

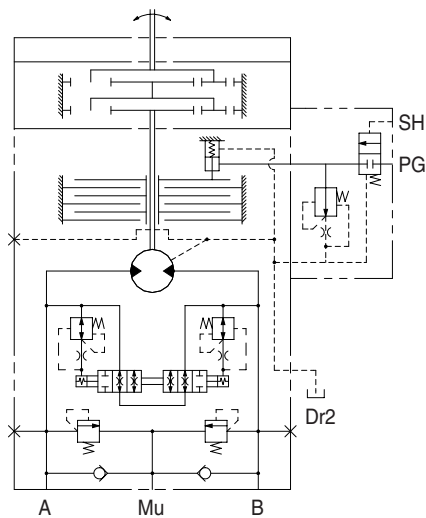
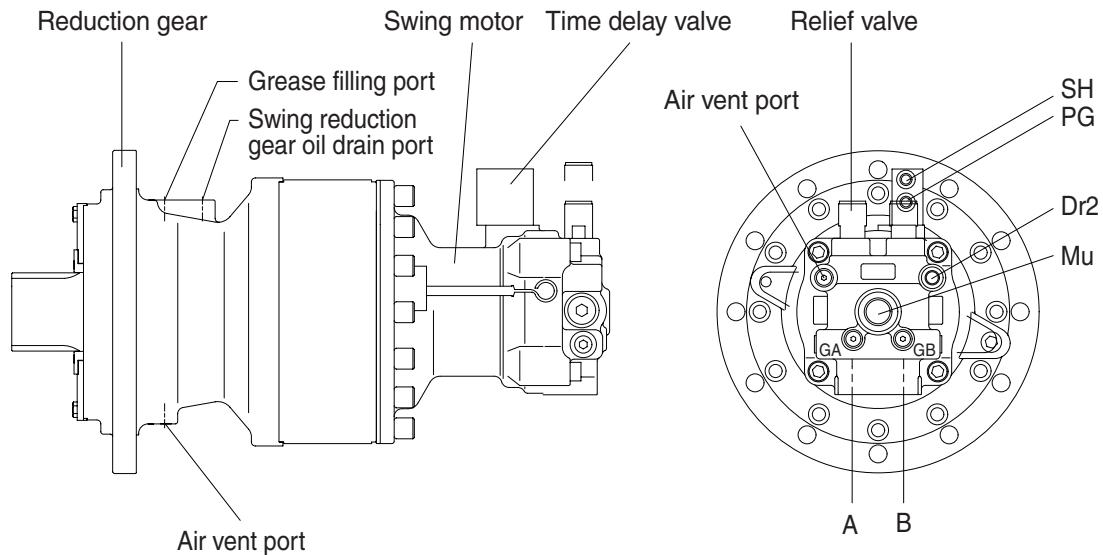
## GROUP 3 SWING DEVICE

### A. SWING DEVICE(T3X150CHB, UP TO #1937)

#### 1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

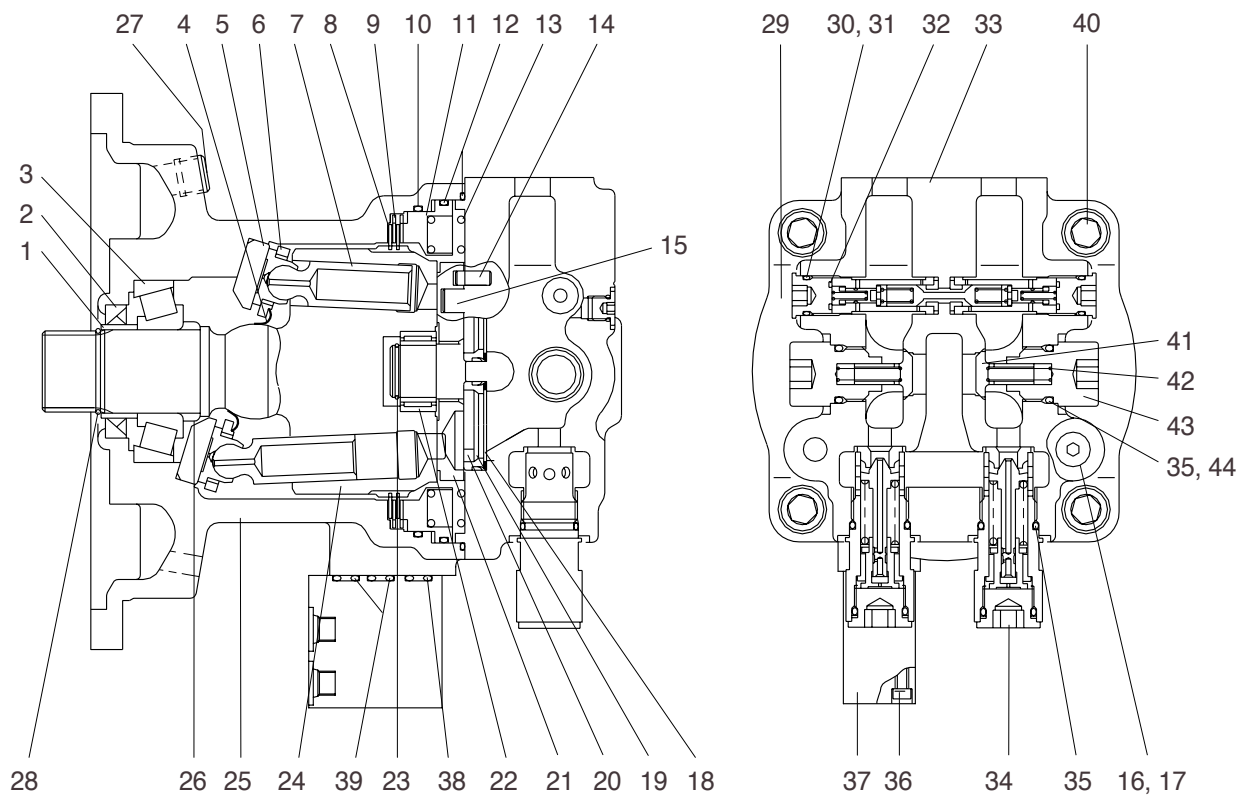
Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.



