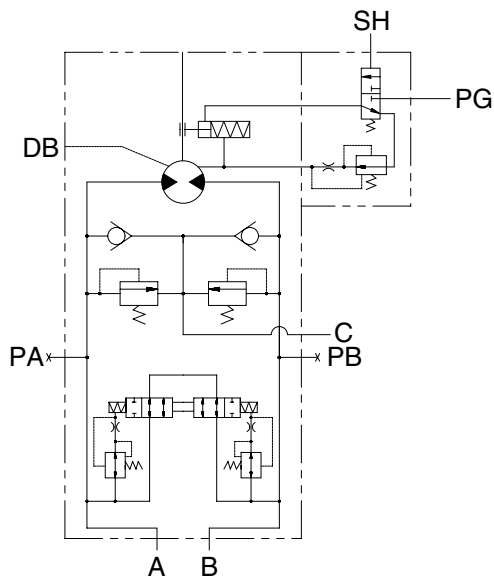
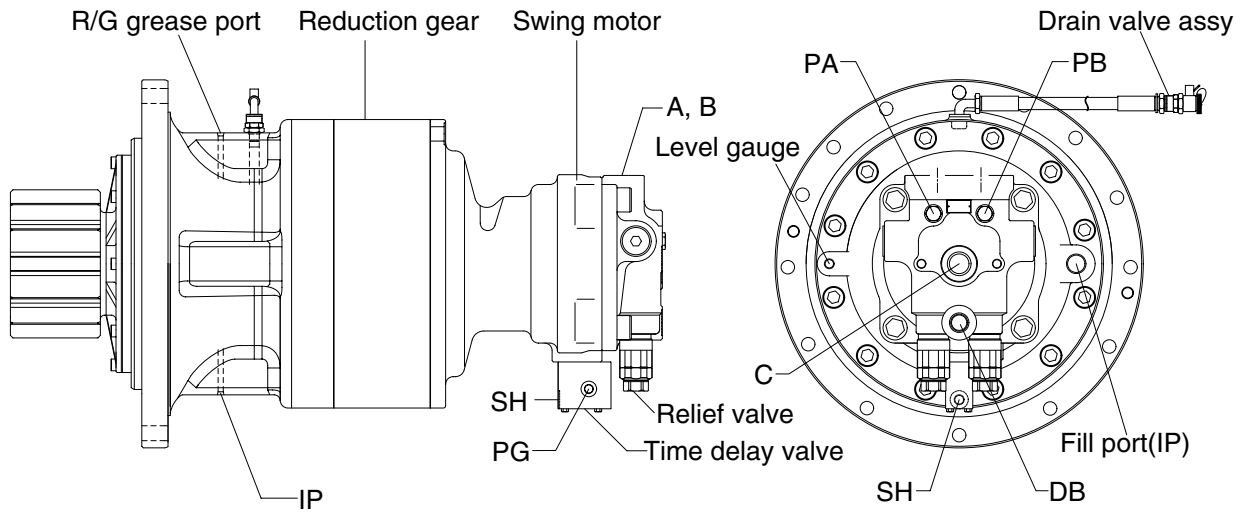


GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

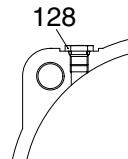
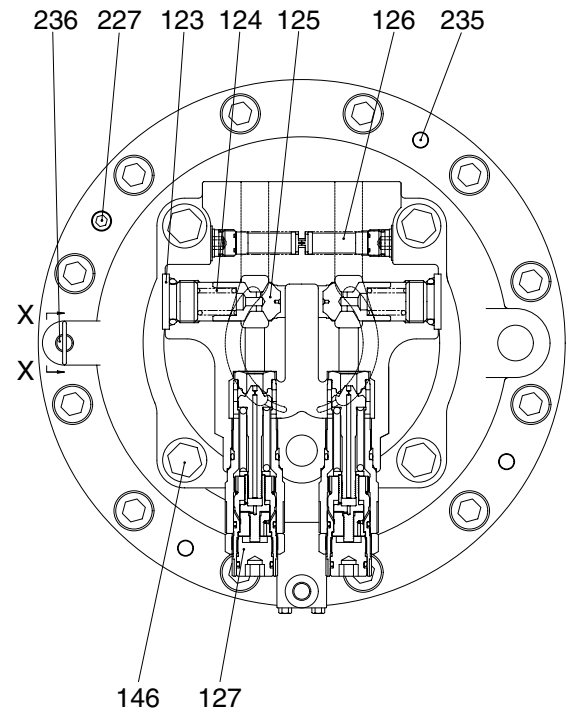
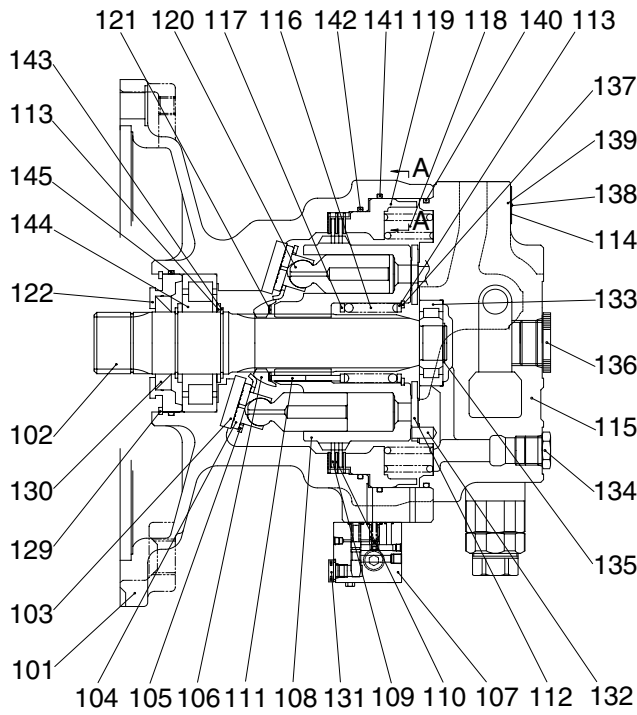
Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.



