# SECTION 6 WORK EQUIPMENT

## GROUP 1 STRUCTURE AND FUNCTION

### 1. HYDRAULIC SYSTEM OUTLINE

The loader hydraulic system is a pilot operated, open center system which is supplied with flow from the fixed displacement main hydraulic pump.
The pilot control system is a low pressure, closed center hydraulic system which is supplied with flow from the second(Steering) pump.

The loader system components are :

- Main pump
- Main control valve
- Bucket cylinders
- Boom cylinders
- Coupler cylinder
- Pilot supply unit
- Remote control valve(Pilot control valve)
- Safety valve

The pilot supply unit consists of the pressure reducing valve, relief valve and accumulator.

Flow from the main hydraulic pump not used by the steering system leaves the priority valve EF port. It flows to the inlet port plate of four blocks type main control valve.

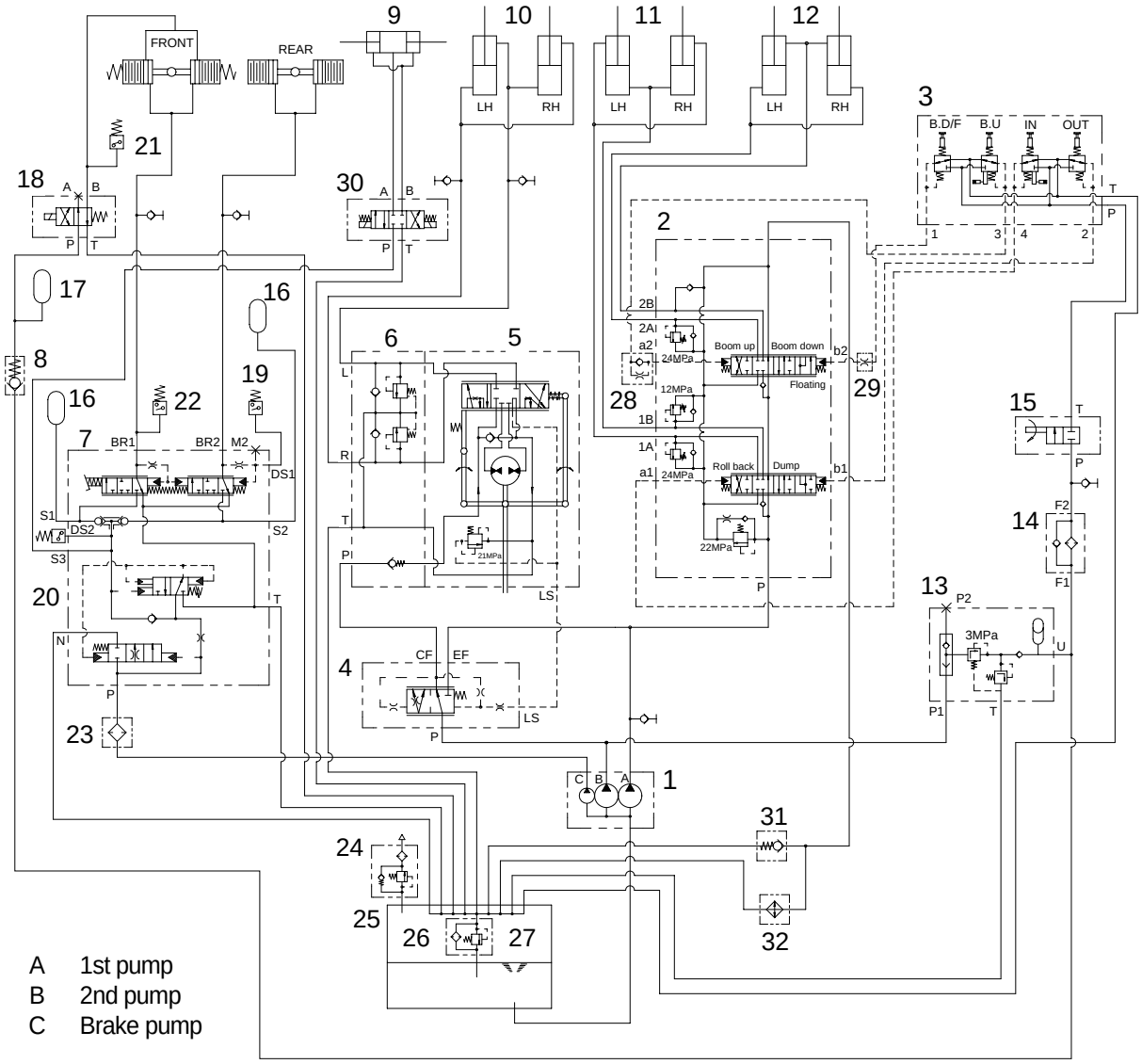
The main control valve is a tandem version spool type, open center valve which routes flow to the boom, bucket or auxiliary cylinders(Not shown) when the respective spools are shifted.

Flow from the steering pump(The first pump) is routed to the pilot supply unit where the steering pump outlet pressure is reduced to pilot circuit pressure. The pilot supply unit flow to the remote control valve.
The remote control valve routed flow to either end of each spool valve section in the main control valve to control spool stroke.

A accumulator mounted on pilot supply unit supplies a secondary pressure source to operated remote control valve so the boom can be lowered if the engine is off.

