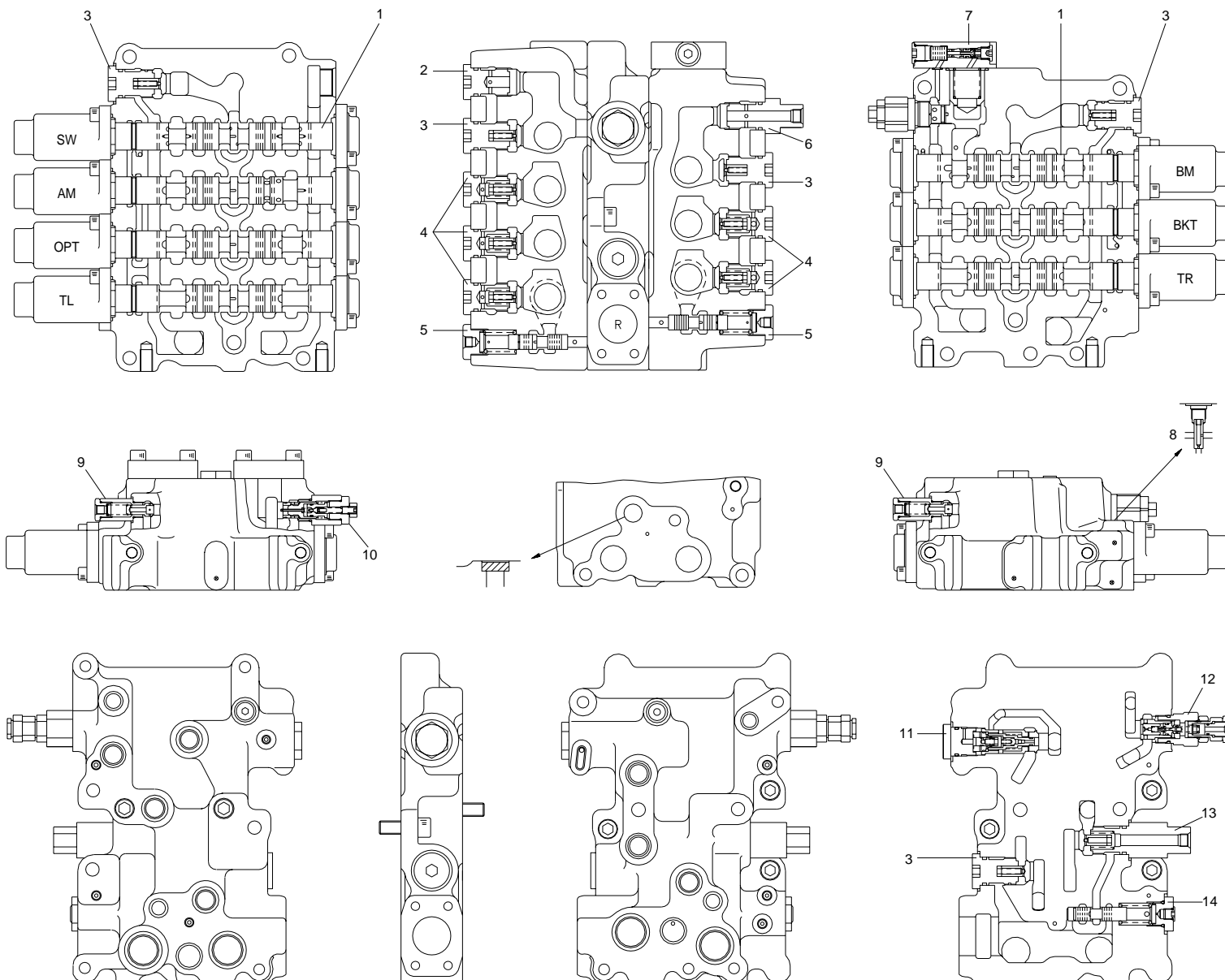


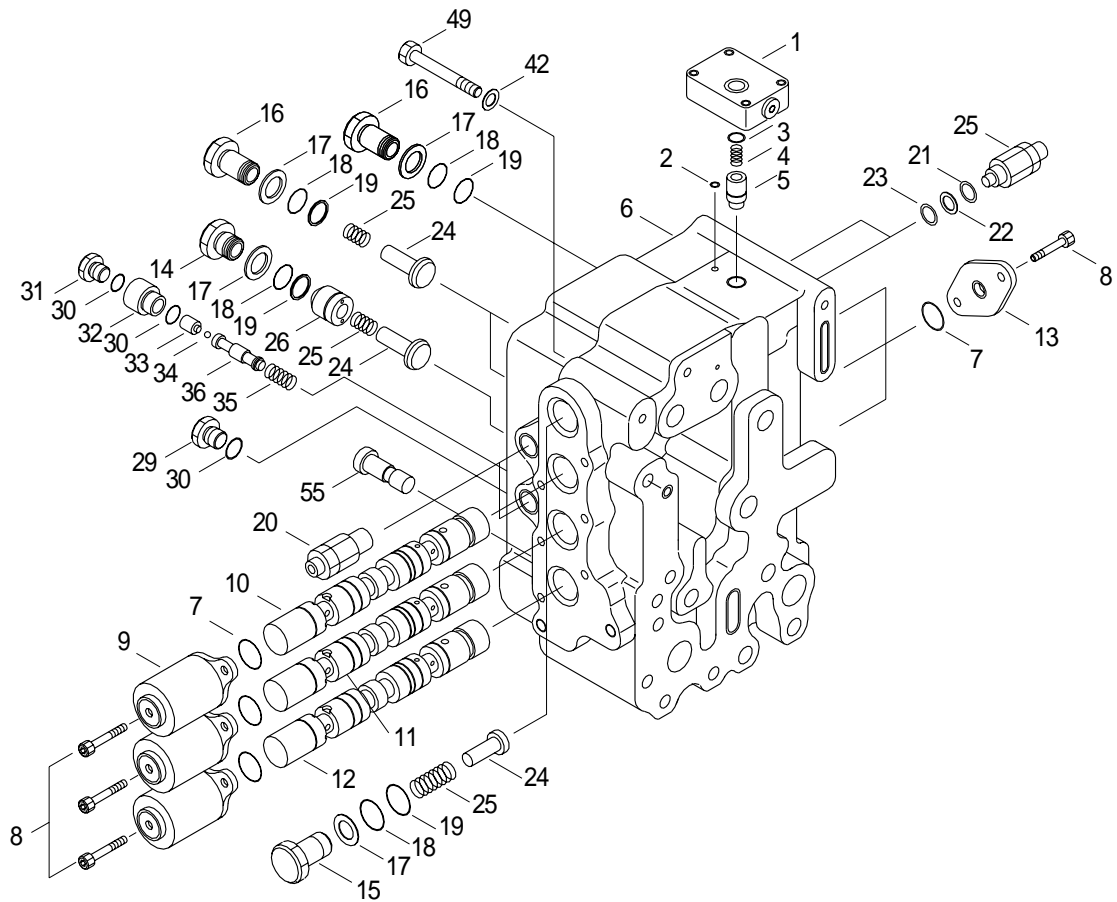
GROUP 2 MAIN CONTROL VALVE

1. STRUCTURE

- 1 Plunger
- 2 Orifice
- 3 Load check valve
- 4 Load check valve
- 5 Center bypass valve
- 6 Orifice
- 7 Foot relief valve
- 8 Orifice
- 9 Foot relief valve
- 10 Over load relief valve
- 11 Logic valve
- 12 Main relief valve
- 13 Arm summation check valve
- 14 Travel straight valve

