SECTION 2 STRUCTURE AND FUNCTION

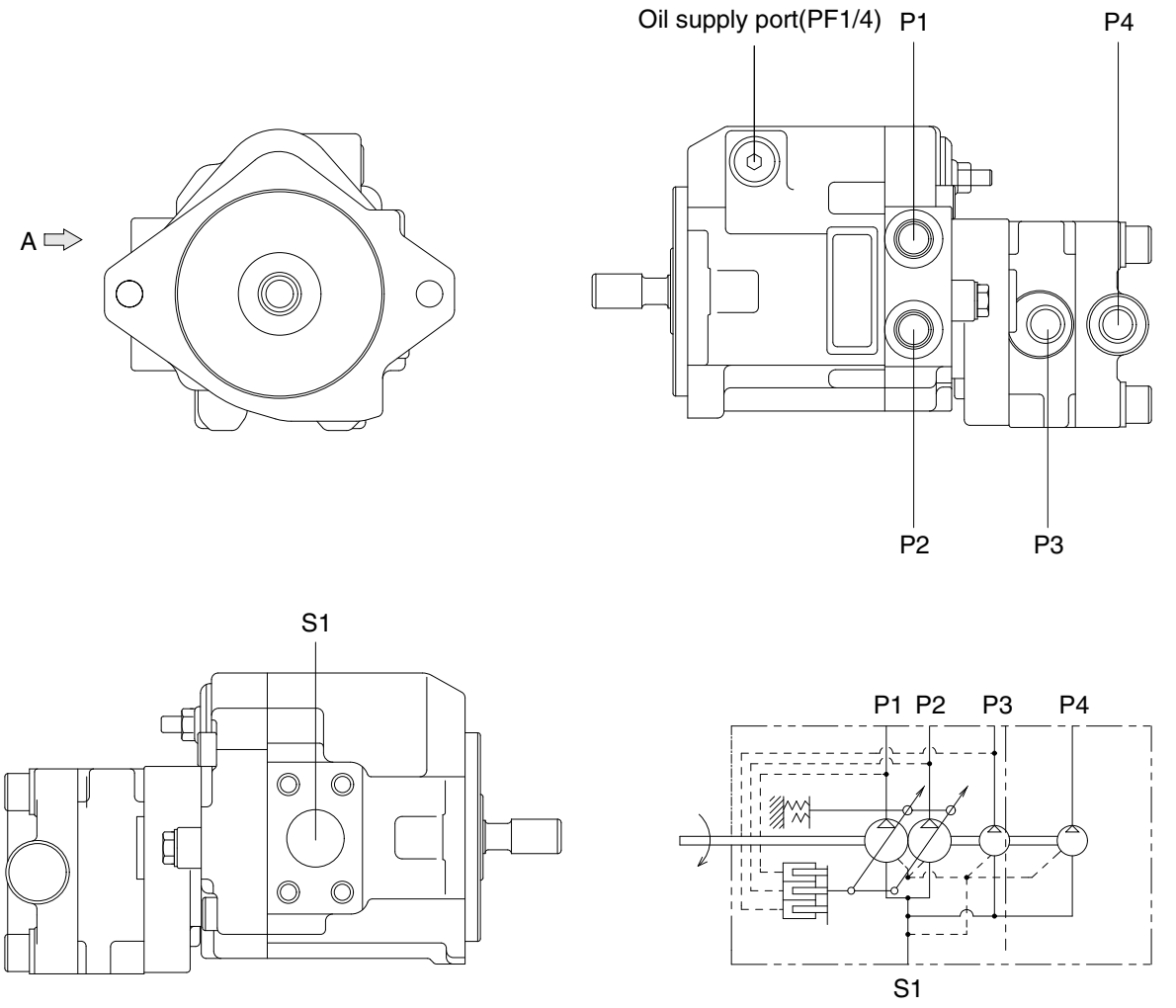
GROUP 1 HYDRAULIC PUMP

1. GENERAL

This is a variable displacement double-piston pump for discharge with equal displacements from one cylinder block. This pump is so compact as to appear a single pump though this is actually a double pump.

Because this pump has one swash plate, the tilting angle is the same for two pumps. Tilting of the pump changes in response to the total pressure of P1 + P2. Namely, the output is controlled to the constant value so that the relationship between the discharge pressure and flow rate Q becomes constant, (P1 + P2) * Q =Constant.

The third pump and pilot pump can be connected to the same shaft via a coupling.

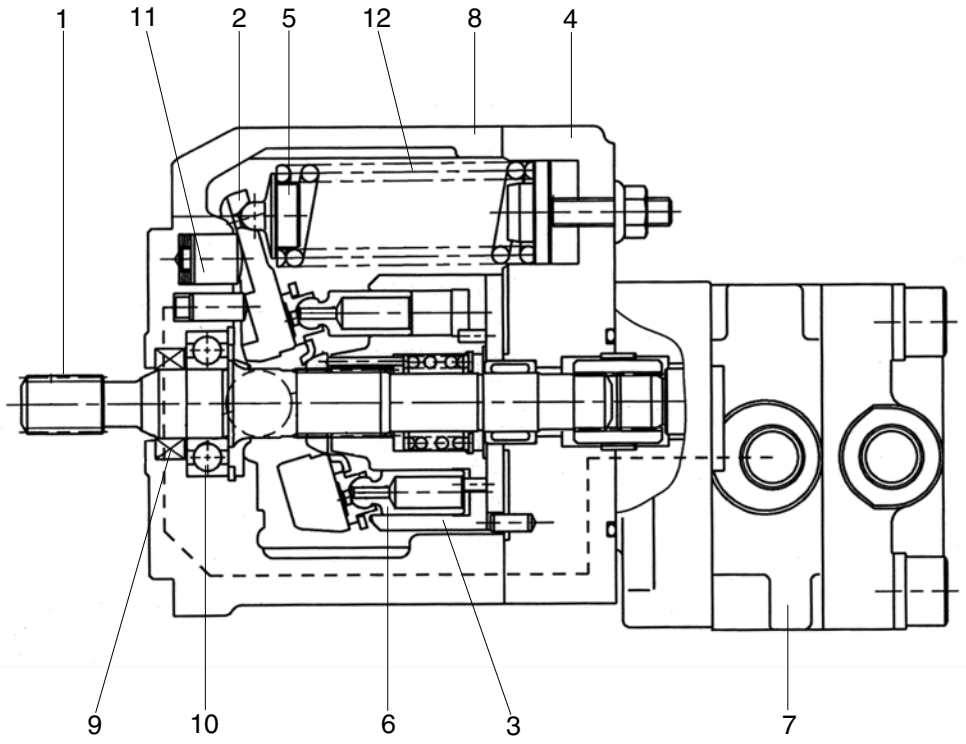


17Z9A2MP01

Description of the ports

Port	Port name	Port size
S1	Suction port	SAE 1
A1, A2, A3, A4	Discharge port	PF 3/8

2. MAJOR COMPONENTS AND FUNCTIONS



17Z9A2MP02

1	Drive shaft assembly	7	Gear pump
2	Swash plate assembly	8	Body
3	Cylinder barrel	9	Oil seal
4	Port plate assembly	10	Bearing
5	Spring holder assembly	11	Stopper pin assembly
6	Piston	12	Spring

This is a variable displacement double-piston pump for discharge with two equal displacements from one cylinder block. Because this is one cylinder barrel, there is only one suction port.

The oil is divided into two equal flows by the control plate in the cover and directed to two discharge ports provided in the cover.

The discharge pressure directed to the piston tilts the hanger by overcoming the spring force.

Since the piston stroke changes according to the tilting angle of the hanger, the flow can be changed.

The simultaneous tilting angle constant-output control method is employed.

The pilot pump can be connected to the same shaft via a coupling.

1) PRINCIPLE OF OPERATION

(1) Function of pump

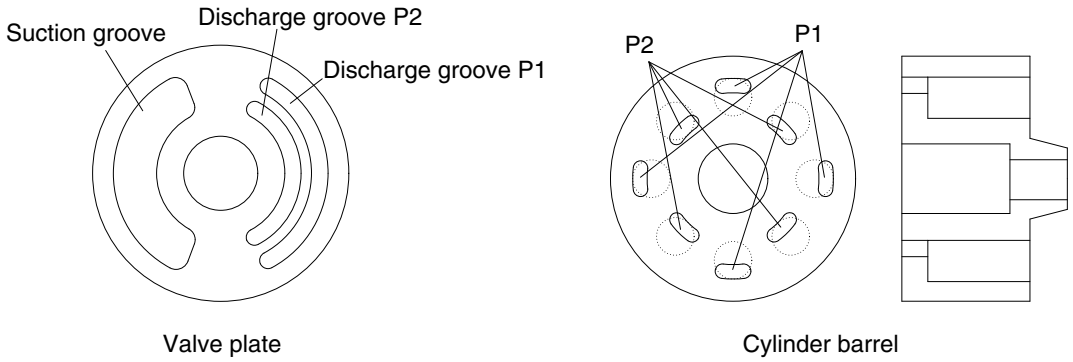


Figure 1 Working principle of PVD pump

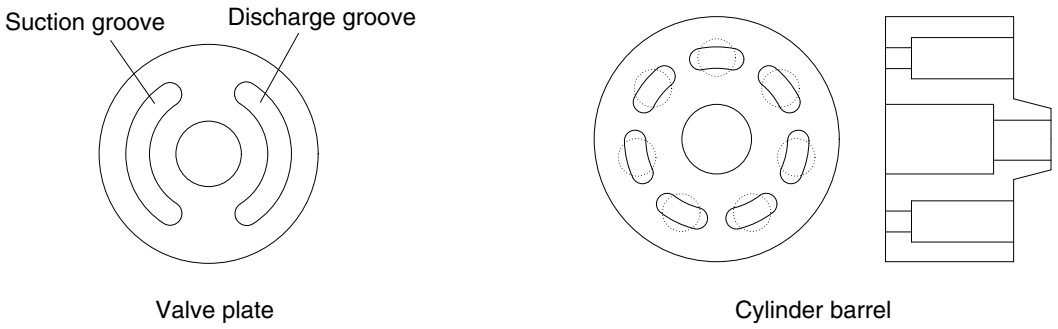


Figure 2 Working principle of Conventional type

R17Z9A2MP05

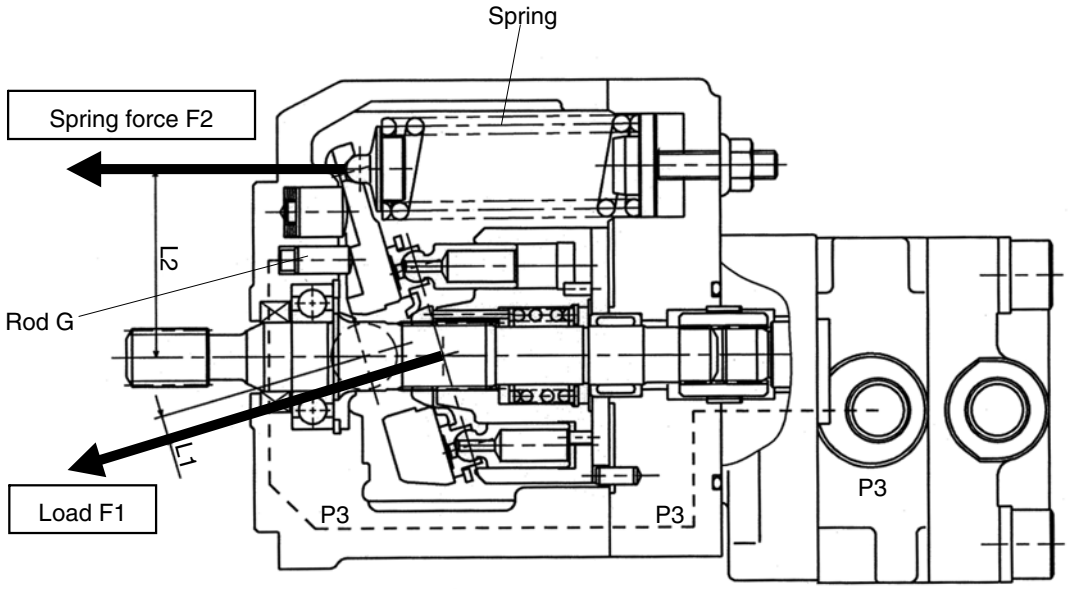
This pump adopts a new method using even numbered pistons to make functions of two same volume pumps available in one casing of a swash plate type variable volume piston pump.

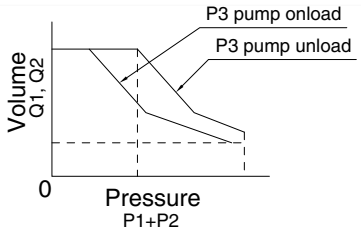
Conventional valve plate has one suction groove and one discharge groove respectively as shown in figure 2. But this method adopts one common suction groove and two discharge grooves on the outer side (P1) and the inner side (P2) as shown in figure 1, the piston room in the cylinder barrel opens to either the outer side (P1) or the inner side (P2) discharge groove of the valve plate alternately, and the discharges are performed independently on the inner side and the outer side.

Since this model has even numbered pistons, same No of pistons open to the outer side and the inner side of the valve plate. All pistons are of same swash plate, so the discharges from the outer side (P1) and the inner side (P2) are equal.

Also, since only one swash plate is used, the discharges from P1 and P2 ports changes equally when the swash plate angle of rake changes in variable controls. So, there is no difference between the two discharges.

2) CONTROL FUNCTIONS





P-Q characteristic

17Z9A2MP04

(1) Constant horse power variable structure

The pump output flow rate is variable depending on an angle of the swash plate which is controlled according to the pump output pressure. This control enables the pump consumption horse power to be sustained at the maximum. The tilt point of the swash plate is the balls located behind the swash plate. The load F1 from the pistons is in the direction shown in the illustration and generates a clockwise moment against the swash plate. Against this force the spring (force F2) is located in the opposite direction to keep the horse power constant and set at the appointed load. As the pressure increases, the above clockwise moment increases, and when it overcomes the counter-clockwise moment created by the spring force, the spring is sagged and the swash plate angle gets smaller. Then the output flow rate is reduced to keep the horse power constant.
This prevents engine stall and the engine horse power can be utilized at the maximum.

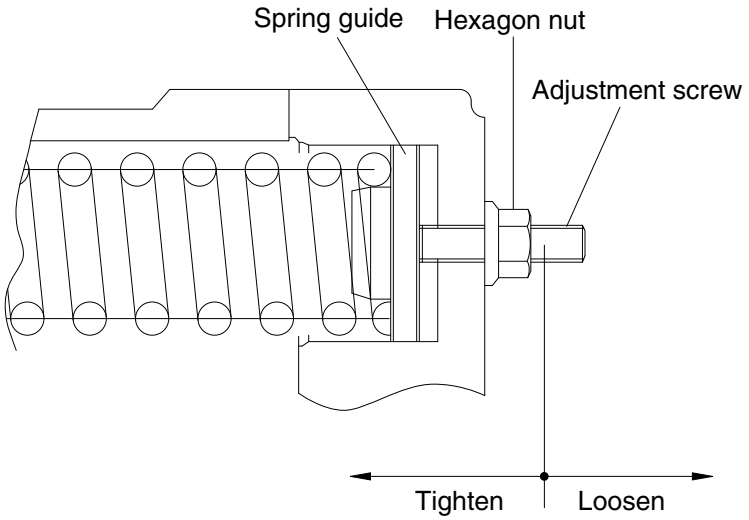
(2) Power shift mode (Reduced horse power control by P3 pressure)

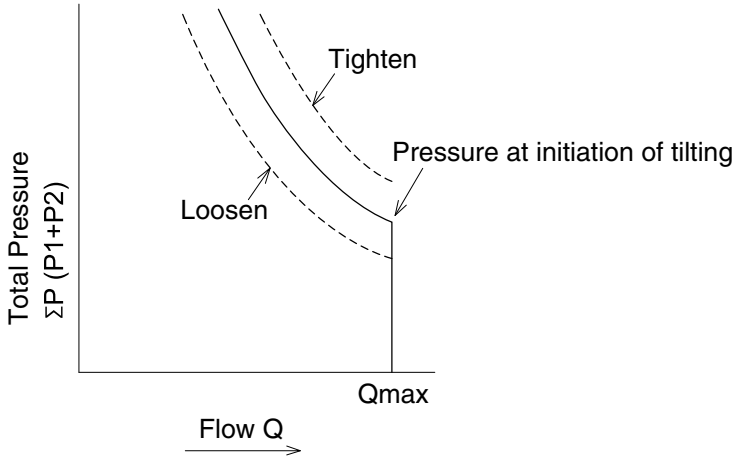
This control keeps the maximum value of the pump consumption horse power including the third pump (gear pump) constant. When the P3 (gear pump) pressure acts on the rod G, a clockwise moment proportion to the pressure acts on the swash plate and the P-Q characteristic shifts so that the total pump consumption horse power including the gear pump horse power is kept constant.