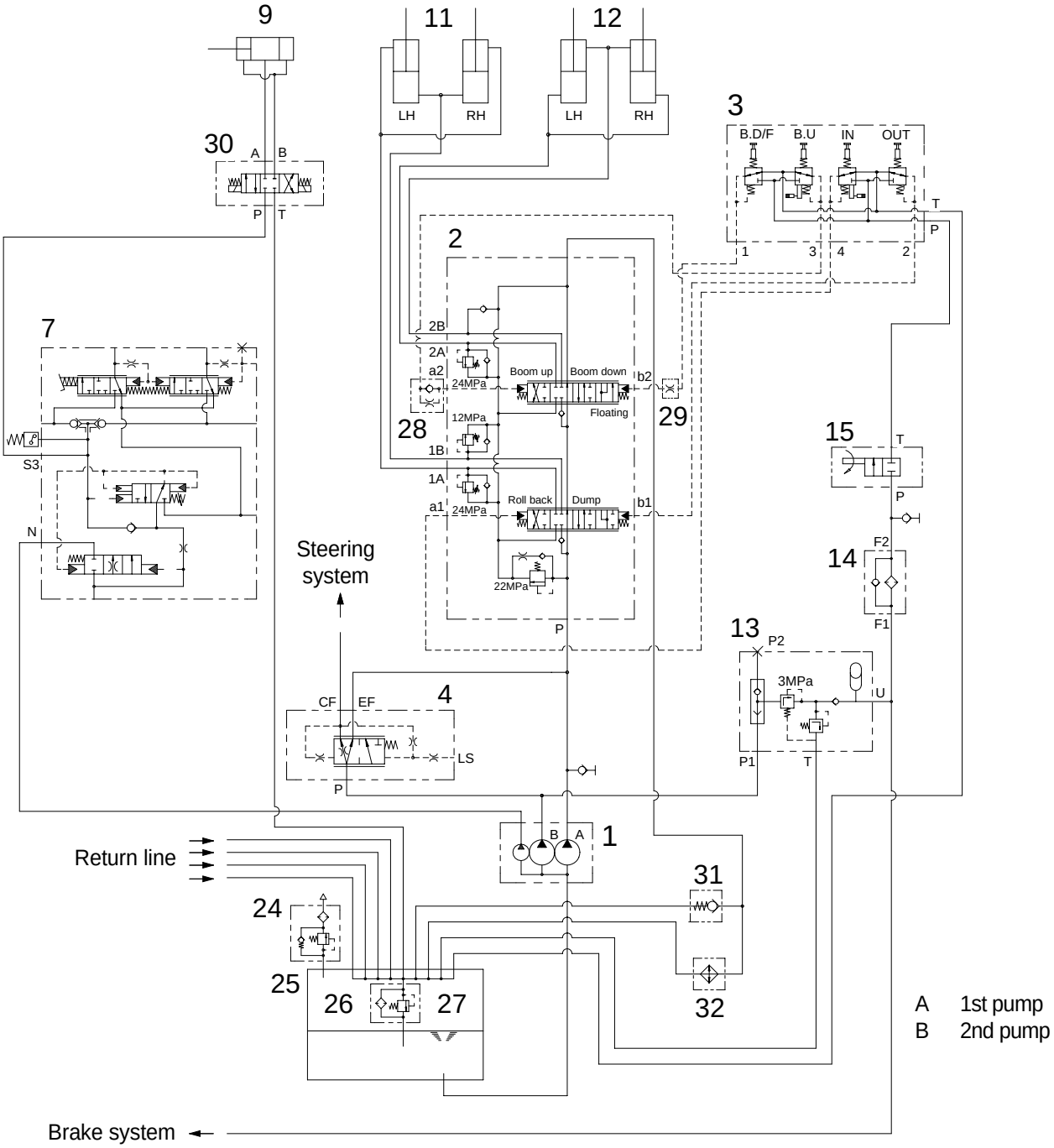
The return circuit for the main hydraulic system have return filter inside the hydraulic tank. The return filter uses a filter element and a bypass valve. The bypass valve is located in the upside of filter.

