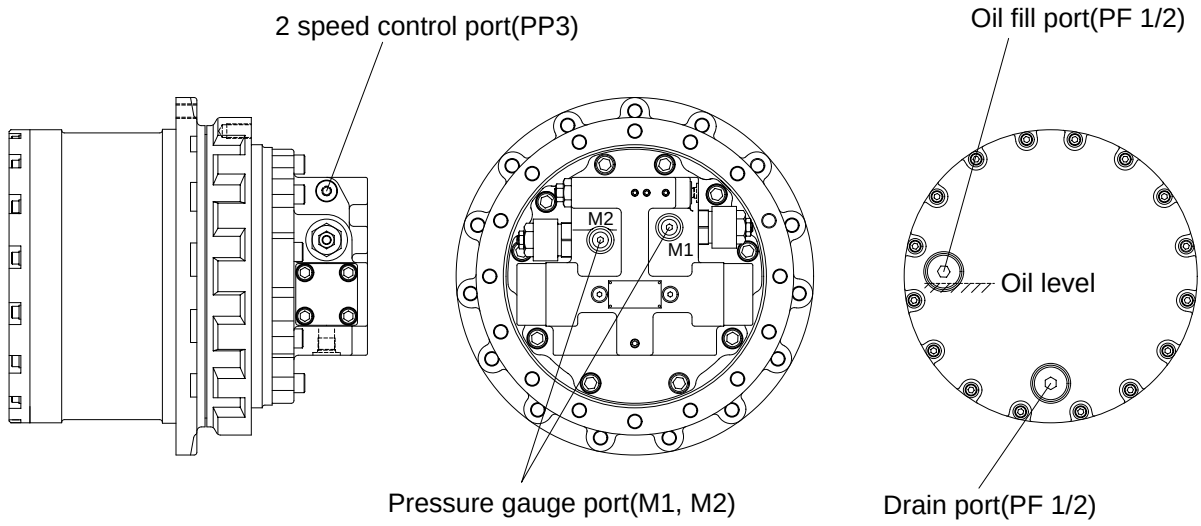
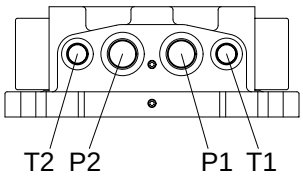
* TYPE 1 (31N3-40010)

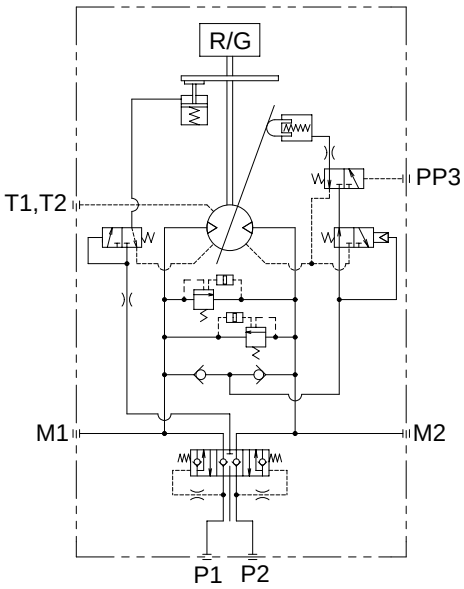
1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



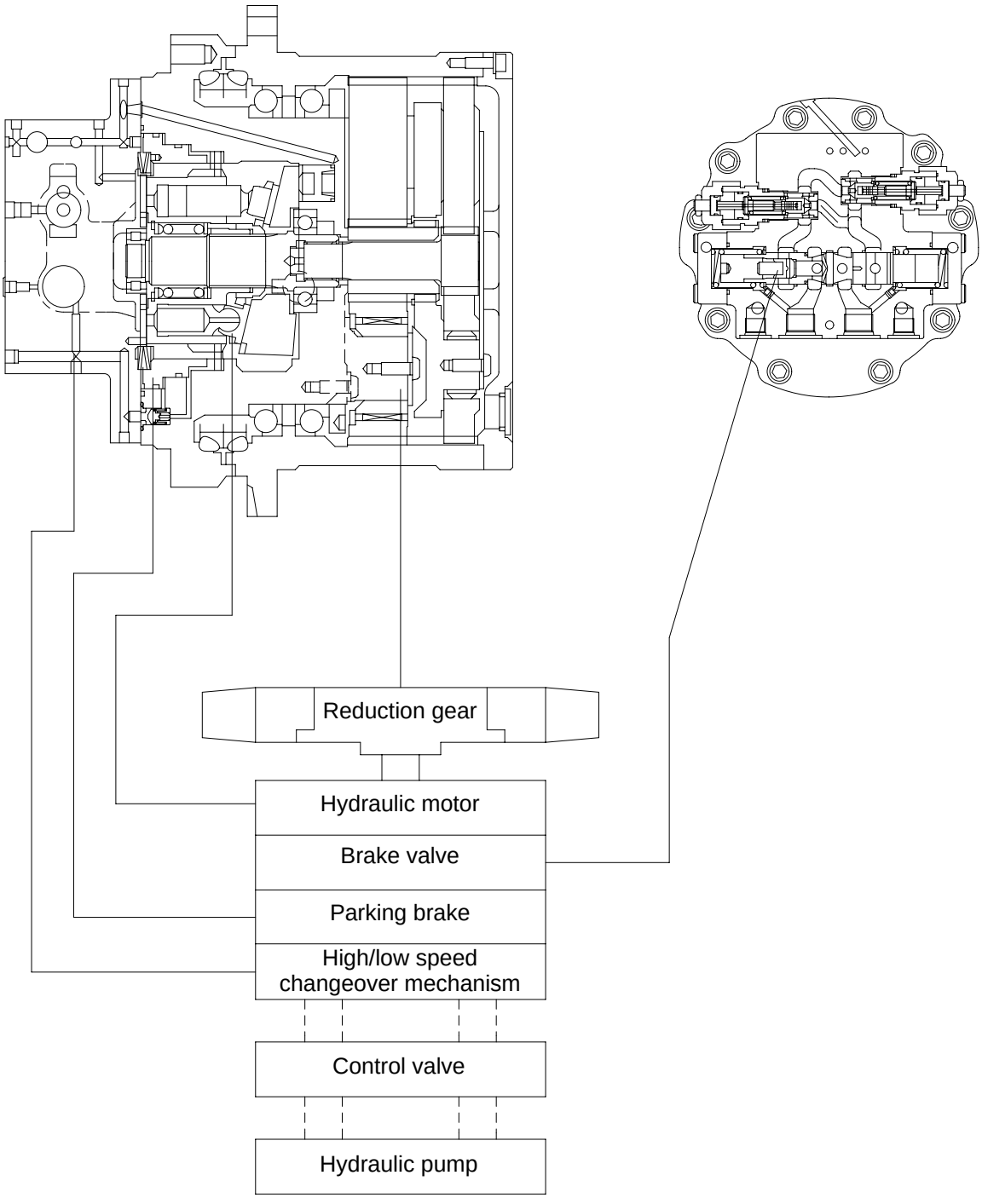




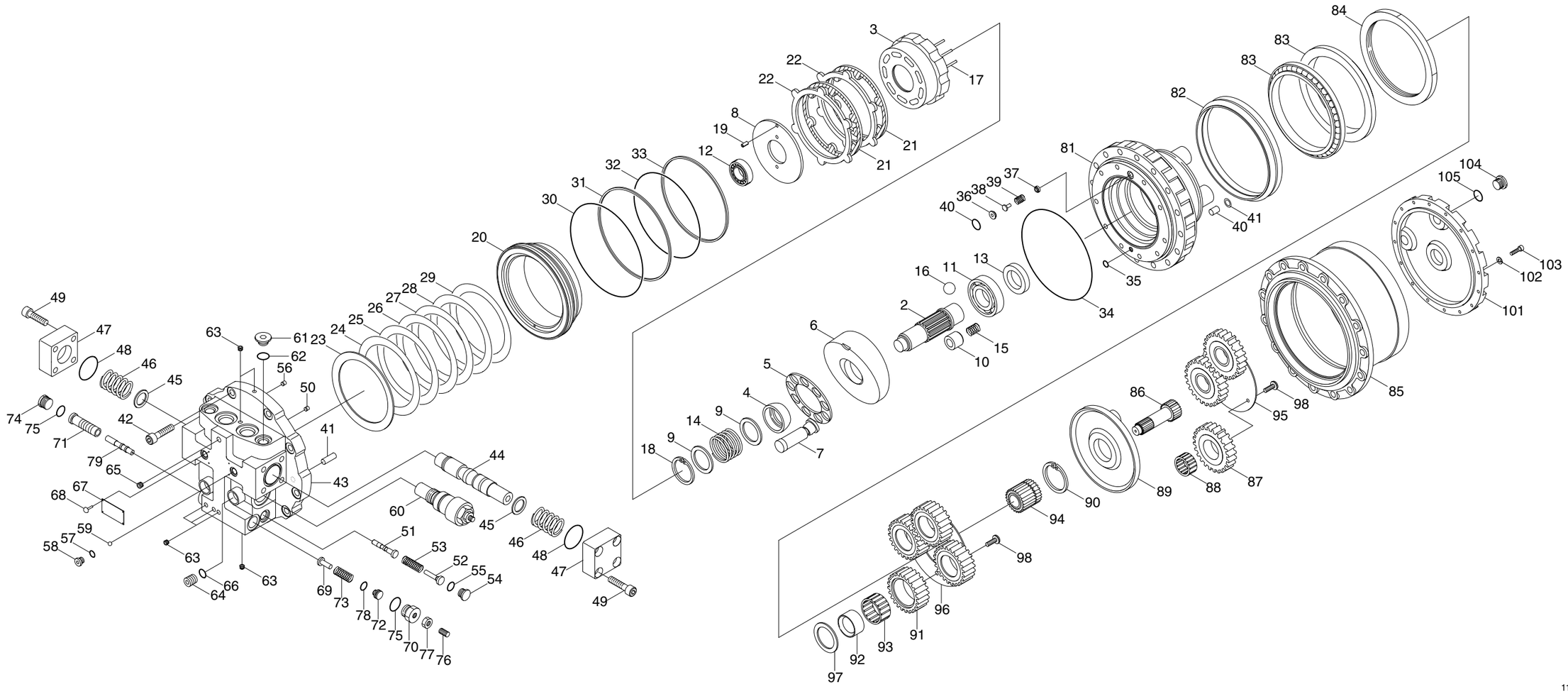
Port	Port name	Port size
P1	Main port	SAE 5000psi 1"
P2	Main port	SAE 5000psi 1"
M1, M2	Gauge port	PT 1/4
T1, T2	Drain port	PF 1/2
PP3	2 speed control port	PF 1/4

11072TM01

1) BASIC STRUCTURE



11072TM02



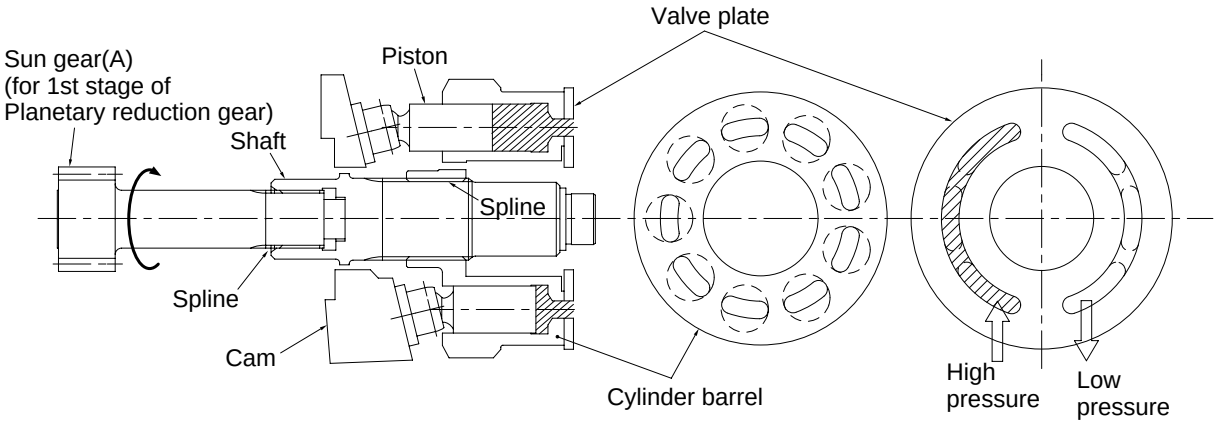
11072TM04

2	Shaft	20	Brake piston	37	Retainer	54	Plug	71	Sleeve	89	Carrier
3	Cylinder barrel	21	Friction plate	38	Poppet	55	O-ring	72	Stopper	90	Sun gear B
4	Ball retainer	22	Steel plate	39	Spring	56	Orifice	73	Spring	91	Planetary gear B
5	Retainer	23	Disk spring	40	O-ring	57	Steel ball	74	Plug	92	Bushing
6	Cam	24	Shim(1.0T)	41	Pin	58	Plug	75	O-ring	93	Needle bearing B
7	Piston assembly	25	Shim(1.2T)	42	Bolt	59	O-ring	76	Screw	94	Snap ring
8	Valve plate	26	Shim(1.4T)	43	Motor cover assembly	60	Relief valve assembly	77	Nut	95	Thrust plate(2)
9	Plate	27	Shim(1.6T)	44	Spool assembly	61	Plug	78	O-ring	96	Thrust plate(3)
10	Piston assembly	28	Shim(1.8T)	45	Washer	62	O-ring	79	Rod	97	Thrust plate(4)
11	Ball bearing	29	Shim(2.0T)	46	Spring	63	Plug	81	Casing body	98	Screw
12	Roller bearing	30	O-ring	47	Cover	64	Plug	82	Floating seal	99	Washer
13	Oil seal	31	Back up ring	48	O-ring	65	Plug	83	Angular bearing	100	Parallel pin
14	Spring	32	O-ring	49	Bolt	66	O-ring	84	Ring nut	101	Cover
15	Spring	33	Back up ring	50	Orifice	67	Name plate	85	Casing gear	102	Spring washer
16	Steel ball	34	O-ring	51	Spool	68	Rivet	86	Sun gear A	103	Bolt
17	Pin	35	O-ring	52	Stopper	69	Spring guide	87	Planetary gear A	104	Plug
18	Snap ring	36	Seat	53	Spring	70	Plug	88	Needle bearing A	105	O-ring
19	Spring pin										

