

SECTION 2 STRUCTURE AND FUNCTION

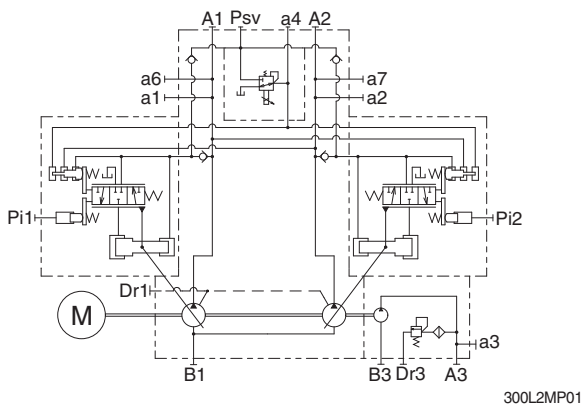
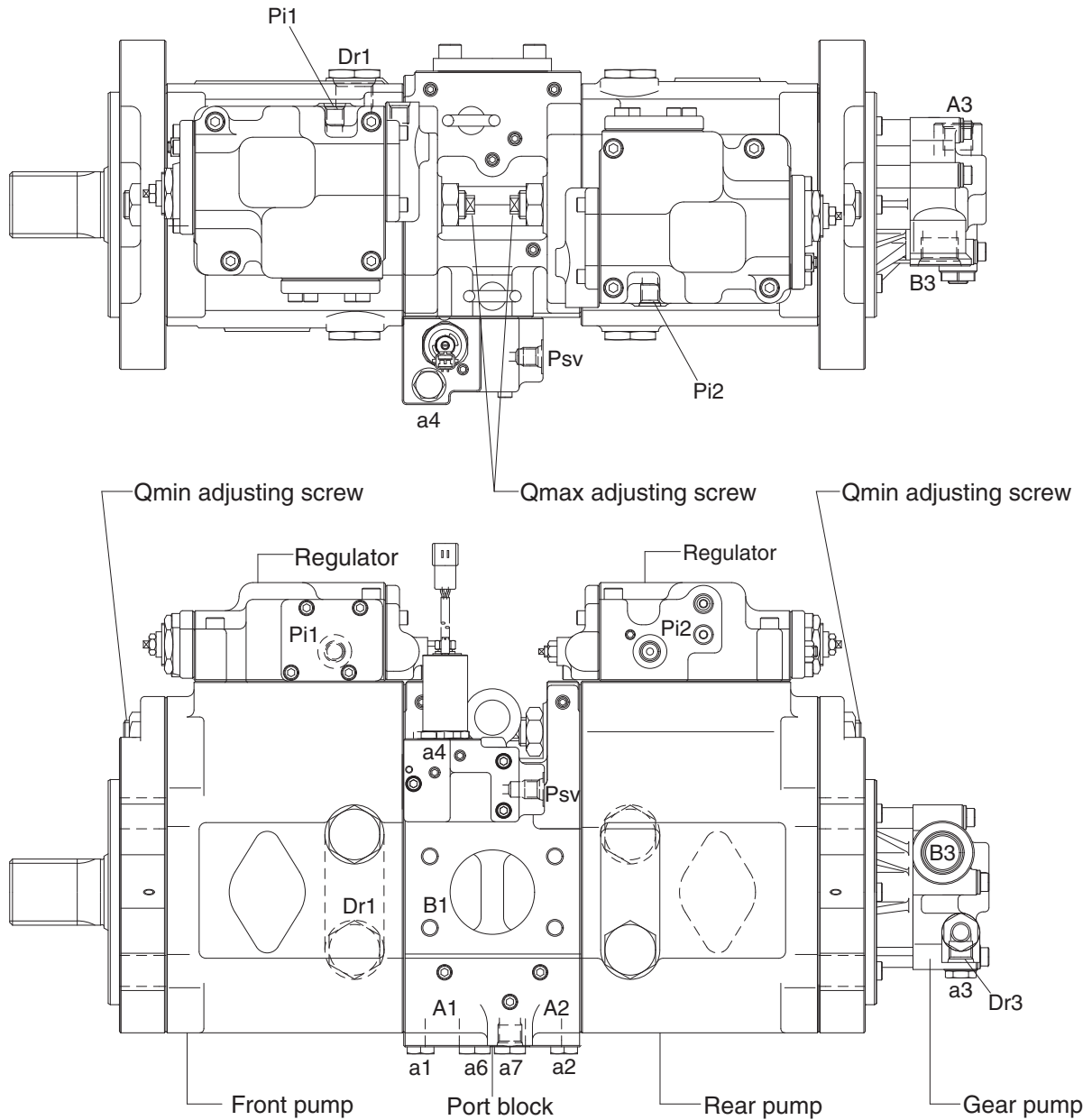
Group 1 Pump Device	2-1
Group 2 Main Control Valve	2-20
Group 3 Swing Device	2-60
Group 4 Travel Device	2-71
Group 5 RCV Lever	2-85
Group 6 RCV Pedal	2-92

SECTION 2 STRUCTURE AND FUNCTION

GROUP 1 PUMP DEVICE

1. STRUCTURE

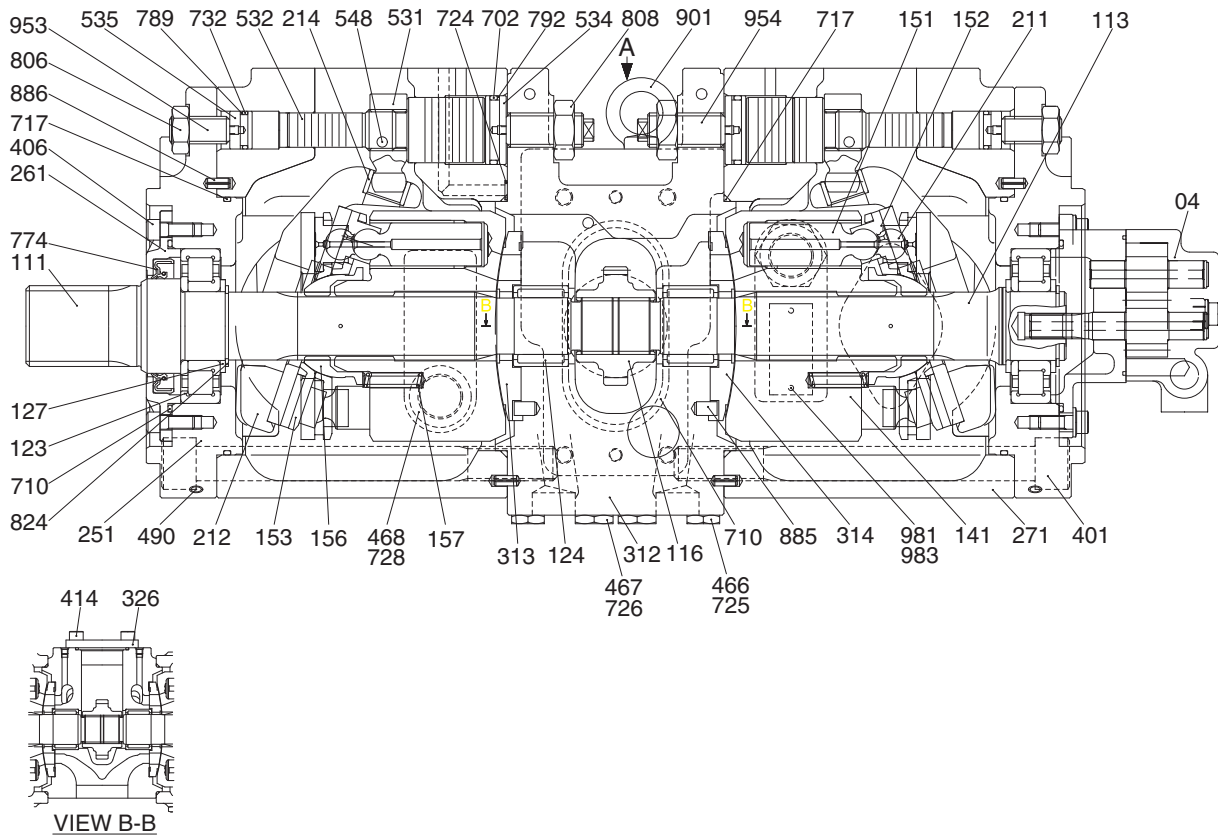
The pump device consists of main pump, regulator and gear pump.



Port	Port name	Port size
A1, 2	Delivery port	SAE6000 psi 1"
B1	Suction port	SAE2500 psi 2 1/2"
Dr1	Drain port	PF 3/4 - 20
Pi1, i2	Pilot port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 15
a1, 2, 4	Gauge port	PF 1/4 - 15
a6, a7	Gauge port	PF 3/8 - 17
a3	Gauge port	PF 1/4 - 14
A3	Gear pump delivery port	PF 1/2 - 19
B3	Gear pump suction port	PF 3/4 - 20.5
Dr3	Gear pump drain port	PF 3/8 - 15

1) MAIN PUMP (1/2)

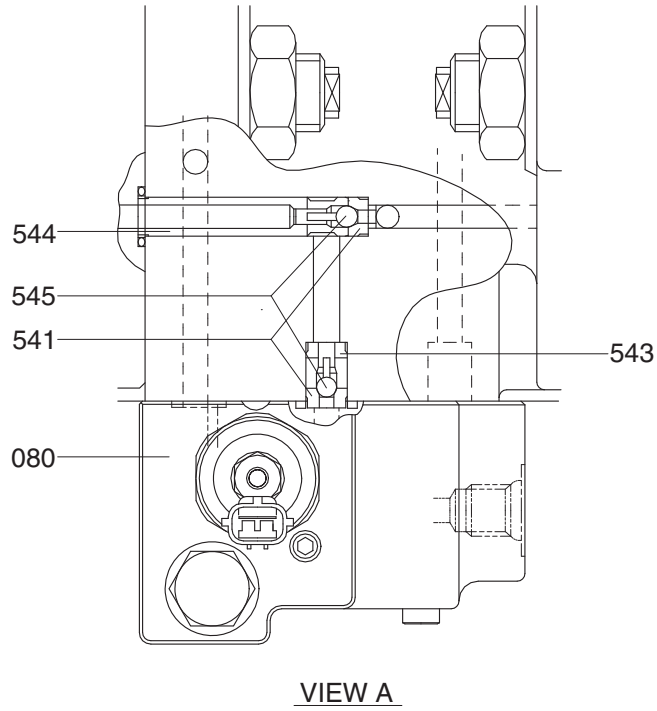
The main pump consists of two piston pumps (front & rear) and valve block.



29092MP02

04	Gear pump	271	Pump casing	710	O-ring
111	Drive shaft (F)	312	Valve block	717	O-ring
113	Drive shaft (R)	313	Valve plate (R)	724	O-ring
116	Gear	314	Valve plate (L)	725	O-ring
123	Roller bearing	326	Cover	728	O-ring
124	Needle bearing	401	Hexagon socket bolt	732	O-ring
127	Bearing spacer	406	Hexagon socket bolt	774	Oil seal
141	Cylinder block	414	Hexagon socket bolt	789	Back up ring
151	Piston	466	VP plug	792	Back up ring
152	Shoe	467	VP plug	806	Hexagon head nut
153	Set plate	468	VP plug	808	Hexagon head nut
156	Spherical bushing	490	VP plug	824	Snap ring
157	Cylinder spring	531	Tilting pin	885	Pin
211	Shoe plate	532	Servo piston	886	Spring pin
212	Swash plate	534	Stopper (L)	901	Eye bolt
214	Bushing	535	Stopper (S)	953	Set screw
251	Swash plate support	548	Feedback pin	954	Set screw
261	Seal cover (F)	702	O-ring		

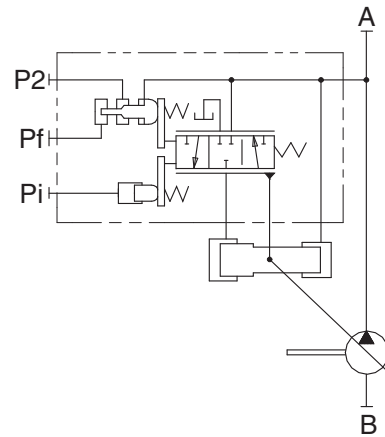
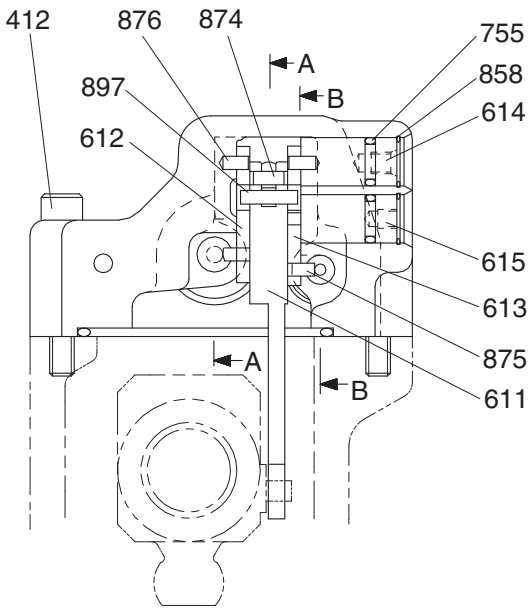
MAIN PUMP (2/2)



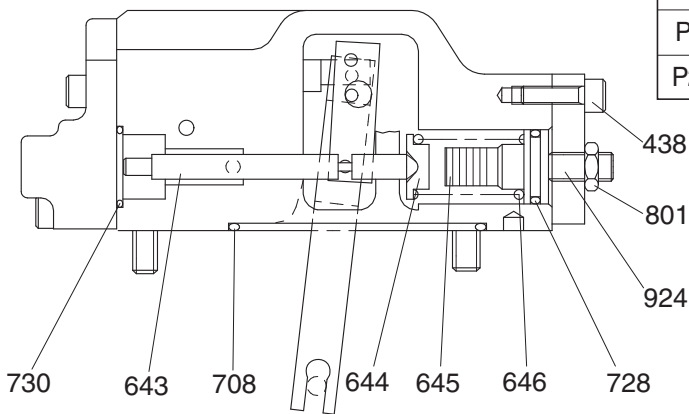
- | | | | | | |
|-----|-----------------------------|-----|-----------|-----|------------|
| 080 | Proportional reducing valve | 543 | Stopper 1 | 545 | Steel ball |
| 541 | Seat | 544 | Stopper 2 | | |

3009SH2MP02

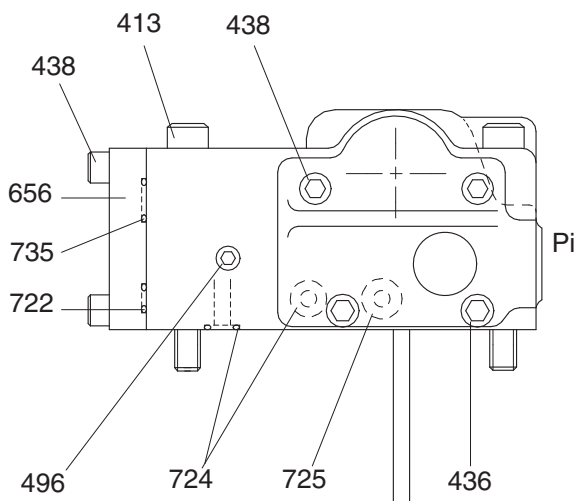
2) REGULATOR (1/2)



Port	Port name	Port size
A	Delivery port	1"
B	Suction port	2 1/2"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



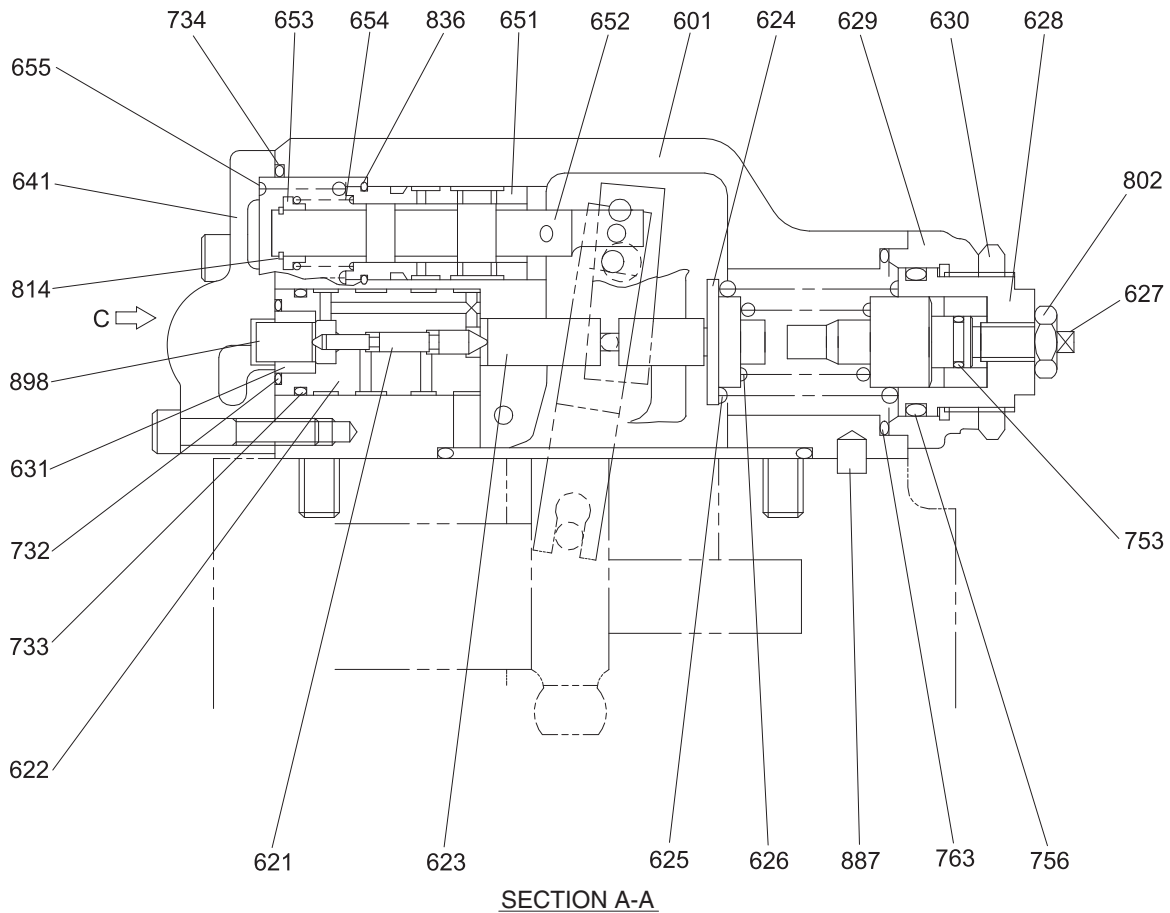
SECTION B-B



VIEW C

29092MP03

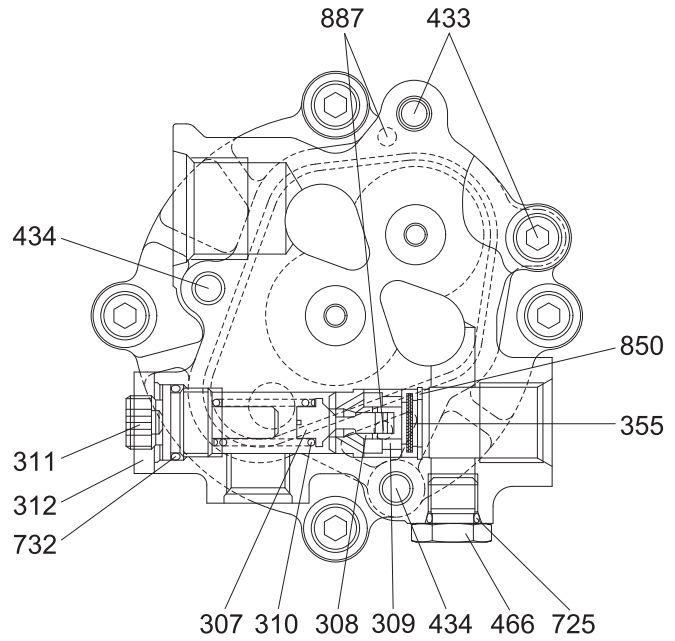
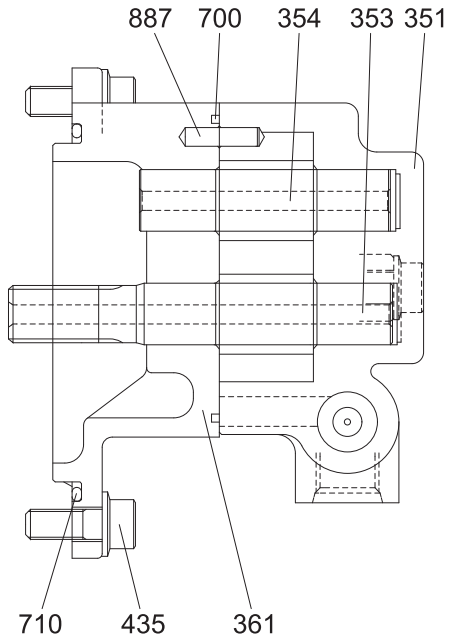
REGULATOR (2/2)



29092MP04A

412 Hexagon socket screw	630 Lock nut	733 O-ring
413 Hexagon socket screw	631 Sleeve, pf	734 O-ring
436 Hexagon socket screw	641 Pilot cover	735 O-ring
438 Hexagon socket screw	643 Pilot piston	753 O-ring
496 Plug	644 Spring seat (Q)	755 O-ring
601 Casing	645 Adjust stem (Q)	756 O-ring
611 Feed back lever	646 Pilot spring	763 O-ring
612 Lever (1)	651 Sleeve	801 Nut
613 Lever (2)	652 Spool	802 Nut
614 Fulcrum plug	653 Spring seat	814 Snap ring
615 Adjust plug	654 Return spring	836 Snap ring
621 Compensator piston	655 Set spring	858 Snap ring
622 Piston case	656 Block cover	874 Pin
623 Compensator rod	708 O-ring	875 Pin
624 Spring seat (C)	722 O-ring	876 Pin
625 Outer spring	724 O-ring	887 Pin
626 Inner spring	725 O-ring	897 Pin
627 Adjust stem (C)	728 O-ring	898 Pin
628 Adjust screw (C)	730 O-ring	924 Set screw
629 Cover (C)	732 O-ring	

3) GEAR PUMP



3009SH2MP03

307 Poppet
 308 Seat
 309 Ring
 310 Spring
 311 Screw
 312 Nut
 351 Gear case

353 Drive gear
 354 Driven gear
 355 Filter
 361 Front case
 433 Flange socket
 434 Flange socket
 435 Flange socket

466 Plug
 700 Ring
 710 O-ring
 725 O-ring
 732 O-ring
 850 Snap ring
 887 Pin

2. FUNCTION

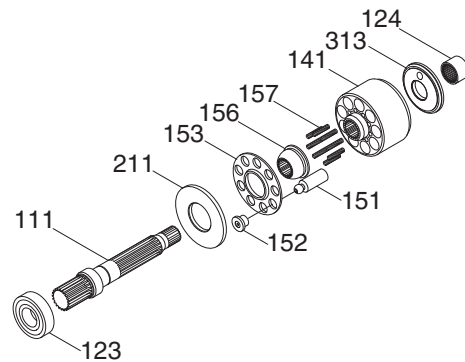
1) MAIN PUMP

The pumps may be classified roughly into the rotary group performing a rotary motion and working as the major part of the whole pump function: the swash plate group that varies the delivery rates: and the valve cover group that changes over oil suction and discharge.

(1) Rotary group

The rotary group consists of drive shaft (F)(111), cylinder block (141), piston shoes (151,152), set plate (153), spherical bush (156), and cylinder spring (157). The drive shaft is supported by bearing (123,124) at its both ends.

The shoe is caulked to the piston to form a spherical coupling. It has a pocket to relieve thrust force generated by loading pressure and to take hydraulic balance so that it slides lightly over the shoe plate (211). The sub group composed by a piston and a shoe is pressed against the shoe plate by the action of the cylinder spring via a retainer and a spherical bush. Similarly, the cylinder block is pressed against valve plate (313) by the action of the cylinder spring.



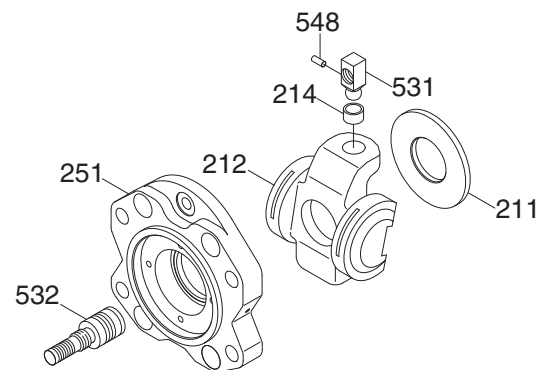
29092MP06

(2) Swash plate group

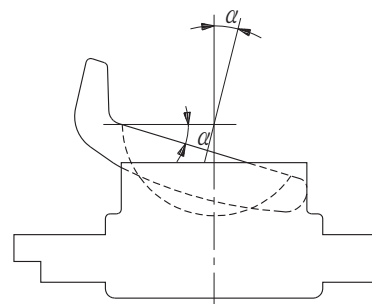
The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), tilting bush (214), tilting pin (531) and servo piston (532).

The swash plate is a cylindrical part formed on the opposite side of the sliding surface of the shoe and is supported by the swash support.

If the servo piston moves to the right and left as hydraulic force controlled by the regulator is admitted to hydraulic chamber located on both sides of the servo piston, the swash plate slides over the swash plate support via the spherical part of the tilting pin to change the tilting angle (α)



29092MP07



2-7

(3) Valve block group

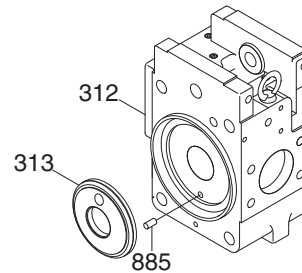
The valve block group consists of valve block (312), valve plate (313) and valve plate pin (885).

The valve plate having two melon-shaped ports is fixed to the valve block and feeds and collects oil to and from the cylinder block.

The oil changed over by the valve plate is connected to an external pipeline by way of the valve block.

Now, if the drive shaft is driven by a prime mover (electric motor, engine, etc), it rotates the cylinder block via a spline linkage at the same time. If the swash plate is tilted as in Fig (previous page) the pistons arranged in the cylinder block make a reciprocating motion with respect to the cylinder block, while they revolve with the cylinder block.

If you pay attention to a single piston, it performs a motion away from the valve plate (oil sucking process) within 180 degrees, and makes a motion towards the valve plate (or oil discharging process) in the rest of 180 degrees. When the swash plate has a tilting angle of zero, the piston makes no stroke and discharges no oil.



29092MP08

2) REGULATOR

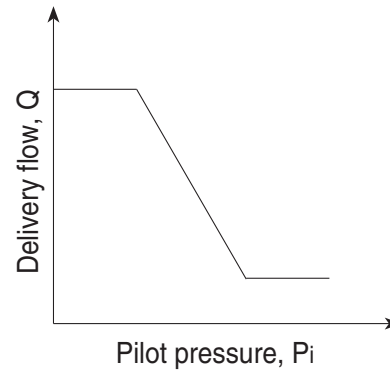
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

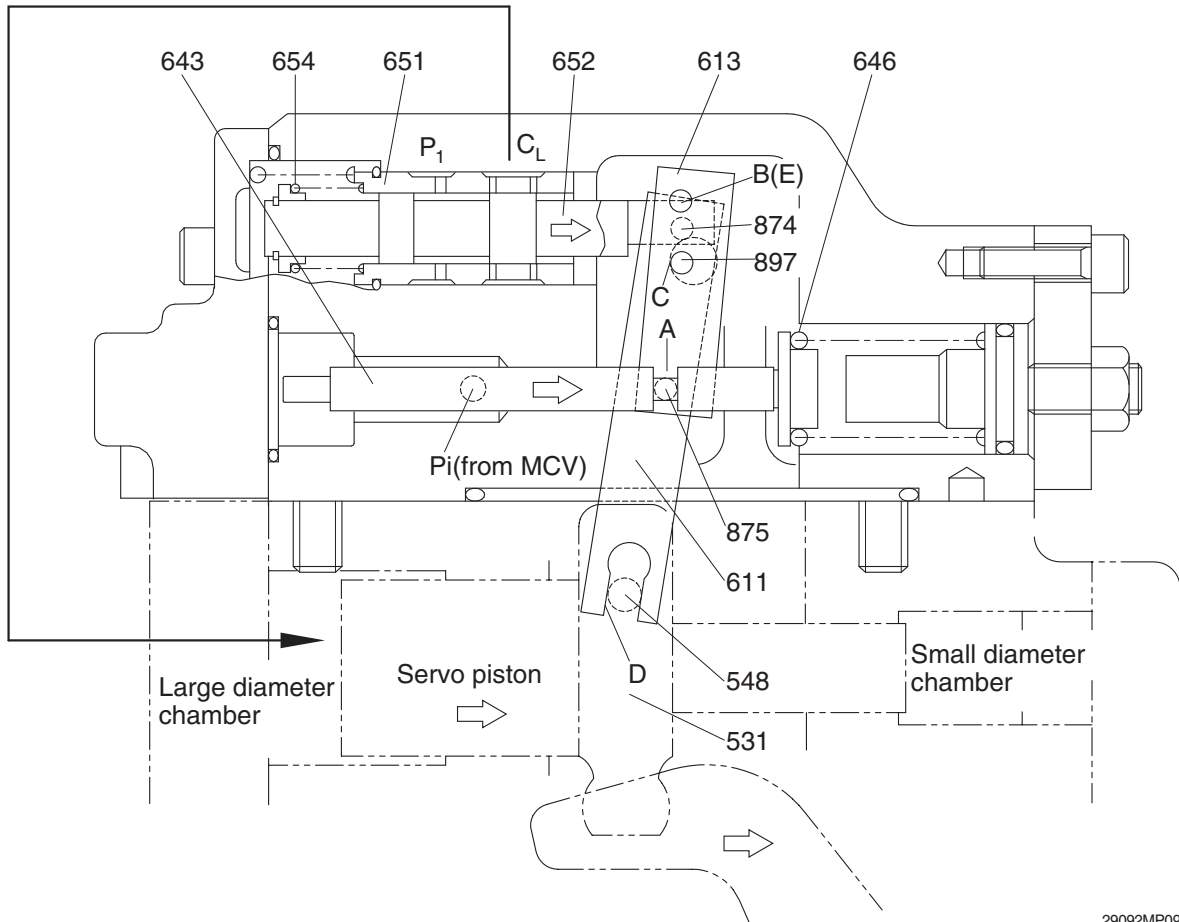
By changing the pilot pressure P_i , the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

This regulator is of the negative flow control in which the delivery flow Q decreases as the pilot pressure P_i rises.

With this mechanism, when the pilot pressure corresponding to the flow required for the work is commanded, the pump discharges the required flow only, and so it does not consume the power uselessly.



① Flow reducing function



29092MP09A

As the pilot pressure P_i rises, the pilot piston (643) moves to the right to a position where the force of the pilot spring (646) balances with the hydraulic force.

The groove (A) in the pilot piston is fitted with the pin (875) that is fixed to lever 2 (613). Therefore, when the pilot piston moves, lever 2 rotates around the fulcrum of point B [Fixed by the fulcrum plug (614) and pin (875)]. Since the large hole section (C) of lever 2 contains a protruding pin (897) fixed to the feedback lever (611), the pin (897) moves to the right as lever 2 rotates. Since the opposing-flat section (D) of the feedback lever is fitted with the pin (548) fixed by the tilting pin (531) that swings the swash plate, the feedback lever rotates around the fulcrum of point D, as the pin (897) moves.

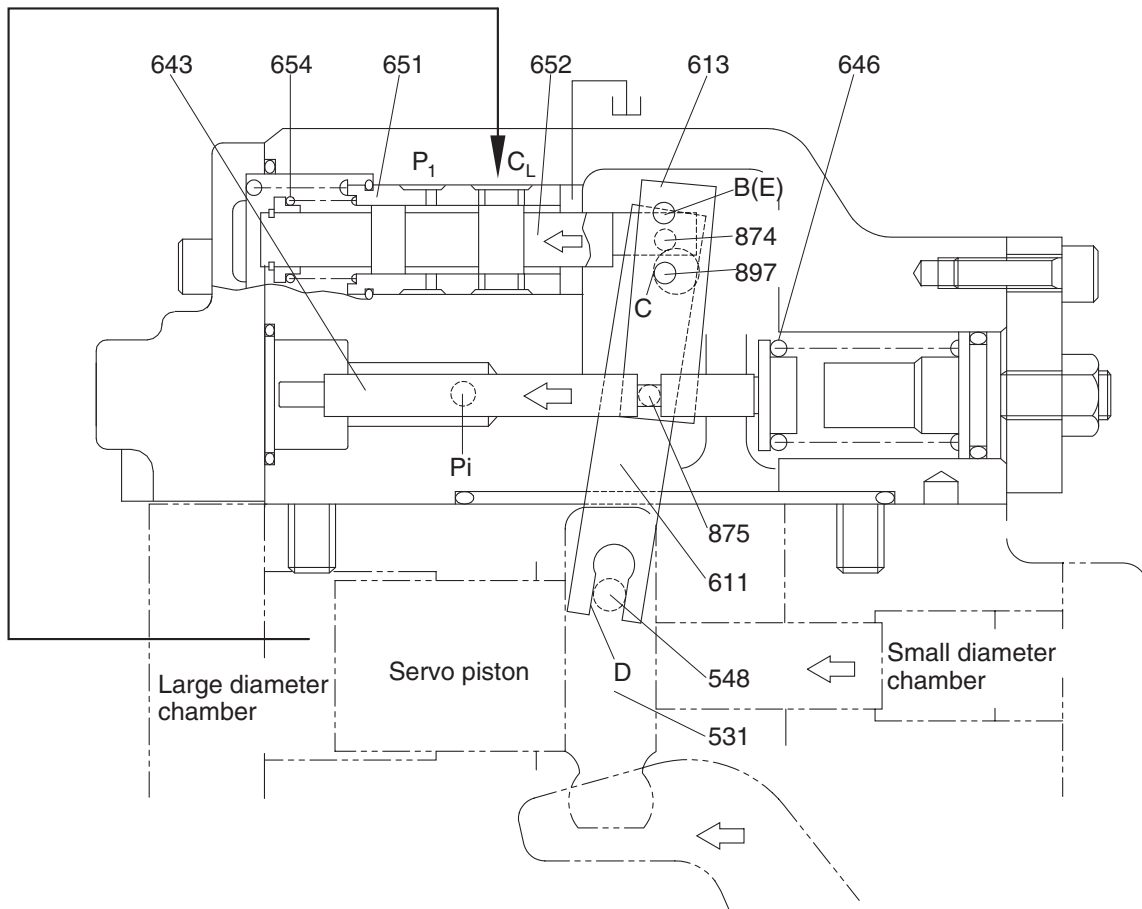
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

The movement of the spool causes the delivery pressure P_1 to connect to port CL through the spool and to be admitted to the large diameter section of the servo piston. The delivery pressure P_1 that is constantly admitted to the small diameter section of the servo piston moves the servo piston to the right due to the area difference, resulting in decrease of the tilting angle.

When the servo piston moves to the right, point D also moves to the right. The spool is fitted with the return spring (654) and is tensioned to the left at all times, and so the pin (897) is pressed against the large hole section (C) of lever 2.

Therefore, as point D moves, the feedback lever rotates around the fulcrum of point C, and the spool is shifted to the left. This causes the opening between the sleeve (651) and spool (652) to close slowly, and the servo piston comes to a complete stop when it closes completely.

② Flow increasing function



29092MP10

As the pilot pressure P_i decreases, the pilot piston (643) moves to the left by the action of the pilot spring (646) and causes lever 2 (613) to rotate around the fulcrum of point B. Since the pin (897) is pressed against the large hole section (C) of lever 2 by the action of the return spring (654) via the spool (652), pin (874), and feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 2 rotates, and shifts the spool to the left. Port CL opens a way to the tank port as the spool moves. This deprives the large diameter section of the servo piston of pressure, and shifts the servo piston to the left by the discharge pressure P_1 in the small diameter section, resulting in an increase in the flow rate.

As the servo piston moves, point D also moves to the left, the feedback lever rotates around the fulcrum of point C, and the spool moves to the right till the opening between the spool and sleeve is closed.

③ **Adjustment of flow control characteristic**

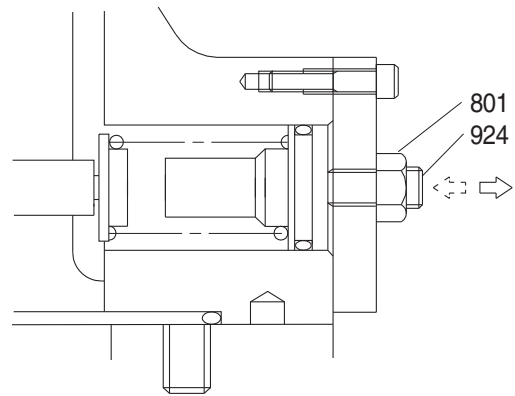
The flow control characteristic can be adjusted with the adjusting screw.

Adjust it by loosening the hexagon nut (801) and by tightening (or loosening) the hexagonal socket head screw (924).

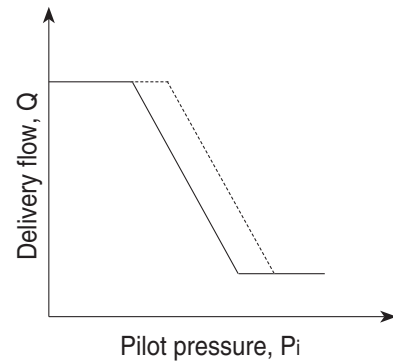
Tightening the screw shifts the control chart to the right as shown in the figure.

※ **Adjusting values are shown in table.**

Speed	Adjustment of flow control characteristic		
	Tightening amount of adjusting screw (924)	Flow control starting pressure change amount	Flow change amount
(min ⁻¹)	(Turn)	(kgf/cm ²)	(l /min)
1800	+1/4	+0.7	+14.6



2-12



(2) Total horsepower control

The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.

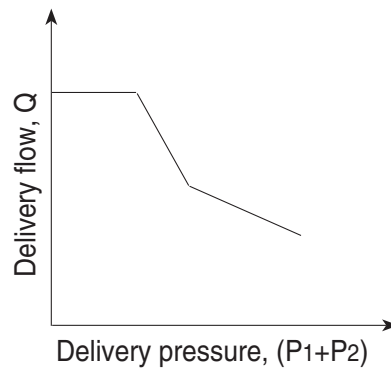
(The input horsepower is constant when the speed is constant.)

Since the regulator is of the simultaneous total horsepower type that operates by the sum of load pressures of the two pumps in the tandem double-pump system, the prime mover is automatically prevented from being overloaded, irrespective of the load condition of the two pumps, when horsepower control is under way.

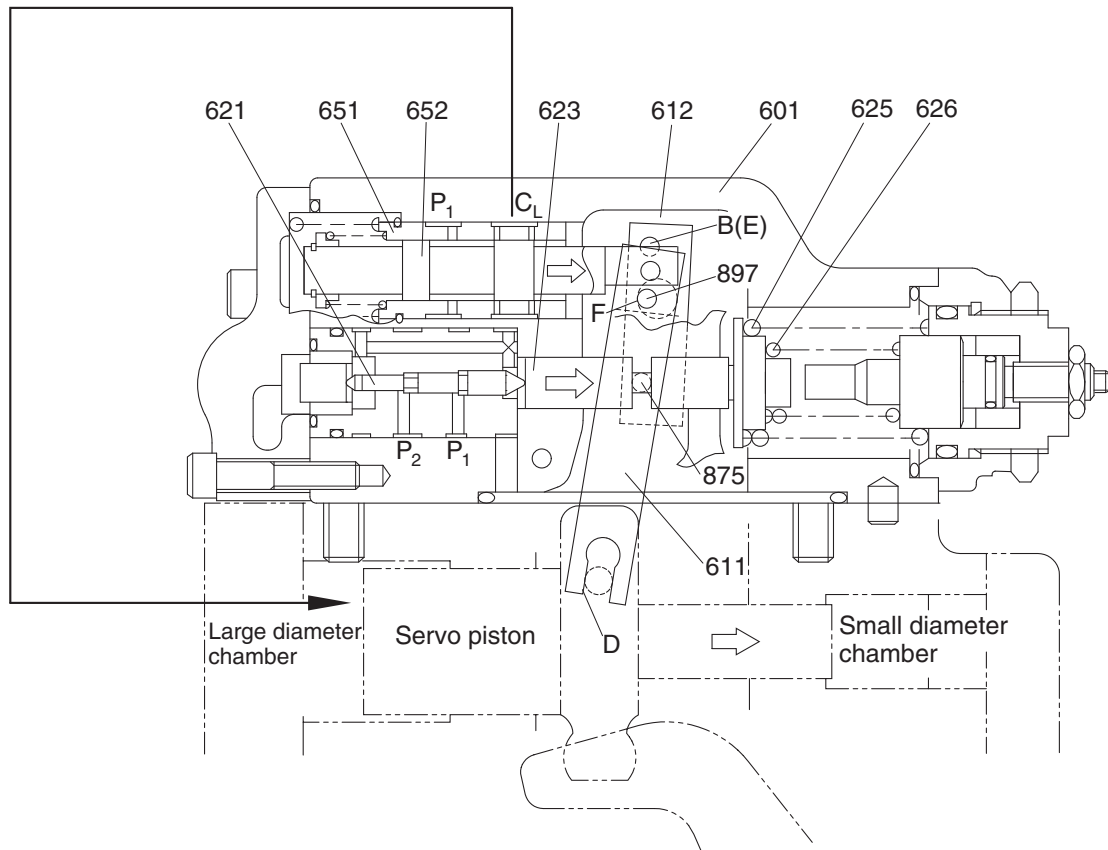
Since this regulator is of the simultaneous total horsepower type, it controls the tilting angles (displacement volumes) of the two pumps to the same value as represented by the following equation :

$$\begin{aligned} T_{in} &= P1 \times q / 2 \pi + P2 \times q / 2 \pi \\ &= (P1+P2) \times q / 2 \pi \end{aligned}$$

The horsepower control function is the same as the flow control function and is summarized in the following. (for detailed behaviors of respective parts, refer to the section of flow control).



① Overload preventive function



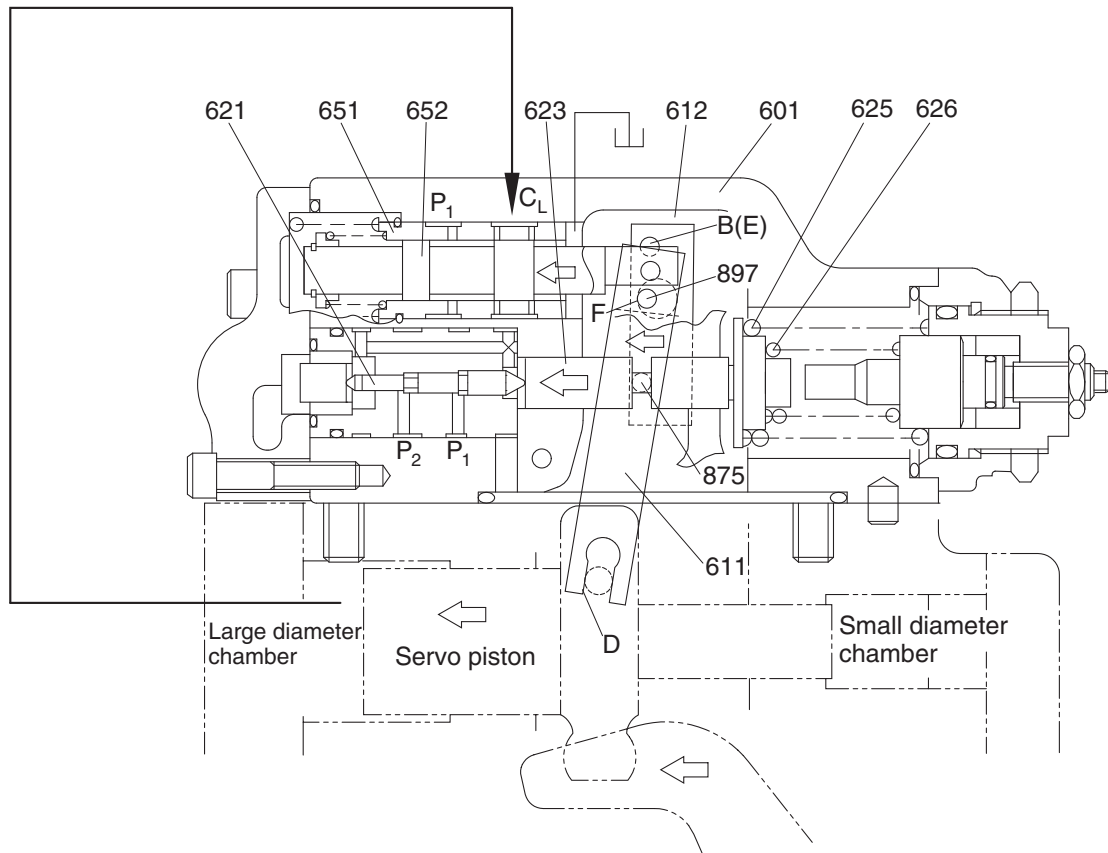
29092MP11

When the self pump delivery pressure P_1 or the companion pump delivery pressure P_2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force. The movement of the compensating rod is transmitted to lever 1 (612) via pin (875).

Lever 1 rotates around the pin (875) (E) fixed to the casing (601).

Since the large hole section (F) of lever 1 contains a protruding pin (897) fixed to the feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 1 rotates, and then the spool (652) is shifted to the right. As the spool moves, the delivery pressure P_1 is admitted to the large diameter section of the servo piston via port CL, causes the servo piston move to the right, reduces the pump delivery, flow rate, and prevents the prime mover from being overloaded. The movement of the servo piston is transmitted to the feedback lever via point D. Then the feedback lever rotates around the fulcrum of point F and the spool is shifted to the left. The spool moves till the opening between the spool (652) and sleeve (651) is closed.

② Flow reset function



29092MP12

As the self pump delivery pressure P_1 or the companion pump delivery pressure P_2 decreases, the compensating rod (623) is pushed back by the action of the springs (625 & 626) to rotate lever 1 (612) around point E. Rotating of lever 1 (612) causes the feedback lever (611) to rotate around the fulcrum of point D and then the spool (652) to move to the left. As a result, port CL opens a way to the tank port.

This causes the servo piston to move to the left and the pump's delivery rate to increase.

The movement of the servo piston is transmitted to the spool by the action of the feedback mechanism to move it till the opening between the spool and sleeve is closed.

③ **Low tilting angle (low flow) command preferential function**

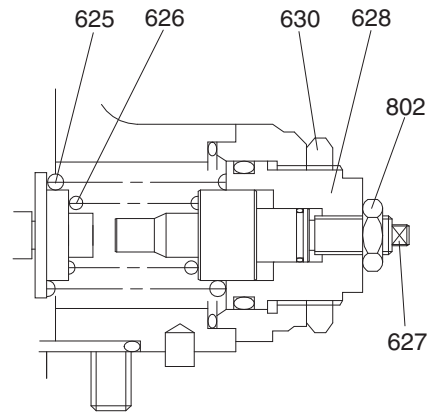
As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins (Ø4) protruding from the large hole (Ø8), only the lever lessening the tilting angle contacts the pin (897); the hole (Ø8) in the lever of a larger tilting angle command is freed without contacting the pin (897). Such a mechanical selection method permits preference of the lower tilting angle command of the flow control and horsepower control.

④ **Adjustment of input horsepower**

Since the regulator is of total cumulative horsepower type, adjust the adjusting screws of both the front and rear pumps, when changing the horsepower set values. The pressure change values by adjustment are based on two pumps pressurized at the same time, and the values will be doubled when only one pump is loaded.

a. **Adjustment of outer spring**

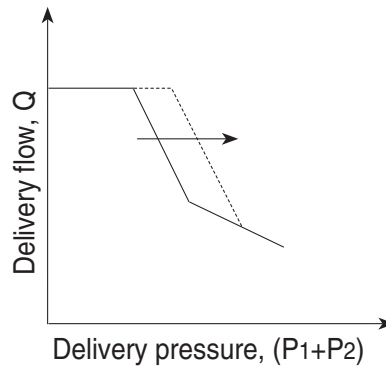
Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner spring (626), return the adjusting screw QI (627) by $N \times A$ turns at first. ($A=1.59$)



※ **Adjusting values are shown in table.**

Speed	Adjustment of outer spring		
	Tightening amount of adjusting screw (C) (628)	Compensating control starting pressure change amount	Input torque change amount
(min ⁻¹)	(Turn)	(kgf/cm ²)	(kgf · m)
1800	+1/4	+19	+5.6

8007A2MP03



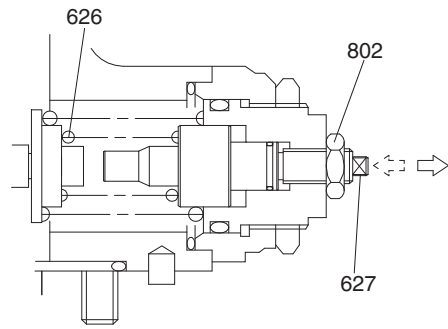
b. Adjustment of inner spring

Adjust it by loosening the hexagon nut (802) and by tightening (or loosening) the adjusting screw QI (627).

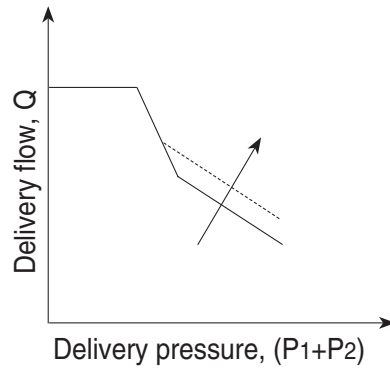
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ Adjusting valves are shown in table.

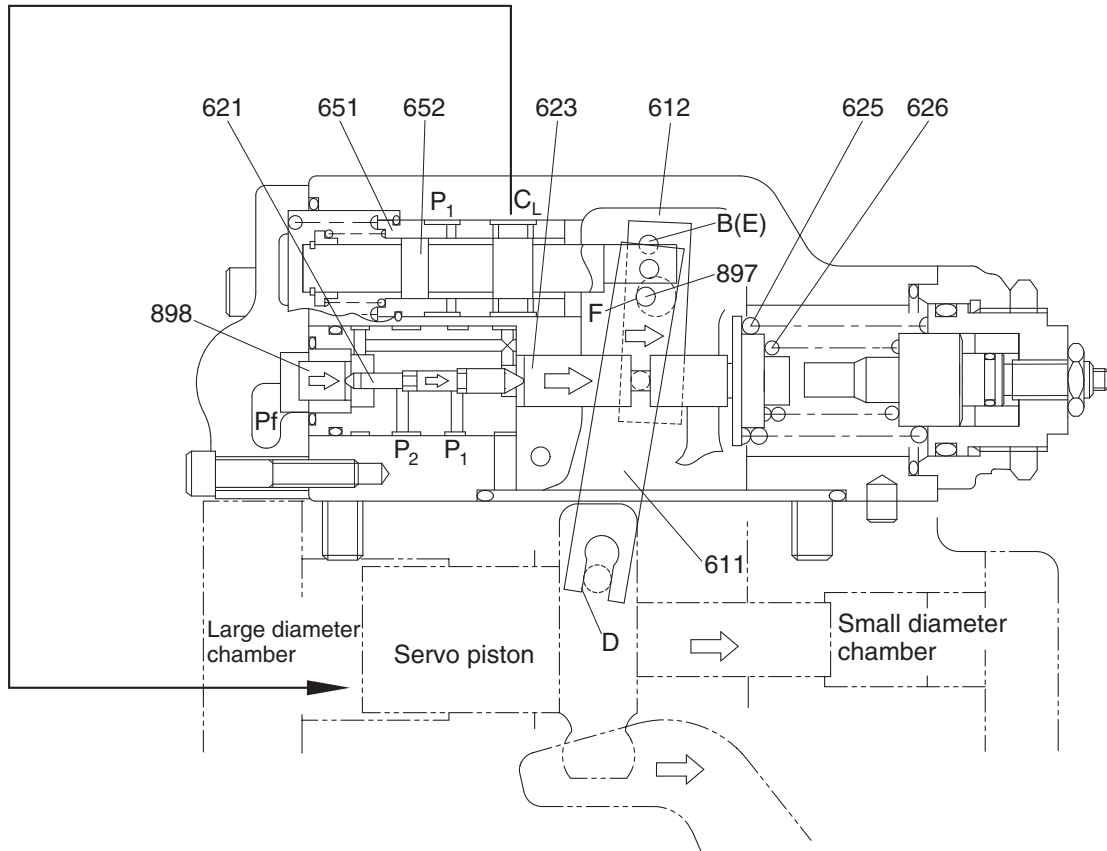
Speed	Adjustment of inner spring		
	Tightening amount of adjusting screw (QI) (627)	Flow change amount	Input torque change amount
(min ⁻¹)	(Turn)	(kgf/cm ²)	(kgf · m)
1800	+1/4	+12.6	+5.7



8007A2MP04



(3) Power shift control



29092MP13

The set horsepower valve is shifted by varying the command current level of the proportional pressure reducing valve attached to the pump. Only one proportional pressure reducing valve is provided.

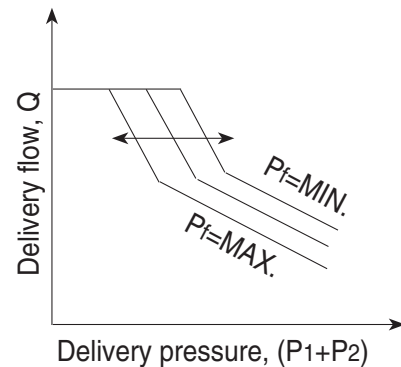
However, the secondary pressure P_f (power shift pressure) is admitted to the horsepower control section of each pump regulator through the pump's internal path to shift it to the same set horsepower level.

This function permits arbitrary setting of the pump output power, thereby providing the optimum power level according to the operating condition.

The power shift pressure P_f controls the set horsepower of the pump to a desired level, as shown in the figure.

As the power shift pressure P_f rises, the compensating rod (623) moves to the right via the pin (898) and compensating piston (621).

This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure P_f falls.



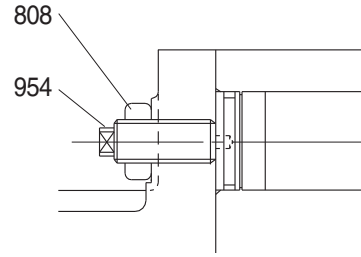
(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

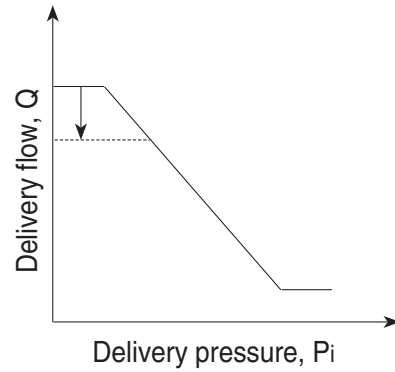
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

The maximum flow only is adjusted without changing other control characteristics.

Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min ⁻¹)	(Turn)	(ℓ/min)
1800	+1/4	-5.6



2-19(1)

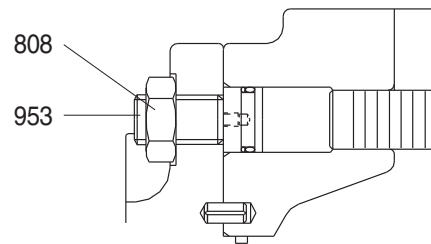


② Adjustment of minimum flow

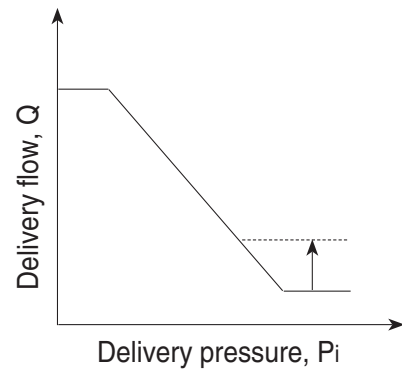
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

However, remember that, if tightened too much, the required horsepower during the maximum delivery pressure (or during relieving) may increase.

Speed	Adjustment of min flow	
	Tightening amount of adjusting screw (953)	Flow change amount
(min ⁻¹)	(Turn)	(ℓ/min)
1800	+1/4	+4.5

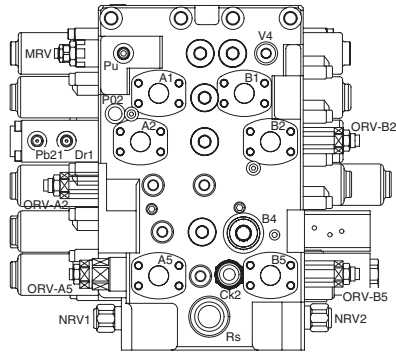


2-19(2)

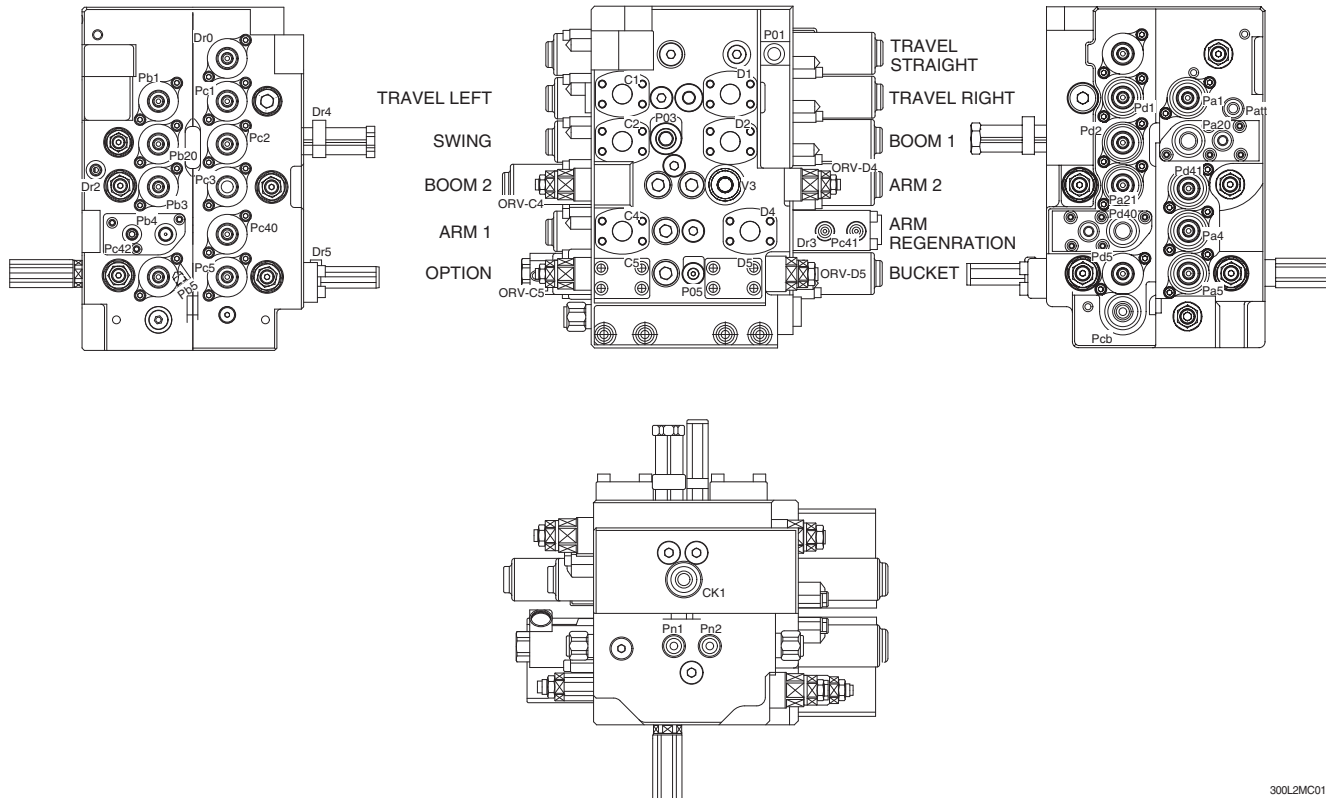
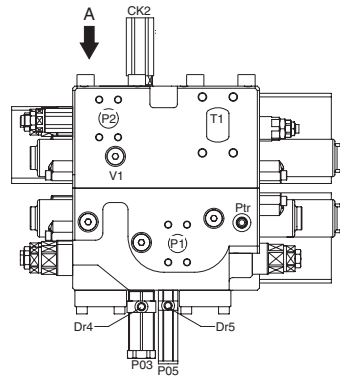


GROUP 2 MAIN CONTROL VALVE (TYPE 1)

1. STRUCTURE



VIEW A

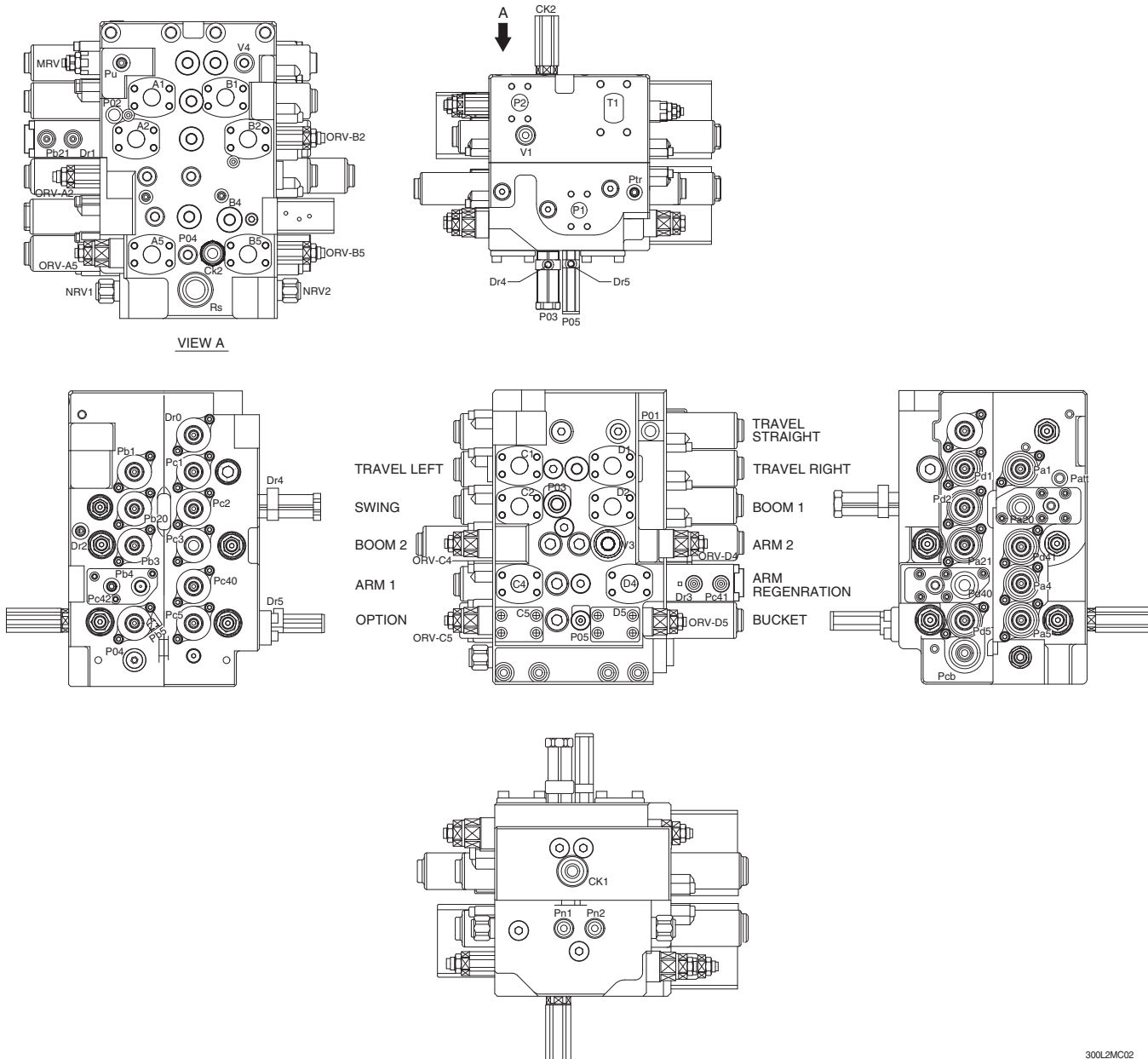


Mark	Port name	Port size	Tightening torque
Rs V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Ck1 Ck2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

300L2MC01

MAIN CONTROL VALVE (TYPE 2)

1. STRUCTURE

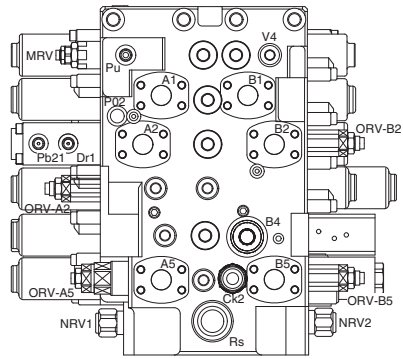


Mark	Port name	Port size	Tightening torque
R5 V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Pc42 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
CK1 CK2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

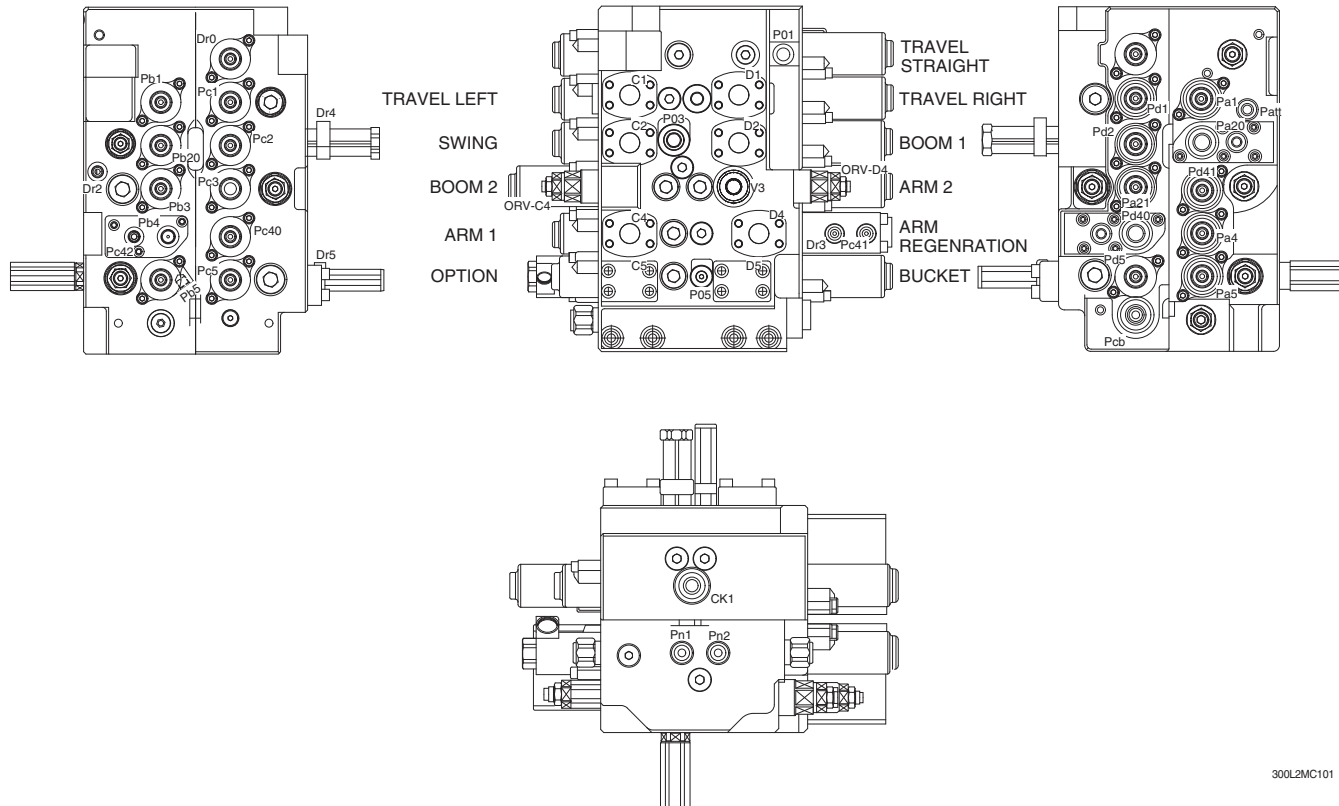
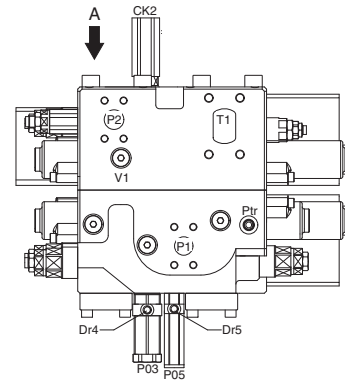
300L2MC02

MAIN CONTROL VALVE (TYPE 3)

1. STRUCTURE



VIEW A

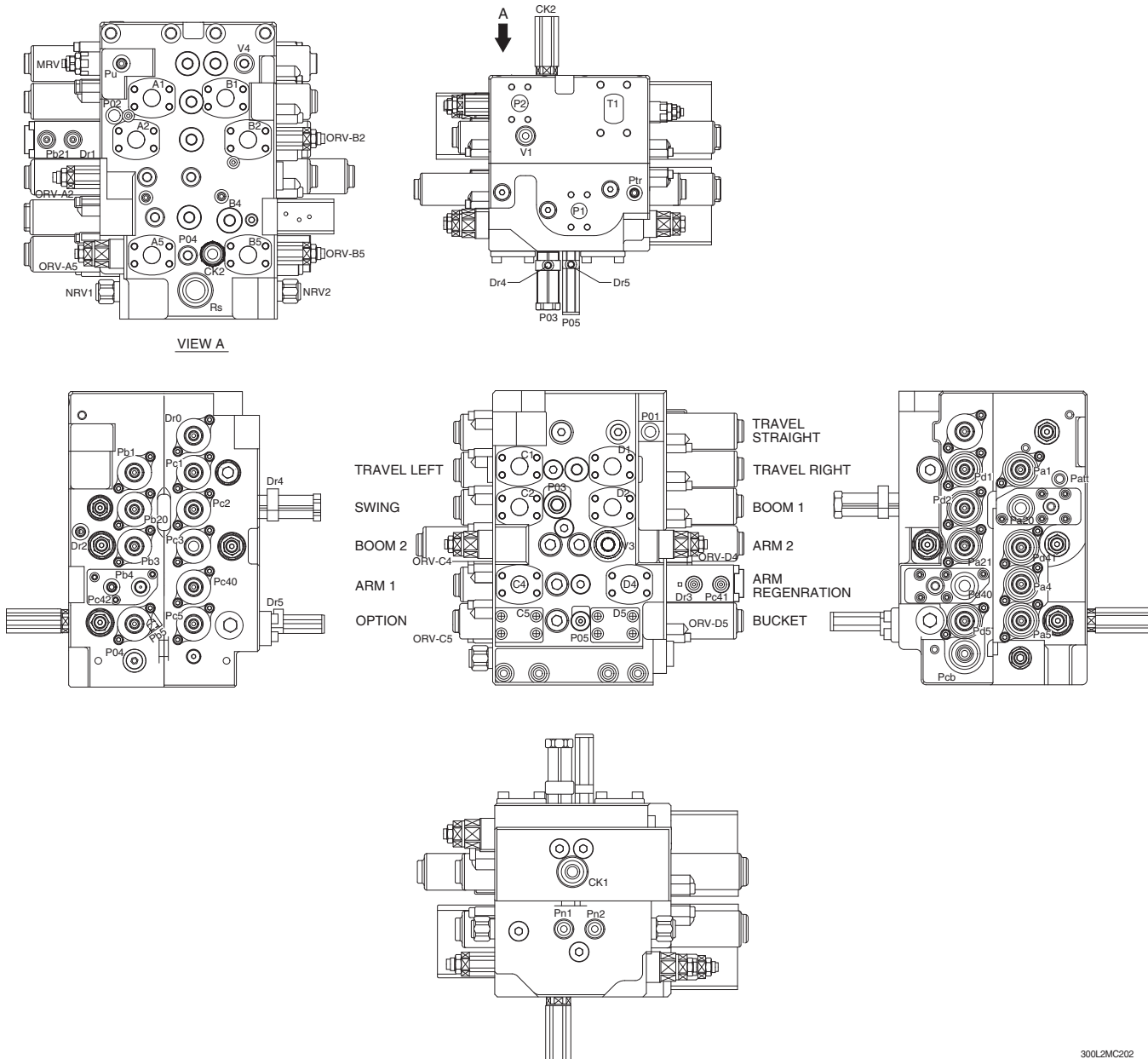


Mark	Port name	Port size	Tightening torque
Rs V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Pc42 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
CK1 CK2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

300L2MC101

MAIN CONTROL VALVE (TYPE 4)

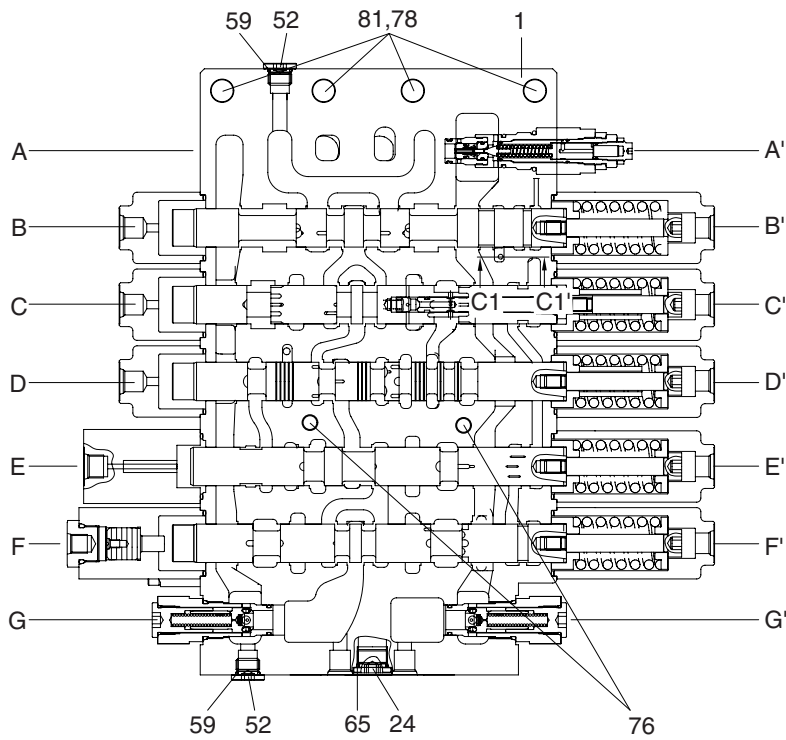
1. STRUCTURE



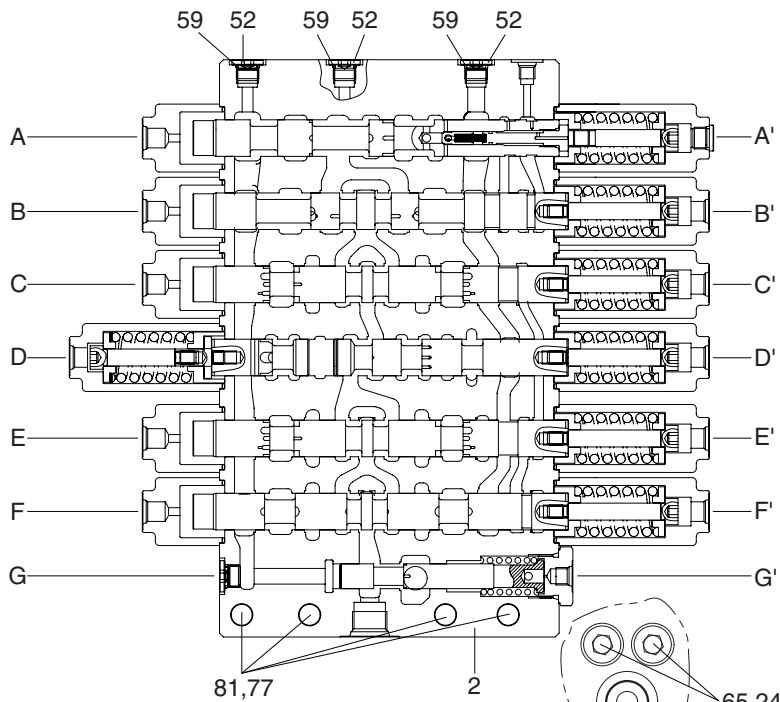
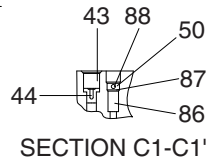
Mark	Port name	Port size	Tightening torque
Rs V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
CK1 CK2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

300L2MC202

· MCV TYPE 1



P1 BLOCK SPOOL SECTION

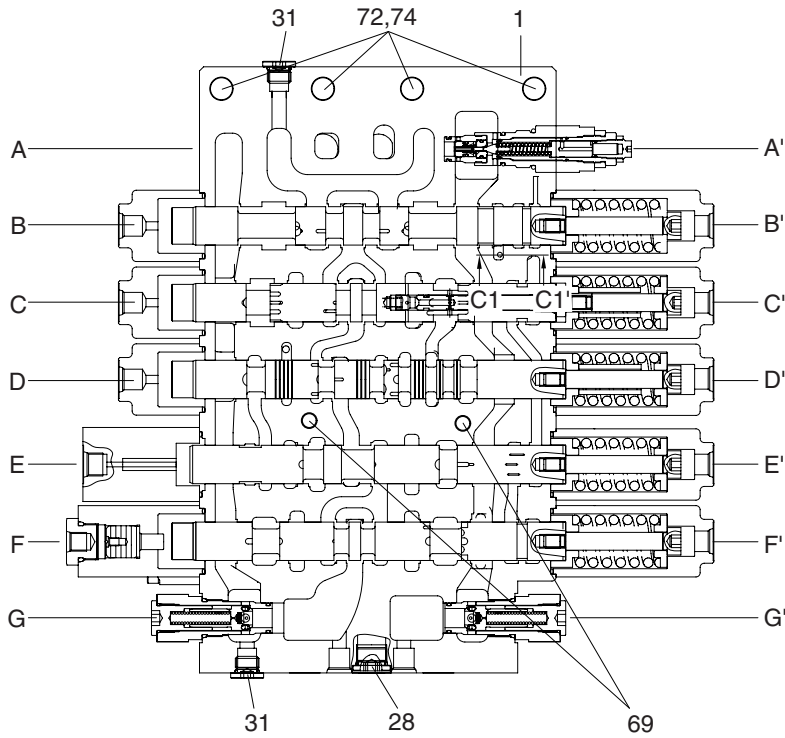


P2 BLOCK SPOOL SECTION

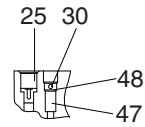
- 1 Housing (P1)
- 2 Housing (P2)
- 24 Plug
- 43 Orifice-signal
- 44 Coin type filter
- 50 O-ring
- 52 Plug
- 59 O-ring
- 65 O-ring
- 76 Hex socket head bolt
- 77 Hex socket head bolt
- 78 Hex socket head bolt
- 81 Spring washer
- 86 Poppet
- 87 Check spring
- 88 Plug

300L2MC10

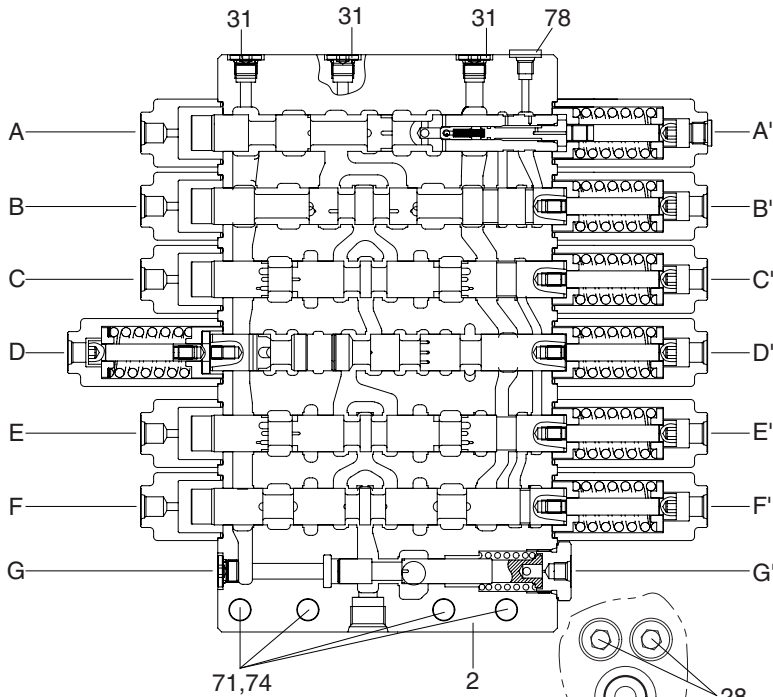
· MCV TYPE 2



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

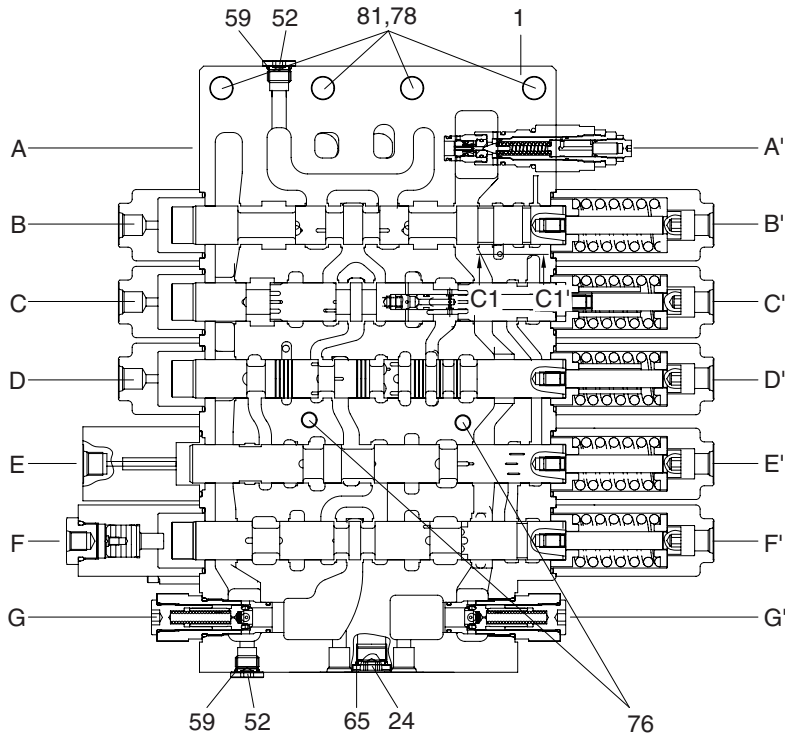


P2 BLOCK SPOOL SECTION

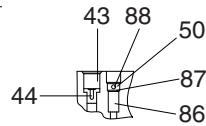
- 1 Housing (P1)
- 2 Housing (P2)
- 25 Orifice-signal
- 28 Plug
- 30 Plug
- 31 Plug
- 47 Poppet
- 48 Spring
- 69 Hex socket head bolt
- 71 Hex socket head bolt
- 72 Hex socket head bolt
- 74 Spring washer
- 78 Dust cap

300L2MC15

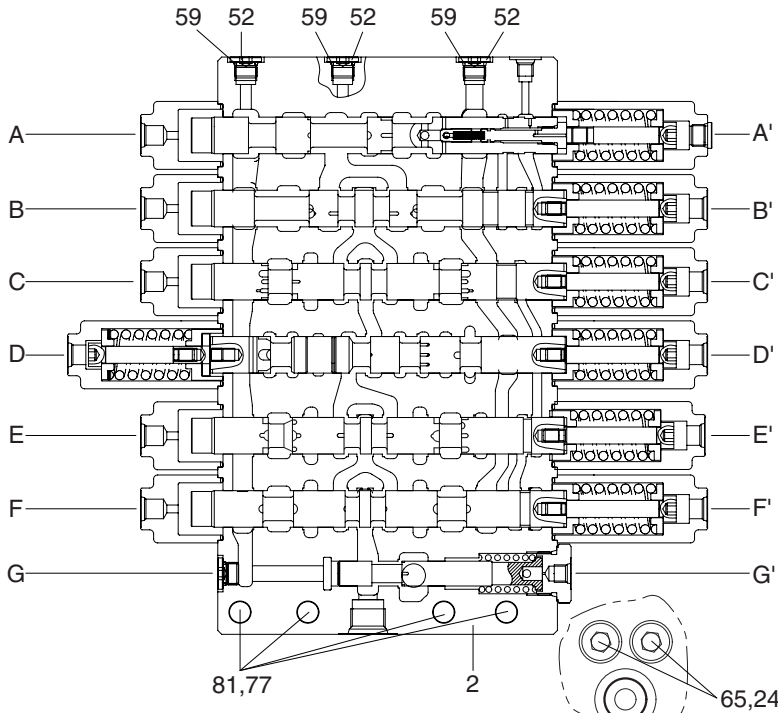
· MCV TYPE 3



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

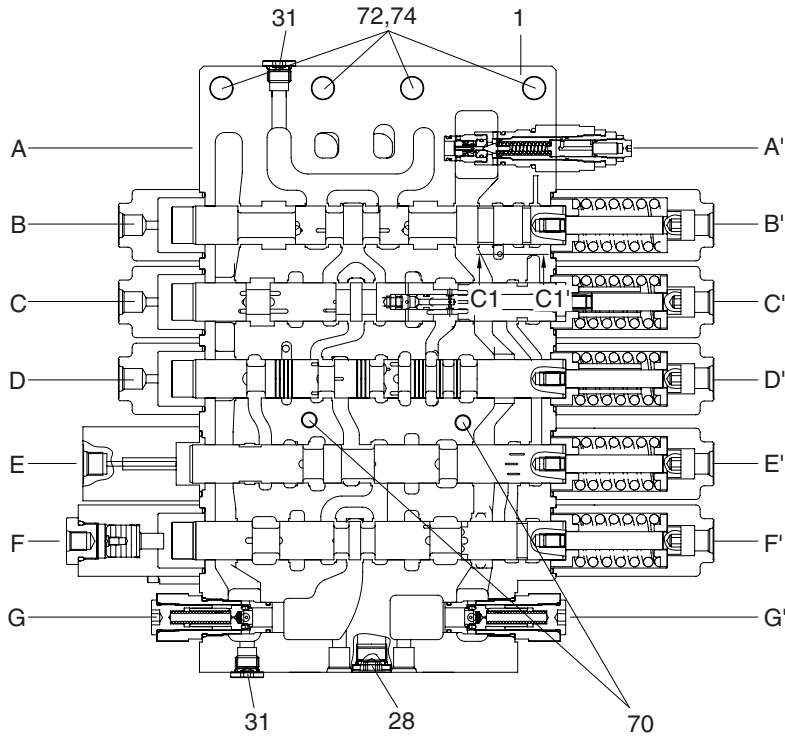


P2 BLOCK SPOOL SECTION

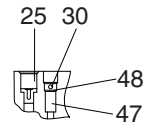
- 1 Housing (P1)
- 2 Housing (P2)
- 24 Plug
- 43 Orifice-signal
- 44 Coin type filter
- 50 O-ring
- 52 Plug
- 59 O-ring
- 65 O-ring
- 76 Hex socket head bolt
- 77 Hex socket head bolt
- 78 Hex socket head bolt
- 81 Spring washer
- 86 Poppet
- 87 Check spring
- 88 Plug

300L2MC110

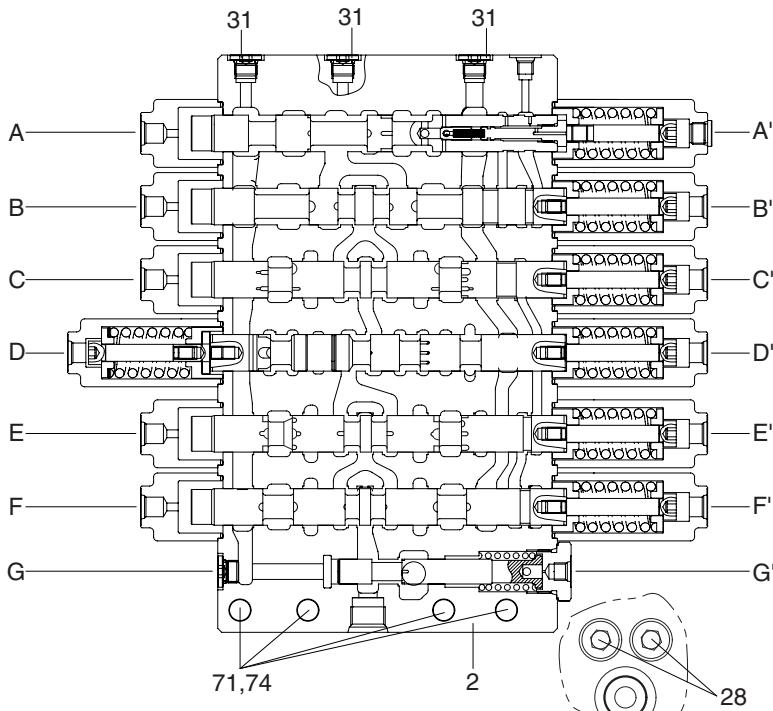
· MCV TYPE 4



P1 BLOCK SPOOL SECTION



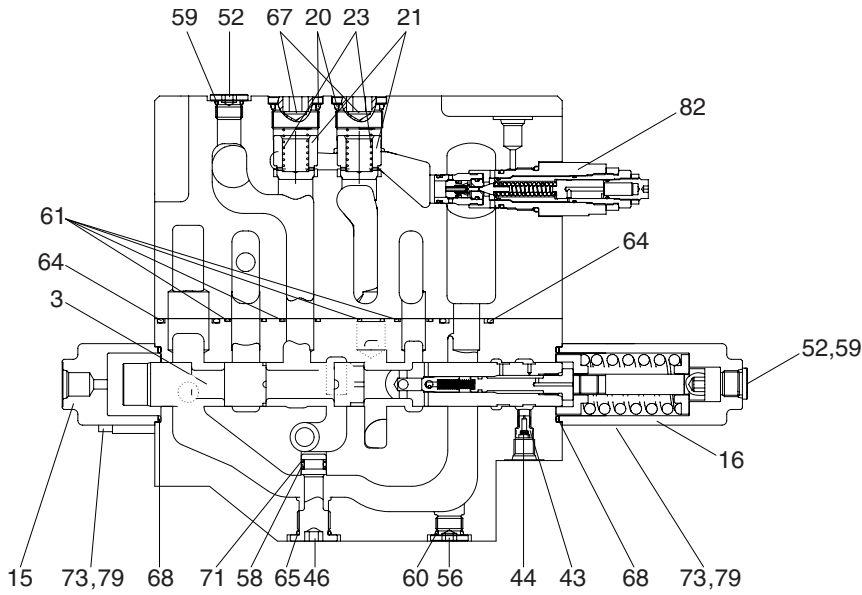
SECTION C1-C1'



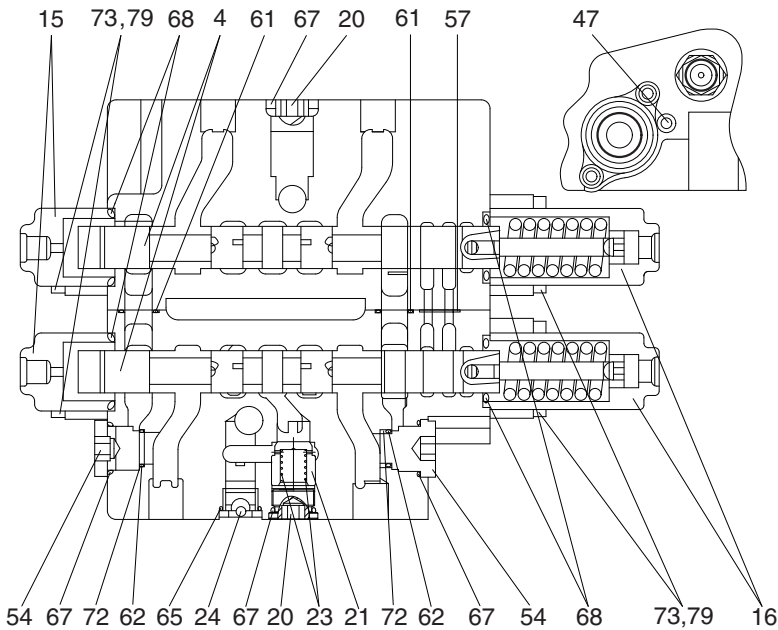
P2 BLOCK SPOOL SECTION

- 1 Housing (P1)
- 2 Housing (P2)
- 25 Orifice-signal
- 28 Plug
- 30 Plug
- 31 Plug
- 47 Poppet-signal
- 48 Spring-signal
- 70 Hex socket head bolt
- 71 Hex socket head bolt
- 72 Hex socket head bolt
- 74 Spring washer

· MCV TYPE 1



A-A' (STRAIGHT-TRAVEL & SUPPLY)

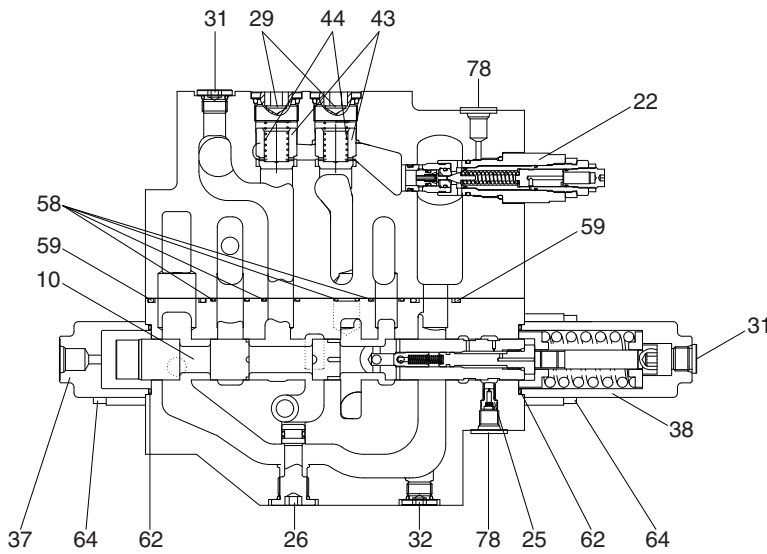


B-B' (TRAVEL RIGHT & LEFT)

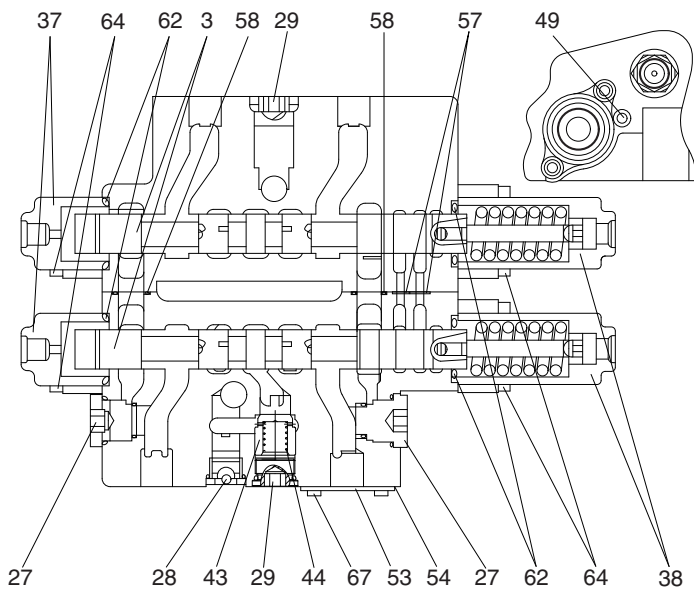
- 3 Spool-straight
- 4 Spool-travel
- 15 Cover A-pilot
- 16 Cover B1-pilot
- 20 Plug
- 21 Poppet 1-check valve
- 23 Spring 1-check valve
- 24 Plug
- 43 Orifice-signal
- 44 Coin type filter
- 46 Plug
- 47 Plug
- 52 Plug
- 54 Plug
- 56 Plug
- 57 O-ring
- 58 O-ring
- 59 O-ring
- 60 O-ring
- 61 O-ring
- 62 O-ring
- 64 O-ring
- 65 O-ring
- 67 O-ring
- 68 O-ring
- 71 Back-up ring
- 72 Back-up ring
- 73 Hex socket head bolt
- 79 Washer
- 82 Main relief valve

300L2MC111

· MCV TYPE 2



A-A' (STRAIGHT-TRAVEL & SUPPLY)

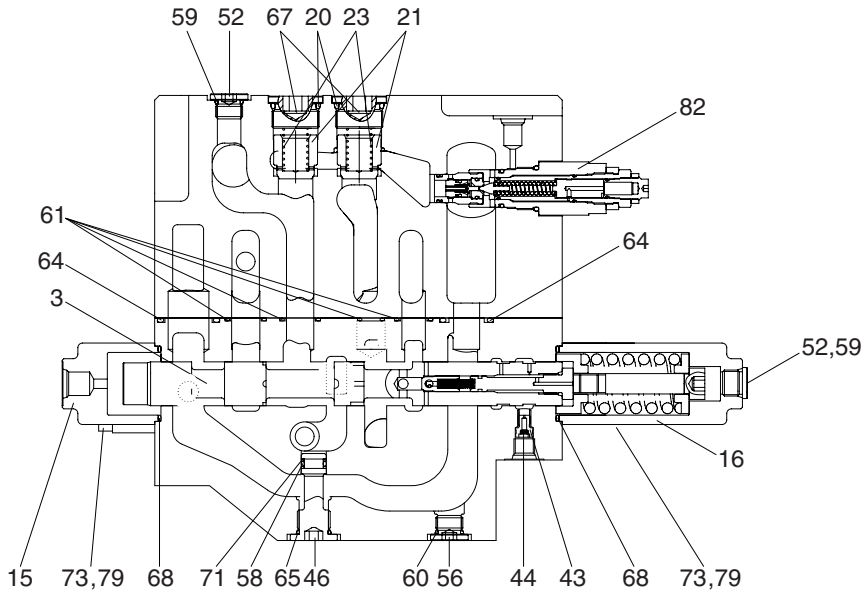


B-B' (TRAVEL RIGHT & LEFT)

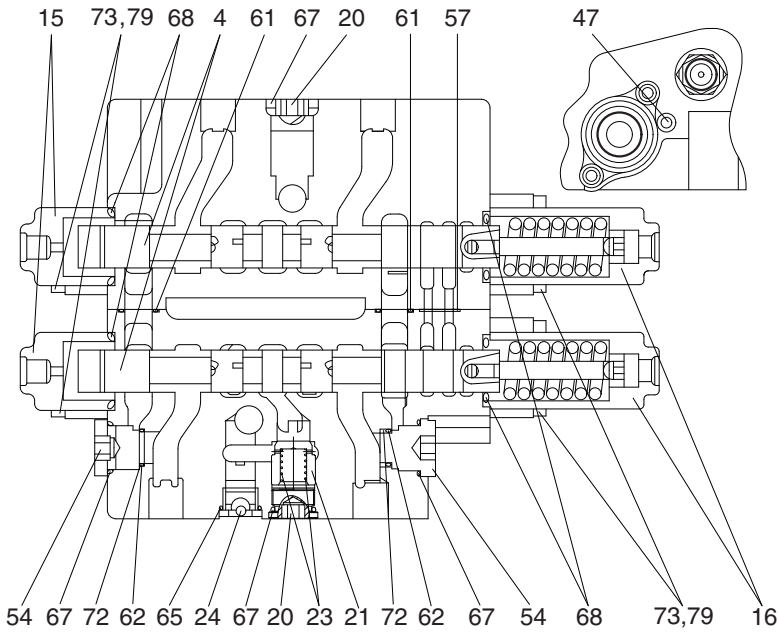
- 3 Spool-travel
- 10 Spool-straight
- 22 Main relief valve
- 25 Orifice-signal
- 26 Parallel block plug
- 27 Plug
- 28 Plug
- 29 Plug
- 31 Plug
- 32 Plug
- 37 Cover A-pilot
- 38 Cover B1-pilot
- 43 Poppet 1-check valve
- 44 Spring 1-check valve
- 49 Plug
- 53 Cover 1
- 54 Gasket 1
- 57 O-ring
- 58 O-ring
- 59 O-ring
- 62 O-ring
- 64 Hex socket head bolt
- 67 Hex socket head bolt
- 78 Dust cap

300L2MC116

· MCV TYPE 3



A-A' (STRAIGHT-TRAVEL & SUPPLY)

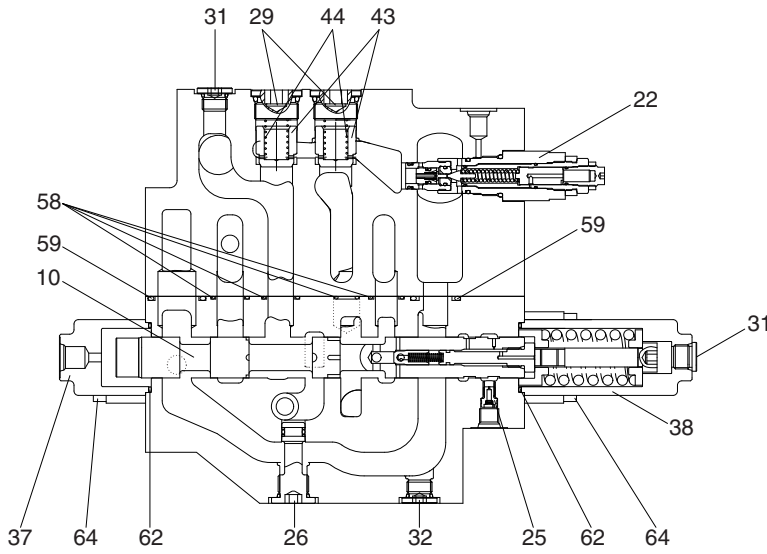


B-B' (TRAVEL RIGHT & LEFT)

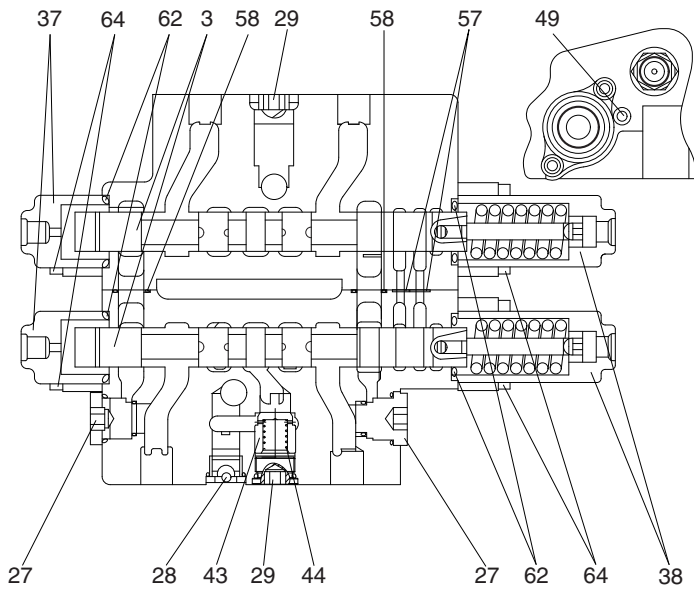
- 3 Spool-straight
- 4 Spool-travel
- 15 Cover A-pilot
- 16 Cover B1-pilot
- 20 Plug
- 21 Poppet 1-check valve
- 23 Spring 1-check valve
- 24 Plug
- 43 Orifice-signal
- 44 Coin type filter
- 46 Plug
- 47 Plug
- 52 Plug
- 54 Plug
- 56 Plug
- 57 O-ring
- 58 O-ring
- 59 O-ring
- 60 O-ring
- 61 O-ring
- 62 O-ring
- 64 O-ring
- 65 O-ring
- 67 O-ring
- 68 O-ring
- 71 Back-up ring
- 72 Back-up ring
- 73 Hex socket head bolt
- 79 Washer
- 82 Main relief valve

300L2MC111

· MCV TYPE 4



A-A' (STRAIGHT-TRAVEL & SUPPLY)

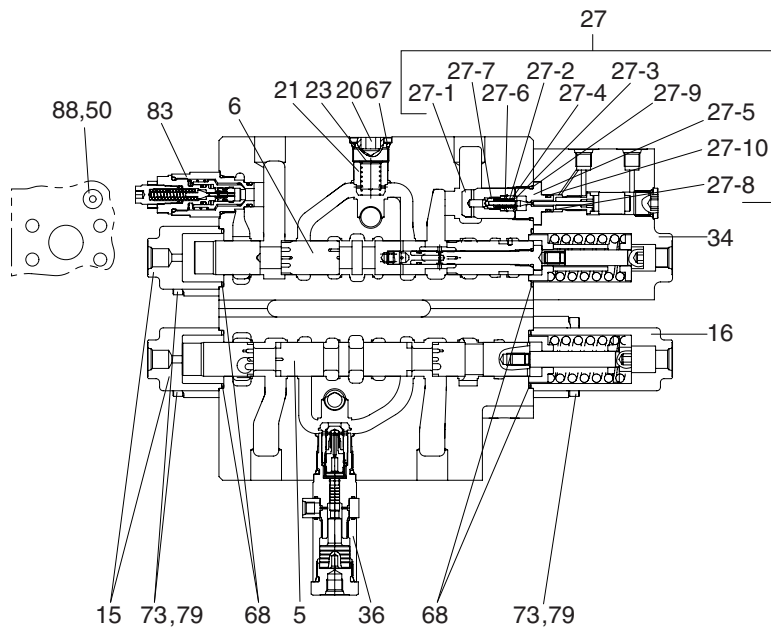


B-B' (TRAVEL RIGHT & LEFT)

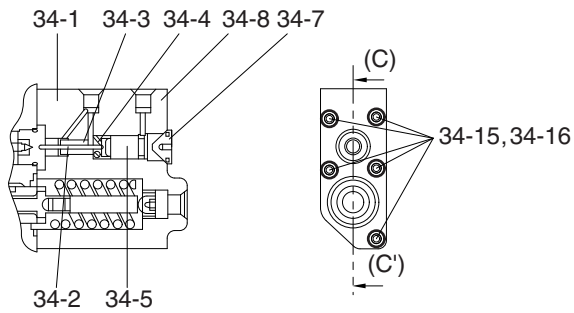
- 3 Spool-travel
- 10 Spool-straight travel
- 22 Main relief valve
- 25 Orifice-signal
- 26 Parallel block plug
- 27 ORV Plug
- 28 Plug
- 29 Plug
- 31 Plug
- 32 Plug
- 37 Cover A-pilot
- 38 Cover B1-pilot
- 43 Poppet 1-check valve
- 44 Spring 1-check valve
- 49 Plug
- 57 O-ring
- 58 O-ring
- 59 O-ring
- 62 O-ring
- 64 Hex socket head bolt

300L2MC216

· MCV TYPE 1



C-C' (SWING & BOOM 1)

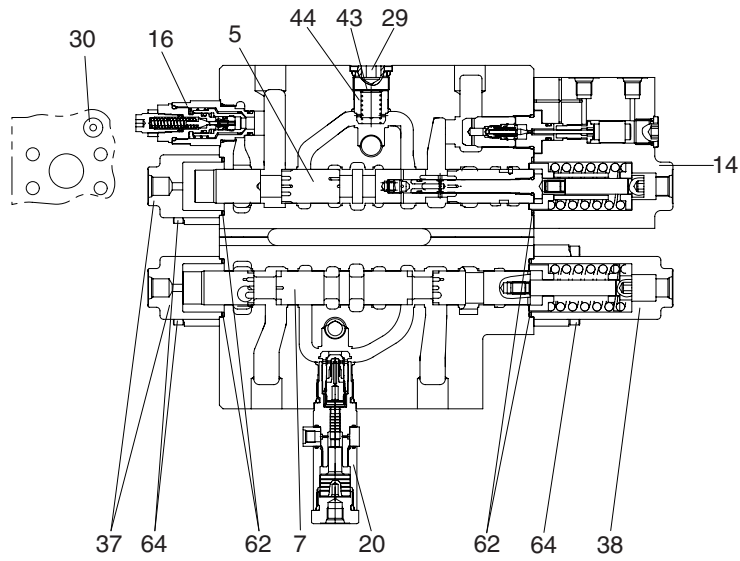


34 DETAIL (HOLDING ASSY)

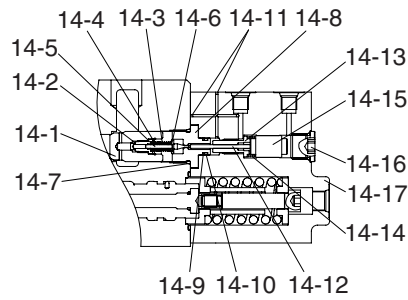
300L2MC12

5	Spool-swing	27-5	Poppet seat	34-7	Plug
6	Spool-boom	27-6	C-ring	34-8	Plug
15	Cover A-pilot	27-7	Restrictor-lock valve	34-15	Socket bolt
16	Cover B1-pilot	27-8	O-ring	34-16	Spring washer
20	Plug	27-9	O-ring	36	Logic valve
21	Poppet 1-check valve	27-10	Back up ring	50	O-ring
23	Spring 1-check valve	34	Holding kit A1	67	O-ring
27	Holding kit B	34-1	Block-holding P1	68	O-ring
27-1	Poppet	34-2	Piston 1-holding	73	Hex socket head bolt
27-2	Spring	34-3	Guide piston-holding	79	Washer
27-3	Poppet guide	34-4	Spring 1-lock valve	83	Overload relief valve
27-4	Pilot poppet	34-5	Piston 2-holding	88	Plug

· MCV TYPE 2



C-C' (SWING & BOOM 1)

