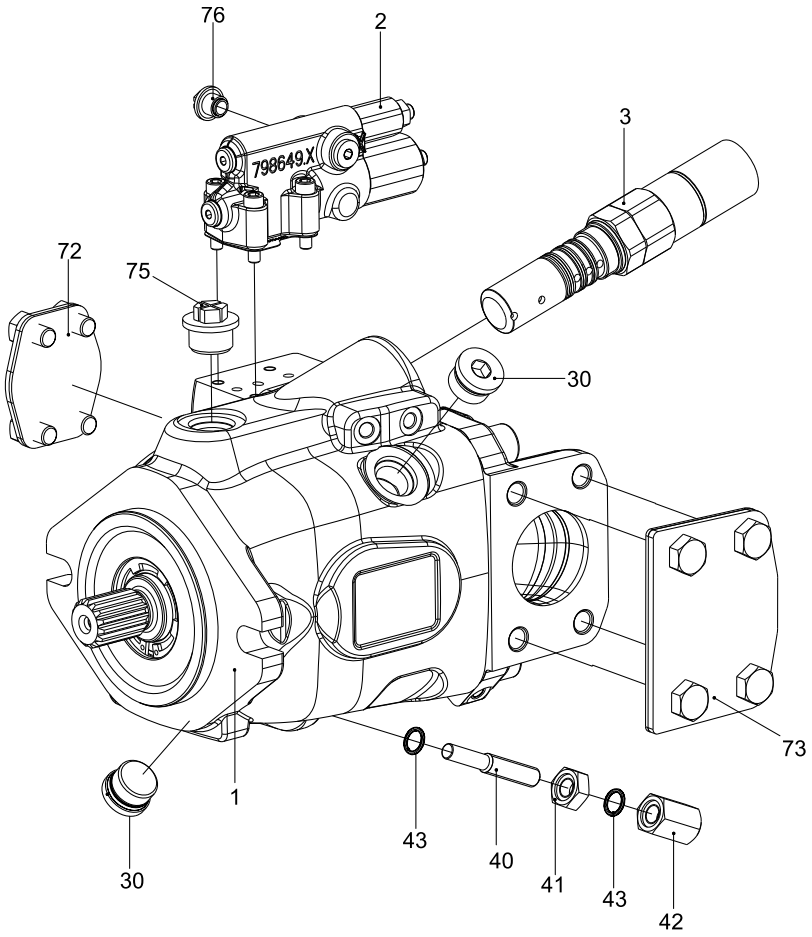
SECTION 2 STRUCTURE AND FUNCTION

SECTION 2 STRUCTURE AND FUNCTION

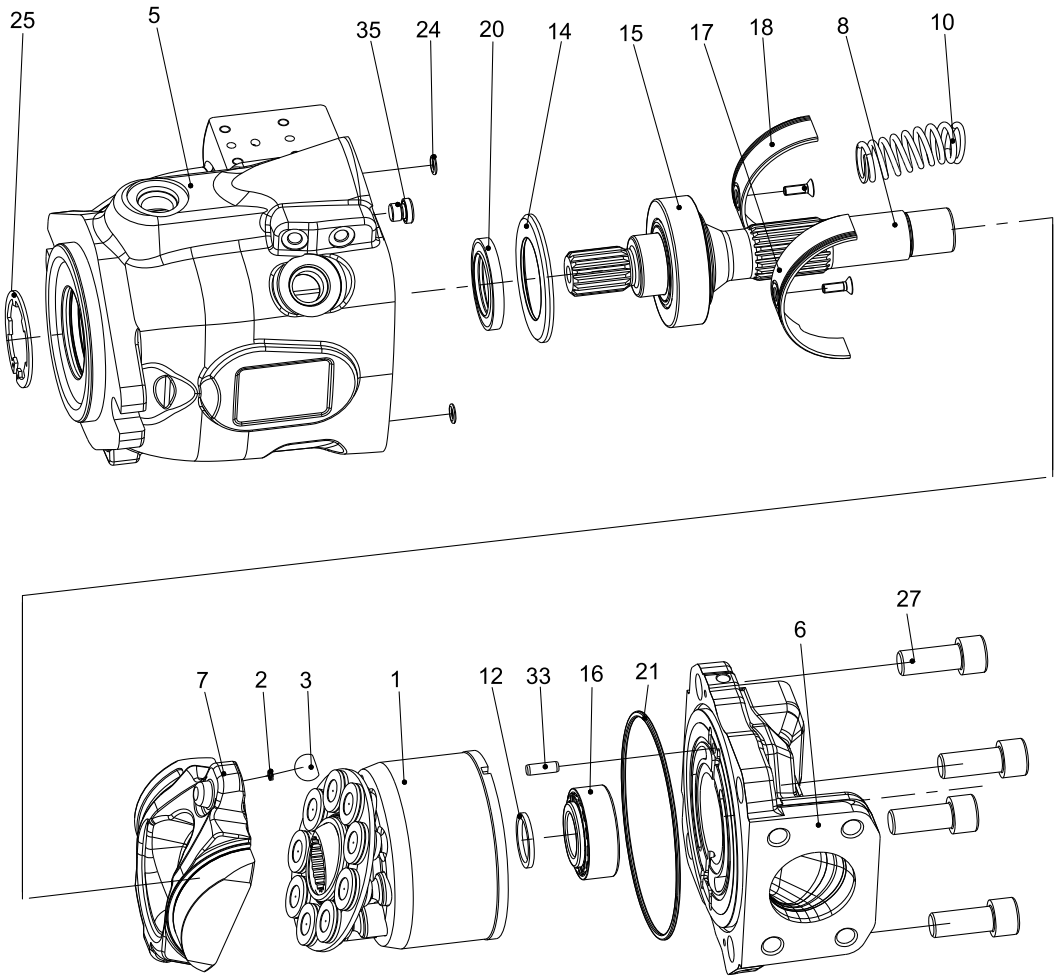
GROUP 1 HYDRAULIC PUMP

1. STRUCTURE (1/2)



1	Main pump	43	O-ring
2	Control valve	72	Cover
3	Control valve	73	Cover
30	Locking screw	75	Screw
40	Stop screw	76	Screw
41	Nut		
42	Cap		

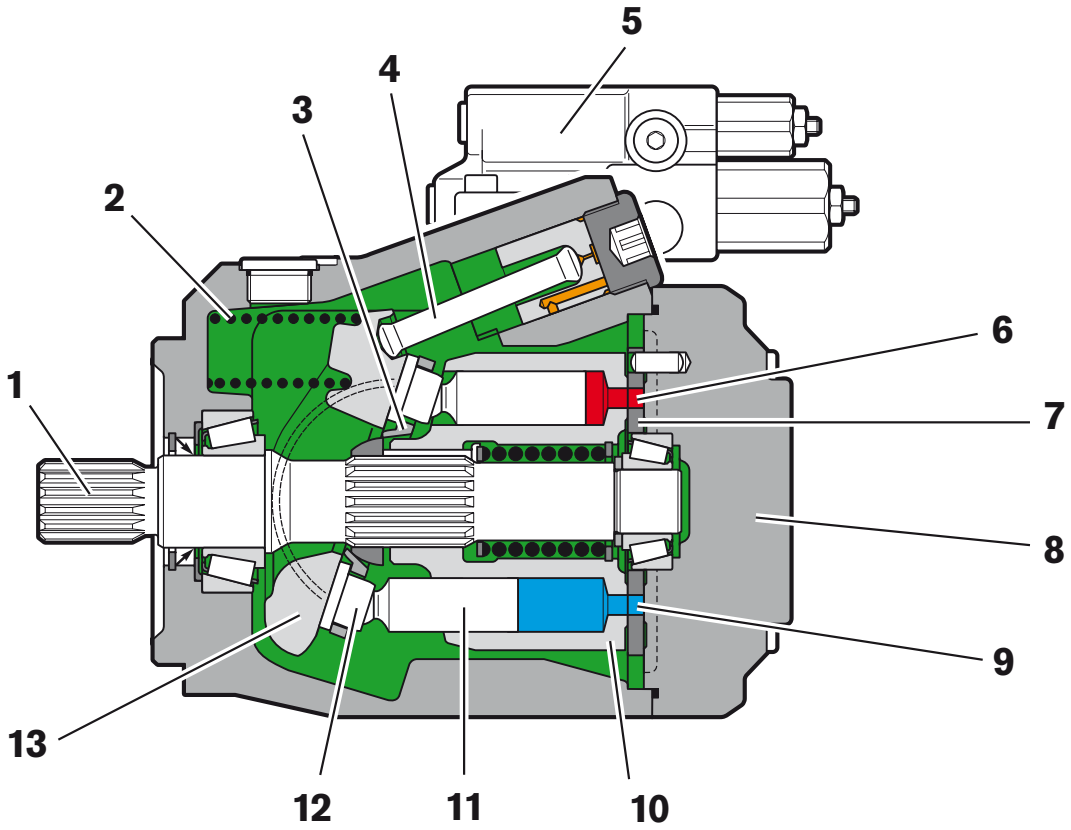
STRUCTURE (2/2)



1	Rotary Assy	16	Taper roller bearing
2	Spring	17	Liner bearing
3	Stopper	18	Liner bearing
5	Pump housing	20	Seal ring
6	Port plate	21	O-ring
7	Swash plate	24	Seal ring
8	Drive shaft	25	Retainer ring
10	Spring	27	Socket screw
12	Adjust shim	33	Cylinder pin
14	Stop ring	35	Screw
15	Taper roller bearing		

2. PRINCIPAL COMPONENTS AND FUNCTIONS

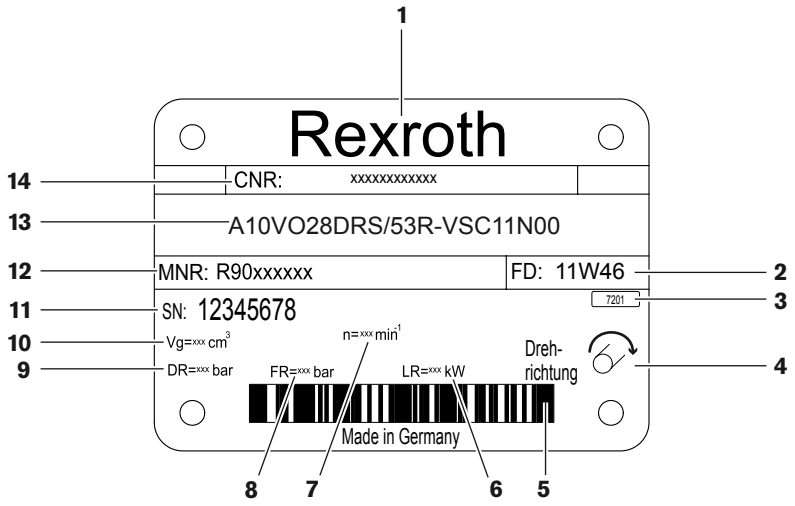
The A10VO, A10VSO, A10VNO, A10VSNO are variable pumps with axial piston rotary group in swashplate design for hydrostatic drive in an open circuit. Flow is proportional to drive speed and displacement. The flow can be steplessly changed by controlling the swashplate (13). For axial piston units with swashplate design, the pistons (11) are arranged axially with respect to the drive shaft (1).



1	Drive shaft	**6**	High-pressure side	**11**	Piston
2	Spring	**7**	Control plate	**12**	Slipper pad
3	Retaining plate	**8**	Port plate	**13**	Swashplate
4	Stroke piston	**9**	Suction side		
5	Control valve	**10**	Cylinder		

3. PRODUCT IDENTIFICATION

The axial piston unit can be identified from the name plate. The following example shows an A10VO name plate:

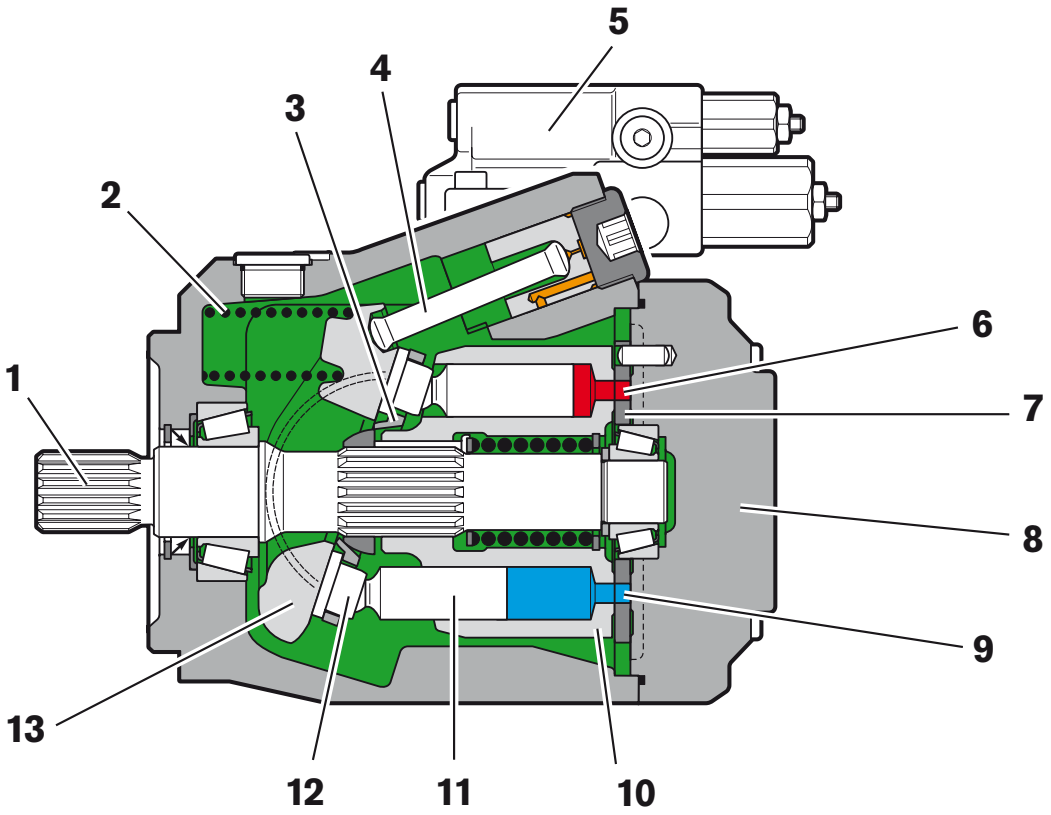


1 Manufacturer
2 Production date
3 Internal plant designation
4 Direction of rotation (viewed on drive shaft) – here: clockwise
5 Bar code
6 Power setting (optional)
7 Speed
8 Flow setting (optional)
9 Pressure controller setting (optional)
10 Minimum displacement
11 Serial number
12 Material number of theaxialpistonunit
13 Ordering code
14 Customer material number

4. Function of pump

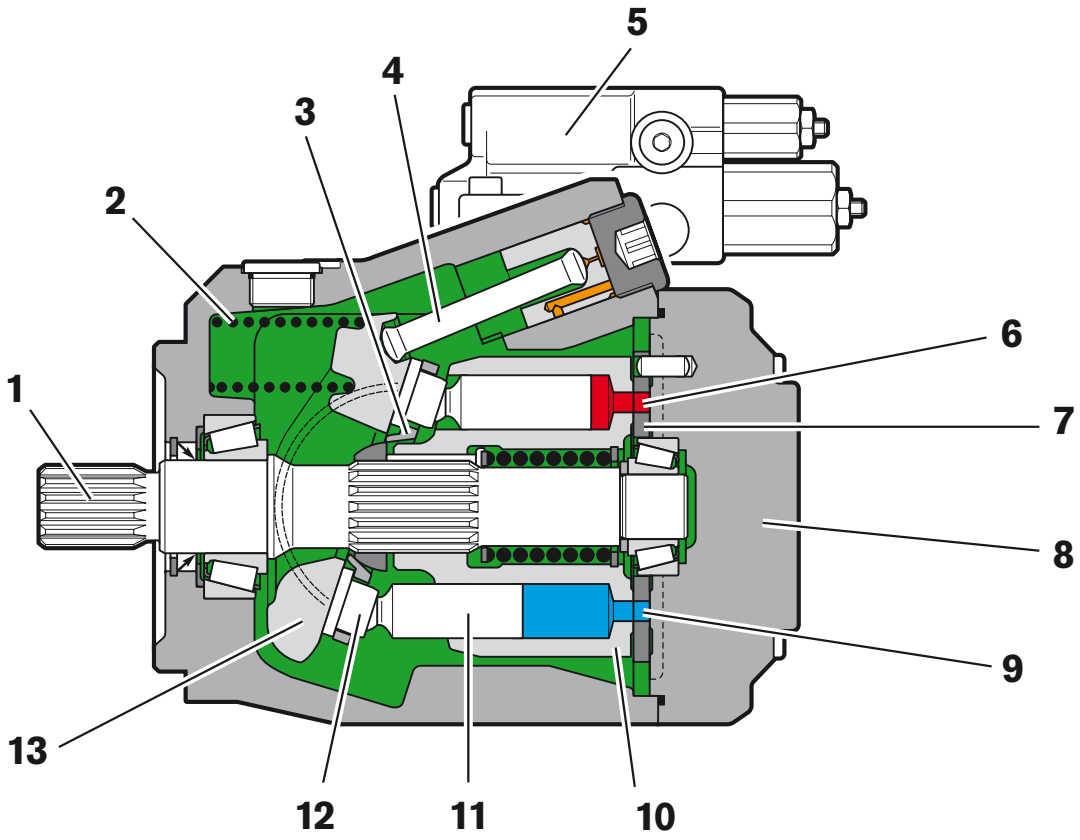
1) Pump

Torque and rotational speed are applied to the drive shaft (**1**) by an engine. The drive shaft is connected by splines to the cylinder (**10**) to set this in motion. With every revolution, the pistons (**11**) in the cylinder bores execute one stroke whose magnitude depends on the setting of the swashplate (**13**). The pistons hold the slipper pads (**12**) onto the glide surface of the swashplate with the retaining plate (**3**) and guide them along. The swashplate setting during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position. Here, hydraulic fluid is fed in and drained out through the two control slots in the control plate (**7**) according to the stroke displacement. On the suction side (**9**) hydraulic fluid flows into the piston chamber as the piston recedes. At the same time, on the high-pressure side (**6**) the fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons.



