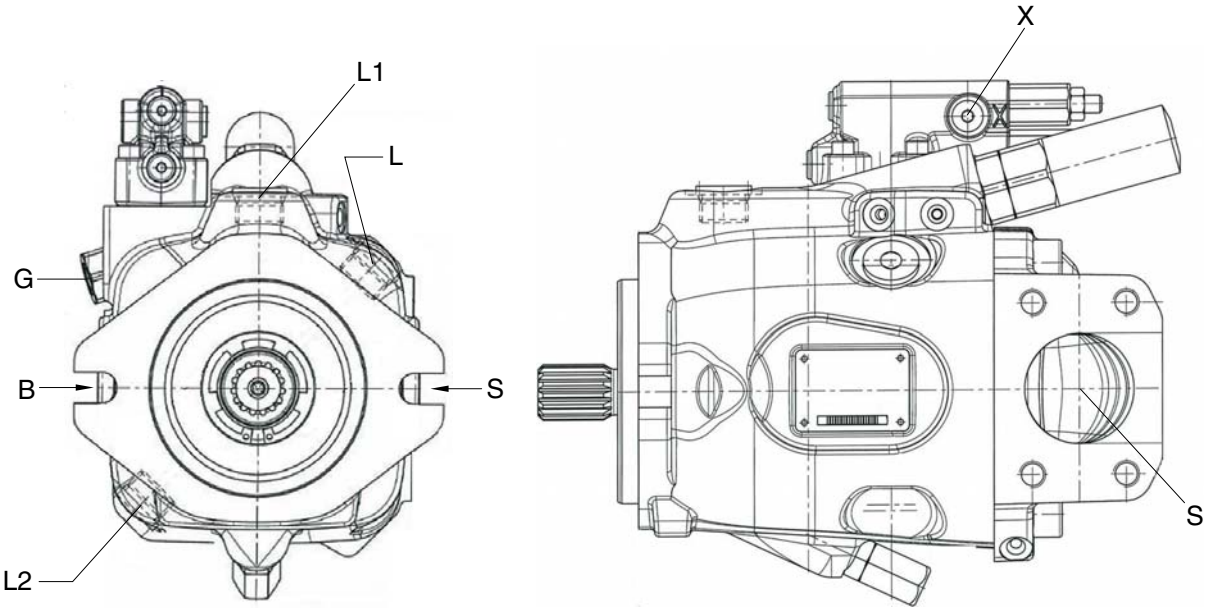
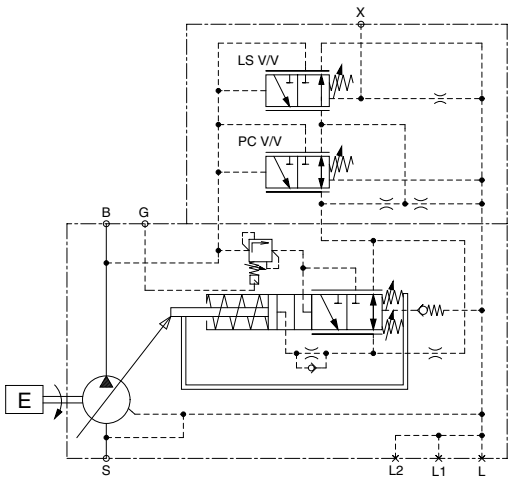
SECTION 2 STRUCTURE AND FUNCTION

GROUP 1 HYDRAULIC PUMP

1. GENERAL

This main pump is variable displacement piston type with load sensing system.





Hydraulic circuit

48AZ2MP01

Description of the ports

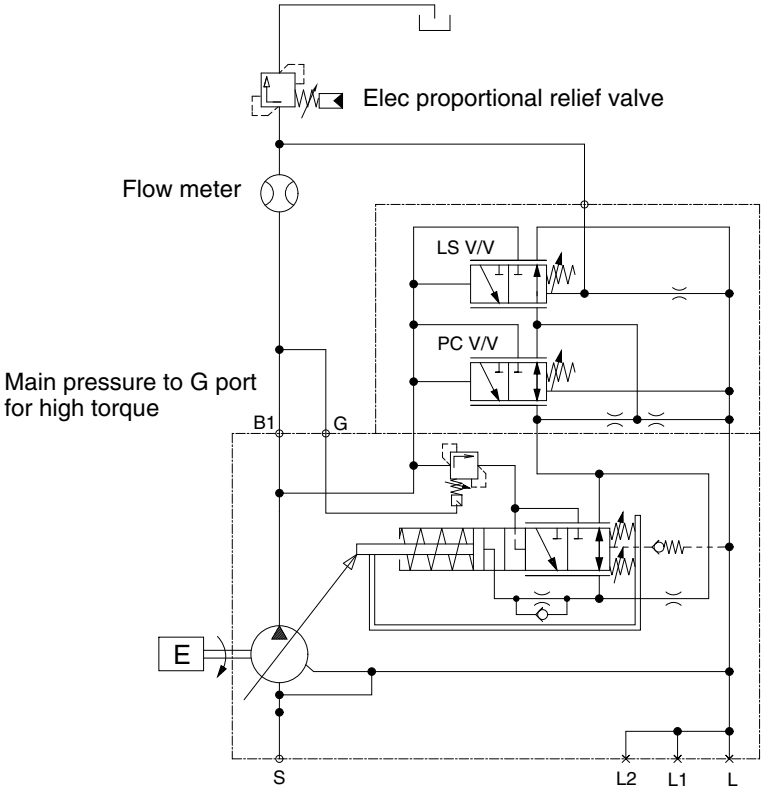
Port	Name	Bore
S	Suction port	SAE 2"
B	Discharge port	SAE 1"
G	High pressure port for dual torque function	M10x1
X	Pilot pressure port	PF7/16-20UNF
L, L1, L2	Case drain port	PF7/8-14UNF

2. START OF POWER CONTROL

Setting of starting point in P-Q curve shall be carried out as per following conditions and procedures.

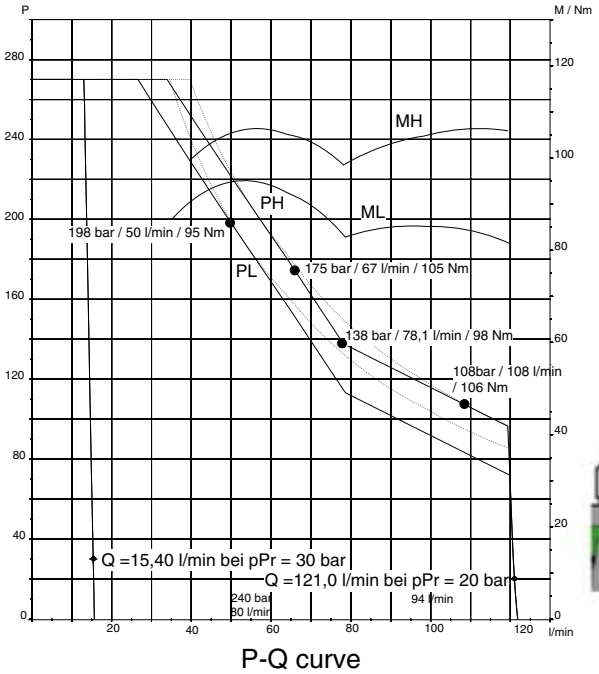
1) CONDITIONS

(1) Engine shall be running at 2000 rpm.
(2) Oil temperature shall be adjusted at 40 ℃.
(3) Pressure gauges and a flow meter shall be installed.

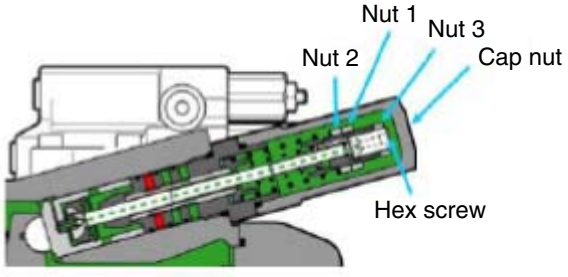


Schematic circuit

85A2MP10



P-Q curve



Pump schematic drawing

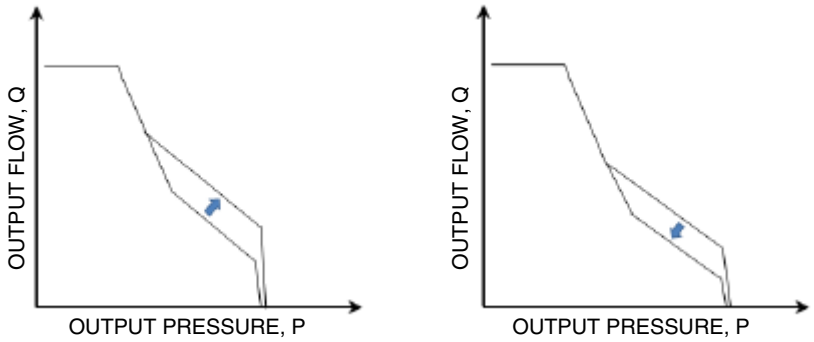
48AZ2MP11

2) PROCEDURES

(1) Loosen nut 1 fixing nut 2.
(2) Adjust outer spring by tightening or loosening nut 2.
① Increase pressure up to 170 bar.
② Turn Nut 2 clockwise to increase power until pumping flow reaches 123 ℓ/min (±4 ℓ/min).
(3) Secure the setting of nut 2 by tightening nut 1.

3) CHANGE OF P-Q CURVE

(1) If length of outer spring is decreased by tightening nut 2, the P-Q curve is moved to right in general like a graph left under as the spring tension is increased.
(2) If length of outer spring is increased by loosening nut 2, the P-Q curve is moved to left in general like a graph right under as the spring tension is decreased.



85A2MP12

3. END OF POWER CONTROL

Setting of ending point in P-Q curve shall be carried out following procedures and conditions.

1) CONDITIONS

(1) The conditions shall be set same as above.

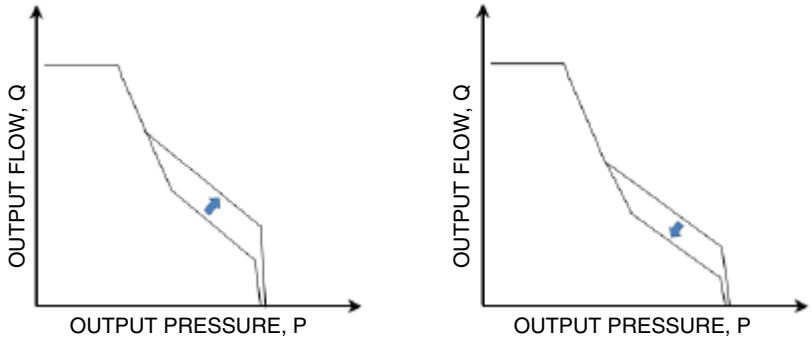
2) PROCEDURES

(1) Loosen the nut 3.
(2) Set end of control by turning Hexagonal screw.
① Increase pressure to 220 bar.
② Turn Screw clockwise to increase power until 92 ℓ /min (±4 ℓ /min) is reached.
(3) Secure the setting of nut 3.
(4) Tighten Cap nut.

3) CHANGE OF P-Q CURVE

(1) If length of Inner spring is deceased by tightening hexagonal screw, lower part of P-Q curve is moved to right like a graph left under as the tension force of spring is increased.

(2) If length of Inner spring is increased by loosening hexagonal screw, lower part of P-Q curve is moved to left like a graph left under as the tension force of spring is decreased.



85A2MP13

4. APPENDIXES

Required torque for bolt tightening

Part	Name	Required torque	
		kgf·m	lbf·ft
Nut 1	14 mm	5.1	36.9
Nut 2	14 mm	5.1	36.9
Nut 3	10 mm	4.1	29.7
Cap nut	32 mm	7.1	51.4
Hexagon screw	10 mm	-	-

5. DUAL TORQUE MODE

Pump power needs to be decreased in case that engine power is not enough to cover air condition operating at maximum pump operating. This function lets the pump power decrease by operating of dual torque valve.

(1) Normal operating condition (without air conditioner mode)

Solenoid valve (7) maintains the pushed position and allows oil to flow from passage (15) to passage (19). The pressure pushes dual torque valve (5) not to allow the pumping oil to flow toward control valve (6) inside. As a result, pressure in front of dual torque valve (5) does not effect on the angle of swash plate (25).

(2) Excessive operating condition (by air conditioner mode)

If air conditioner operates with maximum pump operating, the increased power will overload engine. Therefore, pump power needs to be decreased to share power consumption with air conditioner without overload to engine.

Connection between passage (15) and passage (19) is blocked by deactivation of solenoid valve (7). Dual torque valve which was pushed by the pressure in passage (19) also returns to initial position by spring force. This return allows the pumping oil to flow toward control valve (6) inside. The angel of swash plate (25) is decreased by the pressure in control valve. As a result, pump flow is decreased and power consumption by pump also is decreased.

6. UPSTROKE

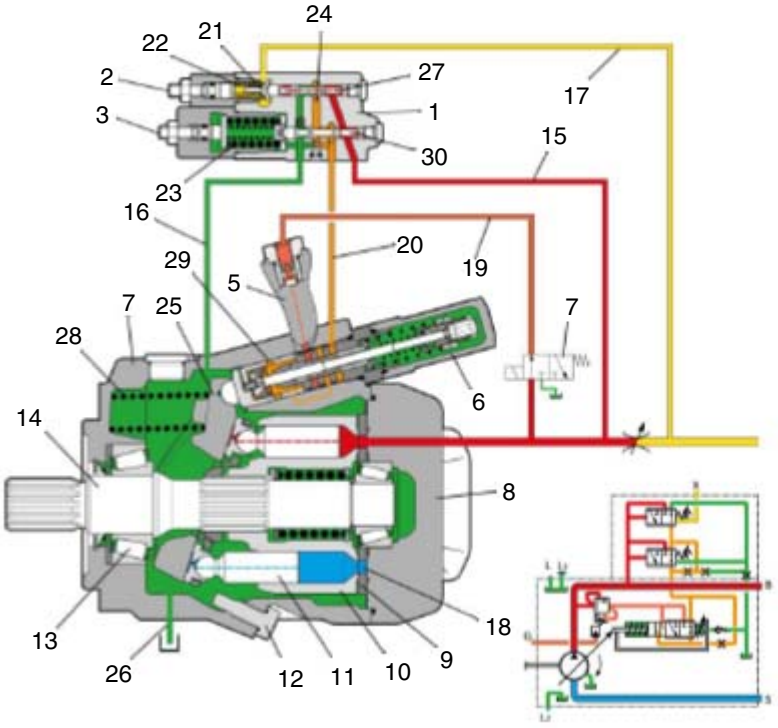
Upstroking of the pump occurs as a demand for flow from attachment.

The increased demand for flow causes a LS pressure in passage (17). The LS pressure in passage (17) combines with the force of spring (22) in cavity (21). The force of spring (22) causes pump pressure to be higher than pressure of passage (17).

If the combination of LS pressure and spring force is greater than the pump discharge pressure in passage (15), this difference pressure causes a spool (27) to move right. As the spool (27) moves right, the spool (27) blocks inflow of pumping oil to control piston (6) through passage (20). Swash plate (25) is controlled by pressure and flow as much as hydraulic system requests.

Pilot oil in passage (20) drains to passage (24). The oil then flows into housing through passage (16) into the housing and finally drains to tank. It also causes pumping flow to increase. As flow requirement is satisfied, pump output pressure increases. The pressure increases until the pressure in passage (24) moves flow compensator spool (27) up to be satisfied with system requirement for pressure and flow.

· Pump discharge pressure = force of spring (22) + LS pressure (17)



85A2MP14

1 Regulator
2 Flow adjustment screw
3 Pressure adjustment screw
4 Pump housing
5 Dual torque valve
6 Control valve
7 Solenoid valve
8 Port plate
9 Distributor plate
10 Cylinder block
11 Piston
12 Minimum flow limitation valve
13 Bearing
14 Drive shaft
15 Passage (high pressure)
16 Passage (leakage pressure)
17 Passage (pilot pressure)
18 Passage (suction pressure)
19 Passage (dual torque valve pilot pressure)
20 Passage (control piston pilot pressure)
21 Cavity
22 Spring
23 Spring
24 Passage
25 Swash plate
26 Casing drain
27 Flow compensator spool
28 Spring
29 Cross drilled hole
30 Pressure compensator spool

7. DESTROKE

The decreased flow demand causes LS pressure in passage (17). LS pressure in passage (17) combines with force of spring (22) in cavity (21).

This combination of LS pressure and spring force is less than the pump pressure in passage (15). It causes flow compensator spool (27) to move left.

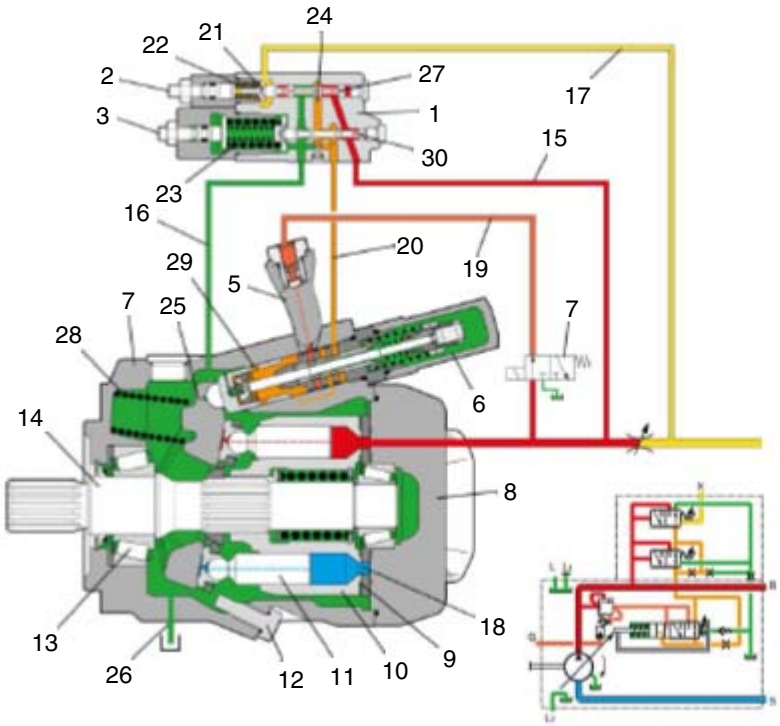
Pumping oil now flows through passage (15). The oil then flows past flow compensator spool (27), and then to control piston (6) through passage (20).

Combined force of pump pressure behind control piston (6) and counter spring (28) is bigger than force of springs inside control piston (6). Angle of swash plate (25) decreases.

This action results in decreasing of pump output and system pressure.

When the flow is decreased enough, flow compensator spool (27) moves right up to the balance position.

Swash plate (25) maintains the angle that is sufficient to provide the lower required pressure. If the operator does not operate RCV lever or pedal, the pump will return to low pressure stand-by.



85A2MP15

8. LOW PRESSURE STAND-BY

Low pressure standby constitutes the following condition: a running engine and inactive attachment. There is no flow demand or pressure demand on the pump. Therefore, there is no LS pressure in passage (17).

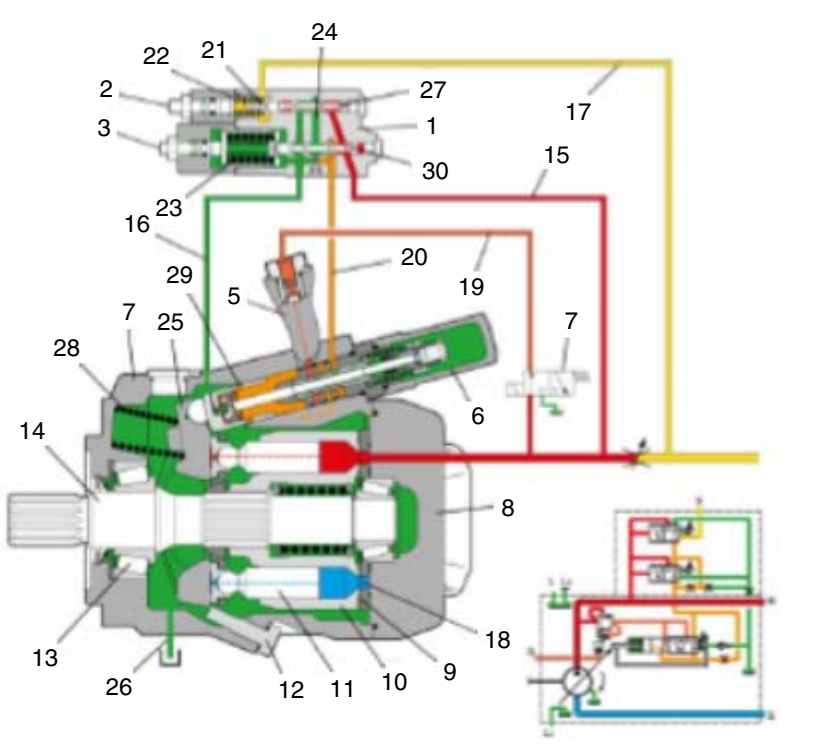
Before you start the engine, counter spring (28) holds swash plate (25) at the maximum angle. As the pump begins to operate, oil begins to flow and pressure increases in the system.

As the pressure increases, the pressure pushes flow compensator spool (27) against spring (22). It causes flow compensator spool (27) to move left. It opens passage (24) in order to allow pumping oil to flow to control piston (6) via passage (20).

The oil acts against control piston (6) in order to overcome the force of counter spring (28). The oil causes control piston (6) to move to the left. When control piston (6) moves to the left, the piston moves swash plate (25) toward the minimum angle. Control piston (6) continues to move to the left until cross-drilled hole (29) allows the oil to drain to pump housing. Cross-drilled hole (29) limits the maximum travel of control piston (6) toward the left.

The pump supplies a sufficient amount of flow that can compensate for the system leakage and the pump leakage. The leakage to the pump housing is flowed from the cross-drilled hole. The pump maintains low pressure stand-by. Low pressure stand-by should not exceed 15 bar.

※ Low pressure standby will vary in the same pump as the system leakage or the pump leakage increases. The pump will slightly upstroke in order to compensate for the leakage increasing. Control piston (6) will cover much flow control than the flow through the cross-drilled hole.



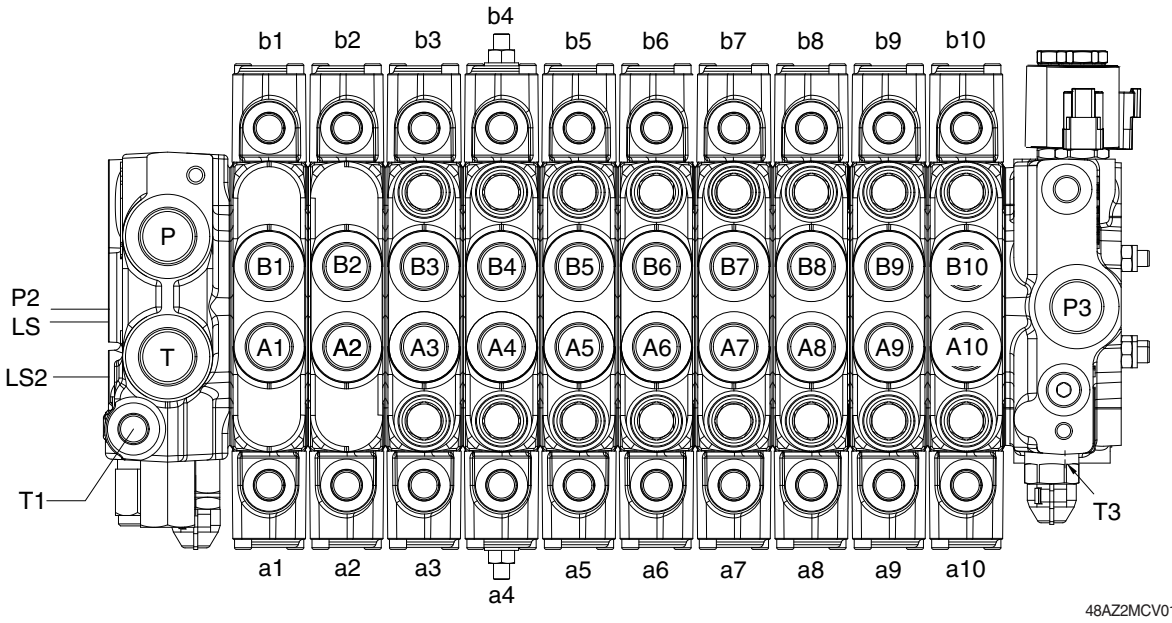
85A2MP16

9. CUT OFF FUNCTION

Once sudden pressure increasing in LS line occurs while attachments work, flow decreasing should be a necessary function to prevent a shock inside the pump. When high pressure in passage (15) flows to regulator (1), spools are likely to move by its force. However, shift of flow compensator spool (27) is restricted by LS pressure pushing spring (22) which is generated from attachments. Therefore, flow compensator spool (27) still blocks a connection from passage (27) to passage (24). The flow blocked by flow compensator spool (27) alternatively shifts pressure compensator spool (30) to right. Passage (15) connects to passage (20) by this shift. High pressure flows to control valve (6), then decreases an angle of swash plate (25). Pumping flow finally will decrease by shift of flow compensator spool (27) although flow compensator spool (27) does not shift.

GROUP 2 MAIN CONTROL VALVE

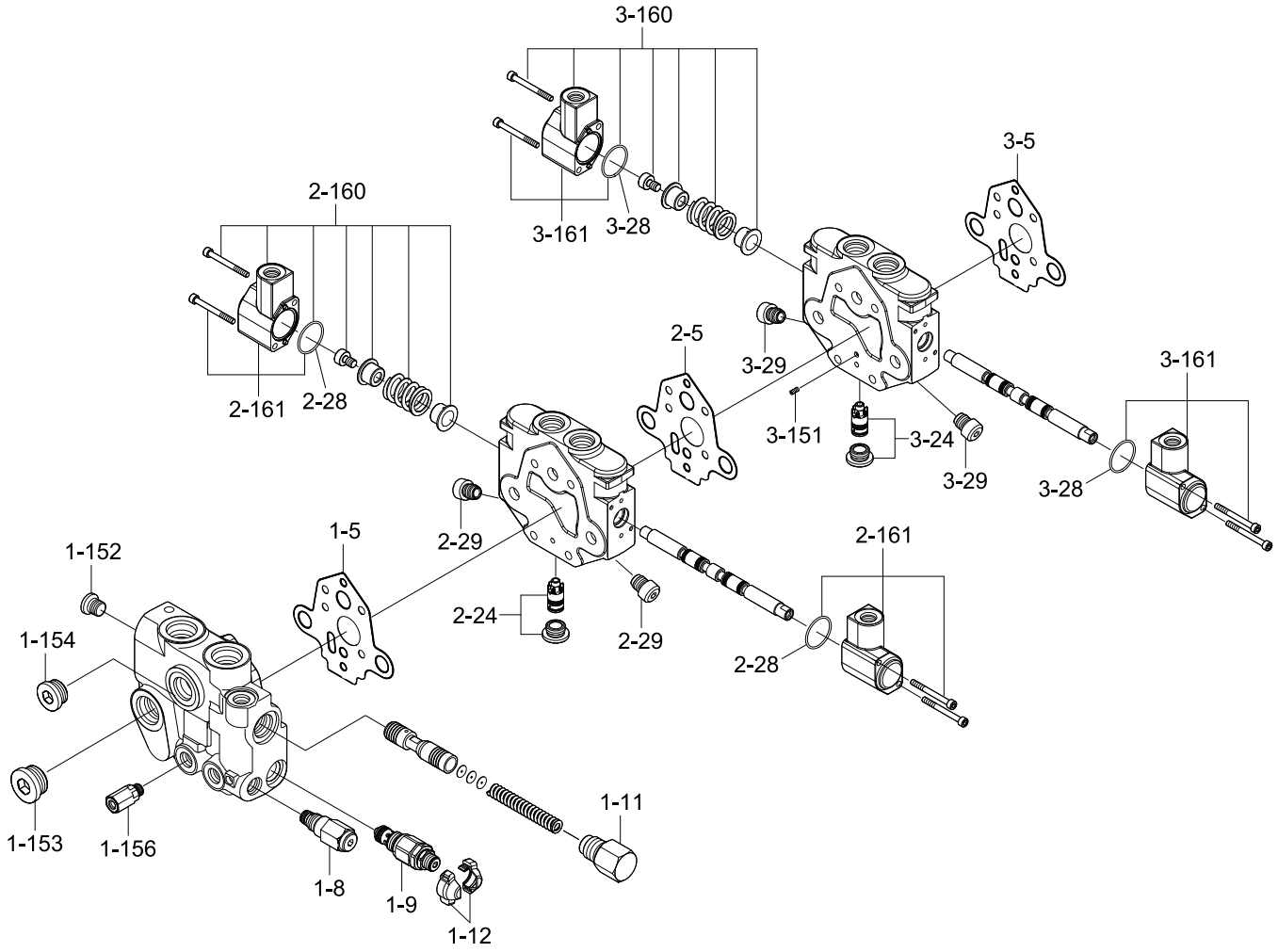
1. OUTLINE



Mark	Port name
P	Pump port
P3	Pump port
A4	Swing port (LH)
B4	Swing port (RH)
A7	Dozer down port
B7	Dozer up port
A8	Boom swing port (LH)
B8	Boom swing port (RH)
A10	Rotating port-CCW
B10	Rotating port-CW
A5	Arm out port
B5	Arm in port
A2	Travel port [LH/FW]
B2	Travel port [LH/RR]
A1	Travel port [RH/FW]
B1	Travel port [RH/RR]
A3	Boom up port
B3	Boom down port
A6	Bucket in port
B6	Bucket out port
A9	Auxiliary 1 port (opt)
B9	Auxiliary 1 port (opt)
T	Tank return port

Mark	Port name
T1, T3	Tank return port
a4	Swing pilot port (LH)
b4	Swing pilot port (RH)
a7	Dozer down pilot port
b7	Dozer up pilot port
a8	Boom swing pilot port (LH)
b8	Boom swing pilot port (RH)
a10	Rotating pilot port-CCW
b10	Rotating pilot port-CW
a5	Arm out pilot port
b5	Arm in pilot port
a2	Travel pilot port (LH/FW)
b2	Travel pilot port (LH/RR)
a1	Travel pilot port (RH/FW)
b1	Travel pilot port (RH/RR)
a3	Boom up pilot port
b3	Boom down pilot port
a6	Bucket in pilot port
b6	Bucket out pilot port
a9	Auxiliary 1 pilot port (opt)
b9	Auxiliary 1 pilot port (opt)
LS	Load sensing port
LS2	Load sensing port

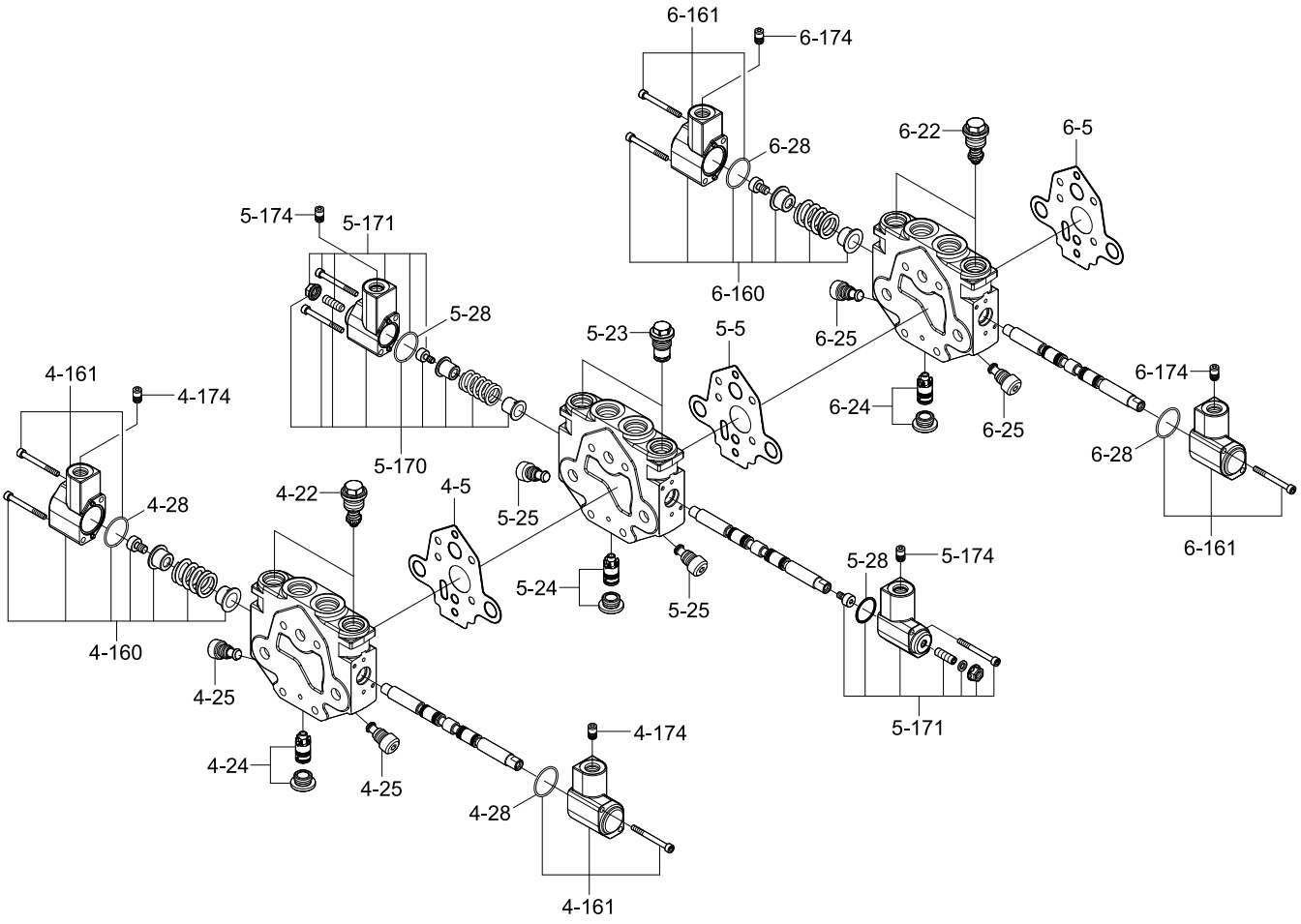
2. STRUCTURE (1/4)



48AZ2MCV02

1	Inlet block assy	1-154	Sealing plug	3	Travel block assy
1-5	Plate seal	1-156	Shuttle valve	3-5	Plate seal
1-8	Flow regulator	2	Travel block assy	3-24	Compensator kit
1-9	Relief valve	2-5	Plate seal	3-28	Seal kit
1-11	Plug	2-24	Compensator kit	3-29	Orifice plug
1-12	Locking cover	2-28	Seal kit	3-151	Throttle screw
1-12	Locking cover	2-29	Orifice plug	3-160	W/spool cover kit
1-152	Sealing plug	2-160	W/spool cover kit	3-161	Cover kit
1-153	Sealing plug	2-161	Cover kit		

