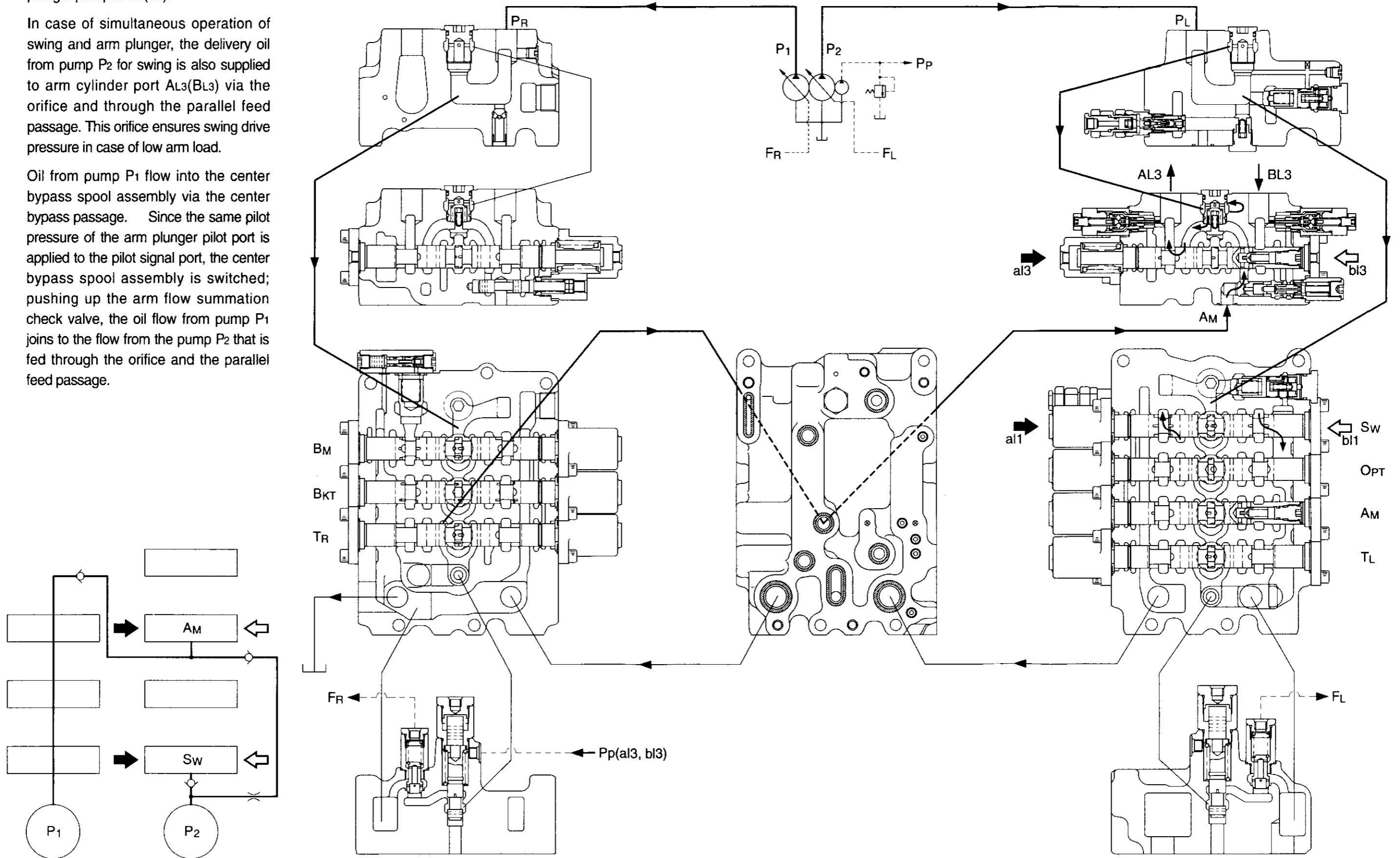


(7) Swing priority circuit

Oil from pump P₂ is fed into cylinder port AL₁(BL₁) by adding pressure to swing plunger pilot port a₁₁(b₁₁).

In case of simultaneous operation of swing and arm plunger, the delivery oil from pump P₂ for swing is also supplied to arm cylinder port AL₃(BL₃) via the orifice and through the parallel feed passage. This orifice ensures swing drive pressure in case of low arm load.

Oil from pump P₁ flow into the center bypass spool assembly via the center bypass passage. Since the same pilot pressure of the arm plunger pilot port is applied to the pilot signal port, the center bypass spool assembly is switched; pushing up the arm flow summation check valve, the oil flow from pump P₁ joins to the flow from the pump P₂ that is fed through the orifice and the parallel feed passage.



(8) Travel priority circuit

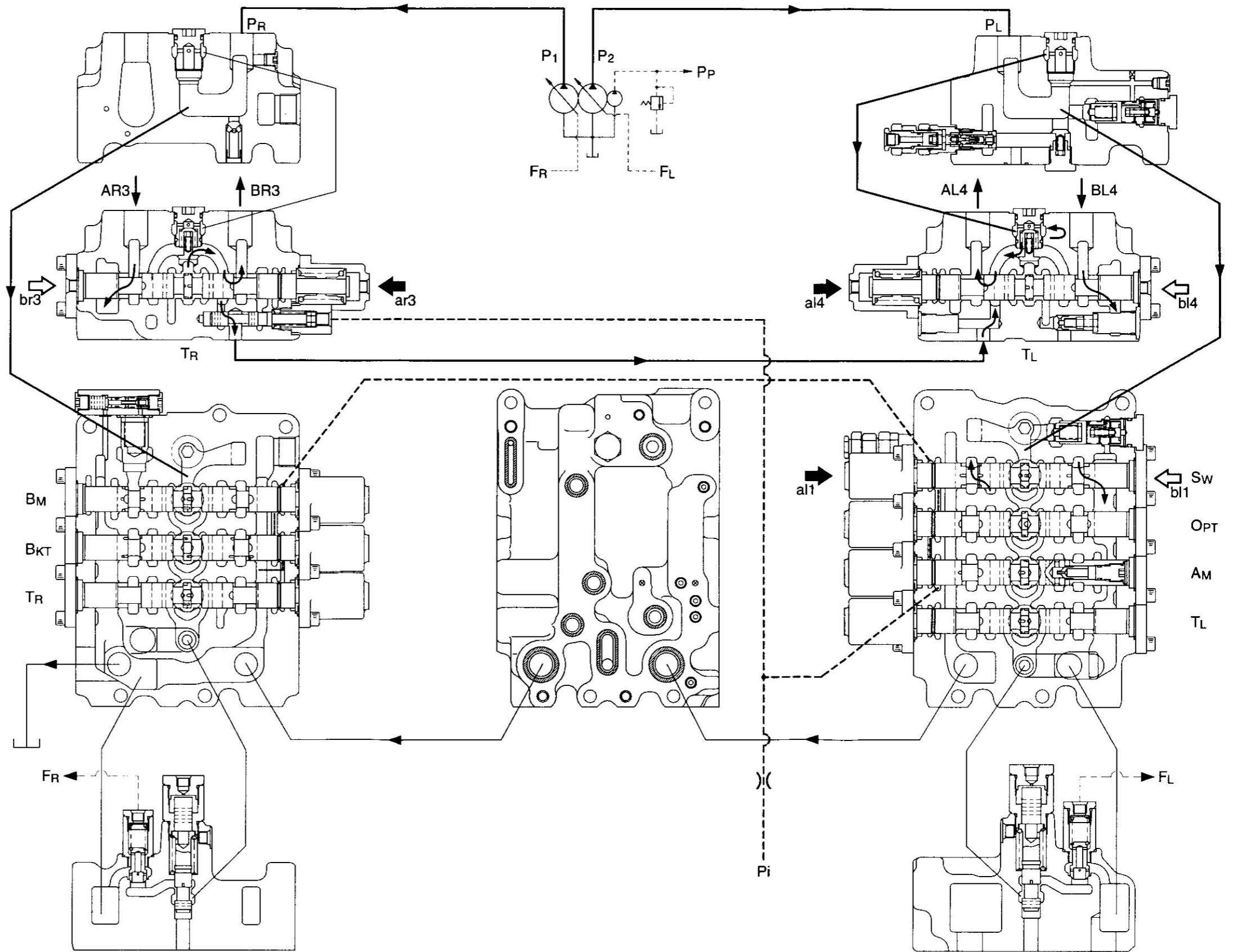
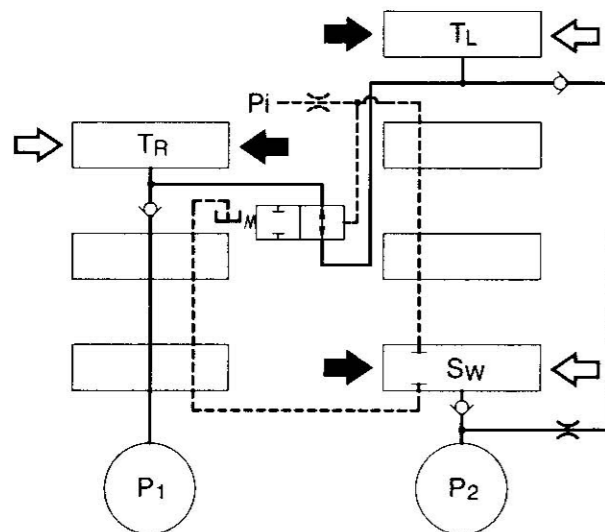
This circuit keeps straight travel in case of simultaneous operation of other actuators (Sw, AM, BKT, BM) during a straight travel.