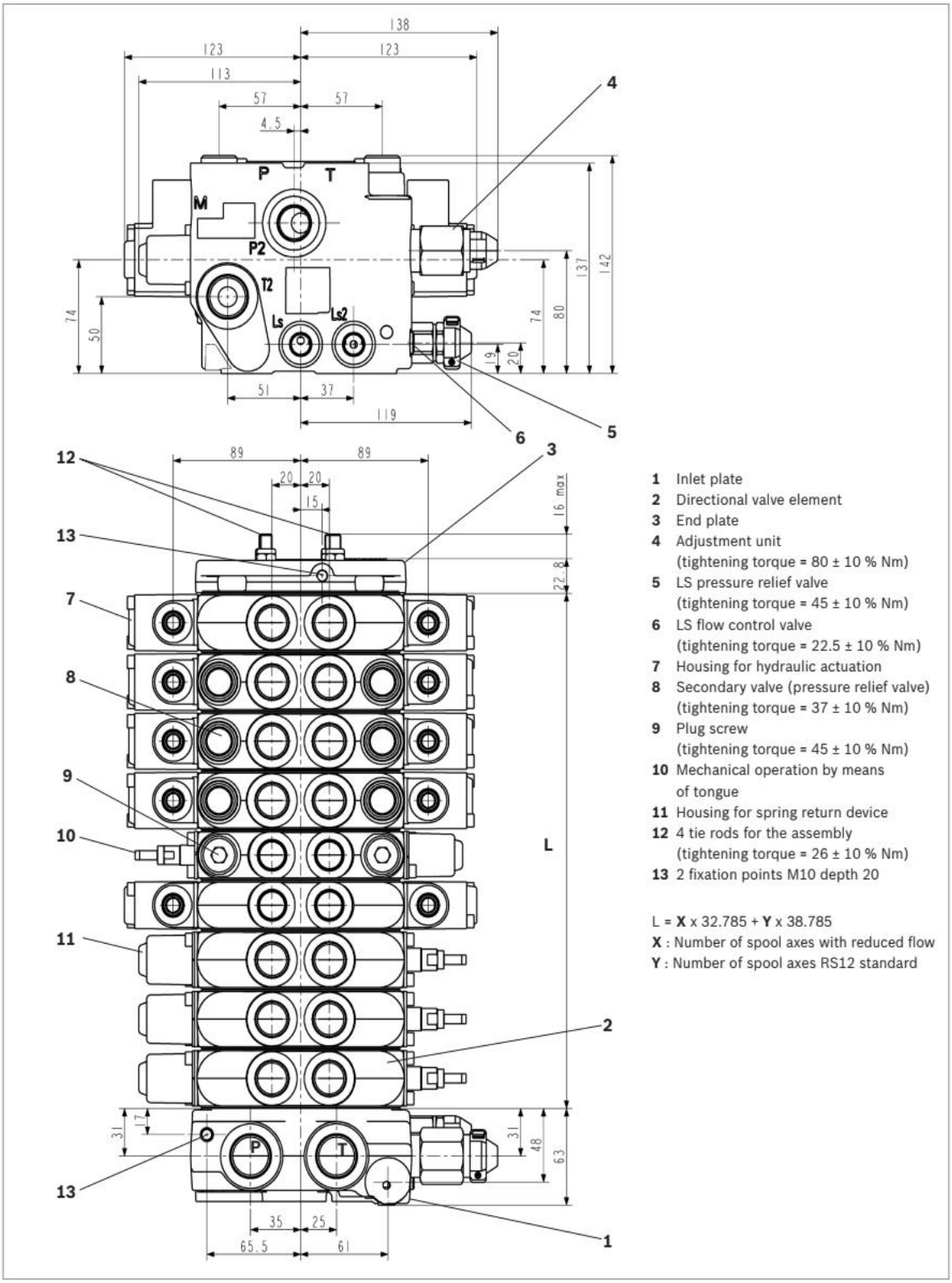
2) CONTROL FUNCTIONS

The swivel angle of the swashplate (**13**) is steplessly variable. Controlling the swivel angle of the swashplate changes the piston stroke and therefore the displacement. The swivel angle is changed hydraulically by means of the stroke piston. The swashplate is mounted in swivel bearings for easy motion and it is kept in balance by a spring (**2**). Increasing the swivel angle increases the displacement; reducing the angle results in a corresponding reduction in displacement.



GROUP 2 MAIN CONTROL VALVE

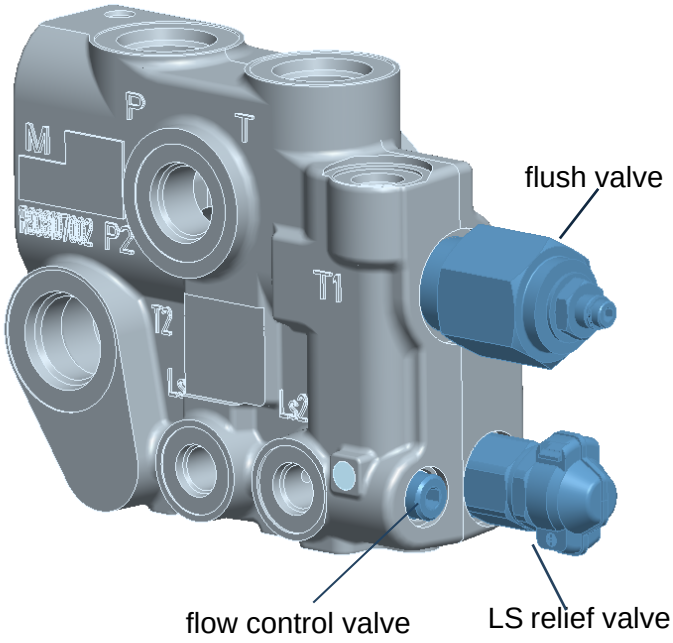
1. OUTLINE(REXRORH RS12)

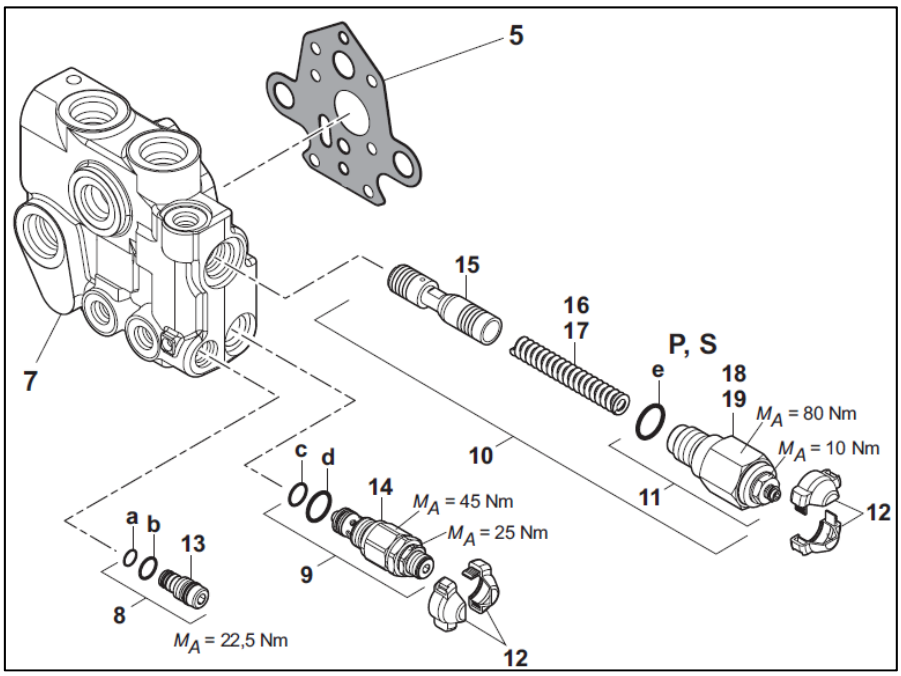


1 Inlet plate
2 Directional valve element
3 End plate
4 Adjustment unit
(tightening torque = 80 ± 10 % Nm)
5 LS pressure relief valve
(tightening torque = 45 ± 10 % Nm)
6 LS flow control valve
(tightening torque = 22.5 ± 10 % Nm)
7 Housing for hydraulic actuation
8 Secondary valve (pressure relief valve)
(tightening torque = 37 ± 10 % Nm)
9 Plug screw
(tightening torque = 45 ± 10 % Nm)
10 Mechanical operation by means of tongue
11 Housing for spring return device
12 4 tie rods for the assembly
(tightening torque = 26 ± 10 % Nm)
13 2 fixation points M10 depth 20

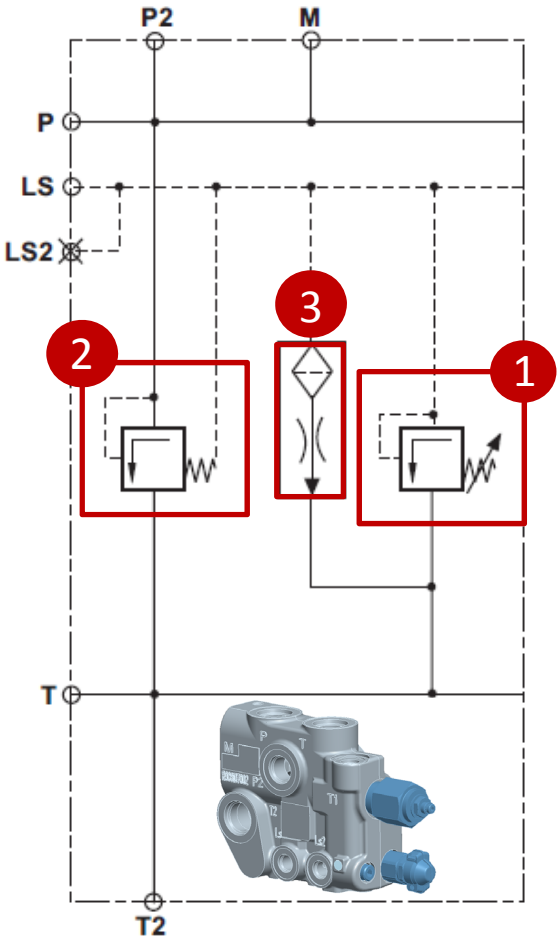
L = **X** x 32.785 + **Y** x 38.785
X : Number of spool axes with reduced flow
Y : Number of spool axes RS12 standard

2.FEED GROUP (REXRORH RS12) 1/2





2.FEED GROUP (REXRORH RS12) 2/2

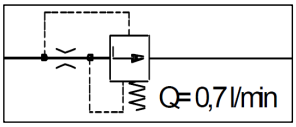


1. LS relief valve: overflow LS oil line working pressure

2. Flush valve:

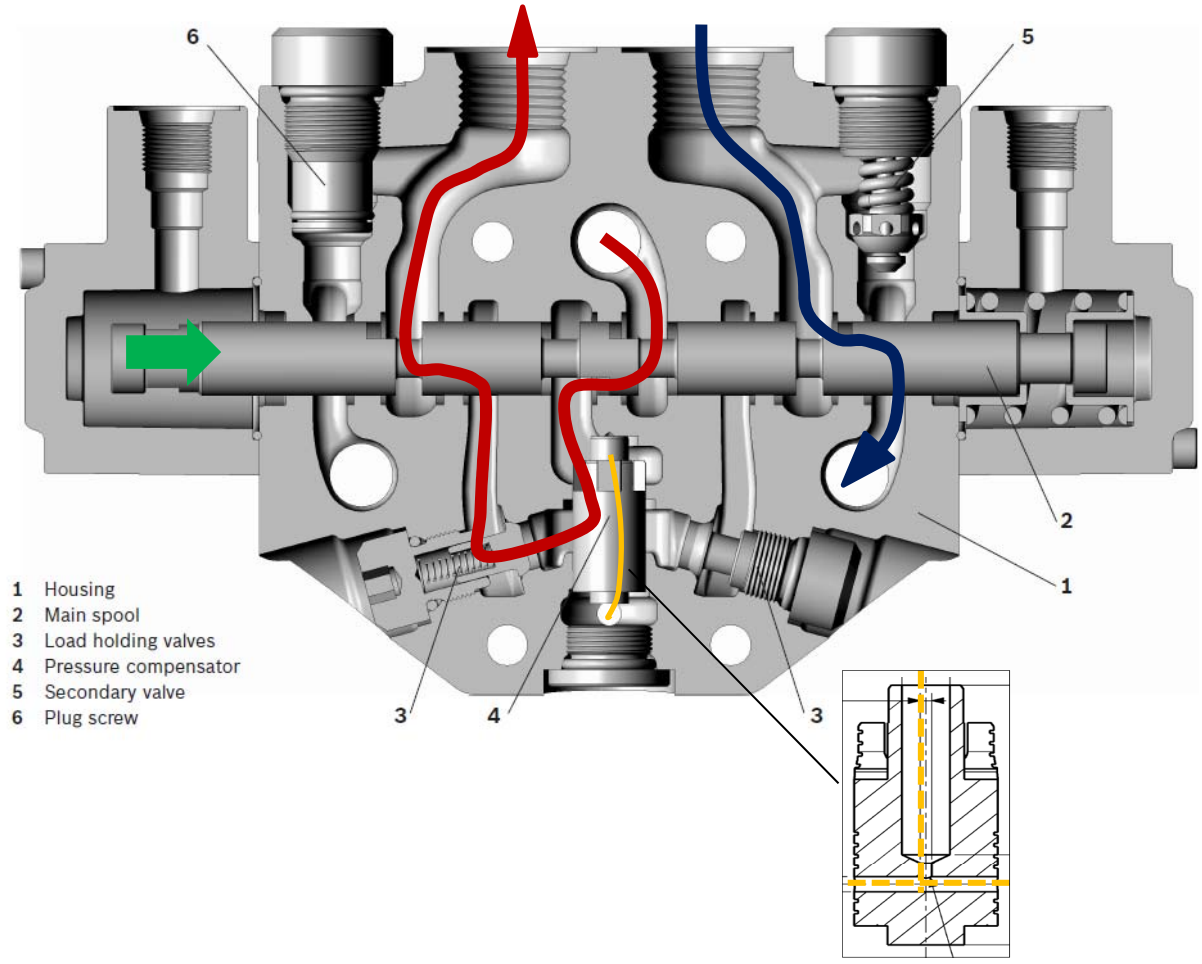
- Medium standby pressure: fast response and accumulator pressure loss to ensure machine action
- The median flushing
- Combined with LS relief valve, it acts as the main relief valve of the system