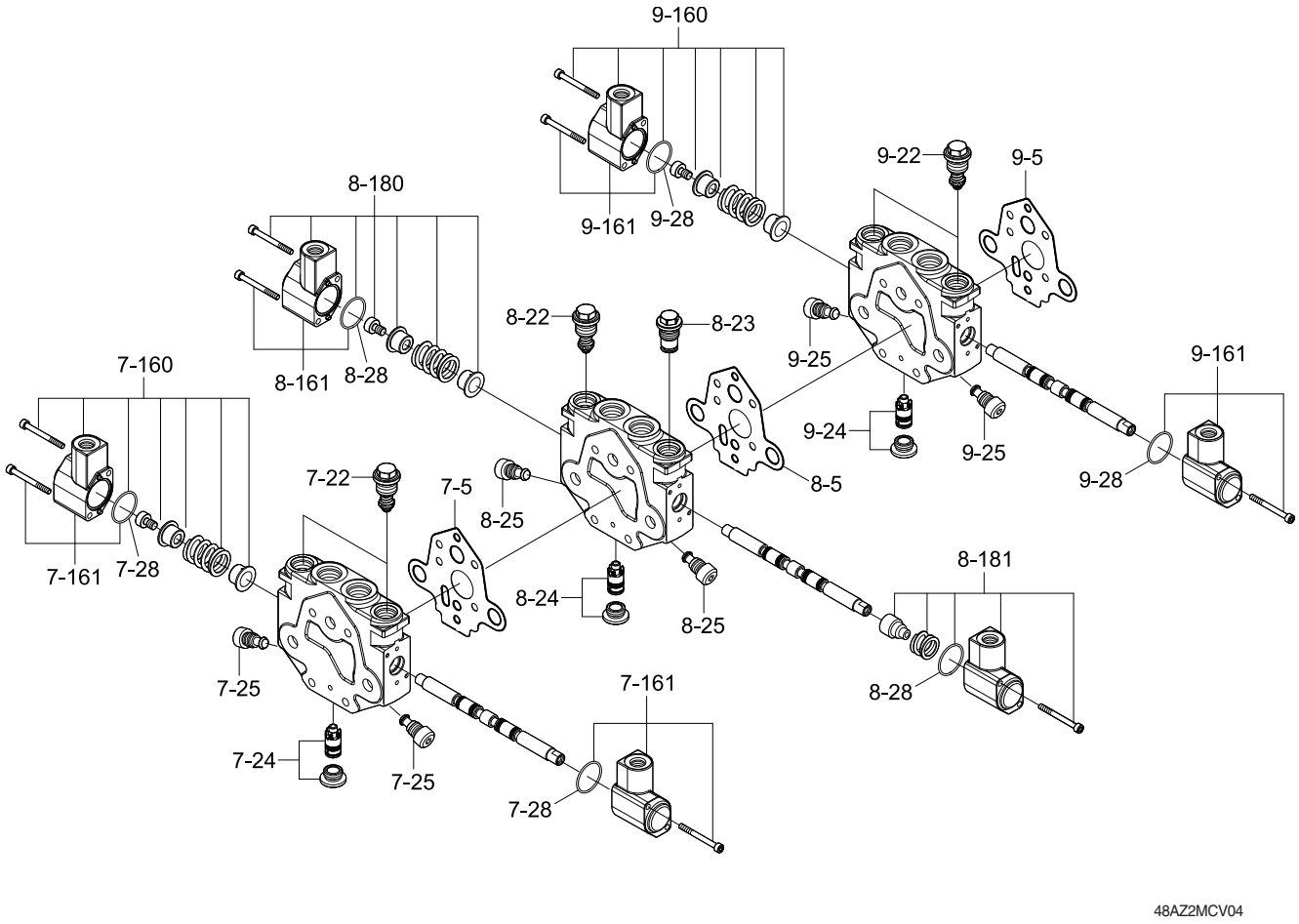
STRUCTURE (2/4)



48AZ2MCV03

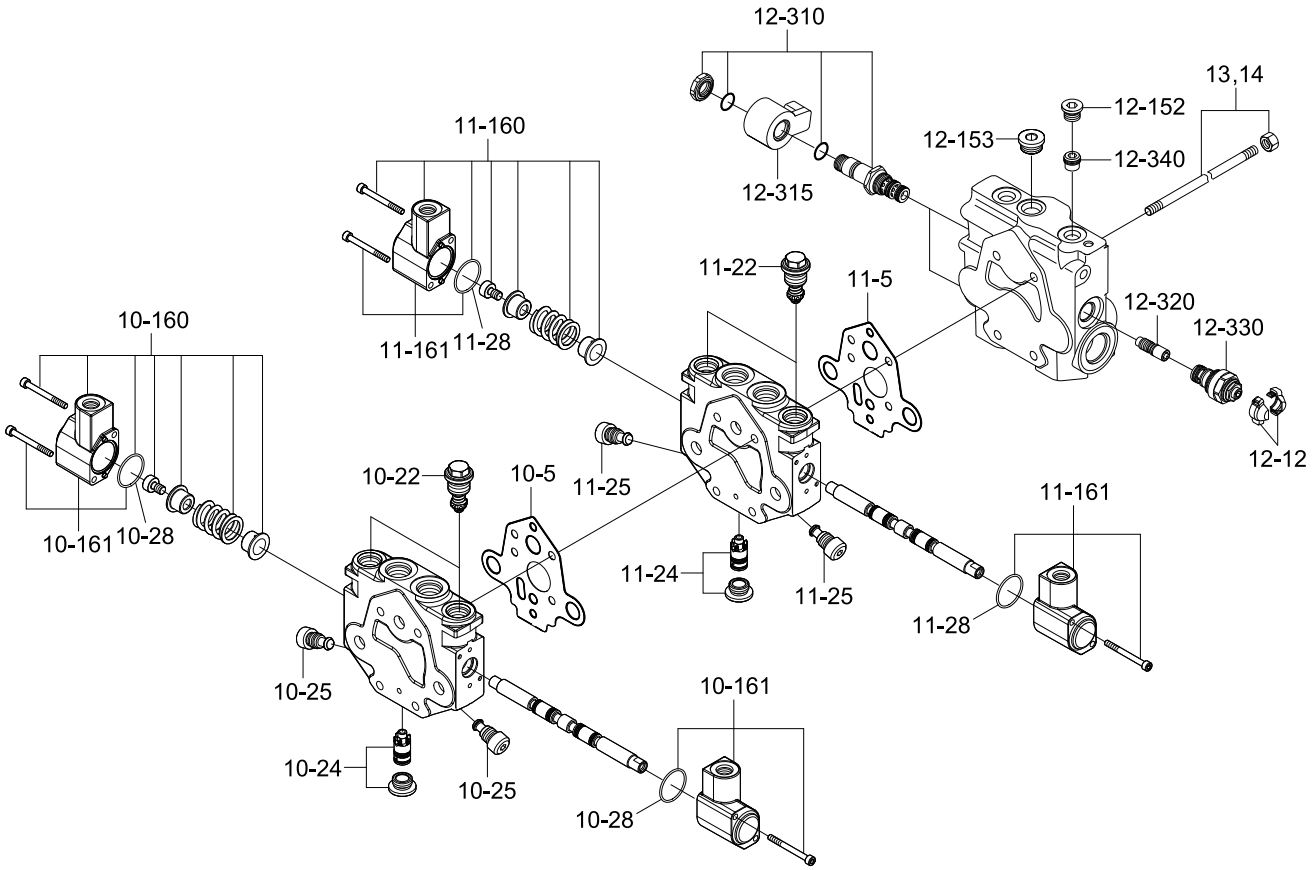
4	Boom block assy	5	Swing block assy	6	Arm block assy
4-5	Plate seal	5-5	Plate seal	6-5	Plate seal
4-22	Relief valve	5-23	Plug	6-22	Relief valve
4-24	Compensator kit	5-24	Compensator kit	6-24	Compensator kit
4-25	Check valve	5-25	Check valve	6-25	Check valve
4-28	Seal kit	5-28	Seal kit	6-28	Seal kit
4-160	W/spool cover kit	5-170	W/spool cover kit	6-160	W/spool cover kit
4-161	Cover kit	5-171	Cover kit	6-161	Cover kit
4-174	Snubber	5-174	Snubber	6-174	Snubber

STRUCTURE (3/4)



7	Bucket block assy	8-5	Plate seal	9	Boom swing block assy
7-5	Plate seal	8-22	Anticavitation valve	9-5	Plate seal
7-22	Relief valve	8-23	Plug	9-22	Relief valve
7-24	Compensator kit	8-24	Compensator kit	9-24	Compensator kit
7-25	Check valve	8-25	Check valve	9-25	Check valve
7-28	Seal kit	8-28	Seal kit	9-28	Seal kit
7-160	W/spool cover kit	8-161	Cover kit	9-160	W/spool cover kit
7-161	Cover kit	8-180	W/spool cover kit	9-161	Cover kit
8	Dozer block assy	8-181	W/spool cover kit		

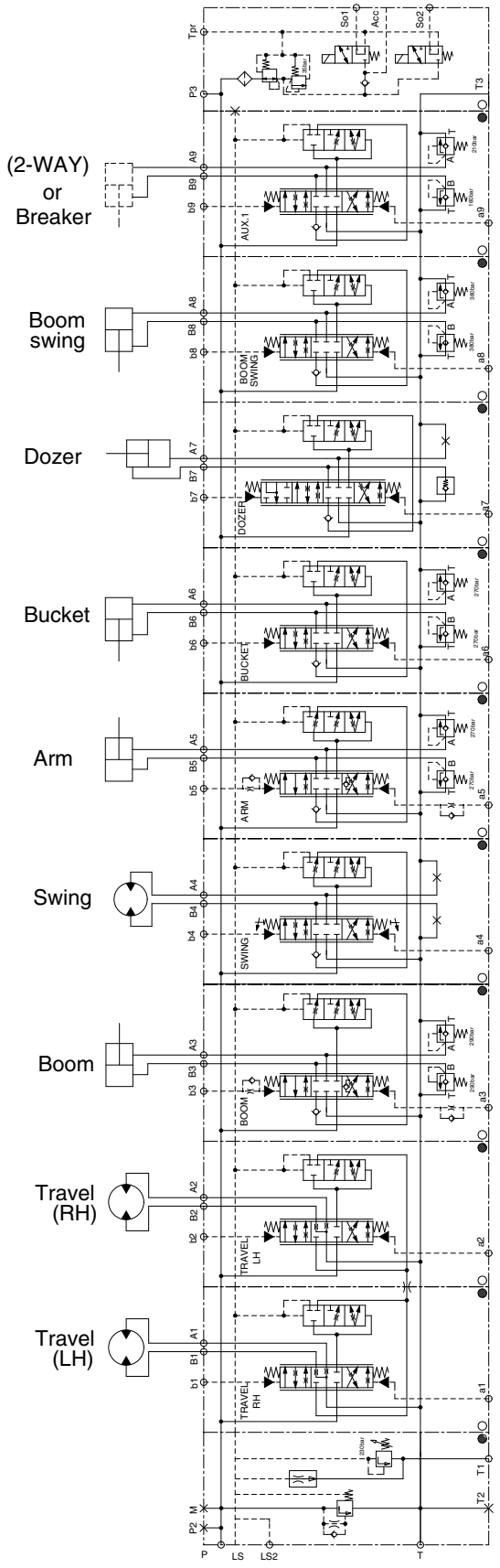
STRUCTURE (4/4)



48AZ2MCV05

10	Aux 1 block assy	11-5	Plate seal	12-152	Sealing plug
10-5	Plate seal	11-22	Relief valve	12-153	Sealing plug
10-22	Relief valve	11-24	Compensator kit	12-310	Valve kit
10-24	Compensator kit	11-25	Check valve	12-315	Solenoid
10-25	Check valve	11-28	Seal kit	12-320	Shuttle
10-28	Seal kit	11-160	W/spool cover kit	12-330	Pressure relief valve
10-160	W/spool cover kit	11-161	Cover kit	12-340	Filter
10-161	Cover kit	12	Outlet block assy	13	Tie rod
11	Aux 2 block assy	12-12	Locking cover	14	Tie rod

3. HYDRAULIC CIRCUIT (boom swing, 2-way)

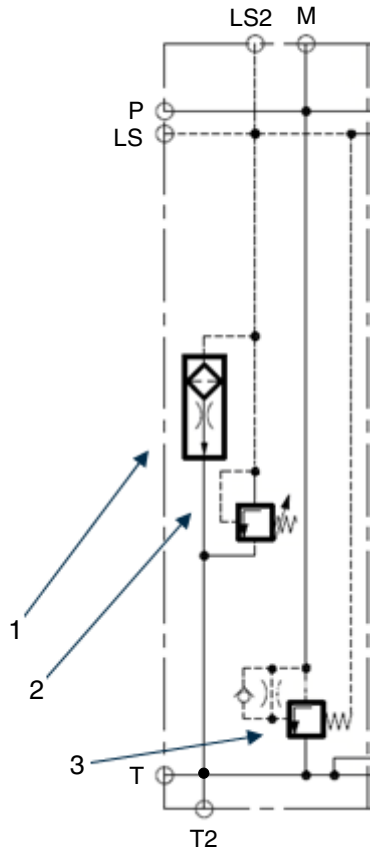


48AZ2MCV06

4. FUNCTION

1) INLET ELEMENT DESCRIPTION

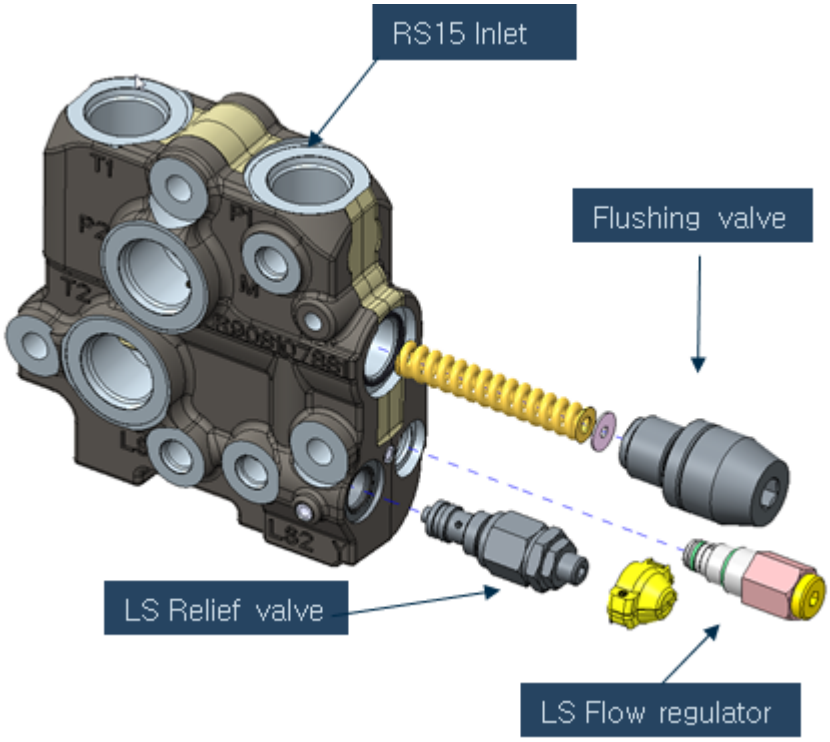
- The inlet plate has the line connections P, T, LS, T2 and M.
- The inlet element moreover comprises all components necessary for the system function: One flow control valve (1) for the controlled unloading of the LS line and one LS pressure relief valve (2) to limit the maximum system pressure.
- Protection of the system by means of LS pressure relief valve (2) combined with flushing valve (3).



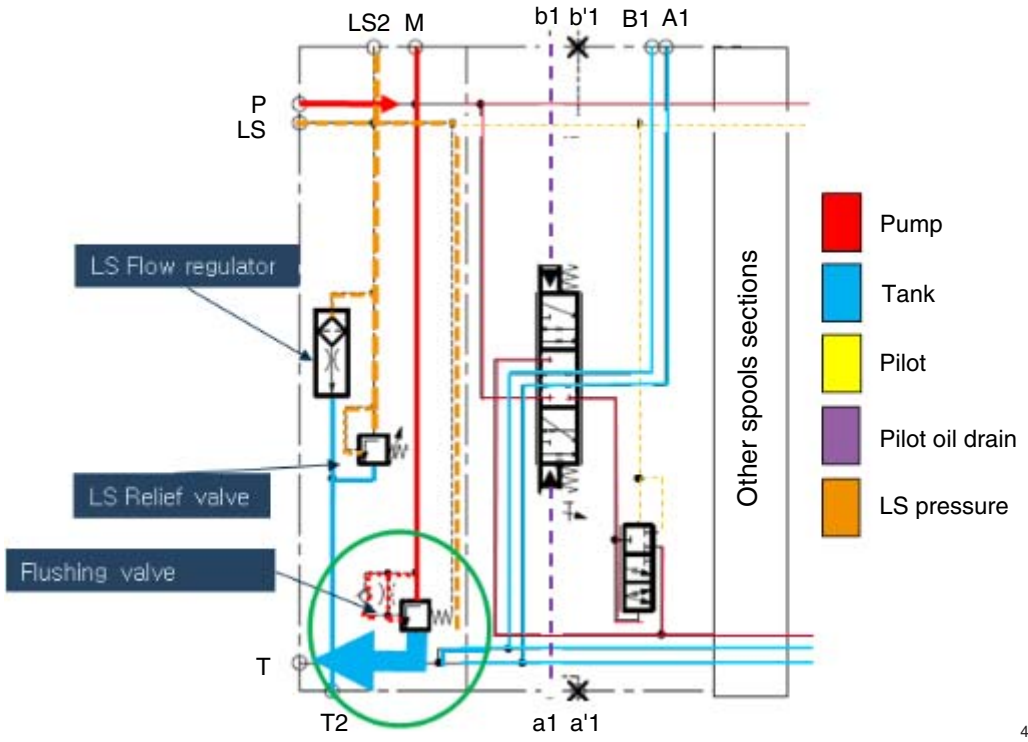
48AZ2MCV10

(1) Inlet description - all spools at neutral position

First section-travel-represented at neutral



85A2MC11



48AZ2MCV12

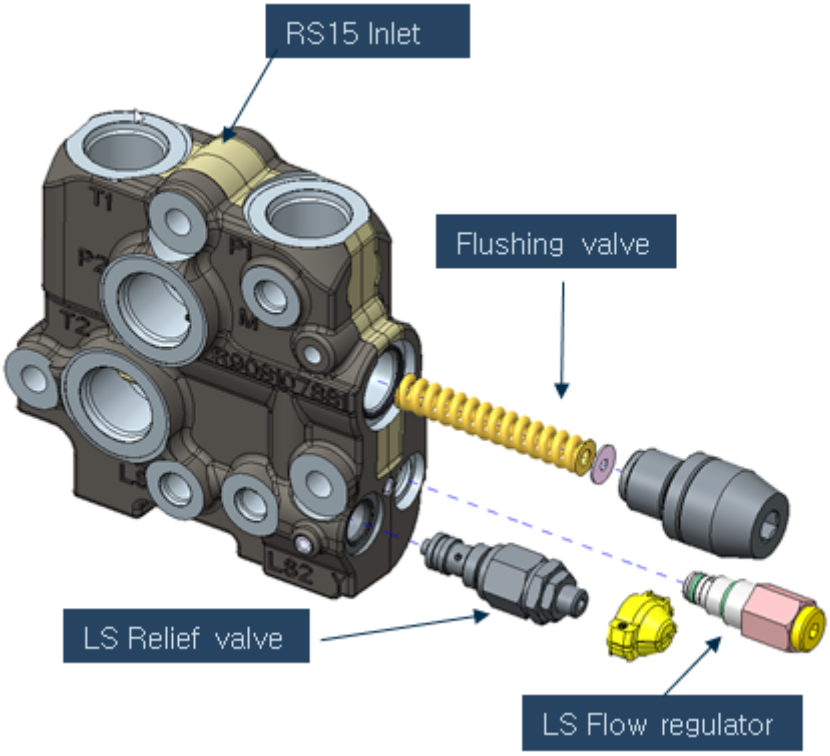
The Inlet element allows the exchange of the in the flow from the pump and the out flow to the tank.

When all sections are in neutral position, the pump is in stand-by and flow is reduced to the minimum pump flow (14 ℓ/min).

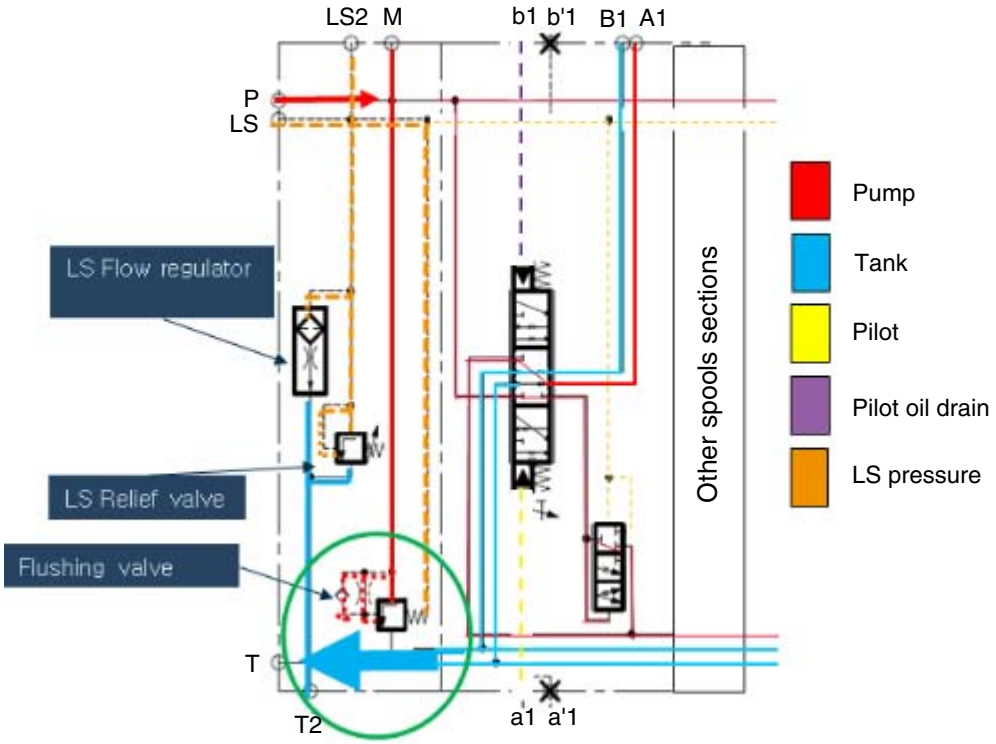
All the minimum pump flow pass through the flushing valve which is open, it means connected to the tank.

(2) Inlet description - spool actuated

First section-travel-PABT spool position represented.



85A2MC13

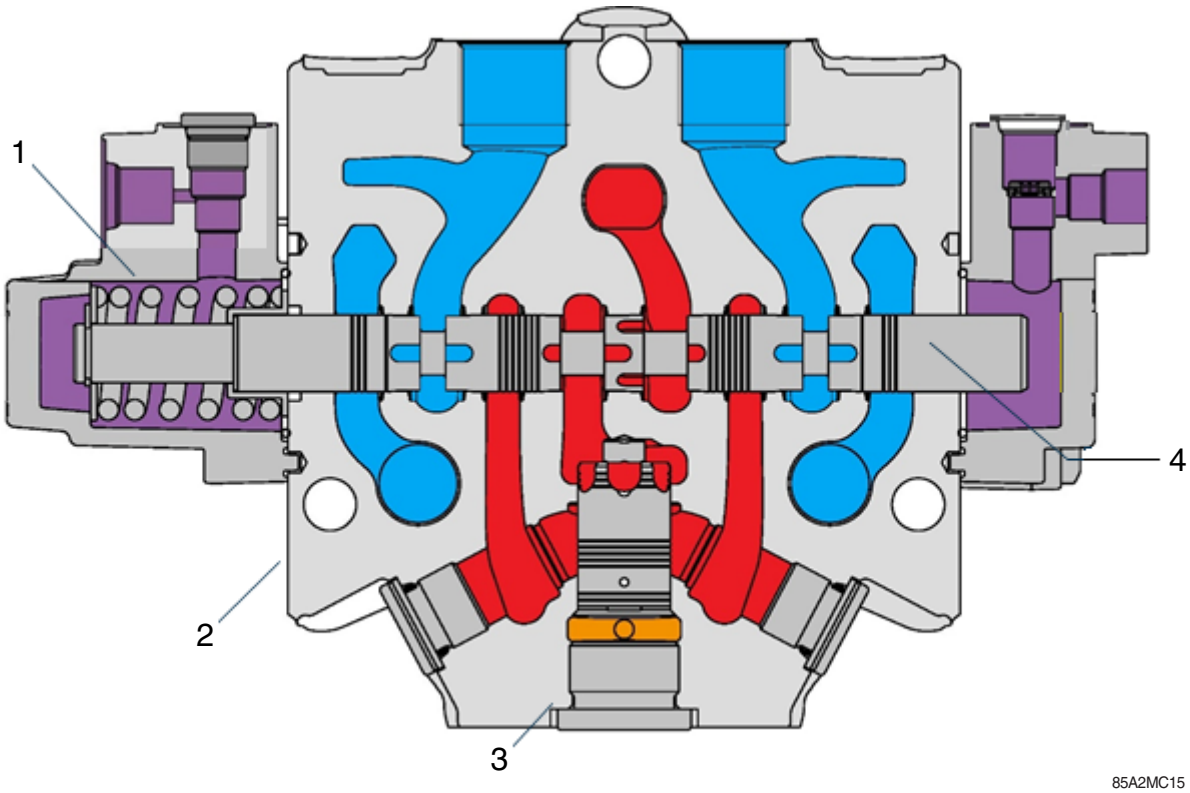


48AZ2MCV14

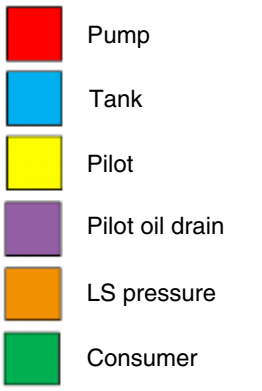
As soon as one or more spool moves, the flow stop to pass trough the flushing valve, which is closed, not anymore connected to the tank. The flow pass trough the spool to reach the movement, and then go to the tank by the T line after the spool.

2) TRAVEL SECTION DESCRIPTION - SECTION 1 AND 2

(1) Component description



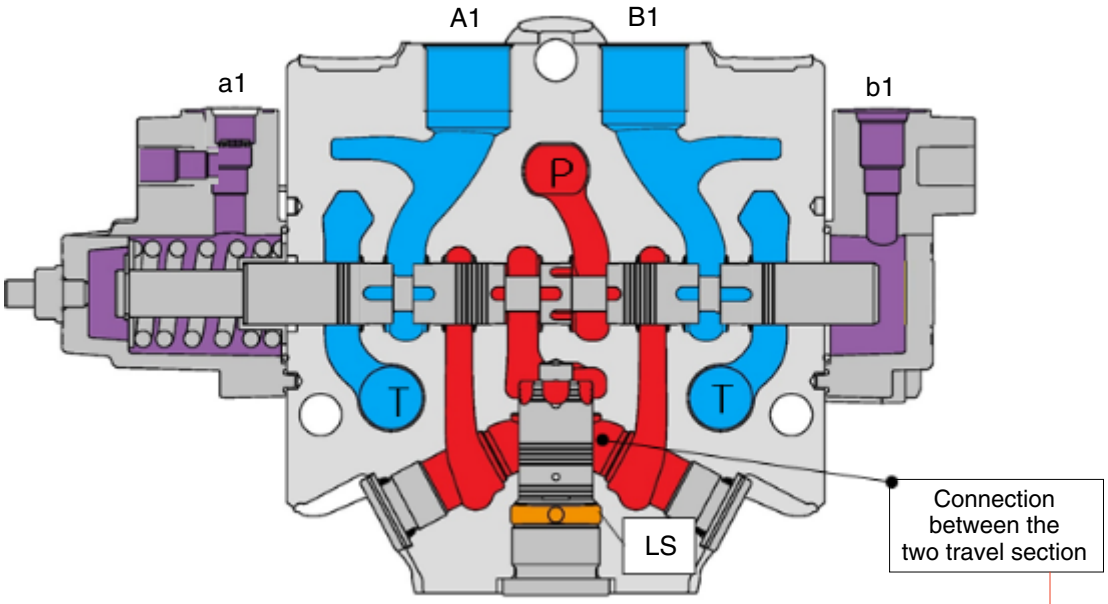
85A2MC15



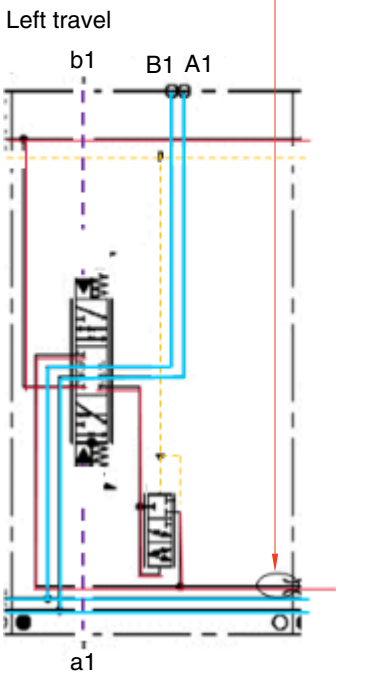
85A2MC16

1 Spring pack
2 Housing
3 Pressure compensator
4 Spool

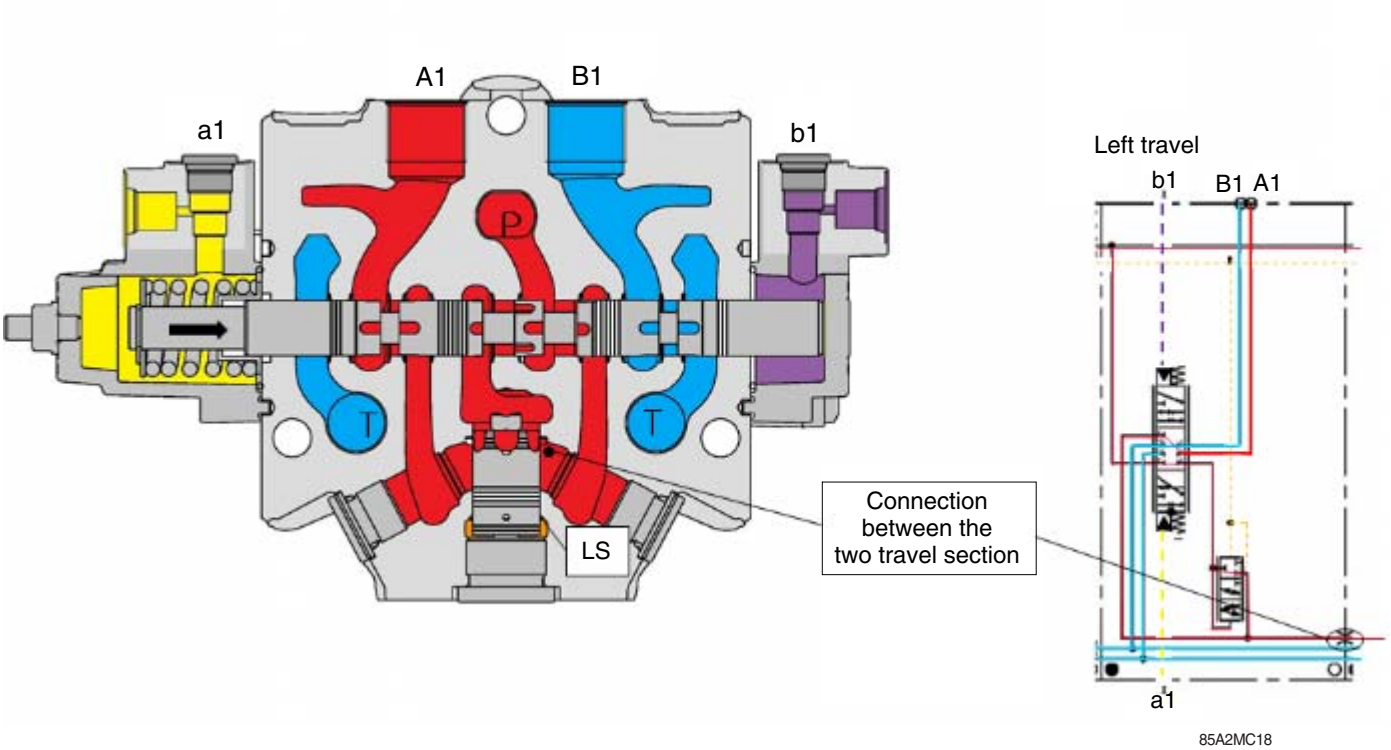
(2) Neutral position



The spool is in neutral position, pump is in low pressure stand-by. The A and B ports are not connected to the pumps but to the tank. This is in order to ensure A and B to be drained to tank. The two translation branches, 1 and 2, are connected in order not to have differences in traction.

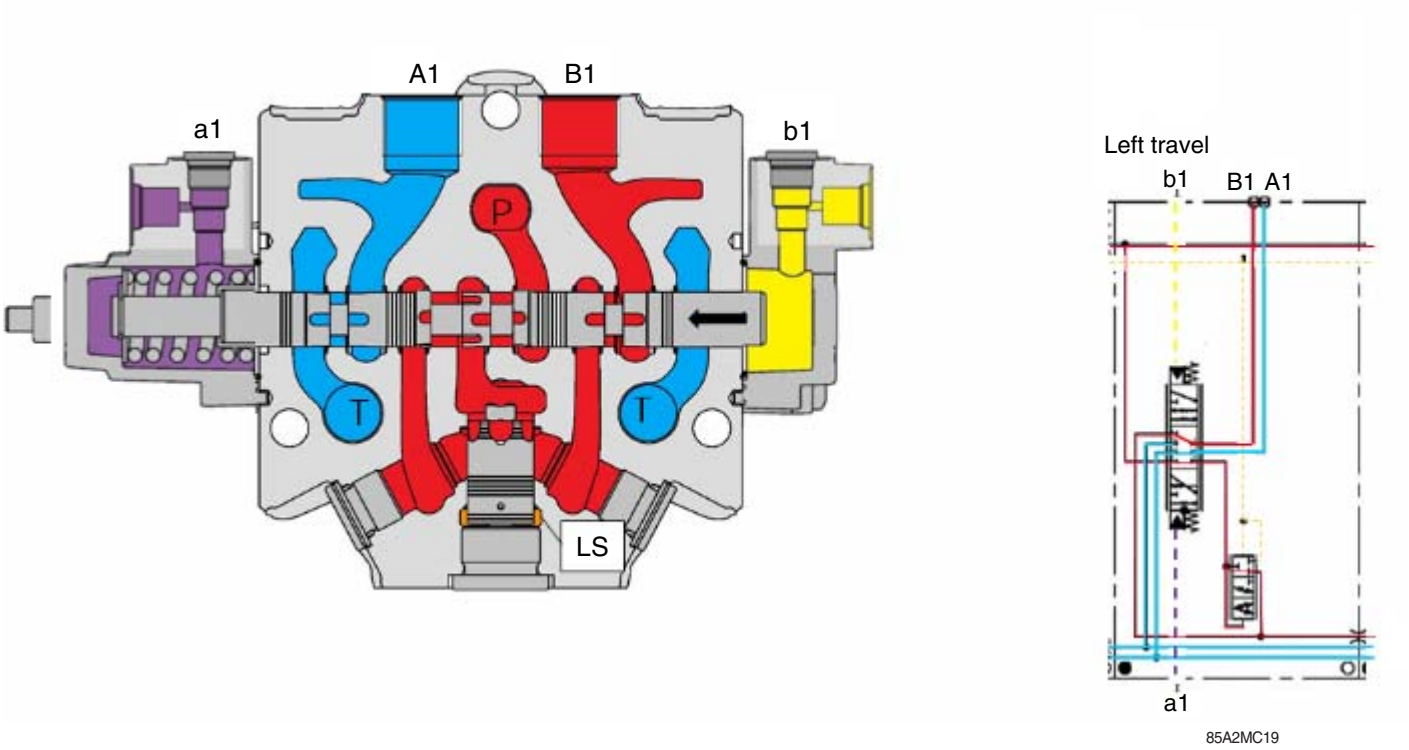


(3) Travel forward position



When the pilot pressure is led to the port a1, the oil from the pump flows to the cylinder port A1 and oil from the cylinder flows into the tank through the cylinder port B1.

