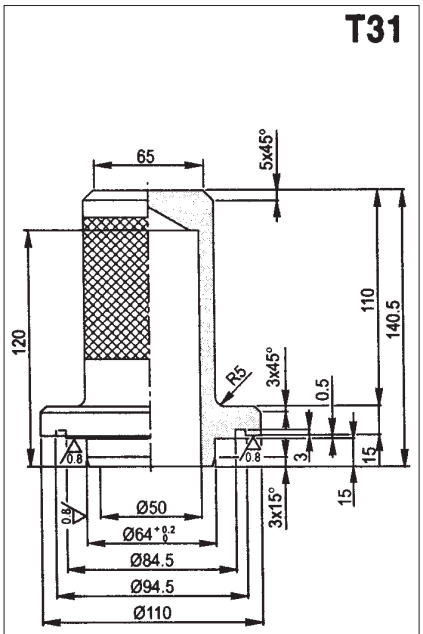
## T30




2316

14W7FA281

## T31

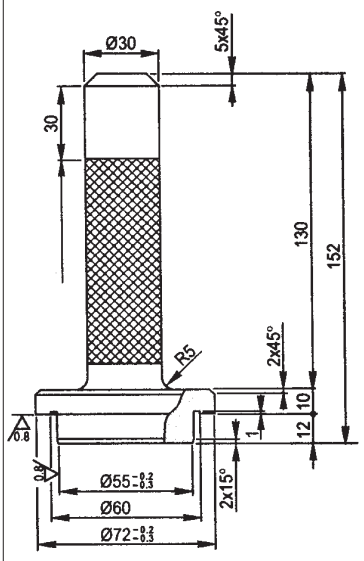



3739

14W7FA282

## T32

Front only




2317

14W7FA283

## B. FRONT AXLE (#0074 and up)

### 1. REMOVAL FRONT AXLE

1) Propeller shaft mounting nut (1, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)

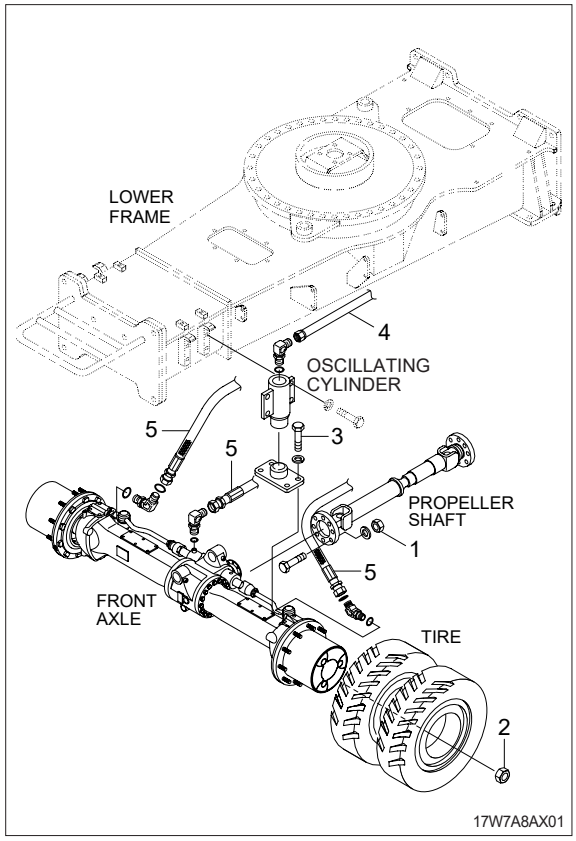
2) Wheel nut (2, M22)
   · Tightening torque : $60^{+0}_{-5}$ kgf · m
   ($433^{+0}_{-36}$ lbf · ft)

3) Oscillating cylinder supporting mounting bolt (3, M16)
   · Tightening torque : 12.3±2.5 kgf · m
   (88.9±18.1 lbf · ft)

4) Pipe assy (4)

5) Hose assy (5)

6) Front axle weight : 540 kg (1190 lb)



## 3. GENERAL INSTRUCTIONS

### 1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.

(3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.

(4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100°C.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

## 2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

## 3) LUBRICANT SPECIFICATIONS

(1) Gear oils with limited - slip additives.

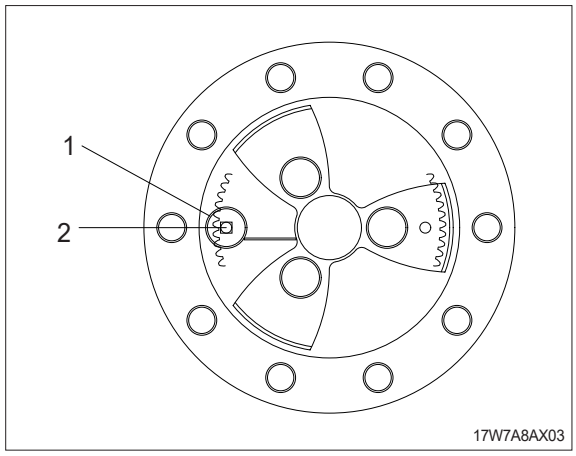
(2) API GL-5

(3) MIL-L-2105D (SAE 85W-90, 85W-140 with LS-Additive)

## 4) BRAKE LINING WEARING TEST

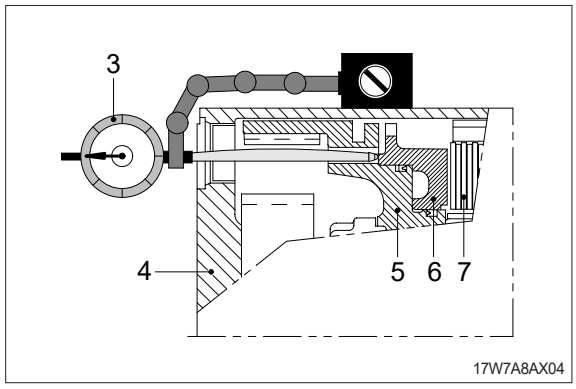
(1) The measurement of wear on the multi-disc brake only gives limited information on the total state of the plate pack without disassembling the output.
Make measurement of lining wear at least once per year, in particular, however, in case of a different braking behaviour, like :
- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

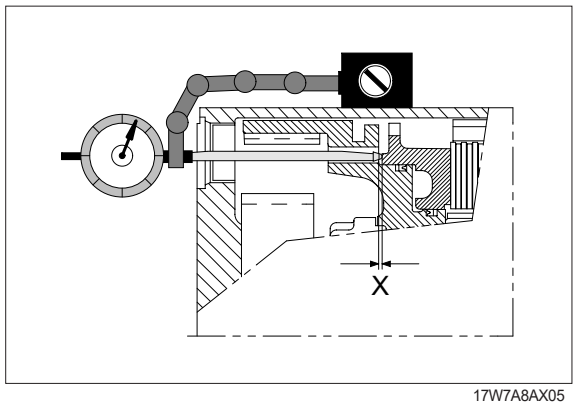
※ To avoid injury when opening the oil drain/ oil filler plug (1), due to a possible pressure build-up in the planetary carrier bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and filler plug (1).




(2) Then turn output until oil filler / oil drain hole (2) is on 9 o'clock position.

1 = Oil filler-/oil drain hole
2 = Gauge hole ( ø =10 mm) in ring gear
9 o'clock position
3 = Dial indicator with solenoid support
4 = Planetary carrier
5 = Ring gear
6 = Piston
7 = Plate pack
X = Piston stroke



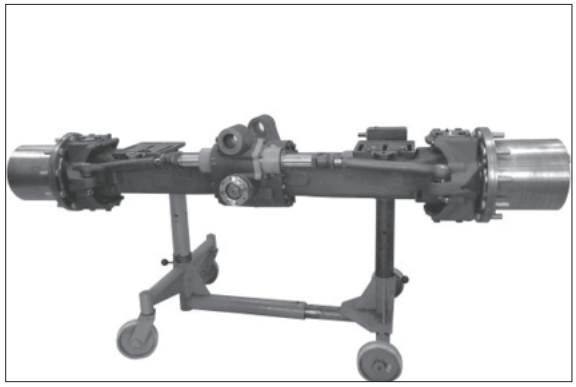



## 3. DISASSEMBLY

### 1) STEERING

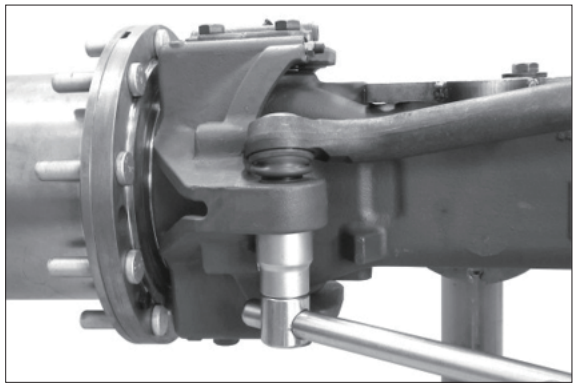
(1) Fix the axle to the assembly truck.

(S) Assembly truck 5870 350 000
(S) Support 5870 350 106



17W98FA001

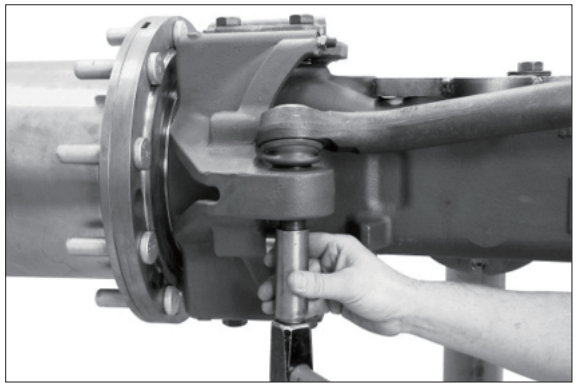
(2) Loosen locknut.



17W98FA002

(3) Force out tie rod from bevel seat.

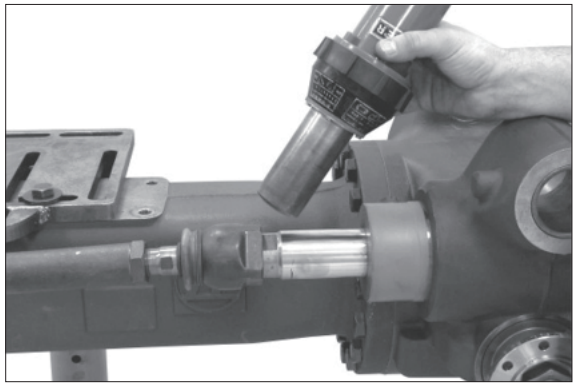
※ Use suitable mandrel (brass or aluminum).



17W98FA003

(4) Warm up piston rod by means of hot air blower.

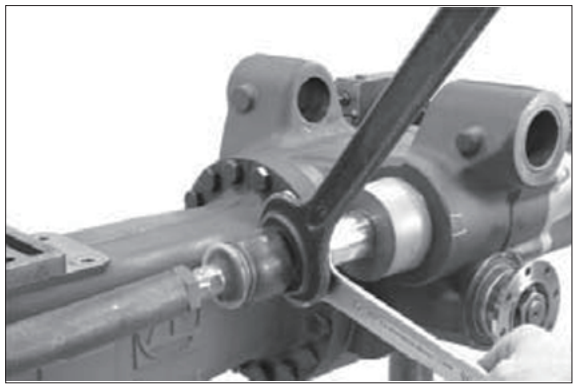
※ Axial joint is installed with Loctite no. 243.



17W98FA004

(5) Separate both tie rods from piston rod.

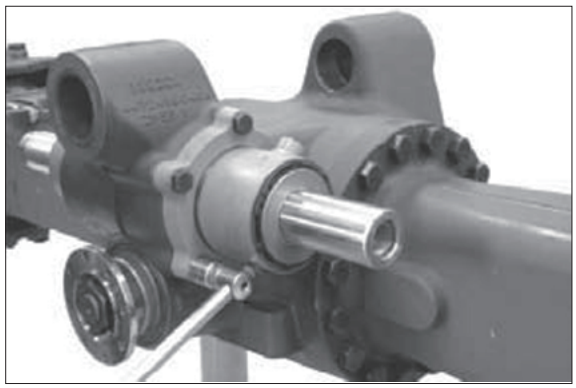
※ If work is just to be done on piston rod, guide or sealing elements, no disassembly of the steering cylinder assy is required.



17W98FA005

(6) Loosen hexagon screws.

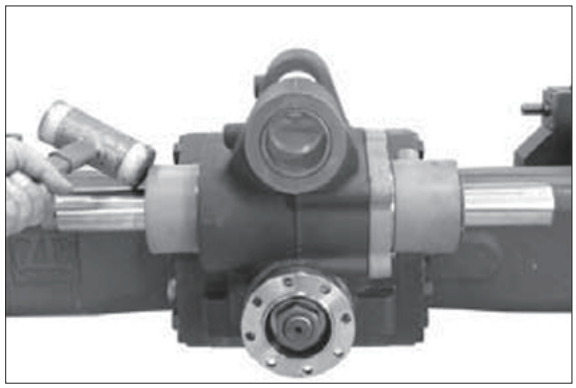
※ Mark radial installation position of steering cylinder to axle housing – assembly aid.



17W98FA006

(7) Drive out steering cylinder assy from axle housing hole.

※ Use a plastic hammer.



17W98FA007

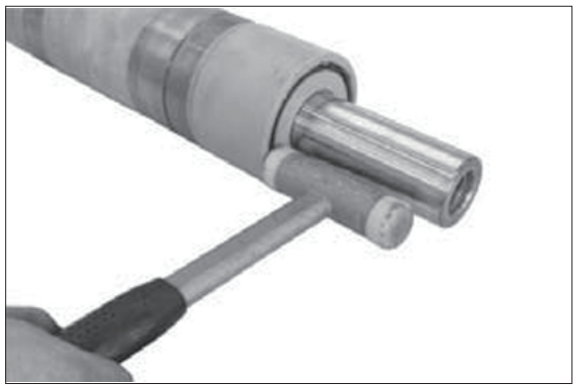
(8) Unsnap the retaining ring and remove the releasing flange.

17W98FA008

(9) Unsnap retaining ring.

17W98FA009

(10) Push/force the brake head into the cylinder tube, until the retaining ring (see figure FA011) can be removed.



17W98FA010

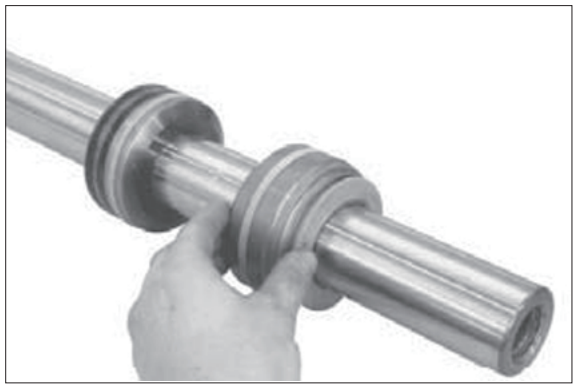
(11) Unsnap retaining ring.

Then drive out piston rod together with brake head from cylinder tube.

17W98FA011

(12) Pull off brake head from the piston rod.

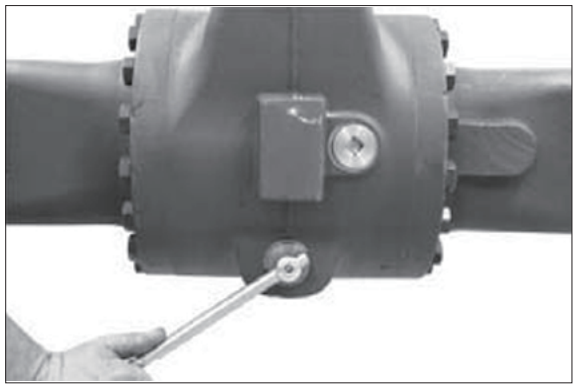
Then remove all sealing elements from piston rod, brake head and cylinder tube.



17W98FA012

## 2) OUTPUT

(1) Loosen screw plug and drain oil from the axle.

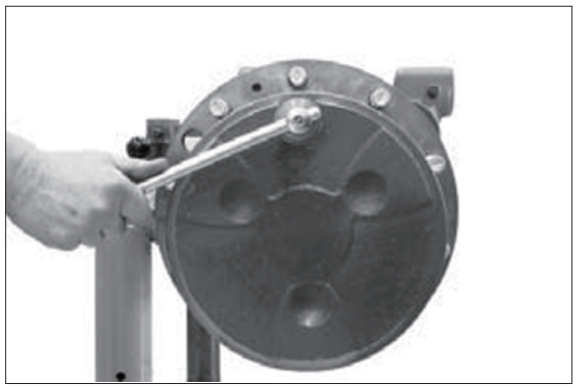


17W98FA013

(2) Loosen screw plug and drain oil from the planetary carrier.

※ To avoid injury due to a possible pressure build-up in the oil system of the planetary carrier, bring oil filler and control plug to 12 o'clock position and carefully unscrew. Then bring drain hole to 6 o'clock position and drain oil.

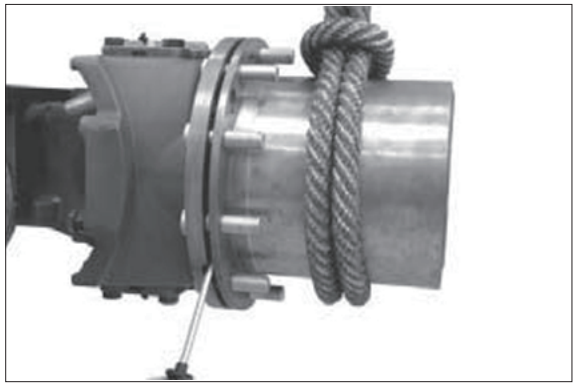
※ Use suitable collecting basin environmental protection.



17W98FA014

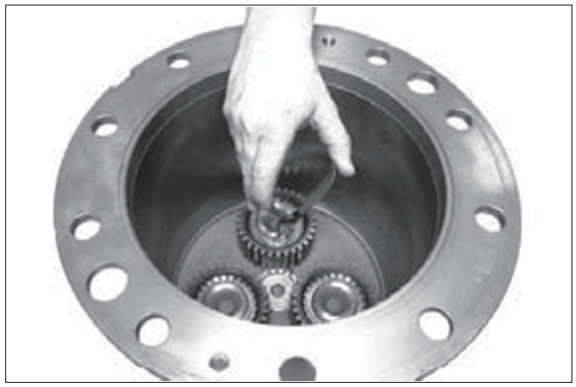
**(3) Planetary carrier**

Loosen both hexagon screws and separate planetary carrier from hub.



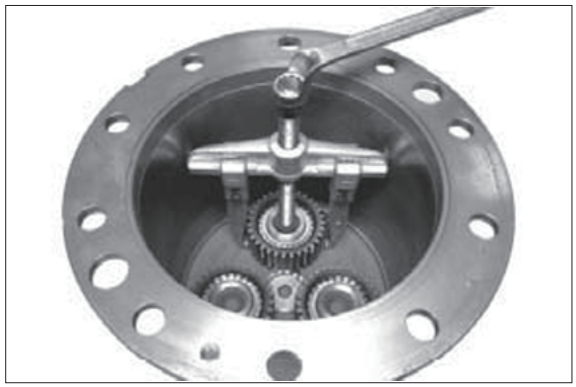
17W98FA015

(4) Unsnap retaining ring.



17W98FA016

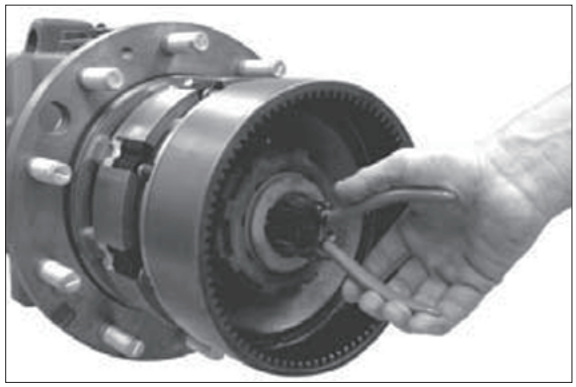
(5) Pull off planetary gear together with cylindrical roller bearing.



17W98FA017

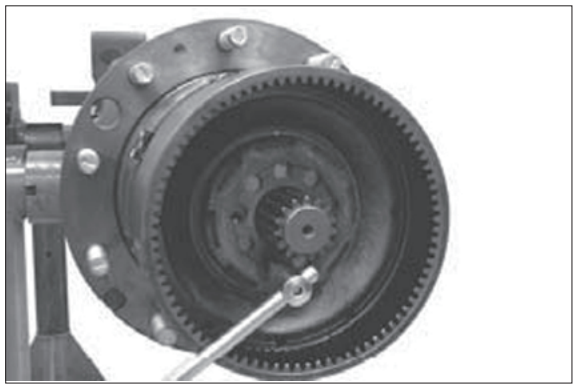
**(6) Brake**

Unsnap retaining ring and remove both thrust washers.



17W98FA018

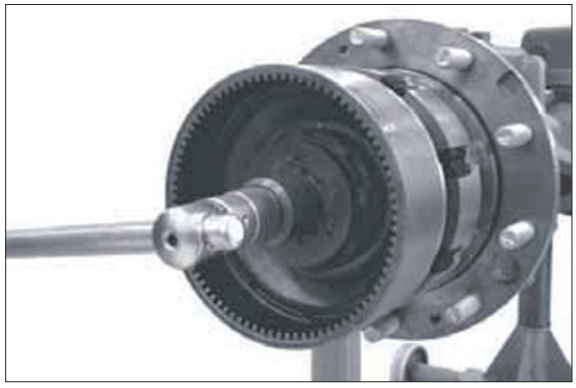
(7) Loosen cylindrical screw (slotted nut fixing).



17W98FA019

(8) Loosen slotted nut.

(S) Socket wrench 5870 656 097

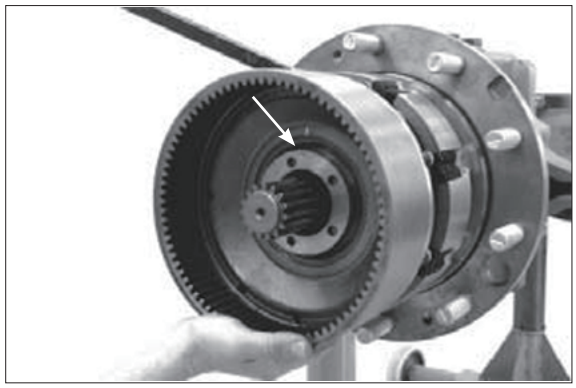


17W98FA020

(9) Press off ring gear together with piston from joint housing.

(S) Assembly lever 5870 345 036

※ Pay attention to releasing O-ring (arrow).



17W98FA021

(10) Loosen hexagon screws and remove releasing spring sleeves and compression springs.

17W98FA022

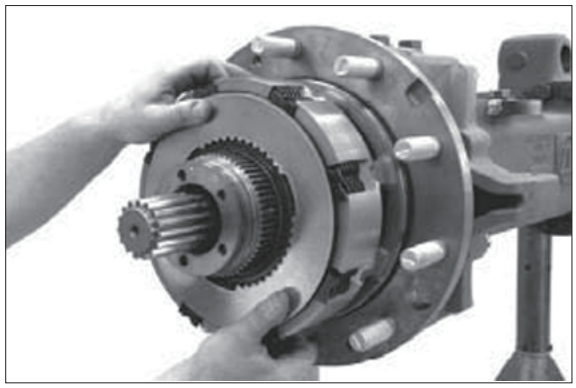
(11) Press off piston from ring gear.

17W98FA023

(12) Remove sealing elements from the annular grooves (see arrows) of the ring gear.

17W98FA024

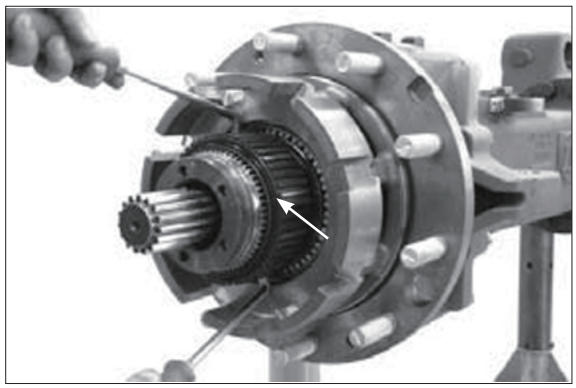
(13) Remove disk package.



17W98FA025

(14) Remove O-ring (see arrow) and lift off disk carrier from the joint housing.

(S) Adjusting device 5870 400 001



17W98FA026

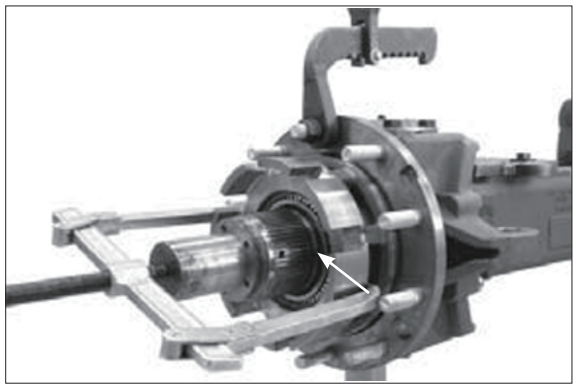
**(15) Hub**

Remove O-ring (see arrow).

Secure hub with lifting bracket (S) and pull from joint housing by means of a two armed puller.

(S) Lifting bracket 5870 281 043
(S) Pressure piece 5870 100 067

※ Pay attention to releasing bearing inner ring.

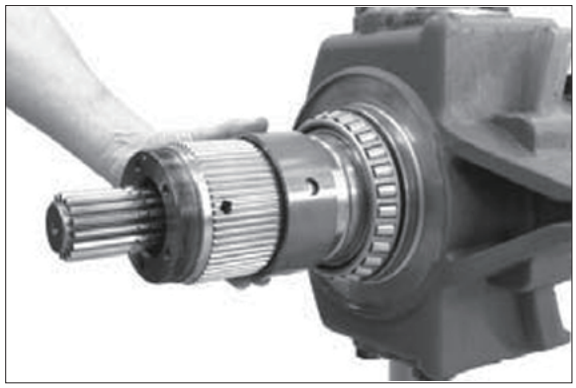


17W98FA027

(16) Use a lever to lift-off shaft seal ring (see arrow) from hub hole and force both bearing outer rings out of the hub.

17W98FA028

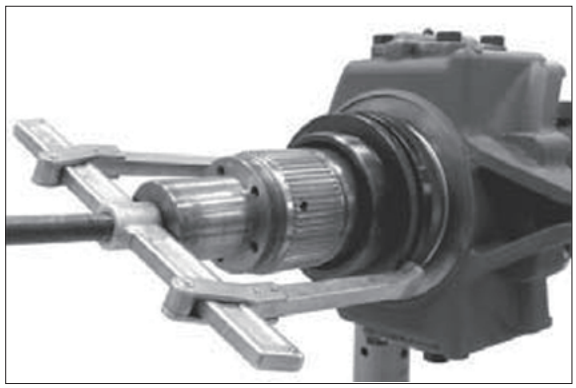
(17) Remove spacer bushing.



17W98FA029

(18) Pull tapered roller bearing from joint housing.

(S) Grab sleeve 5873 013 015
(S) Pressure piece 5870 100 067



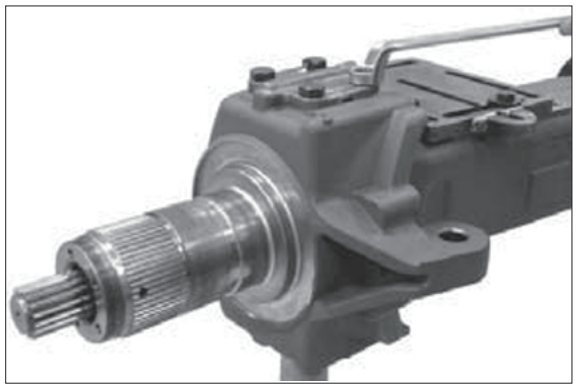
17W98FA030

**(19) Knuckle housing**

Loosen threaded joint and remove upper bearing pin.

※ Pay attention to releasing O-ring.

※ Remove lower bearing pin only after securing the knuckle housing (see figure FA032).

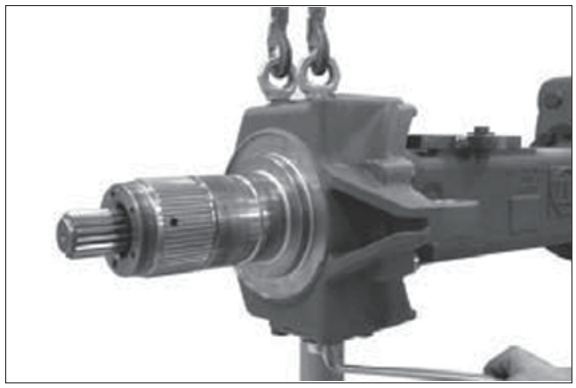


17W98FA031

(20) Secure knuckle housing by means of lifting tackle.

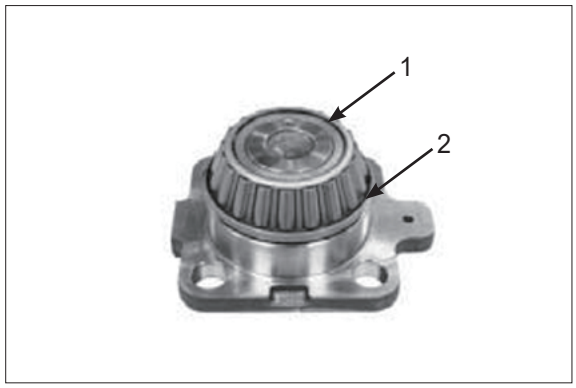
Then loosen threaded joint and remove lower bearing pin.

(S) Eyebolts (M 16) 0636 804 001



17W98FA032

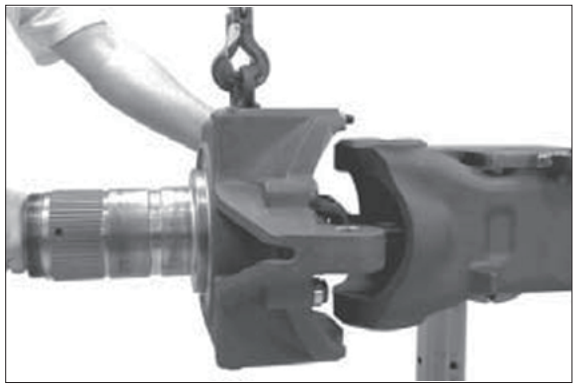
(21) Use lever to remove tapered roller bearing (1) from bearing pin, remove releasing sealing cap (2) and the O-ring lying behind.



17W98FA033

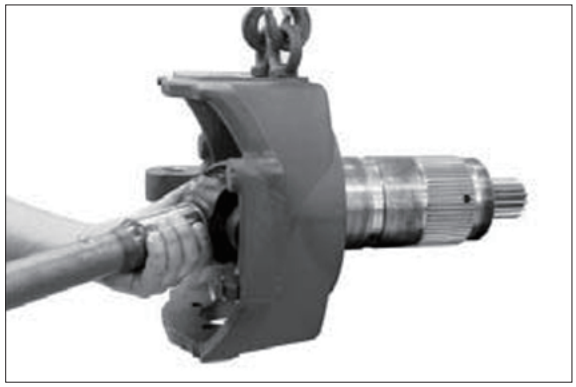
(22) Separate knuckle housing with double u-joint shaft from the axle housing.

※ Pay attention to shaft seal ring in the axle housing risk of damage.


17W98FA034

(23) Pull out double u-joint shaft from knuckle housing.

※ Pay attention to shaft seal ring in the knuckle housing risk of damage.


17W98FA035

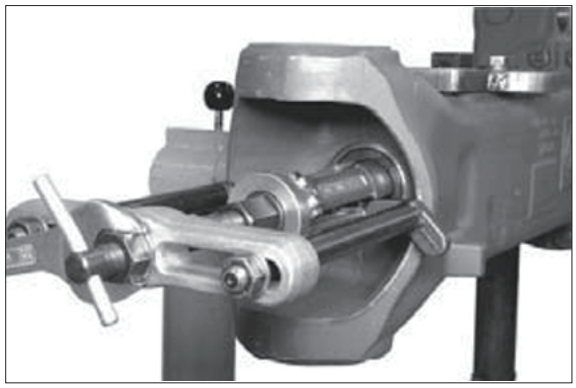
(24) Pull out shaft seal ring and afterwards the bushing behind from the axle housing.

(S) Internal extractor 5870 300 007
(S) Counter support 5870 300 020


17W98FA036

(25) Pull out shaft seal ring and afterwards the bushing behind from the axle housing.

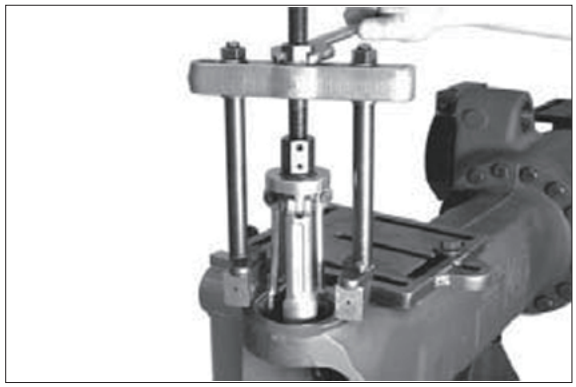
(S) Internal extractor 5870 300 007
(S) Counter support 5870 300 020



17W98FA037

(26) Pull out both bearing outer rings from the pivot bearing holes.

(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98FA038

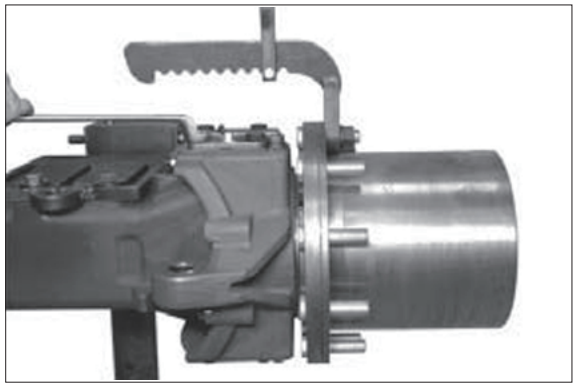
**(27) Output assy**

※ If work is required on the differential or pinion, you may disassembly the output as complete unit (operation FA039 and FA040).

Secure output assy by means of lifting tackle (S).

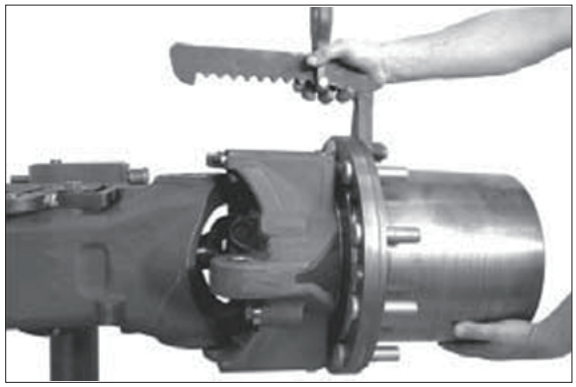
(S) Lifting bracket 5870 281 043

Then loosen threaded joints of both bearing pins.



17W98FA039

(28) Remove both bearing pins and separate the output assy from the axle housing.

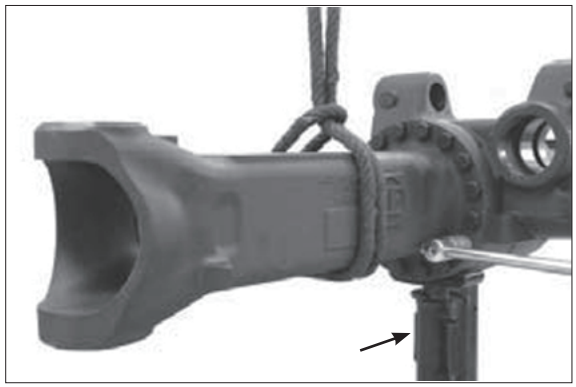


17W98FA040

### 3) INPUT

(1) Support axle to axle drive housing (see arrow).
Then secure axle housing (crown wheel side) by means of lifting tackle and loosen threaded joint.
Then separate axle housing from axle drive housing.

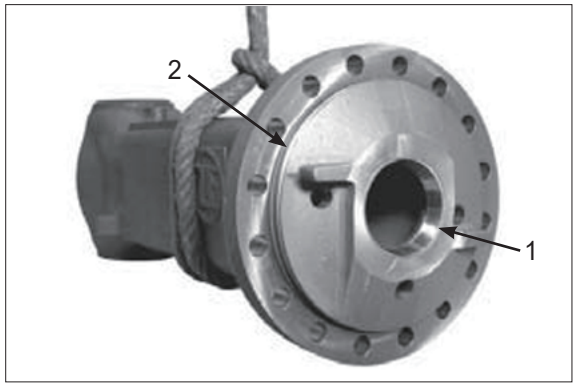
※ Pay attention to possibly releasing differential.



17W98FA041

(2) Pull bearing outer ring (arrow 1) from the bearing hole and remove releasing shim.
Then remove O-ring (arrow 2).

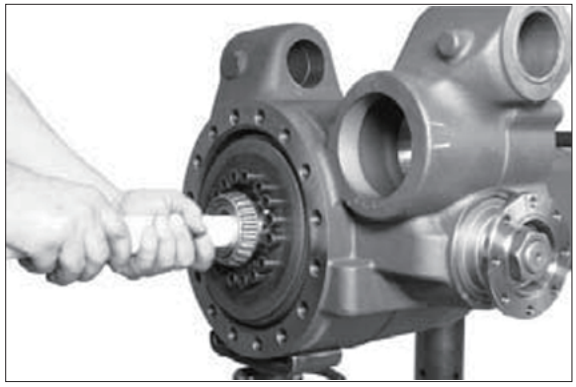
(S) Striker 5870 650 004




17W98FA042

(3) Lift differential out of the axle drive housing.

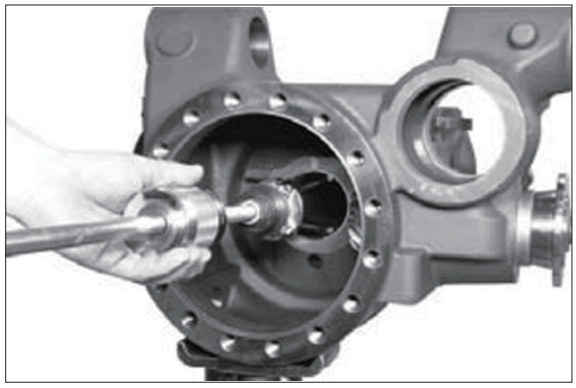
※ Disassembly of the differential is described as of page 8-189.



17W98FA043

(4) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove releasing shim.

(S) Striker 5870 650 004

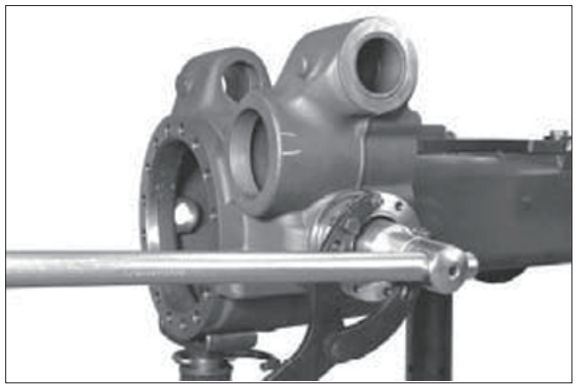


17W98FA044

(5) Warm up hexagon nut by means of hot air blower.
Then loosen hexagon nut and remove the releasing shim.

(S) Clamping fork 5870 240 025

※ Hexagon nut is installed with Loctite no. 262.



17W98FA045

(6) Pull input flange from pinion.
If necessary, remove screen sheet from flange.

17W98FA046

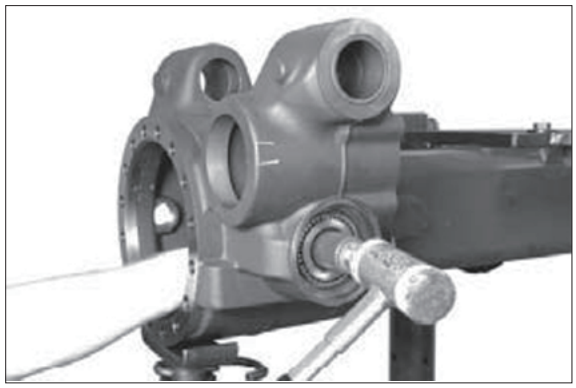
(7) Use a lever to remove the shaft seal ring from the housing hole.

17W98FA047

(8) Force out input pinion and remove releasing roller bearing.

※ Use plastic hammer.

※ If tapered roller bearings should not be replaced, pay attention that the outer bearing inner ring with all its rolls is in contact with bearing outer ring when forcing out the input pinion.



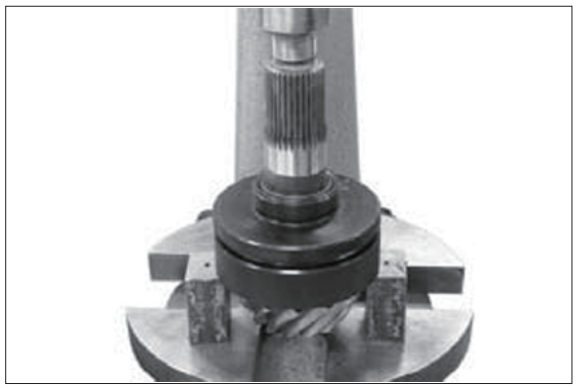
17W98FA048

(9) Remove spacer ring.

17W98FA049

(10) Press roller bearing from input pinion.

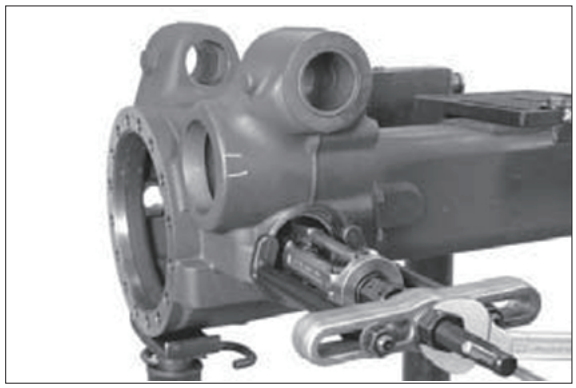
(S) Grab sleeve 5873 001 037



17W98FA050

(11) Pull off outer bearing outer ring from bearing hole.

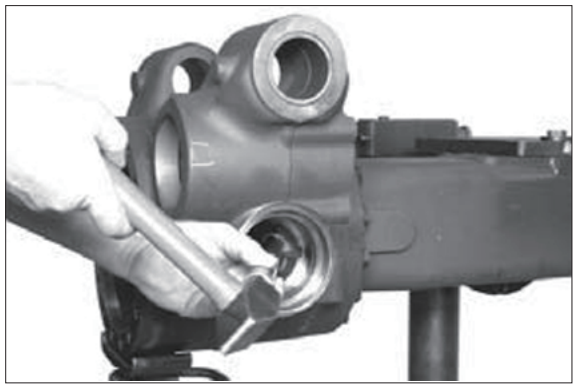
(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98FA051

(12) Force out bearing outer ring from the inner bearing hole pay attention to the shim behind.

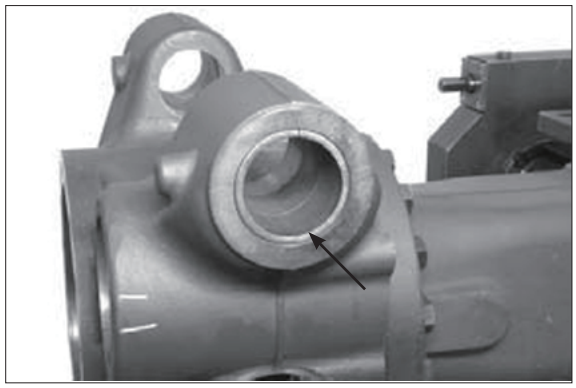
※ Mark shim (with regard to position/bearing allocation) assembly aid.



17W98FA052

(13) If necessary, provide bushings with a separating slot (see arrow) and remove from holes.

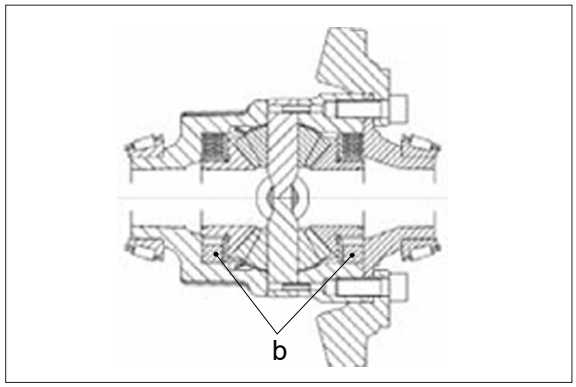
※ Bushings are destroyed by this.



17W98FA053

## 4) DIFFERENTIAL

(1) Differential
b = Constant spacers



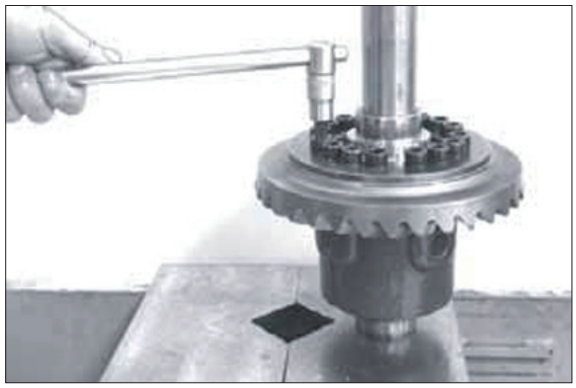

17W98FA054

(2) Pull both tapered roller bearings from differential carrier.

| | |
|---|---|
| (S) Grab sleeve | 5873 011 019 |
| (S) Basic tool | 5873 001 000 |
| (S) Pressure piece | 5870 100 009 |

17W98FA055

(3) Use press to fix differential and loosen threaded joint crown wheel / differential carrier.