2. FUNCTION

1) HYDRAULIC MOTOR

(1) Motoring function



11072TM05

High-pressure oil is supplied to the left port of motor.
The oil goes into the cylinder barrel through the valve plate. The high pressure pushes the piston to the left. The piston moves to the left position and simultaneously rotates the cylinder barrel sliding on the cam surface. Shaft is connected to the cylinder barrel and the planetary gear (A) is connected to the shaft. So, the rotation is taken out by the sun gear rotation as shown.

When high-pressure oil is supplied to the opposite port of the motor, then the rotating direction is reversed and the sun gear (A) rotates in the reversed direction.

The rotation of sun gear (A) is transferred to the reduction gear section.

The torque and speed generated by the motor depends on the displacement (=volume per revolution) of the motor.
The volume per revolution depends on the cam angle Ø.

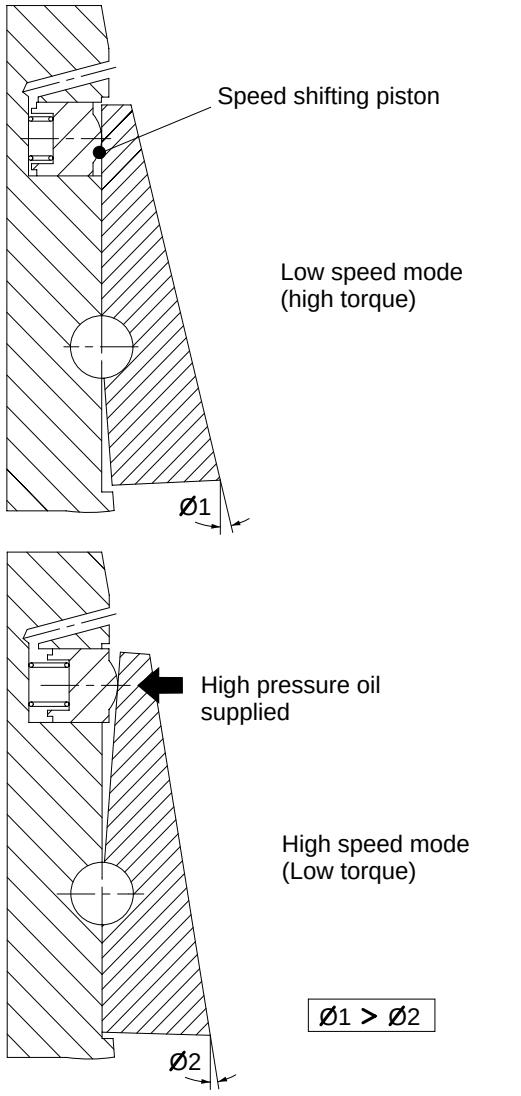
(2) Speed-shifting function

The torque and speed generated by the motor depends on the displacement of the motor. And the displacement depends on the cam angle Ø.

The bigger the cam angle Ø is, the higher the torque is and the lower the speed is.

The smaller the cam angle Ø is, th lower the torque is and the higher the speed is.

This travel drive is equipped with a speed shifting piston, and when high pressure oil is supplied to it, the speed-shifting piston pushes cam and makes the cam angle smaller. This means that the mode is shifted from low speed mode to high speed mode.



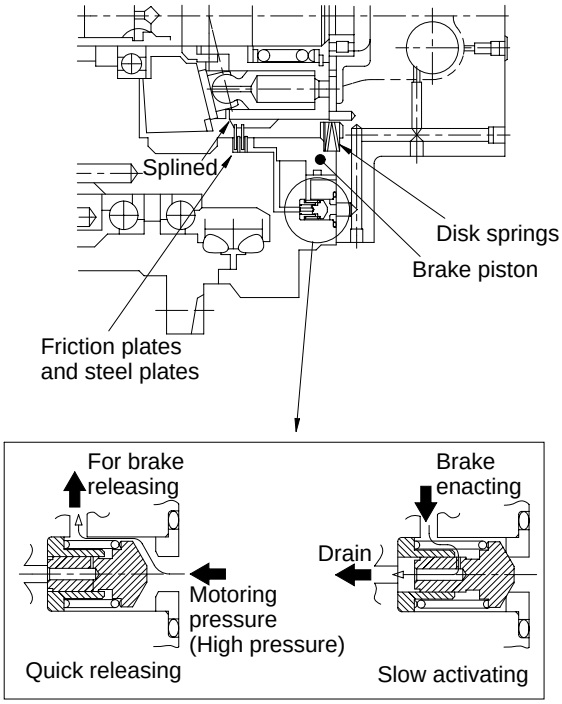
11072TM06

(3) Parking brake function

This travel drive is equipped with a parking brake. It gives parking brake torque to the motor when high pressure oil is NOT supplied to the motor and the motor is NOT traveling. Also, it releases parking brake when high-pressure oil is supplied to the motor and the motor is traveling.

As high-pressure oil is supplied to the travel motor, the parking brake is quickly released and the motor starts rotation.
When the high pressure oil supply to the motor stops, the motor stops rotation and the parking brake is slowly activated by the brake piston motion because of the force of a pair of disk springs.

Slow activating and quick releasing of parking brake can prevent possible damage to friction plates and steel plates.



11072TM07

2) BRAKE VALVE

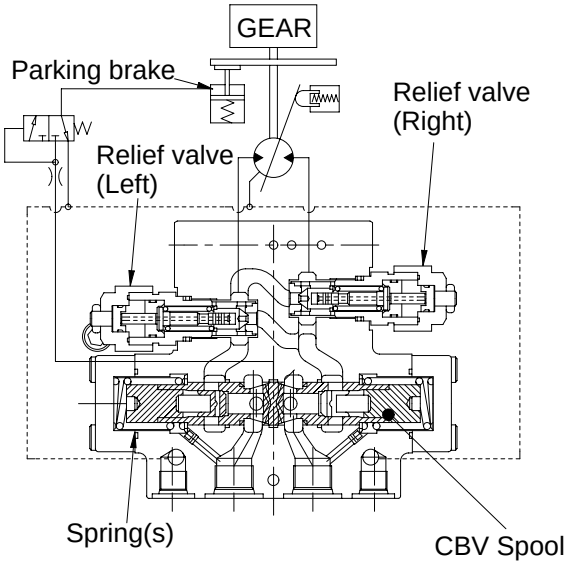
(1) Counterbalance valve function

① Level travel

When high pressure oil is NOT supplied to the brake valve, CBV spool is at the center because of two springs beside it.
Now oil flow passage from motor is closed.

When high-pressure oil is supplied to the right port of brake valve, CBV spool is moved to the left position because of the pressure at the right end of CBV spool.
Now that oil-flow passage from the motor is open at the left shoulder of the CBV spool, oil flows and motor rotates.

When supplied pressure at the right port is decreased during the vehicle deceleration or stopping process, there is a pressure decrease at the right end of CBV spool.
Then CBV spool is moved to the right direction because of the spring force at the left side of CBV spool. Then oil-flow passage from the motor at the shoulder of the CBV spool gets narrower and at last it is closed when high pressure oil supply is shut-up to brake valve.
In this passage closing process, there occurs a pressure increase in outlet side of the motor ("=back pressure").



11072TM08

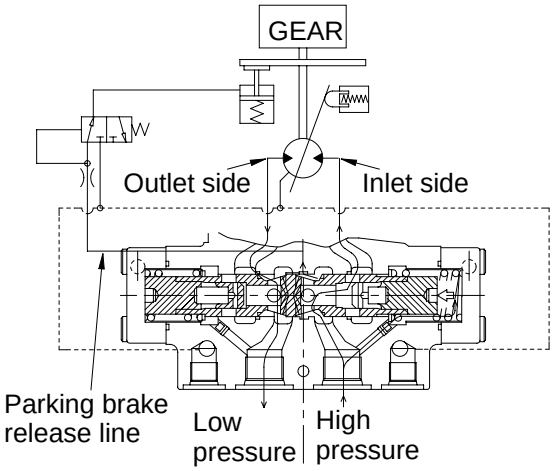
② **Down-slope travel**

· If there is NOT a counterbalance valve equipped

When the vehicle travels down a slope, gravity makes the travel drives rotate more speedily than you intended. The "overrunning" cannot be controlled by the supplying oil flow rate. Also, the pumps cannot maintain the oil supply to the motors and there will be a negative pressure in the inlet side of motor. This might cause cavitation in the travel motors.

· Function and mechanism of counter-balance valve

In down-slope traveling, the pressure at the right port decreases because of lack of supplied oil. Then, the pressure at the right end of CBV spool also decreases and CBV spool moves back to the right direction from the left position. Now that oil-flow passage from the motor at the shoulder of the CBV spool gets narrower and then there will occur a pressure increase in outlet side of the motor (="back pressure").
This "back pressure" can prevent the motor from "overrunning" and cavitation.



11072TM09

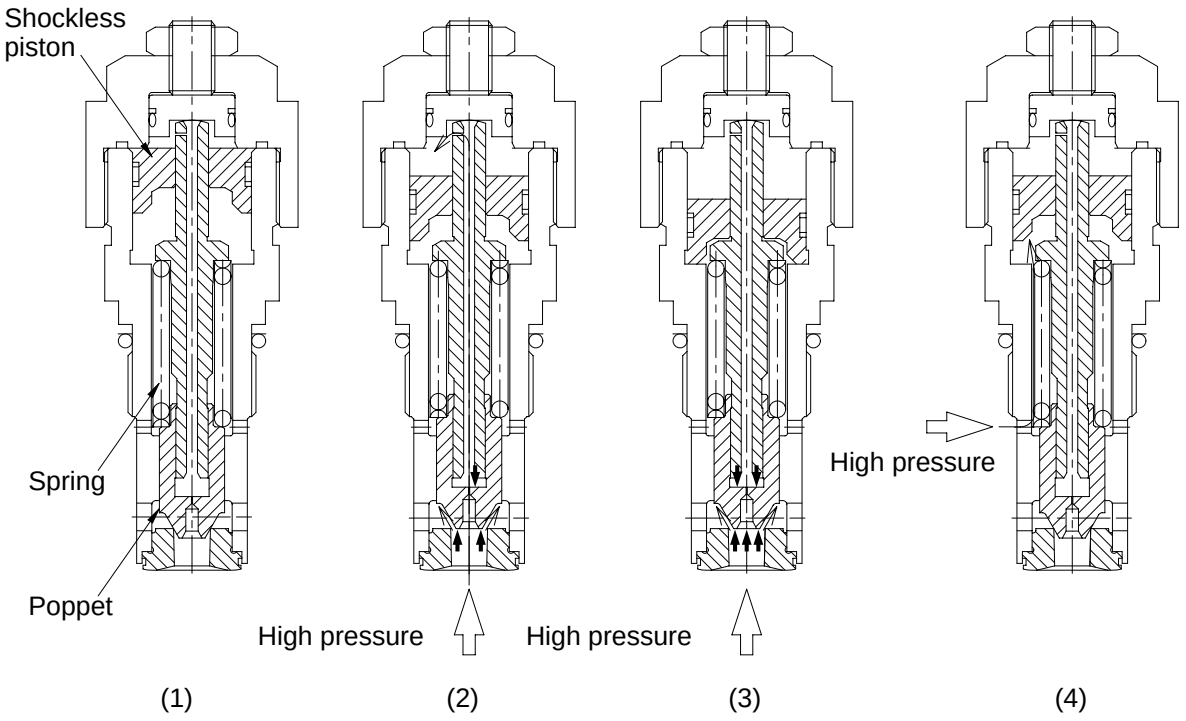
③ **Oil supply for parking brake release**

For starting the travel drive rotation, when pump oil is supplied to the right port of brake valve, CBV spool moves to the left position and also opens passage to parking brake releasing.

