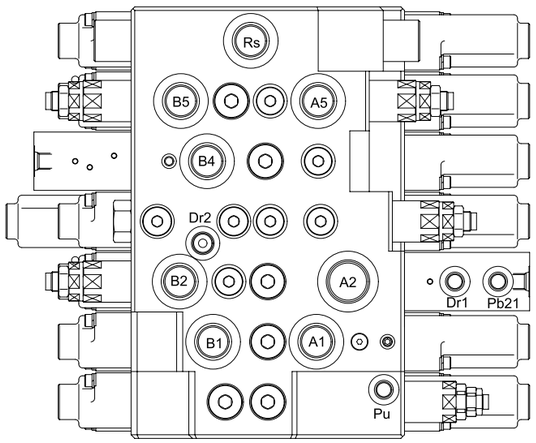
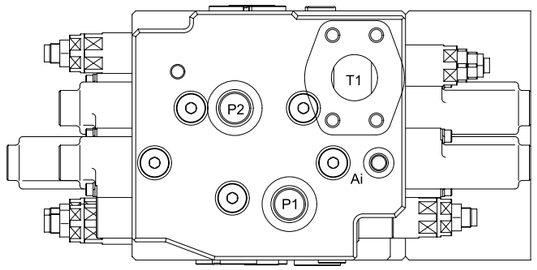
A. ALP165

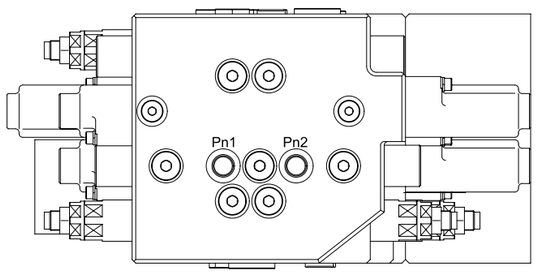
1. STRUCTURE



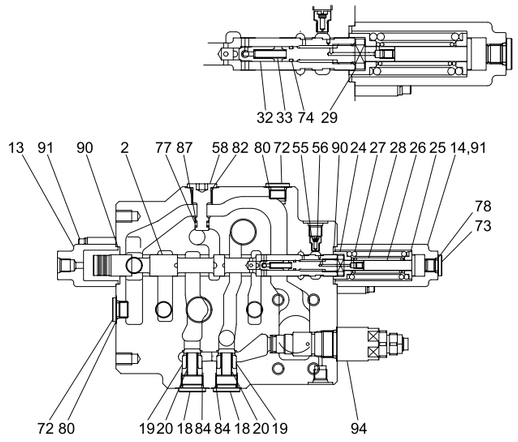
VIEW A



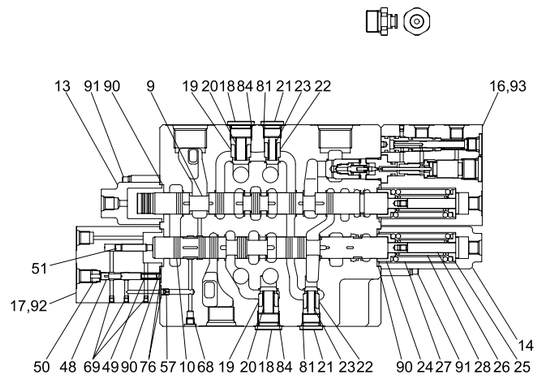
A →



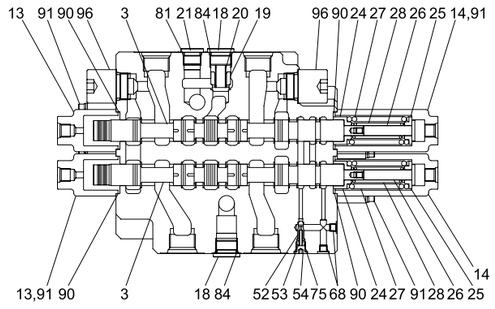
Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	G1/4	3.5~3.9kgf · m (25.3~28.2lbf · ft)
Pa1	Travel left pilot port(FW)		
Pb1	Travel left pilot port(BW)		
Pc1	Travel right pilot port(BW)		
Pd1	Travel right pilot port(FW)		
Pa20	Boom up pilot port		
Pa21	Boom up confluence pilot port		
Pb20	Boom down pilot port		
Pb21	Lock valve pilot port(Boom)		
Pc2	Swing pilot port(RH)		
Pd2	Swing pilot port(LH)		
Pb3	Arm in confluence pilot port		
Pc3	Swing priority pilot port		
Pa4	Option A pilot port(Breaker)		
Pb4	Arm in regeneration cut port		
Pc40	Arm in pilot port		
Pc41	Lock valve pilot port(Arm)		
Pc42	Arm in regen-cut signal selector port		
Pd40	Arm out pilot port		
Pd41	Arm out confluence pilot port		
Pa5	Bucket in pilot port		
Pb5	Bucket out pilot port		
Pc5	Option B pilot port		
Pd5	Option B pilot port		
Pc6	Option C pilot port		
Pd6	Option C pilot port		
PO	Pilot pressure port		
Pu	Main relief pressure up		
Ai	Auto idle signal port		
Dr0	Drain port(Travel straight)		
Dr1	Drain port(Boom holding valve)		
Dr2	Drain port(Boom2 & swing priority)		
Dr3	Drain port(Arm holding valve)		
Pn1	Negative control signal port(P1 port side)		
Pn2	Negative control signal port(P2 port side)		
A1	Travel motor left side port(FW)	G3/4	15~18kgf · m (109~130lbf · ft)
B1	Travel motor left side port(BW)		
C1	Travel motor right side port(BW)		
D1	Travel motor right side port(FW)		
B2	Boom rod side port		
C2	Swing motor port(LH)		
D2	Swing motor port(RH)		
B4	Option A port(Breaker)		
A5	Bucket head side port		
B5	Bucket rod side port		
C5	Option B port		
D5	Option B port		
C6	Option C port		
D6	Option C port		
P1	Pump port(P1 side)		
P2	Pump port(P2 side)		
A2	Boom head side port	G1	20~25kgf · m (115~180lbf · ft)
C4	Arm head side port		
D4	Arm rod side port		
T1	Return port	SAE3000, 1 1/2 (M12)	8.5~11.5kgf · m (61.5~83.1lbf · ft)



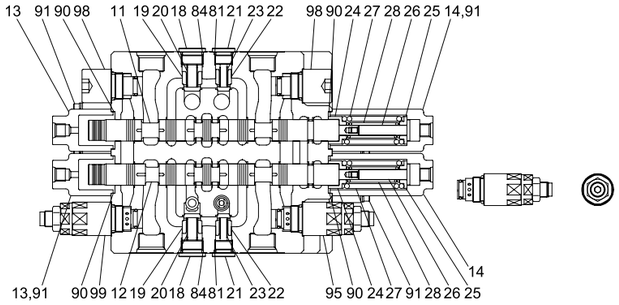
A - A(STRAIGHT-TRAVEL & SUPPLY)



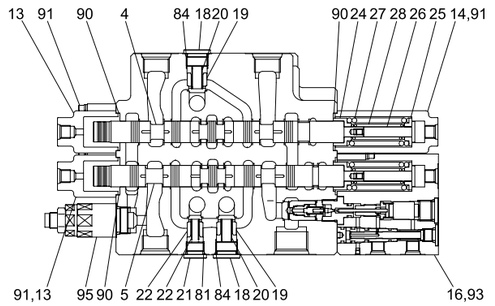
E - E(ARM & ARM REGENERATION /BREAKER)



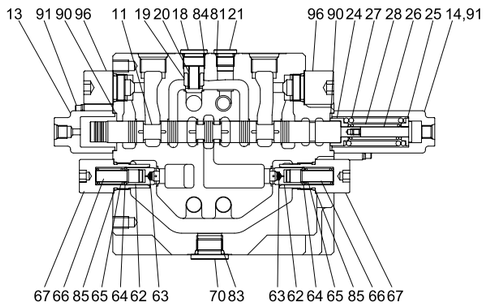
B - B(TRAVEL RIGHT & LEFT)



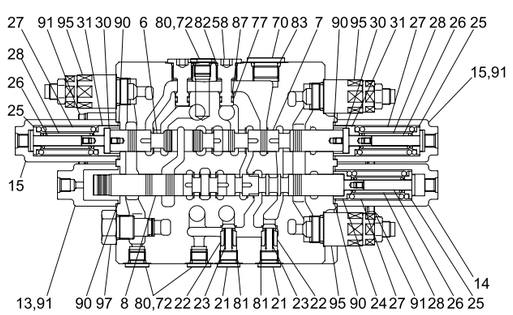
F - F(OPTION & BUCKET)

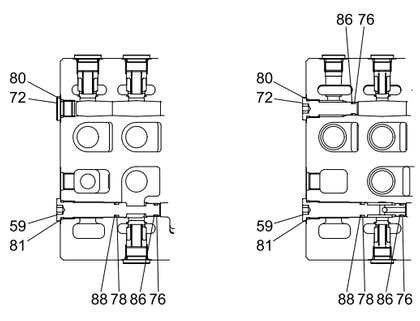


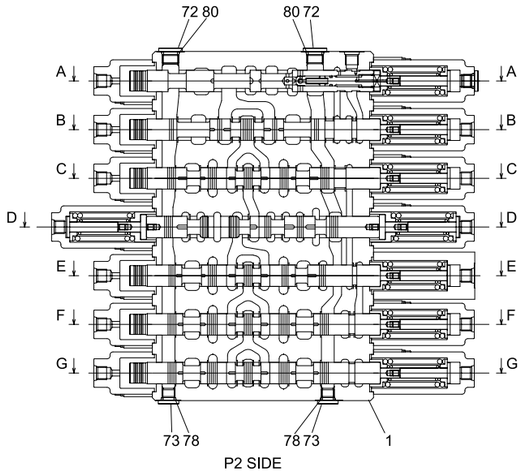
C - C(SWING & BOOM)



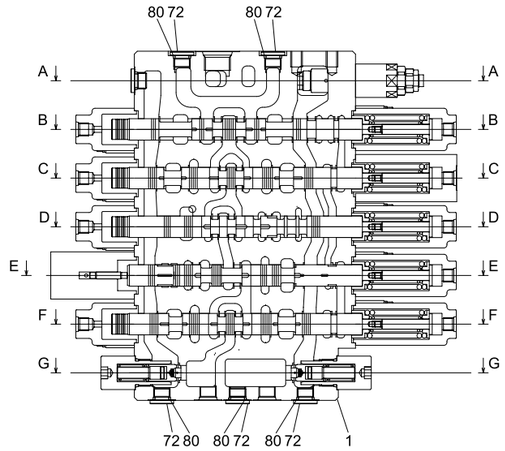
G - G(OPTION & NEGATIVE CONTROL)



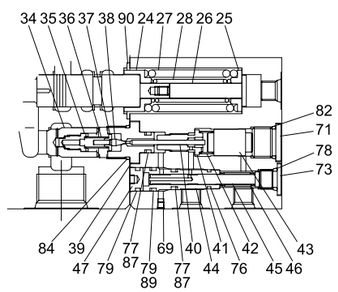




P2 SIDE



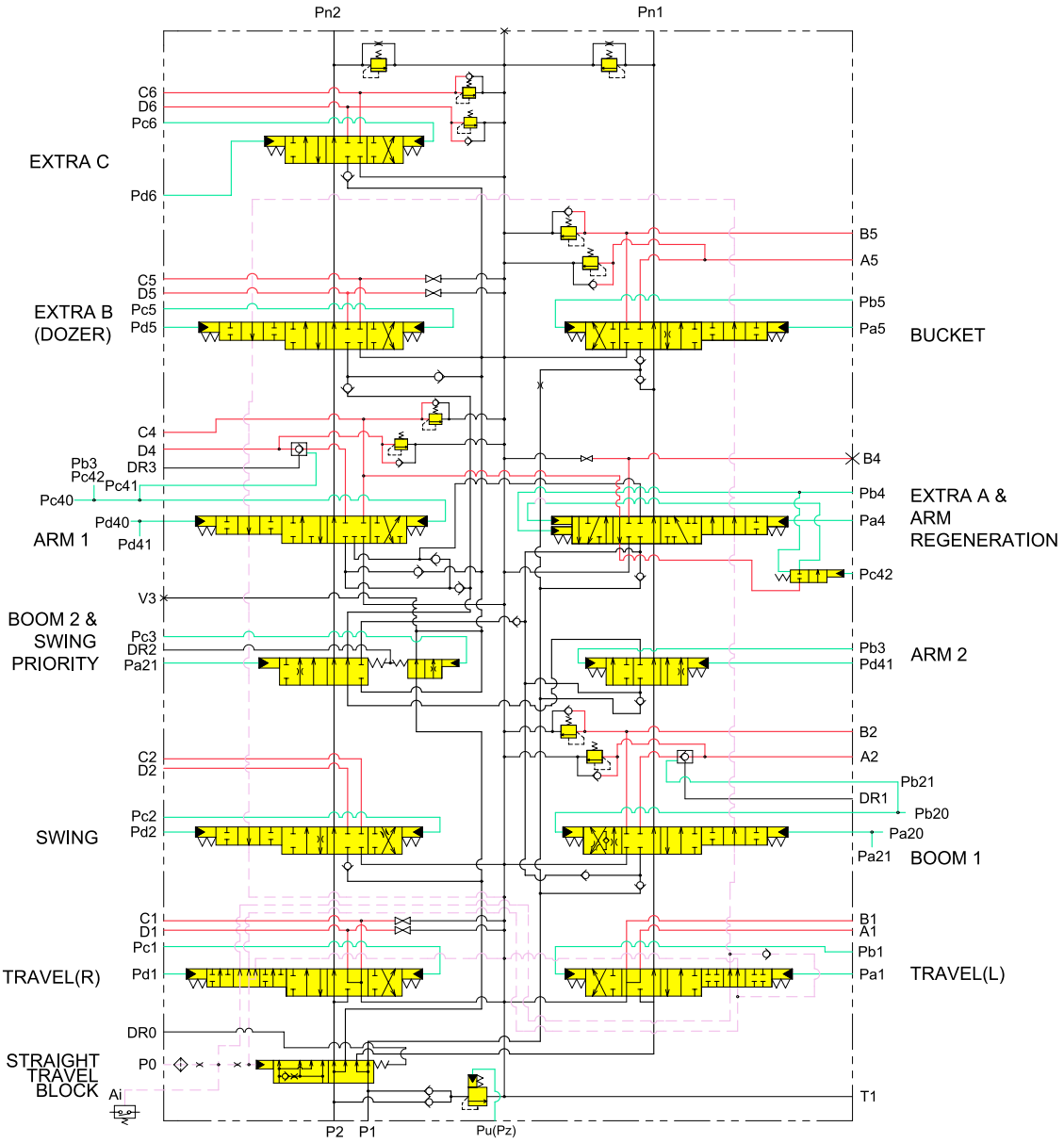
P1 SIDE



DETAIL OF LOCK VALVE(BOOM & ARM)

1	Body	50	Stopper-regeneration
2	Spool-straight travel	51	Piston-cut off
3	Spool-travel	52	Poppet-signal
4	Spool-swing	53	Spring-signal
5	Spool-boom	54	Plug
6	Spool-swing priority	55	Orifice-signal
7	Spool-boom2	56	Coin type filter
8	Spool-arm2	57	Orifice-plug
9	Spool-arm	58	Plug
10	Spool-arm regeneration & breaker	59	Plug
		60	Plug
11	Spool-option	61	Plug-orifice
12	Spool-bucket	62	Poppet-negative control
13	Cover-pilot A	63	Coin type filter
14	Cover-pilot B1	64	Spring seat
15	Cover-Pilot B2	65	Spring-negative control
16	Block-holding	66	Piston-negative control
17	Block-regeneration	67	Socket-negative control
18	Plug	68	Plug
19	Poppet1-check valve	69	Plug
20	Spring-check valve	70	Plug
21	Plug	71	Plug
22	Poppet2-check valve	72	Plug
23	Spring-check valve	73	Plug
24	Spring seat1	74	O-ring
25	Spring seat3	75	O-ring
26	Spacer bolt	76	O-ring
27	Spring-return(L)	77	O-ring
28	Spring-return(S)	78	O-ring
29	Stopper1-TS	79	O-ring
30	Stopper2-priority	80	O-ring
31	Spring seat2	81	O-ring
32	Poppet-TS check valve	82	O-ring
33	Spring-TS check valve	83	O-ring
34	Poppet-lock valve	84	O-ring
35	Restrictor-lock valve	85	O-ring
36	Spring-lock valve pilot	86	Back-up ring
37	Guide poppet	87	Back-up ring
38	Poppet-pilot	88	Back-up ring
39	Seat-poppet	89	Back-up ring
40	Piston1	90	O-ring
41	Guide-piston	91	Bolt with washer
42	Spring1-lock valve	92	Socket head bolt
43	Piston2	93	Socket head bolt
44	Socket-lock valve	94	Main relief valve
45	Spool-lock valve	95	Over load relief valve
46	Spring2-lock valve	96	Plug-relief valve
47	Stopper-lock valve	97	Plug-relief valve
48	Spool-regen selector	98	Plug-relief valve
49	Spring-regeneration	99	Over load relief valve

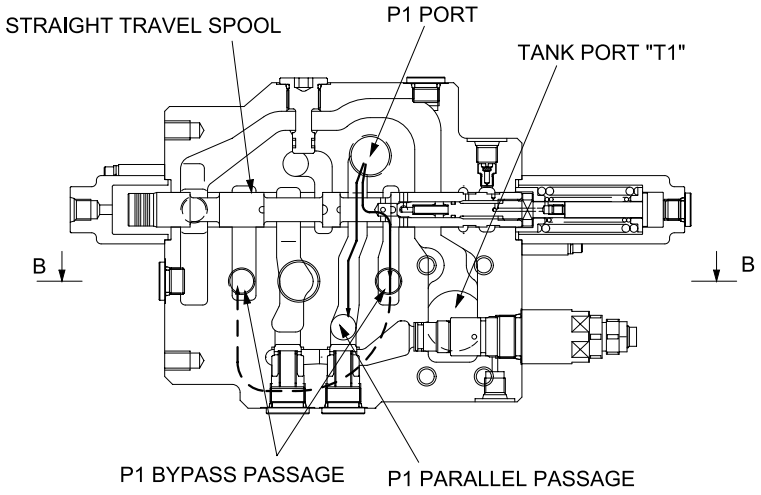
2. HYDRAULIC CIRCUIT



3. FUNCTION

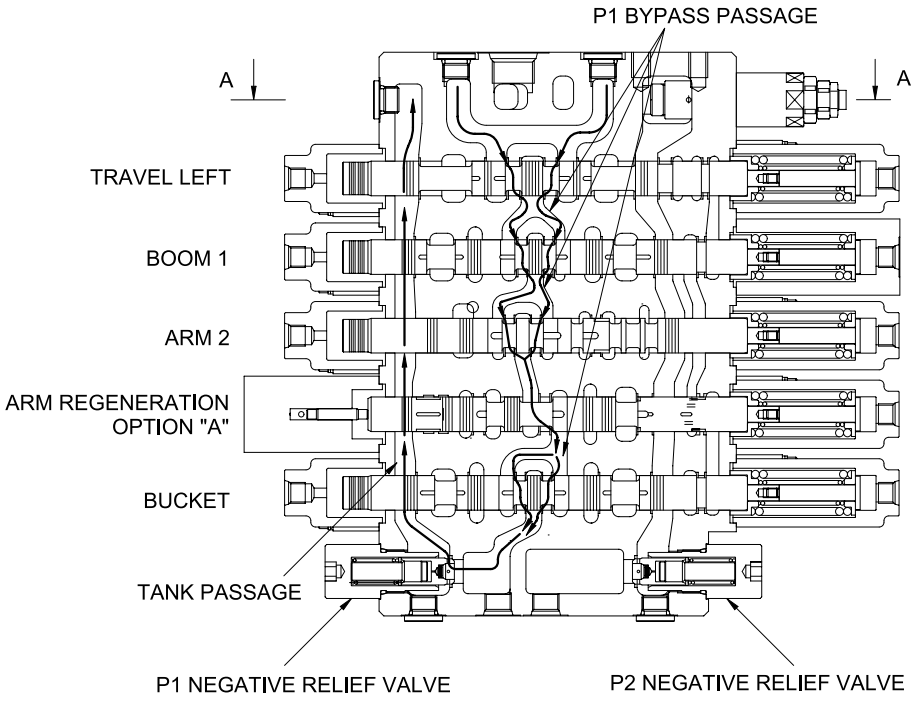
1) CONTROL IN NEUTRAL FUNCTION

(1) P1 SIDE



14072SF13

SECTION A-A



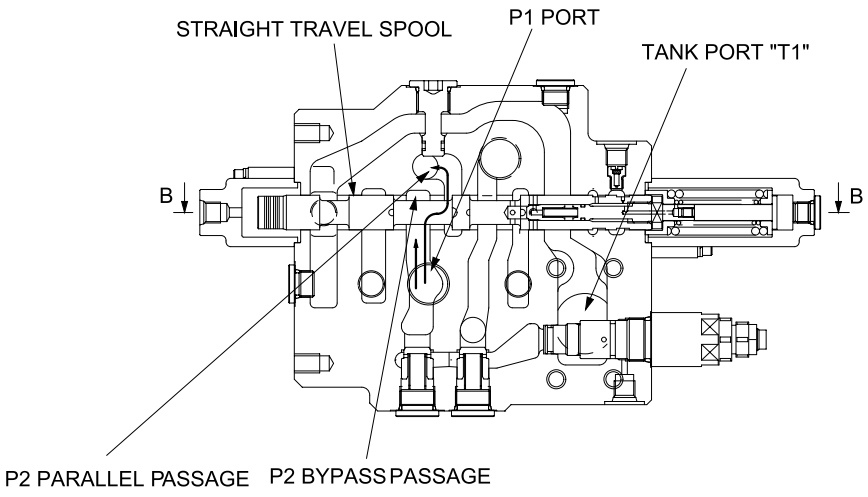
SECTION B-B

14072SF15

The hydraulic fluid from pump P1 flows into the main control valve through the inlet port "P1", pass the travel straight spool, into the P1 bypass passage and P1parallel passage.

