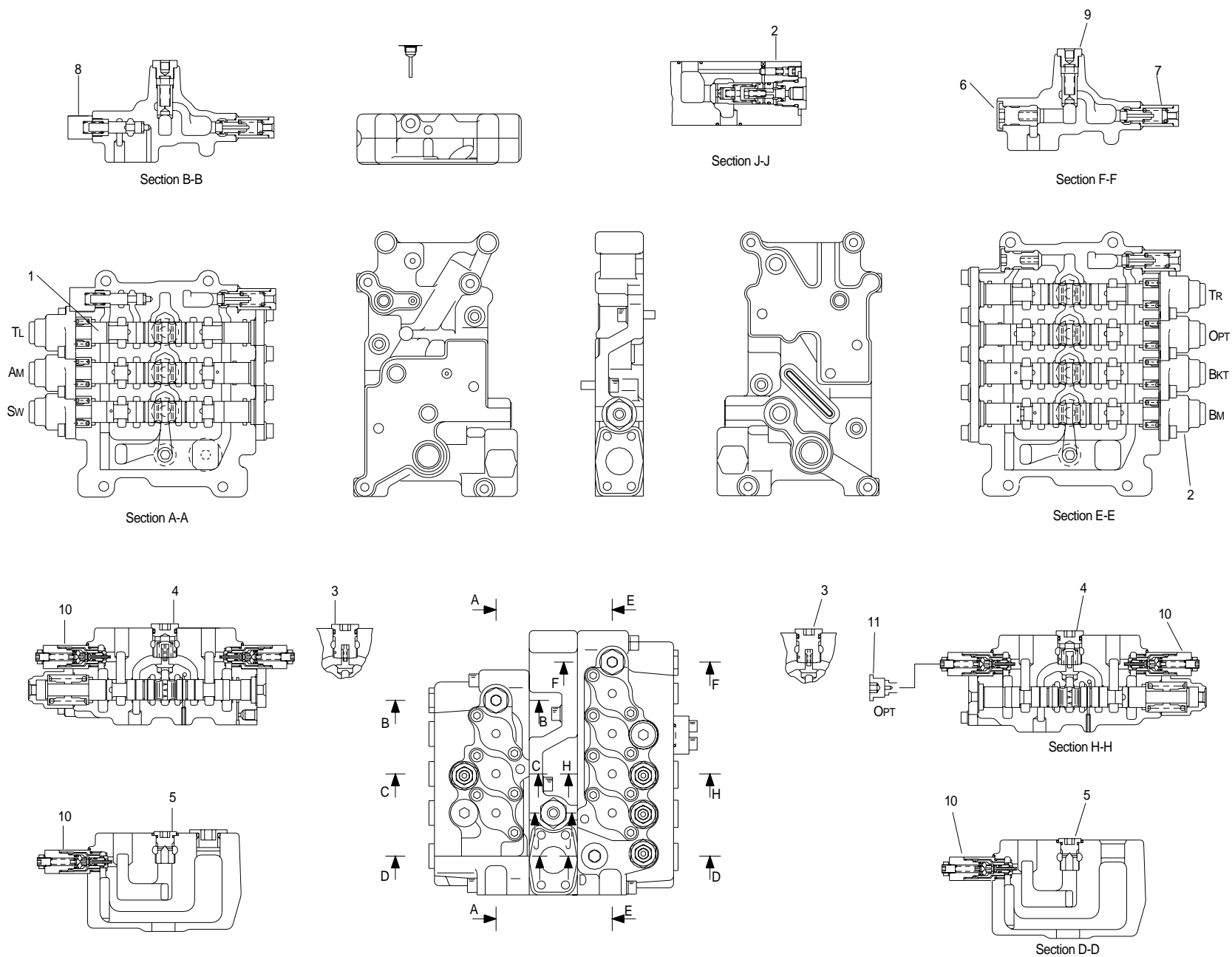


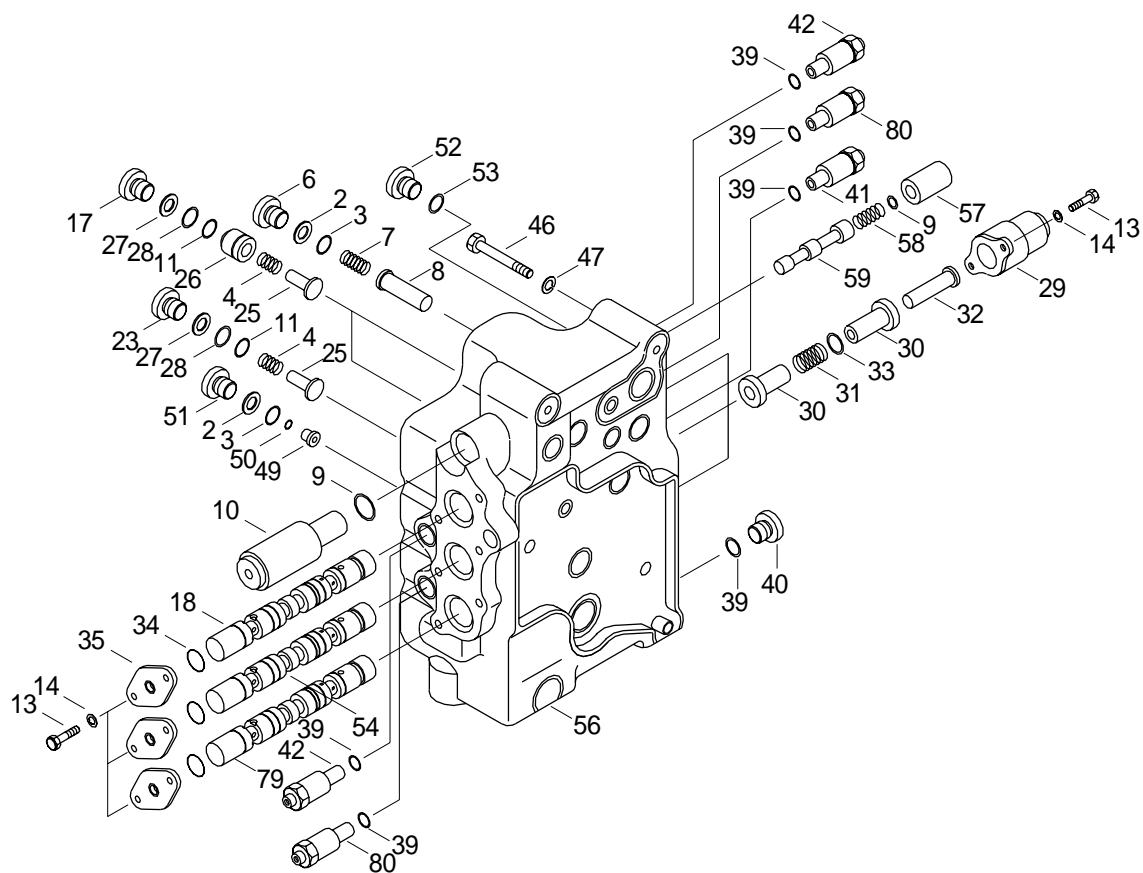
GROUP 2 MAIN CONTROL VALVE

1. STRUCTURE

- 1 Plunger
- 2 Logic check assy
- 3 Check assy
- 4 Load check assy
- 5 Orifice assy
- 6 Check valve assy
- 7 Foot relief assy
- 8 Selector valve assy
- 9 Logic valve assy
- 10 Relief assy
- 11 Option port

