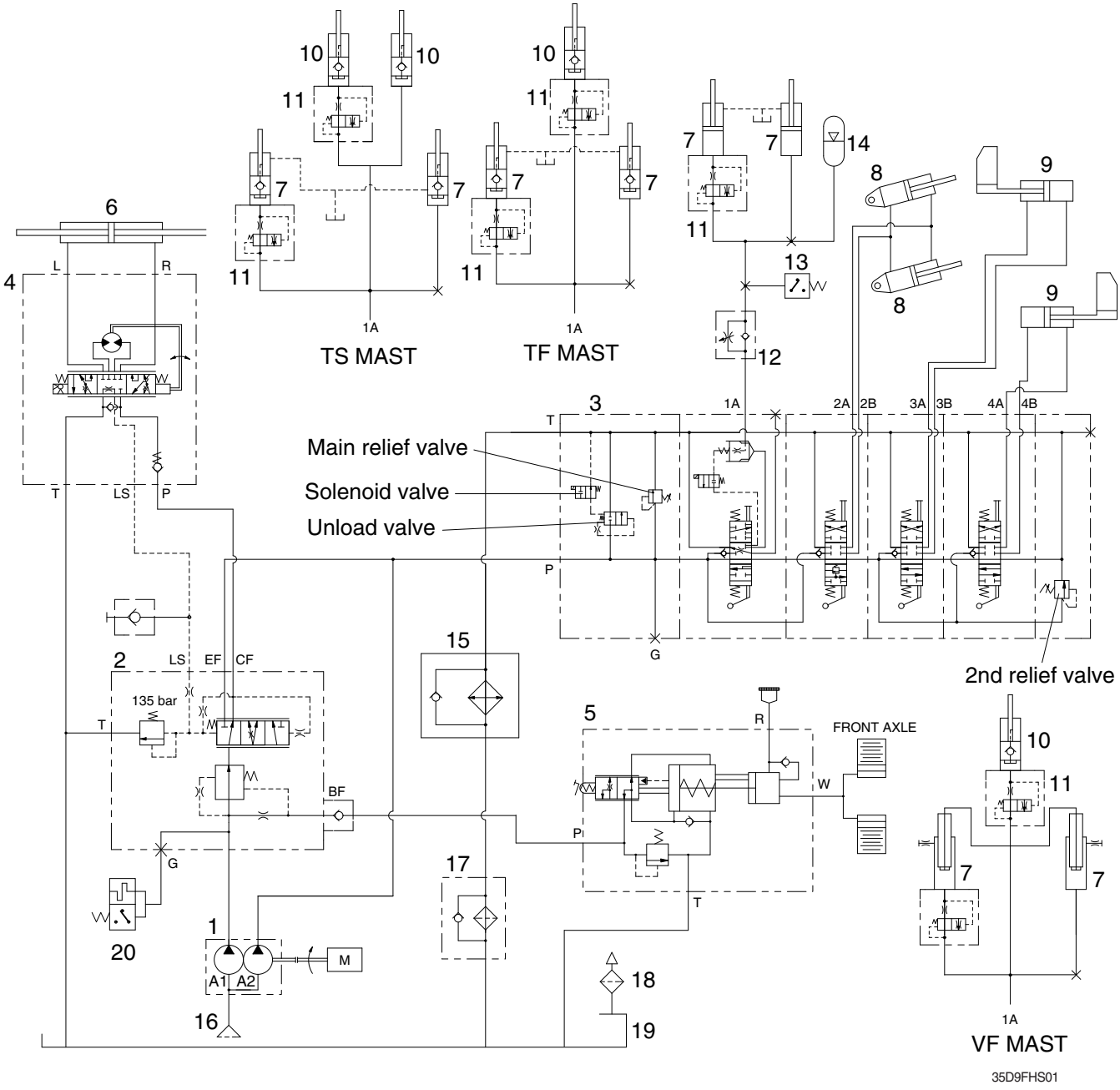
SECTION 6 HYDRAULIC SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC CIRCUIT

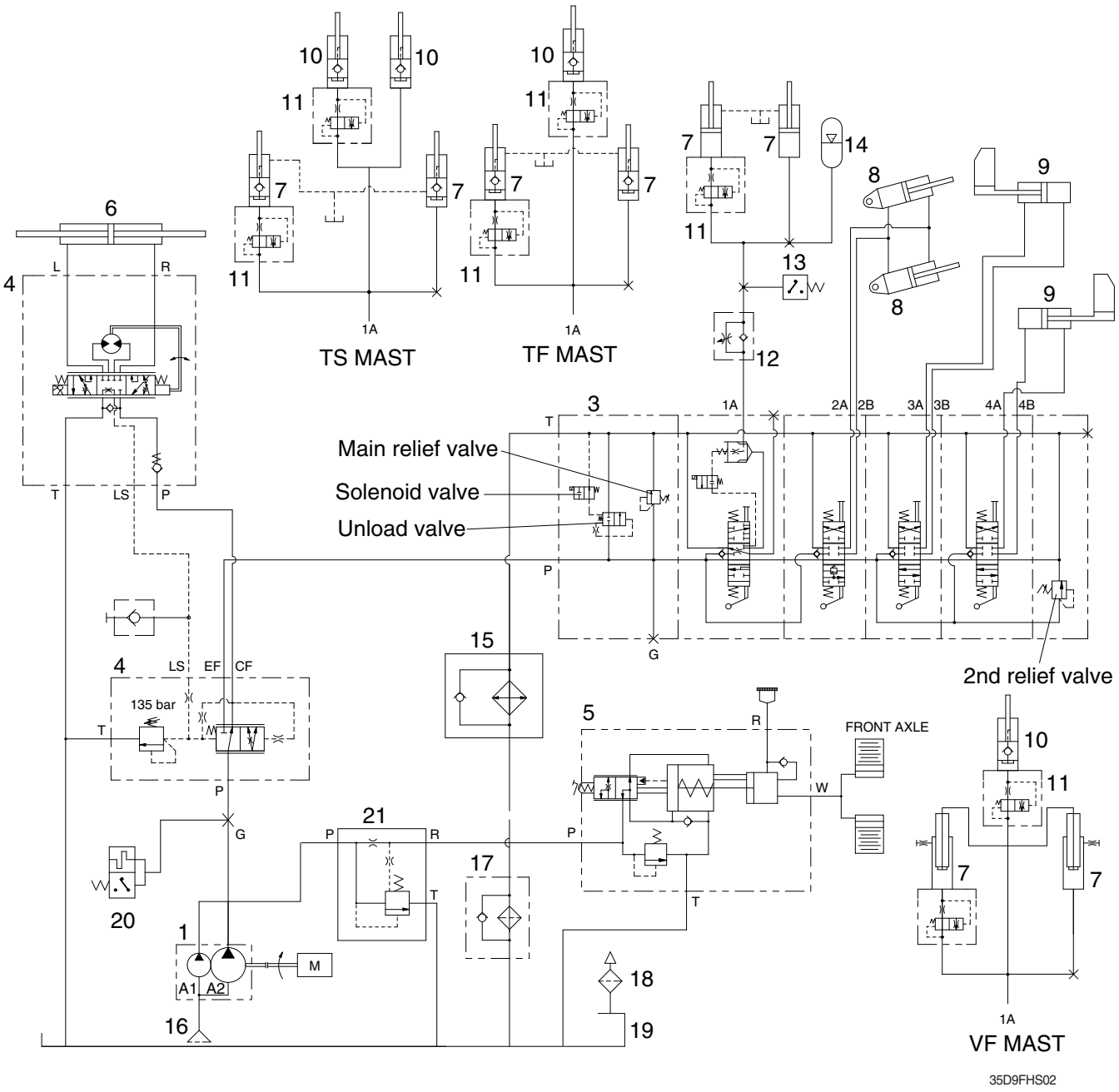
· **TYPE 1** (pump with dual flow divider, 35D-9F:~#59, 40D-9F:~#22, 45D-9F:~#556, 50DA-9F: ~#57)



1	Hydraulic gear pump	8	Tilt cylinder	15	Hydraulic oil cooler
2	Dual flow divider	9	Fork positioner cylinder	16	Suction filter
3	Main control valve	10	Free lift cylinder	17	Return filter
4	Steering unit	11	Down safety valve	18	Air breather
5	Brake valve	12	Flow regulator	19	Hydraulic oil tank
6	Steering cylinder	13	Load sensor	20	Pressure/temperature sensor
7	Lift cylinder	14	Accumulator		

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

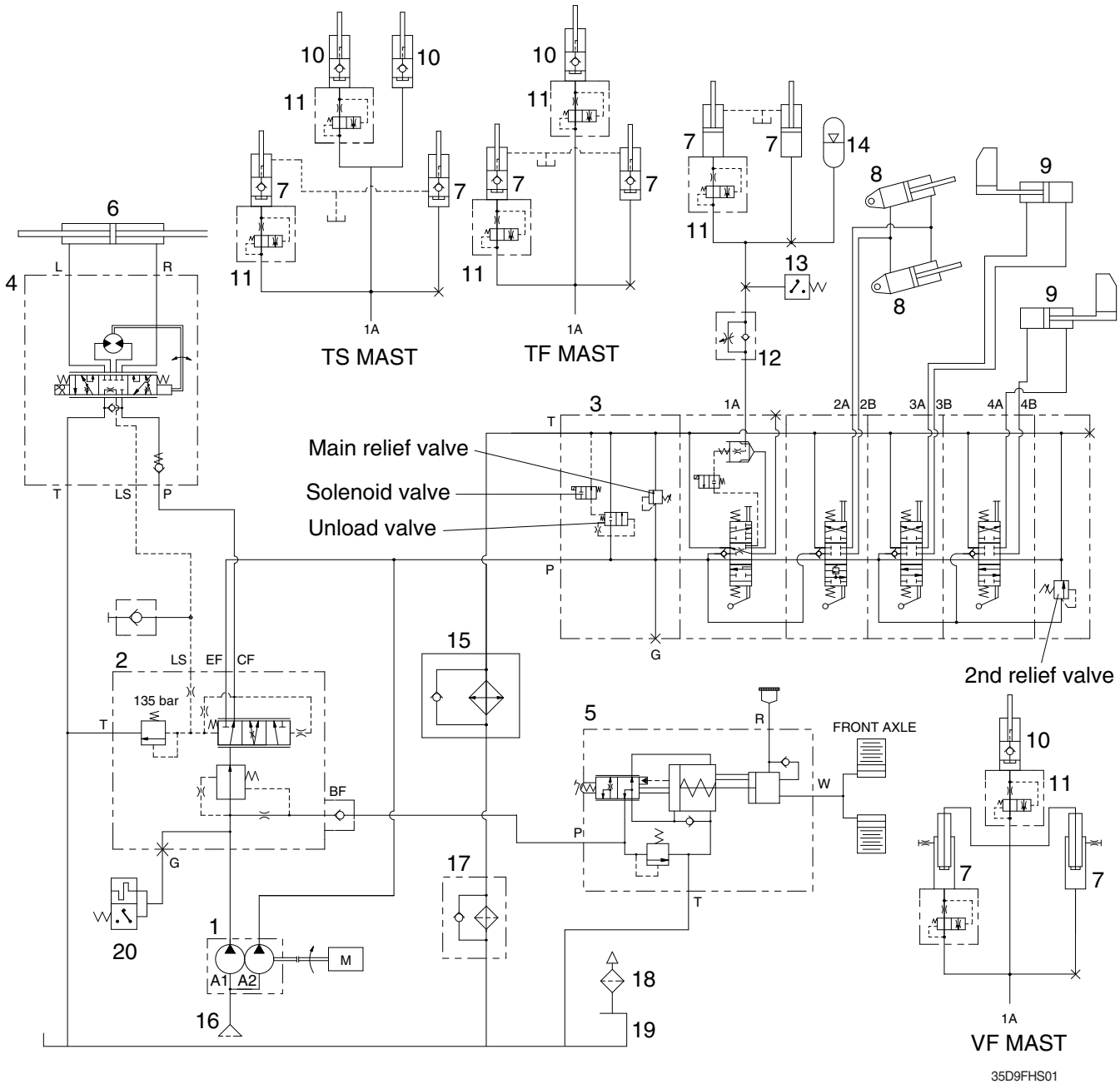
· **TYPE 2** (pump and priority valve, 35D-9F:~#59, 40D-9F:~#22, 45D-9F:~#556, 50DA-9F: ~#57)



1	Hydraulic gear pump	8	Tilt cylinder	15	Hydraulic oil cooler
2	Priority valve	9	Fork positioner cylinder	16	Suction filter
3	Main control valve	10	Free lift cylinder	17	Return filter
4	Steering unit	11	Down safety valve	18	Air breather
5	Brake valve	12	Flow regulator	19	Hydraulic oil tank
6	Steering cylinder	13	Load sensor	20	Pressure/temperature sensor
7	Lift cylinder	14	Accumulator	21	Flow control valve

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

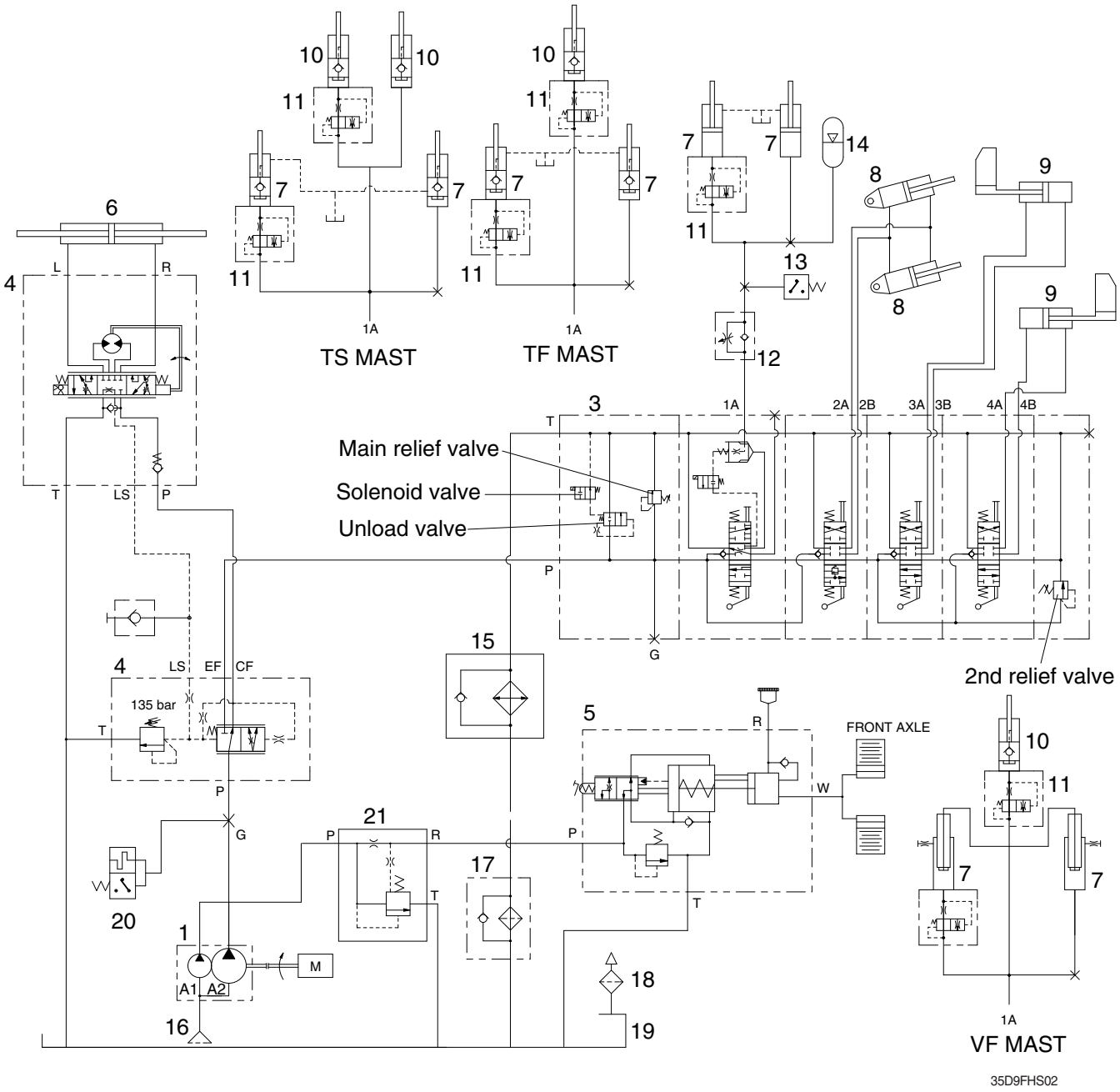
· **TYPE 1** (JM01-General Lever, NR01-General pump)
(35D-9F:#60~#231, 40D-9F:#23~#94, 45D-9F:#557~#1048, 50DA-9F: #58~#271)



1	Hydraulic gear pump	8	Tilt cylinder	15	Hydraulic oil cooler
2	Dual flow divider	9	Fork positioner cylinder	16	Suction filter
3	Main control valve	10	Free lift cylinder	17	Return filter
4	Steering unit	11	Down safety valve	18	Air breather
5	Brake valve	12	Flow regulator	19	Hydraulic oil tank
6	Steering cylinder	13	Load sensor	20	Pressure/temperature sensor
7	Lift cylinder	14	Accumulator		

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

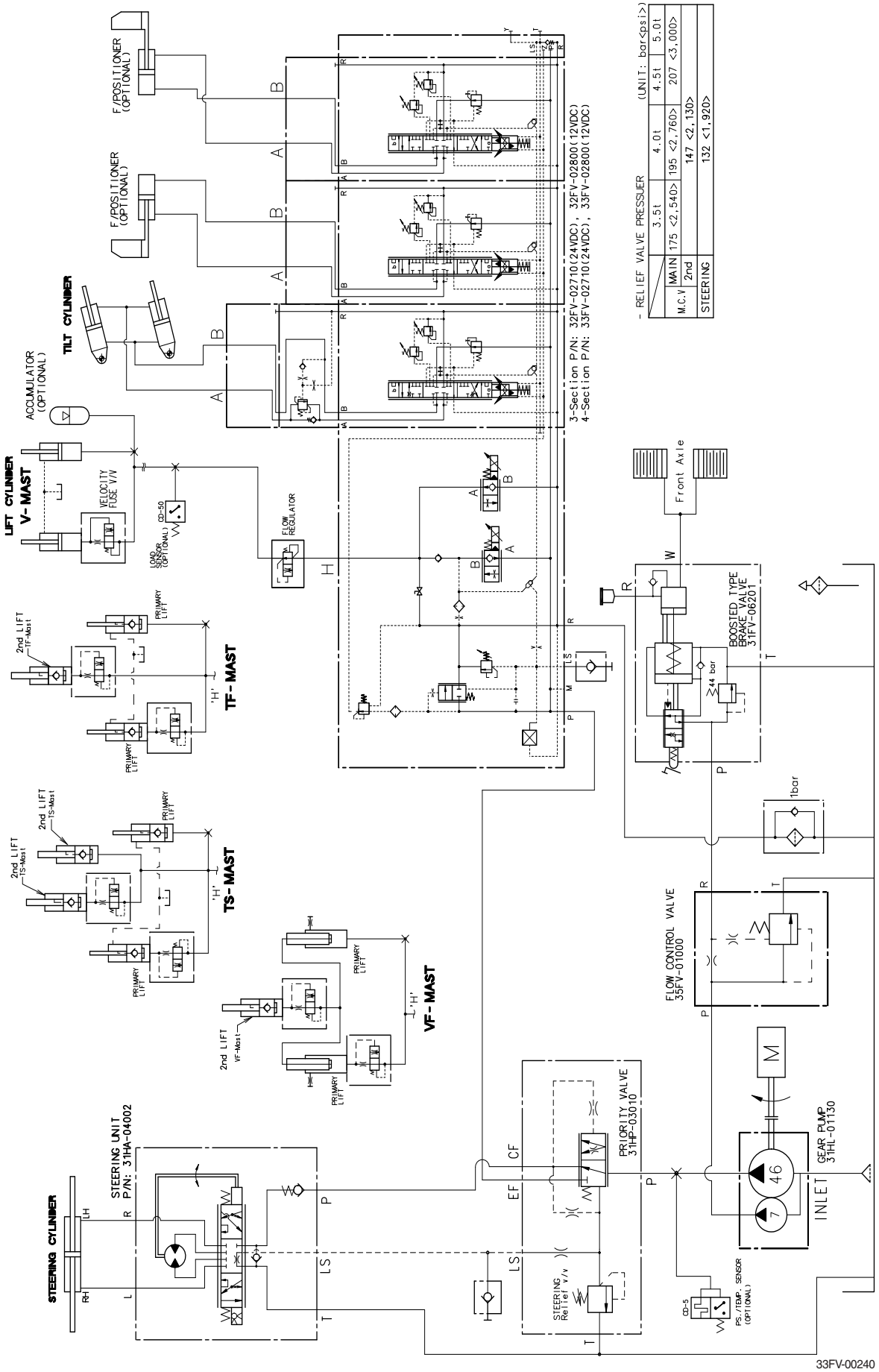
· **TYPE 2** (JM01-General Lever, NR02-Low Noise pump)
(35D-9F:#60~#231, 40D-9F:#23~#94, 45D-9F:#557~#1048, 50DA-9F: #58~#271)



1	Hydraulic gear pump	8	Tilt cylinder	15	Hydraulic oil cooler
2	Priority valve	9	Fork positioner cylinder	16	Suction filter
3	Main control valve	10	Free lift cylinder	17	Return filter
4	Steering unit	11	Down safety valve	18	Air breather
5	Brake valve	12	Flow regulator	19	Hydraulic oil tank
6	Steering cylinder	13	Load sensor	20	Pressure/temperature sensor
7	Lift cylinder	14	Accumulator	21	Flow control valve

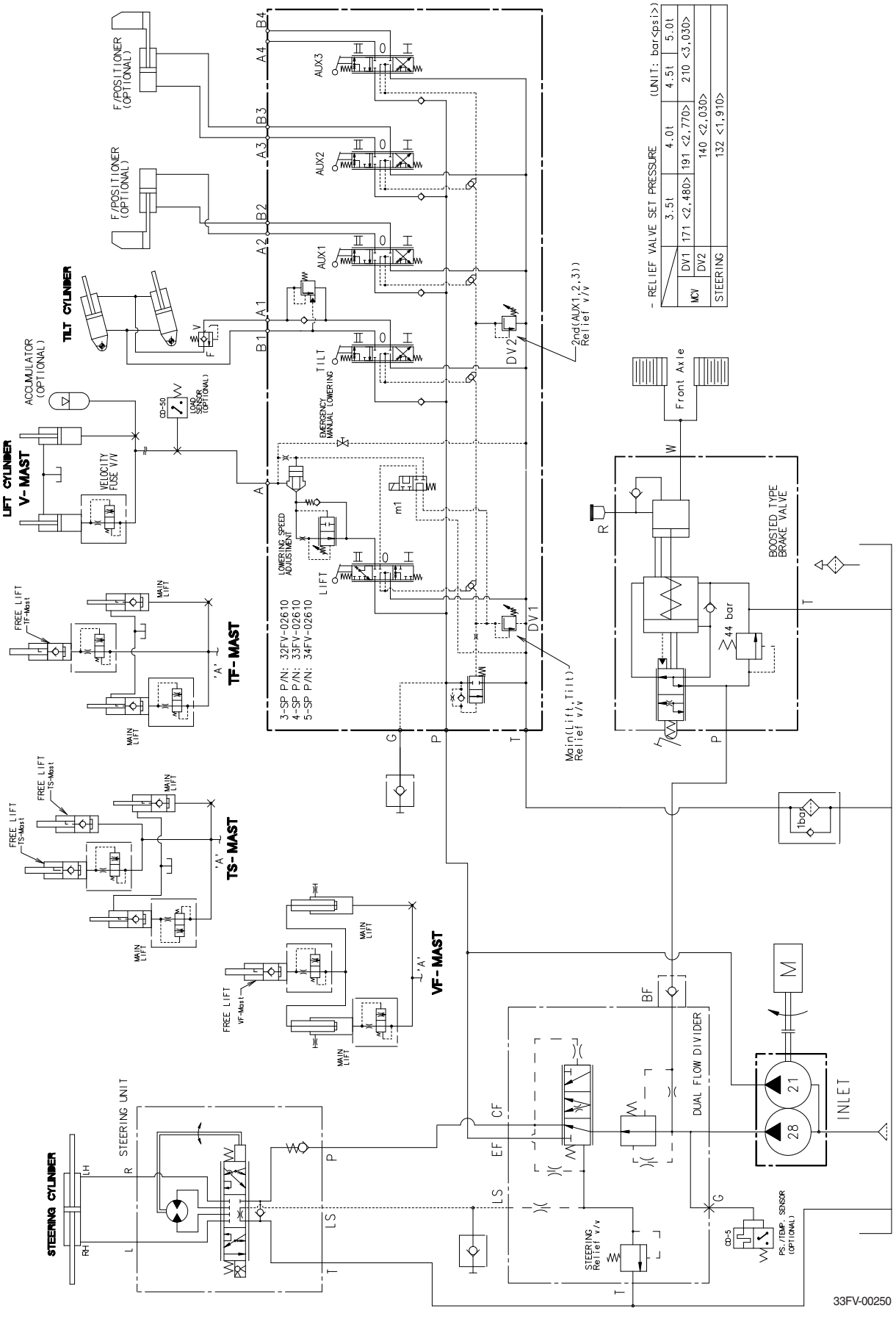
※ The circuit diagram may differ from the equipment, so please check before a repair.

· **FINGER-TIP**(JM02-Finger-Tip Lever, NR02-Low Noise pump)



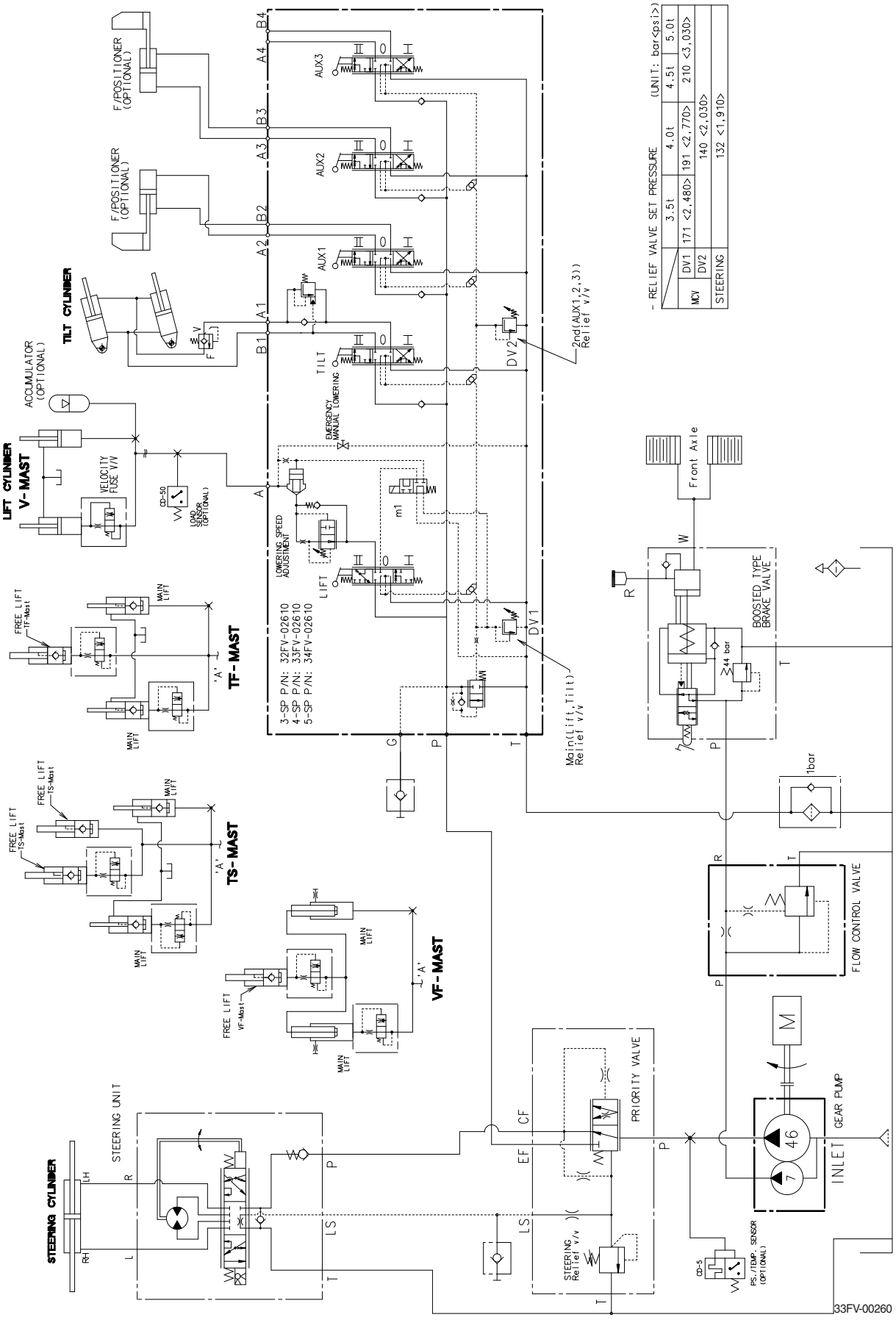
※ The circuit diagram may differ from the equipment, so please check before a repair.

