

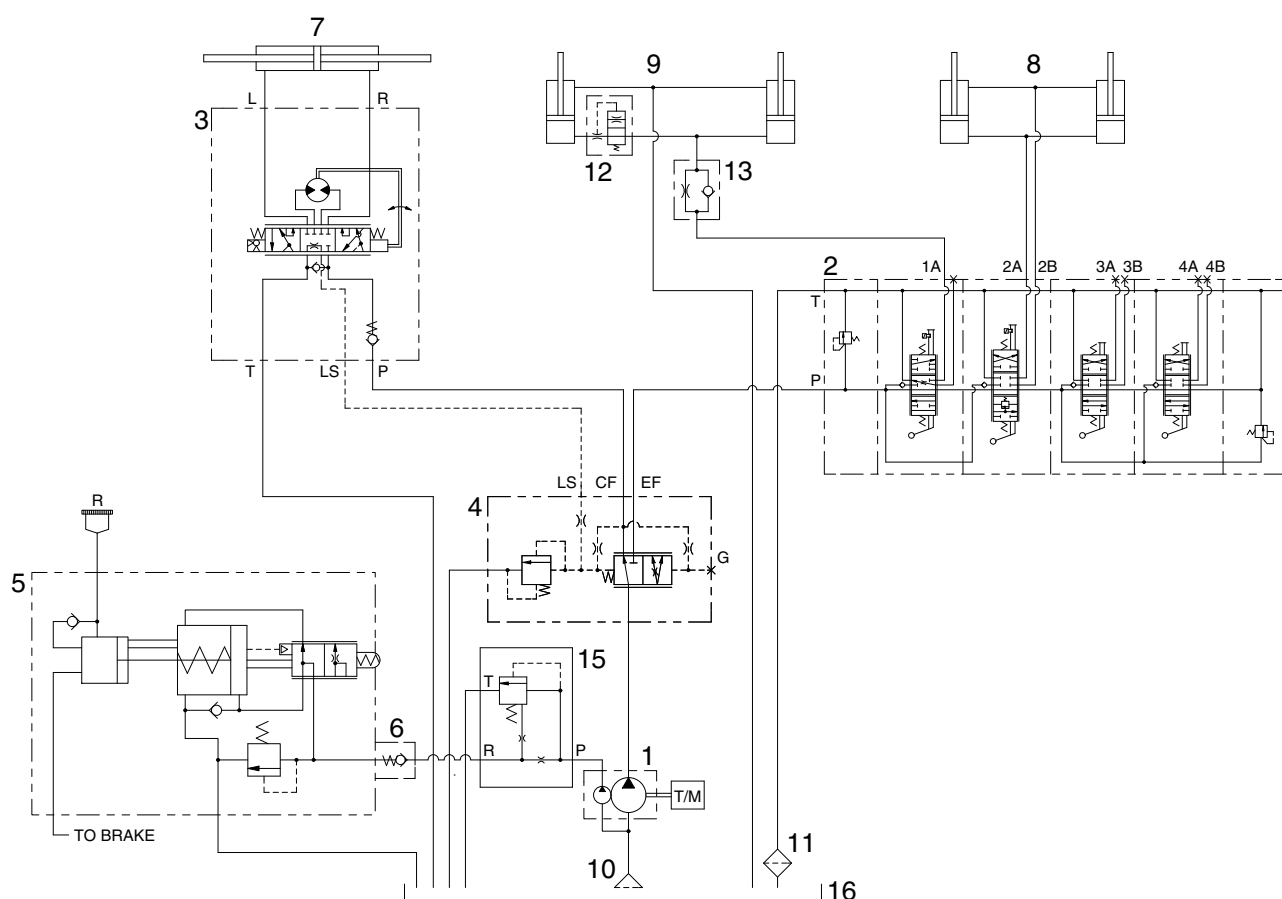
SECTION 6 HYDRAULIC SYSTEM

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SECTION 6 HYDRAULIC SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC CIRCUIT

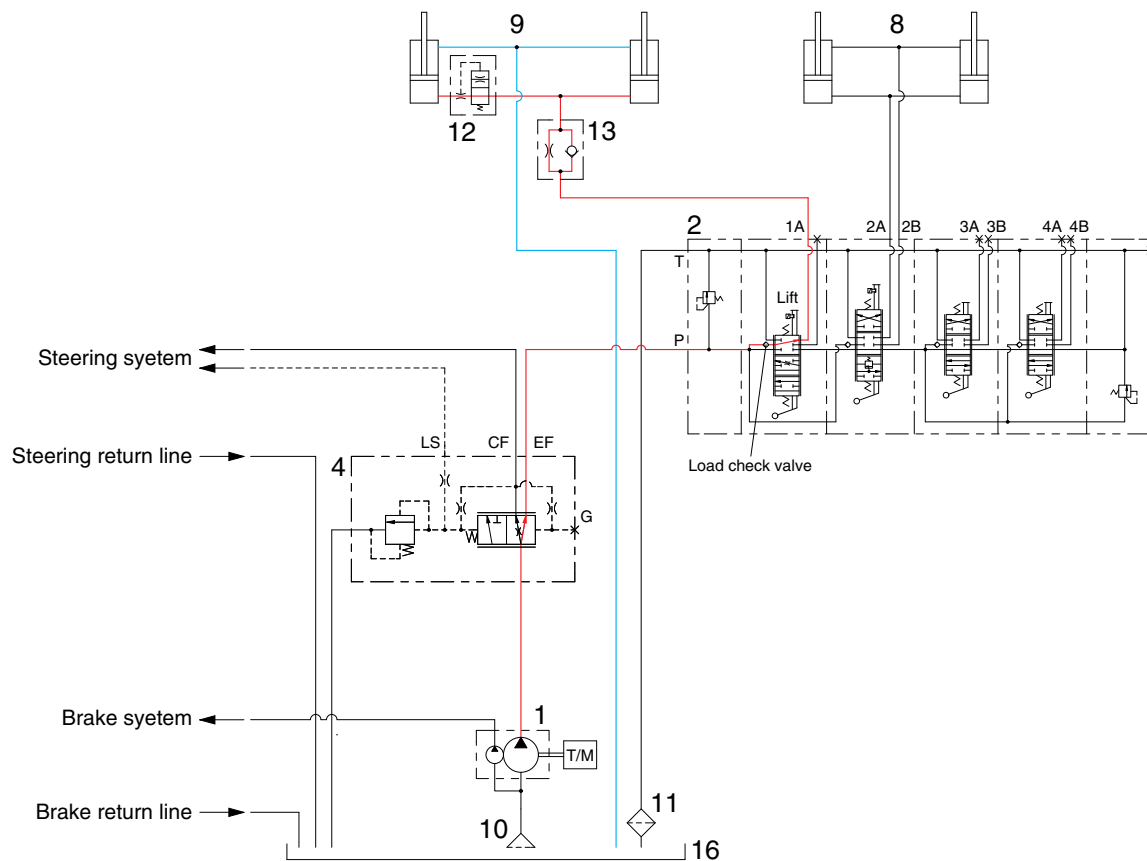


35D9KHS01

- | | |
|-----------------------|-----------------------|
| 1 Hydraulic gear pump | 9 Lift cylinder |
| 2 Main control valve | 10 Suction filter |
| 3 Steering unit | 11 Return filter |
| 4 Priority valve | 12 Down safety valve |
| 5 Brake valve | 13 Down control valve |
| 6 Check valve | 15 Flow control valve |
| 7 Steering cylinder | 16 Hydraulic oil tank |
| 8 Tilt cylinder | |

※ 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

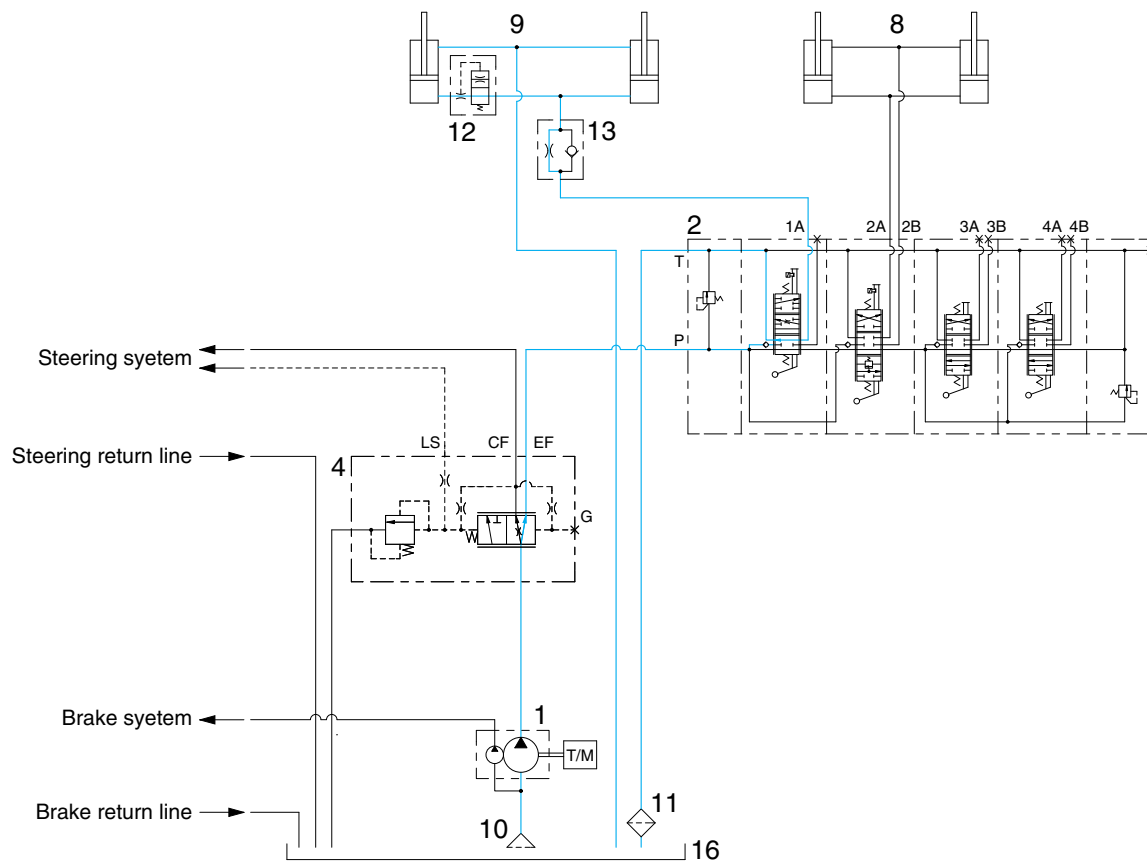


35D9KHS02

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 (2) through the priority valve (4) and then goes to the large chamber of lift cylinder (9) by pushing the load check valve of the spool. The oil from the small chamber of lift cylinder (9) 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

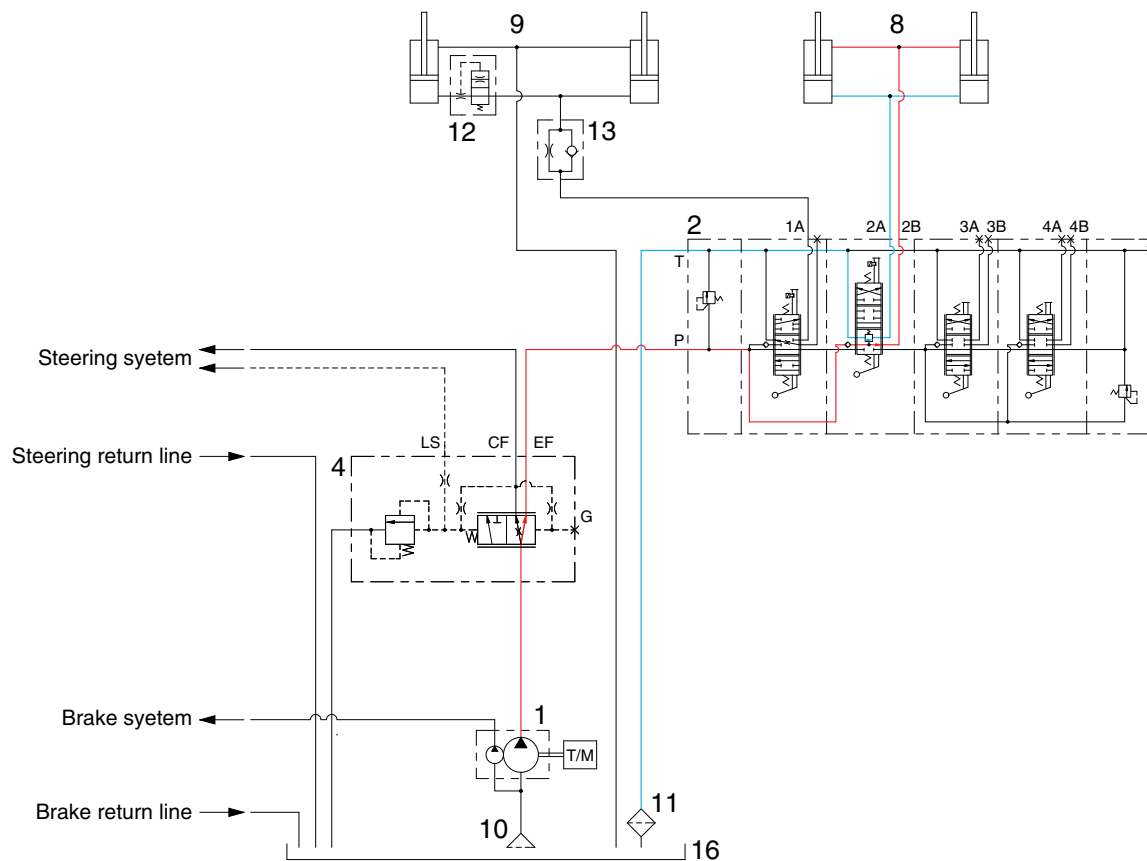


35D9KHS03

When the lift control is pushed forward, the spool on the first block is moved to lower position. The work port (B1) 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



35D9KHS04

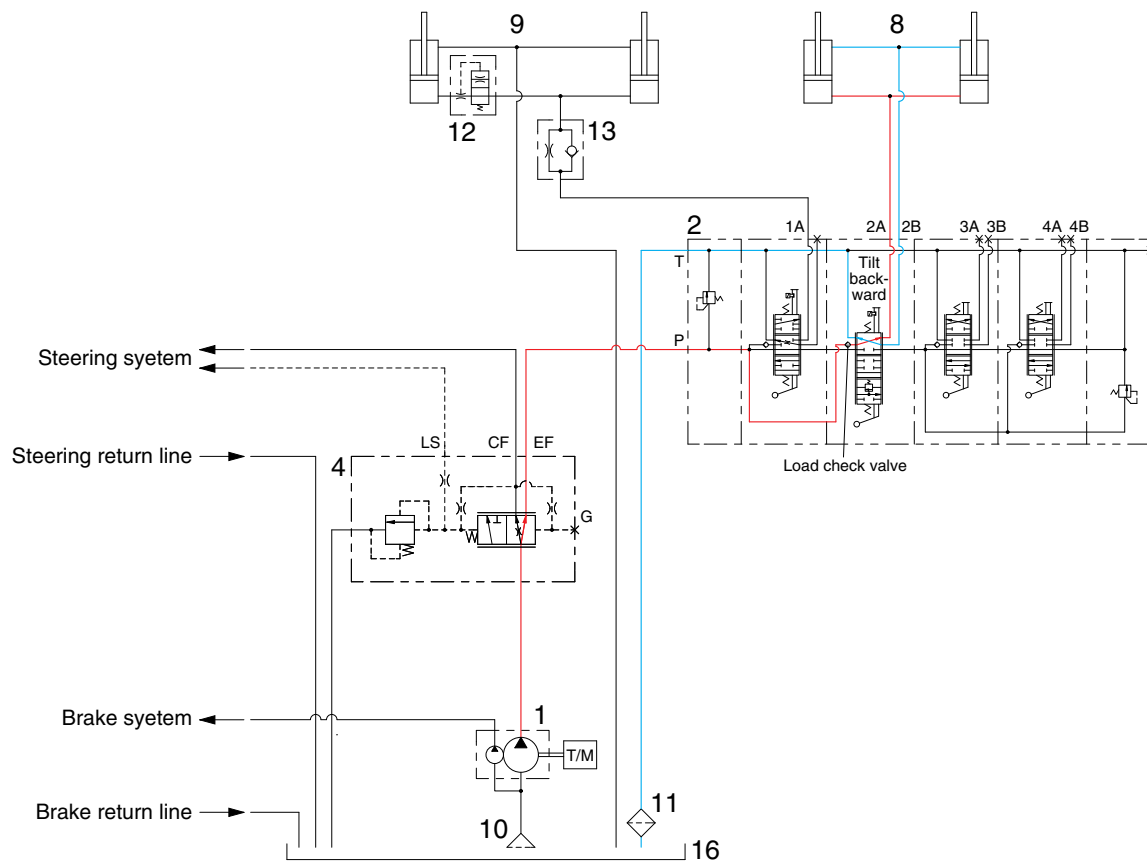
When the tilt control lever is pushed forward, the spool on the second block is moved to tilt forward position.