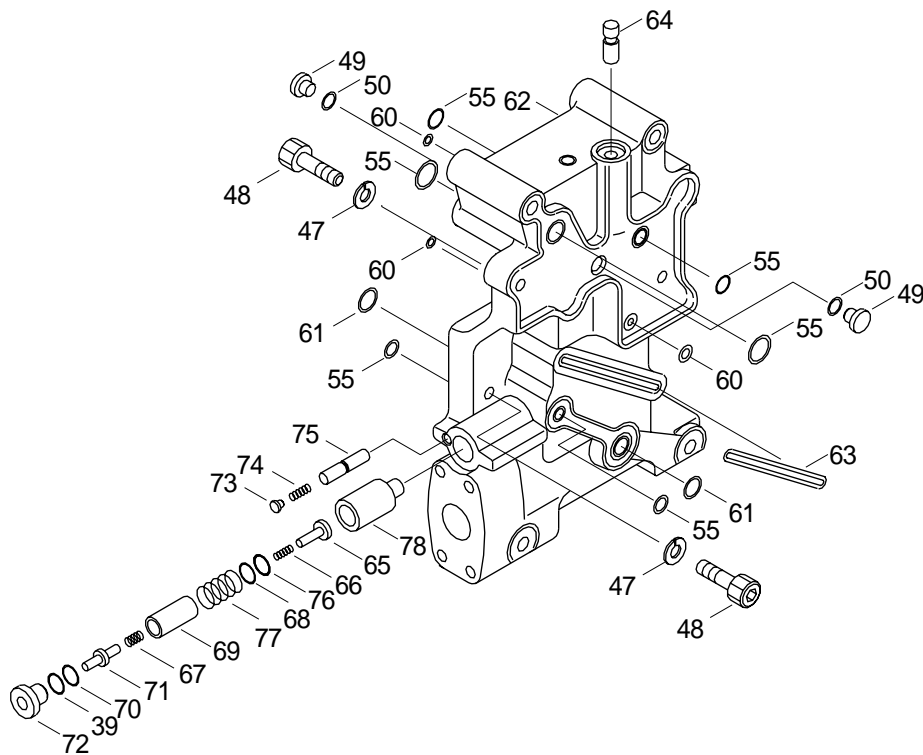


STRUCTURE



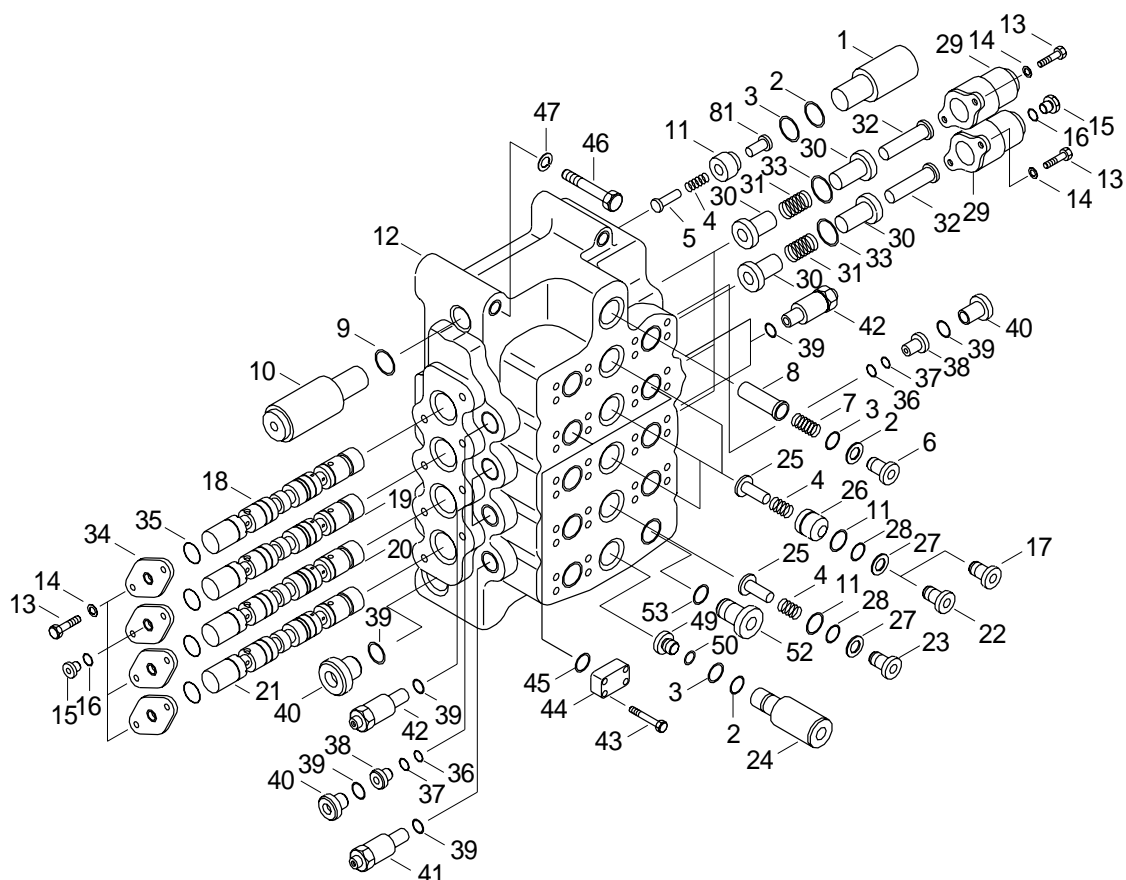
2	Back up ring	26	Check	47	Spring washer
3	O-ring	27	Back up ring	49	Cap
4	Spring	28	O-ring	50	O-ring
6	Cap	29	Cover	51	Cap
7	Spring	30	Spring guide	52	Cap
8	Poppet	31	Spring	53	O-ring
9	O-ring	32	Plunger cap	54	Plunger
10	Port relief valve	33	O-ring	56	Housing
11	Nylon chip	34	Retainer	57	Cap
13	Bolt	35	O-ring	58	Spring
14	Spring washer	39	O-ring	59	Spool
17	Cap	40	Cap	79	Plunger
18	Plunger	41	Main relief	80	Port relief
23	Cap	42	Port relief		
25	Check	46	Bolt		

STRUCTURE



39	O-ring	63	O-ring	72	Cap
47	Spring washer	64	Orifice	73	Plug
48	Bolt	65	Check	74	Spring
49	Cap	66	Spring	75	Check
50	O-ring	67	Spring	76	Back up ring
55	O-ring	68	O-ring	77	Spring
60	O-ring	69	Sleeve	78	Poppet
61	O-ring	70	O-ring		
62	Manifold	71	Piston		

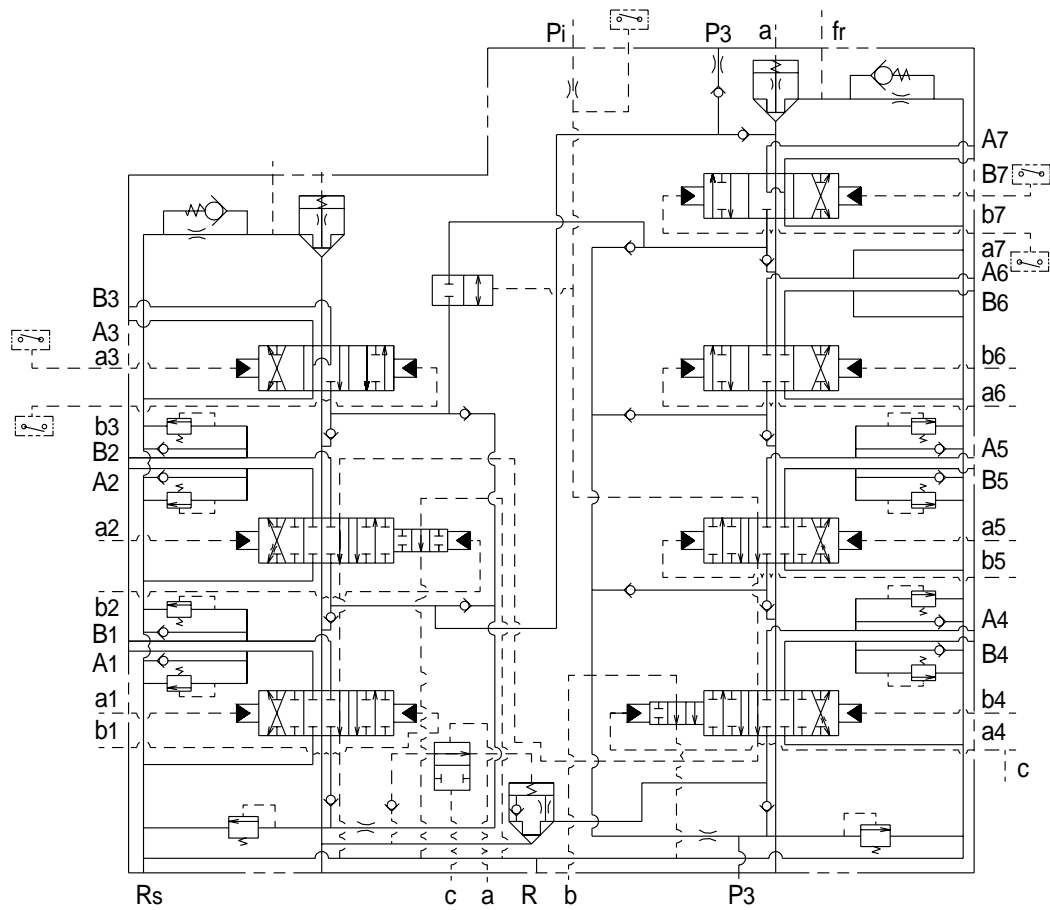
STRUCTURE



1	Cap	19	Plunger	37	Back up ring
2	Back up ring	20	Plunger	38	Plug
3	O-ring	21	Plunger	39	O-ring
4	Spring	22	Plunger	40	Cap
5	Check	23	Cap	41	Main relief
6	Cap	24	Cap	42	Port relief
7	Spring	25	Check	43	Bolt
8	Poppet	26	Check	44	Plunger
9	O-ring	27	Back up ring	45	O-ring
10	Port relief	28	O-ring	46	Bolt
11	Nylon chip	29	Cover	47	Spring washer
12	Housing	30	Spring guide	49	Cap
13	Bolt	31	Spring	50	O-ring
14	Spring washer	32	Plunger cap	52	Cap
15	Cap	33	O-ring	53	O-ring
16	O-ring	34	Retainer	81	Check
17	Cap	35	O-ring		
18	Plunger	36	O-ring		

2. FUNCTION

1) HYDRAULIC CIRCUIT DIAGRAM



2) BASIC OPERATION

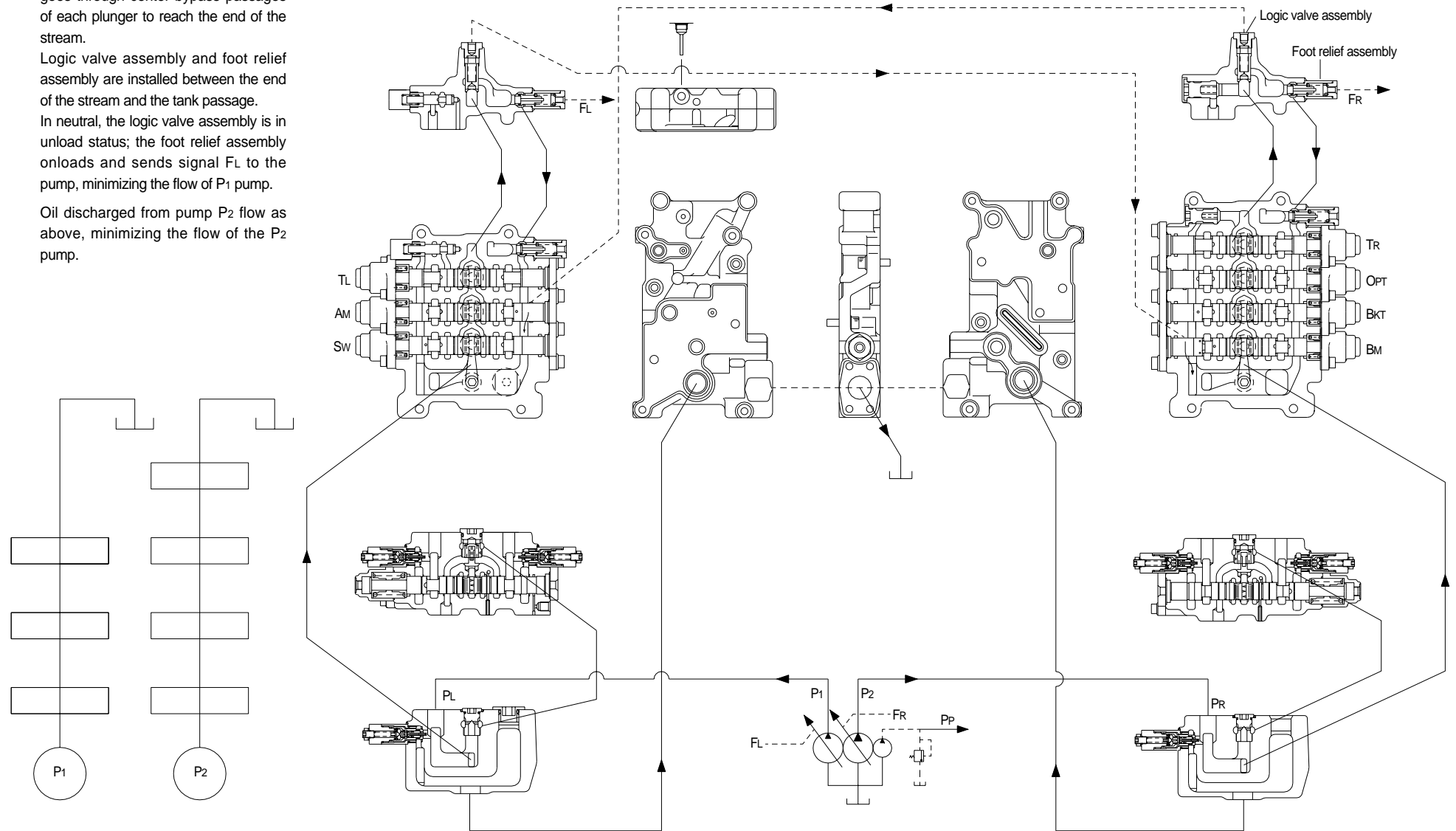
(1) Neutral circuit

Oil discharged from P₁ flows in from control valve's entrance port PL and goes through center bypass passages of each plunger to reach the end of the stream.