When the travel drive is in "stop" state, passage to brake releasing is closed.

As to the detail of parking brake function, please refer to "(3) parking brake function".

(2) Crossover relief valve function



11072TM10

This travel drive is equipped with a pair of shockless crossover relief valves. The purpose is as below :

- The relief valve prevents the ocurrence of a shock load while travel deceleration or stopping process.
- It prevents overload to the motor.
- It compensates for the lack of oil during vehicle deceleration or stopping processes.
- The relief valves are "shockless" type, which is effective for shock reduction.

① **If there is NOT a crossover relief valves equipped**(considering two cases for example)

- When the vehicle is in slowing down or stopping operation stage, a pressure increase (="back pressure") occurs in the motor because of the function of counterbalance valve as mentioned in "2)-(1) counterbalance valve function". If the stopping operation for vehicle is sudden, this "back pressure" occurs suddenly and it may cause a shocking feeling for the opperator, or in worse cases, break down of the machine.

- When the vehicle is in the rotation starting operation stage, high pressure will be applied into the motor. If the starting operation is too sudden, a sudden pressure increase occurs in the motor. It may cause a shock.
  In order to make the harmful pressure shock softer, and for operator feeling improvement or for machine protection, this travel drive is equipped with crossover relief valve.

② Function and mechanism of shock-less crossover relief valves

Please refer to the figures in "2)-(1) counterbalance valve function" and on this page.
The explanation below is described about relief valve(right).
Firstly, the relief valve(right) is in condition (1) previous page.

When a sudden pressure increase occurs in the outlet side of the motor in deceleration or stopping process, the shock of high pressure pushes down shockless piston in the relief valve as shown in (2), while relieving high pressure oil with poppet moving up.
During moving down shockless piston, the pressure behind the poppet is not so high because of the existence of flow moving down the shockless piston, and relieving pressure is rather low.

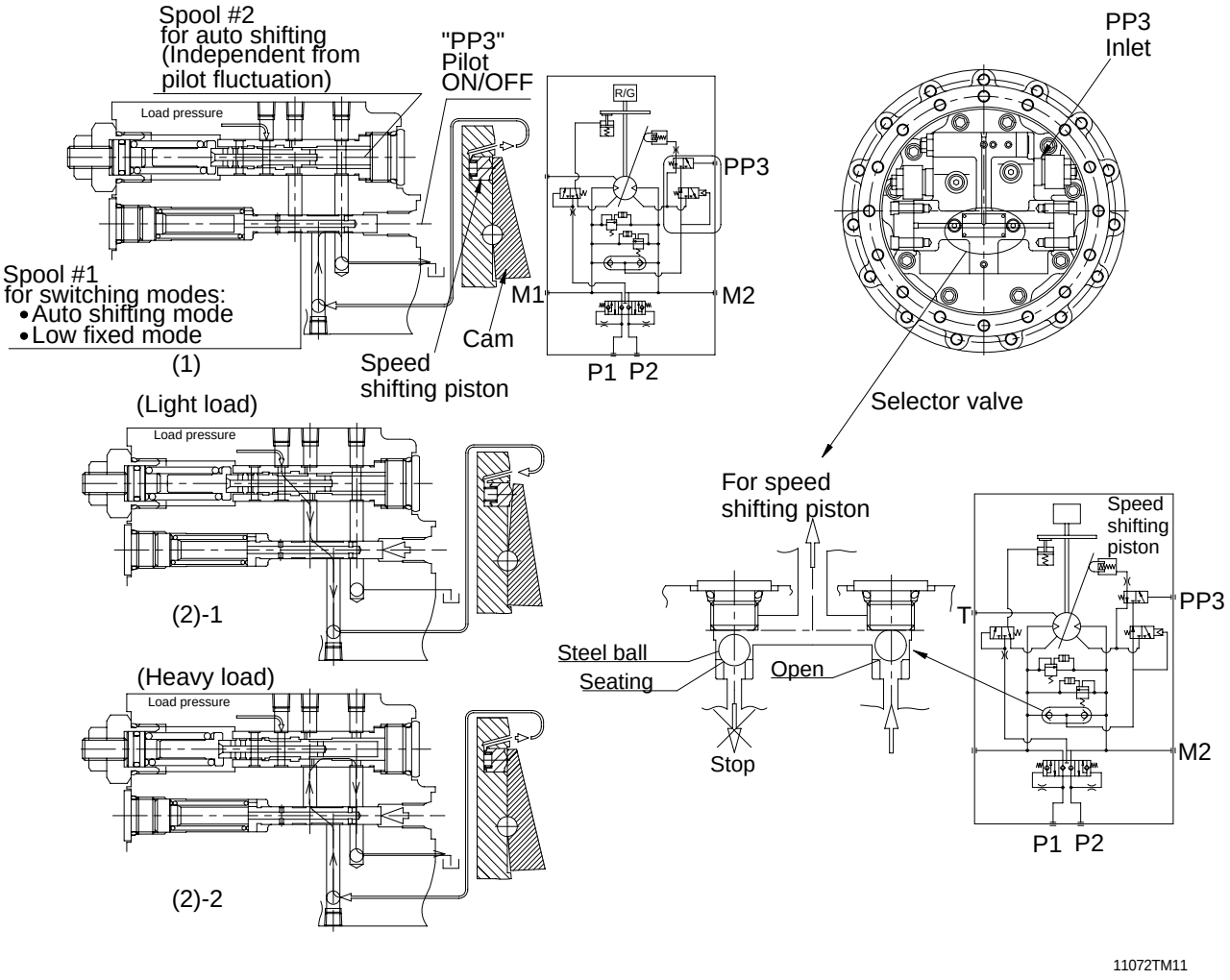
Next, when the shockless piston has been completely pushed down to the end of stroke as shown in (3), the relieving pressure increases to the finally intended set pressure, because there is no more flow moving down the shockless piston, and the pressure behind the poppet is high.

After stopping the motor, when you start rotating the motor again, resetting of shockless piston occurs, pushing up the shockless piston up with the high pressure in the inlet side of the motor.

③ Oil compensation

During the relieving action, the relief valve also have a function of oil flow compensation giving the relieved oil flow from the outlet side to the inlet side. This function helps to prevent a vacuum condition in the motor.

(3) Automatic 2-speed shifting function



Automatic 2-speed shifting function has two modes (1) and (2) as below :

- (1) Low speed fixed mode... always low speed
- (2) Automatic 2-speed shifting mode
  - (2)-1 When motor load pressure is light, High speed.
  - (2)-2 When motor load pressure is heavy, Low speed.

This function above consists of three components.

- Spool #1 for switching modes
  Auto-shifting mode(if PP3 is applied)
  Low-speed-fixed mode (if PP3 is NOT applied)
- Spool #2 for auto shifting
  If load pressure < set value then High-speed
  If load pressure > set value then Low-speed
- Selector valve, which always picks out high pressure and provide it to the SPOOL #2 regardless of the rotating direction of motor.

Functions

Please refer to (1) shown above.

When the pilot pressure PP3 is NOT applied, SPOOL #1 is at the right position because of the spring behind the spool. Now the motor is always at low speed regardless of the position of SPOOL #2.

When the pilot pressure PP3 is applied, SPOOL #1 is at the left position because of PP3. Now the motor is at automatic 2-speed-shifting mode. The displacement of the motor can be changed based on the motor load pressure.

Please refer to (2)-1.

Now the pilot pressure is applied, and the motor is at automatic 2-speed-shifting mode. When the motor load pressure is low, SPOOL #2 is at the right position because of the spring behind the spool. And the load pressure is led to the chamber behind the speed-shifting piston and it pushes piston and changes the cam angle smaller. This means that the motor is at High speed.

Please refer to (2)-2.

Now the pilot pressure is applied, and the motor is at automatic 2-speed-shifting mode. When the motor load pressure is high, SPOOL #2 is at the left position because of the motor load pressure pushing the spool to the left. Then the load pressure is locked at the SPOOL #2 and is NOT led to the chamber behind the speed-shifting piston. The cam angle remains big. This means that the motor is at Low speed.

As to the detail of cam angle change, please refer to "1) Hydraulic motor section (2) speed-shifting function".

3) REDUCTION GEAR

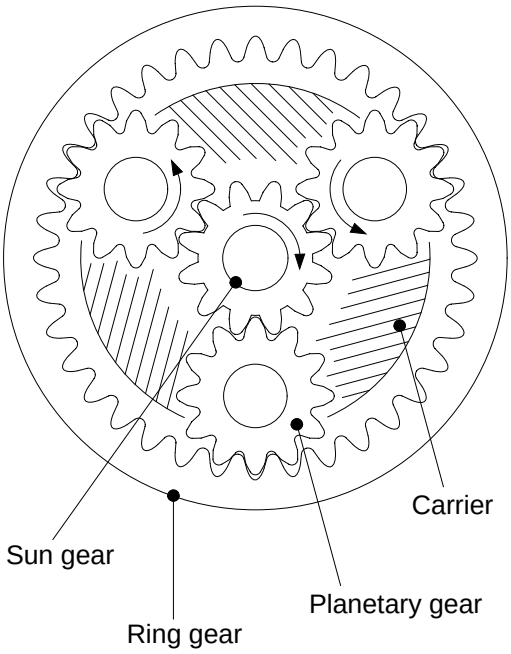
(1) Function

A general construction of planetary reduction gear system is as shown right.

The system mainly consists of these parts below.

NAME	Number of teeth
Sun Gear	Zs
Planetary gears	Zp
Carrier	-
Ring gear	Zr

Planetary reduction gear system



11072TM12

① Planetary type

Firstly, let's think about the case that Ring Gear is fixed and rotation is given to Sun gear. This is called "PLANETARY TYPE" as sun gear rotates clockwise, planetary gears will revolve around sun gear, and the revolution will rotate carrier.

Now we can take the clockwise rotation at carrier by giving a clockwise rotation to sun gear.

The rotation speed of carrier(output)is different from that of sun gear(input) as below.

(input)/(output) is called "Reduction ratio(i)".

Reduction ratio (i) = (Input)/(Output) = Zr / Zs + 1

② Star type

Next let's think about the case that the carrier is fixed and rotation is given to sun gear. This is called "STAR TYPE" as sun gear rotates clockwise, planetary gears will rotate at the same position, and they will make ring gear rotate counter-clockwise.

Now we can take out a counterclockwise rotation at ring gear by giving a clockwise rotation to sun gear.

The rotation speed of ring gear is different from that of sun gear as below.

Reduction ratio (i) = (Input)/(Output) = Zr / Zs

③ In the travel drive

This travel drive is equipped with 2-stage planetary reduction gear system, which consists of mixture of PLANETARY TYPE and STAR TYPE.

Input is given to sun gear of 1ST stage and output is taken out at ring gear.

Ring gear is commonly used in 1ST stage and 2ND stage.

