

# SECTION 5 STEERING SYSTEM



Group 1 Structure and function ..... 5-1

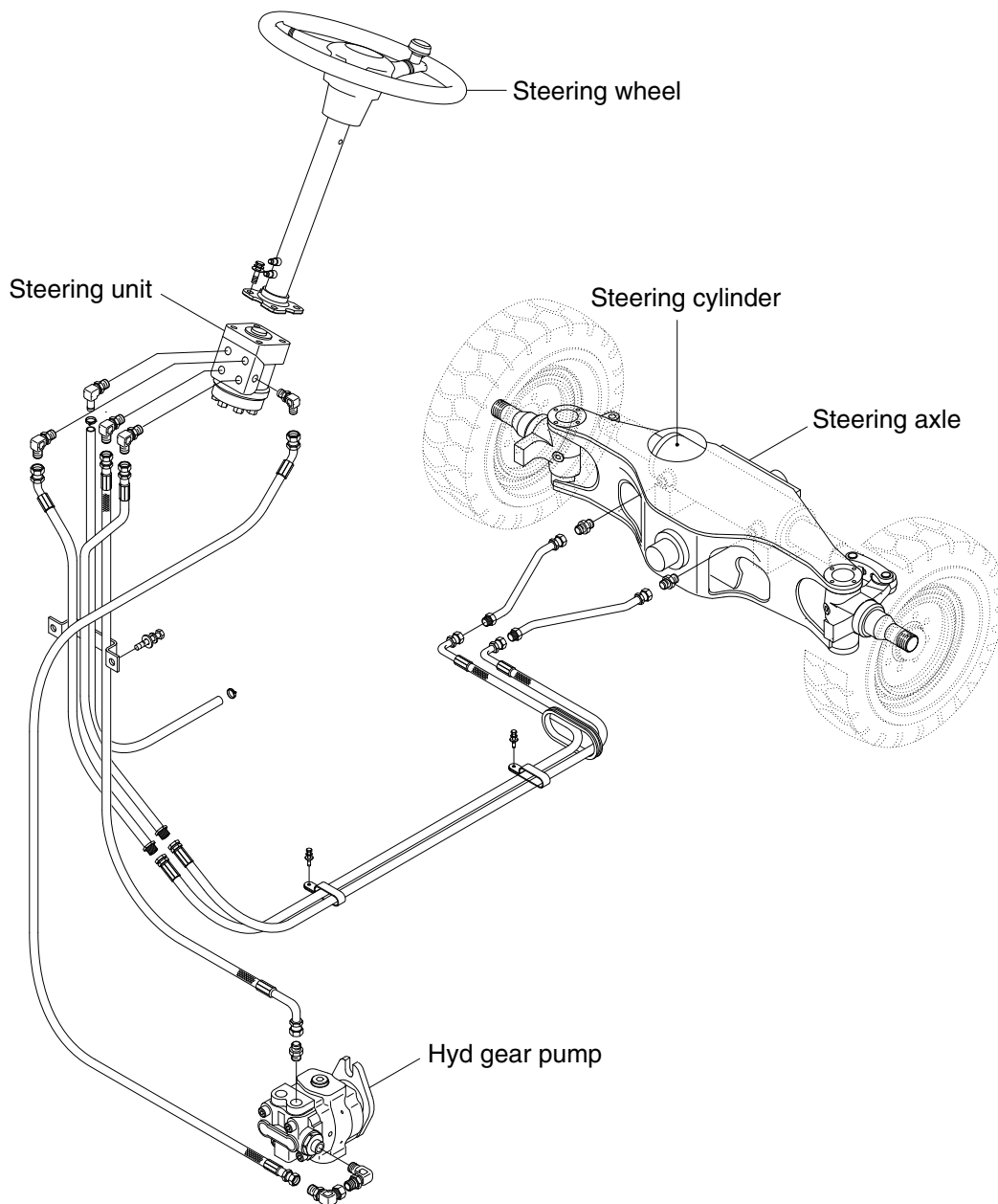
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# SECTION 5 STEERING SYSTEM

## GROUP 1 STRUCTURE AND FUNCTION

### 1. OUTLINE

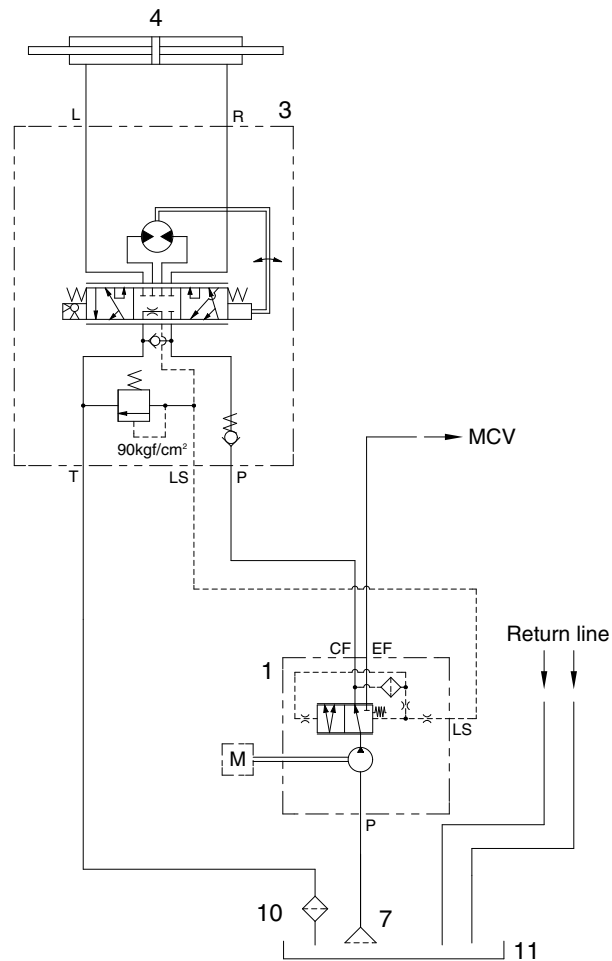


22B9SS01

The steering system for this machine is composed of steering wheel assembly, steering unit, steering cylinder, steering axle and pipings. The steering force given to the steering wheel enters the steering unit through the steering column. The required oil flow is sensed by the function of the control section of the unit, and pressurized oil delivered from the hydraulic pump is fed to the steering cylinder. The force produced by the steering cylinder moves the knuckle of steering tires through the intermediate link.

The axle body is unit structure having steering knuckles installed to its both ends by means of king pins. Hub and wheel are mounted through bearing to spindle of knuckle.

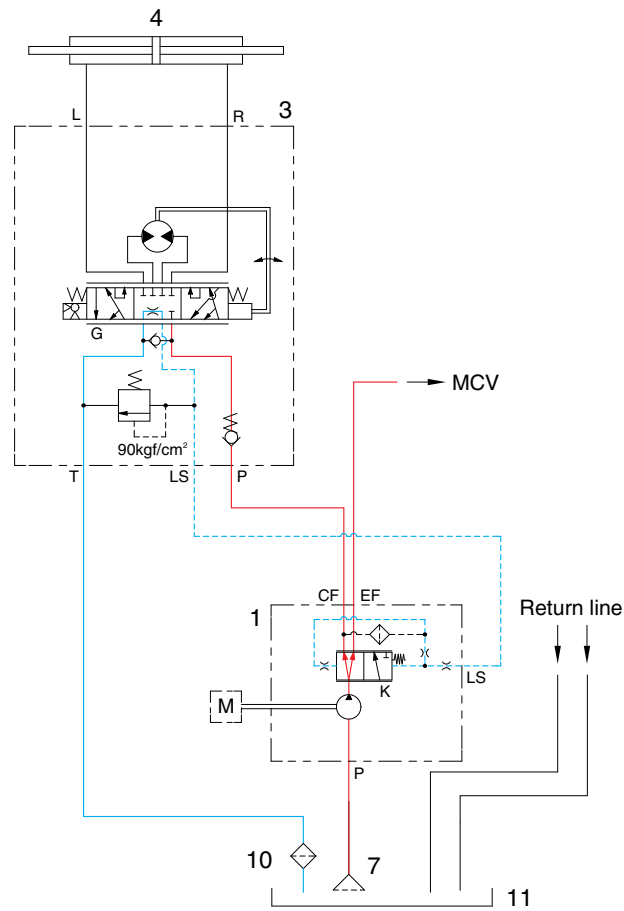
## 2. HYDRAULIC CIRCUIT



22B9SS02

- |   |   |    |                    |
|---|---|----|--------------------|
| 1 | Hydraulic gear pump with priority valve | 7  | Suction strainer   |
| 3 | Steering unit                           | 10 | Return filter      |
| 4 | Steering cylinder                       | 11 | Hydraulic oil tank |

## 1) NEUTRAL

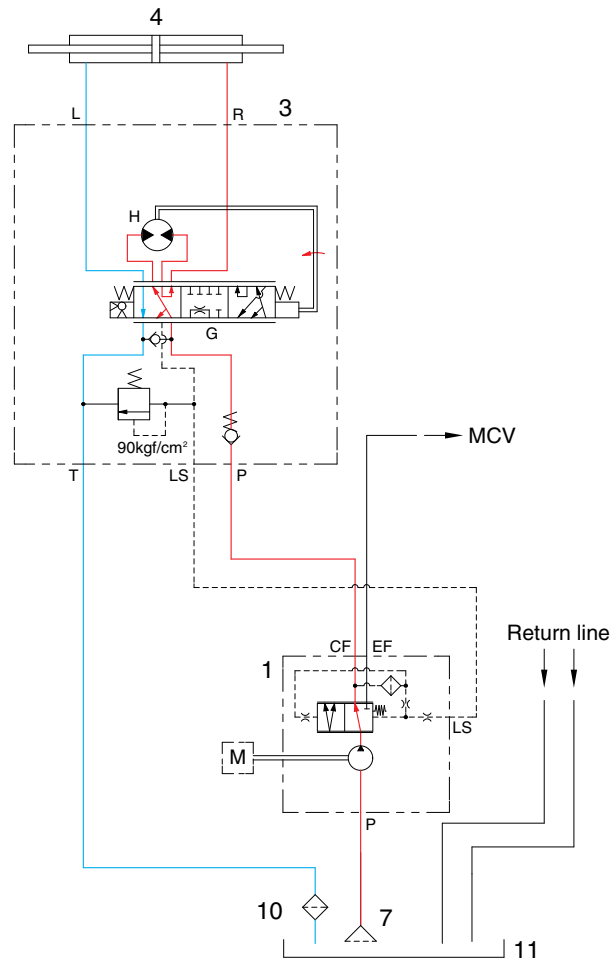


22B9SS03

The steering wheel is not being operated so control spool (G) does not move.

The oil from hydraulic tank (11) enters to hydraulic gear pump (1) and pressurized so that the oil flows into the inlet port (P) of steering unit (3) and the spool (K) moves to the right. Most of pump oil flows to MCV through the EF port and partially flows into the hydraulic tank (11) through the spool (K).

## 2) LEFT TURN



22B9SS04

When the steering wheel is turned to the left, the spool (G) within the steering unit (3) connected with steering column turns in left hand direction.

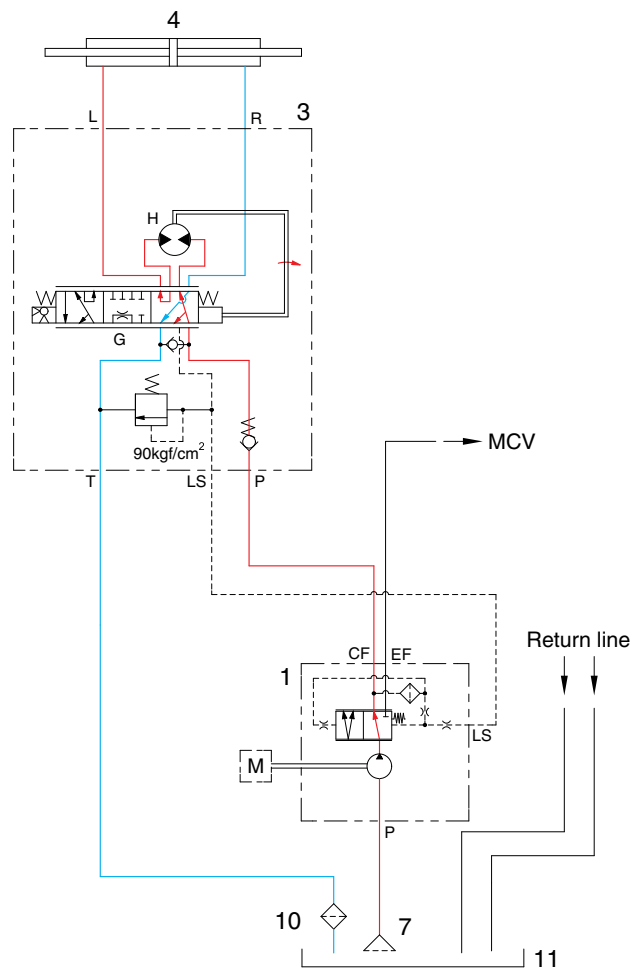
As this time, the oil discharged from hydraulic gear pump (1) flows into the spool (G) of the steering unit(3) through the inlet port (P) and flows to gerotor (H).

Oil flow from the gerotor flows back into the spool (G) where it is directed out to the left work port (L).

Oil returned from cylinder (4) returns to hydraulic tank (11).

When the above operation is completed, the machine turns to the left.

### 3) RIGHT TURN



22B9SS05

When the steering wheel is turned to the right, the spool (G) within the steering unit (3) connected with steering column turn in right hand direction.

As this time, the oil discharged from hydraulic gear pump (1) flows into the spool (G) of the steering unit (3) through the inlet port (P) and flows to gerotor (H).

