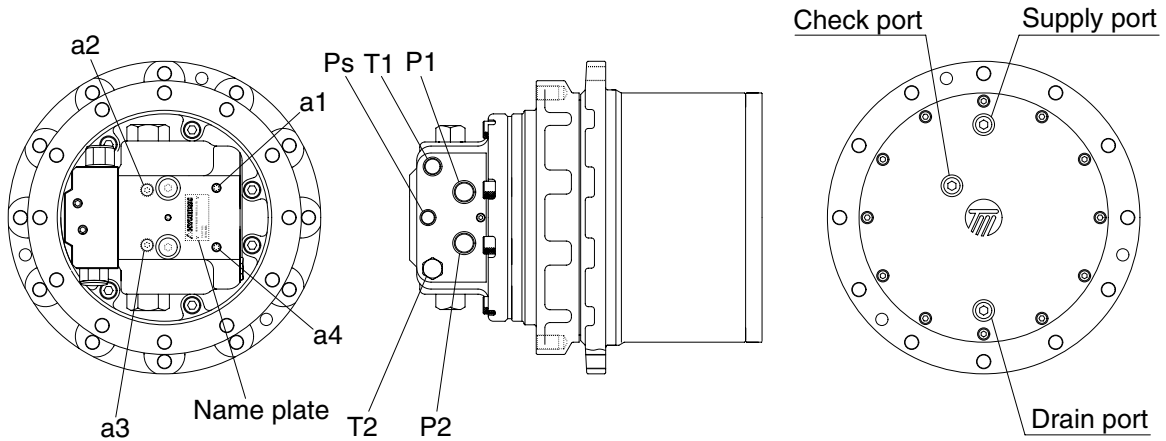


# GROUP 4 TRAVEL DEVICE

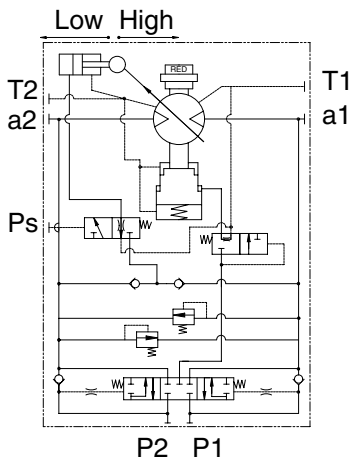
## 1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