The reduction ratio is as below

$$\text{Reduction ratio (i)} = (\text{Input})/(\text{Output}) = (Zr / Zs1 + 1) \times (Zr / Zs2 + 1) - 1$$

Here

Zs1 = Number of teeth for 1ST stage sun gear

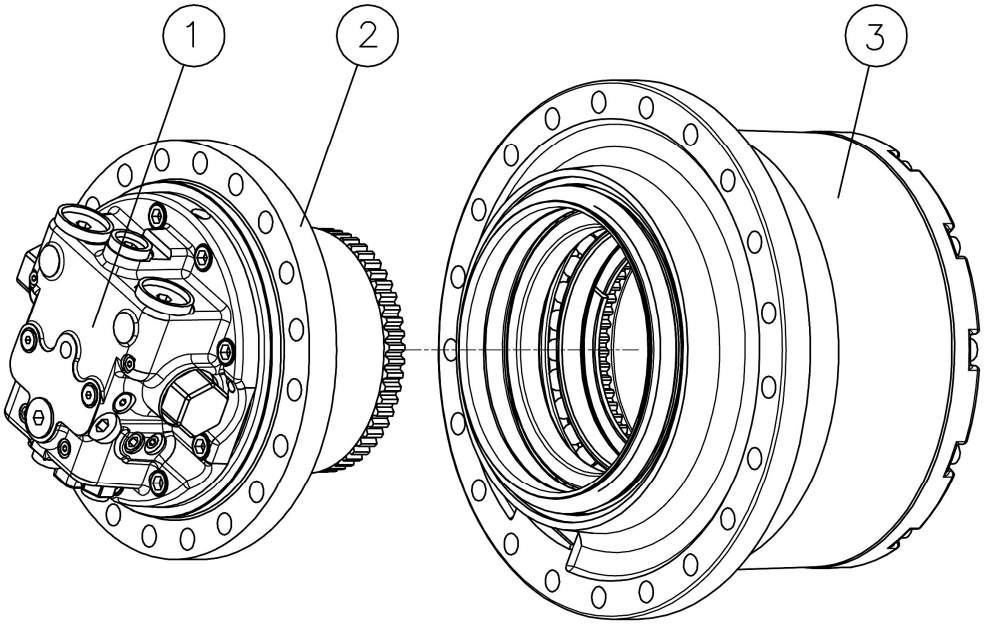
Zs2 = Number of teeth for 2ND stage sun gear

Zr = Number of teeth for ring gear

* TYPE 3 (31N3-40040)

= overview =

Track device consists of track motor(1, 2) and track gear box(3)



1.- Valve Casing 2. -Shaft Casing 3. -Track Gear Box

2. Specification

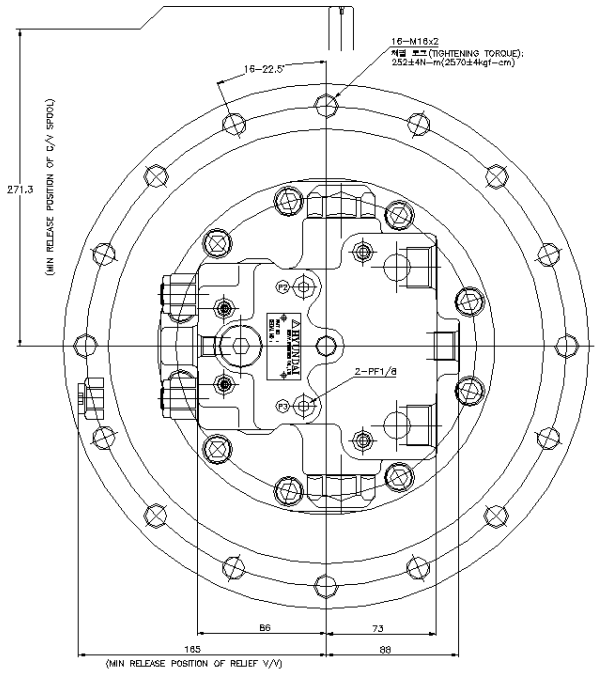
Descriptions	Units	Specification
Oil Flow	lpm	112
Set Pressure Of Relief Valve (Cracking)	Kgf /cm2	330 (300)
Motor Displacement	cc/ rev	67.3/41.2
Motor Output Torque	Kgf - m	35.35/21.64
Motor Speed	rpm	1644.2/2718.4
Brake Torque	Kgf - m	Min 20
Brake Release Pressure	Kgf /cm2	8.75
Two Speed control Pressure	Kgf /cm2	20~70
Automatic Shift Pressure	Kgf /cm2	290 (at 40)
Weight	Kg	54

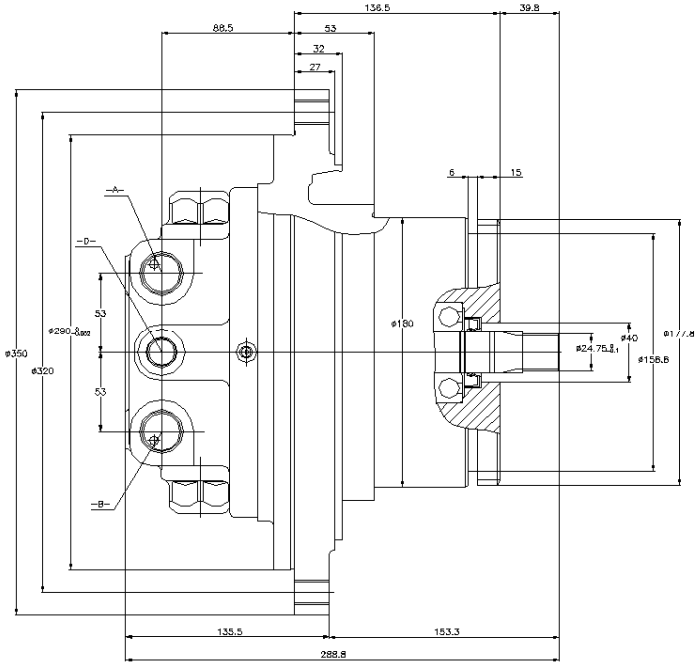
--- Reference ---

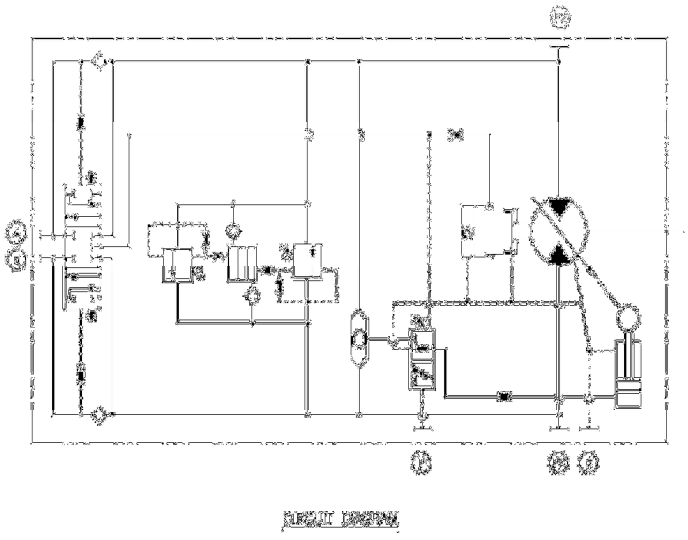
1. Output Torque and RPM is theory.

3. STRUCTURE AND HOW IT WORKS

3-1. Dimension

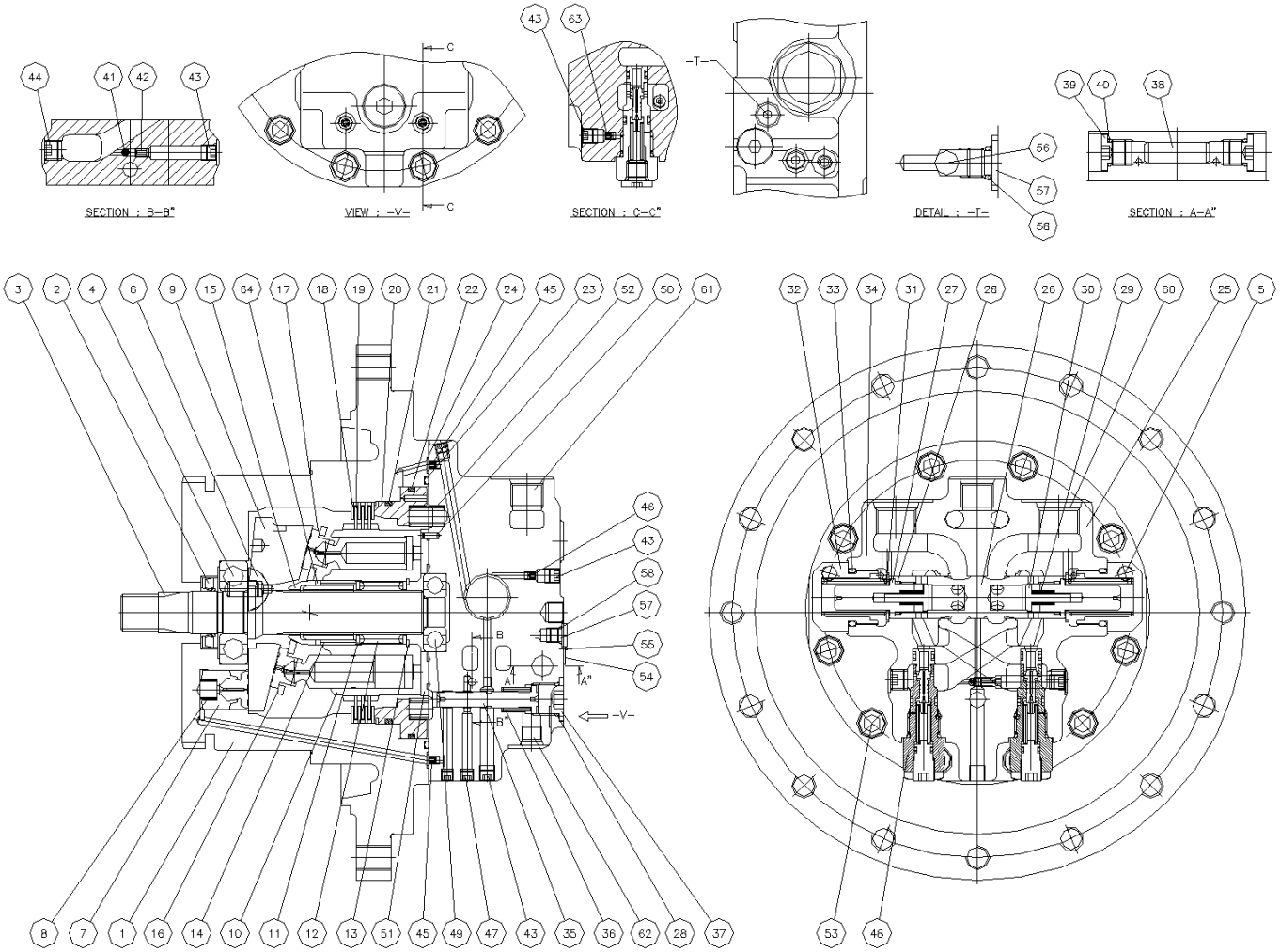






	Port name	Port dimension
A, B	Main	1 -1/16 – 12UNF-2B
Dr	Drain	3/4 -16 UNF-2B
Pi	Two speed control	7/16 – 20UNF -2B
P1, P2	GAUGE	PF 1/8

