SECTION 6 HYDRAULIC SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC SYSTEM OUTLINE

The hydraulic system consists of a main 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) MAIN PUMP

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

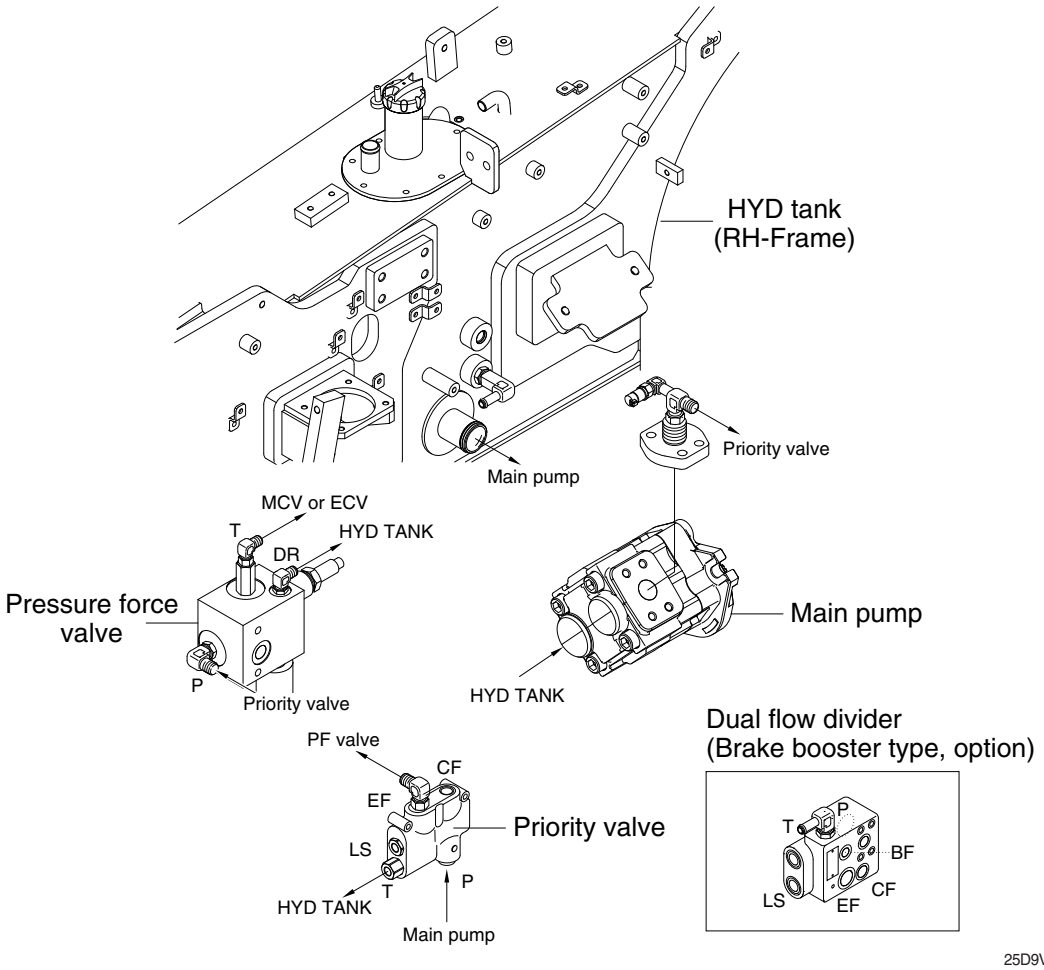
2) MCV OR ECV

· Lift function, Tilt function, Auxiliary function (Sideshift etc.), Fingertip controller (ECV)

3) HYDRAULIC OIL TANK

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

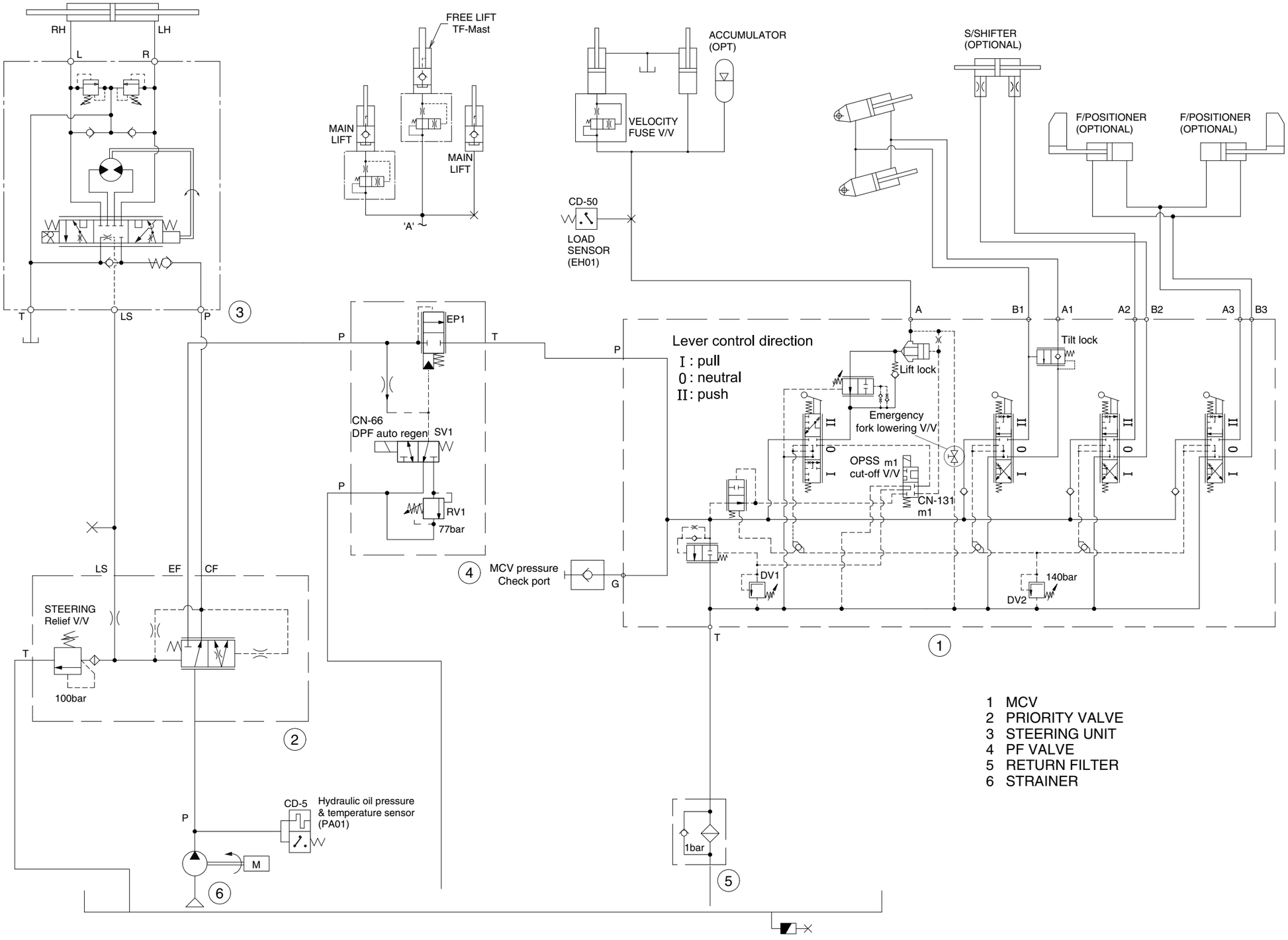
4) PRESSURE FORCED VALVE



25D9V6HS01A

2. HYDRAULIC CIRCUIT

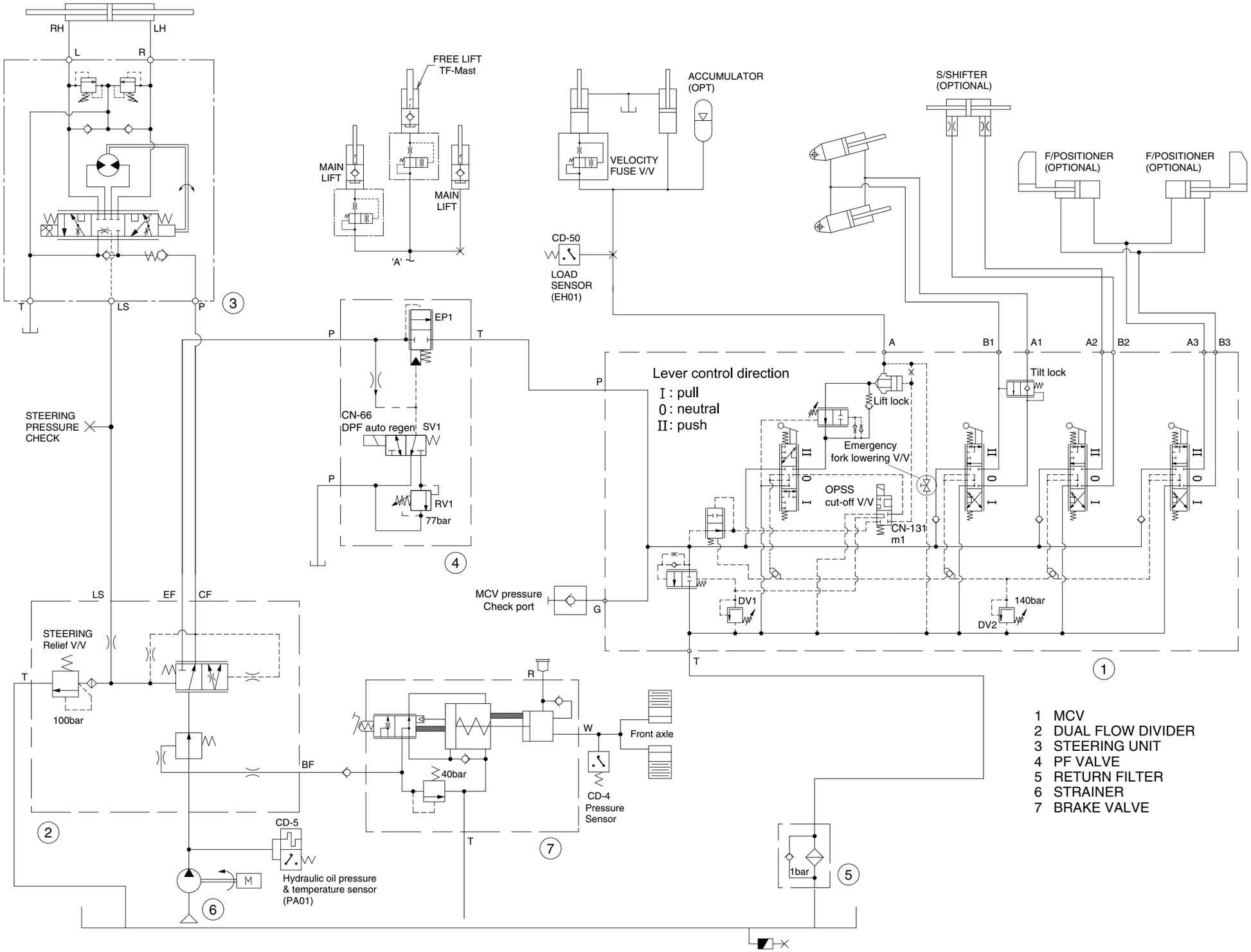
1) NON-BOOSTER BRAKE TYPE



1 MCV
2 PRIORITY VALVE
3 STEERING UNIT
4 PF VALVE
5 RETURN FILTER
6 STRAINER

33HN-06010-00

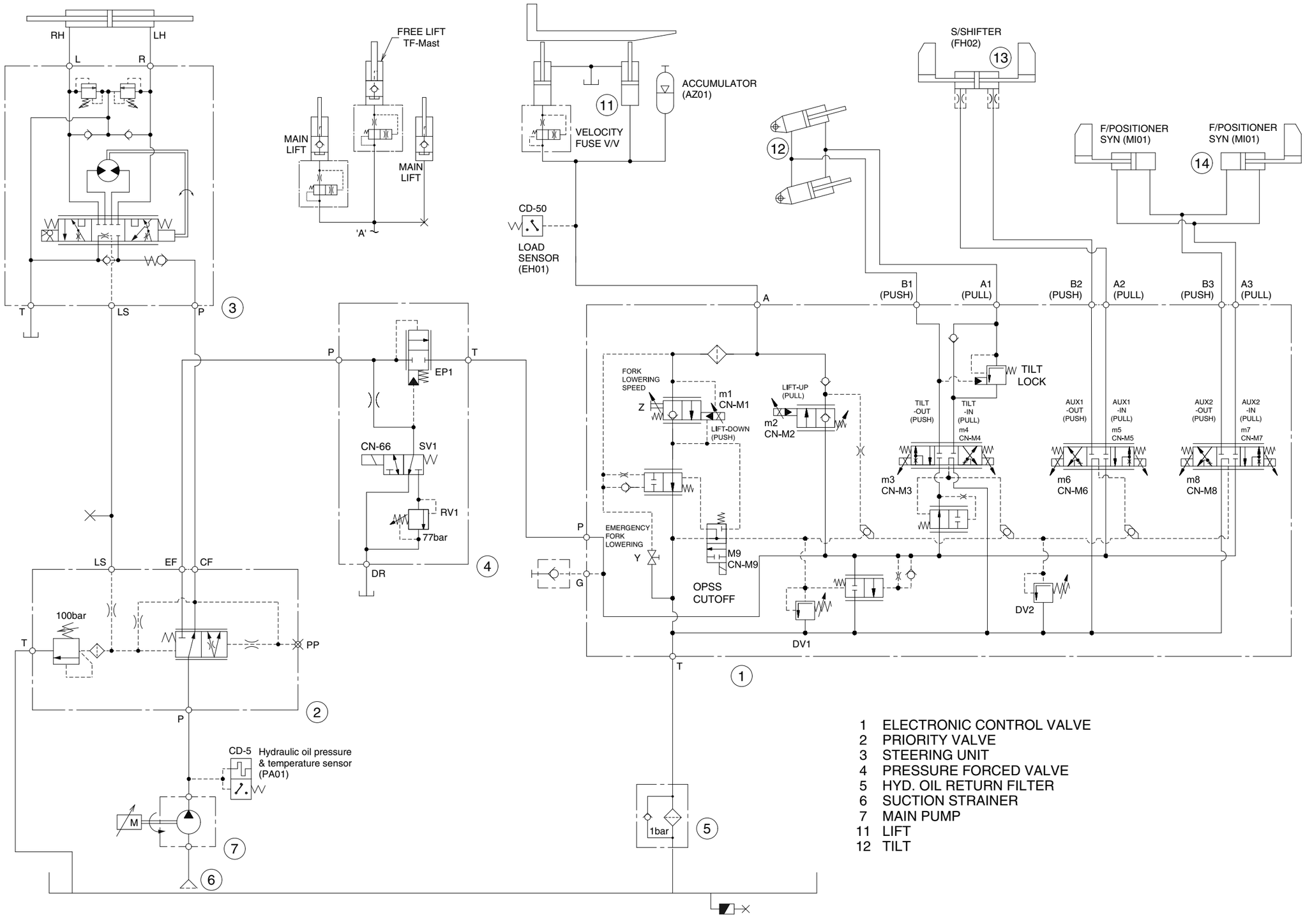
2) BOOSTER BRAKE TYPE (OPTION)



