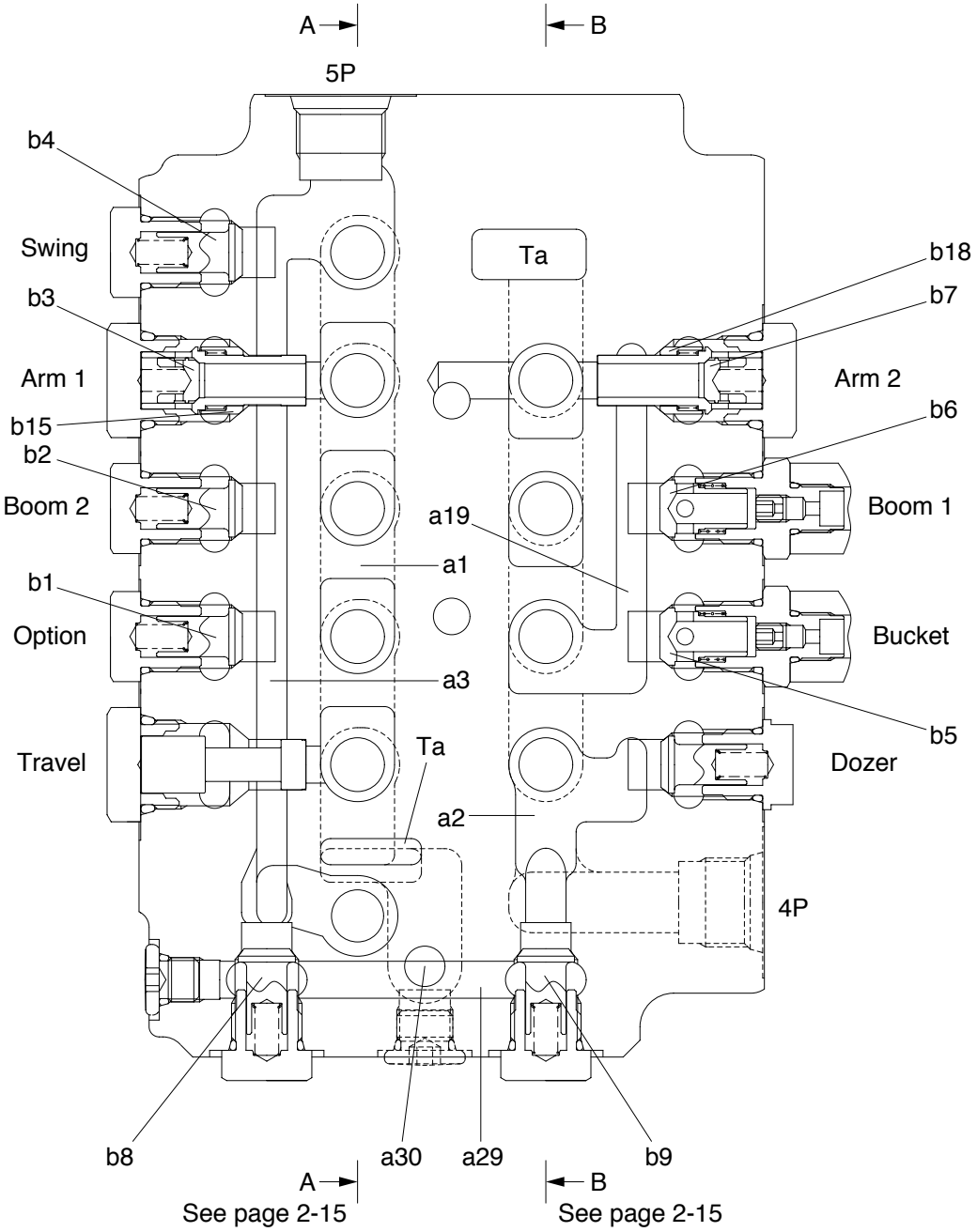
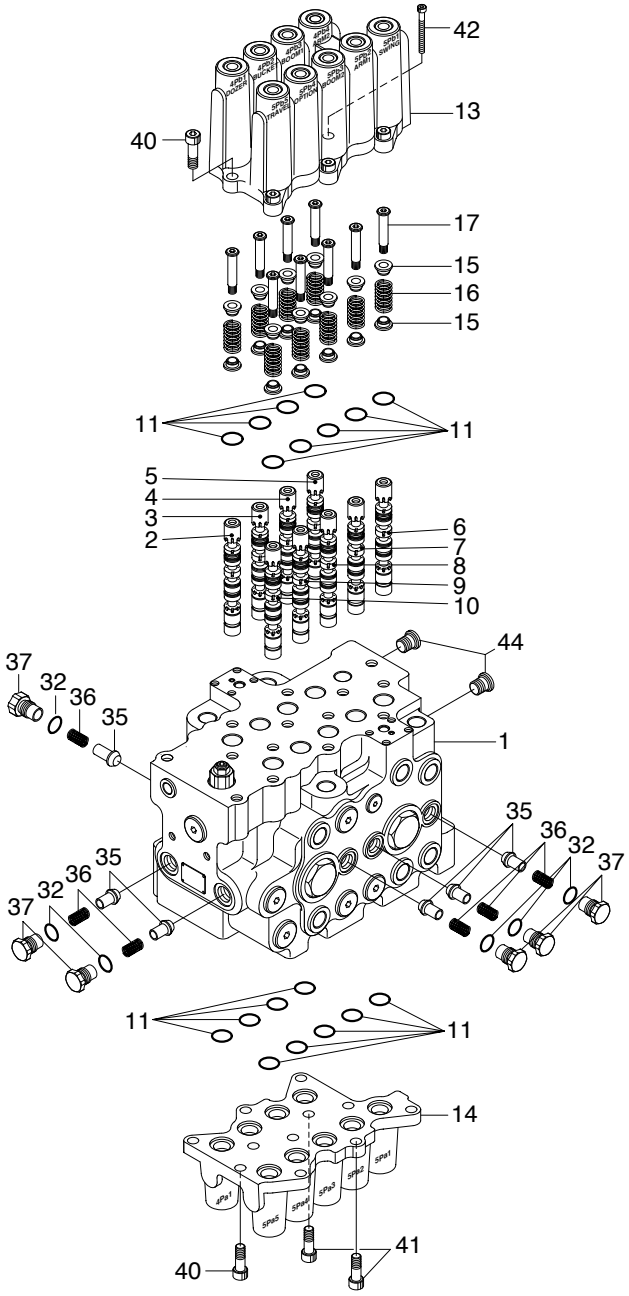
GROUP 2 MAIN CONTROL VALVE