3) CONTROL / ADJUSTMENT PROCEDURE

(1) Loosen the hexagonal nut.

(2) Tighten or loosen the adjusting screw to set the power shifting line.

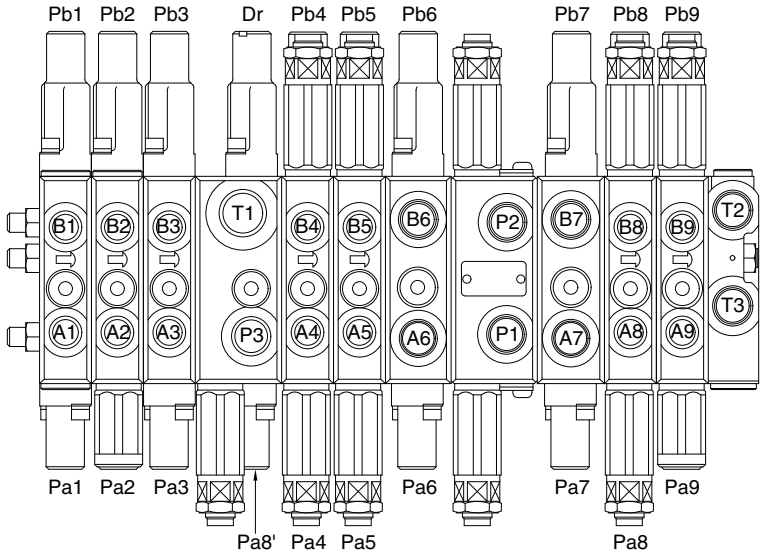


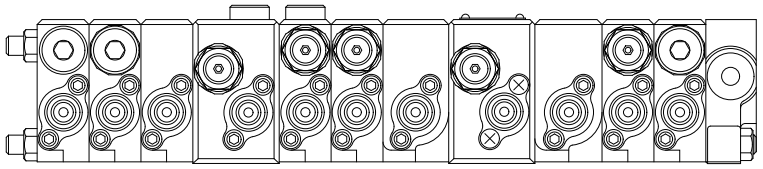


17Z9A2MP07

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE



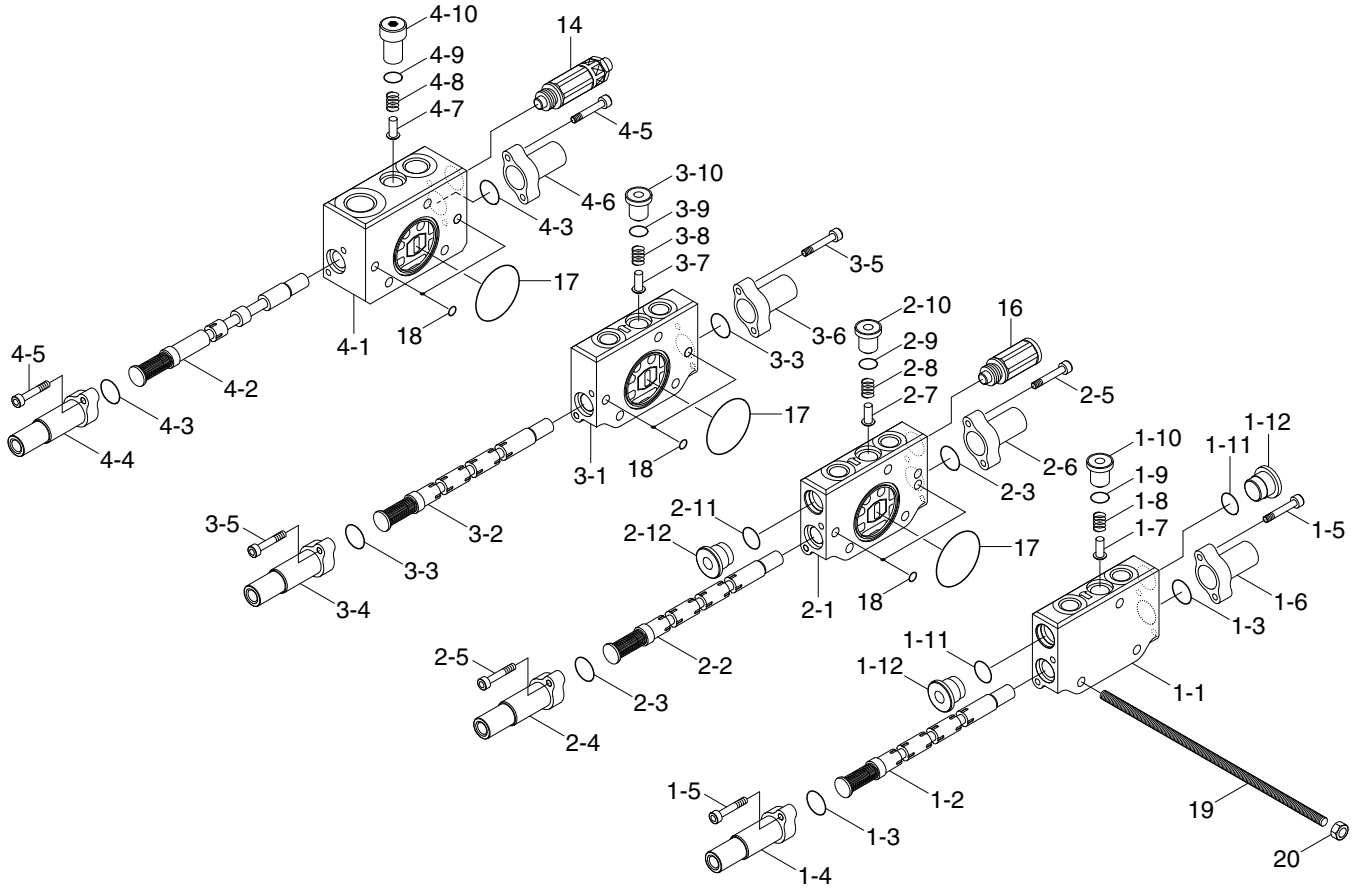


17Z9A2MC01

Mark	Port name	Port size	Tightening torque
T1	Tank return port	PF 1/2	6~7 kgf · m
A6	Travel [RH/RR] port	PF 3/8	4.0~5.0 kgf · m
B6	Travel [RH/FW] port		
A7	Travel [LH/RR] port		
B7	Travel [LH/FW] port		
P1	P1 (A1) pump port		
P2	P2 (A2) pump port		
P3	P3 (A3) pump port		
T2	Tank return port		
T3	Tank return port		
A1	Dozer	PF 1/4	2.5~3.0 kgf · m
B1	Dozer		
A2	Boom swing (RH) port		
B2	Boom swing (LH) port		
A3	Swing (LH) port		
B3	Swing (RH) port		
A4	Option port		
B4	Option port		
A5	Arm out port		
B5	Arm in port		
A8	Boom up port		

Mark	Port name	Port size	Tightening torque
B8	Boom down port	PF 1/4	2.5~3.0 kgf · m
A9	Bucket out port		
B9	Bucket in port		
Pa1	Dozer down pilot port	PF 1/8	1.0~1.5 kgf · m
Pb1	Dozer up pilot port		
Pa2	Boom swing (RH) pilot port		
Pb2	Boom swing (LH) pilot port		
Pa3	Swing (RH) pilot port		
Pb3	Swing (LH) pilot port		
Pa5	Arm out pilot port		
Pb5	Arm in pilot port		
Pa6	Travel [RH/RR] pilot port		
Pb6	Travel [RH/FW] pilot port		
Pa7	Travel [LH/RR] pilot port		
Pb7	Travel [LH/FW] pilot port		
Pa8	Boom up pilot port		
Pb8	Boom down pilot port		
Pa9	Bucket out pilot port		
Pb9	Bucket in pilot port		
Pa8'	Boom connecting pilot port		
Dr	Travel drain port		

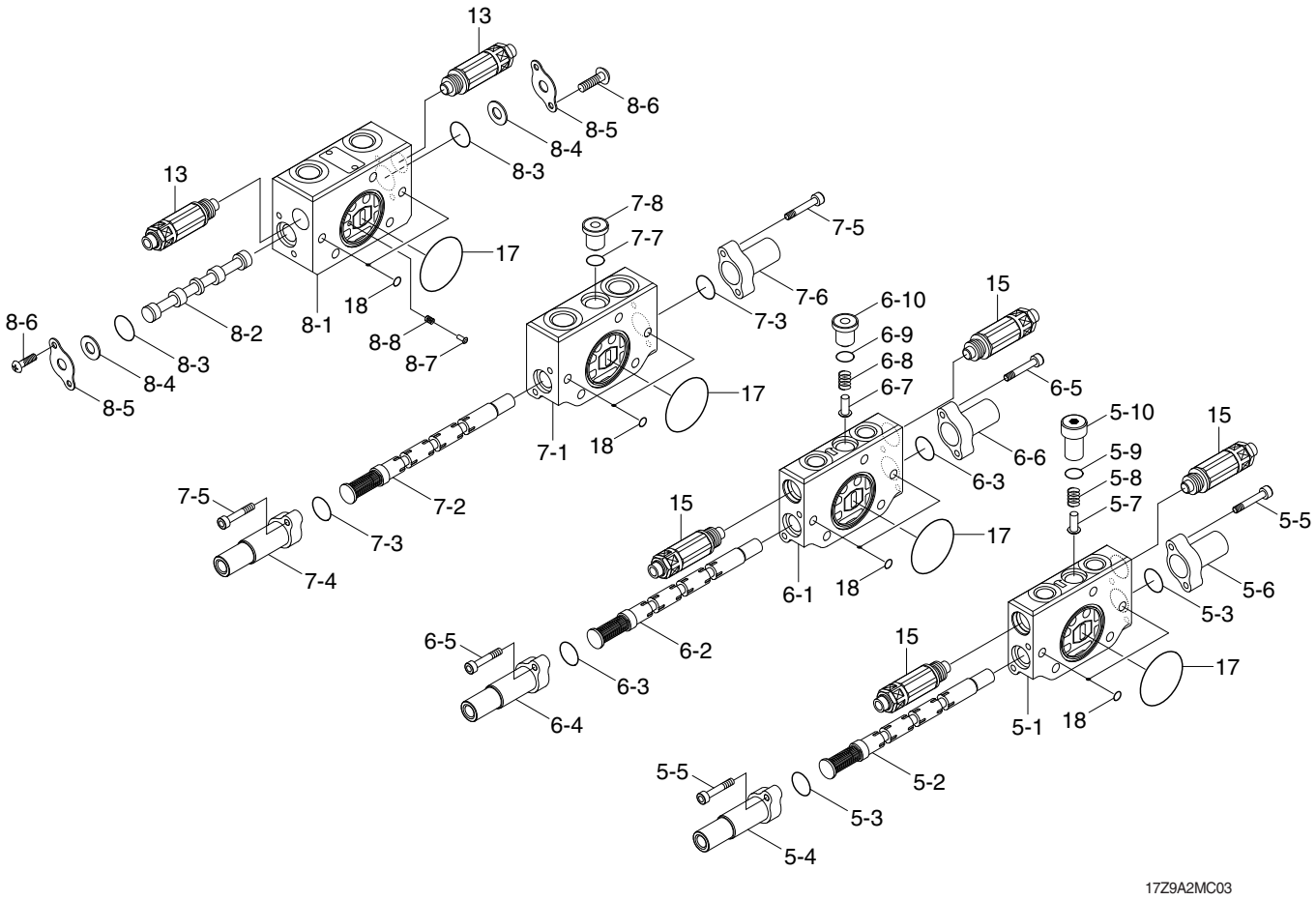
2. STRUCTURE (1/3)



17Z9A2MC02

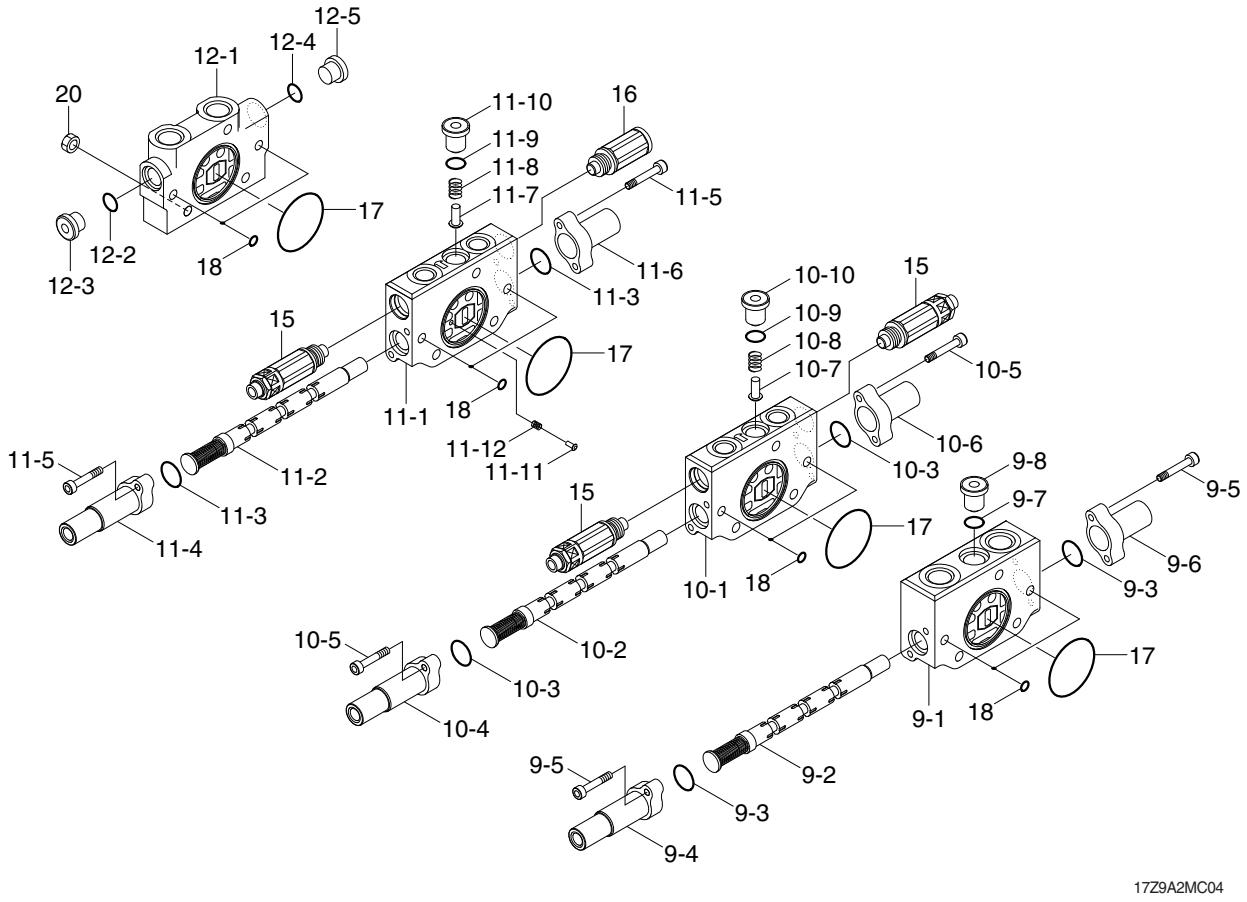
1	Dozer work body	2-5	Bolt	3-10	Plug
1-1	Work body	2-6	Pilot cover	4	Connecting body
1-2	Spool assy	2-7	Poppet	4-1	Work body
1-3	O-ring	2-8	Spring	4-2	Spool assy
1-4	Pilot cover	2-9	O-ring	4-3	O-ring
1-5	Bolt	2-10	Plug	4-4	Pilot cover
1-6	Pilot cover	2-11	O-ring	4-5	Bolt
1-7	Poppet	2-12	Plug	4-6	Pilot cover
1-8	Spring	3	Swing work body	4-7	Poppet
1-9	O-ring	3-1	Work body	4-8	Spring
1-10	Plug	3-2	Spool assy	4-9	O-ring
1-11	O-ring	3-3	O-ring	4-10	Plug
1-12	Plug	3-4	Cover	14	Relief valve
2	Boom swing work body	3-5	Bolt	16	Anticavitation valve
2-1	Work body	3-6	Pilot cover	17	O-ring
2-2	Spool assy	3-7	Poppet	18	O-ring
2-3	O-ring	3-8	Spring	19	Tie bolt
2-4	Pilot cover	3-9	O-ring	20	Hex nut