1 MCV
2 DUAL FLOW DIVIDER
3 STEERING UNIT
4 PF VALVE
5 RETURN FILTER
6 STRAINER
7 BRAKE VALVE

33HN-06110-00

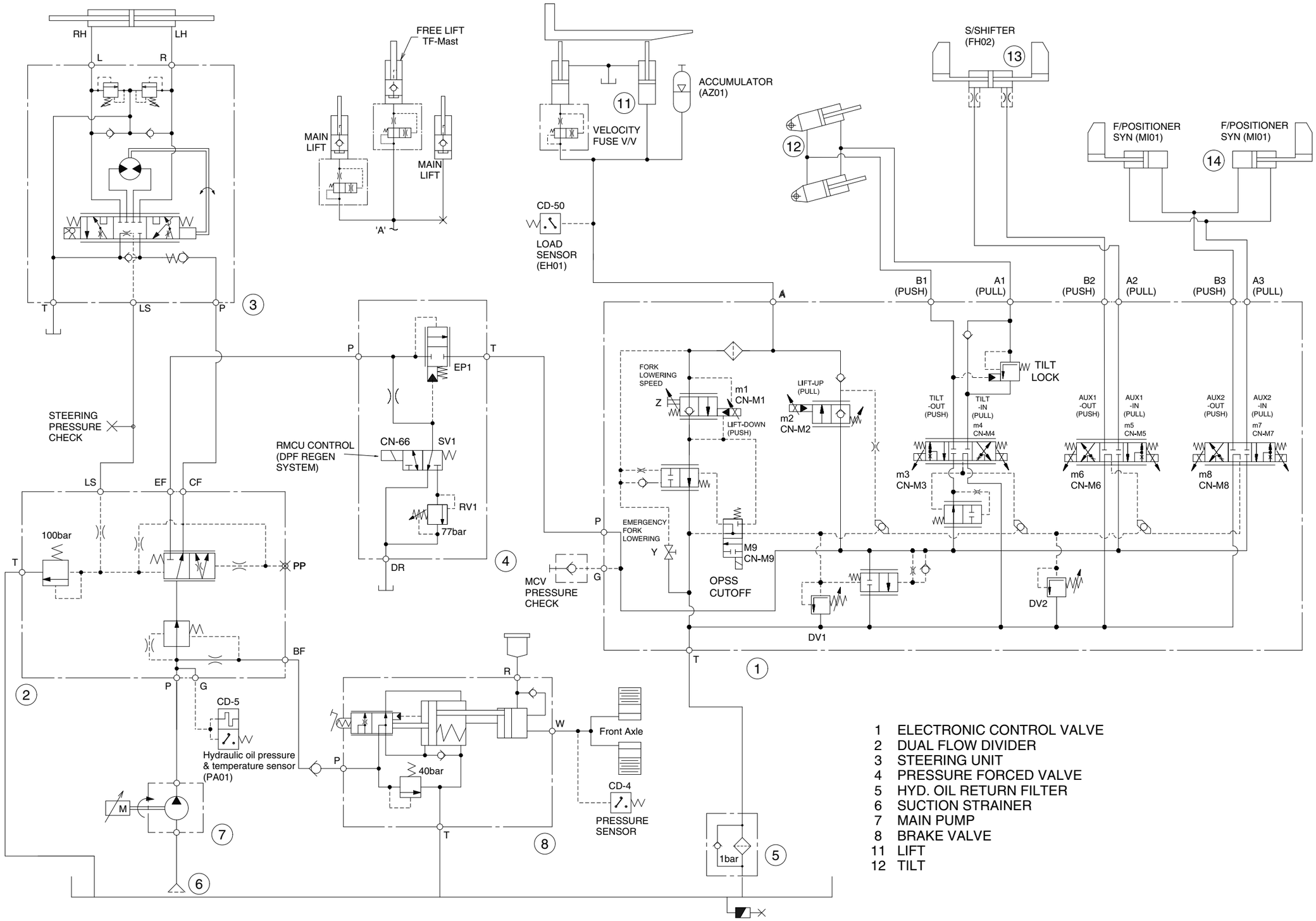
3) FINGERTIP, NON-BOOSTER BRAKE TYPE (OPTION)



1 ELECTRONIC CONTROL VALVE
2 PRIORITY VALVE
3 STEERING UNIT
4 PRESSURE FORCED VALVE
5 HYD. OIL RETURN FILTER
6 SUCTION STRAINER
7 MAIN PUMP
11 LIFT
12 TILT

33HN-06020-00

4) FINGERTIP, BOOSTER BRAKE TYPE (OPTION)

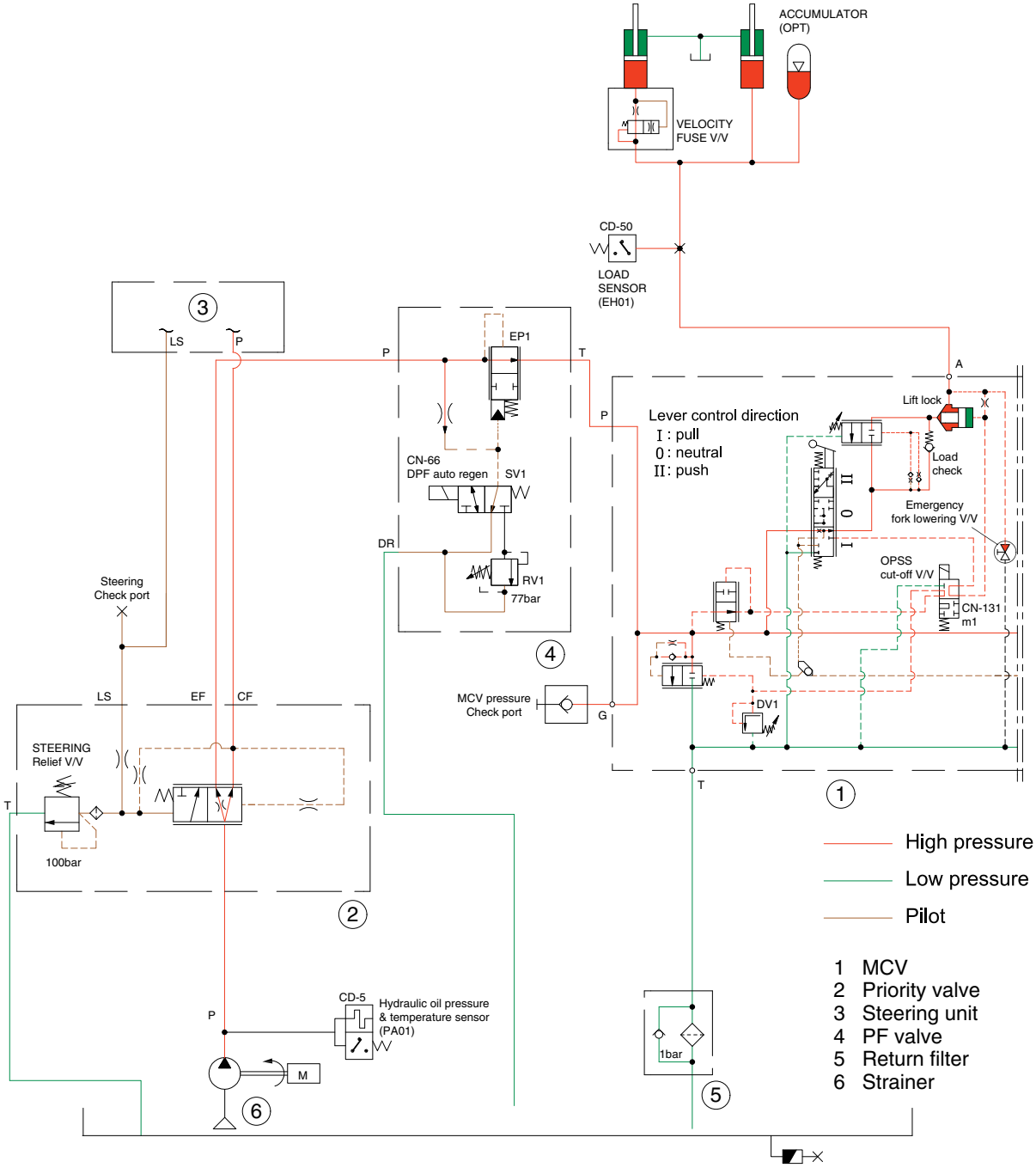


1 ELECTRONIC CONTROL VALVE
2 DUAL FLOW DIVIDER
3 STEERING UNIT
4 PRESSURE FORCED VALVE
5 HYD. OIL RETURN FILTER
6 SUCTION STRAINER
7 MAIN PUMP
8 BRAKE VALVE
11 LIFT
12 TILT

33HN-06120-00

3. WORK EQUIPMENT HYDRAULIC CIRCUIT

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

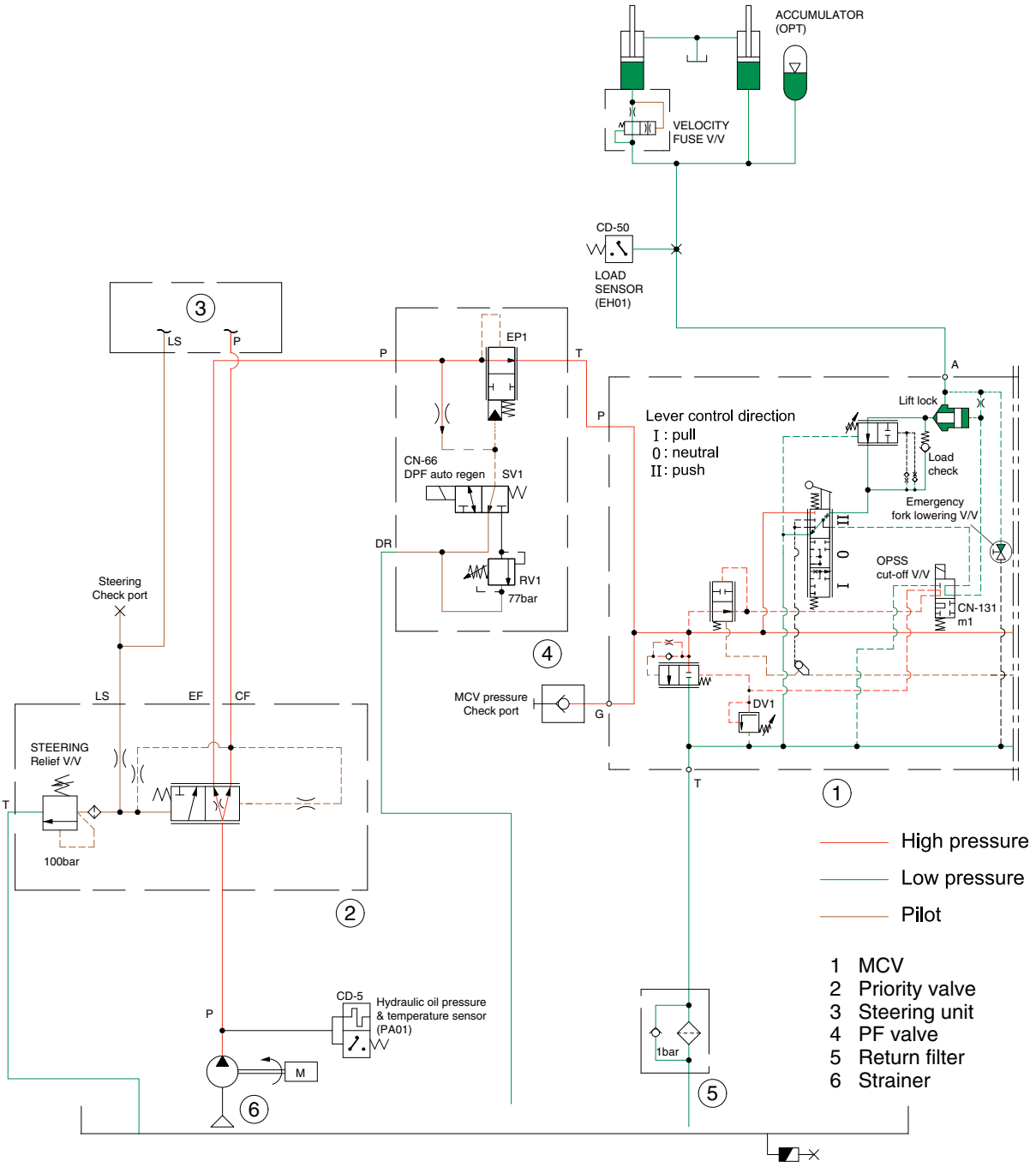


25D9V6HS02

When the lift control lever is pulled back, the spool in the first block is moves to lift position.
The oil from the pump flows into main control valve (1) through the priority valve (2). 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