## 2. HYDRAULIC CIRCUIT



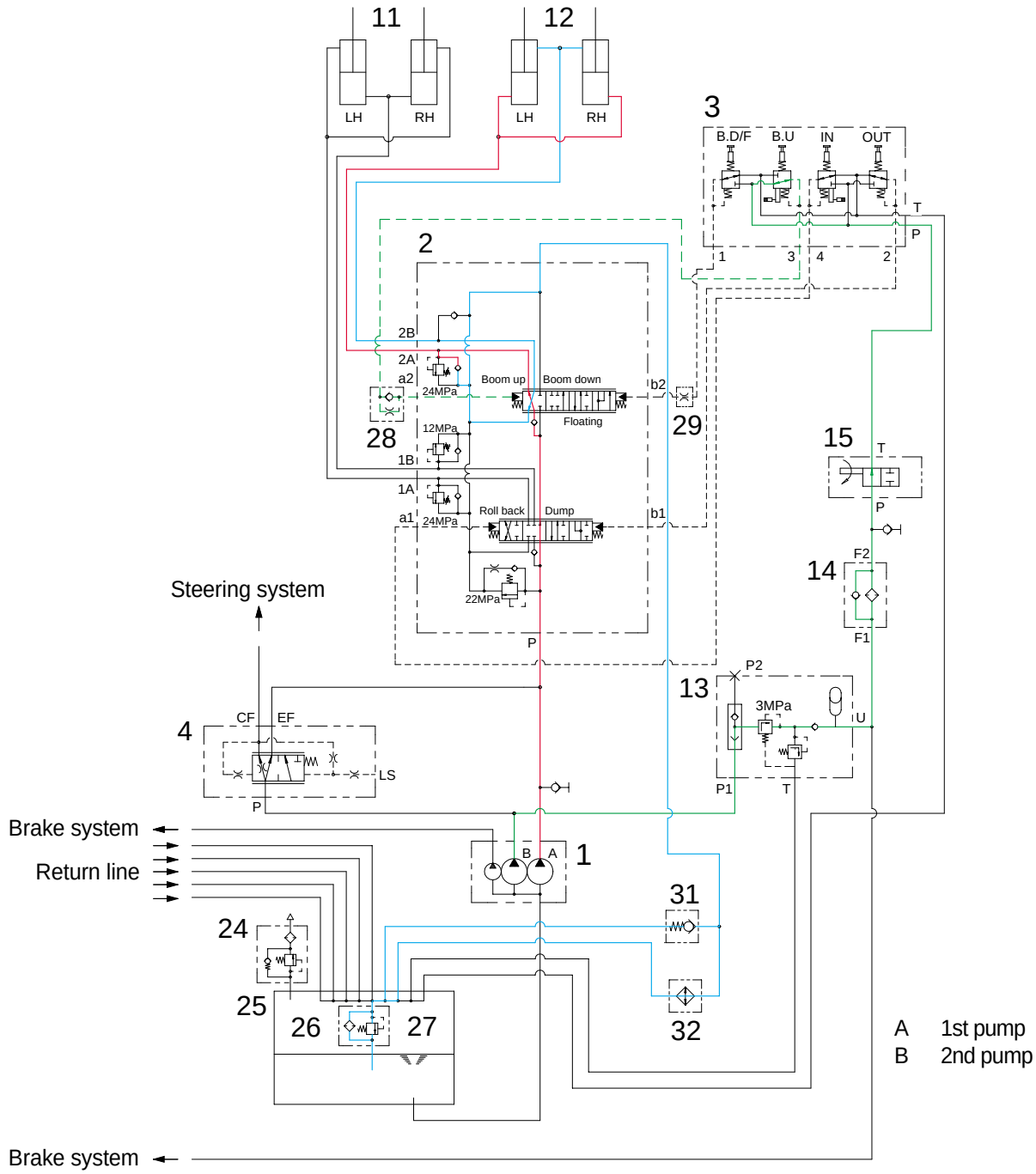

| | | | | | |
|---|---|---|---|---|---|
| 1 | Main pump | 12 | Boom cylinder | 23 | Line filter |
| 2 | Main control valve | 13 | Pilot supply unit | 24 | Air breather |
| 3 | Remote control valve | 14 | Line filter | 25 | Hydraulic tank |
| 4 | Priority valve | 15 | Safety valve | 26 | Return filter |
| 5 | Steering unit | 16 | Accumulator | 27 | By pass valve |
| 6 | Valve block | 17 | Accumulator | 28 | Shockless valve |
| 7 | Brake valve | 18 | Solenoid valve | 29 | Orifice connector |
| 8 | Check valve | 19 | Pressure switch | 30 | Solenoid valve |
| 9 | Coupler cylinder | 20 | Pressure switch | 31 | Oil cooler(Option) |
| 10 | Steering cylinder | 21 | Pressure switch | 32 | Check valve(Option) |
| 11 | Bucket cylinder | 22 | Pressure switch | | |