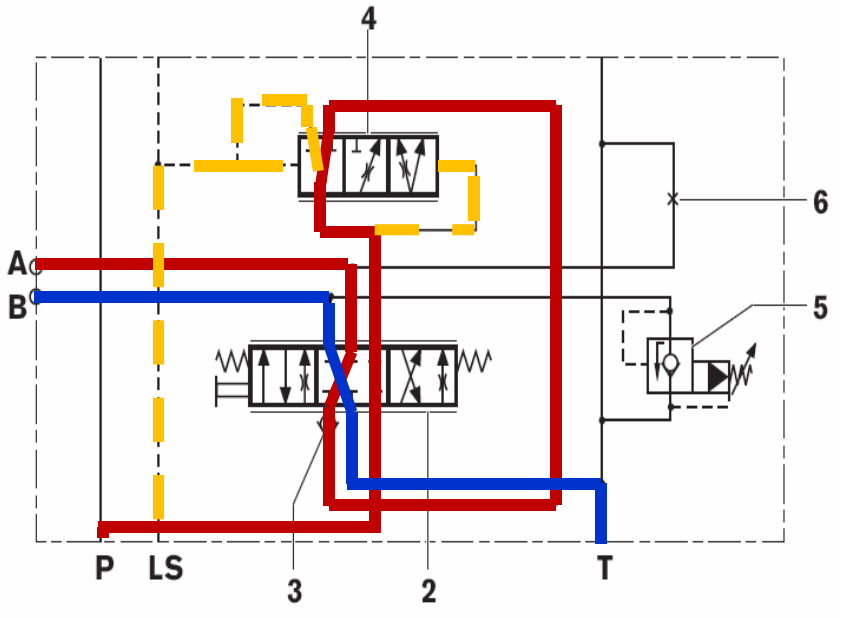
3. Flow control valve: release LS oil pressure



4. System pressure: LS overflow pressure + flushing valve pressure

3. WORKING GROUP (REXRORH RS12)





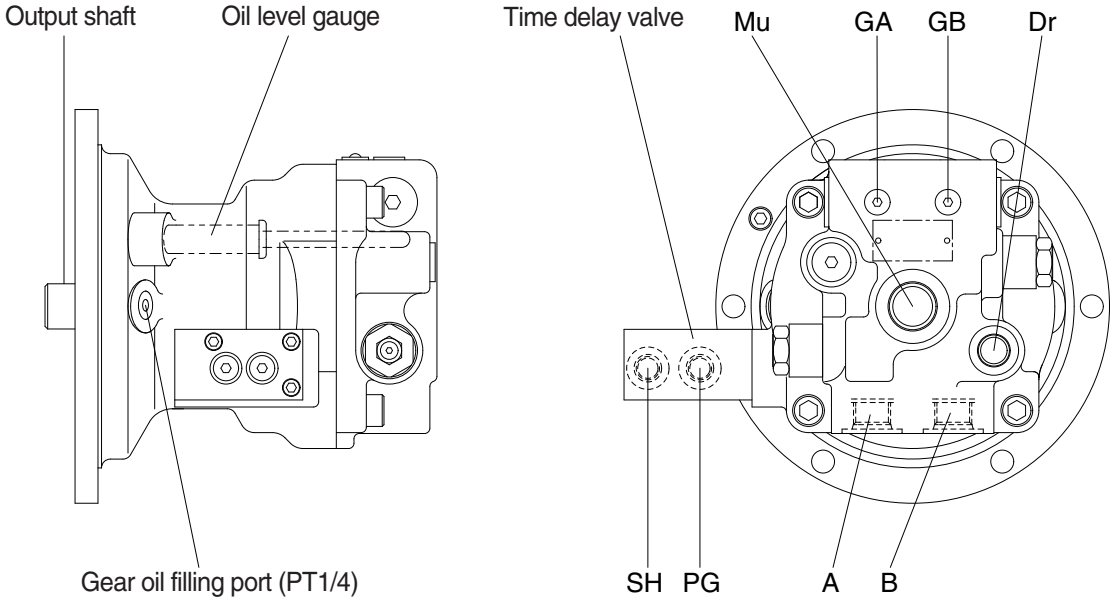
GROUP 3 SWING DEVICE

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.



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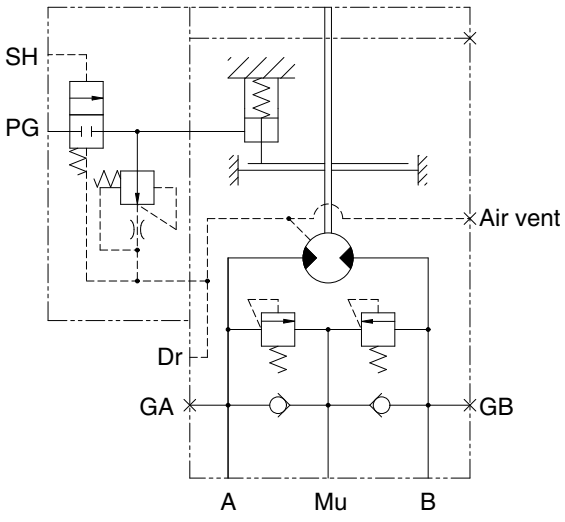
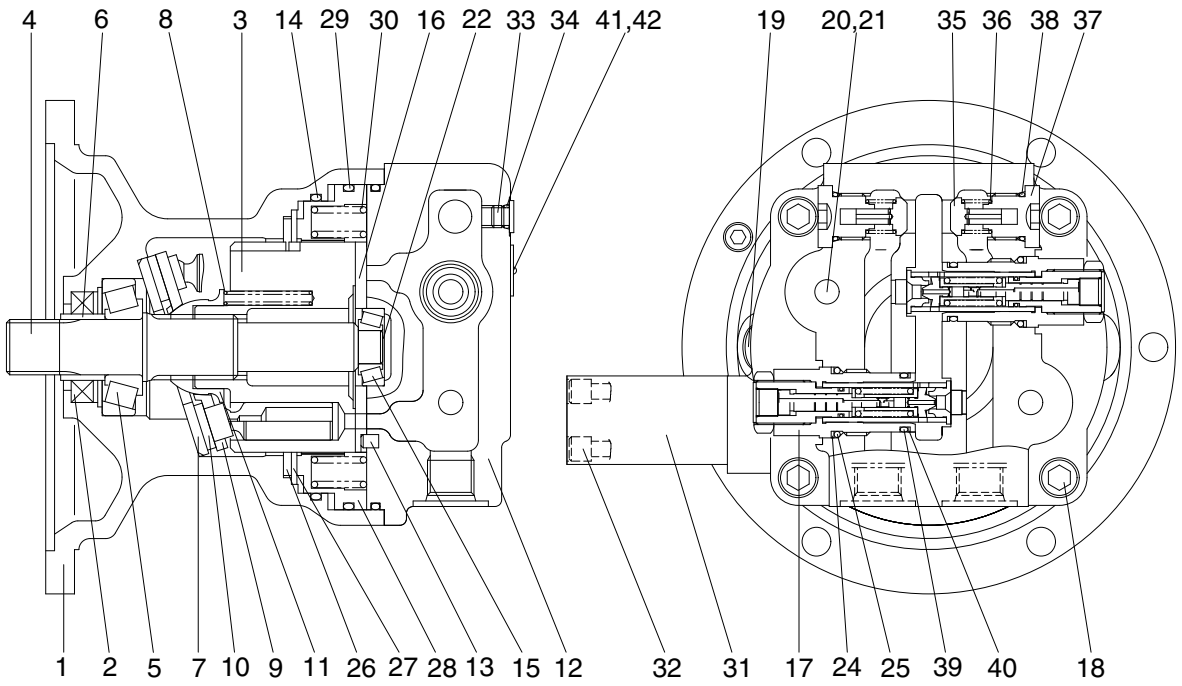


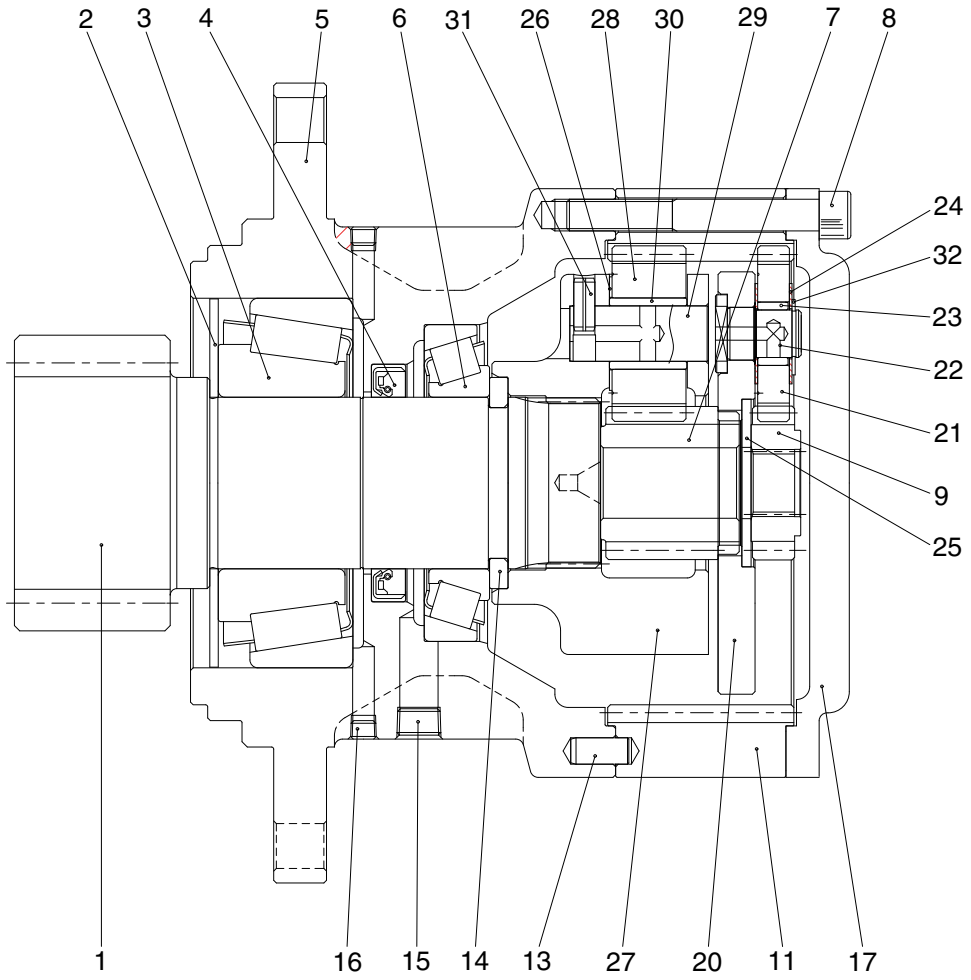
Hydraulic circuit

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



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

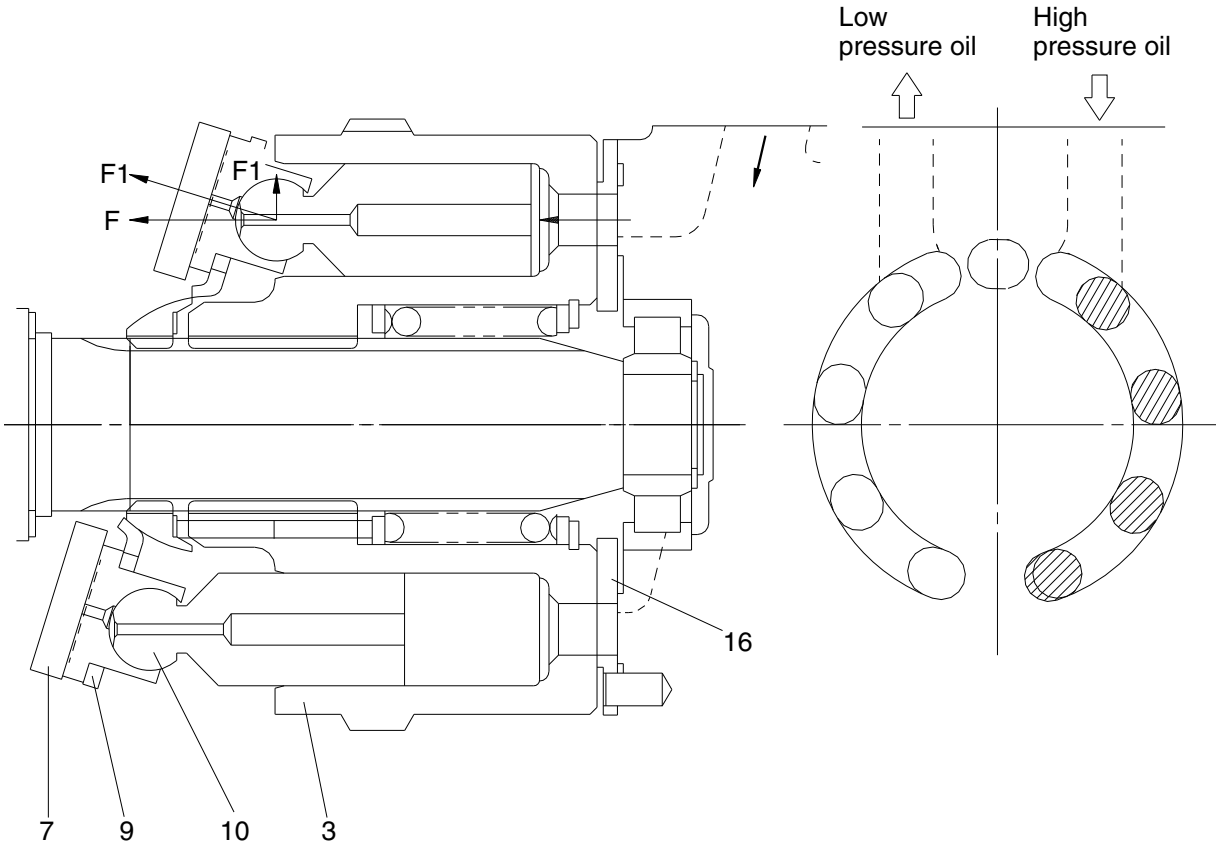
When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force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

$$T = \frac{p \times q}{2\pi},\ q = Z \cdot A \cdot PCD \cdot \tan\theta,\ F1 = \frac{F}{\cos\theta},\ F_2 = F\tan\theta,\ S = PCD \times \tan\theta$$

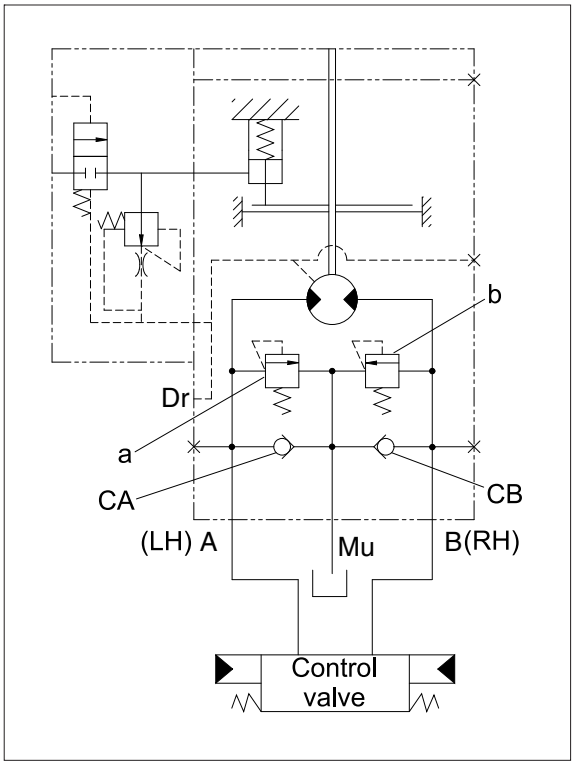
Where p : Effective difference of pressure (kgf/cm^2)
q : Displacement (cc/rev)
T : Output torque ($kgf \cdot cm$)
Z : Piston number (9EA)
A : Piston area (cm^2)
θ: Tilting angle of swash plate (degree)
S : Piston stroke (cm)



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.