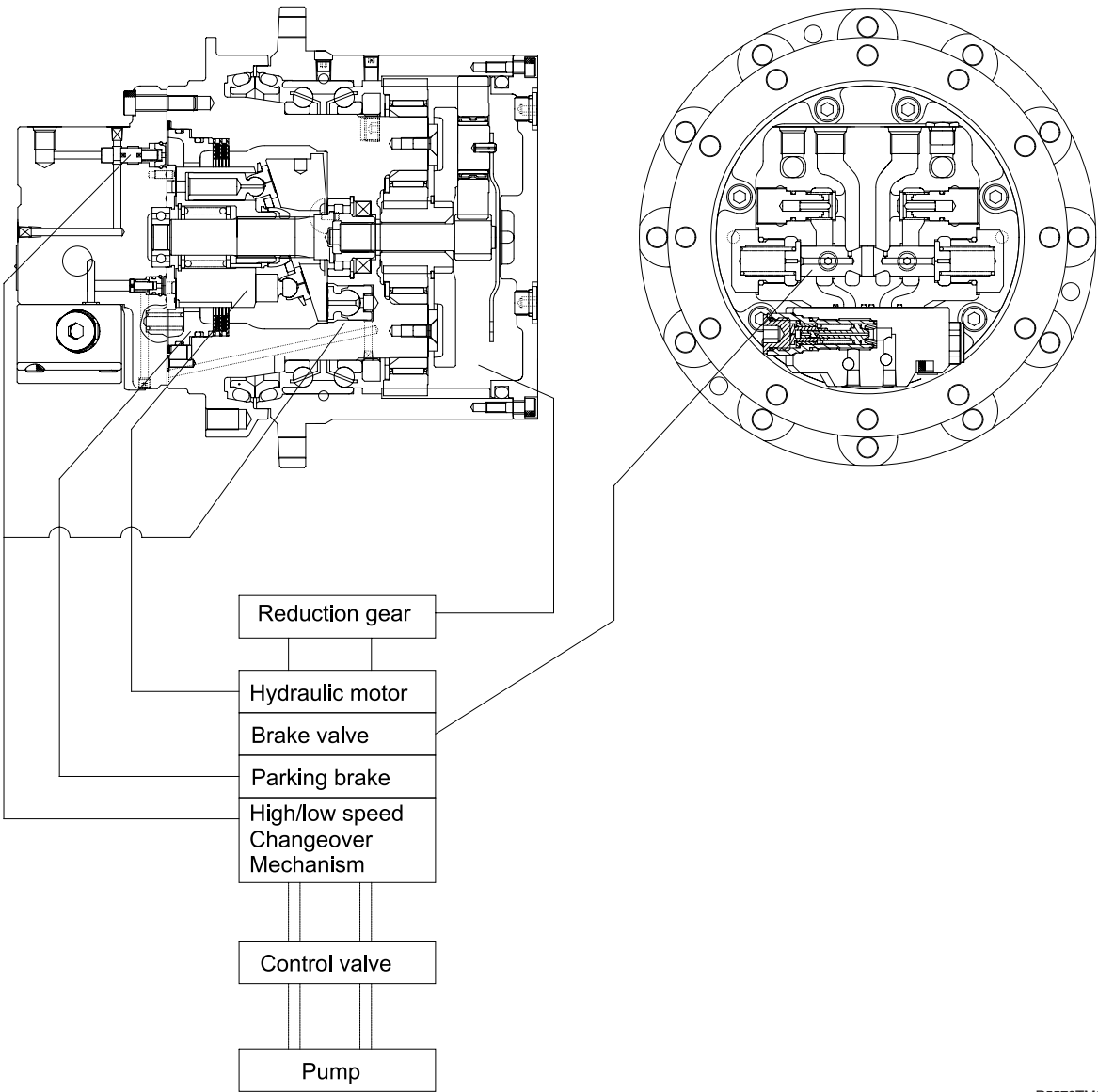
R5572SF50



Port	Port name	Port size
P1	Main port	PF 1/2
P2	Main port	PF 1/2
a1,a2	Gauge port	PT 1/4
a3,a4	Gauge port	PT 1/8
T1,T2	Drain port	PF 3/8
Ps	2 speed control port	PF 1/4