## 3. WORK EQUIPMENT HYDRAULIC CIRCUIT



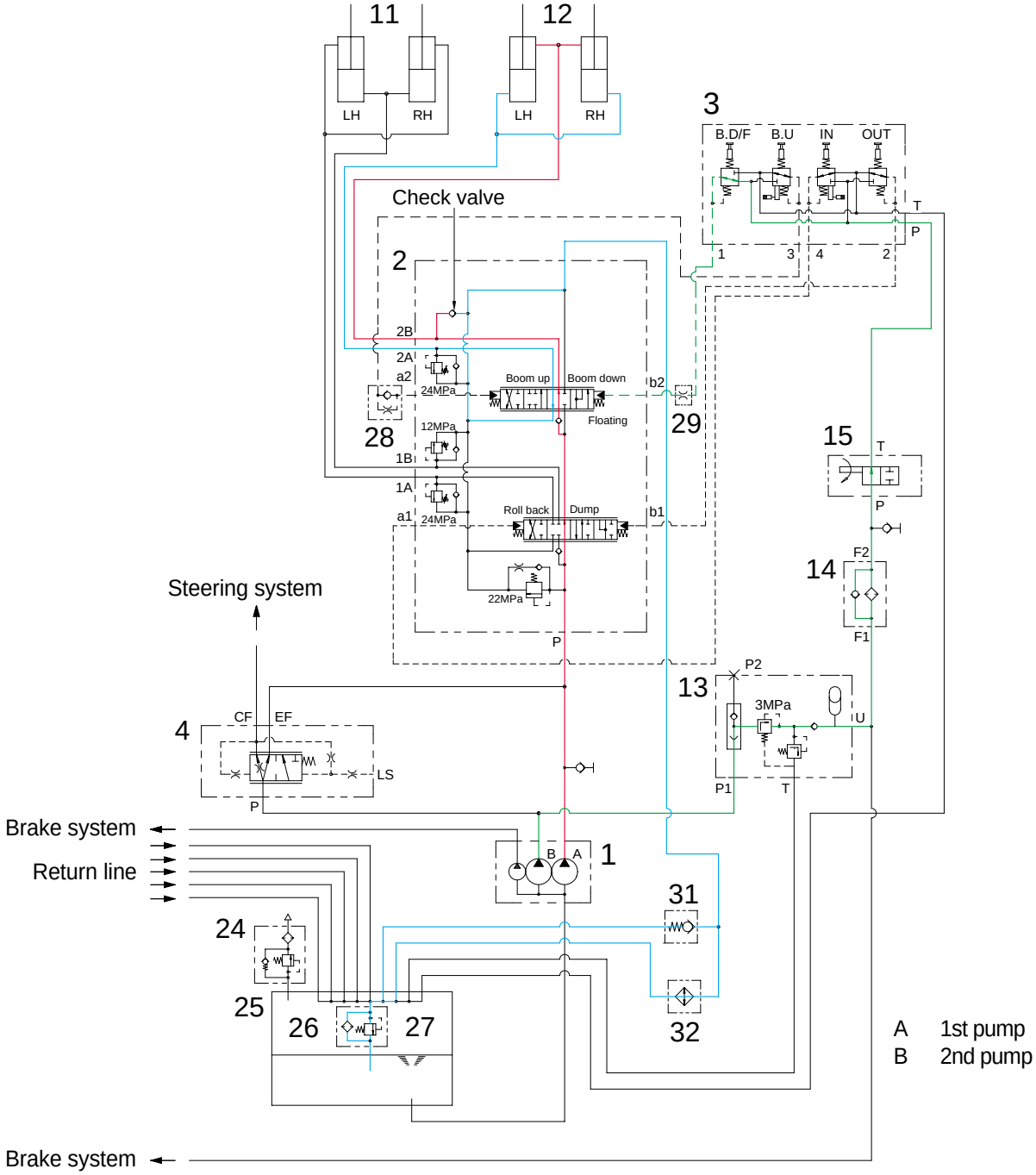

| | | | | | |
|---|---|---|---|---|---|
| 1 | Main pump | 12 | Boom cylinder | 27 | Bypass valve |
| 2 | Main control valve | 13 | Pilot supply unit | 28 | Shockless valve |
| 3 | Remote control valve | 14 | Line filter | 29 | Orifice connector |
| 4 | Priority valve | 15 | Safety valve | 30 | Solenoid valve |
| 7 | Brake valve | 24 | Air breather | 31 | Oil cooler(Option) |
| 9 | Coupler cylinder | 25 | Hydraulic tank | 32 | Check valve(Oprion) |
| 11 | Bucket cylinder | 26 | Return filter | | |

