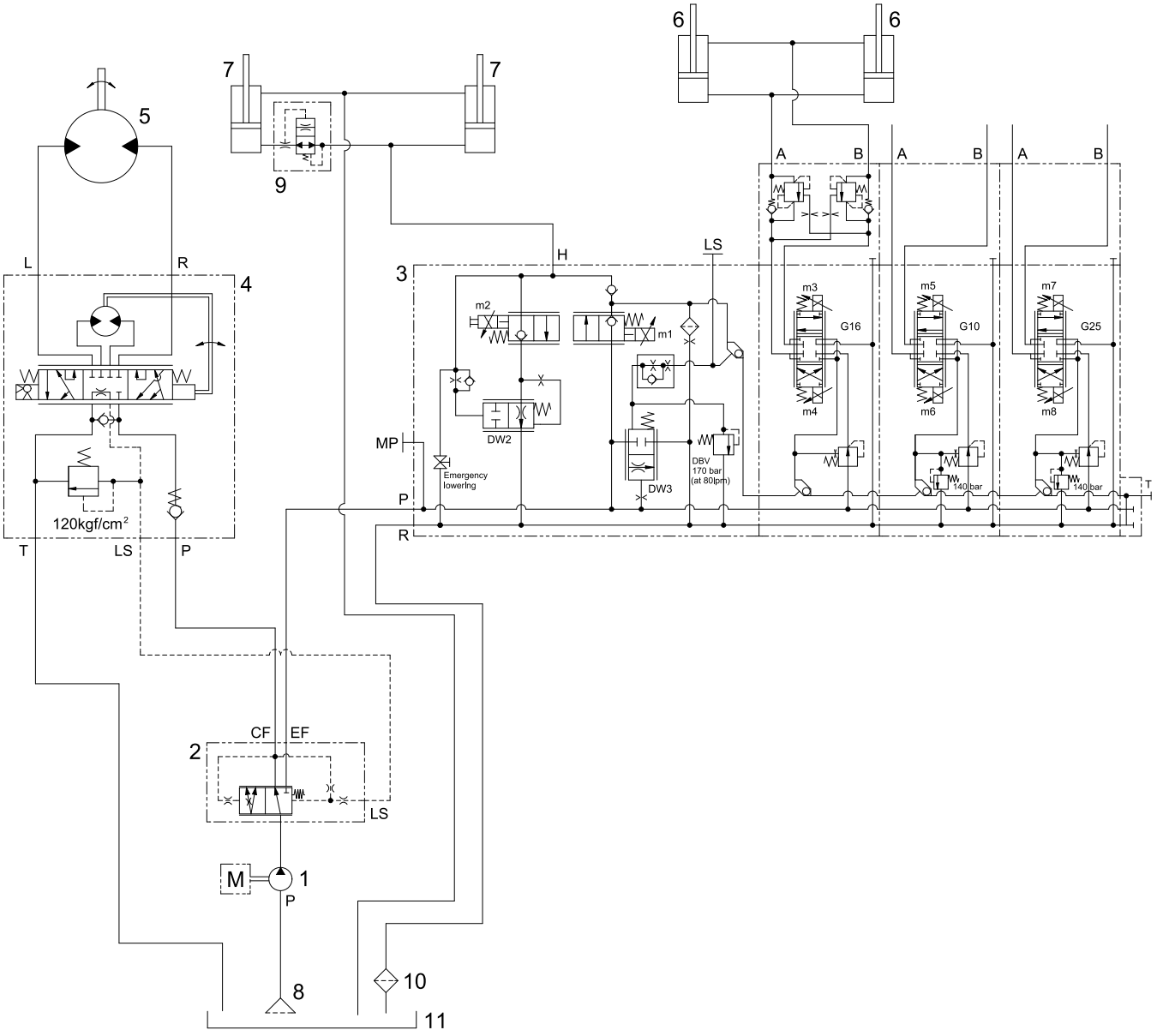
SECTION 6 HYDRAULIC SYSTEM

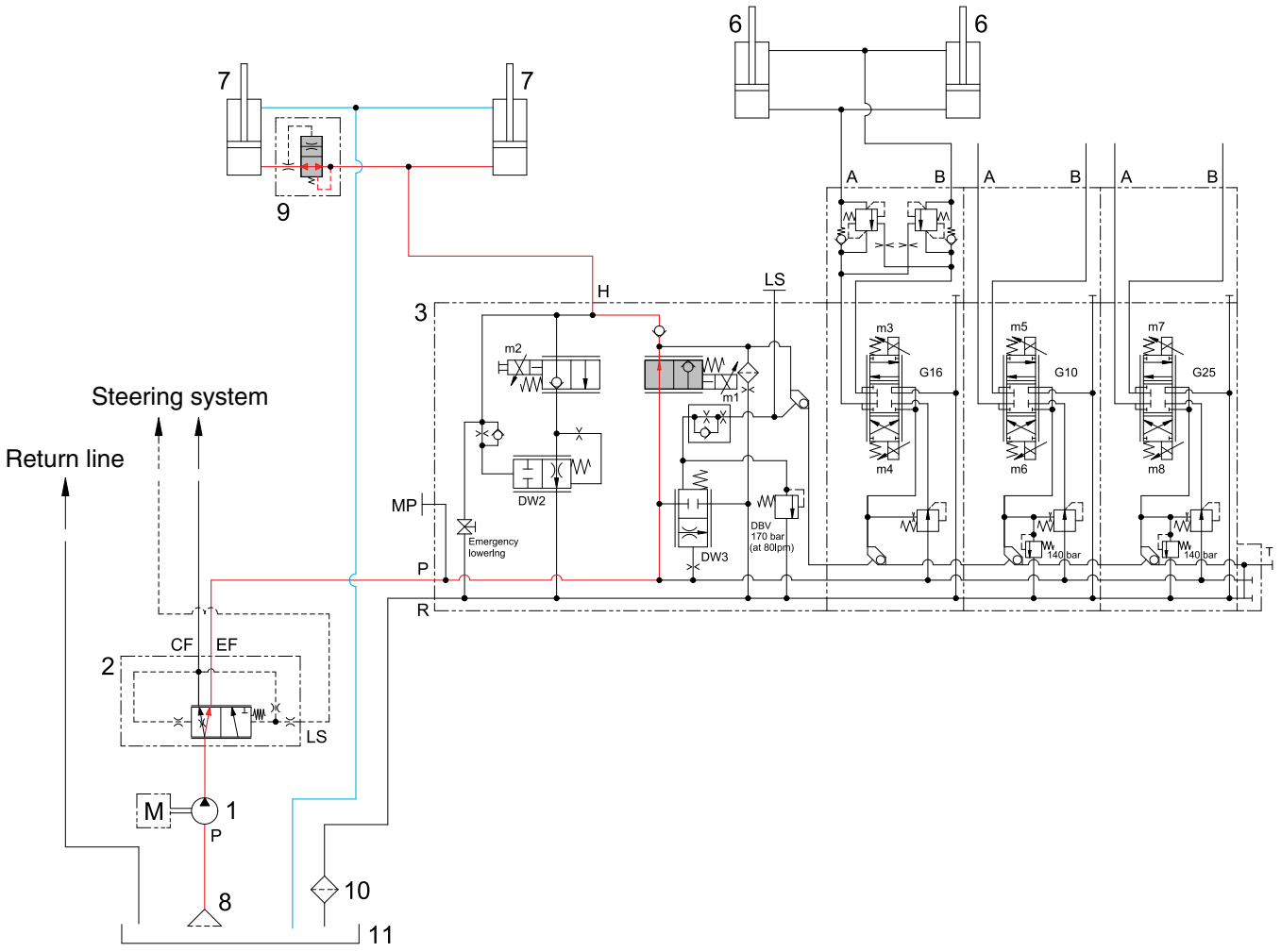
GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC CIRCUIT



1	Hydraulic gear pump	7	Lift cylinder
2	Priority valve	8	Suction strainer
3	Main control valve	9	Down safety valve
4	Steering unit	10	Return filter
5	Steering hydraulic motor	11	Hydraulic oil tank
6	Tilt cylinder		

1) WHEN THE JOYSTICK IS IN THE LIFT POSITION



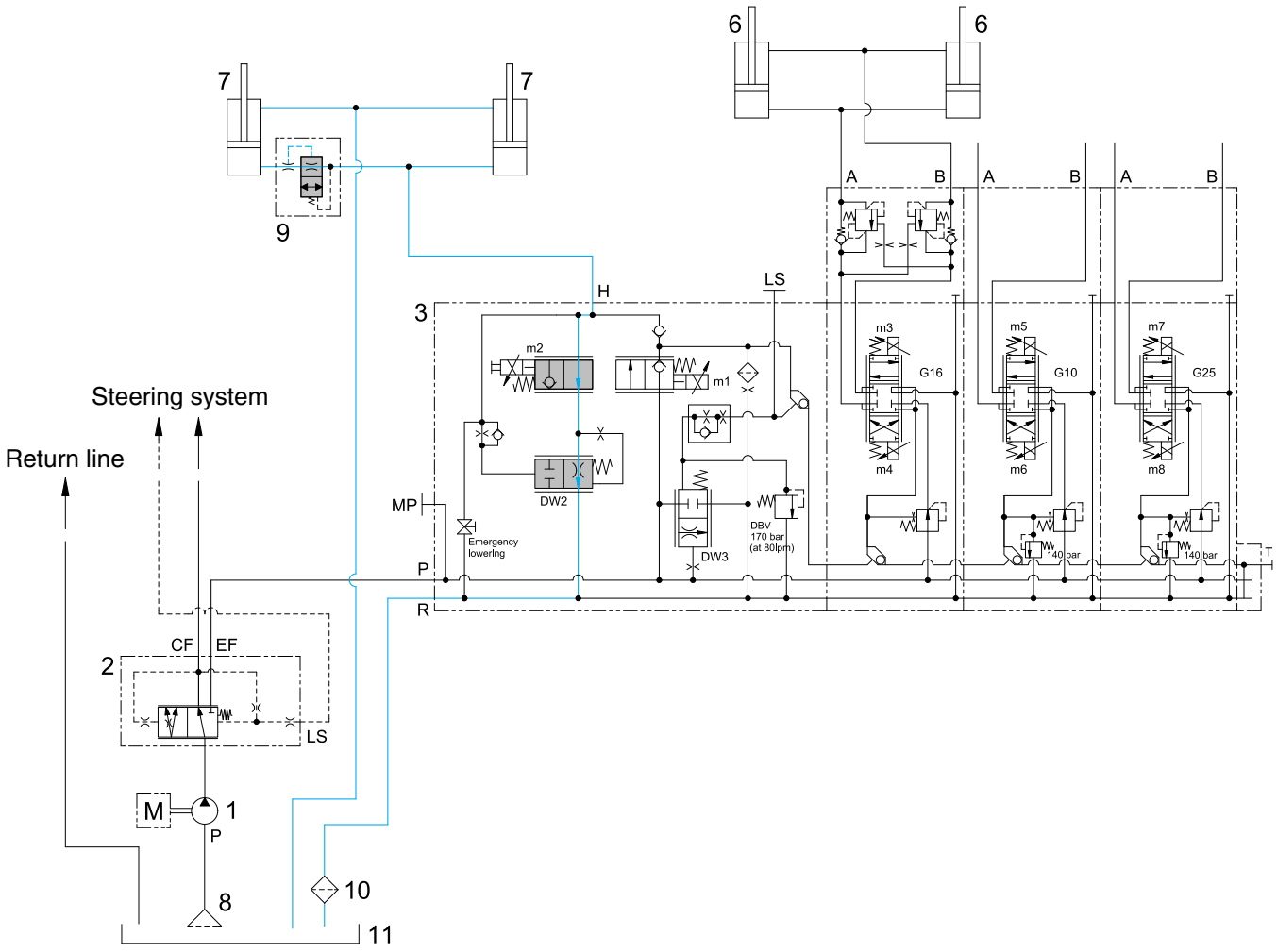
18BCS9HS02

When the joystick is pulled back, the solenoid valve (M1) on the main block is energized and then the spool moves to lift position.

