SECTION 6 HYDRAULIC SYSTEM

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GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC SYSTEM OUTLINE

The hydraulic system consists of a variable displacement pump, a control valve (MCV or ECV), lift cylinders and tilt cylinders. Refer to below followings. The oil is supplied from the tank at the left side of the frame. The hydraulic return filter is installed inside in the hydraulic tank. For the high-pressure piping, the o-ring fitting method (ORFS) that provides high sealing performance is employed to improve hydraulic system serviceability.

1) VARIABLE DISPLACEMENT PUMP

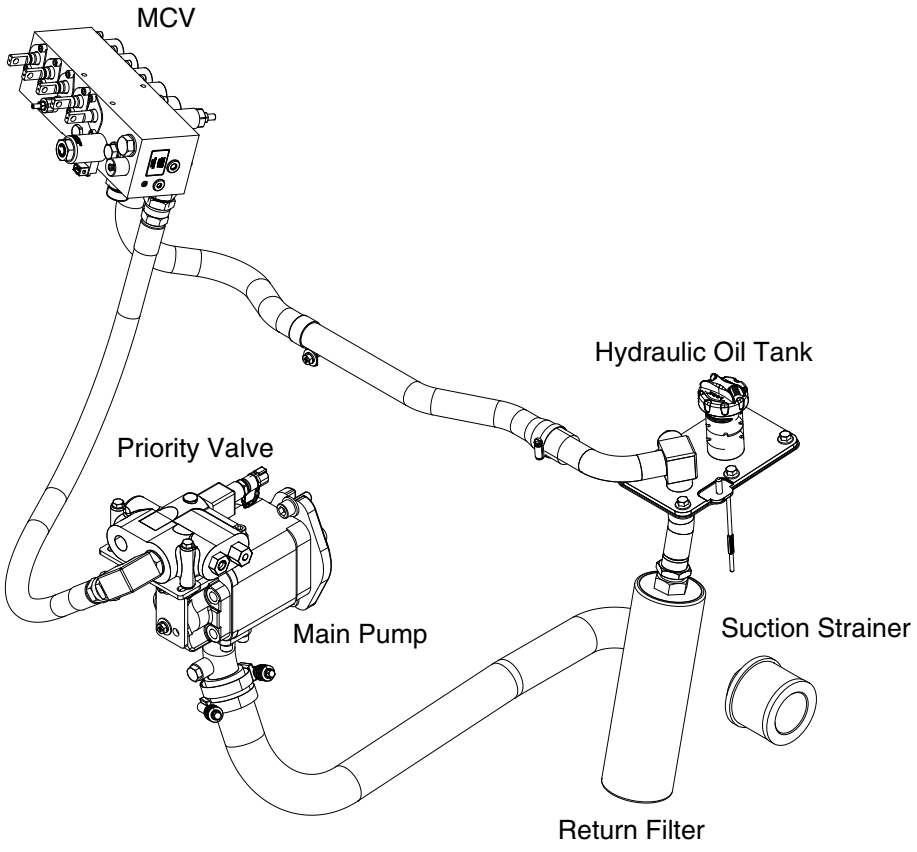
· Lift cylinder ,Tilt cylinder, Steering cylinder, Auxiliary function cylinder

2) MCV OR ECV

· Lift function, Tilt function, Auxiliary function (Sideshift etc.)

3) HYDRAULIC OIL TANK

· Return filter, Suction Strainer, Air breather, Drain plug-magnetic



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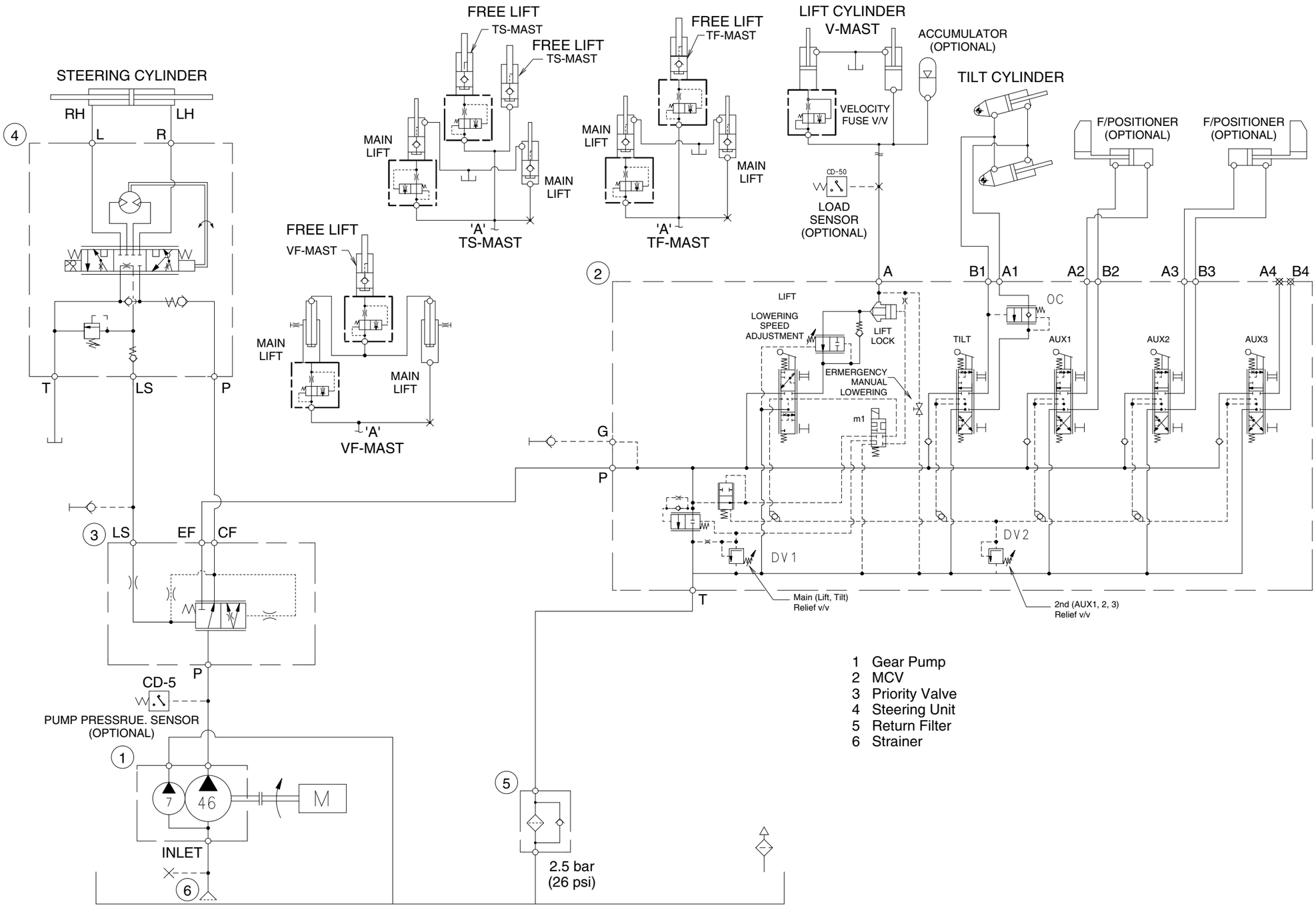
2. HYDRAULIC CIRCUIT

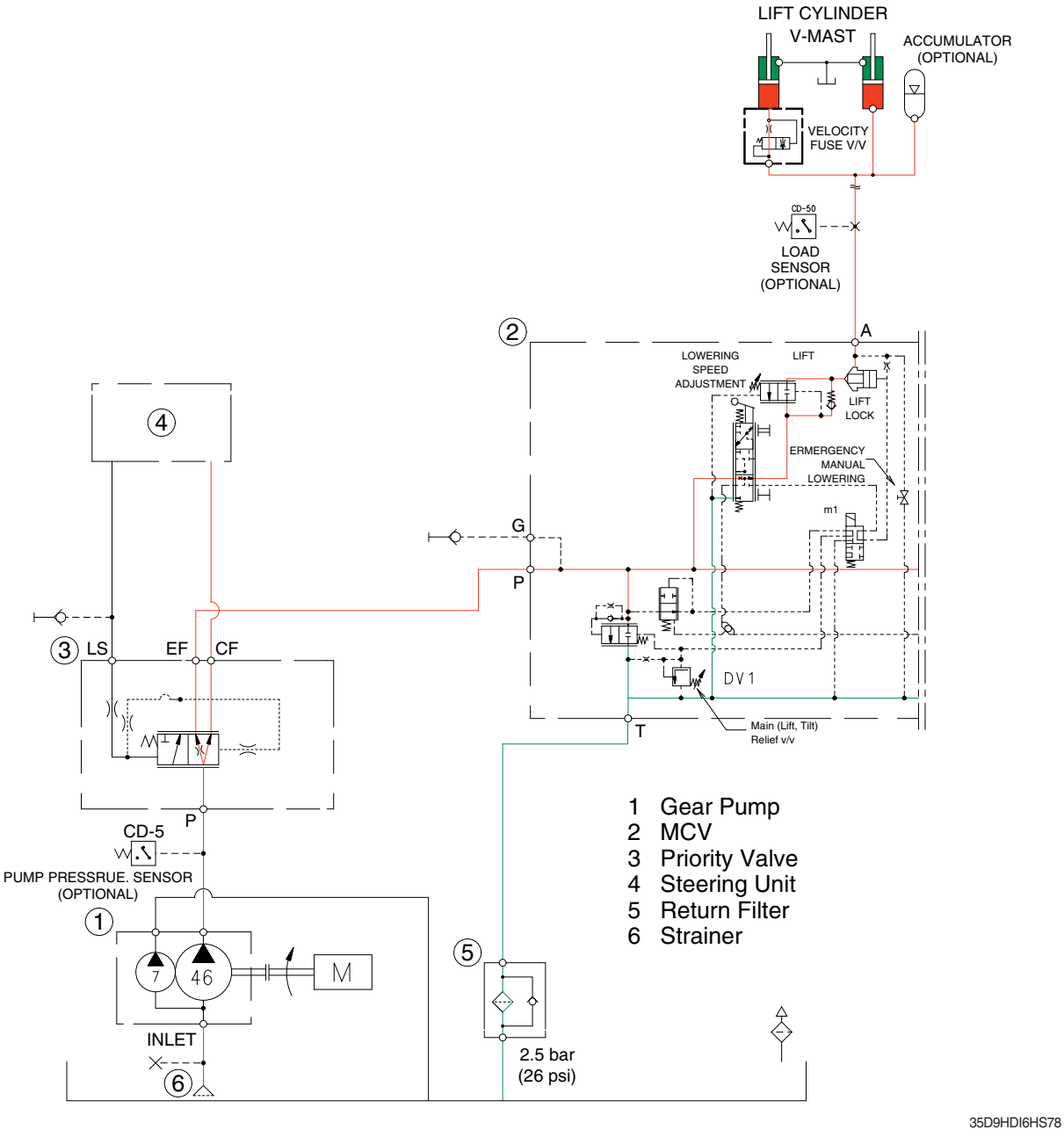


1 Gear Pump
2 MCV
3 Priority Valve
4 Steering Unit
5 Return Filter
6 Strainer

3YFH-00030-01

3. WORK EQUIPMENT HYDRAULIC CIRCUIT

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



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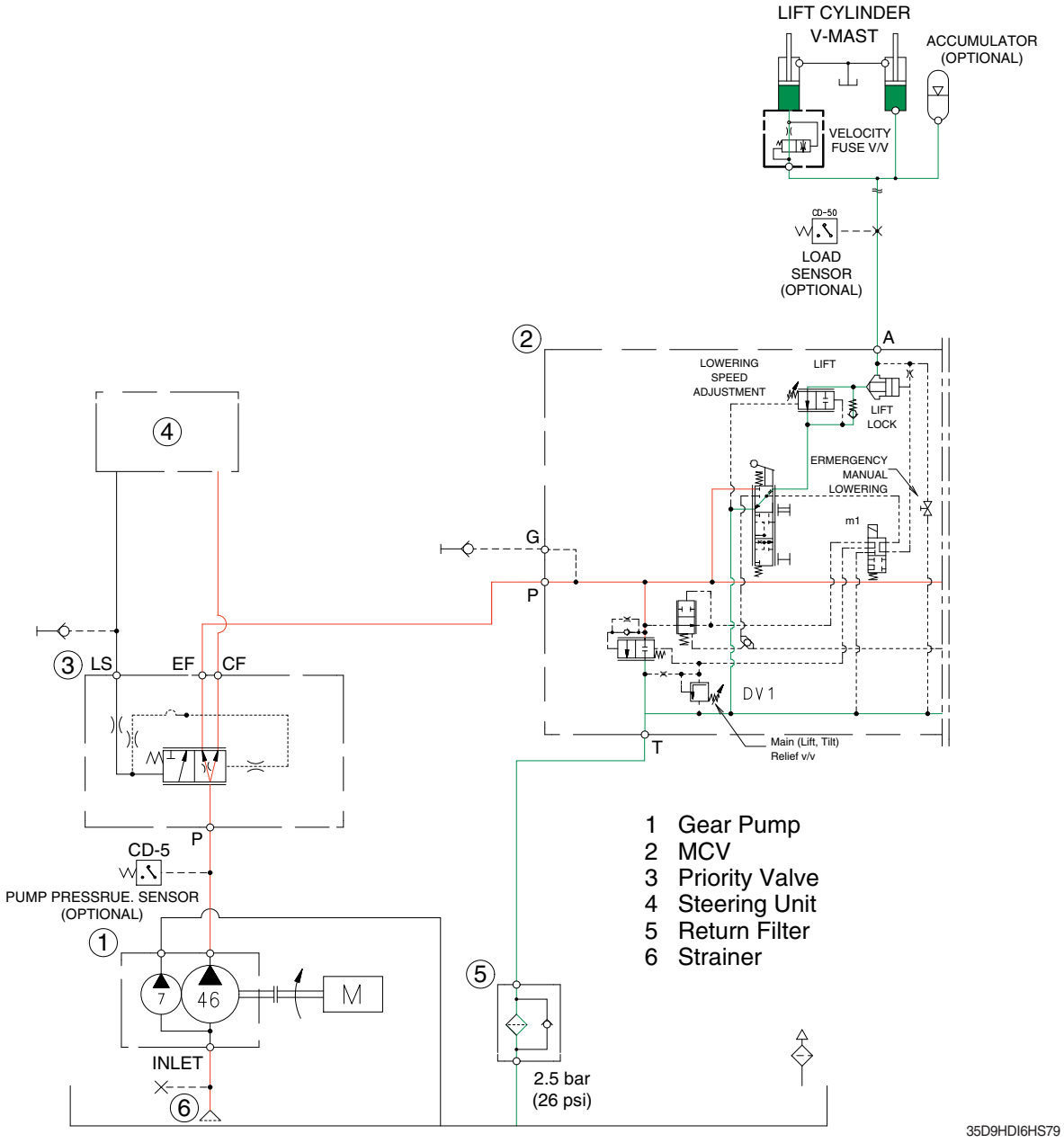
When the lift control lever is pulled back, the spool in the first block is moves to lift position.
The oil from the pump (1) flows into main control valve (2) through the priority valve (3). Then goes to the large chamber of lift cylinder by pushing the load check valve of the spool and lift lock valve.
The oil from the small chamber of lift cylinder 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.

