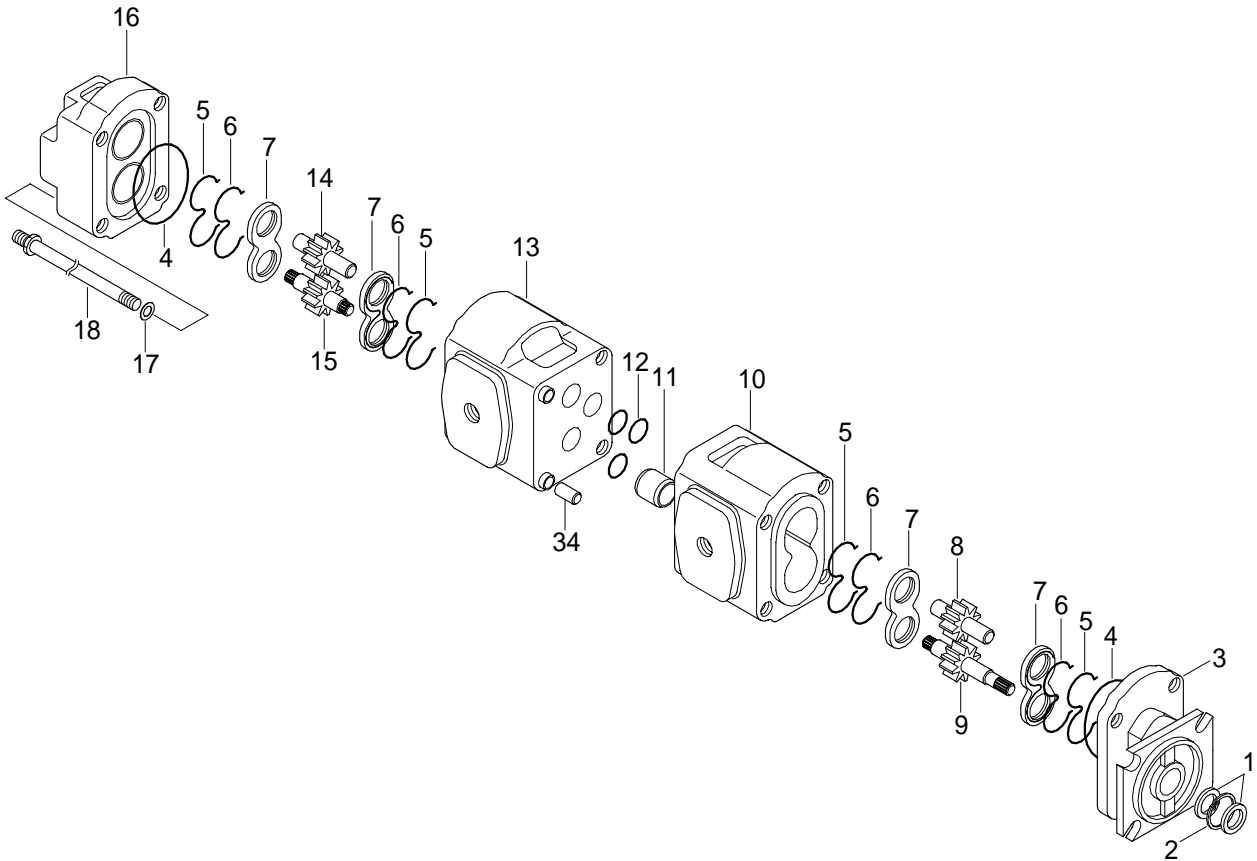


## GROUP 4 DISASSEMBLY AND ASSEMBLY

### 1. MAIN PUMP

#### 1) STRUCTURE



1 Shaft seal

2 Circlip

3 Flange

4 O-ring

5 Seal

6 Seal

7 Balance plate

8 Driven gear

9 Drive gear

10 Front body

11 Splined coupling

12 O-ring

13 Center body

14 Driven gear

15 Drive shaft

16 Cover

17 Washer

18 Stud assy

34 Dowel

## 2) GENERAL INSTRUCTION

### (1) Cleanliness

① Cleanliness is the primary means of assuring satisfactory hydraulic pump life. Components such as flanges and covers are best cleaned in soap and hot water, then air dried. Gears should be washed in solvent, air dried, and oiled immediately.

**▲ Certain cleaning solvents are flammable. Do not allow sources of ignition in the area when using cleaning solvents.**

② Protect all exposed surfaces and open cavities from damage and foreign material.

※ **Gear journals and gear faces are super finished. Take care not to touch these surfaces after oil and solvent have been removed.**