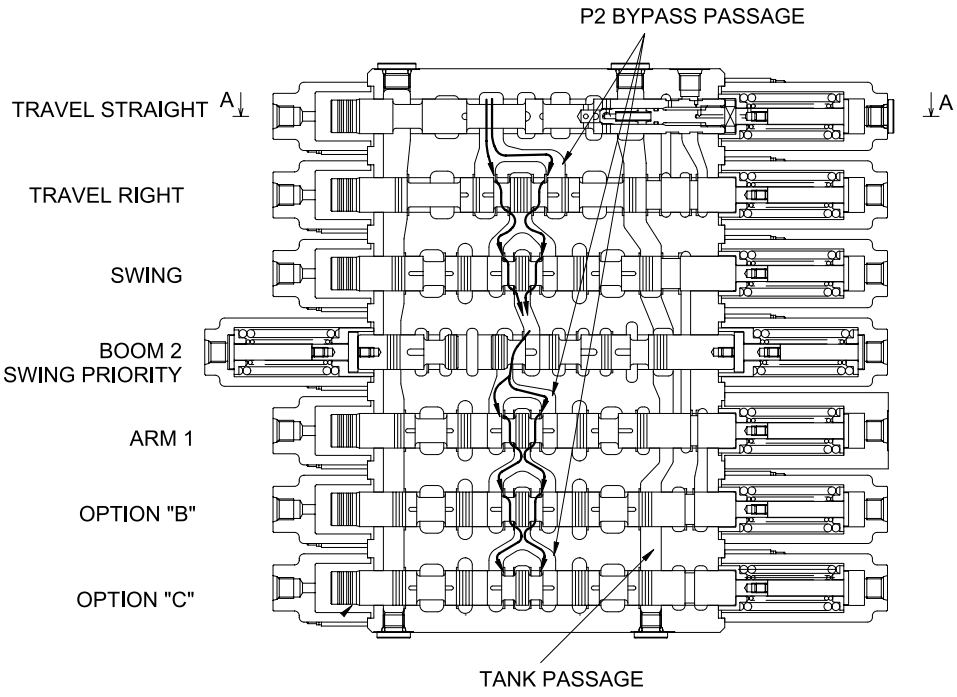
The hydraulic fluid from the pump P1 is directed to the tank through the bypass passage of spools : travel left, boom1, arm2, arm regeneration & option A and bucket, the negative relief valve, tank passage, and the tank port "T1"

(2) P2 SIDE



SECTION A-A

14072SF14



SECTION B-B

14072SF16

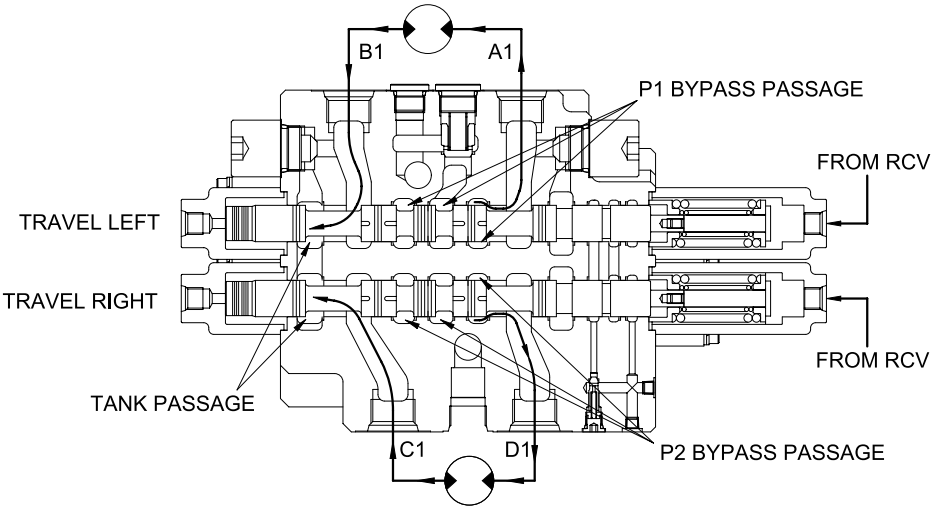
The hydraulic fluid from pump P2 flows into the main control valve through the inlet port "P2", pass the straight travel spool, into the P2 bypass passage and P2 parallel passage.

The hydraulic fluid from the pump P2 is directed to the tank through the bypass passage of spools : travel right, swing, boom2 & swing priority, arm1, option "B" and option "C", and the negative relief valve with the tank passage.

2) EACH SPOOL OPERATION

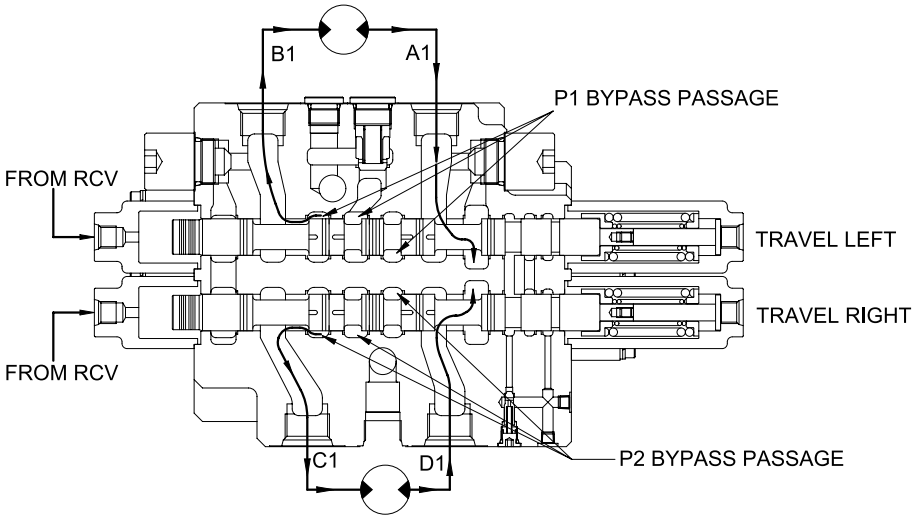
(1) TRAVEL OPERATION

① Travel forward operation



14072SF17

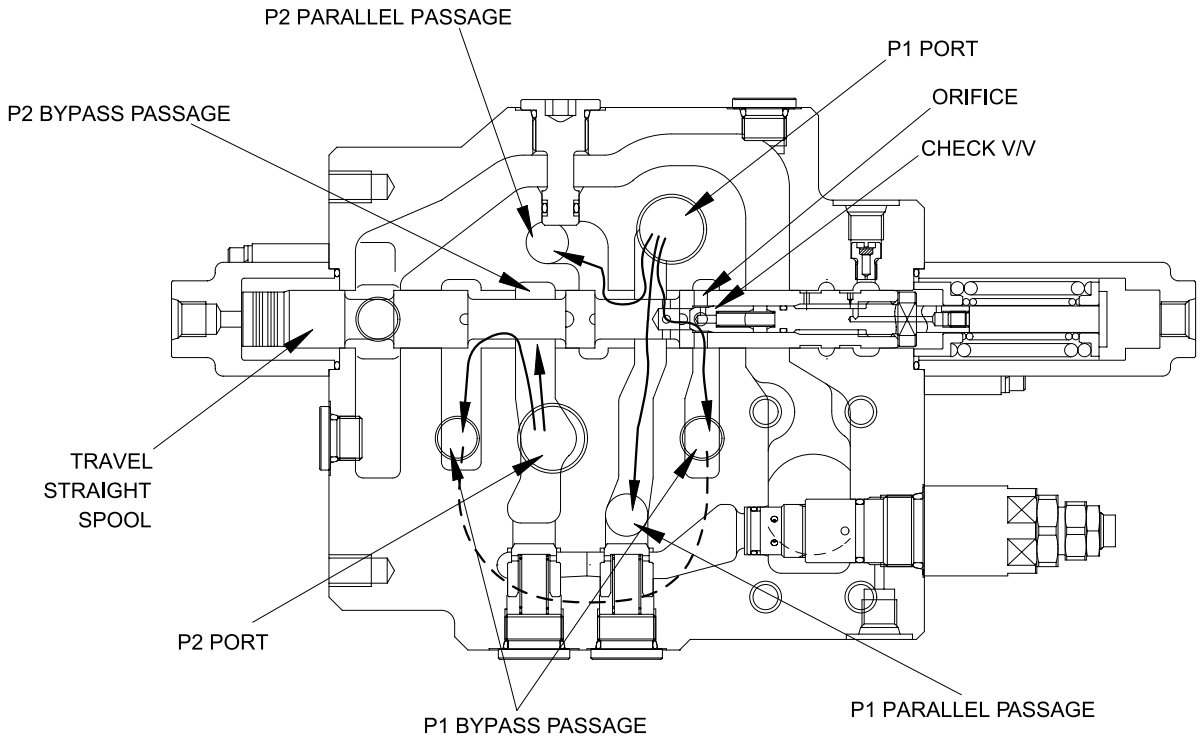
② Travel backward operation



14072SF18

During the travel operation, the hydraulic fluid of the pump P1 is supplied to the travel motor and the hydraulic fluid of the pump P2 is supplied to the other travel motor.
The pilot pressure from the pilot control valve is supplied to the spring side of pilot port (pa1, pd1).
And it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump P1 flow into the travel left spool through the bypass passage and hydraulic fluid from the pump P2 flow into the travel right spool through the bypass passage.
Then they are directed to the each travel motor through port A1 and D1. As a result, the travel motors turn and hydraulic fluid returns to the tank passage through the travel spools.
In case of the opposite operation, the operation is similar.

(2) TRAVEL STRAIGHT FUNCTION



This function keeps straight travel in case of simultaneous operation of other actuators(boom, arm, bucket, swing) during a straight travel.

① **During travel only :**

The hydraulic fluid of the pump P1 is supplied to the travel motor and the pump P2 is supplied to the other motor.

Thus, the machine keep travel straight.

② **The other actuator operation during straight travel operation :**

When the other actuator spool(s) is selected under straight travel operation, the straight travel spool is moved.

The hydraulic fluid from pump P1 is supplied actuator through P1 and P2 parallel pass and travel motors through orifice at side of straight travel spool.

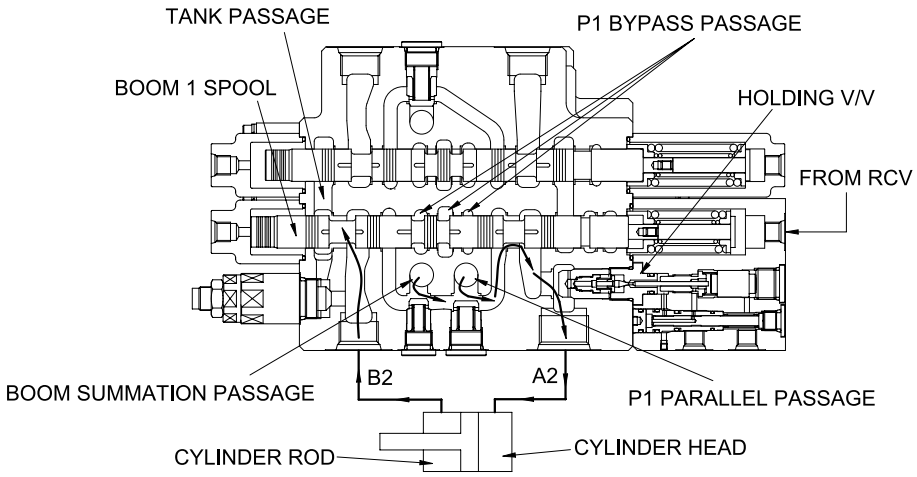
The hydraulic oil fluid from pump P2 is supplied to travel motors(left/right).

Therefore, the other actuator operation with straight travel operation, hydraulic oil fluid from pump P1 is mainly supplied to actuator, and the hydraulic oil fluid form pump P2 is mainly supplied to travel motors(left/right).

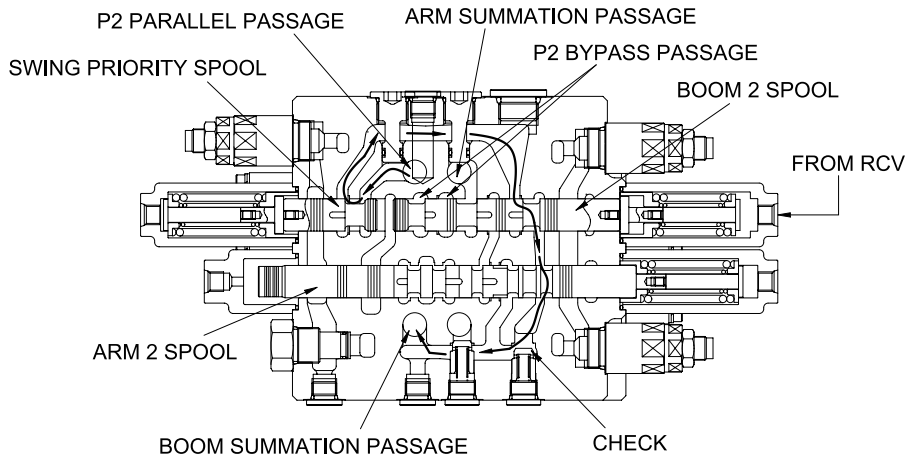
Then the machine keeps straight travel.

(3) BOOM OPERATION

① Boom up operation



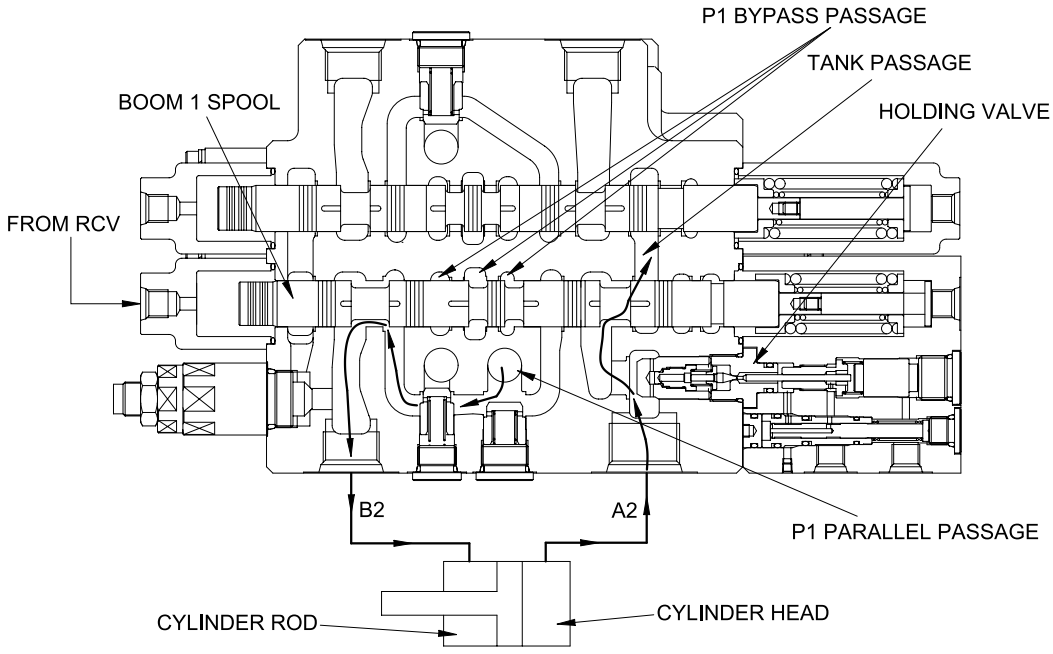
14072SF24



14072SF25

During boom up operation, the pilot pressure from RCV is supplied into the port Pa20 and shift the boom1 spool in the left direction. The hydraulic oil fluid from pump P1 is entered P1 parallel passage and then passes through the load check valve and boom holding valve then flows into the port A2.
Following this it flows into the head side of the boom cylinder.
(In this case, the boom holding valve is free flow condition)
At the same time the pilot pressure through the port Pa21 shifts the boom2 spool. The hydraulic oil fluid from pump P2 entered boom summation passage via the P2 parallel passage, the swing priority spool, the boom2 spool, arm1 spool and the check. The flows combine in passage and are directed to port A2 and head side of boom cylinder.
The flow from rod side of the boom cylinder return to the boom1 spool through the port B2. There after it is directed to the hydraulic oil tank through the tank passage.

