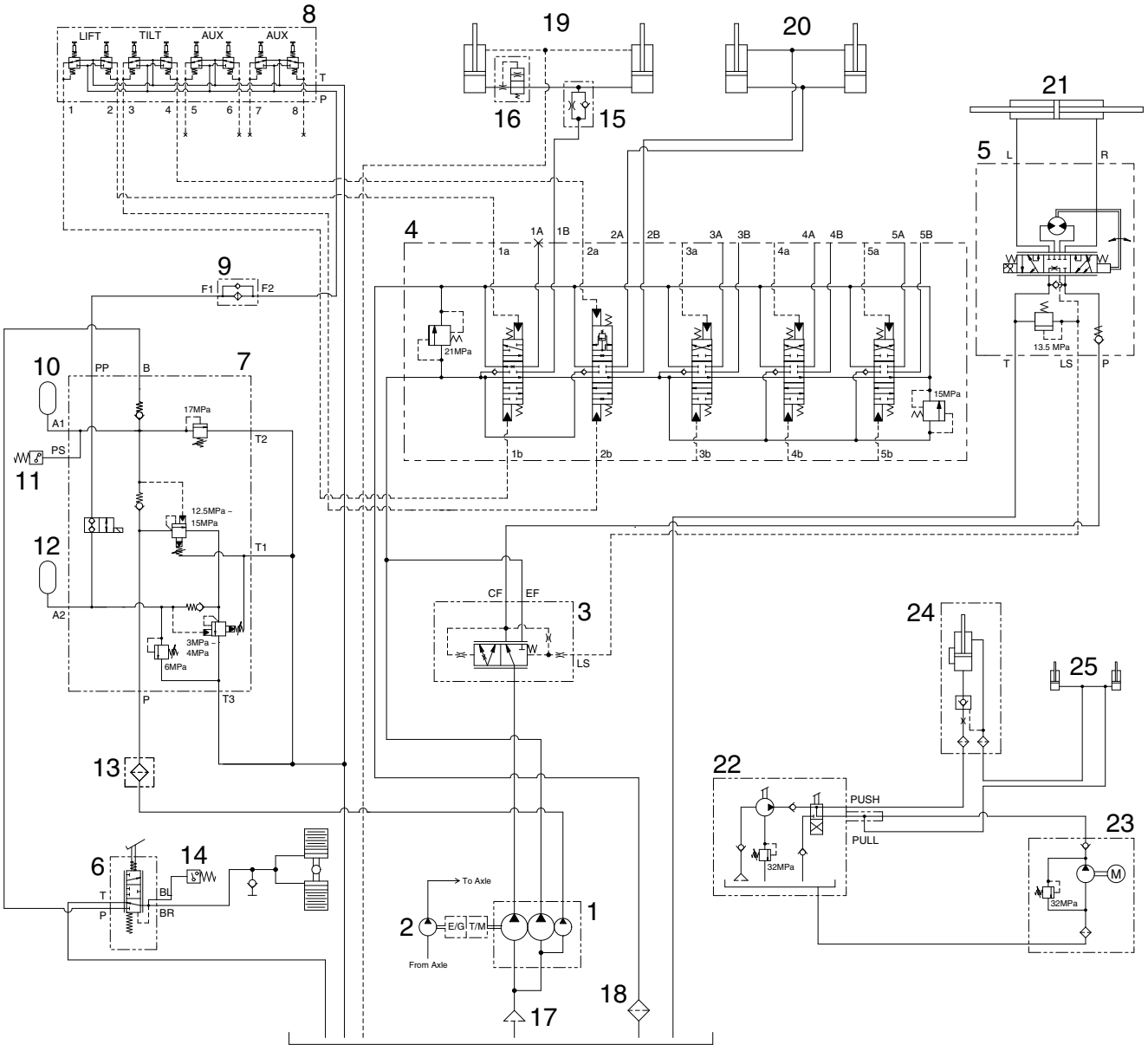
SECTION 6 HYDRAULIC SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC CIRCUIT

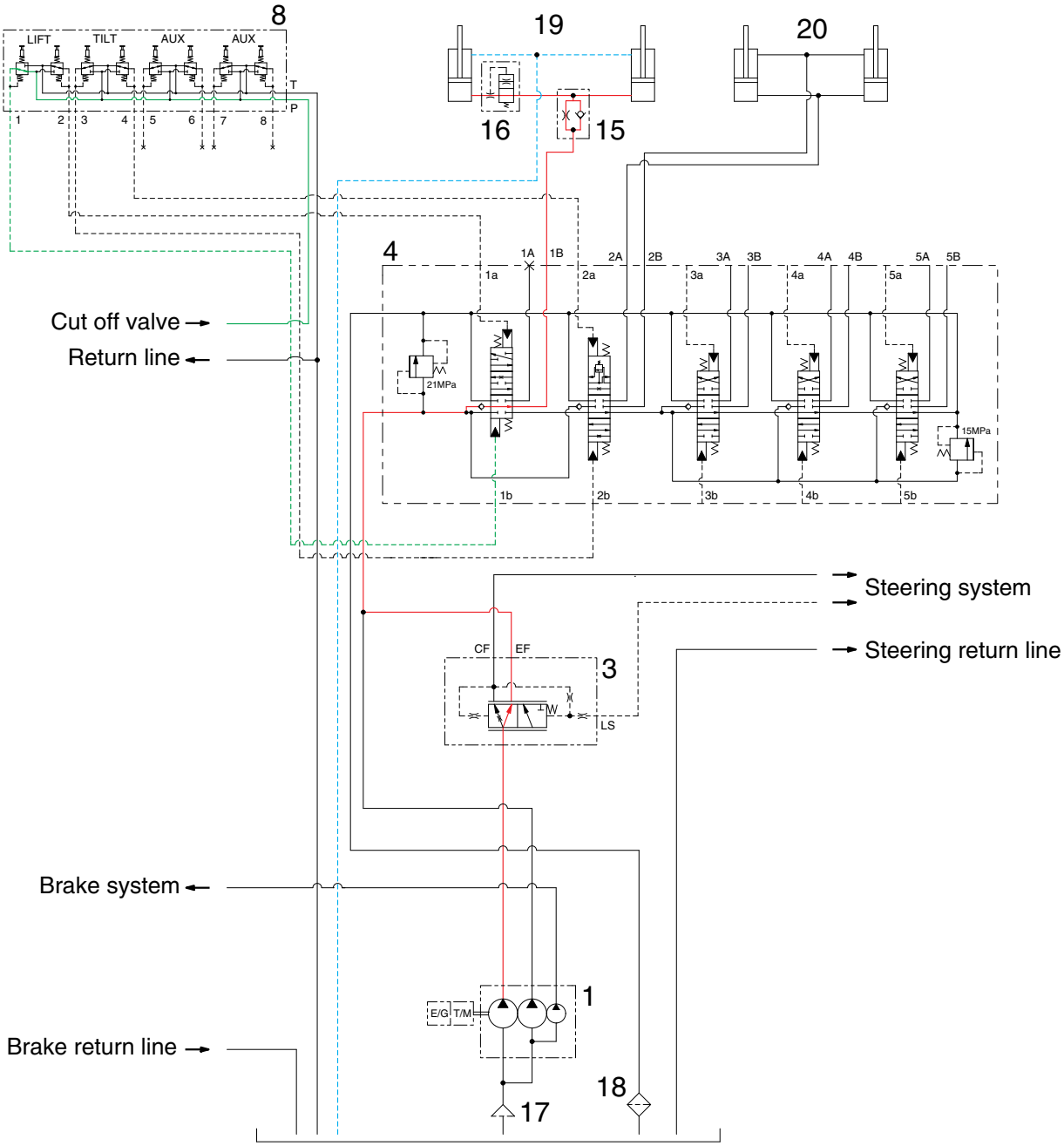


80D9HS01

1	Hydraulic gear pump	10	Accumulator	19	Lift cylinder
2	Axle cooling pump	11	Pressure switch	20	Tilt cylinder
3	Priority valve	12	Accumulator	21	Steering cylinder
4	Main control valve	13	Line filter	22	Hand pump
5	Steering unit	14	Pressure switch	23	Elec pump
6	Brake valve	15	Down control valve	24	Cab tilt cylinder
7	Cut-off valve	16	Down safety valve	25	Latch
8	Remote control valve	17	Strainer		
9	Suction filter	18	Return filter		

※ The circuit diagram may differ from the equipment, so please check before a repair.

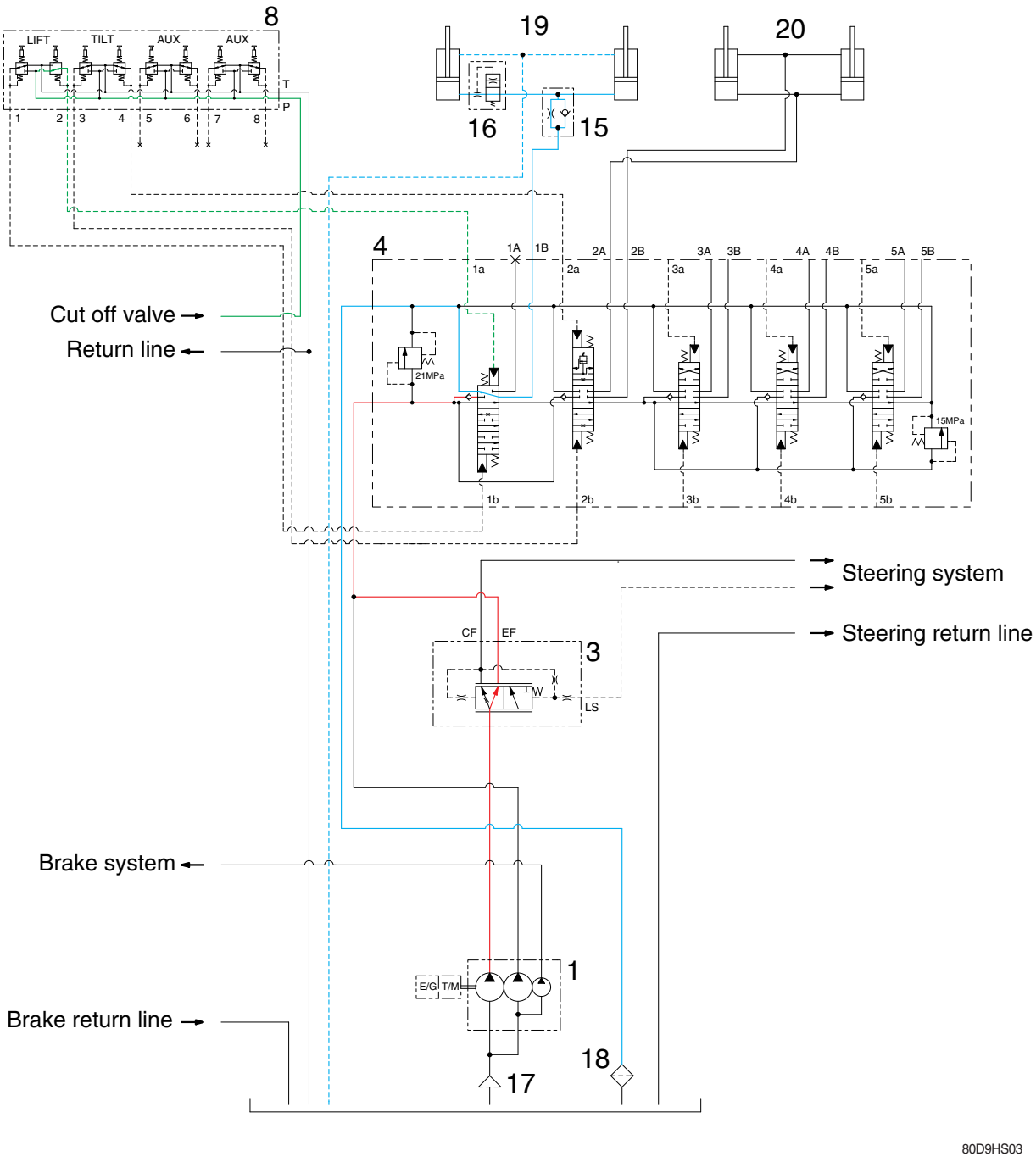
1) WHEN THE LIFT CONTROL LEVER IS IN THE LIFT POSITION



When the lift control lever is pulled back, the spool on the first block is moves to lift position.
The oil from hydraulic gear pump (1) flows into main control valve (4) and then goes to the large chamber of lift cylinder (19) by pushing the load check valve of the spool.
The oil from the small chamber of lift cylinder (19) returns to hydraulic oil tank at the same time.
When this happens, the forks go up.

※ The circuit diagram may differ from the equipment, so please check before a repair.