17W98FA056

(4) Press crown wheel from differential.

17W98FA057

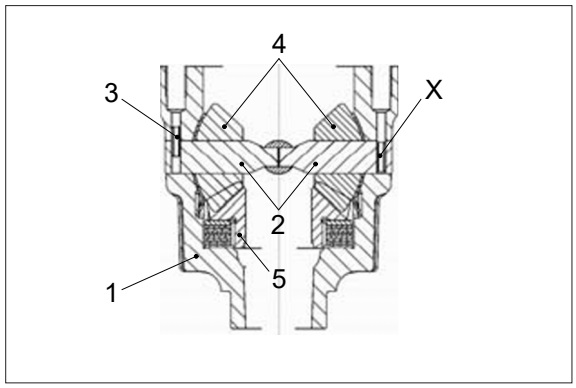
(5) Remove single parts.
Remove axle bevel gear together with thrust washer and constant spacer from the differential carrier.

17W98FA058

(6) Force slotted pins (considering position "X", see subsequent sketch FA060) into the spider shafts.

17W98FA059

(7) Comment on sketch:
1 = Differential carrier
2 = Spider shafts (short)
3 = Slotted pins
4 = Differential bevel gears
5 = Axle bevel gear
X = Position of the slotted pin to force out the spider shafts




17W98FA060

(8) Force out both spider shafts (short).

17W98FA061

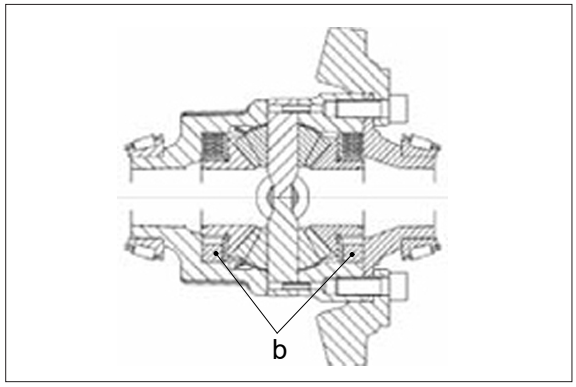
(9) Remove all single parts.

17W98FA062

## 4. REASSEMBLY

### 1) DIFFERENTIAL

(1) b = Constant spacers

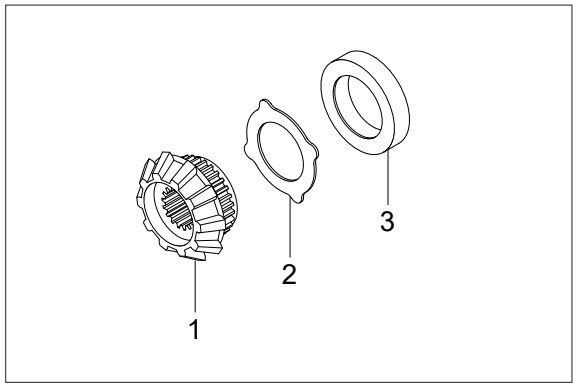



17W98FA054

(2) All outer and inner disks are replaced by a constant spacer (see figure FA066).

1 = Axle bevel gear
2 = Pressure disk
3 = Constant ring

※ No measuring / setting of the axial play of the two axle bevel gears is required, therefore single parts can be immediately oiled.




17W98FA065

(3) Insert premounted axle bevel gear into the differential carrier.

17W98FA066

(4) Insert differential bevel gears (1) with thrust washers (2) and fix with spider shafts (3 and 4).

※ Pay attention to radial installation position of the thrust washers.


17W98FA067

(5) Check axial play of the axle bevel gear 0.0 ~ 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the setting procedure separate the single parts again.

Then oil and reassemble all single parts again.

※ Make sure that thickness and arrangement of the second disk package are identical (figure FA071).

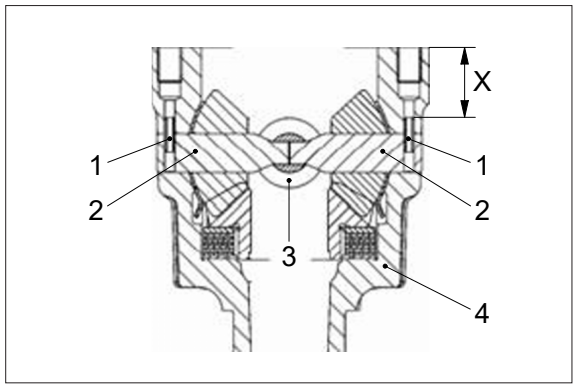
17W98FA068

(6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch FA070).

17W98FA069

(7) Comment on sketch:

1 = Slotted pin
2 = Spider shaft (short)
3 = Spider shaft
4 = Differential carrier
X = Installation dimension 34 ± 0.5 mm

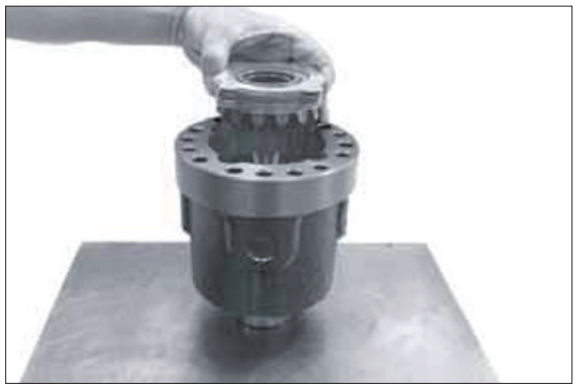



17W98FA070

(8) Mount second axle bevel gear with thrust washer and constant spacer (see also figure FA065).

※ Mount the pressure disk with the coated surface showing to the outer disk.

※ Thickness and arrangement of the disk package must be identical on both sides of the differential gear.



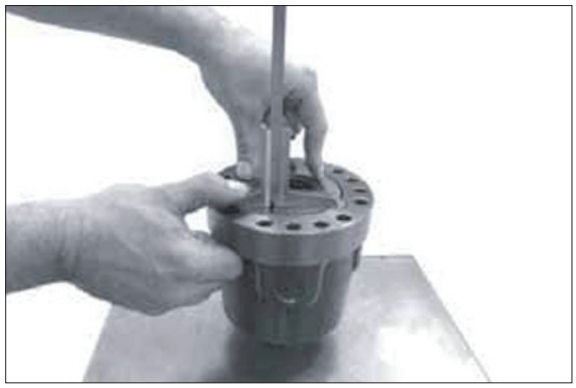
17W98FA071

(9) Check axial play of the second axle bevel gear 0.0~0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the resetting procedure remove the second axle bevel gear together with the disk package from the differential carrier.

Then oil and reassemble all single parts.

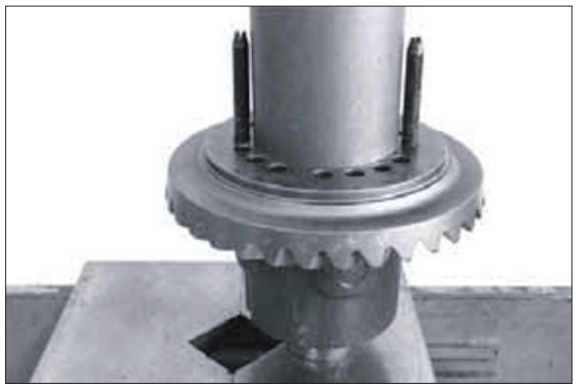


17W98FA072

(10) Mount two adjusting screws (S) and insert cover.
(S) Adjusting screws (M12 × 1.5)
5870 204 027

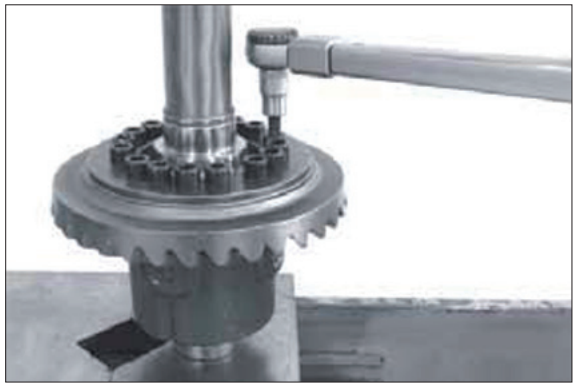
17W98FA073

(11) Press crown wheel onto the cover / differential carrier until contact position is obtained.



17W98FA074

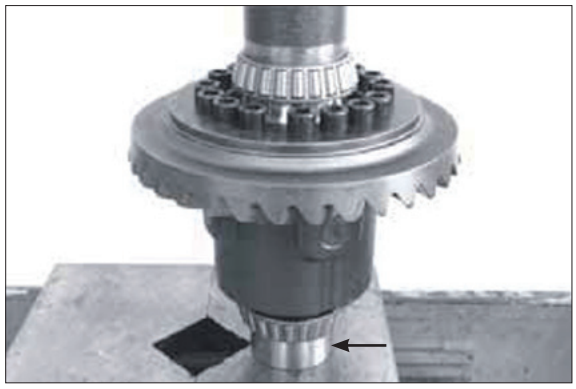
(12) Fix differential with press and tighten crown wheel with cylindrical screws.
Tightening torque (M12 × 1,5/12.9) . . . . . MA = 145 Nm



17W98FA075

(13) Press on both bearing inner rings until contact is obtained.

※ Use an appropriate support (arrow) differential may not be supported on the bearing cage.



17W98FA076

## 2) INPUT

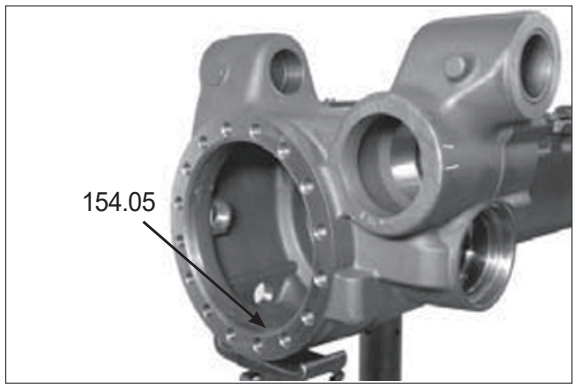
### (1) Input pinion

※ The following measuring procedures must be carried out with utmost accuracy. Inaccurate measurements lead to an incorrect contact pattern and another disassembly and reassembly of the input pinion is required.

### (2) Determine thickness of the shim to obtain a correct contact pattern

Read dimension I from the axle drive housing.

Dimension I e.g . . . . . 154.05 mm



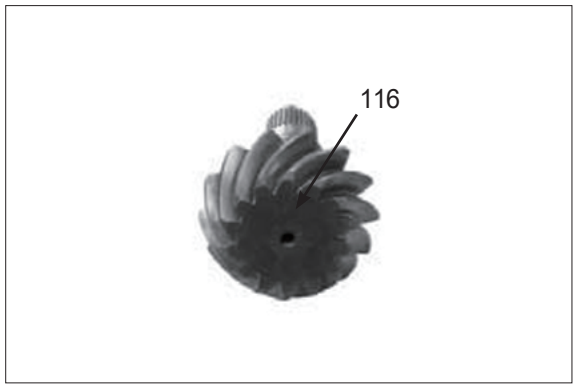

17W98FA077

(3) Read dimension II (pinion dimension).

Dimension II e.g. . . .. . . . . . 116.00 mm

In case of a + or – deviation of the pinion dimension for production reasons the relevant value is marked by hand on the pinion.

Pinion dimension (without + or – deviation) = 116.0 mm
Pinion dimension with an indicated + 0.1 deviation = 116.1 mm
Pinion dimension with an indicated – 0.1 deviation = 115.9 mm



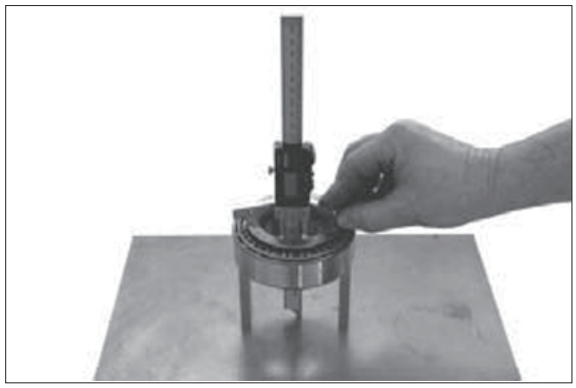

17W98FA078

(4) Determine dimension III (bearing width).

※ Make sure that the rollers are located without any play (rotate bearing g inner ring several times in both directions roller setting).

Since the installed roller bearing is subject to a pre-load in installation position, consider an experience deduction of 0.1 mm.

Dimension III, e.g. 36.60 mm – 0.1 mm . . . . . = 36.50 mm

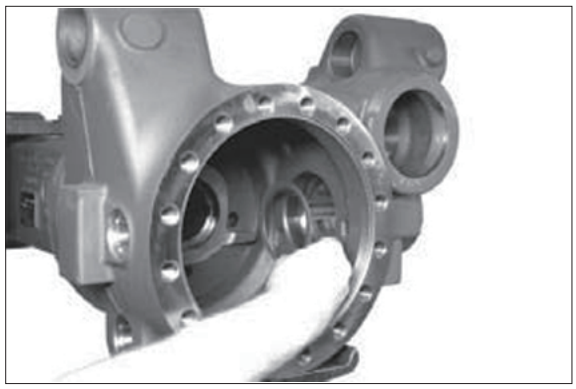


17W98FA079

(5) Calculation example "B" :

Dimension I . . . . . 154.05 mm
Dimension X . . . . . - 152.50 mm
Difference = shim s = 1.55 mm

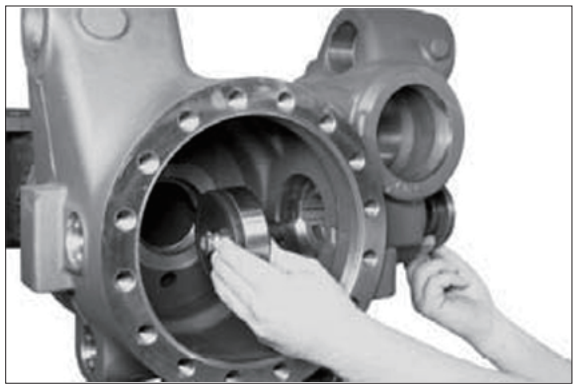
Insert the determined shim (e.g. s = 1.55 mm) into the inner bearing hole.



17W98FA080

(6) Undercool bearing outer ring (see arrow) and bring into contact position in the bearing hole by using the assembly fixture (S).

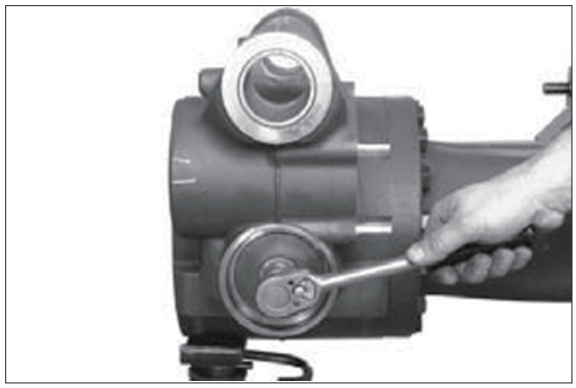
(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056



17W98FA081

(7) Undercool outer bearing outer ring and insert into bearing hole until contact is obtained.

(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056

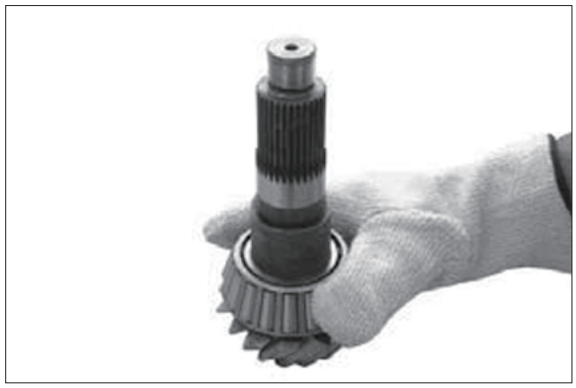


17W98FA082

**(8) Setting of rolling torque of the input pinion bearing 1.0 ... 3.0 Nm (without shaft seal ring)**

Warm up roller bearing and insert until contact is obtained.

※ Adjust bearing after cooling down.



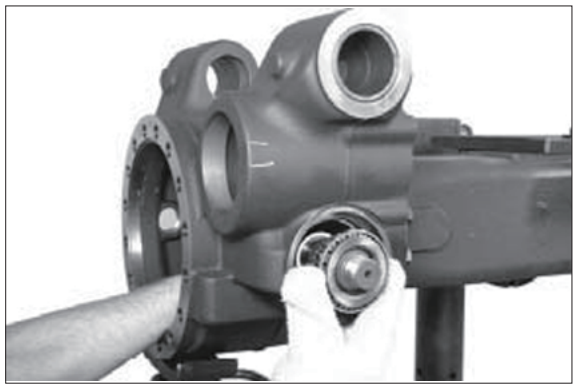
17W98FA083

(9) Insert spacer ring (e.g. s = 16.96 mm).

※ According to our experience, the necessary rolling torque is obtained when reusing the spacer ring which has been removed during disassembly (e.g. s = 16.96 mm).
A later check of the rolling torque, however, is absolutely necessary.

17W98FA084

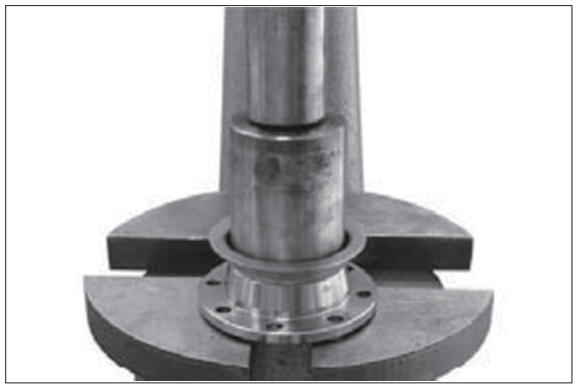
(10) Insert the preassembled input pinion into the axle housing and mount the heated roller bearing until contact is obtained.



17W98FA085

(11) Press screen sheet (see arrow) onto the input flange until contact is obtained.

※ The shaft seal ring is mounted only after contact pattern check.



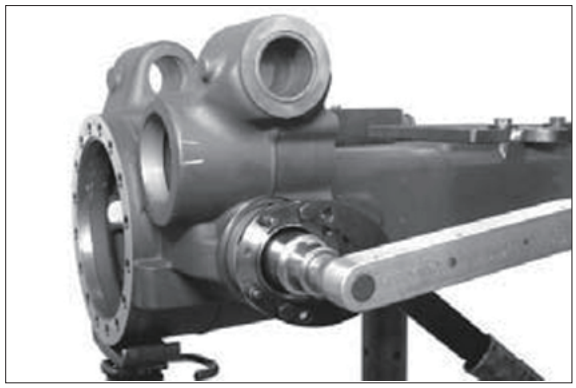
17W98FA086

(12) Mount input flange, fix with disk and hexagon nut.

Tightening torque (M30x1,5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ During the tightening process rotate the input pinion several times in both directions.



17W98FA087

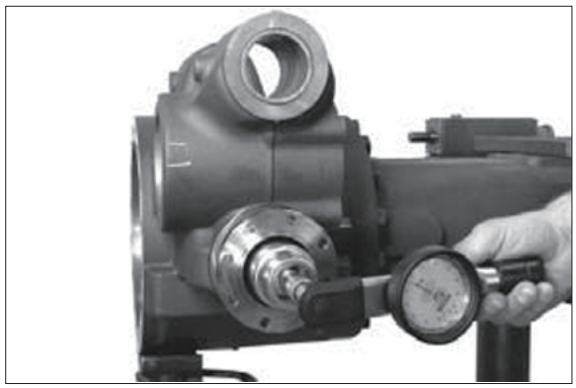
(13) Check rolling torque (1.0 ... 3.0 Nm without shaft seal ring).

※ When installing new bearings try to achieve the upper value of the rolling torque.

※ In case of deviations from the necessary rolling torque correct with a corresponding spacer ring (Figure FA084) as specified below.

Insufficient rolling torque
install thinner spacer ring

Excessive rolling torque
install thicker spacer ring.

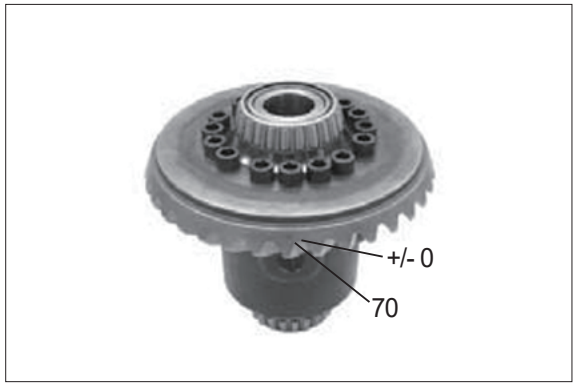


17W98FA088

(14) Determine shim for setting the bearing rolling torque (differential bearing) and backlash ( bevel gear set).

※ The required shims must be determined on the basis of the read value (test dimension / crown wheel) and the corresponding specifications of the table next page : (KRS – SET – RIGHT) :
Read test dimension from crown wheel rear.

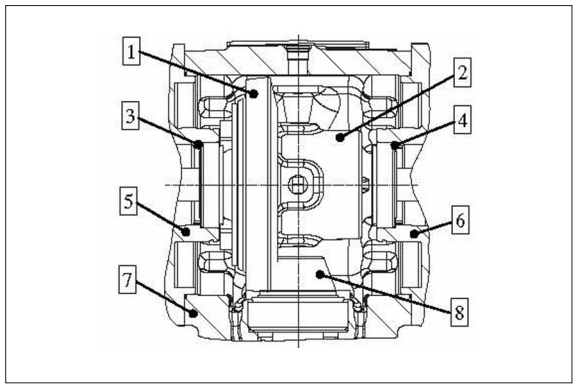
※ Test dimension "70" is stamped into the crown wheel rear. Without + or deviation specification, this corresponds to test dimension / Actual value "70" in the table below.
According to this value the necessary shims are allocated in the table next page.




17W98FA089

※ In case of + or – deviation of the test dimension for production reasons, it is additionally signed on the crown wheel rear (e.g. - 20 or - 10 . 10 or 20) .

※ In accordance with this deviation the necessary shims are allocated in the below table.



17W98FA090

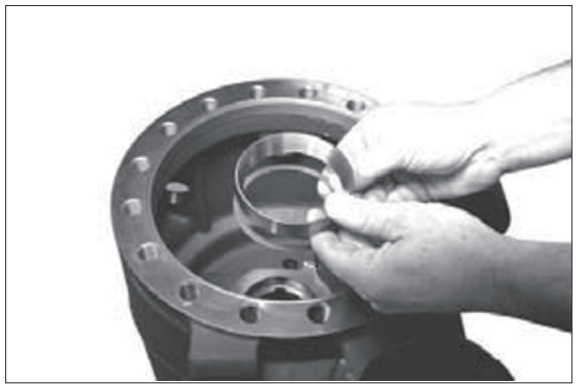
(15) Comment on sketch:

1 = Crown wheel 2 = Differential carrier
3 = Shim (crown wheel side) 4 = Shim (diff. carrier side)
5 = Axle housing 6 = Axle housing
7 = Axle drive housing 8 = Input pinion

| Setting disks for differential | | | | | |
|---|---|---|---|---|---|
| Test dimension/Marking of crown wheel 70 and deviation | -20 | -10 | 0 | 10 | 20 |
| Result → Test dimension / Act. value | 69.80 | 69.90 | 70.0 | 70.10 | 70.20 |
| **Shim/Diff. carrier side** Required disk thickness | 0.95 | 1.05 | 1.15 | 1.25 | 1.35 |
| Shim no. | 0730 006 518 | 0730 006 519 | 0730 006 521 | 0730 006 522 | 0730 006 524 |
| **Shim/Crown wheel side** Required disk thickness | 1.35 | 1.25 | 1.15 | 1.05 | 0.95 |
| Shim no. | 0730 006 524 | 0730 006 522 | 0730 006 521 | 0730 006 519 | 0730 006 518 |

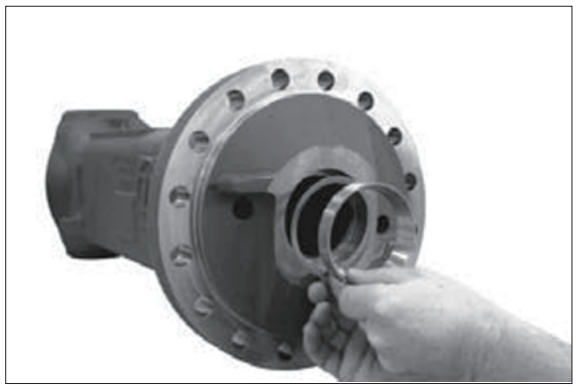
(16) Insert the determined shim (e.g. s = 1.15 mm) and the bearing outer ring into the hole of the axle housing on the differential carrier side.

※ Pivot axle housing 90°.



17W98FA091

(17) Insert the determined shim (e.g. s = 1.15 mm) and the bearing outer ring into the hole of the axle housing on the crown wheel side.



17W98FA092

**(18) Check the contact pattern of the bevel gear set**

Wet some drive and coast flanks of the crown wheel with marking ink.

17W98FA093

(19) Insert the preassembled differential into the axle drive housing.

(S) Internal extractor 5870 300 005

17W98FA094

(20) Use lifting tackle to mount the axle housing (crown wheel side) and preliminarily fix with hexagon screws.

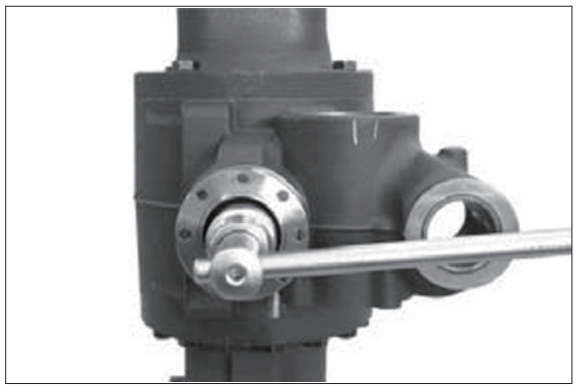
Tightening torque (M18/10.9) . . . . . MA = 390 Nm

※ Preliminarily fix axle housing without O-ring.

17W98FA095

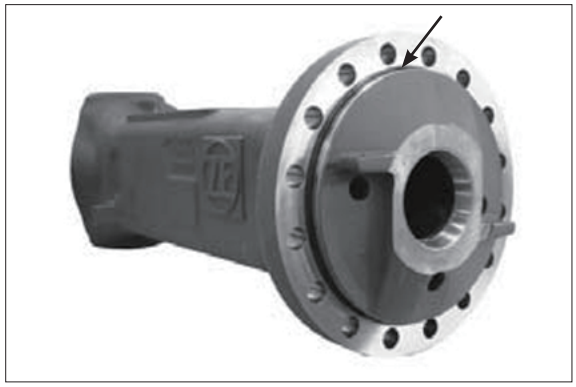
(21) Roll the crown wheel by rotation on the input flange several times in both directions over the input pinion.
Then remove axle housing again and lift differential out of the axle drive housing.
Compare the obtained contact pattern with contact pattern example page 0/4 and 0/5.

※ In case of a contact pattern deviation a measuring mistake was made when determining the shim (figure FA080), which must be absolutely corrected.



17W98FA096

(22) Grease O-ring (see arrow) and mount to axle housing.



17W98FA097

(23) Use lifting tackle to mount the axle housing (part II), finally tighten with hexagon screws.

Tightening torque (M18/10.9) . . . . . MA = 390 Nm

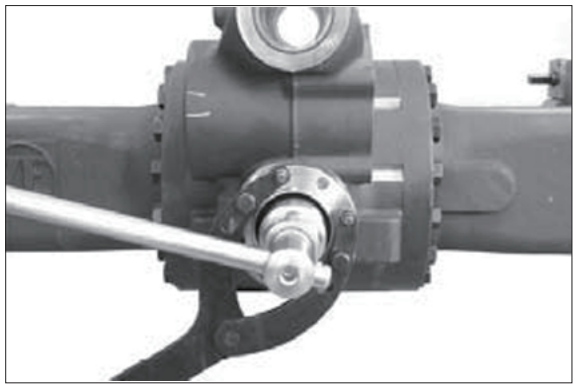
Then bring axle into horizontal position and reassemble the second clamping angle (S) (see also figure FA001).

17W98FA098

**(24) Mount shaft seal ring (input flange)**

Loosen hexagon nut and pull the input flange from the input pinion.

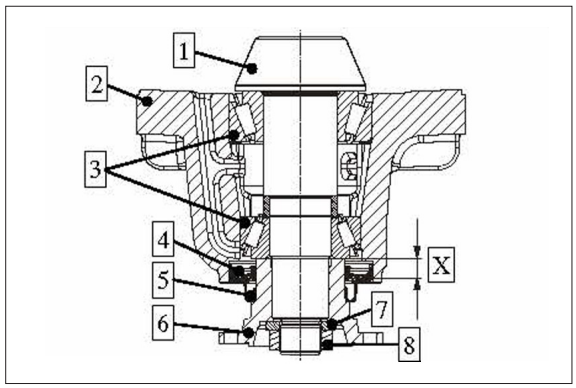
(S) Clamping fork 5870 240 025



17W98FA099

(25) Comment on sketch:

1 = Input pinion
2 = Axle drive housing
3 = Tapered roller bearing
4 = Shaft seal ring
5 = Screen sheet
6 = Input flange
7 = Disk
8 = Hexagon nut
X = Installation dimension → 13.5 +0, 2 mm



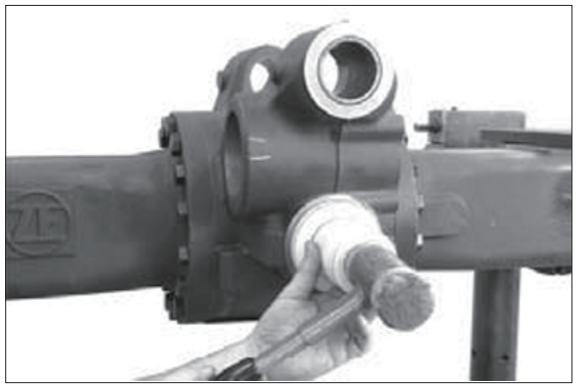

17W98FA100

(26) Mount shaft seal ring with the seal lip showing to the oil chamber.

(S) Driver tool 5870 048 286

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting, wet contact face shaft seal ring/axle drive housing with lubricant. Apply grease on seal and dust lip of the shaft seal ring.



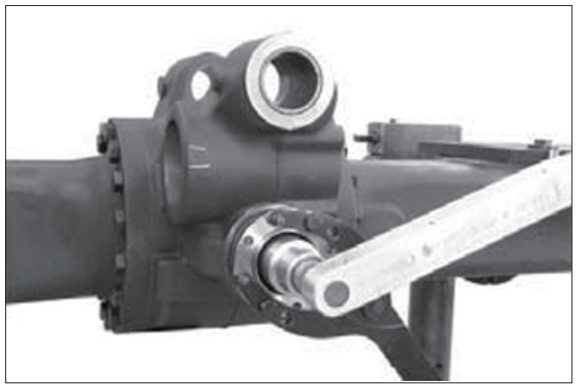
17W98FA101

(27) Mount input flange, finally tighten with disk and hexagon nut.

Tightening torque (M30x1.5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ Wet thread of the hexagon nut with Loctite no. 262.



17W98FA102

### 3) OUTPUT

#### (1) Preassembly axle housing

Insert bushing into hole of axle housing considering installation dimension “B” and installation position "Y" (see also sketch FA104 and FA106).

| | |
|---|---|
| (S) Driver tool | 5870 055 081 |
| (S) Handle | 5870 260 002 |

17W98FA103

(2) Comment on sketch:

1 = Axle housing

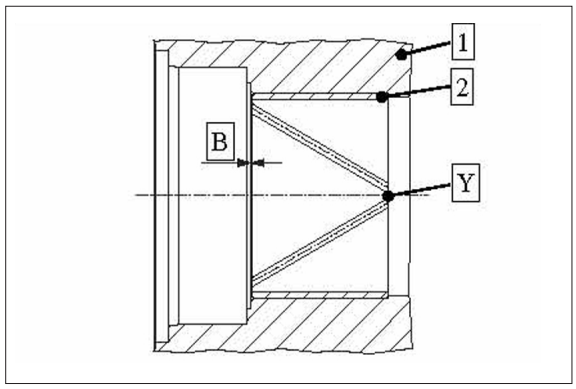
2 = Bushing

B = Installation dimension 1.0±0.3 mm

Y = Installation position / lubrication groove outlet of bushing (top view)

※ Lubrication groove outlet (V-point) must be mounted in 6 o’clock position (bottom) and showing to the oil chamber side.

※ Use of the specified driver tool (S) ensures the exact installation depth of the bushing.

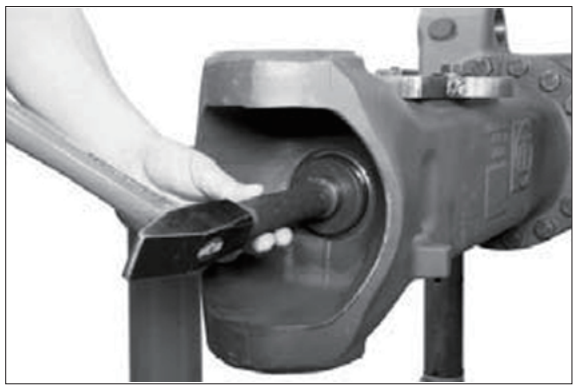



17W98FA104

(3) Flush-mount seal ring with the seal lip showing to the oil chamber (see sketch FA106) into the axle housing hole.

| | |
|---|---|
| (S) Driver tool | 5870 055 081 |
| (S) Handle | 5870 260 002 |

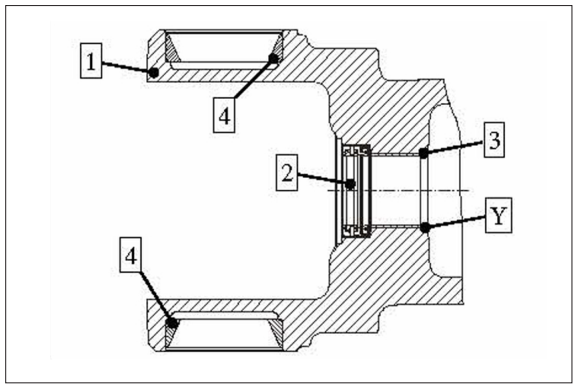
※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.



17W98FA105

※ Just before fitting wet the contact face shaft seal ring/axle drive housing with lubricant.
Apply grease on seal and dust lip of the shaft seal ring.

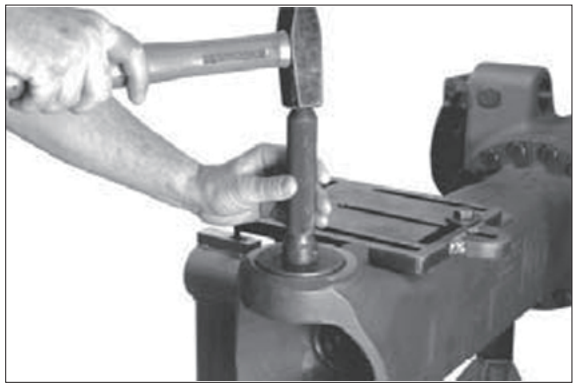
(4) Comment on sketch:
1 = Axle housing
2 = Shaft seal ring
3 = Bushing
4 = Bearing outer rings (pivot bearing)
Y = Lubrication groove outlet (V-point – in 6 o'clock position and on oil chamber side)



17W98FA106

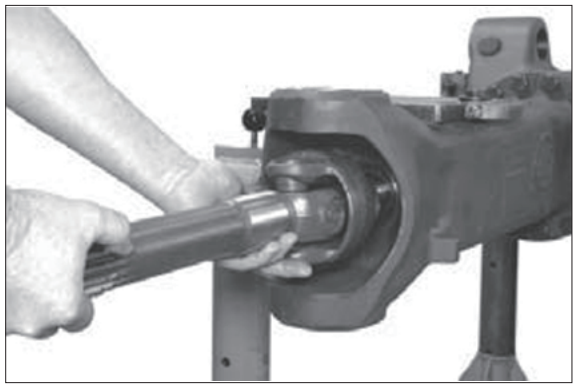
(5) Insert both bearing outer rings into the pivot bearing holes of the axle housing.

(S) Driver tool 5870 058 058
(S) Handle 5870 260 002


17W98FA107

(6) Install the u-joint shaft by inserting the u-joint shaft into the axle bevel gear teeth.

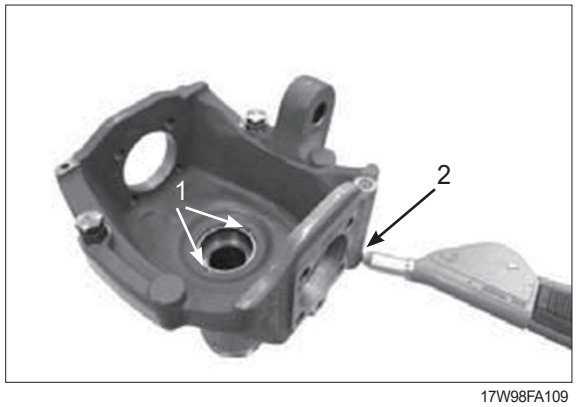
※ Pay attention to shaft seal ring in the axle housing risk of damage.


17W98FA108

**(7) Knuckle housing** (pivot bearing-SET-RIGHT)
Seal machining openings of oil supply holes – position 1 and 2 with plugs.

(S) Lever riveting tongs 5870 320 016

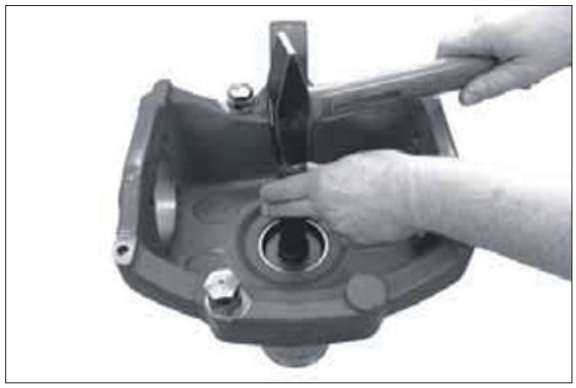
※ Operation is only required when using a new knuckle housing.



17W98FA109

(8) Insert bushing into the hole of the knuckle housing considering the installation dimension "B" and installation position "Y" (see also sketch FA111 and FA113).

| | |
|---|---|
| (S) Driver tool | 5870 055 081 |
| (S) Handle | 5870 260 002 |



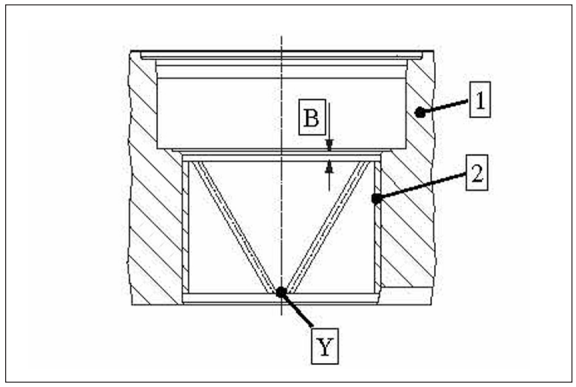
17W98FA110

(9) Comment on sketch:

1 = Knuckle housing
2 = Bushing
B = Installation dimension . . . 1.0±0.2 mm
Y = Installation position / lubrication groove outlet of the bushing

※ Lubrication groove outlet (V-point) must be mounted in 6 o'clock position (bottom) and showing to the oil chamber side (referred to the axle fitted into the vehicle).

※ Use of the specified driver tool (S) ensures the exact installation depth of the bushing.

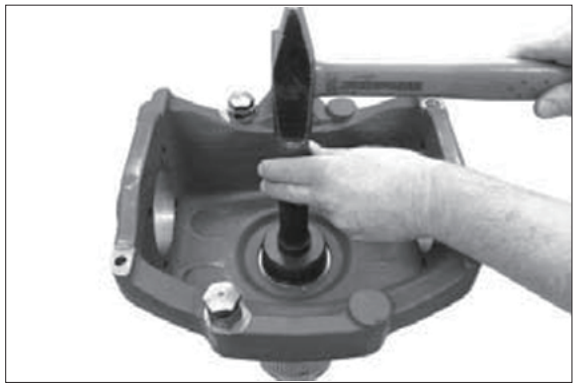



17W98FA111

(10) Insert shaft seal ring into the hole of the knuckle housing with the seal lip showing to the oil chamber – considering the installation dimension "W" (see also sketch below).

| | |
|---|---|
| (S) Driver tool | 5870 055 081 |
| (S) Handle | 5870 260 002 |

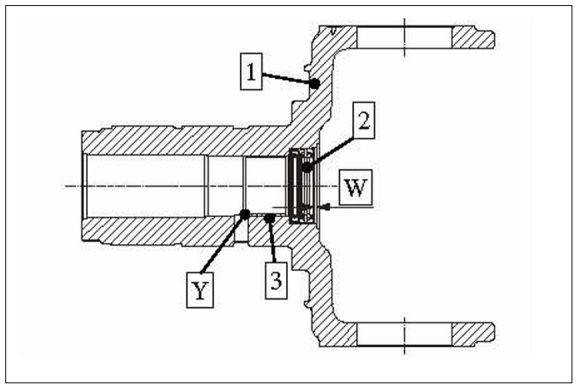
※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.



17W98FA112

(11) Comment on sketch:
1 = Knuckle housing
2 = Shaft seal ring
3 = Bushing
W = Installation dimension – shaft seal ring ..... 2.0±0.2 mm
Y = Lubrication groove outlet (V-point) must be mounted in 6 o'clock position and showing to the oil chamber side (referred to the axle fitted into the vehicle)

※ Just before fitting wet contact face shaft seal ring / knuckle housing with sealing agent.
Apply grease on seal and dust lip of the seal ring.



17W98FA113

(12) Grease O-ring (see arrow) and insert it into the groove of the bearing pin.


17W98FA114

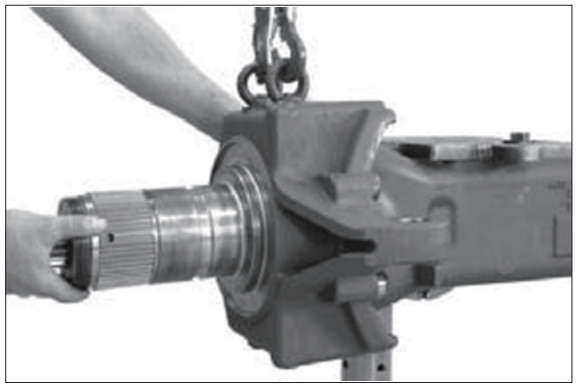
(13) Place sealing cap (see arrow) and mount the tapered roller bearing until contact position is obtained.


17W98FA115

(14) Locate pre-assembled knuckle housing on axle housing and carefully mount u-joint shaft.

(S) Eyebolts (M 16) 0636 804 001

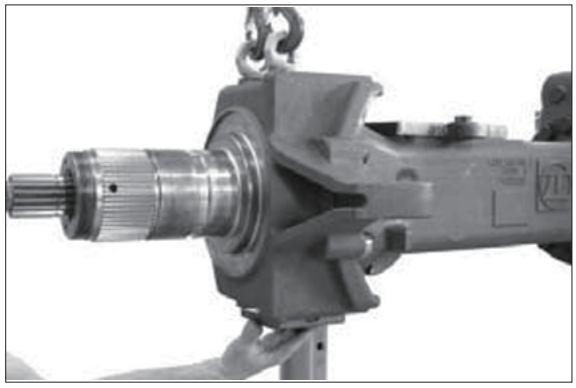
※ Pay attention to shaft seal ring in the knuckle housing risk of danger.



17W98FA116

(15) Insert the pre-assembled lower bearing pin and preliminarily fix with hexagon screws.

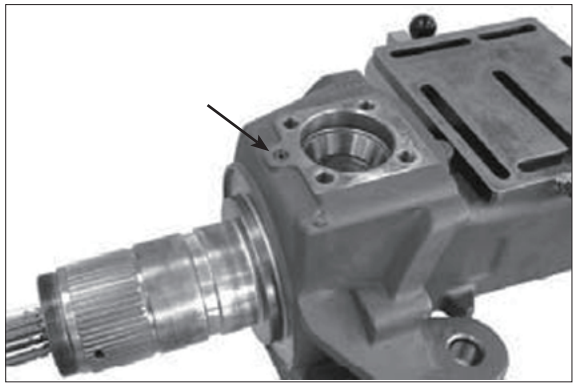
※ Pay attention to installation position mount bearing pin with lubrication nipple showing to axle centre.



17W98FA117

(16) Insert O-ring (see arrow) or O-rings into countersink of the knuckle housing.