- ① **During straight travel by operating left/right travel plunger (TL, TR):** Oil from pump P1 is fed into cylinder port AR3 (BR3) by the operation of TR plunger. Oil from pump P2 is fed into cylinder port AL4 (BL4) by the operation of TL plunger. Thus, straight travel is performed separately with pump P1 driving rightward travel (TR) and pump P2 driving leftward travel (TL).

- 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. When the swing plunger is completely switched, oil discharged from pump P2 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 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.

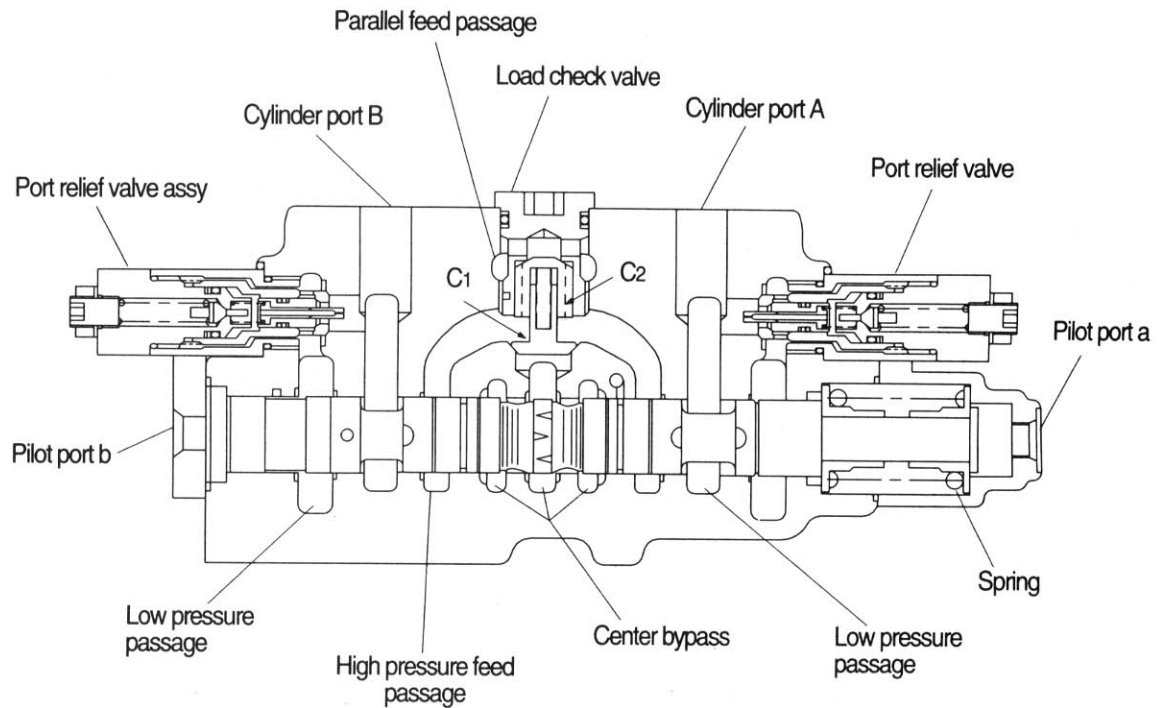
The basic operation is same with swing even in the case of other actuators on upper frame of machine during straight travel.