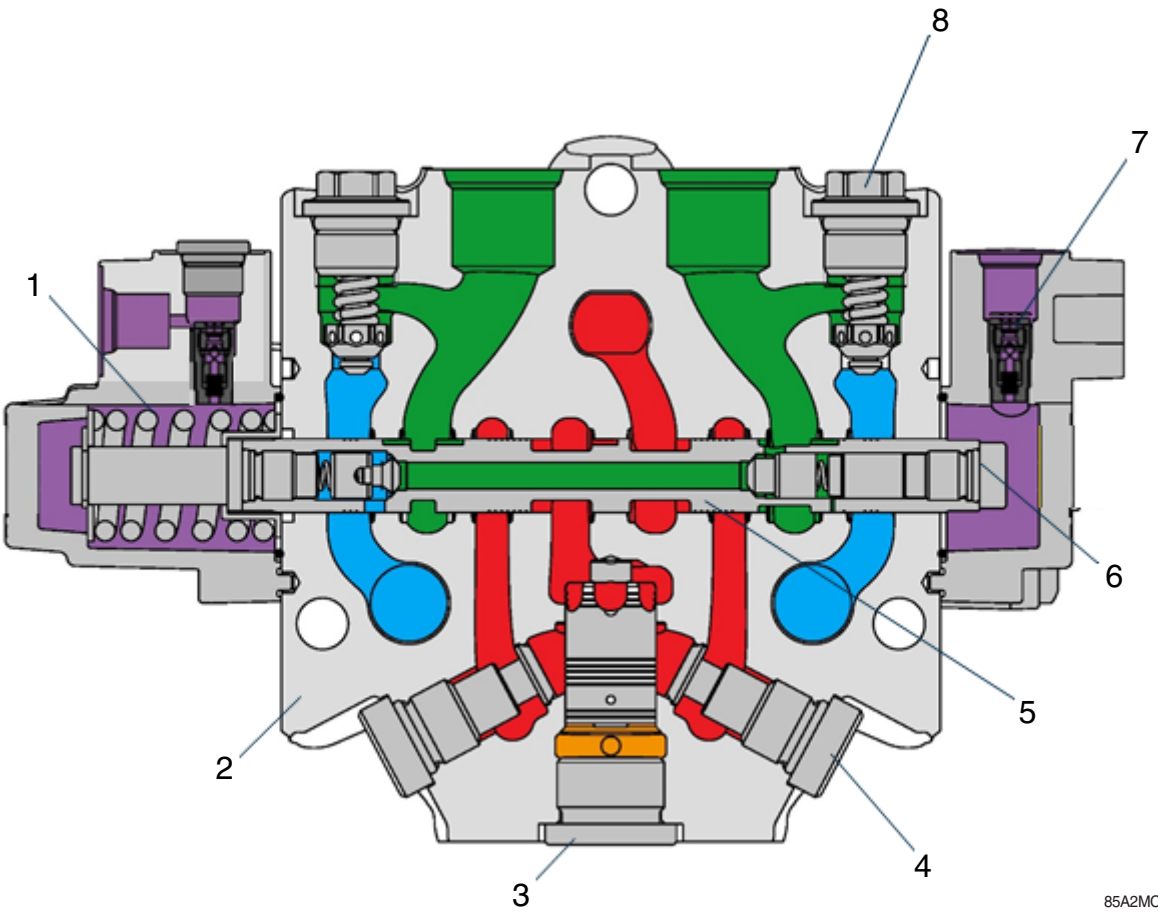
(4) Travel reverse position



When the pilot pressure is led to the port b1, the oil from the pump flows to the cylinder port B1 and oil from the cylinder flows into the tank through the cylinder port A1.

3) BOOM AND ARM SECTION 3 AND 5 DESCRIPTION - WITH REGENERATION SPOOLS

(1) Component description



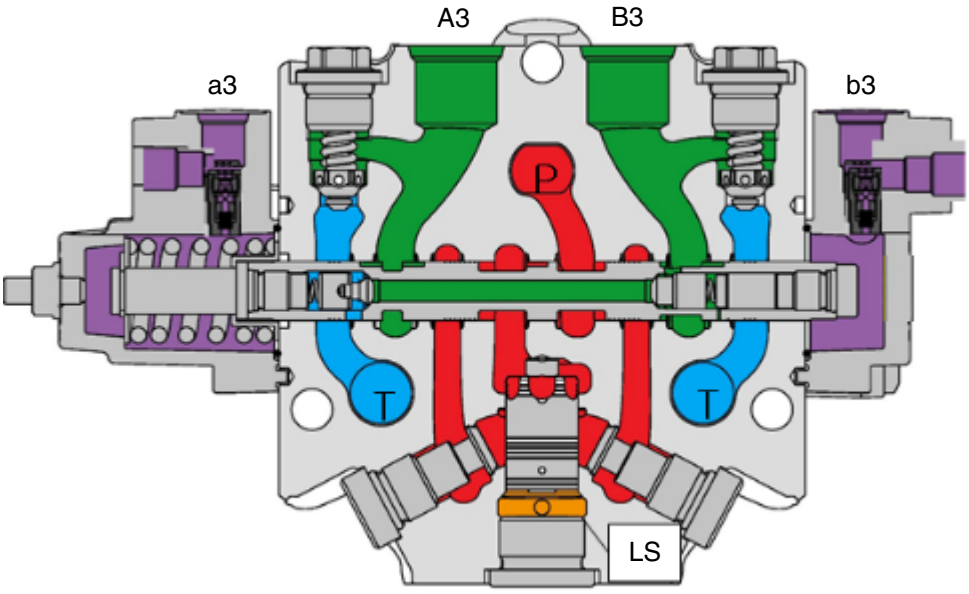
85A2MC20

- Pump
- Tank
- Pilot
- Pilot oil drain
- LS pressure
- Consumer
- Regeneration flow (position PABT on nest pages)

85A2MC21

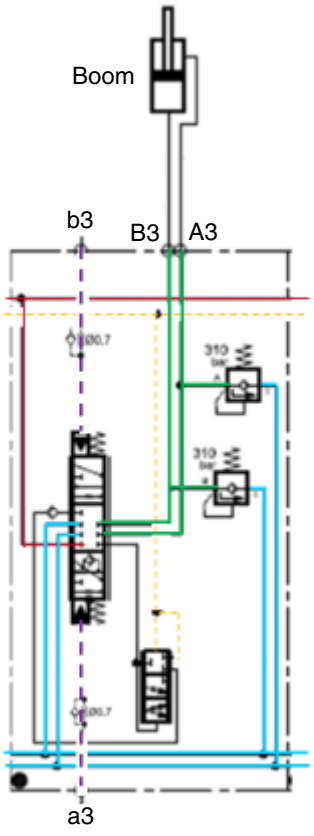
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Regeneration spool
6 Spool
7 Shuttle valve
8 Relief valves

(2) Neutral position



85A2MC22

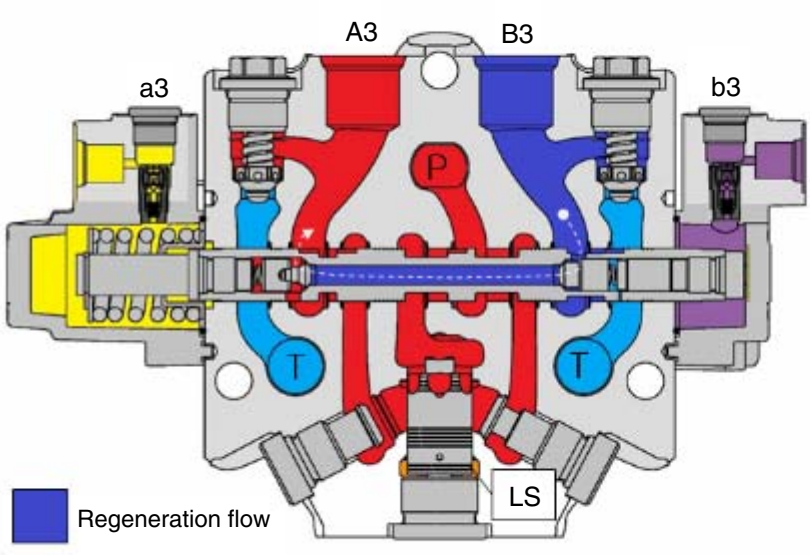
The spool is in neutral position, oil from the pump is blocked, pump is in low pressure stand-by. The A and B ports are not connected to the pump nor the tank.

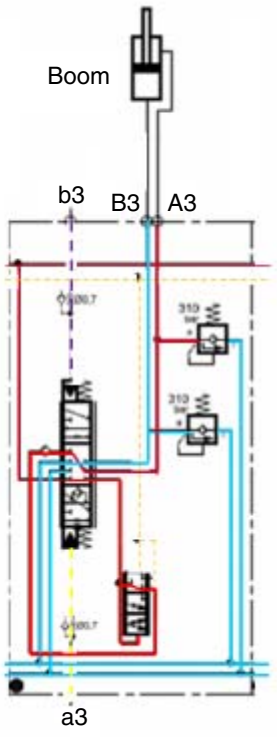


85A2MC23

(3) Boom section description

① Boom down position

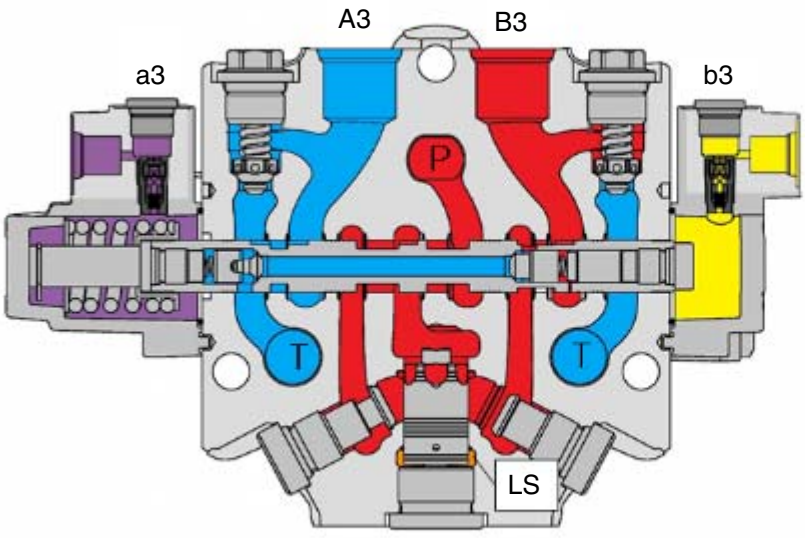


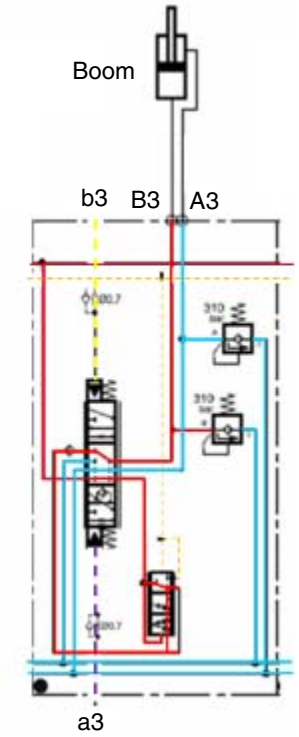


85A2MC24

When the pilot pressure is led to the port a4, the oil from the pump flows to the cylinder port A4 and oil from the cylinder flows partially into the tank and partially trough regeneration path B to A through the cylinder port B4 .

② Boom up position



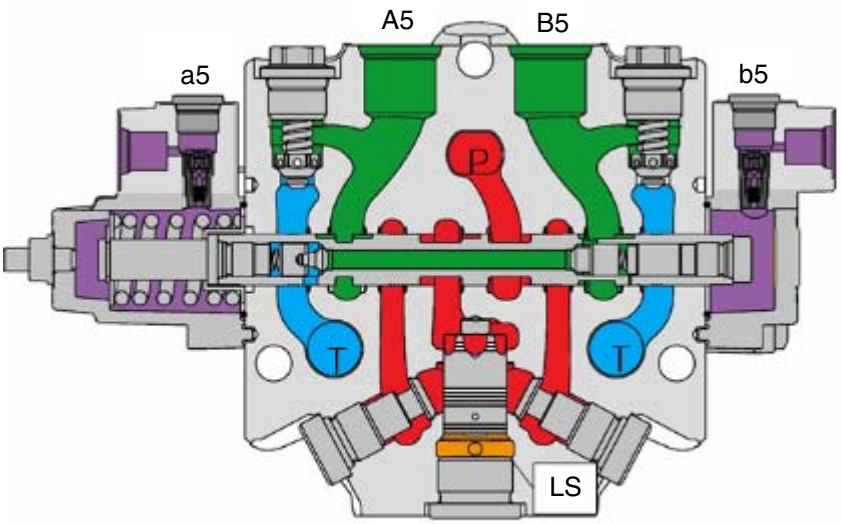


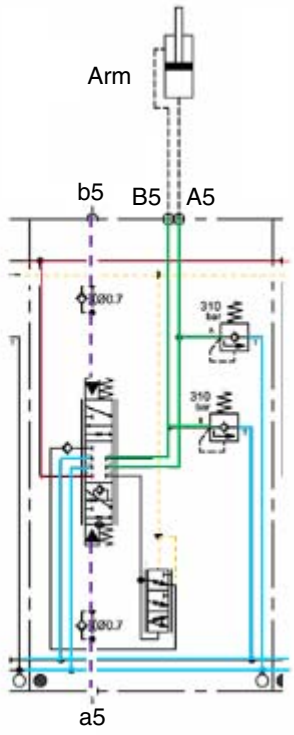
85A2MC25

When the pilot pressure is led to the port b4, the oil from the pump flows to the cylinder port B4 and oil from the cylinder flows into the tank through the cylinder port A4.

(4) Arm section description

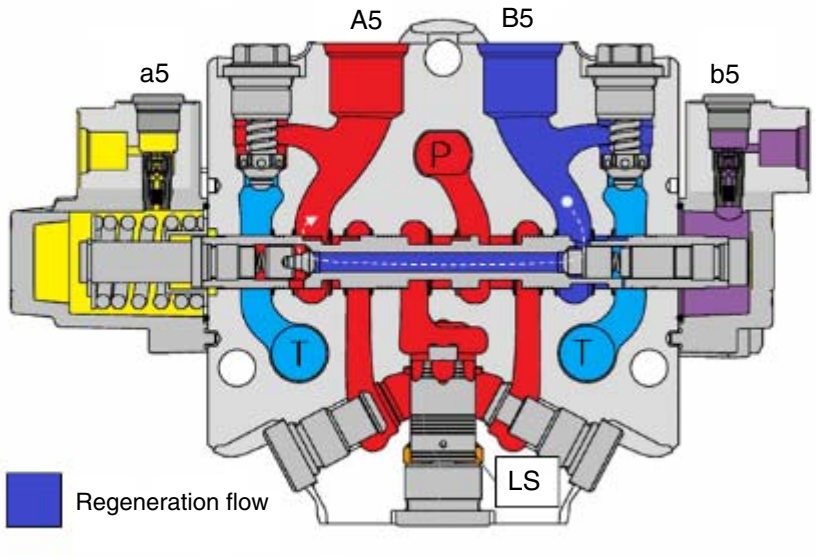
① Neutral position

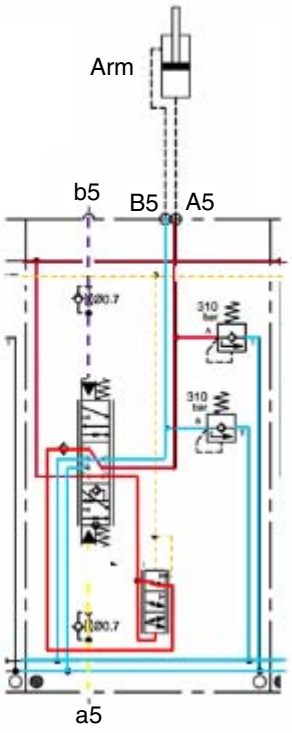




The spool is in neutral position, oil from the pump is blocked, pump is in low pressure stand-by. The A5 and B4 ports are not connected to the pump nor the tank.

② Arm roll in position

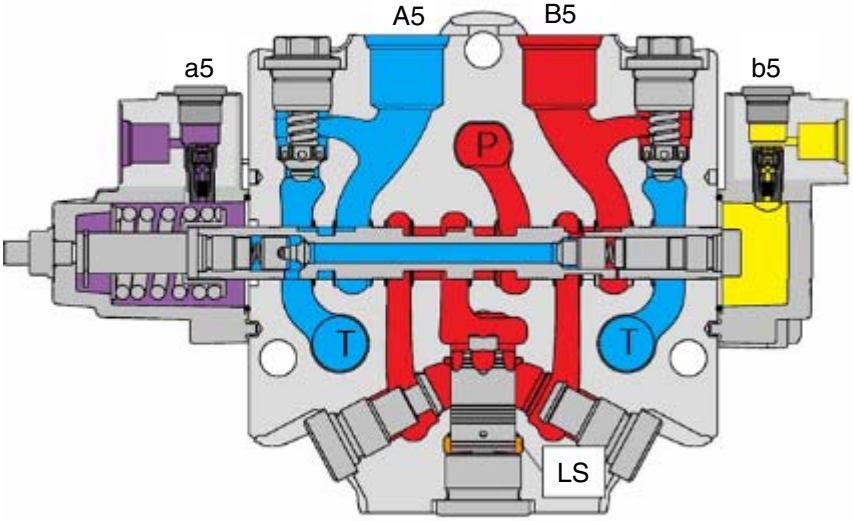


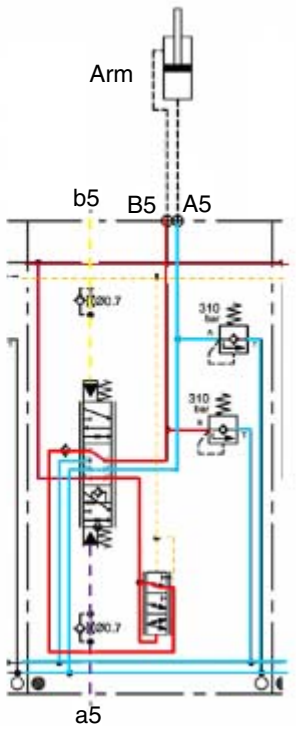


48AZ2MCV27

When the pilot pressure is led to the port a5, the oil from the pump flows to the cylinder port A5 and oil from the cylinder flows partially into the tank and partially trough regeneration path B to A through the cylinder port B5.

③ Arm roll out position



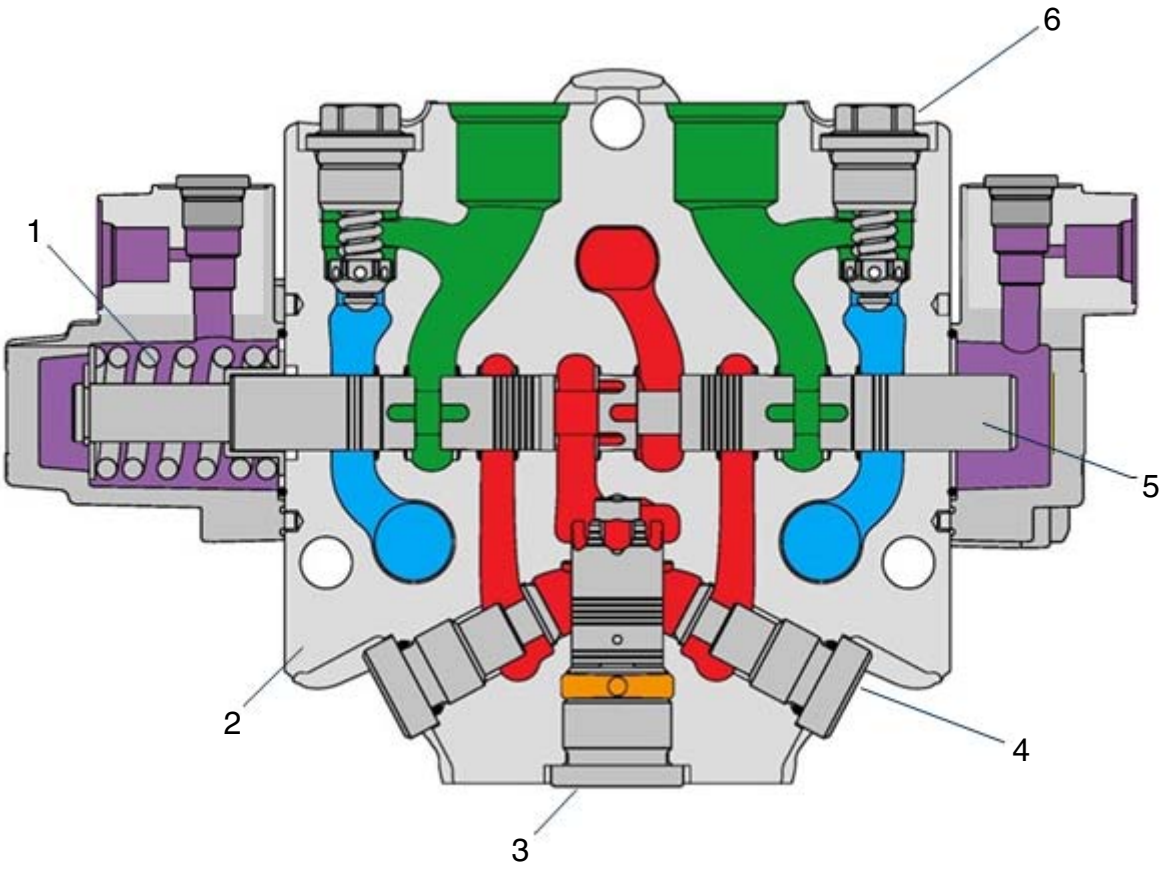


48AZ2MCV28

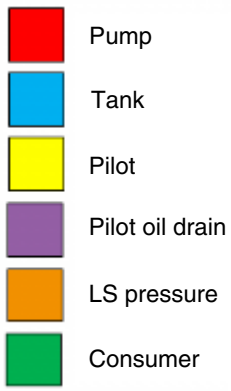
When the pilot pressure is led to the port b5, the oil from the pump flows to the cylinder port B5 and oil from the cylinder flows into the tank through the cylinder port A5.

4) BUCKET SECTION DESCRIPTION - SECTION 6

(1) Component description



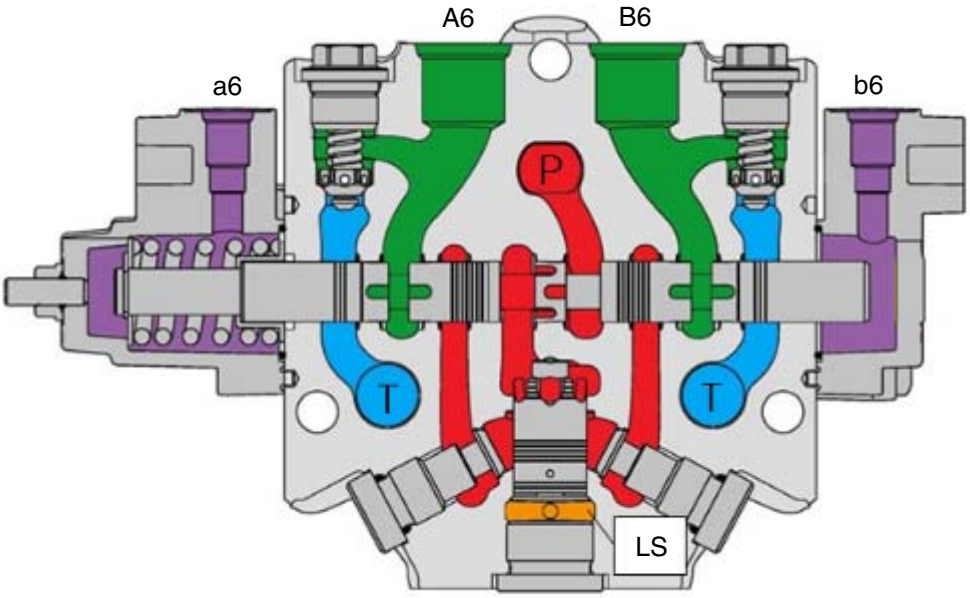
85A2MC29



85A2MC30

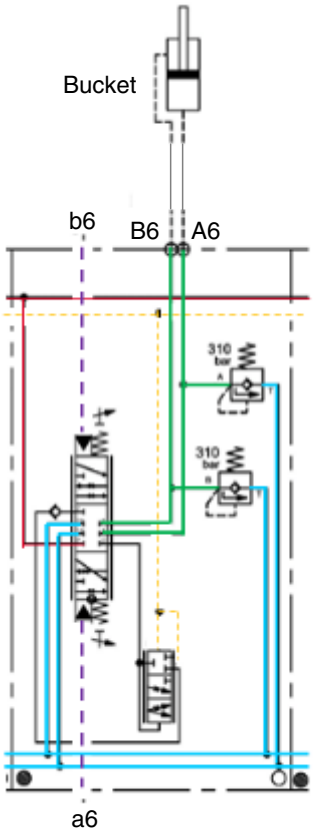
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
7 Overload relief valves

(2) Neutral position



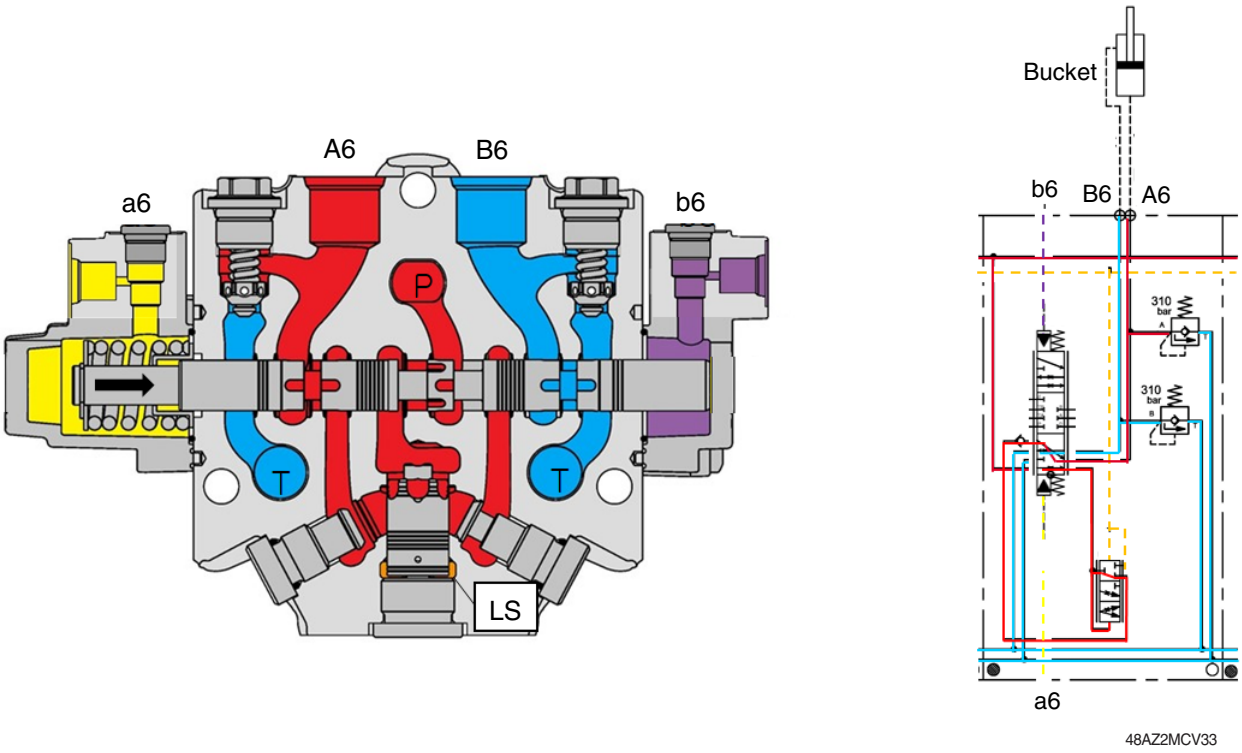
48AZ2MCV31

The spool is in neutral position, pump is in low pressure stand-by. The A6 and B6 ports are not connected to the pumps nor the tank.



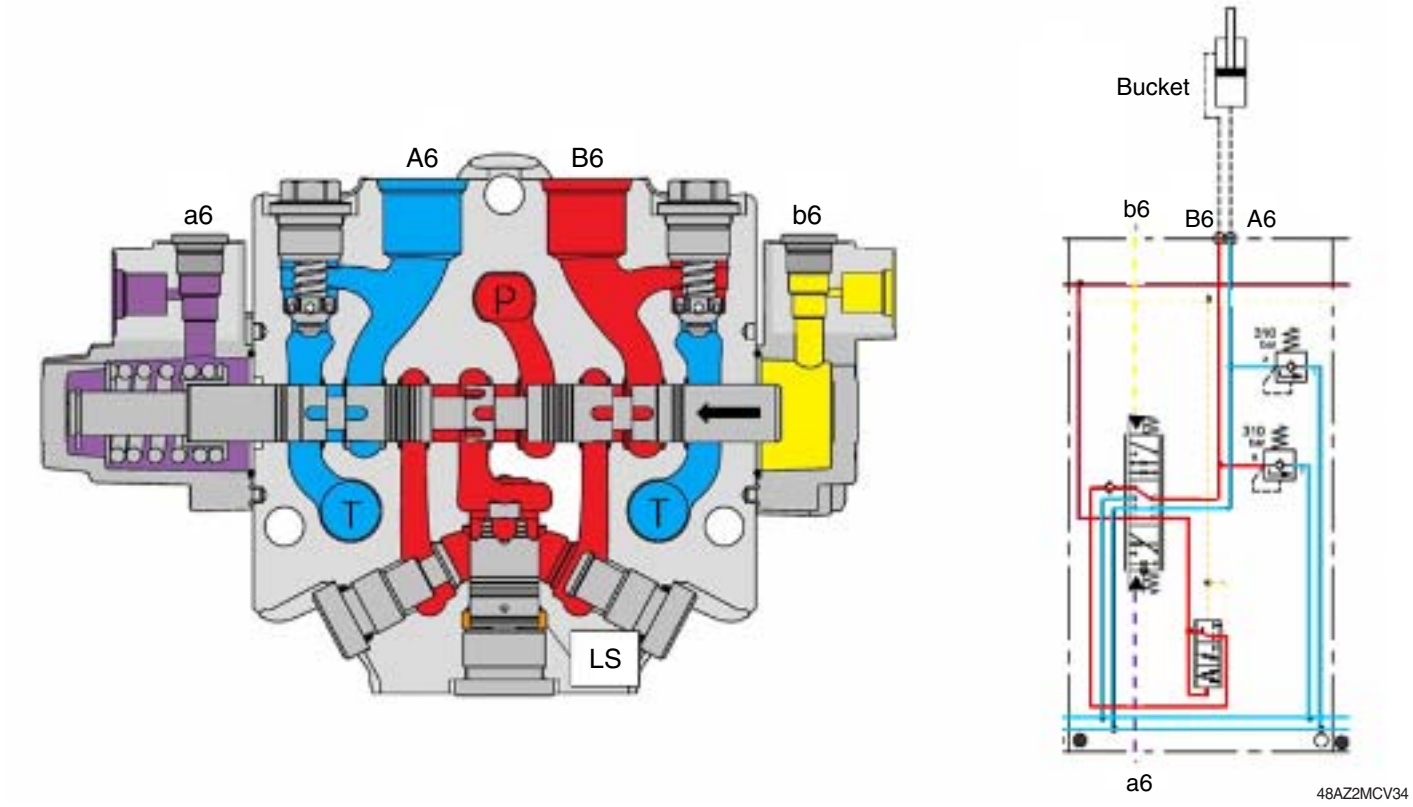
48AZ2MCV32

(3) Bucket roll in position



When the pilot pressure is led to the port a6, the oil from the pump flows to the cylinder port A6 and oil from the cylinder flows into the tank through the cylinder port B6.