3-2. STRUCTURE



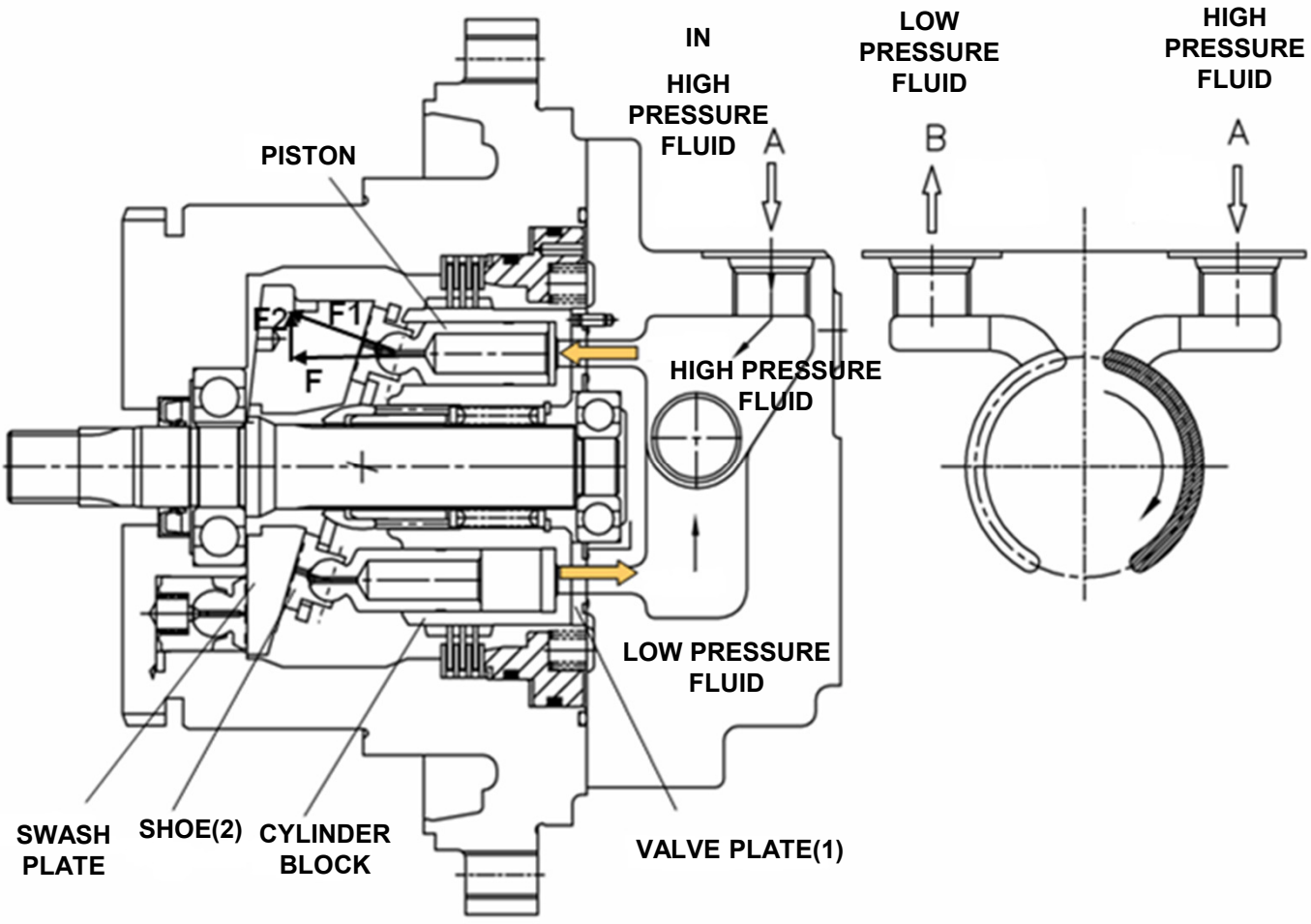
1	SHAFT CASING	**II–B–15**	BALL GUIDE	**III–31**	PLATE	49	BEARING
2	OIL SEAL	**II–B–16**	SET PLATE	**III–32**	P L U G	50	P I N
3	SHAFT	**II–C**	PISTON KIT	**III–33**	O–RING	**II–A–51**	VALVE PLATE
4	BEARING	17	PISTON ASS'Y	**III–34**	SPRING	52	SPRING
5	P I N	18	STEEL PLATE	35	SPOOL	53	WRENCH BLOT
6	SWASH BALL	19	FRICTION PLATE	36	SPRING	54	NAME PLATE
I	SWASH PISTON KIT	20	BRAKE PISTON	37	P L U G	55	RIVET
I–7	SWASH PISTON	21	RING	38	PISTON	56	STEEL BALL
8	SPRING	22	RING	39	P L U G	57	P L U G
9	SWASH PLATE	23	O–RING	40	O–RING	58	O–RING
II	ROTARY KIT	24	O–RING	41	STEEL BALL	59	SEAL KIT
II–A	CYLINDER BLOCK KIT	25	VALVE CASING	42	ORIFICE	60	PLASTIC PLUG
II–A–10	CYLINDER BLOCK	**III**	MAIN SPOOL KIT	43	P L U G	61	PLASTIC PLUG
II–A–11	SPRING SEAT	**III–26**	MAIN SPOOL	44	P L U G	62	PLASTIC PLUG
II–A–12	SPRING	**III–27**	P L U G	45	ORIFICE	63	ORIFICE
II–A–13	SNAP RING	**III–28**	O–RING	46	ORIFICE	**64**	**SPACER**
II–A–14	P I N	**III–29**	SPRING	47	P L U G		
II–B	RETAINER KIT	**III–30**	CHECK	48	RELIEF VALVE ASS'Y		

3-3. HOW IT WORKS

Hydraulic motor comprises with a Rotary group, Relief valves, a Parking Brake, a Counter balance valve, a High/low-speed control unit.

3-3-1 ROTARY PART

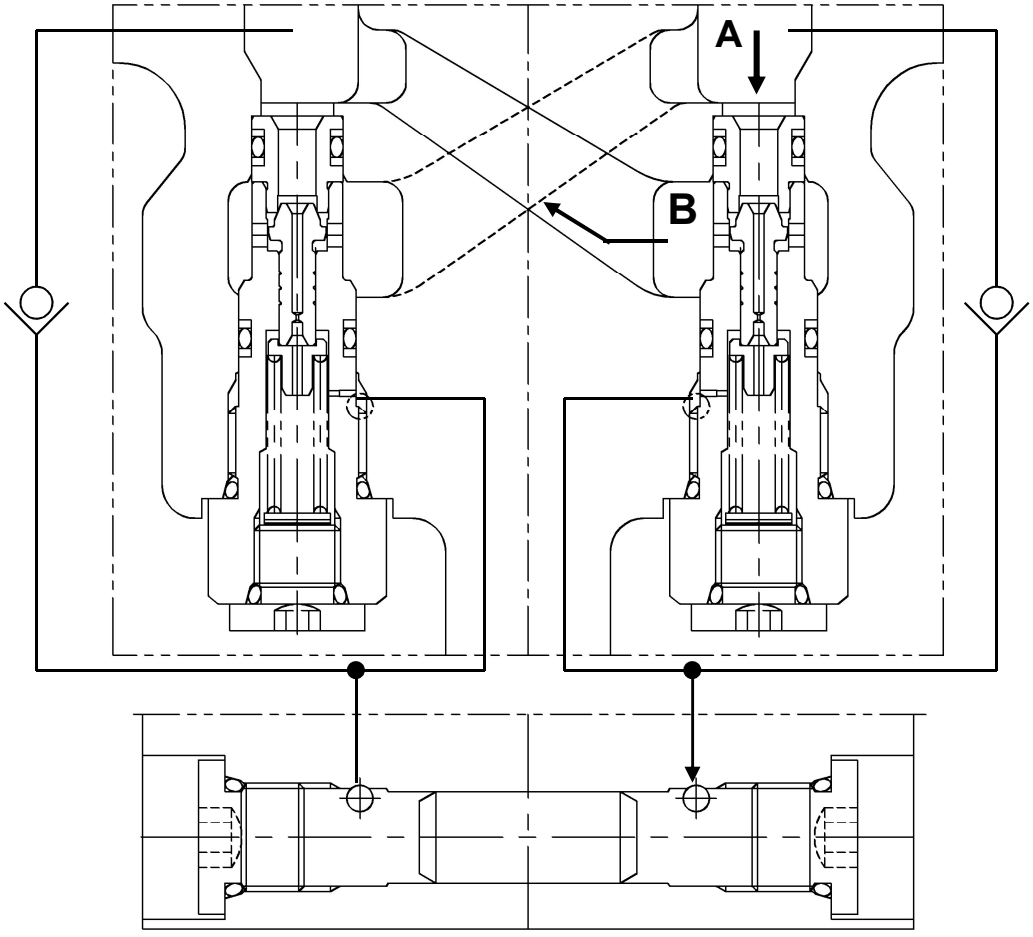
In the figure below, Axis directional force F1 occurs when the high pressure oil flows into the Cylinder block through to the valve plate(1) port, and the piston moves to the left hand side. This force F1, which takes Shoe(3) as a medium, split into axial force F which is parallel with a shaft, and radial force F2 which is perpendicular to the shaft. By the reaction force F2, Cylinder block rotate with piston and shoe, while Shoe(2) moves on the Shoe plate with piston. There are 9 pistons inserted into the Cylinder block and they rotate with the Cylinder block by taking high pressure oil in order at the entrance. When the oil flow is reversed, piston and cylinder block rotate in the opposite direction.



3-3-2 RELIEF VALVE

Function of Relief Valve

When the control valve spool is returned to neutral, the circuit between control valve and motor is blocked, and traveling movement stops. However, motor continues rotating because of the traveling inertia of the excavator's heavy weight. Then the motor will act as a pump, and oil blocked between control valve and motor will be pressured sharply and the increased oil pressure will damage internal parts. To prevent this damage, Relief valve discharge the high pressure oil from A to B which has lower pressure.



Setting Pressure : 350 kgf/cm2

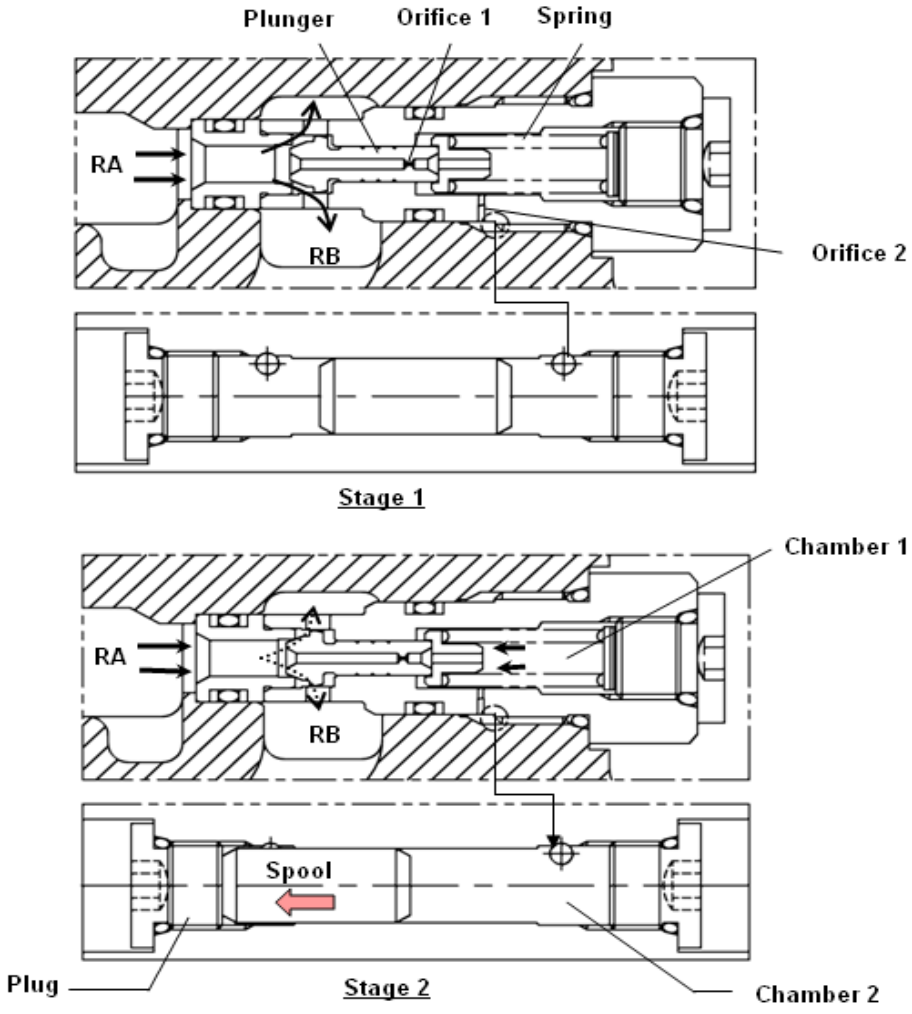
Back Pressure : 5 kgf/cm2

Cracking Pressure : 315 kgf/cm2(Over)

Starting up

In figure RELIEF VALVE A,

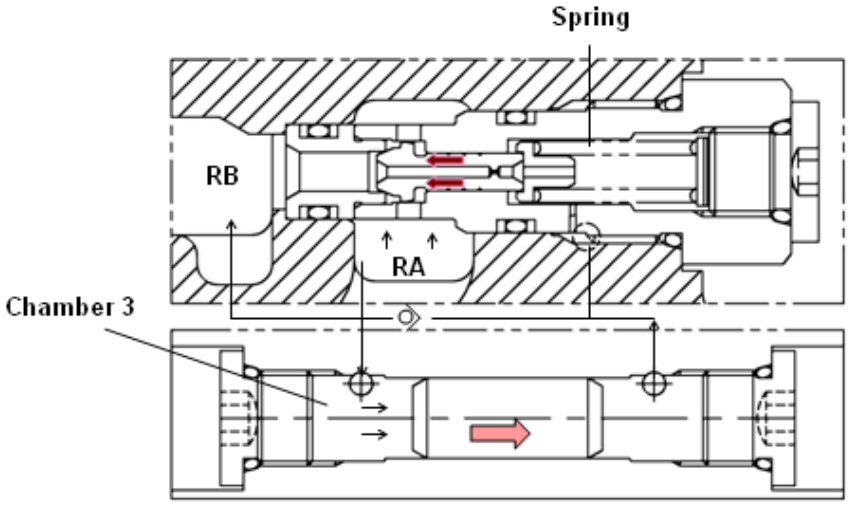
when travel control lever moves, high pressure oil works to rise the pressure of RA port up. This pressurized oil press plunger to the right, and then sustain the power of the spring, the plunger moves to the right and release the pressure oil of RA port to RB port(Stage 1) The plunger moves slowly by the pressure oil which flows into Chamber 1 through Orifice 1. The pressure oil flowed into chamber1 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