The oil from hydraulic gear pump (1) flows into main control valve (2) through the priority valve (4) and then goes to the large chamber of tilt cylinder (8) by pushing the load check valve of the spool. The oil at the small chamber of tilt cylinder (8) 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



35D9KHS05

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 (2) through the priority valve (4) and then goes to the small chamber of tilt cylinder (8) by pushing the load check valve of spool.

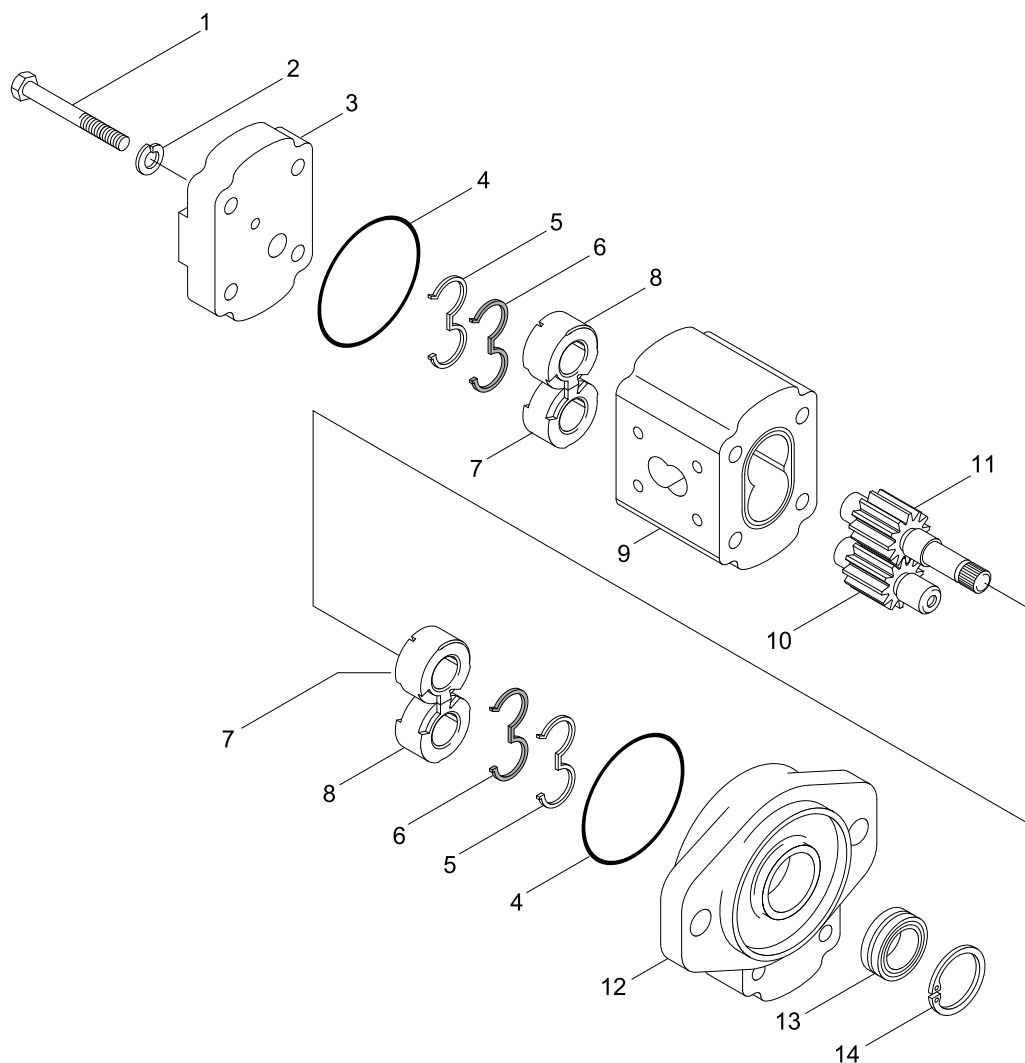
The oil at the large chamber of tilt cylinder (8) returns to hydraulic tank at the same time.

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



D353HS06

1	Bolt	6	Seal	11	Drive gear
2	Spring washer	7	Bushing	12	Flange
3	End cover	8	Bushing	13	Shaft seal
4	O-ring	9	Body	14	Circlip
5	Back up seal	10	Driven gear		

2) OPERATION

This pump comprised of an end cover, a body, bushings and a mounting flange bolted together with through bolts. The gear journals are supported in plane bearings within pressure balanced bushings to give high volumetric and mechanical efficiencies.

3. MAIN CONTROL VALVE (Old type)

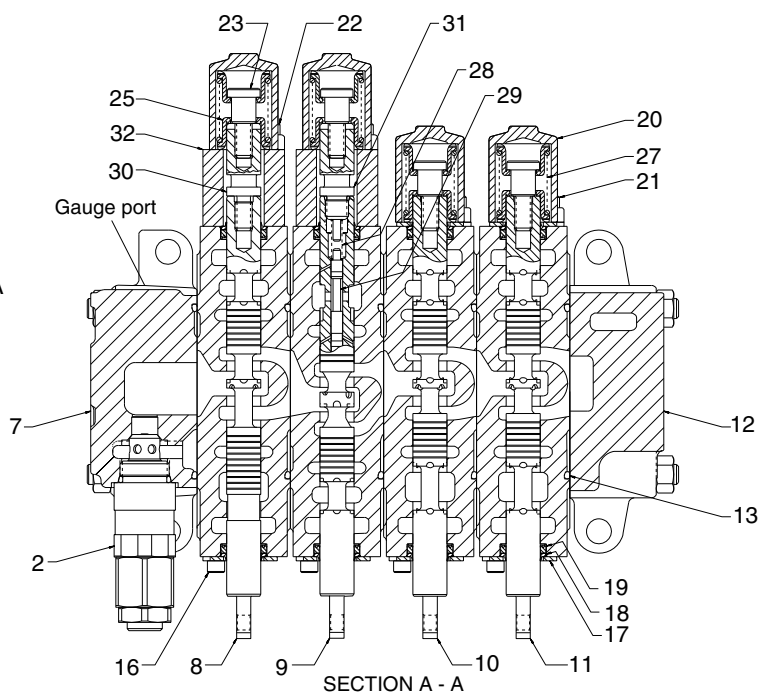
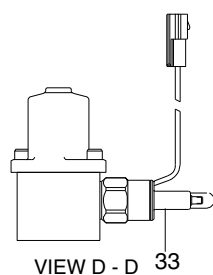
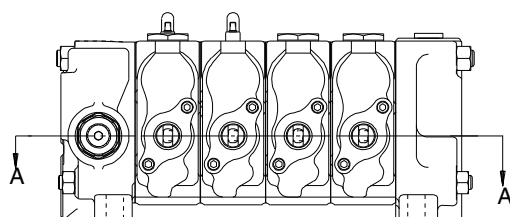
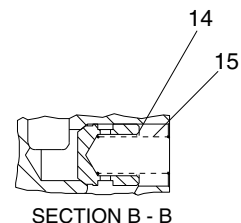
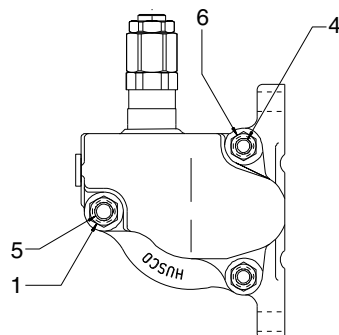
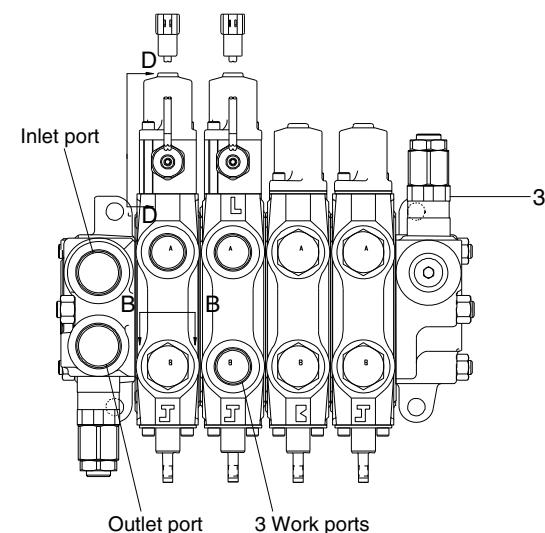
1) STRUCTURE (4 Spool)

· Machine serial number

35D-9K : -#0078 45D-9K : -#0380

40D-9K : -#0006 50D-9K : -#0059

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



35DS7HS07

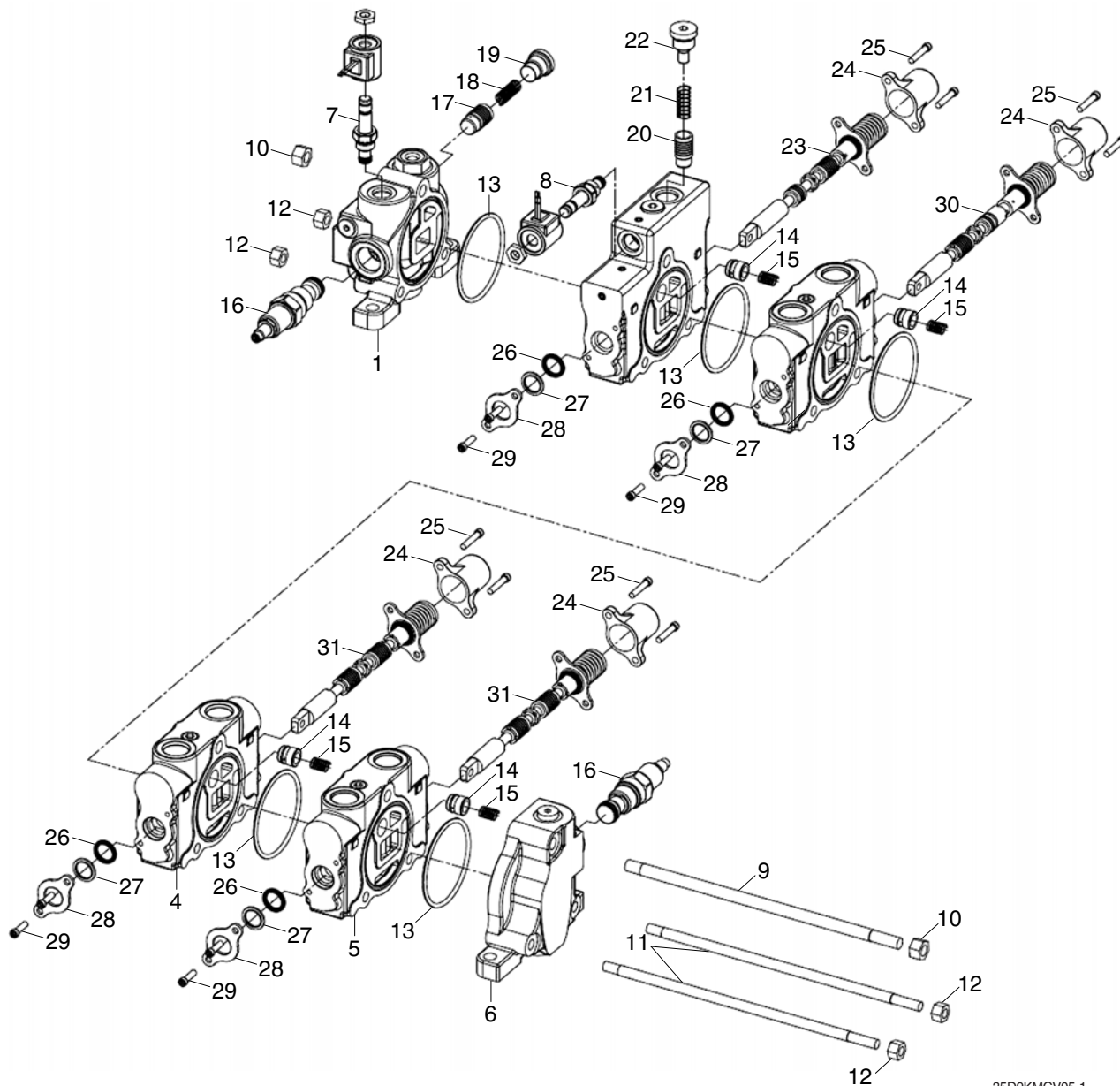
- | | | |
|----------------------|------------------------|-------------------|
| 1 Special nut | 12 Outlet section assy | 23 Spool end |
| 2 Main relief valve | 13 O-ring | 25 Spring seat |
| 3 Aux relief valve | 14 Poppet | 27 Spring |
| 4 Tie rod | 15 Spring | 28 Spring |
| 5 Tie rod | 16 Screw | 29 Piston |
| 6 Special nut | 17 Seal plate | 30 Spool end |
| 7 Inlet section assy | 18 Wiper | 31 Spool end |
| 8 Spool section-lift | 19 Spool seal | 32 Spool cap |
| 9 Spool section-tilt | 20 Spool cap | 33 Solenoid valve |
| 10 Spool section-A1 | 21 Screw cap | |
| 11 Spool section-A2 | 22 Screw cap | |

MAIN CONTROL VALVE (Current type)

1) STRUCTURE (4 Spool)

· Machine serial number

- 35D-9K : #0079- - 45D-9K : #0381-
- 40D-9K : #0007- - 50DA-9K : #0060-

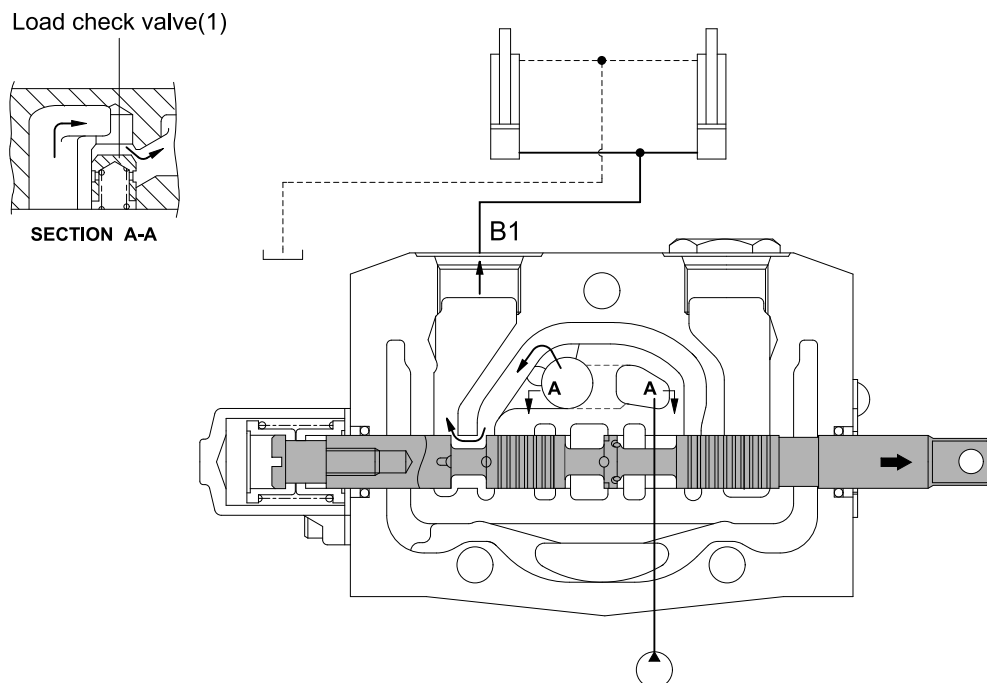


35D9KMCV05-1

- | | | |
|-----------------------|------------------|--------------------|
| 1 Main block | 12 Nut | 23 Lift spool assy |
| 2 Lift section | 13 O-ring | 24 Cap |
| 3 Tilt section | 14 Inlet poppet | 25 Bolt |
| 4 Aux1 section | 15 Spring | 26 Quad ring |
| 5 Aux2 section | 16 Relief valve | 27 Back up ring |
| 6 Cover | 17 Unload poppet | 28 Plate |
| 7 Main solenoid valve | 18 Spring | 29 Bolt |
| 8 Lift solenoid valve | 19 Plug | 30 Tilt spool assy |
| 9 Bolt | 20 Safety poppet | 31 Aux spool assy |
| 10 Nut | 21 Spring | |
| 11 Bolt | 22 Plug | |

2) LIFT SECTION OPERATION

(1) Lift position



D353HS08

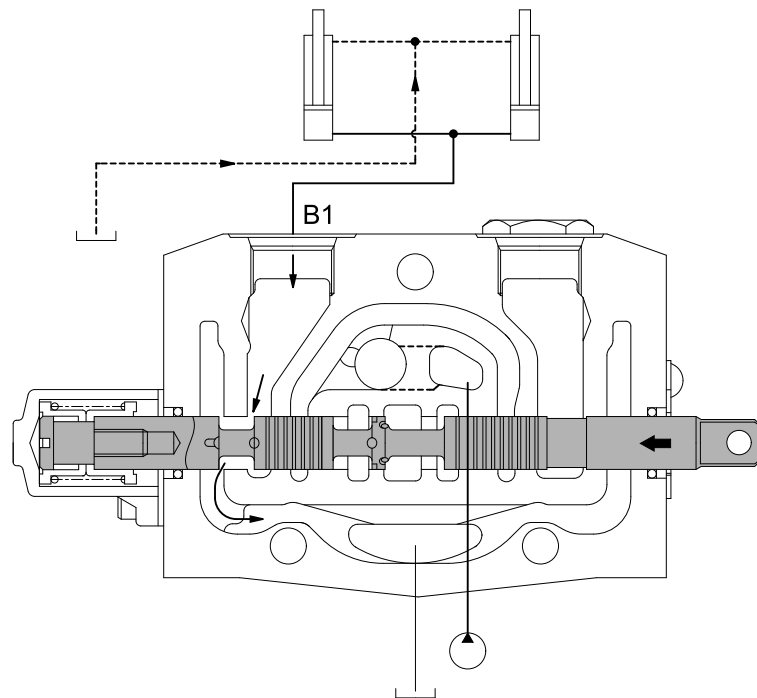
When the lift control lever is pulled back, the spool moves to the right and the neutral passage is closed.