Logic valve assembly and foot relief assembly are installed between the end of the stream and the tank passage.

In neutral, the logic valve assembly is in unload status; the foot relief assembly onloads and sends signal FL to the pump, minimizing the flow of P₁ pump.

Oil discharged from pump P₂ flow as above, minimizing the flow of the P₂ pump.

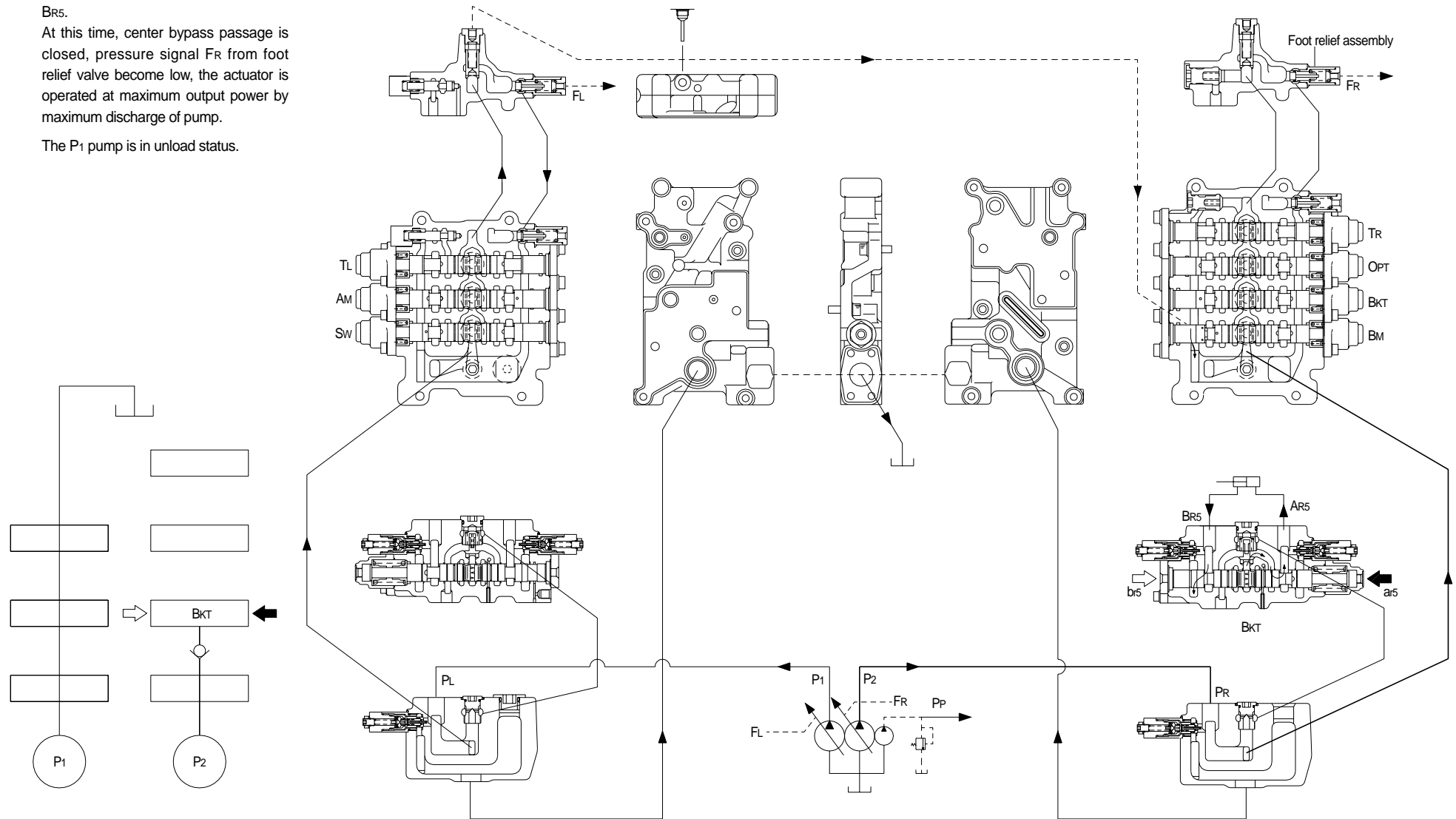


(2) Bucket operation circuit

Oil from pump P2 is fed into cylinder port AR5 by adding pressure to bucket plunger pilot port a5 and the oil from actuator flow tank through cylinder port BR5.

At this time, center bypass passage is closed, pressure signal F_R from foot relief valve become low, the actuator is operated at maximum output power by maximum discharge of pump.

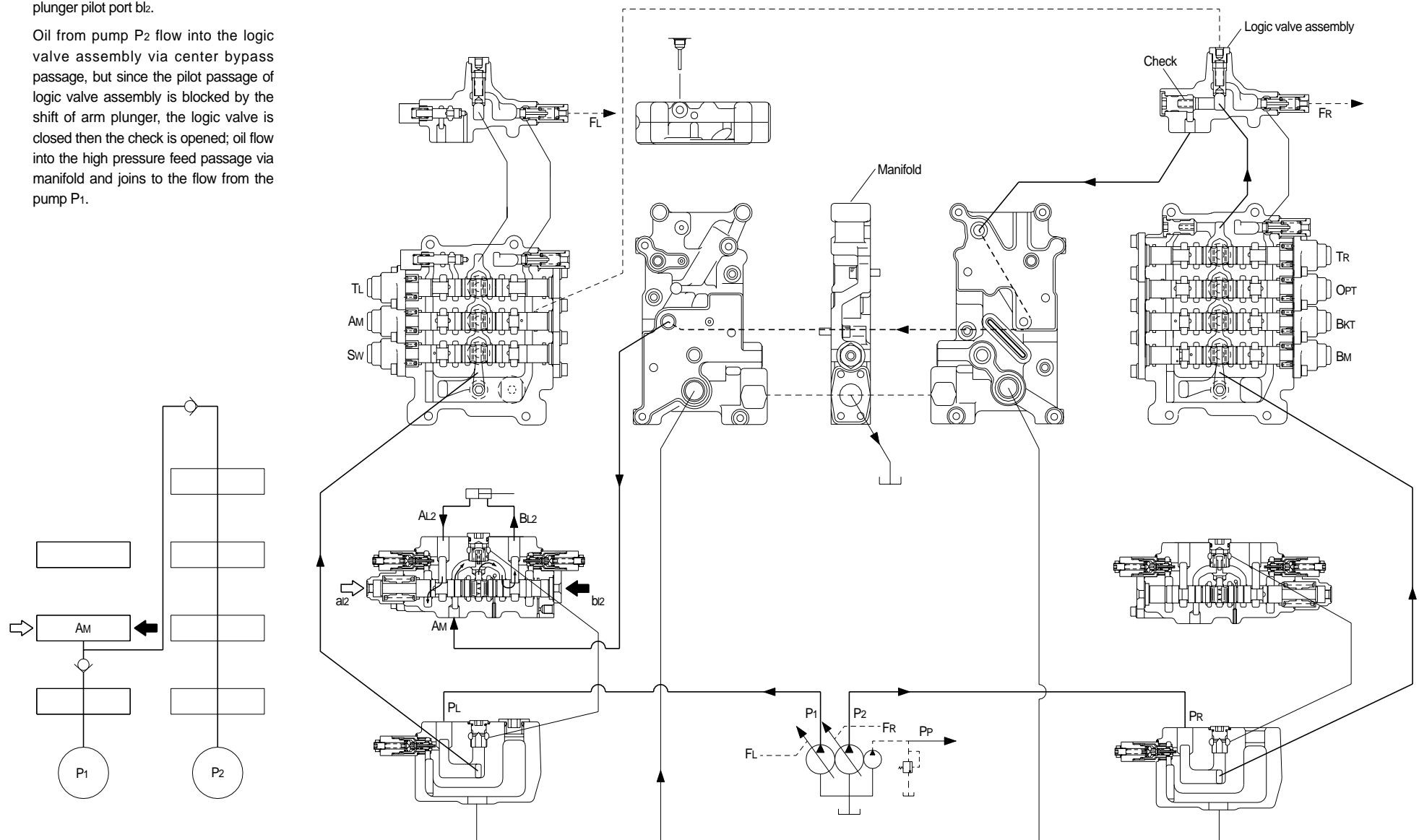
The P₁ pump is in unload status.



(3) Arm flow summation circuit

Oil from pump P1 is feed into cylinder port BL2 by adding pressure to arm plunger pilot port bl2.

Oil from pump P₂ flow into the logic valve assembly via center bypass passage, but since the pilot passage of logic valve assembly is blocked by the shift of arm plunger, the logic valve is closed then the check is opened; oil flow into the high pressure feed passage via manifold and joins to the flow from the pump P₁.