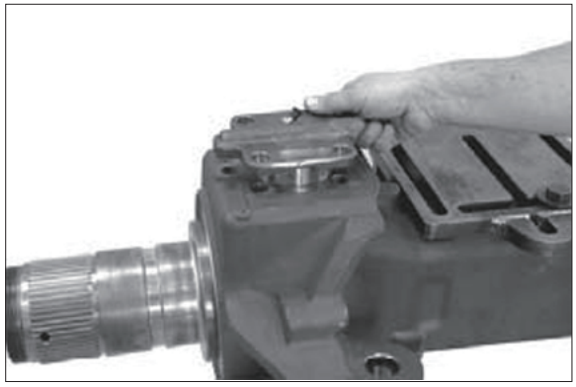
1 ps for version with breather valve in the knuckle housing
2 pcs for version with breather valve in the bearing pin



17W98FA118

(17) Insert pre-assembled upper bearing pin.

※ Observe installation position mount bearing pin with oil supply holes showing to axle centre.

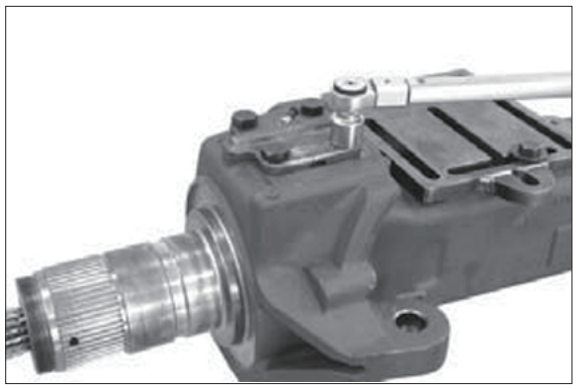


17W98FA119

(18) Fix both bearing pins definitely.

※ Tightening torque (M 16 / 10.9T) . .. . . . . MA = 280 Nm

※ Use of new locking screw is imperative.



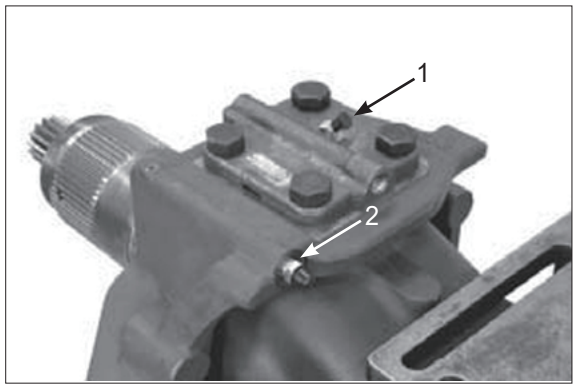
17W98FA120

(19) Mount lubrication nipple in both bearing pins (arrow 1 showing to the axle centre) and apply grease to the pivot bearing.

Tightening torque (M 10 × 1.0) . . . . . MA = 3 Nm

Mount breather valve (arrow 2, position depending on version : integrated in the knuckle housing or in the bearing lid) and provide with dust cap.

Tightening torque (M 14 × 1.5) . . . . . MA = 20Nm



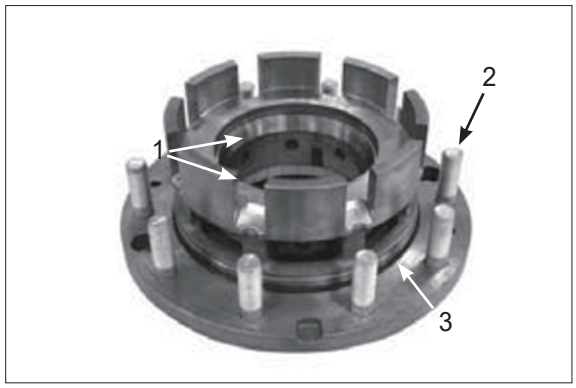

17W98FA121

**4) HUB** (Hub bearing-SET-RIGHT)

(1) Insert both bearing outer rings (1) of the hub bearing until contact position is obtained.

Press wheel bolts (2) into the hub until contact position is obtained.

Oil O-ring (3) and locate in annular groove of hub.



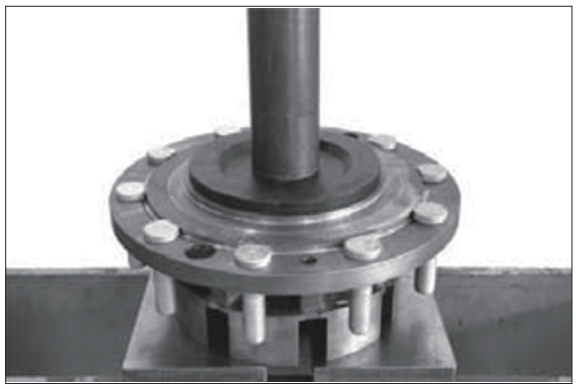

17W98FA122

(2) Press shaft seal ring with the marking "OUT SIDE" showing outside (upwards) into the hub.

(S) Driver tool 5870 051 035

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

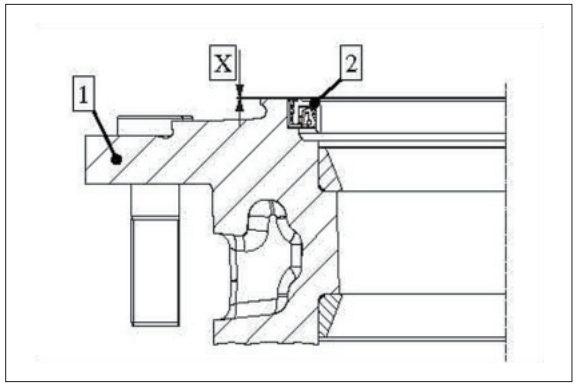
※ Just before fitting, wet contact face shaft seal ring/hub with lubricant.



17W98FA123

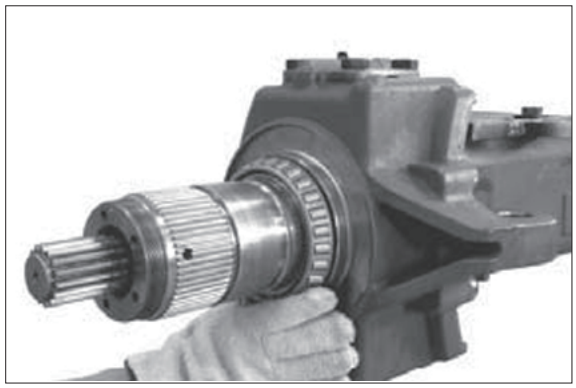
(3) Comment on sketch:

1 = Hub
2 = Shaft seal ring
X = Installation dimension – Shaft seal ring
..... 0.0~0.3 mm



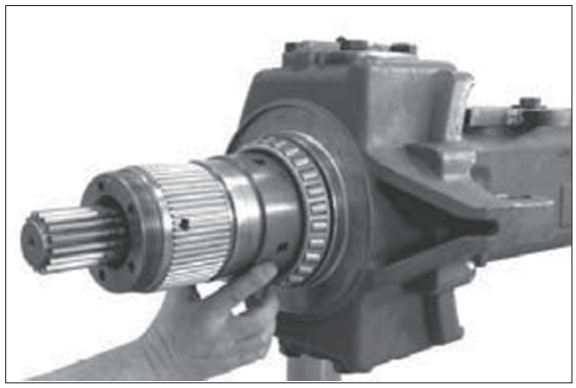

17W98FA124

(4) Heat the tapered roller bearing and mount until contact position with the knuckle housing is obtained.



17W98FA125

(5) Insert spacer bushing.



17W98FA126

(6) Install preassembled hub until contact is obtained and fix with heated tapered roller bearing.

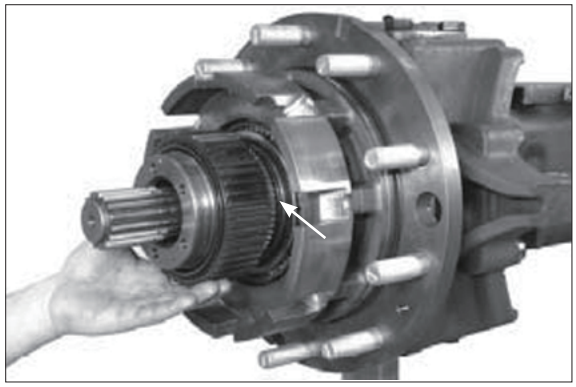
(S) Lifting bracket 5870 281 043

※ Just before fitting wet the seal lips of the shaft seal ring with lubricant.

17W98FA127

(7) Oil O-ring and insert it into the annular groove (see arrow) of the knuckle housing.

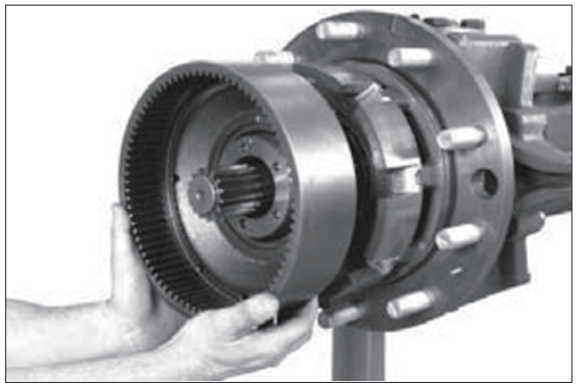
Then install disk carrier.



17W98FA128

(8) Bring disk carrier and hub bearing into contact position (figure FA129 and FA130)

Install ring gear (without sealing elements).



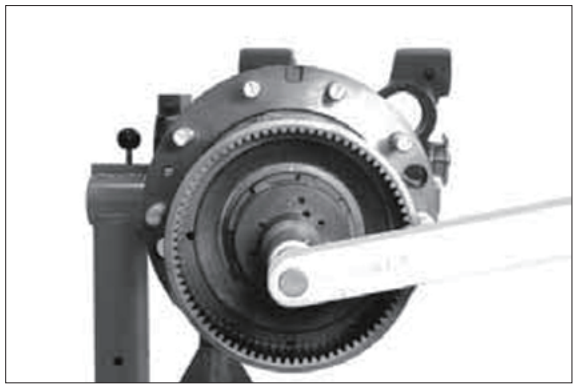
17W98FA129

(9) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of max. 1400 Nm.

(S) Socket wrench 5870 656 097

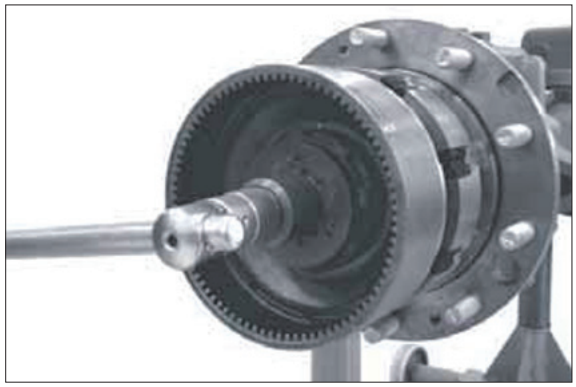
※ While tightening the slotted nut rotate hub in both directions several times roller setting.

※ Apply lubricant to thread knuckle housing / slotted nut.



17W98FA130

(10) Loosen slotted nut again and remove ring gear.



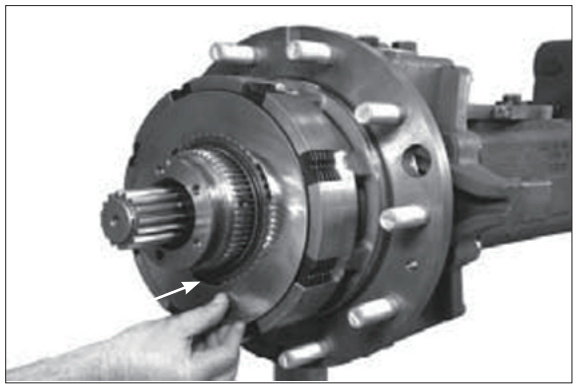
17W98FA131

### 5) DISK BRAKE

(1) Install disk package alternately starting with an outer disk.

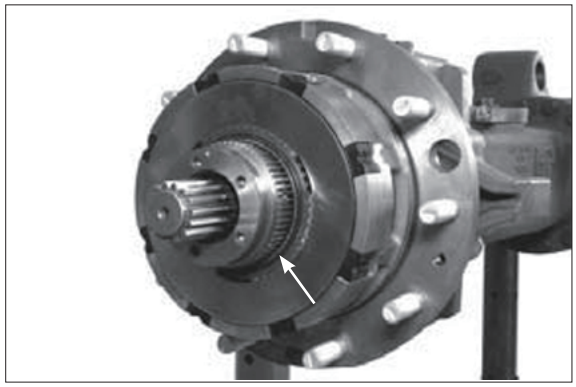
※ Take the actually required disk fitting / arrangement from the corresponding spare parts list.

※ Bring inner clutch disks in a position where one of the tooth recesses (see arrow) is in 6 o'clock position with axle being installed in the vehicle.



17W98FA132

(2) Oil O-ring and locate in annular groove of disk carrier.



17W98FA133

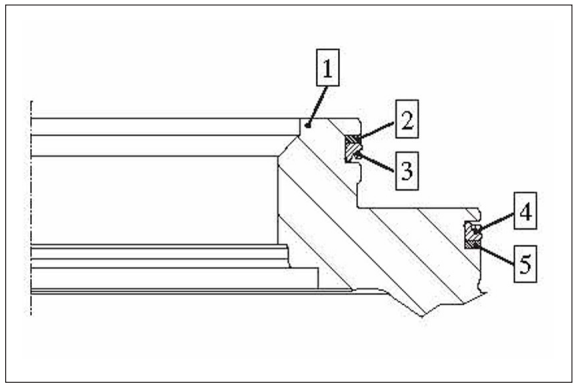
(3) Oil U- and support rings and insert them into the annular grooves of the ring gear.

※ Observe installation position, see sketch below.

17W98FA134

(4) Comment on sketch:

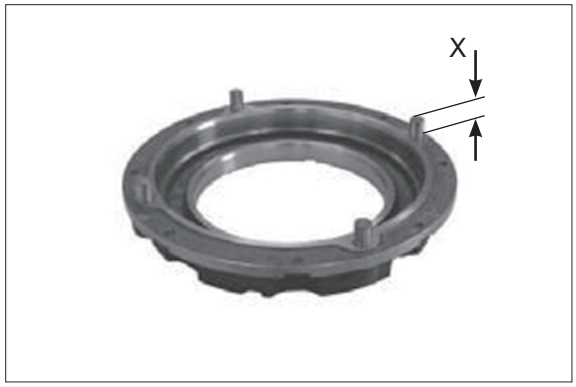
1 = Ring gear
2 = Support ring
3 = U-ring
4 = U-ring
5 = Support ring




17W98FA135

(5) Mount cylindrical pins into piston, considering installation dimension "X".

X = Installation dimension . . . . . 18.00 mm




17W98FA136

(6) Install piston on ring gear.

17W98FA137

(7) Fix piston with "new" hexagon screws (1), spring sleeves (2) and compression springs (3 and 4).

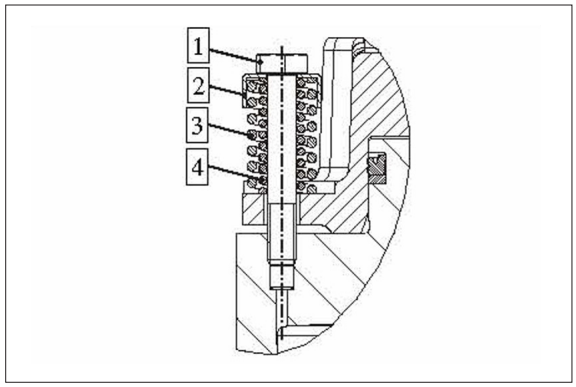
Tightening torque (M 6/8.8) . . . . . MA = 8 Nm

※ Use hexagon screws just once.

17W98FA138

(8) Comment on sketch:

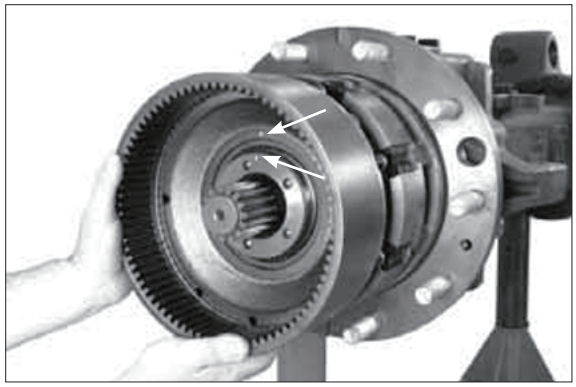
1 = Hexagon screw (special version)
2 = Spring sleeve
3 = Compression spring
4 = Compression spring




17W98FA139

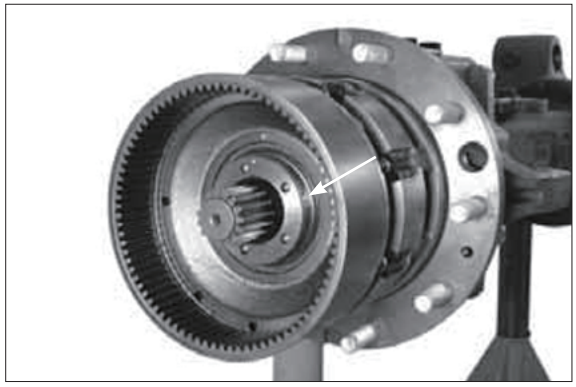
(9) Mount preassembled ring gear considering the installation position (markings O in 12 o'clock position - see arrows).

※ Ensure exact toothing position of oil supply holes knuckle housing / ring gear (pressure oil supply to brake piston).



17W98FA140

(10) Oil O-ring and insert in recess (see arrow).



17W98FA141

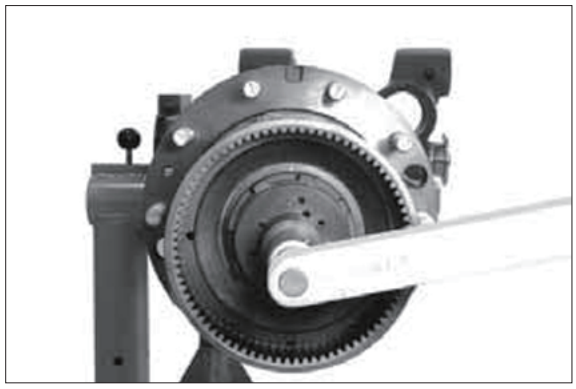
(11) Fix ring gear with slotted nut.

Tightening torque:
(M 85x 1.5). . . . . MA = 1400 + 200 Nm

(S) Socket wrench 5870 656 097

※ First tighten slotted nut with 1400 Nm, then retighten slotted nut until a fixing hole overlaps a threaded hole in the knuckle housing.
While tightening the slotted nut rotate hub in both directions several times roller setting.

※ Wet thread knuckle housing / slotted nut with lubricant.



17W98FA142

**(12) Make leakage test of multi-disk brake**

Mount threaded coupling (S) and connect HP pump.

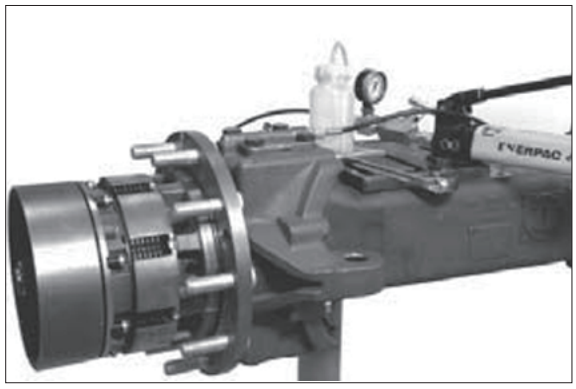
(S) HP pump 5870 287 007
(S) Threaded coupling (M14x1.5) 5870 950 102
(S) Breather bottle 5870 286 072

※ Breathe brake completely before starting the test.

**Test media :**
Motor oils SAE-10W

**High-pressure test:**
Build up test pressure p = 100 bar and close locking valve of HP pump.
A pressure drop by max. 3 bar is permissible during a 5-minute test duration.

**Low pressure test:**
Reduce test pressure p = 5 bar and close locking valve.
No pressure drop is allowed during a 5-minute testing duration.



17W98FA143

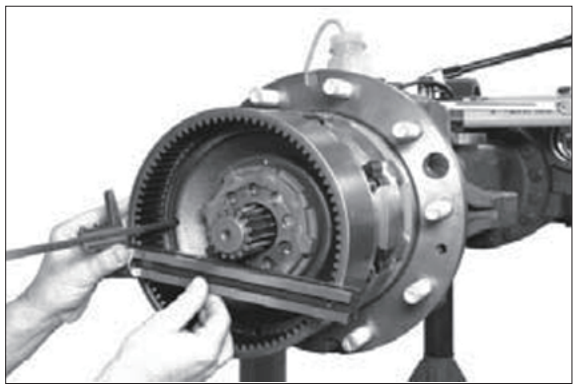
(13) **Adjust and check piston stroke**

Piston stroke / disk clearance = 0.7 ..... 1.3 mm
Build up braking pressure (100 bar) and close locking valve of the HP pump.

Determine dimension "A", from face of the ring gear (1) through measuring hole (see also sketch FA145) to the face of the piston (3).

Dimension "A" e.g. . . . . 83.10 mm

※ Breathe brake completely before starting the measuring operation.

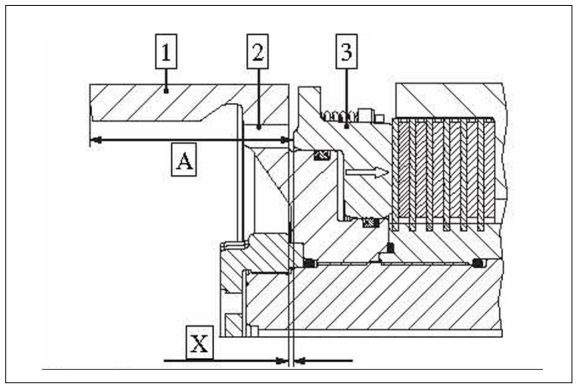


17W98FA144

(14) Then open locking valve of the HP pump and release pressure from brake (reset piston through compression springs).

Determine dimension "B", from the face of the ring gear (1) through the measuring hole (see also sketch FA146) to the face of the piston (3).

Dimension "B" e.g. . . . . 82.10 mm




17W98FA145

(15) CALCULATION EXAMPLE:

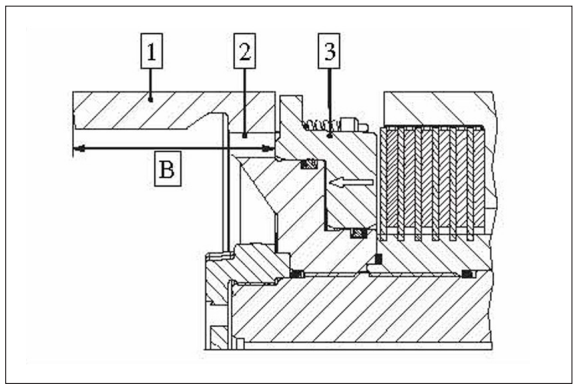
Dimension "A" e.g. . . . . 83.10 mm
Dimension "B" e.g. . . .. . . . . . - 82.10 mm
Difference = Piston stroke = 1.00 mm

※ If the required piston stroke (0.7 ... 1.3 mm) is not achieved, correct it with the corresponding inner clutch disk (s) – refer to corresponding spare parts list.

Then remove HP pump (S), breather bottle (S) and threaded coupling (S).

Comment on sketch 43 and 44:
1 = Ring gear
2 = Measuring hole
3 = Piston
X = Piston stroke / disk clearance

(S) Straightedge 5870 200 022




17W98FA146

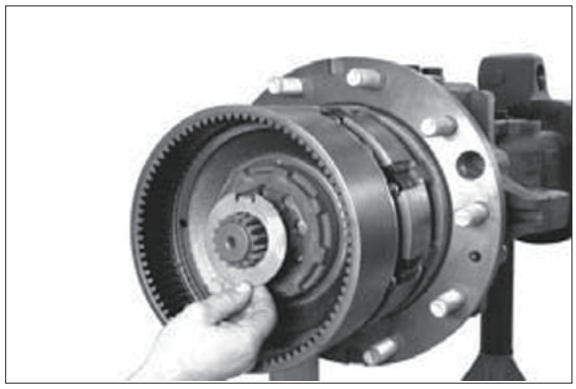
(16) Secure slotted nut with cylindrical screw (please also refer to figure FA142)

Tightening torque (M 10/8.8) . . . . . MA = 32 Nm

17W98FA147

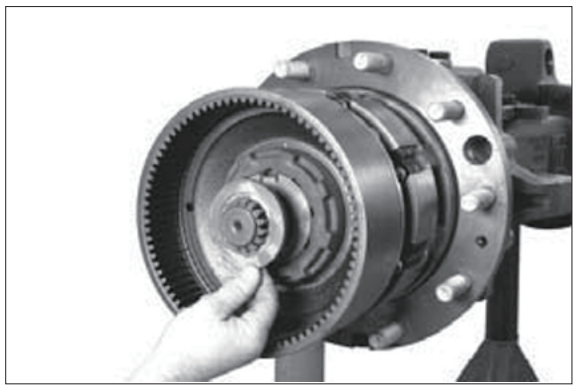
(17) Insert thrust washer.

※ Observe installation position ensure that both lugs of the thrust washer are engaged each in a spare fixing hole of the slotted nut.



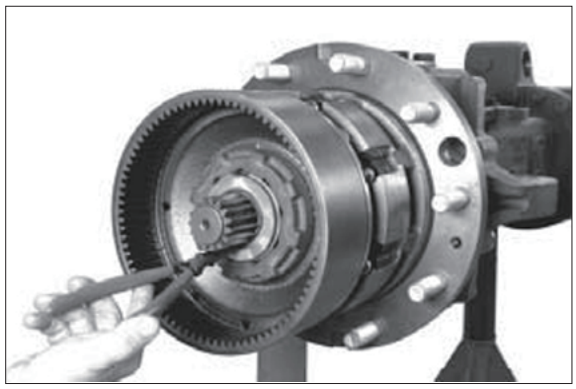
17W98FA148

(18) Mount thrust washer with shoulder showing to the retaining ring (outwards).



17W98FA149

(19) Fix thrust washers by using a retaining ring.



17W98FA150

## 6) PLANETARY CARRIER

(1) Press thrust washer into the planetary carrier until contact position is obtained.

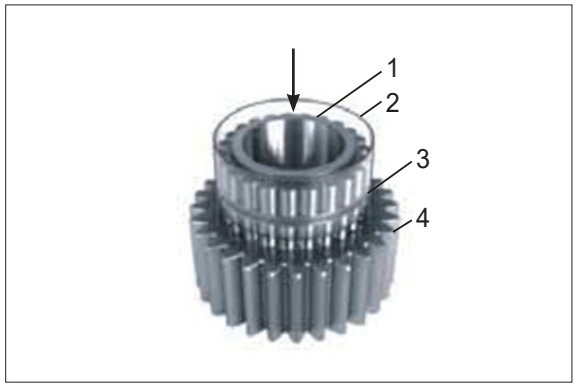
(S) Driver tool 5870 048 245

17W98FA151

(2) Insert the cylindrical roller bearing into the planetary gear for this purpose press the cylindrical roller bearing through the packaging sleeve until the snap ring engages into the annular groove of the planetary gear.

※ Use packaging sleeve to facilitate assembly.

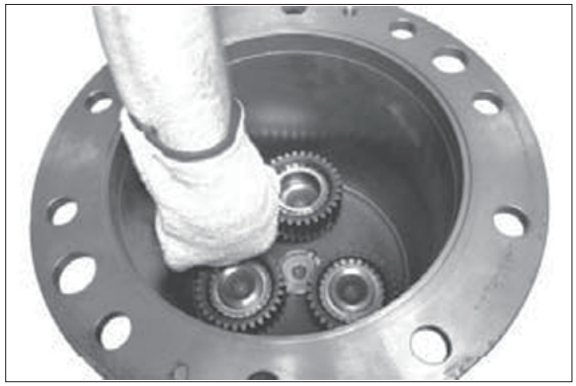
1 = Cylindrical roller bearing
2 = Packaging sleeve
3 = Snap ring
4 = Planetary gear




17W98FA152

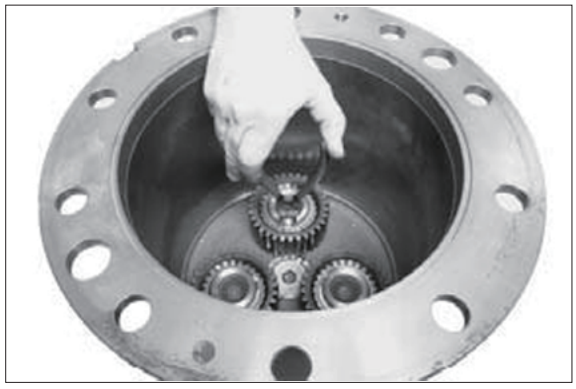
(3) Warm up bearing inner ring and install pre-assembled planetary gear until contact is obtained.

※ Mount bearing inner ring with large radius, showing to the planetary carrier (downwards).



17W98FA153

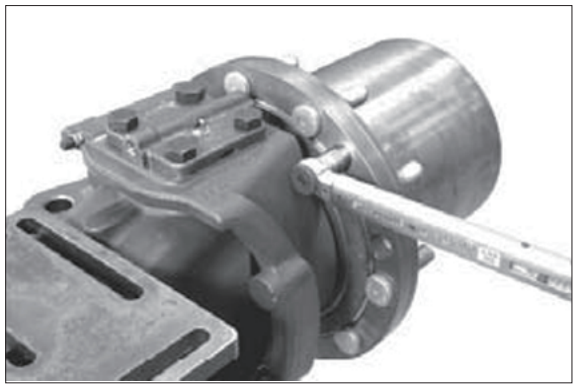
(4) Fix planetary gear by means of retaining ring.



17W98FA154

(5) Install preassembled planetary carrier and fix with hexagon screws.

Tightening torque (M12/8.8) . . . . . MA = 55 Nm



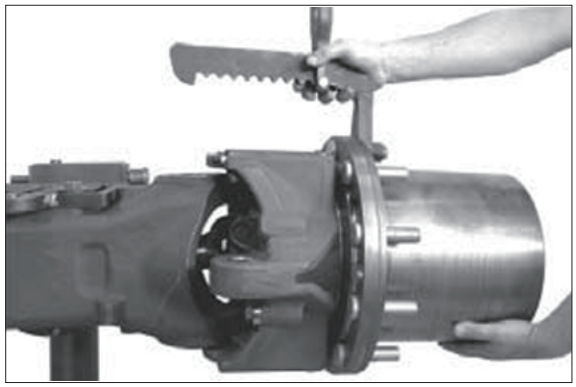
17W98FA155

**(6) Output assy**

Locate output assy on the axle by means of the lifting bracket (S) by installing the u-joint shaft in the axle bevel gear toothing.

(S) Lifting bracket 5870 281 043

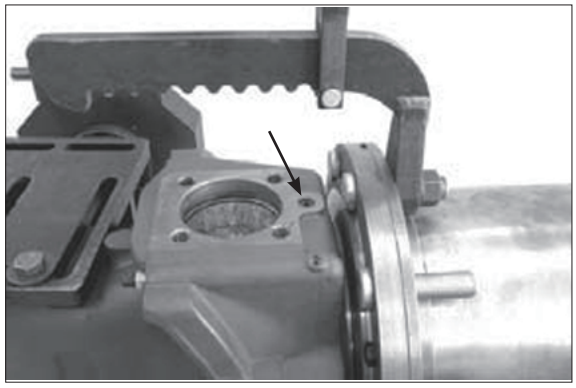
※ Pay attention to shaft seal ring in the axle housing risk of damage.



17W98FA156

(7) Insert O-ring (see arrow) or O-rings into the countersink (s) of the knuckle housing.

1 pc for version with breather valve in knuckle housing.
2 pcs. for version with breather valve in bearing pin.



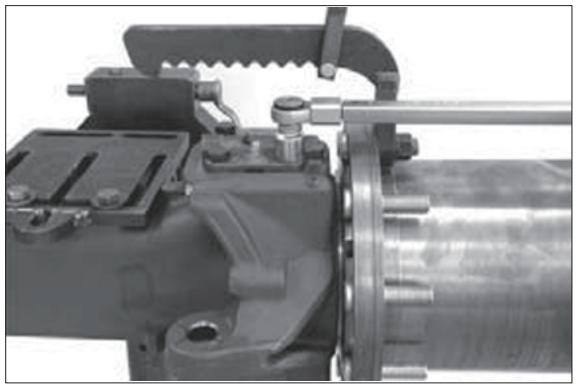
17W98FA157

(8) Mount both bearing pins and fix with hexagon screws or locking screws.

Tightening torque (M16/10.9T) . . . . . MA = 280 Nm

※ Observe installation position, mount upper bearing pin with oil supply holes showing to axle centre.

※ Use of new locking screw is imperative.



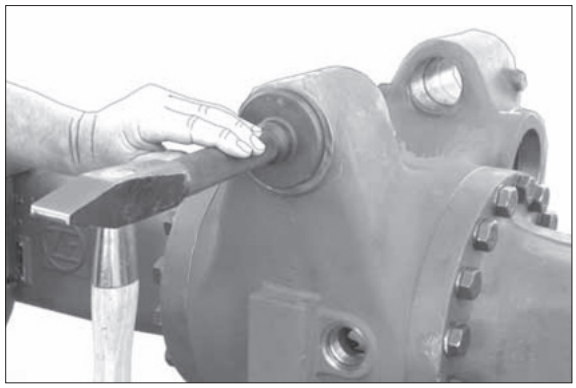
17W98FA158

### (9) Pivot bearing

Super-cool bushings and insert into the heated pivot bearing hole until contact is obtained.

※ Observe installation position for bushing version with slot, insert bushings with slot in 12 o'clock position.

※ Prior to putting the axle into operation, fill in oil.

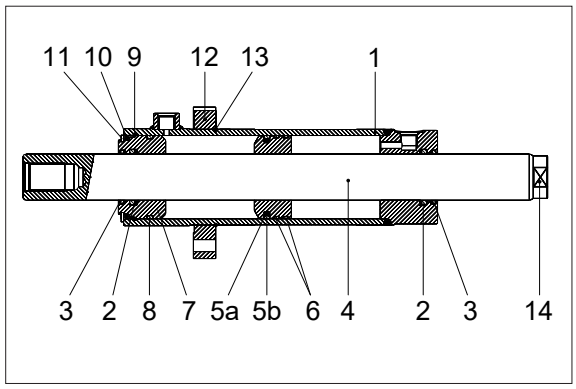


17W98FA159

## 7) STEERING

(1) Comment on sketch:

1 = Steering cylinder
2 = Grooved ring
3 = Scraper
4 = Piston rod
5a = O-ring
5b = Form seal ring 〉Piston sealing
6 = Guide ring
7 = Brake head
8 = Dual ring
9 = Retaining ring
10 = O-Ring (only for version "with" O-ring)
11 = Retaining ring
12 = Flange
13 = Retaining ring
14 = Wrench point of attack (piston rod)



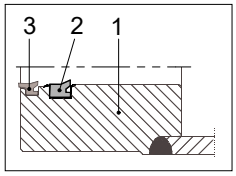

17W98FA160

### (2) Preassemble steering

Mount U-ring (2) and scraper (3) in the steering cylinder (1).

※ Observe installation position – see detailed sketch.

Detailed sketch:

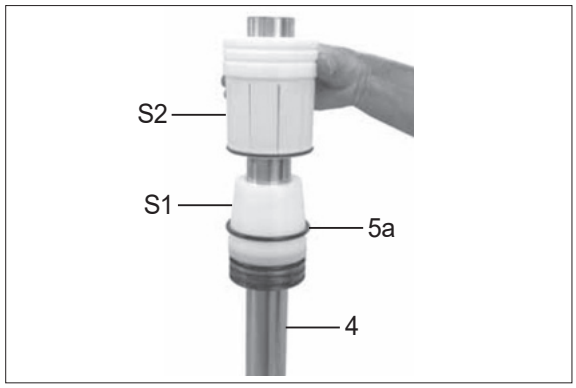



17W98FA161

(3) Position inner installer (S1) on piston rod (4).

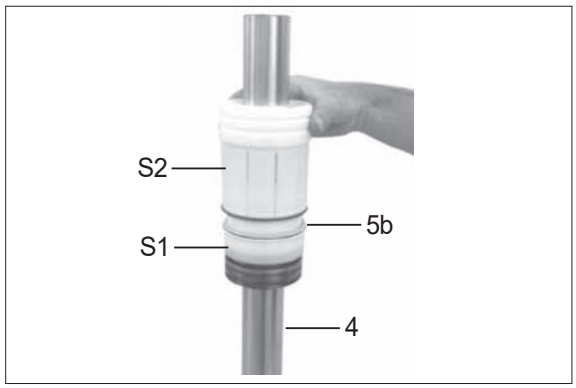
Mount O-ring (5a) and press with inner installer (S2) into annular groove (arrow) of the piston (4).

(S) Inner installer (S1) 5870 651 086
(S) Inner installer (S2) 5870 651 087



17W98FA162

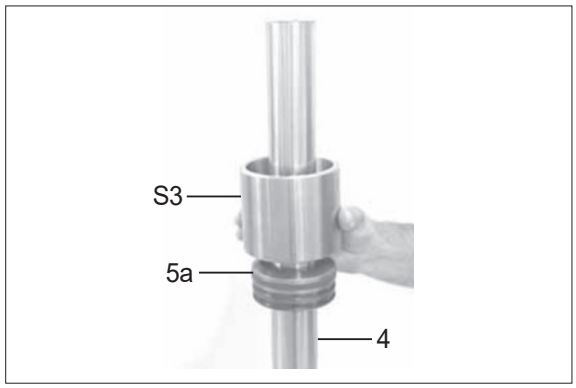
(4) Install form seal ring (5b) and press with inner installer (S2) into the annular groove of the piston (4).



17W98FA163

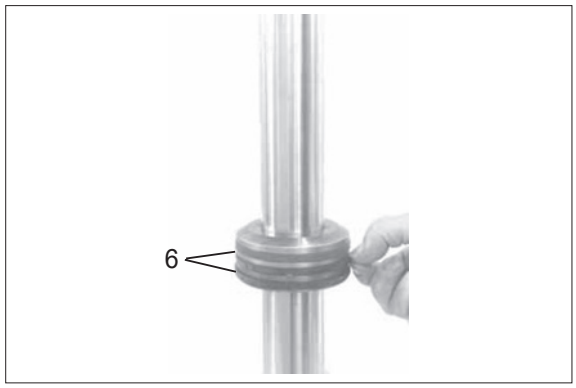
(5) Calibrate form seal ring (5b) with calibration bush (S3).

(S) Calibration bush (S3) 5870 651 090



17W98FA164

(6) Place both guide rings (6) into the annular grooves of the piston rod.

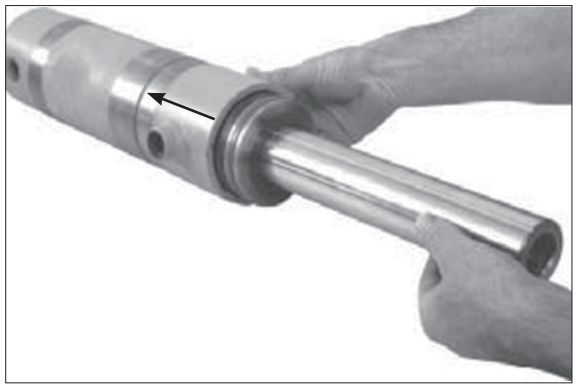


17W98FA165

(7) Insert preassembled piston rod into the steering cylinder.

※ Slightly oil all sealing elements before installing the piston rod.

※ Observe installation position, insert piston rod with wrench point of attack (14, see also sketch FA160) showing in direction of arrow.

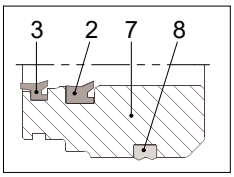


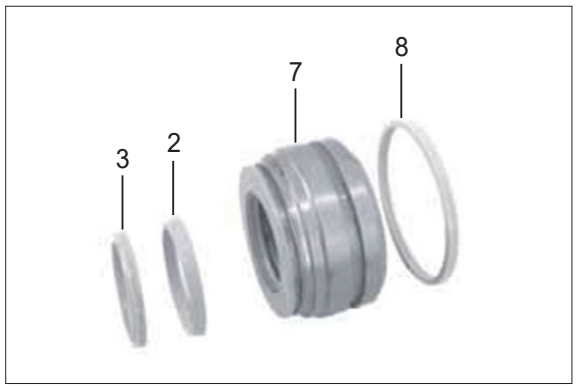
17W98FA166

(8) Insert U-ring (2), scraper (3) and dual ring (8) into the grooves of the brake head (7).

※ Observe installation position in this connection refer to detailed sketch.

Detailed sketch:




17W98FA167

(9) Push preassembled brake head into the steering cylinder so that the retaining ring (see figure FA169) can be mounted.

※ Slightly oil all sealing elements before inserting the brake head.

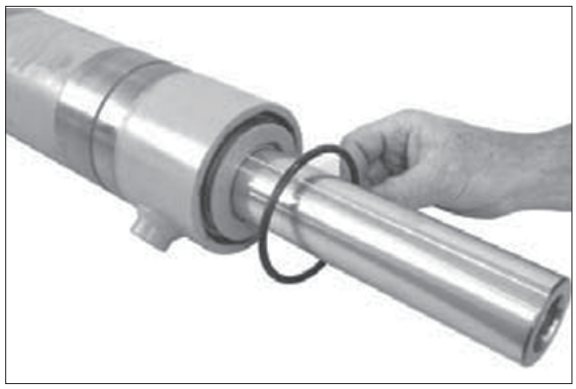
17W98FA168

(10) Engage retaining ring (9) into the groove of the cylinder tube.

17W98FA169

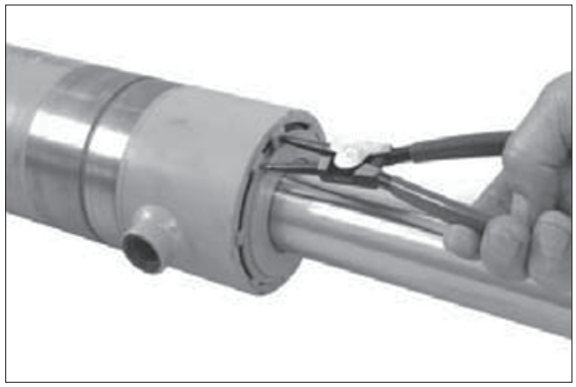
(11) Position the inserted brake head (7) on the snap ring (9) until contact is obtained (arrow).

Only for version with O-ring (see corresponding spare parts list) : Oil O-ring (10) and place into the recess.



17W98FA170

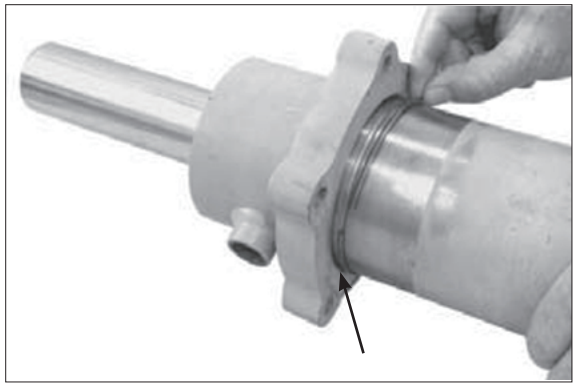
(12) Fix brake head (7) with retaining ring (11).



17W98FA171

(13) Install flange (12) and engage retaining ring (13).

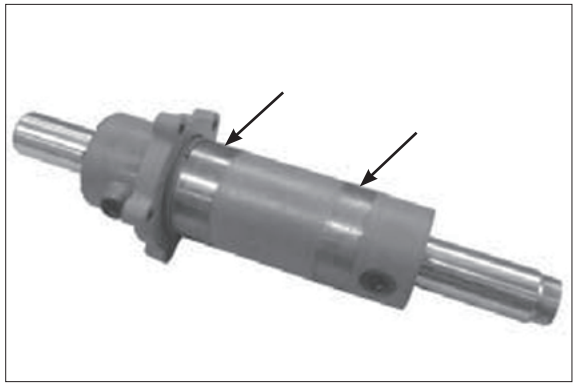
※ Observe installation position of flange mount flange with chamfer (see arrow) showing to the snap ring.



17W98FA172

**(14) Mount steering**

Apply anti-corrosive agent (Weicon Anti-Seize) on contact faces (cylinder tube / axle housing, see arrow).



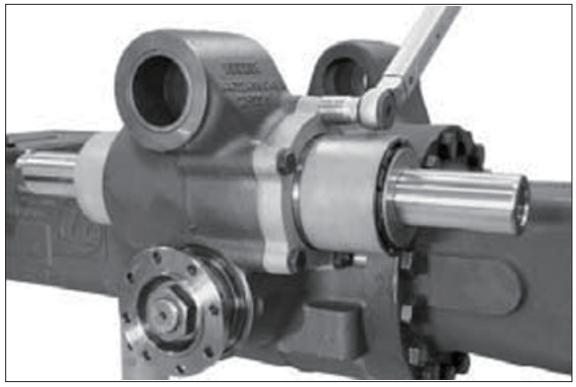
17W98FA173

(15) Insert preassembled steering cylinder into axle housing and fix with hexagon screws.

Tightening torque (M 12/8.8) . . . . . MA = 79 Nm

※ The radial installation position of the steering cylinder (position of the hydr. connections) is customer specific see also disassembly instructions figure FA018.