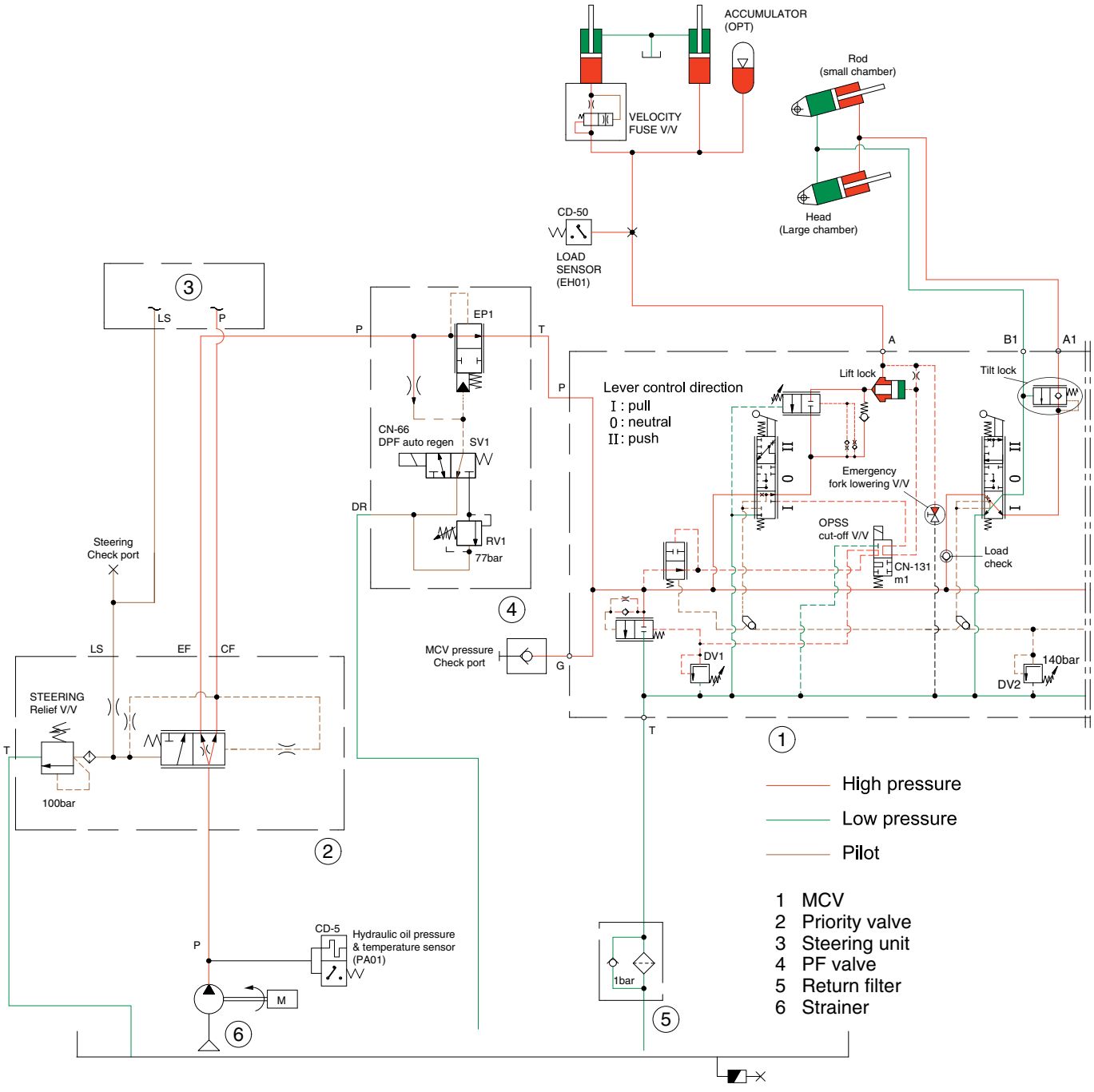


25D9V6HS03

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 BACKWARD POSITION



25D9V6HS04

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

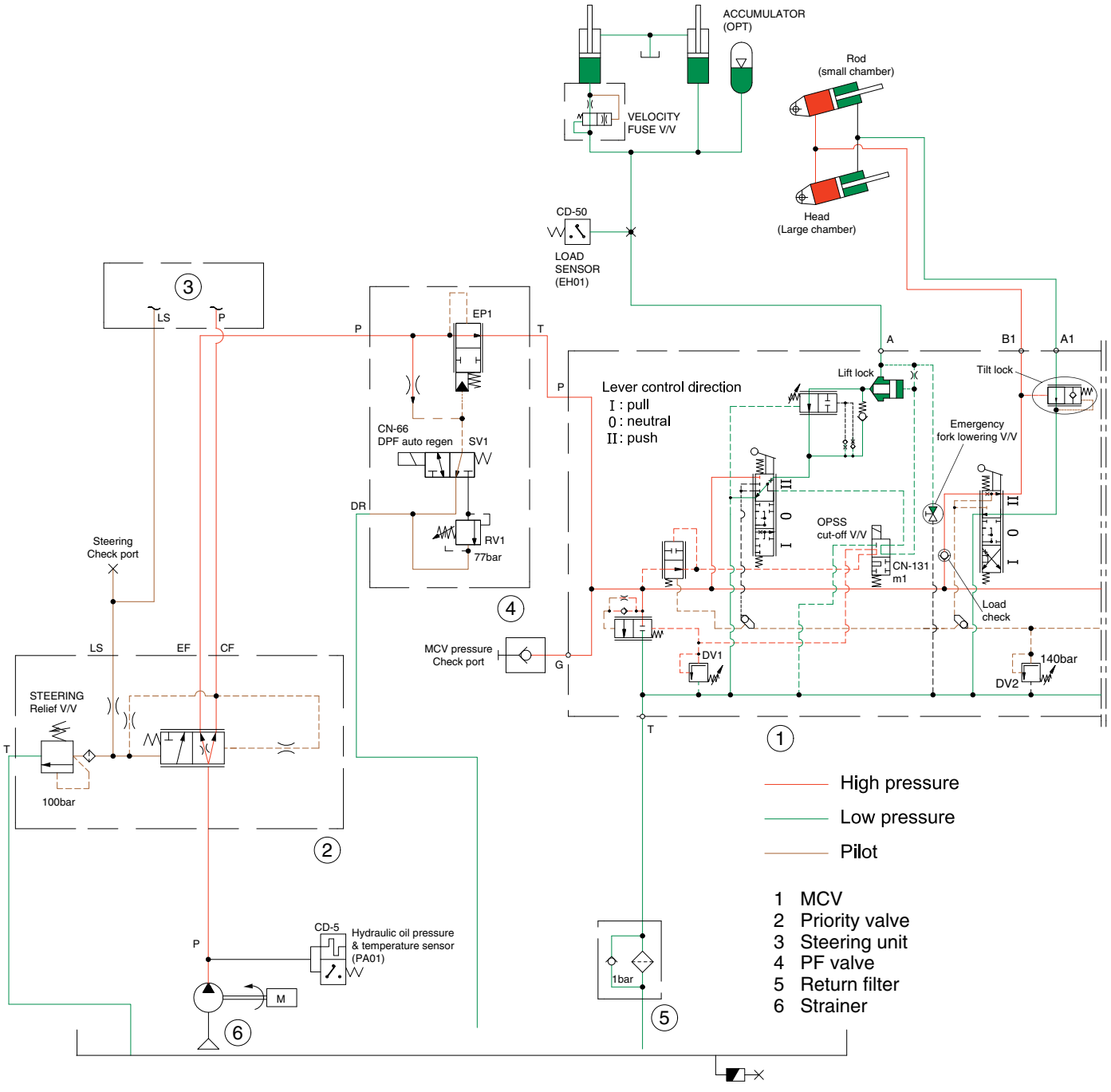
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the small chamber of tilt cylinder by pushing the load check valve of the spool and tilt lock valve.

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.

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



25D9V6HS05

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

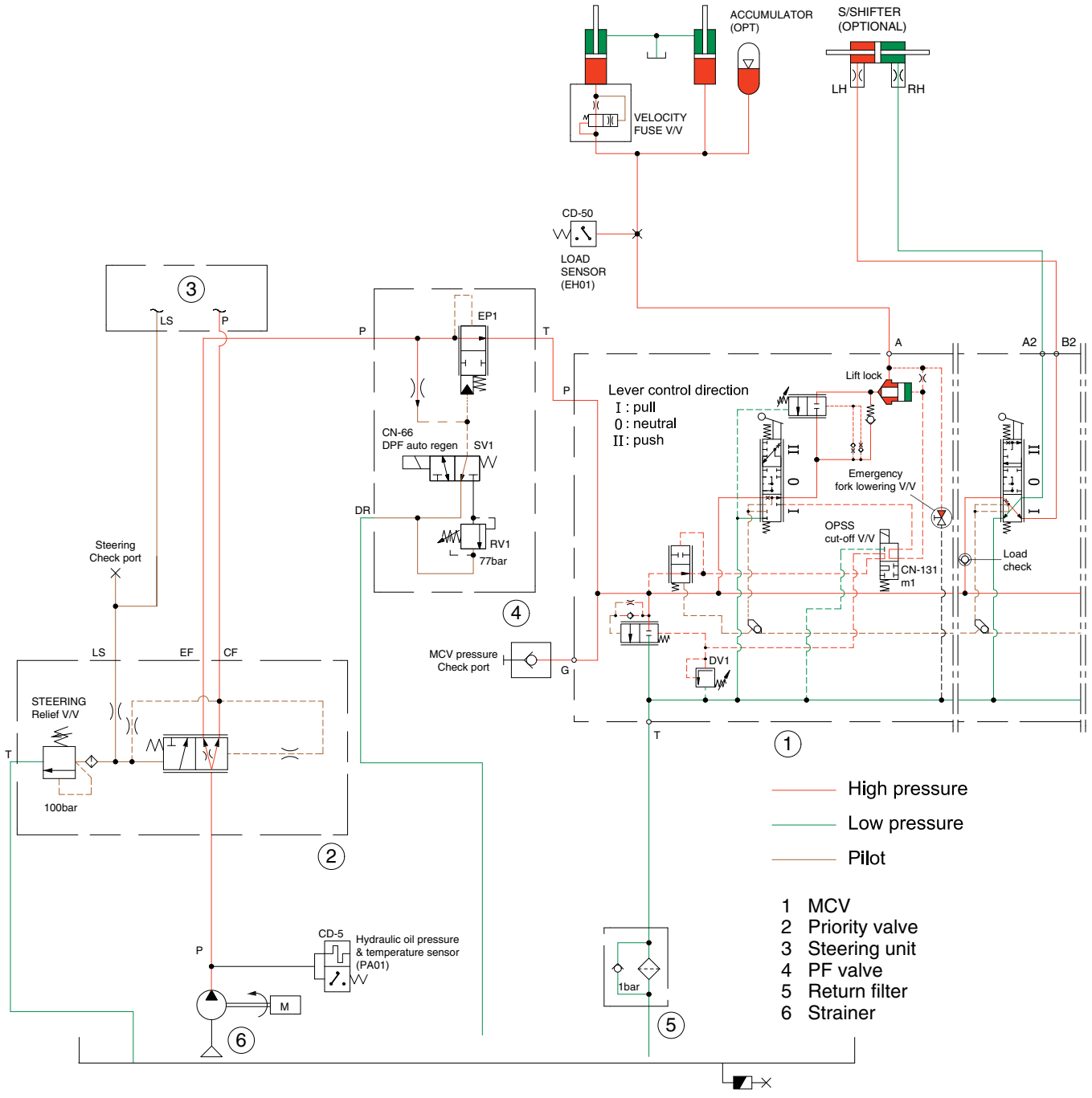
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the large chamber of tilt cylinder by pushing the load check valve of the spool and tilt lock valve.

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.

5) WHEN THE SIDE SHIFTER LEVER IS IN THE RIGHT POSITION (OPTION)



25D9V6HS06

When the side shifter lever is pulled backward, the spool in the third block is moved to side shifter right position.

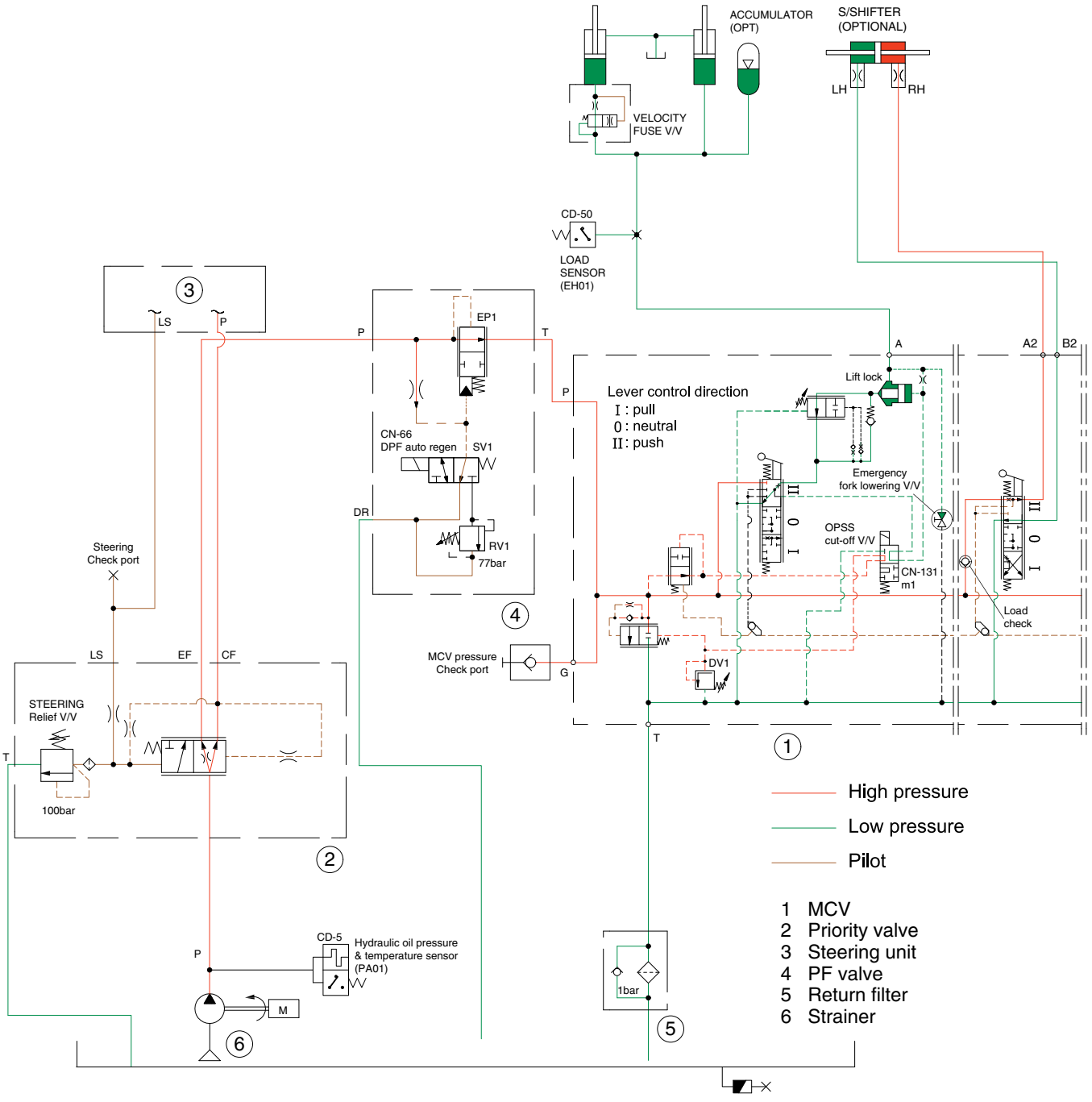
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the LH chamber of side shifter cylinder by pushing the load check valve of the spool.

The oil at the RH chamber of side shifter cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the side shifter goes right.

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

6) WHEN THE SIDE SHIFTER LEVER IS IN THE LEFT POSITION (OPTION)



25D9V6HS07

When the side shifter lever is pushed forward, the spool in the third block is moved to side shifter left position.