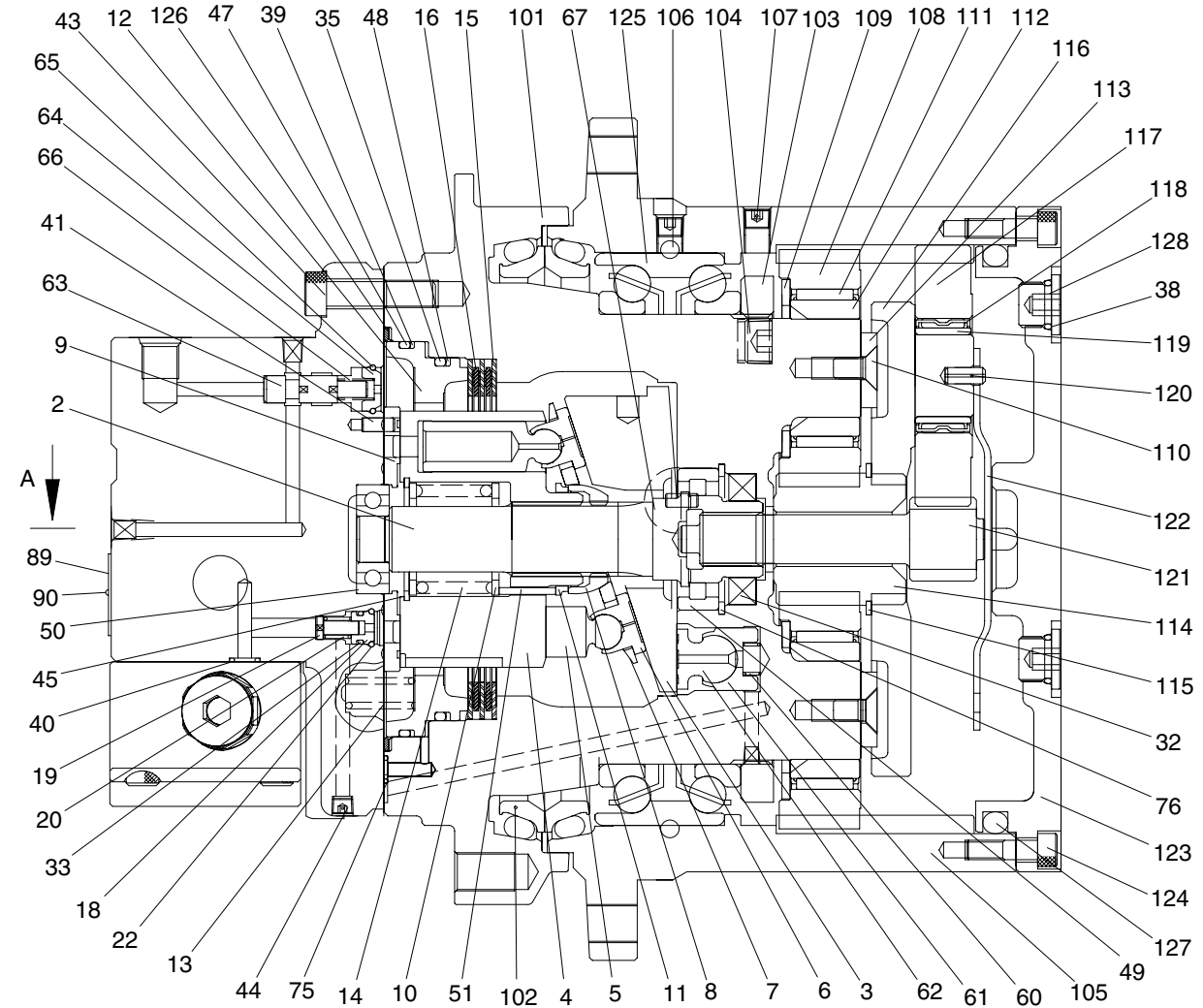
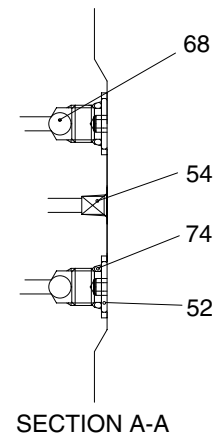
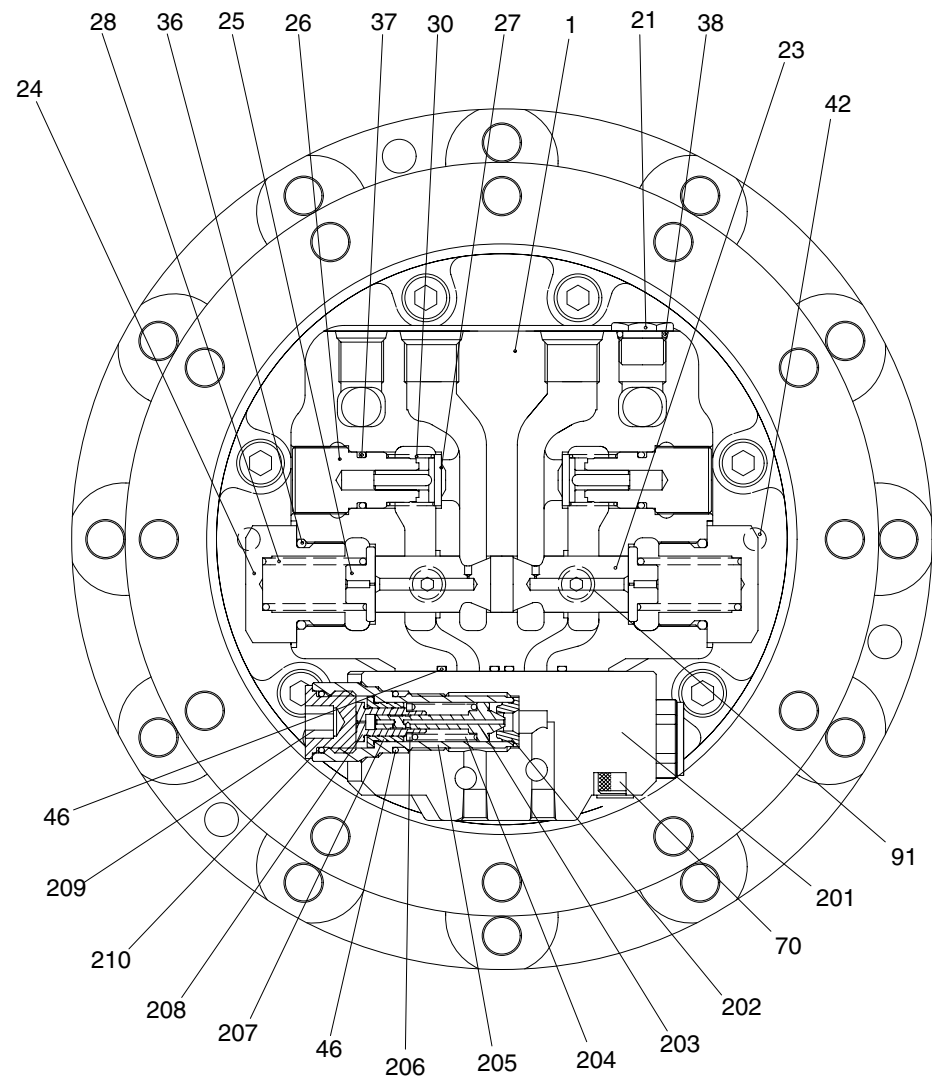
R5572SF51