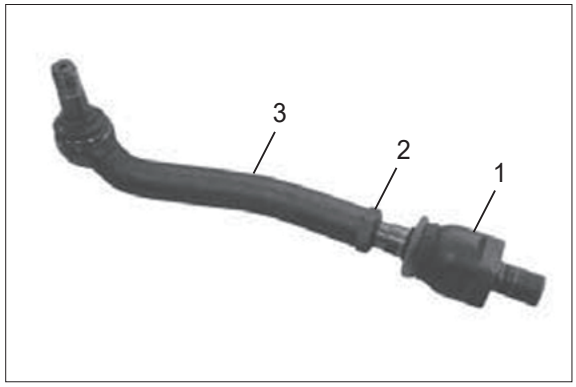
※ Wet the thread of the hexagon screws with Loctite no. 243.



17W98FA174

(16) Bolt hexagon nut (2) and ball joint (3) to axial joint (1).

※ Do not tighten hexagon nut before setting the track.



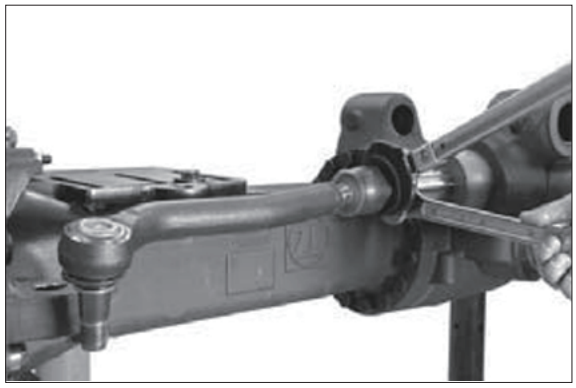

17W98FA175

(17) Fix both tie rods to piston rod (with offset showing to the axle housing).

Tightening torque (M30 × 1.5) . . . . . MA = 450 Nm

(S) Socket wrench (SW 55) 5870 656 100

※ Wet thread of the axial joint with Loctite no. 243.

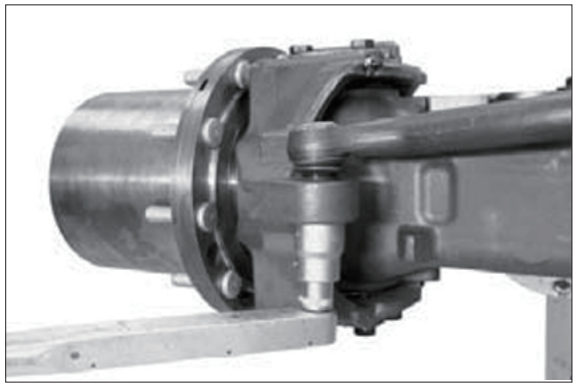


17W98FA176

(18) Install tie rod into knuckle housing and fix with "new" locking nut.

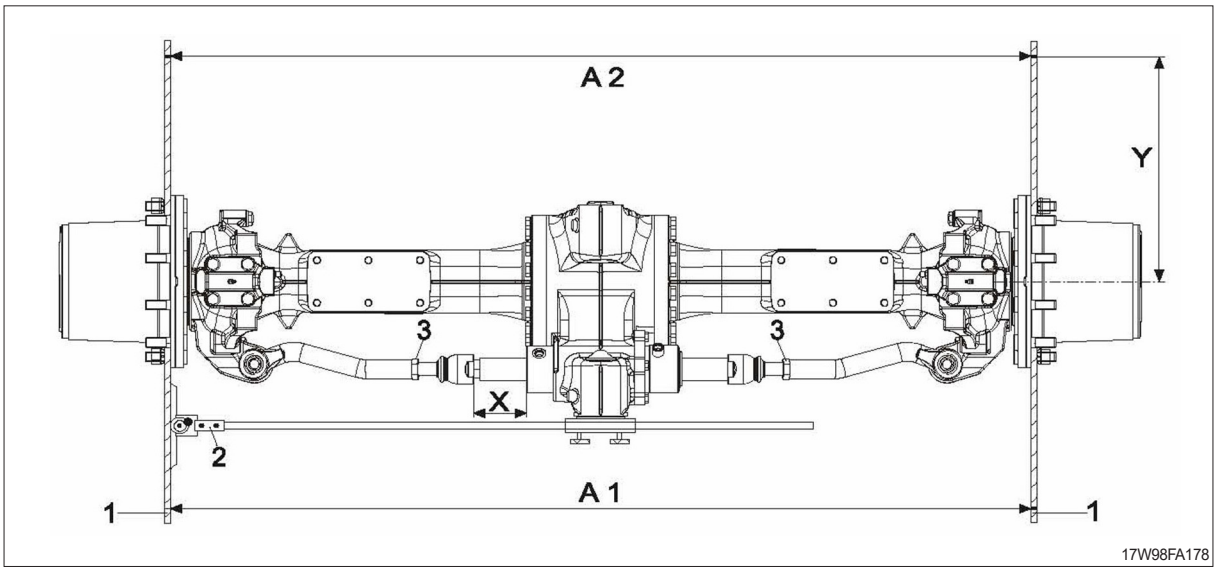
Tightening torque (M 27 × 1.5) . . . . . MA = 600 Nm

※ Use locking screws just once.



17W98FA177

## (19) Steering setting and checking




1 = (S) Straightedge 5870 200 029
2 = (S) Measuring device 5870 200 033
3 = Hexagon nut
X = Installation dimension (central position – piston rod)
Y = Distance – wheel center to rim flangeBasic track setting

## (20) Basic track setting

Bring piston rod in central position.
Dimension X = 119 mm (measured from front face/steering cylinder to contact face/axial joint).

※ Do not change axial position of piston rod any more during track setting.

Mount straightedge (1) in horizontal and central axis position.
Fix measuring device (2) to yoke.
Loosen hexagon nut (3) and set length of tie rod (axial joint) until the measuring device (2) indicates 0° (corresponds to a track setting of zero mm).

※ For a toe-in and toe-out setting, which might be required, stick to the vehicle manufacturer's specification.

※ Make setting on both output sides.

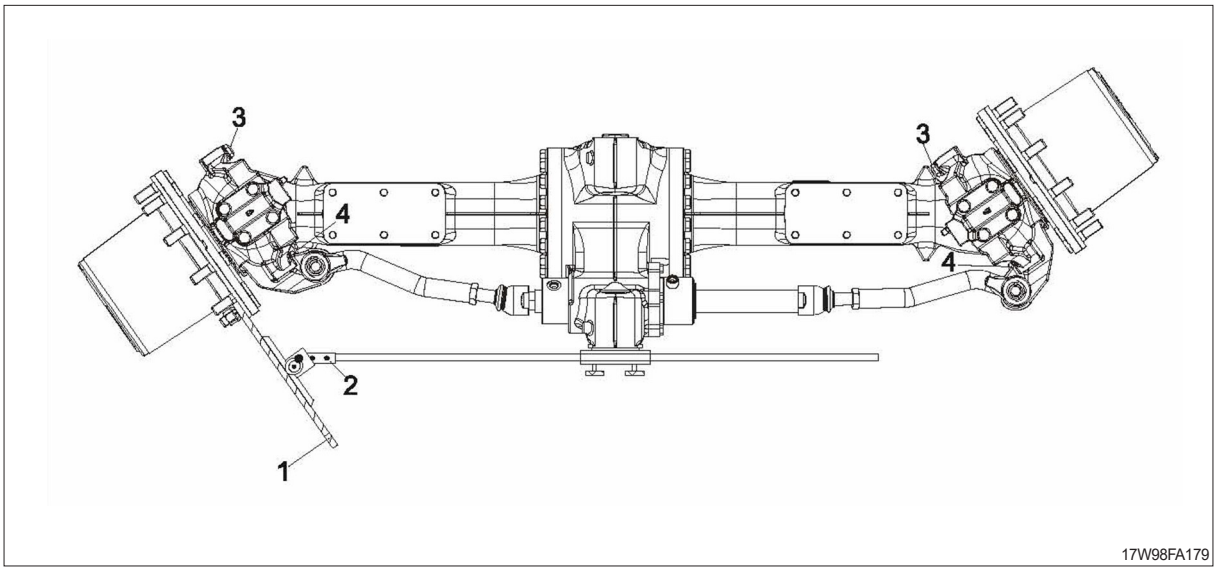
Check track setting (0°):
Determine dimension A1.
Rotate both outputs by 180° – dimension A2 must equal dimension A1.
Dimension "Y" = distance between rim center and rim flange.

Then fix both tie rods (axial joint) by means of hexagon nut (3).

Tightening torque (M28 × 1.5) . . . . . MA = 390 - 410 Nm

### (21) Steering angle setting

※ When track setting is required, steering angle setting may only be carried out after track setting has been completed.




1 = (S) Straightedge 5870 200 029
2 = (S) Measuring device 5870 200 033
3 = Stop screw with stop washer (optional)
4 = Stop screw with hexagon nut

Mount straightedge (1) in horizontal and central axis position.
Fix measuring device (2) to yoke.
Pivot output until the required steering angle (e.g. 35°) is indicated on the measuring device (2).

※ Take the value of the steering angle to be set from the vehicle manufacturer's specifications.

Bring the stop screw (4) on the axle housing in contact position and lock with hexagon nut.
Tightening torque (M18 / 10.9) . . . . . MA = 300 Nm

Then set inner stop by means of stop screw (3) and stop washer (s = optional).
Tightening torque (M18 / 10) . . . . . MA = 390 Nm

※ Make setting on both output sides.

### (22) Check leakage of steering

Make leakage test of steering in both steering directions by means of HP pump.

Test pressure: 200 bar
Test medium: Engine oils SAE 10W

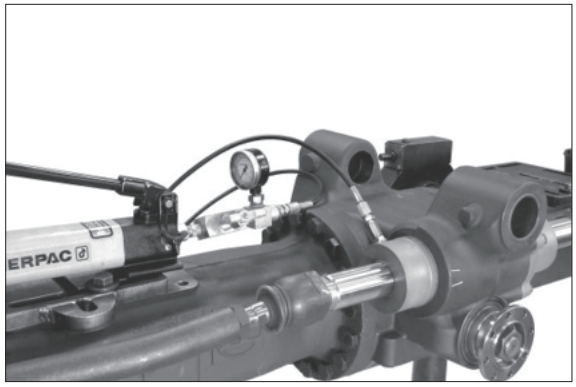
Test pressure p = Build up 200 bar (bleed pressure chamber).

Then close connection to HP pump by means of locking valve.

A 5 bar pressure drop is permissible during a test duration of 20 sec.

| | |
|---|---|
| (S) HP pump | 5870 287 007 |
| (S) Reduction | 5870 950 161 |
| (S) Clutch | 0501 207 939 |

※ Prior to putting the axle into operation fill it with oil.



17W98FA180

## C. REAR AXLE (#0074 and up)

### 1. REMOVAL REAR AXLE

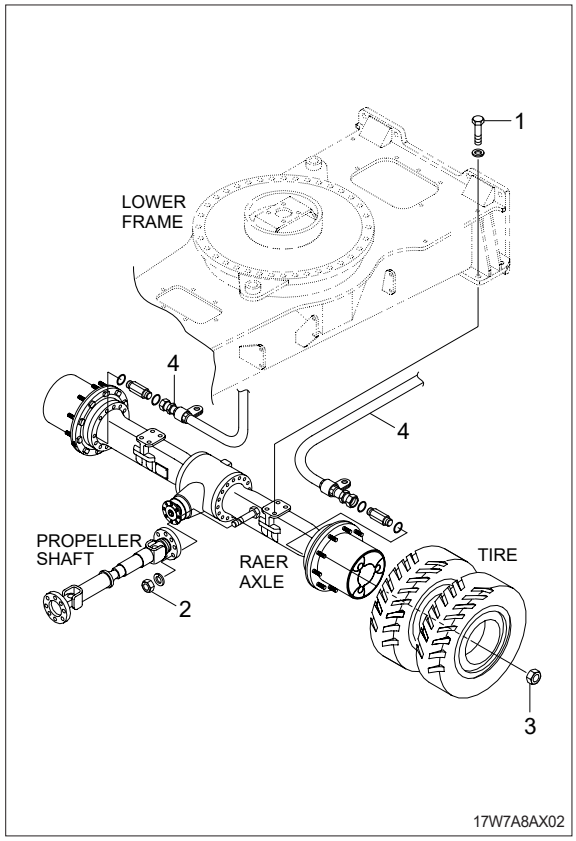
1) Rear axle mounting nut (1, M20)
   · Tightening torque : 58 ± 6.3 kgf · m
   (419 ± 45.5 lbf · ft)

2) Propeller shaft mounting bolt (2, M10)
   · Tightening torque : 5.9 ± 0.6 kgf · m
   (42.7 ± 4.3 lbf · ft)

3) Wheel nut (3, M22)
   · Tightening torque : 60 $^{0}_{-5}$ kgf · m
   (434 $^{0}_{-36}$ lbf · ft)

4) Hose assy (4)

5) Axle weight : 450 kg (992 lb)



## 2. GENERAL INSTRUCTIONS

### 1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.

(3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.

(4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100°C.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

## 2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

## 3) LUBRICANT SPECIFICATIONS

(1) Gear oils with limited - slip additives.

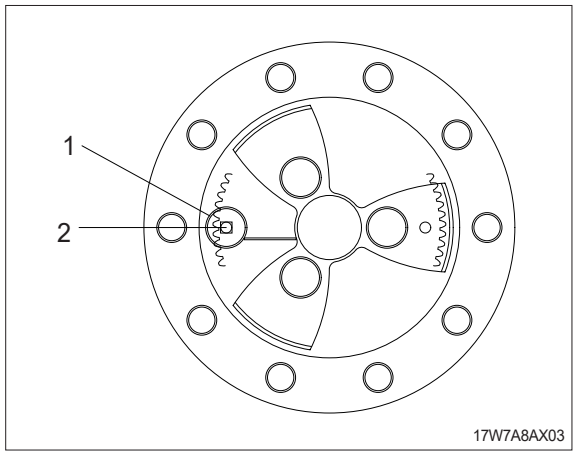
(2) API GL-5

(3) MIL-L-2105D (SAE 85W-90, 85W-140 with LS-Additive)

## 4) BRAKE LINING WEARING TEST

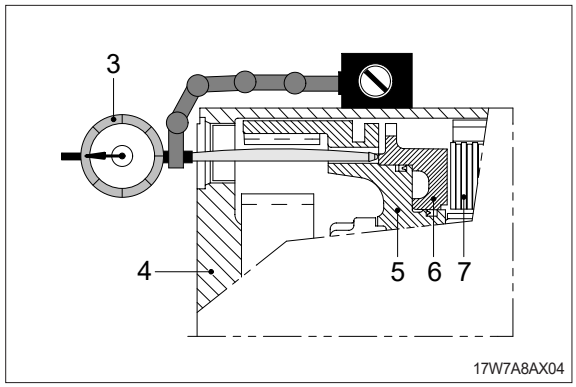
(1) The measurement of wear on the multi-disc brake only gives limited information on the total state of the plate pack without disassembling the output.
Make measurement of lining wear at least once per year, in particular, however, in case of a different braking behaviour, like :
- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

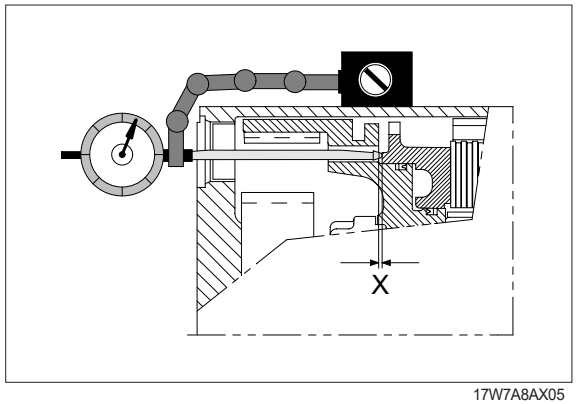
※ To avoid injury when opening the oil drain/ oil filler plug (1), due to a possible pressure build-up in the planetary carrier bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and filler plug (1).




(2) Then turn output until oil filler / oil drain hole (2) is on 9 o'clock position.

1 = Oil filler-/oil drain hole
2 = Gauge hole ( ø =10 mm) in ring gear
9 o'clock position
3 = Dial indicator with solenoid support
4 = Planetary carrier
5 = Ring gear
6 = Piston
7 = Plate pack
X = Piston stroke



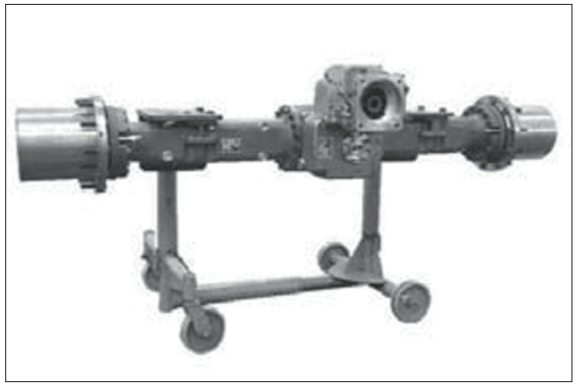



## 3. DISASSEMBLY

### 1) OUTPUT

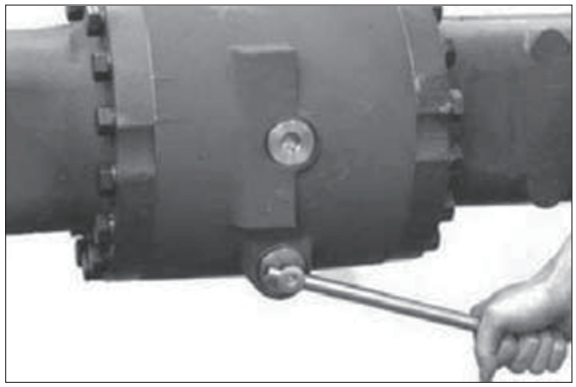
(1) Attach axle to the assembly truck.

(S) Assembly truck 5870 350 000
(S) Supporting bracket 5870 350 106



17W98RA001

(2) Loosen screw plug and drain oil from the axle.

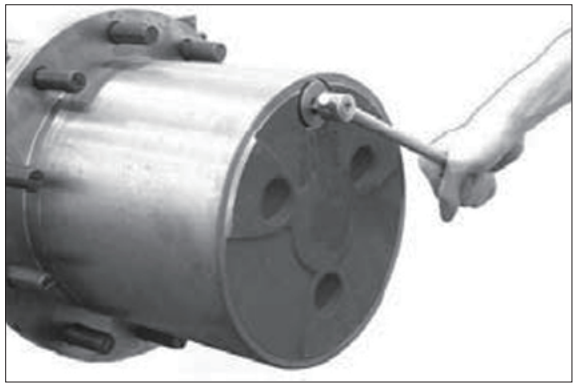


17W98RA002

(3) Loosen screw plug and drain oil from the planetary carrier.

※ To avoid any risk of injury due to a possible pressure buildup in the oil system of the planetary carrier, bring oil filler / level check plug to the uppermost position (12 o'clock) and turn it out carefully.
Then bring drain hole to 6 o'clock position and drain oil.

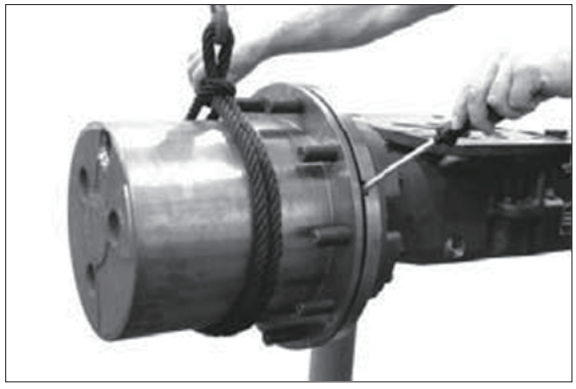
※ Use suitable oil reservoir environmental protection.



17W98RA003

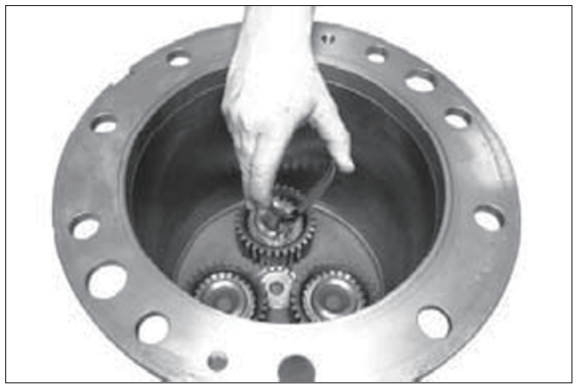
**(4) Planetary carrier**

Loosen both hexagon screws and separate planetary carrier from the hub.



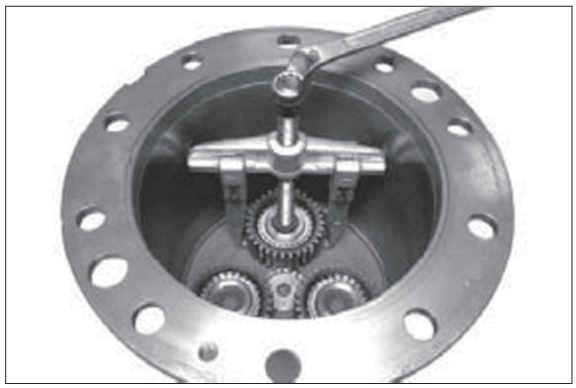
17W98RA004

(5) Snap out retaining ring.



17W98RA005

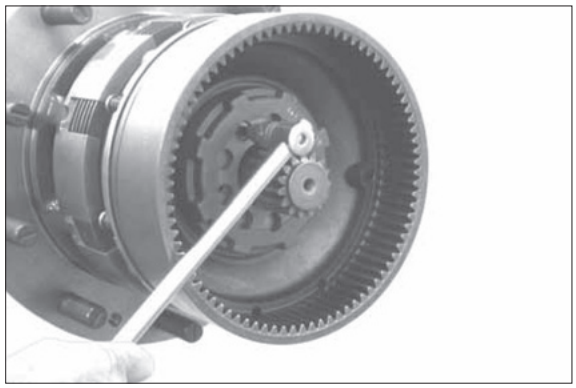
(6) Pull off planetary gear together with cylindrical roller bearing.



17W98RA006

**(7) Brake**

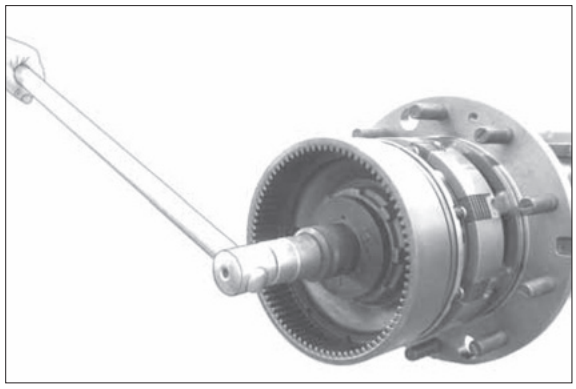
Loosen cylindrical screw (slotted nut fixing).



17W98RA007

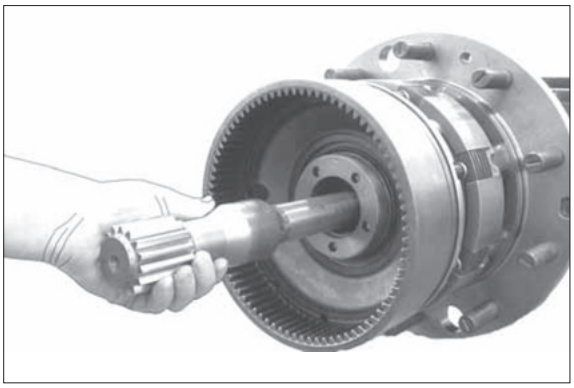
(8) Loosen slotted nut.

(S) Socket wrench 5870 656 097



17W98RA008

(9) Pull sun gear together with stub shaft out of the axle housing.

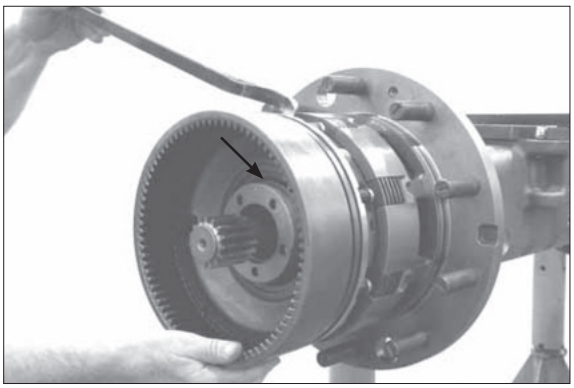


17W98RA009

(10) Press ring gear together with piston off the hub carrier.

(S) Assembly lever 5870 345 036

※ Pay attention so that the O-ring (arrow) does not drop.



17W98RA010

(11) Loosen hexagon screws and remove releasing spring sleeves and compression springs.

17W98RA011

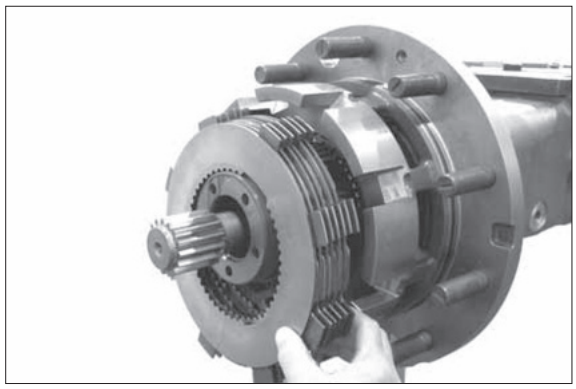
(12) Press piston off the ring gear.

17W98RA012

(13) Remove sealing elements from the annular grooves (see arrows) of the ring gear.

17W98RA013

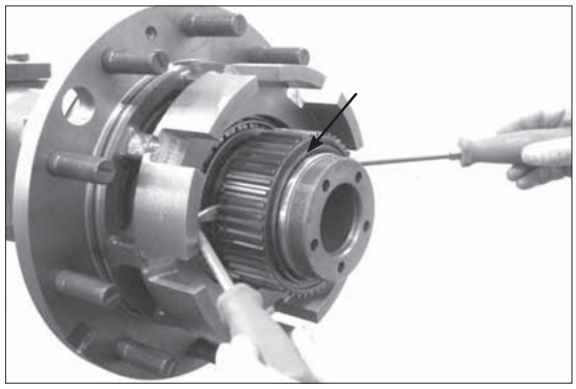
(14) Remove disk package.



17W98RA014

(15) Remove O-ring (seee arrow) and use a lever to remove disk carrier from hub carrier.

(S) Resetting device 5870 400 001



17W98RA015

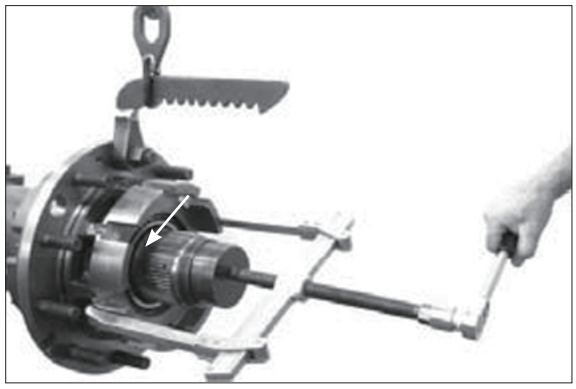
**(15) Hub**

Remove O-ring (see arrow).

Secure hub with lifting bracket (S) and pull it off the hub carrier by means of a two armed puller.

(S) Lifting bracket 5870 281 043
(S) Pressure piece 5870 100 063

※ Pay attention that the releasing bearing inner ring does not drop.

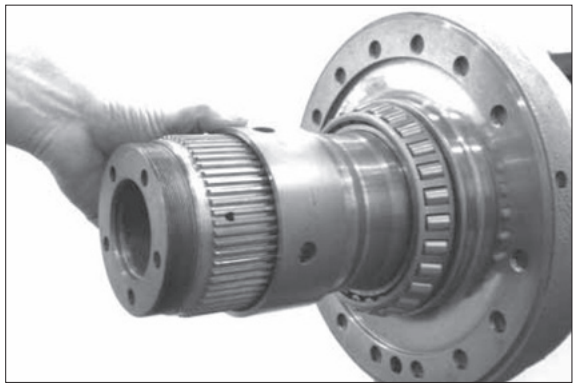


17W98RA016

(17) Use a lever to remove the shaft seal ring (see arrow) from the hub hole and force both bearing outer rings out of the hub.

17W98RA017

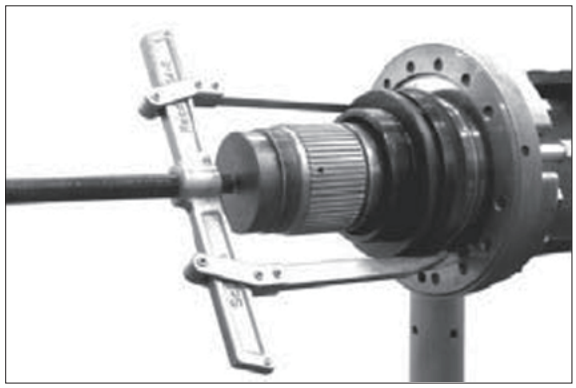
(18) Remove spacer bush.



17W98RA018

(19) Pull tapered roller bearing off the hub.

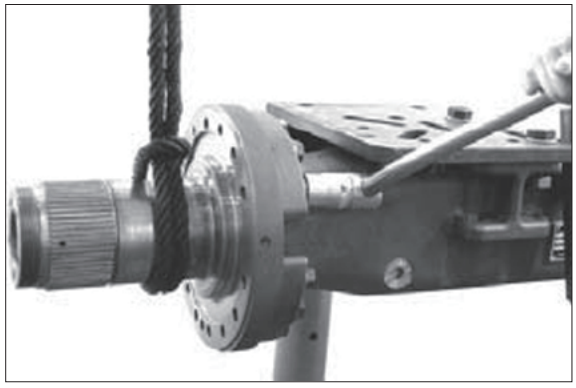
| | |
|---|---|
| (S) Grab sleeve | 5873 013 015 |
| (S) Pressure piece | 5870 100 063 |



17W98RA019

(20) Secure hub carrier with lifting tackle, loosen threaded joint and separate hub carrier from the axle housing.

Then remove single parts such as screw neck, breather valve and O-ring from the hub carrier.



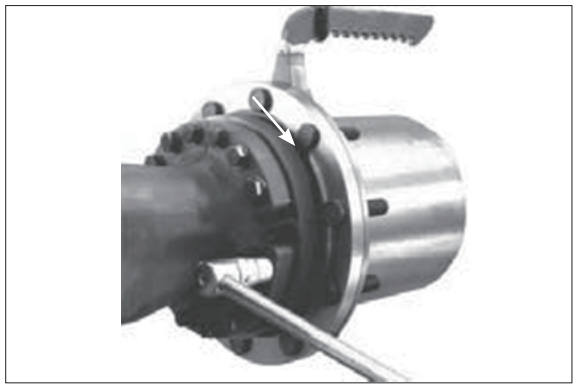
17W98RA020

(21) Output assy

※ If work is to be done on the differential or pinion, you may remove the output as a complete unit (operations figure RA021 and RA022).

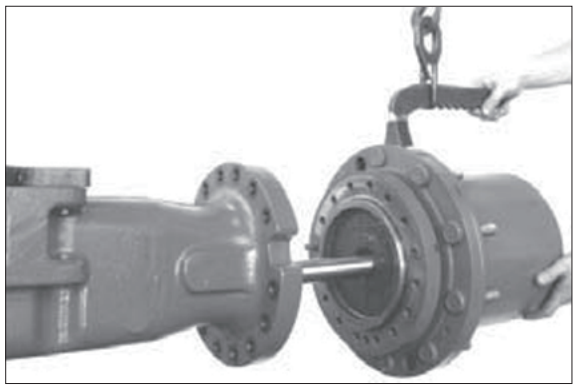
Secure output by means of lifting tackle (S) and loosen threaded joint.

(S) Lifting bracket 5870 281 043



17W98RA021

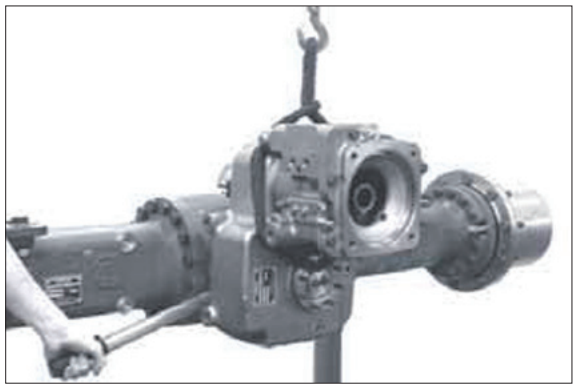
(22) Separate output assy from the axle housing and pull out stub shaft.



17W98RA022

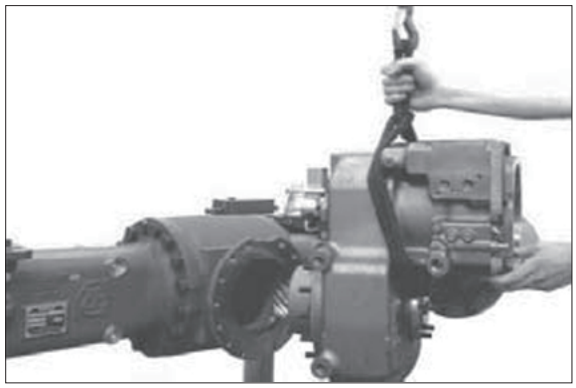
2) INTPUT

(1) Secure transmission with lifting tackle and loosen threaded joint (transmission/axle drive housing).



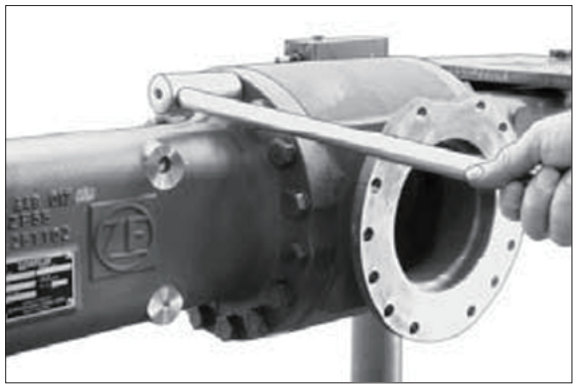
17W98RA023

(2) Separate transmission from the axle.



17W98RA024

(3) Secure axle housing (on crown wheel side) by means of lifting tackle and loosen threaded joint.

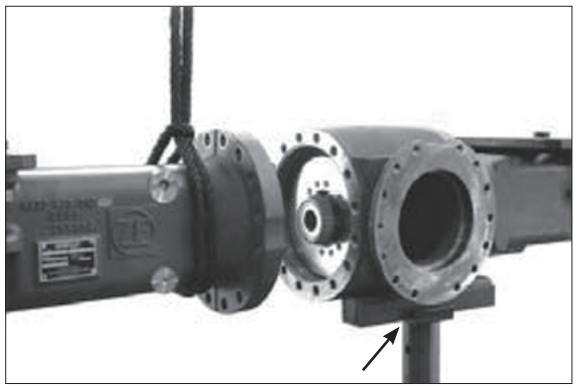


17W98RA025

(4) Support axle at the axle drive housing (see arrow).

Then separate axle housing from the axle drive housing.

※ Pay attention that the differential does not drop.

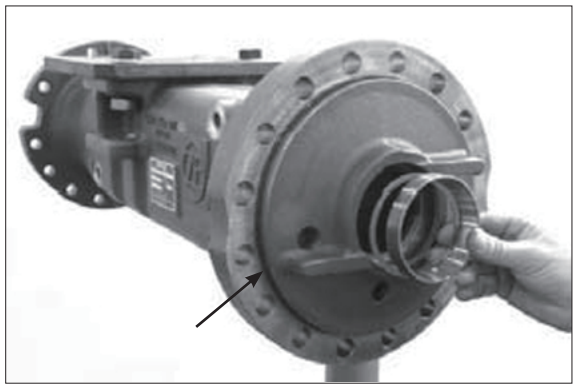


17W98RA026

(5) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

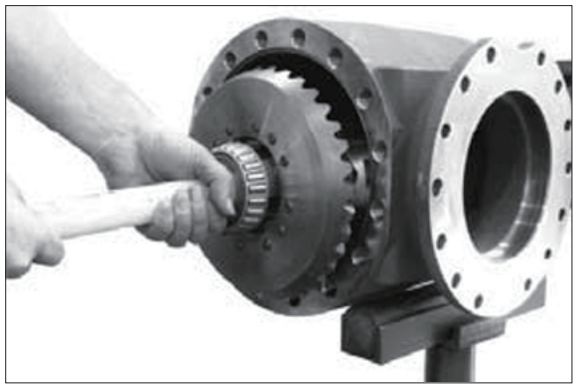
(S) Striker 5870 650 004



17W98RA027

(6) Lift differential out of the axle drive housing.

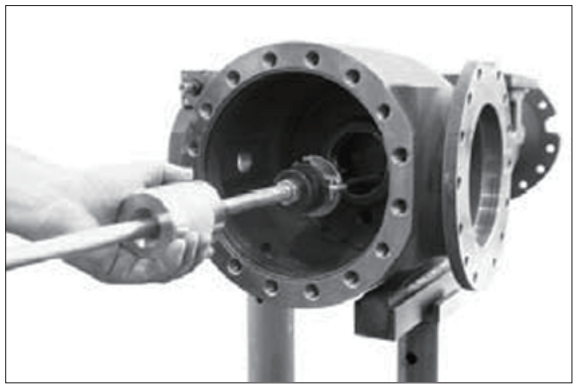
※ Disassembly of the differential see description on page 8-241 and following.



17W98RA028

(7) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove the releasing shim.

(S) Striker 5870 650 004

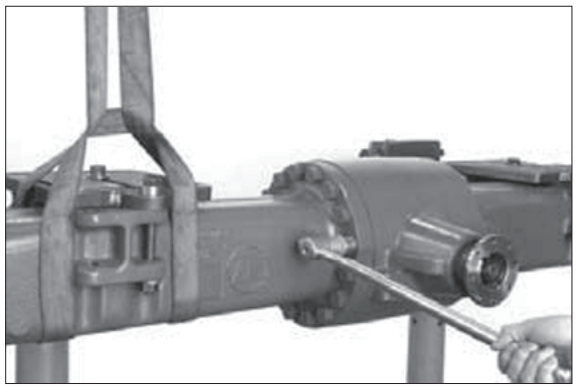


17W98RA029

(8) Secure axle housing (on crown wheel side, part II) by means of lifting tackle and loosen threaded joint.

Then separate axle housing (part II) from the axle drive housing.

※ Pay attention that the differential does not drop.

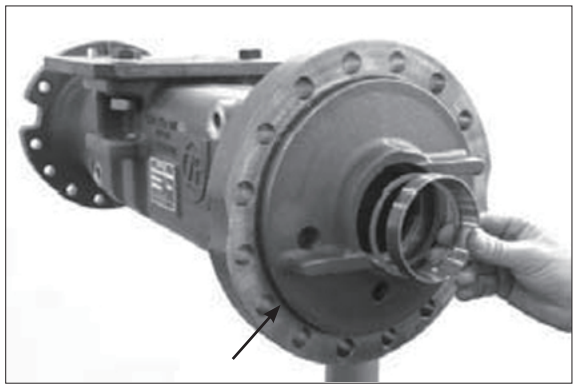


17W98RA030

(9) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

(S) Striker 5870 650 004

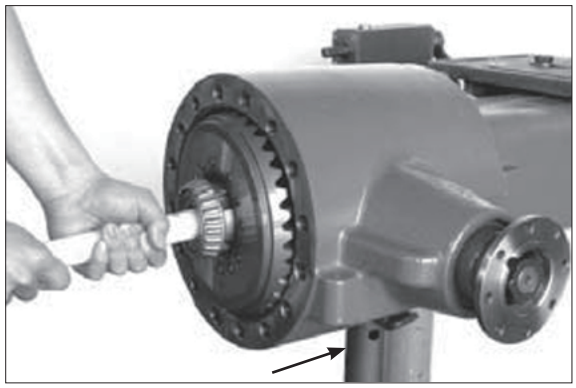


17W98RA031

(10) Support axle at the axle drive housing (see arrow).

Then lift differential out of the axle drive housing.

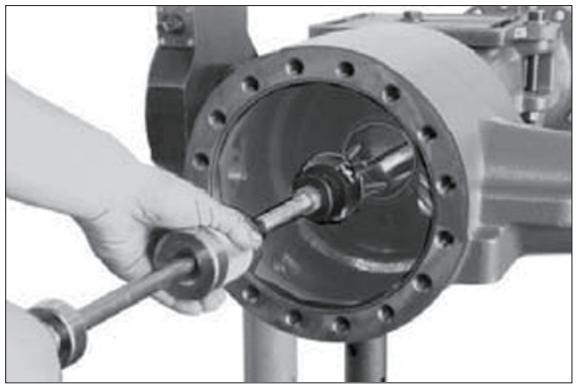
※ Disassembly of the differential see description on page 8-241 and following.



17W98RA032

(11) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove the releasing shim.

(S) Striker 5870 650 004



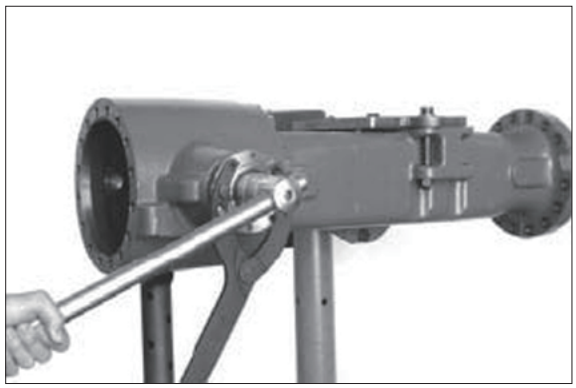
17W98RA033

(12) Heat up hexagon nut with hot-air blower.

Then loosen hexagon nut and remove the releasing washer.

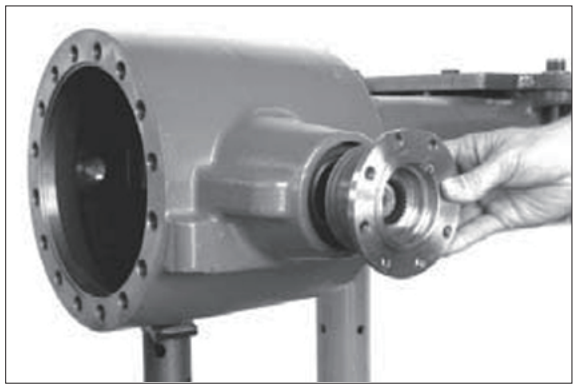
(S) Clamping fork 5870 240 025

※ Hexagon nut is secured with Loctite no. 262.



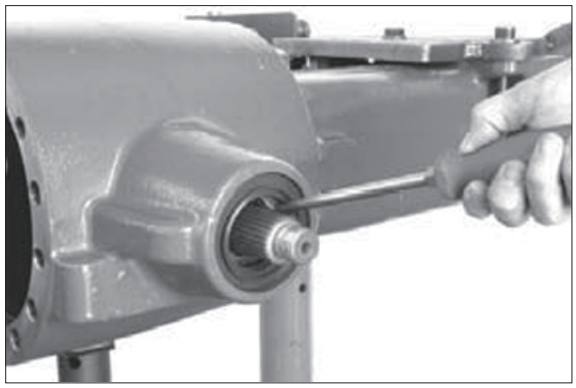
17W98RA034

(13) Pull input flange off the pinion.
If required, remove screen sheet from the flange.



17W98RA035

(14) Use a lever to remove the shaft seal ring out of the housing hole.

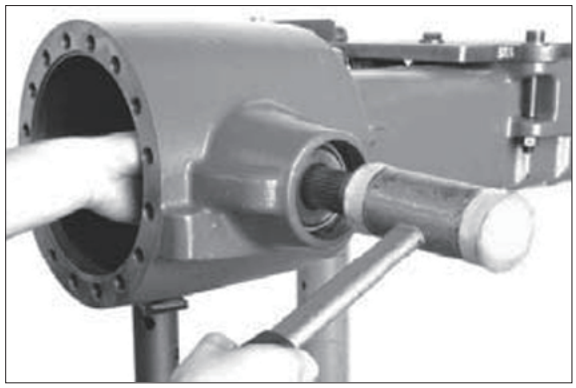


17W98RA036

(15) Force out input pinon and remove the releasing roller bearing.

※ Use a plastic hammer.

※ If the tapered roller bearings are not replaced, pay attention that all the rollers of the outer bearing inner ring are always in contact with the bearing outer ring when forcing out the input pinion.



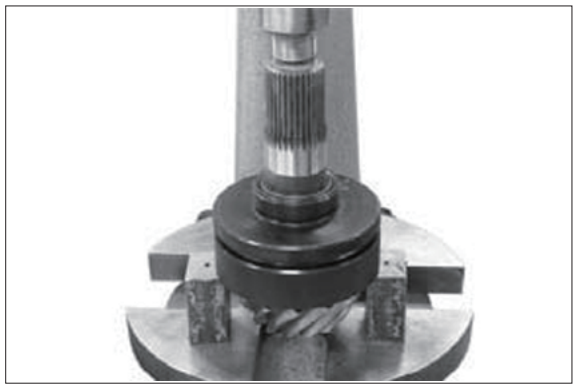
17W98RA037

(16) Remove spacer ring.

17W98RA038

(17) Press roller bearing off the input pinion.