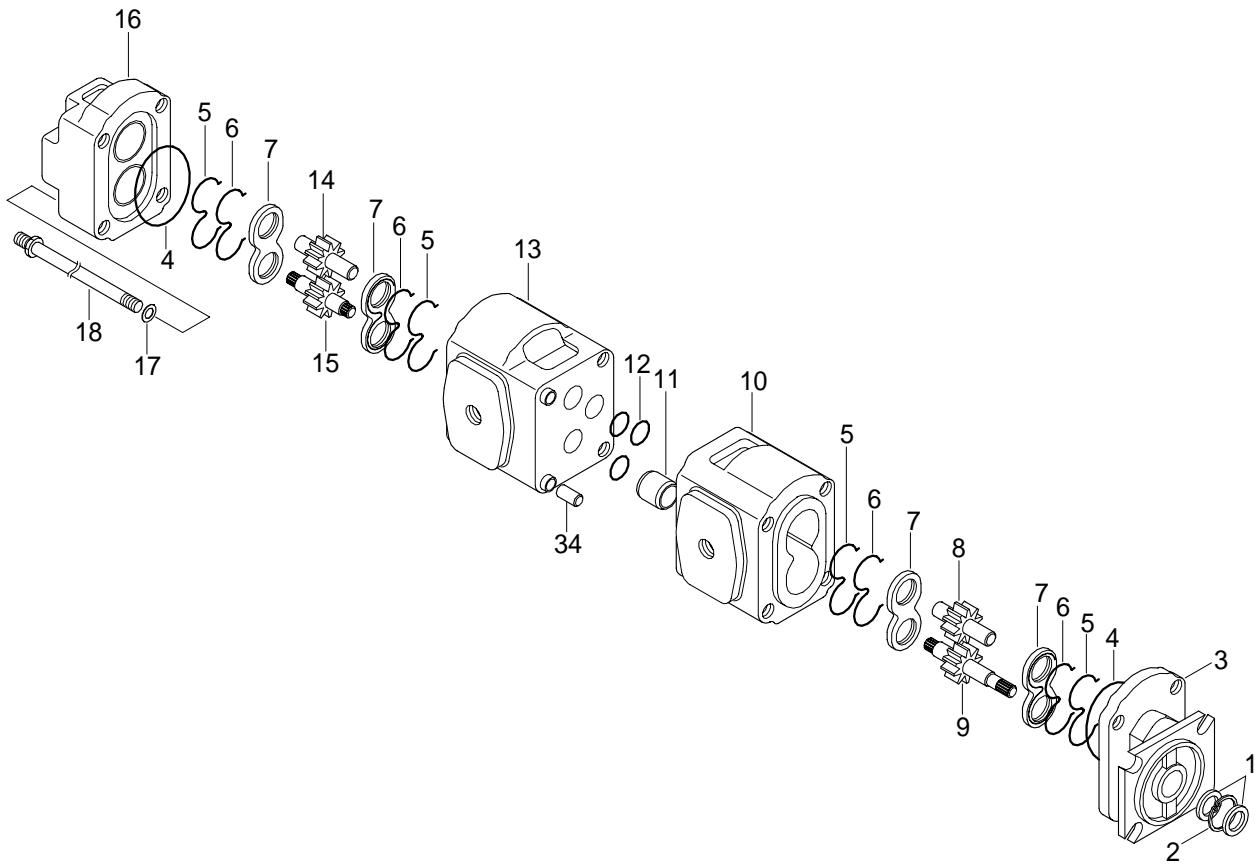
### (2) Lubrication of moving parts

During assembly, all running surfaces(Bushing and spacer plate) must be lightly lubricated with a clean oil or aerosol lubricant.

### (3) Tools required for assembly

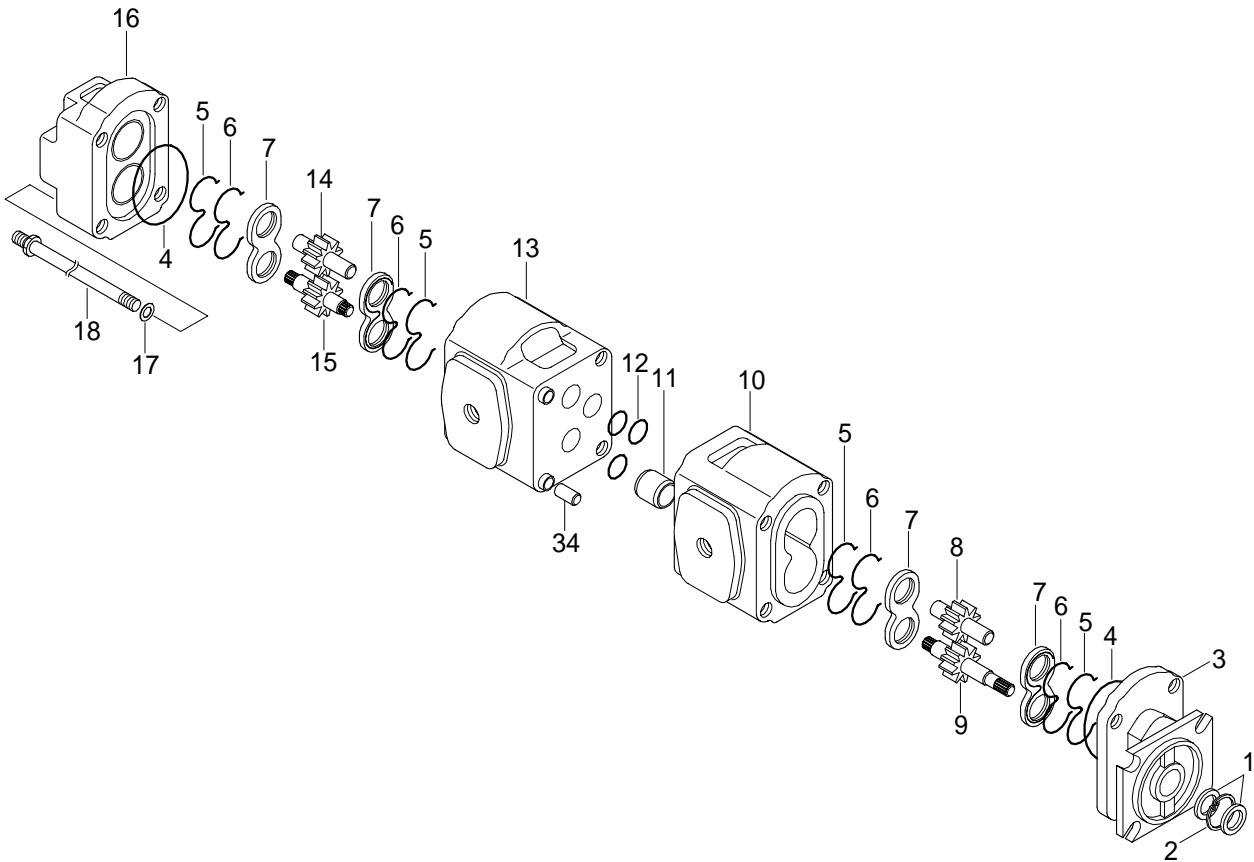
- ① Torque wrench(0~20kgf · m, 0~150lbf · ft)
- ② Open end wrenches
- ③ Seal installation tools(Inner and outer)
- ④ Shaft bullet(Seal protector)
- ⑤ Installation plate

### 3) DISASSEMBLY



- ※ Prior to starting work ensure that the pump and the working area are thoroughly clean and free from sources of contamination.
- (1) Mark end cover(16), rear body(13), front body(10) and mounting flange(3) to ensure correct assembly.
- (2) On parallel shafted pumps remove key(20) and circlip(19).
- (3) Remove the 4 bolts(18) serrated washers(17) clamping the units together, separate the pumps by removing the rear unit from the location dowels in the body - use a soft faced hammer.
- (4) Remove splined coupling(11) and discard O-ring(12) sealing the internal passages between the pump sections.
- (5) Disassemble rear pump by removing the end cover(16) from the body(13), free cover front location spigot using a soft faced hammer.
- (6) Remove drive shaft(15) from its bore by pushing it out from the connection hole in the rear face, this will also remove balance plate(7).
- ※ Note position of gear and balance plate for correct reassembly.
- (7) Remove driven gear(8) and lower balance plate(7).

## DISASSEMBLY



- (8) Discard O-ring(4) from end cover, seal(6) and seal energizer(5) from balance plates.
- (9) Disassemble front pump by separating flange(3) from its location spigot in body(10) - use soft faced hammer.
- (10) Remove shaft seal(1) from flange(3). Flanges have two shaft seals fitted back to back and the outer shaft seal must be removed first to gain access to retaining circlip(2).
- (11) Remove circlip(2) and inner shaft seal(1) take care to ensure that the seal recess is not damaged as this could result in leakage.
- (12) Grasp drive shaft(9) and remove it with balance plate(7), finally remove driven gear(8) and lower balance plate(7).  
※ Note their positions for correct assembly.
- (13) Remove and discard O-ring(4) in flange recess and seal(6) and seal energizer(5) from balance plates.
- (14) Clean off all loctite sealant from flange/ body and end cover/body interfaces.