3) OPERATIONAL DESCRIPTION OF CONTROL VALVE

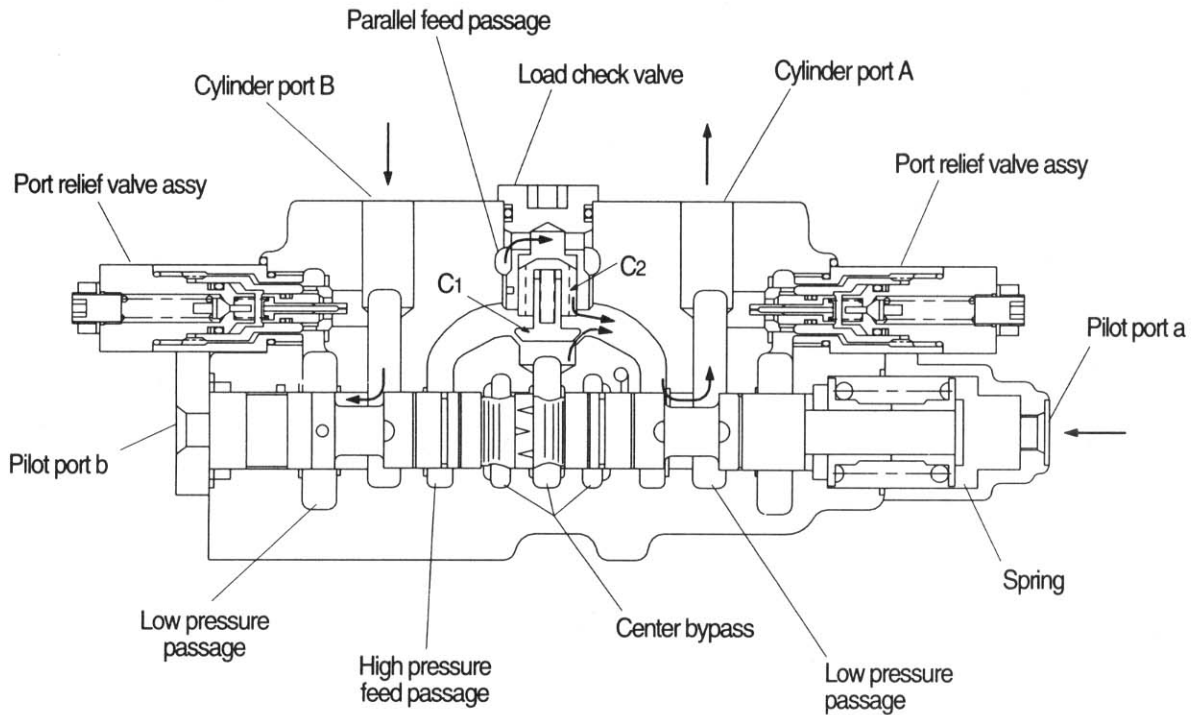
(1) Plunger operation

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



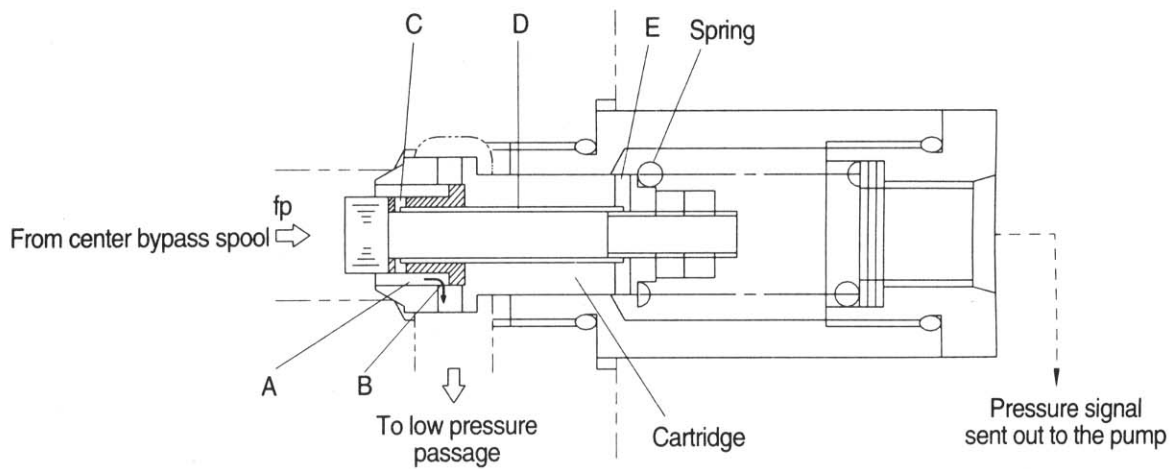
When actuated (pressure is applied to pilot port a), the plunger moves to the left; the center bypass is shut off; oil from the center bypass pushes up the check valve C₁ and flows into cylinder port A via the high pressure feed passage. Meanwhile, oil from the parallel feed passage pushes down check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

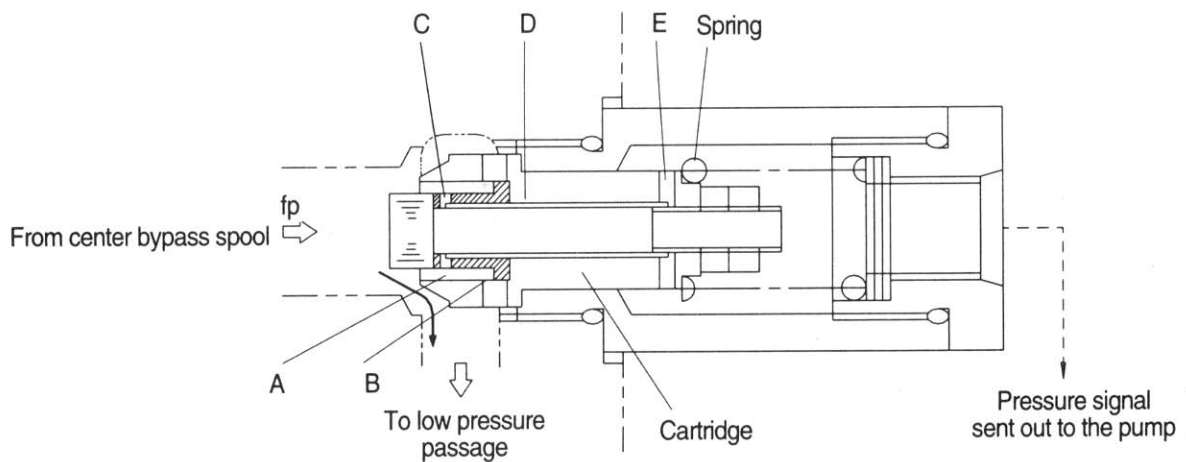
① f_p is lower than spring force



Oil from the center bypass spool valve flows into the tank via passage(A), throttle(B) and the low pressure passage.

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

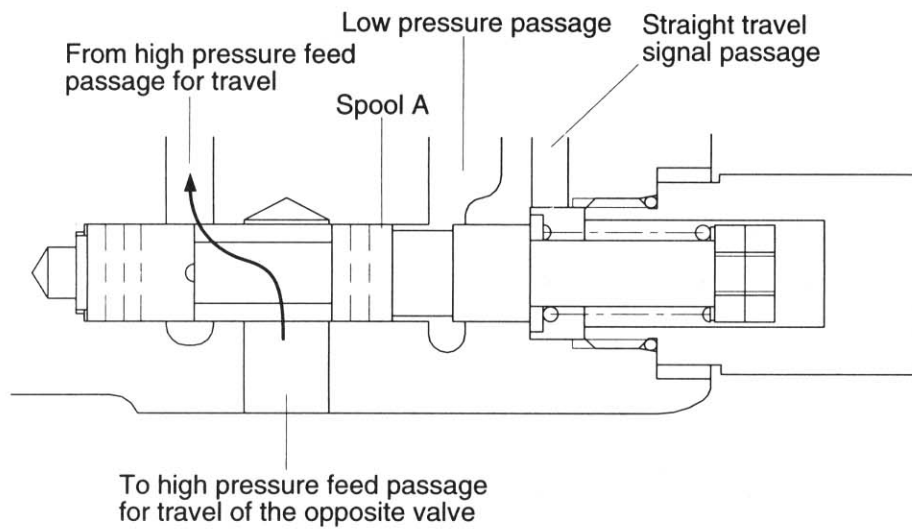
② f_p is higher than spring force



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.

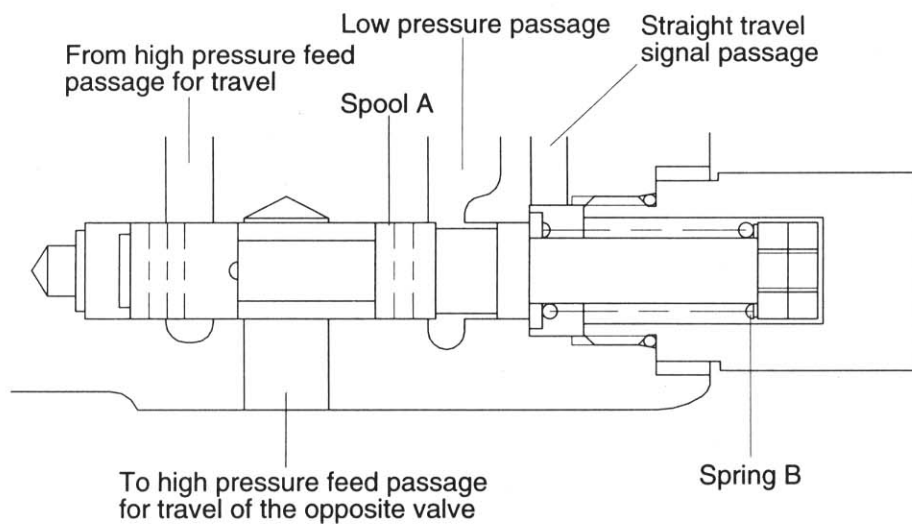
(3) Selector valve operation

① Straight travel signal : ON



The spool(A) moves to the left; the high pressure passage for travel of the opposite 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.

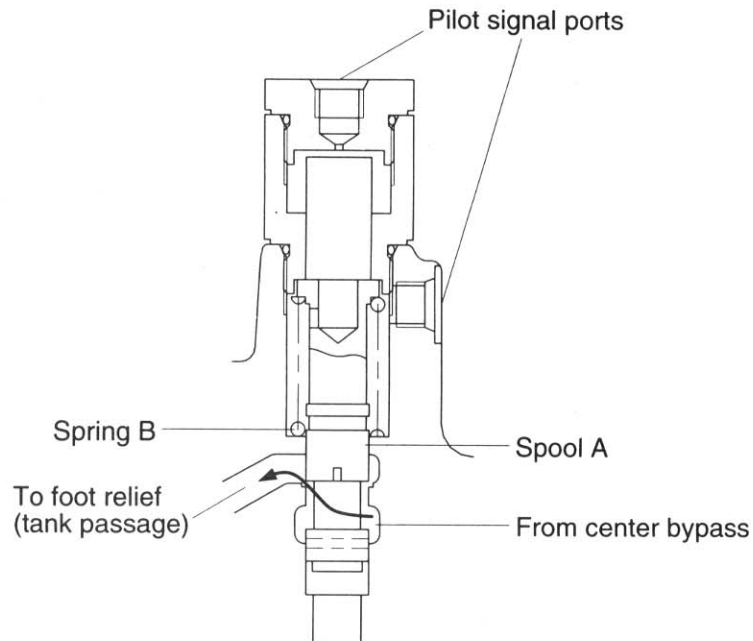
② Straight travel signal : OFF



The spring(B) returns the spool(A), which shuts off the high pressure feed passages of T_R and T_L.