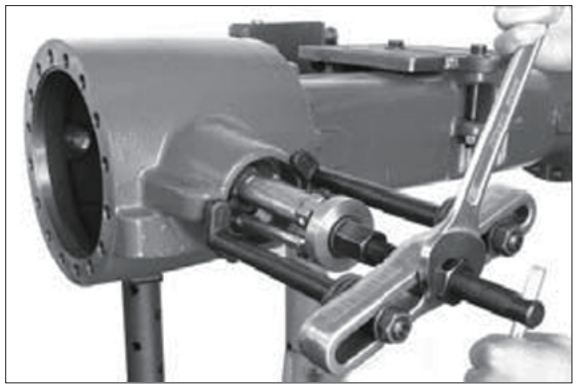
(S) Grab sleeve 5873 001 037



17W98RA039

(18) Pull external bearing outer ring out of the bearing hole.

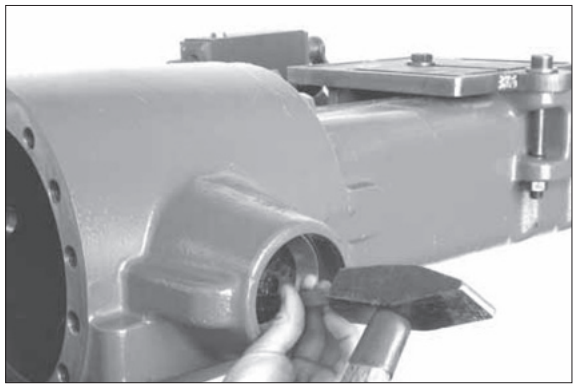
(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98RA040

(19) Force bearing outer ring off the inner bearing hole pay attention to the shim behind.

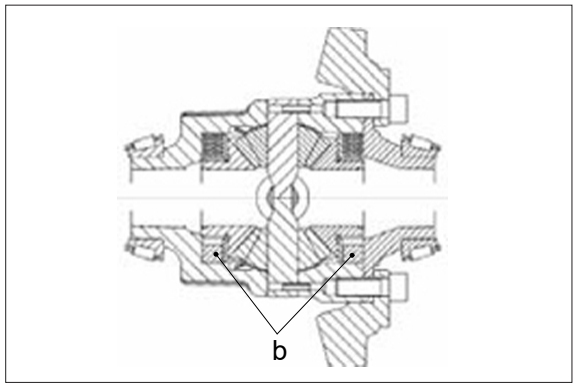
※ Mark shim regarding position/bearing allocation reassembly aid.



17W98RA041

### 3) DIFFERENTIAL

(1) b = Constant spacers



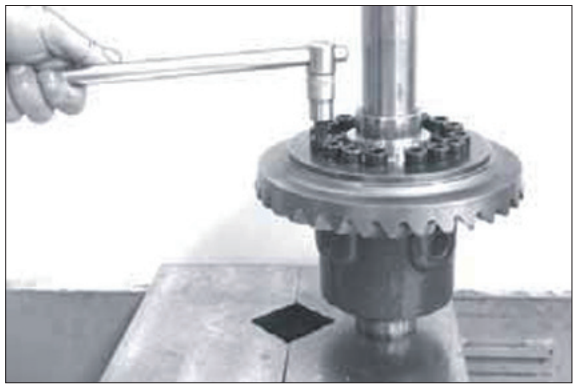

17W98RA042

(2) Pull both tapered roller bearings from differential carrier.

| | |
|---|---|
| (S) Grab sleeve | 5873 011 019 |
| (S) Basic tool | 5873 001 000 |
| (S) Pressure piece | 5870 100 009 |

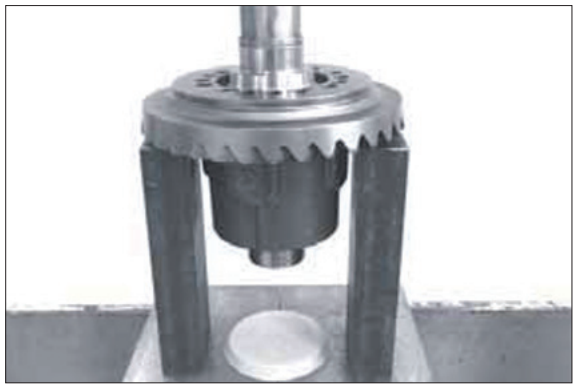
17W98RA043

(3) Use press to fix differential and loosen threaded joint crown wheel / differential carrier.



17W98RA044

(4) Press crown wheel from differential.



17W98RA045

(5) Remove single parts.

Remove axle bevel gear together with thrust washer and constant spacer from the differential carrier.

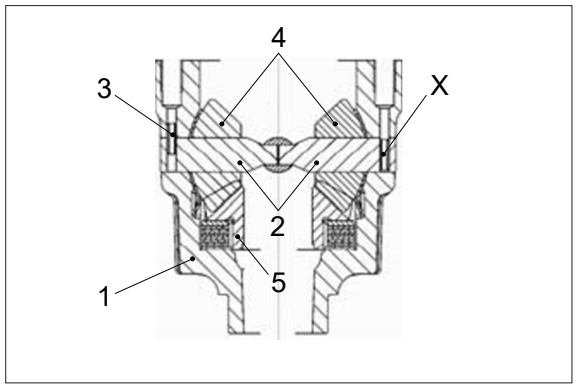
17W98RA046

(6) Force slotted pins (considering position "X", see subsequent sketch) into the spider shafts.

17W98RA047

(7) Comment on sketch:

1 = Differential carrier
2 = Spider shafts (short)
3 = Slotted pins
4 = Differential bevel gears
5 = Axle bevel gear
X = Position of the slotted pin to force out the spider shafts




17W98RA048

(8) Force out both spider shafts (short).

17W98RA049

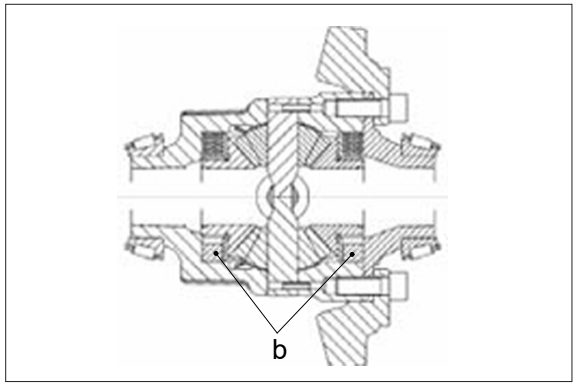
(9) Remove all single parts.

17W98RA050

## 4. REASSEMBLY

### 1) DIFFERENTIAL

(1) b = Constant spacers

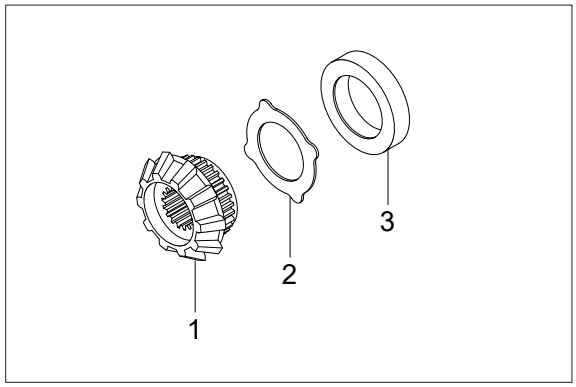



17W98RA042

(2) All outer and inner disks are replaced by a constant spacer (see figure FA054).

1 = Axle bevel gear
2 = Pressure disk
3 = Constant ring

※ No measuring / setting of the axial play of the two axle bevel gears is required, therefore single parts can be immediately oiled.




17W98RA053

(3) Insert premounted axle bevel gear into the differential carrier.

17W98RA054

(4) Insert differential bevel gears (1) with thrust washers (2) and fix with spider shafts (3 and 4).

※ Pay attention to radial installation position of the thrust washers.


17W98RA055

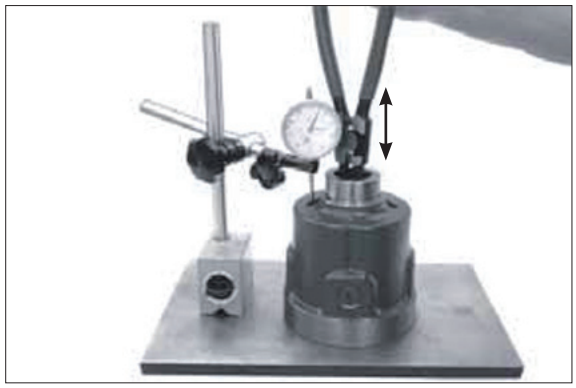
(5) Check axial play of the axle bevel gear 0.0 … 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the setting procedure separate the single parts again.

Then oil and reassemble all single parts again.

※ Make sure that thickness and arrangement of the second disk package are identical (Figure RA059).



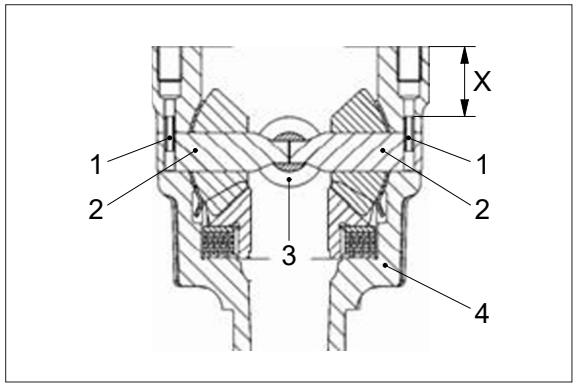
17W98RA056

(6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch RA058).

17W98RA057

(7) Comment on sketch:

1 = Slotted pin
2 = Spider shaft (short)
3 = Spider shaft
4 = Differential carrier
X = Installation dimension 34 ± 0.5 mm




17W98RA058

(8) Mount second axle bevel gear with thrust washer and constant spacer (see also figure RA053).

※ Mount the pressure disk with the coated surface showing to the outer disk.

※ Thickness and arrangement of the disk package must be identical on both sides of the differential gear.

17W98RA059

(9) Check axial play of the second axle bevel gear 0.0 … 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the resetting procedure remove the second axle bevel gear together with the disk package from the differential carrier.

Then oil and reassemble all single parts.

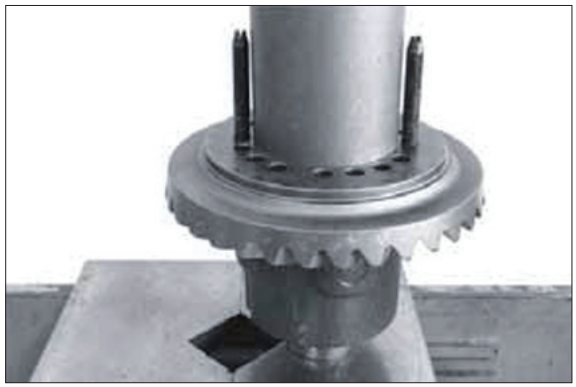
17W98RA060

(10) Mount two adjusting screws (S) and insert cover.

(S) Adjusting screws (M12 × 1.5)
5870 204 027

17W98RA061

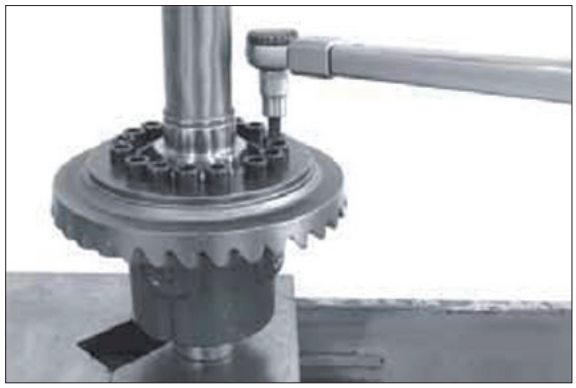
(11) Press crown wheel onto the cover / differential carrier until contact position is obtained.



17W98RA062

(12) Fix differential with press and tighten crown wheel with cylindrical screws.

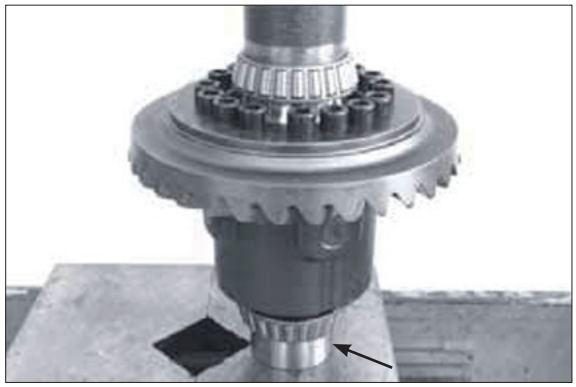
Tightening torque (M12 × 1.5/12.9) . . . . . MA = 145 Nm



17W98RA063

(13) Press on both bearing inner rings until contact is obtained.

※ Use an appropriate support (arrow) differential may not be supported on the bearing cage.

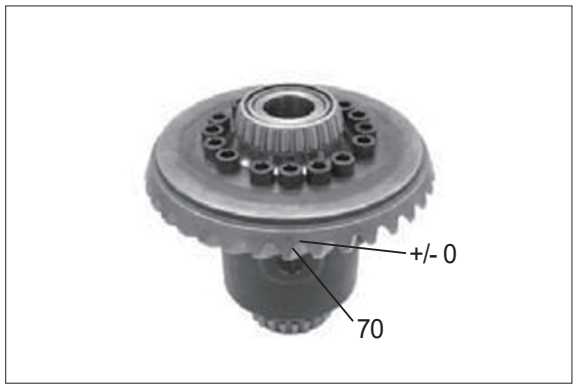


17W98RA064

## 2) INPUT

(1) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set).

※ Determine the required shims on basis of the read value (test dimension/ crown wheel) and the corresponding specifications of the table next page : (KRS – SET – RIGHT) (KRS = bevel gear set)

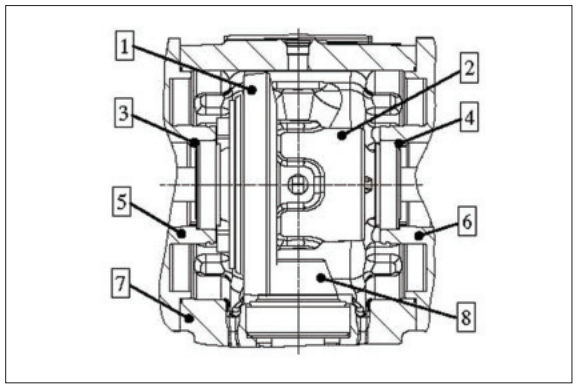



17W98RA065

(2) Test dimension see crown wheel rear side.

※ The test dimension "70" is stamped into the crown wheel rear side. If no + or deviation is indicated, this value corresponds with the test dimension/ actual value "70" in the table below. According to this value, the required shims are allocated in the table below.

Any + or - deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.



17W98RA066

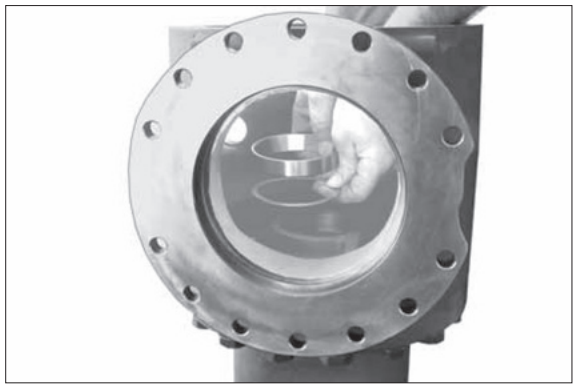
· Legend to sketch:

1 = Crown wheel
2 = Differential carrier
3 = Shim (crown wheel side)
4 = Shim (diff. carrier side)
5 = Axle housing
6 = Axle housing
7 = Axle drive housing
8 = Input pinion

| Setting disks for differential | | | | | |
|---|---|---|---|---|---|
| Test dimension/crown wheel marking 70 and deviation | -20 | -10 | 0 | 10 | 20 |
| results in→test dim. / actual value | 69.80 | 69.90 | 70.0 | 70.10 | 70.20 |
| Shim/ diff. carrier side Required shim thickness | 0.95 | 1.05 | 1.15 | 1.25 | 1.35 |
| Shim No. | 0730 006 518 | 0730 006 519 | 0730 006 521 | 0730 006 522 | 0730 006 524 |
| Shim/crown wheel side Required shim thickness | 1.35 | 1.25 | 1.15 | 1.05 | 0.95 |
| Shim No. | 0730 006 524 | 0730 006 522 | 0730 006 521 | 0730 006 519 | 0730 006 518 |

(3) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on differential carrier side.

※ Rotate axle housing by 90°.



17W98RA067

(4) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on crown wheel side.

17W98RA068

**(5) Contact pattern check of bevel gear set**

Cover some drive and coast flanks of the crown wheel with marking ink.

17W98RA069

(6) Place preassembled differential into the axle drive housing.

(S) Internal extractor 5870 300 005

17W98RA070

(7) Use lifting tackle to mount the axle housing (crown wheel side) and preliminarily fix it with hexagon screws.

Tightening torque (M18/10.9) . . . . . MA = 390 Nm

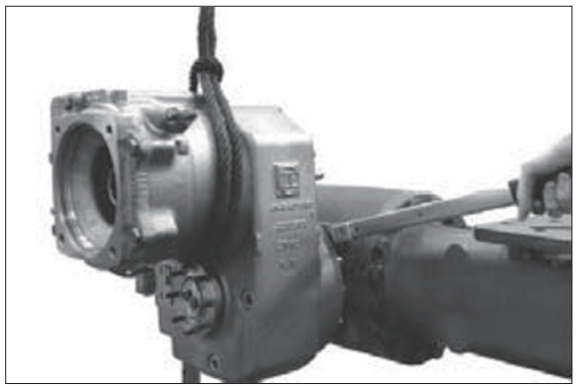
※ Preliminarily fix axle housing without O-ring.

17W98RA071

(8) Rotate axle by 90° and support it.

Use lifting tackle to bring HL transmission into contact position with the axle housing and fix it.

Tightening torque . . . . . MA = 79 Nm



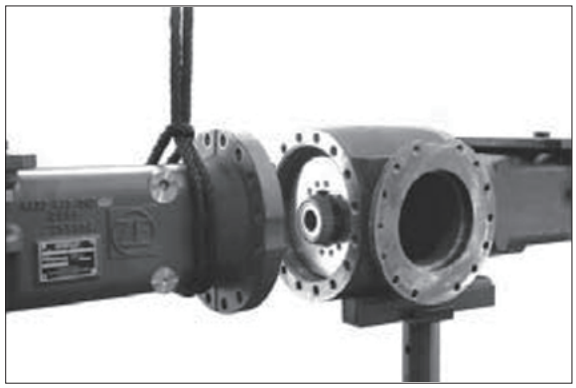
17W98RA072

(9) By rotating the input flange, roll crown wheel over the input pinion in both directions several times.

Then remove transmission and axle housing and lift differential out of the axle drive housing.

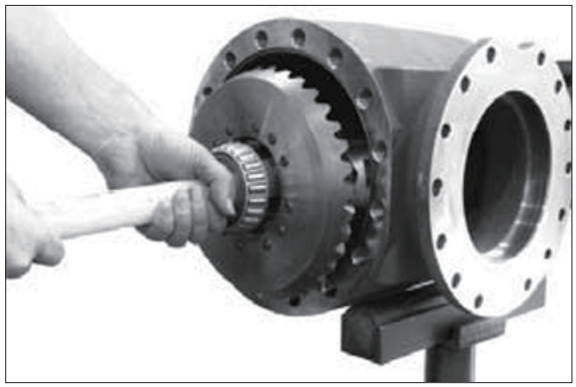
Compare the obtained contact pattern.

※ In case of a contact pattern deviation, check the pinion shimming of the transmission.



17W98RA073

(10) After contact pattern check, place differential into the axle drive housing.



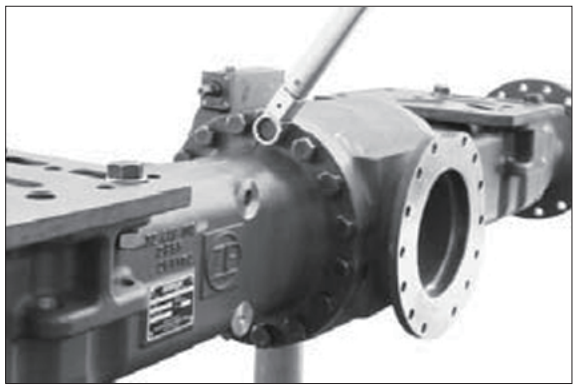
17W98RA074

(11) Grease O-ring (see arrow) and mount it to axle housing.

17W98RA075

(12) Use lifting tackle to mount the axle housing and finally tighten it with hexagon screws.

Tightening torque (M18/10.9) . . . . . MA = 390 Nm



17W98RA076

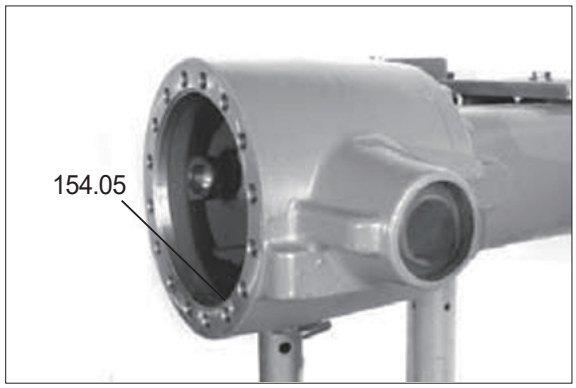
### 3) INPUT PINION

The following measuring operations must be carried out with utmost accuracy.
Inaccurate measurements lead to an incorrect contact pattern and require an additional disassembly and reassembly of the input pinion.

#### (1) Determination of shim thickness to obtain a correct contact pattern

Read dimension I from the axle drive housing.

Dim. I e.g. . . . . 154.05 mm




17W98RA077

(2) Read dimension II (pinion dimension).

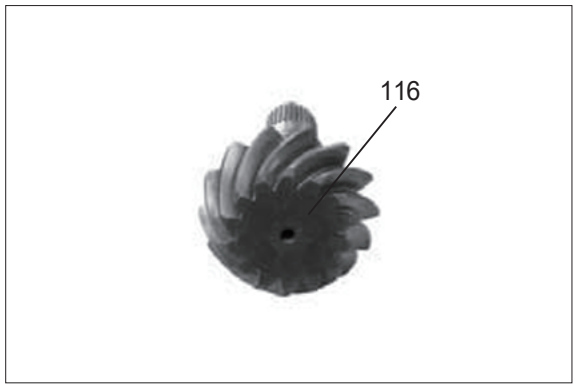
Dim. II e.g. . . . . 116.00 mm

In case of a + or - deviation of the pinion dimension for production reasons, the respective value is marked by hand on the pinion.

Pinion dim. (without + or – deviation) = 116.0 mm

Pinion dim. with + 0.1 deviation value = 116.1 mm

Pinion dim. with - 0.1 deviation value = 115.9 mm




17W98RA078

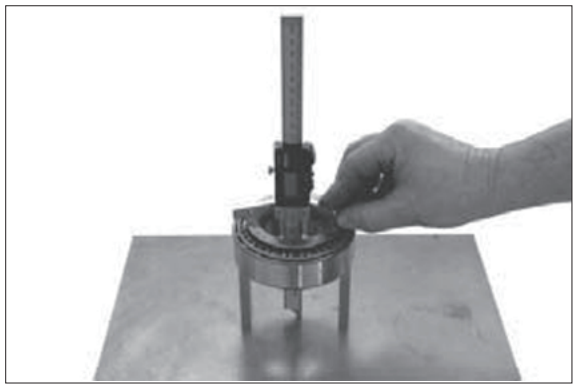
(3) Determine dimension III (bearing width).

※ Make sure that the rollers are located without any play (rotate bearing inner ring several times in both directions roller setting).

Since the installed roller bearing is subject to a preload in installation position, deduct an experience value of 0.1 mm.

Dimension III, e.g. 36.60 mm - 0.1 mm = 36.50 mm

(S) Gage blocks 5870 200 066

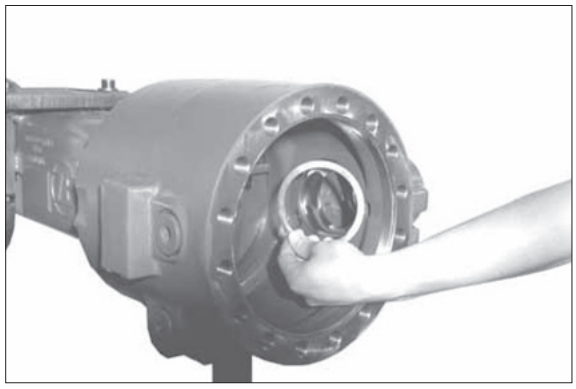


17W98RA079

(4) Calculation example :

Dimension I . . . . . 154.05 mm
Dimension X . . . . . - 152.50 mm
Difference = shim s = 1.55 mm

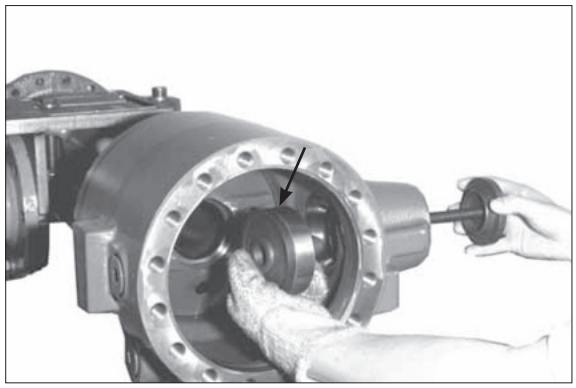
Place the determined shim (e.g. thickness = 1.55 mm) into the inner bearing hole.



17W98RA080

(5) Undercool bearing outer ring (see arrow) and bring it into contact position in the bearing hole by using the assembly fixture (S).

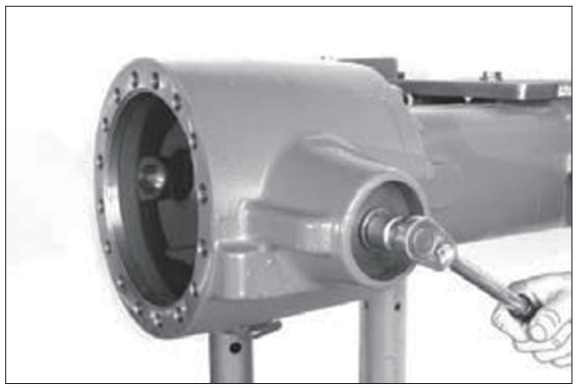
(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056



17W98RA081

(6) Undercool external bearing outer ring and insert it into the bearing hole until contact is obtained.

(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056

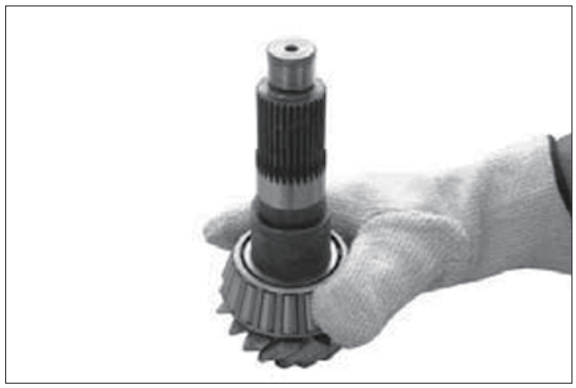


17W98RA082

**(7) Adjustment of the rolling torque of input pinion bearing 1.0 ... 3.0 Nm** (without shaft seal ring)

Heat up roller bearing and install it until contact is obtained.

※ Adjust bearing after cooling-down.



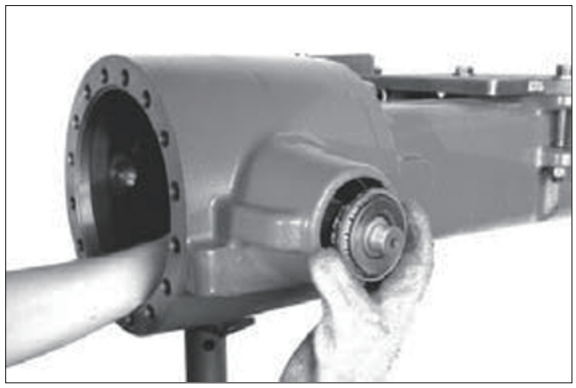
17W98RA083

(8) Mount spacer ring (e.g. thickness = 16.96 mm).

※ According to our experience, the necessary rolling torque is obtained when reusing the spacer ring which has been removed during disassembly (e.g. thickness = 16.96 mm).
A later check of the rolling torque, however, is absolutely necessary.

17W98RA084

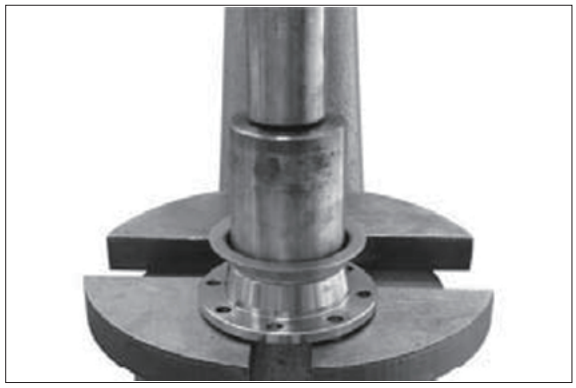
(9) Place the preassembled input pinion into the axle housing and mount the heated roller baring until contact is obtained.



17W98RA085

(10) Press screen sheet (see arrow) onto the input flange until contact is obtained.

※ Do not fit the shaft seal ring until the contact pattern has been checked.



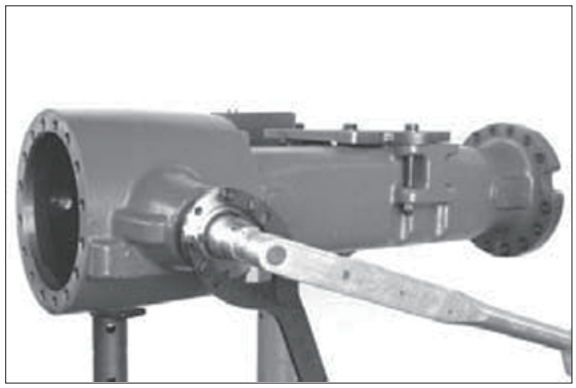
17W98RA086

(11) Mount input flange and fix it with washer and hexagon nut.

Tightening torque (M30x1.5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ While tightening, rotate the input pinion in both directions several times.



17W98RA087

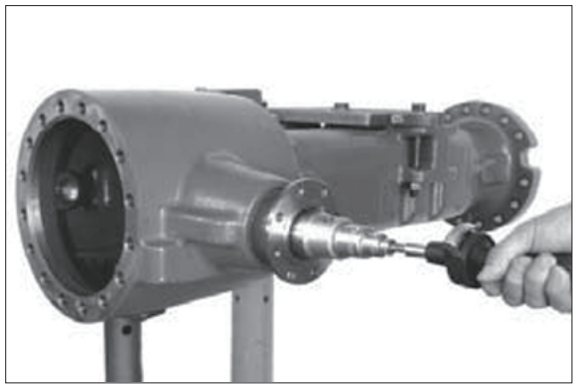
(12) Check rolling torque (1.0 ... 3.0 Nm without shaft seal ring).

※ When installing new bearings, try to achieve the upper value of the rolling torque.

※ Any deviation from the required rolling torque must be corrected with an appropriate spacer ring (Figure RA110) as specified below.

Insufficient rolling torque - install thinner spacer ring.

Excessive rolling torque - install thicker spacer ring.



17W98RA088

(13) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set)

※ Determine the required shims on basis of the read value (test dimension/crown wheel) and the corresponding specifications of the table below:
(KRS – SET – RIGHT) (KRS = bevel gear set) : Test dimension see crown wheel rear side.

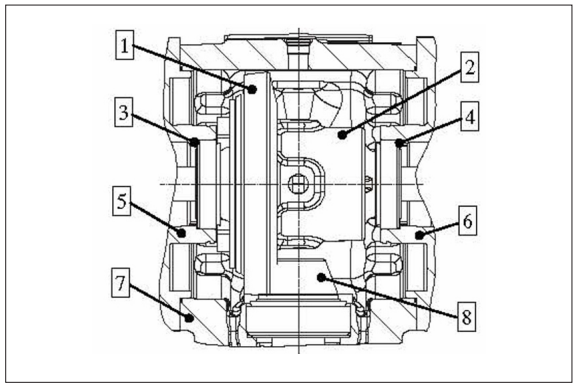
※ The test dimension "70" is stamped into the crown wheel rear side. If no + or deviation is indicated, this value corresponds with the test dimension/ actual value "70" in the table below. According to this value, the required shims are allocated in the table below.

※ Any + or – deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. – 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.

17W98RA089

(14) Legend to sketch:

1 = Crown wheel
2 = Differential carrier
3 = Shim (crown wheel side)
4 = Shim (diff. carrier side)
5 = Axle housing
6 = Axle housing
7 = Axle drive housing
8 = Input pinion

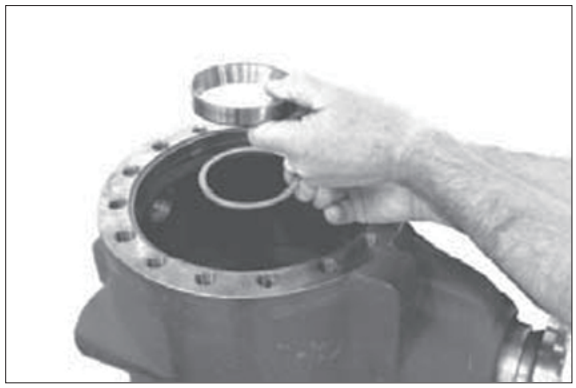



17W98RA090

| Shims for differential | | | | | |
|---|---|---|---|---|---|
| Test dimension/crown wheel marking 70 and deviation | -20 | -10 | 0 | 10 | 20 |
| results in → test dim. / actual value | 69.80 | 69.90 | 70.0 | 70.10 | 70.20 |
| Shim/ diff. carrier side Required shim thickness | 0.95 | 1.05 | 1.15 | 1.25 | 1.35 |
| Shim No. | 0730 006 518 | 0730 006 519 | 0730 006 521 | 0730 006 522 | 0730 006 524 |
| Shim/crown wheel side Required shim thickness | 1.35 | 1.25 | 1.15 | 1.05 | 0.95 |
| Shim No. | 0730 006 524 | 0730 006 522 | 0730 006 521 | 0730 006 519 | 0730 006 518 |

(15) Place determined shim (e.g. thickness = 1.15 ㎜) and bearing outer ring into the hole of the axle housing on differential carrier side (part I).

※ Rotate axle housing by 90°.



17W98RA091

(16) Place determined shim (e.g. thickness = 1.15 ㎜) and bearing outer ring into the hole of the axle housing on crown wheel side (part II).

17W98RA092

**(17) Contact pattern check of bevel gear set**

Cover some drive and coast flanks of the crown wheel with marking ink.

17W98RA093

(18) Place preassembled differential into the axle drive housing.

17W98RA094

(19) Use lifting tackle to mount the axle housing (crown wheel side, part II) and preliminarily fix it with hexagon screws.

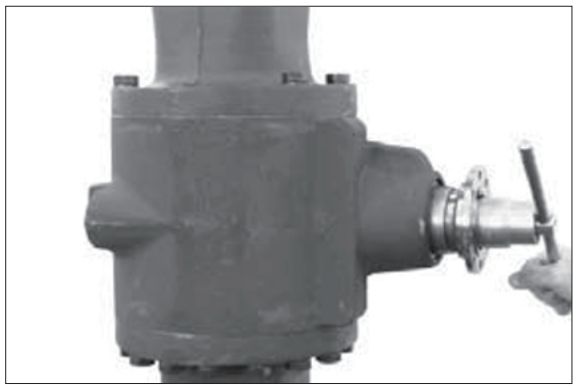
Tightening torque (M18/10.9) . . . . . MA = 390 Nm

※ Preliminarily fix axle housing without O-ring.

17W98RA095

(20) By rotating the input flange, roll crown wheel over the input pinion in both directions several times.
Then remove axle housing and lift differential out of the axle drive housing.
Compare the obtained contact pattern with contact pattern.

※ In case of a contact pattern deviation it is imperative to correct the measuring error which was made when determining the shim (figure RA080).



17W98RA096

(21) After contact pattern check, place differential into the axle drive housing.

Grease O-ring (see arrow) and mount it to the axle housing.

17W98RA097

(22) Use lifting tackle to mount the axle housing and finally fix it with hexagon screws.

Tightening torque (M18/10.9) . . . . . MA = 390 Nm

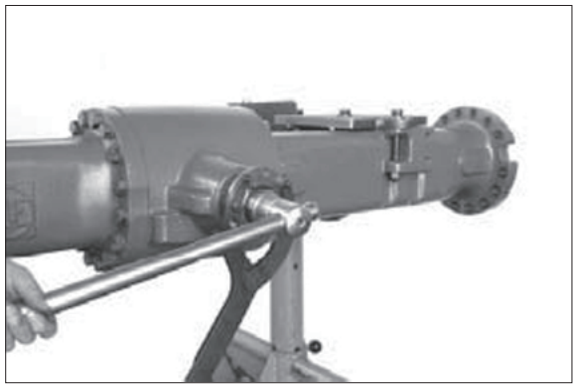
Then bring axle into horizontal position and reassemble the second supporting bracket (S) (see also figure RA001).

17W98RA098

**(23) Fitting of shaft seal ring** (input flange)

Loosen hexagon nut and pull input flange off the input pinion.

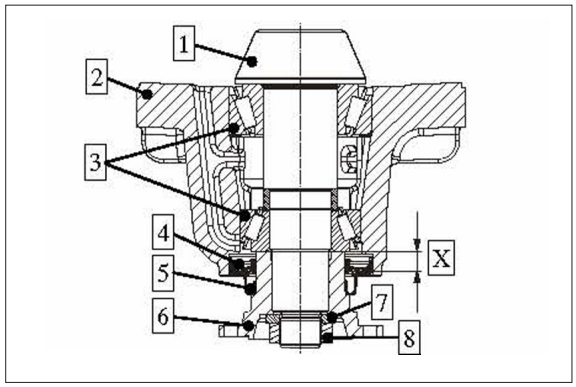
(S) Clamping fork 5870 240 025



17W98RA099

(24) Legend to sketch:

1 = Input pinion
2 = Axle drive housing
3 = Tapered roller bearing
4 = Shaft seal ring
5 = Screen sheet
6 = Input flange
7 = Washer
8 = Hexagon nut
X = Installation dimension → 13.5 +0. 2 mm




17W98RA100

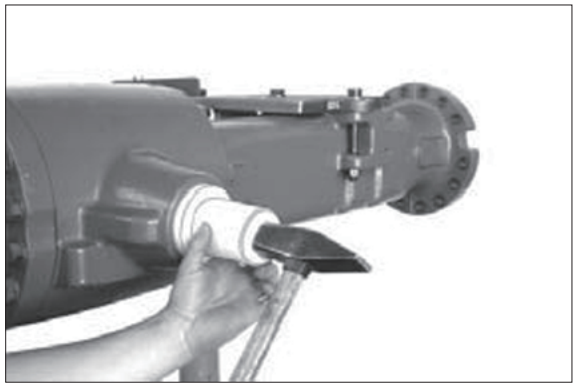
(25) Mount shaft seal ring with the sealing lip facing the oil chamber.

(S) Driver tool 5870 048 286

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting, apply lubricant to the contact face of shaft seal ring/axle drive housing.

Apply grease to seal and dust lip of the shaft seal ring.



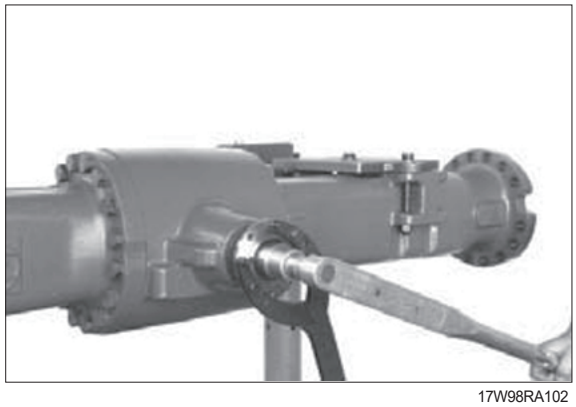
17W98RA101

(26) Mount input flange and finally fix it with washer and hexagon nut.

Tightening torque (M30x1.5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ Wet thread of hexagon nut with Loctite no. 262.



17W98RA102

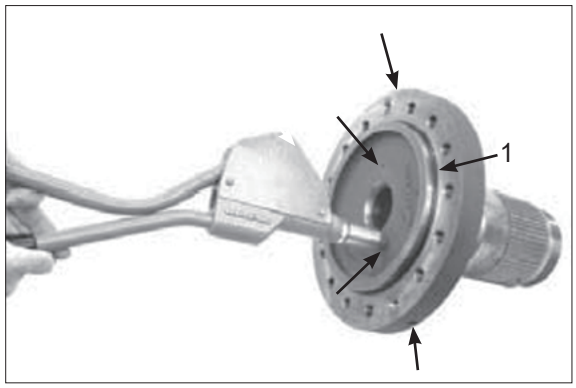
## 4) OUTTPUT

### (1) Hub carrier

Grease O-ring (1) and mount it to hub carrier.

The following operation is only required when fitting a new hub carrier :
Seal machining openings (arrows) of oil supply holes with plugs.

(S) Lever riveting tongs 5870 320 016

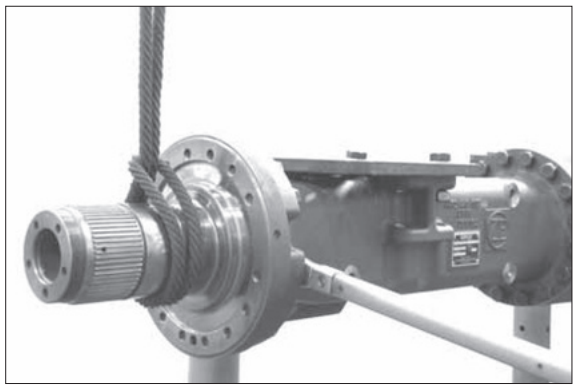


17W98RA103

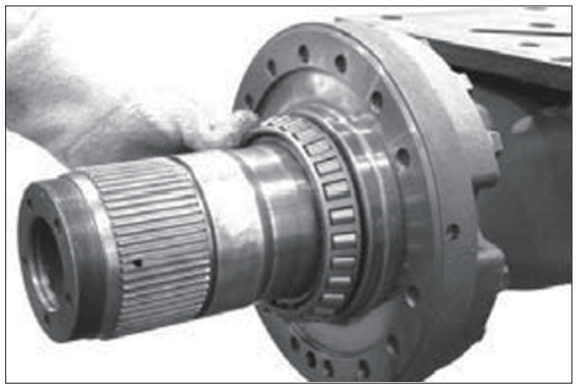
(2) Mount preassembled hub carrier to the axle housing, considering the installation position, and fix it with hexagon screws.

Tightening torque (M 16/10.9) . . . . . MA = 280 Nm

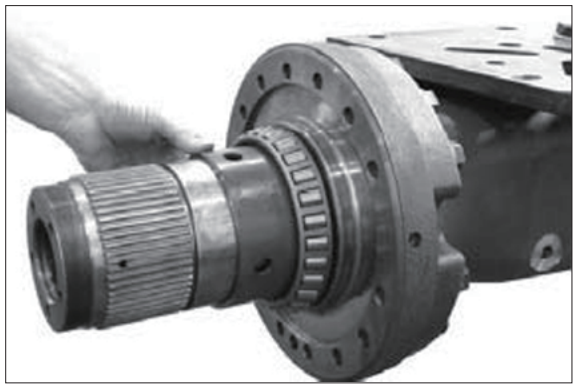
※ Ensure radial installation position. Stamped circle (see arrow) must be in uppermost (12 o'clock) position.


17W98RA104

**(3) Hub** (Hub bearing SET-RIGHT)
Heat up tapered roller bearing and mount it to hub carrier until contact is obtained.


17W98RA105

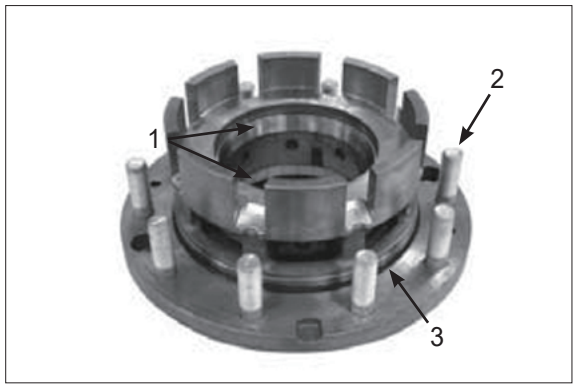
(4) Mount spacer bushing.


17W98RA106

(5) Insert both bearing outer rings (1) of the hub bearing until contact position is obtained.

Press wheel bolts (2) into the hub until contact position is obtained.

Grease O-ring (3) and place it into the annular groove of the hub.