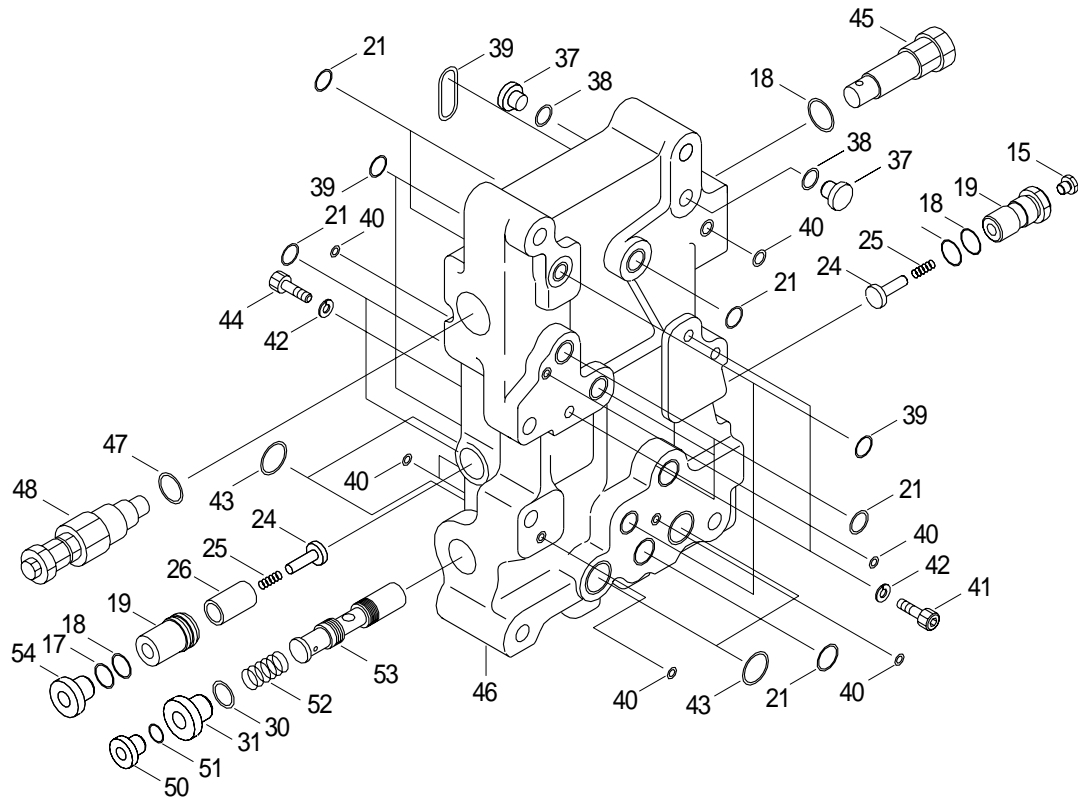


STRUCTURE



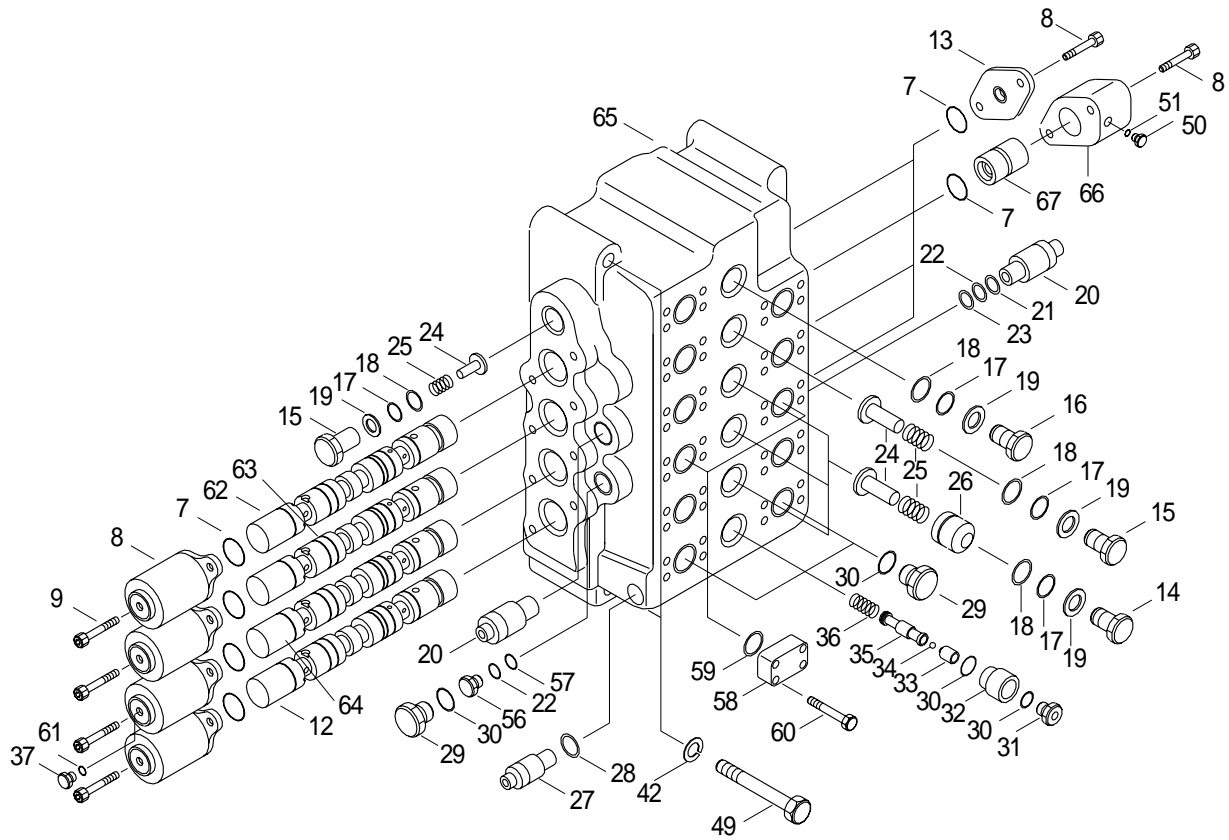
1	Cover	14	Cap	27	Foot relief valve
2	O-ring	15	Cap	28	O-ring
3	O-ring	16	Cap	29	Cap
4	Spring	17	Back up ring	30	O-ring
5	Poppet	18	O-ring	31	Cap
6	Housing	19	Nylon chip	32	Cap
7	O-ring	20	Over load relief valve	33	Piston
8	Bolt	21	O-ring	34	Steel ball
9	Cover	22	Back up ring	35	Spring
10	Plunger	23	O-ring	36	Spool
11	Plunger	24	Check	42	Washer
12	Plunger	25	Spring	49	Bolt
13	Cover	26	Check		

STRUCTURE



15	Cap	37	Cap	47	O-ring
17	Back up ring	38	O-ring	48	Main relief
18	O-ring	39	O-ring	50	Cap
19	Nylon chip	40	O-ring	51	O-ring
21	O-ring	41	Bolt	52	Spring
24	Check	42	Washer	53	Spool
25	Spring	43	O-ring	54	Cap
26	Check	44	Bolt	55	Orifice
30	O-ring	45	Logic check		
31	Cap	46	Manifold		

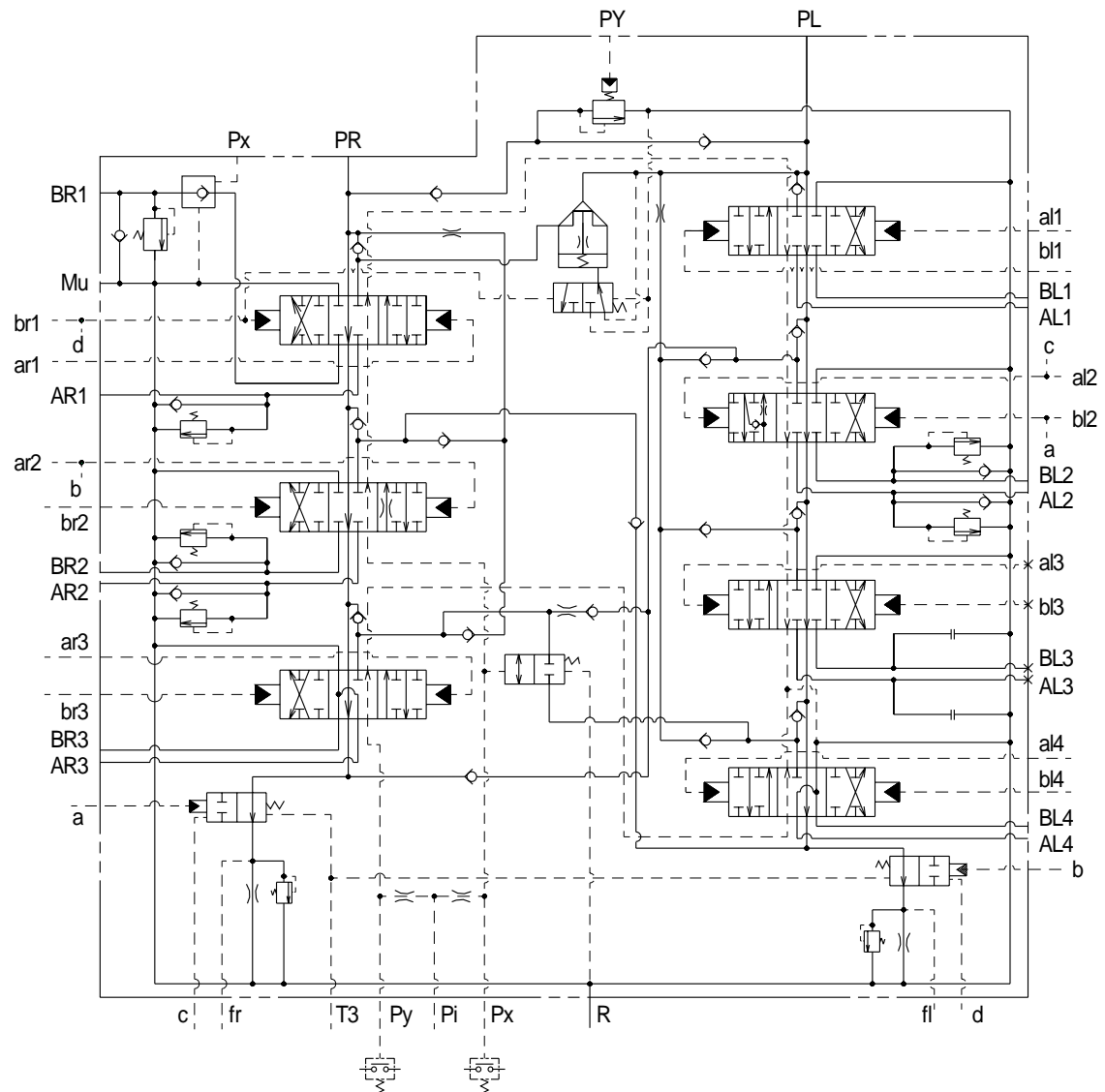
STRUCTURE



7	O-ring	24	Check	49	Bolt
8	Bolt	25	Spring	50	Cap
9	Cover	26	Check	51	O-ring
12	Plunger	27	Foot relief valve	56	Plug
13	Cover	28	O-ring	57	O-ring
14	Cap	29	Cap	58	Plunger
15	Cap	30	O-ring	59	O-ring
16	Cap	31	Cap	60	Bolt
17	Back up ring	32	Cap	61	O-ring
18	O-ring	33	Piston	62	Plunger
19	Nylon chip	34	Steel ball	63	Plunger
20	Over road relief valve	35	Spring	64	Plunger
21	O-ring	36	Spool	65	Housing
22	Back up ring	37	Cap	66	Cover
23	O-ring	42	Washer	67	Piston

2. FUNCTION

1) HYDRAULIC CIRCUIT DIAGRAM



2) BASIC OPERATION

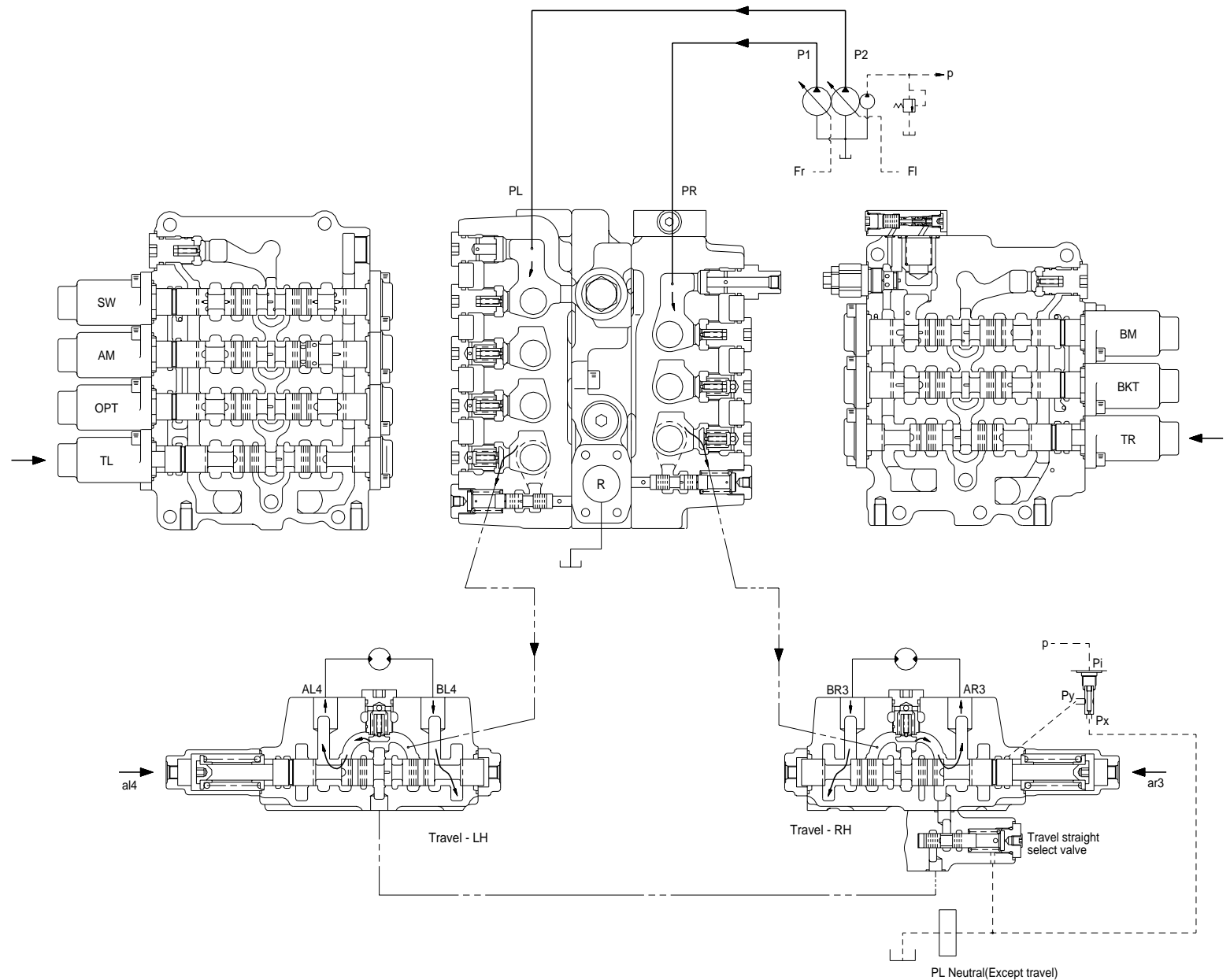
(1) Travel straight circuit

This circuit keeps straight travel in case of simultaneous operation of other actuators (SW, AM, BKT, BM) during a straight travel.

