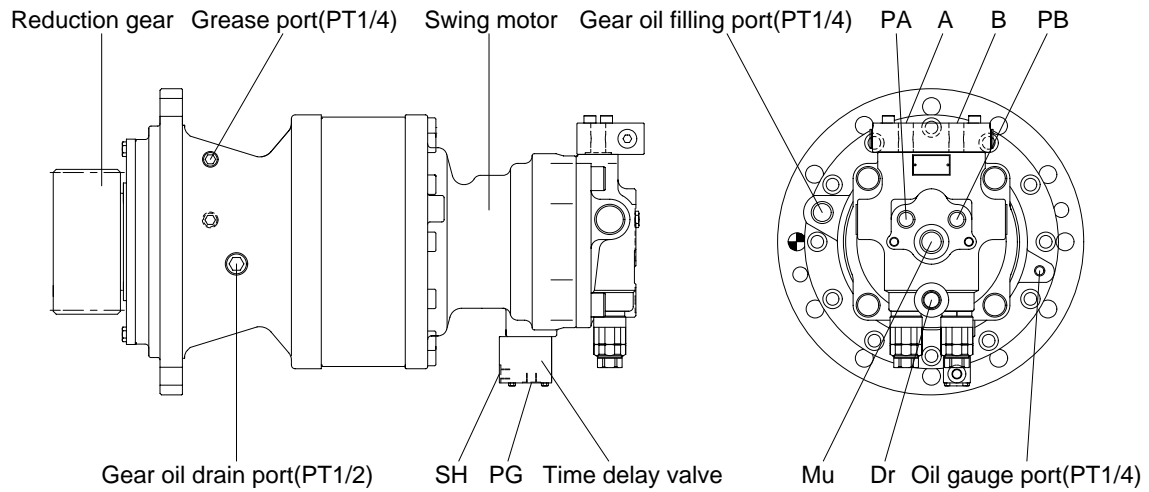


## GROUP 3 SWING DEVICE

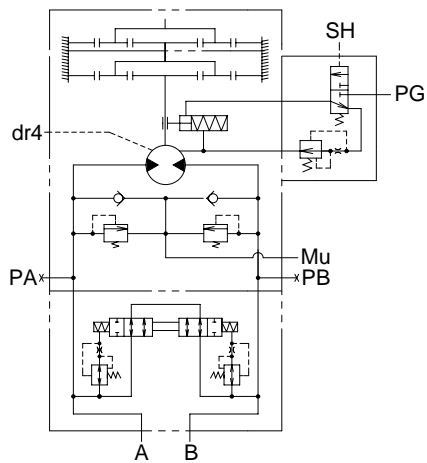
### 1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