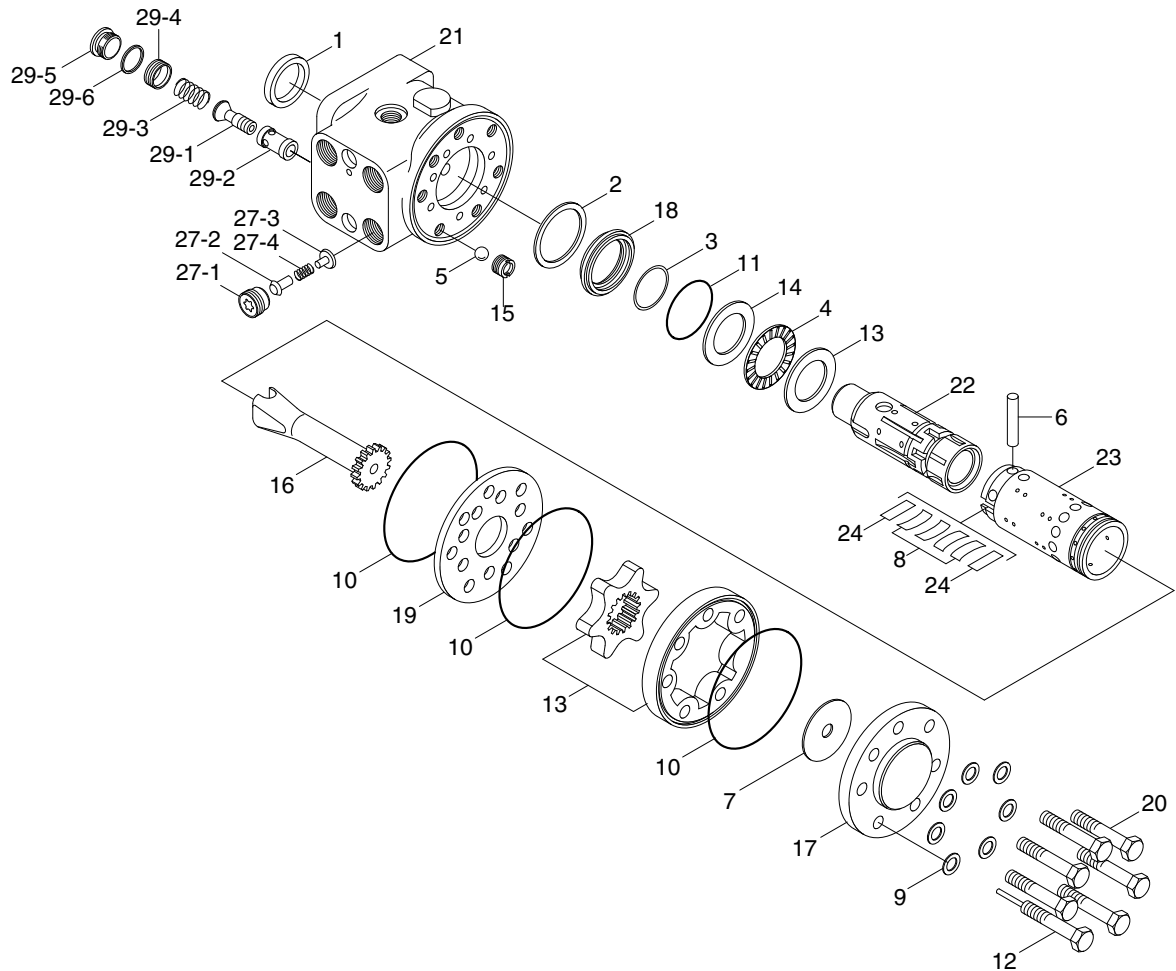
Oil flow from the gerotor flows back into the spool (G) where it is directed out to the right work port (R).

Oil returned from cylinder (4) returns to hydraulic tank (11).

When the above operation is completed, the machine turns to the right.

### 3. STEERING UNIT

#### 1) STRUCTURE



22B7SS08

- |                    |                  |                       |
|--------------------|------------------|-----------------------|
| 1 Dust seal        | 13 Gerotor set   | 27 P-port check valve |
| 2 Retaining seal   | 14 Bearing race  | 27-1 Plug             |
| 3 Cap seal         | 15 Bore screw    | 27-2 Poppet           |
| 4 Thrust bearing   | 16 Drive         | 27-3 Spring seat      |
| 5 Ball             | 17 End cap       | 27-4 Spring           |
| 6 Pin              | 18 Gland bushing | 29 Relief valve       |
| 7 Spacer           | 19 Plate         | 29-1 Spool            |
| 8 Centering spring | 20 Cap screw     | 29-2 Bushing          |
| 9 Washer           | 21 Housing       | 29-3 Spring           |
| 10 O-ring          | 22 Spool         | 29-4 Spring seat      |
| 11 O-ring          | 23 Sleeve        | 29-5 Plug             |
| 12 Rolled screw    | 24 Plate spring  | 29-6 O-ring           |

## 2) OPERATION

The steering unit is composed of the control valve(rotary valve) and the metering device. The control valve controls the flow of oil from the pump in the interior of the unit depending on the condition of the steering wheel. The metering device is a kind of hydraulic motor composed of a stator and a rotor. It meters the required oil volume, feeds the metered oil to the power cylinder and detects cylinder's motion value, that is, cylinder's motion rate.

When the steering wheel is turned, the spool turns, the oil path is switched and the oil is fed into the metering device. As a result, the rotor is caused to run by oil pressure, and the sleeve is caused to run through the drive shaft and cross pin. Therefore, when the spool is turned, the spool turns by the same value in such a manner that it follows the motion of the spool. Steering motion can be accomplished when this operation is performed in a continuous state.

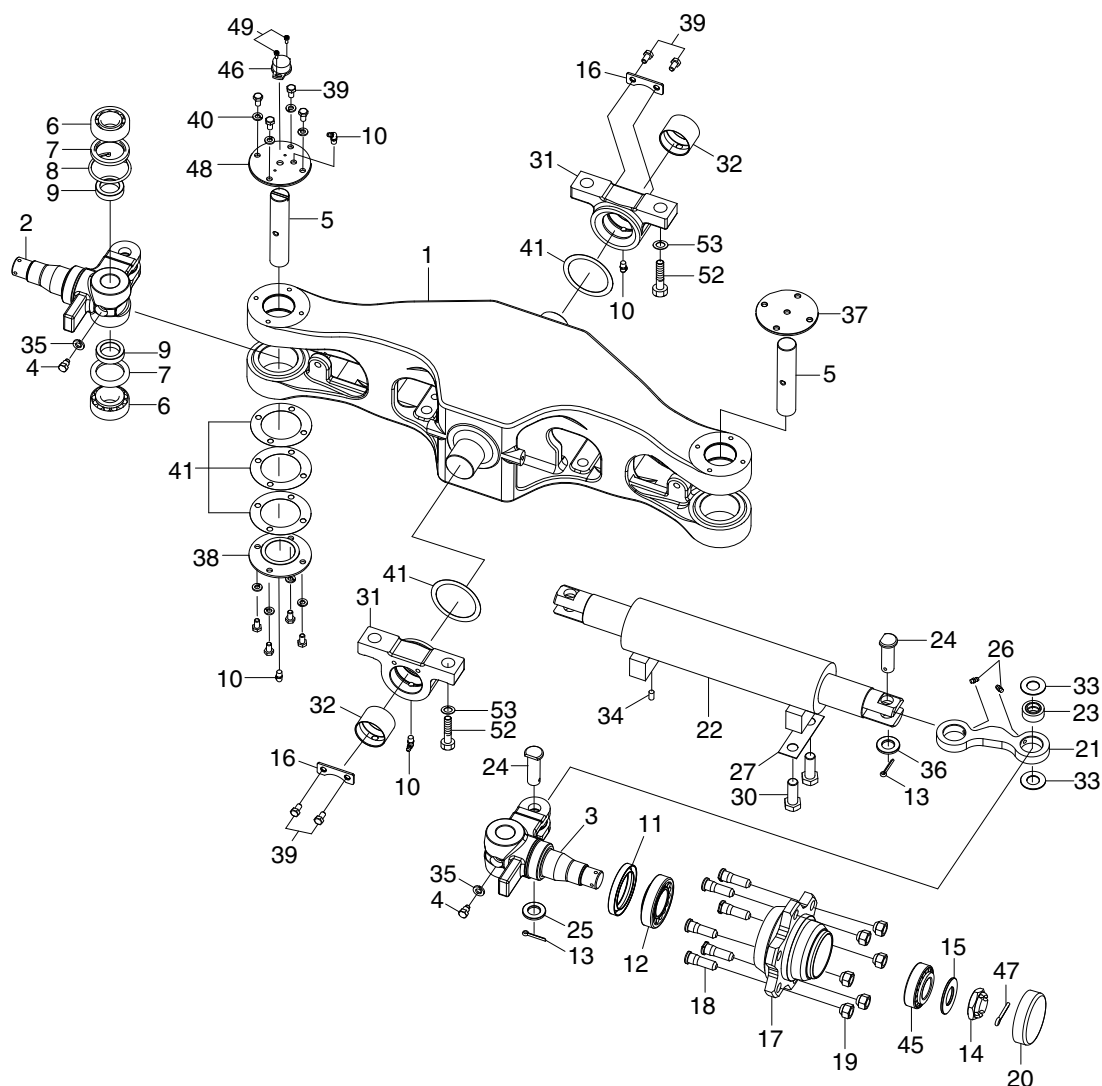
**▲ If the hoses of the steering system are incorrectly connected, the steering wheel can turn very rapidly when the key switch is ON. Keep clear of the steering wheel when the key switch is ON.**

The centering spring for the spool and sleeve is provided to cause the valve to return to the neutral position. It is therefore possible to obtain a constant steering feeling, which is transmitted to the hands of the driver. Return to the center position occurs when the steering wheel is released.



## 4. STEERING AXLE

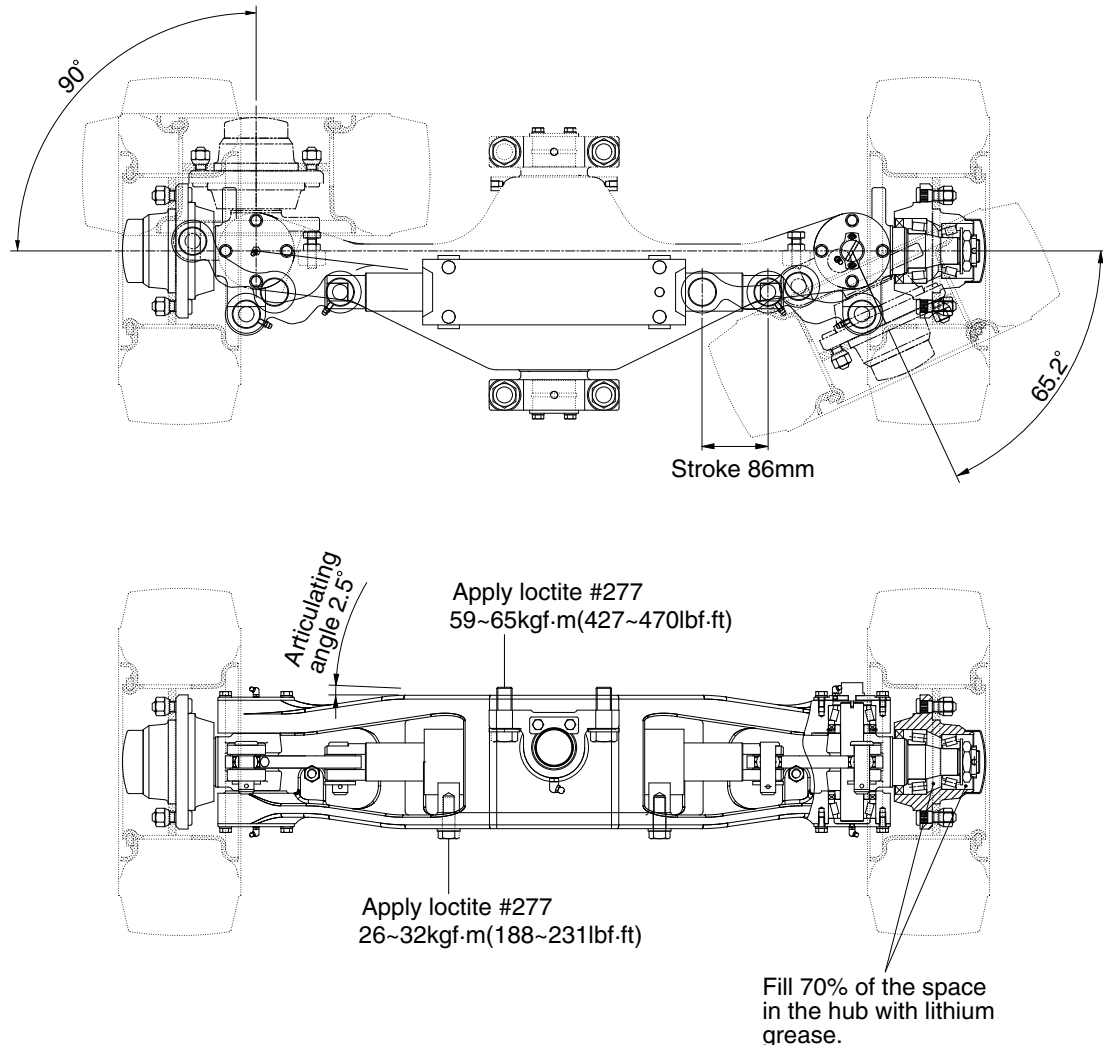
### 1) STRUCTURE



22B9SS06

1	Steering axle body	17	Hub	35	Spring washer
2	Knuckle-RH	18	Hub bolt	36	Hardened washer
3	Knuckle-LH	19	Hub nut	37	Upper cover
4	Bolt	20	Hub cap	38	Lower cover
5	King pin	21	Steering link	39	Hex bolt
6	Taper roller bearing	22	Steering cylinder assy	40	Spring washer
7	Oil seal	23	SPH plain bearing	41	Shim
8	Snap ring	24	Steering link pin	45	Taper roller bearing
9	Collar	25	Plain washer	46	Potentiometer assy
10	Grease nipple	26	Grease nipple	47	Split pin
11	Oil seal	27	Lock plate	48	Cover
12	Taper roller bearing	30	Hex bolt	49	W/Washer bolt
13	Split pin	31	Trunnion block	52	Hex bolt
14	Slotted nut	32	Bushing	53	Hardened washer
15	Washer	33	Thrust washer		
16	Plate	34	Pin		

## 2) TIGHTENING TORQUE AND SPECIFICATION

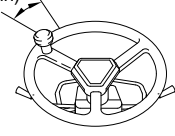


22B7SS07

Type	Unit	Center pin support single shaft
Max steering angle of wheels(Inside/Outside)	degree	90/65.2
Tread(Front/Rear)	mm(in)	993(39.1)/980(38.6)

## GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

### 1. OPERATIONAL CHECKS

Check item	Checking procedure
<b>Steering wheel</b> 30-60mm (1.2-2.4 in) 	<ul style="list-style-type: none"> <li>Set rear wheels facing straight forward, then turn steering wheel to left and right. Measure range of steering wheel movement before rear wheel starts to move. Range should be 30~60mm at rim of steering wheel. If play is too large, adjust at gear box.</li> <li>Test steering wheel play with forklift stopped.</li> </ul>
<b>Knuckle</b>	<ul style="list-style-type: none"> <li>Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear.</li> </ul>
<b>Steering axle</b>	<ul style="list-style-type: none"> <li>Ask assistant to drive machine at minimum turning radius.</li> <li>Fit bar and a piece of chalk at outside edge of counterweight to mark line of turning radius.</li> <li>Min turning radius(Outside) : Refer to page 1-5(Specifications)</li> </ul>
<b>Hydraulic pressure of power steering</b>	Remove cap from check port of priority valve and install oil pressure gauge. Turn steering wheel fully and check oil pressure. ※ Oil pressure : 90 kgf/cm <sup>2</sup> (1286 psi)

### 2. TROUBLESHOOTING

#### 1) STEERING SYSTEM

Problem	Cause	Remedy
Steering wheel drags.	<ul style="list-style-type: none"> <li>Low oil pressure.</li> <li>Bearing faulty.</li> <li>Spring spool faulty.</li> <li>Reaction plunger faulty.</li> <li>Ball-and-screw assembly faulty.</li> <li>Sector shaft adjusting screw excessively tight.</li> <li>Gears poorly meshing.</li> <li>Flow divider coil spring fatigued.</li> </ul>	<ul style="list-style-type: none"> <li>Check lockout. Repair.</li> <li>Clean or replace.</li> <li>Clean or replace.</li> <li>Replace.</li> <li>Clean or replace.</li> <li>Adjust.</li> <li>Check and correct meshing.</li> <li>Replace.</li> </ul>
Steering wheel fails to return smoothly.	<ul style="list-style-type: none"> <li>Bearing faulty.</li> <li>Reaction plunger faulty.</li> <li>Ball-and-screw assy faulty</li> <li>Gears poorly meshing.</li> </ul>	<ul style="list-style-type: none"> <li>Clean or replace.</li> <li>Replace.</li> <li>Clean or replace.</li> <li>Check and correct meshing.</li> </ul>

Problem	Cause	Remedy
Steering wheel turns unsteadily. Steering system makes abnormal sound or vibration.	<ul style="list-style-type: none"> <li>• Lockout loosening.</li> <li>• Metal spring deteriorated.</li> <li>• Gear backlash out of adjustment.</li> <li>• Lockout loosening.</li> <li>• Air in oil circuit.</li> </ul>	<ul style="list-style-type: none"> <li>• Retighten.</li> <li>• Replace.</li> <li>• Adjust.</li> <li>• Retighten.</li> <li>• Bleed air.</li> </ul>
Abnormal sound heard when steering wheel is turned fully	Valve <ul style="list-style-type: none"> <li>• Faulty. (Valve fails to open.)</li> </ul> Piping <ul style="list-style-type: none"> <li>• Pipe(from pump to power steering cylinder) dented or clogged.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust valve set pressure and check for specified oil pressure.</li> <li>• Repair or replace.</li> </ul>
Piping makes abnormal sounds.	Oil pump <ul style="list-style-type: none"> <li>• Lack of oil.</li> <li>• Oil inlet pipe sucks air.</li> <li>• Insufficient air bleeding.</li> </ul>	<ul style="list-style-type: none"> <li>• Add oil.</li> <li>• Repair.</li> <li>• Bleed air completely.</li> </ul>
Valve or valve unit makes abnormal sounds.	Oil pump <ul style="list-style-type: none"> <li>• Oil inlet pipe sucks air.</li> </ul> Valve <ul style="list-style-type: none"> <li>• Faulty. (Unbalance oil pressure)</li> </ul> Piping <ul style="list-style-type: none"> <li>• Pipe(from pump to power steering) dented or clogged.</li> <li>• Insufficient air bleeding.</li> </ul>	<ul style="list-style-type: none"> <li>• Repair or replace.</li> <li>• Adjust valve set pressure and check specified oil pressure.</li> <li>• Repair or replace.</li> <li>• Bleed air completely.</li> </ul>
Insufficient or variable oil flow.	<ul style="list-style-type: none"> <li>• Flow control valve orifice clogged.</li> </ul>	<ul style="list-style-type: none"> <li>• Clean</li> </ul>
Insufficient or variable discharge pressure.	Piping <ul style="list-style-type: none"> <li>• Pipe(from tank to pipe) dented or clogged.</li> </ul>	<ul style="list-style-type: none"> <li>• Repair or replace.</li> </ul>
Steering cylinder head leakage (Piston rod)	<ul style="list-style-type: none"> <li>• Packing foreign material.</li> <li>• Piston rod damage.</li> <li>• Rod seal damage and distortion.</li> <li>• Chrome gilding damage.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace</li> <li>• Grind surface with oil stone.</li> <li>• Replace</li> <li>• Grind</li> </ul>
Steering cylinder head thread (A little bit leak is no problem)	<ul style="list-style-type: none"> <li>• O-ring damage.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace</li> </ul>
Welding leakage	<ul style="list-style-type: none"> <li>• Cylinder tube damage.</li> </ul>	<ul style="list-style-type: none"> <li>• Tube replace.</li> </ul>
Rod	<ul style="list-style-type: none"> <li>• Tube inside damage.</li> <li>• Piston seal damage and distortion</li> </ul>	<ul style="list-style-type: none"> <li>• Grind surface with oil store.</li> <li>• Replace</li> </ul>
Piston rod bushing inner diameter excessive gap	<ul style="list-style-type: none"> <li>• Bushing wear.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace</li> </ul>

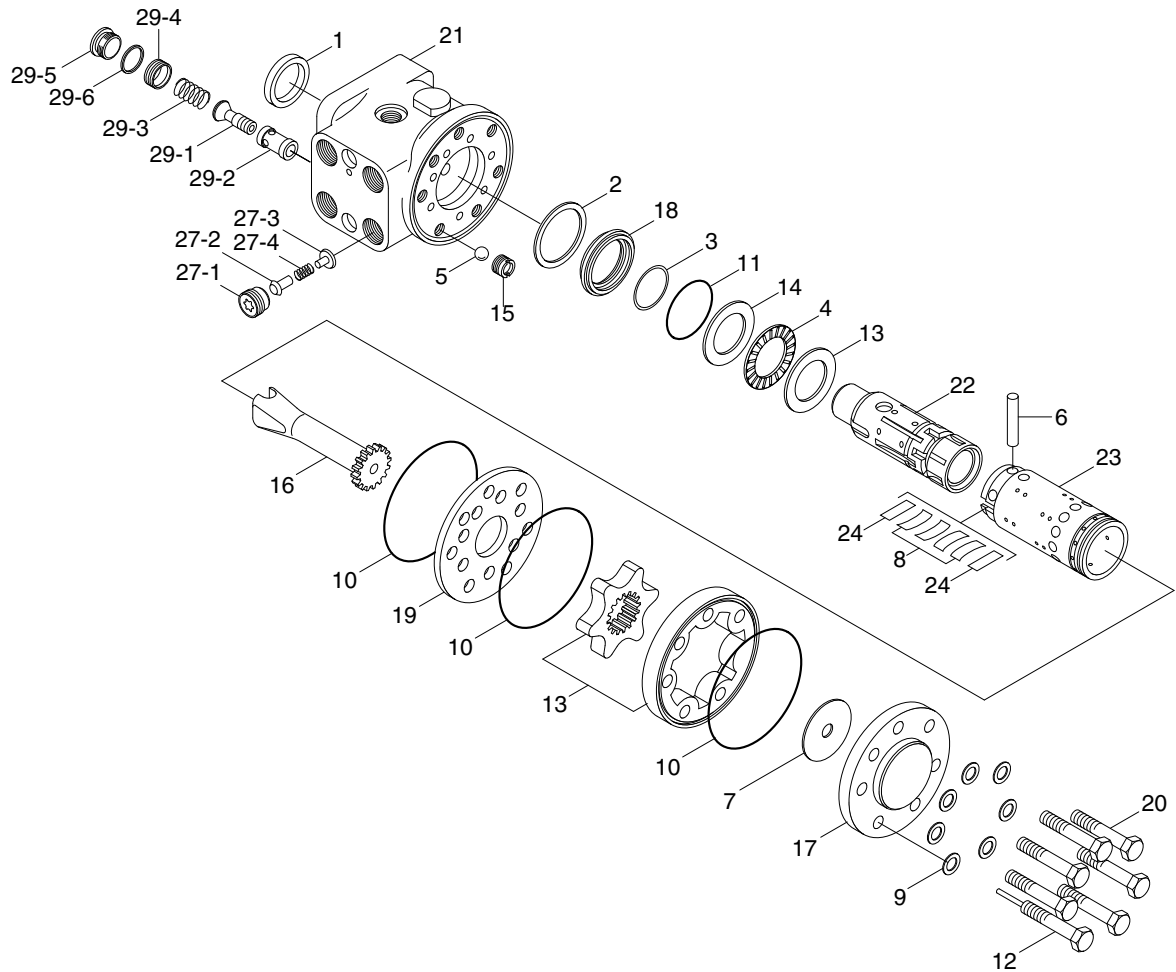
## 2) POWER STEERING UNIT

Problem	Cause	Remedy
Oil leakage	<ul style="list-style-type: none"> <li>• Fittings loose, worn, or damaged.</li> <li>• Deteriorated seals by excessive heat.</li> <li>• Loose screw or its deteriorated sealing.</li> <li>• Internal seals worn or damaged.</li> <li>• Damaged seal grooves.</li> <li>• Housing crack.</li> </ul>	<ul style="list-style-type: none"> <li>• Check and replace the damaged parts.</li> <li>• Replace the seals.</li> <li>• Replace the sealing and tighten screw appropriately.</li> <li>• Replace it.</li> <li>• Replace the unit or related parts.</li> <li>• Replace the unit.</li> </ul>
Noise or vibration	<ul style="list-style-type: none"> <li>• Air inclusion in the system.</li> <li>• Valve timing error when the unit is assembled.</li> <li>• Hydraulic pipe noise interference.</li> <li>• Control valve damage or clogging.</li> </ul>	<ul style="list-style-type: none"> <li>• Bleed the air.</li> <li>• Correct the timing.</li> <li>• Consult the component manufacturer.</li> <li>• Replace the valve.</li> </ul>
Heavy steering operation	<ul style="list-style-type: none"> <li>• Lack of sufficient oil supply.</li> <li>• Excessive heat.</li> <li>• Broken pump.</li> <li>• Leakage in the line or connections.</li> <li>• Clogged orifice.</li> <li>• High back pressure.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the pump and the line.</li> <li>• Locate the heat source and correct it.</li> <li>• Replace it.</li> <li>• Replace it.</li> <li>• Disassemble, clean, and reassemble it.</li> <li>• Adjust the pressure.</li> </ul>
Irregular or no response	<ul style="list-style-type: none"> <li>• Broken pump.</li> <li>• Excessive heat.</li> <li>• Broken centering spring.</li> <li>• Misalignment with column.</li> <li>• Incorrect piping to the four port.</li> <li>• Parts missing.</li> <li>• High back pressure.</li> <li>• Corrosion on the moving parts.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace it.</li> <li>• Locate the heat source and remove it.</li> <li>• Replace it.</li> <li>• Disassemble and adjust it.</li> <li>• Correct it.</li> <li>• Install the parts correctly.</li> <li>• Adjust the pressure.</li> <li>• Replace it.</li> </ul>

## GROUP 3 DISASSEMBLY AND ASSEMBLY

### 1. STEERING UNIT

#### 1) STRUCTURE

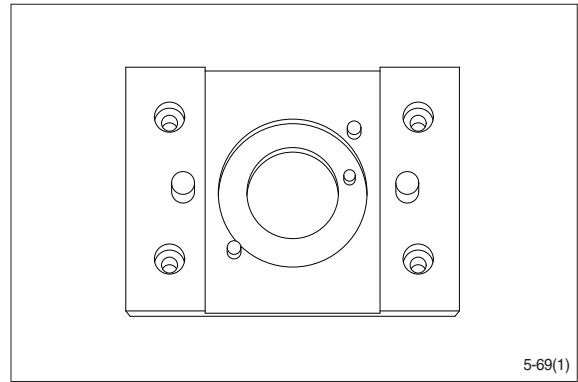


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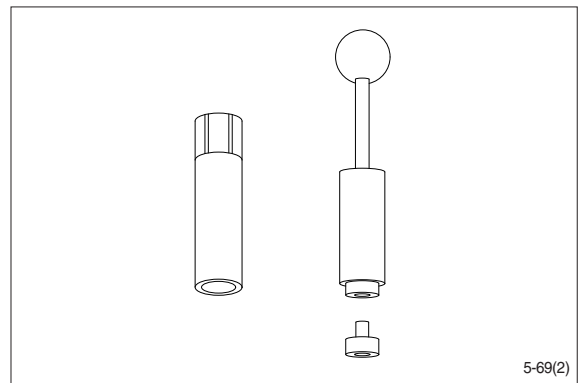
- |                    |                  |                       |
|--------------------|------------------|-----------------------|
| 1 Dust seal        | 13 Gerotor set   | 27 P-port check valve |
| 2 Retaining seal   | 14 Bearing race  | 27-1 Plug             |
| 3 Cap seal         | 15 Bore screw    | 27-2 Poppet           |
| 4 Thrust bearing   | 16 Drive         | 27-3 Spring seat      |
| 5 Ball             | 17 End cap       | 27-4 Spring           |
| 6 Pin              | 18 Gland bushing | 29 Relief valve       |
| 7 Spacer           | 19 Plate         | 29-1 Spool            |
| 8 Centering spring | 20 Cap screw     | 29-2 Bushing          |
| 9 Washer           | 21 Housing       | 29-3 Spring           |
| 10 O-ring          | 22 Spool         | 29-4 Spring seat      |
| 11 O-ring          | 23 Sleeve        | 29-5 Plug             |
| 12 Rolled screw    | 24 Plate spring  | 29-6 O-ring           |

## 2) TOOLS

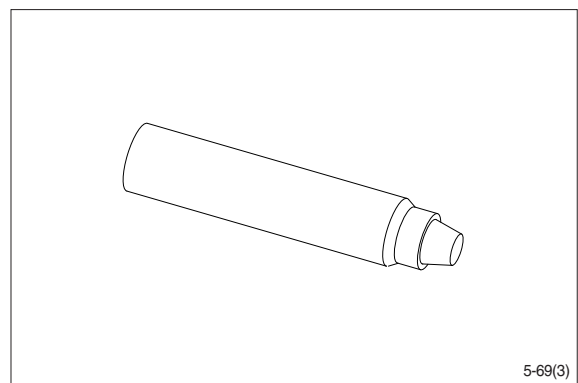
(1) Holding tool.



