SECTION 2 STRUCTURE AND FUNCTION

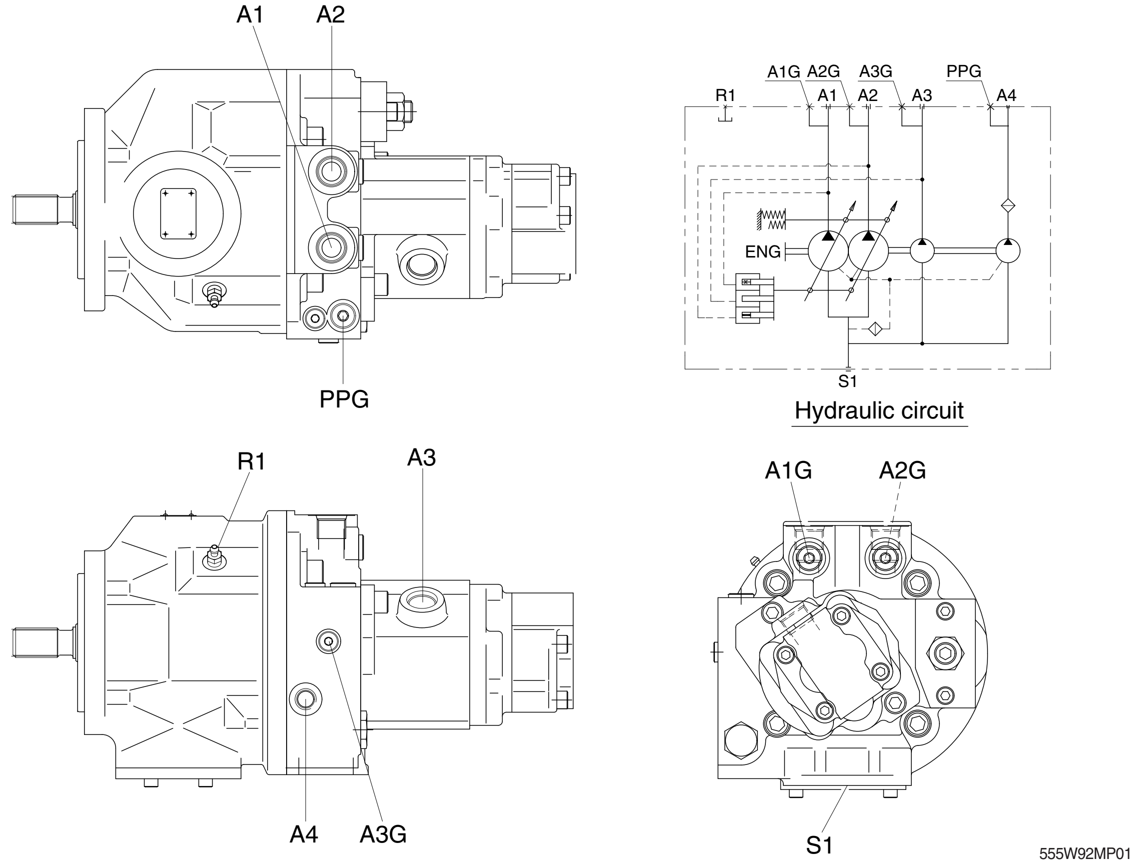
GROUP 1 HYDRAULIC PUMP

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.

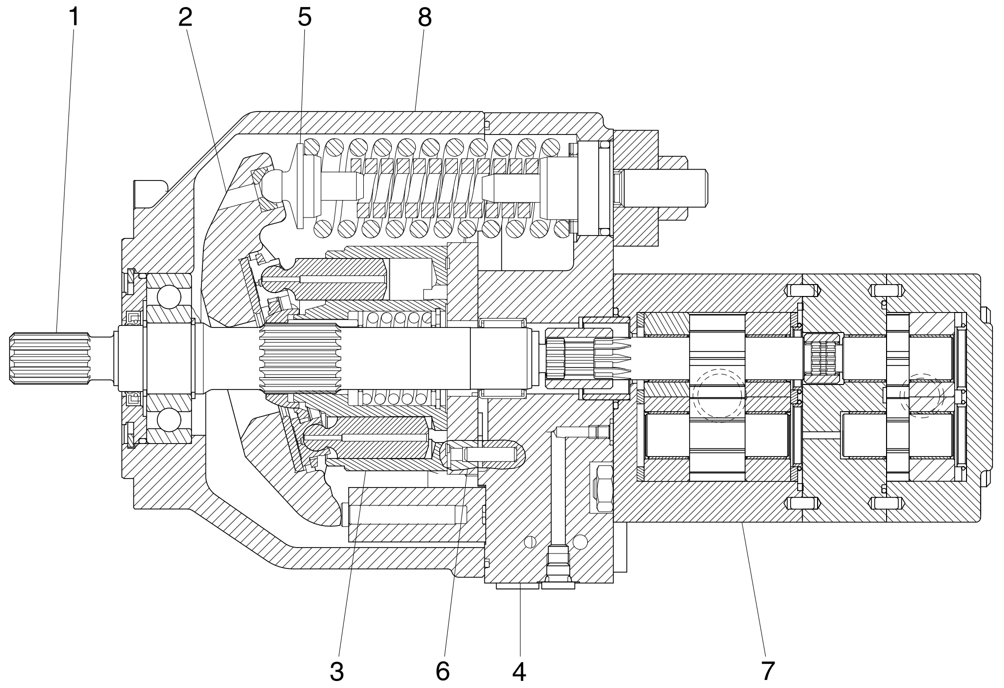
The third pump and pilot pump can be connected to the same shaft via a coupling.



Description of the ports

Port	Name	Bore
S1	Suction port	SAE 1 1/2 (standard)
A1, A2	Discharge port	PF 1/2
A3	Discharge port	PF 1/2
A4	Discharge port	PF 1/4
A1G, A2G	Gauge port	PF 1/4 with quick coupler
A3G	Gauge port	PF 1/8 with quick coupler
PPG	Gauge port	PF 1/4 with quick coupler
R1	Air bleeder port	M10×1.0 with bleeder valve

2. PRINCIPAL COMPONENTS AND FUNCTIONS



1	Drive shaft	5	Control spring
2	Hanger	6	Control piston
3	Rotary group	7	Gear pump
4	Cover	8	Housing

SPECIFICATIONS

● Capacity : 2×25+16.2+6.5 cc/rev

● Rated oil flow : 2×60+38.9+15.6 ℓ/min

● Rated pressure : 2×220+200+30 kgf/cm^2

This is a variable displacement double-piston pump for discharge with two equal displacements from one cylinder block. Because this is one rotary group, 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 control piston tilts the hanger by overcoming the spring force.

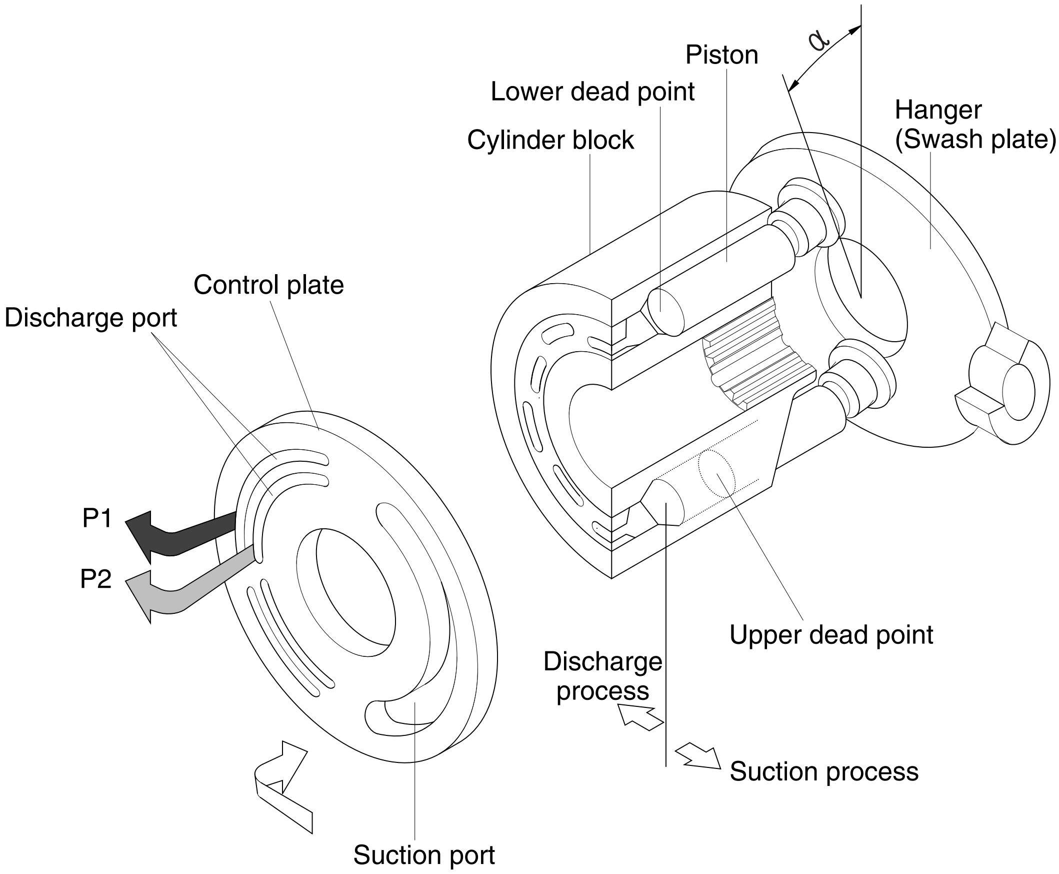
Since the piston stroke changes according to the tilting angle of the hanger, the flow can be changed.

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

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

1) PRINCIPLE OF OPERATION

(1) Function of pump



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The cylinder block is connected via spline and can rotate together with the drive shaft.

The piston assembled into the cylinder block performs reciprocal operation while following the swash plate on the hanger.

The piston moves in a direction to increase the displacement during a stroke from the lower to the upper dead points. The oil flows from the suction port via a port plate into the cylinder block (suction process).

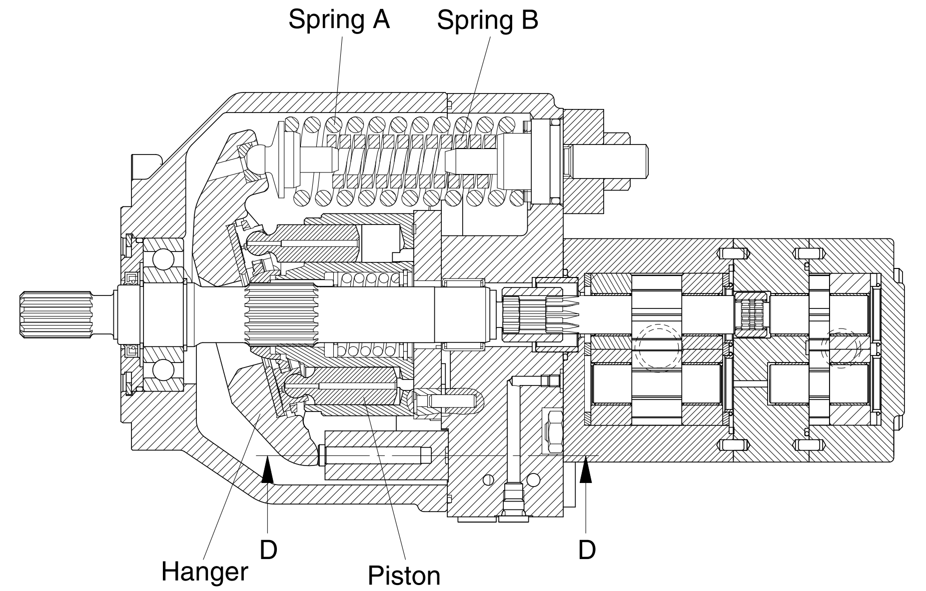
During a stroke from the upper to the lower dead points, the piston moves in a direction to decrease the displacement. The oil is discharged to the discharge port (discharge process).

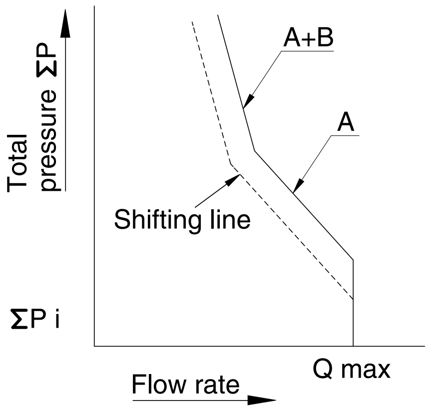
The displacement can be changed by changing the tilting of the hanger (swash plate).

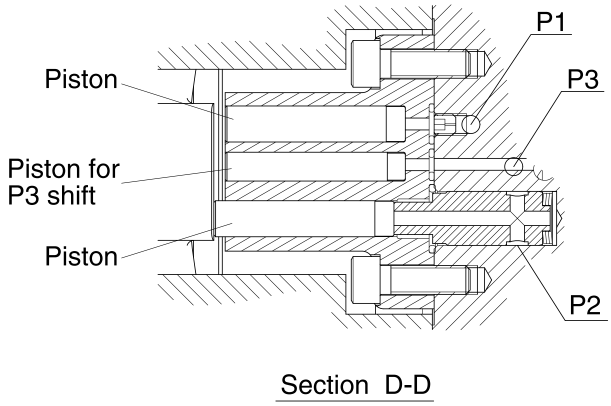
The oil sucked through the port in the cylinder block is discharged from the discharge port in the port plate.

The oil sucked through the port on the outside of the cylinder block is discharged from the discharge port on the outside of the port plate.

2) CONTROL FUNCTIONS







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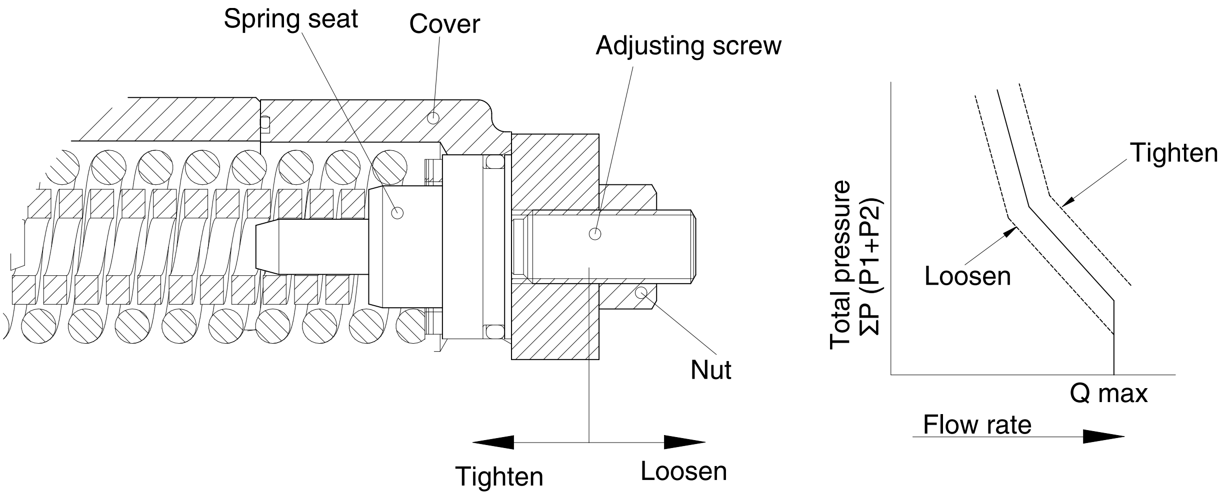
The discharge pressures P1 and P2 are directed to the pistons of equal area act on the hanger.
The spring is provided to act against the discharge pressure. When the oil pressure acting on the piston is less than the installation load of the spring A (outer spring), the hanger is fixed to the maximum tilting position. When the oil, pressure acting on the piston exceeds the installation load of the spring A the hanger is tilted and kept tilted at a position where the oil pressure is balanced with the spring force. (Region A in the middle of the figure above)
When the oil pressure acting on the piston rises further to reduce the tilting angle, the spring B which has been inactive up to now becomes active.
To overcome the spring force of two springs, the oil pressure must be higher and the shifting line becomes more steep. (Regions A + B in the middle of the figure above)
When the P3 oil pressure acts on the shift piston, the control shifting line is shifted.

3) CONTROL / ADJUSTMENT PROCEDURE

(1) Loosen the hexagonal nut.

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



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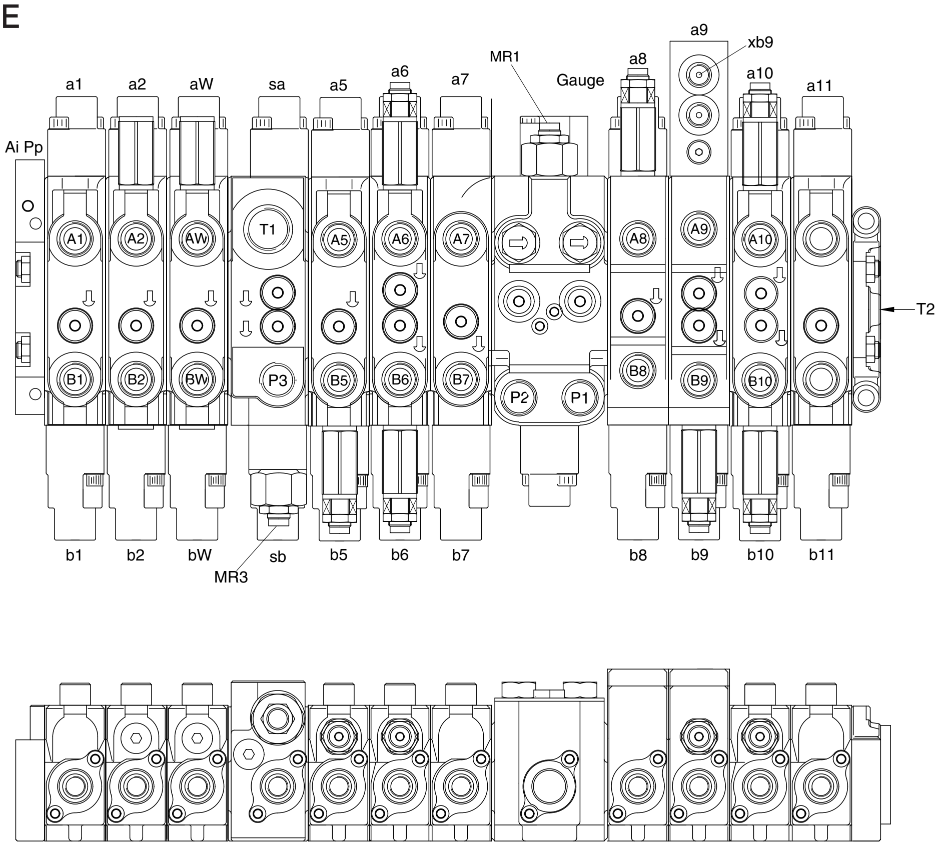
GROUP 2 MAIN CONTROL VALVE

1. OUTLINE



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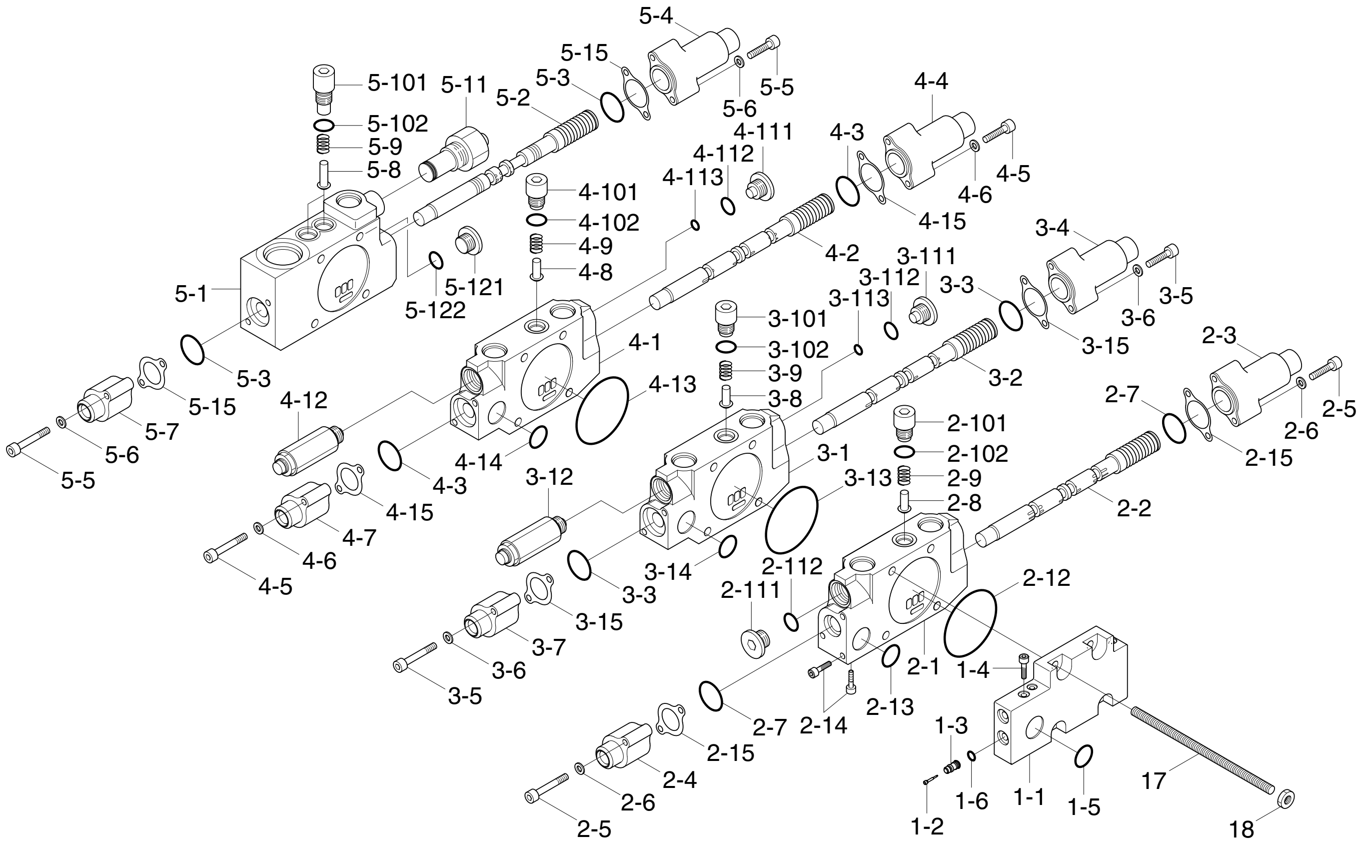
Mark	Port name	Port size	Tightening torque
P1	P1 pump port	PF 1/2	6.0~7.0 kgf · m
P2	P2 pump port		
P3	P3 pump port		
A1	Swing port (LH)		
B1	Swing port (RH)		
A2	Dozer down port		
B2	Dozer up port		
AW	Boom swing port (LH)		
BW	Boom swing port (RH)		
A5	Boom 2 port		
B5	Breaker port		
A6	Arm out port		
B6	Arm in port		
A7	Travel port (FW)		
B7	Travel port (BW)		
A8	Travel port (FW)		
B8	Travel port (BW)		
A9	Boom up port		
B9	Boom down port		
A10	Bucket out port		
MR1 MR3	Main relief valve	-	

Mark	Port name	Port size	Tightening torque
B10	Bucket in port	PF1/2	6~7 kgf · m
B11	Arm 2 port		
T2	Tank return port	PF3/4	8~9 kgf · m
T1	Tank return port	PF1	10~12 kgf · m
a1	Swing pilot port (LH)	PF1/4	2.5~3.0 kgf · m
b1	Swing pilot port (RH)		
a2	Dozer down pilot port		
b2	Dozer up pilot port		
aw	Boom swing pilot port (LH)		
bw	Boom swing pilot port (RH)		
a5	Boom 2 pilot port		
b5	Breaker pilot port		
a6	Arm out pilot port		
b6	Arm in pilot port		
a7	Travel pilot port (LH/FW)		
b7	Travel pilot port (LH/RR)		
a8	Travel pilot port (RH/FW)		
b8	Travel pilot port (RH/RR)		
a9	Boom up pilot port		
b9	Boom down pilot port		
a10	Bucket out pilot port		
b10	Bucket in pilot port		
a11	Arm 2 pilot port		
b11	Arm 2 pilot port		
Pp	Pilot supply port	PF1/4	
Ai	Auto idle signal port		