While traveling

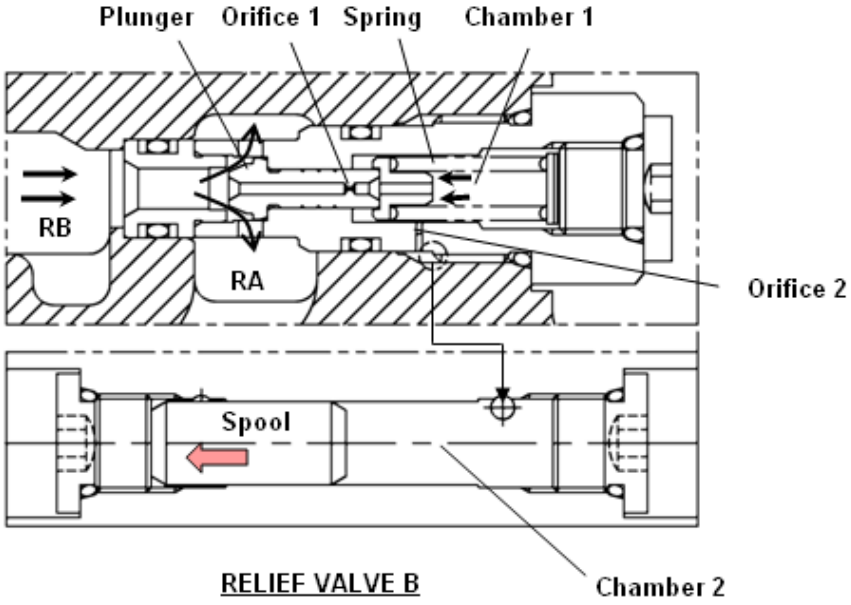
During traveling operation, RA port pressure goes up and RB port pressure goes down. Thus RA port pressure oil flows into Chamber3, and pushes plunger to the left with a high pressure and the power of the spring.



RELIEF VALVE B

Braking

In figure RELIEF VALVE B, when it stops or operates reversely, RA port pressure is decreased and RB port pressure suddenly goes up by the inertia of the machine heavy structure. 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.



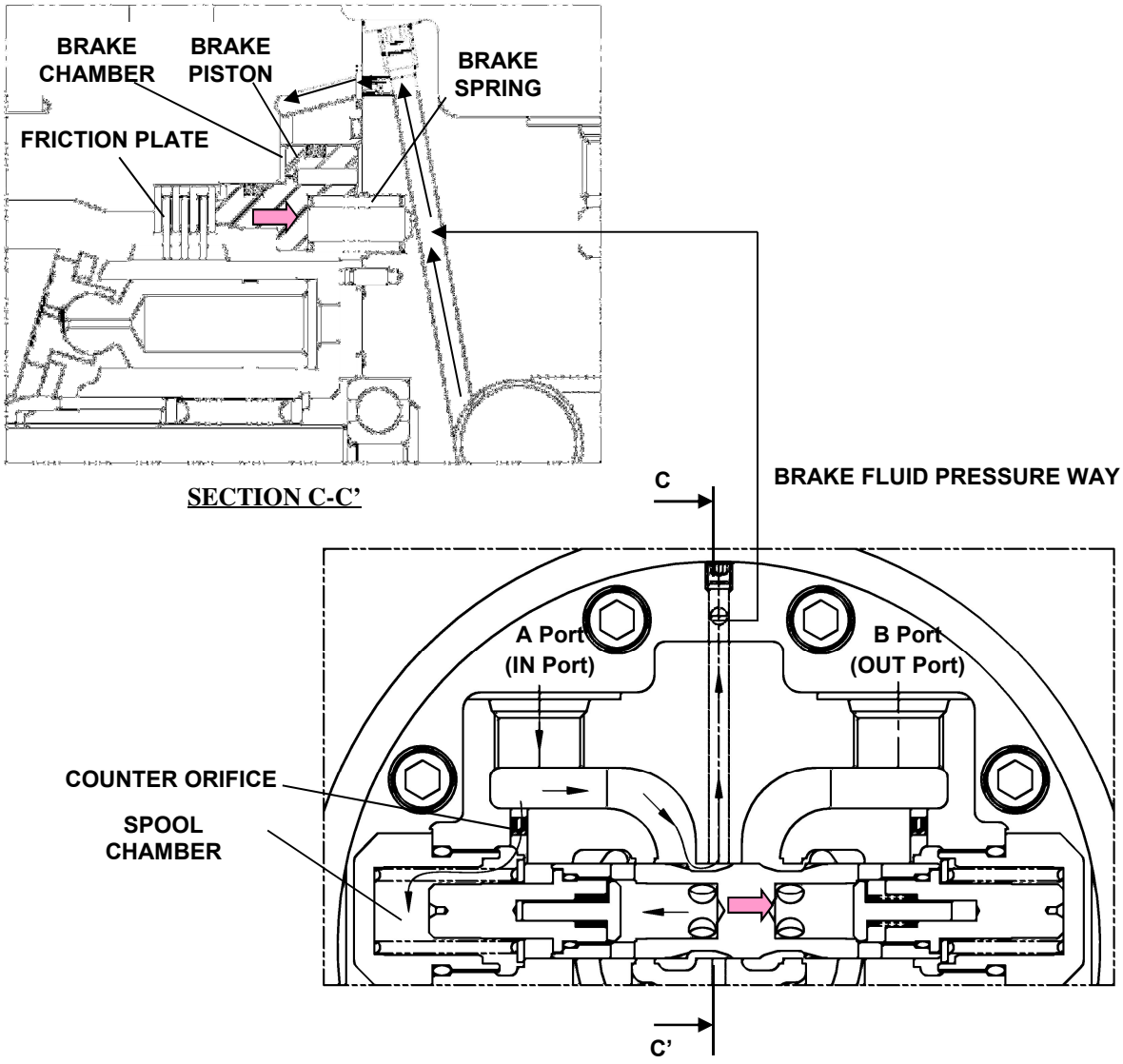
RELIEF VALVE B

3-3-3 PARKING BRAKE

Parking Brake system consists of a brake piston, springs, friction plates and separating plates, and some orifices to control responsibility of the brake piston. The brake is usually held with the force of compressed spring, and it is released automatically by traveling oil pressure coming from inlet A, or B when the motor starts to run.

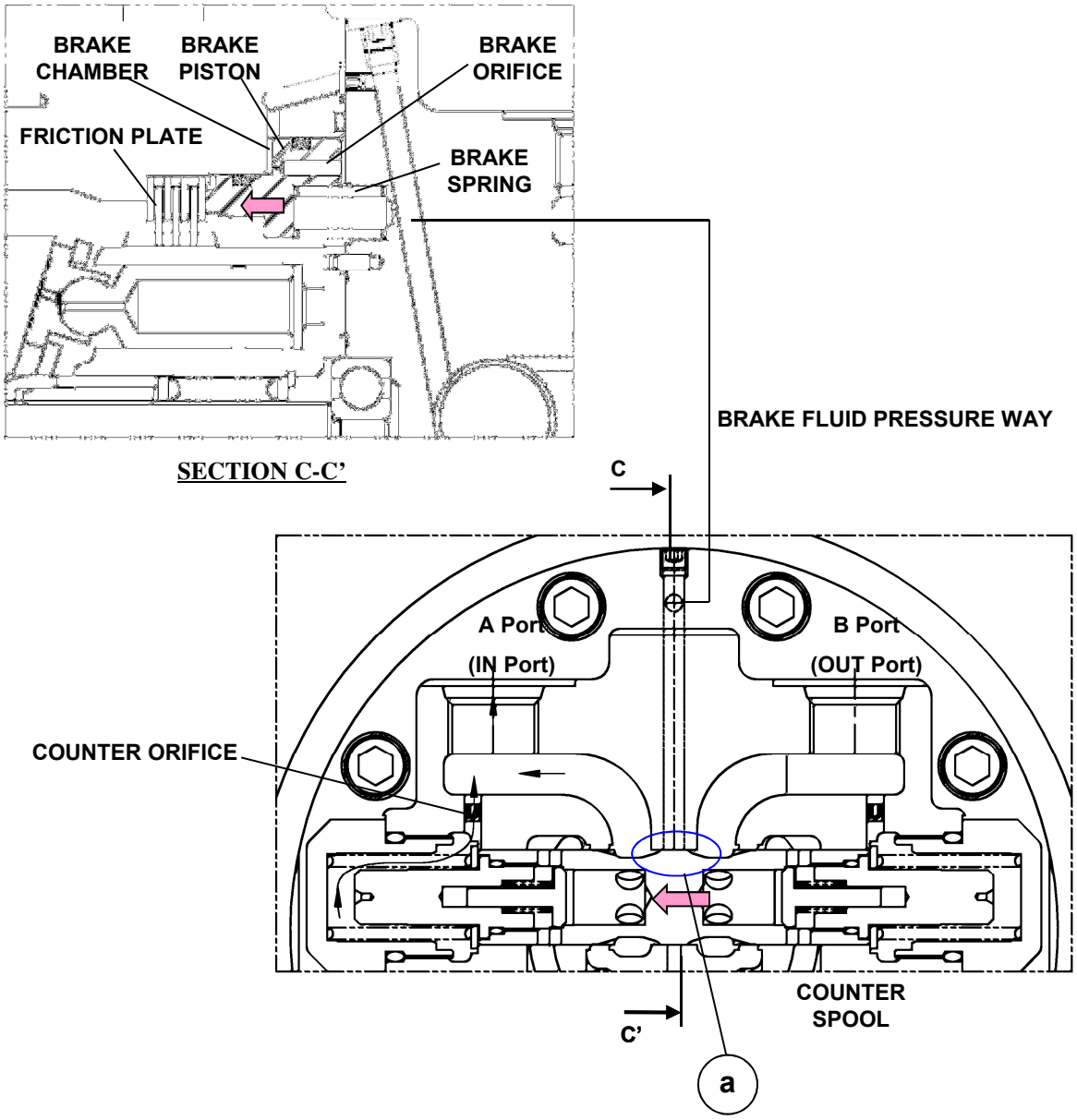
• PARKING BRAKE OFF

When operator moves 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 flows to the brake chamber of motor through a brake passage, and makes brake piston move against brake spring force to allow clearance between fiction plates and separate plates thereby releasing the brake.



- **PARKING BRAKE ON**

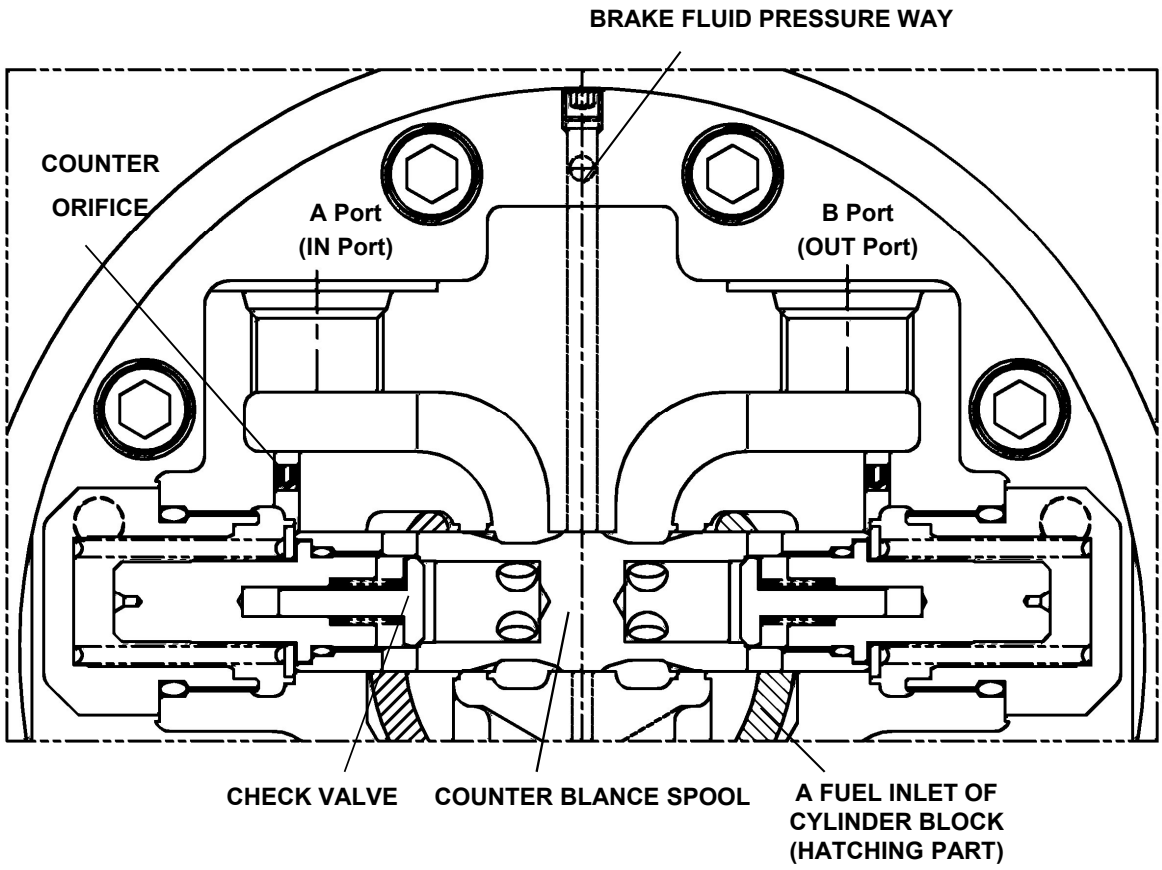
When the control lever is returned to neutral position, the circuit between control vale and motor is blocked. As oil pressure in spool chamber drops to zero and the counter balance spool returns to neutral position. At the spool neutral position, notch ⓐ is disconnected from oil supply port A, instead, brake chamber oil is drained to tank through BRAKE ORIFICE which is center opened.