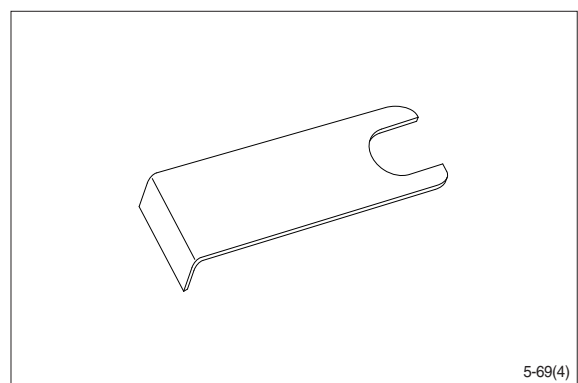
(2) Assembly tool for O-ring and kin-ring.



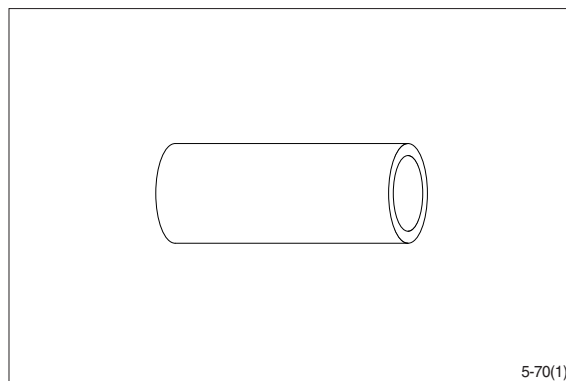
(3) Assembly tool for lip seal.



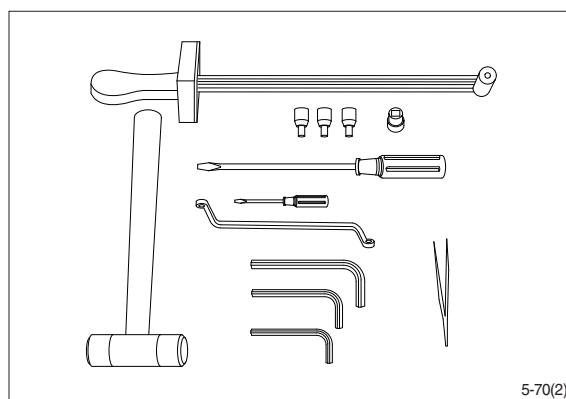
(4) Assembly tool for cardan shaft.



(5) Assembly tool for dust seal.

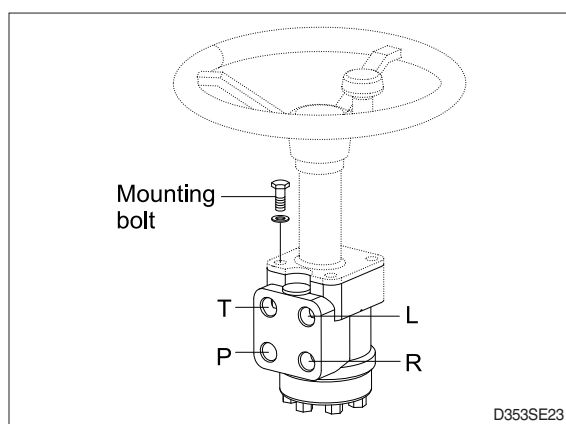


- (6) Torque wrench 0~7.1 kgf · m  
(0~54.4 lbf · ft)  
13 mm socket spanner  
6, 8 mm and 12 mm hexagon sockets  
12 mm screwdriver  
2 mm screwdriver  
13 mm ring spanner  
6, 8 and 12 mm hexagon socket spanners  
Plastic hammer  
Tweezers



### 3) TIGHTENING TORQUE

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

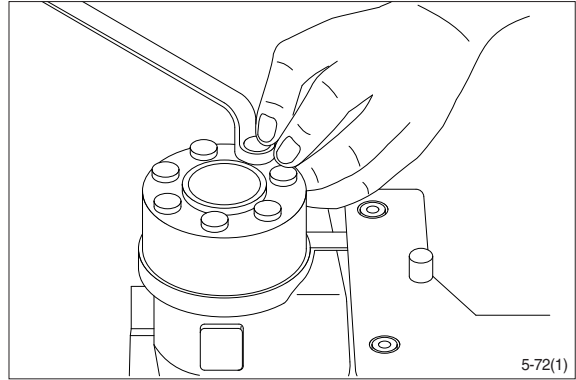


Port	Size	Torque [kgf · m (lbf · ft)]
L	3/4-16 UNF	6.1±0.6 (44.1±4.3)
R	3/4-16 UNF	6.1±0.6 (44.1±4.3)
T	3/4-16 UNF	6.1±0.6 (44.1±4.3)
P	3/4-16 UNF	6.1±0.6 (44.1±4.3)
Mounting bolt	M10×1.5	4.0±0.5 (29±3.6)

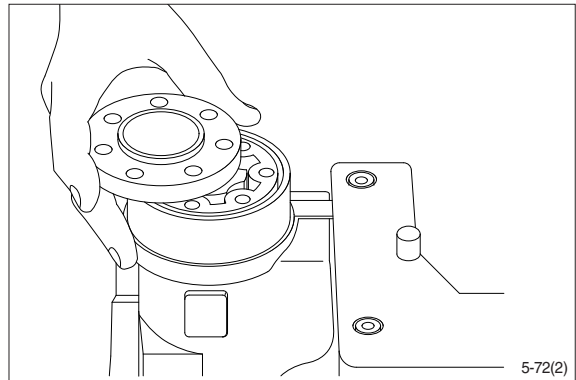


#### 4) DISASSEMBLY

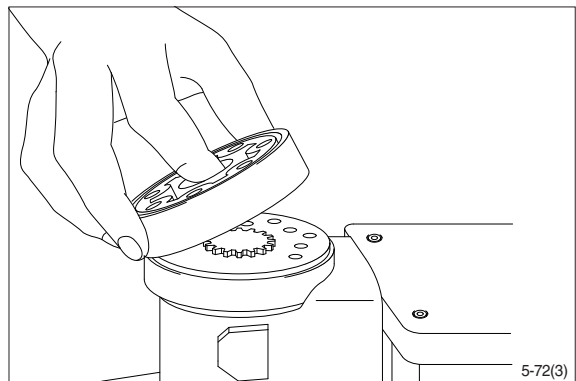
- (1) Disassemble steering column from steering unit and place the steering unit in the holding tool.  
Screw out the screws in the end cover (6-off plus one special screw).



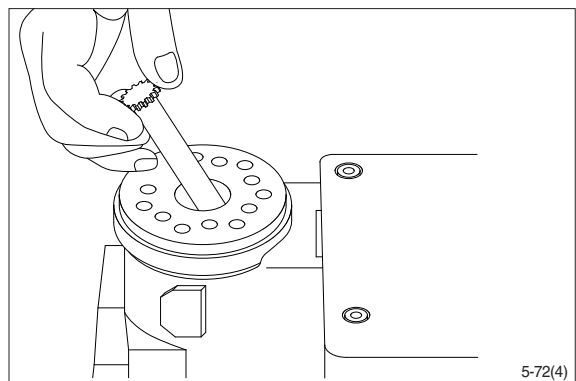
- (2) Remove the end cover, sideways.



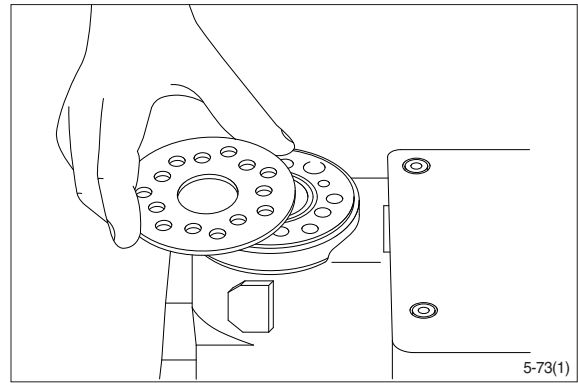
- (3) Lift the gearwheel set (With spacer if fitted) off the unit.  
Take out the two O-rings.



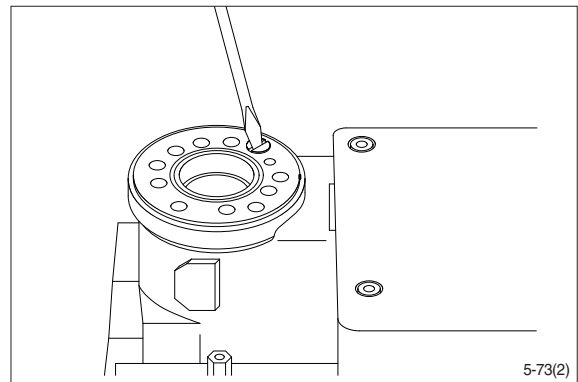
- (4) Remove cardan shaft.



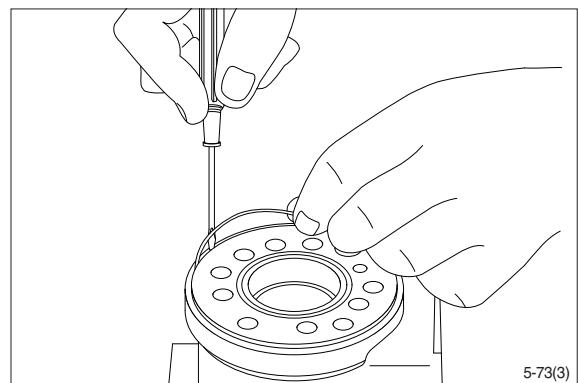
(5) Remove distributor plate.



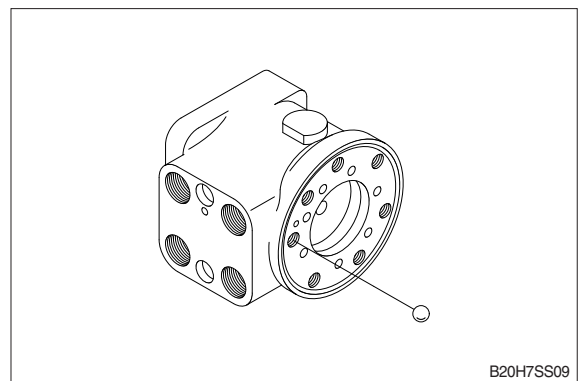
(6) Screw out the threaded bush over the check valve.



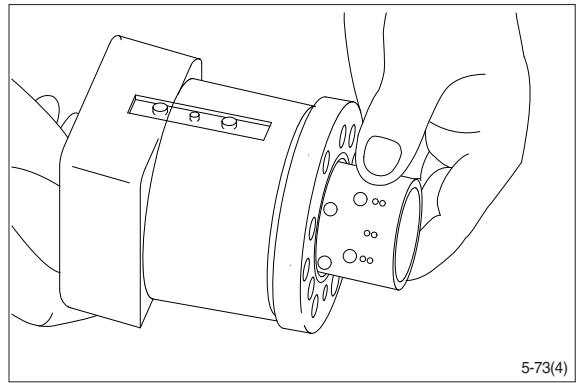
(7) Remove O-ring.



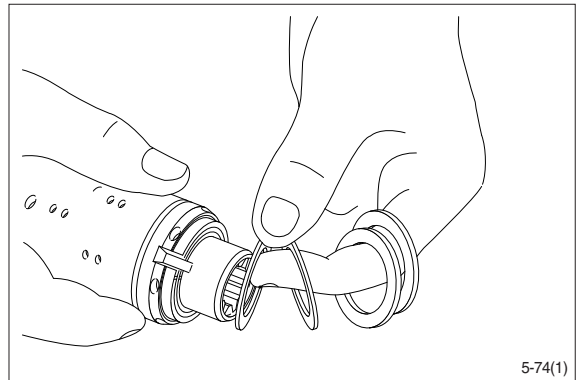
(8) Shake out the check valve ball.



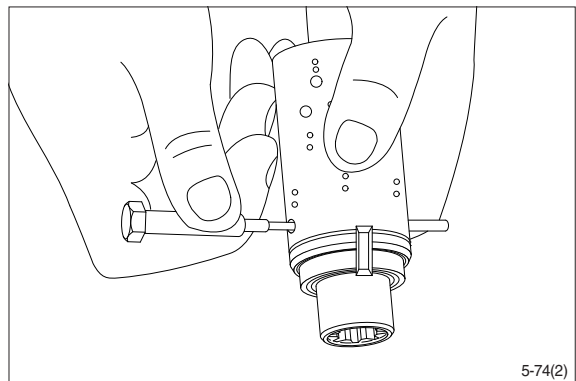
- (9) Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and thrust bearing will be pushed out of the housing together.



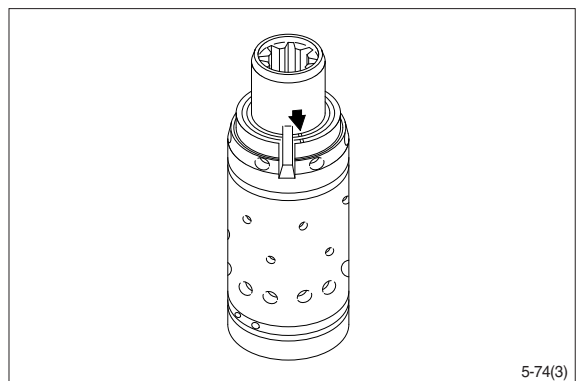
- (10) Take ring, bearing races and thrust bearing from sleeve and spool. The outer (Thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



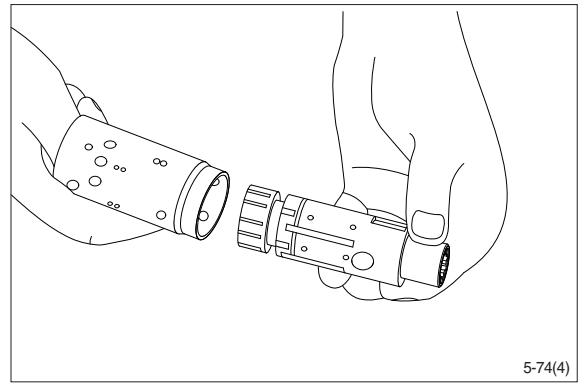
- (11) Press out the cross pin. Use the special screw from the end cover.