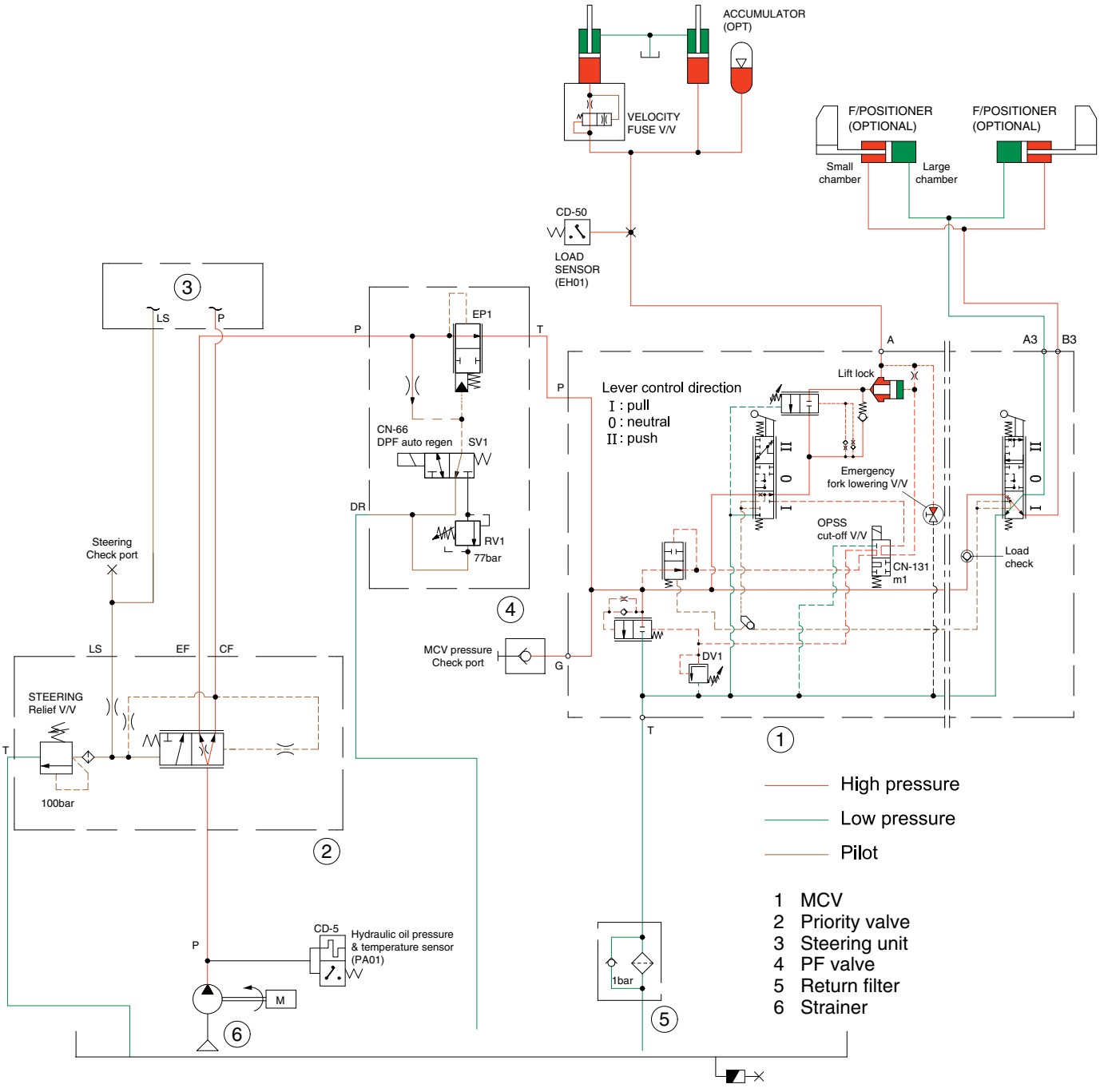
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the RH chamber of side shifter cylinder by pushing the load check valve of the spool.

The oil at the LH chamber of side shifter cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the side shifter goes left.

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

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



25D9V6HS15

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

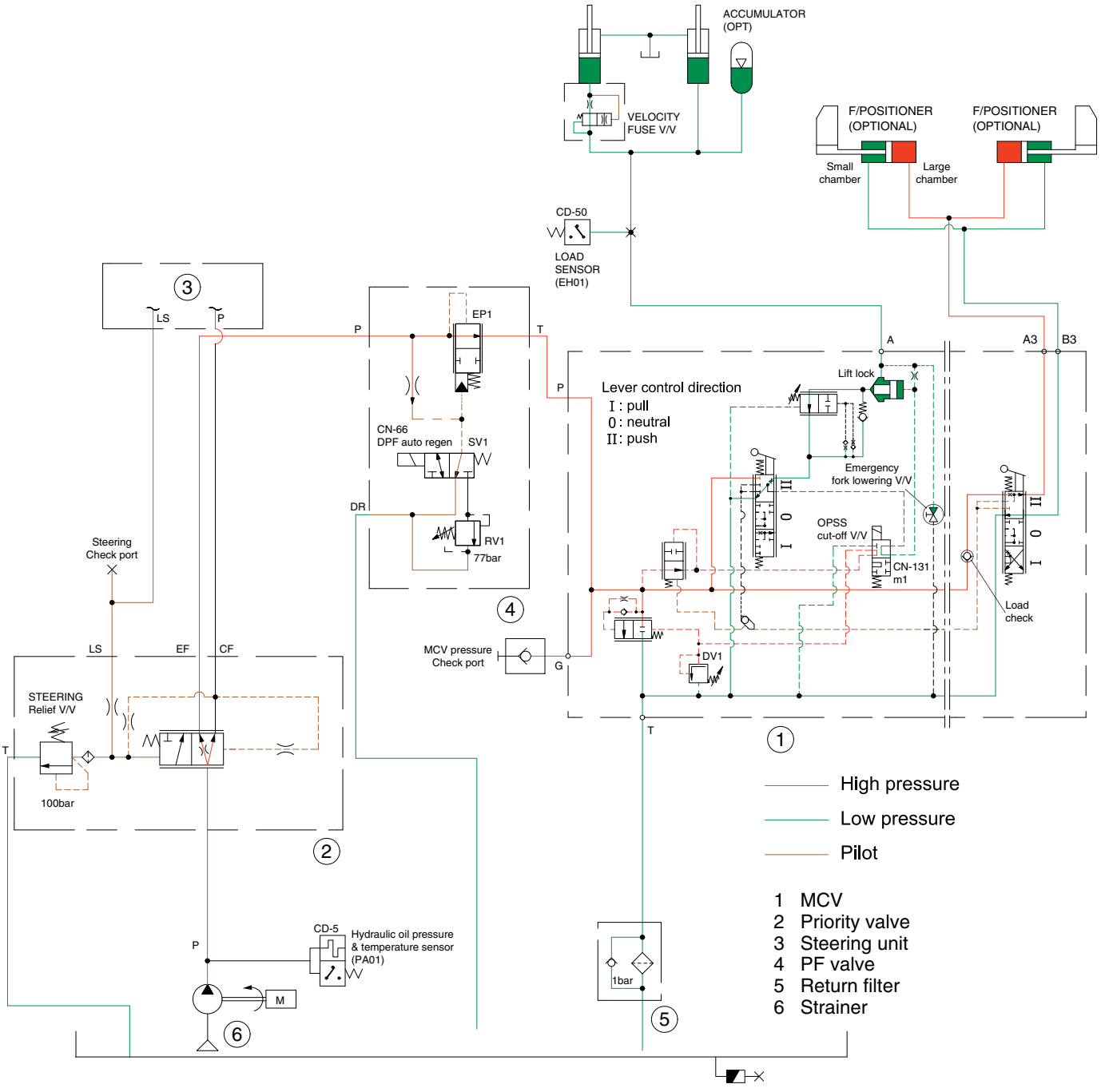
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the large chamber of fork positioner cylinder by pushing the load check valve of the spool.

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.

8) WHEN THE FORK POSITIONER LEVER IS IN THE CLOSE POSITION (OPITON)



25D9V6HS16

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

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

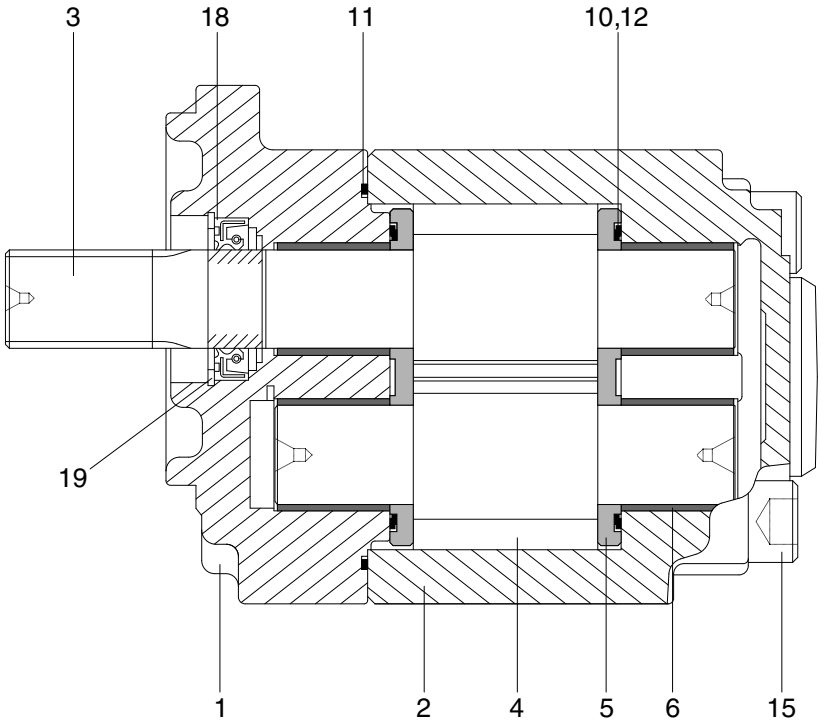
The oil at the large chamber of fork positioner cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the forks are close.

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

2. HYDRAULIC GEAR PUMP

1) STRUCTURE



22D9HS14-1

1	Front cover	5	Side gear	12	Back up ring
2	Body	6	Bushing	15	Bolt
3	Drive gear	10	Gasket (3-shaped)	18	Oil seal
4	Driven gear	11	O-ring	19	Retaining ring

※ Seal kit (EA) : 10 (2), 11 (1), 12 (2), 18 (1), 19 (1)

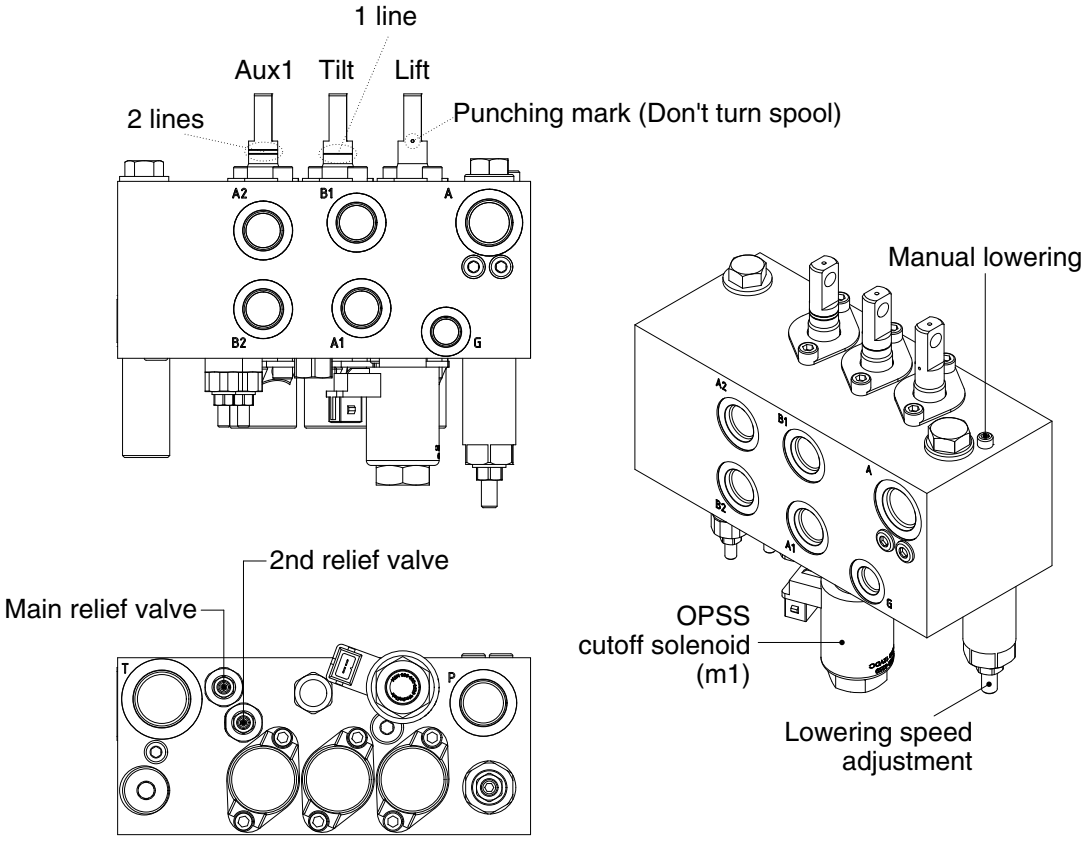
(2) Operation

This pump comprises of a front cover and a body bolted together. The gear journals are supported by bushings (6) to give high volumetric and mechanical efficiencies.

3. MAIN CONTROL VALVE

1) STRUCTURE

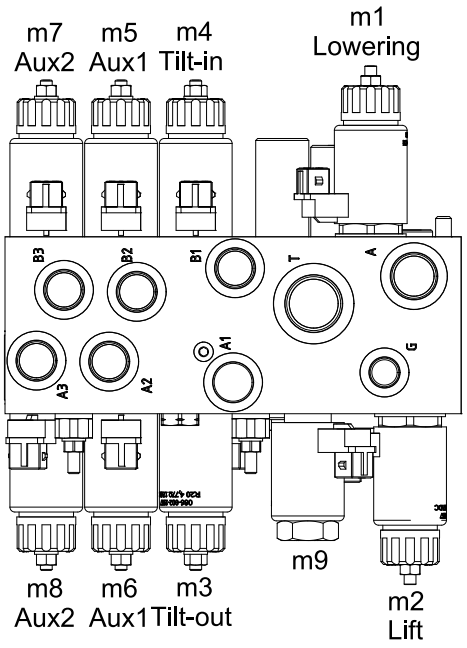
(1) 3 spool

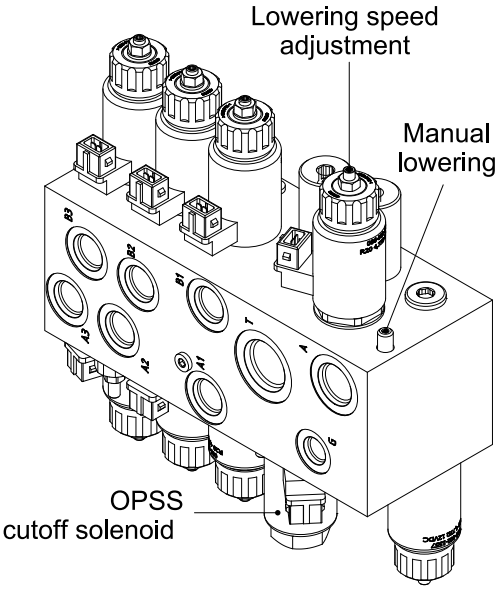


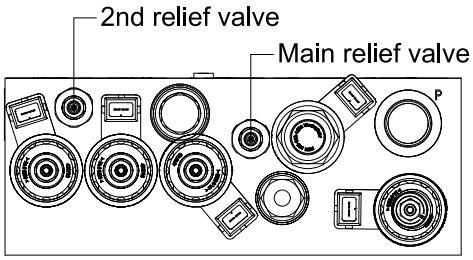
25D9V6HS08

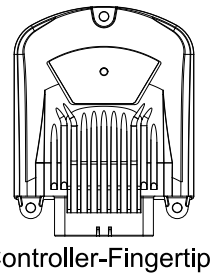
Port	Port name	Port size	Tightening torque	
			kgf·m	lbf·ft
A	Lift / Lower	7/8-14 UNF	7	50.6
A1, B1	Tilt rod / head	3/4-16 UNF	5	36.2
A-, B-	Aux 1, Aux 2	3/4-16 UNF	5	36.2
P	Inlet	7/8-14 UNF	7	50.6
T	Outlet	1 1/16-12 UN	9.5	68.7
G	Gauge, Pilot	9/16-18UNF	3	21.7
m1	Cuttoff solenoid	-	4	28.9
	Coil	-	0.7	5.1

(2) Fingertip MCV (option)









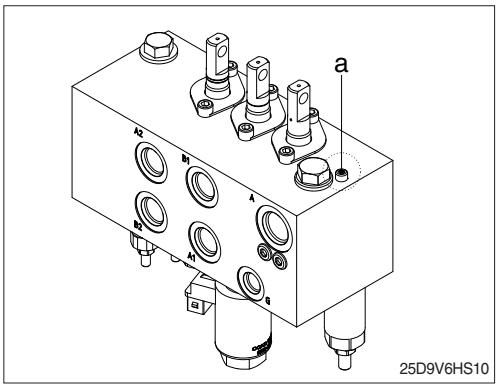
25D9V6HS09

Port	Port name	Port size	Tightening torque	
			kgf·m	lbf·ft
A	Lift / Lower	7/8-14 UNF	7	50.6
A1, B1	Tilt rod / head	3/4-16 UNF	5	36.2
A-, B-	Aux 1, Aux 2	3/4-16 UNF	5	36.2
P	Inlet	7/8-14 UNF	7	50.6
T	Outlet	1 1/16-12 UN	9.5	68.7
G	Gauge	9/16-18UNF	3	21.7

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).