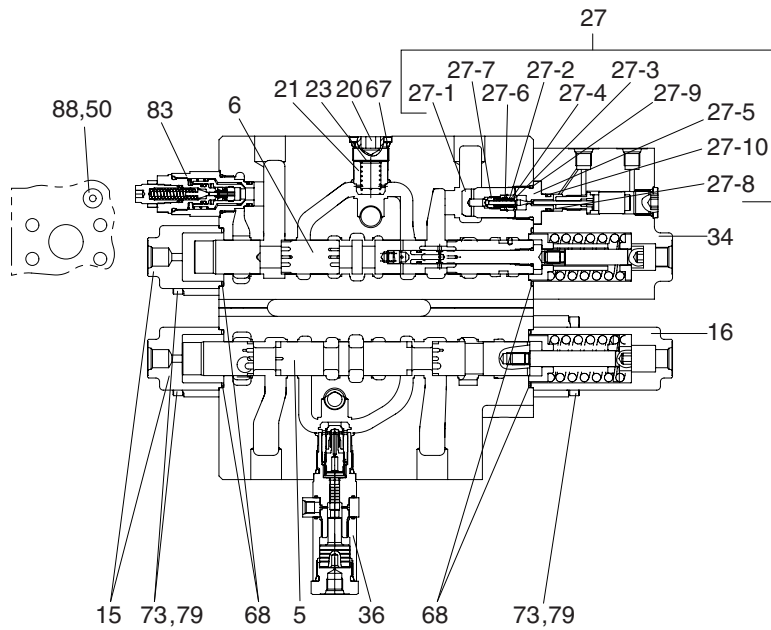


14 DETAIL (HOLDING VALVE ASSY)

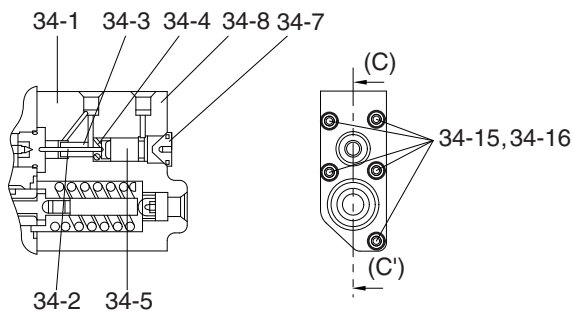
300L2MC17

- | | | |
|-----------------------|--------------------|--------------------------|
| 5 Spool-boom 1 | 14-8 Poppet seat | 16 Overload relief valve |
| 7 Spool-swing | 14-9 Back up ring | 20 Logic valve |
| 14 Holding valve assy | 14-10 O-ring | 29 Plug |
| 14-1 Poppet | 14-11 Plug | 30 Plug |
| 14-2 Restrictor | 14-12 Pilot piston | 37 Cover A-pilot |
| 14-3 Spring | 14-13 Piston guide | 38 Cover B1-pilot |
| 14-4 C-ring | 14-14 Spring | 43 Spring 1-check valve |
| 14-5 Pilot poppet | 14-15 Main piston | 44 Poppet 1-check valve |
| 14-6 Poppet guide | 14-16 Plug | 62 O-ring |
| 14-7 O-ring | 14-17 Block | 64 Hex socket head bolt |

· MCV TYPE 3



C-C' (SWING & BOOM 1)

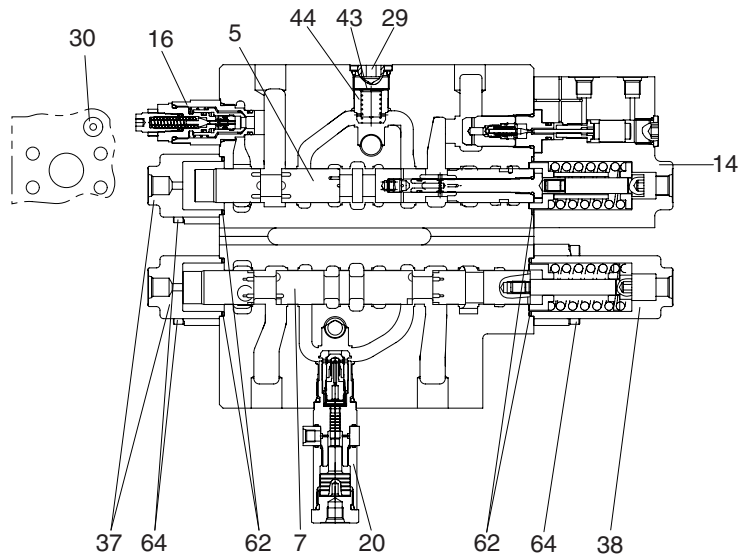


34 DETAIL (HOLDING ASSY)

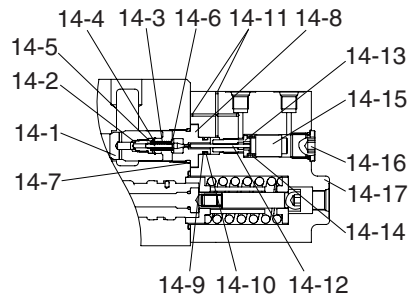
300L2MC112

5	Spool-swing	27-5	Poppet seat	34-7	Plug
6	Spool-boom	27-6	C-ring	34-8	Plug
15	Cover A-pilot	27-7	Restrictor-lock valve	34-15	Socket bolt
16	Cover B1-pilot	27-8	O-ring	34-16	Spring washer
20	Plug	27-9	O-ring	36	Logic valve
21	Poppet 1-check valve	27-10	Back up ring	50	O-ring
23	Spring 1-check valve	34	Holding kit A1	67	O-ring
27	Holding kit B	34-1	Block-holding P1	68	O-ring
27-1	Poppet	34-2	Piston 1-holding	73	Hex socket head bolt
27-2	Spring	34-3	Guide piston-holding	79	Washer
27-3	Poppet guide	34-4	Spring 1-lock valve	83	Overload relief valve
27-4	Pilot poppet	34-5	Piston 2-holding	88	Plug

· MCV TYPE 4



C-C' (SWING & BOOM 1)

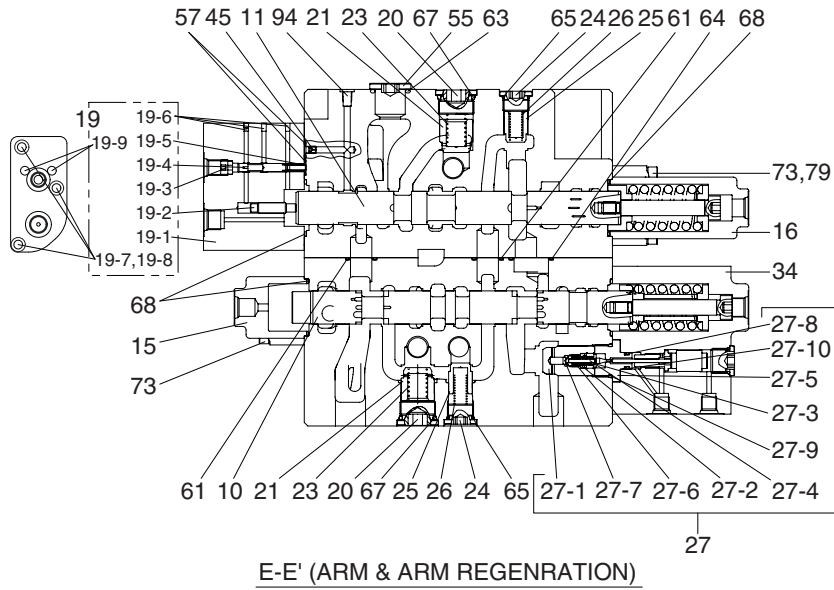


14 DETAIL (HOLDING VALVE ASSY)

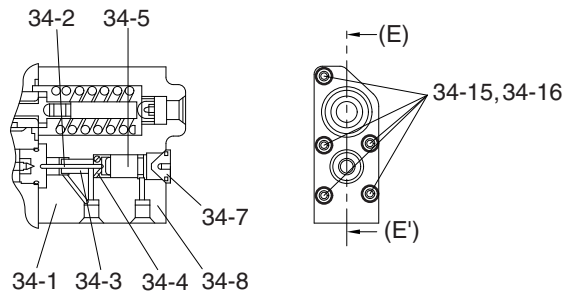
300L2MC217

- | | | | | | |
|------|--------------------|-------|--------------|----|-----------------------|
| 5 | Spool-boom 1 | 14-8 | Poppet seat | 16 | Overload relief valve |
| 7 | Spool-swing | 14-9 | Back up ring | 20 | Logic valve-swing |
| 14 | Holding valve assy | 14-10 | O-ring | 29 | Plug |
| 14-1 | Poppet-main | 14-11 | Plug | 30 | Plug |
| 14-2 | Restrictor | 14-12 | Pilot piston | 37 | Cover A-pilot |
| 14-3 | Spring-pilot | 14-13 | Piston guide | 38 | Cover B1-pilot |
| 14-4 | C-ring | 14-14 | Spring | 43 | Spring 1-check valve |
| 14-5 | Pilot poppet | 14-15 | Main piston | 44 | Poppet 1-check valve |
| 14-6 | Poppet guide | 14-16 | Plug | 62 | O-ring |
| 14-7 | O-ring | 14-17 | Block | 64 | Hex socket head bolt |

· MCV TYPE 1



E-E' (ARM & ARM REGENERATION)

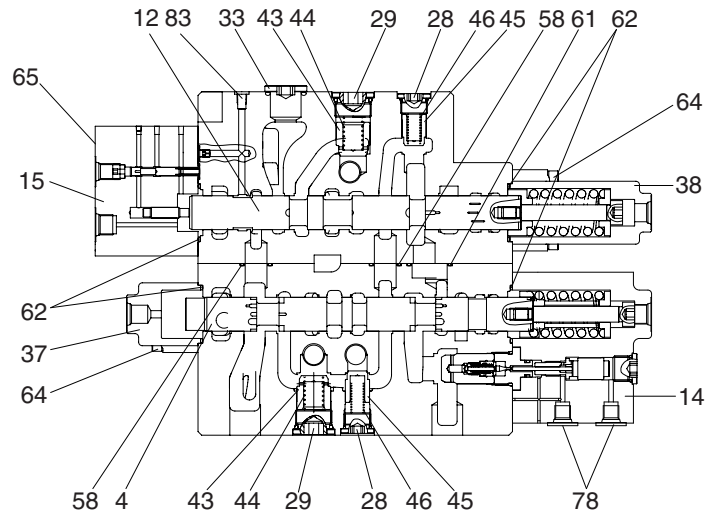


34 DETAIL (HOLDING ASSY)

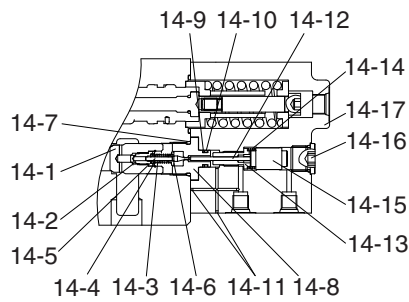
300L2MC13

10	Spool-arm 1	25	Poppet 2-check valve	34-5	Piston 2-holding
11	Spool-arm regeneration	26	Spring 2-check valve	34-7	Plug
15	Cover A-pilot	27	Poppet-lock valve	34-8	Plug
16	Cover B1-pilot	27-1	Poppet	34-15	Socket bolt
19	Arm-regeneration	27-2	Spring	34-16	Spring washer
19-1	Block-regeneration	27-3	Poppet guide	45	Orifice-plug
19-2	Piston-cut off	27-4	Pilot poppet	55	Plug
19-3	Stopper-regeneration	27-5	Poppet seat	57	O-ring
19-4	Spool-regeneration	27-6	C-ring	61	O-ring
19-5	Spring-regeneration	27-7	Restrictor-lock valve	63	O-ring
19-6	Plug	27-8	O-ring	64	O-ring
19-7	Socket bolt	27-9	O-ring	65	O-ring
19-8	Spring wahser	27-10	Back up ring	67	O-ring
19-9	Pin-regeneration	34	Holding kit A1	68	O-ring
20	Plug	34-1	Block-holding P1	73	Hex socket head bolt
21	Poppet 1-check valve	34-2	Piston 1-holding	79	Washer
23	Spring 1-check valve	34-3	Guide piston-holding	94	Plug
24	Plug	34-4	Spring 1-lock valve		

· MCV TYPE 2



E-E' (ARM & ARM REGENERATION)

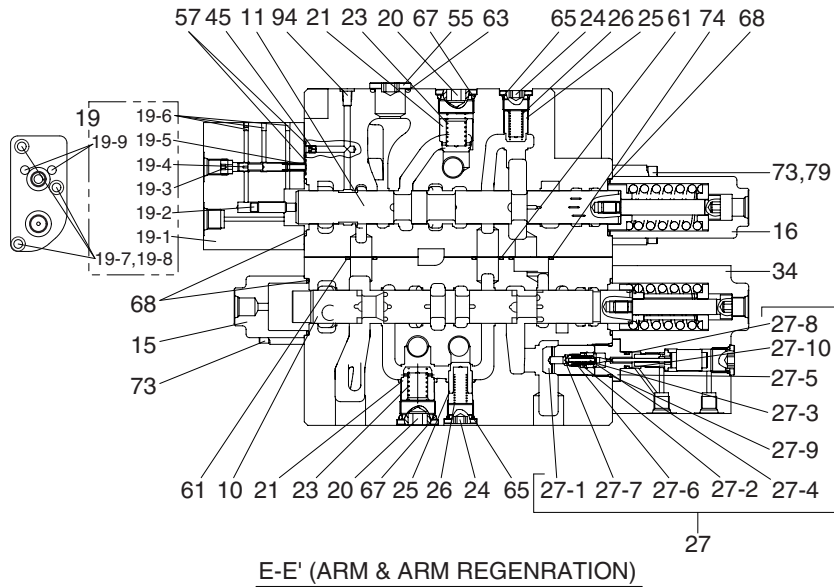


14 DETAIL (HOLDING VALVE ASSY)

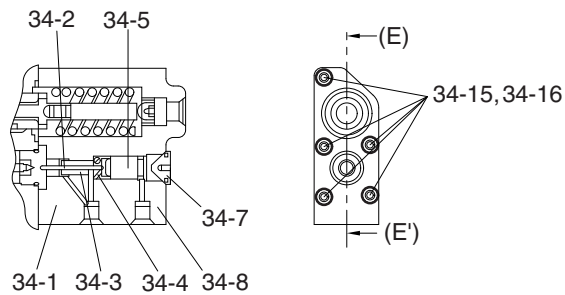
300L2MC18

4	Spool-arm 1	14-11	Plug	43	Poppet 1-check valve
12	Spool-arm regeneration	14-12	Pilot piston	44	Spring 1-check valve
14	Holding valve assy	14-13	Piston guide	45	Poppet 2-check valve
14-1	Poppet	14-14	Spring	46	Spring 2-check valve
14-2	Restrictor	14-15	Main piston	58	O-ring
14-3	Spring	14-16	Plug	61	O-ring
14-4	C-ring	14-17	Block	62	O-ring
14-5	Pilot poppet	15	Arm regeneration valve	64	Hex socket head bolt
14-6	Poppet guide	28	Plug	65	Hex socket head bolt
14-7	O-ring	29	Plug	78	Dust cap
14-8	Poppet seat	33	Plug	83	Plug
14-9	Back up ring	37	Cover A-pilot		
14-10	O-ring	38	Cover B1-pilot		

· MCV TYPE 3



E-E' (ARM & ARM REGENERATION)

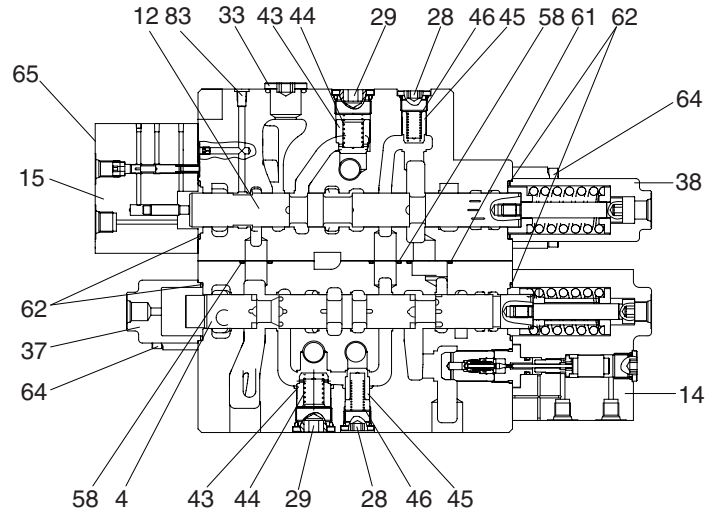


34 DETAIL (HOLDING ASSY)

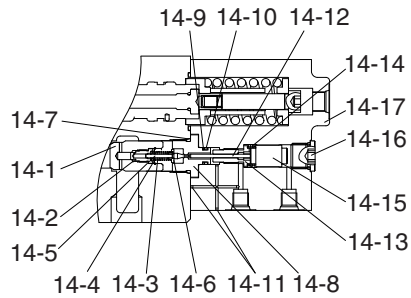
300L2MC113

10	Spool-arm 1	25	Poppet 2-check valve	34-5	Piston 2-holding
11	Spool-arm regeneration	26	Spring 2-check valve	34-7	Plug
15	Cover A-pilot	27	Holding kit B	34-8	Plug
16	Cover B1-pilot	27-1	Poppet	34-15	Socket bolt
19	Arm-regeneration	27-2	Spring	34-16	Spring washer
19-1	Block-regeneration	27-3	Poppet guide	45	Orifice-plug
19-2	Piston-cut off	27-4	Pilot poppet	55	Plug
19-3	Stopper-regeneration	27-5	Poppet seat	57	O-ring
19-4	Spool-regeneration	27-6	C-ring	61	O-ring
19-5	Spring-regeneration	27-7	Restrictor-lock valve	63	O-ring
19-6	Plug	27-8	O-ring	65	O-ring
19-7	Socket bolt	27-9	O-ring	67	O-ring
19-8	Spring wahser	27-10	Back up ring	68	O-ring
19-9	Pin-regeneration	34	Holding kit A1	73	Hex socket head bolt
20	Plug	34-1	Block-holding P1	74	O-ring
21	Poppet 1-check valve	34-2	Piston 1-holding	79	Washer
23	Spring 1-check valve	34-3	Guide piston-holding	94	Plug
24	Plug	34-4	Spring 1-lock valve		

· MCV TYPE 4



E-E' (ARM & ARM REGENERATION)

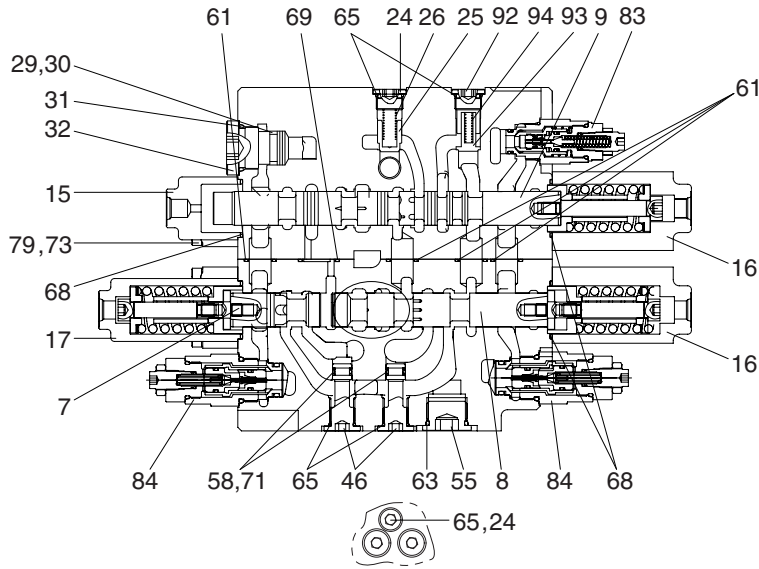


14 DETAIL (HOLDING VALVE ASSY)

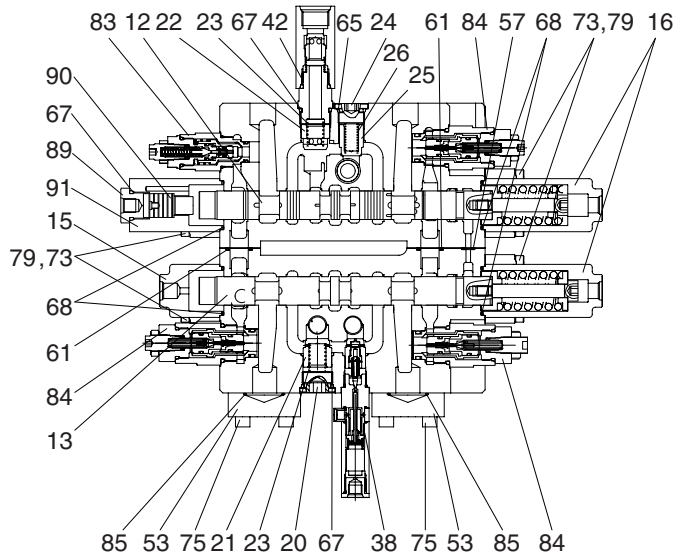
300L2MC218

- | | | |
|---------------------------|---------------------------|-------------------------|
| 4 Spool-arm 1 | 14-11 Plug | 43 Poppet 1-check valve |
| 12 Spool-arm regeneration | 14-12 Pilot piston | 44 Spring 1-check valve |
| 14 Holding valve assy | 14-13 Piston guide | 45 Poppet 2-check valve |
| 14-1 Poppet-main | 14-14 Spring | 46 Spring 2-check valve |
| 14-2 Restrictor | 14-15 Main piston | 58 O-ring |
| 14-3 Spring-pilot | 14-16 Plug | 61 O-ring |
| 14-4 C-ring | 14-17 Block | 62 O-ring |
| 14-5 Pilot poppet | 15 Arm regeneration valve | 64 Hex socket head bolt |
| 14-6 Poppet guide | 28 Plug | 65 Hex socket head bolt |
| 14-7 O-ring | 29 Plug | 83 Plug |
| 14-8 Poppet seat | 33 Plug | |
| 14-9 Back up ring | 37 Cover A-pilot | |
| 14-10 O-ring | 38 Cover B1-pilot | |

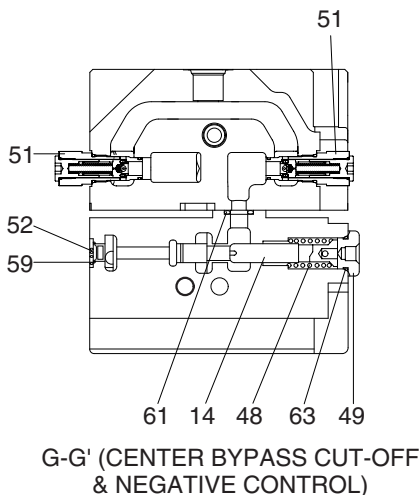
· MCV TYPE 1



D-D' (SWING PRIORITY-BOOM2 & ARM2)



F-F' (OPTION & BUCKET)

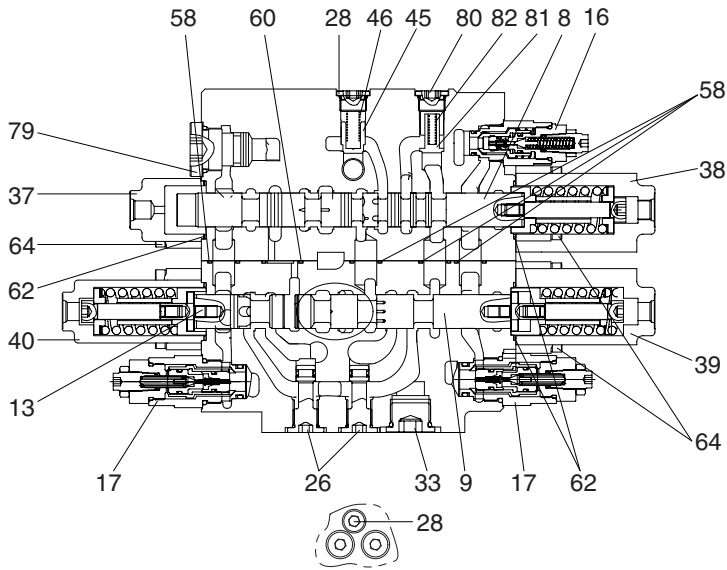


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

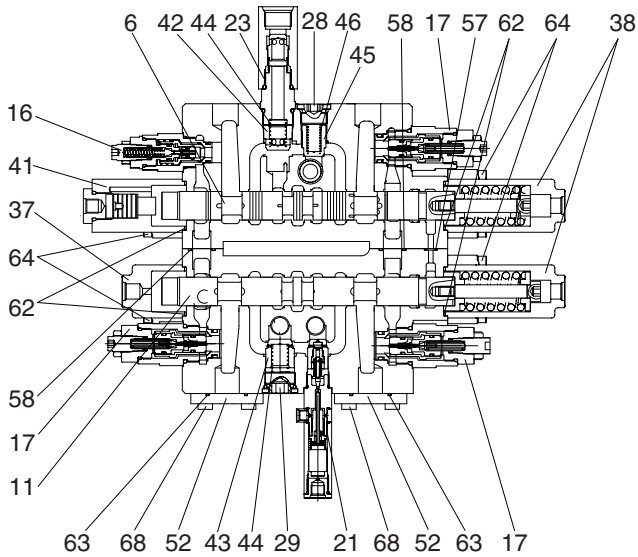
- 7 Spool-swing priority
- 8 Spool-boom 2
- 9 Spool-arm 2
- 12 Spool-bucket
- 13 Spool-option
- 14 Spool-bypass cut
- 15 Cover A-pilot
- 16 Cover B1-pilot
- 17 Cover B2-pilot
- 20 Plug
- 21 Poppet 1-check valve
- 22 Poppet-L/C bucket
- 23 Spring 1-check valve
- 24 Plug
- 25 Poppet 2-check valve
- 26 Spring 2-check valve
- 29 Back up ring
- 30 O-ring
- 31 O-ring
- 32 Plug
- 38 Load check valve assy
- 42 Check valve
- 46 Plug
- 48 Spring-bypass cut spool
- 49 Plug-bypass cut spool
- 51 Negative control valve
- 52 Plug
- 53 Flange
- 55 Plug
- 57 O-ring
- 58 O-ring
- 59 O-ring
- 61 O-ring
- 63 O-ring
- 65 O-ring
- 67 O-ring
- 68 O-ring
- 69 O-ring
- 71 Back-up ring
- 73 Hex socket head bolt
- 75 Socket bolt
- 79 Washer
- 83 Overload relief valve
- 84 Overload relief valve
- 85 O-ring
- 89 Plug
- 90 Piston
- 91 Pilot cover C1
- 92 Plug
- 93 Poppet
- 94 Spring

300L2MC14

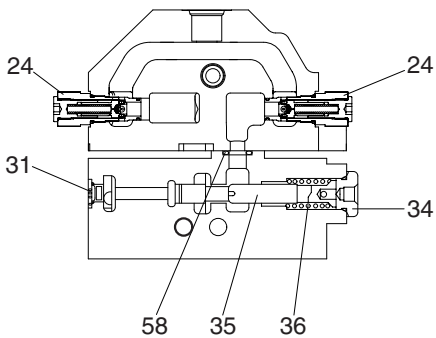
· MCV TYPE 2



D-D' (SWING PRIORITY-BOOM 2 & ARM 2)



F-F' (OPTION & BUCKET)

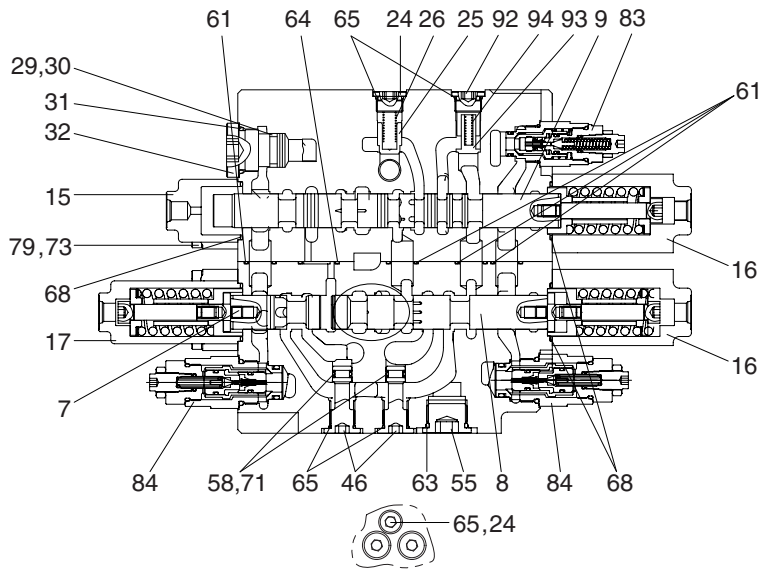


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

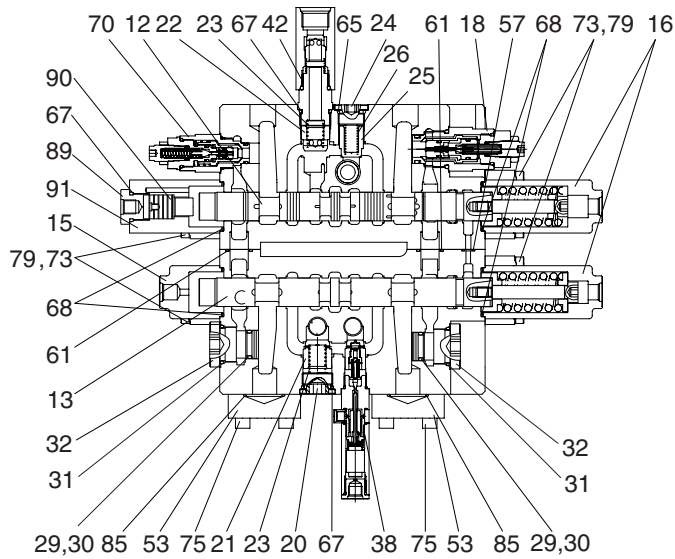
- 6 Spool-bucket
- 8 Spool-arm 2
- 9 Spool-boom 2
- 11 Spool-option
- 13 Spool-swing priority
- 16 Overload relief valve
- 17 Overload relief valve
- 21 Option logic valve assy
- 23 Spool-bypass cut
- 24 Negative control valve
- 26 Plug
- 28 Plug
- 29 Plug
- 31 Plug
- 33 Plug
- 34 Plug-bypass cut spool
- 35 Spool-bypass cut
- 36 Spring-bypass cut spool
- 37 Cover A-pilot
- 38 Cover B1-pilot
- 39 Cover B2-pilot
- 40 Cover B3-pilot
- 41 Pilot cover C1
- 42 Poppet L/C-bucket
- 43 Poppet 1-check valve
- 44 Spring 1-check valve
- 45 Poppet 2-check valve
- 46 Spring 2-check valve
- 52 Flange
- 57 O-ring
- 58 O-ring
- 60 O-ring
- 62 O-ring
- 63 O-ring
- 64 Hex socket head bolt
- 67 Hex socket head bolt
- 68 Hex socket head bolt
- 79 Plug
- 80 Plug
- 81 Poppet 3-check valve
- 82 Spring 3-check valve

300L2MC19

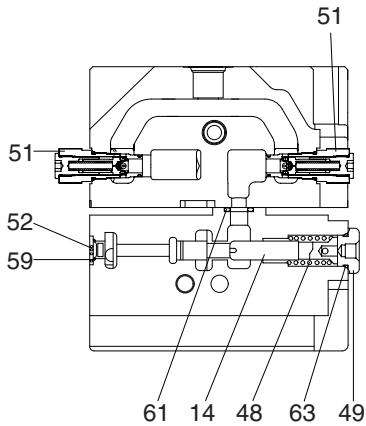
· MCV TYPE 3



D-D' (SWING PRIORITY-BOOM2 & ARM2)



F-F' (OPTION & BUCKET)

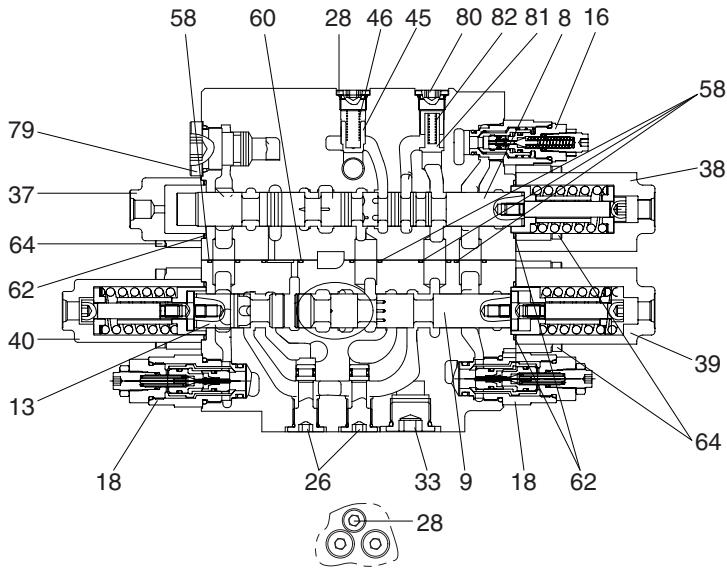


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

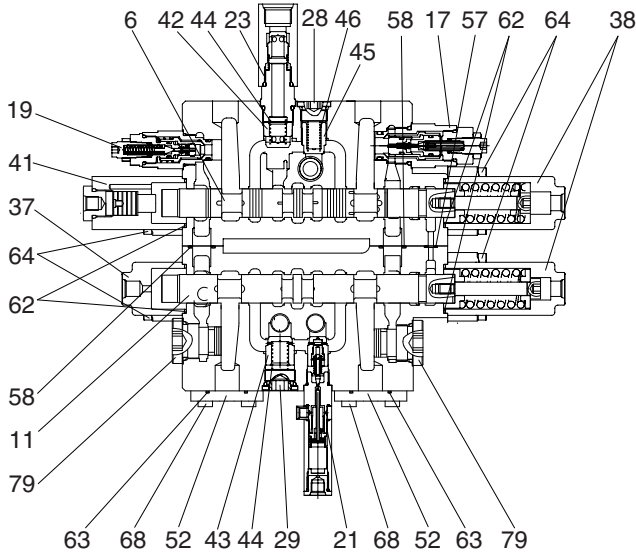
- 7 Spool-swing priority
- 8 Spool-boom 2
- 9 Spool-arm 2
- 12 Spool-bucket
- 13 Spool-option
- 14 Spool-bypass cut
- 15 Cover A-pilot
- 16 Cover B1-pilot
- 17 Cover B3-pilot
- 18 Overload relief valve
- 20 Plug
- 21 Poppet 1-check valve
- 22 Poppet-L/C bucket
- 23 Spring 1-check valve
- 24 Plug
- 25 Poppet 2-check valve
- 26 Spring 2-check valve
- 29 O-ring
- 30 Back-up ring
- 31 O-ring
- 32 Plug
- 38 Load check valve assy
- 42 Check valve
- 46 Plug
- 48 Spring-bypass cut spool
- 49 Plug-bypass cut spool
- 51 Negative control valve
- 52 Plug
- 53 Flange
- 55 Plug
- 57 O-ring
- 58 O-ring
- 59 O-ring
- 61 O-ring
- 63 O-ring
- 65 O-ring
- 67 O-ring
- 68 O-ring
- 70 Overload relief valve
- 71 Back-up ring
- 73 Hex socket head bolt
- 75 Socket bolt
- 79 Washer
- 83 Overload relief valve
- 84 Overload relief valve
- 85 O-ring
- 89 Plug
- 90 Piston
- 91 Pilot cover C1
- 92 Plug
- 93 Poppet
- 94 Spring

300L2MC114

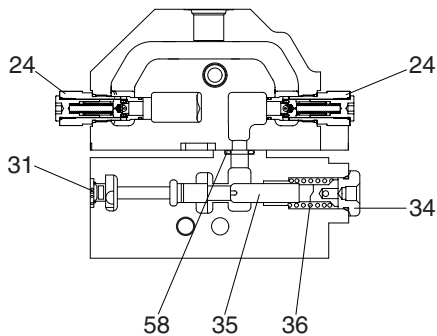
· MCV TYPE 4



D-D' (SWING PRIORITY-BOOM 2 & ARM 2)



F-F' (OPTION & BUCKET)

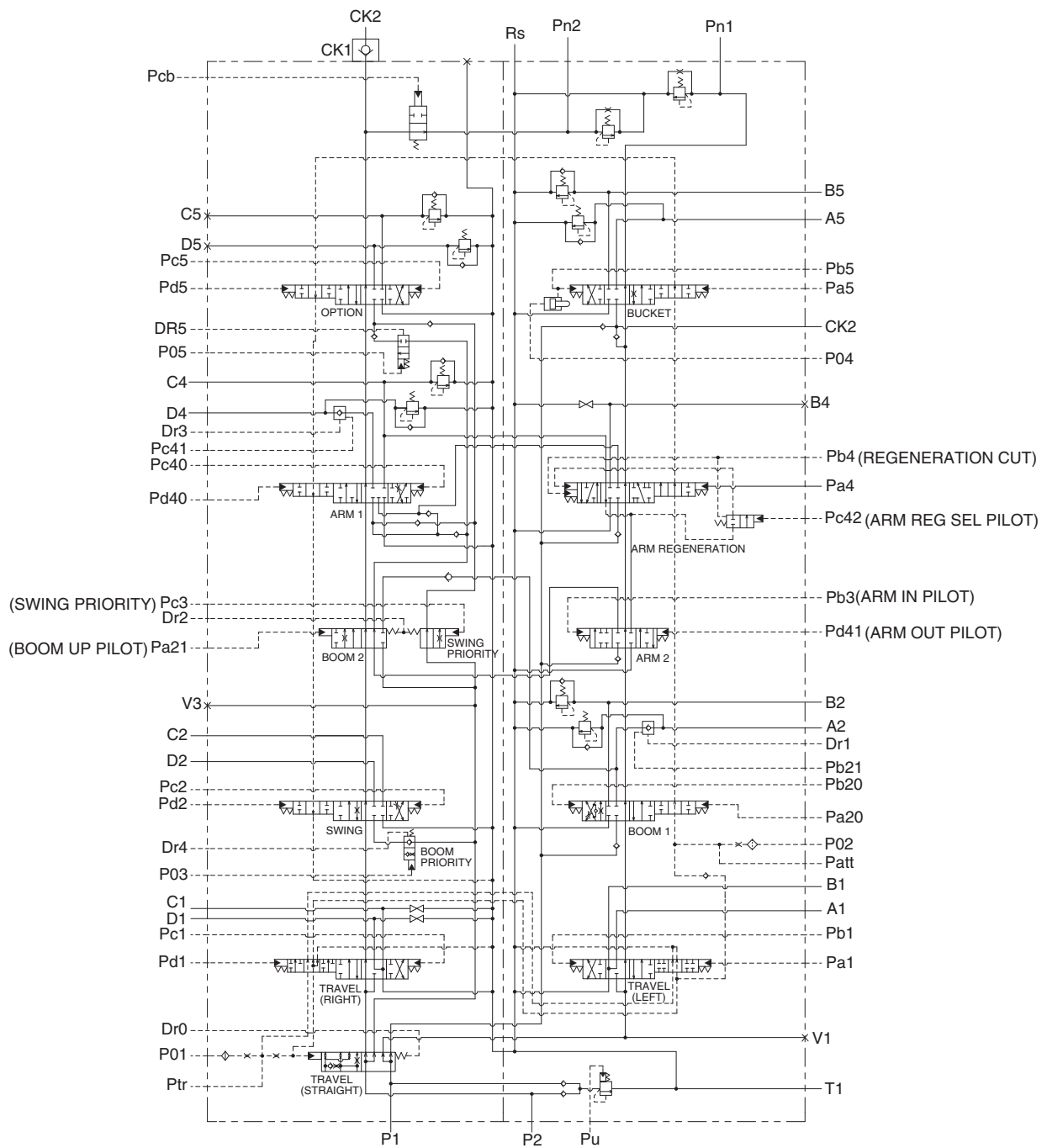


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

- 6 Spool-bucket
- 8 Spool-arm 2
- 9 Spool-boom 2
- 11 Spool-option
- 13 Spool-swing priority
- 18 Overload relief valve
- 19 Overload relief valve
- 21 Option logic valve
- 23 Spool-bypass cut
- 24 Negative control valve
- 26 Plug
- 28 Plug
- 29 Plug
- 31 Plug
- 33 Plug
- 34 Plug-bypass cut spool
- 35 Spool-bypass cut
- 36 Spring-bypass cut spool
- 37 Cover A-pilot
- 38 Cover B1-pilot
- 39 Cover B2-pilot
- 40 Cover B3-pilot
- 41 Pilot cover C1
- 42 Poppet L/C-bucket
- 43 Poppet 1-check valve
- 44 Spring 1-check valve
- 45 Poppet 2-check valve
- 46 Spring 2-check valve
- 52 Flange
- 57 O-ring
- 58 O-ring
- 60 O-ring
- 62 O-ring
- 63 O-ring
- 64 Hex socket head bolt
- 68 Hex socket head bolt
- 79 Plug
- 80 Plug
- 81 Poppet 3-check valve
- 82 Spring 3-check valve

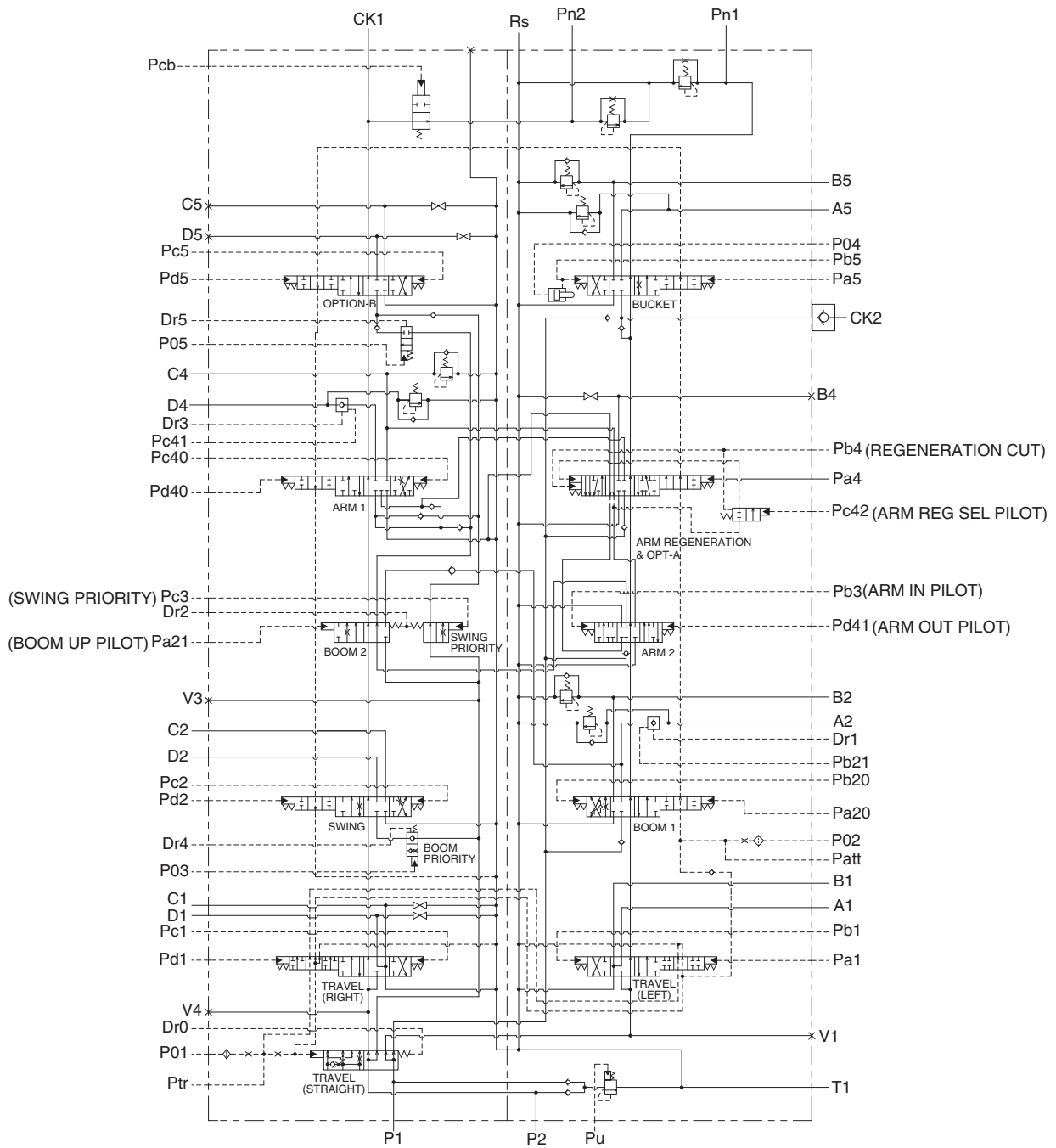
300L2MC219

2. HYDRAULIC CIRCUIT (TYPE 1 & 2)



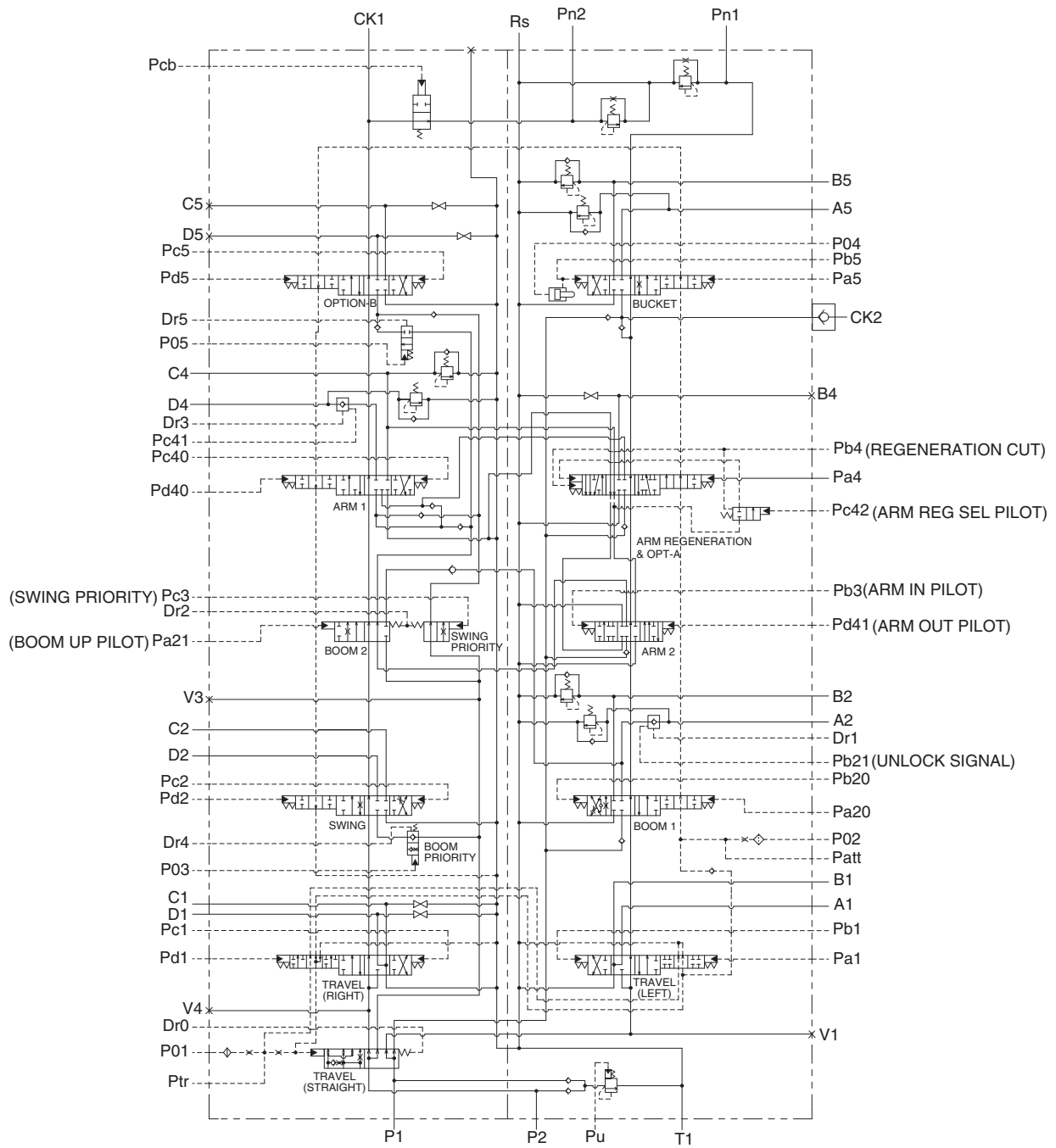
300L2MC20

HYDRAULIC CIRCUIT (TYPE 3)



300L2MC120

HYDRAULIC CIRCUIT (TYPE 4)



300L2MC220

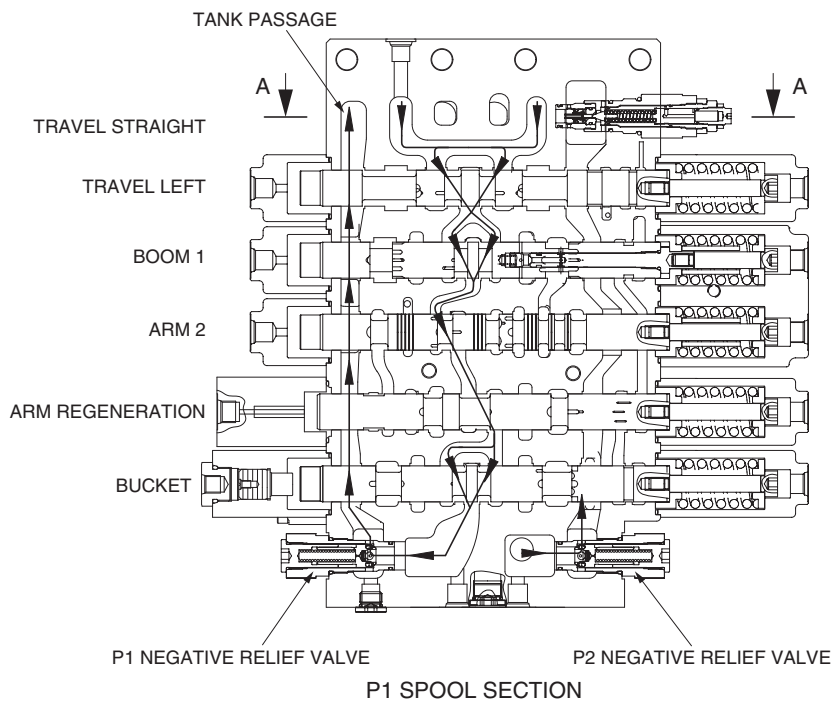
3. FUNCTION

1) CONTROL IN NEUTRAL

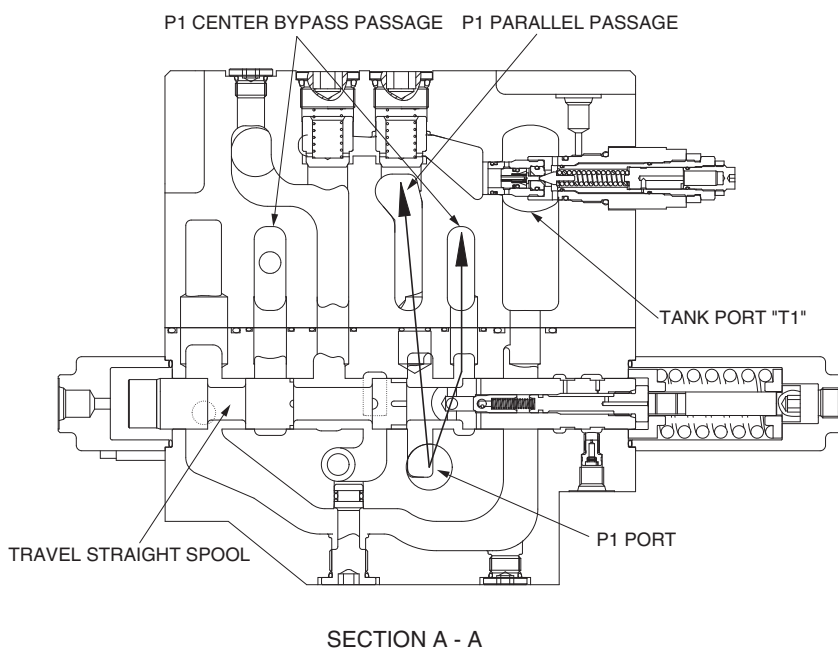
(1) P1 SIDE

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

When the straight travel spool is in neutral position, the bypass passage is not shut off. Then the hydraulic fluid from the pump P1 is directed to the tank through the bypass passage of spools : travel left, boom 1, arm 2, arm regeneration & option A and bucket, the negative relief valve of P1, tank passage, and the tank port "T1"



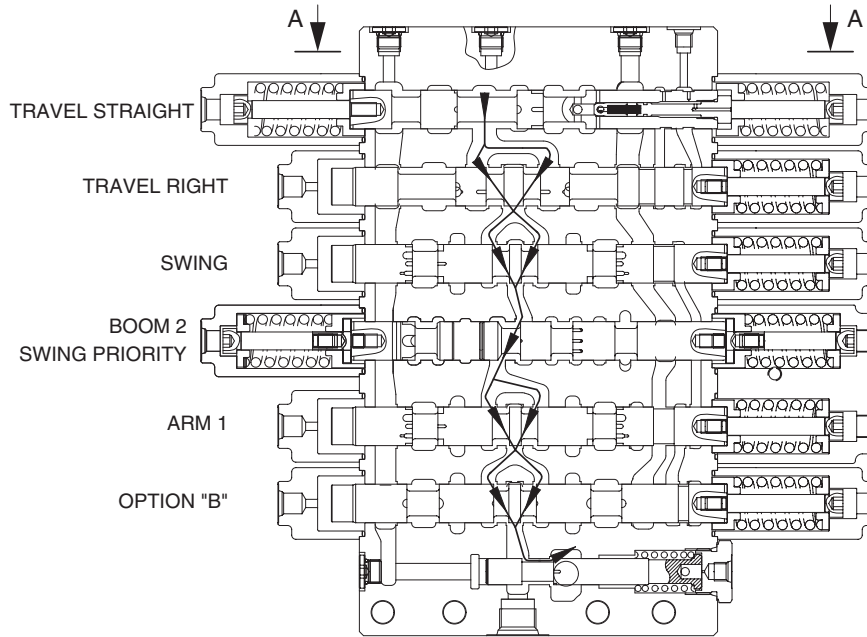
3009A2MC03



3009A2MC04

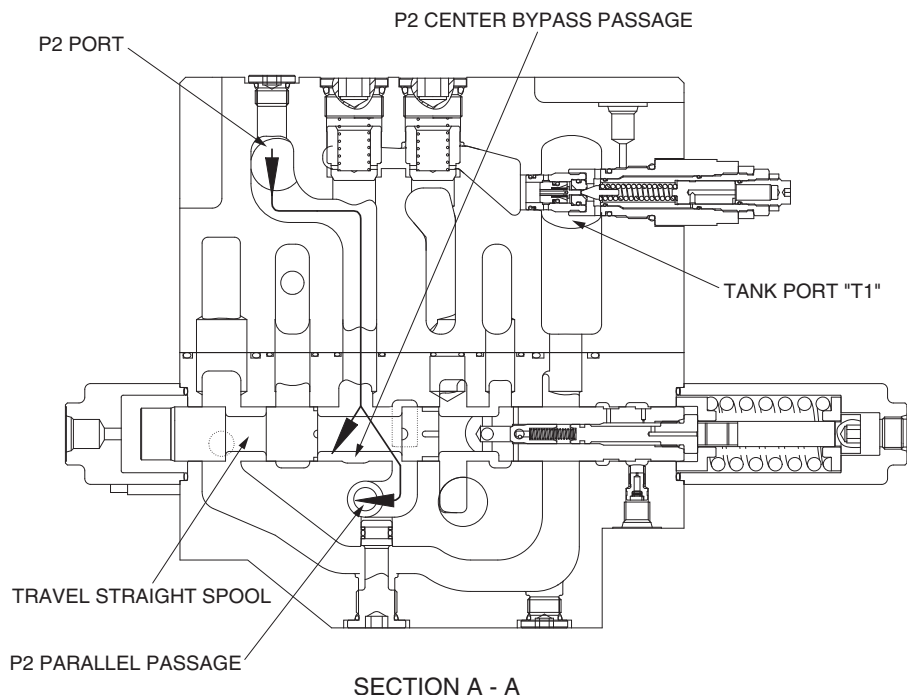
(2) P2 SIDE

The hydraulic fluid from pump flows into the main control valve through the inlet port "P2", pass the land of the straight travel spool, into the P2 bypass passage and P2 parallel passage. When the straight travel spool is in neutral position, the bypass passage is not shut off. Then the hydraulic fluid from the pump P2 is directed to the tank through the bypass passage of spools : travel right, swing, boom 2 & swing priority, arm 1, option "B" and option "C" of bypass passage summation, and the negative relief valve of P2, the tank passage and the tank port "T1".