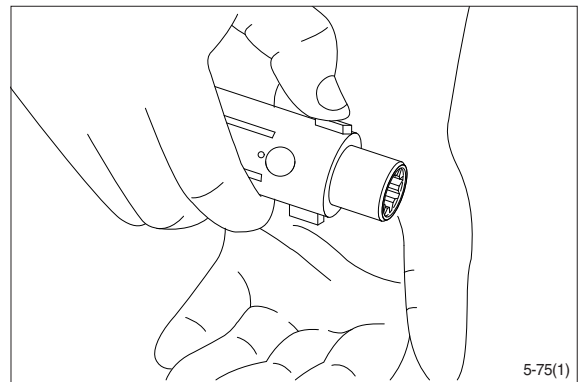
- ※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position springs (See drawing). If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



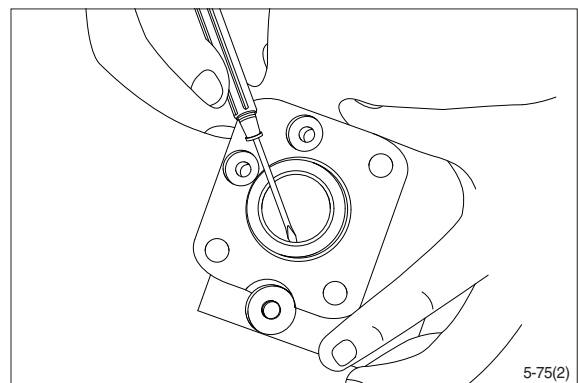
(12) Carefully press the spool out of the sleeve.



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

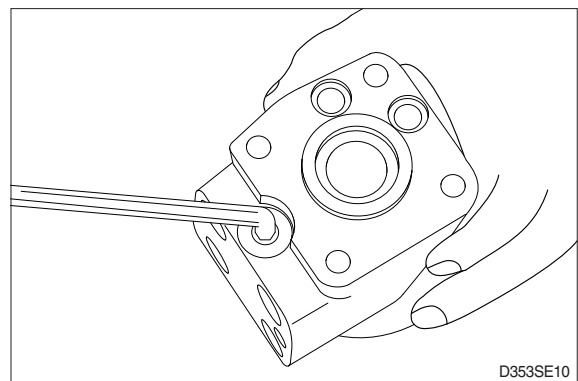


(14) Remove dust seal and O-ring.

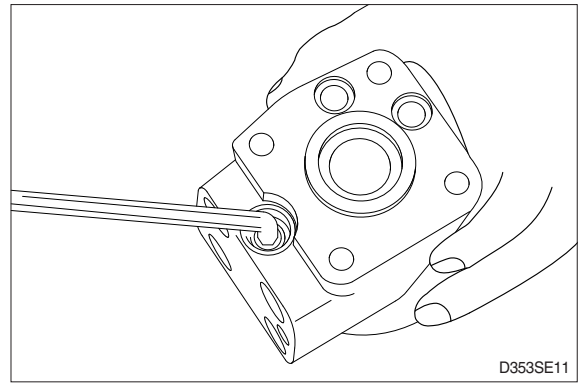


### Disassembling the pressure relief valve

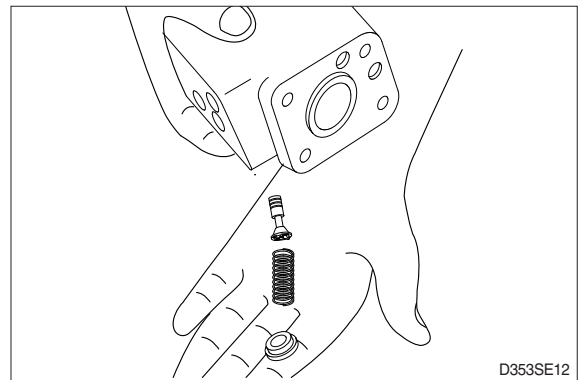
(15) Screw out the plug using an 8mm hexagon socket spanner.  
Remove seal washers.



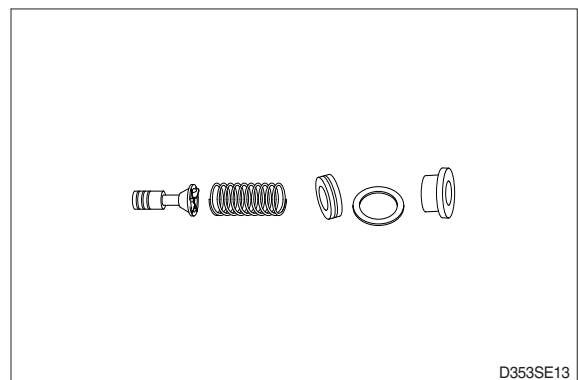
- (16) Unscrew the setting screw using an 8mm hexagon socket spanner.



- (17) Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.



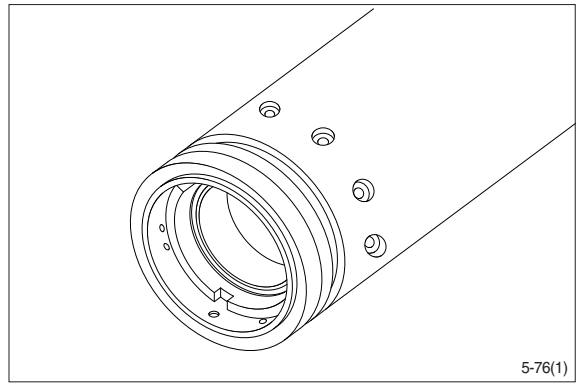
- (18) The pressure relief valve is now disassembled.



## 5) ASSEMBLY

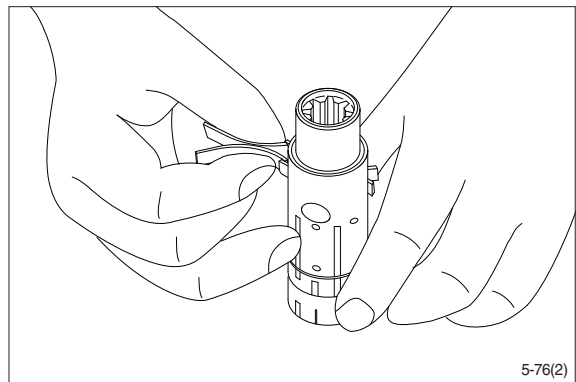
(1) Assemble spool and sleeve.

※ 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.

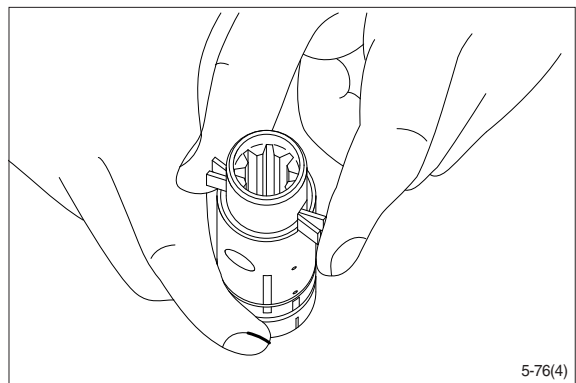


(2) Place the two flat neutral position springs in the slot.

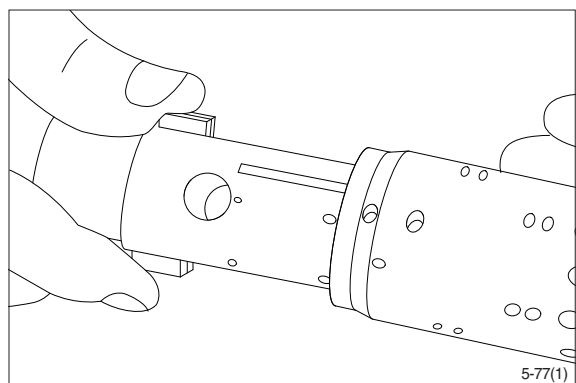
Place the curved springs between the flat ones and press them into place (see assembly pattern).



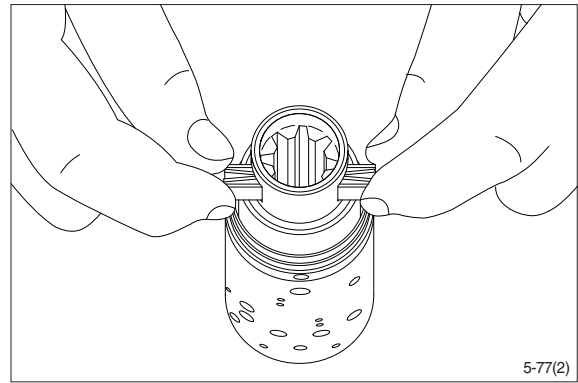
(3) Line up the spring set.



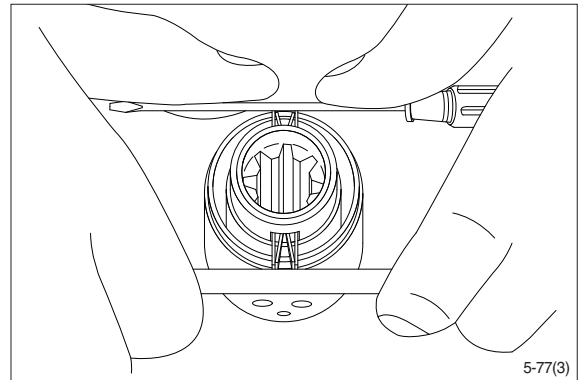
(4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other.



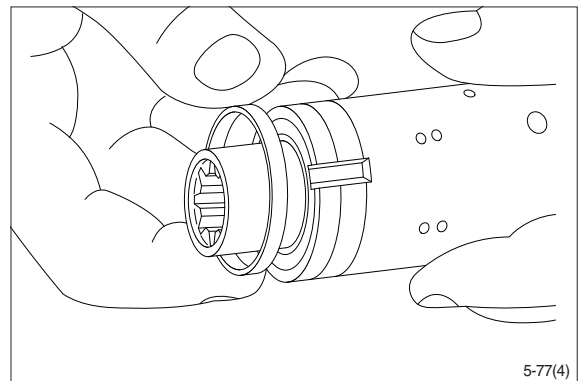
- (5) Press the springs together and push the neutral position springs into place in the sleeve.



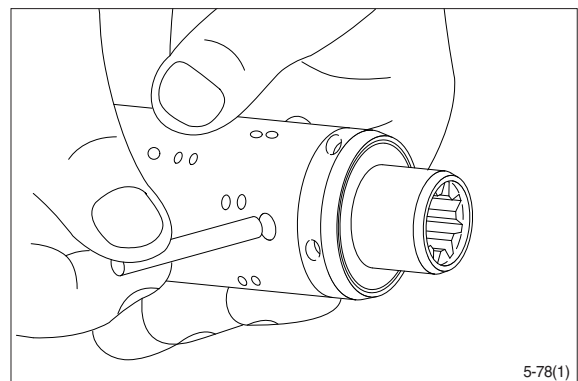
- (6) Line up the springs and center them.



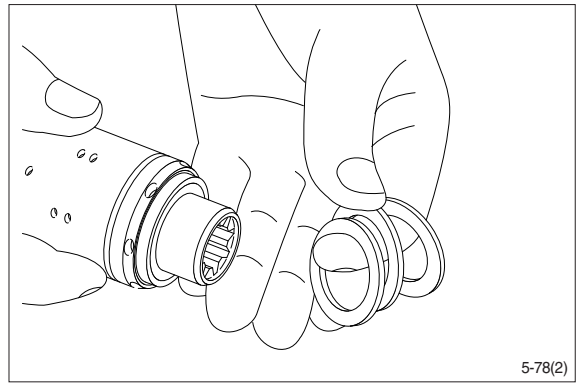
- (7) Guide the ring down over the sleeve.  
※ The ring should be able to rotate free of the springs.



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

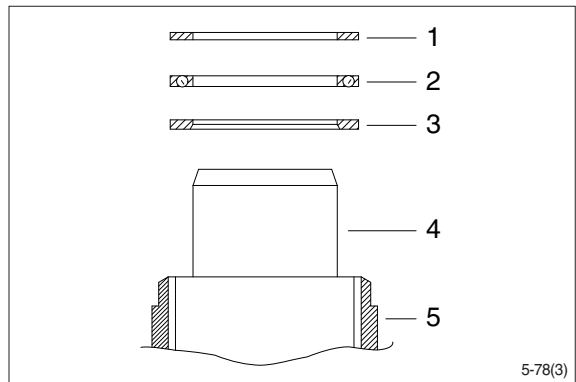


- (9) Fit bearing races and needle bearing as shown on below drawing.