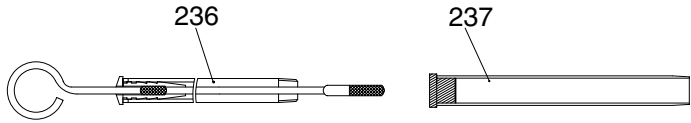
32092SM01

Port	Port name	Port size
A, B	Main port	SAE 5000psi 3/4"
DB	Drain port	PF 1/2-19
C	Make up port	PF 1-24
PA, PB	Gauge port	PF 1/4-12
PG	Brake release port	PF 1/4-12
SH	Brake pilot port	PF 1/4-12
IP	Grease inlet port	PT 1/4

1) SWING MOTOR



SECTION A - A

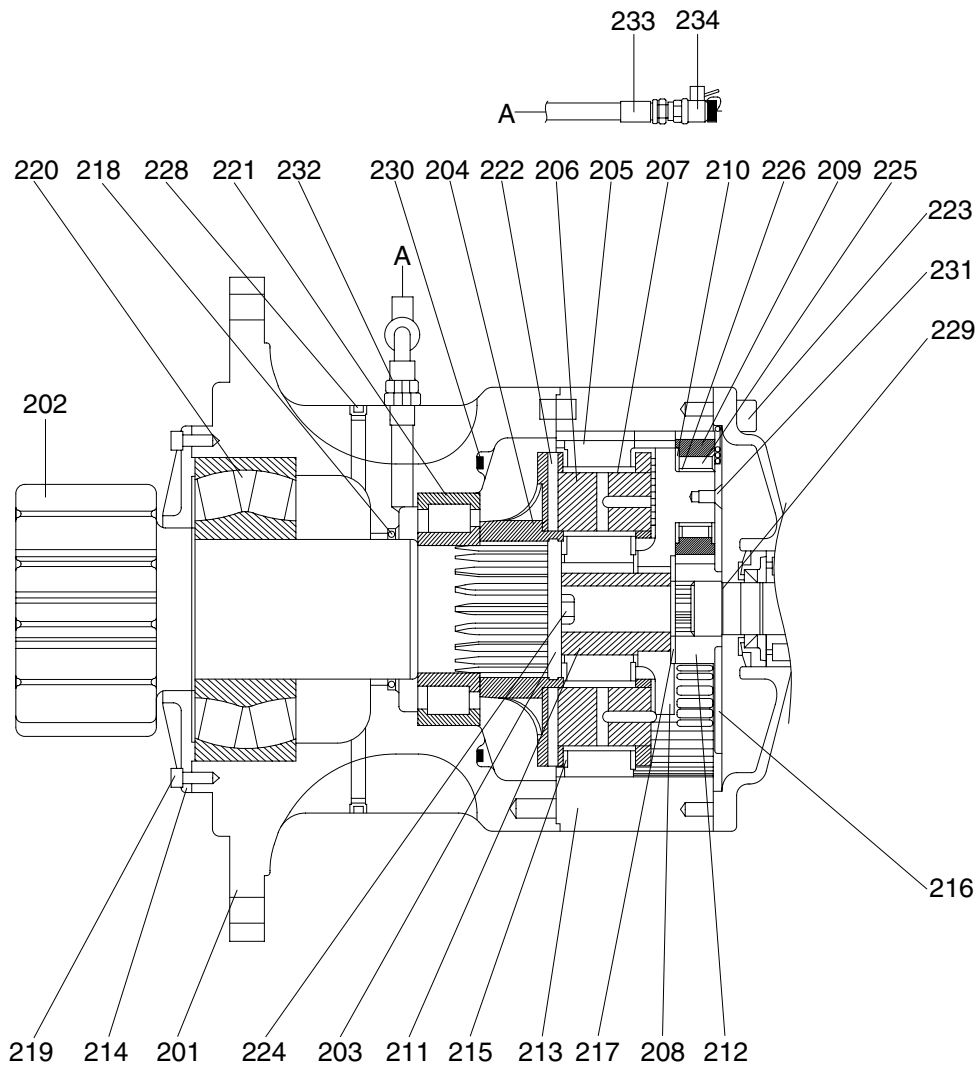


SECTION X-X

32092SM02

101	Casing A1	118	Brake spring	135	Ring snap
102	Drive shaft	119	Brake piston	136	Dust plug
103	Shoe plate	120	Piston	137	Ring snap
104	Shoe	121	Spacer F	138	Name plate
105	Retainer	122	Front cover	139	Rivet screw
106	Spherical bush	123	RO plug	140	O-ring
107	Brake valve	124	Spring	141	O-ring
108	Cylinder block	125	Plunger K	142	O-ring
109	Friction plate	126	S/reaction less valve	143	Ring snap
110	Separation pate	127	Relief valve	144	Roller bearing
111	Push rod	128	VP plug	145	O-ring
112	Valve plate	129	Ring snap	146	Socket bolt
113	Spacer	130	Oil seal	227	Socket bolt
114	VP plug	131	Dust plug	235	Pin
115	Valve casing	132	Pin spring	236	Level gauge
116	Cylinder spring	133	Roller bearing	237	Air breather assy
117	Spacer R	134	Dust plug		

2) REDUCTION GEAR



32092RG01

201	Casing	212	Sun gear 1	223	Socket bolt
