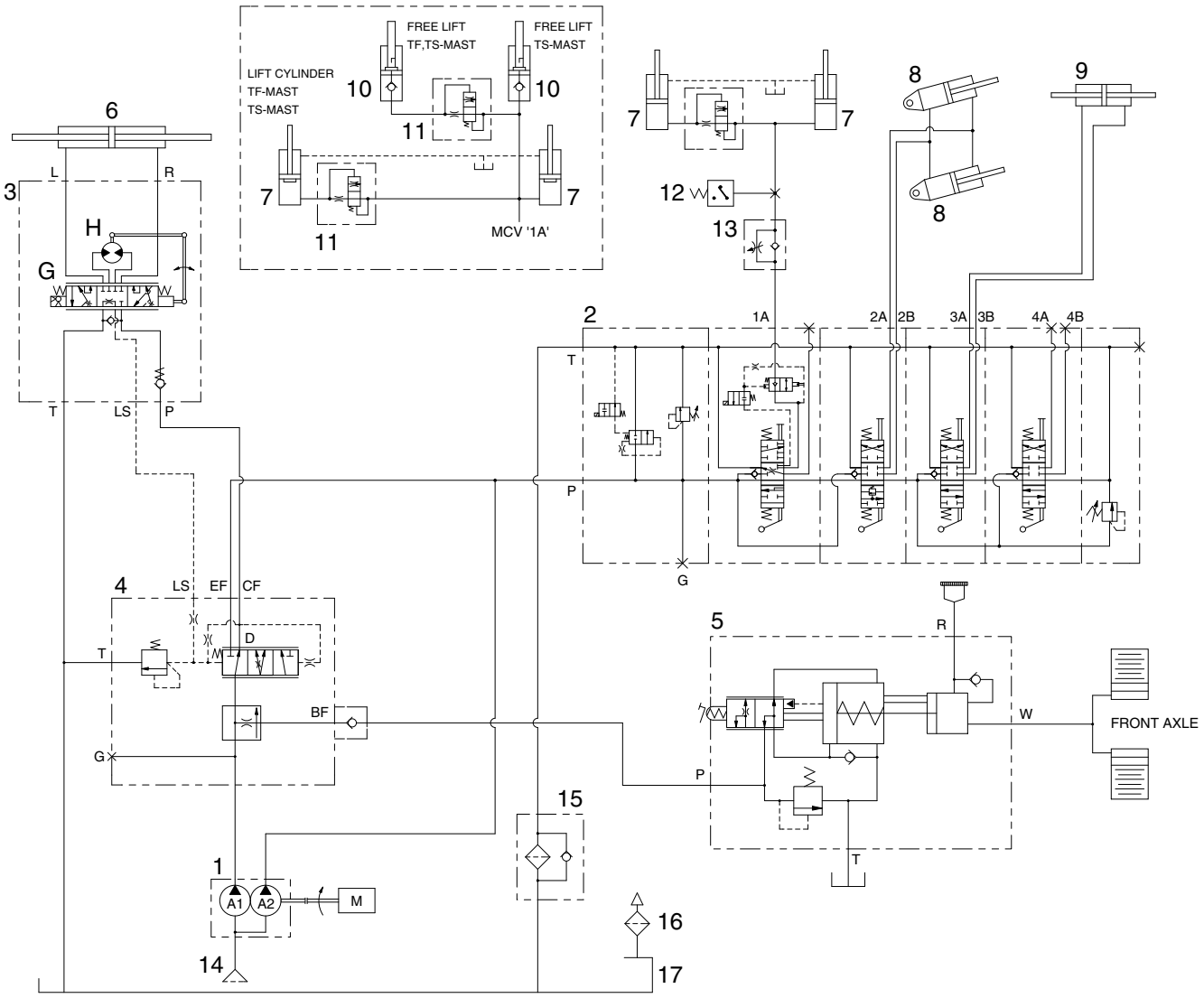
SECTION 6 HYDRAULIC SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC CIRCUIT

· **TYPE 1** (Pump with dual flow divider)

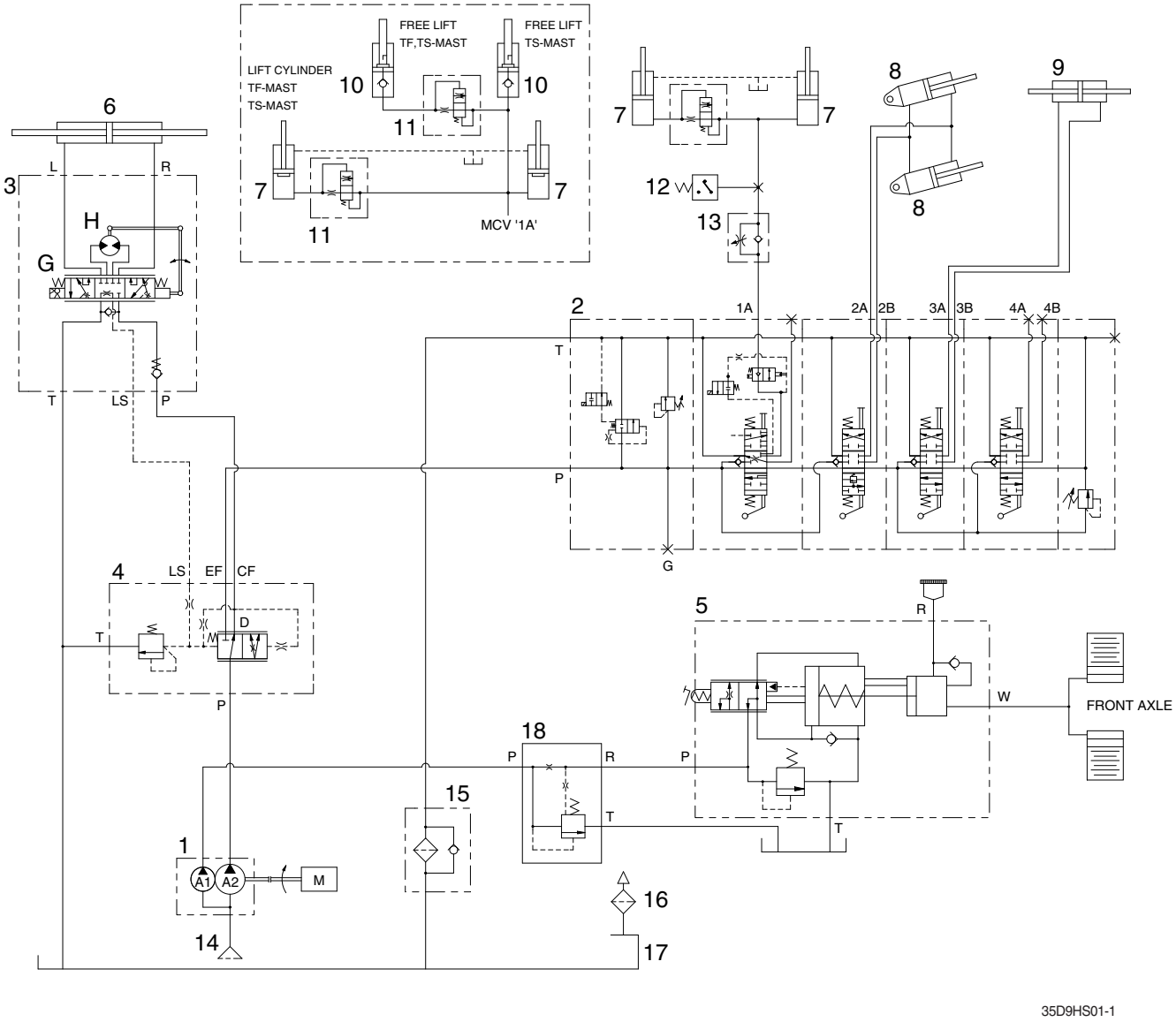


35D9HS01

1	Hydraulic gear pump	10	Free lift cylinder
2	Main control valve	11	Down safety valve
3	Steering unit	12	Load sensor
4	Priority valve	13	Flow control valve
5	Brake valve	14	Suction filter
6	Steering cylinder	15	Return filter
7	Lift cylinder	16	Air breather
8	Tilt cylinder	17	Hydraulic oil tank
9	Side shift cylinder		

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

· **TYPE 2** (Pump without priority valve)



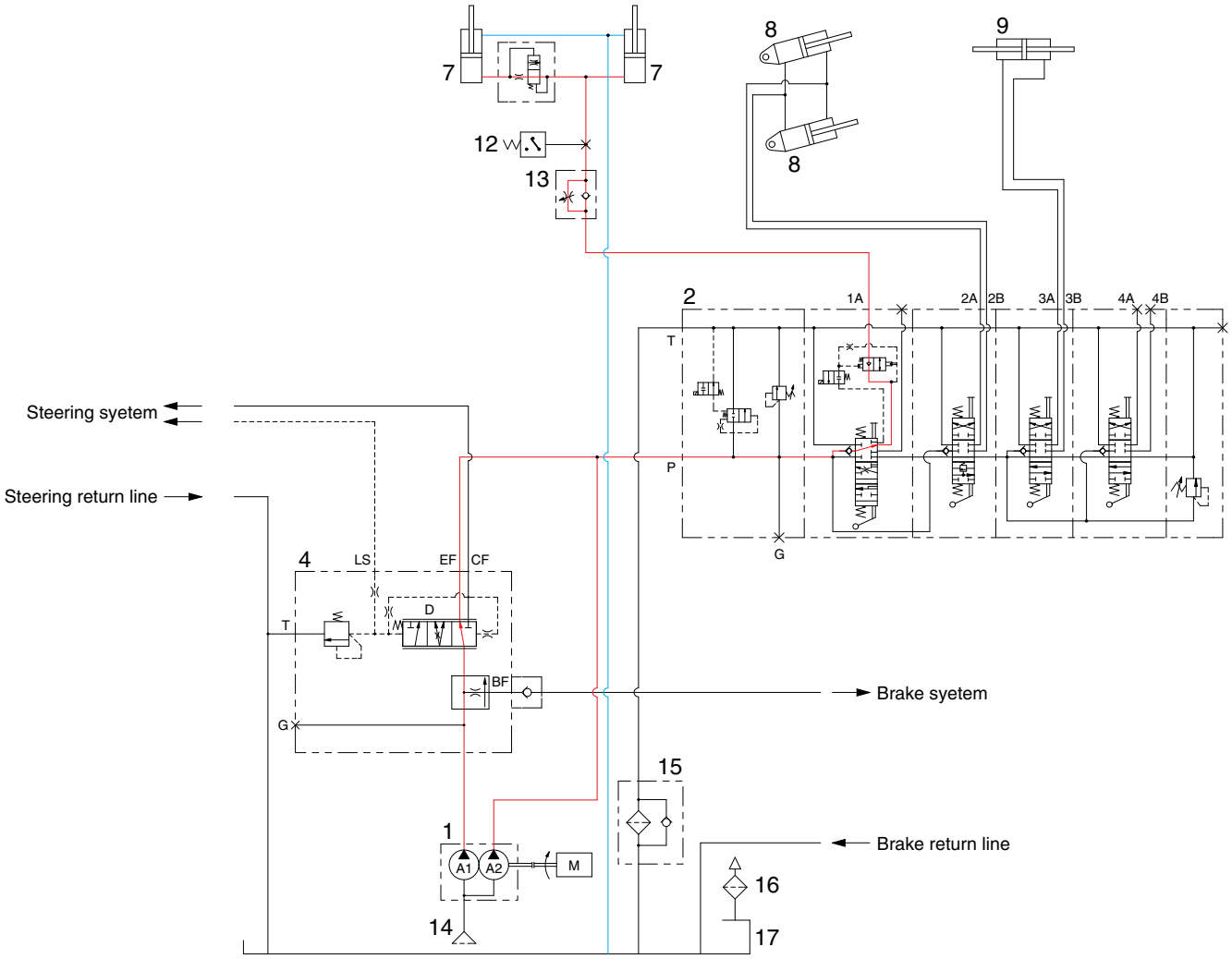
35D9HS01-1

1	Hydraulic gear pump	10	Free lift cylinder
2	Main control valve	11	Down safety valve
3	Steering unit	12	Load sensor
4	Priority valve	13	Flow control valve
5	Brake valve	14	Suction filter
6	Steering cylinder	15	Return filter
7	Lift cylinder	16	Air breather
8	Tilt cylinder	17	Hydraulic oil tank
9	Side shift cylinder	18	Flow control valve

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

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

※ The operation explanations are based on the pump with dual flow divider.

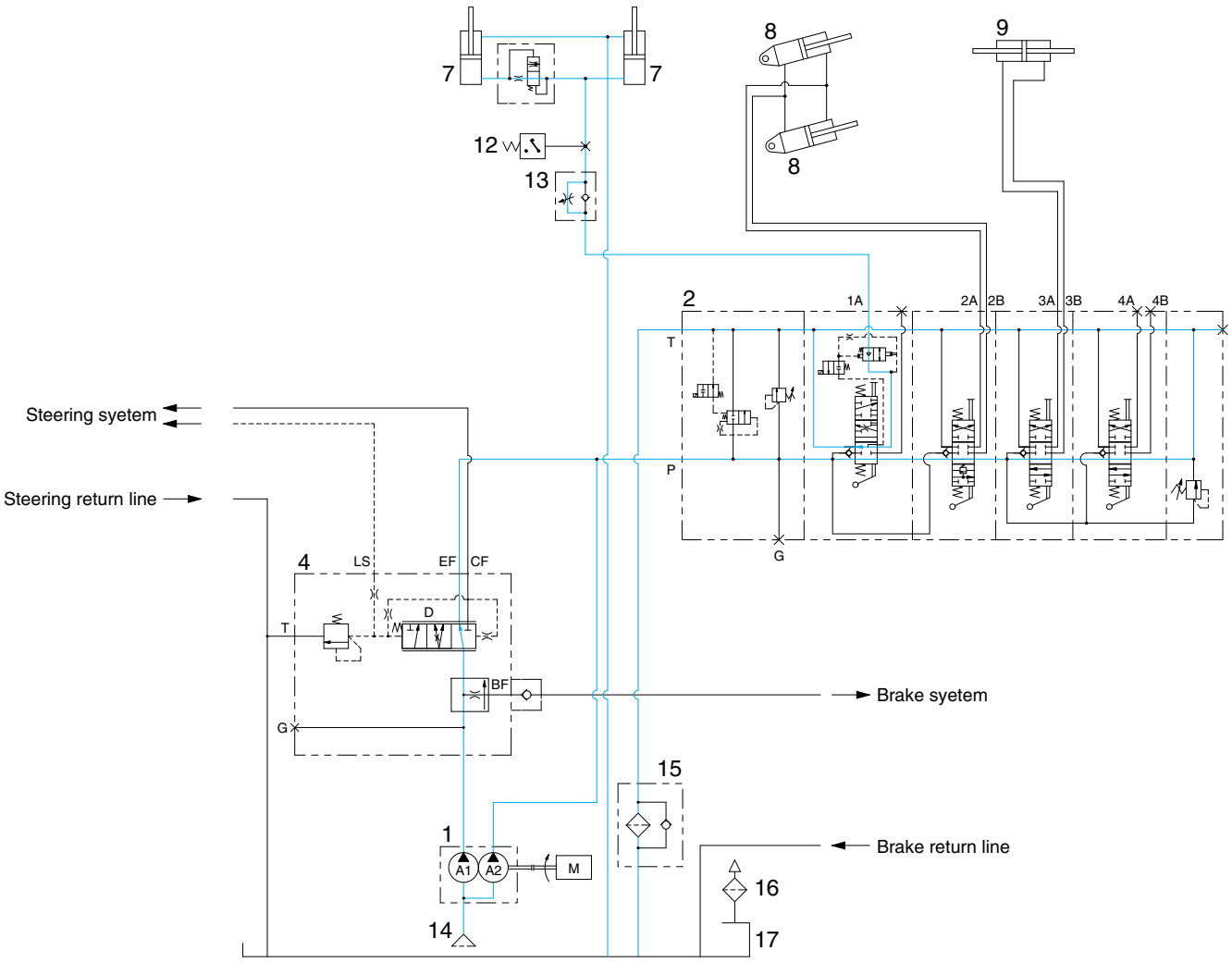


35D9HS02

When the lift control lever is pulled back, the spool in the first block is moves to lift position.
The oil from the A2 pump of the hydraulic gear pump (1) is joined the oil from the A1 pump through the priority valve in the dual flow divider (4) and it flows into main control valve (2) and then goes to the large chamber of lift cylinder (7) by pushing the load check valve of the spool.
The oil from the small chamber of lift cylinder (7) returns to hydraulic oil tank (17) 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