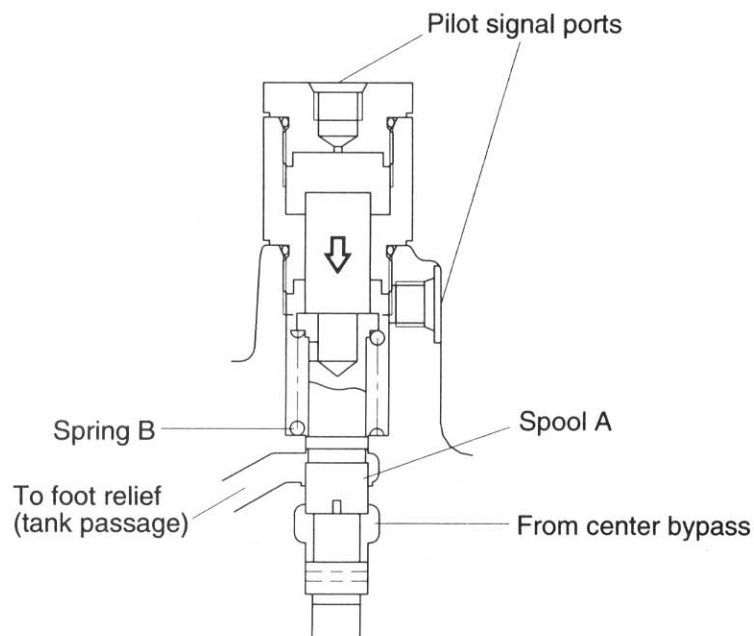
(4) Center bypass spool valve operation

① Pilot pressure signal : OFF



Spring(B) sets spool(A) in position ; oil from center bypass flows into the tank passage via the foot relief valve.

② Pilot pressure signal : ON

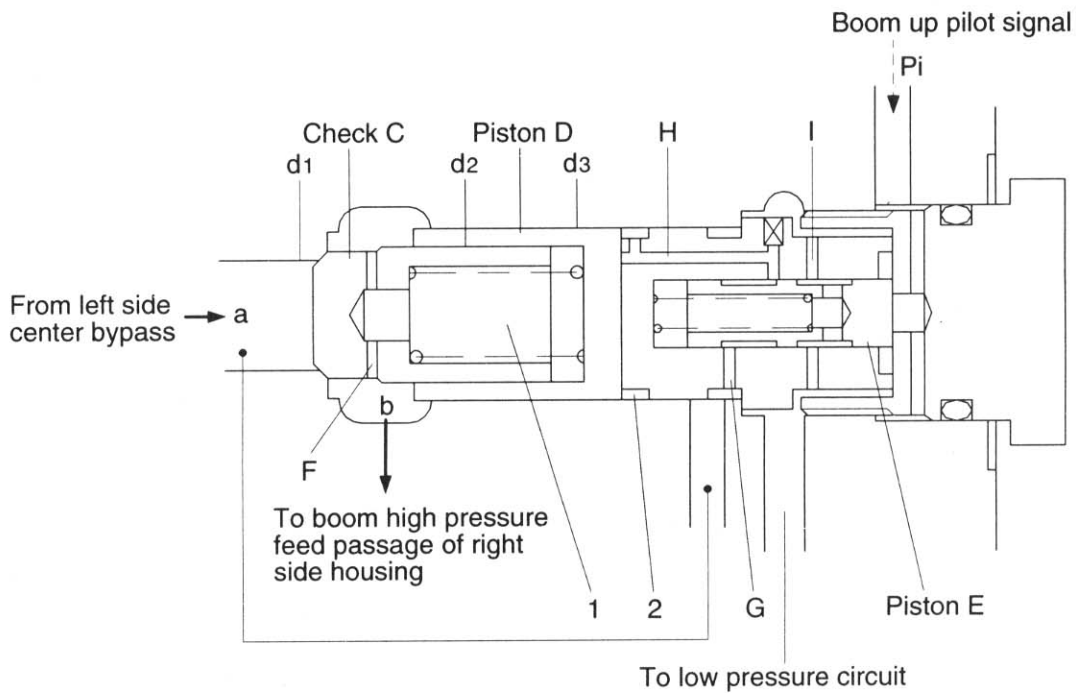


When pilot pressure reaches a preset spring(B) force, the spool(A) moves down and shuts off the flow through the center bypass.

(5) Logic check valve operation

① Boom down or neutral

When boom up pilot pressure is not supplied to Pi port



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

Pressure in the passage a(P_a) enters chamber(2) via passage(G) and passage(H). Pressure in the passage b(P_b) enters chamber(1) via passage(F).

If $P_a > P_b$

Piston(D) moved to left by the force of d_3 area $\times (P_a - P_b)$. Also, check valve(C) is seated by the movement of piston(D) and passage from a to b is blocked, because $d_1 < d_3$.

If $P_a < P_b$

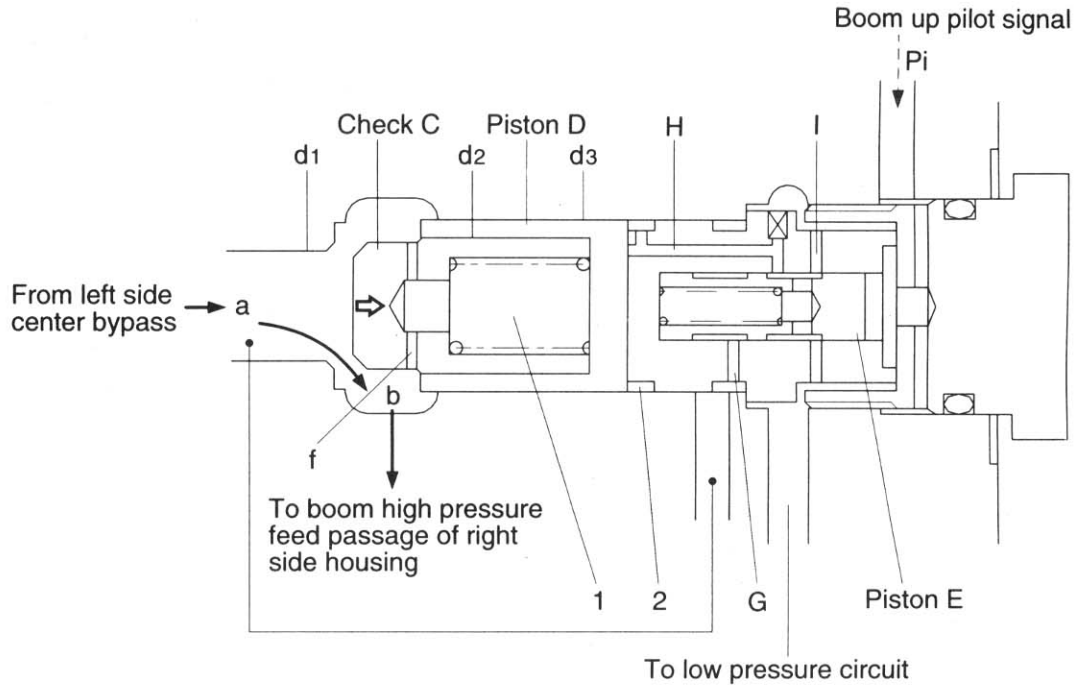
Passage from b to a is blocked by the check valve(C).