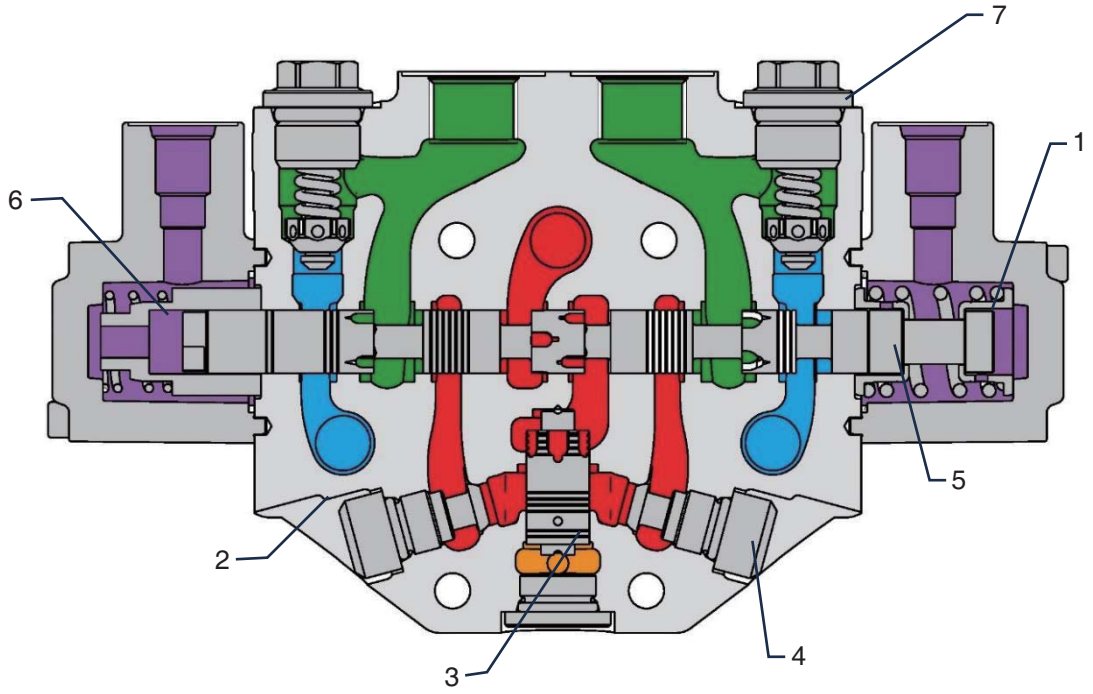
(4) Bucket roll out position



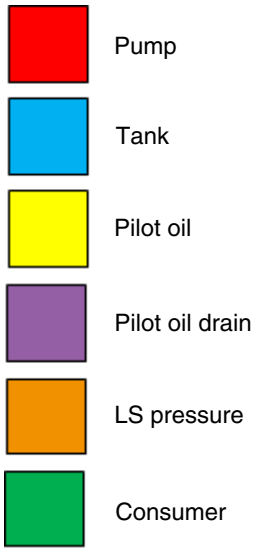
When the pilot pressure is led to the port b6, the oil from the pump flows to the cylinder port B6 and oil from the cylinder flows into the tank through the cylinder port A6.

5) DOZER SECTION DESCRIPTION - SECTION 7

(1) Component description



85A2MC35

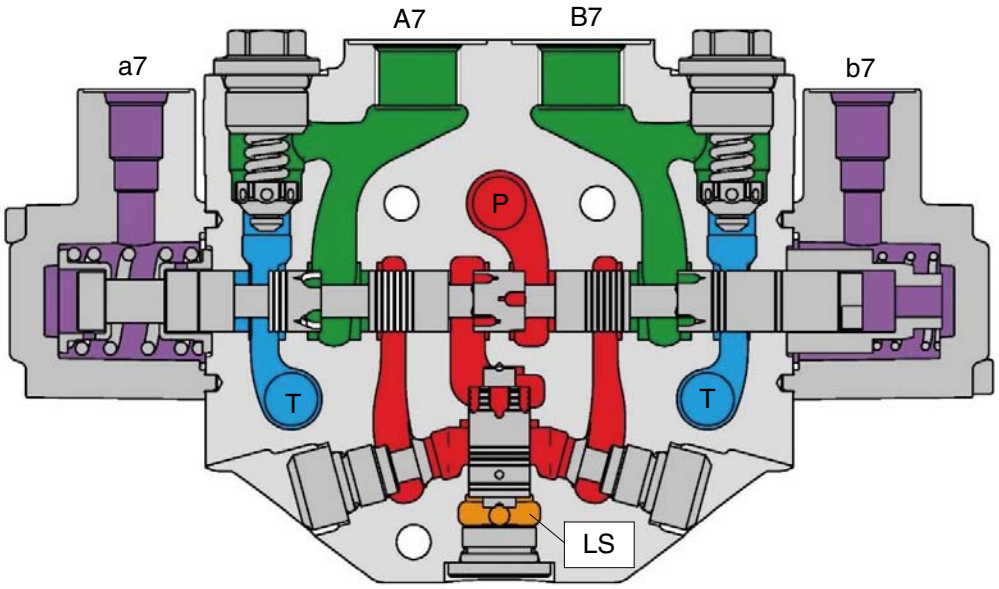


48AA2MC43

1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Fourth position spring pack
7 Relief valves

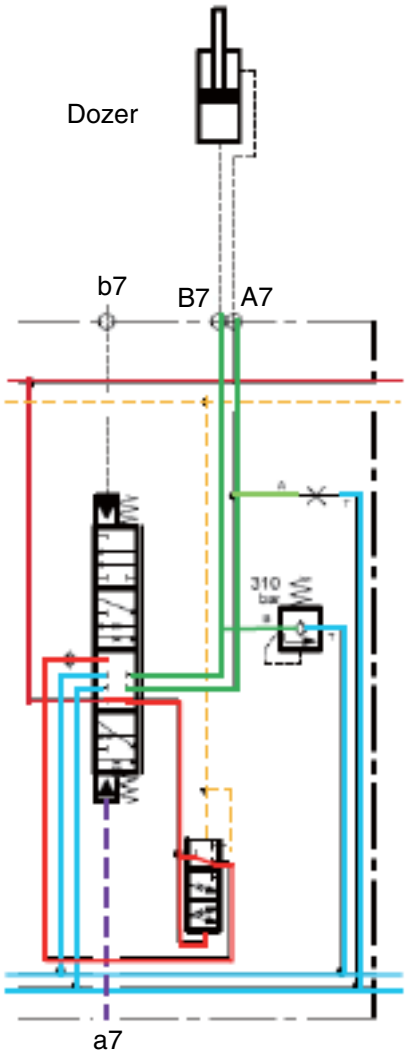
※ This particular slide has a four position spool: neutral, PABT, PBAT and floating position.

(2) Neutral position



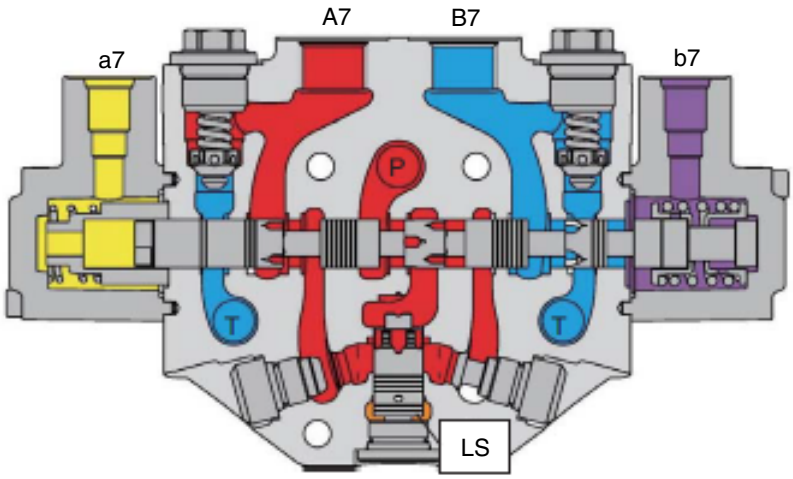
48AZ2MCV37

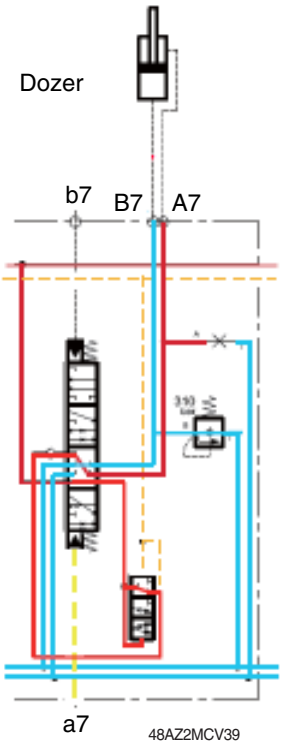
The spool is in neutral position, oil from the pump is not connected to the A7 or to the B7 ports. Pump is in low pressure stand-by.



48AZ2MCV38

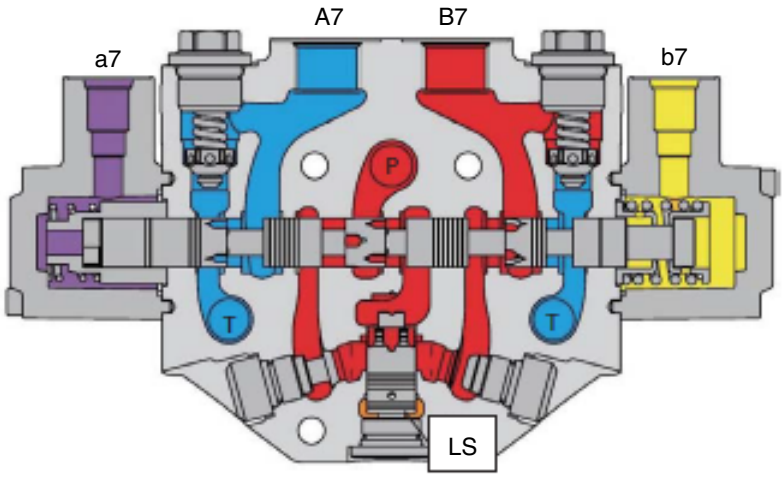
(3) PABT position (dozer up)

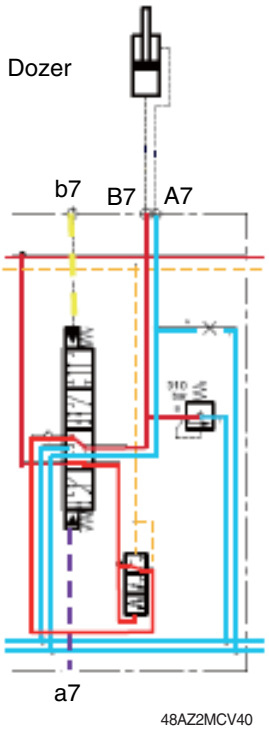




When the pilot pressure is led to the port a7, the oil from the pump flows to the cylinder port A7 and oil from the cylinder flows into the tank through the cylinder port B7.

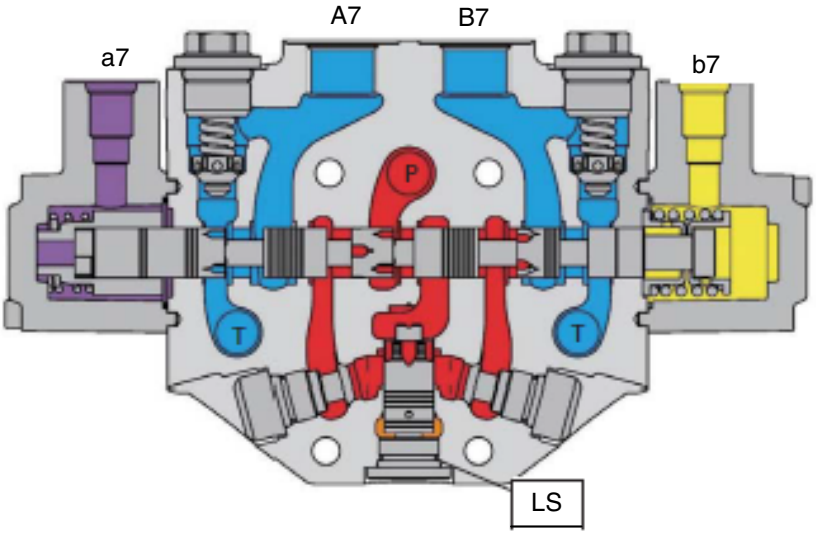
(4) PBAT position (dozer down)

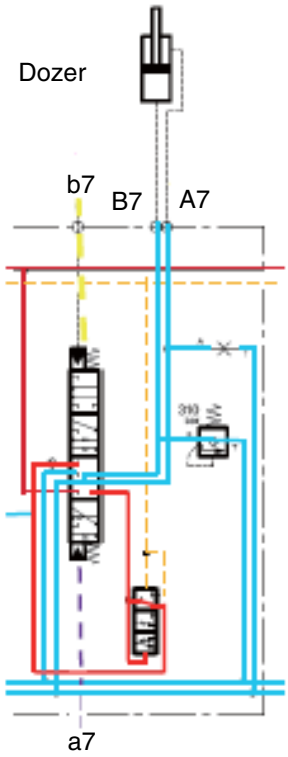




When the pilot pressure is led to the port b7, the oil from the pump flows to the cylinder port B7 and oil from the cylinder flows into the tank through the cylinder port A7.

(5) Floating position

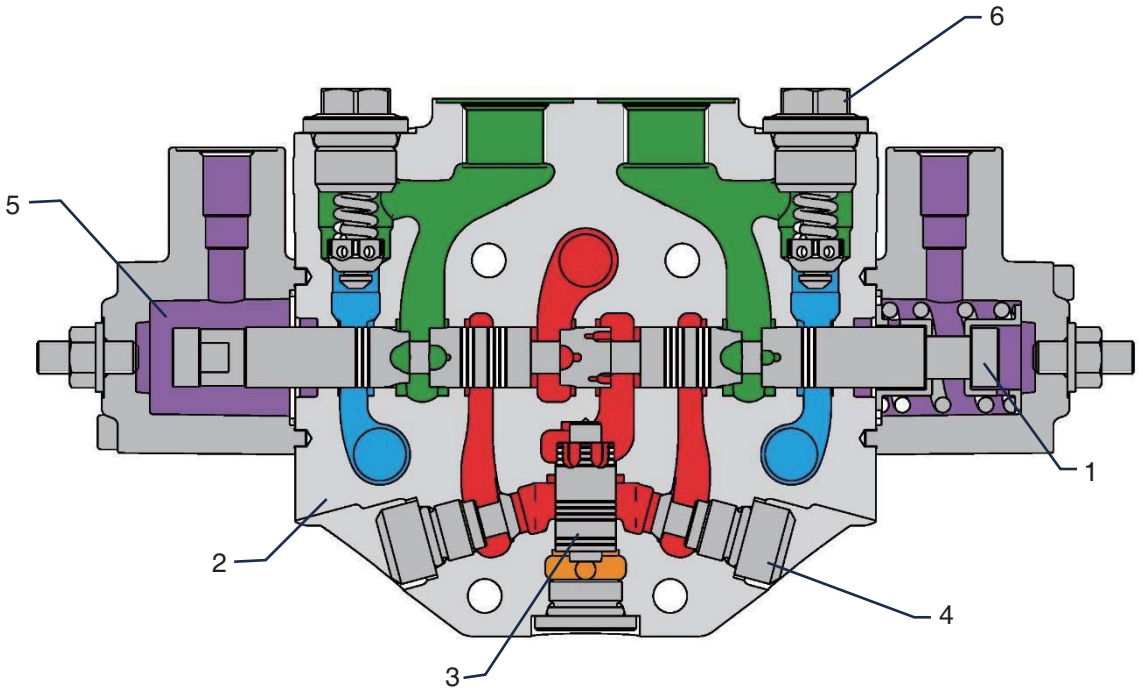




When the pilot pressure is led to the port b6 to maximal pressure, the spool is in the forth position, floating. The pump is in low pressure stand-by while A7 and B7 are connected to tank.

6) SLICES DESCRIPTION 8 : BOOM SWING

(1) Component description



85A2MC42

Pump

Tank

Pilot oil

Pilot oil drain

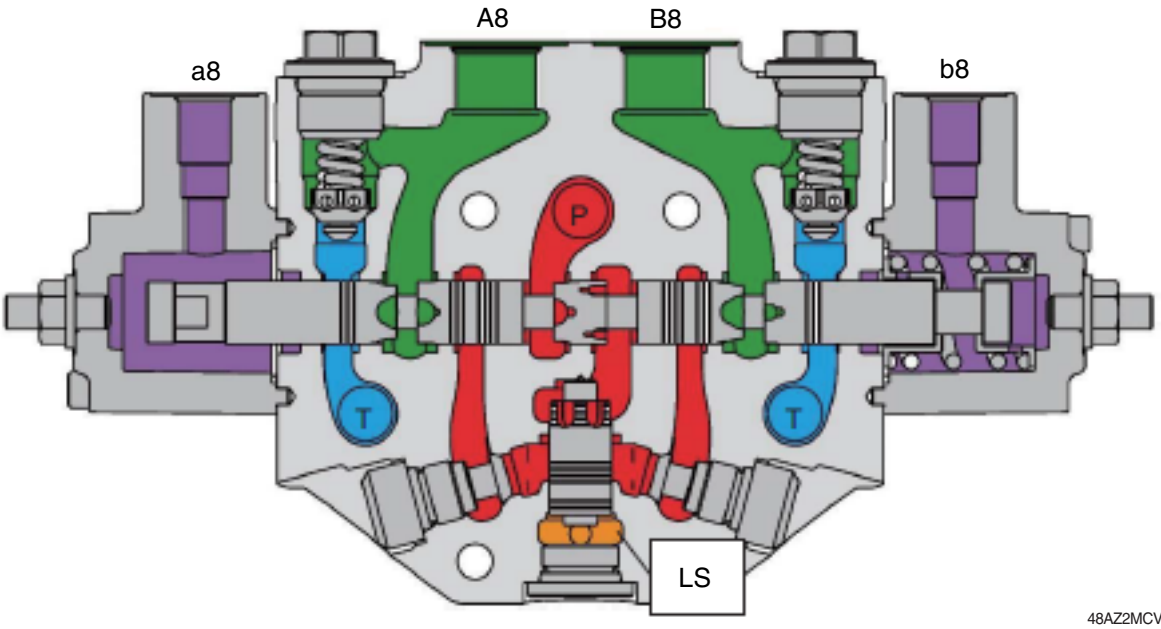
LS pressure

Consumer

48AA2MC43

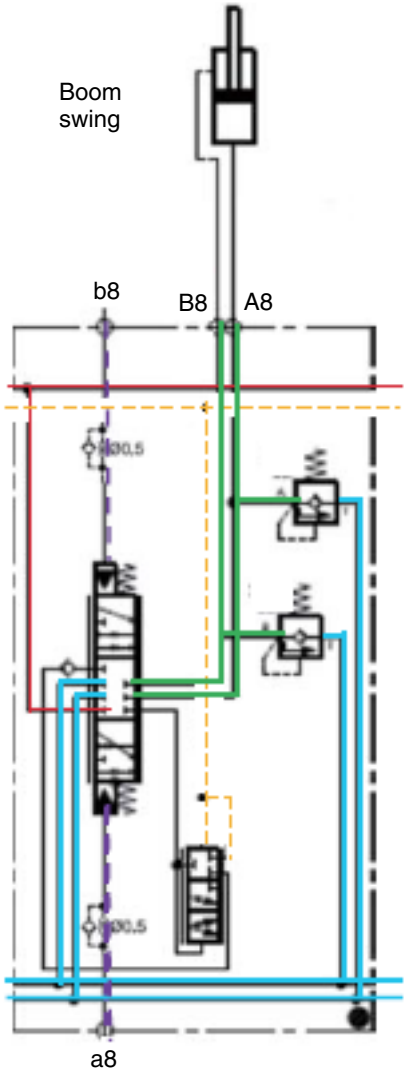
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Relief valves

(2) Neutral position



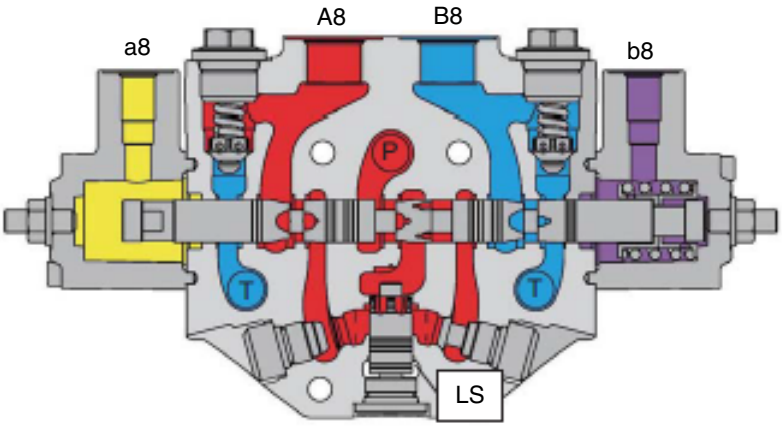
48AZ2MCV44

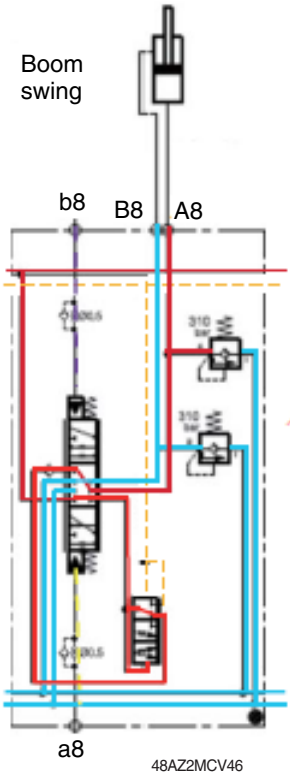
The spool is in neutral position, pump is in low pressure stand-by. The A8 and B8 ports are not connected to the pumps nor the tank.



48AZ2MCV45

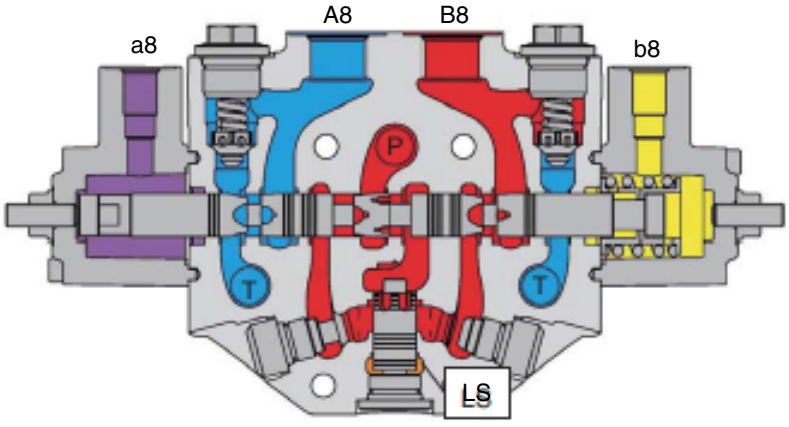
(3) PABT position

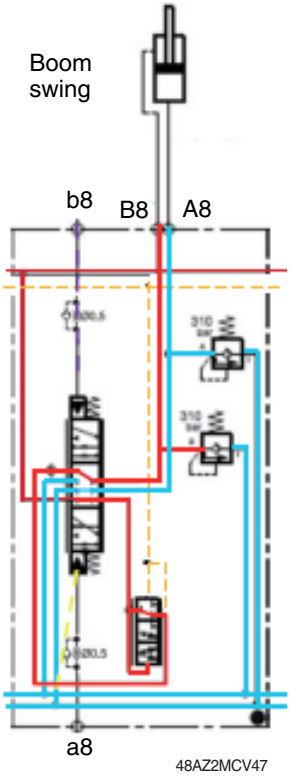




When the pilot pressure is led to the port a7, the oil from the pump flows to the cylinder port A7 and oil from the cylinder flows into the tank through the cylinder port B7.

(4) PBAT position

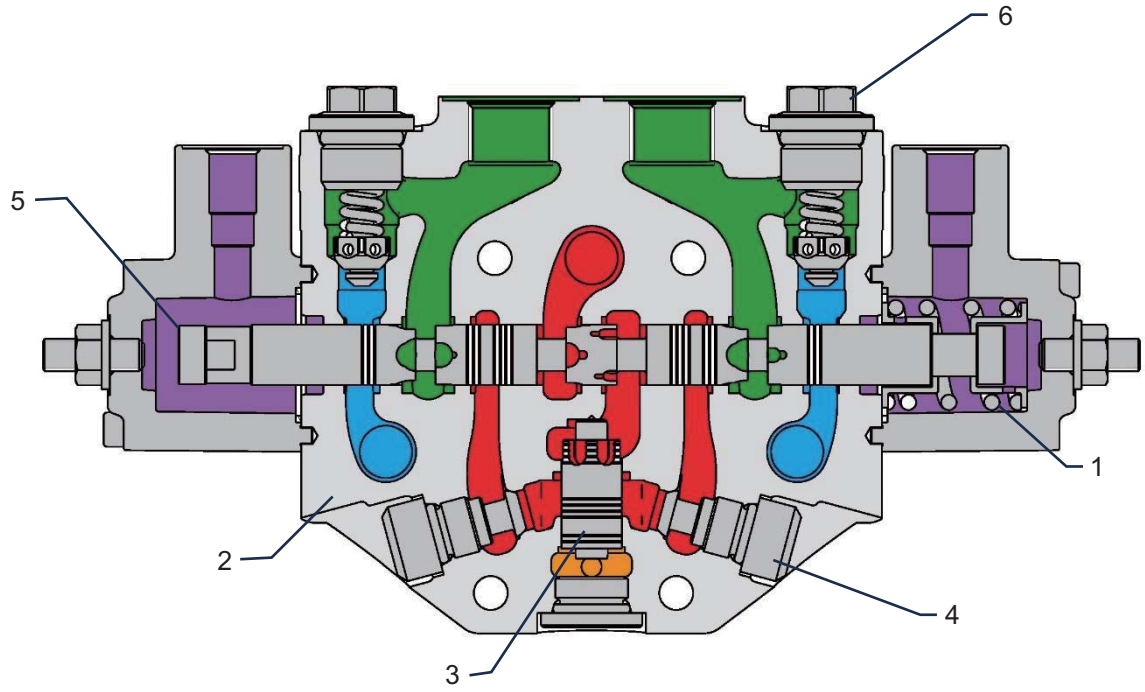




When the pilot pressure is led to the port b7, the oil from the pump flows to the cylinder port B7 and oil from the cylinder flows into the tank through the cylinder port A7.

7) SLICES DESCRIPTION 9 : AUX 1

(1) Component description



85A2MC48

Pump

Tank

Pilot oil

Pilot oil drain

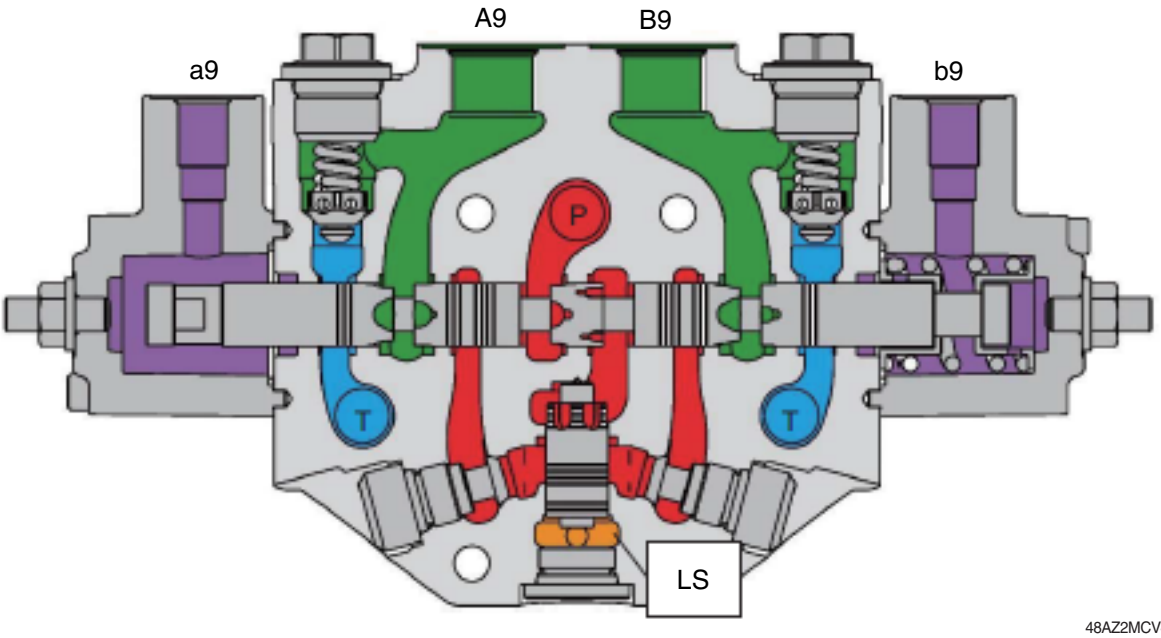
LS pressure

Consumer

1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Relief valves

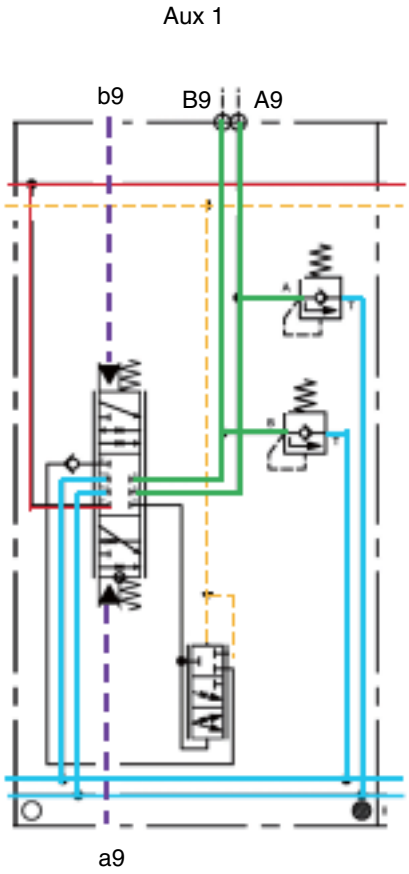
48AA2MC43

(2) Neutral position



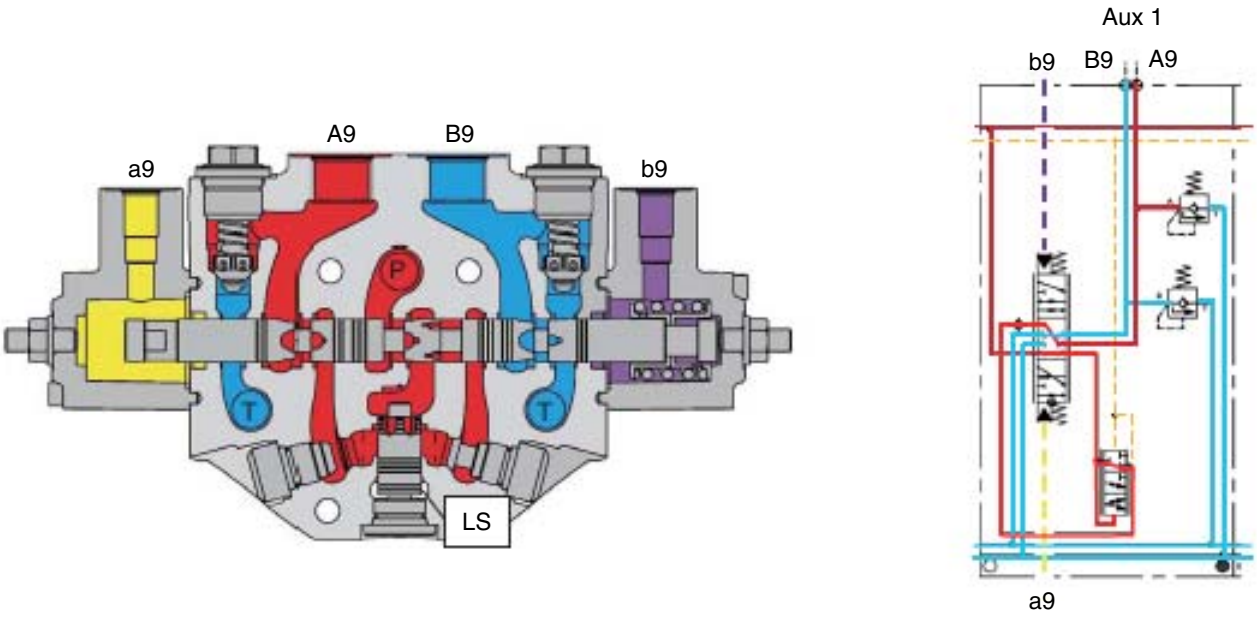
48AZ2MCV49

The spool is in neutral position, pump is in low pressure stand-by. The A9 and B9 ports are not connected to the pumps nor the tank.



48AZ2MCV50

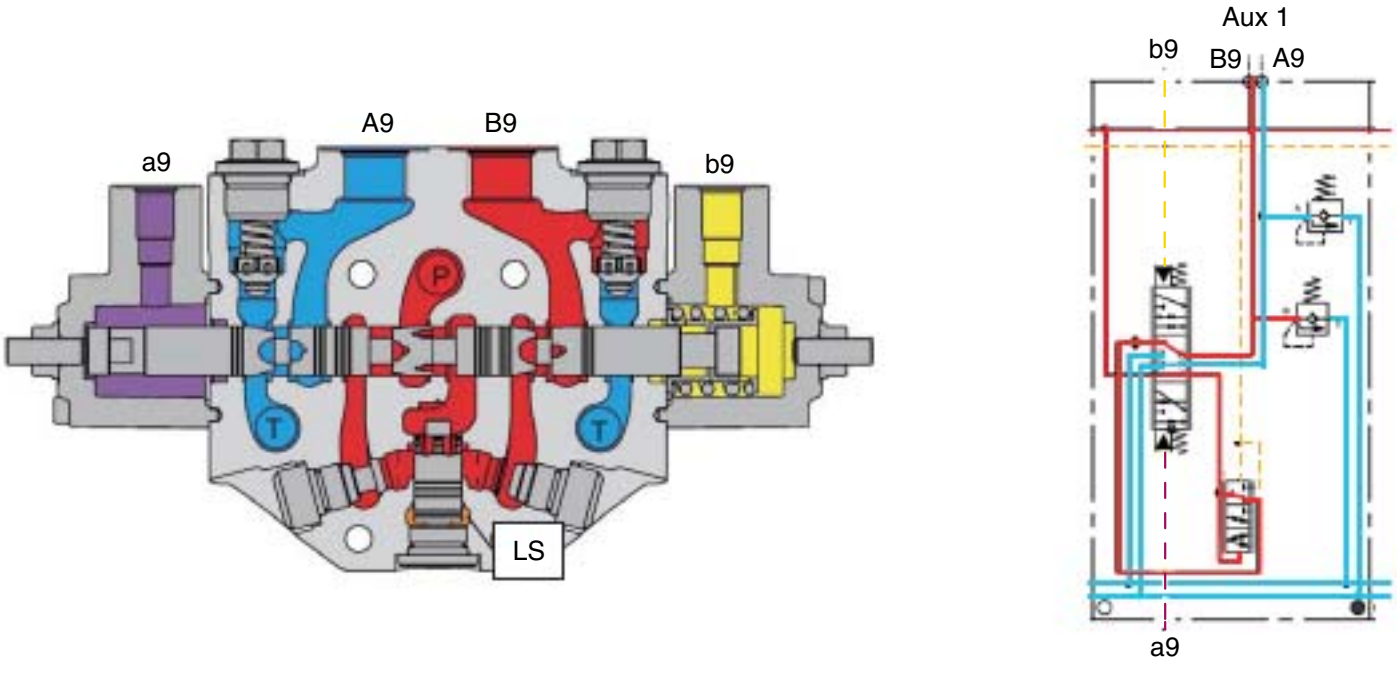
(3) PABT position



48AZ2MCV51

When the pilot pressure is led to the port a9, the oil from the pump flows to the cylinder port A9 and oil from the cylinder flows into the tank through the cylinder port B9.