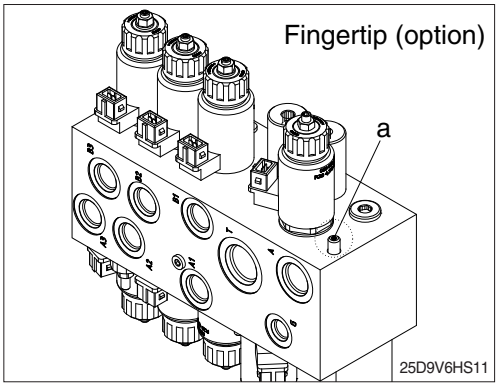
⚠ Manual override features are intended for emergency use, not for continuous-duty operation.

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. 200 × 0.9=180 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.

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 : 200 ± 3 bar (2900 ± 43 psi)
    ★175 ± 3 bar (2540 ± 43 psi) / ★ : EU, AN corporate sales equipment (25D-9V/VS)
  - 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.)

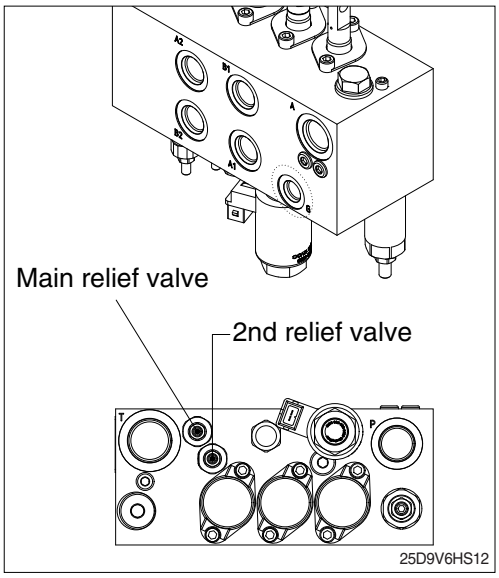
⚠ **Hot hydraulic oil can cause serious burns to skin. Do not touch hydraulic components or oil during test. Make sure hydraulic oil has cooled to safe temperature before installing or removing test equipment.**

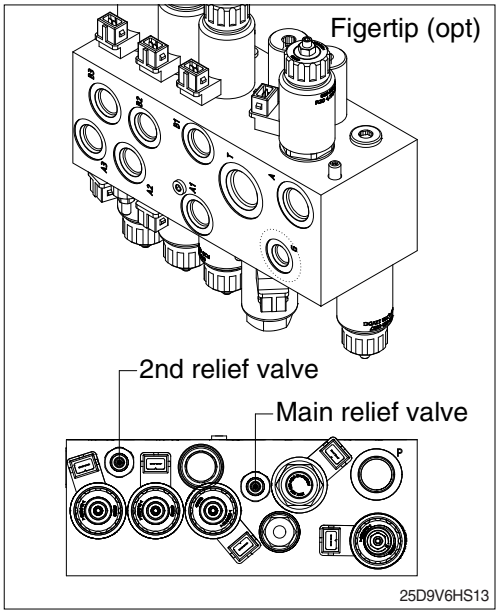
⚠ **Hydraulic oil under pressure can be injected into skin. Lower forks to ground and relieve all circuit pressure before removing test plugs from valve.**

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.

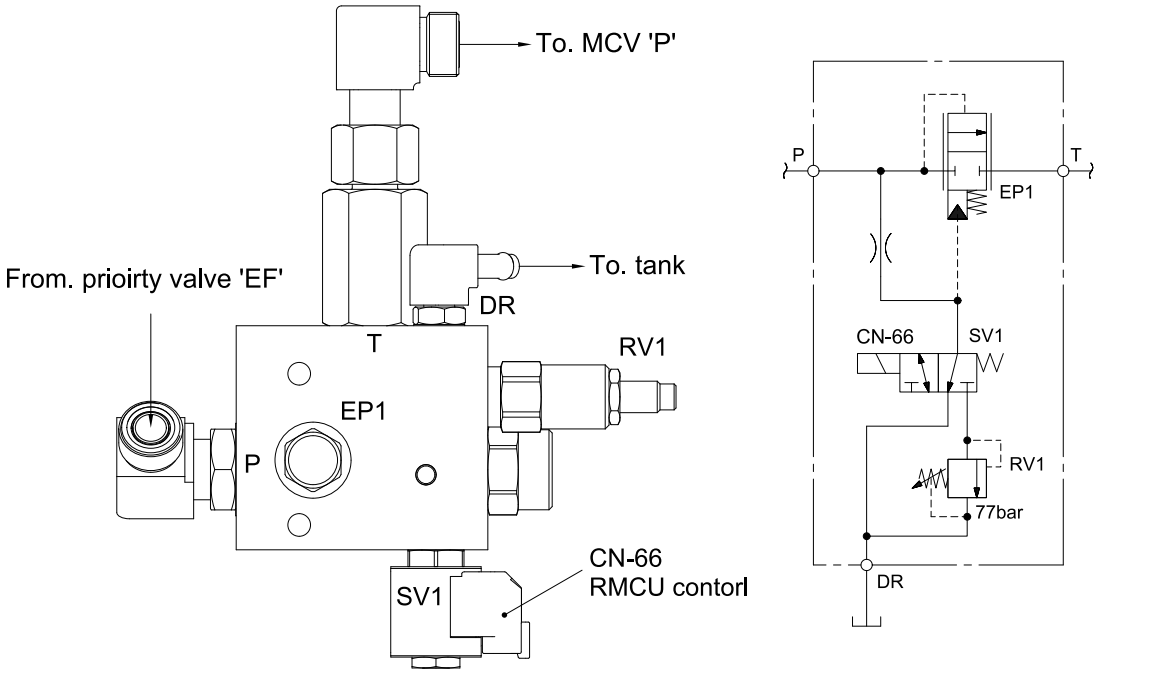
⚠ **The MCV relief valve adjustment screw is very sensitive. Operate in 1/4 turn increments to avoid system overpressure.**

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





4. PRESSURE FORCED ALVE



25D9V6HS14

Port	Port size	Component	Related issues	Remarks
P	G 3/4	Priority valve 'EF'	-	-
T	G 3/4	MCV 'P' or ECV 'P'	-	-
DR	9/16-18 UNF	Hydraulic oil tank	Back pressure	-

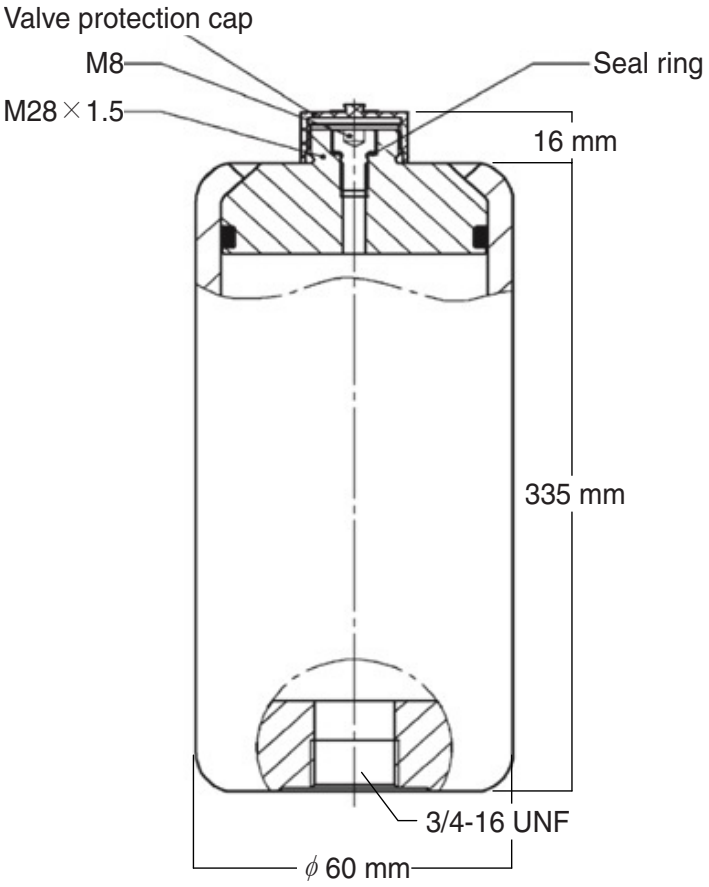
It is a DPF Aiding hydraulic system that helps the engine aftertreatment system. It is possible to work with the working device during automatic regeneration. However, there is a difference between the working device and the running operation when the automatic reproduction rice production is simultaneous, and the forced reproduction (stopping reproduction) is required when the automatic reproduction is not completed.

This valve follows the RMCU control method according to the DPF Aiding Level condition. Noise is generated because pressure is created to remove DPF during the control process.

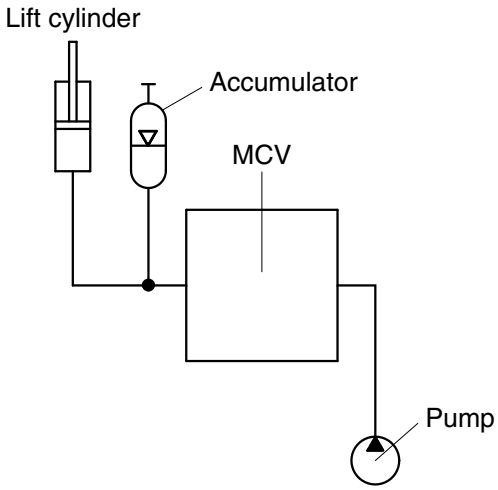
The control method includes operating temperature conditions for preventing an abnormal rise in oil temperature.

5. MAST ACCUMULATOR

1) STRUCTURE



35D9VB6HS52



35D9VB6HS59

Parts No.	Normal volume	Pre-charging pressure at 20 ℃ (68 ℉)	Gas	Weight
35HN-05000	0.5 ℓ (0.13 U.S. gal)	25 bar (363 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.

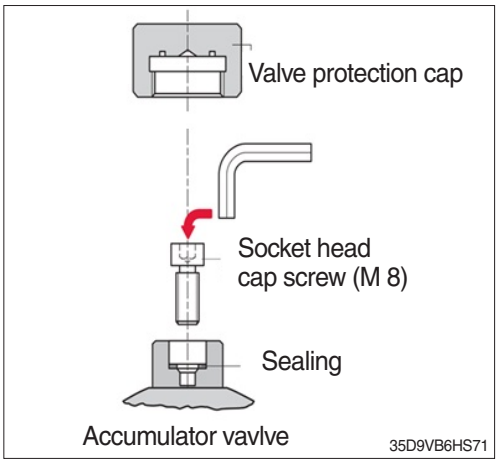
⑥ Wait 5-10 minutes for the filled nitrogen gas pressure to stabilize, then recheck the set pressure and adjust if necessary.

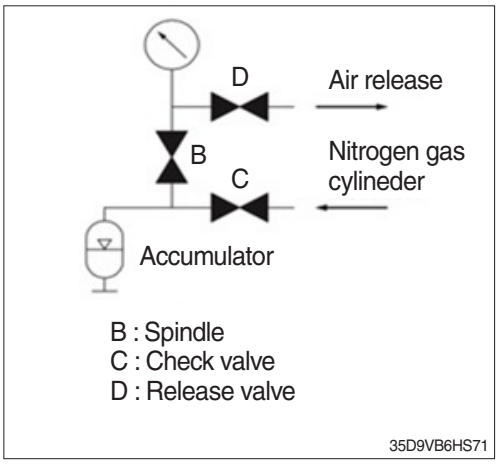
⑦ Open the release valve and blow out gas in the FPU.

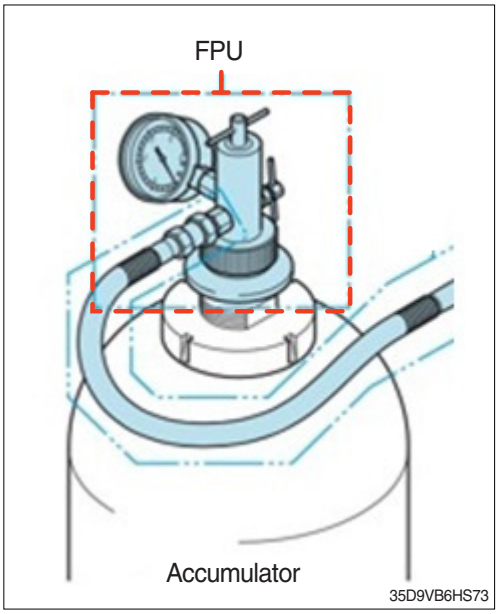
※ **If there is gas in the charging hose and FPU, it cannot be separated, and it is very dangerous if it is forcibly separated. Be sure to separate the charging hose and after blowing out the gas inside the FPU.**

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.

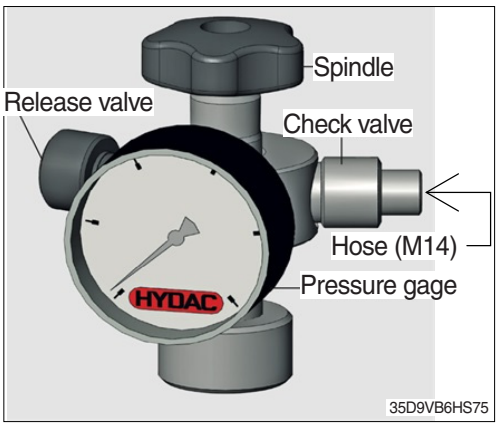
⑥ When filling is complete, close the gas valve of the accumulator using the valve of the nitrogen gas cylinder and the spindle of the FPU.

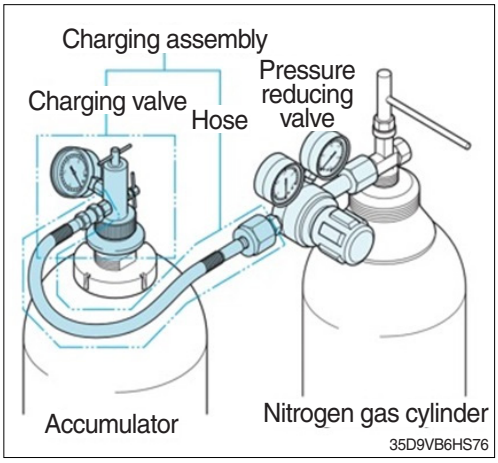
※ **When adding nitrogen to the accumulator filled with nitrogen gas, wait 5-10 minutes for the temperature and pressure of the gas mixture to stabilize, then check the pressure again and adjust if necessary.**

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.