P2 SPOOL SECTION

300L2MC03



SECTION A - A

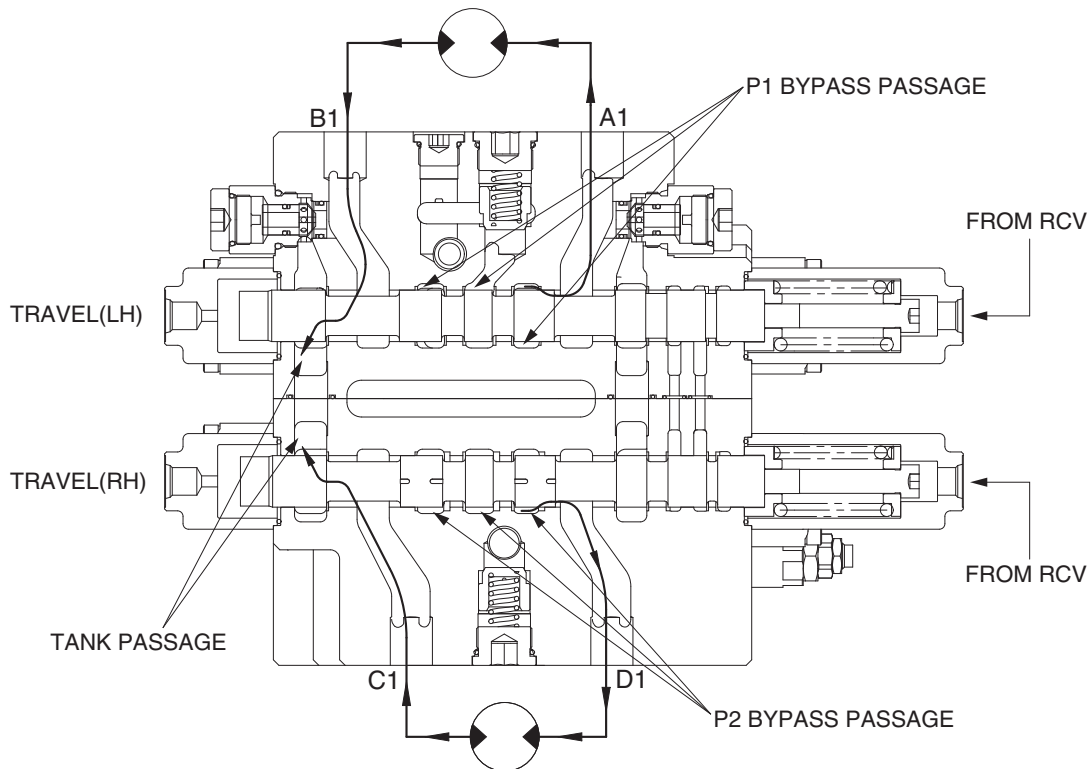
3009A2MC05

2) TRAVEL OPERATION

(1) TRAVEL FORWARD OPERATION

During the travel forward operation, the pilot pressure of RCV is supplied to the port of the spring side, and it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump flows into the bypass passage of travel spool through the land of the straight travel spool.

Then the bypass passage is shut off by the movement of the spool, they are directed to the each travel motor through port B1 and D1. At the same time, the hydraulic fluid from the each travel motor through port A1 and C1 returns to the tank passage through the travel spools.

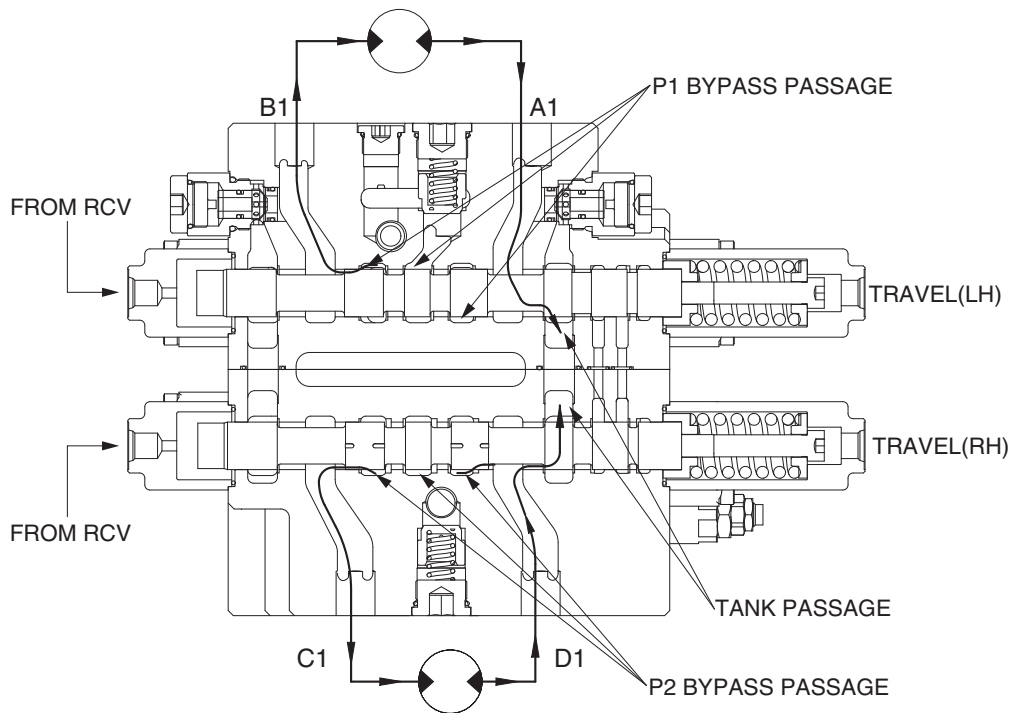


29092MC07

(2) TRAVEL REVERSE OPERATION

During the travel reverse operation, the pilot pressure of RCV is supplied to the port of the spring opposite side, and it shifts travel right and left spools in the right direction against springs. Hydraulic fluid from the pump flows into the bypass passage of travel spool through the land of the straight travel spool.

Then the bypass passage is shut off by the movement of the spool, they are directed to the each travel motor through port A1 and C1. At the same time, the hydraulic fluid from the each travel motor through port B1 and D1 returns to the tank passage through the travel spools.



29092MC08

(3) TRAVEL STRAIGHT FUNCTION

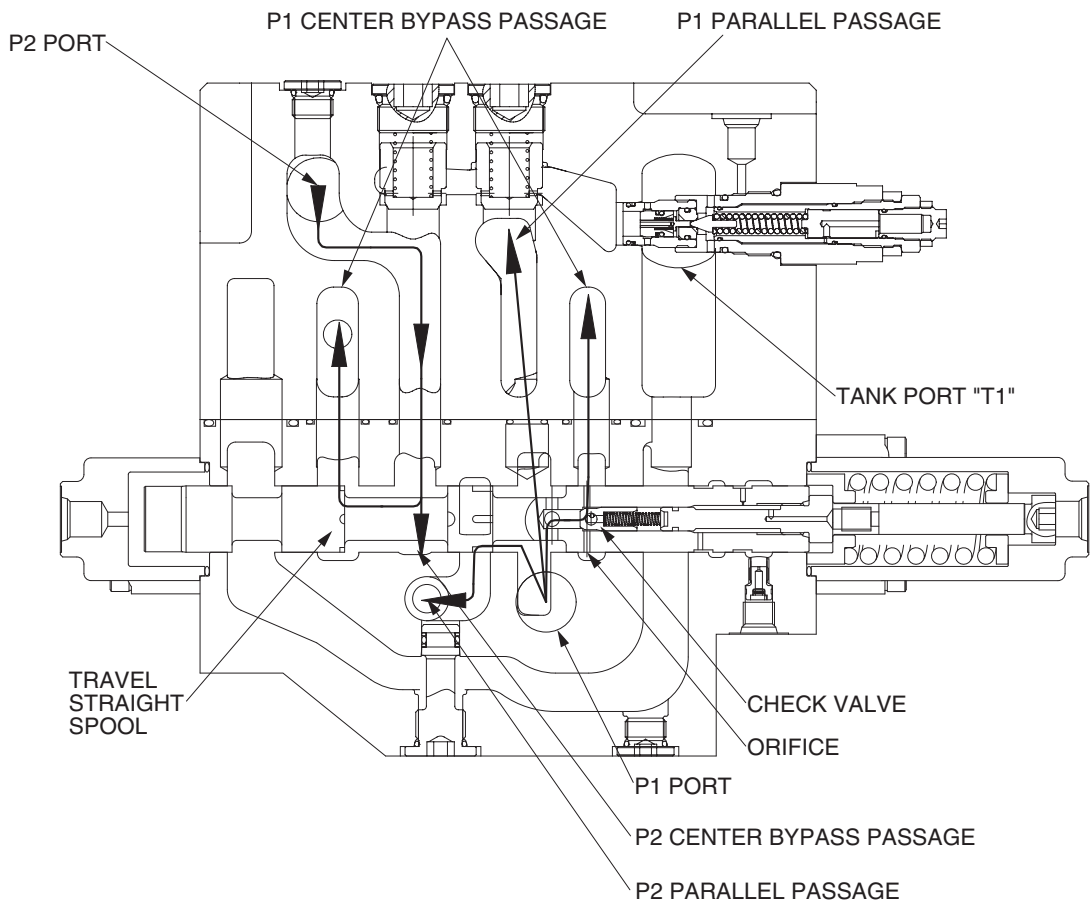
Straight travel valve is the valve for keeping traveling straight when boom, arm, bucket or swing is operated at the time of traveling. Therefore the oil from the P1 and P2 pump flows into the control valve through the each passage in neutral condition.

When the both travels and any of attachment is switched, the pilot pressure is applied the port of spring chamber and the travel straight spool is shifted.

When the straight travel spool is shifted, the oil pressure from P1 is led to the each attachment switching section through the P1 and P2 parallel passage. Also some of oil is combined with bypass of P1 side by opening of check valve of spool inside through the orifice of the straight travel spool.

On the other hand, the oil from P2 is supplied to the both travel section through P1 and P2 bypass passage.

Therefore, when attachment is switched at the time of both travels, since the oil of P2 mainly flows to both travels, and the oil of P1 mainly flows to attachments, it can keep traveling straight.



29092MC09

3) BOOM OPERATION

(1) BOOM UP OPERATION

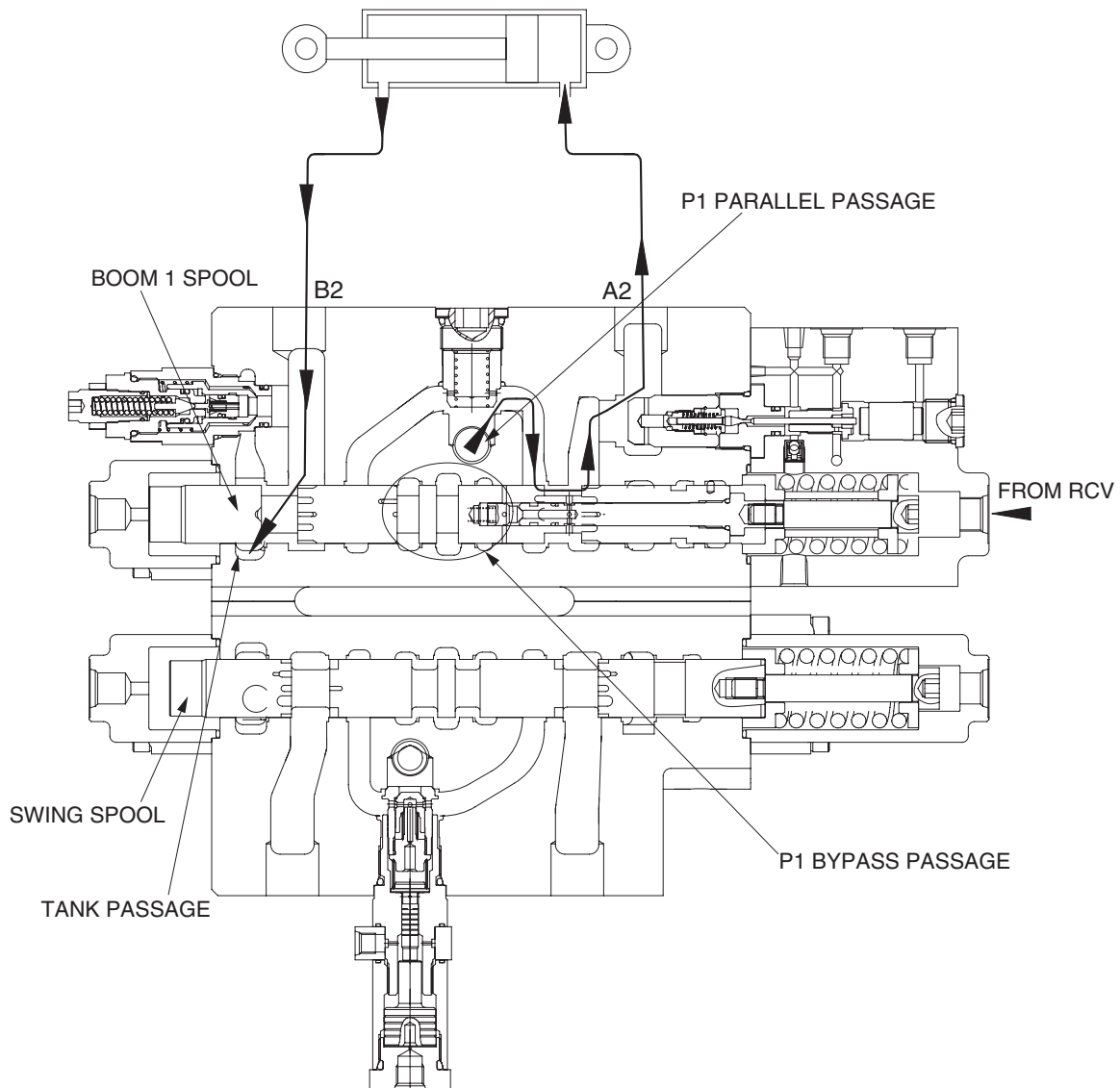
During boom up operation, the pilot secondary pressure from RCV is supplied to the port of the spring side and shifts the boom 1 spool in the left direction. The bypass passage is shut off by the movement of the spool and the hydraulic oil fluid from pump P1 is entered P1 parallel passage and then passes through the load check valve, bridge passage and boom holding valve then flows into the port A2.

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

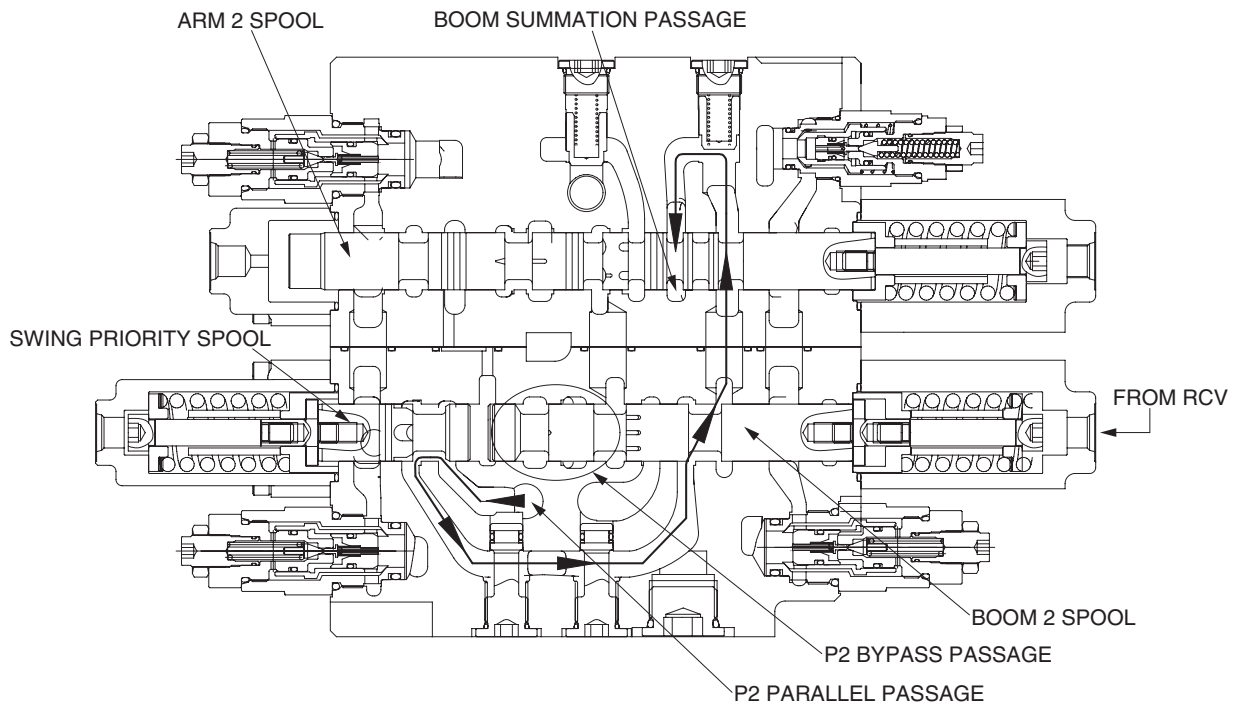
(In this case, the boom holding valve is free flow condition)

At the same time, the pilot pressure from RCV is supplied to the port of the spring side of boom 2 and shifts the boom 2 spool. The bypass passage is shut off by the movement of the spool and the hydraulic oil fluid from pump P2 entered boom summation passage via the P2 parallel passage, the land of the swing priority spool, notch of the boom 2 spool, arm 2 spool and the check. The flows combine in passage and are directed to port A2 and head side of boom cylinder.

At the same time, the flow from rod side of the boom cylinder return to the boom 1 spool through



300L2MC04



29092MC11

(2) BOOM DOWN OPERATION

During the boom lowering operation, the pilot pressure from RCV is supplied to the port of the spring opposite side and shifts the boom 1 spool in the right direction.

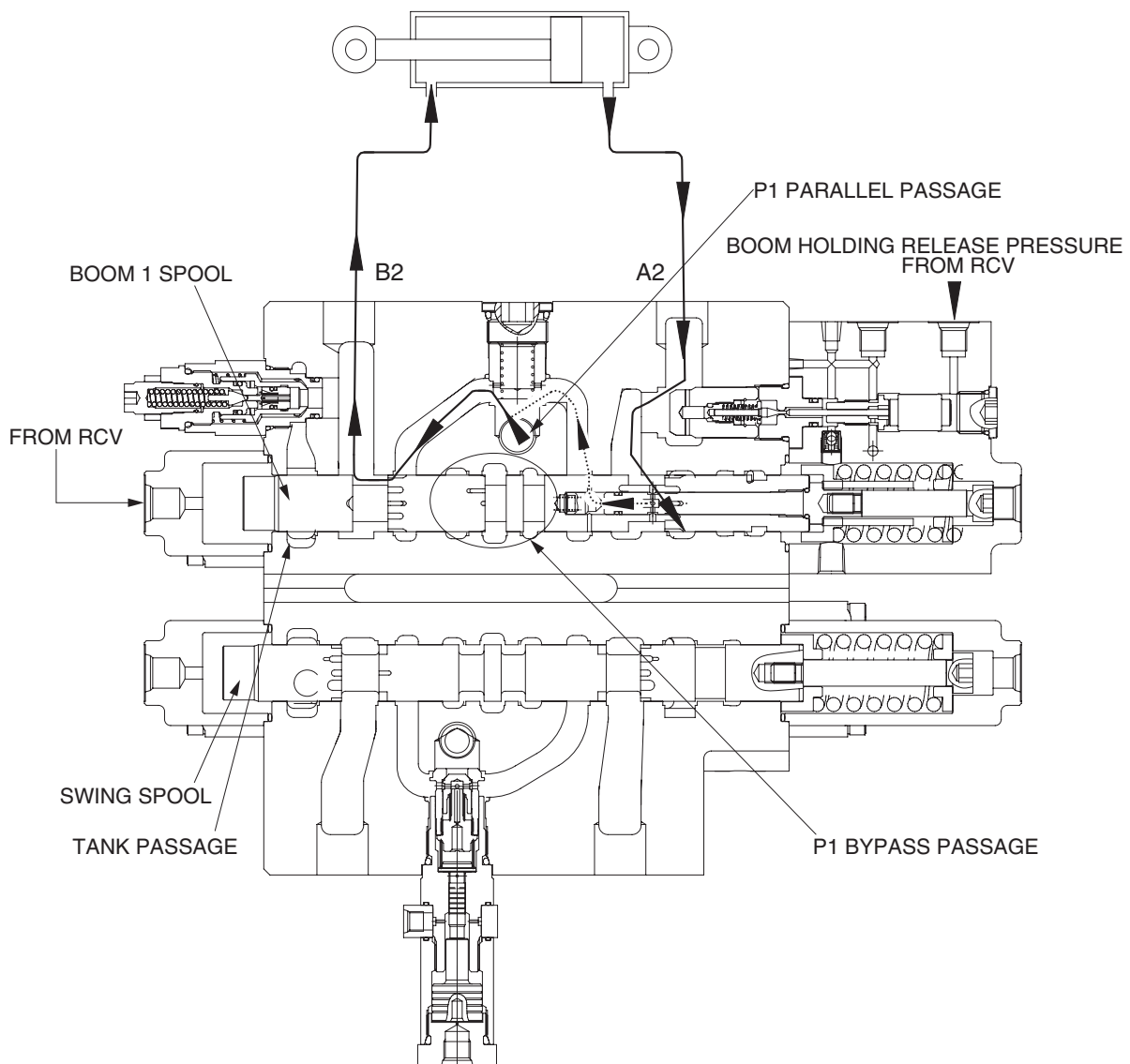
The bypass passage is shut off by the movement of the spool and the hydraulic fluid from the pump P1 enters the parallel passage and is directed to the port B2 through the load check valve. Following this, it flows into the rod side of the boom cylinder.

At the same time, the return flow from the head side of the boom cylinder returns to the port A2 and boom holding valve. And it is directed to the hydraulic oil tank through opened tank passage by movement of the boom 1 spool.

Meanwhile some of return flow is directed to P1 parallel passage through the internal passage of the boom 1 spool. (boom regeneration)

In this case, the holding valve is open condition, for details of the boom holding valve, see page following page.

During the boom lowering operation, the fluid from P2 pump is not summation.



300L2MC05

4) HOLDING VALVE OPERATION

(1) HOLDING OPERATION

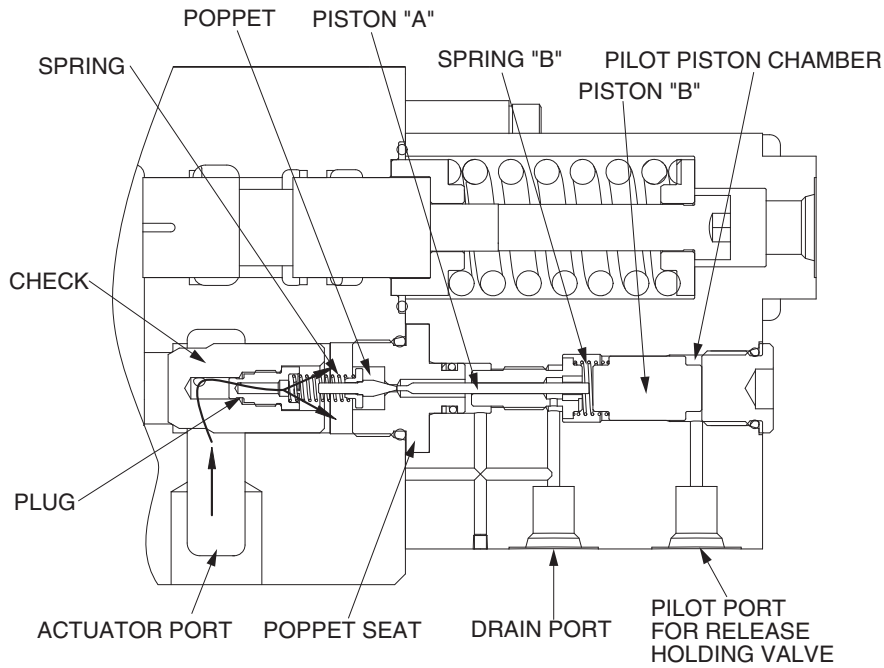
At neutral condition, the pilot piston chamber is connected to drain port through the pilot port.

And the piston "B" is supported with spring "B".

Also, 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.



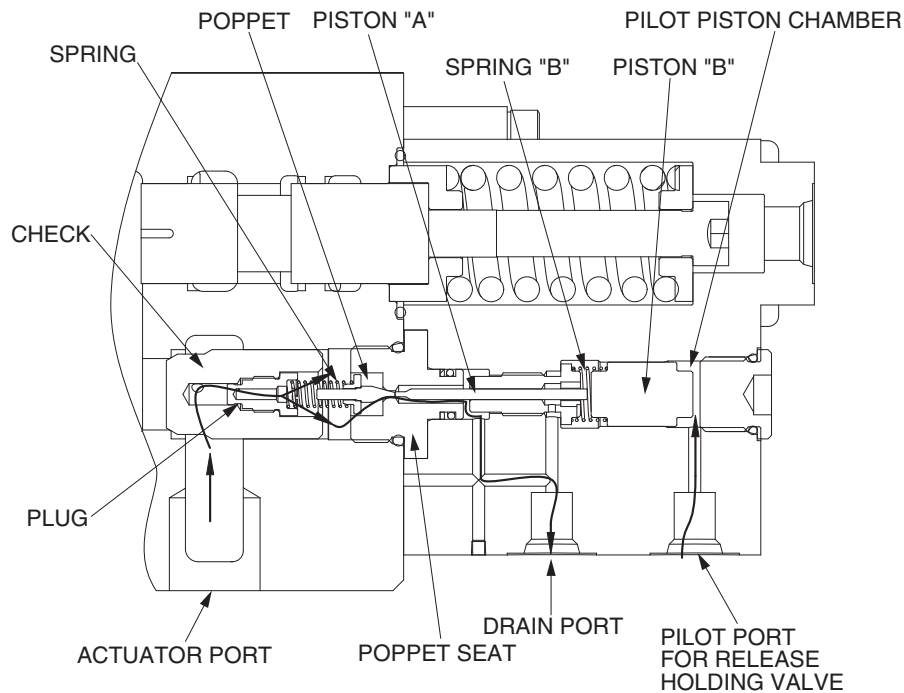
29092MC13

(2) RELEASE HOLDING OPERATION

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 socket and spool and internal passage 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.



29092MC14

5) BUCKET OPERATION

(1) BUCKET IN OPERATION (TYPE 1 & 2)

① Bucket operation only

During the bucket in operation, the pilot secondary pressure from RCV is supplied to port of the spring side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port A5 through the check2.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check1.

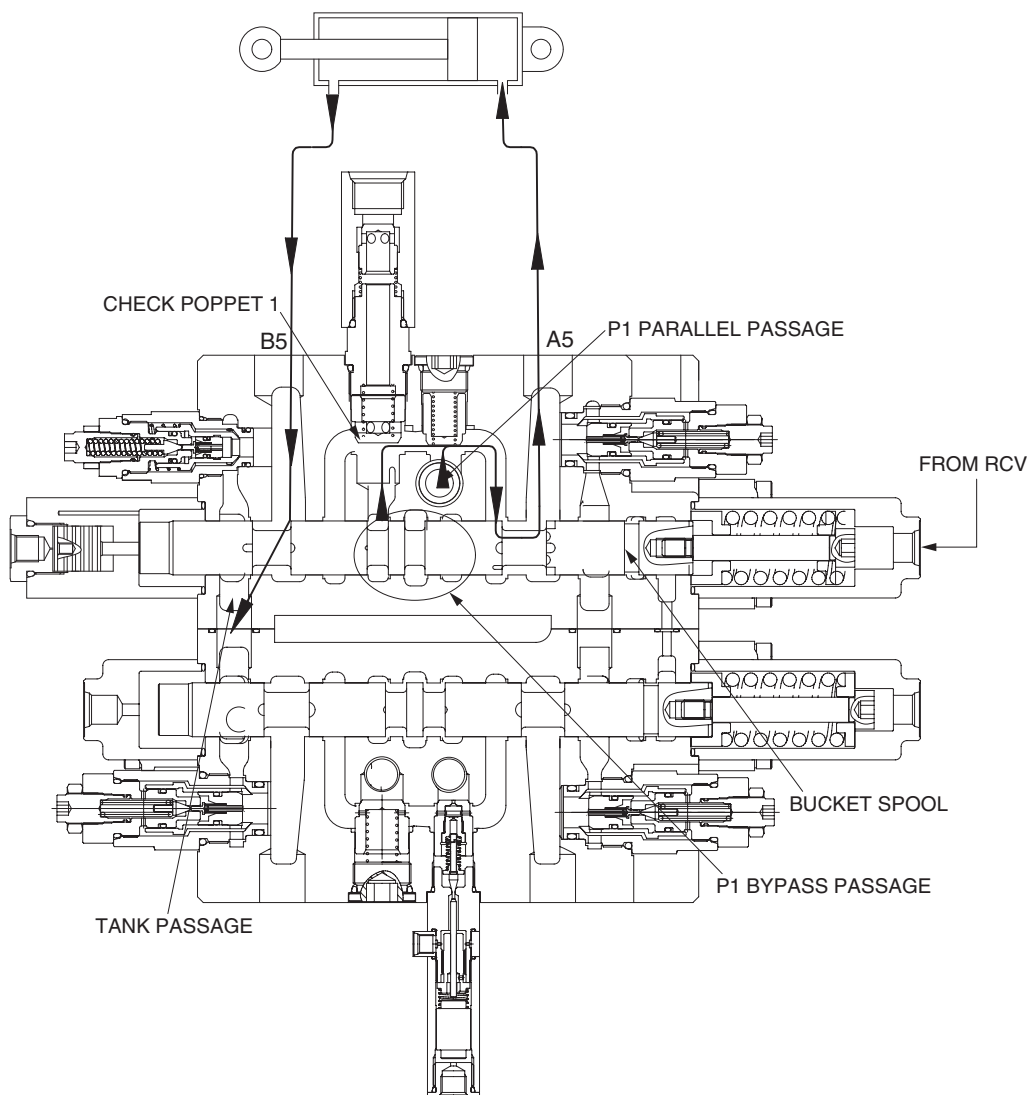
Following this it flows into the head side of the bucket cylinder.

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 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.



300L2MC21

(1) BUCKET IN OPERATION (TYPE 3 & 4)

① Bucket operation only

During the bucket in operation, the pilot secondary pressure from RCV is supplied to port of the spring side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port A5 through the check2.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check1.

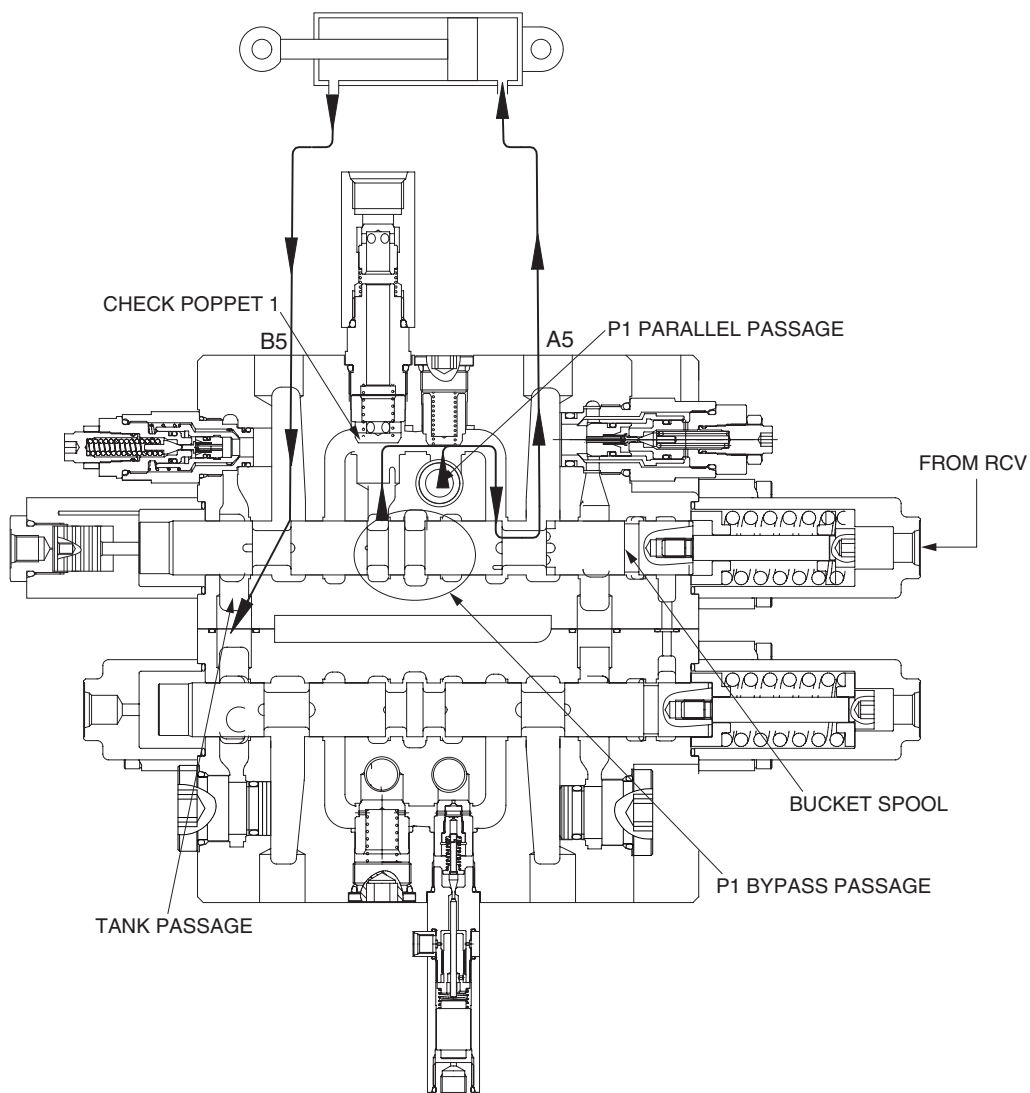
Following this it flows into the head side of the bucket cylinder.

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 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.



300L2MC121

(2) BUCKET OUT OPERATION (TYPE 1 & 2)

① Bucket operation only

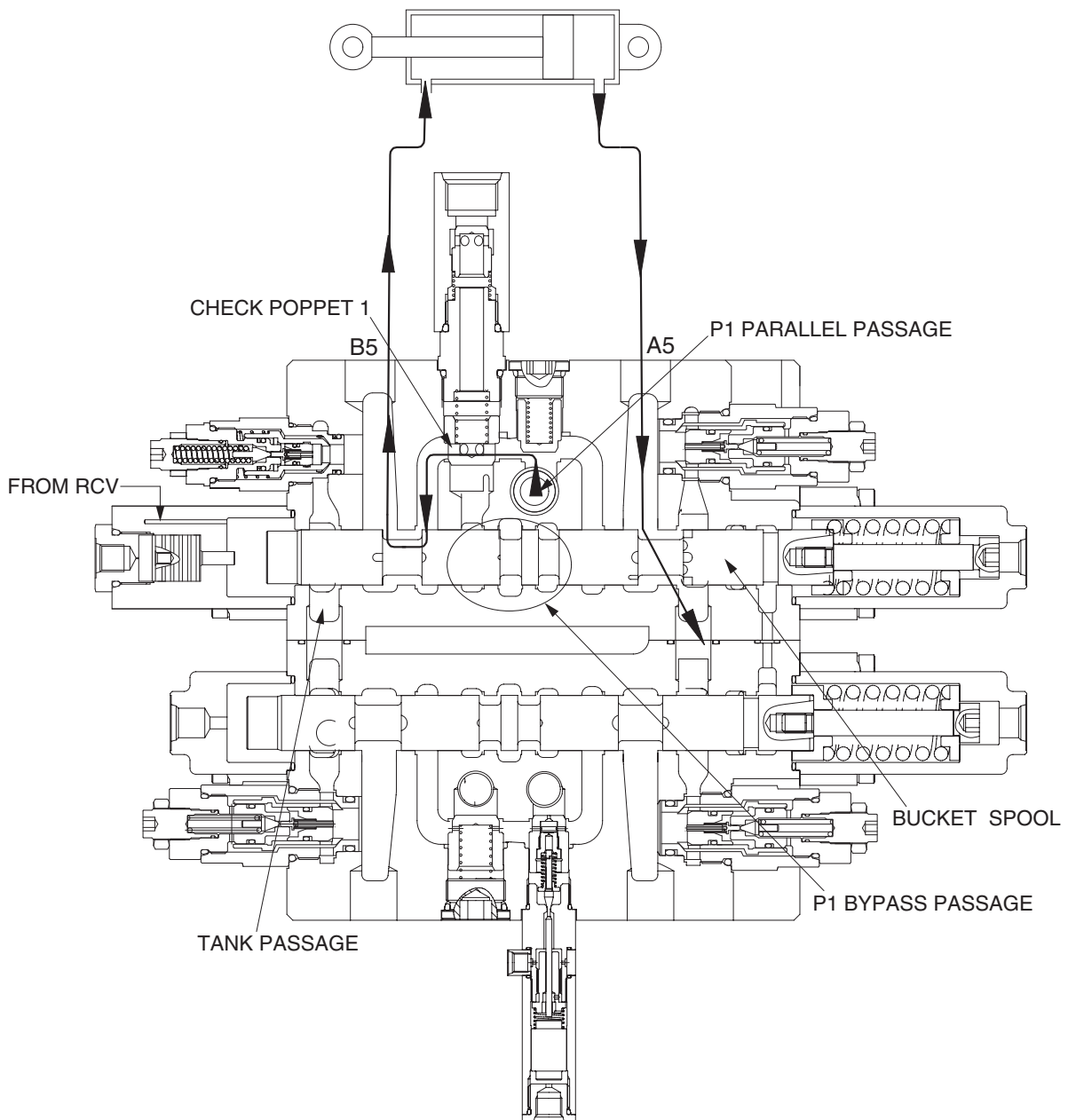
During the bucket out operation, the pilot secondary pressure from RCV is supplied to port of the spring opposite side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B5 through the check1.

The return flow from the rod side of the bucket cylinder returns to the hydraulic oil tank through the tank passage and the port A5.

② Bucket operation with arm or boom operation

When combined operation, the same as above.



300L2MC23

(2) BUCKET OUT OPERATION (TYPE 3 & 4)

① Bucket operation only

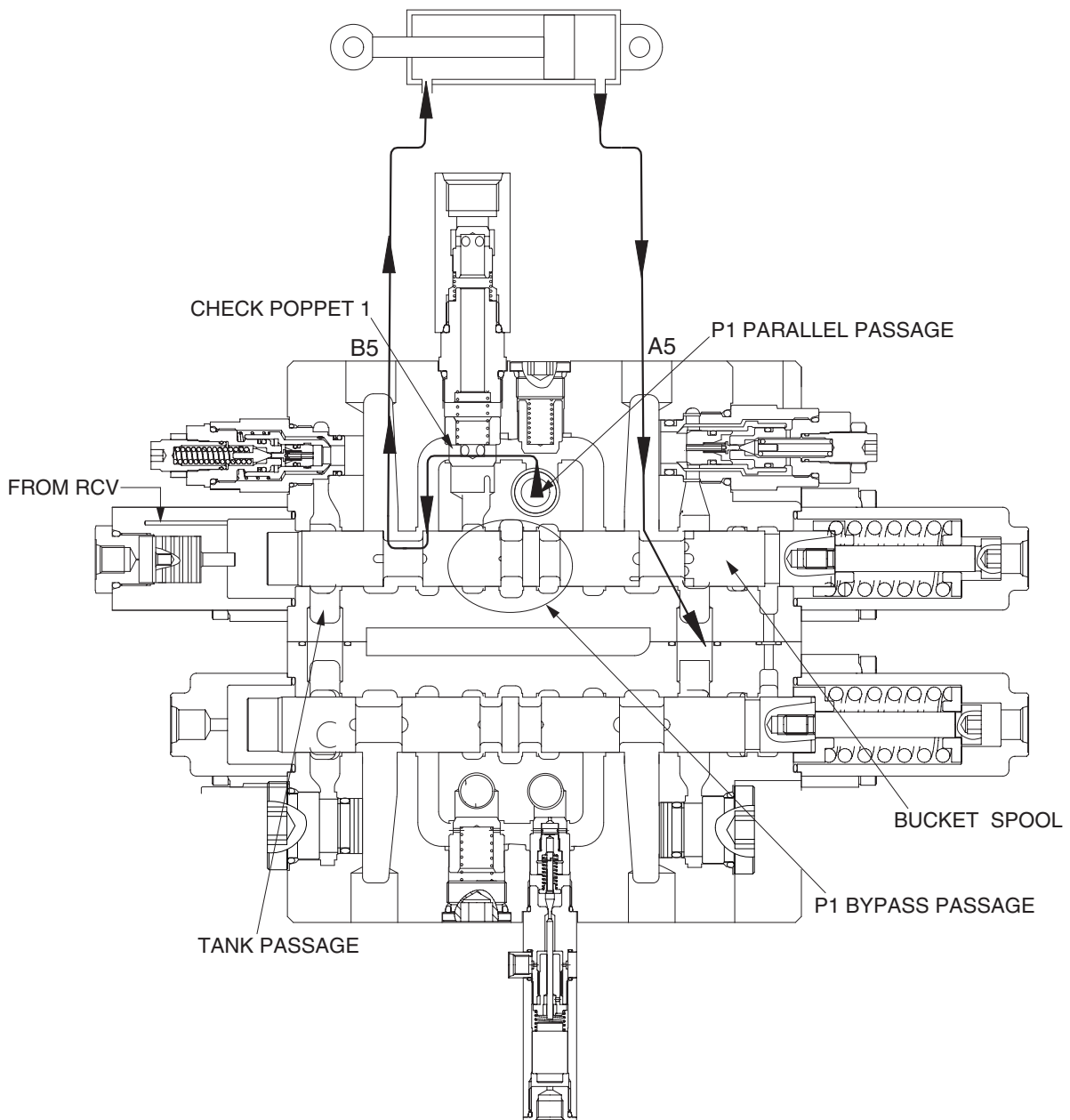
During the bucket out operation, the pilot secondary pressure from RCV is supplied to port of the spring opposite side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B5 through the check1.

The return flow from the rod side of the bucket cylinder returns to the hydraulic oil tank through the tank passage and the port A5.

② Bucket operation with arm or boom operation

When combined operation, the same as above.



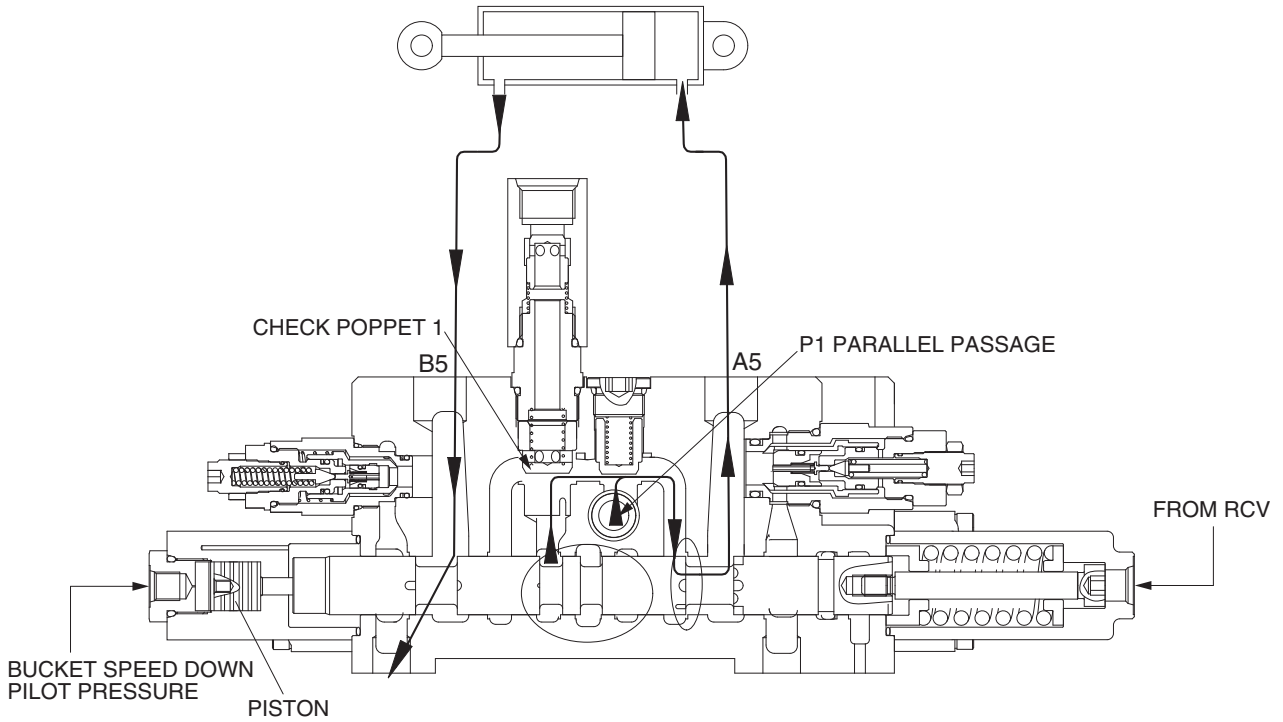
300L2MC123

(3) BUCKET SLOW OPERATION

This function is used to speed up of the boom by reducing the bucket speed when bucket operation with boom operation simultaneously.

When the boom up operation, the boom up pilot pressure is supplied the pilot port of bucket spool stroke limit and the piston is shifted to the right and then the bucket spool stroke is limited and the open of the bucket spool is reduced.

Accordingly, the oil of the bucket spool is reduced and the boom speed up.



300L2MC06

6) SWING OPERATION

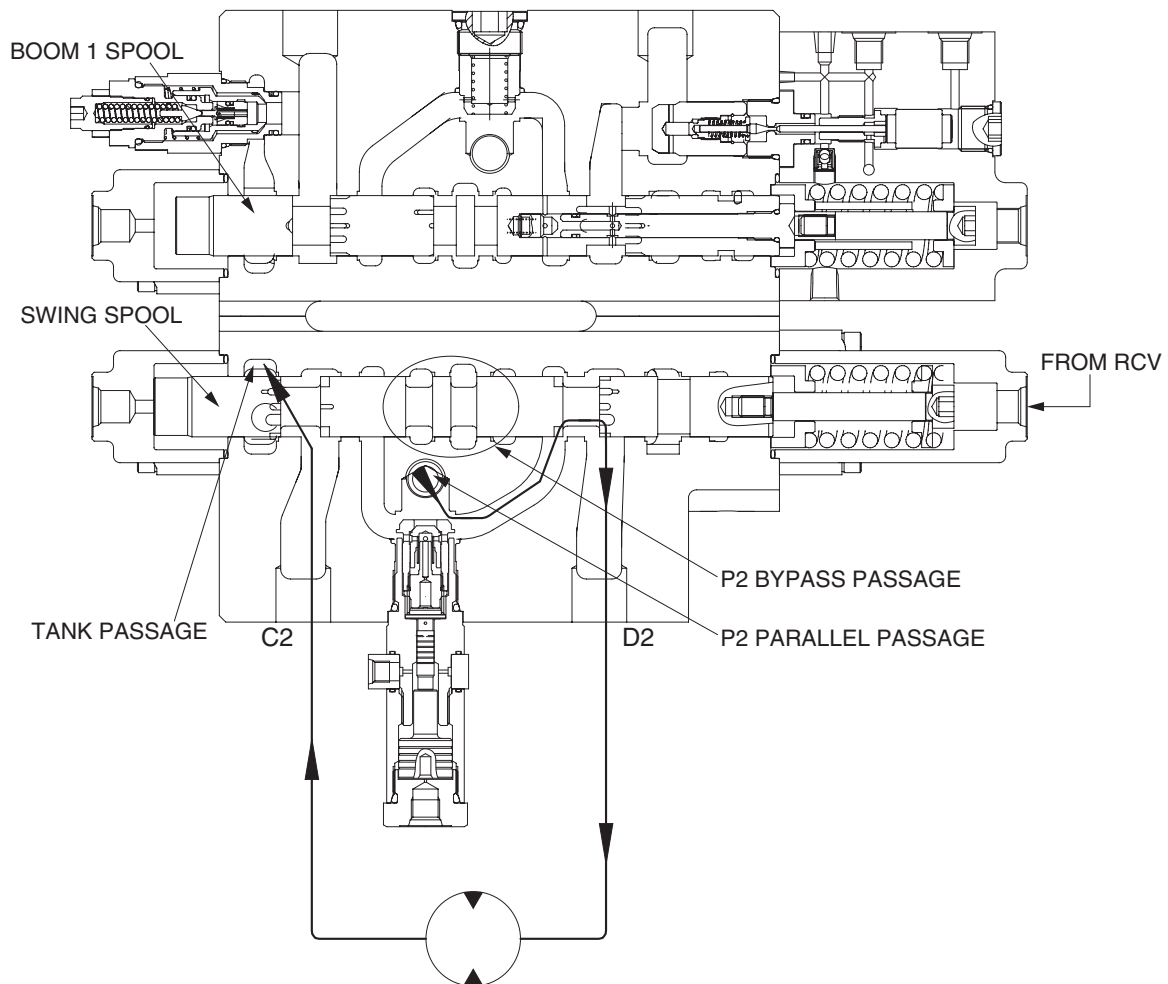
(1) SWING LEFT & RIGHT OPERATION

During the swing left operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shift the swing spool in left direction. The bypass passage is shut off by the movement of the spool and 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 to swing left operation but the pilot secondary pressure from the RCV is supplied to the port of the spring opposite side.

Accordingly, the hydraulic fluid from pump P2 flows into swing motor through the port C2 and returns to the hydraulic oil tank through the port D2 and the tank passage.

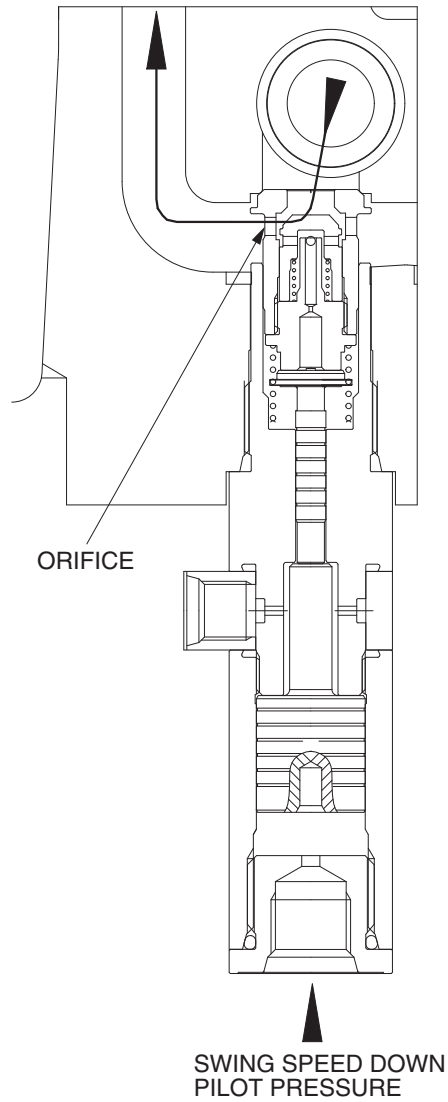


29092MC18

(2) SWING SLOW DOWN OPERATION

This operation is used to speed up the boom or arm by reducing the swing speed when swing operation with boom or arm operation.

The poppet of swing logic valve is closed by the pilot pressure of swing speed down is supplied to the port, the fluid from the port P2 is drained through orifice. Accordingly, the fluid from the port P2 is reduced and swing speed is slow down.



29092MC19

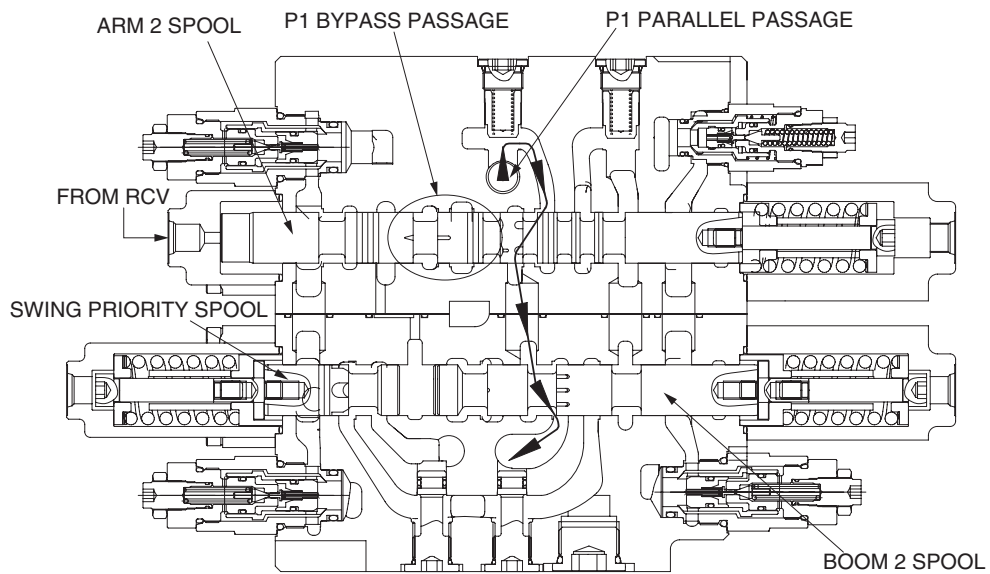
7) ARM OPERATION

(1) ARM IN OPERATION

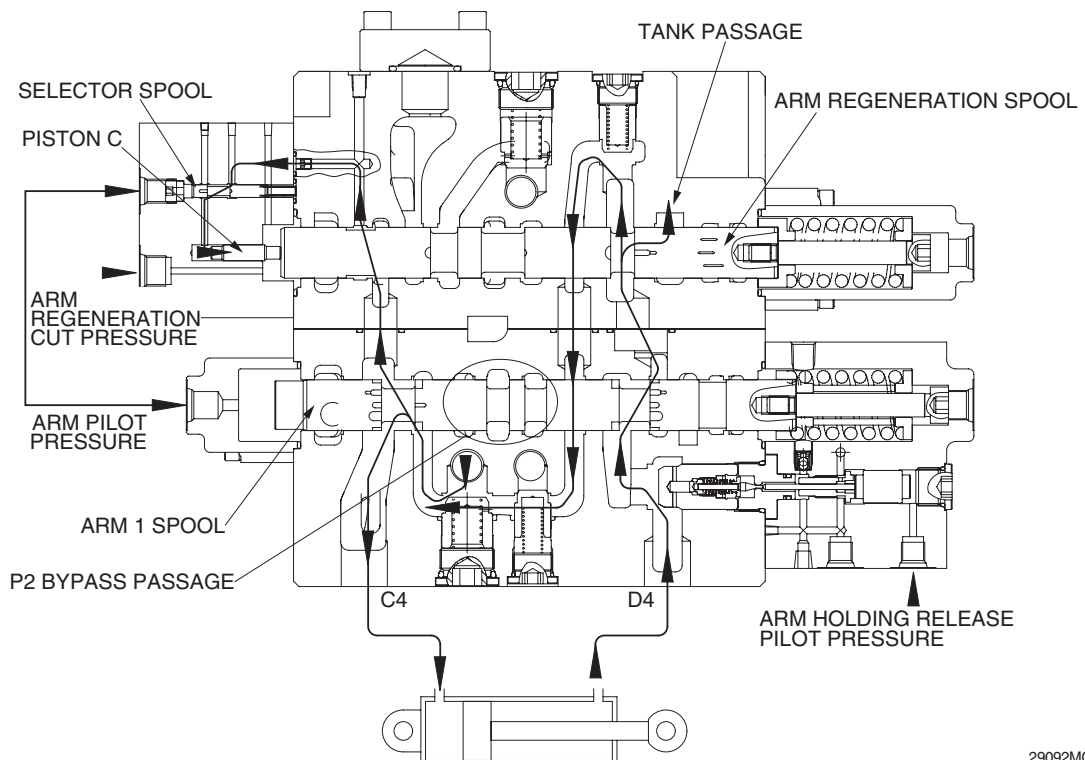
During arm in operation, the pilot secondary pressure from the RCV is supplied to the port of spring opposite side and shifts arm 1 spool in the right direction.