1) BASIC STRUCTURE



R5572TM04

## 2) STRUCTURE

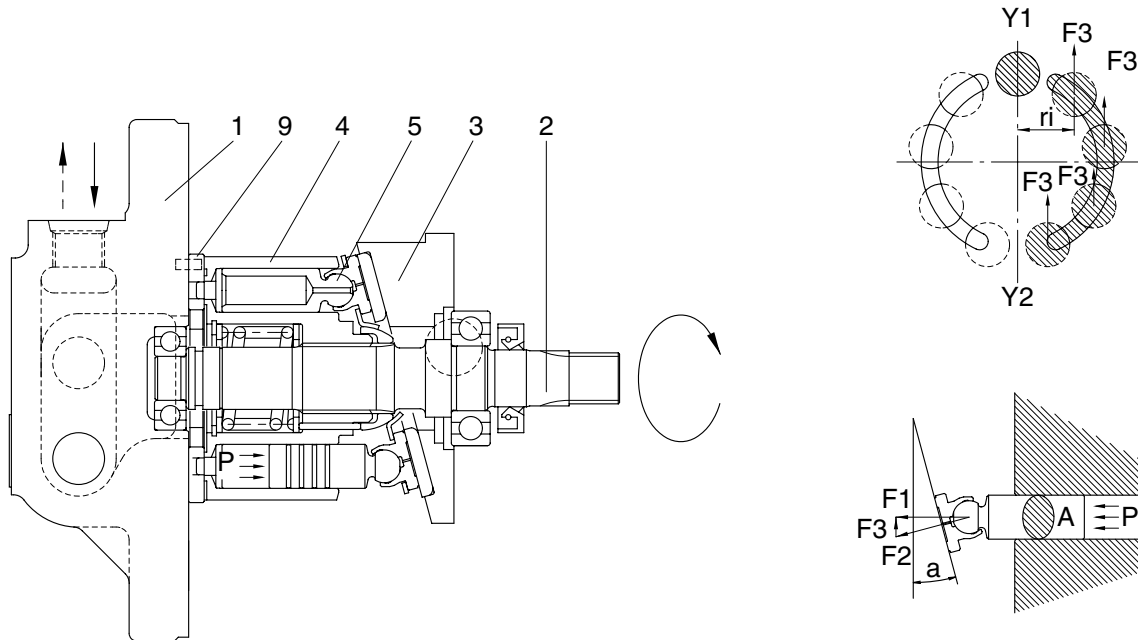


1 Rear flange	19 Valve	39 O-ring	62 Shoe	104 PT plug	121 Drive gear
2 Main shaft	20 Spring	40 O-ring	63 Valve	105 Housing	122 Thrust plate(R)
3 Swash plate	21 VP plug	41 Parallel pin	64 Stopper	106 Steel ball	123 Cover
4 Cylinder block	22 Ring	42 Parallel pin	65 Ring	107 PT plug	124 Socket bolt
5 Piston	23 Main spool	43 Socket bolt	66 Spring	108 Planetary gear(F)	125 Angular bearing
6 Shoe	24 Plug	44 PT plug	67 Pivot	109 Thrust washer	126 O-ring
7 Retainer plate	25 Spring retainer	45 Snap ring	68 Steel ball	110 Screw	127 O-ring
8 Thrust ball	26 Plug	46 O-ring	70 Socket bolt	111 Needle bearing	201 Valve block
9 Timing plate	27 Valve	47 Back up ring	74 O-ring	112 Collar	202 Seat
10 Washer	28 Spring	48 Back up ring	75 O-ring	113 Thrust plate(F)	203 Plunger
11 Collar washer	30 Spring	49 Roller bearing	76 Snap ring	114 Sun gear	204 Spring
12 Parking piston	32 Oil seal	50 Ball bearing	89 Name plate	115 Snap ring	205 Body
13 Spring	33 O-ring	51 Roller	90 Rivet screw	116 Holder	206 Shim
14 Spring	35 O-ring	52 RO plug	91 PT plug	117 Planetary gear(R)	207 Piston
15 Friction plate	36 O-ring	54 NPTF plug	101 Holder flange	118 Needle bearing	208 Rod
16 Mating plate	37 O-ring	60 Spring	102 Floating seal	119 Inner race	209 Plug
18 Valve seat	38 O-ring	61 Piston	103 Nut ring	120 Spring pin	210 Backup ring