2. STRUCTURE (1/4)



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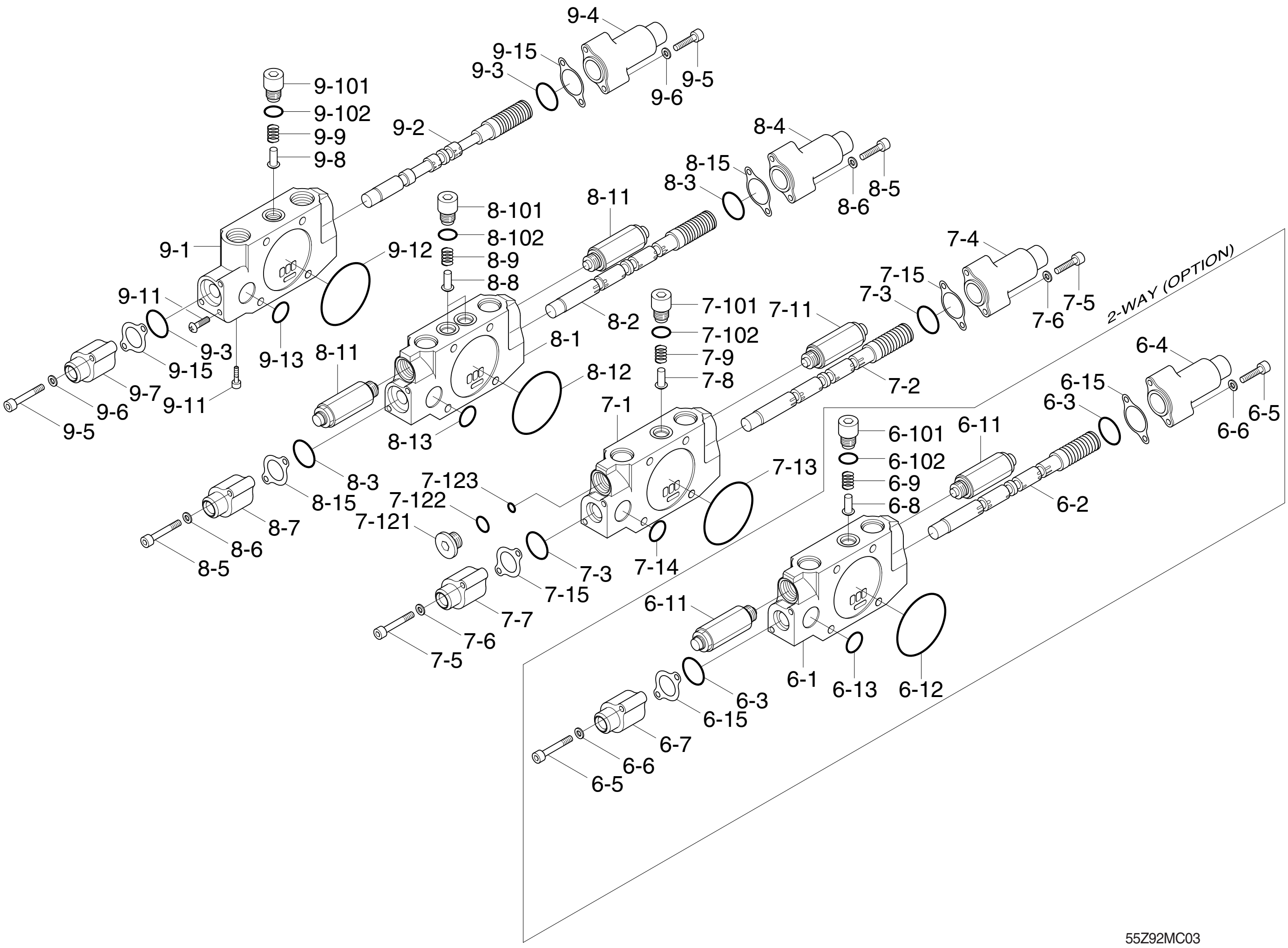
1	Ai cover	3	Dozer block	4	Boon swing assy	5	Inlet assy
2	Section assy-Swing	3-1	Work block	4-1	Work block	5-1	Work block (Ta)
2-1	Work block	3-2	Dozer spool assy	4-2	Spool assy (B/S)	5-2	Spool assy
2-2	Spool assy-Swing	3-3	O-ring	4-3	O-ring	5-3	O-ring
2-3	Pilot cap (A)	3-4	Pilot cap (A)	4-4	Pilot cap (A)	5-4	Pilot cap (A)
2-4	Pilot cap (B1)	3-5	Socket bolt	4-5	Wrench bolt	5-5	Wrench bolt
2-5	Wrench bolt	3-6	Plain washer	4-6	Plain washer	5-6	Plain washer
2-6	Plain washer	3-7	Pilot cap (B1)	4-7	Pilot cap (B1)	5-7	Pilot cap (B1)
2-7	O-ring	3-8	Check poppet	4-8	Check poppet	5-8	Check poppet
2-8	Check poppet	3-9	Check spring	4-9	Check spring	5-9	Check spring
2-9	Check spring	3-10	Plug	4-10	Plug assy	5-10	Plug assy
2-10	Plug	3-101	Check plug (M14)	4-101	Plug 1- check (M14)	5-101	Plug 1- check (M14)
2-101	Plug 1-Check M14	3-102	O-ring	4-102	O-ring	5-102	O-ring
2-102	O-ring	3-11	Plug	4-11	Plug assy	5-11	Main relief valve
2-11	Plug	3-111	Plug	4-111	Plug	5-12	Cap-Pf1/4 plug
2-111	Plug-PF3/8	3-112	O-ring	4-112	O-ring	5-121	Cap-Pf1/4 plug
2-112	O-ring	3-113	O-ring	4-113	O-ring	5-122	O-ring
2-12	O-ring	3-12	Check valve	4-12	Check valve	5-15	Gasket
2-13	O-ring	3-13	O-ring	4-13	O-ring	17	Tie bolt
2-14	Plug-Taper	3-14	O-ring	4-14	O-ring	18	Nut
2-15	Gasket	3-15	Gasket	4-15	Gasket		

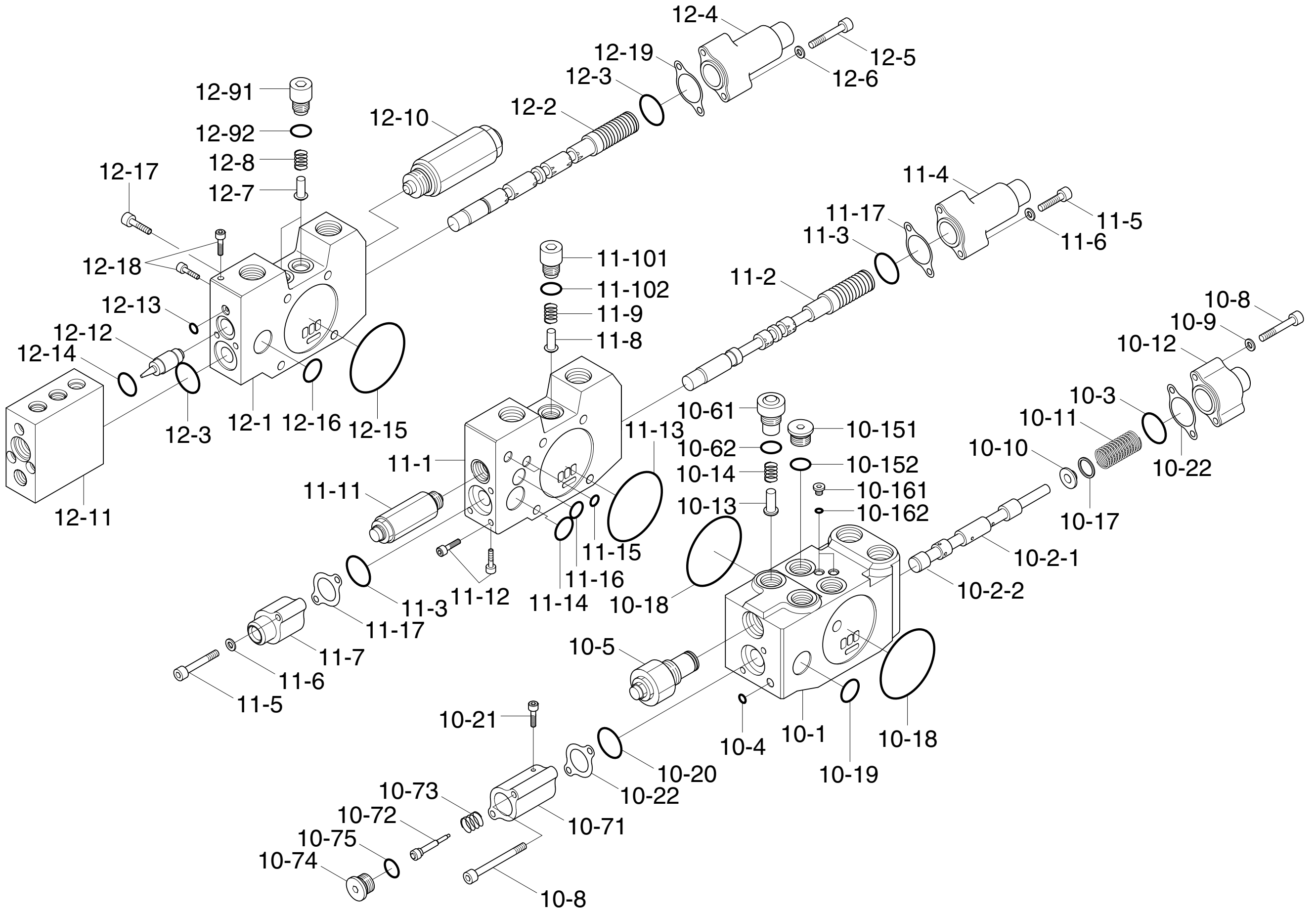
STRUCTURE (2/4)



55Z92MC03

6	2 Way block	7-1	Work block (Ba3)	7-14	O-ring	8-15	Gasket
6-1	Work block	7-2	Boom 2 spool assy	7-15	Gasket	9	Travel block assy
6-2	Rotator spool assy	7-3	O-ring	8	Arm 1 block assy	9-1	Work block (Dk)
6-3	O-ring	7-4	Pilot cap (A)	8-1	Work block (B3)	9-2	Travel spool assy
6-4	Pilot cap (A)	7-5	Wrench bolt	8-2	Arm 1 spool assy	9-3	O-ring
6-5	Wrench bolt	7-6	Plain washer	8-3	O-ring	9-4	Pilot cap (A)
6-6	Plain washer	7-7	Pilot cap (B1)	8-4	Pilot cap (A)	9-5	Wrench bolt
6-7	Pilot cap (B1)	7-8	Check poppet	8-5	Socket bolt	9-6	Plain washer
6-8	Check poppet	7-9	Check spring	8-6	Plain washer	9-7	Pilot cap (B1)
6-9	Check spring	7-10	Plug assy	8-7	Pilot cap (B1)	9-8	Check poppet
6-10	Plug assy	7-101	Plug	8-8	Check poppet	9-9	Check spring
6-101	Plug 1 check (M14)	7-102	O-ring	8-9	Check spring	9-10	Plug 1 check (M14)
6-102	O-ring	7-11	Overload relief valve	8-10	Plug	9-101	Plug 1 check (M14)
6-11	Overload relief valve	7-12	Plug assy	8-101	Plug 1 check (M14)	9-102	O-ring
6-12	O-ring	7-121	Plug	8-102	O-ring	9-11	Taper plug
6-13	O-ring	7-122	O-ring	8-11	Overload relief valve	9-12	O-ring
6-15	Gasket	7-123	O-ring	8-12	O-ring	9-13	O-ring
7	Boom 2 breaker	7-13	O-ring	8-13	O-ring	9-15	Gasket

STRUCTURE (3/4)



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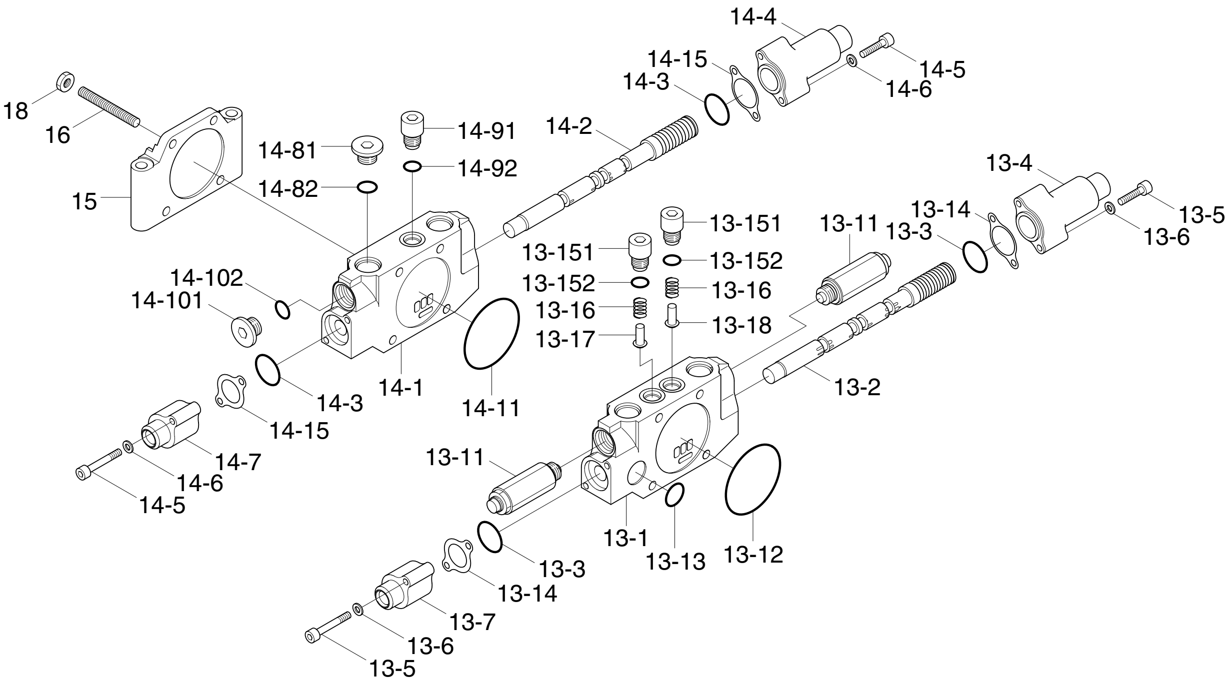
10	Inlet block (P1, P2)	10-11	Pilot spring	11-4	Pilot cap (A)	12-4	Pilot cap (A)
10-1	Work block	10-12	Pilot cap (B2)	11-5	Wrench bolt	12-5	Wrench bolt
10-2	Spool (Ts)	10-13	Check poppet	11-6	Plain washer	12-6	Plain washer
10-2-1	Spool (Ts)	10-14	Check spring	11-7	Pilot cap (B1)	12-7	Check poppet
10-2-2	Spool plug bolt	10-15	Plug assy-PF3/8	11-8	Check poppet	12-8	Check spring
10-3	O-ring	10-151	Plug	11-9	Check spring	12-9	Plug assy
10-4	O-ring	10-152	O-ring	11-10	Plug 1 assy	12-91	Check plug 1 (M14)
10-5	Main relief valve	10-16	Plug UNF5/16	11-101	Check plug 1 (M14)	12-92	O-ring
10-6	Plug 3 assy	10-161	Plug UNF5/16	11-102	O-ring	12-10	Overload relief valve
10-61	Plug-PF3/8	10-162	O-ring	11-11	Overload relief valve	12-11	Holding valve
10-62	O-ring	10-17	Spring shim	11-12	Taper plug	12-12	Holding valve
10-7	Cap assy-Ts check	10-18	O-ring	11-13	O-ring	12-13	O-ring
10-71	Cap -Ts check	10-19	O-ring	11-14	O-ring	12-14	O-ring
10-72	Poppet check valve	10-20	O-ring	11-15	O-ring	12-15	O-ring
10-73	Check spring	10-21	Taper plug	11-16	O-ring	12-16	O-ring
10-74	Plug-PF1/8	10-22	Gasket	11-17	Gasket	12-17	Wrench bolt
10-75	O-ring	11	Travel block assy	12	Boom 1 block assy	12-18	Taper plug
10-8	Wrench bolt	11-1	Work block (Od)	12-1	Block boom 1	12-19	Gasket
10-9	Plain washer	11-2	Travel spool assy (R)	12-2	Boom 1 spool assy		
10-10	Spring seat	11-3	O-ring	12-3	O-ring		

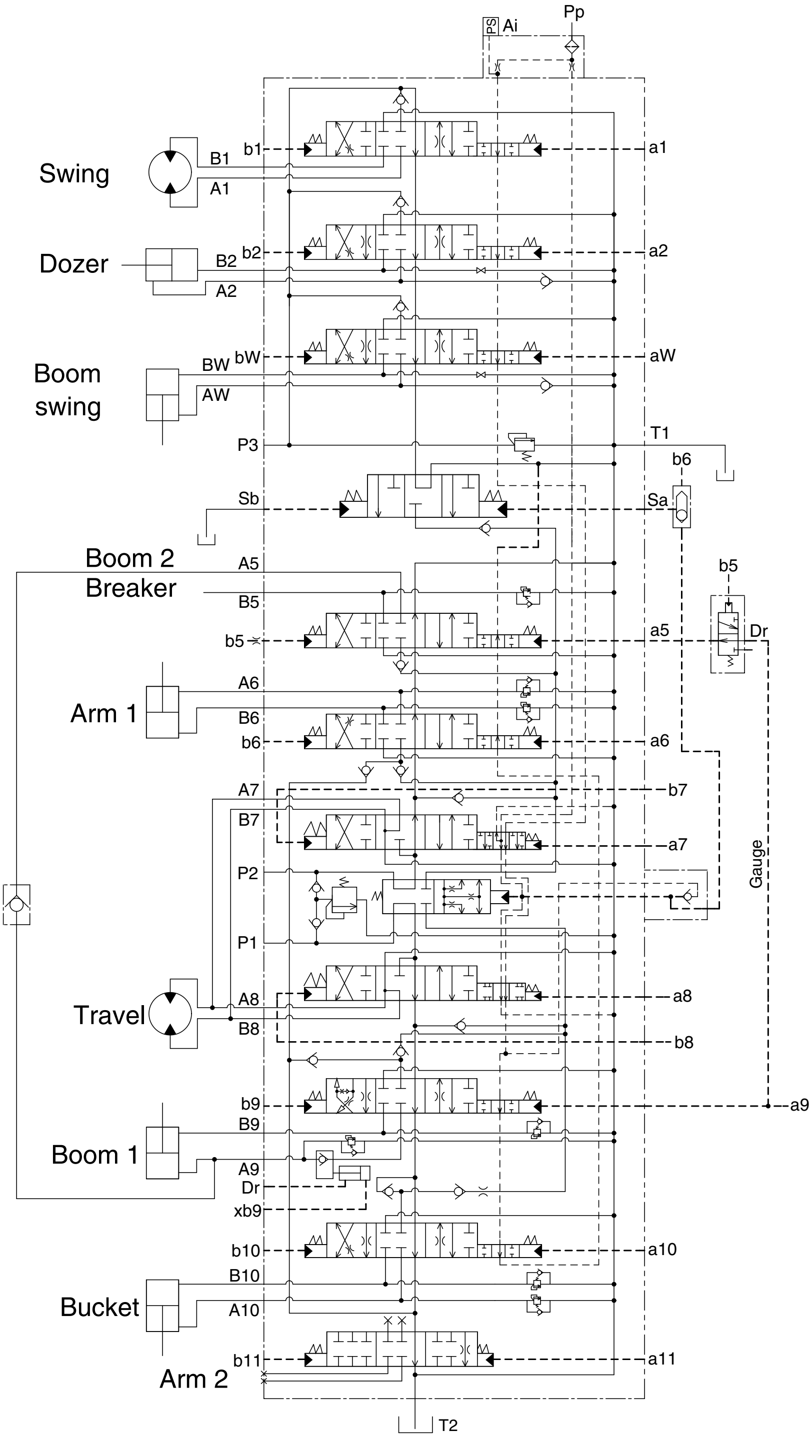
STRUCTURE (4/4)



55Z92MC05

13	Bucket block assy	13-152	O-ring	14-81	Plug PF1/2
13-1	Bucket block	13-16	Check spring	14-82	O-ring
13-2	Bucket spool assy	13-17	Check poppet	14-9	Plug assy
13-3	O-ring	13-18	Check poppet	14-91	Check plug 1 (M14)
13-4	Pilot cap (A)	14	Arm 2 assy	14-92	O-ring
13-5	Wrench bolt	14-1	Work block (Ae)	14-10	Plug assy
13-6	Plain washer	14-2	Arm 2 assy	14-101	Plug PF3/8
13-7	Pilot cap (B1)	14-3	O-ring	14-102	O-ring
13-11	Overload relief valve	14-4	Pilot cap (A)	14-11	O-ring
13-12	O-ring	14-5	Wrench bolt	14-15	Gasket
13-13	O-ring	14-6	Plain washer	15	End cover (He)
13-14	Gasket	14-7	Pilot cap (B1)	16	Tie bolt
13-15	Plug assy	14-8	Plug PF1/2	18	Nut
13-151	Check plug 1 (M14)				

3. HYDRAULIC CIRCUIT (boom swing)



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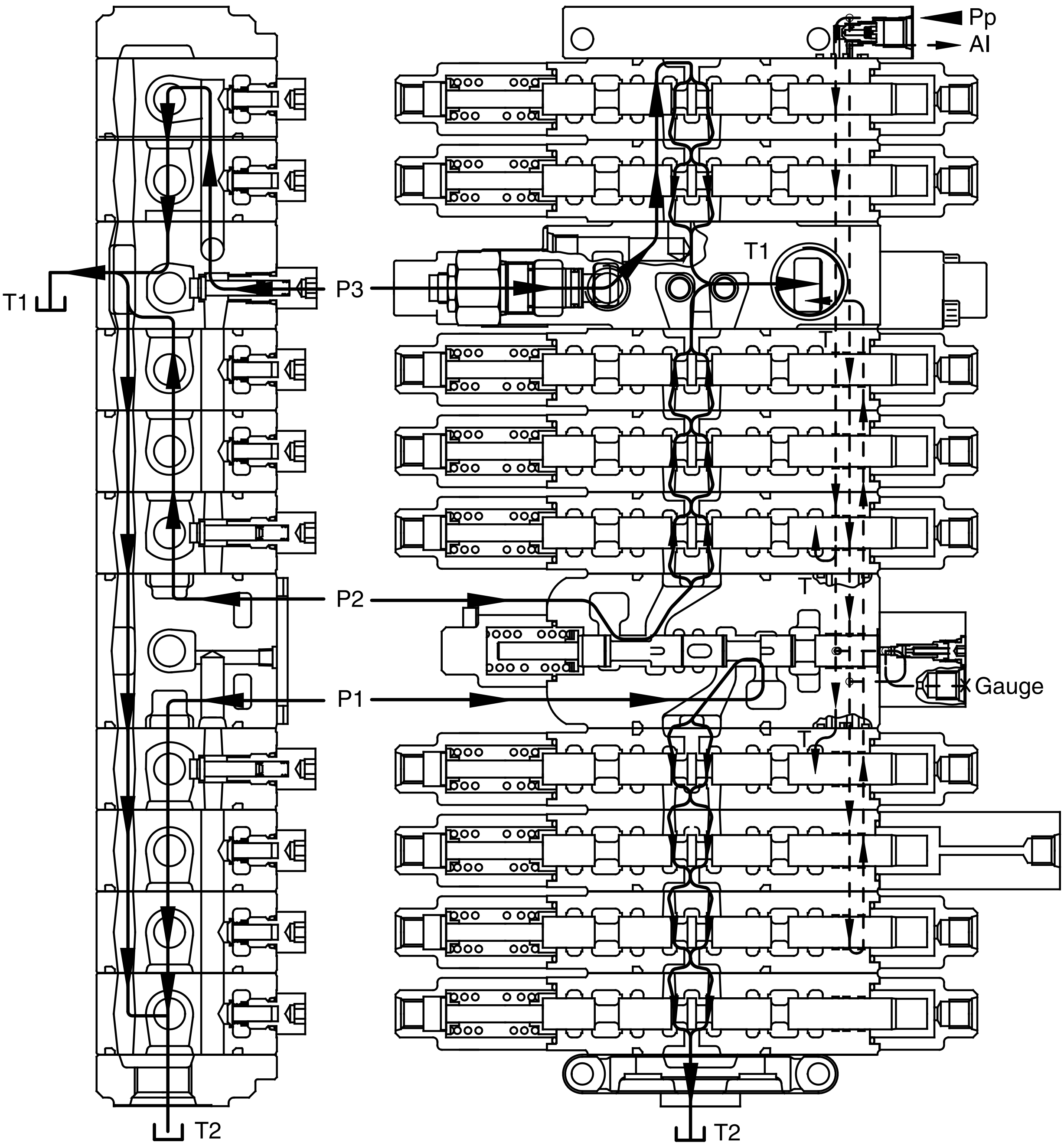
4. FUNCTION

1) CONTROL IN NEUTRAL FUNCTION



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In neutral, spring sets the spool at the neutral position, the hydraulic oil from pumps flows to the tank through the center bypass.

(1) P1

The oil discharged from the hydraulic pump flows into control valve P1 port, and then flows the right side travel valve through the travel straight valve. In neutral, the oil flows through the center bypass passage in the direction of right travel → boom 1 → bucket → arm 2 spool, and then flows from the center bypass passage to the tank port T1 and T2.

(2) P2

The oil discharged from the hydraulic pump flows into control valve P2 port, and then flows the left side travel valve through the travel straight valve. In neutral, the oil flows through the center bypass passage in the direction of left travel → arm 1 → boom 2/breaker spool, and then flows from the center bypass passage to the tank port T1 and T2.

(3) P3

The oil discharged from the hydraulic pump flows into control valve P3.
In neutral, the oil flows through the center bypass passage in the direction of swing → dozer spool, and then flows from the center bypass passage to the tank port T1 and T2.

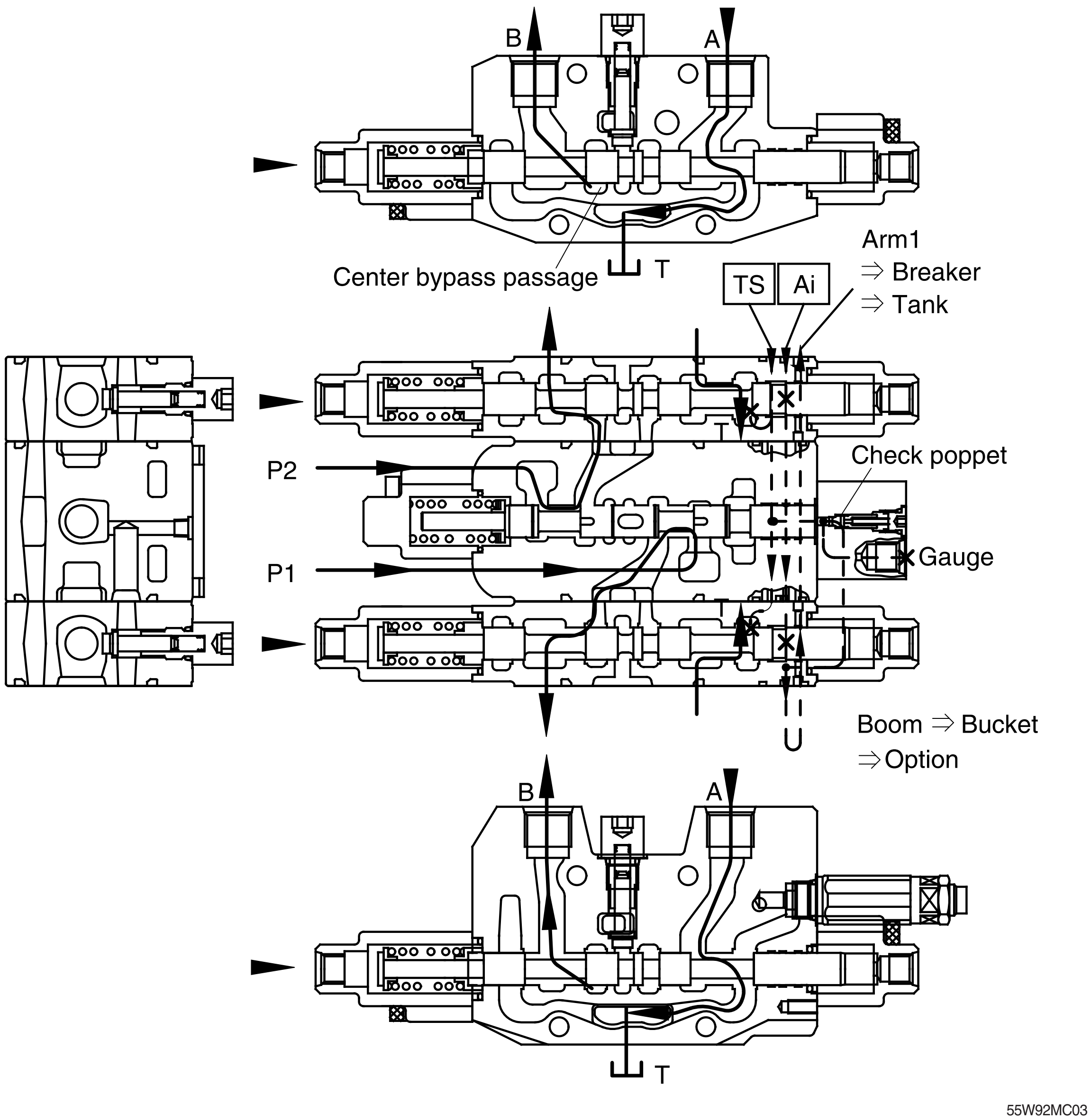
(4) Pp

When Pp port is applied with pilot pressure, the oil flows into the swing block through TS signal passage and Ai signal passage independently via an orifice.