1. STRUCTURE

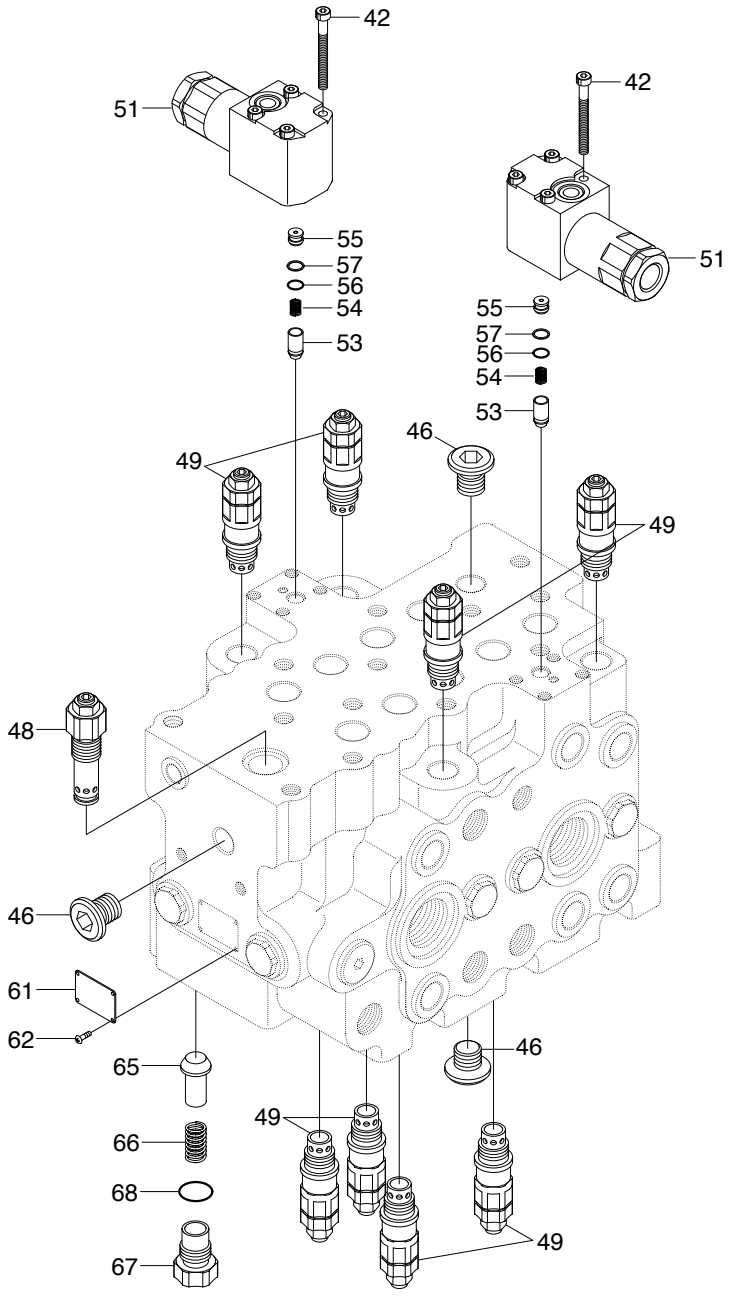


STRUCTURE(1/3)



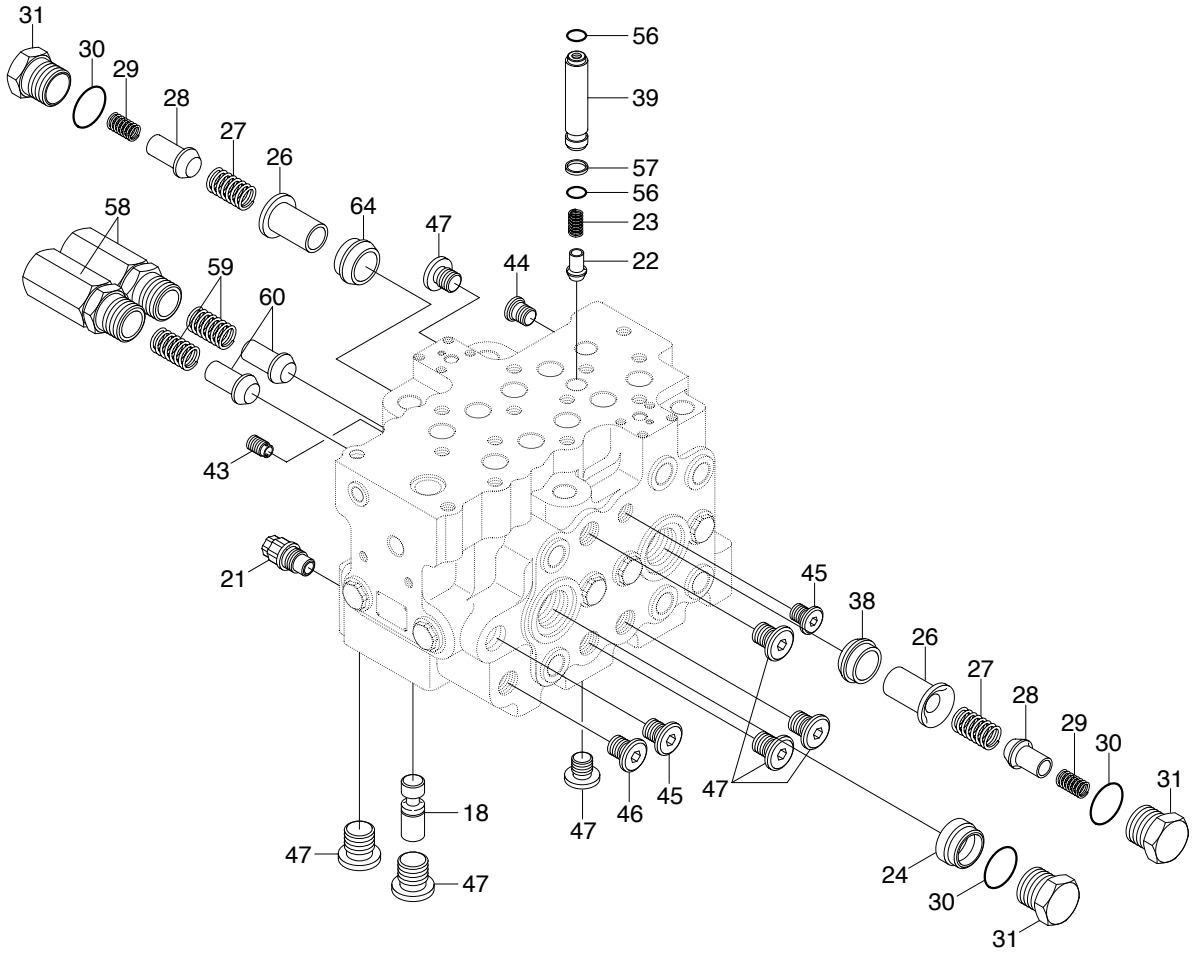
1	Housing valve	9	Service spool	32	O-ring
2	Dozer spool	10	Travel spool	35	Poppet
3	Bucket spool	11	O-ring	36	Spring
4	Boom1 spool	13	Cap	37	Plug
5	Arm2 spool	14	Cap	40	Socket head bolt
6	Swing spool	15	Spring seat	41	Socket head bolt
7	Arm1 spool	16	Spring	42	Socket head bolt
8	Boom2 spool	17	Spool end	44	Plug assembly

STRUCTURE(2/3)