· **TYPE 1** (BUCHHOLZ, NR01-General pump)
(35D-9F:#232~, 40D-9F:#95~, 45D-9F:#1049~, 50DA-9F: #272~)



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

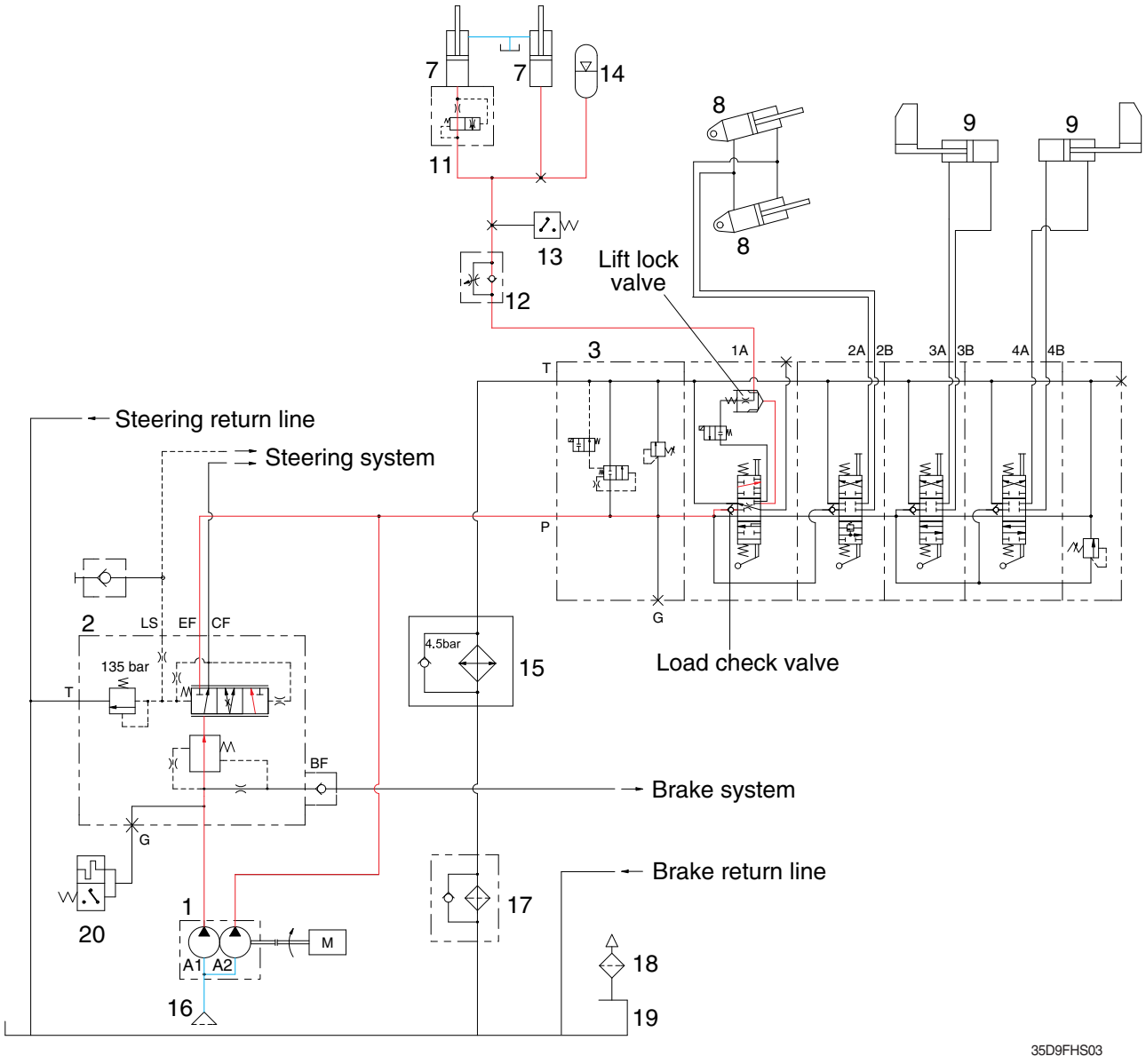
· **TYPE 2** (BUCHHOLZ, NR02-Low Noise pump)
(35D-9F:#232~, 40D-9F:#95~, 45D-9F:#1049~, 50DA-9F: #272~)



※ 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.

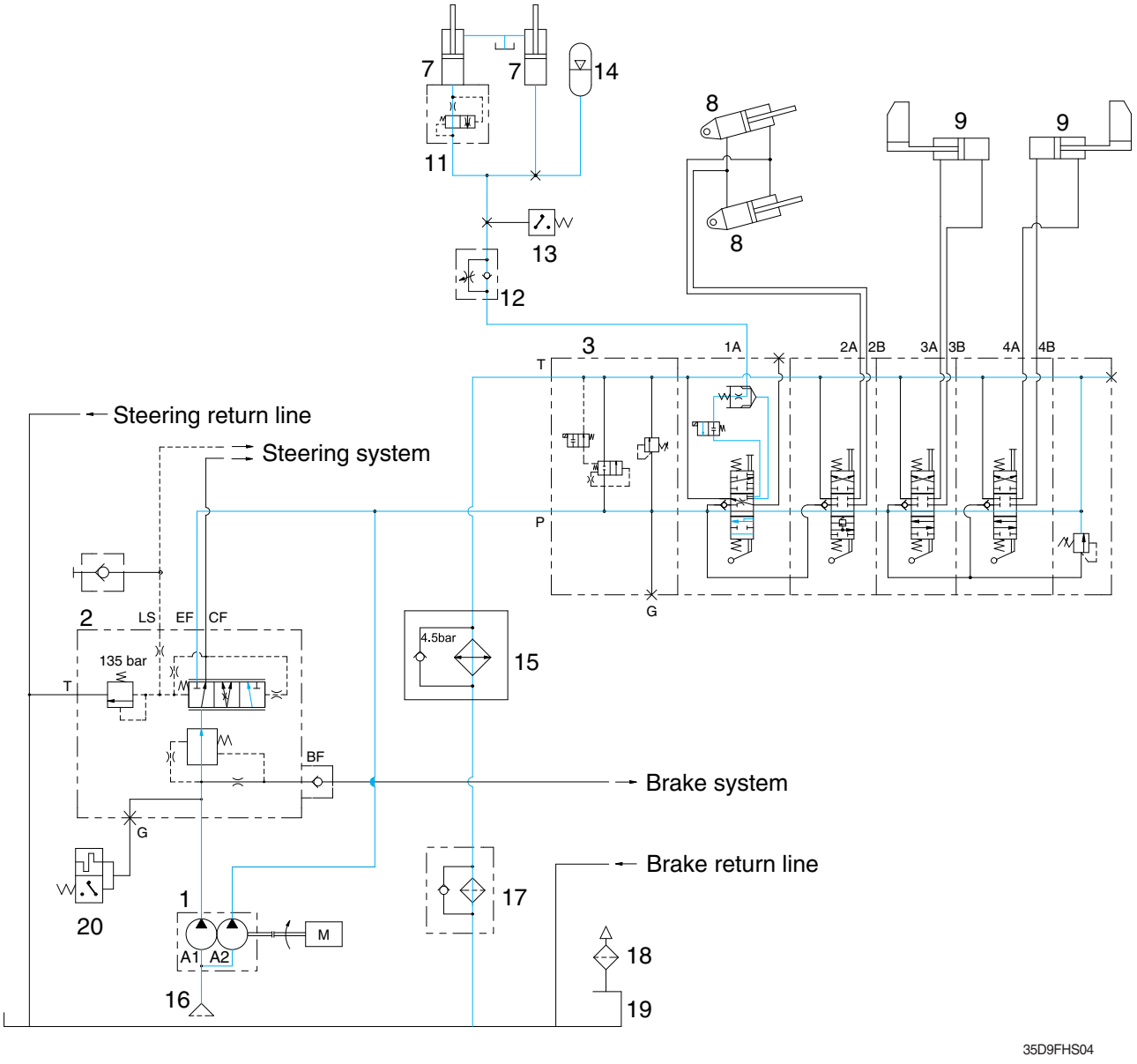


35D9FHS03

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 (2) and it flows into main control valve (3) and then goes to the large chamber of lift cylinder (7) by pushing the load check valve of the spool and lift lock valve.
The oil from the small chamber of lift cylinder (7) returns to hydraulic oil tank (19) at the same time.
When this happens, the forks go up.

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

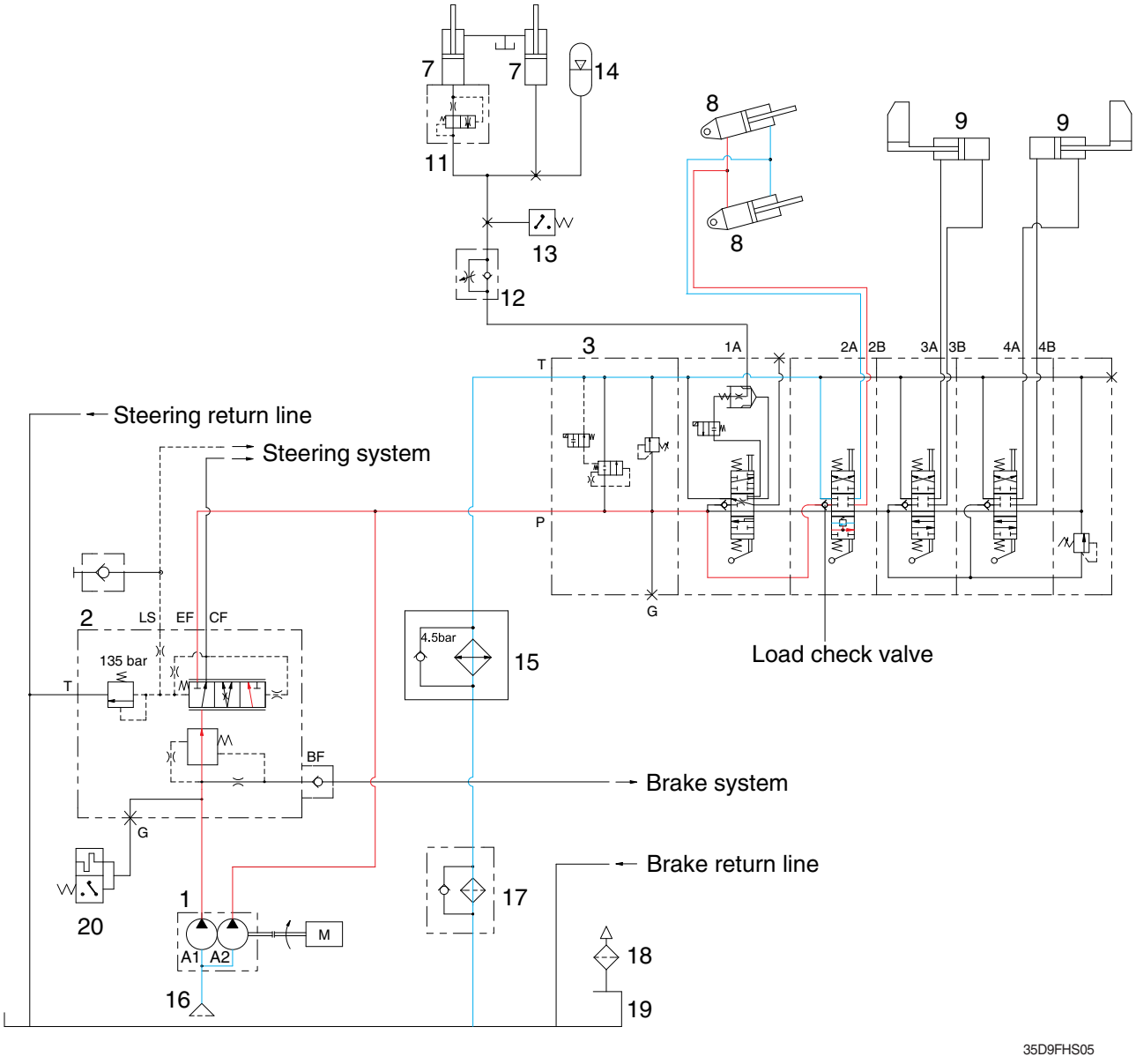
2) WHEN THE LIFT CONTROL LEVER IS IN THE LOWER POSITION



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

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

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



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

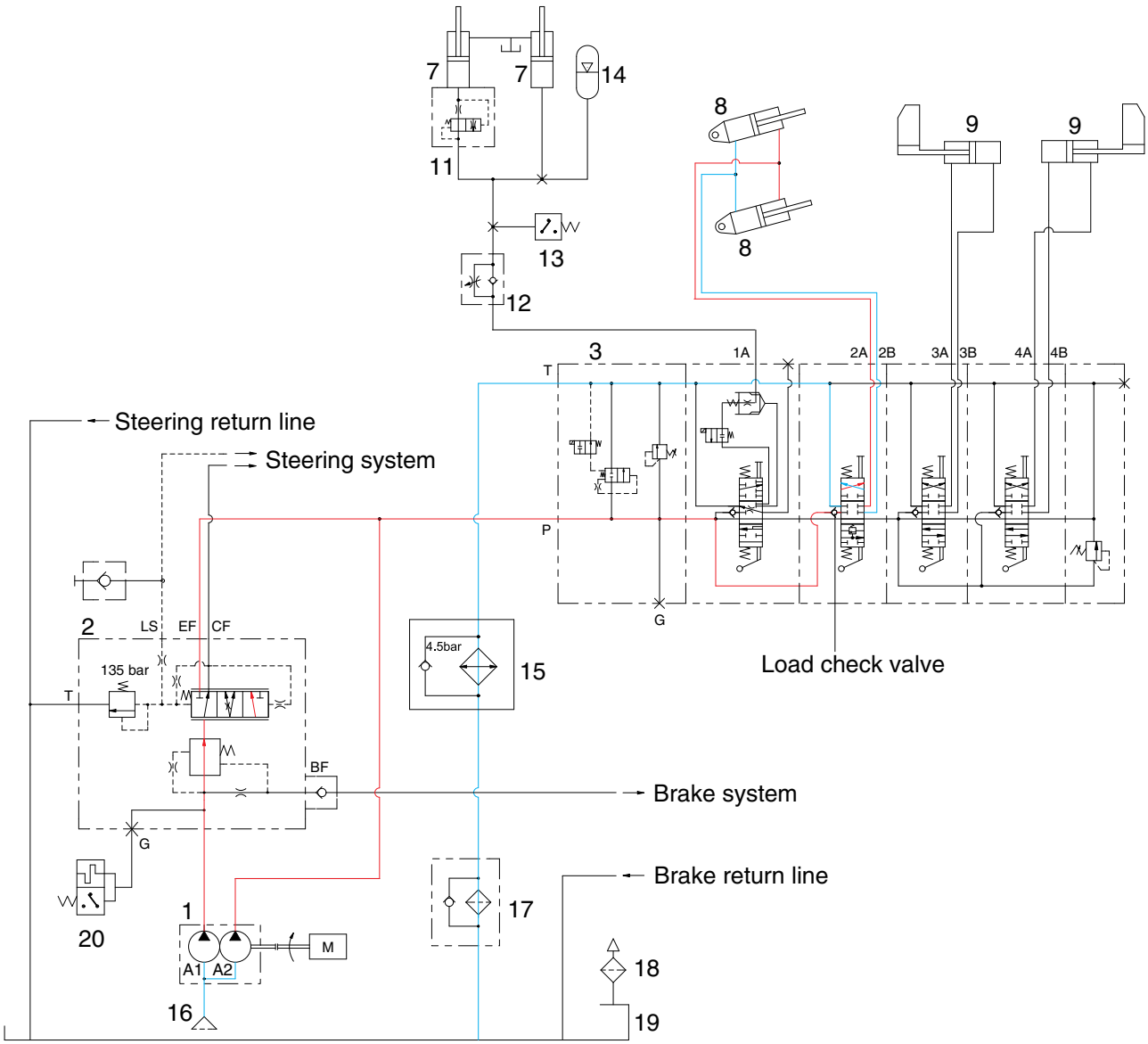
The oil from the A2 pump of the hydraulic gear pump (1) is joined the oil from the A1 pump through the priority valve in the dual flow divider (2) and it flows into main control valve (3) and then goes to the large chamber of tilt cylinder (8) by pushing the load check valve of the spool.

The oil at the small chamber of tilt cylinder (8) returns to hydraulic oil tank (19) through the hydraulic oil cooler (15) and return filter (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



35D9FHS06

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 (2) and it flows into main control valve (3) and then goes to the small chamber of tilt cylinder (8) by pushing the load check valve of spool.

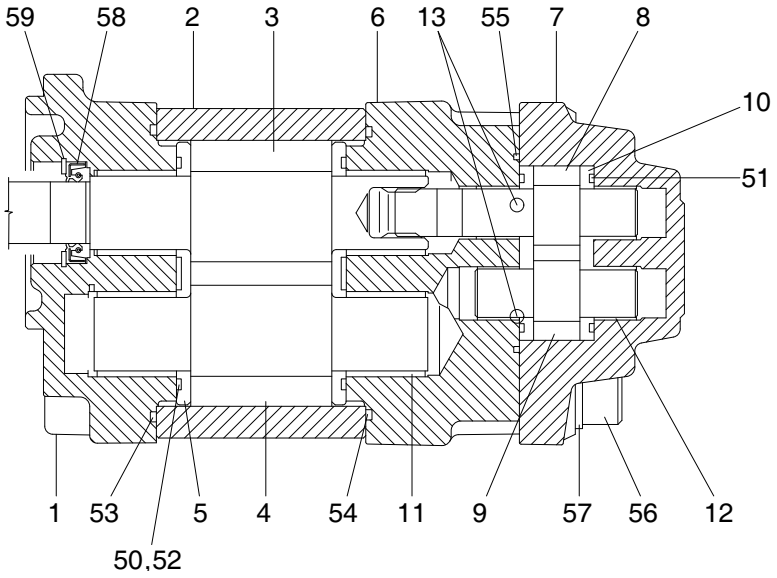
The oil at the large chamber of tilt cylinder (8) returns to hydraulic oil tank (19) through the hydraulic oil cooler (15) and return filter (17) at the same time.

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 (low noise)

1) STRUCTURE



35D9HS14-1

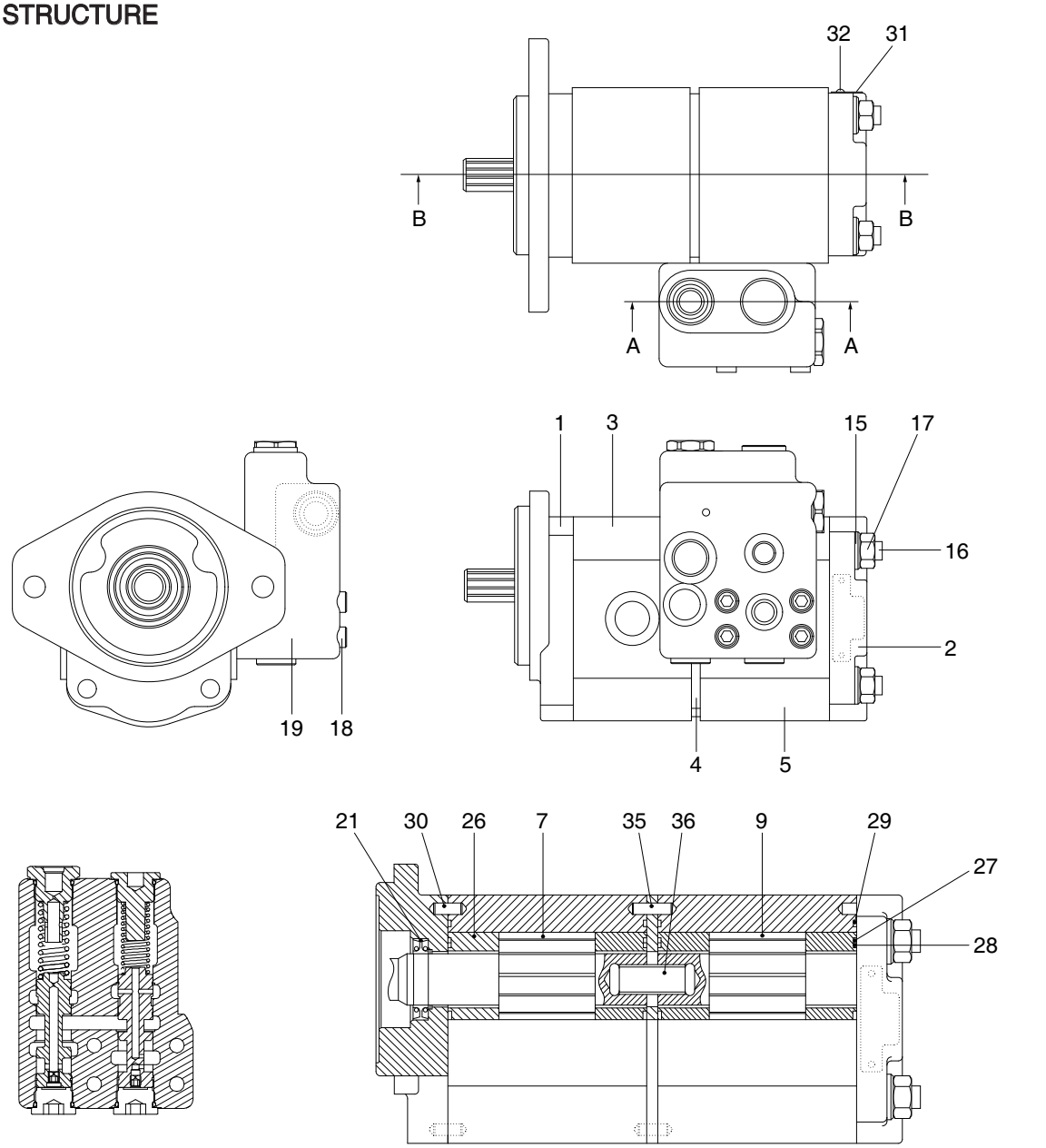
1	Front cover	9	Driven gear 2	53	Gasket
2	Body1	10	Side plate 2	54	Gasket
3	Drive gear 1	11	Bushing	55	Gasket
4	Driven gear 1	12	Bushing	56	Socket bolt
5	Side plate 1	13	Steel ball	57	Washer
6	Adapter plate	50	Gasket (3 shaped)	58	Oil seal
7	Body 2	51	Gasket (3 shaped)	59	Retainer ring
8	Drive gear 2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

2) OPERATION

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

HYDRAULIC GEAR PUMP (with dual flow divider)

1) STRUCTURE

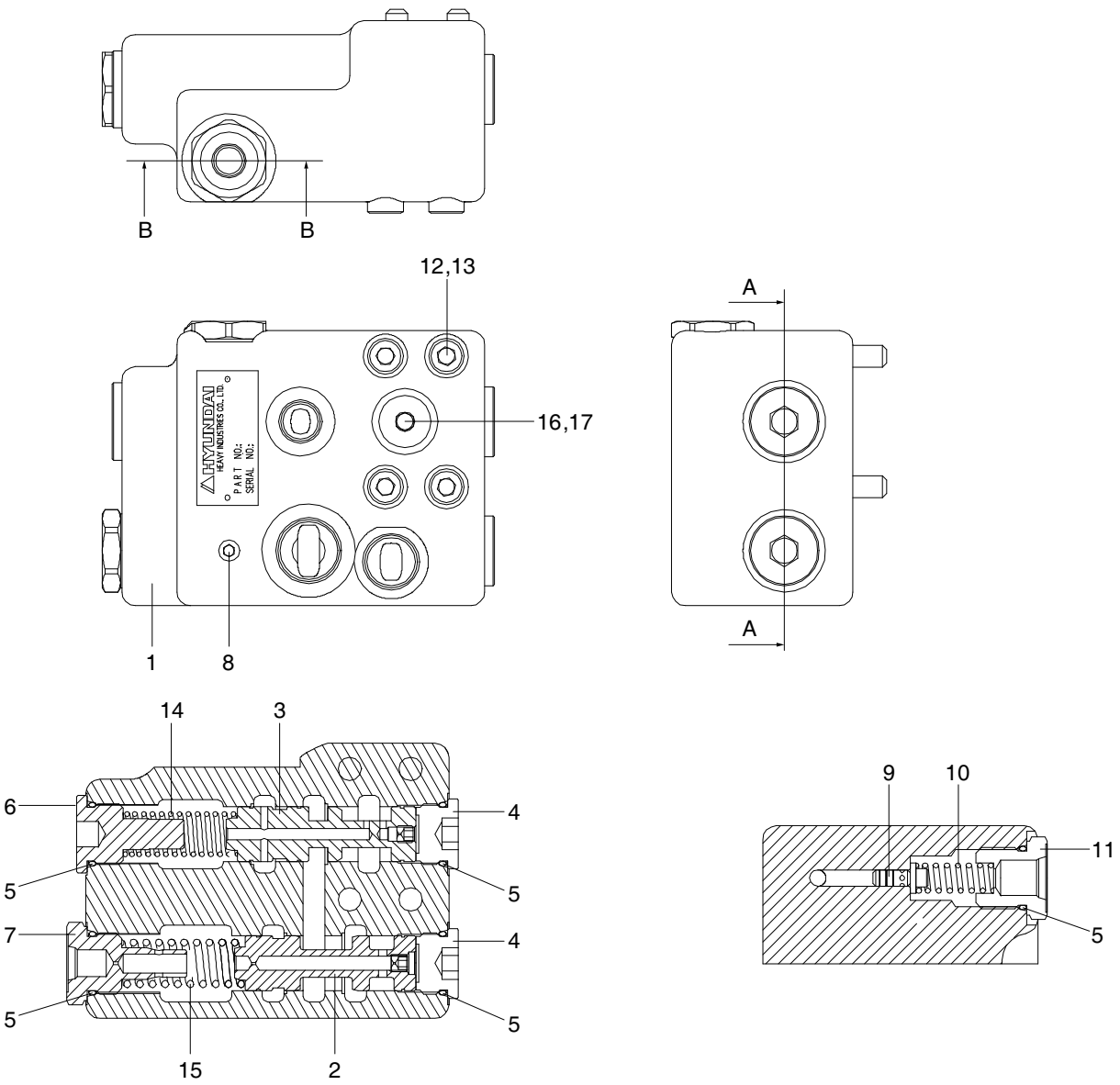


1	SEC housing	9	Gear set	21	Double seal lip	31	Name plate
2	PEC housing	15	Washer	26	Bushing	32	Screw
3	Gear housing	16	Stud bolt	27	Seal	35	Dowel pin
4	Mid plate	17	Nut	28	Backup seal	36	Connection shaft
5	Gear housing	18	Bolt	29	Seal		
7	Gear shaft set	19	Dual flow divider	30	Dowel pin		

2) 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.

DUAL FLOW DIVIDER



SECTION A-A

SECTION B-B

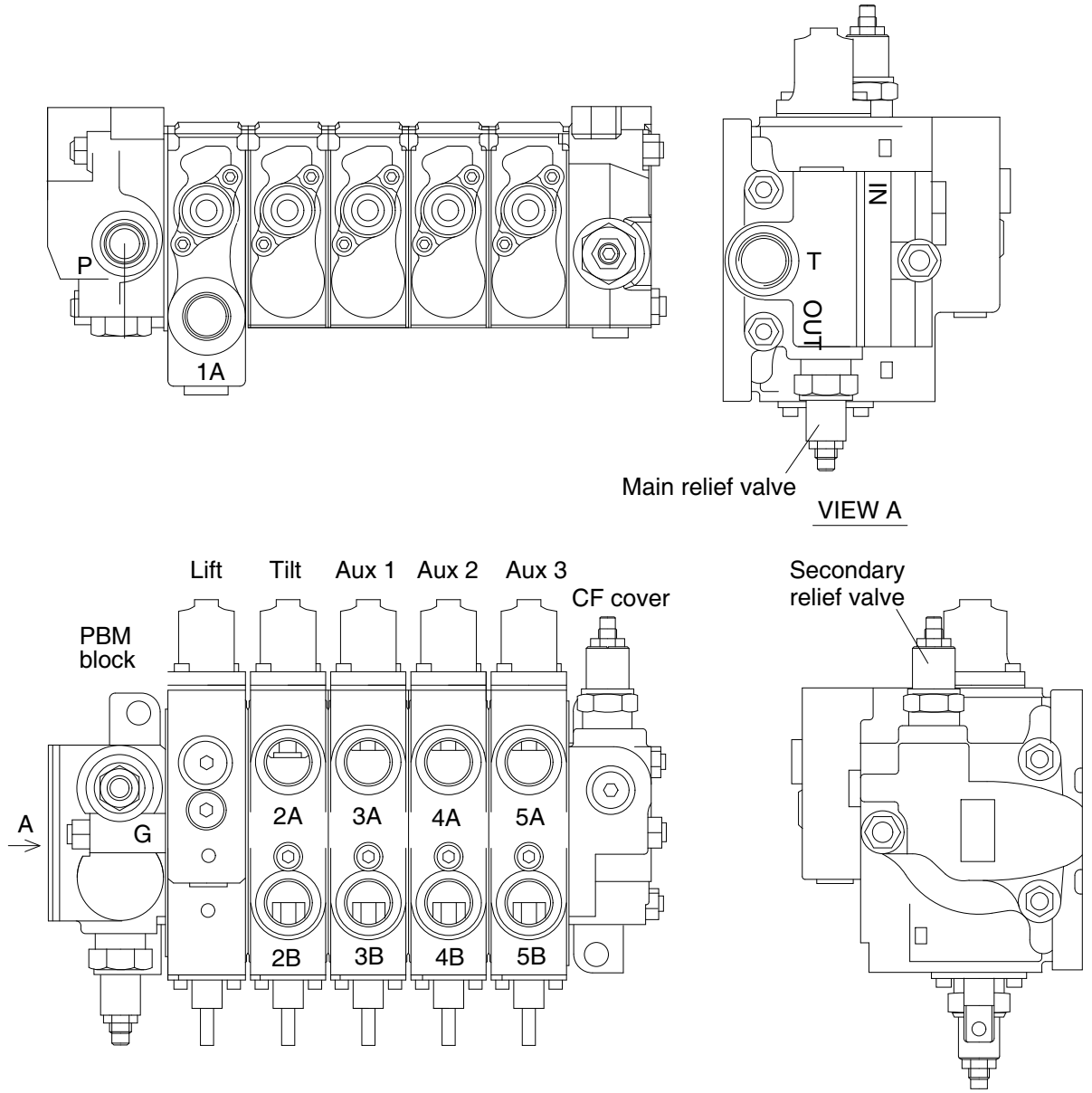
35D9HS16

1	Dual divider block	7	LS plug	13	Spring washer
2	SF spool assy	8	Plug	14	BF spring
3	BF spool assy	9	LS relief poppet	15	SF spring
4	Stopper plug	10	LS relief spring	16	Plug
5	O-ring	11	LS relief plug	17	O-ring
6	BF plug	12	Bolt		