With the spool in neutral, the oil flows into the tank passage through the all section of the control valve(except arm 2 section). As a result, the TS valve is not shifted and the auto idle signal pressure is not raised.

2) EACH SPOOL OPERATION

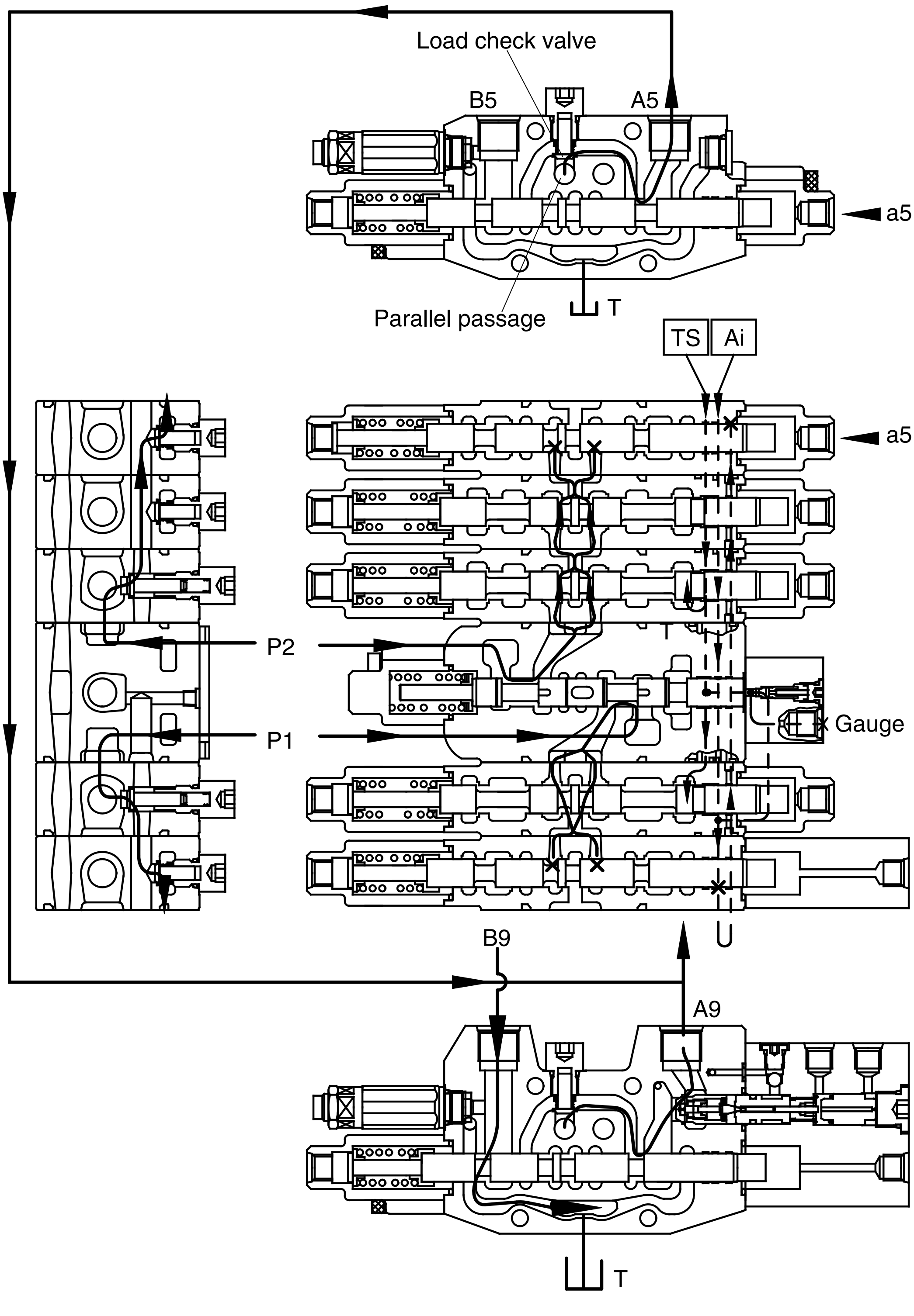
(1) Travel operation (forward / backward)



- During travel (forward/backward) operation, the pilot pressure from RCV is supplied into the travel pilot port and shift the travel spool in the right direction.
- The hydraulic oil fluid from pump is entered center bypass passage of inlet block (P1, P2) and then flows into the port of travel motor.
- The oil from the port A of travel motor flows into the main control valve and return to the hydraulic oil tank through the tank passage.
- The TS signal passage is shut off by shifting of the travel spool, but it is connected with Ai signal passage and drain to the hydraulic oil tank. As a result, the travel straight spool is not shifted.
- The Ai signal passage is connected with travel block through swing and dozer block and it is shut off by shifting of the travel spool and then signal pressure of auto idle is raised.

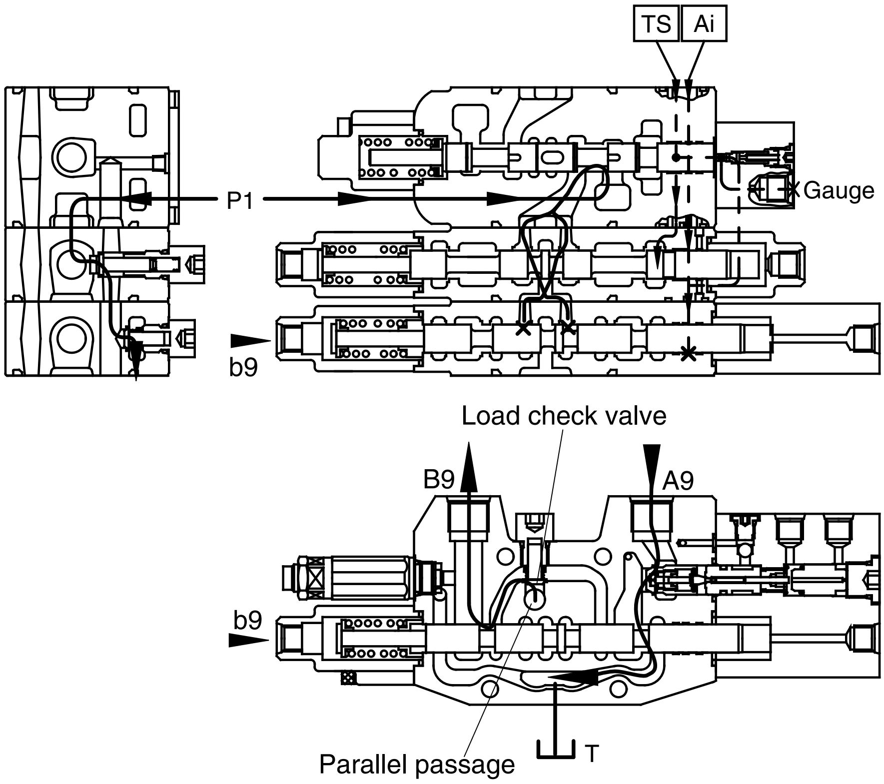
(2) Boom operation

① Boom up operation (P1 and P2 summation)



· During boom up operation, the pilot pressure from RCV is supplied into the port a9 and shift the boom 1 spool in the left direction. The hydraulic oil fluid from pump P1 is entered P1 parallel passage and then passes through the load check valve then flows into the port A9.
  Following this, it flows into the head side of the boom cylinder.
  At the same time the pilot pressure through the port a5 shifts the boom 2 spool. The hydraulic oil fluid from pump P2 is entered P2 parallel passage and then passes through the load check valve then flows into the port A5. The flows combine in hydraulic hoses and are directed to the cylinder head side of boom cylinder.
  The flow from rod side of the boom cylinder return to the boom 1 spool through the port B9. There after it is directed to the hydraulic oil tank through the tank passage.
· The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
· The Ai signal passage oil from the Pp port is shut off by shifting of the boom 1 spool and then signal pressure of auto idle is raised.

② Boom down operation



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· During the boom lowing operation, the pilot pressure from RCV is supplied to the port b9 and shift the boom 1 spool in the right direction.
The hydraulic fluid from the pump P1 enters the parallel passage and is directed to the port B9 through the load check valve. Following this, it flows into the rod side of the boom cylinder.
The return flow from the head side of the boom cylinder returns to the boom 1 spool through the port A9. Thereafter it is directed to the hydraulic oil tank through tank passage.
· The hydraulic oil flow from the Pp port is same as the boom up operation.

(3) Bucket operation

① Bucket roll in operation

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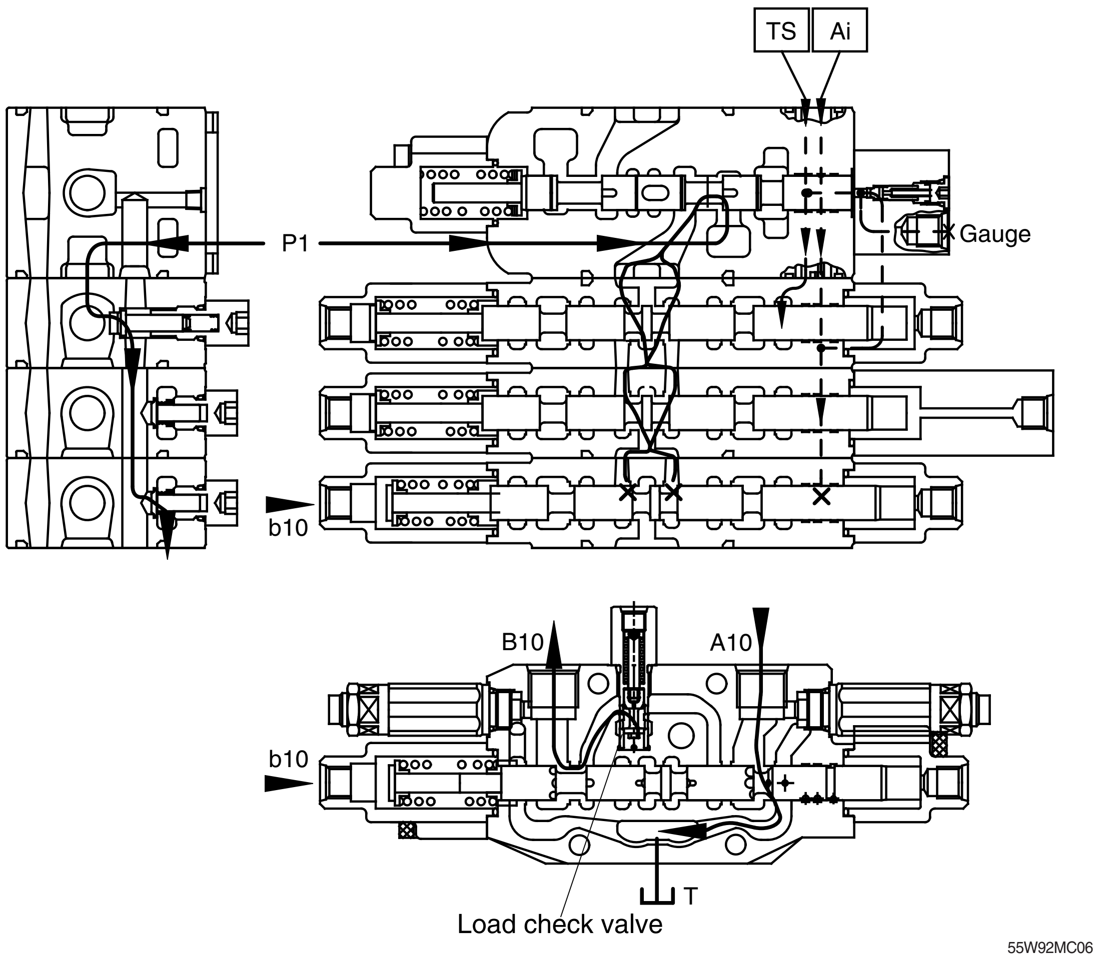

- During the bucket roll in operation, the pilot pressure from RCV is supplied to port b10 and shift the bucket spool in the right direction.
  The hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B10 through the load check valve.
  Following this, it flows into the head side of the bucket cylinder.
  The return flow from the rod side of the bucket cylinder returns to the bucket spool through the port A10. Thereafter it is directed to the hydraulic oil tank through the tank passage.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the bucket spool and then signal pressure of auto idle is raised.

② Bucket roll out operation

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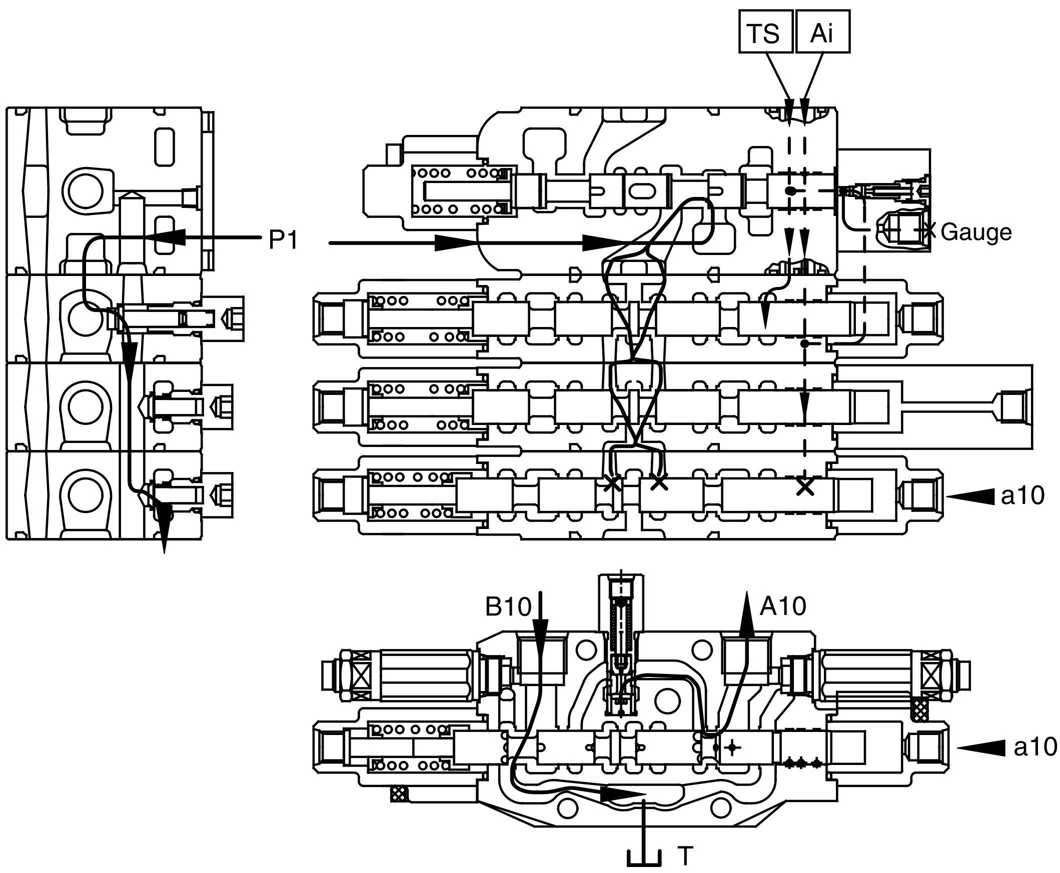

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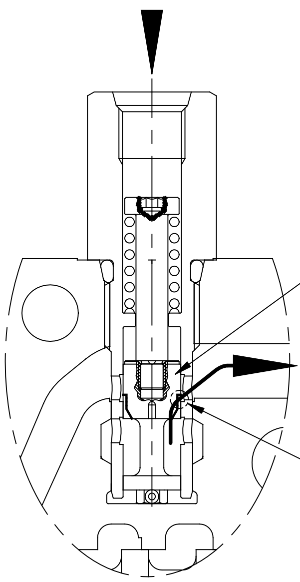
· In case of the bucket roll out operation, the operation is similar.
· The hydraulic oil flow from the Pp port is same as the bucket in operation.

③ Bucket load check valve operation



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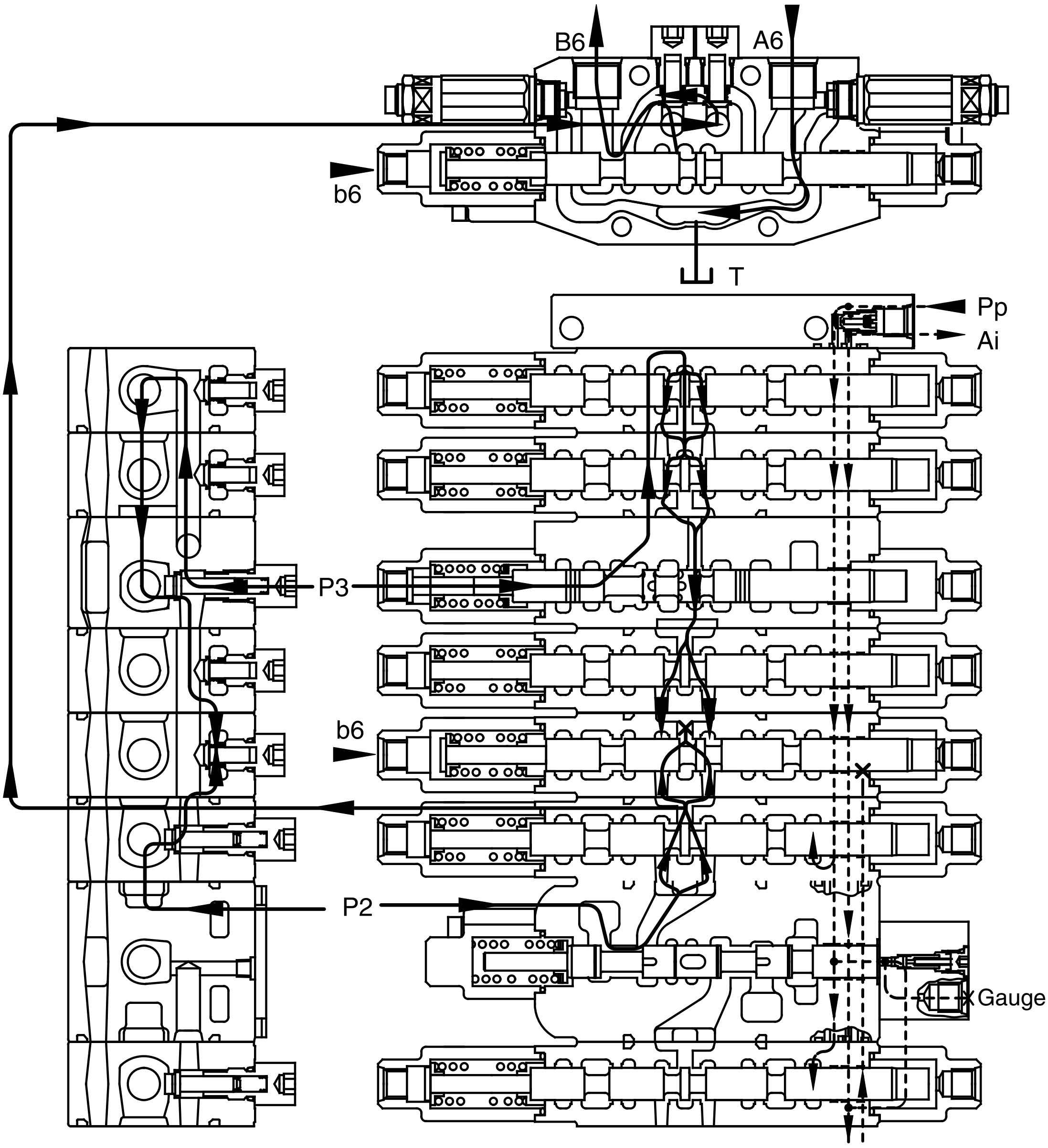
- This function is used to speed up of the boom or arm by reducing the bucket speed when bucket operation with boom or arm operation simultaneously.
- When the signal pressure flows into port pp2, the plunger is shifted and orifice is made.
- The hydraulic oil from the port P1 flow into bucket cylinder via the orifice and then the speed of bucket cylinder is slow down.
  Accordingly, the much fluid from the port P1 is supplied other cylinder than the bucket cylinder.

(4) Arm operation

① **Arm roll in operation** (P1 and P2 summation)



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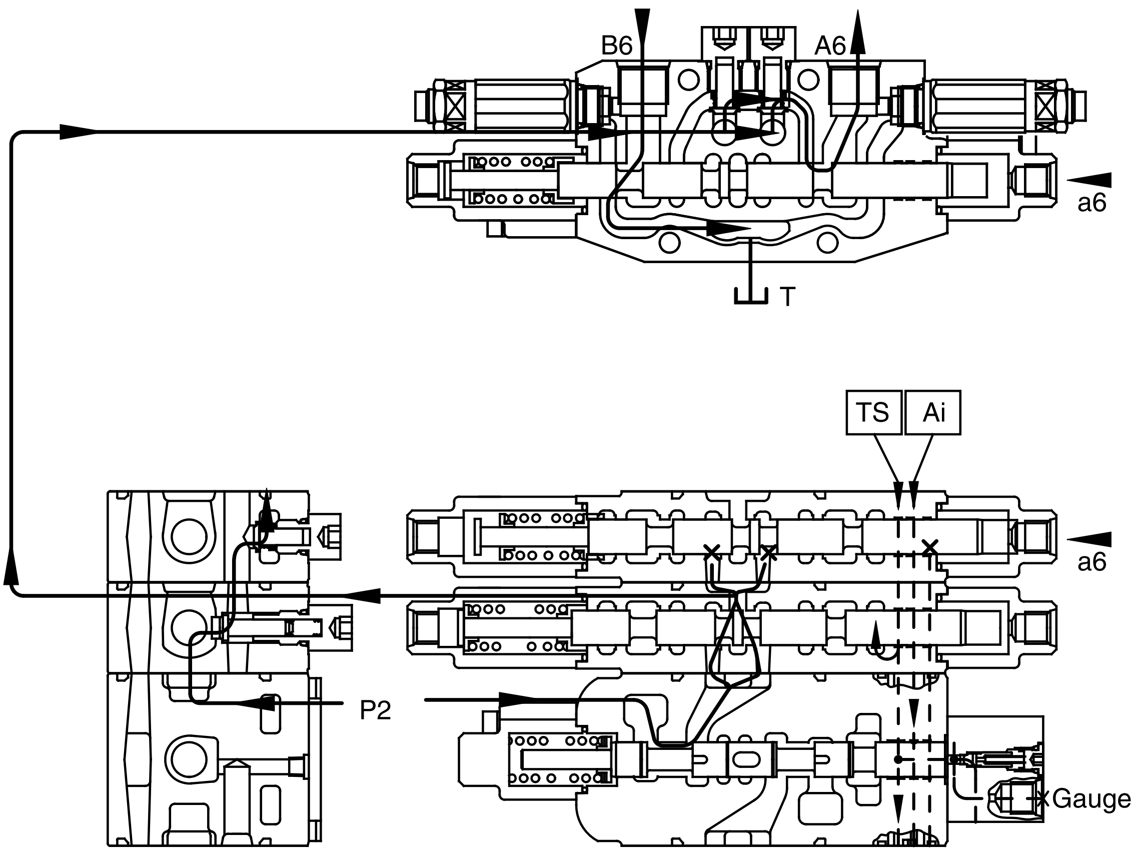
- During arm roll in operation the pilot pressure from the RCV is supplied to the port b6 and shifts arm 1 spool in the right direction.
- Also, the pilot pressure is supplied to the port Sa through the external piping and shift the spool of P3 inlet block.
  The hydraulic oil from the pump P2 flows into the arm cylinder head side through P2 parallel passage, the load check valve and the port B6.
  At same time, the hydraulic fluid from the pump P3 flows into the arm summation passage in arm 1 spool through the P3 inlet spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the arm spool and then signal pressure of auto idle is raised.