Port	Port name	Port size
A	Main port	PF 3/4
B	Main port	PF 3/4
Dr2	Drain port	PF 3/8
Mu	Make up port	PF 1
PG	Brake release port	PF 1/4
SH	Stand by port	PF 1/4
GA, GB	Gage port	PF 1/4

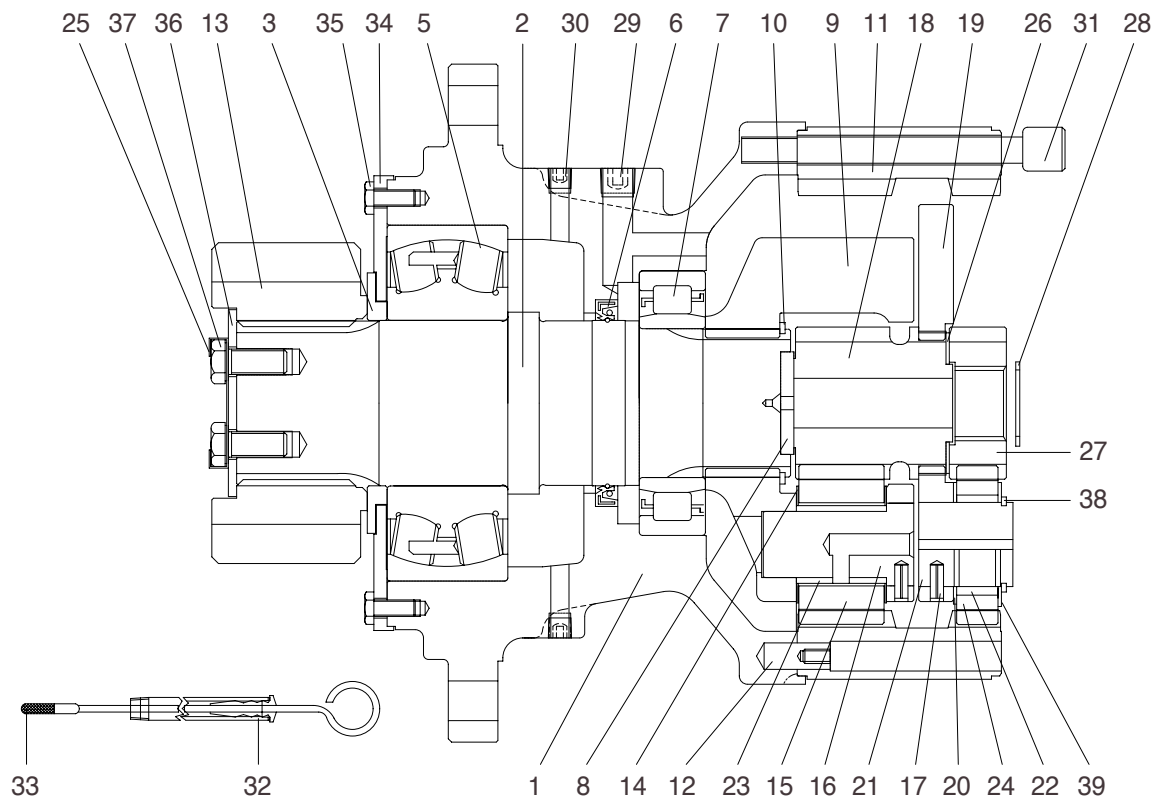
21072SF03

## 1) SWING MOTOR



1	Inner ring	16	Cap	31	O-ring
2	Oil seal	17	O-ring	32	O-ring
3	Taper roller bearing	18	Coned disc spring	33	Cover
4	Backing spring	19	Teflon ring	34	Relief assembly
5	Cam plate	20	Bushing	35	O-ring
6	Return plate	21	Balance plate	36	Hexagon socket bolt
7	Piston assembly	22	Needle bearing	37	Time delay valve
8	Lining plate	23	Snap ring	38	O-ring
9	Plate	24	Cylinder	39	O-ring
10	O-ring	25	Housing	40	Hexagon socket bolt
11	Piston	26	Collar	41	Check
12	O-ring	27	Plug	42	Spring
13	Spring	28	Snap ring	43	Cap
14	Parallel pin	29	Bypass valve assembly	44	Back up ring
15	Piston	30	Back up ring		

## 2) REDUCTION GEAR



1	Casing	15	Planet gear 2	28	Stop ring
2	Drive shaft	16	Pin 2	29	Plug
3	Spacer	17	Spring pin	30	Plug
5	Roller bearing	18	Sun gear 2	31	Socket bolt
6	Oil seal	19	Carrier 1	32	Gauge pipe
7	Roller bearing	20	Side plate 1	33	Gauge bar
8	Thrust bearing	21	Pin 1	34	Cover plate
9	Carrier 2	22	Needle cage	35	Hexagon socket bolt
10	Stop ring	23	Bush 2	36	Lock plate
11	Ring gear	24	Planet gear 1	37	Hexagon socket bolt
12	Knock pin	25	Lock washer	38	Stop ring
13	Pinion gear	26	Side plate 3	39	Side plate 2
14	Thrust gear	27	Sun gear 1		

## 2. FUNCTION

### 1) ROTARY PART

When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(1), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(2) upon the return plate(3) which acts upon the swash plate(4) via an hydrostatic bearing. Force F1 perpendicular to swash plate(4) and force F2 perpendicular to cylinder center.

Being transferred to the cylinder block(5) through piston, force F2 causes rotational moment at surroundings of cylinder.

Since cylinder block has 9 equidistantly arrayed pistons, rotational torque is transmitted to cylinder shaft in order by several pistons connected to the inlet port of high pressurized oil. When the direction of oil flow is reversed, rotational direction of cylinder is also reversed. Output torque is given by the equation.

$$T = \frac{p \times q}{2}, q = Z \cdot A \cdot \text{PCD} \cdot \tan \alpha, F_1 = \frac{F}{\cos \alpha}, F_2 = F \tan \alpha, S = \text{PCD} \times \tan \alpha$$

Where p : Effective difference of pressure(kgf/cm<sup>2</sup>)

q : Displacement(cc/rev)

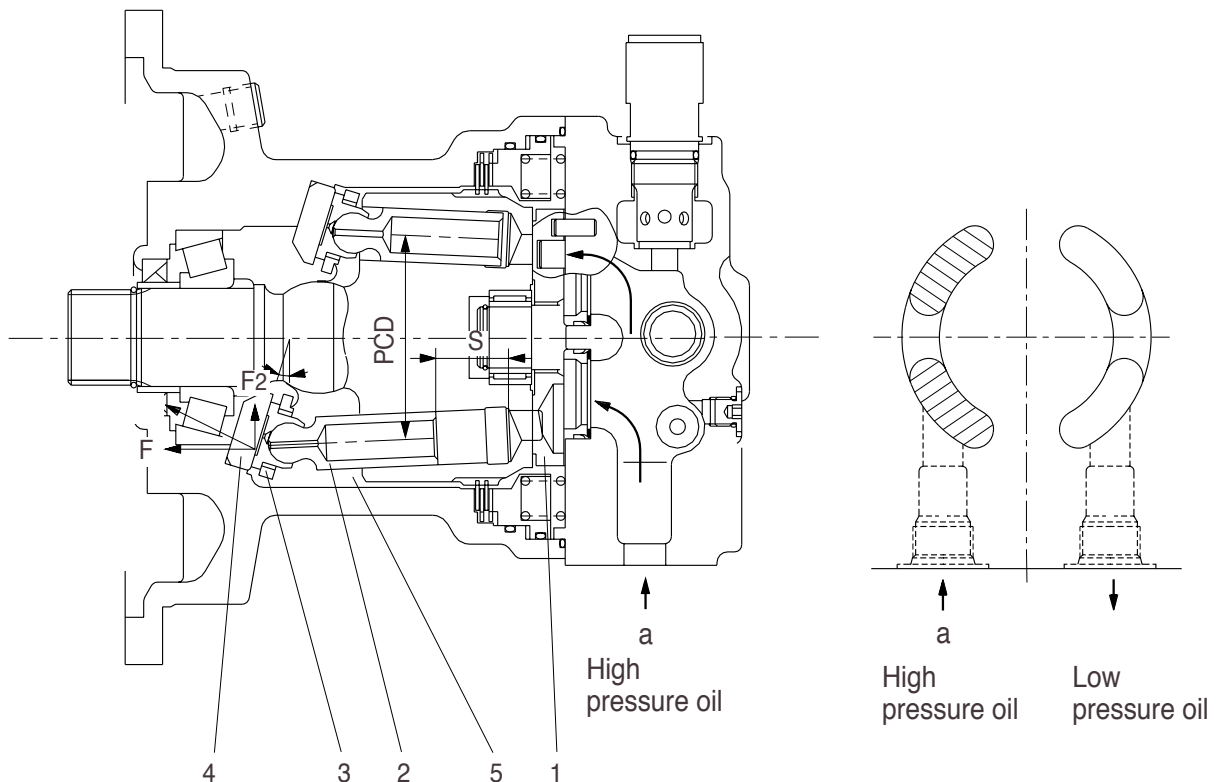
T : Output torque(kgf · cm)