202	Pinion shaft	213	Ring gear	224	Hex bolt
203	Preload plate	214	Cover	225	Needle bearing
204	Carrier 2	215	Thrust washer	226	Inner ring
205	Planet gear 2	216	Thrust plate	228	PT plug
206	Pin	217	Thrust washer	229	Snap ring
207	Bush	218	Oil seal	230	Magnet
208	Carrier 1	219	Socket bolt	231	Flat head screw
209	Planet gear 1	220	Spherical roller bearing	232	Connector
210	Thrust washer	221	Cylindrical roller bearing	233	Hose assembly
211	Sun gear 2	222	Spring pin	234	Drain valve assembly

2. FUNCTION

1) ROTARY PART

When high pressurized oil enters a cylinder through port (a), which is the inlet of valve plate (112), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston (120) upon the retainer (105) which acts upon the shoe plate (103) via an hydrostatic bearing. Force F1 perpendicular to shoe plate (103) and force F2 perpendicular to cylinder center. Being transferred to the cylinder block (108) 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.

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

Where p : Effective difference of pressure (kgf/cm²)

q : Displacement (cc/rev)

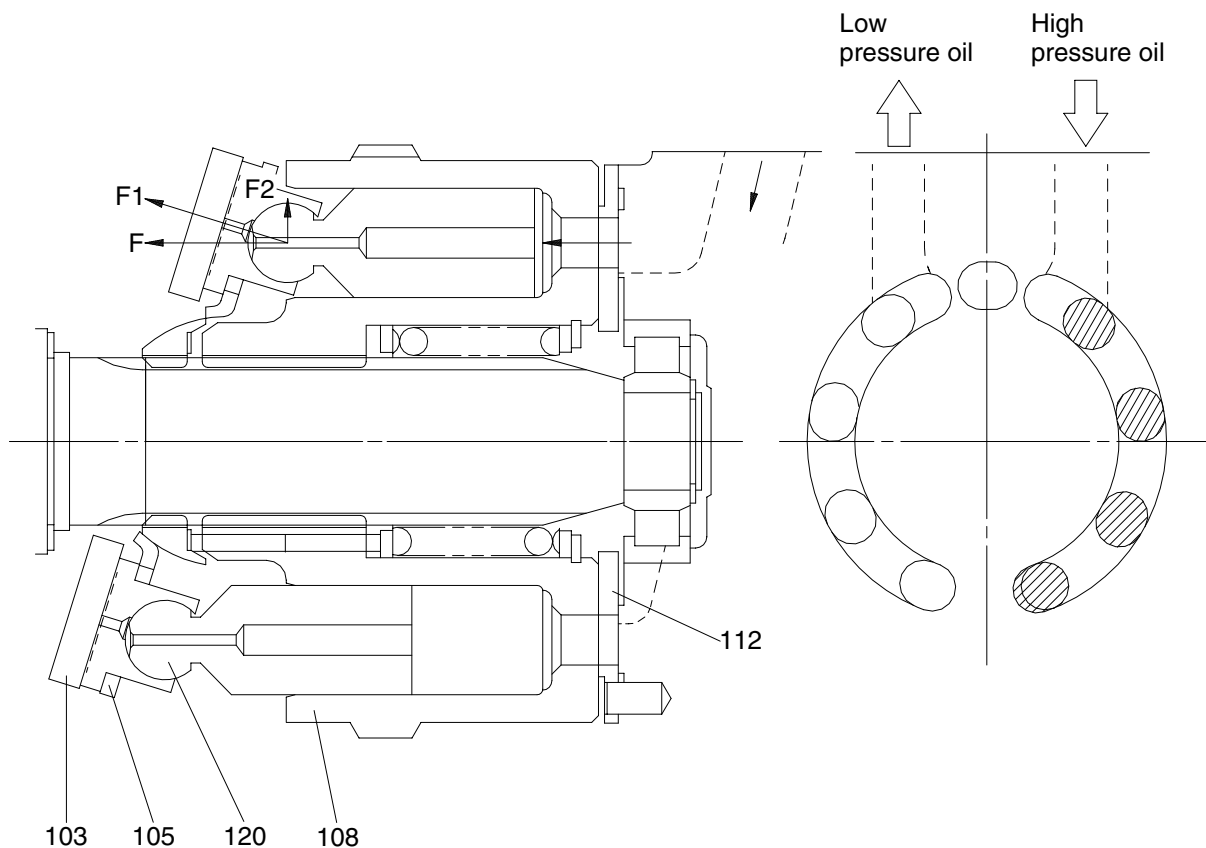
T : Output torque (kgf · cm)