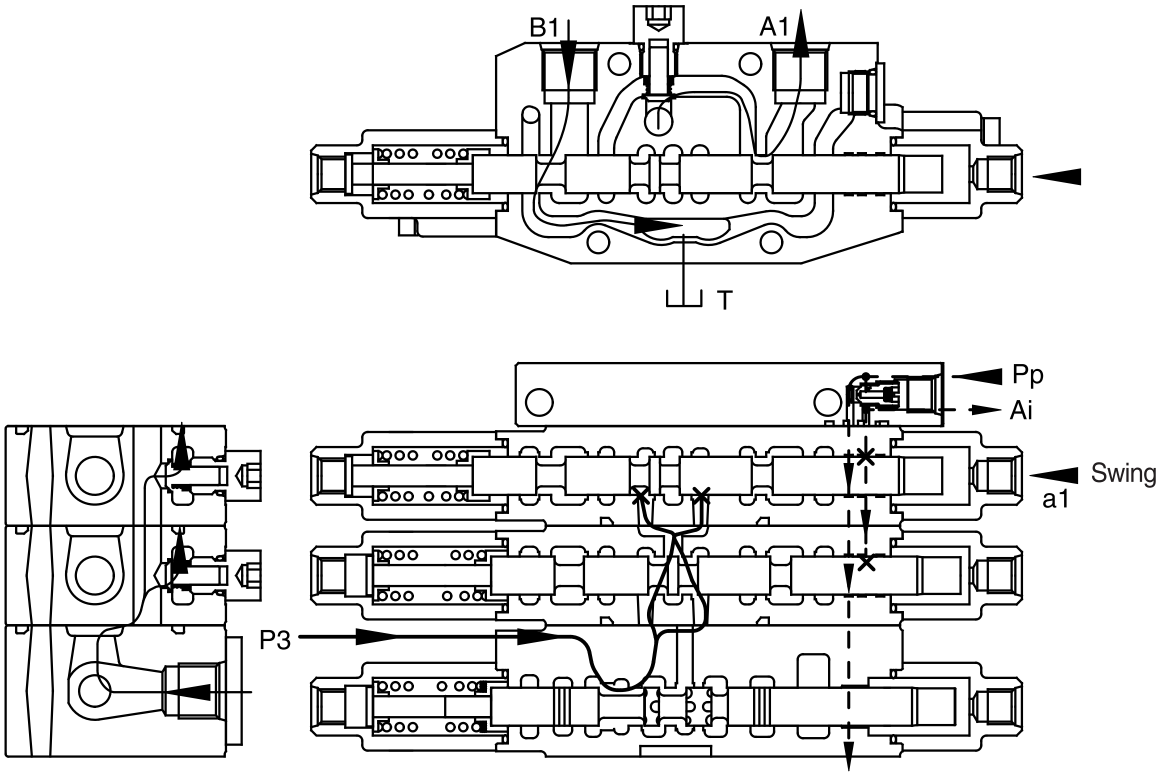
② Arm roll out operation



55W92MC09

- During arm roll out operation the pilot pressure from RCV is supplied to the port a6 and shifts arm 1 spool in the left direction.
  The hydraulic fluid from pump P2 flows into arm 1 spool through the parallel passage. Then it enters into the arm cylinder rod side through the load check valve and the port A6.
  The return flow from the arm cylinder head side returns to the hydraulic tank through the port B6 the arm1 spool and tank passage.
- The hydraulic oil flow from the Pp port is same as the arm roll in operation.

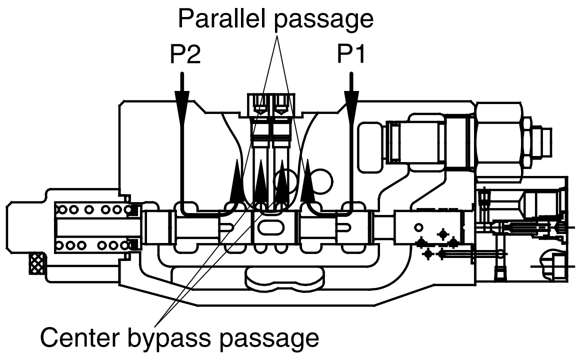
(5) Swing operation

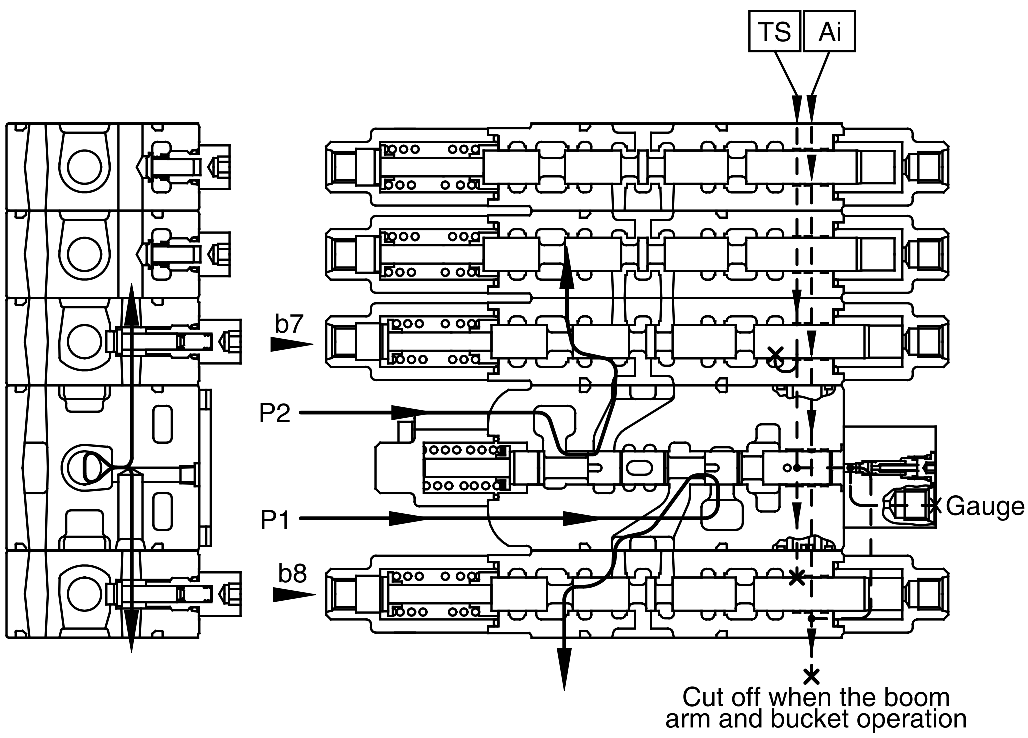


555C92MC16

- The pilot pressure from the RCV is supplied to the a1 and shift the swing spool in left direction. The hydraulic fluid from pump P3 flows into swing spool through the parallel passage. Then it is directed to swing motor through the port A1. As a result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port B1, swing spool and the tank passage.
  In case of swing left operation, the operation is similar.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the swing spool and then signal pressure of auto idle is raised.

(6) Travel straight spool





55W92MC10

① The other actuator operation during travel operation.

When the other actuator spool(s) is selected under travel operation, the straight travel spool is moved.

Some of hydraulic fluid from pump P1 and P2 is supplied to the travel motors through parallel passage and the other hydraulic fluid is supplied to the actuator(s) through center bypass passage via orifice passage.

Thus, the machine keeps the speed and power of the actuator and travel.

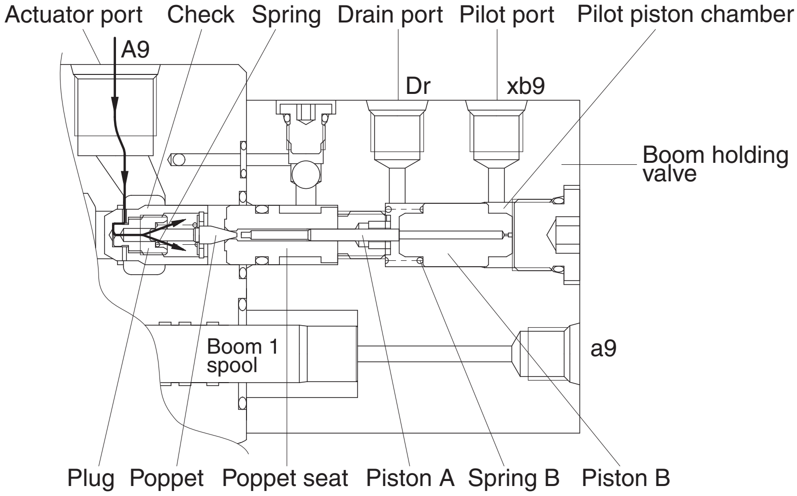
② The arm in operation during straight travel operation.

The arm in pilot pressure flows into P3 pilot port Sa through the external piping and the spool is shifted. As a result, the fluid of P3 pump is combined with the arm in operation through parallel passage and then the arm in speed up.

Refer to the arm in operation for the details.

(7) Holding valve operation

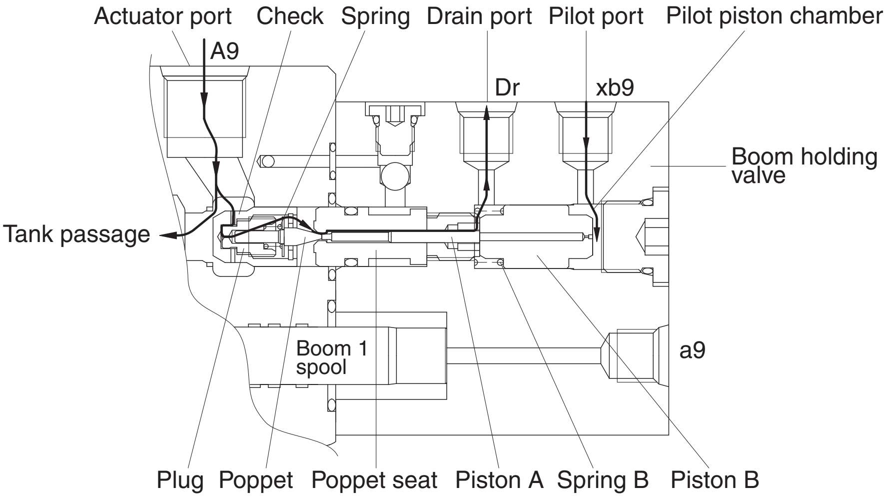
① Holding operation



55W72MC16

At neutral condition, the pilot piston chamber is connected to drain port through the pilot port.
And the piston "B" is supported with spring "B".
Also, the pressured fluid from actuator entered to inside of the holding valve through the periphery hole of check, crevice of the check and the plug and the periphery hole of plug.
Then, this pressured oil pushed the poppet to the poppet seat and the check to the seat of body.
So the hydraulic fluid from actuator is not escaped and the actuator is not moved.

② Release holding operation



55W72MC17

The pilot pressure is supplied to the pilot port for release holding valve and shifts the piston "B" in the left direction against the spring "B", and shifts the poppet in the left direction through piston "B" and piston "A" against spring "B" and shifts the spool in the left side.
At same time, the return fluid from actuator returns to the drain port through the periphery hole of check, crevice of the check and the plug, the periphery hole of the plug, in side of holding valve, crevice of the poppet and the poppet seat, the periphery hole of the poppet seat, crevice of socket and spool and internal passage of spool.
When the poppet is opened, pressure of inside of holding valve is decreased and the return fluid from actuator returns to the tank passage through the notch of spool.

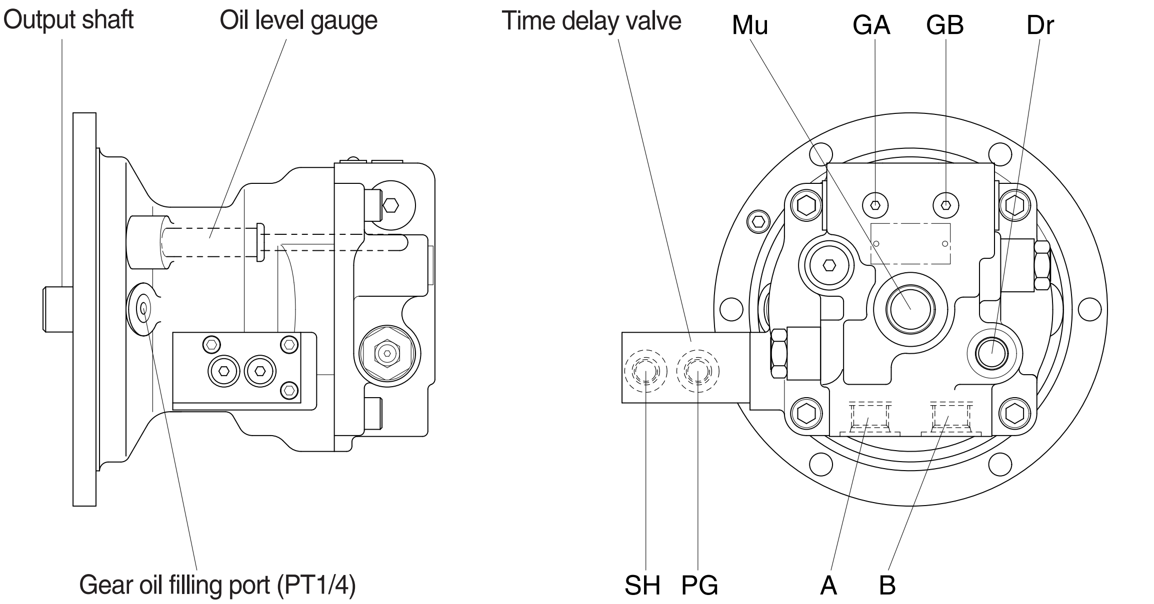
GROUP 3 SWING DEVICE

1. STRUCTURE

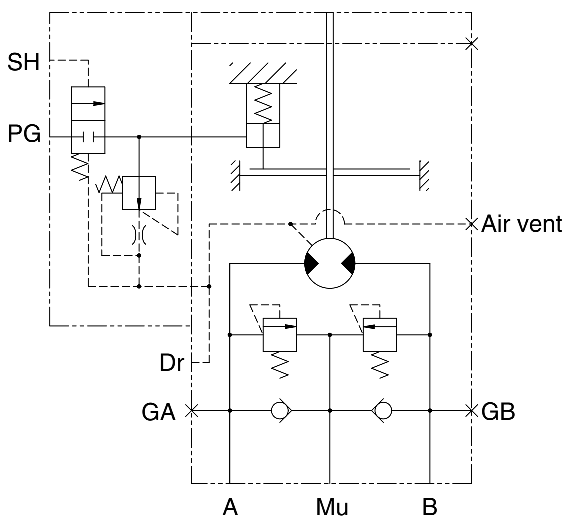
Swing device consists swing motor, swing reduction gear.

1) SWING MOTOR

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

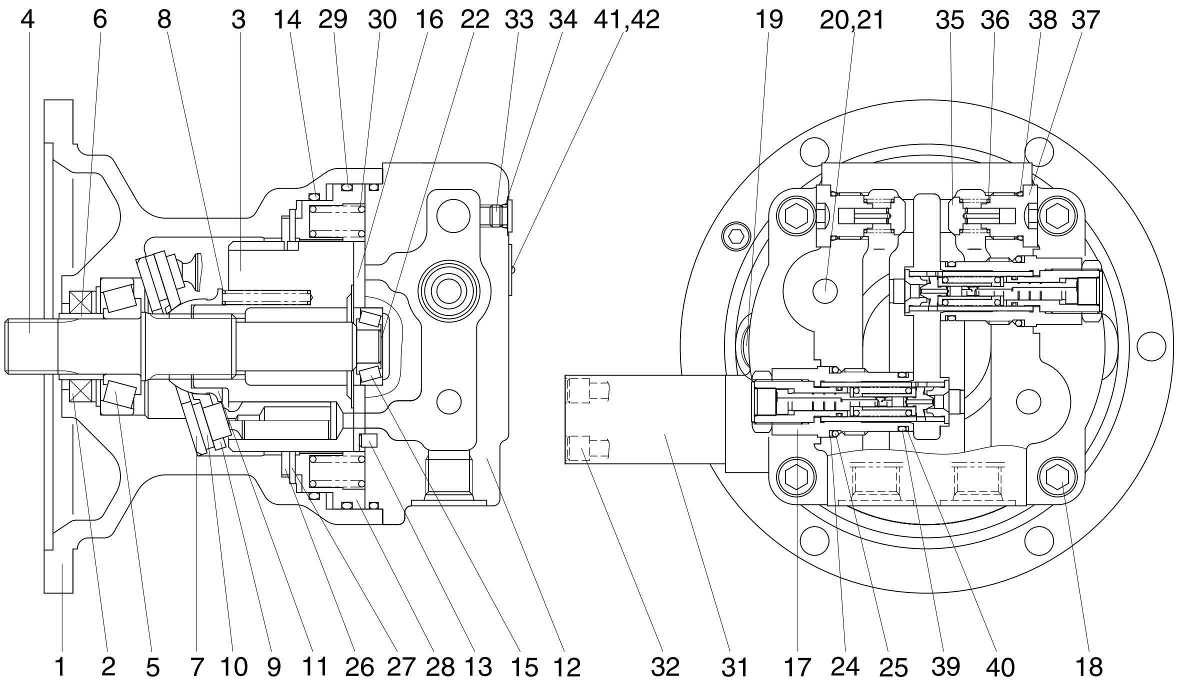


555K2SM01



Hydraulic circuit

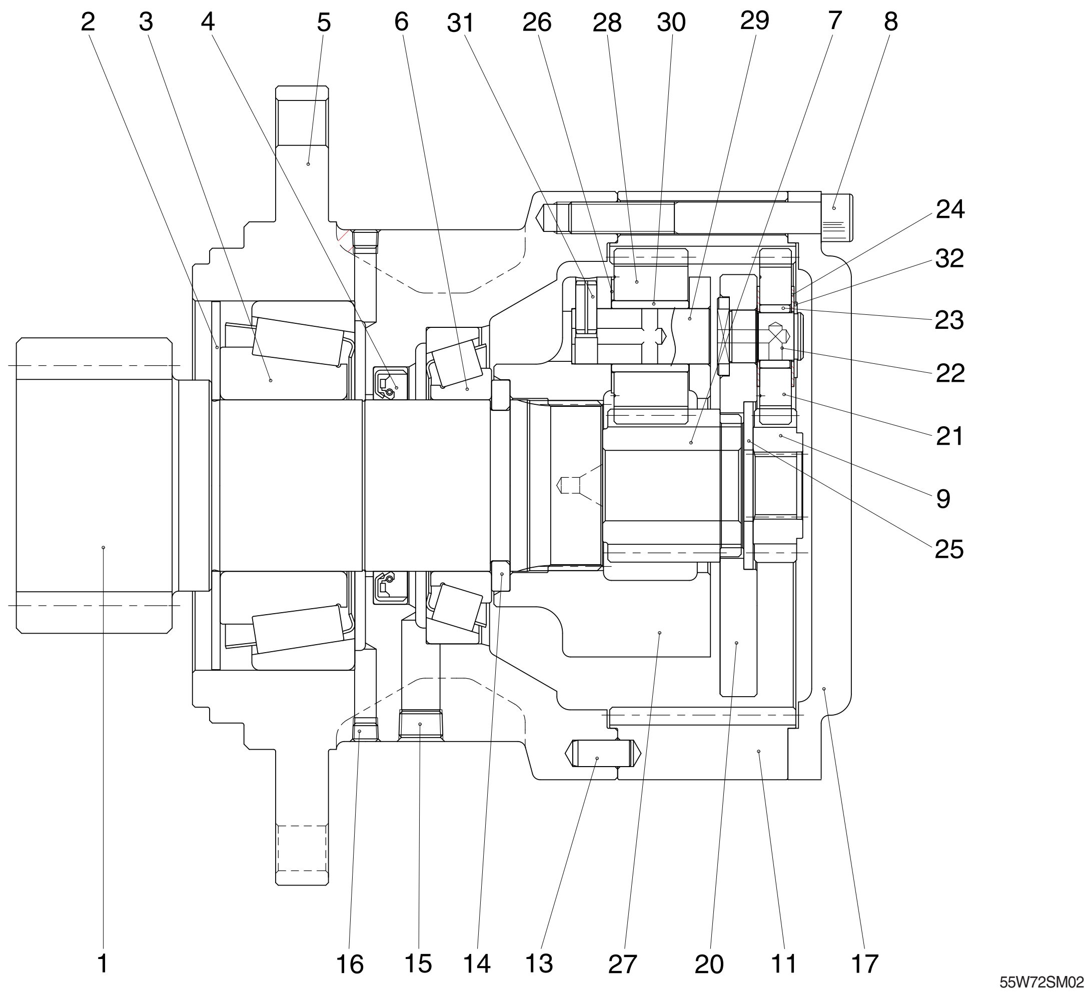
Port	Port name	Port size
A	Main port	SAE PF 1/2
B	Main port	SAE PF 1/2
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
GA,GB	Gauge port	PF 1/4



555K2SM03

1	Body	15	Taper bearing	30	Spring
2	Oil seal	16	Valve plate	31	Time delay valve
3	Cylinder block	17	Relief valve assy	32	Socket bolt
4	Shaft	18	Socket bolt	33	Plug
5	Taper bearing	19	Plug	34	O-ring
6	Bushing	20	Plug	35	Valve
7	Shoe plate	21	O-ring	36	Spring
8	Spring	22	Shim	37	Plug
9	Set plate	24	Back up ring	38	O-ring
10	Piston shoe assy	25	O-ring	39	O-ring
11	Ball guide	26	Friction plate	40	Back up ring
12	Rear cover	27	Plate	41	Name plate
13	Pin	28	Parking piston	42	Rivet
14	O-ring	29	O-ring		

2) REDUCTION GEAR



1	Shaft	12	Carrier assy 2	23	Bushing 1
2	Bearing cover	13	Dowel pin	24	Thrust washer 1
3	Taper roller bearing	14	Collar	25	Thrust washer 3
4	Case	15	Plug	26	Thrust washer 2
5	Oil seal	16	Plug	27	Carrier assy 2
6	Taper roller bearing	17	Cover	28	Planet gear 2
7	Sun gear 2	18	Pipe	29	Pin 2
8	Socket bolt	19	Level gauge	30	Bushing 2
9	Sun gear 1	20	Carrier assy 1	31	Spring pin
10	Carrier assy 1	21	Planet gear 1	32	Snap ring
11	Ring gear	22	Pin 1	33	Thrust washer 4

2. FUNCTION

1) ROTARY PART

When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force F1 perpendicular to swash plate(7) and force F2 perpendicular to cylinder center.

Being transferred to the cylinder block(3) through piston, force F2 causes rotational moment at surroundings of cylinder.

Since cylinder block has 9 equidistantly arrayed pistons, rotational torque is transmitted to cylinder shaft in order by several pistons connected to the inlet port of high pressurized oil. When the direction of oil flow is reversed, rotational direction of cylinder is also reversed. Output torque is given by the equation.

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

Where p : Effective difference of pressure (kgf/cm^2)

q : Displacement (cc/rev)

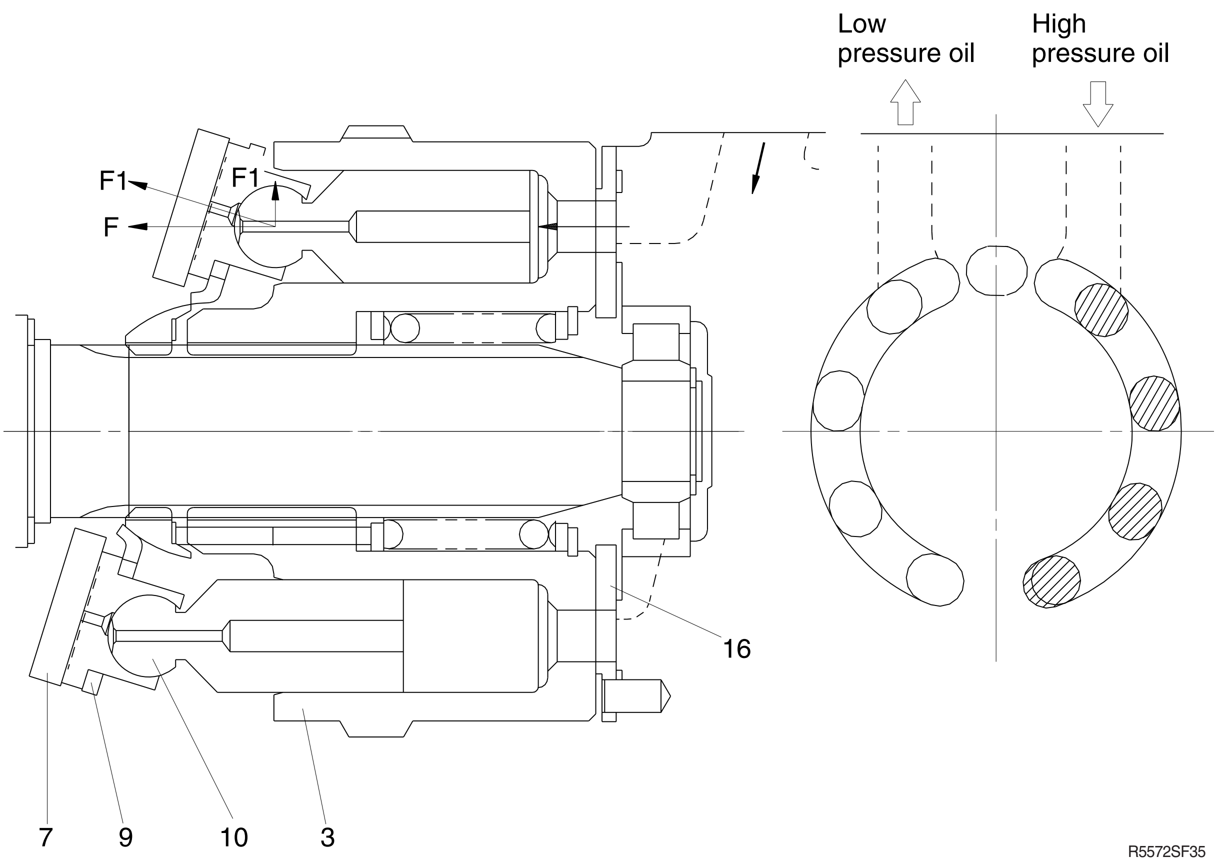
T : Output torque (kgf·cm)

Z : Piston number (9EA)

A : Piston area (cm^2)

θ: Tilting angle of swash plate (degree)

S : Piston stroke (cm)



R5572SF35

2) MAKE UP VALVE

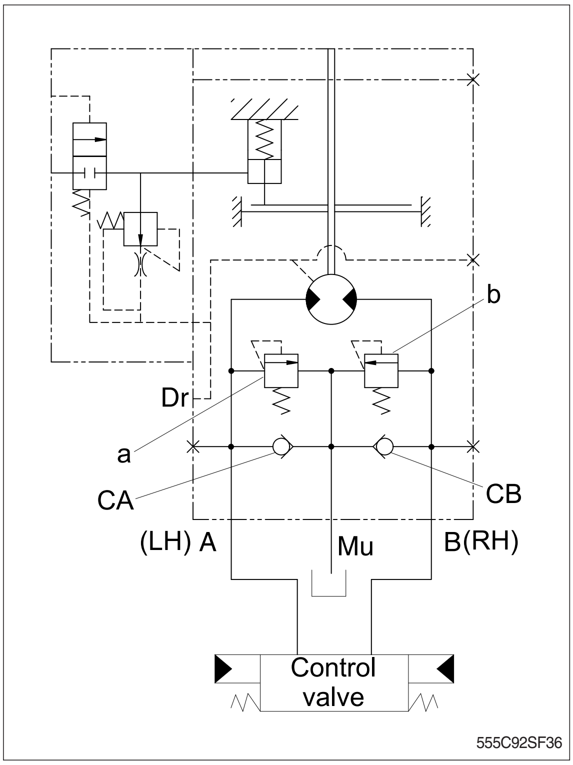
(1) Outline

The safety valve portion consists of a check valve and safety valve.