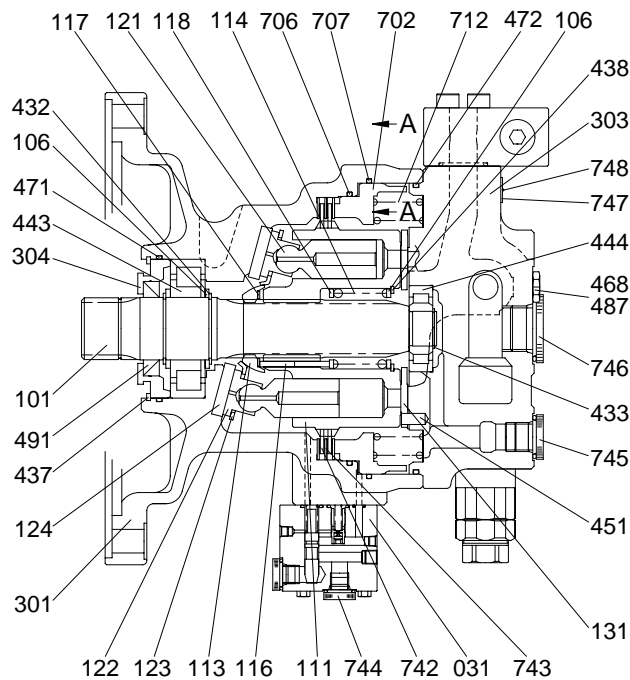
17W72SM01



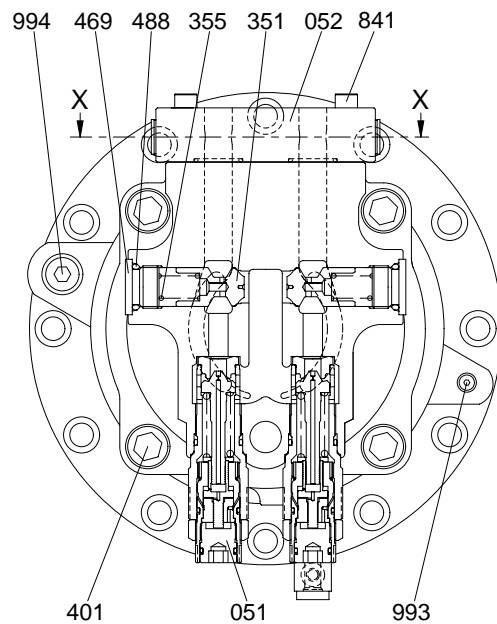
Hydraulic circuit

Port	Port name	Port size
A	Main port	SAE PF 3/4
B	Main port	SAE PF 3/4
Dr	Drain port	PF 1/2
Mu	Make up port	PF 1
PG	Brake release port	PF 1/4
SH	Brake pilot port	PF 1/4
PA,PB	Gage port	PF 1/4