3. MAIN CONTROL VALVE

1) STRUCTURE

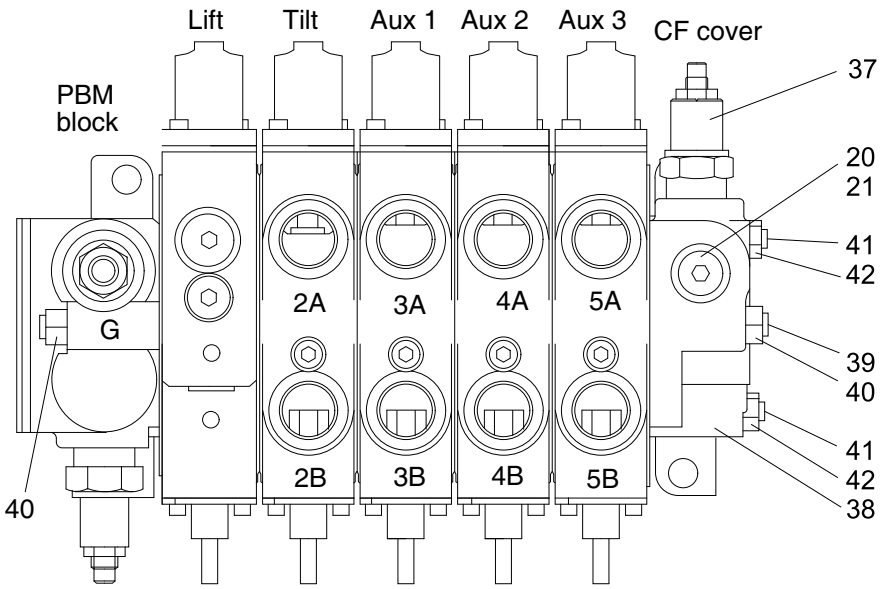
(1) 5 spool, without OPSS



35D9FHS100

Port	Port name	Port size	Remark
P	Inlet port	1-1/16-12 UN	
T	Tank port	1-5/16-12 UN	
1A	Lift port	1-1/16-12 UN	
2A	Tilt port-forward	1-1/16-12 UN	
2B	Tilt port-backward	1-1/16-12 UN	
3A 3B	Auxiliary 1 port	1-1/16-12 UN	
4A 4B	Auxiliary 2 port	1-1/16-12 UN	
5A 5B	Auxiliary 3 port	1-1/16-12 UN	
G	Gauge port	9/16-18 UNF	

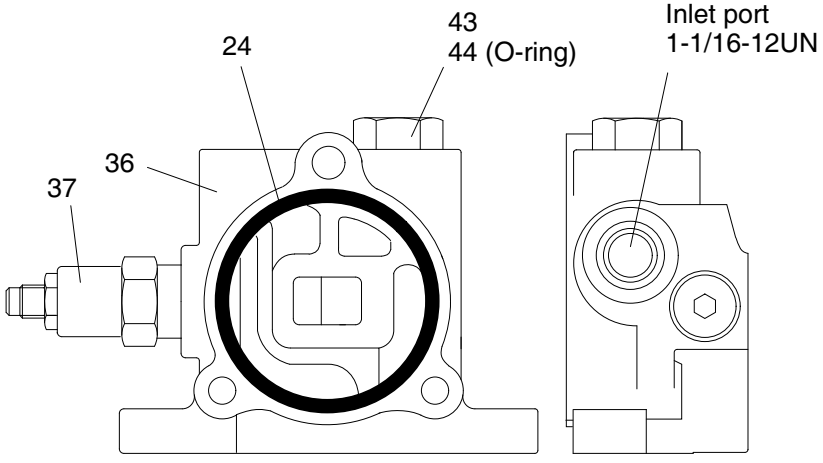
·PBM block and CF cover



35D9FHS101

20	Plug	38	CF cover	41	Bolt
21	O-ring	39	Bolt	42	Nut
37	Relief valve	40	Nut		

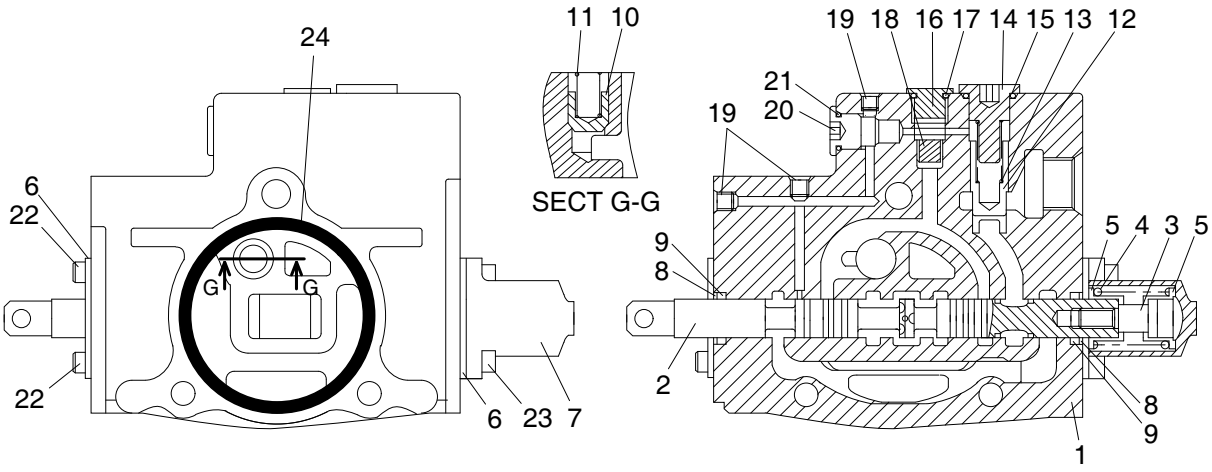
·PBM block



35D9FHS102

24	O-ring	37	Relief valve	44	O-ring
36	PBM block	43	Plug		

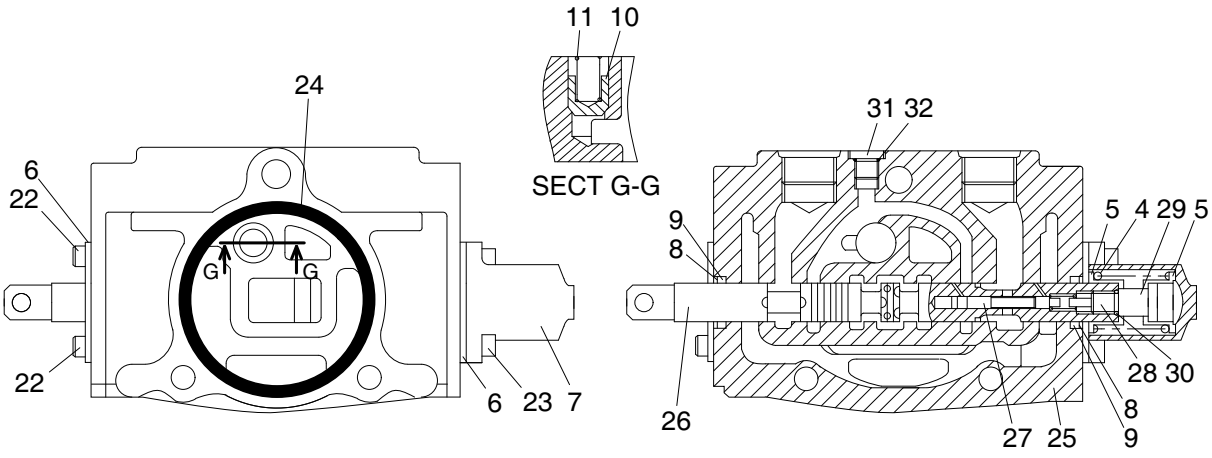
·Lift section



35D9FHS103

1	JM block	9	QUAD ring	17	O-ring
2	Lift spool	10	Inlet poppet	18	Plug
3	Lock plug	11	Spring	19	Plug
4	Spring	12	Safety poppet	20	Plug
5	Spring seat	13	Spring	21	O-ring
6	Plate	14	Plug	22	Bolt
7	Cap	15	O-ring	23	Bolt
8	Back up ring	16	Plug	24	O-ring

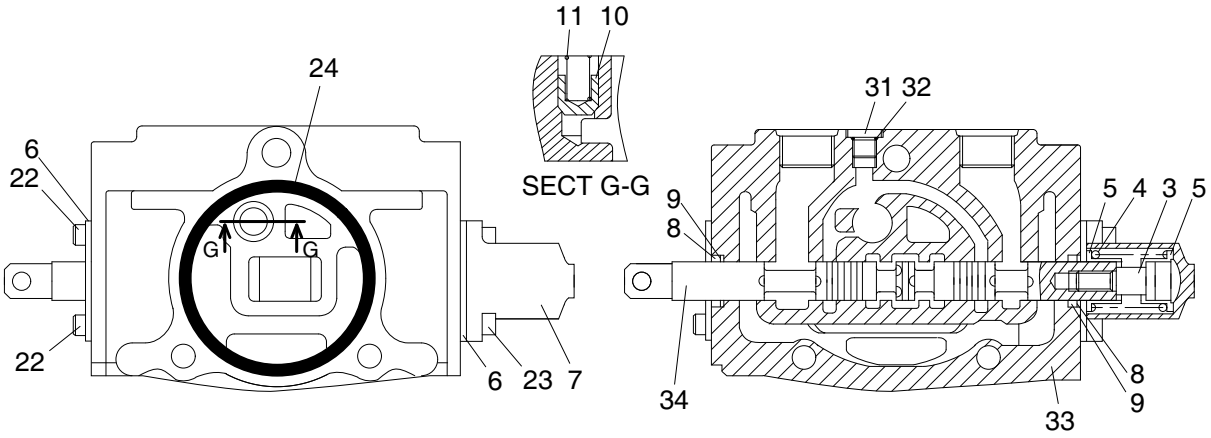
·Tilt section



35D9FHS104

4	Spring	11	Spring	28	Spring
5	Spring seat	22	Bolt	29	Tilt lock plug
6	Plate	23	Bolt	30	O-ring
7	Cap	24	O-ring	31	Plug
8	Back up ring	25	JM block	32	O-ring
9	QUAD ring	26	Tilt spool		
10	Inlet poppet	27	Tilt piston		

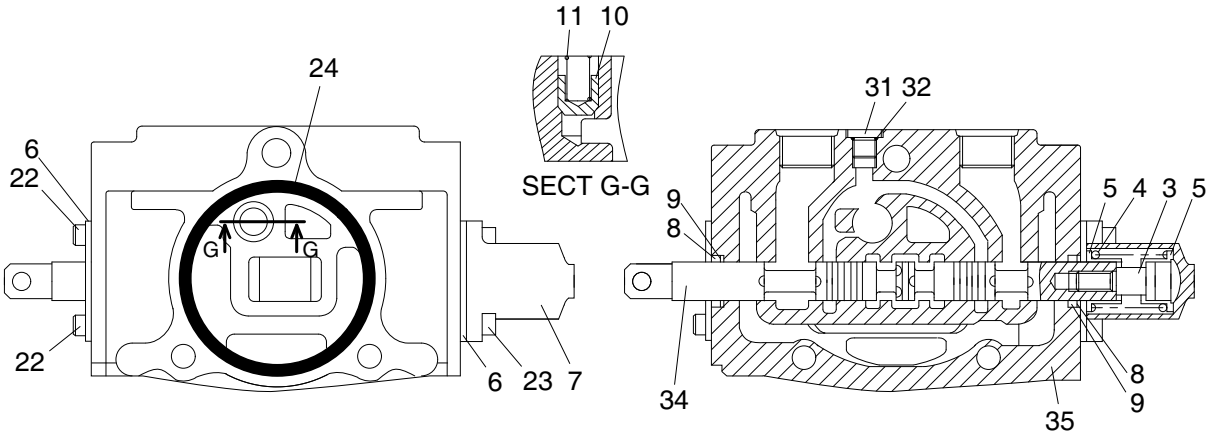
·Auxiliary 1 section



35D9FHS105

3	Lock plug	9	QUAD ring	31	Plug
4	Spring	10	Inlet poppet	32	O-ring
5	Spring seat	11	Spring	33	BO block
6	Plate	22	Bolt	34	Auxiliary spool
7	Cap	23	Bolt		
8	Back up ring	24	O-ring		

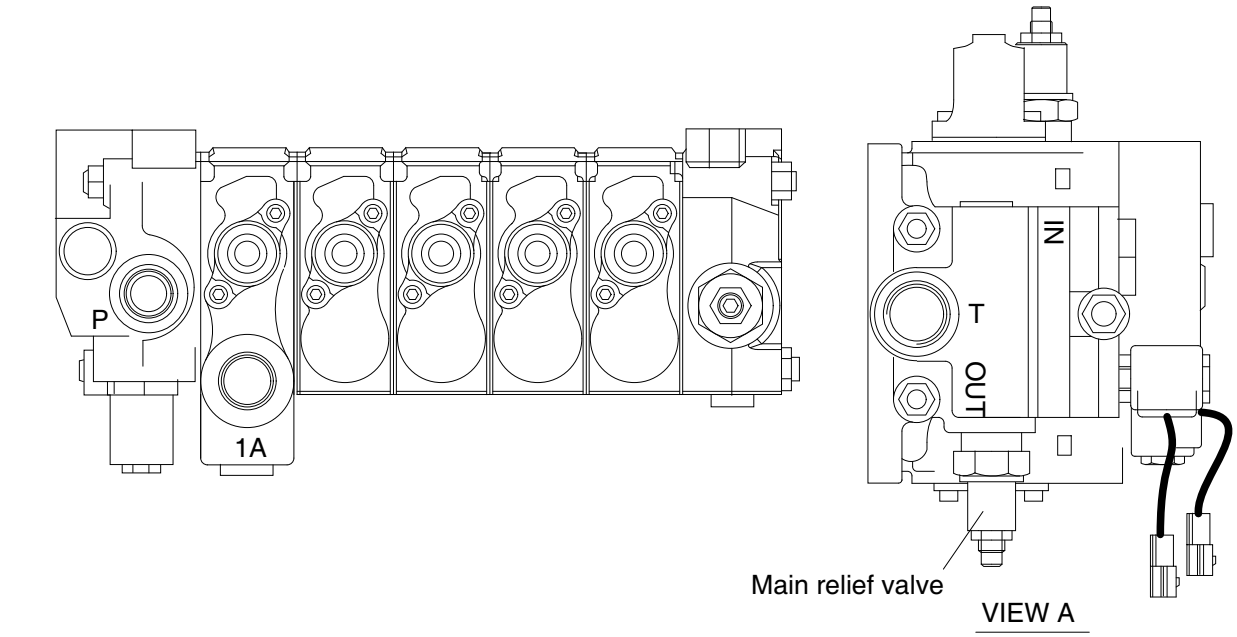
·Auxiliary 2 and 3 section

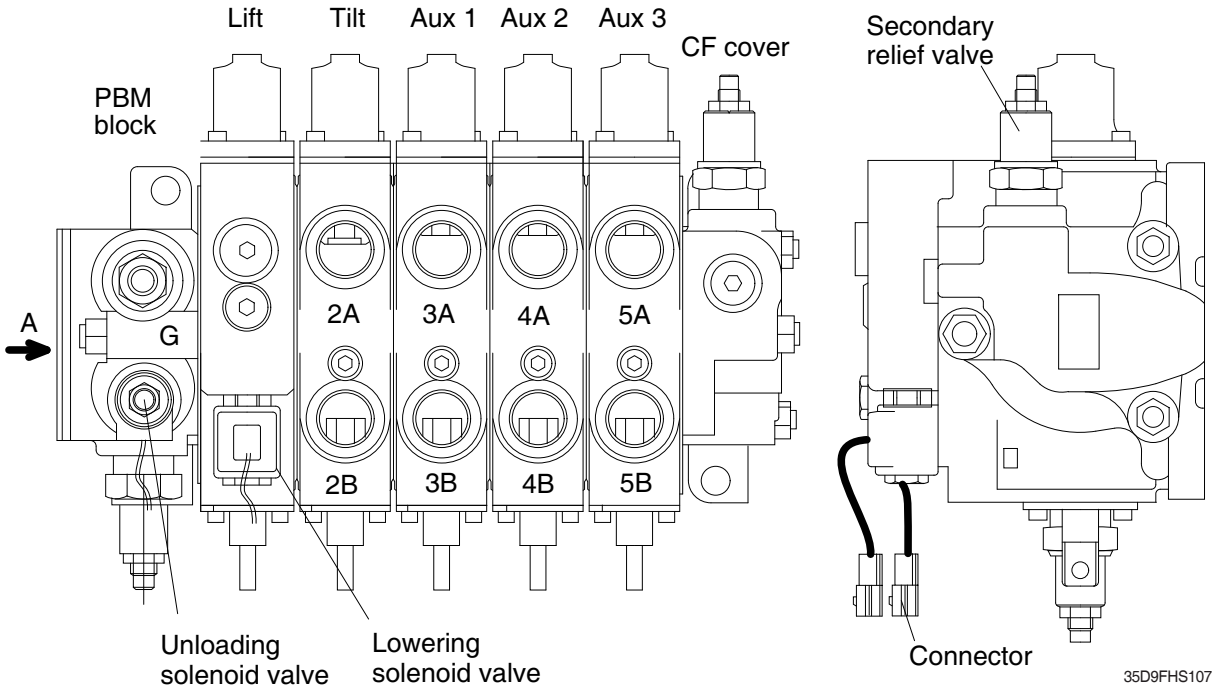


35D9FHS106

3	Lock plug	9	QUAD ring	31	Plug
4	Spring	10	Inlet poppet	32	O-ring
5	Spring seat	11	Spring	34	Auxiliary spool
6	Plate	22	Bolt	35	JO block
7	Cap	23	Bolt		
8	Back up ring	24	O-ring		

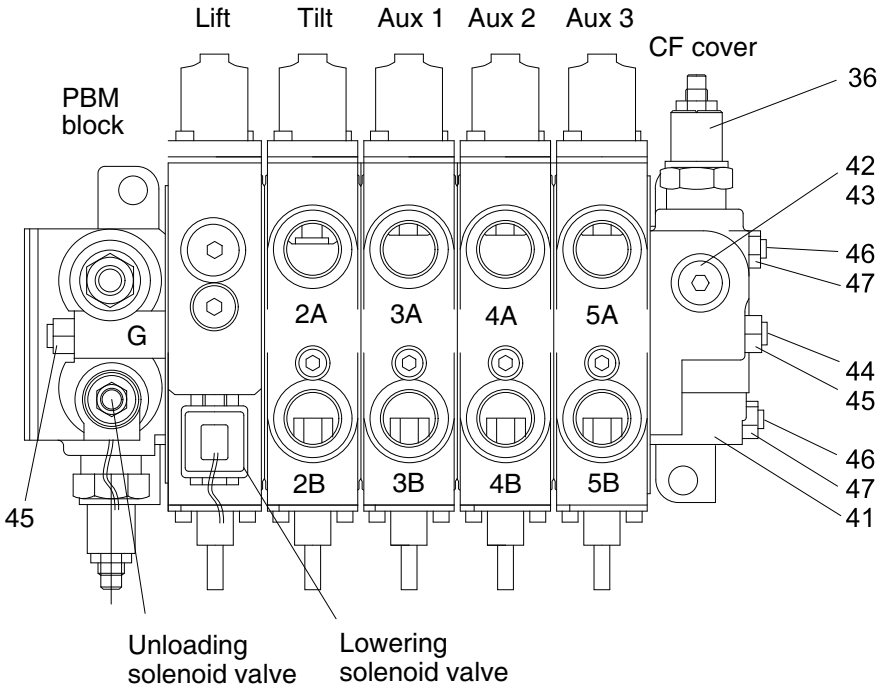
(2) 5 spool, travel and mast OPSS





Port	Port name	Port size	Remark
P	Inlet port	1-1/16-12 UN	
T	Tank port	1-5/16-12 UN	
1A	Lift port	1-1/16-12 UN	
2A	Tilt port-forward	1-1/16-12 UN	
2B	Tilt port-backward	1-1/16-12 UN	
3A 3B	Auxiliary 1 port	1-1/16-12 UN	
4A 4B	Auxiliary 2 port	1-1/16-12 UN	
5A 5B	Auxiliary 3 port	1-1/16-12 UN	
G	Gauge port	9/16-18 UNF	

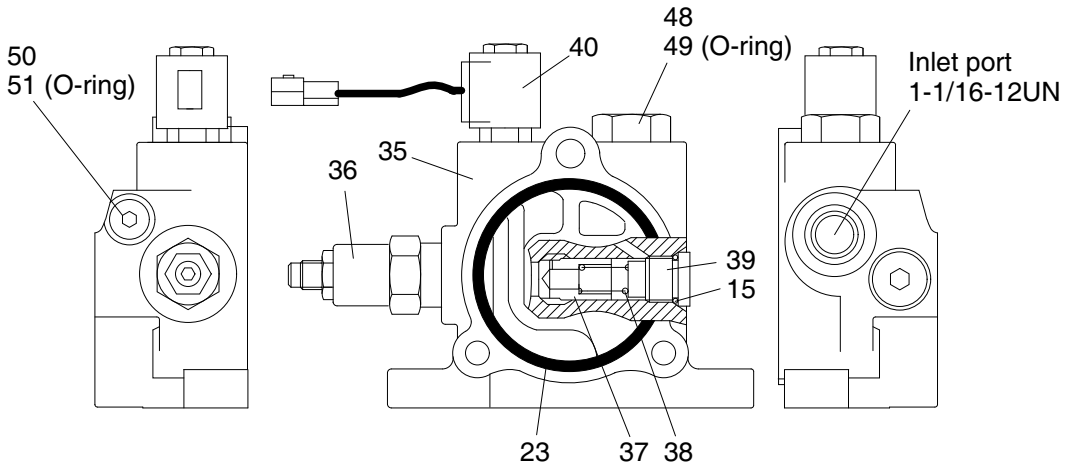
·PBM block and CF cover



35D9FHS108

36	Relief valve	43	O-ring	46	Bolt
41	Bolt	44	Bolt	47	Nut
42	Plug	45	Nut		

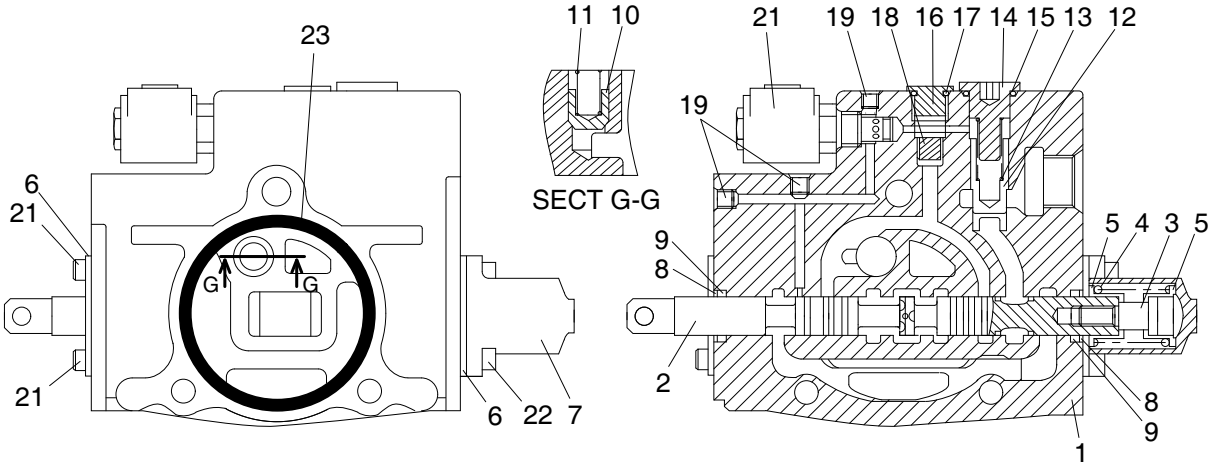
·PBM block



35D9FHS109

15	O-ring	37	Unload poppet	48	Gauge plug
23	O-ring	38	Spring	49	O-ring
35	PBM block	39	Plug	50	Plug
36	Relief valve	40	Solenoid valve	51	O-ring

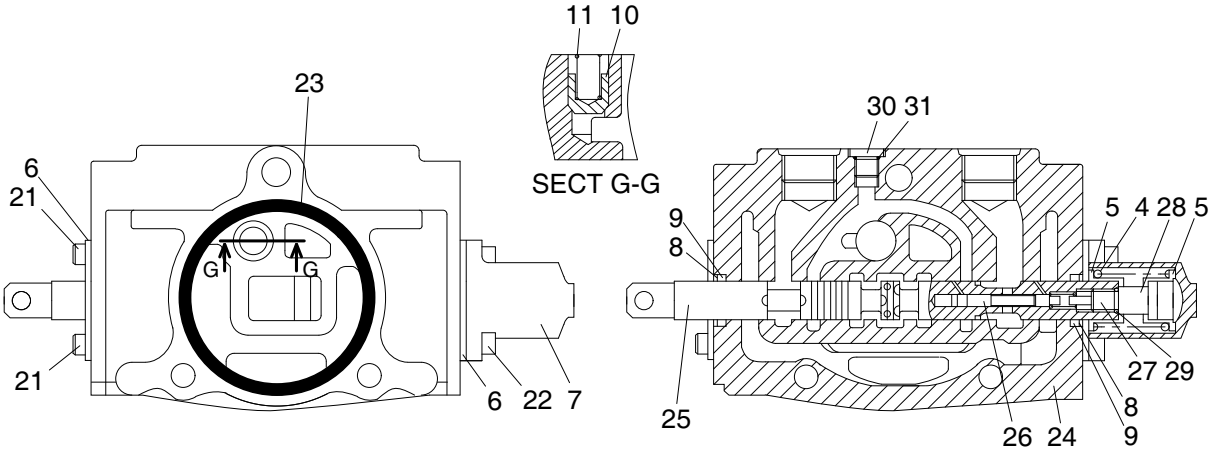
·Lift section



35D9FHS110

1	JM block	9	QUAD ring	17	O-ring
2	Lift spool	10	Inlet poppet	18	Plug
3	Lock plug	11	Spring	19	Plug
4	Spring	12	Safety poppet	20	Solenoid valve
5	Spring seat	13	Spring	21	Bolt
6	Plate	14	Plug	22	Bolt
7	Cap	15	O-ring	23	O-ring
8	Back up ring	16	Plug		

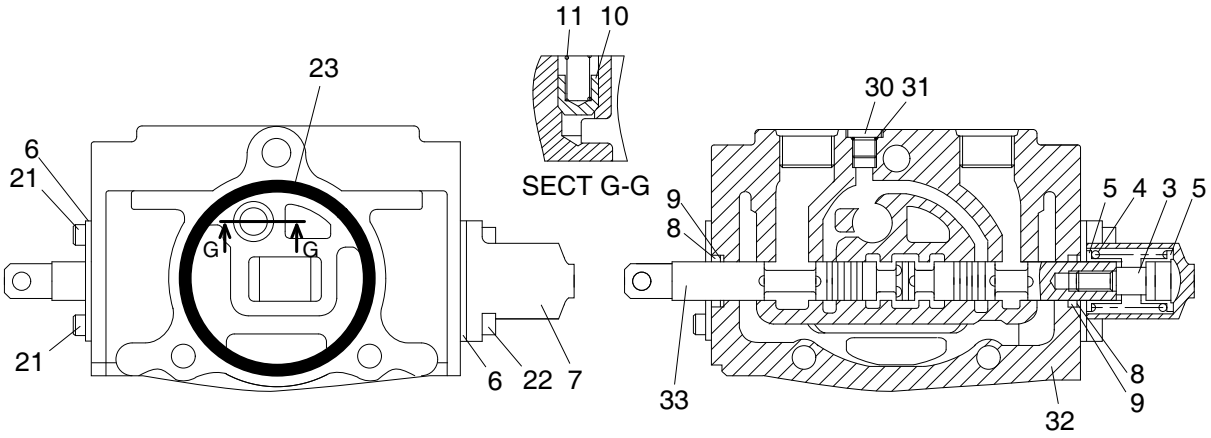
·Tilt section



35D9FHS111

4	Spring	11	Spring	27	Spring
5	Spring seat	21	Bolt	28	Tilt lock plug
6	Plate	22	Bolt	29	O-ring
7	Cap	23	O-ring	30	Plug
8	Back up ring	24	JM block	31	O-ring
9	QUAD ring	25	Tilt spool		
10	Inlet poppet	26	Tilt piston		

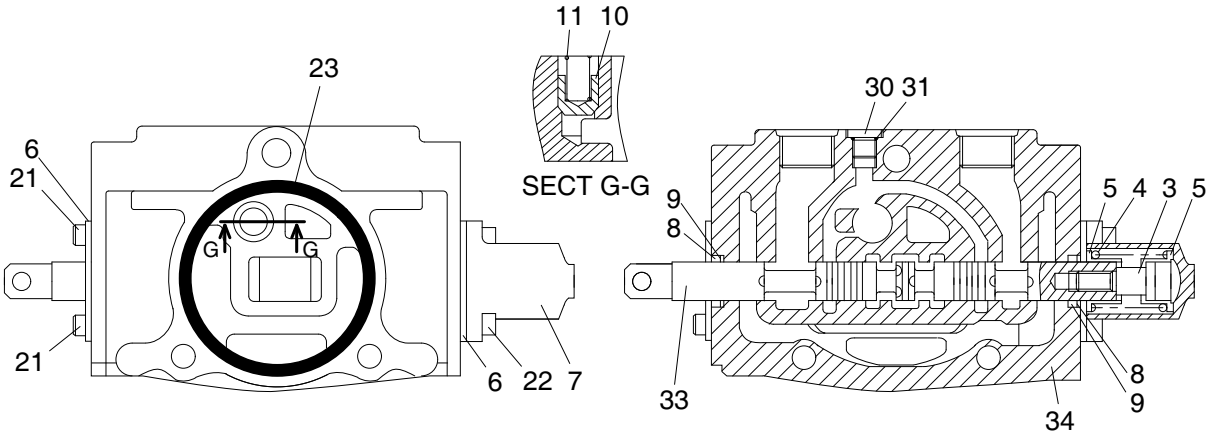
·Auxiliary 1 section



35D9FHS112

3	Lock plug	9	QUAD ring	30	Plug
4	Spring	10	Inlet poppet	31	O-ring
5	Spring seat	11	Spring	32	BO block
6	Plate	21	Bolt	33	Auxiliary spool
7	Cap	22	Bolt		
8	Back up ring	23	O-ring		

·Auxiliary 2 and 3 section

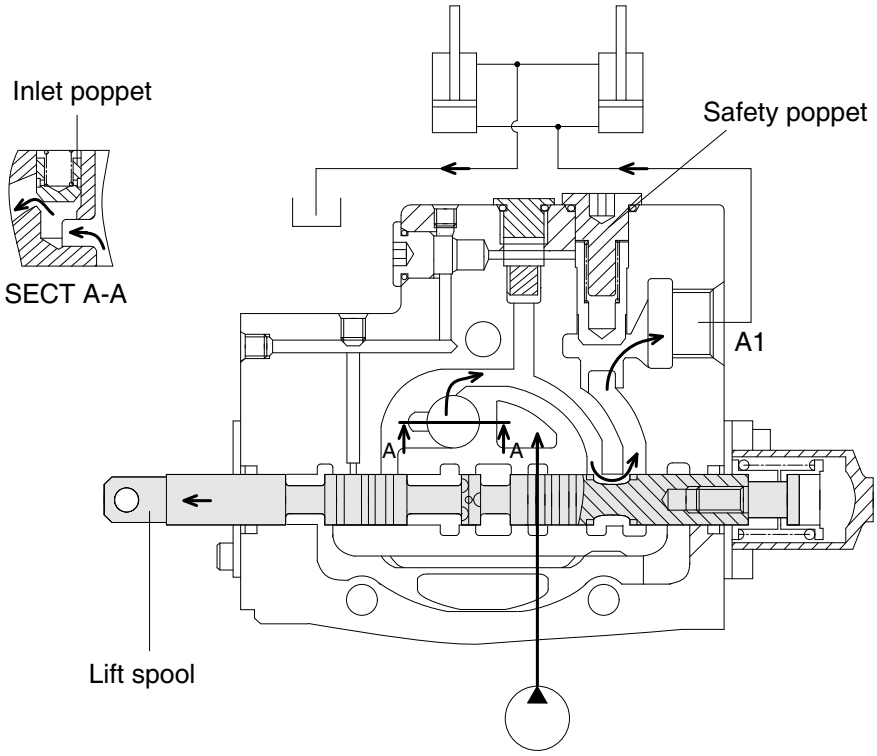


35D9FHS113

3	Lock plug	9	QUAD ring	30	Plug
4	Spring	10	Inlet poppet	31	O-ring
5	Spring seat	11	Spring	33	Auxiliary spool
6	Plate	21	Bolt	34	JO block
7	Cap	22	Bolt		
8	Back up ring	23	O-ring		

2) LIFT SECTION OPERATION

(1) Lift position



35D9FHS114

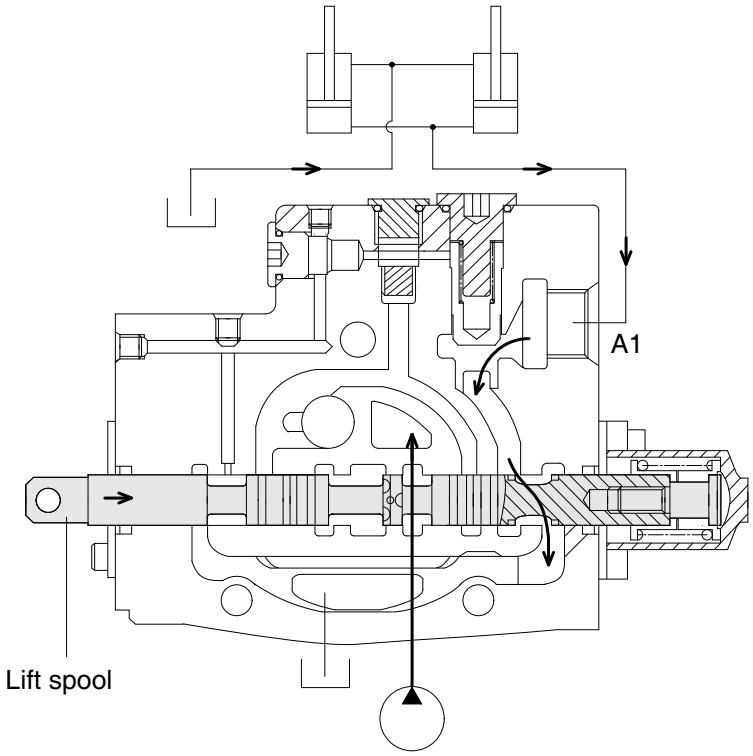
When the lift control lever is pulled back, the spool moves to the left and the neutral passage is closed.