(2) Function

When the swing is stopped, the output circuit of the motor continues to rotate because of inertia. For this reason, the pressure at the output side of the motor becomes abnormality high, and this will damage the motor. To prevent this, the oil causing the abnormal hydraulic pressure is allowed to escape from the outlet port (high-pressure side) of the motor to port Mu, thereby preventing damage to the motor.

Compared with a counterbalance valve, there is no closed-in pressure generated at the outlet port side when slowing down the swing speed. This means that there is no vibration when slowing down, so the ease of swing control is improved.



(3) Operation

① When starting swing

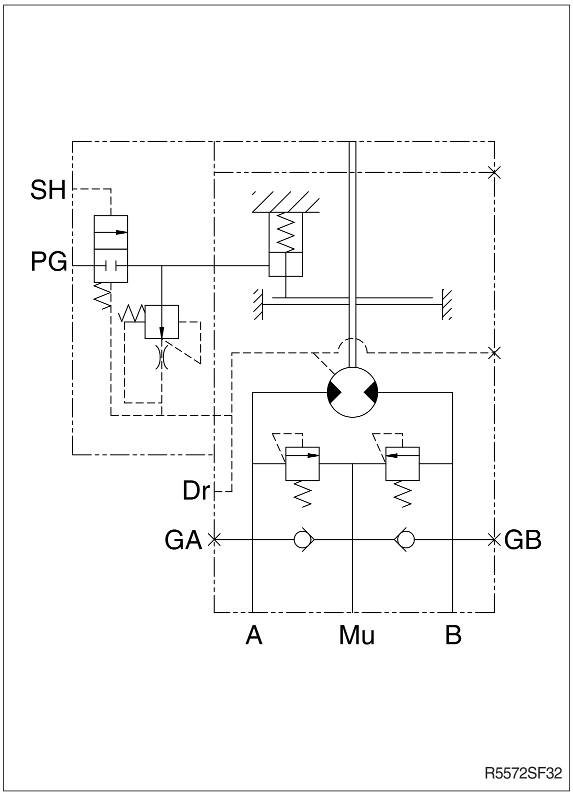
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port of the motor passes from port A through the control valve and returns to the tank.

② When stopping swing

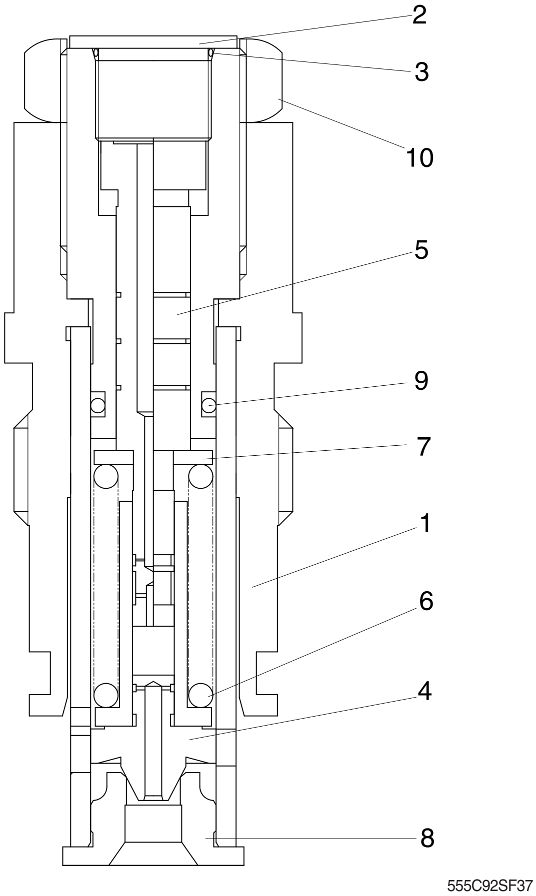
· When the swing control lever is returned to neutral, no pressurized oil is supplied from the pump to port B.
  The return circuit to the tank is closed by the control valve. So the oil from the outlet port of the motor increases in pressure at port A. Resistance to the rotation of the motor is created, and the brake starts to act.

· The pressure at port A rises to the set pressure of make up valve a, and in this way, a high brake torque acts on the motor, and the motor stops.

· When make up valve a is being actuated, the relief oil from make up valve a and the oil from port Mu pass through check valve CB and are supplied to port B. This prevents cavitation from forming at port B.



3) RELIEF VALVE



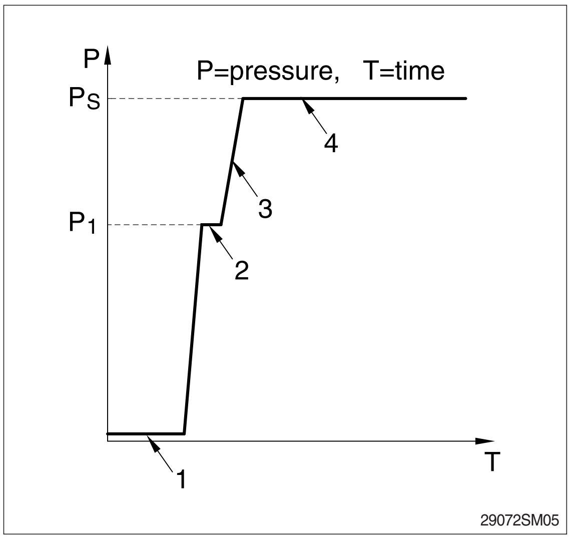
1	Body
2	Plug
3	O-ring
4	Plunger
5	Piston
6	Spring
7	Spring seat
8	Seat
9	O-ring
10	Nut

(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.

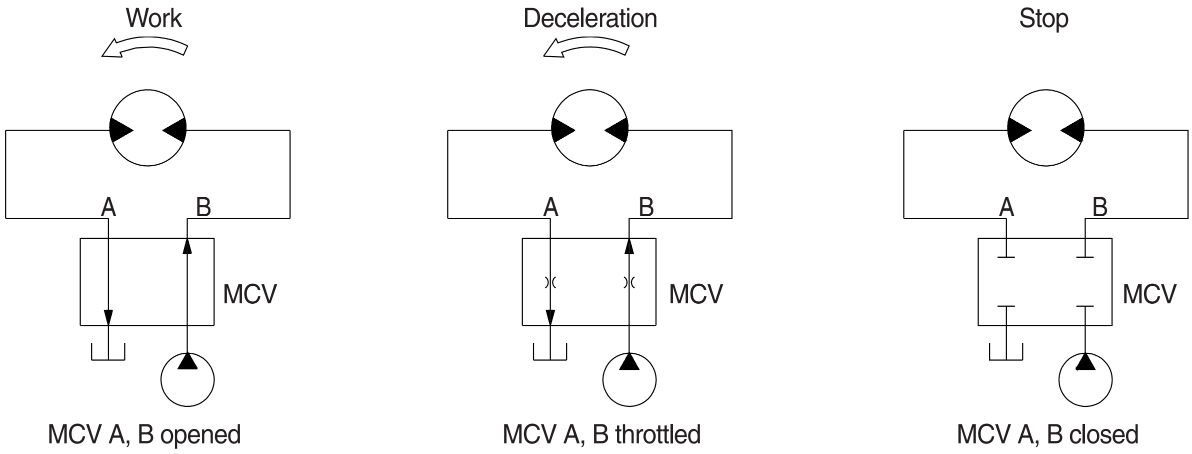


4) BRAKE SYSTEM

(1) Control valve swing brake system

This is the brake system to stop the swing motion of the excavator during operation.

In this system, the hydraulic circuit is throttled by the swing control valve, and the resistance created by this throttling works as a brake force to slow down the swing motion.



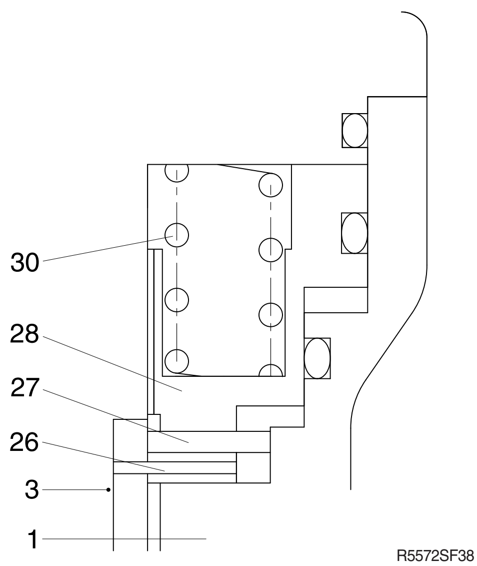
(2) Mechanical swing parking brake system

The mechanical swing parking brake system is installed to prevent the upper structure from swinging downhill because of its own weight when the excavator is parked on a slope since it completely eliminates the hydraulic drift of swing motion while the excavator is on a slop, work can be done more easily and safely.

① Brake assembly

Circumferential rotation of separate plate (27) is constrained by the groove located at casing (1). When housing is pressed down by brake spring (30) through friction plate (26), separate plate (27) and brake piston (28), friction force occurs there.

Cylinder (3) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.

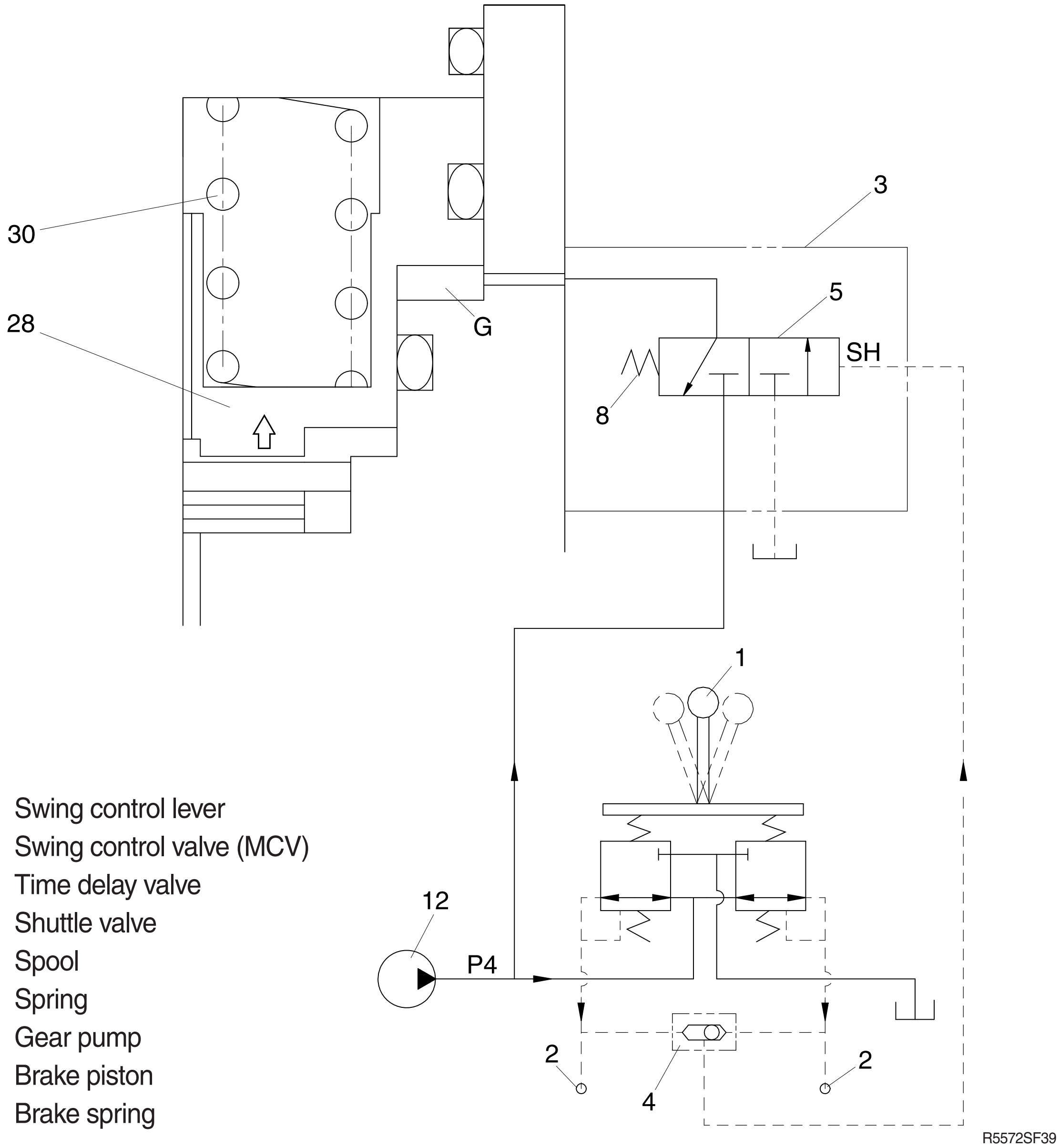


1	Casing	27	Separate plate
3	Cylinder	28	Brake piston
26	Friction plate	30	Brake spring

② Operating principle

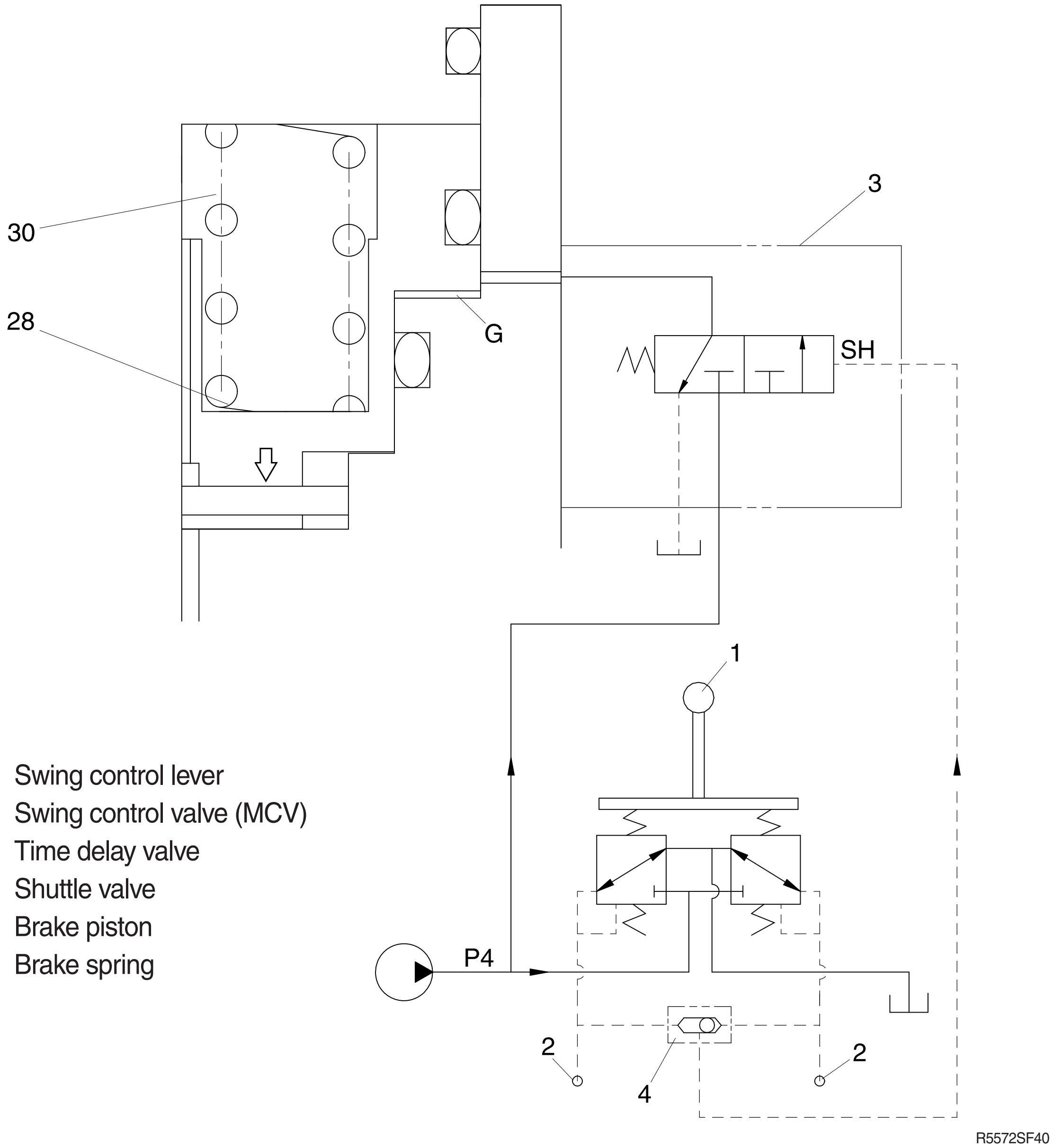
a. When the swing control lever (1) is set to the swing position, the pilot oil go to the swing control valve (2) and to SH of the time delay valve (3) via the shuttle valve (4), this pressure move spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P4) goes to the chamber G.

This pressure is applied to move the piston (28) to the upward against the force of the spring (30). Thus, it releases the brake force.



1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
5 Spool
8 Spring
12 Gear pump
28 Brake piston
30 Brake spring

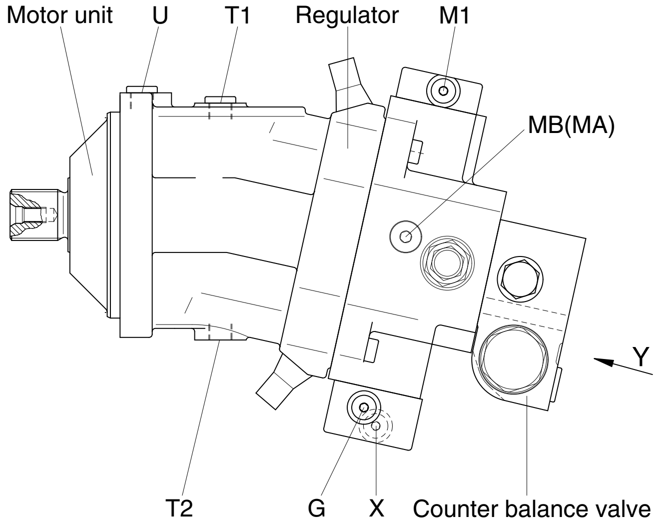
b. When the swing control lever (1) is set the neutral position, the time delay valve (3) shifts the neutral position and the pilot oil blocked chamber G.
Then, the piston (28) is moved lower by spring (30) force and the return oil from the chamber G is drain.

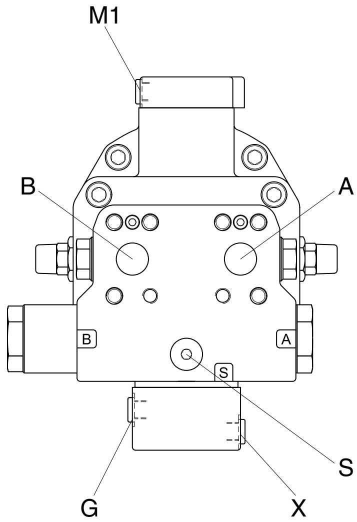


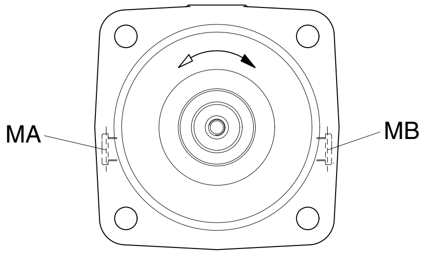
1	Swing control lever
2	Swing control valve (MCV)
3	Time delay valve
4	Shuttle valve
28	Brake piston
30	Brake spring

1. CONSTRUCTION

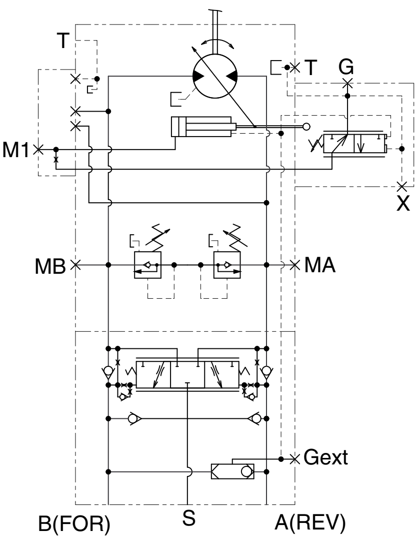
Travel motor consists motor unit, regulator and counter balance valve.







VIEW Y

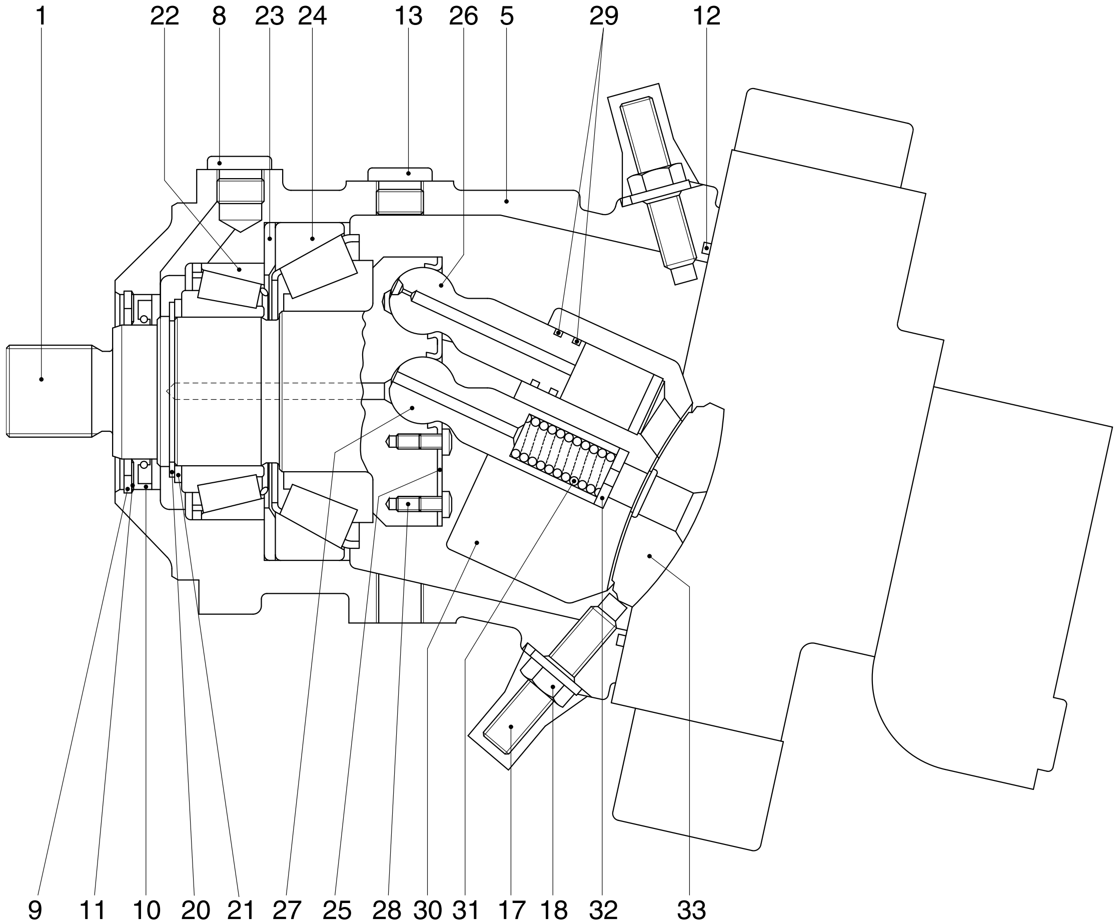


Hydraulic circuit

Port	Port name	Port size
A, B	Main port	SAE 6000psi 1
G	Gauge port	M14×1.5
M1	Gauge port	M14×1.5
X	Pilot pressure port	M14×1.5
T2	Drain port	M18×1.5
U	Flushing port	M18×1.5
S	Make up port	M22×1.5
MA,MB	Gauge port	M18×1.5

