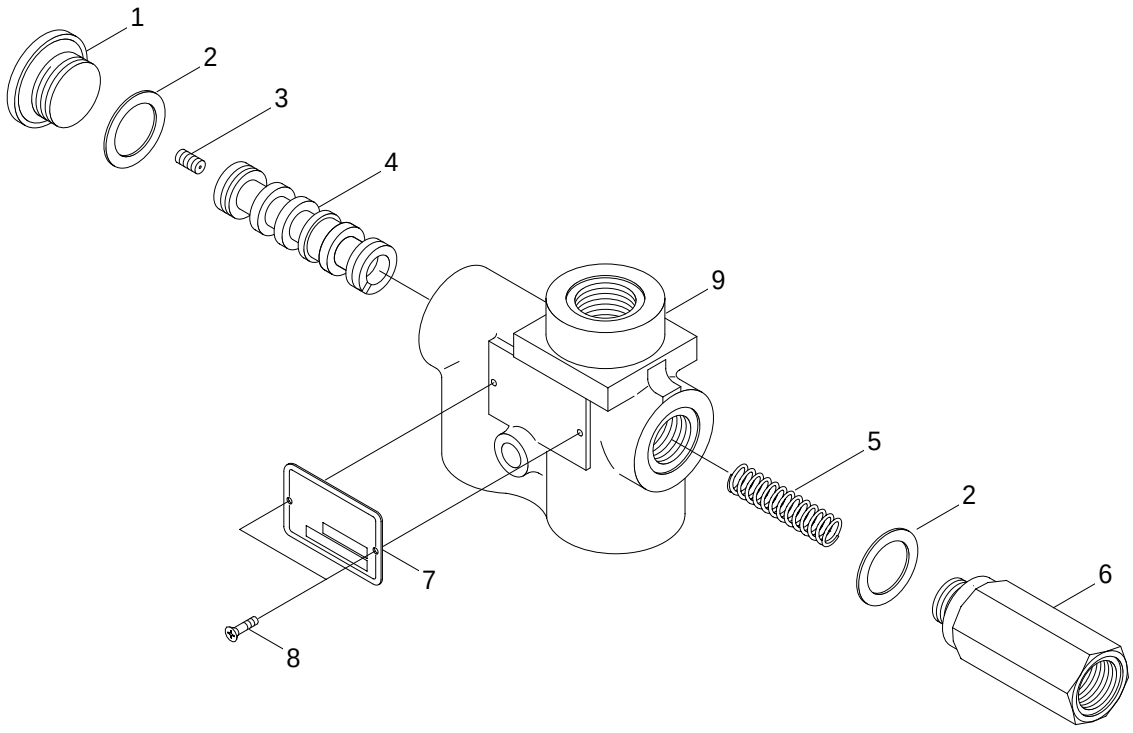
GROUP 4 DISASSEMBLY AND ASSEMBLY

1. PRIORITY VALVE

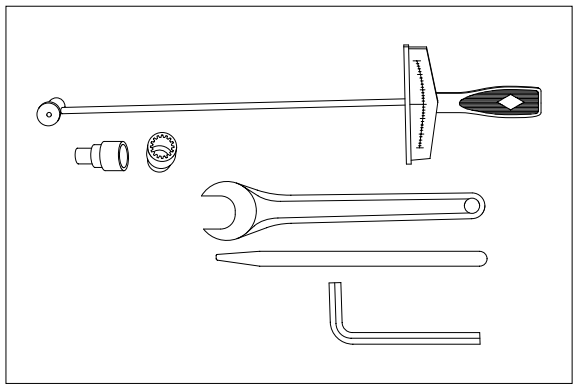
1) STRUCTURE



1	Plug	4	Spool	7	Name plate
2	Seal ring	5	Spring	8	Drive screw
3	Orifice	6	Plug	9	Housing

2) TOOLS

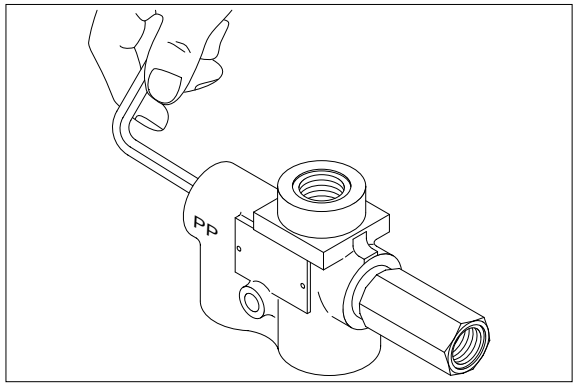
- Open-end spanner 22㎜.
- Nylon pin.
- Hexagon socket spanner 8㎜.
- Torque wrench.
- Socket spanner 22㎜.
- Hexagon socket spanner insert 8㎜.



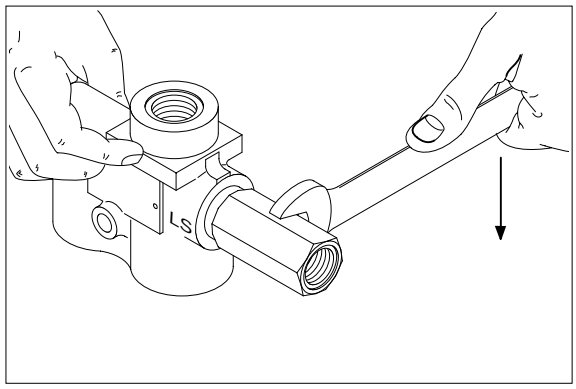
3) DISASSEMBLY

※ Cleanliness is the primary means of assuring satisfactory the priority valve life.
Select clean place.
Before removing the piping, clean the surrounding area of valve ports.

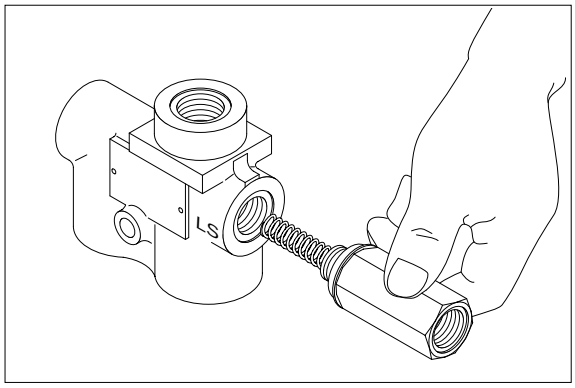
(1) Screw out the PP plug using the 8㎜ hexagon socket spanner.
Remove the seal ring.



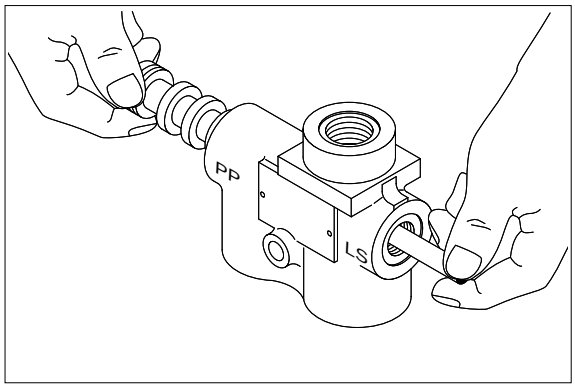
(2) Loosen the LS plug using the 22㎜ open-end spanner.



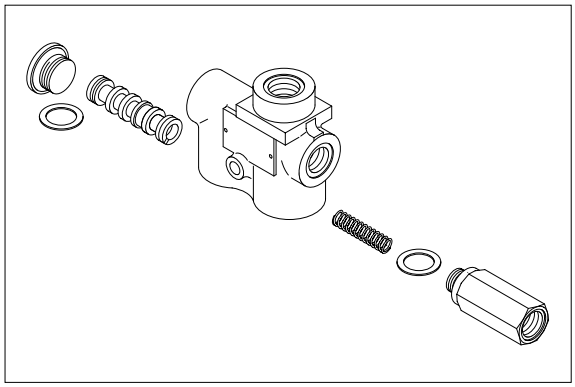
(3) Pull out the plug with seal ring and spring.



(4) Press out the spool using the nylon pin.



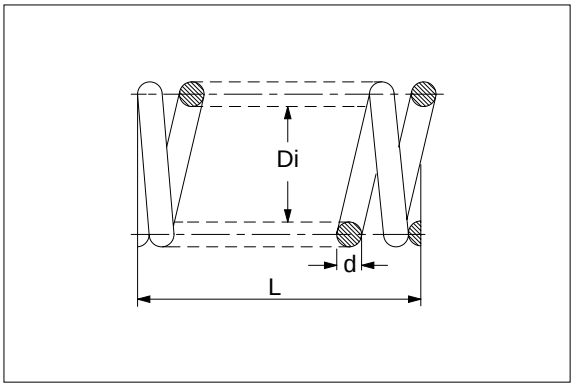
(5) Disassembled priority valve.



4) MODIFICATION

(1) The control spring pressure can be altered by replacing the spring(See table below). Replace name plate so that code no. and control spring pressure match each other again.

Control spring pressure(bar)	d(mm)	Di(mm)	L(mm)
4	1.8	6.9	54
7	2.0	6.5	55



(2) Cleaning

Clean all parts carefully in low aromatic kerosene.

(3) Inspection and replacement

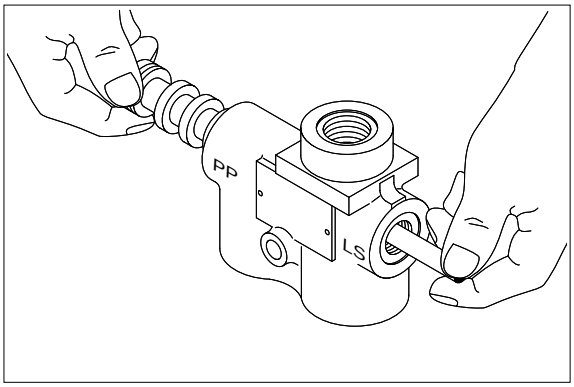
Check all parts carefully and make any replacements necessary. All seal rings must be replaced.

(4) Lubrication

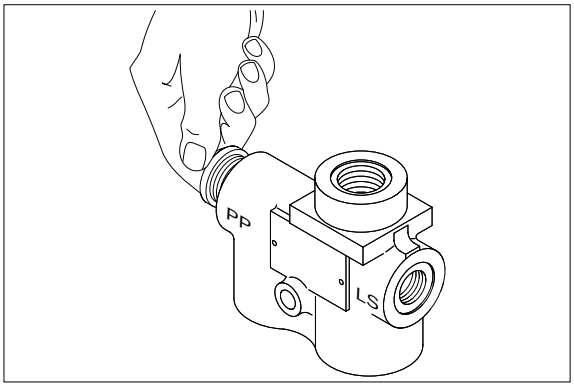
Before assembly, lubricate all parts with hydraulic oil.

5) ASSEMBLY

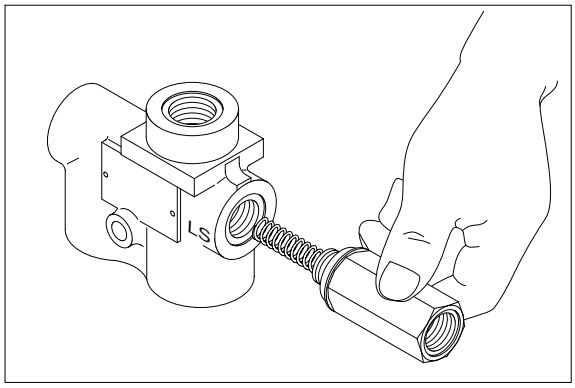
(1) Guide the spool into the bore. Use the nylon pin to center the spool in the bore.



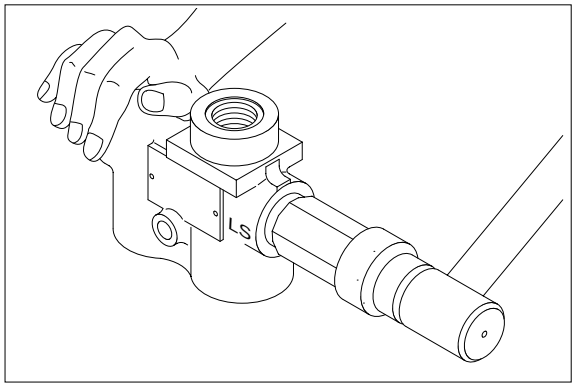
(2) Put in the PP plug.
Remember seal ring.



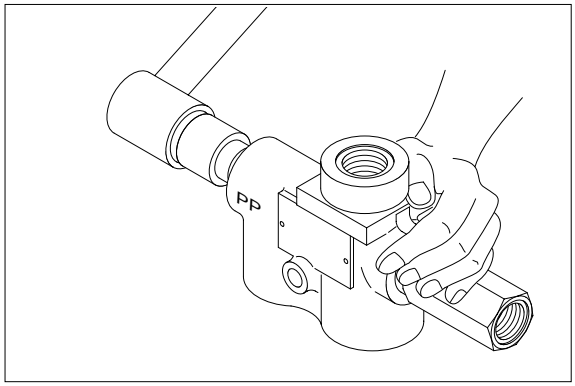
(3) Guide the spring and LS plug into the bore.
Remember seal ring.