(4) PBAT position

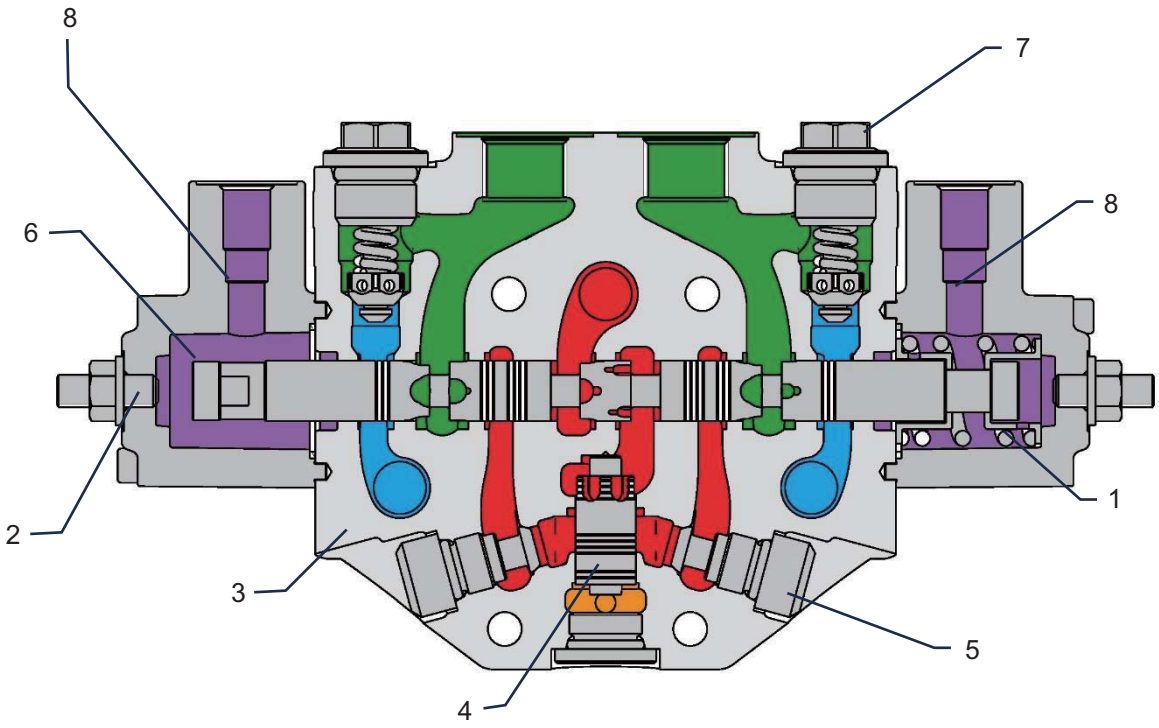


48AZ2MCV52

When the pilot pressure is led to the port b9, the oil from the pump flows to the cylinder port B9 and oil from the cylinder flows into the tank through the cylinder port A9.

8) SWING SLICE DESCRIPTION

(1) Component description



85A2MC53

Pump

Tank

Pilot oil

Pilot oil drain

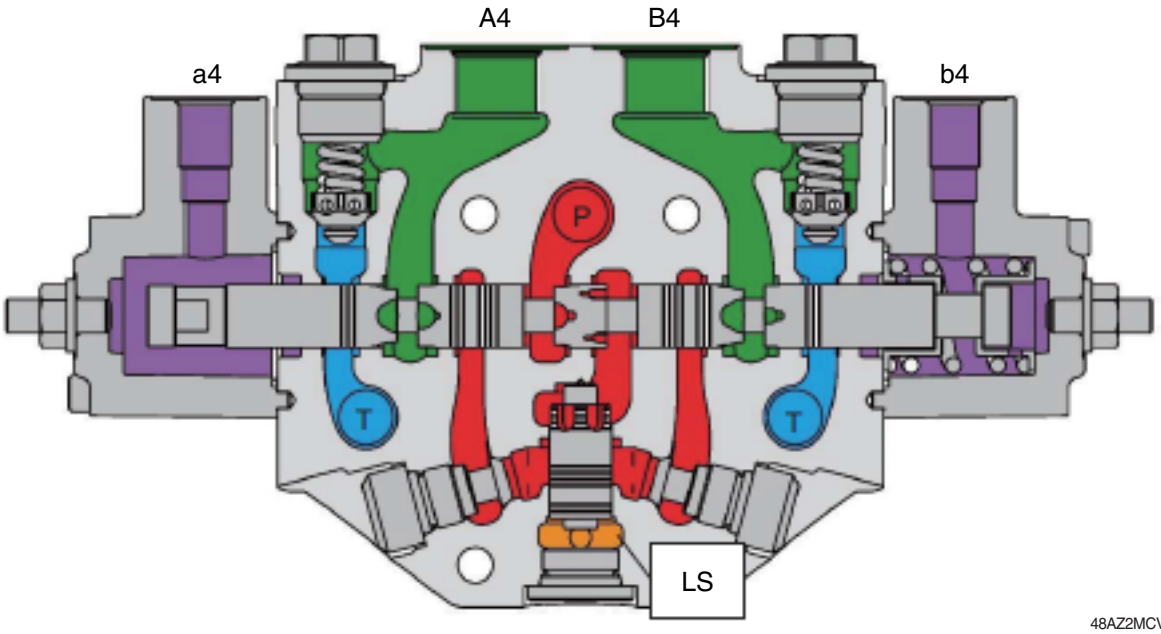
LS pressure

Consumer

1 Spring pack
2 Stroke limitation device
3 Housing
4 Pressure compensator
5 Check valves
6 Spool
7 Plug
8 Snubbers

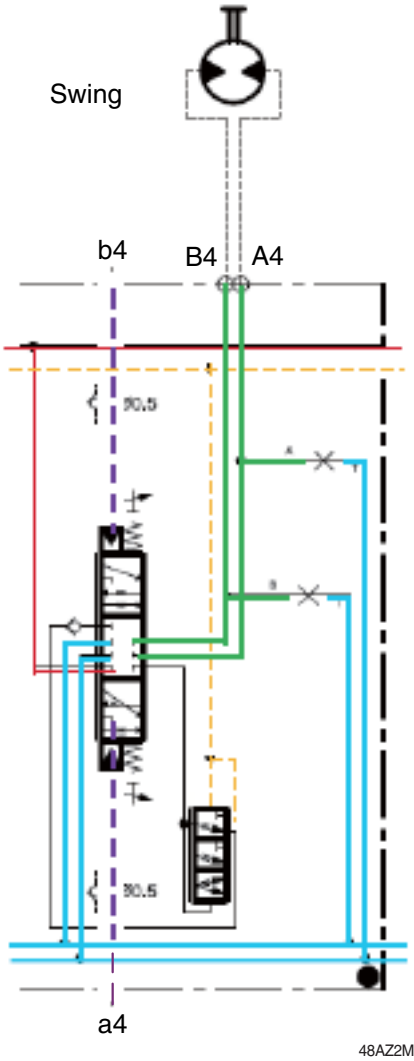
48AA2MC43

(2) Neutral position



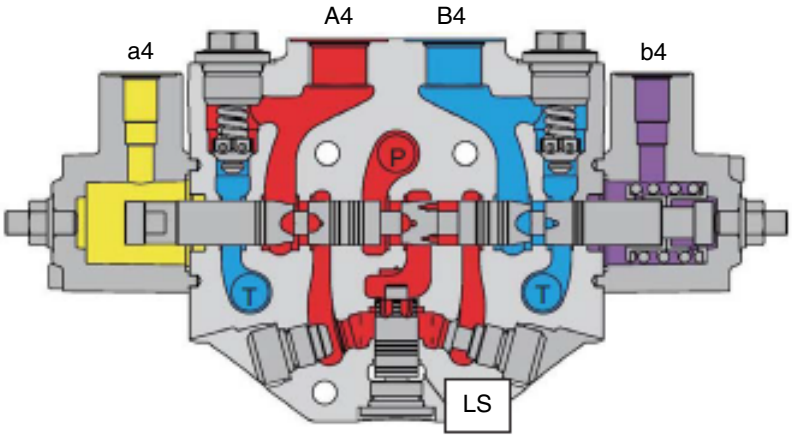
48AZ2MCV54

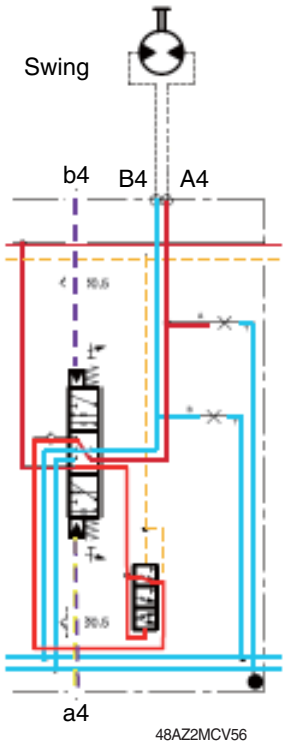
The spool is in neutral position, pump is in low pressure stand-by. The A4 and B4 ports are not connected to the pumps nor the tank. This slice is equipped with spool stroke limiters



48AZ2MCV55

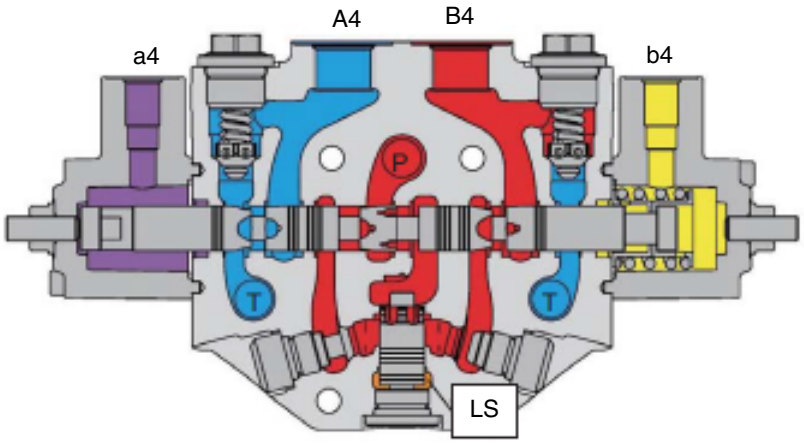
(3) PABT position

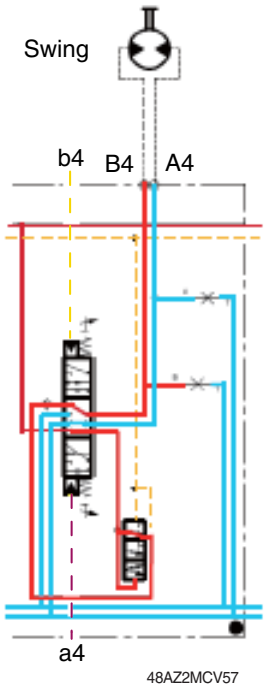




When the pilot pressure is led to the port a4, the oil from the pump flows to the motor port A4 and oil from the cylinder flows into the tank through the motor B4.

(4) PBAT position





When the pilot pressure is led to the port b4, the oil from the pump flows to the motor port B4 and oil from the cylinder flows into the tank through the motor port A4.

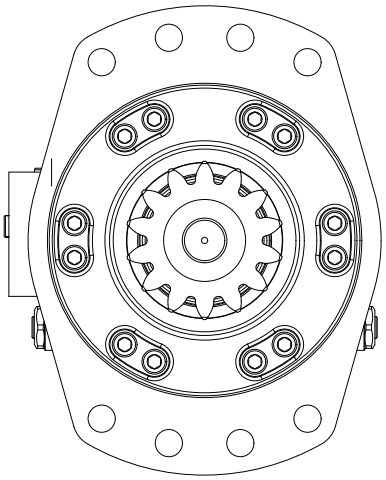
GROUP 3 SWING DEVICE

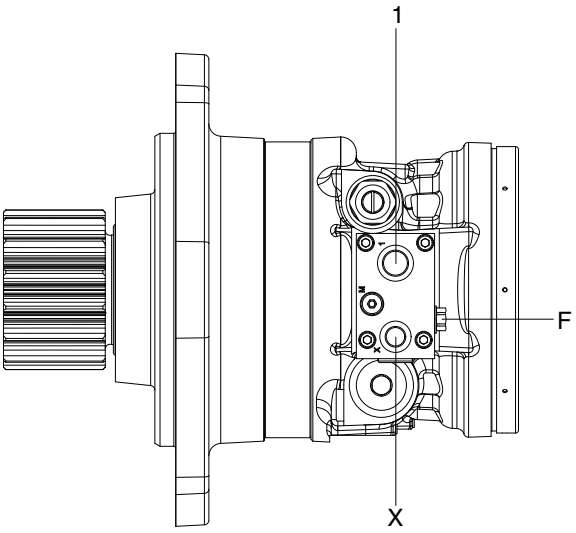
1. STRUCTURE

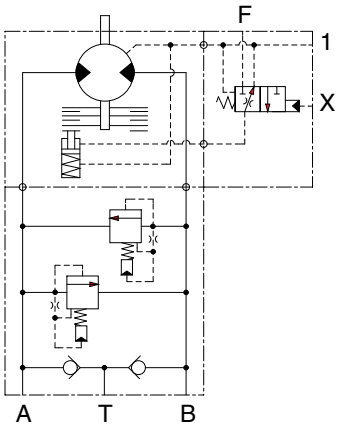
Swing device consists swing motor and swing reduction gear.

1) SWING MOTOR

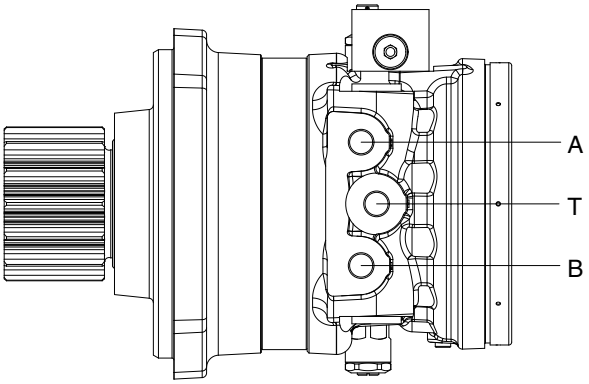
Swing motor include mechanical parking valve, relief valve and make up valve.







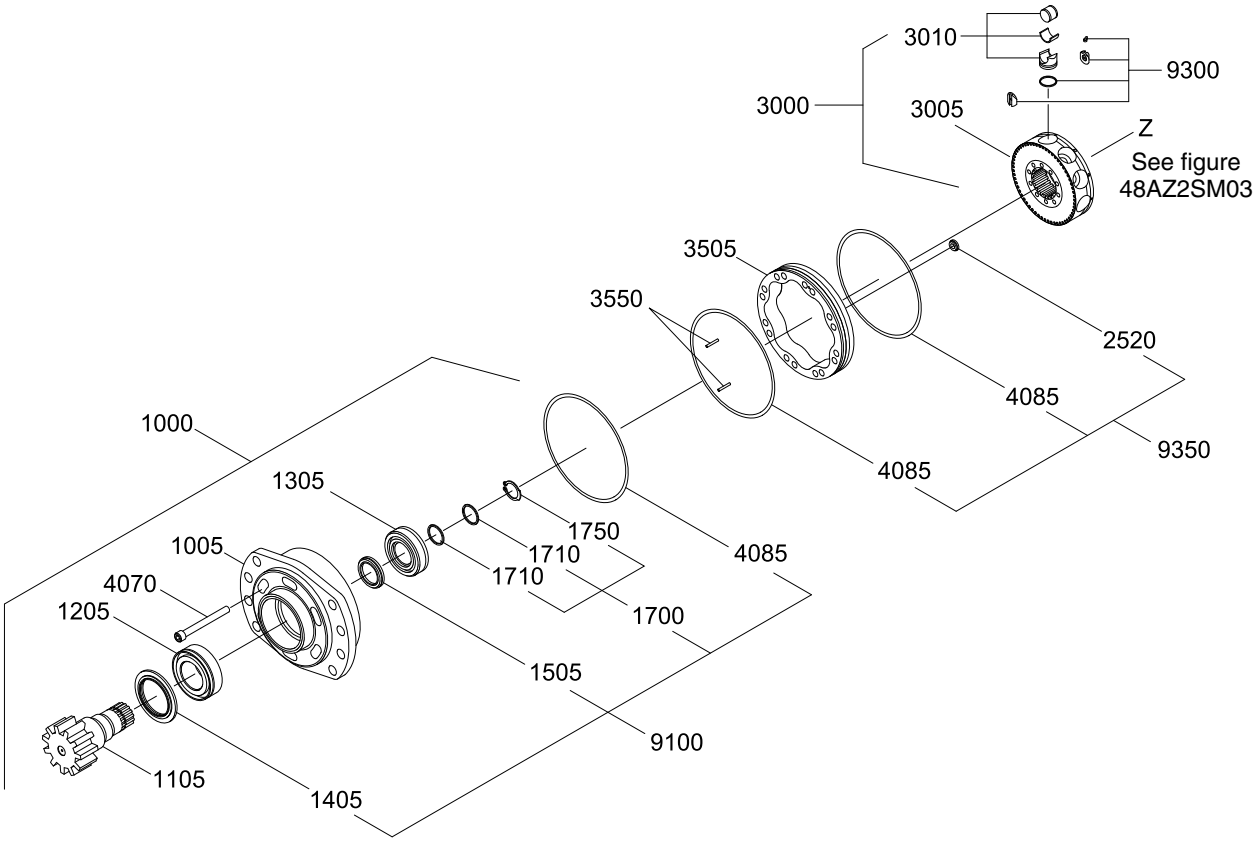
Hydraulic circuit



48AZ2SM01

Port	Port name	Port size
A	Main port	PF 3/8
B	Main port	PF 3/8
1	Drain port	PF 3/8
X	Pilot port	PF 1/4
T	Make up port	PF 3/8
F	Brake release port	PF 1/4

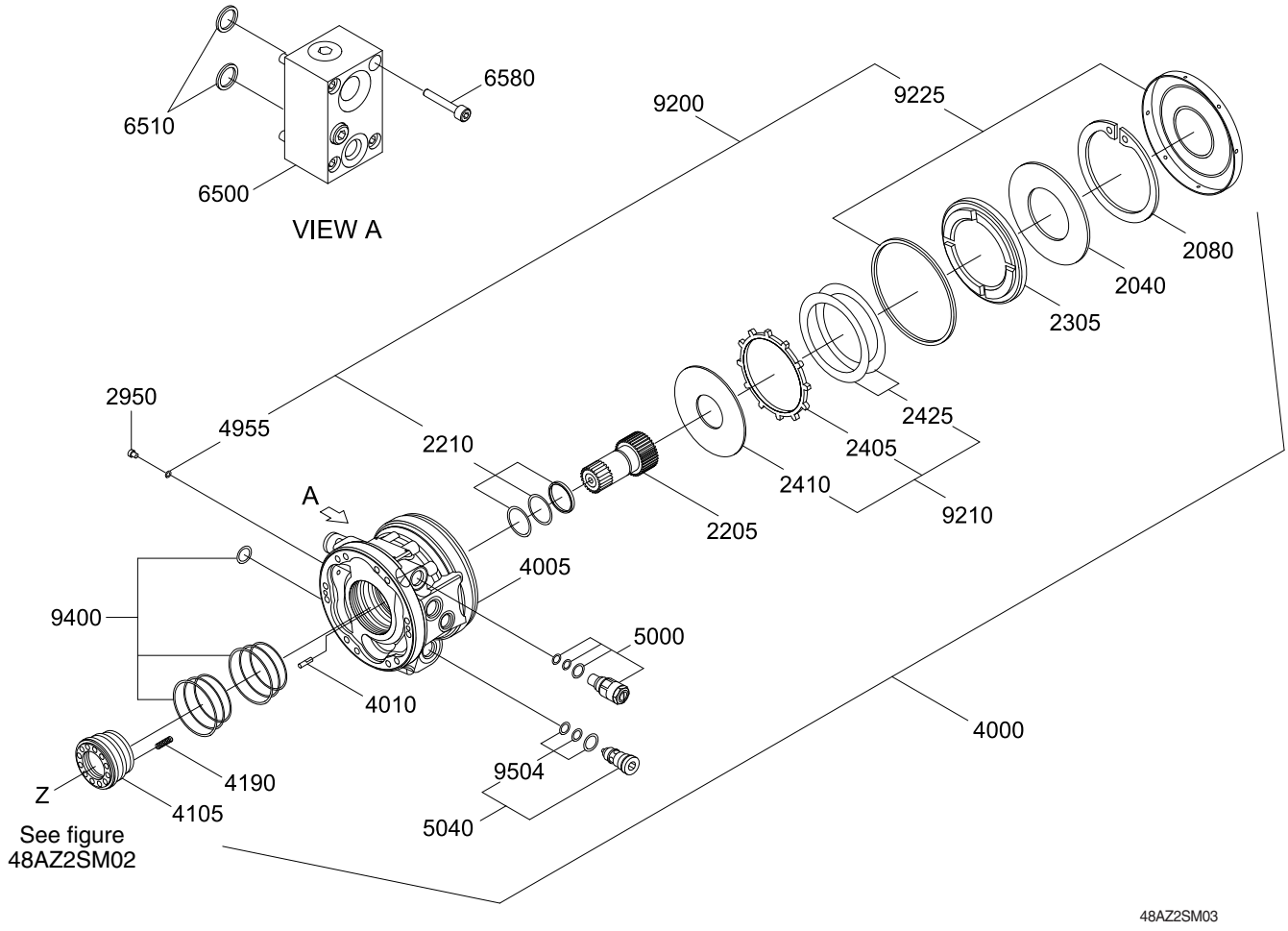
2) COMPONENTS (1/2)



48AZ2SM02

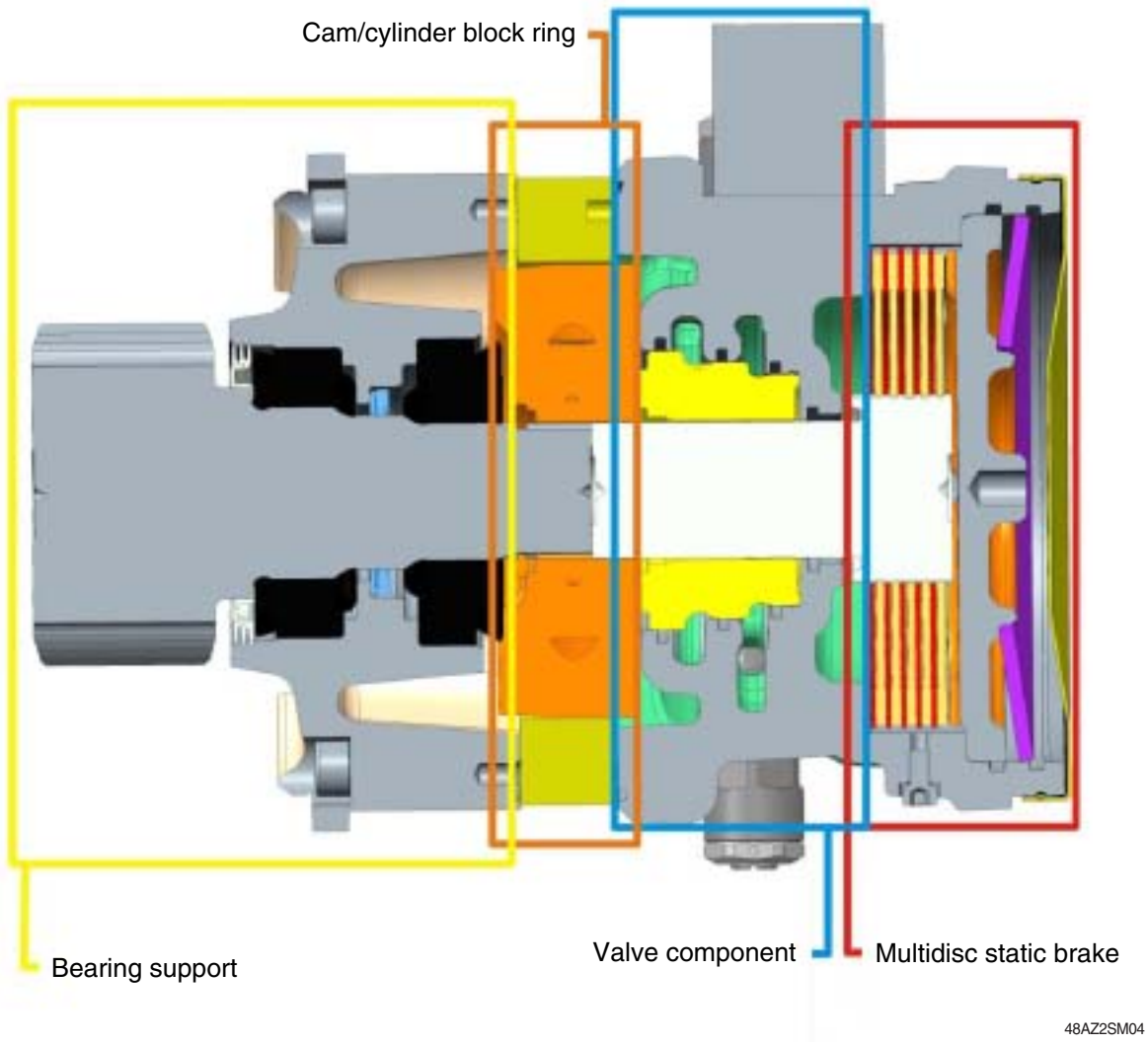
1000	Bearing support assy	1700	Shim kit	3505	Cam ring
1005	Support	1710	Shim	3550	Spring pin
1105	Shaft	1750	Snap ring	4070	Screw
1205	Taper roller bearing	2520	Plug	4085	O-ring
1305	Taper roller bearing	3000	Cylinder block assy	9100	Seal kit
1405	Seal ring	3005	Block	9300	Piston service kit
1505	Oil seal	3010	Piston kit	9350	Seal kit

COMPONENTS (2/2)



2040	Spring washer	4000	Brake valve housing assy	6500	Brake valve
2080	Snap ring	4005	Housing	6510	O-ring
2205	Brake shaft	4010	Roll pin	6580	Screw
2210	Seal kit	4105	Brake valve	9200	Brake service kit
2305	Brake piston	4190	Spring	9210	Brake service kit
2405	External disc	4955	O-ring	9225	Brake cover kit
2410	Internal disc	5000	Release valve	9400	Seal kit
2425	Shim kit	5040	Check valve	9504	Seal kit
2950	Screw				

2. MAJOR PARTS

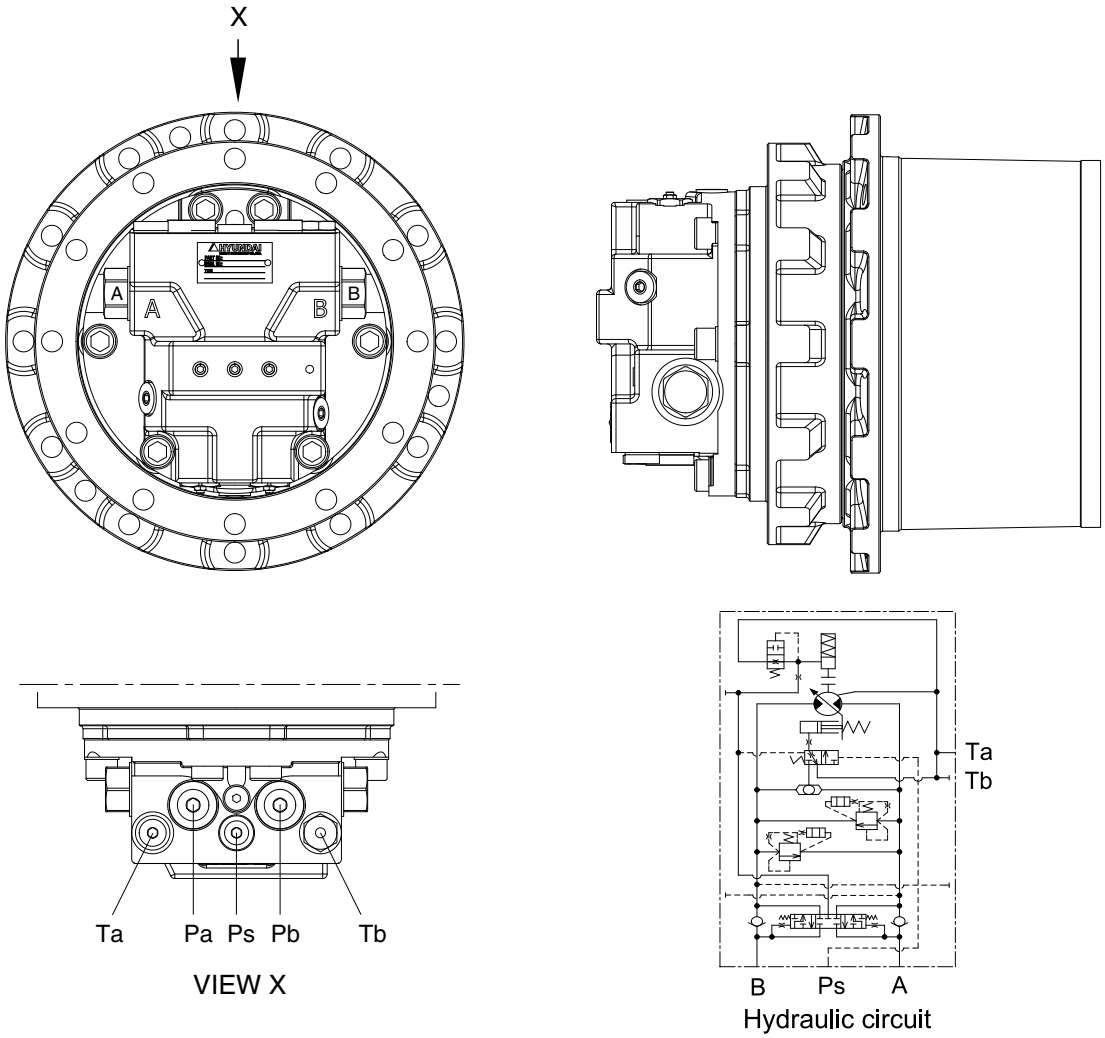


GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

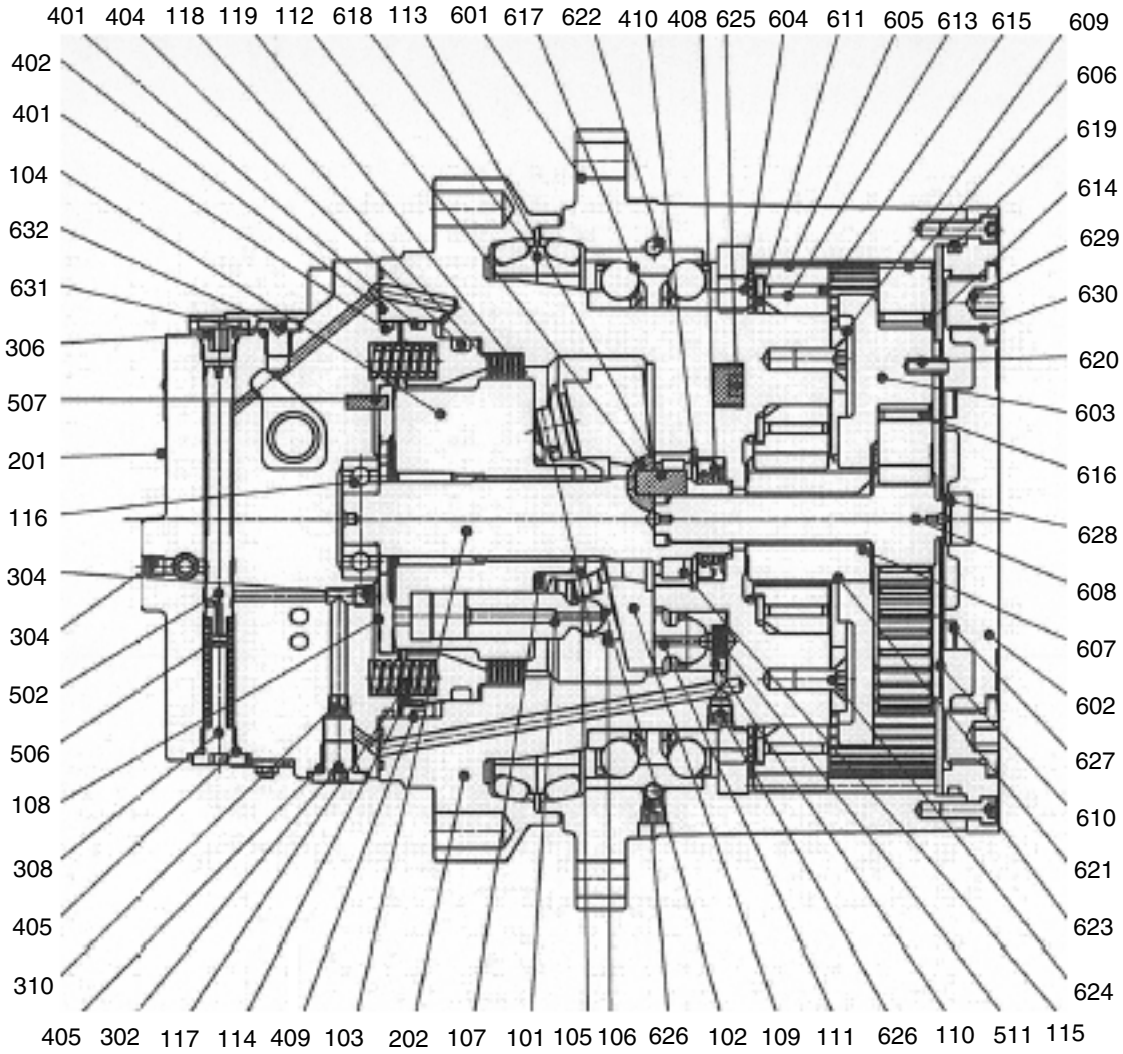
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.