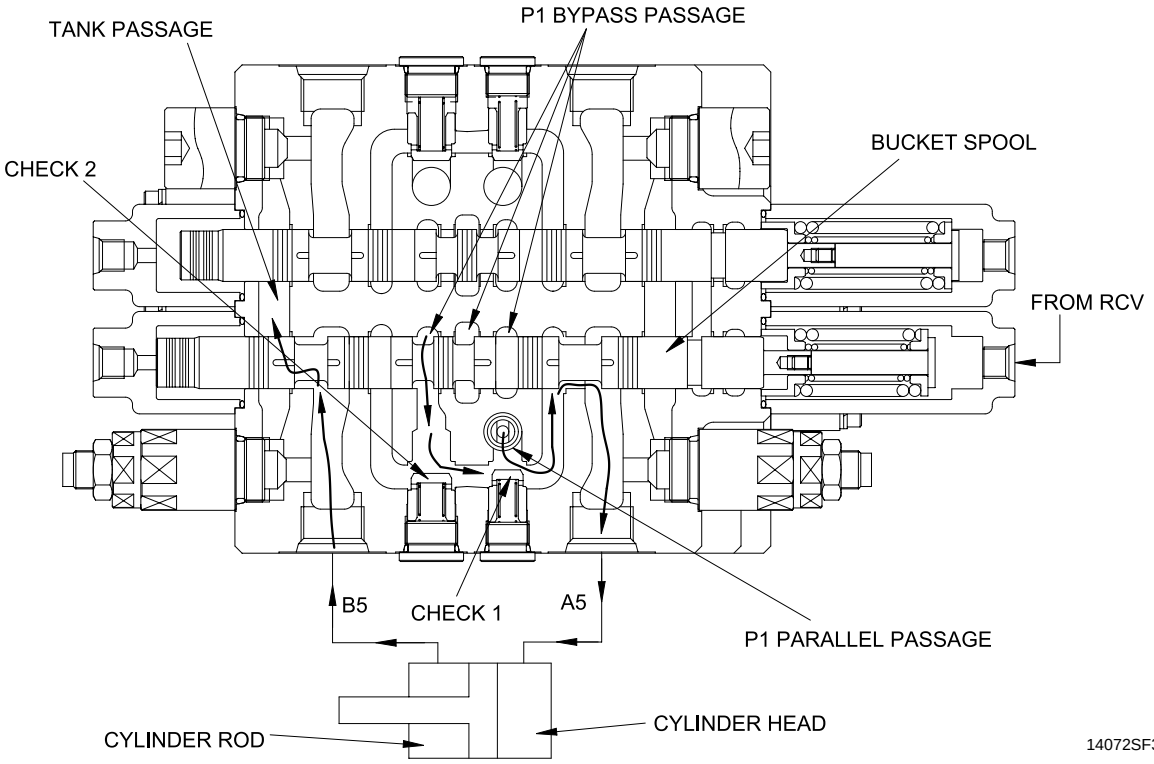
② Boom down operation



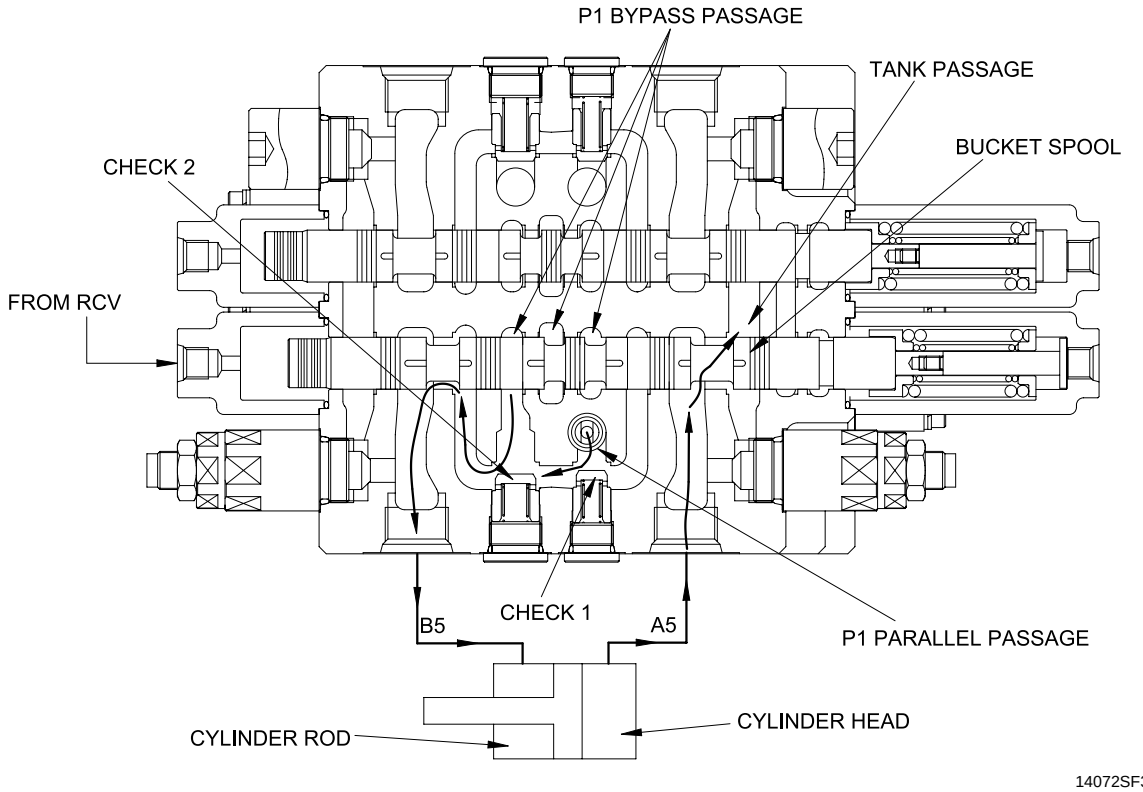
During the boom lowing operation, the pilot pressure from RCV is supplied to the port Pb20 and shift the boom1 spool in the right direction.
The hydraulic fluid from the pump P1 enters the parallel passage and is directed to the port B2 through the load check valve. Following this, it flows into the rod side of the boom cylinder.
The return flow from the head side of the boom cylinder returns to the boom1 spool through the port A2 and boom holding valve. Thereafter it is directed to the hydraulic oil tank through tank passage.
For details of the boom holding valve, see page 2-36.

(4) BUCKET OPERATION

① Bucket roll in operation



② Bucket roll out operation



① Bucket roll in operation

During the bucket roll in operation, the pilot pressure from RCV is supplied to port Pa5 and shift the bucket spool in the left direction.

The hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port A5 through the check1.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check2.

Following this it flows into the head side of the bucket cylinder.

The return flow from the rod side of the bucket cylinder returns to the bucket spool through the port B5. Thereafter it is directed to the hydraulic oil tank through the tank passage.

② Bucket roll out operation

In case of the bucket roll out operation, the operation is similar

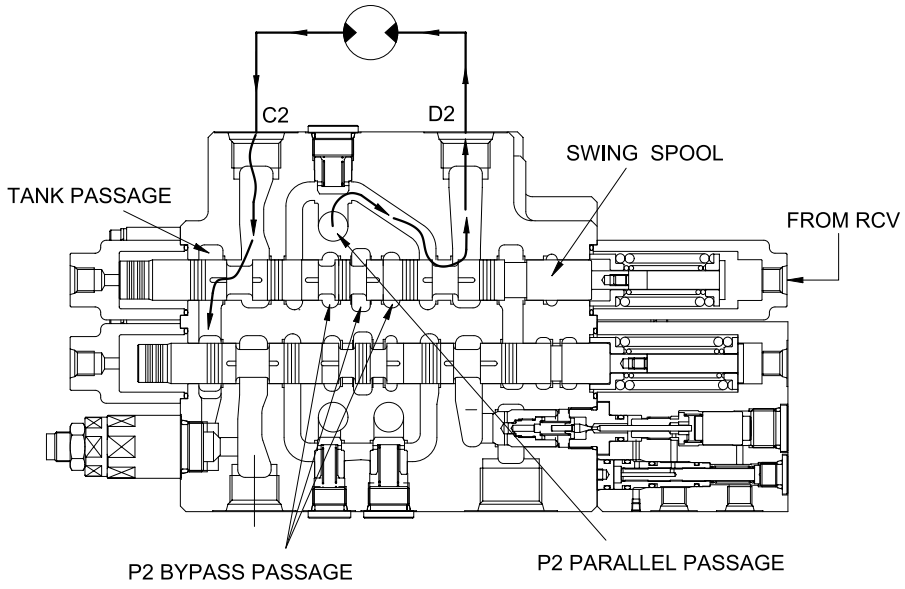
③ Bucket operation with arm or boom operation

When combined operation, mostly same as above but the fluid from bypass passage is empty.

So only the fluid from parallel passage is supplied to the bucket cylinder. Also, parallel passage is installed the orifice for supplying the fluid from pump to the boom or the arm operation prior to the bucket operation.

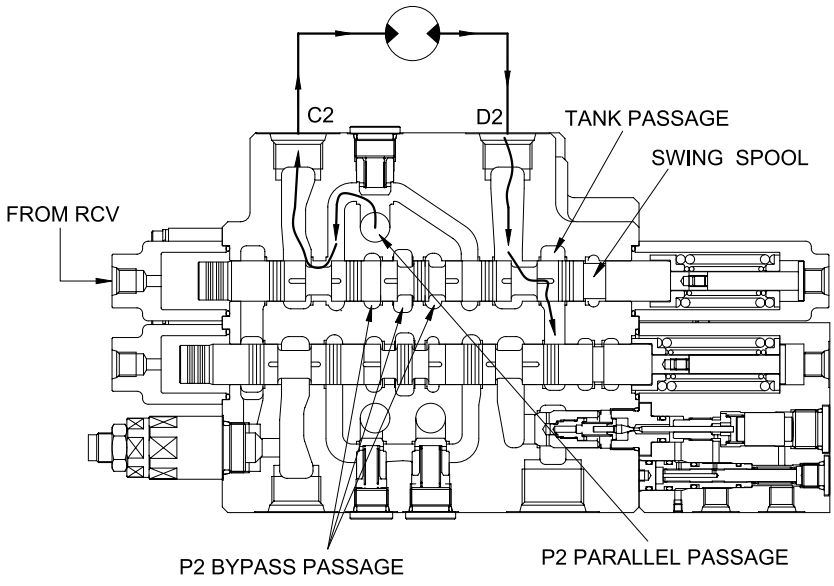
(5) SWING OPERATION

① Swing left operation



14072SF32

② Swing right operation

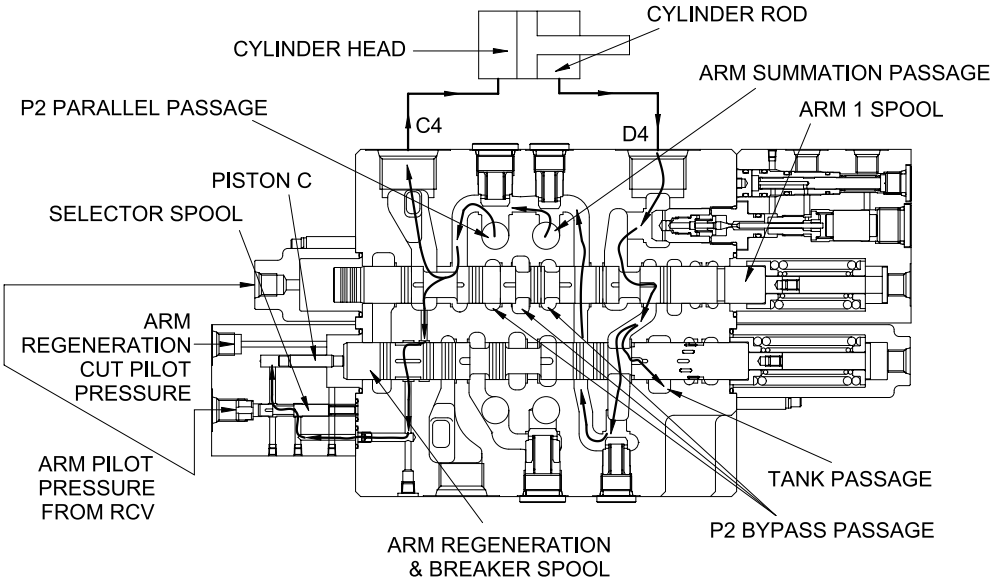


14072SF33

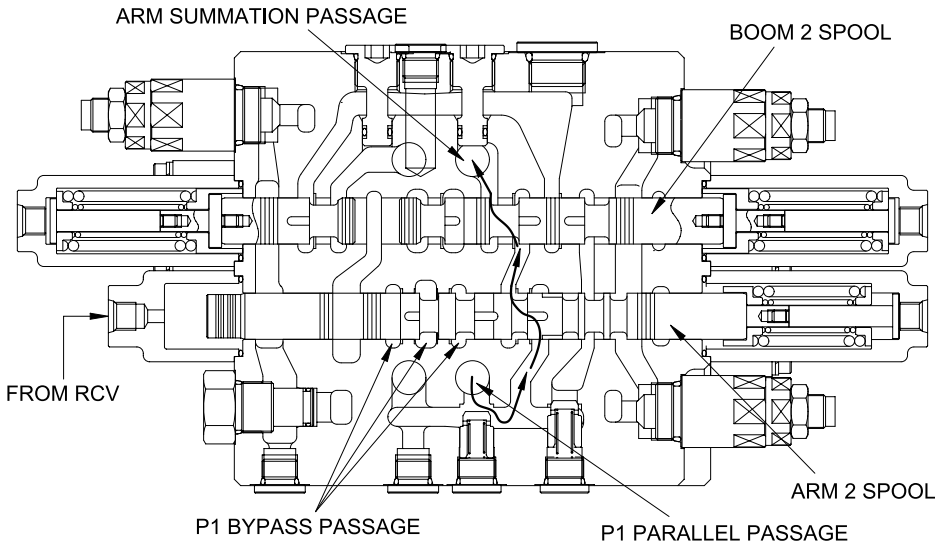
The pilot pressure from the RCV is supplied to the Pd2 and shift the swing spool in left direction. The hydraulic fluid from pump P2 flows into swing spool through the parallel passage. Then it is directed to swing motor through the port D2. As the result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port C2, swing spool and the tank passage .
In case of swing right operation, the operation is similar.

(6) ARM OPERATION

① Arm roll in operation



14072SF21



14072SF20

· **Arm roll in operation :**

During arm roll in operation the pilot pressure from the RCV is supplied to the port Pc4o and Pb3 and shifts arm1 spool and arm2 spool in the right direction.

The hydraulic oil from the pump P2 flows into the arm cylinder head side through P2 parallel passage, the load check valve and the port C4.

At same time, the hydraulic fluid from the pump P1 flows into the arm summation passage through parallel passage, the check valve, the arm2 spool and the boom2 spool. Then it entered the arm cylinder head side with hydraulic fluid from arm1 spool.

- **Arm regeneration :**

The return flow from the arm cylinder rod side is pressurized by self weight of arm and so, returns to port D4. The pressurized oil returning to port D4 enters the arm regeneration & breaker spool through the arm holding valve and the arm1 spool. It is suppled the arm cylinder head through internal passage. This is called the arm regeneration function.

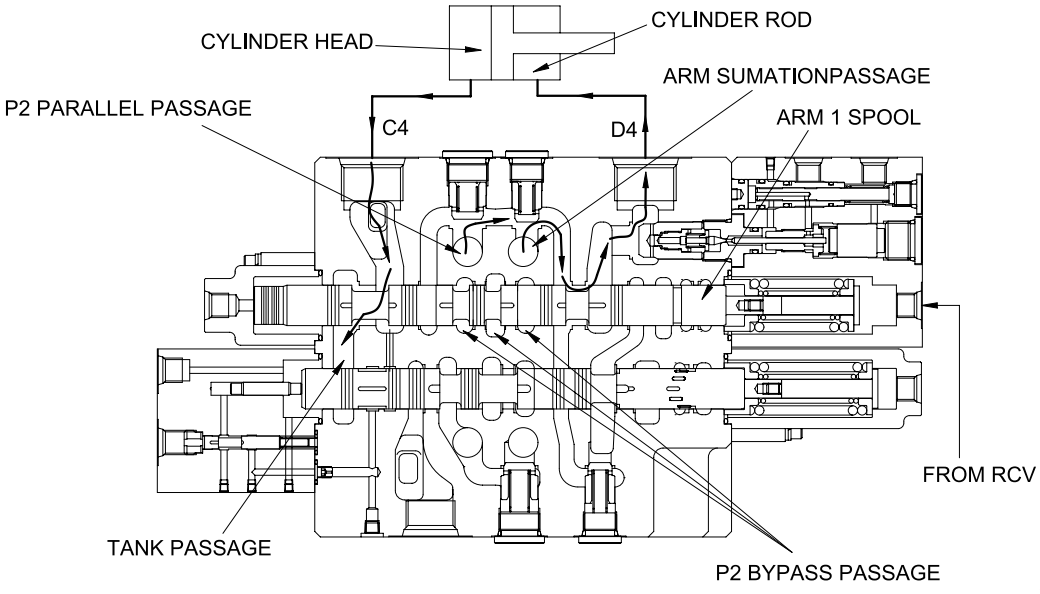
The amount of regeneration fluid are changed by movement of the arm regeneration & breaker spool.

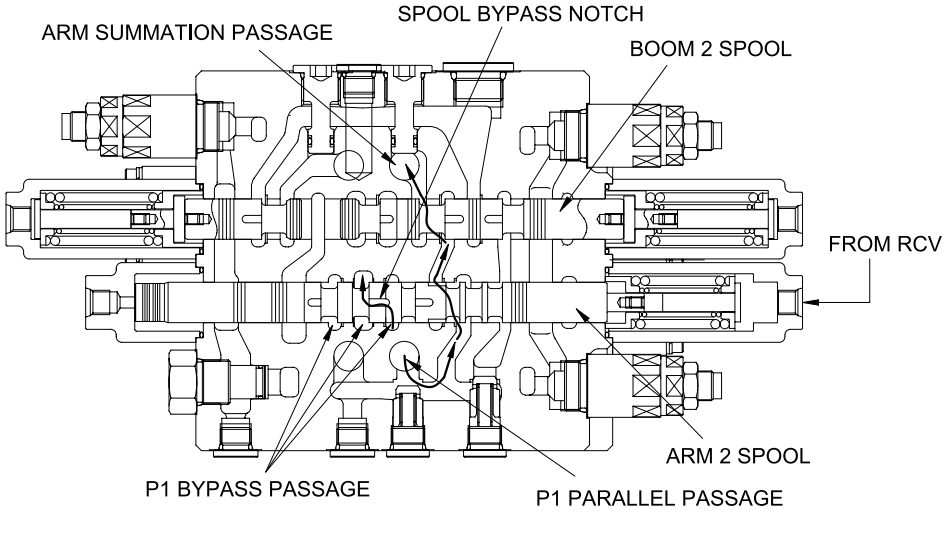
A few fluid after P2 parallel passage is push piston "C" through the notch of arm regeneration spool and selector spool. At this time, the selector spool is opened by pilot pressure from RCV.

Then, the arm regeneration spool shift to right side and flow to tank pass increases and regeneration flow decreases. Therefore, pressure of arm cylinder head increases, then, arm regeneration flow decreases.

Furthermore, the arm regeneration cut pressure is supplied to port and arm regeneration spool is move into the right direction fully. The flow from the arm cylinder rod is returned to the hydraulic oil tank and regeneration function is not activated.

② Arm roll out operation





During arm roll out operation the pilot pressure from RCV is supplied to the port Pd40 and the Pd41 and shifts arm1 spool and arm2 spool in the right direction.

The hydraulic fluid from pump P2 flows into arm1 spool through the parallel passage. Then it enters into the arm cylinder rod side through the load check valve, bridge passage, arm holding valve and the port D4.

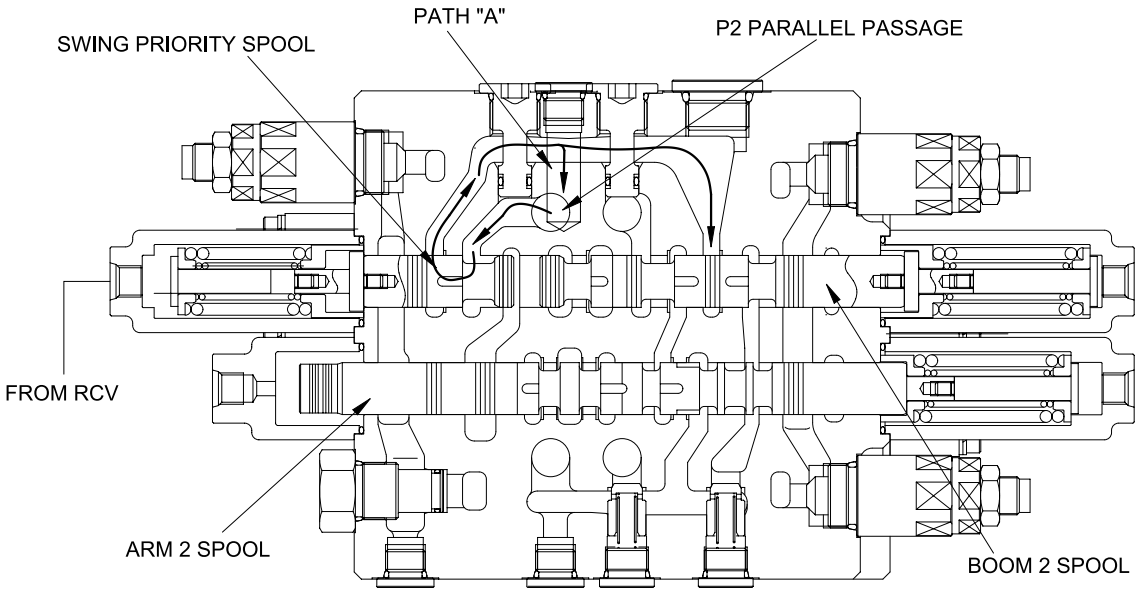
Some of the hydraulic fluid from pump P2 bypassed through bypass notch.