The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic oil from the pump P2 flows into the arm cylinder head side through P2 parallel passage, the load check valve, bridge passage and the port C4.

At same time, the pilot secondary pressure from the RCV is supplied to the port of spring opposite side and shifts arm 2 spool in the right direction. The bypass passage is shut off by the movement of the spool and the hydraulic fluid from the pump P1 flows into the arm summation passage through parallel passage, the check valve, the arm 2 spool and the boom 2 spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.



29092MC20



29092MC21

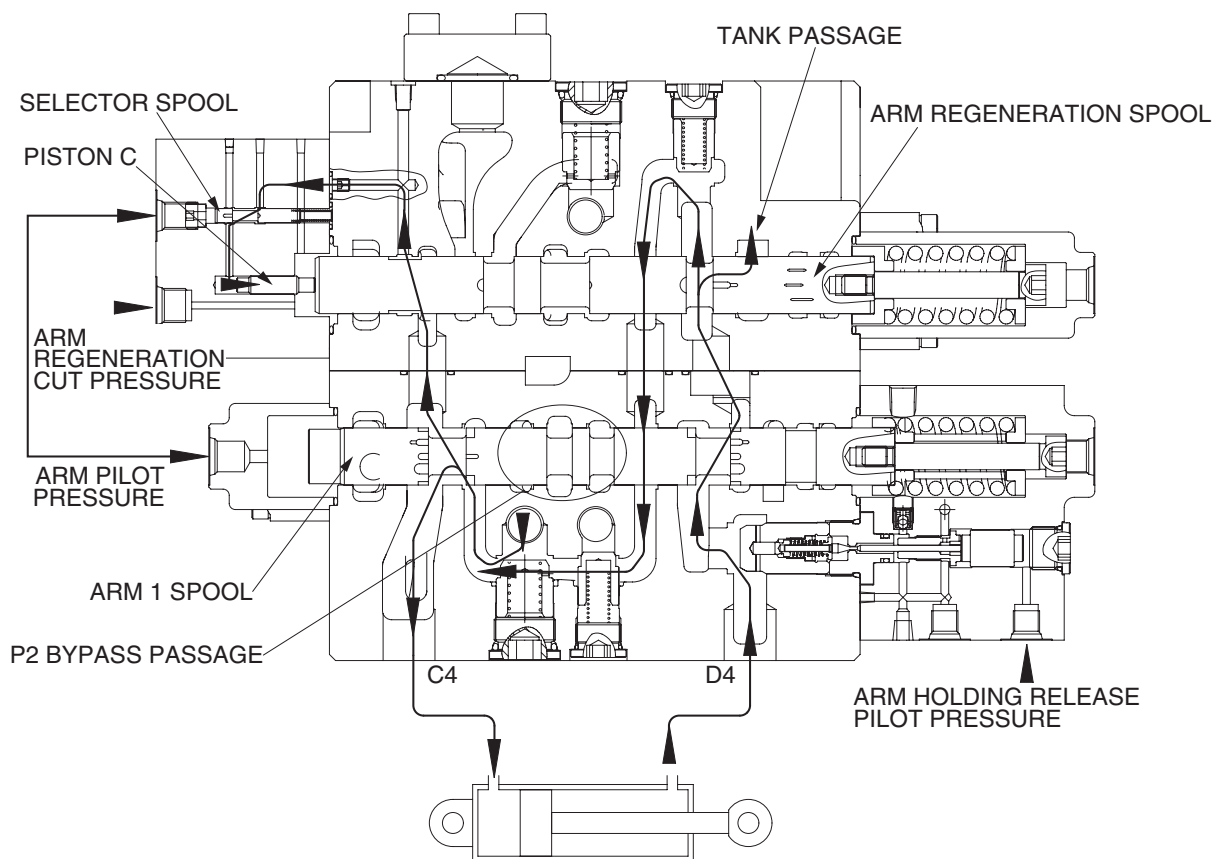
ARM REGENERATION

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 spool through the arm holding valve and the arm 1 spool. It is supplied the arm cylinder head through internal passage. This is called the arm regeneration function.

The amount of regeneration fluid is changed by movement of the arm regeneration spool. A few fluids 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 shifts 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.

The arm regeneration cut pressure is supplied to the port of spring opposite side 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. (The return fluid is maximum condition)



29092MC21

(2) ARM OUT OPERATION

During arm out operation, the pilot secondary pressure from RCV is supplied to the port of spring side and shifts arm 1 spool in the left direction.

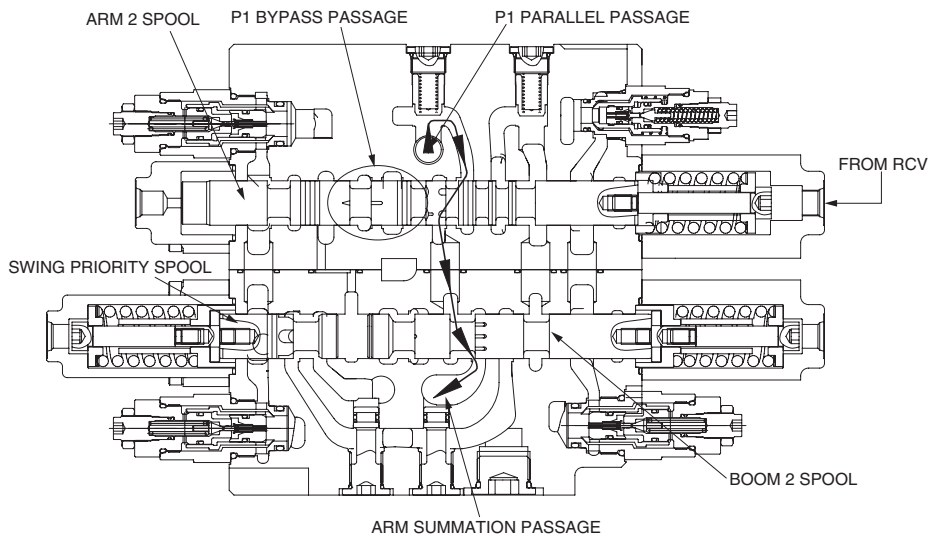
The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P2 flows into arm 1 spool through the parallel passage. Then it enters into the arm cylinder rod side through the load check valve, bridge passage, arm holding valve and the port D4.

Also, the pilot secondary pressure from RCV is supplied to the port of spring side and shifts arm 2 spool in the left direction.

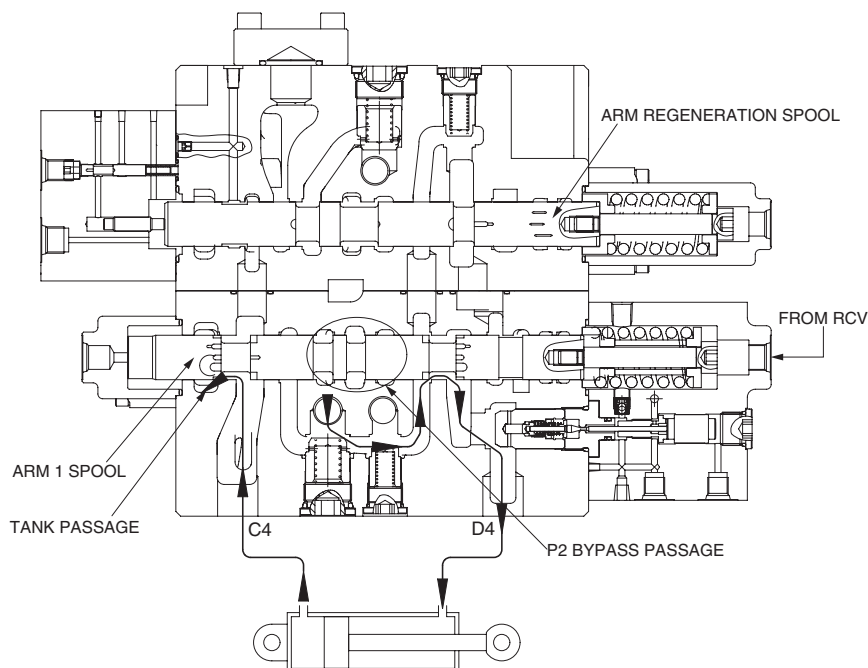
The bypass passage is shut off by the movement of the spool and some of the hydraulic fluid from pump P2 bypassed through bypass notch. The rest of hydraulic fluid from pump P2 flows into the arm summation passage through P1 parallel passage the check valve arm 2 spool and boom 2 spool.

Then it enters into the arm cylinder rod side with the fluid from the arm 1 spool.

The return flow from the arm cylinder head side returns to the hydraulic tank through the port C4 the arm 1 spool and tank passage.



29092MC22



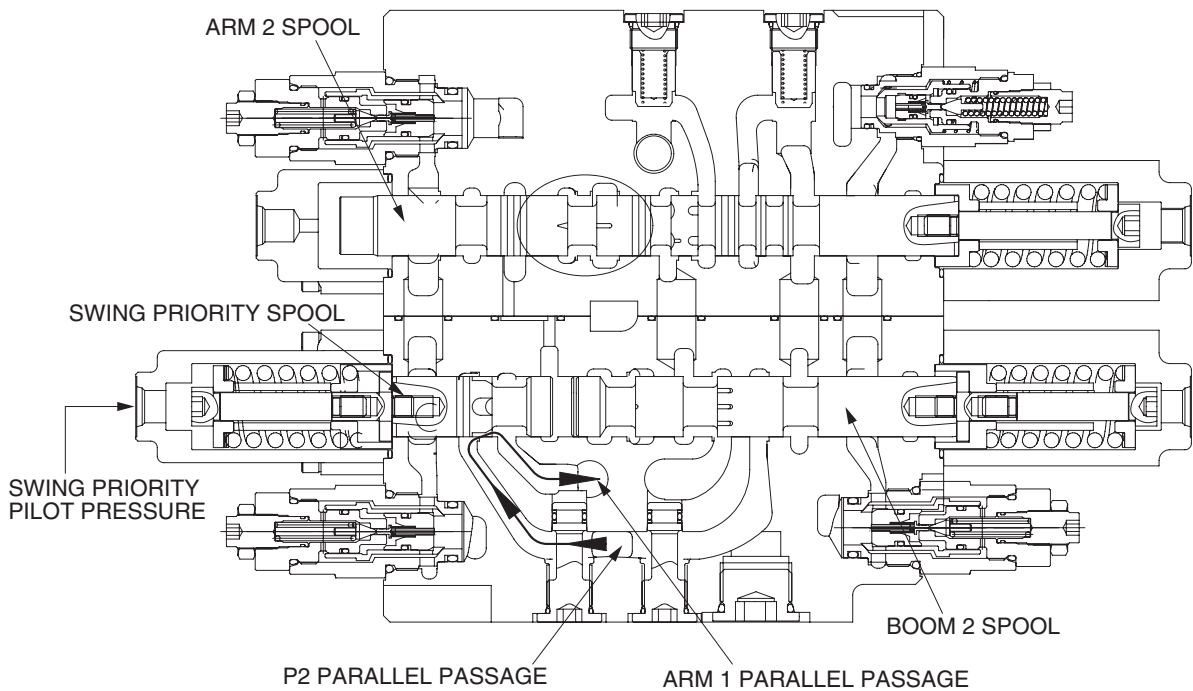
29092MC23

8) SWING PRIORITY FUNCTION

During swing priority operation, the pilot secondary pressure is supplied to the port of the spring side of the swing priority spool and shift swing priority spool in the right direction.

The hydraulic fluid from P2 parallel passage flows into the parallel passage of arm 1 side through swing priority spool and the passage "A" and also flows into the boom 2 spool.

When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the fluid from pump P2 flows to swing side more then the boom 2, arm 1, option B and bucket summation spools to make the swing operation most preferential.



29092MC24

9) OPERATION OF OPTION

(1) OPERATION BY PUMP P2

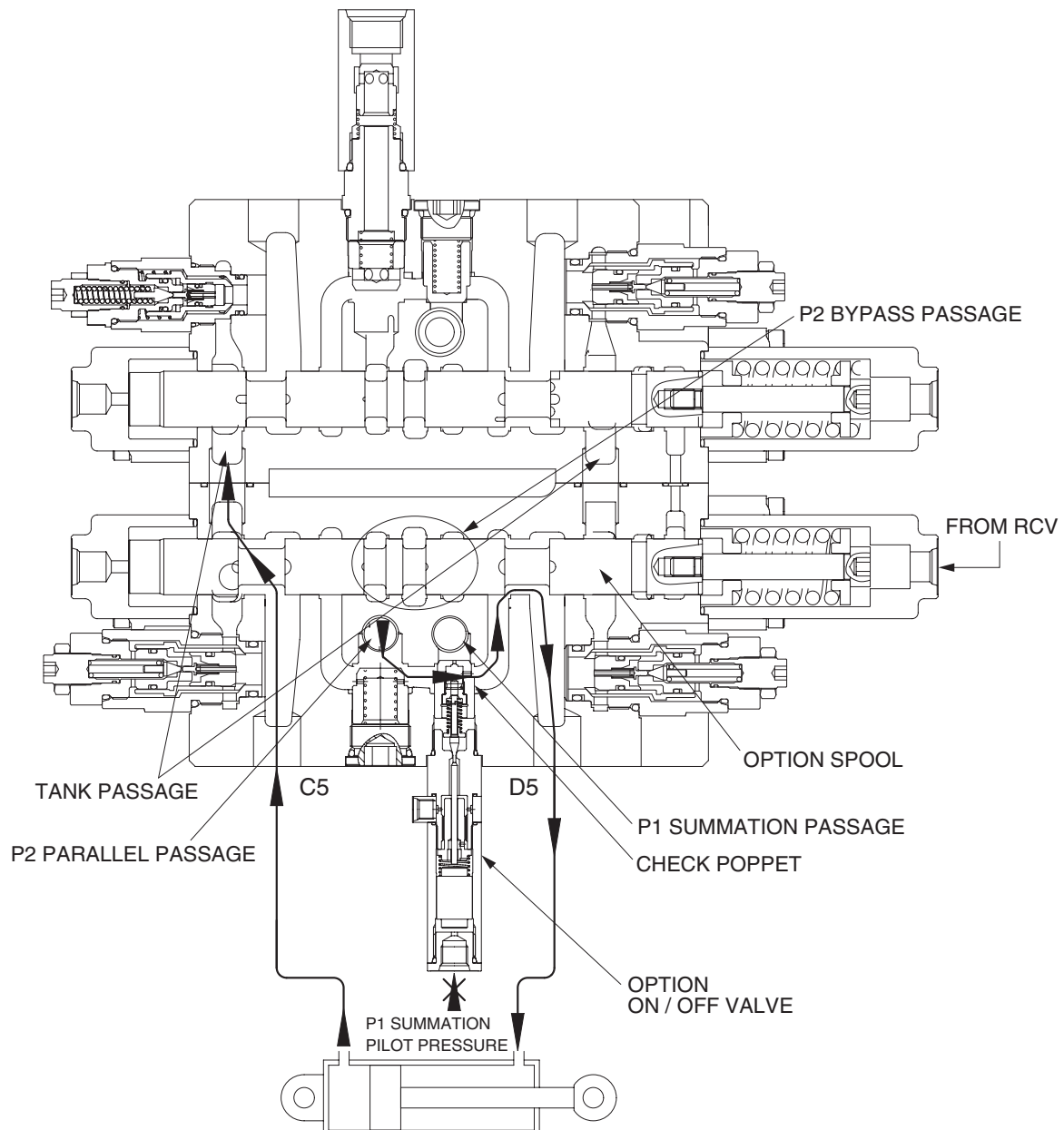
The pilot secondary pressure from RCV is supplied to the port of spring side and shifts option spool as the figure.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P2 flows into actuator through the load check valve, bridge passage and port D5.

If the pilot pressure is not supplied to P1 summation pilot port and is not shifts arm 2 spool. Accordingly, the pump P1 fluid connected the parallel passage is not flowing the check poppet of option ON/OFF valve and the fluid from pump is not joined the fluid from P2.

At the same time, the fluid from actuator returns to the tank passage through port C5 and notch of the option spool.

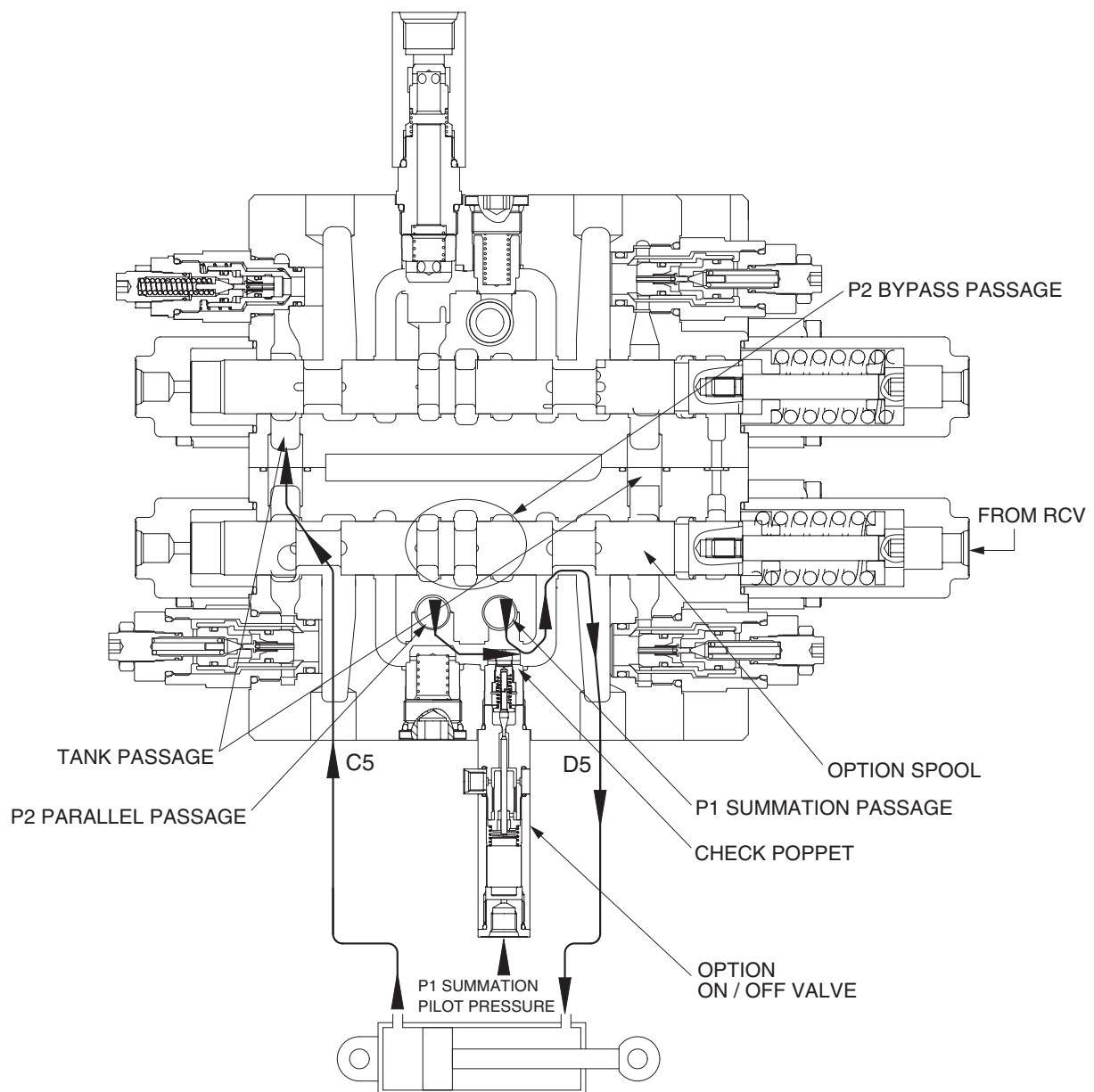
In case of reverse operation, the operating principle is same as above.



3009A2MC26

10) SUMMATION OPERATION WITH PUMP P1

The pilot pressure from RCV is supplied to option pilot port and one of arm 2 pilot port at the same time, the fluid for the arm summation is build up. This fluid flows into the arm 1 spool priority but the arm is not operated, the fluid flows into P1 summation passage. Now the pilot pressure of RCV is supplied to the P1 summation pilot port of option ON/OFF valve, the fluid from pump P1 opens the load check valve and flows into port D5 with the fluid of pump P2.



3009A2MC27

11) NEGATIVE RELIEF VALVE OPERATION

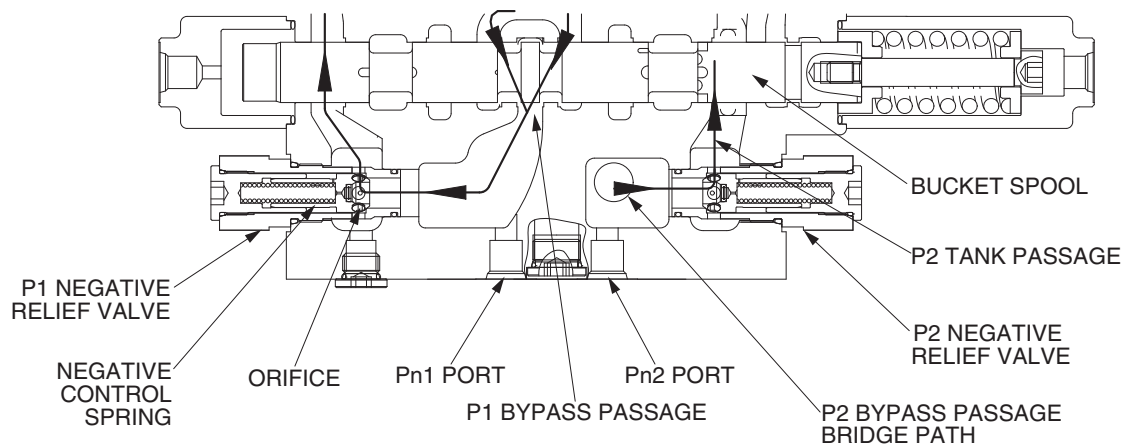
When no function is being actuated on P1 side, the hydraulic fluid from the pump P1, flows into the tank passage through the bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump P1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

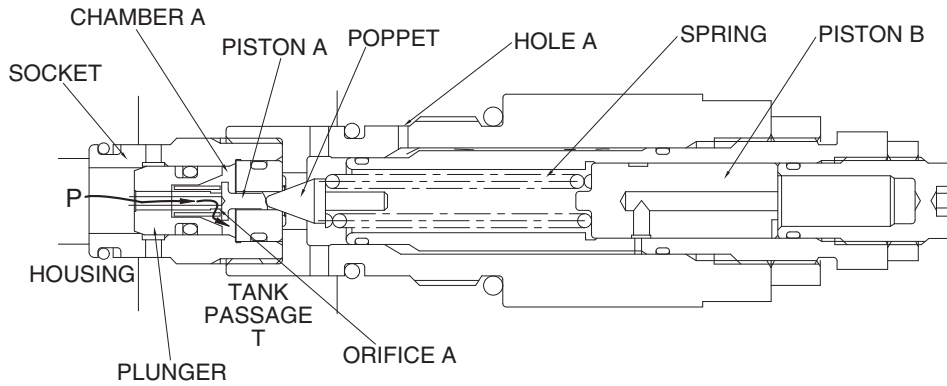
For the pump P2 the same negative control principle.



29092MC28

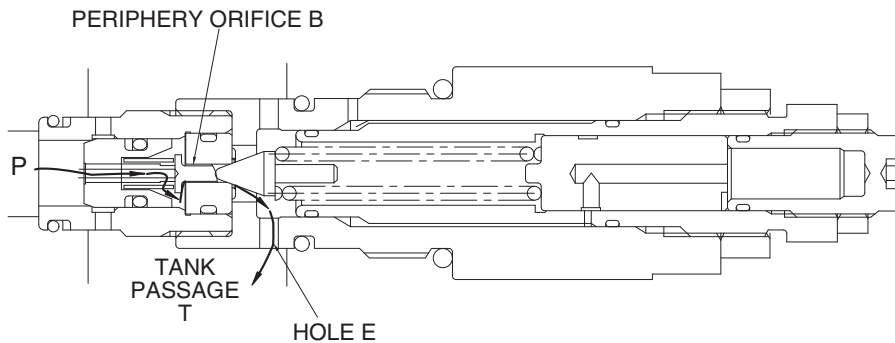
12) OPERATION OF MAIN RELIEF VALVE

- (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.



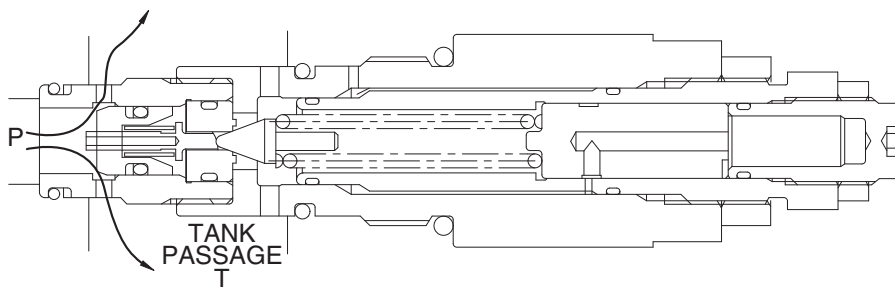
29092MC29

- (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 plunger internal passage, periphery orifice A, chamber A, periphery orifice B and the hole (E).



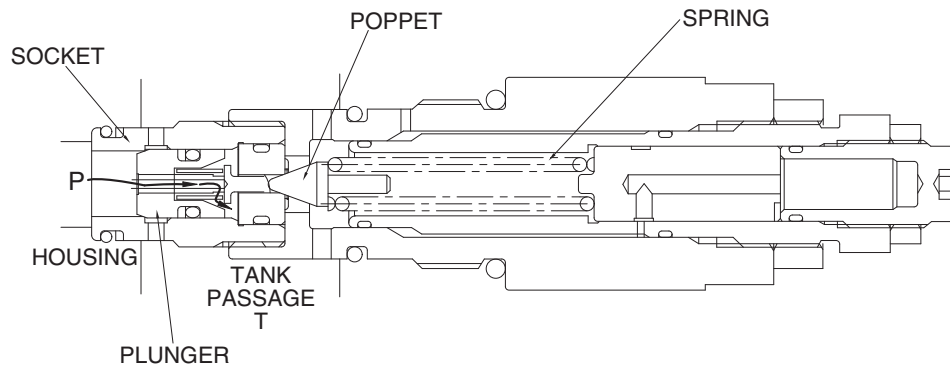
29092MC30

- (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).



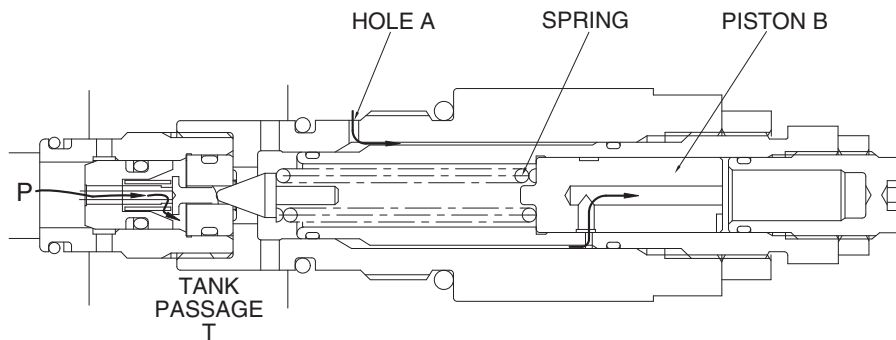
29092MC31

- (4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



29092MC29-2

- (5) 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.

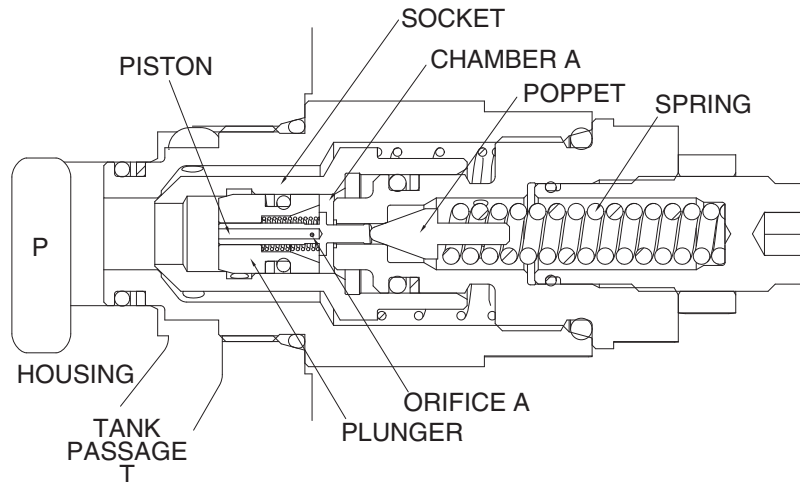


29092MC29-1

13) OPERATION OF OVERLOAD RELIEF VALVE

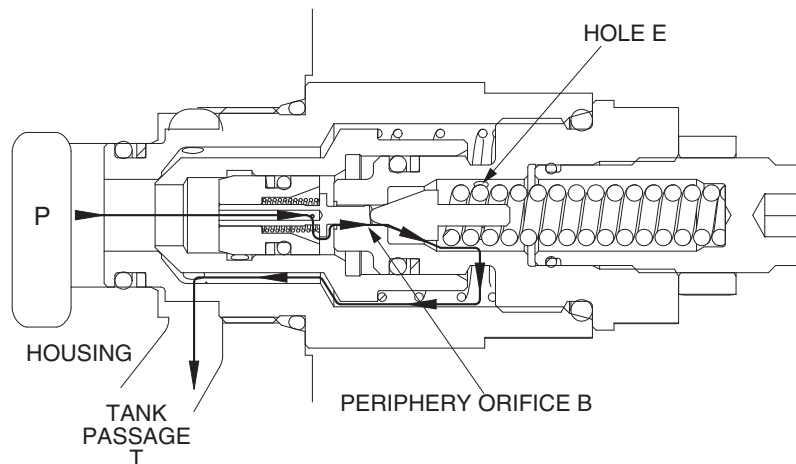
FUNCTION AS RELIEF VALVE

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



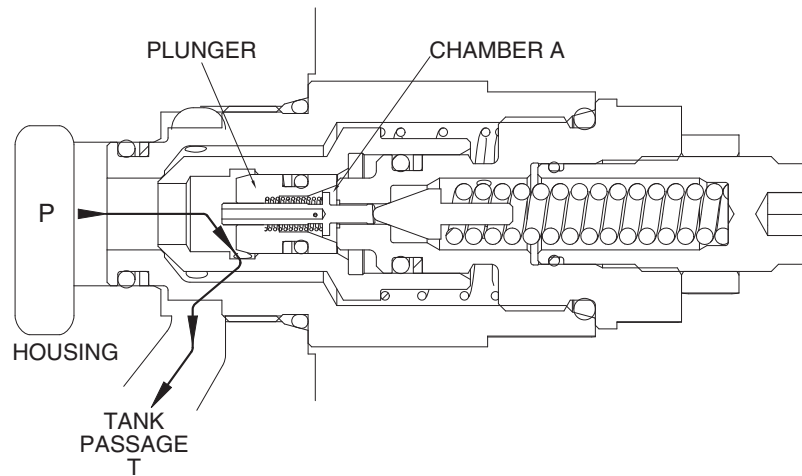
29092MC32

- (2) When the pressure at port P becomes equal to the set pressure of the spring, the pressurized oil pushes open the poppet and flows to tank passage (T) through the plunger internal passage, orifice A, chamber A, periphery orifice B and hole E.



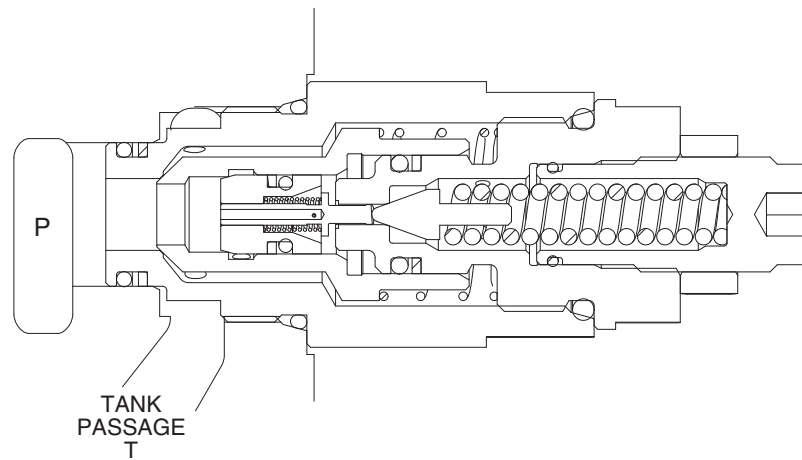
29092MC33

- (3) 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).



29092MC34A

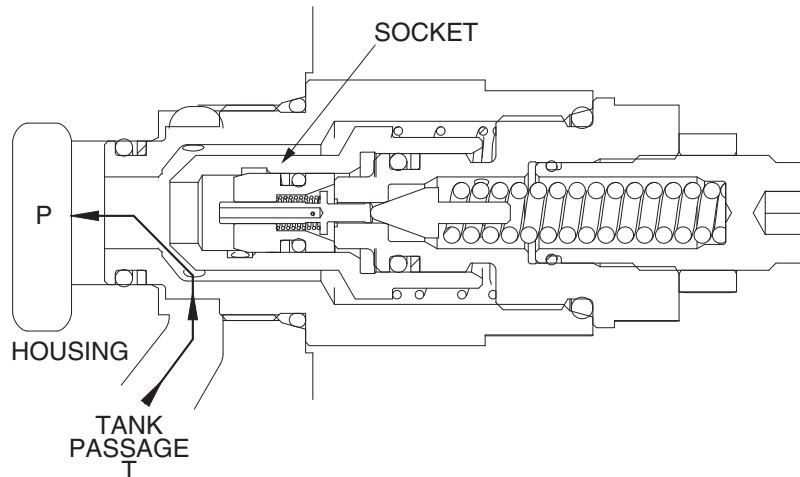
- (4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



29092MC32-1

MAKE-UP FUNCTION

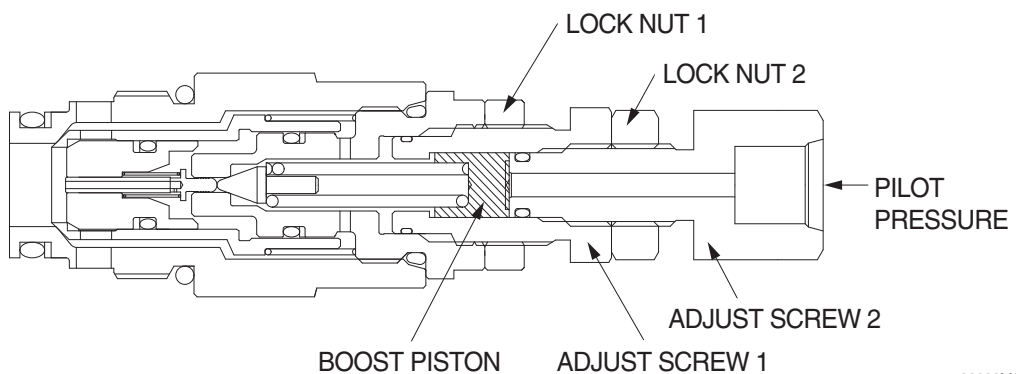
- (5) When negative pressure exists at port P, the oil is supplied through tank passage (T). When the pressure at tank passage (T) becomes higher than that of at port P, the socket moves in the right direction. Then, sufficient oil passes around the socket from tank passage (T) to port P and fills up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



29092MC35

14) BREAKER OVERLOAD RELIEF VALVE FUNCTION

- (1) The structure and function of 2 stage relief valve is similar with the overload relief but it can set the higher pressure by pilot pressure.



29092MC46

Boost function

- (1) When the pilot pressure is supplied, the spring is a little compressed by moving of the boost piston and the set pressure is higher as length of spring compressed.

Pressure set method

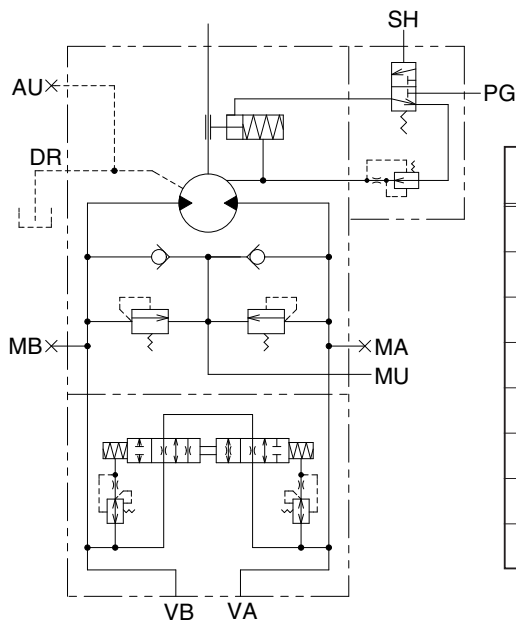
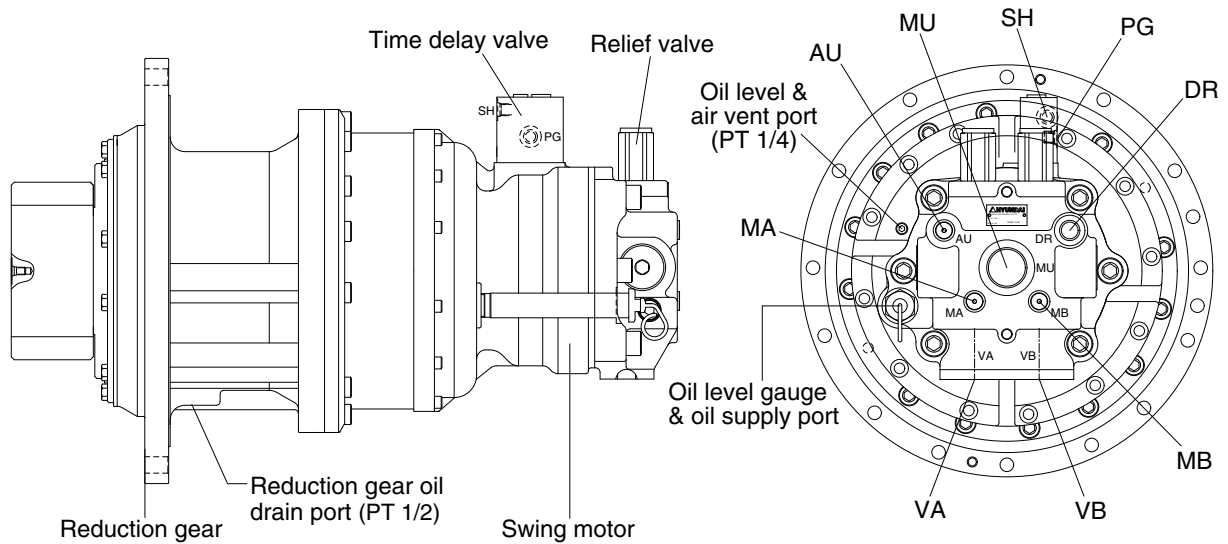
- (2) Loosen lock nut 1 and 2 and then full tighten adjust screw 2.
- (3) Set the high pressure by adjusting the adjust screw 1 and 2 and then fix it by the lock nut 1. Keep the adjust screw 1 do not move when fixing the lock nut 1.
- (4) Set the low pressure by adjusting the adjust screw 2 and then fix it by the lock nut 2. Keep the adjust screw 2 do not move when fixing the lock nut 2.

GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.

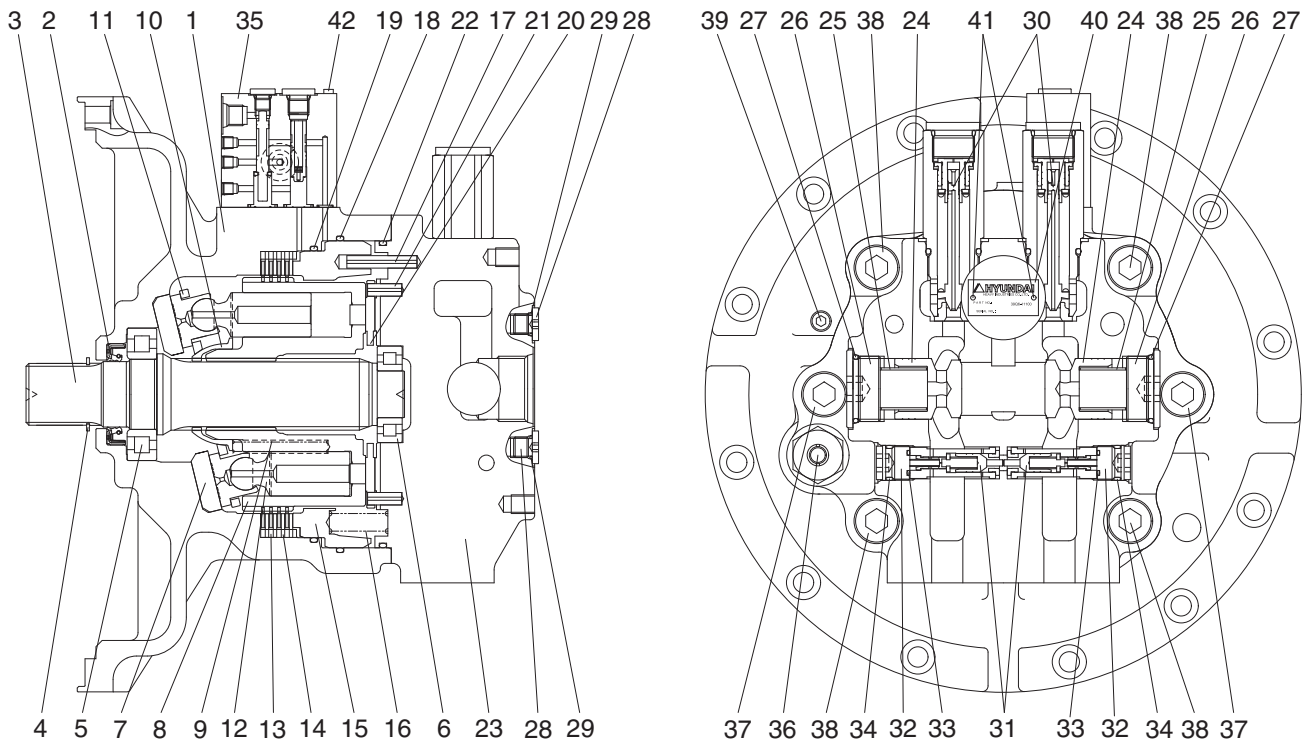


Hydraulic circuit

Port	Port name	Port size
VA	Main port	ø 20
VB	Main port	ø 20
DR	Drain port	PF 1/2
MU	Make up port	PF 1 1/4
PG	Brake release stand by port	PF 1/4
SH	Brake release port	PF 1/4
MA, MB	Gauge port	PF 1/4
AU	Air vent port	PF 1/4

300L2SM01

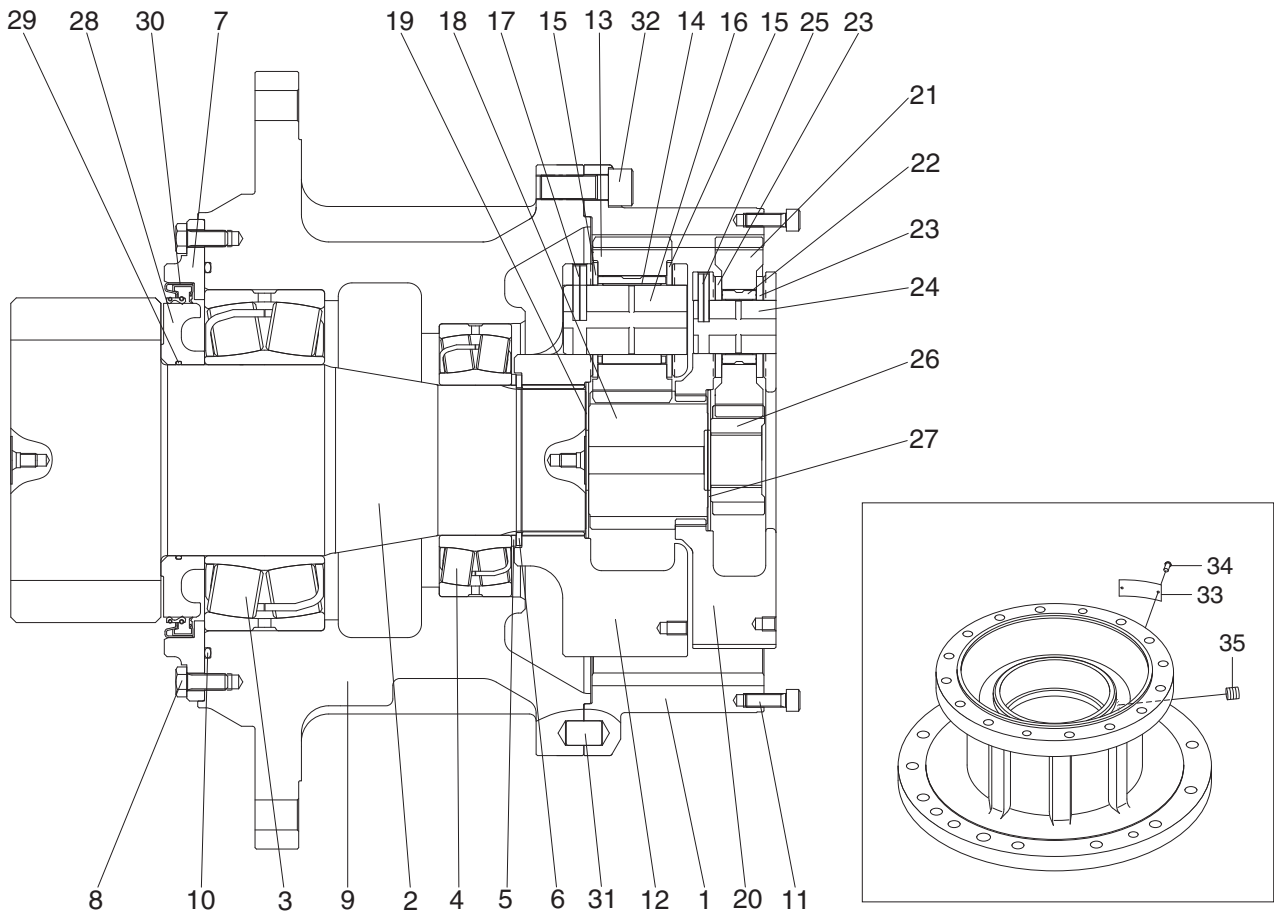
1) SWING MOTOR



300L2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) REDUCTION GEAR



300L2SM03

- | | | | | | |
|----|----------------------|----|------------------|----|----------------------|
| 1 | Ring gear | 13 | Planetary gear 2 | 25 | Spring pin 1 |
| 2 | Drive shaft | 14 | Needle bearing 2 | 26 | Sun gear 1 |
| 3 | Bearing | 15 | Thrust washer 2 | 27 | Thrust plate 1 |
| 4 | Bearing | 16 | Carrier pin 2 | 28 | Sleeve |
| 5 | Thrust plate | 17 | Spring pin 2 | 29 | O-ring |
| 6 | Snap ring | 18 | Sun gear 2 | 30 | Oil seal |
| 7 | Cover | 19 | Thrust plate 2 | 31 | Parallel pin |
| 8 | Hex head bolt | 20 | Carrier 1 | 32 | Hex socket head bolt |
| 9 | Casing | 21 | Planetary gear 1 | 33 | Name plate |
| 10 | O-ring | 22 | Needle bearing 1 | 34 | Rivet |
| 11 | Hex socket head bolt | 23 | Thrust washer 1 | 35 | Plug |
| 12 | Carrier 2 | 24 | Carrier pin 1 | | |

2. PRINCIPLE OF DRIVING

2.1 Generating the turning force

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (8) through valve casing of motor (1), and valve plate (20).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston (12).

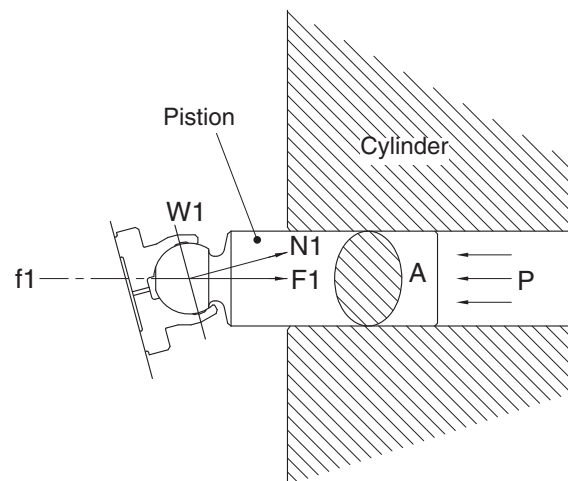
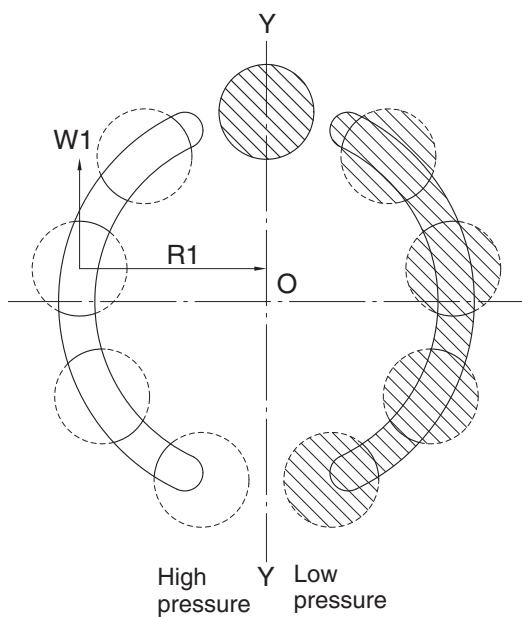
The high hydraulic can generate the force, $F1=P \times A$ (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, $F1$, is divided as $N1$ thrust partial pressure and $W1$ radial partial pressure, in case of the plate of a tilt angle, α .

$W1$ generates torque, $T=W1 \times R1$, for Y-Y line connected by the upper and lower sides of the piston as following pictures.

The sum of torque ($\sum W1 \times R1$), generated from each piston (4~5 pieces) on the side of a high hydraulic, generates the turning force.

This torque transfers the turning force to a cylinder (8) through a piston; because a cylinder is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



21078TM05

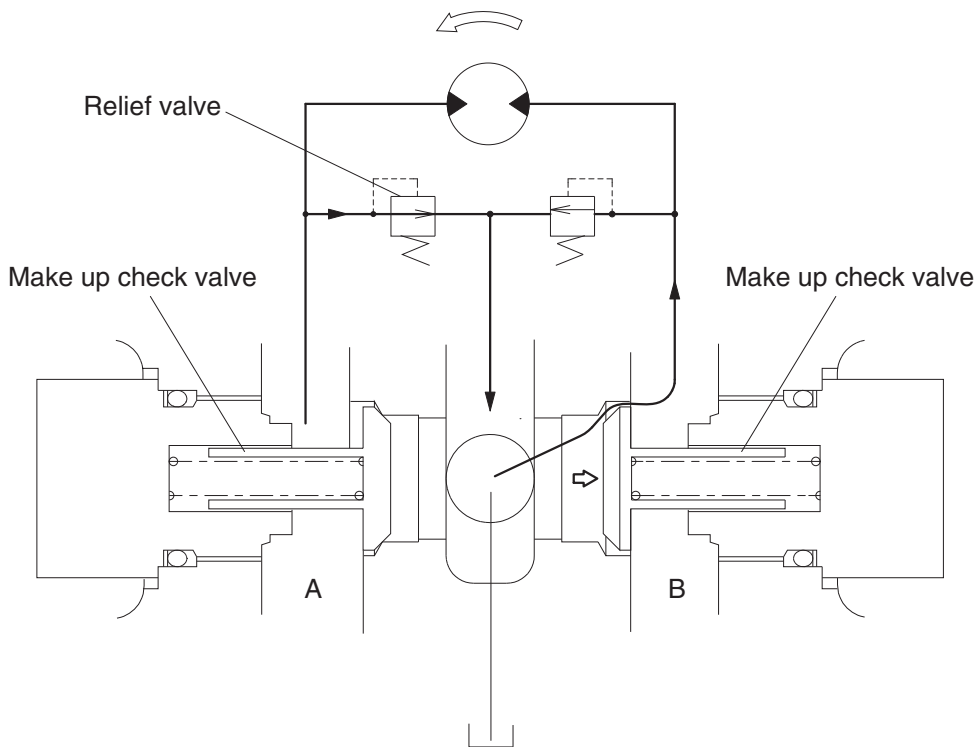
2) MAKE UP VALVE

In the system using this type of motor, there is no counter balance functioning valve and there happens the case of revolution exceeding hydraulic supply of motor. To prevent the cavitation caused by insufficient oil flow there is a make up valve to fill up the oil insufficiency.

A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve.

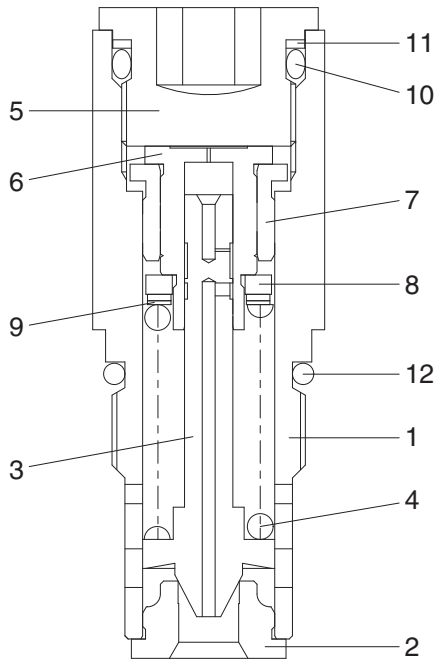
Pressurized oil into the port B, the motor rotate counterclockwise.

If the plunger of MCV moves neutral position, the oil in the motor is drain via left relief valve, the drain oil run into motor via right make up valve, which prevent the cavitation of motor.