### 1) WHEN THE RCV LEVER IS IN THE RAISE POSITION



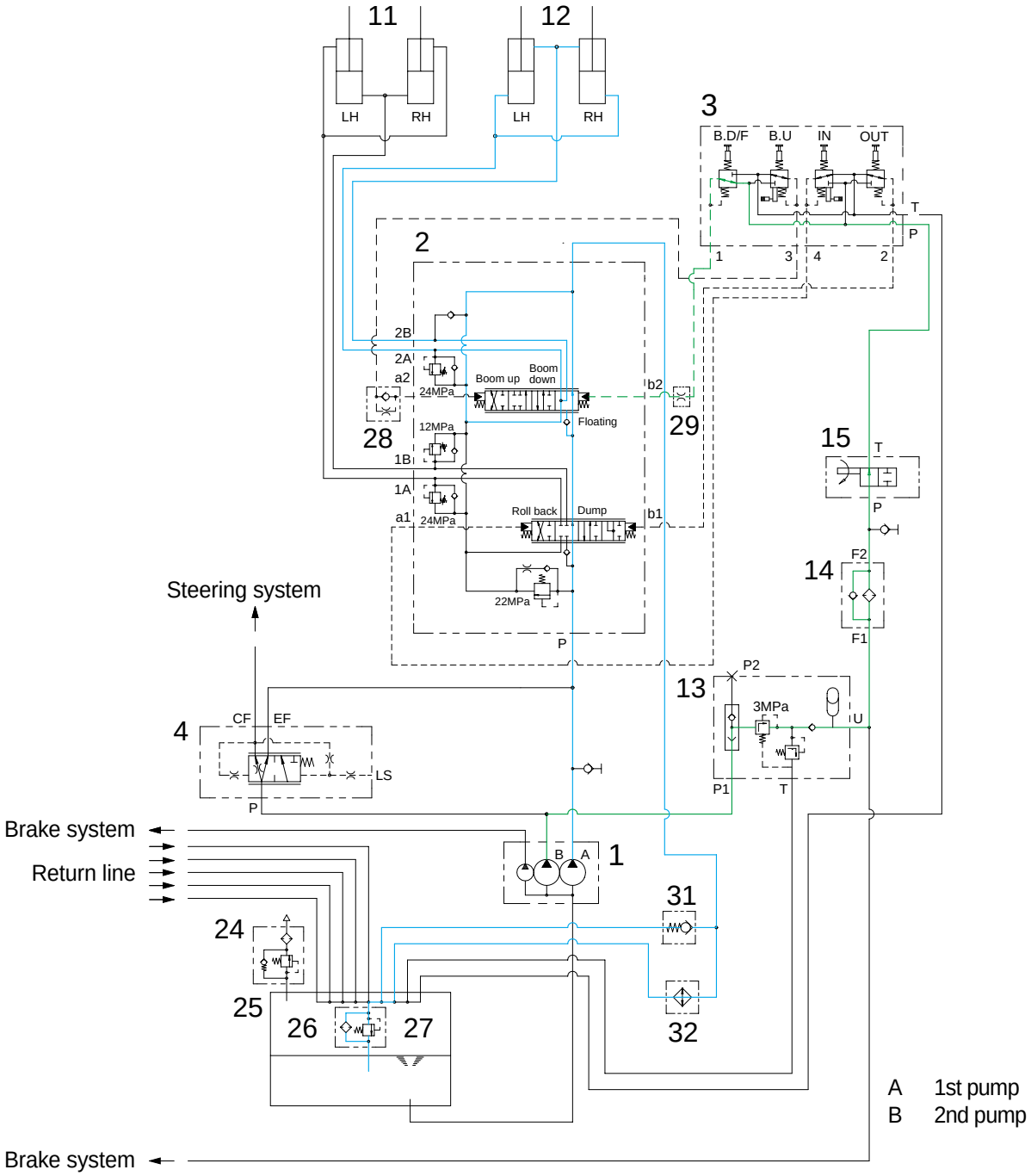

- When the RCV lever(3) is pulled back, the boom spool on the second block is moved to raise position by pilot oil pressure from port 3 of RCV through shockless valve(28).
- The oil from main pump(1) flows into main control valve(2) and then goes to the large chamber of boom cylinder (12) by pushing the load check valve of the boom spool through center bypass circuit of the bucket spool.
- The oil from the small chamber of boom cylinder(12) returns to hydraulic oil tank(25) through the boom spool at the same time.
- When this happens, the boom goes up.

## 2) WHEN THE RCV LEVER IS IN THE LOWER POSITION



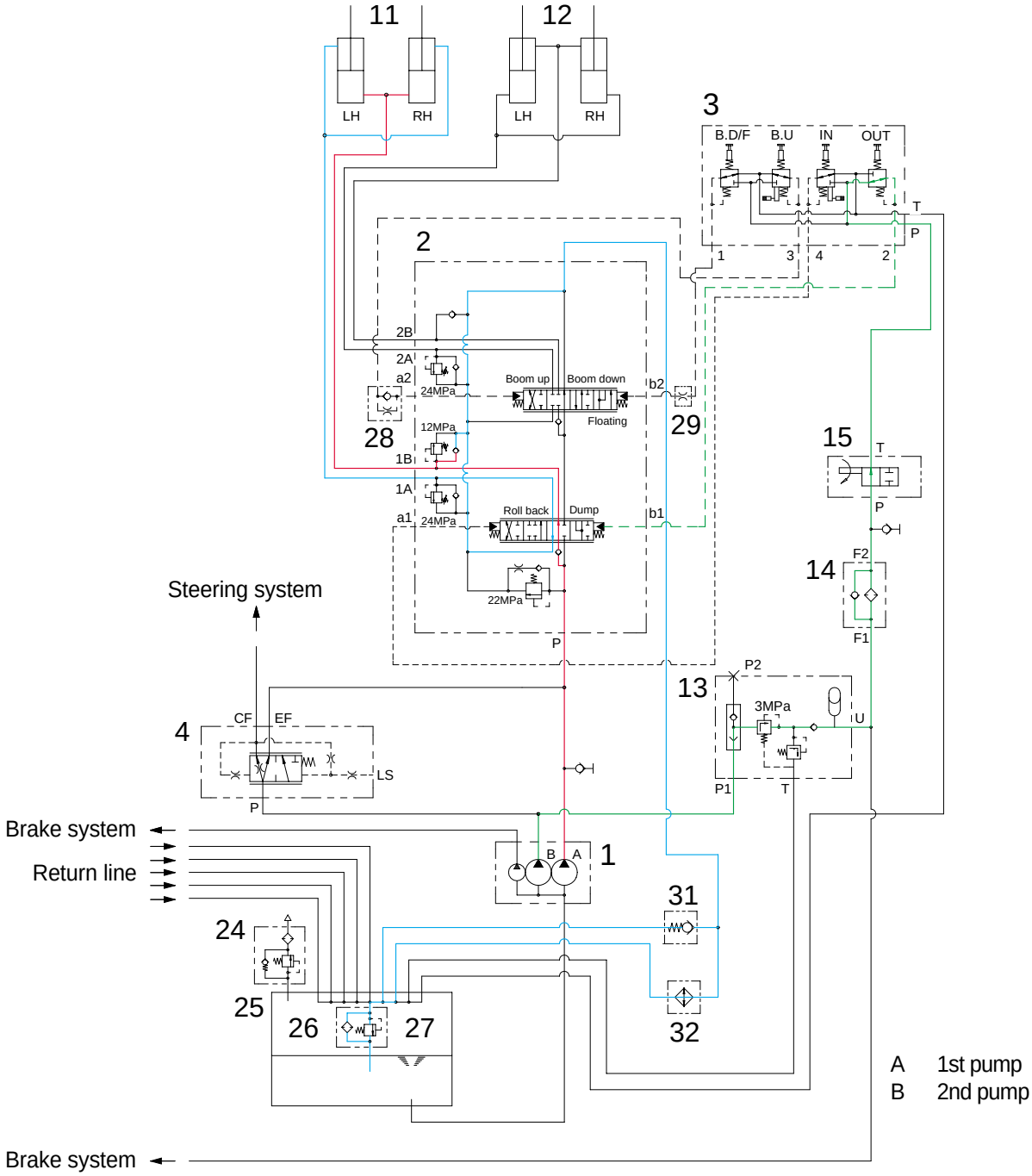

- When the RCV lever(3) is pushed forward, the boom spool on the second block is moved to lower position by pilot pressure from port 1 of RCV through orifice connector(29).
- The oil from main pump(1) flows into main control valve and then goes to small chamber of boom cylinder(12) by pushing the load check valve of the boom spool through center bypass circuit of the bucket spool.
- The oil returned from large chamber of boom cylinder(12) returns to hydraulic tank(25) through the boom spool at the same time.
- When the lowering speed of boom is faster, the return oil from the large chamber of boom cylinder combines with the oil from the pump through the check valve, and flows into the small chamber of the cylinder.
  This prevents cylinder cavitation by the negative pressure when the pump flow cannot match the boom down speed.