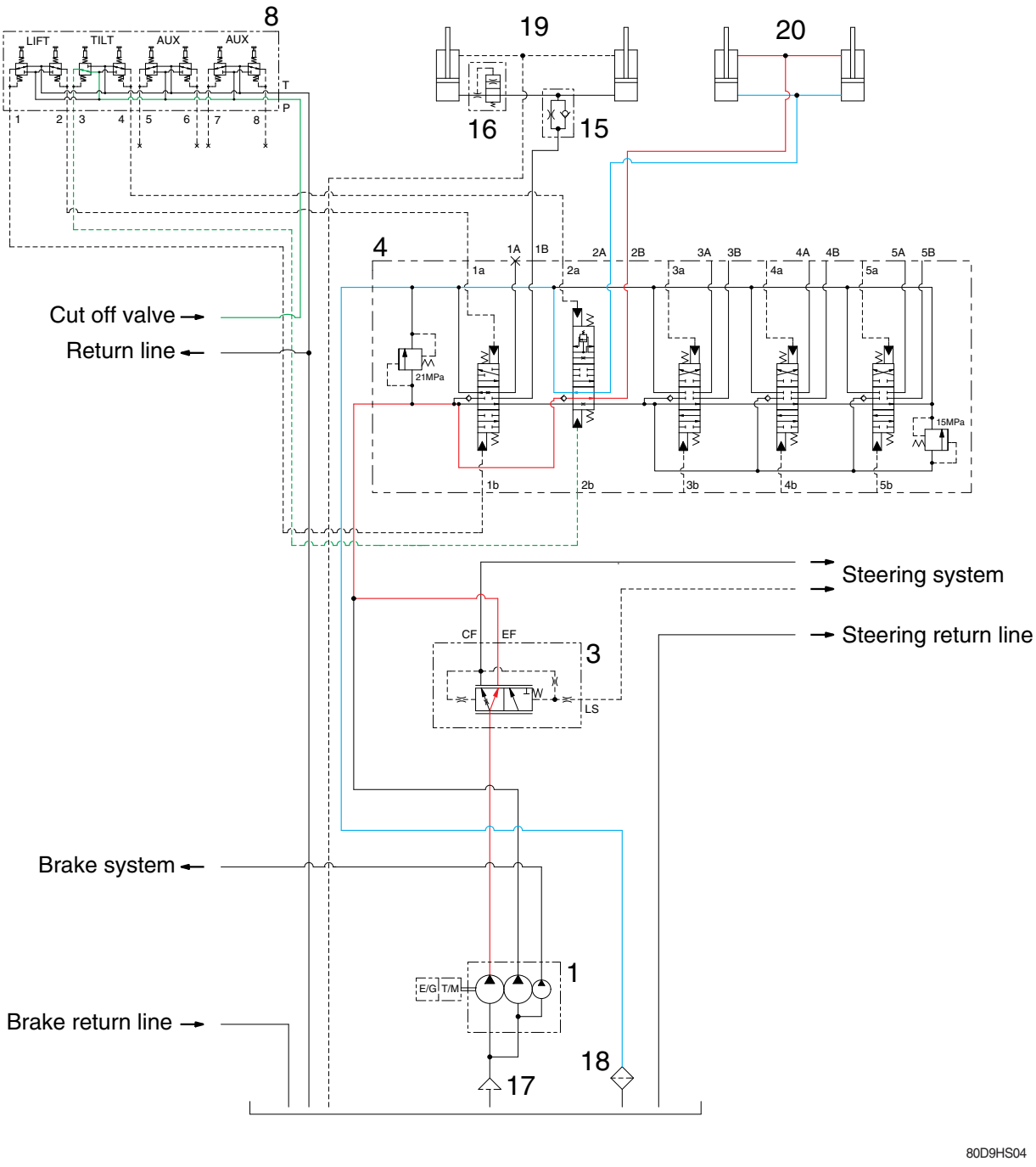
2) WHEN THE LIFT CONTROL LEVER IS IN THE LOWER POSITION



When the lift control is pushed forward, the spool on the first block is moved to lower position.
The work port (1B) and the small chamber and the large chamber are connected to the return passage, so the lift will be lowered due to its own weight.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3) WHEN THE TILT CONTROL LEVER IS IN THE FORWARD POSITION



When the tilt control lever is pushed forward, the spool on the second block is moved to tilt forward position.

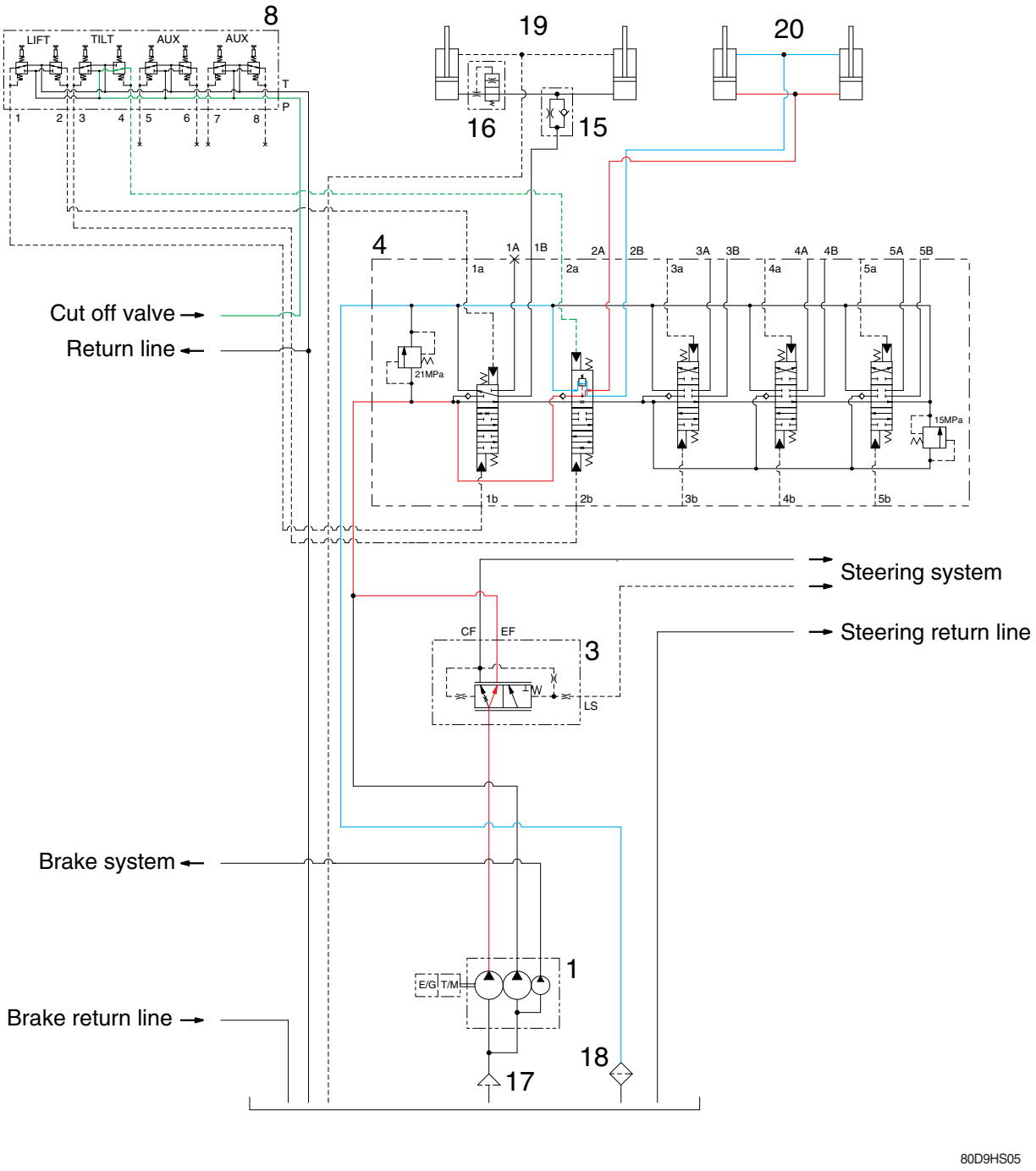
The oil from hydraulic gear pump (1) flows into main control valve (4) and then goes to the large chamber of tilt cylinder (20) by pushing the load check valve of the spool.

The oil at the small chamber of tilt cylinder (20) returns to hydraulic tank at the same time.

When this happens, the mast tilt forward.

※ The circuit diagram may differ from the equipment, so please check before a repair.

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



When the tilt control lever is pulled back, the spool on the second block is moved to tilt backward position.

The oil from hydraulic gear pump (1) flows into main control valve (4) and then goes to the small chamber of tilt cylinder (20) by pushing the load check valve of spool.

The oil at the large chamber of tilt cylinder (20) returns to hydraulic tank at the same time.

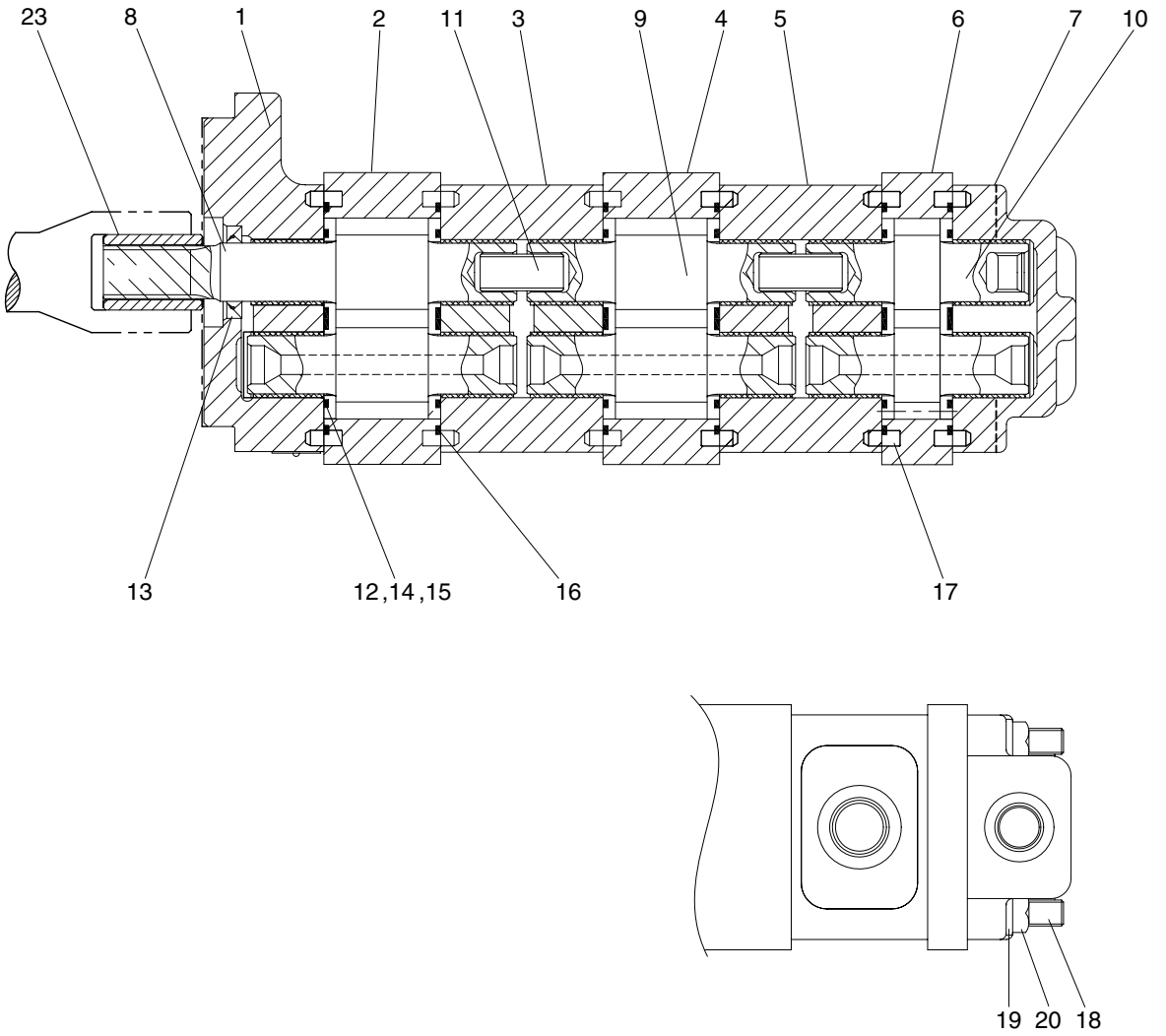
When this happens, the mast tilt backward.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. HYDRAULIC GEAR PUMP

1) STRUCTURE

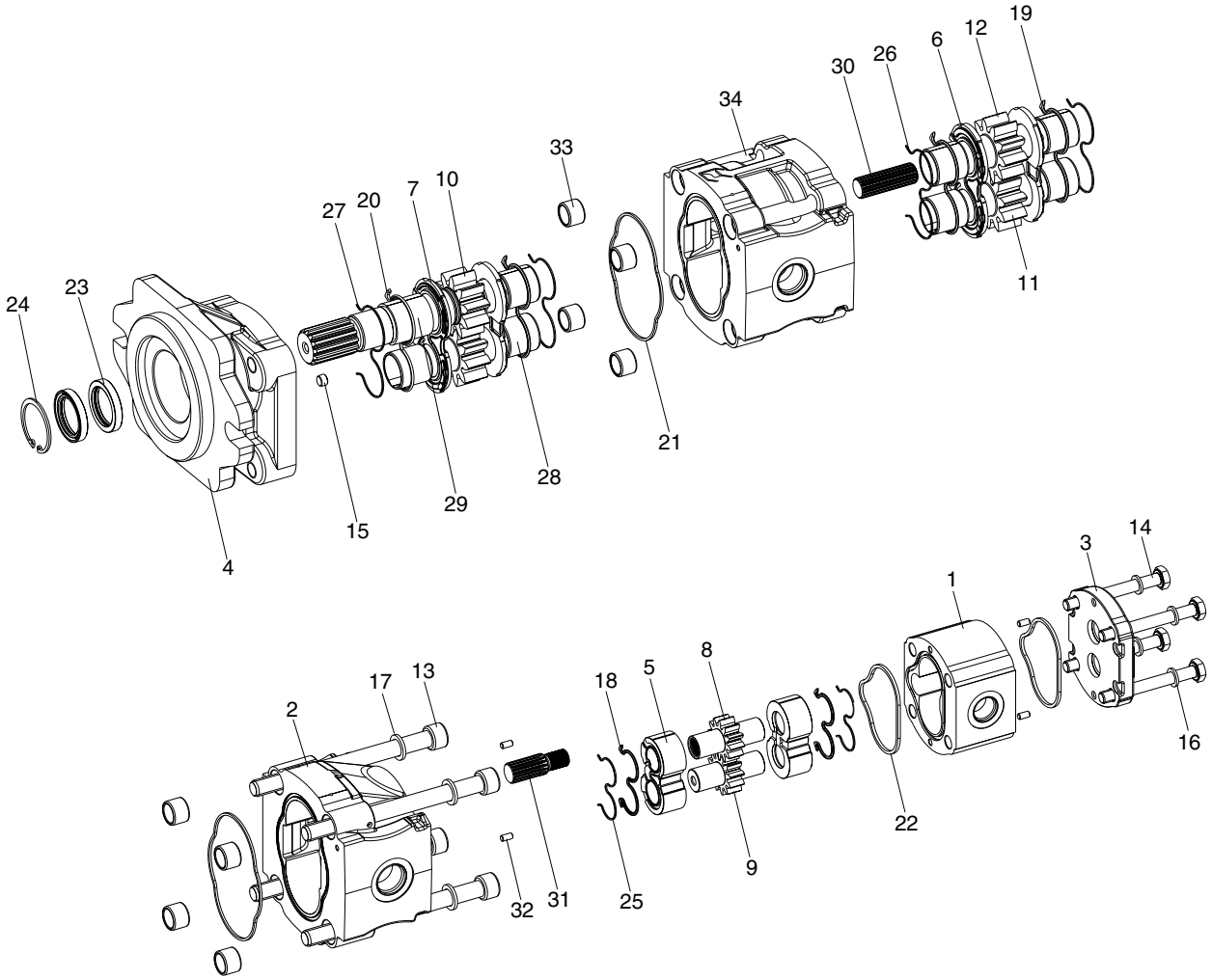
(1) General pump (STD)