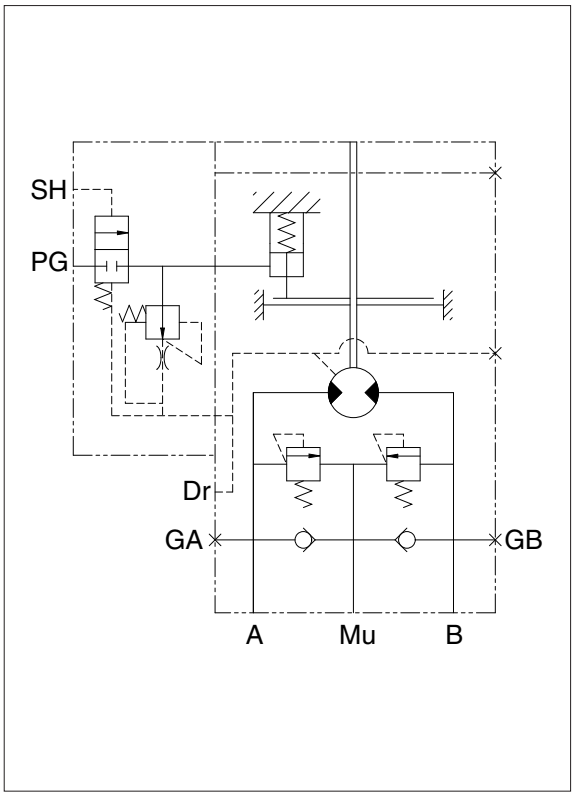
(3) Operation

① When starting swing

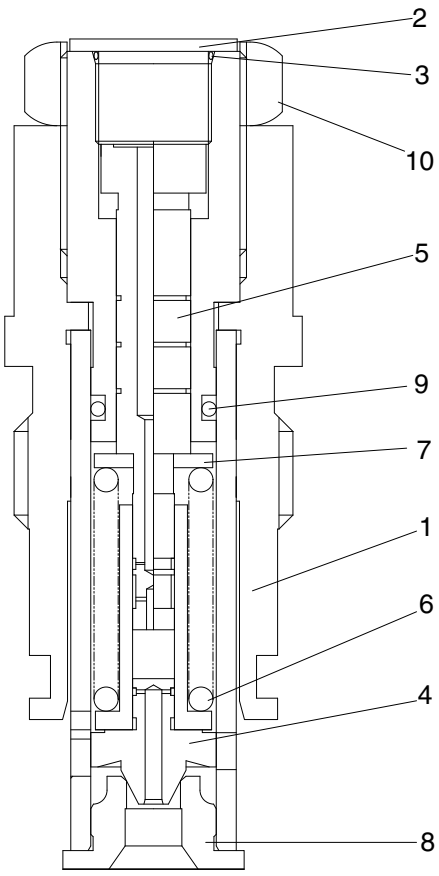
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port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



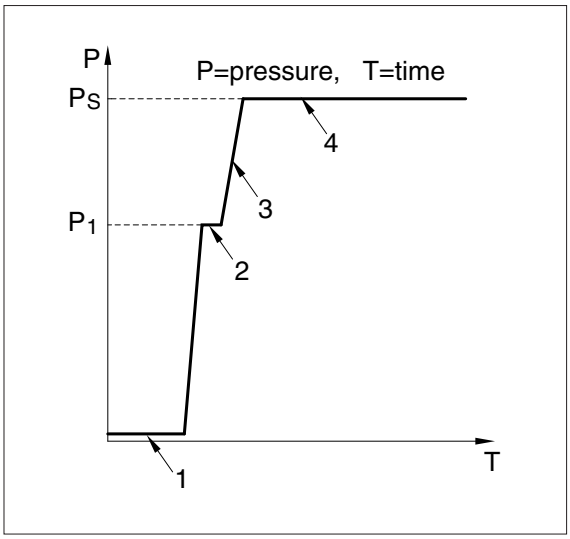
1 Body
2 Plug
3 O-ring
4 Plunger
5 Piston
6 Spring
7 Spring seat
8 Seat
9 O-ring
10 Nut

(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.

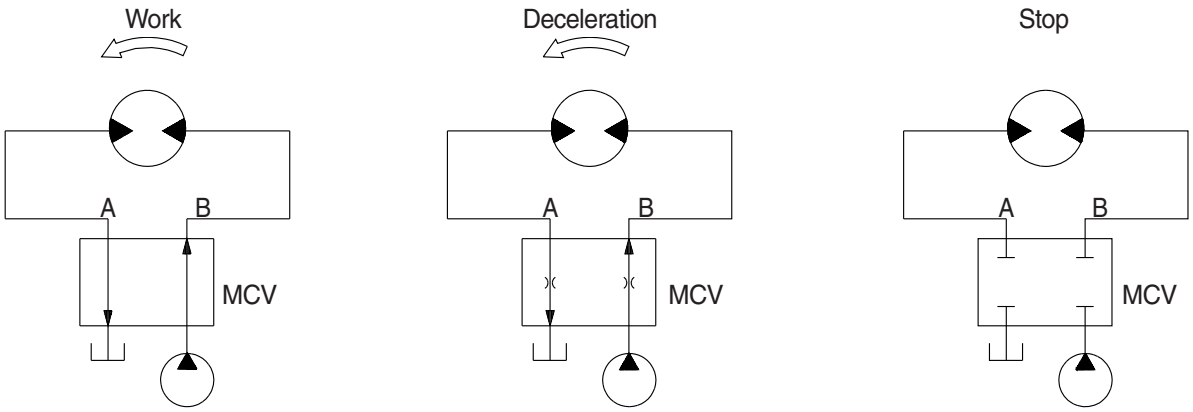


4) BRAKE SYSTEM

(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.



MCV A, B opened　　MCV A, B throttled　　MCV A, B closed

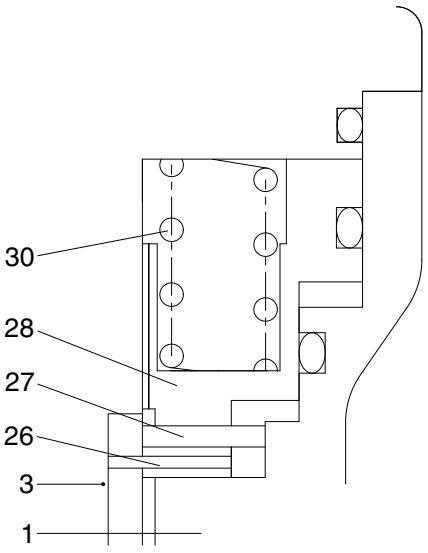
(2) Mechanical swing parking brake system

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.

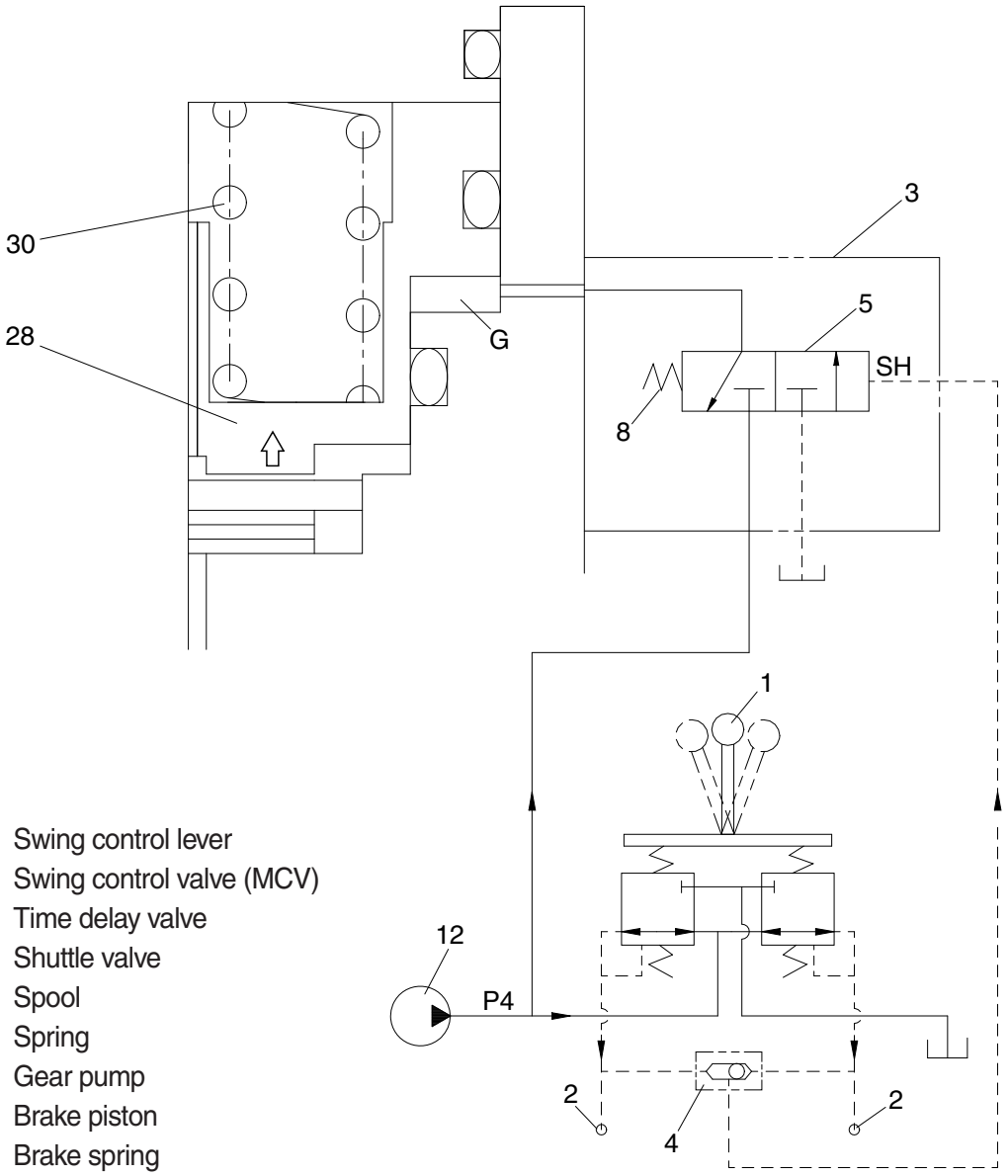


1	Casing	27	Separate plate
3	Cylinder	28	Brake piston
26	Friction plate	30	Brake spring

② Operating principle

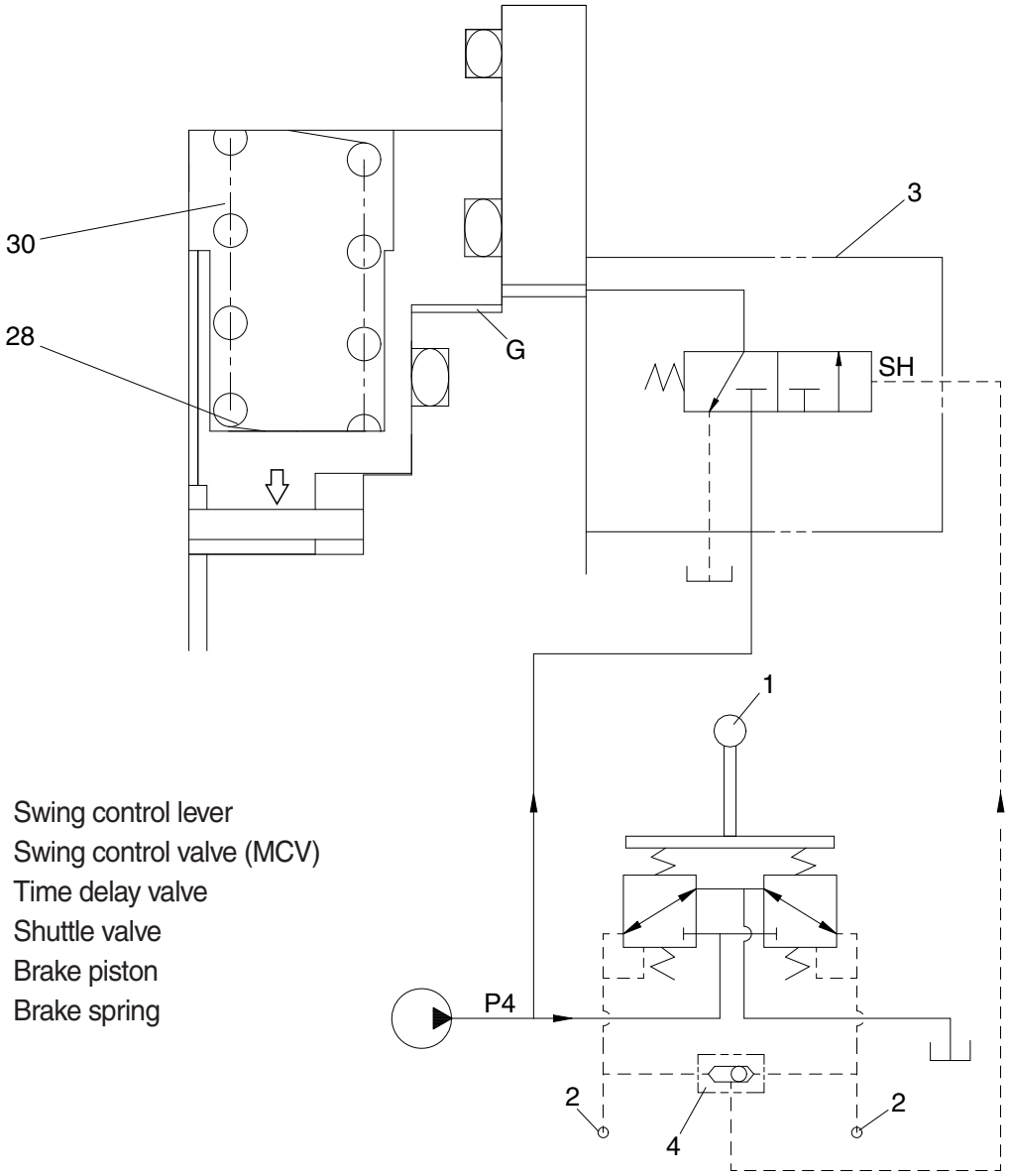
a. When the swing control lever (1) is set to the swing position, the pilot oil go to the swing control valve (2) and to SH of the time delay valve (3) via the shuttle valve (4), this pressure move spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P4) goes to the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

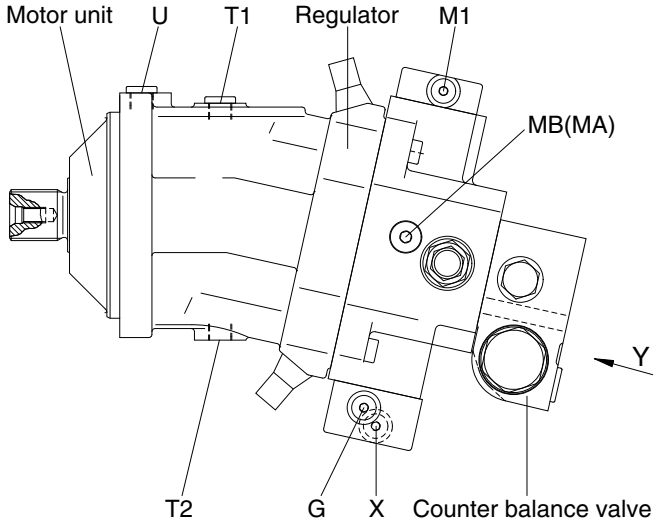


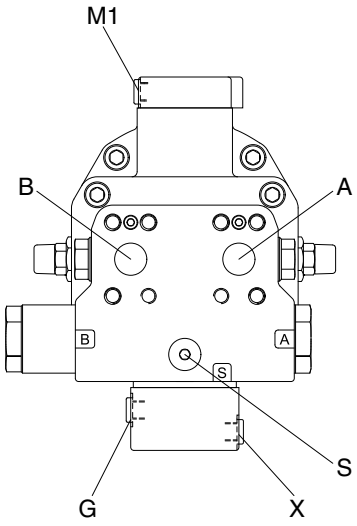
1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
28 Brake piston
30 Brake spring

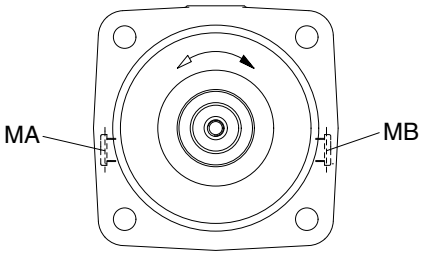
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