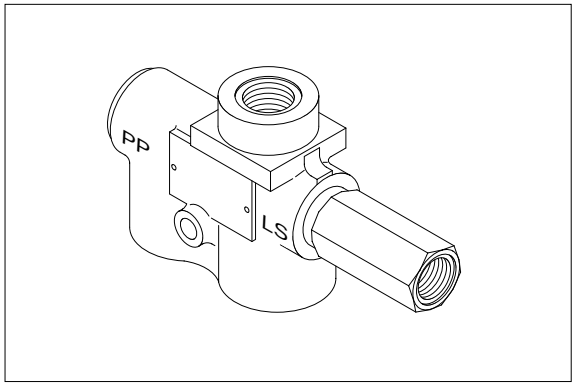
(4) Tighten the LS plug with torque wrench using a 22 socket spanner insert.
・Tighten torque : 5.1±1kgf・m
(36.9±7.2lbf・ft)



(5) Tighten the PP plug with a torque wrench using a 8㎜ hexagon socket spanner insert.
・Tighten torque : 5.1±1kgf・m
(36.9±7.2lbf・ft)



(6) The priority valve is now assembled.

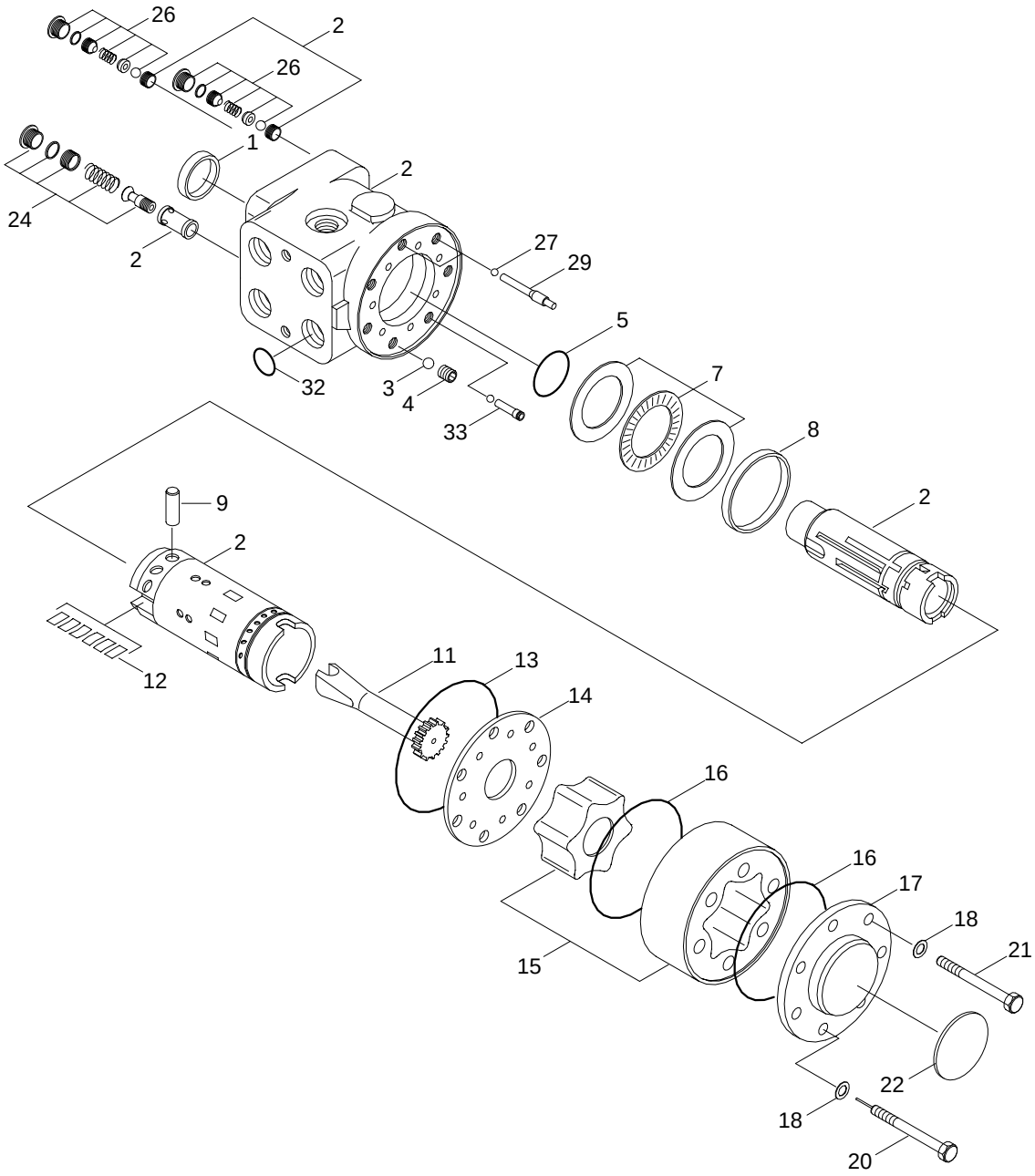


6) TROUBLESHOOTING

Problem	Cause	Remedy
Steering wheel is heavy	1. Relief valve of steering unit is clogged with dirt.	Disassembly, clean and reassembly.
	2. Spool is stuck.	Disassembly, clean and reassembly or replace.
	3. Orifice of plug and spool is clogged.	Disassembly, clean and reassembly.
(Steering wheel is heavy at engine low idle)	a. Pump is faulty.	Check pump.
(Steering speed is not high at engine high idle)	b. Control pressure is low.	Reset control pressure.
	c. Piping is faulty.	Replace piping.
	d. Pump is faulty.	Check pump.
Abnormal noise	1. Relief valve of steering unit is clogged with dirt.	Disassembly, clean and reassembly.
	2. Spool is stuck.	Disassembly, clean and reassembly or replace.
Leakage	1. Loosen the plug.	Retighten the specified torque.
	2. O-ring is damaged.	Replace.

2. STEERING UNIT

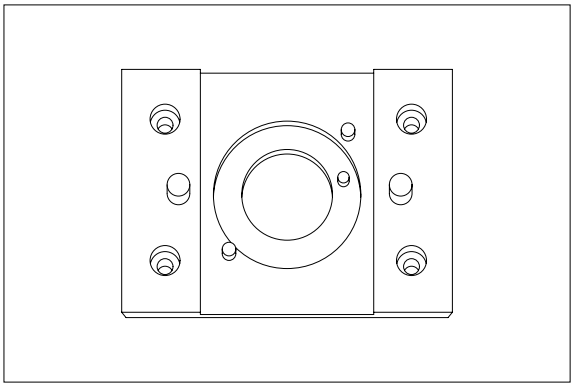
1) STRUCTURE



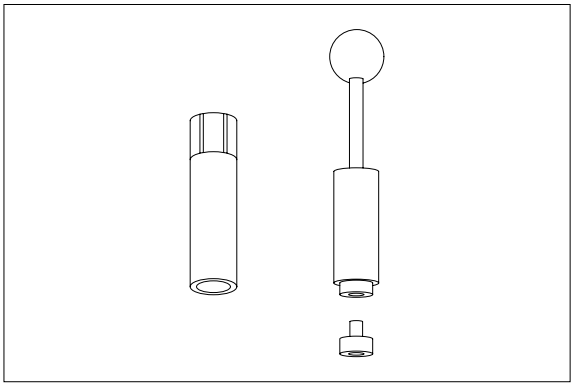
1	Dust seal ring	12	Spring set	22	Name plate
2	Housing, spool, sleeve	13	O-ring	24	Pilot relief valve
3	Ball	14	Distributor plate	26	Shock valve
4	Bushing	15	Gearwheel set	27	Ball
5	Roto Glyd O-ring	16	O-ring	29	Pin bushing
7	Bearing assy	17	End cover	32	Check valve
8	Ring	18	Washer	33	LS check valve
9	Cross pin	20	Pin screw		
11	Cardan shaft	21	Screw		

2) TOOLS

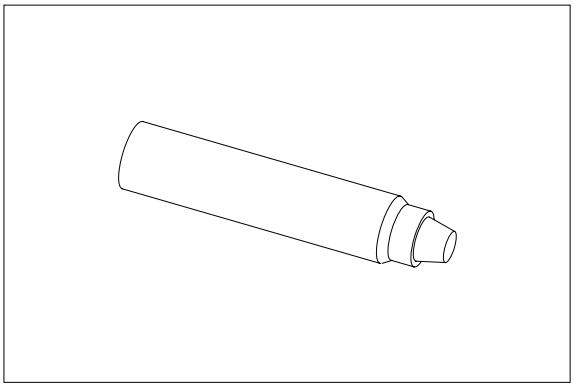
(1) Holding tool.
Part no. : SJ 150-9000-2



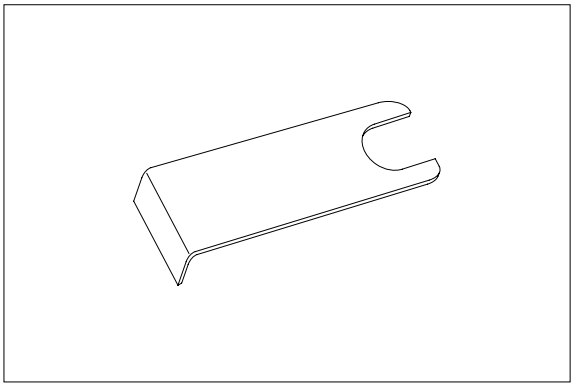
(2) Assembly tool for O-ring and kin-ring.
Part no. : SJ 150-9000-11



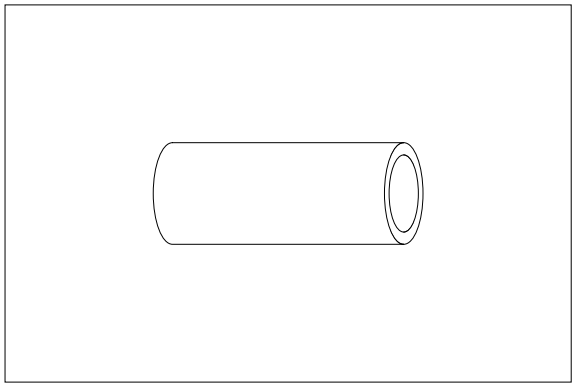
(3) Assembly tool for lip seal.
Part no. : SJ 150-9000-17



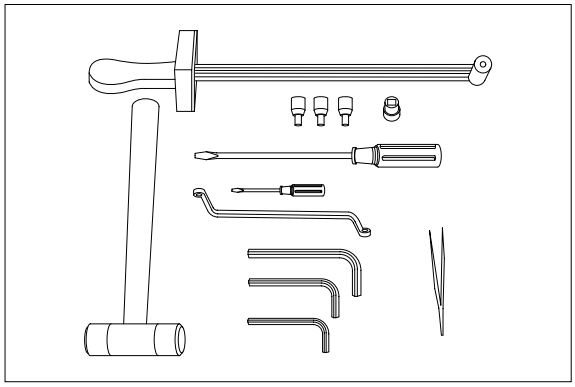
(4) Assembly tool for cardan shaft.
Part no. : SJ 150-9000-3



(5) Assembly tool for dust seal.
Part no. : SJ 150-9000-22

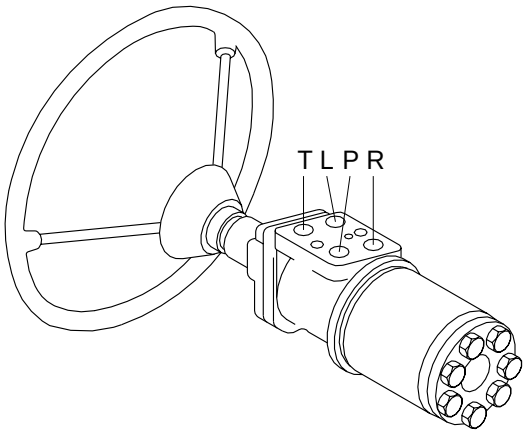


(6) Torque wrench 0~7.1kgf · m
(0~54.4lbf · ft)
13mm socket spanner
6, 8mm and 12mm hexagon sockets
12mm screwdriver
2mm screwdriver
13mm ring spanner
6, 8 and 12mm hexagon socket spanners
Plastic hammer
Tweezers



3) TIGHTENING TORQUE AND HYDRAULIC CONNECTIONS

(1) Hydraulic connections



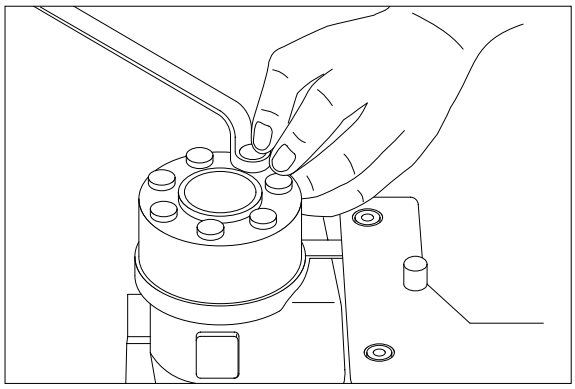
L : Left port
R : Right port
T : Tank
P : Pump