The oil supplied from the pump pushes up the inlet poppet and safety poppet and then flow into the large chamber of the lift cylinder through the port A1.

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

The return oil from the small chamber of the lift cylinders flows into the hydraulic tank.

(2) Lower position

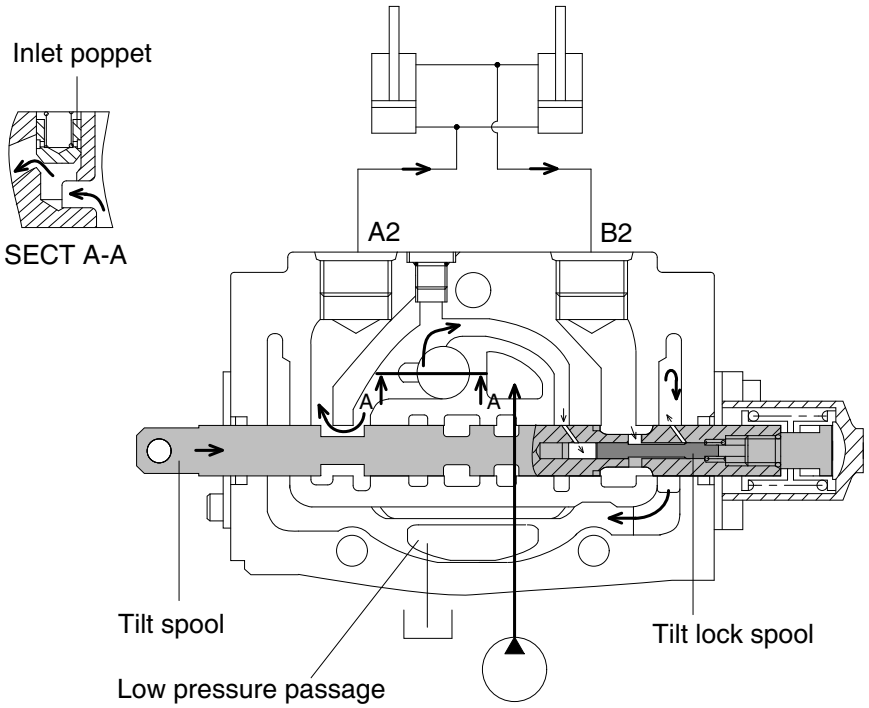


35D9FHS115

When the lift control lever is pushed forward, the lift spool moves to the right and the neutral passage is closed.
The spool moves to the lift lower position, the oil of the large chamber of the lift cylinder is connected to the hydraulic tank through low pressure passage and the oil of the small chamber is connect to the hydraulic tank.
Consequently, in lift lower position the fork drops due to its own weight.

3) TILT SECTION OPERATION

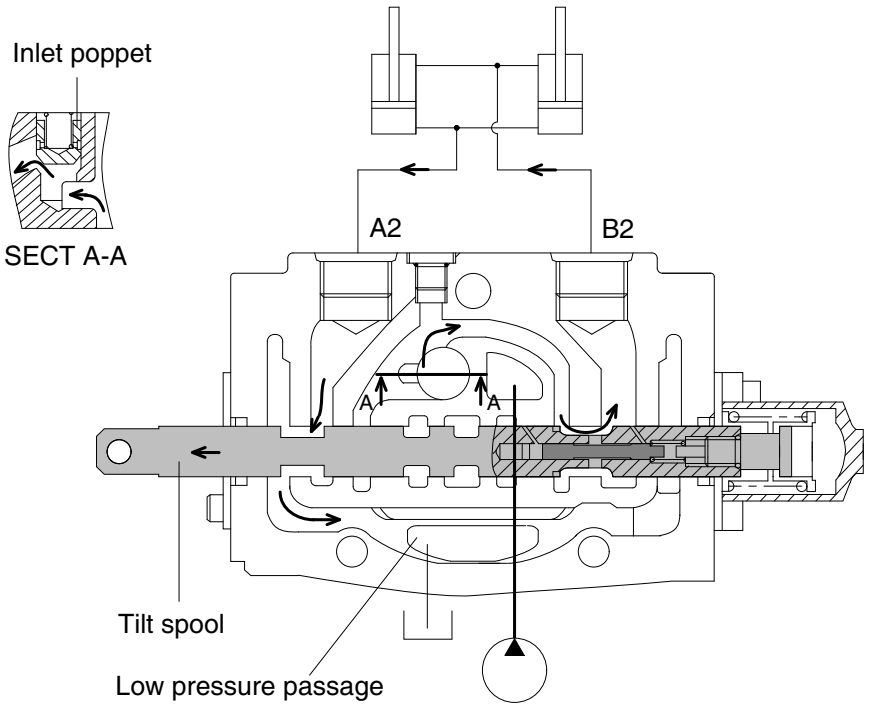
(1) Tilt forward position



35D9FHS116

When the tilt control lever is pushed forward, the tilt spool moves to the right and the neutral passage is closed.
The oil supplied from the pump pushes up the inlet poppet and flow into the large chamber of the tilt cylinder through the port A2.
The pump pressure reaches proportionally the load of cylinders and fine control finished by closing the neutral passage.
The return oil from the small chamber of the tilt cylinder port flows into the hydraulic tank through the port B2 and hole of the tilt lock spool.

(2) Tilt backward position



35D9FHS117

When the tilt control lever is pulled back, the tilt spool moves to the left and the neutral passage is closed.
The oil supplied from the pump pushes up the inlet poppet and flows into the small chamber of the 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 the large chamber of the tilt cylinder flows into the hydraulic tank through the port A2 and low pressure passage.

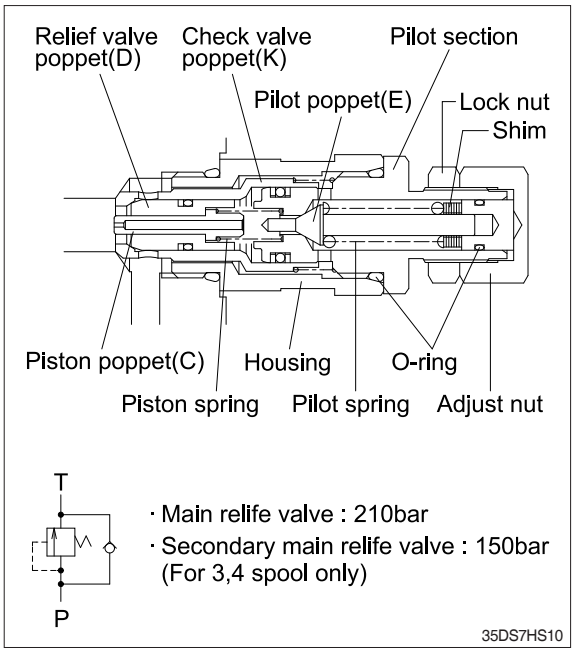
4) MAIN RELIEF VALVE

(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

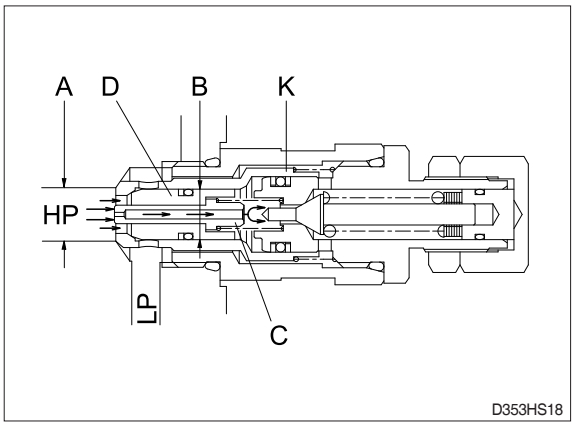
① Loosen lock nut.
② Set adjusting nut to desired pressure setting.
③ If desired pressure setting cannot be achieved, add or remove shims as required.
④ Tighten lock nut.
⑤ Retest in similar manner as above.



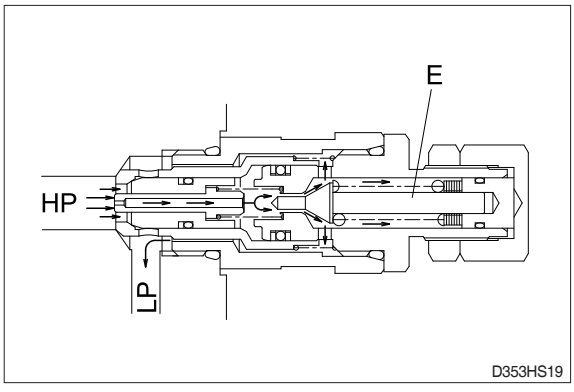
(2) Function

① As work port relief

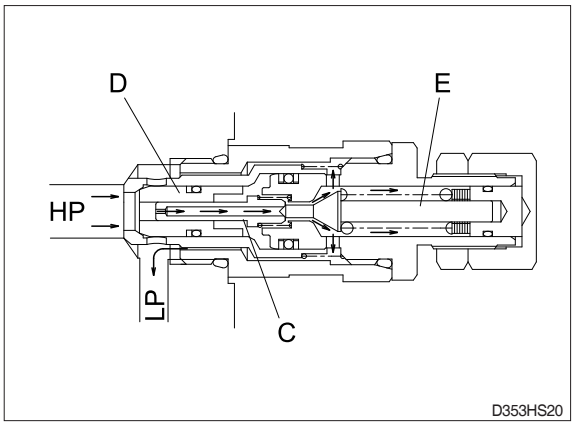
The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown.



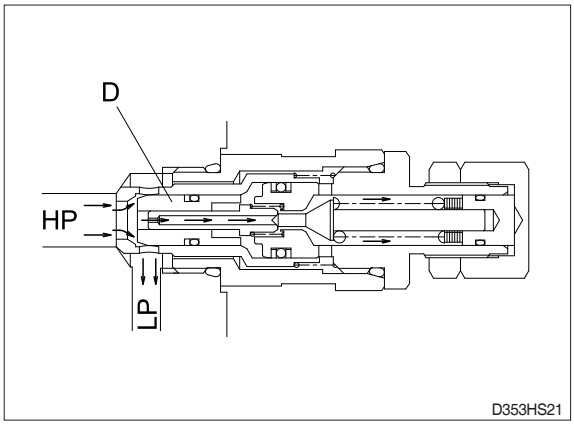
The oil pressure in the high pressure port HP has reached the setting of the pilot poppet spring force and unseats the pilot poppet E and oil flows around the poppet through the cross drilled holes and to the low pressure area LP.



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.

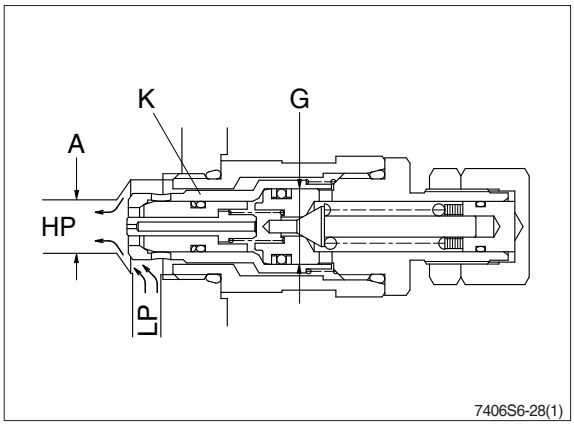


The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.



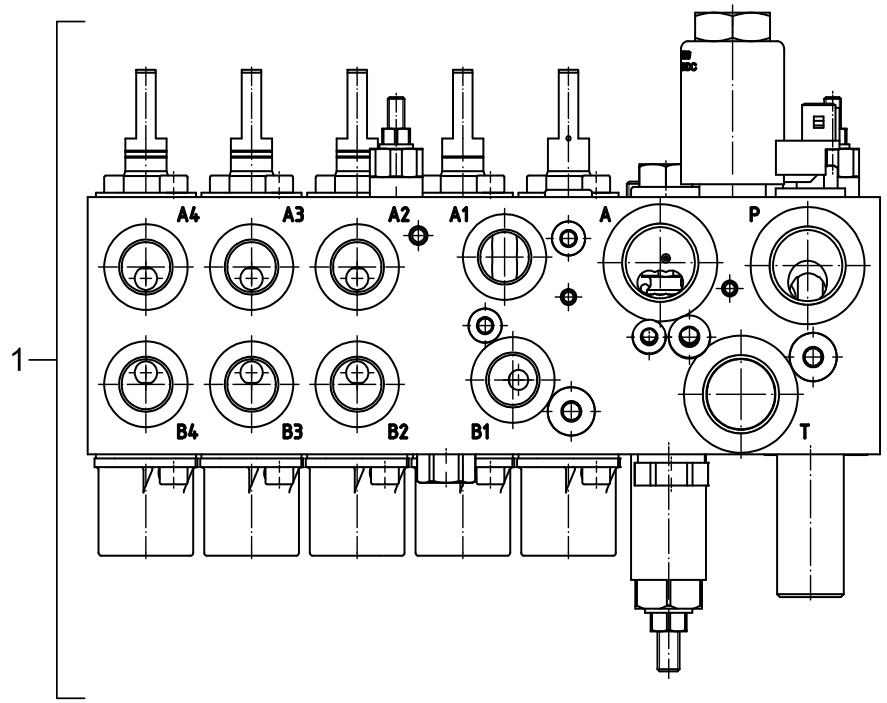
② As anti void

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.

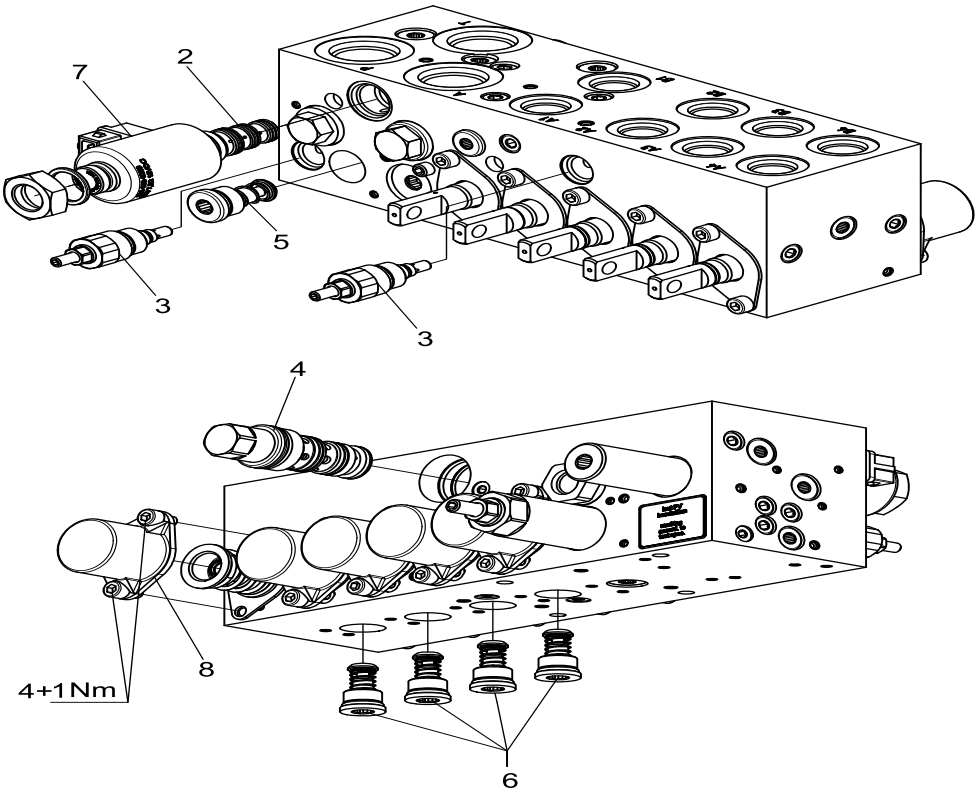


·BUCHHOLZ MCV (STD. 35D-9F : #232~, 40D-9F : #95~, 45D-9F : #1049~, 50DA-9F: #272~)

1) STRUCTURE (5 SPOOL, WITH OPSS)

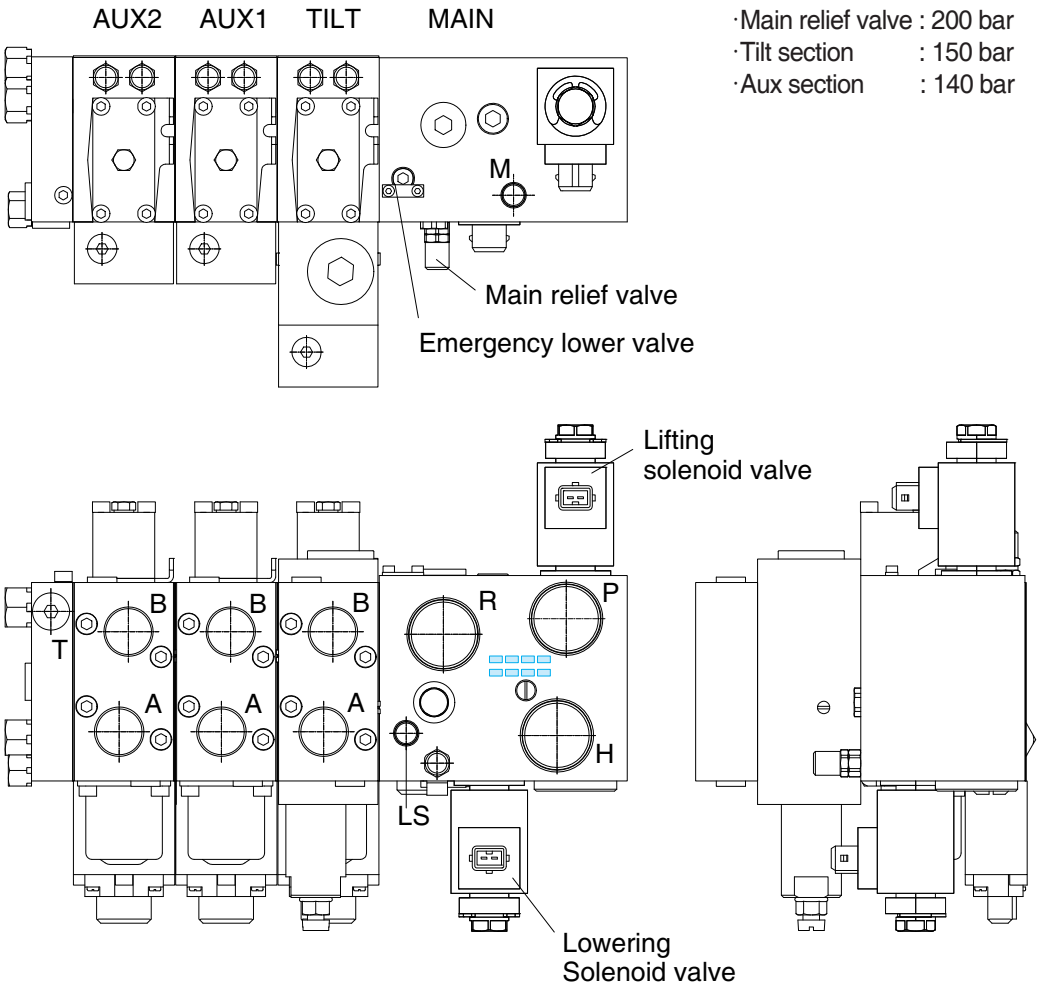


1	Control V/V	4	Overcenter V/V	7	Solenoid coil 12V
2	Directional V/V	5	Check V/V NG12	8	Spring cap with screws
3	Pressure relief V/V NG4	6	Check V/V NG10.5		



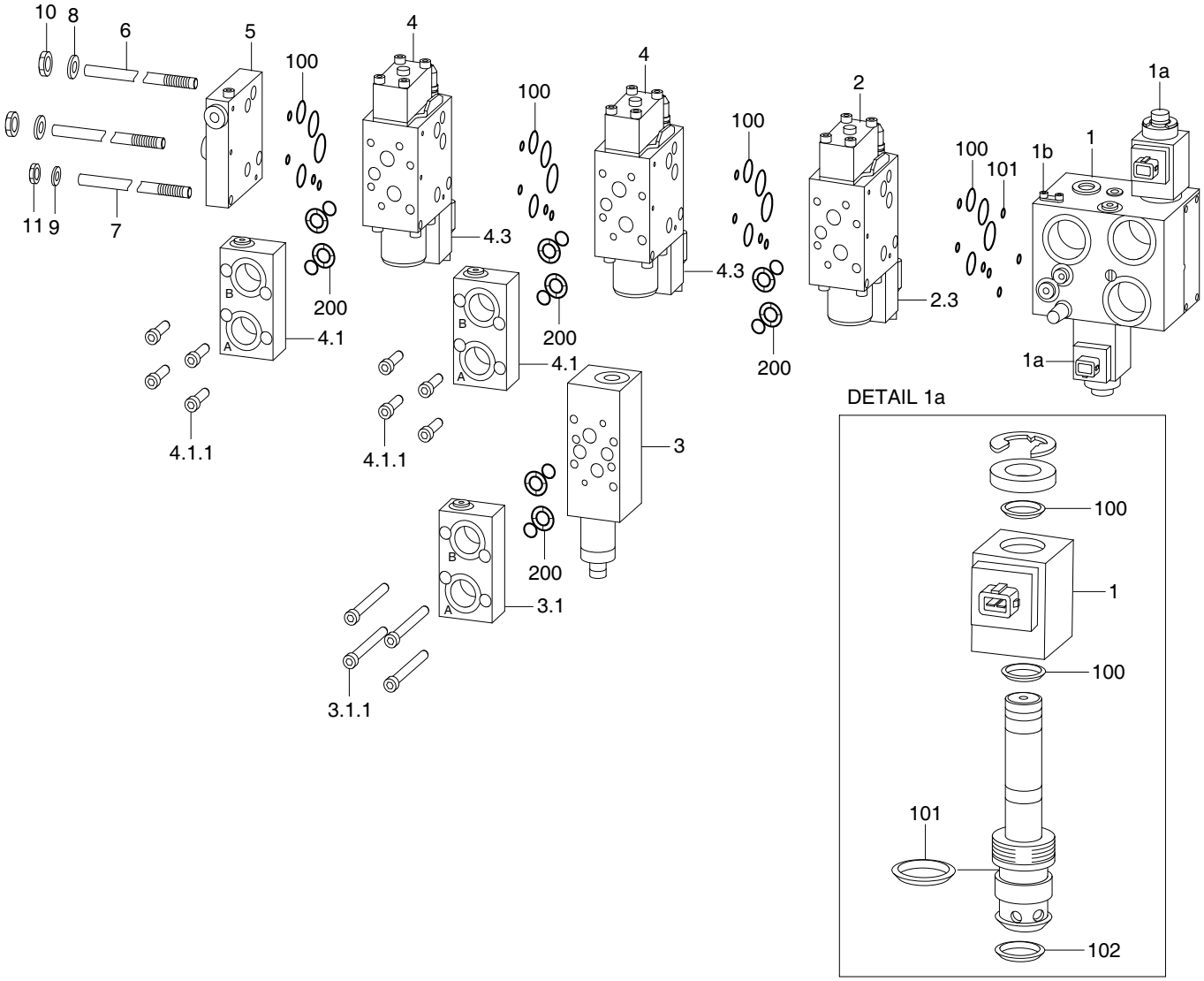
4. MAIN CONTROL VALVE (FINGER TIP, OPT)

1) STRUCTURE (4-SPOOL)



35D9FHS120

Port	Port name	Port size	Remark
P	Inlet port	1 5/16 12 UNF	
T	Tank port	1 5/16 12 UNF	
H	Lift port	1 5/16 12 UNF	
Tilt A	Forward port	7/8 14 UNF	
Tilt B	Backward port	7/8 14 UNF	
Aux1 A B	Auxiliary 1 port	7/8 14 UNF	
Aux2 A B	Auxiliary 2 port	7/8 14 UNF	
M	Gauge port	7/16 20 UN	



35D9FHS121

1	Main section assy	4	Auxiliary section assy	8	Disc shape washer
1a	Solenoid valve	4.1	Adapter	9	Washer
2	Tilt section assy	4.1.1	Head screw	10	Hex nut
2.2	Tilt section spool	4.2	Auxiliary section assy	11	Hex nut
2.3	Twin solenoid valve	4.3	Twin solenoid	100	Side flange seal kit
3	Counter balance valve	5	End plate	101	O-ring
3.1	Adapter	6	Tension rod	200	Ancillary seal kit
3.3.1	Head screw	7	Tension rod		

2) MAIN SECTION

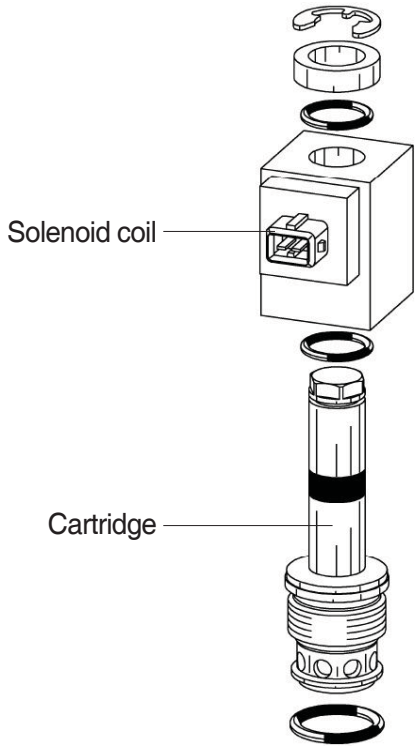
(1) Lifting and lowering valve

※ Flow rate : 160 lpm
※ Maximum pressure : 185 bar

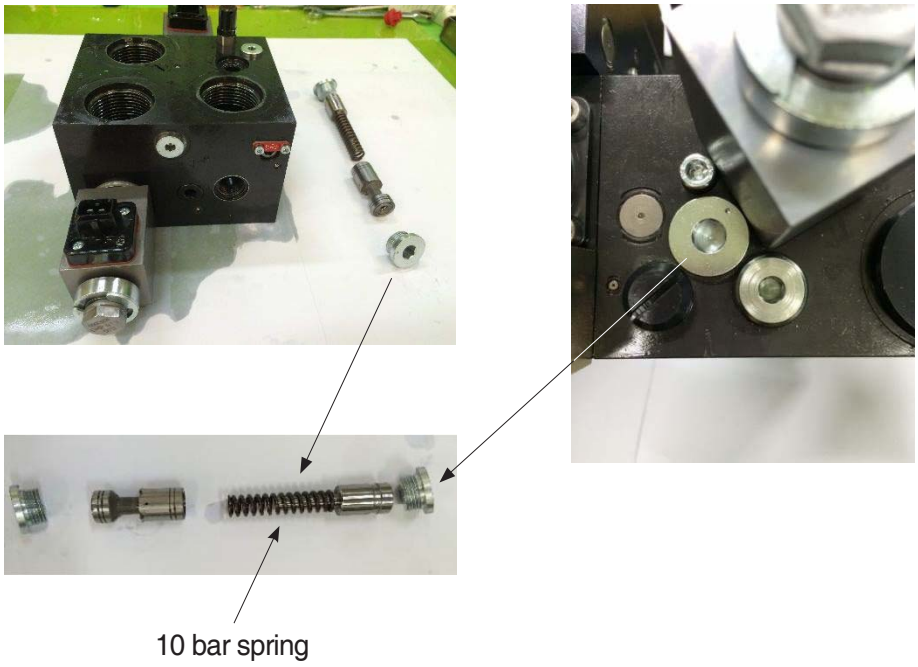
※ When it can't control lifting and lowering, need to check solenoid valve.
Because of contamination material solenoid valve often can't operate properly that means valve poppet and seat opened.