Z : Piston number (9EA)

A : Piston area (cm²)

θ : Tilting angle of swash plate (degree)

S : Piston stroke (cm)



32092SM03

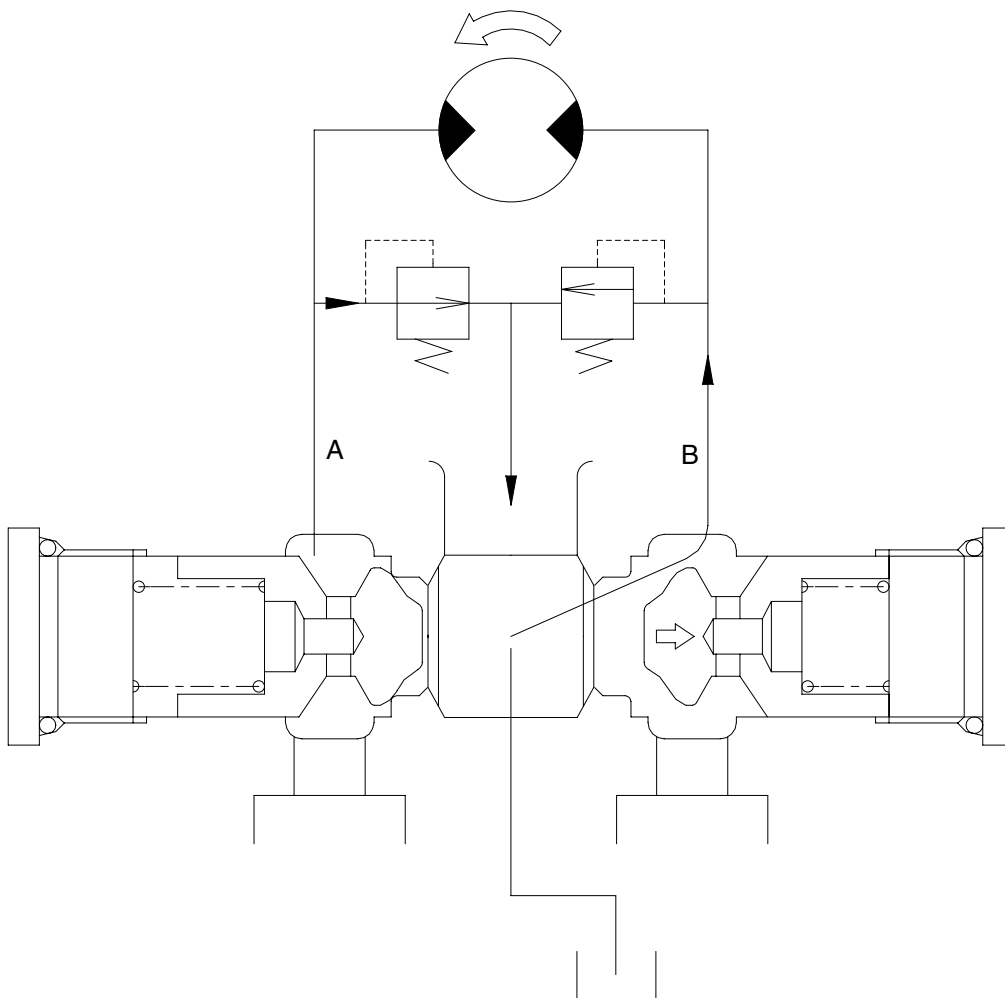
2) MAKE UP VALVE

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.