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







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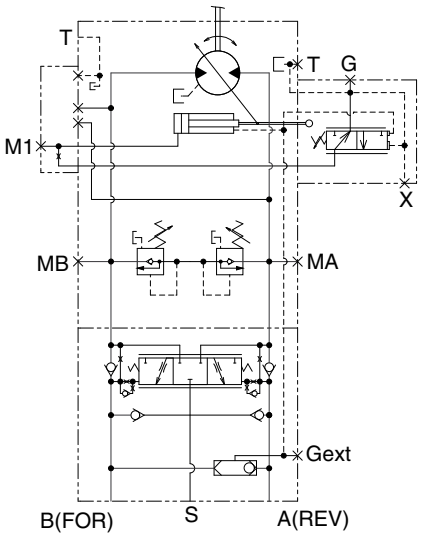
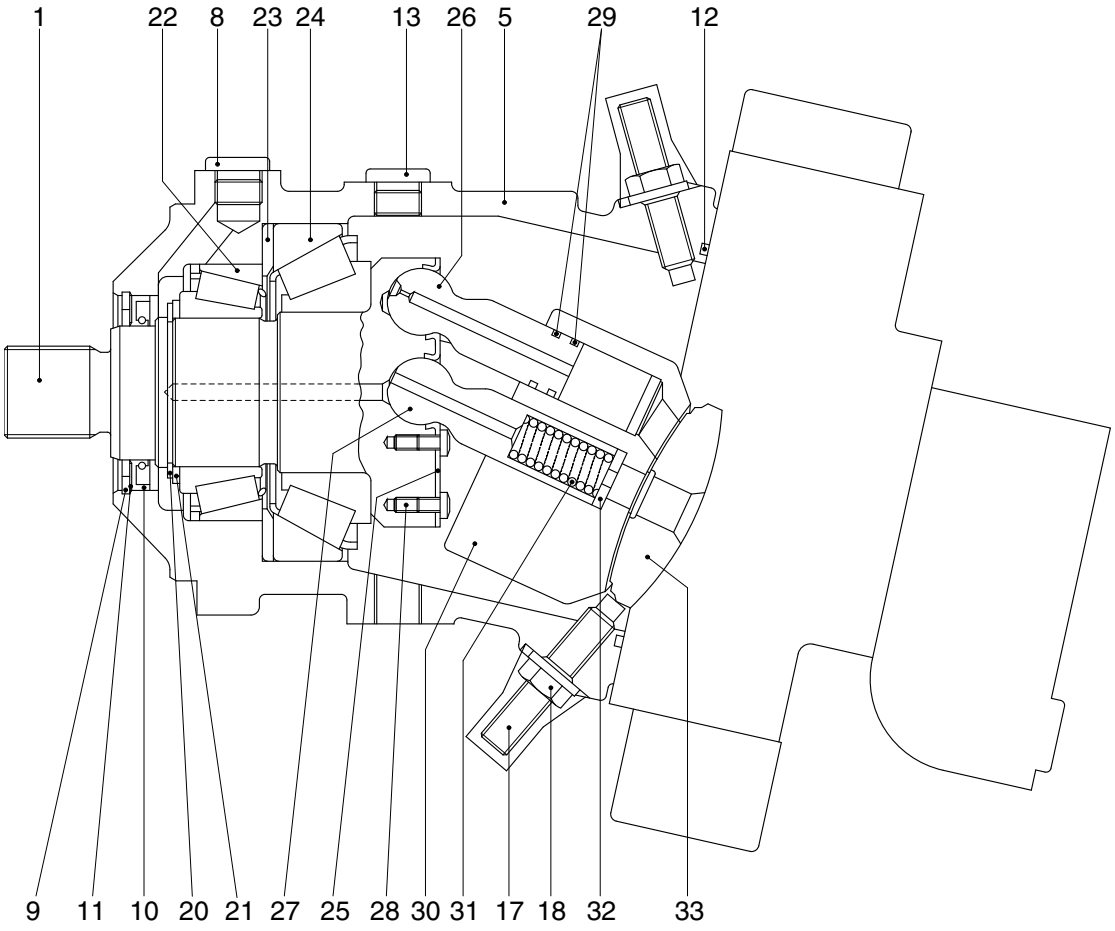


Hydraulic circuit

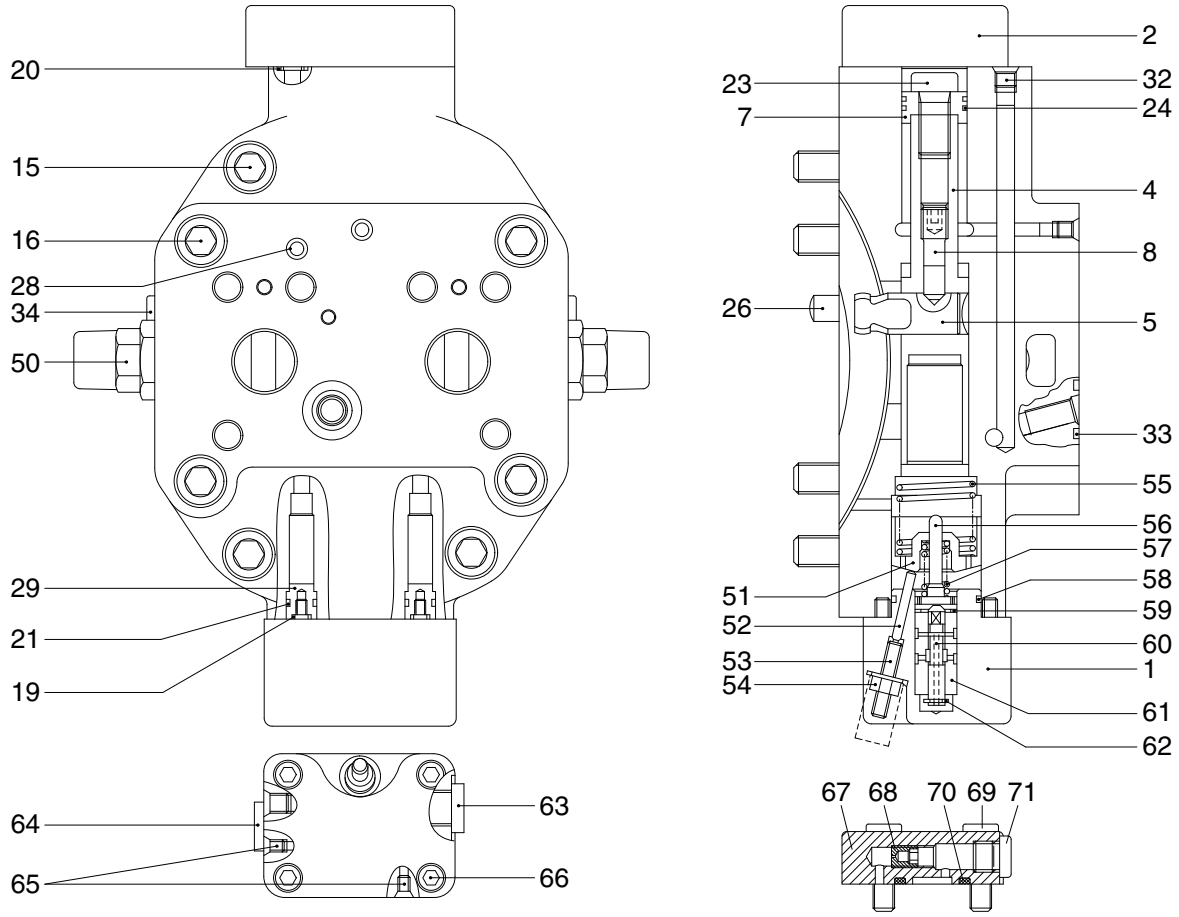
Port	Port name	Port size
A, B	Main port	SAE 6000psi 1
G	Gauge port	M14×1.5
M1	Gauge port	M14×1.5
X	Pilot pressure port	M14×1.5
T2	Drain port	M18×1.5
U	Flushing port	M18×1.5
S	Make up port	M22×1.5
MA,MB	Gauge port	M18×1.5

1) MOTOR UNIT



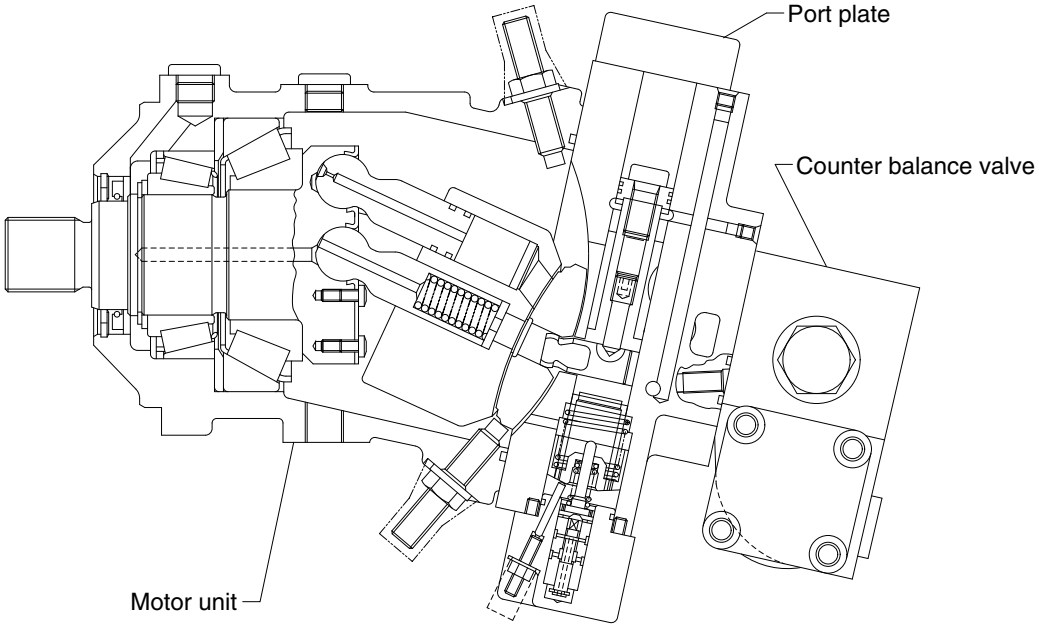
1	Drive shaft	17	Threaded pin	26	Piston
5	Housing	18	Seal lock nut	27	Center pin
8	Locking screw	20	Retaining ring	28	Pan head screw
9	Retaining ring	21	Back up plate	29	Steel sealing ring
10	Shaft seal ring	22	Taper roller bearing	30	Cylinder block
11	Back up plate	23	Shim	31	Pressure spring
12	O-ring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

2) REGULATOR



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



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˚.

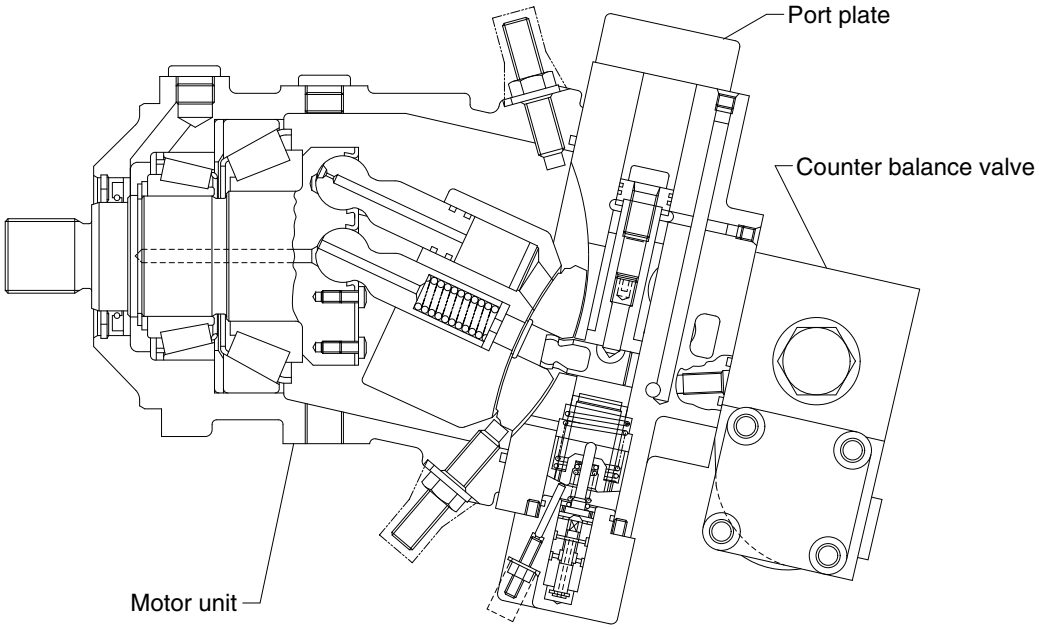
The variable displacement motor with integrated counterbalance valve is designed to be operated in open loop.

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.

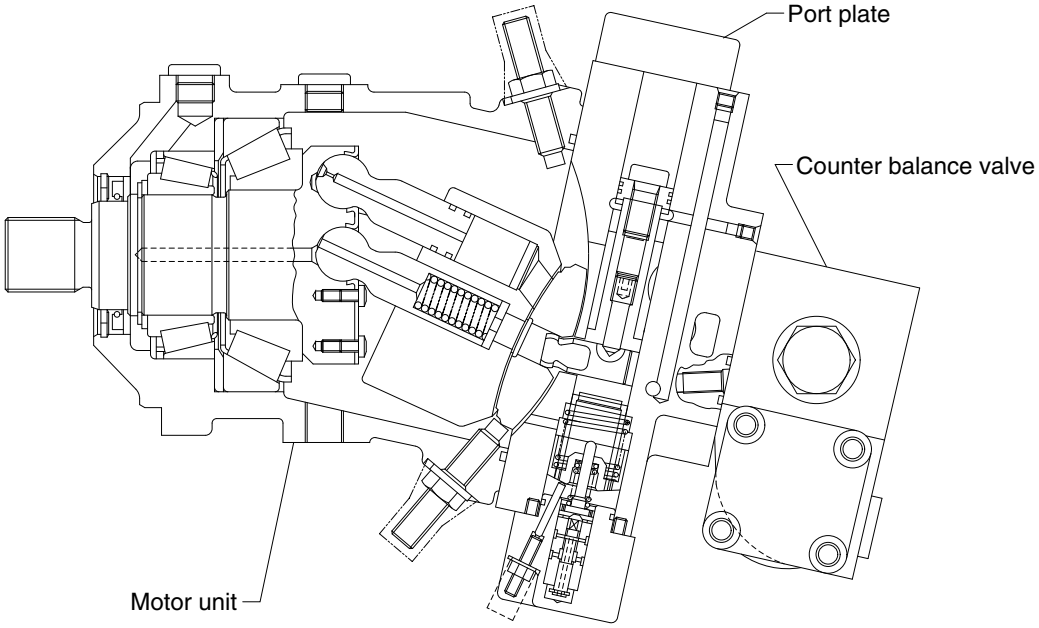
5) FUNCTION AS TO CIRCUIT DIAGRAM

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.