55W9A2TM01

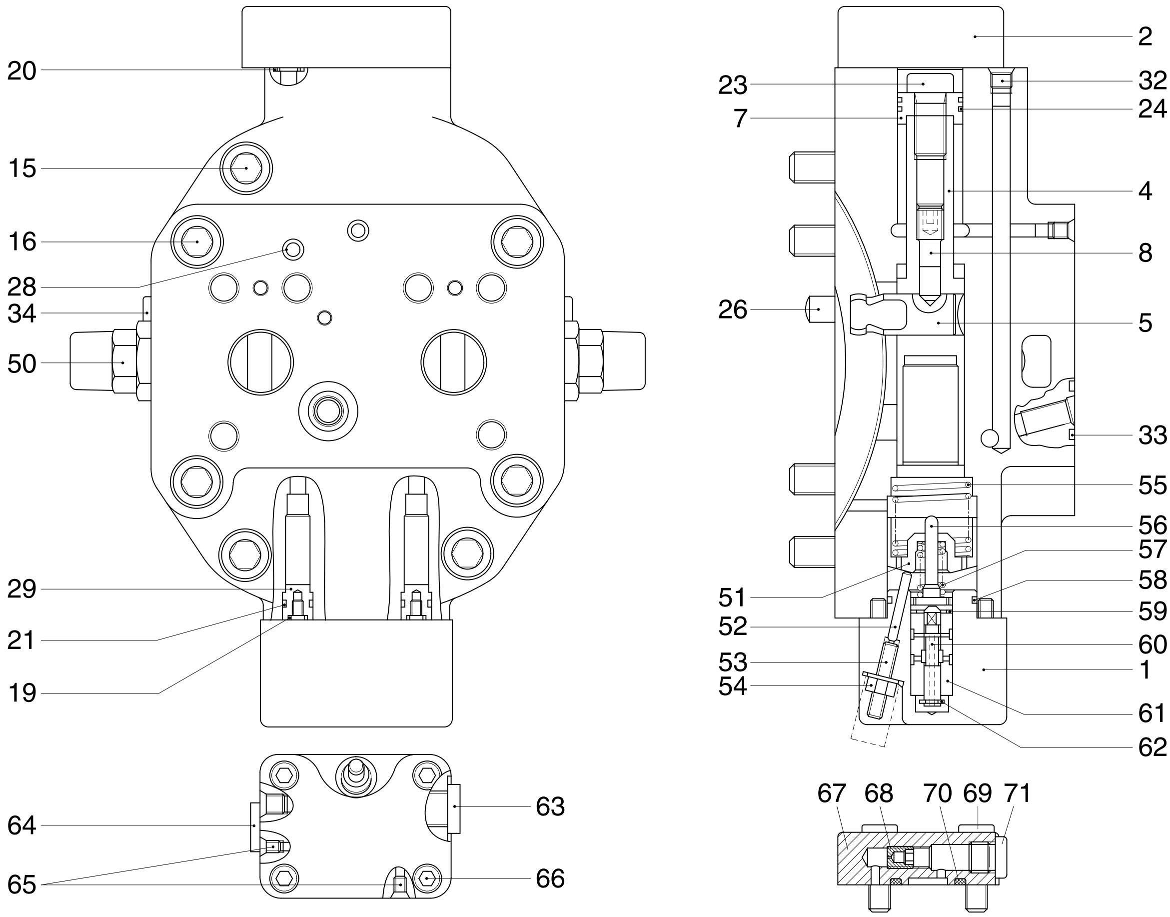
1) MOTOR UNIT



200W34TM02

1	Drive shaft	17	Threaded pin	26	Piston
5	Housing	18	Seal lock nut	27	Center pin
8	Locking screw	20	Retaining ring	28	Pan head screw
9	Retaining ring	21	Back up plate	29	Steel sealing ring
10	Shaft seal ring	22	Taper roller bearing	30	Cylinder block
11	Back up plate	23	Shim	31	Pressure spring
12	O-ring	24	Taper roller bearing	32	Adjustment shim
13	Locking screw	25	Retaining plate	33	Control lens

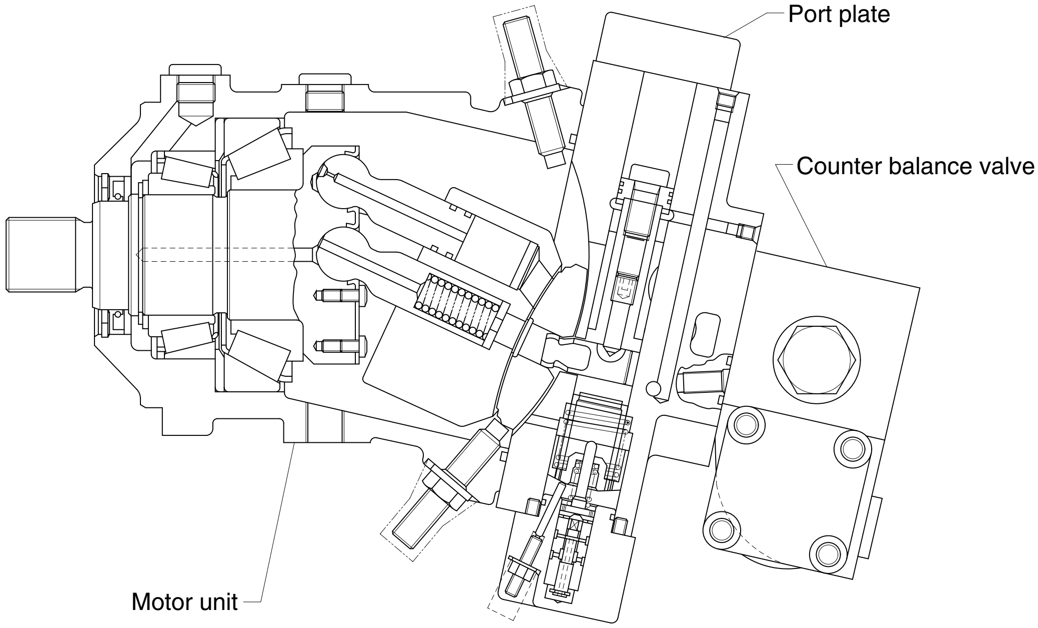
2) REGULATOR



55W72TM03

1	Control housing	28	Double break off pin	59	Retaining ring
2	Cover	29	Plug	60	Control piston
4	Positioning piston	32	Double break off pin	61	Control bushing
5	Positioning trunnion	33	O-ring	62	Retaining disc
7	Piston	34	Locking screw	63	Locking screw
8	Threaded pin	50	Relief valve	64	Locking screw
15	Socket head screw	51	Adjusting bushing	65	Double break off pin
16	Socket head screw	52	Cylinder pin	66	Socket head screw
19	O-ring	53	Threaded pin	67	Cover
20	O-ring	54	Seal lock nut	68	Throttle screw
21	O-ring	55	Pressure spring	69	Socket head screw
23	Socket head screw	56	Spring collar	70	O-ring
24	Square ring	57	Pressure spring	71	Locking screw
26	Cylinder pin	58	O-ring		

2. FUNCTION



14W72TM05

1) VARIABLE DISPLACEMENT MOTOR (with integrated counterbalance valve)
The variable displacement motor has a rotary group in bent axis design.
The torque is generated directly at the drive shaft.
The cylinder barrel is driven by a tapered piston arrangement.
The change of displacement is generated by the control lens via positioning piston. The control lens slides on a circular shaped surface.

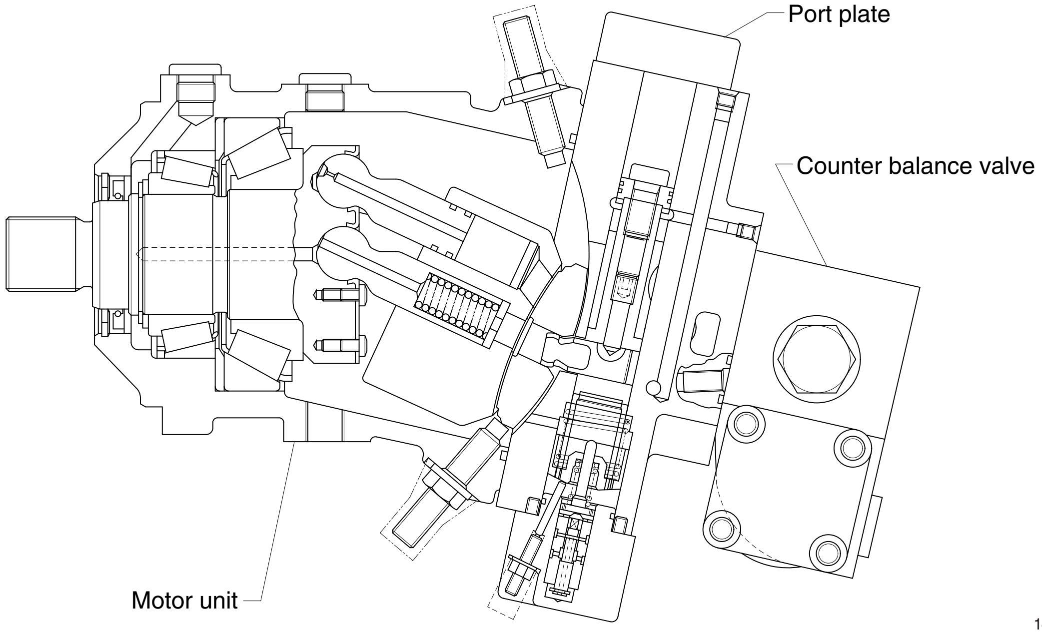
In case of constant pump flow volume and high pressure
- The output speed is increased at smaller swivel angle, the torque is reduced
- The torque rises at swivel angle increase, the output speed is decreased

The max swivel angle is 25˚, the min swivel angle is 0˚.

The variable displacement motor with integrated counterbalance valve is designed to be operated in open loop.

Min and max displacement are limited by a stop screw. Stepless adjustment to various higher values is possible.
※ Reduction to smaller displacement may result in overspeeding the motor.

2) PORT PLATE
With high pressure dependent control HA1, mounted counterbalance valve, integrated secondary pressure relief valves, plugged gauge and boosting ports, service ports to the rear.



3) HIGH PRESSURE DEPENDENT CONTROL

The displacement is-dependent on operating pressure - automatically adjusted. Upon reaching the operating pressure set at the control valve - internally measured at A or B - the motor swivels from V_{gmin} to V_{gmax} until output torque = load torque. For values lower than the adjusted one the motor keeps min swivel angle. The necessary positioning energy is taken from the respective high pressure side via shuttle valve.

Swivelling results in a change of the displacement.
Swivel time is controlled by an orifice installed in the cover of the large positioning piston side.

4) COUNTERBALANCE VALVE

Mounted at the rear of the port plate.
Incase of downhill traveling or deceleration of the machine a counterbalance valve avoids overspeeding and cavitation of hydraulic motor.

5) FUNCTION AS TO CIRCUIT DIAGRAM

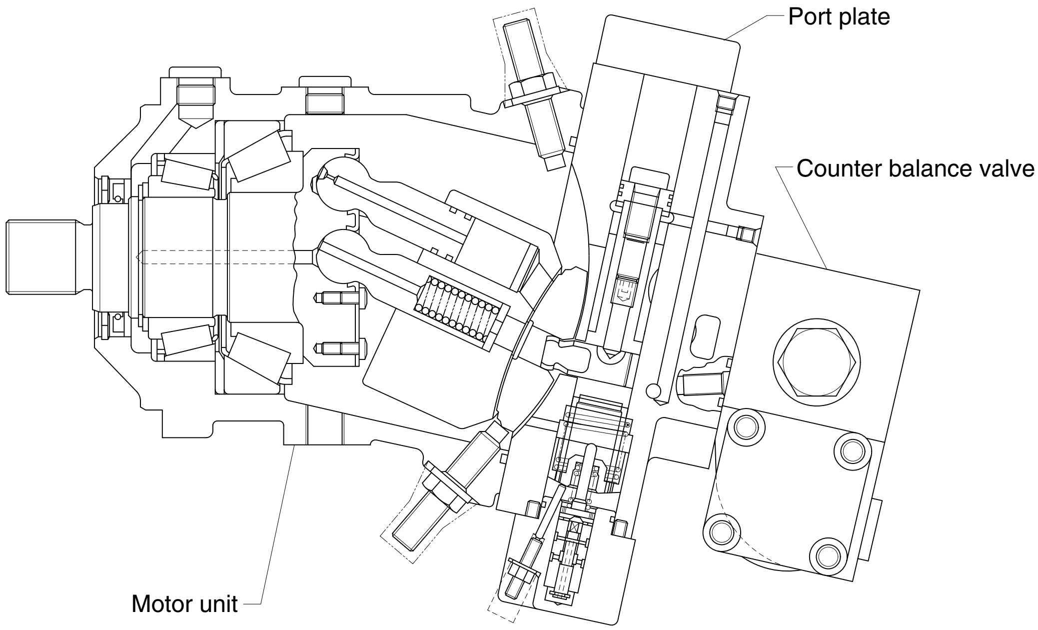
Check valves in the inlet line A and B for by passing of the counterbalance valve.
At traveling forward the return oil flow is controlled by a counterbalance spool. At drop in inlet pressure the counterbalance spool throttles the return oil flow. The motor is locked. The oil behind the spool is led to the low pressure side via an additional check valve. Same function for traveling forward and backward.

Braking means for the motor that

- At reduced or zero inlet flow the counterbalance spool reaches a modulating position or a neutral position caused by spring force
- The high pressure oil (at outlet side of the motor) is returned to the low pressure side(At inlet side) of the motor via crossover relief valves.

As the control pressure for regulation of the HA control via the integrated shuttle valve is no longer available, the motor with HA control and counterbalance valve will swivel to its minimum displacement during deceleration.
In addition, an external boost flow/pressure can be applied at port S for preventing cavitation.

※ Counterbalance valves do not replace the service and parking brake.



14W72TM05

6) INSTALLATION

The housing must be filled entirely with oil and shall also not run empty at rotary group standstill.

7) FILTRATION

According to purity class 9 as to NAS 1638, 6 as to SAE, ASTM, AIA and 18/15 as to ISO/DIS 4406.

8) PRESSURE

Ports A or B : Normal 400bar, peak pressure 450 bar
Port A + B : Pressure summation below 700 bar
Max permissible intermittent case pressure : 6 bar

9) DIRECTION OF ROTATION/ DIRECTION OF FLOW

With view on the drive shaft - clockwise/ A to B; Counter-clockwise/ B to A

10) LEAKAGE OIL TEMPERATURE

In the bearing area max permitted -25˚C to +80˚C; Short time operation -40˚C to +115˚C

11) COMMISSIONING

Fill the housing entirely with oil through highest located T port. Also connect the leakage oil pipe at this port. After commissioning check sealing and make visual control of the complete installation.

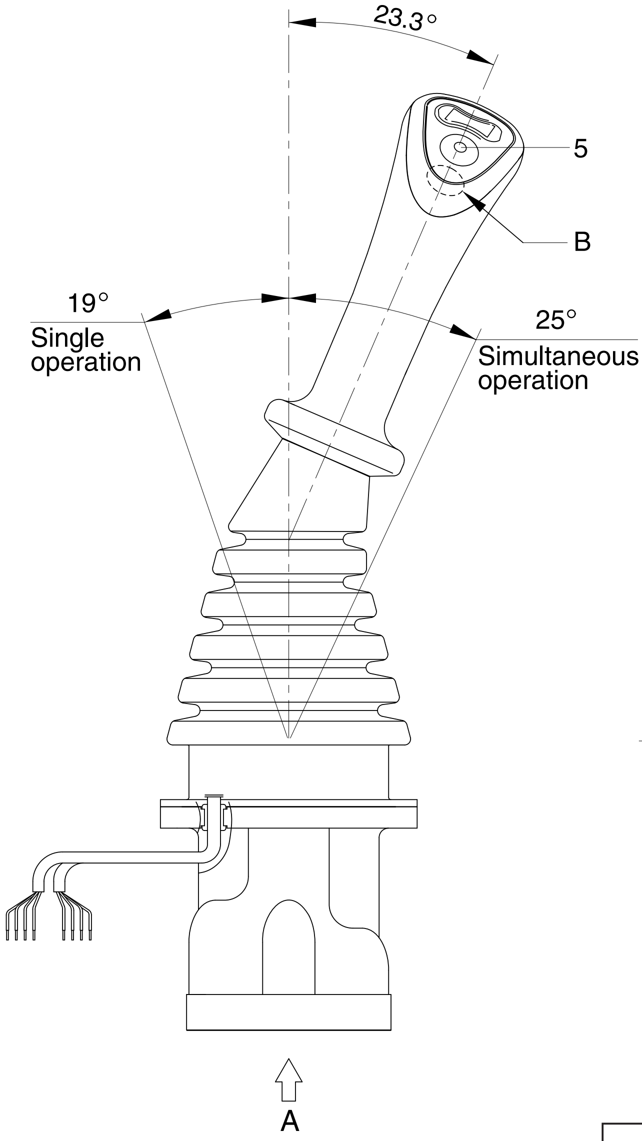
GROUP 5 RCV LEVER

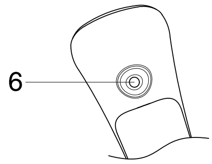
1. STRUCTURE

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.

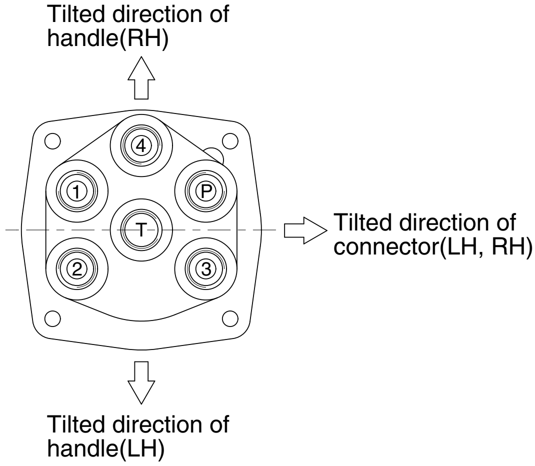
Switches

No.	LH	RH
5	One touch decel	Horn
6	-	Breaker





DETAIL B



VIEW A

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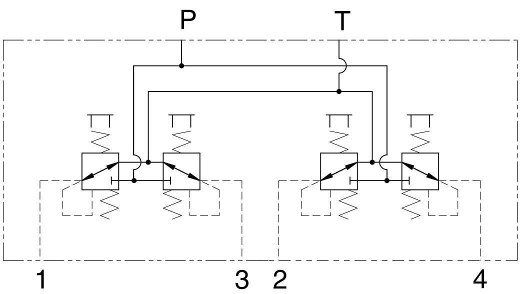


Hydraulic circuit

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	
1	Left swing port	Bucket out port	
2	Arm in port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm out port	Boom up port	

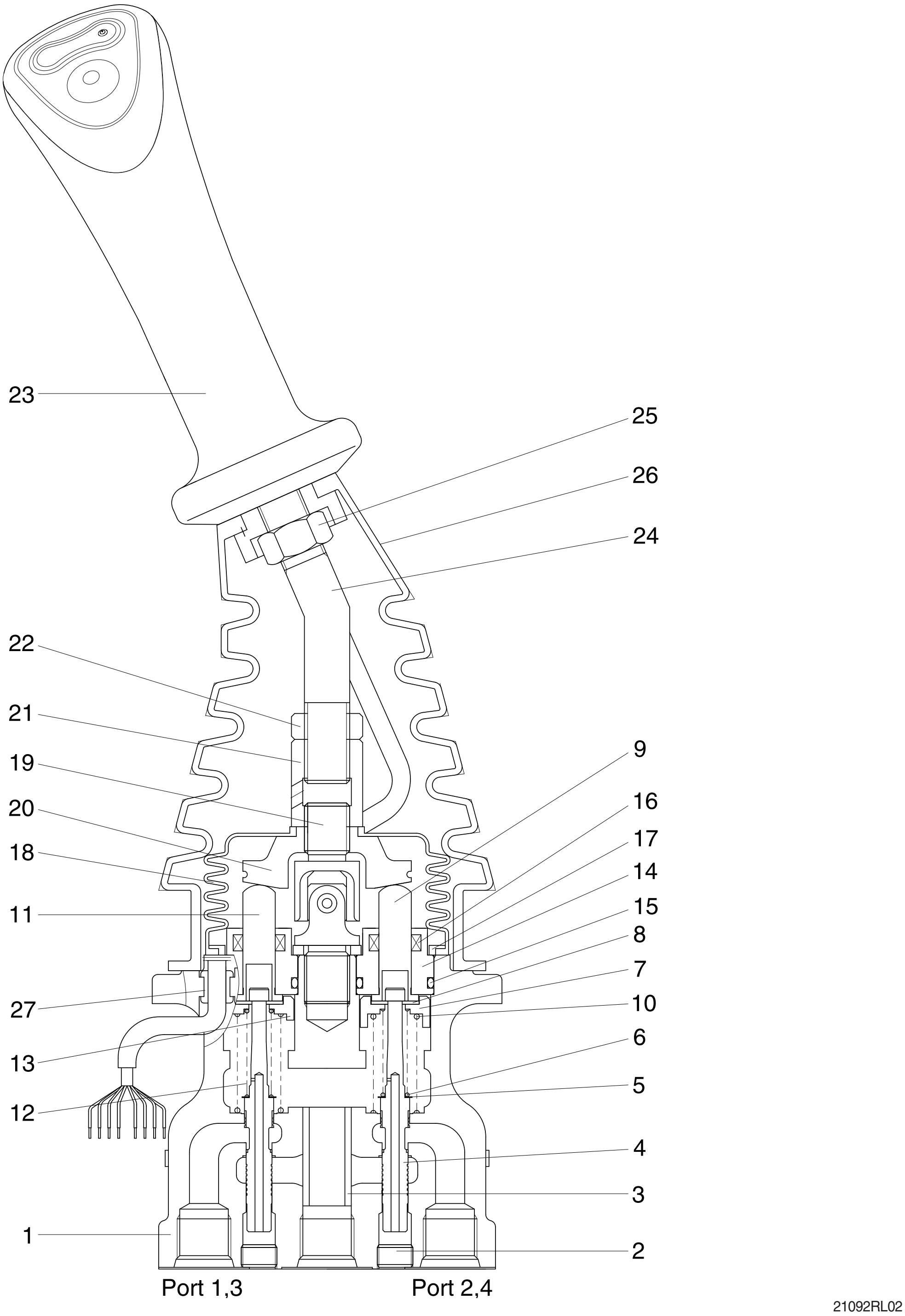
CROSS SECTION

The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (4), spring (6) for setting secondary pressure, return spring (10), stopper (8), spring seat (7, 13) and shim (5). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (9, 11) by the return spring.

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

CROSS SECTION



1	Case	8	Stopper	15	O-ring	22	Lock nut
2	Plug	9	Push rod	16	Rod seal	23	Handle assembly
3	Bushing	10	Spring	17	Plate	24	Handle bar
4	Spool	11	Push rod	18	Boot	25	Nut
5	Shim	12	Spring	19	Joint assembly	26	Boot
6	Spring	13	Spring seat	20	Swash plate	27	Bushing
7	Spring seat	14	Plug	21	Adjusting nut		

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that 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 ports (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 or 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 (4) 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 port pressure oil to tank port T.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9,11) is inserted and can slide in the plug (14).

For the purpose of changing the displacement of the push rod through the swash plate (20) and adjusting nut (21) are provided the handle (23) that can be tilted in any direction around the fulcrum of the universal joint (19) center.

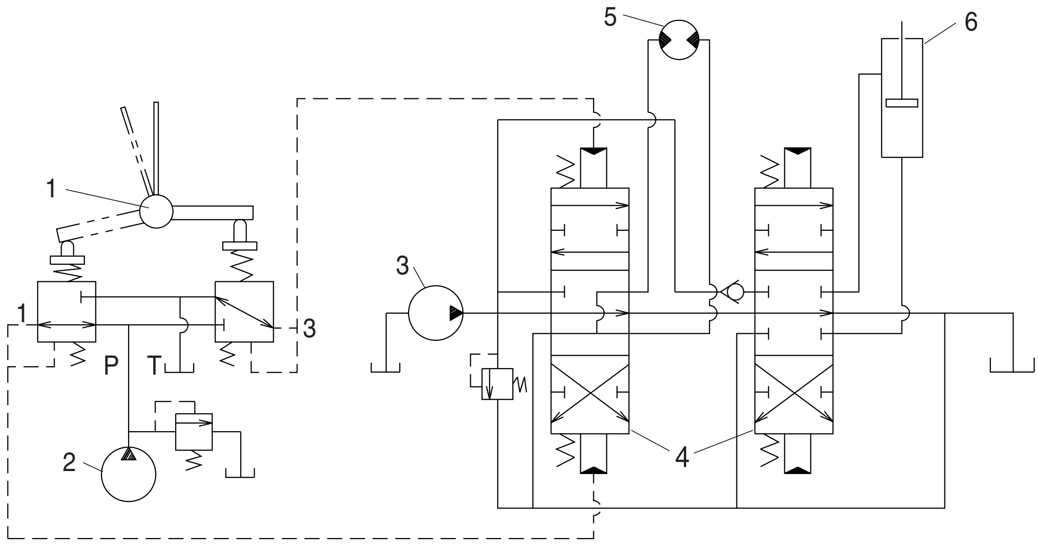
The spring (10) works on the case (1) and spring seat (7, 13) and tries to return the push rod (9,11) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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 and the attached operation explanation drawing.

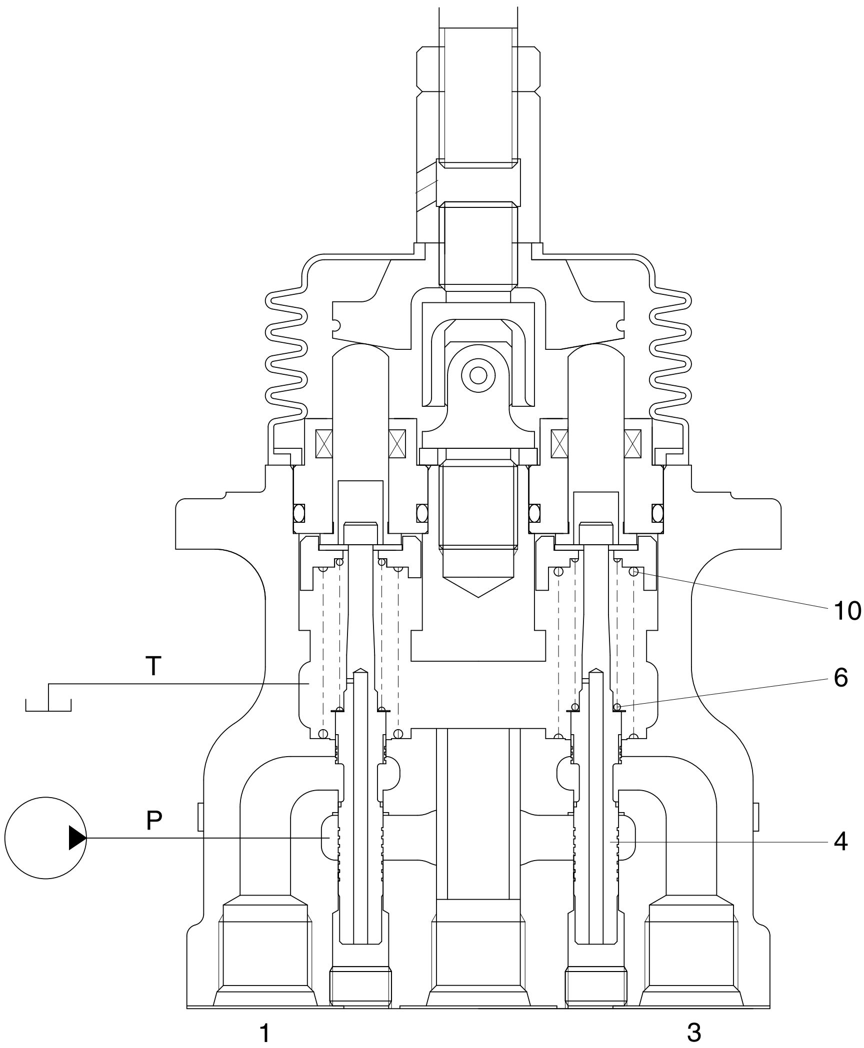
The diagram shown below is the typical application example of the pilot valve.