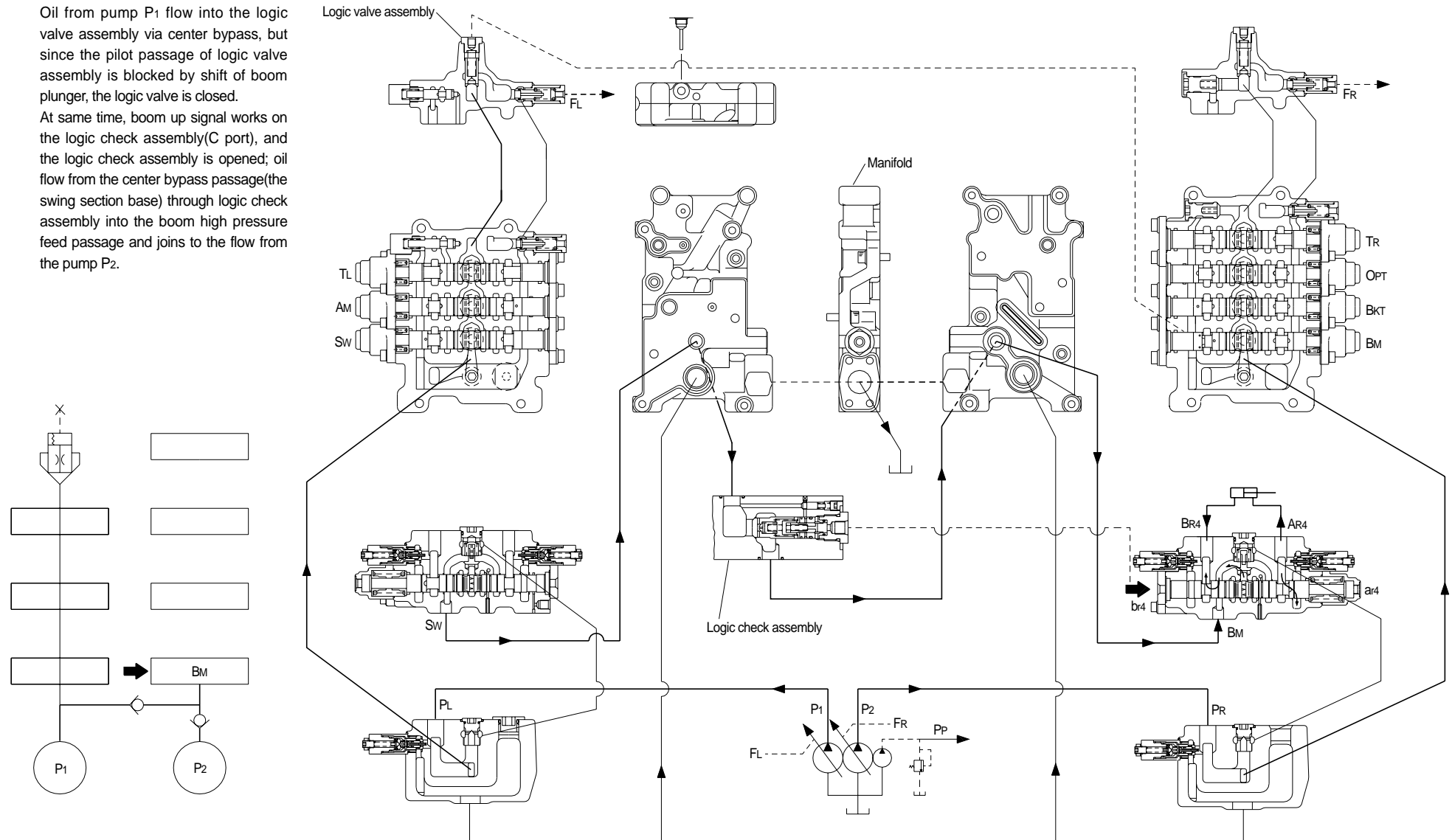


(4) Boom up flow summation circuit

Oil from pump P₂ is fed into cylinder port BR₄ by adding pressure to boom plunger pilot port br₄.

Oil from pump P₁ flow into the logic valve assembly via center bypass, but since the pilot passage of logic valve assembly is blocked by shift of boom plunger, the logic valve is closed.

At same time, boom up signal works on the logic check assembly(C port), and the logic check assembly is opened; oil flow from the center bypass passage(the swing section base) through logic check assembly into the boom high pressure feed passage and joins to the flow from the pump P₂.

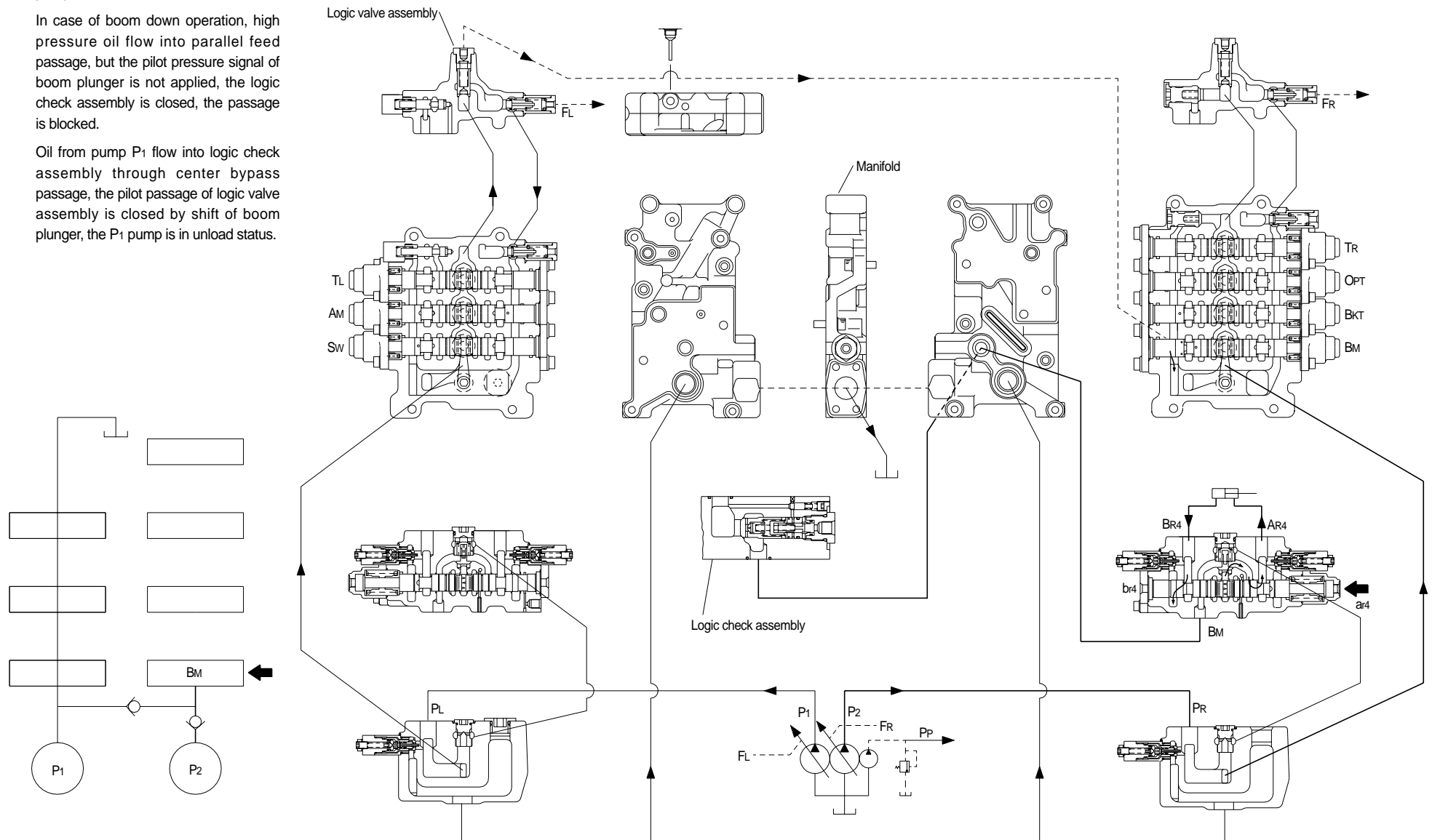


(5) Boom down flow circuit

Oil from pump P₂ is fed into cylinder port AR₄ by adding pressure to boom plunger pilot port ar₄.

In case of boom down operation, high pressure oil flow into parallel feed passage, but the pilot pressure signal of boom plunger is not applied, the logic check assembly is closed, the passage is blocked.

Oil from pump P₁ flow into logic check assembly through center bypass passage, the pilot passage of logic valve assembly is closed by shift of boom plunger, the P₁ pump is in unload status.

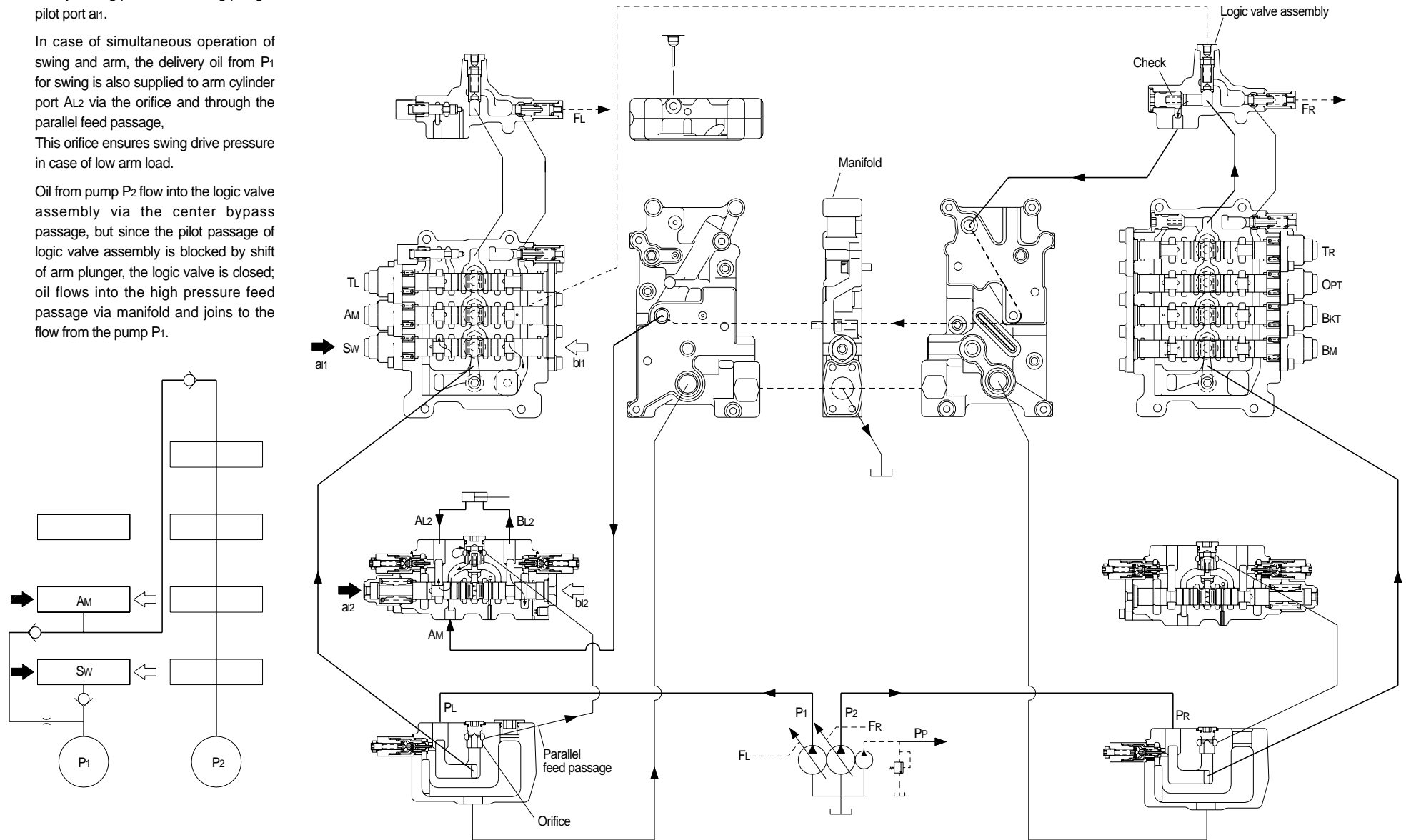


(6) Swing priority circuit

Oil from pump P₁ is fed into cylinder port A_{L1} by adding pressure to swing plunger pilot port a₁₁.