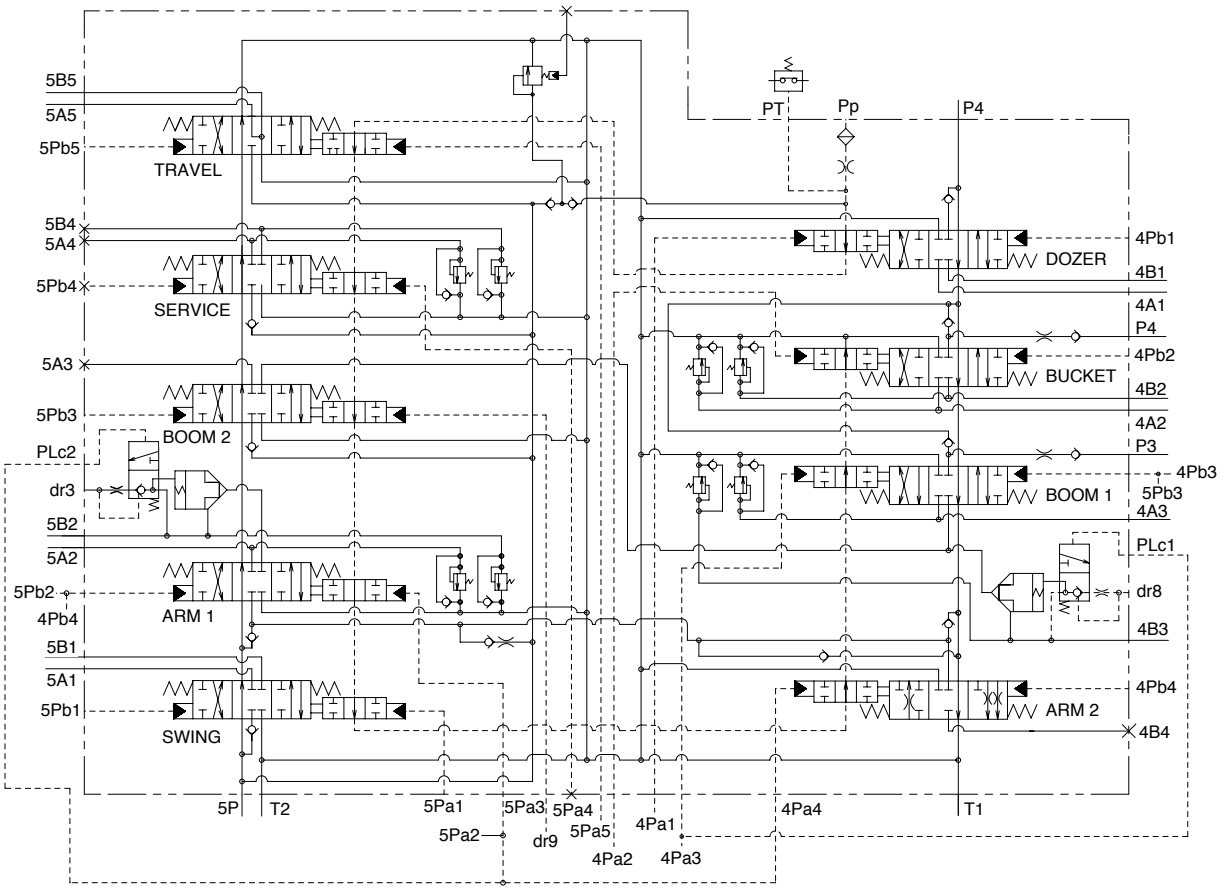
42	Socket head bolt	54	Spring	62	Screw drive
46	Plug assembly	55	Spacer	65	Poppet
48	Relief valve kit	56	O-ring	66	Spring
49	Relief valve kit	57	Back up ring	67	Plug
51	Anti-drift valve assembly	61	Name plate	68	O-ring
53	Poppet				

STRUCTURE(3/3)



18	Spacer	29	Spring	46	Plug assembly
21	Plug assembly	30	O-ring	47	Plug assembly
22	Poppet	31	Plug	56	O-ring
23	Spring	38	Sleeve	57	Back up ring
24	Spacer	39	Plug	58	Check valve
26	Poppet	43	Plug	59	Spring
27	Spring	44	Plug assembly	60	Poppet
28	Poppet	45	Plug assembly	64	Sleeve

2. HYDRAULIC CIRCUIT



2) SINGLE OPERATION

(1) Operation of travel and dozer spool

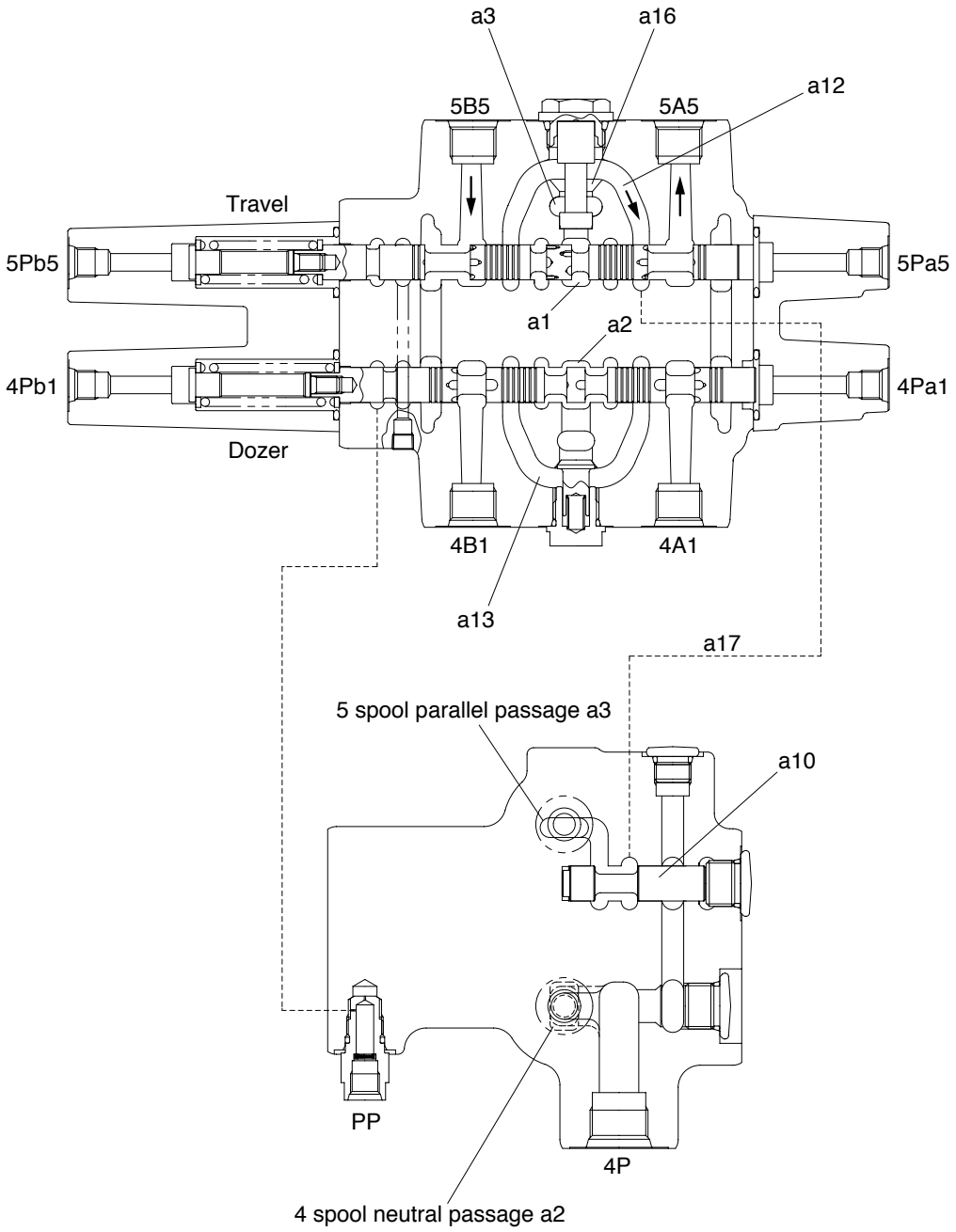
When the dozer spool is pushed to the left by the pilot pressure of port 4Pa1, the neutral passage(a2) is closed, and the oil discharged from pump P2 flows into cylinder port 4A1 via neutral passage(a2, a13).