Z : Piston number(9EA)

A : Piston area(cm<sup>2</sup>)

$\alpha$  : Tilting angle of swash plate(degree)

S : Piston stroke(cm)



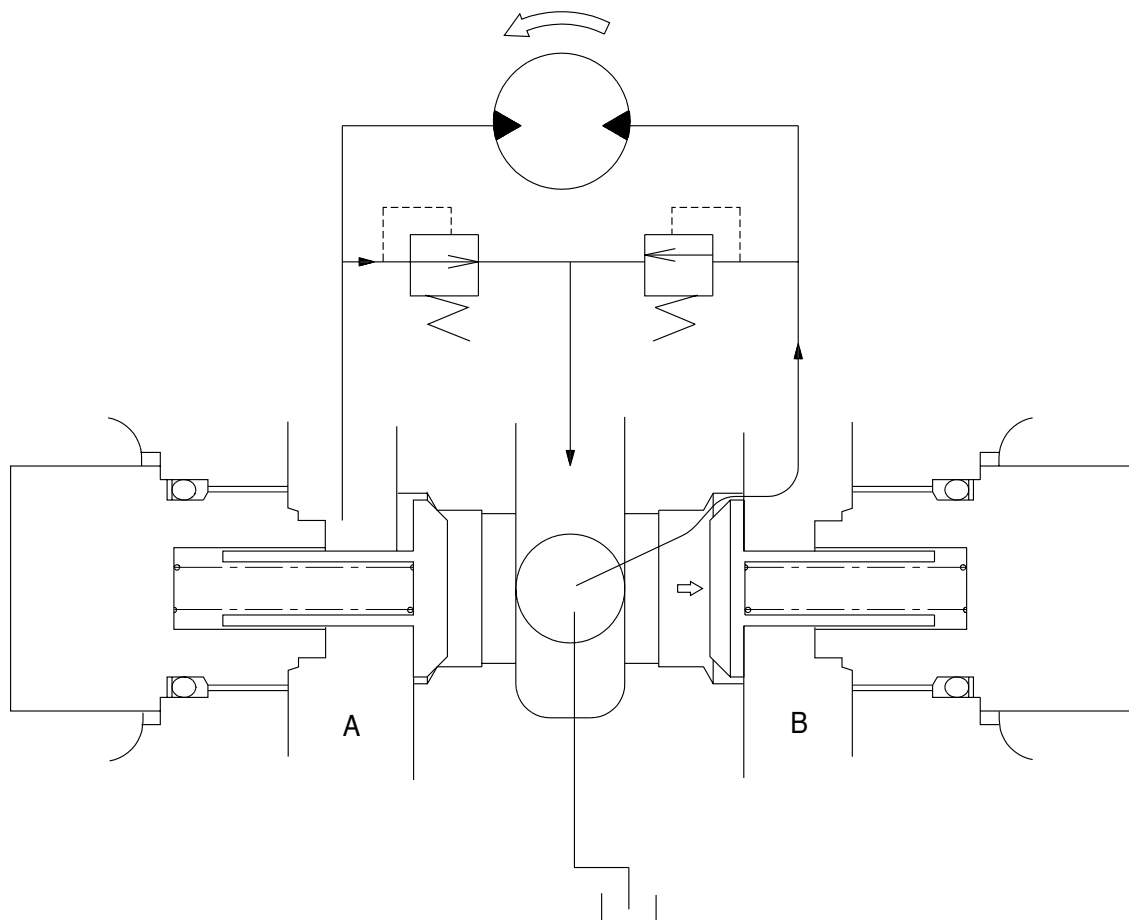
## 2) MAKE UP VALVE

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.

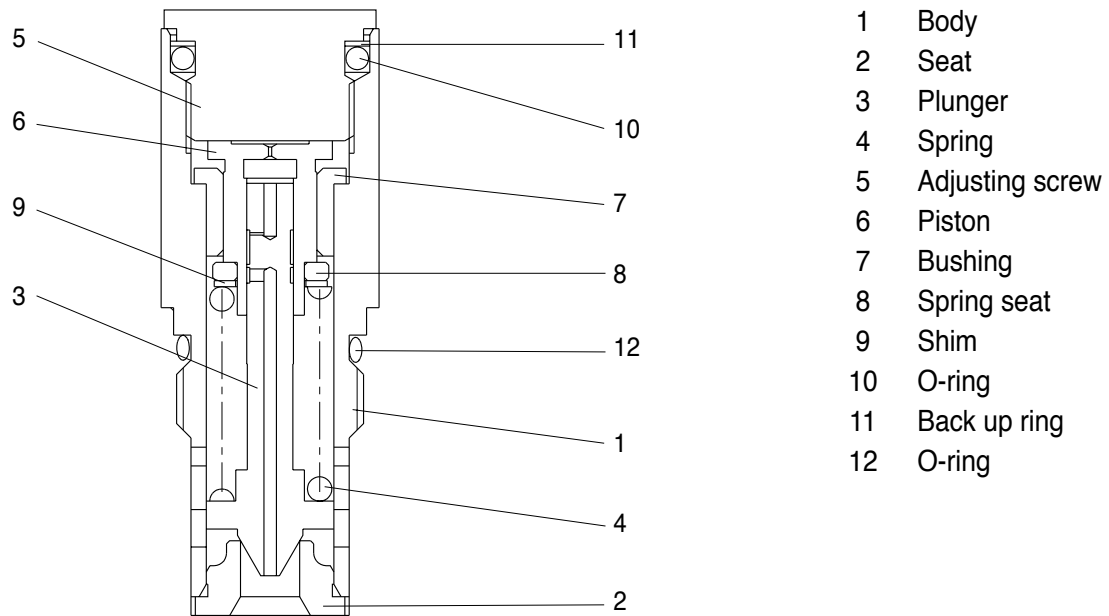
A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve.