STRUCTURE (2/3)



5	PTO work body	6-4	Pilot cover	7-8	Plug
5-1	Work body	6-5	Bolt	8	Inlet work body
5-2	Spool assy	6-6	Pilot cover	8-1	Work body
5-3	O-ring	6-7	Poppet	8-2	Spool assy
5-4	Pilot cover	6-8	Poppet	8-3	O-ring
5-5	Bolt	6-9	O-ring	8-4	Plate
5-6	Pilot cover	6-10	Plug	8-5	Plate
5-7	Poppet	7	Travel work body	8-6	Screw
5-8	Spring	7-1	Work body	8-7	Poppet
5-9	O-ring	7-2	Spool assy	8-8	Spring
5-10	Plug	7-3	O-ring	13	Relief valve
6	Arm work body	7-4	Pilot cover	15	Overload relief valve
6-1	Work body	7-5	Bolt	17	O-ring
6-2	Spool assy	7-6	Pilot cover	18	O-ring
6-3	O-ring	7-7	O-ring		

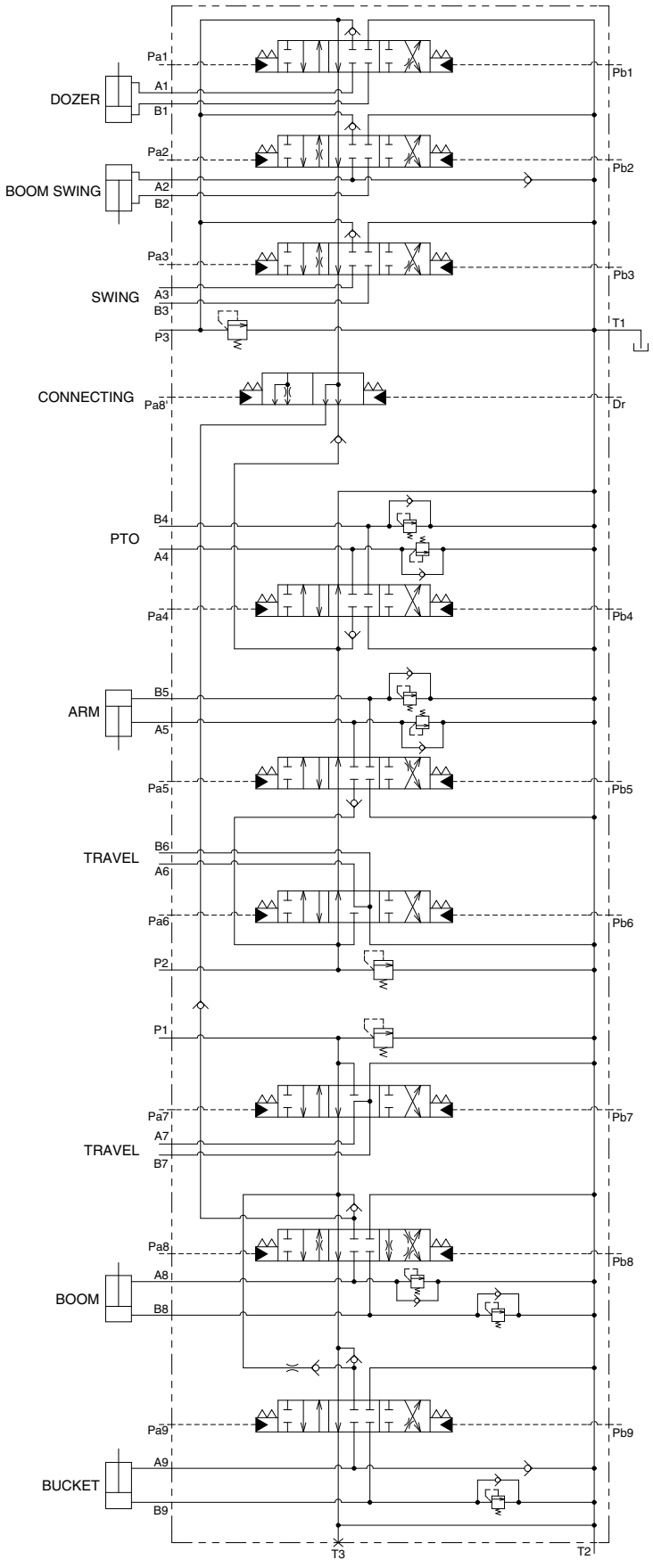
STRUCTURE (3/3)



17Z9A2MC04

9	Travel work body	10-6	Pilot cover	11-10	Plug
9-1	Work body	10-7	Poppet	11-11	Poppet
9-2	Spool assy	10-8	Spring	11-12	Spring
9-3	O-ring	10-9	O-ring	12	Outlet work body
9-4	Pilot cover	10-10	Plug	12-1	Work body
9-5	Bolt	11	Bucket work body	12-2	O-ring
9-6	Pilot cover	11-1	Work body	12-3	Plug
9-7	O-ring	11-2	Spool assy	12-4	O-ring
9-8	Plug	11-3	O-ring	12-5	Plug
10	Boom work body	11-4	Pilot cover	15	Overload relief valve
10-1	Work body	11-5	Bolt	16	Anticavitation valve
10-2	Spool assy	11-6	Pilot cover	17	O-ring
10-3	O-ring	11-7	Poppet	18	O-ring
10-4	Pilot cover	11-8	Spring	20	Hex nut
10-5	Bolt	11-9	O-ring		

3. HYDRAULIC CIRCUIT



17Z9A2MC05

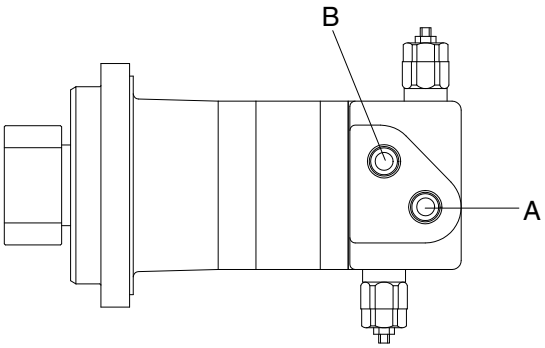
GROUP 3 SWING DEVICE

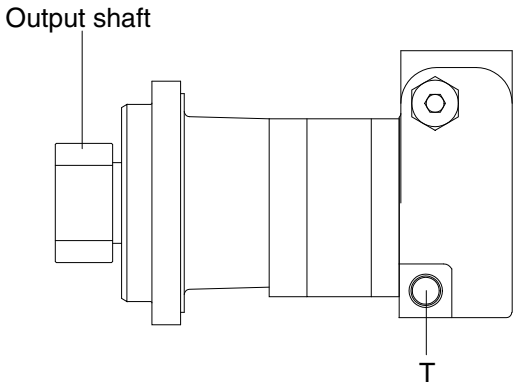
1. STRUCTURE

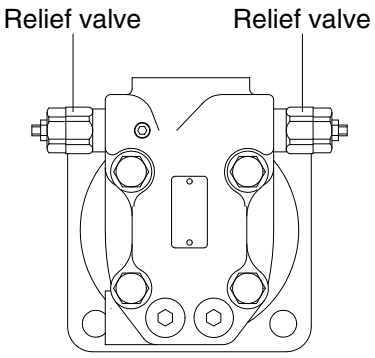
Swing device consists swing motor and swing reduction gear.

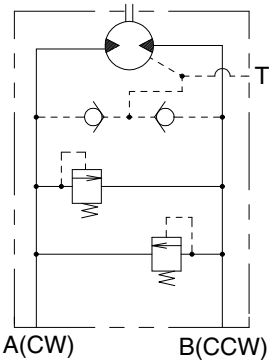
1) SWING MOTOR

Swing motor include mechanical relief valve, make up valve and check valve.







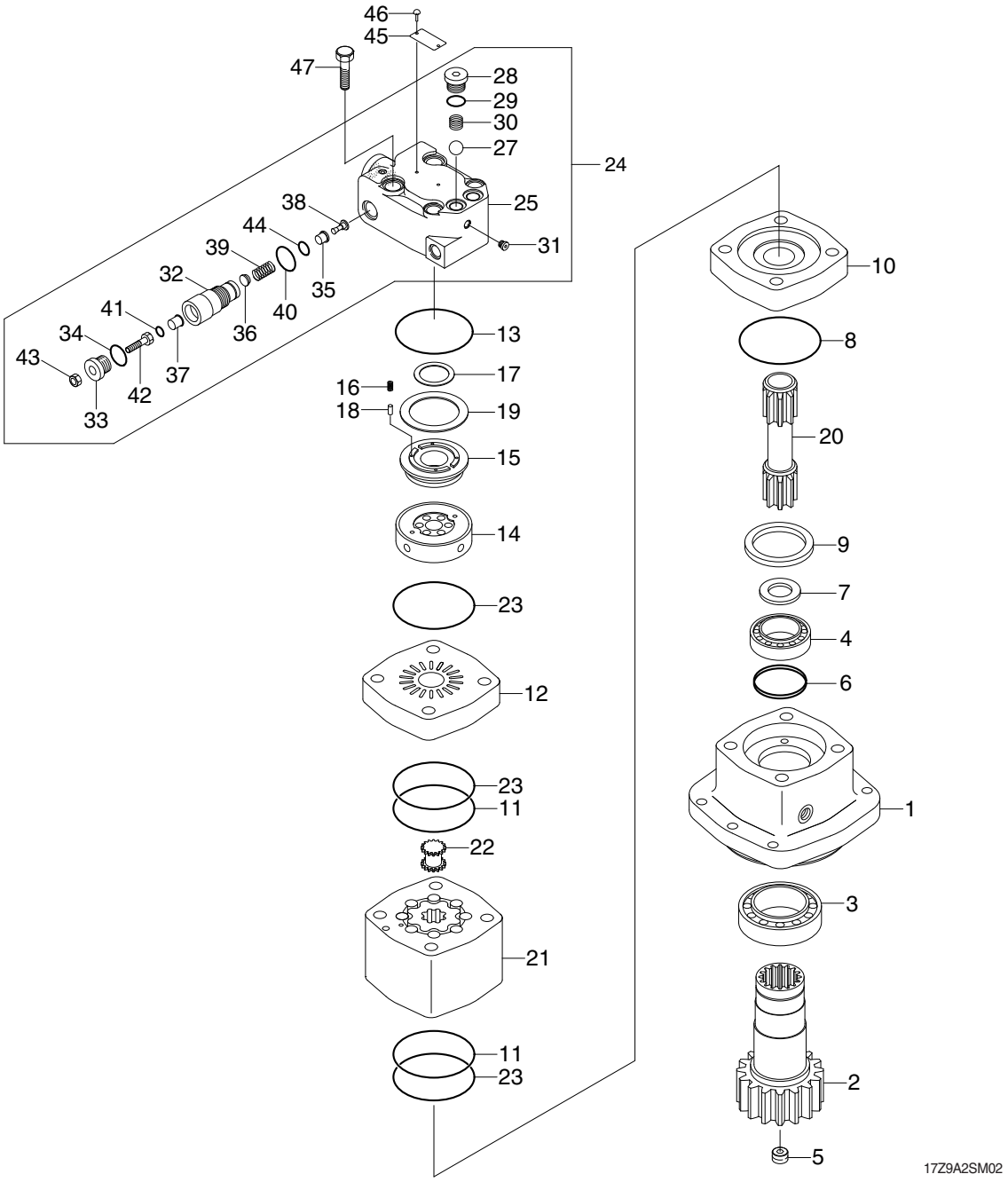


HYDRAULIC CIRCUIT

17Z9A2SM01

Port	Port name	Port size
A	Main port	PF 3/8
B	Main port	PF 3/8
T	Drain port	PF 3/8

2) COMPONENTS

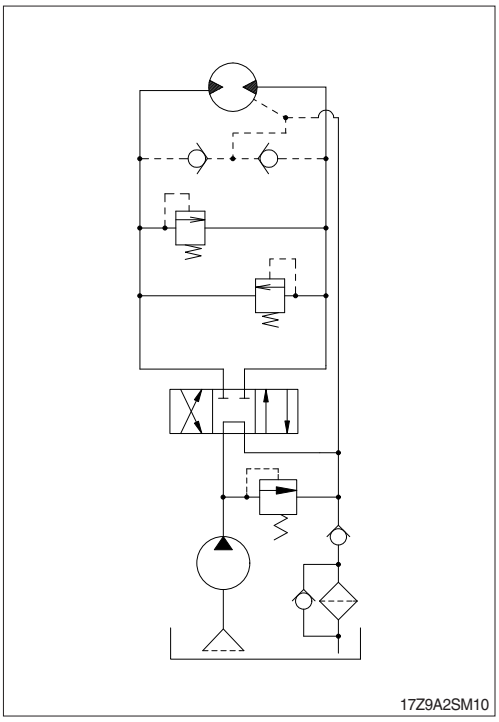


1	Bearing housing	13	O-ring	25	Valve housing	37	Spring push
2	Pinion gear	14	Valve	26	Relief cartridge	38	Orifice plate
3	Ball bearing	15	Balancing ring	27	Steel ball	39	Spring
4	Ball bearing	16	Spring	28	Plug	40	O-ring
5	Plug	17	Inner face seal	29	O-ring	41	O-ring
6	X-ring	18	Pin	30	Spring	42	Hexagon socket set screw
7	Retaining ring	19	Outer face seal	31	Plug	43	Hexagon nut
8	O-ring	20	Drive	32	Cartridge	44	O-ring
9	Shaft face seal	21	Gerotor	33	Screw guide	45	Name plate
10	Wear plate	22	Valve drive	34	O-ring	46	Rivet
11	O-ring	23	O-ring	35	Needle valve	47	Hexagon bolt
12	Valve plate	24	Valve housing assy	36	Spring seat		