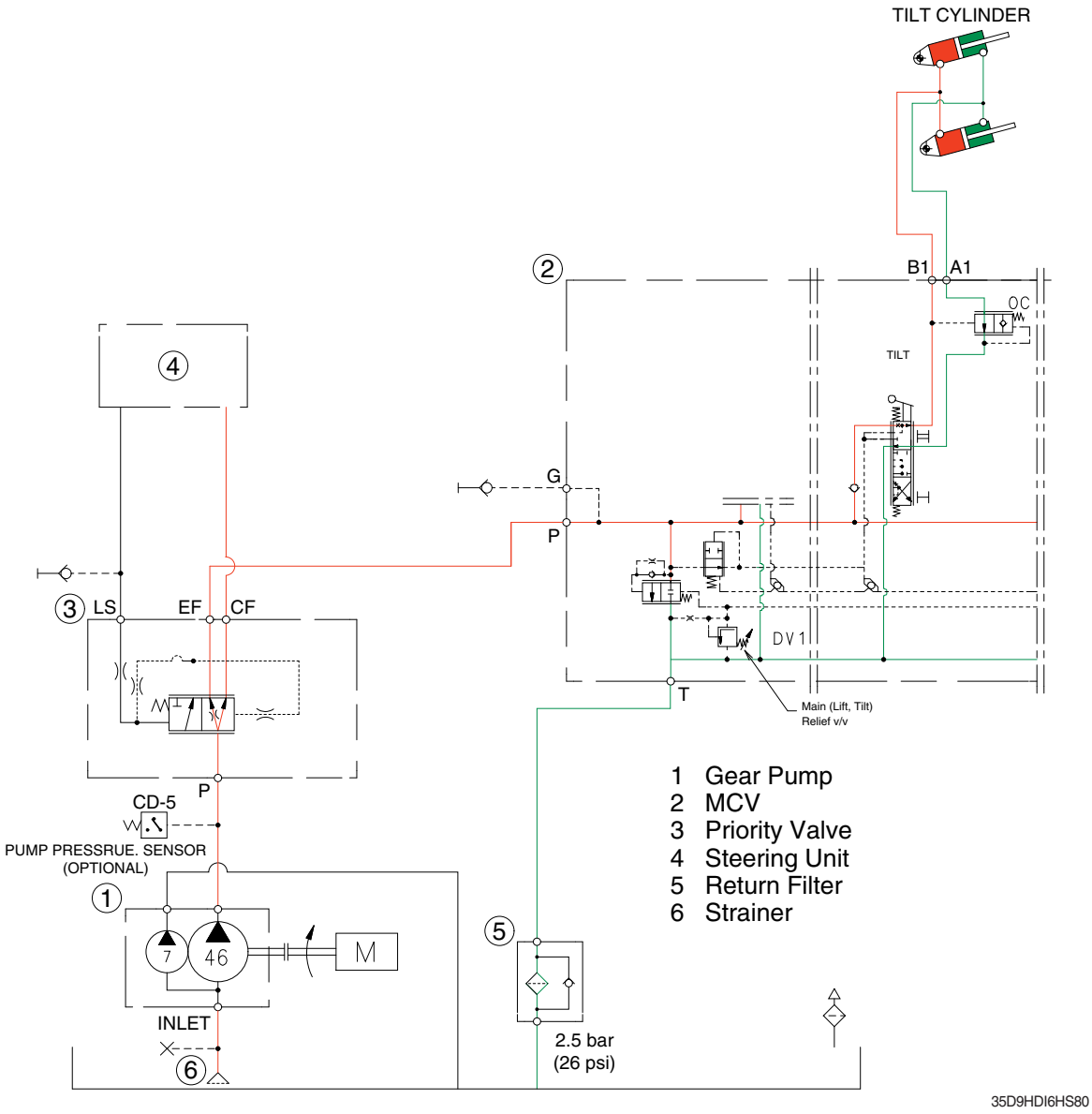
2) WHEN THE LIFT CONTROL LEVER IS IN THE LOWER POSITION



When the lift control is pushed forward, the spool in the first block is moved to lower position.
The work port and the small chamber and the large chamber are connected to the return passage, so the forks 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 in the second block is moved to tilt forward position.

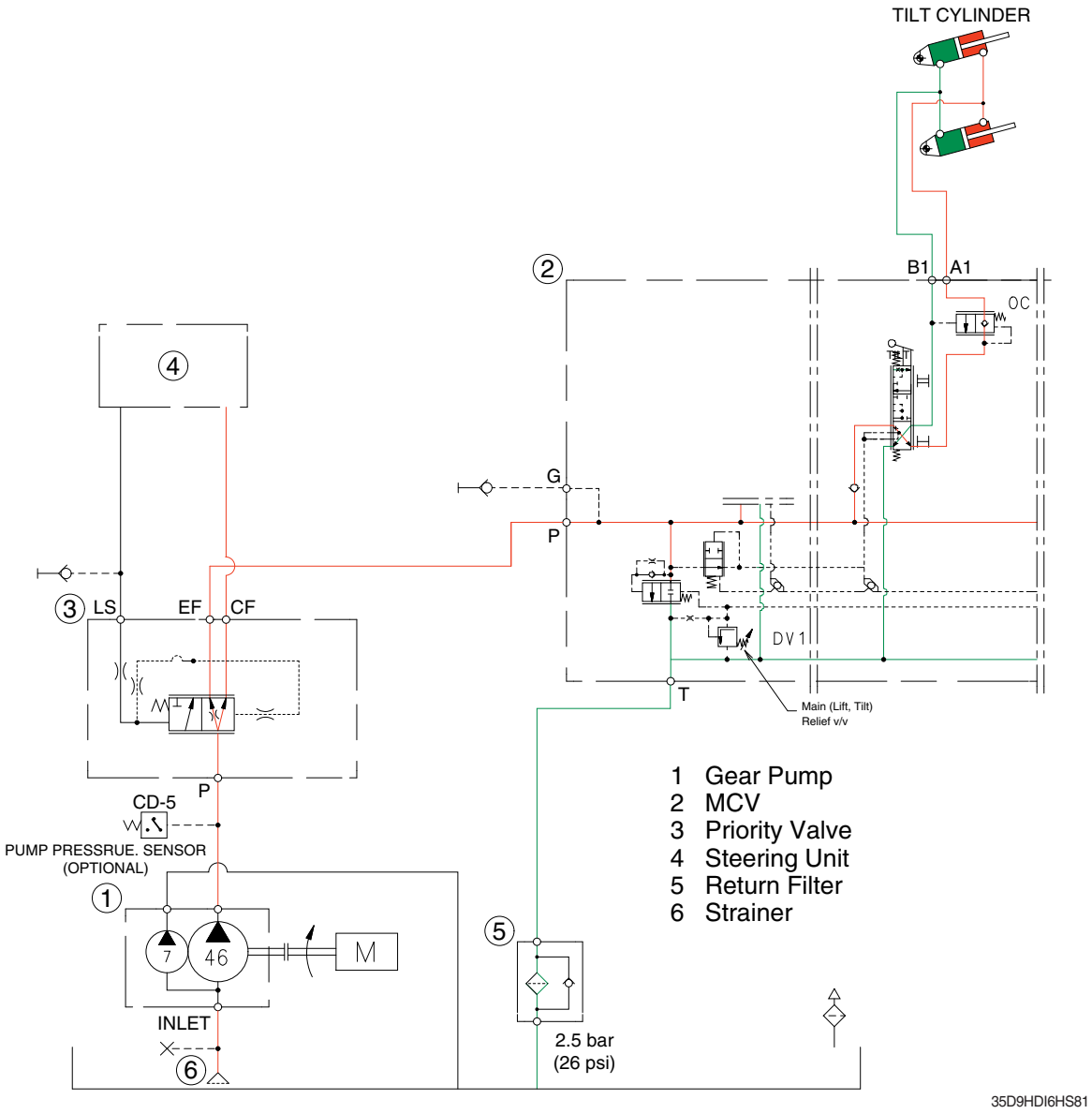
The oil from the pump (1) flows into main control valve (2) through the priority valve (3). Then goes to the large chamber of tilt cylinder by pushing the load check valve of the spool and lift lock valve.

The oil at the small chamber of tilt cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter 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 in the second block is moved to tilt backward position.

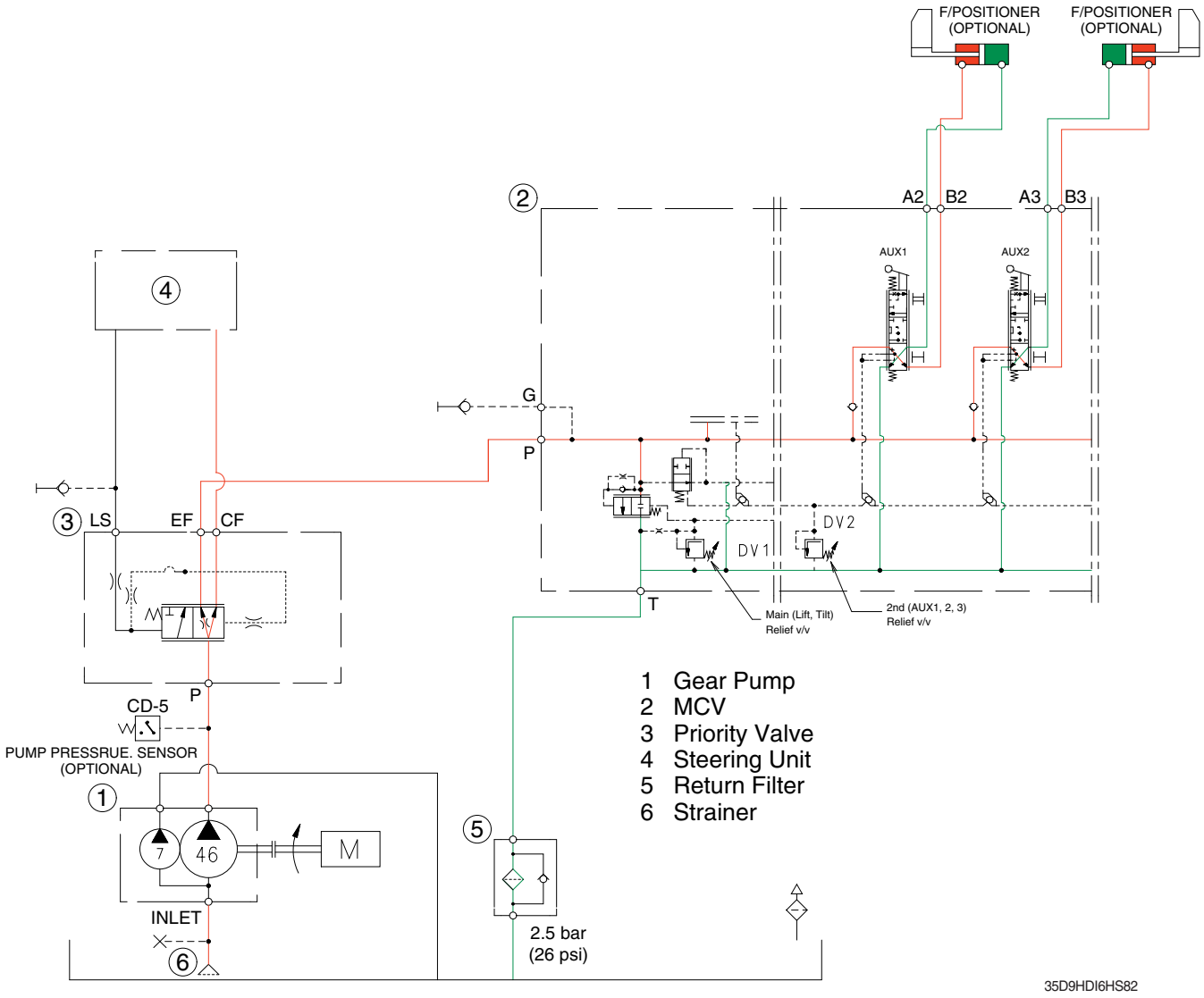
The oil from the pump (1) flows into main control valve (2) through the priority valve (3). Then goes to the small chamber of tilt cylinder by pushing the load check valve of the spool and lift lock valve.