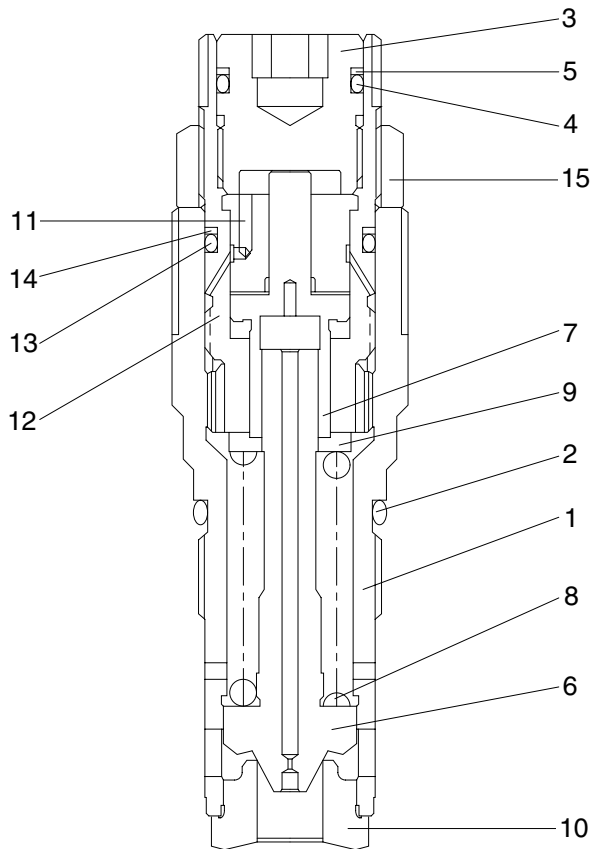
Pressurized oil into the port B, the motor rotate counterclockwise.

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.



29072SM09

3) RELIEF VALVE



- 1 Body
- 2 O-ring
- 3 Plug
- 4 O-ring
- 5 Back up ring
- 6 Plunger
- 7 Piston
- 8 Spring
- 9 Seat spring
- 10 Seat
- 11 Sleeve
- 12 Adjust plug
- 13 O-ring
- 14 Back up ring
- 15 Nut

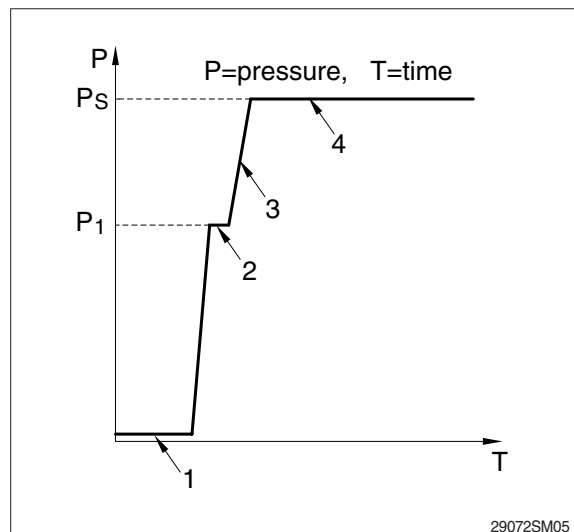
29072SM03

(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.

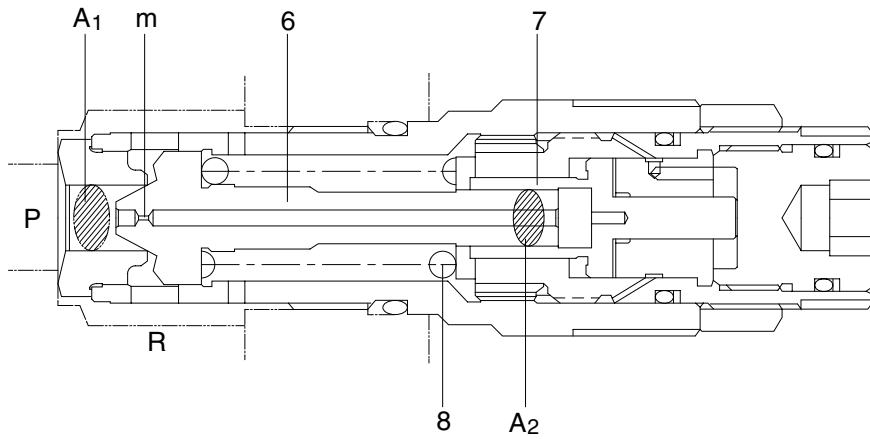
(2) Function of relief valve

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.



29072SM05

- ① Ports (P, R) at tank pressure.

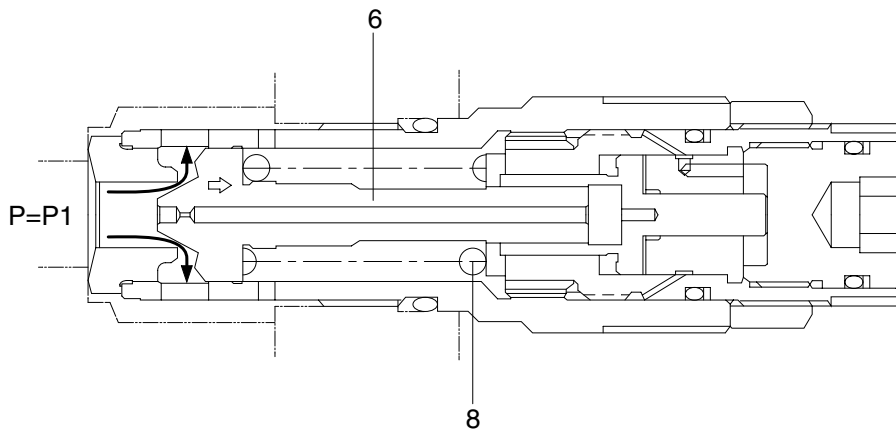


29072SM04

- ② When hydraulic oil pressure ($P \times A_1$) reaches the preset force (F_{SP}) of spring (8), the plunger (6) moves to the right as shown.