The oil from cylinder port 4B1 returns to the tank via the low pressure passage(Ta).

Also, the travel spool is pushed to the left by the pilot pressure of port 5Pa5, the oil discharged from pump P1 flows into cylinder port 5A5 via parallel passage(a3) and passage(a16, a12).

At the same time, the oil flows into passage(a12) through parallel passage(a3, a17).

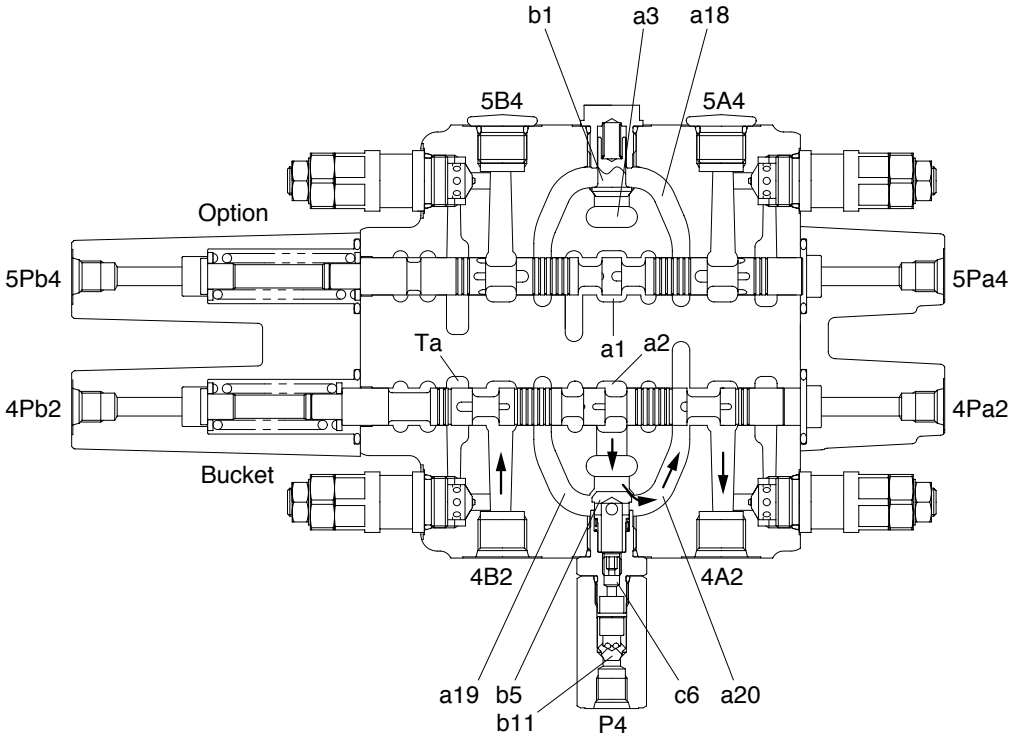
The oil from cylinder port 5B5 returns to the tank via the low pressure passage(Ta).



(2) Operation of bucket spool

When the bucket spool is pushed to the right by the pilot pressure of port(4Pa2), the neutral passage(a2) is closed, the oil discharged from pump P2 pushes up the load check valve(b5) through parallel passage(a19) and flows into cylinder port 4A2.

The oil from cylinder port 4B2 returns to the tank via the low pressure passage(Ta).

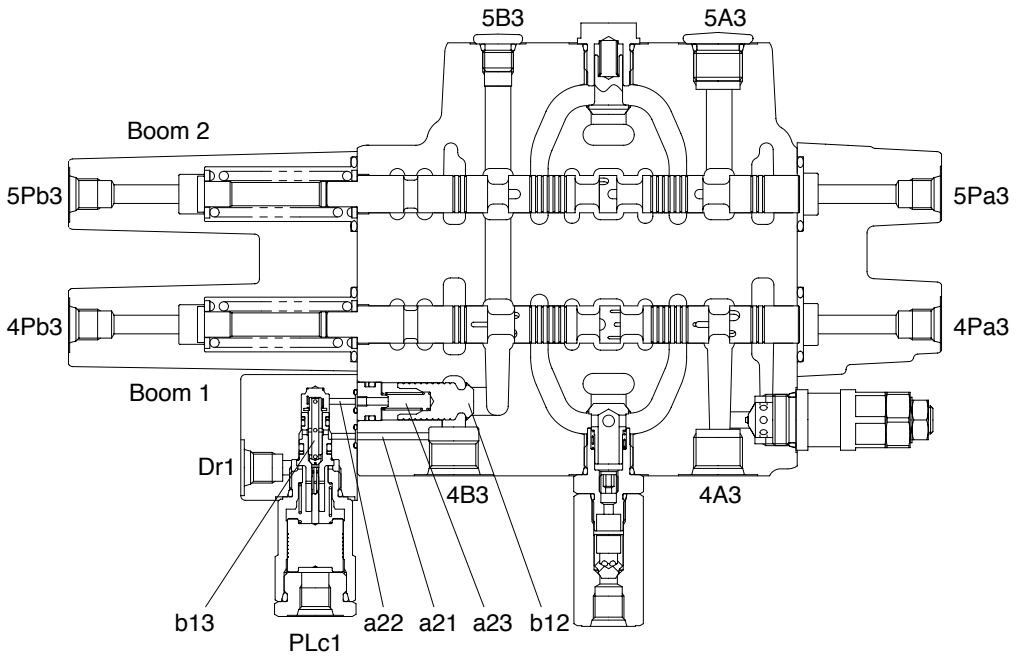


(3) Operation of boom spool

① Neutral

This valve is providing the anti-drift valve on the cylinder bottom side of boom 1 section.