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

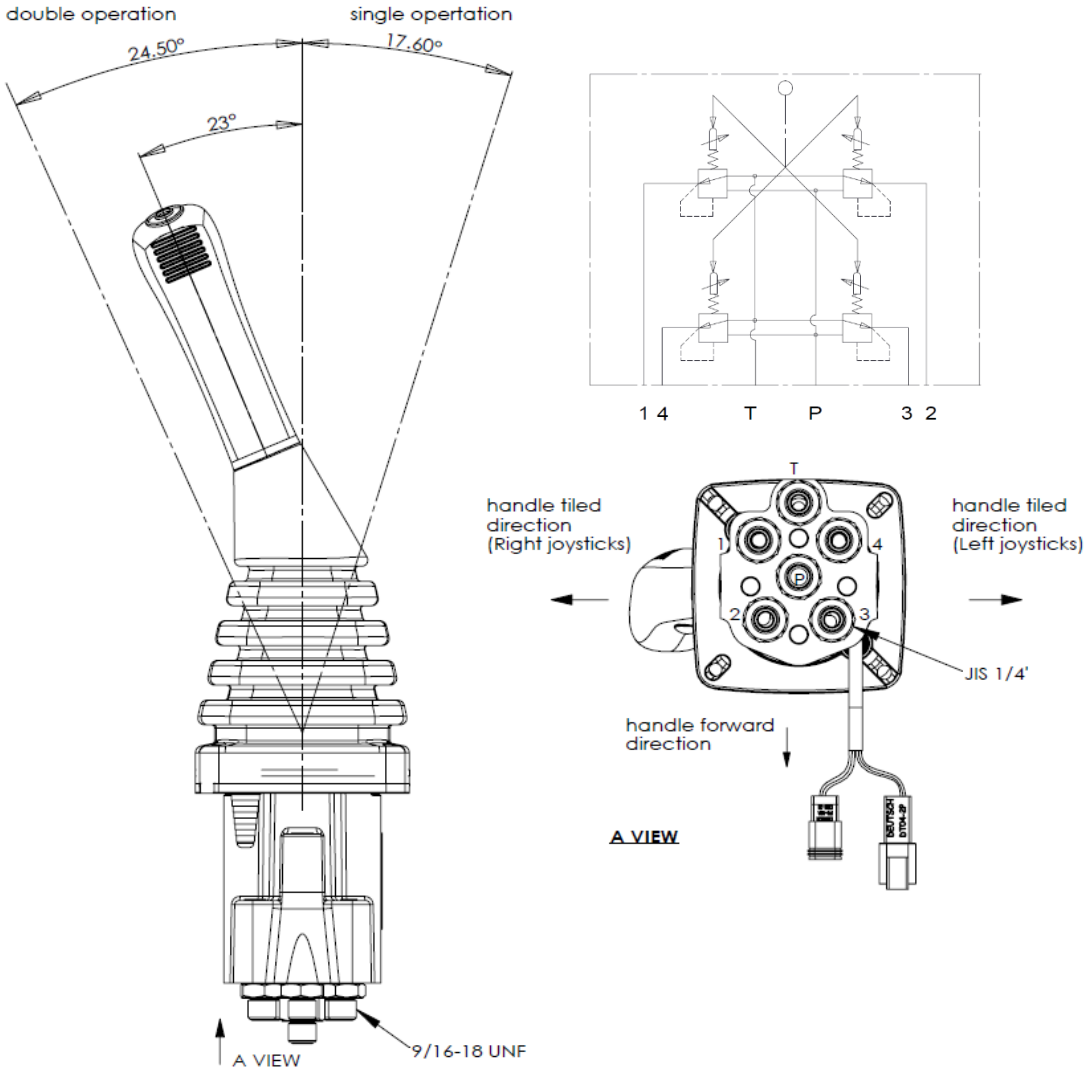
11) COMMISSIONING

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

- **STRUCTURE:**
  SVM980 joysticks with Anti-dampening design to built a advantage low lever effort, it have a whole cast iron body that can work at more higher flow capacity and life. And Compatible with Walvoil levers and rubber boots.

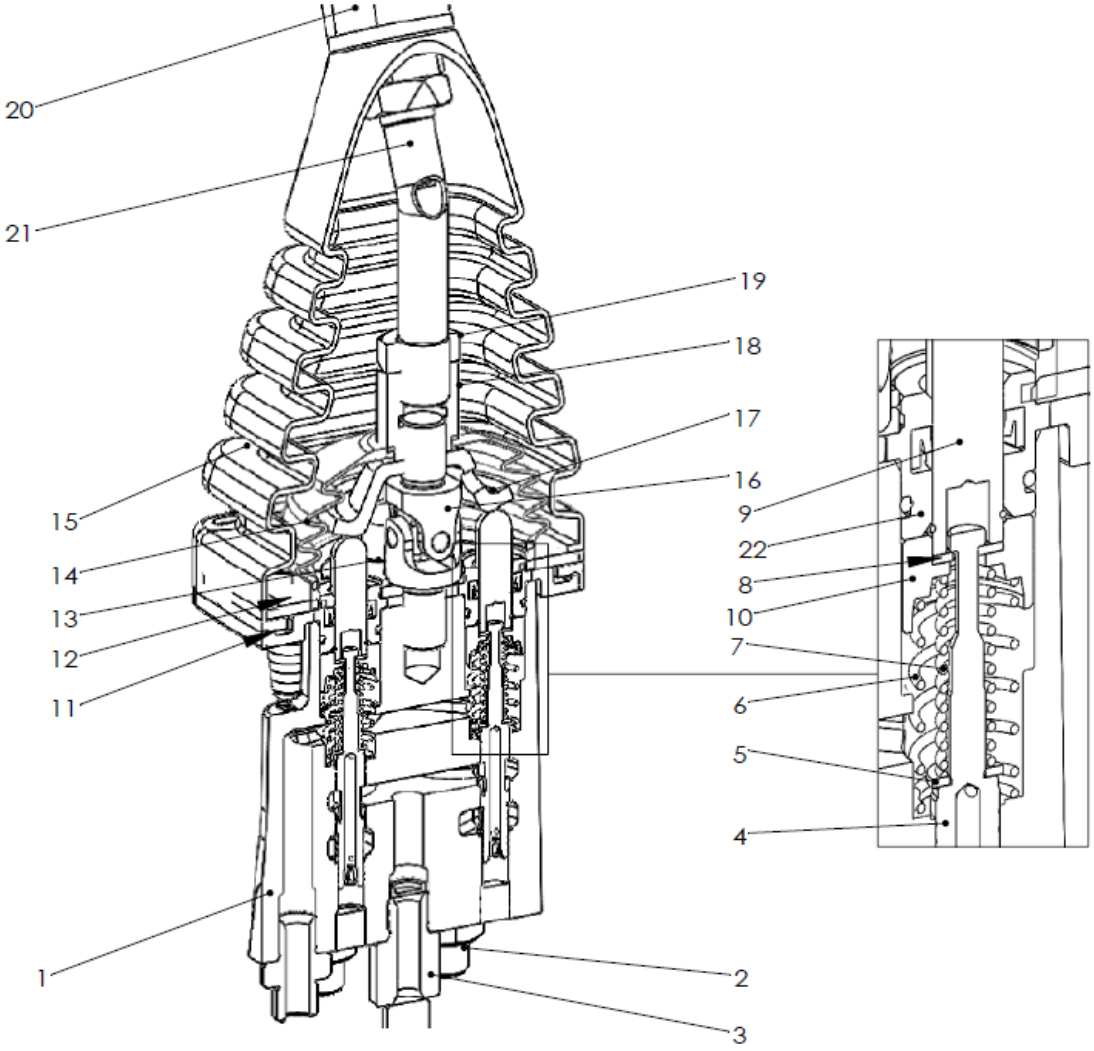


Port	Left joysticks	Right joysticks	Port size
P	Pilot oil inlet port	Pilot oil inlet port	JIS 1/4'
T	Pilot oil return port	Pilot oil return port	With adaptor
1	Left swing port	Bucket out port	9/16-18 UNF
2	Arm in port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm out port	Boom up port	

- **CROSS SECTION:**

  The construction of this pilot valve is showing the whole internal components which to built the pilot curve and how to work.

  pressure reducing section is composed of spool (4), spring seat (5), reducing spring (7), The return spring (6), lock washer (8), guider ring (10), bullet (9), piston (22), the reducing spring (7) to create the pilot pressure 8~28bar during his whole stroke in the setting, the spool (4) is pushed against to the normal position by return spring (6).



Port P with adaptor '3', Port 1,2,3,4,T with adaptor '2'.

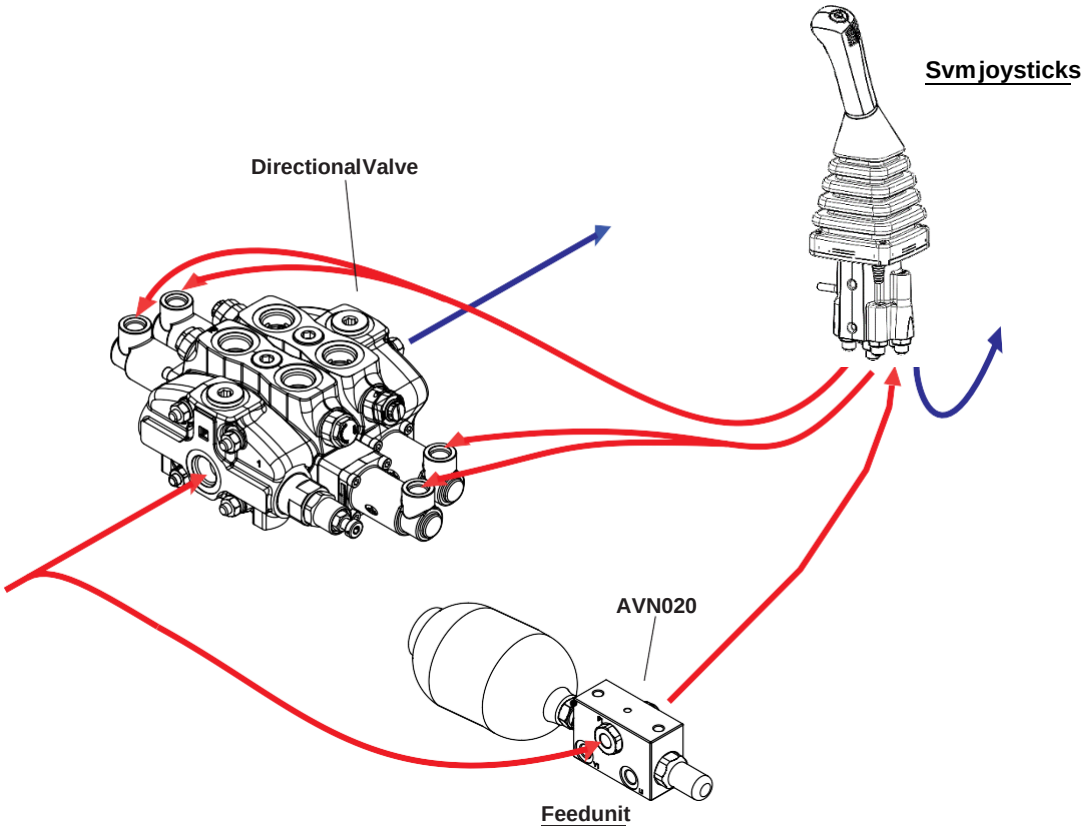
1 Body	2 Short adaptor	3 Long adaptor	4 Spool
5 Spring seat	6 Return spring	7 Reduce spring	8 Lock Washer
9 Bullet	10 Guider ring	11 Fixing flange	12 Press flange
13 Circle flange	14 In rubber bellow	15 Rubber bellow	16 Cardon Joint
17 Selector	18 Link nut	19 Lock nut	20 Handle
21 Bent joint	22 Piston		

- **FUNCTION:**

This is an ideal hydraulic proportional remote control system when max. movement precision and long-lasting reliability are required.

The system needs a secondary circuit with low pressure pilotage, fed separately by a dedicated pump and in derivation to the primary one. In this last case, it is necessary to include a feeding unit with eventual accumulator for emergency interventions into the circuit.

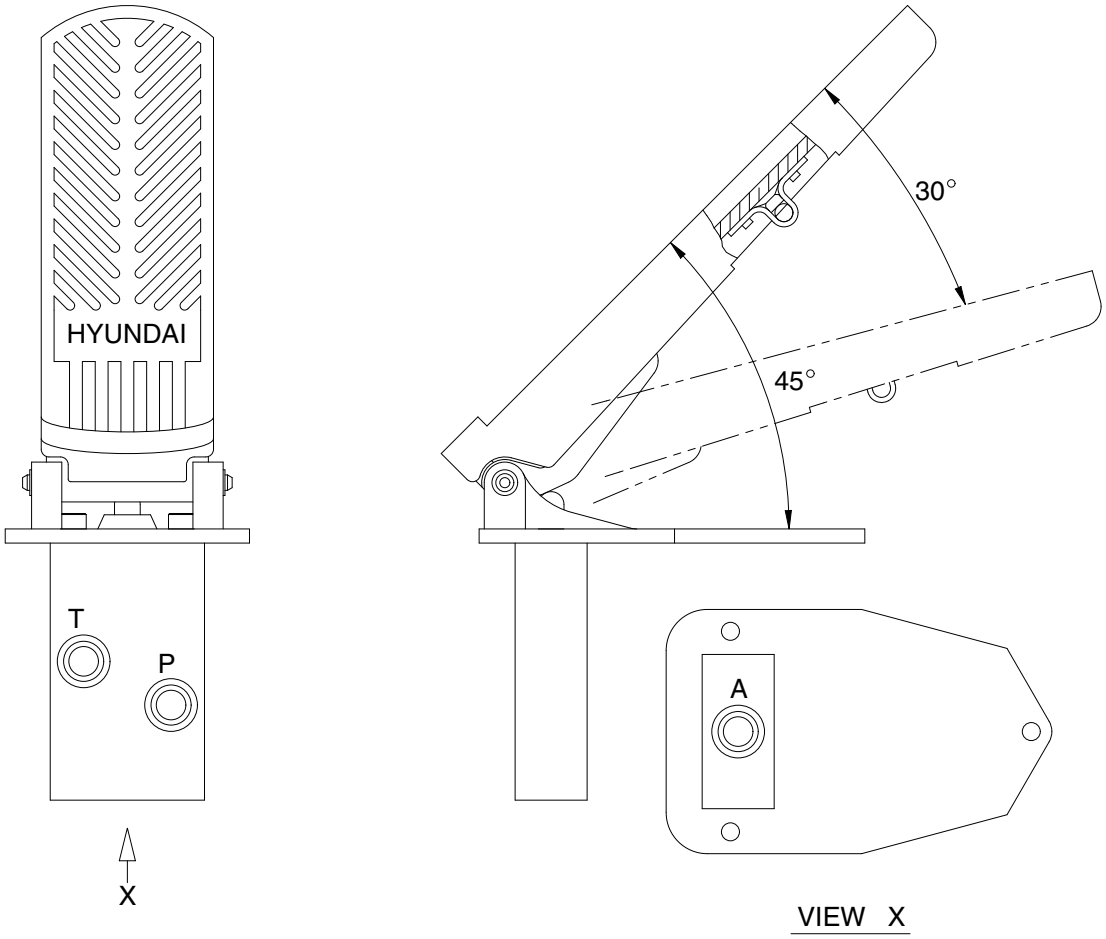
1) Inlet port(P) where oil be fed from pilot pump or Feed unit.
2) Out port (1,2,3,4) be supplied oil from inlet port and send to main valve control kits,
3) T port connect to oil tank.

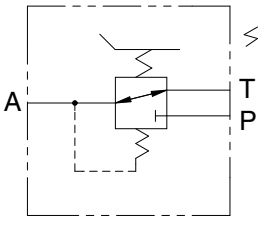


GROUP 6 ACCELERATOR PEDAL

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.



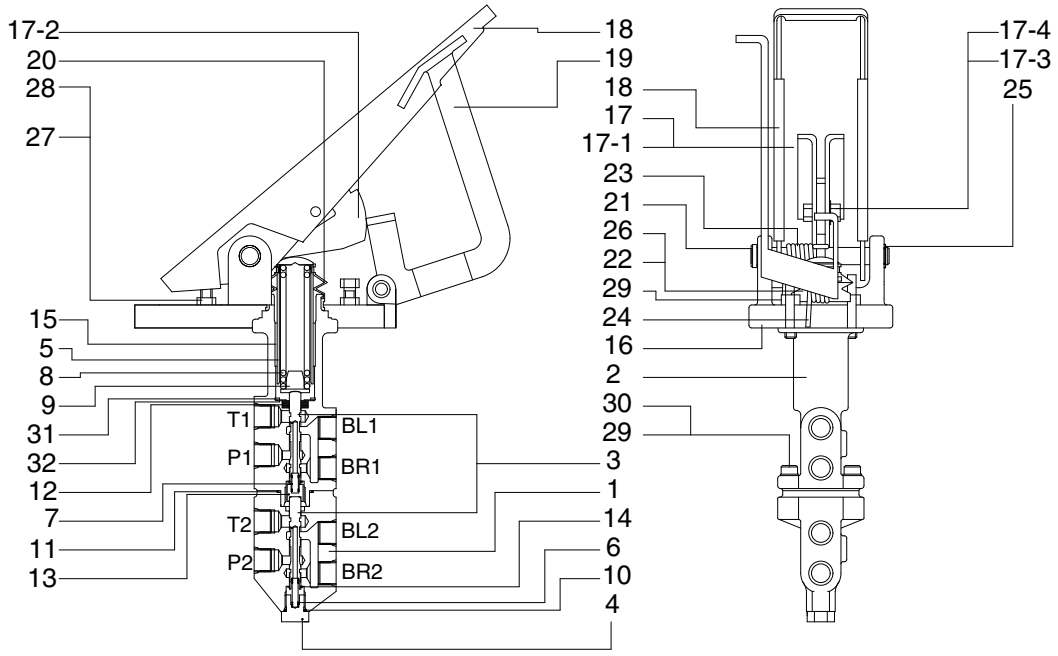


Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
A	Pilot oil output port	

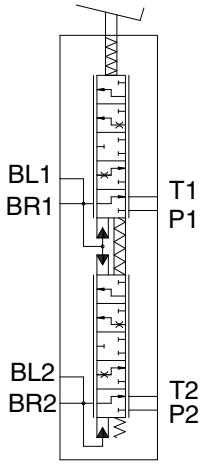
GROUP 7 BRAKE PEDAL (VALVE)

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.