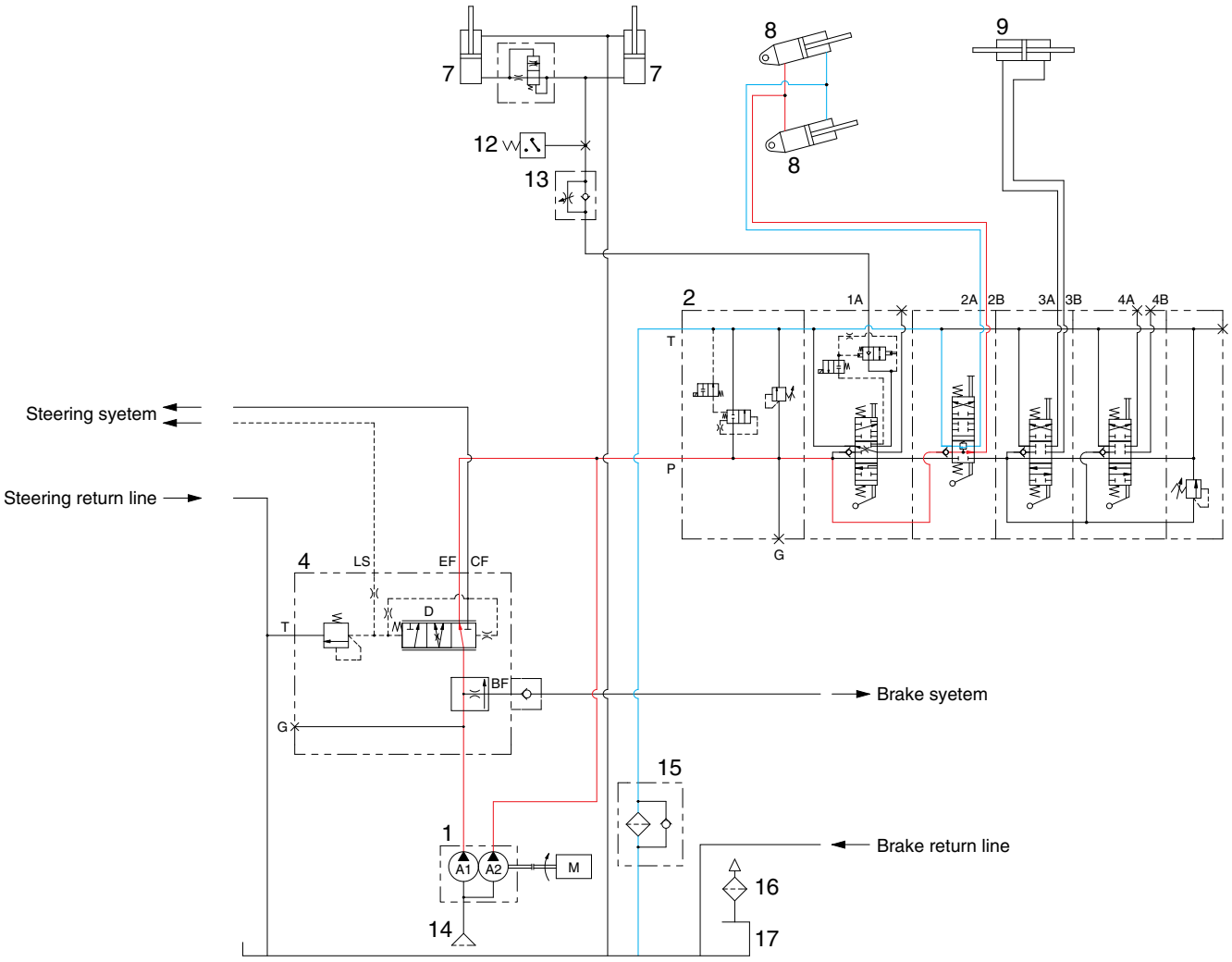


35D9HS03

When the lift control is pushed forward, the spool in the first block is moved to lower position.
The work port (B1) and the small chamber and the large chamber are connected to the return passage, so the 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

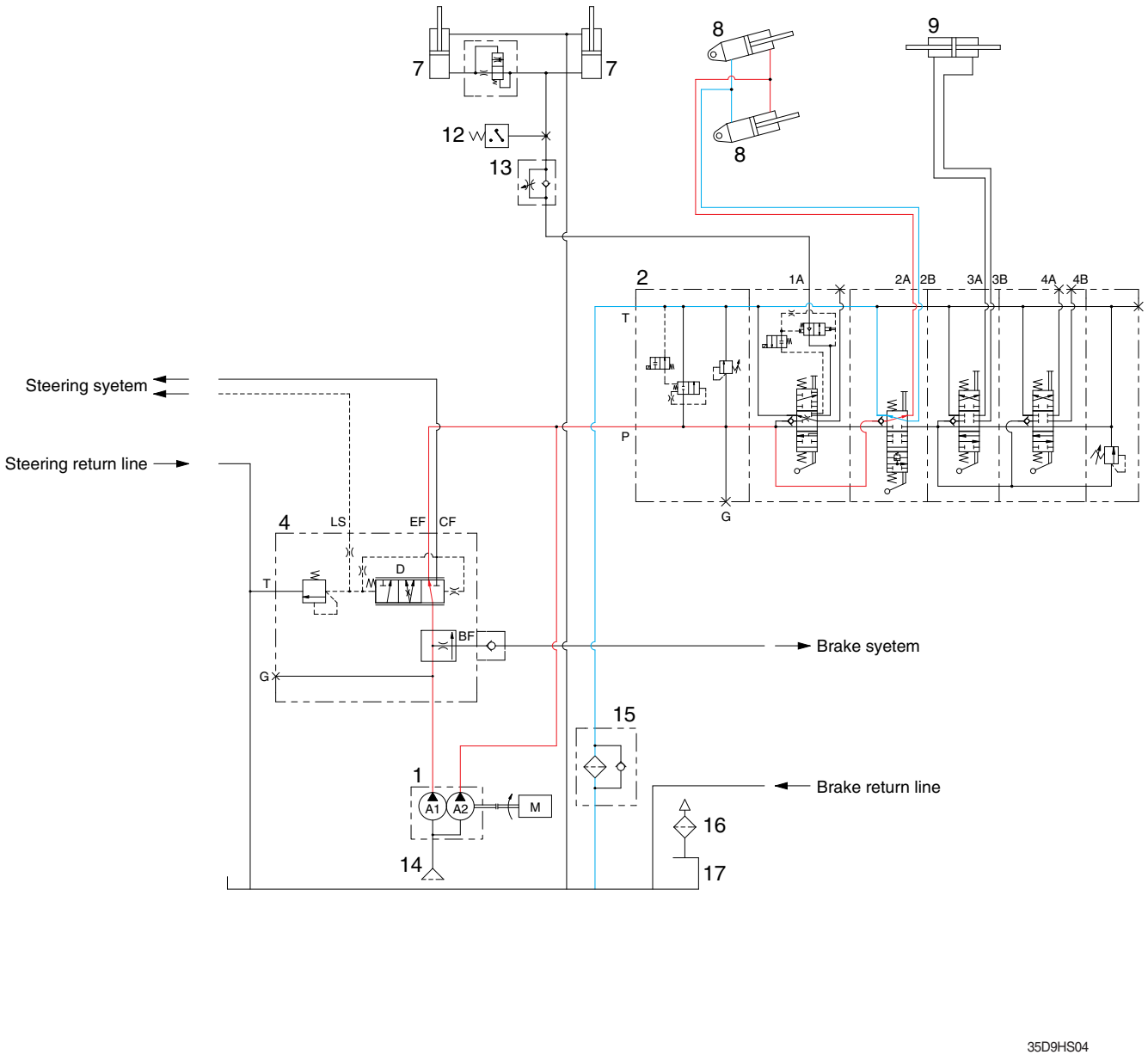


35D9HS05

When the tilt control lever is pushed forward, the spool in the second block is moved to tilt forward position.
The oil from the A2 pump of the hydraulic gear pump (1) is joined the oil from the A1 pump through the priority valve in the dual flow divider (4) and it flows into main control valve (2) and then goes to the large chamber of tilt cylinder (8) by pushing the load check valve of the spool.
The oil at the small chamber of tilt cylinder (8) returns to hydraulic oil tank (17) 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 A2 pump of the hydraulic gear pump (1) is joined the oil from the A1 pump through the priority valve in the dual flow divider (4) and it flows into main control valve (2) and then goes to the small chamber of tilt cylinder (8) by pushing the load check valve of spool.

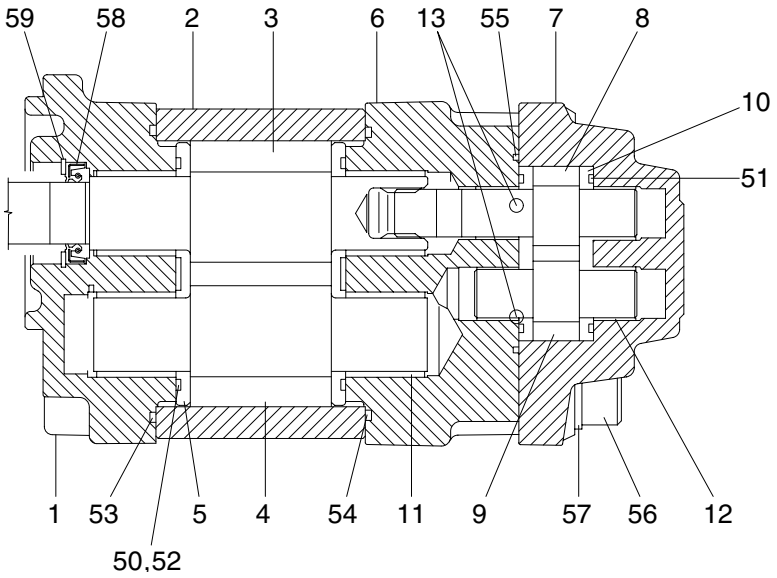
The oil at the large chamber of tilt cylinder (8) returns to hydraulic oil tank (17) at the same time.

When this happens, the mast tilt backward.

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

2. HYDRAULIC GEAR PUMP (without priority valve)

1) STRUCTURE



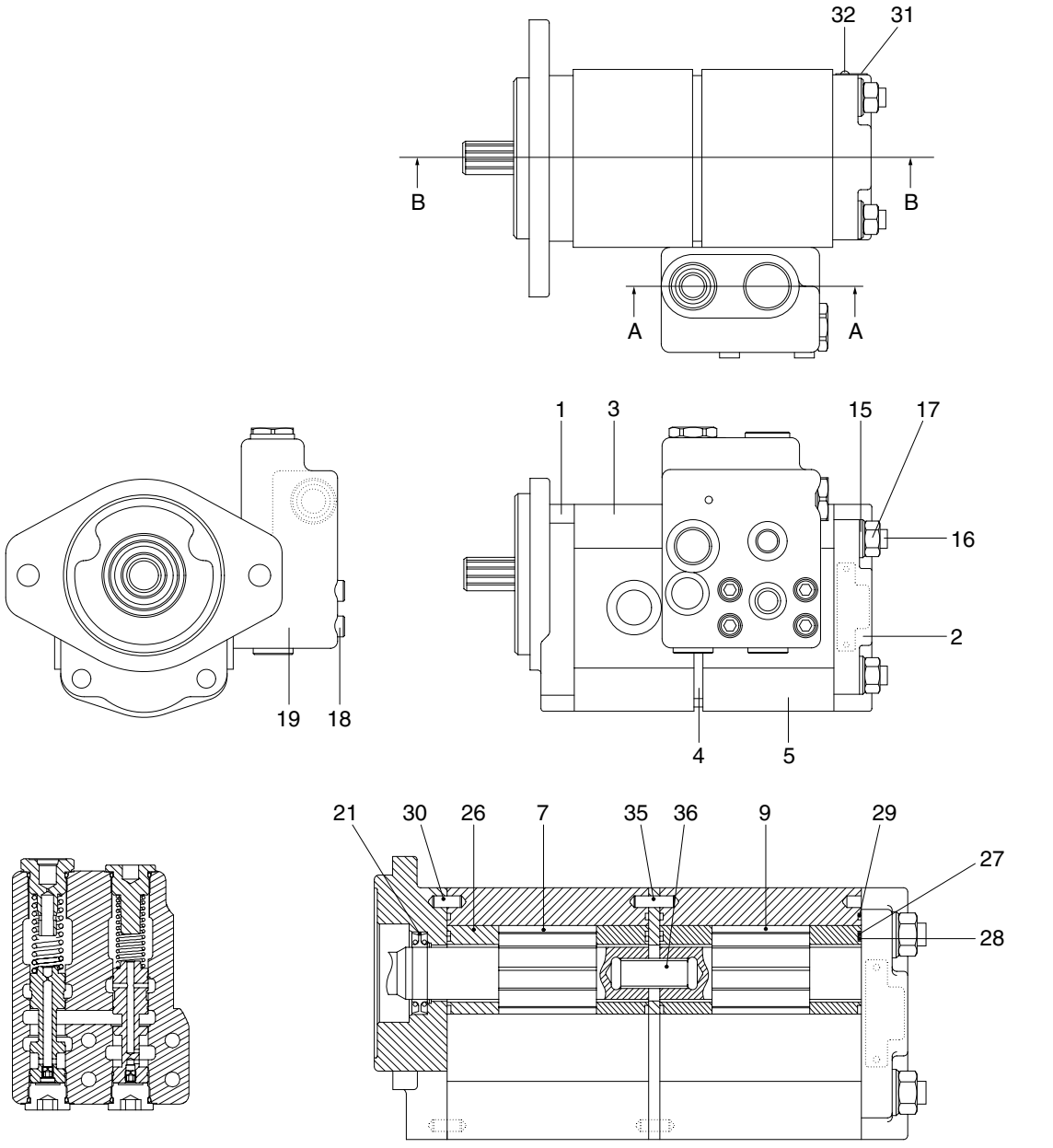
35D9HS14-1

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) 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.

HYDRAULIC GEAR PUMP (with dual flow divider)



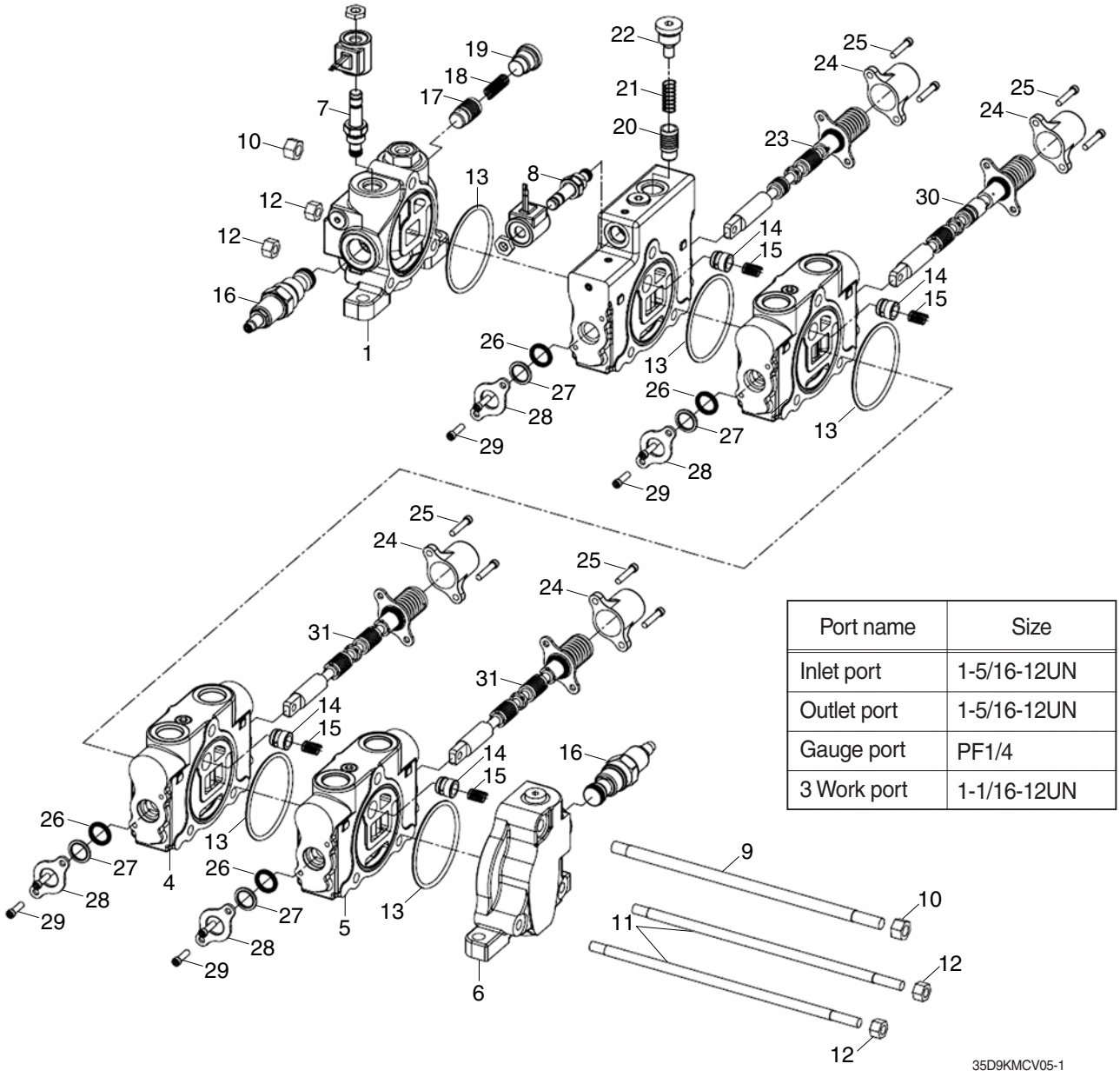
1	SEC housing	9	Gear set	21	Double seal lip	31	Name plate
2	PEC housing	15	Washer	26	Bushing	32	Screw
3	Gear housing	16	Stud bolt	27	Seal	35	Dowel pin
4	Mid plate	17	Nut	28	Backup seal	36	Connection shaft
5	Gear housing	18	Bolt	29	Seal		
7	Gear shaft set	19	Dual flow divider	30	Dowel pin		

OPERATION

This pump is comprised of a SEC housing (1), two gear housing (3, 5), a mid plate (4) and a PEC housing (2) bolted with together through bolts (16) and equipped with a dual flow divider (19). The gear shaft set (7) and gear set (9) are supported by bushings (26) to give high volumetric and mechanical efficiencies.