R5572TM10

# 1. FUNCTION

## 1) HYDRAULIC MOTOR



R5572TM11

The pressurized oil delivered from the hydraulic pump flows to rear flange(1) of the motor, passes through the brake valve mechanism, and is introduced into cylinder block(4) via timing plate(9). This oil constructively introduced only to one side of (Y1)-(Y2) connecting the upper and lower dead points of stroke of piston(5). The pressurized oil fed to one side in cylinder block(4) pushes each piston(5)(four or five) and generates a force  $F(\text{kgf}) = P(\text{kgf/cm}^2) \times A(\text{cm}^2)$ .

This force acts on swash plate(3), and is resolves into components(F2 and F3) because swash plate(3) is fixed at an angle  $\alpha$  with the axis of drive shaft(2).

Radial component(F3) generates respective torques ( $T = F3 \times ri$ ) for (T1)-(Y2). This residual of torque ( $T = S(F3 \times ri)$ ) rotates cylinder block(4) via piston(5). Cylinder block(4) is spline coupled with drive shaft(2).

So the drive shaft(2) rotates and the torque is transmitted.

## 2) BRAKE VALVE

### (1) Brake released(starting/running)

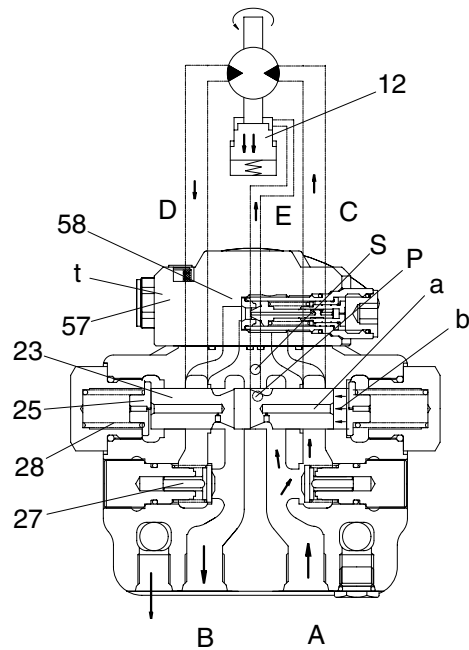
When the pressurized oil supplied from port (A) the oil opens valve(27) and flows into port (C) at the suction side of hydraulic motor to rotate motor.

At the same time, the pressurized oil passes through pipe line (a) from a small hole in spool(23) and flow into chamber (b).

The oil acts on the end face of spool(23) which is put in neutral position by the force of spring(28), thus causing spool(23) to slide to the left. When spool(23) slides, port (D) on the passage at the return side of hydraulic motor, which is closed by the spool groove during stoppage, communicates with port (B) at the tank side and the return oil from the hydraulic motor runs into the tank. In consequence, the hydraulic motor rotates. Moreover, sliding of spool(23) causes the pressurized oil to flow into ports (P) and (S).

The pressurized oil admitted into port (P) activates piston(12) of the parking brake to release the parking brake force (For details, refer to description of the parking brake).

On the other hand, the pressurized oil introduced into port (S) flows into chamber (t) and presses stopper(57) against the inside of body(55) to prevent spool(58) from moving, thus disabling communication at port (C) side of the hydraulic motor (Suction side and return side of hydraulic motor). When the pressurized oil is supplied from port (B) spool(23) and valve(27) move reversely and the hydraulic motor also rotates reversely.



R5572TM13

## (2) Brake applied(stopping/stalling)

When the pressurized oil supplied from port (A) is stopped during traveling, no hydraulic pressure is applied and spool(23) which has slid to the left will return on the right(neutral) via spring retainer(25) by the force of spring(28).

The oil in chamber (b) will flow to port (A) side through pipe line (a) in spool(23).