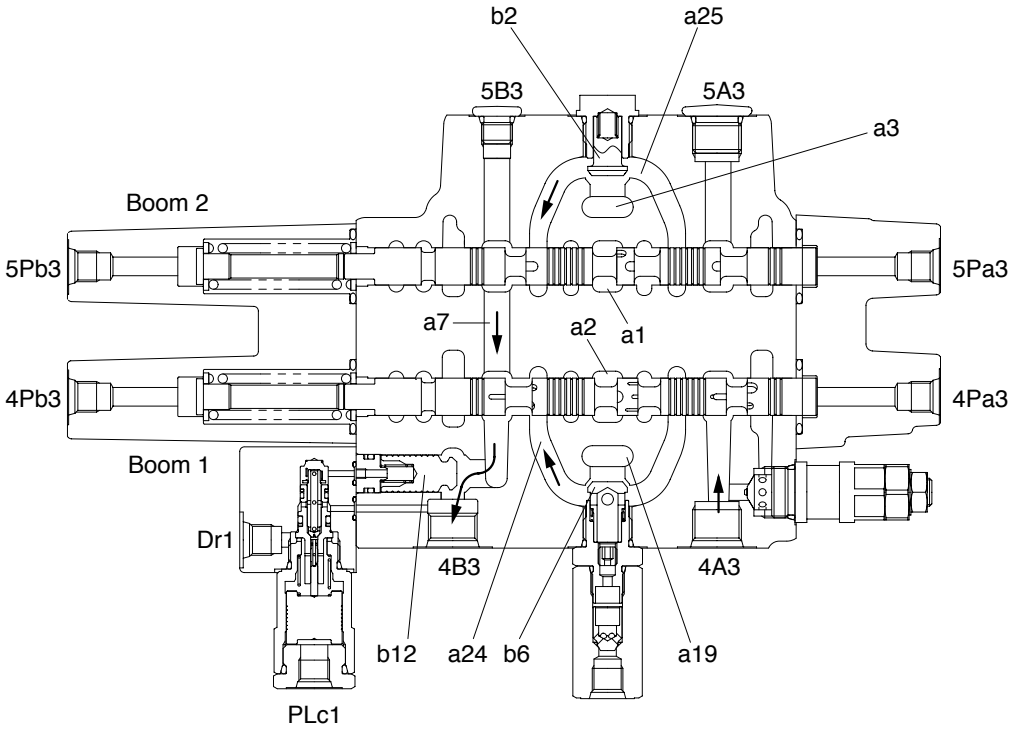
In neutral, the poppet(b12) is seated by the pressure of spring chamber(a23) because the oil from the port 4B3 is connection with spring chamber(a23) via passage(a21), spool(b13) and passage(a22).



② **Boom up**(Flow summation)

When the boom 1 spool is pushed to the right by the pilot pressure of port 4Pb3 via passage(25), the neutral passage(a2) is closed, the oil discharged from pump P2 pushes up the load check valve(b6) via parallel passage(a19), passes through passage(a24) and then flows into cylinder port 4B3. At the same time, the boom 2 spool is pushed to the right, the neutral passage(a1) is closed, the oil discharged from pump P1 pushes up the load check valve(b2) via parallel passage(a3) and then joins to the port 4B3.

The return oil from cylinder port(4A3) flows into the tank via the low pressure passage(Ta).



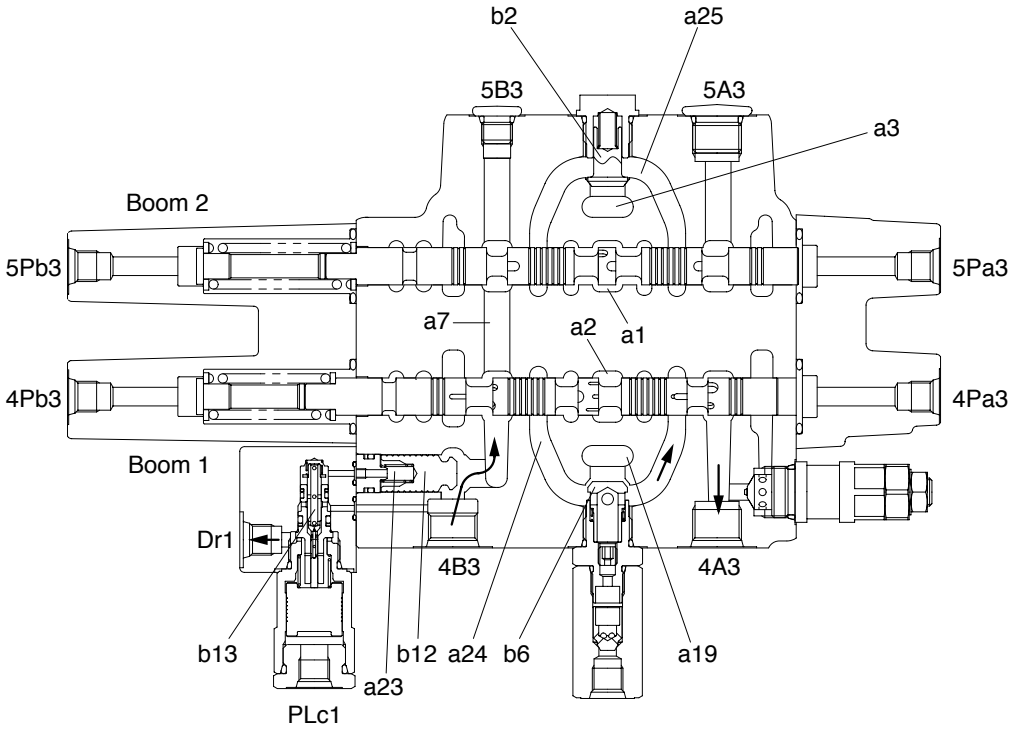
③ **Boom down**

When the boom 1 spool is pushed to the left by the pilot pressure of port 4Pa3, the neutral passage(a2) is closed.

The oil discharged from pump P2 pushes up the load check valve(b6) via parallel passage(a19) and flows into cylinder port 4A3.

At the same time, the spool(b13) of anti-drift valve pushes down because pilot pressure port 4Pa3 connected with port PLc1.

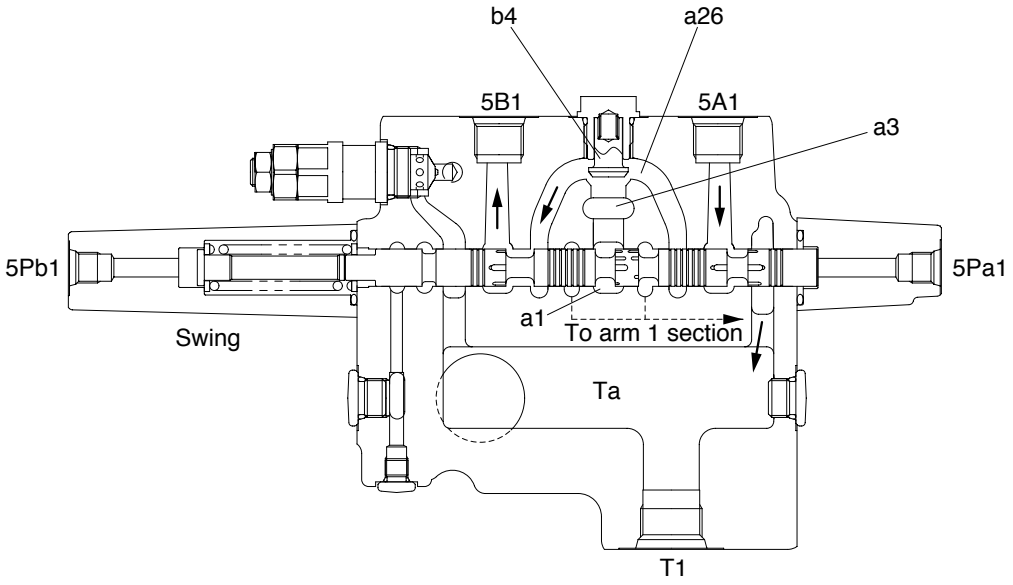
Which release the pressure of spring chamber(a23), the poppet(b12) is opened; and then the oil from cylinder port 4B3 returns to the tank via the low pressure passage(Ta).