The rest of hydraulic fluid from pump P2 flows into the arm summation passage through P1 parallel passage the check valve arm2 spool and boom2 spool.

Then it enters into the arm cylinder rod side with the fluid from the arm1 spool.

The return flow from the arm cylinder head side returns to the hydraulic tank through the port C4 the arm1 spool and tank passage.

(7) SWING PRIORITY FUNCTION

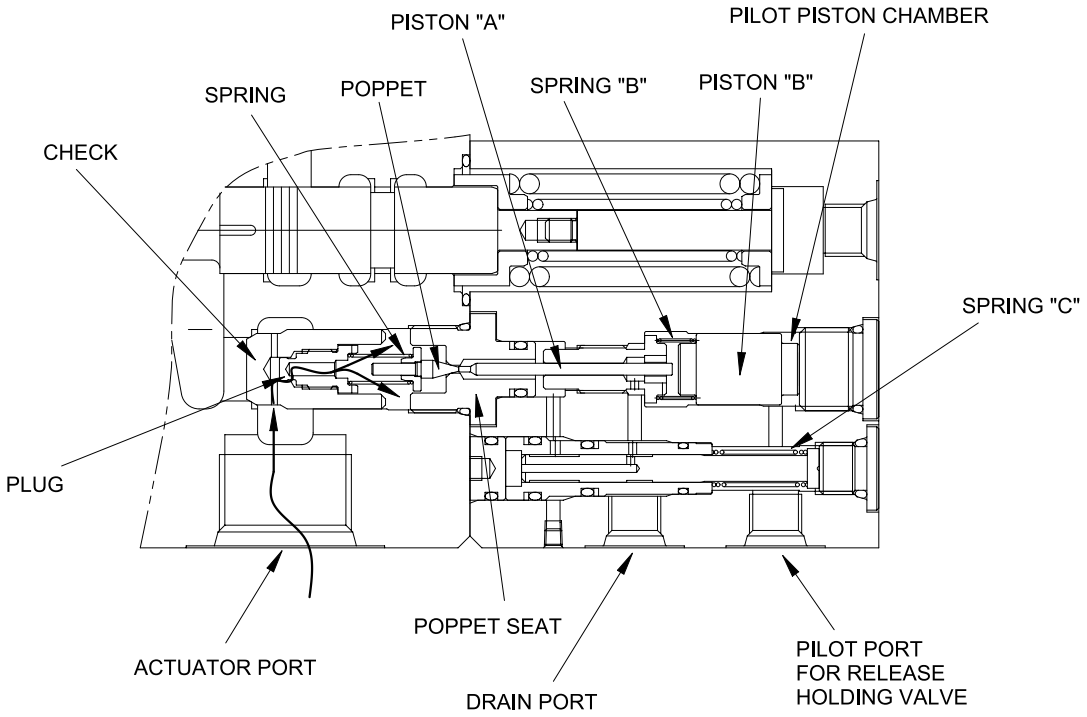


14072SF27

During swing priority operation, the pilot pressure is supplied to the port Pc3 and shift swing priority spool in the right direction.
The hydraulic fluid from P2 parallel passage flows into the parallel passage of arm1 side through swing priority spool and the passage "A" and also flows into the boom2 spool.
Due to shifting of the swing priority spool, the fluid from pump P2 flows to swing side more then next spools to make the swing operation most preferential.

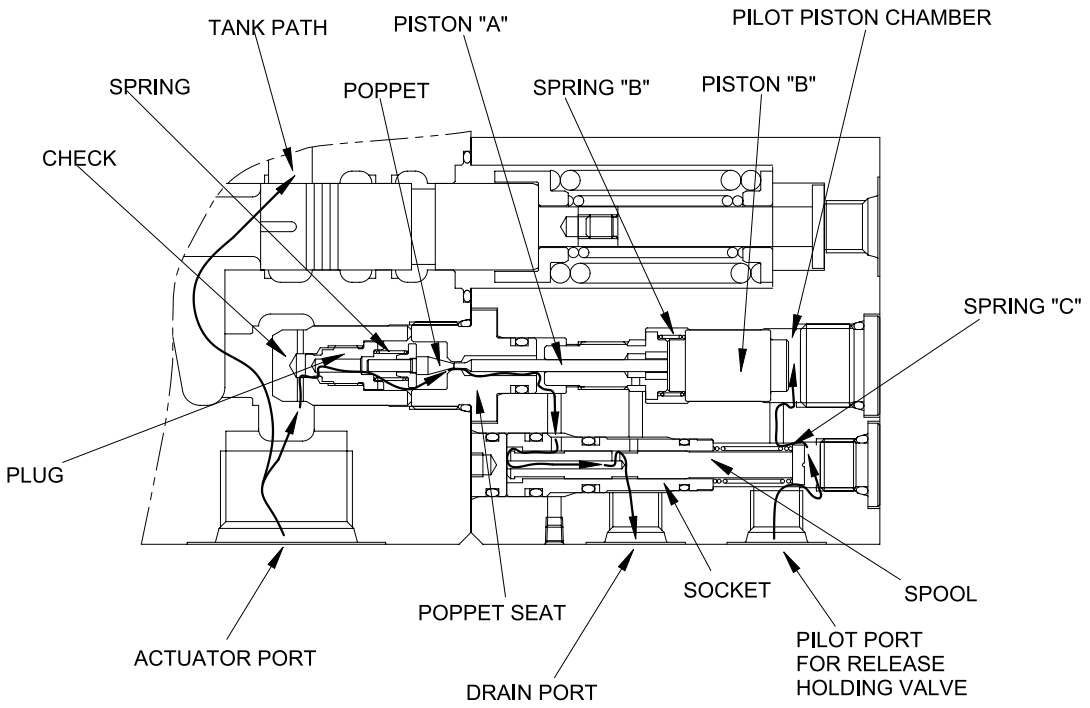
(8) HOLDING VALVE OPERATION

① Holding operation



At neutral condition, the pilot piston chamber is connected to drain port through the pilot port.
And the piston "B" is supported with spring "B" and the pressured fluid from actuator entered to inside of the holding valve through the periphery hole of check, crevice of the check and the plug and the periphery hole of plug.
Then, this pressured oil pushed the poppet to the poppet seat and the check to the seat of body.
So the hydraulic fluid from actuator is not escaped and the actuator is not moved.

② **Release holding operation**



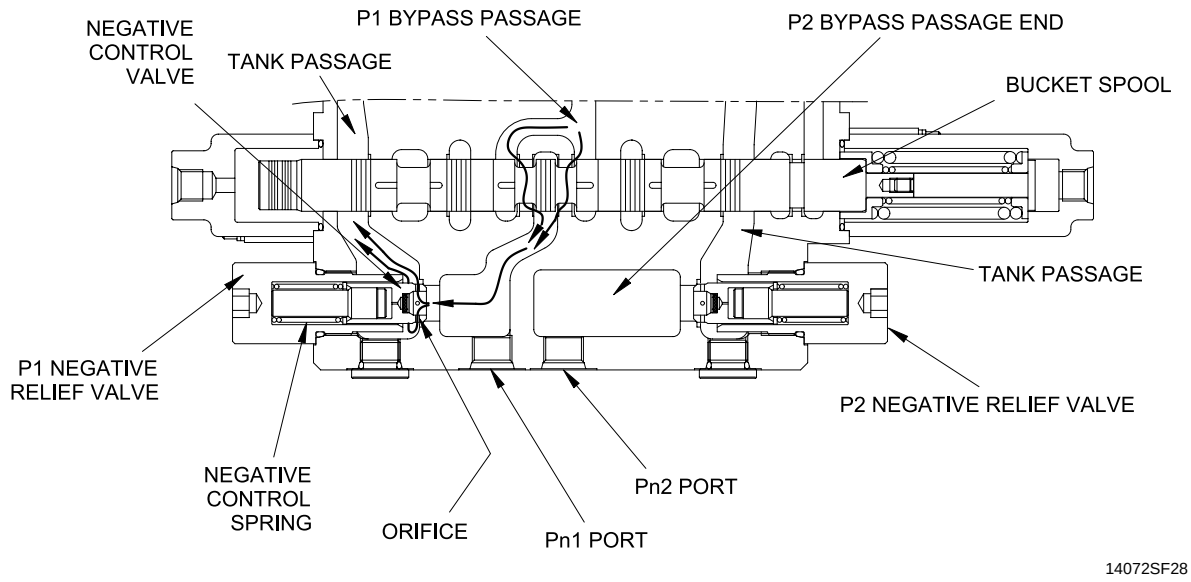
14072SF31

The pilot pressure is supplied to the pilot port for release holding valve and shifts the piston "B" in the left direction against the spring "B", and shifts the poppet in the left direction through piston "B" and piston "A" against spring "B" and shifts the spool in the left side.

At same time, the return fluid from actuator returns to the drain port through the periphery hole of check, crevice of the check and the plug, the periphery hole of the plug, in side of holding valve, crevice of the poppet and the poppet seat, the periphery hole of the poppet seat, crevice of the socket and spool and inside of spool.

When the poppet is opened, pressure of inside of holding valve is decreased and the return fluid from actuator returns to the tank passage through the notch of spool.

(9) NEGATIVE CONTROL



When no function is being actuated on P1 side, the hydraulic fluid from the pump P1, flows into the tank passage through the bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump P1 regulator.

It controls the pump regulator so as to minimize the discharge of the pump P1.

The bypass passage is shut off when the shifting of one or more spools and the flow through bypass passage became zero. The pressure of negative control signal become zero and the discharge of the pump P1 become maximum.

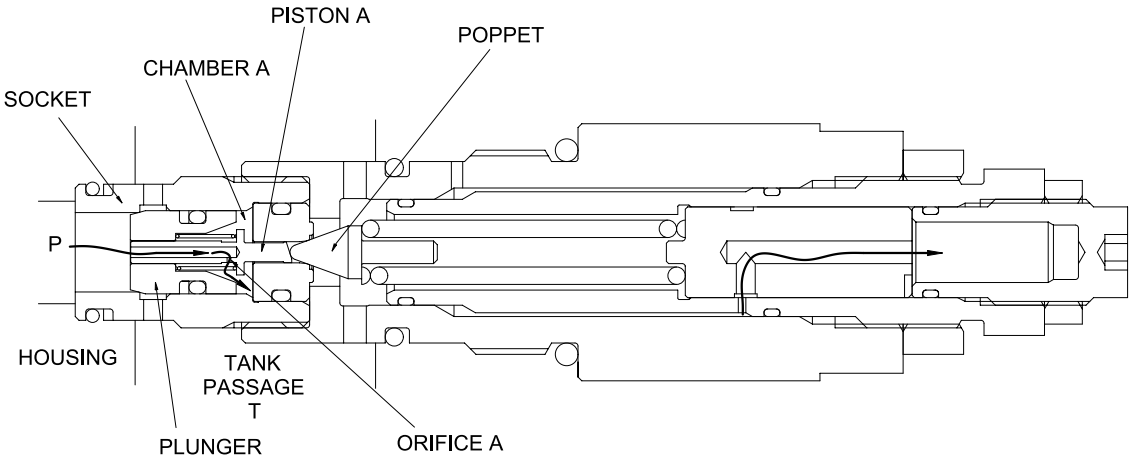
The negative control pressure reaches to the set level, the hydraulic fluid in the passage pushes open negative control valve and escapes into the return passage.

For the pump P2 the same negative control principle.

(10) OPERATION OF MAIN RELIEF VALVE

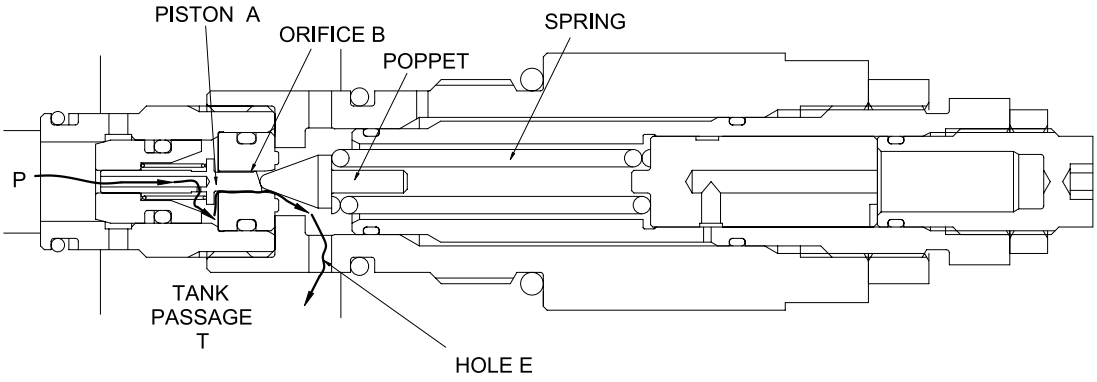
The main relief valve is fitted to the straight travel valve block and functions as follows :

① The pressurized oil passes through the orifice (A) of the plunger is filled up in chamber A of the inside space, and seats the plunger against the housing securely.



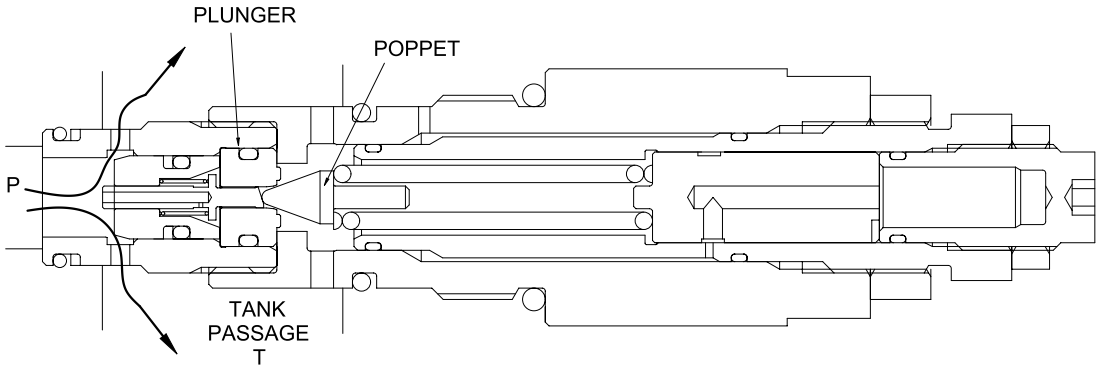
14072SF36

② When the pressure at (P) becomes equal to the set pressure of the spring the hydraulic oil passes through the piston (A) pushes open the poppet and flows to tank passage (T) through the hole (E).



14072SF37

③ Opening the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T)

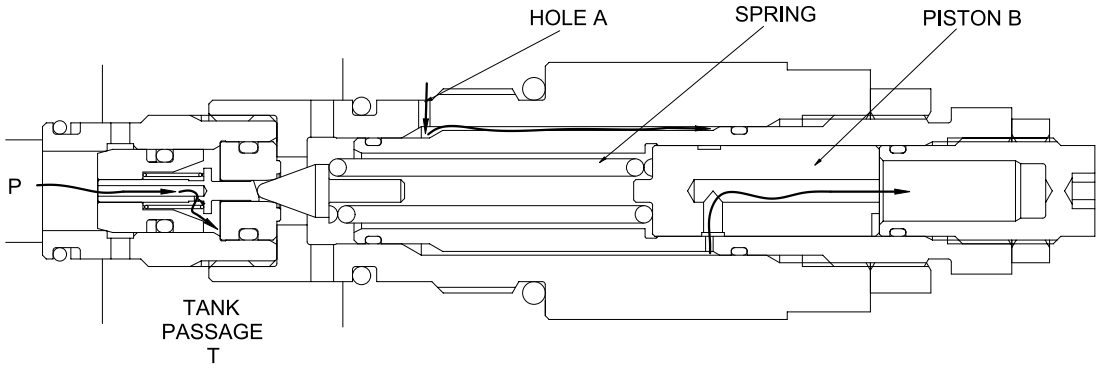


14072SF38

④ High pressure setting pilot signal(Pu) : ON

When the power boost switch is ON, the pilot pressure enters through hole A.

It pushes the piston(B) in the left direction to increase the force of the spring and change the relief set pressure to the high pressure.

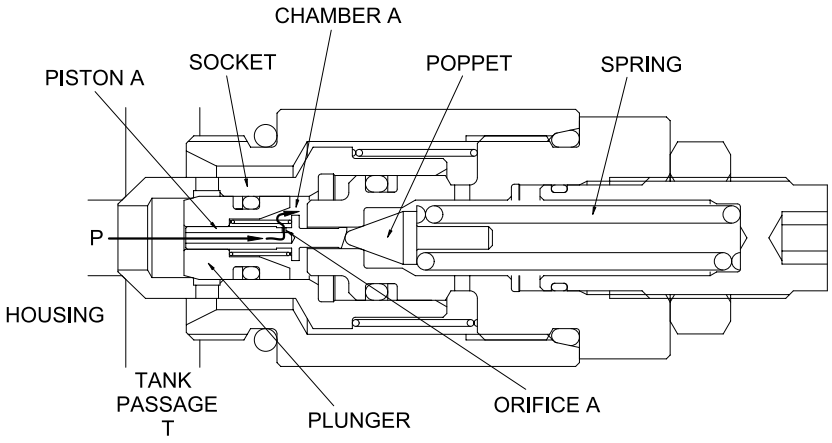


14072SF36

(11) OPERATION OF PORT RELIEF VALVE

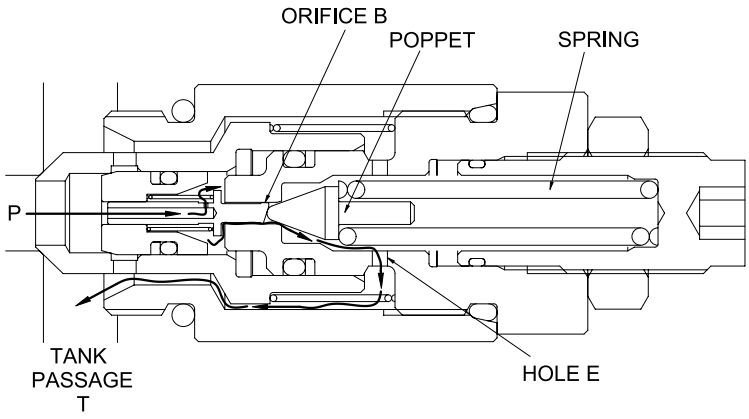
① Function as relief valve

ⓐ The pressurized oil passes through the piston A and orifice is filled up in chamber A of the inside space and seat the plunger against the socket and the socket against the housing securely.



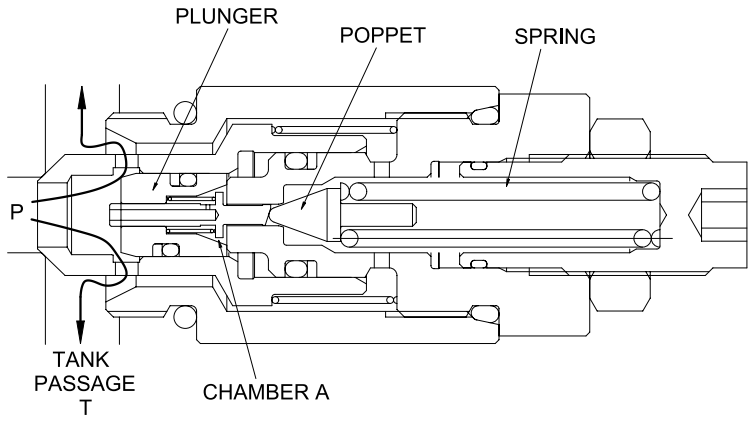
14072SF39

ⓑ When the pressure at port P becomes equal to the set pressure of the spring, the pressurized oil pushes open the poppet flows to tank passage (T) through hole E.