However, a back pressure produced by the restricting effect of pipe line (a) whereby the return speed of spool(23) is controlled.

At the same time, the hydraulic motor will rotate by the force of inertia even if the pressurized oil is stopped.

Accordingly, the return oil will return to port (B) side from port (D) through a passage between the groove in spool(23) and rear flange(1). When spool(23) completely returns to neutral, the above-mentioned passage is fully closed and the hydraulic motor stops.

As explained above, the hydraulic motor is smoothly braked and stopped by gradually controlling the return oil from the hydraulic motor by the return speed of spool(23), its shape, etc.

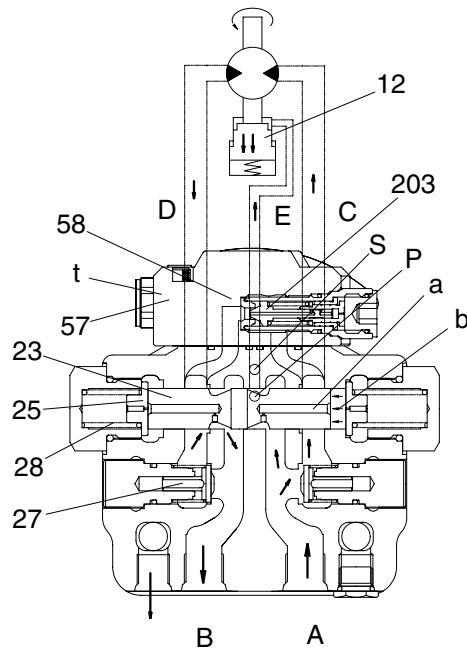
However, the hydraulic motor will rotate by the force of inertia. This means that the hydraulic motor will suck oil functioning as a pump.

However, no oil is supplied because the pressurized oil is stopped. In consequence, cavitation occurs on the hydraulic motor, thus adversely affecting it.

At the same time, the passage closed by spool(23), whereby the return oil from the hydraulic motor is enclosed at port (D) side and the pressure is increased.

This pressure slides plunger(203) to the left to short-circuit port (D) and (C) which prevents pressure rise and cavitation (surge cut valve function and anti-cavitation valve function).

Valve(27) is activated by a slight negative pressure to open the oil passage between the oil line at port (A) side and port (C) at the suction side of motor, thus preventing cavitation of the hydraulic motor.



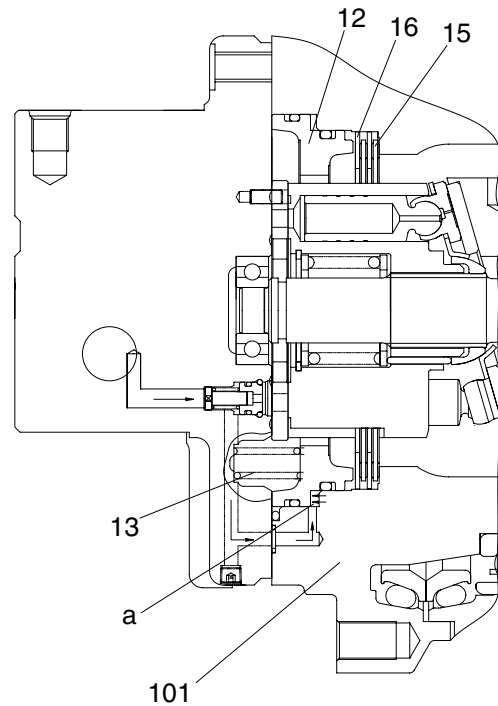
R5572TM12

### 3) PARKING BRAKE

#### (1) Running

When the pressurized oil is supplied from the valve, the spool of brake valve in the hydraulic motor assembly actuates to open the passage to the parking brake and the pressurized oil is introduced into cylinder chamber (a) which is composed of the spindle of reduction gear assembly and piston(12).

When the hydraulic pressure reaches  $9\text{kgf/cm}^2(0.88\text{Mpa})$  or more, it overcomes the force of spring(13) and shifts piston(12) with shift of piston(12) no pressing force is applied to mating plate(16) and friction plate(15) and the movement of friction plate(15) becomes free, whereby the brake force to the cylinder in the hydraulic motor assembly is released.