(4) Operation of swing spool

When the swing spool is pushed to the right by the pilot pressure of port 5Pb1, the neutral passage(a1) is closed, the oil discharged from pump P1 pushes up the load check valve(b4) via parallel passage(a3), passes through passage(a26) and then flows into cylinder port 5B1.

The oil from cylinder port 5A1 returns to the tank via the low pressure passage(Ta).



(5) Operation of arm spool

① **Arm out**(Flow summation)

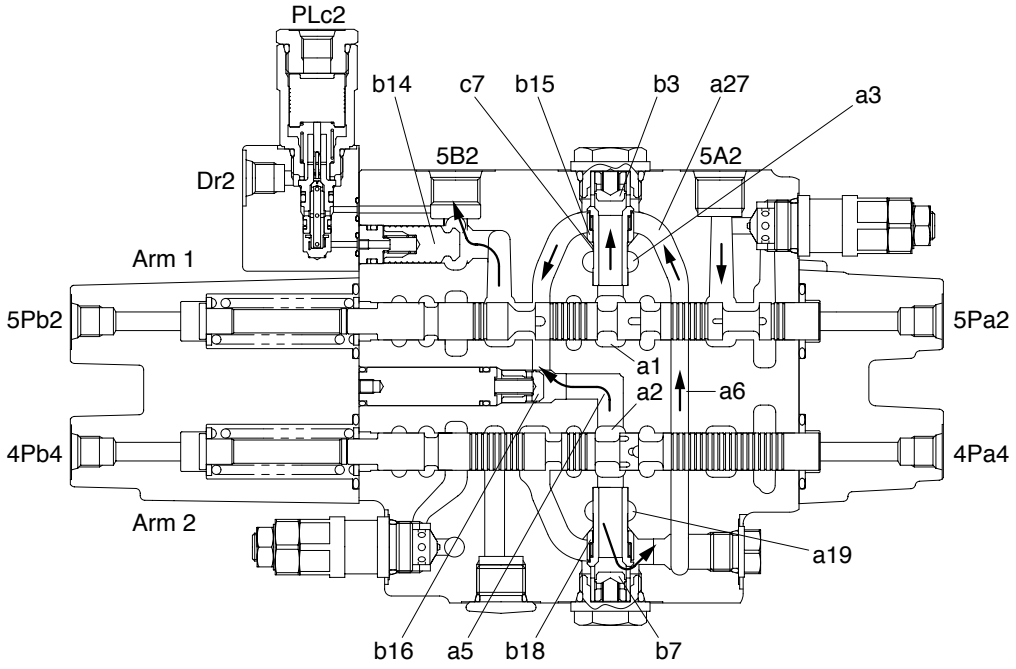
When the arm 1 spool is pushed to the right by pilot pressure of port 5Pb2, the neutral passage(a1) is closed, the oil discharged from pump P1 pushes open the tandem check valve(b3) through neutral passage(a1); and then oil flows into cylinder port 5B2 via passage (a27) and poppet(b14) of anti drift valve.

Also, the oil partly flow into port 5B2 through orifice(c7), load check valve(b15) and passage(a27).

At the same time, the arm 2 spool is pushed to the right, the neutral passage(a2) is closed, the oil discharged from pump P2 joins to the port 5B2 through neutral passage(a2) and the anti valve(b16) through parallel passage(a5).

The oil passes through passage(a6) and passage(a27), pushes up the tandem check valve(b7) and then joints to port 5B2.

The oil from cylinder port 5A2 returns to the tank via the low pressure passage(Ta).



② **Arm in**(Flow summation)

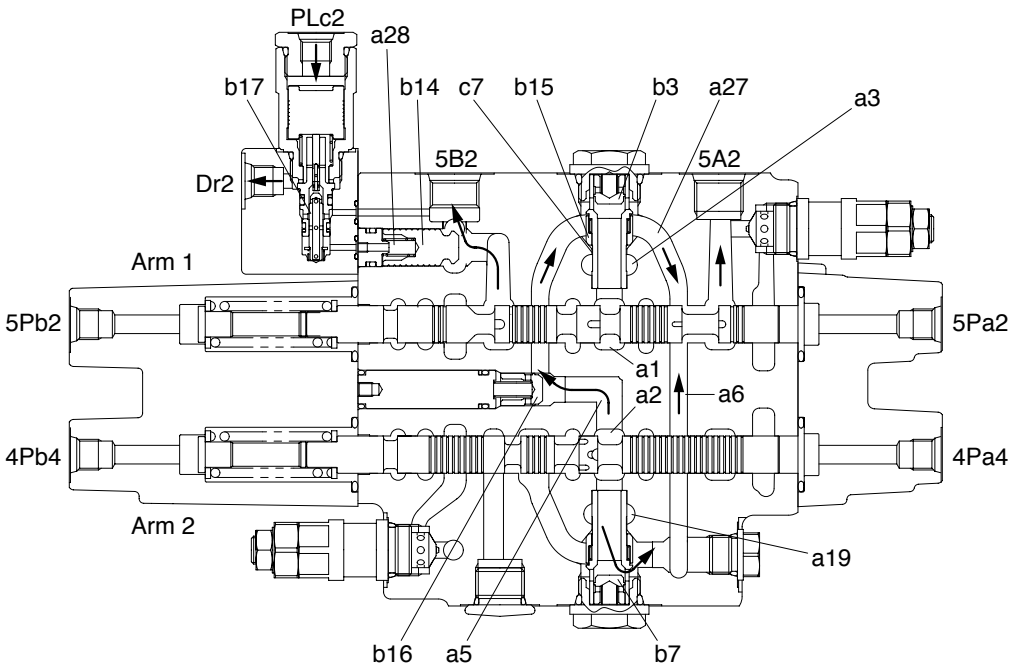
When the arm 1 spool is pushed to the left by pilot pressure of port 5Pa2, the neutral passage (a1) is closed, the oil discharged from pump P1, pushes up tandem check valve(b3) through neutral passage(a1); and then oil flows into cylinder port 5A2 via passage(a27).

Also, the oil partly flow into port 5A2 through parallel passage(a3), orifice(c7), load check valve (b15) and passage(27).

At the same time, the spool(b17) of anti drift valve pushes open because pilot pressure port 5Pa2 connected with port PLc2; release the pressure of spring chamber(a28) the poppet(b14) is opened; and then the oil from cylinder port 5B2 returns to the tank via the low pressure passage(Ta).

Also, the port 4Pa4 is connected with the port 5Pa2, the arm 2 spool is pushed to the left simultaneously the arm 1 spool and the neutral passage(a2) is closed. The oil discharged from pump P2 pushes up the check valve(b16) through neutral passage(a2) and parallel passage (a5, a27); and then joints to port 5A2.