## 1) SWING MOTOR



SECTION A-A

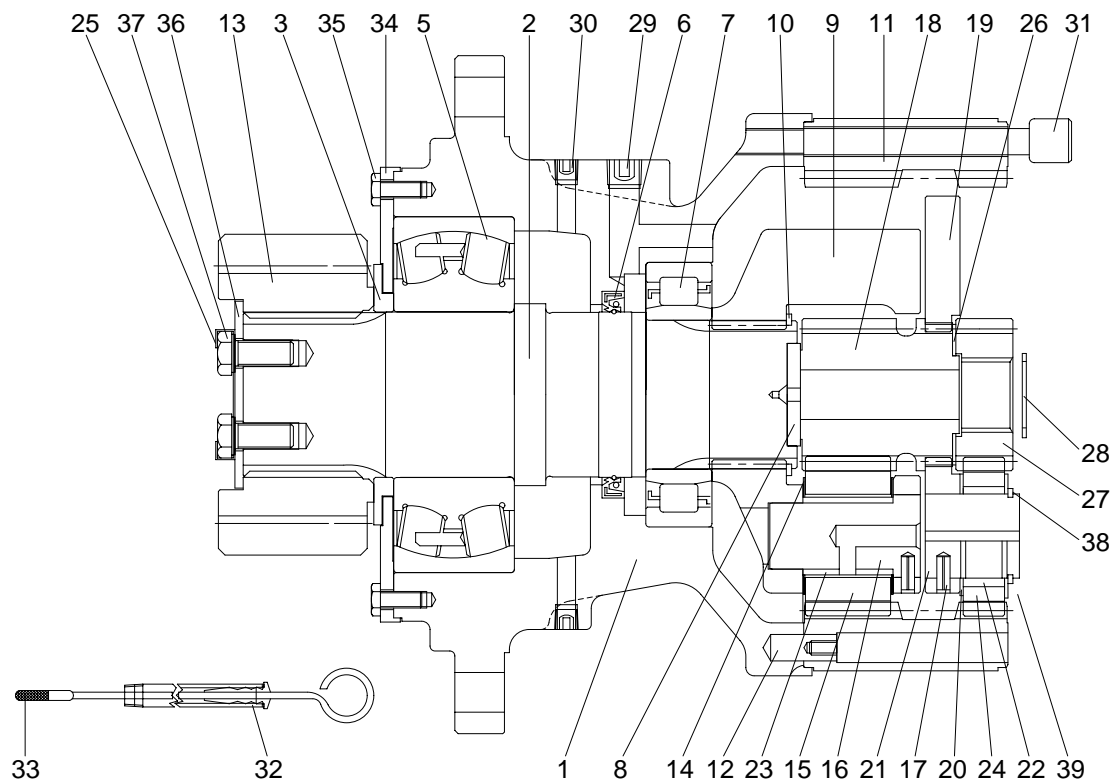


SECTION X-X

17W72SM02

031 Brake valve	123 Retainer	464 Plug
051 Relief valve	124 Shoe plate	468 Plug
052 Reactionless valve assy	131 Valve plate	469 Plug
053 Valve	151 Plug	471 O-ring
054 Block	161 O-ring	472 O-ring
055 Plug	162 O-ring	485 O-ring
056 Back up ring	163 O-ring	487 O-ring
057 O-ring	171 Hexagon screw	488 O-ring
058 Plug	301 Casing	491 Oil seal
059 O-ring	303 Casing	702 Piston
060 O-ring	304 Front cover	706 O-ring
101 Drive shaft	351 Plunger	707 O-ring
106 Spacer	355 Spring	712 Brake spring
111 Cylinder block	401 Hexagon socket bolt	742 Friction plate
113 Bushing	432 Snap ring	743 Separate plate
114 Spring	433 Snap ring	744 Plug
116 Push rod	437 Snap ring	745 Plug
117 Spacer	438 Snap ring	746 Plug
118 Spacer	443 Roller bearing	841 Hexagon socket bolt
121 Piston	444 Roller bearing	993 Plug
122 Shoe	451 Spring pin	994 Plug

## 2) REDUCTION GEAR



17W72SM03

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 plate	21	Pin 1	34	Cover plate
9	Carrier 2	22	Needle cage	35	Hexagon bolt
10	Stop ring	23	Bush 2	36	Lock plate
11	Ring gear	24	Planet gear 1	37	Hexagon bolt
12	Knock pin	25	Lock washer	38	Stop ring
13	Pinion gear	26	Side plate 3	39	Side plate 2
14	Thrust washer	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(131), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(121) upon the return plate(123) which acts upon the swash plate(124) via an hydrostatic bearing. Force F1 perpendicular to swash plate(124) and force F2 perpendicular to cylinder center. Being transferred to the cylinder block(111) 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.

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

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

q : Displacement(cc/rev)

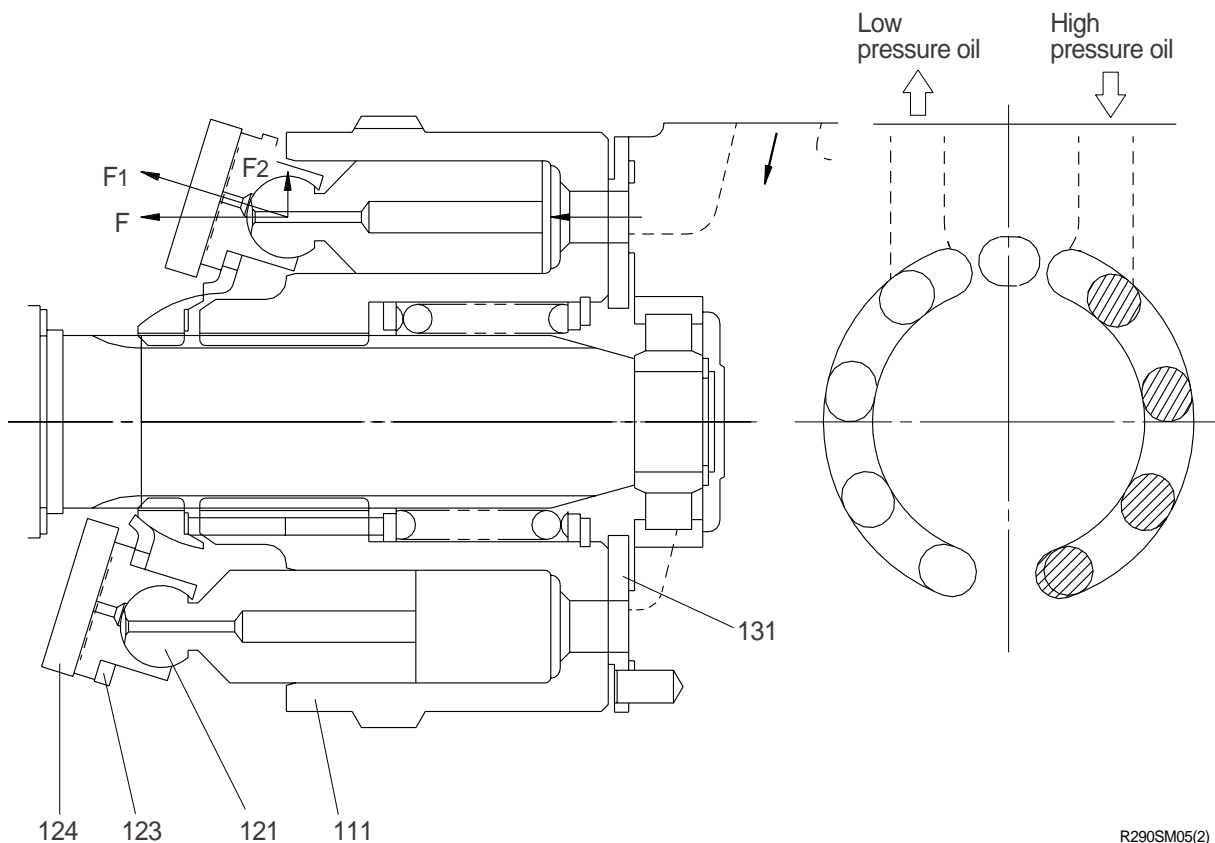
T : Output torque(kgf · cm)