50D7EHS06

1	Cover	8	Shaft gear	15	Seal
2	Gear housing	9	Drive gear	16	Seal
3	Carrier	10	Gear set	17	Dowel pin
4	Gear housing	11	Shaft	18	Stud bolt
5	Carrier	12	Thrust plate	19	Washer
6	Gear housing	13	Seal	20	Hex-nut
7	Cover	14	Seal	23	Shaft

(2) Low noise pump (OPT)

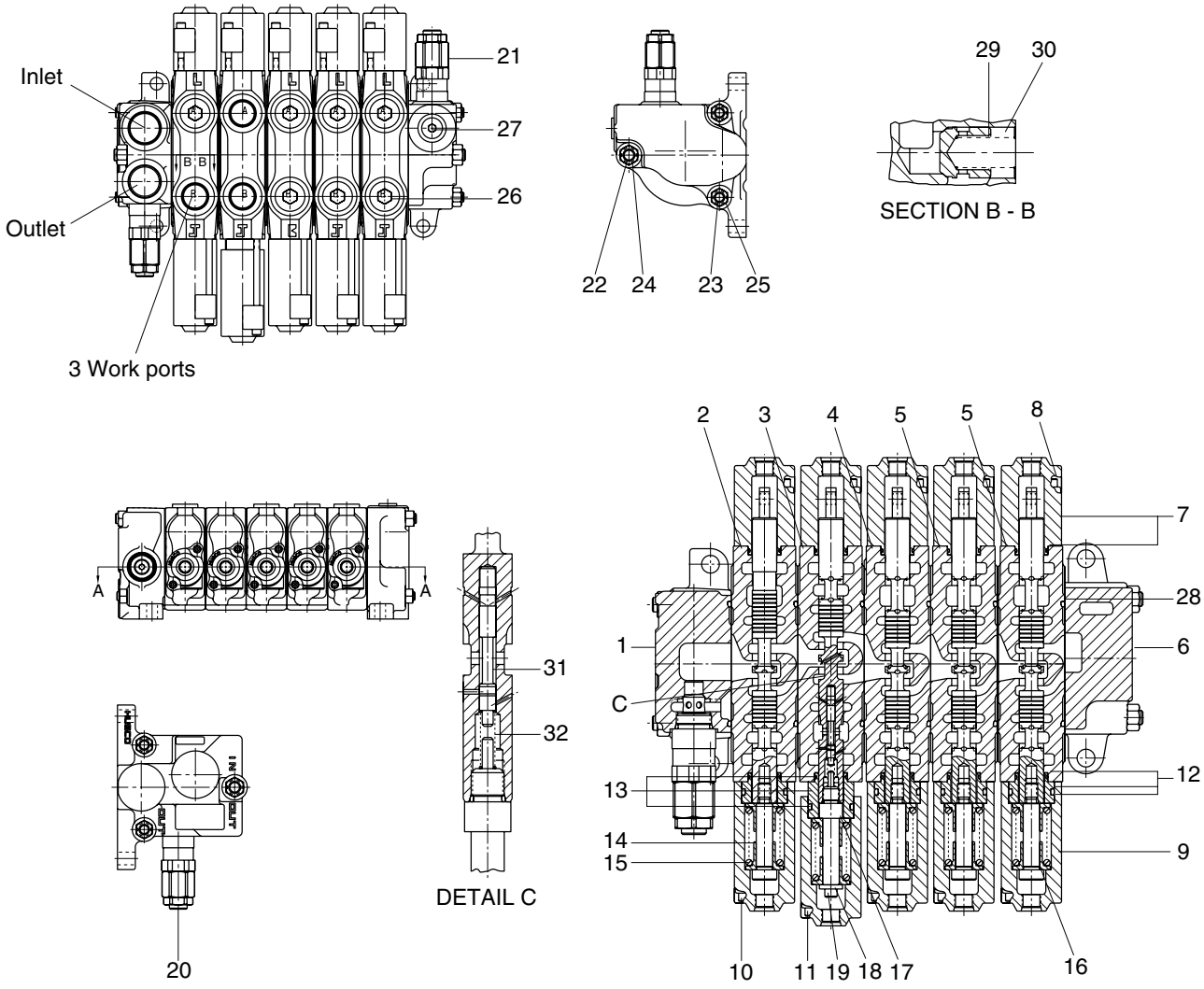


80D7HS06

1	Body	13	Screw	25	Antiextrusion
2	Body	14	Screw	26	Antiextrusion ring
3	Rear cover	15	Grub screw	27	Upper antiextrusion ring
4	Cover	16	Washer	28	Sleeve bearing
5	Thrust plate	17	Washer	29	Upper sleeve bearing
6	Thrust plate	18	Seal	30	Hub
7	Upper thrust plate	19	Seal	31	Hub
8	Drive gear	20	Upper seal	32	Dowel pin
9	Driven gear	21	Standard seal	33	Steel bushing
10	Drive shaft	22	Seal	34	G. housing
11	Driven gear	23	Shaft seal		
12	Drive shaft	24	Ring		

3. MAIN CONTROL VALVE

1) STRUCTURE (5 Spool)



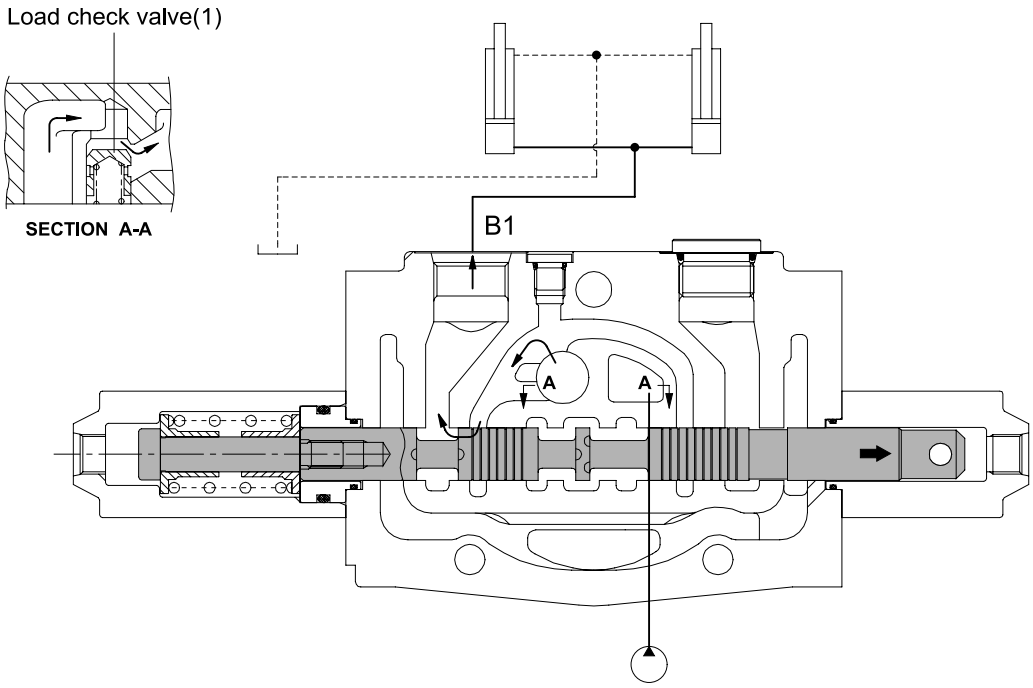
Port name	Size
Inlet port	1-5/16-12UNF
Outlet port	1-5/16-12UNF
Gauge port	PF1/4
Work port	1-1/16-12UNF

80D9HS07

1	Inlet section assy	12	Retainer	23	Tie rod
2	Spool section assy (Lift)	13	Retainer	24	Special nut
3	Spool section assy (Tilt)	14	Spring set	25	Special nut
4	Spool section assy (Aux)	15	Spring	26	Plug
5	Spool section assy (Aux)	16	Screw	27	Plug
6	Outlet section assy	17	Spool end	28	O-ring
7	Spool cap	18	Washer	29	Poppet
8	Cap screw	19	Cap screw	30	Spring
9	Spool cap	20	Main relief valve assy	31	Piston
10	Cap screw	21	Port relief valve assy	32	Spring
11	Cap screw	22	Tie rod		

2) LIFT SECTION OPERATION

(1) Lift position



80D9HS08

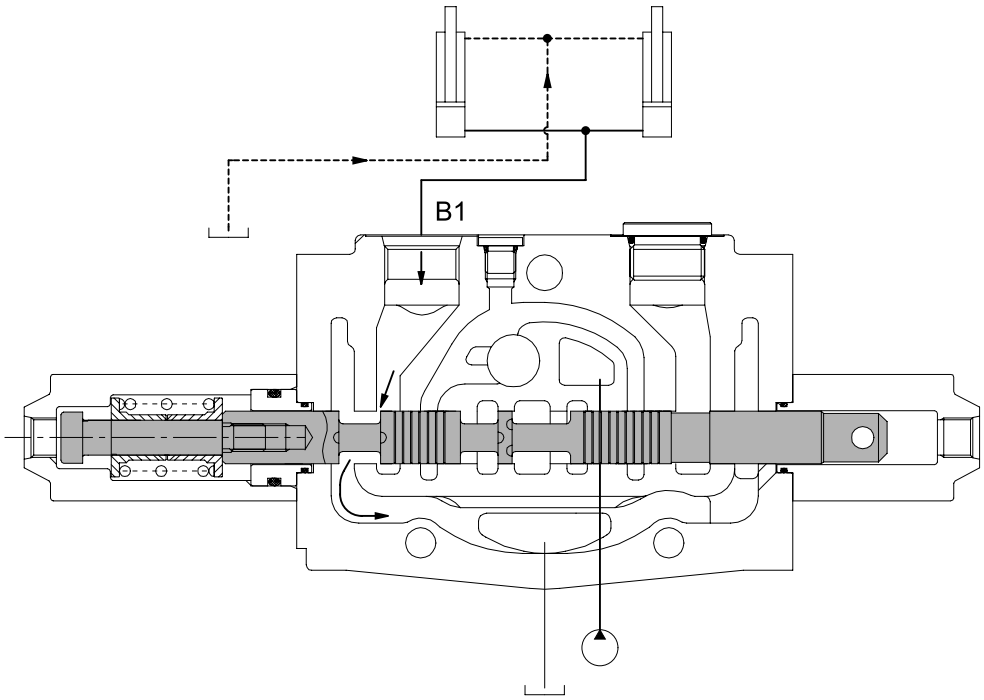
When the lift control lever is pulled back, the spool moves to the right and the neutral passage is closed.

The oil supplied from the pump pushes up the load check valve (1) and flow into lift cylinder port (B1).

The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.

The return oil from cylinder flows into the tank.

(2) Lower position

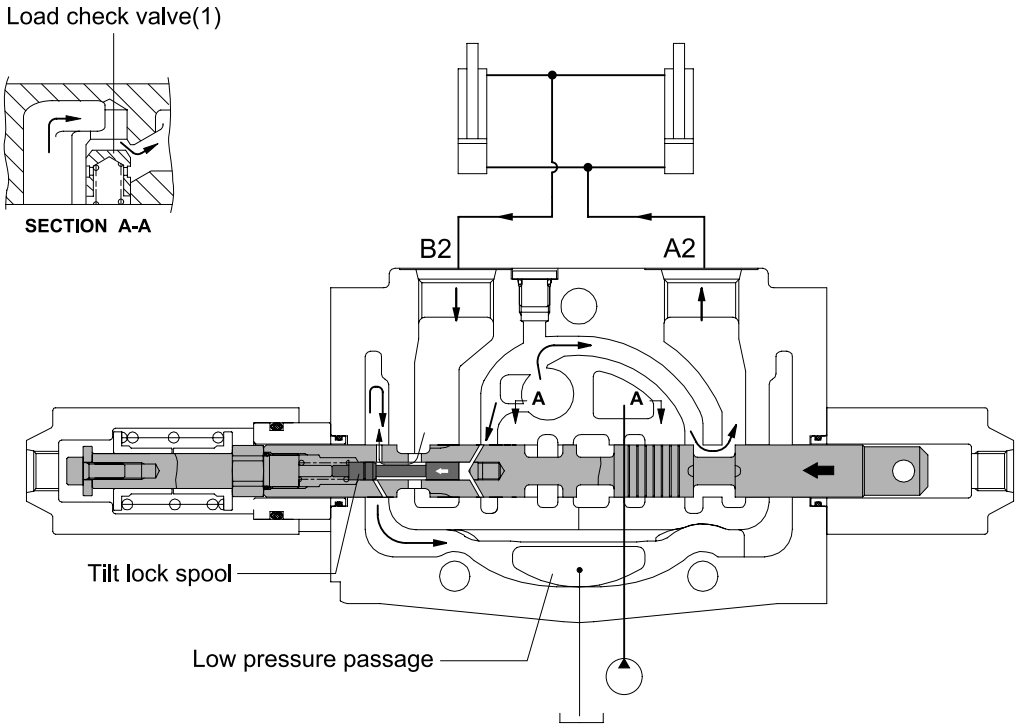


80D9HS09

When the lift control lever is pushed forward, the spool moves to the left and the neutral passage is closed.
The spool moves to the lift lower position, opening up the neutral passage to tank and (B1) → T.
In lift lower position the fork drops due to its own weight.

3) TILT SECTION OPERATION

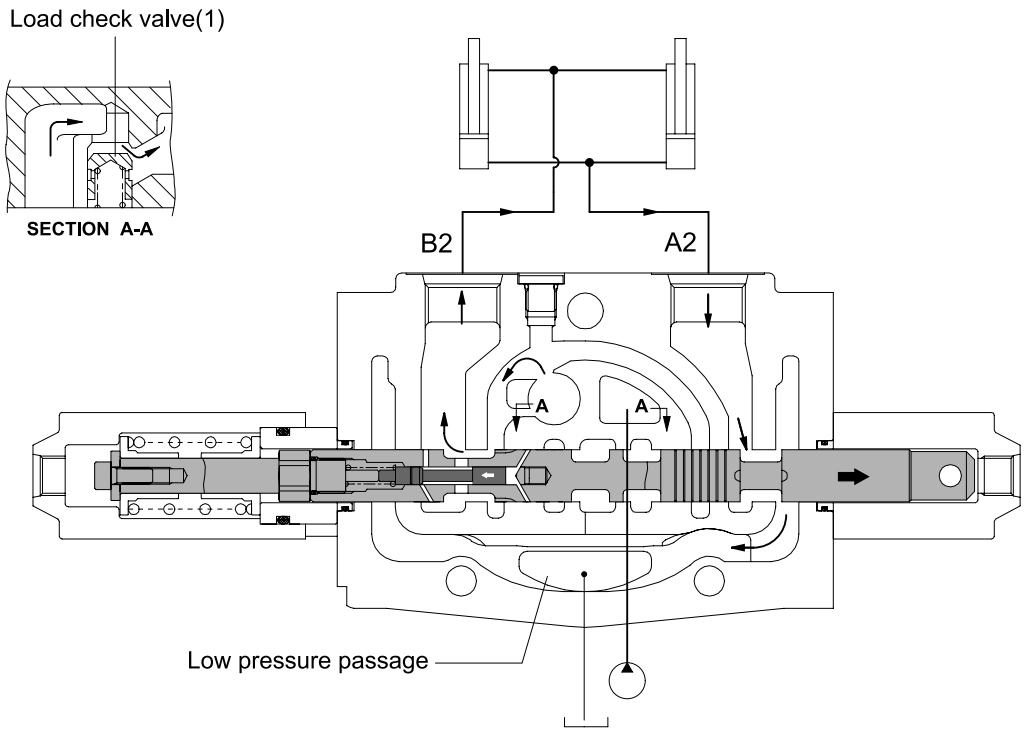
(1) Tilt forward position



80D9HS10

When the tilt control lever is pushed forward, the spool moves to the left and the neutral passage is closed.
The oil supplied from the pump pushes up the load check valve (1) and flow into tilt cylinder port (A2).
The pump pressure reaches proportionally the load of cylinders and fine control finished by closing the neutral passage.
The return oil from cylinder port (B2) flows into the tank through the hole of the tilt lock spool.