The oil from hydraulic gear pump (1) flows into main control valve (3) through the priority valve (2) and then goes to the large chamber of lift cylinder (7) by pushing the load check valve on the main block.

The oil from the small chamber of lift cylinder (7) returns to hydraulic oil tank (11) at the same time. When this happens, the forks go up.

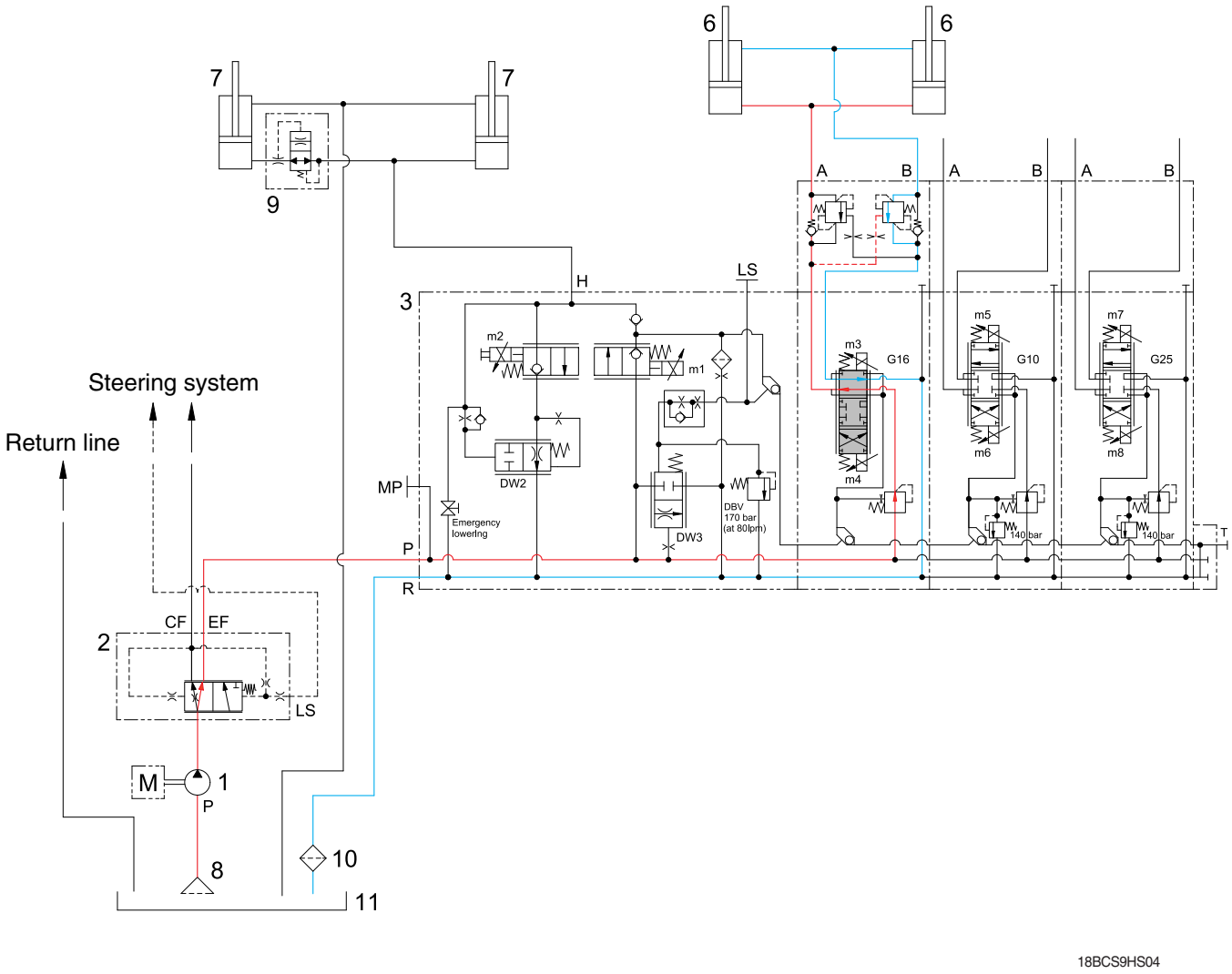
2) WHEN THE JOYSTICK IS IN THE LOWER POSITION



18BCS9HS03

When the joystick is pushed forward, the solenoid valve (M2) on the main block is energized and then the spool moves to lower position.
The oil of the small chamber and the large chamber flows to the hydraulic tank at the same time, so the forks will be lowered due to its own weight.

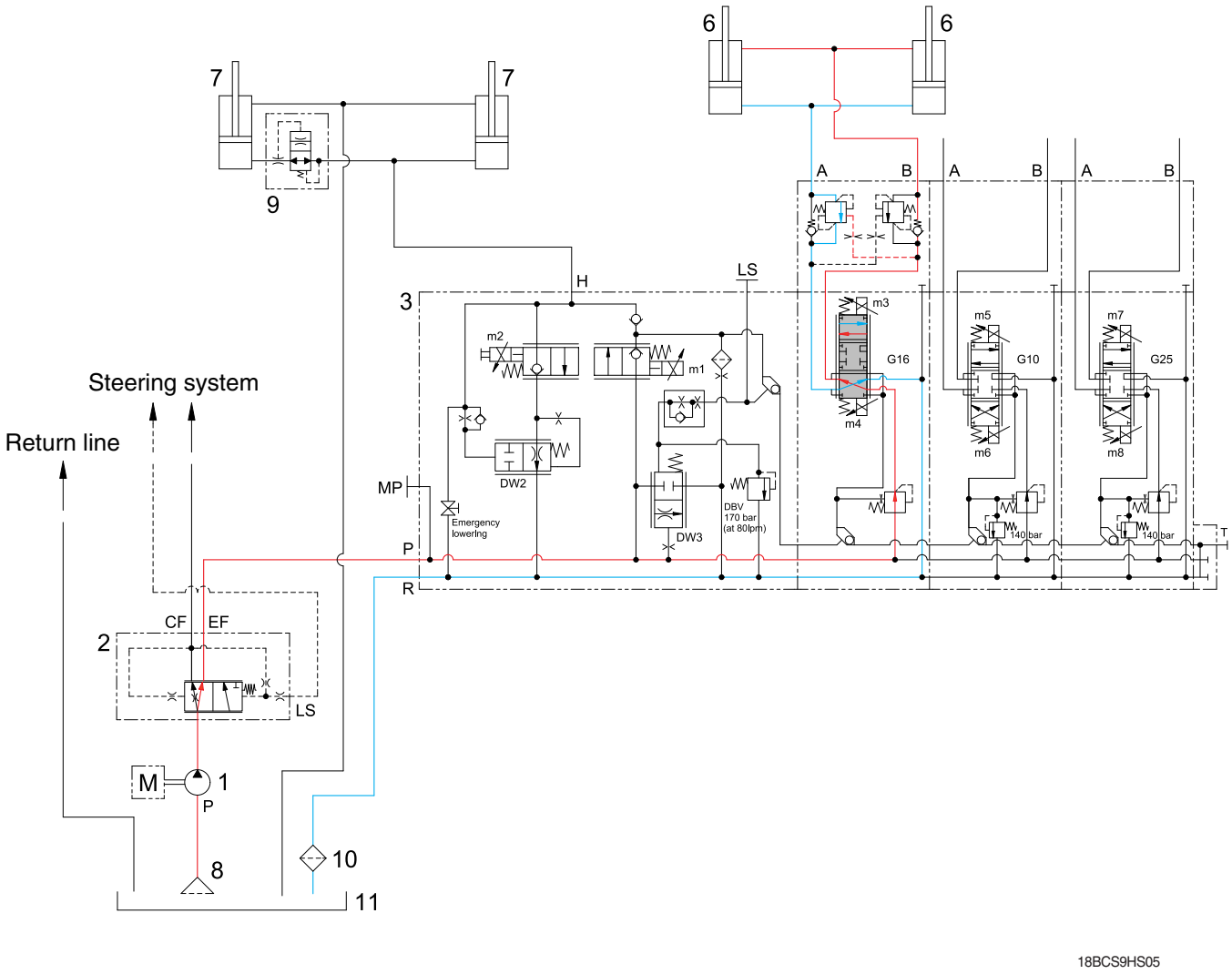
3) WHEN THE JOYSTICK IS IN THE FORWARD POSITION



18BCS9HS04

When the tilt button of the joystick is pushed forward position, the solenoid valve (M3) on the tilt block is energized and then the spool moves to tilt forward position.
The oil from hydraulic gear pump (1) flows into main control valve (3) through the priority valve (2) and then goes to the large chamber of tilt cylinder (6) by pushing the load check valve on the tilt block.
The oil at the small chamber of tilt cylinder (6) returns to hydraulic tank (11) at the same time.
When this happens, the mast tilt forward.

4) WHEN THE TILT CONTROL LEVER IS IN THE BACKWARD POSITION



18BCS9HS05

When tilt button of the joystick is pushed the backward position, the solenoid valve (M4) on the tilt block is energized and then the spool moves to tilt backward position.

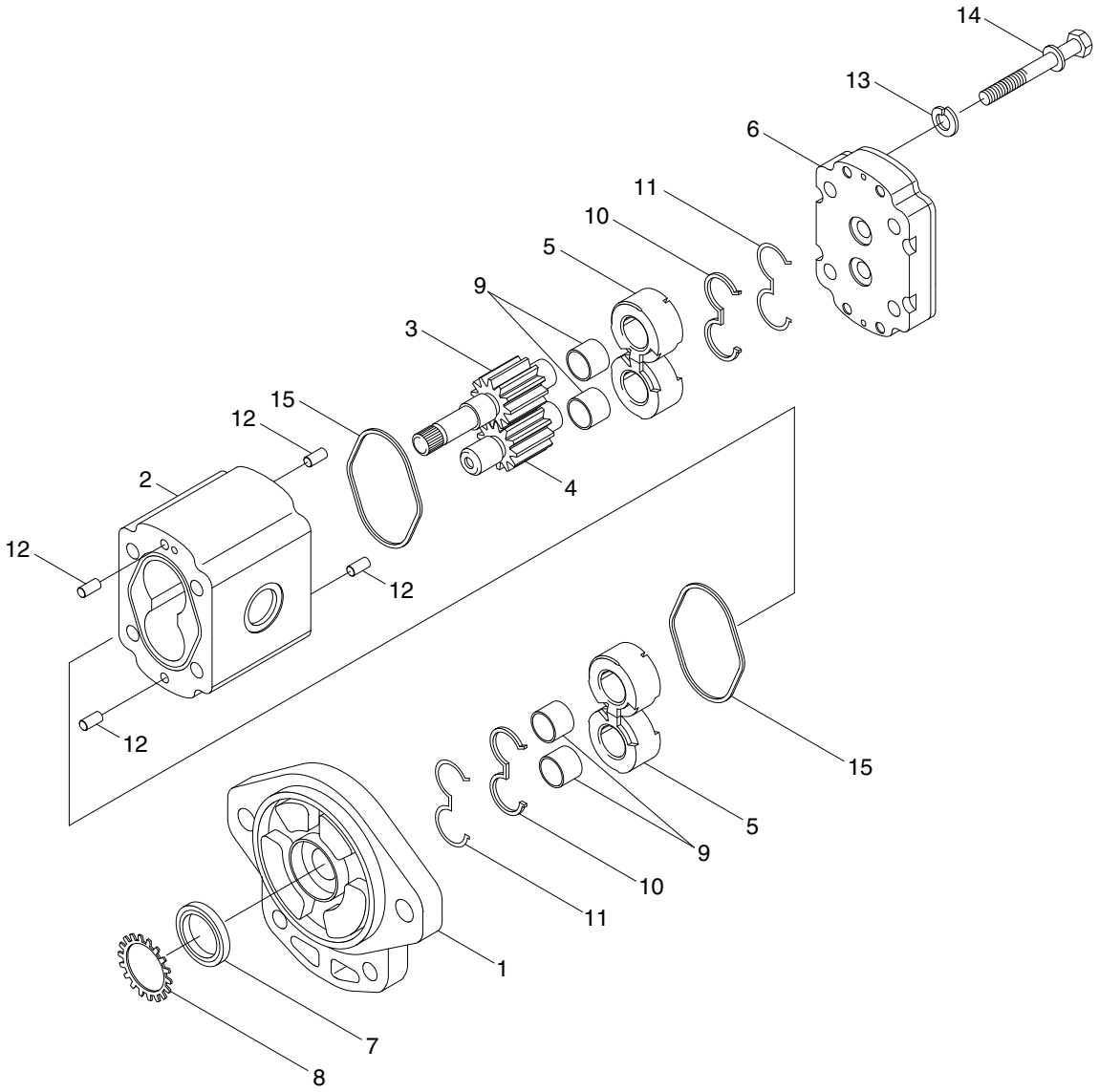
The oil from hydraulic gear pump (1) flows into main control valve (3) through the priority valve (2) and then goes to the small chamber of tilt cylinder (6) by pushing the load check valve on the tilt block.