3. MAIN CONTROL VALVE

1) STRUCTURE (4 Spool)

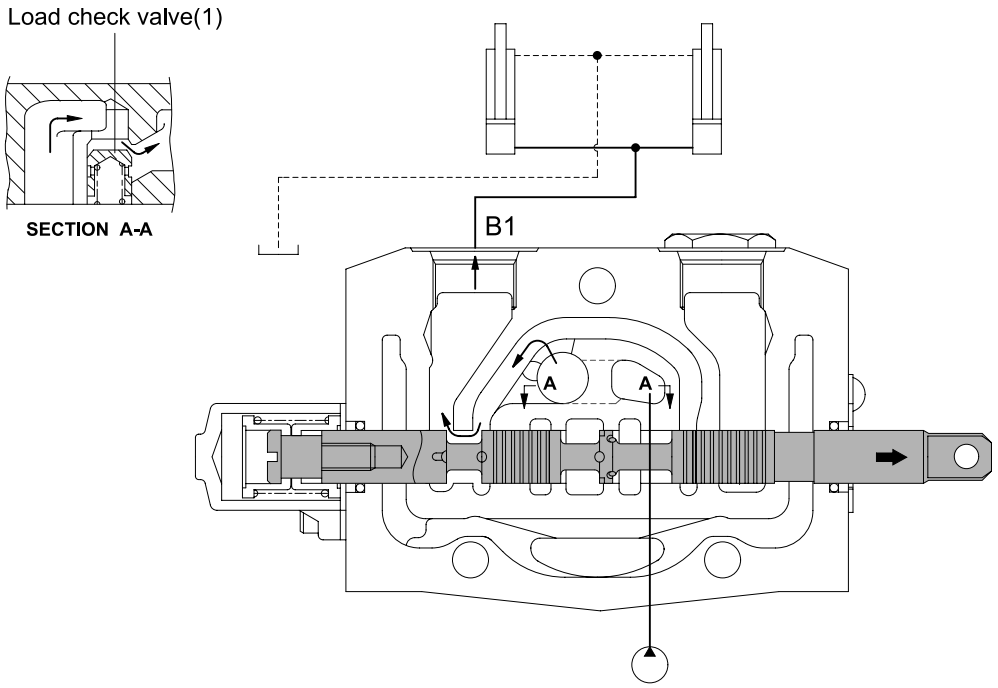


Port name	Size
Inlet port	1-5/16-12UN
Outlet port	1-5/16-12UN
Gauge port	PF1/4
3 Work port	1-1/16-12UN

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

2) LIFT SECTION OPERATION

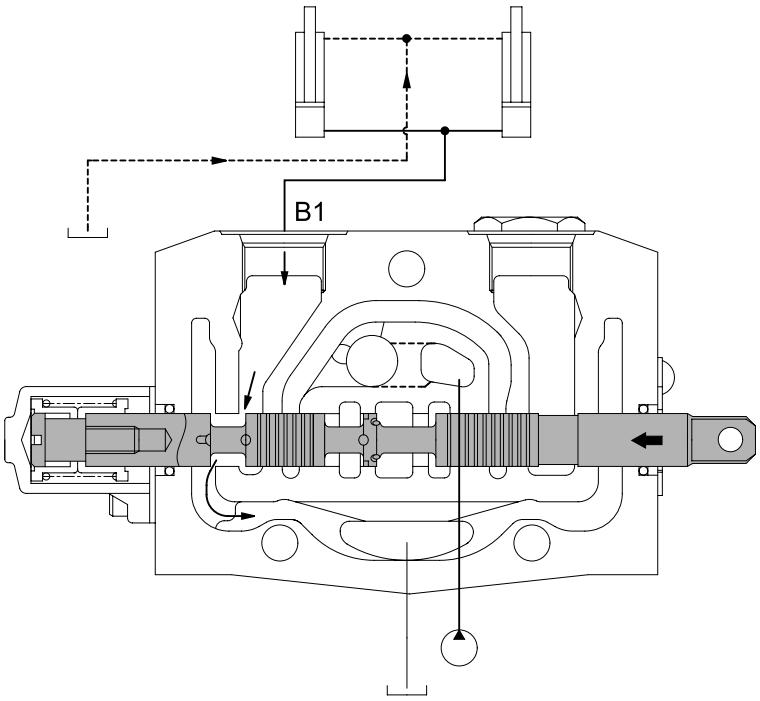
(1) Lift position



D353HS08

When the lift control lever is pulled back, the spool moves to the right and the neutral passage is closed.
The oil supplied from the pump pushes up the load check valve (1) and flow into lift cylinder port (B1).
The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.
The return oil from cylinder flows into the tank.

(2) Lower position

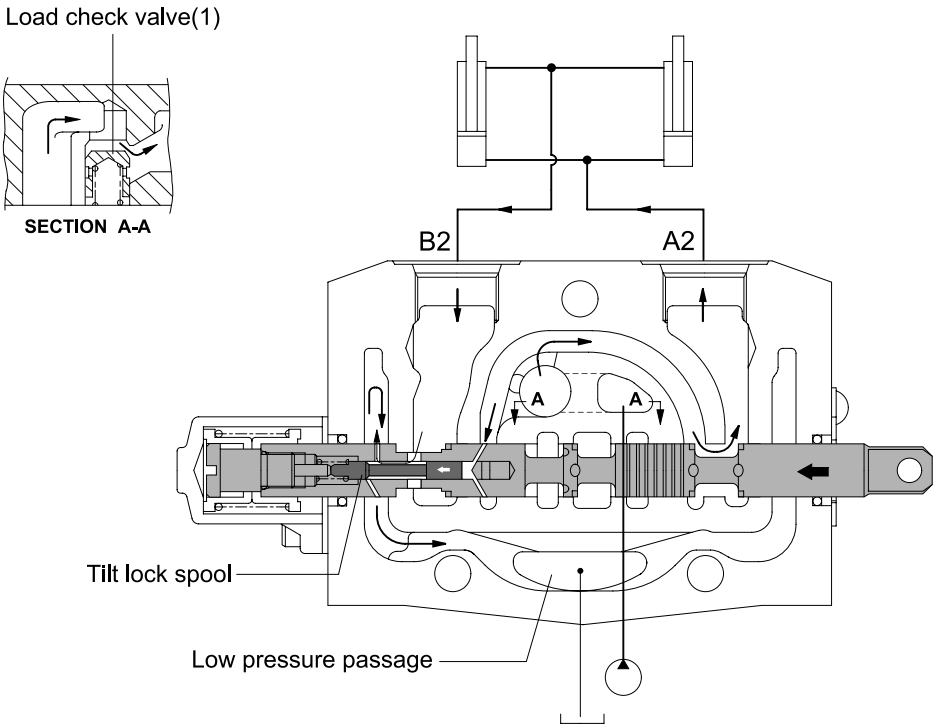


D353HS09

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

3) TILT SECTION OPERATION

(1) Tilt forward position



D353HS10

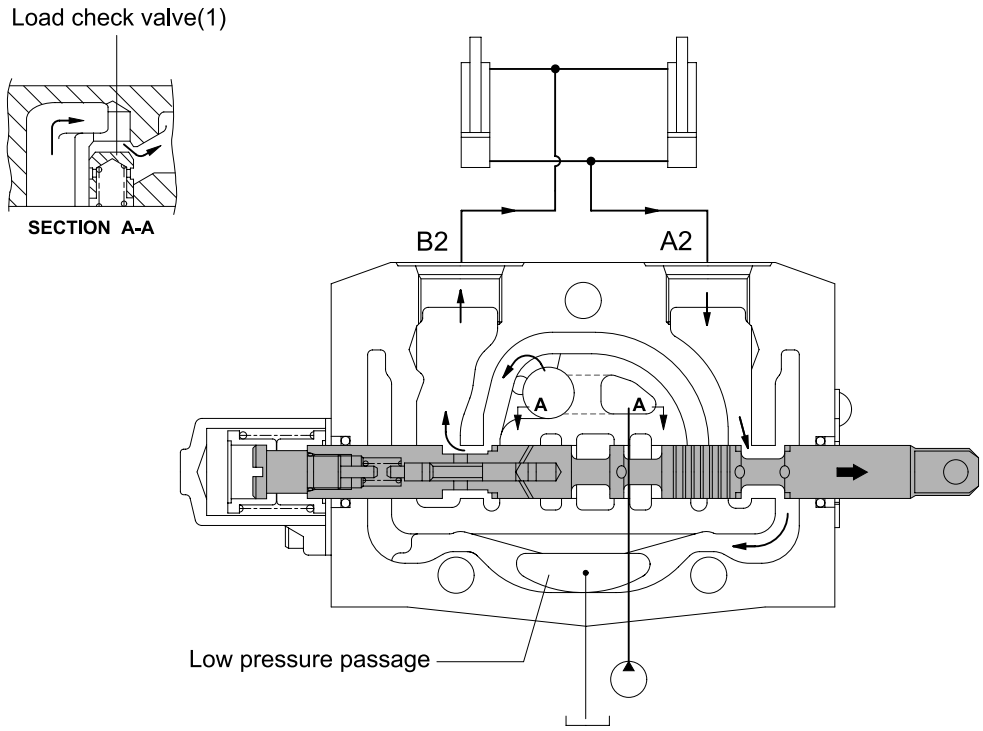
When the tilt control lever is pushed forward, the spool moves to the left and the neutral passage is closed.

The oil supplied from the pump pushes up the load check valve (1) and flow into tilt cylinder port (A2).

The pump pressure reaches proportionally the load of cylinders and fine control finished by closing the neutral passage.

The return oil from cylinder port (B2) flows into the tank through the hole of the tilt lock spool.

(2) Tilt backward position



D353HS11

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

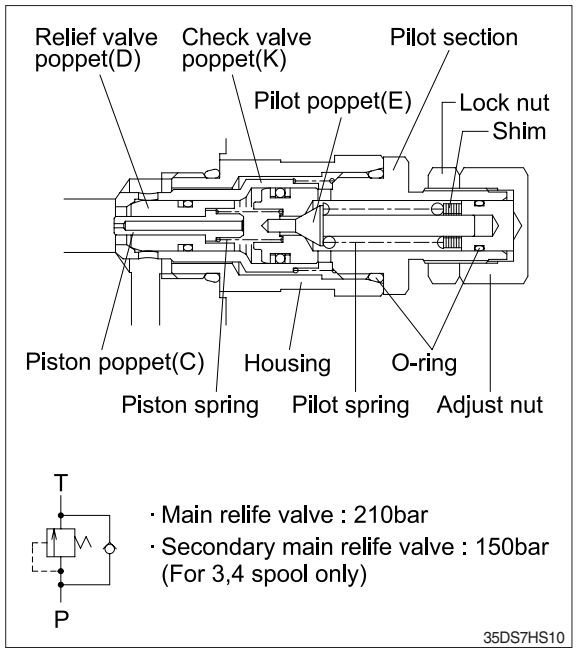
4) MAIN RELIEF VALVE

(1) Pressure setting

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

Procedure

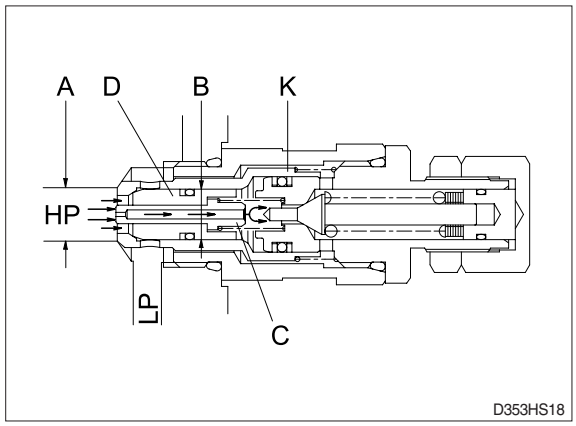
① Loosen lock nut.
② Set adjusting nut to desired pressure setting.
③ If desired pressure setting cannot be achieved, add or remove shims as required.
④ Tighten lock nut.
⑤ Retest in similar manner as above.



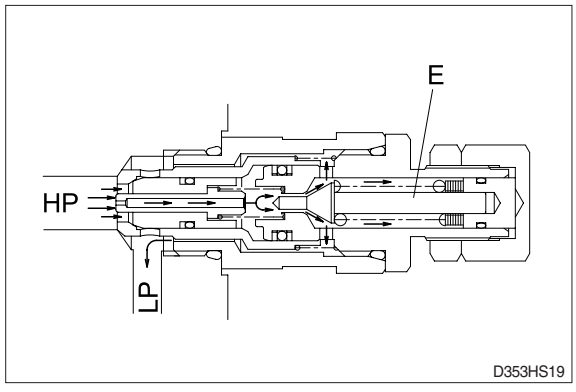
(2) Function

① As work port relief

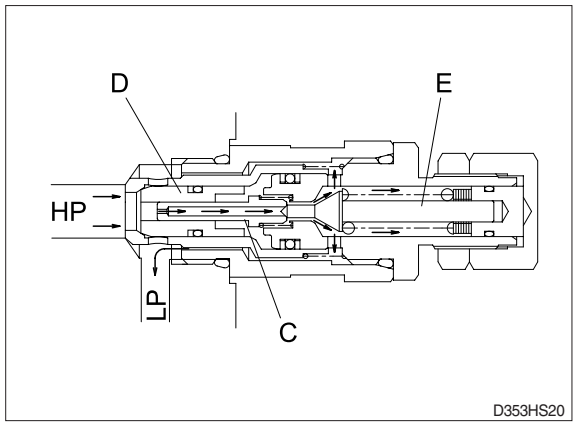
The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown.



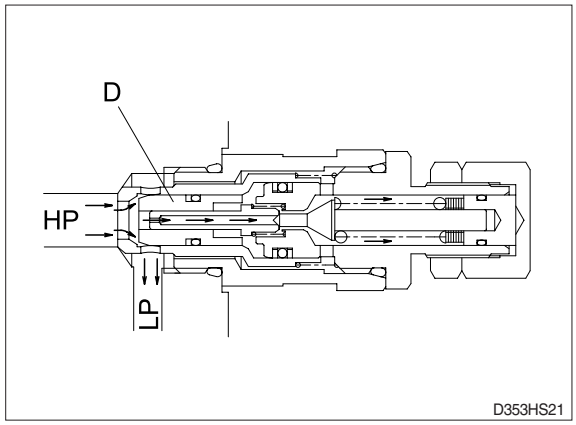
The oil pressure in the high pressure port HP has reached the setting of the pilot poppet spring force and unseats the pilot poppet E and oil flows around the poppet through the cross drilled holes and to the low pressure area LP.