(2) Tightening torque

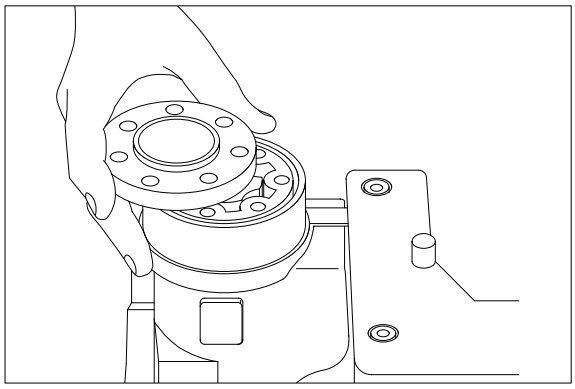
Screwed connection	Max. tightening torque [kgf · m(lbf · ft)]			
	With cutting edge	With copper washer	With aluminum washer	With O - ring
1/4 BSP.F	4.1(29.7)	2.0(14.5)	3.1(22.4)	-
3/8 BSP.F	6.1(44.1)	2.0(14.5)	5.1(36.9)	-
1/2 BSP.F	10.2(73.8)	3.1(22.4)	8.2(59.3)	-
7/16-20 UNF	-	-	-	2.0(14.5)
3/4-16 UNF	-	-	-	6.1(44.1)
M 12×1.5	4.1(29.7)	2.0(14.5)	3.1(22.4)	2.0(14.5)
M 18×1.5	7.1(51.4)	2.0(14.5)	5.1(36.9)	5.1(36.9)
M 22×1.5	10.2(73.8)	3.1(22.4)	8.2(59.3)	7.1(51.4)

4) DISASSEMBLY

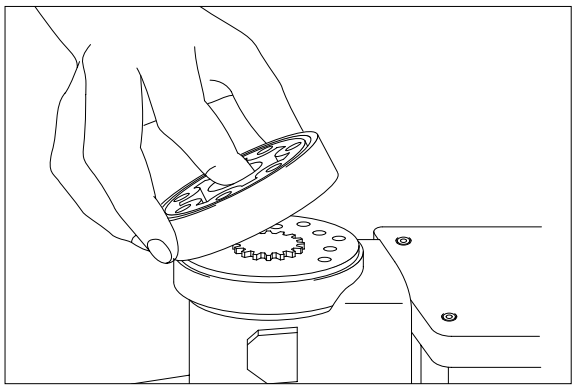
(1) Disassemble steering column from steering unit and place the steering unit in the holding tool.
Screw out the screws in the end cover(6-off plus one special screw).



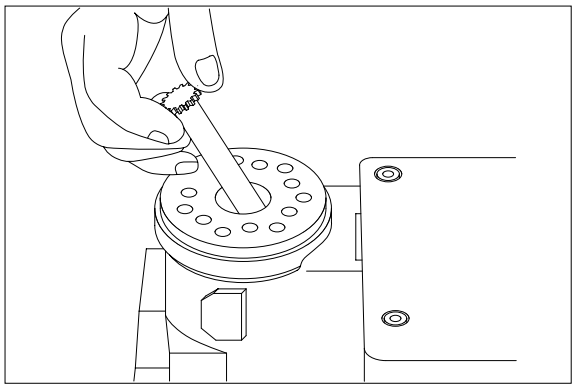
(2) Remove the end cover, sideways.



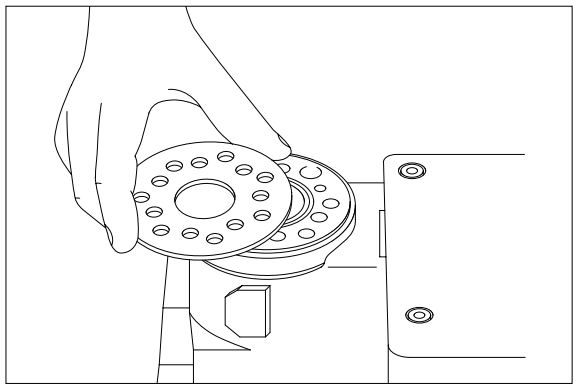
(3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.



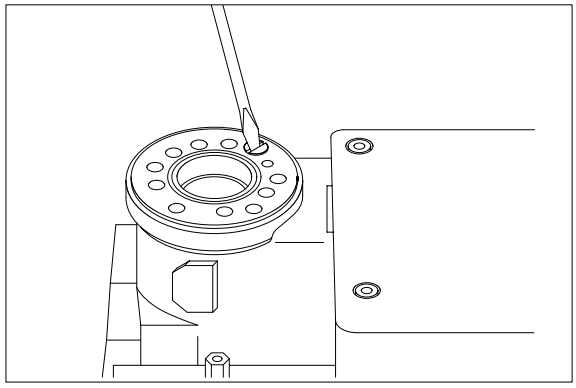
(4) Remove cardan shaft.



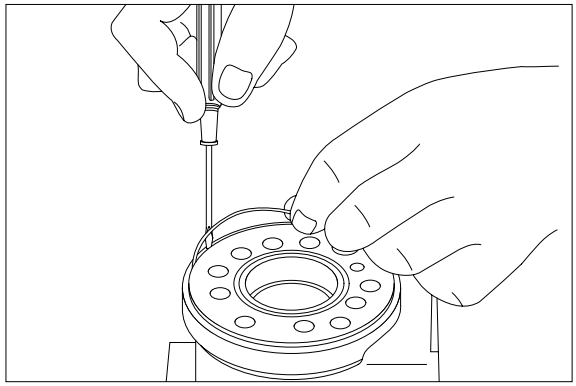
(5) Remove distributor plate.



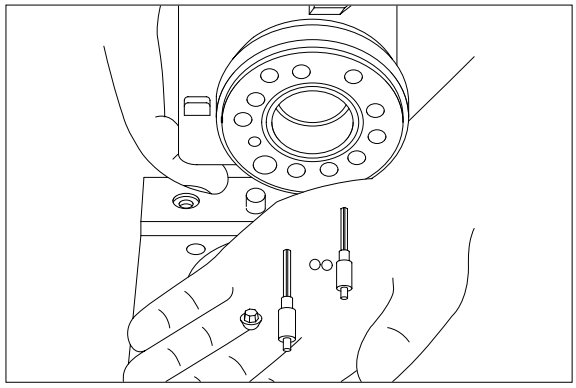
(6) Screw out the threaded bush over the check valve.



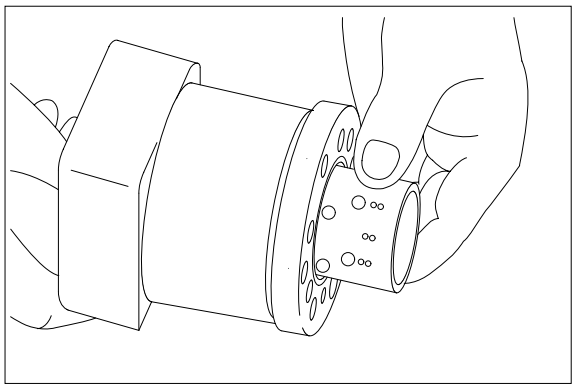
(7) Remove O-ring.



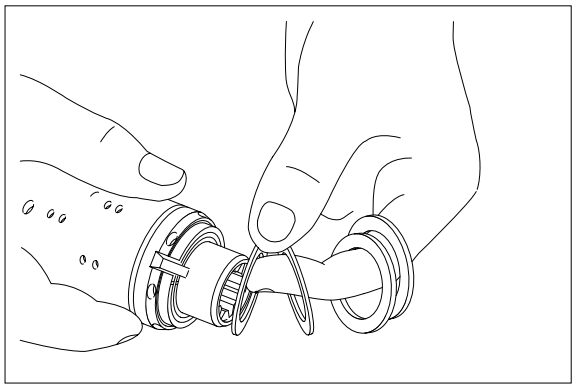
(8) Shake out the check valve ball and suction valve pins and balls.



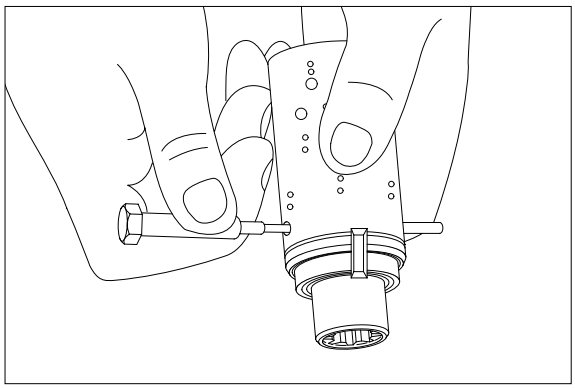
(9) Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and needle bearing will be pushed out of the housing together.



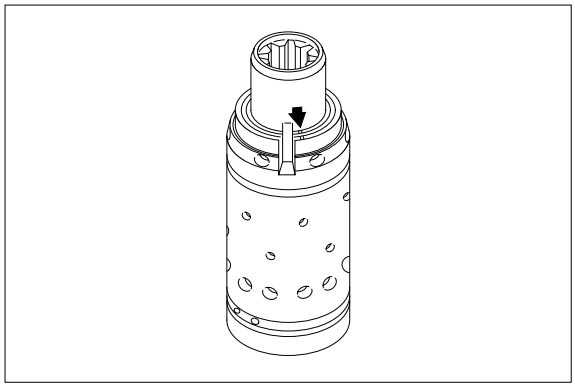
(10) Take ring, bearing races and needle bearing from sleeve and spool. The outer (thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



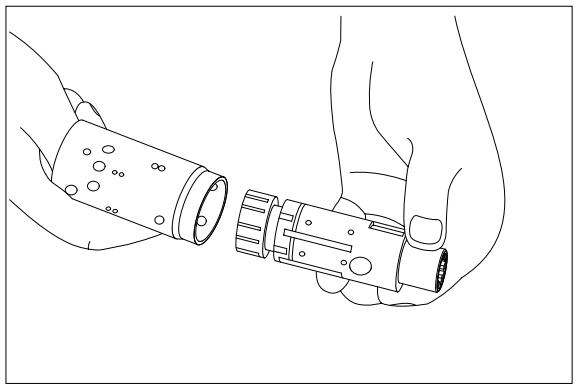
(11) Press out the cross pin. Use the special screw from the end cover.



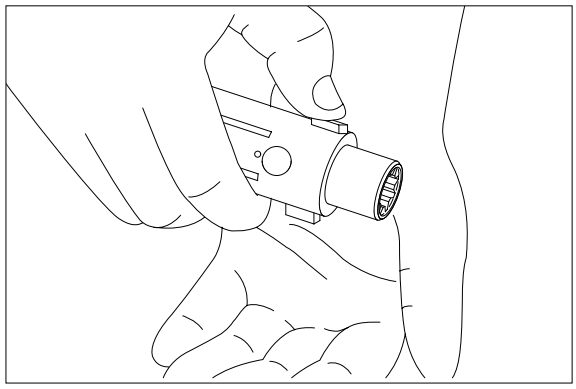
※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position springs (see drawing).
If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



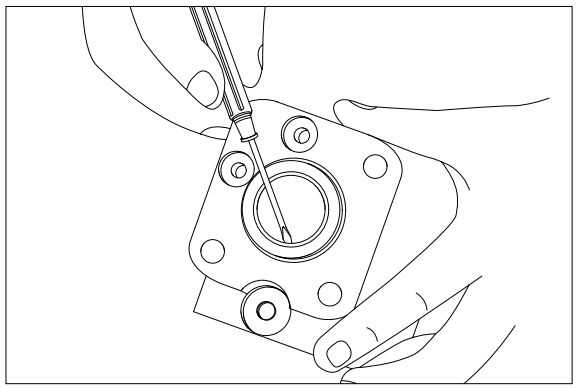
(12) Carefully press the spool out of the sleeve.



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

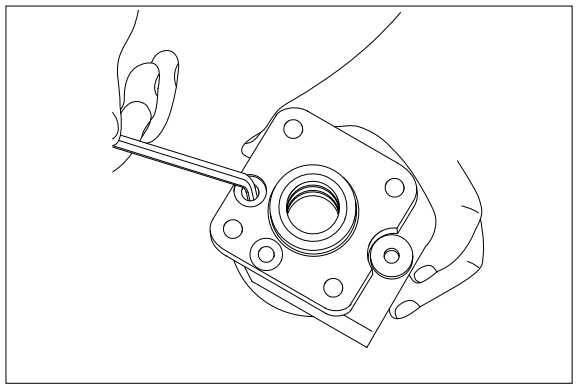


(14) Remove dust seal and O-ring.