Z : Piston number(9EA)

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

: Tilting angle of swash plate(degree)

S : Piston stroke(cm)



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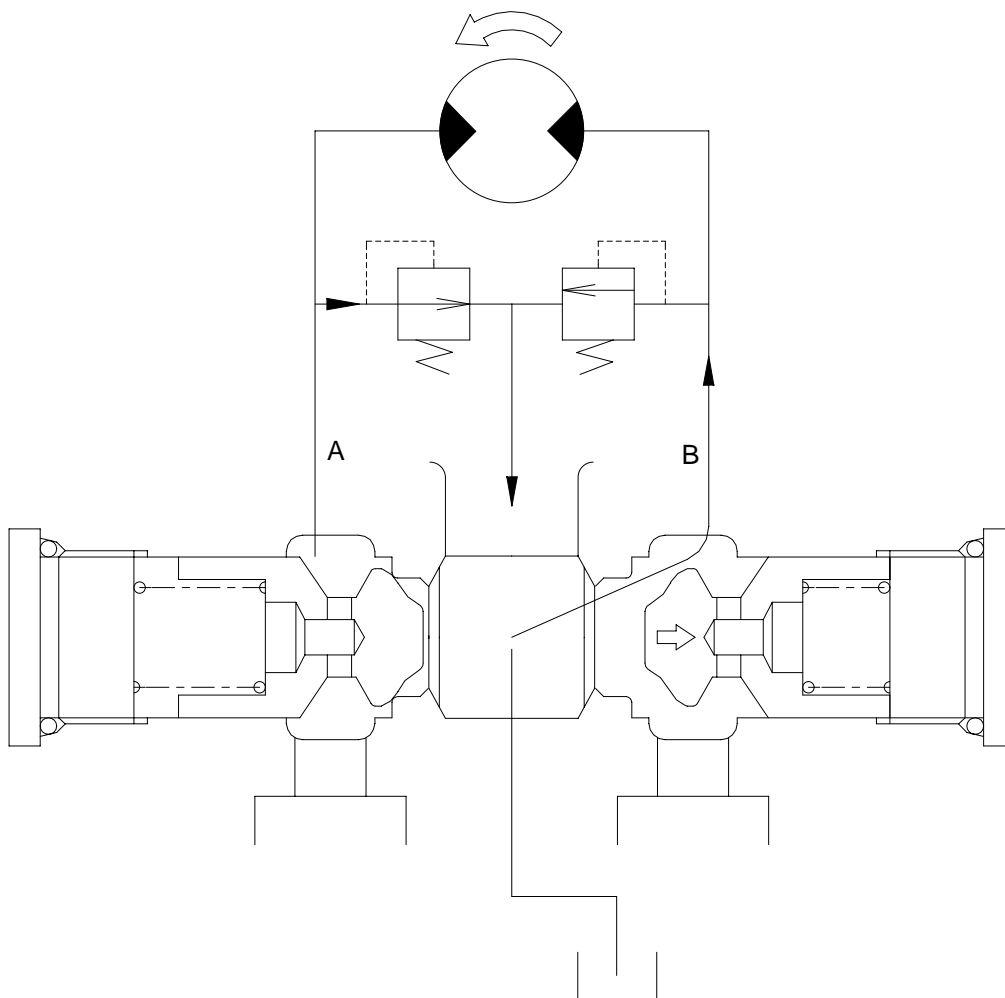
## 2) MAKE UP VALVE

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.