① During straight travel by operating left/right travel plunger (TL, TR):

Operation of travel spool, the pilot signal(Px) line inside the control valve is blocked, but the pilot signal(Px) line is connected to the tank by orifice therefore, the travel straight select valve is not operated; oil from pump P1 is fed into cylinder port AR3 only.

Oil from pump P2 is fed into cylinder port BL4 by the operation of TR plunger. Thus, straight travel is performed separately with pump P1 driving rightward travel(TL) and pump P2 driving leftward travel(TR).



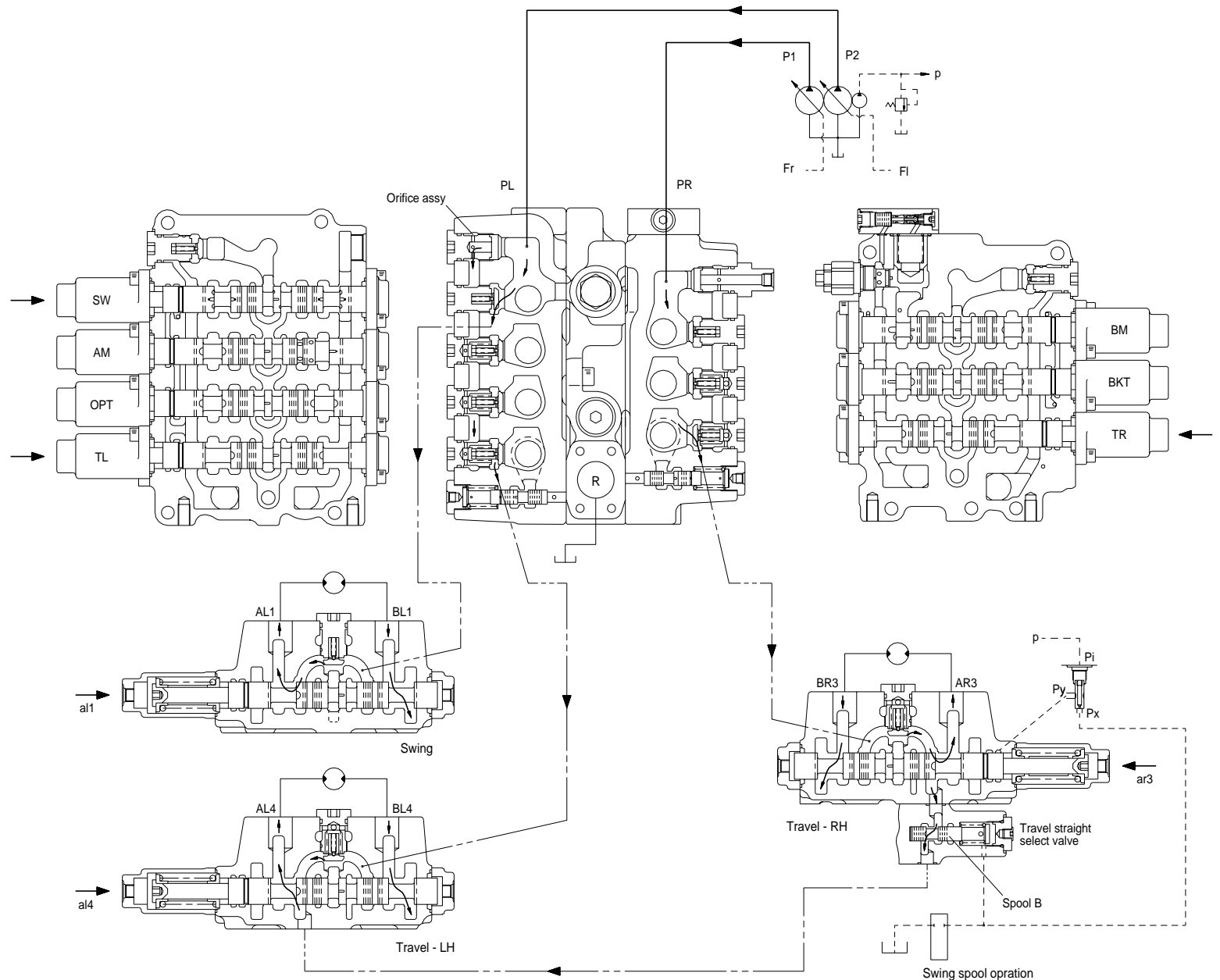
② In case of a swing operation during straight travel for instance :

At the beginning of swing plunger stroke the pilot signal(Px) line inside the control valve is blocked and the signal pressure makes the connection between the feed passages of right and left travel plungers(TL, TR) by switching spool (B) of travel straight select valve. When the swing plunger is completely switched, oil discharged from pump P1 preferentially flows into swing motor which is positioned upstream.

Thus, simultaneous operation of swing and straight travel is made possible as oil from pump P2 is fed to swing and oil from pump P1 is fed to right travel(TR) and left travel(TL).

The orifice(A) at the upstream of the parallel feed passage sends surplus oil of swing to right and left travel(TL, TR) to avoid abrupt change of the vehicle speed.

The basic operation is same with swing even in the case of other actuators on upper frame of machine during straight travel.



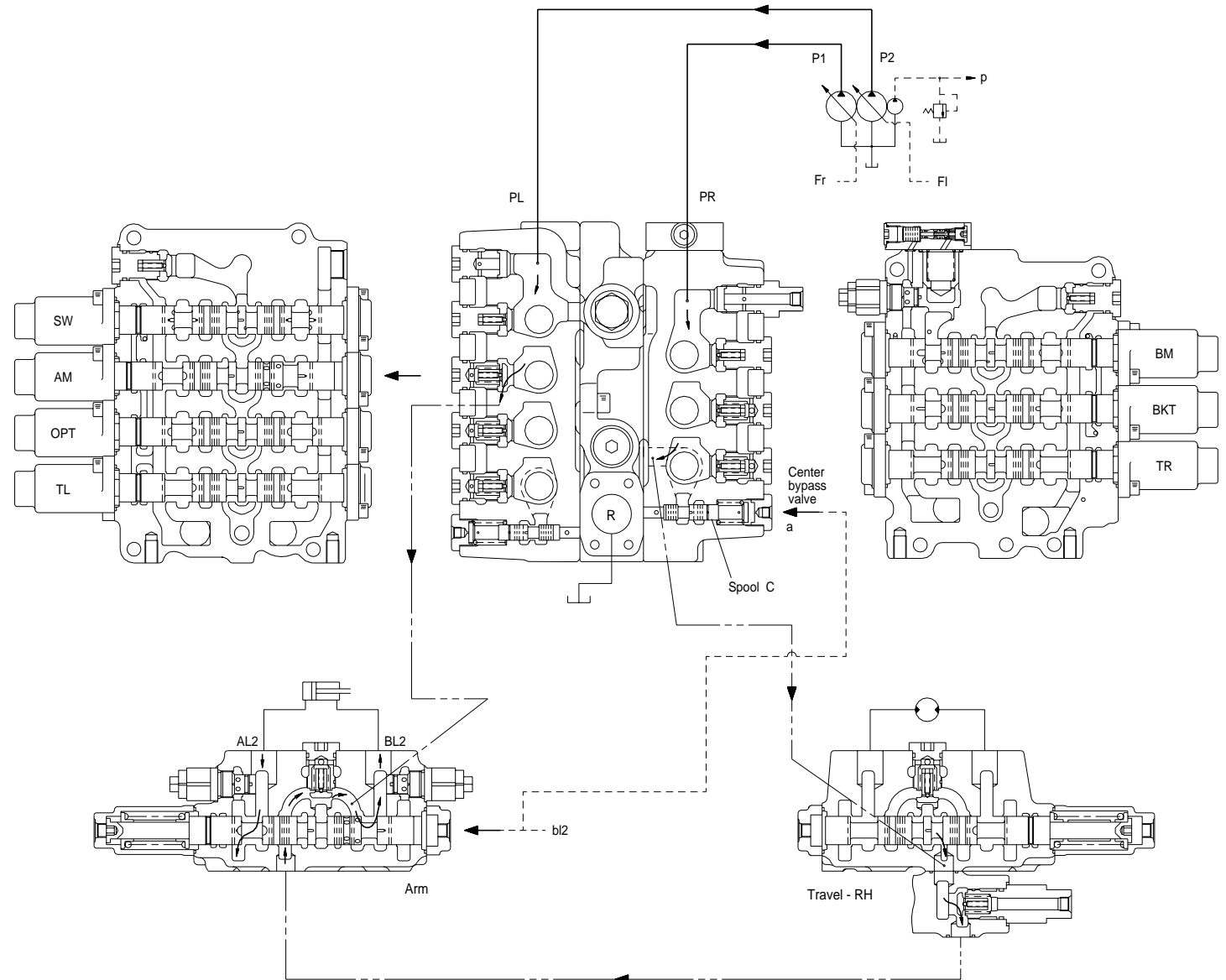
(2) Arm flow summation circuit

· Arm out operation

Oil from pump P2 is fed into cylinder port BL2 by adding pressure to arm plunger pilot port bl2.

Oil from pump P1 flows into the center bypass valve assembly via the center bypass passage. Since the same pilot pressure of the arm plunger pilot port is applied to the pilot signal port of the center bypass valve assembly (C), the center bypass spool is switched; pushing up the arm flow summation check valve in the manifold through center bypass passage of RH travel section. Oil flows into the high pressure feed passage, and joins to the flow from the pump P2.