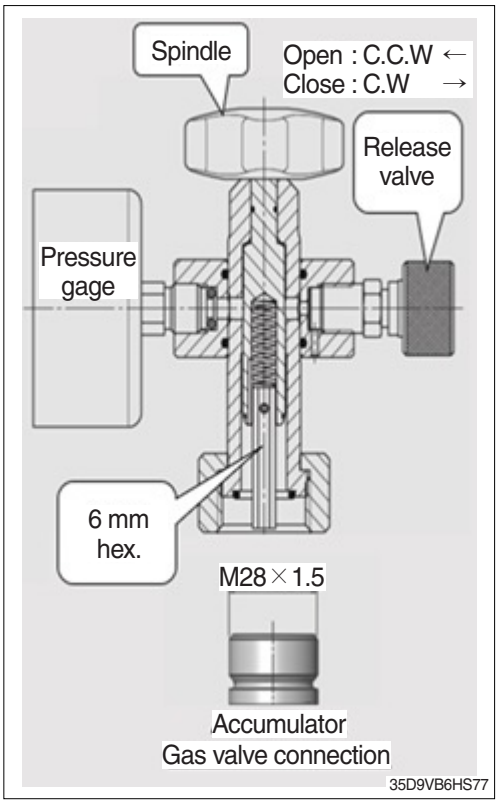


⑩ Open the release valve and blow out nitrogen gas in the FPU.

※ **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.**

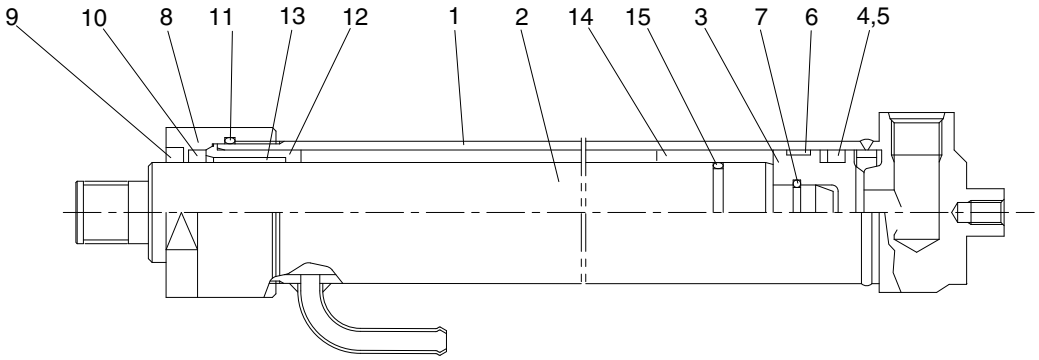
⑪ Remove the FPU from the accumulator.

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.



6. LIFT CYLINDER

1) V-MAST

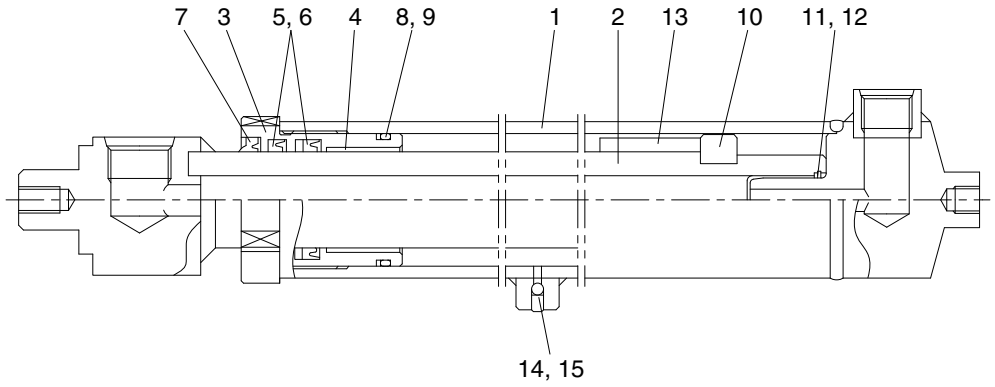


D255HS18

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

※ Seal kit : 4 ~ 6, 9 ~ 11

2) VF AND VS-MAST

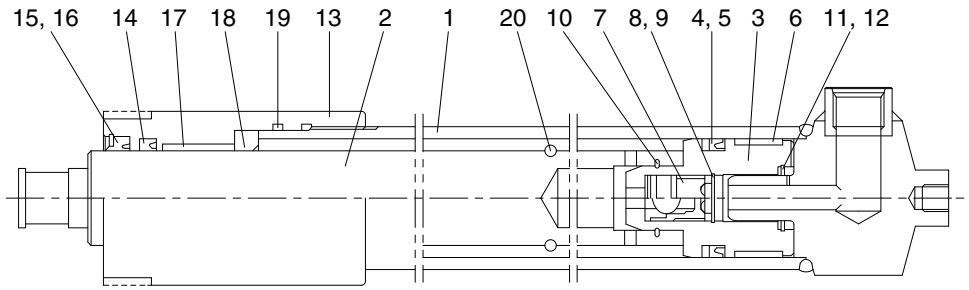


22B9FHS20

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	Spacer
4	Rod bushing	9	Back up ring	14	Steel ball
5	U-packing	10	Piston ring	15	Set screw

※ Seal kit : 5 ~ 9, 11, 15

3) TF AND TS-MAST

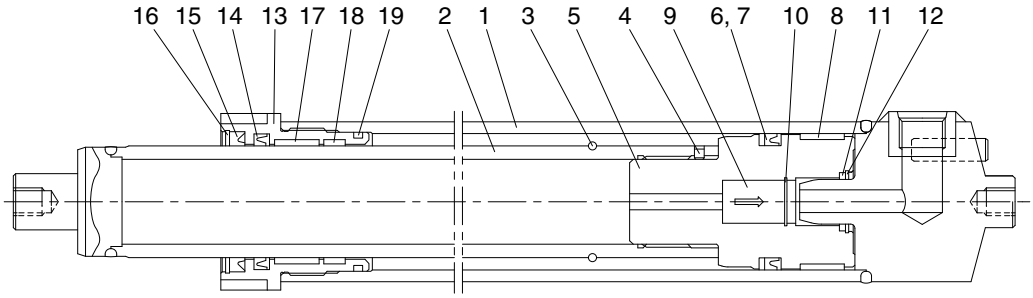


22B9FHS21

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

※ Seal kit : 4 ~ 6, 14, 15, 19

4) QF-MAST (LH)

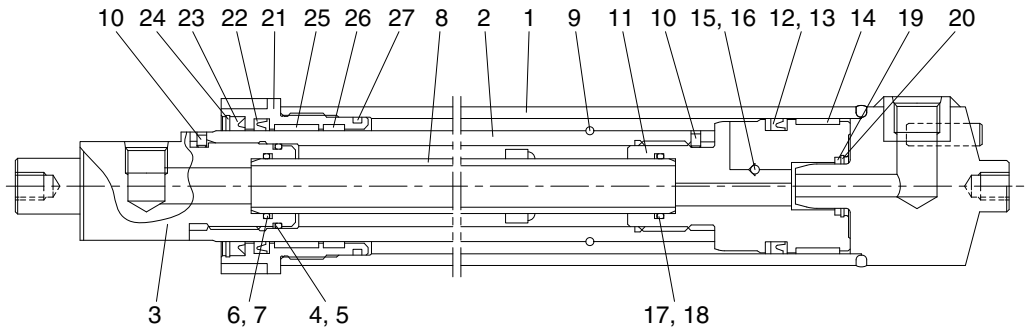


22B9FHS22

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

※ Seal kit : 6 ~ 8, 14, 15, 17 ~ 19

5) QF-MAST (RH)

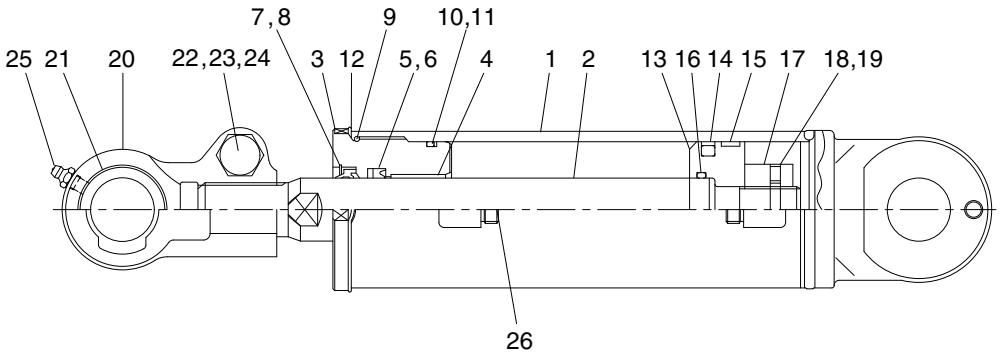


22B9FHS23

1	Tube assembly	10	Set screw	19	Cushion seal
2	Rod	11	Piston	20	Retaining ring
3	Rod end	12	Back up ring	21	Rod cover
4	O-ring	13	U-packing	22	U-packing
5	Back up ring	14	Wear ring	23	Dust wiper
6	O-ring	15	Check valve	24	Retaining ring
7	Back up ring	16	Retaining ring	25	Wear ring
8	Inner rod assembly	17	O-ring	26	Dust ring
9	Stop ring	18	Back up ring	27	O-ring

※ Seal kit : 4 ~ 7, 12 ~ 14, 17 ~ 19, 22, 23, 25~ 27

7. TILT CYLINDER



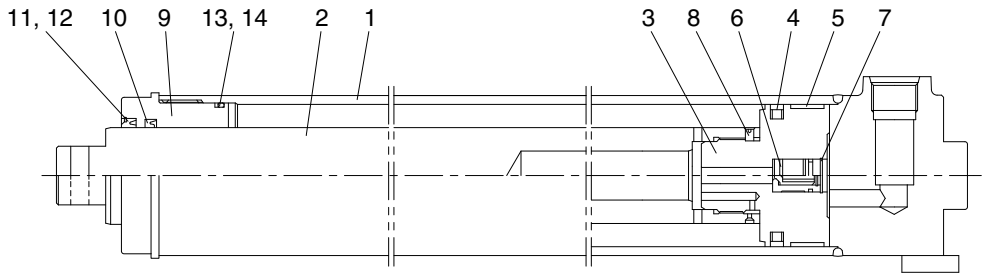
22D9HHS23

1	Tube assembly	10	O-ring	19	Socket bolt
2	Rod	11	Back up ring	20	Rod eye
3	Gland	12	Lock washer	21	Spherical bearing
4	DU bushing	13	Piston	22	Hexagon bolt
5	Rod seal	14	Piston seal	23	Hexagon nut
6	Back up ring	15	Wear ring	24	Spring washer
7	Dust wiper	16	O-ring	25	Grease nipple
8	Snap ring	17	Lock nut	26	O-ring
9	O-ring	18	Steel ball		

※ Seal kit (EA) : 5 ~ 7 (1), 9 ~ 11 (1), 14 ~ 16 (1), 26 (2)

8. FREE LIFT CYLINDER

1) VF-MAST AND TF-MAST (35DN-9V/VS)

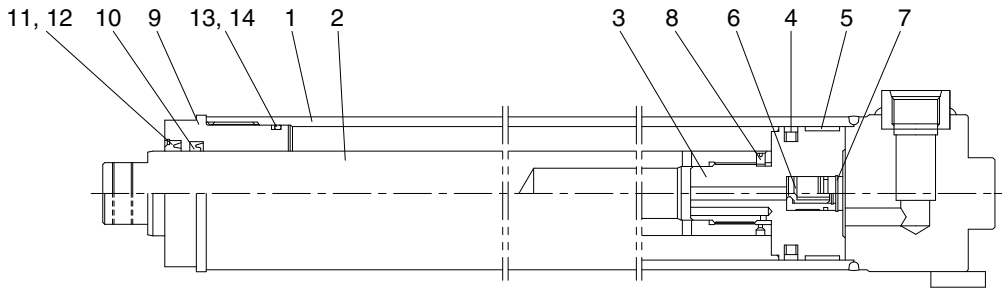


25L9AHS34

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		

※ Seal kit : 4, 5, 10, 11, 13, 14

2) TF-MAST (25/30D-9V/VS)

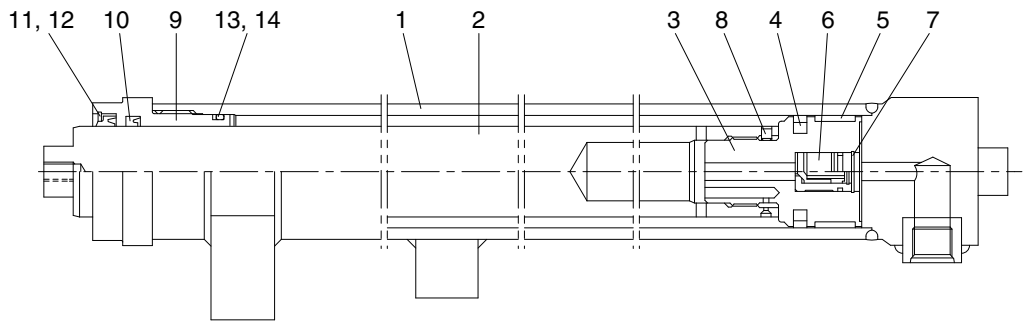


25L9AHS35

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		

※ Seal kit : 4, 5, 10, 11, 13, 14, 16

3) VS AND TS-MAST (35DN-9V/VS)

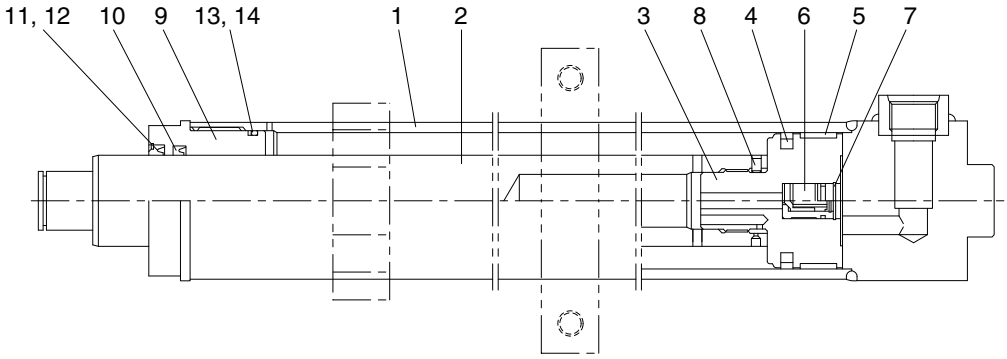


25L9AHS36

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		

※ Seal kit : 4, 5, 10, 11, 13, 14

4) TS-MAST (25/30D-9V/VS)

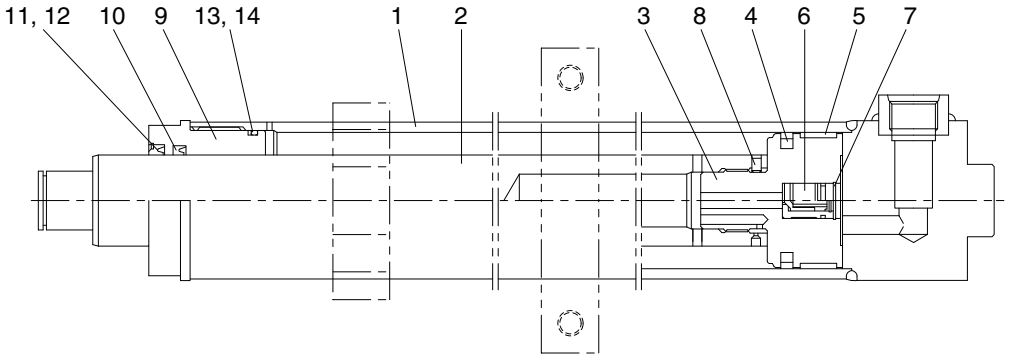


25L9AHS37

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		

※ Seal kit : 4, 5, 10, 11, 13, 14, 16

5) QF-MAST



25L9AHS38

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		

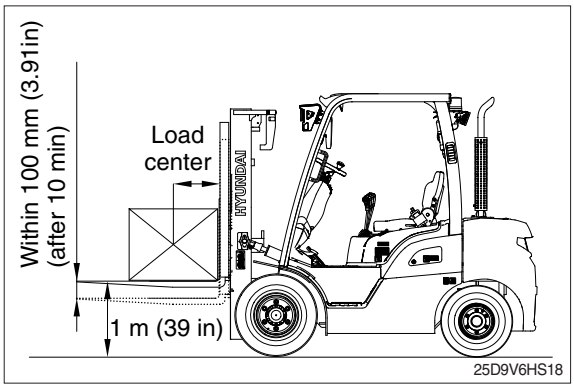
※ Seal kit : 4, 5, 10, 11, 13, 14, 16

1. OPERATIONAL CHECKS

1) CHECK ITEM

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

(2) Set mast vertical and raise 1 m (39 inch) from ground. Wait for 10 minutes and measure hydraulic drift (amount forks move down and amount mast tilts forward).