2. OPERATION

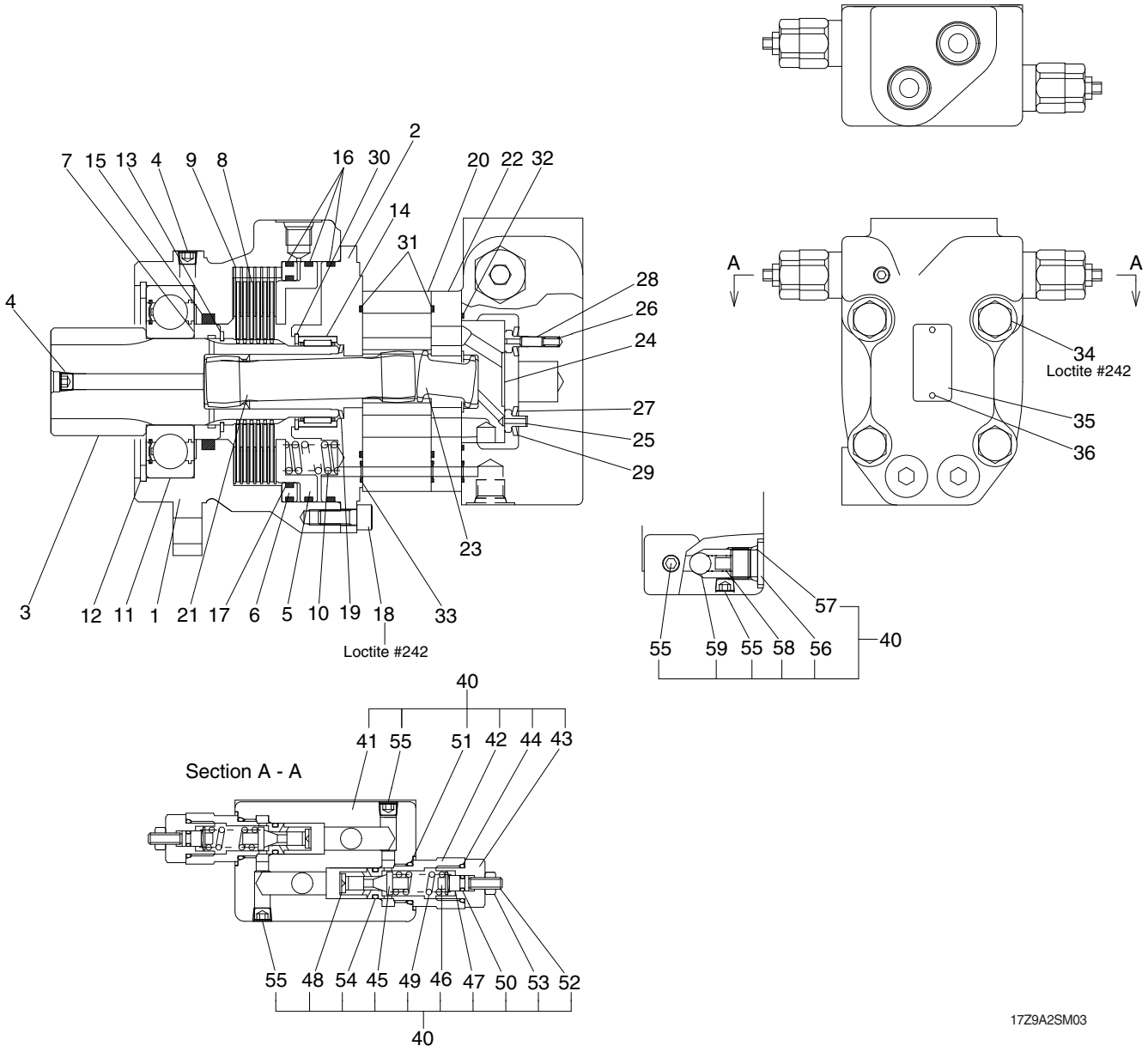
1) PREVENTION OF CAVITATION

When a load with great inertia is stopped suddenly or a motor is turned by an external load, cavitation may be generated. In order to prevent cavitation, sufficient boost pressure must be applied to the suction side of the hydraulic motor. The boost pressure changes according to the motor speed and the viscosity of hydraulic oil, so apply pressure exceeding the specified boost pressure.



2. SWING MOTOR WITH PARKING BRAKE

1) STRUCTURE



1	Bearing housing	15	X-ring	29	Outer face seal	46,47	Spring seat
2	Flange mounting	16,17	O-ring	30	Snap ring	48	Orifice plug
3	Pinion gear	18	Cap screw	31,32	O-ring	49	Spring
4	Plug	19	Shaft face seal	33	O-ring	50	O-ring
5	Piston	20	Geroler	34	Bolt	51	O-ring
6	Ring	21	Drive	35	Name plate	52	Hexagon screw
7	Collar	22	Valve plate	36	Rivet	53	Hexagon nut
8	Friction disk	23	Valve drive	40	Valve housing assy	54	O-ring
9	Center plate	24	Valve	41	Valve housing	55	Plug
10	Spring	25	Balancing ring	42	Cartridge	56	Plug
11	Front bearing	26	Spring	43	Screw guide	57	O-ring
12,13	Snap ring	27	Inner face seal	44	O-ring	58	Spring
14	Rear bearing	28	Pin	45	Needle valve	59	Ball

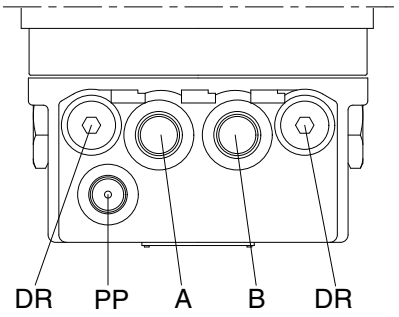
GROUP 4 TRAVEL DEVICE

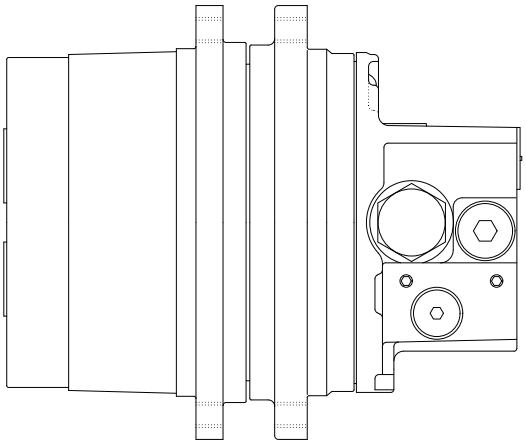
1. CONSTRUCTION

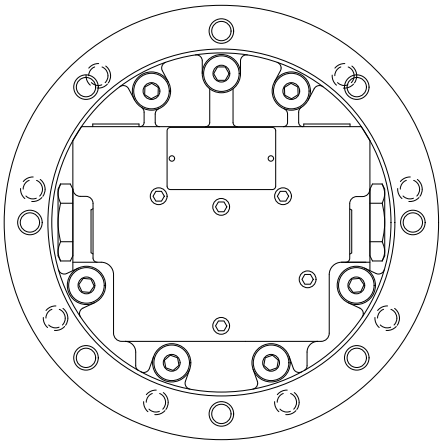
Travel device consists travel motor and gear box.

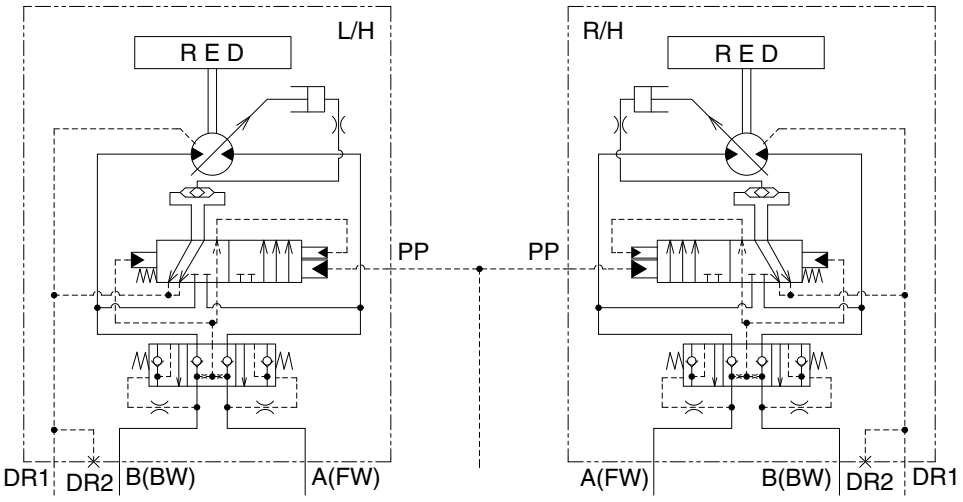
Travel motor includes counterbalance valve, parking brake and high/low speed changeover mechanism.

Port	Port name	Port size
A	Main port	PF 3/8
B	Main port	PF 3/8
DR1, DR2	Drain port	PF 1/4
PP	2 speed control port	PF 1/4





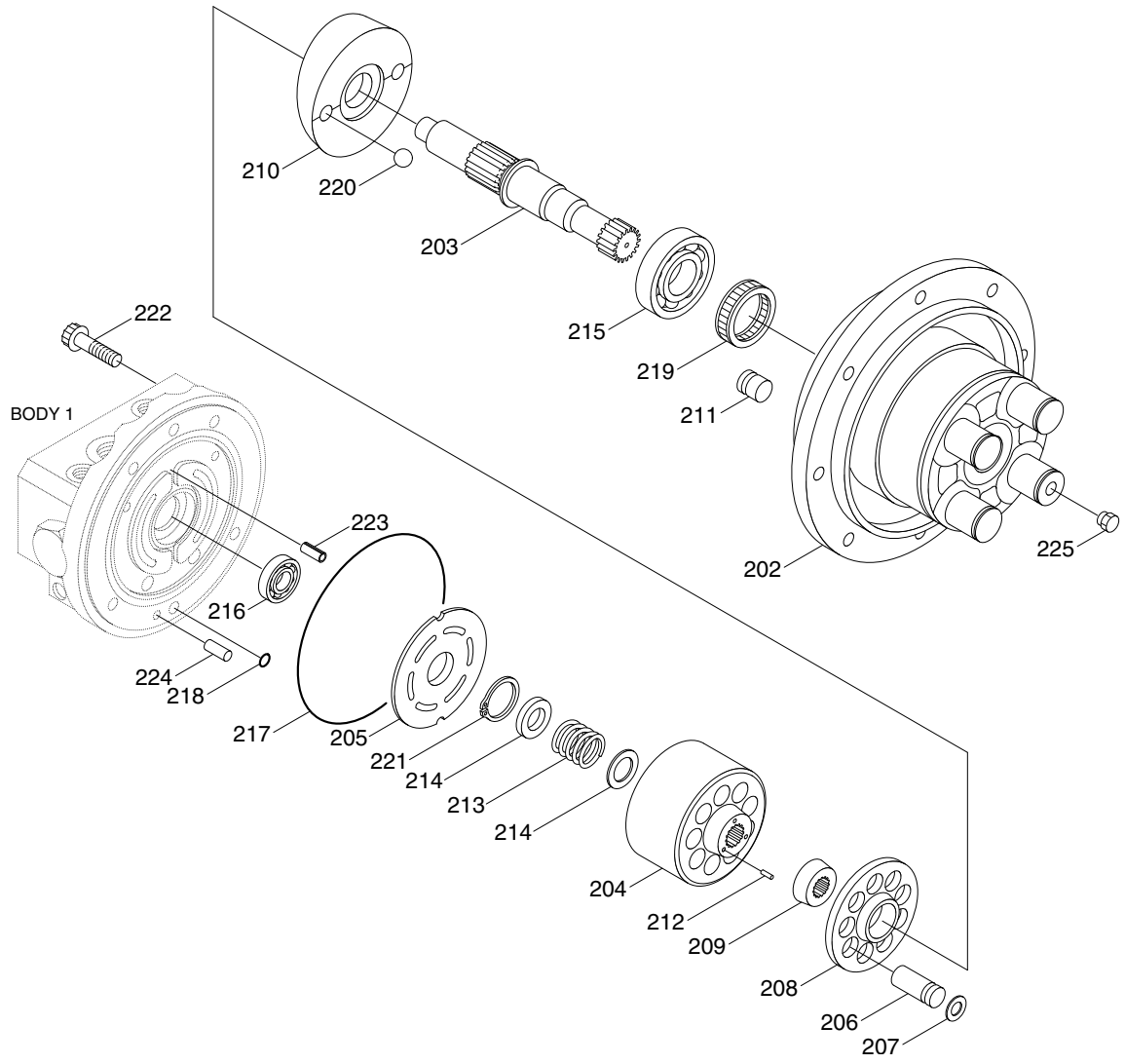




HYDRAULIC CIRCUIT

17Z9A2TM01

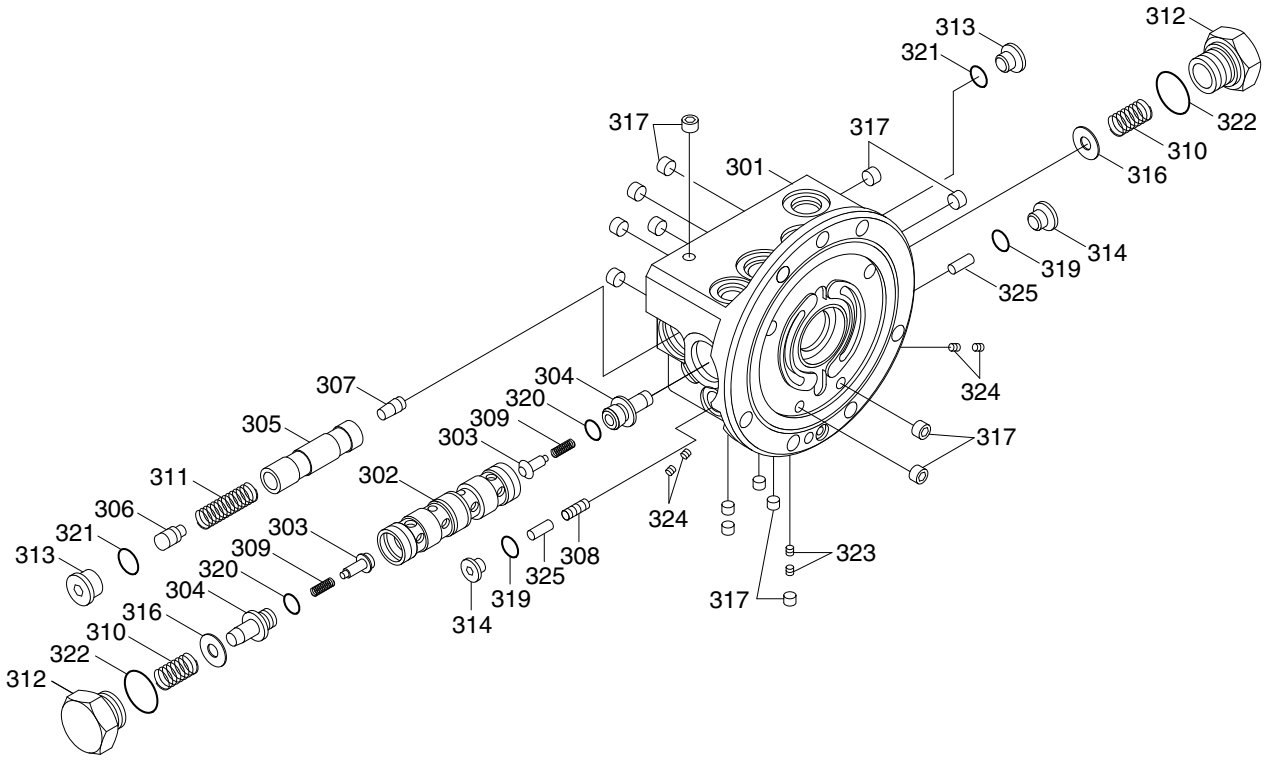
2) STRUCTURE (1/3)



1692TM02

202	Body 2	210	Swash plate	218	O-ring
203	Shaft	211	Control piston	219	Oil seal
204	Cylinder barrel	212	Pin	220	Ball
205	Valve plate	213	Spring C	221	Snap ring
206	Piston	214	Retainer	222	Screw
207	Shoe	215	Bearing	223	Spring pin
208	Shoe holder	216	Bearing	224	Pin
209	Barrel holder	217	O-ring	225	Plug