(2) Tilt backward position



80D9HS11

When the tilt control lever is pulled back, the spool moves to the right and the neutral passage is closed.
The oil supplied from the pump pushes up the load check valve (1) and flows into tilt cylinder port (B2). The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.
The return oil from cylinder port (A2) flows into the tank via the low pressure passage.

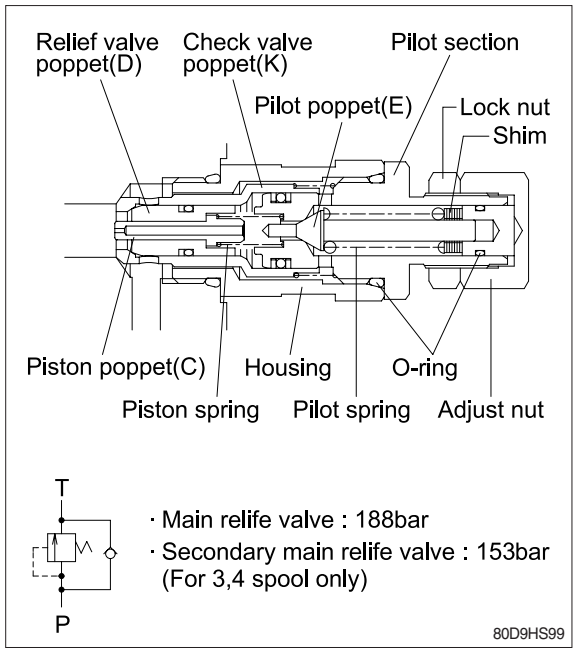
4) MAIN RELIEF VALVE

(1) Pressure setting

A good pressure gauge must be installed in the line which is in communication with the work port relief. A load must be applied in a manner to reach the set pressure of the relief unit.

Procedure

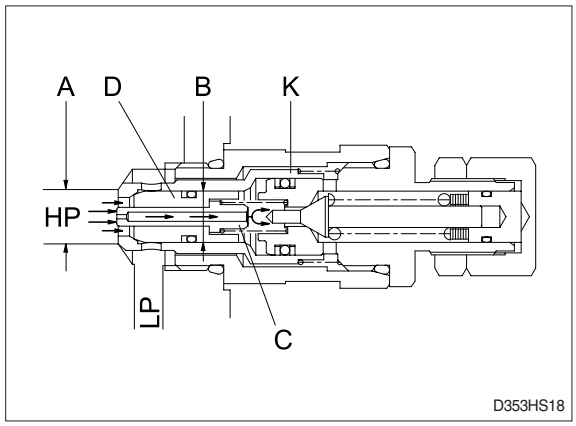
① Loosen lock nut.
② Set adjusting nut to desired pressure setting.
③ If desired pressure setting cannot be achieved, add or remove shims as required.
④ Tighten lock nut.
⑤ Retest in similar manner as above.



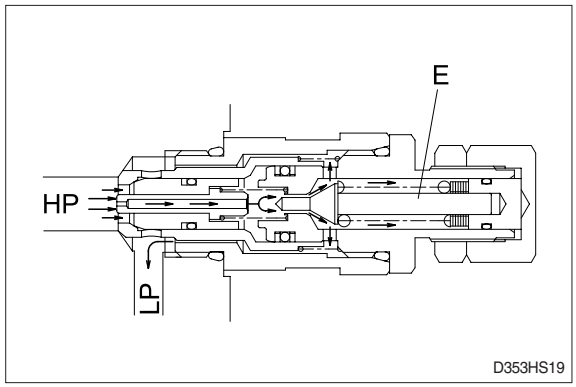
(2) Function

① As work port relief

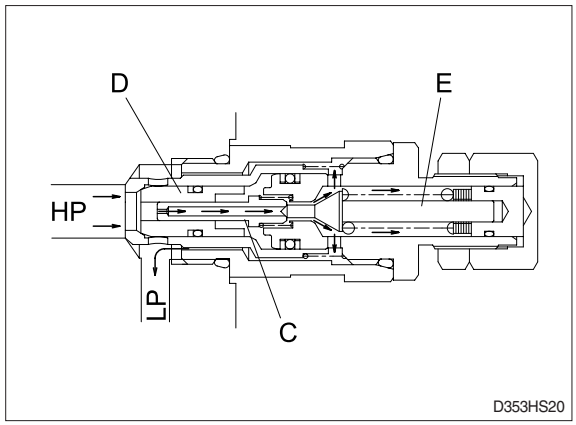
The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown.



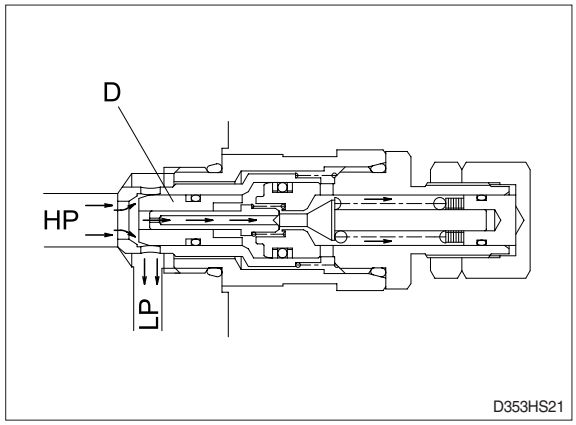
The oil pressure in the high pressure port HP has reached the setting of the pilot poppet spring force and unseats the pilot poppet E and oil flows around the poppet through the cross drilled holes and to the low pressure area LP.



The loss of oil behind poppet C, effected by the opening of pilot poppet E, causes poppet C to move back and seat against pilot puppet E. This shuts off the oil flow to the area behind relief valve poppet D, and causes a low pressure area internally.

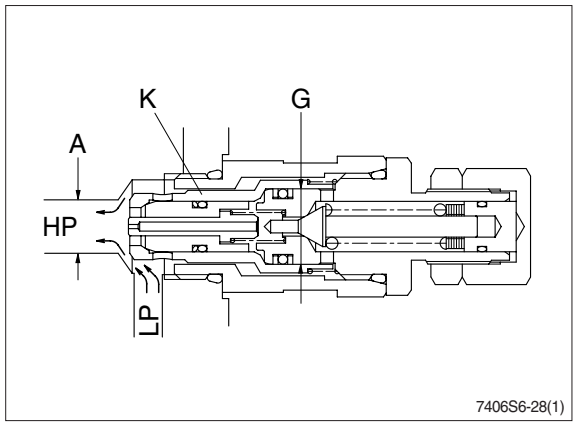


The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.



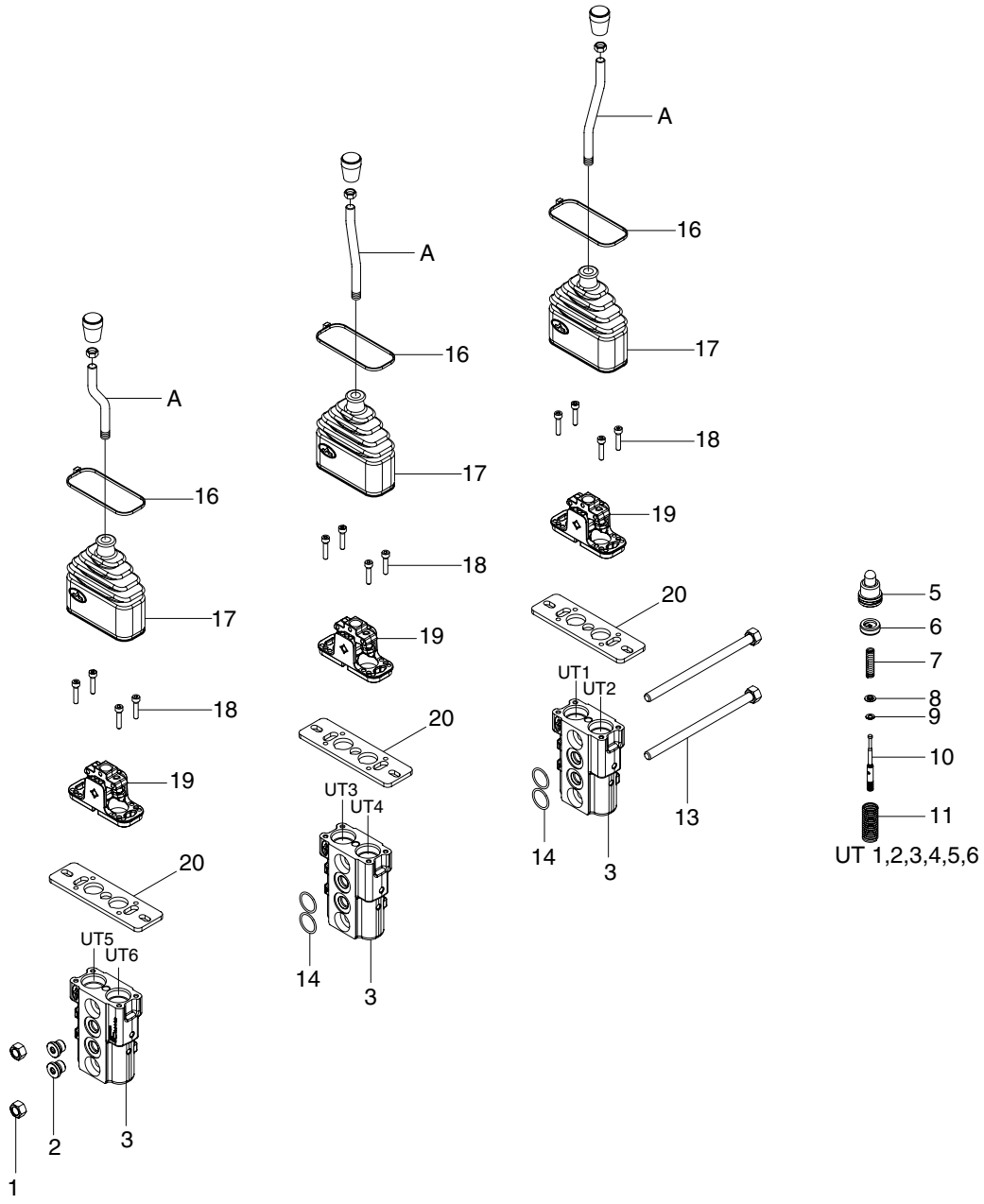
② As anti void

The anti-void unit supplies oil to the high pressure port HP when cavitation has occurred. A lower pressure exists in the port HP compared to the low pressure chamber LP. The difference between the effective area of diameter A and G causes imbalance of the check valve poppet K which unseats, thus allowing oil from the low pressure chamber LP to enter the port HP and fill the void.



4. REMOTE CONTROL VALVE

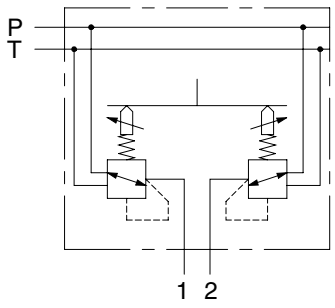
1) STRUCTURE



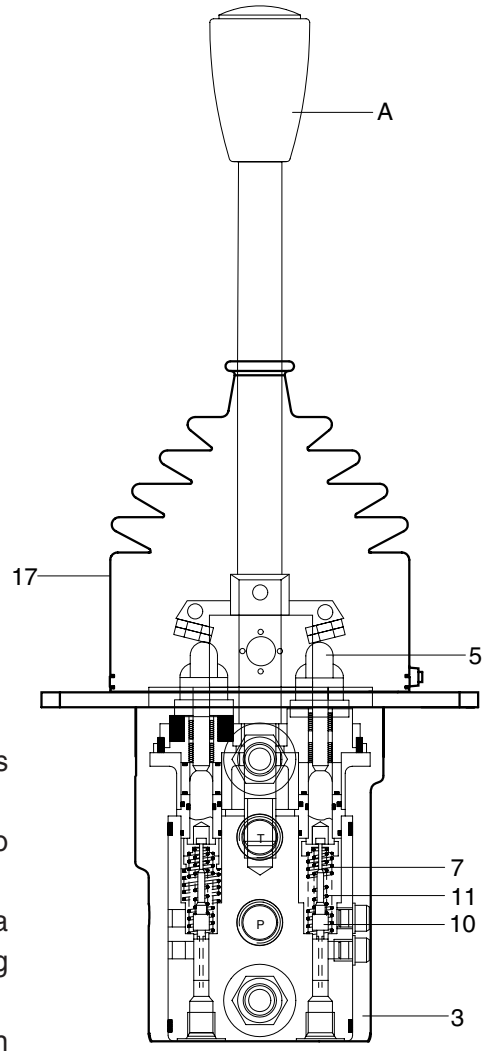
100D7RCV00

A	Lever	7	Metering spring	14	O-ring
1	Nut	8	Seeger ring	15	Kit 3
2	Plug	9	Seeger ring	16	Clamp
3	Body	10	Docking rod	17	Rubber bellows
4	Kit 1	11	Spring	18	Screw
5	Plunger kit	12	Kit 2	19	Support kit
6	Spring guide	13	Tie rod with nut	20	Flange

2) OPERATION



HYDRAULIC CIRCUIT



100D7RCV01

(1) Hydraulic functional principle

Pilot devices with end position locks operate as direct operated pressure reducing valves.