## 4) INSPECTION AND REPAIR

### (1) Assessment

Each components should be thoroughly cleaned, carefully examined and assessed for suitability re-use. Below is a guide for inspecting the various components.

### (2) Body

- ① Inspect the body bore cut-in where both gears wipe into the body.
- ② The body can only be re-used if the **cut-in** is bright and polished in appearance and the depth does not exceed 0.15mm(0.006").
- ③ The body should be replaced if the surface is scored, has a matt appearance or shows signs that the tip of the gears have dug in and torn away the surface material.
- ④ The body should be inspected to ensure that there is no superficial damage which may adversely effect performance or sealing. Pay particular attention to the port threads and body O-ring seal recesses.

### (3) Mounting flange and end cover

- ① The inner surfaces should be inspected to ensure that there is no unusual wear or scoring in the regions where the body O-rings and backing rings contact, which result in external leakage.
- ② Check the shaft seal recess for scoring or damage that could result in oil leakage around the outer diameter of the shaft seal. Replacement shaft seals can be refitted with Loctite hydraulic sealant to overcome slight damage in this area.

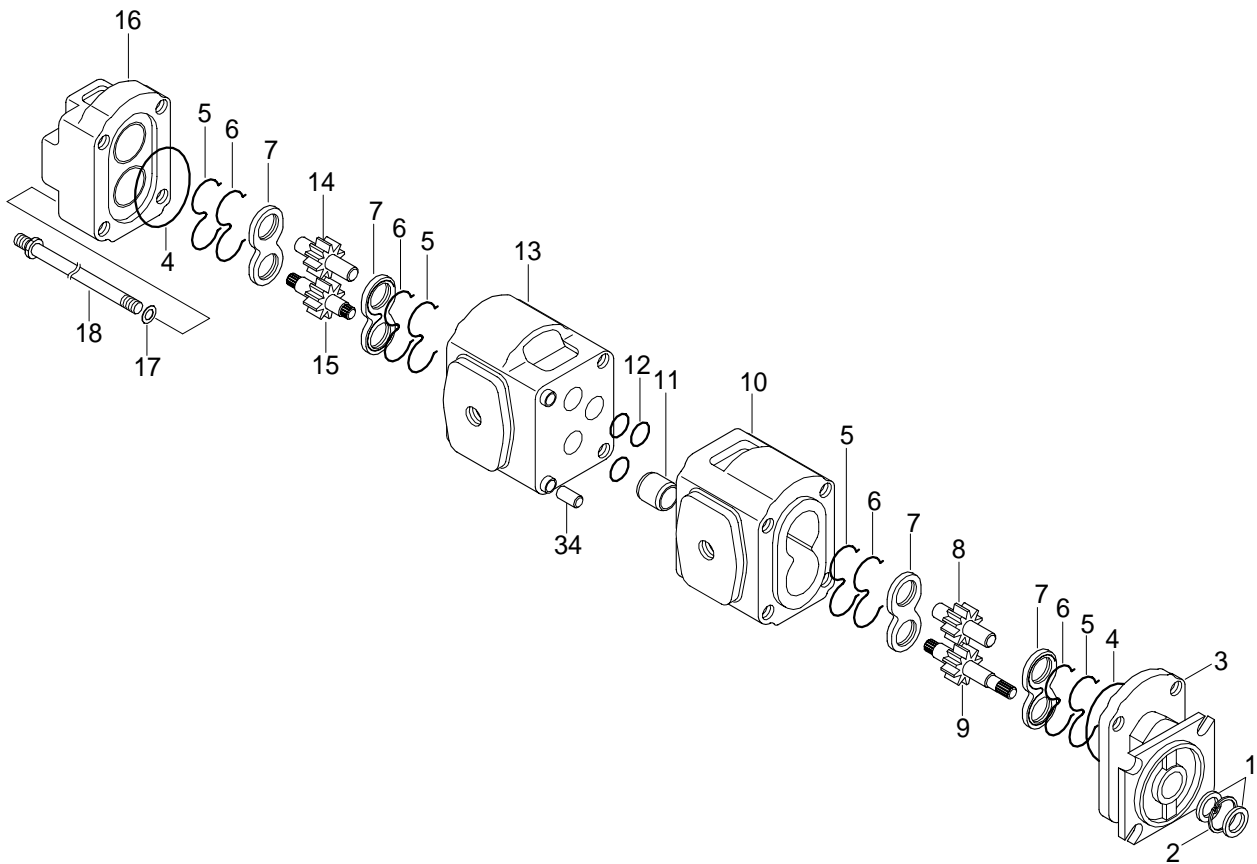
### (4) Balance plate

- ① The side faces which abut the gears should be perfectly flat showing no sign of scoring. Characteristically there are bright polished areas on this surface caused by loading against the gear side faces, which is often more pronounced on the low pressure side. The balance plate should be replaced if there is any general scoring or fine scoring with a matt appearance or tearing of the surface material. Often there is a witness where the tips of the opposing gears have wiped an overlap reassembling a half moon shape. There must be no noticeable wear step as it is critical that the balance plate side face is completely flat to the gear side face.
- ② The bearing liners are acceptable providing that they are not scored or show other damage. The general outside area of the balance plate should not show any prominent signs of wear.

### (5) Gears

- ① The gear side faces should be examined for bruising or scoring. Often operation on contaminated fluid shows scoring between the root of the gear and the journal undercut, which leaves a wear step. If a wear step can be felt, coincidental with the root diameter, by drawing a sharp pointed tool across the surface from the undercut outwards towards the tip of the gear, then the gear is unserviceable.
- ② The gear teeth should then be carefully examined to ensure that there are no signs of bruising or pitting.
- ③ The journal bearing surfaces should be completely free from scoring or bruising. The surface should appear highly polished and smooth to touch.
- ④ Examine the area where the shaft seal lips run on the drive shaft, this shows up as a polished ring or rings. If a noticeable groove can be felt or there is scoring the shaft should be replaced.
- ⑤ Provided the drive shaft is not damaged from the drive-coupling and the gears have not been harmed as described above, then the gears can be re-used. If, however, the gears are damaged they must be replaced as a matched pair.
- ⑥ As a matter of good practice, when pumps have been disassembled, all the seals should be replaced. It is most important that only the genuine seals are used.