### 3) WHEN THE RCV LEVER IS IN THE FLOAT POSITION



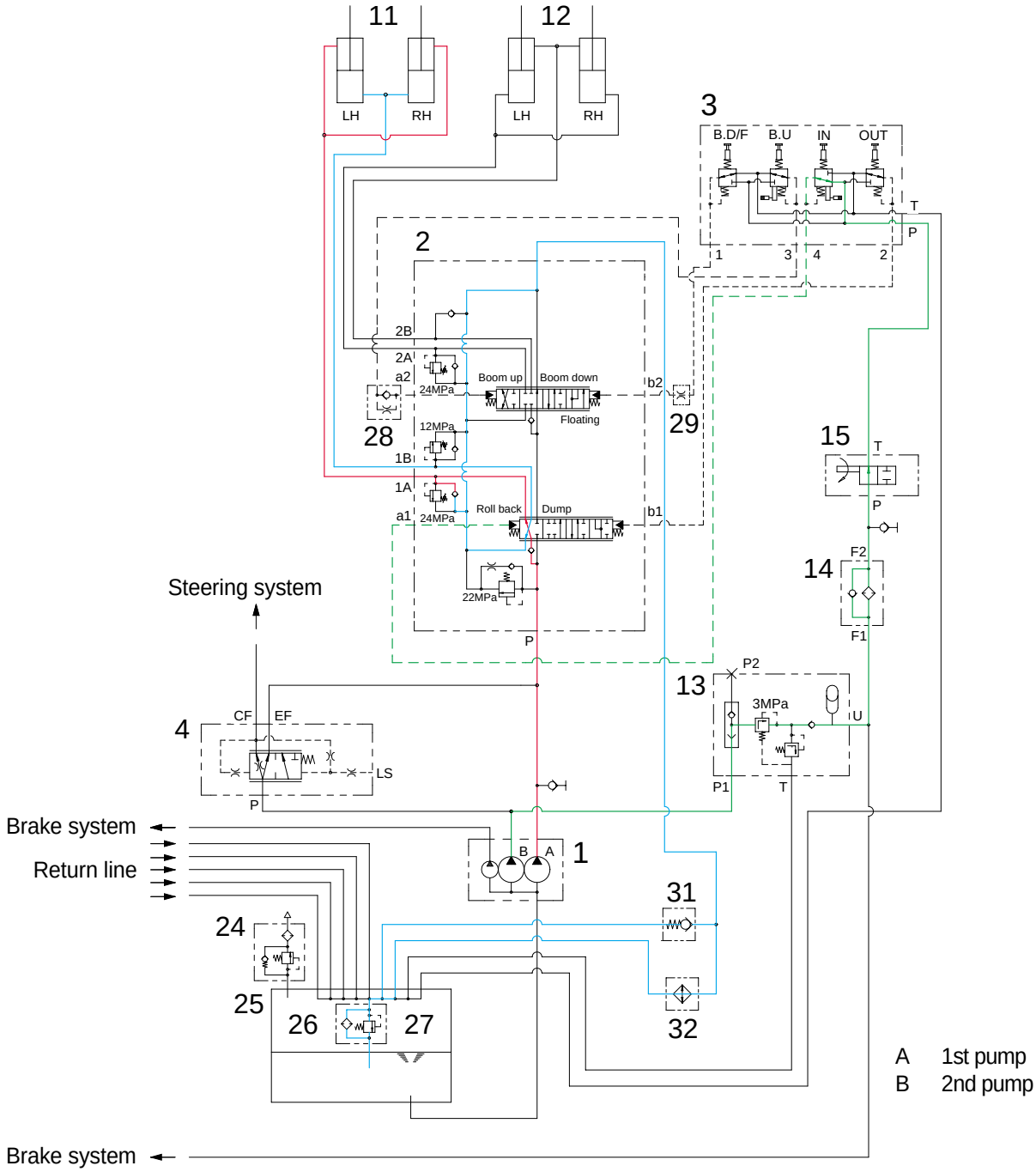

- When the RCV lever(3) is pushed further forward from the lower position, the pilot pressure reaches to 13-15 bar, then the boom spool on the second block is moved to floating position.
- The work ports(2A), (2B) and the small chamber and the large chamber are connected to the return passage, so the boom will be lowered due to it's own weight.
- In this condition, when the bucket is in contact with the ground, it can be move up and down in accordance with the shape of the ground.