2-70

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

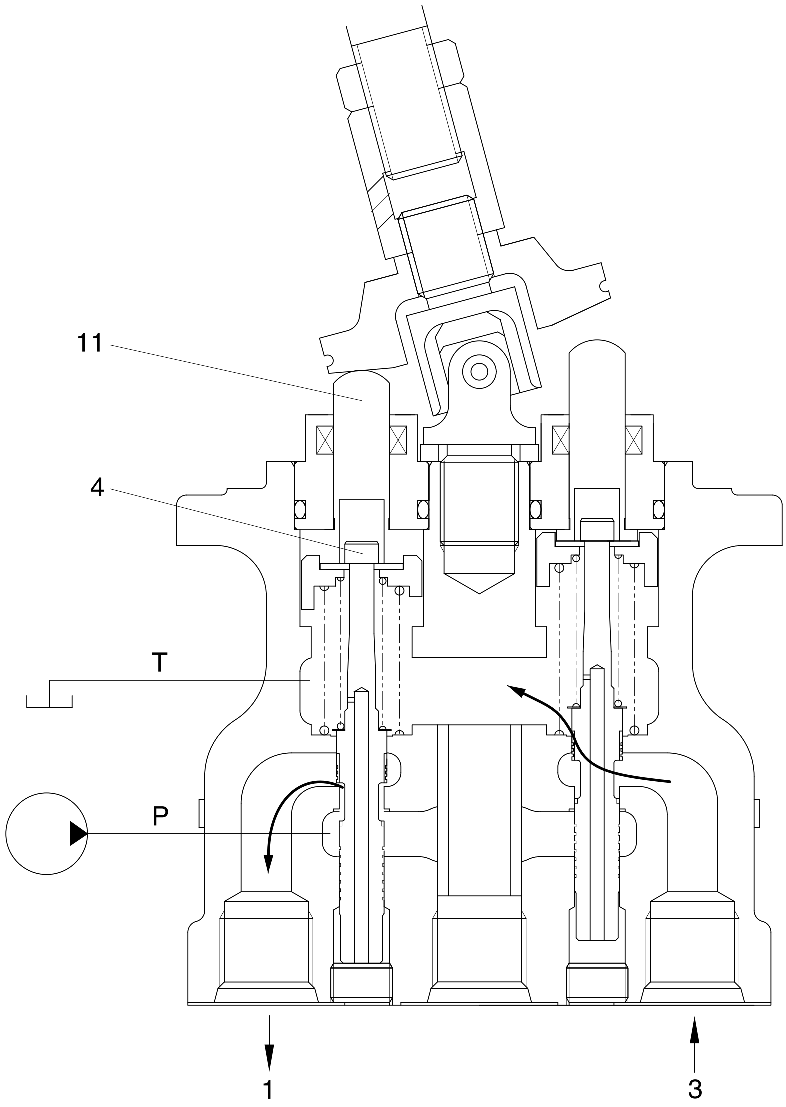
(1) Case where handle is in neutral position



21092RL03

The force of the spring (6) that determines the output pressure of the pilot valve is not applied to the spool (4). Therefore, the spool is pushed up by the spring (10) to the position of port (1, 3) 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 handle is tilted



21092RL04

When the push rod (11) is stroked, the spool (4) 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.

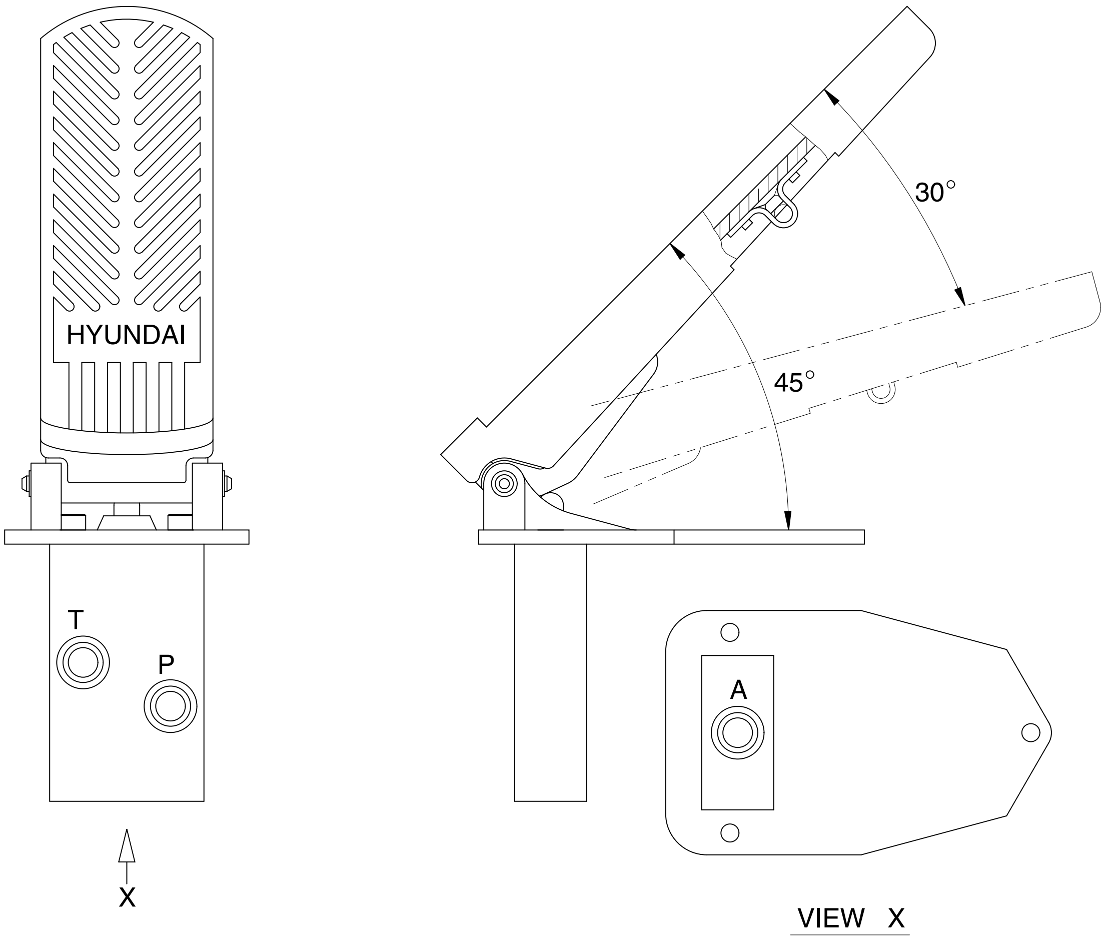
In this manner the secondary pressure is kept at the constant value.

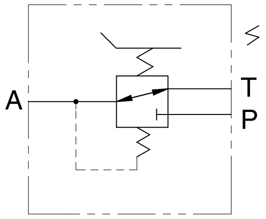
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

GROUP 6 ACCELERATOR PEDAL

1. STRUCTURE

The casing has the oil inlet port P (primary pressure), and the oil return port T (tank). In addition the secondary pressure is taken out through port A.





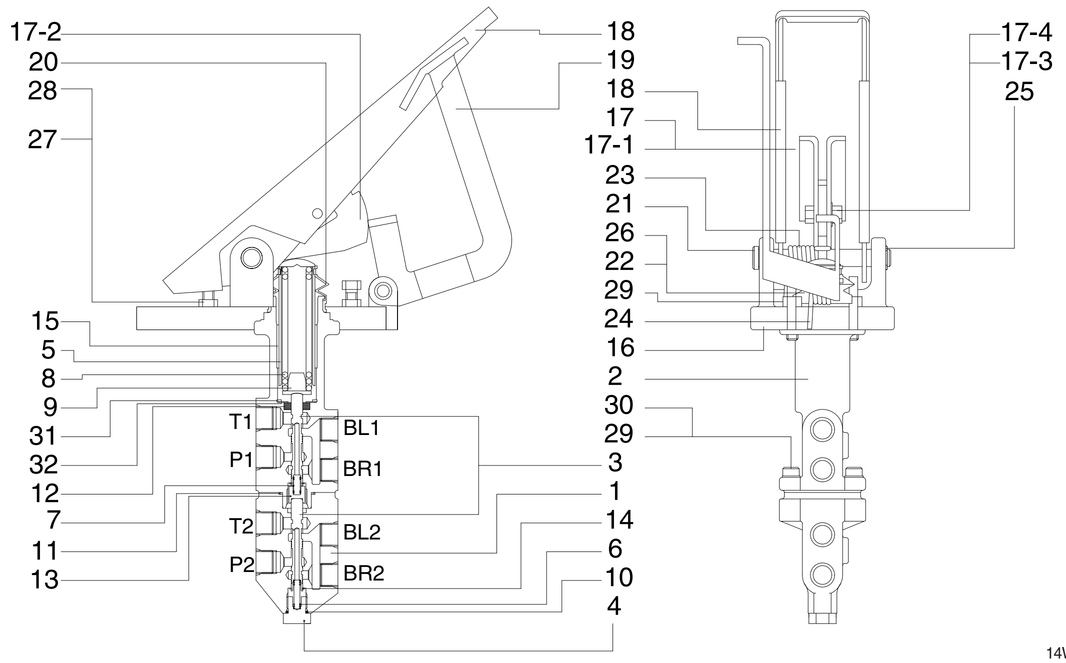
Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
A	Pilot oil output port	

55W72AP01

GROUP 7 BRAKE PEDAL (VALVE)

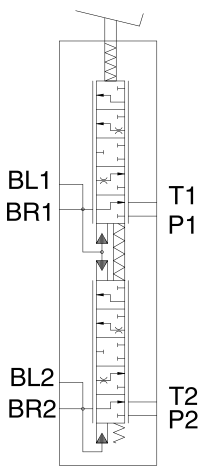
1. STRUCTURE

The casing (spacer) has the oil inlet port A(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.



14W72BV01

1	Lower body	13	Spring guide	21	Lock pin 1
2	Upper body	14	Stop ring-C	22	Lock pin 2
3	Spool	15	DU bushing	23	Torsion spring 1
4	Plug	16	Pedal plate	24	Torsion spring 2
5	Holder	17	Pedal assy	25	Stop ring-C
6	Lower spring	17-1	Pedal	26	E-ring
7	Upper spring	17-2	Lock plate	27	Hex bolt
8	Main spring	17-3	Hex bolt	28	Hex nut
9	Spring retainer	17-4	Plat washer	29	Socket head bolt
10	O-ring	18	Pedal rubber	30	Spring washer
11	O-ring	19	Latch	31	Plat washer
12	Oil seal	20	Rubber cover	32	Stop ring-C



14W72BV02

Port	Port name	Port size
P1	Port	PF 3/8
P2	Port	PF 3/8
BR1	Brake cylinder port	PF 3/8
BR2	Brake cylinder port	PF 3/8
BL1	Pluging	PF 3/8
BL2	Pluging	PF 3/8
T1	Drain port	PF 3/8
T2	Drain port	PF 3/8

2. FUNCTION

1) PURPOSE

The purpose of the brake valve is to sensitively increase and decrease the braking pressure when the brake pedal is actuated.

2) READY POSITION

When the braking system is ready for operation, its accumulator pressure acts directly on port P1/P2 of the brake valve. A connection is established between ports BR1/BR2 and port T1/T2 so that the wheel brakes ports BR1/BR2 are pressureless via the returns ports T1/T2.

3) PARTIAL BRAKING

When the brake valve is actuated, an amount of hydraulic pressure is output as a ratio of the foot force applied.

The spring assembly (8) beneath pedal plate (16) is designed in such a way that the braking pressure changes depending on the angle. In the lower braking pressure range, the machine can be slowed sensitively.

When the braking process is commenced, the upper spool (3) is mechanically actuated via spring assembly (8), and the lower spool (3) is actuated hydraulically by spool (3). As spools (3) move downward, they will first close returns T1/T2 via the control edges, thus establishing a connection between accumulator port P1/P2 and ports BR1/BR2 for the wheel brake cylinders. The foot force applied now determines the output braking pressure. The control spools (3) are held in the control position by the force applied (spring assembly) above the spools and the hydraulic pressure below the spool (balance of forces).

After output of the braking pressure, spools (3) are in a partial braking position, causing ports P1/P2 and T1/T2 to close and holding the pressure in ports BR1/BR2.

4) FULL BRAKING POSITION

When pedal (17) is fully actuated, an end position of the brakes is reached and a connection established between accumulator ports P1/P2 and brake cylinder ports BR1/BR2. Returns T1/T2 are closed at this point.

When the braking process ended, a connection is once again established between brake cylinder ports BR1/BR2 and return ports T1/T2, closing accumulator ports P1/P2.

The arrangement of spools in the valve ensures that even if one braking circuit fails the other remains fully operational. This is achieved by means of the mechanical actuation of both spools and requires slightly more pedal travel.

5) LIMITING THE BRAKING PRESSURE

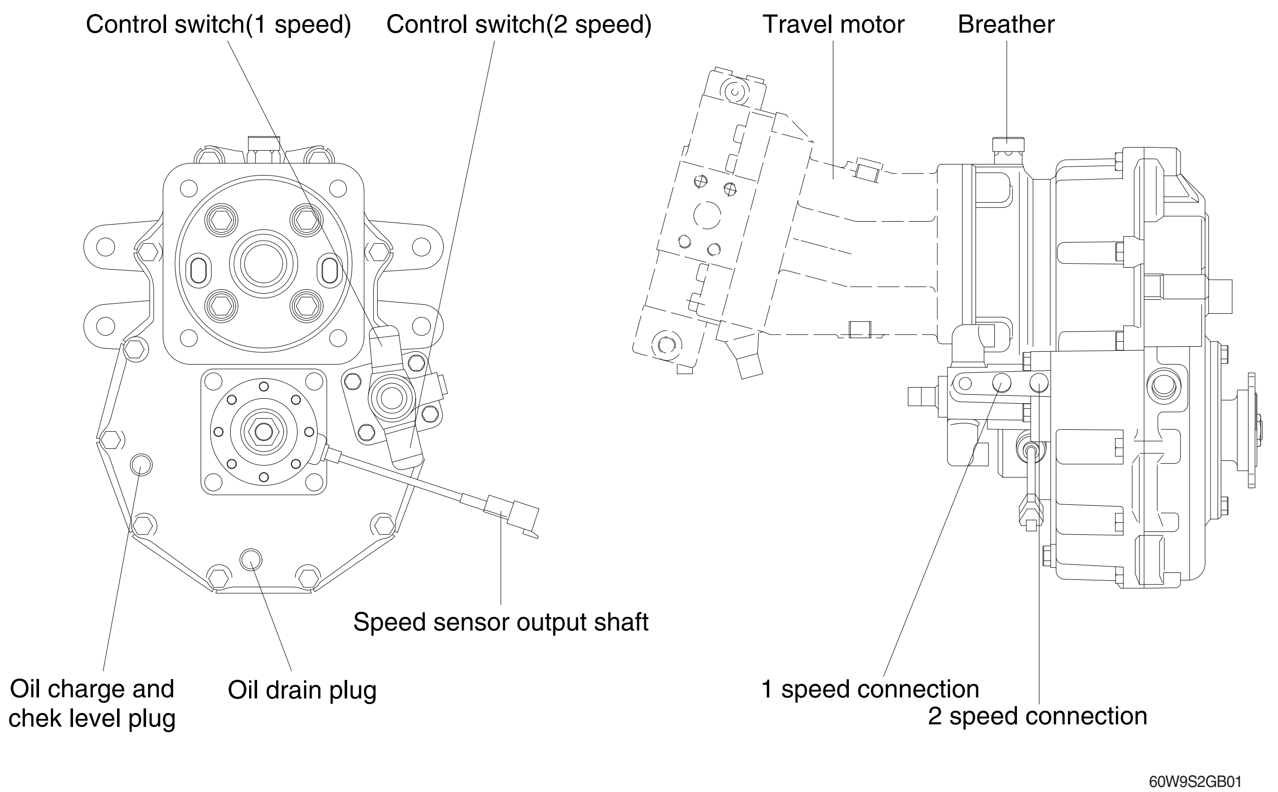
Pedal restriction screw (29) on pedal plate (16) below pedal (17) is used to limit the braking pressure.

6) FAILURE OF A CIRCUIT

In the event of the lower circuit failing, the upper circuit will remain operational. Spring assembly (8) will mechanically actuate spool (3). In the event of the upper circuit failing, the lower circuit will remain operational since the lower spool (3) is mechanically actuated by spring assembly (8) and spool (3).

GROUP 8 GEAR BOX

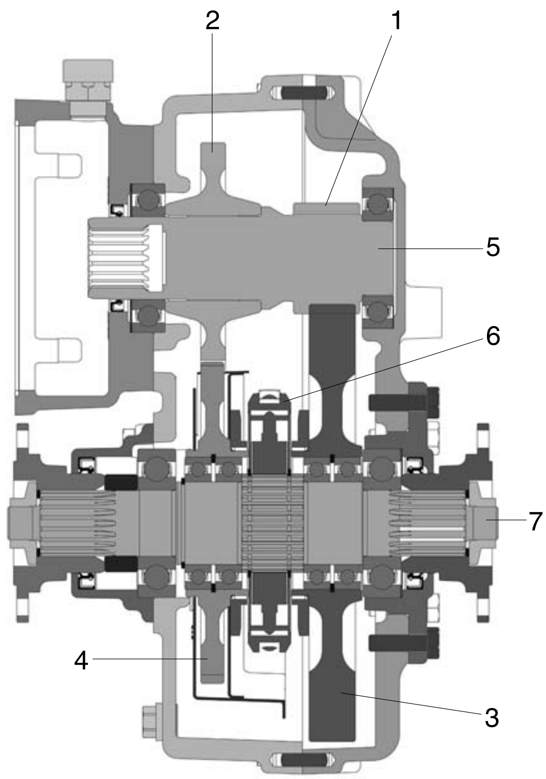
1. STRUCTURE

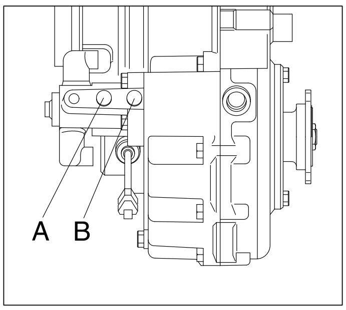


2. GEAR BOX FUNCTION

It explains mechanism, function operation principle and caution in the operation of transfer gear box applied to for this equipment.

1) GEAR BOX MECHANISM





60W9S2GB02

1	Input shaft gear 1	4	Output shaft gear 2	7	Output shaft
2	Input shaft gear 2	5	Input shaft		
3	Output shaft gear 1	6	Change selector		

2) FUNCTION

Transfer gear box applied to R60W-9S is a hydraulic system having 1, 2 speed gear and its system is dog clutch type.

Once pushing 1 speed button for speed change, exhausted hydraulic power flow from the pump supplied to port "A" by operating 1, 2 speed solenoid valve and change selector (6) pushed by selector shift goes in gear with output shaft gear 1 (3).

The power gear box is moved to input gear shaft 1 (1), output shaft gear 1 (3), change selector (6), output shaft (7) and this procedure lead to 1 speed operation status.

Meanwhile, once pushing 2 speed button in the equipment stop condition, hydraulic power flow from the pump supplied to port "B" and change selector (6) pushed by selector shaft goes in gear with output shaft gear 2 (4).

The power gear box is moved to input shaft gear 2 (2), output shaft gear 2 (4), change selector (6), output shaft (7) and this procedure lead to 2 speed operation status.

3. TECHNICAL DATA

1) GENERAL DATA

(1) Max. input power : 70 kW

(2) Max. input torque : 71.4 kgf·m

(3) Max. input speed : 4500 rpm

(4) Hydraulic motor : 80 cc/rev

(5) Gear ration
·1st speed : 4.06 : 1
·2nd speed : 1.31 : 1

(6) Output flange
·Bolt for propshaft connection : M10×1.25
·Gear box weight : 75 kg (165 lb)

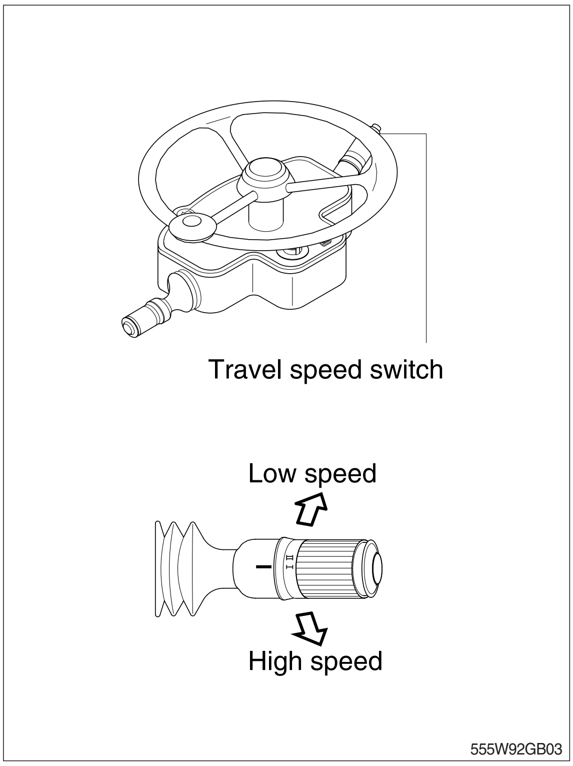
2) GEAR BOX CONTROL

(1) Control pressure
① At connection P1 and P2 at Low/High speed : 26~32 kgf/cm^2
② Definition of lubricants : SAE 80W-90 API GL-4

3) HOW TO CHANGE THE TRAVEL SPEED

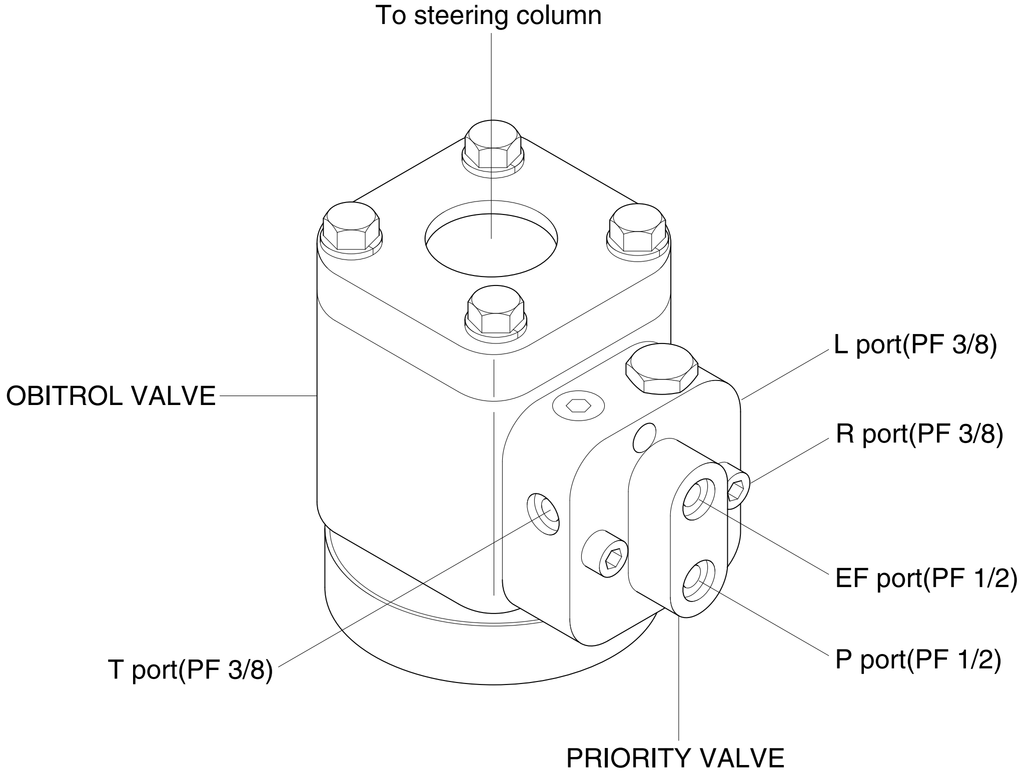
If you want to change the speed, be sure to operate according to the following procedure. Otherwise, unreasonable operation may cause fatal impact and failure to the transfer box (gear box).

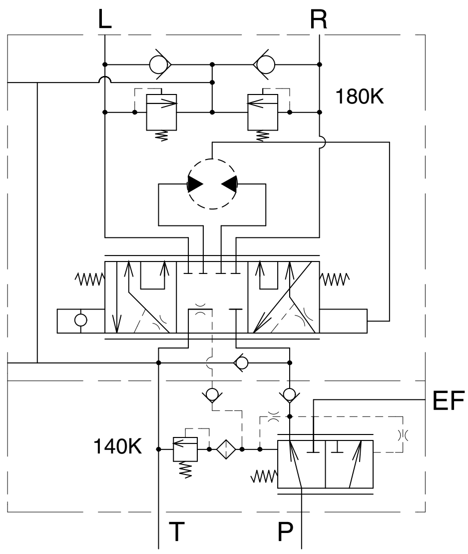
- In case of changing the travel speed, be sure to stop the machine completely.
- Keep the machine on the stationary state and stepping the brake pedal to full stroke. Thereafter, select the speed switch to the desired position.
  When operating the travel speed switch without stepping brake pedal and stopping the machine completely, the operation of gear box can not be worked actually even though the position of speed switch is left to the desired position.
- When turning the key switch to "OFF" position to stop the machine, be sure to transfer the travel speed switch to the low speed position.
  Because the position of solenoid valve for travel is automatically transferred to the low speed position when turning the key switch to "OFF"position.