- Solenoid valve

※ Tightening torque :
9.2 kgf · m (66.5 lbf · ft)



(2) 3-way controller

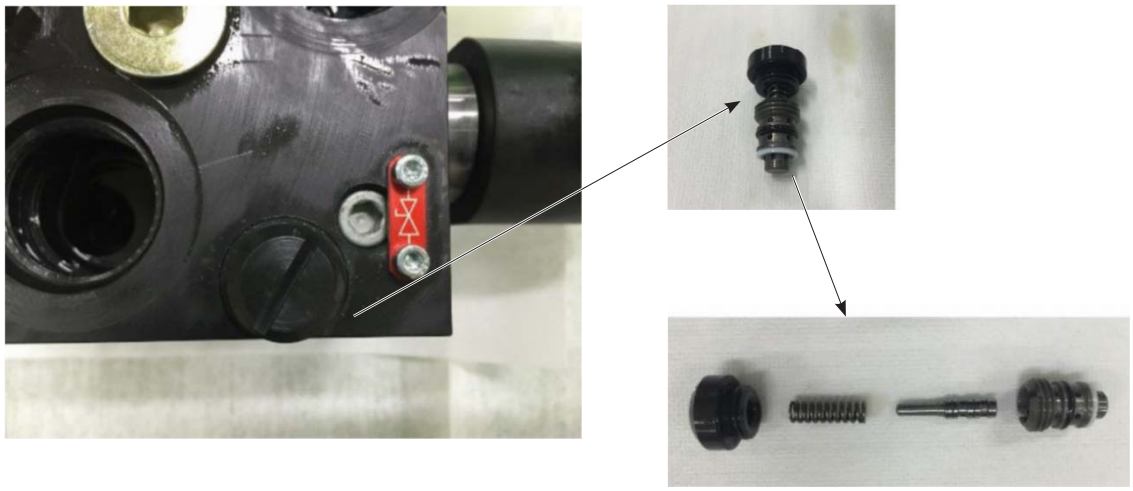


35D9FHS203

※ During unloading, supplied oil by the pump return to tank keeping 10 bar of system pressure.

(3) Pressure reducing and B damping screw

① Pressure reducing vavle

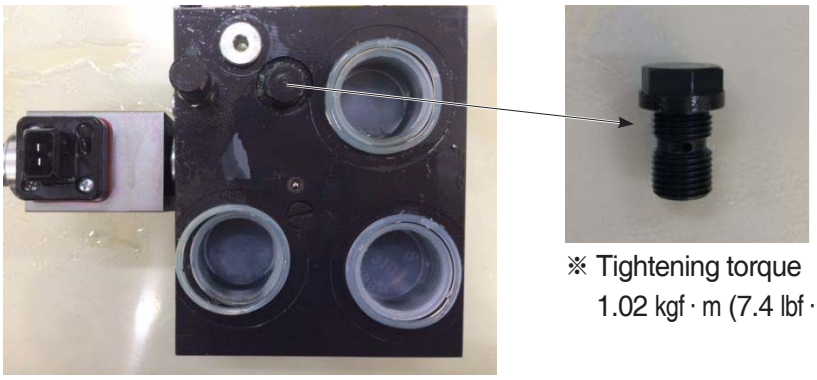


※ Tightening torque : 0.71 kgf · m (5.2 lbf · ft)
※ Use a flat head screw driver.

35D9FHS204

※ Pressure reducing valve controls valve actuation by suppling internal control oil.

② B damping screw



※ Tightening torque
1.02 kgf · m (7.4 lbf · ft)

35D9FHS205

※ B damping standard type that connects load sensing line.

(4) Pressure relief valve

35D9FHS206

※ Tightening torque (1)
1.43 kgf · m (10.3 lbf · ft)
※ Use with a 12 mm spanner.

35D9FHS207

※ Tightening torque (2)
1.43 kgf · m (10.3 lbf · ft)
※ Use with a 3 mm wrench

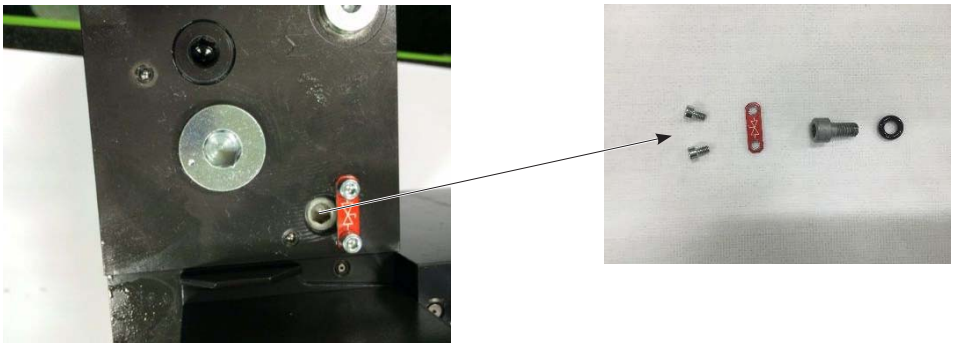
= Pressure increases
= Pressure increases

35D9FHS208

※ Rotating clockwise to increase setting pressure with a wrench.
※ 80 bar increase and decrease per 1 turn.

(5) Emergency lowering valve and shuttle valve

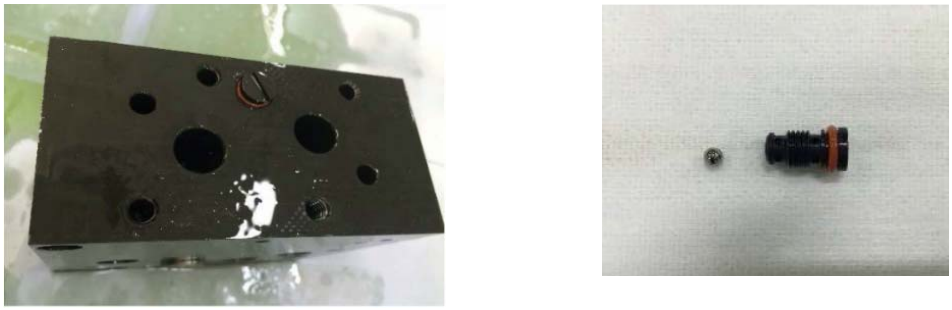
① Emergency lowering valve



35D9FHS209

※ When need to force lowering, rotate counter clockwise increasingly with emergency lowering valve.

② Shuttle valve

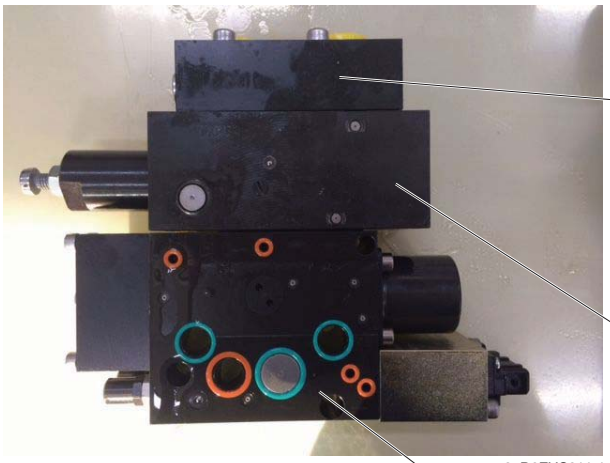


35D9FHS210

※ Transfer bigger load pressure through shuttle valve.
※ Use a flat head screw driver.

3) TILT SECTION

(1) Tilt vavle section

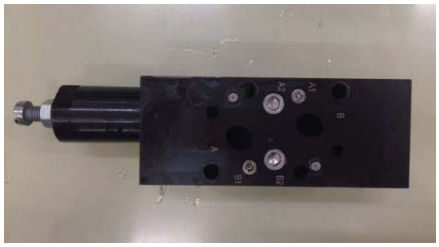


35D9FHS211-1

- Ancillary block

35D9FHS211-2

- Counter balance valve block



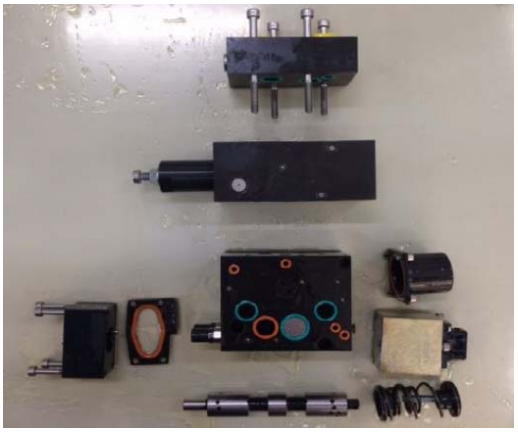
35D9FHS211-3

- Valve section block

35D9FHS211-4

※ Flow rate : 80 lpm
※ Load holding pressure : 140 bar
※ Tilt section pressure limit : 150 bar

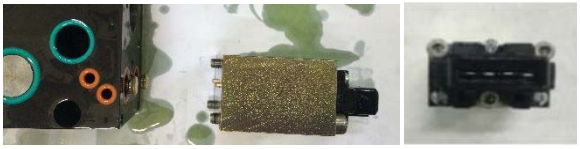
(2) Disassembly valve section



- Disassemble spool

※ All block type

- Disassemble coil



※ Solenoid 4 pin coil

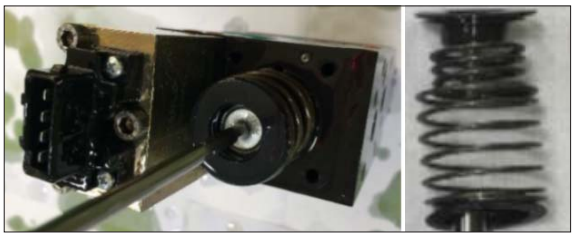
35D9FHS212

- Dissembling process

① Release spring cap

35D9FHS213

② Release spring cap completely

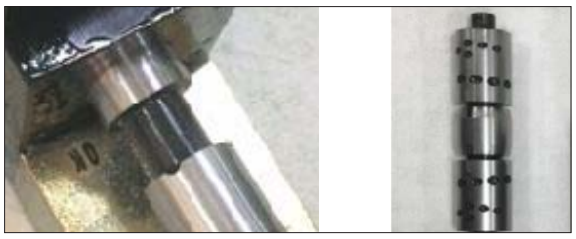


35D9FHS214

③ Release lever block

35D9FHS215

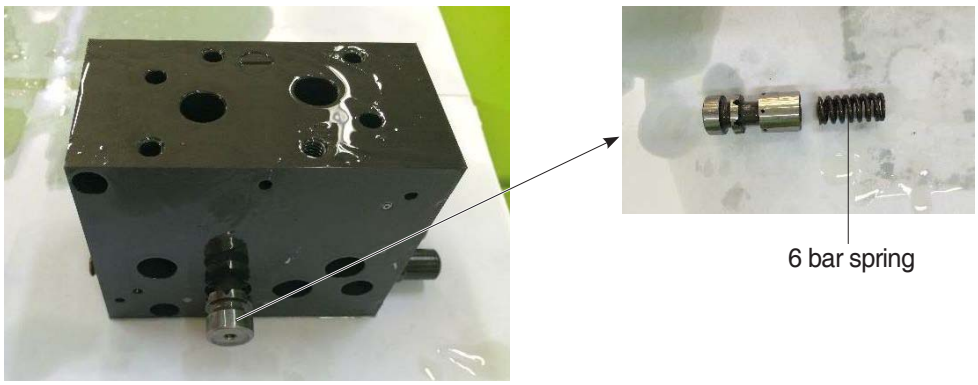
④ Pull out spool



35D9FHS216

(3) 2 way controller and shuttle valve

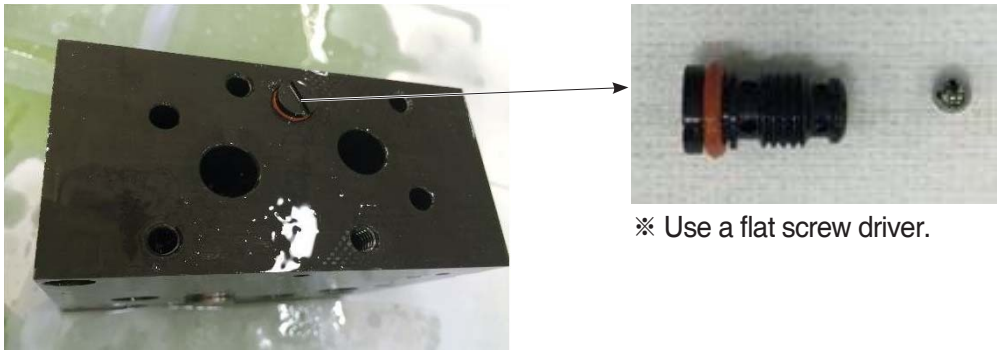
① 2 way controller



35D9FHS217

※ 2 way controller make it keep 6 bar regardless of load change between in and out of spool.

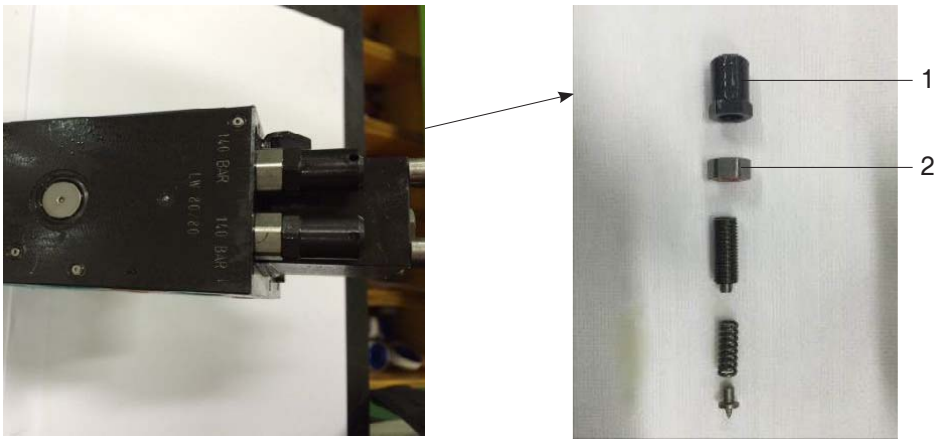
② Shuttle valve



35D9FHS218

※ Transfer bigger load pressure through shuttle valve.

(4) Second relief valve



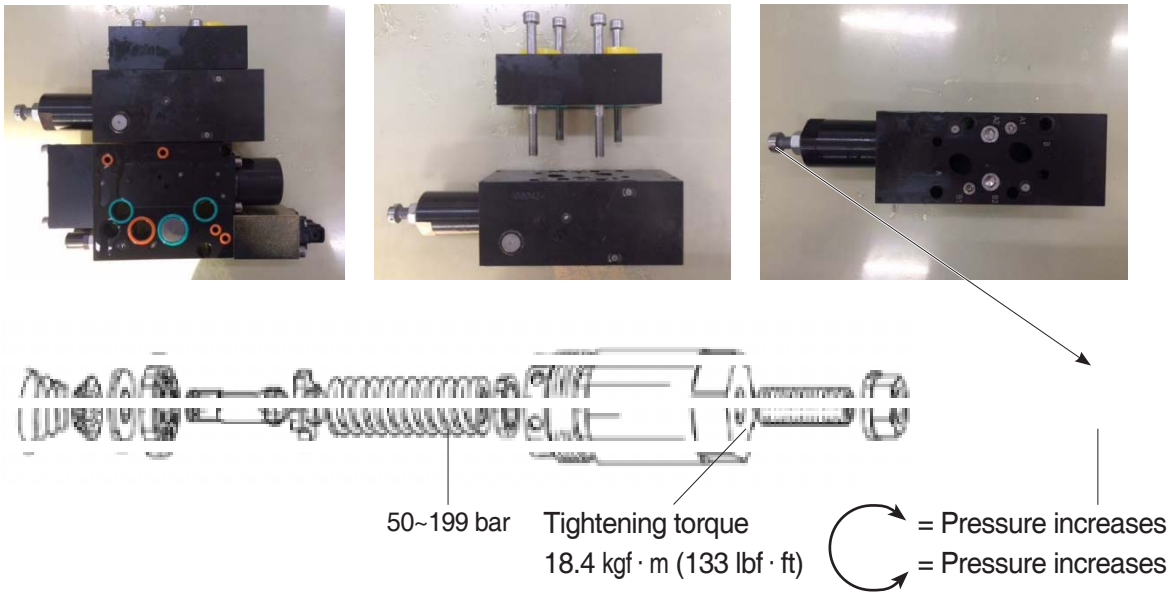
※ Tightening torque (1)
1.43 kgf · m (10.3 lbf · ft)
※ Use with a 12 mm spanner.

※ Tightening torque (2)
1.43 kgf · m (10.3 lbf · ft)
※ Use with a 3 mm wrench

= Pressure increases
= Pressure increases

※ Controlling individual section pressure, rotating clockwise to increase setting pressure with a wrench.
※ 80 bar increase and decrease per 1 turn.

(5) Counter balance valve

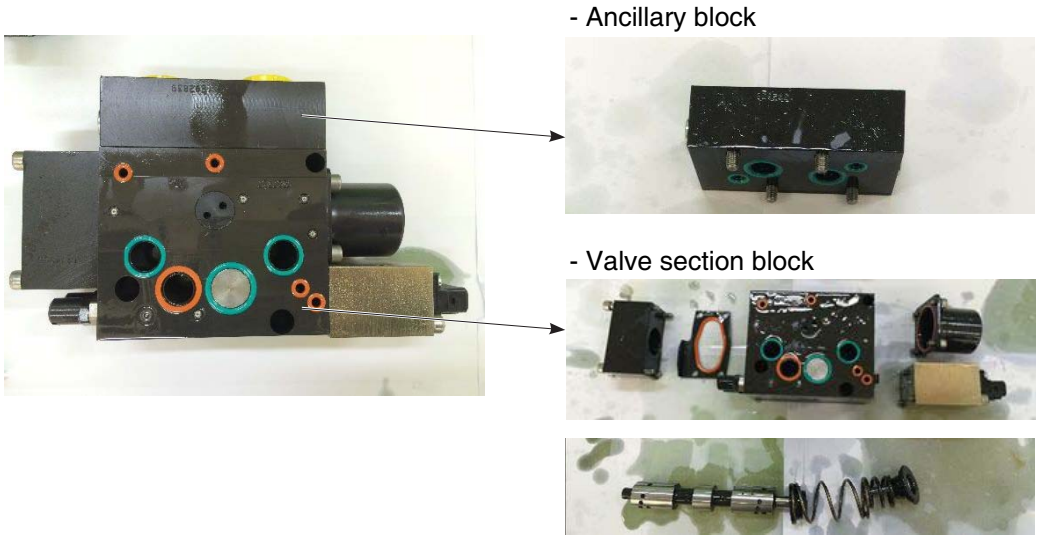


35D9FHS222

※ Counter balance valve needs during tilting out operation.

4) AUXILIARY SECTION

(1) Auxiliary vavle section



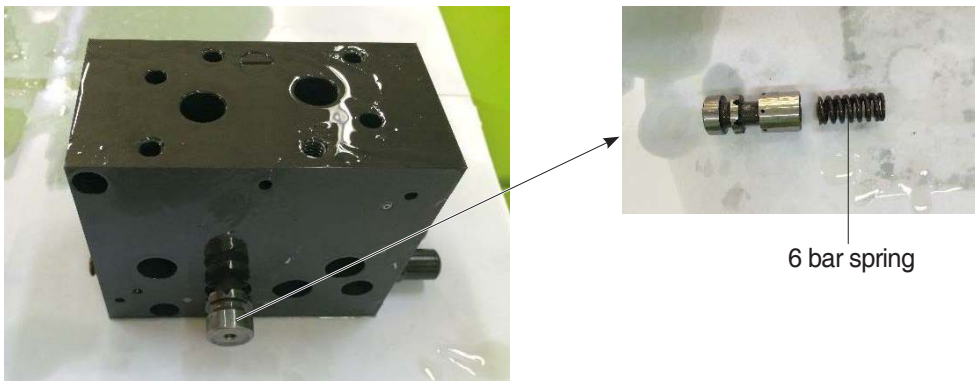
35D9FHS223

※ Flow rate : 63 lpm

※ Pressure limit auxiliary section : 140 bar

(2) 2 way controller and shuttle valve

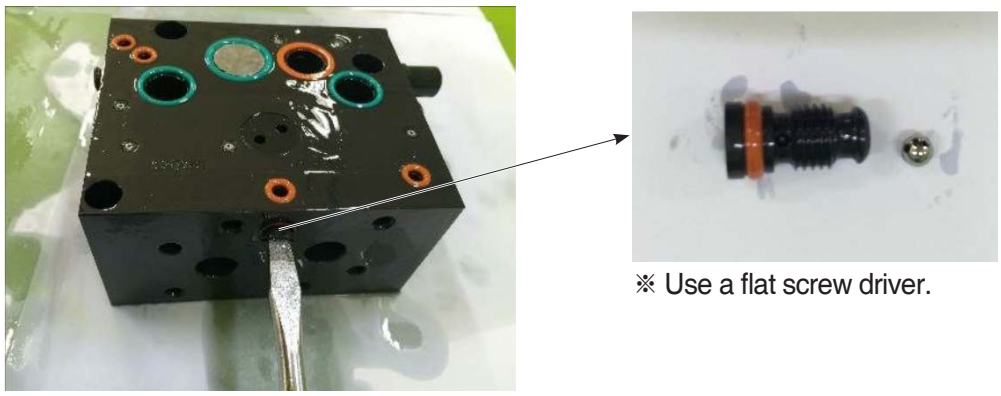
① 2 way controller



35D9FHS217

※ 2 way controller make it keep 6 bar regardless of load change between in and out of spool.

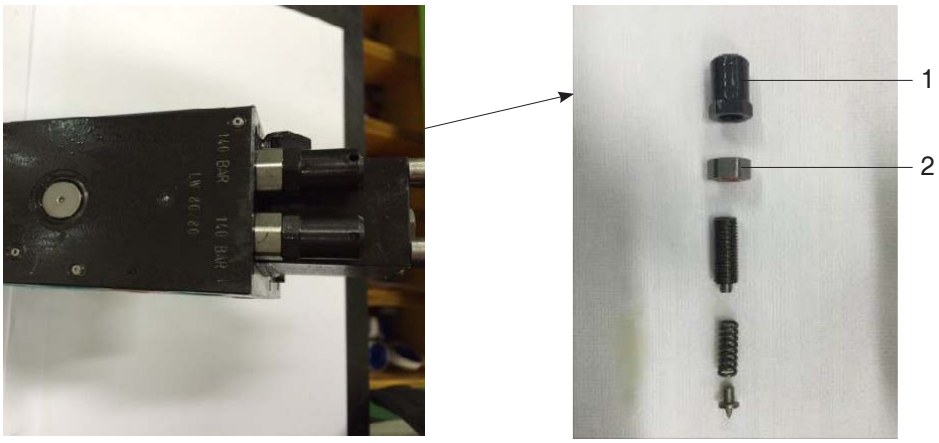
② Shuttle valve



35D9FHS224

※ Transfer bigger load pressure through shuttle valve.

(3) Second relief valve



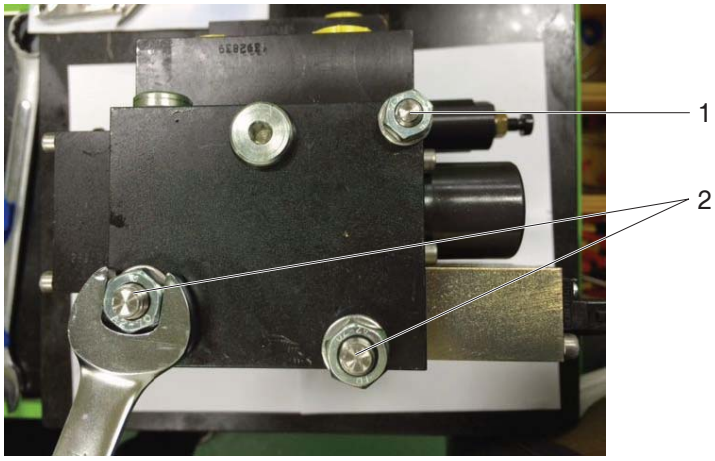
※ Tightening torque (1)
1.43 kgf · m (10.3 lbf · ft)
※ Use with a 12 mm spanner.

※ Tightening torque (2)
1.43 kgf · m (10.3 lbf · ft)
※ Use with a 3 mm wrench

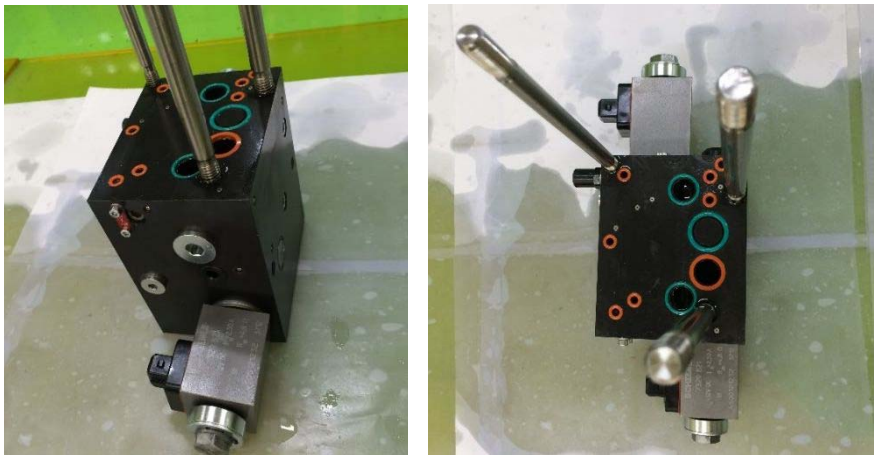
= Pressure increases
= Pressure increases

※ Controlling individual section pressure, rotating clockwise to increase setting pressure with a wrench.
※ 80 bar increase and decrease per 1 turn.

5) TENSION ROD SETS



35D9FHS225



35D9FHS226

※ Tightening torque
- Item 1 (M10, 2 EA) : 4.7 kgf · m (34.0 lbf · ft)
- Item 2 (M8, 1 EA) : 2.3 kgf · m (16.6 lbf · ft)

※ When it needs to disassemble finger tip main control valve, it's possible to release tension rod sets.

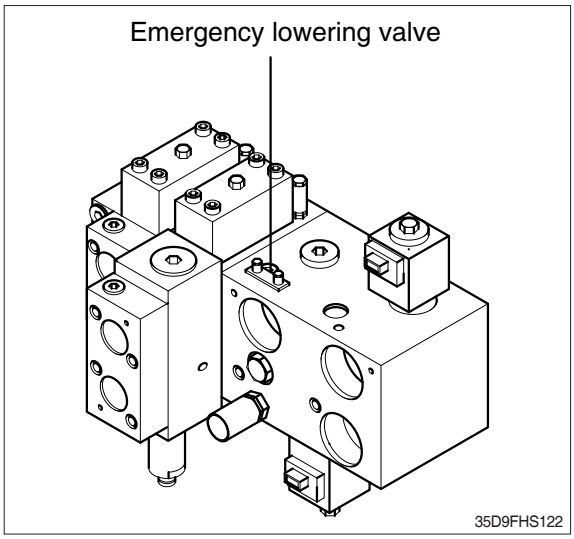
6) EMERGENCY LOWERING

In case of the mast cannot be lowered due to a problem in the controller, active the emergency lowering valve on the valve block with hexagonal wrench.

(1) Turn off the electric emergency switch.

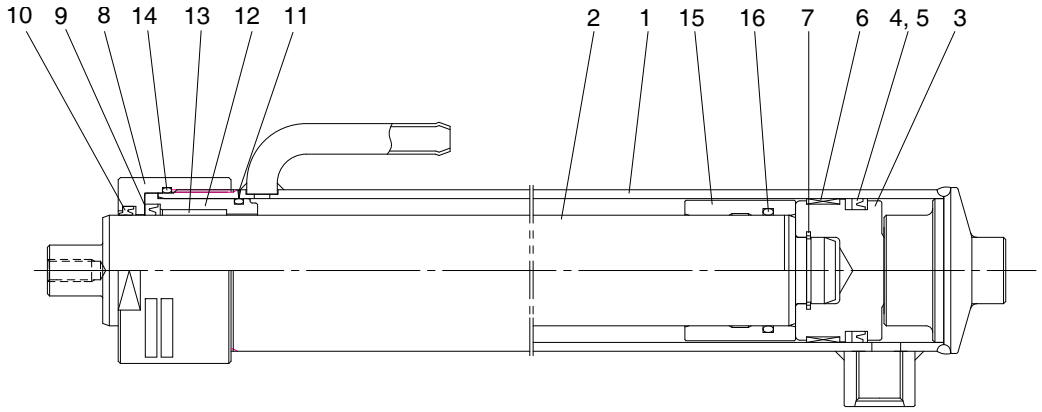
(2) Rotate counter clockwise the emergency lowering valve using hexagonal wrench and lower the mast and the load carriage slowly.