48AZ2TM01

Port	Port name	Port size
Pa	Main port	PF 1/2
Pb	Main port	PF 1/2
a1, a2	Gauge port	PT 1/4
Ta, Tb	Drain port	PF 3/8
Ps	2 speed control port	PF 1/4

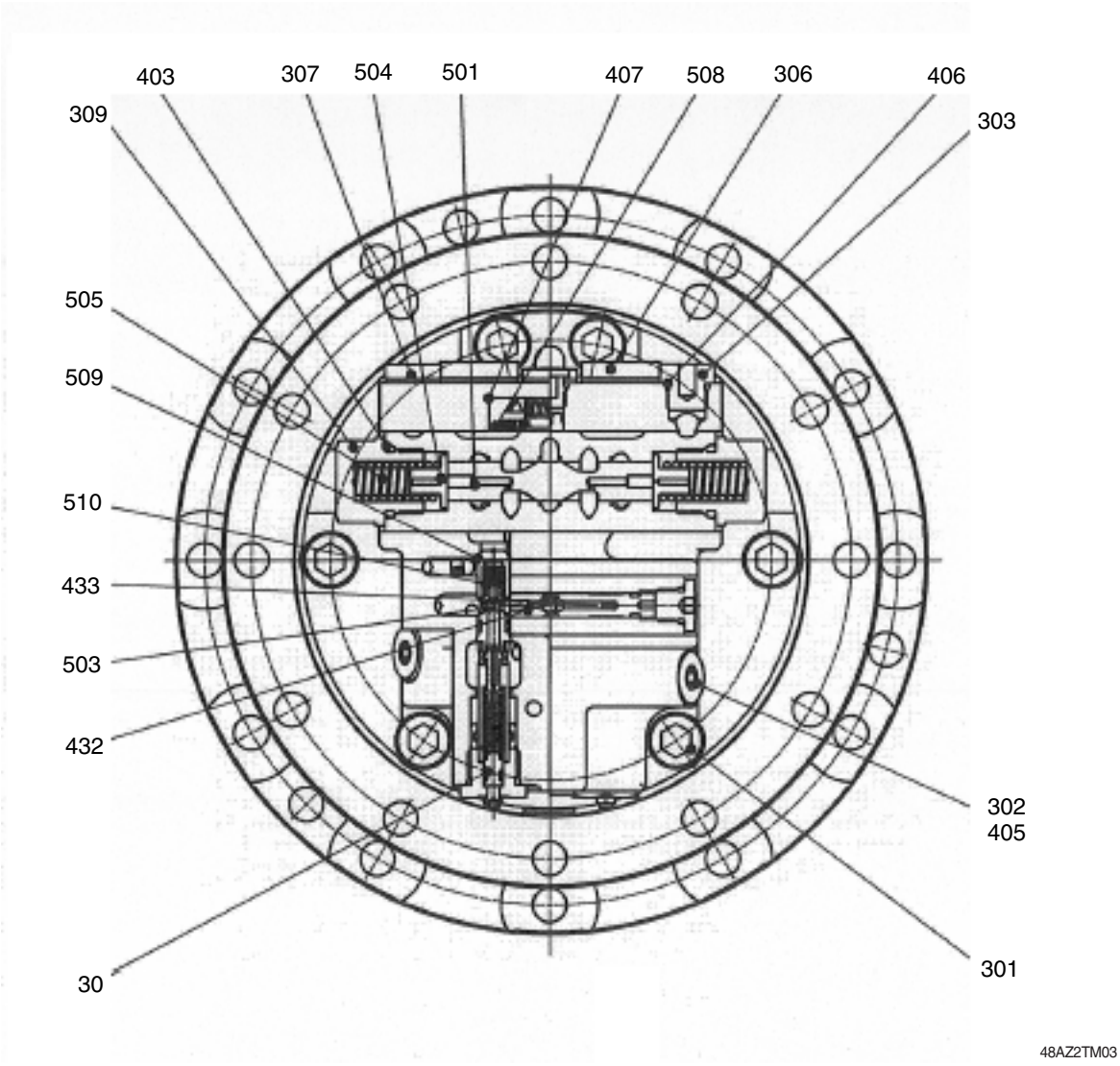
1) STRUCTURE (1/2)



48AZ2TM02

101	Piston	118	Friction plate	506	Spring	616	Needle bearing
102	Shoe	119	Separator plate	507	Spring pin	617	Angular bearing
103	Drive shaft	137	O-ring	511	Spring	618	Floating seal kit
104	Cylinder block	201	Valve casing	601	Housing	619	O-ring
105	Spherical bushing	202	Casing	602	Cover	620	Spring pin
106	Set plate	302	Plug	603	Holder	621	Snap ring
107	Cylinder spring	304	NPTF plug	604	Ring nut	622	Steel ball
108	Valve plate	305	Dust plug	605	Planetary gear F	623	Socket bolt
109	Swash plate	308	2 speed plug	606	Planetary gear R	624	Bolt
110	Swash piston	310	Restrictor	607	Sun gear	625	Plug
111	Swash shoe	401	O-ring	608	Ring nut	626	Plug
112	Pivot	402	O-ring	609	Thrust plate F	627	Side plate A
113	Pivot pin	404	O-ring	610	Thrust plate R	628	Side plate B
114	Brake piston	408	Oil seal	611	Thrust washer	629	Plug
115	Roller bearing	409	Back up ring	613	Collar	630	O-ring
116	Ball bearing	410	Snap ring	614	Inner race	631	O-ring
117	Brake spring	502	2 speed spool	615	Needle bearing	632	Plug

STRUCTURE (2/2)

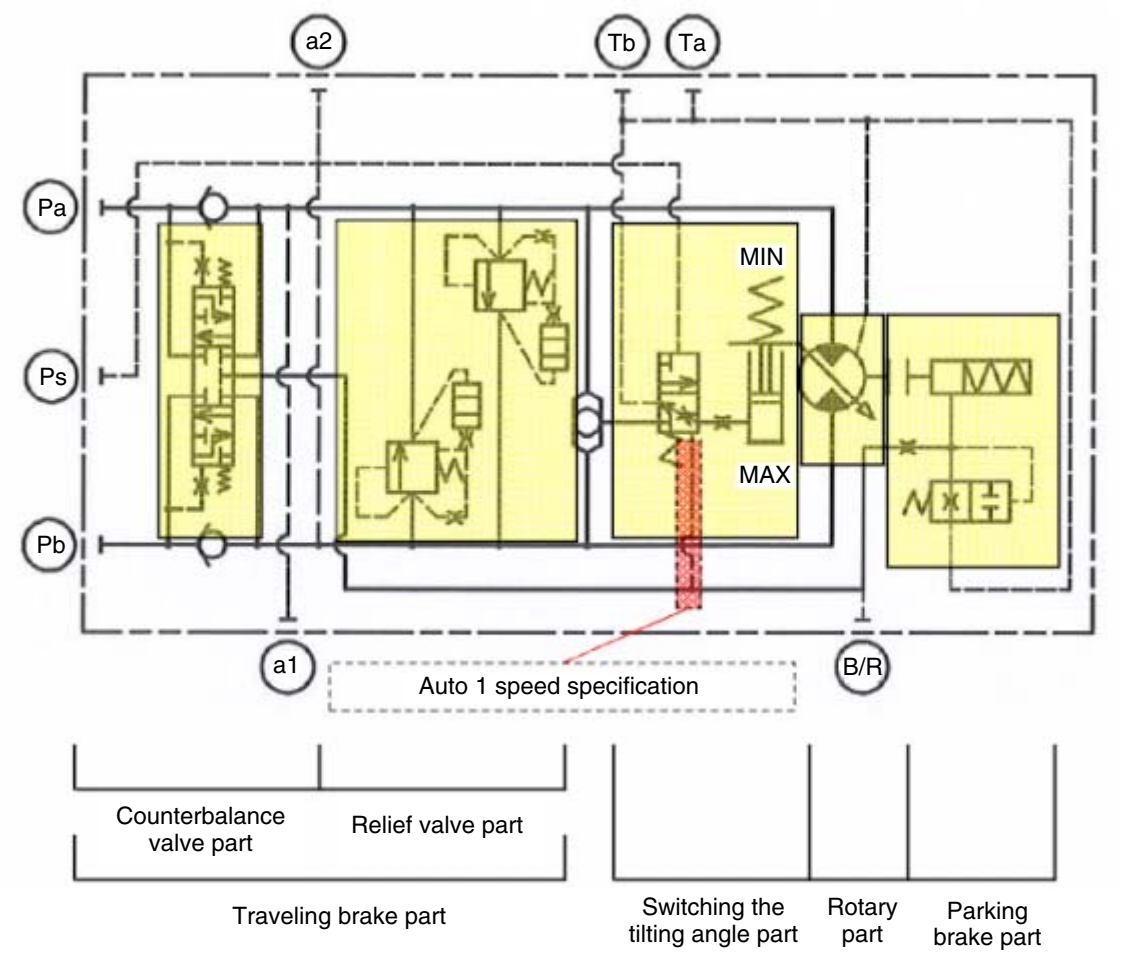


30	Relief valve assy	403	O-ring	503	Steel ball
301	Socket bolt	405	O-ring	504	Plunger
302	Plug	406	O-ring	505	Main spool spring
303	Drain plug	407	Name plate	508	Pin
306	Dust plug	432	Seat	509	Spring cap
307	Dust plug	433	Seat casing	510	Cap
309	Set plug	501	Main spool		

2) MAJOR COMPONENT

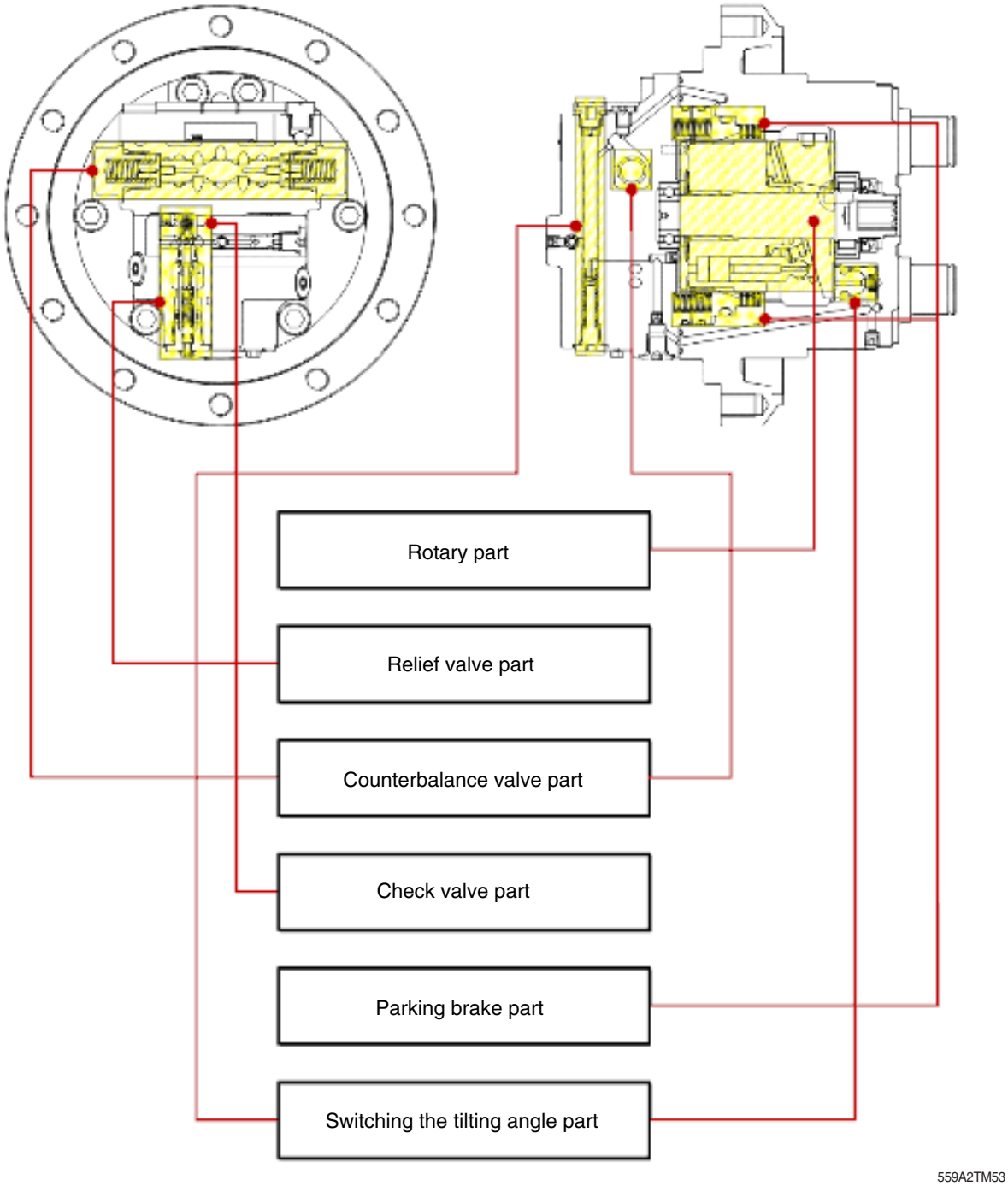
This product is only composed of hydraulic motor. Reduction parts are not composed.
This hydraulic motor is variable swash plate axial piston motor. It is composed of 4 parts.

- Rotary part which makes rotatory power
- Traveling brake valve part
- Parking brake part
- Switching the tilting angle part (auto 1/2 speed control part)



559A2TM52

3) BASIC STRUCTURE



2. WORKING PRINCIPLE

1) HYDRAULIC MOTOR SECTION

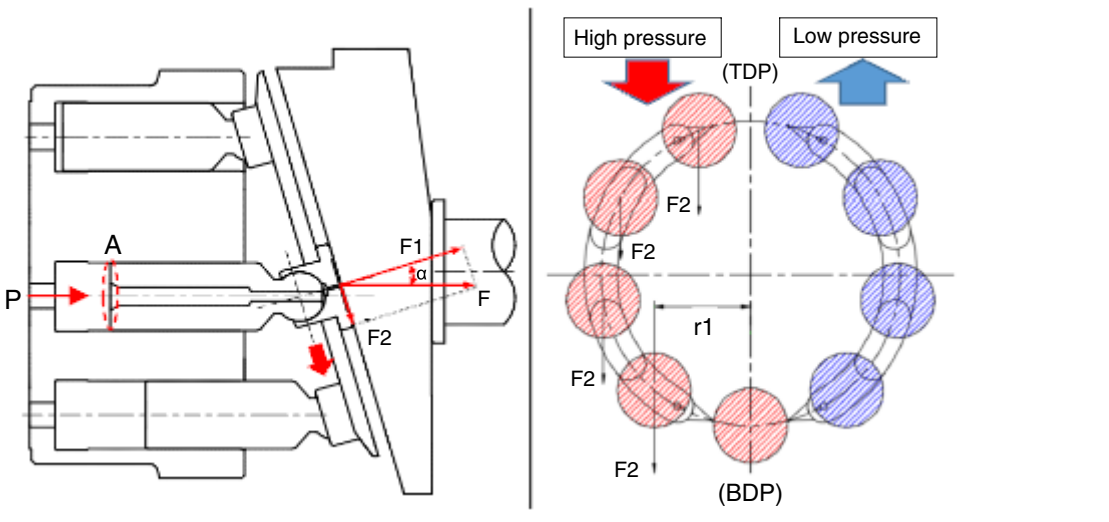
When high pressure oil passes from pump through the inlet port of the valve plate(108) and flows into the cylinder (104) as shown in figure, the oil pressure acts upon the piston (101) to generate the axial force "F". The force "F" acts on the swash (109) plane in the axial direction.

F = P × A (P : Pressure, A : Area)

The swash plate (109) is fixed with an inclination angle of α to the axis of the drive shaft (103).
Therefore, this force is divided into two vector forces through the shoe (102) : namely, the force F1 vertical to the swash plate (109) and the force F2 perpendicular to the drive shaft (103).
Because of the force "F2", piston (101) slides along with shoe (102) in the direction of the arrow in Figure. This force "F2" is transmitted to the cylinder block (104) via the piston (101) and generates a couple of forces which turn the output drive shaft (103).
In the cylinder block (104) nine pistons are equispaced and the pistons connected to the high pressure oil inlet ports give their rotating torque to the output shaft sequentially.
When the oil inflow/outflow direction are reversed, the rotating direction of the output shaft is reversed.
The theoretical output torque "T [N/m]" is given by the flowing.

$$T = \frac{P \times q}{2\pi}$$

P : Effective pressure difference (Mpa), q : Displacement per revolution (cm^3)



559A2TM54

2) TRAVELING BRAKE VALVE

Traveling brake valve is composed of relief valve, counterbalance valve and check port A is connected with hydraulic pump and port B is connected with tank.

(1) In case of traveling

When the compressed oil, which is supplied along the inlet port, exceeds certain pressure, it pushes cap (509). And, it is supplied to one side of the casing (202).

It is trying to rotate the hydraulic motor.

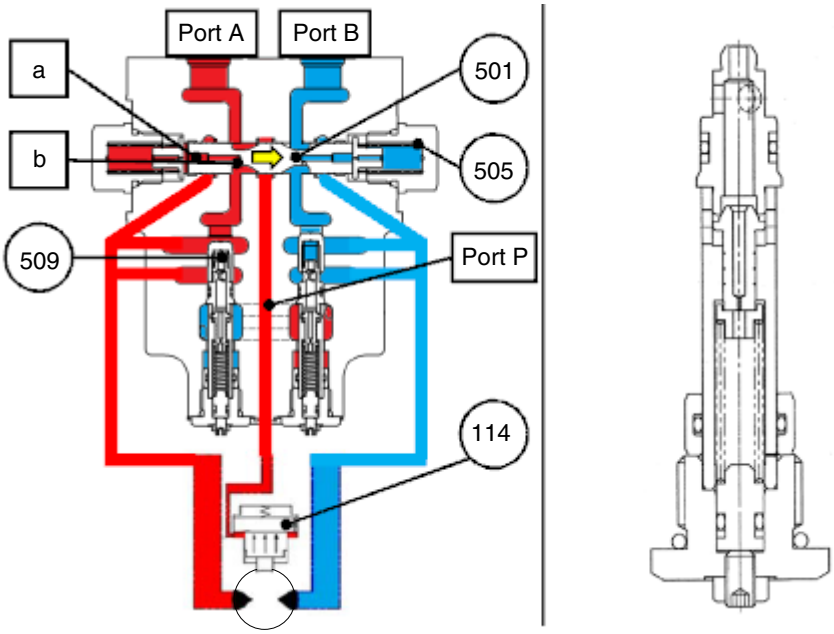
At the same time, the compressed oil enters the chamber {a} along small hole {b} of main spool (501) and acts on the face of main spool (501). After increasing pressure of oil, when this pressure exceeds the spring elasticity force of main spool spring (505), main spool (501), which is held in neutral by the spring elasticity force, moves to the right.

The inlet side and outlet side that was blocked by main spool (501) during stop connect with each other. So, return oil returns to the oil tank, so the hydraulic motor rotates.

Furthermore as main spool (501) moves, the path of parking brake (port P) is connected.

When compressed pressure, which enter to (port P) , becomes brake release pressure, it operates brake piston (114) and parking brake is released.

If the direction of oil inlet is reversed, main spool (501) and check valve motion is reversed. Output rotation direction is also reversed.



559A2TM55

(2) In case of stop

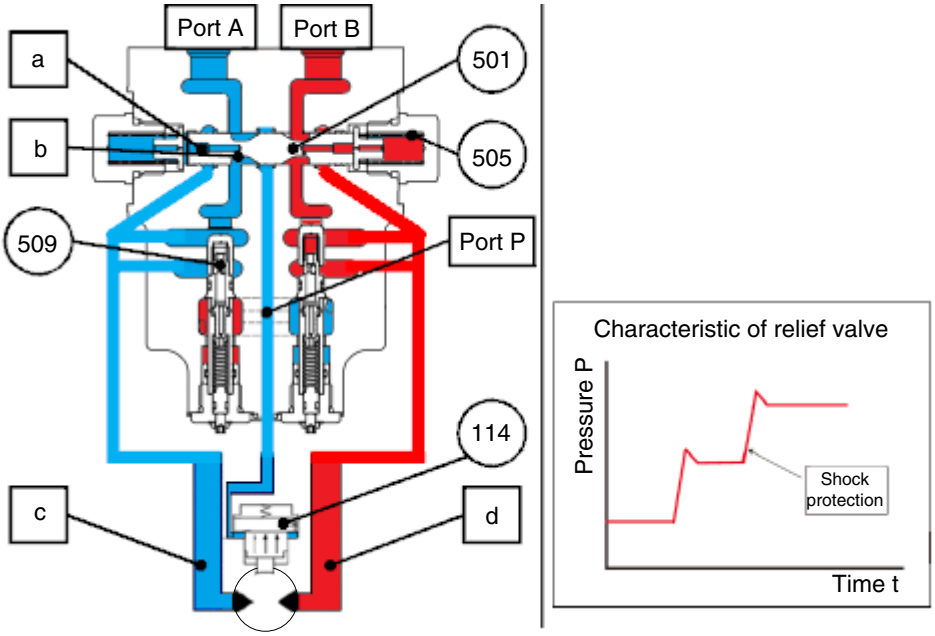
If the pressure supplied along the port to the inlet breaks while traveling, the pressure applied to the section of the main spool (501) is removed. Therefore, the main spool (501), which was pushed to the right, returns to neutral due to the spring elasticity force of the main spool spring (505).

The rotary part continues to rotate under inertia even if pressure is lost from the inlet side. As the main spool (501) returns to neutral, the connected inlet and outlet sides of the flow path are blocked. Since there is no escape location for the returned oil, the pressure of the exit side (D) is raised.

The returned oil with increased pressure enters the relief valve (30). if it exceeds the set pressure of the relief valve (30), operates the relief valve (30). The flow path from the outlet side {D} to the inlet side {C} is connected. And it controls the pressure on the outlet side.

At the same time it prevents cavitation on the inlet side.

It also relieves the shock during stop while controlling pressure on the outlet side with relief valve (30) in two stages, and apply soft braking to the hydraulic motor by applying an orifice and notch on the main spool (501).



559A2TM56

(2) In case of stop

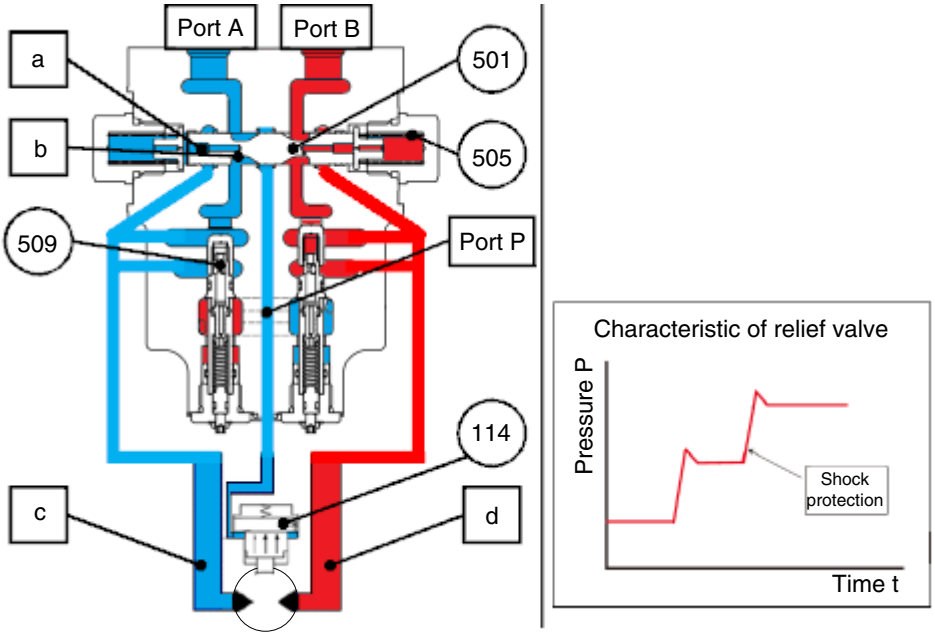
If the pressure supplied along the port to the inlet breaks while traveling, the pressure applied to the section of the main spool (501) is removed. Therefore, the main spool (501), which was pushed to the right, returns to neutral due to the spring elasticity force of the main spool spring (505).

The rotary part continues to rotate under inertia even if pressure is lost from the inlet side. As the main spool (501) returns to neutral, the connected inlet and outlet sides of the flow path are blocked. Since there is no escape location for the returned oil, the pressure of the exit side (D) is raised.

The returned oil with increased pressure enters the relief valve (30). if it exceeds the set pressure of the relief valve (30), operates the relief valve (30). The flow path from the outlet side {D} to the inlet side {C} is connected. And it controls the pressure on the outlet side.

At the same time it prevents cavitation on the inlet side.

It also relieves the shock during stop while controlling pressure on the outlet side with relief valve (30) in two stages, and apply soft braking to the hydraulic motor by applying an orifice and notch on the main spool (501).



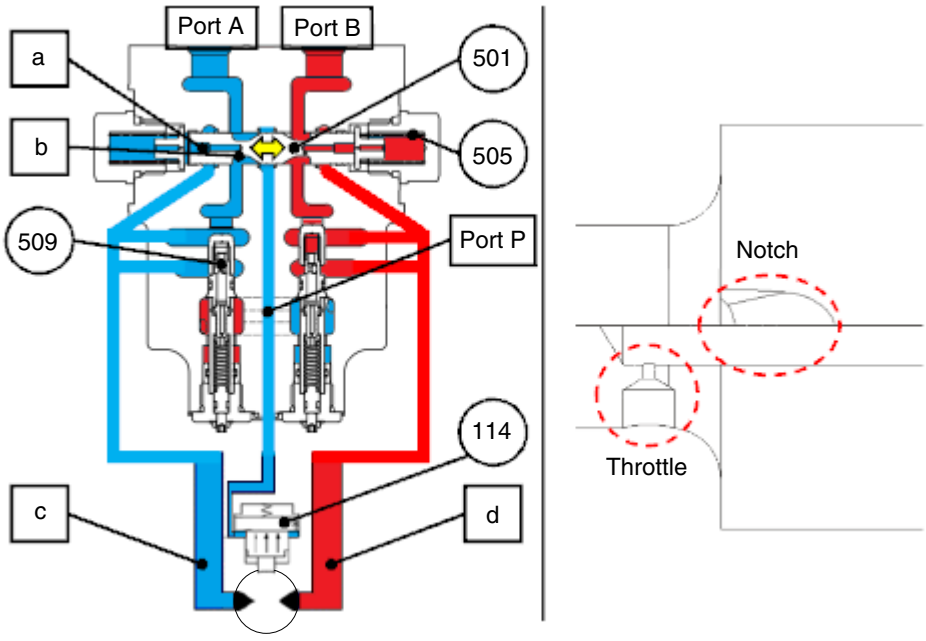
559A2TM56

(3) In case of overrun

Overrun is when the excavator's speed is increased by the it's gravity (inertia), such as when an excavator is going downhill, causing the hydraulic motor to rotate above the supply flow of the hydraulic pump.

In the case of overrun, the compressed oil on the inlet side is entered into the rotary and the pressure on the inlet side is reduced. Therefore, due to the spring elasticity force of the main spool spring (505), main spool (501) returns to neutral, as it stops.

At the same time, back pressure is generated due to the throttle (notch of main spool) between the outlet side (D) and the outlet port (port B) passage. The back pressure controls the return speed of the main spool (501) and hydraulic motor, which is about to be rotated by inertia forces, is decelerated. The operation of main spool (501) is controlled by the notch of main spool (501) and throttle. So motor smoothly moves according to the supply flow rate.



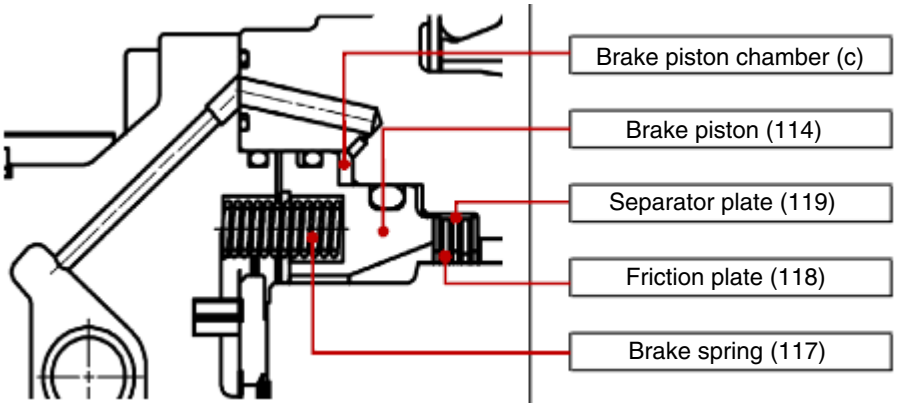
559A2TM57

3) PARKING BRAKE

The parking brake is wet-type multiple disk brakes. It is a negative brake system which is released when the brake release pressure enters the brake piston chamber.

The internal structure of parking brake is shown in figure. Friction plate (118) and separator plate (119) are alternately stacked, and acting on springs to produce brake torque with friction forces.

It prevents not only the braking of excavators but also overrun or slip during traveling and stopping on the slip.



559A2TM58

(1) In case traveling

The cylinder block (104) is connected to the drive shaft (103) with spline. In addition, the separator plate (119) is restrained from circumferentially-rotating by an arc groove cut on the casing (202).

The friction plate (118) which is connected to the arc groove cut on cylinder block (104), can be rotated along the cylinder block (104).

When pressurized oil is supplied from the inlet side during traveling operation, the blocked flow path is opened. so pressurized oil is supplied to the brake piston chamber (c) that is comprised inside brake piston (114) and casing (202).

If the hydraulic force F4 of the brake piston chamber (c) is greater than the spring elasticity force F3 of the brake spring (117), then brake piston (114) move to valve casing. (above brake release pressure)

F3 = k x n , k : Spring constant, x : Spring stroke, n : Number of spring brake

F4 = P × (A1 - A2), P : Main pressure of input, (A1 - A2) : Area difference of brake piston

The force that friction plate (118) and separator plate (119) pressurize the casing (202) disappears and the brake releases.

So, the hydraulic motor can rotate.

(2) In case of stop

If the pressurized oil supplied by the inlet is cut off during stop, the pressurized oil supplied to the brake piston chamber (c) will also be blocked. (below brake release pressure)

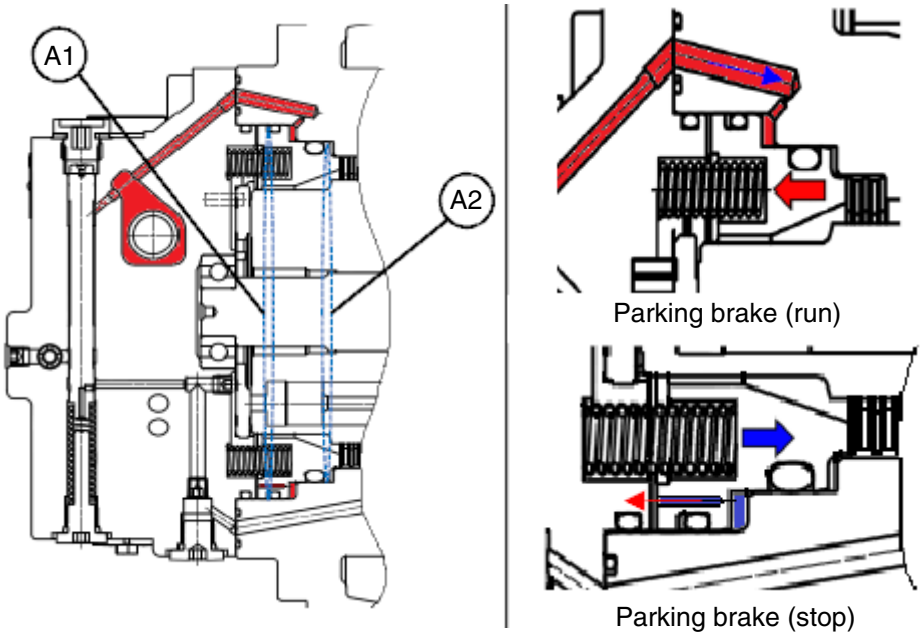
If the spring elasticity force F3 of the brake spring (117) is greater than the hydraulic force F4 of the brake piston chamber (c), then brake piston (114) move to casing by spring elasticity force. The hydraulic oil of the brake piston (114) is drained through the throttle. Therefore brake piston (114) smoothly operates.

F3 < F4

F3 = k x n , k : Spring constant, x : Spring stroke, n : Number of spring brake

F4 = P × (A1 - A2), P : Main pressure of input, (A1 - A2) : Area difference of brake piston

When the brake piston (114) pushes casing (202) by the brake spring (117), the frictional force appears between friction plate (118), casing (202), separator plate (119) and brake piston (114). parking brake appears by friction force and spring elasticity of the brake spring (117), the drive shaft (103) is constrained.



559A2TM59

4) 1/2 SPEED SWITCHING OPERATION (AUTOMATIC 1/2 SPEED CONTROL PART)

(1) Low speed traveling

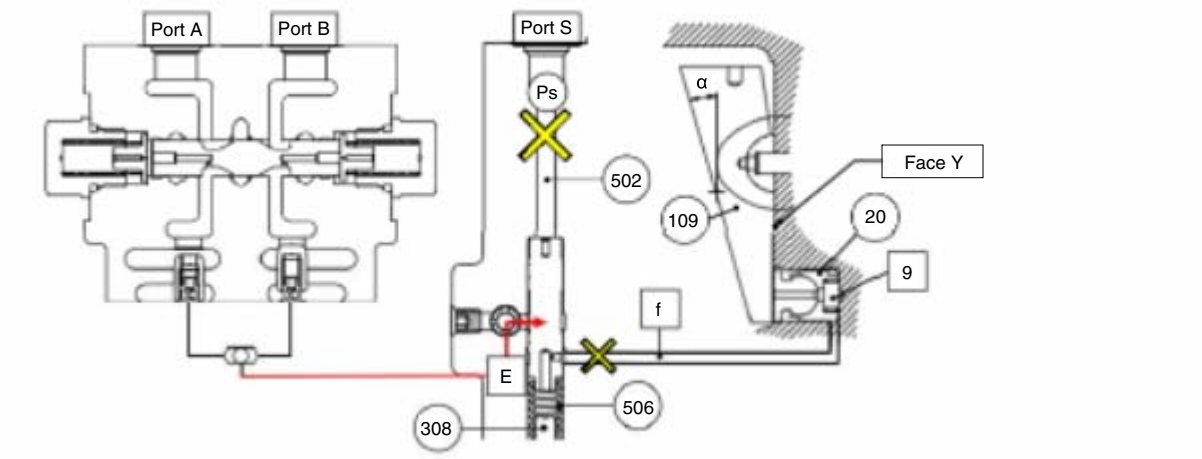
If pilot pressure is not supplied on pilot port (port S), 2 speed spool (502) is pushed in the direction of the port S by spring elasticity of 2 speed spool spring (506).

As a result, the compressed oil from the high pressure selection check valve (E) is not connected to the swash piston chamber (g).

The compressed oil of swash piston chamber{g} is drained through the flow path of 2 speed spool chamber (f).

So, the compressed oil from the high pressure selection check valve (E) is not connected to the swash piston chamber {g}. As a result, the swash plate (109) will be the maximum angle α and the stroke of the piston (101) will be long. So, a large amount of oil will be required for rotating the motor once.

Therefore the displacement of the hydraulic motor is maximized and rotated at low speed.