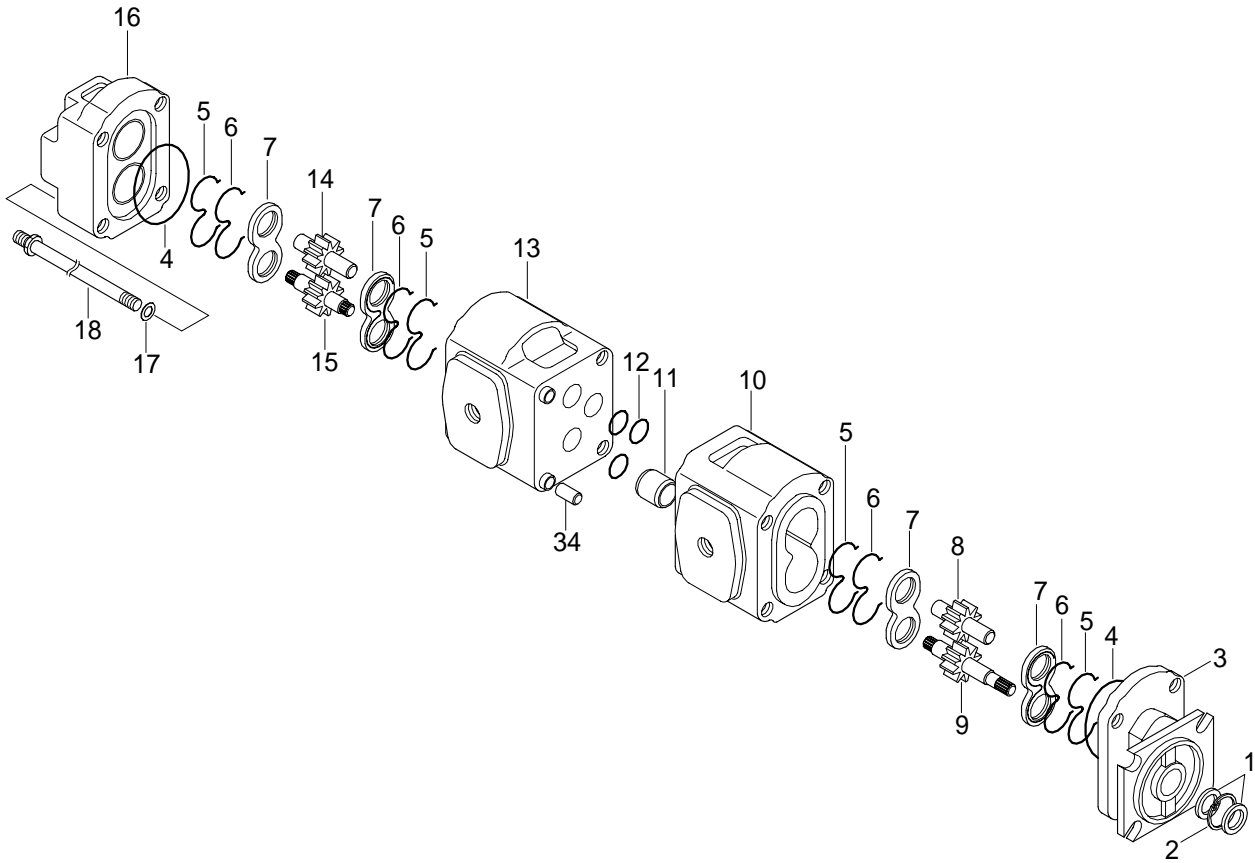
### 3) ASSEMBLY



- ※ Prior to assembly all parts must be perfectly clean and lubricated with clean hydraulic oil.
- ※ Renew all seals using clean hydraulic oil as a lubricant.

#### (1) Front pump

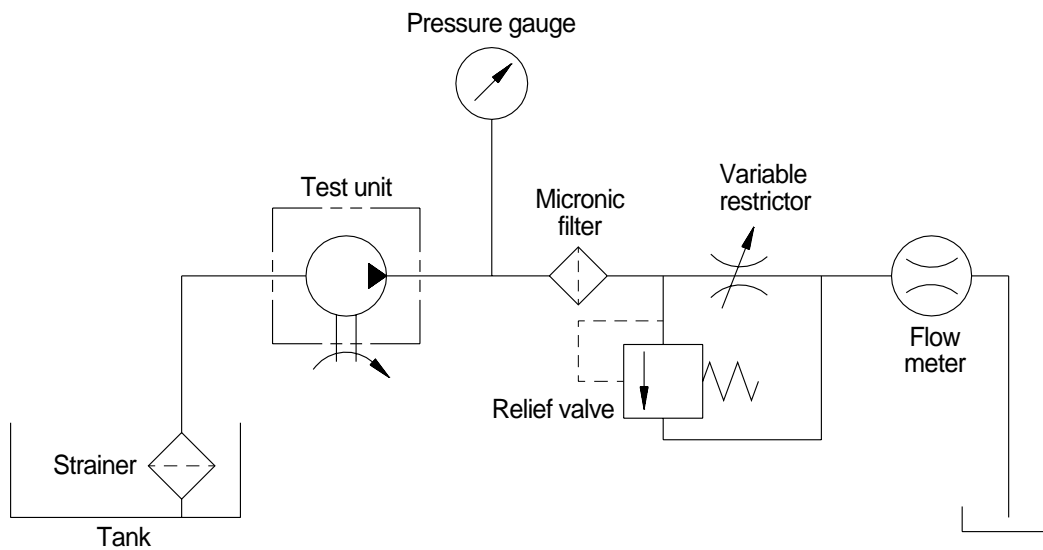
- ① Fit inner shaft seal(1) into the recess in the mounting flange, with the garter spring facing into the pump, refit circlip(2) into its groove.  
Fit outer shaft seal with garter spring facing uppermost. Coat lips of seals with a high melting point grease.
- ※ If the seal recess has been scored, then seal outside diameter can be coated with loctite hydraulic sealant to prevent leakage.
- ② Stand pump body on its rear face, fit seal(6) and seal energizer(5) to the groove in the balance plate. Carefully feed the balance plate into the body bores. Ensure that the seals remain in position and that the two small holes through the balance plate are to the low pressure side of the unit, i.e. side with large 4 bolt port pattern.
- ③ Insert drive shaft(9) and driven gear(8) into their original bores.
- ④ Replace top balance plate with small holes to low pressure side of the unit, fit seal(6) and seal energizer(5) to grooves in balance plate.
- ⑤ Fit O-ring(4) to groove in mounting flange and apply a small amount of loctite sealant to the body lower face, i.e. outboard of oval spigot. This sealant is to prevent moisture entering this area preventing corrosion.
- ⑥ Carefully feed mounting flange over the drive shaft, ensure flange is in its original position-4mm hole in rear face of flange must be to the low pressure side of the unit. Tap flange on to its location spigot with a soft faced hammer.



## (2) Rear pump

- ① Support front pump on the mounting flange-not the drive shaft-fit O-rings(12) into the grooves around connection passages in the rear face, replace splined coupling(11).
- ② Fit rear pump body to front pump ensuring that it locates on the dowels and the through holes line up.
- ③ Fit seal(6) and seal energizer(5) to grooves in balance plate(7) and carefully feed into body bores. Ensure seals remain in position and that the two small holes through the balance plate are to the low pressure side, i.e. the side without a port.
- ④ Fit drive gear(15) ensuring that it locates in the splined coupling(11), fit driven gear(14).
- ⑤ Replace upper balance plate in its original position, i.e. with 2 small holes to low pressure side, fit seal(6) and seal energizer(5) to groove in plate.
- ⑥ Fit O-ring(4) to groove in end cover, apply a small amount of loctite sealant to lower face of body, i.e. outboard of oval spigot.
- ⑦ Fit end cover in its original position, washer(17) and through bolts(18).  
Tightening torque :  $9.5 \pm 0.5\text{kgf} \cdot \text{m}$  ( $68.7 \pm 6.3\text{lb} \cdot \text{ft}$ )
- ⑧ Pour a small amount of clean hydraulic oil into ports and check that the unit rotates without undue force. If excessive force it required then seals in balance plates are possibly trapped and the unit should be disassembled and reassembled correctly.