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



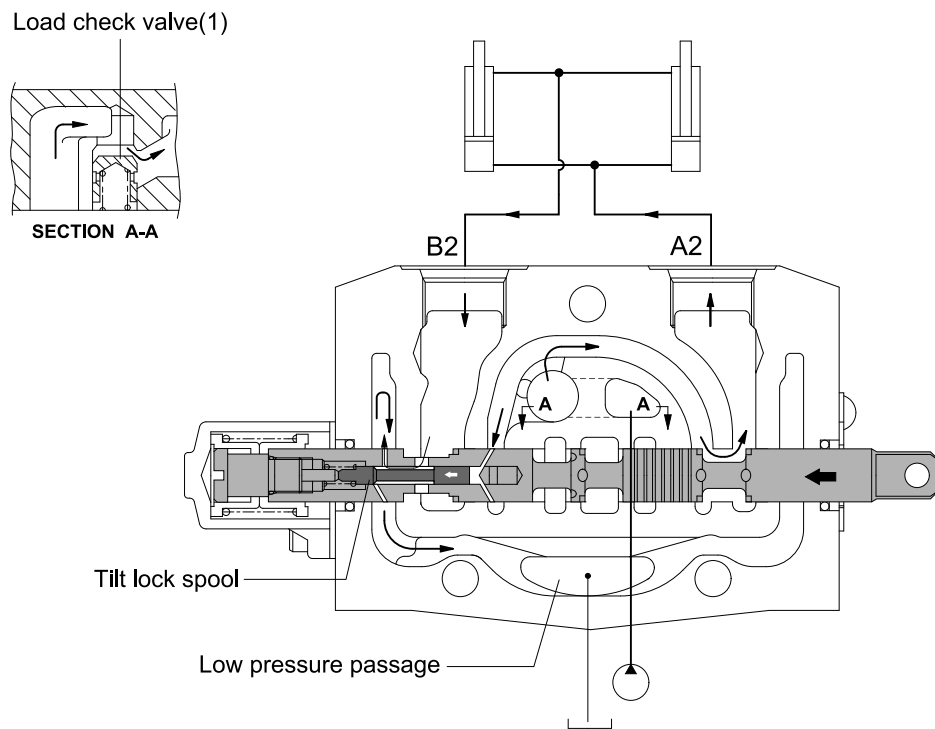
D353HS09

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



D353HS10

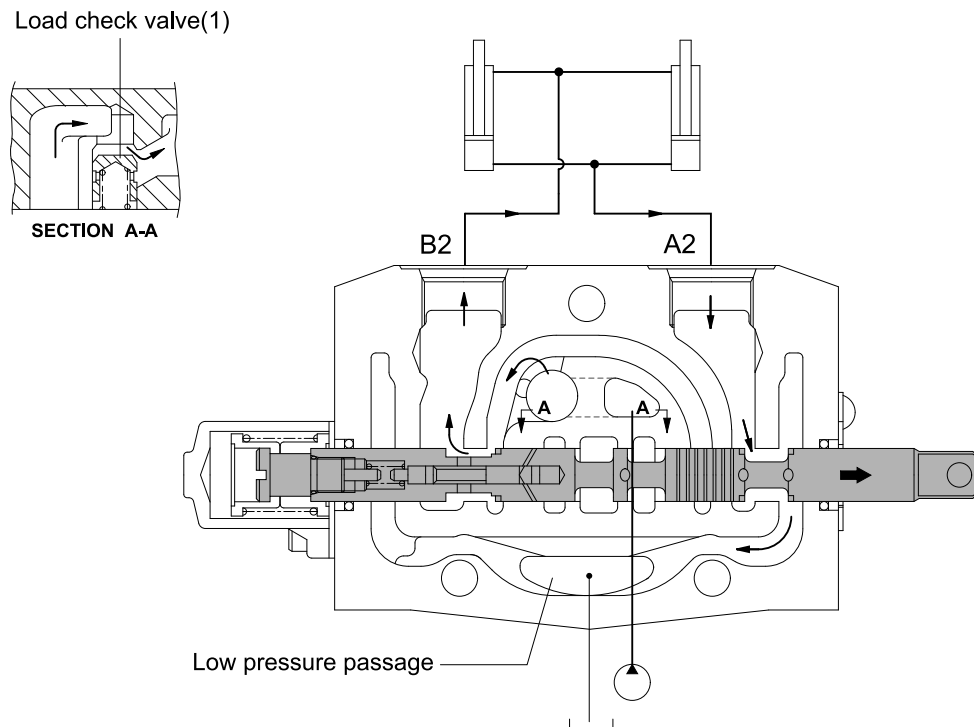
When the tilt control lever is pushed forward, the spool moves to the left and the neutral passage is closed.

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



D353HS11

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.

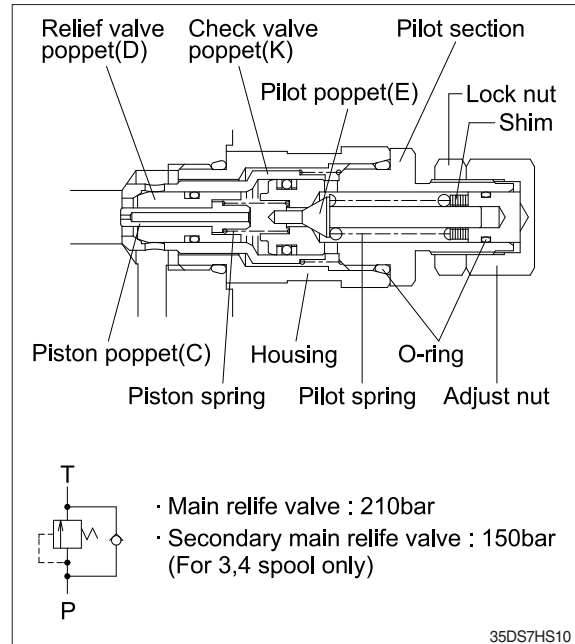
4) MAIN RELIEF VALVE

(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

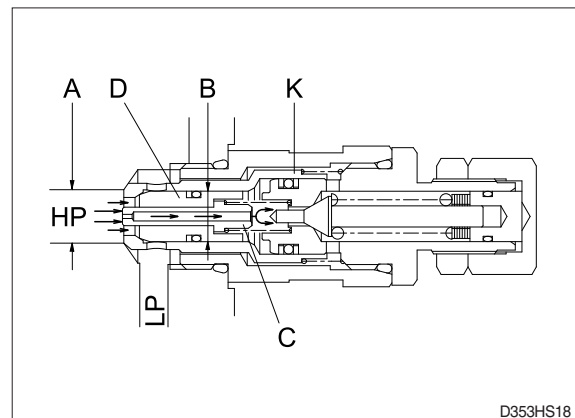
- ① Loosen lock nut.
- ② Set adjusting nut to desired pressure setting.
- ③ If desired pressure setting cannot be achieved, add or remove shims as required.
- ④ Tighten lock nut.
- ⑤ Retest in similar manner as above.



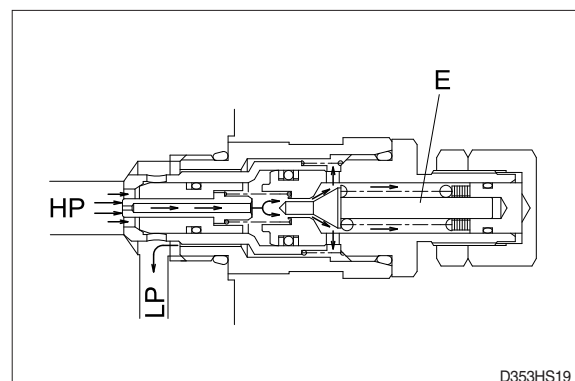
(2) Function

① As work port relief

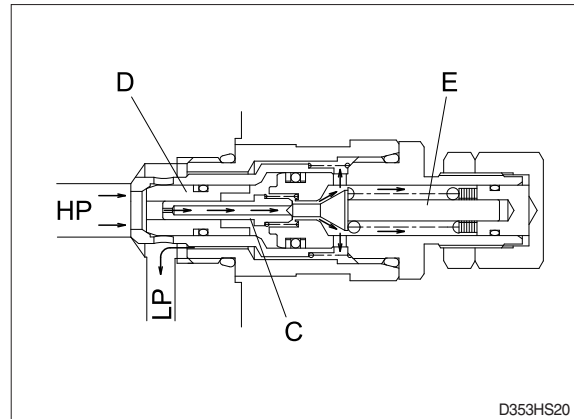
The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown.



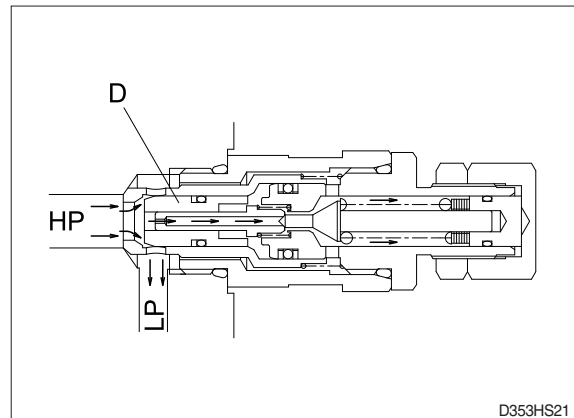
The oil pressure in the high pressure port HP has reached the setting of the pilot poppet spring force and unseats the pilot poppet E and oil flows around the poppet through the cross drilled holes and to the low pressure area LP.



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.

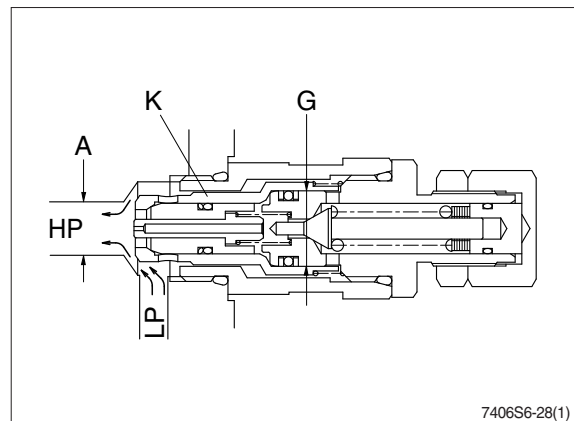


The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.

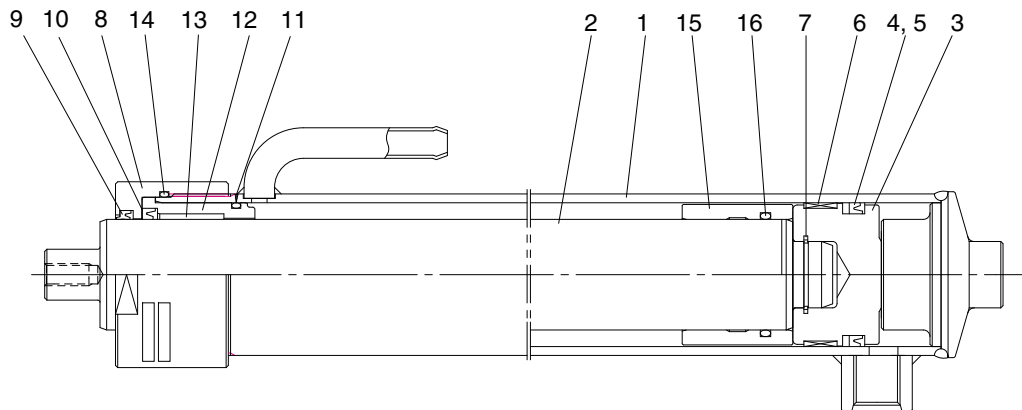


② As anti void

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.



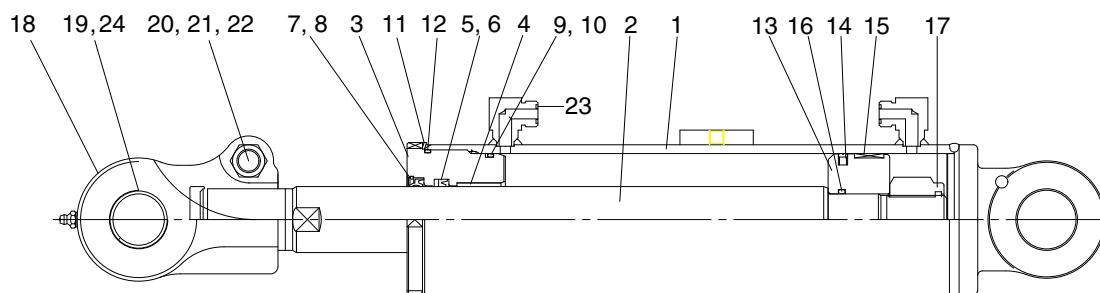
4. LIFT CYLINDER



D357HS12

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

5. TILT CYLINDER



35D9KHS13

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

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 10 minutes and measure hydraulic drift (amount forks move down and amount mast tilts forward).

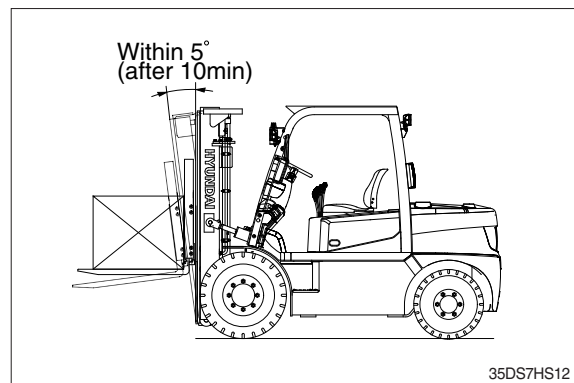
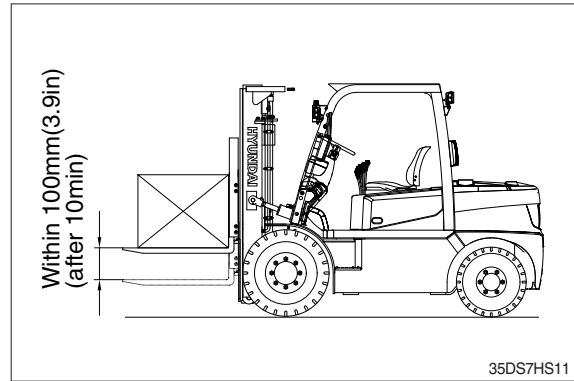
· Hydraulic drift

- 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.

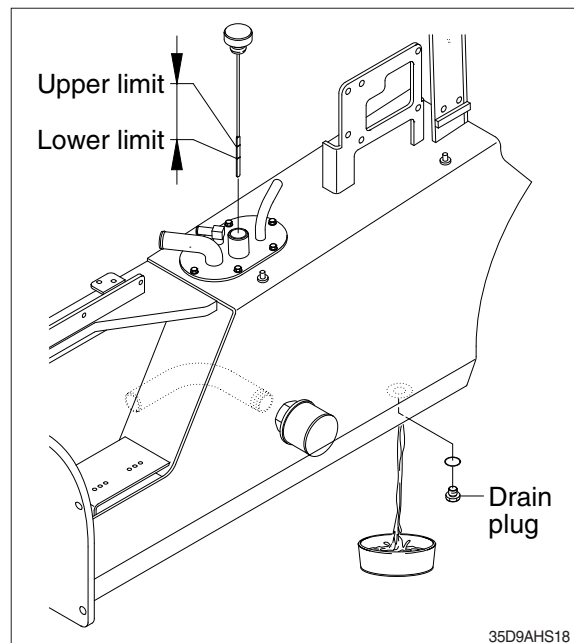
- (3) Check that clearance between tilt cylinder bushing and mounting pin is within standard range.

	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).