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.



### 3) RELIEF VALVE

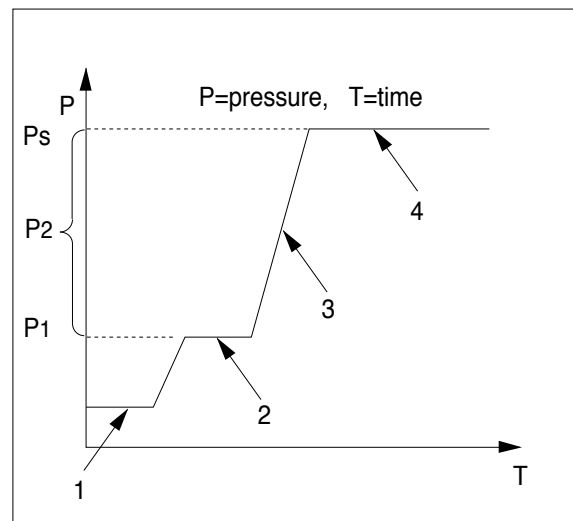


#### (1) Construction of relief valve

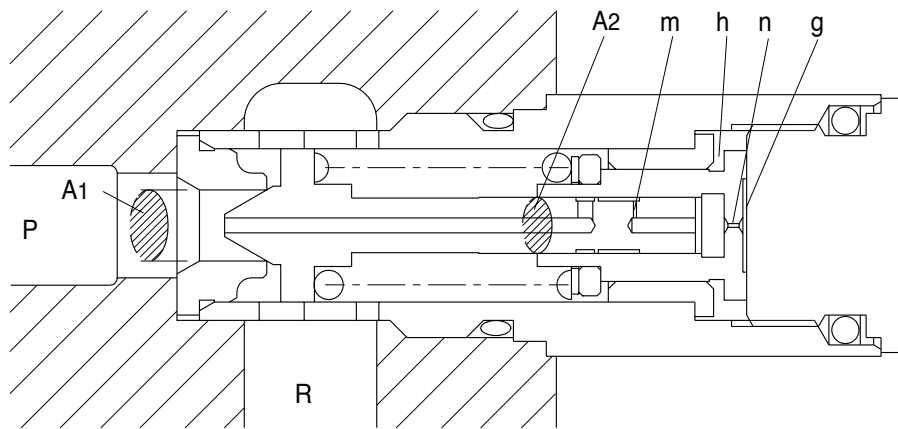
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

#### (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.



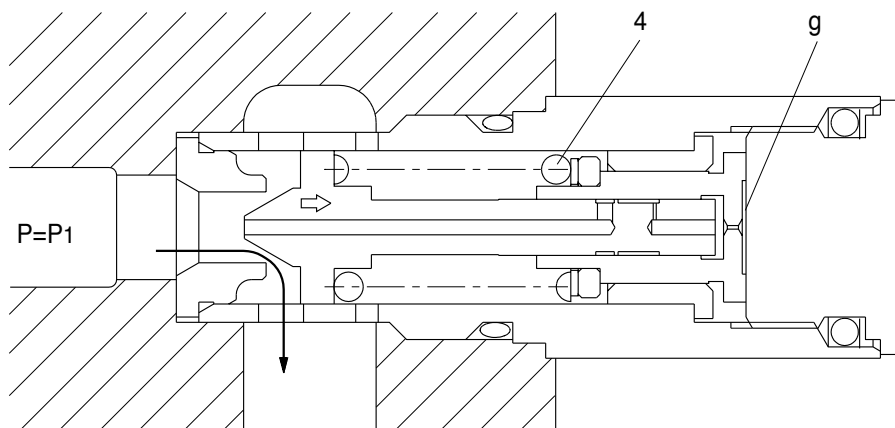
Ports (P,R) at tank pressure.



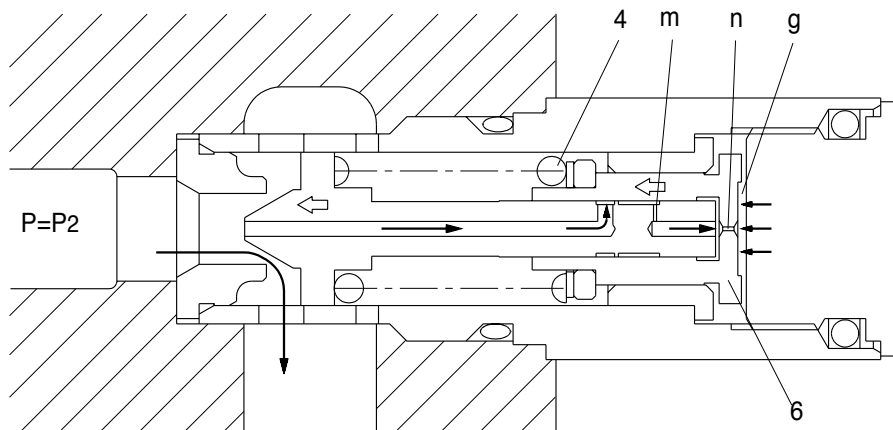
When hydraulic oil pressure( $P \times A_1$ ) reaches the preset force( $F_{sp}$ ) of spring(4), the plunger(3) moves to the right as shown.

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

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



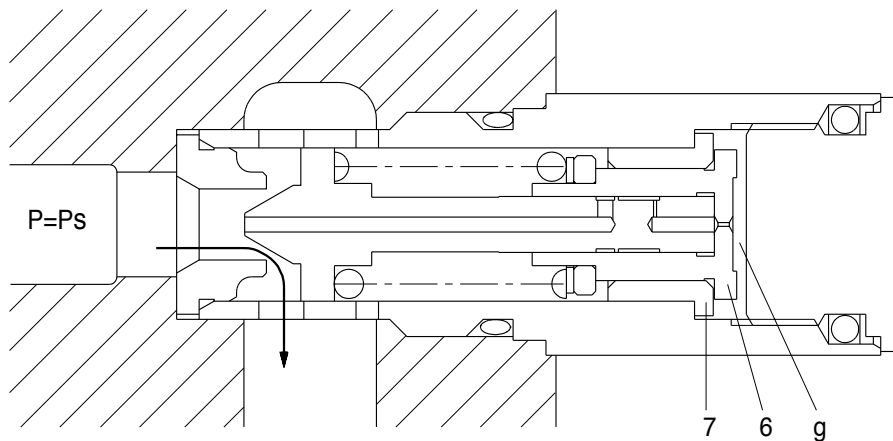
The oil flow chamber g via orifice m and n. When the pressure of chamber g reaches the preset force( $F_{SP}$ ) of spring(4), the piston(6) moves left and stop the piston(6) hits the bottom of bushing(7).



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( $P_s$ ).