14072SF40

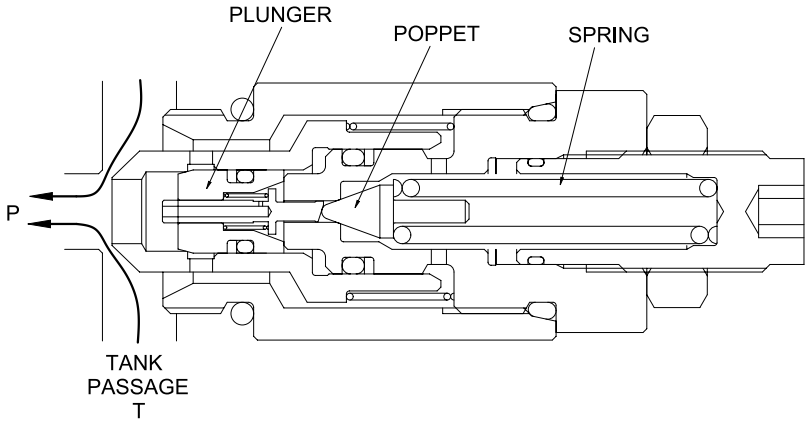
ⓒ Opening of the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T).



14072SF41

② **Make-up function**

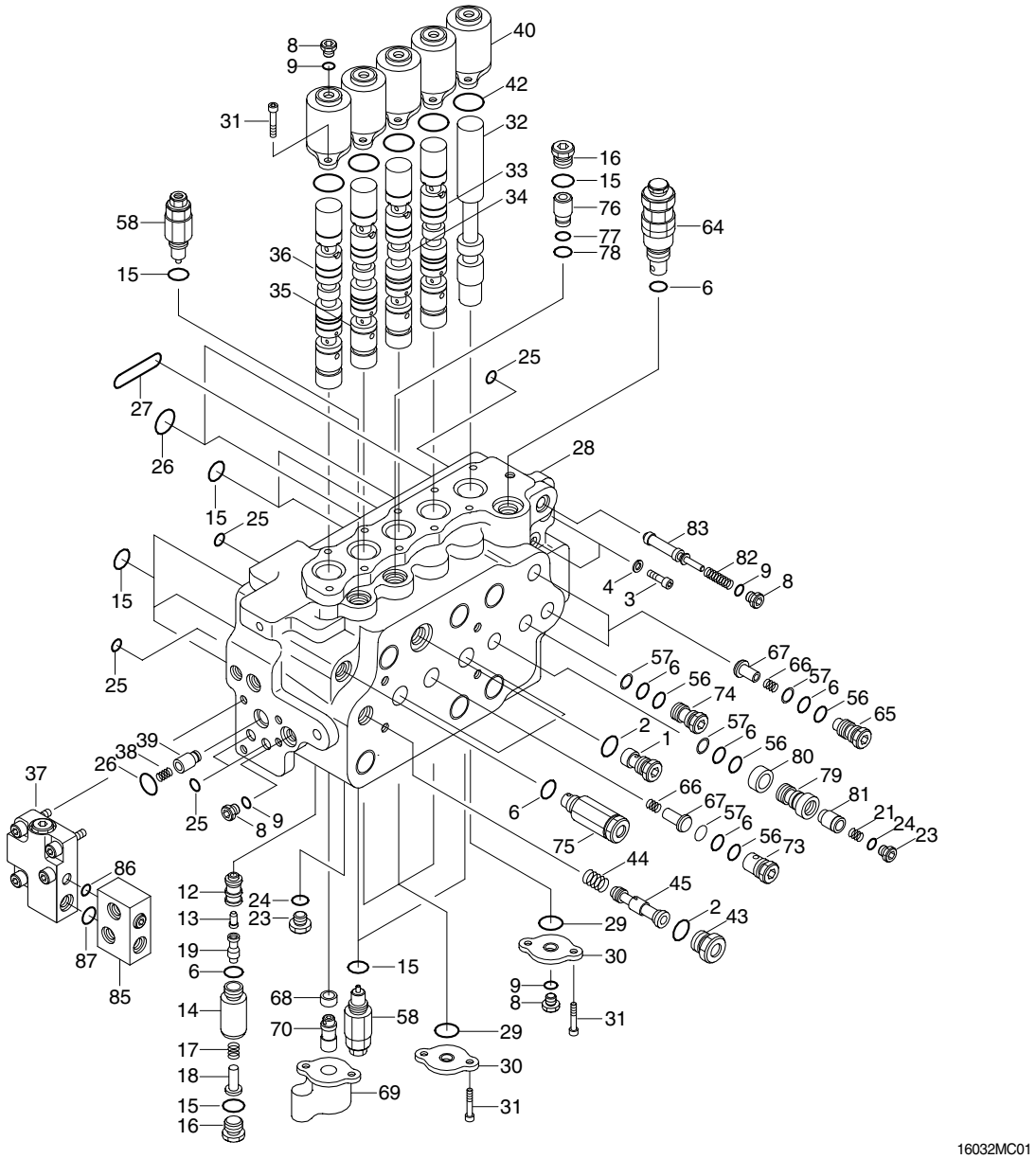
When negative pressure exists at port P, the oil is supplied through tank passage (T). When the pressure at tank passage (T) becomes higher than that at port P, the socket moves in the right direction. Then, sufficient oil passes around the socket from tank passage (T) to port P and fills up the space.



14072SF42

B. UHX22-26

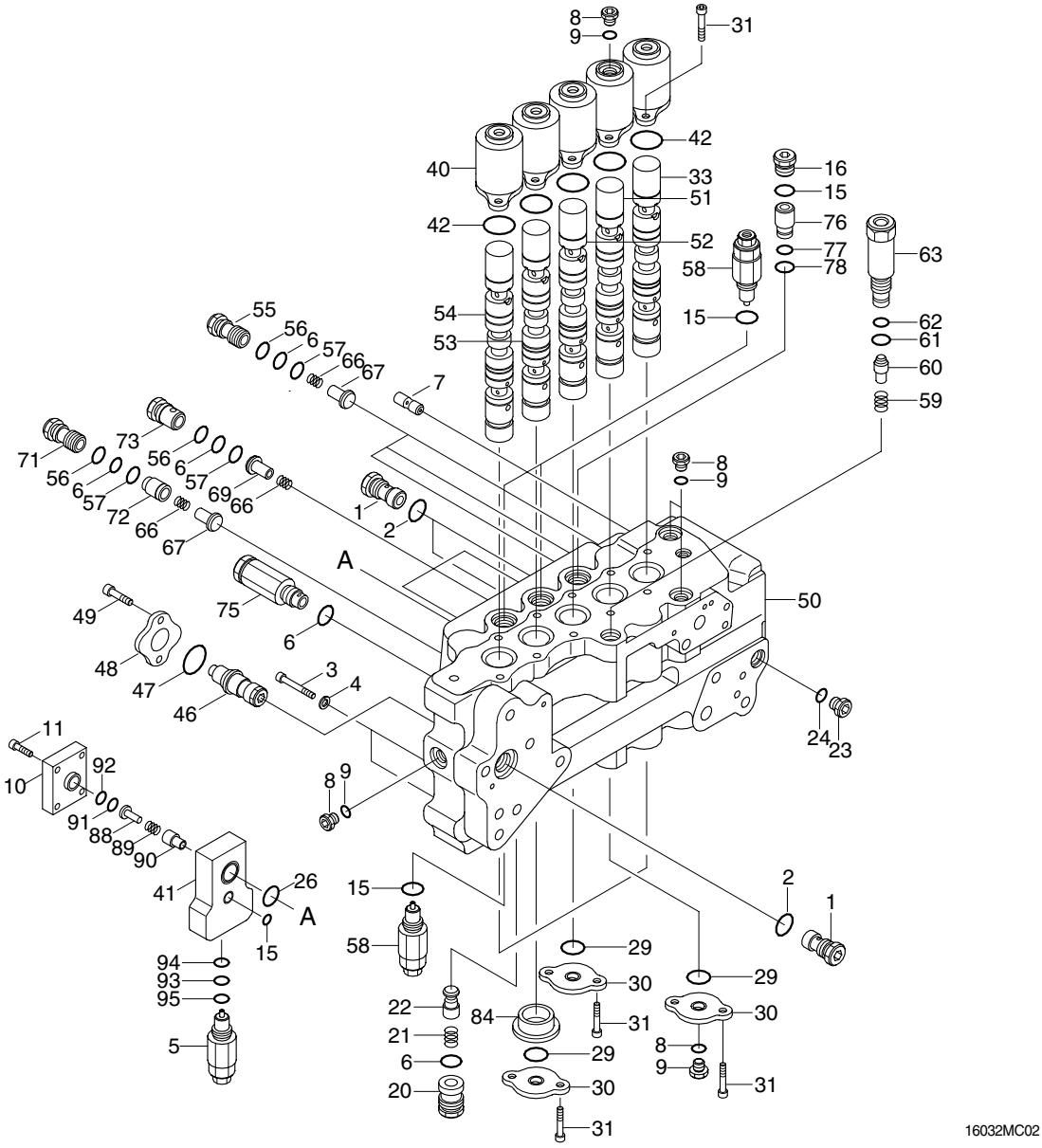
1. STRUCTURE(1/2)



16032MC01

1	Cap	14	Cap	27	O-ring
2	O-ring	15	O-ring	28	Housing
3	Socket bolt	16	Cap	29	O-ring
4	Spring washer	17	Spring	30	Retainer
5	Overload assy	18	Spring guide	31	Socket bolt
6	O-ring	19	Spring guide	32	Plunger assy(TS)
7	Orifice	20	Cap	33	Plunger assy(TL, TR)
8	Cap	21	Spring	34	Plunger assy(SW)
9	O-ring	22	Check	35	Plunger assy(BM2)
10	Cover	23	Cap	36	Plunger assy(AM1)
11	Socket bolt	24	O-ring	37	Cover assy
12	Sleeve	25	O-ring		
13	Check	26	O-ring		

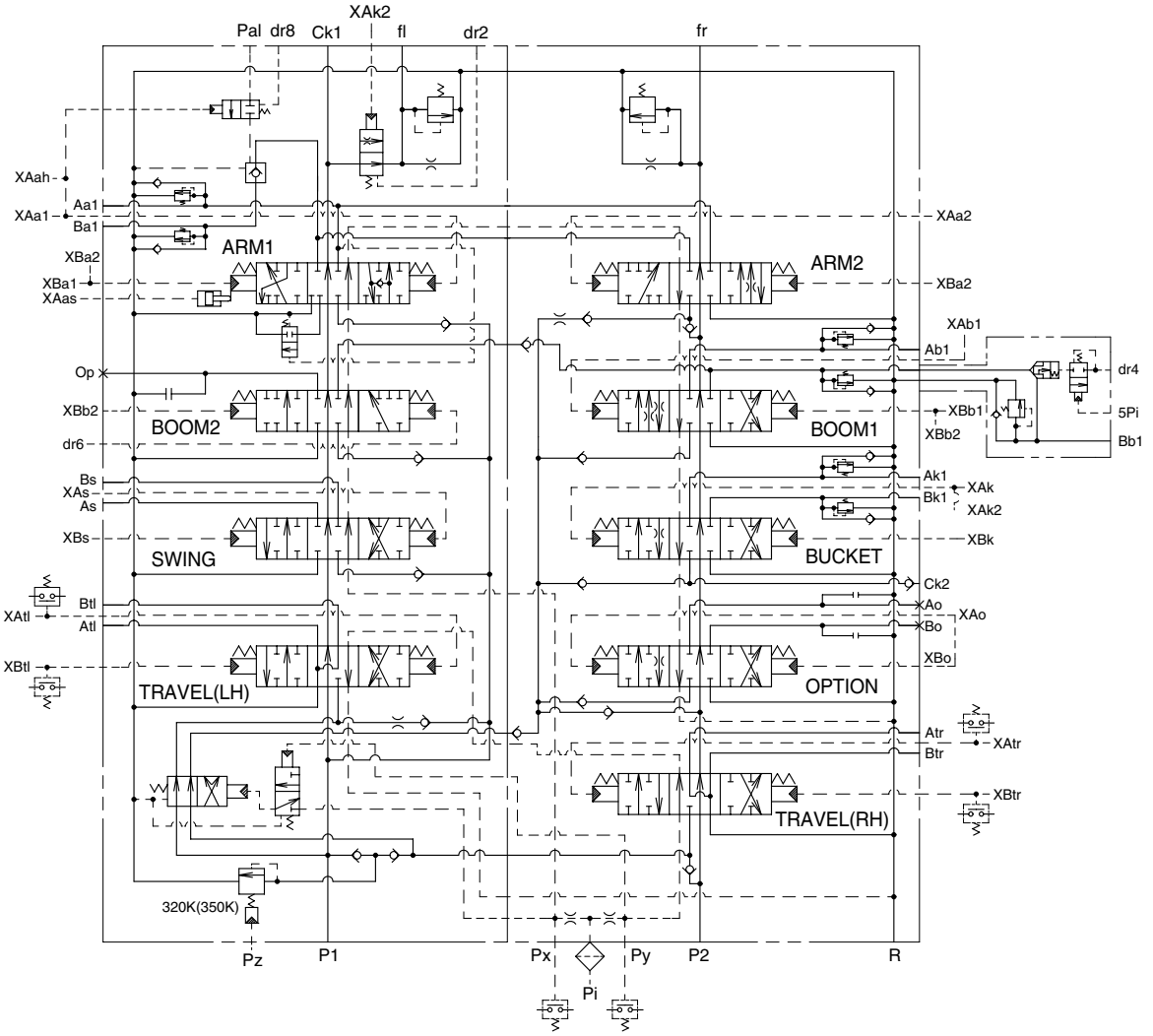
STRUCTURE(2/2)



38	Spring	53	Plunger assy(BM1)	68	Spacer	83	Spool
39	Poppet	54	Plunger assy(AM2)	69	Cover	84	Stopper
40	Cover	55	Cap	70	Piston	85	Selector assy
41	Manifold	56	Back up ring	71	Cap	86	O-ring
42	O-ring	57	Nylon chip	72	Check	87	O-ring
43	Cap	58	Overload assy	73	Cap	88	Spring guide
44	Spring	59	Spring	74	Cap	89	Spring
45	Spool	60	Check	75	Foot relief assy	90	Poppet
46	Plug	61	O-ring	76	Plug	91	O-ring
47	O-ring	62	Back up ring	77	Back up ring	92	Back up ring
48	Retainer	63	Cap	78	O-ring	93	O-ring
49	Socket bolt	64	Main relief assy	79	Cap	94	Back up ring
50	Housing	65	Cap	80	Spacer	95	O-ring
51	Plunger assy(OPT)	66	Spring	81	Check		
52	Plunger assy(BKT)	67	Check	82	Spring		

2. FUNCTION

1) HYDRAULIC CIRCUIT



16032MC03

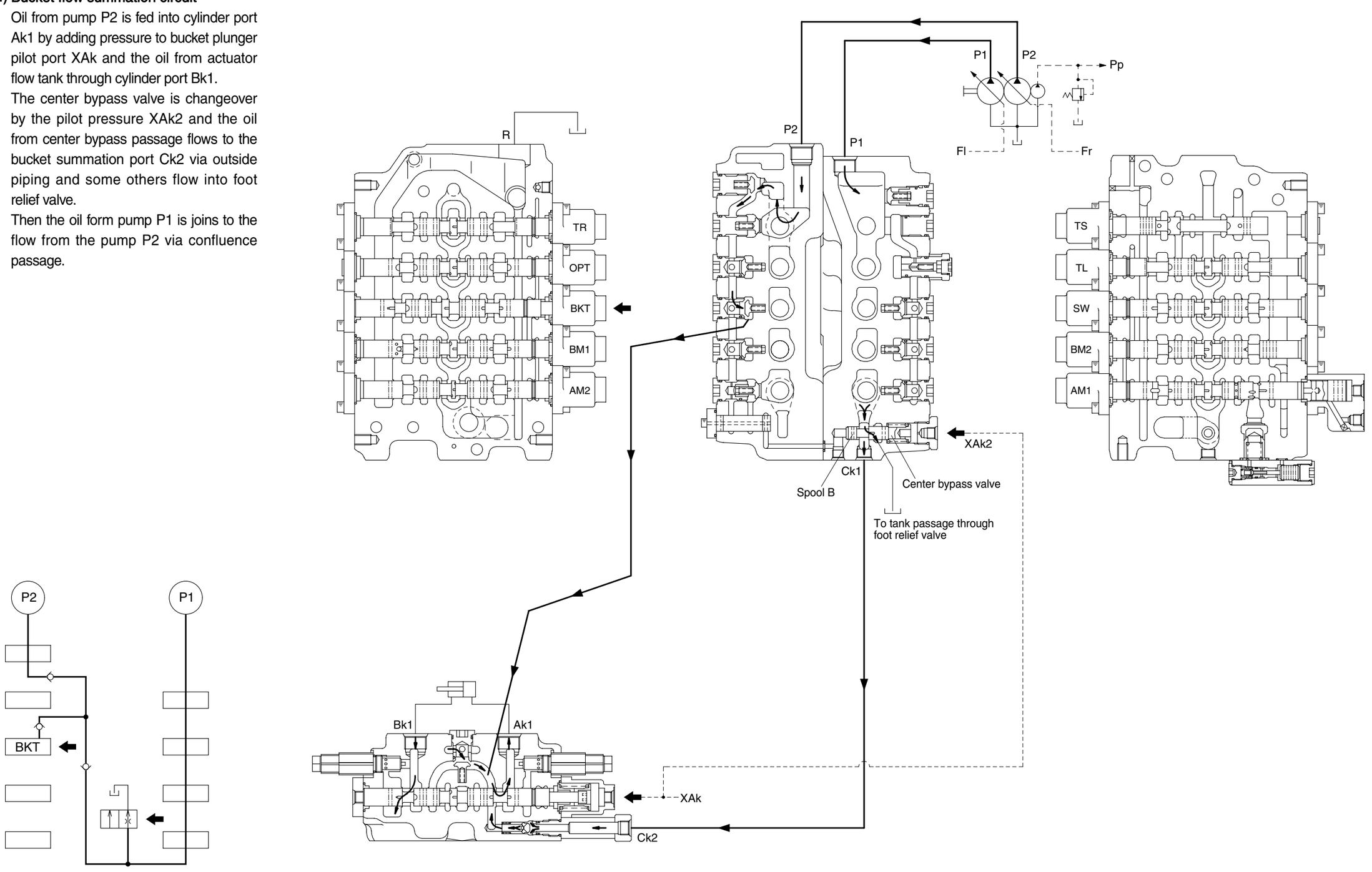
2) BASIC OPERATION

(1) Bucket flow summation circuit

Oil from pump P2 is fed into cylinder port Ak1 by adding pressure to bucket plunger pilot port XAk and the oil from actuator flow tank through cylinder port Bk1.

The center bypass valve is changeover by the pilot pressure XAk2 and the oil from center bypass passage flows to the bucket summation port Ck2 via outside piping and some others flow into foot relief valve.

Then the oil form pump P1 is joins to the flow from the pump P2 via confluence passage.