3) CONTROL VALVE

- (1) Raise forks to maximum height and measure oil pressure.
Check that oil pressure is 210 kgf/cm².
(2990 psi)

2. TROUBLESHOOTING

1) SYSTEM

Problem	Cause	Remedy
Large fork lowering speed	<ul style="list-style-type: none"> Seal inside control valve defective. Oil leaks from joint or hose. Seal inside cylinder defective. 	<ul style="list-style-type: none"> Replace spool or valve body. Replace. Replace packing.
Large spontaneous tilt of mast	<ul style="list-style-type: none"> Tilting backward : Check valve defective. Tilting forward : tilt lock valve defective. Oil leaks from joint or hose. Seal inside cylinder defective. 	<ul style="list-style-type: none"> Clean or replace. Clean or replace. Replace. Replace seal.
Slow fork lifting or slow mast tilting	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Excessive restriction of oil flow pump suction side. Gear or bearing in hydraulic pump defective. 	<ul style="list-style-type: none"> Clean filter. Replace gear or bearing.
Control valve lever is locked	<ul style="list-style-type: none"> Foreign matter jammed between spool and valve body. Valve body defective. 	<ul style="list-style-type: none"> Clean. Tighten body mounting bolts uniformly.
High oil temperature	<ul style="list-style-type: none"> Lack of hydraulic oil. High oil viscosity. Oil filter clogged. 	<ul style="list-style-type: none"> Add oil. Change to SAE10W, class CD engine oil. Clean filter.

Problem	Cause	Remedy
Actuator (cylinder or motor) works slowly or does not operate.	<ul style="list-style-type: none"> • Shortage of oil in oil tank. • Decrease of relief valve pressure. • Spool got stuck. • Shortage of oil flow to the valve. 	<ul style="list-style-type: none"> • Check the oil level in the oil tank. • Install pressure gauge on the circuit, and check the pressure with it by handling the lever. • Check that manual lever moves smoothly. • Check that lever stroke is enough. • Check that oil flow of the pump is within specified rate.
Cylinder lowers considerably under normal circumstance.	<ul style="list-style-type: none"> • Internal leakage of cylinder happens frequently. • Excessive leakage from spool of the valve. • Spool got stuck. • Leakage in a part of the circuit. 	<ul style="list-style-type: none"> • Fit the stop valve on the pipe between valve and cylinder, observe the internal leakage of cylinder. • Check the oil viscosity is not too low. • Check that manual lever moves smoothly. • Check the circuit. • Observe leakage from pipes.
Pressure does not increase sufficiently.	<ul style="list-style-type: none"> • Defect of relief valve. • Leakage in a part of the circuit. 	<ul style="list-style-type: none"> • Check the relief valve. • Check the circuit. • Observe leakage from pipes.
Temperature rising of the hydraulic oil.	<ul style="list-style-type: none"> • Working with higher pressure than rated pressure. • Low viscosity of oil. • Leakage from a part of the circuit. • Oil leakage in the pump. • Insufficient suction of the pump. 	<ul style="list-style-type: none"> • Check the flow pressure. • Check the sort of oil and viscosity. • Check if the circuit is relieved at all times. • Check if the temperature of pump surface higher 30°C than oil temperature. • Check the oil tank volume. • Check if the suction strainer is blocked.
Steering force is heavy.	<ul style="list-style-type: none"> • Defect of steering relief valve. 	<ul style="list-style-type: none"> • Check the steering relief valve.

2) HYDRAULIC GEAR PUMP

Problem	Cause	Remedy
Pump does not develop full pressure	<ul style="list-style-type: none"> • System relief valve set too low or leaking. • Oil viscosity too low. • Pump is worn out. 	<ul style="list-style-type: none"> • Check system relief valve for proper setting. • Change to proper viscosity oil. • Repair or replace pump.
Pump will not pump oil	<ul style="list-style-type: none"> • Reservoir low or empty. • Suction strainer clogged. 	<ul style="list-style-type: none"> • Fill reservoir to proper level. • Clean suction strainer.
Noisy pump caused by cavitation	<ul style="list-style-type: none"> • Oil too thick. • Oil filter plugged. • Suction line plugged or too small. 	<ul style="list-style-type: none"> • Change to proper viscosity. • Clean filters. • Clean line and check for proper size.
Oil heating	<ul style="list-style-type: none"> • Oil supply low. • Contaminated oil. • Setting of relief valve too high or too low. • Oil viscosity too low. 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Low oil level. • Air leaking into suction line. • Wrong kind of oil. 	<ul style="list-style-type: none"> • Fill reservoir to proper level. • Tighten fittings, check condition of line. • Drain reservoir, fill with non-foaming oil.
Shaft seal leakage	<ul style="list-style-type: none"> • Worn shaft seal. • Worn shaft in seal area. 	<ul style="list-style-type: none"> • Replace shaft seal. • Replace drive shaft and seal.

3) MAIN RELIEF VALVE

Problem	Cause	Remedy
Can't get pressure	<ul style="list-style-type: none"> • Poppet stuck open or contamination under seat. 	<ul style="list-style-type: none"> • Check for foreign matter of poppets and their mating parts. Parts must slide freely.
Erratic pressure	<ul style="list-style-type: none"> • Pilot poppet seat damaged. • Poppet C sticking in D. 	<ul style="list-style-type: none"> • Replace the relief valve. • Clean and remove surface marks for free movement.
Pressure setting not correct	<ul style="list-style-type: none"> • Normal wear. Lock nut & adjust screw loose. 	<ul style="list-style-type: none"> • See ★How to set pressure on work main relief.
Leaks	<ul style="list-style-type: none"> • Damaged seats. • Worn O-rings. • Parts sticking due to contamination. 	<ul style="list-style-type: none"> • 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.

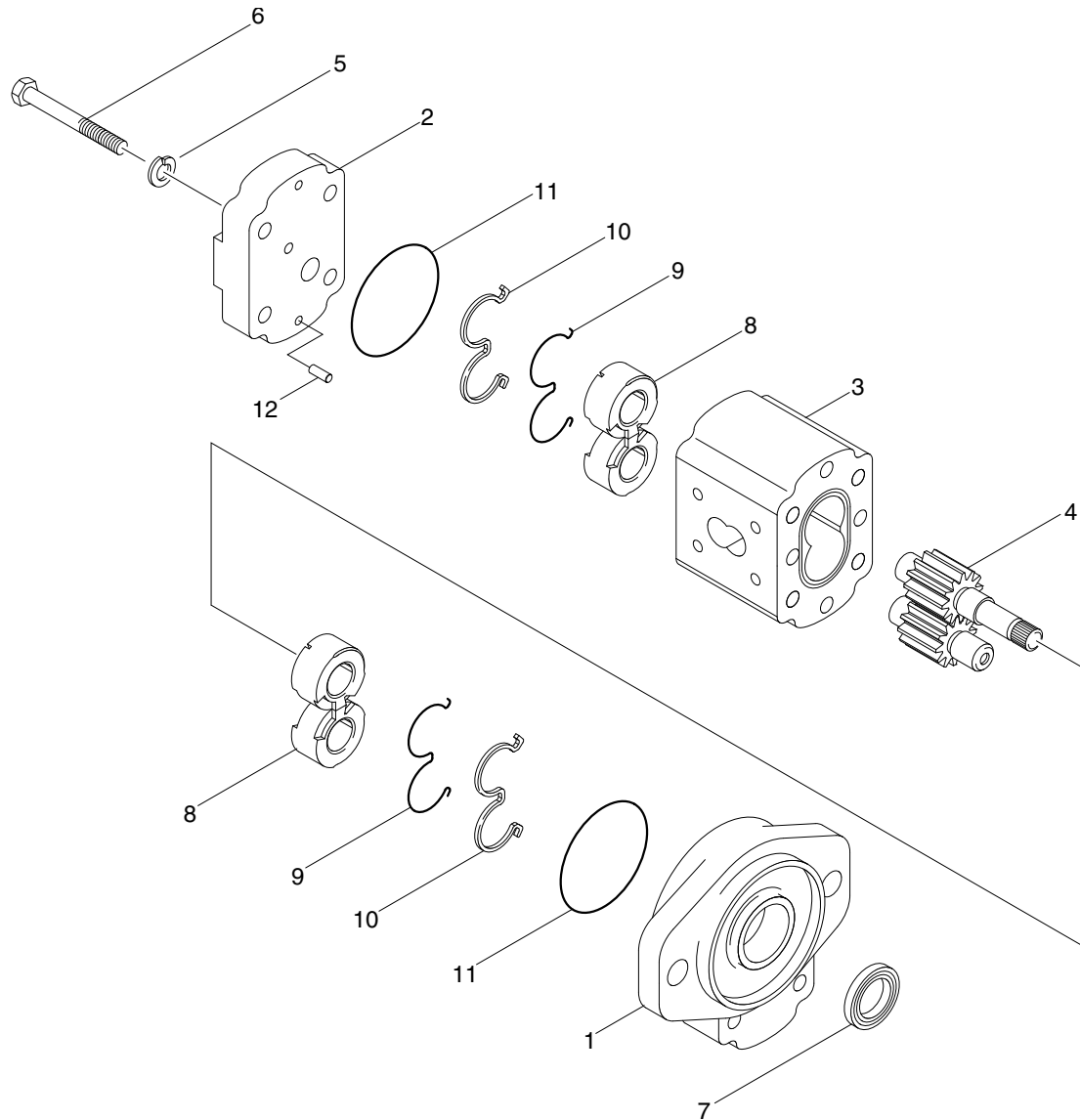
4) LIFT CYLINDER

Problem	Cause	Remedy
Oil leaks out from rod cover through rod	<ul style="list-style-type: none"> • Foreign matters on packing. • Unallowable score on rod. • Unusual distortion of dust seal. • Chrome plating is striped. 	<ul style="list-style-type: none"> • Replace packing. • Smooth rod surface with an oil stone. • Replace dust seal. • Replace rod.
Oil leaks out from cylinder rod cover thread	<ul style="list-style-type: none"> • O-ring damaged. 	<ul style="list-style-type: none"> • Replace O-ring.
Rod spontaneously retract	<ul style="list-style-type: none"> • Scores on inner surface of tube. • Unallowable score on the inner surface of tube. • Foreign matters in piston seal. 	<ul style="list-style-type: none"> • Smooth rod surface with an oil stone. • Replace cylinder tube. • Replace piston seal.
Wear (clearance between cylinder tube and wear ring)	<ul style="list-style-type: none"> • Excessive clearance between cylinder tube and wear ring. 	<ul style="list-style-type: none"> • Replace wear ring.
Abnormal noise is produced during tilting operation	<ul style="list-style-type: none"> • Insufficient lubrication of anchor pin or worn bushing and pin. • Bent tilt cylinder rod. 	<ul style="list-style-type: none"> • Lubricate or replace. • Replace.

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. MAIN PUMP

1) STRUCTURE



D357HS06

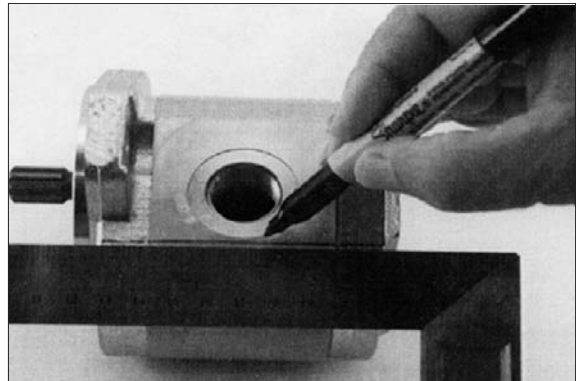
- | | | | | | |
|---|----------|---|--------------------|----|--------------|
| 1 | Flange | 5 | Washer | 9 | Channel seal |
| 2 | Cover | 6 | Bolt | 10 | Back up ring |
| 3 | Body | 7 | Lip seal | 11 | O-ring |
| 4 | Gear set | 8 | Bushing block assy | 12 | Dowel pin |

2) DISASSEMBLY

※ Tools required

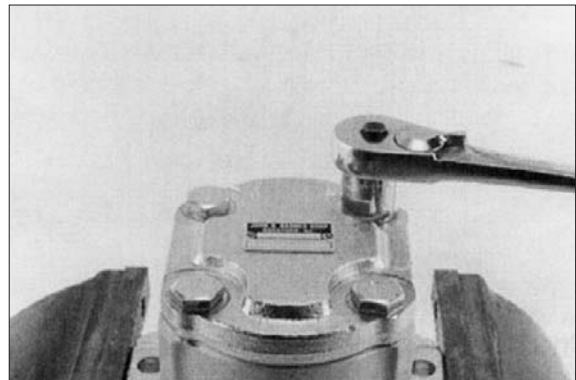
- Metric socket set
- Internal snap ring pliers
- Shaft seal sleeve
- Torque wrench : 13.8 kgf·m (100 lbf·ft)

- (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.



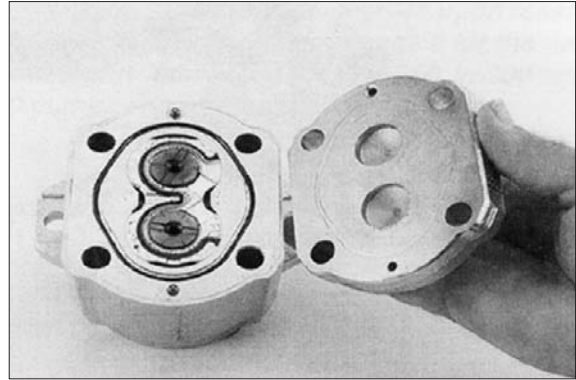
PUMP 01

- (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.



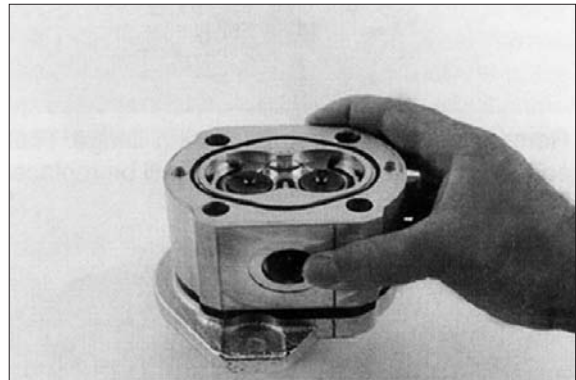
PUMP 02

(8) Lift and remove end cover.



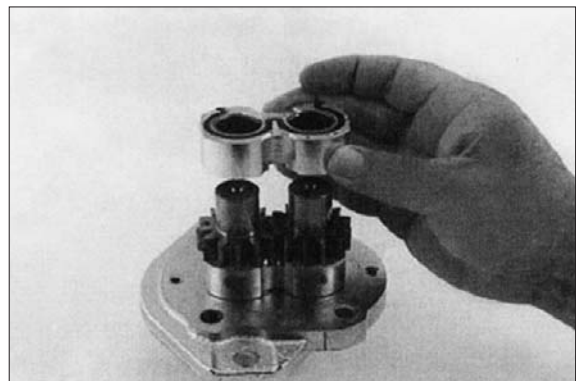
PUMP 03

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



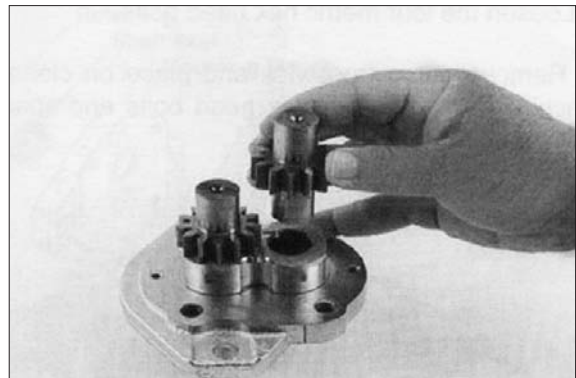
PUMP 04

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



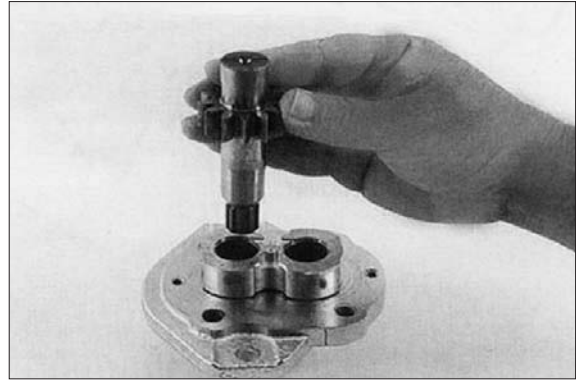
PUMP 05

(11) Remove idler shaft from bearing block.



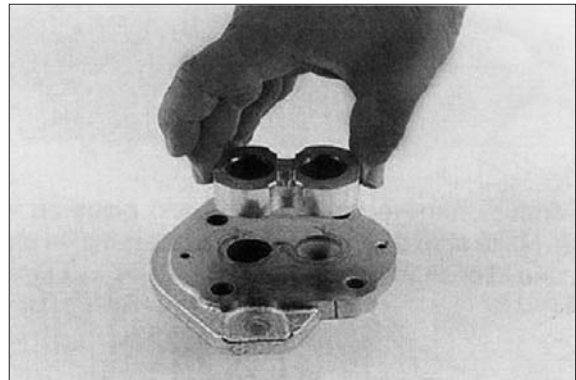
PUMP 06

- (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.