21092SM04

3) RELIEF VALVE



- 1 Body
- 2 Seat
- 3 Plunger
- 4 Spring
- 5 Adjusting screw
- 6 Piston
- 7 Bushing
- 8 Spring seat
- 9 Shim
- 10 O-ring
- 11 Back up ring
- 12 O-ring

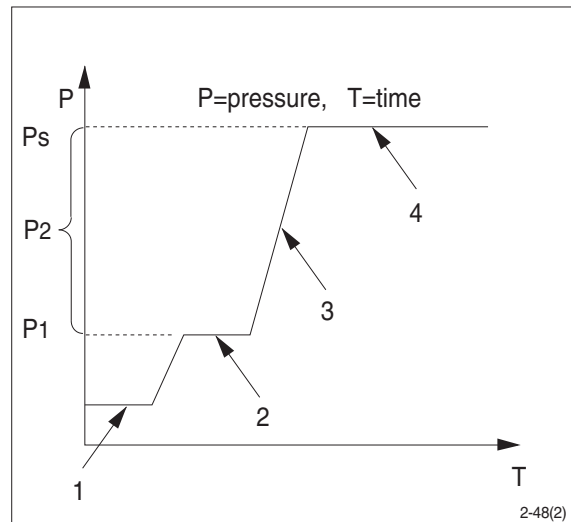
14007A2SM05

(1) Construction of relief valve

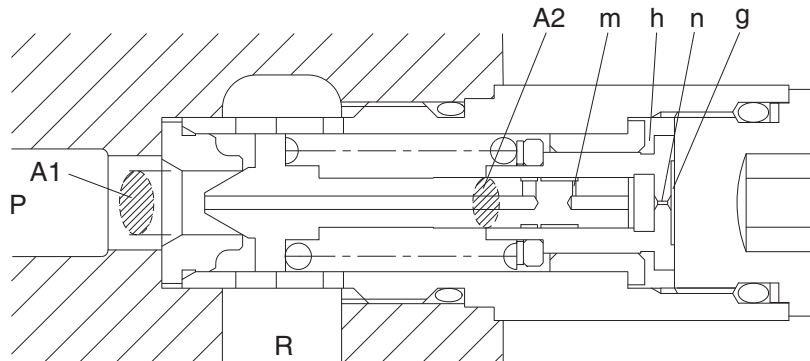
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

Figure illustrates how the pressure acting on the relief valve is related to its rising process. Here is given the function, referring to the figure following page.



- ① Ports (P,R) at tank pressure.

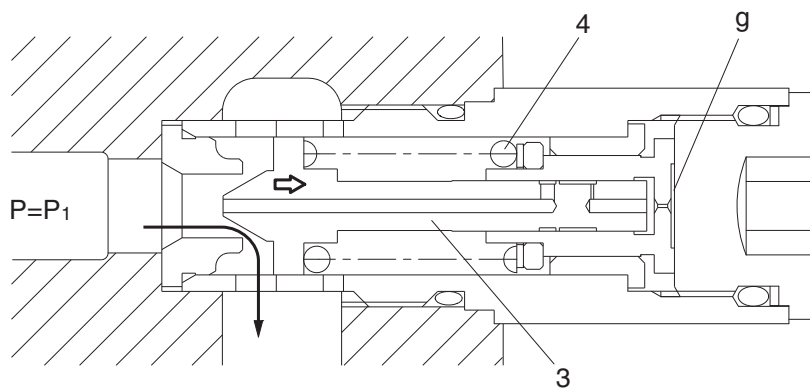


14007A2SM06

- ② When hydraulic oil pressure ($P \times A_1$) reaches the preset force (F_{SP}) of spring (4), the plunger (3) moves to the right as shown.

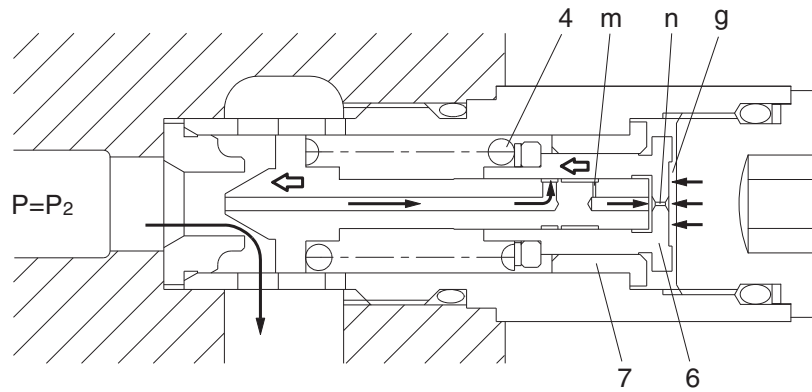
$$P_1 \times A_1 = F_{SP} + P_g \times A_2$$

$$P_1 = \frac{F_{SP} + P_g \times A_2}{A_1}$$



14007A2SM07

- ③ The oil flow chamber g via orifice m and n. When the pressure of chamber g reaches the preset force (F_{SP}) of spring (4), the piston (6) moves left and stop the piston (6) hits the bottom of bushing (7).

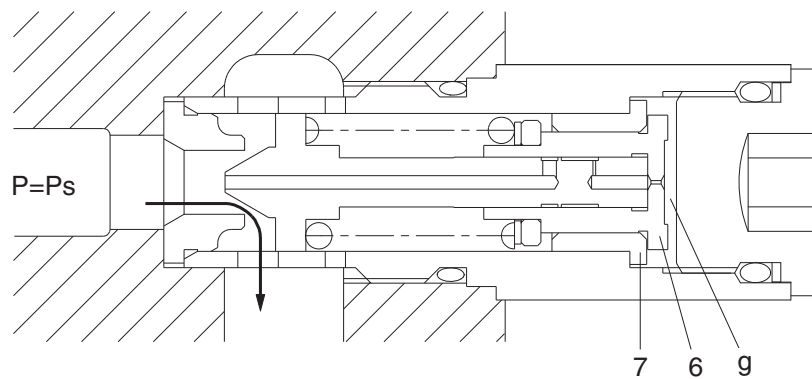


14007A2SM08

- ④ When piston (6) hits the bottom of bushing (7), it stops moving to the left any further. As the result, the pressure in chamber (g) equals (P_s).

$$P_s \times A_1 = F_{sp} + P_s \times A_2$$

$$P_s = \frac{F_{sp}}{A_1 - A_2}$$



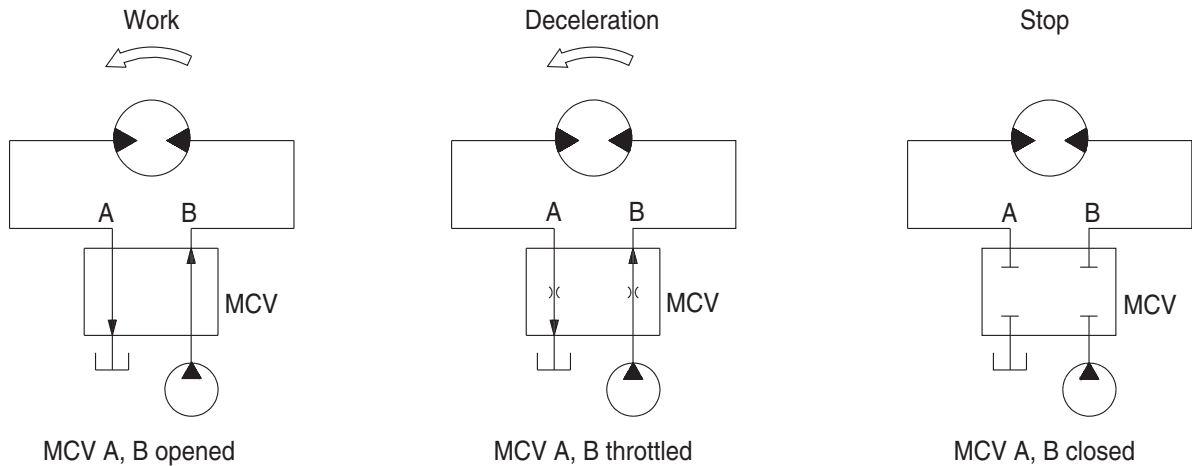
14007A2SM09

4) BRAKE SYSTEM

(1) Control valve swing brake system

This is the brake system to stop the swing motion of the excavator during operation.

In this system, the hydraulic circuit is throttled by the swing control valve, and the resistance created by this throttling works as a brake force to slow down the swing motion.



2-48(1)

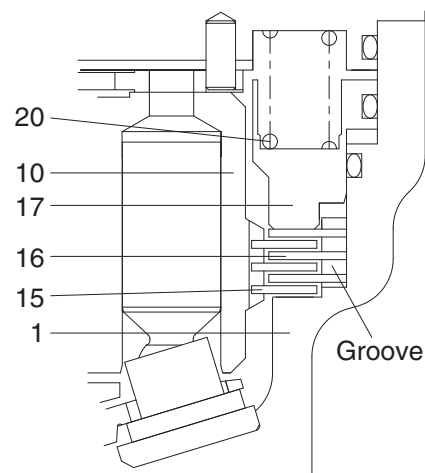
(2) Mechanical swing parking brake system

This is function as a parking brake only when all of the RCV lever (except swing, arm in) are not operated.

① Brake assembly

Circumferential rotation of separate plate (16) is constrained by the groove located at housing (1). When housing is pressed down by brake spring (20) through friction plate (15), separate plate (16) and brake piston (17), friction force occurs there.

Cylinder block (10) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



21092SM15

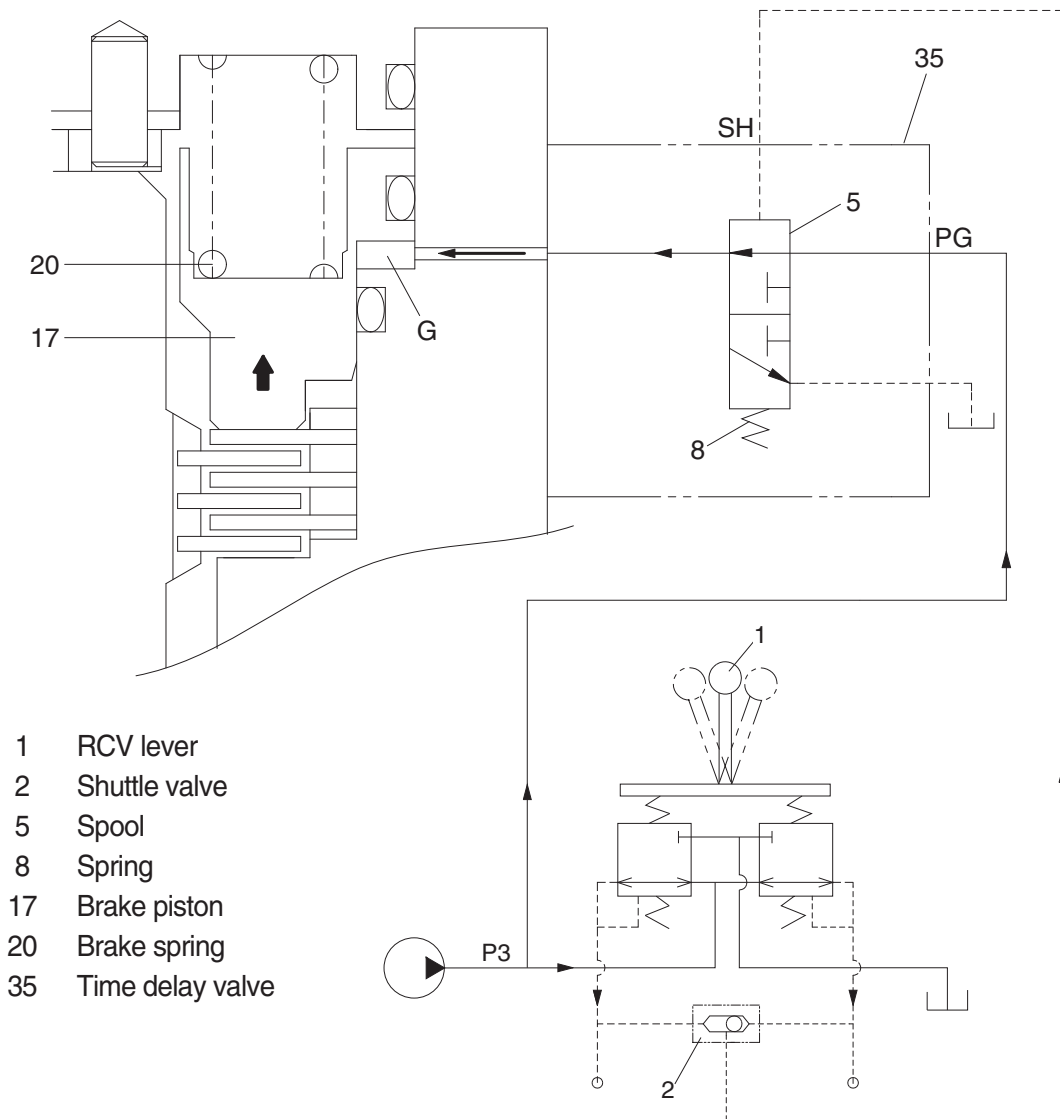
1	Housing	16	Separate plate
10	Cylinder block	17	Brake piston
15	Friction plate	20	Spring

② **Operating principle**

a. When the RCV lever (1) is set to the swing or arm in operating position, the pilot oil go to SH of the time delay valve (35).

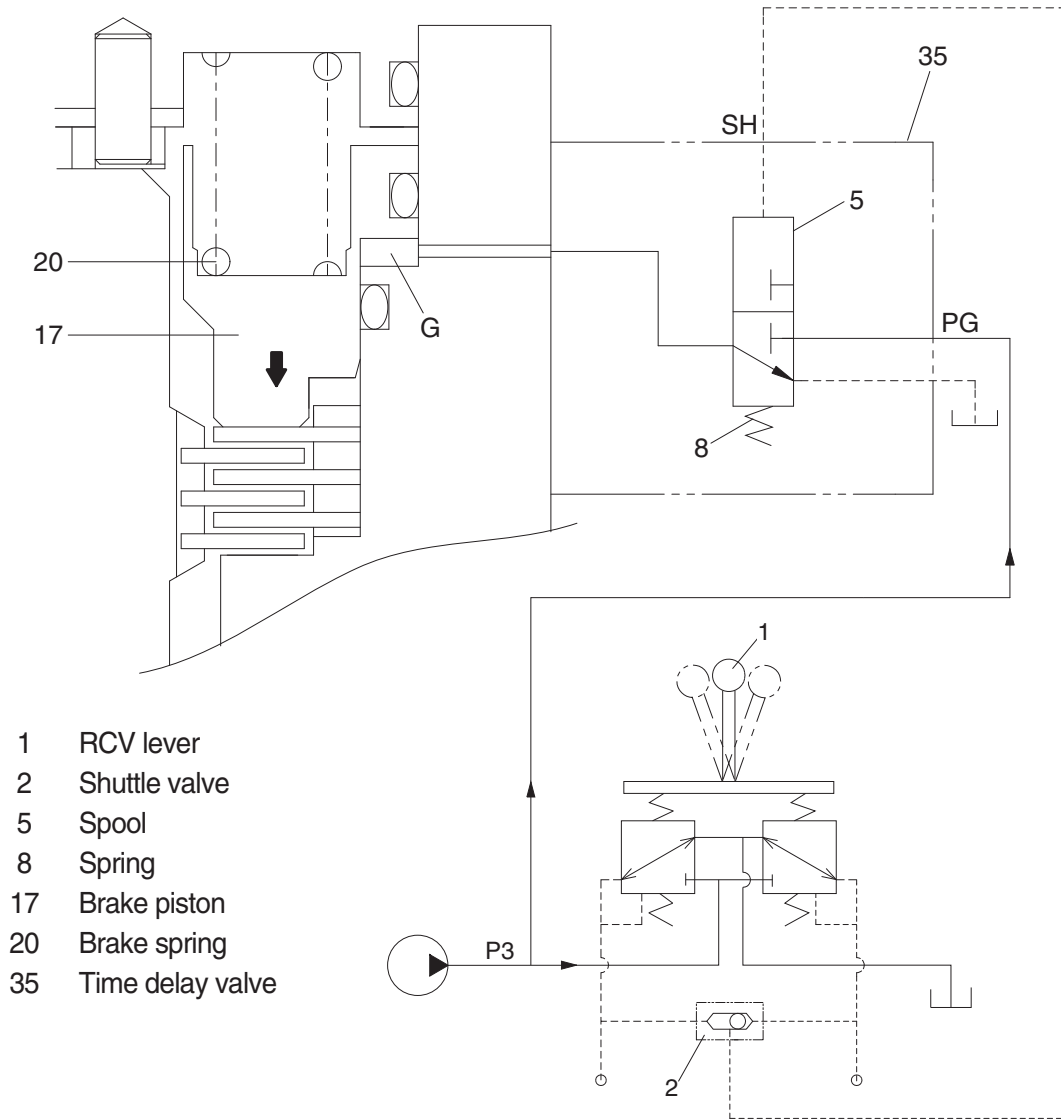
This pressure moves spool (5) to the leftward against the force of the spring(8), so pilot pump charged oil (P3) goes to the chamber G through port PG.

This pressure is applied to move the piston (17) to the upward against the force of the spring (20). Thus, it releases the brake force.



300L2SM04

- b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to the top. Then, the brake piston (17) is moved lower by spring force and the return oil from the chamber G flows back to tank port. At this time, the brake works.



- 1 RCV lever
- 2 Shuttle valve
- 5 Spool
- 8 Spring
- 17 Brake piston
- 20 Brake spring
- 35 Time delay valve

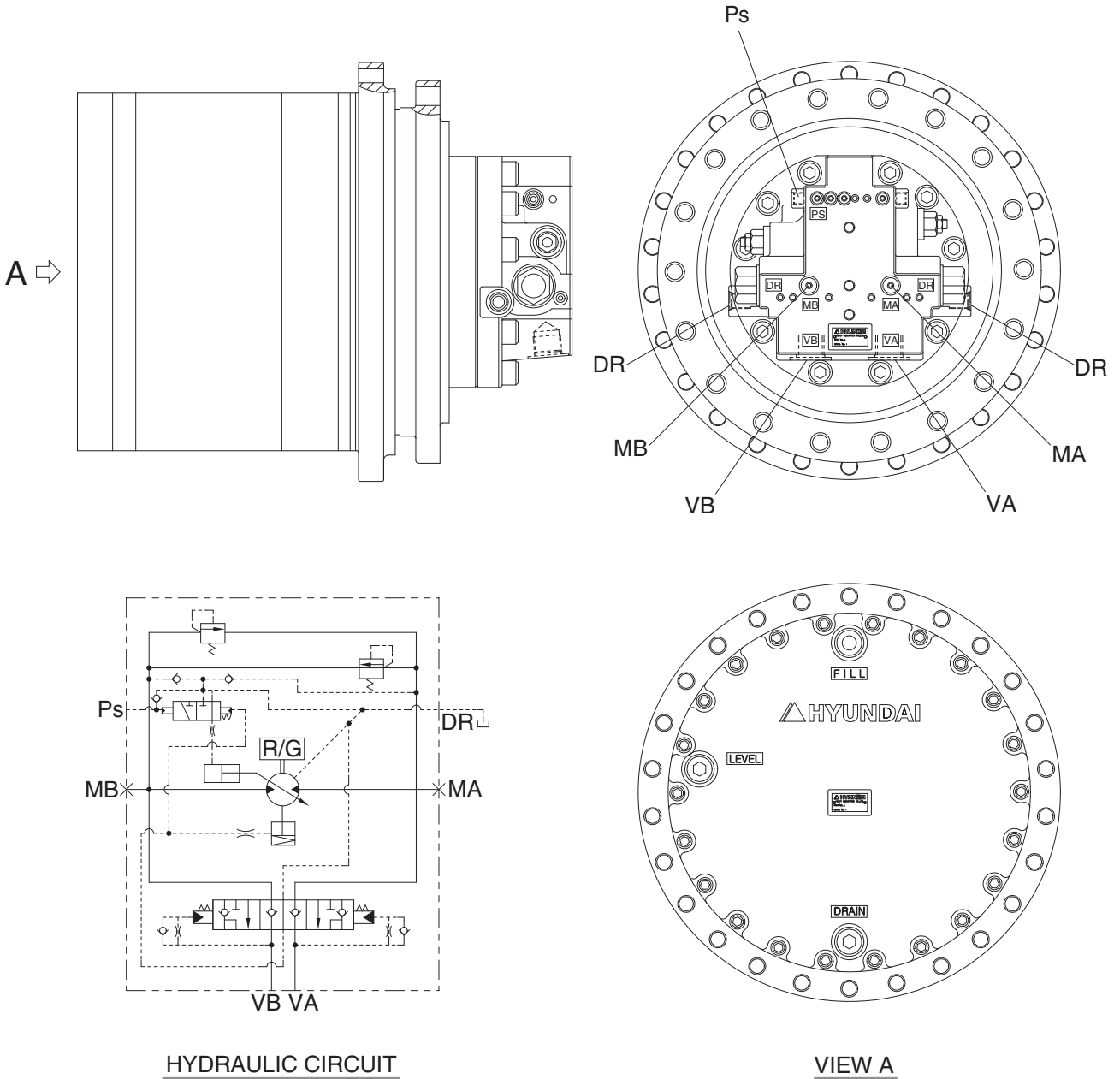
300L2SM05

GROUP 4 TRAVEL DEVICE (TYPE 1 & 3)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.

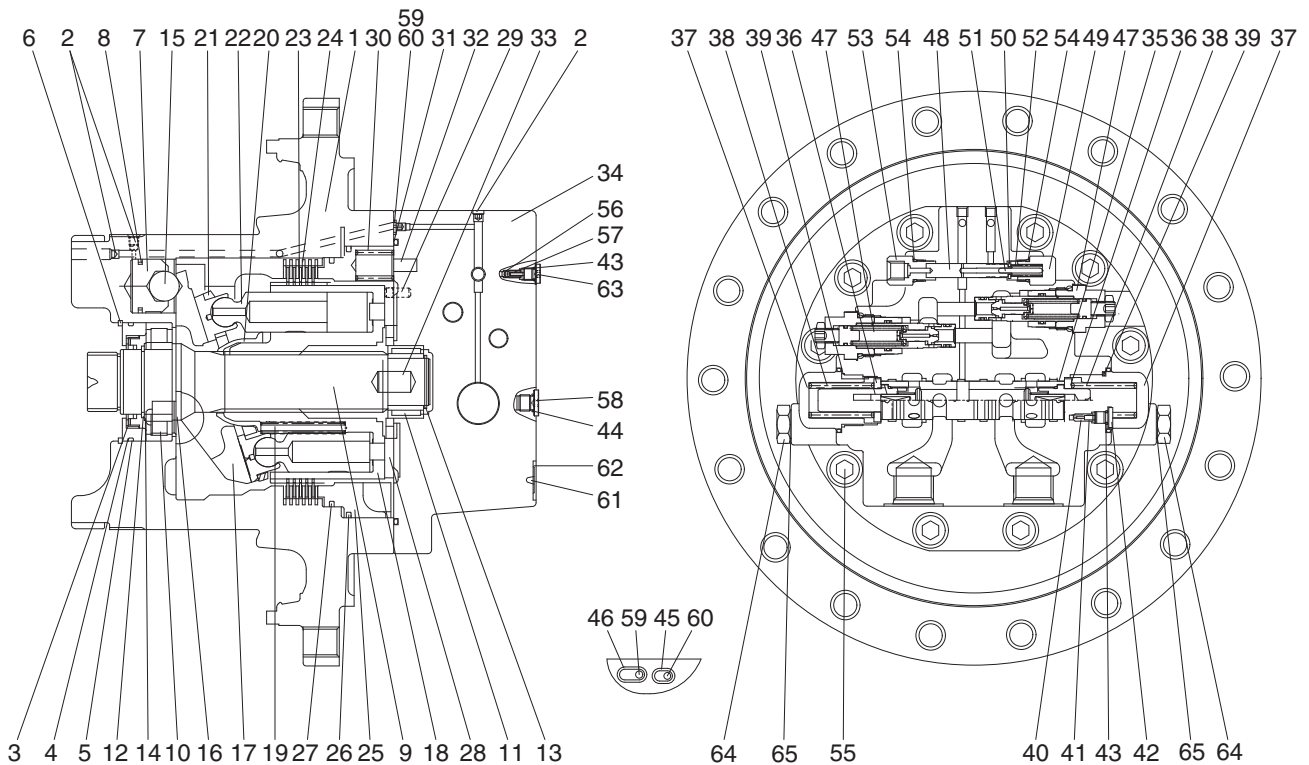


300L2TM01

Port	Port name	Port size
VA, VB	Valve port	PF 1
Ps	Pilot port	PF 1/4
DR	Drain port	PF 1/2
MA, MB	Gauge port	PF 1/4

2. SPECIFICATION

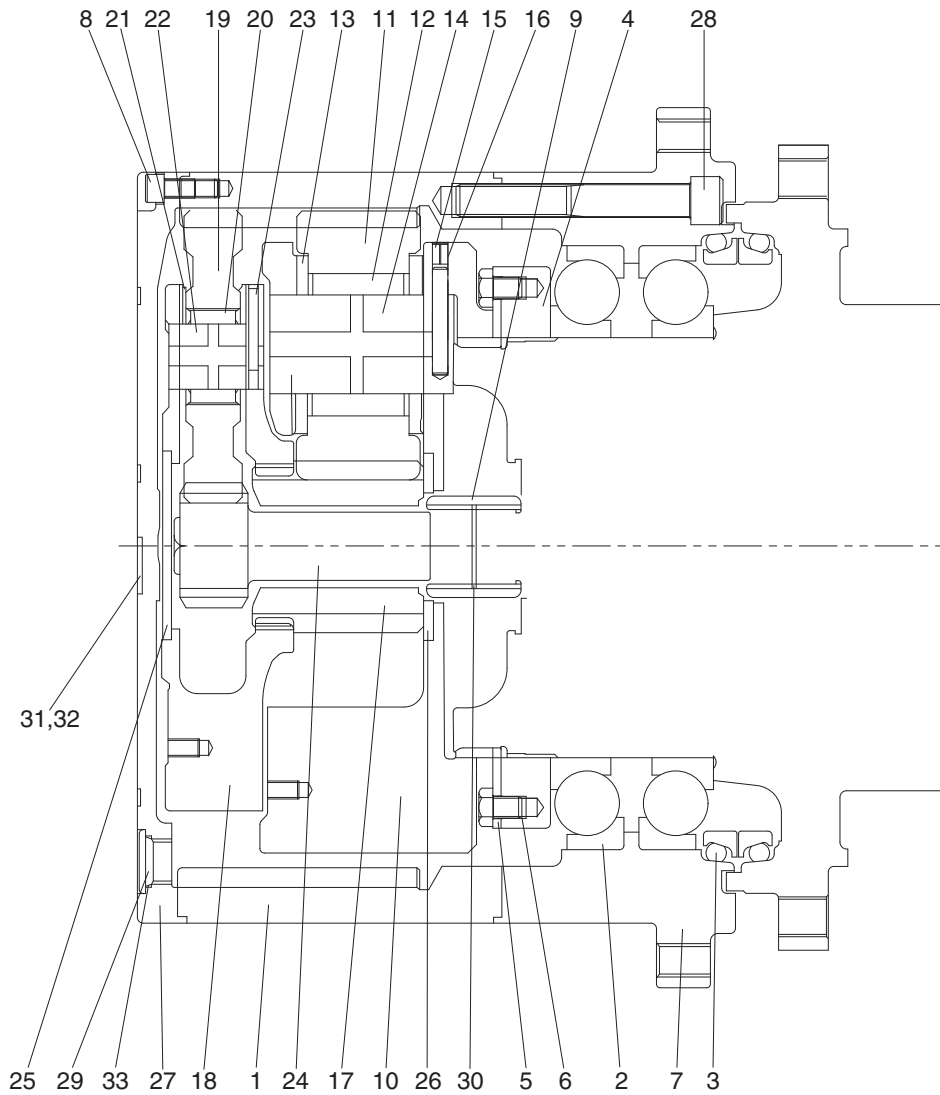
1) TRAVEL MOTOR



300L2TM02

1	Casing	23	Friction plate	45	O-ring
2	Plug	24	Separate plate	46	O-ring
3	Oil seal	25	Parking piston	47	Relief valve assy
4	Thrust block	26	D-ring	48	Spool
5	O-ring	27	D-ring	49	Plug
6	Snap ring	28	Valve plate	50	Spring seat
7	Piston	29	Parallel pin	51	Parallel pin
8	Piston seal	30	Spring	52	Spring
9	Shaft	31	O-ring	53	Connector
10	Cylinder roller bearing	32	Spring pin	54	O-ring
11	Needle bearing	33	Parallel pin	55	Hexagon socket head bolt
12	Snap ring	34	Rear cover	56	Check valve
13	Snap ring	35	Main spool assy	57	Spring
14	Thrust plate	36	Spring seat	58	Plug
15	Steel ball	37	Plug	59	Restrictor
16	Pivot	38	Spring	60	Restrictor
17	Swash plate	39	O-ring	61	Name plate
18	Cylinder block	40	Restrictor	62	Rivet
19	Spring	41	Spring	63	Plug
20	Ball guide	42	Plug	64	Plug
21	Retainer plate	43	O-ring	65	O-ring
22	Piston assy	44	O-ring		

2) TRAVEL REDUCTION GEAR



300L2TM03

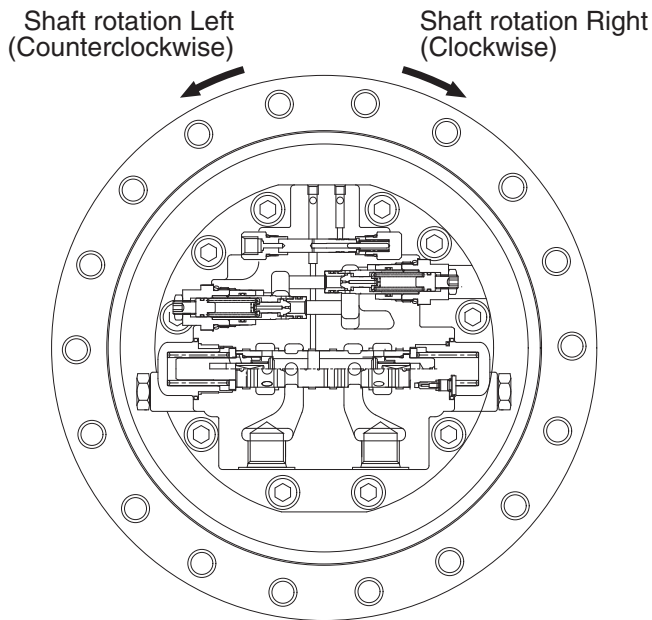
1	Gear ring	12	Needle bearing 2	23	Spring pin 1
2	Ball bearing	13	Thrust washer 2	24	Sun gear 1
3	Floating seal assy	14	Carrier pin 2	25	Thrust plate
4	Nut ring	15	Spring pin 2	26	Thrust plate
5	Lock plate	16	Solid pin 2	27	Cover
6	Hexagon socket head bolt	17	Sun gear 2	28	Hexagon socket head bolt
7	Housing	18	Carrier 1	29	Plug
8	Hexagon socket head bolt	19	Planetary gear 1	30	Snap ring
9	Coupling	20	Needle bearing 1	31	Name plate
10	Carrier 2	21	Thrust washer 1	32	Rivet
11	Planetary gear 2	22	Carrier pin 1	33	O-ring

3. OPERATION

1) MOTOR

High pressure oil delivered from hydraulic pump is led to inlet port that is provided in the brake valve portion and, through the rear cover (34) and valve plate (28), led to cylinder block (18).

The oil flow and direction of shaft rotation are indicated in table.



Inlet port	Outlet port	Direction of shaft rotation (viewing from rear cover)
VB	VA	Right (clockwise)
VA	VB	Left (counterclockwise)

300L2TM04

As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

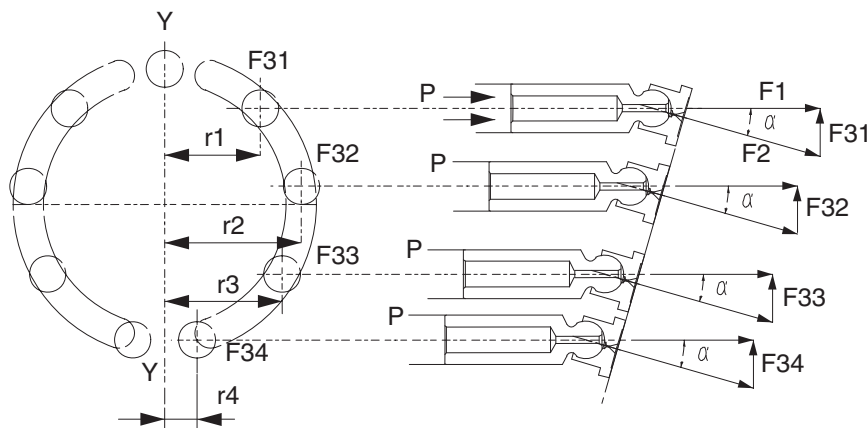
$$F1 = P \times A \text{ (P : pressure, A : area of piston section)}$$

The swash plate (17) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-34.

This radial force is applied to axis Y-Y as turning force and generate drive torque of T.

$$T = r_1 \cdot F31 + r_2 \cdot F32 + r_3 \cdot F33 + r_4 \cdot F34$$

This drive torque is transmitted via cylinder block (18) to driving shaft (9).



29092TM07

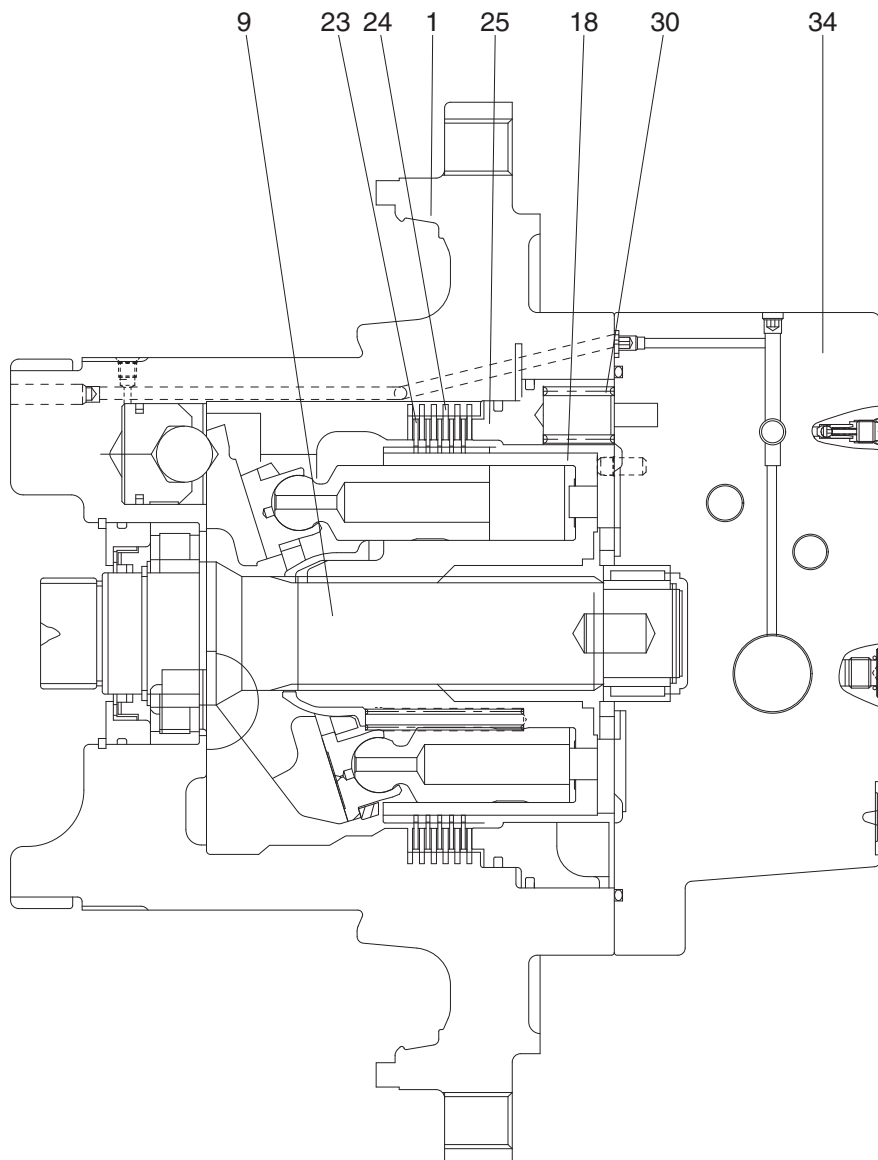
2) PARKING BRAKE

Parking brake is released when high pressure oil selected by the brake valve portion that is connected directly to the rear cover (34), is applied to the parking piston (25).

Otherwise the braking torque is always applied.

This braking torque is generated by the friction between the separated plates (24), inserted into the casing (1), and friction plates (23), coupled to cylinder block (18) by the outer splines.

When no pressure is activated on the parking piston (25), it is pushed by the brake springs (30) and it pushes friction plates (23) and separated plates (24) towards casing (1) and generates the friction force which brakes the rotation of cylinder block (18) and hence the shaft (9).



2609A2TM05

3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

When high speed pilot line is charged with the pressure P_A that overcome the spring (52), the spring (52) is compressed and spool (48) shifts to the right to connect the port P and port C.

Then, the highest pressure is selected by the check valve (56) from inlet and outlet pressure of the motor and high speed pilot line pressure and pushes shifter piston (7). As a result, swash plate (17) turns around the line L which connect the two pivots (16) as shown by dotted lines. The turn stops at the stopper (1-1) of casing and swash plate (17) keeps the position.

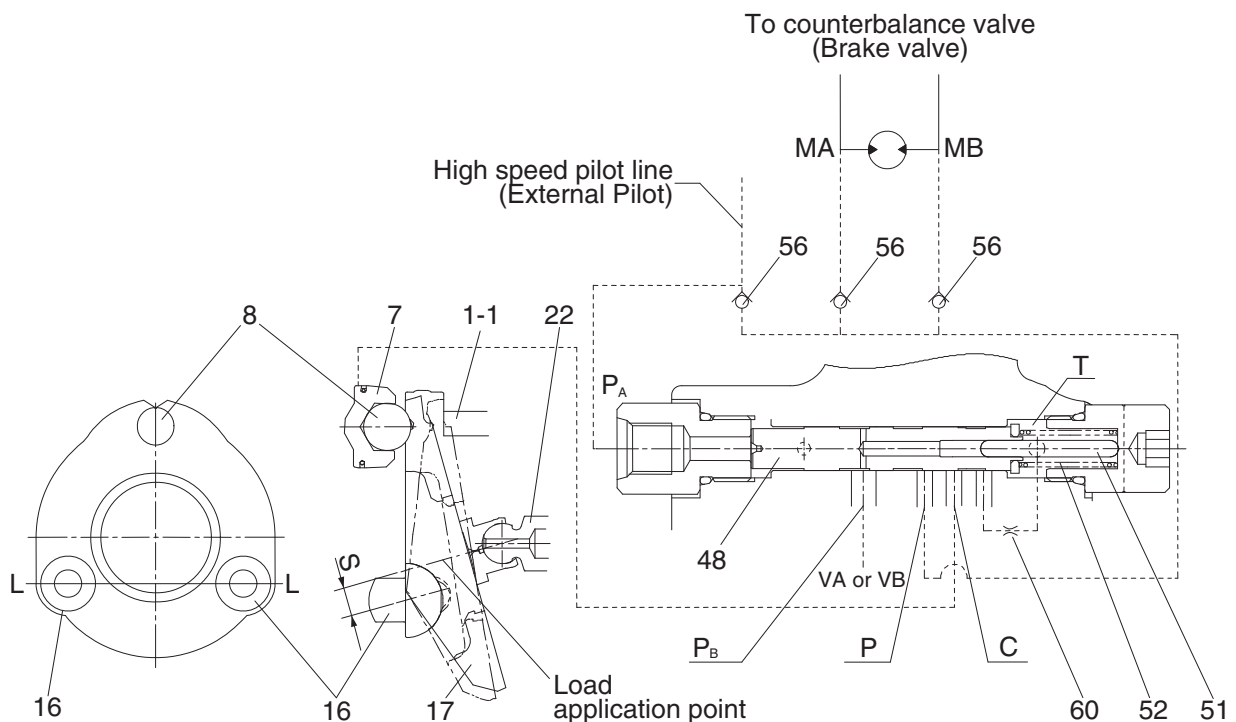
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

When no pressure is in the high speed pilot line P_A , spool (35) is pushed back by the spring (52) and pressure that pressed the shifter piston (7) is released to the hydraulic tank through restrictor (60).

Here, nine pistons are there and they equally spaced on the swash plate (17). The force that summed up those of pistons comes to almost the center of the swash plate (17) as shown. Since the pivots (16) are off-set by S from the center, the rotating force of product S and the force moves swash plate (17) to the former position and the speed returns to low.

When the power demand exceeds the engine power, such as in steep slope climbing or turning at high speed mode, the system step down to the low speed automatically. The mechanism is that: pump pressure is led to the port P_B and this pressure activate on pin (51). When the pressure at P_B exceeds predetermined value, spool (48) returns to the left by the counter-pressure against pin (51) and the pressure on the shifter piston (7) through port C is released to the tank and the motor comes to low speed.

When P_B goes down, the spool (48) moves to the right and the speed become high.

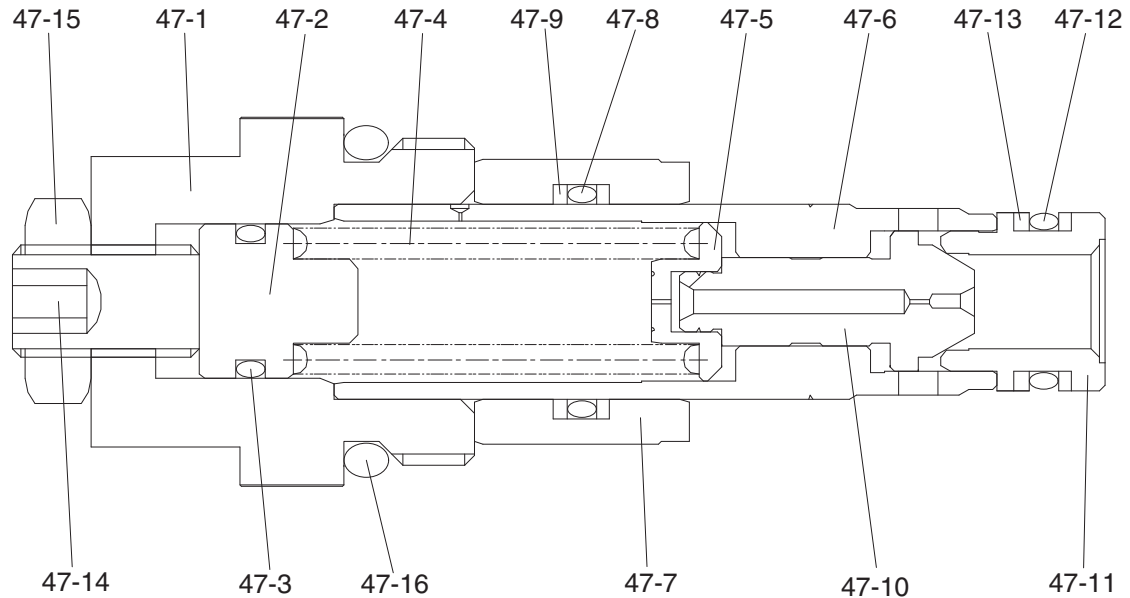


2609A2TM06

4) OVERLOAD RELIEF VALVE

(1) Structure

This valve is screwed in the motor rear cover (34) and consists of : plug (47-1) that is screwed and fixed in the rear cover (34), poppet (47-10) and supports the poppet seat (47-11), spring (47-4) that is operating relief valve setting pressure and supports the spring seat (47-5), that is inserted in the sleeve (47-6), screw (47-14) that is adjust the spring force, nut (47-15) that fix screw (47-14), piston (47-7) that reduce the shock.



2609A2TM07

47-1 Plug	47-7 Piston	47-12 O-ring
47-2 Guide	47-8 O-ring	47-13 Back-up ring
47-3 O-ring	47-9 Back-up ring	47-14 Socket screw
47-4 Spring	47-10 Poppet	47-15 Hexagon nut
47-5 Spring seat	47-11 Poppet seat	47-16 O-ring
47-6 Sleeve		

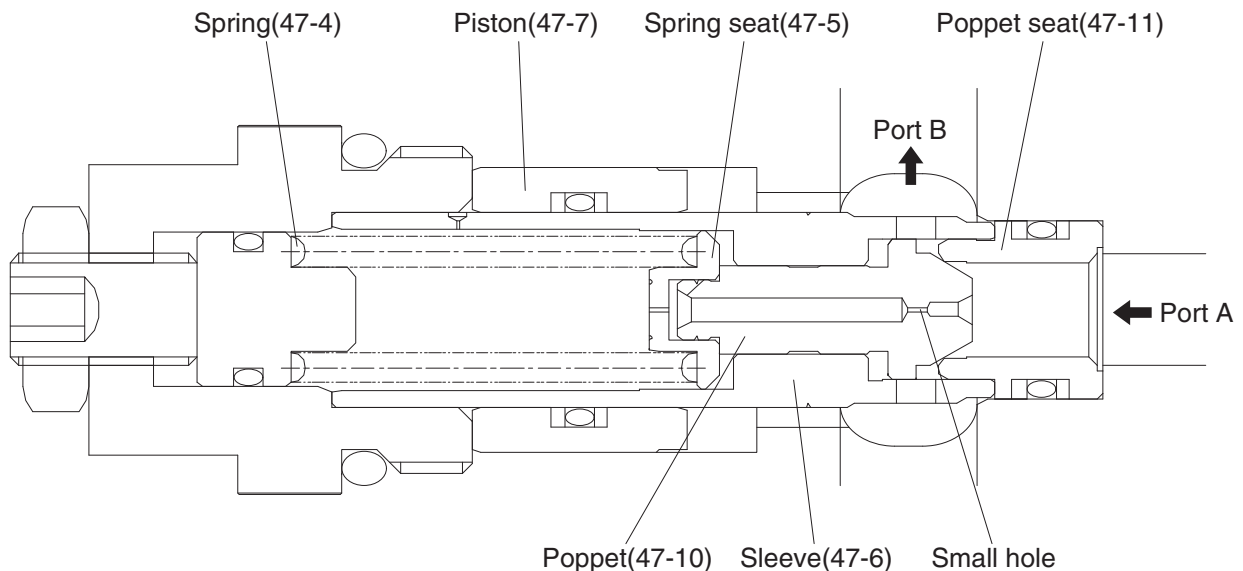
(2) Operation

Two pieces of overload valves are located at cross-over position in the counterbalance circuit of brake valve and have the following functions:

- ① When hydraulic motor starts, keep the driving pressure below predetermined value and while accelerating, bypasses surplus oil to return line.
- ② When stopping the motor, keep the brake pressure, that develops on the outlet side of motor, under the predetermined value to stop the inertial force.
- ③ To accelerate sharply while starting, and to mitigate the braking shock while stopping. For these purposes, the developed pressure is kept comparatively low for a short period, then keep the line pressure as normal value. While the pressure is low, meshing of reduction gears, crawler and sprocket etc. can be smoothly done and the shock are absorbed.

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of poppet (47-10) which seats on the poppet seat (47-11) and, at the same time, is delivered, via small hole, to the spring seat (47-5) located inside the sleeve (47-6) and the seat bore pressure increases up to "A" port pressure. The poppet (47-10) opposes to spring (47-4) by the force of the pressure exerted on the area difference between poppet seat's effective diameter and spring seat bore and keep the predetermined pressure.

When hydraulically braking, the piston (47-7) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (47-7) through the small hole in the poppet (47-10) and piston (47-7) moves rightward until it touches the stopper in rear cover. In this while, the poppet (47-10) maintains "A" port pressure at comparatively low against the spring (47-4) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



2609A2TM08

5) BRAKE VALVE

(1) Structure

The brake valve portion mainly consists of the following parts:

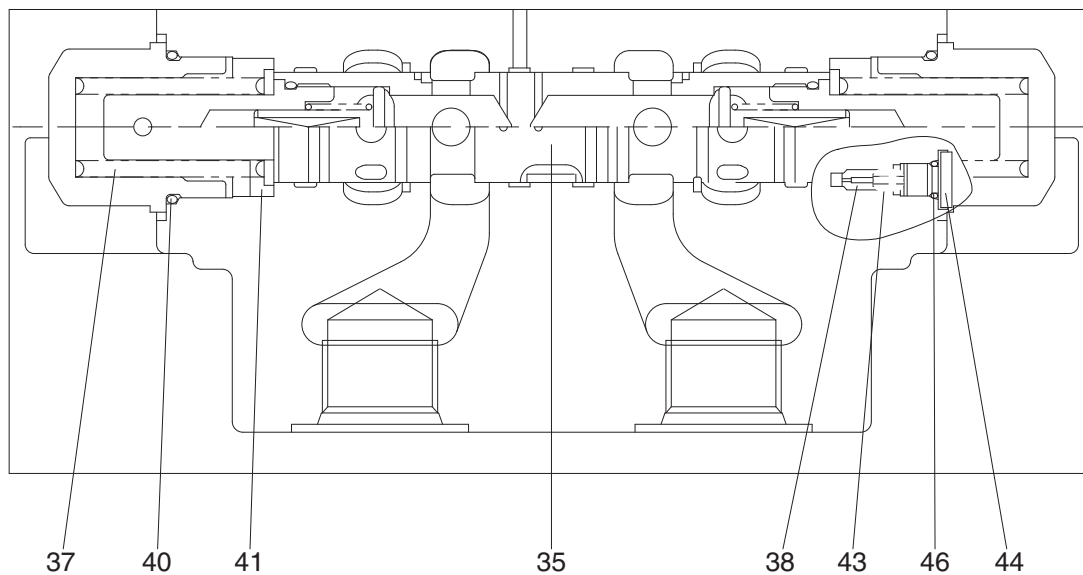
① Spool

By shifting the spool (35), the discharged oil from hydraulic motor is automatically shut off or restricted according to the condition and give the effect of holding, accelerating, stopping and counterbalance operations.

(See page 2-74, (2) Operation)

② Check valve (built in the spool)

This valve is located in the oil supplying passage to hydraulic motor, and at the same time functions to lock oil displacement. Therefore, this valve serves as not only a suction valve but also a holding valve for hydraulic motor.



2609A2TM09

35	Main spool	40	O-ring	44	O-ring
37	Spring	41	Spring seat	46	Plug
38	Restrictor	43	Restrictor spring		

(2) Operation

① Holding operation

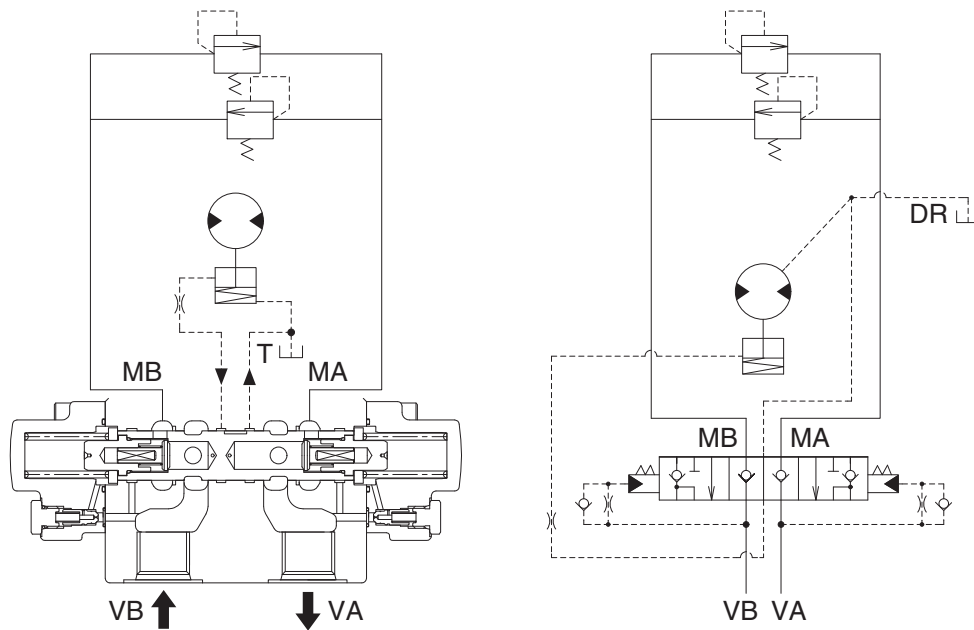
When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring (38) located on both spool ends holds the spool (35) at central position.

Therefore, the passages from VA to MA and VB to MB are closed, which result in closing MA and MB ports connected to hydraulic motor.

Since the passage to parking brake is connected to the tank line, the brake cylinder pressure is equal to the tank pressure and the brake is applied by the springs. Thus, the rotation of the motor is mechanically prevented.

If external torque is exerted on the motor shaft, the motor would not rotate as usual by this negative parking brake.

In case the brake should be released for some reason, pressure is built on MA or MB port. But, due to oil leakage inside hydraulic motor or so, high-pressure oil escapes from the closed circuit and motor rotates a bit. So, the cavitation tends to occur in the lower pressure side of the closed circuit. Then, the check valve, built in the spool (35), operates to avoid the cavitation and opens the passage from VA to MA or from VB to MB. Then the oil equivalent to the leakage is sucked from the tank line to the closed circuit.



25092TM29

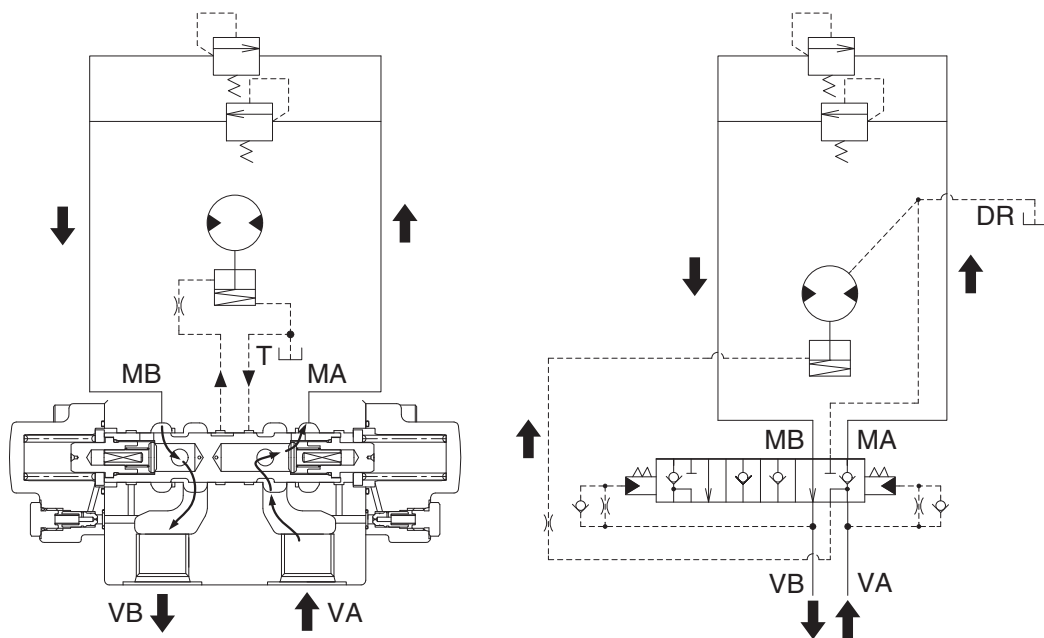
② Accelerating operation

When VA and VB ports are connected respectively to pump and tank by operating the control valve, hydraulic oil from pump is forwarded through VA port to push open the check valve provided inside spool (35), and oil flows to motor via MA port to rotate the motor.