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

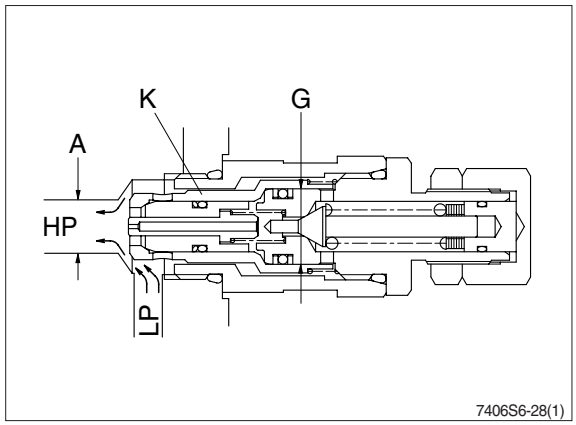


The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.

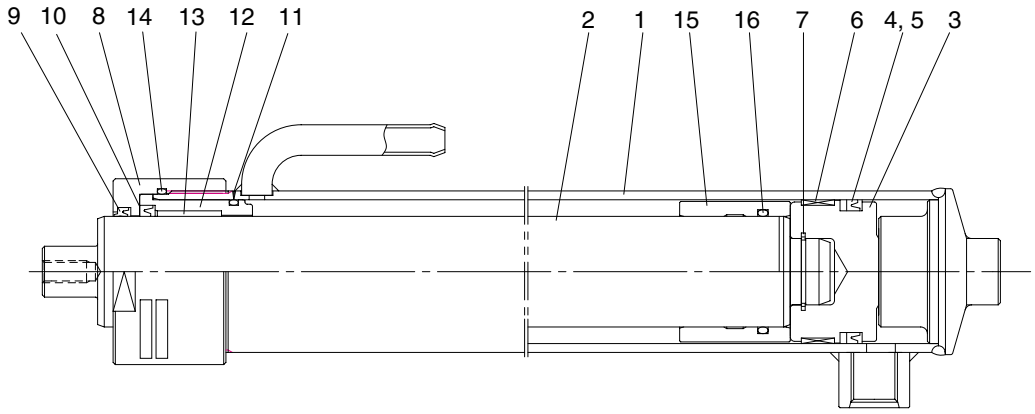


② As anti void

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



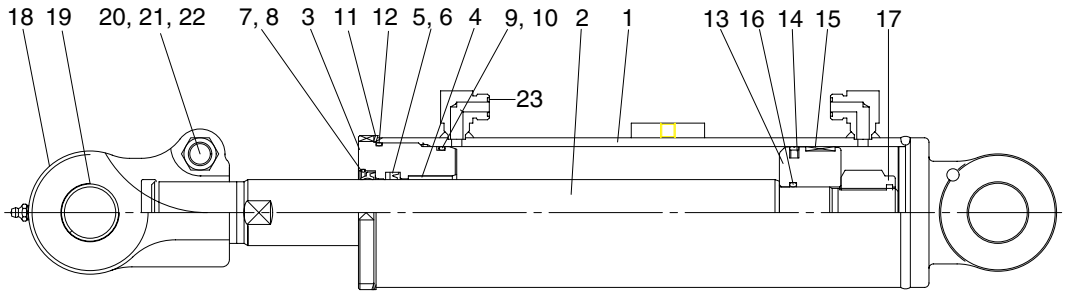
4. LIFT CYLINDER



D357HS12

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

5. TILT CYLINDER



D357HS13

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

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

1) CHECK ITEM

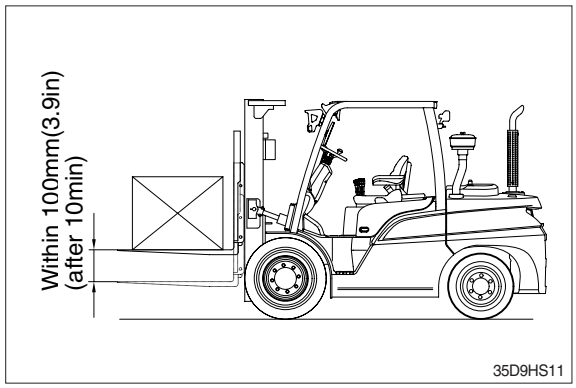
(1) Check visually for deformation, cracks or damage of rod.

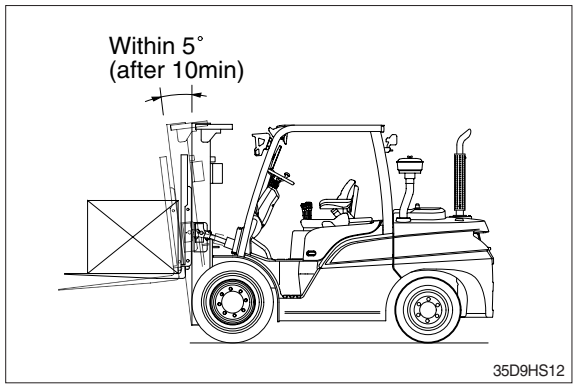
(2) Load maximum load, set mast vertical and raise 1m from ground. Wait for 10 minutes and measure hydraulic drift (amount forks move down and amount mast tilts forward).

· **Hydraulic drift**

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

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





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

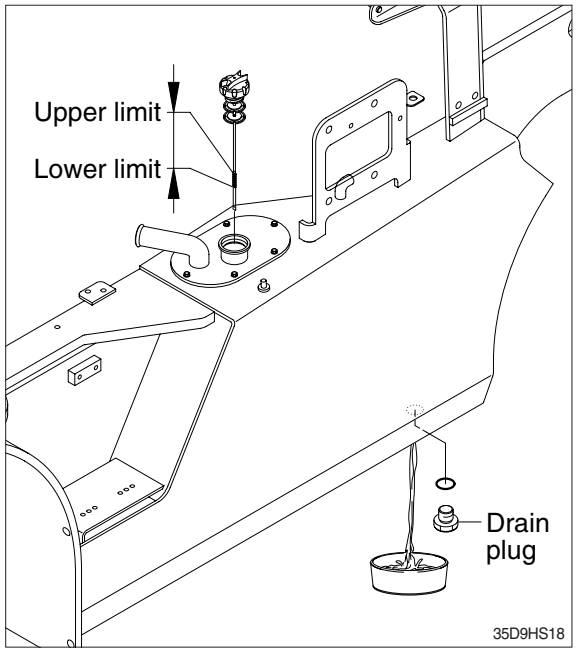
mm (in)

Standard	Under 0.6 (0.02)

2) HYDRAULIC OIL

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

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



3) CONTROL VALVE

(1) Raise forks to maximum height and measure oil pressure.
Check that oil pressure is 210 kgf/cm^2.
(2990 psi)

2. TROUBLESHOOTING

1) SYSTEM

Problem	Cause	Remedy
Large fork lowering speed	· Seal inside control valve defective. · Oil leaks from joint or hose. · Seal inside cylinder defective.	· Replace spool or valve body. · Replace. · Replace packing.
Large spontaneous tilt of mast	· Tilting backward : Check valve defective. · Tilting forward : tilt lock valve defective. · Oil leaks from joint or hose. · Seal inside cylinder defective.	· Clean or replace. · Clean or replace. · Replace. · Replace seal.
Slow fork lifting or slow mast tilting	· Lack of hydraulic oil. · Hydraulic oil mixed with air. · Oil leaks from joint or hose. · Excessive restriction of oil flow on pump suction side. · Relief valve fails to keep specified pressure. · Poor sealing inside cylinder. · High hydraulic oil viscosity. · Mast fails to move smoothly. · Oil leaks from lift control valve spool. · Oil leaks from tilt control valve spool.	· Add oil. · Bleed air. · Replace. · Clean filter. · Adjust relief valve. · Replace packing. · Change to SAE10W, class CD engine oil. · Adjust roll to rail clearance. · Replace spool or valve body. · Replace spool or valve body.
Hydraulic system makes abnormal sounds	· Excessive restriction of oil flow pump suction side. · Gear or bearing in hydraulic pump defective.	· Clean filter. · Replace gear or bearing.
Control valve lever is locked	· Foreign matter jammed between spool and valve body. · Valve body defective.	· Clean. · Tighten body mounting bolts uniformly.
High oil temperature	· Lack of hydraulic oil. · High oil viscosity. · Oil filter clogged.	· Add oil. · Change to SAE10W, class CD engine oil. · Clean filter.

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) HYDRAULIC GEAR PUMP

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

3) MAIN RELIEF VALVE

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

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

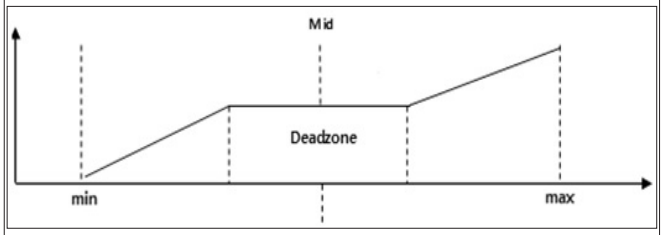
- Loosen lock nut.
- Set adjusting nut to desired pressure setting.
- If desired pressure setting cannot be achieved, tighten or loosen the adjusting screw as required.
- Tighten lock nut.
- Retest in similar manner as above.

4) LIFT CYLINDER

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

5) FINGER TIP (OPTION)

(1) DTC Error code and Trouble shooting

Category	DTC Error Code	Action
Lever setting error	· Lift Lever Setting Error · Tilt Lever Setting Error · Aux1 Lever Setting Error · Aux2 Lever Setting Error  * VCU : Valve Control Unit (HAWE "CANIO14+") **DTC : Diagnostic Trouble Code	Check Lever Setting Value is correct like below values, and retry lever setting correctly. Min = 0.3~0.7 Mid = 2.3~2.7 Max = 4.3~4.7 (Voltage) If the Lever Value doesn't change from "0", Check fingertip levers. It might parts failure or Electric wire failure.
Valve open error	· Lift up (down) Valve 0 (1) Open · Tilt in (out) Valve 2 (3) Open · Aux1 in (out) Valve 4 (5) Open · Aux2 in (out) Valve 6 (7) Open	Check Valve Electric wire open circuit.
Valve short error	· Lift up (down) Valve 0 (1) Short · Tilt in (out) Valve 2 (3) Short · Aux1 in (out) Valve 4 (5) Short · Aux2 in (out) Valve 6 (7) Short	Check Valve Electric wire short circuit.
Valve VCC missing error	· Lift up (down) Valve 0 (1) VCC missing · Tilt in (out) Valve 2 (3) VCC missing · Aux1 in (out) Valve 4 (5) VCC missing · Aux2 in (out) Valve 6 (7) VCC missing	Check VCU VCC(Supply Voltage). About 24V must be supplied for A1, A8, B5 Pin.

(2) Equipment setup - Finger Tip(option)

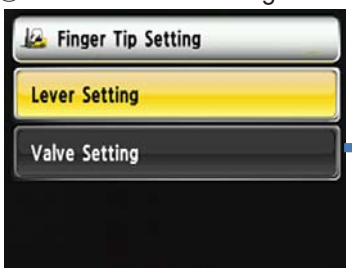
※ How to set the "Finger Tip Lever Position"

① Press the "Equipment" button

② Enter password : Defult "0000"

③ Press the"Finger Tip Setting" button

④ Press the"Lever Setting" button



⑤ Press the"Lift Lever" button

⑥ You can enter "Lift Lever" display

⑦ Activate the "Min" button

⑧ Pull the lever backwards as much as possible and set Min. voltage value

⑨ Place the lever in neutral and set the Mid value

⑩ Push the lever forwards as much as possible and set the Max value

⑪ Lift lever setting is completed

⑫ Repeat the same process for "Tilt, Aux1, Aux2 Lever"as 5-11

※ How to set the "Finger Tip Lever Deadzone"

① Press the "Lever Deadzone" button

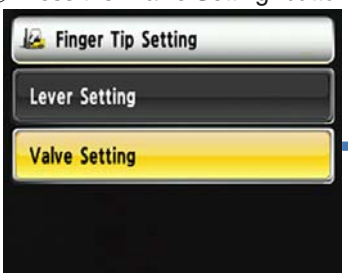
② Press the "Upper Zone" button

③ Set the upper deadzone value

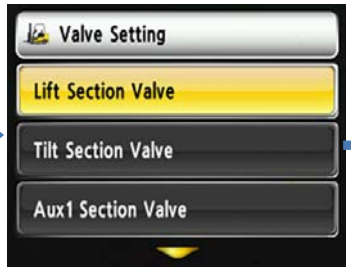
④ Repead for "Lower Zone" as 2-3

※ How to set the "Finger Tip Lift Section Valve"

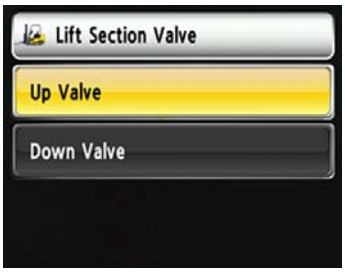
① Press the "Valve Setting" button



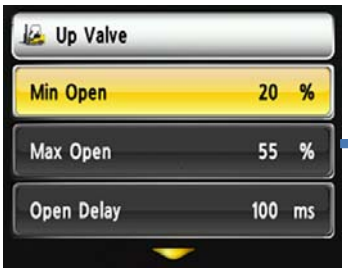
② Press the "Lift Section Valve" button



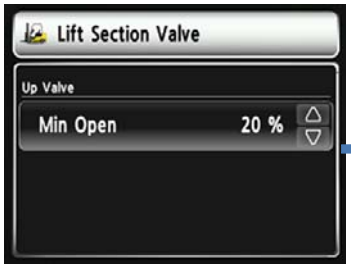
③ Press "Up valve" or "Down Valve" button



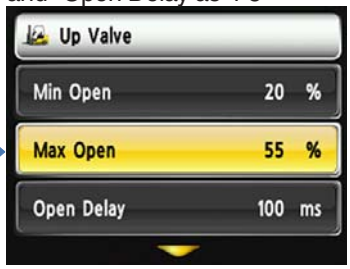
④ Press the "Min Open" button



⑤ Set the mininum open value

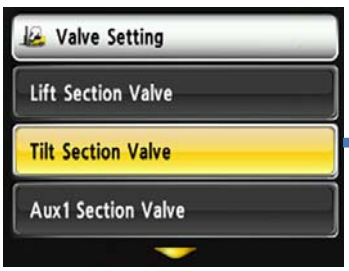


⑥ Set the "Maximum Opening" and "Open Delay as 4-5

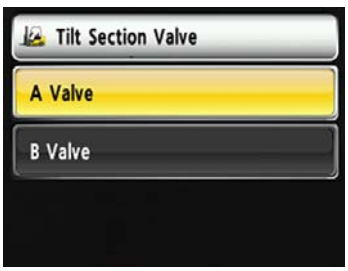


※ How to set the "Finger Tip Tilt, Aux1, Aux2 Section Valve"

① Press "Tilt Section Valves" or "Aux1 Section Valve" or "Aux2 Section Valve" button