The oil at the large chamber of tilt cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter 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.

5) WHEN THE FORK POSITIONER LEVER IS IN THE SPREAD-OUT POSITION (OPTION)



When the fork positioner lever is pulled backward, the spool in the third, fourth block is moved to fork positioner spread out position.

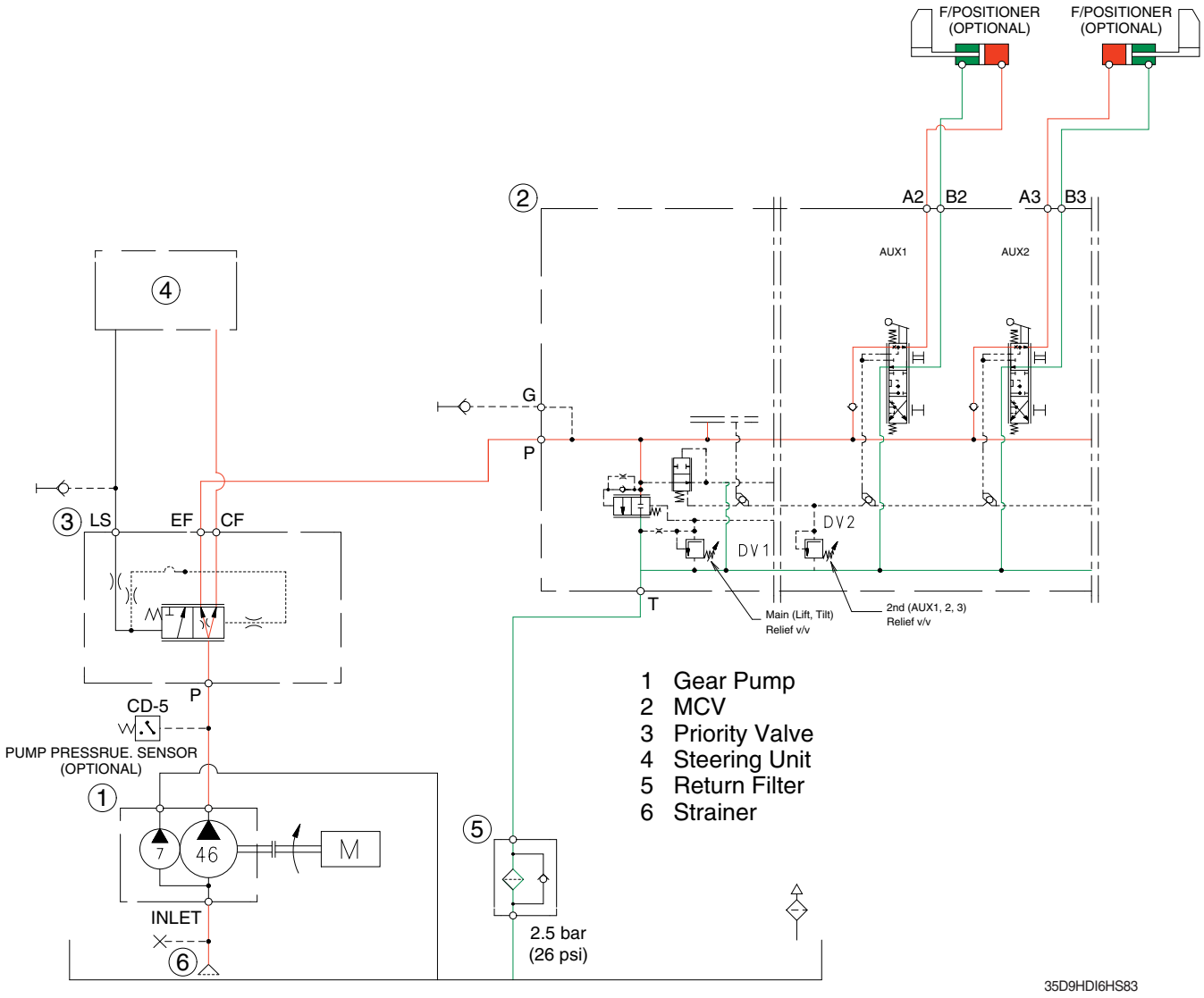
The oil from the pump (1) flows into main control valve (2) through the priority valve (3). Then goes to the large chamber of fork positioner cylinder by pushing the load check valve of the spool and lift lock valve.

The oil at the small chamber of fork positioner cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the forks are spread out.

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

6) WHEN THE FORK POSITIONER LEVER IS IN THE CLOSE POSITION (OPTION)



When the fork positioner lever is pushed forward, the spool in the third, fourth block is moved to fork positioner spread out position.

The oil from the pump (1) flows into main control valve (2) through the priority valve (3). Then goes to the small chamber of fork positioner cylinder by pushing the load check valve of the spool and lift lock valve.

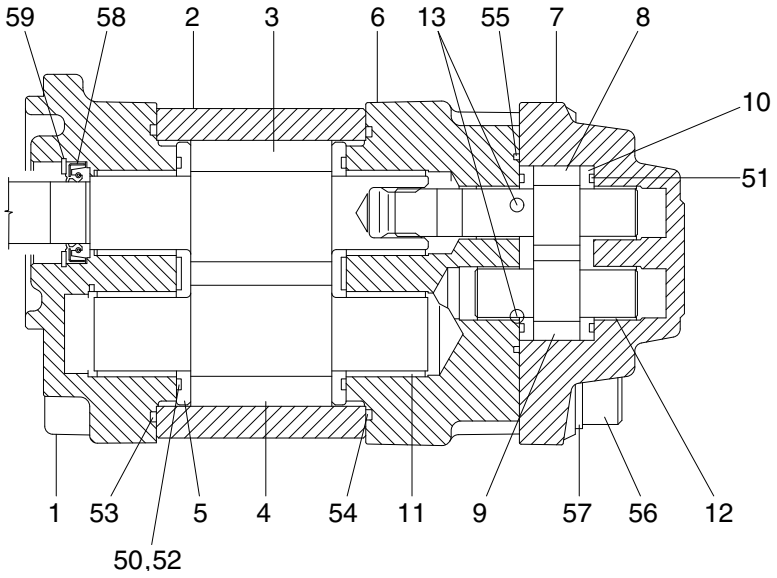
The oil at the large chamber of fork positioner cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the forks are close.

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

4. HYDRAULIC GEAR PUMP

1) STRUCTURE



35D9HS14-1

1	Front cover	9	Driven gear 2	53	Gasket
2	Body1	10	Side plate 2	54	Gasket
3	Drive gear 1	11	Bushing	55	Gasket
4	Driven gear 1	12	Bushing	56	Socket bolt
5	Side plate 1	13	Steel ball	57	Washer
6	Adapter plate	50	Gasket (3 shaped)	58	Oil seal
7	Body 2	51	Gasket (3 shaped)	59	Retainer ring
8	Drive gear 2	52	Back up ring		

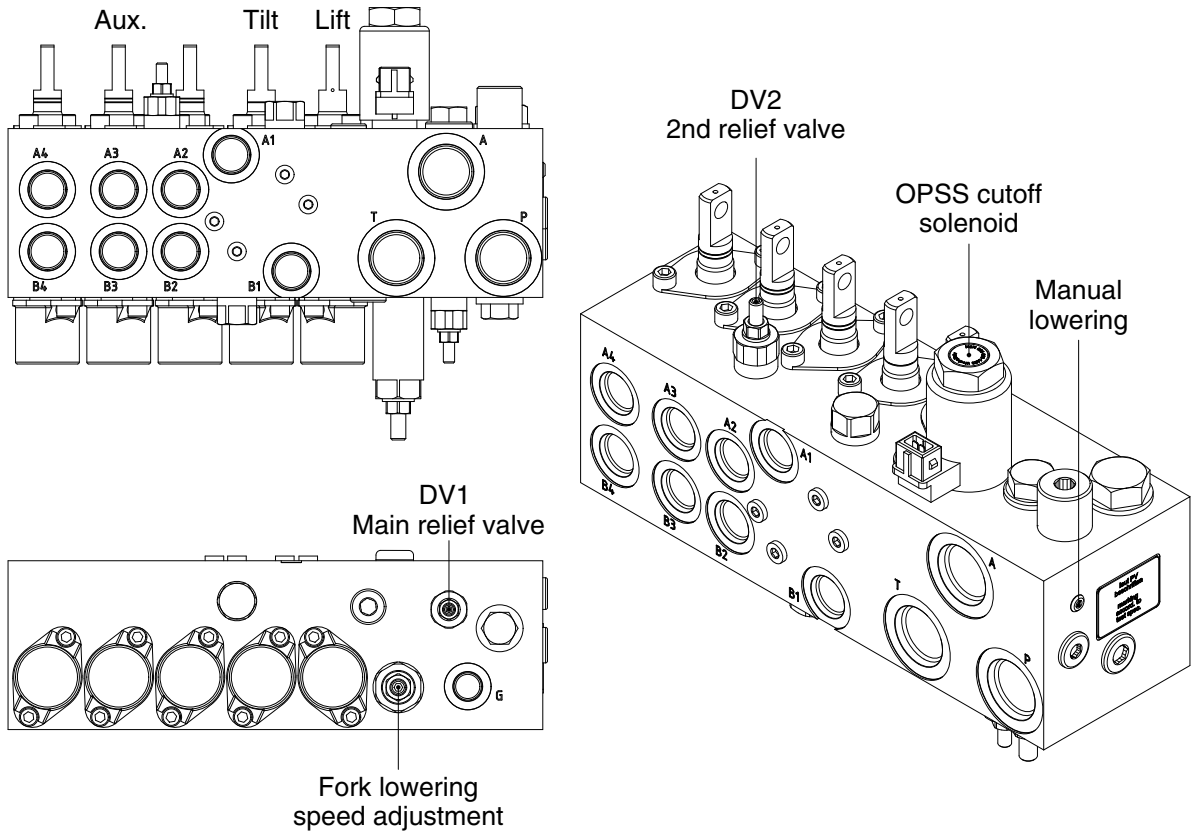
2) OPERATION

This pump is comprised of a front cover (1), 1st pump body (2), a adapter plate (6) and a 2nd pump body (7) bolted together with through bolts (56). The drive gears (3, 8) and driven gears (4, 9) are supported by bushings (11, 12) and side plates (5, 10) to give high volumetric and mechanical efficiencies.

5. MAIN CONTROL VALVE

1) STRUCTURE

(1) 5 spool



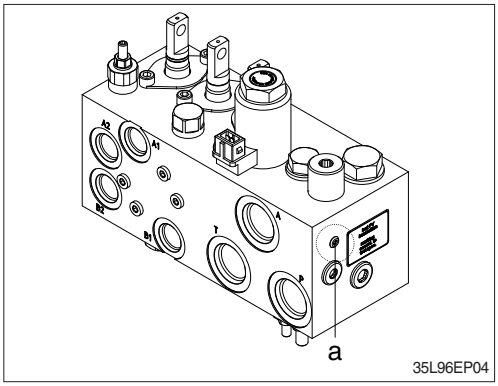
35L96HS53

Port	Port name	Port size	Tightening torque	
			kgf·m	lbf·ft
A	Lift / Lower	1-1/16-12 UN	12	86.8
A1, B1	Tilt rod / head	3/4-16 UNF	5	36.2
A-, B-	Aux 1, Aux 2, Aux 3	3/4-16 UNF	5	36.2
P	Inlet	7/8-14 UNF	7	50.6
T	Outlet	1 1/16-12 UN	12	86.8
G, LS	Gauge, Pilot	9/16-18UNF	4	28.9

2) FUNCTION

(1) Emergency fork lowering

In case that the mast can't be lowered due to a problem in the controller, activate the emergency lowering valve on the MCV assy by rotating the valve (a).



⚠ Manual override features are intended for emergency use, not for continuous-duty operation.

① Open the bonnet.

② Use the L-wrench (3 mm) to slowly undo the screw for the emergency lowering feature in an anti-clockwise direction until lowering begins.

※ Do not undo the screw more than 1.5 turns.

※ If lowering still does not begin, there is a mechanical block. Do not under any circumstances continue to unscrew the emergency lowering feature.

③ After lowering is complete, the screw must be screwed back in again

※ Do not exceed a tightening torque of maximum 0.25 kgf·m (1.81 lbf·ft).

⚠ When operating the emergency lowering valve in order to lower the mast inevitably, always make certain that any person should not stand or pass under the mast, the fork and platform so as to avoid from unexpected accident such as severe personal injury or death.

(2) **Cutoff solenoid for hydraulic blocking**

This device is a mast interlock that prevents the hydraulic functions of the MCV from being activated unless the driver is seated. In addition, it is a key lowering interlock device that prevents the fork from descending even when the ignition key is turned off. This safety function is defined in ISO 3691-1 and should not be arbitrarily disabled in the MCV.

(3) Relief valve

① Main relief valve (DV1)

The main relief valve limits the maximum pressure for the lift and tilt functions. If the lift or tilt function is operated simultaneously with the auxiliary function, the maximum pressure of the lift or tilt function is limited by the 2nd relief valve pressure setting. Typically the main relief valve would not require any field adjustment. If adjustment is necessary, refer to next page for main relief valve test and adjustment.

② 2nd relief valve (DV2)

The secondary relief valve limits the maximum pressure of the auxiliary function and is set lower than the main relief valve. Secondary relief valves may require pressure adjustment depending on the type of attachment.

※ If pressure adjustment is required, it is recommended to adjust within 90% of the main relief valve set pressure (e.g. 210 × 0.9=190 bar). If the main relief valve is too close to the set pressure, a problem of inter-circuit interference may occur. Refer next page for relief valve test and adjustment for adjustment instructions. As for the auxiliary function, up to 2 fingertip control methods and up to 3 manual control methods are provided as options.