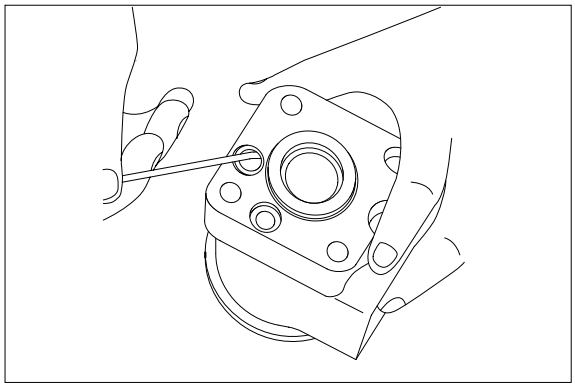


Disassembling the dual shock valves

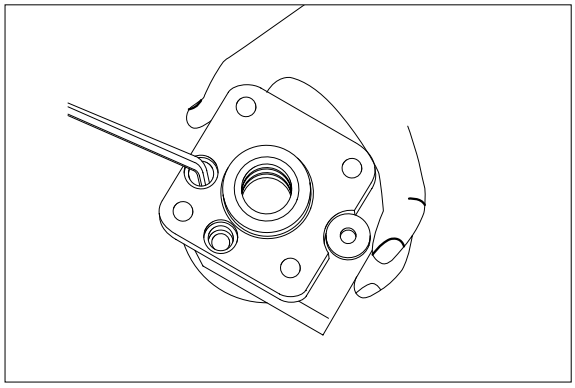
(15) Remove plugs from shock valves using a 6mm hexagon socket spanner.



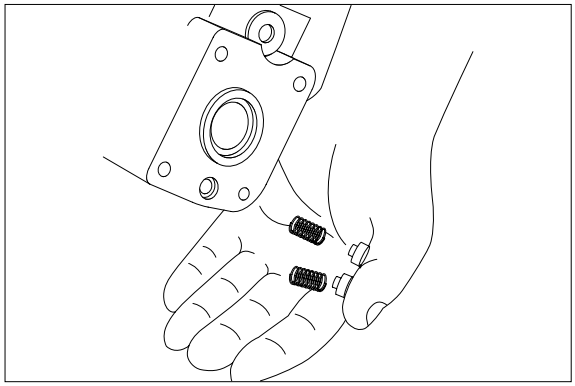
(16) Remove seal washers(2-off).



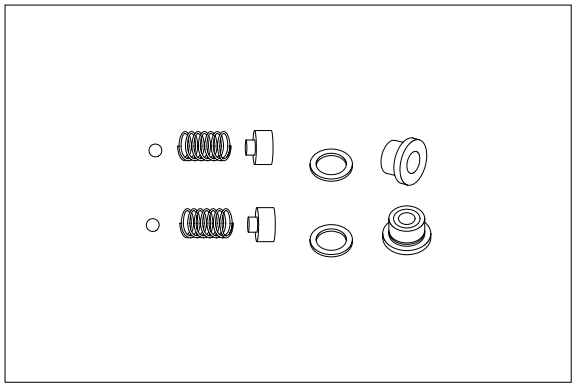
(17) Unscrew the setting screws using a 6㎜ hexagon socket spanner.



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

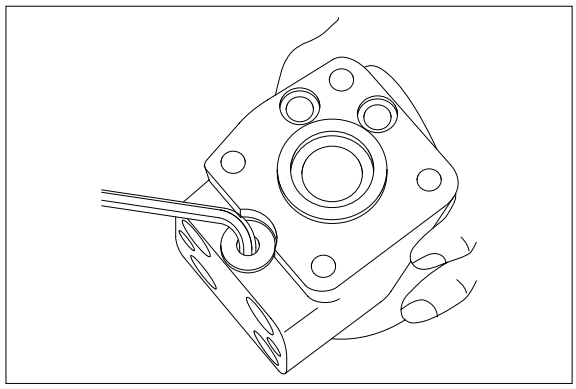


(19) The dual shock valves are now disassembled.

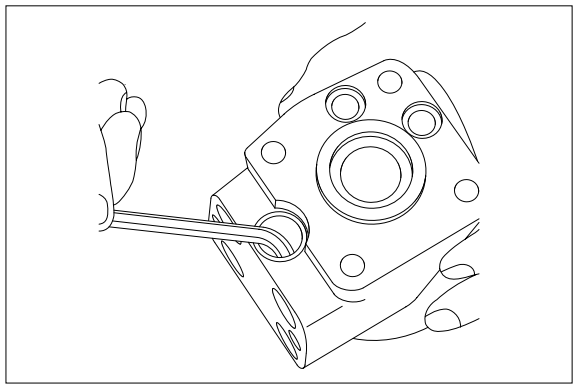


Disassembling the pressure relief valve

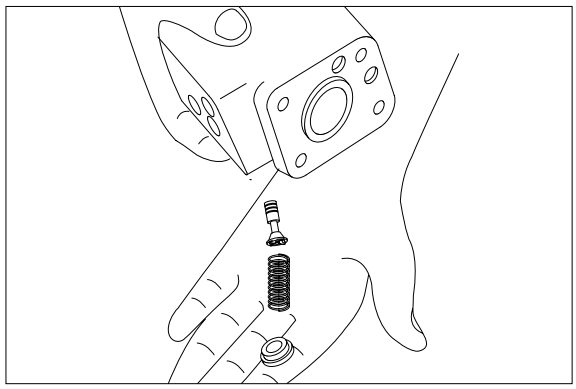
(20) Screw out the plug using an 8mm hexagon socket spanner. Remove seal washers.



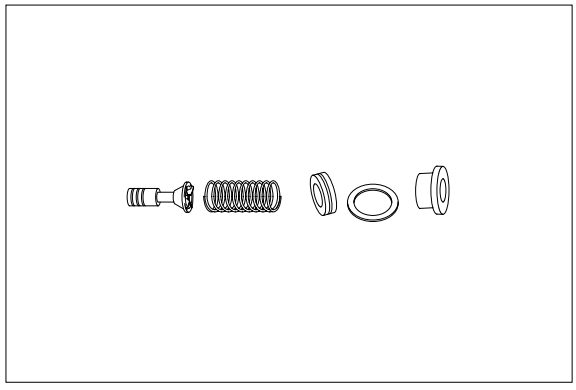
(21) Unscrew the setting screws using an 8mm hexagon socket spanner.



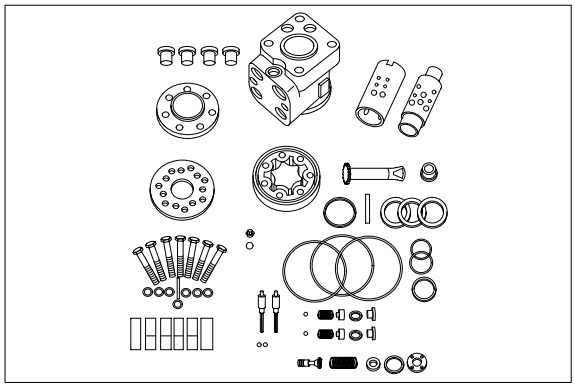
(22) Shake out springs and piston. The valve seat is bonded into the housing and cannot be removed.



(23) The pressure relief valve is now disassembled.



(24) The steering unit is now completely disassembled.



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

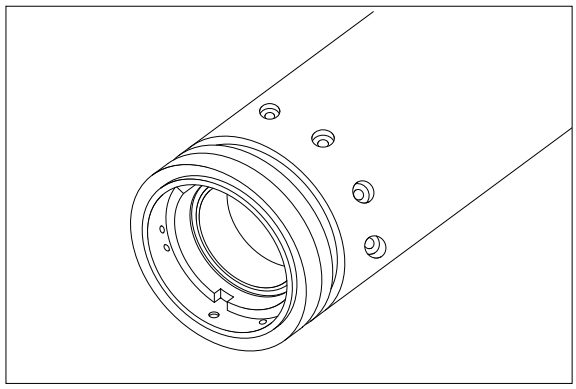
※ **Inspection and replacement**
Replace all seals and washers. Check all parts carefully and make any replacements necessary.

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

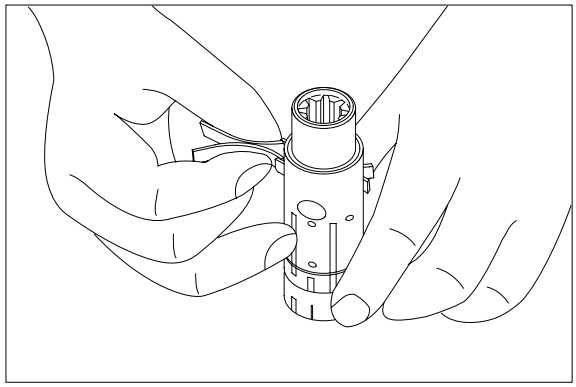
5) ASSEMBLY

(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.

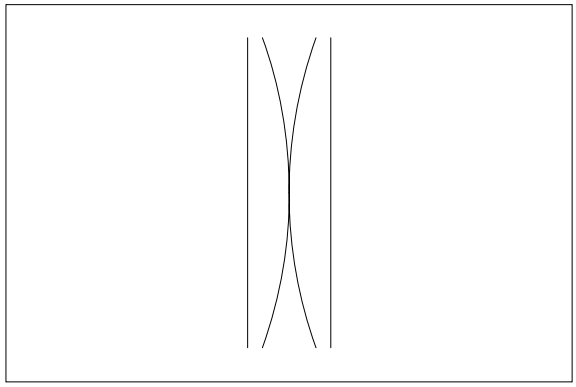


(2) Place the two flat neutral position springs in the slot.
Place the curved springs between the flat ones and press them into place (see assembly pattern).

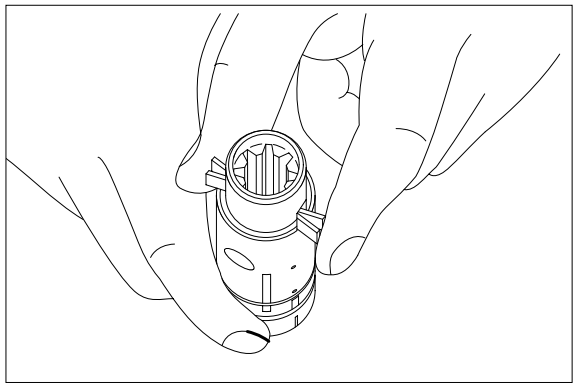


※ **Assembly pattern and color part no. for neutral position springs**

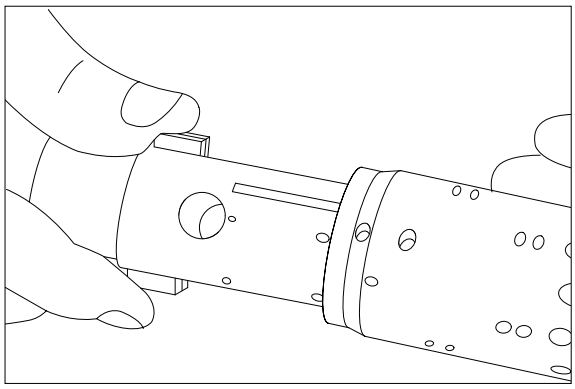
- Weak springs (Blue)
  2 - off flat, blue : Part no. 150-0748
  2 - off curved, blue : Part no. 150-0749
- Blue set
  Spare set : Part no. 150-4265



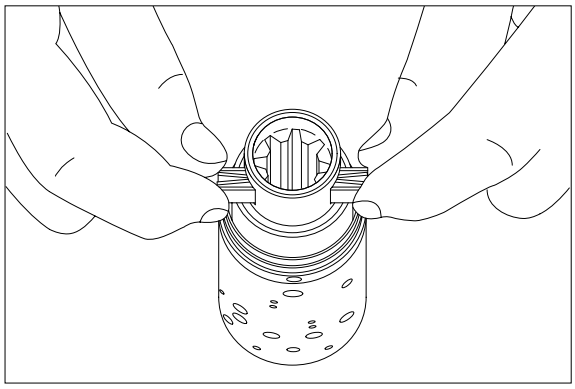
(3) Line up the spring set.



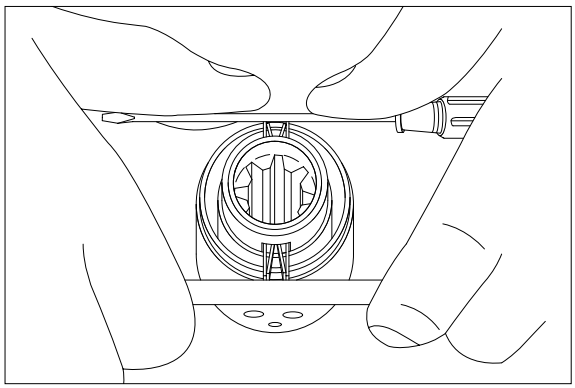
(4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other(See page 5-44).



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

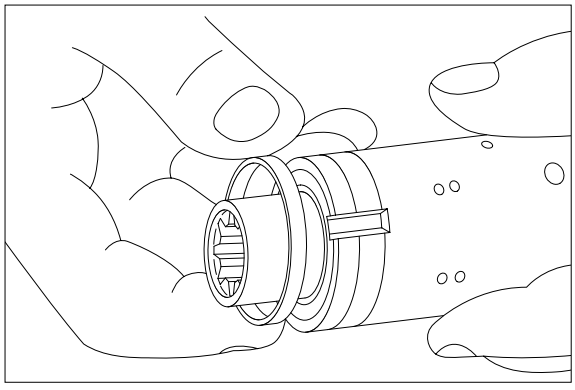


(6) Line up the springs and center them.