The oil at the large chamber of tilt cylinder (6) returns to hydraulic tank (11) at the same time.

When this happens, the mast tilt backward.

2. HYDRAULIC GEAR PUMP

1) STRUCTURE



14BRJ9HS19

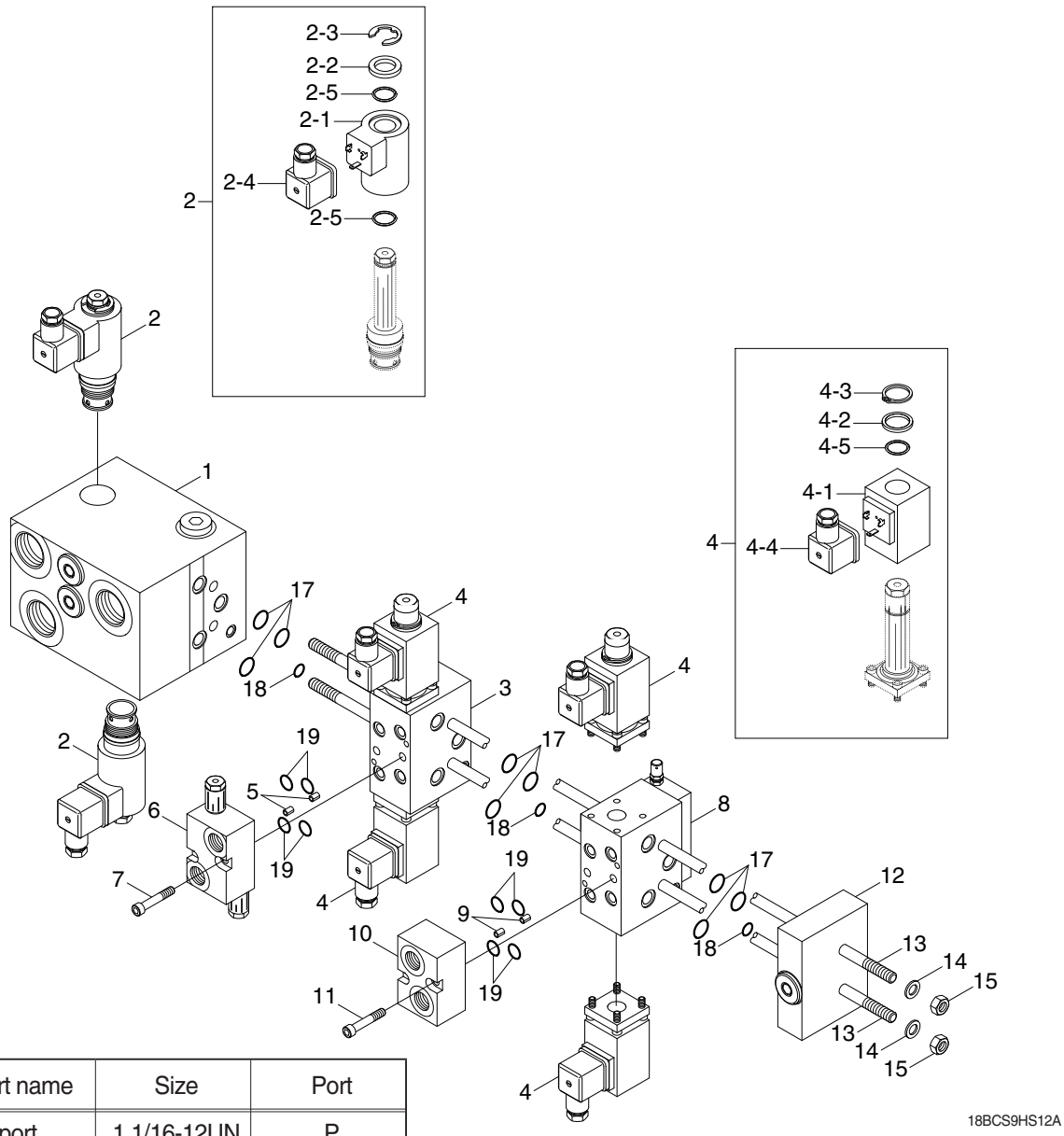
1	Housing	6	Rear cover	11	E-back up ring
2	Body	7	Oil seal	12	Pin
3	Drive gear	8	Snap ring	13	Washer
4	Idle gear	9	DU bushing	14	Hex bolt
5	Side plate	10	E-seal	15	O-ring

2) OPERATION

This pump comprises of an rear cover (6), a body (2), bushings (9) and a housing (1) bolted together with bolts (14). The gear journals are supported in side plate (5) within pressure balanced bushings to give high volumetric and mechanical efficiencies.

3. MAIN CONTROL VALVE

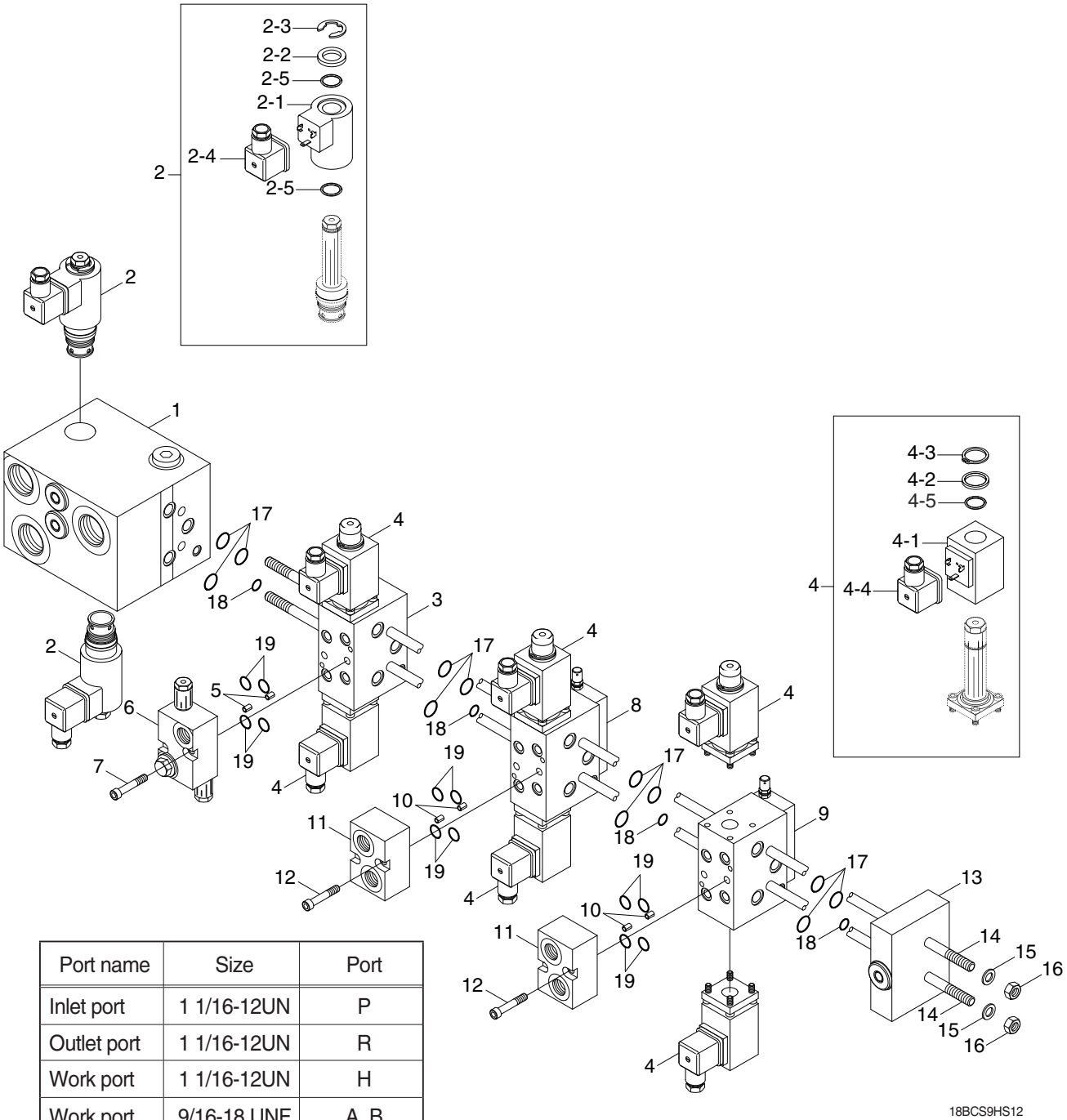
1) STRUCTURE (3 Spool)



Port name	Size	Port
Inlet port	1 1/16-12UN	P
Outlet port	1 1/16-12UN	R
Work port	1 1/16-12UN	H
Work port	9/16-18 UNF	A, B

1	Main block	4-2	Disc	11	Hex socket screw
2	Solenoid valve (Lift)	4-3	Circlip	12	End block
2-1	EVI coil	4-4	Black plug	13	Tension rod
2-2	Washer	4-5	O-ring	14	Shape washer
2-3	Lock washer	5	Roll pin	15	Hexagon nut
2-4	Black plug	6	Adapter	17	O-ring
2-5	O-ring	7	Hex socket screw	18	O-ring
3	Tilt block	8	Auxiliary block	19	O-ring
4	Solenoid valve	9	Roll pin		
4-1	Coil	10	Adapter		

2) STRUCTURE (4 Spool, Option)



Port name	Size	Port
Inlet port	1 1/16-12UN	P
Outlet port	1 1/16-12UN	R
Work port	1 1/16-12UN	H
Work port	9/16-18 UNF	A, B

1	Main block	4-2	Disc	11	Adapter
2	Solenoid valve (Lift)	4-3	Circlip	12	Hex socket screw
2-1	EVI coil	4-4	Black plug	13	End block
2-2	Washer	4-5	O-ring	14	Tension rod
2-3	Lock washer	5	Roll pin	15	Shape washer
2-4	Black plug	6	Adapter	16	Hexagon nut
2-5	O-ring	7	Hex socket screw	17	O-ring
3	Tilt block	8	Auxiliary block	18	O-ring
4	Solenoid valve	9	Auxiliary block	19	O-ring
4-1	Coil	10	Roll pin		

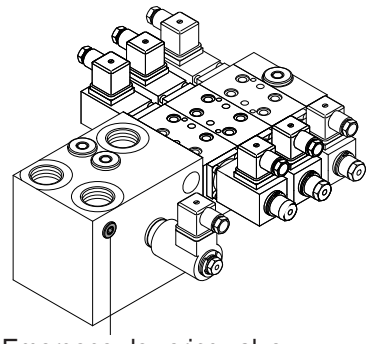
3) EMERGENCY LOWERING

In case of the mast cannot be lowered due to a problem in the controller, active the emergency lowering valve on the valve block with hexagonal wrench.

(1) Turn off the electric emergency switch.