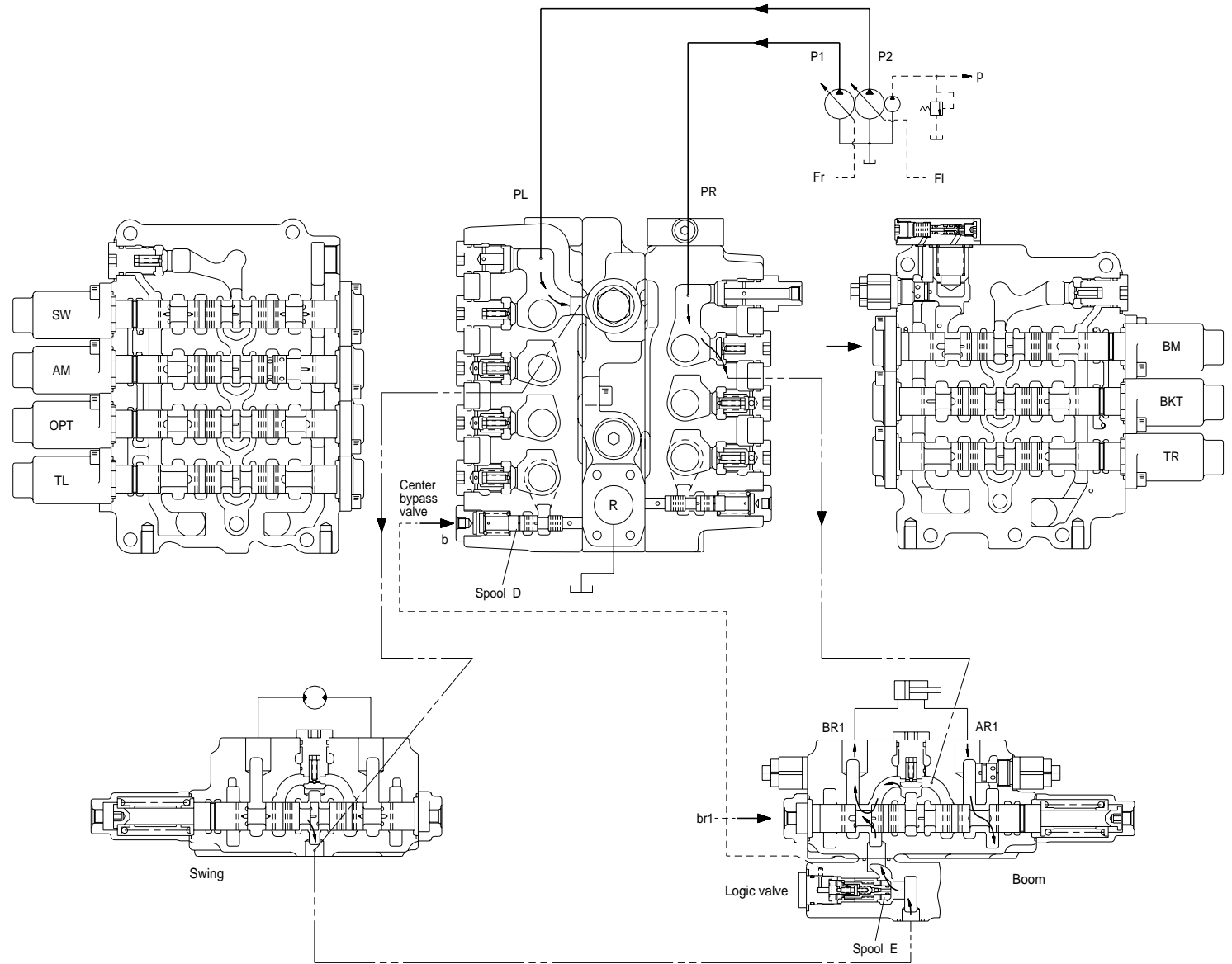
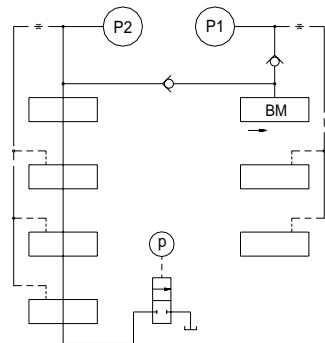
· Arm in operation is same as above, summing the flow of the P2 pump. (Pilot signal pressure is applied a port.)



(3) Boom up flow summation circuit

Oil from pump P1 is fed into cylinder port BR1 by adding pressure to boom plunger pilot port br1.

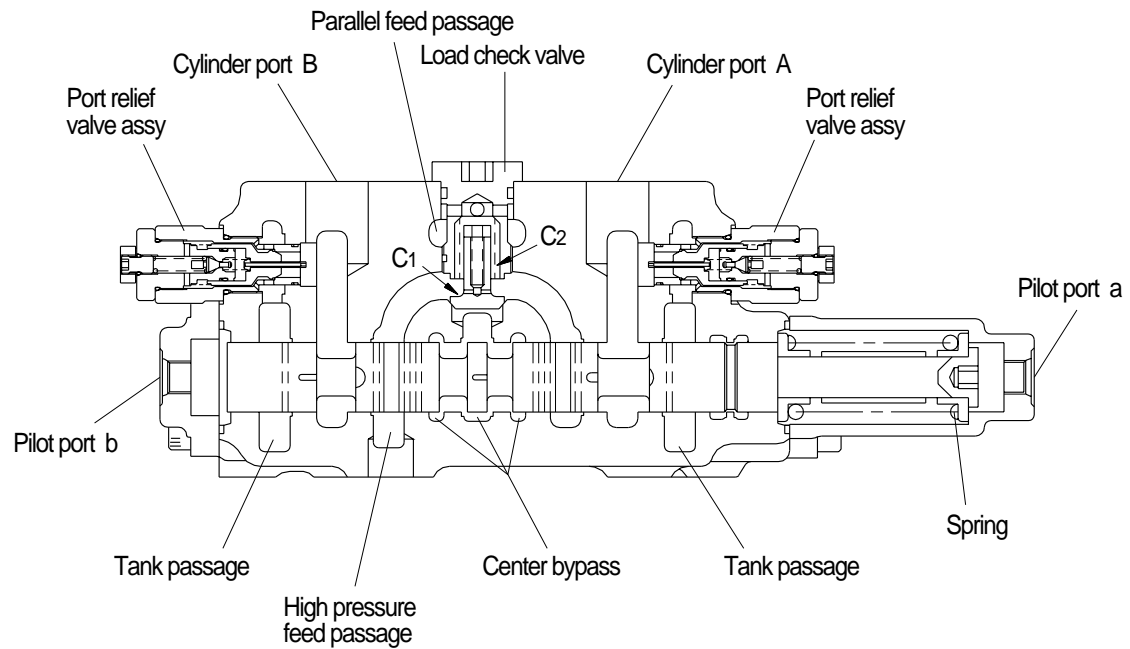
Oil from pump P2 flows into spool(D) of the center bypass valve assembly via the center bypass passage. Since the same pilot pressure of the boom plunger pilot port is applied to the pilot port(b), the center bypass spool assembly closes. At the same time, boom(up) signal works on the logic check valve and the valve(E) opens; oil flows from the center bypass passage of swing section through the logic check assembly into the boom high pressure feed passage and joins to the flow from the pump P1.



3) OPERATIONAL DESCRIPTION OF CONTROL VALVE

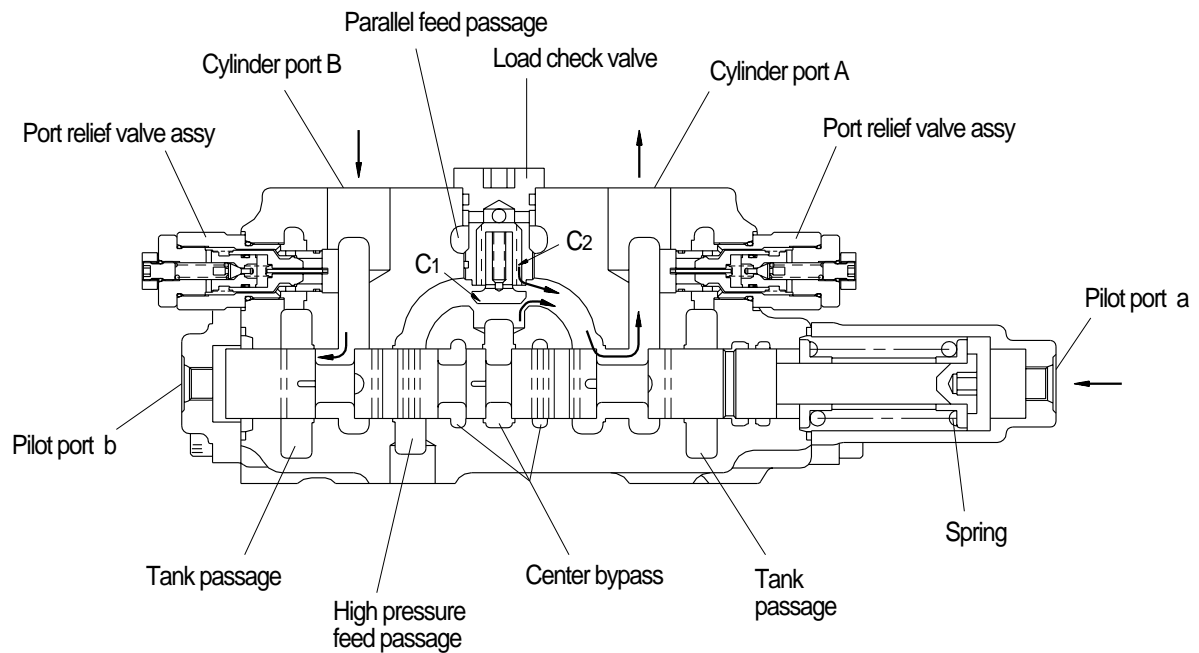
(1) Plunger operation

① Neutral position of plunger



In neutral, spring sets the plunger at the neutral position; the high pressure feed passage is shut off by the plunger; oil from the pump flows through the center bypass.

② Operation of plunger



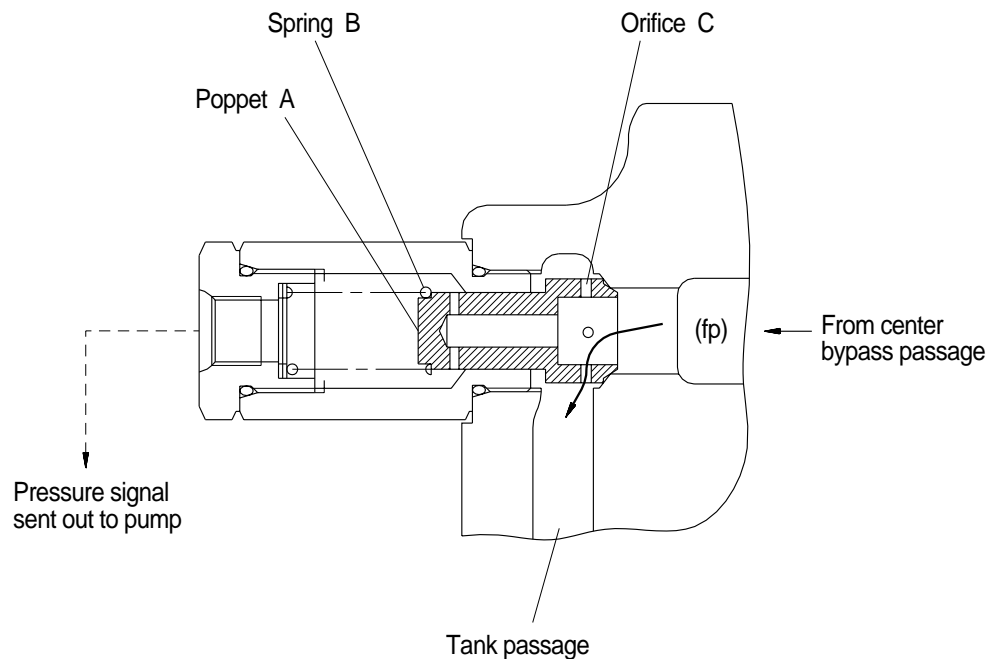
When actuated (pressure is applied to pilot port a), the plunger moves to the left; the center bypass is shut off; oil from the center bypass pushes up the check valve C₁ and flows into cylinder port A via the high pressure feed passage. Meanwhile, oil from the parallel feed passage pushes down check valve C₂ and flows into cylinder port A via the high pressure feed passage.