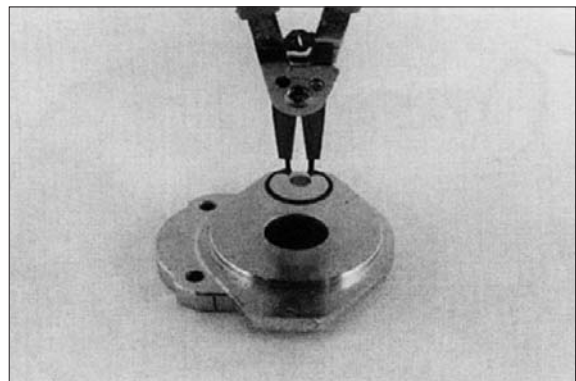
PUMP 07

- (13) Remove the front bearing block.



PUMP 08

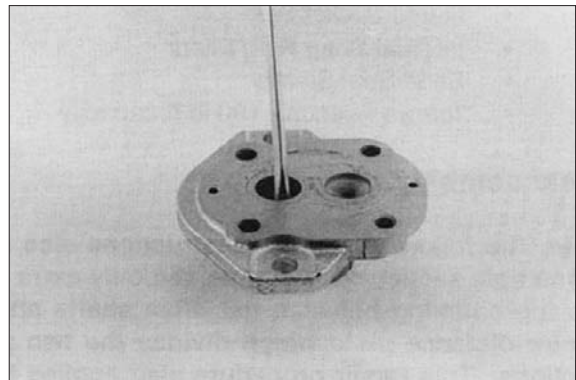
- (14) Turn mounting flange over, with shaft seal up, and remove the retaining ring with proper snap ring pliers.



PUMP 09

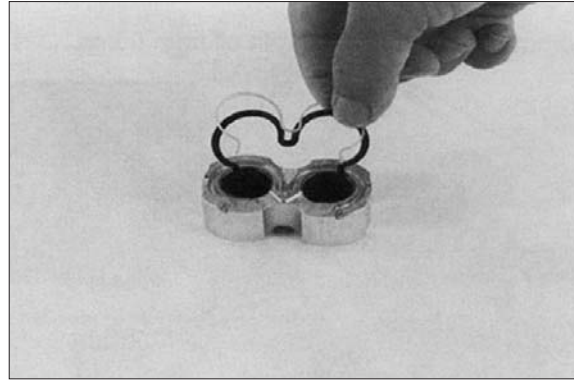
- (15) Remove the oil seal from mounting flange, be careful not to mar or scratch the seal bore.

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



PUMP 10

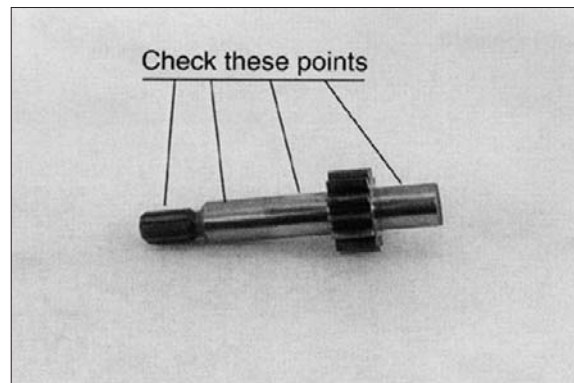
- (17) Remove seals from both bearing blocks and discard.



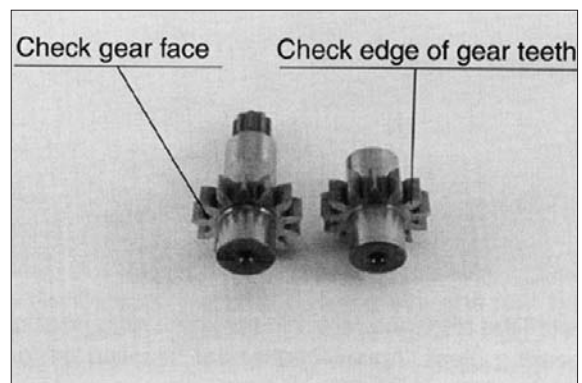
PUMP 11

3) 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.
- (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 12



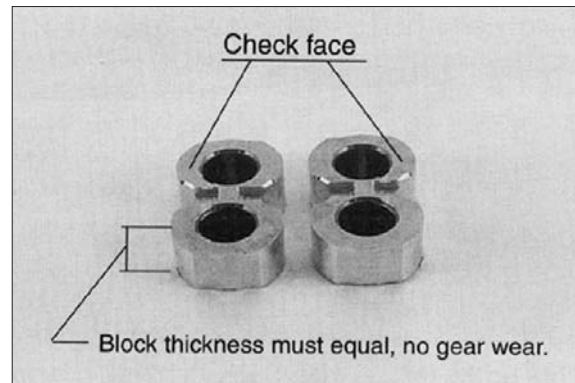
PUMP 13

- (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.**

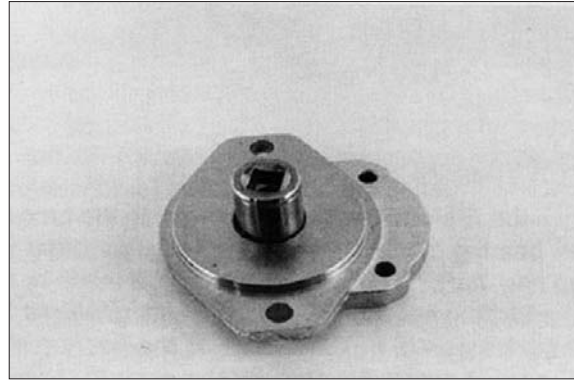


PUMP 14

4) ASSEMBLY

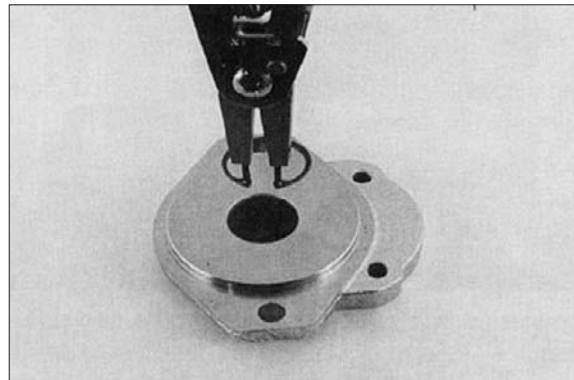
※ New seals should be installed upon reassembly of pump.

- (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.



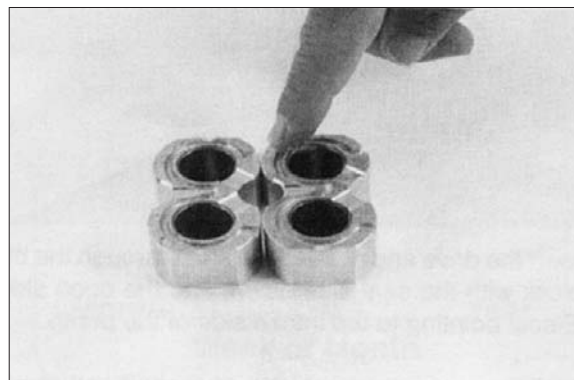
PUMP 15

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



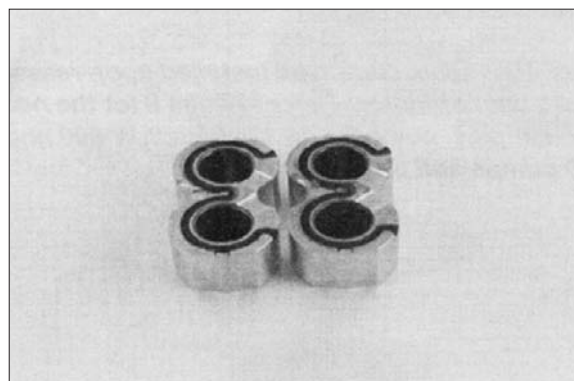
PUMP 16

- (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.



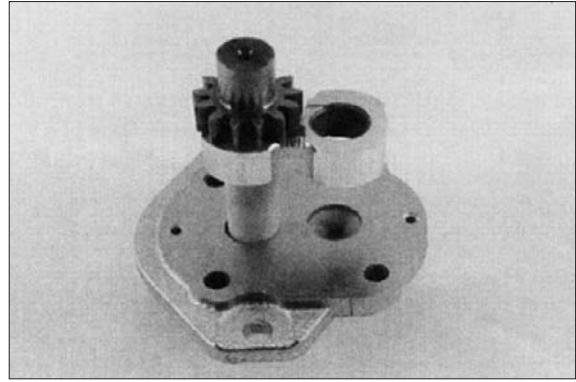
PUMP 17

- (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

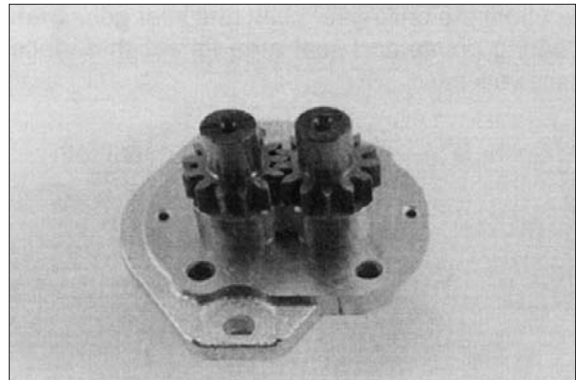
- (7) Insert the drive end of the drive shaft through the bearing block with the seal side down, and the open side of the E-seal pointing to the intake side of the pump.



PUMP 19

- (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.

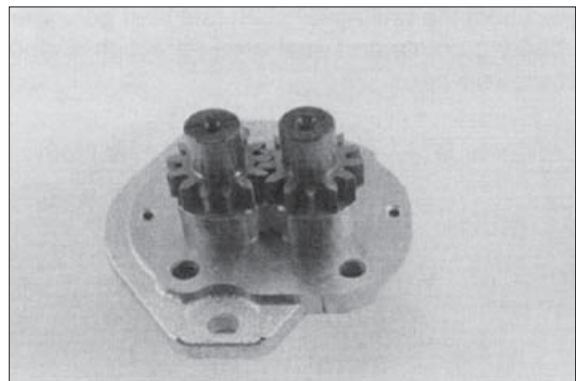
- (9) Install the idler gear shaft in the remaining position in the bearing block. Apply a light coat of clean oil to the face of the drive and idler gears.



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.

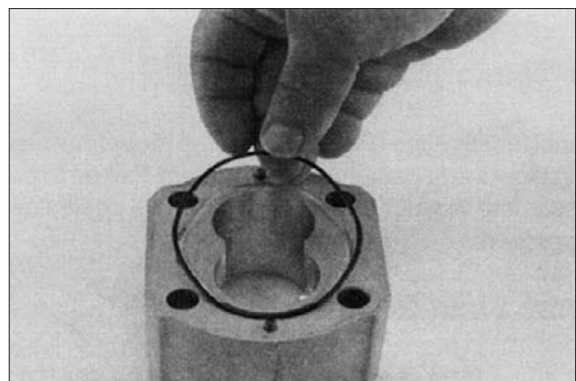
- (11) Install two dowel pins in the holes in the mounting flange or two long dowel pins through gear housing if pump is a multiple section pump.



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.

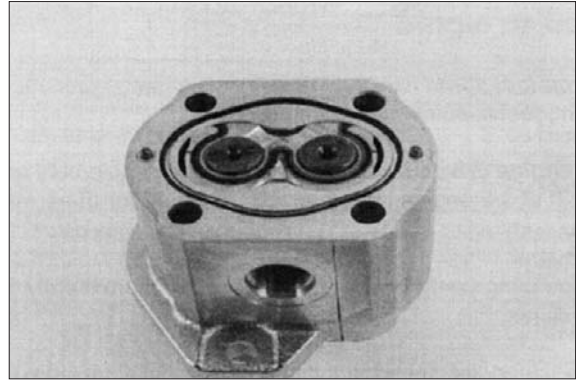
Also coat the new O-ring and install them in the grooves.



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.

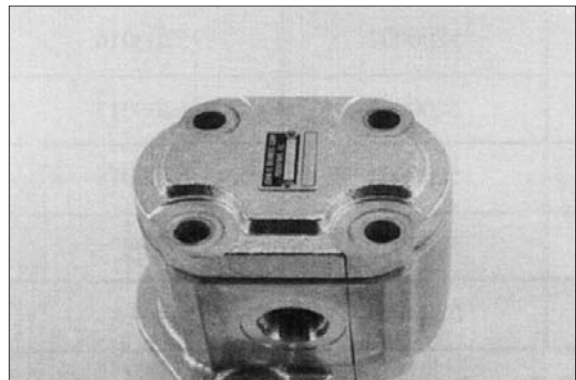
Check to make sure the intake port in the housing is on the same side as the open end of the E-seal and that the marked lines on the mounting flange and gear housing are in alignment.



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 than 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.



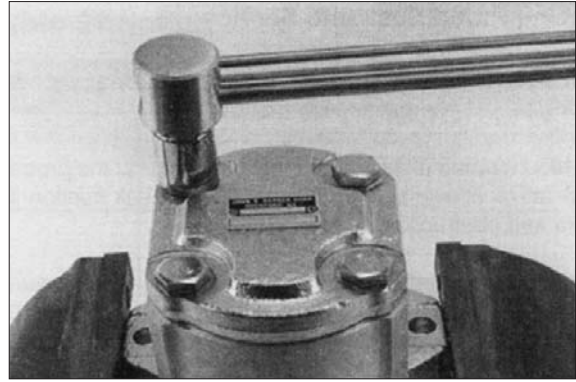
PUMP 25

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

- Tighten torque : 11.1~11.8 kgf·m
(80~85 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

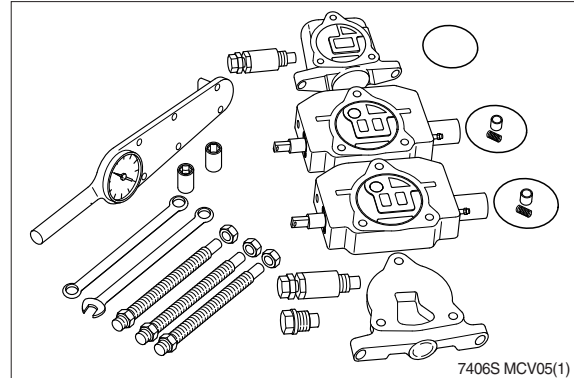
2. MAIN CONTROL VALVE (Old type)

- Machine serial number

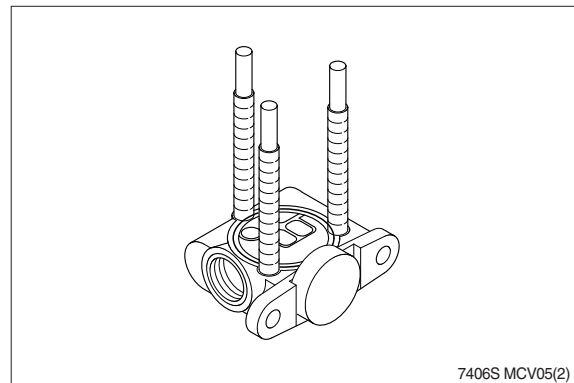
35D-9K : -#0078 45D-9K : -#0380

40D-9K : -#0006 50D-9K : -#0059

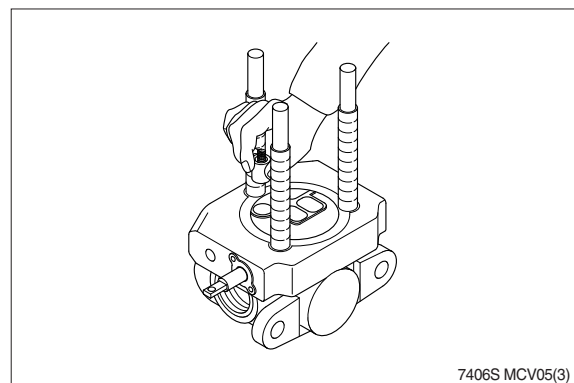
- 1) Lay out valve components on a clean, flat working surface. The inlet assembly will include an O-ring, and the spool section (s) include an O-ring, a load check poppet and a load check spring. Tools required for basic valve assembly include 3/4 and 11/16 open or box end wrenches and a torque wrench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



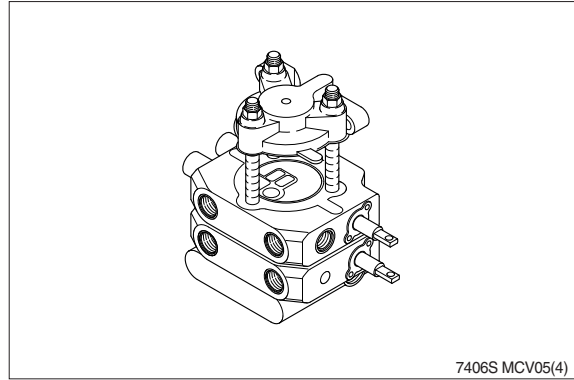
- 2) Assemble tie rod nuts to one end of each tie rod with one or two threads showing. Insert tie rods through tie rod holes of inlet (Large tie rod at top). Lay inlet on end with tie rods up, place O-ring into position.