② **Boom up**

When boom up pilot pressure is supplied to P_i port

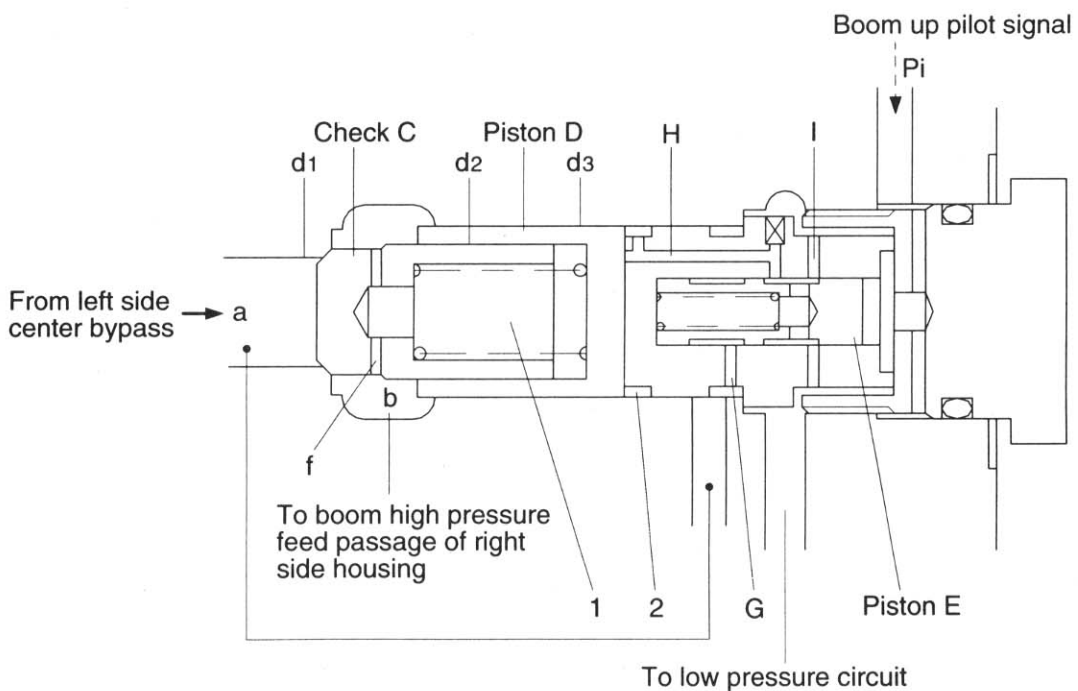
Piston(E) moves to left; passage(H) is shut off from passage(G) ; passage(H) and passage(I) are connected ; chamber(2) is connected to the low pressure circuit.

If $P_a > P_b$



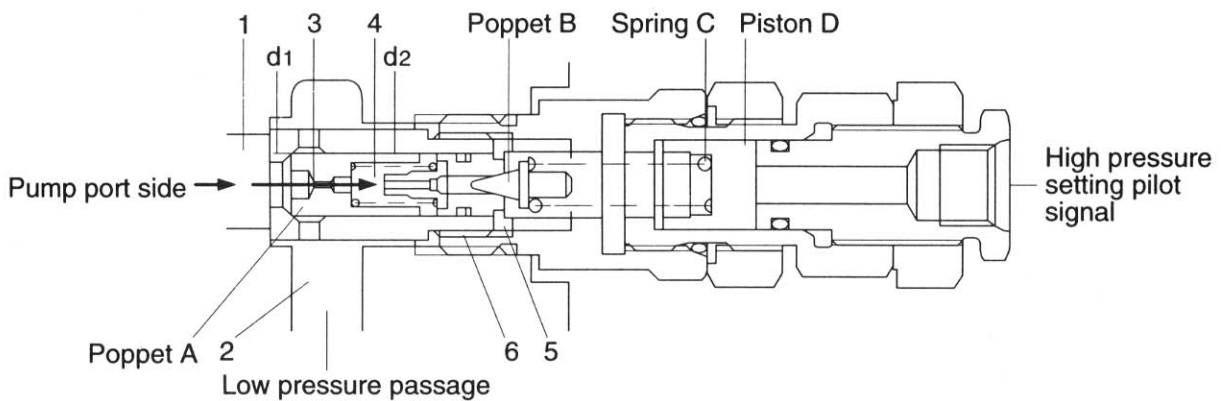
Spring force sets piston(D) at the shown position ; check valve(C) is lifted; oil flows through from a to b.

If $P_a < P_b$

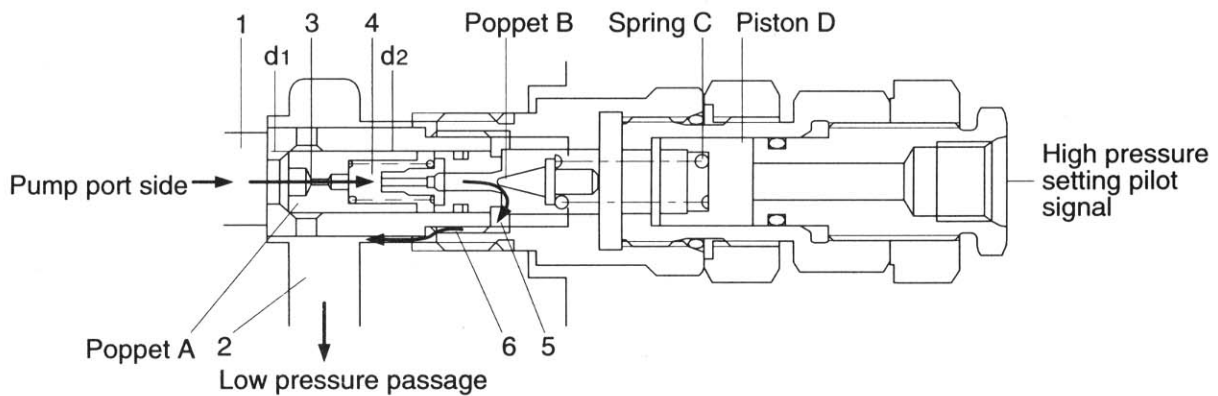


Passage from b to a is blocked by the check valve(C).