The return oil from cylinder port B flows into the tank via the tank passage.

※ Reversed when pressure is applied to pilot port b.

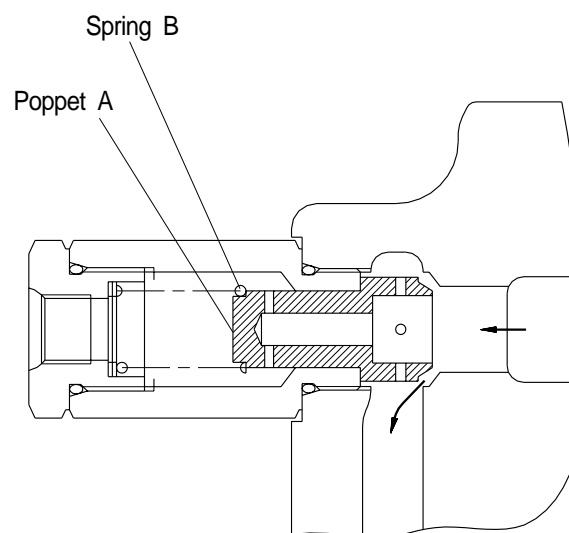
(2) Foot relief valve operation

① f_p is lower than spring force



Hydraulic oil from the center bypass passage flows into the tank via orifice(C) of poppet(A). Pressure f_p generated by orifice(C) is led to the pump, to control the pump delivery flow.

② f_p is higher than spring force

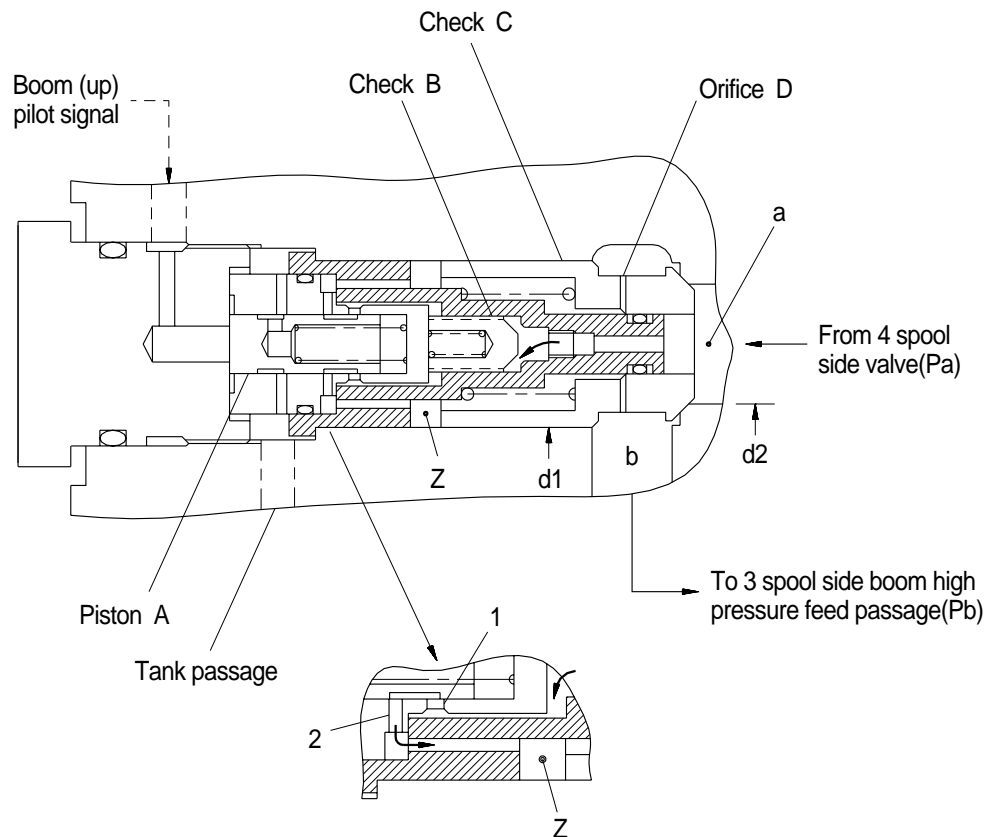


If a large amount flows due to delayed pump response, etc., and pressure f_p reaches the preset spring(B) force, then the poppet(A) is lifted and functions as a relief valve.

(3) Logic check valve operation

① Boom down or neutral

When boom up pilot pressure is not supplied.



Spring force sets piston (A) in the shown position;

Pressure in the passage a (P_a) enters chamber (Z) via passage (1) and passage(2).

Pressure in the passage b (P_b) enters chamber (Z) via orifice(D).

If $P_a > P_b$

Check valve (C) is seated by area $d_1 > d_2$ and passage from a to b is blocked.

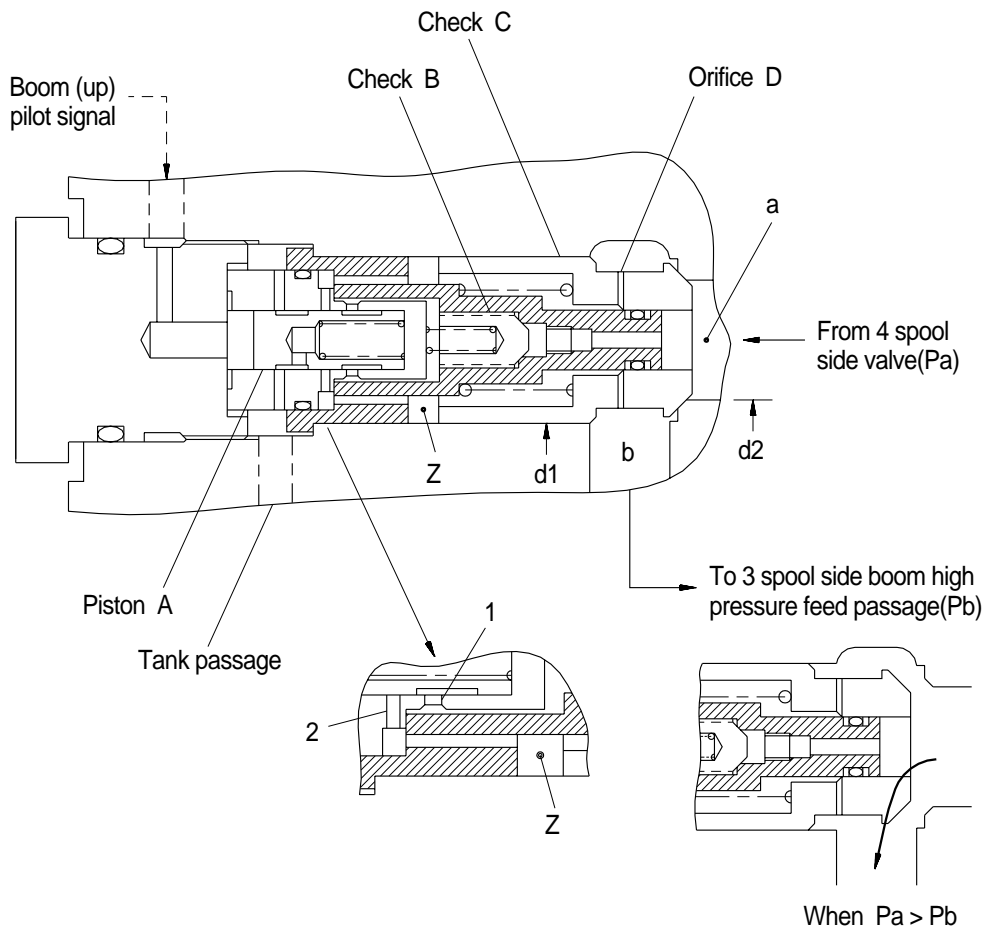
If $P_a < P_b$

Passage from b to a is blocked by the check valve (C).

② Boom up

When boom up pilot pressure is supplied.

Piston (A) moves to right; passage (1) is shut off from passage (2).



When $P_a > P_b$

Check valve (C) is lifted as the shown position; oil flows through from a to b.

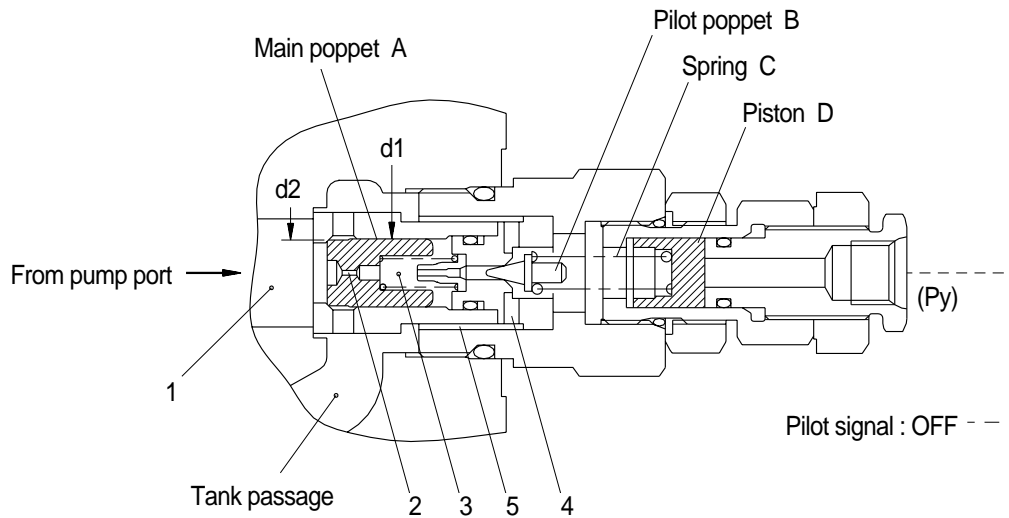
When $P_a < P_b$

Passage from b to a is blocked by the check valve (C), because $d_1 > d_2$.