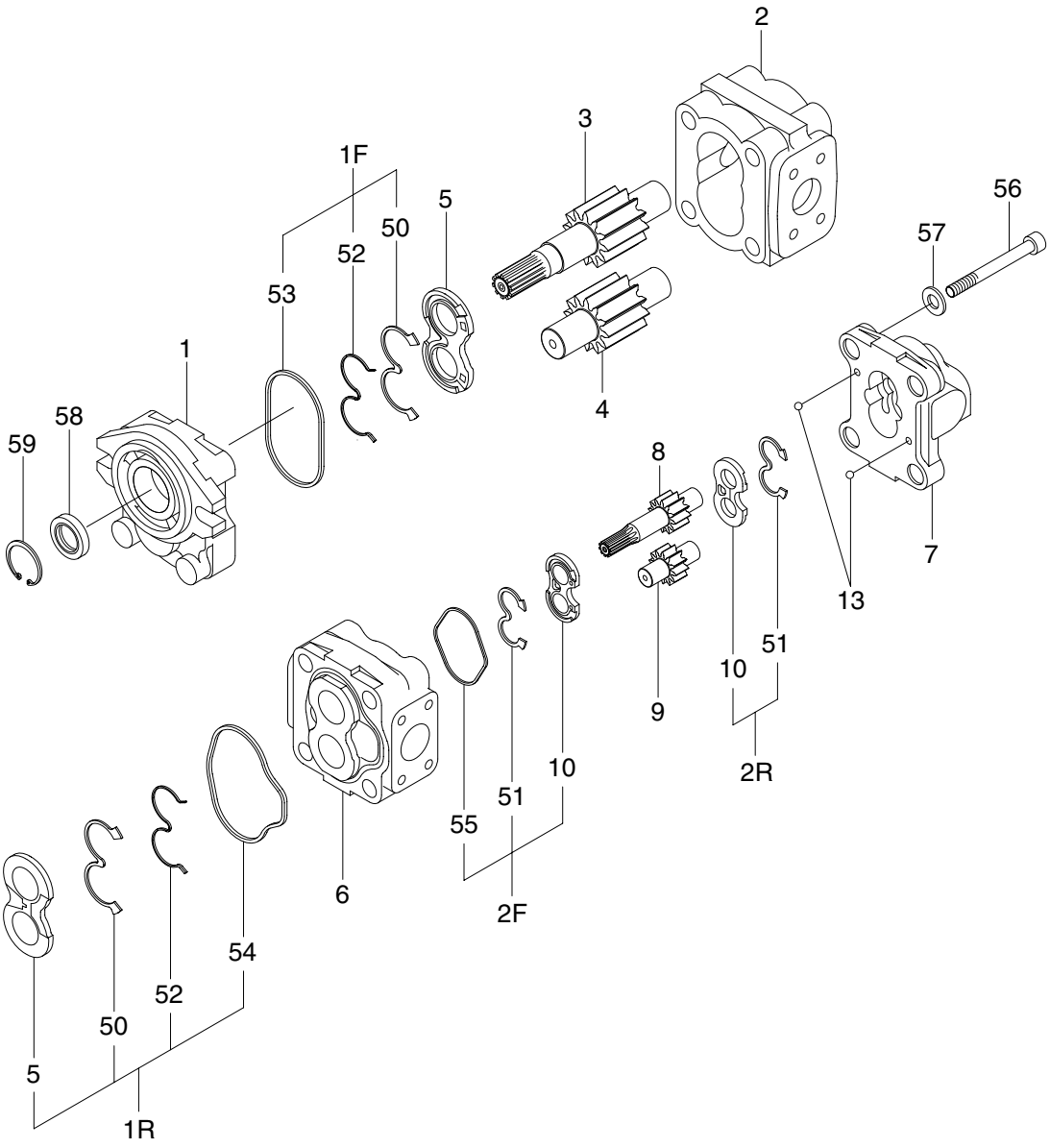


② Press "A Valve" or "B Valve"and set the value



1. MAIN PUMP

1) STRUCTURE (without priority valve)



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

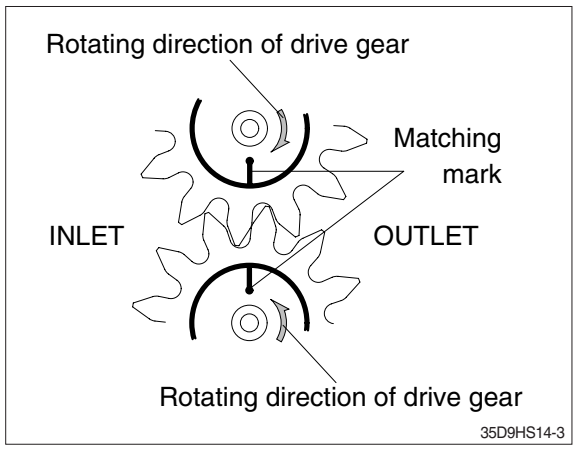
① Fix the mounting parts of front cover with the body side up to the vice.

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 before disassembling.

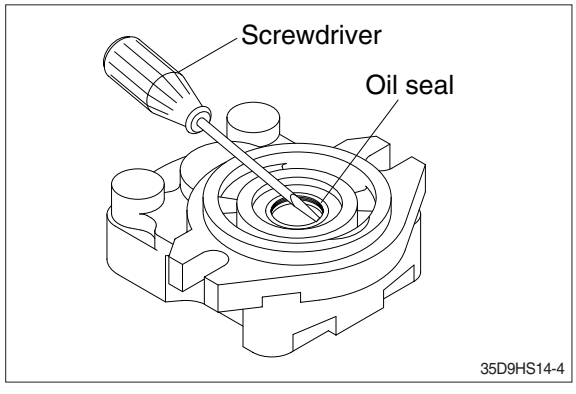
③ Remove the four bolts (56) and disassemble the parts (item 7 → 6 → 2).
Please see the instructions below.

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.



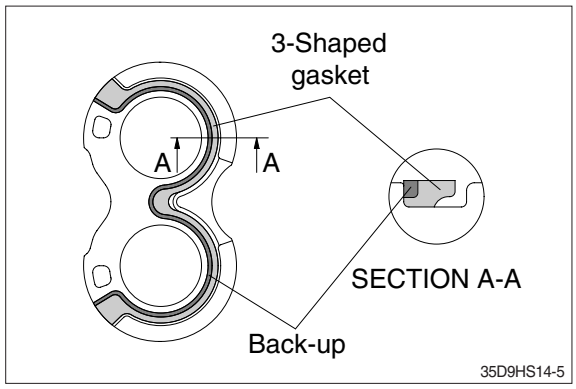
(3) Assembly

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

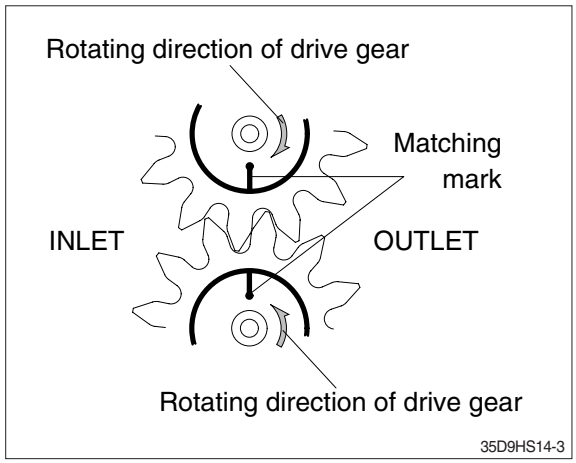
② Clean each part to remove dust before reassembling.

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.



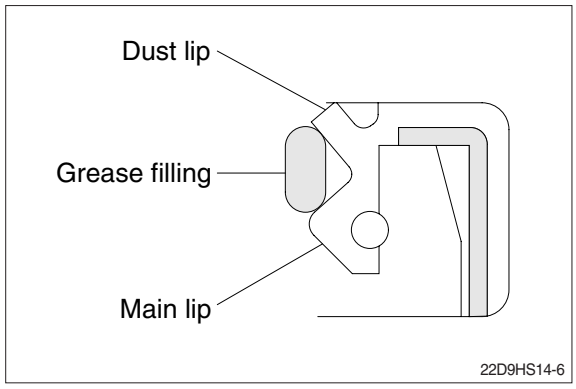
· Fix the drive gear and driven gear by matching each mark.



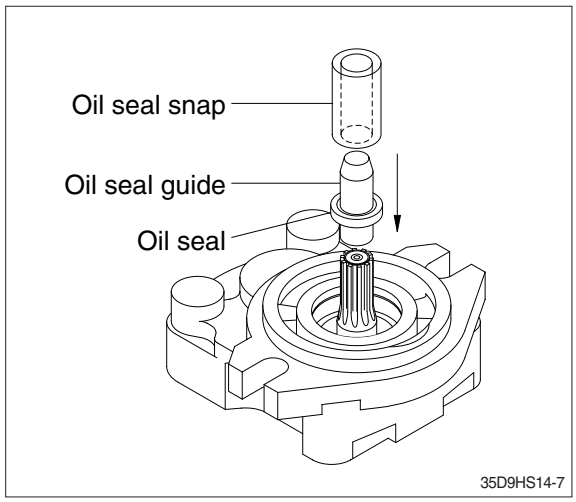
④ Tighten 4 bolts evenly by 13.3~14.3 kgf·m (96.2~103 lbf·ft) torque.

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

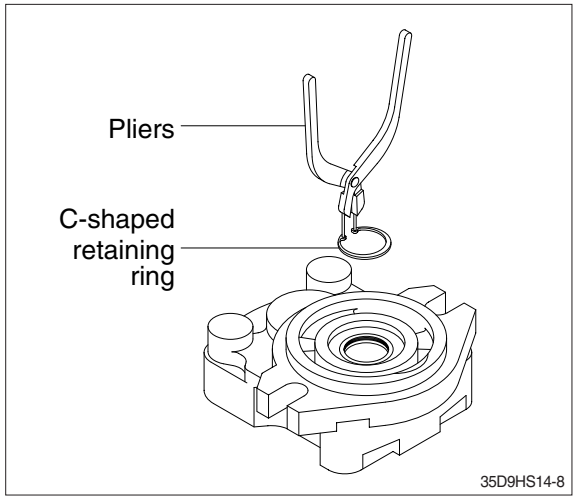
⑥ Fill the dent between the main lip and dust lip of oil seal with grease.



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.



3) TROUBLESHOOTING

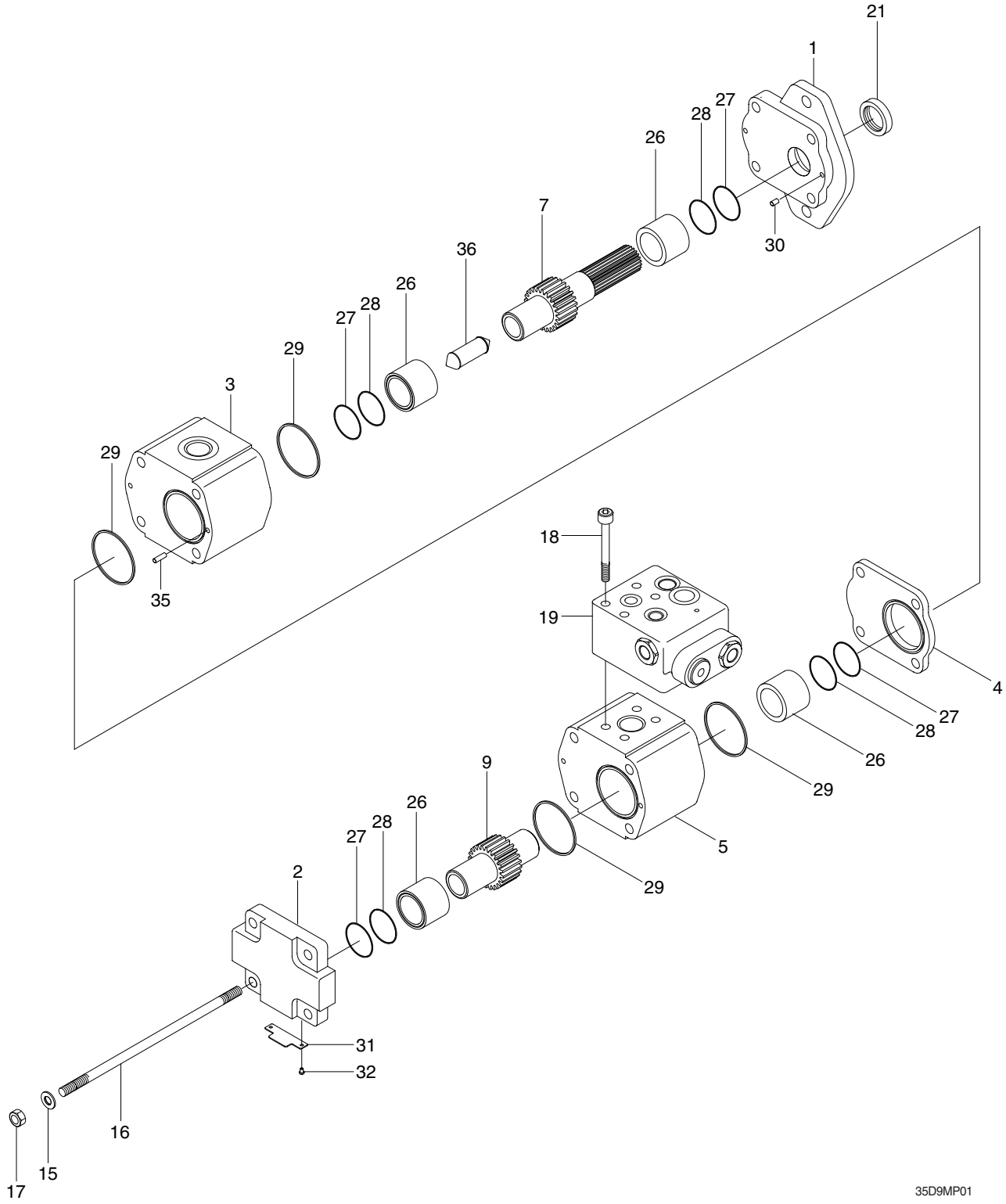
Status	Possible factors	Solutions
Leakage from the oil seal	· Reverse rotation. · Abnormal high pressure in the inlet. · Seal lips damaged by wastes. · Sealed parts of the shaft damaged or worn out. · Poor shaft centering.	· Rotate the pump to the right way. · Keep the designated pressure. · Replace 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 hy 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. · Lack of capacity or breakdown of the cooling system. · Damage of the internal parts.	· Set the pressure appropriately. · Change the cooling system. · 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 internal parts.	· 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.

HYDRAULIC GEAR PUMP (with dual flow divider)



1	SEC housing	9	Gear set	21	Double seal lip	31	Name plate
2	PEC housing	15	Washer	26	Bushing	32	Screw
3	Gear housing	16	Stud bolt	27	Seal	35	Dowel pin
4	Mid plate	17	Nut	28	Backup seal	36	Connection shaft
5	Gear housing	18	Bolt	29	Seal		
7	Gear shaft set	19	Dual flow divider	30	Dowel pin		

2) DISASSEMBLY

(1) General precautions

① If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces.

② Excessive force while prying can result in misalignment and seriously damage parts. If parts are difficult to fit during assembly, tap gently with a soft hammer (never use an iron hammer).

③ Gears are closely matched, therefore they must be kept together as sets when removed from a unit. Handle with care to avoid damage to the journals or teeth. Avoid touching gear journals.

(2) Disassembly

① Place the pump in a vise with the drive shaft pointing down.

※ Do not grip on or near any machined surfaces during assembly or disassembly.

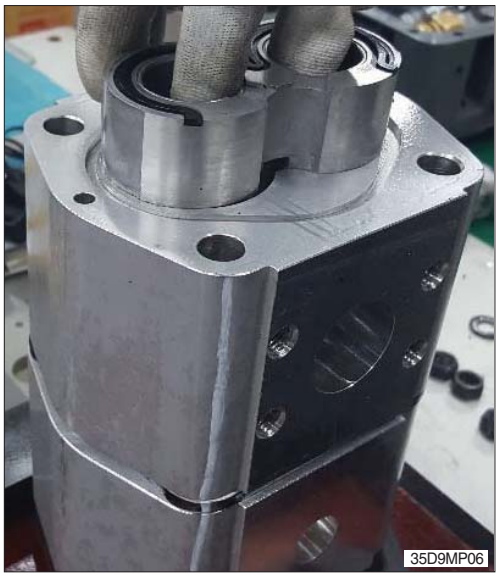
※ Match-mark all sections.
Be sure to align these marks when reassembling.

② Use a socket wrench to remove the 4 cap screws on single units or the 4 hex nuts, studs and washers of multiple units.

③ If prying is necessary, be careful not to damage the machined surfaces.

④ Remove the bush block . Examine and replace if necessary.

※ Detail see page 6-32, 33.



⑤ Carefully remove the drive and driven gears.
Avoid tapping the gear teeth together or against other hardened surfaces.
Keep these gears together because they are a matched set.
Examine and replace if necessary.
Remove the bush block from the gear housing.
Examine and replace if necessary.

⑥ Lift the gear housing from the mid plate.
If prying is necessary, take care not to damage machined surfaces.
Examine and replace if necessary.
Dowel pins will remain in either the rear gear housing or the front gear housing.

⑦ Remove the mid pate.

⑧ Lift the gear housing from the shaft end cover to prevent damage to contact face and edges.
Dowel pins will remain in either the gear housing or port end cover.
Do not remove them.

⑨ Remove the bush block.
Examine and replace if necessary.

※ Detail see page 6-32, 33.

⑩ Carefully remove the drive and driven gears.
Avoid tapping the gear teeth together or against other hardened surfaces.
Keep these gears together because they are a matched set. Examine and replace if necessary.
Remove the bush block from the gear housing. Examine and replace if necessary.