## 6) RUNNING-IN

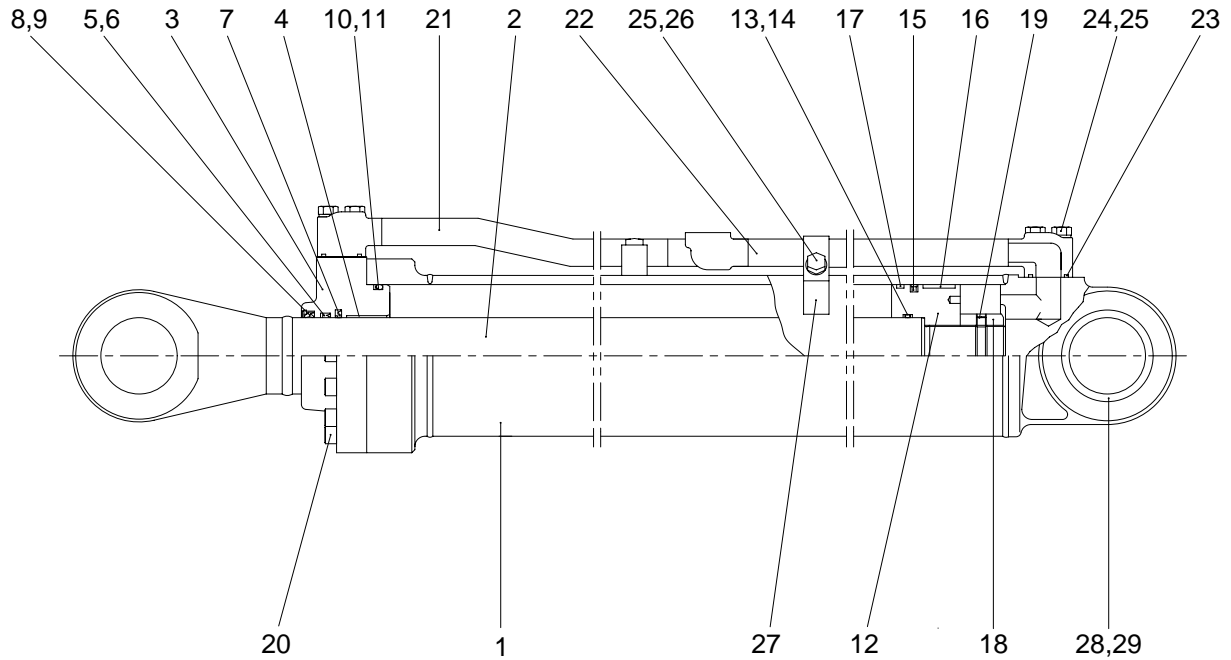


- (1) A unit which has been reassembled with either new gears, balance plate or body, must be carefully run-in before it is subjected to full working conditions.
- (2) Ideally this should be done on a test rig(See figure) where pressure can be gradually applied and any wipings from the body cut-in arrested by filters.
- (3) It is recommended that the unit is run-in at 1500rpm, initially, at zero pressure for one minute then in stages with the pressure increased by 500psi every minute, until maximum rated pressure has been attained. Frequently check the system temperature, ensuring that it does not exceed the maximum permissible figure of 80°C. If the temperature exceeds the system or unit specification the test must be delayed and operated off-load until acceptable temperatures are obtained.