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

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



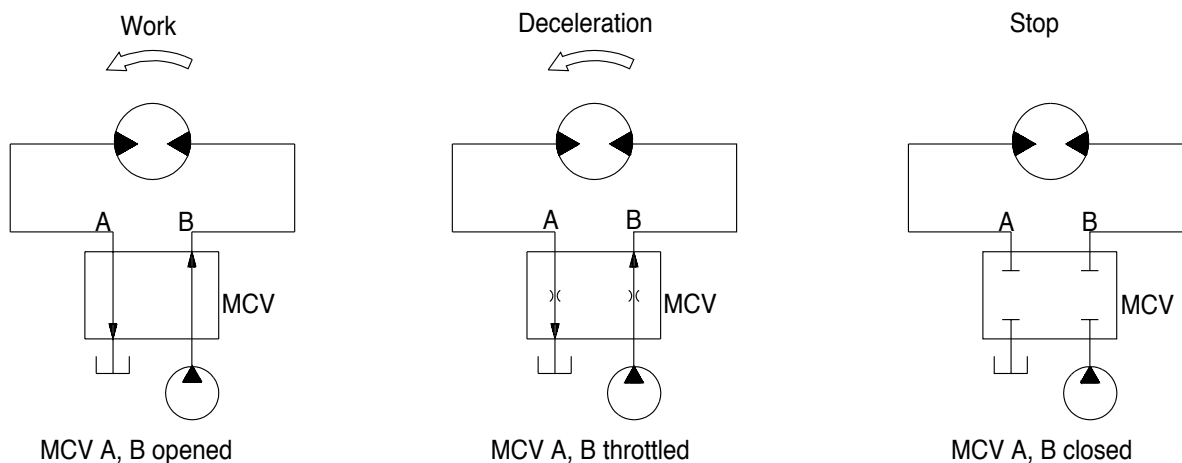


#### 4) BRAKE SYSTEM

##### (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.



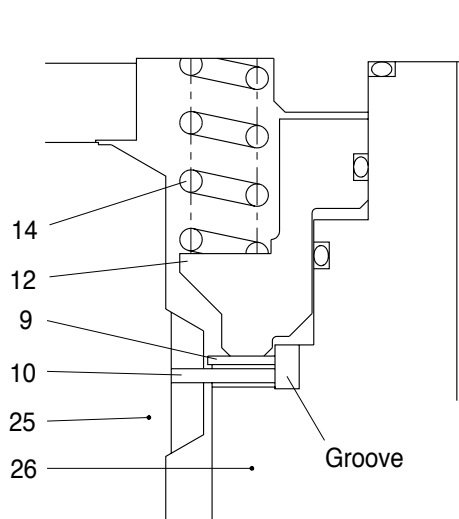
##### (2) Mechanical swing parking brake system

The mechanical swing parking brake system is installed to prevent the upper structure from swinging downhill because of its own weight when the excavator is parked on a slope since it completely eliminates the hydraulic drift of swing motion while the excavator is on a slope, work can be done more easily and safely.

##### Brake assembly

Circumferential rotation of separate plate(9) is constrained by the groove located at housing(26). When housing is pressed down by brake spring(14) through lining plate(10), separate plate(9) and brake piston(12), friction force occurs there.

Cylinder(25) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.