R5572TM14

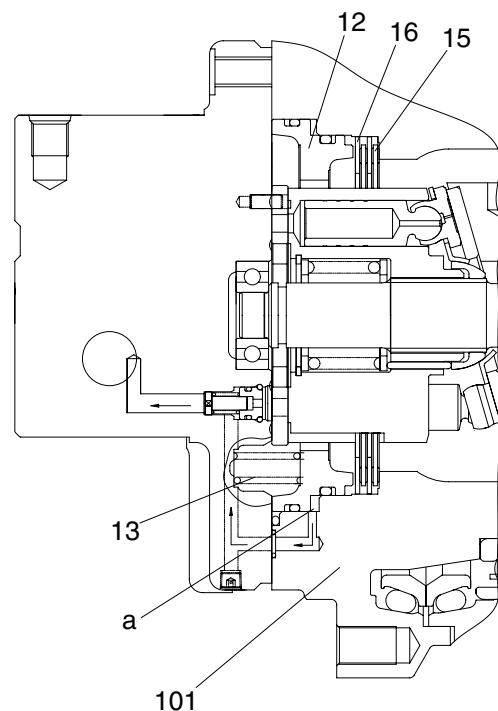
#### (2) Stopping

When the pressurized oil from the brake valve is shut off and the pressure in cylinder chamber (a) drops  $9\text{kgf/cm}^2(0.88\text{Mpa})$  or less, piston(12) will return by the force of spring(13).

Piston(12) is pushed by this force of spring(13), and mating plate(16) and friction plate(15) in free condition are pressed against the holder flange of reduction gear assembly.

The friction force produced by this pressing stops rotation of the cylinder and gives a braking torque( $8.4\text{kgf} \cdot \text{m}(60.8 \text{ N} \cdot \text{m})$ ) to the hydraulic motor shaft.

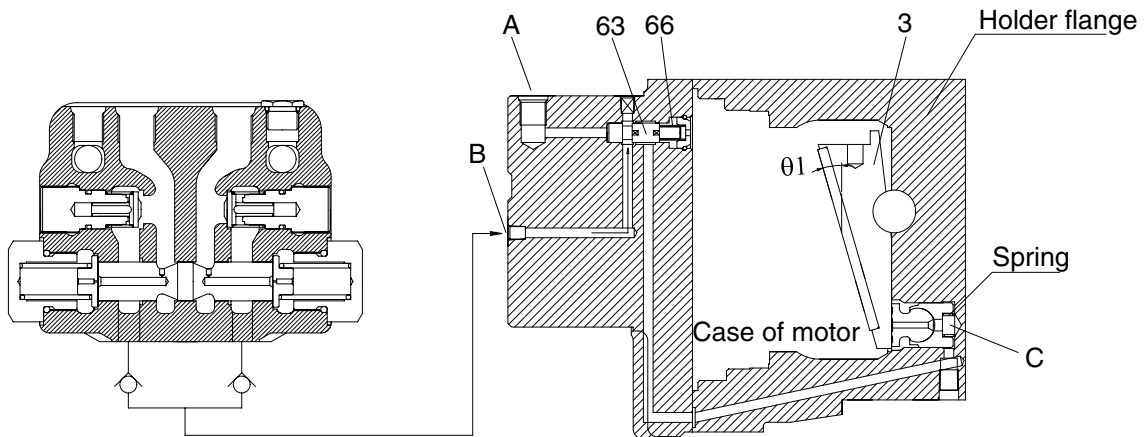
Note that oil control through a proper oil passage ensures smooth operation.



R5572TM15

#### 4) HIGH/LOW SPEED CHANGEOVER MECHANISM

(1) At low speed-at pilot pressure of less than  $10\text{kgf/cm}^2(0.98\text{Mpa})$