(3) After lowering, close the emergency lowering valve.



5. LIFT CYLINDER

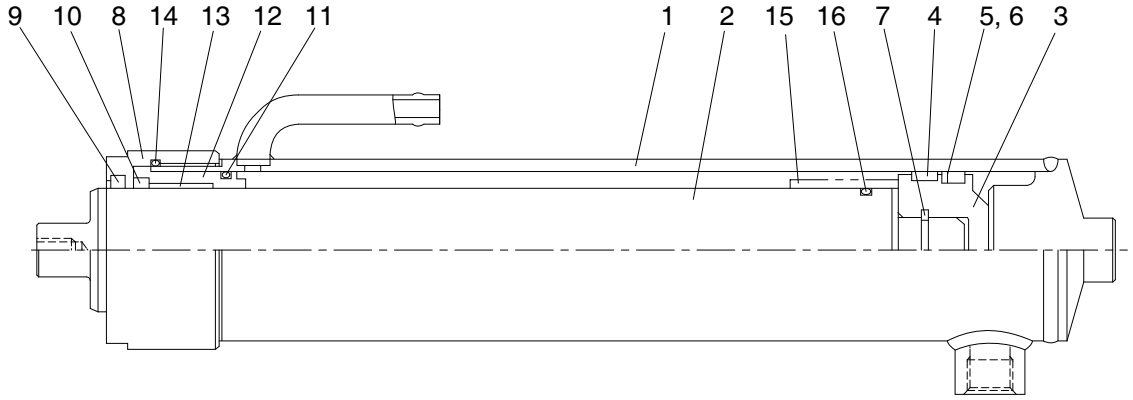
1) V MAST (35/40/45D-9F)



35D9FHS125

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

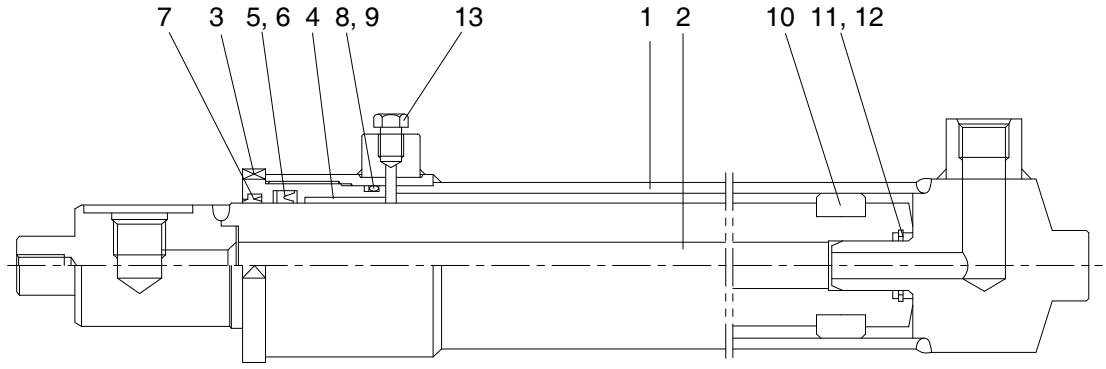
2) V MAST (50DA-9F)



35D9FHS126

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

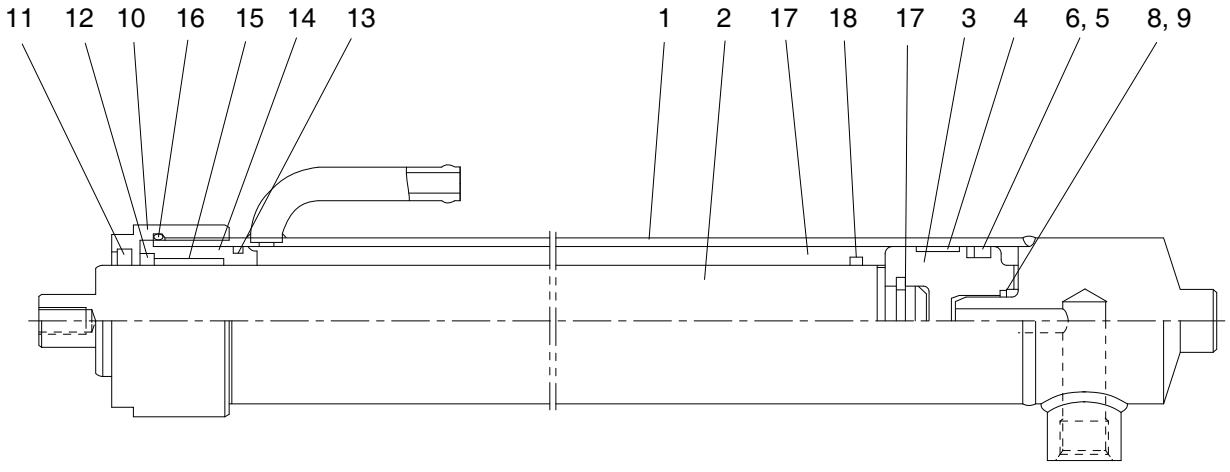
3) VF MAST



35D9FHS127

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

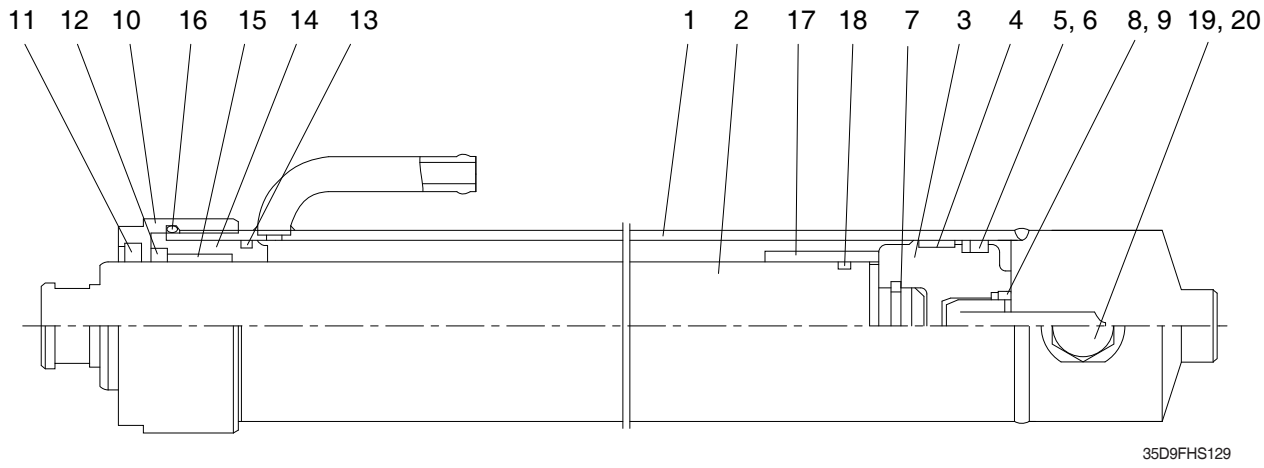
4) TF MAST (35/40/45D-9F)



35D9FHS128

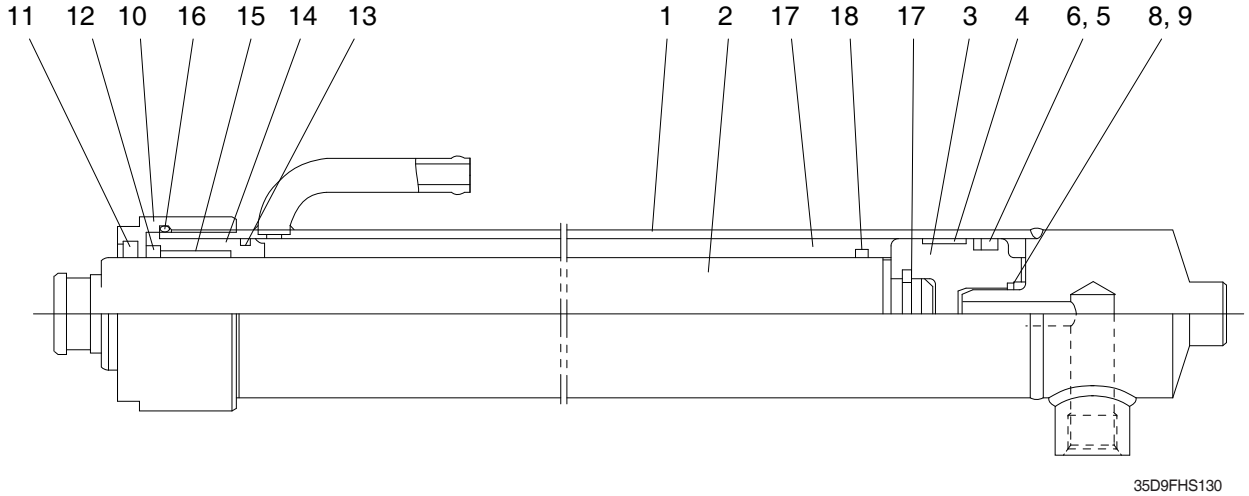
1	Tube assembly	7	Stop ring	13	O-ring
2	Rod	8	Cushion seal	14	Stopper
3	Piston	9	Retaining ring	15	Rod bushing
4	Wear ring	10	Rod cover	16	O-ring
5	U-packing	11	Dust wiper	17	Spacer
6	Back up ring	12	U-packing	18	O-ring

5) TF AND TS-MAST (50D-9F)



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

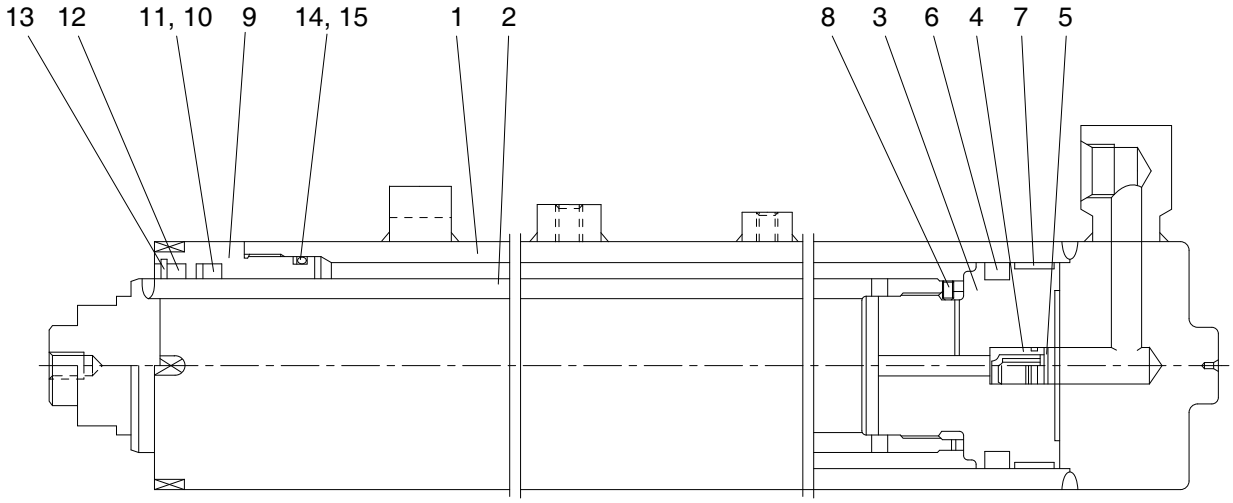
6) TS MAST (35/40/45D-9F)



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

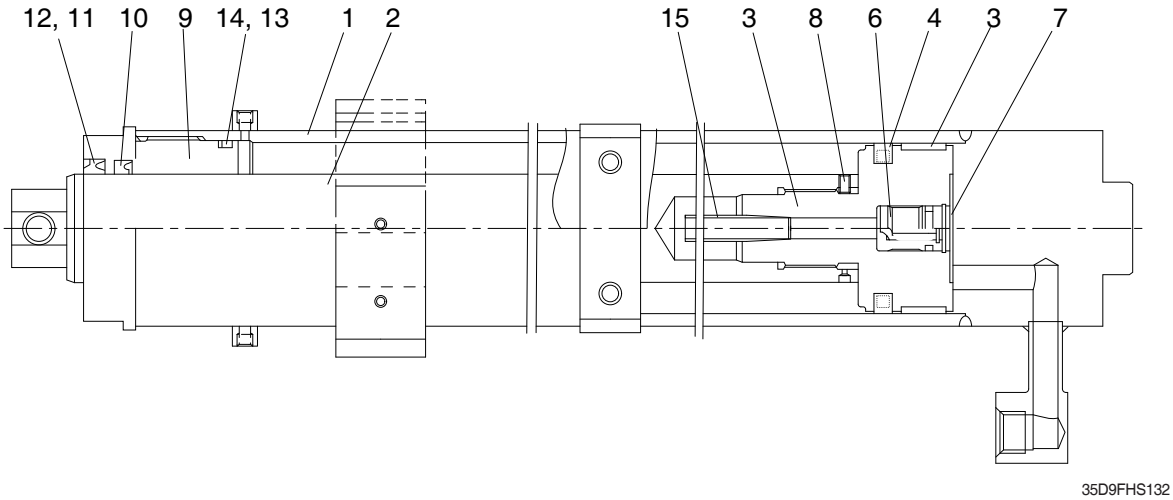
6. FREE LIFT CYLINDER

1) VF AND TF MAST (35/40/45D-9F)



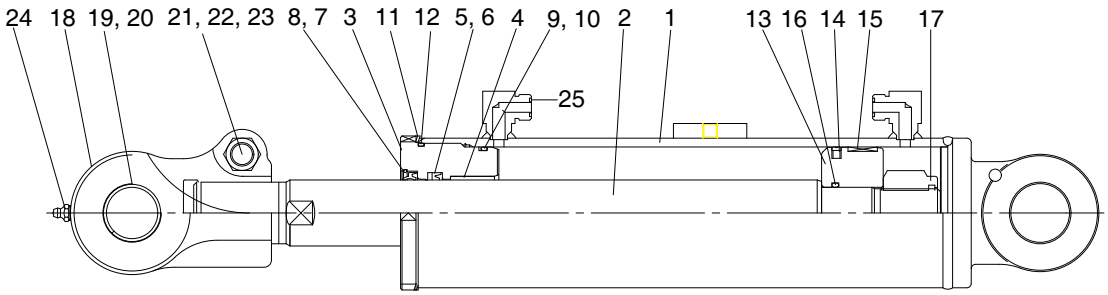
1	Tube assembly	6	Piston seal	11	Back up ring
2	Rod assembly	7	Wear ring	12	Dust wiper
3	Piston	8	Set screw	13	Retaining ring
4	Check valve	9	Rod cover	14	O-ring
5	Retaining ring	10	U-packing	15	Back up ring

2) TS MAST



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

7. TILT CYLINDER



35D9FHS133

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

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

1) CHECK ITEM

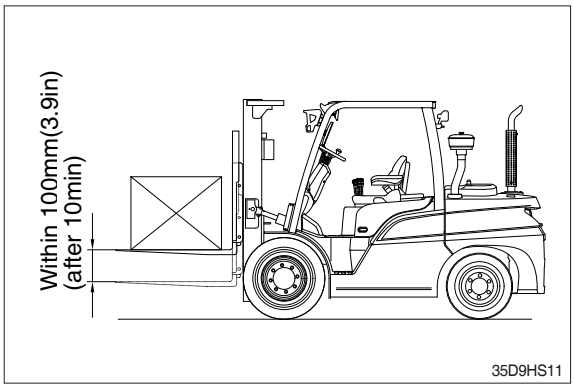
(1) Check visually for deformation, cracks or damage of rod.

(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°

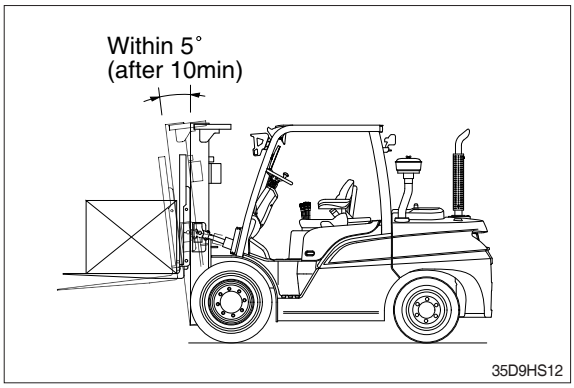
If the hydraulic drift is more than the specified value, replace the control valve or cylinder packing.



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

mm (in)

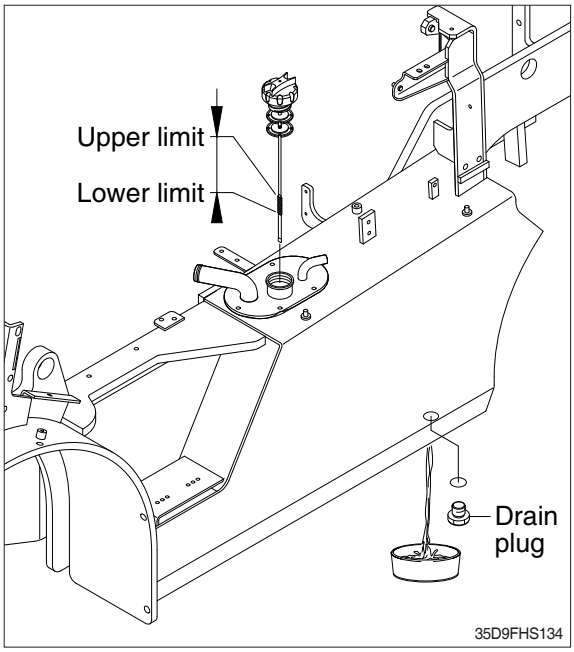
Standard	Under 0.6 (0.02)



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

Problem	Cause	Remedy
Actuator (cylinder or motor) works slowly or does not operate.	· Shortage of oil in oil tank. · Decrease of relief valve pressure. · Spool got stuck. · Shortage of oil flow to the valve.	· Check the oil level in the oil tank. · Install pressure gauge on the circuit, and check the pressure with it by handling the lever. · Check that manual lever moves smoothly. · Check that lever stroke is enough. · Check that oil flow of the pump is within specified rate.
Cylinder lowers considerably under normal circumstance.	· Internal leakage of cylinder happens frequently. · Excessive leakage from spool of the valve. · Spool got stuck. · Leakage in a part of the circuit.	· Fit the stop valve on the pipe between valve and cylinder, observe the internal leakage of cylinder. · Check the oil viscosity is not too low. · Check that manual lever moves smoothly. · Check the circuit. · Observe leakage from pipes.
Pressure does not increase sufficiently.	· Defect of relief valve. · Leakage in a part of the circuit.	· Check the relief valve. · Check the circuit. · Observe leakage from pipes.
Temperature rising of the hydraulic oil.	· Working with higher pressure than rated pressure. · Low viscosity of oil. · Leakage from a part of the circuit. · Oil leakage in the pump. · Insufficient suction of the pump.	· Check the flow pressure. · Check the sort of oil and viscosity. · Check if the circuit is relieved at all times. · Check if the temperature of pump surface higher 30˚C than oil tempera-ture. · 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.

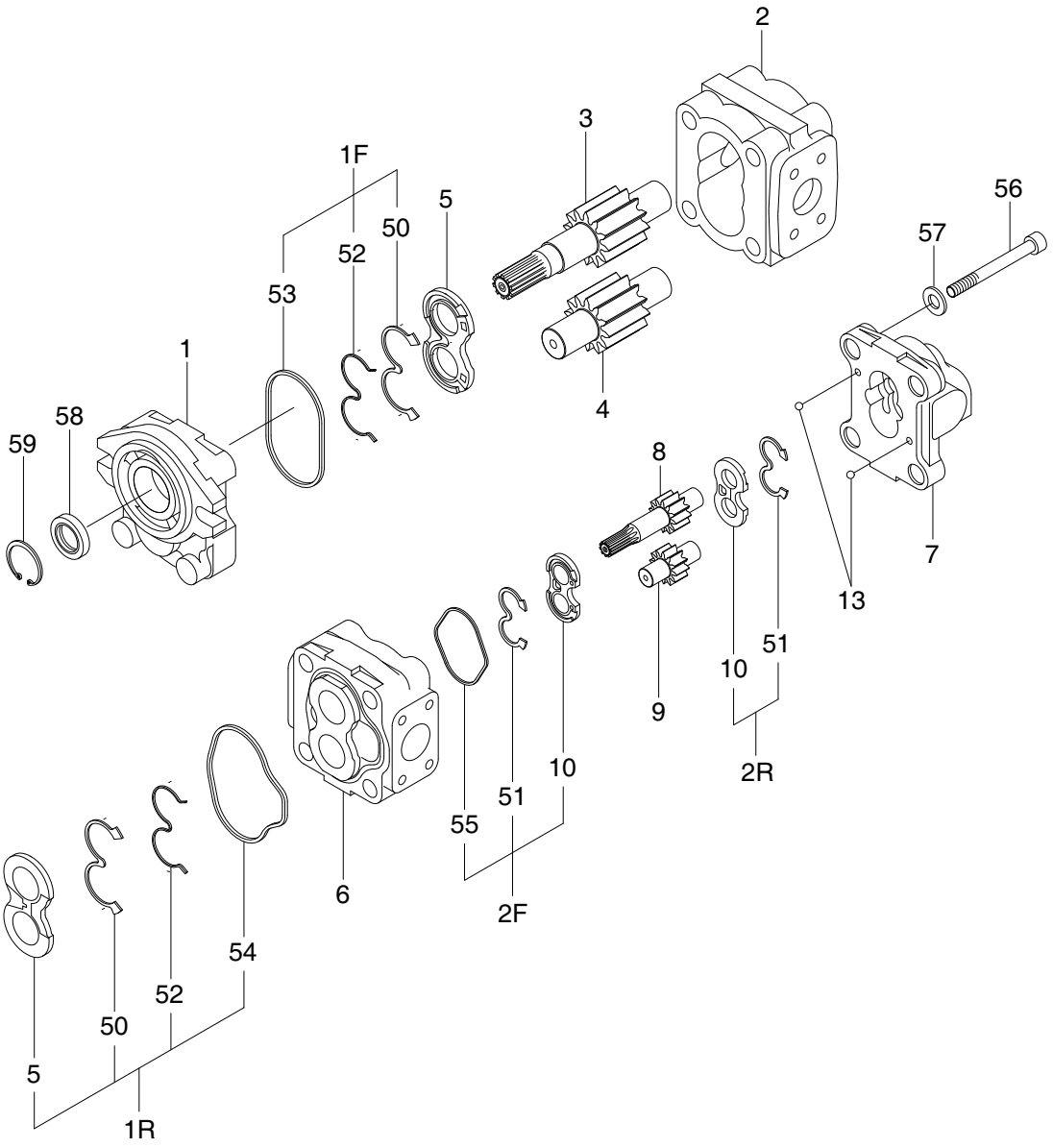
4) LIFT CYLINDER

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.

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. MAIN PUMP

1) STRUCTURE (low noise)



35D9HS14-2

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

2) DISASSEMBLY AND ASSEMBLY

(1) Safety precautions

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

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

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

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

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

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

(2) Disassembly

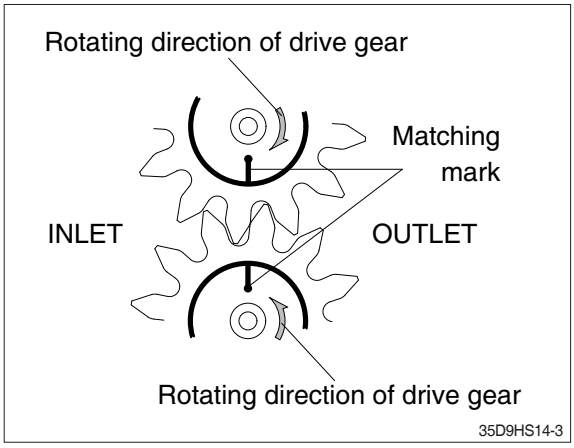
① Fix the mounting parts of front cover with the body side up to the vice.

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

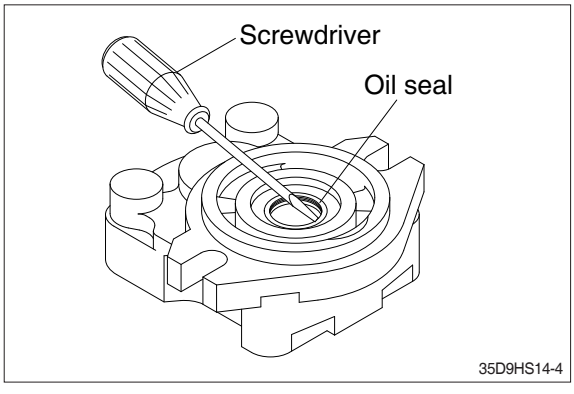
③ Remove the four bolts (56) and disassemble the parts (item 7 → 6 → 2).
Please see the instructions below.

④ Mark on the shaft ends of the body side.

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



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



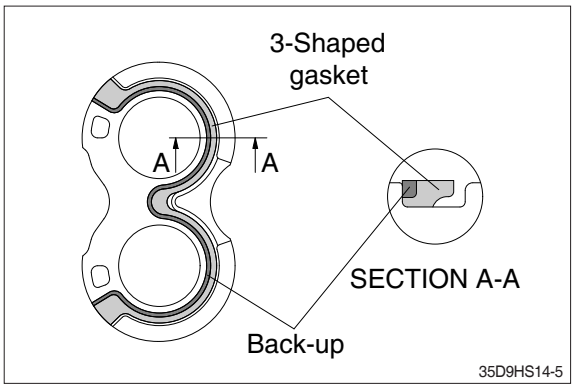
(3) Assembly

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

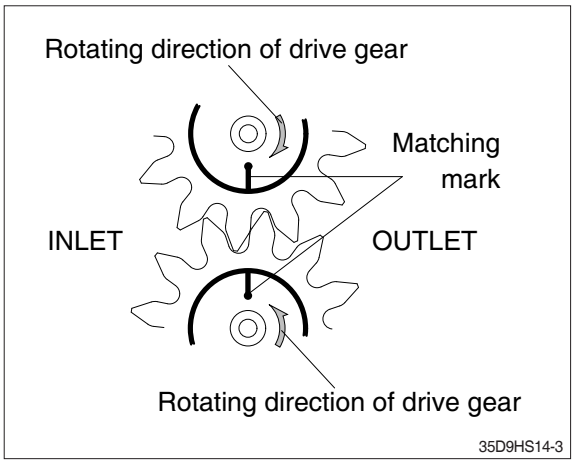
② Clean each part to remove dust before reassembling.

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

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



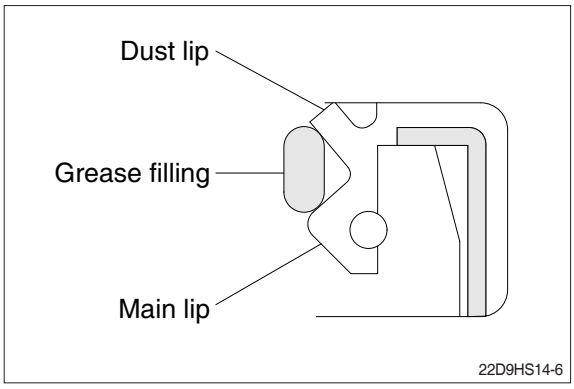
· Fix the drive gear and driven gear by matching each mark.



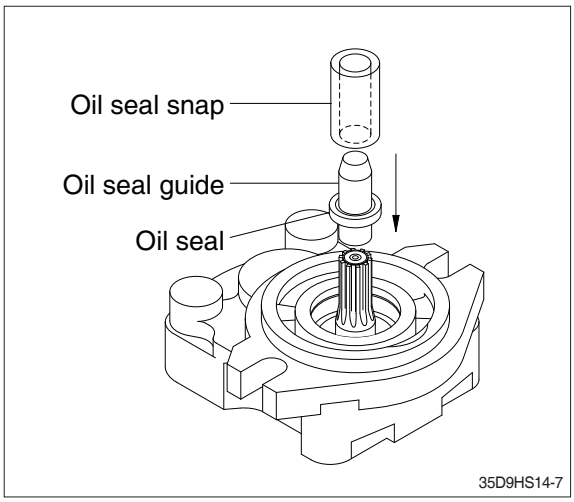
④ Tighten 4 bolts evenly by 13.3~14.3 kgf·m (96.2~103 lbf·ft) torque.

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

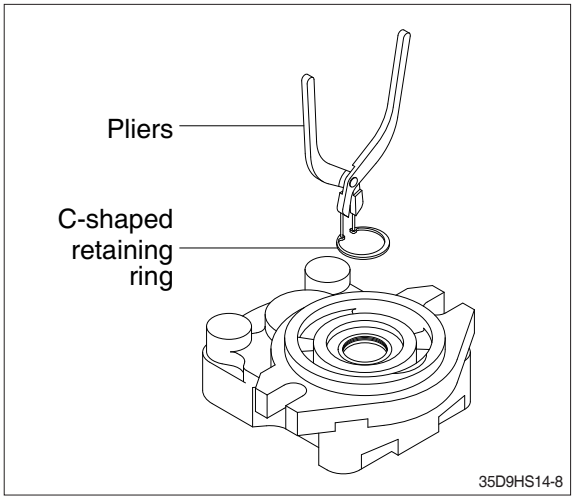
⑥ Fill the dent between the main lip and dust lip of oil seal with grease.



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



⑧ Attach the C-shaped retaining ring for hole.