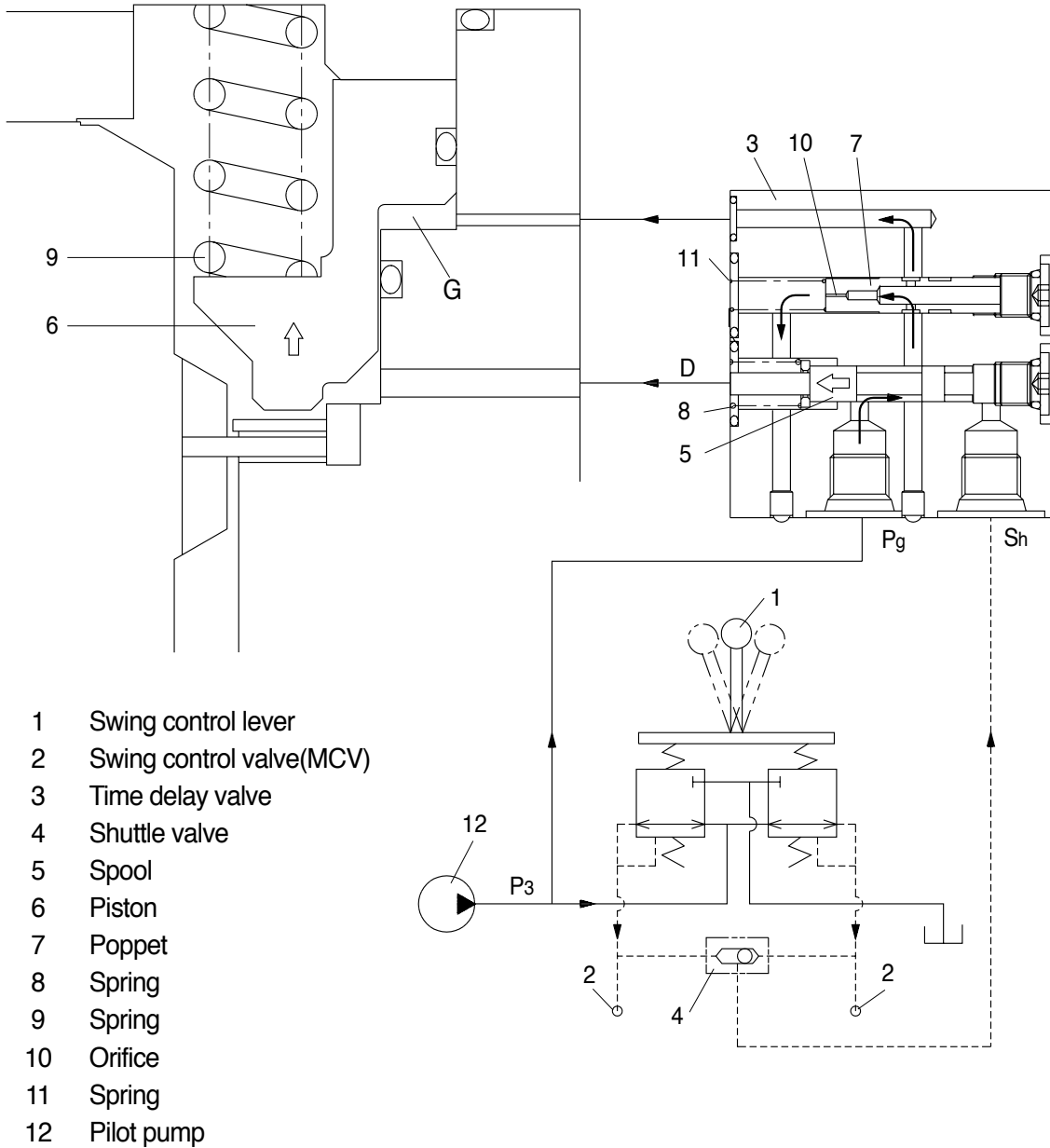


9	Separate plate	14	Spring
10	Lining plate	25	Cylinder
12	Brake piston	26	Housing

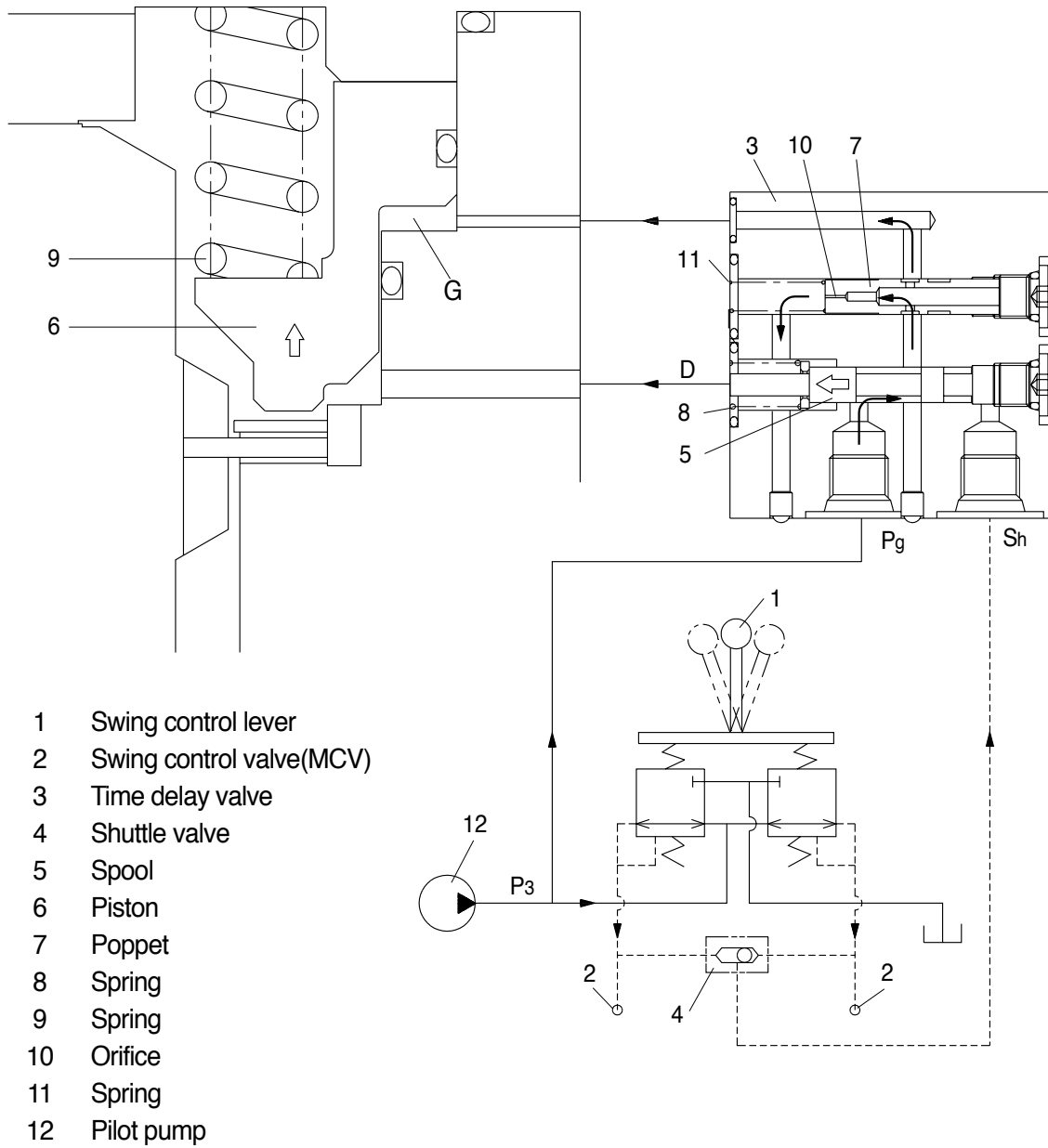
## Operating principle

- a. When the swing control lever(1) is set to the swing position, the pilot oil go to the swing control valve(2) and to Sh of the time delay valve(3) via the shuttle valve(4), this pressure move spool(5) to the leftward against the force of the spring(8), so pilot pump charged oil(P3) goes to the chamber G.

This pressure is applied to move the piston(6) to the upward against the force of the spring(9). Thus, it releases the brake force.



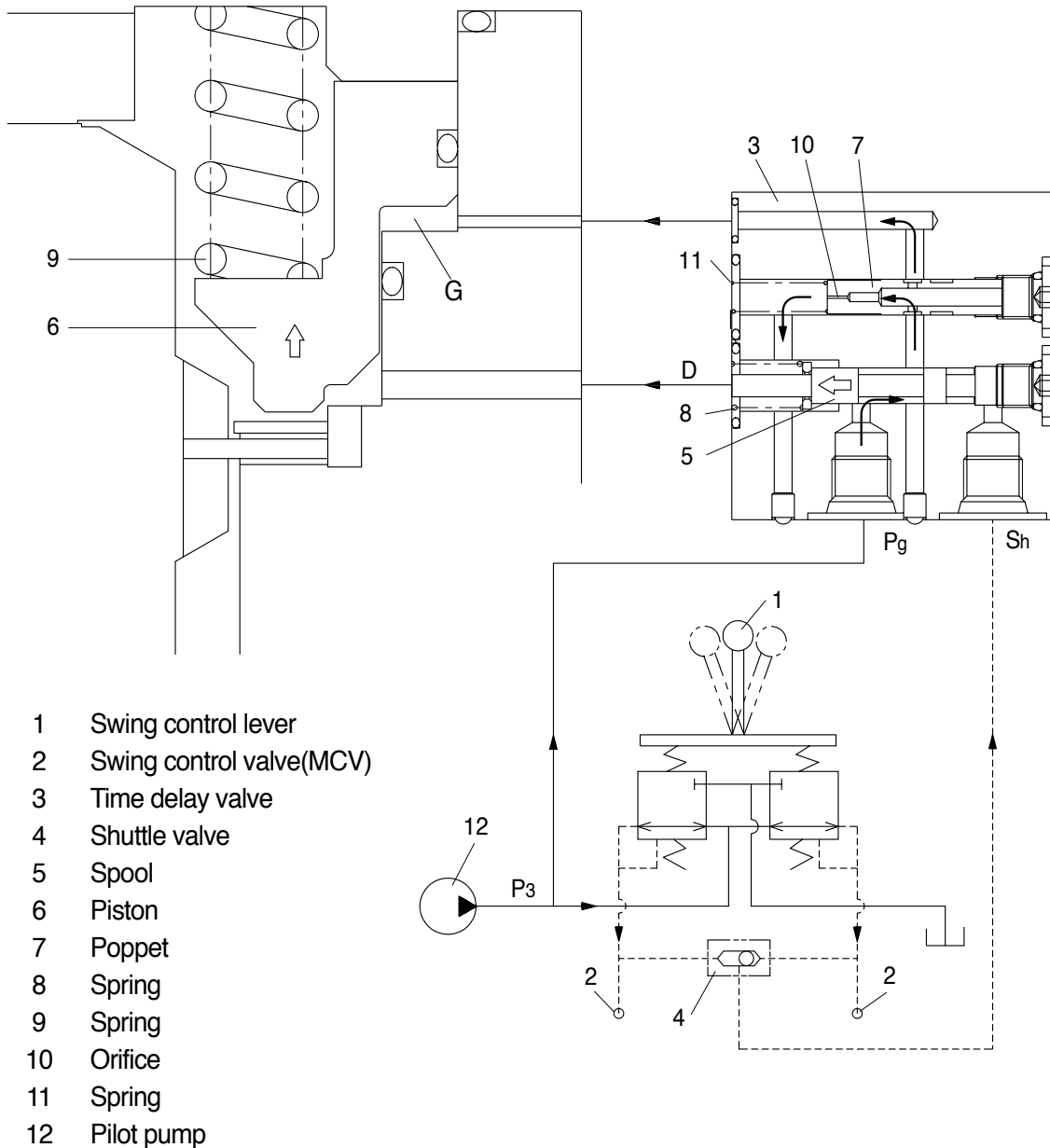
b. Meantime, the oil pressure of port D balance with the preset force of spring(11), the pressure of chamber G keeps constant pressure.