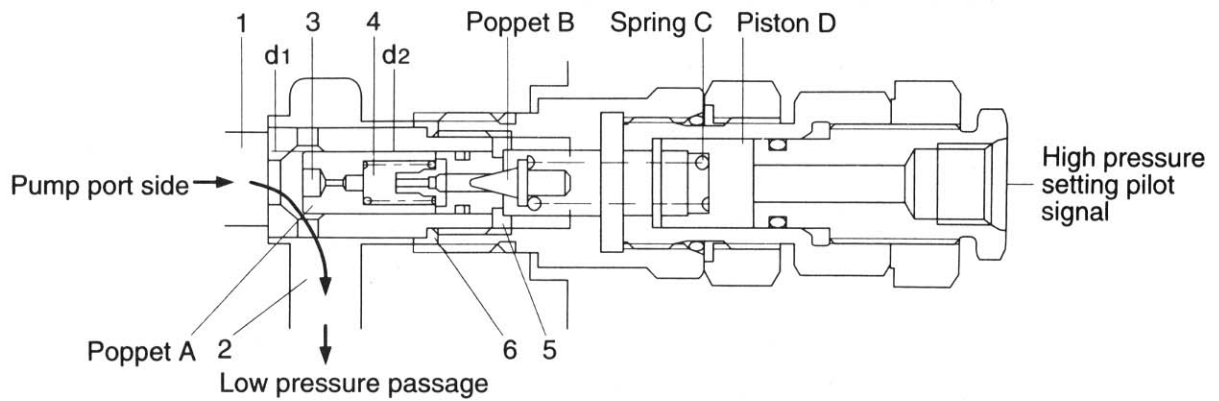
(6) Main relief valve operation



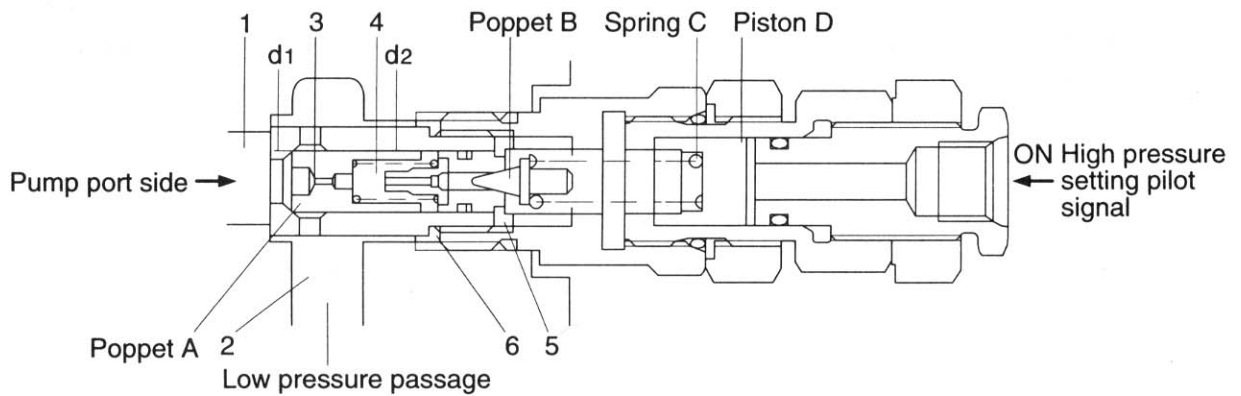
This relief valve is built-in between the pump port side(1) and low pressure passage(2). Hydraulic oil from the pump port side enters chamber(4) via orifice(3) of poppet(A). Because $d_1 < d_2$, poppet(A) is securely seated.



When hydraulic pressure oil reaches the pressure preset by spring(C), pilot poppet(B) opens; oil flows around poppet(B) and into the low pressure passage via side hole(5) and passage(6).



When the above oil flow is formed, pressure drops before and behind orifice(3) ; when pressure of chamber(1) X area d1 is larger than pressure of chamber(2) X area d2, poppet(A) is lifted and hydraulic oil flows into the low pressure passage.

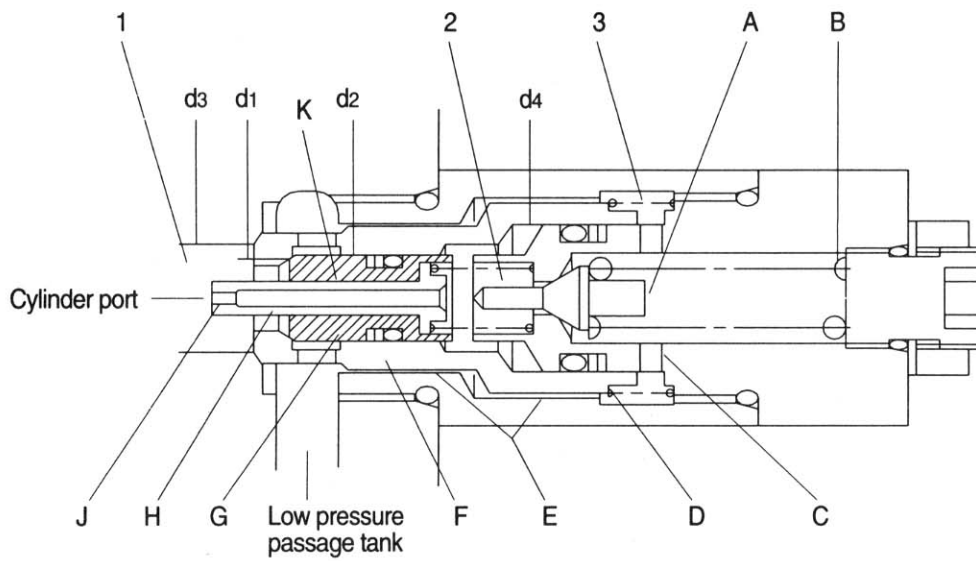


High pressure setting pilot signal : ON

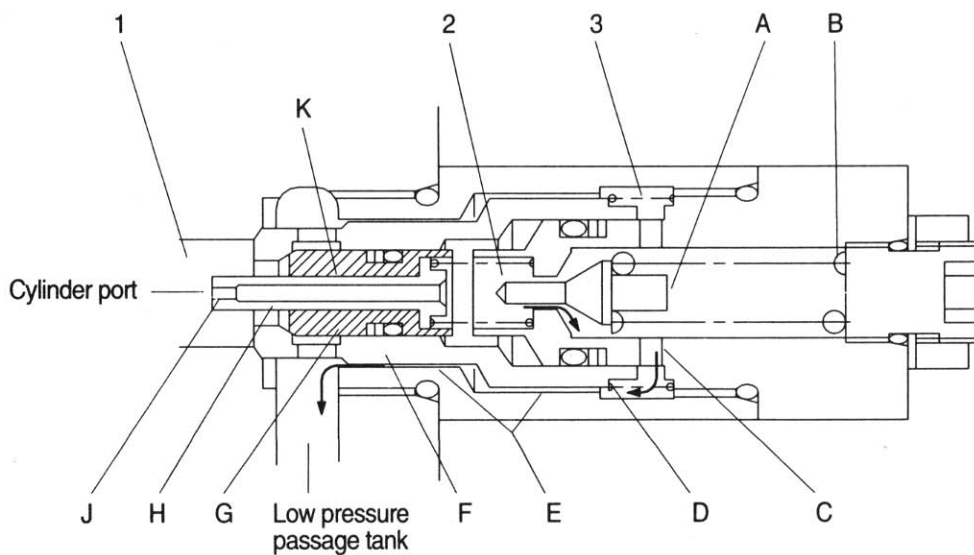
Piston(D) moves to left ; set pressure of spring(C) rises, making high pressure setting.