(4) Main relief valve operation

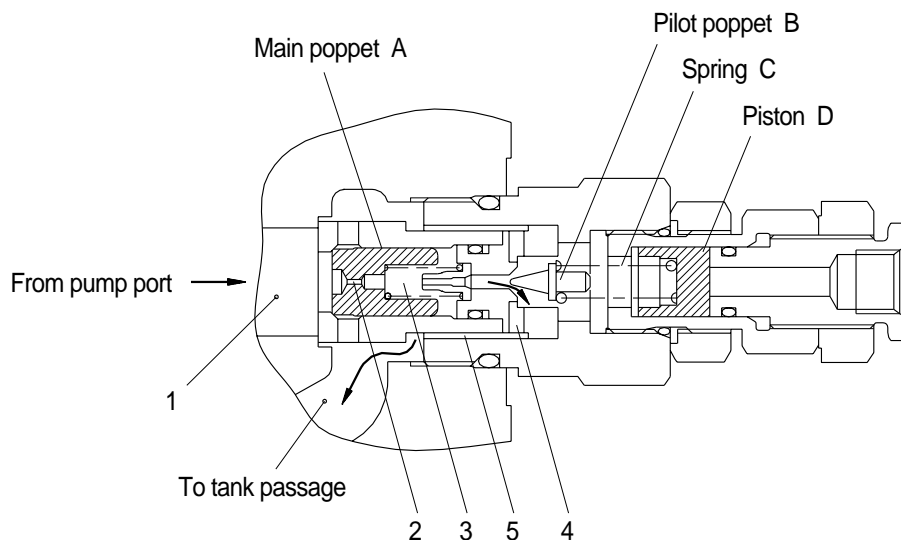
① High pressure setting pilot signal : OFF

Piston (D) is seated to the right by spring (C) force.

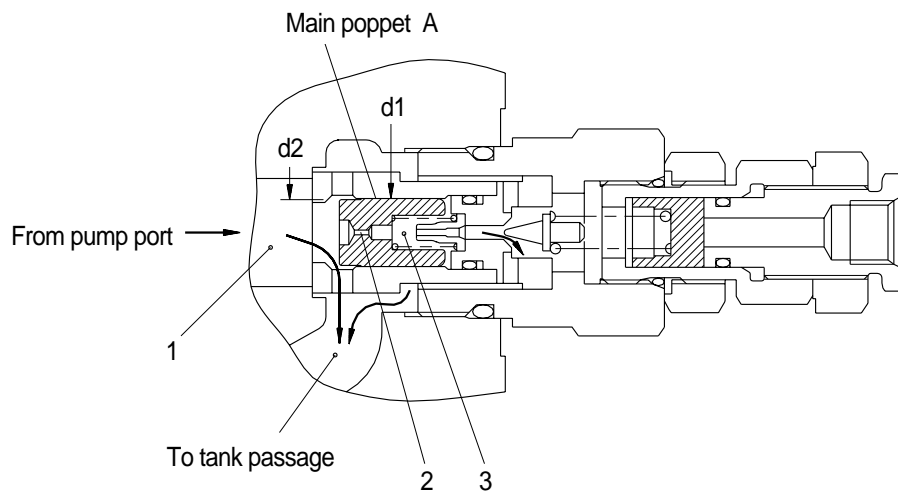


This relief valve is built-in between the pump port side (1) and tank passage.

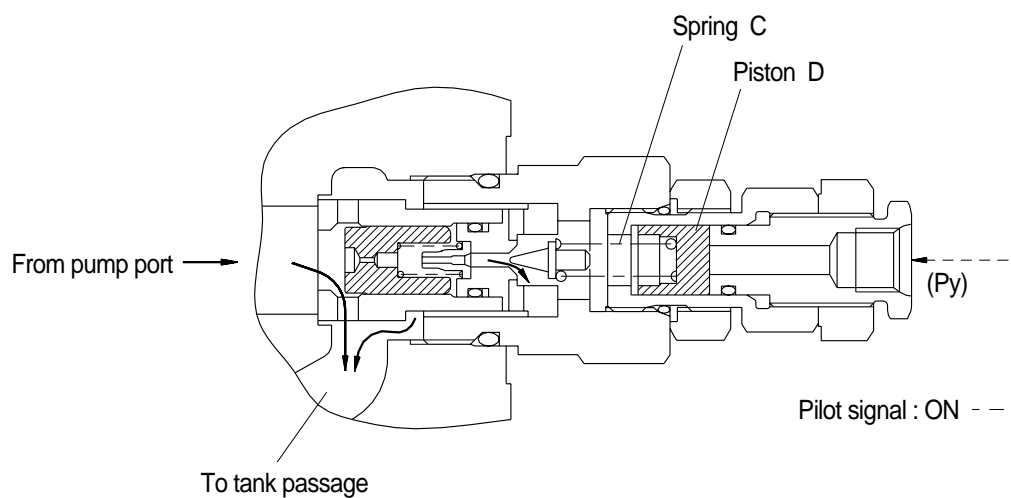
Hydraulic oil from the pump port side enters chamber (3) via orifice (2) of poppet (A). Because $d1 > d2$, poppets (A) is securely seated.



When hydraulic oil reaches the pressure preset by spring (C), pilot poppet (B) opens; oil flows around pilot poppet (B) and into the tank passage via side hole (4) and passage (5).



When the above oil flow is formed, pressure drops before and behind orifice (2); when pressure of chamber (1) x area d_2 is larger than pressure of chamber (3) x area d_1 , main poppet (A) is lifted and hydraulic oil flows into the tank passage.

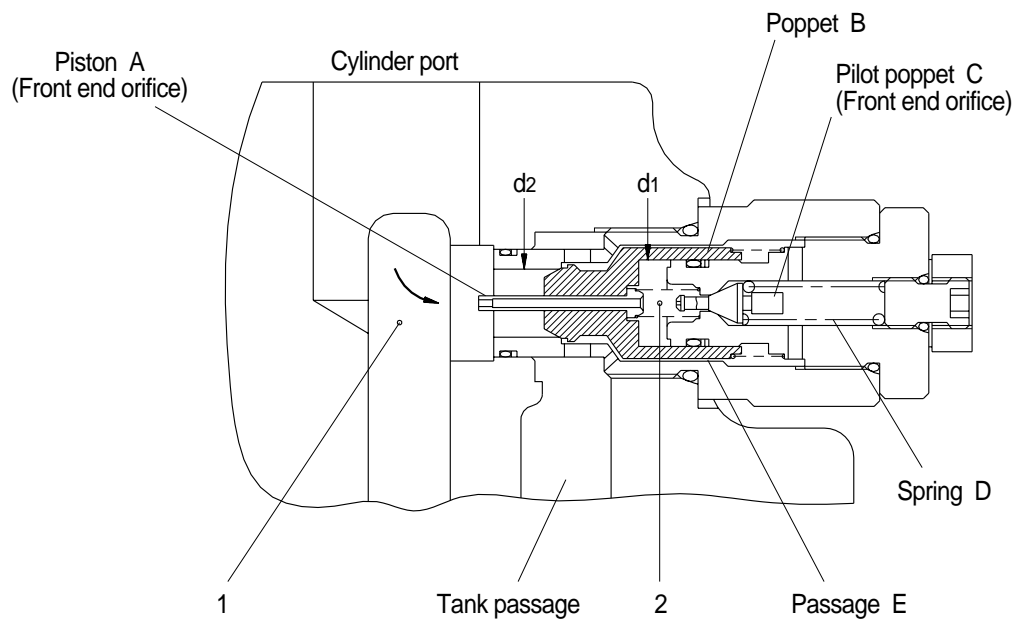


② High pressure setting pilot signal : ON

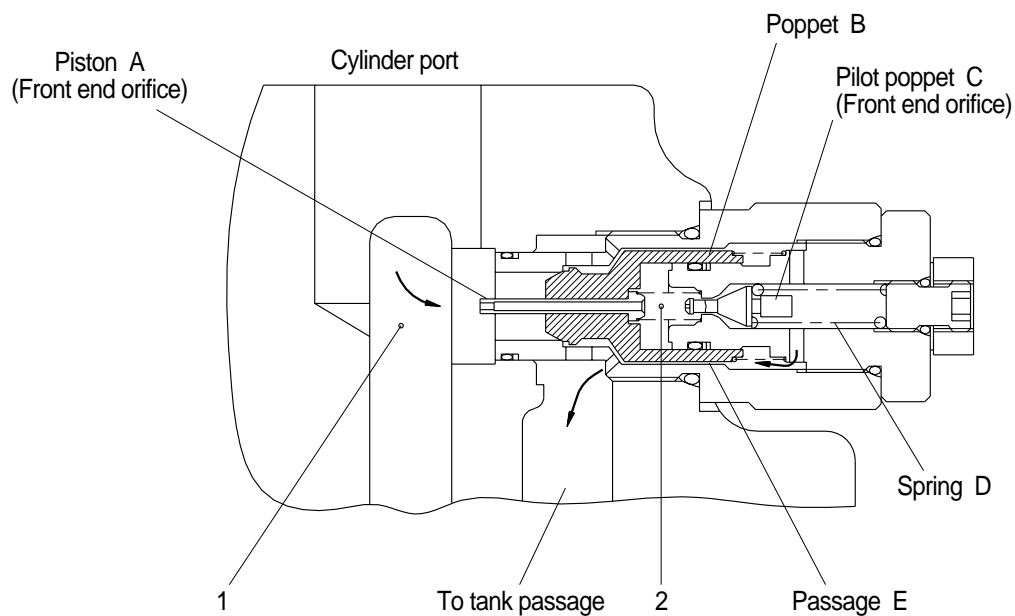
Piston (d) moves to left; set pressure of spring (C) rises, making high pressure setting.