Therefore, the pressure increases and negative brake is released by the pressure supplied from pump. At the same time, the pressure of pilot chamber increases to push and move the spool (35) leftwards, overcoming the spring (38) force. Thus, the return line from MB to VB opens to rotate the motor.

In case inertia load is too big to start rotation, accelerating pressure reaches the set pressure of relief valve and high pressure oil is being relieved while the motor gains the rotational speed.

As the rotational speed goes up, the relieved volume decreases, and finally the motor rotates at a fixed speed.



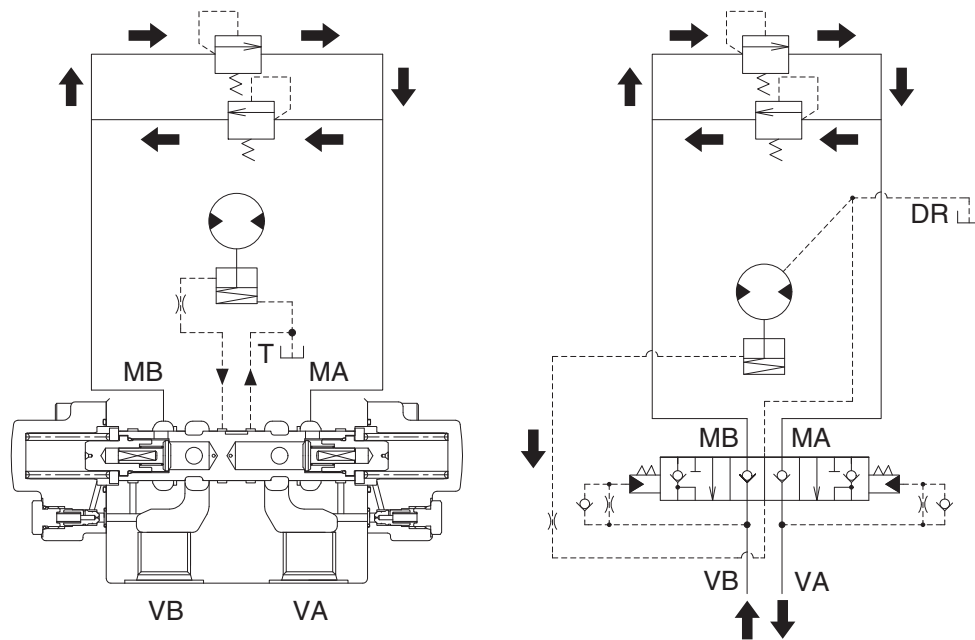
25092TM30

③ Stopping operation

Returning the control valve to neutral position while running the motor, the oil supply is cut off and VA and VB ports are connected to the tank line. Then the pressure of the pilot chamber located on both spool ends become equal, and the spool (35) returns to the neutral position by spring (38) force. Thus, the passage from MA to VA is closed.

Owing to the inertia force of the load, the hydraulic motor tends to continue the rotation. Here, the motor functions as a pump and forwards the oil to MB port but the passage is blocked and MB port pressure increases. Then the relief valve opens to relieve the pressure and rotational speed decelerates and at last the motor stops.

Negative brake release pressure is gradually lowered due to the restrictor and finally the brake works and the motor is mechanically stopped.



25092TM31

④ Counterbalance operation

Counterbalance operation is required to decelerate slowly the hydraulic motor while absorbing inertia force.

In case the hydraulic oil is gradually decreased from pump to VB port, the drive shaft of hydraulic motor tends to rotate faster than that matched to the volume of oil supply.

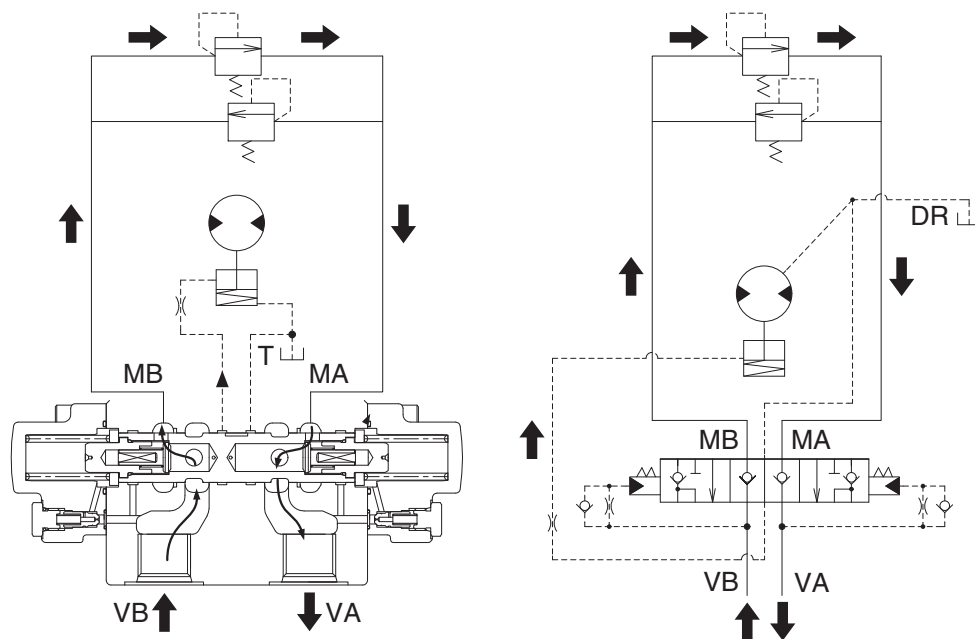
Consequently, the pilot chamber pressure on MB to VB side decreases and the spring (38) force moves the spool (35) leftwards towards neutral position.

Therefore, the area of passage from MA to VA becomes smaller and the pressure on MA side rises due to increased resistance in the passage and the motor receives hydraulic braking effect.

If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and spool (35) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond to the volume of supplied oil.

In order to give stable counterbalance operation, the restrictors (40) are set in the pilot chamber to damp the spool (35) movement.

The parking brake is released during pressure adjusting action of the spool (35).



25092TM32

6) REDUCTION GEAR

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.

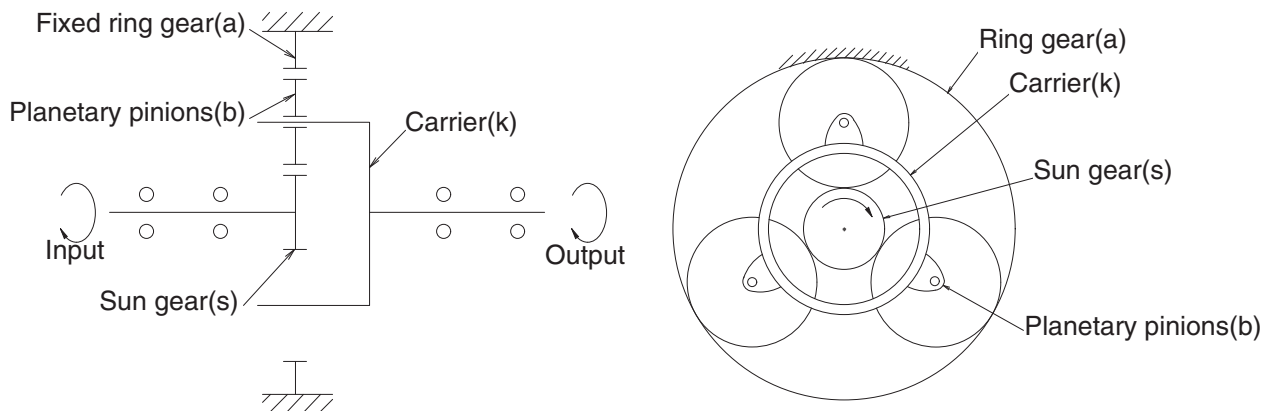
This reduction unit utilizes two stages, planetary reduction system.

Planetary reduction system consists of sun gear, planetary gears, (planetary) carriers, and ring gear.

When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).

This movement is transferred to carrier (k) and deliver the torque.

This mechanism is called planetary gear mechanism.

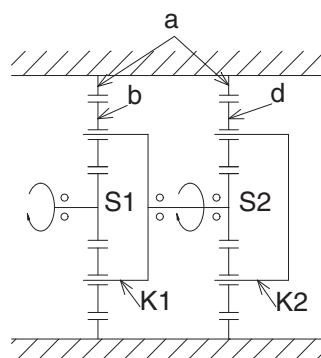


29072TM10

29072TM11

When the sun gear **S1** is driven by input shaft, planetary action occurs among gears **S1**, **a** and **b** and revolution of gear **b** transfers the rotation of carrier **K1** to second sun gear **S2**, and also evokes planetary action between gear **S2**, **a** and **d**.

This time, because carrier **K2** is fixed to frame, gear **d** drives ring gear **a** and then ring gear **a** rotates to drive sprocket.



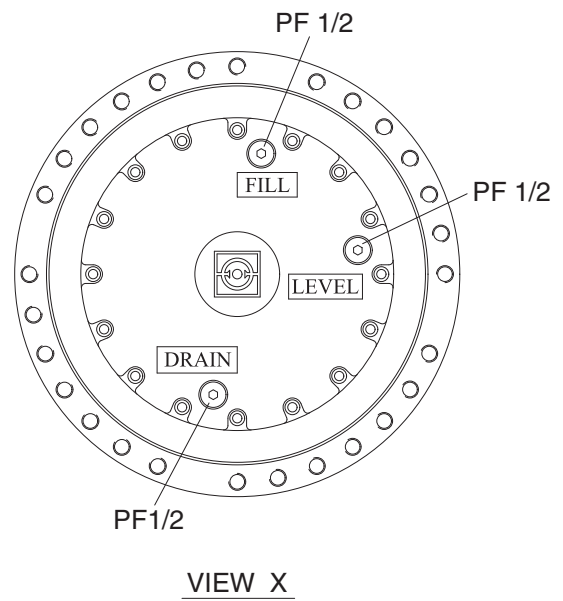
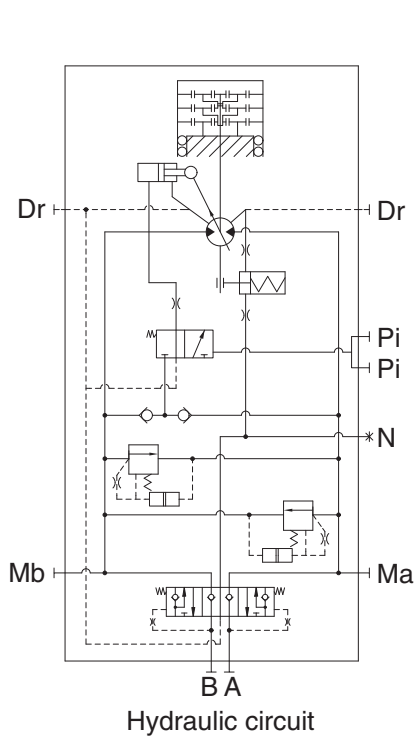
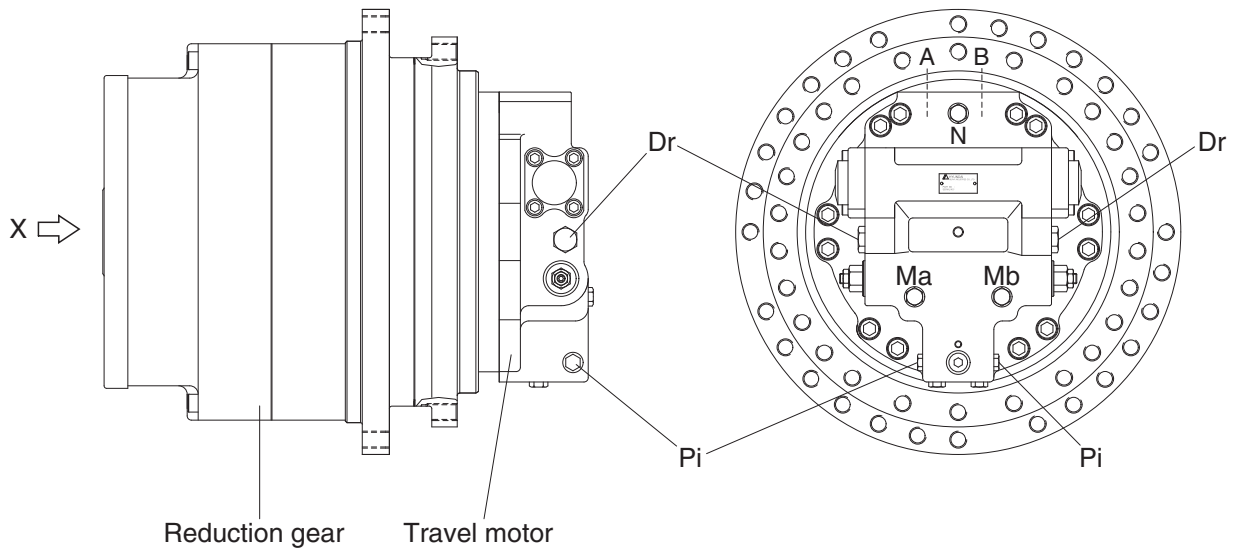
29072TM12

■ TRAVEL MOTOR (TYPE 2)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.

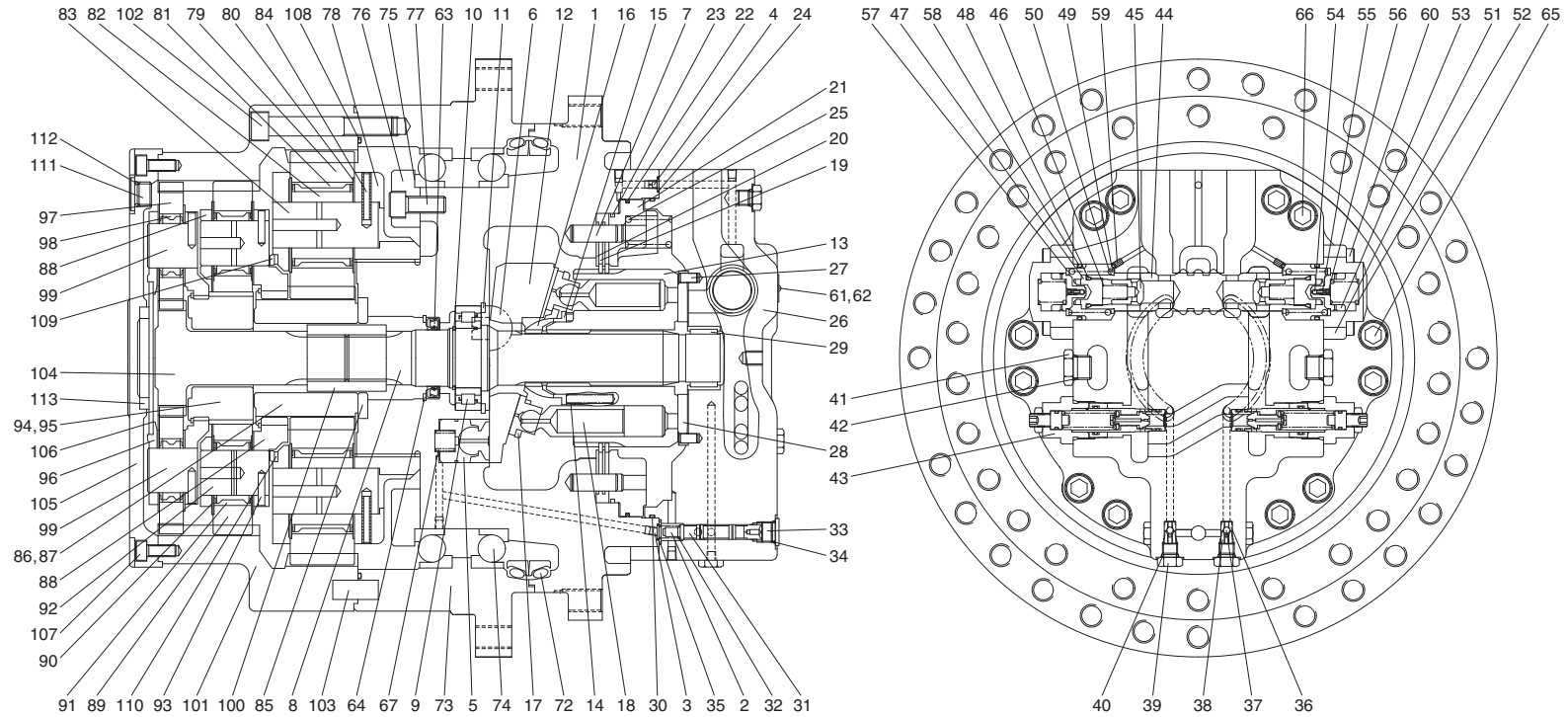


3809A2TM21

Port	Port name	Port size
A, B	Main port	SAE 6000 psi \varnothing 25
Pi	Two speed control port	PF 1/4
Dr	Drain port	PF 1/2
Ma, Mb	Gage port	PF 1/4
N	Brake release port	PF 1/4

2. SPECIFICATION

1) TRAVEL MOTOR



1 Shaft casing	15 Spacer	29 Needle bearing	43 Relief valve assy	57 Spring seat	75 Shim	89 Planetary gear	103 Planetary pin
2 Plug	16 Ball guide	30 O-ring	44 Main spool	58 O-ring	76 Bearing guide	90 Plate	104 Drive gear
3 Orifice	17 Set plate	31 Swash spool	45 Check	59 Orifice	77 Wrench bolt	91 Needle bearing	105 End cover
4 Orifice screw	18 Piston & Shoe assy	32 Swash spring	46 Spring	60 Wrench bolt	78 Carrier	92 Pin	106 Plate
5 Swash piston	19 Friction plate	33 Plug	47 Plug	61 Name plate	79 Planetary gear	93 Spring pin	107 Wrench bolt
6 Swash ball	20 Separator plate	34 O-ring	48 O-ring	62 Rivet	80 Plate	94 Sun gear	108 O-ring
7 Brake pin	21 Brake piston	35 O-ring	49 Spring seat	63 Oil seal	81 Needle bearing	95 Snap ring	109 Ring
8 Shaft	22 Piston ring	36 Seat	50 Spring	64 Snap ring	82 Bearing bushing	96 Carrier	110 Ring
9 Roller bearing	23 Piston ring	37 Steel ball	51 Cover	65 Wrench bolt	83 Pin	97 Planetary gear	111 Plug
10 Stop ring	24 O-ring	38 Stopper	52 Spring	66 Wrench bolt	84 Spring pin	98 Needle bearing	112 O-ring
11 Lock ring	25 Brake spring	39 Plug	53 Spool	67 Spring pin	85 Thrust plate	99 Pin	113 Bushing
12 Swash plate	26 Valve casing	40 O-ring	54 Steel ball	72 Floating seal	86 Sun gear	100 Coupling	
13 Cylinder block	27 Valve plate pin	41 Plug	55 Spring	73 Hub	87 Snap ring	101 Ring gear	
14 Cylinder spring	28 Valve plate	42 O-ring	56 Plug	74 Bearing	88 Carrier	102 Wrench bolt	

3809A2TM22

3. PRINCIPLE OF DRIVING

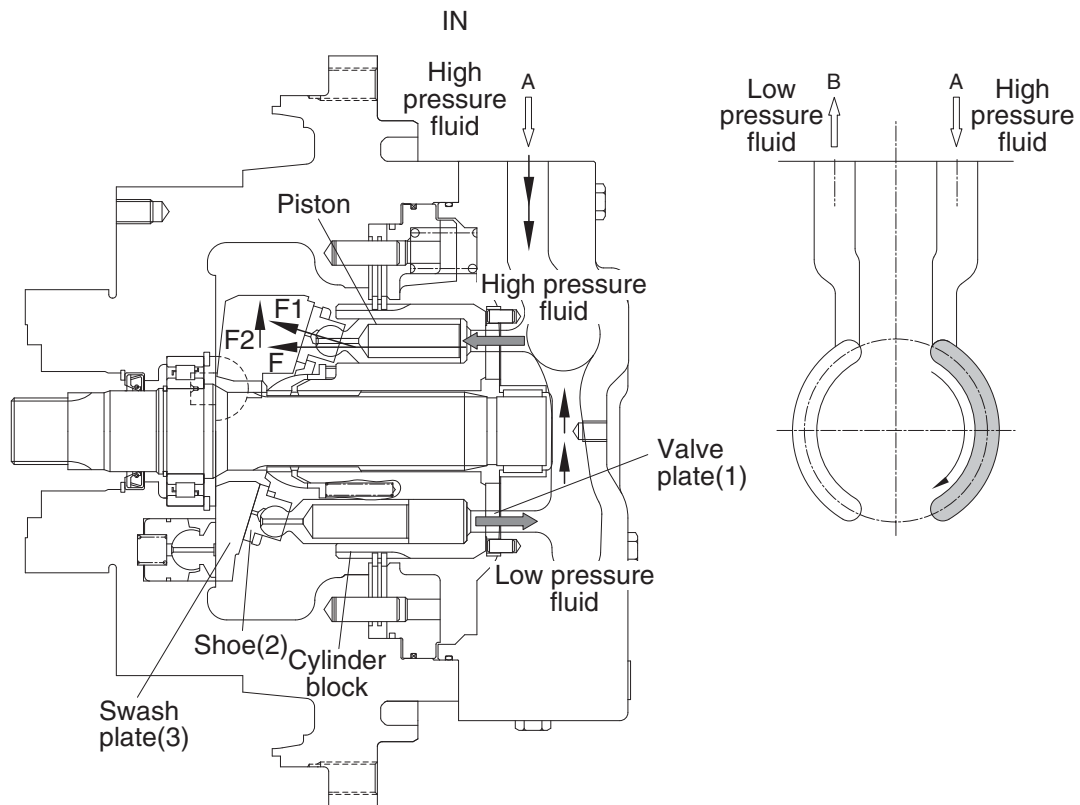
Travel motor comprises with rotary, relief valve, parking brake, counterbalance valve and 2-speed control.

1) WORKING OF ROTARY PART

In the figure below, axis direction power F occurs, when the high pressure oil flows in the cylinder block through to the valve plate (1) port, and the piston moves to the left hand side.

This power F , which takes shoe (2) as a medium, split into F_1 power vertical to swash plate (3), and F_2 power perpendicular from an axis. Through F_2 power, cylinder block rotate with piston and shoe, while shoe (2) moves on the swash plate with piston. There are 9 pistons inserted into the cylinder block and they rotate with the cylinder block by taking high pressure gas in order at the entrance.

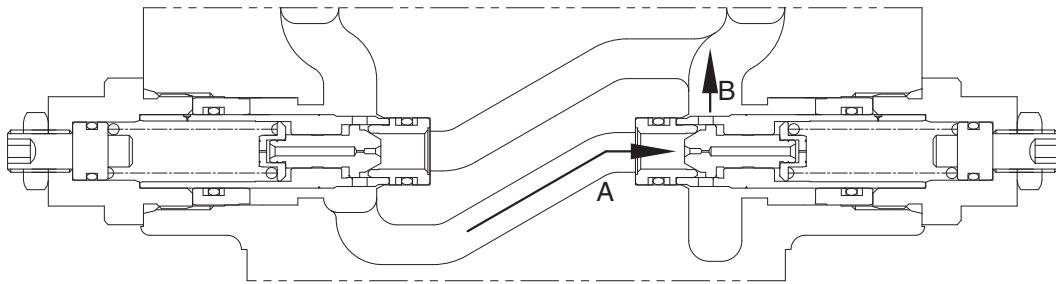
When you reverse the flow of the high pressure oil, piston and cylinder block rotate in the opposite direction above the shoe plate.



3809A2TM23

2) WORKING OF RELIEF VALVE

When the port from control valve to motor is closed, traveling movement stops. However, motor continues rotating because of the traveling inertia of the machine's upper body. By doing so, motor is damaged by the gradual rising of the pressure at the exit. To prevent this damage, relief valve discharge the gradual rising pressure from the exit to the entrance which has lower pressure.



3809A2TM24

- Setting pressure : 360 kgf/cm²
- Back pressure : 5 kgf/cm²
- Cracking pressure : 330 kgf/cm² over

- AT THE BEGINNING OF TRAVELING

RELIEF VALVE A

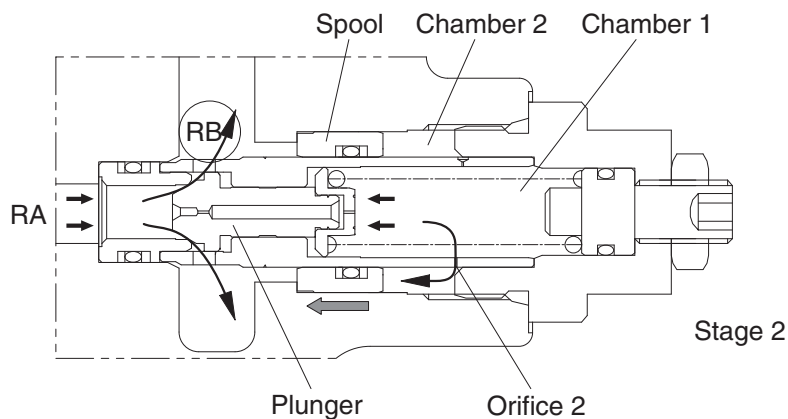
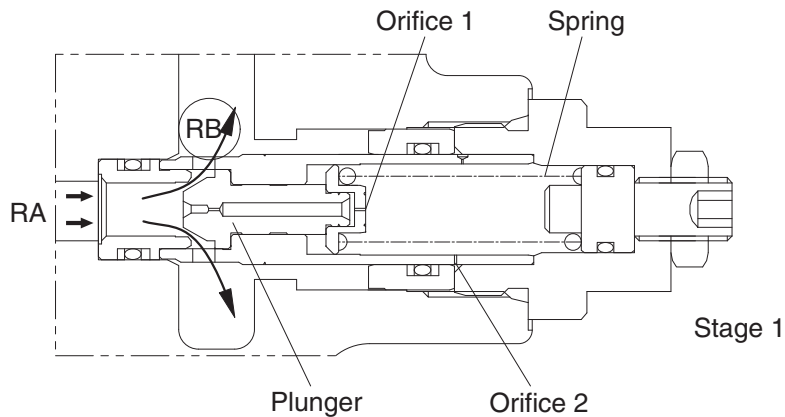
Traveling manipulation lever works to rise the pressure of RA port up. When this pressure oil press plunger to the right, and then sustain the power of the spring, the plunger moves to the right and release the pressure oil of RA port to RB port (stage 1).

The plunger moves slowly by the pressure oil which flows into chamber 1 through orifice 1.

The pressure oil flowed into chamber 1 flows into chamber 2 through orifice 2, and at this point, the plunger moves to the left again, when the spring is compressed by the flowed pressure oil which press the spool to the left. (stage 2).

When the RA port pressure goes up much more and the set pressure overcome the power of the compressed spring again, the plunger moves to the right and the pressure has of RA port is released to RB port.

Thus, at the early stage of the relief-valve operation, it works primarily at lower pressure, after then, shock is reduced during rotating at the set pressure as the secondary operation.

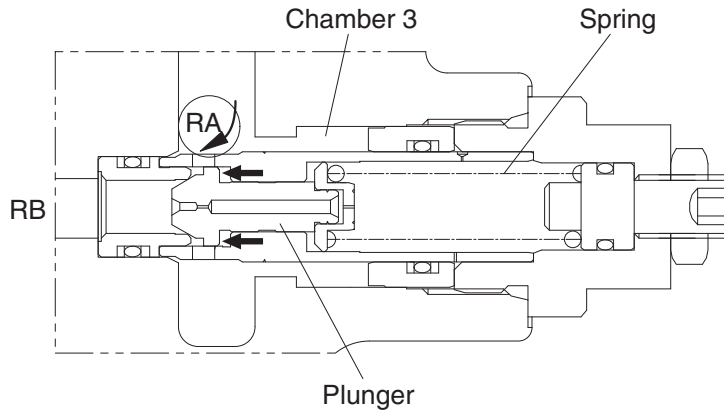


RELIEF VALVE A

- DURING TRAVELING OPERATION

RELIEF VALVE B

During traveling operation, RA port pressure goes up and RB port pressure goes down. Thus RA port pressure oil flows into chamber 3, and pushes plunger to the left with a high pressure and the power of the spring.



RELIEF VALVE B

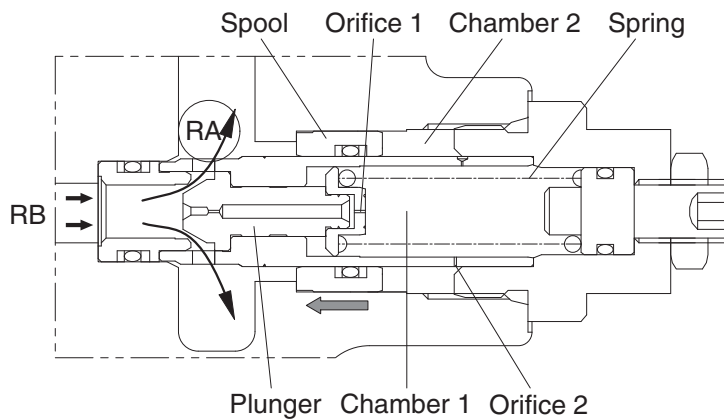
3809A2TM26

- WHEN IT STOP

RELIEF VALVE B

When it stops or operates reversely, RA port pressure is extremely lowered and RB port pressure gradually goes up because of the swing inertia from the upper swing part of machine.

Consequently, relief valve B operates as the same order as relief valve A, and maintains the set pressure by releasing the high pressure of RB port to RA port.



RELIEF VALVE B

3809A2TM27

3) WORKING OF PARKING BRAKE

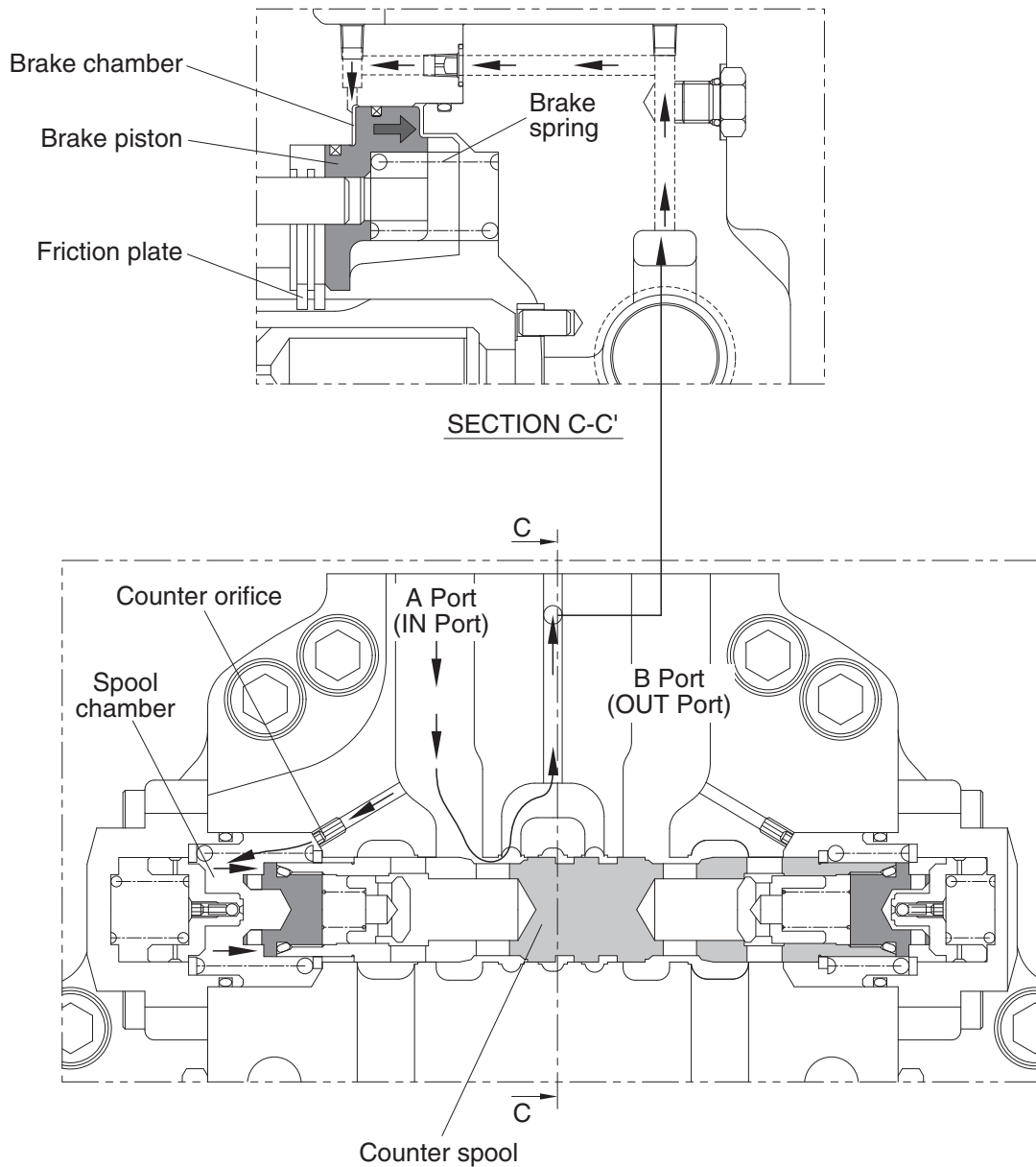
Parking brake consists of many wet friction plate. The brake is usually held with the power of spring, and it only removed by traveling pressure of motor.

- **Parking brake OFF**

If worker operates the traveling control lever, traveling working pressurized oil into IN PORT flows from spool chamber through counter orifice.

Pressurized oil pushes counter balance spool to right.

Then notch of spool opens the brake line. At the same time, pressurized oil flow to brake chamber of motor from brake line. Brake piston to force of brake spring moves to right and brake lift.



3809A2TM28

- **Parking brake ON**

If worker leave lever in neutral, pressurized oil supply to in port of motor stop.

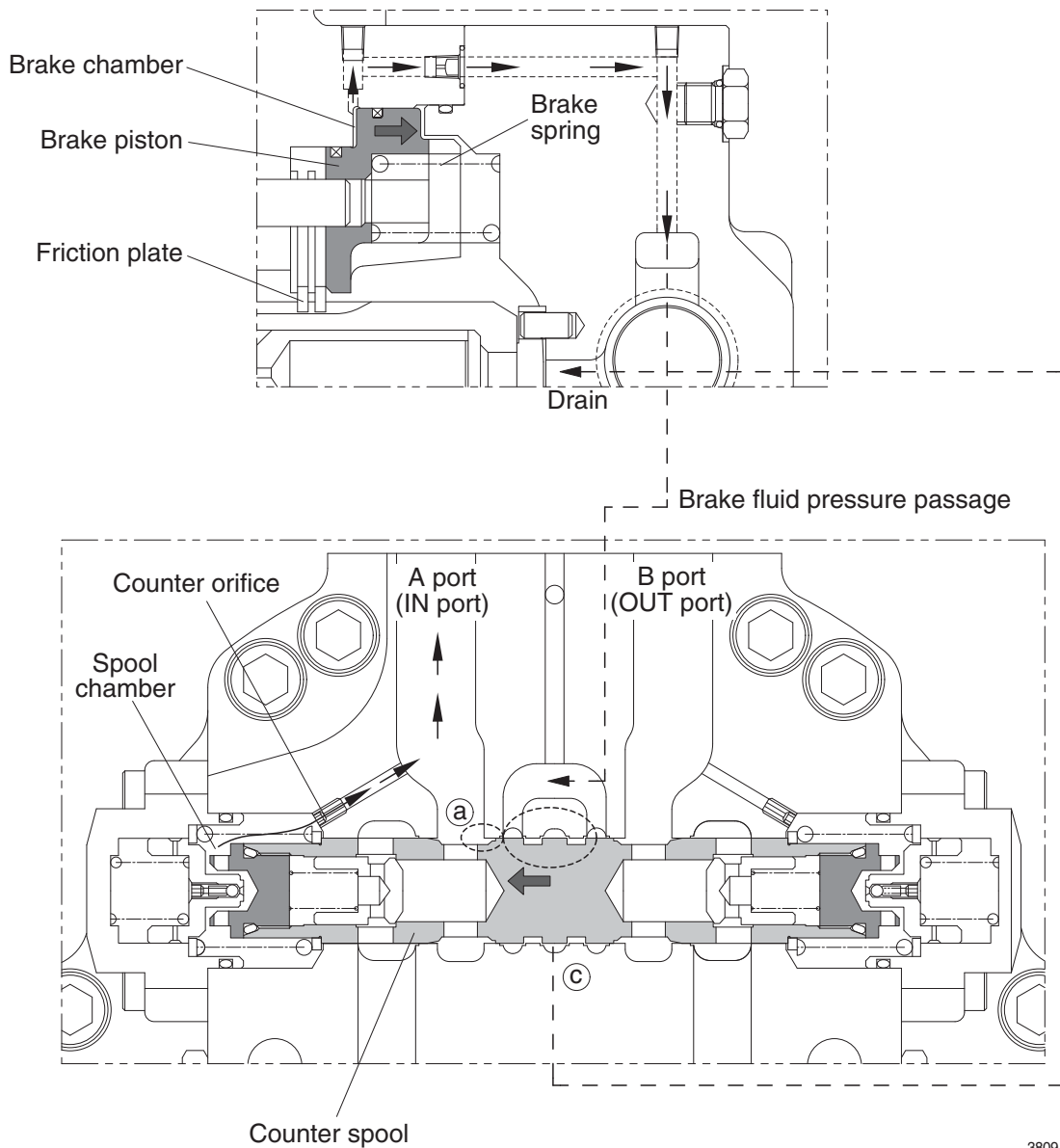
If pressurized oil supply stop, in port pressure decline and pressurized oil of spool chamber moves to oil tank through counter orifice. Therefore counter balance spool return in neutral.

If spool leave in neutral, notch (a) part of spool obstructed and brake pressurized oil obstructed.

Brake pressurized oil line obstructed. So pressurized oil supply to brake chamber obstructed.

Therefore if pressure of brake chamber decline, brake piston to force of brake spring moves to left and push friction plate.

If brake force happens, brake stop. And pressurized oil to brake chamber drain to motor casing internal through line (c) to counter spool center.



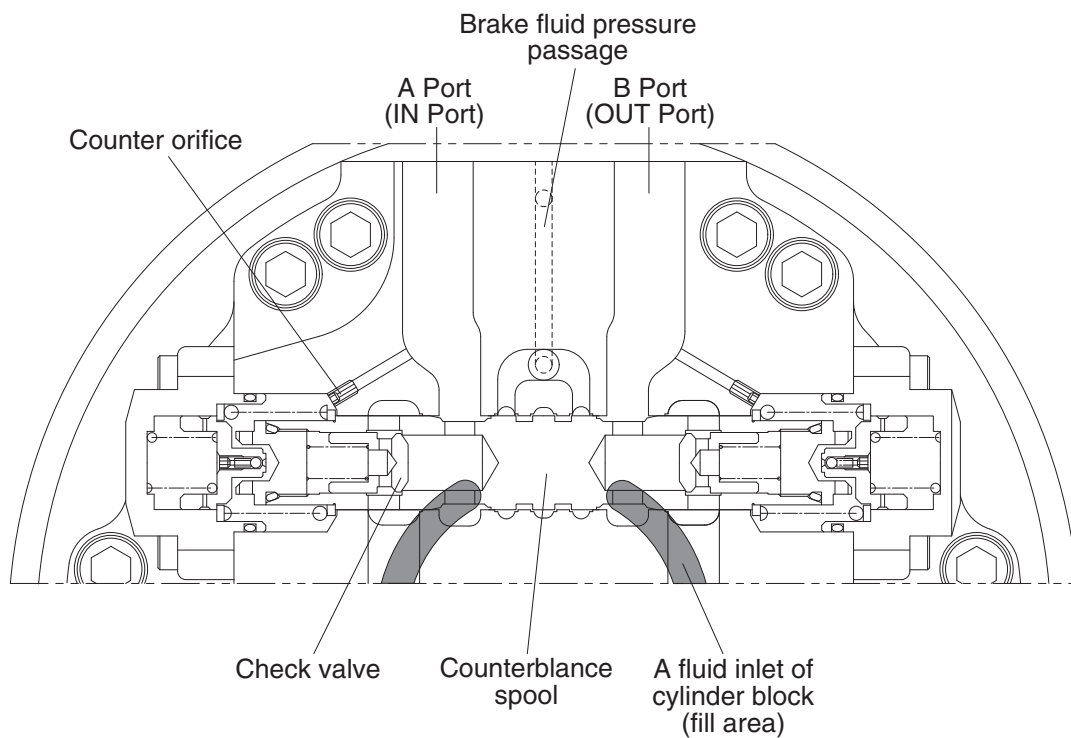
3809A2TM29

4) COUNTERBALANCE VALVE

- **Function of counterbalance valve**

- (1) Parking brake off and operation of motor
- (2) When motor descend in slope, traveling velocity control.
- (3) After motor stop in slope, slip prevention.
- (4) When motor stop, supplement the flow.

- **NEUTRAL**



3809A2TM30

5) HOW TO WORK

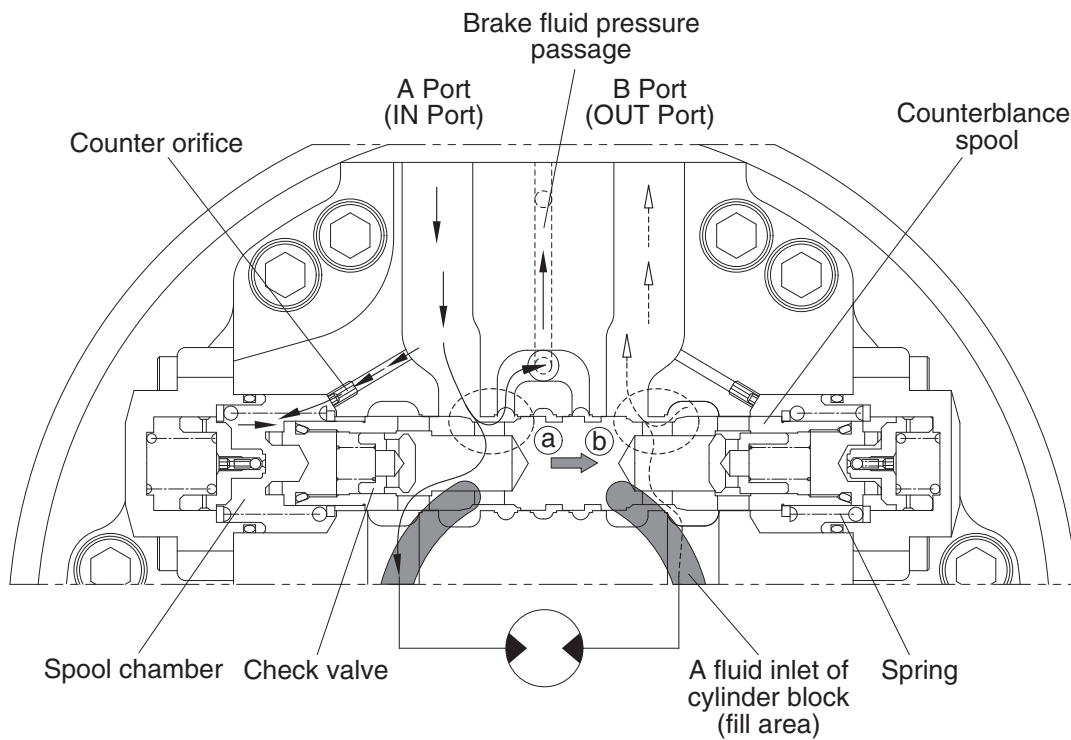
(1) When motor travel

If worker operates the traveling control lever, traveling working pressurized oil into IN PORT flows from spool chamber through counter orifice.

If spool moves to right, notch of spool open line (a) of brake pressurized oil.

Then pressurized oil lift the brake. At the same time, notch of counterbalance spool opens the line (b).

Flowed pressurized oil to A port opens check valve and cylinder block of motor rotate.



3809A2TM31

(2) When motor stop

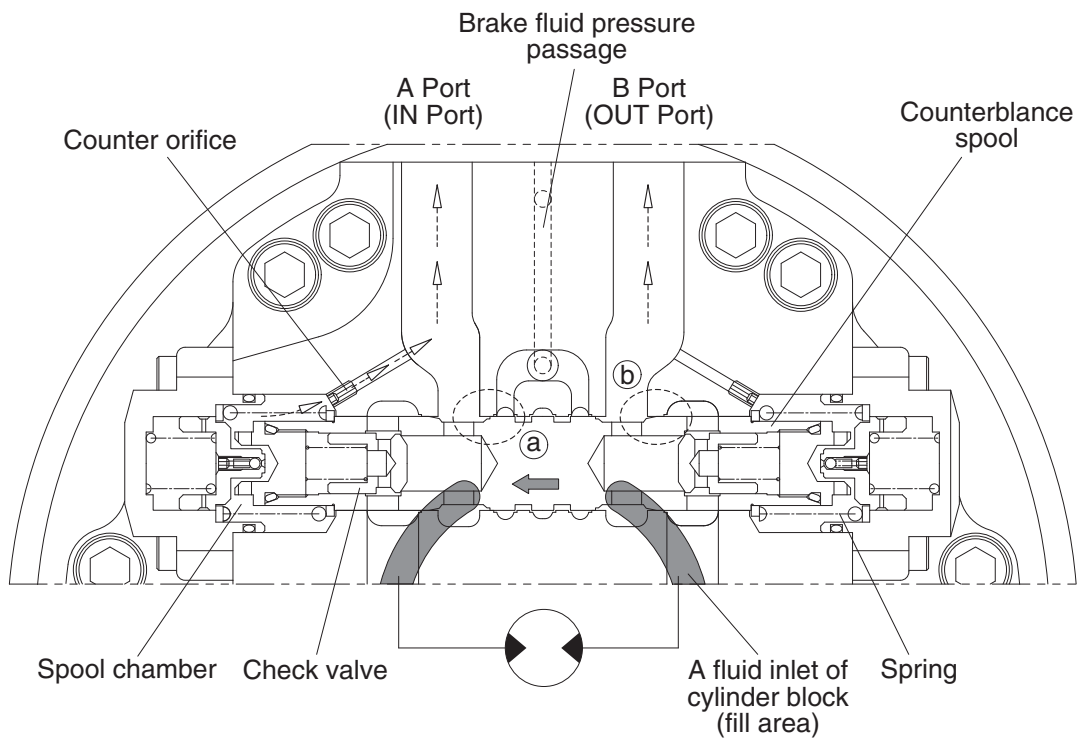
If worker leave lever in neutral, pressurized oil supply to in port of motor stop.

If pressurized oil supply stop, A port pressure decline and pressurized oil of spool chamber moves to oil tank through counter orifice. Therefore counterbalance spool return in neutral.

If counterbalance spool moves to left, line (b) by notch of counterbalance spool obstructed and brake pressurized oil obstructed.

At the same time, line (a) by notch of counterbalance valve obstructed. Therefore brake obstructed.

If brake force happens, brake stop.



3809A2TM32

6) TWO SPEED (LOW SPEED - HIGH SPEED) CHANGEOVER EQUIPMENT

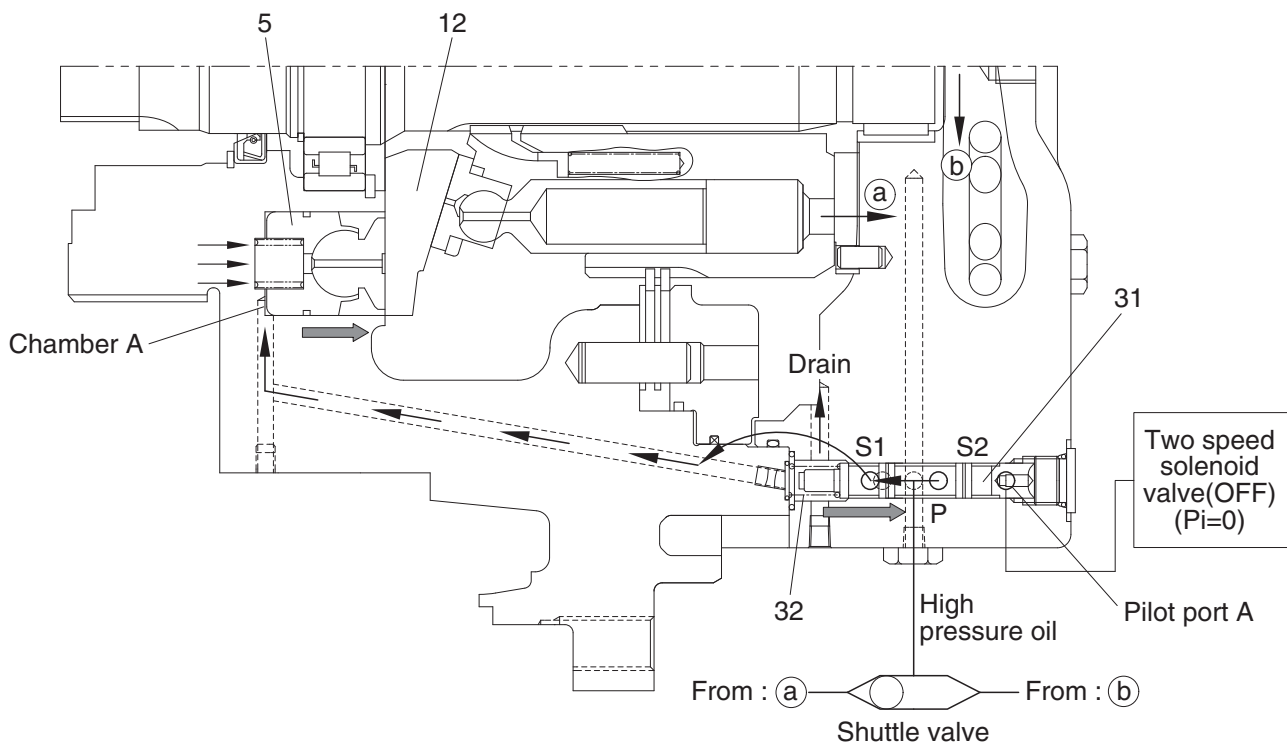
Rotation speed of track motor is depended on slope angle of swash plate (12).

When swash plate angle is Max, the motor rotates at low speed.

When swash plate angle is Min, the motor rotates at high speed.

• Low speed

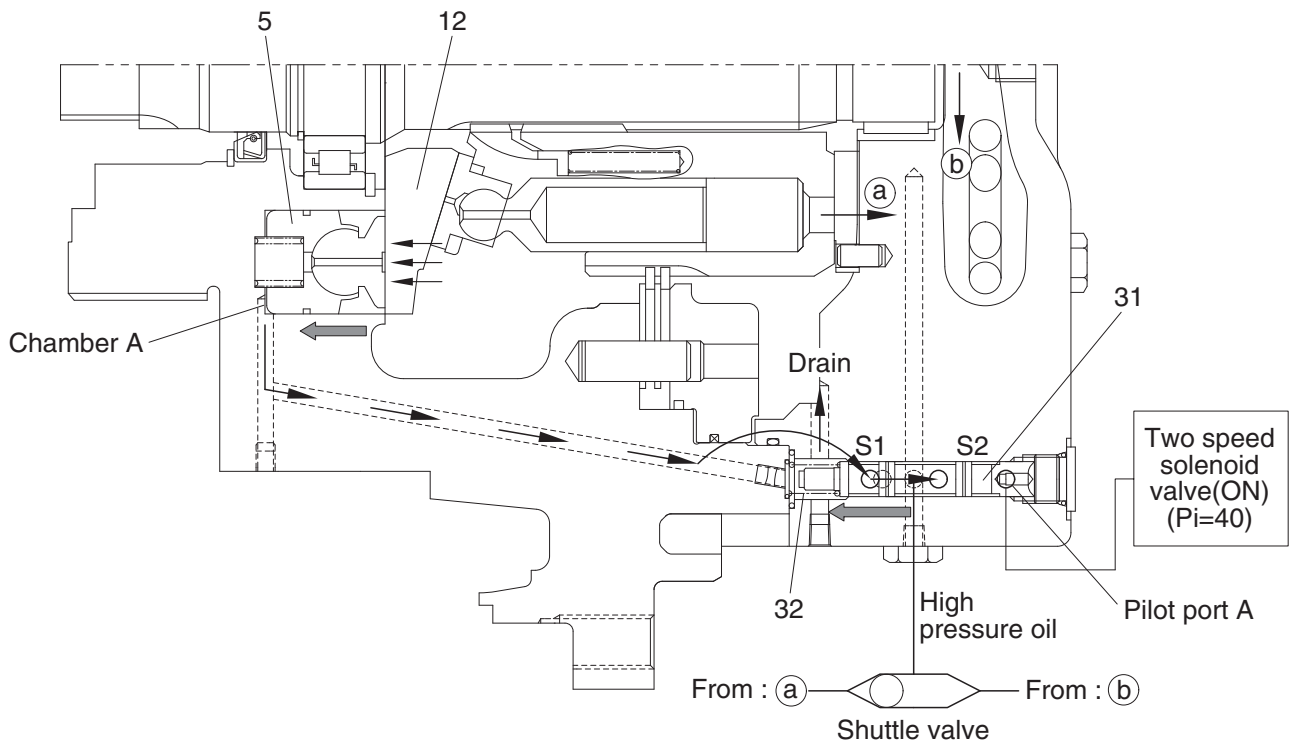
- When the pilot pressure on spool (31) is disconnected, pilot pressure does not pass to pilot port A. Two speed changeover spool (31) moves right by the spring (32) force.
- High pressure oil of (a) port (or (b) port) of cylinder block flow to P port of two speed changeover spool (31) through shuttle valve.
- Pressurized oil of two speed changeover spool flow to chamber A of swash piston (5) through S2 port.
- Swash plate moves to increase swash angle, so the motor rotates at low speed.



3809A2TM33

• **High speed**

- The pilot pressure on spool (31) of the displacement changeover valve overcomes the force of spring (32), and the spool moves left.
- High pressure oil of (a) port (or (b) port) of cylinder block flow to P port of two speed changeover spool (31) through shuttle valve.
- Swash plate moves to decrease swash angle, so the motor rotates at high speed.



3809A2TM34

4. REDUCTION GEAR

1) PLANETARY GEAR MECHANISM

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.

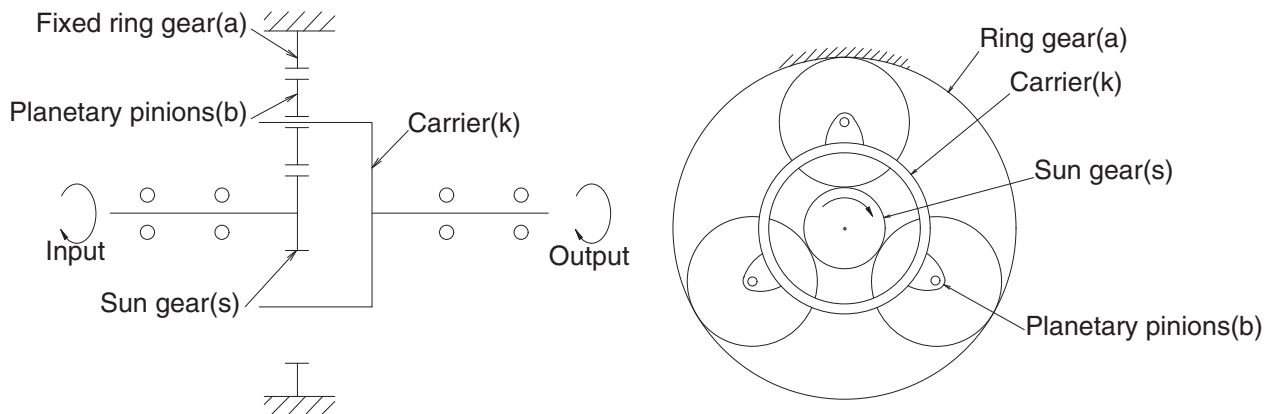
This reduction unit utilizes two stages, planetary reduction system.