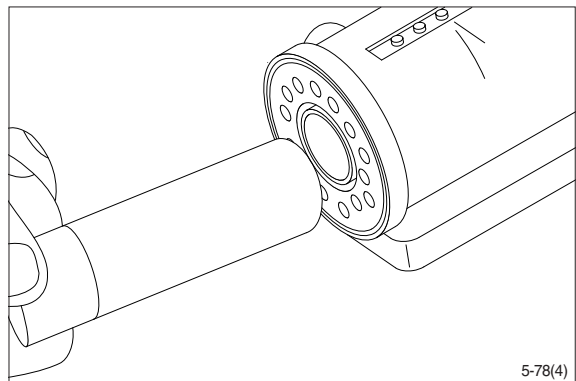
※ **Assembly pattern for standard bearings**

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



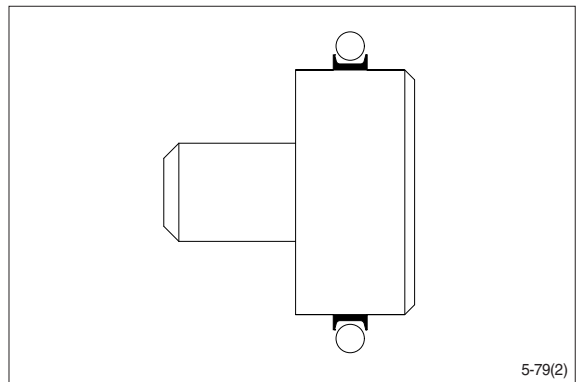
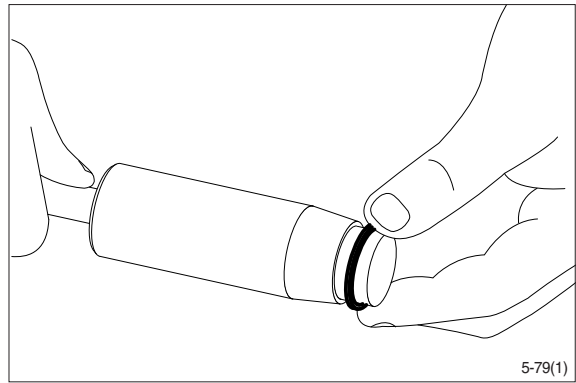
**Installation instruction for O-ring**

- (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.

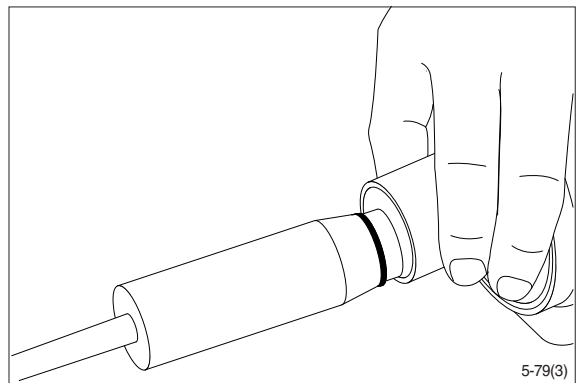




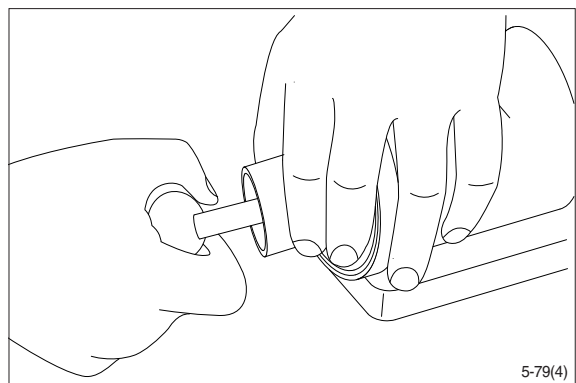
- (11) Grease O-ring with hydraulic oil and place them on the tool.



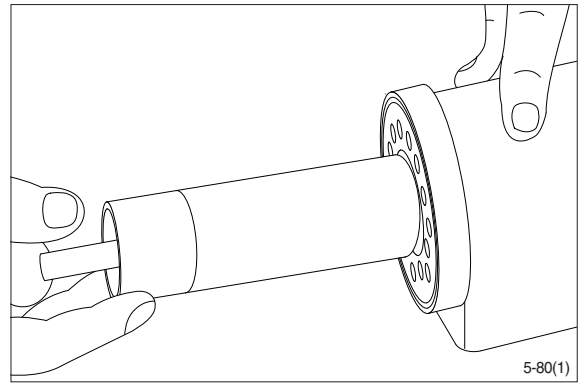
- (12) Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



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

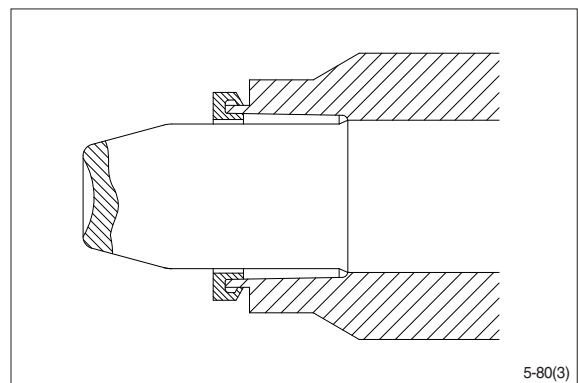
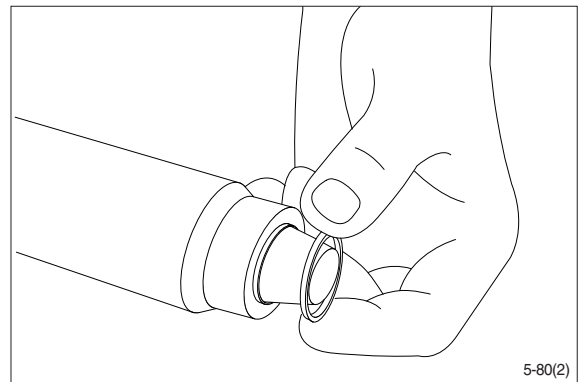


- (14) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.

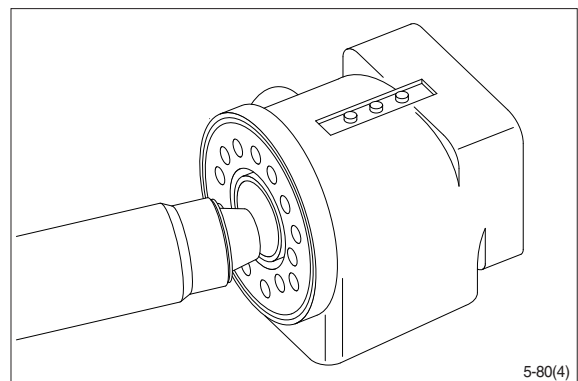


#### Installation instructions for lip seal

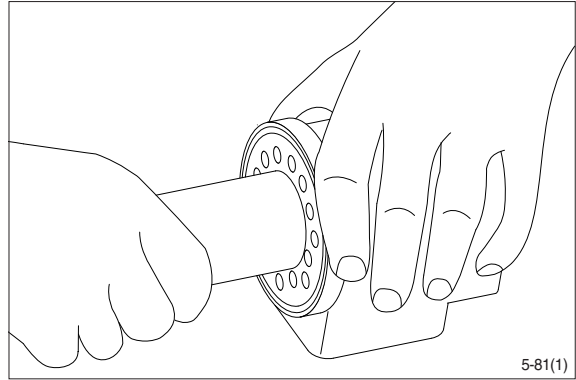
- (15) Lubricate the lip seal with hydraulic oil and place it on the assembly tool.



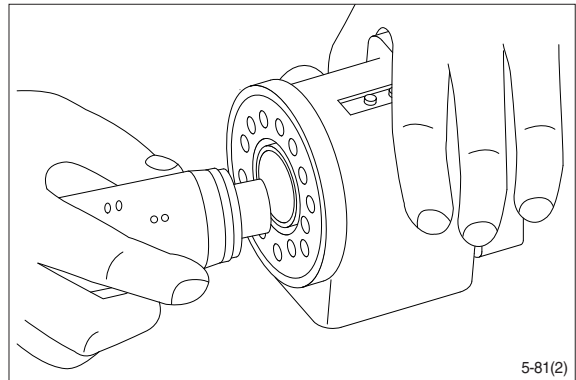
- (16) Guide the assembly tool right to the bottom.



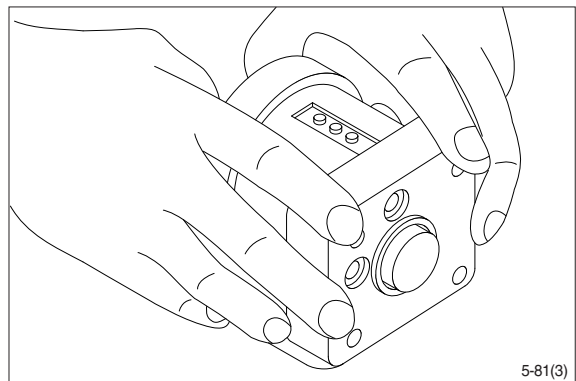
- (17) Press and turn the lip seal into place in the housing.



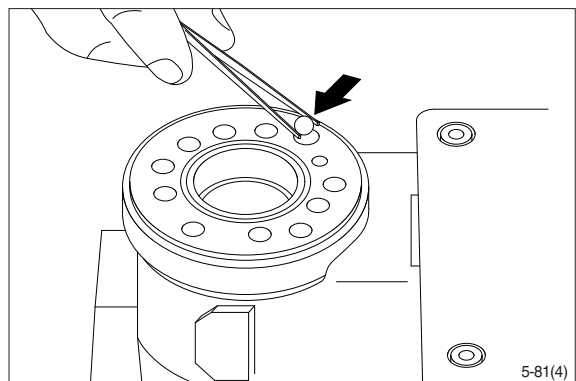
- (18) With a light turning movement, guide the spool and sleeve into the bore.  
※ Fit the spool set holding the cross pin horizontal.



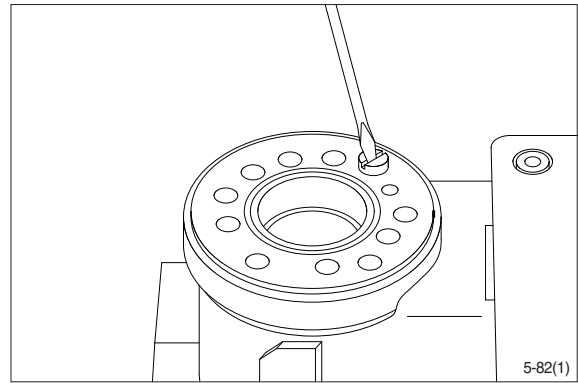
- (19) The spool set will push out the assembly tool guide.  
The O-ring are now in position.



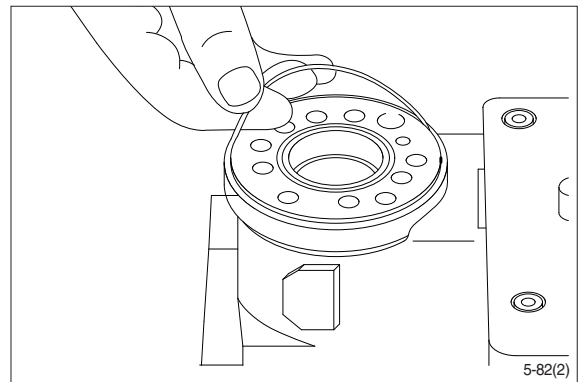
- (20) Turn the steering unit until the bore is vertical again. Put the check valve ball into the hole indicated by the arrow.



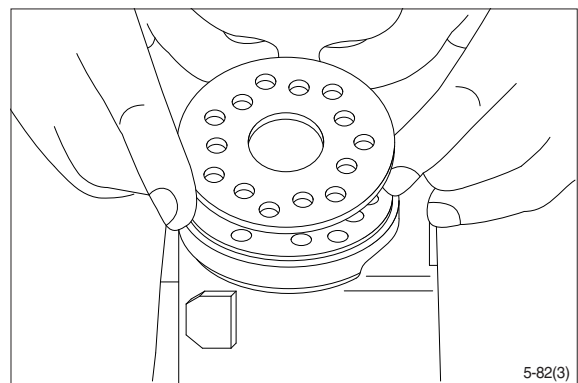
- (21) Screw the threaded bush lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.



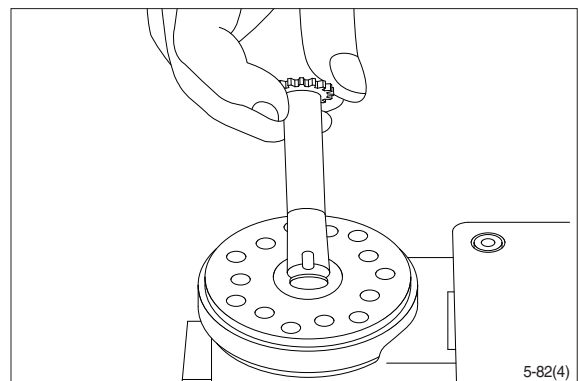
- (22) Grease the O-ring with mineral oil approx. viscosity 500 cSt at 20° C.



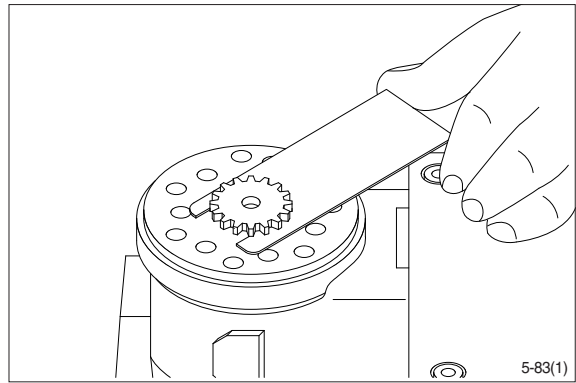
- (23) Place the distributor plate so that the channel holes match the holes in the housing.



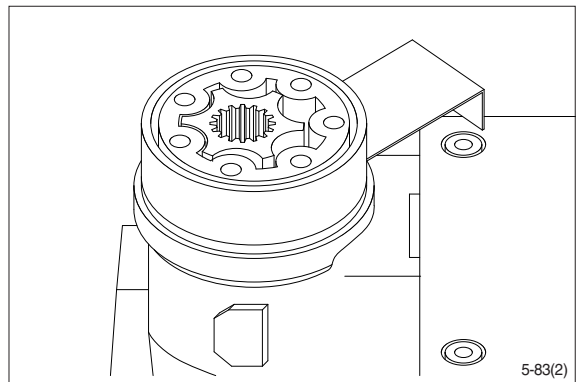
- (24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



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



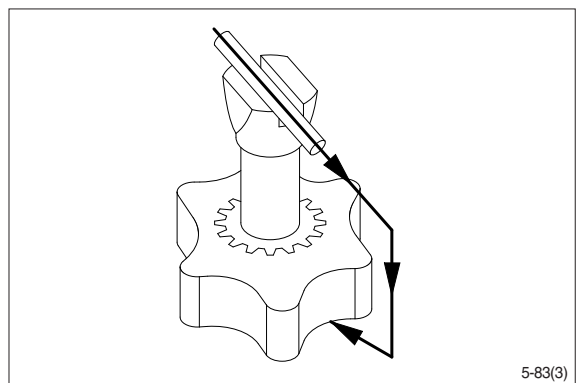
- (26) Grease the two O-rings with mineral oil approx. viscosity 500 cSt at 20° C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



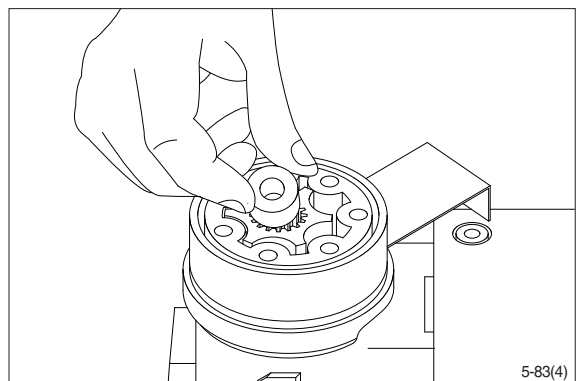
**(27) Important**

Fit the gearwheel (Rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown.