### 4) WHEN THE RCV LEVER IS IN THE DUMP POSITION



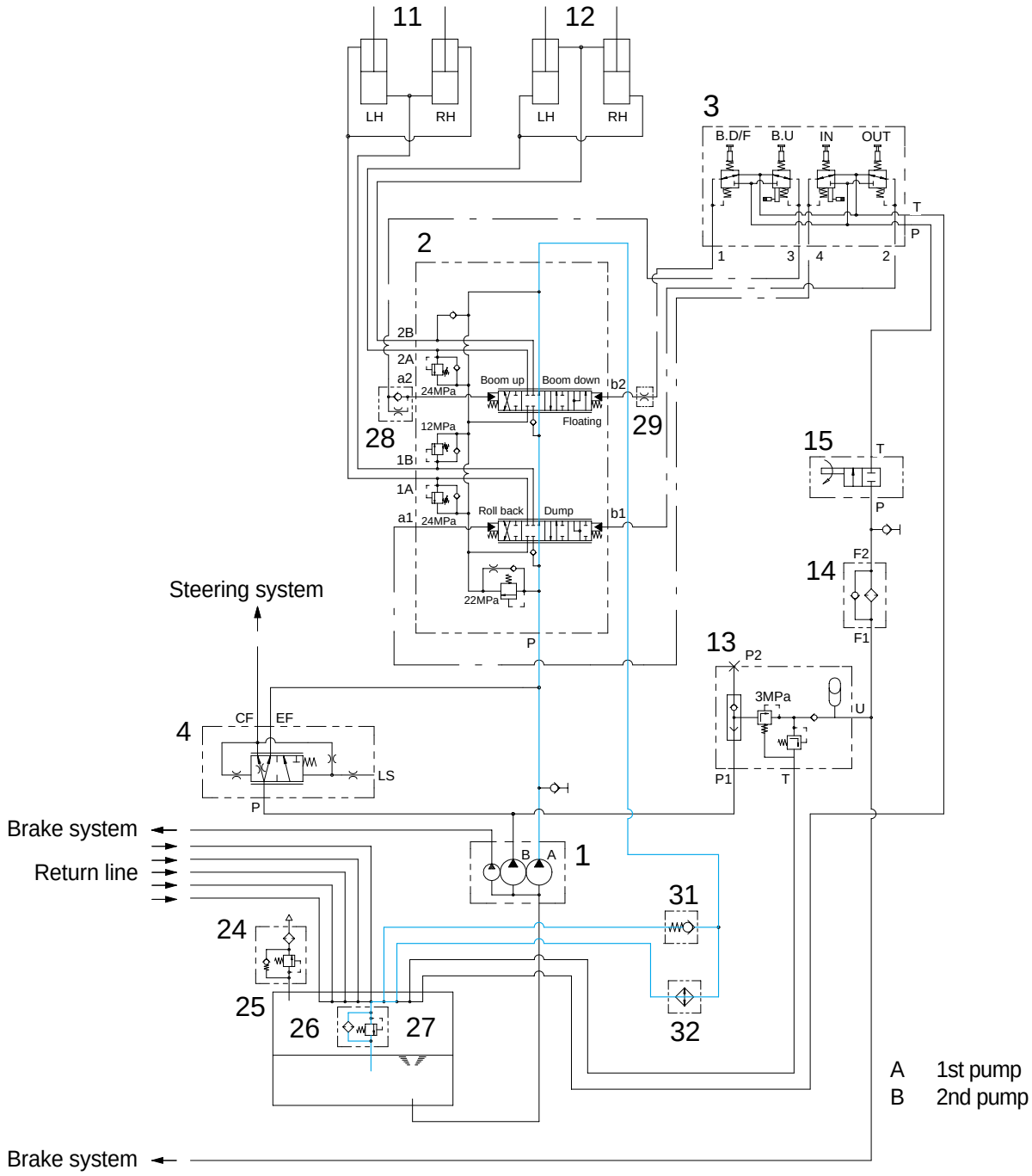

- If the RCV lever(3) is pushed right, the bucket spool on the first block is moved to dump position by pilot oil pressure from port 2 of RCV.
- The oil from main pump(1) flows into main control valve(2) and then goes to the small chamber of bucket cylinder(11) by pushing the load check valve of the bucket spool.
- The oil at the large chamber of bucket cylinder(11) returns to hydraulic tank(25) through the bucket spool.
- When this happens, the bucket is dumped.
- When the dumping speed of bucket is faster, the oil returned from the large chamber of bucket cylinder combines with the oil from the pump, and flows into the small chamber of the cylinder.
  This prevents cylinder cavitation by the negative pressure when the pump flow cannot match the bucket dump speed.

### 5) WHEN THE RCV LEVER IS IN THE ROLL BACK(Retract) POSITION




- If the RCV lever(3) is pulled left, the bucket spool on the first block is moved to roll back position by pilot oil pressure from port 4 of RCV.
- The oil from main pump(1) flows into main control valve(2) and then goes to the large chamber of bucket cylinder by pushing the load check valve of the bucket spool.
- The oil at the chamber of bucket cylinder(11) returns to hydraulic tank(25) through the bucket spool.
- When this happens, the bucket roll back.
- When the rolling speed of bucket is faster, the return oil from the small chamber of bucket cylinder combines with the oil from the pump, and flows into the large chamber of the cylinder.
  This prevents cylinder cavitation by the negative pressure when the pump flow cannot match the bucket rolling speed.