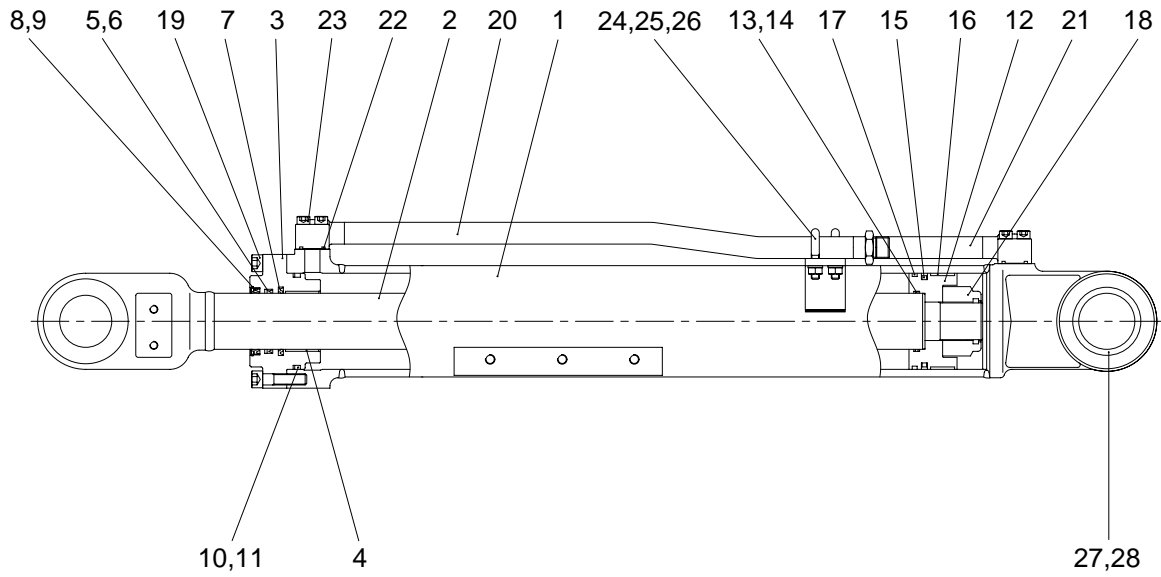
## 2. BOOM AND BUCKET CYLINDER

### 1) BOOM CYLINDER



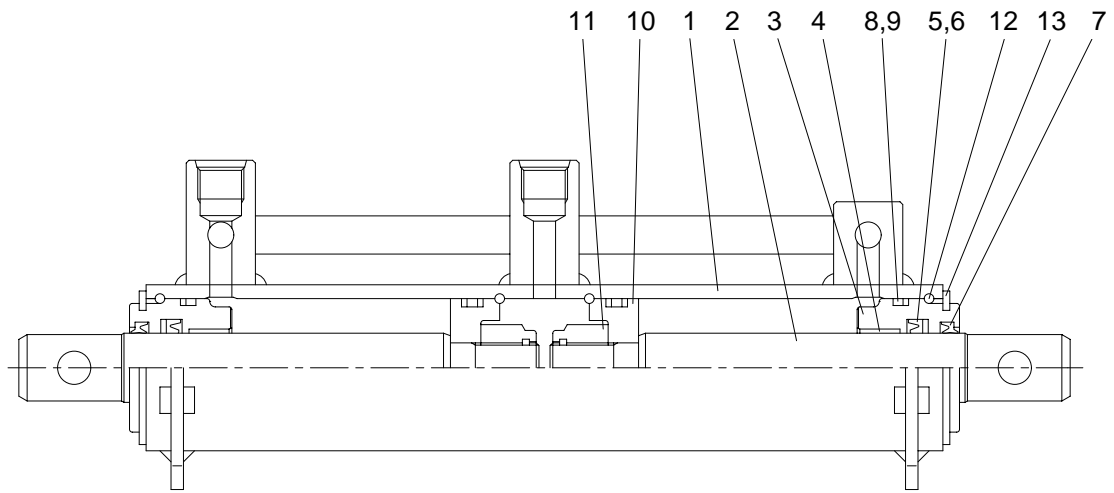
1	Tube assy	11	Back up ring	21	Pipe assy
2	Rod assy	12	Piston	22	Pipe assy
3	Gland	13	O-ring	23	O-ring
4	Bushing	14	Back up ring	24	Bolt
5	Rod seal	15	Piston seal	25	Spring washer
6	Back up ring	16	Wear ring	26	Bolt
7	Buffer ring	17	Piston nut	27	Clamp
8	Dust wiper	18	Lock nut	28	Bushing
9	Snap ring	19	Set screw	29	Dust seal
10	O-ring	20	Bolt		

## 2) BUCKET CYLINDER



1	Tube assy	11	Back up ring	21	Pipe assy
2	Rod assy	12	Piston	22	O-ring
3	Gland	13	O-ring	23	Bolt
4	Bushing	14	Back up ring	24	U-bolt
5	Rod seal	15	Piston seal	25	Nut
6	Back up ring	16	Wear ring	26	Spring washer
7	Buffer ring	17	Dust ring	27	Bushing
8	Dust wiper	18	Nut	28	Dust seal
9	Snap ring	19	Bolt		
10	O-ring	20	Pipe assy		

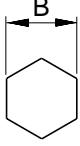
### 3) COUPLER CYLINDER



- |   |           |    |              |    |                |
|---|-----------|----|--------------|----|----------------|
| 1 | Tube assy | 6  | Back up ring | 11 | Nylon nut      |
| 2 | Rod       | 7  | Dust wiper   | 12 | Stop ring      |
| 3 | Gland     | 8  | O-ring       | 13 | Retaining ring |
| 4 | Bushing   | 9  | Back up ring |    |                |
| 5 | Rod seal  | 10 | Piston       |    |                |

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Tool name	Remark	
Allen wrench	8	
	12	
Spanner	17	
	27	
	75	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

### (2) Tightening torque

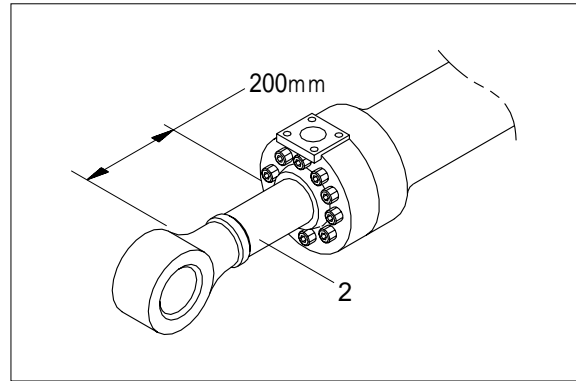
Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	19	M14 × 2	15±2	108±14
		23	M10 × 1.5	5.4±0.5	39±3.6
	Boom cylinder	20	M14 × 2	15±2	108±14
Hex head bolt	Boom cylinder	24	M10 × 1.5	5.4±0.5	39±3.6
		26	M10 × 1.5	3.2±0.3	23±2.2
Piston nut	Bucket cylinder	18	M48 × 2	250±25	1808±18
	Boom cylinder	18	M64 × 3	150±10	1085±72
	Coupler cylinder	11	M18 × 1.5	32±3	231±22
Piston	Bucket cylinder	12	M64 × 3	100±15	723±109
	Boom cylinder	12	M64 × 3	100±15	723±109
Set screw	Boom cylinder	19	M10 × 1.5	5.4±0.5	39±3.6

### 3) DISASSEMBLY

#### (1) Remove gland and piston rod

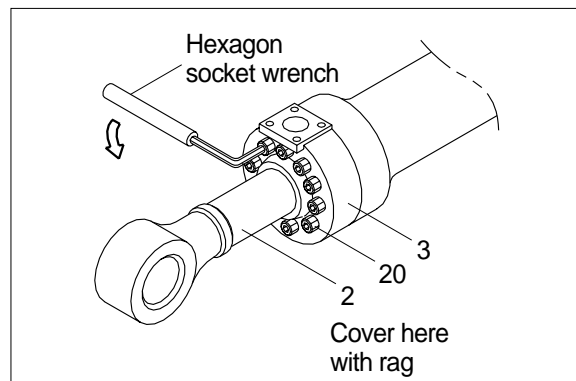
① Hold the clevis section of the tube in a vise. Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



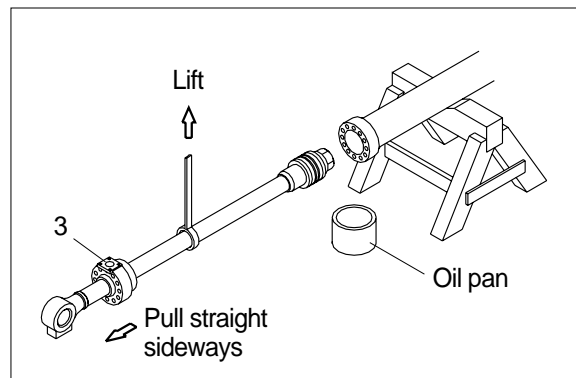
③ Loosen and remove socket bolts(20) of the gland(3) in sequence.

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



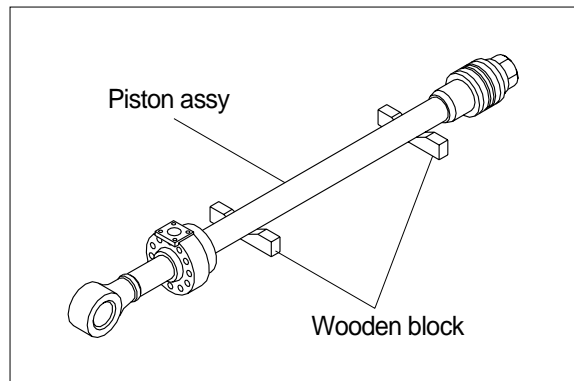
④ Draw out gland(3) and piston rod(2) assembly together from cylinder tube(1).

※ 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.