3) TROUBLESHOOTING

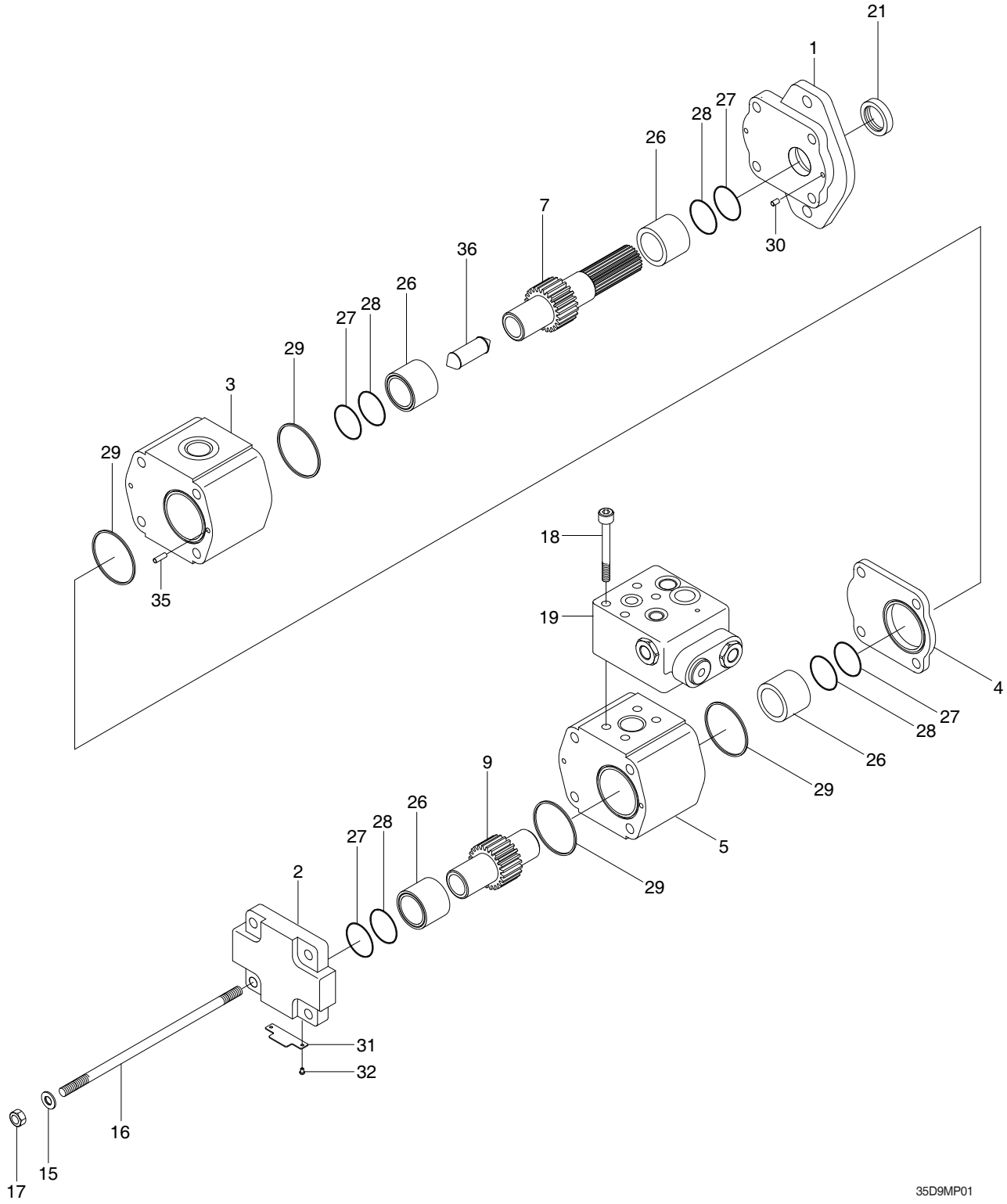
Status	Possible factors	Solutions
Leakage from the oil seal	·Reverse rotation. ·Abnormal high pressure in the inlet. ·Seal lips damaged by wastes. ·Sealed parts of the shaft damaged or worn out. ·Poor shaft centering.	·Rotate the pump to the right way. ·Keep the designated pressure. ·Replace the oil 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.

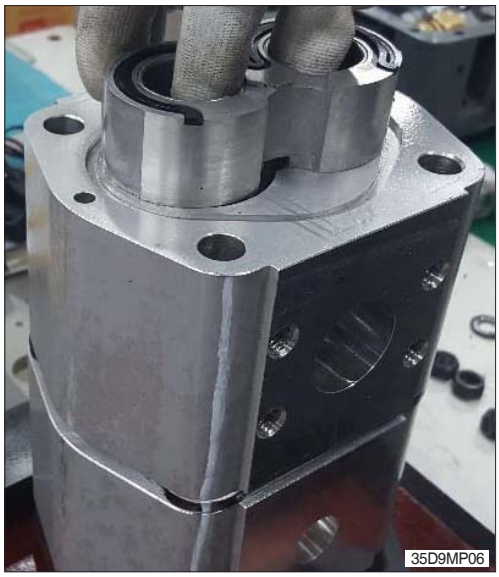
※ Match-mark all sections.
Be sure to align these marks when reassembling.

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.

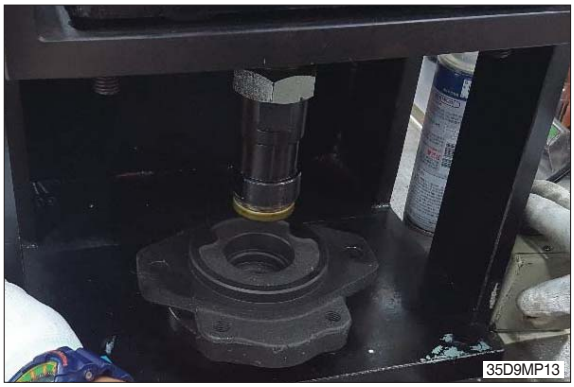
※ Detail see page 6-32, 33.

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.

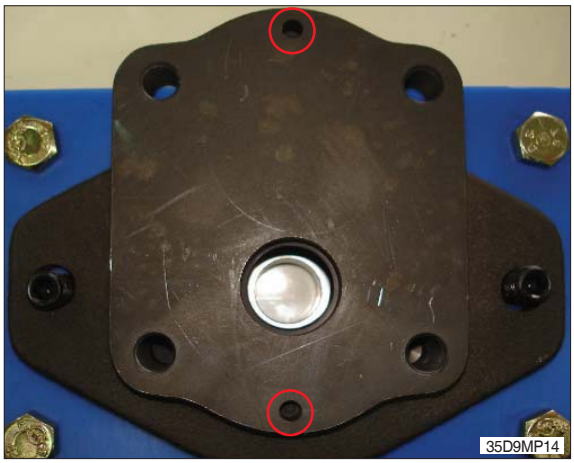

35D9MP12

3) ASSEMBLY

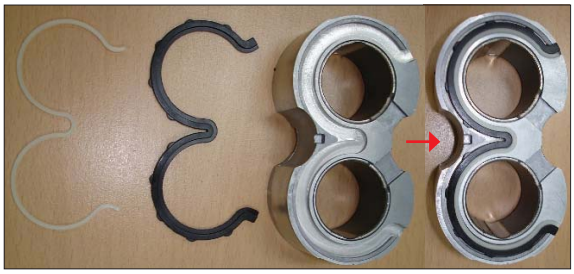
① Press it into the mounting flange side of the shaft end cover with an air press. Be careful not to damage the lip of the seal. Press in until flush with the recess.


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.

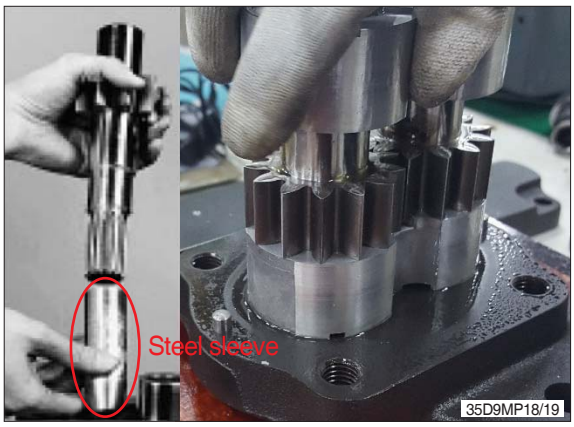

35D9MP14

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.

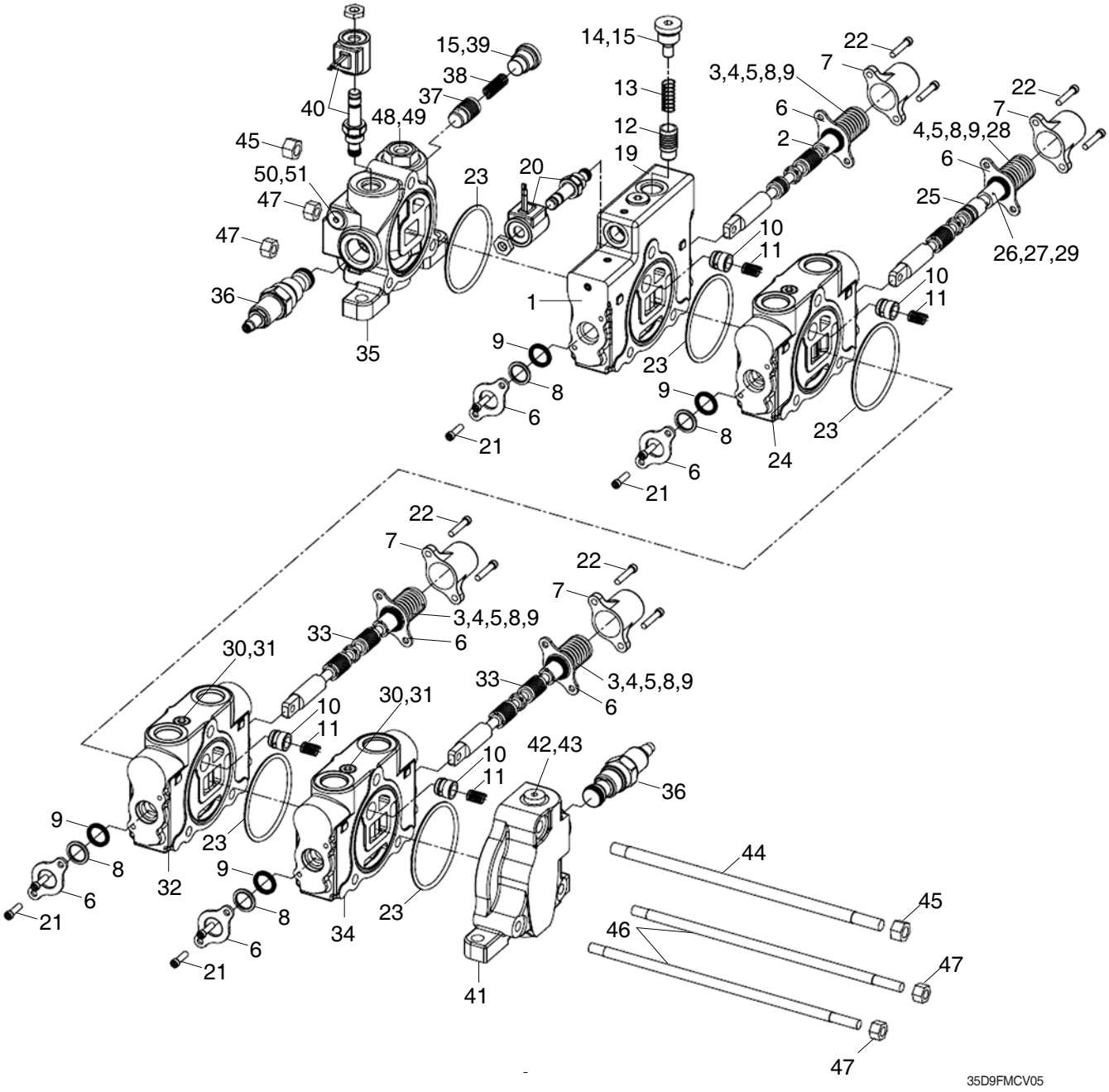
※ Detail see page 6-32, 33.

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).

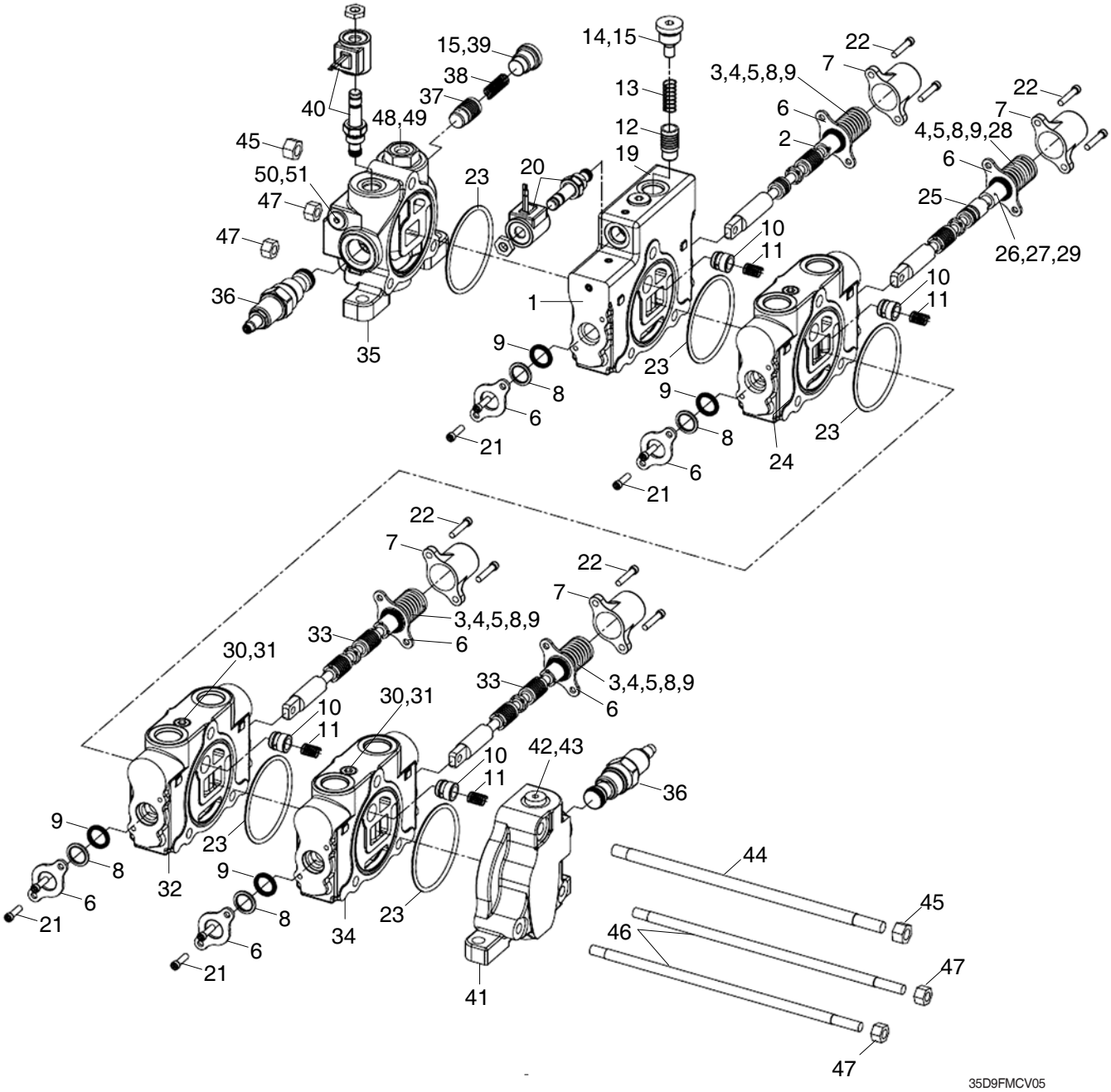
2. MAIN CONTROL VALVE

1) STRUCTURE (4 Spool, mast and travel OPSS, 1/2)



1	JM block	11	Spring	21	Bolt
2	Lift spool	12	Safety poppet	22	Bolt
3	Lock plug	13	Spring	23	O-ring
4	Spring	14	Plug	24	JM block
5	Spring seat	15	O-ring	25	Tilt spool
6	Plate	16	Plug	26	Tilt piston
7	Cap	17	O-ring	27	Spring
8	Back up ring	18	Plug	28	Tilt lock plug
9	QUAD ring	19	Plug	29	O-ring
10	Inlet poppet	20	Solenoid valve	30	Plug

STRUCTURE (4 Spool, mast and travel OPSS, 2/2)



31	O-ring	38	Spring	45	Nut
32	BO block	39	Plug	46	Bolt
33	Auxiliary spool	40	Solenoid valve	47	Nut
34	JO block	41	Bolt	48	Gauge plug
35	PBM block	42	Plug	49	O-ring
36	Relief valve	43	O-ring	50	Plug
37	Unload poppet	44	Bolt	51	O-ring

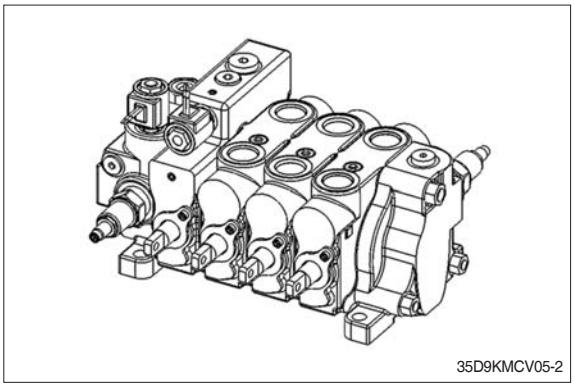
2) DISASSEMBLY AND ASSEMBLY

(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.

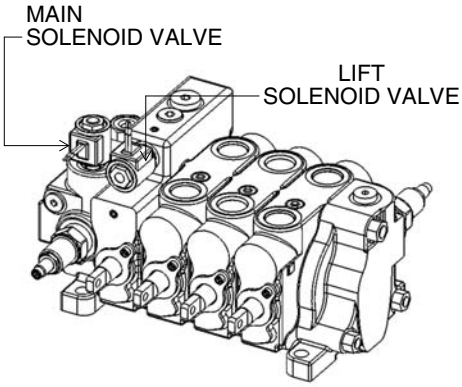
② Arrange the removed parts on a shelf not to mistake the original position when reassembling.

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.

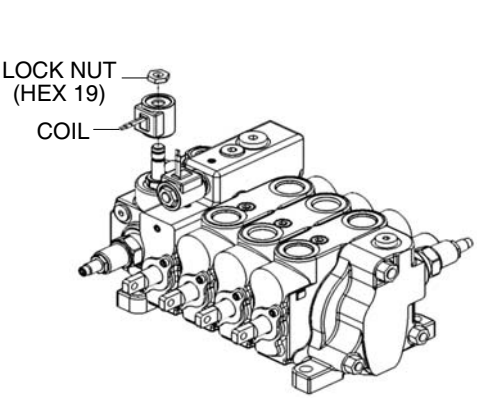
(3) Replacing each part of the MCV (disassembly and assembly)

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



35D9KMCV05-3

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

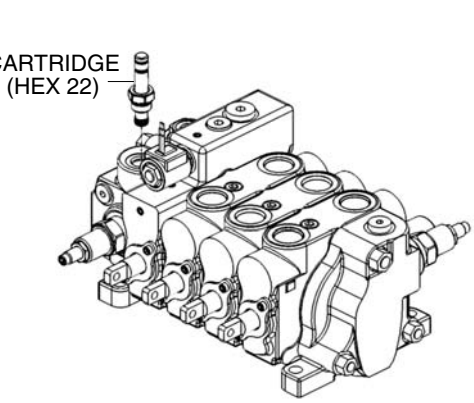


35D9KMCV05-4

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.

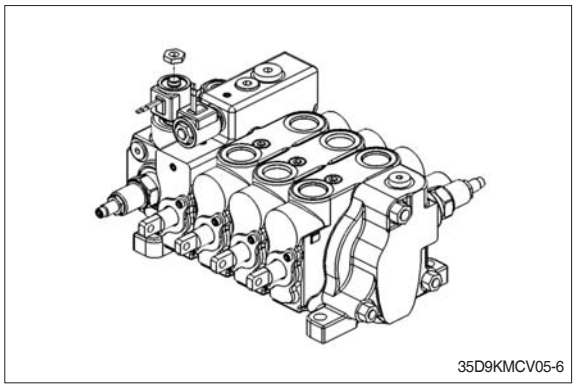


35D9KMCV05-5

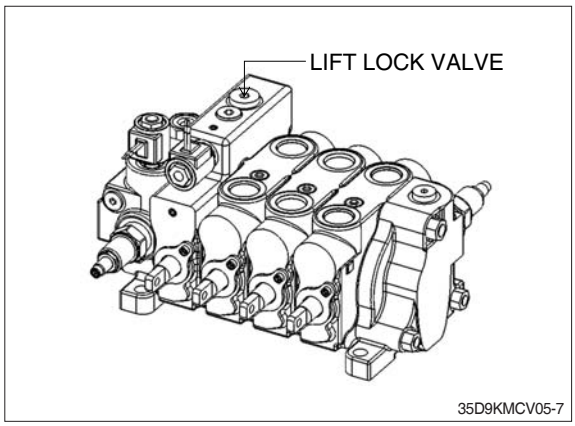
c. Insert the coil into the cartridge and tighten the lock nut.
   ·Lock nut tightening torque (hex 19)
   0.55~0.7 kgf · m (4.0~5.1 lbf · ft)

※ 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.

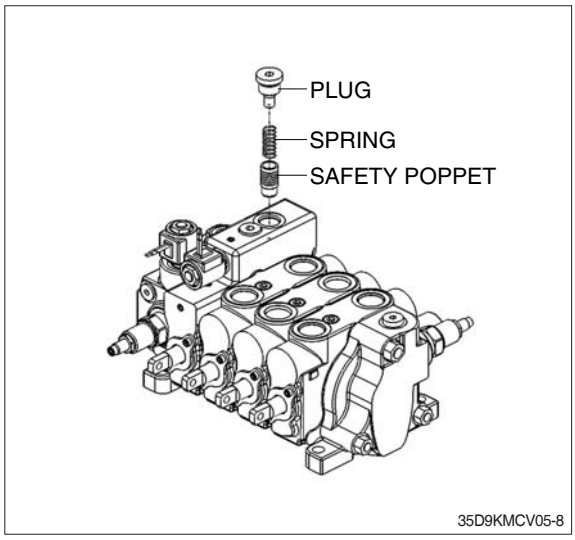

35D9KMCV05-6

② **Replacement of the lift lock valve**



35D9KMCV05-7

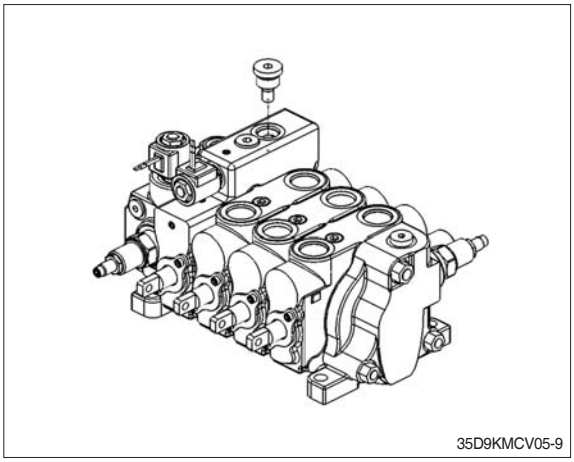
a. Loosen the plug and remove the spring and safety poppet from the MCV.



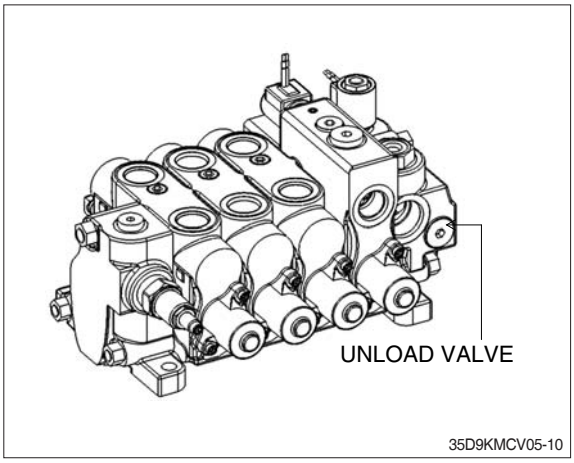
35D9KMCV05-8

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.

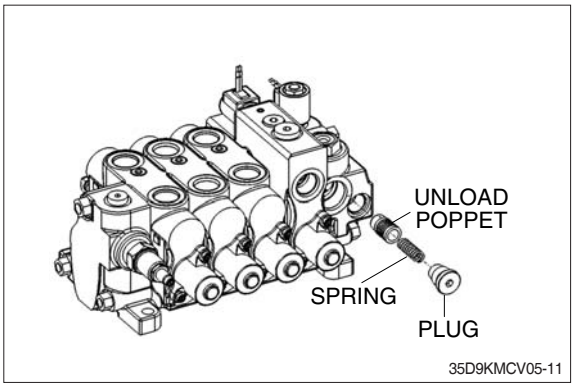

35D9KMCV05-9

③ Replacement of the unload valve



35D9KMCV05-10

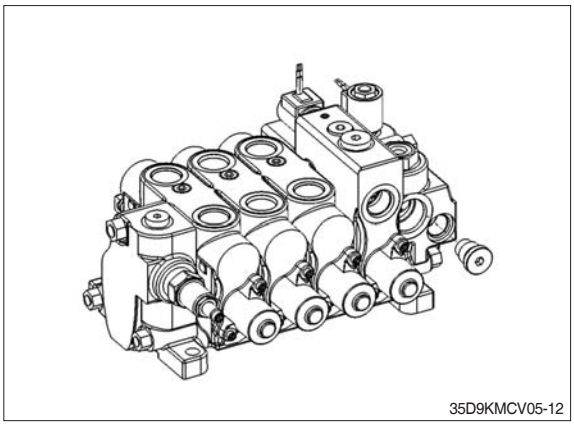
a. Loosen the plug and remove the spring and unload poppet from the MCV.



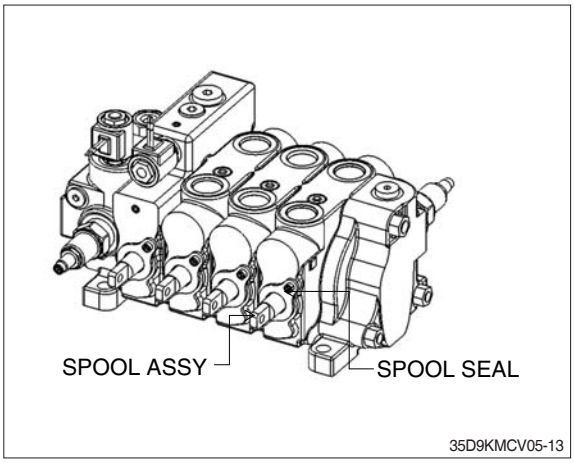
35D9KMCV05-11

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.

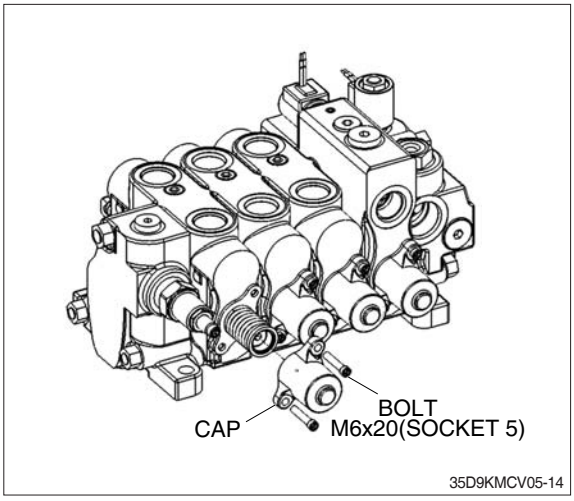

35D9KMCV05-12

④ Replacement of the spool seal and spool assy



35D9KMCV05-13

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

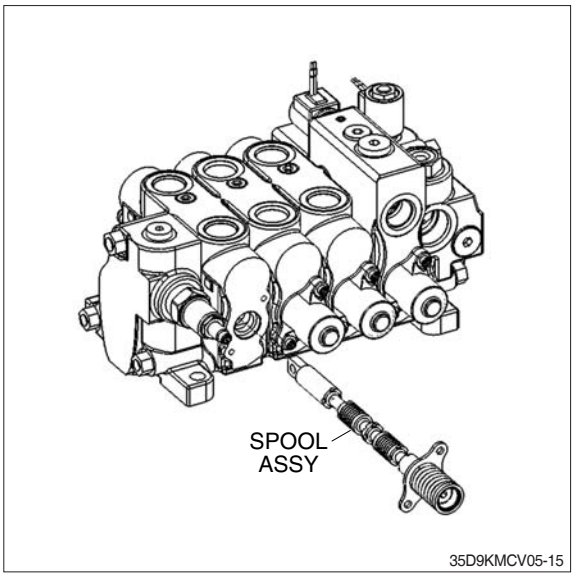


35D9KMCV05-14

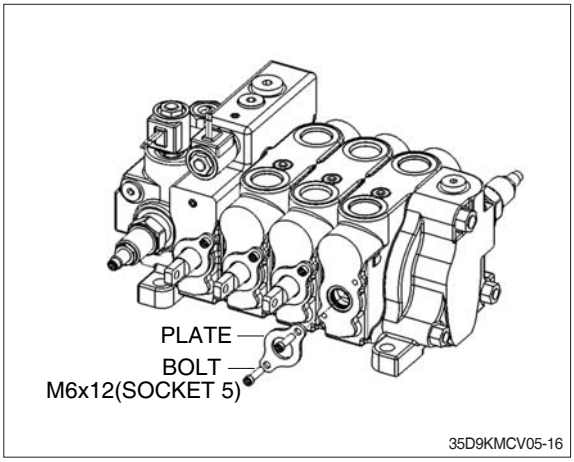
b. Remove the spool assy from the MCV.
   - Install the spool assy and go to the clause f if replacing the spool assy only.

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

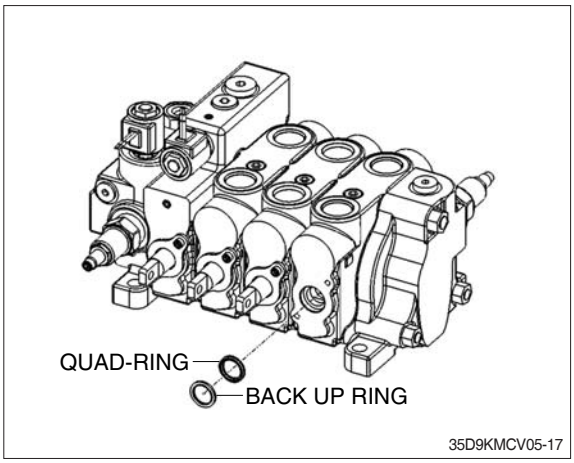
※ Take care not to hit the spool. This can cause stuck of the spool after the spool reassembling.