3) RELIEF VALVE PRESSURE TEST AND ADJUSTMENT

(1) Test specification

- Engine speed : high idle rpm
- Oil temperature : 50 ± 5 ℃ (122 ± 9 ℉)
- MCV relief set pressure
  - Main : 210 ± 3 bar (3045 ± 43 psi)
  - 2nd : 140 ± 3 bar (2030 ± 43 psi)
- Tools : spanner 10 mm, hex. wrench 3 mm

⚠ In general, the main relief valve (DV1) should not be adjusted for boosting applications in the field. Increasing the main relief valve pressure above the specified set pressure can damage the equipment.

⚠ Inspect the relief valve in a safe and clean environment.

⚠ Make sure that there is no other person around the equipment during operation and testing.

⚠ Even after turning off the engine, hydraulic oil may remain in the hydraulic system. To prevent personal injury, lower the fork completely down to the ground. (The mast chain has to be released loosely so that the fork is completely lowered.)

⚠ Before disassembling, tightening, removing, or adjusting piping components (hoses, fittings, plugs, etc.), be sure to turn off the engine. Completely remove the pressure inside the circuit by moving the MCV control lever two or three times in the forward and backward direction. Also opening the hydraulic tank cap and remove the pressure. (If the hydraulic tank breather filter is clogged, the pressure in the tank may remain.)

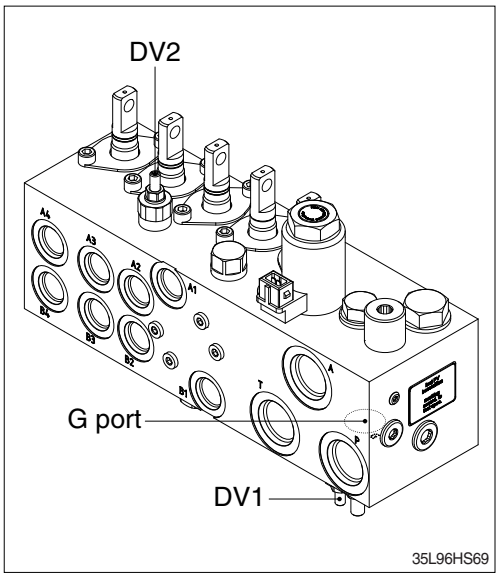
⚠ **Hot hydraulic oil can cause serious burns to skin. Do not touch hydraulic components or oil during test. Make sure hydraulic oil has cooled to safe temperature before installing or removing test equipment.**

⚠ **Hydraulic oil under pressure can be injected into skin. Lower forks to ground and relieve all circuit pressure before removing test plugs from valve.**

① Operate hydraulic system until the oil temperature is within test specification. See Hydraulic WarmUp Procedure.
② Lower the fork to the ground, stop the engine, and apply the parking brake switch.
③ Open the bonnet
④ Connect a pressure gauge to the “G” pressure check port on the MCV.
⑤ Operate engine at test specifications.
⑥ Pull the lift lever to raise the fork all the way and hold it.
⑦ Check pressure gauge reading. Compare the readings and specifications.
⑧ Loosen the MCV relief valve locknut (10 mm) and turn the adjusting (3 mm) screw to adjust the pressure.
- Tightening torque : 0.25 kgf·m (1.81 lbf·ft)
- If pressure is lower than specification, turn relief valve adjusting screw clockwise.
- If the pressure is higher than the specification, turn the adjusting screw counterclockwise.

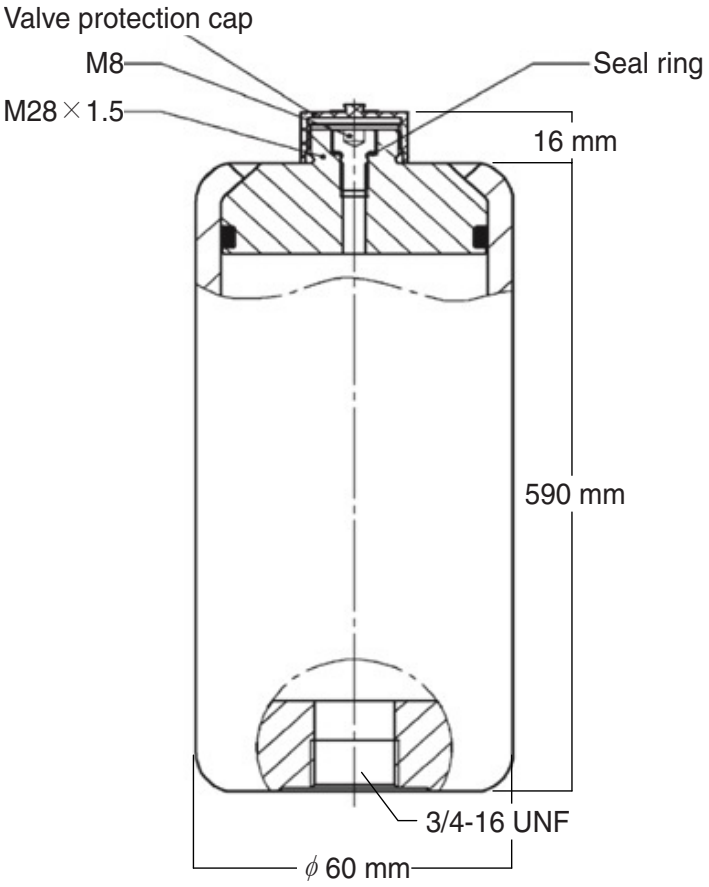
⚠ **The MCV relief valve adjustment screw is very sensitive. Operate in 1/4 turn increments to avoid system overpressure.**

⑨ Repeat step ⑦, ⑧. If pressure is to specifications, remove test equipment.



6. MAST ACCUMULATOR

1) STRUCTURE



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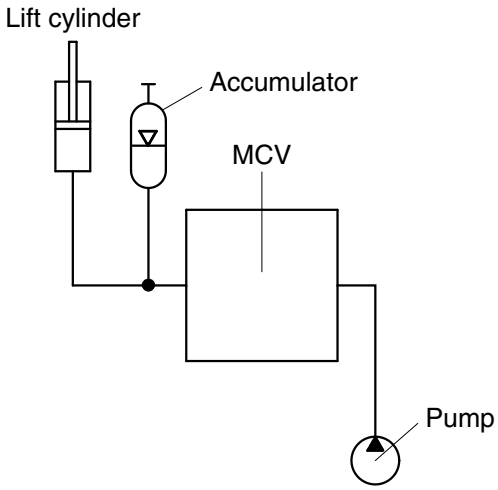


35D9VB6HS59

Parts No.	Normal volume	Pre-charging pressure at 20 ℃ (68 ℉)	Gas	Weight
31HK-70060	1 ℓ (0.26 U.S. gal)	10 bar (145 psi)	Nitrogen gas N_2	4. 8 kg (10.6 lb)

※ Max. working pressure : 280 bar (4000 psi), shell, rod material : carbon steel

※ Permitted operating temperature : -20 ~ +80 ℃ (-4 ~ +176 ℉), seal material : NBR/PUR

The mast accumulator is installed in the hydraulic line of the lift cylinder to absorb fork vibration and reduce hydraulic pulsation, which acts as a shock absorber to reduce vibration that may occur when climbing slopes or driving on rough road surfaces. This helps to prevent damage to fragile items such as glass or ceramics (porcelain) by ensuring the stability of the truck. In addition, when applied to hydraulic attachments (e.g. paper roll clamps, carton clamps, etc.), it can be configured and utilized to help reduce damage to the load through "prevent slipping of loads".

※ The accumulator works effectively under light and heavy loads. The higher the load, the smaller the absorption effect.

※ Compared with the case without the accumulator, this device can repeat overrun and underrun for a certain period of time when the fork stops. The phenomenon is slightly different depending on the load conditions, so please understand its characteristics before operation.

2) PRE-CHARGE PRESSURE

The accumulator is supplied pre-charged with nitrogen gas. The pre-fill pressure provided is indicated on the label of the accumulator shell or engraved on the surface of the top shell of the accumulator. A gas valve connection terminal is provided on the top of the accumulator to adjust the filling pressure (depending on the load or workplace conditions) as needed.

· First, it can be adjusted in the range of 6 ~ 50 bar (87 ~ 725 psi), and more can be adjusted.

· Based on temperature of 20 ℃ (68 ℉), charging is prohibited under high temperature conditions.

3) MAINTENANCE

⚠ **Under no circumstances should the piston accumulator be welded, soldered or mechanically repaired.**

(1) Normal checks

The basic maintenance instructions for the piston type mast accumulator are as follows. To maintain trouble-free operation, it is recommended to perform the following maintenance procedures regularly.

· Check that the connection is tihgt and there are no oil or gas leaks.

· Check the fastening parts.

· Accumulator pre-charge pressure test

(2) Checking for oil leakage into the gas side

Hydraulic oil in the accumulator may leak to the gas side through the piston seal. Check this in the following way. In this case, there is oil leakage on the gas side, so replace the accumulator.

· If a higher filling pressure than the previous test is found.

· When oil or oil mist comes out when loosening the M8 screw with a 6 mm hex. wrench.

※ **If there is oil leakage inside the accumulator, it is recommended not to repair it and replace the parts.**

· The supplied HYDAC SK280 piston accumulator is a non-repairable sealed product.

· It is an economical product with excellent durability and non-repairable structure, optimizing size and weight to reduce costs.

(3) Pre-charge pressure testing and frequency

※ **Check the charging pressure of the accumulator after completely draining the hydraulic oil from the lift cylinder line. If the cylinder line is not fully evacuated, the gas filling pressure may look different. Also, when disconnecting the accumulator connection piping, the pressure oil in the cylinder line must be discharged first.**

It t is recommended to check the filling pressure as follows.

· Initial 250 hour or 6 weeks

· Once 2000 hours or every year.

If there is no significant gas loss during the initial inspection, check 2000 hours.

※ **if the truck continues to run in harsh workplace (or high operating temperature) conditions, it should be tested more often.**

4) GAS RELEASE AND CHARGING

(1) Release

① Loosen the plastic cap and loosen the M8 screw tightly locked to the gas valve connection on the top of the accumulator with a 6 mm hex. wrench and lock it again.

② Connect FPU to the accumulator gas vlave.

※ **Release valve (D) be sure to connect while locked.**

③ Open the accumulator valve (counterclockwise) with the spindle of the FPU and check the gas.

④ Open the release valve of FPU slowly (counter-clockwise) and blow out nitrogen gas until the set pressure is confirmed. Pressure is measured at room temperature around 20 ℃ (68 ℉).

⑤ When the set pressure is reached, close the release valve (clockwise) and close the accumulator valve with the spindle.

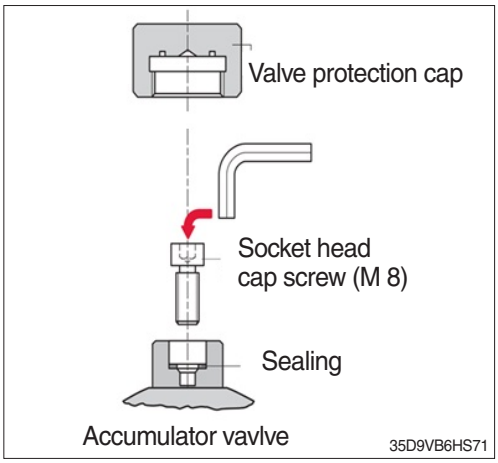
⑥ Wait 5-10 minutes for the filled nitrogen gas pressure to stabilize, then recheck the set pressure and adjust if necessary.

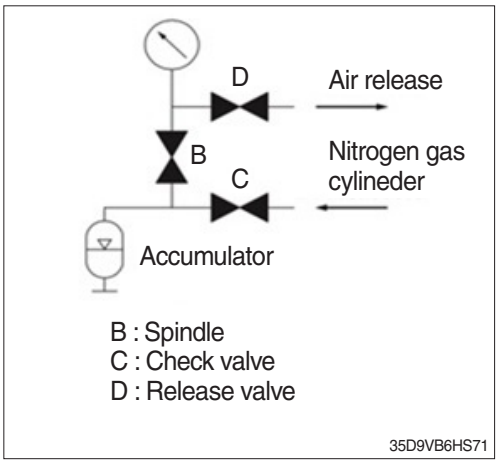
⑦ Open the release valve and blow out gas in the FPU.

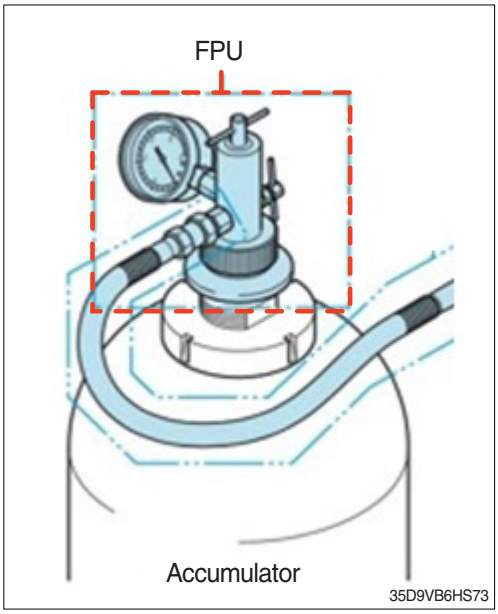
※ **If there is gas in the charging hose and FPU, it cannot be separated, and it is very dangerous if it is forcibly separated. Be sure to separate the charging hose and after blowing out the gas inside the FPU.**

⑧ Separate the FPU from the accumulator.

⑨ Tighten the M8 screw on the top of the accumulator to 2.0 kgf·m (15 lbf·ft) and tighten the plastic cap by hand.