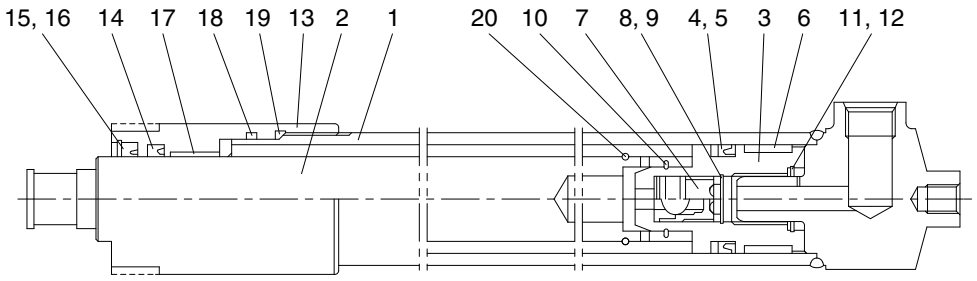
(2) Open the lowering valve using the 5㎜ hexagonal wrench. Slowly lower the mast and the load carriage.

(3) After lowering, close the emergency lowering valve.



BRJ7HS30

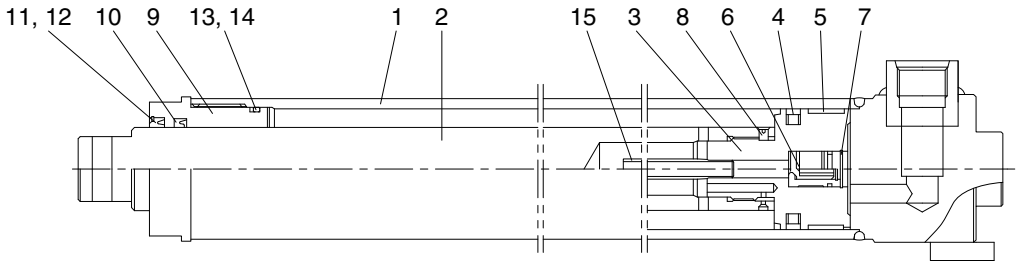
4. LIFT CYLINDER (TF-MAST)



18BCS9HS33

1	Tube assy	8	Spacer	15	Dust wiper
2	Rod	9	Retaining ring	16	Retaining ring
3	Piston	10	Stop ring	17	Rod bushing
4	U-packing	11	Cushion seal	18	Spacer
5	Back up ring	12	Retaining ring	19	O-ring
6	Wear ring	13	Rod cover	20	Stop ring
7	Check valve	14	U-packing		

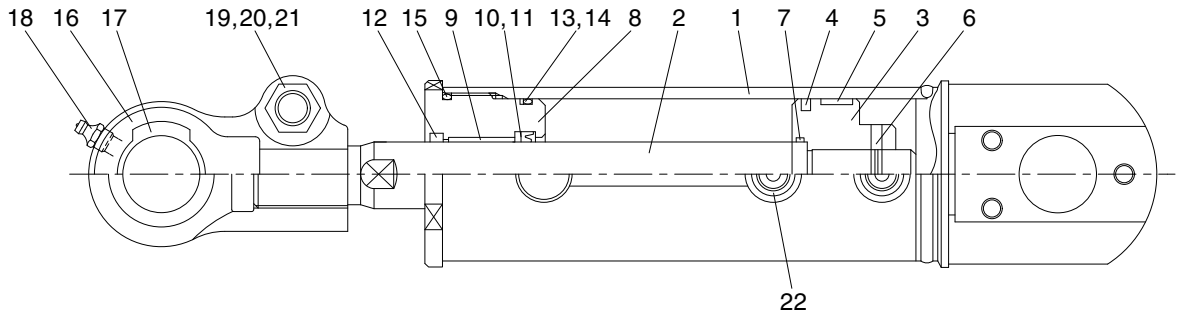
5. FREE LIFT CYLINDER (TF-MAST)



18BCS9HS35

1	Tube assy	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Grand cover	14	Back up ring
5	Wear ring	10	U-packing	15	Pipe

6. TILT CYLINDER

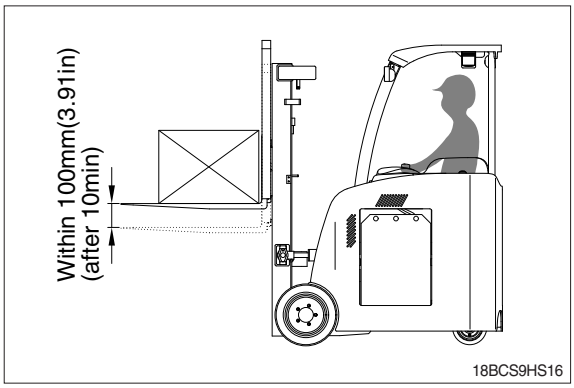


18BCS9HS19

1	Tube assembly	9	Rod bushing	17	Spherical bushing
2	Rod	10	U-packing	18	Grease nipple
3	Piston	11	Back up ring	19	Hexagon bolt
4	Piston seal	12	Dust wiper	20	Spring washer
5	Wear ring	13	O-ring	21	Hexagon nut
6	Set screw	14	Back up ring	22	O-ring
7	O-ring	15	O-ring		
8	Rod cover	16	Eye		

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS



1) CHECK ITEM

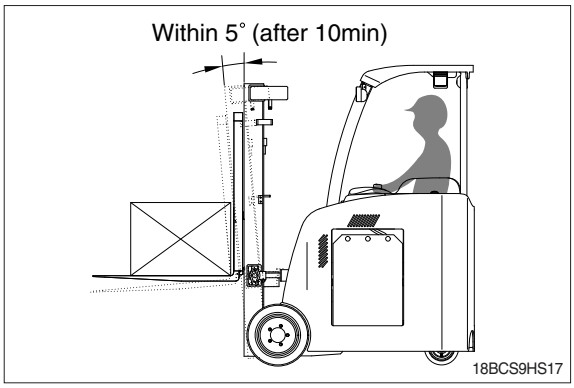
(1) Check visually for deformation, cracks or damage of rod.

(2) Load maximum load, set mast vertical and raise 1m from ground. Wait for 2 minutes and measure hydraulic drift (amount forks move down and amount mast tilts forward).

· **Hydraulic drift**

- Down (Downward movement of forks)
  : Within 100 mm (3.9 in)
- Forward (Extension of tilt cylinder)
  : Within 5°

If the hydraulic drift is more than the specified value, replace the control valve or cylinder packing.

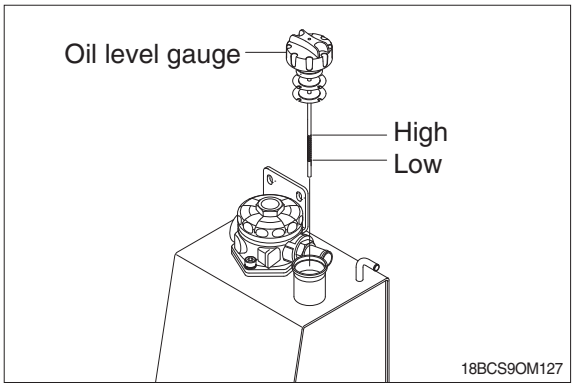


(3) Check that clearance between tilt cylinder bushing and mounting pin is within standard range.

mm (in)

Standard	Under 0.6 (0.02)

2) CHECK AND SUPPLY HYDRAULIC OIL



Check the hydraulic tank oil level. Correct oil level is important for proper system operation. Low oil level can cause pump damage.

Hydraulic oil expands as its temperature rises. Therefore, it is preferable to check the oil level at operating temperature (after approximately 30 minutes of truck operation).

To check the oil level, first park the truck on a level surface.

Put the mast upright in a vertical position and lower the fork carriage fully down. Check the hydraulic oil level. Keep the oil level above the LOW mark by adding recommended hydraulic oil only, as required . **Do not overfill**.

Check the condition of the hydraulic oil (age, color or clarity, contamination). Change the oil as necessary.

3) CONTROL VALVE

(1) Raise forks to maximum height and measure oil pressure. Check that oil pressure.

· 15/18/20BCS-9 : 170 kgf/cm^2 (2418 psi)

2. TROUBLESHOOTING

1) SYSTEM

Problem	Cause	Remedy
Large fork lowering speed	· Seal inside control valve defective. · Oil leaks from joint or hose. · Seal inside cylinder defective.	· Replace spool or valve body. · Replace. · Replace packing.
Large spontaneous tilt of mast	· Tilting backward : Check valve defec- tive. · Tilting forward : tilt lock valve defect- ive. · Oil leaks from joint or hose. · Seal inside cylinder defective.	· Clean or replace. · Clean or replace. · Replace. · Replace seal.
Slow fork lifting or slow mast tilting	· Lack of hydraulic oil. · Hydraulic oil mixed with air. · Oil leaks from joint or hose. · Excessive restriction of oil flow on pump suction side. · Relief valve fails to keep specified pressure. · Poor sealing inside cylinder. · High hydraulic oil viscosity. · Mast fails to move smoothly. · Oil leaks from lift control valve spool. · Oil leaks from tilt control valve spool.	· Add oil. · Bleed air. · Replace. · Clean filter. · Adjust relief valve. · Replace packing. · Change to SAE 10W, class CF engine oil. · Adjust roll to rail clearance. · Replace spool or valve body. · Replace spool or valve body.
Hydraulic system makes abnormal sounds	· Excessive restriction of oil flow pump suction side. · Gear or bearing in hydraulic pump defective.	· Clean filter. · Replace gear or bearing.
Control valve lever is locked	· Foreign matter jammed between spool and valve body. · Valve body defective.	· Clean. · Tighten body mounting bolts uniformly.
High oil temperature	· Lack of hydraulic oil. · High oil viscosity. · Oil filter clogged.	· Add oil. · Change to SAE 10W, class CF engine oil. · Clean filter.

2) HYDRAULIC GEAR PUMP

Problem	Cause	Remedy
Pump does not develop full pressure	· System relief valve set too low or leaking. · Oil viscosity too low. · Pump is worn out.	· Check system relief valve for proper setting. · Change to proper viscosity oil. · Repair or replace pump.
Pump will not pump oil	· Reservoir low or empty. · Suction strainer clogged.	· Fill reservoir to proper level. · Clean suction strainer.
Noisy pump caused by cavitation	· Oil too thick. · Oil filter plugged. · Suction line plugged or too small.	· Change to proper viscosity. · Clean filters. · Clean line and check for proper size.
Oil heating	· Oil supply low. · Contaminated oil. · Setting of relief valve too high or too low. · Oil viscosity too low.	· Fill reservoir to proper level. · Drain reservoir and refill with clean oil. · Set to correct pressure. · Drain reservoir and fill with proper viscosity.
Foaming oil	· Low oil level. · Air leaking into suction line. · Wrong kind of oil.	· Fill reservoir to proper level. · Tighten fittings, check condition of line. · Drain reservoir, fill with non-foaming oil.
Shaft seal leakage	· Worn shaft seal. · Worn shaft in seal area.	· Replace shaft seal. · Replace drive shaft and seal.

3) MAIN RELIEF VALVE

Problem	Cause	Remedy
Can't get pressure	· Poppet stuck open or contamination under seat.	· Check for foreign matter between poppets and their mating parts. Parts must slide freely.
Erratic pressure	· Pilot poppet seat damaged.	· Replace the relief valve.
Pressure setting not correct	· Normal wear. Lock nut & adjust screw loose.	· See ★How to set pressure on work main relief.
Leaks	· Damaged seats. · Worn O-rings. · Parts sticking due to contamination.	· Replace the relief valve. · Install seal and spring kit. · Disassemble and clean.

★ A good pressure gauge must be installed in the line which is in communication with the main relief. A load must be applied in a manner to reach the set pressure of the main relief unit. Then, follow these steps:

- Loosen lock nut.
- Set adjusting nut to desired pressure setting.
- If desired pressure setting cannot be achieved, tighten or loosen the adjusting screw as required.
- Tighten lock nut.
- Retest in similar manner as above.