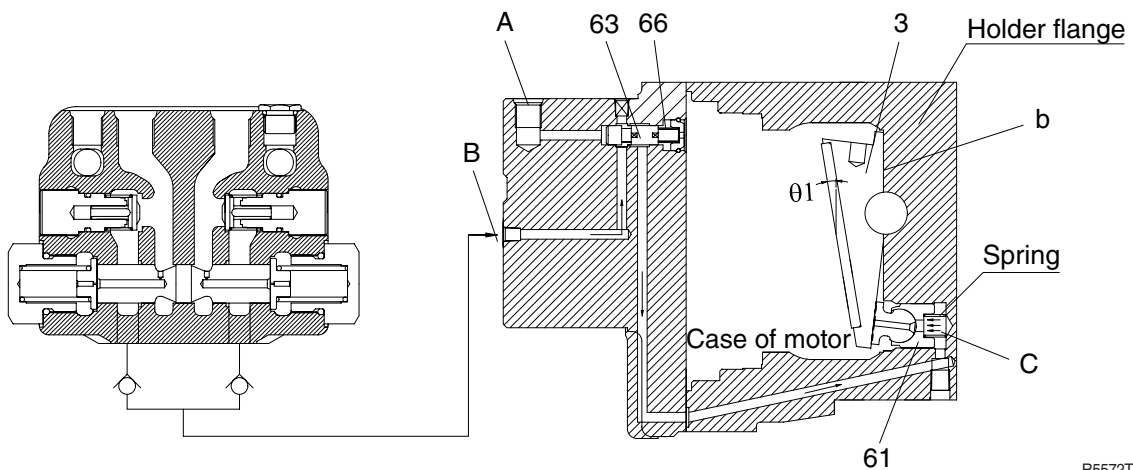


R5572TM16

When no pilot pressure is supplied from port (A) at a pressure of  $10\text{kgf/cm}^2(0.98\text{Mpa})$  or less, valve(63) is pressed toward the left by the force of spring(166), the pressurized oil supply port B is shut off, and oil in chamber (C) is released into the motor case via valve(63).

Consequently, swash plate(3) is tilted at a maximum angle( $\theta_1^\circ$ ) and the piston displacement of hydraulic motor becomes maximum, thus leading to low-speed rotation.

(2) At high speed-at pilot pressure of  $20\text{kgf/cm}^2(1.96\text{Mpa})$  or more



R5572TM17

When a pilot pressure is supplied from port (A) at a pressure of  $20\text{kgf/cm}^2(1.96\text{Mpa})$  or more, the pressure overcomes the force of spring(66) and valve(63) is pressed toward the right. The pressurized oil at supply port (B) is then introduced into chamber (C) via valve(63).

Piston(61) pushes up swash plate(3) until it touches side (b) of the holder flange.

At this time, swash plate(3) is tilted at a minimum angle( $\theta_2^\circ$ ) and the piston displacement of hydraulic motor becomes maximum, thus leading to high-speed rotation.



## 2. REDUCTION GEAR

### 1) FUNCTION

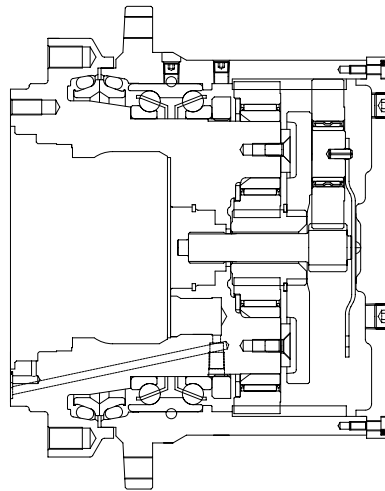
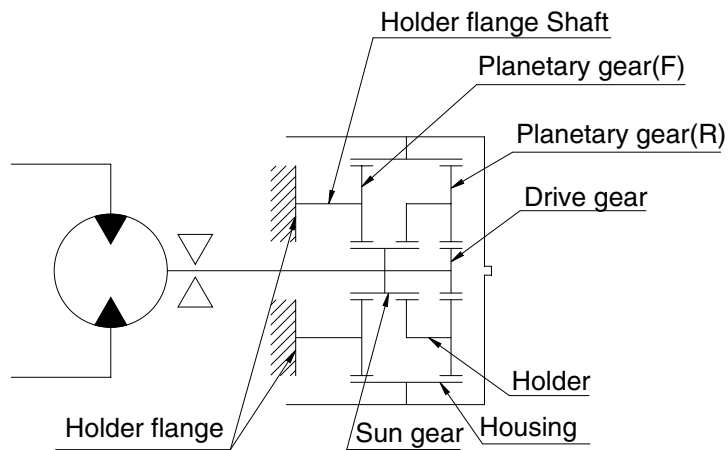
The reduction gear unit consists of a combination of simple planetary gear mechanism.

This mechanism reduce the high speed rotation from the hydraulic motor and convert it into low speed, high torque to rotate the hub(or case), which in turn rotates the sprocket.

### 2) OPERATING PRINCIPLE

Shaft → Drive gear → Planetary Gear R → Housing

→ Holder → Sun gear → Planetary Gear F → Rotation of Housing



R5572TM18

$$\text{Reduction ratio} = (\text{Housing Teeth} / \text{Drive Gear Teeth} + 1) \\ \times (\text{Housing Teeth} / \text{Sun Gear Teeth} + 1) - 1.$$