They basically comprise of control lever (A), two pressure reducing valves, body (3) and locks.

Each pressure reducing valve comprises of a plunger kit (5), a metering spring (7) and a spring (11).

At rest, control lever(A) is held in its neutral position by return springs (11). Ports (1, 2) are connected to tank port T.

When control lever (A) is deflected, plunger kit (5) is pressed against return spring (11) and metering spring (7).

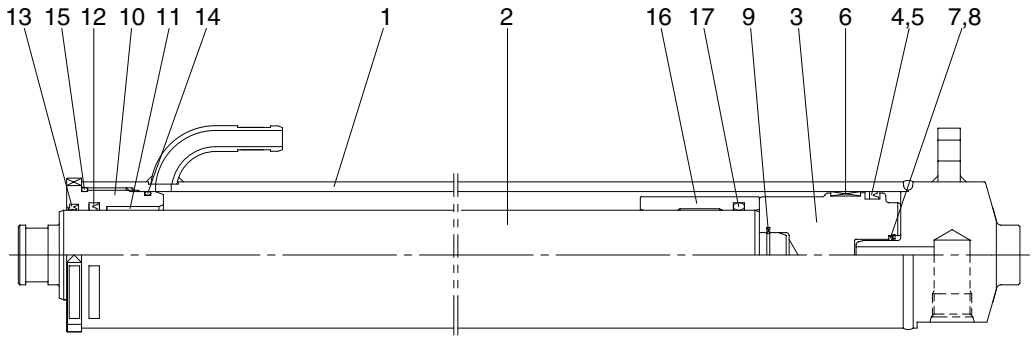
Metering spring (7) initially moves docking rod (10) downwards and closes the connection between the relevant port and tank port T. At the same time the relevant port is connected to port P. The control phase starts as soon as docking rod (10) finds its balance between the force from metering spring (7) and the force, which results from the hydraulic pressure in the relevant port (ports 1, 2).

Due to the interaction between docking rod (10) and metering spring (7) the pressure in the relevant port is proportional to the stroke of plunger (5) and hence to the position of control lever (A).

This pressure control which is dependent on the position of the control lever and the characteristics of the control spring permits the proportional hydraulic control of the main directional valves and high response valves for hydraulic pumps.

A rubber bellows (17) protects the mechanical components in the housing from contamination.

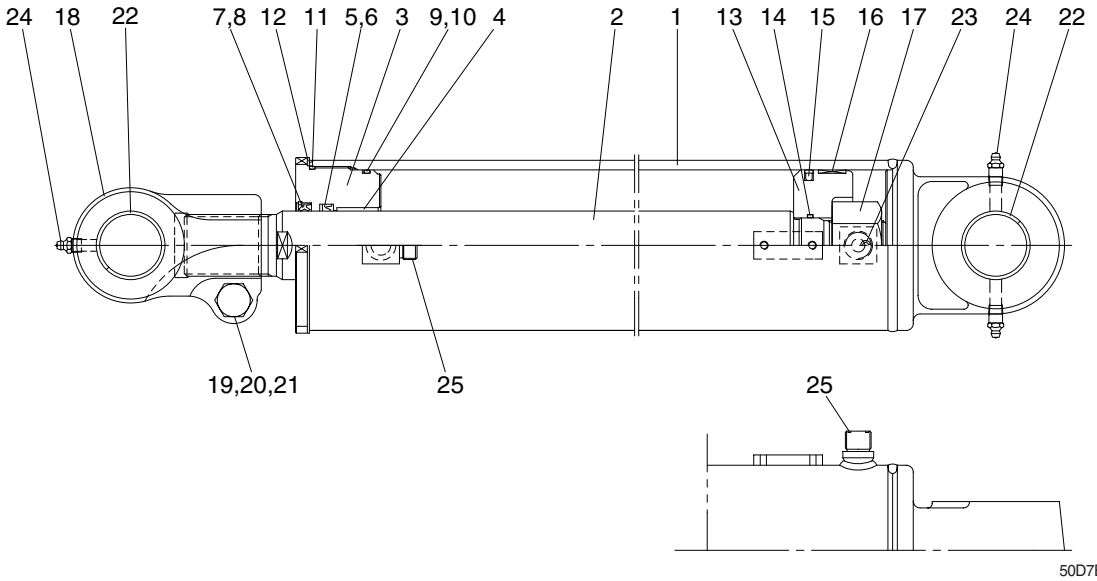
5. LIFT CYLINDER



D507HS12

1	Tube assy	7	Cushion seal	13	Dust wiper
2	Rod	8	Retaining ring	14	O-ring
3	Piston	9	Retaining ring	15	O-ring
4	Piston seal	10	Gland	16	Spacer
5	Back up ring	11	Du bushing	17	O-ring
6	Wear ring	12	Rod seal		

6. TILT CYLINDER



50D7EHS13

1	Tube assy	10	Back up ring	19	Hexagon bolt
2	Rod	11	Lock washer	20	Hexagon nut
3	Gland	12	O-ring	21	Spring washer
4	DU bushing	13	Piston	22	DU bushing
5	Rod seal	14	O-ring	23	Spring-pin
6	Back up ring	15	Piston seal	24	Grease nipple
7	Dust wiper	16	Wear ring	25	O-ring
8	Snap ring	17	Nylon nut		
9	O-ring	18	Rod eye		

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

1) CHECK ITEM

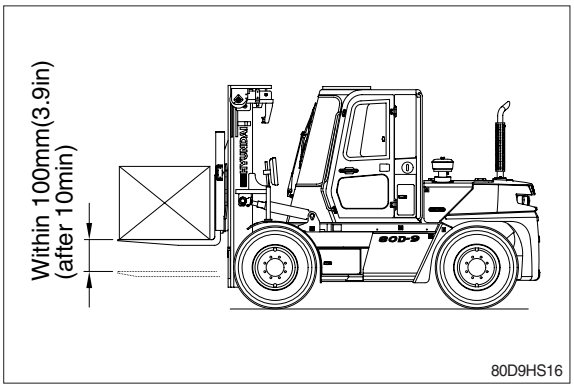
(1) Check visually for deformation, cracks or damage of rod.

(2) Load maximum load, set mast vertical and raise 1 m from ground. Wait for 10 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°

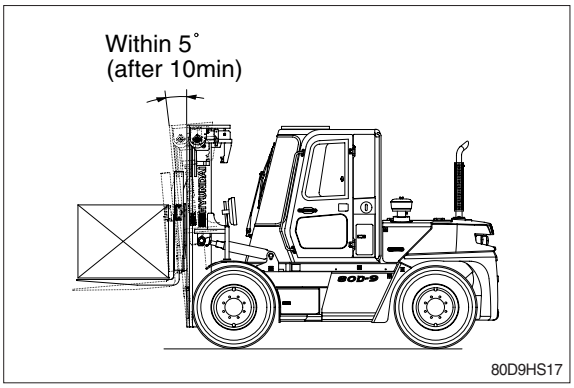
If the hydraulic drift is more than the specified value, replace the control valve or cylinder packing.



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

mm (in)

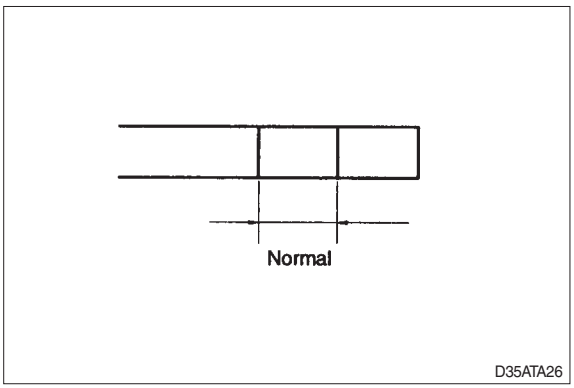
Standard	Under 0.6 (0.02)



2) HYDRAULIC OIL

(1) Using dipstick, measure oil level, and oil if necessary.

(2) When changing hydraulic oil, clean suction strainer(screwed into outlet port pipe) and line filter(screwed into inlet pipe).



3) CONTROL VALVE

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

Check that oil pressure is 188 kgf/cm^2.
(2675 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 defective. · Tilting forward : tilt lock valve defective. · 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 SAE10W, class CD 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 SAE10W, class CD 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 D, E or K stuck open or contamination under seat.	· Check for foreign matter between poppets D, E or K and their mating parts. Parts must slide freely.
Erratic pressure	· Pilot poppet seat damaged. · Poppet C sticking in D.	· Replace the relief valve. · Clean and remove surface marks for free movement.
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.

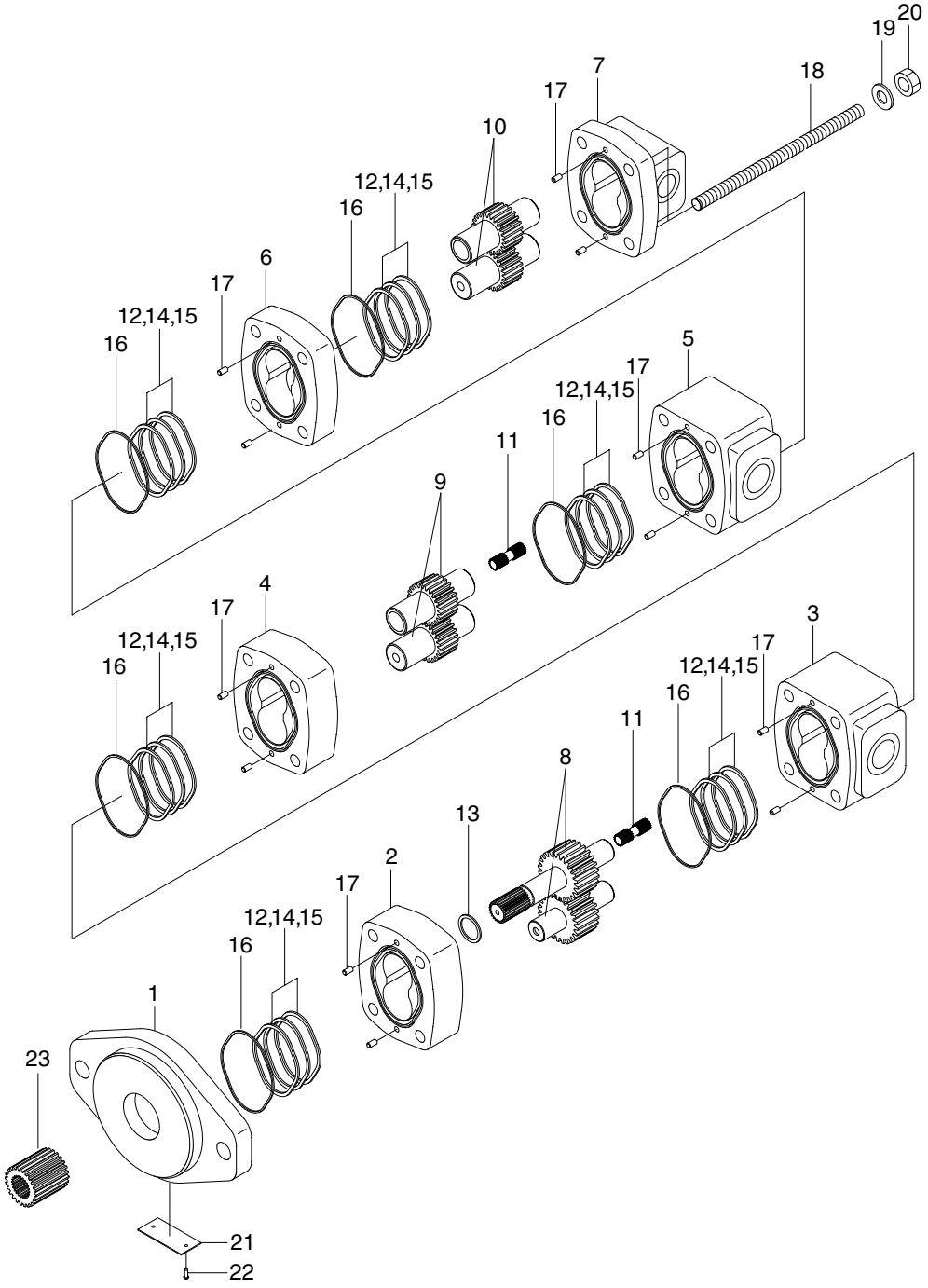
4) LIFT CYLINDER

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.

1. MAIN PUMP

1) STRUCTURE

(1) General pump (STD)



50D7EHS23

1	Cover	8	Gear	15	Seal
2	Gear housing	9	Gear	16	Seal
3	Carrier	10	Gear set	17	Dowel-pin
4	Gear housing	11	Shaft	18	Stud bolt
5	Carrier	12	Thrust plate	19	Washer
6	Gear housing	13	Seal	20	Hex-nut
7	Cover	14	Seal	23	Shaft

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.

(2) Lubrication of moving parts

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

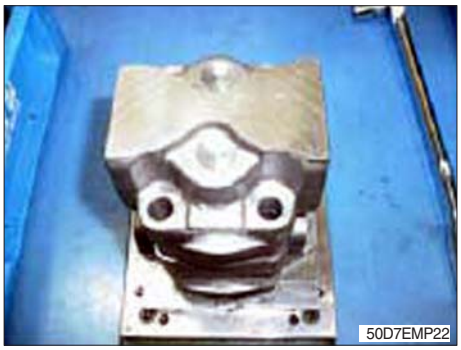
(3) Tools required for assembly

① Socket set (1/2" drive)
② Internal snap ring pliers
③ Shaft seal sleeve or clear tape
④ Torque wrench (200 lbf · ft capacity)
⑤ Plastic hammer
⑥ Torque wrench box end adapters

3) DISASSEMBLY

(1) Loosen and remove the nuts and washers from cover.

(2) Remove cover and dowel pin stud bolts from cover.



(3) Remove connection shaft, drive gear and driven gear set from gear housing.

※ When removing the gear housing, keep it as straight as possible during removal so that it can not happen scratch or damage to inner surface by touching gear teeth.

(4) Remove gear housing from carrier.
Remove thrust plate from gear housing.

(5) Remove bearing carrier from gear housing.

(6) Remove connecting shaft from gear set.
Remove thrust plate from gear housing.

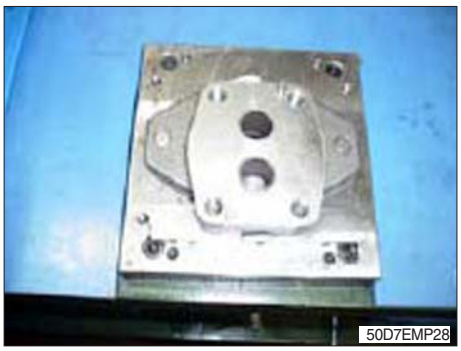
(7) After taking out connecting shaft, remove gear housing, drive gear and driven gear set from cover.