The oil from cylinder port 5B2 returns to the tank via the low pressure passage(Ta).



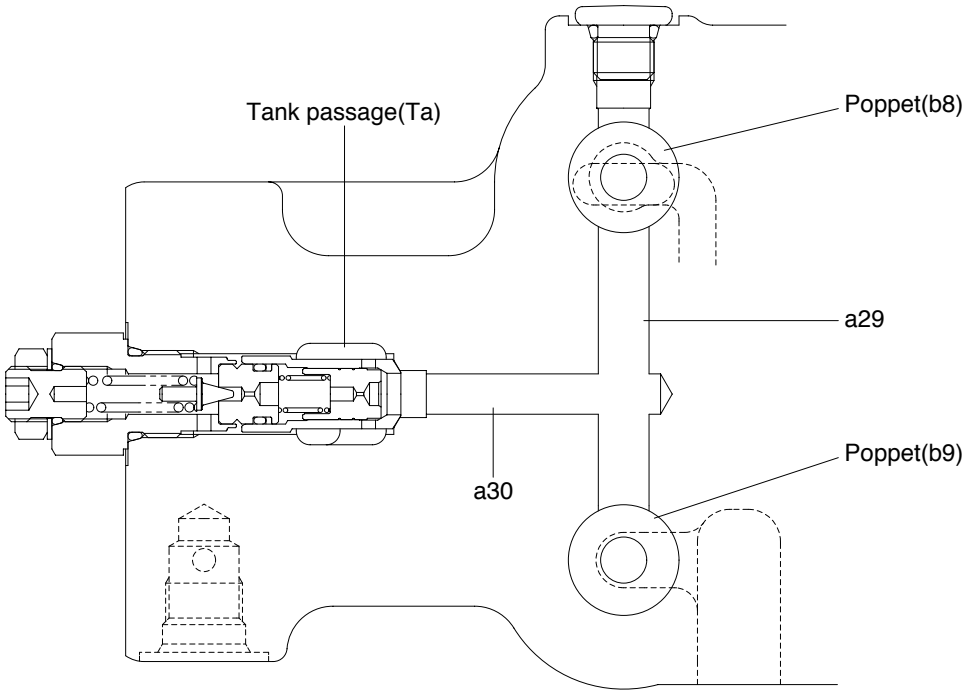
(6) Relief valve

① Main relief valve

The oil from the pump P1 is flows through 5 spool parallel passage(a3), passage(a29) and check valve(b8) to the main relief valves entrance(a30).

The oil from the pump P2 is flows through 4 spool parallel passage(a2) and check valve(b9) to the relief valves entrance(a30).

This main relief valve keeps the setting pressure of pump P1 and P2.



② Over load relief valve

Over load relief valves are provided each cylinder ports of boom 1, arm 1 and bucket.

These prevents the abnormal high pressure of actuators by external force.

Also, over load relief valves setting pressure is lower than main relief valve, controls the high pressure of pump P1 and P2.

When the pressure of cylinder ports create back pressure, this valve opens allowing oil from tank to cylinder port; and then prevents cavitation.

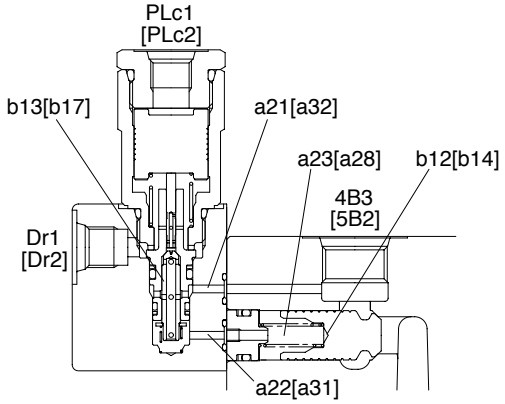
(7) **Anti-drift valve**(Boom and arm section)

Anti-drift valve is provided the boom bottom(Arm rod) side of cylinder port for prevention of self drifting by boom or arm weight.

① **When neutral**

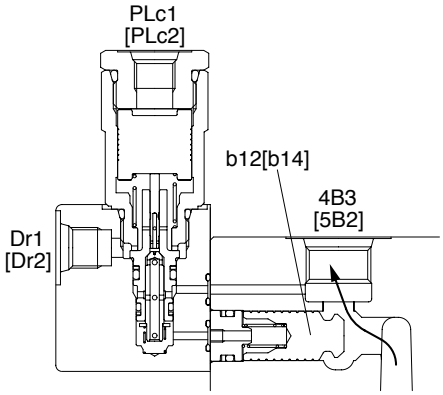
The oil from cylinder port flows into spring chamber〔a23(a28)〕 via passage〔a21(a32)〕, drilled passage of spool〔b13(b17)〕 and 〔a22(a31)〕.

Because of the difference of poppet area and spring force, the poppet〔b12(b14)〕 is seated.



② **When boom up or arm out**

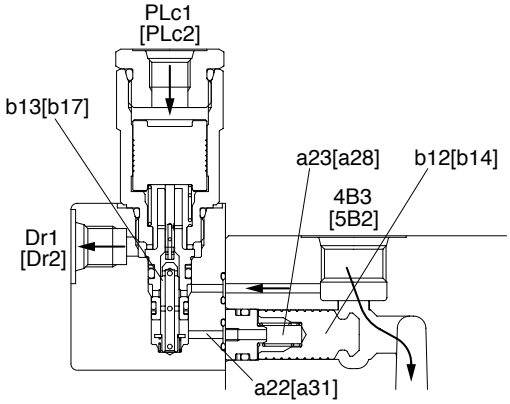
The oil form pump flows into cylinder by pushes open the poppet〔b12(b14)〕.



③ **When boom down or arm in**

The spool〔b13(b17)〕 is pushed down by the pressure of PLc1 or PLc2 Then the oil of spring chamber〔a23(a28)〕 flows into drain port 4Dr1 or 4Dr2 and pushes open poppet〔b12(b14)〕.

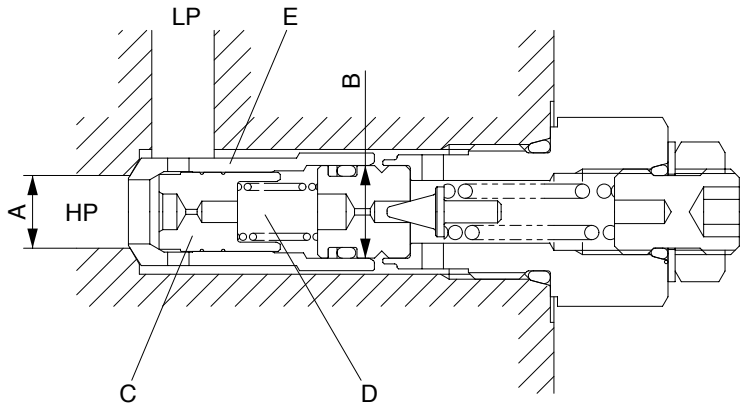
As a result, the oil from cylinder port returns to tank through the boom 1 spool or arm 1 spool.