4) LIFT CYLINDER

Problem	Cause	Remedy
Oil leaks out from rod cover through rod	· Foreign matters on packing. · Unallowable score on rod. · Unusual distortion of dust seal. · Chrome plating is striped.	· Replace packing. · Smooth rod surface with an oil stone. · Replace dust seal. · Replace rod.
Oil leaks out from cylinder rod cover thread	· O-ring damaged.	· Replace O-ring.
Rod spontaneously retract	· Scores on inner surface of tube. · Unallowable score on the inner suface of tube. · Foreign matters in piston seal.	· Smooth rod surface with an oil stone. · Replace cylinder tube. · Replace piston seal.
Wear (clearance between cylinder tube and wear ring)	· Excessive clearance between cylinder tube and wear ring.	· Replace wear ring.
Abnormal noise is produced during tilting operation	· Insufficient lubrication of anchor pin or worn bushing and pin. · Bent tilt cylinder rod.	· Lubricate or replace. · Replace.

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. HYDRAULIC GEAR PUMP

※ **Tools required**

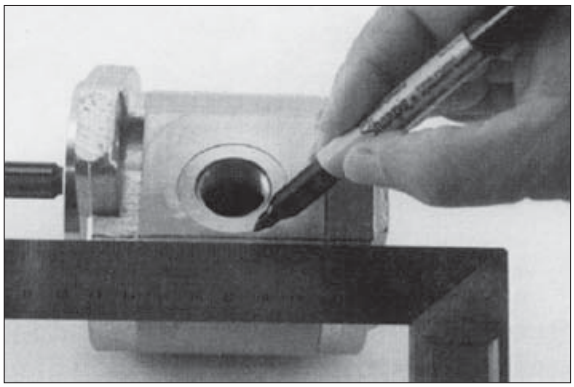
- Metric socket set
- Internal snap ring pliers
- Shaft seal sleeve
- Torque wrench

(1) It is very important to work in a clean work area when repairing hydraulic products. Plug ports and wash exterior of pump with a proper cleaning solvent before continuing.

(2) Remove port plugs and drain oil from pump.

(3) Use a permanent marker pen to mark a line across the mounting flange, gear housing and end cover. This will assure proper reassembly and rotation of pump.

(4) Remove key from drive shaft if applicable.

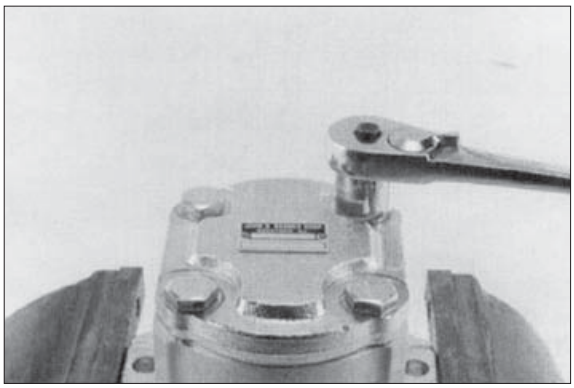


PUMP 01

(5) Clamp mounting flange in a protected jaw vise with pump shaft facing down.

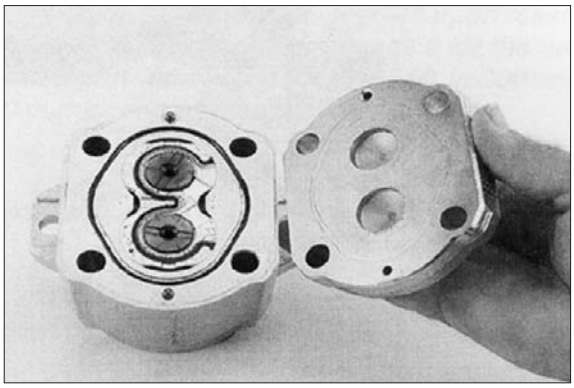
(6) Loosen the four metric hexagon head bolts.

(7) Remove pump from vise and place on clean work bench, remove the four hexagon head bolts and spacers applicable.



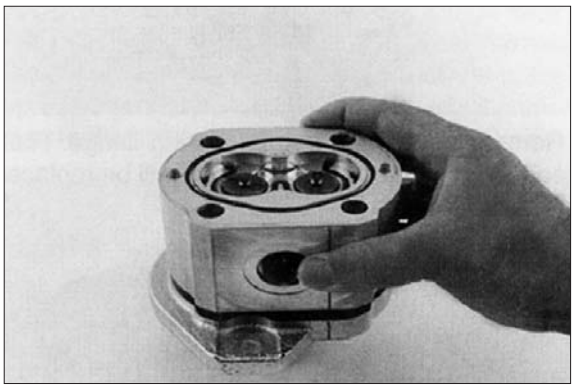
PUMP 02

(8) Lift and remove end cover.



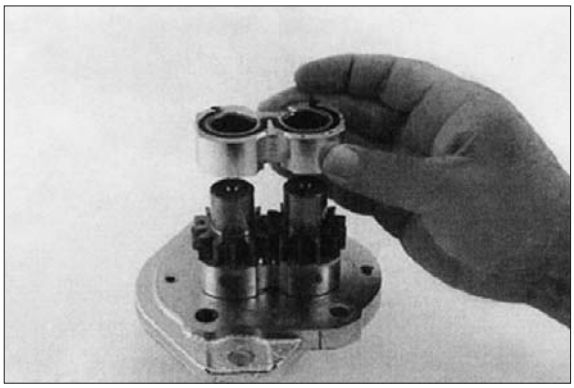
PUMP 03

(9) Carefully remove gear housing and place on work bench. Make sure the rear bearing block remains on the drive and idler shafts.



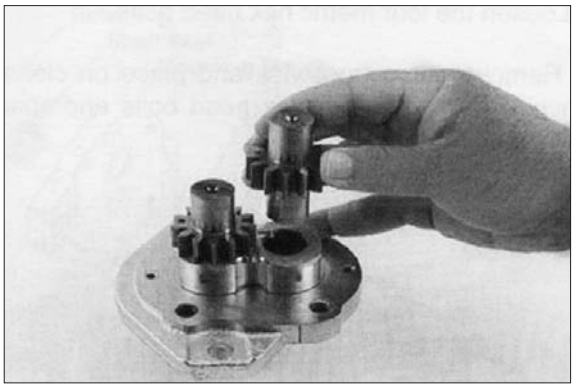
PUMP 04

(10) Remove rear bearing block from drive and idler shafts.



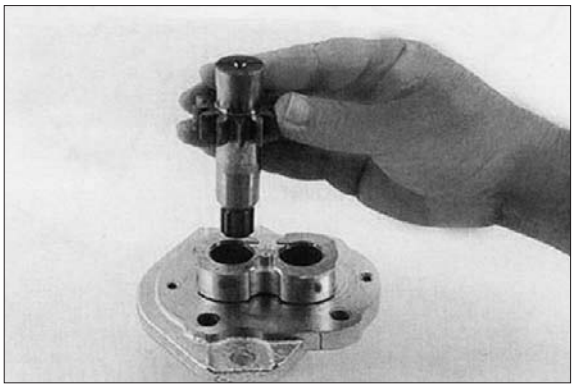
PUMP 05

(11) Remove idler shaft from bearing block.



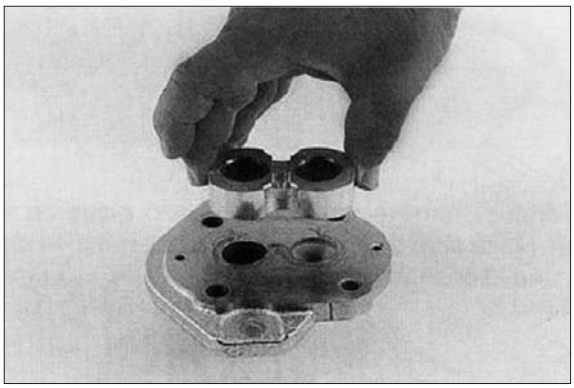
PUMP 06

(12) Remove drive shaft from mounting flange. There is no need to protect the shaft seal as it will be replaced as a new item.



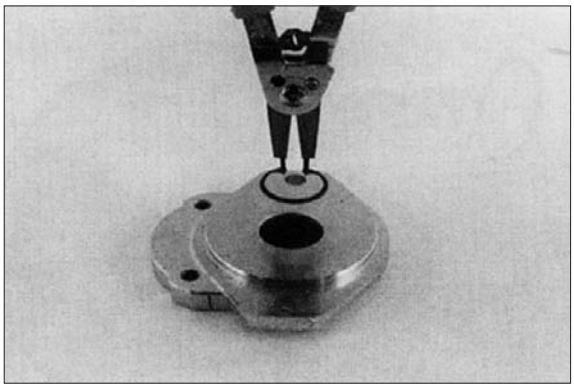
PUMP 07

(13) Remove the front bearing block.



PUMP 08

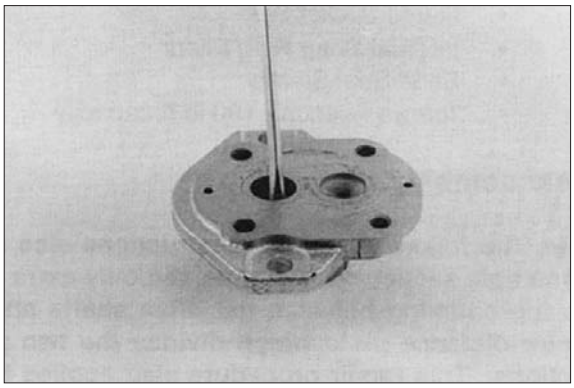
(14) Turn mounting flange over, with shaft seal up, and remove the retaining ring with proper snap ring pliers.



PUMP 09

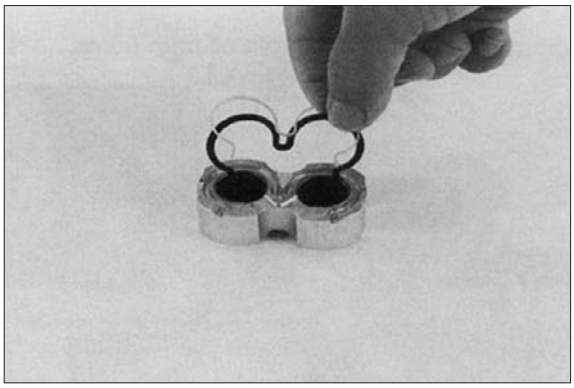
(15) Remove the oil seal from mounting flange, be careful not to mar or scratch the seal bore.

(16) Remove the dowel pins from the gear housing. Do not lose pins.



PUMP 10

(17) Remove seals from both bearing blocks and discard.



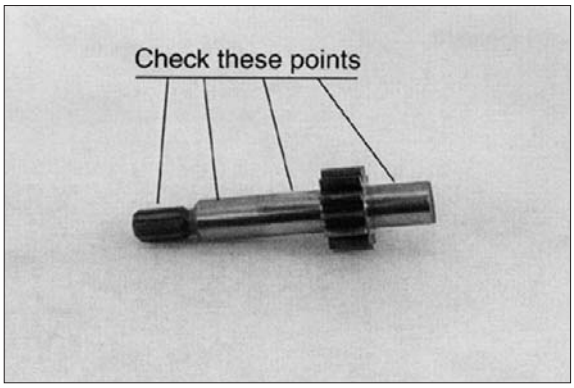
PUMP 11

2) INSPECT PARTS FOR WEAR

(1) Clean and dry all parts thoroughly prior to inspection. It is not necessary to inspect the seals as they will be replaced as new items.

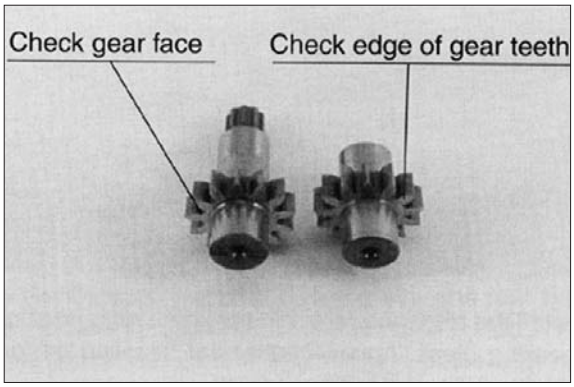
(2) Check drive shaft spline for twisted or broken teeth, check keyed drive shaft for broken or chipped keyway. No marks or grooves on shaft in seal area, some discoloration of shaft is allowable.