35D9MP12

3) ASSEMBLY

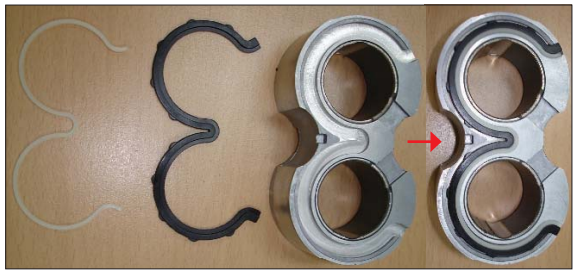
① Press it into the mounting flange side of the shaft end cover with an air press. Be careful not to damage the lip of the seal. Press in until flush with the recess.


35D9MP13

② Insert dowel pin.
Examine all of the dowels. Before inserting, make certain that the hole is clean and free from burrs.
Gently start the pin straight into the hole and tap lightly with a soft hammer.

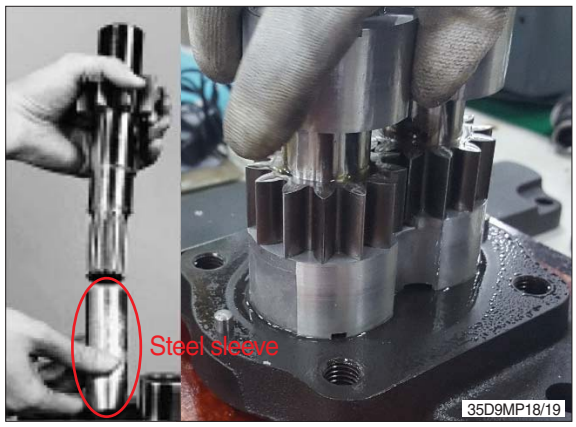

35D9MP14

③ Assemble the channel seals into the grooves in the bush blocks with the flat side of the seal facing away from the bush block such as picture.


35D9MP15/16

④ Gently the bush block assemble on the shaft end cover.
The channel seal from step ③ should face the shaft end cover.
The relief groove in the plate should face the outlet side of the pump.

⑤ Slide the driven gear into the bushing.
Coat the steel sleeve tool with grease.
Place the lightly-greased drive shaft inside the sleeve and slide both through the shaft end cover with a twisting motion, until the integral gear rests against the bush block.
Avoid damaging the double lip seal.
Remove the steel sleeve.
Bush block assemble on the gears.



⑥ Slip the bush block with the seal over the gear journals.
The flat side of the seal should face up with the relief groove facing the outlet side.

⑦ Place the gear housing onto the journals of the drive and driven gears.
Be sure to line up the dowel holes over the dowel pins.
When the parts are parallel, squeeze them together or alternately tap over each dowel until the parts are together.

⑧ Place the mid plate on the gear housing.
Be sure to set driver gear and large hole, and inlet hole and small hole.

⑨ Insert the connecting shaft into the spline of the drive gear.

⑩ Place the gear housing on the mid plate.
Be sure to line up the dowel holes over the dowel pins.
When the parts are parallel, squeeze them together or alternately tap over each dowel until the parts are together.
Slide the bush block through the gear housing on the mid plate.

⑪ Insert the drive and driven gears of the second section in their respective bush block.
Make certain the gears are in contact with the bush block.

※ Detail see page 6-32, 33.

⑫ Slip the bush block with the seal over the gear journals.
The flat side of the seal should face up with the relief groove facing the outlet side.

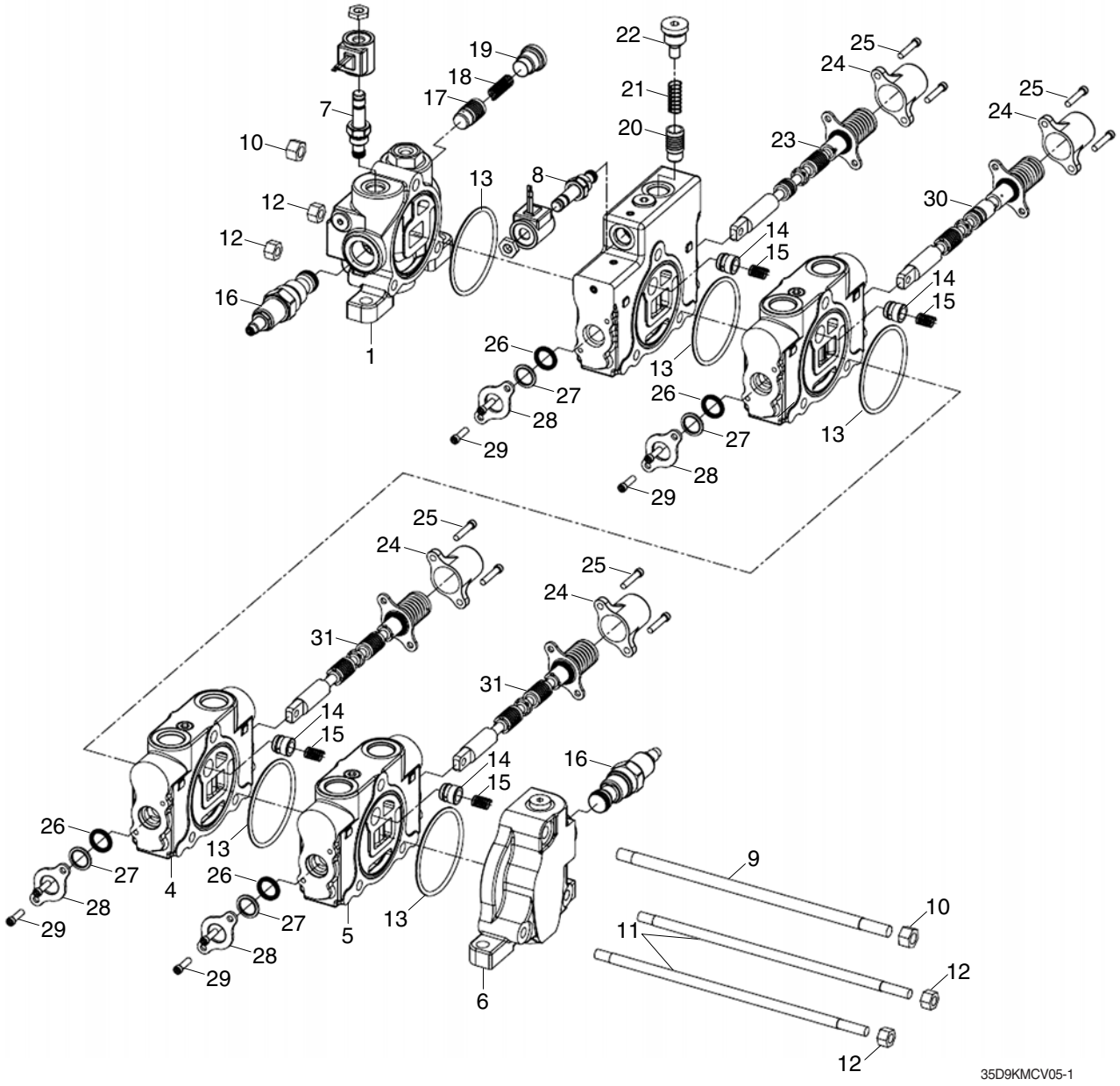
※ Detail see page 6-32, 33.

⑬ Place the port end cover over the gear housing

⑭ Thread the fasteners into the shaft end cover and tighten alternately or cross corner.
Rotate the drive shaft with “pre-rotate jig” to check for binding.
If there is no internal binding, tighten torque diagonally to 10.2 kgf·m (73.8 lbf·ft).

MAIN CONTROL VALVE

1) STRUCTURE (4 Spool)



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

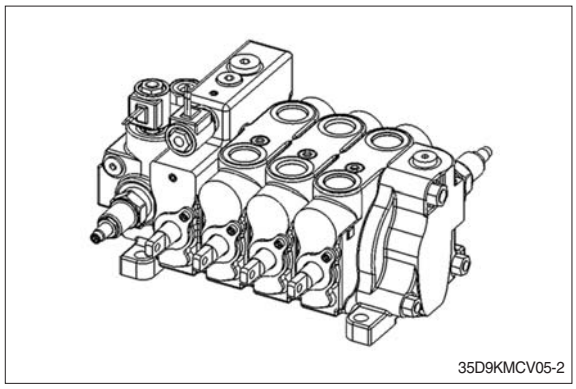
2) DISASSEMBLY AND ASSEMBLY

(1) Removal

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

① Lower the mast to the flat floor and stop the engine.
Release the remaining pressure inside the hydraulic system. Escaping fluid or spring off parts under pressure can cause serious injury when disassembling.

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


35D9KMCV05-2

(2) Precautions for disassembly and assembly

① Clean the surrounding area of the main control valve to prevent dirt or dust from entering when disassembling.

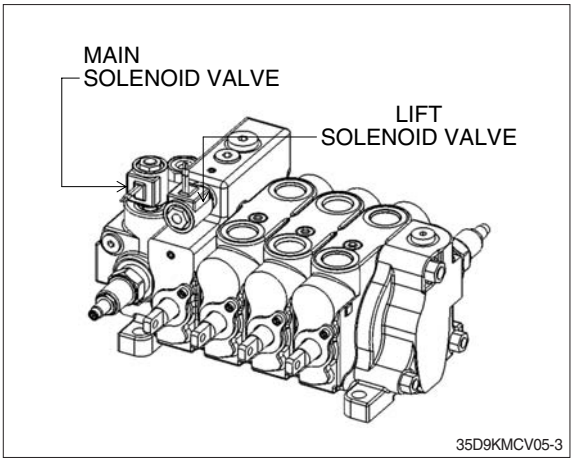
② Arrange the removed parts on a shelf not to mistake the original position when reassembling.

③ Do not hit or drop the parts to reuse except replacing parts.

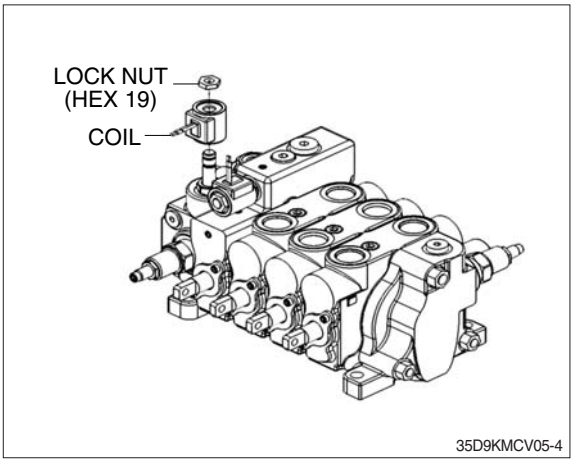
④ Take care not to shock or damage for seal seat of the each section when disassembling.

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

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



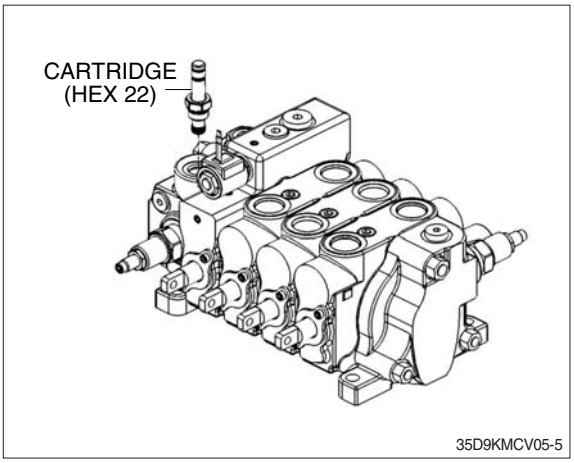
a. Loosen the lock nut (hex 19) and remove the coil from the cartridge of the solenoid valve.



b. Loosen the cartridge (hex 22) and remove it from the MCV.
Apply a few oil to the new O-ring and backup ring and assemble to the new cartridge and fit it into the port of the MCV.
- Cartridge tightening torque (hex 22)
  2.6~2.9 kgf · m (18.8~21.0 lbf · ft)

※ Take care not to damage the O-ring boss of the port.

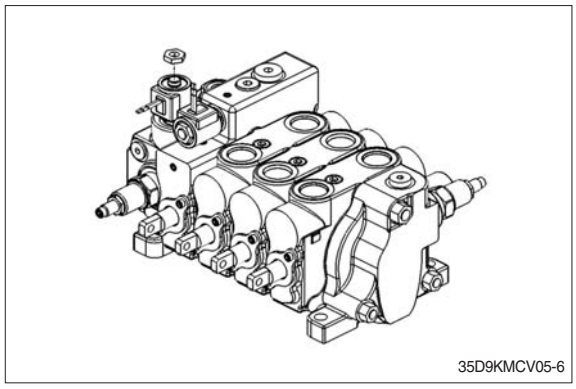
※ Check that the assembly area is free from foreign matter.



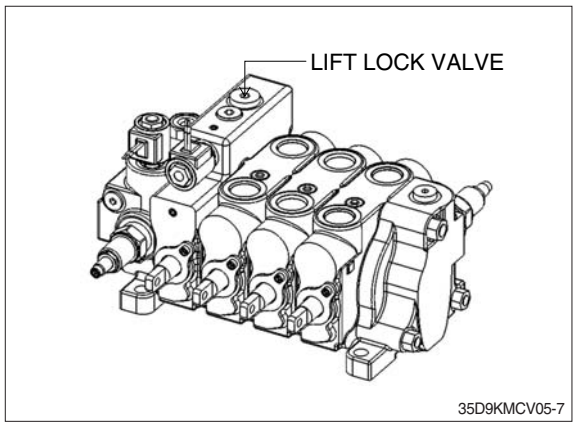
c. Insert the coil into the cartridge and tighten the lock nut.
   · Lock nut tightening torque (hex 19)
   0.55~0.7 kgf · m (4.0~5.1 lbf · ft)

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

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

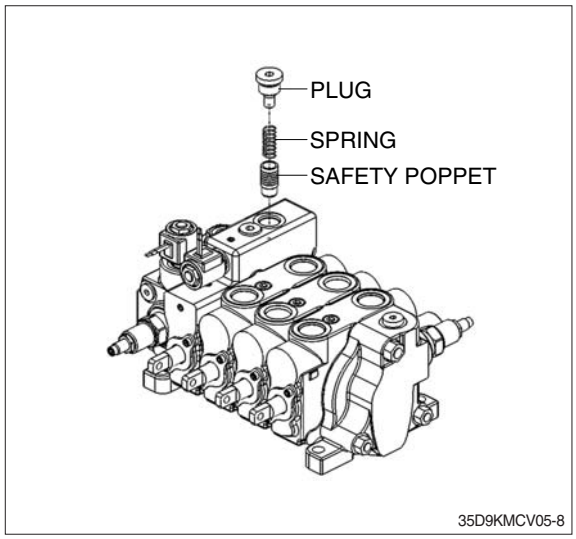

35D9KMCV05-6

② **Replacement of the lift lock valve**



35D9KMCV05-7

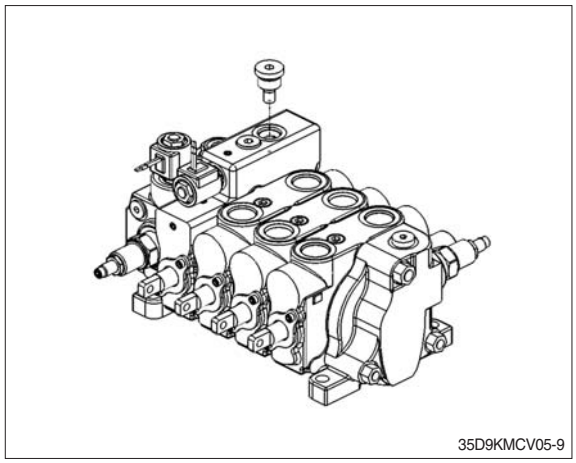
a. Loosen the plug and remove the spring and safety poppet from the MCV.