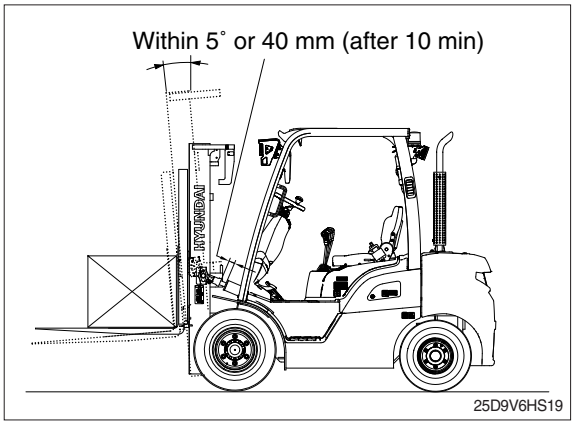


· **Check condition**

- Hydraulic oil : 45±5 ℃ (113±41 ℉)
- Rated capacity load
- Mast substantially vertical
- Key OFF, operator non-existence

· **Hydraulic drift**

- Down (Downward movement of forks)
  : Within 100 mm (3.9 in)
- Forward (Extension of tilt cylinder)
  : Within 5° or 40 mm (1.6 in)

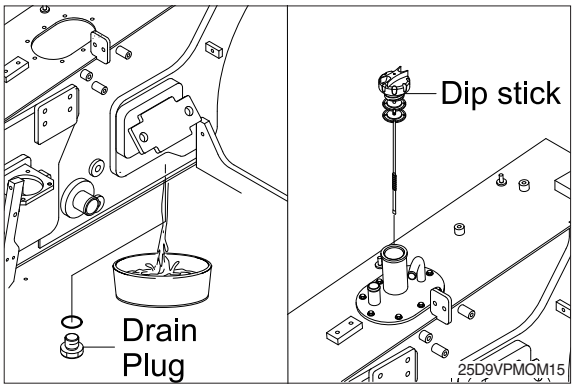


(3) If the hydraulic drift is more than the specified value, replace the control valve or cylinder packing.

2) HYDRAULIC OIL

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

(2) When changing hydraulic oil, clean suction strainer (screwed into suction pipe) and return filter (screwed into return pipe).



3) CONTROL VALVE

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

Model	Unit	Prssure
25/30D-9V, 35DN-9V 25/30D-9VS, 35DN-9VS	bar (psi)	200 ± 3 (2900 ± 43)
★25D-9V/VS		★175 ± 3 (2540 ± 43)

★ : EU, AN corporate sales equipment

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 : Load 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. · Pump detctive. · 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. · Replace pump. · 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 pump.
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. · Priority valve spool flow path is blocked. · Oil filter clogged.	· Add oil. · Replace priority valve. · Clean filter.

2) HYDRAULIC GEAR PUMP

Status	Possible factors	Solutions
Leakage from the oil seal	· Reverse rotation. · Abnormal high pressure in the inlet. · Damage to the seal lip due to foreign objects. · Sealed parts of the shaft damaged or worn out. · Poor shaft centering.	· Rotate the pump to the right way. · Keep the designated pressure. · Replace the oil seal with new one. · Adjust centering. · Change the pump.
Oil leakage from the joint of cover or body	· Looseness of the bolts or breakage of the cover and body. · Degradation or damage of the oil seal caused by heat curing of the gasket.	· Tighten bolt and keep the designated pressure. · Replace the gasket with new one. · Change the pump.
Oil leakage from port	· Looseness of breakage of the port fittings. · Breakage of the seals for fittings. · Breakage of the ports.	· Tighten the fittings and keep the designated pressure. · Replace the seals for fittings with new ones. · Change the pump.
Reduction of the oil amount getting out from the outlet or no pressure produced	· Shortage of the oil in the tank. · Intermal leakage due to abnormal high-temperature or inappropriate viscosity of oil. · Degradation of the performance due to the oil contamination. · Cavitations due to negative pressure. · Breakage of the internal parts. · Reverse rotation.	· Apply the appropriate kind and amount of oil in the tank and change the cooling system. · Change the contamination oil. · Make sure if the the appropriate length and width of inlet pipe are applied and avoid prducing negative pressure by replacing the filter with new one. · Open the inlet valve. · Change the pump. · Rotate the pump to the pump to the right way and avoid prducing the abnormal high-temperature in the inlet.
Rising temperature of pump or oil	· Abnormal generation of heat due to the frequent operation of the pressure control valves. · Damage of the internal parts.	· Set the pressure appropriately. · Change the pump.
Noise and vibration	· Poor installation. · Cavitations. · Intake of air. · Vibration of the pipes and mounting flanges. · Chattering of the relief valves. · Damage of the shaft seal.	· Adjust centering. · Make sure if the the appropriate length and width of inlet pipe are applied and avoid prducing negative pressure by replacing the filter with new one. · Fill the tank with oil and avoid taking air into the inlet pipes. · Reinforce the pipes and mounting flange and prevent resonating. · Replace the relief valve with new one. · Change the pump.

※ Once you disassemble the pump, its performance may not recover after the reassembly.

※ Change the assembly if the pump breaks down.

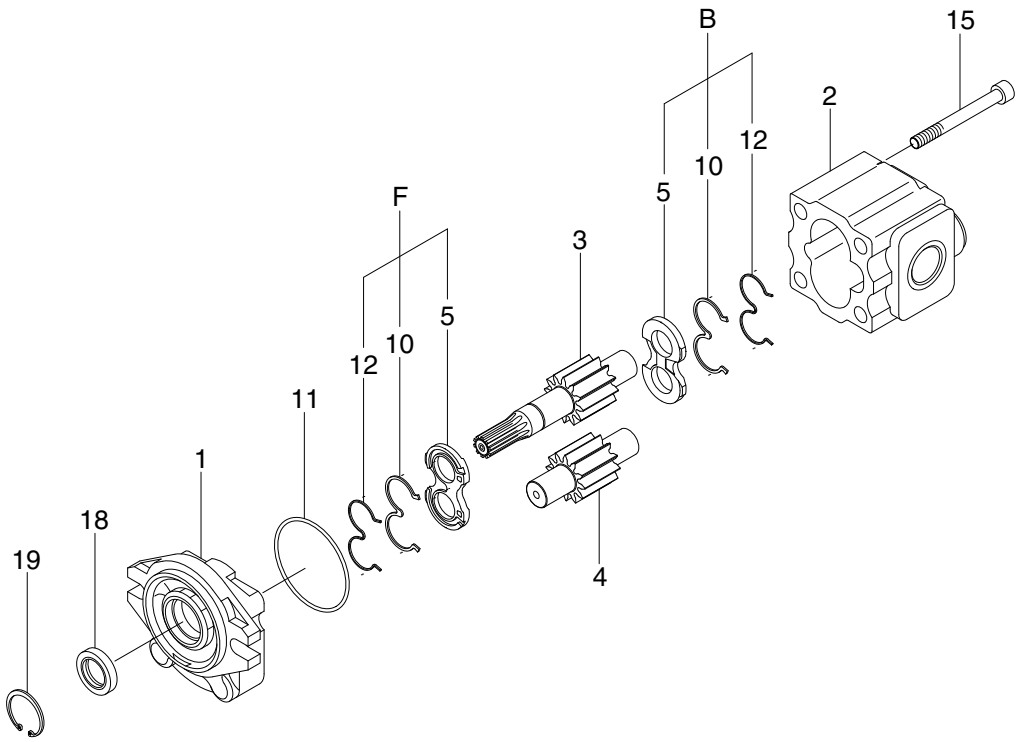
※ If the disassembly is inevitable, you need to consult the Hyundai service center or dealer.

3) LIFT AND TILT CYLINDER

Problem	Cause	Remedy
Oil leaks out from gland 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 gland thread.	· O-ring damaged.	· Replace O-ring.
Rod spontaneously retract.	· Scores on inner surface of tube. · Unallowable score on the inner surface 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. HYDRAULIC GEAR PUMP

1) STRUCTURE



22D9HS14-2

1	Front cover	5	Side gear	12	Back up ring
2	Body	6	Bushing	15	Bolt
3	Drive gear	10	Gasket (3-shaped)	18	Oil seal
4	Driven gear	11	O-ring	19	Retaining ring

※ Seal kit (EA) : 10 (2), 11 (1), 12 (2), 18 (1), 19 (1)

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.

(2) Disassembly

※ Before disassembling the pump, check the oil seal, pump body and cover joints and other oil leaks.

⚠ Remove rust, dirt and dust from the shaft end and pump body. Otherwise, the parts may be damaged or the parts may get inside the pump during disassembly and receive a false diagnosis of the pump.

※ The pump has symmetrical parts. Before disassembling the pump, mark the parts in the manner indicated in "Disassembly Procedure" to ensure correct reassembly. To do this, use oil paint to prevent damage to the parts.

※ Disassembly is a means of finding the source of a problem. Follow the pump disassembly procedure.

※ Check new packings, gaskets and oil seals before disassembly.

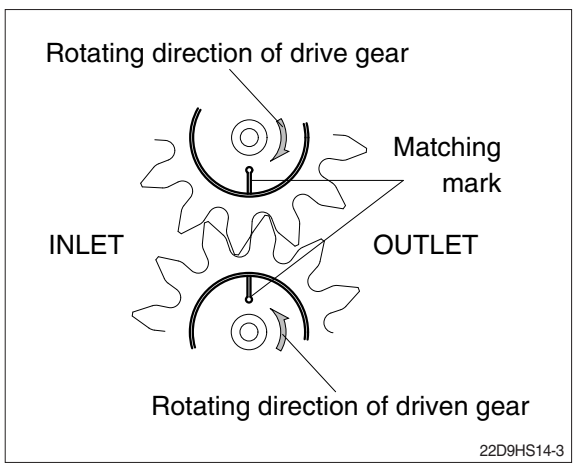
① Fix the mounting parts of front cover with the body side up to the vice.

② Mark on the joints between the front cover (1) and body (2) before disassembling.

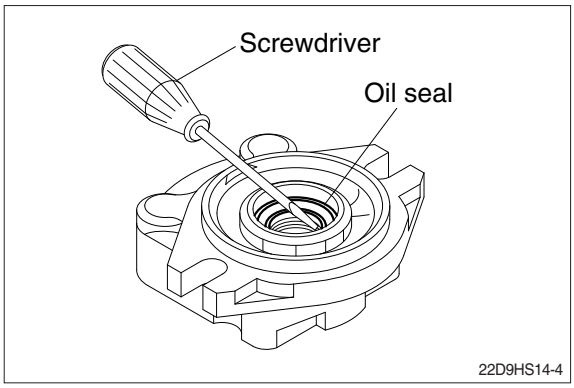
③ Remove the four bolts (15) and disassemble the parts in order starting with the body.
Please see the instructions below.

④ Mark on the shaft ends of the body side.

⑤ Since the pair of side plates (5), 3-shape gaskets (10) and back-ups (12) 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 "B" in the exploded view 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

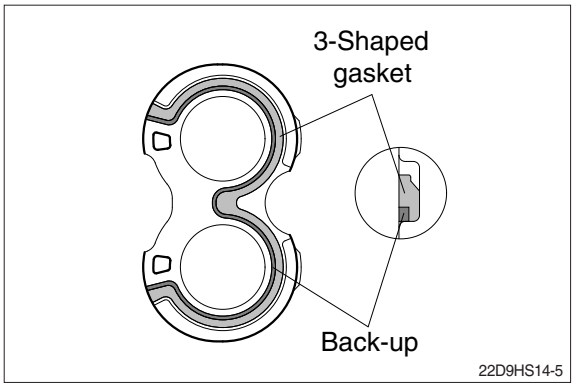
① Replace these items (10, 11, 12, 18, 19) with new ones.

② Clean each part to remove dust before reassembling.

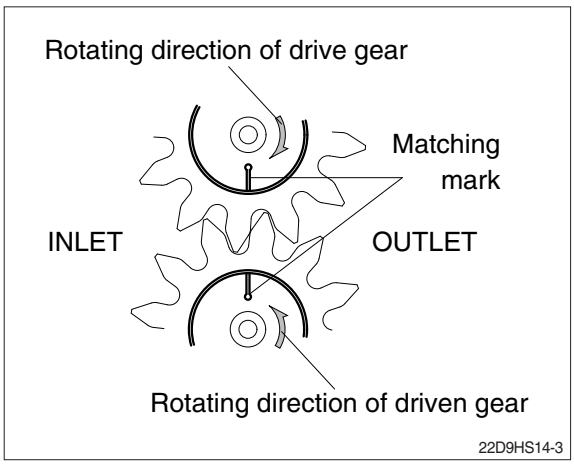
③ Put the body (2) on the worktable with its hole for the gear up.

④ Reassemble the parts in order except for oil seal, retaining ring and bolts.

· Fix the 3-shaped gasket (10) and back-up (12) to the side plate (5) by using grease to prevent them from being twisted or caughts.



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

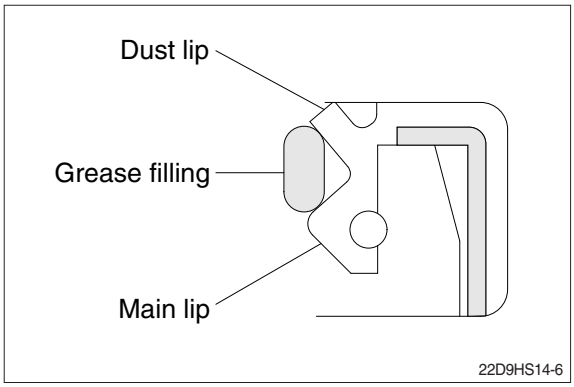


⑤ Invert the assembled pump to make the front cover down and fix the mounting parts to the vice.