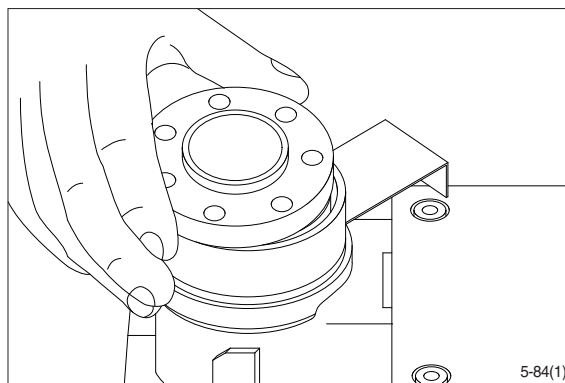
Turn the gear rim so that the seven through holes match the holes in the housing.



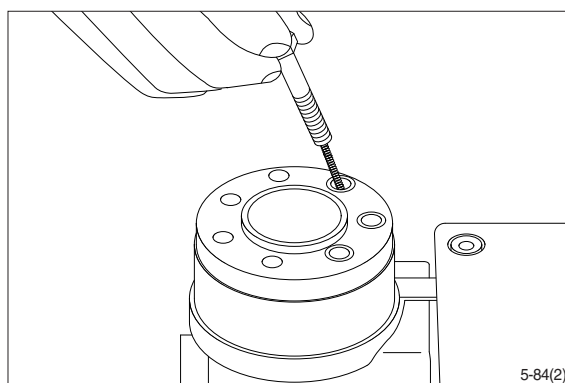
- (28) Fit the spacer, if any.



(29) Place the end cover in position.

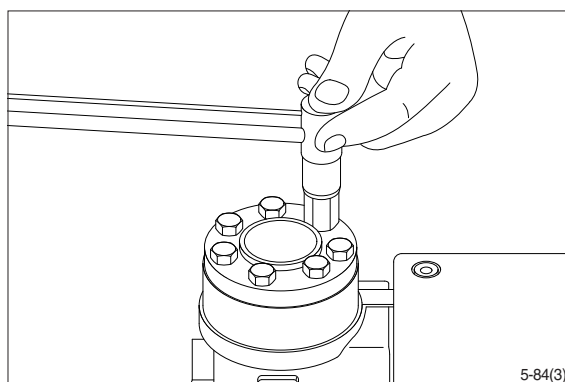


(30) Fit the special screw with washer and place it in the hole shown.

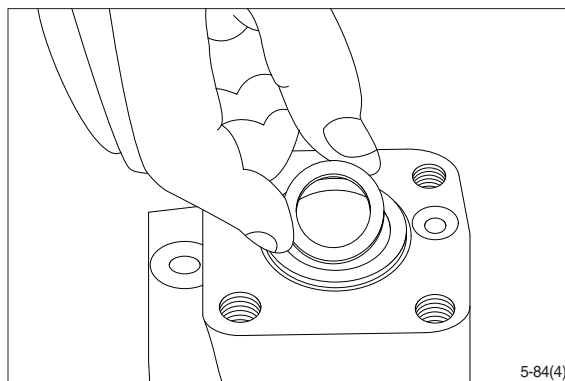


(31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

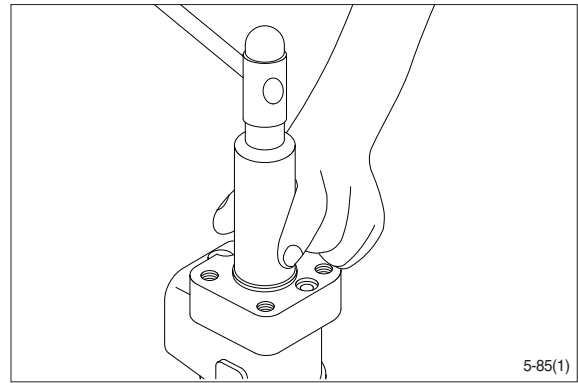
- Tightening torque :  $4.0 \pm 0.5 \text{ kgf} \cdot \text{m}$   
( $28.9 \pm 3.6 \text{ lbf} \cdot \text{ft}$ )



(32) Place the dust seal ring in the housing.

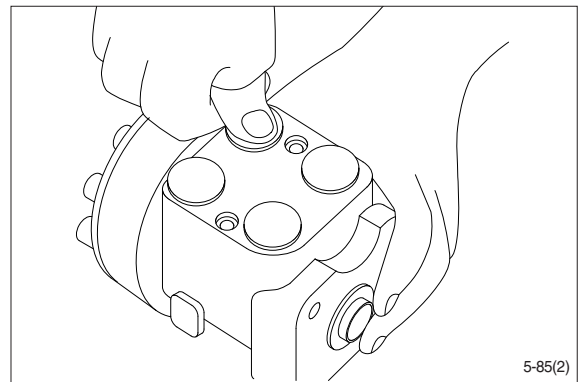


(33) Fit the dust seal ring in the housing.



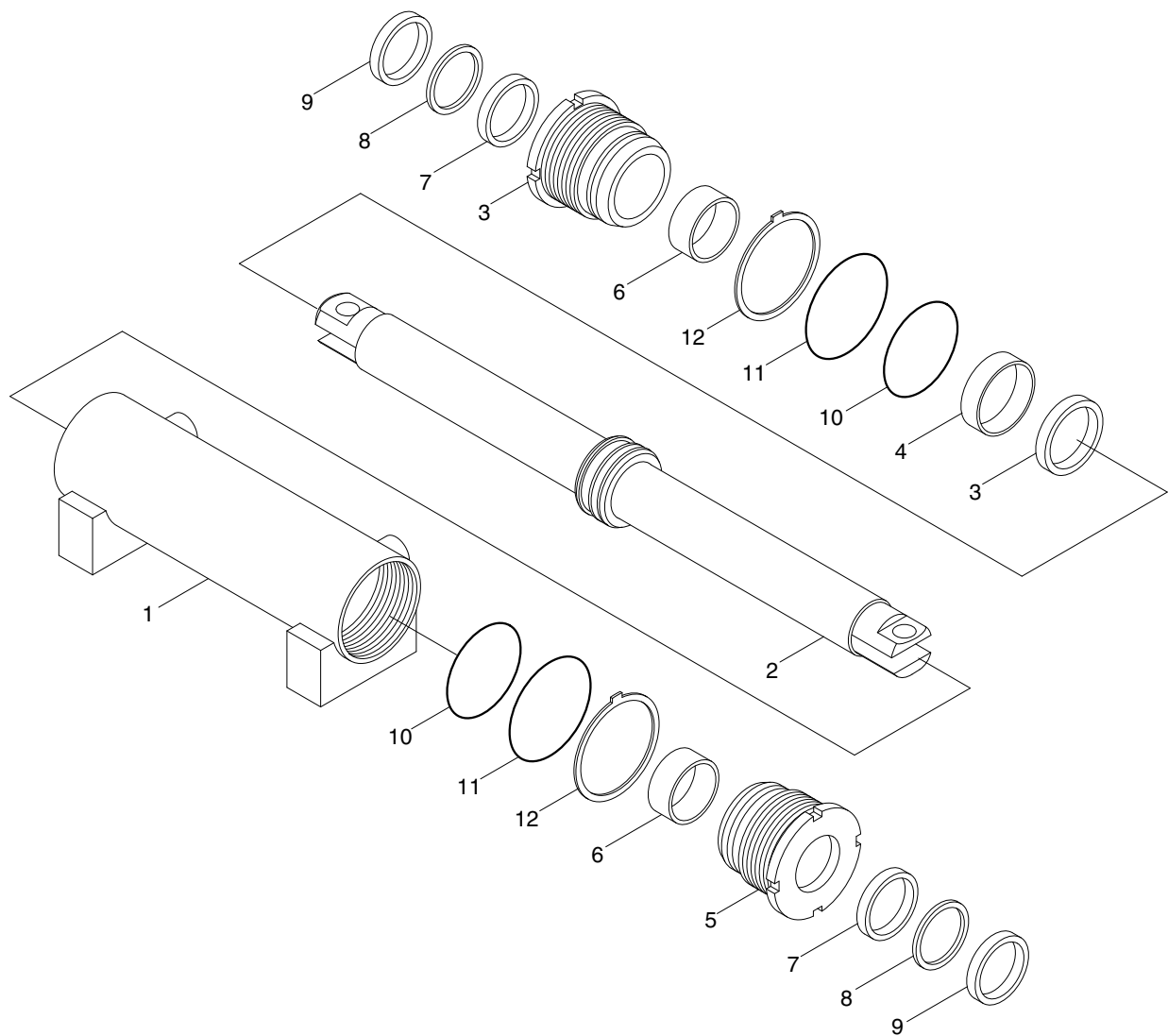
(34) Press the plastic plugs into the connection ports.

※ Do not use a hammer!



## 2. STEERING CYLINDER

### 1) STRUCTURE



20B7SS14

- 1 Tube assembly
- 2 Rod assembly
- 3 Piston seal
- 4 Wear ring

- 5 Gland
- 6 Bushing
- 7 Rod seal
- 8 Back up ring

- 9 Dust wiper
- 10 O-ring
- 11 O-ring
- 12 Lock washer



## 2) DISASSEMBLY

※ Before disassembling steering cylinder, release oil in the cylinder first.

- (1) Put wooden blocks against the cylinder tube, then hold in a vice.
- (2) Remove the gland by hook a wrench in the notch of cylinder head and turn counter-clockwise.
- (3) Remove the cylinder rod and piston from the tube.
- (4) Check wear condition of the sealing parts. If there are some damage, replace with new parts.

## 3) CHECK AND INSPECTION

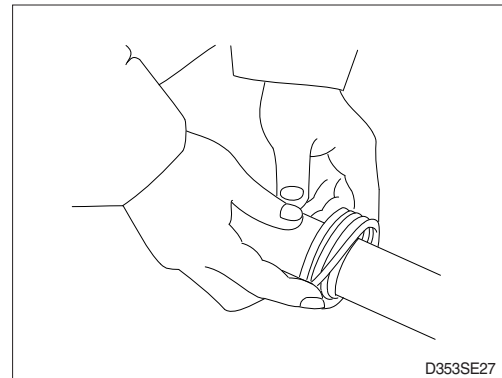
mm(in)

Check item	Criteria		Remedy
	Standard size	Repair limit	
Clearance between piston & cylinder tube	0.064~0.137 (0.0025~0.0054)	0.180 (0.0070)	Replace piston seal
Clearance between cylinder rod & bushing	0.024~0.112 (0.0009~0.0044)	0.120 (0.0049)	Replace bushing
Seals, O-ring	Damage		Replace
Cylinder rod	Dents		Replace
Cylinder tube	Biting		Replace

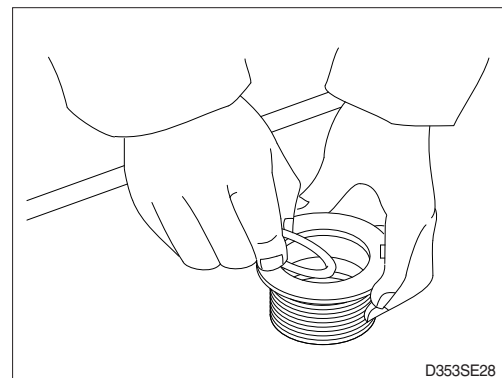
## 4) ASSEMBLY

- (1) Install a new piston seal the groove on the piston.

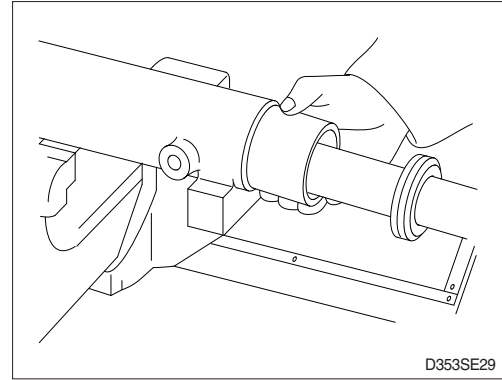
※ Be careful not to scratch the seal too much during installation or it will not seat properly.



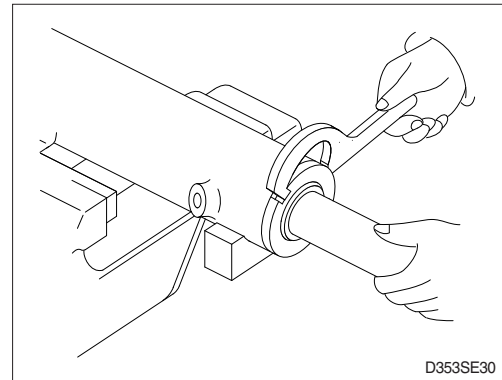
- (2) Install the rod seal to the position in the gland applying a slight coat with grease prior to install.



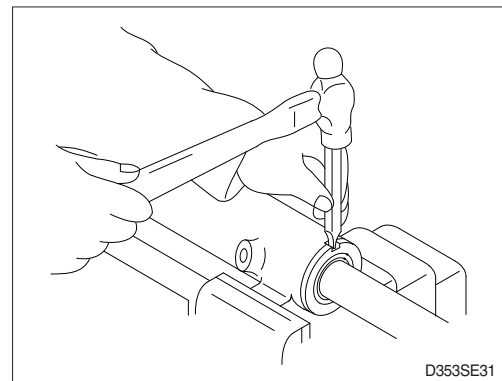
- (3) Install the dust wiper to the gland using a special installing tool. Coat the dust wiper with grease slightly before installing.
- (4) Set a special tool the cylinder, gland assembly into the cylinder tube.