3-3-4) COUNTER BALANCE VALVE

Function

- Control oil flow in the action of mechanical parking brake operation
- Prevent overrun while traveling on down slope
- Work as a hydraulic brake when motor stops, and prevent motor not to slip on slope

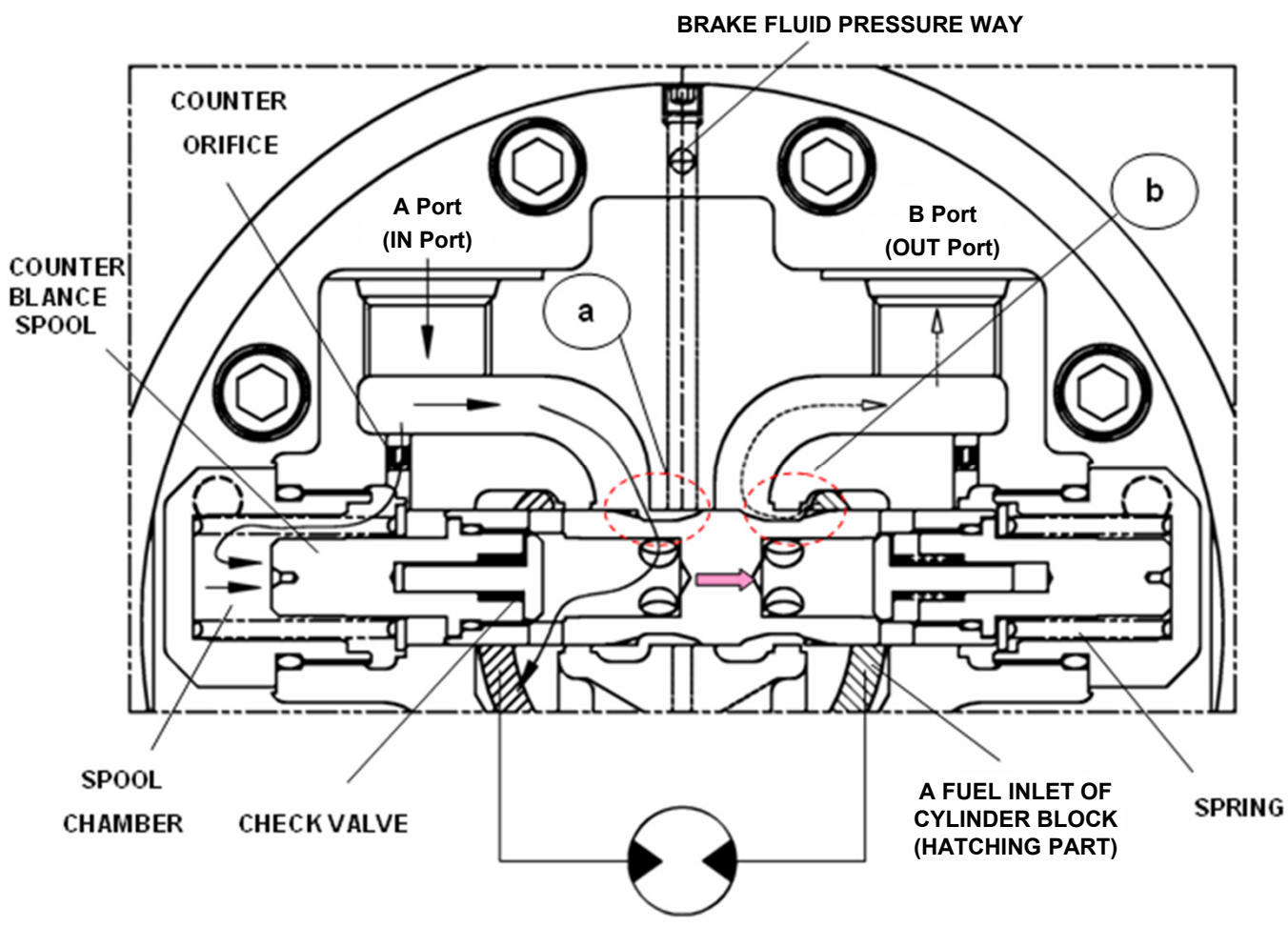


COUNTER BALANCE VALVE OF NEUTRALITY

- **HOW TO WORK**

1) Start

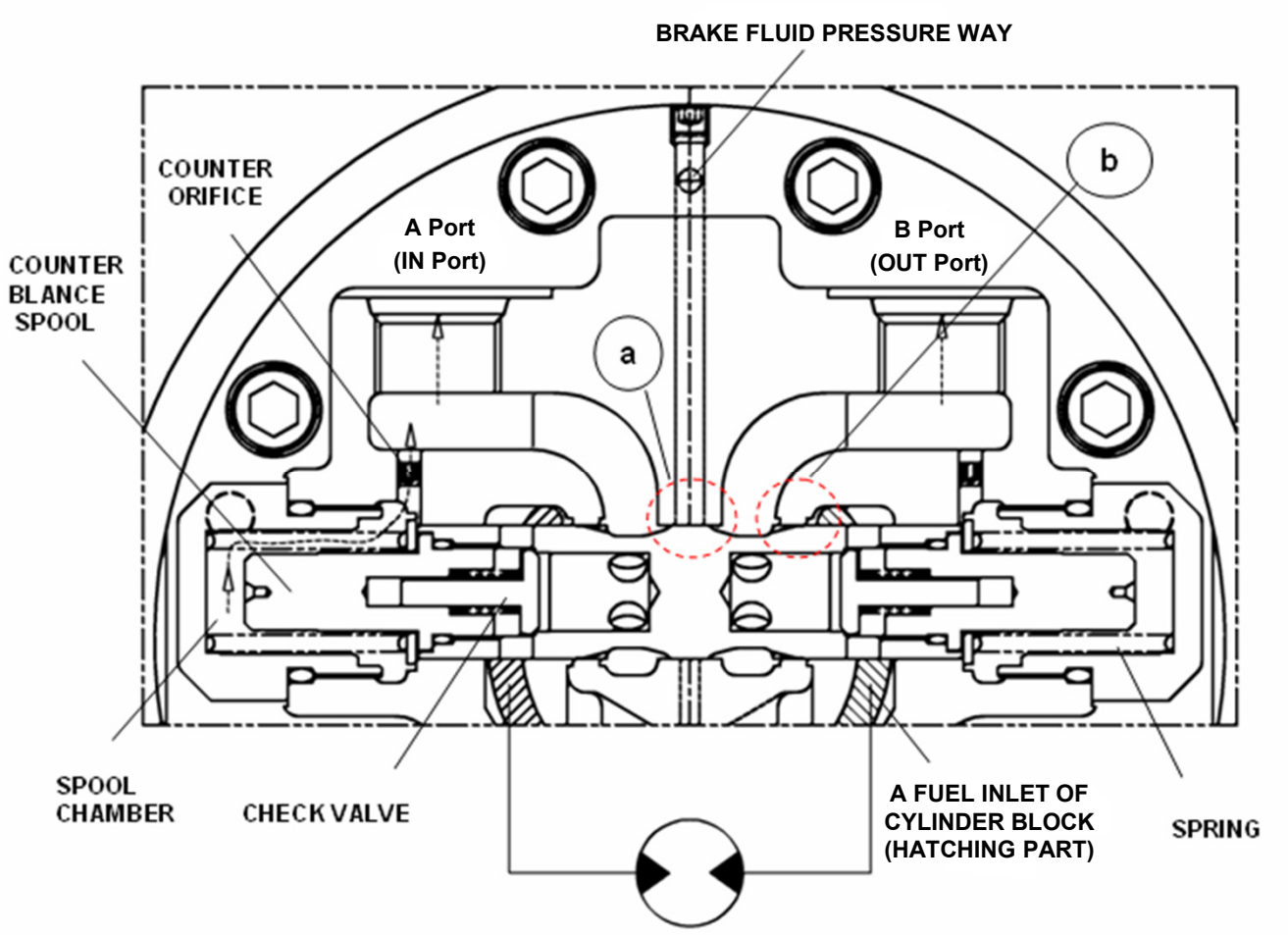
When operator moves a traveling control lever, pressurized oil flows from pump to motor inlet A, and passes into spool chamber through counter orifice, and hydraulic force moves counter balance spool to the right, it makes pump oil flow into cylinder block through check poppet and kidney port. At that time spool notch is opened and pump oil also go through line ⓐ and passes into parking brake chamber, and it releases parking brake. At the same time, return oil from cylinder block flows to outlet B through the line ⓑ.



2) stop

When operator moves a lever to neutral position, pump oil flow is blocked. It reduce oil pressure of supply line down to zero, and oil in the spool chamber moves back to oil tank through counter orifice by the return force of spring in opposite side, and then counter balance spool returns to neutral position.

As the counter balance spool moves to left, line ⓐ is blocked, parking brake line is connected to drain passage designed in the center of counter balance spool, and oil in the parking brake chamber return to tank, finally brake piston return to parking ON position.