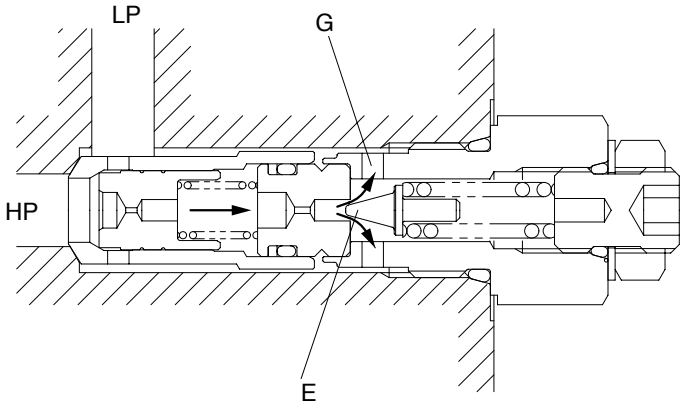
3) RELIEF VALVE OPERATION

(1) Main relief valve

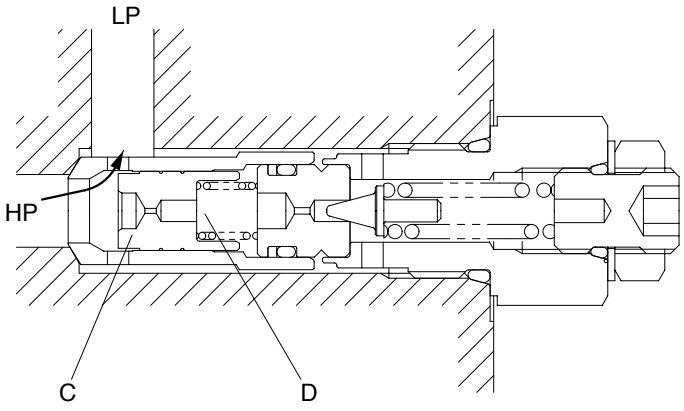
① This relief valve is built-in between the neutral passage(HP) and low pressure passage(LP), and the pressure oil fills up chamber(D) inside via orifice of main poppet(C).
Thus the sleeve(E) and the main poppet(C) are securely seated by difference area of A an B.



② When the pressure in neutral passage(HP) reaches the setting force of spring, pilot poppet(F) is opened.
The oil flows around poppet and into the low pressure passage(LP) via hole(G).



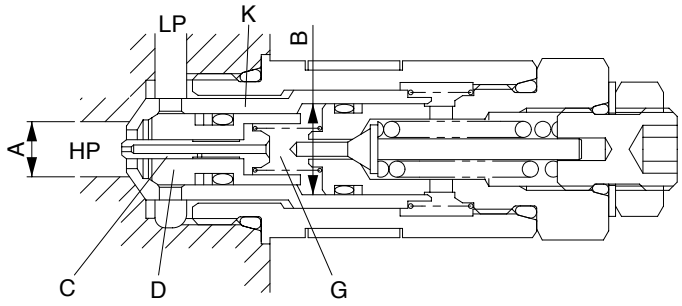
③ When above flow is formed, the pilot poppet(F) is opened; the pressure of chamber(D) drops, the main poppet(C) is opened and then the oil directly flows into the low pressure passage(LP).



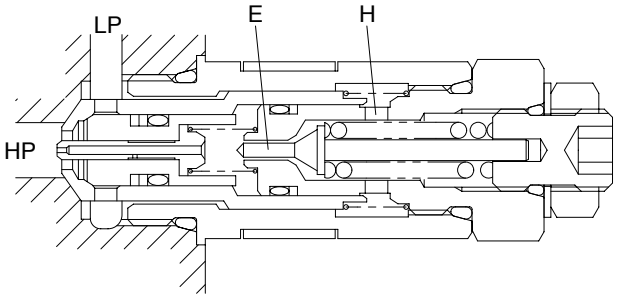
(2) Overload relief valve

① Overload working operation

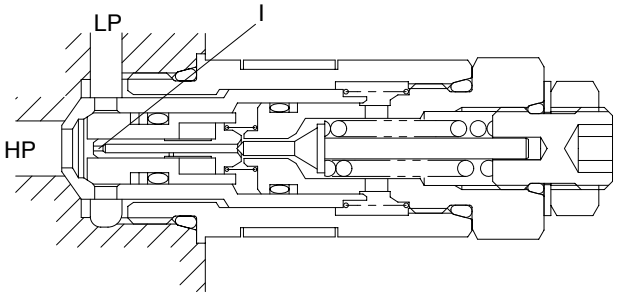
· This relief valve is built-in the cylinder port(HP) and the low pressure passage(LP), and the pressure oil fills up chamber(G) inside via hole of piston(C).
Thus the sleeve(K) and the main poppet(D) are securely seated by difference area of A and B.



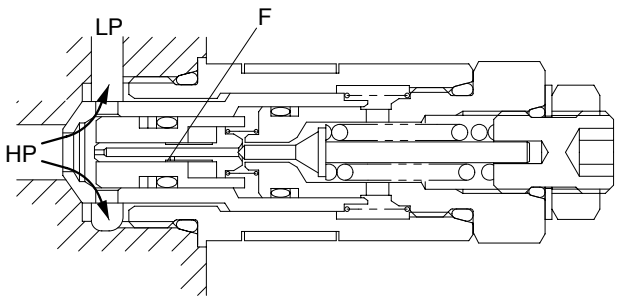
· When the pressure in cylinder port(HP) reaches the setting force of spring, the pilot poppet(E) is opened.
The oil flows around poppet and into the low pressure passage(LP) via hole(H).



· When above flow is formed, the pilot poppet(E) is opened.
The pressure drops before and behind orifice(I); piston(C) moves to right and the piston(C) is seated at the tip of poppet(E).



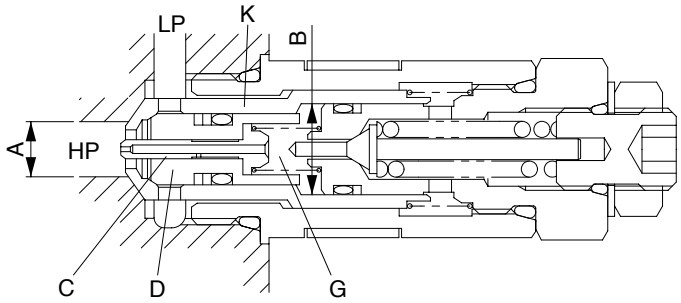
· The oil flow from the high pressure passage(HP) to the poppet(D) behind is only around poppet and orifice(F); then the high pressure passage(HP) is higher than the poppet(D) behind pressure. Thus the poppet(D) is pushed open and the oil directly flows into low pressure passage(LP).



② **Make up operation**

This relief valve is built-in the cylinder port(HP) and the low pressure passage(LP), and the pressure oil fills up chamber(G) inside via hole of piston(C).

Thus the sleeve(K) and the main poppet(D) are securely seated by difference area of A and B.



③ When the cylinder port pressure(HP) drops(Closer to negative pressure) until the cylinder port pressure is lower than the low pressure passage(LP), the sleeve(K) opens by difference area of A and B.

Then the low pressure passage oil flows into cylinder port(HP) in order to prevent cavitation.