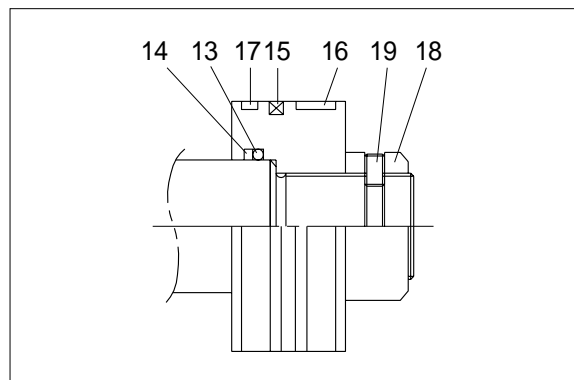
- ※ Note that the plated surface of piston rod(2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

- ⑤ Place the removed piston rod assembly on a wooden V-block that is set level.
- ※ Cover a V-block with soft rag.



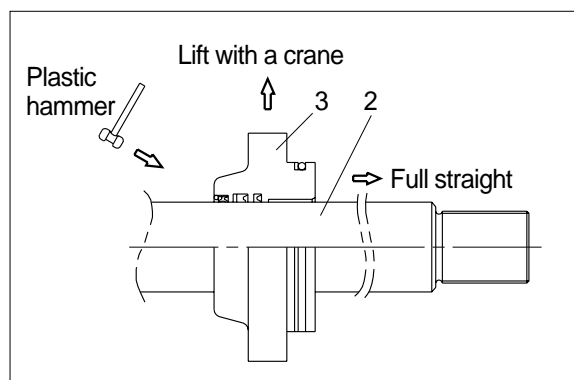
## (2) Remove piston and cylinder head

- ① Loosen the set screw(19) and remove the piston nut(17).
- ② Remove piston assembly(12), back up ring(14), O-ring(13).



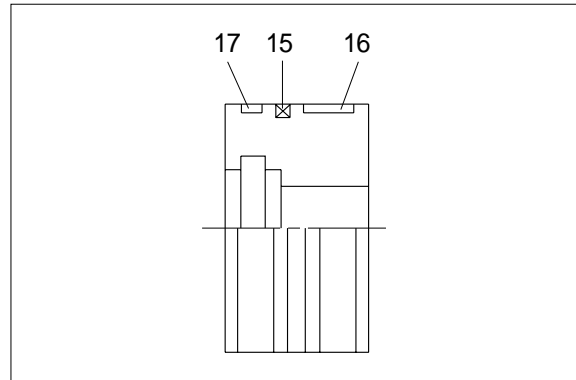
- ③ Remove the gland assembly from piston rod(2).
- ※ If is too heavy to move, move it by striking the flanged part of gland(3) with a plastic hammer.
- ※ Pull it straight with gland assembly lifted with a crane.

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).



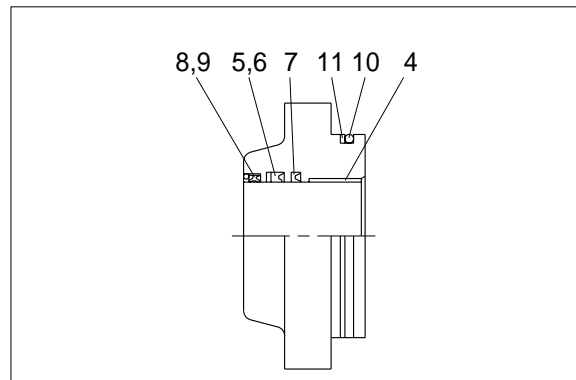
### (3) Disassemble the piston assembly

- ① Remove dust ring(17), 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 snap ring(9) and dust wiper(8).
  - ③ Remove back up ring(6), rod seal(5) and buffer ring(7).
- ※ Exercise care in this operation not to damage the grooves.
- ※ Do not remove seal and ring, if does not damaged.

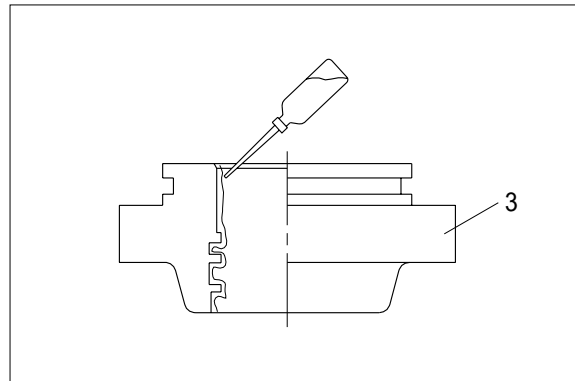


#### 4) ASSEMBLY

##### (1) Assemble gland assembly

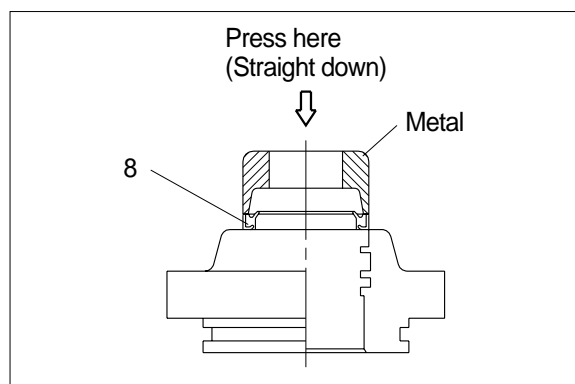
※ Check for scratches or rough surfaces if found smooth with an oil stone.

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.

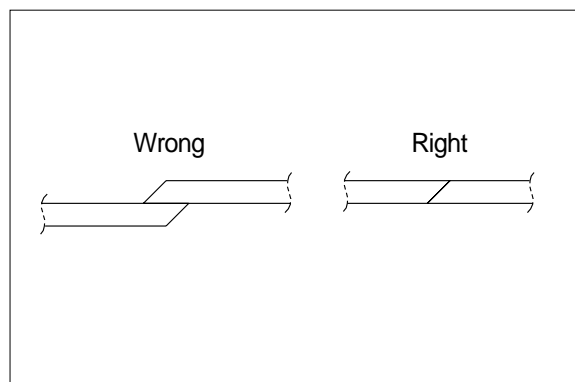
③ At this time, press a pad metal to the metal ring of dust seal.  
Fit snap ring(9) to the stop face.



④ Fit back up ring(6), rod seal(5) and buffer ring(7) to corresponding grooves, in that order.

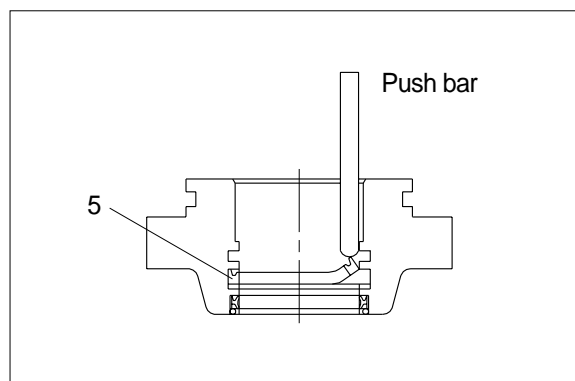
※ Coat each packing with hydraulic oil before fitting it.