(2) Charging

※ **The filling kit operation method was prepared based on HYDAC product standards.**

※ **Accumulator gas pressure adjustment and charging kit must be purchased separately.**

※ **To recharge nitrogen gas, it is convenient to use the HYDAC FPU-1 unit.**

⚠ **Must be filled with clean nitrogen gas only. Never use oxygen or air. Explosion hazard. Basically, nitrogen must use a minimum class 4.0. (99,99 %, filtering < 3 µm)**

① Connect the charging hose to the nitrogen gas cylinder and FPU. Be sure to connect the release valve while it is closed. The release valve has a structure that lengthens when locked and decreases when released.

② Loosen the plastic cap and loosen the M8 screw tightly locked to the gas valve connection on the top of the accumulator with a 6 mm hex. wrench and lightly lock it again.

③ Connect FPU to the accumulator.

④ Using the spindle of FPU, open the M8 screw on the top of the accumulator. (counterclockwise)

⑤ Slowly open the valve of the nitrogen gas cylinder and check the pressure of the gas injected into the accumulator.

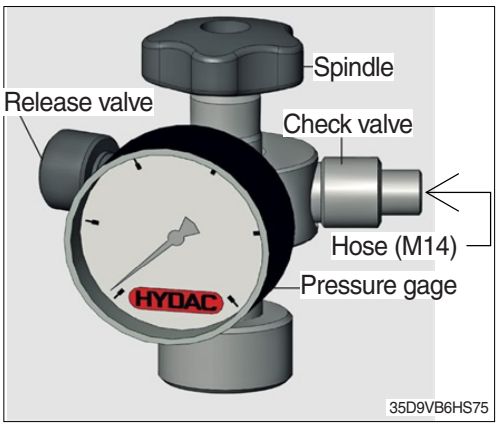
⑥ When filling is complete, close the gas valve of the accumulator using the valve of the nitrogen gas cylinder and the spindle of the FPU.

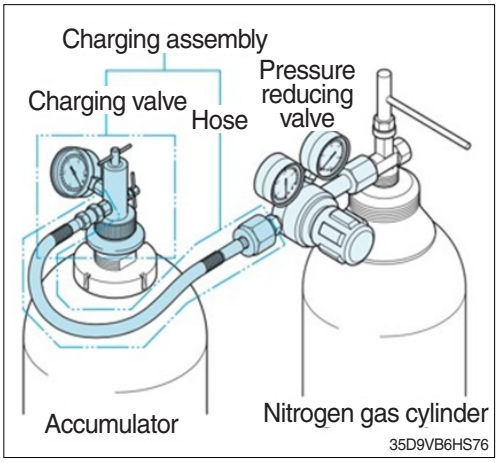
※ **When adding nitrogen to the accumulator filled with nitrogen gas, wait 5-10 minutes for the temperature and pressure of the gas mixture to stabilize, then check the pressure again and adjust if necessary.**

⑦ Open the release valve of FPU to remove nitrogen from the charging hose and FPU.

⑧ Using the spindle of FPU, open the accumulator valve, check the gauge, and adjust the release valve to blow out the accumulator nitrogen to the desired pressure.

⑨ When the desired pressure is reached, close the release valve of the FPU and close the gas valve of the accumulator using the spindle.



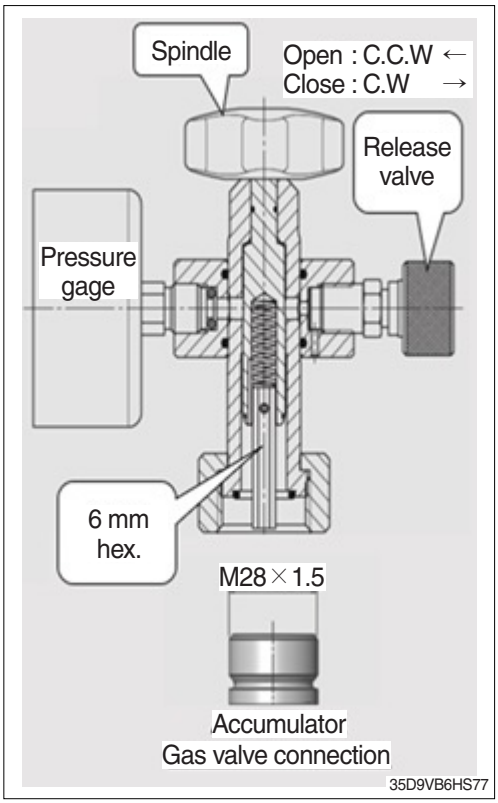


⑩ Open the release valve and blow out nitrogen gas in the FPU.

※ **If there is gas in the charging hose and FPU, it cannot be separated, and it is very dangerous if it is forcibly separated. Be sure to separate the charging hose and after blowing out the gas inside the FPU.**

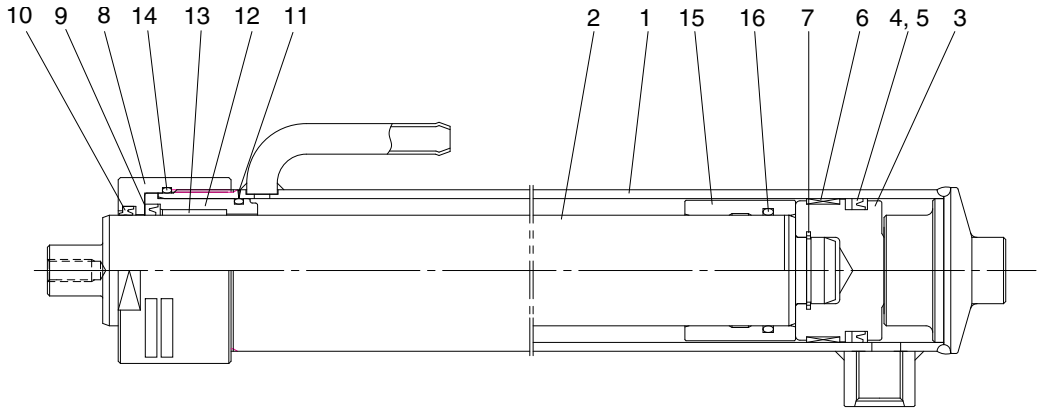
⑪ Remove the FPU from the accumulator.

⑫ Tighten the M8 screw on the top of the accumulator to 2.0 kgf·m (15 lbf·ft) and tighten the plastic cap by hand.



7. LIFT CYLINDER

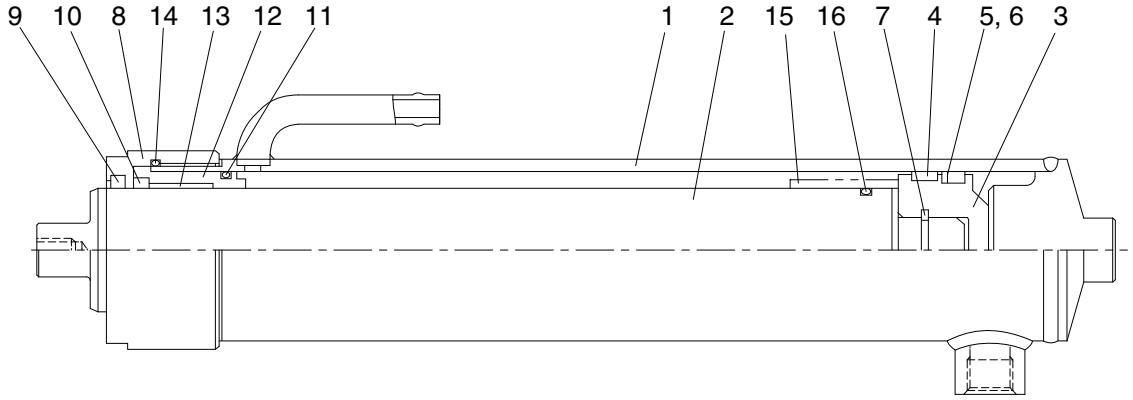
1) V MAST (35/45D-9VB)



35D9FHS125

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

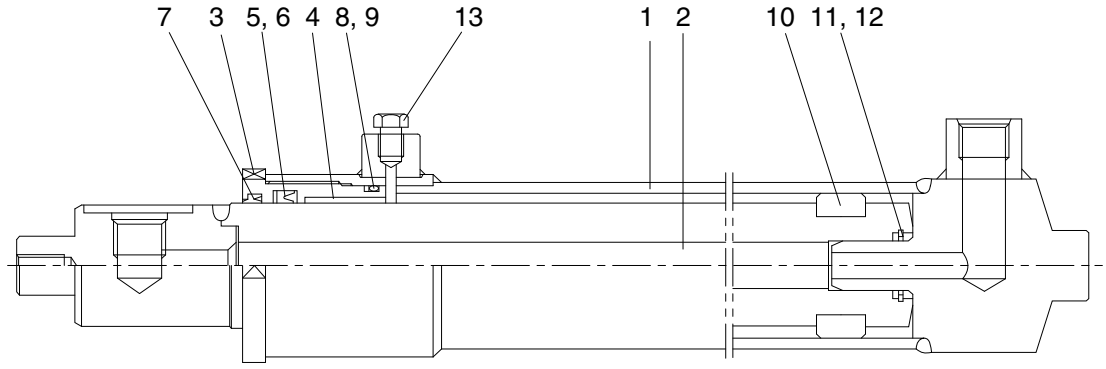
2) V MAST (50DN-9VB)



35D9FHS126

1	Tube assy	7	Stop ring	13	DU busing
2	Rod	8	Rod cover	14	O-ring
3	Piston	9	Dust wiper	15	Spacer
4	Wear ring	10	U-packing	16	O-ring
5	U-packing	11	O-ring		
6	Back up ring	12	Stopper		

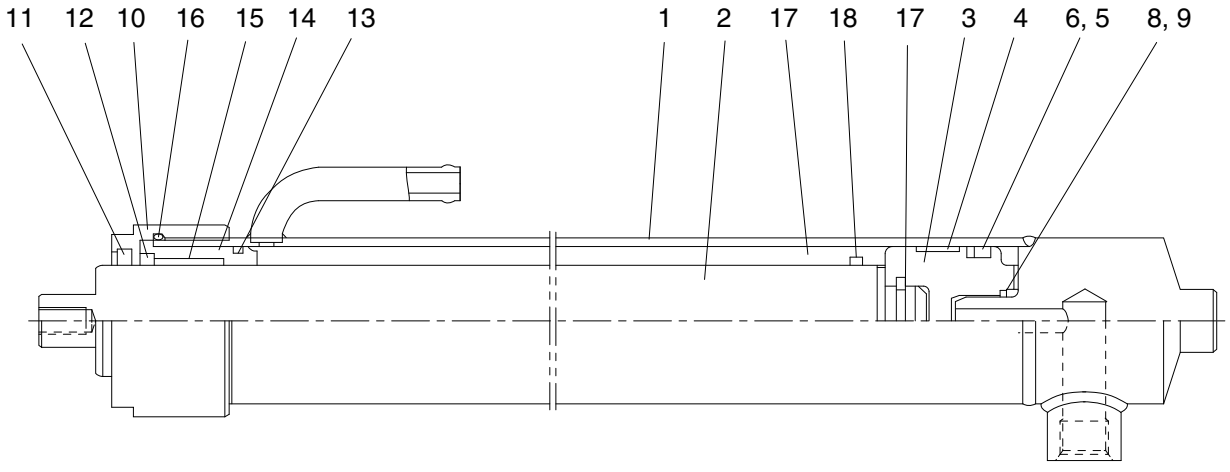
3) VF MAST



35D9FHS127

1	Tube assembly	6	Back up ring	11	Cushion seal
2	Rod assy	7	Dust wiper	12	Retaining ring
3	Rod cover	8	O-ring	13	Bleeder
4	Rod bushing	9	Back up ring		
5	U-packing	10	Piston ring		

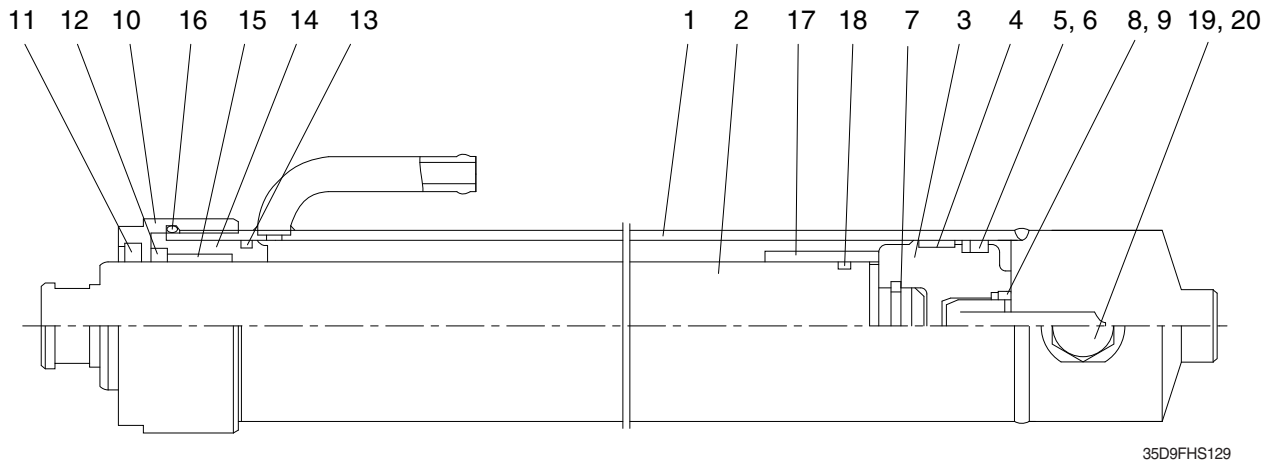
4) TF MAST (35/45D-9VB)