(5) Overload relief valve operation

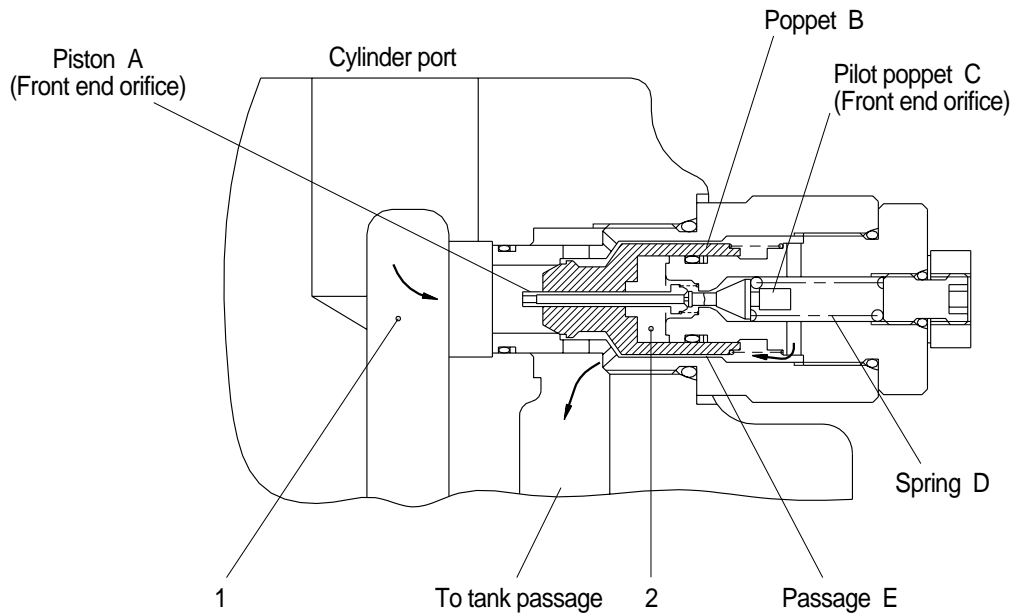
① Overload working operation



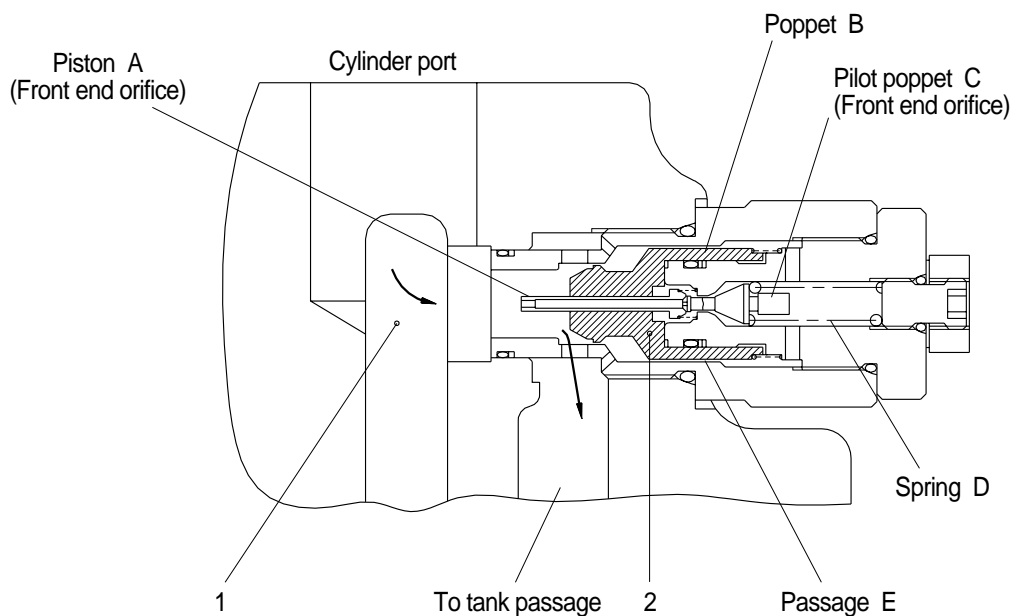
Hydraulic oil from cylinder port enters chamber (2) via orifice of piston (A). Because $d_1 > d_2$, main poppet (A) is securely seated.



When hydraulic pressure reaches the preset force of spring (D), pilot poppet (C) opens; oil flows around poppet (C) and into the tank passage via side hole and passage (E).

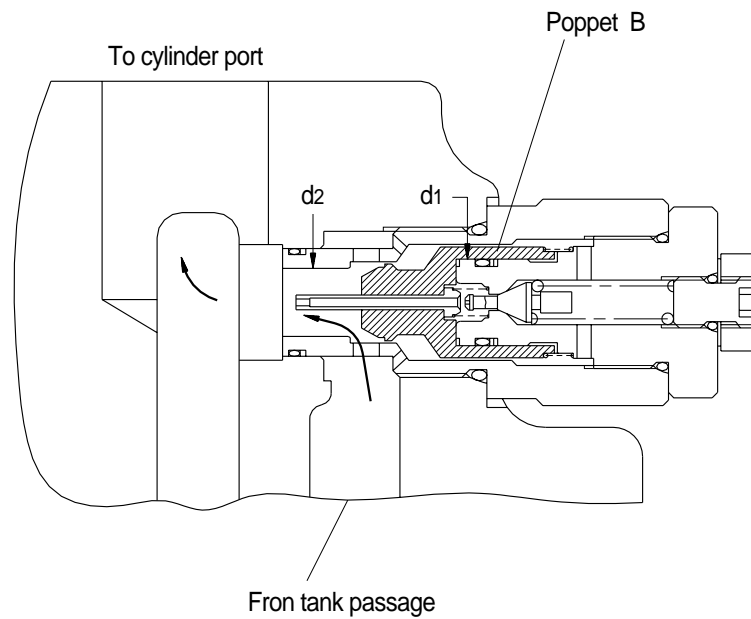


Oil flow is formed; pressure drops before and behind orifice of piston (A); piston (A) moves to right and seats at the tip of pilot poppet (C). Hydraulic oil from chamber (1) flows into the tank passage via orifice of piston (A) and pilot poppet (C), side hole and passage (E).



Pressure drops before and behind orifice of pilot poppet (C), making pressure of chamber (1) > pressure of chamber (2); poppet (B) is lifted and hydraulic oil flows into the tank passage.

② Make up operation

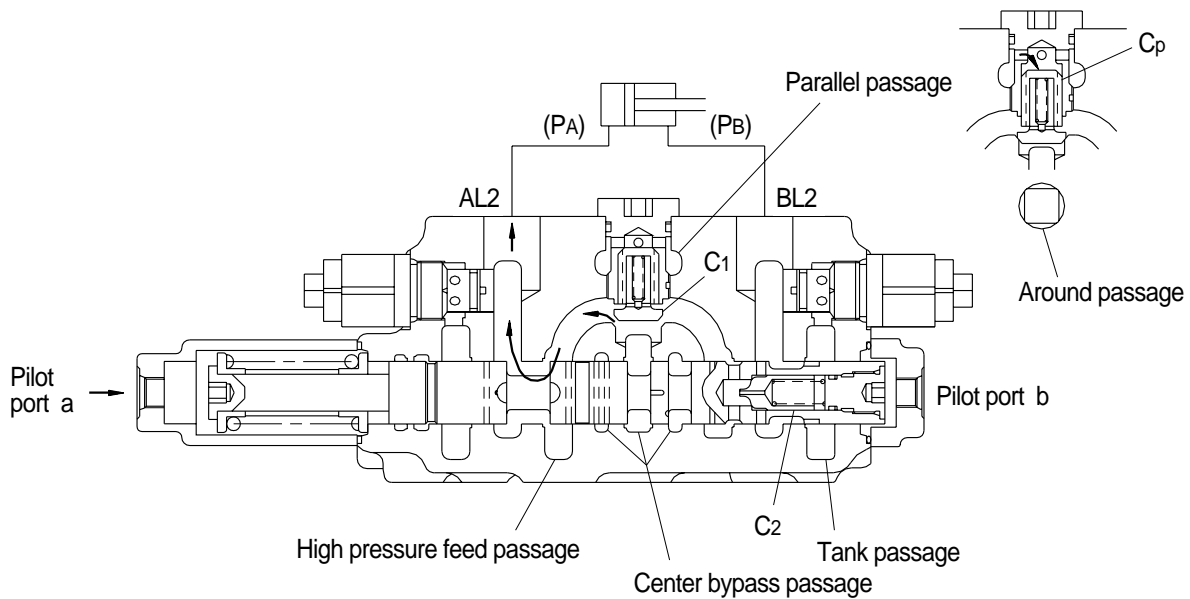


Poppet (B) is securely seated because the cylinder port pressure is normally higher than the tank pressure and $d_1 > d_2$.

When the cylinder port pressure drops (closer to negative pressure) until the cylinder port pressure is lower than the tank pressure, poppet (B) opens receiving the tank pressure for the difference in area between d_1 and d_2 ; oil flows from the tank passage to the cylinder port in order to prevent cavitation.

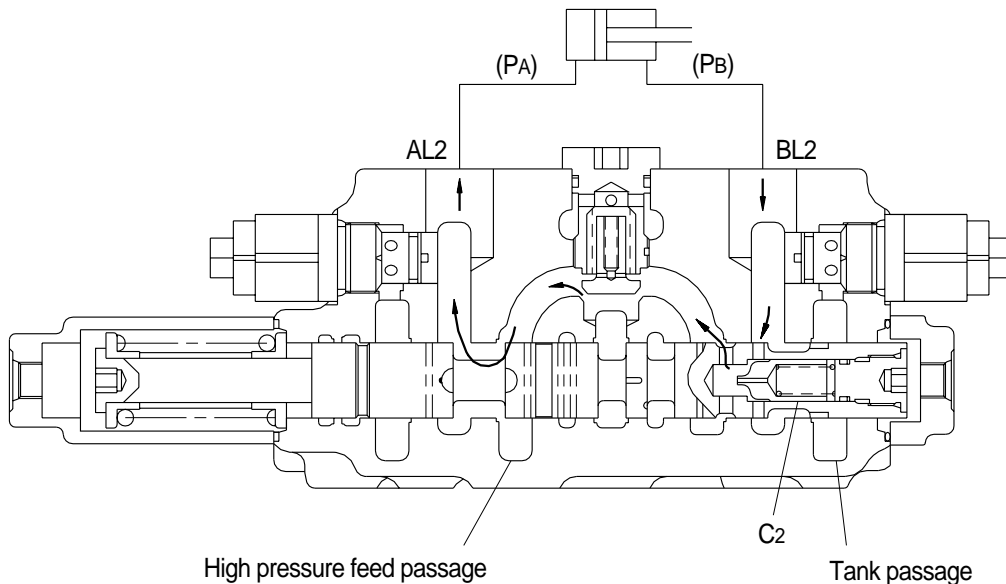
(6) Arm regeneration circuit

① Arm in operation



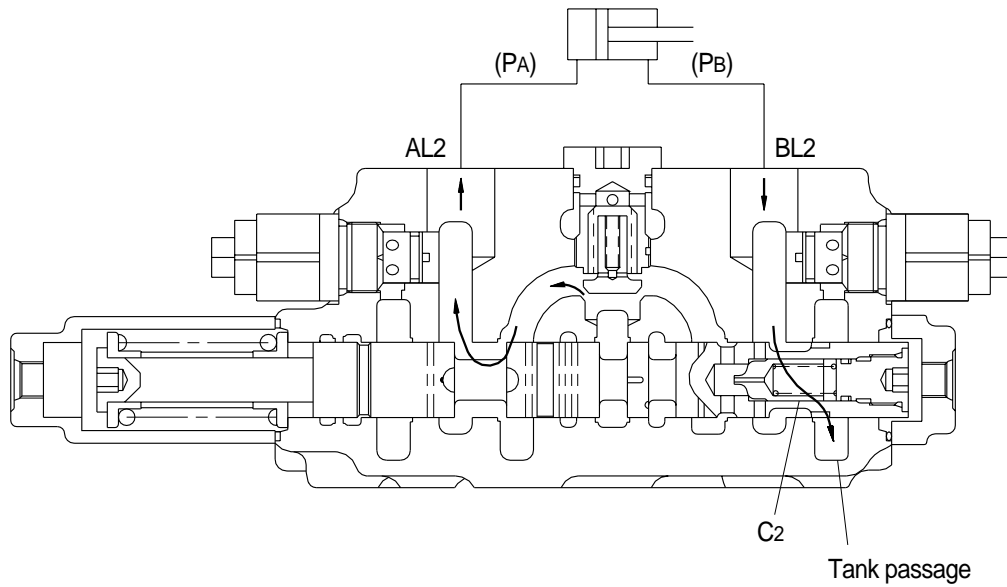
When pressure is applied to pilot port a of the arm plunger, the plunger moves to right as shown; the center bypass passage is shut off; oil from the center bypass pushes up check valve (C1) and flows into cylinder bottom port via the high pressure feed passage.

② PA is lower than PB



Return oil from cylinder rod side pushes up check valve (C2) in the plunger; it flows into cylinder bottom side after returning to the high pressure feed passage.