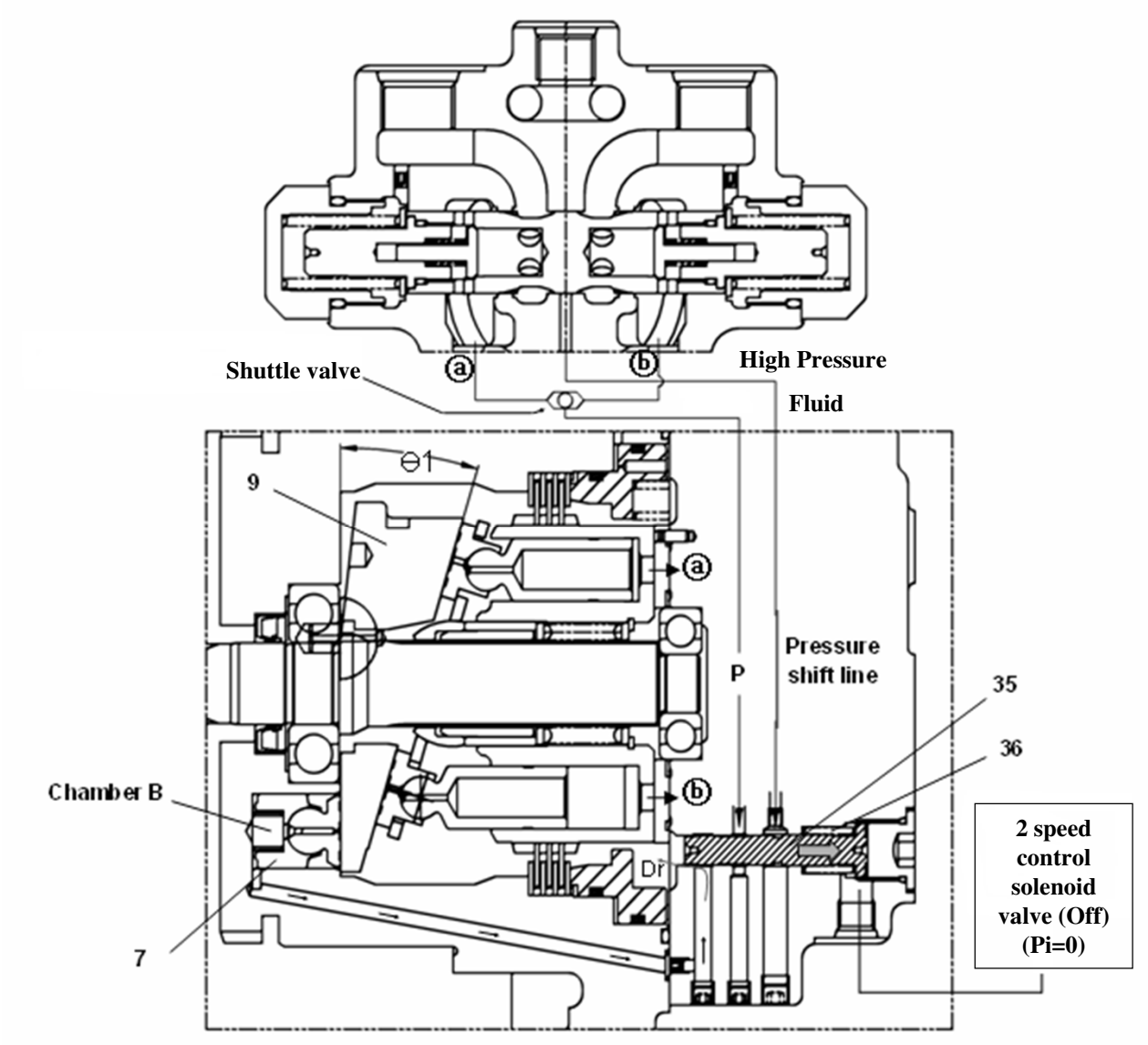


3-3- 5) Variable speed (low/high 2-stage speed) changeover

Rotating speed of the motor depends on slope angle of swash plate(9). Motor rotates slow when the angle is large, and rotates fast when the angle is small.

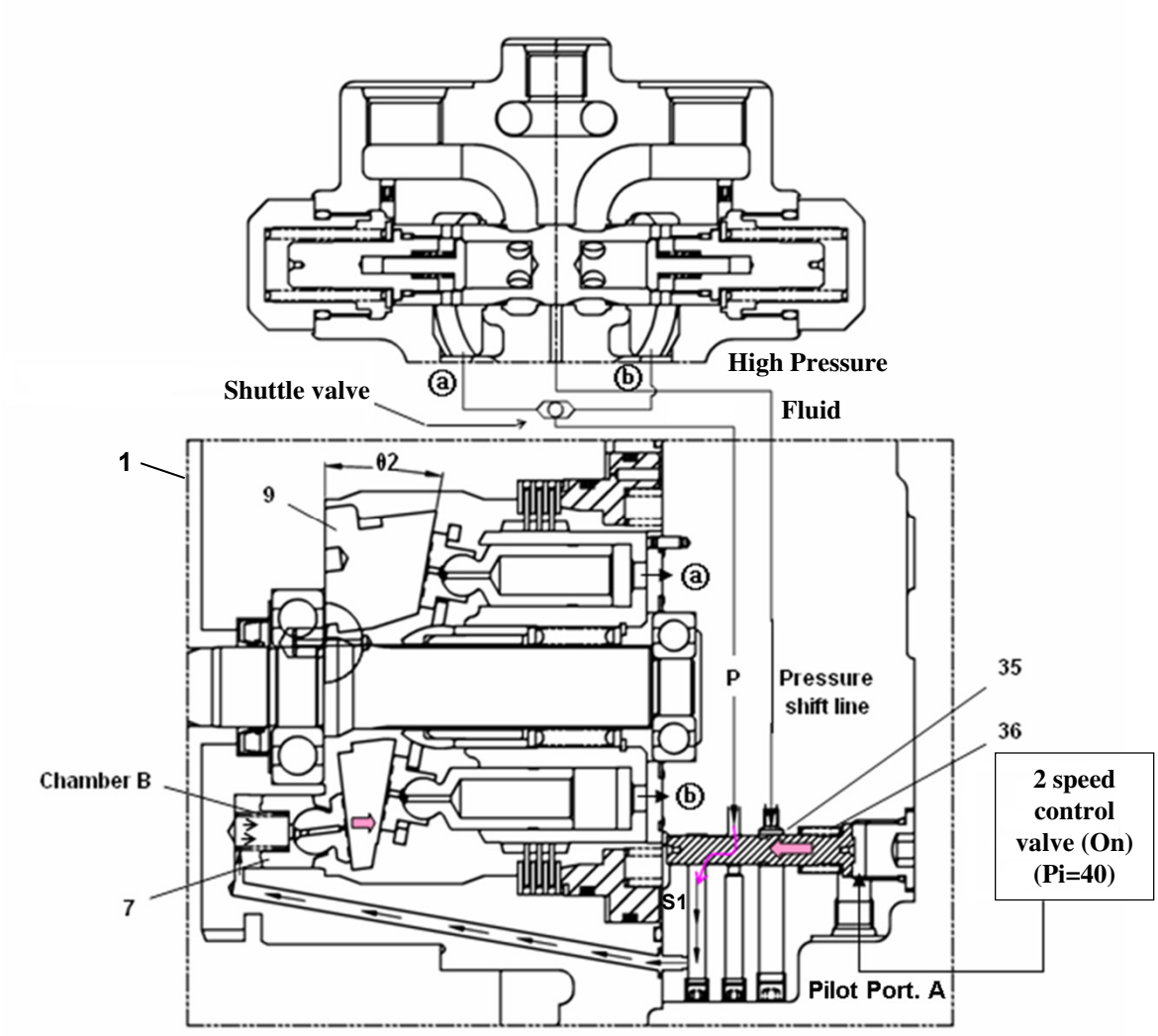
Low speed

When pilot pressure signal Pi=0, spool(35) is located at right side by the spring(36) force and chamber A is connected to casing drain through hole S1. At this spool position, swash plate(9) sustain large angle, and motor rotate at low speed.



High speed

When pilot pressure signal Pi is activated on spool(31), the spool moves to left hand end, and high pressure oil from Port ⓐ or ⓑ is transferred to S1 which is connected to chamber A. The high pressure transferred to chamber A lift the piston(5) up, then the swash plate(12) tilts to smaller angle, and the motor rotates higher speed.



4. USE PRECAUTIONS

• **CHECK**

Check up this list before set up the new motor.

1) Make sure that there is no breakage or missing components which causes while shipping

2) Check there is no loose at each contract part.

3) Check flange side and drain port cover are completely fabricated and there is no dust in motor

• **EXTERNAL LOAD OF SHAFT**

- In principle, shaft column of motor should not catch radial load or thrust load from outside.

• **HYDRAULIC OIL (HYDRAULIC FLUID)**

- the abrasion resistance of hydraulic oil of ISO VG32SK or VG46.

- Operating temperature range of oil and viscosity range.

OPERATING TEMPERATURE RANGE	-10~+80 ℃
VISCOSITY RANGE	15~500mm2/s

• **PARTICULAR ABOUT FILLTER**

When soil, particle of sand or metal powder mix with working oil, it quickens abrasion of moving side in motor and sometimes it causes sticking. Thus to prevent flowing of foreign substances, you should set up a 10 micron filter in oil hydraulic circuit.

※ **Recommend Oil: Grade of the NAS Oil below 8 classes and MILLPORE FILTER pollution**

• **SET UP AND PIPE ARRANGEMENT**

1) Disassemble the oil level port.

2) Tighten the oil level port of track gearbox.

3) Tighten bolt to the specified torque. (TRACK FRAME OF EXCAVATOR and SPROCKET)

4) There is always full of oil in the motor casing.

5) The pressure in the inside of Casing is normally less than 2kgf/cm2.

6) Wash the PIPE enough and do flushing.

7) Use the pipe thicker than motor drain port size for drain pipe and connect it as short as possible.

- **FULL OF OIL AND AIR EMISSION**

1) While driving, it must be full of oil with drain port in the casing.

There are moving types of components, such as, a bearing, piston, shoe and ball guide.

When it is not full of oil, it might causes breakage or sticking, so must be full of oil.

2)When there is an air in the oil pressure circuit or motor, it must be fully removed, because it might causes breaking or poor operation.

- **DRIVING PRECAUTIONS**

1)Check the PIPE is perfectly set up.

2) Please check the correct direction of rotation.

3) Check for leakage from all motor parts.

4) While driving, check the oil temperature which might rise abnormally in short time.

5) Check the pressure is under the set valve.

5. GLITCHES CAUSE AND AID

5.1 General Precautions

1) Before operations, consider abnormal conditions and try to find other causes except for a motor.

2) The abrasion can be generally caused by different substances mixed; so, while the operation of disassembly, caution that unnecessary substances are not added into it.

3) For the inner parts are accurately manufactured, handle with them carefully without damage.

5.2 The Process of Checking abnormalities of Hydraulic Motor

1) Please release a drain plug and check a working oil in a case.
If many chips and metallic dusts are added in the oil, there is a possibility that motor parts get worn out

2) Check the abnormal sounds.
Check whether the body of a motor makes the odd sounds or not.

3) Measuring the pressure of each part.
Before the operation of disassembly, check the abnormality by measuring the pressure of a circuit up to a hydraulic motor.

5.3 Glitches cause and aid

1) The motor does not rotate

SYMPTOMS	CAUSES	COUNTERMEASURES
The pressure of a motor does not increase.	• The oil is bypassed at Relief Valve.	- Fix or exchange Relief Valve.
	• Malfunction of relief valve. - Stick of plunger. - Malfunction of plunger seat part. - Cut of Spring	- Modify of stick part. - Disassembly, Clean. - Exchange a parts. - Exchange the relief valve.
	• The cracks happens at the inner path of Valve Casing.	- Exchange the check valve.
	• Abrasion and abnormality on the adhered surface of Check	- Fix or exchange the abnormal parts.
Although the pressure increases, a hydraulic motor does not rotate.	• Unmeasured external resistance.	- Exchange Friction Plate and Separated Plate.
	• Stick of Counter balance spool.	- Check of Counter balance spool
	• Do not become break off.	- Check and exchange the orifice(4). - Check of brake piston ring.
	• Stick of Brake piston.	- Disassembly and check
	• Stick of friction plate.	- Fix or exchange the abnormal parts.
	• Damage of traveling reduction gear	- Exchange the traveling reduction gear

2) Rotate very slow

SYMPTOMS	CAUSES	COUNTERMEASURES
Lack of the number of rotation	• Shortage of supplied oil.	- Check the oil circuit up to a motor.
	• Oil Temperature is too higher.	- Make the temperature down of the oil
	• Abnormal oil leakage	- Fix or exchange the abnormal parts.
	• Two speed is late. - Stick of swash piston	- Fix or exchange the abnormal parts.

3) To control or adjust a Brake is hard.

SYMPTOMS	CAUSES	COUNTERMEASURES
Brake Torque is low.	• Abrasion of Friction and Separated Plate.	- Fix or exchange the abnormal parts.
	• Damage of Brake Spring.	
	• Damage of brake piston.	

4) Shortage of rotating force at the standard value.

SYMPTOMS	CAUSES	COUNTERMEASURES
Brake is released ,but the turning force is low.	• Excavator main relief valve is not set correctly.	- Resetting the main relief valve.
	• Pressure down of motor relief valve	- Resetting the relief valve pressure. - Exchange the relief valve.
	• Malfunction of check valve.	- Exchange the check valve.
	• Scratch of valve plate.	- Fix or exchange the abnormal parts.

5) Many Slip

SYMPTOMS	CAUSES	COUNTERMEASURES
Brake is released ,but the turning force is week.	• Malfunction of Relief valve	- Fix or exchange the abnormal parts.
	• Check valve error.	
	• Stick of Counter balance spool.	
	• Valve Plate Scratch / Copper peeling phenomena	

6) It is not two speed changeover.

SYMPTOMS	CAUSES	COUNTERMEASURES
It is not variable speed (low/high 2-stage speed) changeover	• Pilot Line error	-Fix or exchange the abnormal parts.
	• Two speed changeover spool stick	
	• Swash piston stick	

7) Oil leakage.

SYMPTOMS	CAUSES	COUNTERMEASURES
Leakage at Oil Seal	• Drain pressure is high.	- Remove the abnormal substances after exchanging the damaged part.
	• Seal error.	- Check a drain line of an equip.
Leakage on a assembled surface	• Damage of a O-ring	- Exchange O-ring.
	• BOLT or Plug is released.	- Tighten the parts with fixed Torque.