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



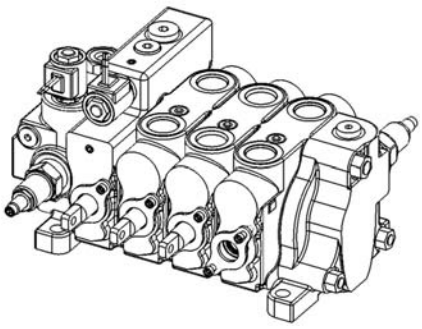
d. Replace the quad-ring and backup ring with a new one.



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.

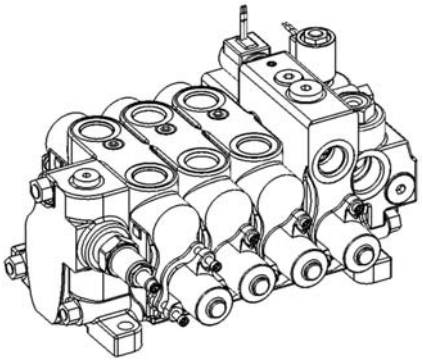


35D9KMCV05-18

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)

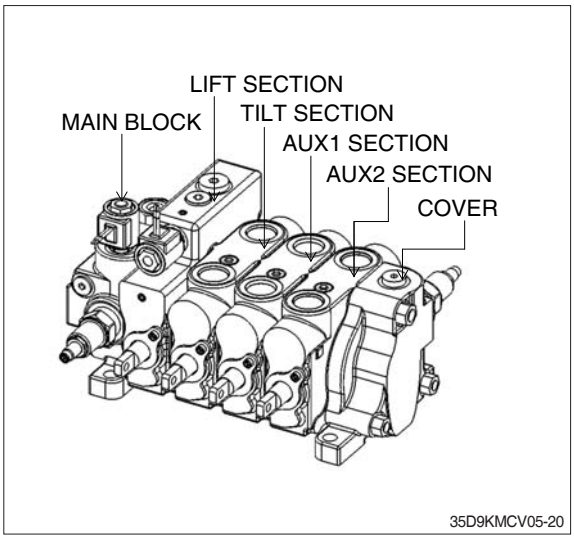
※ Check that the seat surface of the seal is free from foreign matter before assembling.

※ Check that the spool is free from scoring.



35D9KMCV05-19

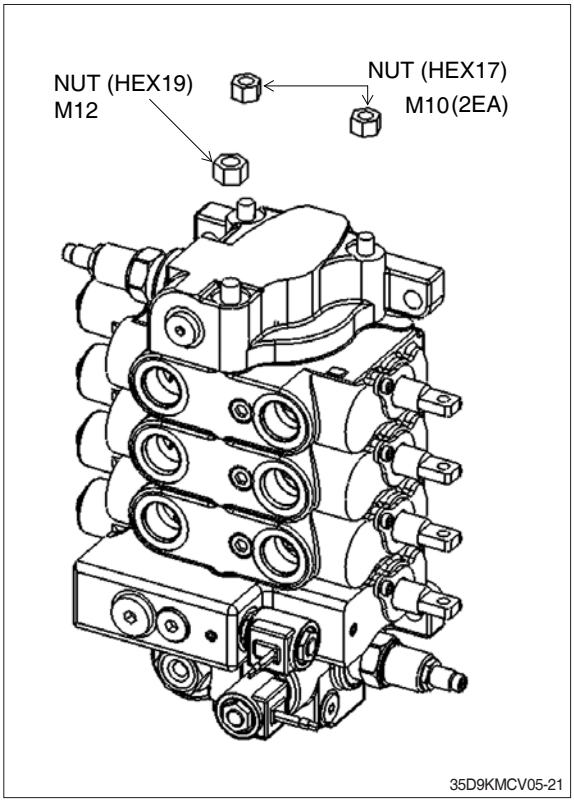
⑤ Replacement of the section assy



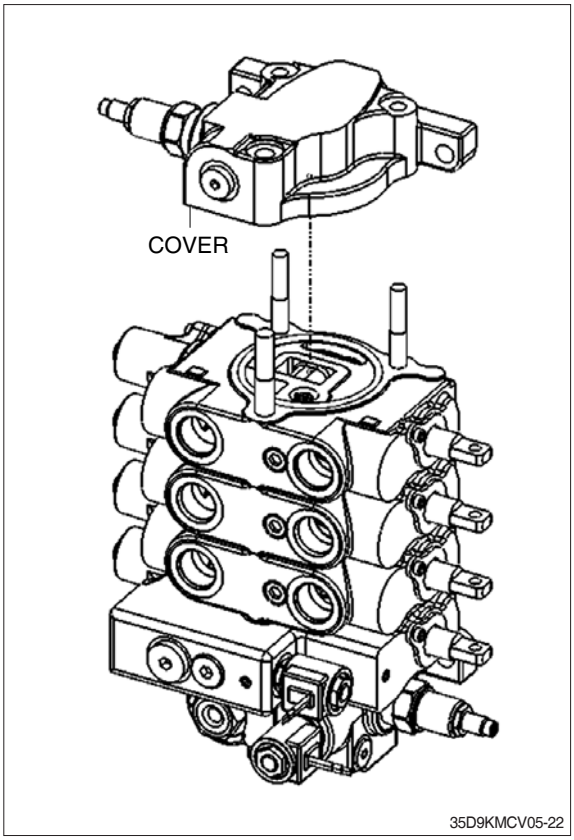
a. Replacement of the lift section

ⓐ 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.

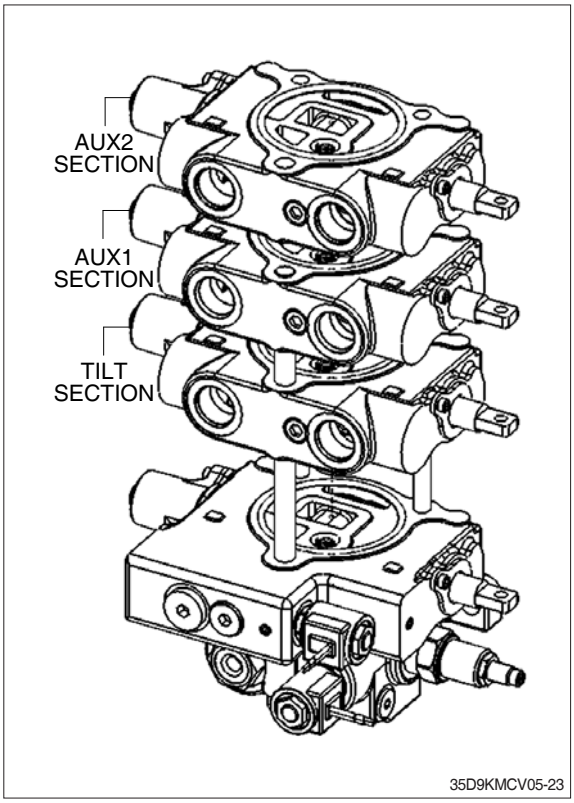


ⓒ Remove the cover form the MCV.



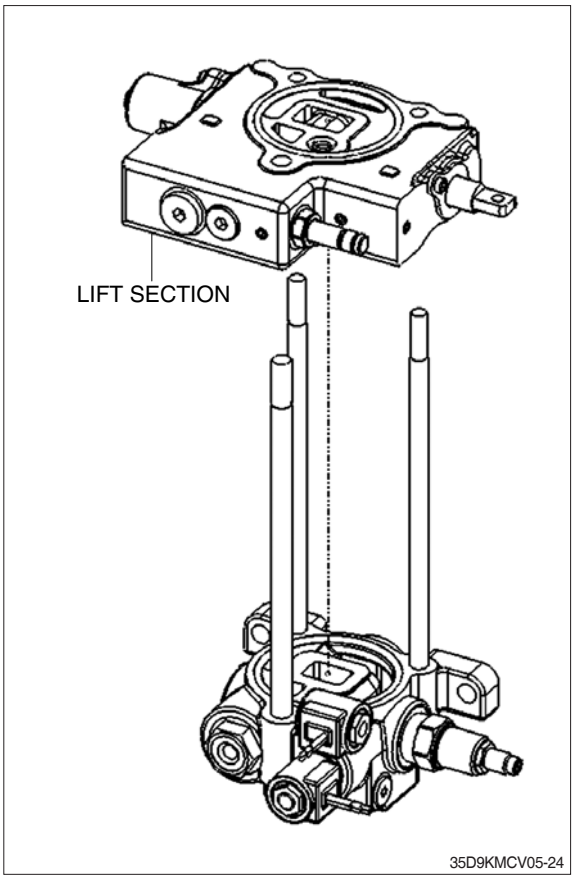
ⓓ Remove the aux3, aux2 section, aux1 section and tilt section from the MCV in order.

※ 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.

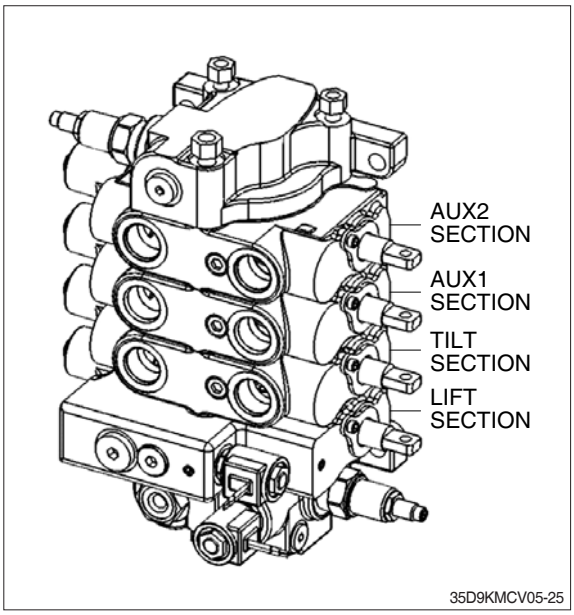
·Tightening torque

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.



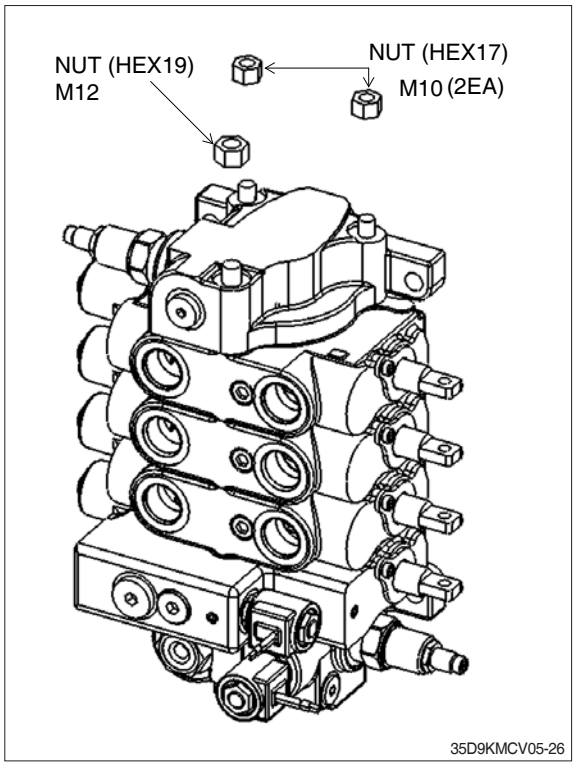
b. Replacement of the other sections

ⓐ Replace the aux3, aux2, aux1 and tilt section same method as the lift section.

⑥ Replacement of the inlet check valve and block seal

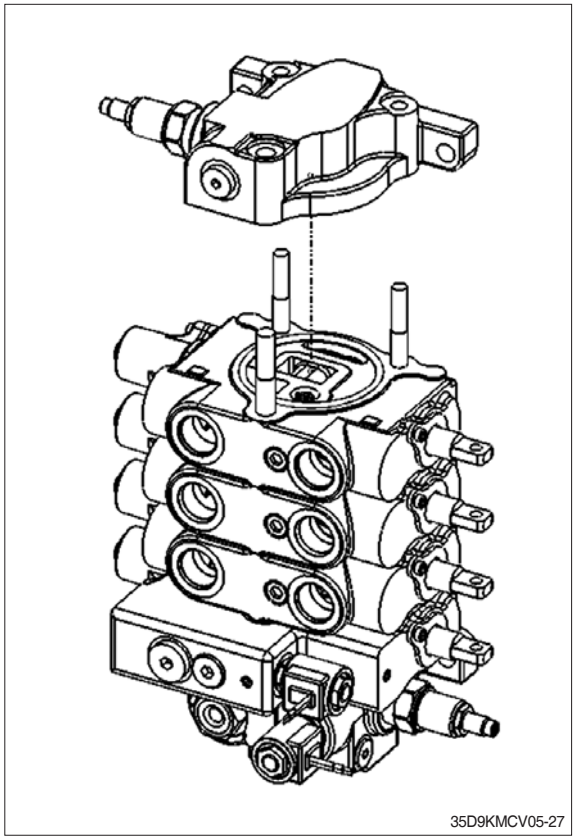
a. Loosen the nut (3EA) a little and place the MCV on the flat table with the main block facing the bottom.

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

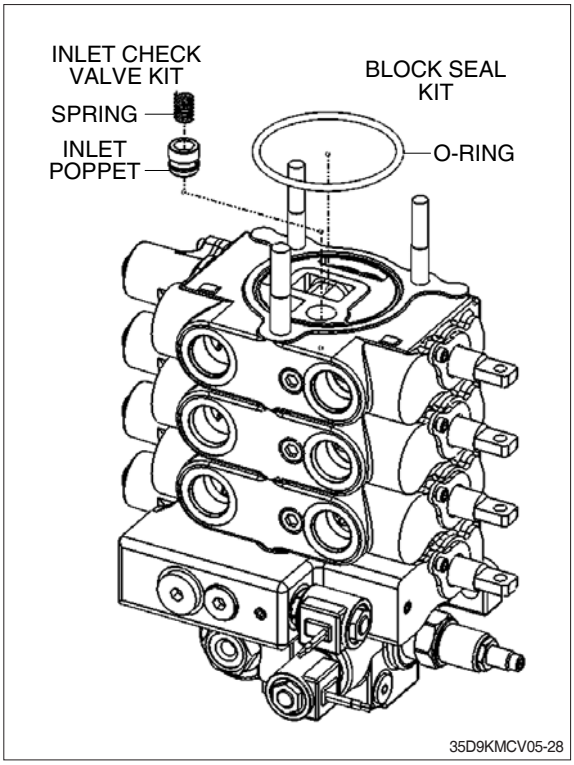


35D9KMCV05-26

c. Remove the cover form the MCV.


35D9KMCV05-27

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



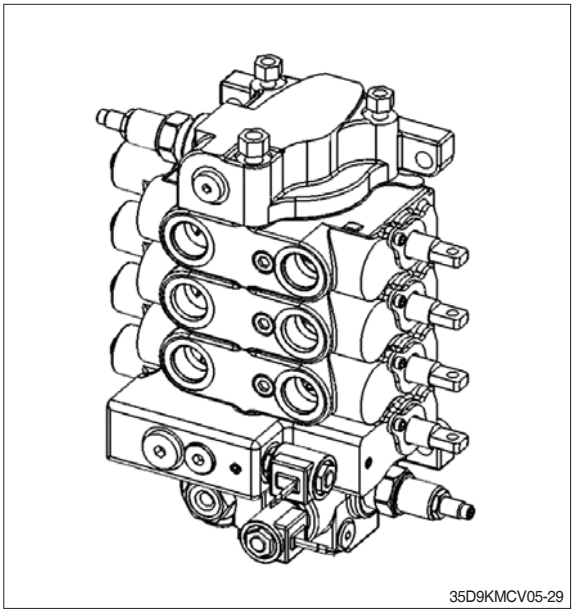
e. Assemble it with a new one in reverse order of above procedures and tighten the bolt.

·Tightening torque

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

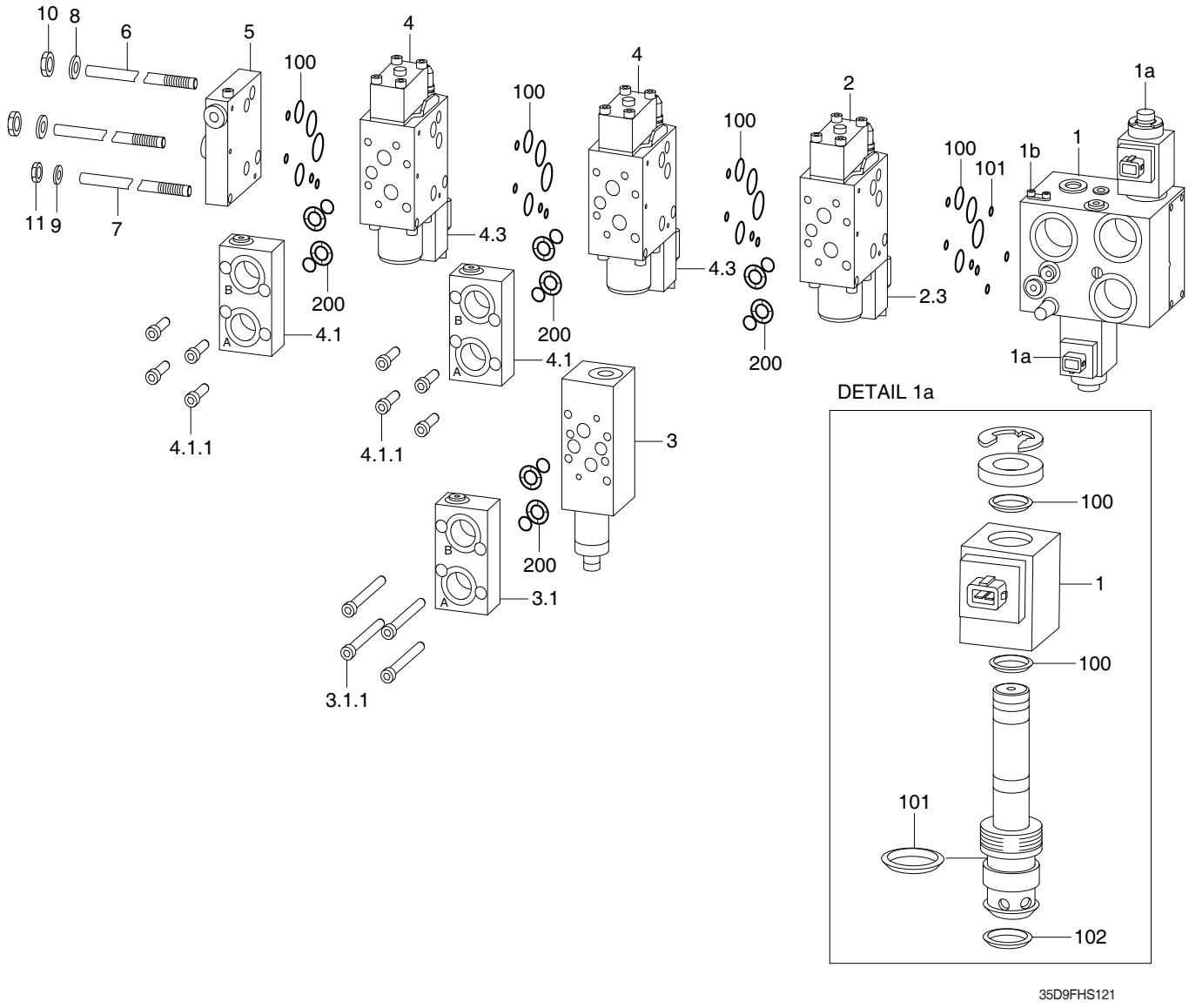
M12 : 9.0±0.45 kgf · m
(65.1±3.3 lbf · ft)

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



3. MAIN CONTROL VALVE (FINGER TIP)

1) STRUCTURE



35D9FHS121

1	Main section assy	4	Auxiliary section assy	8	Disc washer
1a	Solenoid valve	4.1	Adapter	9	Washer
2	Tilt section assy	4.1.1	Head screw	10	Hex nut
2.2	Tilt section spool	4.2	Auxiliary section assy	11	Hex nut
2.3	Twin solenoid valve	4.3	Twin solenoid vavle	100	Side flange seal kit
3	Counter balance valve	5	End plate	101	O-ring
3.1	Adapter	6	Tension rod	200	Ancillary seal kit
3.3.1	Head screw	7	Tension rod		

2) ASSEMBLY INSTRUCTION

(1) General

① Ensure that the assembly area will be clean and free of contamination.
② Use a flat (within 0.5 ㎜) work surface when bolting the valve sections together.
③ Use calibrated torque wrenches and instrumentation.

(2) Block sub assembly

① Attach all the O-rings to the appropriate grooves between the spool sections.
② Stack the valve sections as below picture on a flat surface.
③ Insert all the tension rods through the drilled holes in each of the housings.
④ Press the sections together being careful not to damage sealing surfaces or seals.
⑤ Install nuts to tension rods and progressively torque in a circular pattern on all tie rods.

· Tightening torque
  - Item 10 (M10) : 4.7 ㎏f·m (34.0 lbf·ft)
  - Item 11 (M8) : 2.3 ㎏f·m (16.6 lbf·ft)

3) DISASSEMBLY INSTRUCTION

(1) General

① Disassemble the valve sections on a flat working surface.
② Ensure that the disassembly area will be clean and free of contamination.
③ Keep the disassembly area neat to avoid loss or damage of parts.

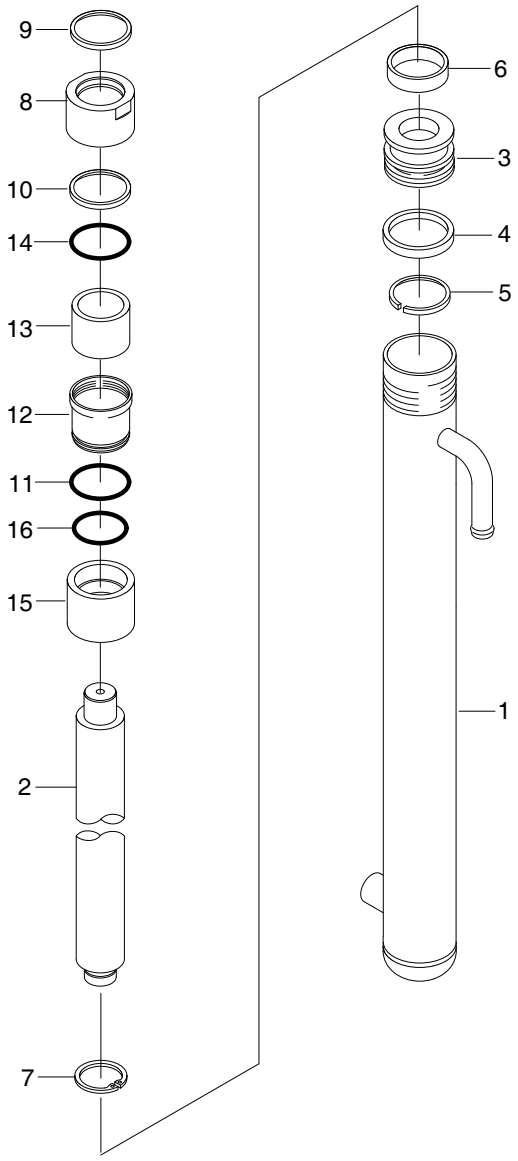
(2) Perform the assembly in reverse order

① Remove the solenoid valves and ancillary blocks from the main blocks.
② Loosen the tension rods from the valve section.
③ Insert all the tension rods through the drilled holes in each of the housings.
④ Press the sections together being careful not to damage sealing surfaces or seals.
⑤ Install nuts to tension rods and progressively torque in a circular pattern on all tie rods.

※ Refer to page 6-79 for details of each section.

4. LIFT CYLINDER

1) STRUCTURE



D357HS19

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

※ Parts list is based on the 35/40/45D-9F.

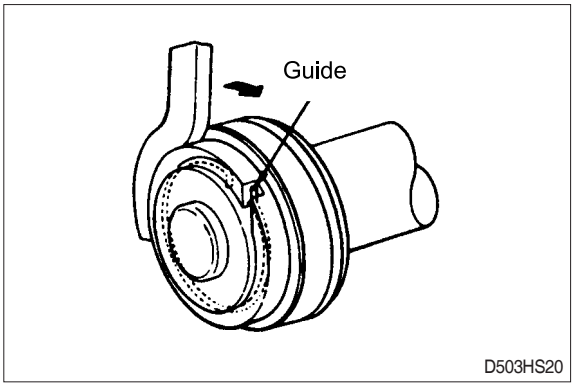
·Specification (standard)

Unit : mm (inch)

Model	I.D	O.D	Stroke	Rod O.D
35/40/45D-9F (V300)	65 (2.6)	73 (2.9)	1485 (58.5)	50 (2.0)
50DA-9F (V290)	70 (2.8)	82 (3.2)	1435 (56.5)	55 (2.2)

2) DISASSEMBLY

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



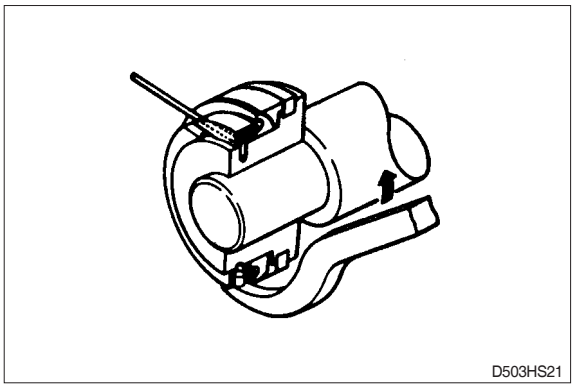
3) CHECK AND INSPECTION

mm (in)

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

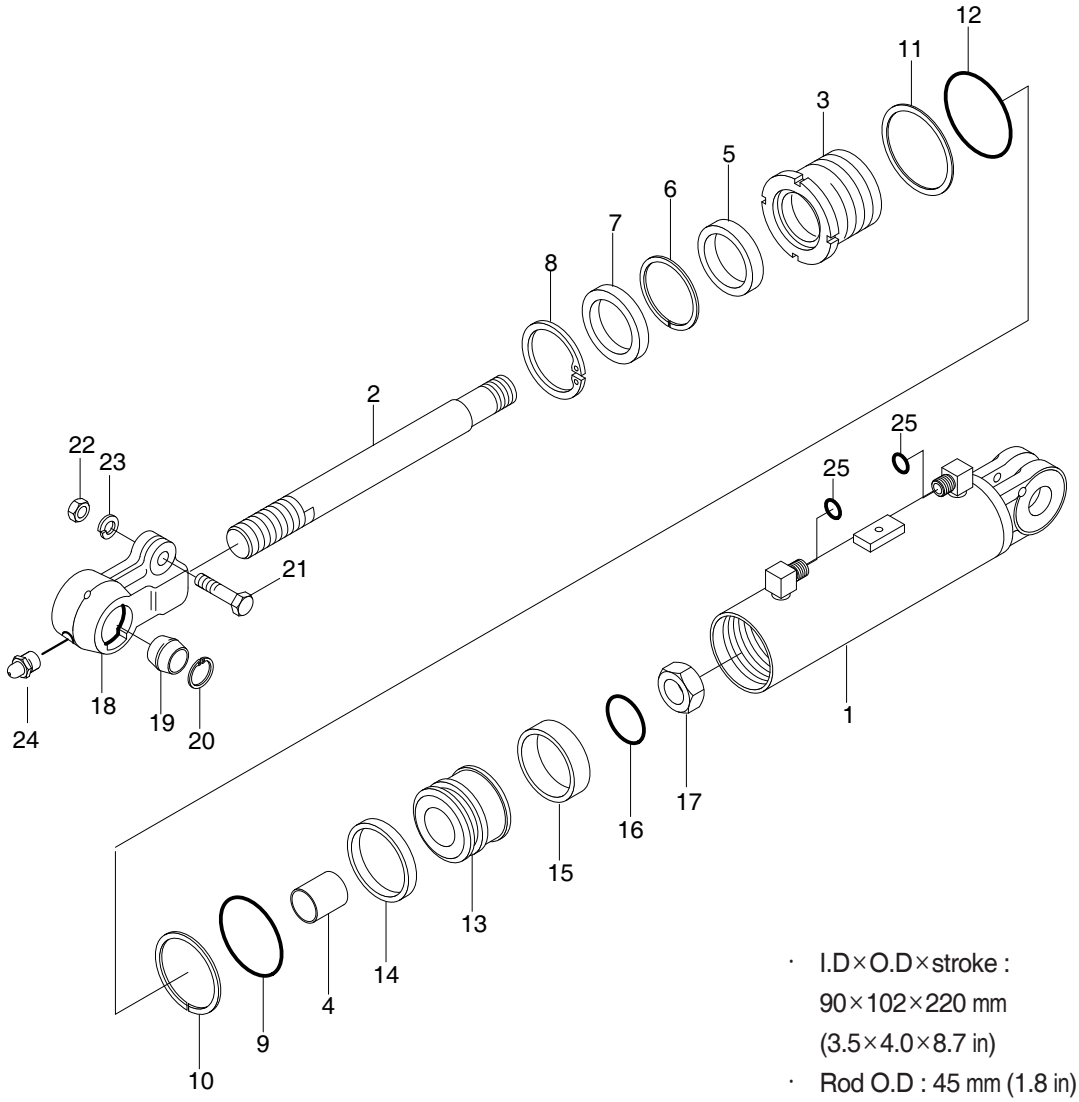
4) ASSEMBLY

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



5. TILT CYLINDER

1) STRUCTURE



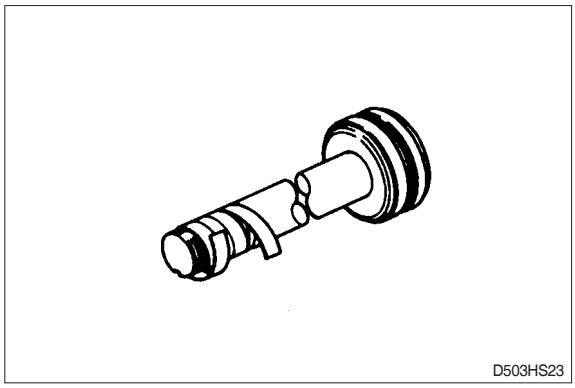
· I.D×O.D×stroke :
90×102×220 mm
(3.5×4.0×8.7 in)
· Rod O.D : 45 mm (1.8 in)

35D9FHS16

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

2) DISASSEMBLY

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



3) CHECK AND INSPECTION

mm (in)

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