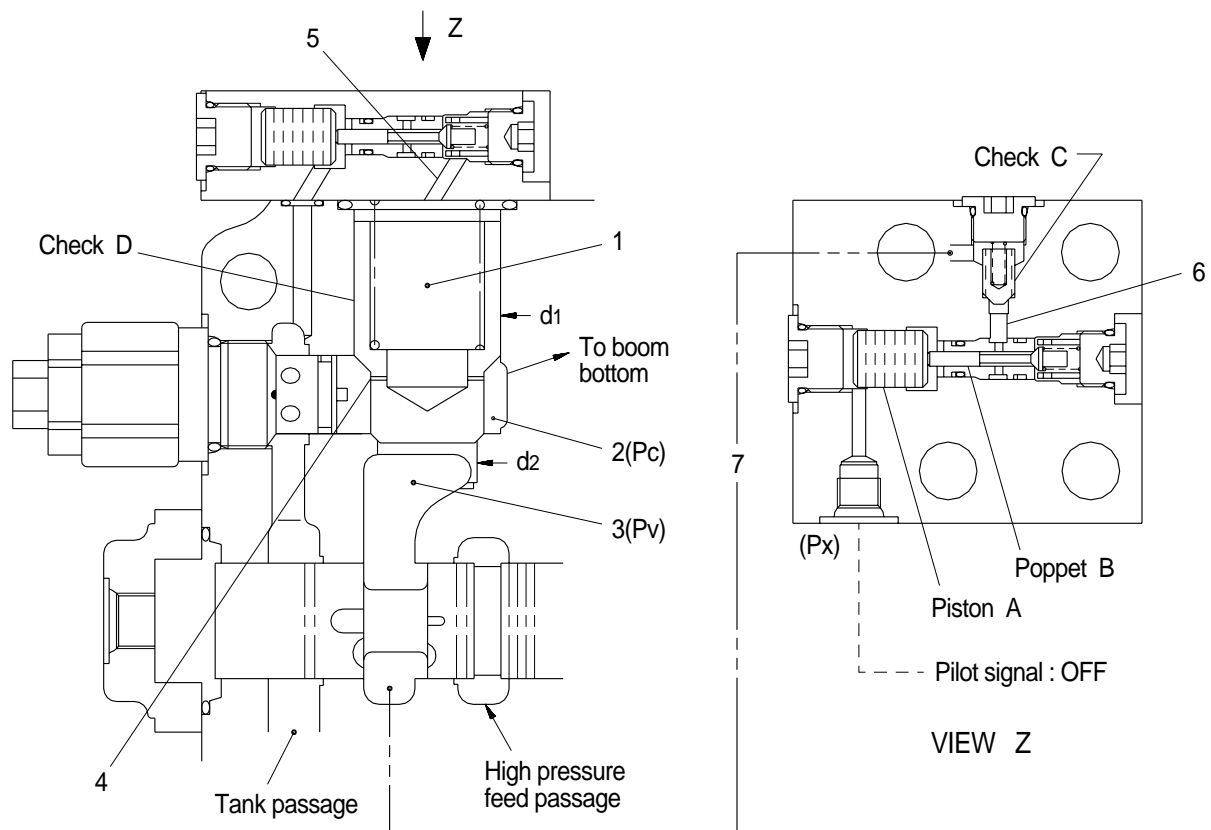
③ PA is higher than PB



The check (C2) is seated by the pressure (PA) of cylinder bottom side, the return oil from cylinder rod side flows into the tank passage.

(7) Load holding valve operation

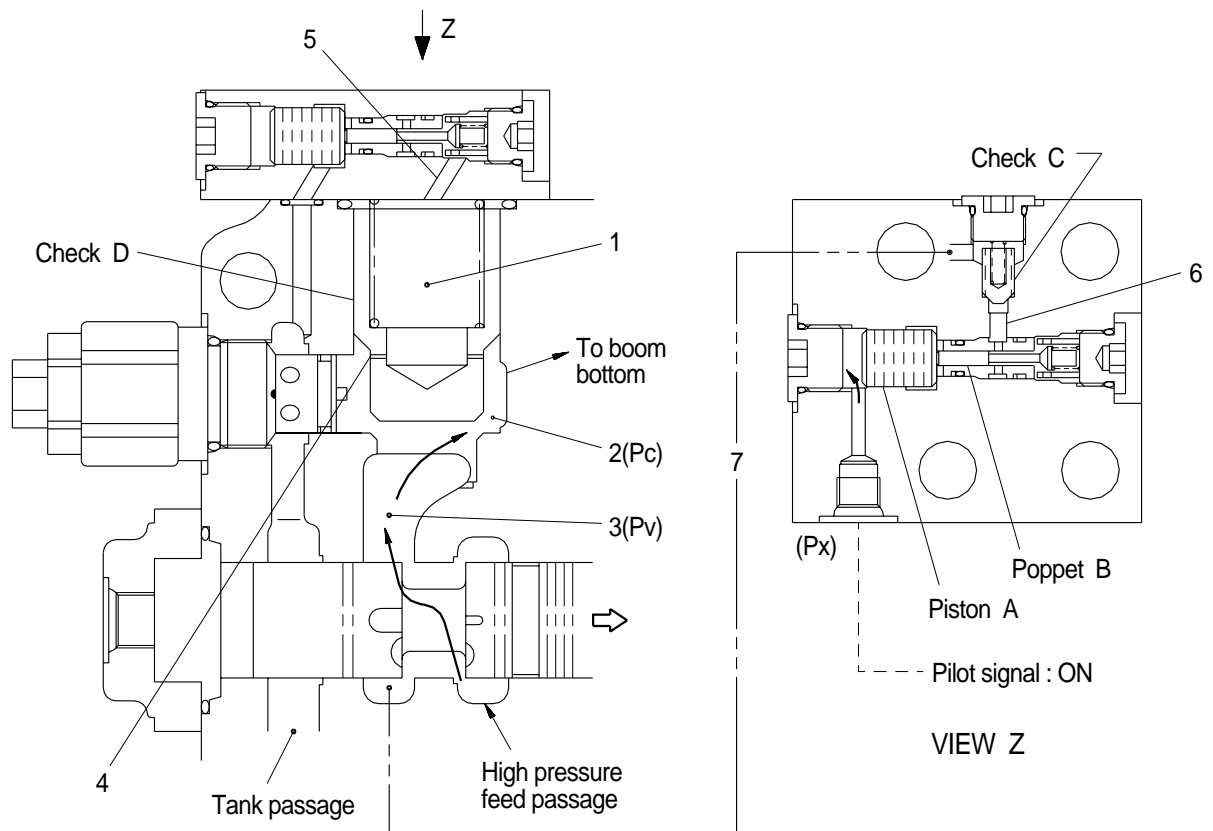
① When the plunger is in neutral (Px pilot signal : OFF)



Piston (A) and poppet (B) are in the status as shown; passages (5) and (6) are shut off by poppet (B).

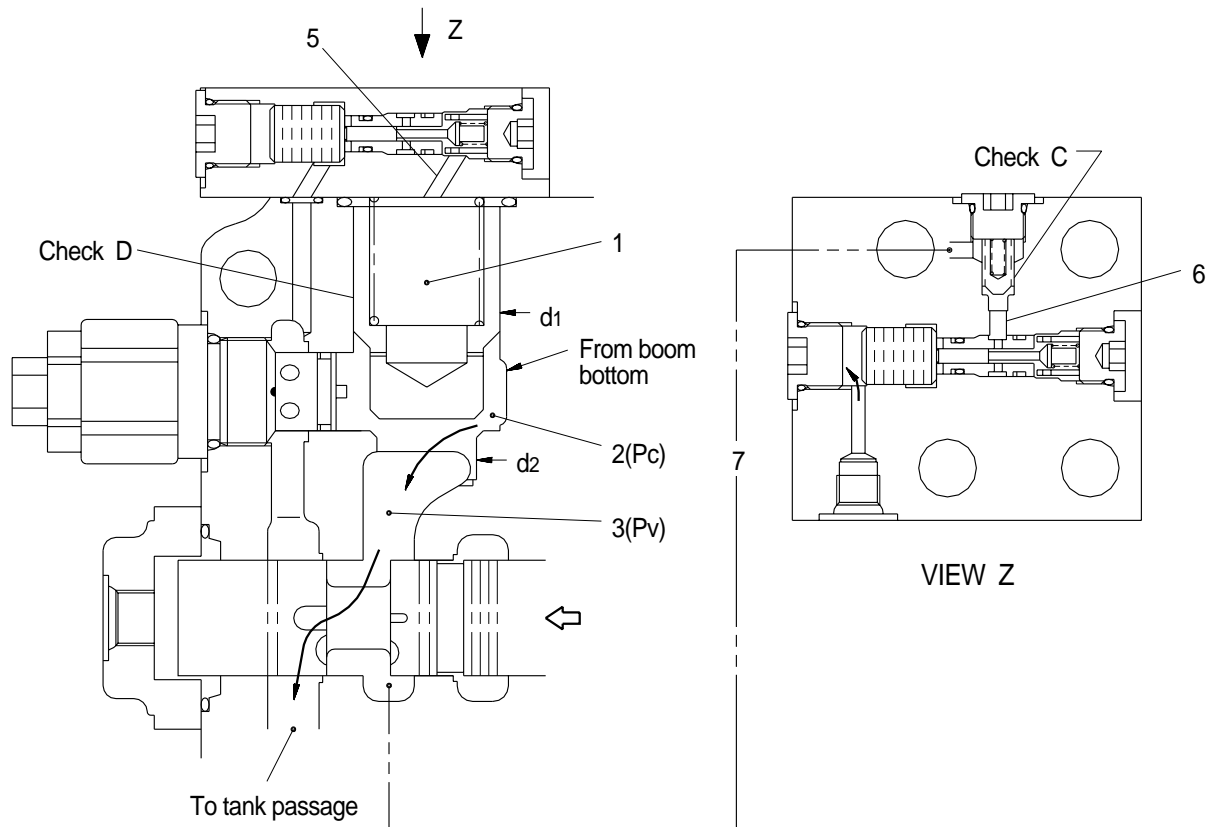
Therefore, the pressure of chamber (1) becomes P_c as it is connected with chamber (2) via orifice (4). Since $d_1 > d_2$, check (C) is seated, chambers (2) and (3) are completely blocked.

- ② **When the plunger is operated** (Px pilot signal : ON)
A. When Pc is lower than Pv (in the case of Boom UP)



Because check valve (C) is seated, passages (6) and (7) are shut off. Therefore, the pressure of chamber (1) becomes Pc as it is connected to chamber (2) via orifice (4); poppet (D) is pushed up; oil from high pressure feed passage flows into the cylinder port.

B. When P_c is higher than P_v (In case of Boom down)



Piston (A) moves to right; poppet (B) opens; passages (5) and (6) are connected.

If pressure P_c of cylinder port chamber (2) is higher than pressure P_v of chamber (3), oil from chamber (1) pushes up check valve (C) via passages (5) and (6) and enters chamber (3) through passage (7). Chamber (3) is connected with the tank passage because the boom plunger is moved to left. Therefore, pressure P_c is applied to (area d_1 - area d_2), pushing up check (D), and oil from the cylinder port flows into the tank passage.