※ When removing the gear housing, keep it as straight as possible so that it can not happen scratch or damage to inner surface by touching gear teeth.
Inspect scoring or excessive wear of shaft and gear teeth for both drive gear and driven gear set.


50D7EMP27

(8) Remove lip seal from the cover.

※ When remove the lip seal from the cover, take care not to give any scratch or damage on the surface of shaft hole or seal bore.


50D7EMP28

4) ASSEMBLY

(1) Throughly clean seal bore, press the shaft seal in to the seal bore of the cover.

※ Uniform pressure must be used to prevent misalignment or damage to the seal.


50D7EMP31

(2) Assemble shaft to the cover.

※ Throughly clean mounting surface of the gear housing for the seals.


50D7EMP32

(3) Assemble gear housing and thrust plate to the cover.

(4) Assemble gear set and thrust plate, shaft.

※ Throughly clean mounting surface of square seal and insert the seal in the gear housing, thrust plate.

(5) Assemble gear housing to carrier using dowel pin.

(6) Assemble gear housing and gear set.

(7) Assemble carrier to gear housing using dowel pins.
Assemble gear housing to carrier using dowel pins.

※ Throughly clean mounting surface of seals, and then insert seals and thrust plate.

※ Take care not to happen any damage of the seals.

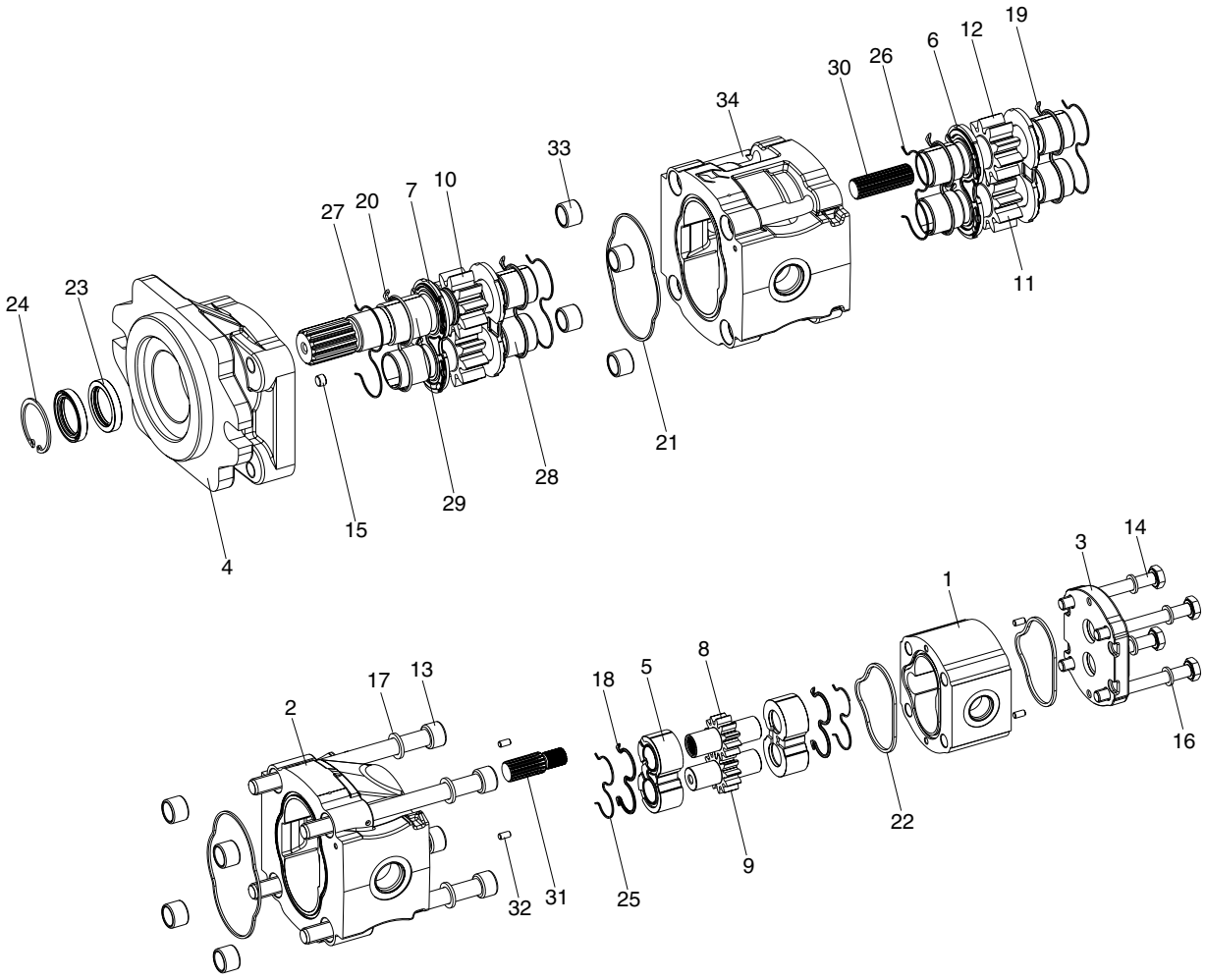
(8) Assemble last drive gear and driven gear set to the drive gear and driven gear set using connecting shaft.
Assemble cover to gear housing using dowel pin.

※ Throughly clean mounting surface of seals and then insert the seals and thrust plate.

※ Take care not to happen any damage of the seals.

(9) Assemble stud bolts, washers and fasten nuts.
· Tightening torque for nut : 15 kg · m

(2) Low noise pump (OPT)



1	Body	13	Screw	25	Antiextrusion
2	Body	14	Screw	26	Antiextrusion ring
3	Rear cover	15	Grub screw	27	Upper antiextrusion ring
4	Cover	16	Washer	28	Sleeve bearing
5	Thrust plate	17	Washer	29	Upper sleeve bearing
6	Thrust plate	18	Seal	30	Hub
7	Upper thrust plate	19	Seal	31	Hub
8	Drive gear	20	Upper seal	32	Dowel pin
9	Driven gear	21	Standard seal	33	Steel bushing
10	Drive shaft	22	Seal	34	G. housing
11	Driven gear	23	Shaft seal		
12	Drive shaft	24	Ring		

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.

(2) Lubrication of moving parts

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

(3) Tools required for assembly

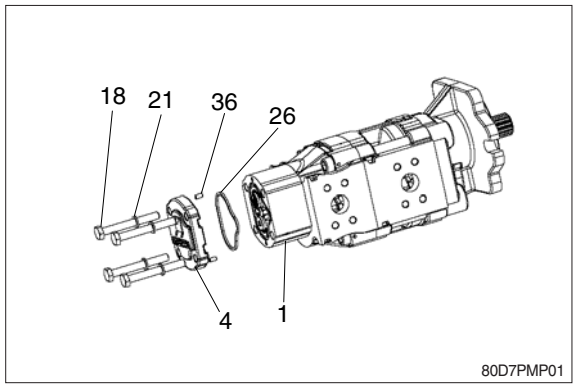
① Socket set (1/2" drive)
② Internal snap ring pliers
③ Shaft seal sleeve or clear tape
④ Torque wrench (200 lbf · ft capacity)
⑤ Plastic hammer
⑥ Torque wrench box end adapters

3) DISASSEMBLY

(1) Rear section

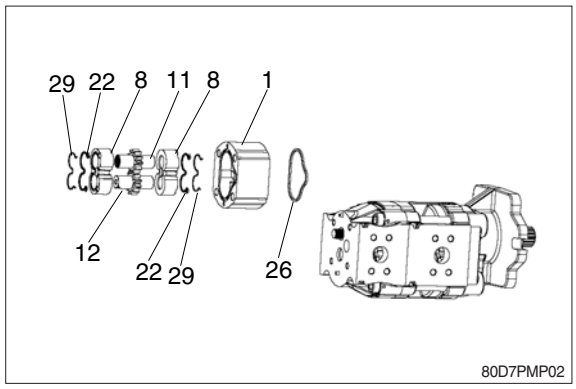
① Loosen and remove the clamp bolts (18) from rear working section (1).

※ Related parts
Washer (21), rear cover (4), dowel pin (36) and square-ring (26).



② Remove driving gear (11), driven gear (12) with thrust plate parts (8, 22, 29), keeping gear as straight as possible, and working section (1) also.

※ Related parts
Back-up ring (29), O-ring (22), thrust plate (8), working body (1) and square ring (26).

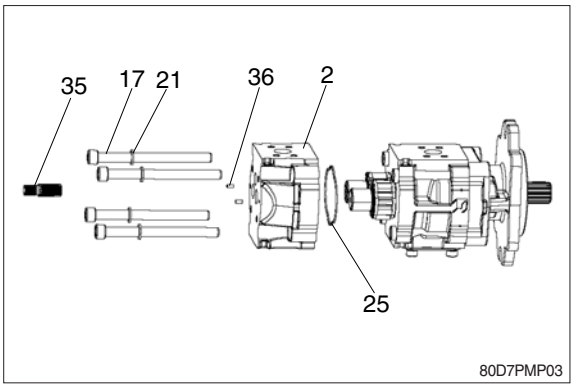


(2) Center section

① Remove through shaft (35) from driving shaft (15).

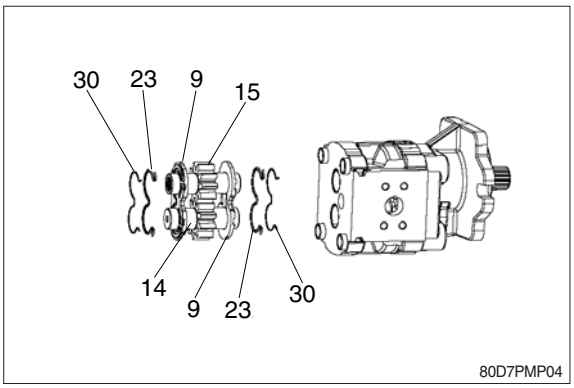
② Loosen and remove the clamp bolt (17) with washer (21), and then remove the working section (2) with dowel pin (36).

※ Related parts
Square ring (25).



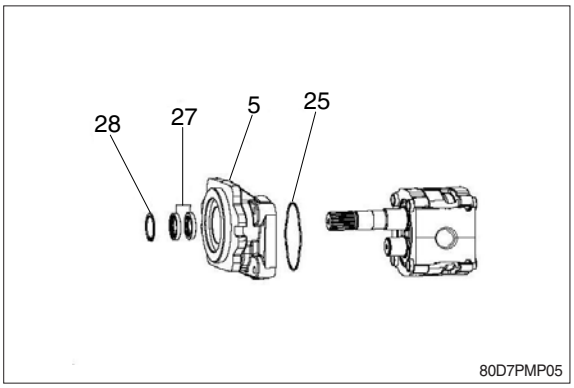
③ Remove driving gear (15), driven gear (14) with thrust plate parts (9, 23, 30), keeping gear as straight as possible, from first working body.

※ Related parts
Back-up ring (30), O-ring (23) and thrust plate (9).



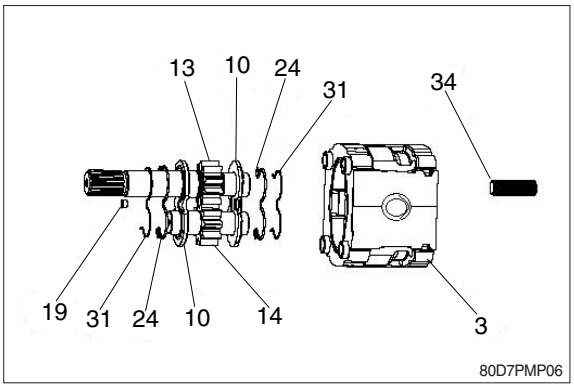
(3) Front section

① Remove the snap-ring (28) and shaft seal (27), and then remove mounting flange (5) and square ring (25) from working section (3).



② Remove driving gear (13), driven gear (14) with through shaft (34) and thrust plate parts (10,24,31) from the working body (3), keeping gear as straight as possible.

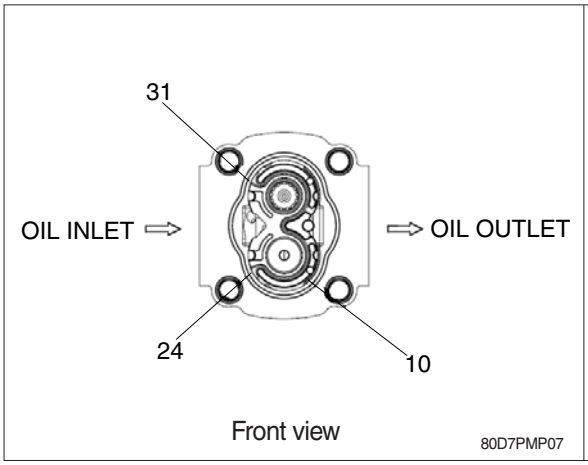
※ Related parts
Plug (19), back-up ring (31), O-ring (24) and thrust plate (10).

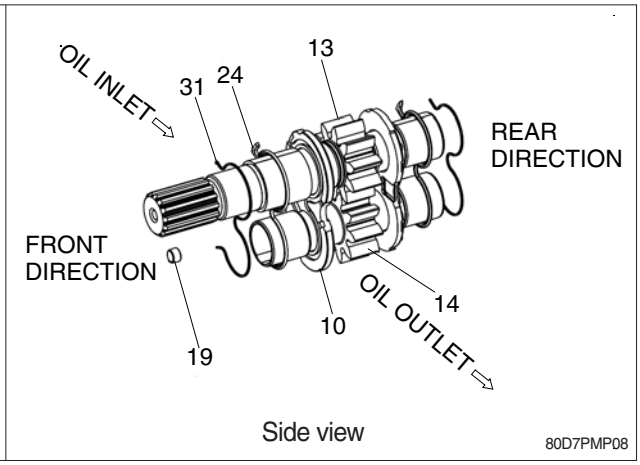


4) REASSEMBLY

※ Information for assembly way of thrust plates

It is important that all of thrust plate parts in this hydraulic pump should be assembled such as below picture during reassembly. Below figures show assembling sequence and direction.