- (5) Using a hook spanner, install the gland assembly, and tighten it with torque  $40 \pm 4 \text{ kgf} \cdot \text{m}$  ( $289 \pm 29 \text{ lbf} \cdot \text{ft}$ ).



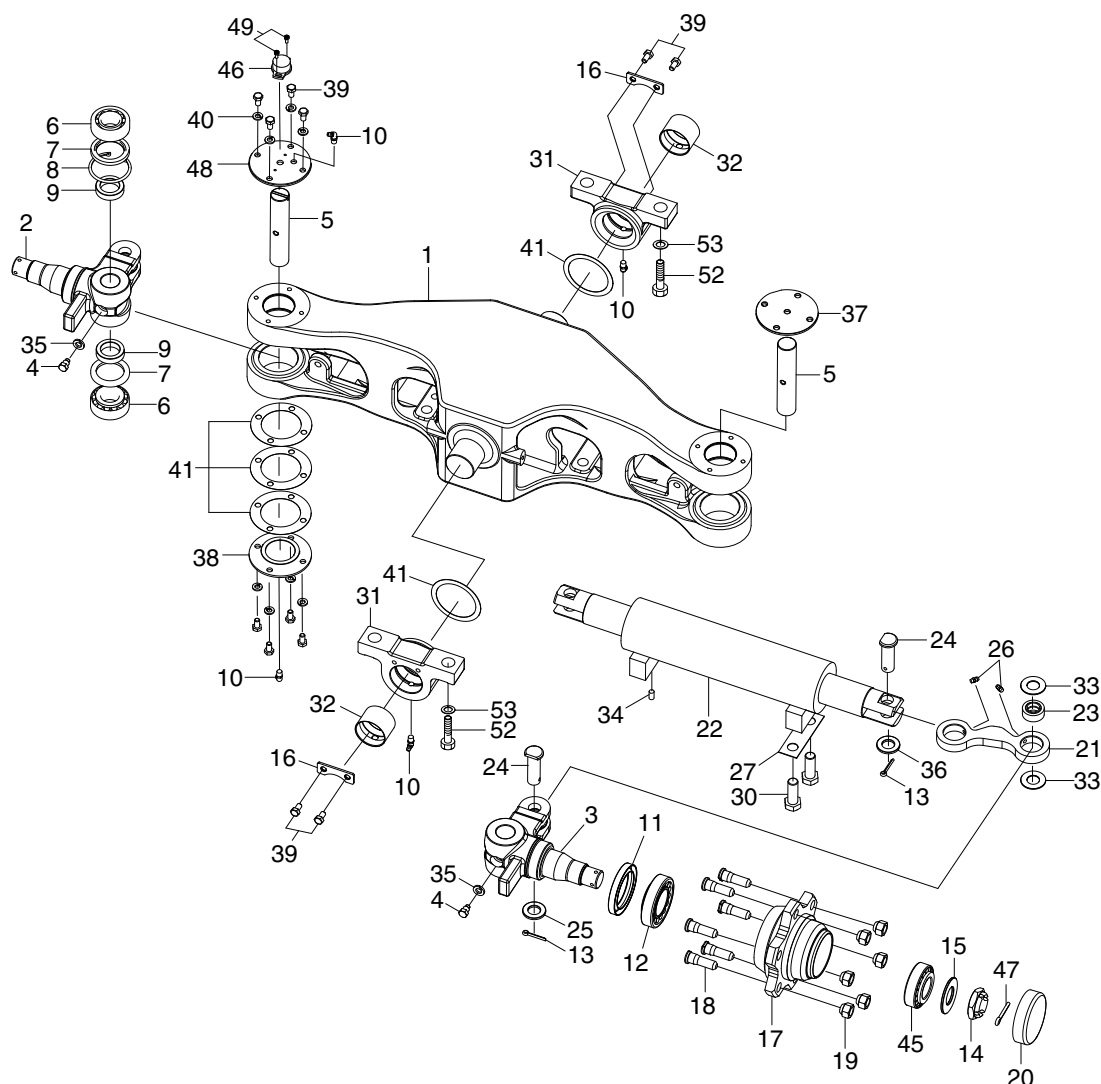
- (6) After the gland assembly was installed to the cylinder tube, calk at the tube end into the groove on the gland to prevent screw loosening.
- ※ If it need calking again, never using previous calking position.



- (7) Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.
- (8) Install cylinder into trail axle.
- (9) While idling the engine with the rear wheels off the ground, operate the steering wheel left and right alternately.
- ※ Then, repeat the above operation at gradually increasing engine rpm. This releases air from the system and completes preparation for operation.
- (10) Stop the engine, lower the floating rear wheels, and check pump joints for oil leaks and looseness and retighten, them as required.

### 3. STEERING AXLE

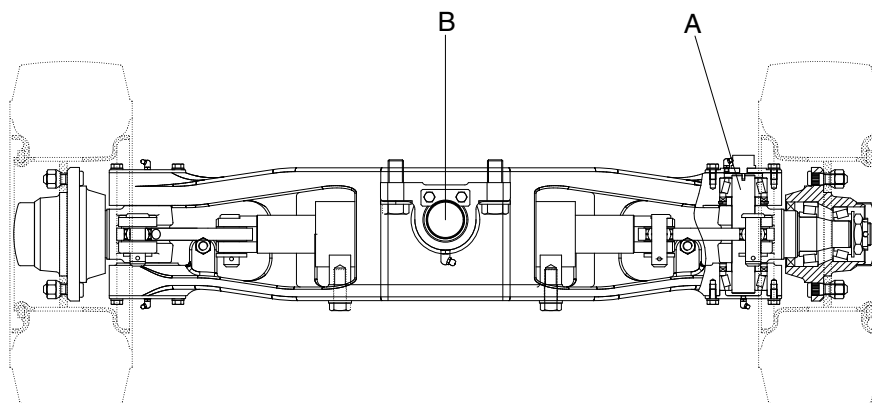
#### 1) STRUCTURE



22B9SS06

1	Steering axle body	17	Hub	35	Spring washer
2	Knuckle-RH	18	Hub bolt	36	Hardened washer
3	Knuckle-LH	19	Hub nut	37	Upper cover
4	Bolt	20	Hub cap	38	Lower cover
5	King pin	21	Steering link	39	Hex bolt
6	Taper roller bearing	22	Steering cylinder assy	40	Spring washer
7	Oil seal	23	SPH plain bearing	41	Shim
8	Snap ring	24	Steering link pin	45	Taper roller bearing
9	Collar	25	Plain washer	46	Potentiometer assy
10	Grease nipple	26	Grease nipple	47	Split pin
11	Oil seal	27	Lock plate	48	Cover
12	Taper roller bearing	30	Hex bolt	49	W/Washer bolt
13	Split pin	31	Trunnion block	52	Hex bolt
14	Slotted nut	32	Bushing	53	Hardened washer
15	Washer	33	Thrust washer		
16	Plate	34	Pin		

## 2) CHECK AND INSPECTION



22B7SS12

mm (in)

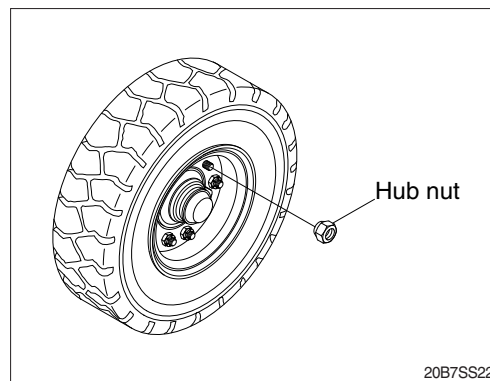
No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
A	Diameter of king pin	30 (1.18)	29.8 (1.17)	Replace
B	Diameter of center pin	50 (2.0)	49.5 (1.9)	Replace
-	Rear axle, hub, knuckle, bearing	<ul style="list-style-type: none"> <li>• Damage, wear</li> <li>• Seizure, abnormal noise, defective rotation</li> </ul>		Replace

### 3) DISASSEMBLY

- ※ Servicing work on the knuckle part can be carried out without removing the axle assy from chassis.

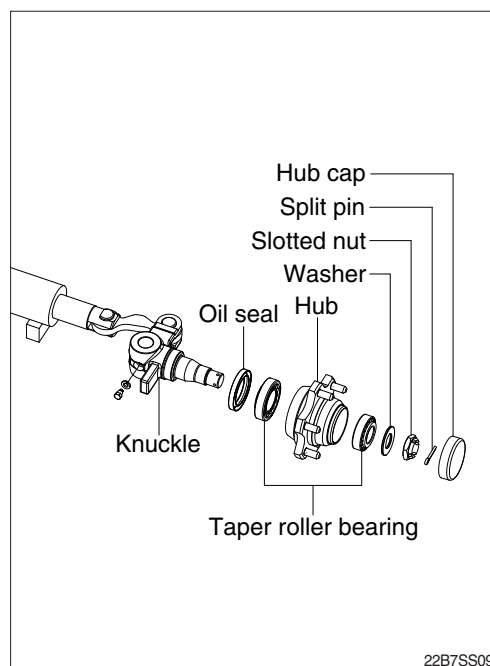
The work can be done by jacking up the balance weight part of the truck.

- (1) Loosen the hub nut and take off the steering wheel tire.

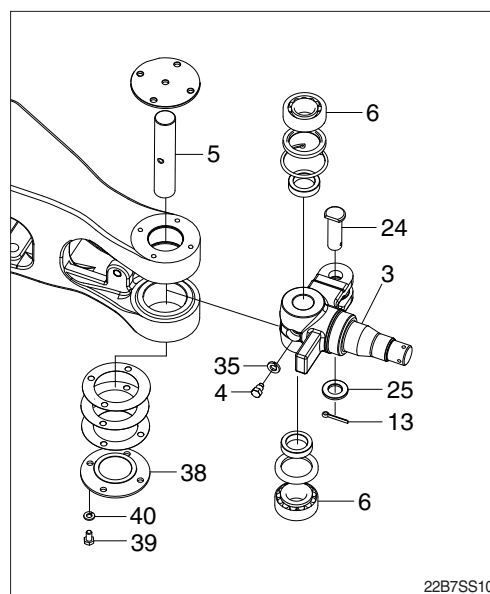


- (2) Remove wheel cap.
- (3) Pull out split pin before removing slotted nut and washer.
- (4) Using the puller, take off the wheel hub together with the bearing.
  - ※ Be very careful because just before the hub comes off, tapered roller bearing will fall out.
- (5) After wheel hub is removed take off the inner race of bearing.
- (6) Pull out oil seal.
  - ※ Don't use same oil seal twice.
- (7) Repeat the same procedure for the other side.

Moreover, when disassembling is completed, part the slotted nut in the knuckle to protect the threaded portion.



- (8) Loosen special bolt (4) and spring washer (35).
- (9) Remove bolt (39), washer (40) and lower cover (38).
- (10) Push out the king pin (5) without damaging the knuckle (3).
- (11) Pull out the thrust bearing (6).
- (12) Remove split pin (13), plain washer (25) and then pull out link pin (24).
- (13) Remove knuckle (3).



#### 4) ASSEMBLY

- ※ In reassembling, have all parts washed, grease applied to lubricating parts, and all expendable items such as oil seal and spring washers replaced by new ones.

Perform the disassembly in reverse order.

- (1) Tighten the special bolt (4) and washer (35) of king pin.

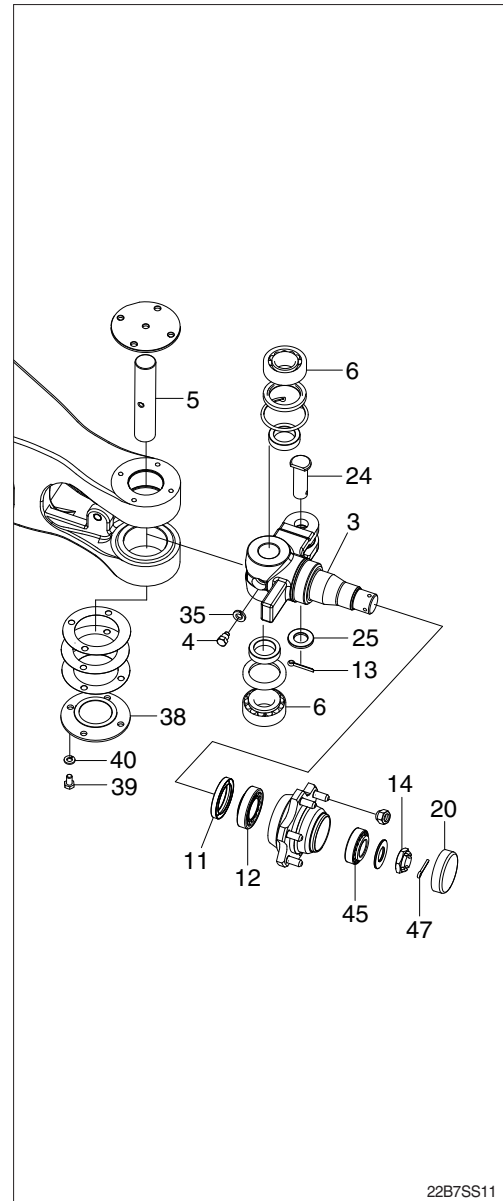
- ※ There is a notch in the middle of the king pin (5), make sure that this notch is on the special bolt side.

- (2) Always use drive-in tool. In assembling the thrust bearing (6), be sure that the fixed ring of the bearing is placed in position facing the knuckle(3).

#### (3) Wheel hub

- Mount oil seal (11) and inner race of tapered roller bearing (12) on the knuckle (3). The bearing should be well greased before assembling.
- Install the outer race of the bearing (45) in the wheel center and assemble to the knuckle (3).
- Tighten nut (14) and lock with split pin (47). In locking with split pin, locate the hole for the split pin by turning the nut back 1/6 of a turn. Adjust the preload of bearing.
- Mount the hub cap (20).

Bearing should be well greased before assembling.



22B7SS11