(3) Inspect both the drive gear shaft and idler gear shafts at the bearing points and seal area for rough surfaces and excessive wear.



PUMP 12

(4) Inspect gear face for scoring or excessive wear. If the face edge of gear teeth are sharp, they will mill into the bearing blocks. If wear has occurred, the parts are unusable.



PUMP 13

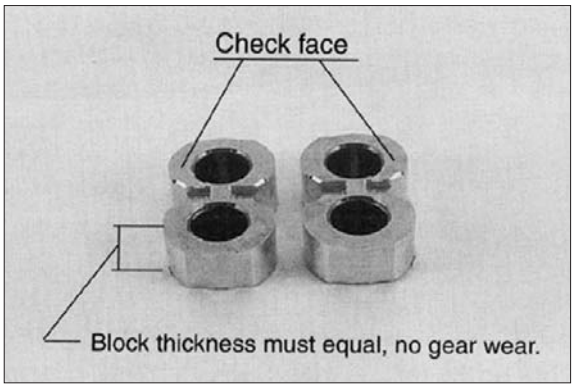
(5) Inspect bearing blocks for excessive wear or scoring on the surfaces which are in contact with the gears. Also inspect the bearings for excessive wear or scoring.

(6) Inspect the area inside the gear housing. It is normal for the surface inside the gear housing to show a clean "wipe" on the inside surface on the intake side. There should not be excessive wear or deep scratches and gouges.

※ **General information**

It is important that the relationship of the mounting flange, bearing blocks and gear housing is correct. Failure to properly assemble this pump will result with little or no flow at rated pressure.

※ **This pump is not bi-rotational.**

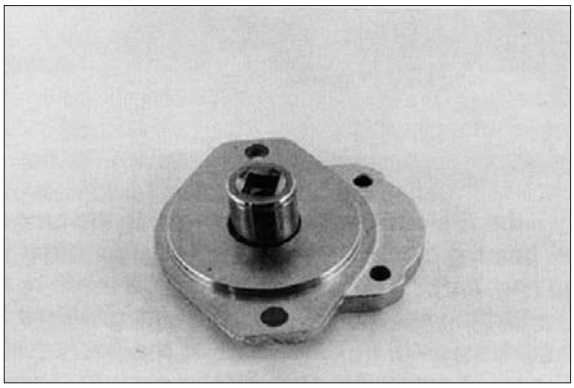


PUMP 14

3) ASSEMBLY

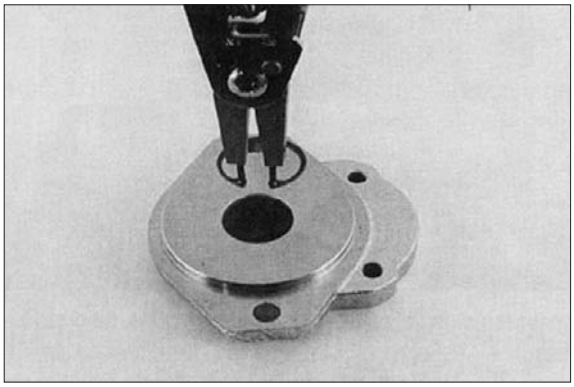
※ **New seals should be installed upon reassembly of pump.**

(1) Install new shaft seal in mounting flange with part number side facing outboard. Press the seal into the seal bore until the seal reaches the bottom of the bore. Uniform pressure must be used to prevent misalignment or damage to the seal.



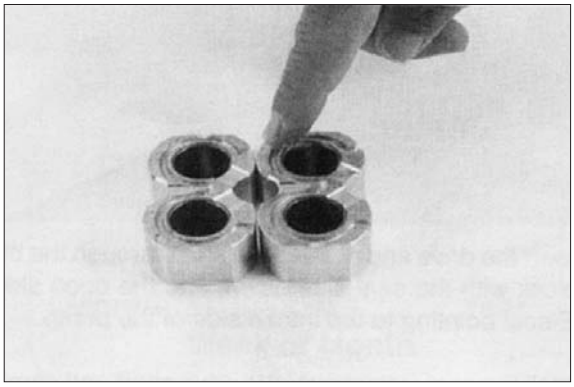
PUMP 15

(2) Install retaining ring in groove in seal bore of mounting flange.



PUMP 16

(3) Place front and back bearing blocks on a clean surface with the E-seal grooves facing up. Apply a light coating of petroleum jelly in the grooves. Also coat the E-seal and backup with the petroleum jelly, this will help keep the seals in place during assembly.

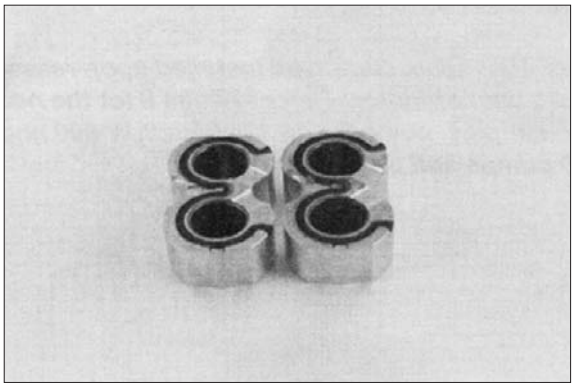


PUMP 17

(4) Place the E-seals, flat side outward, into the grooves in both bearing blocks. Follow by carefully placing the backup ring, flat side outward, in the groove made by the E-seal and the groove in the bearing block.

(5) Place mounting flange, with shaft seal side down, on a clean flat surface.

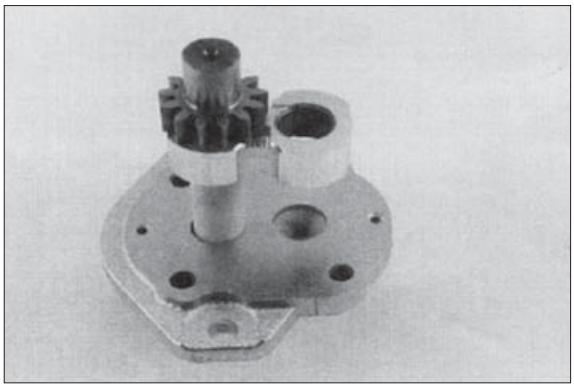
(6) Apply a light coating of petroleum jelly to the exposed face of the front bearing block.



PUMP 18

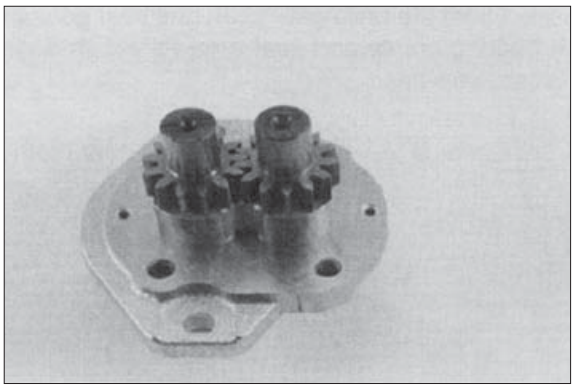
(7) Insert the drive end of the drive shaft through the bearing block with the seal side down, and the open side of the E-seal pointing to the intake side of the pump.

(8) Install the seal sleeve over the drive shaft and carefully slide the drive shaft through the shaft seal. Remove the seal sleeve from shaft.



PUMP 19

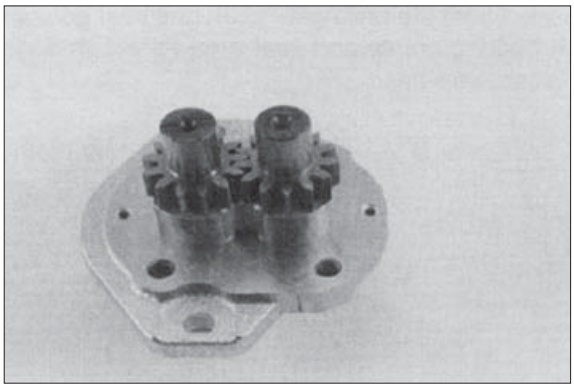
(9) Install the idler gear shaft in the remaining position in the bearing block. Apply a light coat of clean oil to the face of the drive and idler gears.



PUMP 20

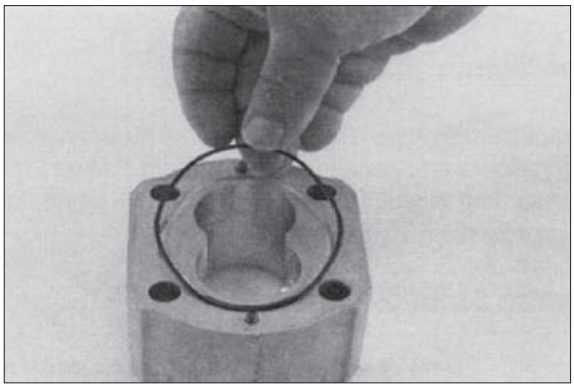
(10) Pick up the rear bearing block, with seal side up and with open end of the E-seal facing the intake side of the pump, place over the drive and idler gear shafts.

(11) Install two dowel pins in the holes in the mounting flange or two long dowel pins through gear housing if pump is a multiple section pump.



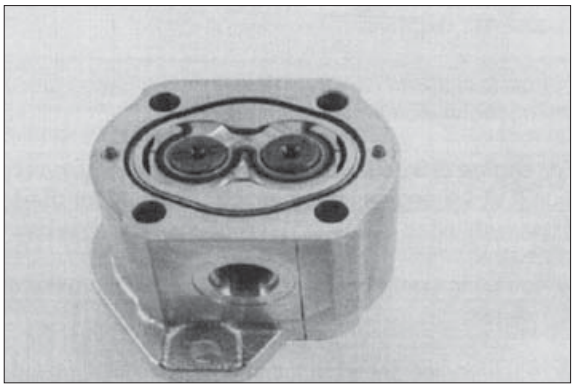
PUMP 21

(12) To install the O-rings in the gear housing, apply a light coating of petroleum jelly in the grooves on both sides of the gear housing.
Also coat the new O-ring and install them in the grooves.



PUMP 22

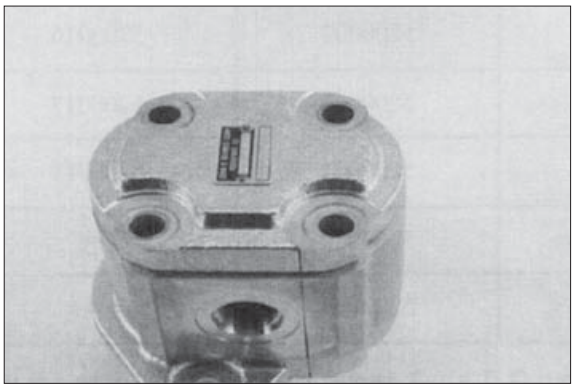
(13) Gently slide the gear housing over the rear bearing block assembly, slide housing down until the housing engages the dowel pins. Press firmly in place with hands, do not force or use any tool.
Check to make sure the intake port in the housing in on the same side as the open end of the E-seal and that the marked lines on the mounting flange and gear housing are in alignment.



PUMP 23

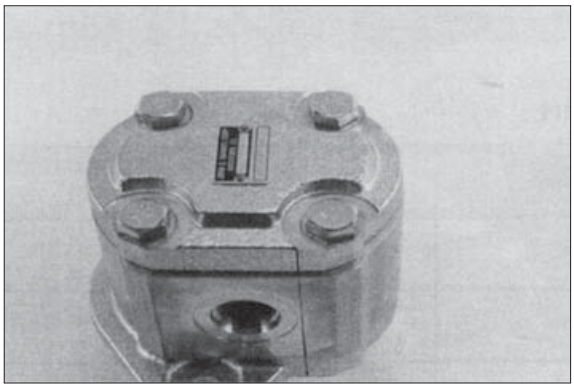
(14) The surface of the rear bearing block should be slightly below the face of the gear housing. If the bearing block sits higher then the rear face of the gear housing then the E-seal or O-ring have shifted out of the groove. If this is the case, remove the gear housing and check for proper seal installation.