In case of simultaneous operation of swing and arm, the delivery oil from P₁ for swing is also supplied to arm cylinder port A_{L2} via the orifice and through the parallel feed passage. This orifice ensures swing drive pressure in case of low arm load.

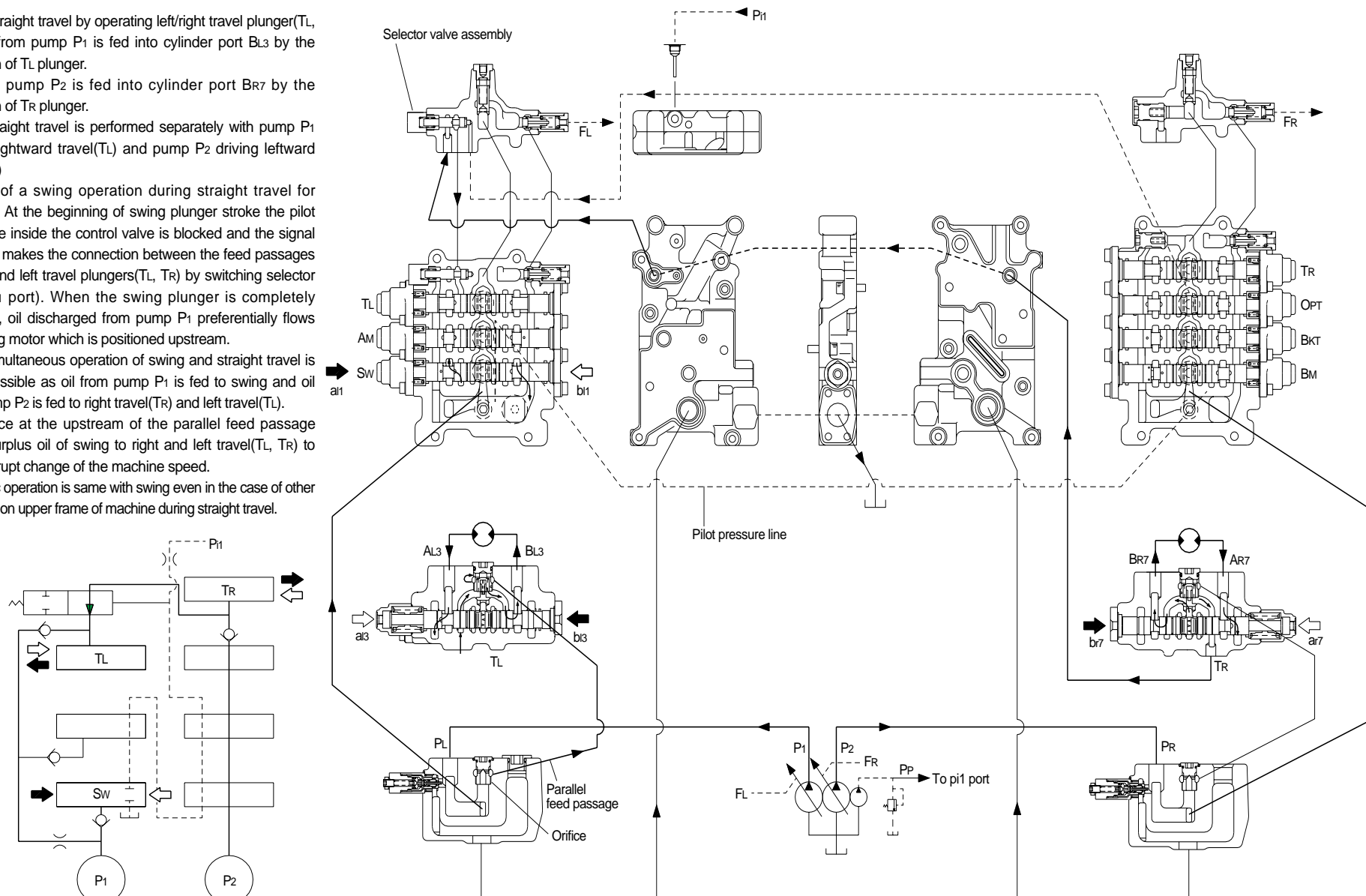
Oil from pump P₂ flow into the logic valve assembly via the center bypass passage, but since the pilot passage of logic valve assembly is blocked by shift of arm plunger, the logic valve is closed; oil flows into the high pressure feed passage via manifold and joins to the flow from the pump P₁.



(7) Travel priority circuit

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

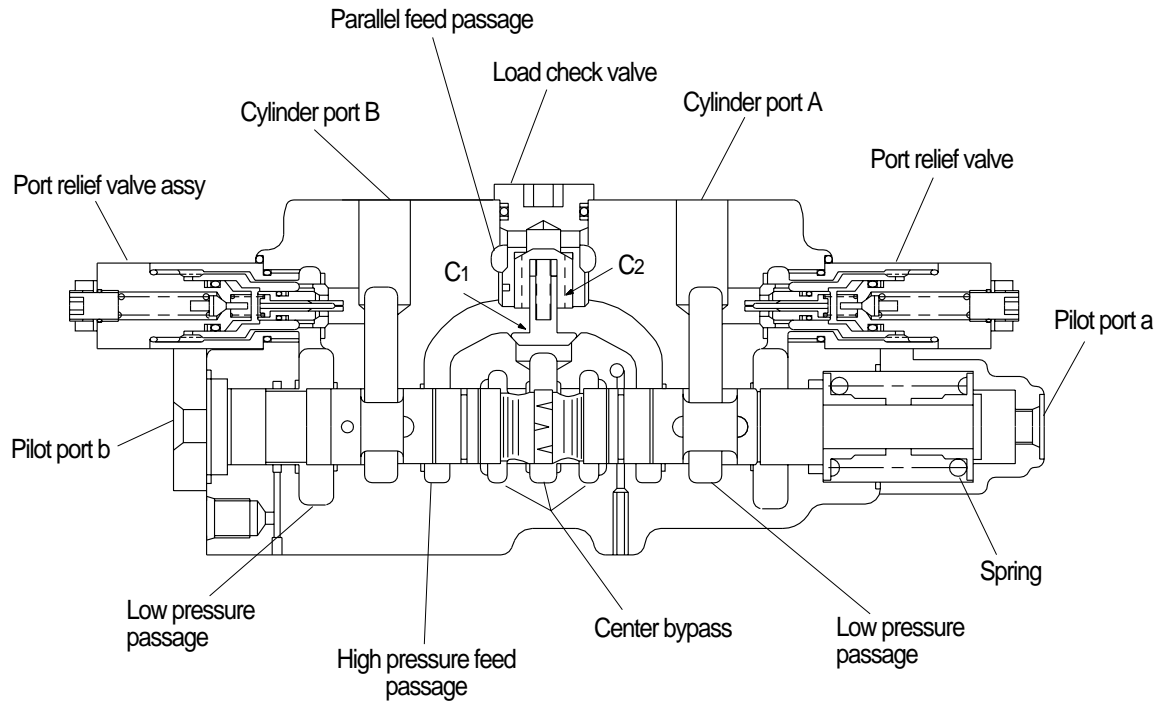
- ① During straight travel by operating left/right travel plunger (TL, TR): Oil from pump P₁ is fed into cylinder port BL₃ by the operation of TL plunger. Oil from pump P₂ is fed into cylinder port BR₇ by the operation of TR plunger. Thus, straight travel is performed separately with pump P₁ driving 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 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 selector valve (P₁ port). 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 P₁ is fed to swing and oil from pump P₂ is fed to right travel (TR) and left travel (TL). The orifice 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 machine speed. The basic operation is same with swing even in the case of other actuators on upper frame of machine during straight travel.