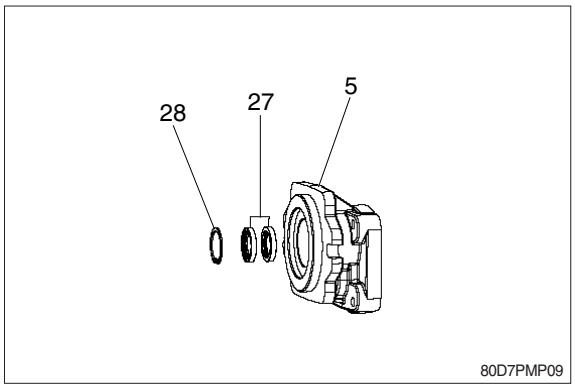


10	Thrust plate	14	Driven gear	24	O-ring
13	Driving gear	19	Plug	31	Back-up ring

(1) Front cover area

① Insert the shaft seal (27) carefully and fit it inside of mounting flange (5) with proper tool.

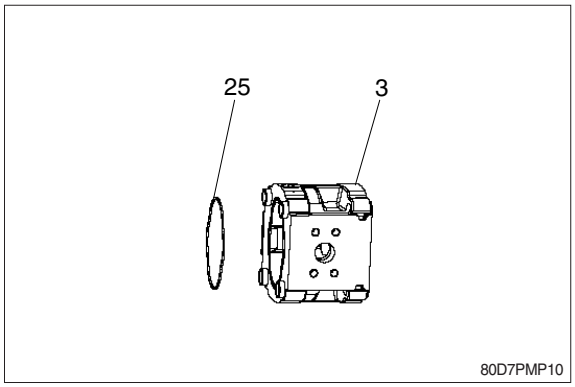
② Fit the snap-ring (28) in pre-arranged position with proper tool.



(2) Center section

① Fit the square ring (25) on the prearranged groove of the working section (3).

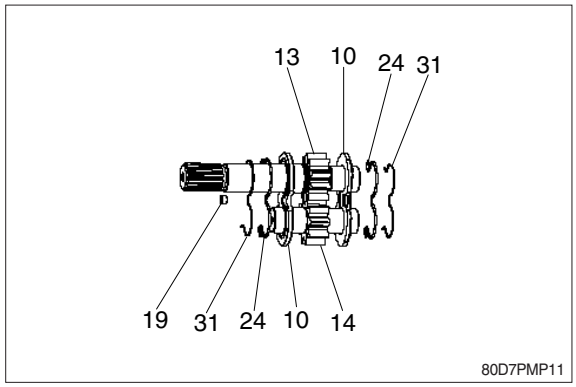
※ Smear clean grease on the square ring (25) to avoid drifting away of square ring from the working section (3).



② Locate the o-ring (24) on the groove prearranged on the thrust plate (10).

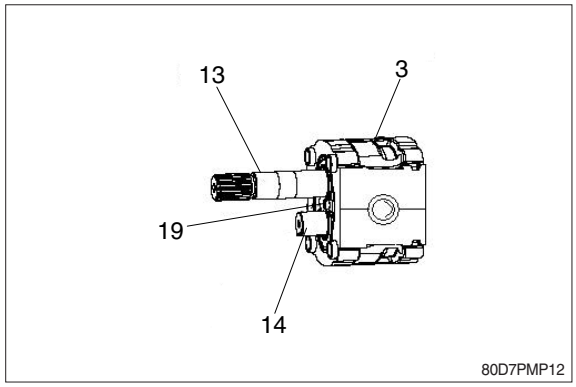
③ Then, locate back-up ring (31) on the groove pre-arranged on the seals (10, 24) with plug (19).

※ Smear clean grease on the seal (24,31). (The front and rear thrust plates and seals and back-up ring are same.)



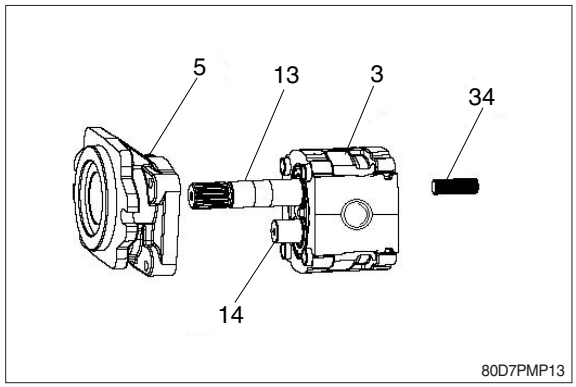
④ Insert the driving gear (13) and driven gear (14) into working section (3) while keeping the gears straight.

※ Locate thrust plate (10+24+31) with care for the direction.



⑤ Locate the completed mounting flange (5+27+28) to working section (3) while tacking care not to give any damage on the shaft seal by edge of shaft (13).

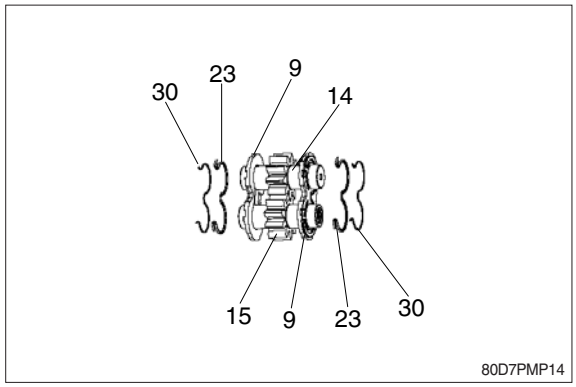
⑥ Insert the through shaft (34) to rear side of the driving shaft (13).



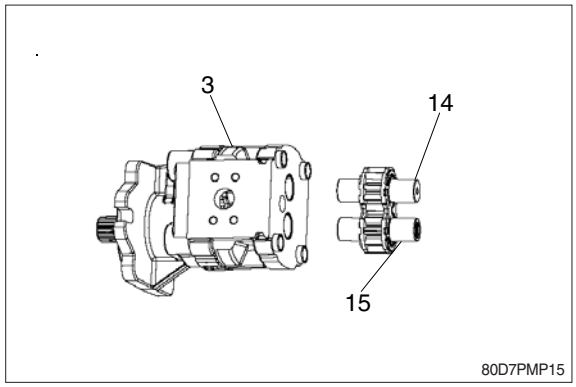
⑦ Locate the O-ring (23) on the groove prearranged on the thrust plate (9).

⑧ Then, locate back-up ring (30) on the groove pre-arranged on the seals (9, 23).

※ Smear clean grease on the seal (9,23) (The front and rear thrust plates and seals and back-up ring are same.)

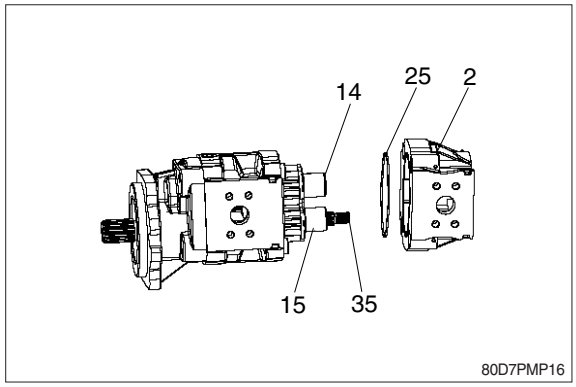


⑨ Insert the driving shaft (15) and driven gear (14) including the completed thrust plate (9+23+30) into working section (3) while keeping the plate straight.

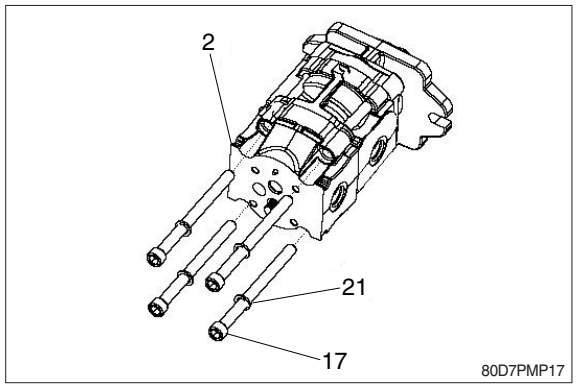


⑩ Insert the through shaft (35) into driving shaft (15), and then locate the working body (2) after inserting the squaring ring (25) to body (2).

※ Smear clean grease on the square ring (25) to avoid drifting away of square ring from the working body (2).



⑪ Tighten the bolt (17) with washer (21) in a cross pattern to torque valve of 140 Nm.

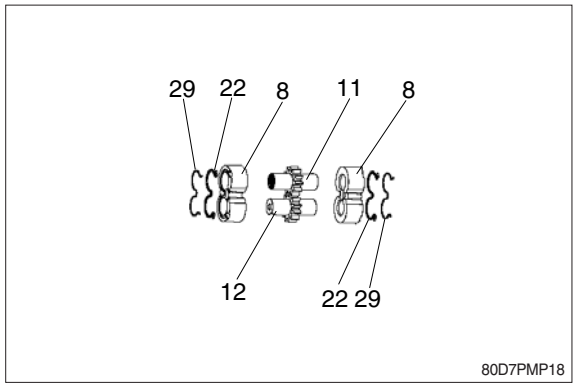


(3) Rear section

① Locate the O-ring (22) on the groove prearranged on the thrust plate (8).

② Then, locate back-up ring (29) on the groove pre-arranged on the seals (8, 22).

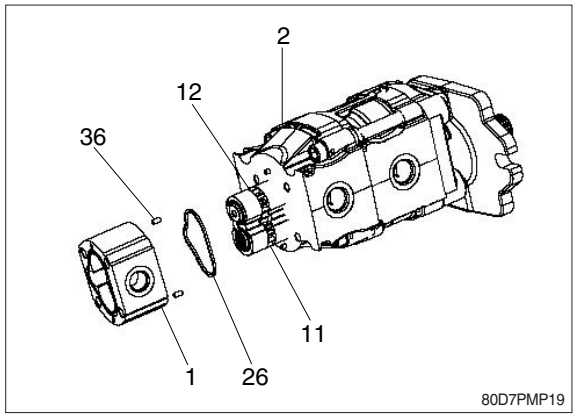
※ Smear clean grease on the seal (8,22) (The front and rear thrust plates and seals and back-up ring are same.)



③ Locate the driving gear (11) and driven gear (12) with thrust plate parts (8+22+29) into working section (2).

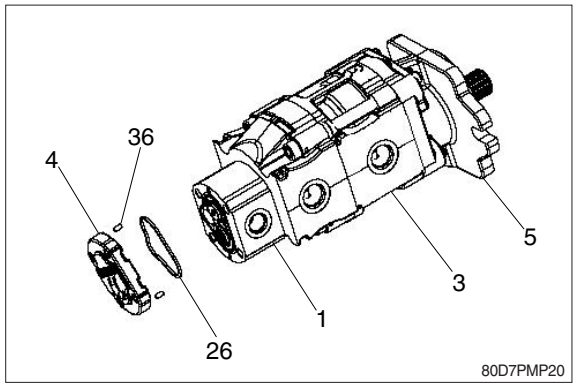
④ Insert the dowel pin into the working section (2) and then, locate the rear working section (1) to working section (2) while keeping the gear straight.

※ Smear clean grease on the square ring (26) to avoid drifting away of square ring from the rear working section (1).



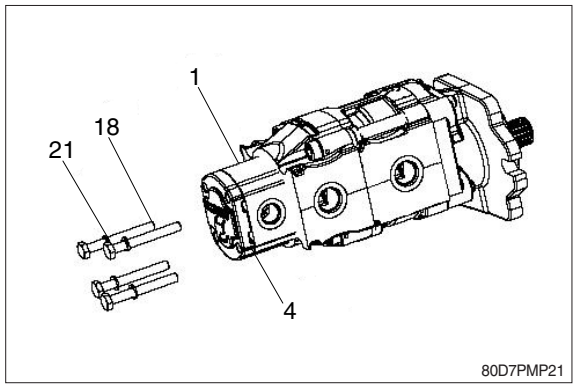
⑤ Locate the rear cover (4) after inserting the square ring (26) and the dowel pin (36) into the rear working section (1).

※ Smear clean grease on the square ring (26) to avoid drifting away of square ring (26) from the rear cover (4).

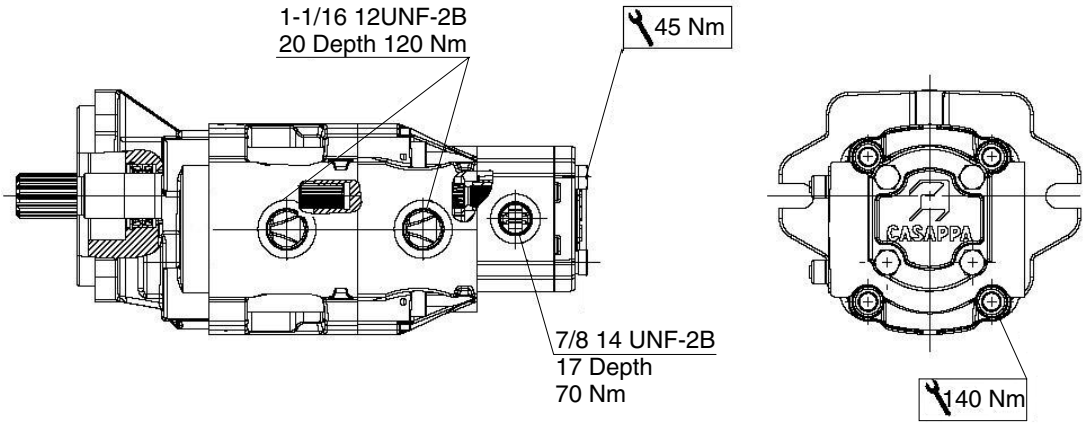


⑥ Tighten the bolt (18) with washer (21) in a cross pattern to torque valve of 45 Nm.

※ Check that the pump rotate freely when the driving shaft is turned by hand. If not a thrust plate seal may be pinched.