c. When the swing control(1) lever is set the neutral position, the spool(5) returns right in the time delay valve(3).

Then, the piston(6) is moved lower by spring force and the return oil from the chamber G flows back to D-port through orifice(10) of the poppet(7).

At this time, the poppet(7) works to make a time lag for 5 seconds.

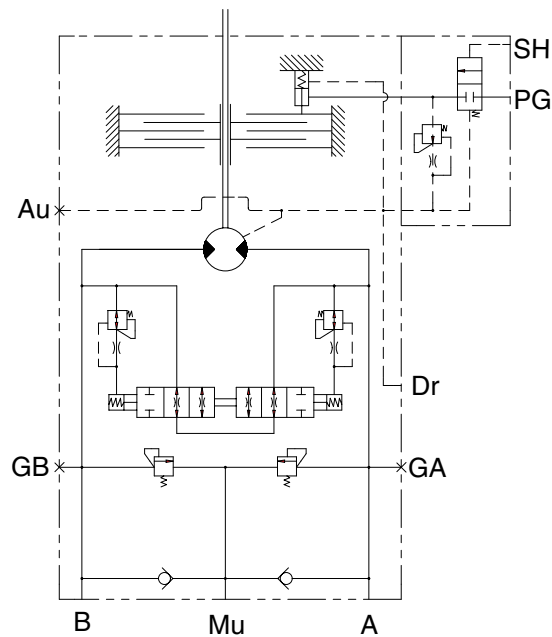
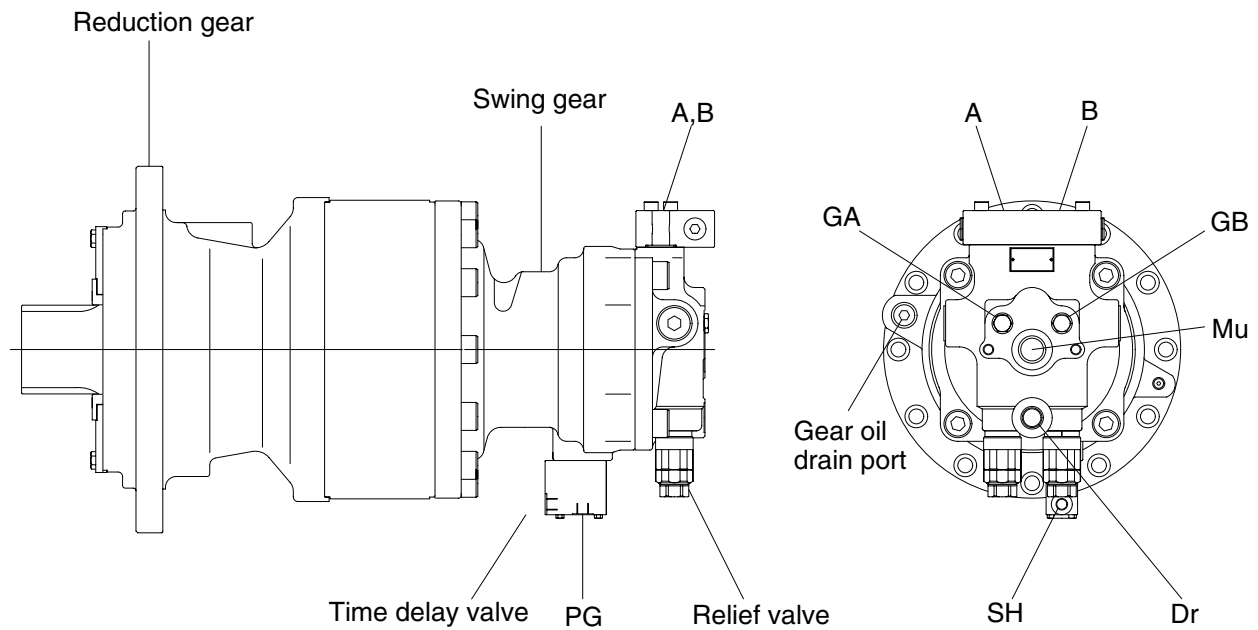