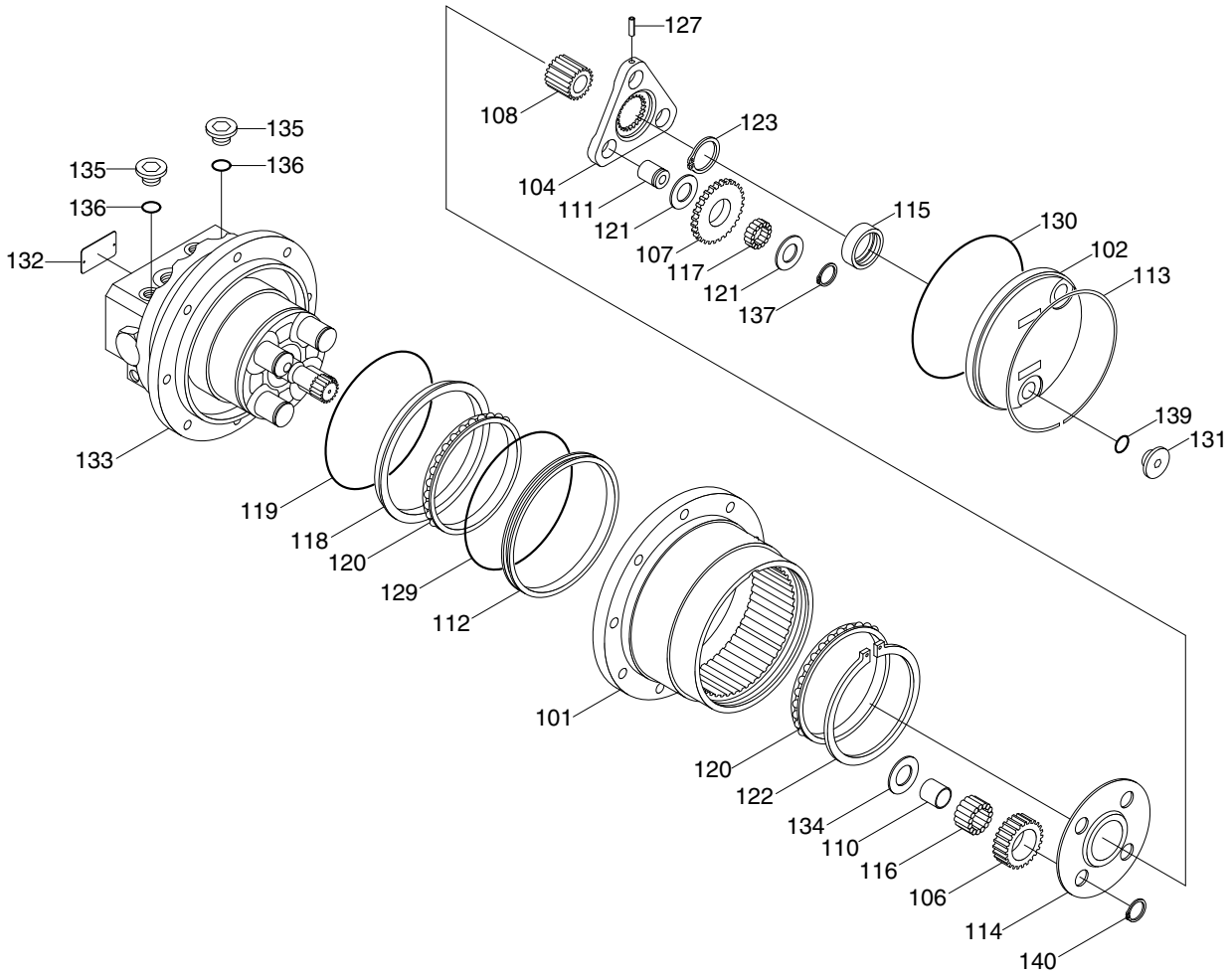
STRUCTURE (2/3)



17Z9A2TM03

301	Body 1	309	Spring V1	319	O-ring
302	Spool	310	Spring V2	320	O-ring
303	Check valve	311	Spring V3	321	O-ring
304	Spring guide	312	Plug	322	O-ring
305	Spool	313	Plug	323	Choke
306	Spool B	314	Ring	324	Choke
307	Spool C	316	Plug	325	Pin
308	Shuttle spool	317	Plug		

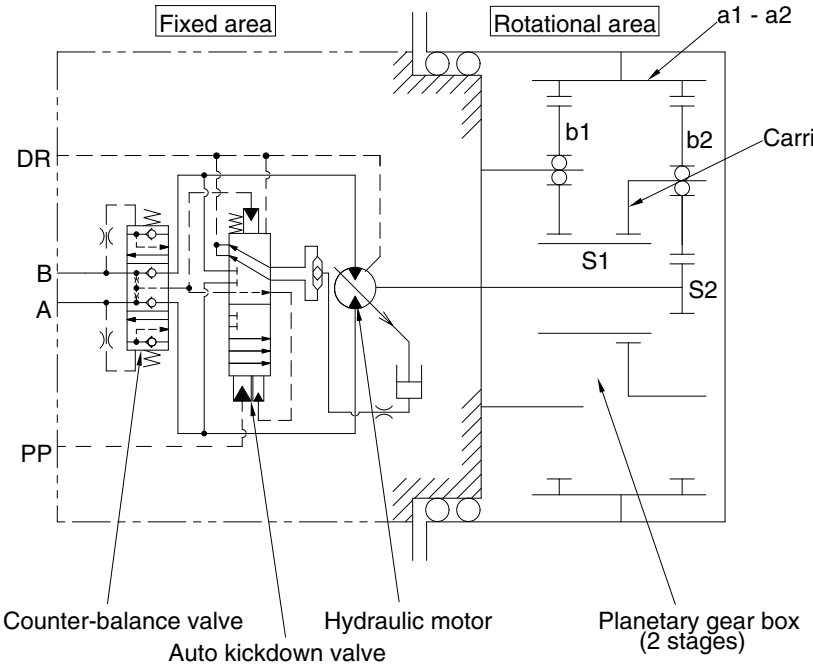
STRUCTURE (3/3)

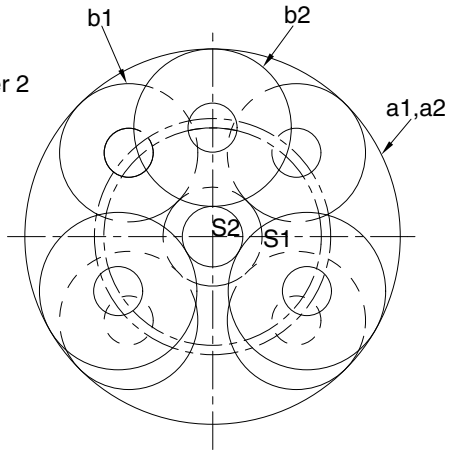


1692TM04

101	Body	113	Snap ring	121	Thrust washer	134	Thrust washer
102	Cover	114	Thrust plate	122	Snap ring	135	Plug
104	Carrier 2	115	Slide ring	123	Snap ring	136	O-ring
106	Gear B1	116	Needle	127	Spring pin	137	Snap ring
107	Gear B2	117	Needle	129	O-ring	139	O-ring
108	Gear S1	118	Floating seat	130	O-ring	140	Snap ring
110	Ring		(Incl 119)	131	Plug		
111	Pin B2	119	O-ring	132	Name plate		
112	Seal ring	120	Bearing	133	Hydraulic motor		

2. DRAWING OF OPERATIONAL PRINCIPLE





※ Note
b1 gear=4pcs, b2 gear=3pcs

17Z9A2TM05

3. OPERATION

Travel motor consists of a hydraulic motor "Fixed parts" and a planetary gear speed reducer "Rotating parts".

1) REDUCTION GEAR SECTION

(1) Function

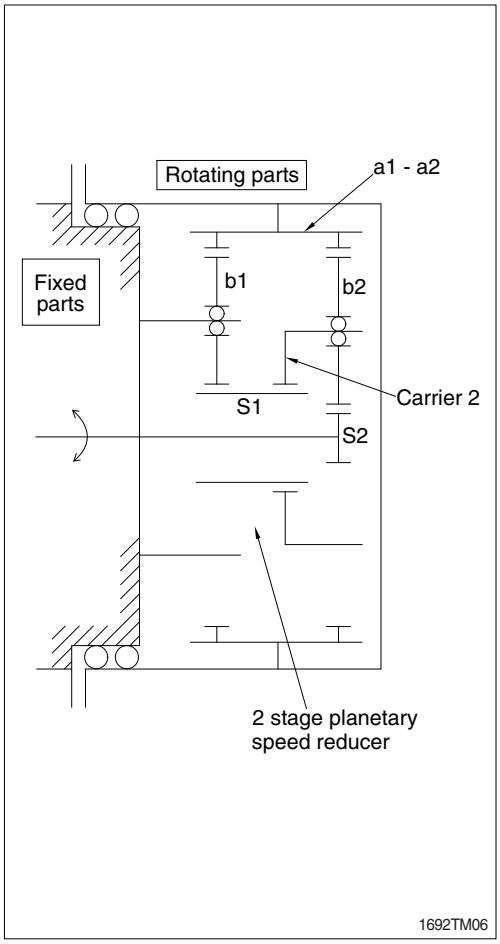
The speed reducer of travel motor is a simple planetary gear type with two stages. The high output speed of the hydraulic motor is reduced to low speed with high torque.

(2) Operation

The S2 gear is attached to the hydraulic motor shaft and the S2 output speed is reduced between the gears (s2, b2, a2) as a first stage speed reducer.

The reduced output speed of this first stage is reduced again between the gears (s1, b1, a1) which are connected to the carrier 2 with the spline.

This reduced output speed of the second stage is transmitted to the body case "rotating parts" through the inner gears (a1, a2) and drives the machine.



The gear ratio of 2 stage simple planetary speed reducer is calculated using the following formula.

$$R = \frac{Zs1}{Zs1+Za1} \times \frac{Zs2}{Zs2+Za2}$$

※ Z_{**} : Number of teeth

With the travel motor, the body case rotating, so the gear ratio is ;

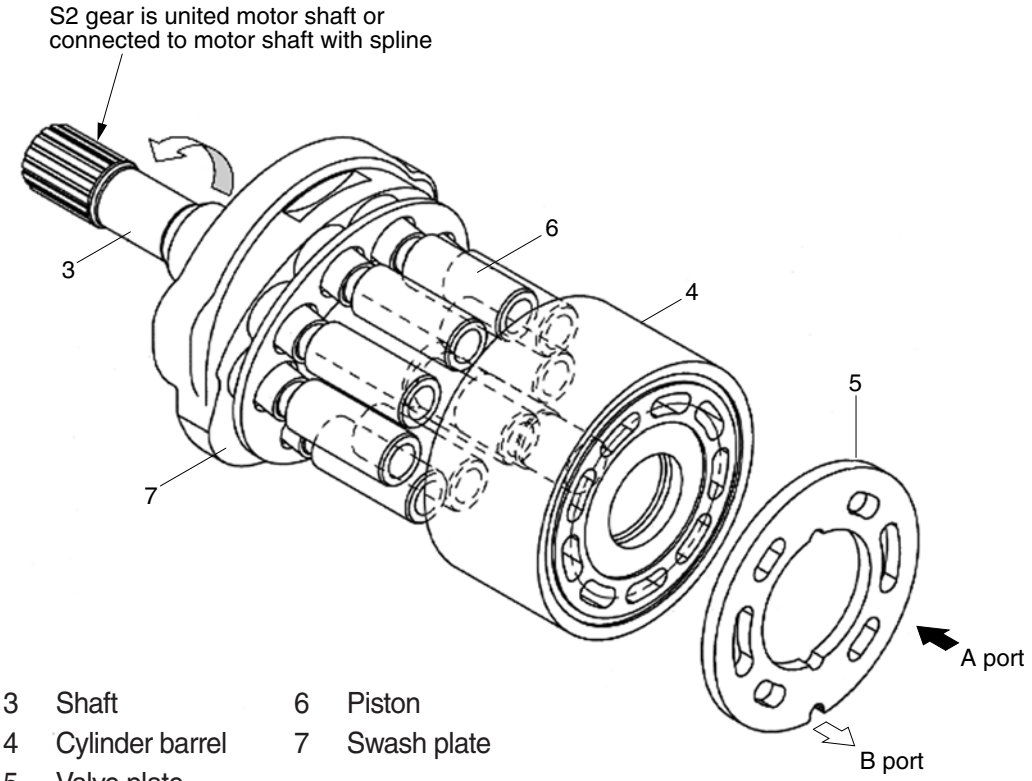
$$R' = \frac{1}{1-1/R}$$

2) HYDRAULIC MOTOR SECTION

(1) Function

This hydraulic motor is an axial piston type, and changes the hydraulic energy supplied from the pump to the rotary motion.

(2) Structure



3	Shaft	6	Piston
4	Cylinder barrel	7	Swash plate
5	Valve plate		

17Z9A2TM06

Through a hydraulic valve, the pressurized oil is supplied to the valve plate (5).
When the pressurized oil is supplied to the A port, this pressurized oil pushes the piston (6) in the clylinder barrel (4). This pushing force is changed to the rotational power by the swash plate (7) and transmitted to the shaft (3) which is connected to the cylinder barrel (4) with the spline. The return flow from the cylinder port is going out through the B port of the valve plate (5). To reverse rotation, pressurized oil is supplied to the B port and returning oil exits through the A port.

(3) 2 speed motor operation

The swash plate, which has surface Ⅰ and Ⅱ in the opposite side to the shoe sliding surface, is supported by the 2 balls which are fixed to the body 2.

Since the balls are located in the eccentric position, in the low speed range, the surface Ⅰ is faced to the body 2 by the oil pressure in the piston and the spring force in the cylinder barrel. The swash plate angle is α (max capacity).

When the pressurized oil is supplied to the (PP) port, the two-speed spool moves to the high position.

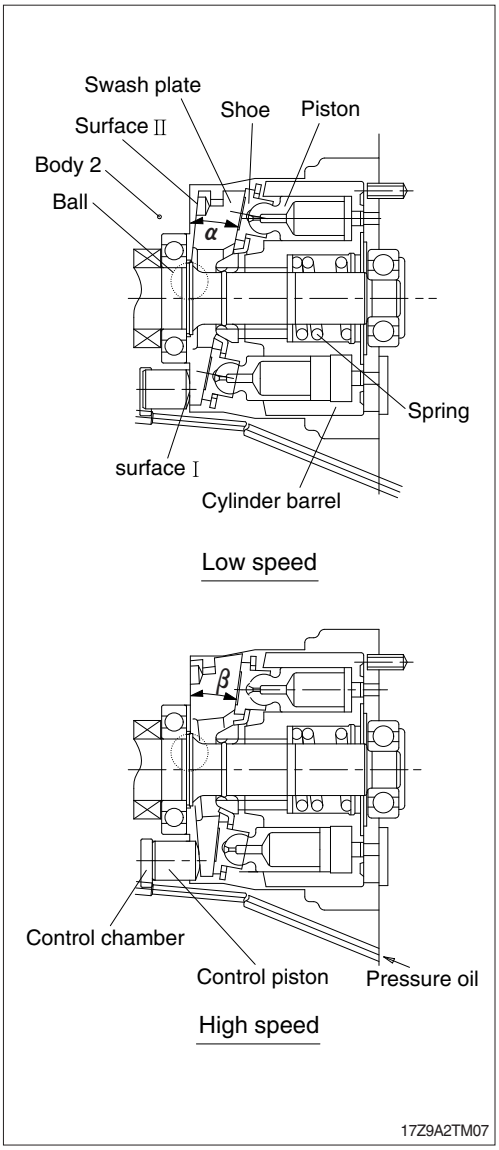
And the pressurized oil of inlet is led to the control chamber through the two-speed spool.