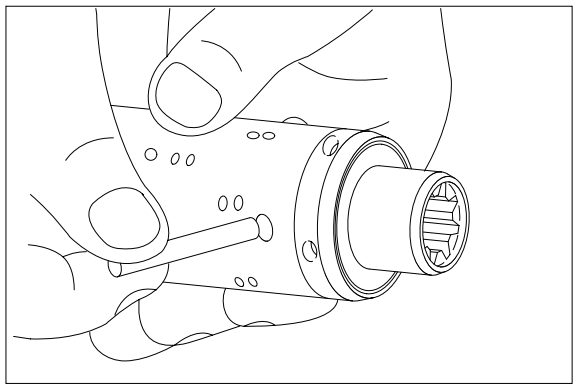


(7) Guide the ring down over the sleeve.

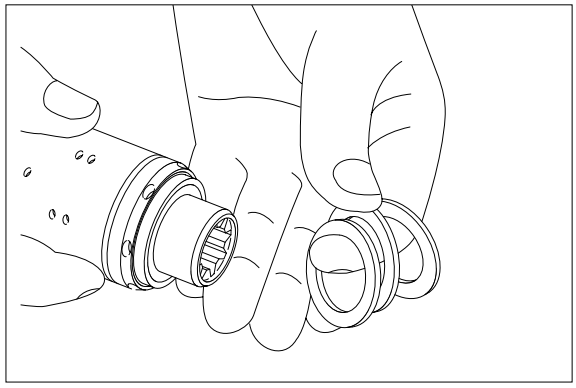
※ The ring should be able to rotate free of the springs.



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



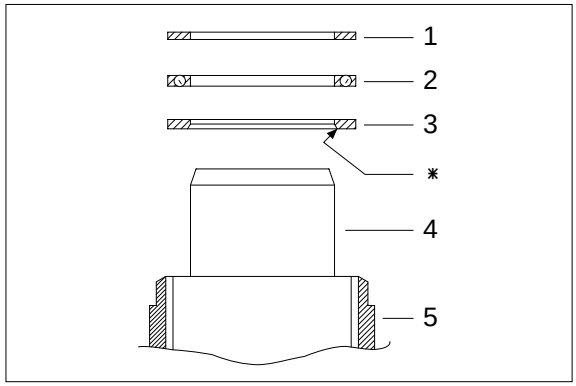
(9) Fit bearing races and needle bearing as shown on below drawing.



※ **Assembly pattern for standard bearings**

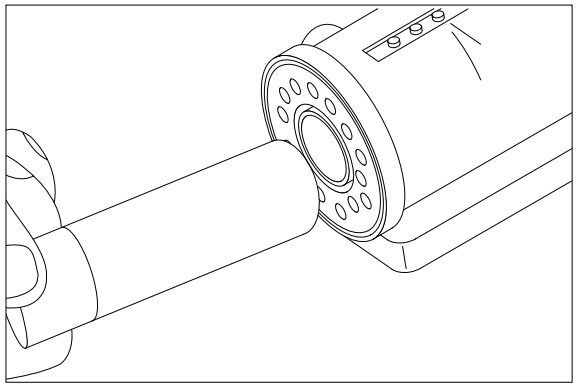
1 Outer bearing race
2 Needle bearing
3 Inner bearing race
4 Spool
5 Sleeve

* The inside chamber on the inner bearing race must face the inner spool.

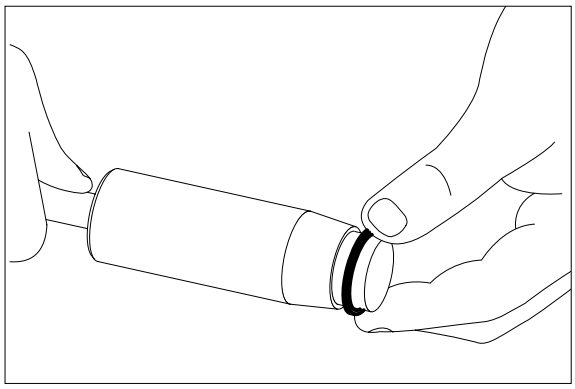


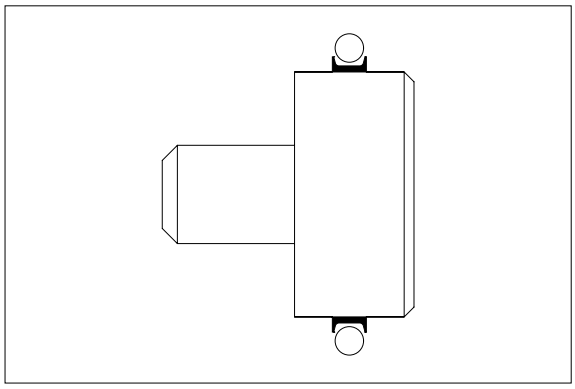
Installation instruction for O-ring

(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.

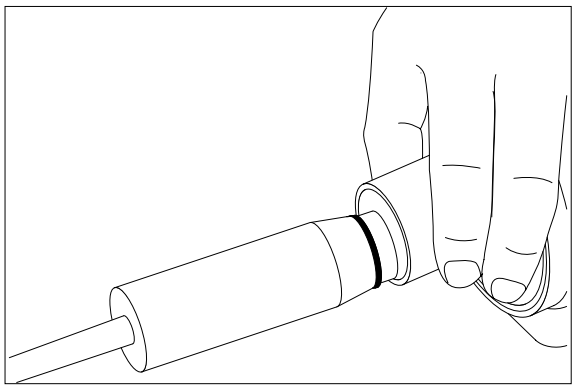


(11) Grease O-ring with hydraulic oil and place them on the tool.

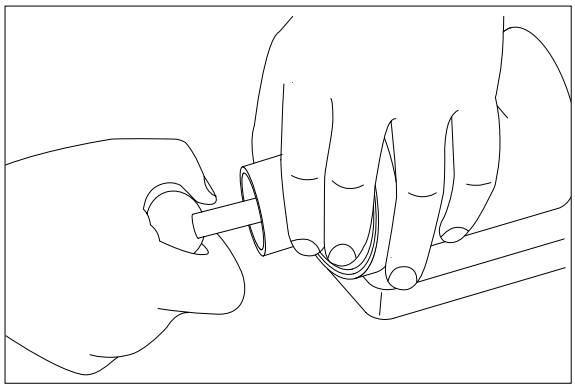




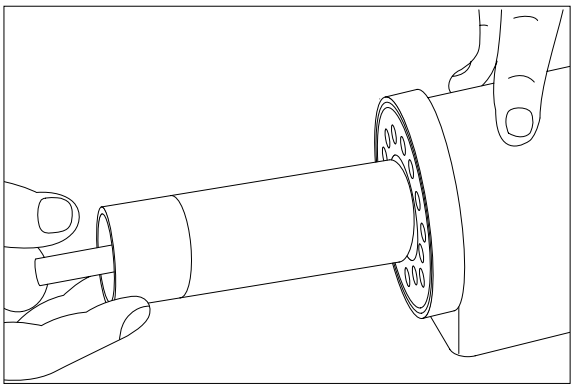
(12) Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



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

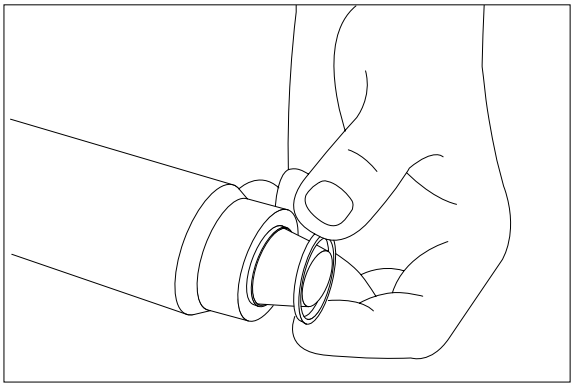


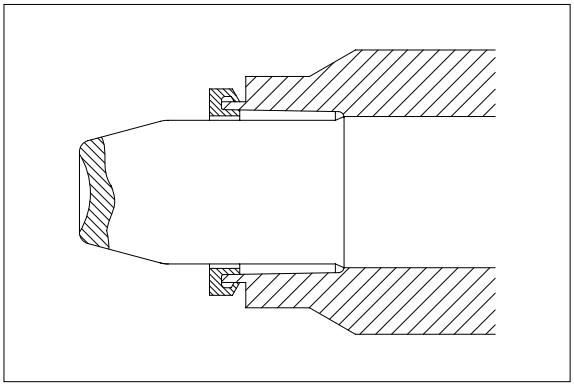
(14) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



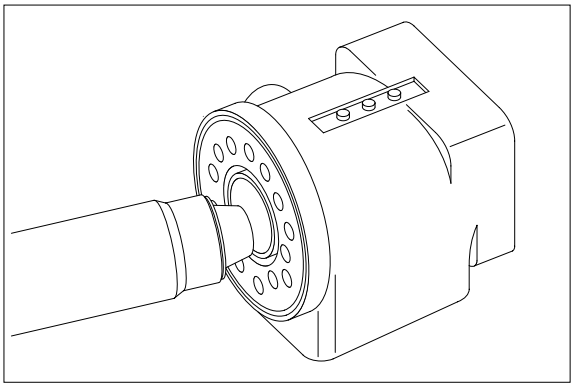
Installation instructions for lip seal

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

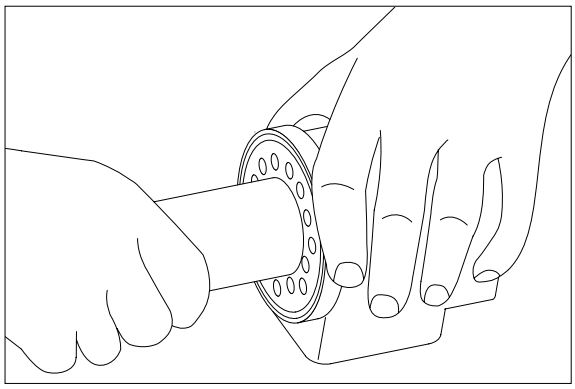




(16) Guide the assembly tool right to the bottom.

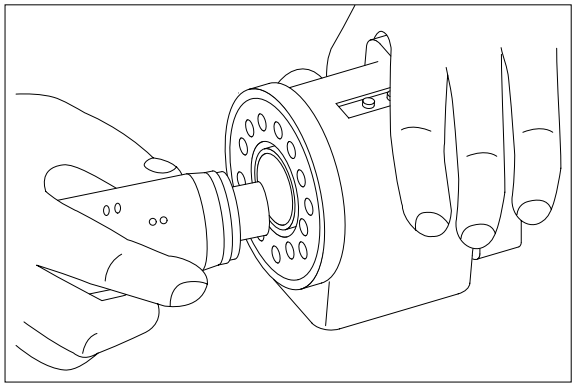


(17) Press and turn the lip seal into place in the housing.

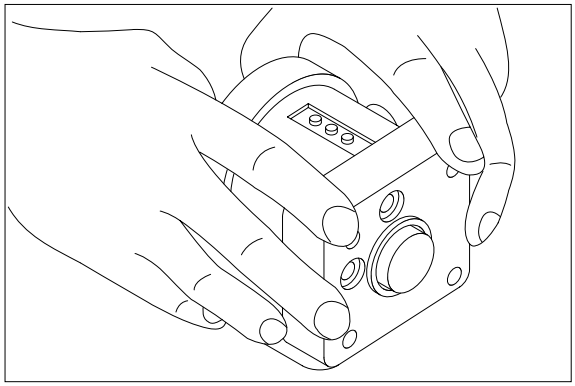


(18) With a light turning movement, guide the spool and sleeve into the bore.

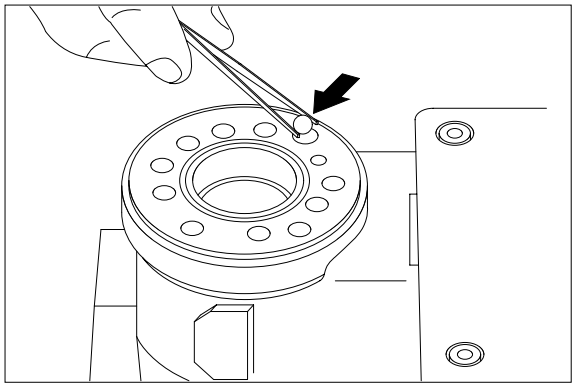
※ Fit the spool set holding the cross pin horizontal.



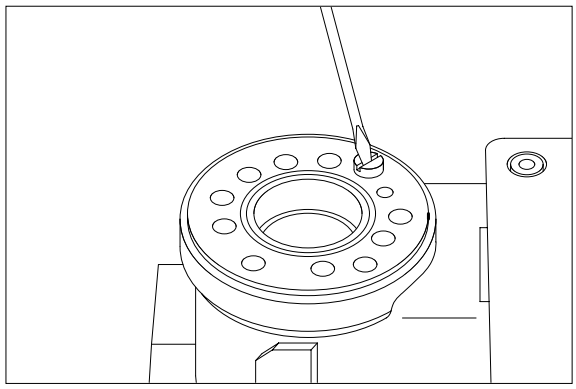
(19) The spool set will push out the assembly tool guide. The O-ring are now in position.