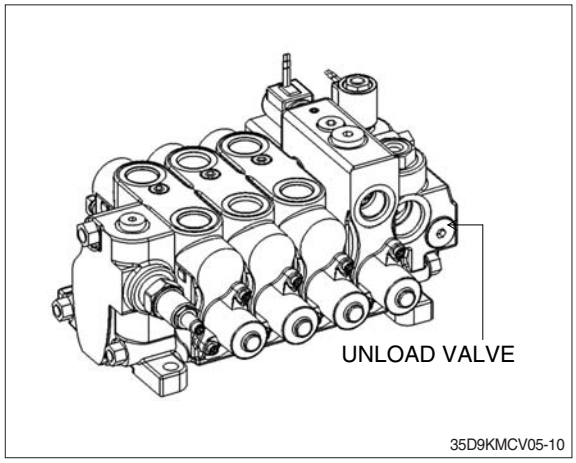
35D9KMCV05-8

b. Assemble the new safety poppet and spring into the MCV in reverse order of the disassembly.
   · Plug tightening torque (socket 8)
   5.1±0.25 kgf · m (36.9±1.8 lbf · ft)

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

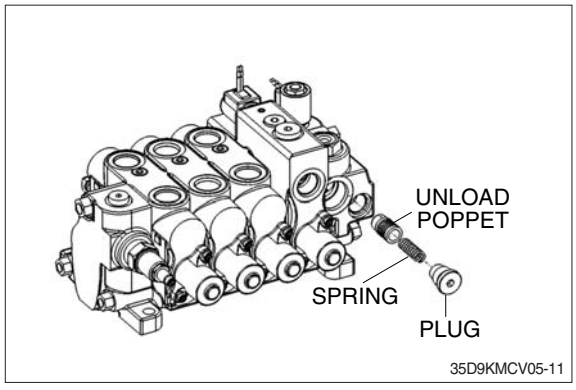

35D9KMCV05-9

③ Replacement of the unload valve



35D9KMCV05-10

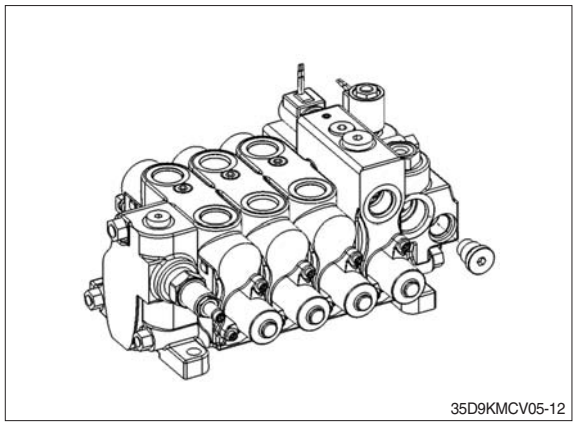
a. Loosen the plug and remove the spring and unload poppet from the MCV.



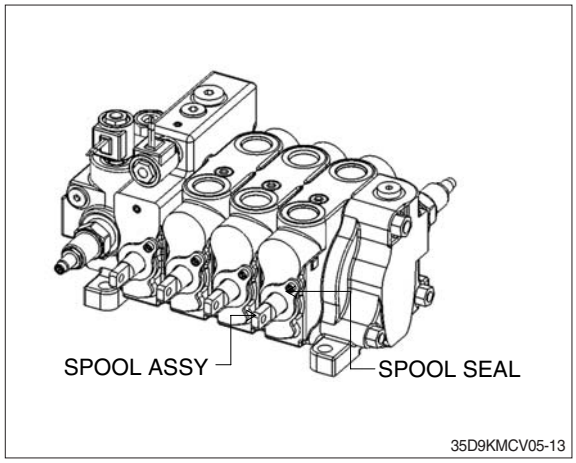
35D9KMCV05-11

b. Assemble the new unload poppet and spring into the MCV in reverse order of the disassembly.
   · Plug tightening torque (socket 8)
   5.1±0.25 kgf · m (36.9±1.8 lbf · ft)

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

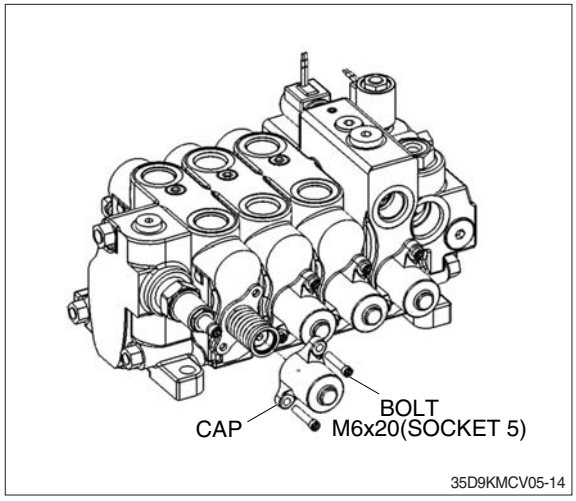

35D9KMCV05-12

④ **Replacement of the spool seal and spool assy**



35D9KMCV05-13

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

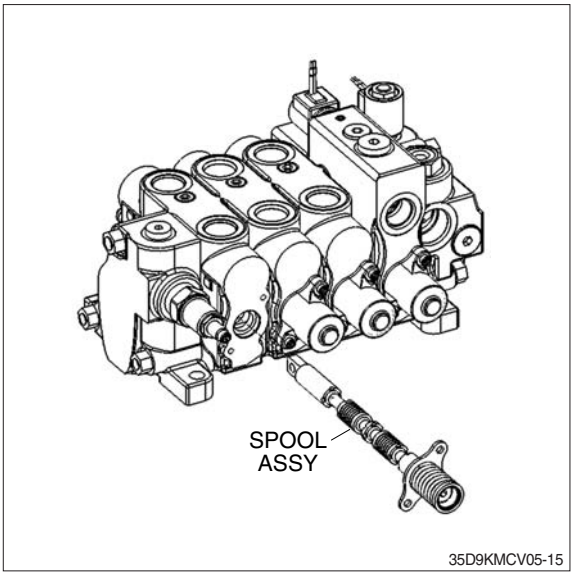


35D9KMCV05-14

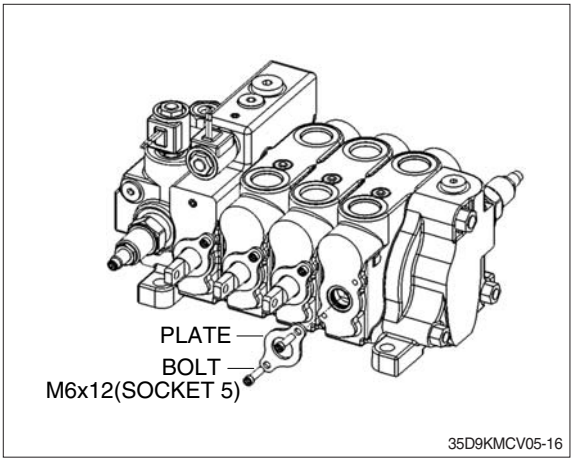
b. Remove the spool assy from the MCV.
   - Install the spool assy and go to the clause f if replacing the spool assy only.

※ Check that the hole of the spool is free from foreign matter.

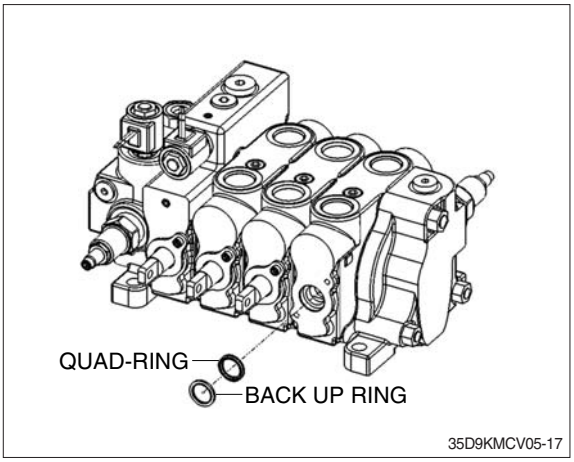
※ Take care not to hit the spool. This can cause stuck of the spool after the spool reassembling.



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



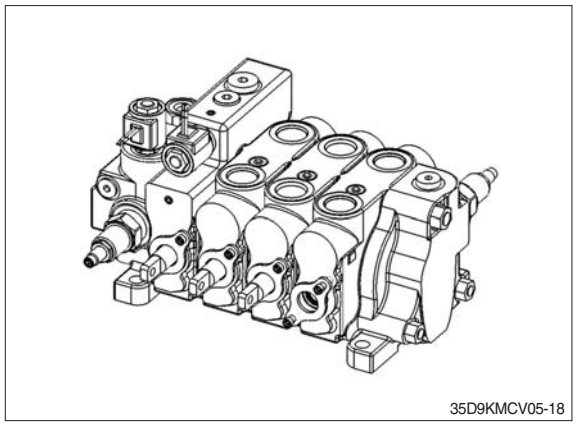
d. Replace the quad-ring and backup ring with a new one.



e. Insert the quad-ring and backup ring into the MCV and assemble the plate with tightening the bolt.
   · Tightening torque (M6×12)
   1.5±0.1 kgf·m (10.8±0.7 lbf·ft)

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

※ Apply a few oil on the seal surface before assembling.

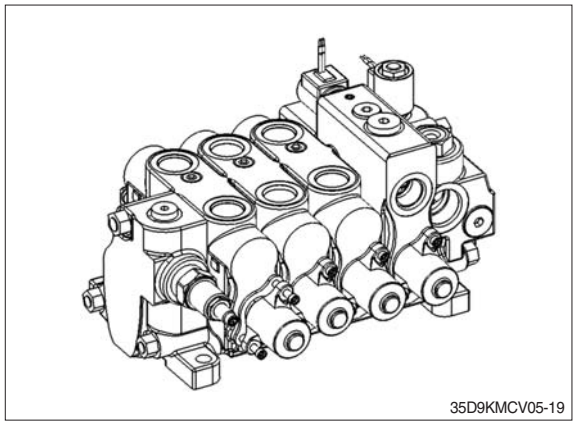


35D9KMCV05-18

f. Insert the spool assy into opposite side of the MCV and assemble the cap with tightening the bolt.
   · Tightening torque (M6×12)
   1.5±0.1 kgf·m (10.8±0.7 lbf·ft)

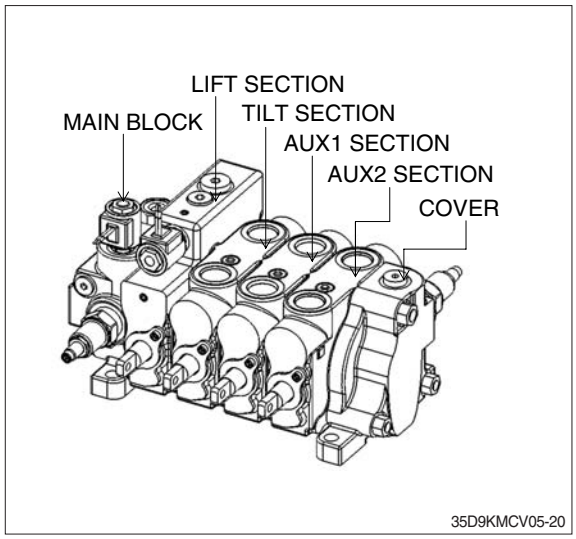
※ Check that the seat surface of the seal is free from foreign matter before assembling.

※ Check that the spool is free from scoring.



35D9KMCV05-19

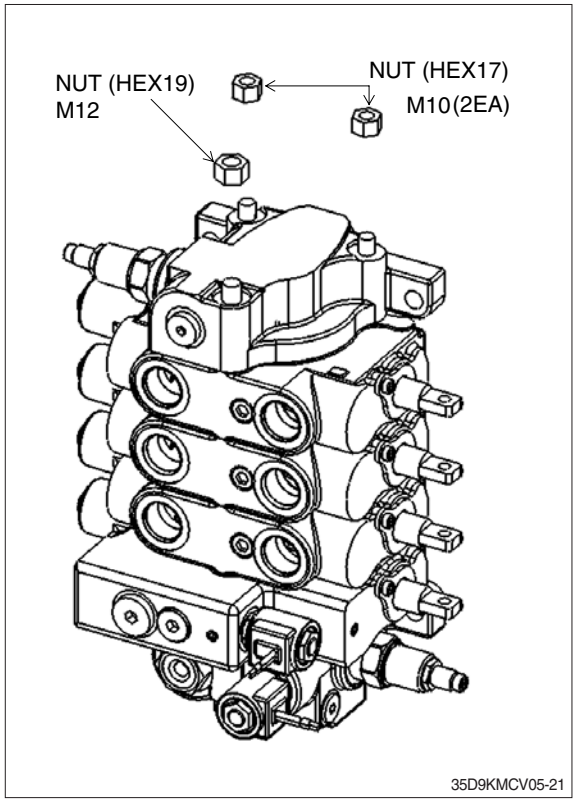
⑤ Replacement of the section assy



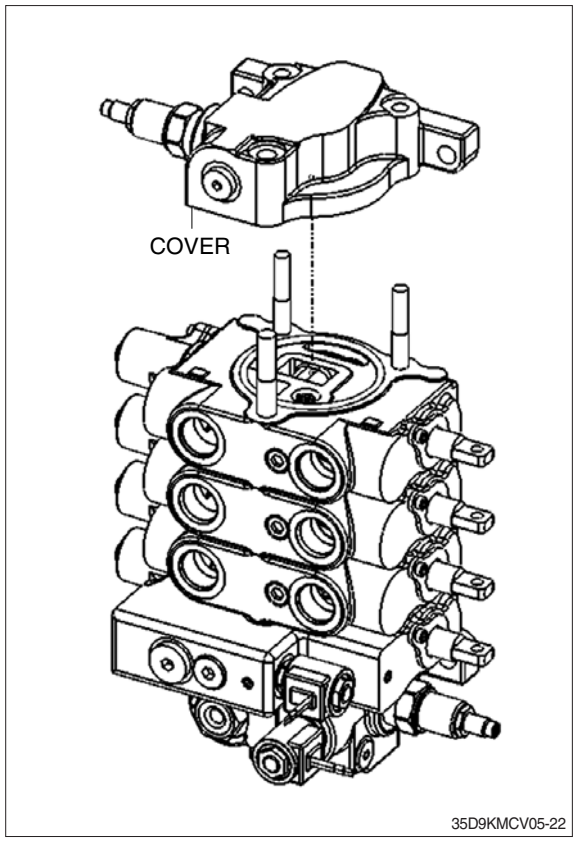
a. Replacement of the lift section

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

ⓑ Remove the nut (3EA) from the bolt.

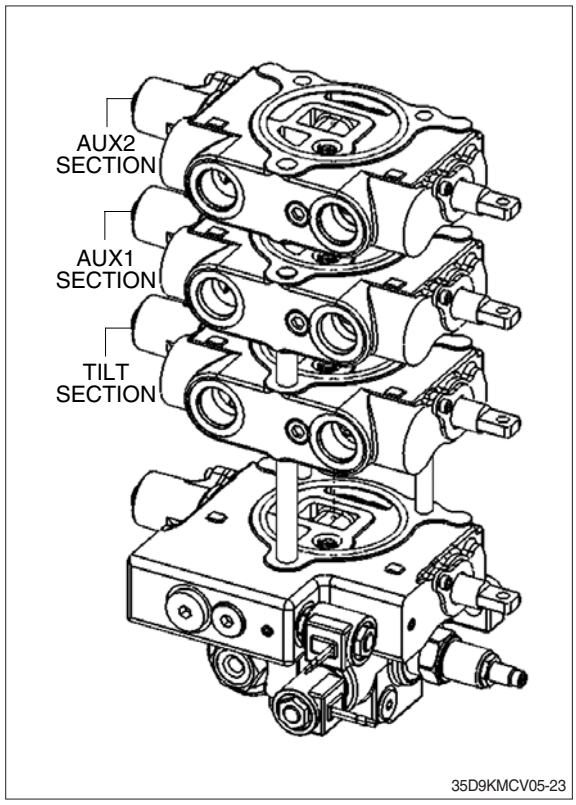


ⓒ Remove the cover form the MCV.



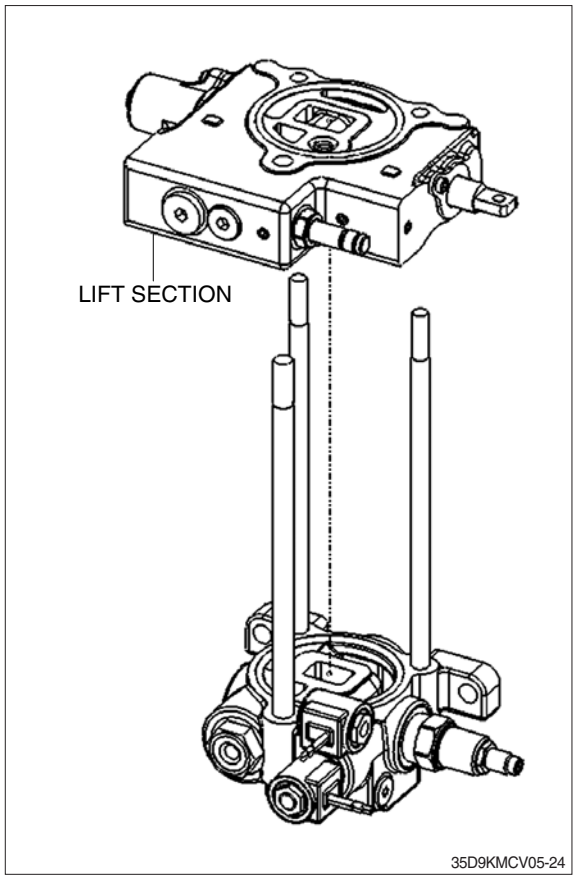
ⓓ Remove the aux2 section, aux1 section and tilt section from the MCV in order.