559A2TM60

(2) High speed traveling

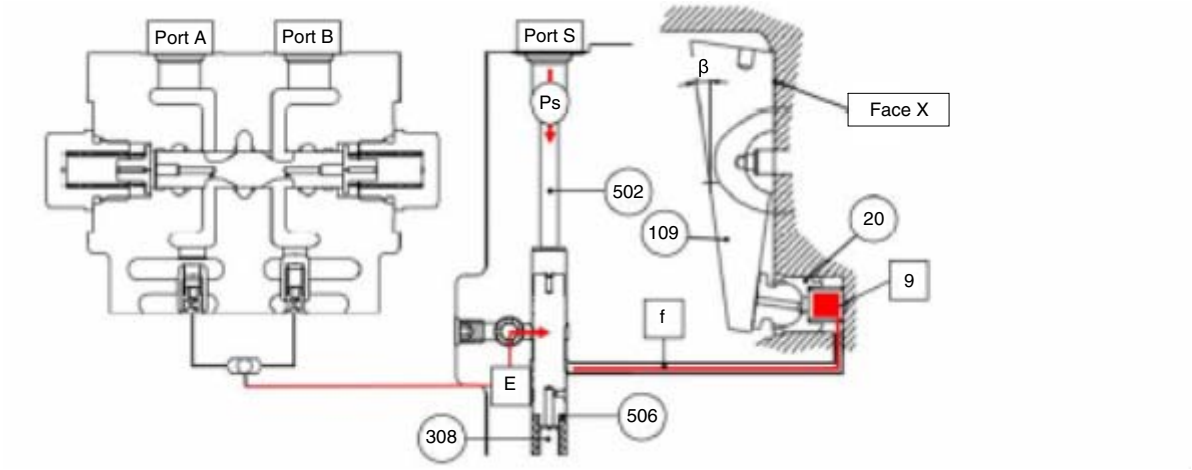
If the pilot pressure (20~50 kgf/cm²) is supplied to the port (port S), the pilot pressure overcomes the oil pressure in the main port and the spring elasticity force of the 2 speed spool spring (506). and it pushes the 2 speed spool (502) to the 2 speed plug (308) direction.

This is why the pressure from the high pressure selection check valve (E) is connected to the flow path (f).

The pressurized oil flows into the {g} chamber along the flow path {f} and pushes swash piston (20) to contact the face 'X' of swash plate (109) with the wall of the casing (202).

As a result, the swash plate (109) is the minimum angle β. Because stroke of piston (101) is shortened, a small amount of oil is used for one revolution.

Therefore, the displacement of the hydraulic motor is minimized and is rotated at high speed.



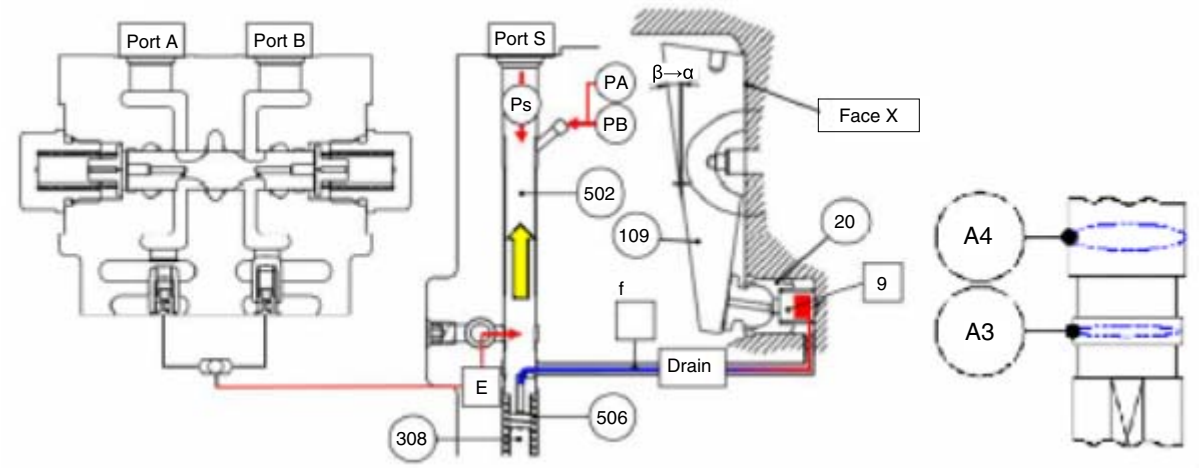
559A2TM61

(3) Automatic 1/2 speed control part

If the load is increased during the 2-speed driving, the hydraulic pressure on the main port is increased. The pressure (△P) of main port and spring elasticity force of 2 speed spool spring (506) will overcome the pressure of pilot, 2 speed spool (502) is pushed in port S direction.

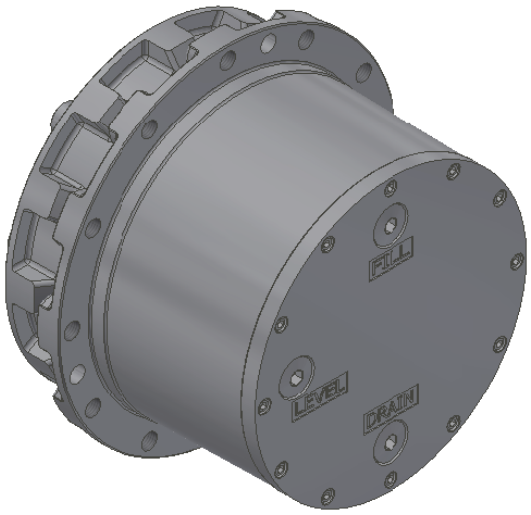
F5 < [{F6 × (A4 - A3)} + (Fspring)]
F5 = PS × A3, PS : Pilot pressure, A3 : 2 speed spool area
F6 = (PA or PB) × (A4 - A3), (PA or PB) : Main pressure difference between inlet side and outlet side
Fspring = K x X ; K : Spring constant of 2 speed spool spring, X : Spring stroke

Therefore, flow path from the high pressure selection check valve (E) to (f) is blocked.
And the pressure of (g) is slowly drained to 2 speed spool chamber (f) through throttle and a notch of 2 speed spool.
The angle of swash plate (109) transfers from β to α, and the motor automatically switches from 2 speed to 1 speed to rotate at low speed.



559A2TM62

5) REDUCTION GEAR



559A2TM63

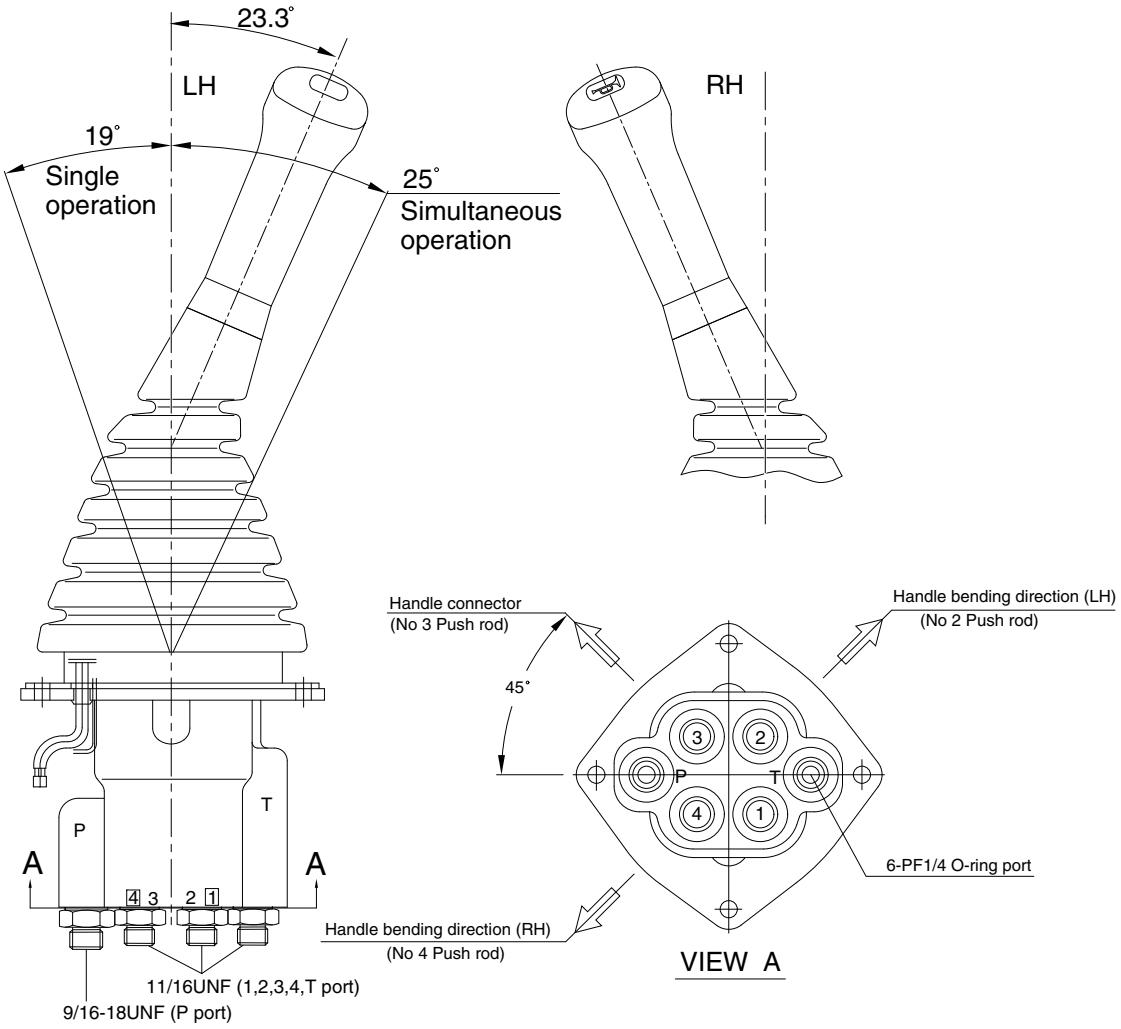
(1) Refer to the section drawing for the basic construction.
(2) The reduction gear consists of two stage planetary gears.
(3) The reduction ratio is determined by the number of teeth of the gear, and the reduction ratio is 42.439.
In other words, the number of revolutions of the hydraulic motor is transmitted to the output shaft at 1 / reduction ratio.
(4) The direction of rotation of the input and output shafts is opposite.

GROUP 5 RCV LEVER

■ TYPE 1 (STD)

1. STRUCTURE

The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1,2,3 and 4 provided at the bottom face.



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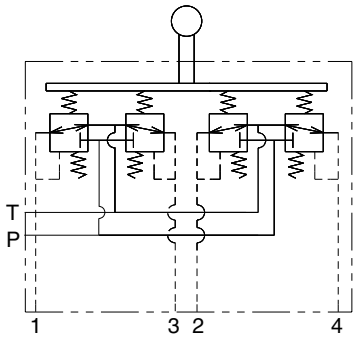


Hydraulic circuit

Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm out port	Boom up port	
3	Right swing port	Bucket in port	
4	Arm in port	Boom down port	

CROSS SECTION

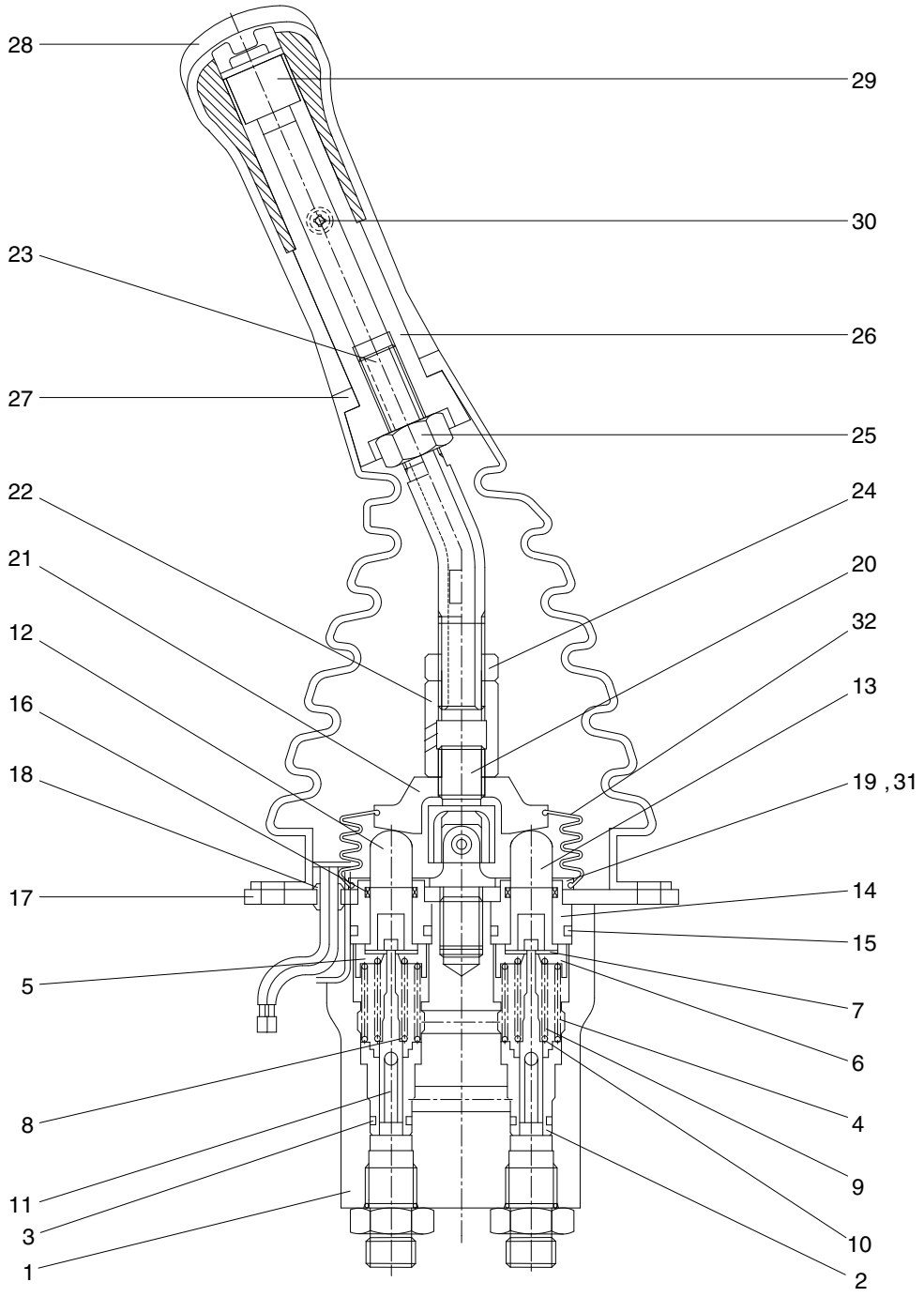
The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (11), spring (8, 9) for setting secondary pressure, return spring (4), stopper (7), spring seat (5, 6) and spring seat (10). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (12, 13) by the return spring.

When the push rod is pushed down by tilting the handle, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.

1	Case	12	Push rod (1, 3)	23	Connector
2	Plug	13	Push rod (2, 4)	24	Nut
3	O-ring	14	Plug	25	Nut
4	Spring	15	O-ring	26	Insert
5	Spring seat (1, 3)	16	Rod seal	27	Boot
6	Spring seat (2, 4)	17	Plate (A)	28	Handle
7	Stopper	18	Bushing	29	Switch assembly
8	Spring (1, 3)	19	Machine screw	30	Screw
9	Spring (2, 4)	20	Joint assembly	31	Plate
10	Spring seat	21	Swash plate	32	Boot
11	Spool	22	Hex nut		

CROSS SECTION



R25Z9A2RL02

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

(1) Inlet port (P) where oil is supplied from hydraulic pump.

(2) Output ports (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.

(3) Tank port (T) necessary to control the above output pressure.

(4) Spool to connect output port to inlet port or tank port.

(5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (11) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring (8, 9) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (12, 13) is inserted and can slide in the plug (14).

For the purpose of changing the displacement of the push rod through the switch plate (21) and adjusting nut (22) are provided the handle (28) that can be tilted in any direction around the fulcrum of the universal joint (20) center.

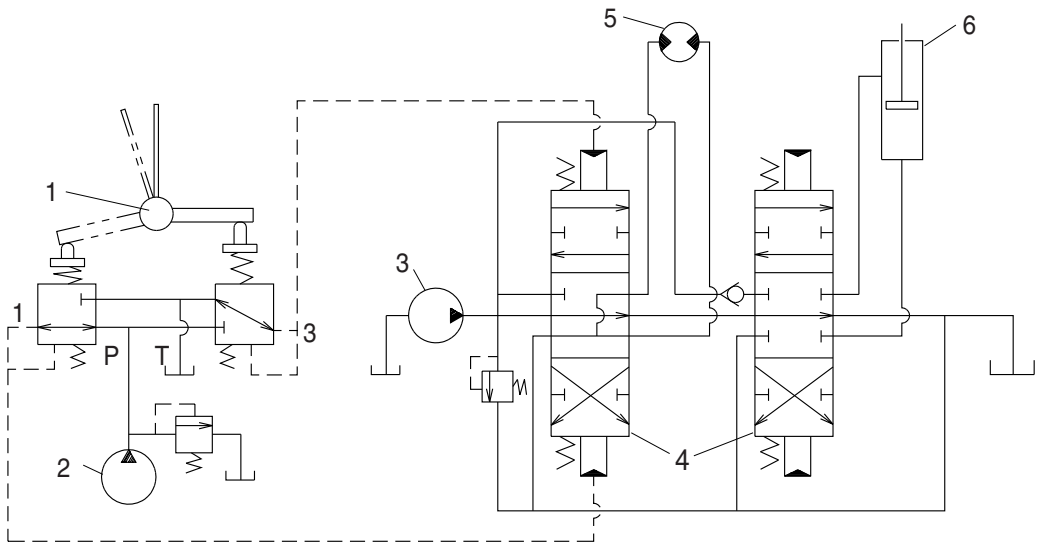
The spring (4) works on the case (1) and spring seat (5, 6) and tries to return the push rod (12, 13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

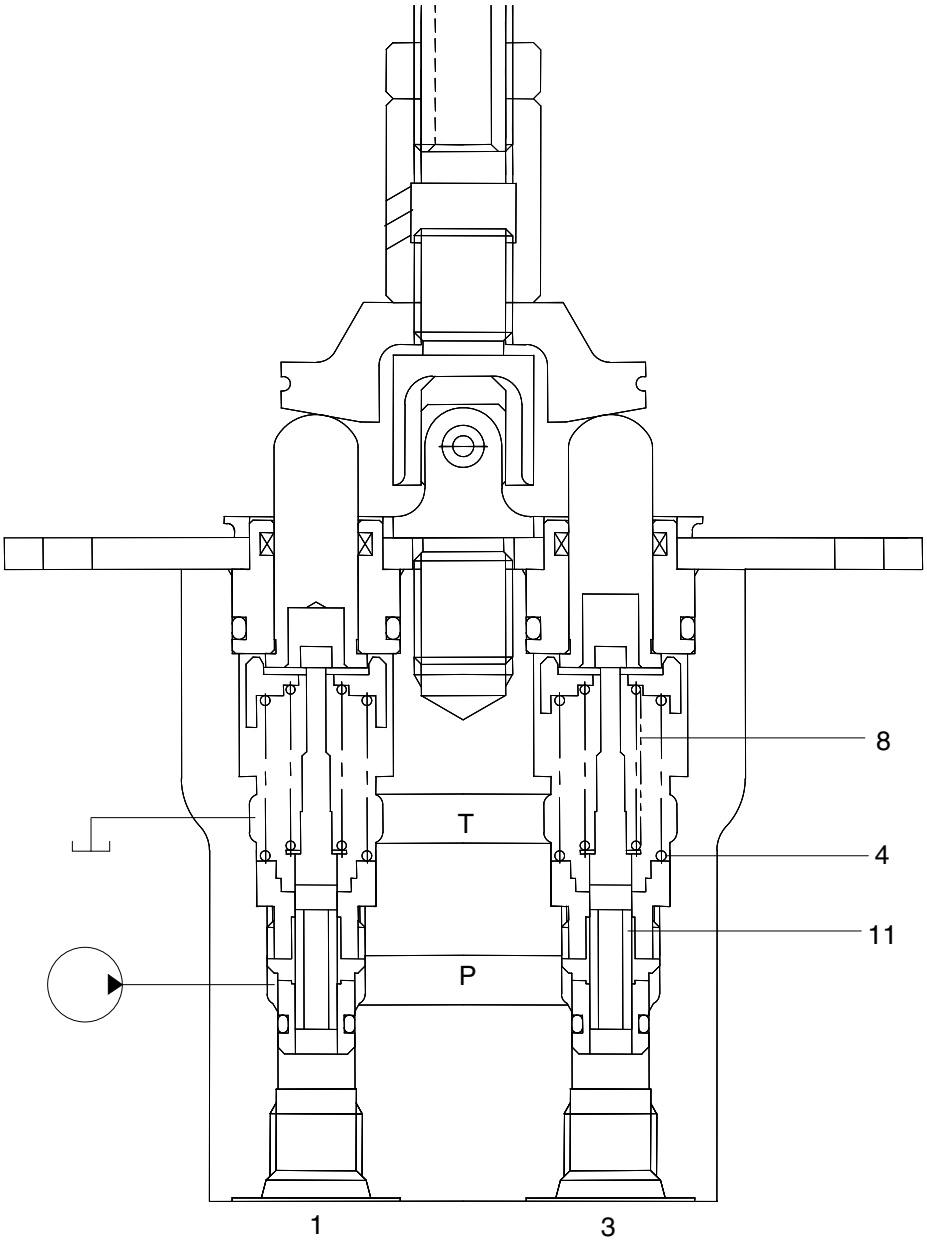
The diagram shown below is the typical application example of the pilot valve.



2-70 (140-7TIER)

1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

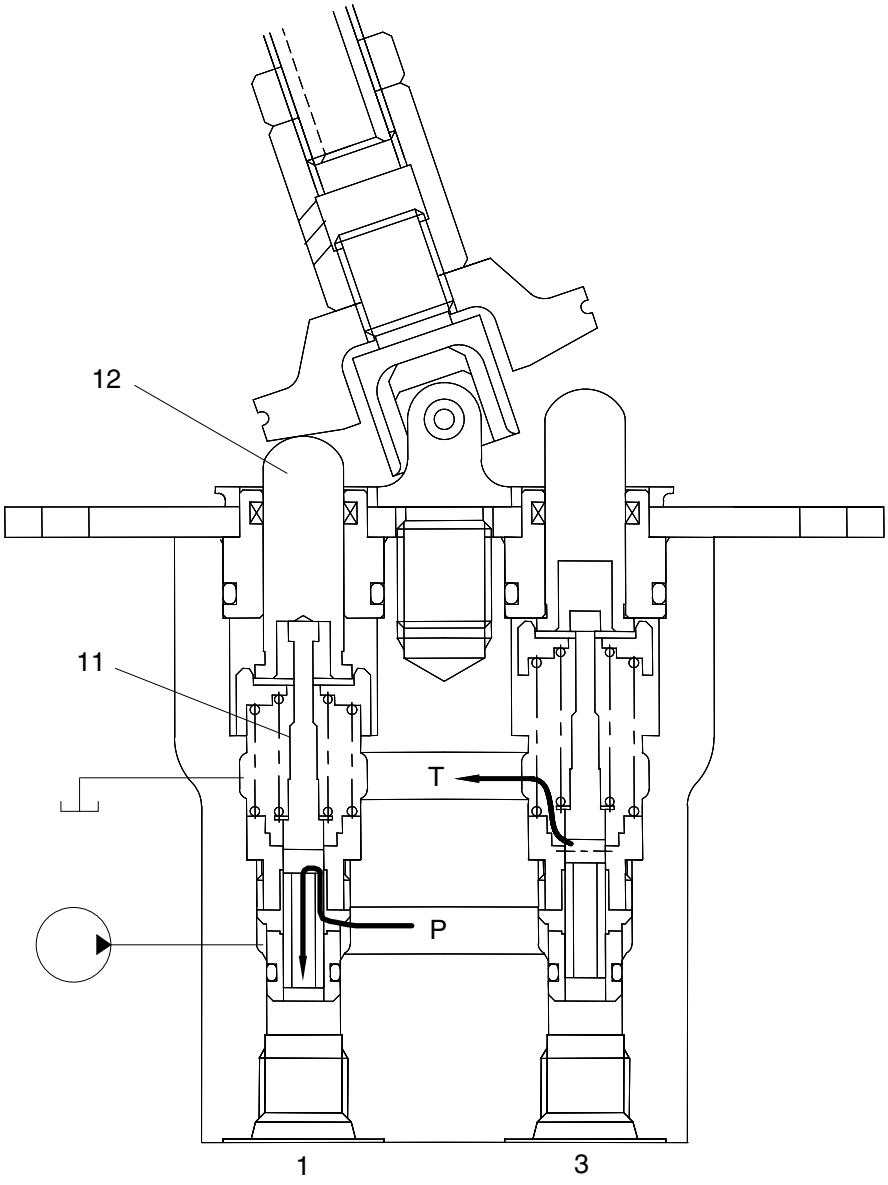
(1) Case where handle is in neutral position



R35Z72RL03

The force of the spring (8) that determines the output pressure of the pilot valve is not applied to the spool (11). Therefore, the spool is pushed up by the spring (4) to the position of port (1, 3) in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where handle is tilted

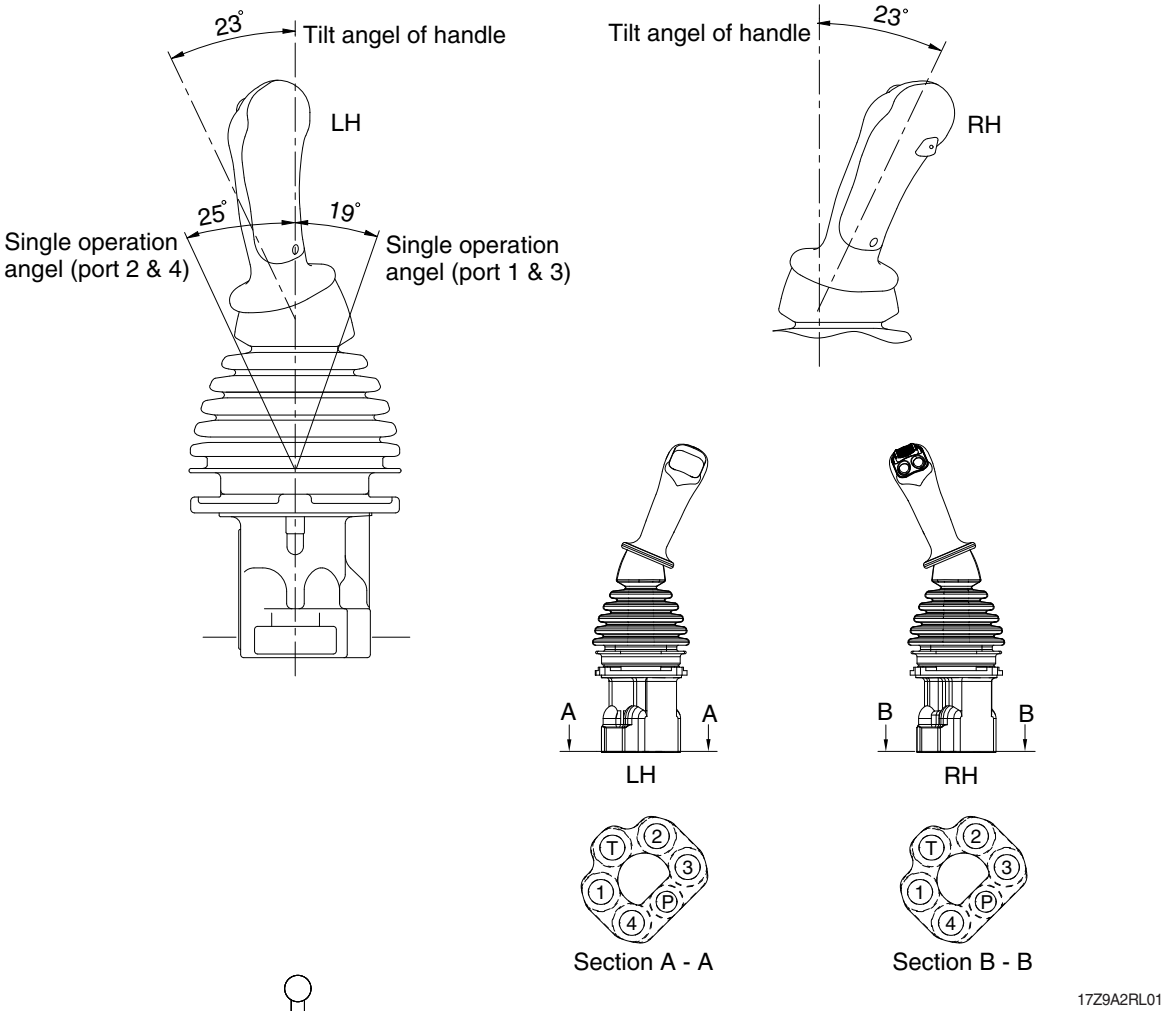


When the push rod (12) is stroked, the spool (11) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.

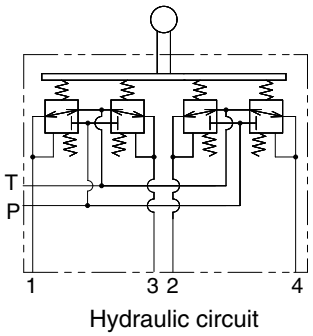
■ TYPE 2 (OPT)

1. STRUCTURE

The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1,2,3 and 4 provided at the bottom face.



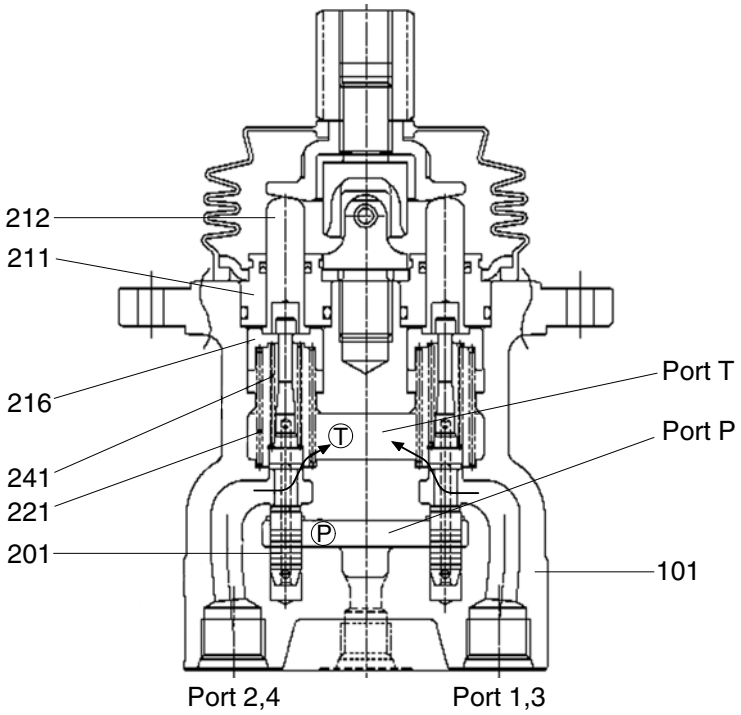
17Z9A2RL01



Hydraulic circuit

Port	LH	RH (with proportional)	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	Pilot oil return port	PF 3/8
1	Left swing port	Bucket out port	
2	Arm out port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm in port	Boom up port	

CROSS SECTION



17Z9A2RL02

101 Casing
201 Spool
211 Plug
212 Push rod
216 Spring seat
221 Return spring
241 Secondary pressure setting spring

The structure of the remote control valve is as shown in the assembly. There is a vertical axial hole in the casing and the reduction valves are inserted into this.

The secondary pressure setting spring (241) is set such that the secondary pressure is calculated as 5.1~10.2 kgf/cm^2. Spool (201) is pushed onto the push rod (212) by return spring (221).
Tilting the control handle pushes down push rod (212), the spring seat (216) also moves down and the setting of the secondary pressure setting spring (241) is changed.
Port P, oil inlet (primary pressure) and port T outlet (tank) are in the casing (101).

2. PERFORMANCE

1) BASIC PERFORMANCE

The remote control valve controls the stroke and direction of the control valve spools. This is achieved by the output pressure of the remote control valve acting on the tip of the control valve spool.

To achieve satisfactory performance, the remote control valve comprises the following elements :

(1) An inlet port (P) for oil fed from the hydraulic pump.

(2) Multiple output ports (1, 2, 3 and 4) to allow pressure from the inlet port to act on the spool tips of the control valve.

(3) A tank port (T) to control the output pressure.

(4) A spool to connect the output port to the inlet port or tank port.

(5) A mechanical assembly, which contains a spring which acts on the spool and controls the output pressure.

2) PERFORMANCE OF THE MAIN PARTS

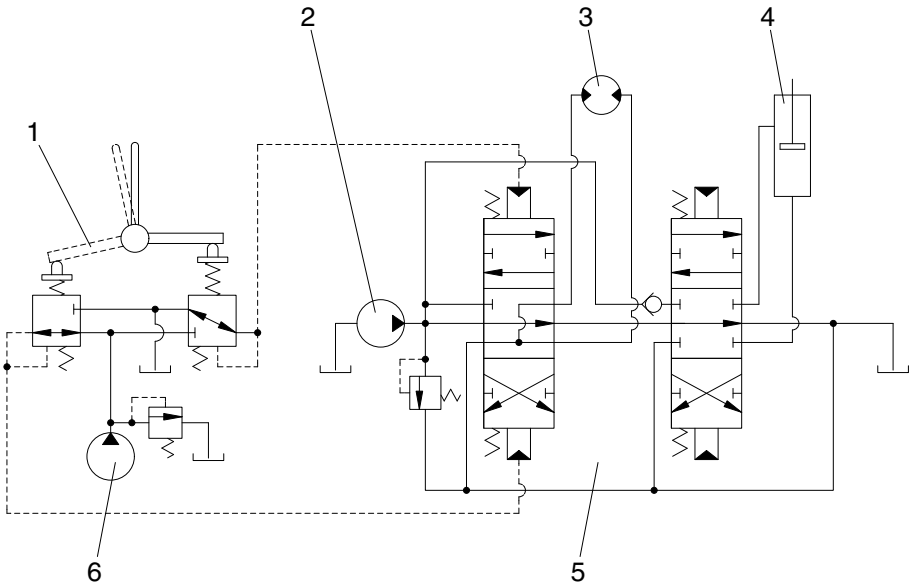
The spool (201) operates to take the supply oil pressure from the hydraulic pump. This switches the oil channel so that the port P oil pressure is directed to the output ports 1, 2, 3, 4 or to port T. The secondary pressure setting spring (241) determines the output pressure that acts on the spool (201).

The push-rod (212), which changes the strain of the secondary pressure setting spring (241), is inserted so that it can move smoothly into the plug (211).