The control piston moves forward until the surface Ⅱ of the swash plate is in contact with the body 2, and the swash plate angle becomes β .

The capacity of the hydraulic motor is made small.

The pressurized oil of the (PP) port is shut off (or the engine is stopped), the two-speed spool moves to the low position.

And the control chamber is led to the tank port through the two-speed spool and the swash plate position comes to the low speed by the spring force.

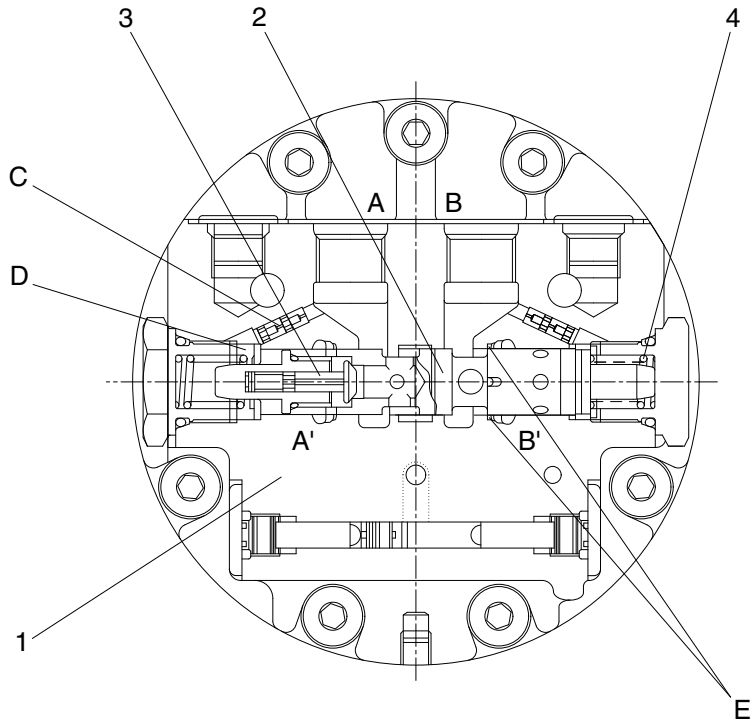


3) HYDRAULIC VALVE SECTION

(1) Counter-balance valve

When the pressurized oil is supplied from the A port, the pressurized oil opens the check valve (3) and flows into the hydraulic motor inlet A' port. At the same time, the pressurized oil goes through the orifice C into the chamber D, pushes the spring (4) and moves the spool (2) to right. Then the returned oil from the hydraulic motor flows into the B port, goes through area E and drives the hydraulic motor. When the pressurized oil is supplied from the B port, the hydraulic motor rotates in reverse.

Even the pressurized oil of the A port is shut off, the hydraulic motor tries to rotate by inertia force. When the pressurized oil from the A port is shut off, the spool (2) tries to return to left by the spring (4) force. At this time, the oil in the chamber D tries to go out to the A port through the orifice C, but due to the throttle effect of orifice C, the spool (2) speed is reduced. With the orifice and notches on the spool, the returned oil is controlled gradually and the hydraulic motor stops smoothly.



17Z9A2TM08

(2) Auto kick down valve

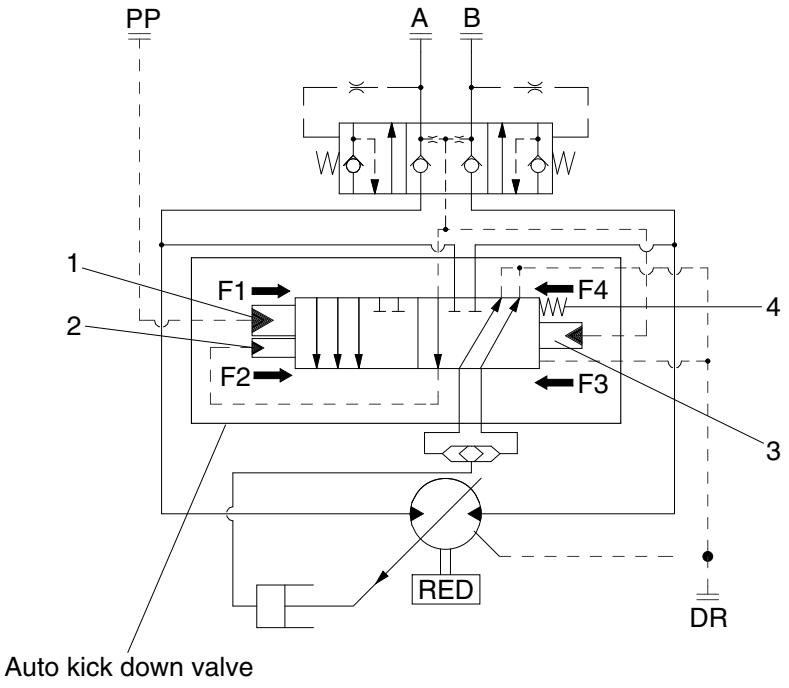
When the travel speed control switch for Hi speed mode is turned on, the pilot pressure for Hi speed mode comes from PP port to the hydraulic pilot (1), then the force F1 occurs. The auto kick down valve moves to the right direction because the F1 is larger than F4, which is by spring (4). Then the speed of track motor is changed to the Hi speed mode.

On the other hand, the operating pressure comes from A or B port to the hydraulic pilot (2) and (3), then the force F2 and F3 occur. The F3 is larger than F2 because the area of (3) is wider than the area of (2). Therefore, if the operating pressure increases, the difference between F2 and F3 also increases.

When the operating pressure is larger than the setting pressure of Hi speed to Lo speed, the right direction resultant of F1 and F2 is smaller than the left direction resultant of F3 and F4.

Therefore the auto kick down valve moves to the left direction, then the speed of track motor is changed to the Lo speed mode. When the operating pressure is smaller than the setting pressure of Lo speed to Hi speed, the right direction resultant of F1 and F2 is larger than the left direction resultant of F3 and F4.

Therefore the auto kick down valve moves to the right direction, then the speed of track motor is changed to the Hi speed mode.

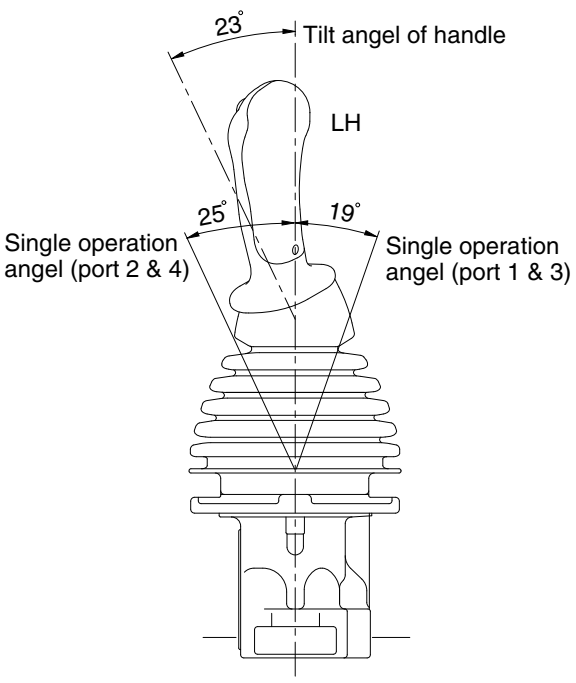


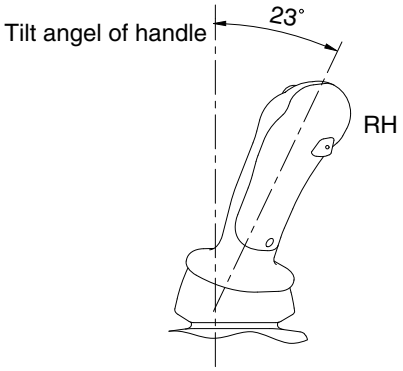
17Z9A2TM10

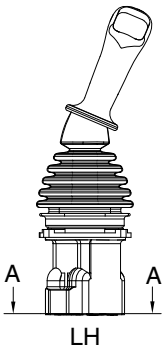
GROUP 5 RCV LEVER

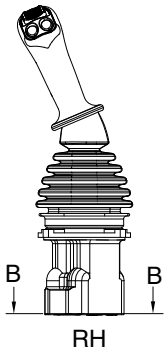
1. STRUCTURE

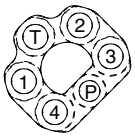
The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1,2,3 and 4 provided at the bottom face.



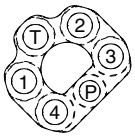






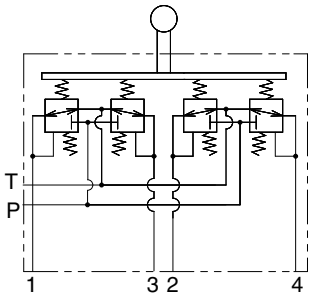


Section A - A



Section B - B

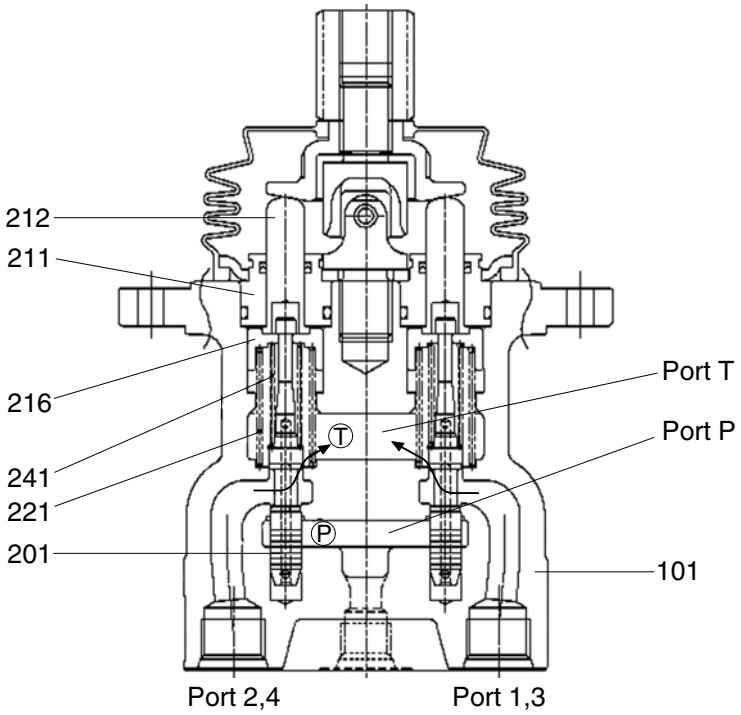
17Z9A2RL01



Hydraulic circuit

Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	Pilot oil return port	PF 3/8
1	Left swing port	Bucket in port	
2	Arm out port	Boom down port	
3	Right swing port	Bucket out port	
4	Arm in port	Boom up port	

CROSS SECTION



17Z9A2RL02

101 Casing
201 Spool
211 Plug
212 Push rod
216 Spring seat
221 Return spring
241 Secondary pressure setting spring

The structure of the remote control valve is as shown in the assembly. There is a vertical axial hole in the casing and the reduction valves are inserted into this.

The secondary pressure setting spring (241) is set such that the secondary pressure is calculated as 5.1~10.2 kgf/cm^2. Spool (201) is pushed onto the push rod (212) by return spring (221).
Tilting the control handle pushes down push rod (212), the spring seat (216) also moves down and the setting of the secondary pressure setting spring (241) is changed.
Port P, oil inlet (primary pressure) and port T outlet (tank) are in the casing (101).

2. PERFORMANCE

1) BASIC PERFORMANCE

The remote control valve controls the stroke and direction of the control valve spools. This is achieved by the output pressure of the remote control valve acting on the tip of the control valve spool.

To achieve satisfactory performance, the remote control valve comprises the following elements :

(1) An inlet port (P) for oil fed from the hydraulic pump.

(2) Multiple output ports (1, 2, 3 and 4) to allow pressure from the inlet port to act on the spool tips of the control valve.

(3) A tank port (T) to control the output pressure.

(4) A spool to connect the output port to the inlet port or tank port.

(5) A mechanical assembly, which contains a spring which acts on the spool and controls the output pressure.

2) PERFORMANCE OF THE MAIN PARTS

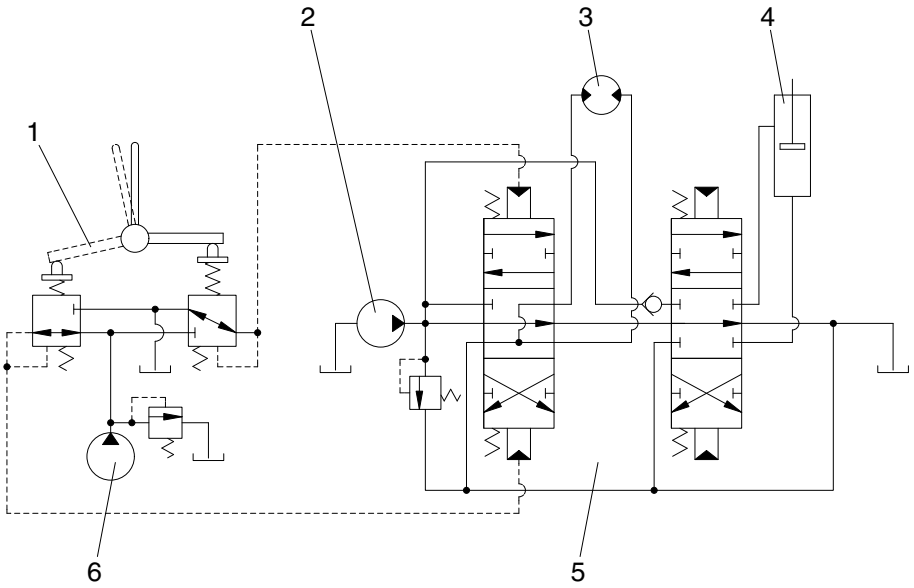
The spool (201) operates to take the supply oil pressure from the hydraulic pump. This switches the oil channel so that the port P oil pressure is directed to the output ports 1, 2, 3, 4 or to port T. The secondary pressure setting spring (241) determines the output pressure that acts on the spool (201).

The push-rod (212), which changes the strain of the secondary pressure setting spring (241), is inserted so that it can move smoothly into the plug (211).

The return spring (221) acts to return the push-rod (212) towards zero displacement without reference to the output pressure acting on the spring seat (216) and casing (101). This acts to ensure the return to neutral of the spool (201) and also acts as a resistance spring to provide the operator with an appropriate operating "feel".

3) OPERATION

The operation of the remote control valve is described in the hydraulic circuit plan and operation explanatory figures (see figures RL04, 05 and 06). The below figure shows a typical example of the use of the remote control valve.



17Z9A2RL03

1	Remote control valve	3	Hydraulic motor	5	Control valve
2	Main pump	4	Hydraulic cylinder	6	Pilot pump

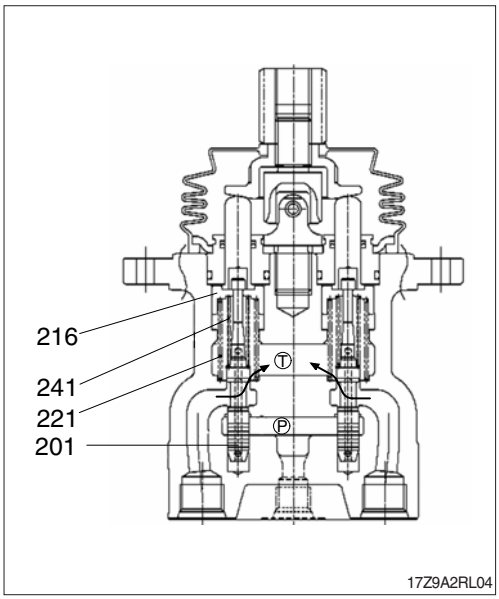
(1) Control handle neutral

The force of the secondary pressure setting spring (241) (which determines the output pressure of the pilot valve) does not act on the spool (201).