(15) Install the two remaining dowel pins in the rear of the gear housing and place the end cover over the back of the pump.



PUMP 24

(16) Install the four spacers and hexagon head bolts through the bolt holes in the end cover, hand tighten.



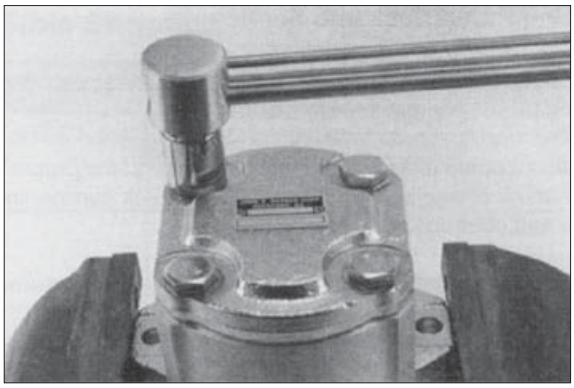
PUMP 25

(17) Place mounting flange of the pump back in the protected jawed vise and alternately torque the bolts.

· Tighten torque : 6~7 kgf · m
(43.4~50.6 lbf · ft)

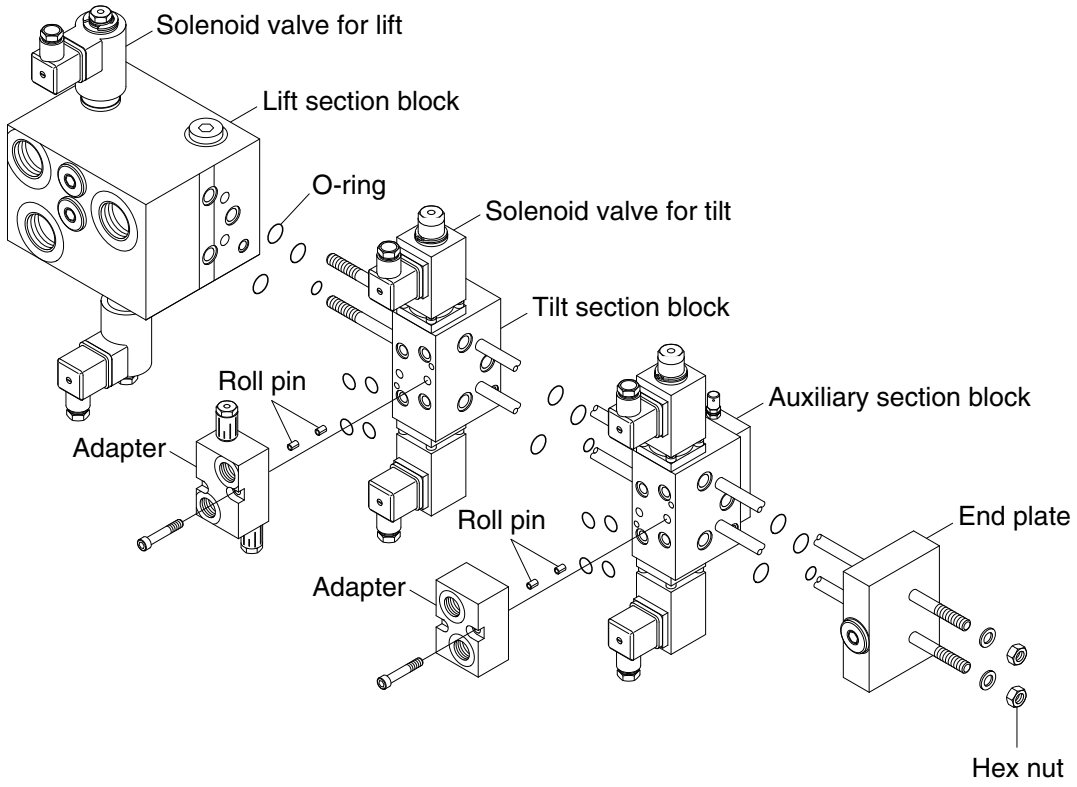
(18) Remove pump from vise.

(19) Place a small amount of clean oil in the inlet of the pump and rotate the drive shaft away from the inlet one revolution. If the drive shaft binds, disassemble the pump and check for assembly problems, then reassemble the pump.



PUMP 26

2. MAIN CONTROL VALVE



18BCS9HS34

1) ASSEMBLY INSTRUCTION

(1) General

① Ensure that the assembly area will be clean and free of contamination.
② Use a flat (within 0.5 ㎜) work surface when bolting the valve sections together.
③ Use calibrated torque wrenches and instrumentation.

(2) Block sub assembly

① Attach all the O-rings to the appropriate grooves between the spool sections.
② Stack the valve sections as below picture on a flat surface.
③ Insert all the tie rods through the drilled holes in each of the housings.
④ Press the sections together being careful not to damage sealing surfaces or seals.
⑤ Install nuts to tie rods and progressively torque in a circular pattern until reaching a torque of 2.3 ㎏f · m (16.6 lbf · ft) on all tie rods.

(3) Lift block solenoid assembly

① The solenoide is installed upper side and below side cavities in lift block. Torque to 4.1 kgf · m (29.7 lbf · ft)
② Install the O-ring, coil, O-ring and washer to the assemblied cartridge.
③ Insert the lock washer to the groove of the cartridge.

(4) Tilt & Auxiliary section assembly

① The solenoid is installed upper side and below side in tilt & auxiliary block with bolts.
Torque to 1 kgf · m (7.2 lbf · ft)
② Install the coil, O-ring and washer to the assemblied cartridge.
③ Insert the snap ring to the groove of the cartridge.
④ Insert the roll pin to the pin hole on the front side of each block.
⑤ Place the O-rings in the O-ring grooves.
⑥ Insert the ancillary blocks to the each body with bolts.

2) DISASSEMBLY INSTRUCTION

(1) General

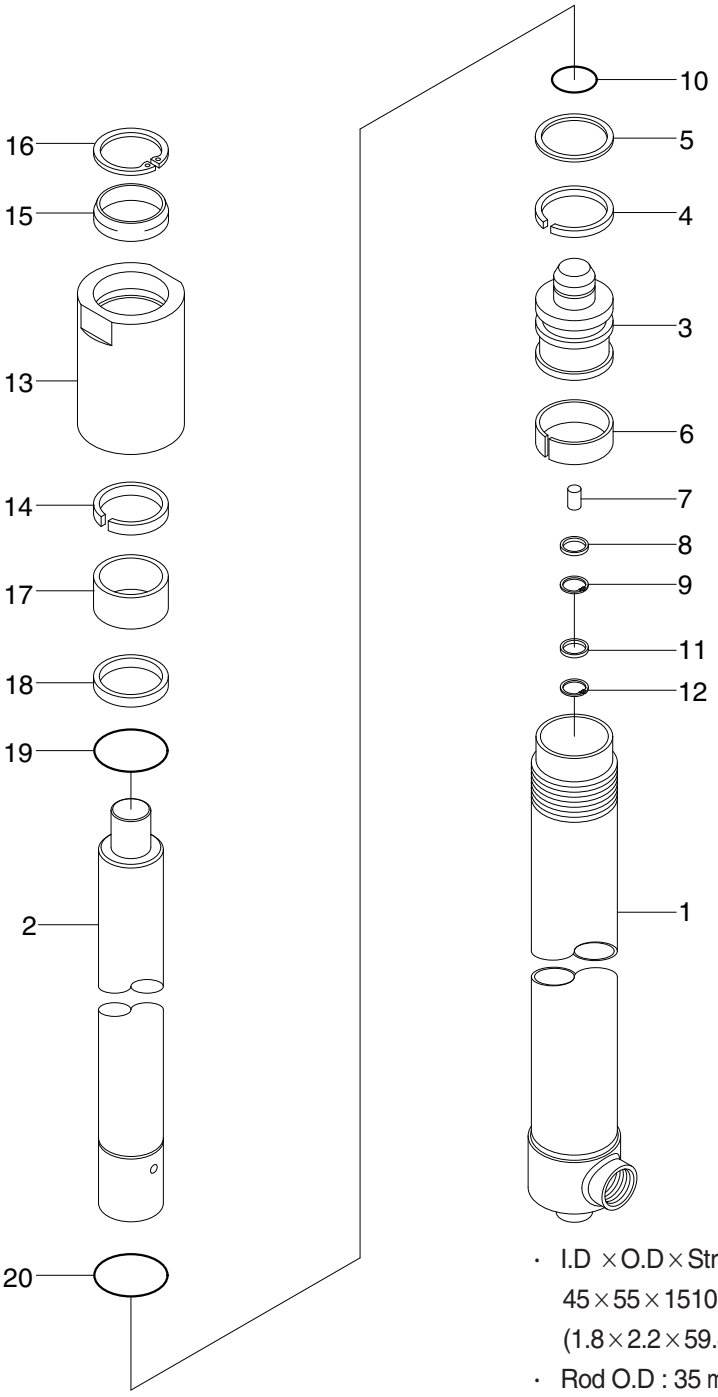
① Disassemble the valve sections on a flat working surface.
② Ensure that the disassembly area will be clean and free of contamination.
③ Keep the disassembly area neat to avoid loss or damage of parts.

(2) Perform the assembly in reverse order

① Remove the solenoid valves and ancillary blocks from the main blocks.
② Loosen the tie-rods from the valve section.
③ Remove the seals between valve section.
④ Valve components are precision items, and care must be taken when handing them to avoid damage or the introduction of contamination that could adversely affect performance.

3. LIFT CYLINDER (TF-MAST)

1) STRUCTURE



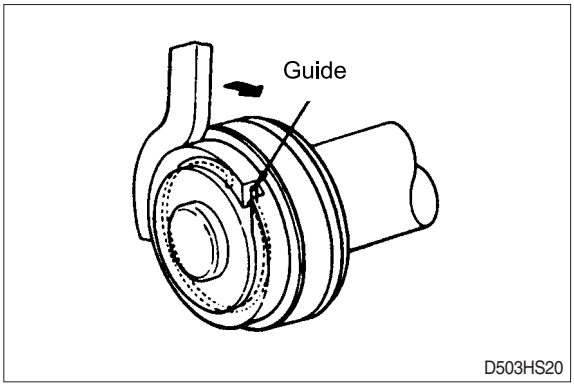
- I.D ×O.D×Stroke (standard, TF470)
  45×55×1510 mm
  (1.8×2.2×59.4 in)
- Rod O.D : 35 mm (1.4 in)

18BR9HS33

1	Tube assy	8	Spacer	15	Dust wiper
2	Rod	9	Retaining ring	16	Retaining ring
3	Piston	10	Stop ring	17	Rod bushing
4	U-packing	11	Cushion seal	18	Spacer
5	Back up ring	12	Retaining ring	19	O-ring
6	Wear ring	13	Rod cover	20	Stop ring
7	Check valve	14	U-packing		

2) DISASSEMBLY

(1) Hold the cylinder tube in a vice, loosen the cylinder head and remove it.
Remove the spacer from the cylinder tube and knock out the bushing. Hook a wrench in the hole in the retainer at the piston end and turn. Lever up the edge of the guide, then turn the guide in again and the guide can be removed.



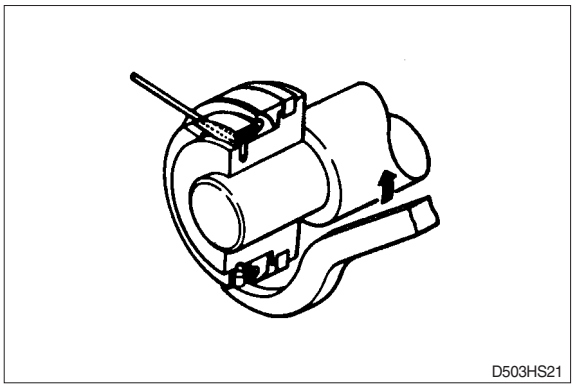
3) CHECK AND INSPECTION

mm (in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between piston ring & tube	0.05~0.030 (0.002~0.012)	0.5 (0.020)	Replace piston ring

4) ASSEMBLY

(1) Soak the piston ring in hydraulic oil at a temperature of 40 to 50 ℃, expand the inside diameter and assemble on the piston. Install a piston seal.
Bend the edge of the guide and rotate it to install the guide completely.