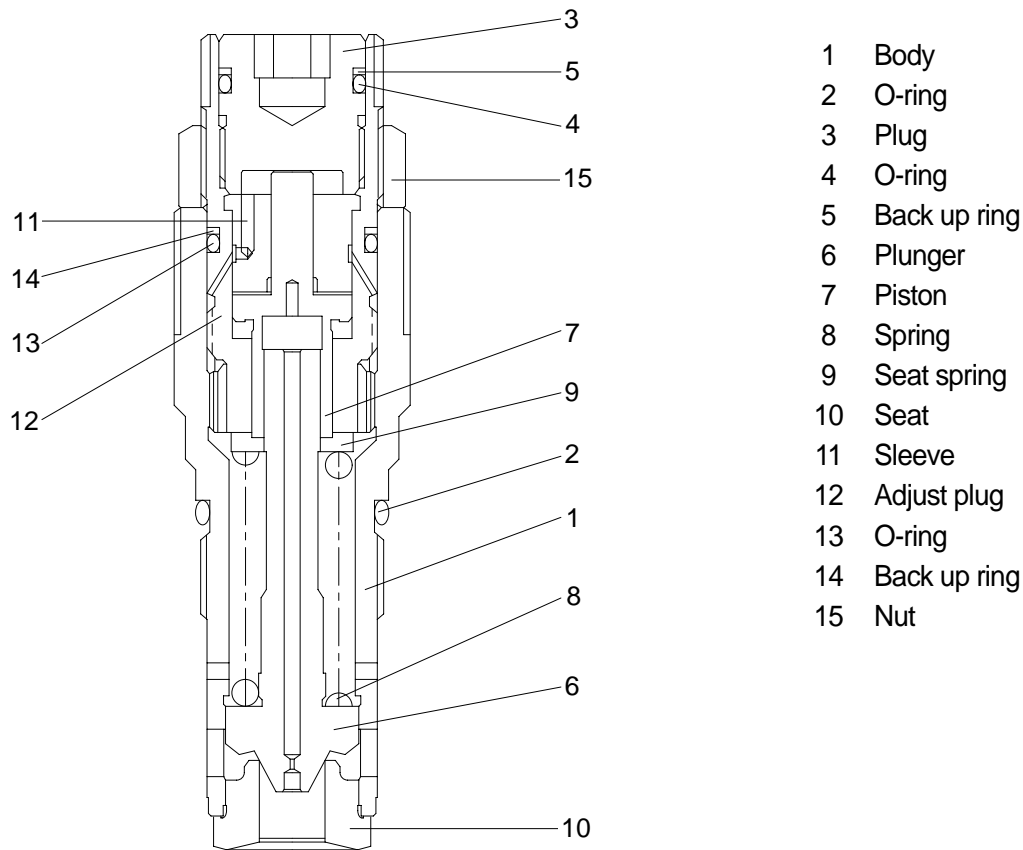
Pressurized oil into the port B, the motor rotate counterclockwise.