GROUP 9 STEERING VALVE

1. STRUCTURE



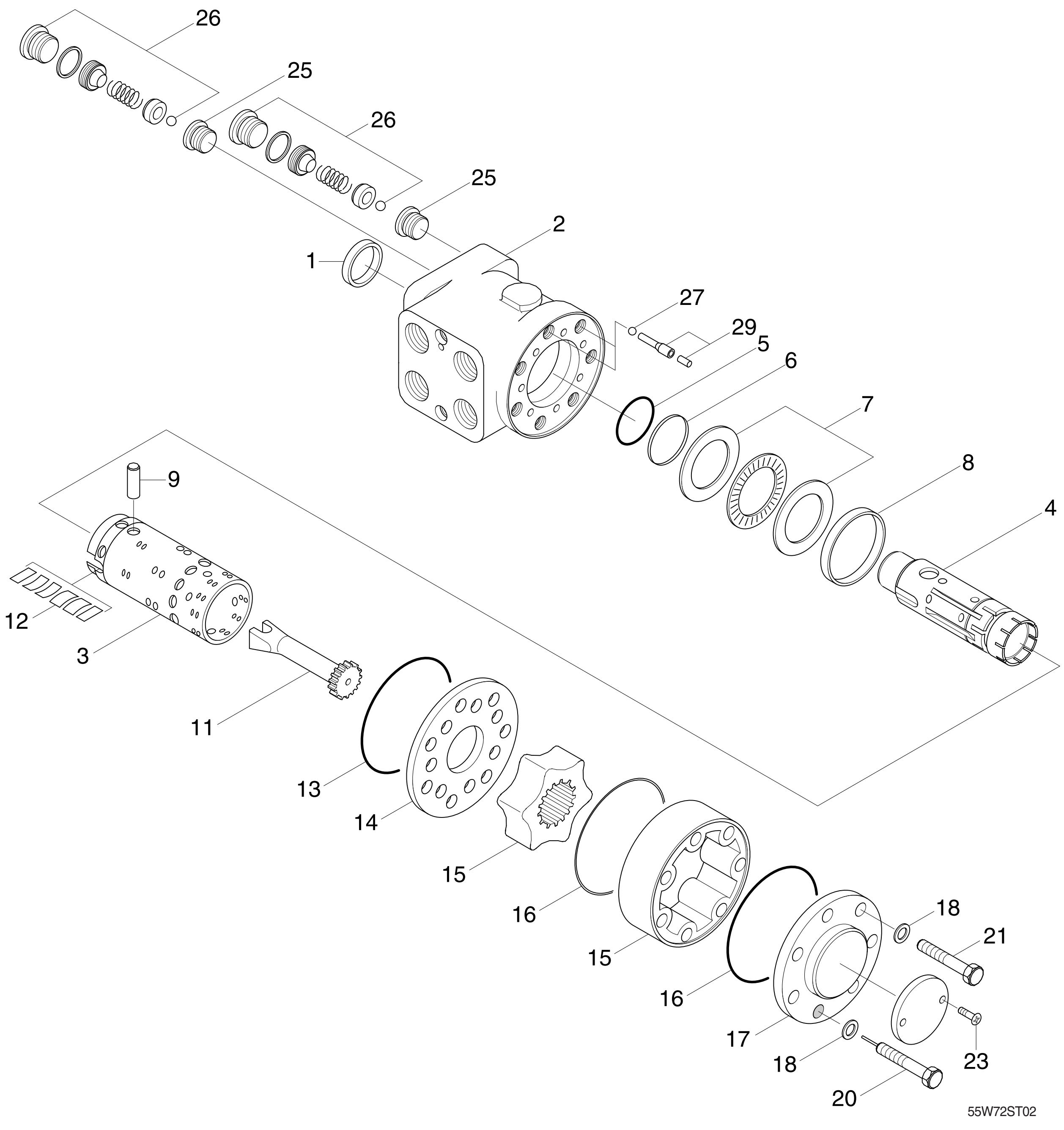


Hydraulic circuit

55W7A2ST01

Port	Port name	Port size
L	Left port	PF 3/8
R	Right port	PF 3/8
P	Pump port	PF 1/2
T	Tank port	PF 3/8
EF	Auxiliary port	PF 1/2

2. COMPONENTS



1	Dust seal ring	11	Shaft	21	Screw
2	Housing	12	Spring set	22	Name plate
3	Sleeve	13	O-ring	23	Drive screw
4	Spool	14	Distributor plate	25	Plug
5	O-ring	15	Gear wheel set	26	Shock valve
6	Kin-ring	16	O-ring	27	Ball
7	Bearing assy	17	End cover	29	Suction valve pin
8	Ring	18	Washer		
9	Cross pin	20	Pin screw		

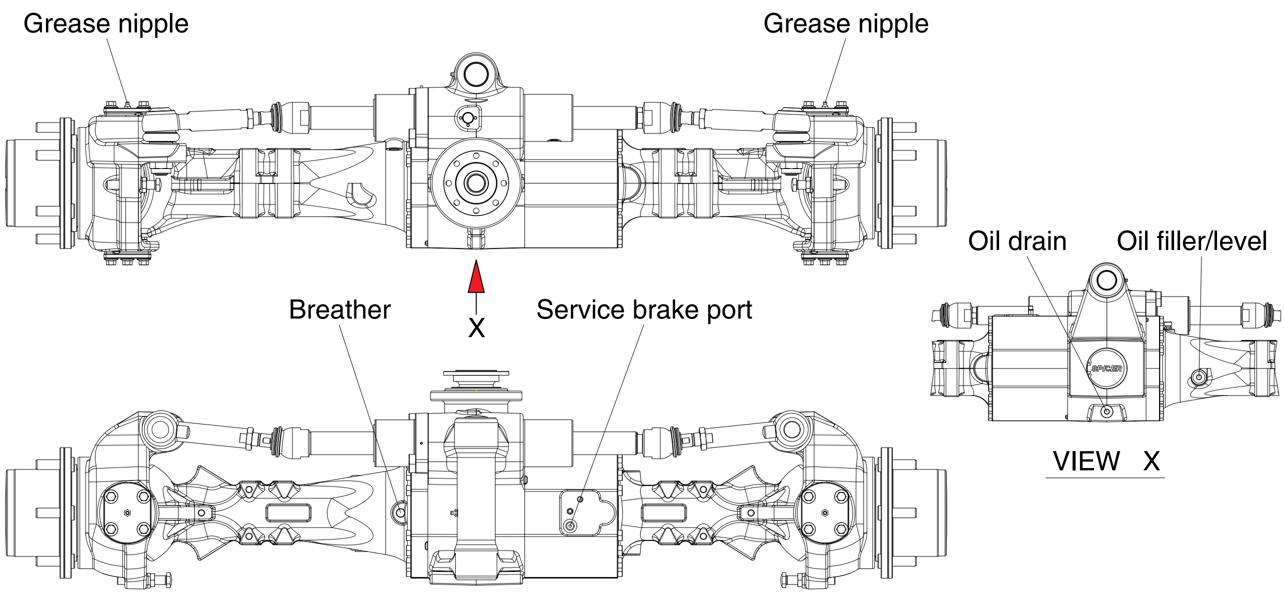
GROUP 10 AXLE

1. OPERATION

·The power from the engine passes through main pump, travel motor and transmission and drive shafts, and is then sent to the front and rear axles.

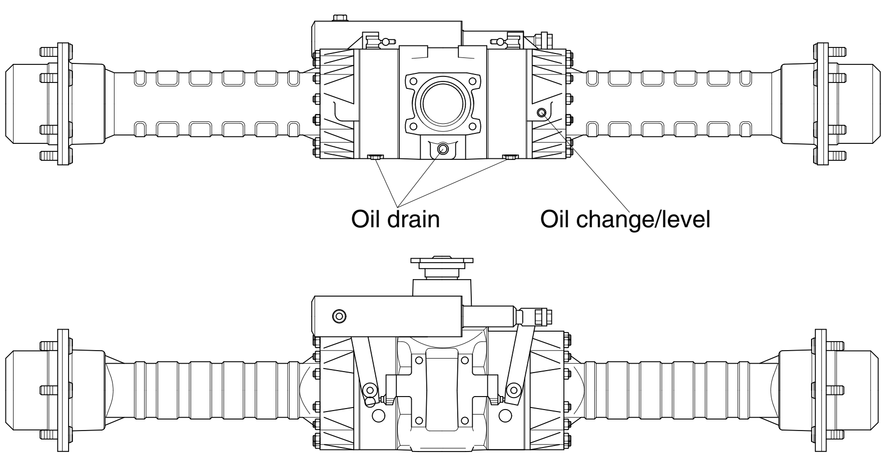
·Inside the axles, the power passes from the bevel pinion to the bevel gear and is sent at right angles. At the same time, the speed is reduced and passes through the both differentials to the axle shafts. The power of the axle shafts is further reduced by planetary-gear-type final drives and is sent to the wheels.

1) FRONT AXLE



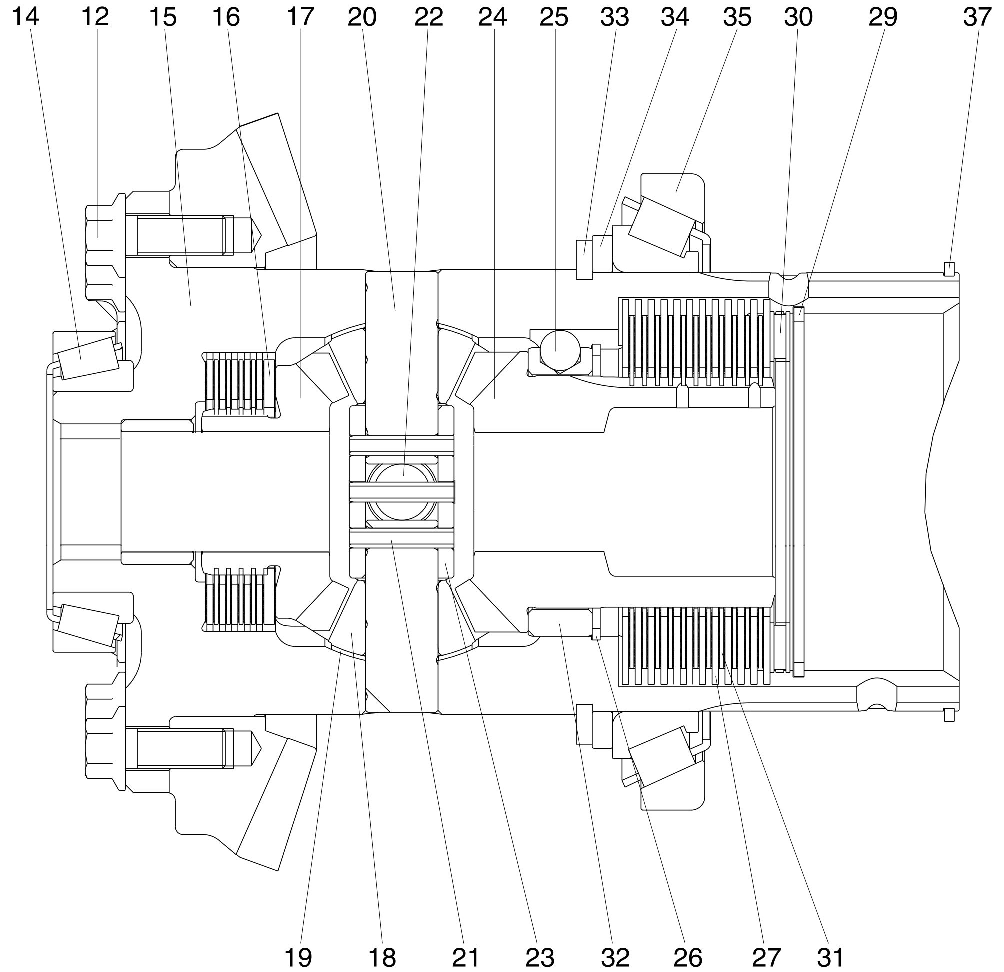
55W72AX01

2) REAR AXLE



55W92AX01

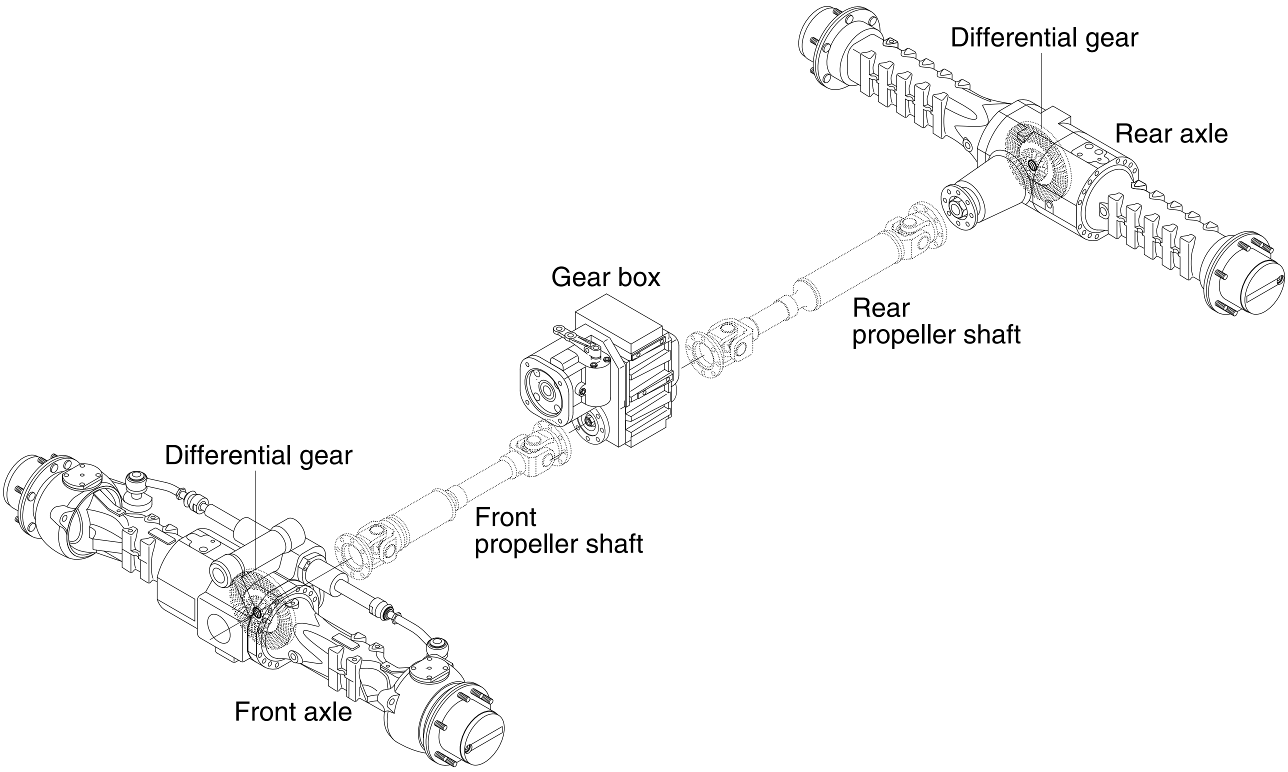
2. SECTION OF DIFFERENTIAL



55W72AX03

11	Bevel gear set	24	Differential side gear
12	Bolt	25	Detend ball
14	Taper roller bearing	26	Circlip
15	Differential carrier	27	Clutch disc
16	Friction washer	29	Circlip
17	Differential side gear	30	Bearing
18	Differential pinion	31	Clutch disc
19	Friction gear	32	Bushing
20	Pin	33	Circlip
21	Dowel	34	Spacer
22	Pin	35	Bearing
23	Shaft retainer	37	Circlip

3. DIFFERENTIAL



The differential is installed on the front and rear axle to transfer the driving torque from the axle to the wheels. The differential transfers half of the output torque of the transmission via the universal drive shaft to the planetary gear of the wheel hubs and transfers the rpm and torque from the gear via the pinion and the ring.

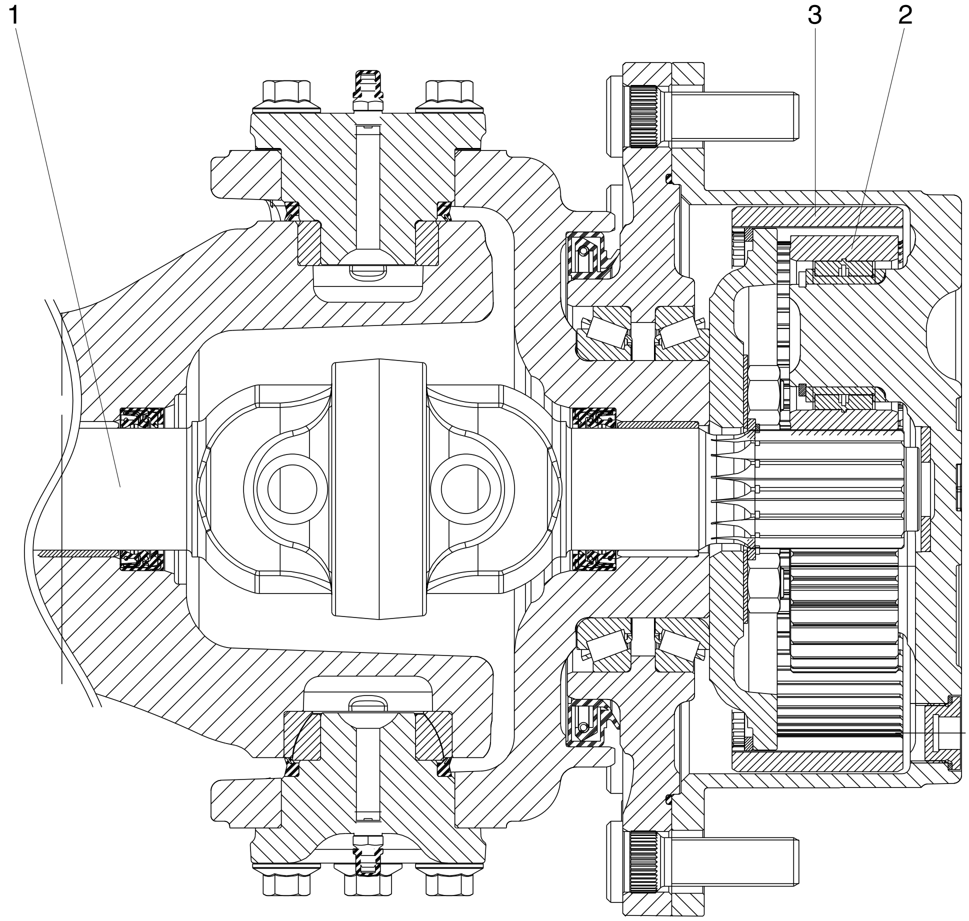
In addition, the differential also servers as an equalizer when going around curves. If the mechanical connection from the transmission to the universal drive shaft, differential, shaft, and planetary gears to the wheels would be rigid, every steering movement would strain the axle construction and would result in increased tire wear.

The equalizing function comes from the special construction of the differential. The power input from the input flange to the pinion shaft, ring and differential housing to the equalizing axle in the differential housing meshes the four equalizing tapered gears with the axle gears, which are located in the equalizing axles. This changes the relative direction of rotation between the shafts meshed with the side gears. This means that one shaft turns clockwise and the other counterclockwise, and one shaft turns faster than the other.

This balancing movement has the disadvantage that when traveling off road, traction is reduced on uneven ground, on loose ground or on snow or ice only wheel per axle is engaged. This disadvantage can be corrected in part by installing a self locking differential.

4. FINAL DRIVE

1) FRONT AXLE



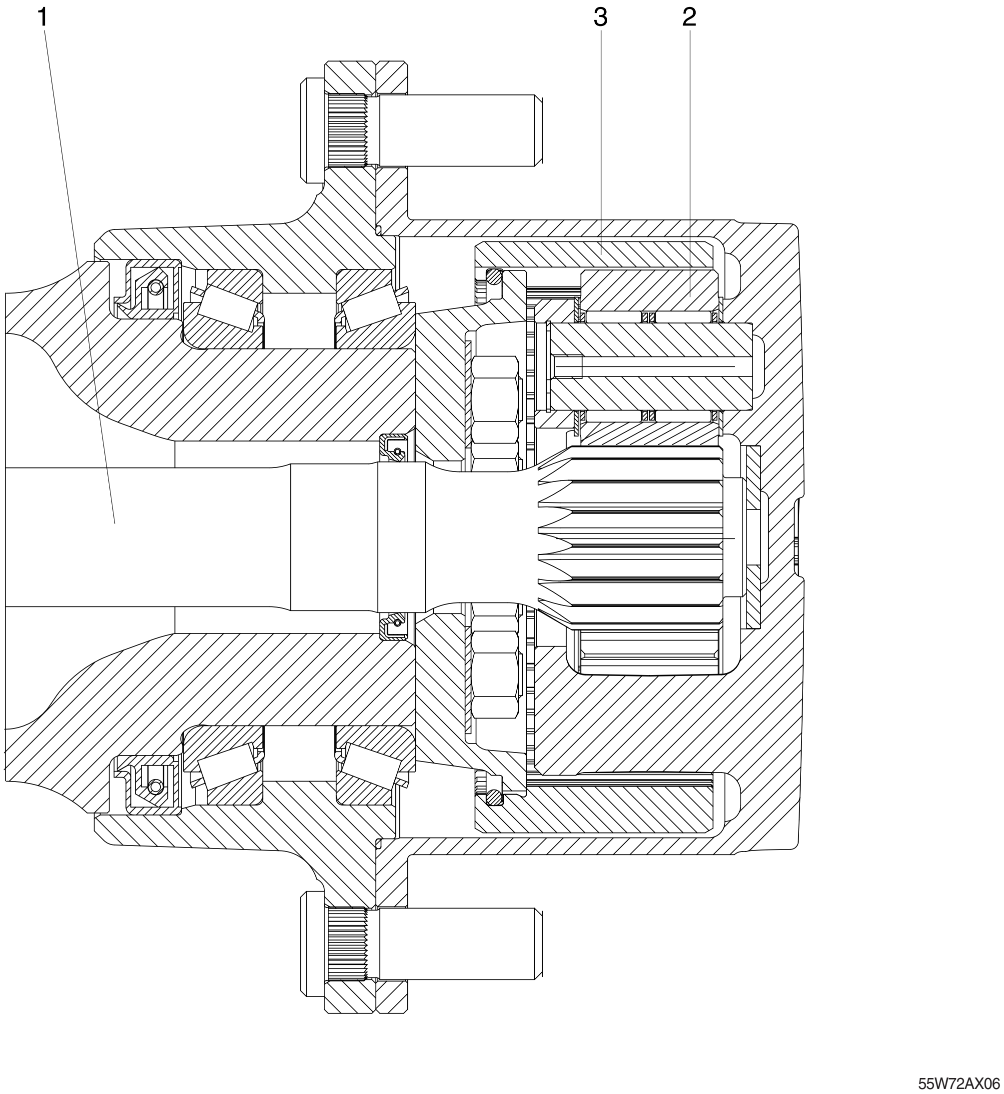
55W72AX05

1	Universal joint	2	Pinion gear	3	Ring gear

(1) To gain a large drive force, the final drive uses a planetary gear system to reduce the speed and send drive force to the tires.

(2) The power transmitted from the differential through universal joint (1) to pinion gear (2).
The pinion gear rotates around the inside of a fixed ring gear (3) and in this way transmits rotation at a reduced speed to the planetary carrier.
This power is then sent to the wheels which are installed to the planetary carriers.

2) REAR AXLE

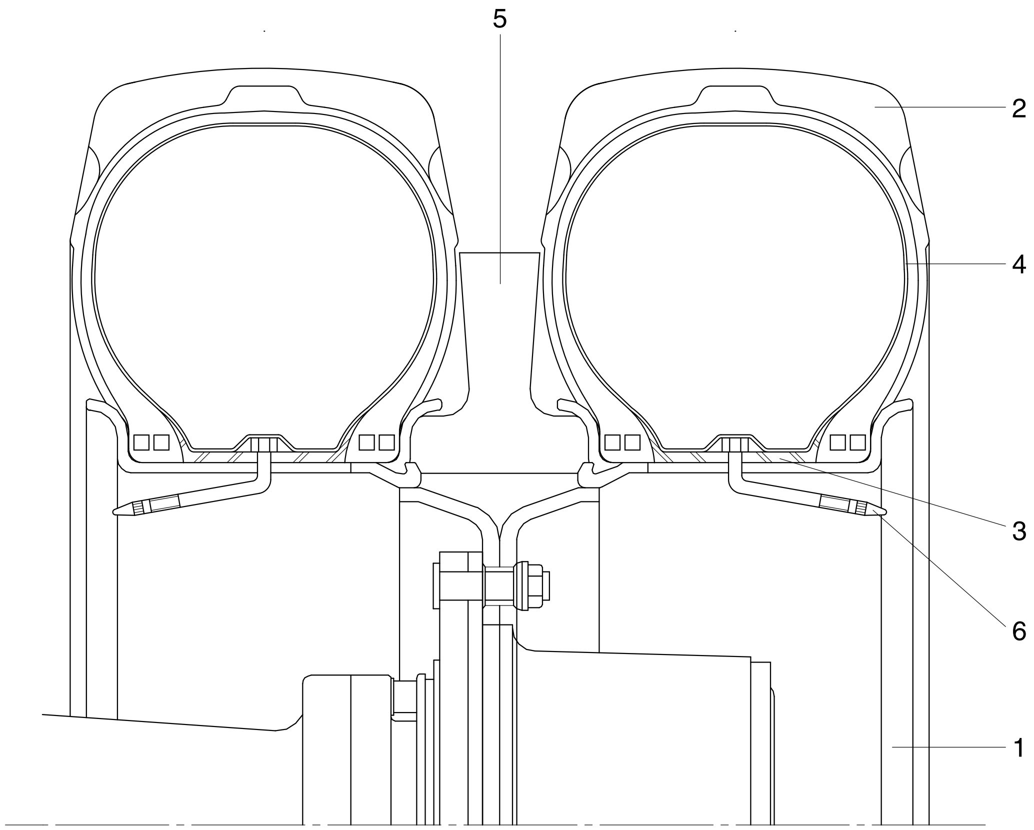


1	Axle half shaft	2	Pinion gear	3	Ring gear

(1) To gain a large drive force, the final drive uses a planetary gear system to reduce the speed and send drive force to the tires.

(2) The power transmitted from the differential through axle half shaft (1) to pinion gear (2). The pinion gear rotates around the inside of a fixed ring gear (3) and in this way transmits rotation at a reduced speed to the planetary carrier.
This power is then sent to the wheels which are installed to the planetary carriers.

5. TIRE AND WHEEL



1	Wheel rim	3	Flap	5	Stone resister ring
2	Tire	4	Tube	6	Valve assembly

1) The tire acts to absorb the shock from the ground surface to the machine, and at the same time they must rotate in contact with the ground to gain the power which drives the machine.
2) Various types of tires are available to suit the purpose. Therefore it is very important to select the correct tires for the type of work and bucket capacity.