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

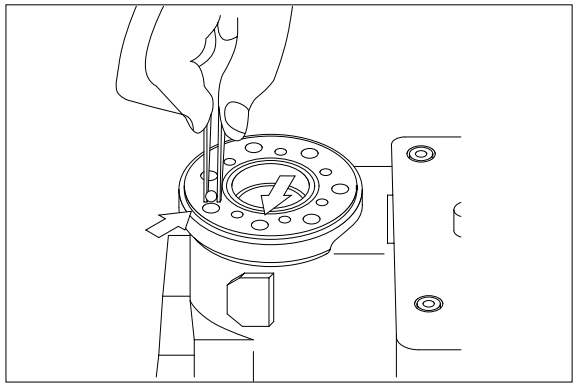


(21) Screw the threaded bush lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

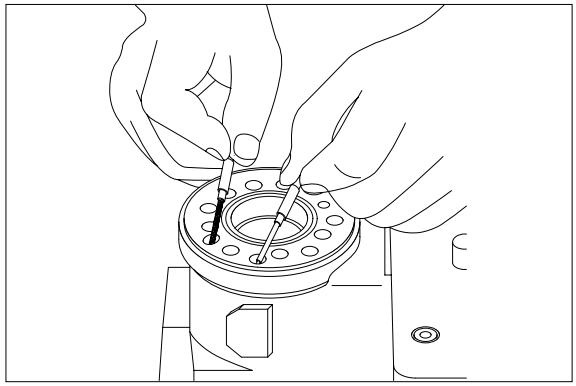


Assembly of the two suction valves

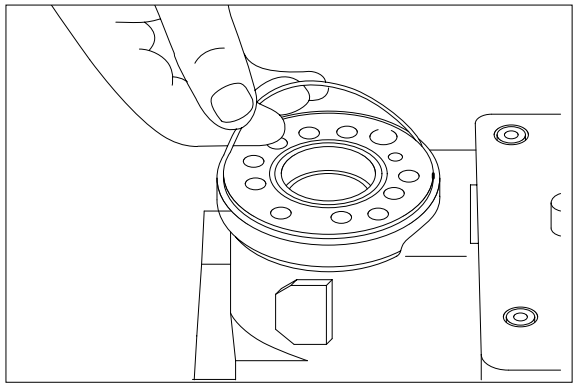
(22) Place a ball in the two holes indicated by the arrows.



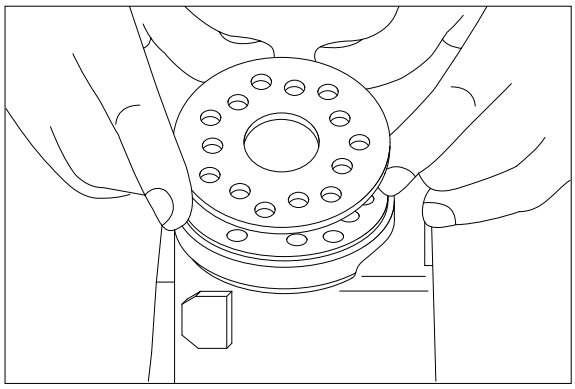
(23) Place a pin in the same two holes.



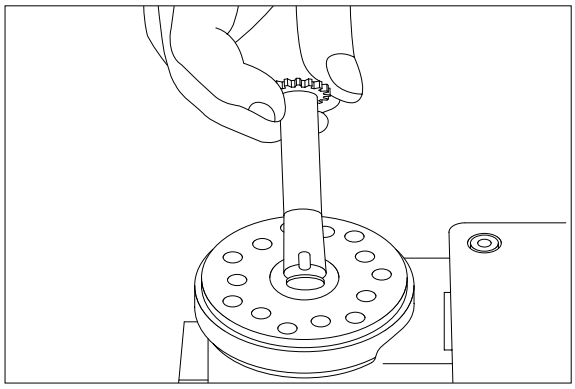
(24) Grease the O-ring with mineral oil approx. viscosity 500 cSt at 20°C.



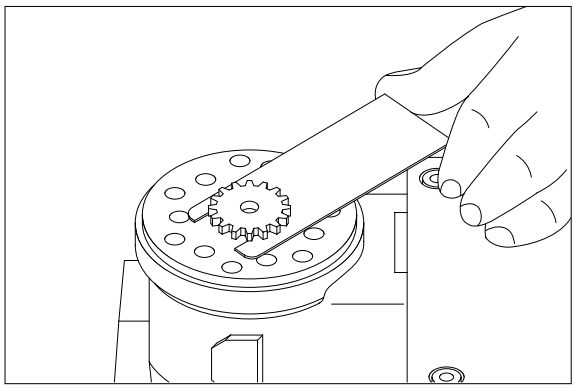
(25) Place the distributor plate so that the channel holes match the holes in the housing.



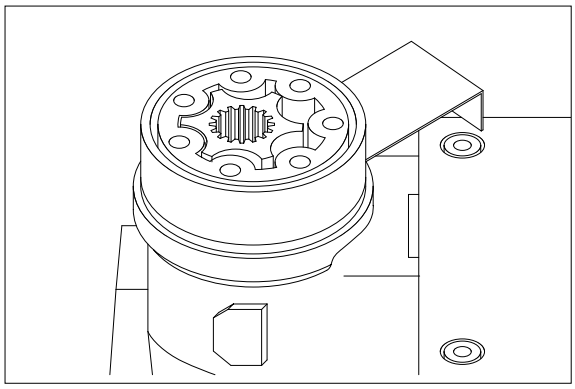
(26) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



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



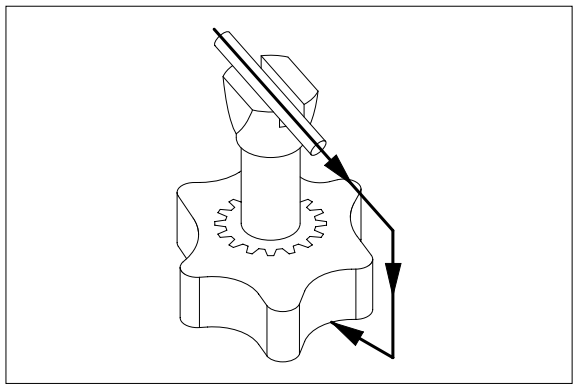
(28) Grease the two O-rings with mineral oil approx. viscosity 500 cSt at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



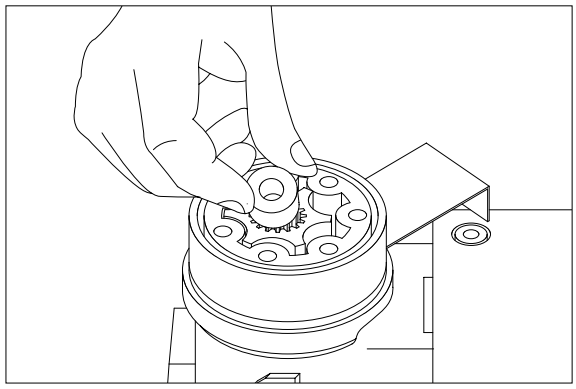
(29) Important

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.

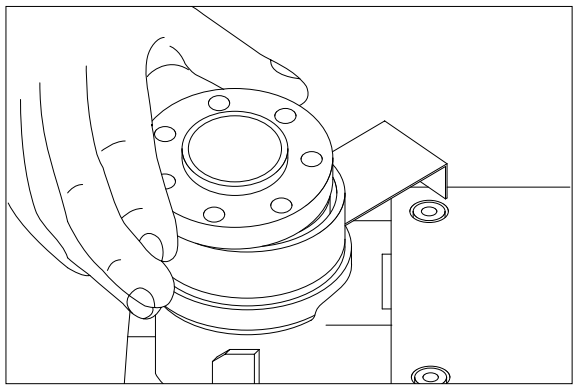
Turn the gear rim so that the seven through holes match the holes in the housing.



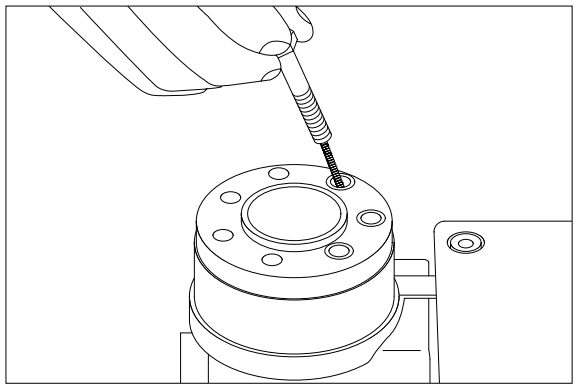
(30) Fit the spacer, if any.



(31) Place the end cover in position.

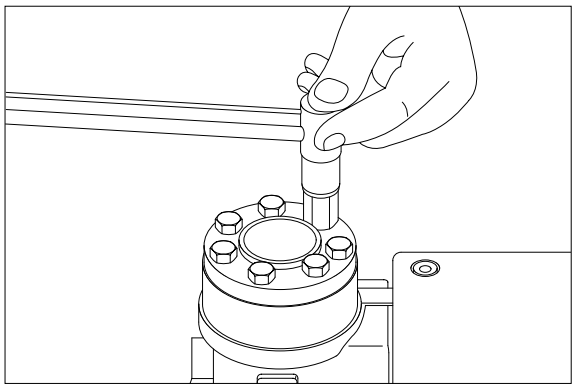


(32) Fit the special screw with washer and place it in the hole shown.



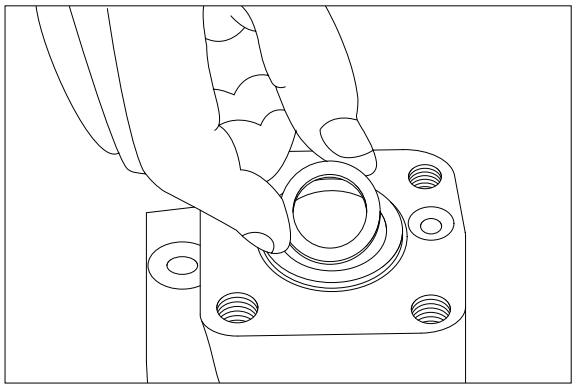
(33) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

・Tightening torque : 3.1±0.6kgf・m
(22.4±4.3lbf・ft)

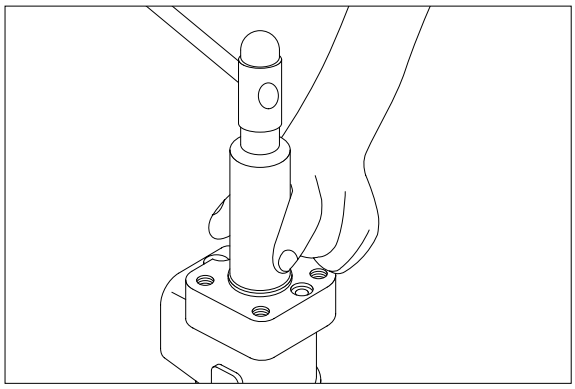


(34) Place the dust seal ring in the housing.

※ The dust seal ring must be placed only after the pressure relief valve and shock valves have been fitted.

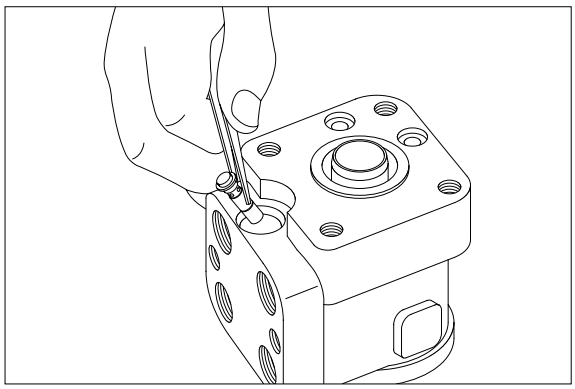


(35) Fit the dust seal ring in the housing using special tool SJ 150-9000-22 (See page 5-35(5)) and a plastic hammer.

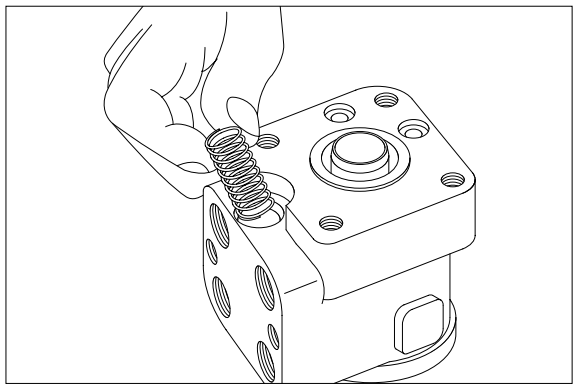


Assembly of the pressure relief valve

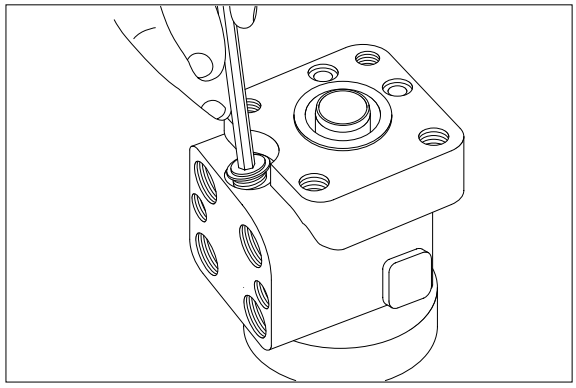
(36) Fit the piston.