(7) Relief valve operation

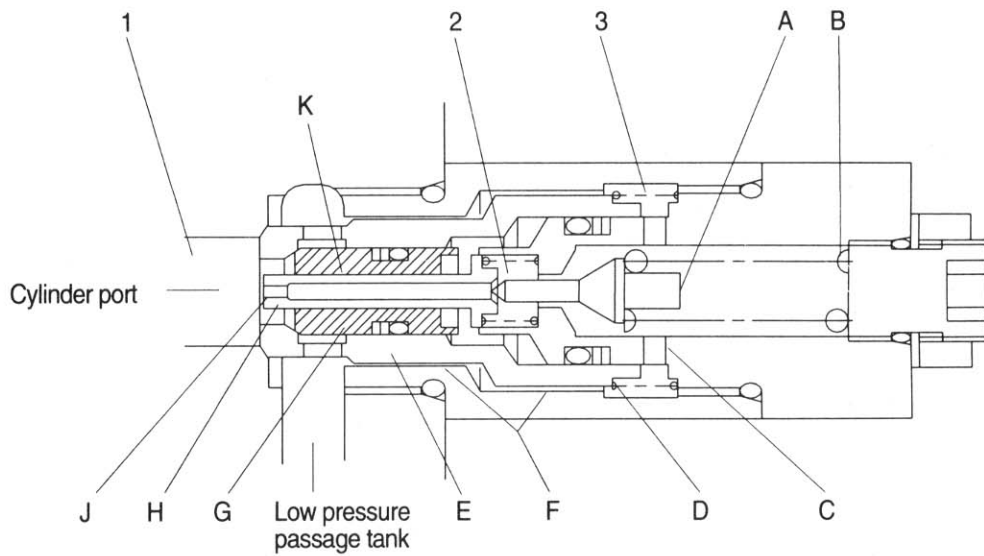
① Overload working operation



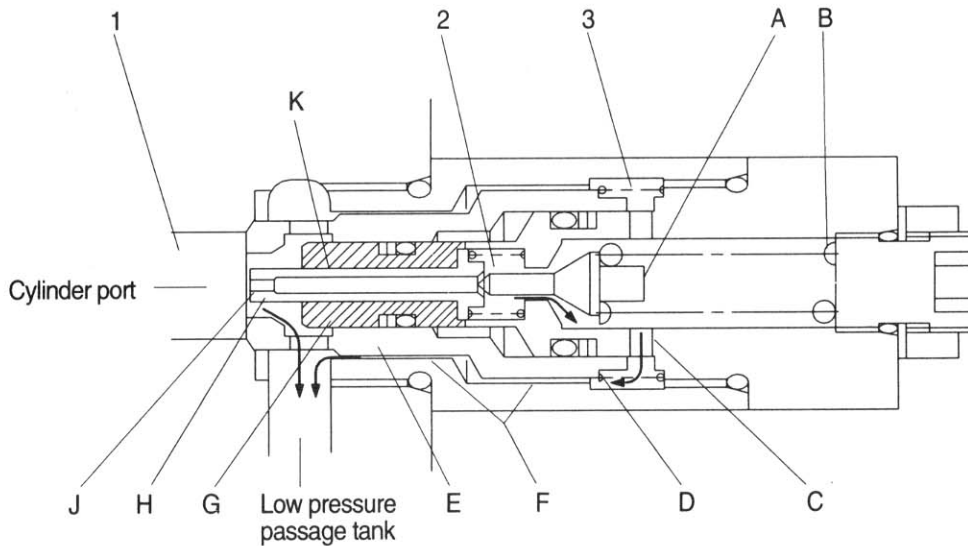
Hydraulic oil from cylinder port enters chamber(2) via orifice(J) of piston(H). Because $d_1 < d_2$ and $d_3 < d_4$, poppets(G) and (F) are securely seated.



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).

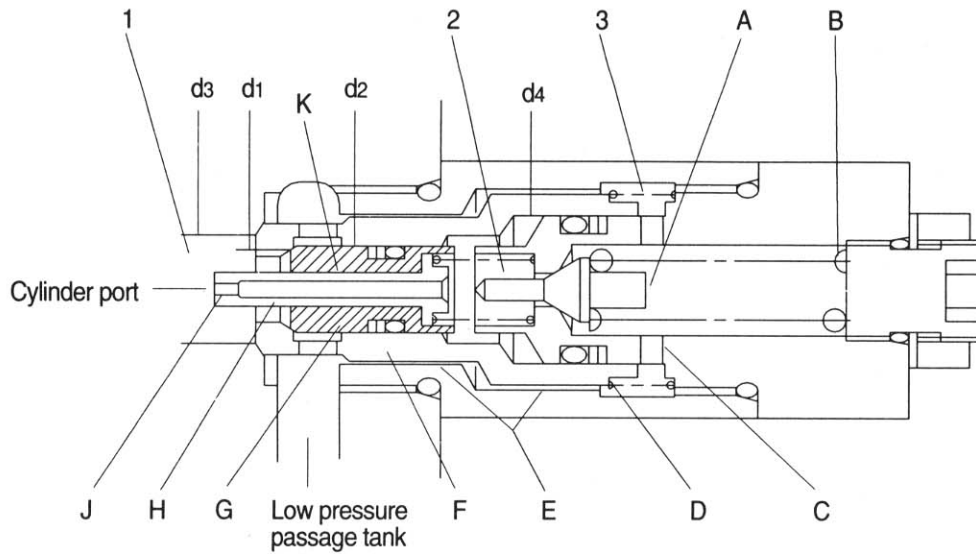


Oil flow is formed; pressure drops before and behind orifice(J); piston(H) moves to right and seats at the tip of poppet(A).

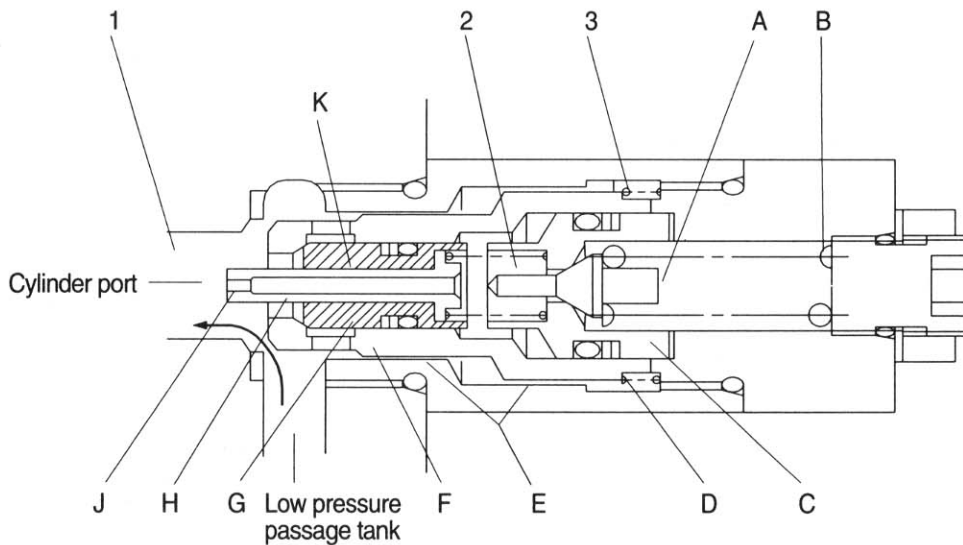


Hydraulic oil from chamber(1) enters chamber(2) via throttle(K) at the tip of poppet(A); it flows around poppet(A) and into the low pressure passage via side hole(C) and passage(E). Pressure drops before and behind throttle(K), making pressure of chamber(1) x area $d_1 >$ pressure of chamber(2) x area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

② Make up operation

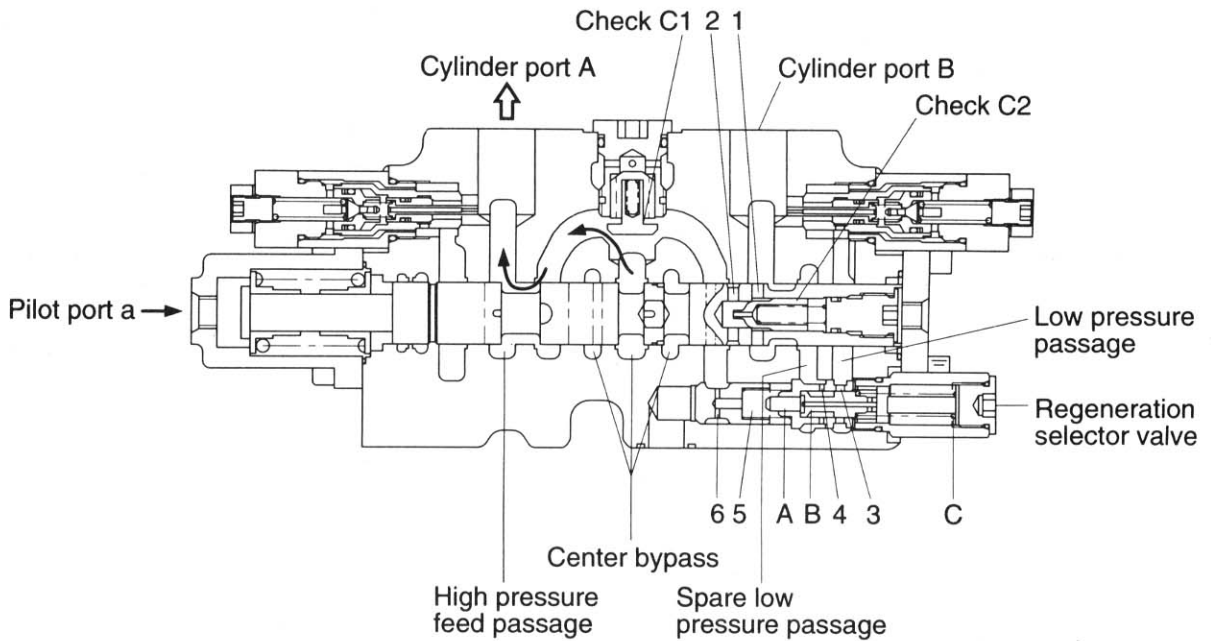


Poppet(F) is securely seated because the cylinder port pressure is normally higher than the tank pressure and $d_3 < d_4$.