16032MC04

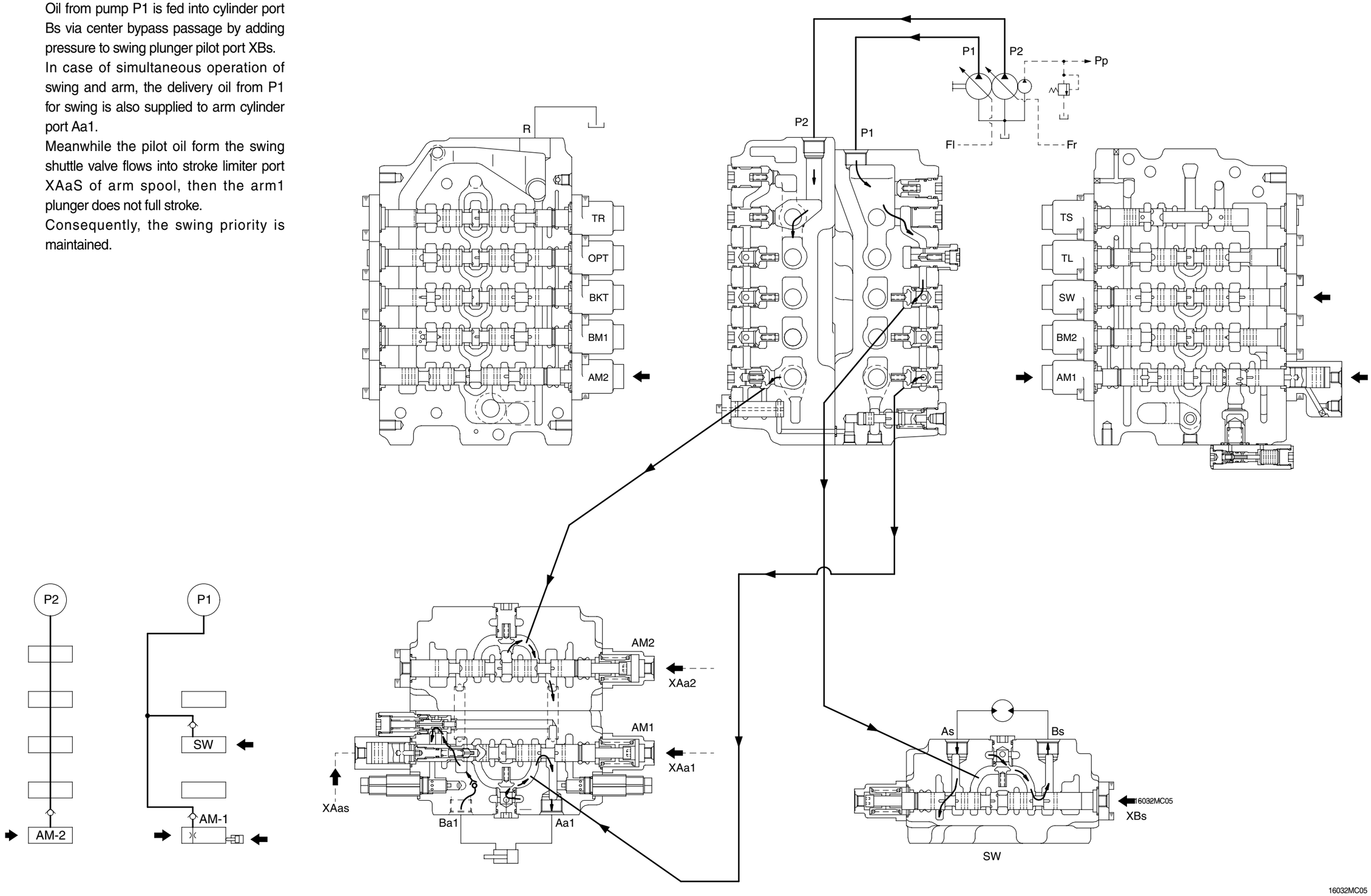
(2) Swing priority circuit

Oil from pump P1 is fed into cylinder port Bs via center bypass passage by adding pressure to swing plunger pilot port XBs.

In case of simultaneous operation of swing and arm, the delivery oil from P1 for swing is also supplied to arm cylinder port Aa1.

Meanwhile the pilot oil form the swing shuttle valve flows into stroke limiter port XAaS of arm spool, then the arm1 plunger does not full stroke.

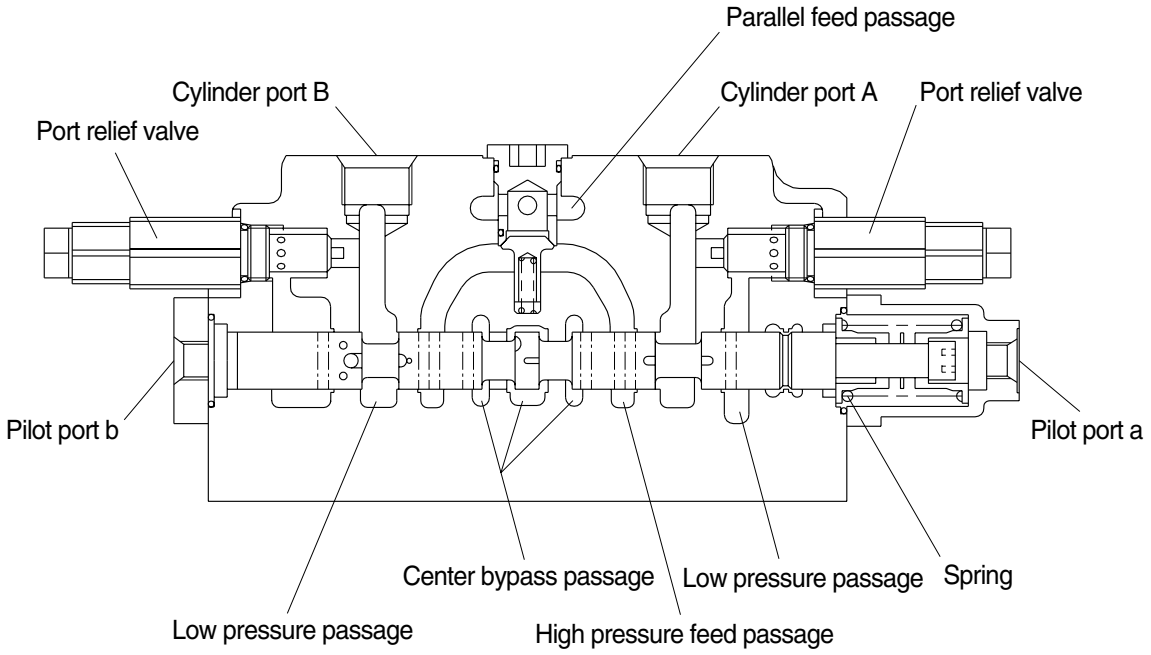
Consequently, the swing priority is maintained.



3) OPERATIONAL DESCRIPTION OF CONTROL VALVE

(1) Plunger operation

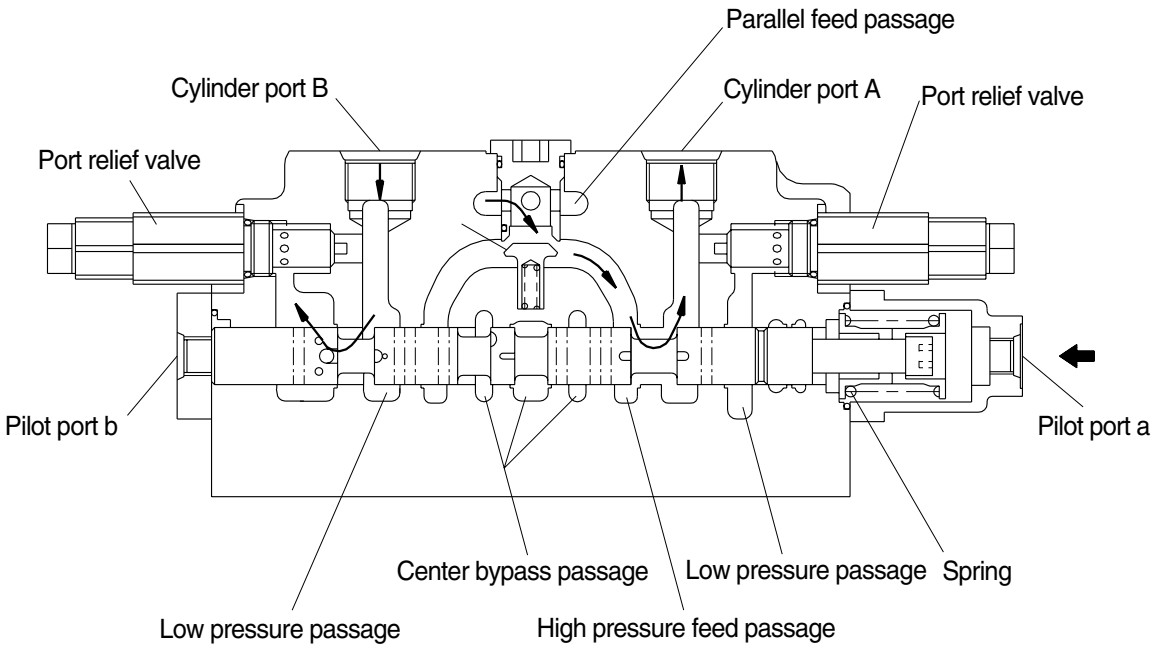
① Neutral position of plunger



18032MC12(1)

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



18032MC12(2)

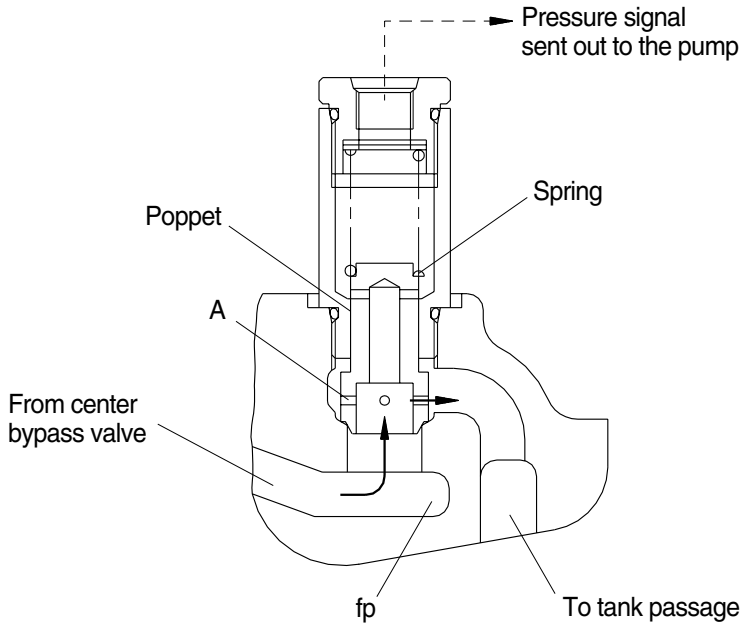
When actuated(Pressure is applied to pilot port a), the plunger moves to the left, the center bypass is shut off; Oil from the parallel feed passage opens the check valve C1 and flows into cylinder port A via the high pressure feed passage.

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

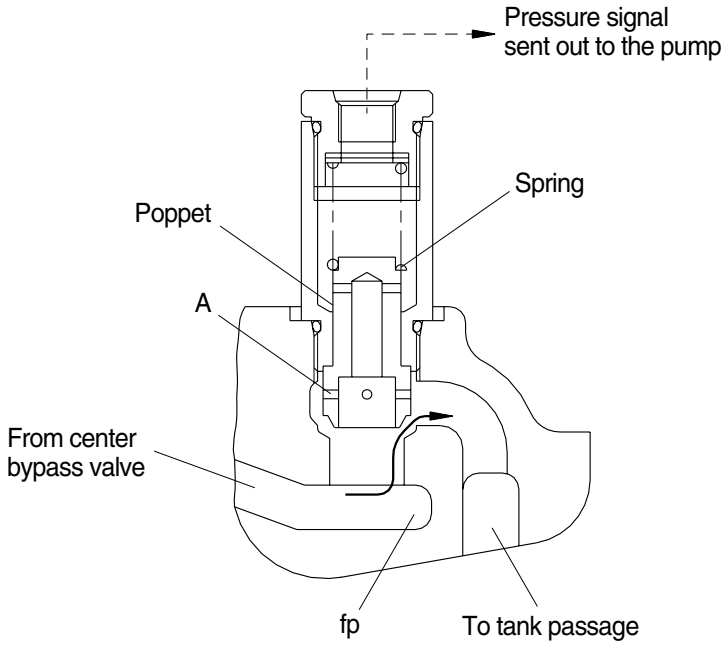
① fp is lower than spring force



18032MC13(1)

Oil from the center bypass valve flows into the tank via orifice(A) of poppet.
Pressure fp generated by orifice(A) is led to the pump, to control the pump delivery flow.

② fp is higher than spring force

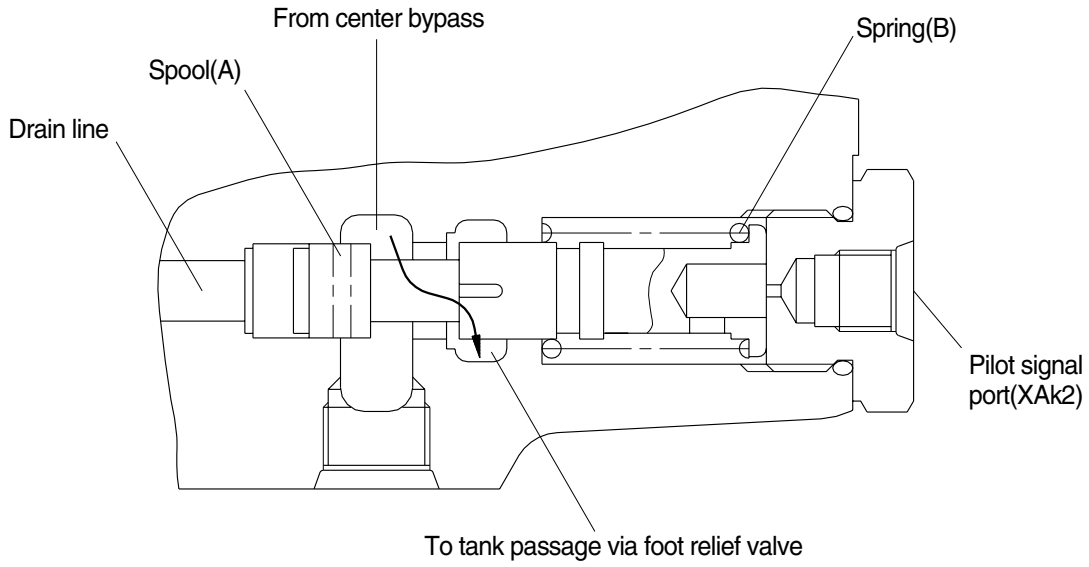


18032MC13(2)

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

(3) Center bypass valve operation

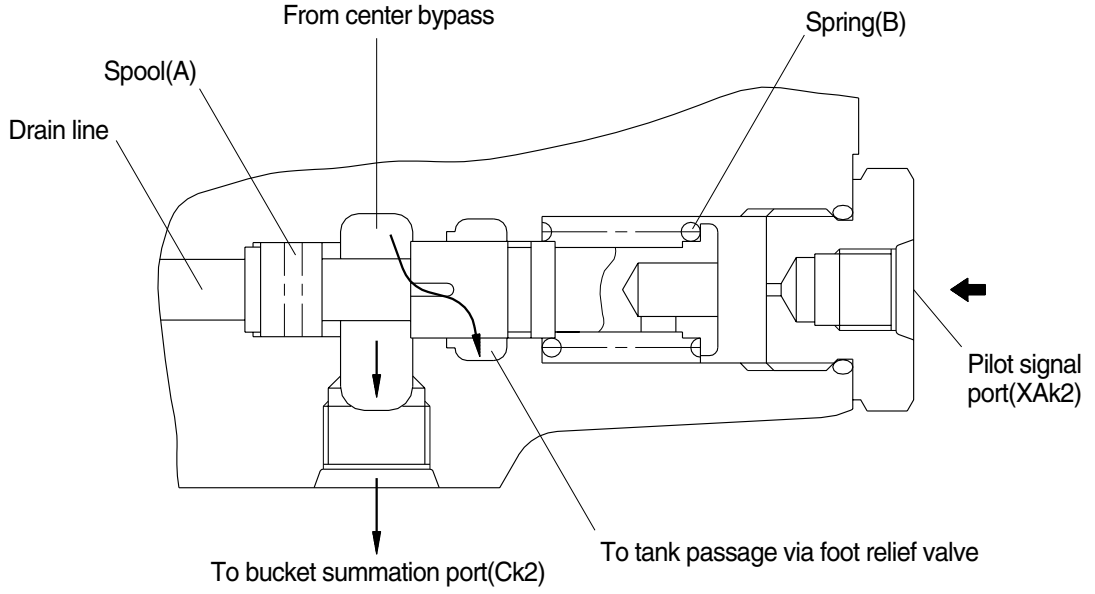
① Pilot pressure signal : OFF



18032MC15(1)

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



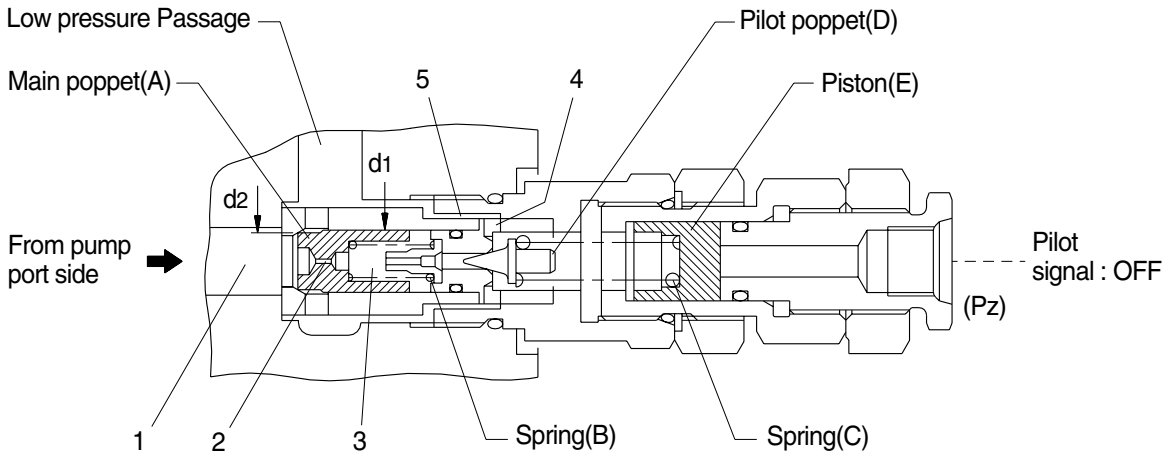
18032MC15(2)

When pilot pressure reaches a preset spring force, the spool(A) moves left and orificed the flow to the foot relief valve.

Then the oil from center bypass flow into bucket summation port Ck2 via out side piping.

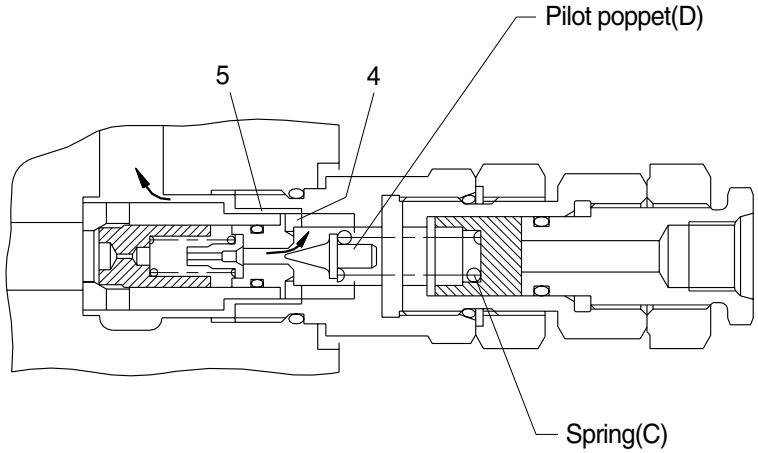
(4) Main relief valve operation

① High pressure setting pilot signal : OFF



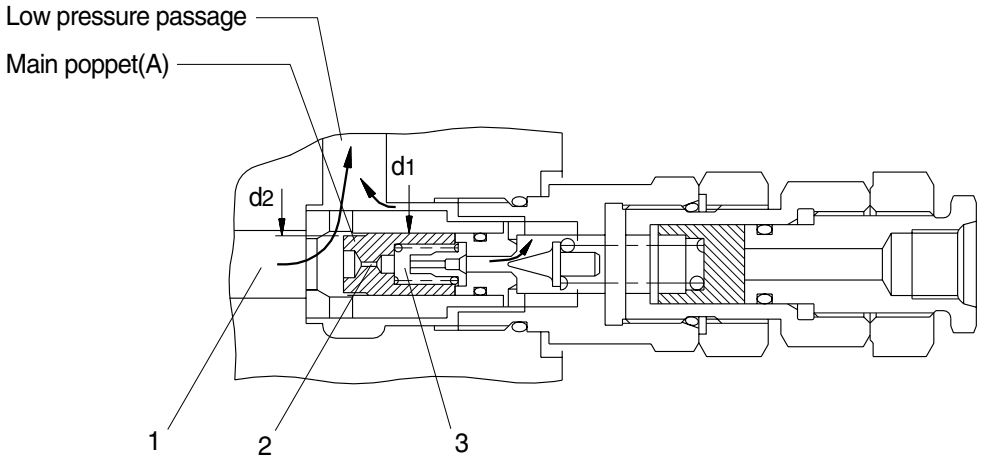
18032MC16(1)

A. This relief valve is built in between the pump port side(1) and low pressure passage.
Piston(E) is seated right end by spring(C).
Hydraulic oil from the pump port side enters chamber(3) via orifice(2) of main poppet(A).
Because d2<d1, main poppet(A) is securely seated.