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



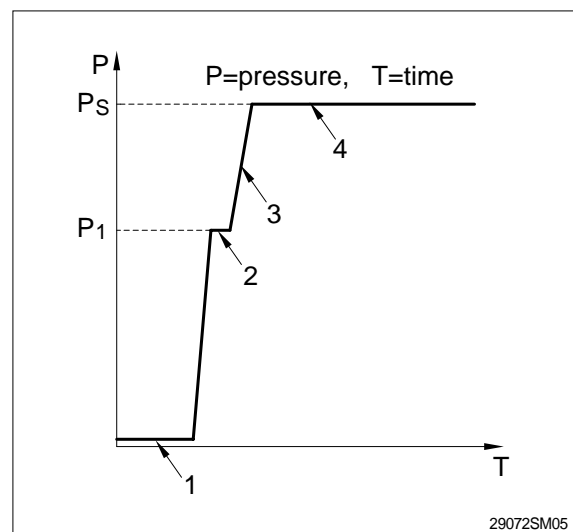
29072SM03

#### (1) Construction of relief valve

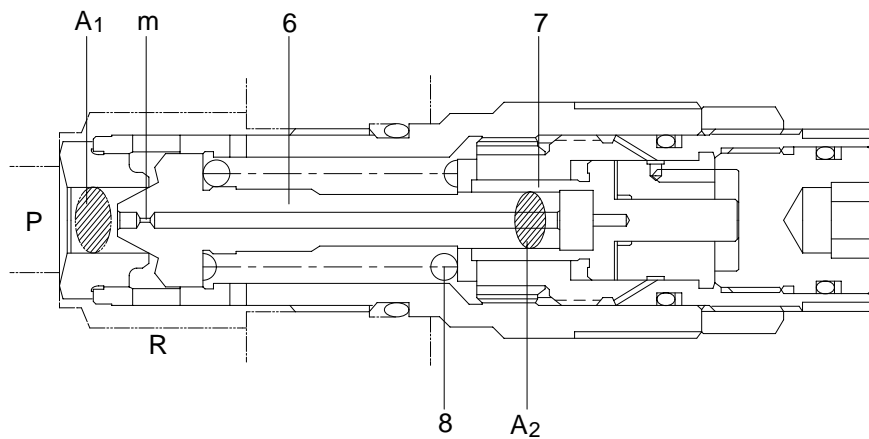
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

#### (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.



Ports (P,R) at tank pressure.

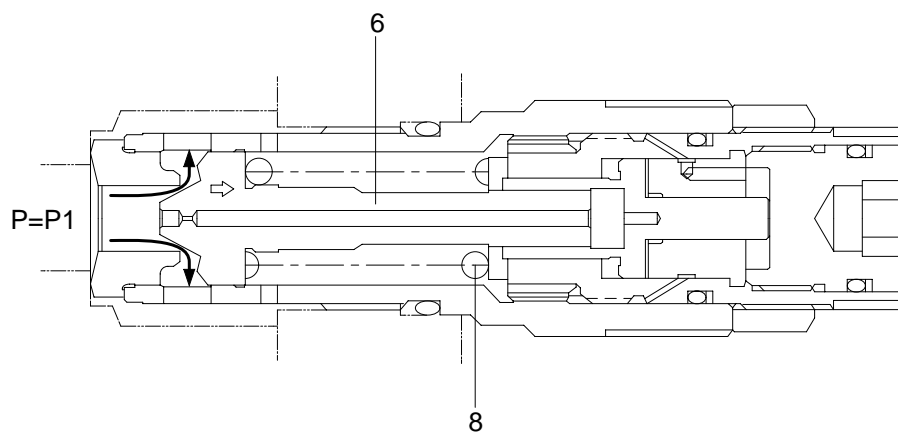


29072SM04

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.

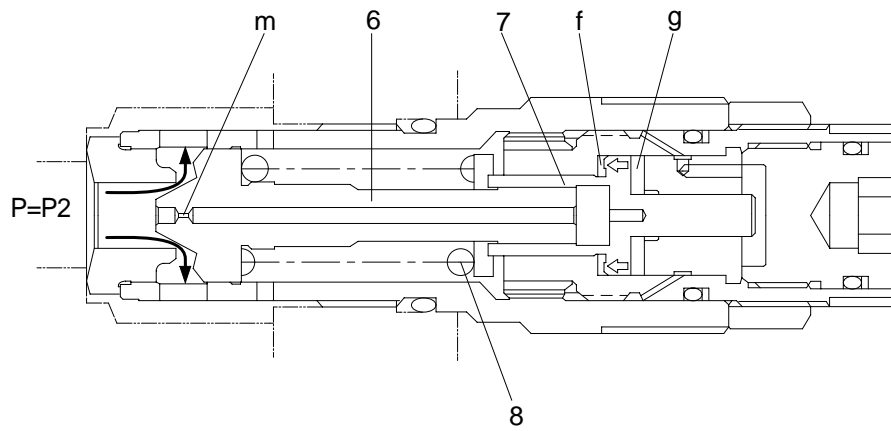
$$P_1 \times A_1 = F_{sp} + P_1 \times A_2$$

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



29072SM06

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.