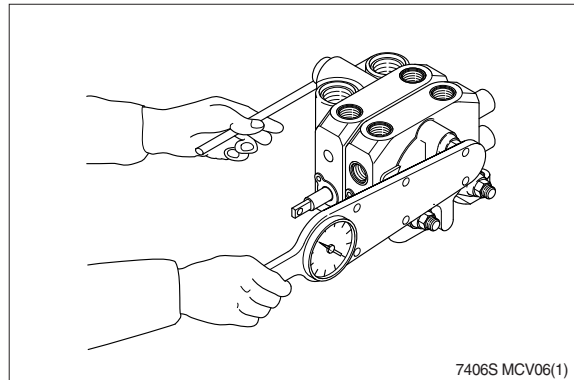
- 3) Place first spool section (O-ring side up) on inlet section, position O-ring and insert load check poppet (Nose down) and spring (Behind poppet) into load check cavity as shown. Repeat this procedure for each spool section ; The load check springs are compressed by the following sections during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



- 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.



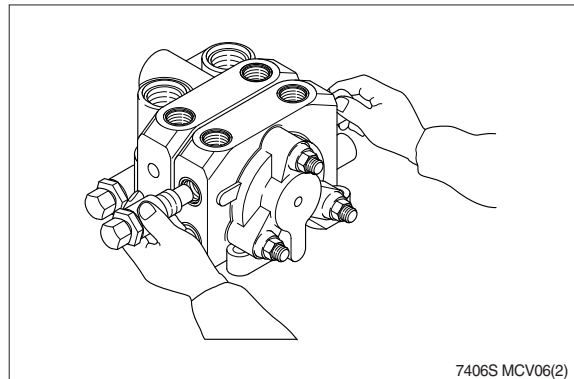
- 5) Position valve assembly with the mounting pads of the end sections on a flat surface. To obtain proper alignment of end sections relative to the spool sections apply downward pressure to the end sections ; Snug tie rod nuts to about 10lbf · ft. Final torque the two 11/16 nuts to 48 ± 5 lbf·ft ;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



- 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 omitted from assembly in certain circuit conditions (i.e., motor spools).

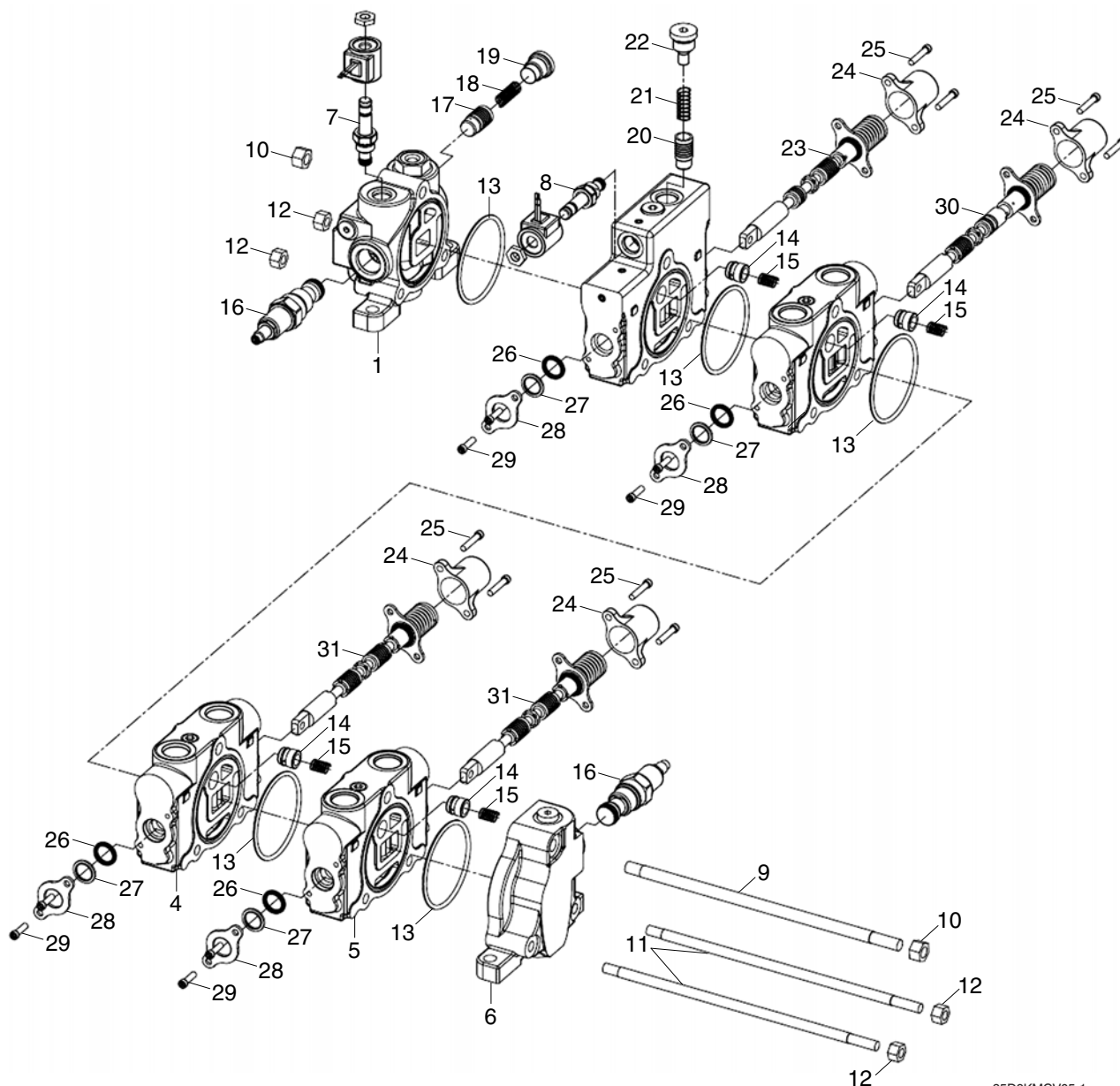


MAIN CONTROL VALVE (Current type)

1) STRUCTURE (4 Spool)

· Machine serial number

- 35D-9K : #0079- - 45D-9K : #0381-
- 40D-9K : #0007- - 50DA-9K : #0060-



35D9KMCV05-1

- | | | |
|-----------------------|------------------|--------------------|
| 1 Main block | 12 Nut | 23 Lift spool assy |
| 2 Lift section | 13 O-ring | 24 Cap |
| 3 Tilt section | 14 Inlet poppet | 25 Bolt |
| 4 Aux1 section | 15 Spring | 26 Quad ring |
| 5 Aux2 section | 16 Relief valve | 27 Back up ring |
| 6 Cover | 17 Unload poppet | 28 Plate |
| 7 Main solenoid valve | 18 Spring | 29 Bolt |
| 8 Lift solenoid valve | 19 Plug | 30 Tilt spool assy |
| 9 Bolt | 20 Safety poppet | 31 Aux spool assy |
| 10 Nut | 21 Spring | |
| 11 Bolt | 22 Plug | |

2) DISASSEMBLY AND ASSEMBLY

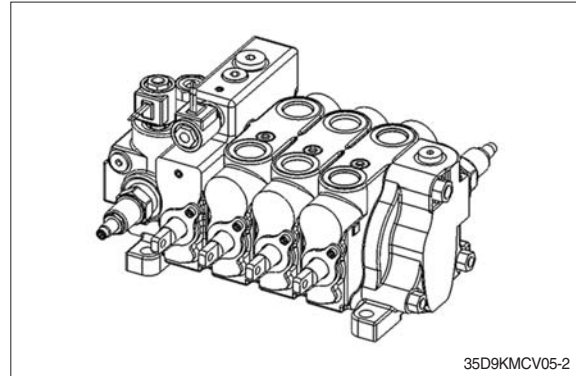
(1) Removal

- Remove the main control valve assy from the truck.
- Precaution for disassembly

- ① Lower the mast to the flat floor and stop the engine.

Release the remaining pressure inside the hydraulic system. Escaping fluid or spring off parts under pressure can cause serious injury when disassembling.

- ② Make match marks on the necessary places before removal to prevent any mistake when assembling. Clean the surrounding area of the main control valve to prevent dirt or dust from entering and remove the hoses and fit blind plugs to the ports.

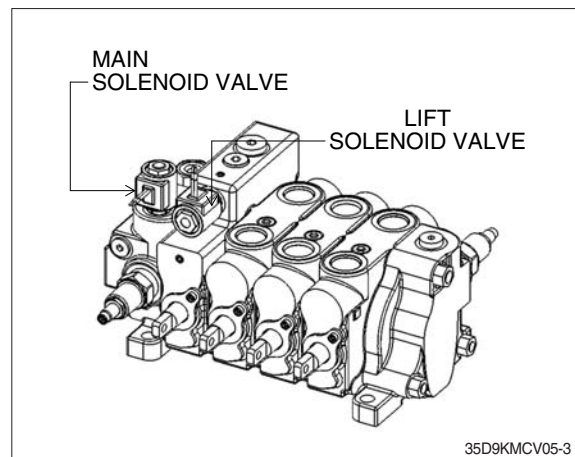


(2) Precautions for disassembly and assembly

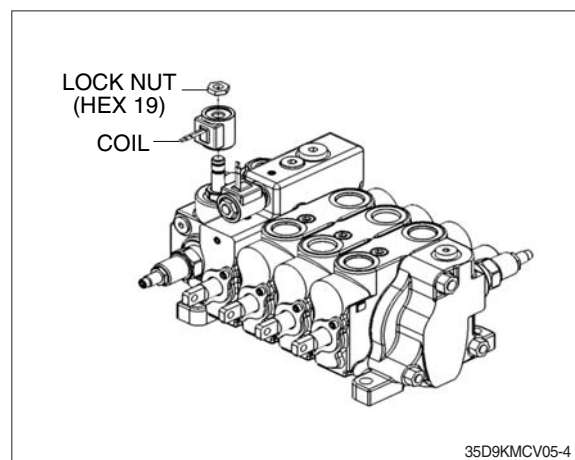
- ① Clean the surrounding area of the main control valve to prevent dirt or dust from entering when disassembling.
- ② Arrange the removed parts on a shelf not to mistake the original position when reassembling.
- ③ Do not hit or drop the parts to reuse except replacing parts.
- ④ Take care not to shock or damage for seal seat of the each section when disassembling.

**(3) Replacing each part of the MCV
(disassembly and assembly)**

**① Replacement of the solenoid valve
(Main / lift solenoid valve)**



- a. Loosen the lock nut (hex 19) and remove the coil from the cartridge of the solenoid valve.

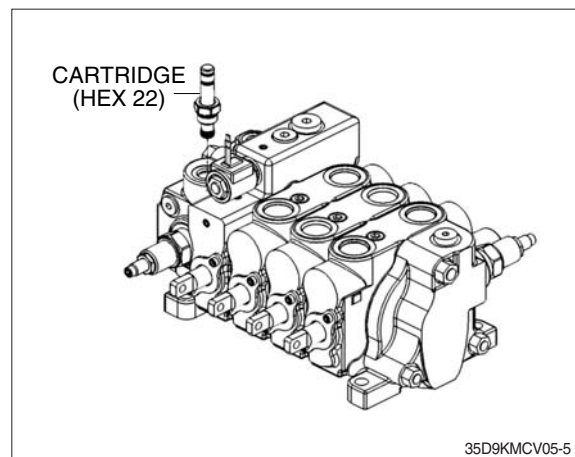


- b. Loosen the cartridge (hex 22) and remove it from the MCV.

Apply a few oil to the new O-ring and backup ring and assemble to the new cartridge and fit it into the port of the MCV.

- Cartridge tightening torque (hex 22)
2.6~2.9 kgf · m (18.8~21.0 lbf · ft)

- ※ Take care not to damage the O-ring boss of the port.
- ※ Check that the assembly area is free from foreign matter.

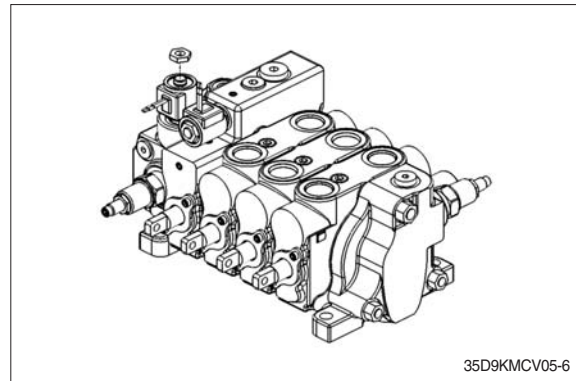


c. Insert the coil into the cartridge and tighten the lock nut.

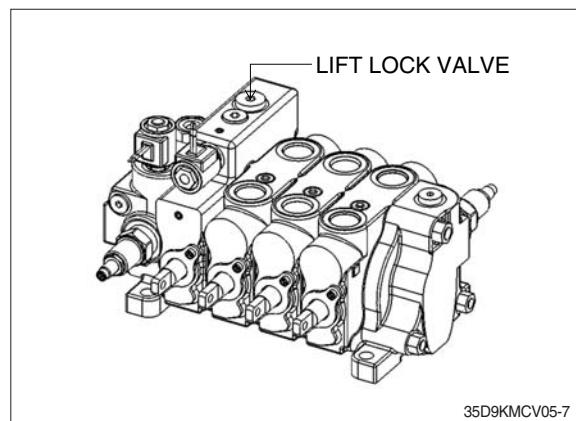
- Lock nut tightening torque (hex 19)
0.55~0.7 kgf · m (4.0~5.1 lbf · ft)

※ Check that the contact surfaces of the cartridge and coil are free from foreign matter.

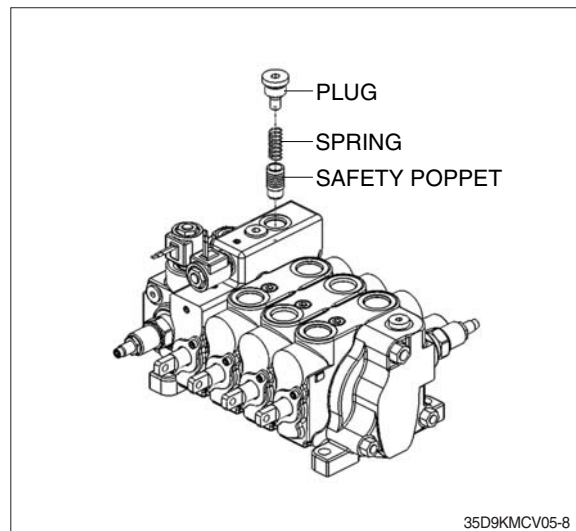
※ Bring imprinted letter of the manufacturer to top position when assembling the coil.



② Replacement of the lift lock valve



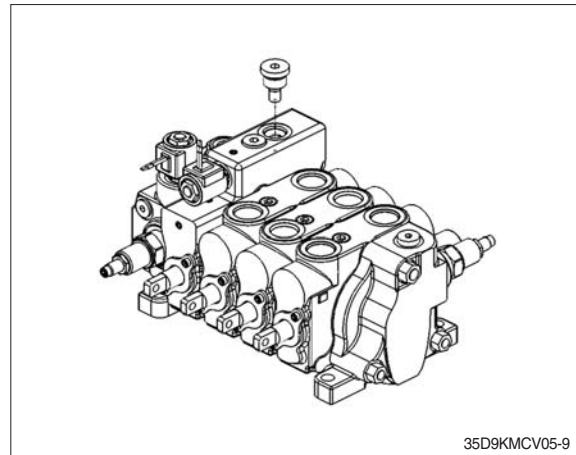
a. Loosen the plug and remove the spring and safety poppet from the MCV.



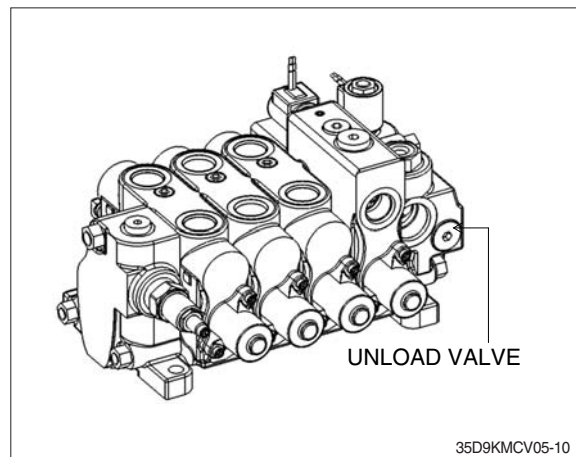
b. Assemble the new safety poppet and spring into the MCV in reverse order of the disassembly.