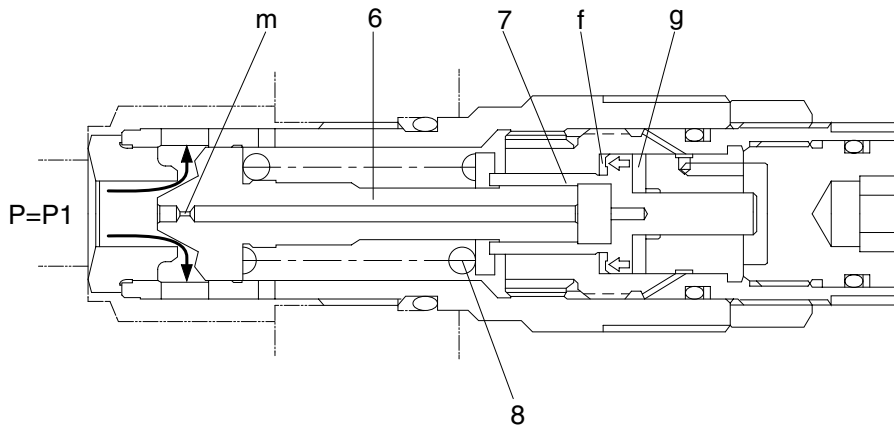
$$P_1 \times A_1 = F_{sp} + P_1 \times A_2$$

$$P_1 = \frac{F_{sp}}{A_1 - A_2}$$



29072SM06

- ③ When the pressure of chamber g reaches the preset force (F_{sp}) of spring (8), the piston (7) moves right and stop the piston (7) hits the end of body.

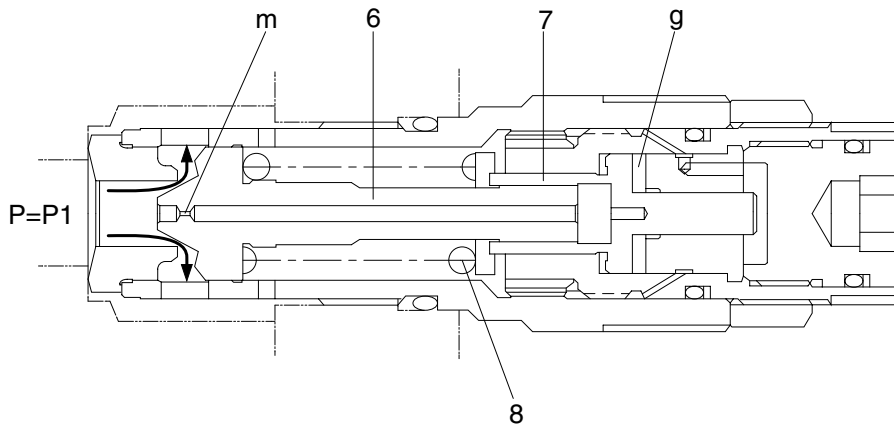


29072SM07

- ④ When piston (7) hits the end of body, it stops moving to the right any further. As the result, the pressure in chamber (g) equals (P_s).

$$P_s \times A_1 = F_{sp} + P_s \times A_3$$

$$P_s = \frac{F_{sp}}{A_1 - A_3}$$



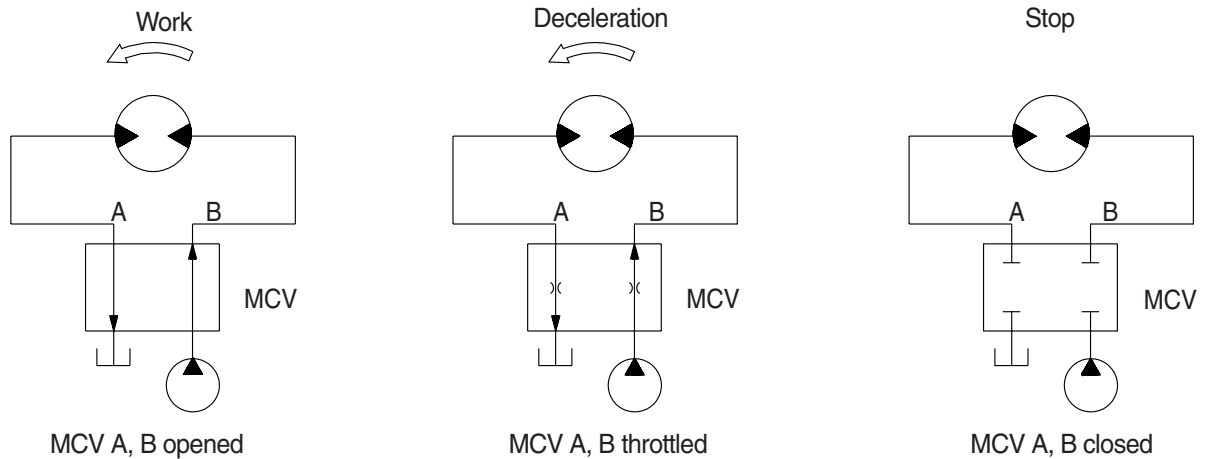
29072SM08

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.