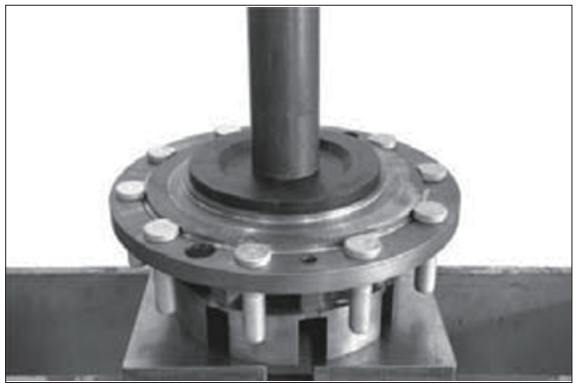
17W98RA107

(6) Press shaft seal ring into the hub, with the marking "OUT SIDE" showing outwards (facing up):

(S) Driver tool 5870 051 035

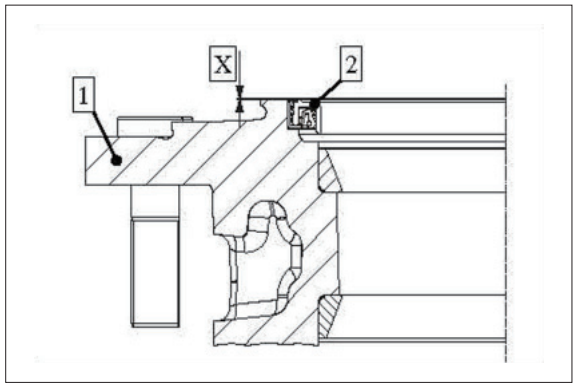
※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Wet outer diameter of the shaft seal ring with Loctite no. 574.


17W98RA108

(7) Legend to sketch:

1 = Hub
2 = Shaft seal ring
X = Installation dimension – shaft seal ring
..... 0.0~0.3 mm

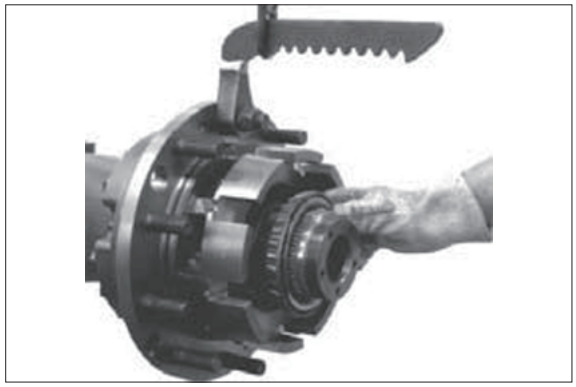


17W98RA109

(8) Mount preassembled hub until contact is obtained and fix it with heated tapered roller bearing.

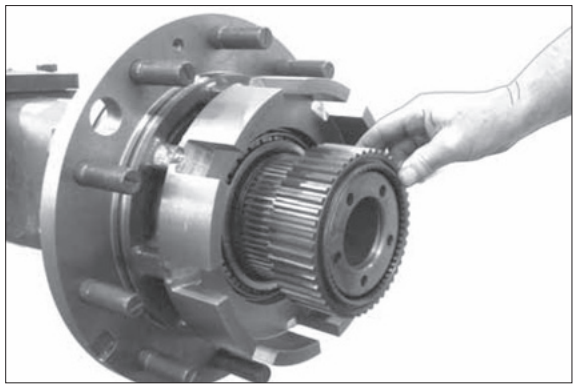
(S) Lifting bracket 5870 281 043

※ Just before fitting, wet sealing lips of shaft seal ring with lubricant.


17W98RA110

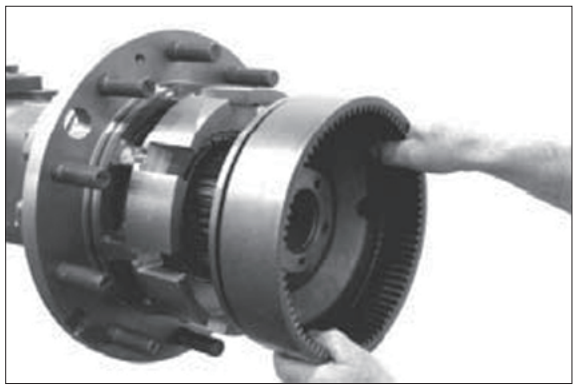
(9) Oil O-ring and insert it into the annular groove (see arrow) of the hub carrier.

Then mount disk carrier.



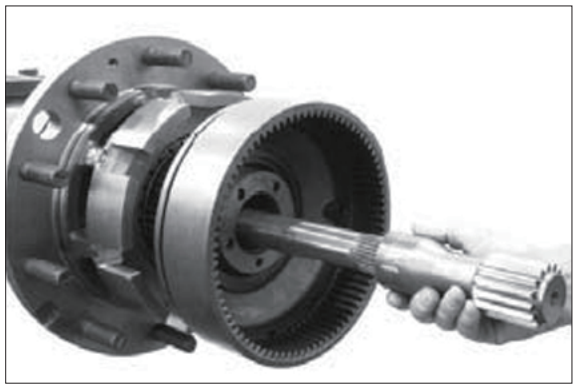
17W98RA111

(10) Bring disk carrier and hub bearing into contact position (figure No. RA112 ... RA115) :
Mount ring gear (without sealing elements).



17W98RA112

(11) Insert stub shaft and sun gear shaft for supporting the socket wrench (see following figure).



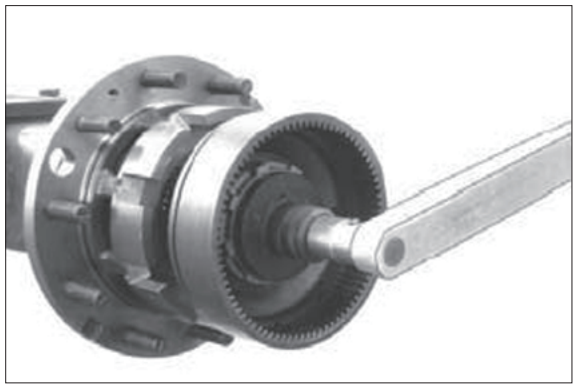
17W98RA113

(12) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of 1400 Nm max.

(S) Socket wrench 5870 656 097

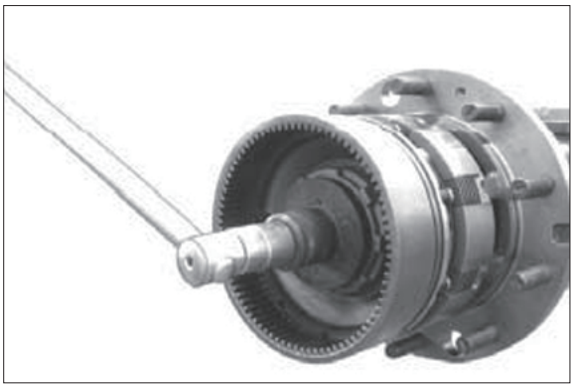
※ While tightening the slotted nut rotate hub in both directions several times roller setting.

※ Apply lubricant to thread of knuckle housing/slotted nut.



17W98RA114

(13) Loosen slotted nut and remove ring gear.

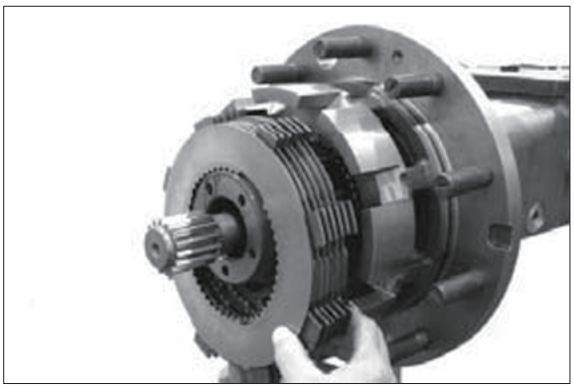


17W98RA115

**(14) Multi-disk brake**

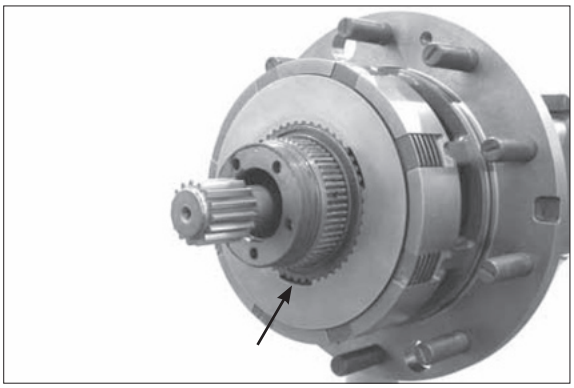
Mount outer and inner disks of the disk package alternately, starting with an outer disk.

※ For the actually required disk fitting/ arrangement please refer to the corresponding spare parts list.



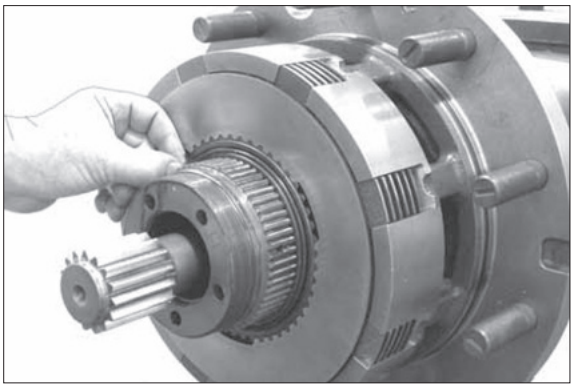
17W98RA116

(15) Bring inner clutch disks into a position where one of the tooth recesses is in 6 o'clock position after installation of the axle into the vehicle.



17W98RA117

(16) Oil O-ring and place it into the annular groove of the disk carrier.



17W98RA118

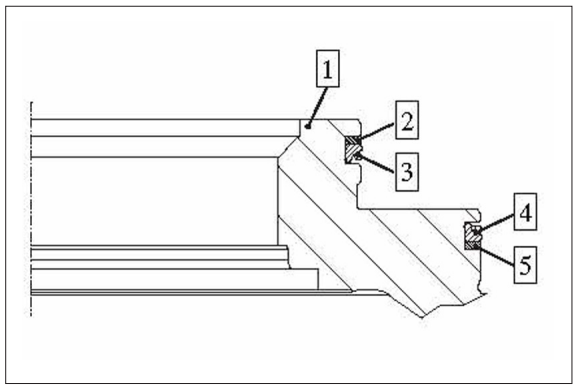
(17) Oil grooved and back-up rings and insert them into the annular grooves of the ring gear.

※ Observe installation position, see sketch below.

17W98RA119

(18) Legend to sketch:

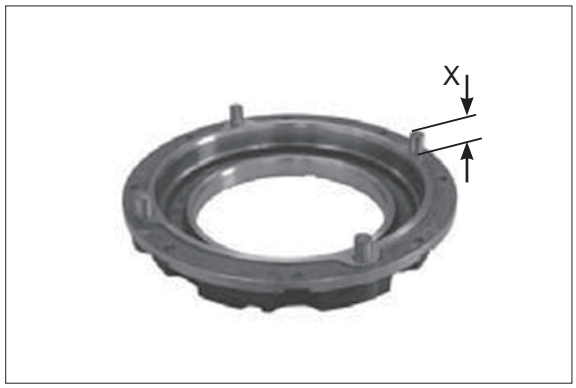
1 = Ring gear
2 = Back-up ring
3 = Grooved ring
4 = Grooved ring
5 = Back-up ring




17W98RA120

(19) Fit cylindrical pins into the piston, considering the installation dimension "X".

X = Installation dimension . . . . . .18.00 mm




17W98RA121

(20) Mount piston onto ring gear.

17W98RA122

(21) Fix piston with "new" hexagon screws (1), spring sleeves (2) and compression springs (3 and 4).

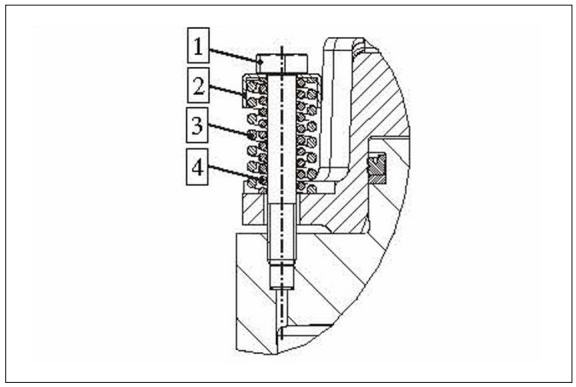
Tightening torque (M 6/8.8) . . . . . MA = 8 Nm

※ Use hexagon screws just once.

17W98RA123

(22) Legend to sketch:

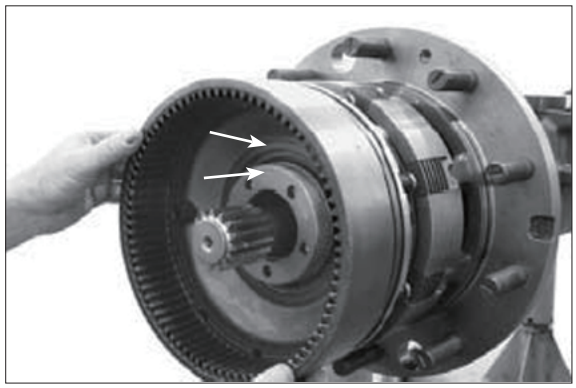
1 = Hexagon screw (special version)
2 = Spring sleeve
3 = Compression spring
4 = Compression spring




17W98RA124

(23) Mount preassembled ring gear, considering the installation position (markings O in 12 o'clock position – see arrows).

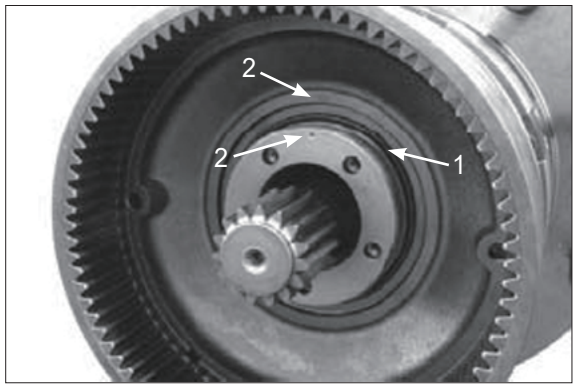
※ Ensure exact toothing position of oil supply holes – hub carrier/ring gear (pressure oil supply to brake piston).



17W98RA125

(24) Oil O-ring and insert it into the recess (see arrow 1).

※ Arrows (2) show once more the markings O and the installation position of hub carrier and ring gear.




17W98RA126

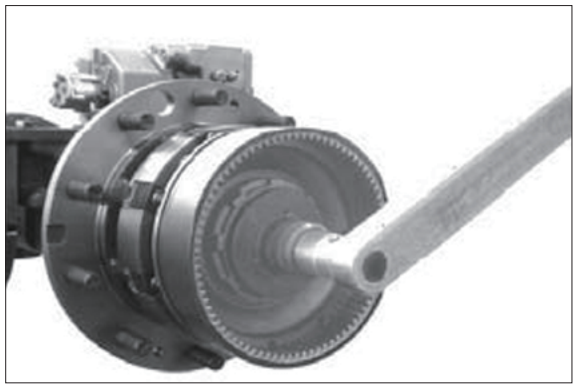
(25) Fix ring gear with slotted nut.

Tightening torque (M85 × 1.5) . . . . . MA = 1400 + 200 Nm

(S) Socket wrench 5870 656 097

※ Pretighten slotted nut with 1400 Nm, then continue tightening the slotted nut until a fixing hole overlaps a threaded hole in the knuckle housing.
While tightening the slotted nut rotate hub in both directions several times – roller setting.

※ Apply lubricant to thread of knuckle housing / slotted nut.



17W98RA127

**(26) Leakage test of multi-disk brake**

Fit breather (arrow) and threaded coupling (S), then connect HP pump.

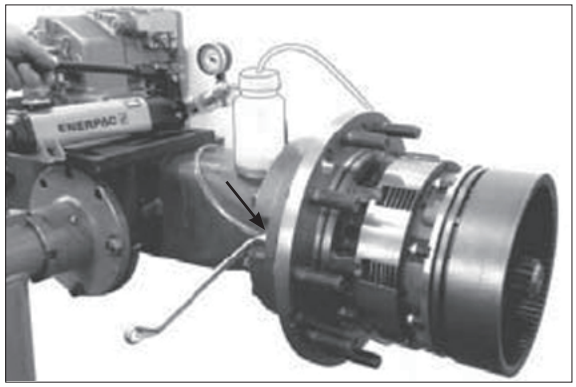
(S) HP pump 5870 287 007
(S) Threaded coupling (M14 × 1.5) 5870 950 102
(S) Breather bottle 5870 286 072

※ Breathe brake completely before starting the test.

**Test media :**
Motor oils SAE-10W

**High-pressure test:**
Build up test pressure p = 100 bar and close shut-off valve of HP pump.
A maximum pressure drop of 3 bar is permissible during a 5-minute test.

**Low-pressure test:**
Reduce test pressure to p = 5 bar and close shut-off valve.
No pressure drop is allowed during a 5-minute test.



17W98RA128

## (27) Adjustment and check of piston stroke

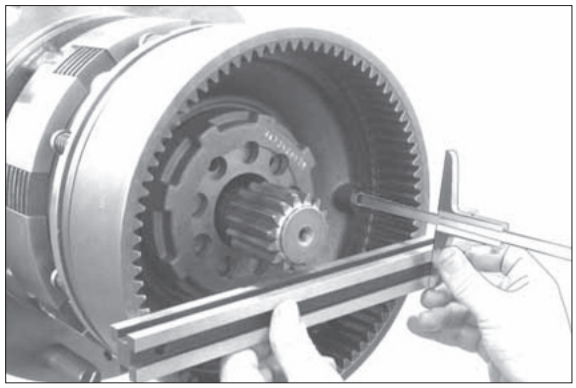
Piston stroke / disk clearance =
0.7 ... 1.3 mm

Build up brake pressure (100 bar) and close shut-off valve of HP pump.

Determine dimension "A", from face of the ring gear (1) through the measuring hole (see also sketch 43) to the face of the piston (3).

Dim. "A" e.g. . . . . 83.10 mm

※ Breathe brake completely before starting the measuring operation.

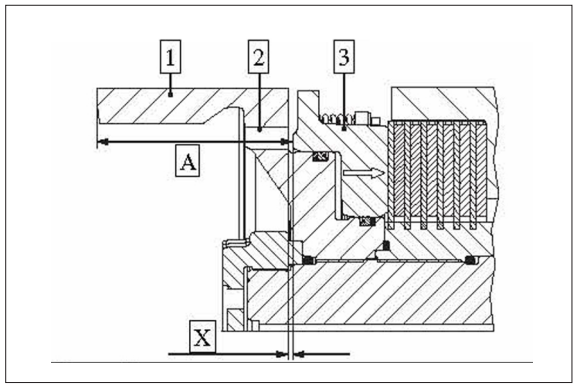


17W98RA129

(28) Then open shut-off valve of HP pump and release pressure from brake (piston return via compression springs).

Determine dimension "B", from the face of the ring gear (1) through the measuring hole (see also sketch RA131) to the face of the piston (3).

Dimension "B" e.g . . . . . 82.10 mm




17W98RA130

(29) Calculation example :

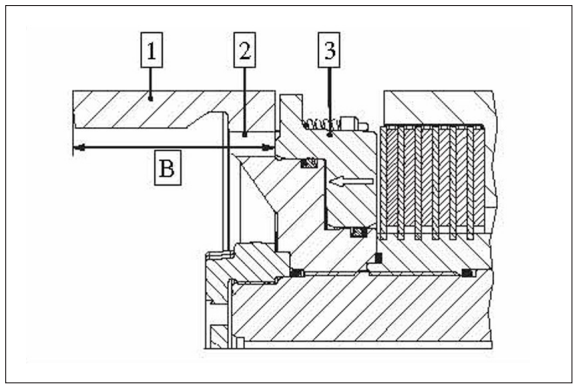
Dimension „A“ e.g. . . . . 83.10 mm
Dimension „B“ e.g. . . . . - 82.10 mm
Difference = piston stroke = 1.00 mm

※ If the required piston stroke (0.7 ... 1.3 mm) is not achieved, correct it with (a) corresponding inner clutch disk(s) – see respective spare parts list.

Then remove HP pump (S), breather bottle (S) and threaded coupling (S).

Legend to sketches RA130 and RA131:
1 = Ring gear
2 = Measuring hole
3 = Piston
X = Piston stroke/disk clearance

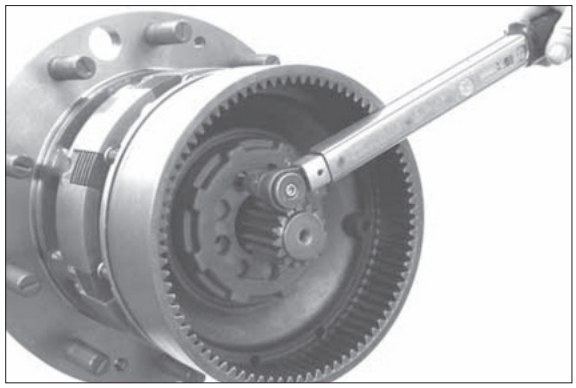
(S) Straightedge 5870 200 022




17W98RA131

(30) Secure slotted nut with cylindrical screw (see also figure RA127).

Tightening torque (M 10/8.8) . . . . . MA = 32 Nm



17W98RA132

**(31) Planetary carrier**

Press thrust washer into the planetary carrier until contact is obtained.

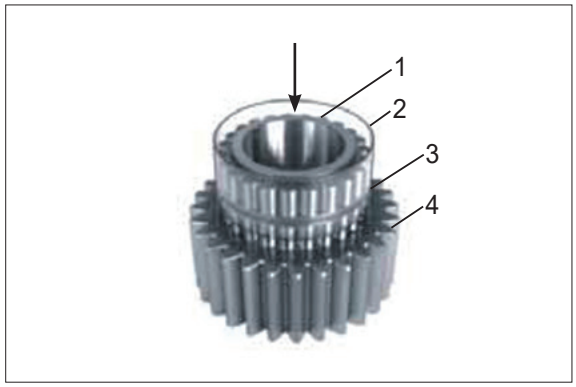
(S) Driver tool 5870 048 245

17W98RA133

(32) Insert the cylindrical roller bearing into the planetary gear – for this purpose press the cylindrical roller bearing through the packaging sleeve until the snap ring engages into the annular groove of the planetary gear.

※ Use packaging sleeve to facilitate assembly.

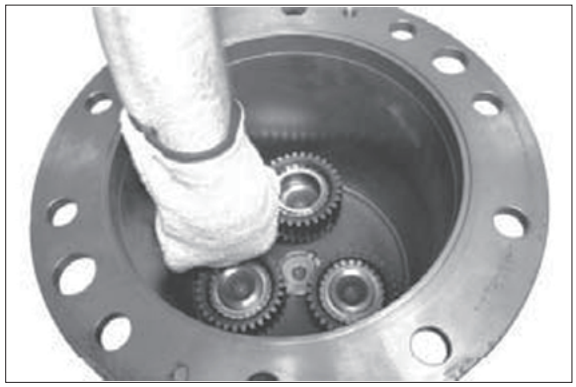
1 = Cylindrical roller bearing
2 = Packaging sleeve
3 = Snap ring
4 = Planetary gear




17W98RA134

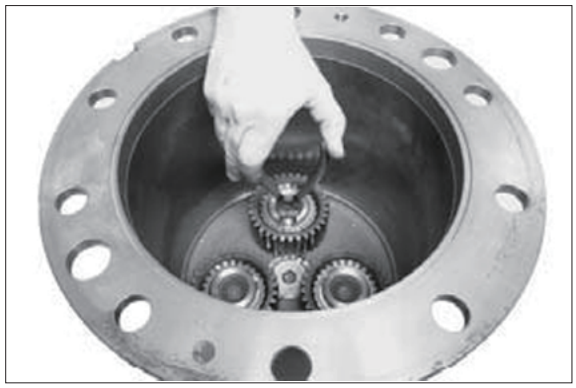
(33) Heat up bearing inner ring and mount preassembled planetary gear until contact is obtained.

※ Mount bearing inner ring with the large radius facing the planetary carrier (downwards).



17W98RA135

(34) Fix planetary gear by means of retaining ring.



17W98RA136

(35) Mount preassembled planetary carrier and fix it with hexagon screws.

Tightening torque (M12/8.8) . . . . . MA = 55 Nm

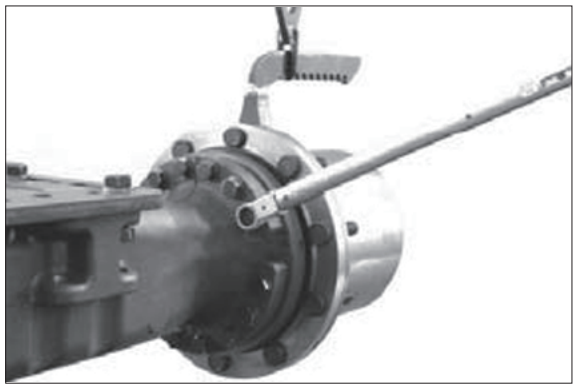
17W98RA137

**(36) Output assy**

Use lifting tackle (S) to locate the output assy at the axle, mount stub shaft into the teeth of the axle bevel gear and fix output assy with hexagon screws.

Tightening torque (M 16/10.9) . . . . . MA = 280 Nm

(S) Lifting bracket 5870 281 043



17W98RA138

※ Prior to putting the axle into operation, fill in oil.

Observe the vehicle manufacturer's instructions and specifications for the installation and commissioning of the unit.

# 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.**

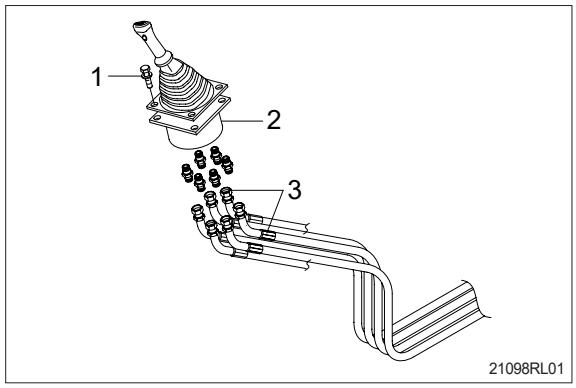
(4) Loosen the socket bolt (1).

(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.

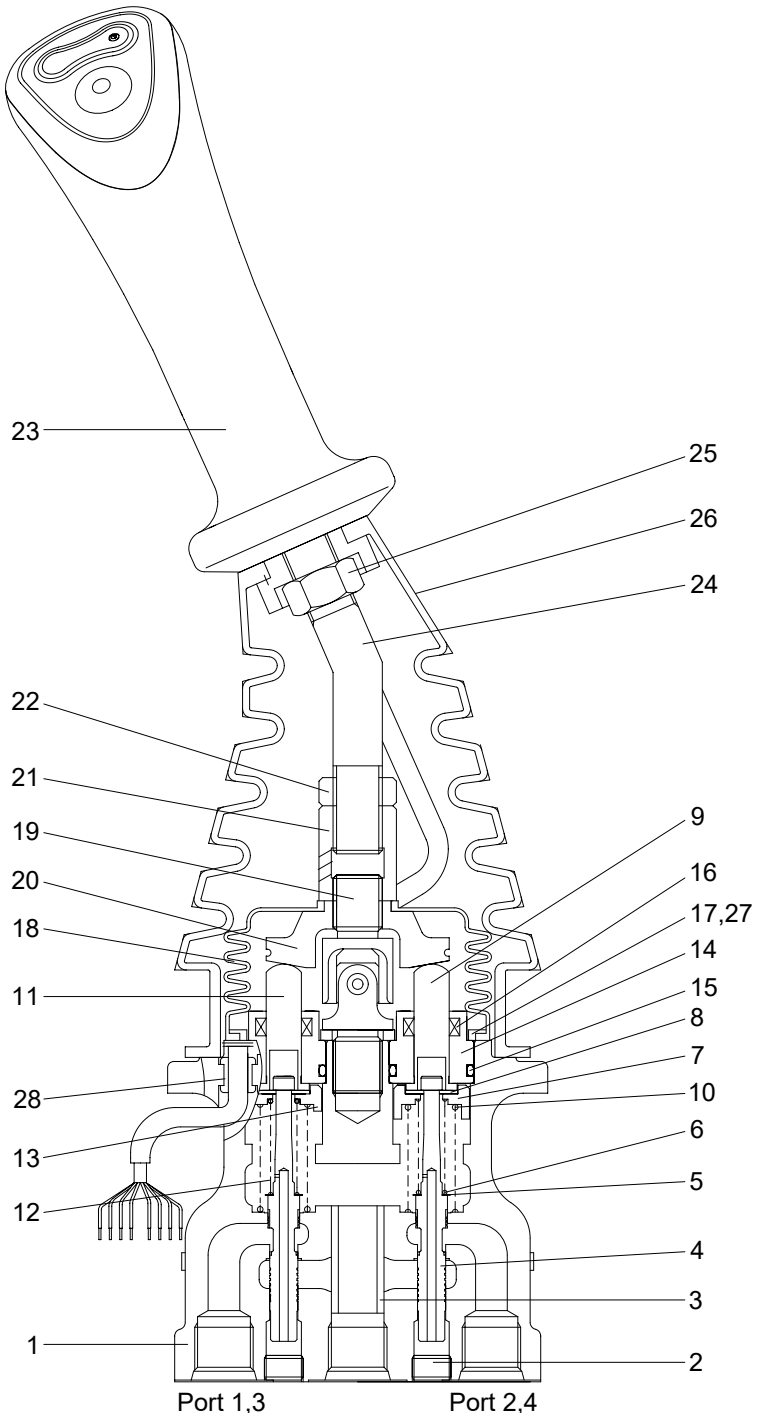

### 2) INSTALL

(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

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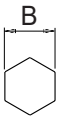
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Case | 8 | Stopper | 15 | O-ring | 22 | Lock nut |
| 2 | Plug | 9 | Push rod | 16 | Rod seal | 23 | Handle assembly |
| 3 | Bushing | 10 | Spring | 17 | Plate | 24 | Handle bar |
| 4 | Spool | 11 | Push rod | 18 | Boot | 25 | Nut |
| 5 | Shim | 12 | Spring | 19 | Joint assembly | 26 | Boot |
| 6 | Spring | 13 | Spring seat | 20 | Swash plate | 27 | Spring pin |
| 7 | Spring seat | 14 | Plug | 21 | Adjusting nut | 28 | Bushing |

## 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 |
| Plug | 2 | PT 1/8 | 3.0 | 21.7 |
| Joint | 19 | M14 | 3.5 | 25.3 |
| Swash plate | 20 | M14 | 5.0±0.35 | 36.2±2.5 |
| Adjusting nut | 21 | M14 | 5.0±0.35 | 36.2±2.5 |
| Lock nut | 22 | M14 | 5.0±0.35 | 36.2±2.5 |

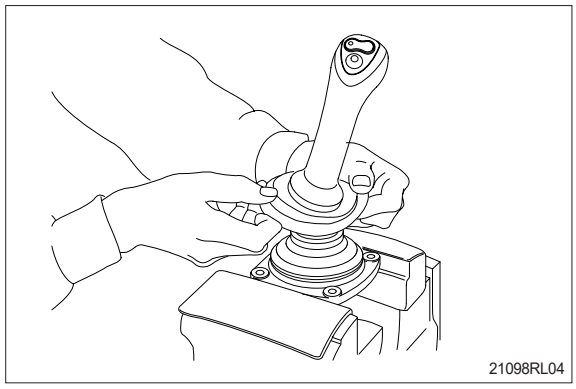
### 3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

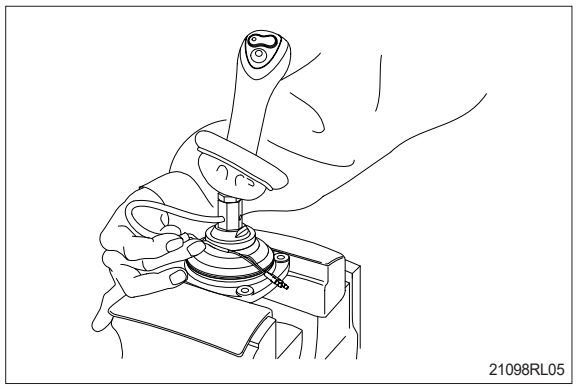
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

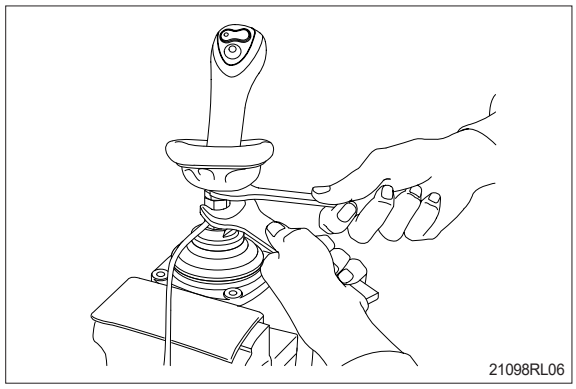
(3) Remove end of boot (26) from case (1) and take it out upwards.



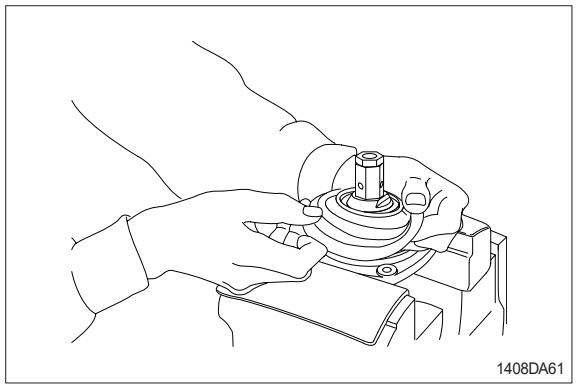

※ For valve with switch, remove cord also through hole of casing.



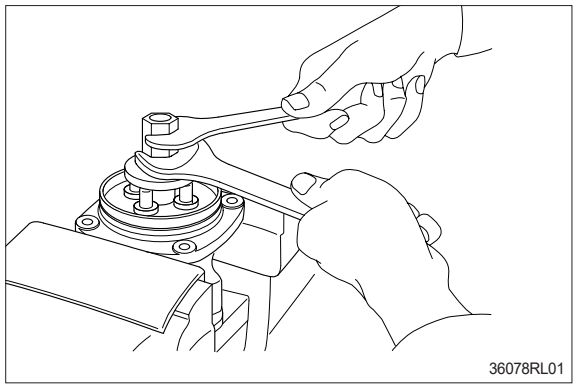

(4) Loosen lock nut (22) and adjusting nut (21) with spanners on them respectively, and take out handle section as one body.

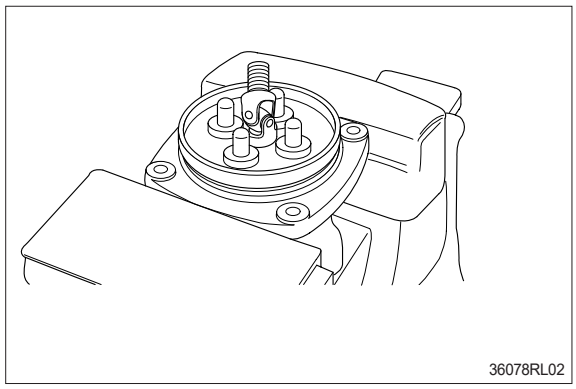



(5) Remove the boot (18).



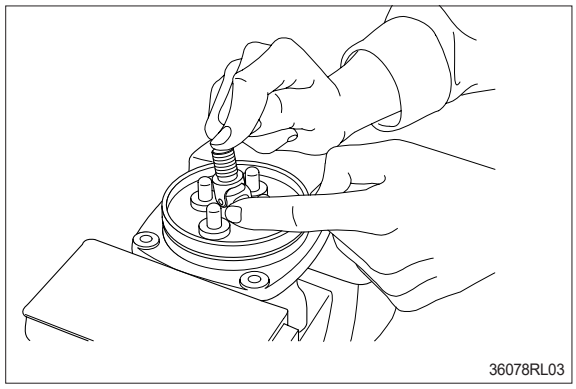
(6) Loosen adjusting nut (21) and swash plate (20) with spanners on them respectively, and remove them.

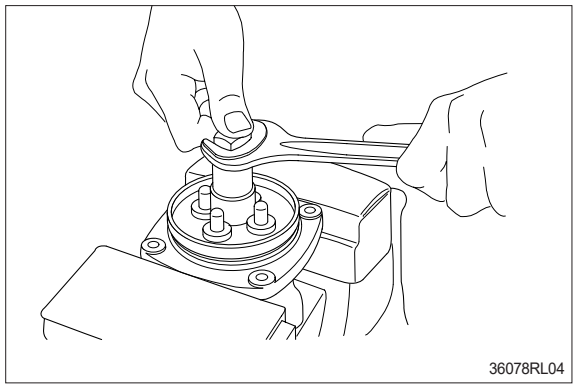


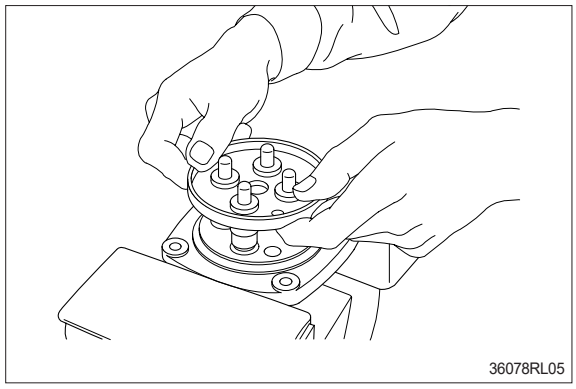

(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (10) is strong in force, plate (17), plug (14) and push rod (11) will come up on loosening joint.
Pay attention to this.



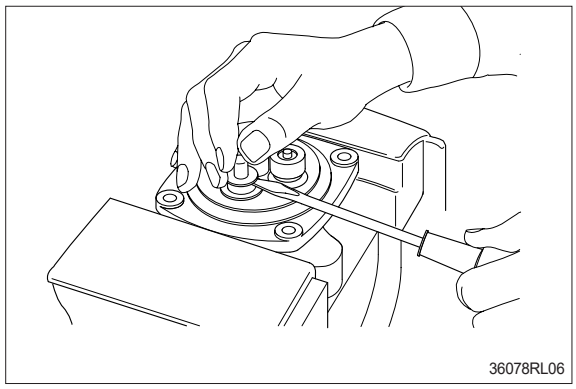
(8) Remove plate (17).




(9) When return spring (10) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.

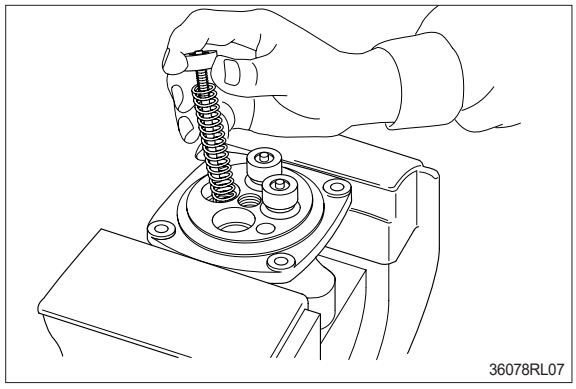
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (10) force.
Pay attention to this.

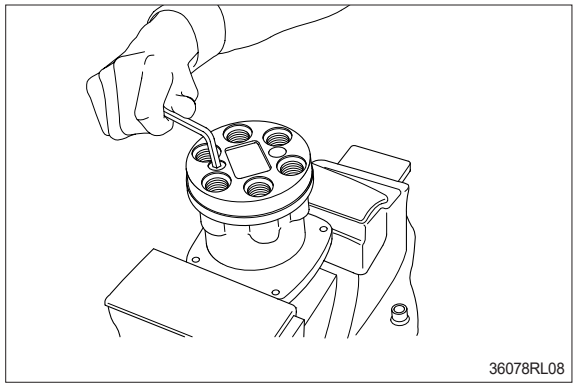



(10) Remove reducing valve subassembly and return spring (10) out of casing.

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




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

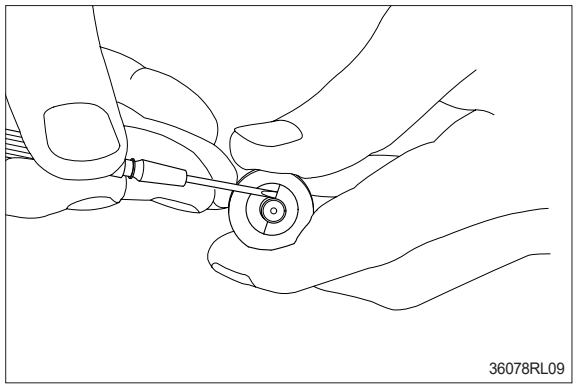


(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

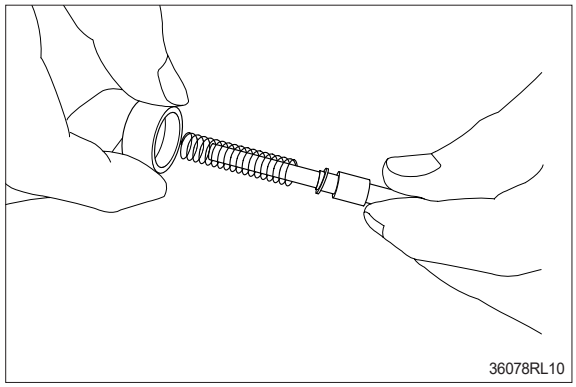
※ Record original position of spring seat (7).

※ Do not push down spring seat more than 6㎜.

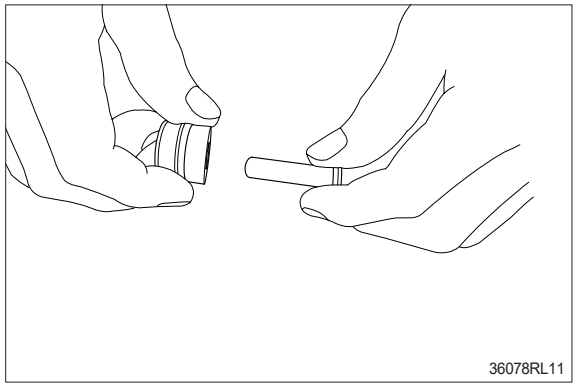



(13) Separate spool (4), spring seat (7), spring (6) and shim (5) individually.

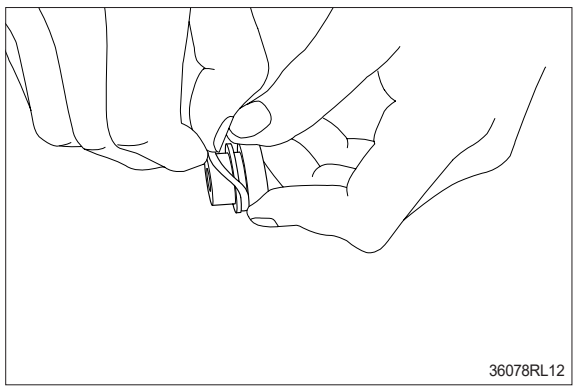
※ Until being assembled, they should be handled as one subassembly group.

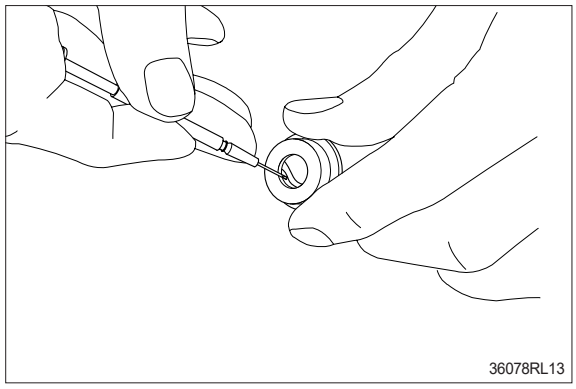



(14) Take push rod (11) out of plug (14).

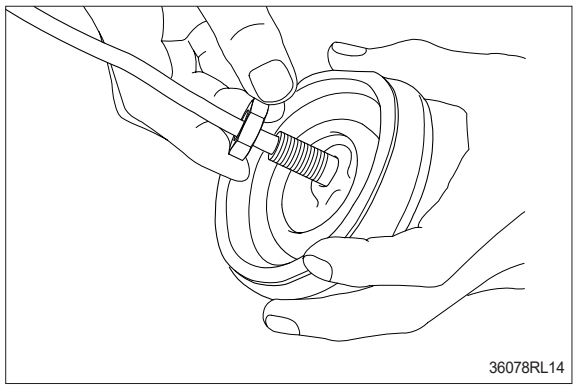


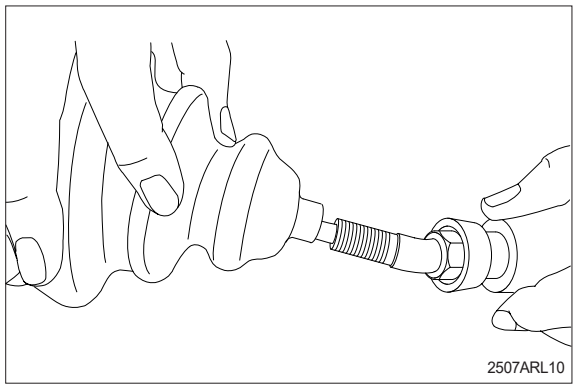

(15) Remove O-ring (15) and seal (16) from plug (14).
Use small minus screwdriver or so on to remove this seal.






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



### (16) Cleaning of parts

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.

### (17) Rust prevention of parts

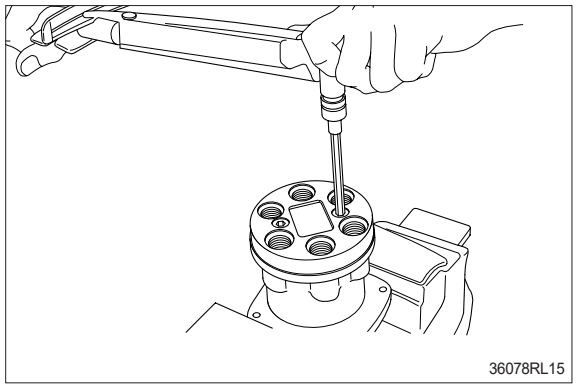
Apply rust-preventives to all parts.