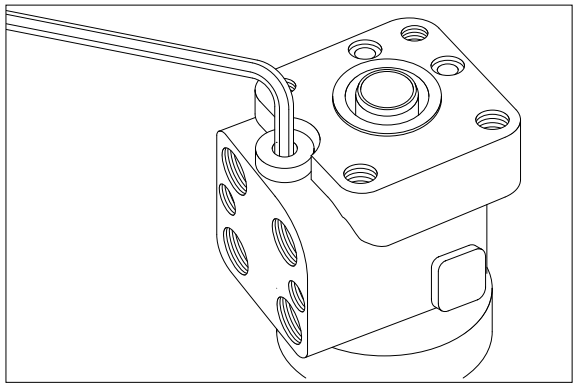
(37) Fit the spring.



(38) Screw in the setting screw with an 8mm hexagon socket spanner.
- Setting pressure : 195±5bar (2830±73psi)

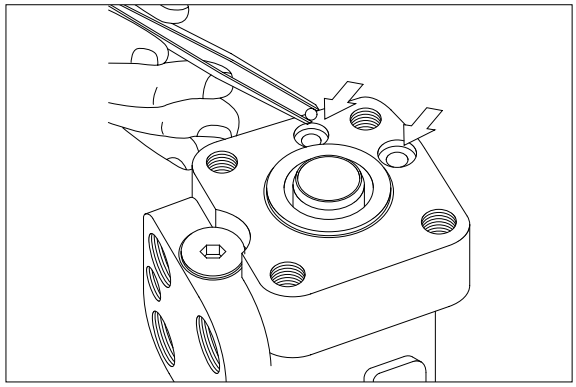


(39) Screw plug with dust seal into the housing using an 8mm hexagon socket spanner.
- Tightening torque : 5.1±1.0kgf·m (36.9±7.2lbf·ft)



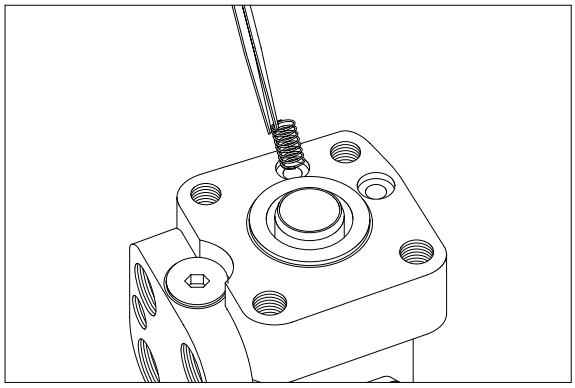
Assembly of the dual shock valve

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



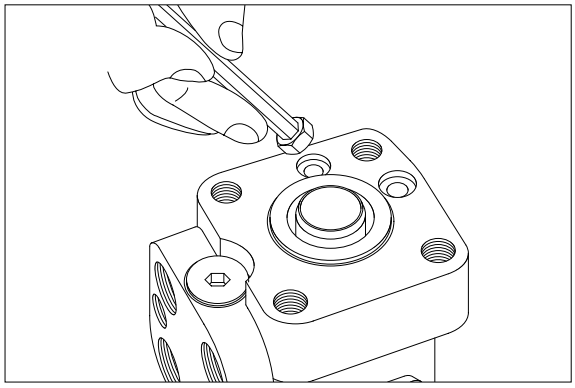
(41) Place springs and valve cones over the two balls.

※ The blue spring applies to setting range 90~180 bar. The untreated spring applies to setting range 190~260 bar.

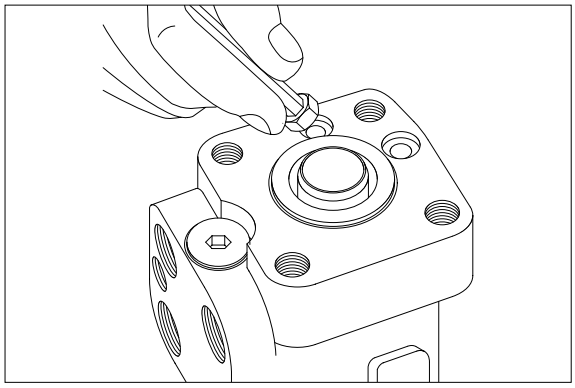


(42) Screw in the two setting screws using a 6㎜ hexagon socket spanner.

・Setting pressure : 250±10bar
(3630±145psi)

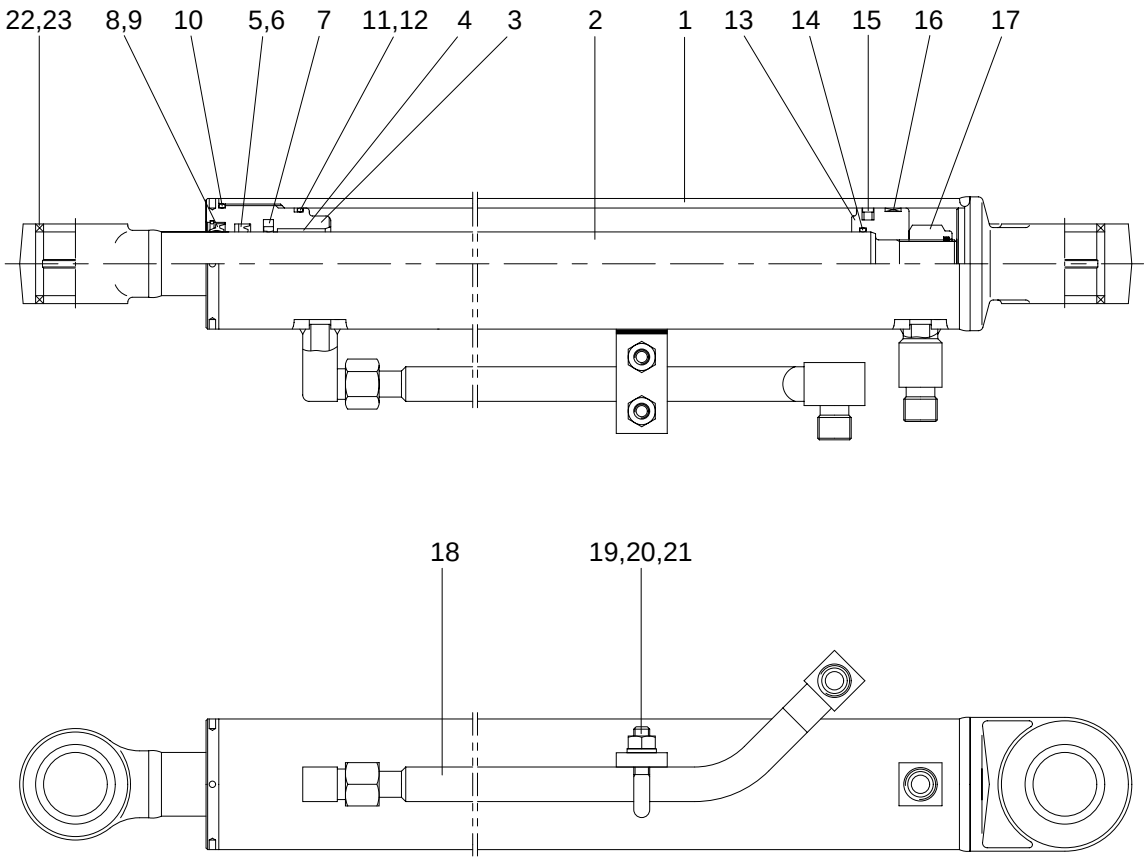


(43) Screw plug with seal ring into the two shock valves and tighten them with a torque of 3.05㎏f・m(22.1lbf・ft)using a 6㎜ hexagon socket spanner.



3. STEERING CYLINDER

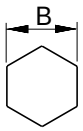
1) STRUCTURE



1	Tube assy	9	Snap ring	17	Nylon nut
2	Rod assy	10	O-ring	18	Pipe assy
3	Gland	11	O-ring	19	U-bolt
4	Du bushing	12	Back up ring	20	Hexagon nut
5	Rod seal	13	Piston	21	Spring washer
6	Back up ring	14	O-ring	22	Bushing
7	Step seal	15	Piston seal	23	Dust seal
8	Dust wiper	16	Wear ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Spanner	17	
	32	
	36	
Steel bar	For gland	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Gland	3	M64 × 1.5	65 ± 7	470 ± 51
Nylon nut	17	M24 × 2	40 ± 4	289 ± 28.9
Nut(Pipe assy)	18	M22 × 1.5	30 ± 3	217 ± 21.7
Nut	20	M10 × 1.5	3.2 ± 0.3	23.1± 2.2

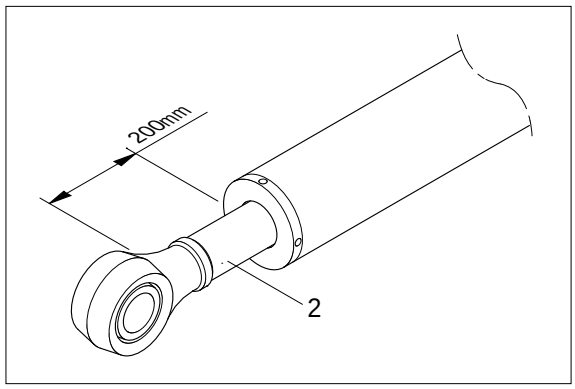
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

① Hold the clevis section of the tube in a vise.

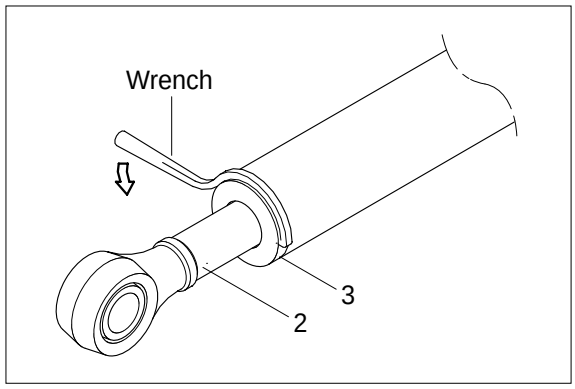
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out piston rod(2) about 200㎜ (7.1in). Because the piston rod is rather heavy, finish extending it with air pressure after the oil draining operation.



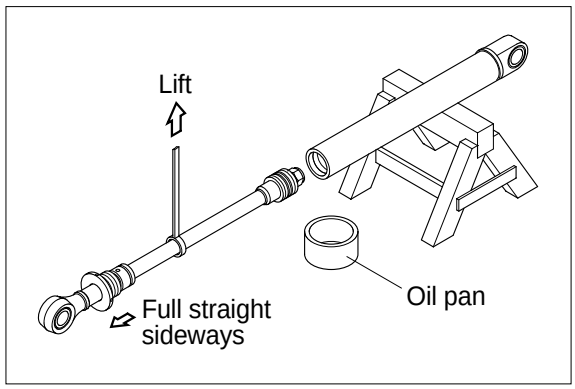
③ Loosen and remove the gland(3).

※ Cover the extracted piston rod(2) with rag to prevent it from being accidentally damaged during operation.



④ Draw out gland(3) and piston rod (2) assembly together from cylinder tube(1).

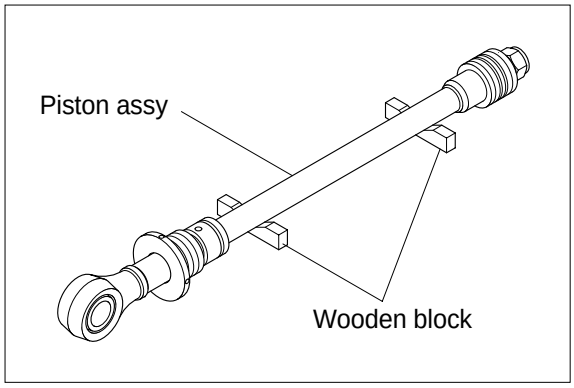
※ Since the piston rod assembly is heavy in this case, lift the tip of the piston rod(2) with a crane or some means and draw it out. However, when piston rod(2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



※ Note that the plated surface of piston rod(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 piston rod assembly on a wooden V-block that is set level.

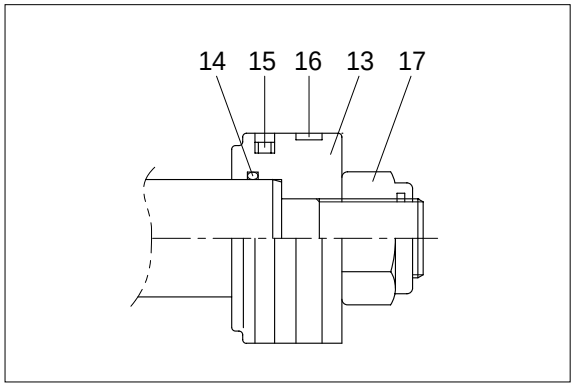
※ Cover a V-block with soft rag.