- Plug tightening torque (socket 8)
 $5.1 \pm 0.25 \text{ kgf} \cdot \text{m}$ ($36.9 \pm 1.8 \text{ lbf} \cdot \text{ft}$)

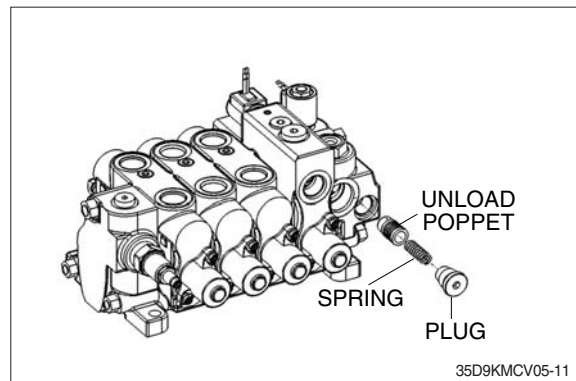
- ※ Check that the assembly area is free from foreign matter.
- ※ Check that the poppet slide smooth into the hole.
- ※ Take care not to damage the O-ring boss of the port.



③ Replacement of the unload valve



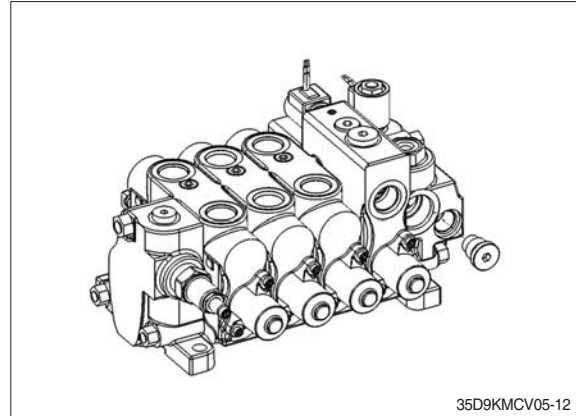
a. Loosen the plug and remove the spring and unload poppet from the MCV.



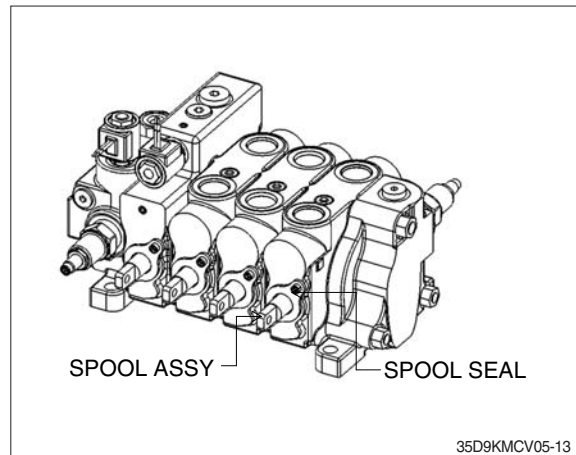
- b. Assemble the new unload poppet and spring into the MCV in reverse order of the disassembly.

- Plug tightening torque (socket 8)
 $5.1 \pm 0.25 \text{ kgf} \cdot \text{m}$ ($36.9 \pm 1.8 \text{ lbf} \cdot \text{ft}$)

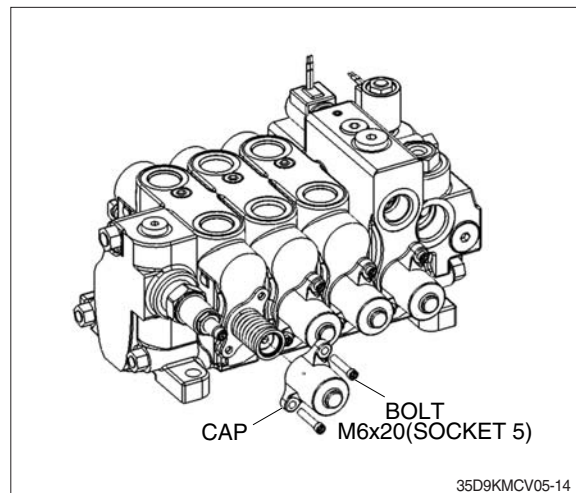
- ※ Check that the assembly area is free from foreign matter.
- ※ Check that the poppet slide smooth into the hole.
- ※ Take care not to damage the O-ring boss of the port.



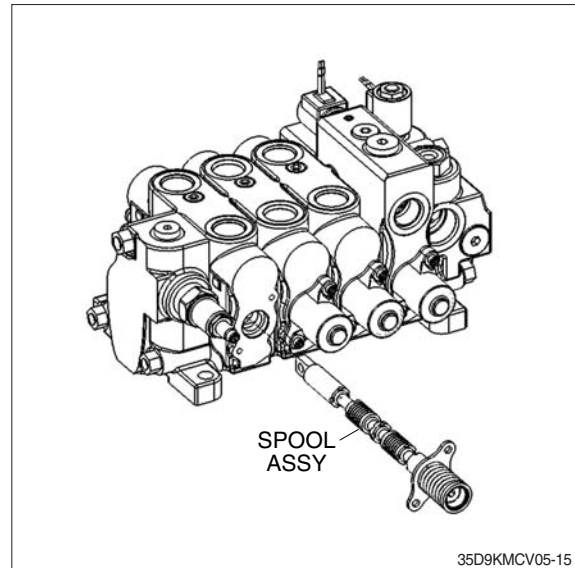
④ Replacement of the spool seal and spool assy



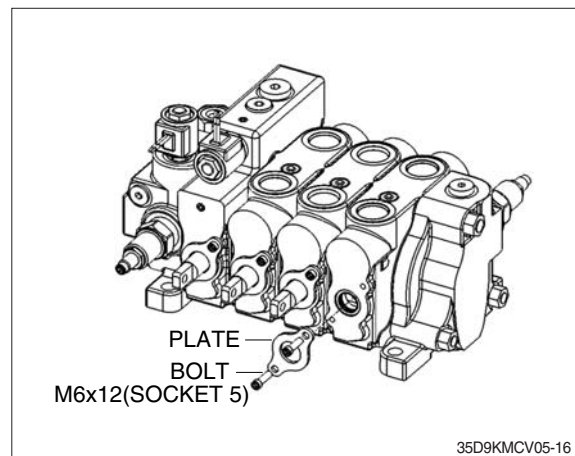
- a. Loosen the bolt and remove the cap from the MCV.



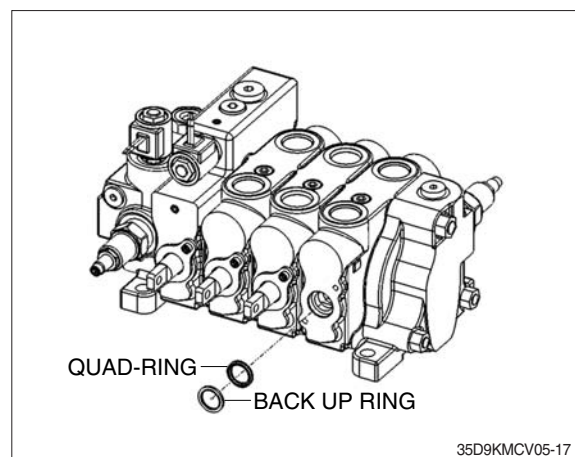
- b. Remove the spool assy from the MCV.
- Install the spool assy and go to the clause f if replacing the spool assy only.
- ※ Check that the hole of the spool is free from foreign matter.
- ※ Take care not to hit the spool. This can cause stuck of the spool after the spool reassembling.



- c. Loosen the bolt that opposite side of removed the spool assy and disassemble the plate.



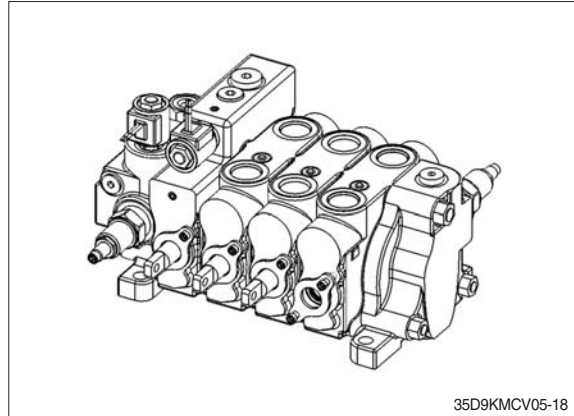
- d. Replace the quad-ring and backup ring with a new one.



- e. Insert the quad-ring and backup ring into the MCV and assemble the plate with tightening the bolt.

- Tightening torque (M6×12)
 $1.5 \pm 0.1 \text{ kgf} \cdot \text{m}$ ($10.8 \pm 0.7 \text{ lbf} \cdot \text{ft}$)

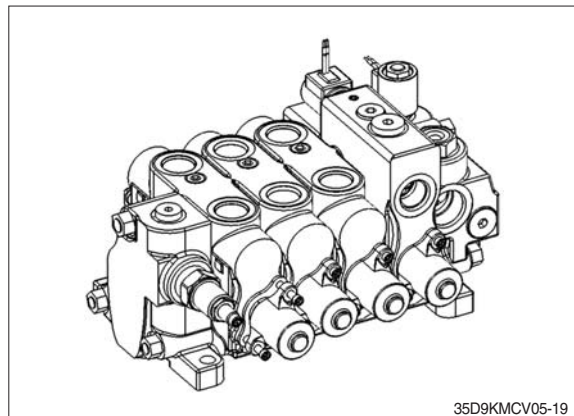
- ※ Check that the seat surface of the seal is free from foreign matter before assembling.
- ※ Apply a few oil on the seal surface before assembling.



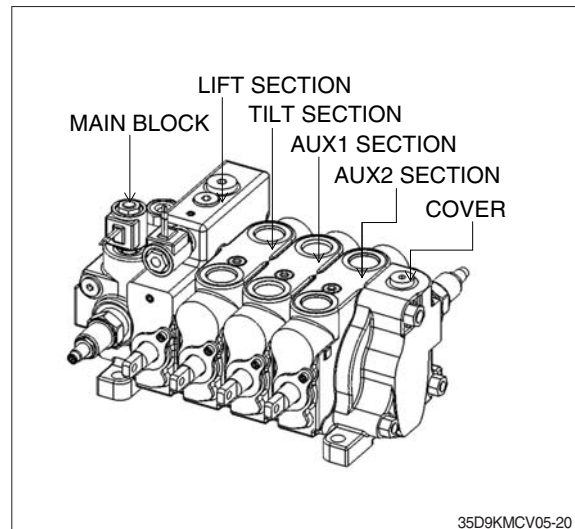
- f. Insert the spool assy into opposite side of the MCV and assemble the cap with tightening the bolt.

- Tightening torque (M6×12)
 $1.5 \pm 0.1 \text{ kgf} \cdot \text{m}$ ($10.8 \pm 0.7 \text{ lbf} \cdot \text{ft}$)

- ※ Check that the seat surface of the seal is free from foreign matter before assembling.
- ※ Check that the spool is free from scoring.

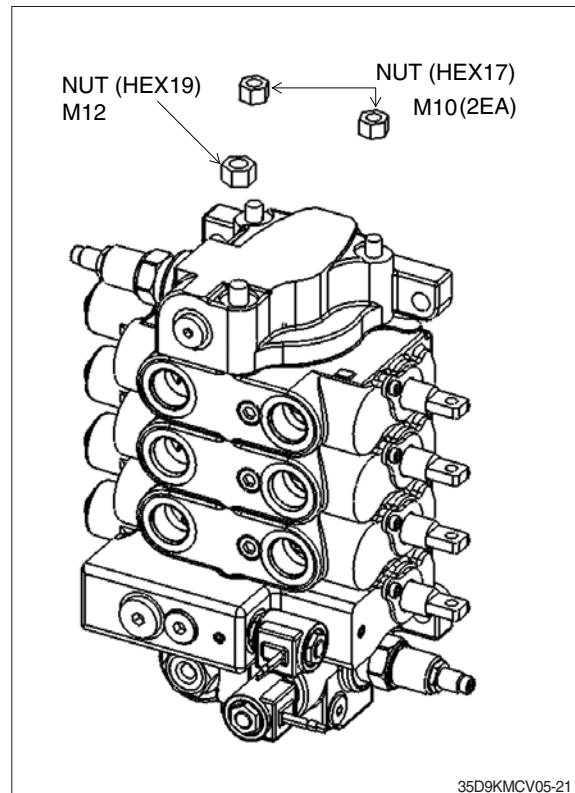


⑤ Replacement of the section assy

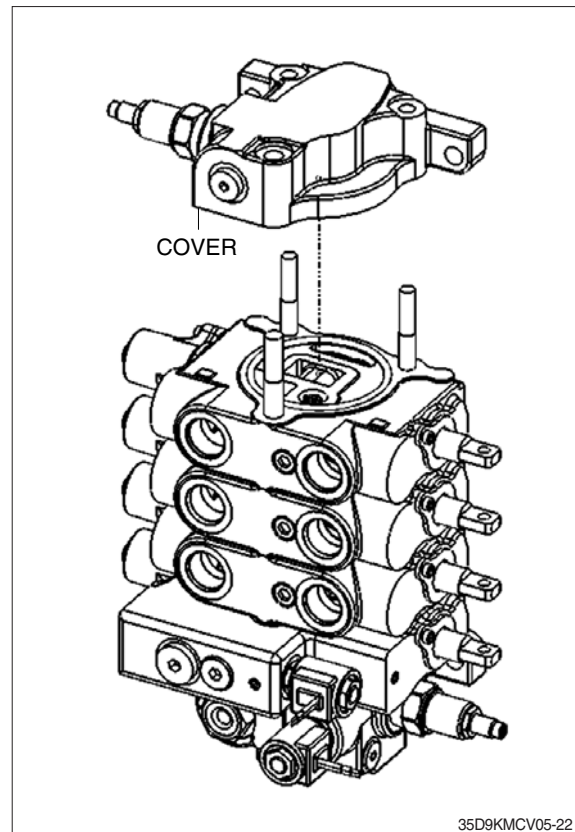


a. Replacement of the lift section

- ① Loosen the nut (3EA) a little and place the MCV on the flat table with the main block facing the bottom.
- ② Remove the nut (3EA) from the bolt.

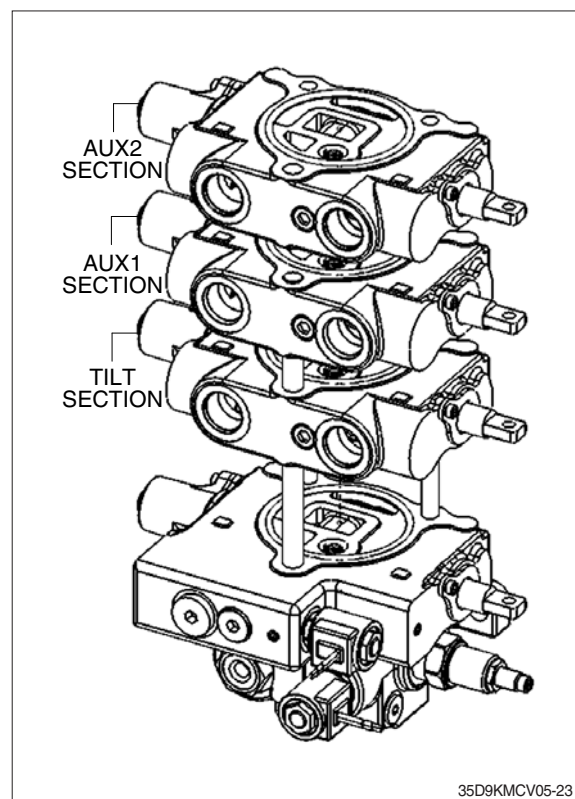


© Remove the cover form the MCV.



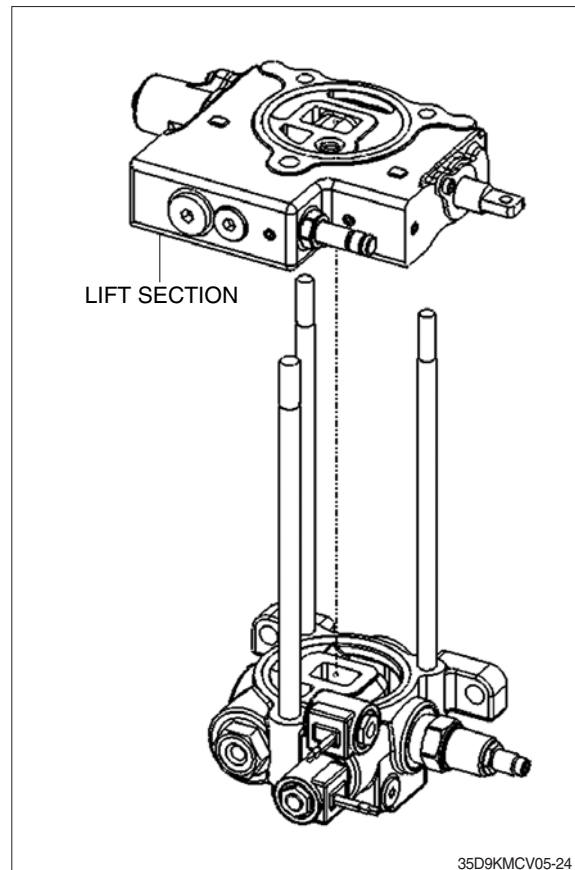
④ Remove the aux2 section, aux1 section and tilt section from the MCV in order.