Spool (201) is pressed upward by the return spring (221) and spring seat (216) .

Output ports (2, 4) and port T are open.

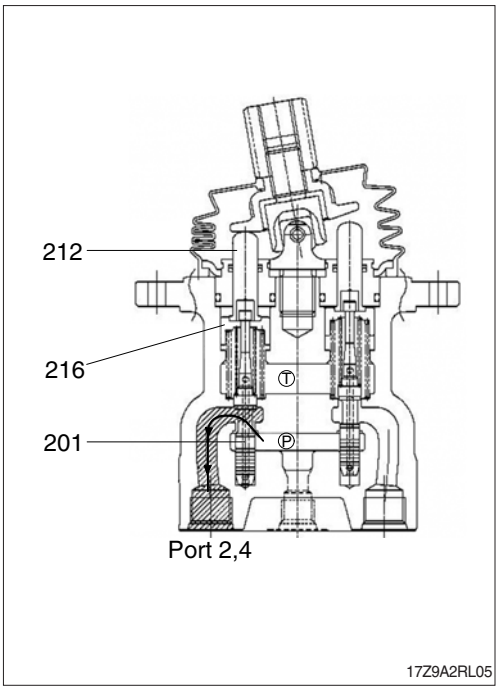
The output pressure is the same as the tank pressure.



17Z9A2RL04

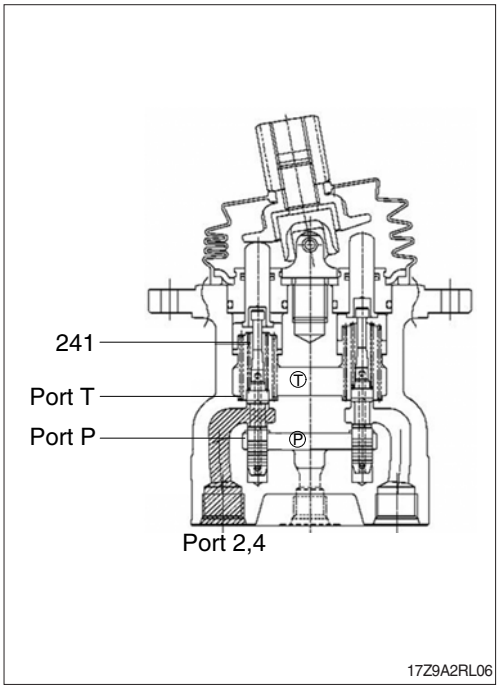
(2) Control handle tilted

The push-rod moves, (spring seat (216)), spool (201) moves downward, port P and ports (2, 4) are open and the oil fed from the pilot pump flows to ports (2, 4) and generates pressure.



(3) Control handle held

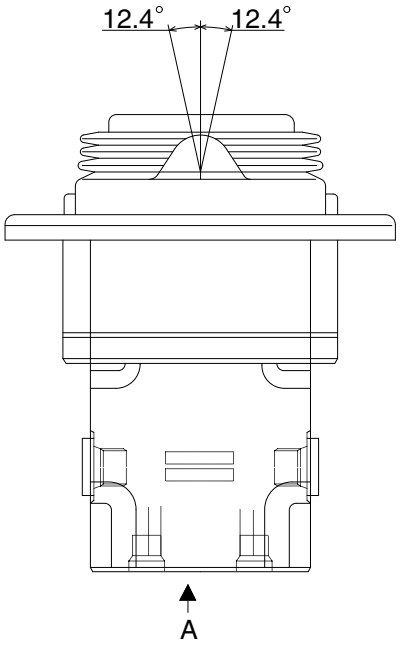
The pressure of ports (2, 4) rises to become equal to the spring (241) force; the oil pressure and spring pressures become balanced. If the pressure of ports (2, 4) exceeds the set pressure, ports (2, 4) and port P close, ports (2, 4) and port T open. If the pressure of ports (2, 4) falls below the set pressure, ports (2, 4) and port P open and ports (2, 4) and port T close. The secondary pressure is kept constant.

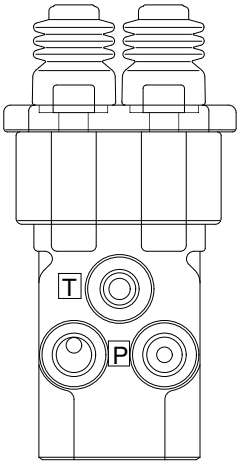


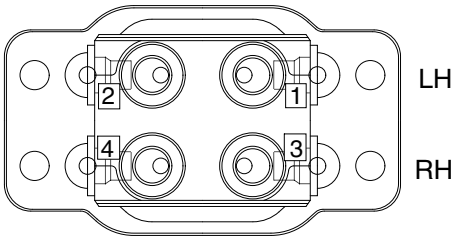
GROUP 6 RCV PEDAL

1. STRUCTURE

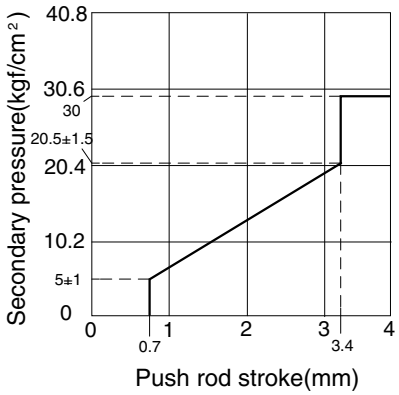
The casing has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.



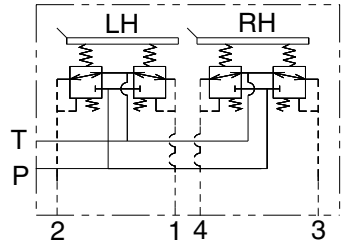




VIEW "A"



R35Z72RCP01



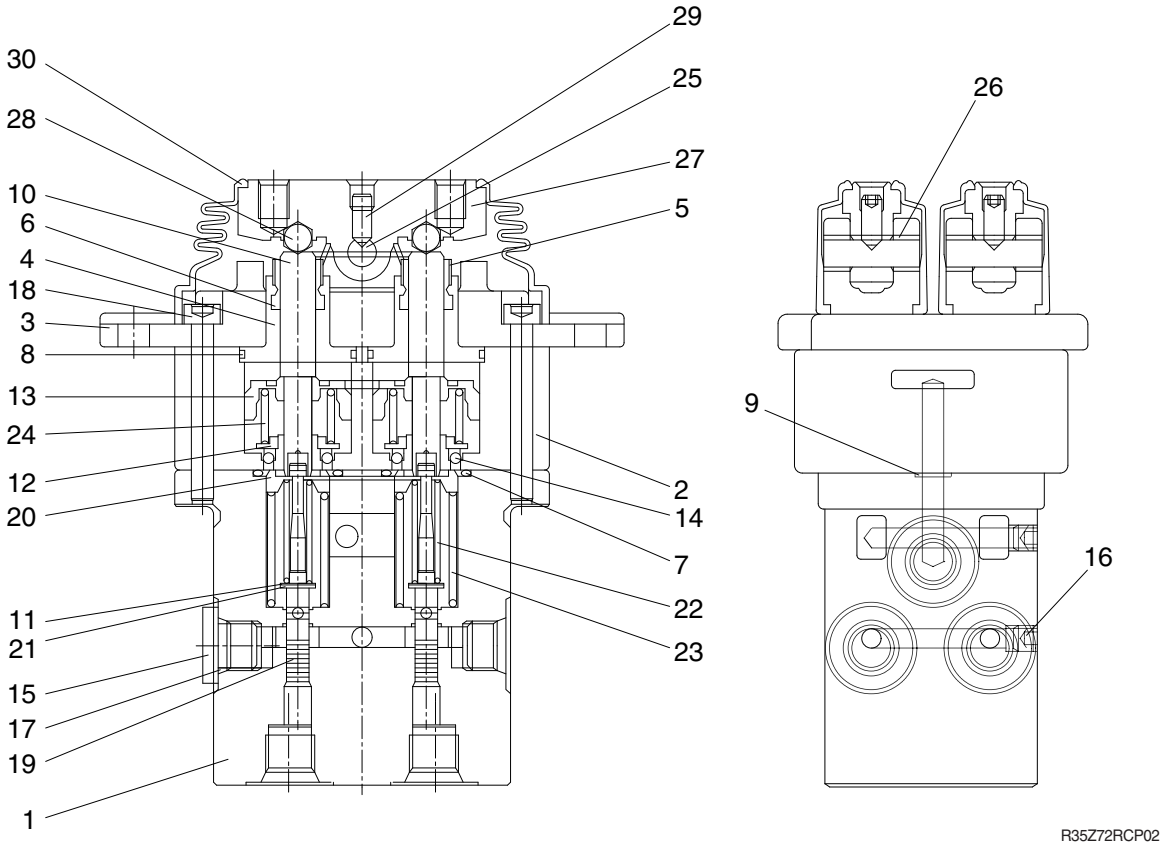
Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, Backward)	
2	Travel (LH, Forward)	
3	Travel (RH, Backward)	
4	Travel (RH, Forward)	

CROSS SECTION

The construction of the RCV pedal is shown in the below drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (19), spring (22) for setting secondary pressure, return spring (23), spring seat (20) and washer (21). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 19 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (10) by the return spring.

When the push rod is pushed down by tilting pedal, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.



R35Z72RCP02

1	Casing (1)	11	Shim	21	Washer
2	Casing (2)	12	Spring seat	22	Spring
3	Cover	13	Piston	23	Spring
4	Plug	14	Steel ball	24	Spring
5	Grease cap	15	Plug	25	Cam shaft
6	Packing	16	Plug	26	Bushing
7	O-ring	17	O-ring	27	Cam
8	O-ring	18	Hex soc head screw	28	Steel ball
9	O-ring	19	Spool	29	Set screw
10	Push rod	20	Spring seat	30	Bellows

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

(1) Inlet port (P) where oil is supplied from hydraulic pump.

(2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.

(3) Tank port (T) necessary to control the above output pressure.

(4) Spool to connect output port to inlet port tank port.

(5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (19) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (22) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (10) is inserted and can slide in the plug (4).

For the purpose of changing th displacement of the push rod through the cam (27) and steel ball (28) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

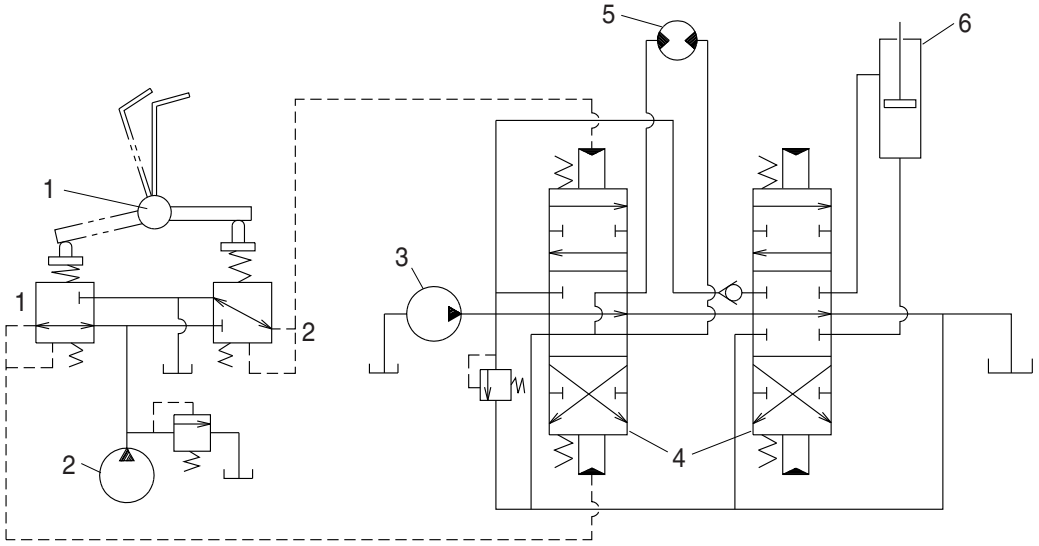
The spring (23) works on the casing (1) and washer (21) and tries to return the push rod (10) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below ant the attached operation explanation drawing.

The diagram shown below is the typical application example of the pilot valve.



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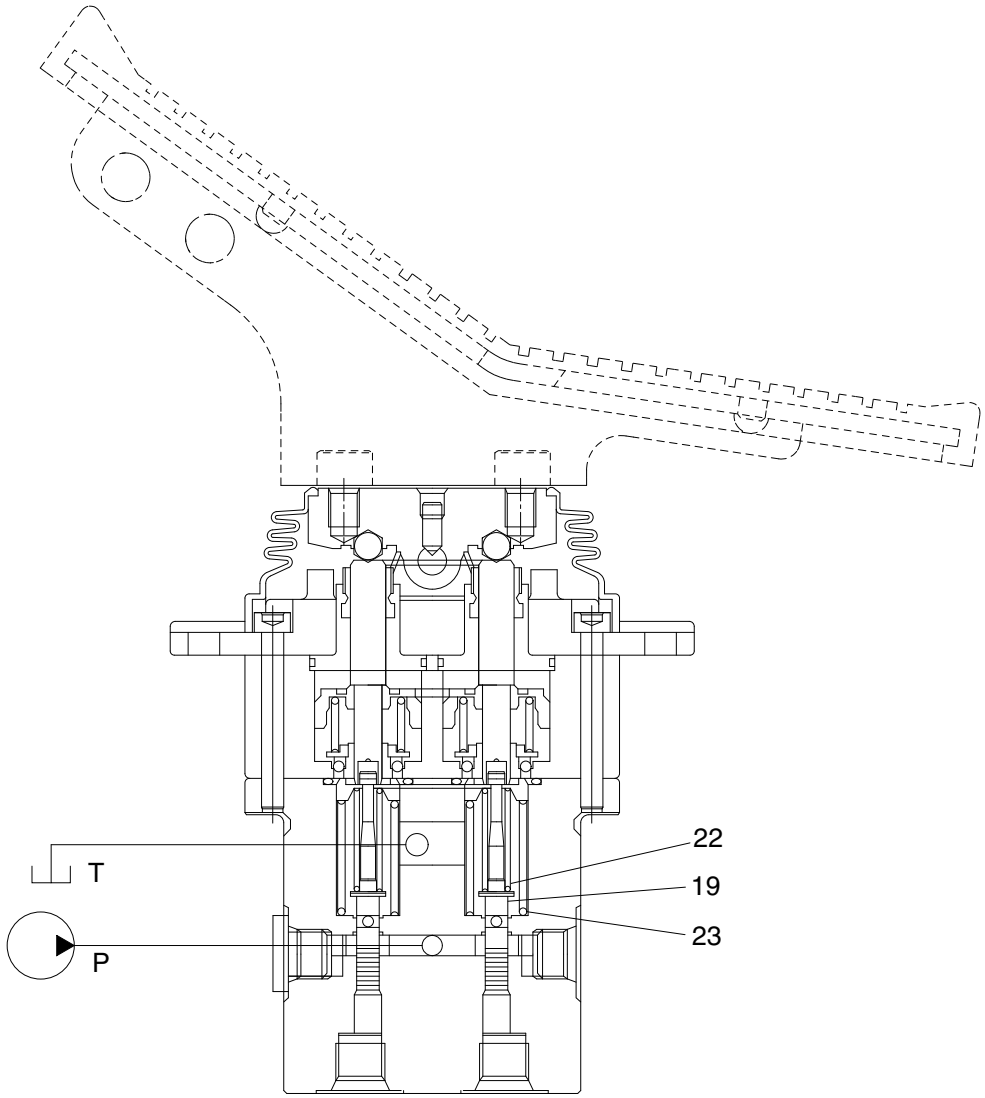
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