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



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

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



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

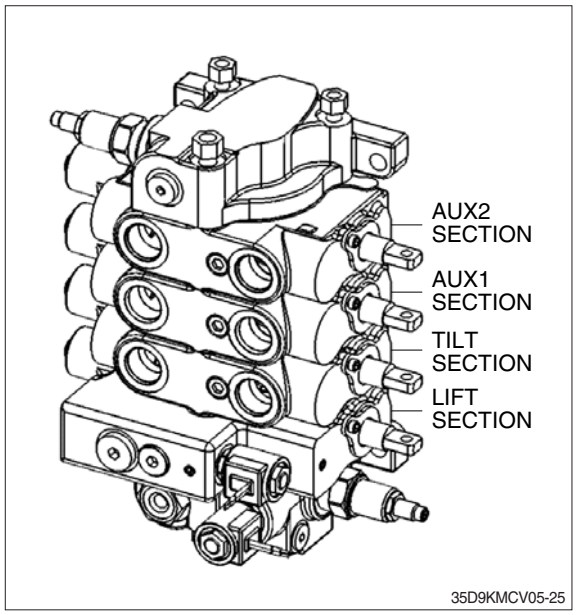
· Tightening torque

M10 : 6.0±0.3 kgf · m
(43.4±2.2 lbf · ft)

M12 : 9.0±0.45 kgf · m
(65.1±3.3 lbf · ft)

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

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



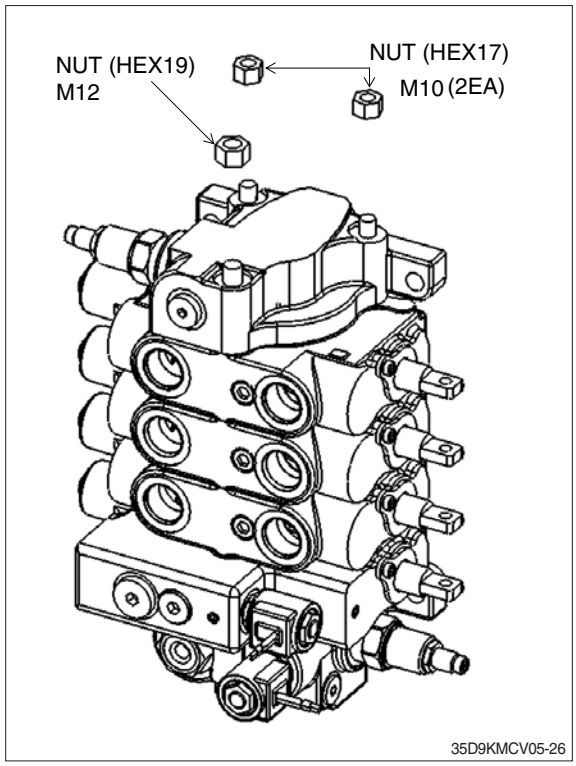
b. Replacement of the other sections

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

⑥ Replacement of the inlet check valve and block seal

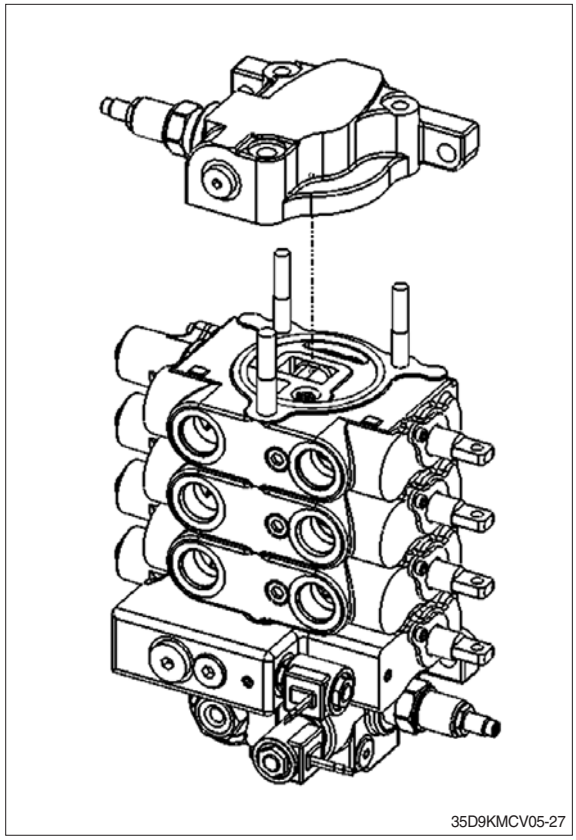
a. Loosen the nut (3EA) a little and place the MCV on the flat table with the main block facing the bottom.

b. Remove the nut (3EA) from the bolt.

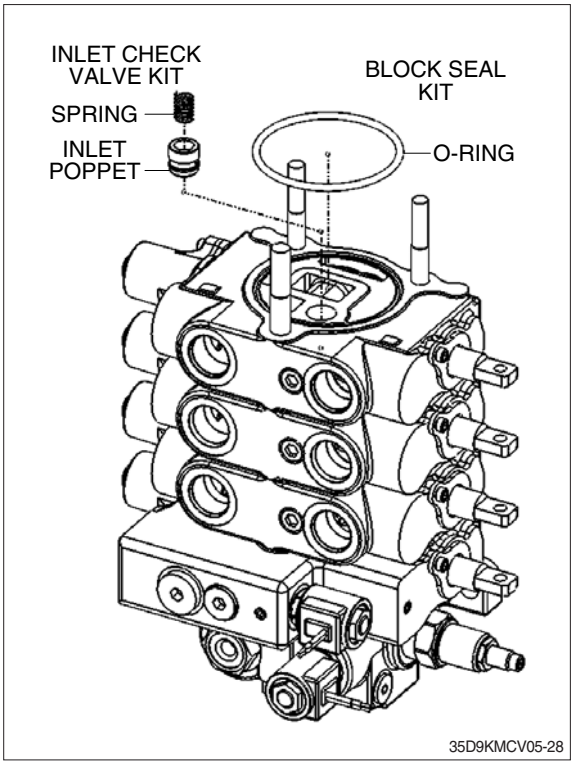


35D9KMCV05-26

c. Remove the cover form the MCV.


35D9KMCV05-27

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



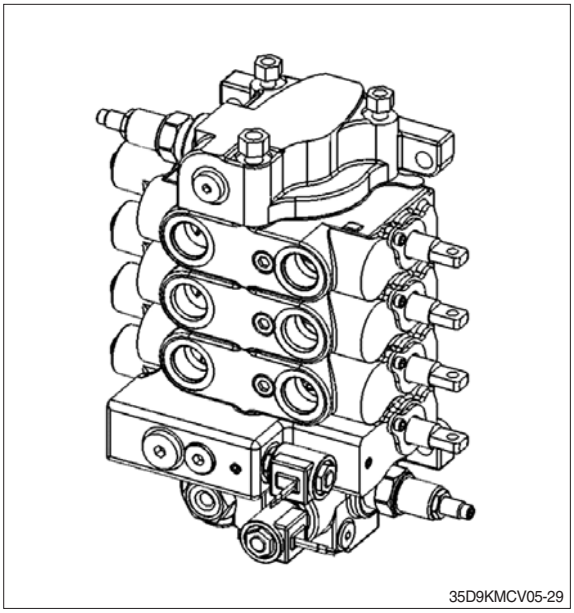
e. Assemble it with a new one in reverse order of above procedures and tighten the bolt.

· Tightening torque

M10 : 6.0±0.3 kgf · m
(43.4±2.2 lbf · ft)

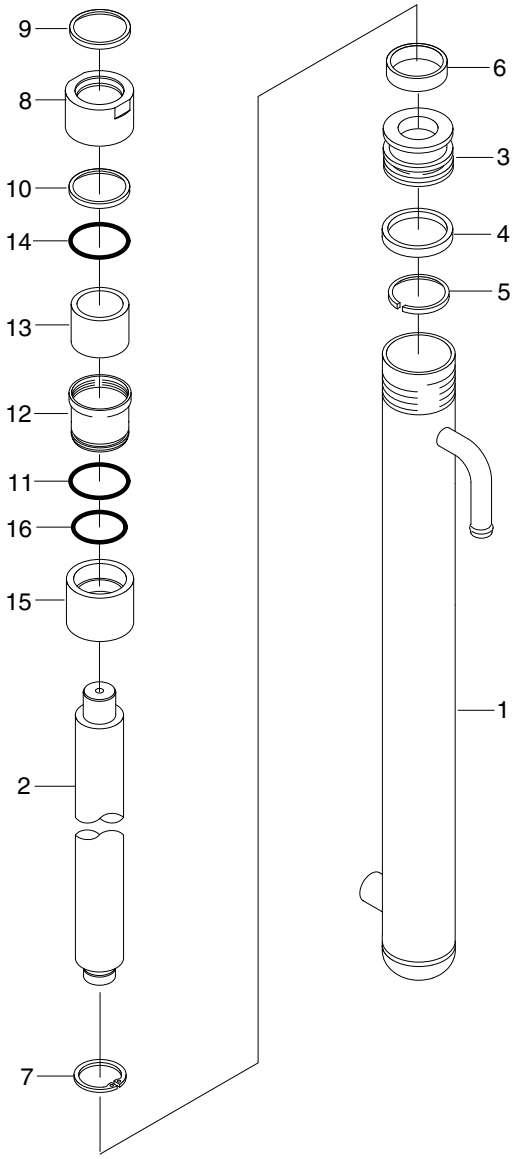
M12 : 9.0±0.45 kgf · m
(65.1±3.3 lbf · ft)

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



4. LIFT CYLINDER

1) STRUCTURE



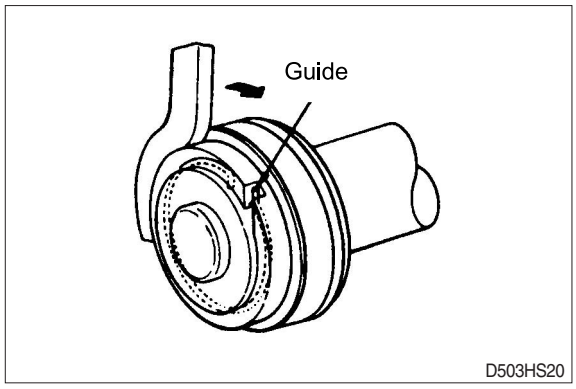
- I.D × O.D × stroke (standard)
  65 × 73 × 1335 mm
  (2.6 × 2.9 × 52.6 in)
- Rod O.D : 50 mm (2.0 in)

D357HS19

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

2) DISASSEMBLY

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



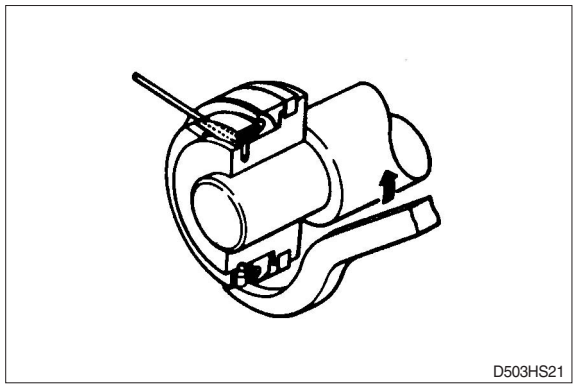
3) CHECK AND INSPECTION

mm (in)

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

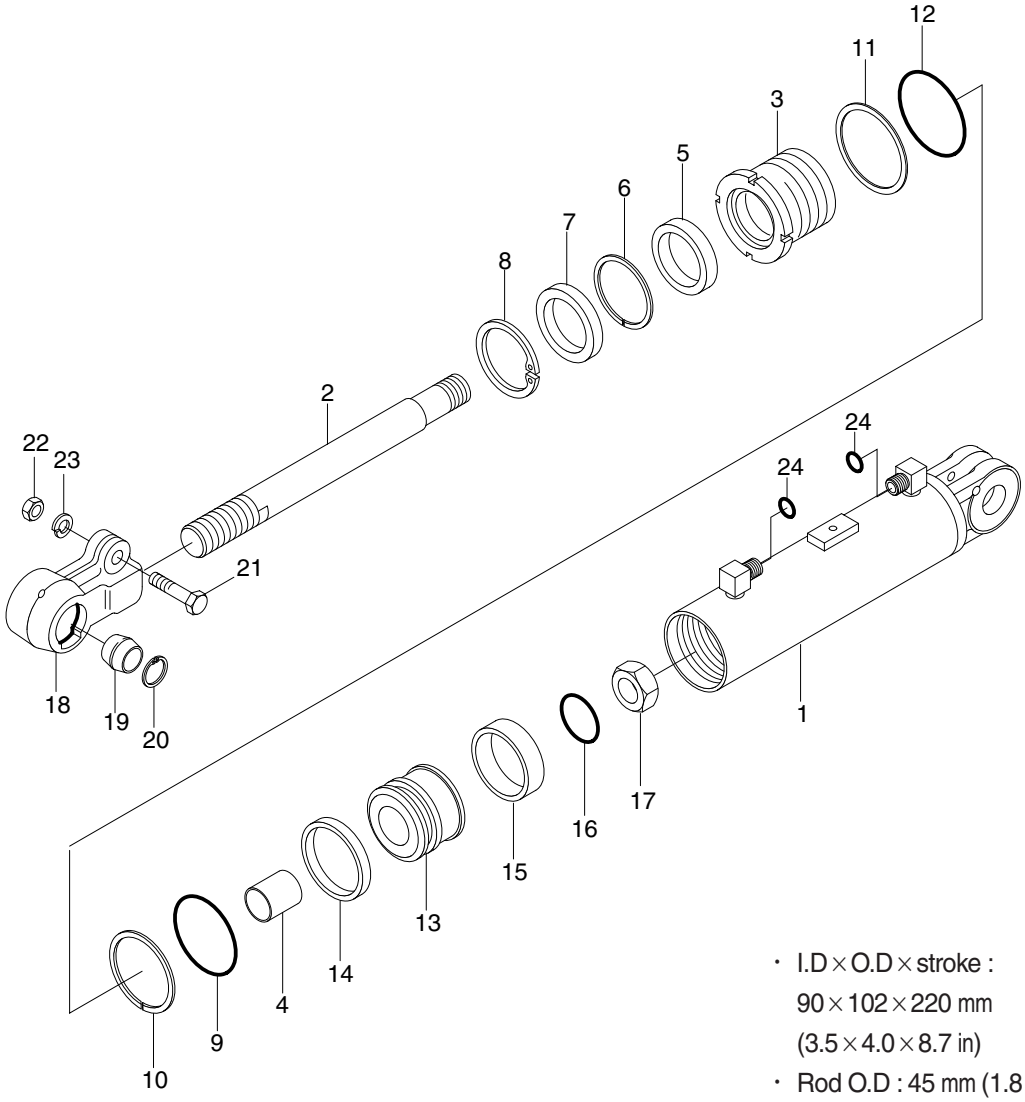
4) ASSEMBLY

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



5. TILT CYLINDER

1) STRUCTURE



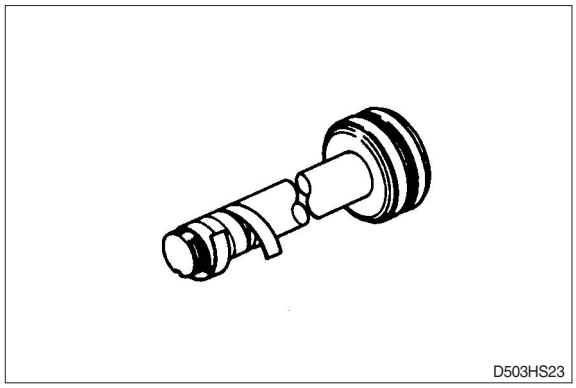
- I.D × O.D × stroke : 90 × 102 × 220 mm (3.5 × 4.0 × 8.7 in)
- Rod O.D : 45 mm (1.8 in)

35DS7HS16

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

2) DISASSEMBLY

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



3) CHECK AND INSPECTION

mm (in)

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