(4) Reference

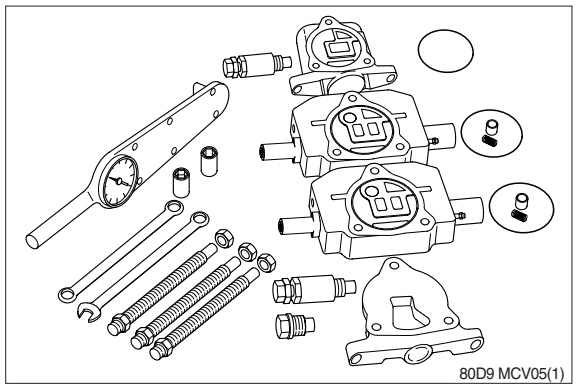


Torque configuration for hydraulic pump

80D7PMP22

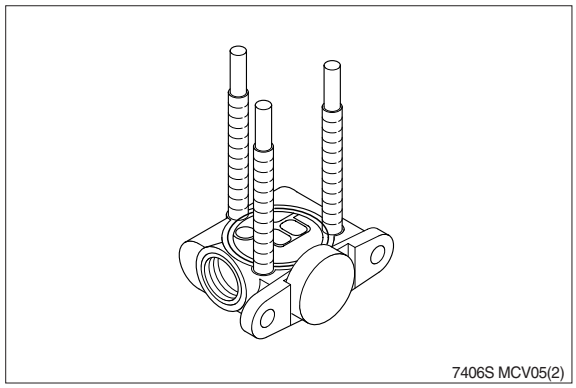
2. MAIN CONTROL VALVE

1) Lay out valve components on a clean, flat working surface. The inlet assembly will include an O-ring, and the spool section (s) include an O-ring, a load check poppet and a load check spring. Tools required for basic valve assembly include 3/4 and 11/16 open or box end wrenches and a torque wrench with thin wall sockets.



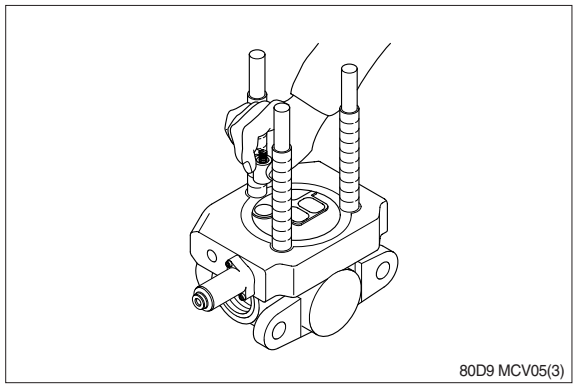
80D9 MCV05(1)

2) Assemble tie rod nuts to one end of each tie rod with one or two threads showing. Insert tie rods through tie rod holes of inlet (Large tie rod at top). Lay inlet on end with tie rods up, place O-ring into position.



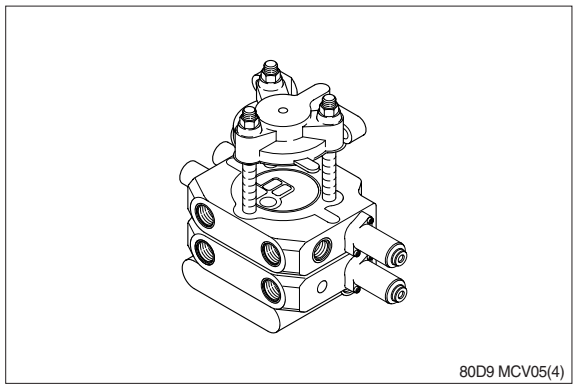
7406S MCV05(2)

3) Place first spool section (O-ring side up) on inlet section, position O-ring and insert load check poppet (Nose down) and spring (Behind poppet) into load check cavity as shown. Repeat this procedure for each spool section ; The load check springs are compressed by the following sections during assembly.



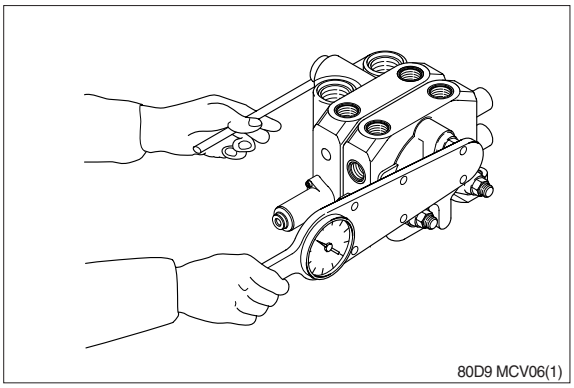
80D9 MCV05(3)

4) Position end section on last spool section as shown and hand tighten tie rod nuts. The end section on picture is a "turn around" section without ports. Universal outlet / power beyond section and power beyond and closed center sections are also used as end sections. These end sections do not have O-ring grooves.



80D9 MCV05(4)

5) Position valve assembly with the mounting pads of the end sections on a flat surface. To obtain proper alignment of end sections relative to the spool sections apply downward pressure to the end sections ; Snug tie rod nuts to about 10lbf · ft.
Final torque the two 11/16 nuts to 48±5 lbf·ft ; Final torque the 3/4 nut to 74±8 lbf·ft.
Check for proper spool movement.

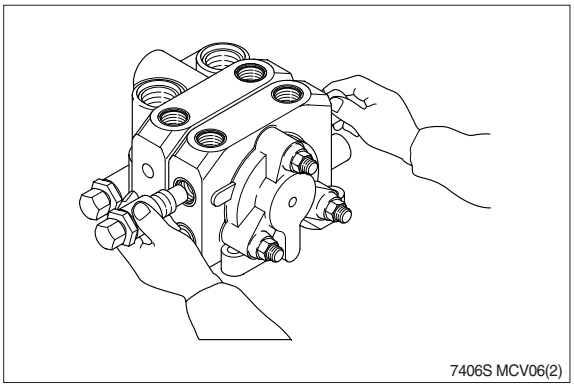

80D9 MCV06(1)

6) Install auxiliary valves and plugs and torque to proper specifications.

※ **General assembly notes:**

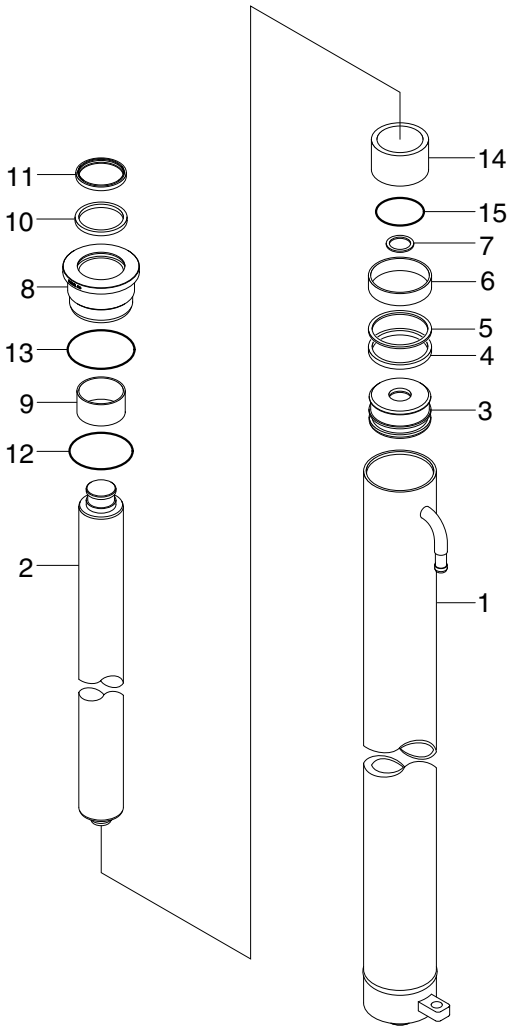
A. Lever assemblies can be installed on section before or after complete valve assembly.

B. The load check and spring may be omitter from assembly in certain circuit conditions (i.e., motor spools).


7406S MCV06(2)

3. LIFT CYLINDER

1) STRUCTURE



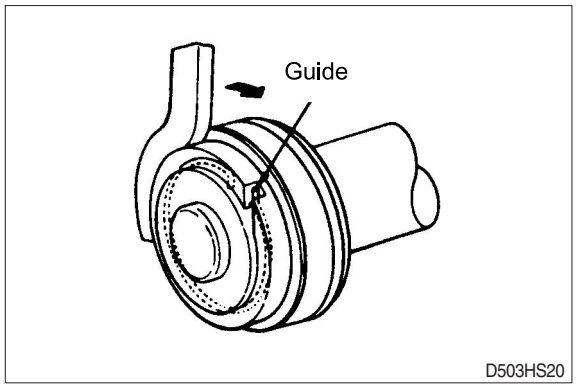
- I.D × O.D × stroke (standard)
  85 × 98 × 1335 mm
  (3.3 × 3.9 × 52.6 in)
- Rod O.D : 60 mm (2.4 in)

80D9HS19

1	Tube assy	9	Du bushing
2	Rod	10	Rod seal
3	Piston	11	Dust wiper
4	Piston seal	12	O-ring
5	Back up ring	13	O-ring
6	Wear ring	14	Spacer
7	Cushion seal	15	O-ring
8	Gland		

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.



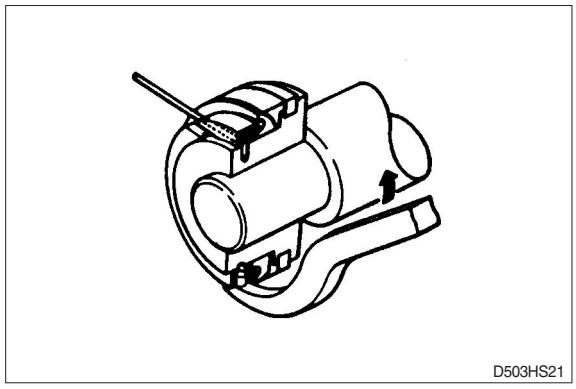
3) CHECK AND INSPECTION

mm (in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.05~0.25 (0.002~0.01)	0.4 (0.0015)	Replace bushing
Clearance between piston ring & tube	0.05~0.35 (0.002~0.013)	0.5 (0.02)	Replace piston ring

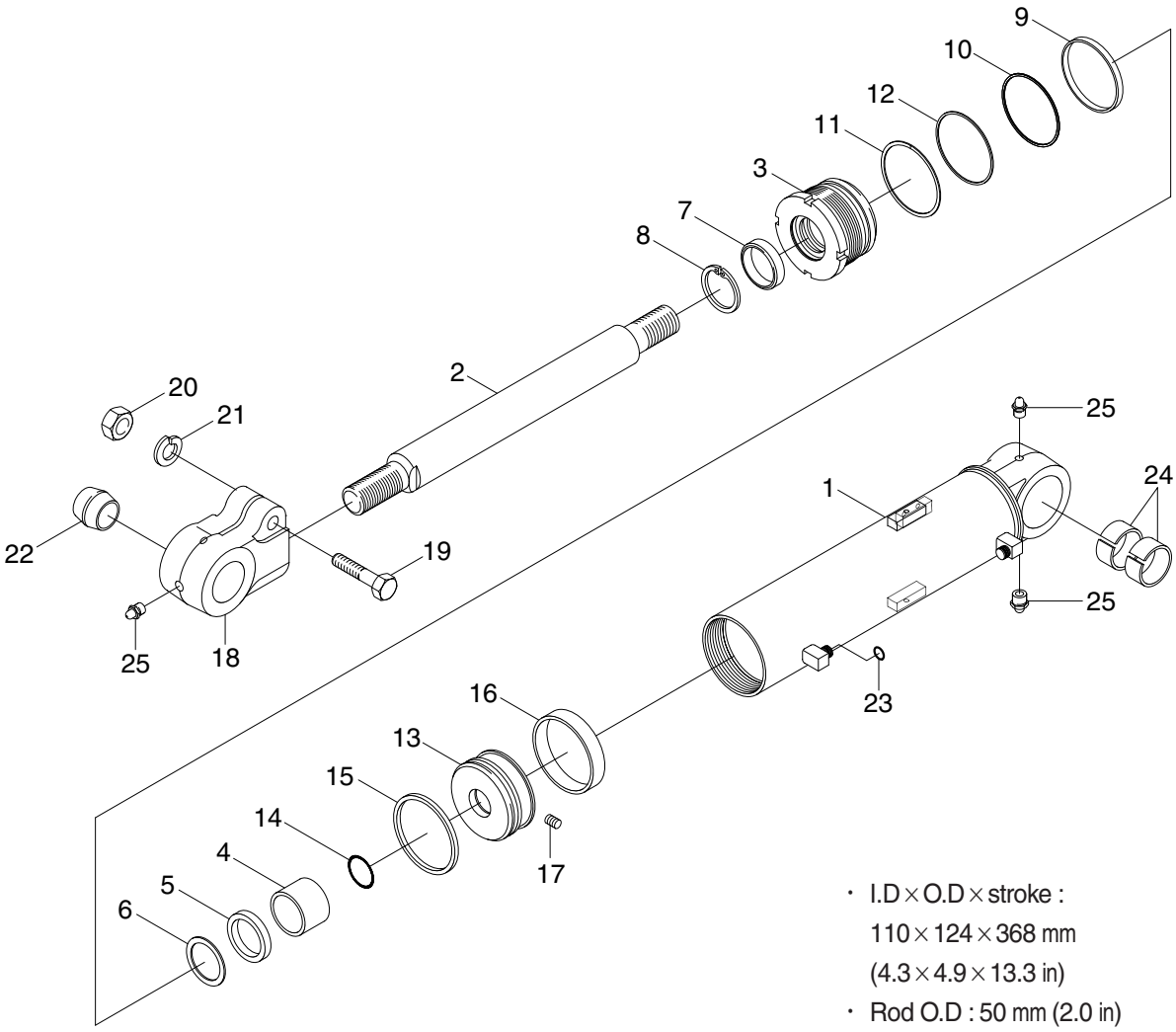
4) ASSEMBLY

(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.



4. TILT CYLINDER

1) STRUCTURE



- I.D × O.D × stroke : 110 × 124 × 368 mm (4.3 × 4.9 × 13.3 in)
- Rod O.D : 50 mm (2.0 in)

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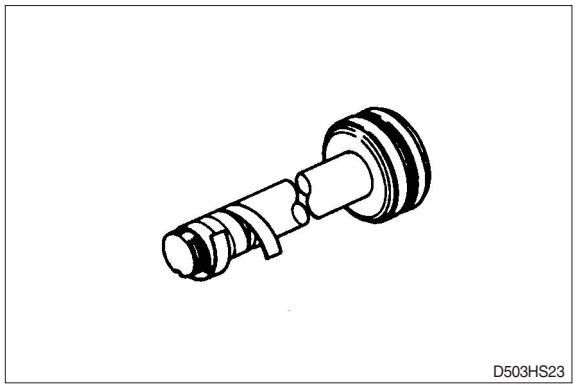
1	Tube assy	10	Back up ring	19	Hexagon bolt
2	Rod	11	Lock washer	20	Hexagon nut
3	Gland	12	O-ring	21	Spring washer
4	DU bushing	13	Piston	22	Spherical bearing
5	Rod seal	14	O-ring	23	O-ring
6	Back up ring	15	Piston seal	24	Rod bush
7	Dust wiper	16	Wear ring	25	Grease nipple
8	Snap ring	17	Set screw		
9	O-ring	18	Rod 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.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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