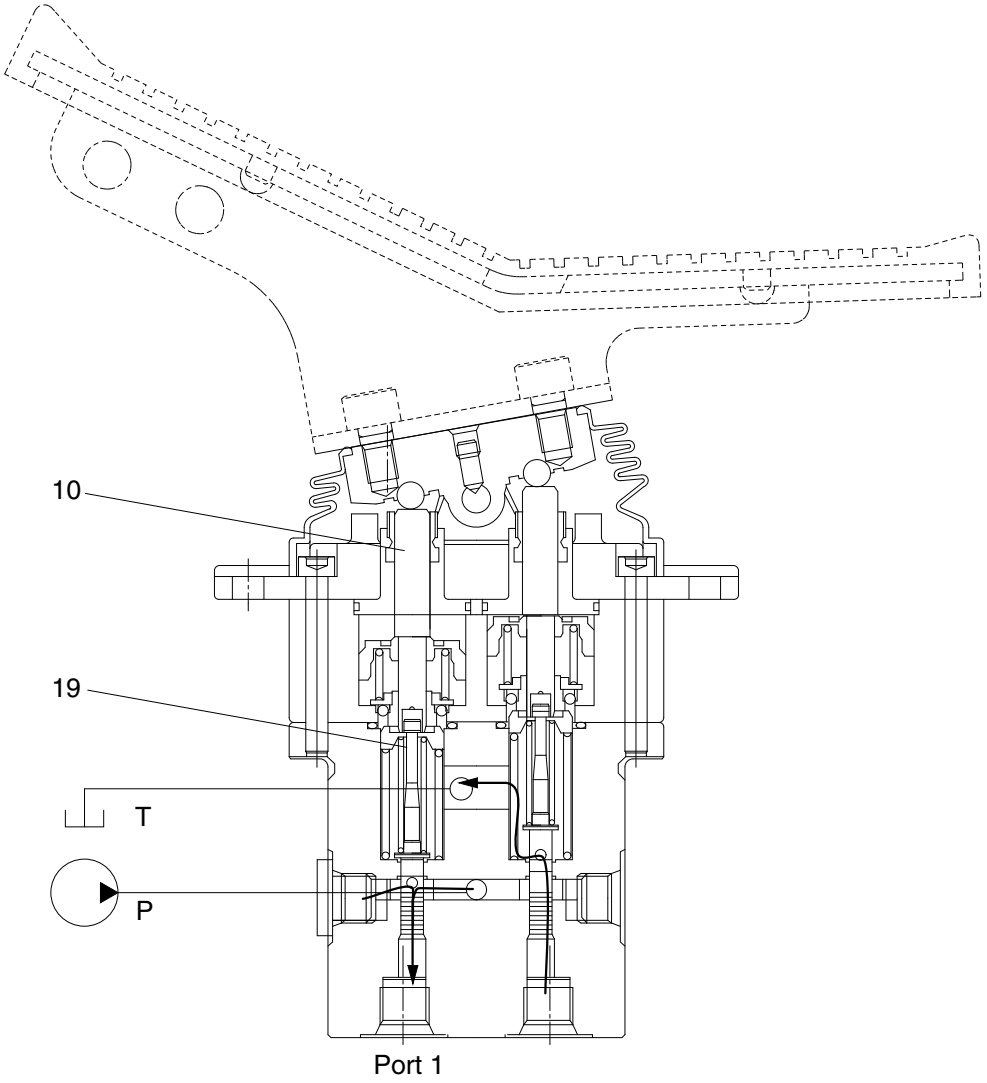
(1) Case where pedal is in neutral position



R35Z72RCP04

The force of the spring (22) that determines the output pressure of the pilot valve is not applied to the spool (19). Therefore, the spool is pushed up by the spring (23) to the position of port 2 in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where pedal is tilted



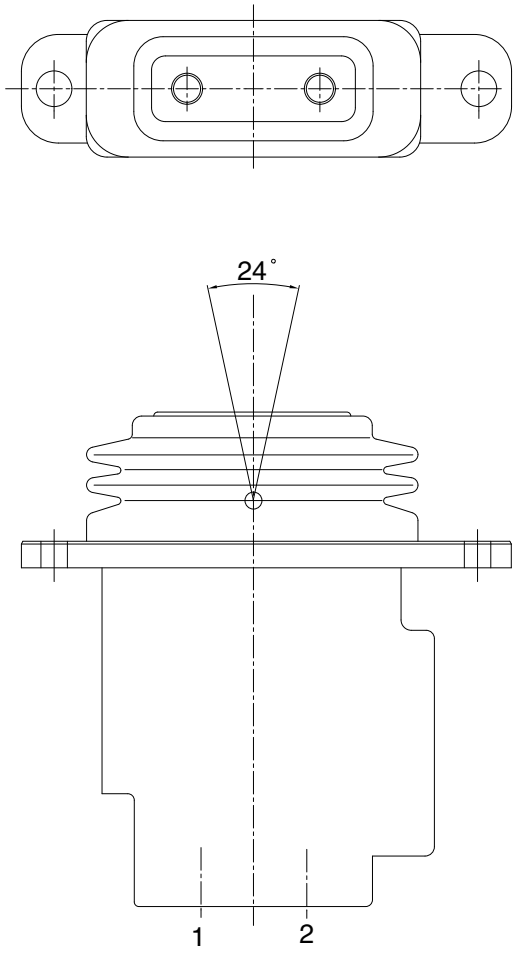
R35Z72RCP05

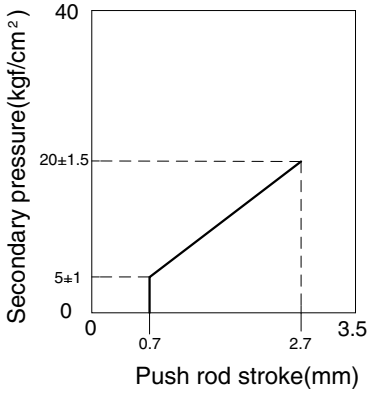
When the push rod (10) is stroked, the spool (19) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.

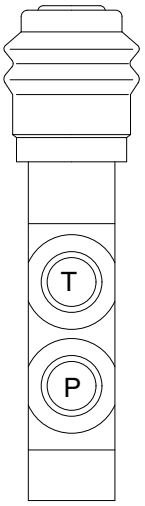
3. BOOM SWING PEDAL

1) STRUCTURE

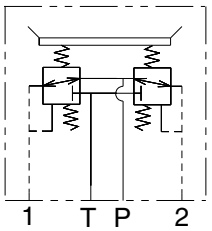
The casing has the oil inlet P (primary pressure) and the oil return port (tank).
In addition the secondary pressure is taken out through port 1 and port 2 provided at the housing bottom face.







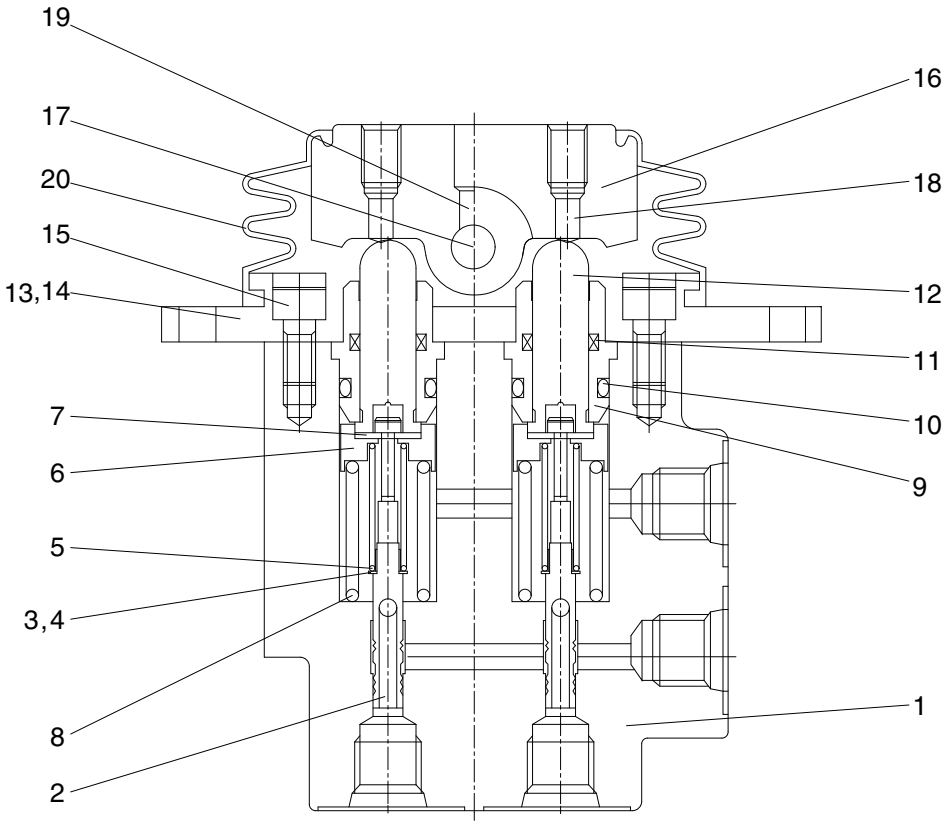
R35Z72RSP01



Hydraulic circuit

Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Boom swing (LH)	
2	Boom swing (RH)	

2) COMPONENT



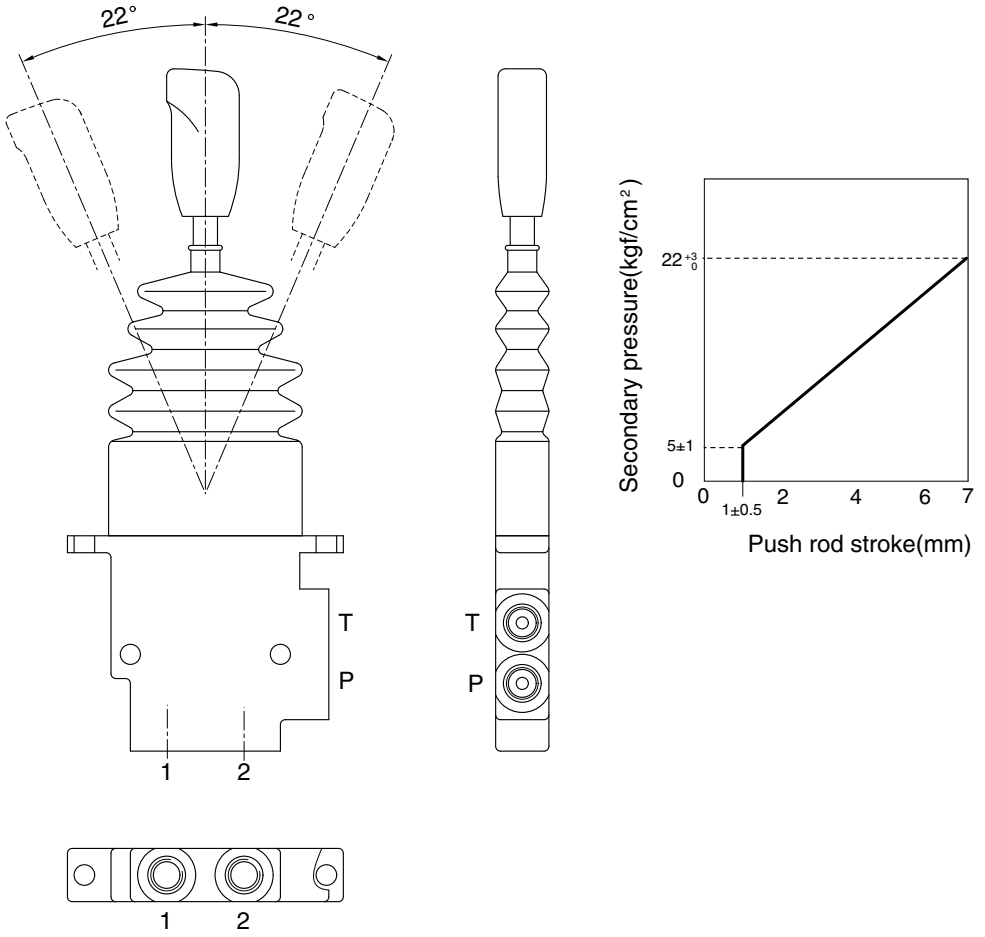
R35Z72RSP02

1	Body	8	Stopper	15	DU bush
2	Plug	9	Spring	16	Wrench bolt
3	O-ring	10	Plug	17	Cam
4	Spool	11	O-ring	18	Pin
5	Spring seat	12	Rod seal	19	Adjust screw
6	Spring	13	Push rod	20	Socket bolt
7	Spring seat	14	Cover	21	Bellows

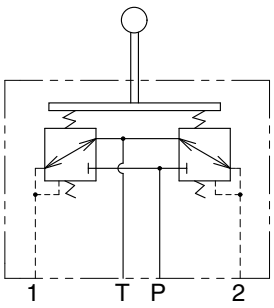
4. DOZER LEVER

1) STRUCTURE

The casing has the oil inlet P (primary pressure) and the oil return port (tank).
In addition the secondary pressure is taken out through port 1 and port 2 provided at the housing bottom face.



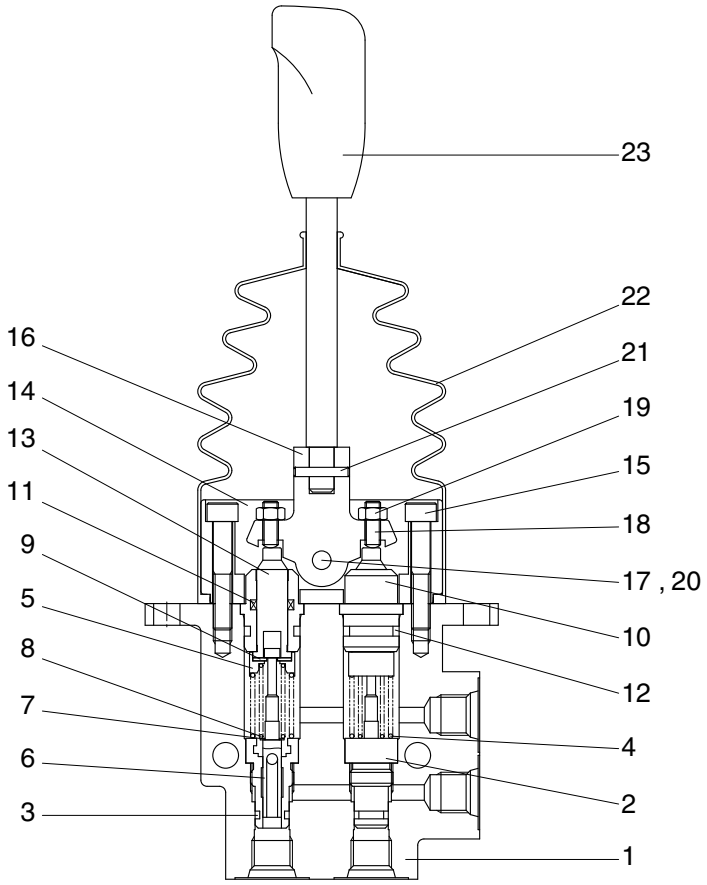
R35Z72DL01



Hydraulic circuit

Port	Port	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	PF 1/4
1	Dozer blade up port	PF 1/4
2	Dozer blade down port	PF 1/4

2) COMPONENT



R35Z72DL02

1	Body	9	Stopper	17	Pin
2	Plug	10	Plug	18	Socket bolt
3	O-ring	11	Rod seal	19	Nut
4	Spring	12	O-ring	20	Snap ring
5	Spring seat	13	Push rod	21	Spring pin
6	Spool	14	Cover	22	Bellows
7	Spring seat	15	Wrench bolt	23	Lever
8	Spring	16	Guide		