## B. SWING DEVICE(RMF151, #1938 and up)

### 1. STRUCTURE

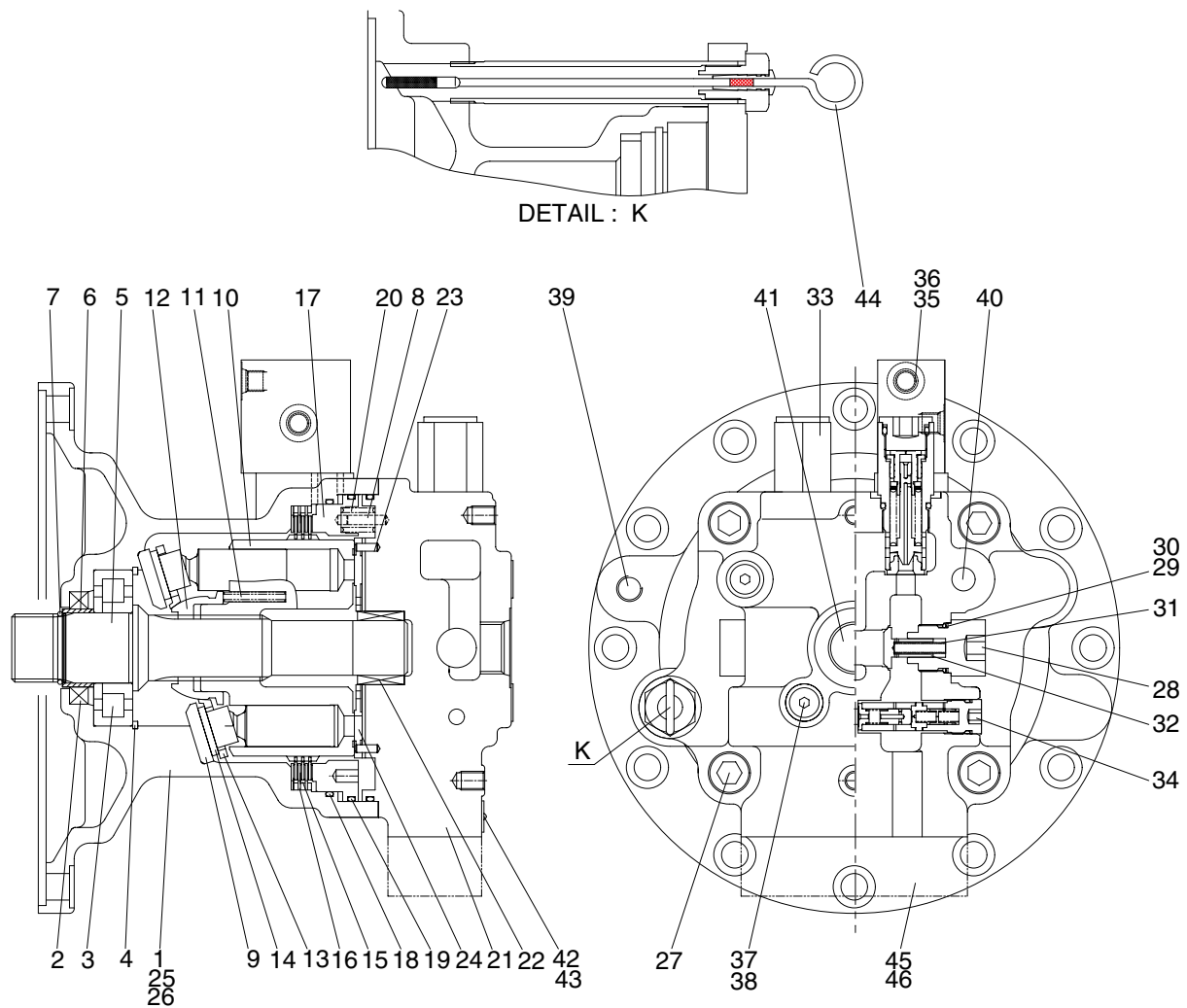
Swing device consists swing motor, swing reduction gear.

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



Port	Port name	Port size
A	Main port	ø 20
B	Main port	ø 20
Dr	Drain port	PF 1/2
Mu	Make up port	PF 1
PG	Brake release port	PF 1/4
SH	Stand by port	PF 1/4
GA, GB	Gage port	PF 1/4
Au	Air vent port	PF 1/4

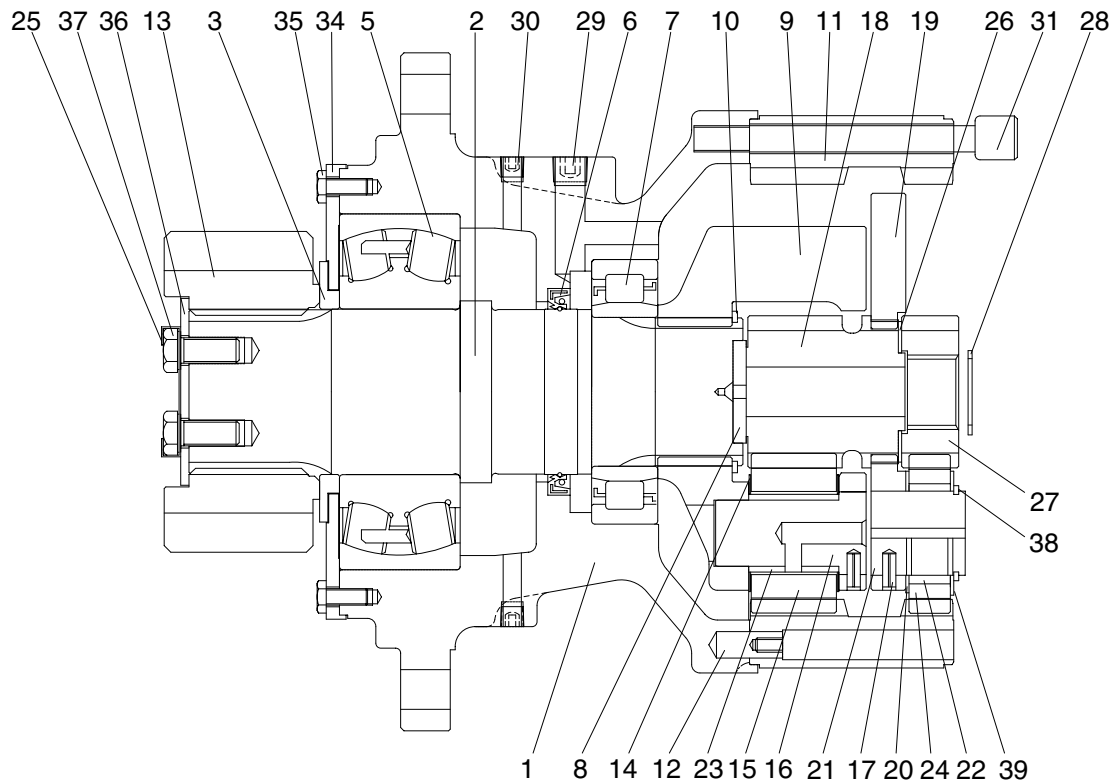
## 1) SWING MOTOR



220072SM02

1	Body	18	O-ring	35	Time delay valve
2	Oil seal	19	O-ring	36	Wrench bolt
3	Roller bearing	20	Spring	37	Plug
4	Snap ring	21	Rear cover	38	O-ring
5	Shaft	22	Needle bearing	39	Plug
6	Bushing	23	Pin	40	Plug
7	Stop ring	24	Valve plate	41	Plug
8	Pin	25	O-ring	42	Name plate
9	Shoe plate	26	O-ring	43	Rivet
10	Cylinder block	27	Wrench bolt	44	Level gauge
11	Spring	28	Plug	45	Flange
12	Ball guide	29	Back up ring	46	O-ring
13	Set plate	30	O-ring	47	Plug
14	Piston assy	31	Spring	48	O-ring
15	Friction plate	32	Check	49	O-ring
16	Plate	33	Relief valve	50	Back up ring
17	Brake piston	34	Anti-inversion valve		

## 2) REDUCTION GEAR



220072SF05A

1	Casing	14	Thrust washer	26	Side plate 3
2	Drive shaft	15	Planet gear 2	27	Sun gear 1
3	Spacer	16	Pin 2	28	Stop ring
5	Roller bearing	17	Spring pin	29	Plug
6	Oil seal	18	Sun gear 2	30	Plug
7	Roller bearing	19	Carrier 1	31	Socket bolt
8	Thrust plate	20	Side plate 1	34	Cover plate
9	Carrier 2	21	Pin 1	35	Hexagon bolt
10	Stop ring	22	Needle cage	36	Lock plate
11	Ring gear	23	Bush 2	37	Hexagon bolt
12	Knock pin	24	Planet gear 1	38	Stop ring
13	Pinion gear	25	Lock washer	39	Side plate 2

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