3) OPERATIONAL DESCRIPTION OF CONTROL VALVE

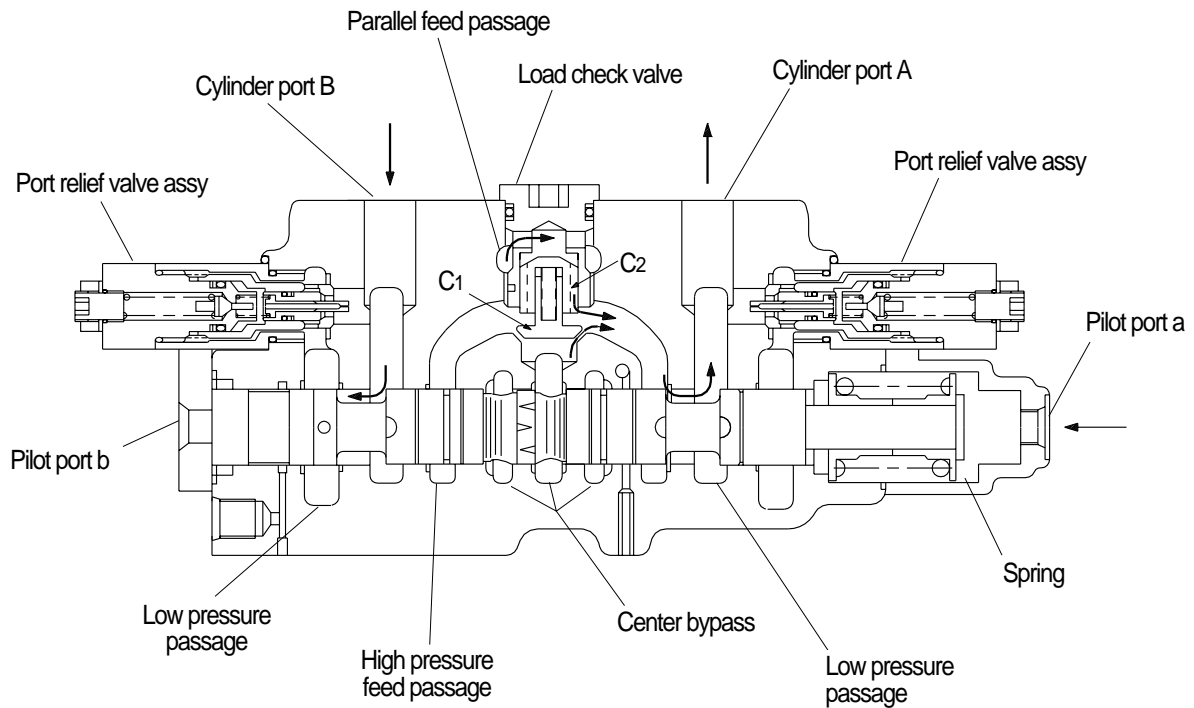
(1) Plunger operation

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



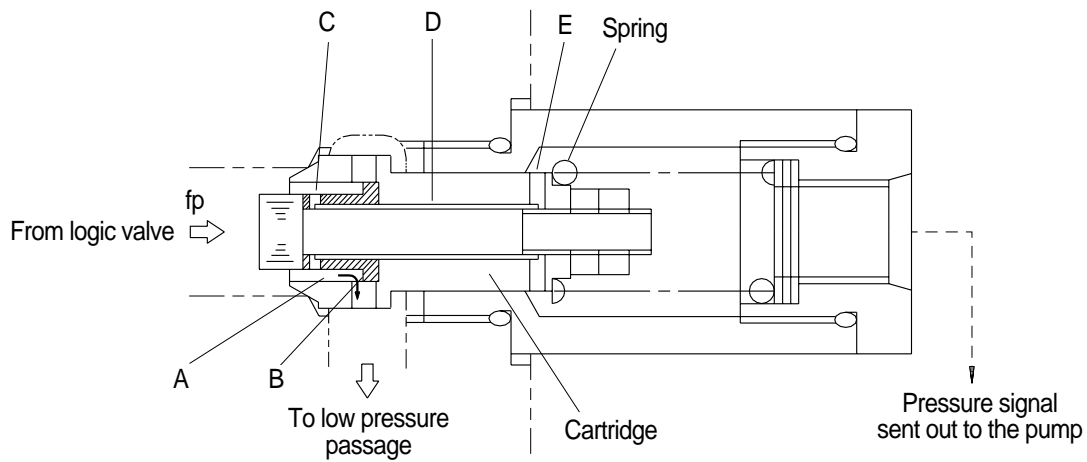
When actuated (pressure is applied to pilot port a), the plunger moves to the left; the center bypass is shut off; oil from the center bypass pushes up the check valve C₁ and flows into cylinder port A via the high pressure feed passage. Meanwhile, oil from the parallel feed passage pushes down check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

※ Reversed when pressure is applied to pilot port b.

(2) Foot relief valve operation

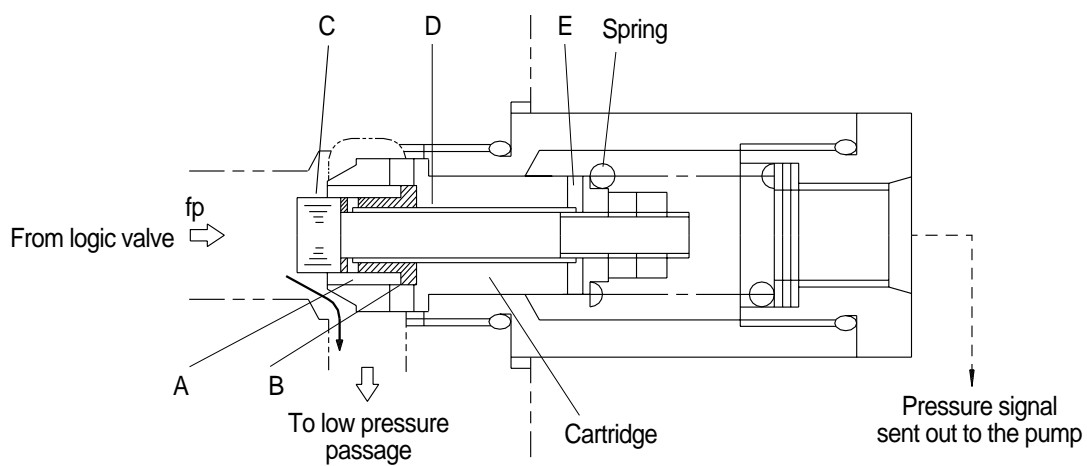
① f_p is lower than spring force



Oil from the logic valve flows into the tank via passage(A), orifice(B) of poppet.

Pressure f_p generated by orifice(B) is led to the pump via hole(C), passage(D) and hole(E), to control the pump delivery flow.

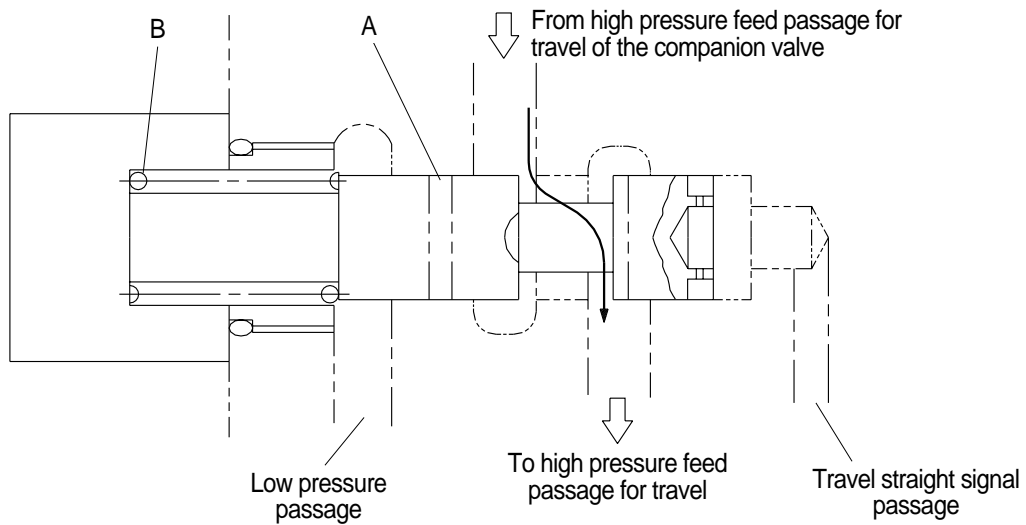
② f_p is higher than spring force



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

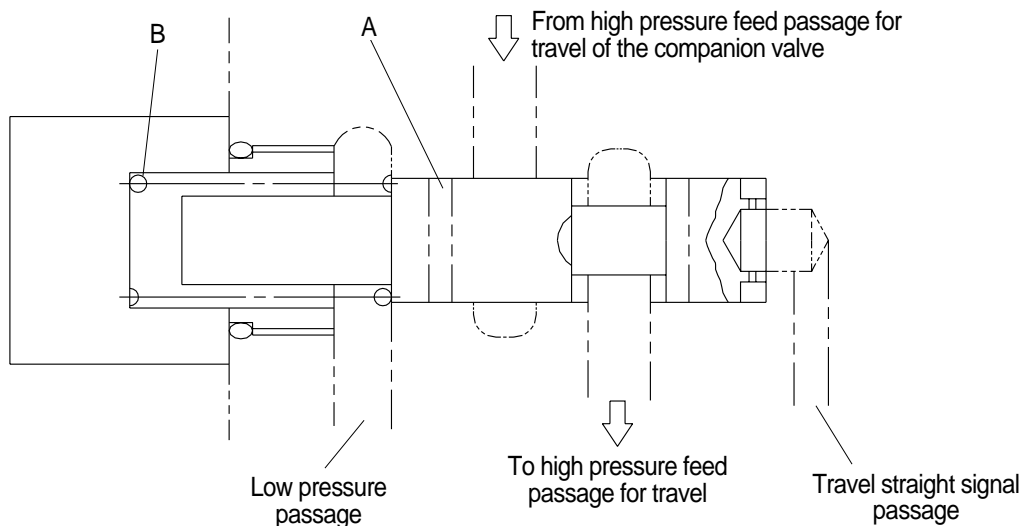
(3) Selector valve operation

① Straight travel signal : ON



If any actuator is operated when traveling, travel straight signal pressure reaches a spring force, the spool(A) moves to the left the high pressure passage for travel of the companion valve(T_L) and the high pressure passage for travel(T_R) are connected, and equal amount of oil flows to T_R and T_L.