The return spring (221) acts to return the push-rod (212) towards zero displacement without reference to the output pressure acting on the spring seat (216) and casing (101). This acts to ensure the return to neutral of the spool (201) and also acts as a resistance spring to provide the operator with an appropriate operating "feel".

3) OPERATION

The operation of the remote control valve is described in the hydraulic circuit plan and operation explanatory figures (see figures RL04, 05 and 06). The below figure shows a typical example of the use of the remote control valve.



17Z9A2RL03

1	Remote control valve	3	Hydraulic motor	5	Control valve
2	Main pump	4	Hydraulic cylinder	6	Pilot pump

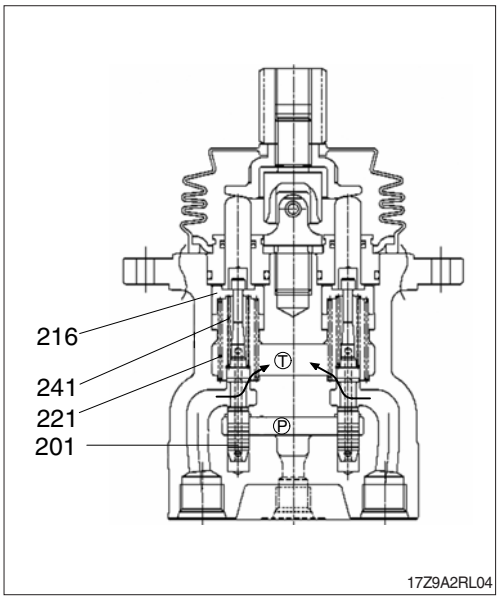
(1) Control handle neutral

The force of the secondary pressure setting spring (241) (which determines the output pressure of the pilot valve) does not act on the spool (201).

Spool (201) is pressed upward by the return spring (221) and spring seat (216) .

Output ports (2, 4) and port T are open.

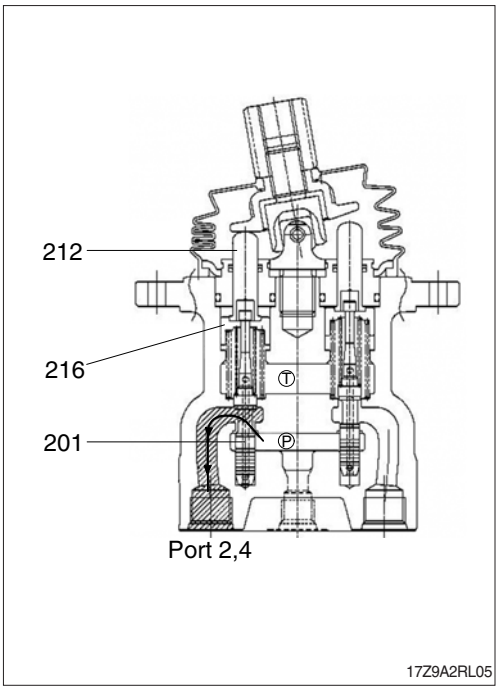
The output pressure is the same as the tank pressure.



17Z9A2RL04

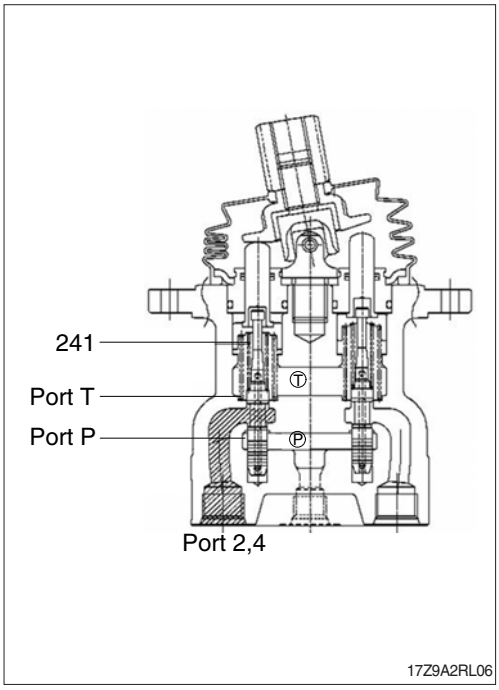
(2) Control handle tilted

The push-rod moves, (spring seat (216)), spool (201) moves downward, port P and ports (2, 4) are open and the oil fed from the pilot pump flows to ports (2, 4) and generates pressure.



(3) Control handle held

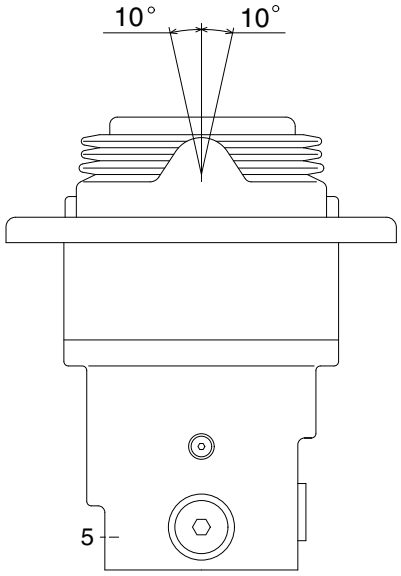
The pressure of ports (2, 4) rises to become equal to the spring (241) force; the oil pressure and spring pressures become balanced. If the pressure of ports (2, 4) exceeds the set pressure, ports (2, 4) and port P close, ports (2, 4) and port T open. If the pressure of ports (2, 4) falls below the set pressure, ports (2, 4) and port P open and ports (2, 4) and port T close. The secondary pressure is kept constant.

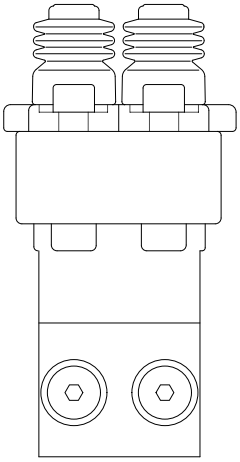


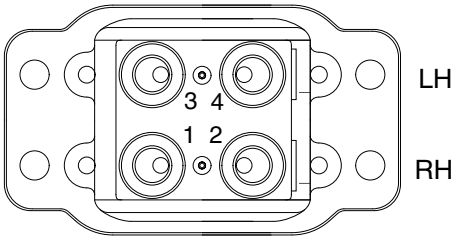
GROUP 6 RCV PEDAL

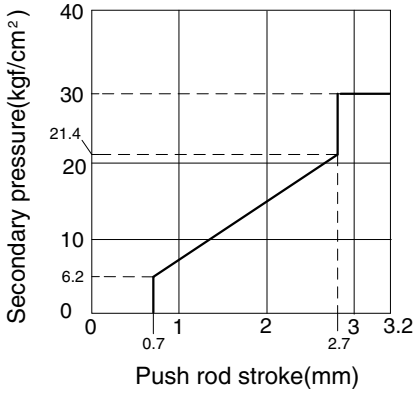
1. STRUCTURE

The casing has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.

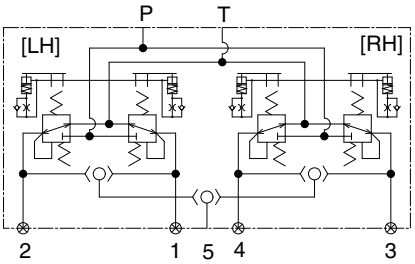








35AZ2RCP01



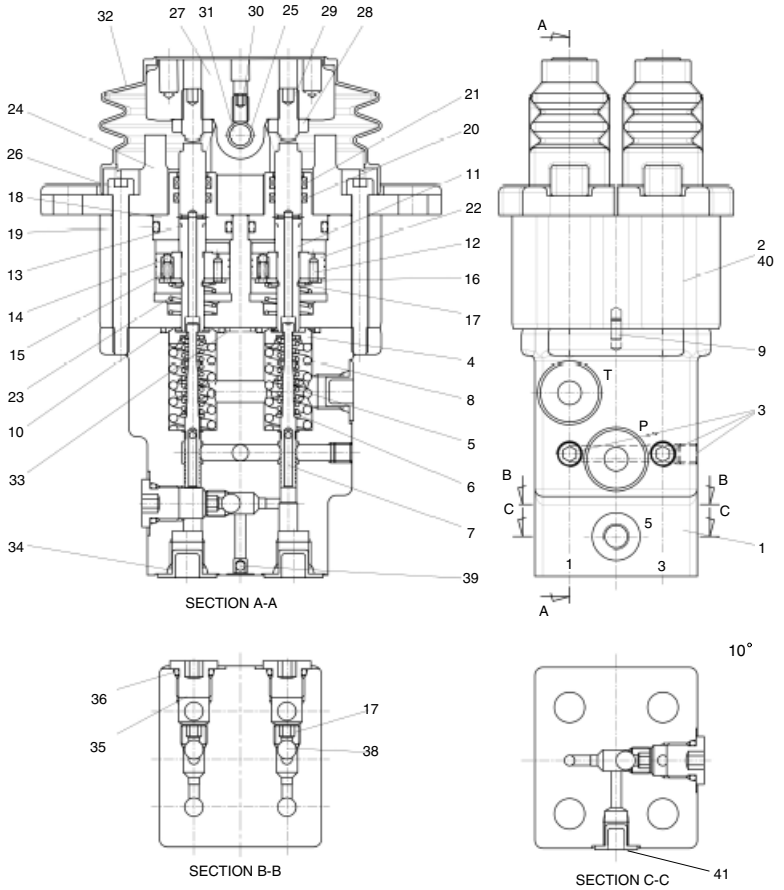
Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, backward)	
2	Travel (LH, forward)	
3	Travel (RH, backward)	
4	Travel (RH, forward)	
5	Travel alarm	PT 1/8

CROSS SECTION

The construction of the RCV pedal is shown in the below drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (7), spring (5) for setting secondary pressure, return spring (8), spring seat (4) and washer (6). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 6.2 to 21.4 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (11) by the return spring.

When the push rod is pushed down by tilting pedal, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.



1	Body 1	15	Spring	29	Set screw
2	Body 2	16	Plate	30	Set screw
3	Plug	17	Snap ring	31	Cam shaft
4	Spring seat	18	Plug	32	Bellows
5	Spring	19	O-ring	33	O-ring
6	Washer	20	Rod seal	34	Cap
7	Spool	21	Dust seal	35	Plug
8	Spring	22	Piston	36	O-ring
9	Spring pin	23	Spring	37	Check seat
10	O-ring	24	Cover	38	Steel ball
11	Push rod	25	Bushing	39	Expander
12	Spring pin	26	Wrench bolt	40	Name plate
13	Seal	27	Cam assy	41	Cap
14	Steel ball	28	Hex nut		

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

(1) Inlet port (P) where oil is supplied from hydraulic pump.

(2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.

(3) Tank port (T) necessary to control the above output pressure.

(4) Spool to connect output port to inlet port tank port.

(5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (7) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (11) is inserted and can slide in the plug (18).

For the purpose of changing th displacement of the push rod through the cam (27) and steel ball (28) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

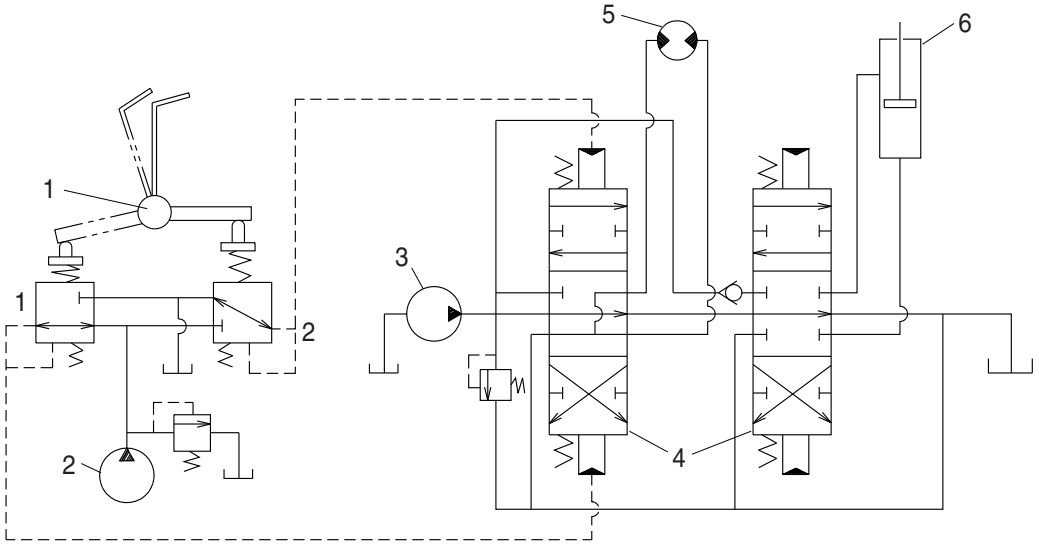
The spring (8) works on the casing (1) and washer (6) and tries to return the push rod (11) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below ant the attached operation explanation drawing.

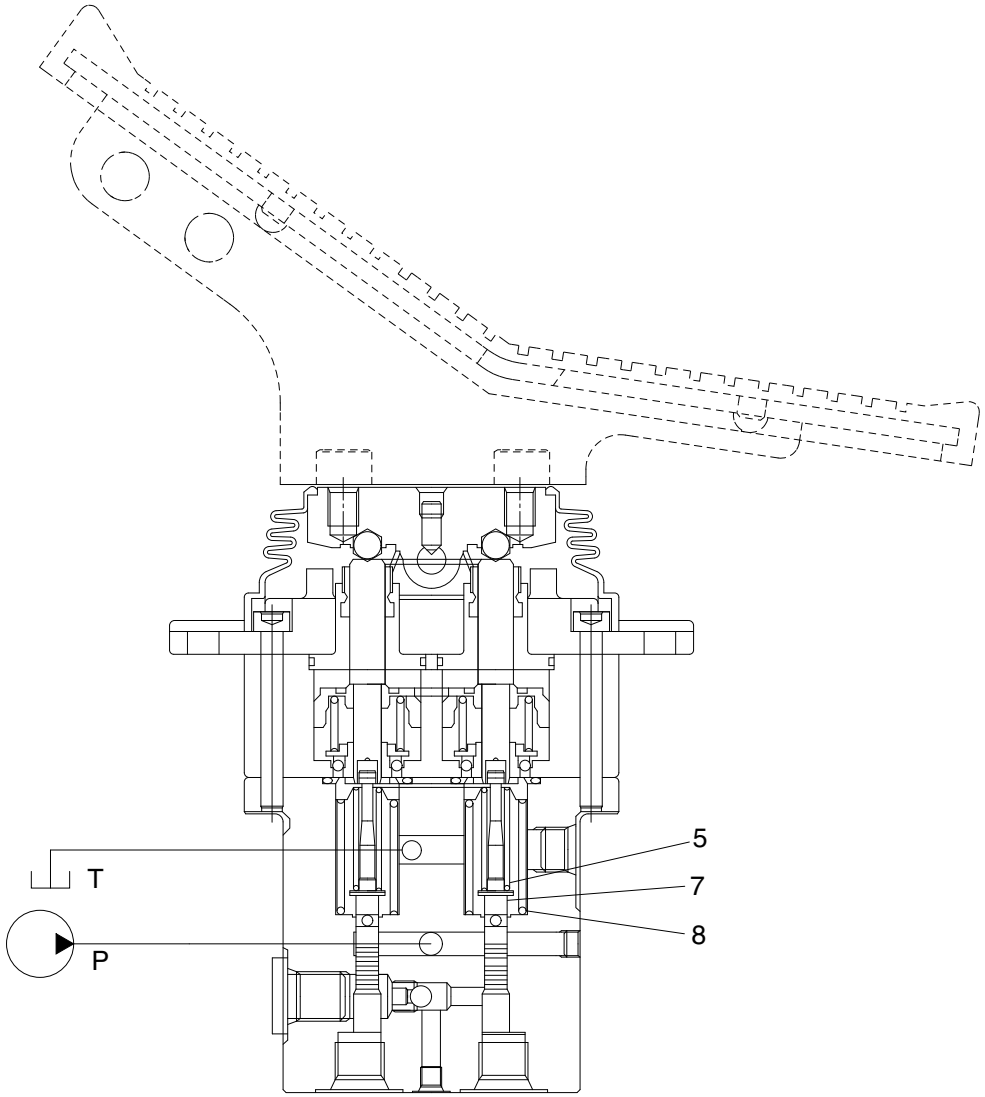
The diagram shown below is the typical application example of the pilot valve.



140LC-7 기타2-76

1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

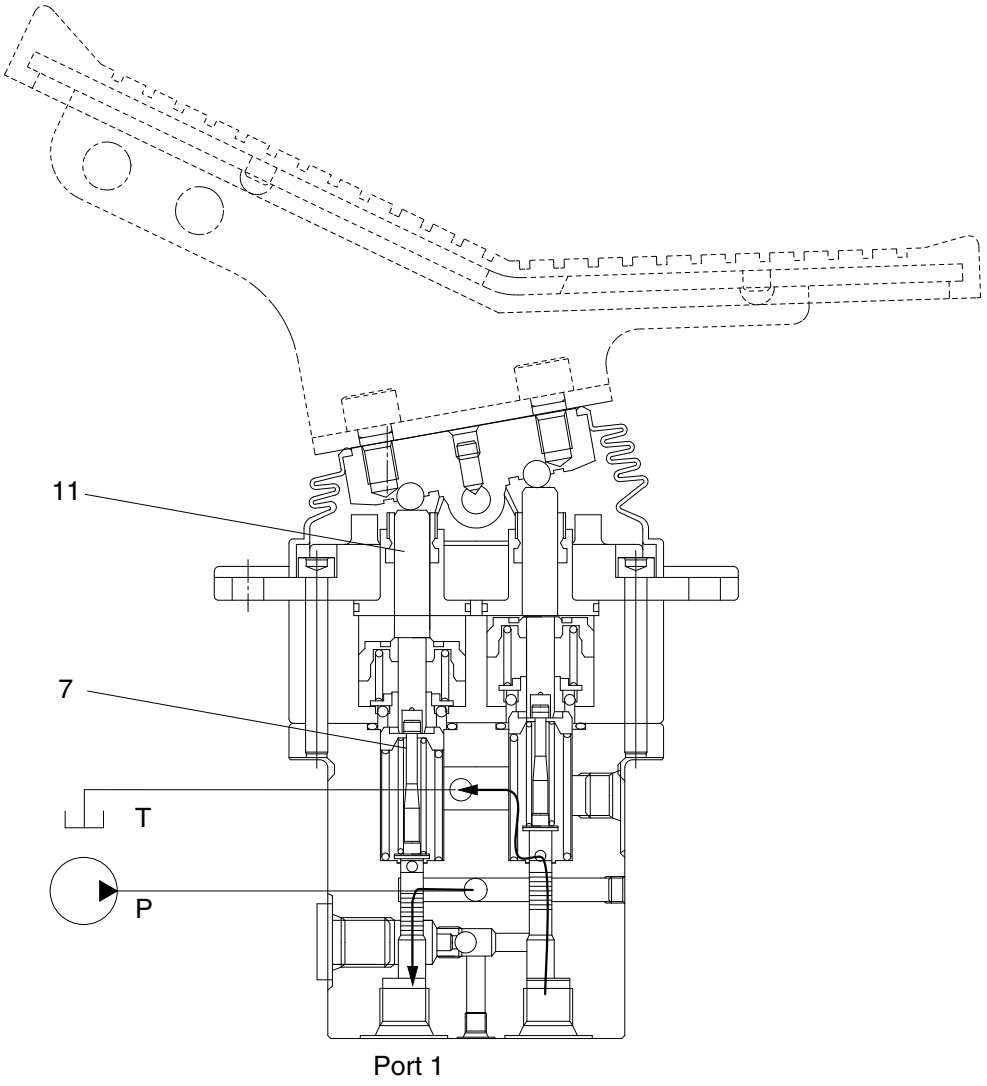
(1) Case where pedal is in neutral position



35AZ2RCP04

The force of the spring (5) that determines the output pressure of the pilot valve is not applied to the spool (7). Therefore, the spool is pushed up by the spring (8) to the position of port 2 in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where pedal is tilted



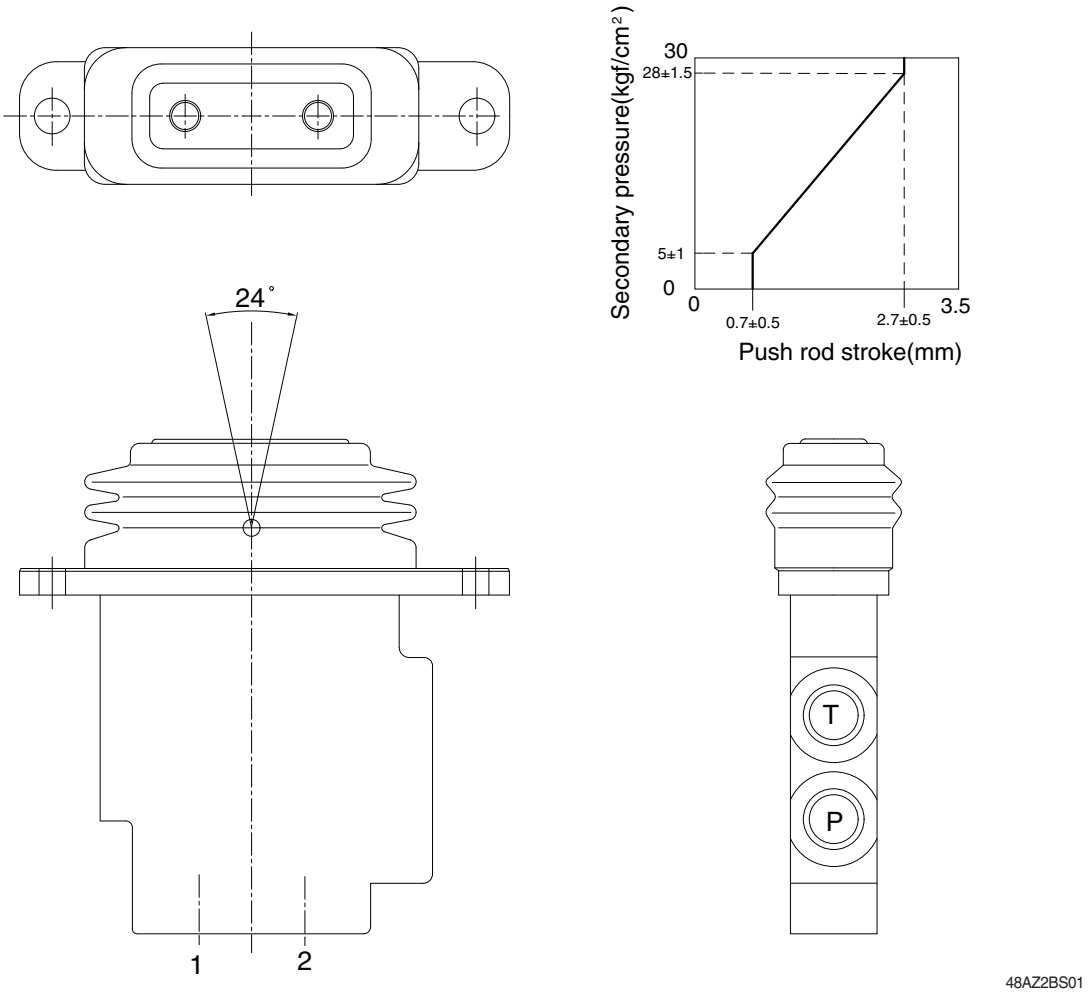
35AZ2RCP05

When the push rod (11) is stroked, the spool (7) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.

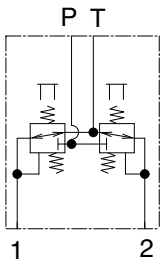
3. BOOM SWING PEDAL

1) STRUCTURE

The casing has the oil inlet P (primary pressure) and the oil return port (tank).
In addition the secondary pressure is taken out through port 1 and port 2 provided at the housing bottom face.



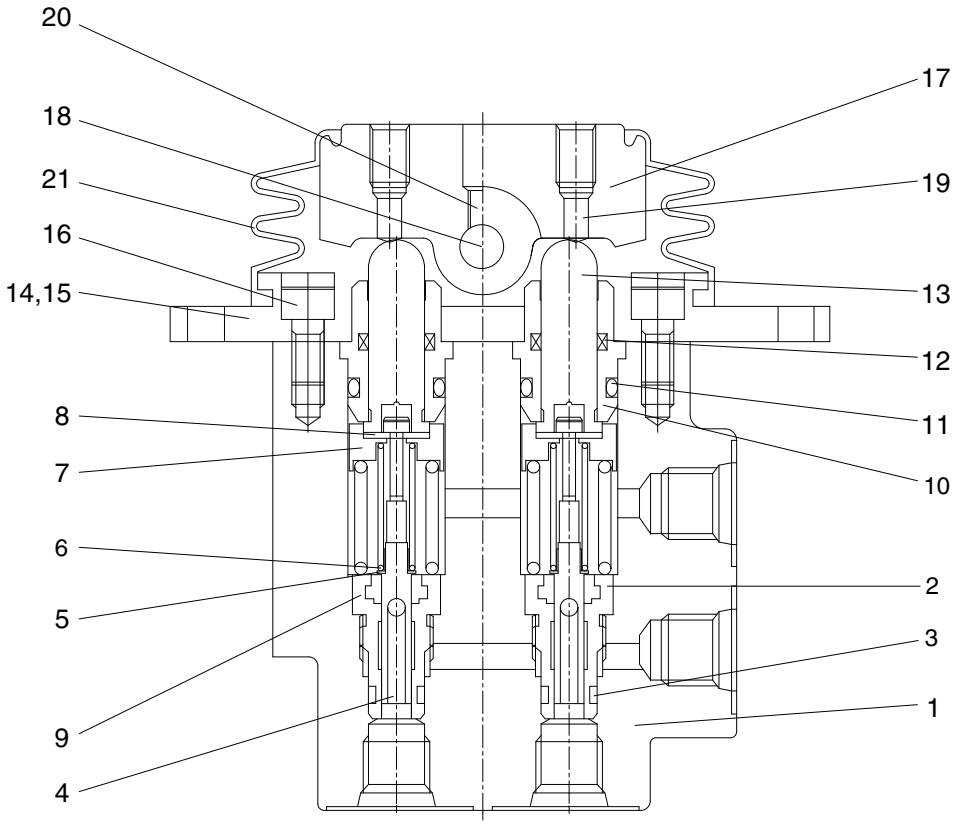
48AZ2BS01



Hydraulic circuit

Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Boom swing (LH)	
2	Boom swing (RH)	

2) COMPONENT



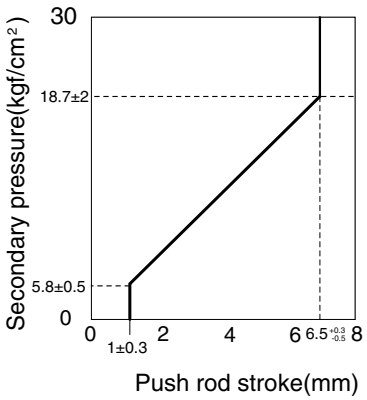
31MT-20050

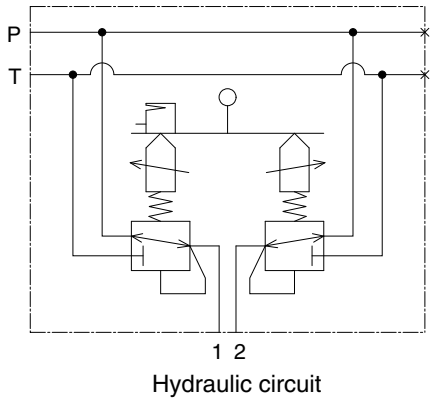
1	Body	8	Stopper	15	DU bush
2	Plug	9	Spring	16	Wrench bolt
3	O-ring	10	Plug	17	Cam
4	Spool	11	O-ring	18	Pin
5	Spring seat	12	Rod seal	19	Adjust screw
6	Spring	13	Push rod	20	Socket bolt
7	Spring seat	14	Cover	21	Bellows

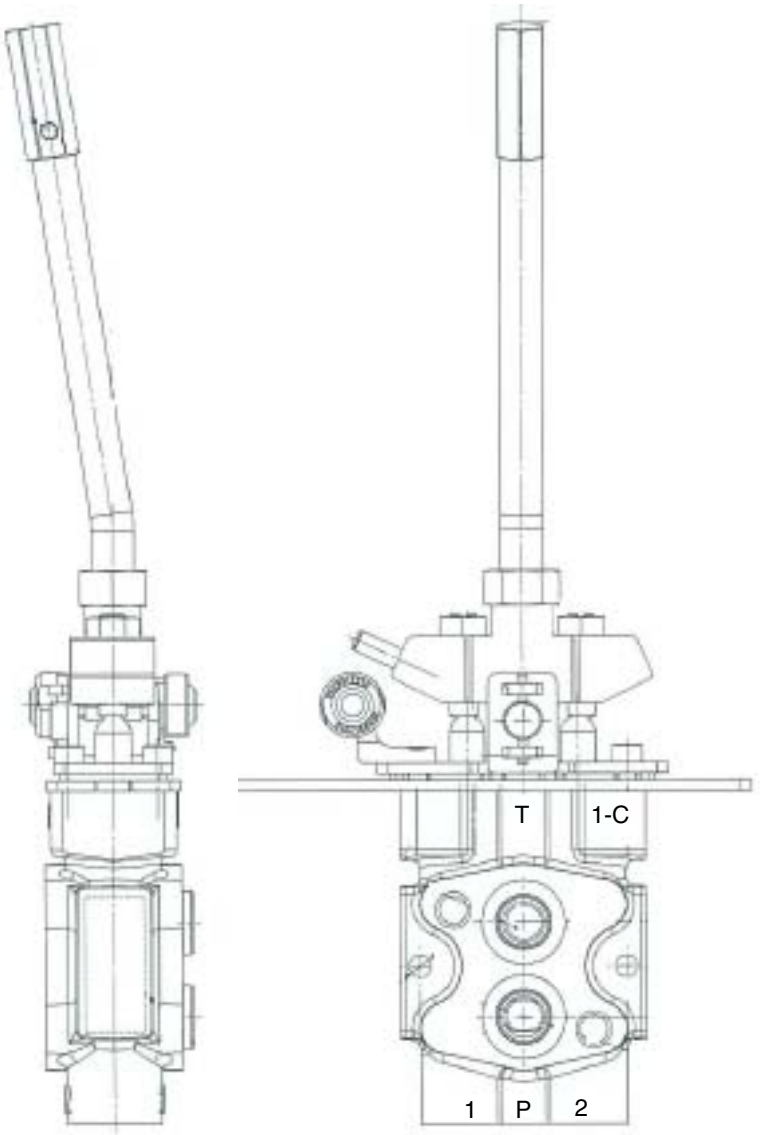
4. DOZER LEVER

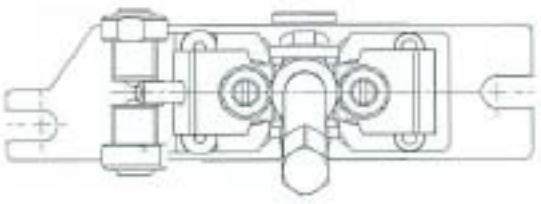
1) STRUCTURE

The casing has the oil inlet P (primary pressure) and the oil return port (tank).
In addition the secondary pressure is taken out through port 1 and port 2 provided at the housing bottom face.





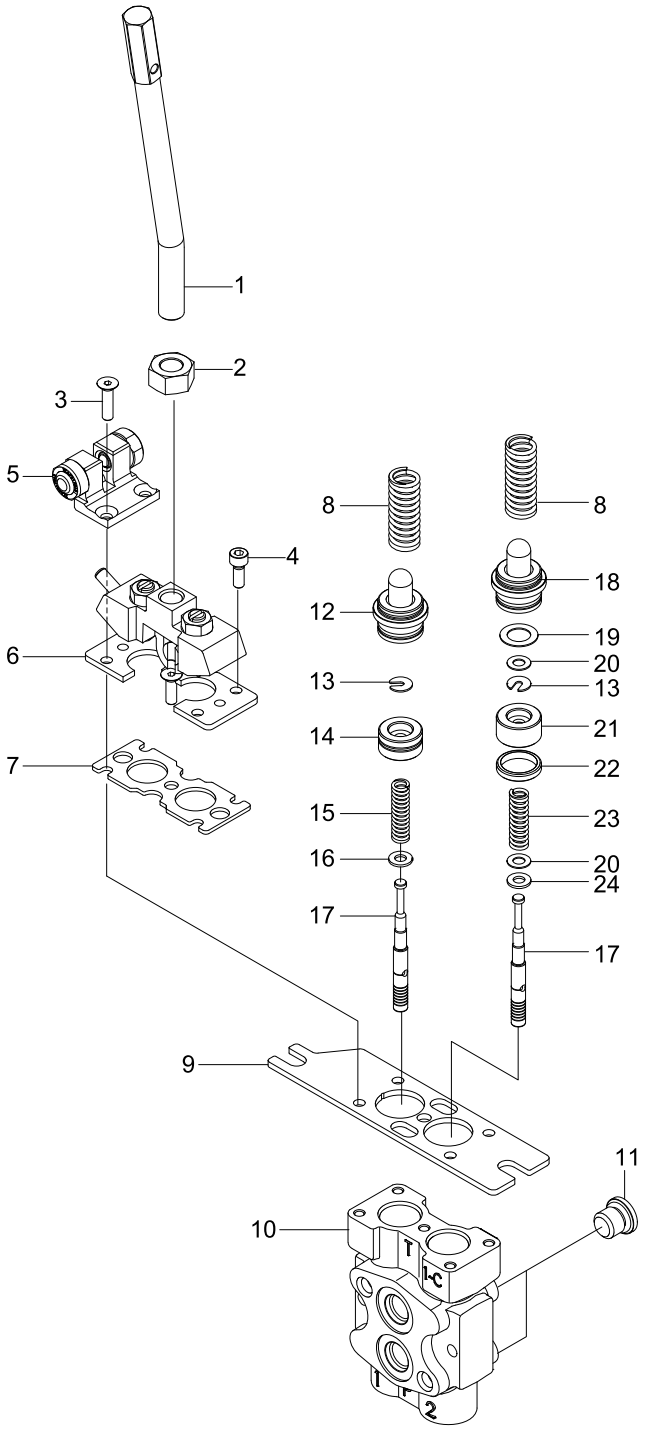




Port	Port	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	PF 1/4
1	Dozer blade up port	PF 1/4
2	Dozer blade down port	PF 1/4

35AZ2DL01

2) COMPONENT



35AZ2DL02

1	RCV lever	9	Lower plate	17	Rod
2	Lever nut	10	Lower body	18	Plunger
3	Screw	11	Plug	19	Spacer
4	Screw	12	Plunger	20	Spacer
5	Bracket	13	Retainer	21	Bushing
6	Upper body	14	Bushing	22	Spacer
7	Upper plate	15	Spring	23	Spring
8	Spring	16	Seal washer	24	Gasket