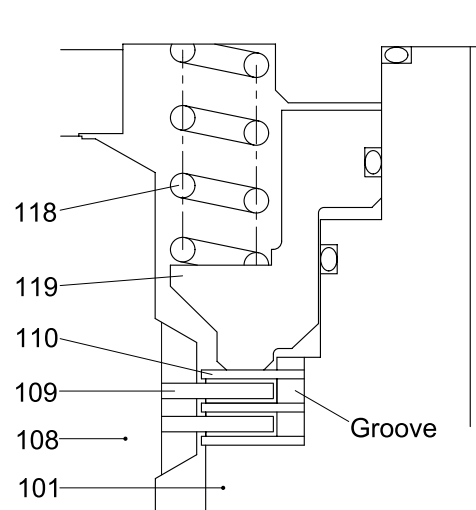
(2) Mechanical swing parking brake system

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.

① Brake assembly

Circumferential rotation of separate plate (110) is constrained by the groove located at casing (101). When housing is pressed down by brake spring (118) through friction plate (109), separate plate (110) and brake piston (119), friction force occurs there.

Cylinder block (108) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.

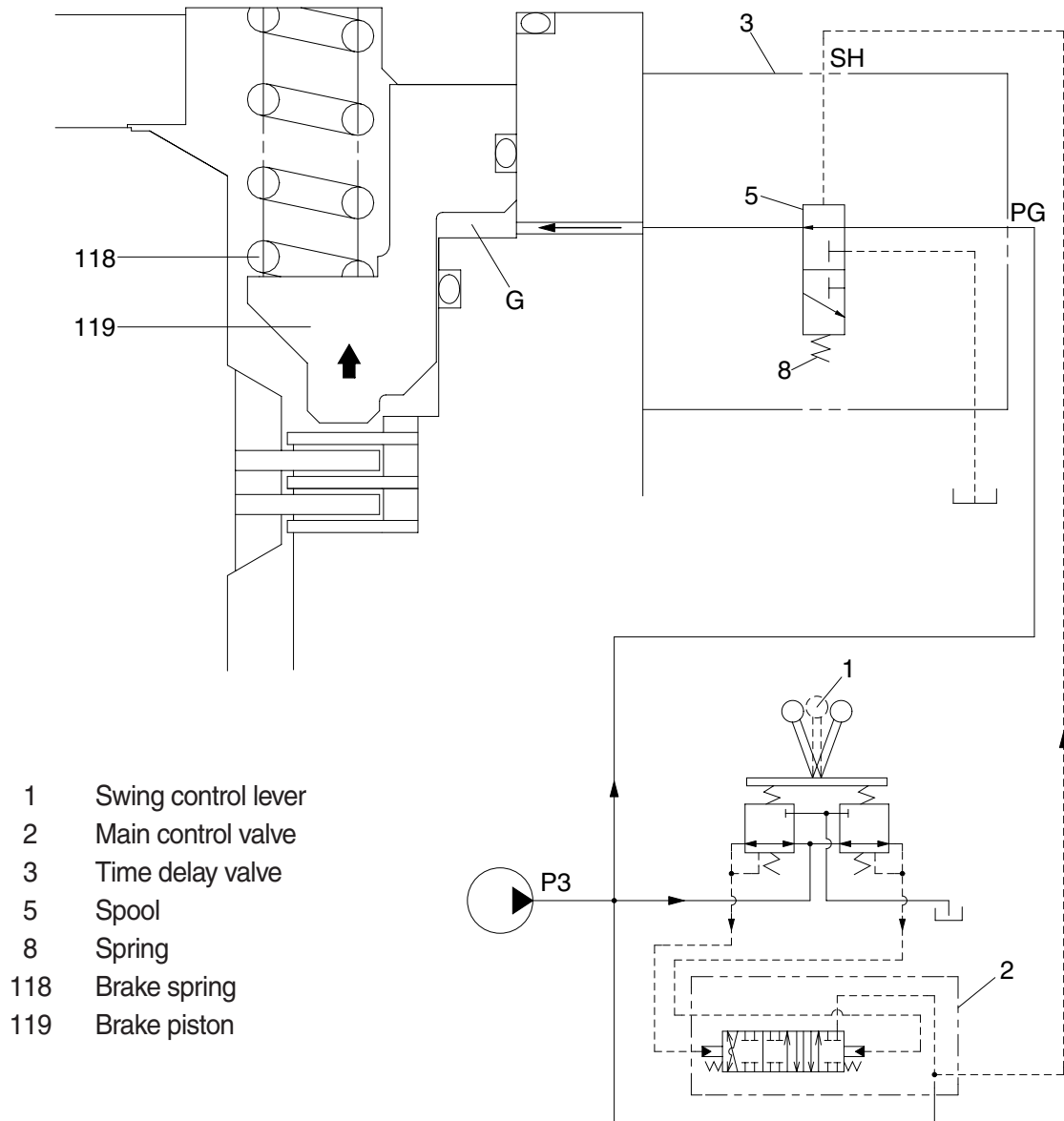


32092SM04

101	Casing	110	Separate plate
108	Cylinder block	118	Brake spring
109	Friction plate	119	Brake piston

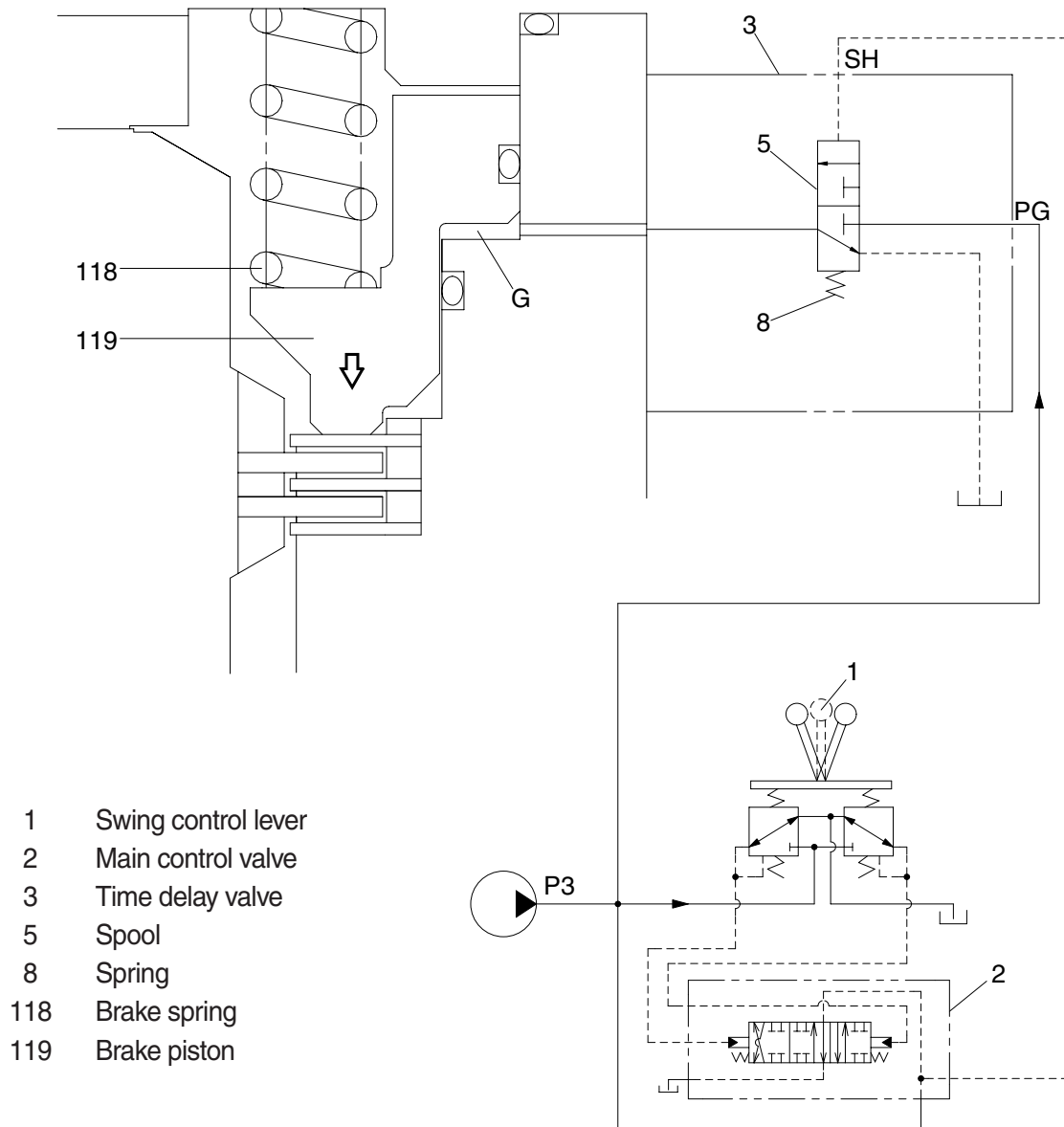
② Operating principle

- a. When the swing control lever (1) is set to the swing position, the each spool is shifted to left or right and the pilot oil flow is blocked. Then the pilot oil go to SH of the time delay valve (3). 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 (119) to the upward against the force of the spring (118). Thus, it releases the brake force.



32092SM05

- b. When the swing control lever (1) is set the neutral position, the spool (5) returns to right. Then, the piston (119) is moved lower by spring (118) force and the return oil from the chamber G flows back to tank port. At this time, the brake works.



32092SM06