② Straight travel signal : OFF

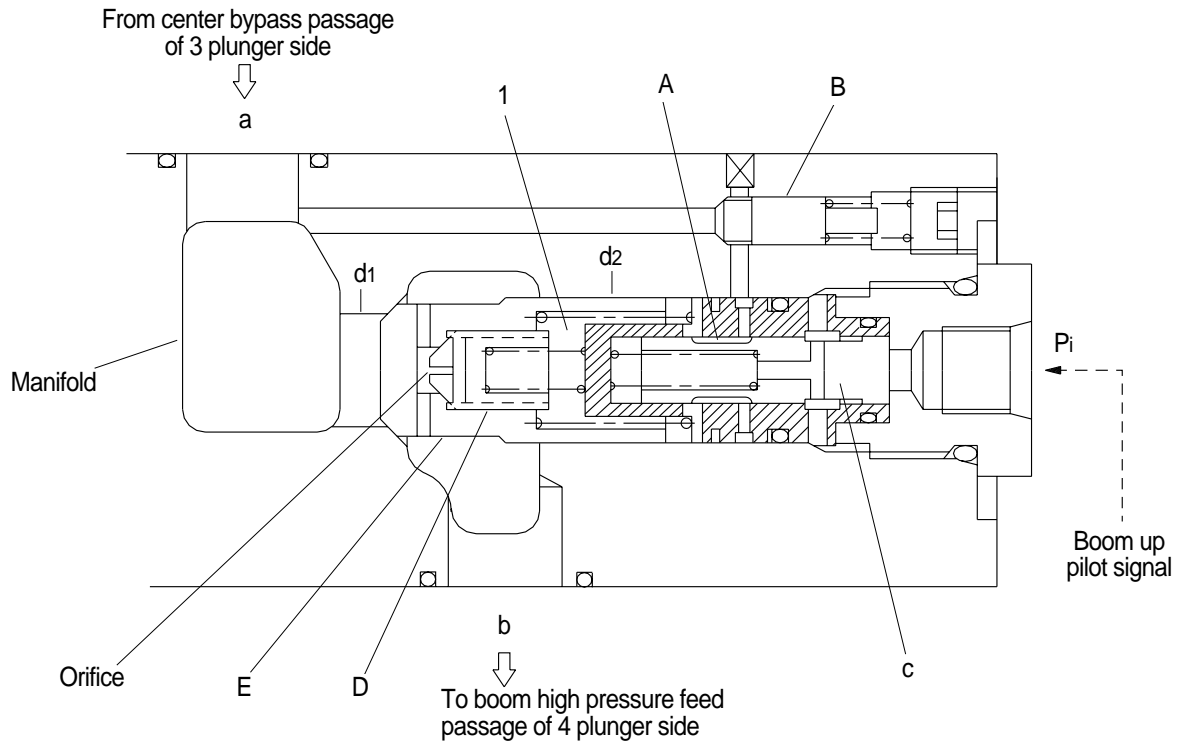


The spring sets spool in position; which shuts off the high pressure feed passages of T_R and T_L.

(4) Logic check valve operation

① Boom down or neutral

when boom up pilot pressure is not supplied to Pi port



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

Pressure in the passage a (P_a) enters chamber (1) via passage (A).

Pressure in the passage b (P_b) enters chamber (1) via orifice and passage (D).

If $P_a > P_b$

Poppet (E) is moved to left by the force of $P_a(d_2 - d_1)$, because $d_1 < d_2$ and passage from a to b is blocked.

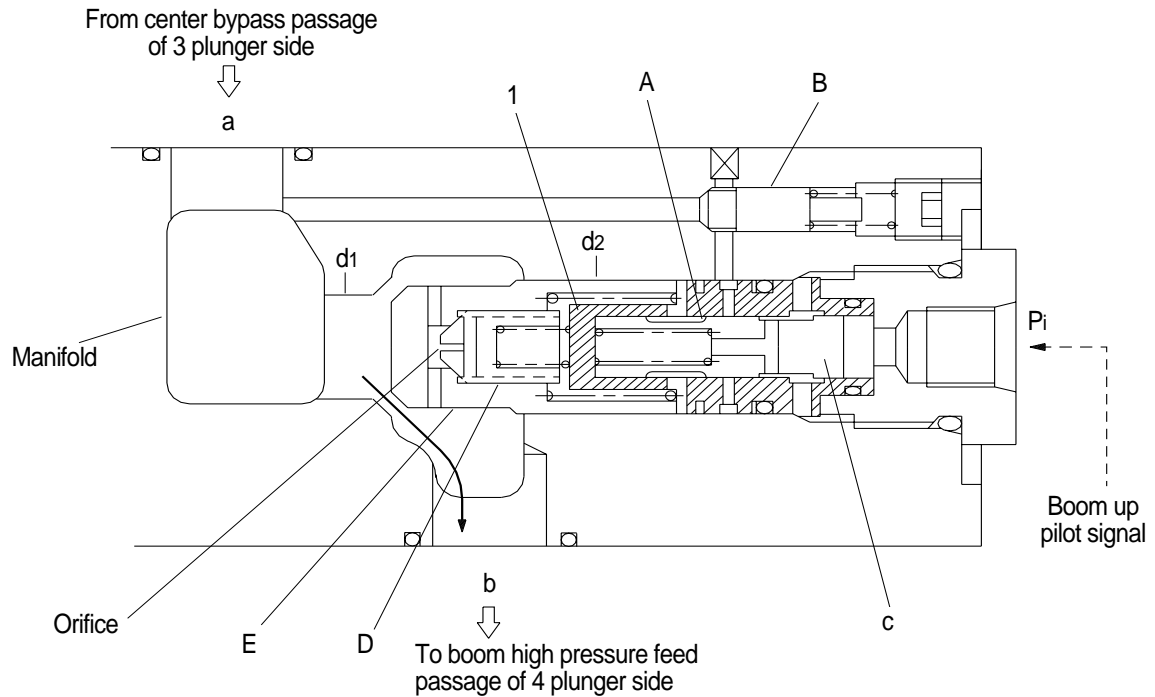
If $P_a < P_b$

Passage from b to a is blocked by the check valve (B). also, passage from b to a is blocked by $d_1 < d_2$ and $P_a < P_b$.

② Boom up

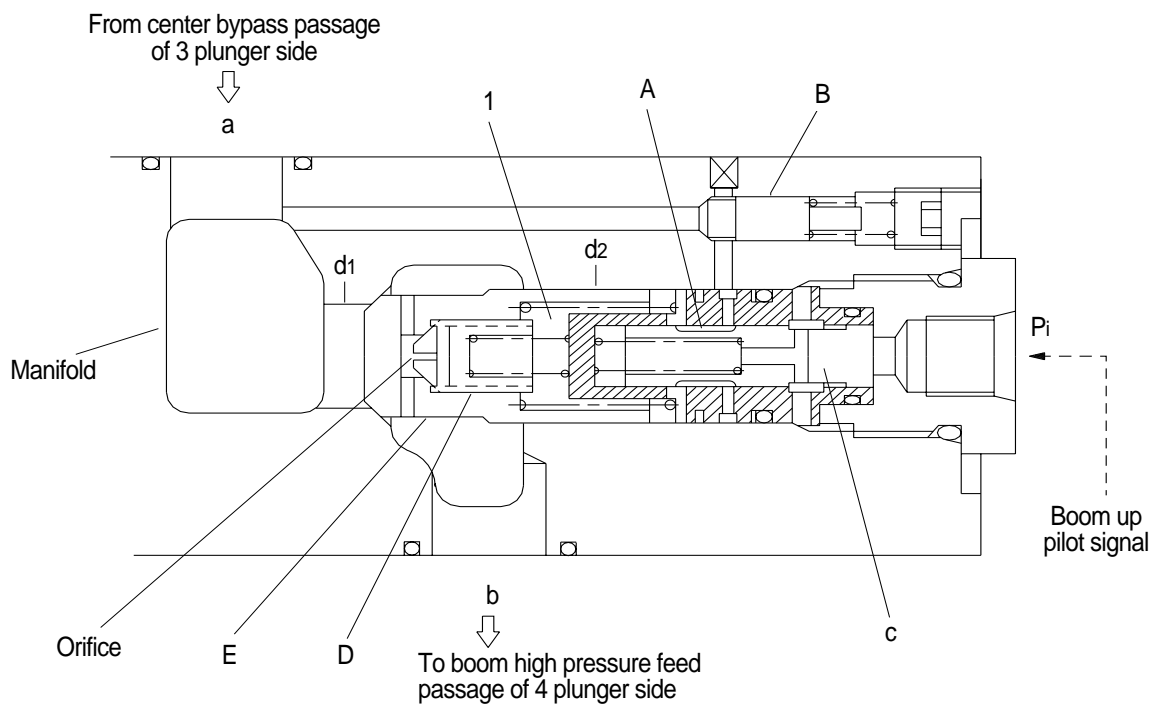
When boom up pilot pressure is supplied to P_i port
Piston (c) moves to left; passage (A) is shut off.

When $P_a > P_b$



The pressure of chamber(1) is equal to pressure P_b ; poppet (E) is lifted; oil flows through from a to b.

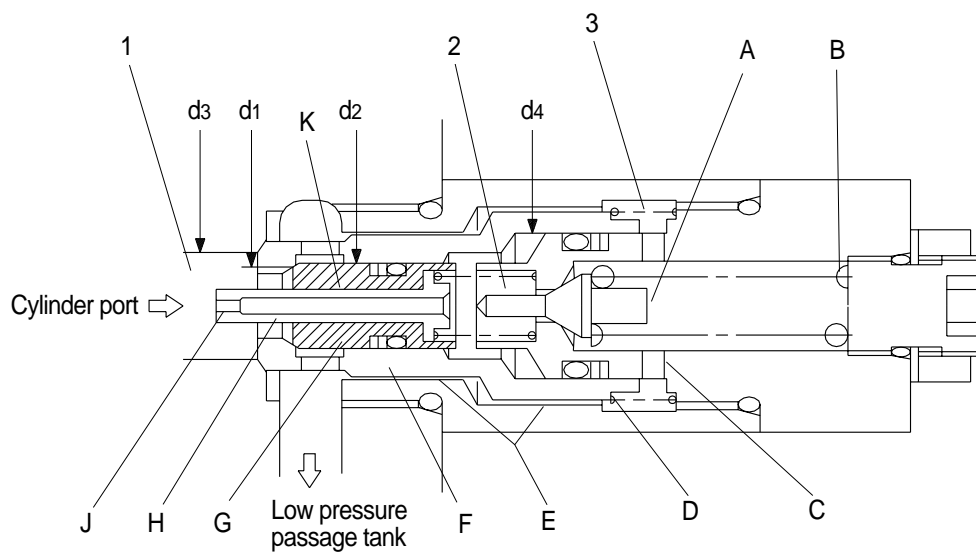
When $P_a < P_b$



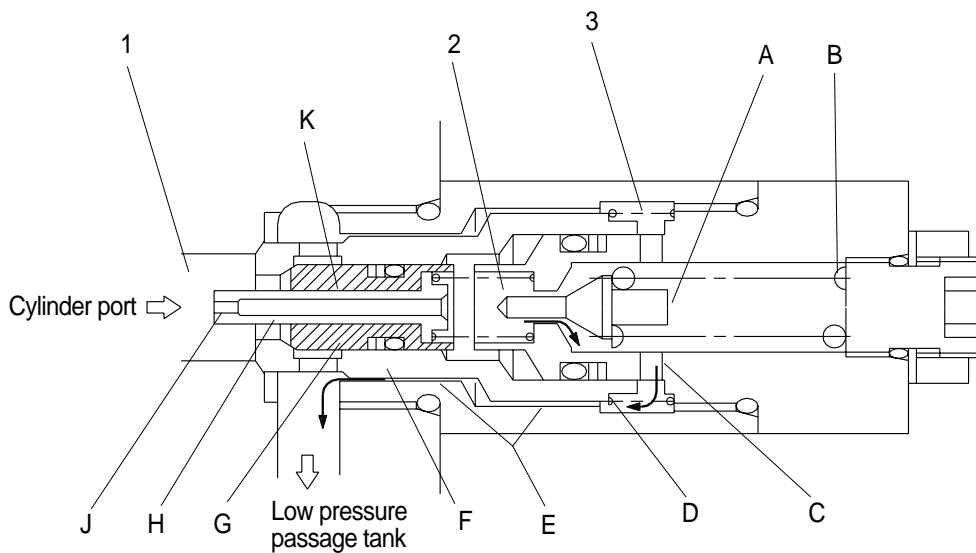
Oil of chamber(1) is shut off; passage b to a is blocked.