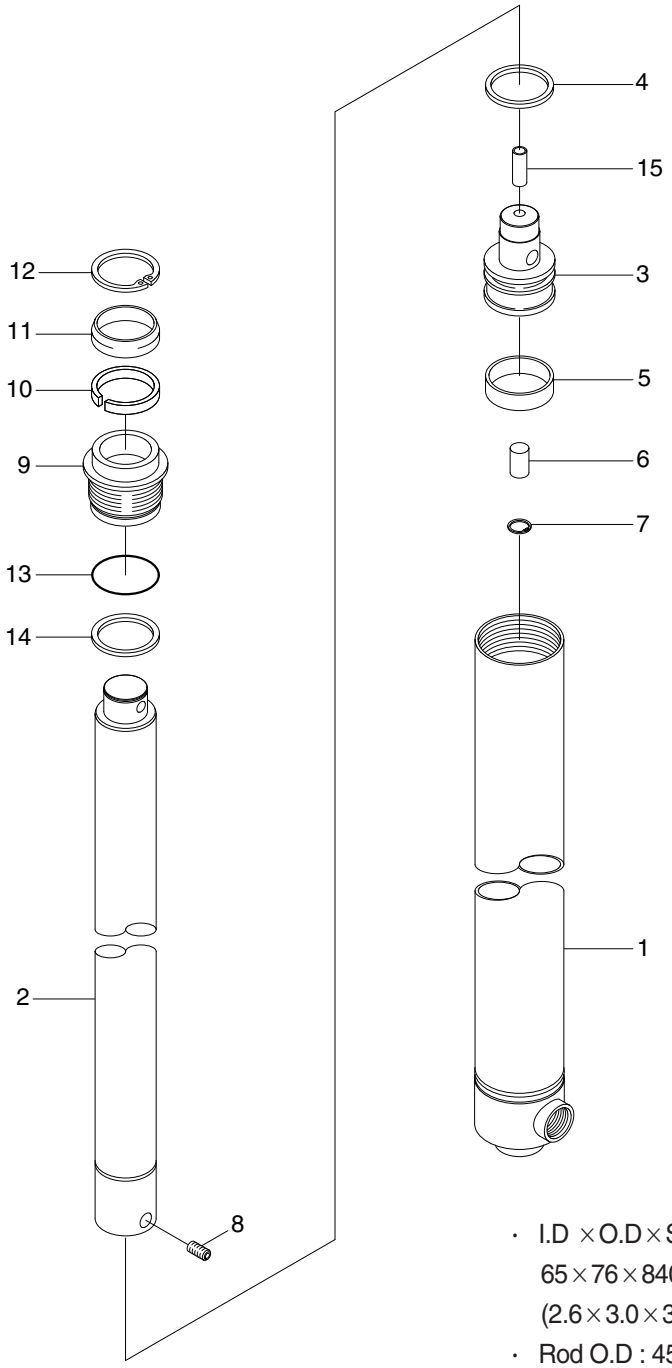
5) TIGHTENING TORQUE

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Rod cover	13	M55 × 2	40 ± 4.0	289 ± 28.9

※ Apply loctite #242 on the thread of the bolt before tightening.

4. FREE LIFT CYLINDER (TF-MAST)

1) STRUCTURE



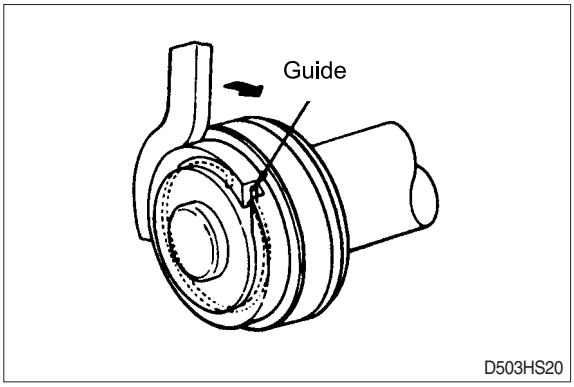
- I.D × O.D × Stroke (standard, TF470)
  65 × 76 × 840 mm
  (2.6 × 3.0 × 33.1 in)
- Rod O.D : 45 mm (1.8 in)

18BCS9HS33A

1	Tube assy	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Grand cover	14	Back up ring
5	Wear ring	10	U-packing	15	Pipe

2) DISASSEMBLY

(1) Hold the cylinder tube in a vice, loosen the cylinder head and remove it.
Remove the spacer from the cylinder tube and knock out the bushing. Hook a wrench in the hole in the retainer at the piston end and turn. Lever up the edge of the guide, then turn the guide in again and the guide can be removed.



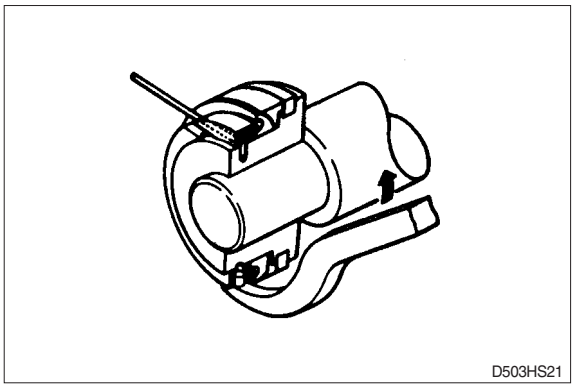
3) CHECK AND INSPECTION

mm (in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between piston ring & tube	0.05~0.030 (0.002~0.012)	0.5 (0.020)	Replace piston ring

4) ASSEMBLY

(1) Soak the piston ring in hydraulic oil at a temperature of 40 to 50℃, expand the inside diameter and assemble on the piston. Install a piston seal.
Bend the edge of the guide and rotate it to install the guide completely.



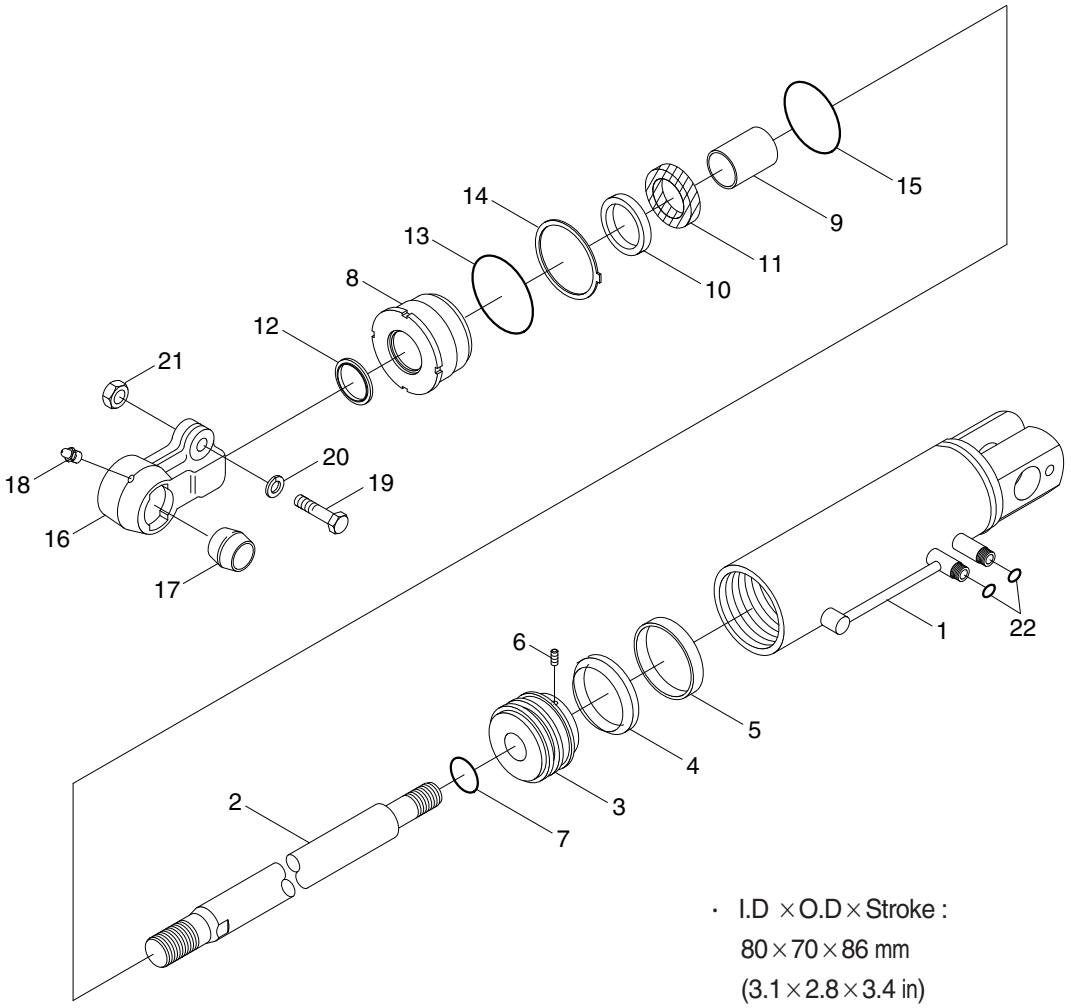
5) TIGHTENING TORQUE

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Rod cover	9	M70×2	50±5.0	362±36.2
Pipe	15	M10×1	1.5±0.15	10.8±1.1
Set screw	8	M8×1.25	0.7±0.07	5.1±0.5

※ Apply loctite #242 on the thread of the bolt before tightening.

5. TILT CYLINDER

1) STRUCTURE



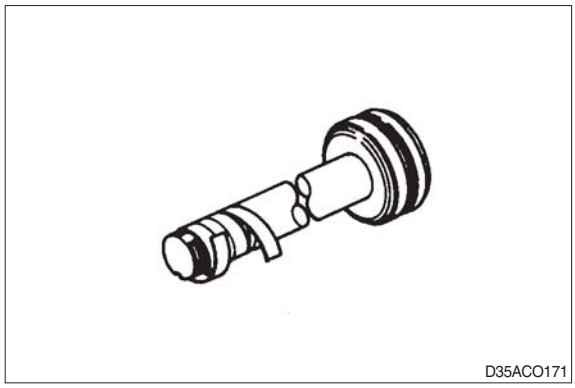
- I.D × O.D × Stroke :
  80 × 70 × 86 mm
  (3.1 × 2.8 × 3.4 in)
- Rod O.D : 30 mm (1.2 in)

18BCS9HS15

1	Tube assembly	9	Rod bushing	17	Spherical bushing
2	Rod	10	U-packing	18	Grease nipple
3	Piston	11	Back up ring	19	Hexagon bolt
4	Piston seal	12	Dust wiper	20	Spring washer
5	Wear ring	13	O-ring	21	Hexagon nut
6	Set screw	14	Back up ring	22	O-ring
7	O-ring	15	O-ring		
8	Rod cover	16	Eye		

2) DISASSEMBLY

(1) Hold the parallel parts of the cylinder tube bottom in a vice and mark the rod head end to show how much it is screwed in, then remove the rod head. Next, hook a wrench into the notch at the cylinder head and remove the cylinder head from cylinder tube.
When doing this, wind tape round the threaded part of the rod and be careful not to damage the dust seal and rod seal inside cylinder head.



3) CHECK AND INSPECTION

mm (in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between rod head bushing & pin	0.10~0.35 (0.004~0.014)	0.6 (0.024)	Replace bushing

4) TIGHTENING TORQUE

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Rod cover	8	M75×2	40±4.0	289±28.9
Piston	3	M22×2	30±3.0	217±21.7
Set screw	6	M8×1.25	1.5±0.15	10.8±1.1

※ Apply loctite #242 on the thread of the bolt before tightening.