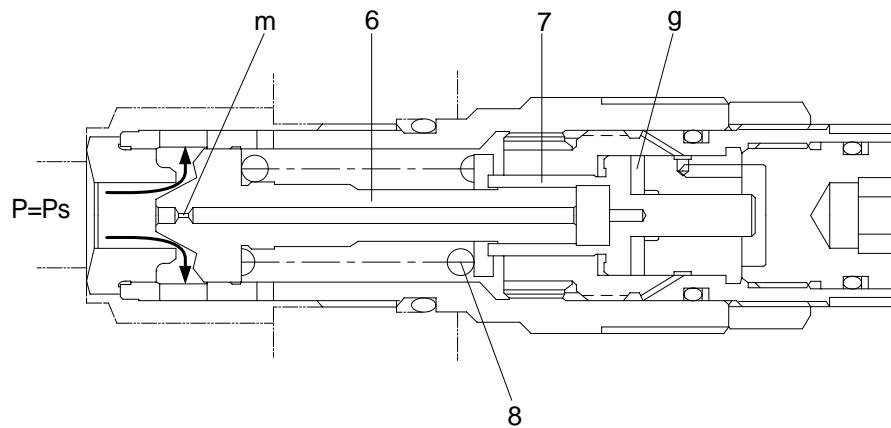


29072SM07

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( $P_s$ ).

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

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



29072SM08

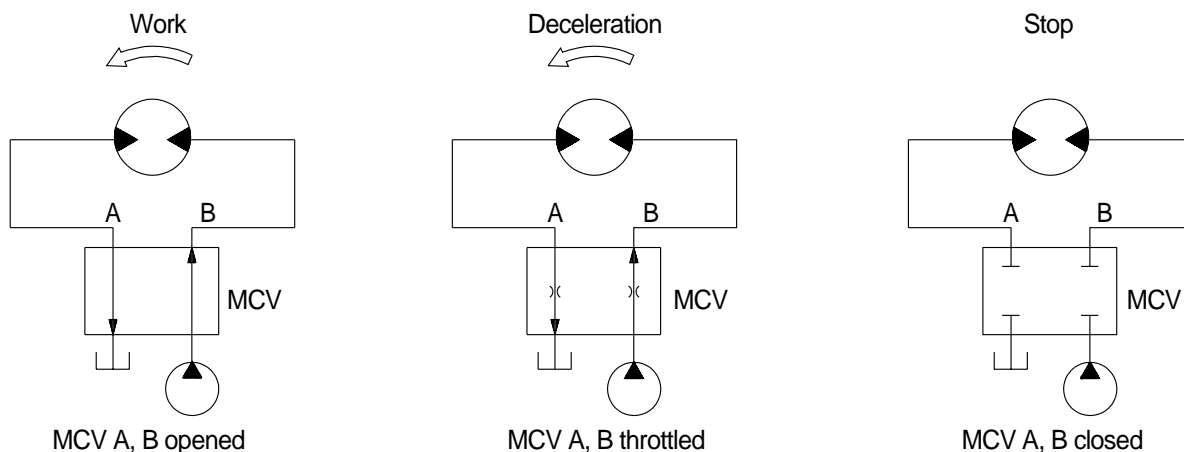


## 4) BRAKE SYSTEM

### (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.



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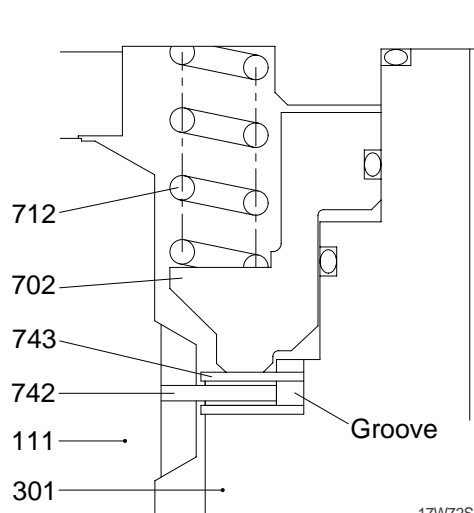
### (2) Mechanical swing parking brake system

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(743) is constrained by the groove located at casing(301). When housing is pressed down by brake spring(712) through friction plate(742), separate plate(743) and brake piston(702), friction force occurs there.