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



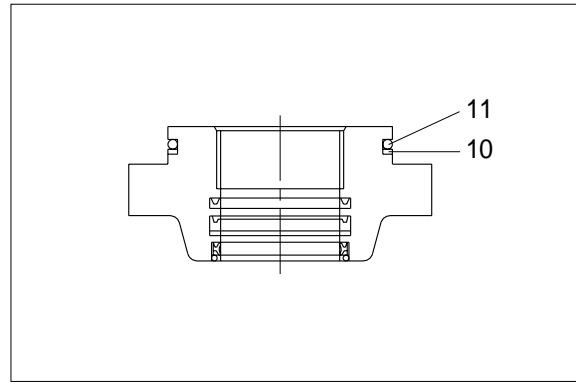
※ Rod seal(5) has its own fitting direction.  
Therefore, confirm it before fitting them.

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



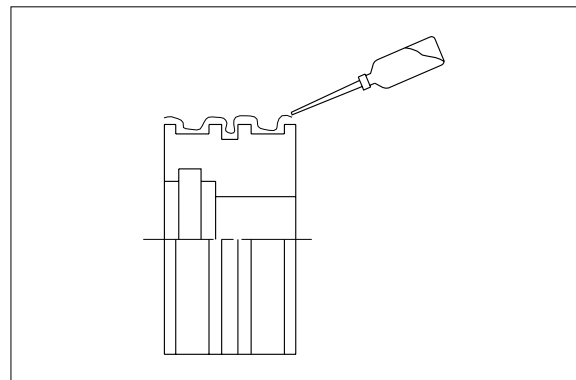


- ⑤ Fit back up ring(11) to gland(3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring(10) to gland(3).

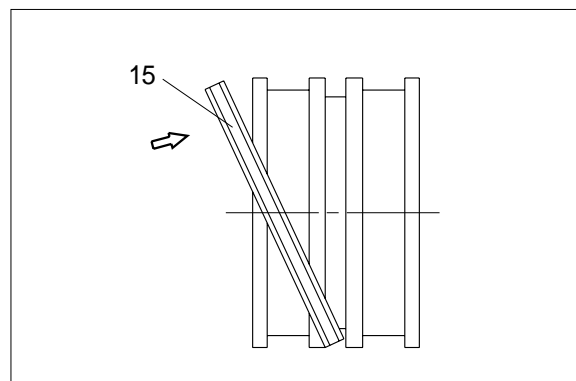


**(2) Assemble gland assembly**

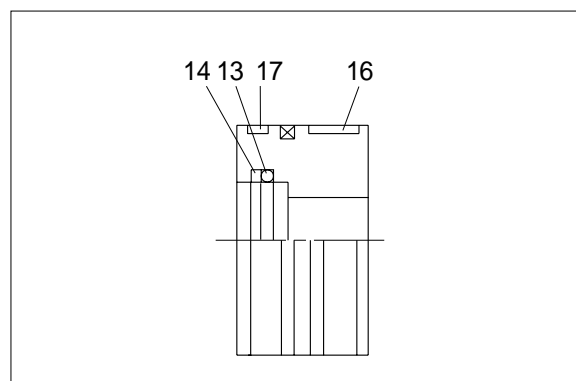
- ※ Check for scratches or rough surfaces if found smooth with an oil stone.
- ① Coat the outer face of piston(12) with hydraulic oil.



- ② Fit piston seal(15) to piston
- ※ Put the piston seal in the warm water of 60~100°C for more than 5 minutes.
- ※ After assembling the piston seal, press its outer diameter to fit in.

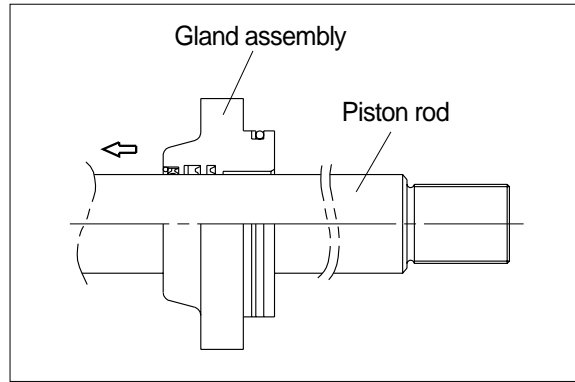


- ③ Fit wear ring(16) and dust ring(17) to piston(12).
- ④ Fit back up rings(14) and O-ring(13) to piston(12).

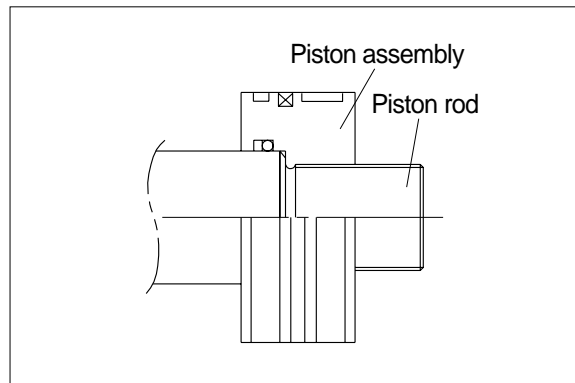


**(3) Install piston and gland**

- 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).

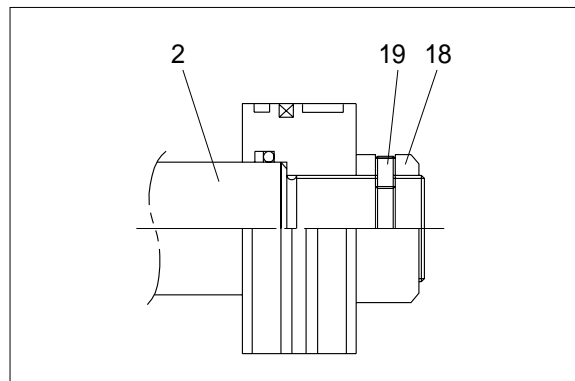


- ④ Fit piston assembly to piston rod.
  - Tightening torque :  $100 \pm 15 \text{ kgf} \cdot \text{m}$   
 $(723 \pm 109 \text{ lbf} \cdot \text{ft})$



- ⑤ Tighten piston nut(18) and screw(19) to piston rod(2).
- Tightening torque

Item	kgf · m	lbf · ft
18	$150 \pm 10$	$1085 \pm 72$
19	$5.4 \pm 0.5$	$39 \pm 3.6$



#### (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 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 bolt.
    - Tightening torque :  $15 \pm 2 \text{kgf} \cdot \text{m}$   
( $108 \pm 14 \text{lb} \cdot \text{ft}$ )