18032MC16(2)

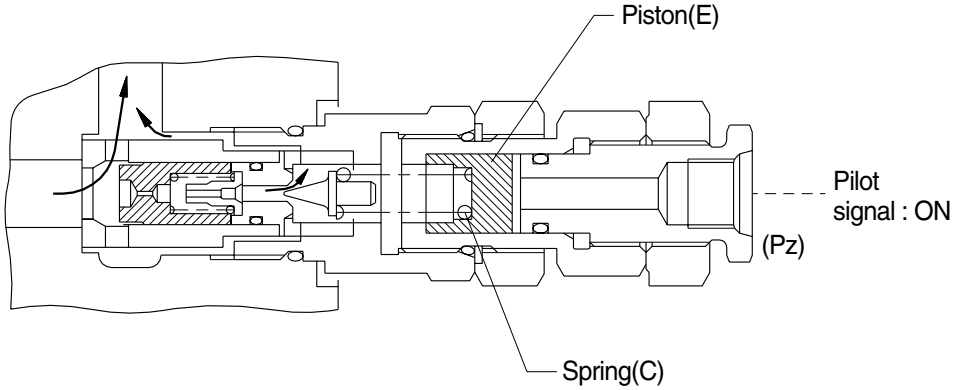
B. When hydraulic oil reaches the pressure preset by spring(C), pilot poppet(D) opens; oil flows around poppet(D) and into the low pressure passage via side hole(4) and passage(5).



18032MC17(1)

C. When the above oil flow is formed, pressure drops before and behind orifice(2) ; When pressure of chamber(1) x area d2 is large than pressure of chamber(3) x area d1, main poppet(A) is opened and hydraulic oil flows into the low pressure passage.

② High pressure setting pilot signal : ON

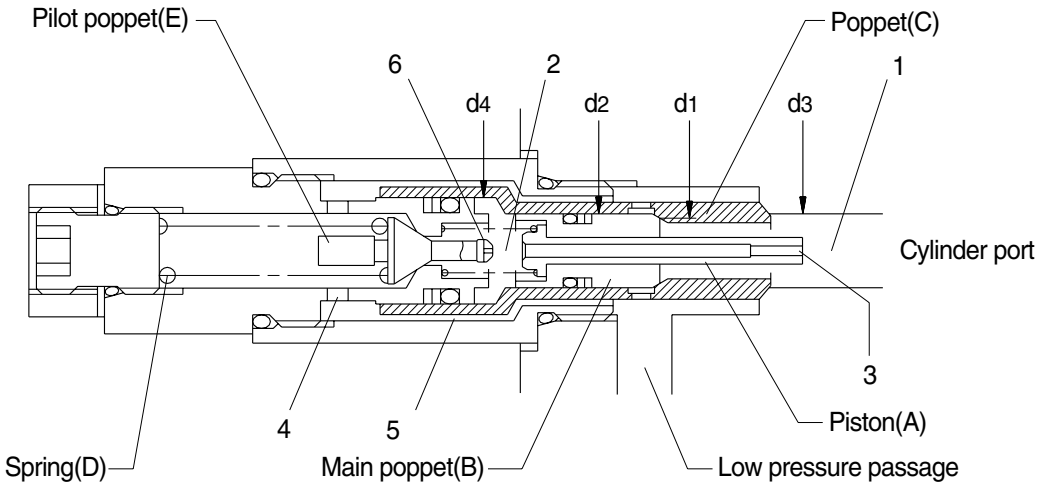


18032MC17(2)

Piston(E) move to left by high pressure setting pilot signal ; Set pressure of spring(C) rises, making high pressure setting.

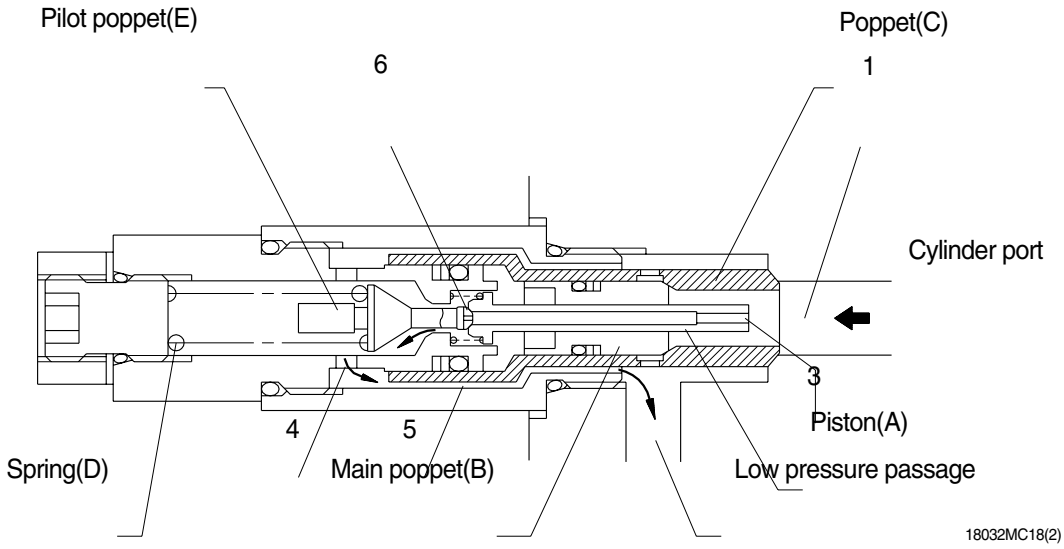
(5) Overload relief valve operation

Overload working operation



18032MC18(1)

A. Hydraulic oil from cylinder port enters chamber(2) via orifice(3) of piston(A). Because $d_1 < d_2$ and $d_3 < d_4$, main poppet(B) and poppet(C) are securely seated.

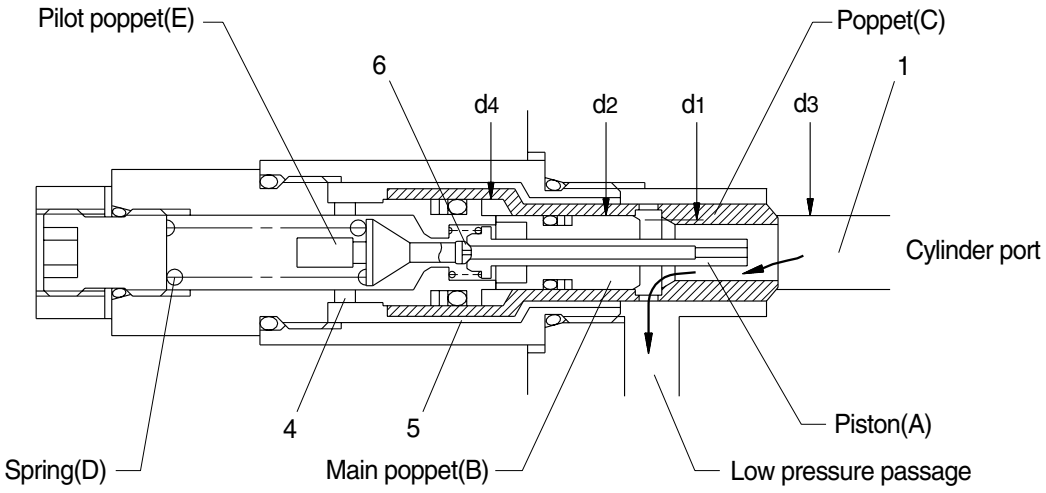


18032MC18(2)

B. When hydraulic pressure reaches the preset force of spring(D), Pilot poppet(E) opens ; Oil flow around pilot poppet(E) and into the low pressure passage via side hole(4) and passage(5).

C. Oil flow formed ; Pressure drops before and behind orifice(3) ; Piston(A) moved to left and seats at the tip of pilot poppet(E).

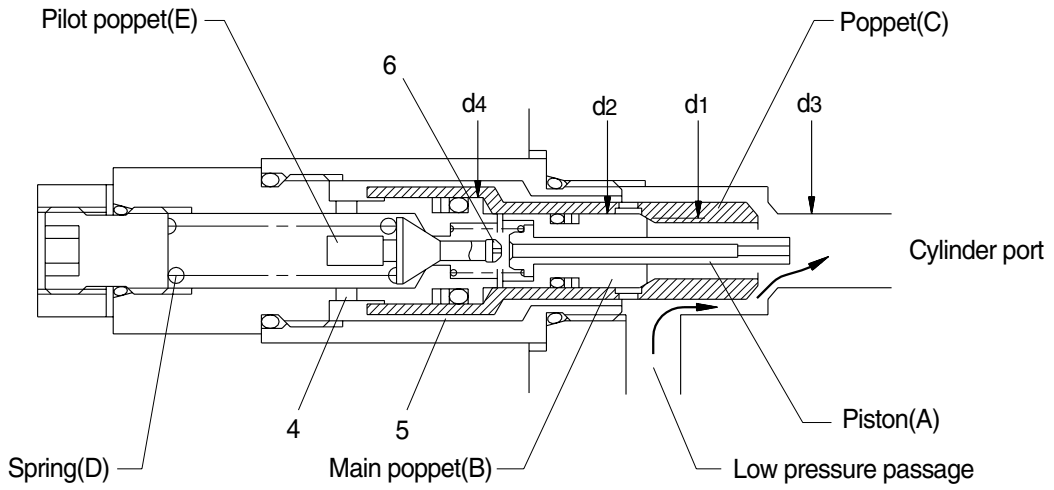
D. Hydraulic oil from chamber(1) enters chamber(2) via throttle(6) at the tip of pilot poppet(E) ; It flows into the low pressure passage via side hole(4) and passage(5).



18032MC19(1)

E. Pressure drops before and behind throttle(6), making pressure of chamber(1) x area d_1>pressure of chamber(2) x area d_2 ; Main poppet(B) is opened and hydraulic oil flows into the low pressure passage.

② Make up operation



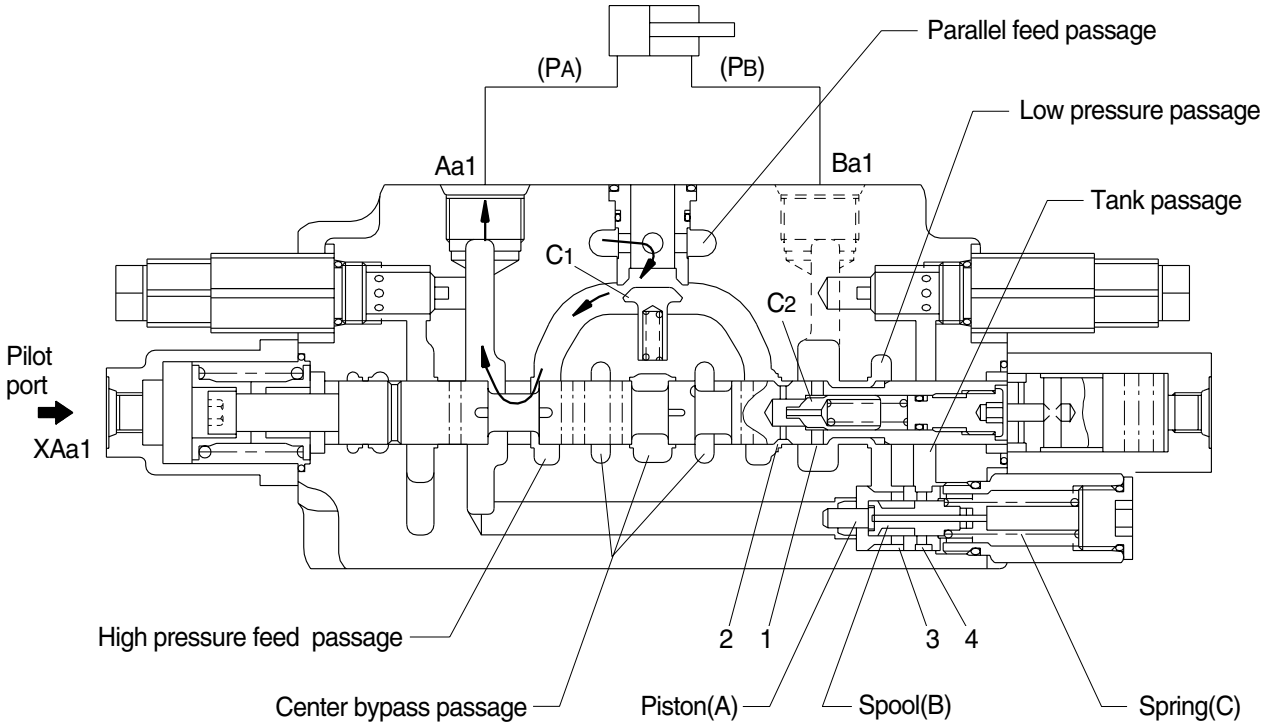
18032MC19(2)

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

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

(6) Arm regeneration operation

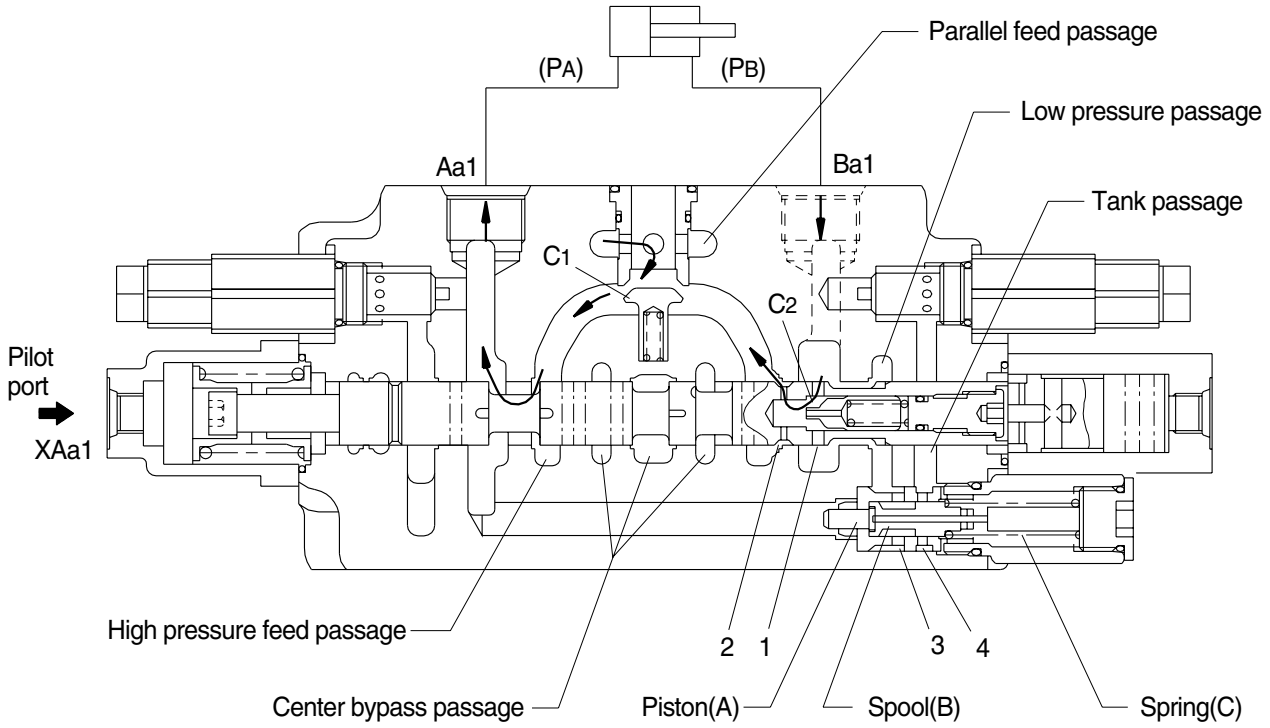
① Arm operation



18032MC20(1)

When pressure is applied to pilot port XAa1 of the arm plunger, the plunger moves to right as shown ; The center bypass passage is shut off ; Oil from the parallel feed passage opens check valve(C_1) and flows into cylinder port Aa1(Head side) via the high pressure feed passage.

② P_B is higher than P_A

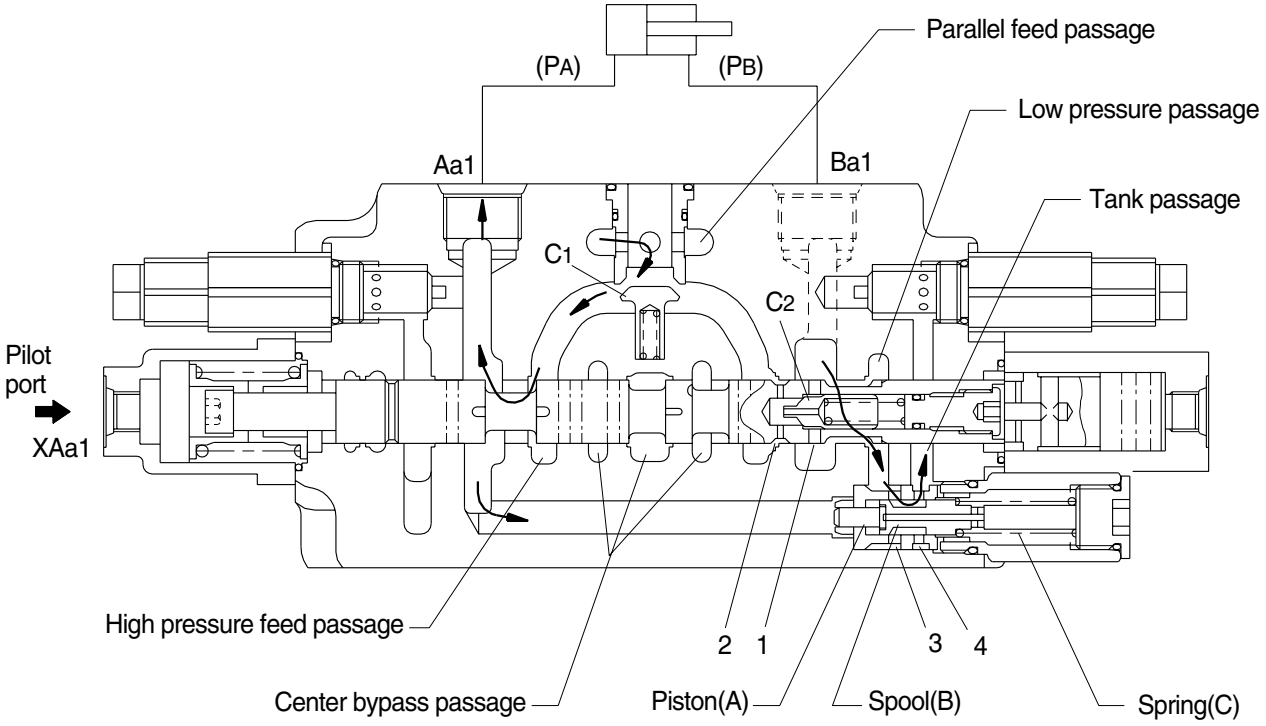


18032MC20(2)

P_A : Pressure of cylinder head side
P_B : Pressure of cylinder rod side

Return oil from cylinder rod side opens check valve(C_2) in the plunger ; It flows into cylinder head side after returning to the high pressure feed passage via passage(1) and (2) in the plunger.
At this time, the regeneration selector spool(B) is at the shown position; as passage(3) is shut off from passage(4) return oil from cylinder rod side does not flow into the tank passage.