35D9FHS128

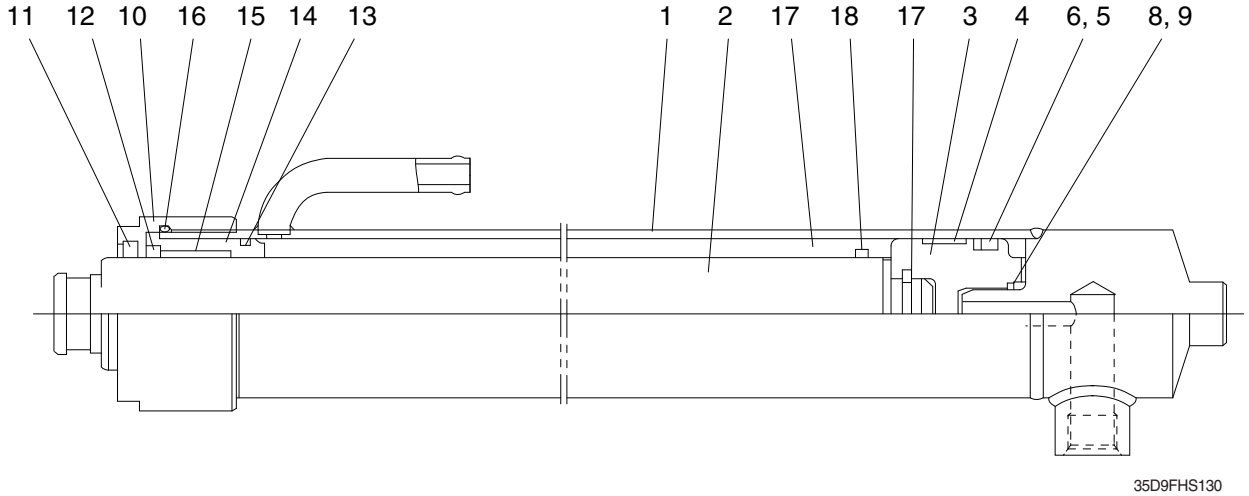
1	Tube assembly	7	Stop ring	13	O-ring
2	Rod	8	Cushion seal	14	Stopper
3	Piston	9	Retaining ring	15	Rod bushing
4	Wear ring	10	Rod cover	16	O-ring
5	U-packing	11	Dust wiper	17	Spacer
6	Back up ring	12	U-packing	18	O-ring

5) TF AND TS-MAST (50DN-9VB)



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

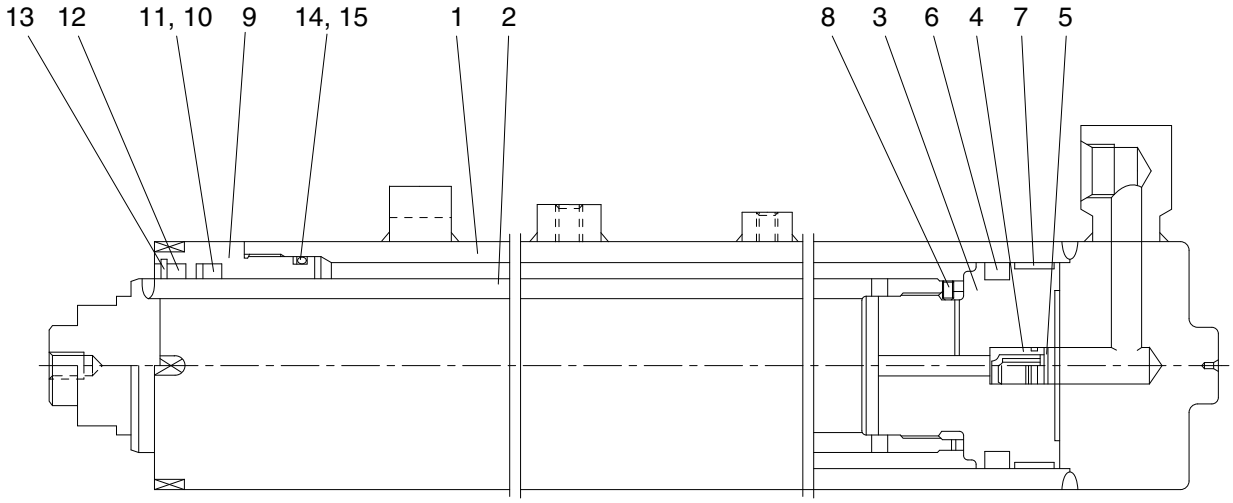
6) TS MAST (35/45D-9VB)



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

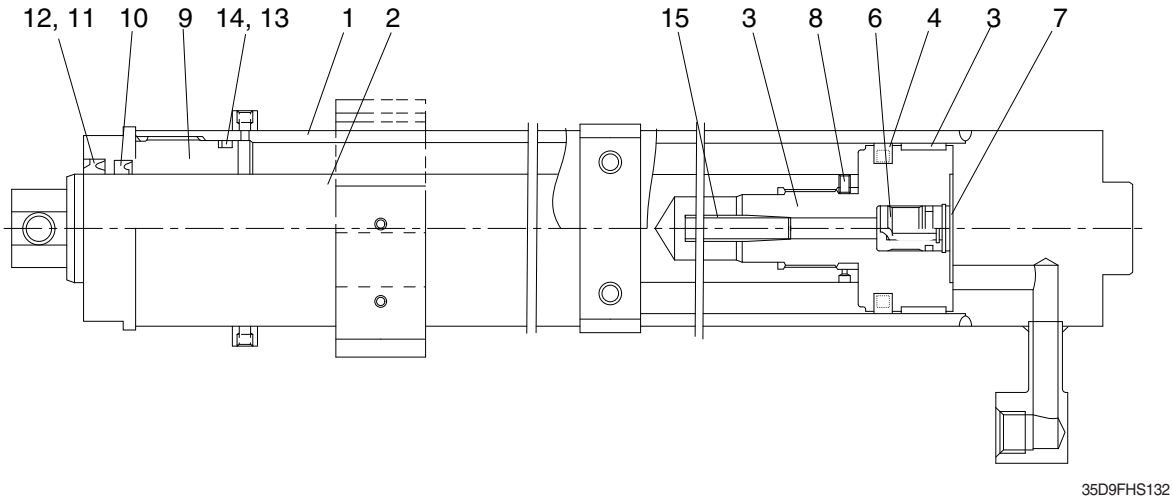
8. FREE LIFT CYLINDER

1) VF AND TF MAST (35/45D-9VB)



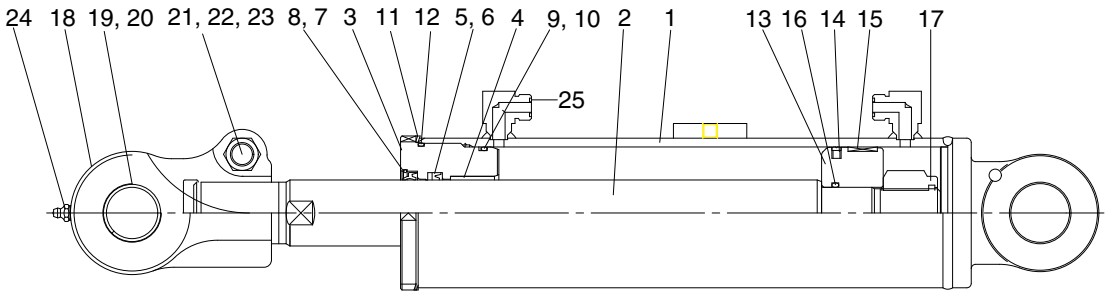
1	Tube assembly	6	Piston seal	11	Back up ring
2	Rod assembly	7	Wear ring	12	Dust wiper
3	Piston	8	Set screw	13	Retaining ring
4	Check valve	9	Rod cover	14	O-ring
5	Retaining ring	10	U-packing	15	Back up ring

2) TS MAST



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

9. TILT CYLINDER



35D9FHS133

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

1. OPERATIONAL CHECKS

1) CHECK ITEM

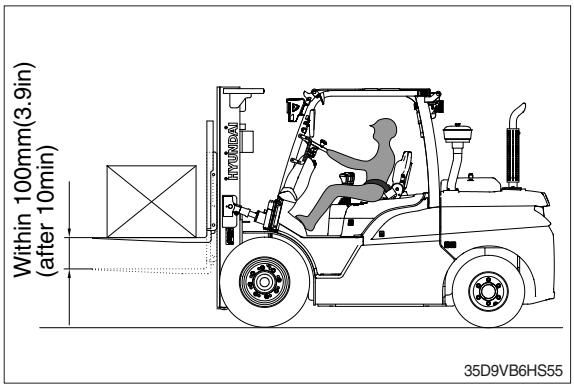
(1) Check visually for deformation, cracks or damage of rod.

(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 °

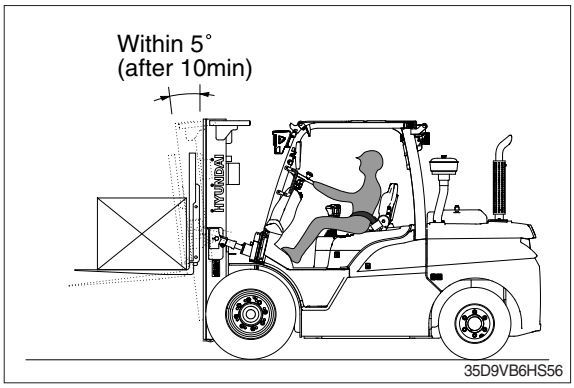
If the hydraulic drift is more than the specified value, replace the control valve or cylinder packing.



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

mm (in)

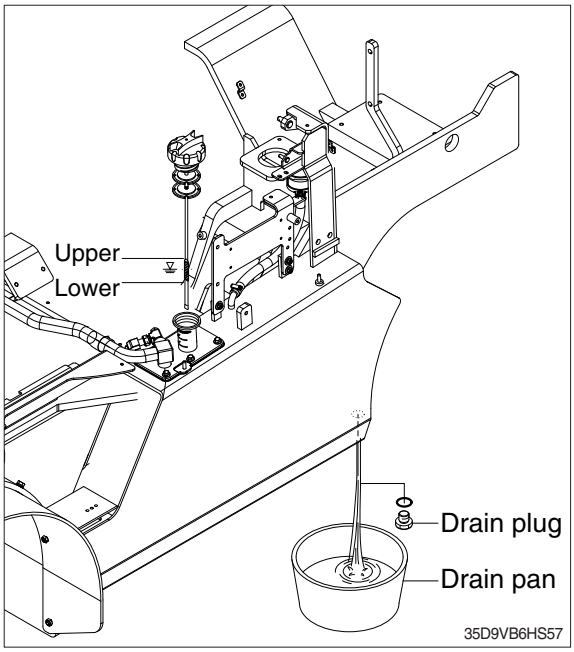
Standard	Under 0.6 (0.02)



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 bar.
(3050 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 CF engine oil. · Adjust roll to rail clearance. · Replace spool or valve body. · Replace spool or valve body.
Hydraulic system makes abnormal sounds	· Excessive restriction of oil flow pump suction side. · Gear or bearing in hydraulic pump defective.	· Clean filter. · Replace gear or bearing.
Control valve lever is locked	· Foreign matter jammed between spool and valve body. · Valve body defective.	· Clean. · Tighten body mounting bolts uniformly.
High oil temperature	· Lack of hydraulic oil. · High oil viscosity. · Oil filter clogged.	· Add oil. · Change to SAE10W, class CF engine oil. · Clean filter.

Problem	Cause	Remedy
Actuator (cylinder or motor) works slowly or does not operate.	· Shortage of oil in oil tank. · Decrease of relief valve pressure. · Spool got stuck. · Shortage of oil flow to the valve.	· 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.	· Internal leakage of cylinder happens frequently. · Excessive leakage from spool of the valve. · Spool got stuck. · Leakage in a part of the circuit.	· 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.	· Defect of relief valve. · Leakage in a part of the circuit.	· Check the relief valve. · Check the circuit. · Observe leakage from pipes.
Temperature rising of the hydraulic oil.	· 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.	· 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.	· Defect of steering relief valve.	· Check the steering relief valve.