(5) Overload relief valve operation

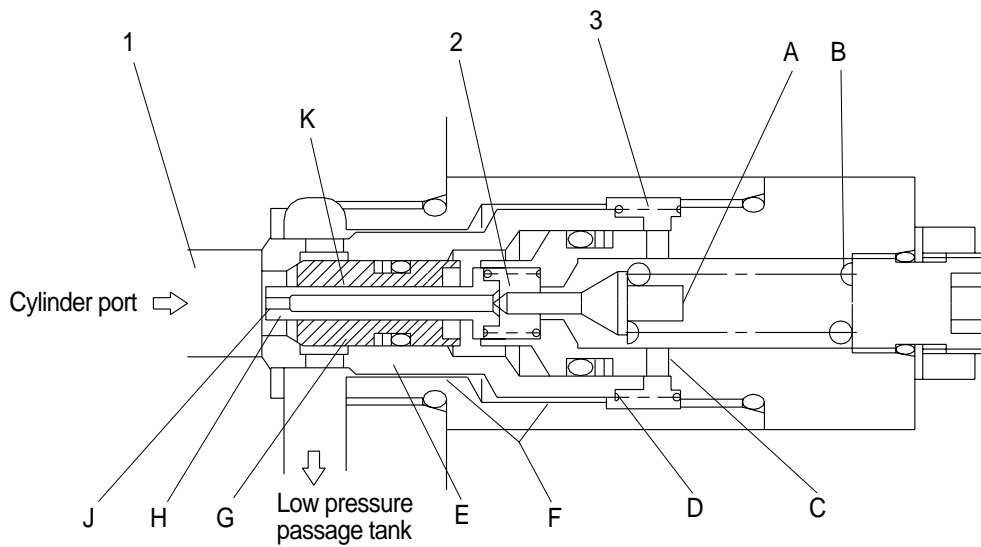
① Overload working operation



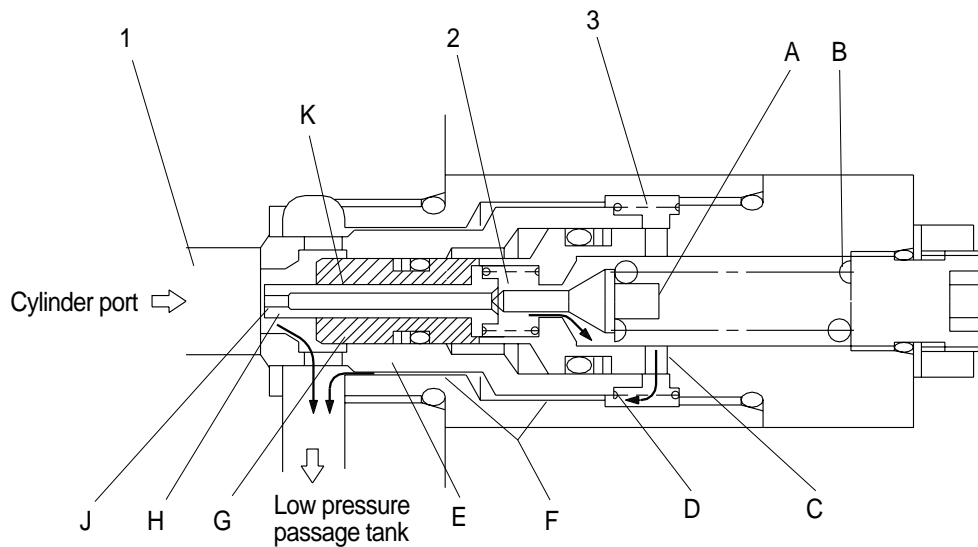
Hydraulic oil from cylinder port enters chamber (2) via orifice (J) of piston (H). Because $d_1 < d_2$ and $d_3 < d_4$, poppets (G) and (F) are securely seated.



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

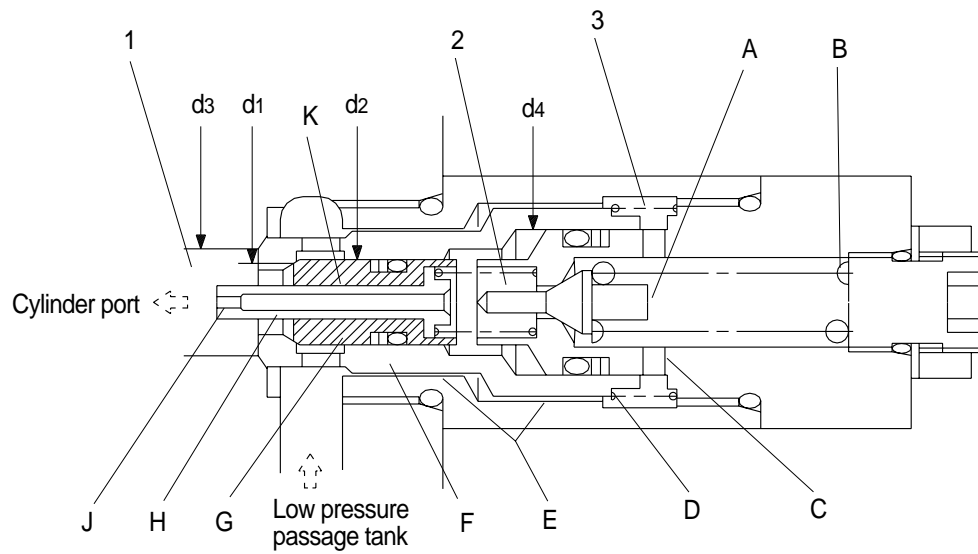


Oil flow is formed; pressure drops before and behind orifice (J); piston (H) moves to right and seats at the tip of poppet (A).

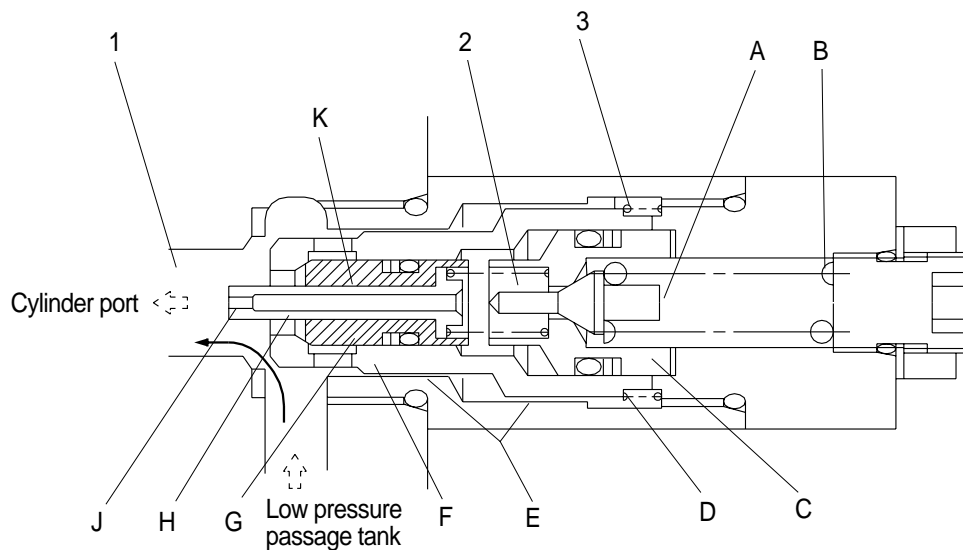


Hydraulic oil from chamber (1) enters chamber (2) via throttle (K) at the tip of poppet (A); it flows around poppet (A) and into the low pressure passage via side hole (C) and passage (E). Pressure drops before and behind throttle (K), making pressure of chamber (1) \times area $d_1 >$ pressure of chamber (2) \times area d_2 ; poppet (G) is lifted and hydraulic oil flows into the low pressure passage.

② Make up operation



Poppet (F) is securely seated because the cylinder port pressure is normally higher than the tank pressure and $d_3 < d_4$.



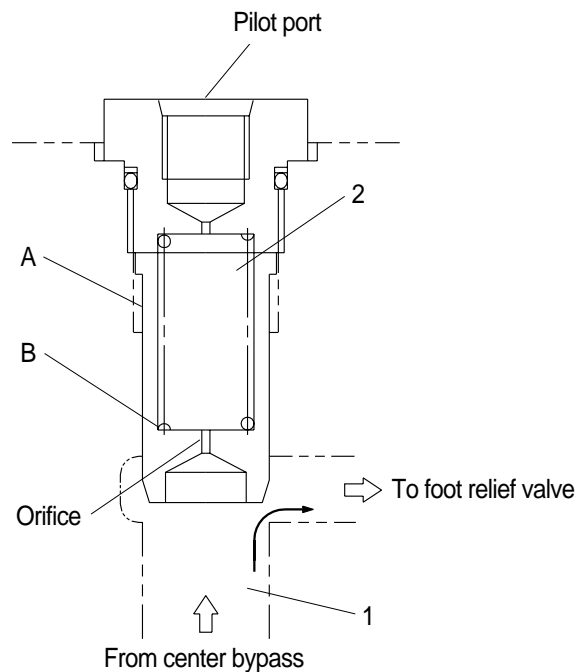
When the cylinder port pressure drops (closer to negative pressure) until the cylinder port pressure is lower than the tank pressure, poppet (F) opens receiving the tank pressure for the difference in area between d_3 and d_4 ; oil flows from the tank passage to the cylinder port in order to prevent cavitation.

(6) Logic valve

① Pilot port : Release

Oil from center by pass flow into pilot port via orifice of poppet(A).

Oil flow is formed; pressure drops before and behind orifice, making pressure of chamber(1) > pressure of chamber(2); poppet(A) is lifted and oil flows into foot relief valve.



② Pilot port : Block

Oil flow of pilot port is blocked; making pressure of chamber(1) = chamber(2), but the poppet(A) is return by spring force and oil flows into foot relief valve is blocked.