③ P_A is higher than P_B



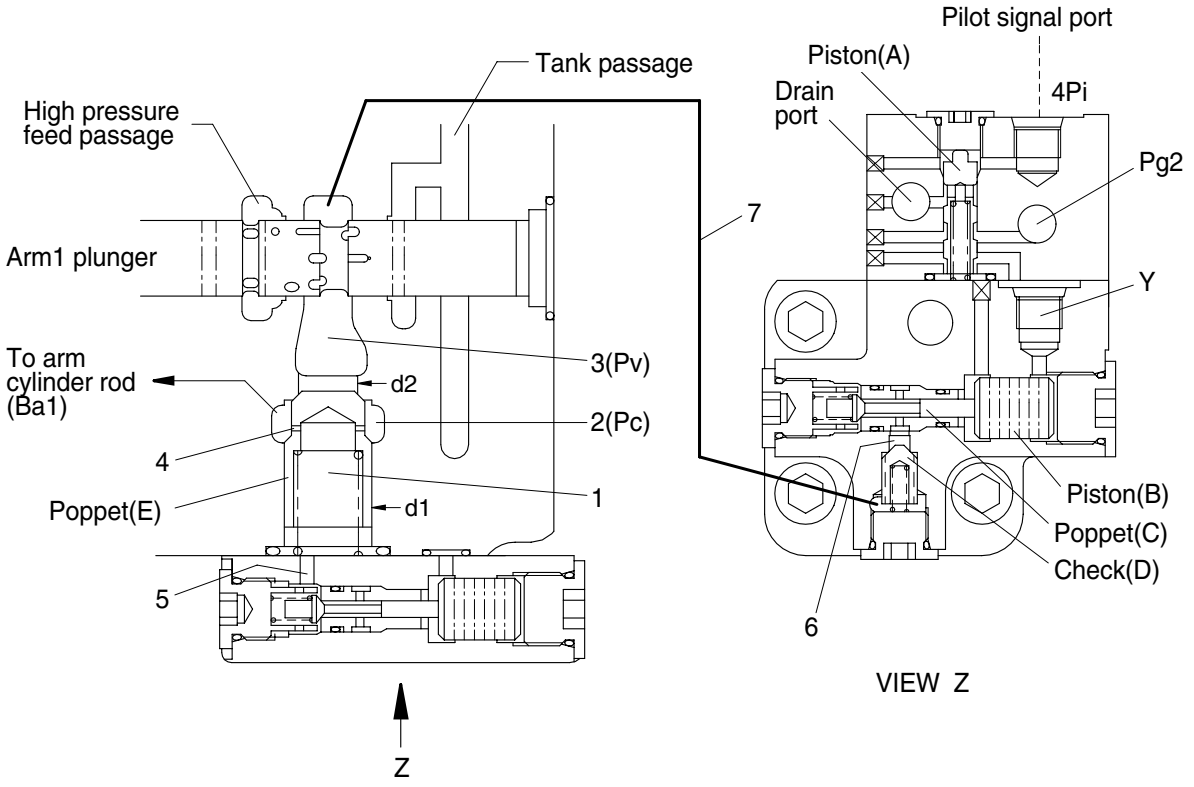
18032MC21

Return oil from cylinder rod side is shut off by check(C_2) in the plunger and passage(2) is blocked from passage(1).

When pressure P_A rises higher than the preset pressure of spring(C) and pushes piston(A) in the regeneration selector to right as shown ; Spool(B) move to right ; Passage(3) and passage(4) are connected ; Return oil from cylinder rod side flows into tank passage via low pressures passage(3) and passage(4).

(7) Arm holding valve operation

① **When the plunger is in neutral**(4Pi pilot signal : OFF)

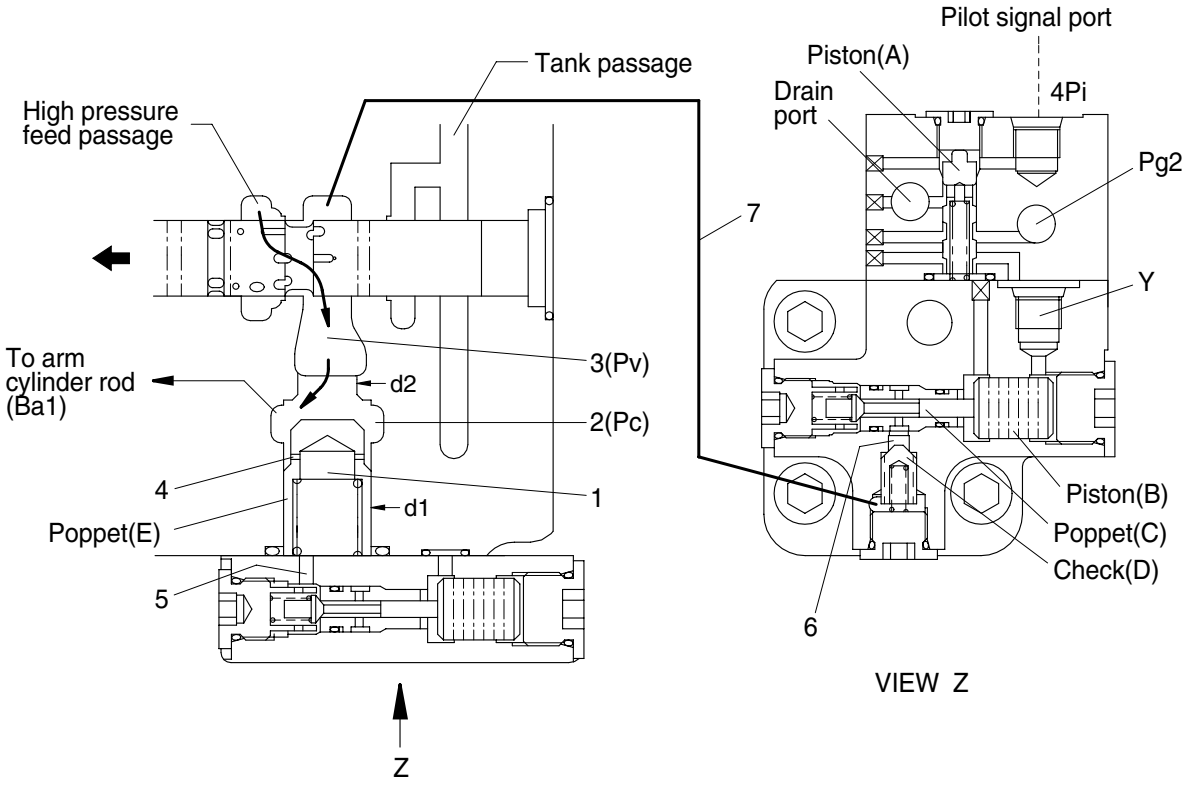


16032MC06A

Piston(A) is in the status as shown ; Pressure signal(Pg2) and chamber(Y) are shut off.
Thus piston(B) and poppet(C) are in the status as shown;Passages(5) and (6) are shut off by poppet(C).
Therefore, the pressure of chamber(1) becomes pressure Pc as it is connected with chamber(2) via orifice(4). Since $d_1 > d_2$, poppet(E) is seated and chambers(2) and (3) are completely blocked.

② **When the plunger is in operation**(4Pi pilot signal : OFF)

· **If Pv is higher than Pc**(In the case of arm out)

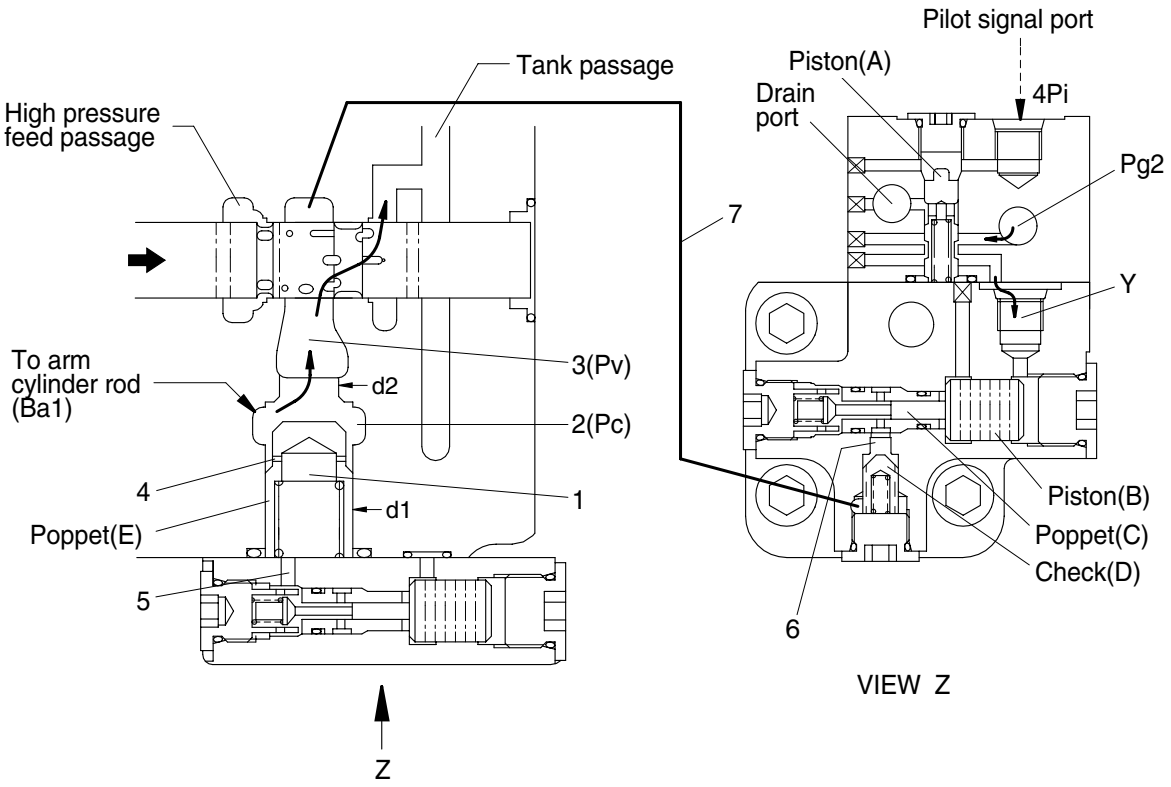


16032MC06B

When the plunger moves to left, the high pressure oil enters to chamber(3).

Therefore, the pressure of chamber(1) becomes Pc as it is connected to chamber(2) via orifice(4) ; Poppet(E) is opened ; Oil from high pressure feed passage flows into the cylinder rod side.

· **If Pc is higher than Pv**(In the case of arm in operation)

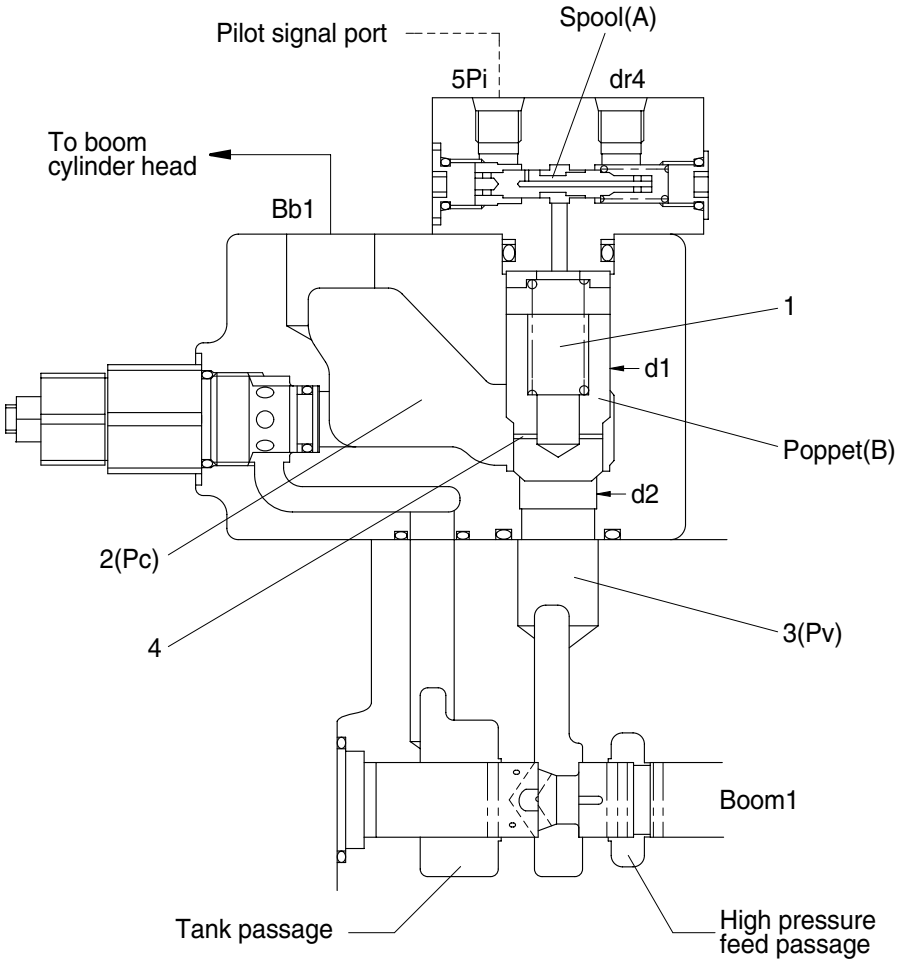


16032MC06C

When the pressure of pilot signal enters, piston(A) moves to down.
When the pressure signal(Pg2) enters to chamber(Y), piston(B) moves to left and poppet(C) opens ; Passages(5) and (6) are connected.
If pressure Pc of cylinder port chamber(2) is higher than pressure Pv of chamber(3)(In the case of arm in operation) 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 arm plunger is moved to right. Therefore, pressure Pc is applied to(Area d_1- area d_2), pushing open poppet(E), and return oil from the cylinder rod side flows into the tank passage.

(8) Boom holding valve operation

① **When the plunger is in neutral**(5Pi pilot signal : OFF)

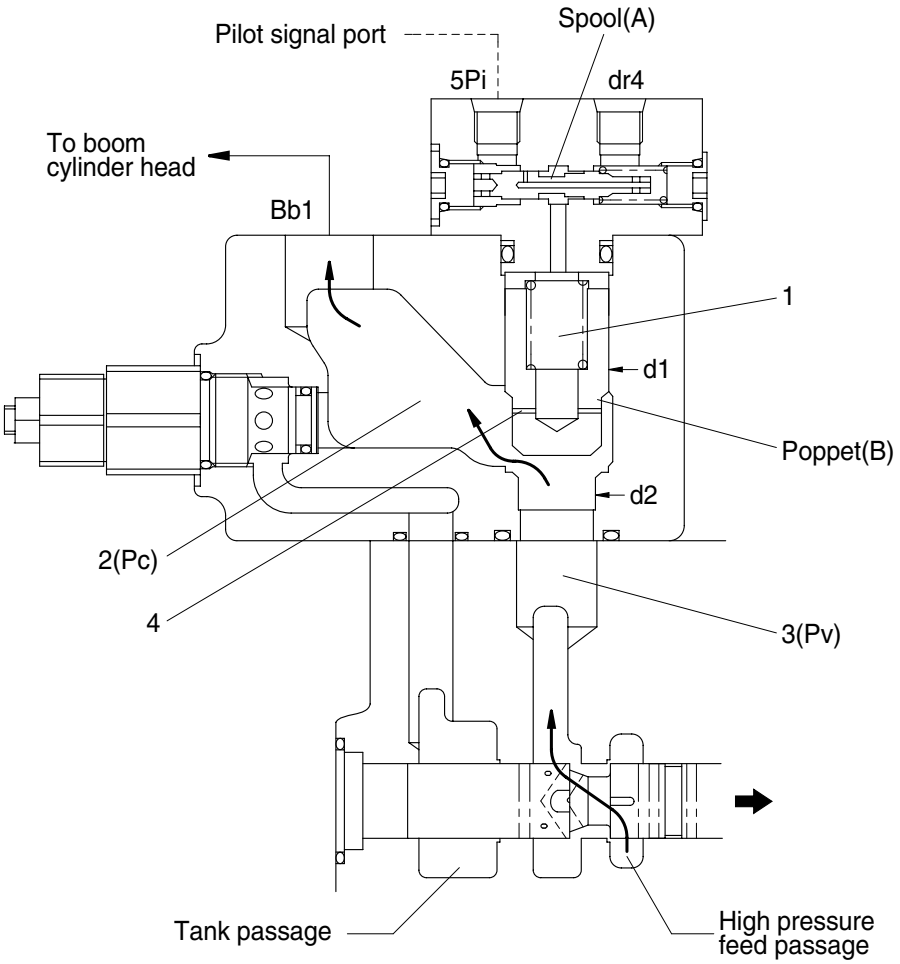


16032MC07

Spool(A) is in the status as shown ; Chamber(1) and drain port(dr4) are shut off by spool(A). Therefore, the pressure of chamber(1) becomes pressure Pc as it is connected with chamber(2) via orifice(4). Since $d_1 > d_2$, poppet(B) is seated and chambers(2) and (3) are completely blocked.

② **When the plunger is in operation**(5Pi pilot signal : OFF)

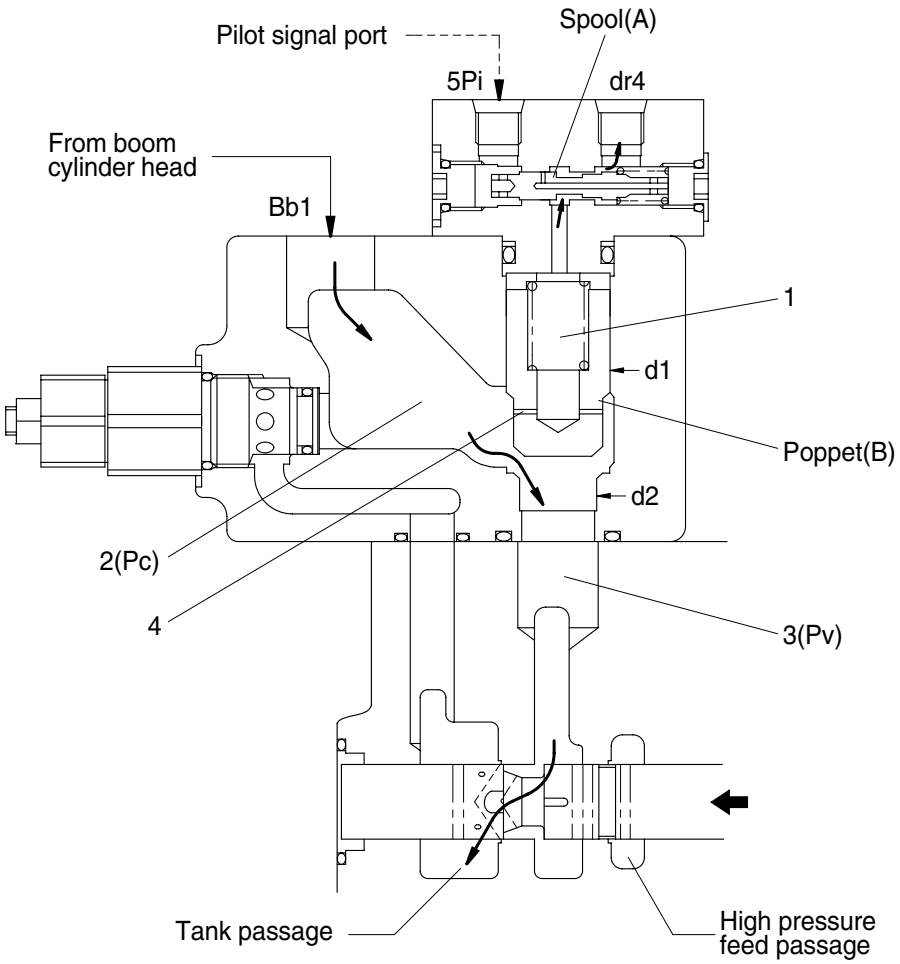
· **If Pv is higher than Pc**(In the case of boom raise)



16032MC08

When the plunger moves to right, the high pressure oil enters to chamber(3).
Therefore, the pressure of chamber(1) becomes Pc as it is connected to chamber(2) via orifice(4) ; Poppet(B) is opened by pressure(Pv) of chamber(3) ; Oil from high pressure feed passage flows into the cylinder head side.

· **If Pc is higher than Pv**(In the case of boom down operation)



16032MC09

When plunger moves to left, chamber(3) is connected with tank passage. At the same time, spool(A) moves to right by the pressure of pilot signal ; Chamber(1) and drain port(dr4) are connected.

Therefore, pressure of chamber(1) becomes low ; Pressure Pc is applied to(Area d1- area d2), pushing open poppet(B), and return oil from the cylinder head side flows into the tank passage.