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

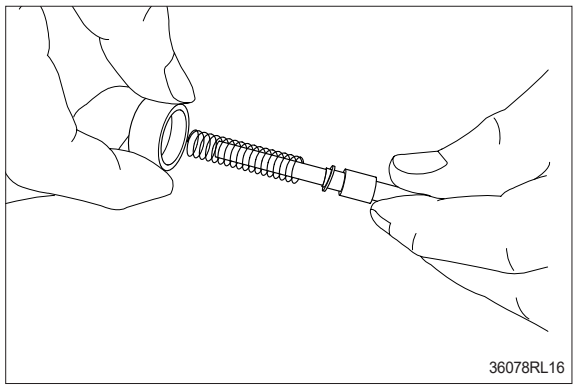
### 4) ASSEMBLY

(1) Tighten hexagon socket head plug (2) to the specified torque.

※ Tighten two bolts alternately and slowly.

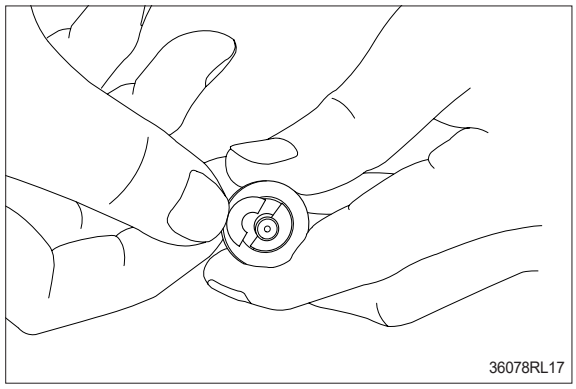



(2) Put shim (5), springs (6) and spring seat (7) onto spool (4) in this order.



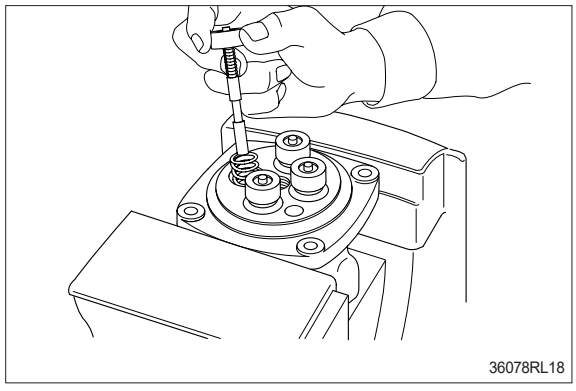

(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.

※ Assemble stopper (8) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.

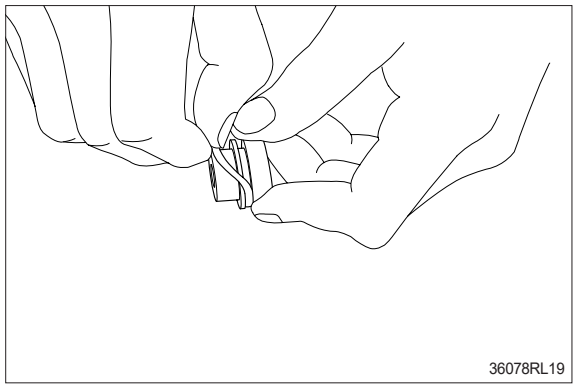



(4) Assemble spring (10) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

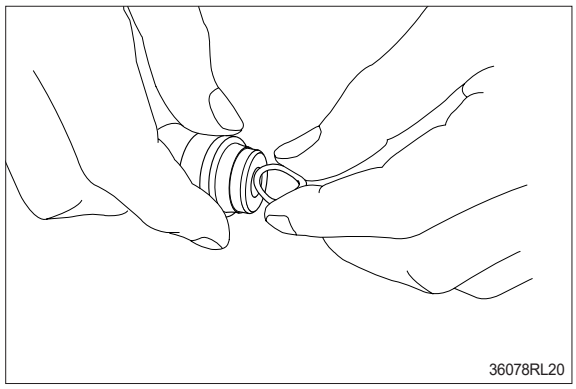


(5) Assemble O-ring (15) onto plug (14).



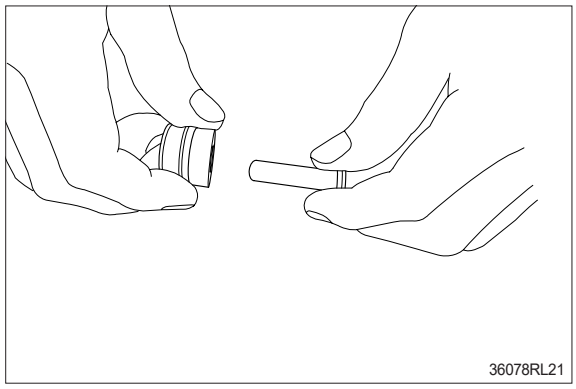

(6) Assemble seal (16) to plug (14).

※ Assemble seal in such lip direction as shown below.



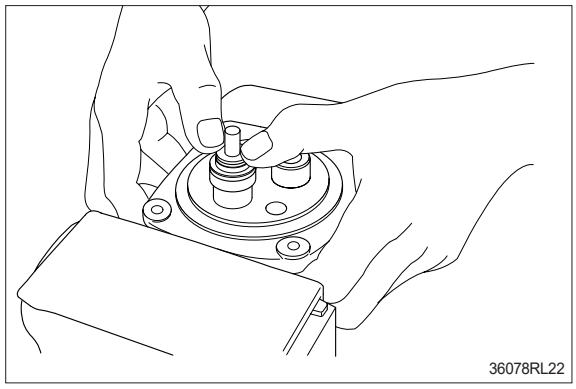

(7) Assemble push rod (11) to plug (14).

※ Apply working oil on push-rod surface.

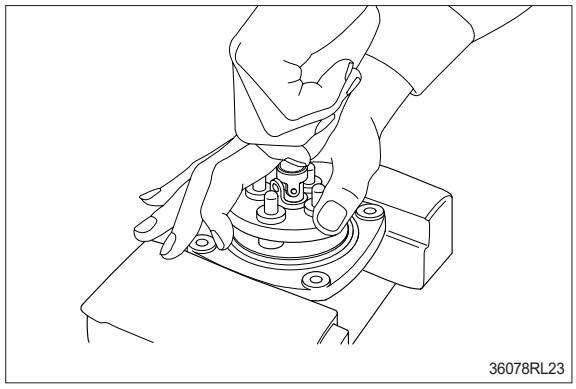



(8) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

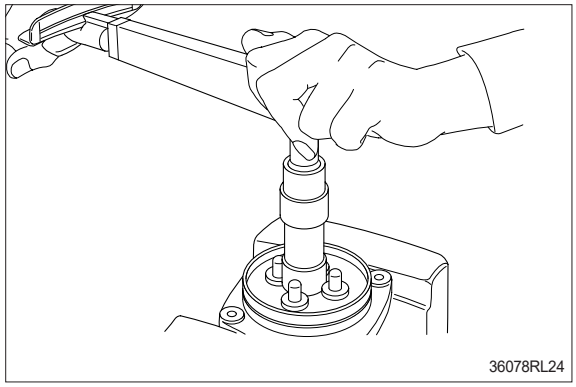


(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.




(10) Fit plate (17).

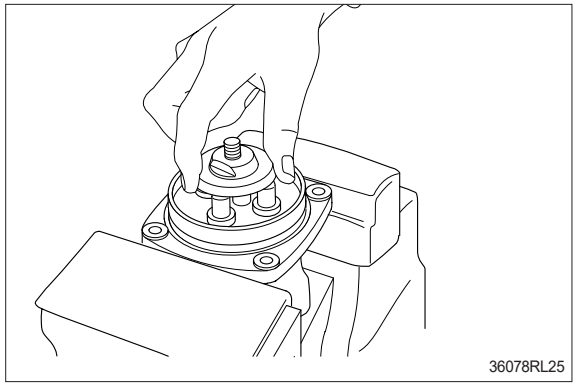
(11) Tighten joint (19) with the specified torque to casing, utilizing jig.




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

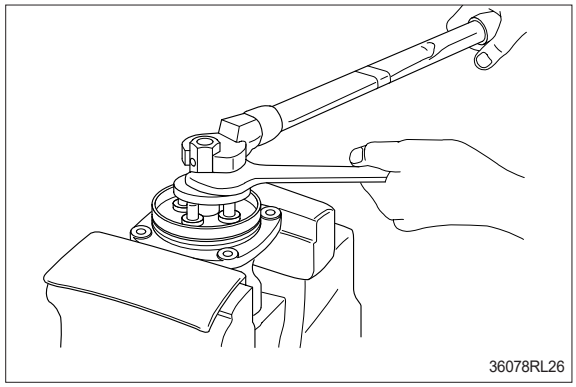
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

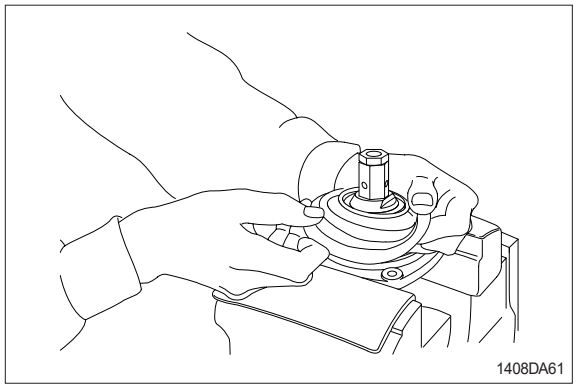



(13) Assemble adjusting nut (21), apply spanner to width across flat of plate (20) to fix it, and tighten adjusting nut to the specified torque.

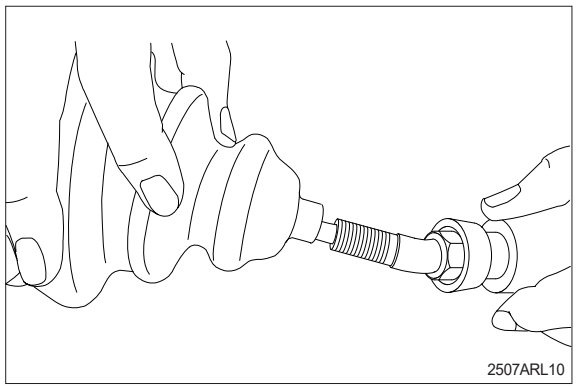
※ During tightening, do not change position of disk.

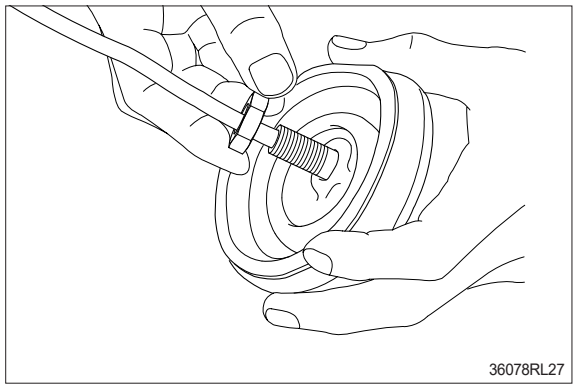


(14) Fit boot (18) to plate.

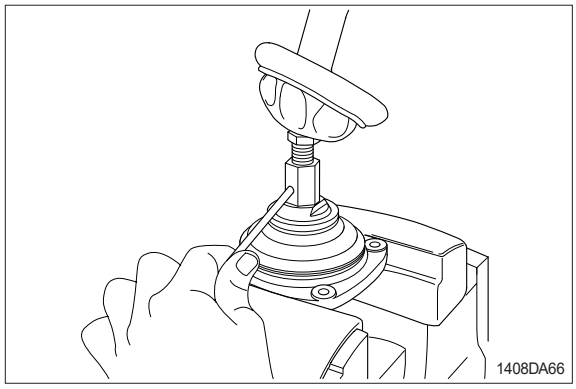



(15) Fit boot (26) and lock nut (22), and handle subassembly is assembled completely.



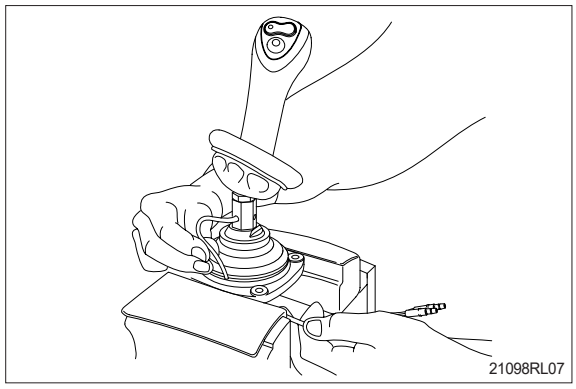




(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.

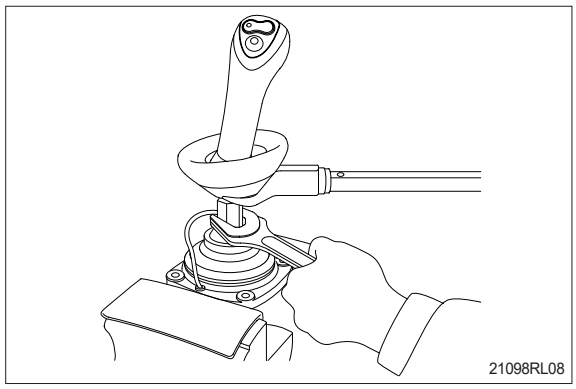


(17) Assemble bushing (28) to plate and pass cord and tube through it.

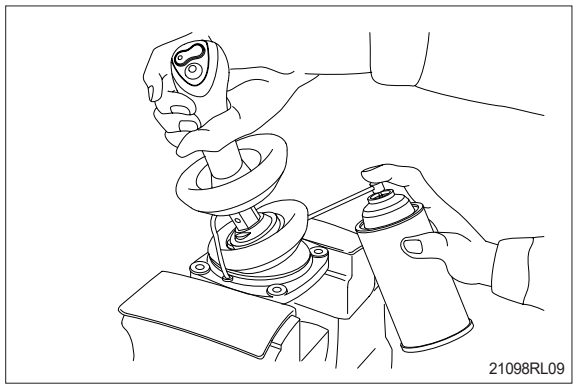
※ Provide margin necessary to operation.




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

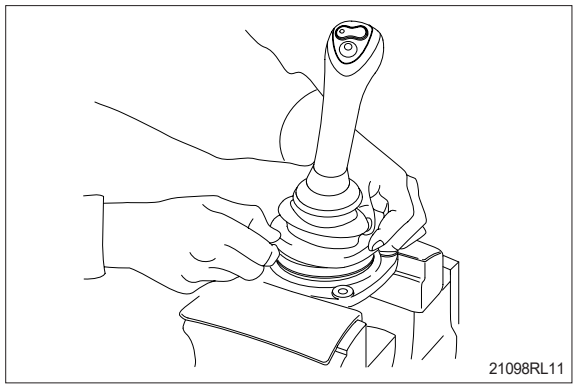



(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.




(20) Assemble lower end of bellows to casing.

(21) 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.

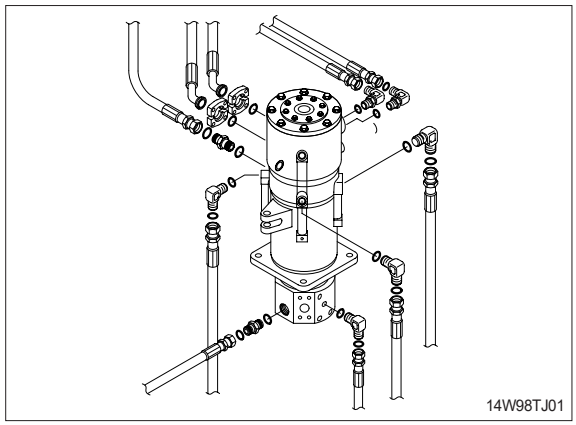
Disconnect all hoses.

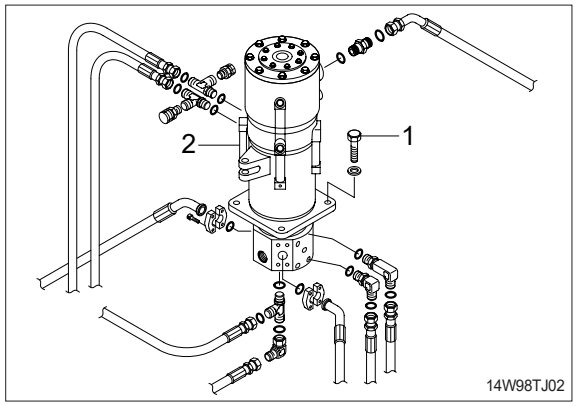
(4) Sling the turning joint assembly (1) and (5) remove the mounting bolt (2).

- Weight : 120 kg (265 lb)
- Tightening torque : 12.3± 1.3 kgf · m (89± 9.4 lbf · ft)

(6) Remove the turning joint (1) 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.

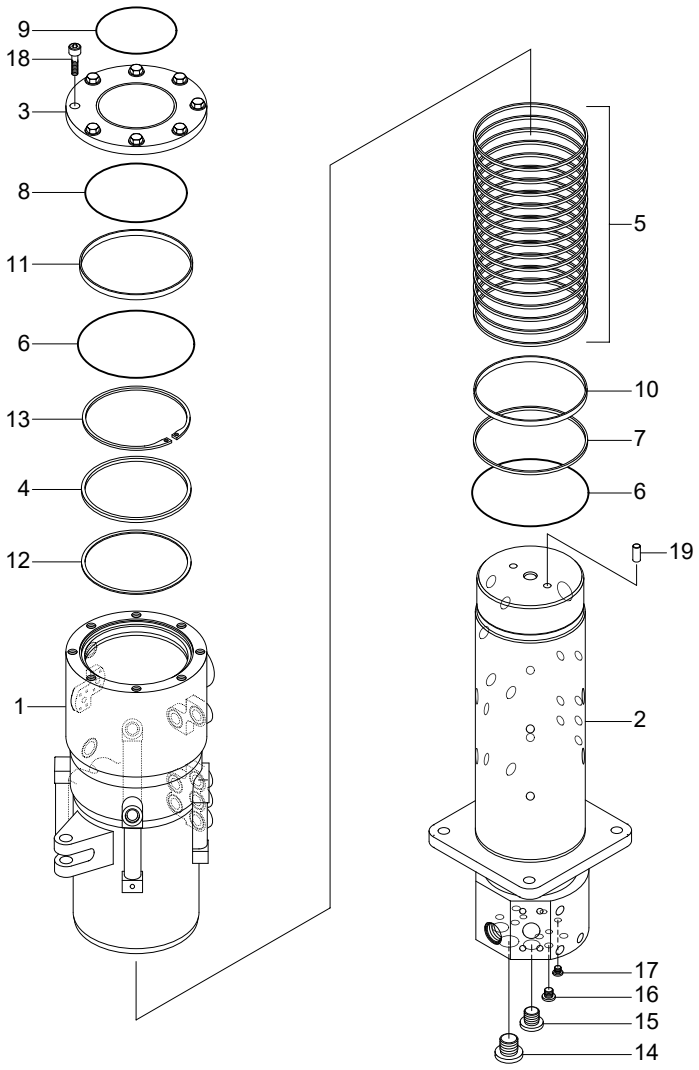
※ Take care of turning joint direction.

※ 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



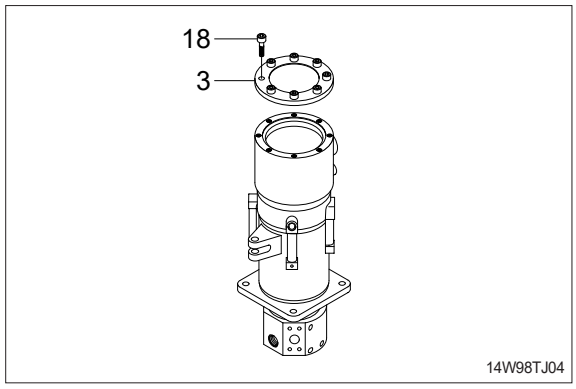

14W98TJ03

| | | | | | |
|---|---|---|---|---|---|
| 1 | Hub | 8 | O-ring | 15 | Plug |
| 2 | Shaft | 9 | O-ring | 16 | Plug |
| 3 | Cover | 10 | Wear ring | 17 | Plug |
| 4 | Spacer | 11 | Wear ring | 18 | Socket bolt |
| 5 | Slipper seal | 12 | Shim | 19 | Spring pin |
| 6 | O-ring | 13 | Retainer ring | | |
| 7 | O-ring | 14 | Plug | | |

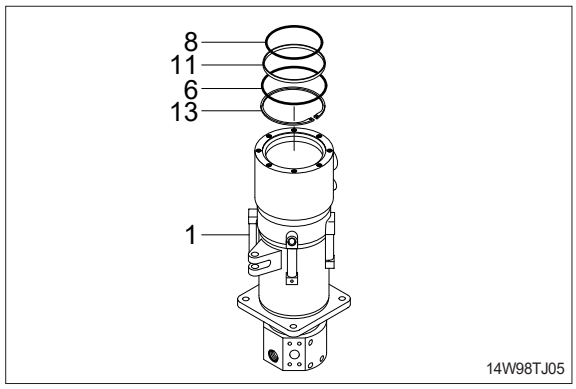
## 2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

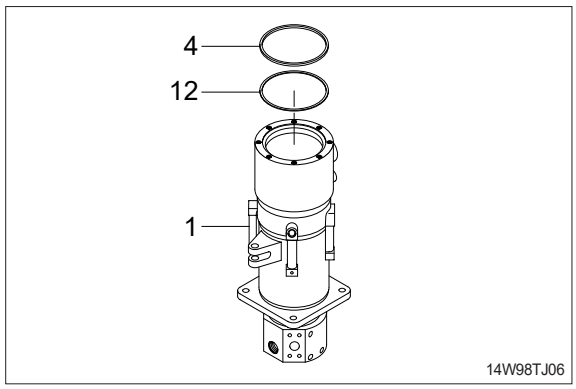
(1) Loosen the socket bolt (18) and remove cover (3).




(2) Remove O-ring (8), wear ring (11), O-ring (6) and retainer ring (13) from hub (1).



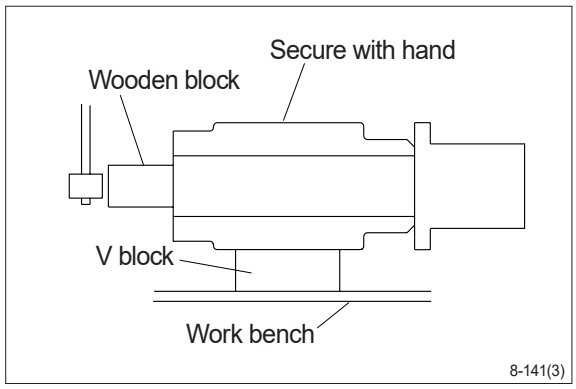

(3) Remove spacer (4) and shim (12) from hub (1).



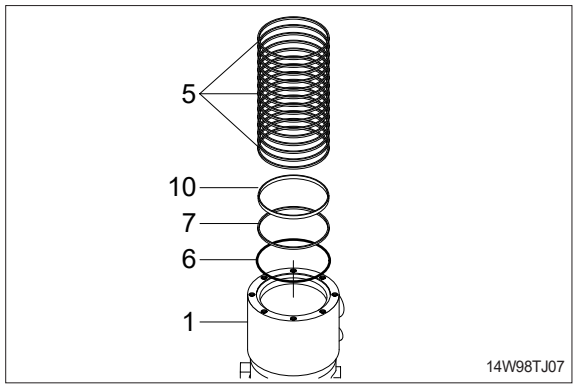

(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the hub with a hammer.

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

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



(5) Remove seventeen slipper seal (5), O-ring (6, 7) and wear ring (10) from hub (1).

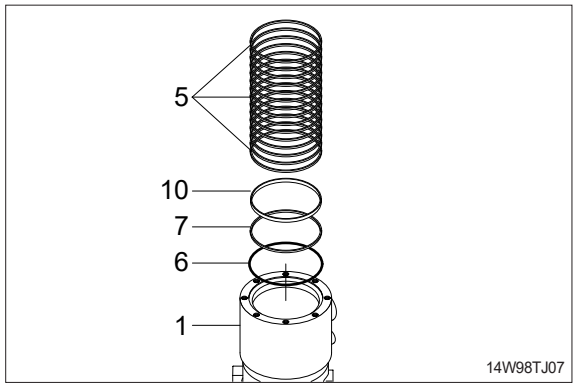


### 3) ASSEMBLY

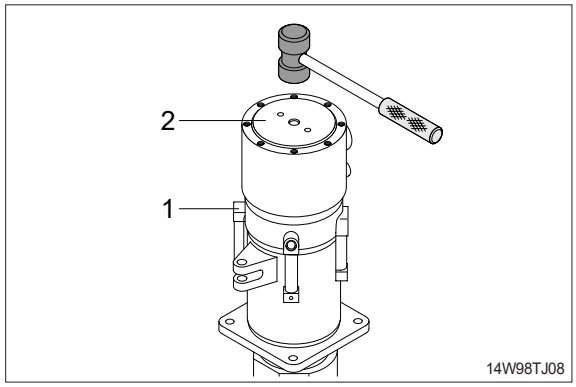
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fit O-ring (7), seventeen slipper seal (5), and wear ring (10).

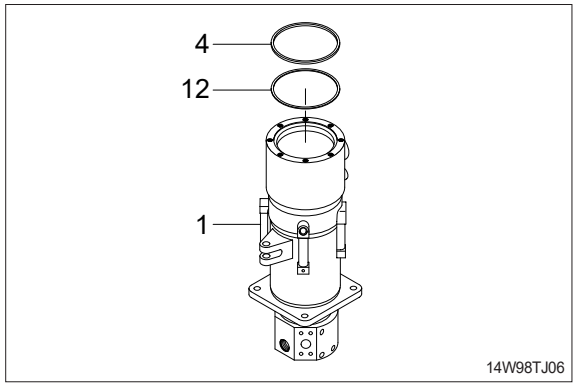
(2) Fit O-ring (6) to shaft (2).




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

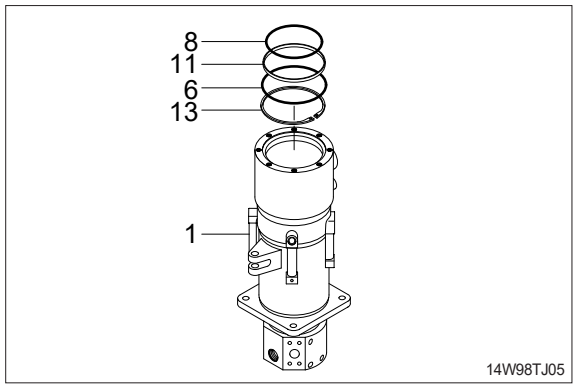



(4) Fit shim (12), and spacer (4) to hub (1) of turning joint upside.

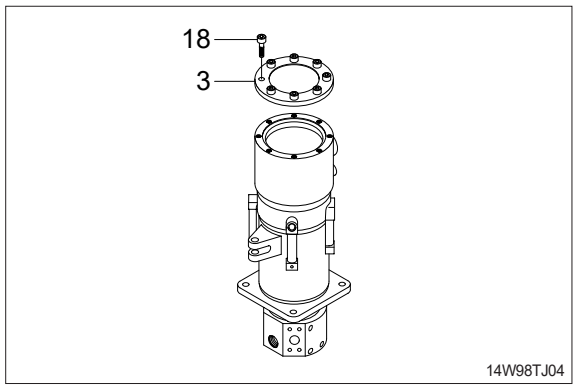


(5) Fit retainer ring (13), O-ring (6) and wear ring (11) to shaft (2).

(6) Fit O-ring (8) to hub (1).




(7) Install cover (3) to hub and tighten bolts (18).
- Torque : 2.35±0.35 kgf · m
  (17.0±2.5 lbf · ft)



## 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.

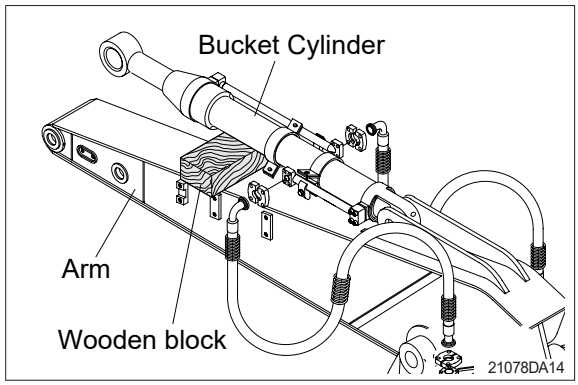
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

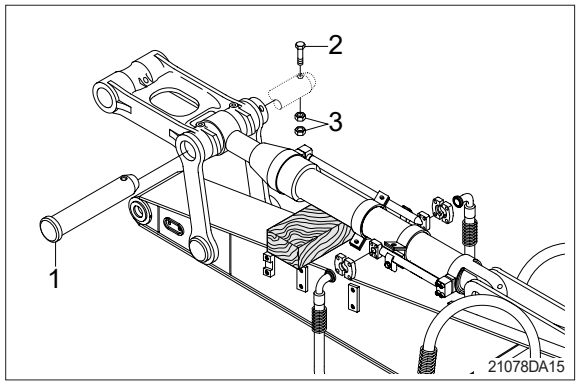
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.


① Set block between bucket cylinder and arm.

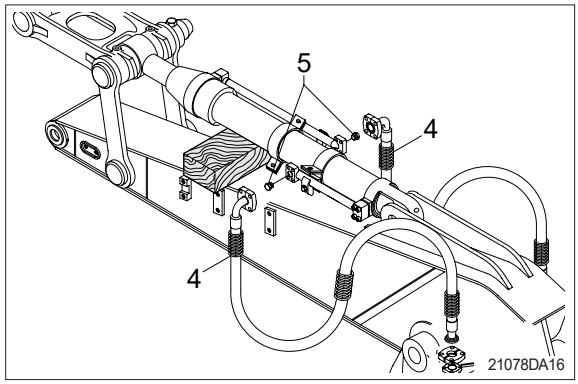



② Remove bolt (2), nut (3) and pull out pin (1).

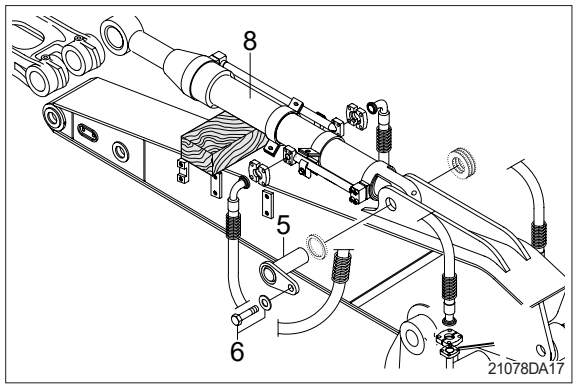
※ Tie the rod with wire to prevent it from coming out.




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 : 100 kg (220 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

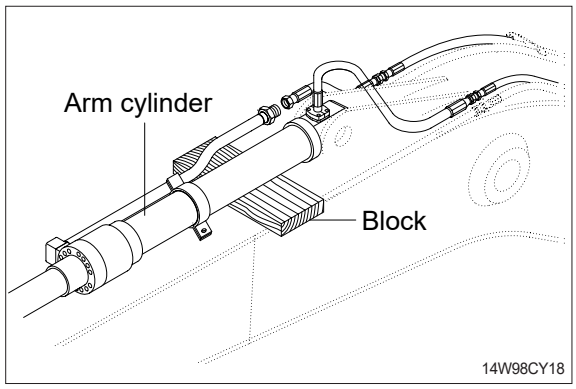
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.

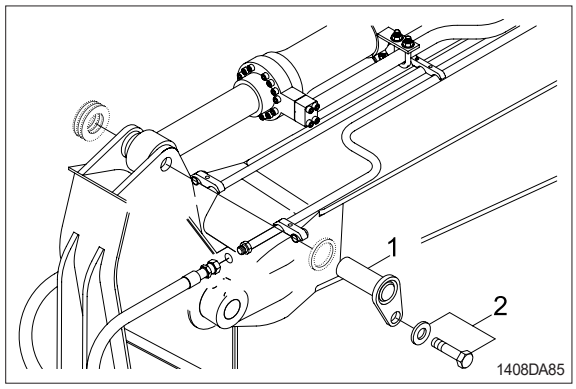
⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**
**Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.**

① Set block between arm cylinder and boom.

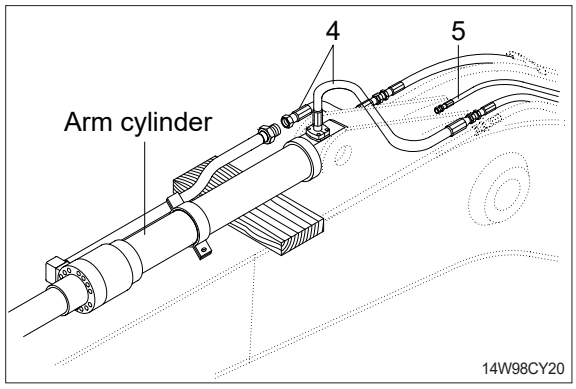

② Remove bolt (2) and pull out pin (1).

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

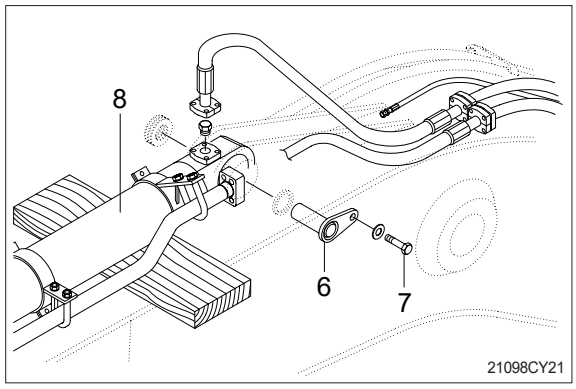



③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).



⑤ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).
⑥ Remove arm cylinder assembly (8).
・Weight : 160 ㎏ (350 ㏪)




**(2) Install**

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the arm cylinder.

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

### 3) BOOM CYLINDER

#### (1) Removal

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

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

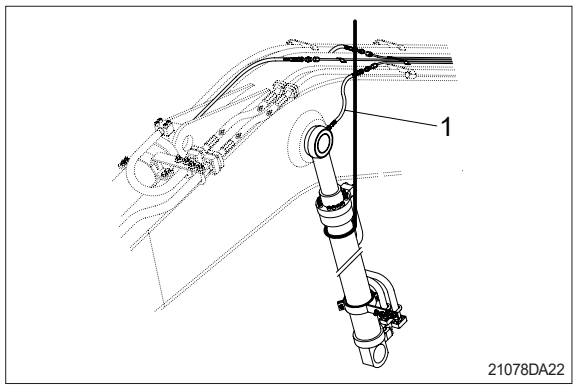
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.


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

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

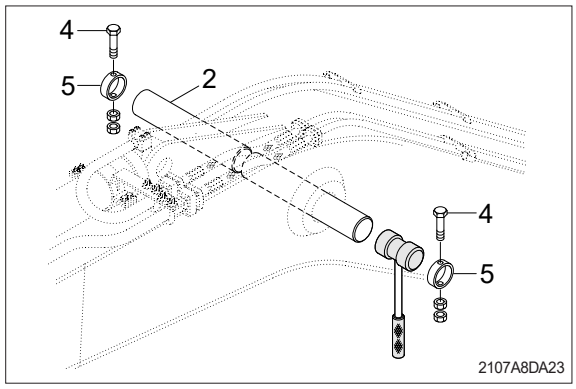
① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

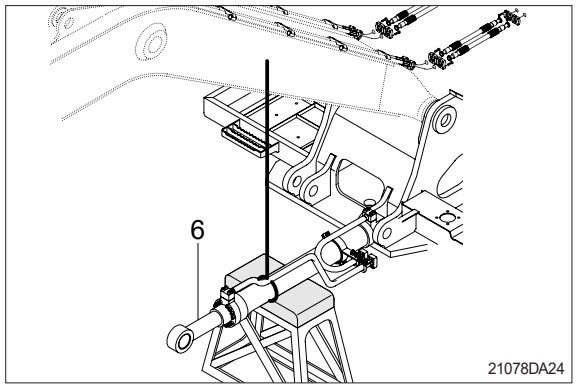



③ Remove bolt (4), stopper (5) and pull out pin (2).

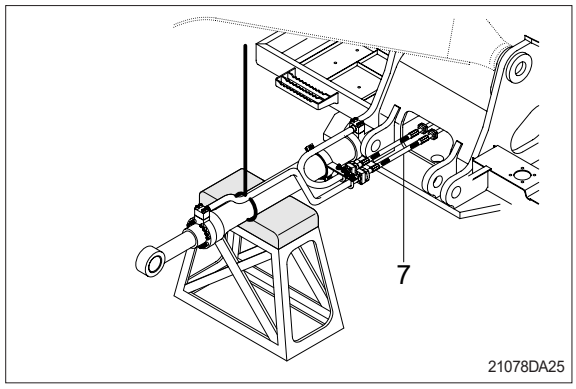
※ Tie the rod with wire to prevent it from coming out.



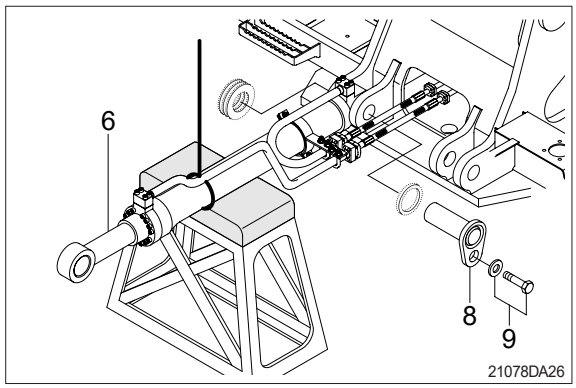

④ Lower the boom cylinder assembly (6) on a stand.



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




⑥ Remove bolt (9) and pull out pin (8).
⑦ Remove boom cylinder assembly (6).
・Weight : 130 ㎏ (285 ㏪)




**(2) Install**

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the boom cylinder.

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

## 4) DOZER CYLINDER

### (1) Removal

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

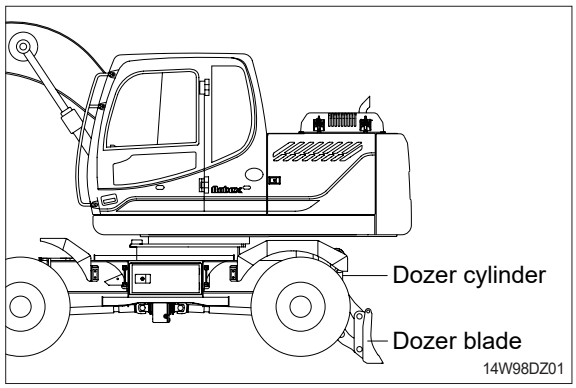
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

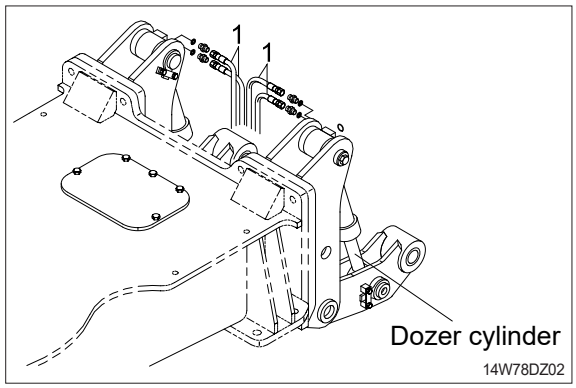
**⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.**

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

① Lower the dozer blade to the ground.

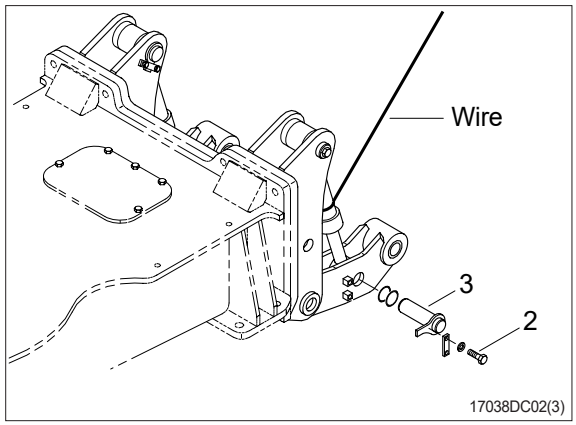

② Disconnect dozer cylinder hoses (1), and put plugs on cylinder pipe.



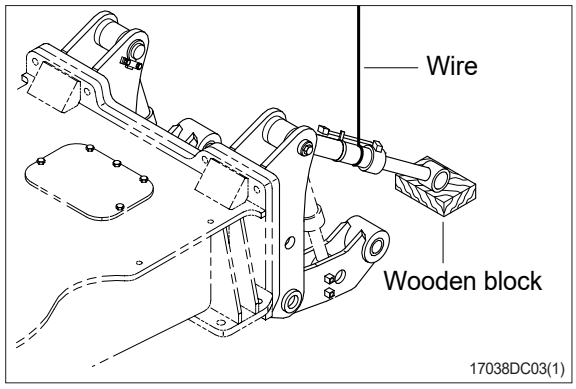

③ Sling dozer cylinder assembly.

④ Remove bolt (2) and pull out pin (3).

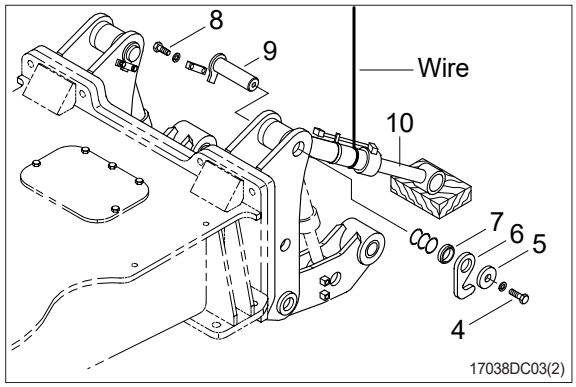
※ Tie the rod with wire to prevent it from coming out.



⑤ Lower the dozer cylinder rod side on a wooden block.




⑥ Loosen the bolt (4) and remove lock washer (5), hook plate (6), and spacer (7). Remove bolt (8) and pull out pin (9).
⑦ Remove the dozer cylinder assy (10).
⑧ ・Weight : 55 kg (120 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.**

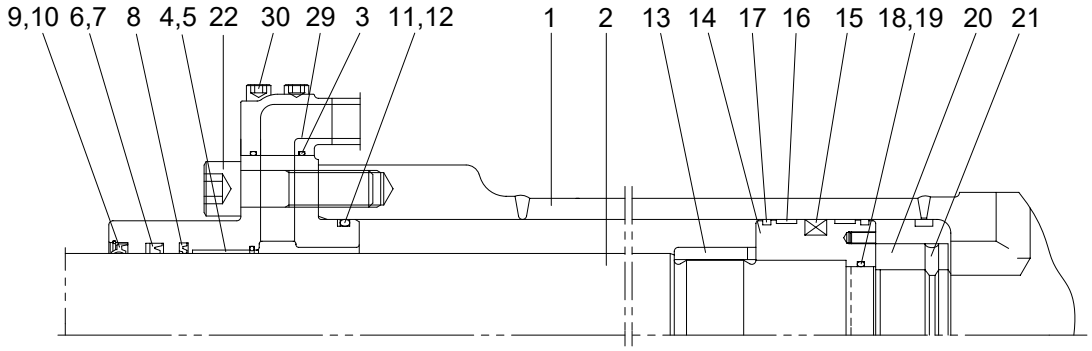
※ Bleed the air from the dozer cylinder.