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



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

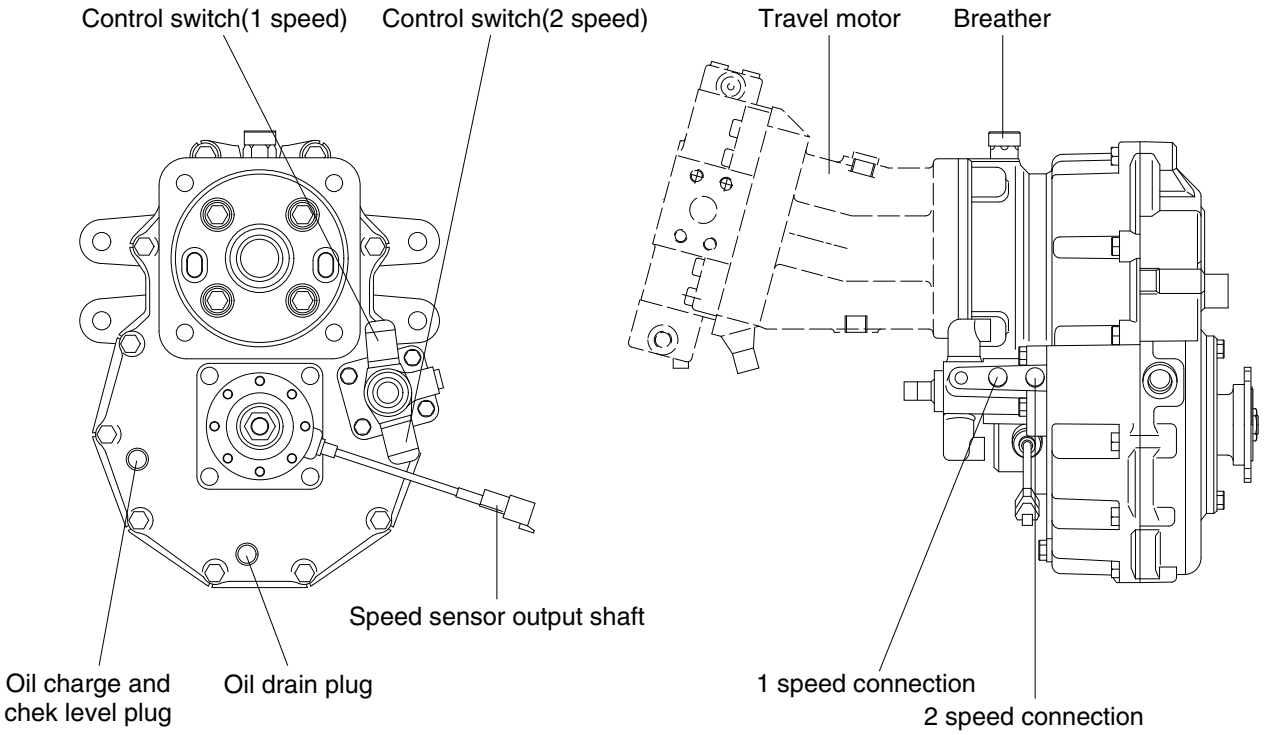
Pedal restriction screw (29) on pedal plate (16) below pedal (17) is used to limit the braking pressure.

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

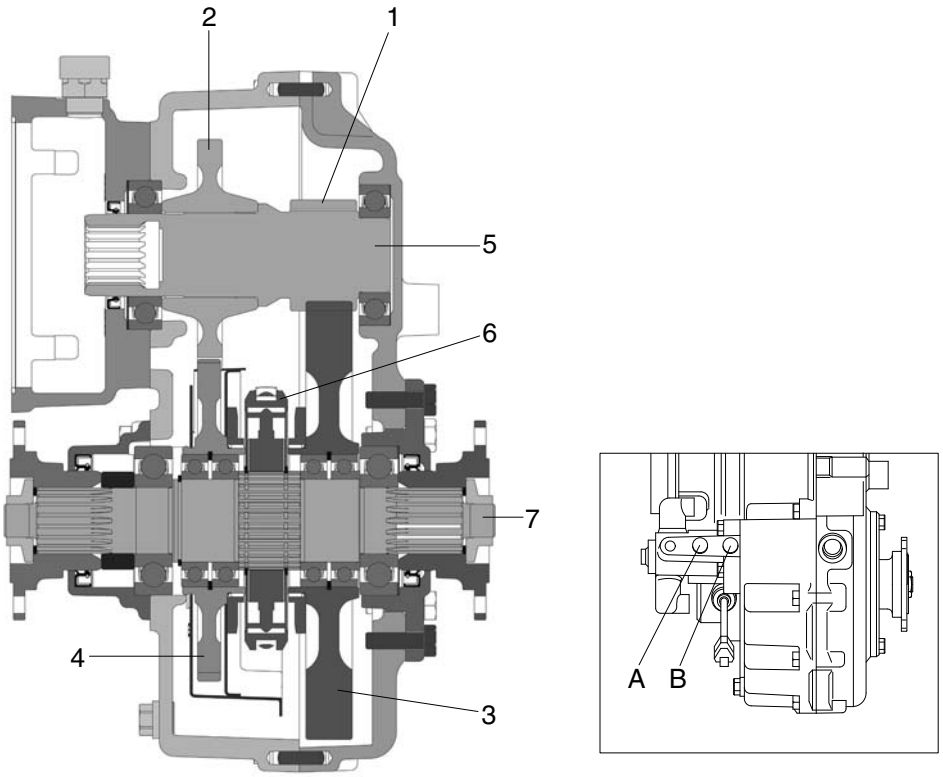
1. STRUCTURE



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



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

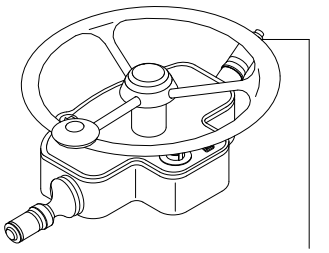
① At connection P1 and P2 at Low/High speed : 26~32 kgf/cm^2

② Definition of lubricants : SAE 80W-90 API GL-4

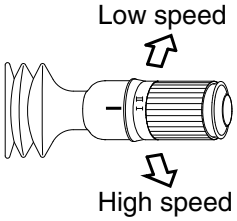
3) HOW TO CHANGE THE TRAVEL SPEED

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.

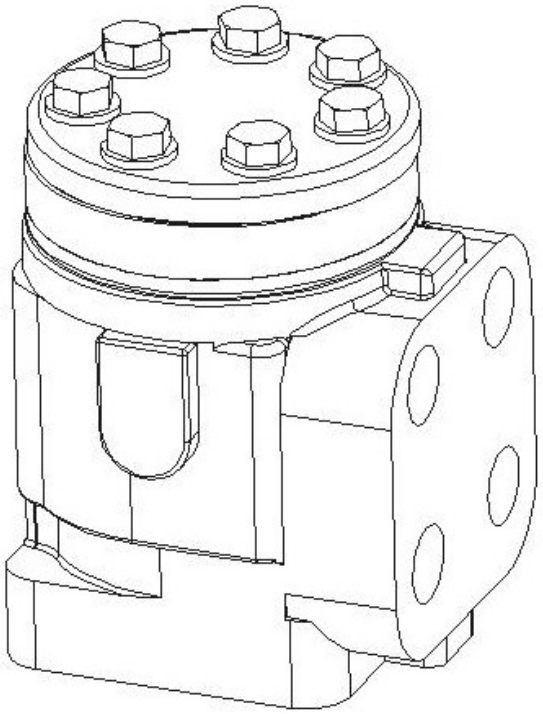


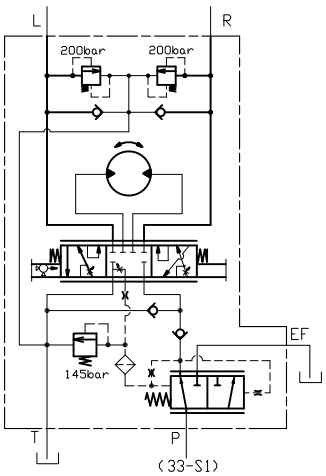
Travel speed switch



GROUP 9 STEERING VALVE

1. STRUCTURE

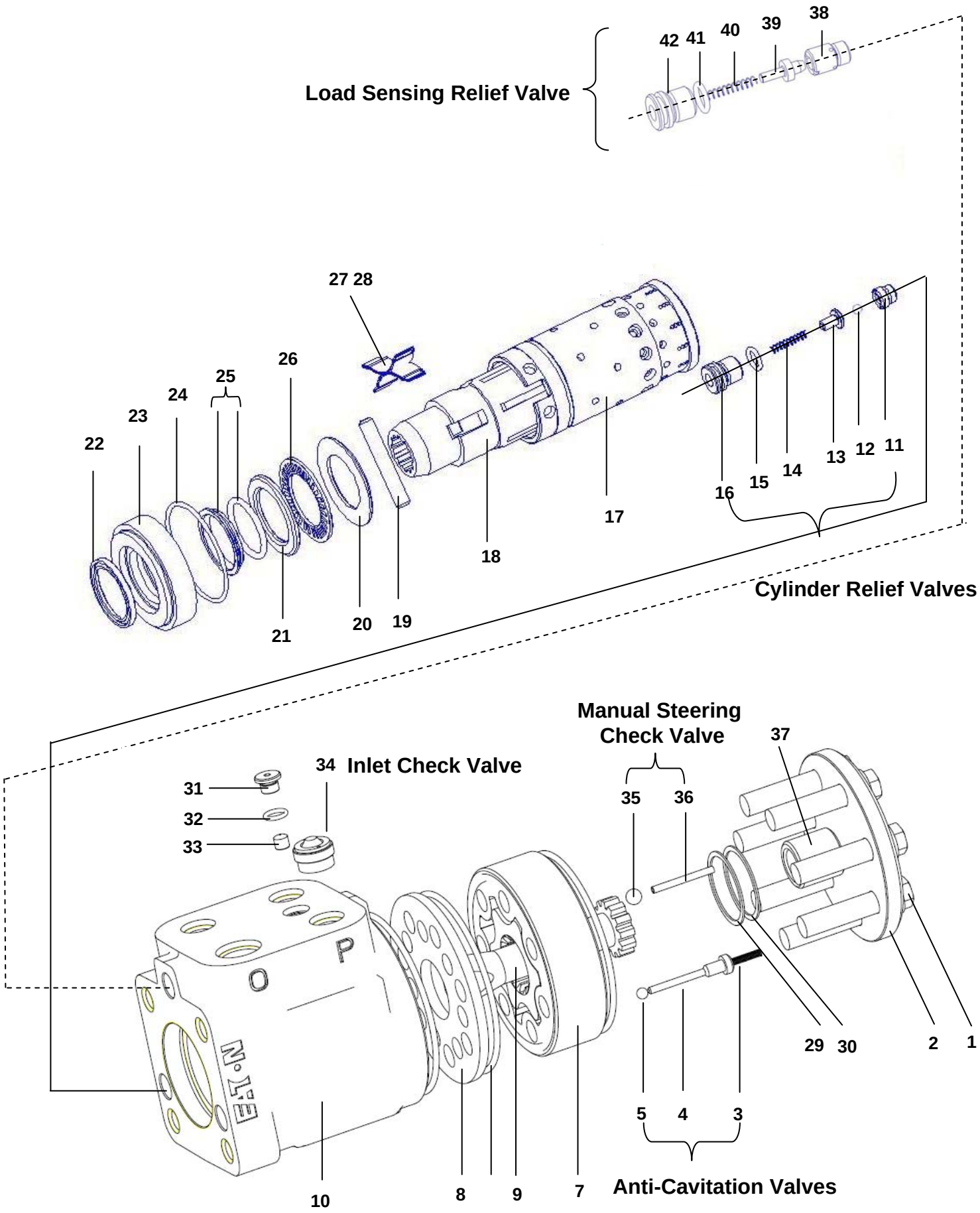




Hydraulic circuit

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


Load Sensing Relief Valve
42
41
40
39
38
27 28
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
Cylinder Relief Valves
Manual Steering
Check Valve
37
34
Inlet Check Valve
31
32
33
35
36
O
P
M.7.3
29
30
2
1
5
4
3
Anti-Cavitation Valves
10
8
9
7

1. Cap Screw (M10)
2. End Cap
3. Spring
4. Plug
5. Ball 4mm
6. Seal, O-ring 77.5mm ID*
7. Gerotor
8. Spacer Plate
9. Drive
10. Housing
11. Valve Seat
12. Ball 5mm
13. Ball Holder
14. O-ring 7.6454mmID*
15. Spring
16. Plug
17. Sleeve
18. Spool
19. Pin
20. Bearing Race
21. Bearing Race
22. Dust Seal*
23. Gland Bushing
24. O-ring 43.2mm ID
25. Shaft Seal Kit*
26. Needle Thrust Bearing
27. Spring
28. Spacer
29. Back-up Washer*
30. Ring, Seal*
31. Plug
32. O-ring 6.07mm ID*
33. Screw, Set
34. Inlet Check Valve
35. Ball 7mm
36. Roll Pin
37. Spacer
38. Valve Set
39. Poppet
40. Spring
41. O-ring 7.6454mmID*
42. Plug

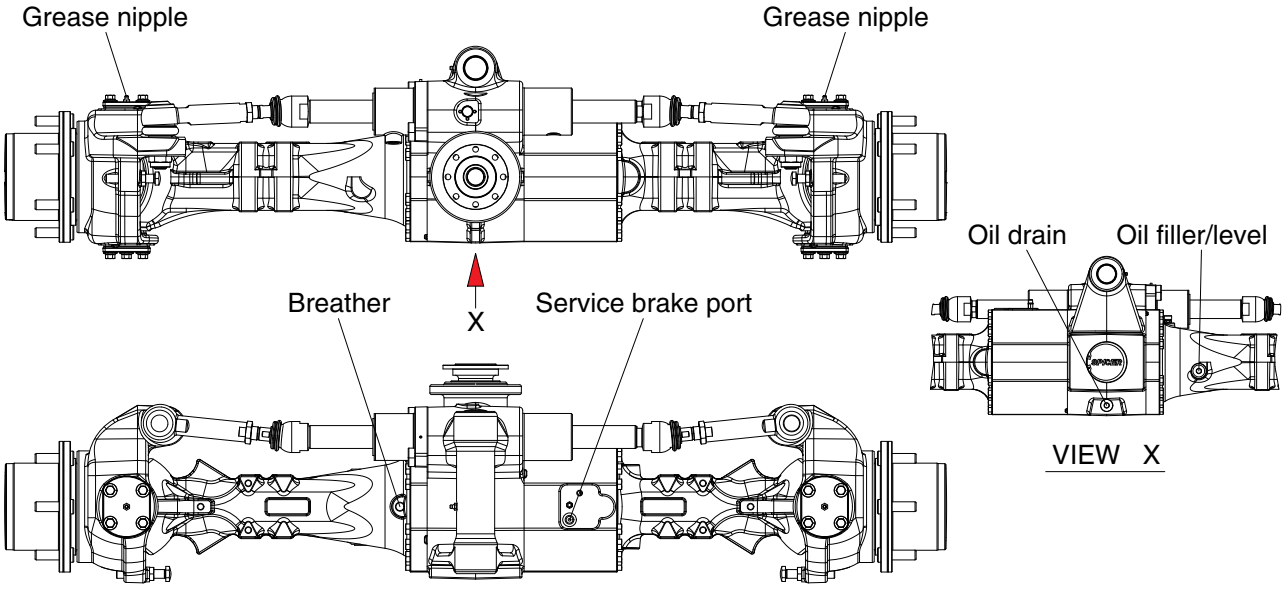
GROUP 10 AXLE

1. OPERATION

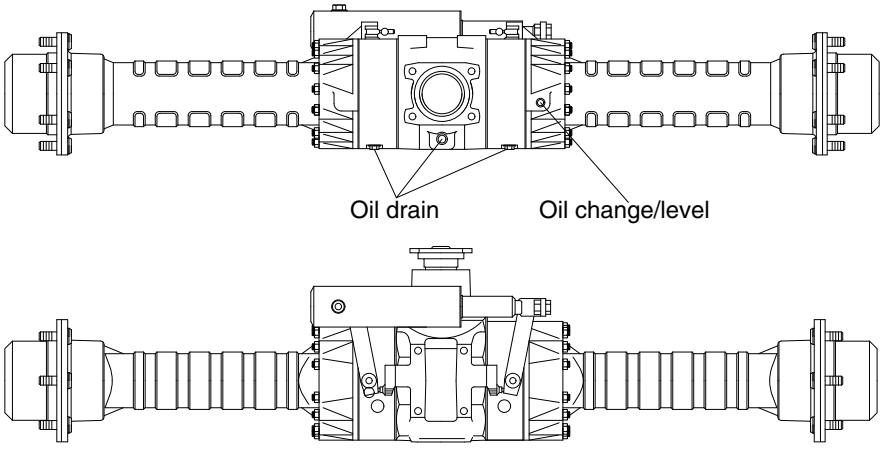
·The power from the engine passes through main pump, travel motor and transmission and drive shafts, and is then sent to the front and rear axles.