Planetary reduction system consists of sun gear, planetary gears, carriers and ring gear.

When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gears (s).

This movement is transferred to carrier (k) and deliver the torque.

This mechanism is called planetary gear mechanism.



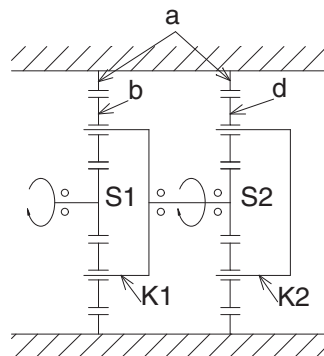
29072TM10

29072TM11

2) TWO STAGES REDUCTION GEAR

When the sun gear S1 is driven by input shaft, planetary action occurs among gears S1, a and b and revolution of gear b transfers the rotation of carrier K1 to second sun gear S2, and also evokes planetary action between gear S2, a and d.

This time, because carrier K2 is fixed to frame, gear d drives ring gear a and then ring gear a rotates to drive sprocket.



29072TM12

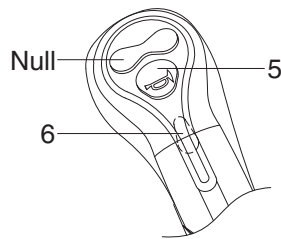
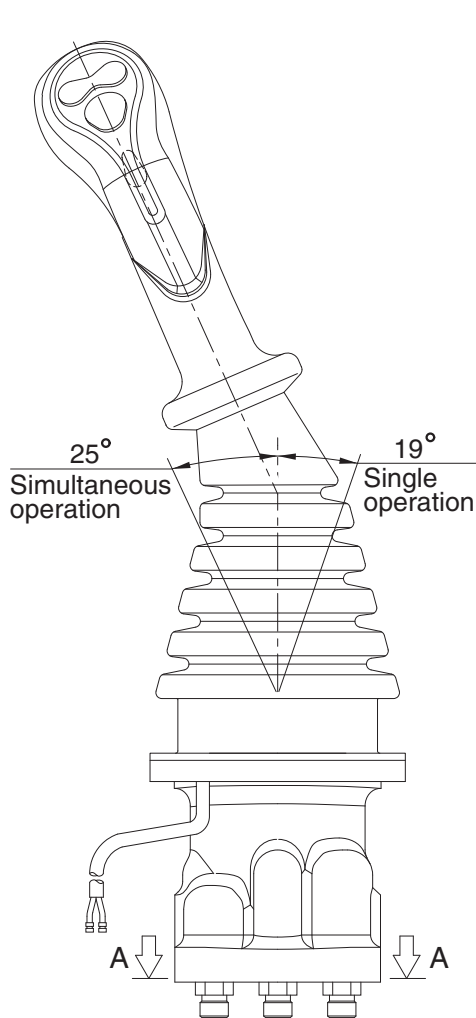
GROUP 5 RCV LEVER

1. STRUCTURE

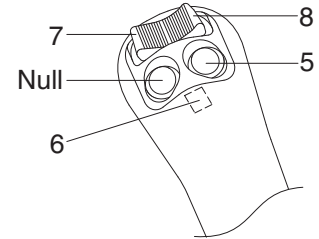
The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.

※ Refer to the parts manual for the types of the RCV lever.

1) TYPE L1, L3, L5, L10



TYPE L1, L3, L10

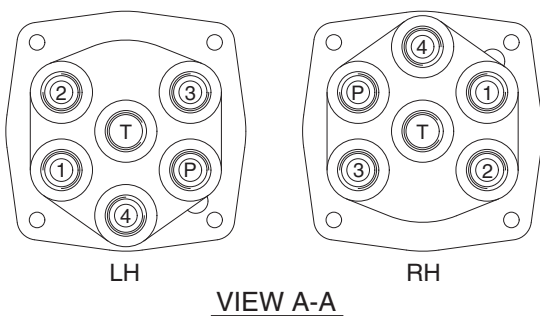
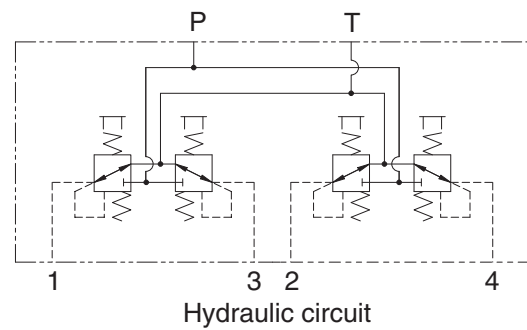


TYPE L5

Switches

Type	No.	LH	RH
L1, L3, L10	5	One touch decel	Horn
	6	Power boost	Breaker
L5	5	One touch decel	Horn
	6	Power boost	Null
	7	CCW rotation	Close
	8	CW rotation	Open

※ Number 7 and 8 : Option attachment

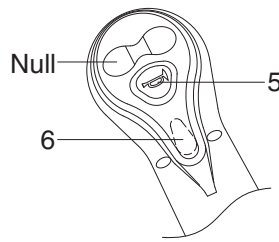
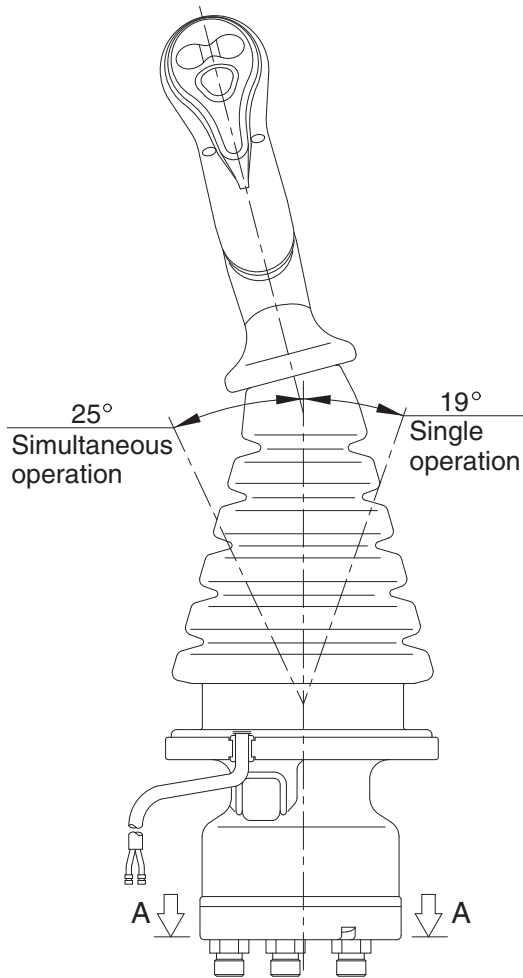


Pilot ports

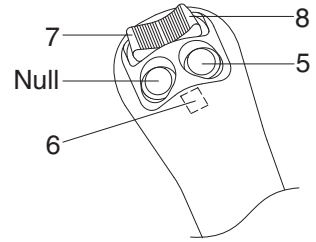
Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 3/8
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm out port	Boom up port	
3	Right swing port	Bucket in port	
4	Arm in port	Boom down port	

300L2RL101

2) TYPE L2, L4, L6, L9



TYPE L2, L4, L9

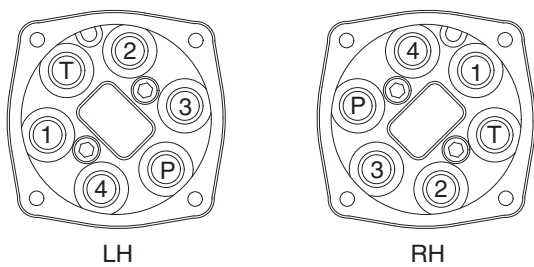
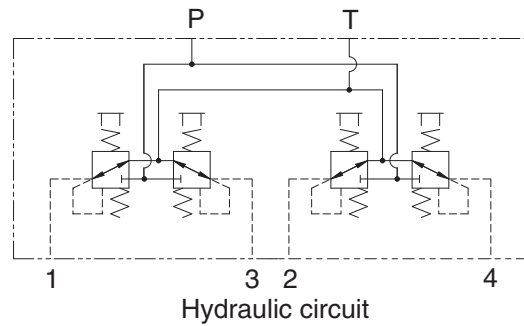


TYPE L6

Switches

Type	No.	LH	RH
L2, L4, L9	5	One touch decel	Horn
	6	Power boost	Breaker
L6	5	One touch decel	Horn
	6	Power boost	Null
	7	CCW rotation	Close
	8	CW rotation	Open

※ Number 7 and 8 : Option attachment



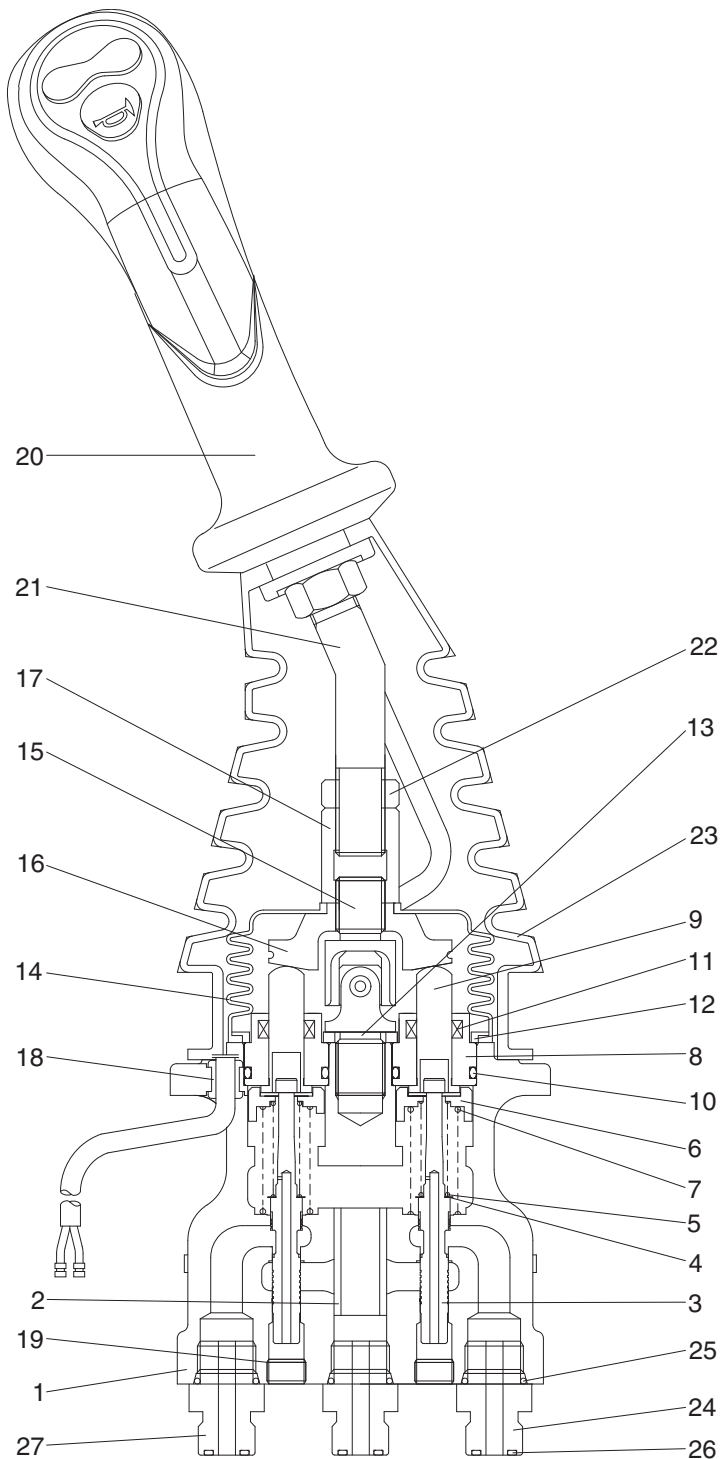
VIEW A-A

Pilot ports

Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 3/8
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm out port	Boom up port	
3	Right swing port	Bucket in port	
4	Arm in port	Boom down port	

300L2RL105

3) CROSS SECTION



- 1 Case
- 2 Bushing
- 3 Spool
- 4 Shim
- 5 Spring
- 6 Spring seat
- 7 Spring
- 8 Plug
- 9 Push rod
- 10 O-ring
- 11 Rod seal
- 12 Plate
- 13 Spacer
- 14 Boot
- 15 Joint assembly
- 16 Swash plate
- 17 Adjusting nut
- 18 Bushing
- 19 Plug
- 20 Handle assembly
- 21 Handle bar
- 22 Nut
- 23 Boot
- 24 Last guard filter
- 25 O-ring
- 26 O-ring
- 27 Connector

300L2RL06

Item numbers are based on the type L1.

The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (3), spring (5) for setting secondary pressure, return spring (7), spring seat (6) and shim (4). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm² (depending on the type). The spool is pushed against the push rod (9) by the return spring.

When the push rod is pushed down by tilting the handle, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port (P) where oil is supplied from hydraulic pump.
- (2) Output ports (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port (T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port or tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type L1.

The functions of the spool (3) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9) is inserted and can slide in the plug (8).

For the purpose of changing the displacement of the push rod through the swash plate (16) and adjusting nut (17) are provided the handle assy (20) that can be tilted in any direction around the fulcrum of the universal joint (15) center.

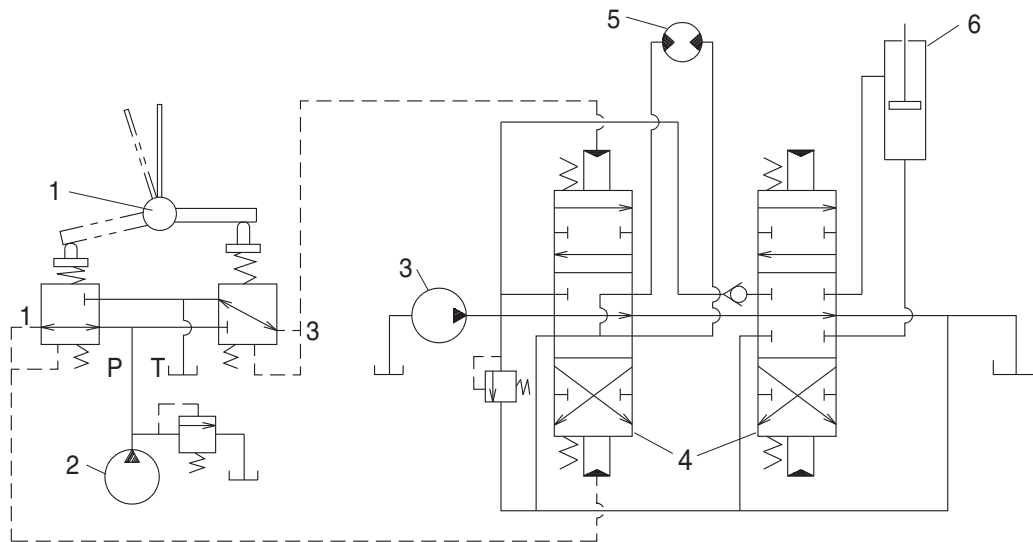
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

The diagram shown below is the typical application example of the pilot valve.



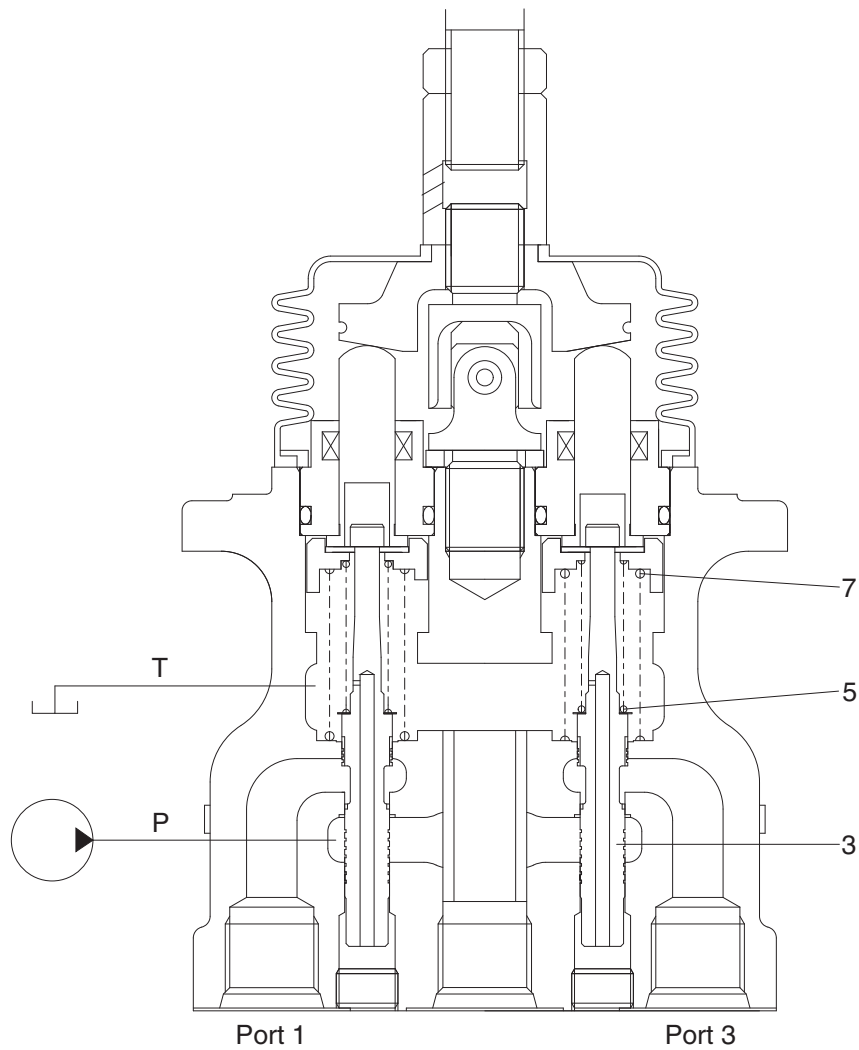
2-70

1 Pilot valve
2 Pilot pump

3 Main pump
4 Main control valve

5 Hydraulic motor
6 Hydraulic cylinder

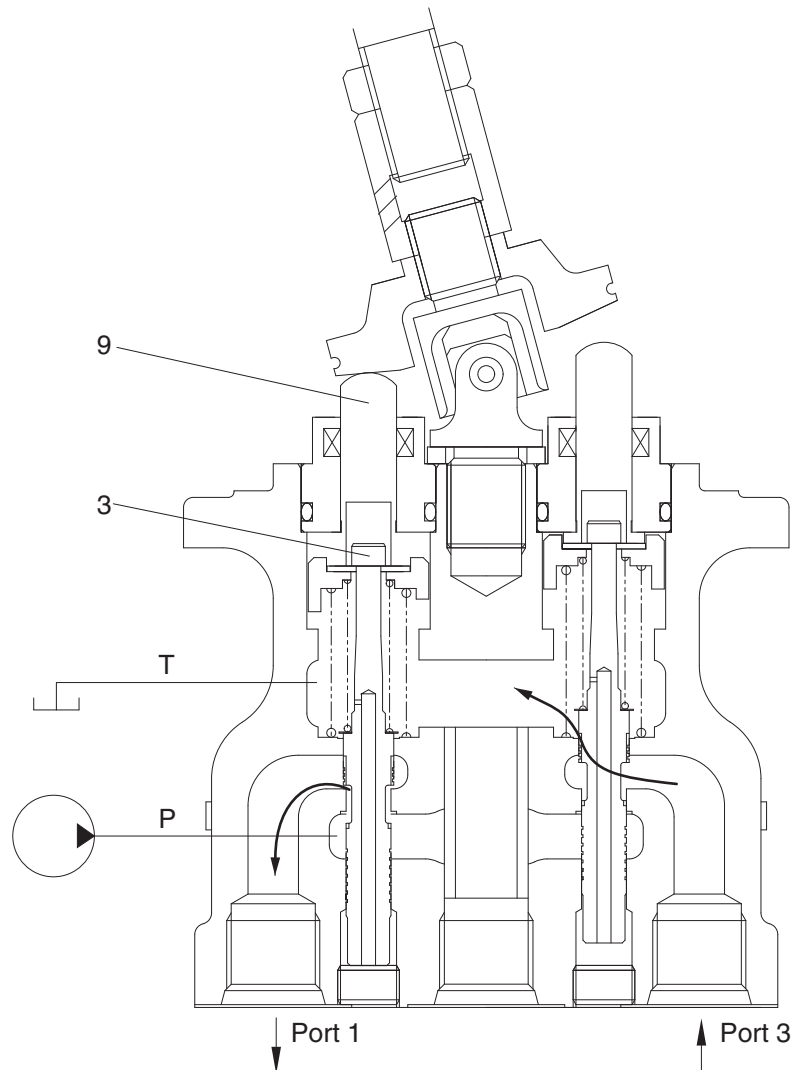
(1) Case where handle is in neutral position



300L2RL03

The force of the spring (5) that determines the output pressure of the pilot valve is not applied to the spool (3). Therefore, the spool is pushed up by the spring (7) to the position of port (1, 3) in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where handle is tilted



300L2RL04

When the push rod (9) is stroked, the spool (3) moves downwards.

Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.

When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.

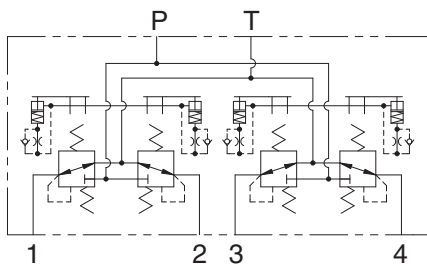
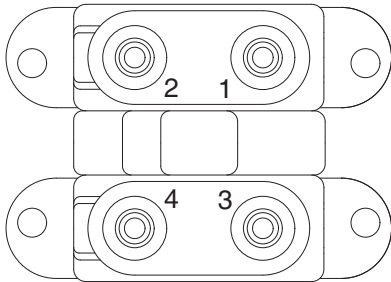
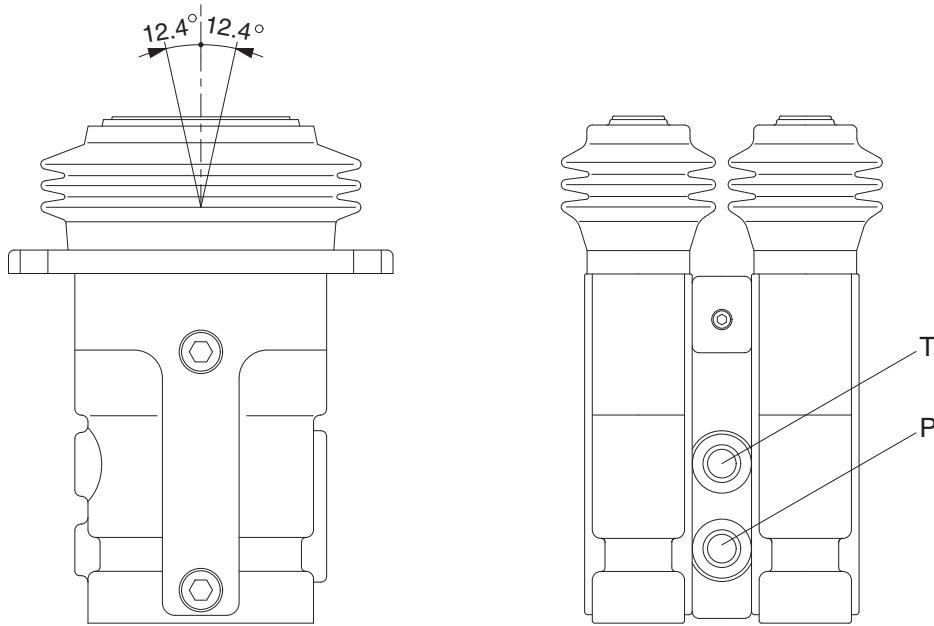
In this manner the secondary pressure is kept at the constant value.

Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

GROUP 6 RCV PEDAL (-#0473)

1. STRUCTURE

The casing (spacer) has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.



Hydraulic circuit

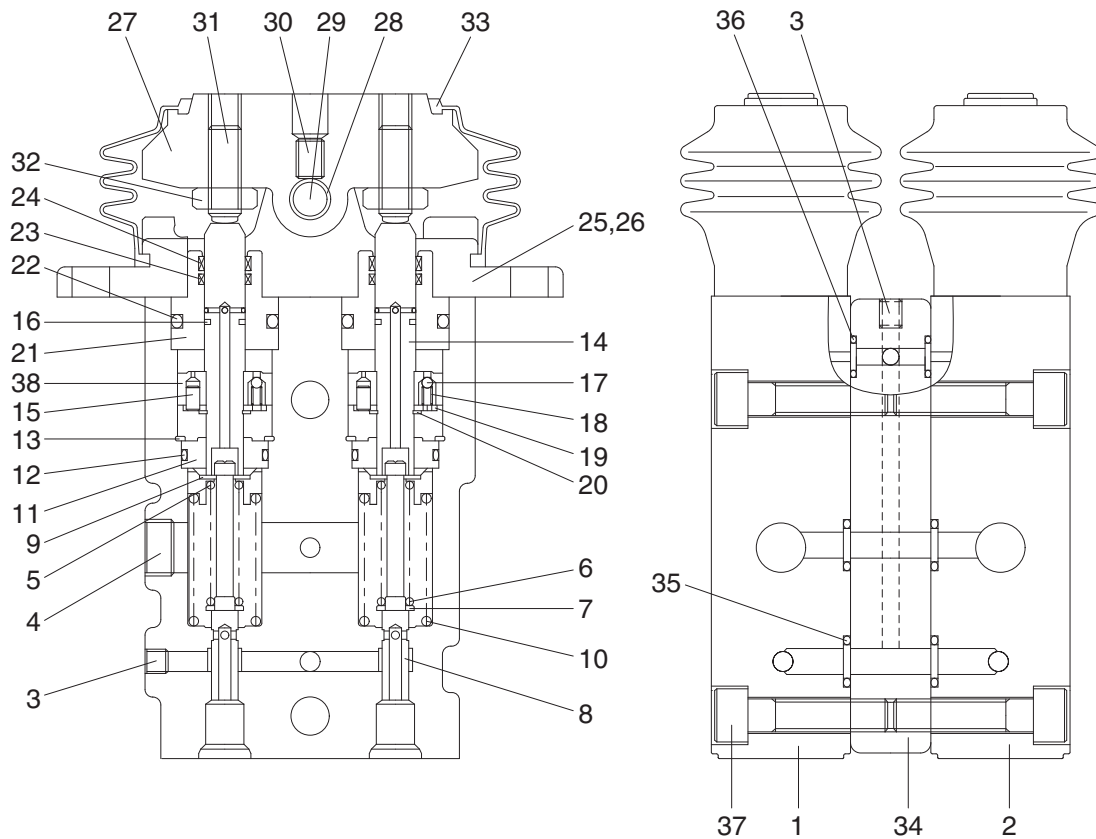
Port	Port	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, Forward)	
2	Travel (LH, Backward)	
3	Travel (RH, Forward)	
4	Travel (RH, Backward)	

CROSS SECTION

The construction of the RCV pedal is shown in the below drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (8), spring (6) for setting secondary pressure, return spring (10), stopper (9), and spring seat (7). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 19 kgf/cm² (depending on the type). The spool is pushed against the push rod (14) by the return spring.

When the push rod is pushed down by tilting pedal, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.



1	Body(1)	14	Push rod	27	Cam
2	Body(2)	15	Spring pin	28	Bushing
3	Plug	16	Seal	29	Cam shaft
4	Plug	17	Steel ball	30	Set screw
5	Spring seat	18	Spring	31	Set screw
6	Spring	19	Plate	32	Nut
7	Spring seat	20	Snap ring	33	Bellows
8	Spool	21	Plug	34	Space
9	Stopper	22	O-ring	35	O-ring
10	Spring	23	Rod seal	36	O-ring
11	Rod guide	24	Dust seal	37	Socket bolt
12	O-ring	25	Cover	38	Piston
13	Snap ring	26	Socket bolt		

21092RP02

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port (P) where oil is supplied from hydraulic pump.
- (2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port (T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21). For the purpose of changing the displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

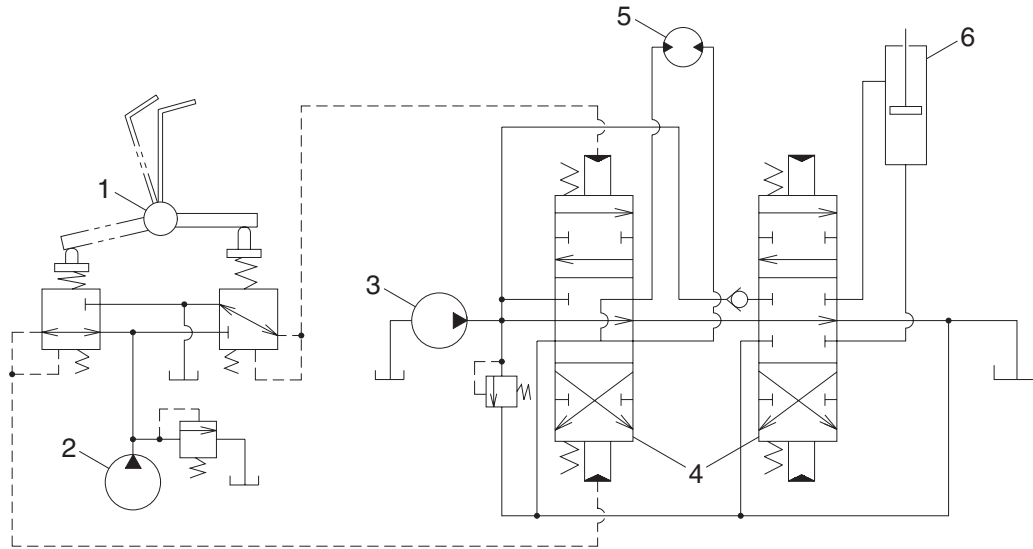
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

The diagram shown below is the typical application example of the pilot valve.



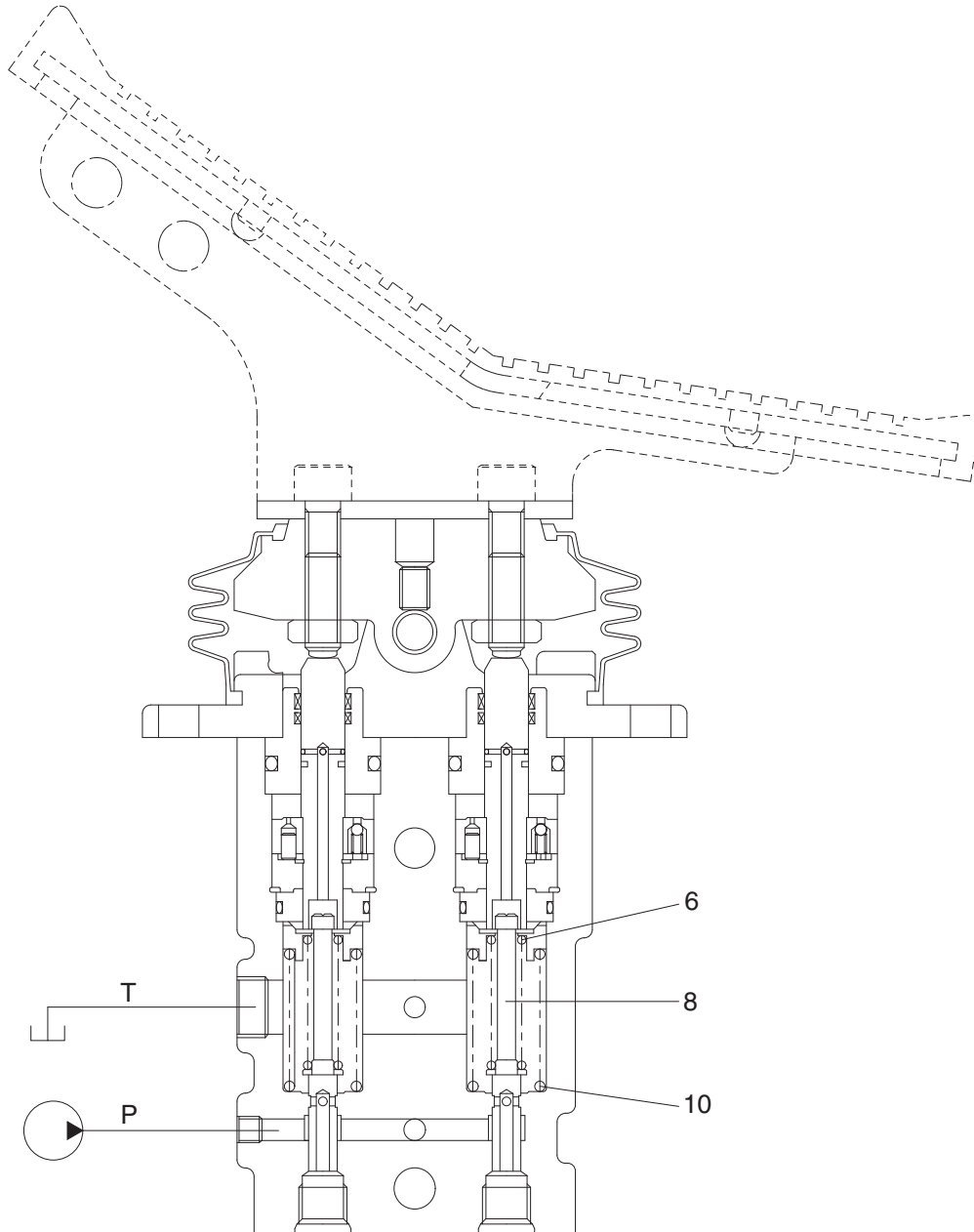
36072SF01

1 Pilot valve
2 Pilot pump

3 Main pump
4 Main control valve

5 Hydraulic motor
6 Hydraulic cylinder

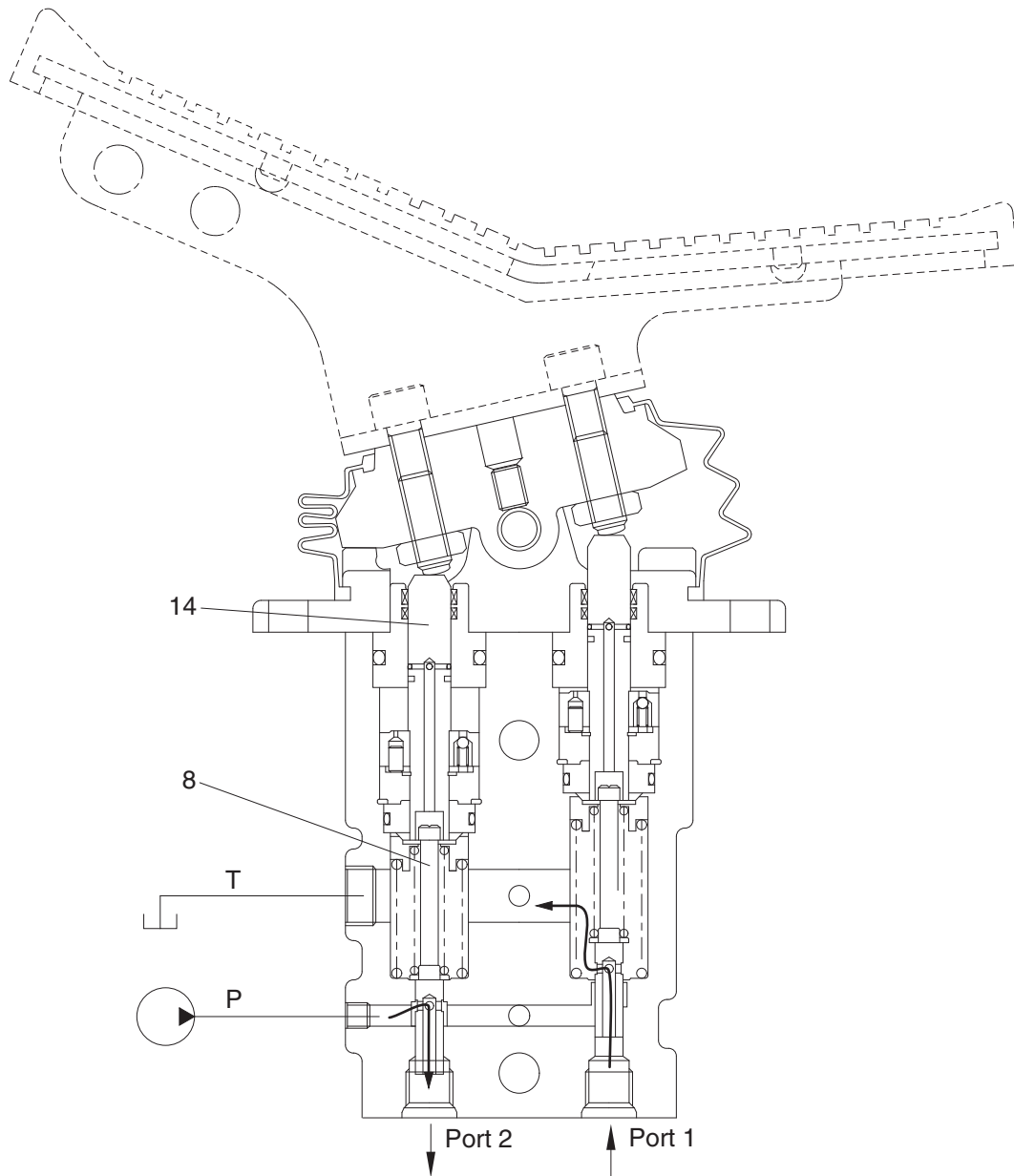
(1) Case where pedal is in neutral position



21092RP03

The force of the spring (6) that determines the output pressure of the pilot valve is not applied to the spool (8). Therefore, the spool is pushed up by the spring (10) to the position of port 2 in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where pedal is tilted



300L2RL08

When the push rod (14) is stroked, the spool (8) moves downwards.

Then port P is connected with port (2), and the oil supplied from the pilot pump flows through port 1 to generate the pressure.

When the pressure at port (2) increases to the value corresponding to the spring force set by tilting the pedal, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (2). If it decreases lower than the set pressure, port P is connected with port (2) and port T is disconnected from port (2).

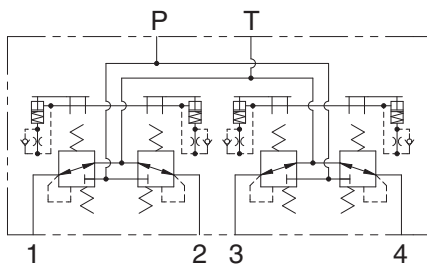
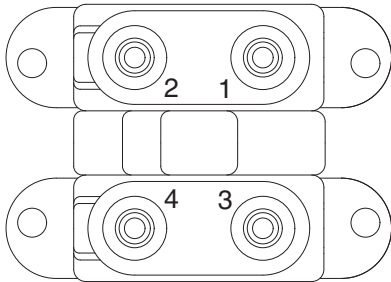
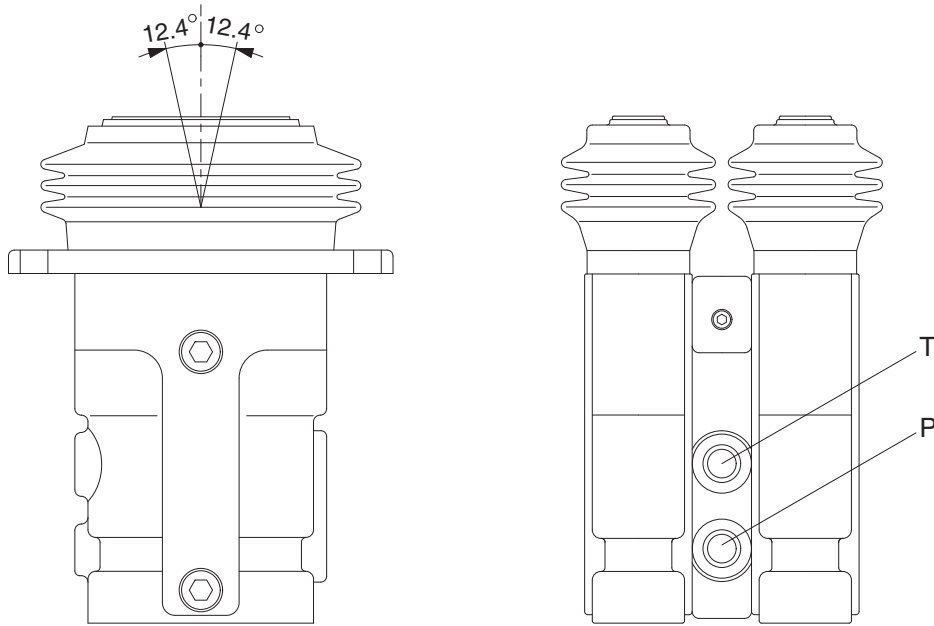
In this manner the secondary pressure is kept at the constant value.

Besides, in some type, when the pedal is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

GROUP 6 RCV PEDAL (#0474-)

1. STRUCTURE

The casing (spacer) has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.



Hydraulic circuit

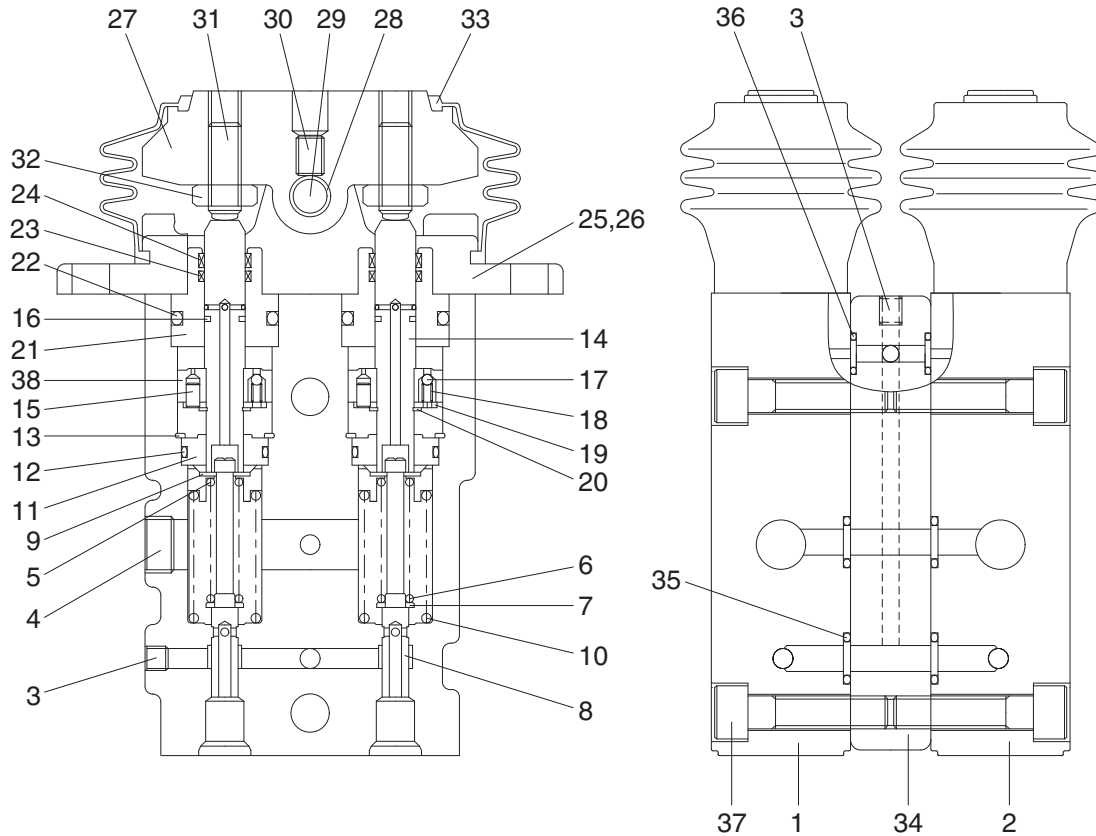
Port	Port	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, Forward)	
2	Travel (LH, Backward)	
3	Travel (RH, Forward)	
4	Travel (RH, Backward)	

CROSS SECTION

The construction of the RCV pedal is shown in the below drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (8), spring (6) for setting secondary pressure, return spring (10), stopper (9), and spring seat (7). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 19 kgf/cm² (depending on the type). The spool is pushed against the push rod (14) by the return spring.

When the push rod is pushed down by tilting pedal, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.



21092RP02

1	Body(1)	14	Push rod	27	Cam
2	Body(2)	15	Spring pin	28	Bushing
3	Plug	16	Seal	29	Cam shaft
4	Plug	17	Steel ball	30	Set screw
5	Spring seat	18	Spring	31	Set screw
6	Spring	19	Plate	32	Nut
7	Spring seat	20	Snap ring	33	Bellows
8	Spool	21	Plug	34	Space
9	Stopper	22	O-ring	35	O-ring
10	Spring	23	Rod seal	36	O-ring
11	Rod guide	24	Dust seal	37	Socket bolt
12	O-ring	25	Cover	38	Piston
13	Snap ring	26	Socket bolt		

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port (P) where oil is supplied from hydraulic pump.
- (2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port (T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21). For the purpose of changing the displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

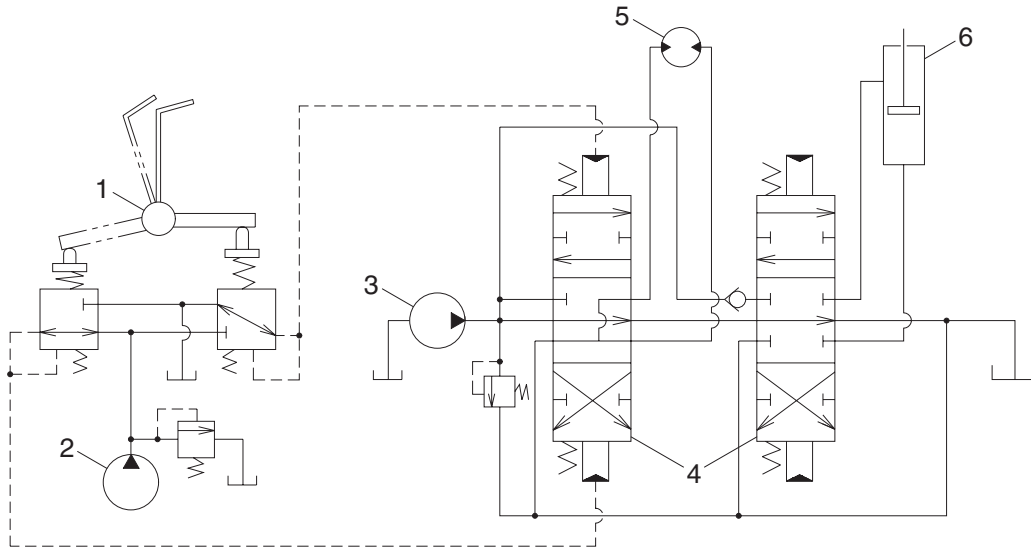
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

The diagram shown below is the typical application example of the pilot valve.



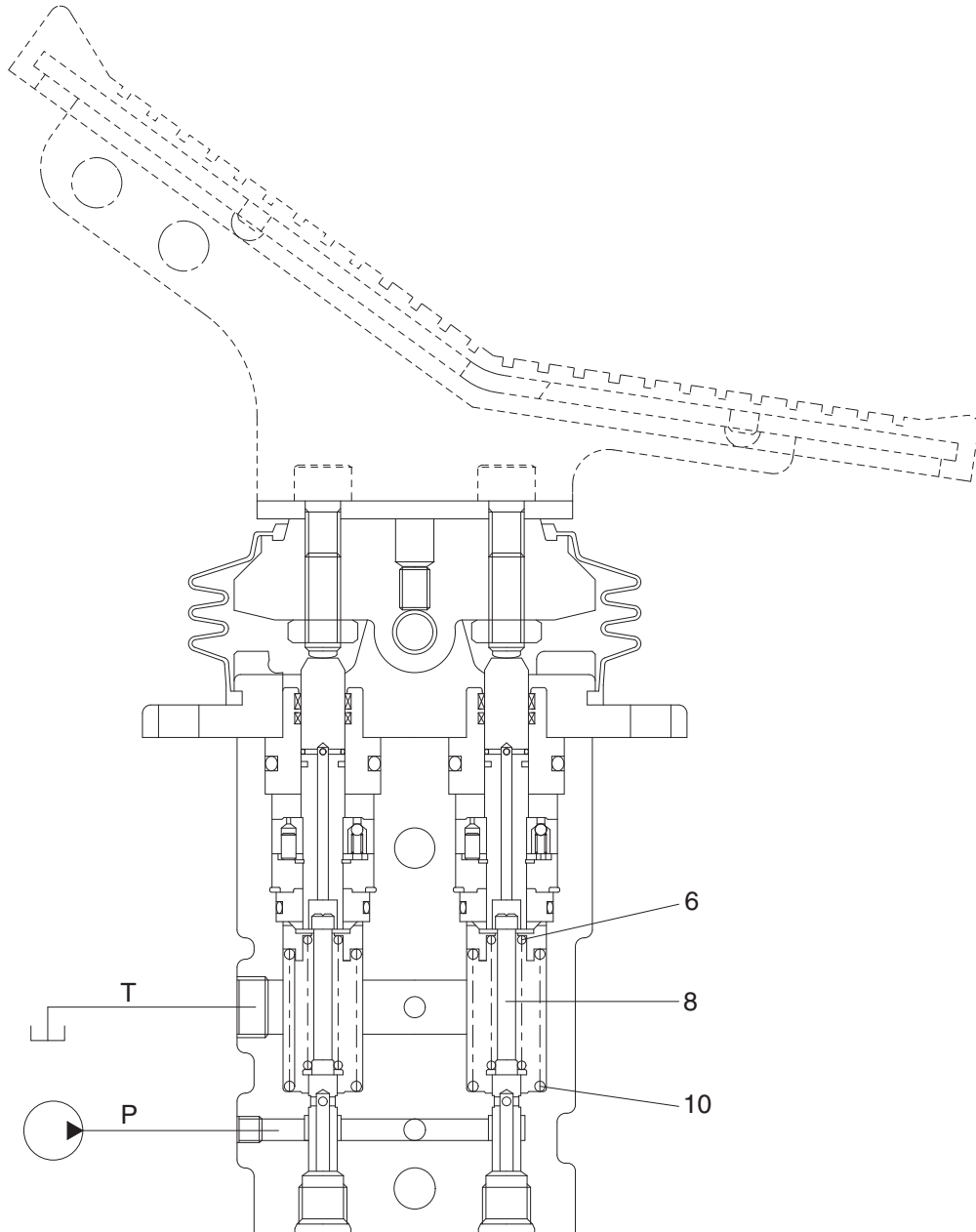
36072SF01

1 Pilot valve
2 Pilot pump

3 Main pump
4 Main control valve

5 Hydraulic motor
6 Hydraulic cylinder

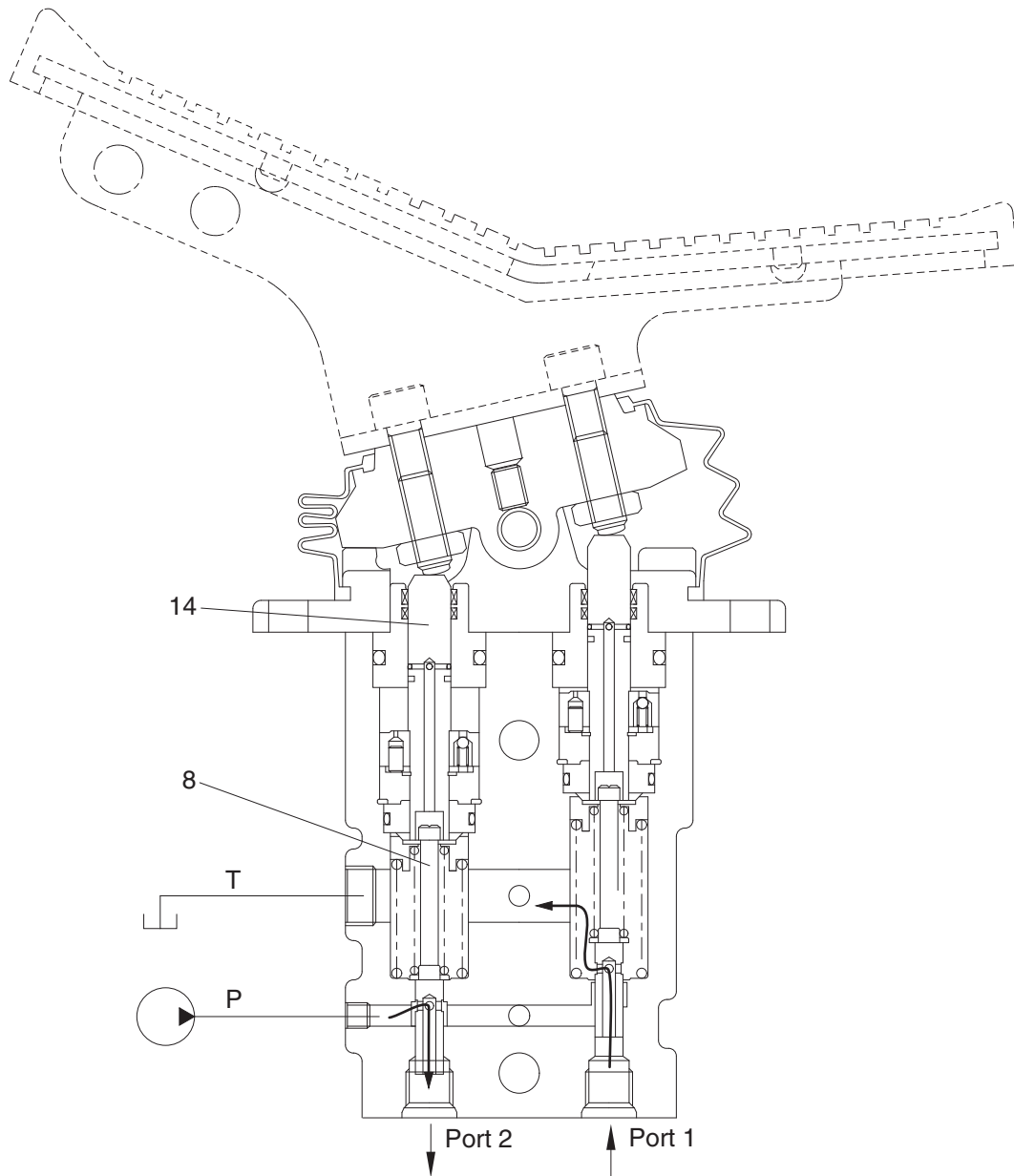
(1) Case where pedal is in neutral position



21092RP03

The force of the spring (6) that determines the output pressure of the pilot valve is not applied to the spool (8). Therefore, the spool is pushed up by the spring (10) to the position of port 2 in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where pedal is tilted



300L2RL08

When the push rod (14) is stroked, the spool (8) moves downwards.

Then port P is connected with port (2), and the oil supplied from the pilot pump flows through port 1 to generate the pressure.

When the pressure at port (2) increases to the value corresponding to the spring force set by tilting the pedal, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (2). If it decreases lower than the set pressure, port P is connected with port (2) and port T is disconnected from port (2).

In this manner the secondary pressure is kept at the constant value.

Besides, in some type, when the pedal is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.