(2) Remove piston and cylinder head

① Remove the nylon nut(17).

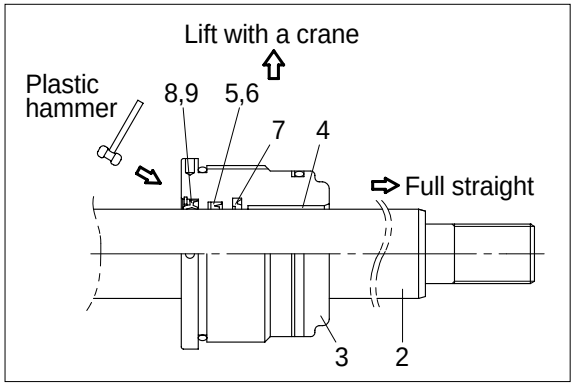
② Remove piston assembly(13), and O-ring(14).



④ Remove the gland(3) assembly from piston rod(2).

※ If it is too heavy to move, move it by striking the flanged part of gland(3) with a plastic hammer.

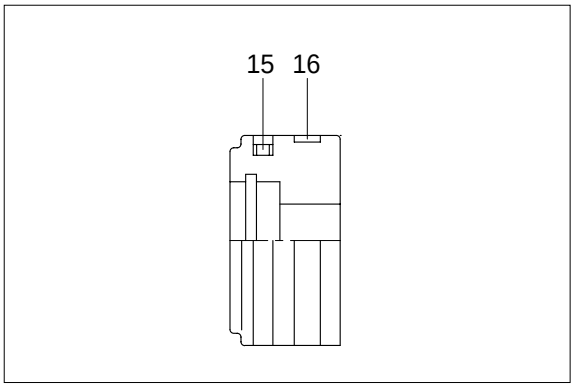
※ Pull it straight with cylinder head assembly lifted with a crane.
Exercise care so as not to damage the lip of rod bushing(4) and packing (5,6,7,8,9) by the threads of piston rod(2).



(3) Disassemble the piston assembly

① Remove wear ring(16) and piston seal (15).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

① Remove back up ring(11), and O-ring (10).

② Remove O-ring(12).

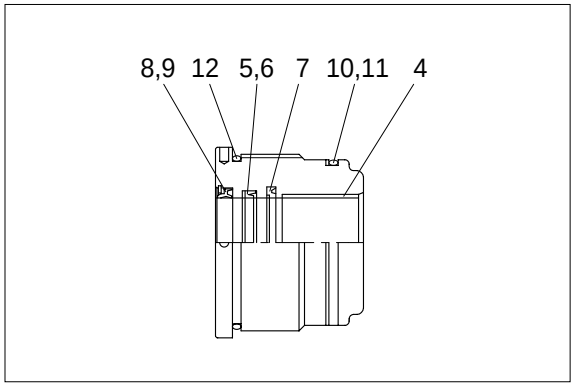
③ Remove snap ring(9) and dust wiper(8).

④ Remove back up ring(6), rod seal(5).

⑤ Remove buffer ring(7).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

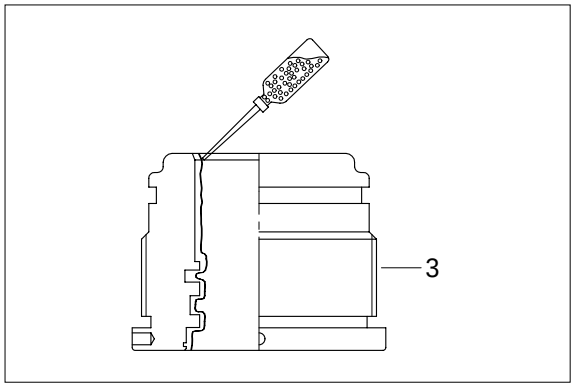


4) ASSEMBLY

(1) Assemble gland assembly

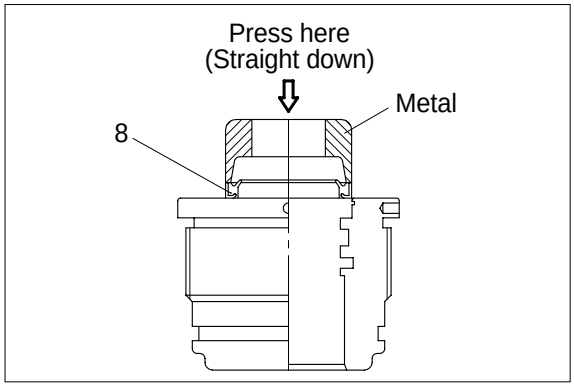
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland(3) with hydraulic oil.



② Coat dust wiper(8) with grease and fit dust wiper(8) to the bottom of the hole of dust wiper.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit snap ring(9) to the stop face.

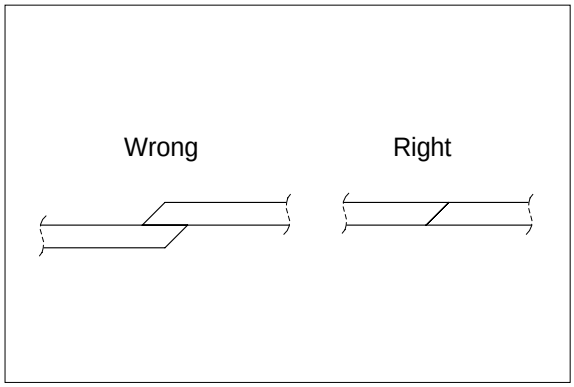


④ Fit back up ring(6) and rod seal(5) to corresponding grooves, in that order.

⑤ Fit buffer ring(7).

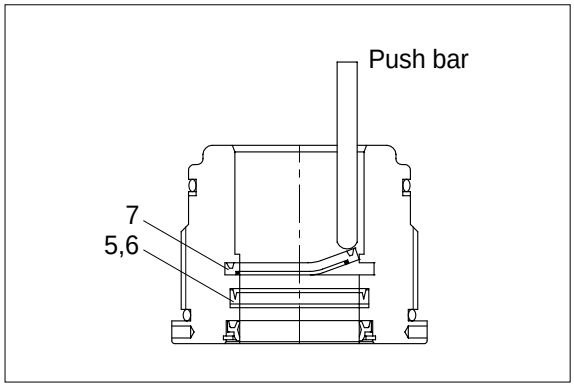
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until onside of it is inserted into groove.



※ Rod seal(5) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal(5) and buffer ring(7) up side down may damage its lip. Therefore check the correct direction that is shown in fig.

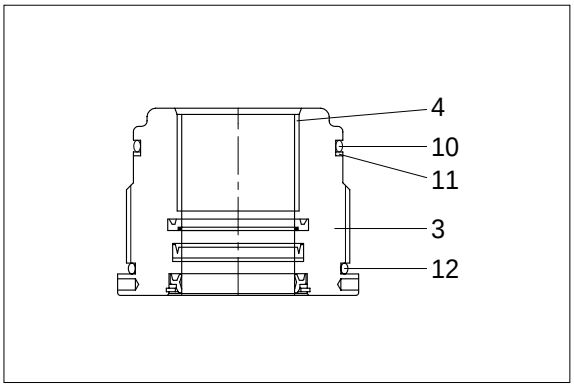


⑥ Fit back up ring(11) to gland (3).

※ Put the backup ring in the warm water of 30~50℃.

⑦ Fit O-ring(10) to gland(3).

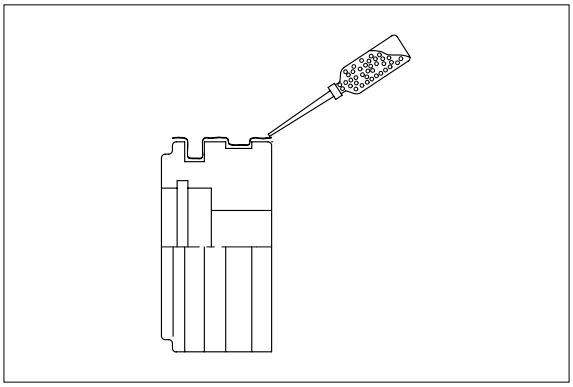
⑧ Fit O-ring(12) to gland(3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

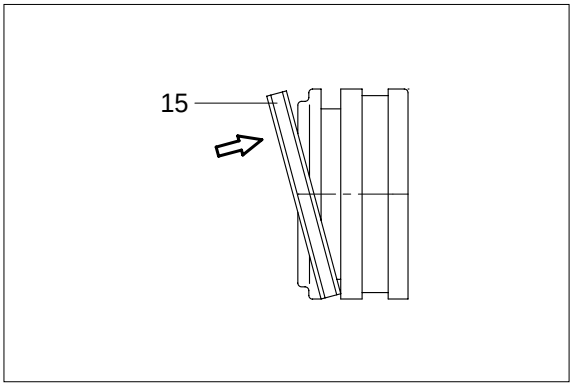
① Coat the outer face of piston(13) with hydraulic oil.



② Fit piston seal(15) to piston

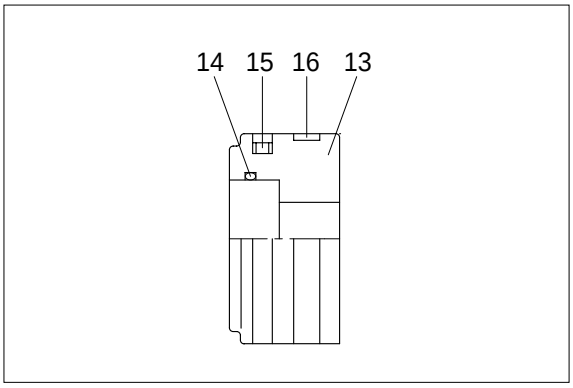
※ Put the piston seal in the warm water of 60~100℃ for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring(16) to piston(13).

④ Fit O-ring(14) to piston(13).

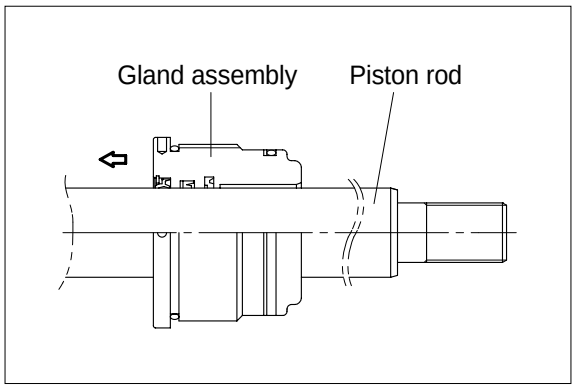


(3) Install piston and gland

① Fix the piston rod assembly to the work bench.

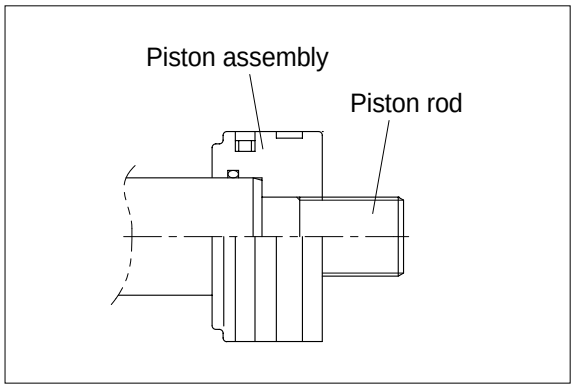
② Apply hydraulic oil to the outer surface of piston rod(2), the inner surface of piston and gland.

③ Insert gland assembly to piston rod(2).



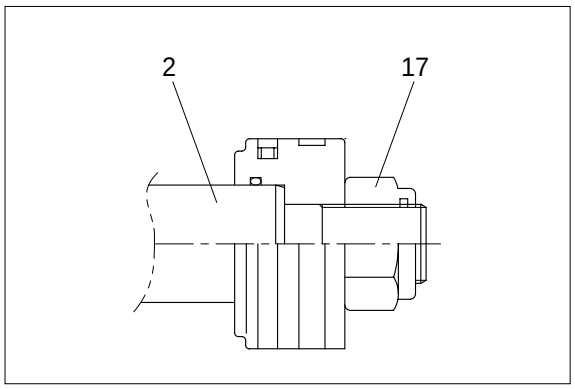
④ Fit piston assembly to piston rod.

・Tightening torque : 50±5kgf・m
(362±36lbf・ft)



⑤ Tighten nylon nut(17) to piston rod(2).

・Tightening torque : 75±8kgf・m
(542±58lbf・ft)



(4) Overall assemble

① Place a V-block on a rigid work bench. Mount the cylinder 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 piston rod assembly in to the cylinder tube assembly, while lifting and moving the piston rod assembly with a crane.

※ Be careful not to damage piston seal by thread of cylinder tube.

③ Match the bolts holes in the cylinder head flange to the tapped holes in the cylinder tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.