2) MAIN PUMP

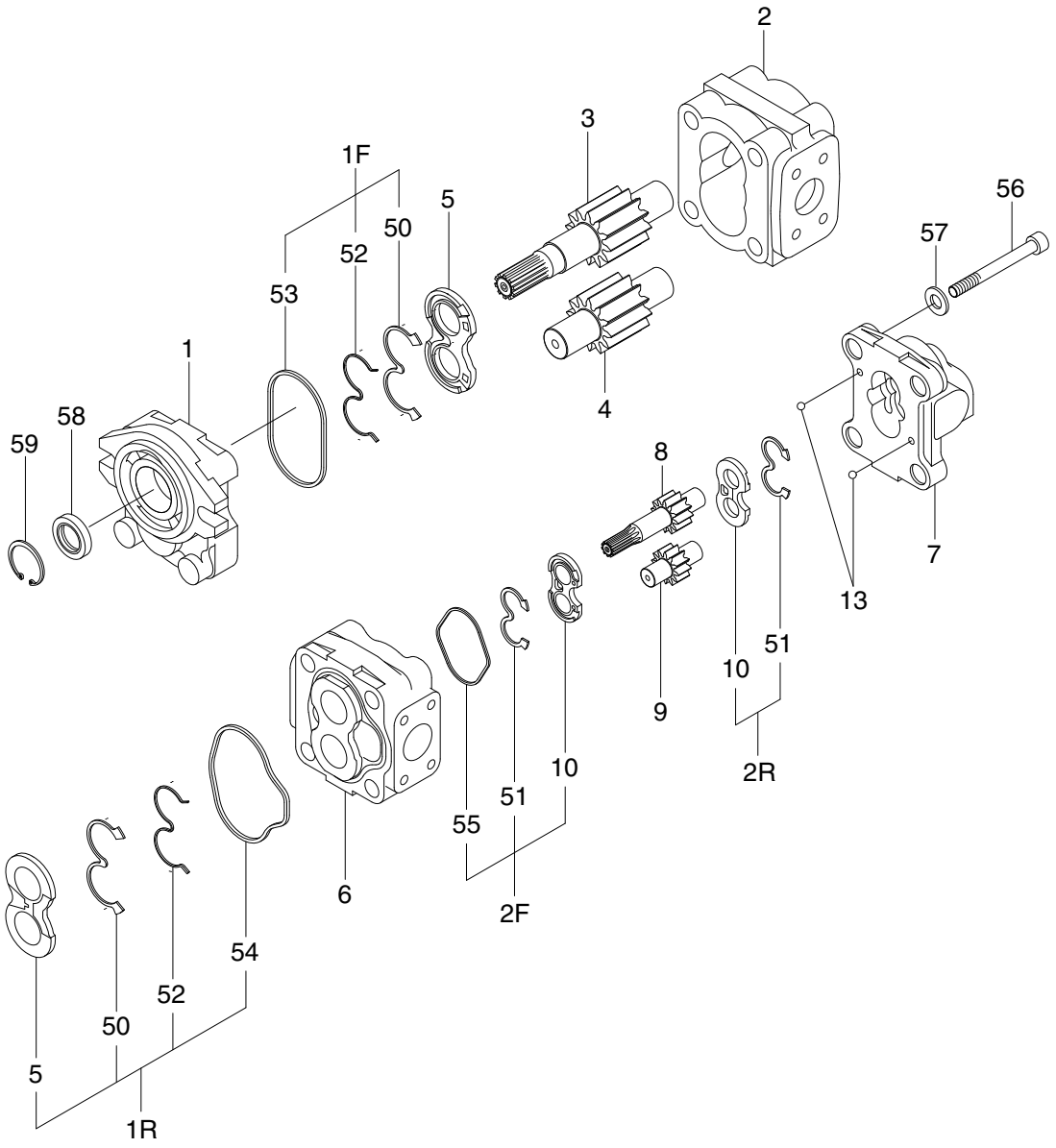
Problem	Cause	Remedy
Unusual noises No or insufficient flow	· Insufficient air bleeding of the hydraulic system.	· Fill the axial pump, suction line for the hydraulic pump and the oil tank. · Completely air bleed the pump and hydraulic system. · Inspect and correct or replace. - Installation position
	· Insufficient suction conditions - Viscosity of the hydraulic fluid too high - Suction pressure too low - Impermissible filter in the suction line - Foreign particles in the suction line	· Optimize inlet conditions. - Use suitable hydraulic fluid. - Fill the suction line with hydraulic fluid. - Remove foreign particles from the suction line.
	· Improper mounting of the axial piston pump	· Inspect and correct the mounting of the pump. - Observe tightening torques.
	· Improper mounting of assembled parts (hydraulic lines)	· Mount assembled parts according to the information provided.
	· Pump control valve vibration	· Optimize the adjustment of the axial pump and the pressure limitation in the hydraulic system.
	· Mechanical damage to the main pump (e.g. bearing damage)	· Inspect and correct or replace.
No or insufficient flow	· Faulty mechanical drive (e.g. defective coupling & spline) · Hydraulic fluid not in optimal viscosity range	· Inspect and correct or replace. · Check temperature range and use suitable hydraulic fluid.
No or insufficient pressure	· Insufficient pilot pressure or control pressure · Output actuator defective (e.g. hydraulic cylinder)	· Check pilot pressure or control pressure. Inspect and correct. · Inspect and correct.
Pressure Flow fluctuations Instabilities	· Malfunction of the control device of the axial pump · Wear or mechanical damage to the axial pump · Unstable control signal	· Inspect and correct. · Inspect and correct or replace. · Inspect and correct.
Increased, unusual vibration	· Bearings worn	· Inspect and correct or replace.
Excessively high temperature of hydraulic fluid and housing	· Wrong setting or malfunction in the pressure relief and pressure control valves e.g.) - high pressure relief valve - pressure cut-off - pressure controller · Axial pump worn	· Optimize the adjustment of the pressure limitation and pressure control valves of the axial pump and the pressure safeguarding in the hydraulic system. · Inspect and correct. · Inspect and correct or replace.

3) 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 (low noise)



35D9HS14-2

1	Front cover	9	Driven gear	53	Gasket
2	Body	10	Side plate	54	Gasket
3	Drive gear	11	Bushing	55	Gasket
4	Driven gear	12	Bushing	56	Socket bolt
5	Side plate	13	Steel ball	57	Washer
6	Adapter plate	50	Gasket (3 shaped)	58	Oil seal
7	Body	51	Gasket (3 shaped)	59	Retainer ring
8	Drive gear	52	Back up ring		

2) DISASSEMBLY AND ASSEMBLY

(1) Safety precautions

※ The installation, piping, maintenance disassembling, inspection, etc. of this product are requsted to be executed by the workers who have technical knowledge, or under the instruction of such workers.

※ For detaching, interrupt the operation of system including this product and detach it for the piping and equipment after the temperature on the surface of product has been cooled down completely (approx 40 ˚C or less).
Otherwise, there is a danger of an oil leak or getting burned.

※ When the reassembled product fails to recover its performance, do not attempt to use it.
If it is used forcibly, the equipment or system may be broken.

※ When disaposing the product, discharge the oil and dispose, it as an industrial waste.

※ To use the product safely, be sure to relevant laws regarding safety.

※ Hyundai can not guarantee the performance if the pump is disassembled.

(2) Disassembly

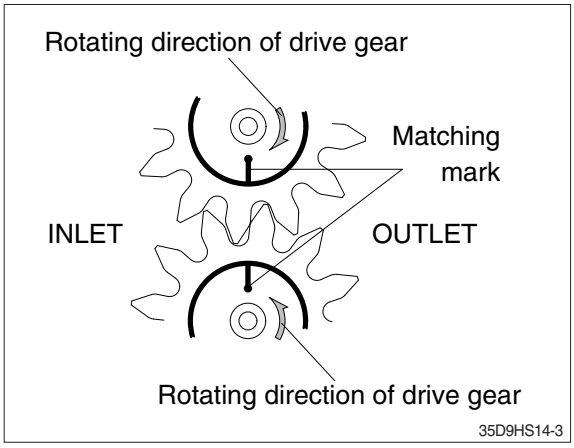
① Fix the mounting parts of front cover with the body side up to the vice.

② Mark on the joints between the front cover (1) and 1st body (2), 1st body (2) and adapter plate (6), adapter plate (6) and 2nd body (7) before disassembling.

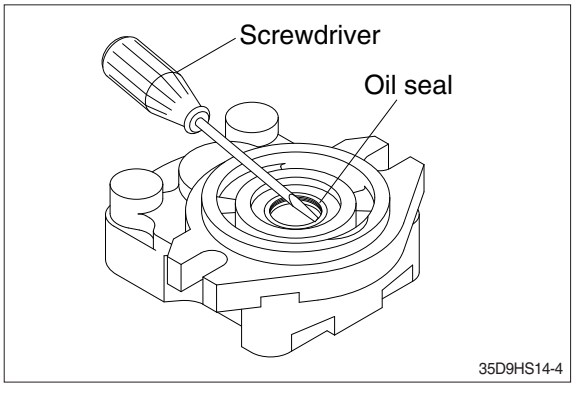
③ Remove the four bolts (56) and disassemble the parts (item 7 → 6 → 2).
Please see the instructions below.

④ Mark on the shaft ends of the body side.

⑤ Since the pair of side plates (5, 10), 3-shape gaskets (50, 51) and back-ups (52) are assembled in different directions, put the tag on each pair to distinguish where the part is used for. (They are shown as "F" and "R" in the structure drawing.)



⑥ After removing the C-shape retaining ring, apply the end of screwdriver, etc. to the inner side of oil seal to detach.



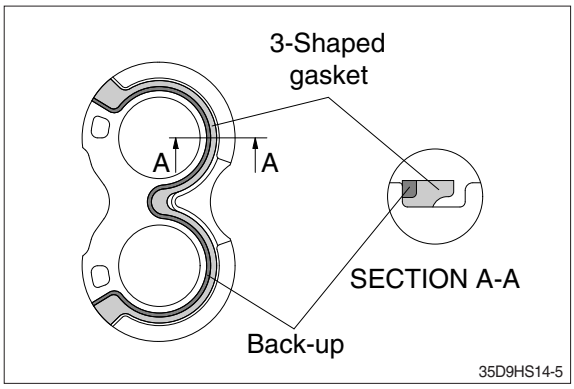
(3) Assembly

① Replace these items (50, 51, 52, 53, 54, 55, 58, 59) with new ones.

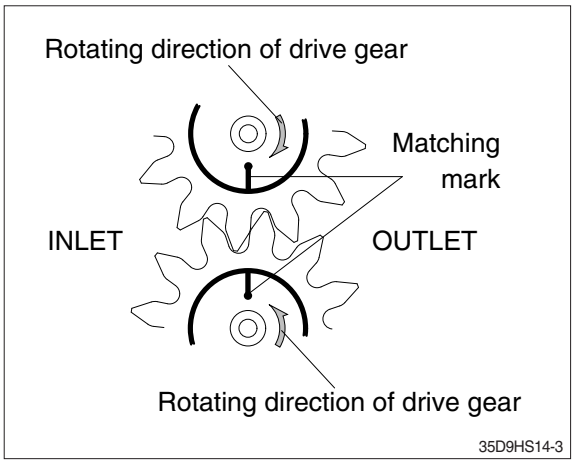
② Clean each part to remove dust before reassembling.

③ Reassemble the parts in order except for oil seal, retaining ring and bolts.

· Fix the 3-shaped gasket (50, 51) and back-up (52) to the side plate (5, 10) by using grease to prevent them from being twisted or caughts.



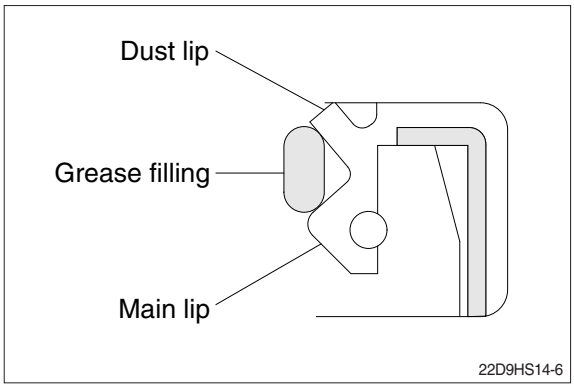
· Fix the drive gear and driven gear by matching each mark.



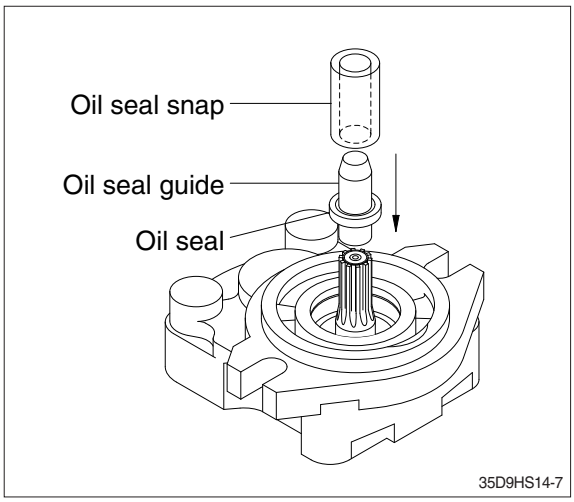
④ Tighten 4 bolts evenly by 13.3~14.3 kgf·m (96.2~103 lbf·ft) torque.

⑤ Invert the assembled pump to make the front cover up and fix the 2nd body to the vice.

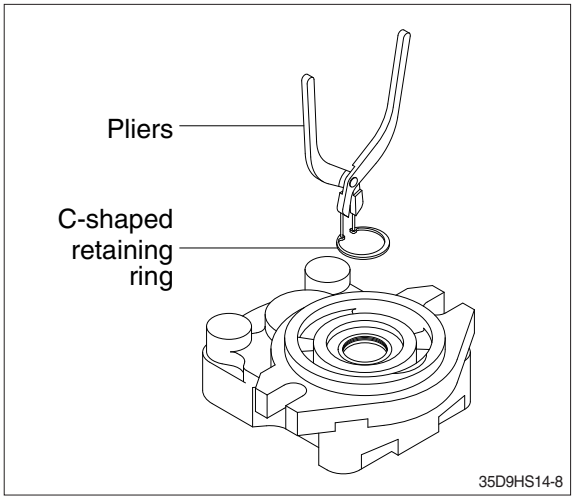
⑥ Fill the dent between the main lip and dust lip of oil seal with grease.



⑦ Fill the oil seal into the hole by using a oil seal guide and oil seal snap.