Cylinder(111) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



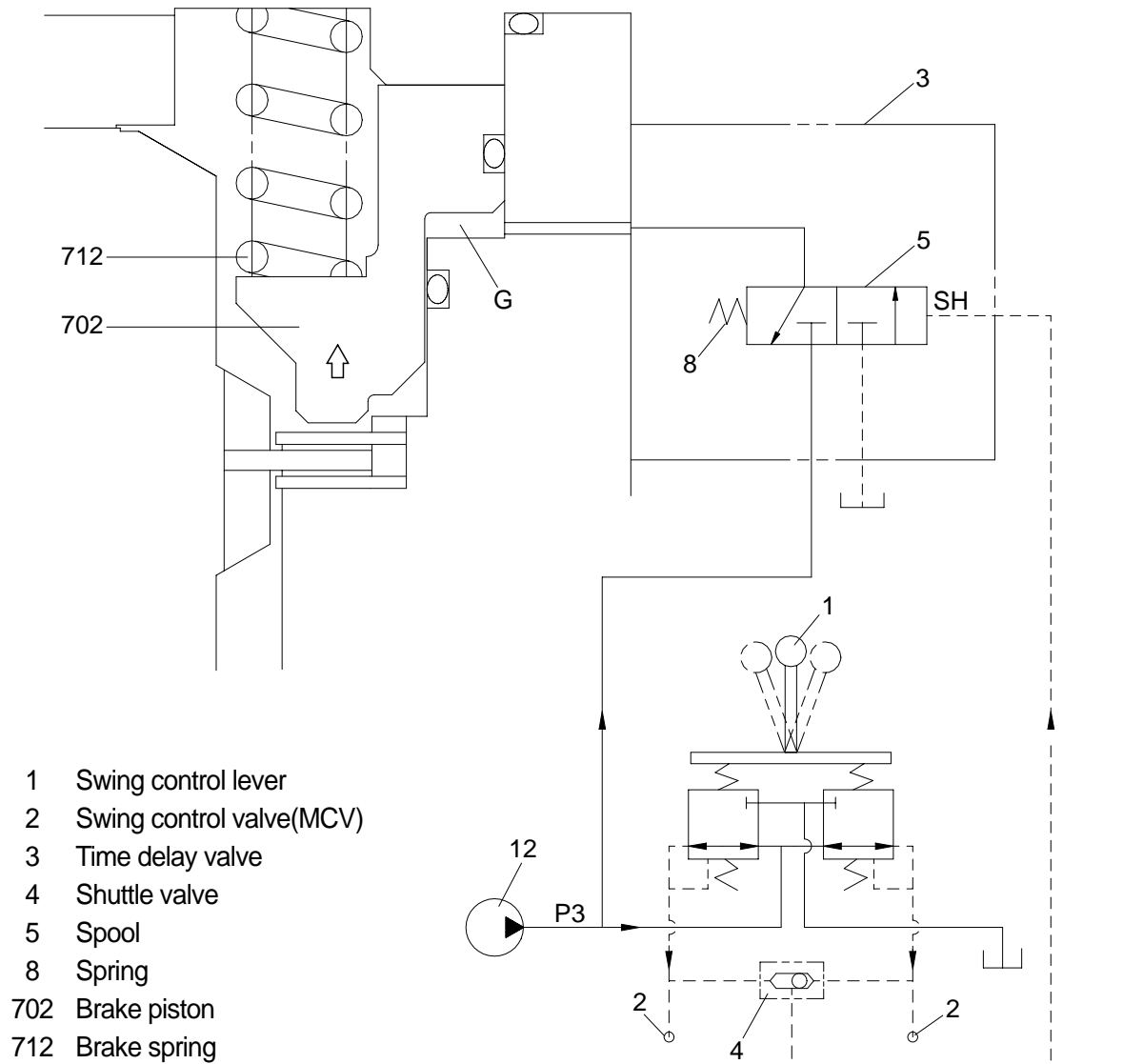
17W72SM04

111	Cylinder	712	Brake spring
301	Casing	742	Friction plate
702	Brake piston	743	Separate plate

### 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(702) to the upward against the force of the spring(712). Thus, it releases the brake force.



17W72SM05

- b. When the swing control lever(1) is set the neutral position, the time delay valve(3) shifts the neutral position and the pilot oil blocked chamber G.
- Then, the piston(702) is moved lower by spring(712) force and the return oil from the chamber G is drain.