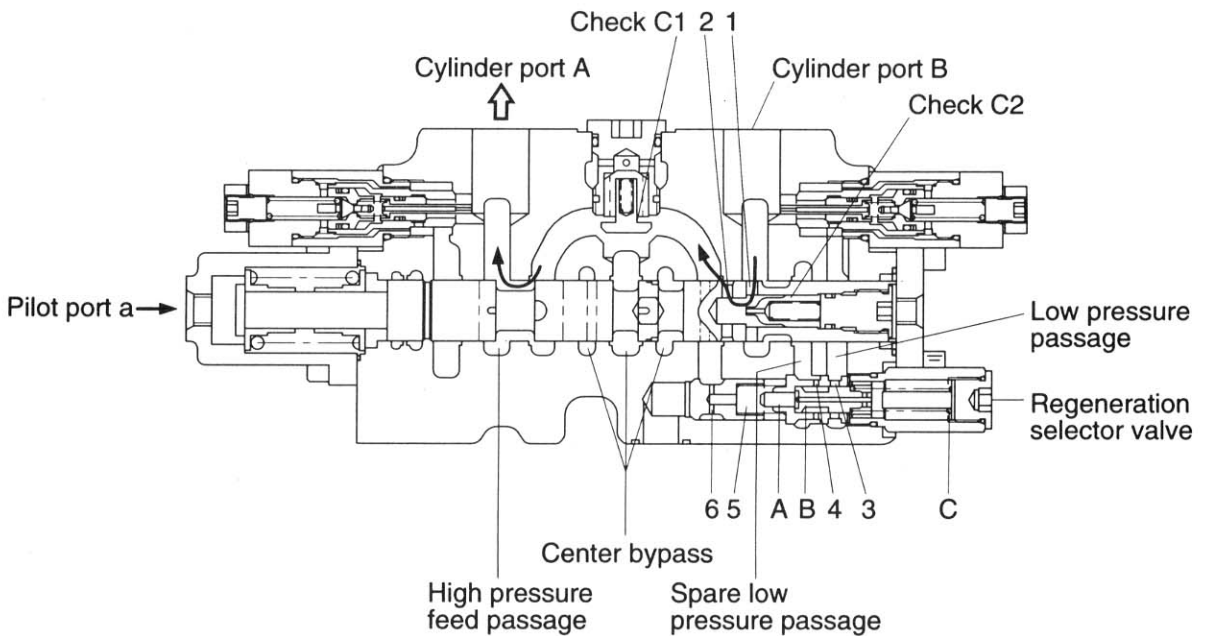


When the cylinder port pressure drops (closer to negative pressure) until the cylinder port pressure is lower than the tank pressure, poppet(F) opens receiving the tank pressure for the difference in area between d_3 and d_4 ; oil flows from the tank passage to the cylinder port in order to prevent cavitation.

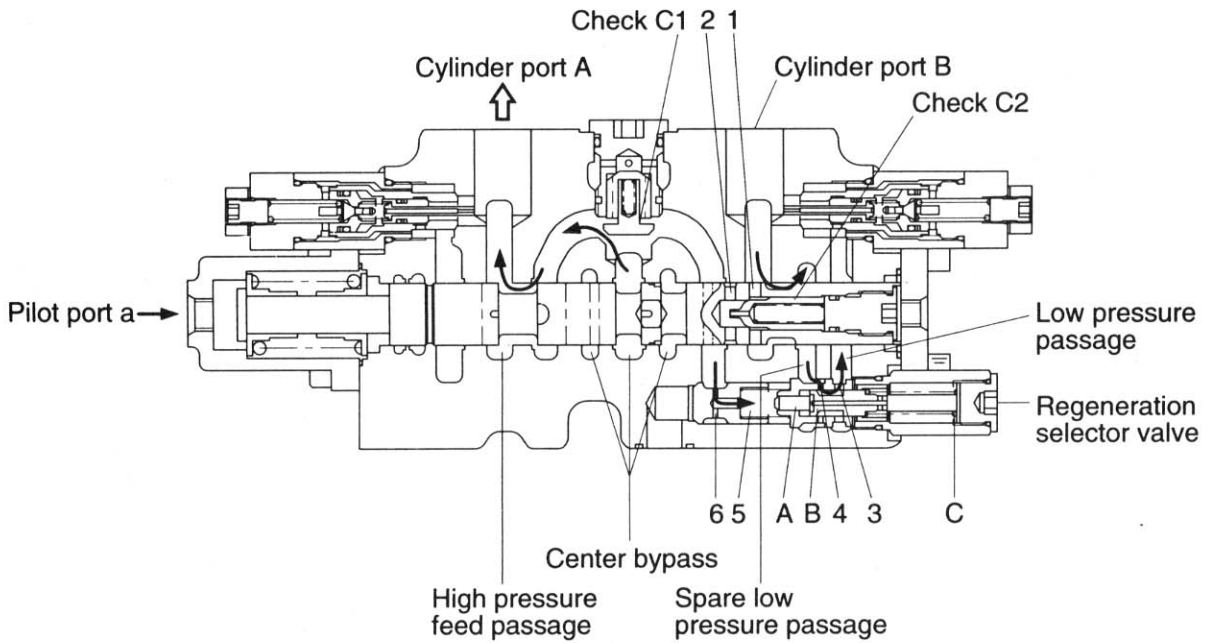
(8) Arm regeneration circuit operation



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 port A via the high pressure feed passage.

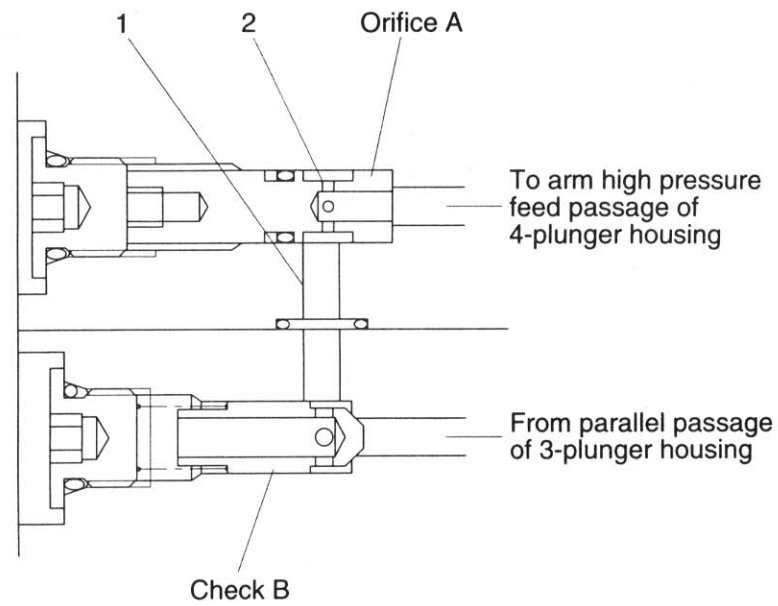


If pressure of high pressure supply passage Pp is lower than pressure on cylinder port side Pb: Return oil from cylinder port B pushes up check valve(C2) in the plunger; it flows into cylinder port A after returning to the high pressure feed passage via passages(1) and (2). At this time, the regeneration selector valve is at the shown position; as passage(3) is shut off from passage(4), return oil from cylinder port B does not flow into the low pressure passage.



If P_P is higher than P_B : Return oil from cylinder port B is shut off by check valve(C2) in the plunger and passage(2) is blocked from passage(1). Pressure of high pressure feed passage P_P is led into chamber(5) via passage(6). When pressure P_P rises higher than the preset pressure of spring(C), piston(A) and spool(B) move to right; passage(3) and passage(4) are connected; return oil from cylinder port B flows into low pressure passage via spare low pressure passage, passage(4) and passage(3).

(9) Internal parallel circuit operation



When arm plunger of 4-plunger side is activated, oil from parallel passage of 3-plunger housing pushes up check valve(B); it flows into the high pressure feed passage of the arm plunger via passage(1) and through passage(2) of orifice(A).