※ Take care not to lose the O-ring, spring and inlet poppet.



③ Remove the lift section kit and replace it with a new one.

※ Take care not to lose the O-ring, spring and inlet poppet.



④ Replace the lift section and assemble the each section in reverse order of above procedures and tighten the bolt.

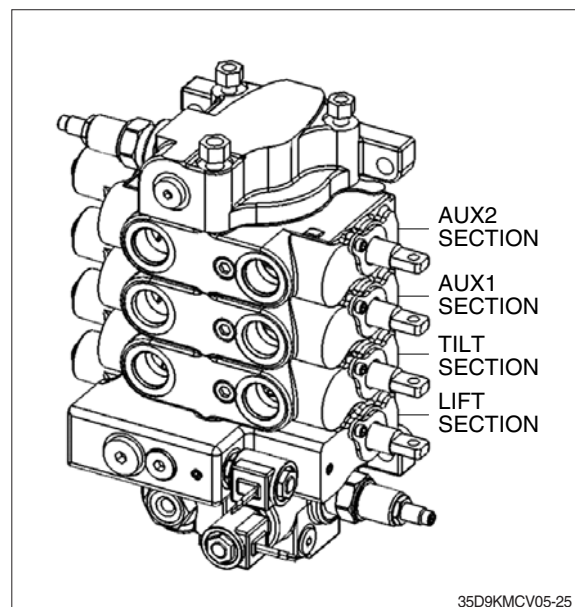
• Tightening torque

M10 : $6.0 \pm 0.3 \text{ kgf} \cdot \text{m}$
($43.4 \pm 2.2 \text{ lbf} \cdot \text{ft}$)

M12 : $9.0 \pm 0.45 \text{ kgf} \cdot \text{m}$
($65.1 \pm 3.3 \text{ lbf} \cdot \text{ft}$)

※ Check that the contact surface of the blocks is free from foreign matter before assembling.

※ Confirm the imprinted letter on the block in order to place each section located original positions.

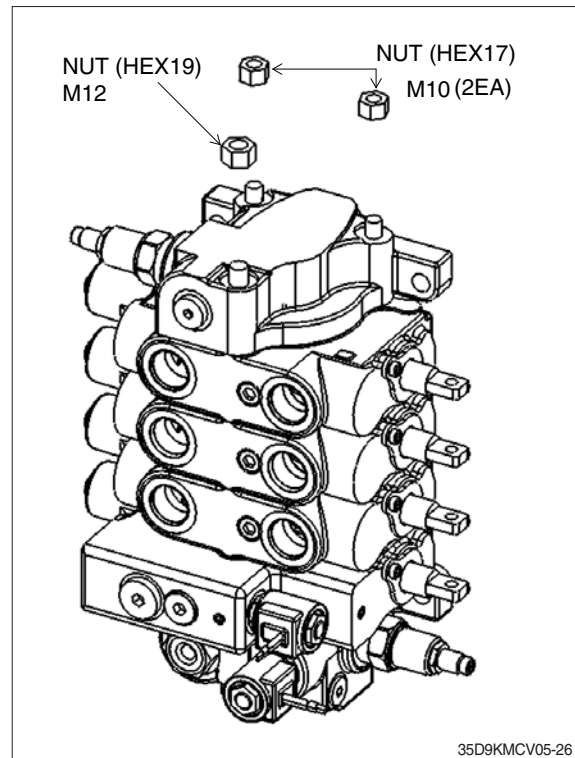


b. Replacement of the other sections

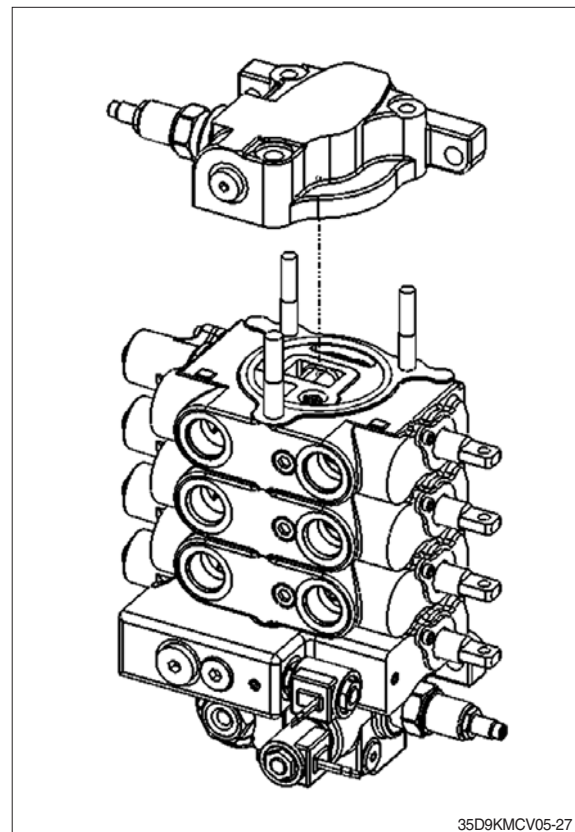
⑤ Replace the aux2, aux1 and tilt section same method as the lift section.

⑥ **Replacement of the inlet check valve and block seal**

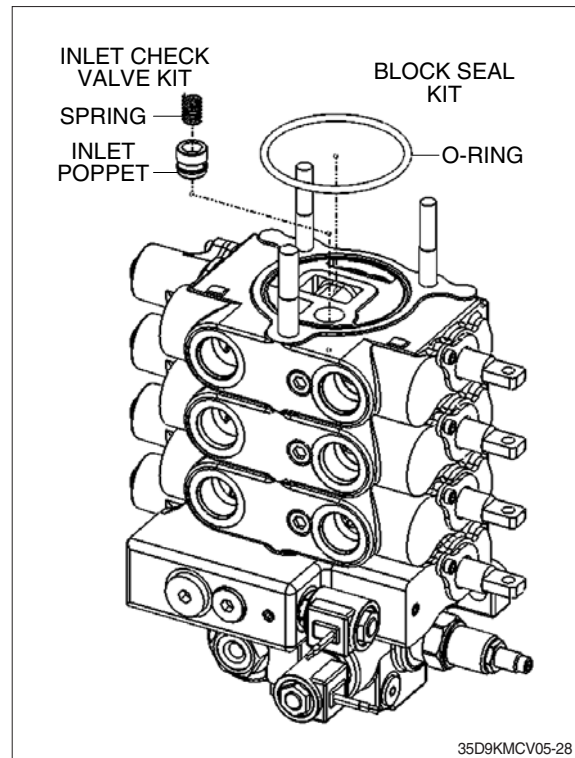
- a. Loosen the nut (3EA) a little and place the MCV on the flat table with the main block facing the bottom.
- b. Remove the nut (3EA) from the bolt.



- c. Remove the cover form the MCV.



- d. Replace the inlet poppet (or block seal) with a new one.



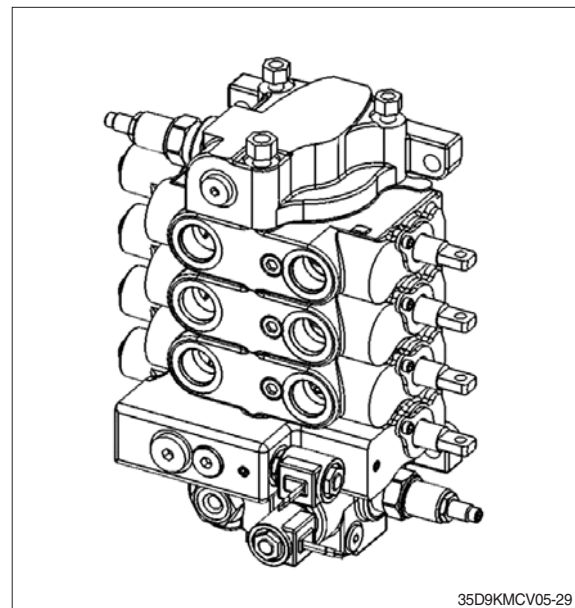
- e. Assemble it with a new one in reverse order of above procedures and tighten the bolt.

• Tightening torque

M10 : $6.0 \pm 0.3 \text{ kgf} \cdot \text{m}$
($43.4 \pm 2.2 \text{ lbf} \cdot \text{ft}$)

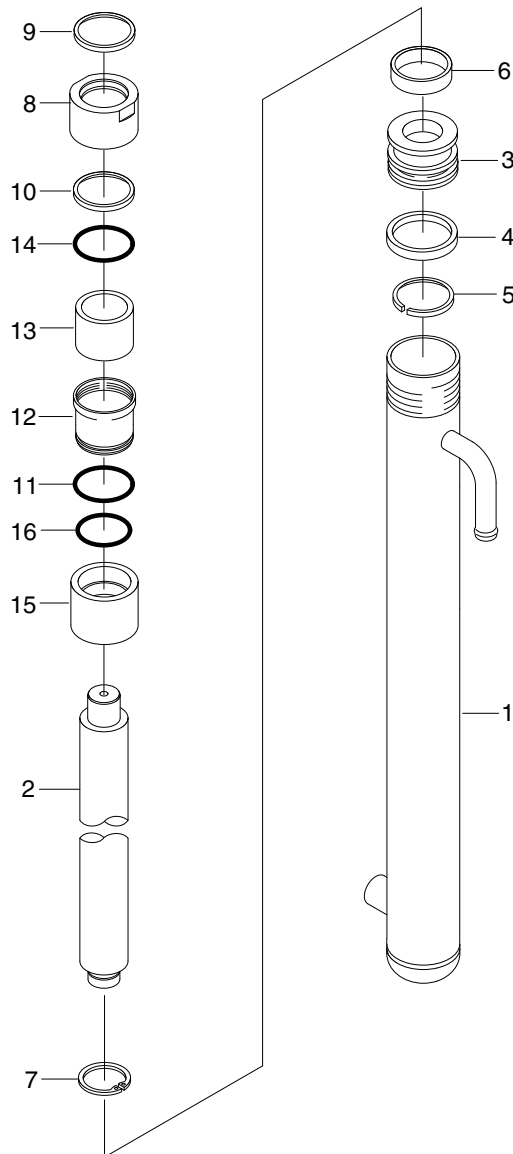
M12 : $9.0 \pm 0.45 \text{ kgf} \cdot \text{m}$
($65.1 \pm 3.3 \text{ lbf} \cdot \text{ft}$)

- ※ Check that the contact surface of the sections is free from foreign matter before assembling.



4. LIFT CYLINDER

1) STRUCTURE



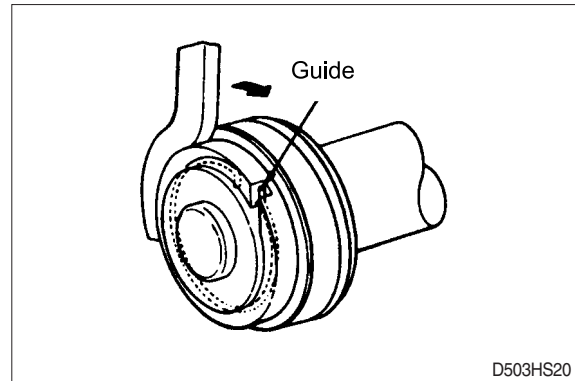
- I.D × O.D × stroke (standard)
65 × 73 × 1335 mm
(2.6 × 2.9 × 52.6 in)
- Rod O.D : 50 mm (2.0 in)

D357HS19

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

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.



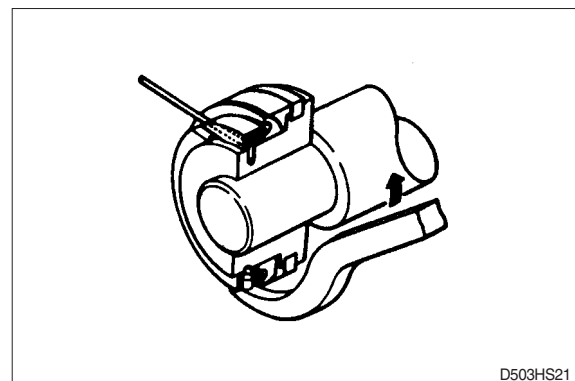
3) CHECK AND INSPECTION

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

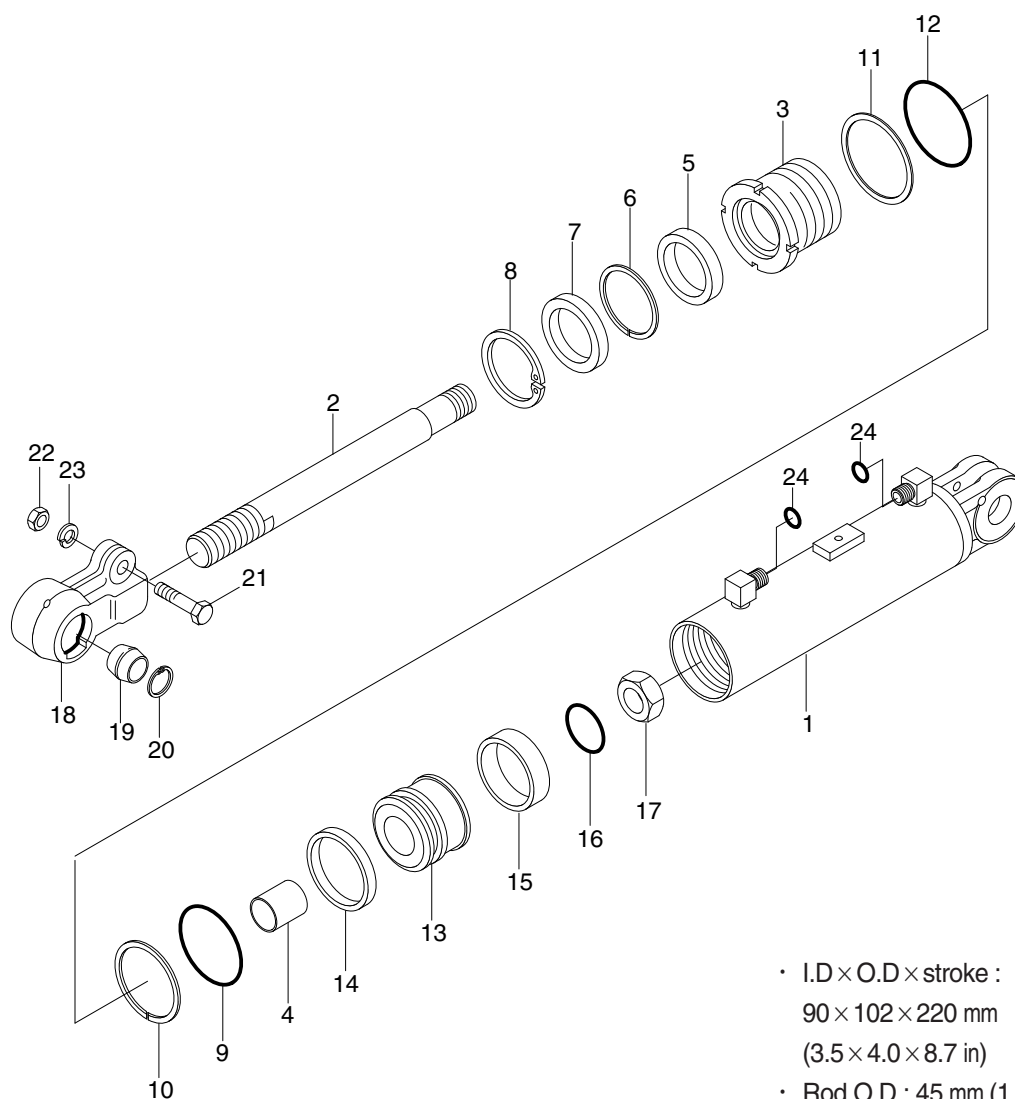
4) ASSEMBLY

- (1) Soak the piston ring in hydraulic oil at a temperature of 40 to 50°C, 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. TILT CYLINDER

1) STRUCTURE



- I.D×O.D×stroke :
90×102×220 mm
(3.5×4.0×8.7 in)
- Rod O.D : 45 mm (1.8 in)

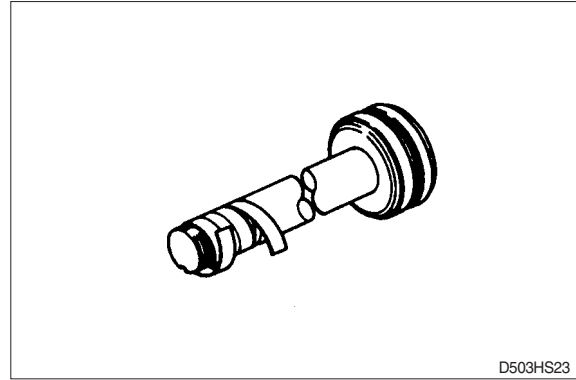
35DS7HS16

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

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