·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.

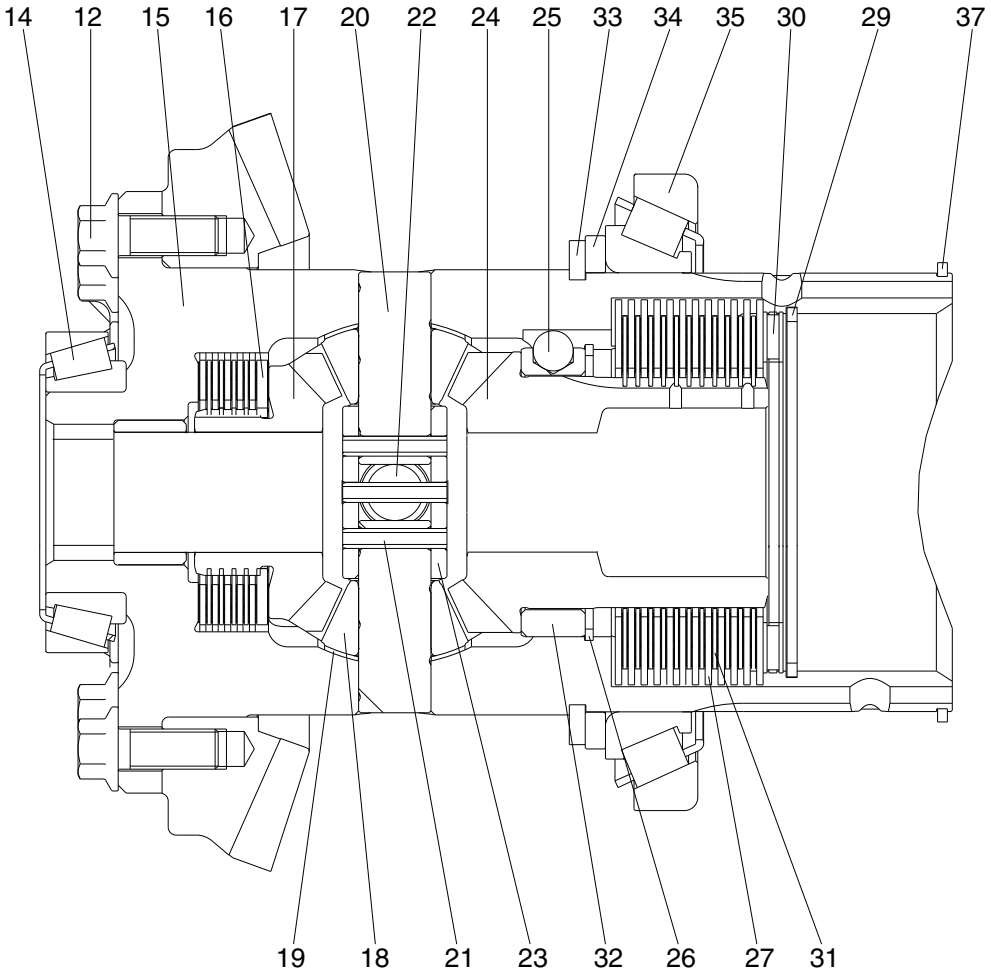
1) FRONT AXLE



2) REAR AXLE

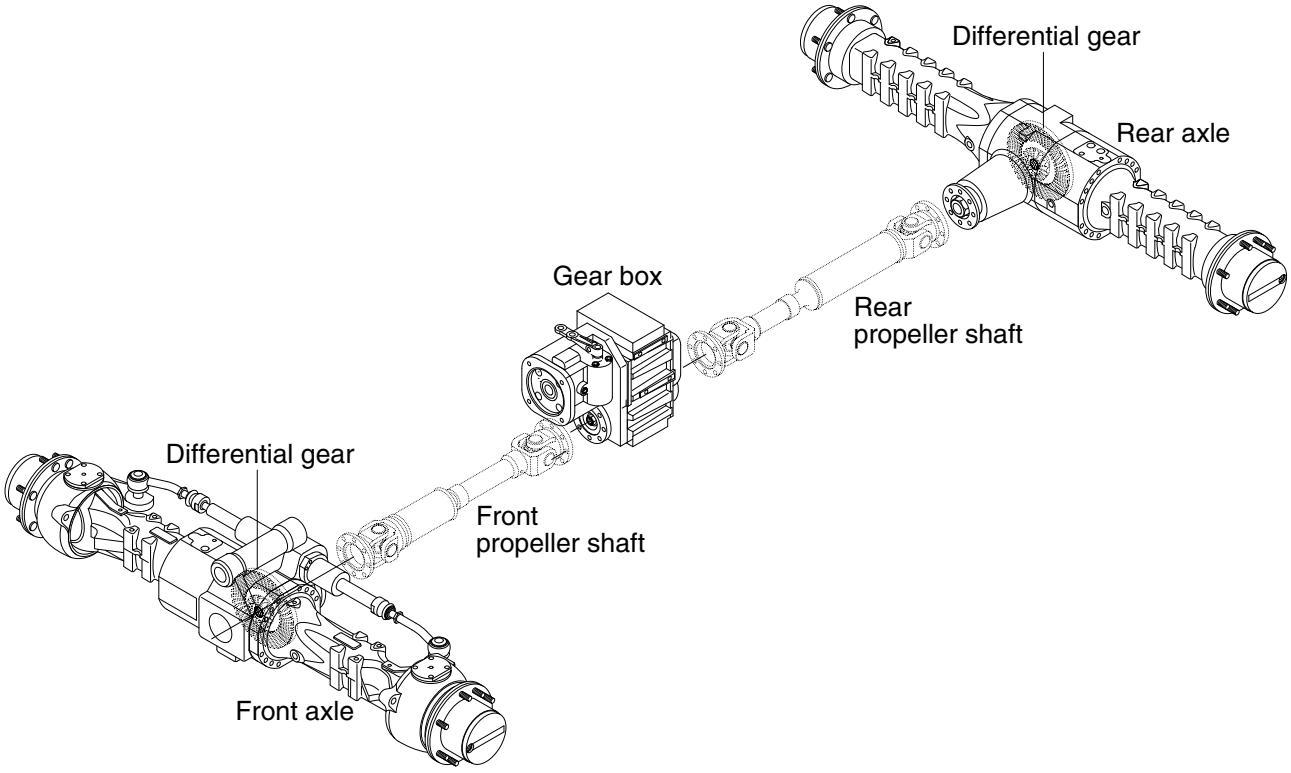


2. SECTION OF DIFFERENTIAL



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

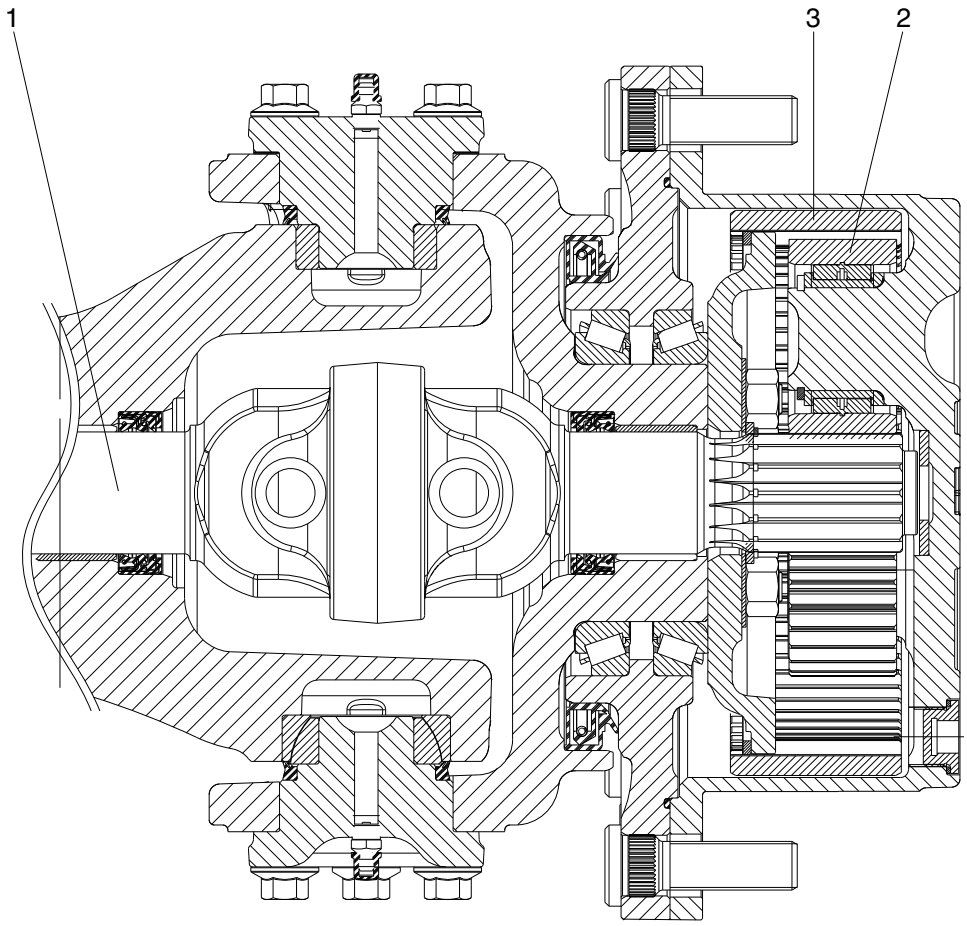
In addition, the differential also servers as an equalizer when going around curves. If the mechanical connection from the transmission to the universal drive shaft, differential, shaft, and planetary gears to the wheels would be rigid, every steering movement would strain the axle construction and would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

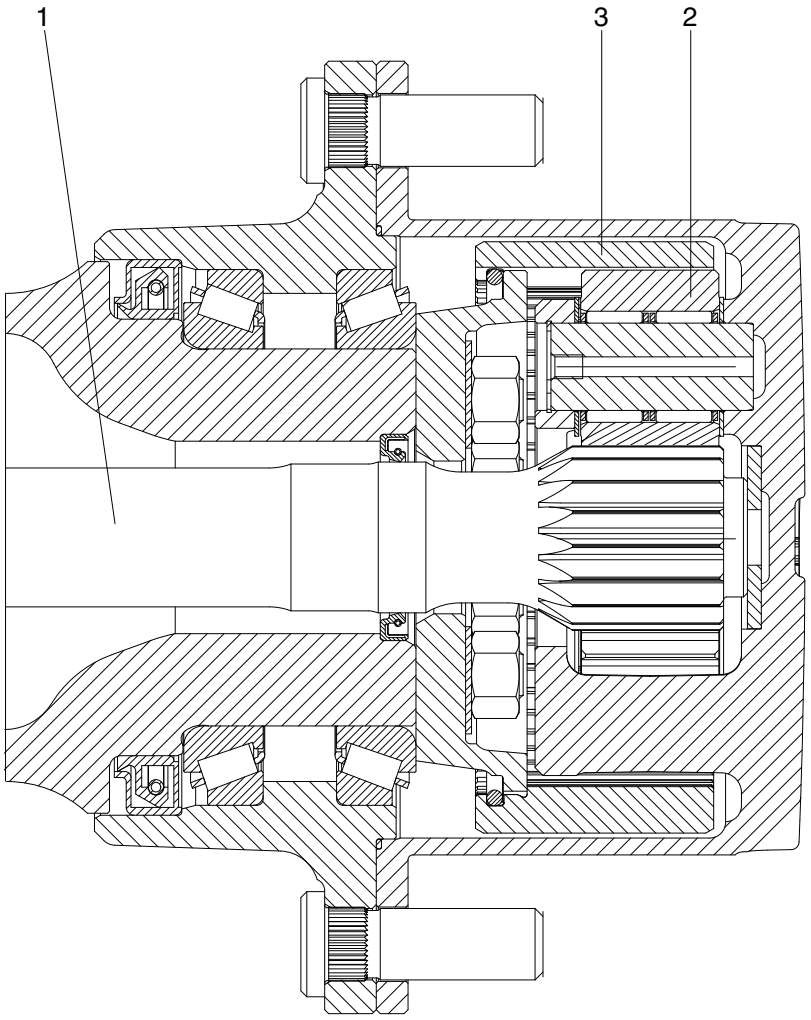


1 Universal joint 2 Pinion gear 3 Ring gear

(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

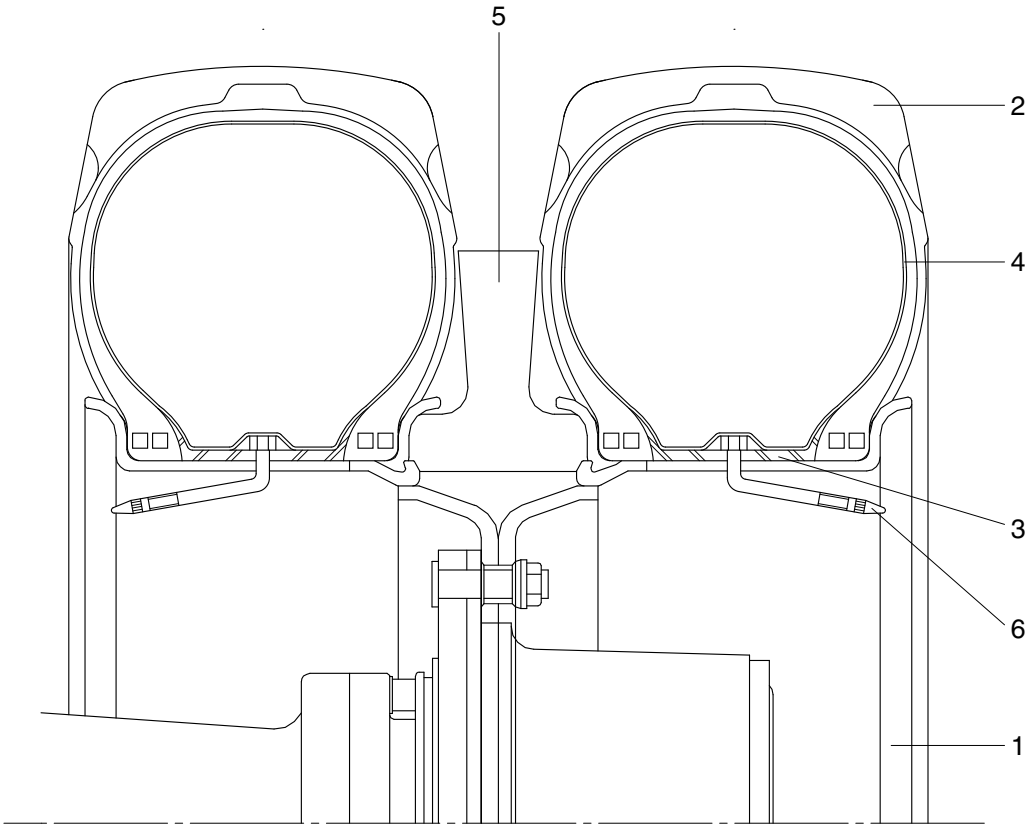


1 Axle half shaft 2 Pinion gear 3 Ring gear

(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.