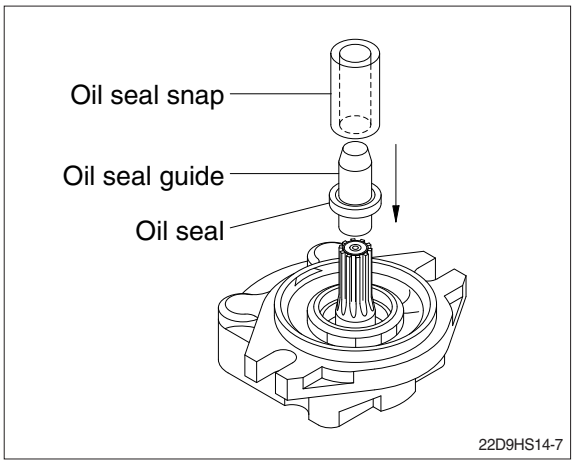
⑥ Tighten 4 bolts evenly by 9.0~9.5 kgf·m (65.1~68.7 lbf·ft) torque.

⑦ Invert the assembled pump again to make the front cover up and fix the body to the vice.

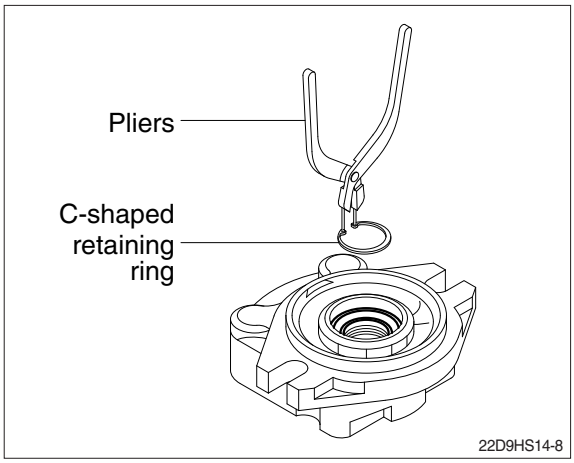
⑧ Fill the dent between the main lip and dust lip of oil seal with grease.



⑨ Fill the oil seal into the hole by using the oil seal guide and oil seal snap.



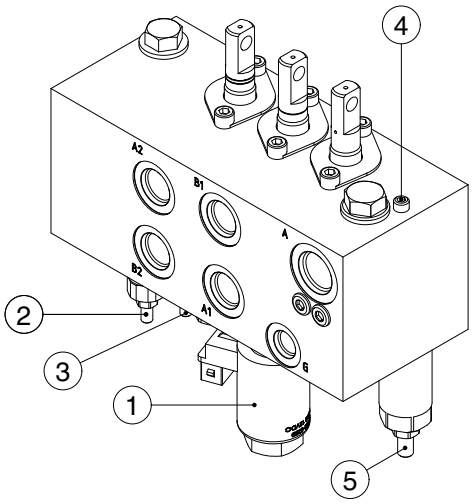
⑩ Attach the C-shaped retaining ring for hole.



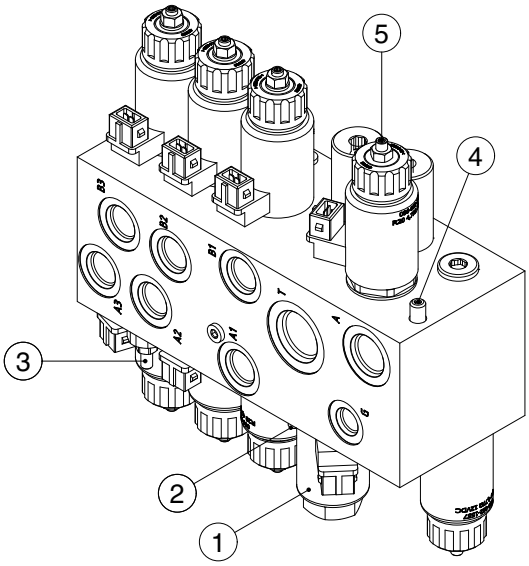
2. MAIN CONTROL VALVE

1) STRUCTURE

Manual



Fingertip (option)



25D9V6HS17

1 OPSS cutoff solenoid
2 Main relief valve (DV1)
3 2nd reilief valve (DV2)
4 Emergency fork lowering
5 Fork lowering speed adjustment

2) DISASSEMBLY AND ASSEMBLY

(1) Cutoff solenoid

※ The pictures is for reference only and the 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.

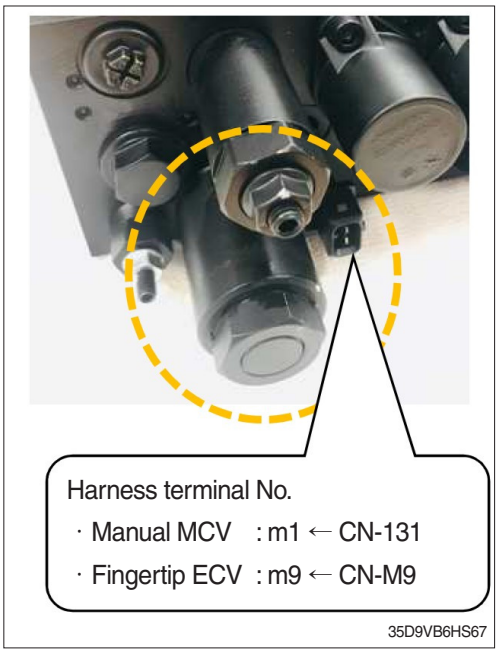
④ Clean the check valve and valve block so that opened valve block cannot become contaminated.

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)

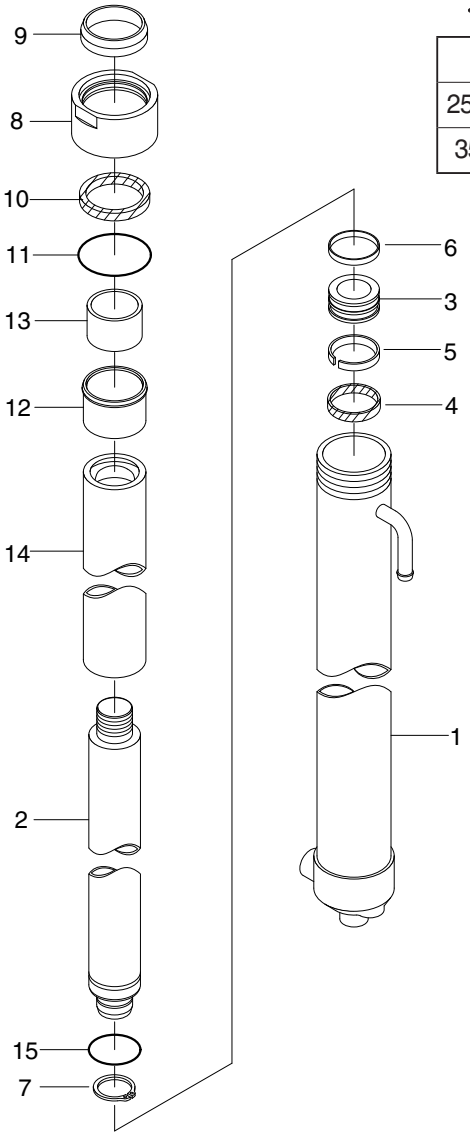
⑥ Refit the solenoid coil according to the direction and tighten with the o-ring side of the nut facing the coil.

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



3. LIFT CYLINDER

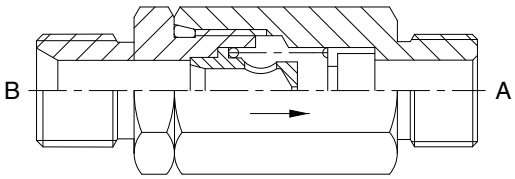
1) STRUCTURE

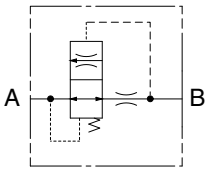


· Specification (V330, standard)

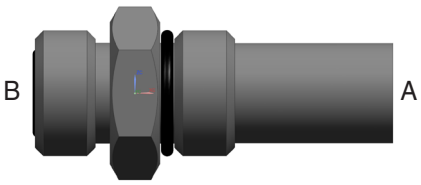
Unit : mm (in)

Model	Tube I.D	Tube O.D	Stroke	Rod O.D
25/30D-9V/VS	50 (2.0)	58 (2.3)	1630 (64.2)	40 (1.4)
35DN-9V/VS	55 (2.2)	63 (2.5)	1630 (64.2)	45 (1.8)





Down safety valve

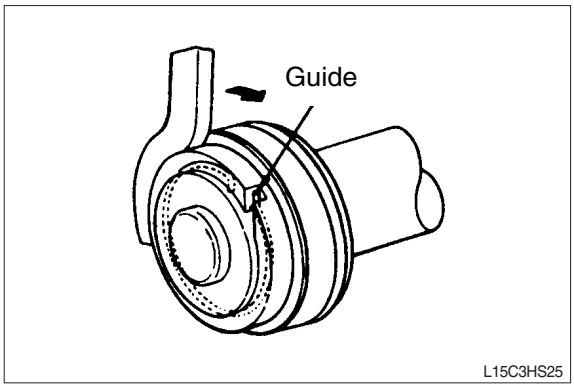


25D9V6HS20

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



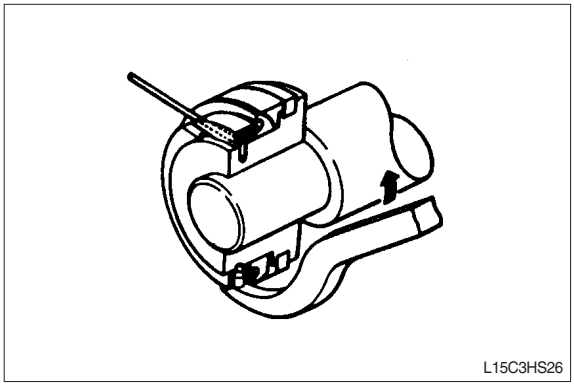
3) CHECK AND INSPECTION

mm (in)

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

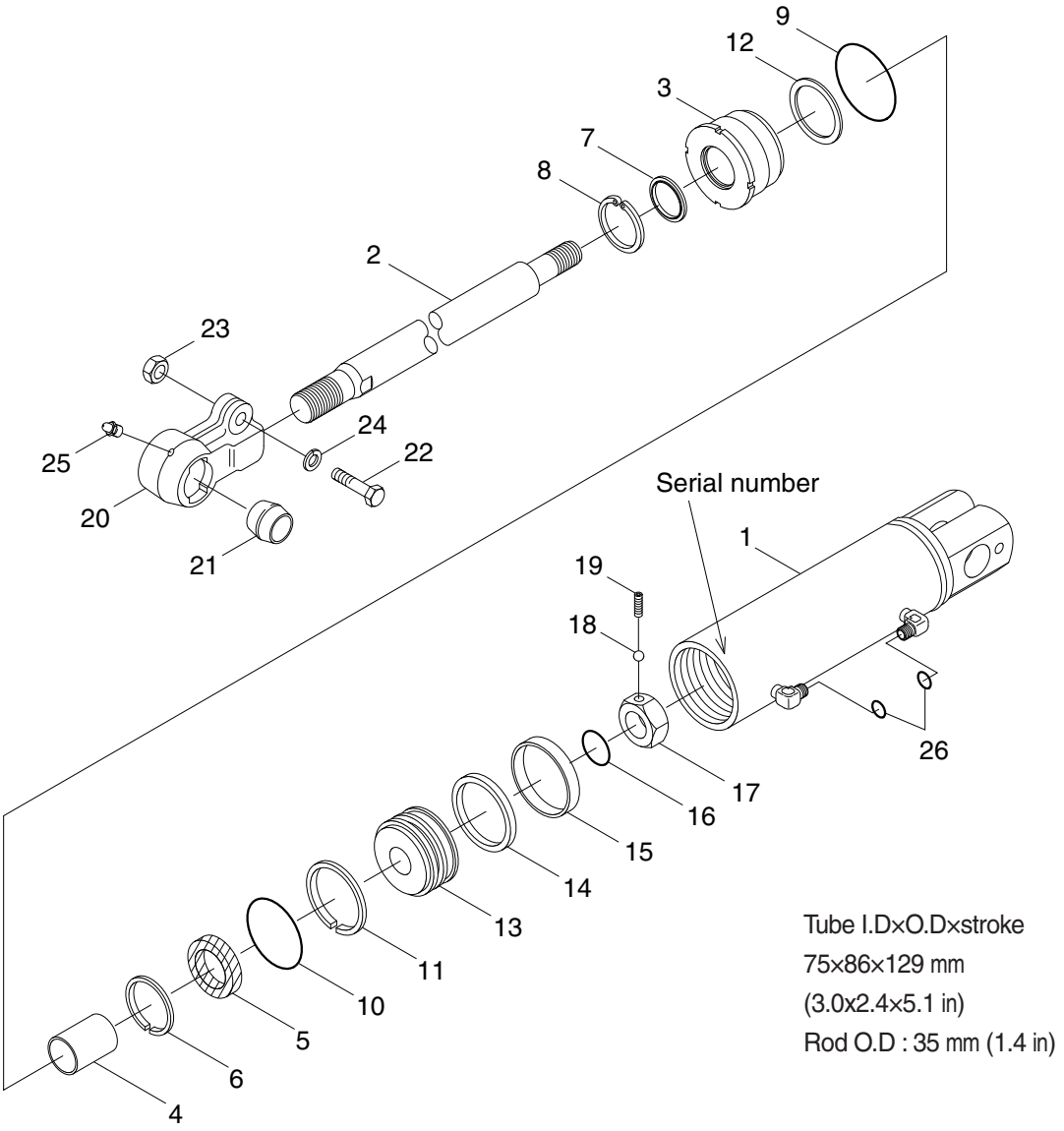
4) ASSEMBLY

(1) Soak the piston ring in hydraulic oil at a temperature of 40 to 50°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.



4. TILT CYLINDER

1) STRUCTURE

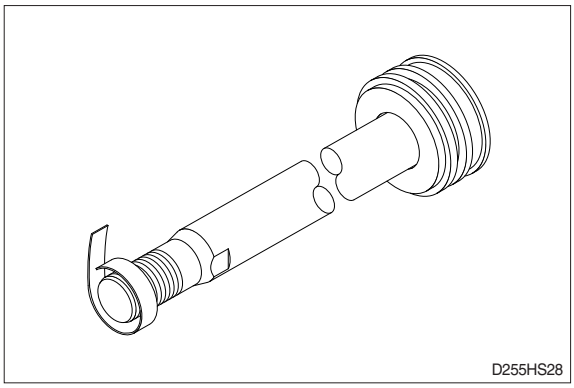


25L9AHS43

1	Tube assembly	10	O-ring	19	Socket screw
2	Rod	11	Back up ring	20	Rod eye
3	Gland	12	Lock washer	21	Spherical bearing
4	DU-bushing	13	Piston	22	Hexagon bolt
5	Rod seal	14	Piston seal	23	Hexagon nut
6	Back up ring	15	Wear ring	24	Spring washer
7	Dust wiper	16	O-ring	25	Grease nipple
8	Snap ring	17	Lock nut	26	O-ring
9	O-ring	18	Steel ball		

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