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

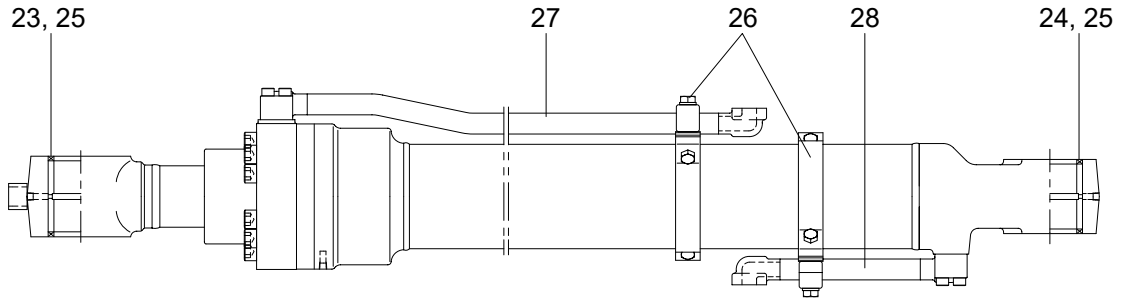
## 2. DISASSEMBLY AND ASSEMBLY

### 1) STRUCTURE

#### (1) Bucket cylinder



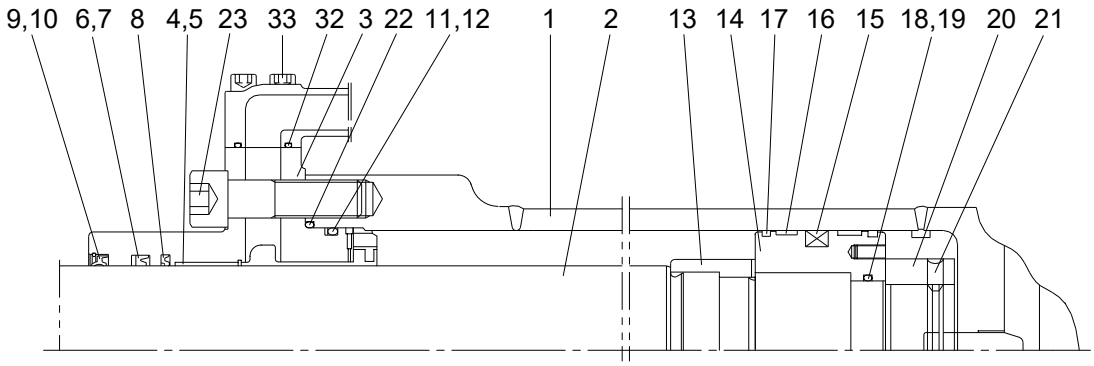

Internal detail



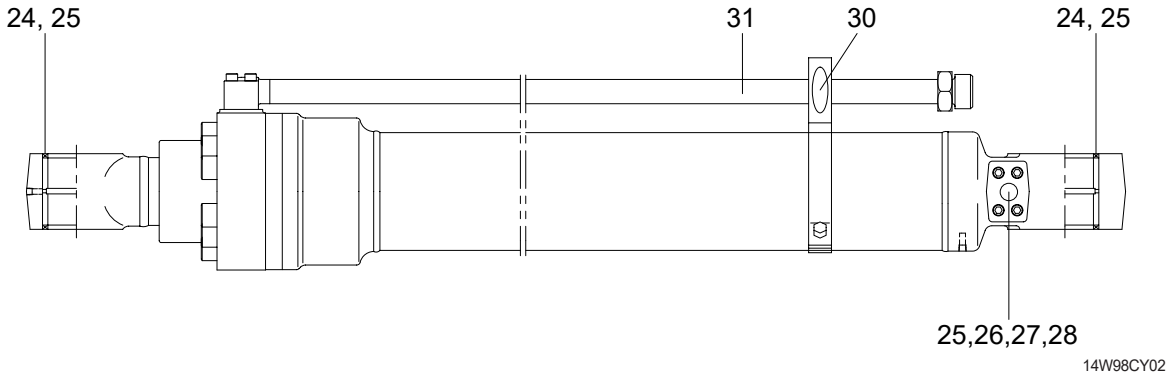

14W98CY01

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

## (2) Arm cylinder

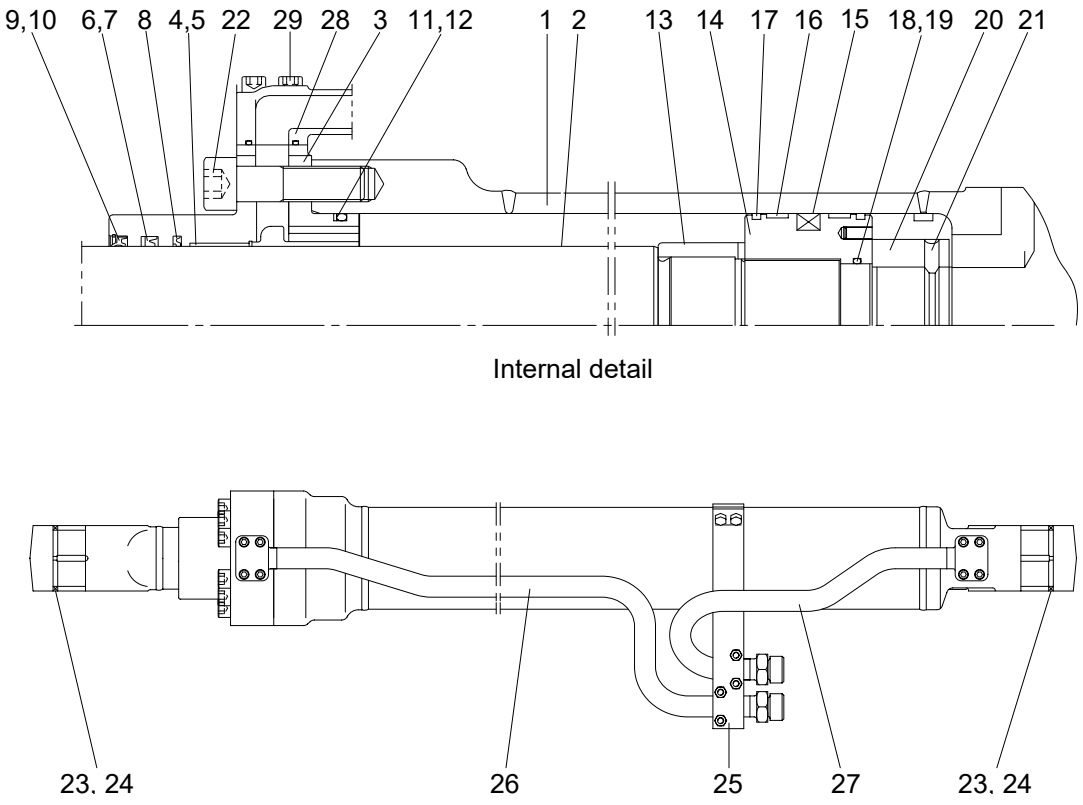



Internal detail




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

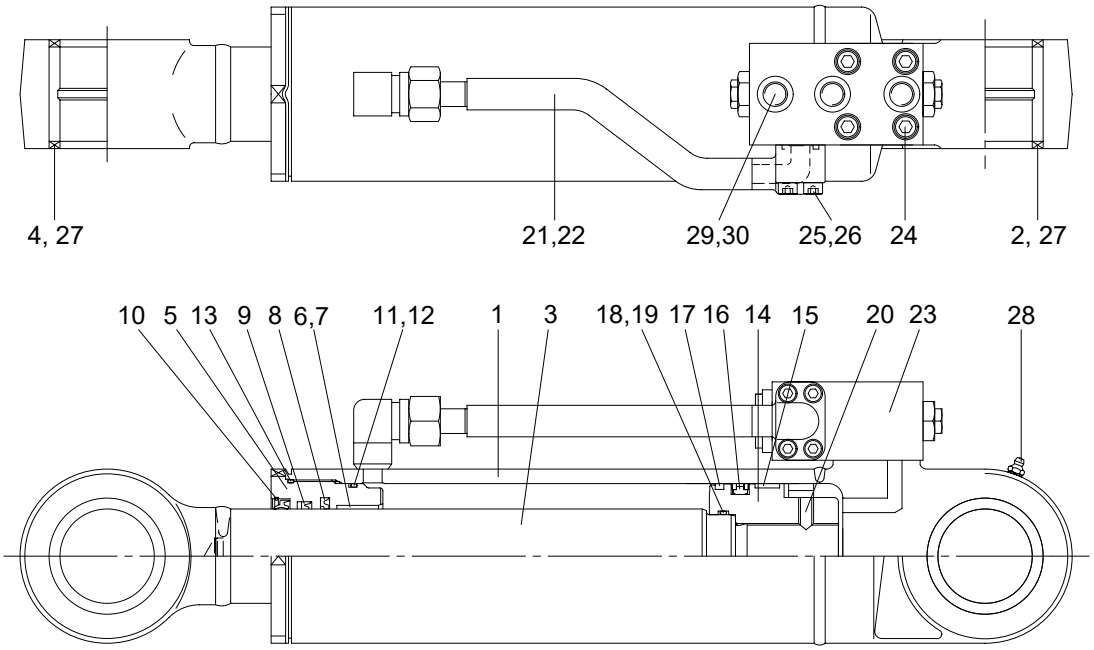
(3) Boom cylinder




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

### (4) Dozer cylinder

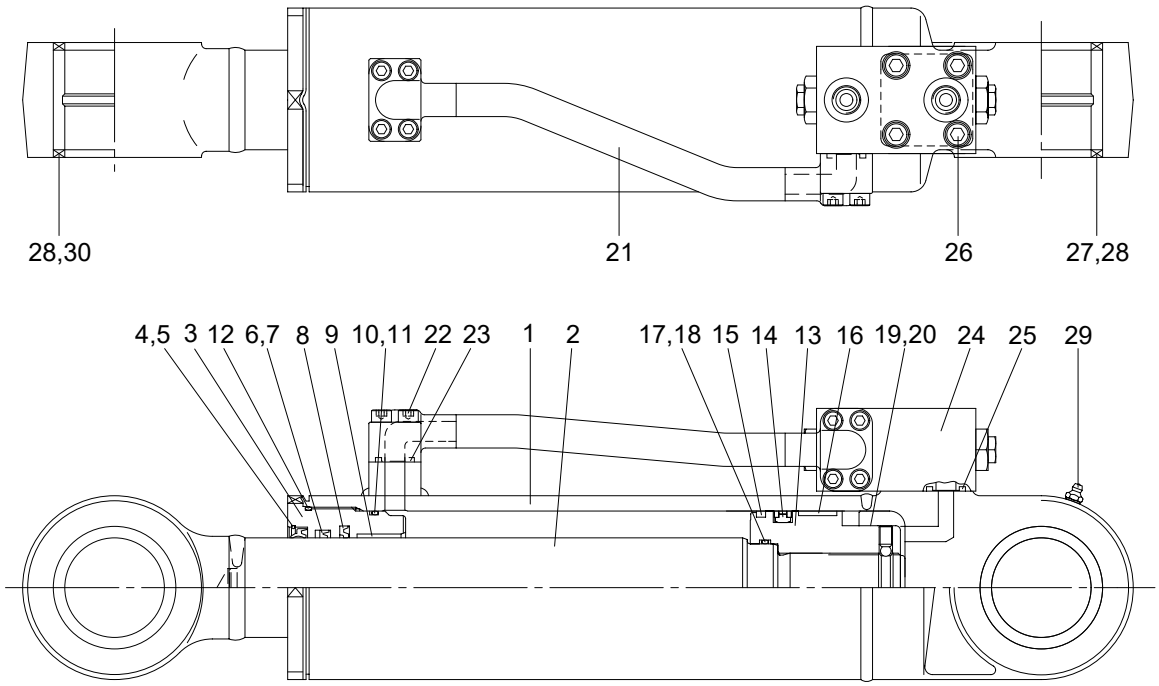
#### ① Rear dozer cylinder




14W98CY04

| | | | | | |
|---|---|---|---|---|---|
| 1 | Tube assembly | 12 | Back up ring | 22 | O-ring |
| 2 | Pin bushing | 13 | O-ring | 23 | Check valve assembly |
| 3 | Rod assembly | 14 | Piston | 24 | Hexagon socket head bolt |
| 4 | Pin bushing | 15 | Wear ring | 25 | Hexagon socket head bolt |
| 5 | Rod cover | 16 | Piston seal | 26 | Spring washer |
| 6 | Rod bushing | 17 | Dust ring | 27 | Wiper pin |
| 7 | Retaining ring | 18 | O-ring | 28 | Grease nipple |
| 8 | Buffer ring | 19 | Back up ring | 29 | Plug |
| 10 | Dust wiper | 20 | Set screw | 30 | O-ring |
| 11 | O-ring | 21 | Pipe assembly | | |

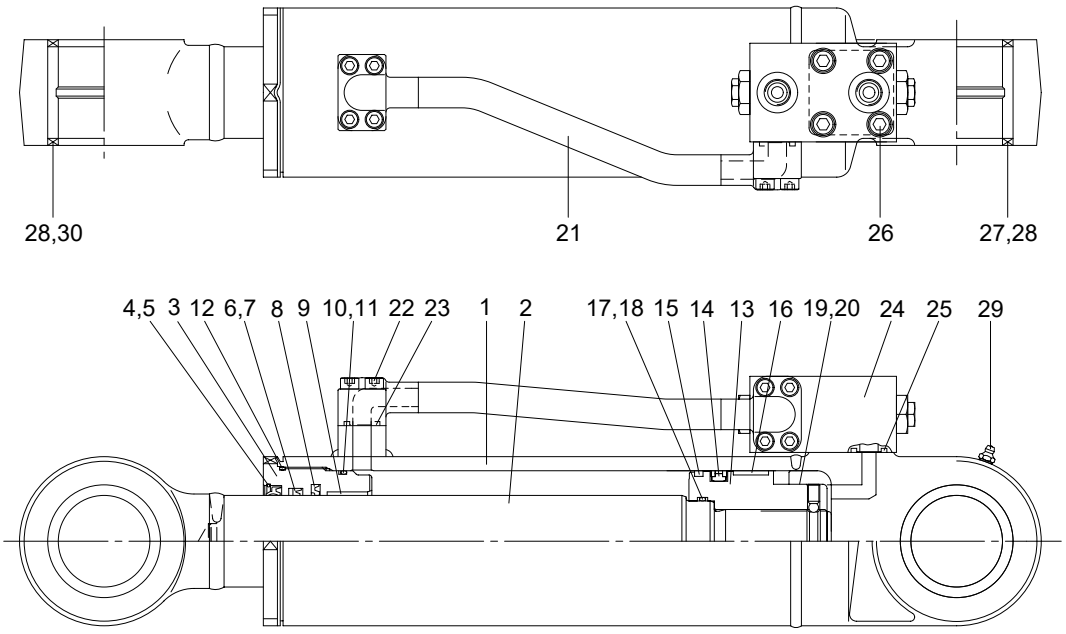
## ② Front dozer cylinder




14W98CY05

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

(5) Outrigger cylinder

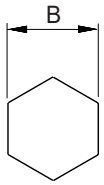



14W98CY06

| | | | | | |
|---|---|---|---|---|---|
| 1 | Tube assembly | 11 | Back up ring | 21 | Pipe assembly |
| 2 | Rod assembly | 12 | O-ring | 22 | Hexagon socket head bolt |
| 3 | Gland | 13 | Piston | 23 | O-ring |
| 4 | Dust wiper | 14 | Piston seal | 24 | Check valve assembly |
| 5 | Retainer ring | 15 | Dust ring | 25 | O-ring |
| 6 | Rod seal | 16 | Wear ring | 26 | Hexagon socket head bolt |
| 7 | Back up ring | 17 | O-ring | 27 | Pin bushing |
| 8 | Buffer ring | 18 | Back up ring | 28 | Pin bushing |
| 9 | Du bushing | 19 | Steel ball | 29 | Dust seal |
| 10 | O-ring | 20 | Set screw | | |

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

| Tool name | Remark | |
|---|---|---|
| Allen wrench | 6 |   |
| | 8 | |
| | 14 | |
| | 17 | |
| Spanner | 7 | |
| | 8 | |
| (-) 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 |
| Socket head bolt | Bucket cylinder | 22 | M14 | 15±2.0 | 108±14.5 |
| | Boom cylinder | | M14 | 15±2.0 | 108±14.5 |
| | Arm cylinder | 23 | M16 | 23±2.0 | 166±14.5 |
| | Dozer cylinder | 25 | M8 | 2.7±0.3 | 19.5±2.2 |
| | Outrigger cylinder | 22 | | | |
| | Dozer cylinder | 24 | M10 | 5.4±0.5 | 39.1±3.6 |
| | Outrigger cylinder | 26 | | | |
| Pipe mounting socket head bolt | Bucket | 30 | M10 | 5.4±0.5 | 39.1±3.6 |
| | Boom | 29 | M8 | 2.7±0.3 | 19.6±2.2 |
| | Arm | 33 | M10 | 5.4±0.5 | 39.1±3.6 |
| Lock nut | Bucket cylinder | 20 | M45 | 100±10.0 | 723±72.3 |
| | Boom cylinder | | M50 | | |
| | Arm cylinder | | M55 | | |
| Piston | Bucket cylinder | 14 | - | 150±15.0 | 1085±109 |
| | Boom cylinder | | | | |
| | Arm cylinder | | | | |
| | Dozer cylinder - Rear | | | | |
| | Dozer cylinder - Front | 13 | | | |
| | Outrigger cylinder | | | 140±14.0 | 1012±101 |

### 3) DISASSEMBLY

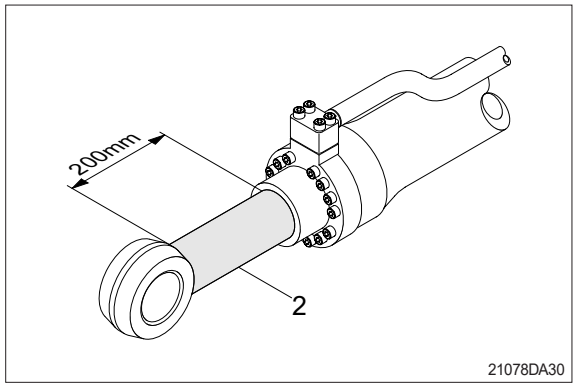
#### (1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

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

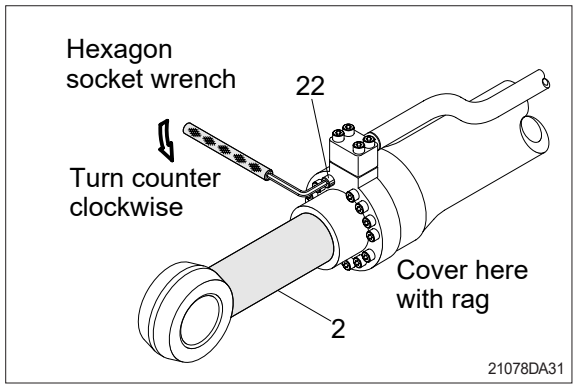
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



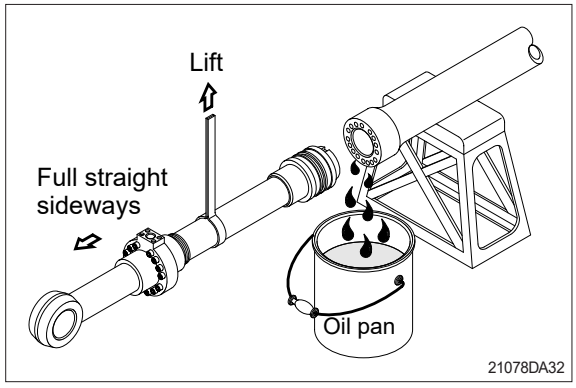

③ Loosen and remove socket bolts (22) of the gland in sequence.

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




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

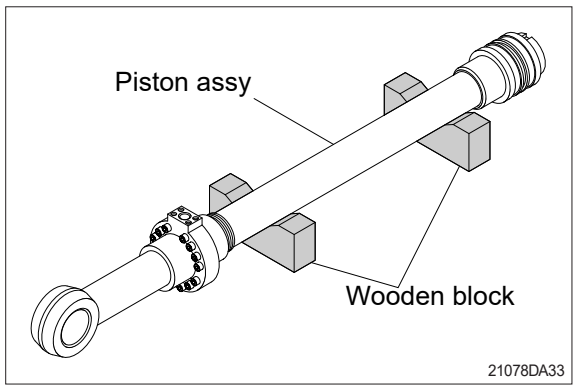
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

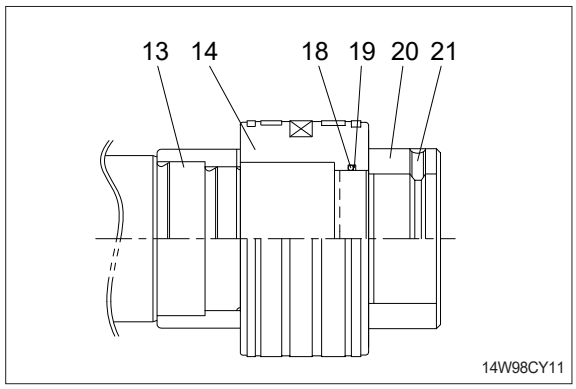



**(2) Remove piston and cylinder head**

① Remove set screw (21).

※ Since set screw (21) and lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock set screw (21) and lock nut (20).

② Remove piston assembly (14), back up ring (19), and O-ring (18).

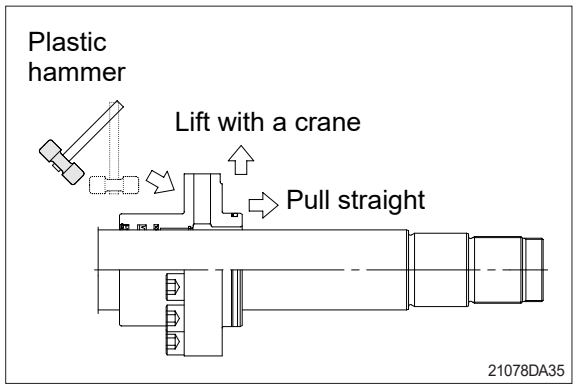



③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

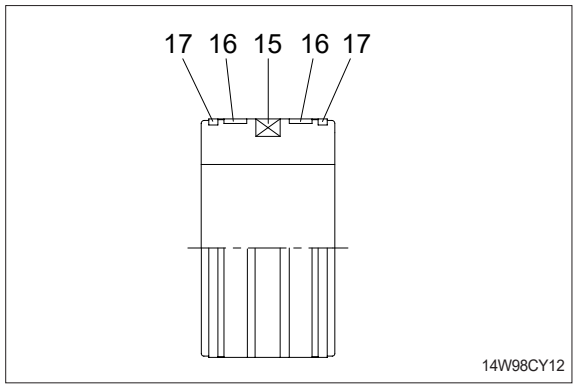
※ Pull it straight with cylinder head assembly lifted with a crane.

Exercise care so as not to damage the lip of rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).



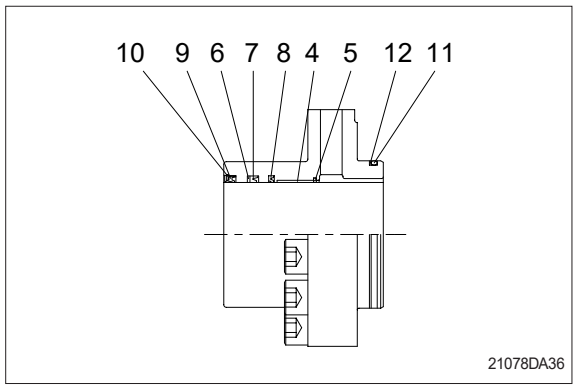
### (3) Disassemble the piston assembly

① Remove wear ring (16).
② Remove dust ring (17) and piston seal (15).
※ Exercise care in this operation not to damage the grooves.




### (4) Disassemble cylinder head assembly

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

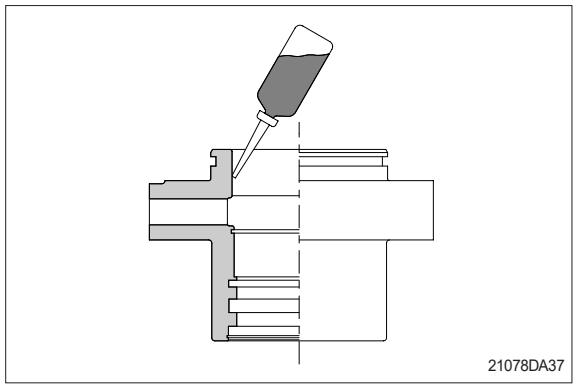


### 3) ASSEMBLY

#### (1) Assemble cylinder head assembly

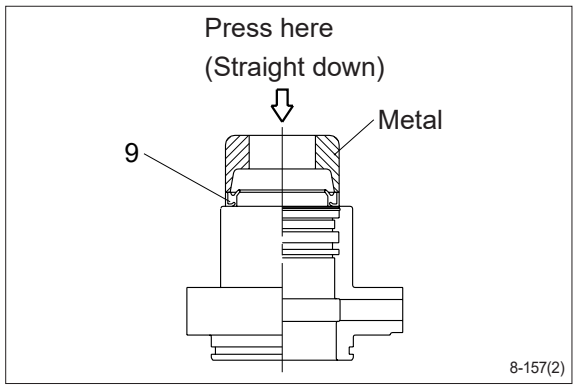
※ Check for scratches or rough surfaces if found smooth with an oil stone.

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




② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

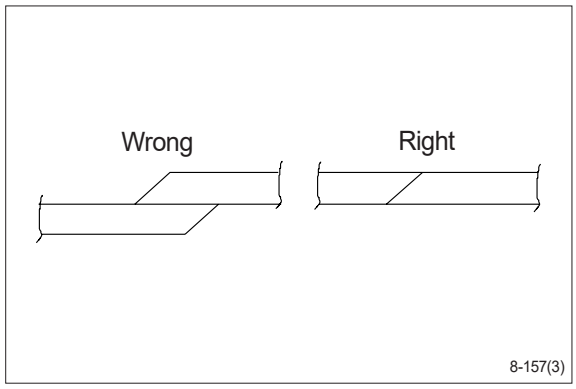
③ Fit snap ring (10) to the stop face.




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

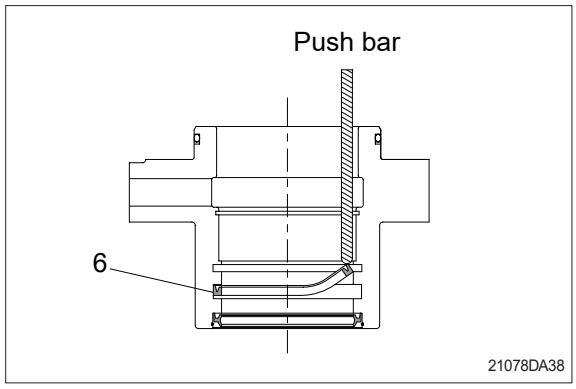
※ Coat each packing with hydraulic oil before fitting it.

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




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

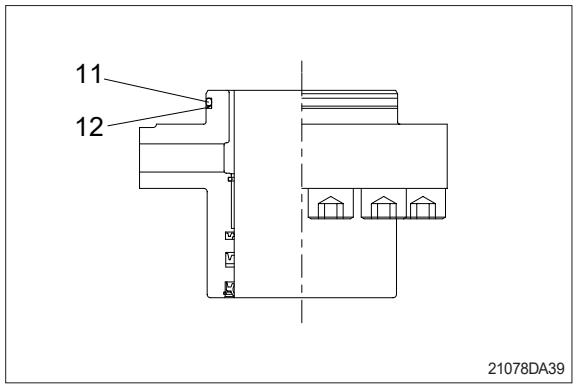
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50℃.

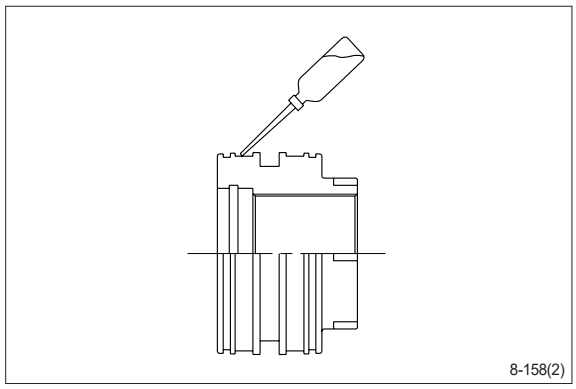
⑥ Fit O-ring (11) to gland (3).




**(2) Assemble piston assembly**

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

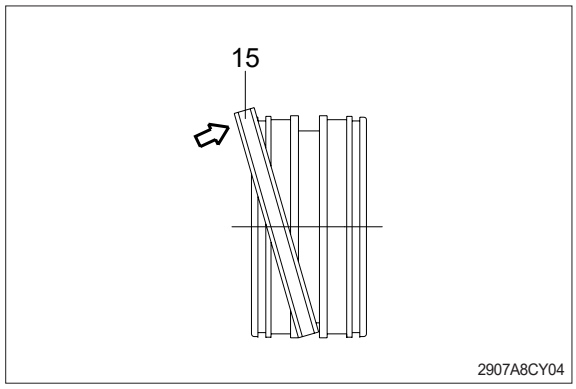
① Coat the outer face of piston (14) with hydraulic oil.



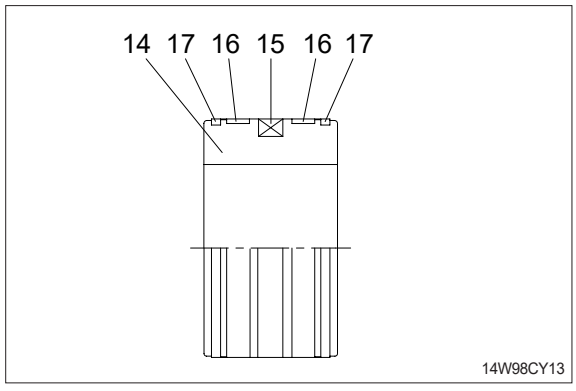

② Fit piston seal (15) to piston.

※ Put the piston seal in the warm water of 60~100℃ for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.




③ Fit wear ring (16) and dust ring (17) to piston (14).

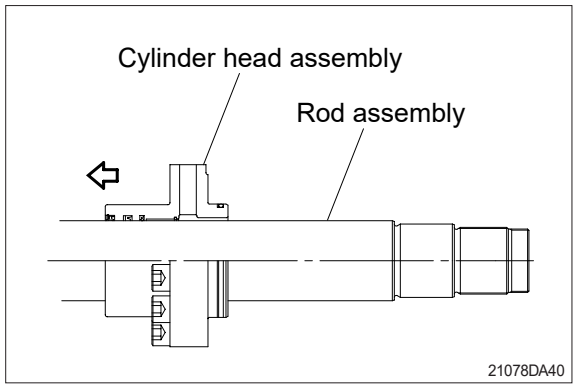


### (3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

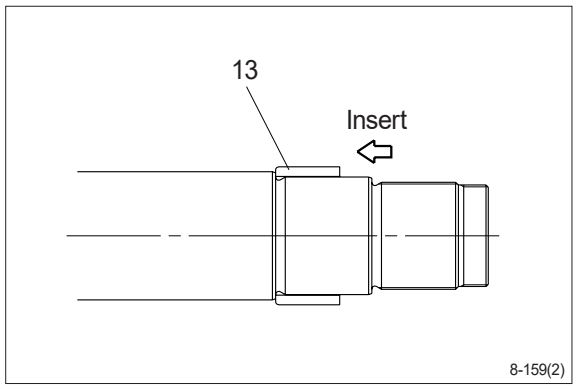
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



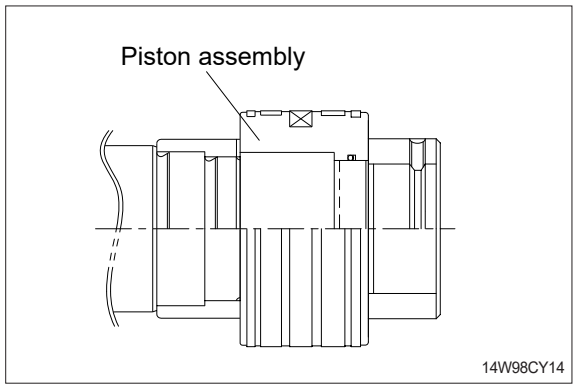

④ Insert cushion ring (13) to rod assembly.

※ Note that cushion ring (13) has a direction in which it should be fitted.




⑤ Fit piston assembly to rod assembly.

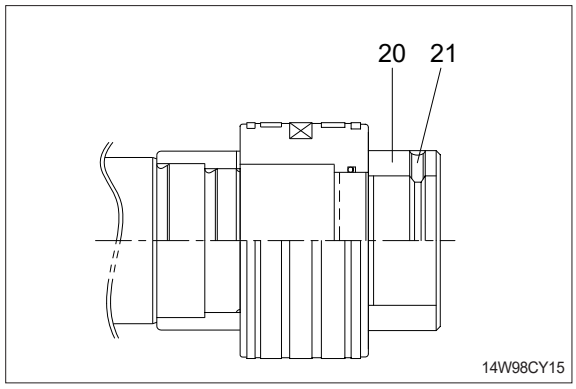
· Tightening torque : 150±15 kgf · m
(1085±108 lbf · ft)




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

· Tightening torque :

| Item | | kgf · m | lbf · ft |
|---|---|---|---|
| 20 | Bucket | 100±10 | 723±72.3 |
| | Boom | | |
| | Arm | | |
| 21 | | 2.7±0.3 | 19.6±2.2 |



### (3) Overall assemble

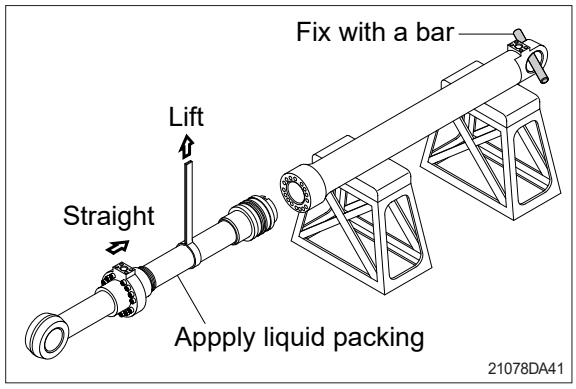
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

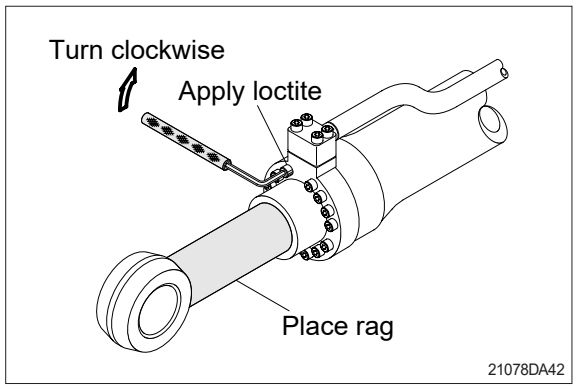
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

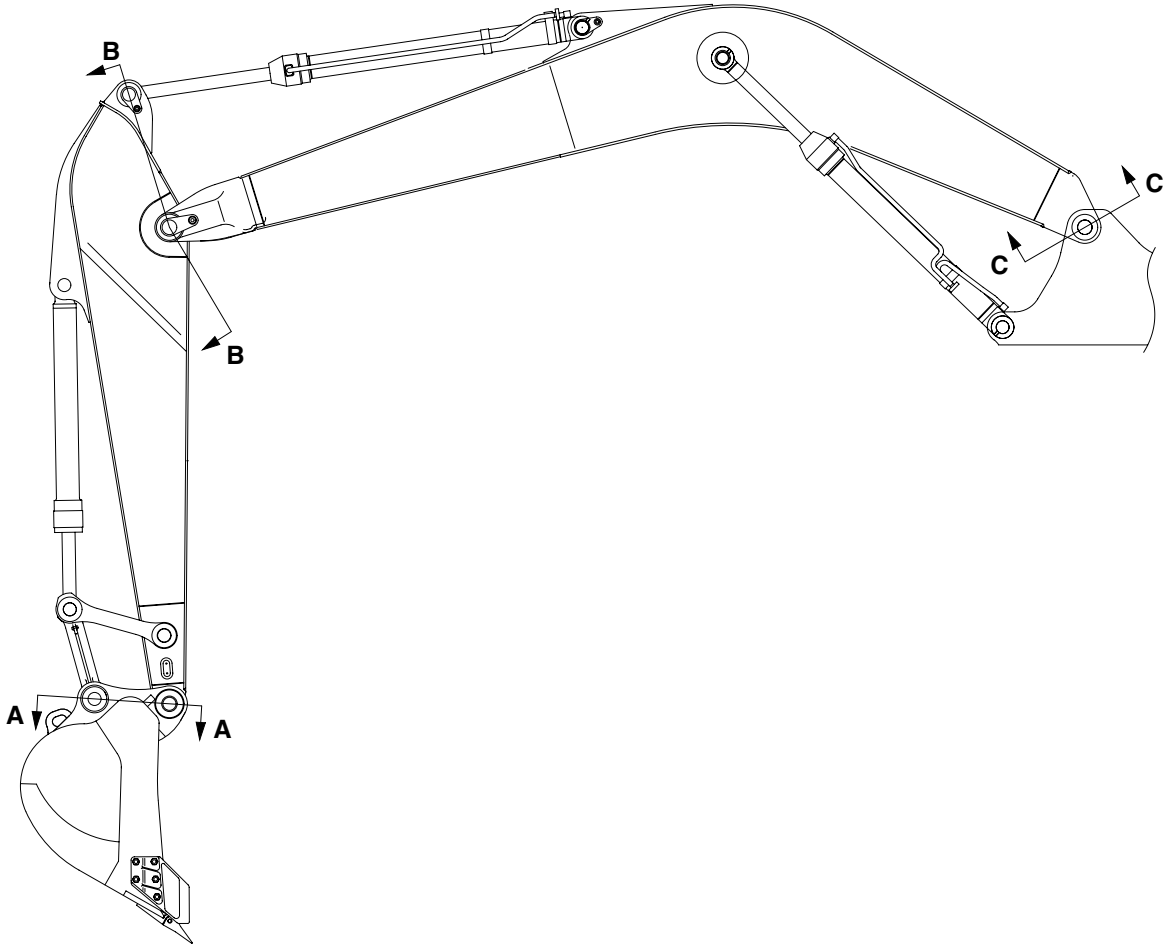
③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

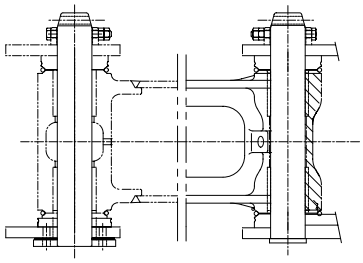
※ Refer to the table of tightening torque.



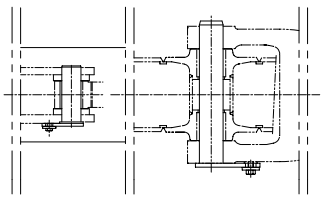



## 1. STRUCTURE

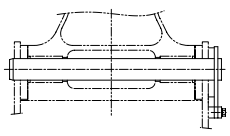


SECTION A



SECTION B



SECTION C

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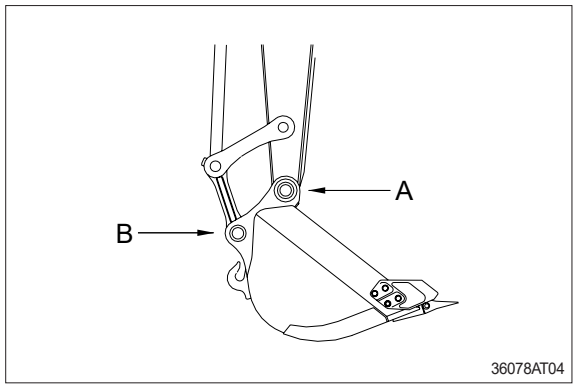
## 2. REMOVAL AND INSTALL

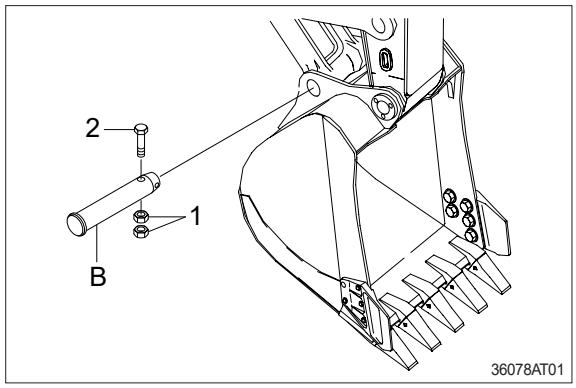
### 1) BUCKET ASSEMBLY

#### (1) Removal

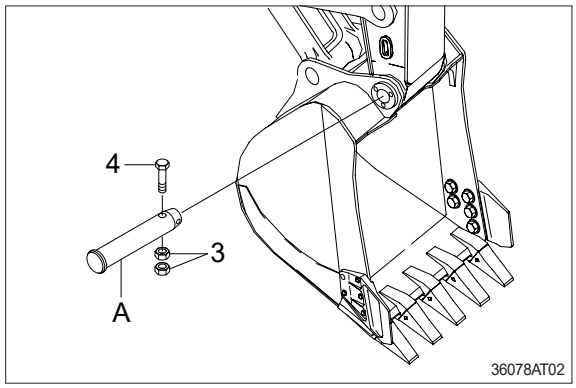
① Lower the work equipment completely to ground with back of bucket facing down.




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




③ Remove nut (3), bolt (4) and draw out the pin (A) then remove the bucket assembly.
· Weight : 480 kg (1060 lb)

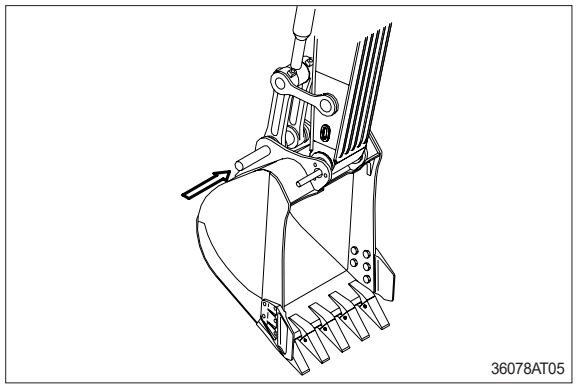



#### (2) Install

① Carry out installation in the reverse order to removal.

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

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



## 2) ARM ASSEMBLY

### (1) Removal

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

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

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

② Disconnect bucket cylinder hose (1).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**

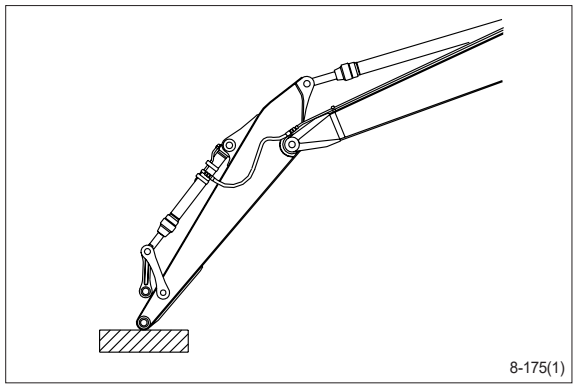
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

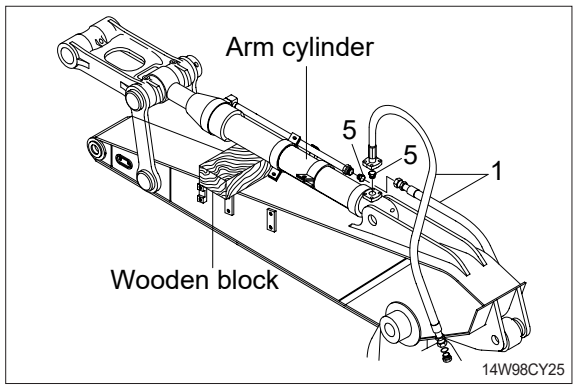
※ Tie the rod with wire to prevent it from coming out.

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

※ · Weight : 385 kg (850 lb)
When lifting the arm assembly, always lift the center of gravity.


8-175(1)



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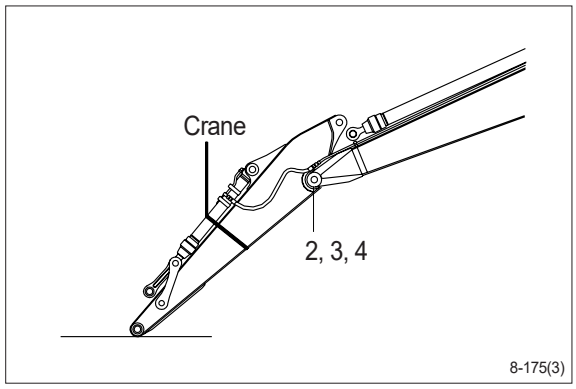

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### (2) Install

① Carry out installation in the reverse order to removal.

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

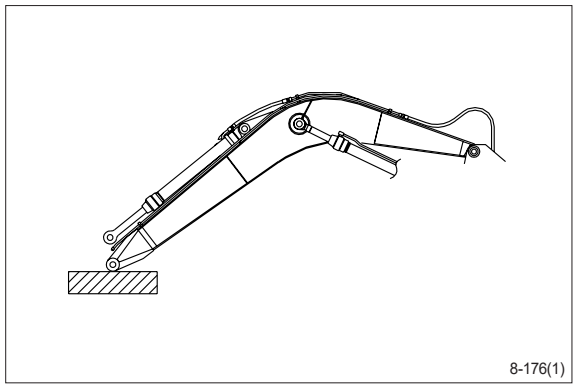
※ Bleed the air from the cylinder.

### 3) BOOM CYLINDER

#### (1) Removal

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

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

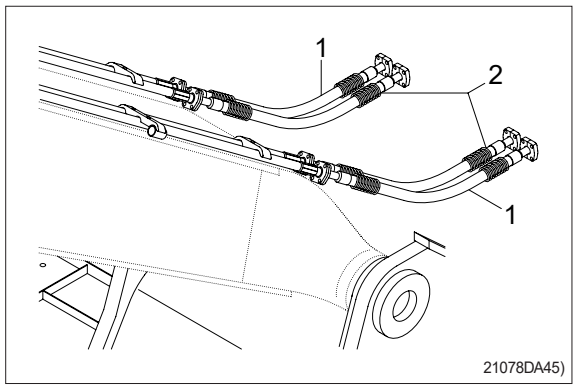



③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

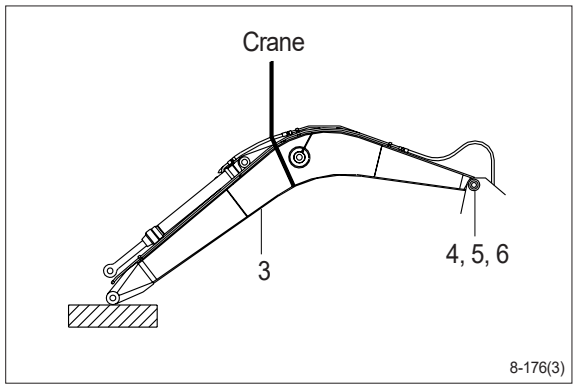
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).




⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight :760 kg (1675 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.