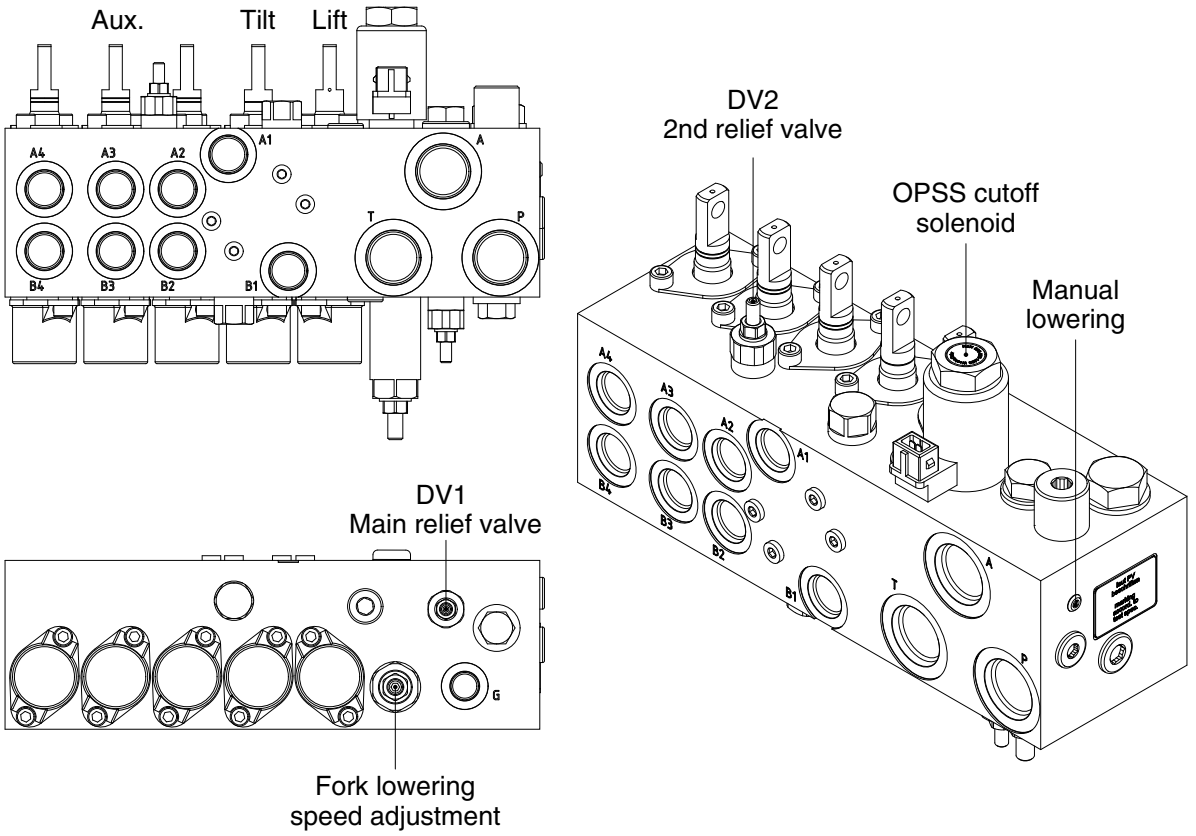


⑧ Attach the C-shaped retaining ring for hole.



2. MAIN CONTROL VALVE

1) STRUCTURE



35L96HS52

2) DISASSEMBLY AND ASSEMBLY

(1) Cutoff solenoid

※ The pictures is for reference only and the The pictures is for reference only and the actual MCV shape may be different. actual MCV shape may be different.

① Park the forklift safely and full lower the forkcarriage.

② Operate the lever in the engine off (key ON) state to discharge the pressure oil in the MCV.

③ Open the bonnet. Loosen nut of the cutoff solenoid and remove coil from the check valve.

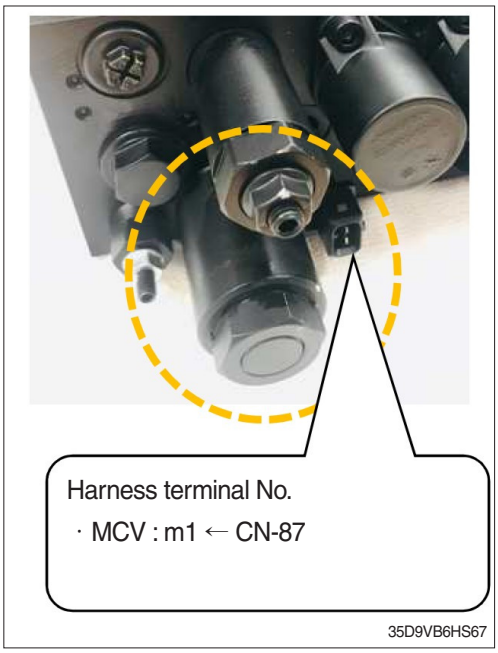
④ Clean the check valve and valve block so that opened valve block cannot become contaminated.

⑤ Loosen the check valve with spanner 17 mm (0.7 in). Apply a light coat of hydraulic oil to the o-rings of the new check valve and insert a new check valve and screw in tightly.

· Tightening torque : 4 kgf·m (28.9 lbf·ft)

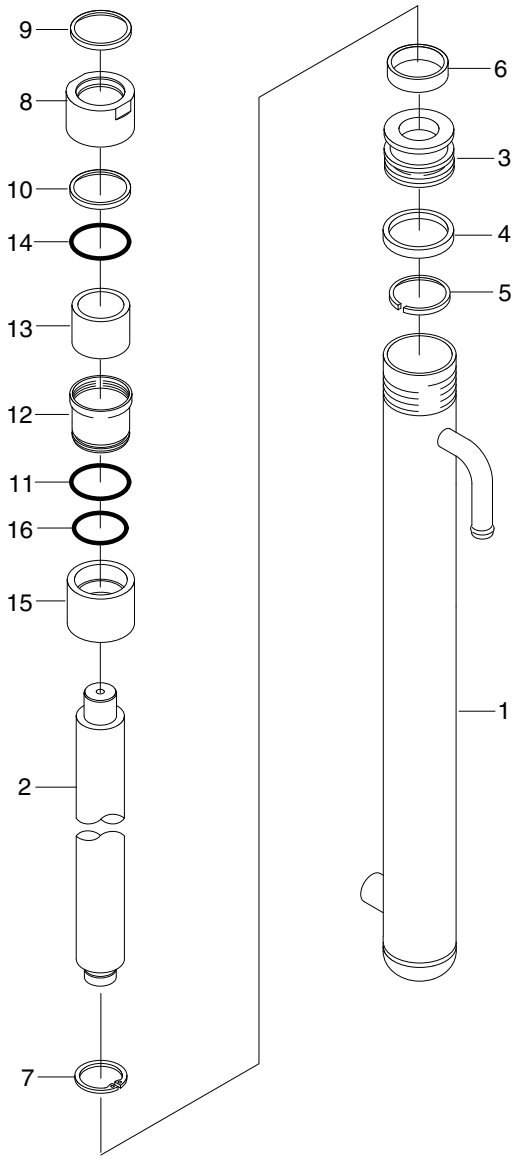
⑥ Refit the solenoid coil according to the direction and tighten with the o-ring side of the nut facing the coil.

· Tightening torque : 0.7 kgf·m (5.1 lbf·ft)



4. LIFT CYLINDER

1) STRUCTURE



D357HS19

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

※ Parts list is based on the 35/45D-9VB

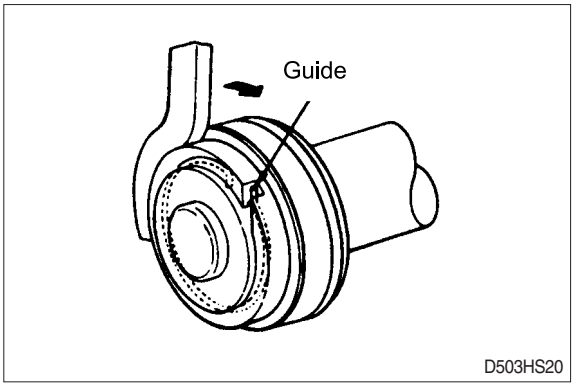
· **Specification (standard)**

Unit : mm (inch)

Model	I.D	O.D	Stroke	Rod O.D
35/45D-9VB (V300)	65 (2.6)	73 (2.9)	1485 (58.5)	50 (2.0)
50DN-9VB (V290)	70 (2.8)	82 (3.2)	1435 (56.5)	55 (2.2)

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.



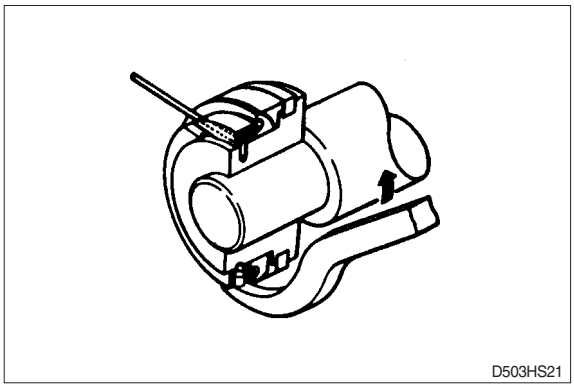
3) CHECK AND INSPECTION

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

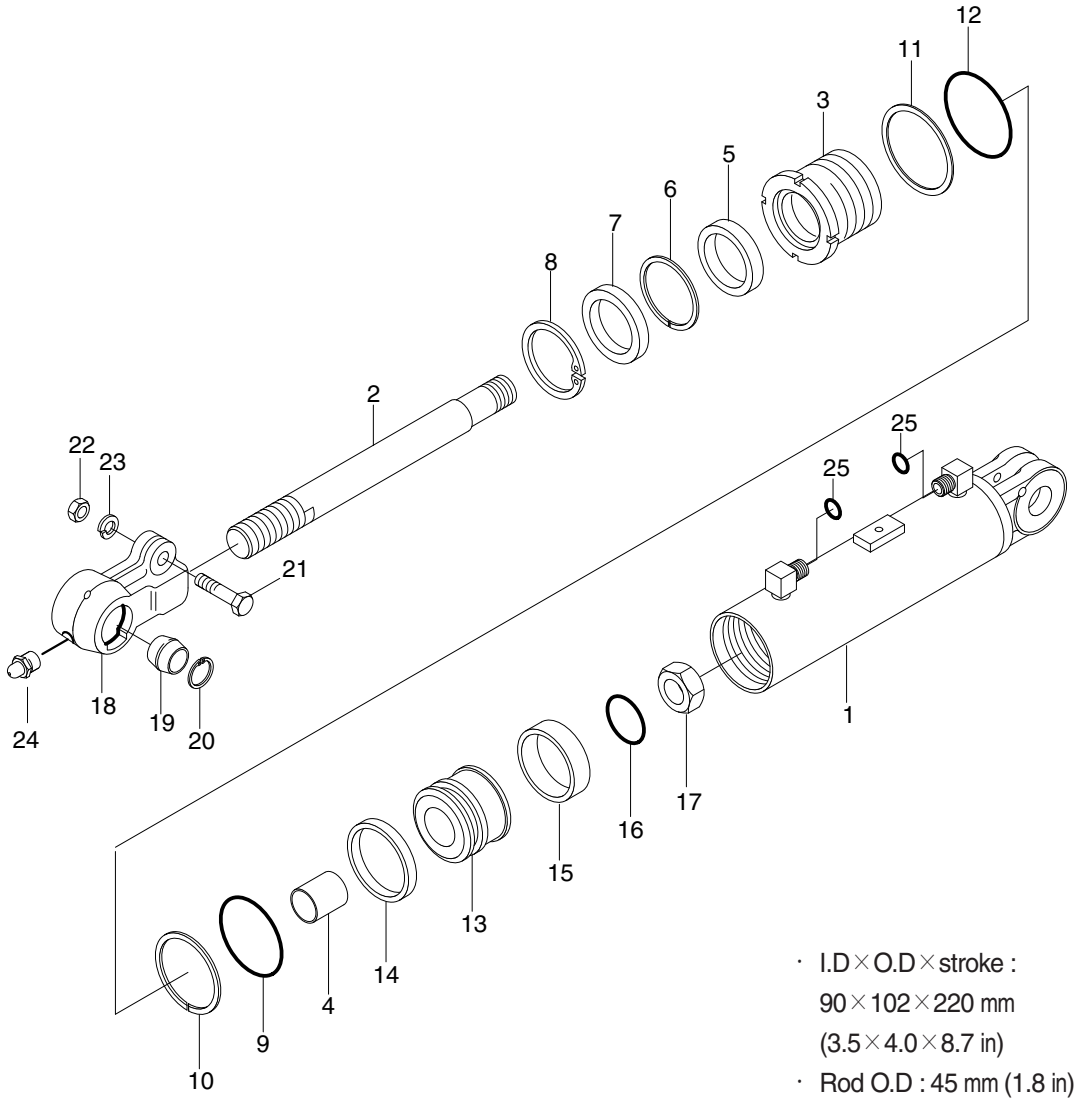
4) ASSEMBLY

(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.



5. TILT CYLINDER

1) STRUCTURE



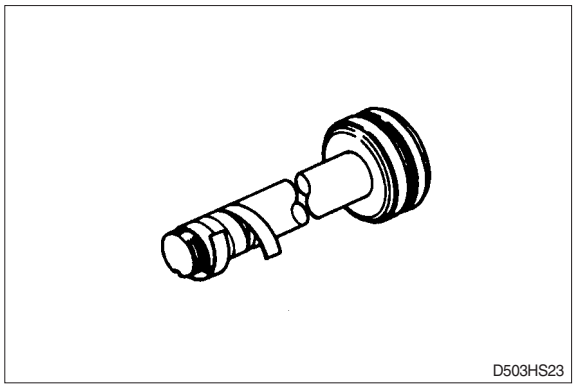
· I.D × O.D × stroke :
90 × 102 × 220 mm
(3.5 × 4.0 × 8.7 in)
· Rod O.D : 45 mm (1.8 in)

35D9FHS16

1	Tube assy	10	Back up ring	19	Spherical bearing
2	Rod	11	Lock washer	20	Retaining ring
3	Rod cover	12	O-ring	21	Hexagon bolt
4	Rod bushing	13	Piston	22	Hexagon nut
5	U-packing	14	Piston seal	23	Spring washer
6	Back up ring	15	Wear ring	24	Grease nipple
7	Dust wiper	16	O-ring	25	O-ring
8	Stop ring	17	Nylon nut		
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.



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