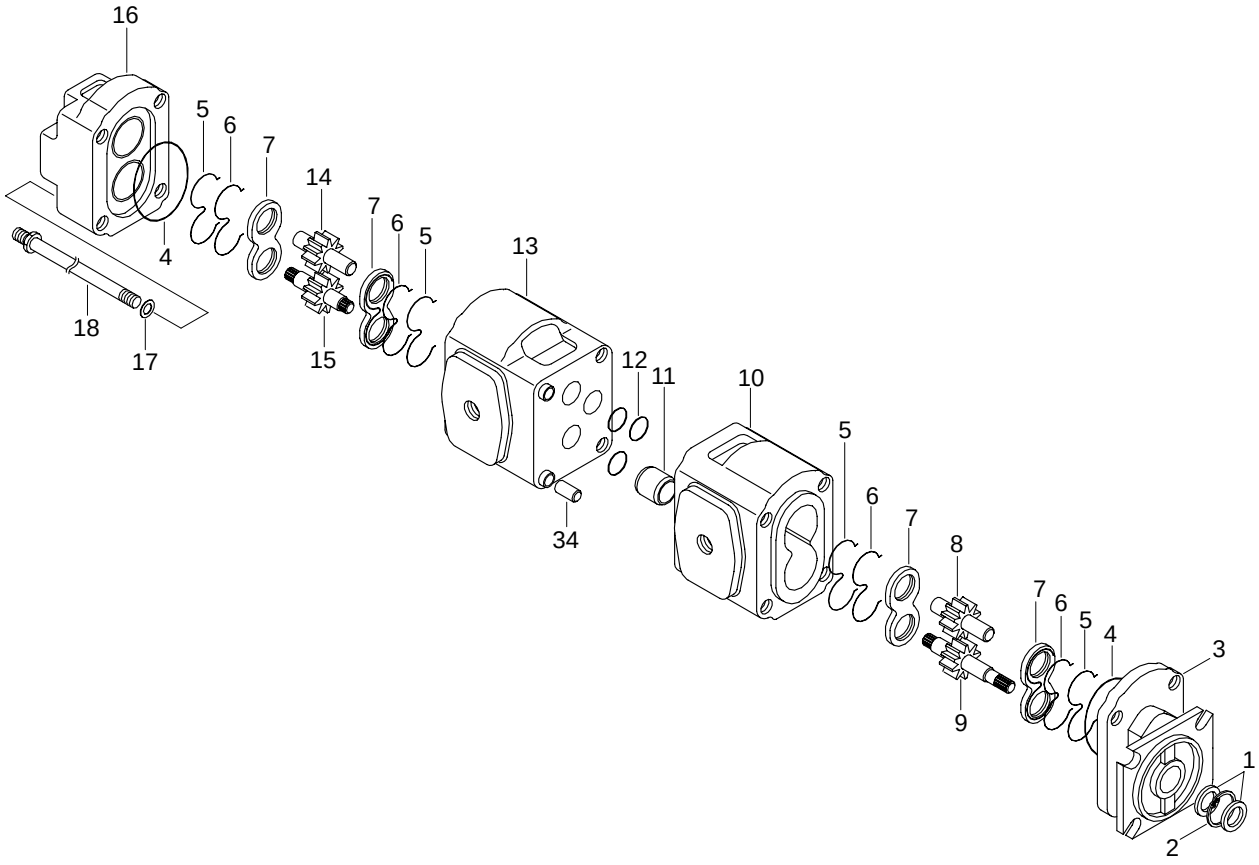
### 6) WHEN THE RCV LEVER IS IN THE HOLD POSITION




- The oil from main pump(1) flows into main control valve(2).
- In this time, the bucket spool and the boom spool are in neutral position, then the oil supplied to main control valve(2) returns into hydraulic tank(25) through center bypass circuit of each spool.
- In this condition, each cylinder keeps the neutral position, so the boom and the bucket is holded.

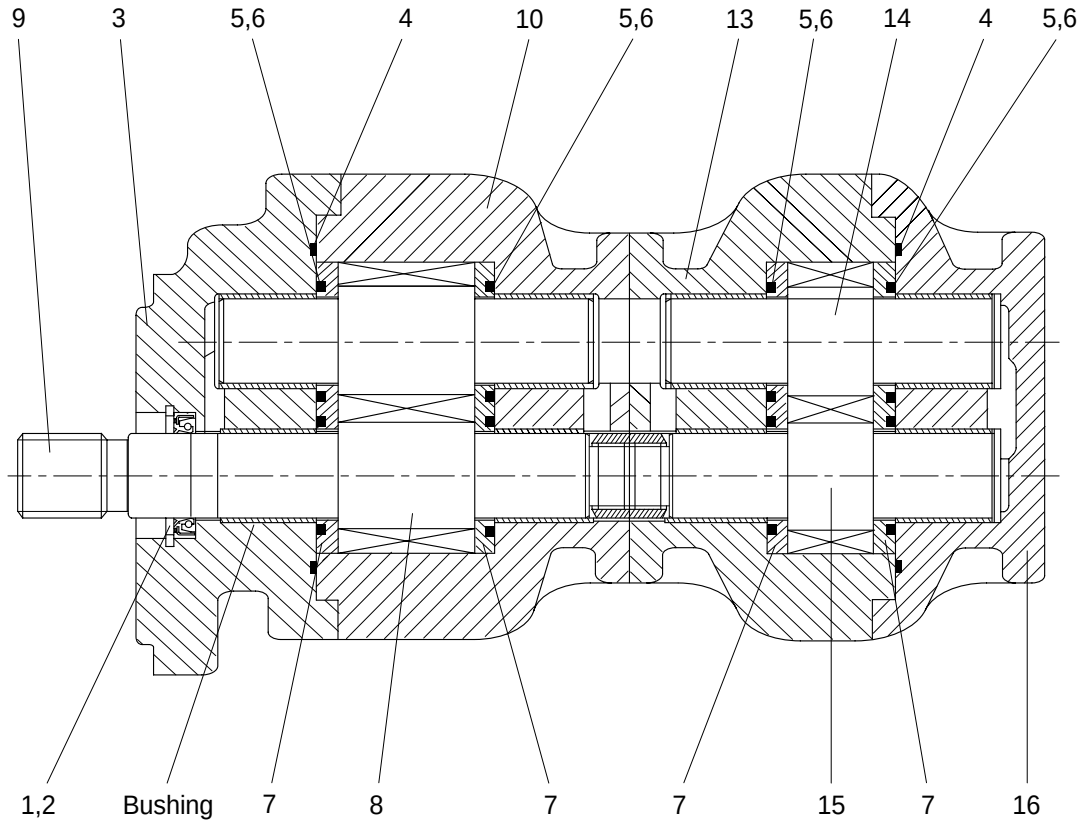
## 3. MAIN PUMP OPERATION

### 1) STRUCTURE




| | | | | | |
|---|---|---|---|---|---|
| 1 | Shaft seal | 8 | Driven gear | 14 | Driven gear |
| 2 | Circlip | 9 | Drive gear | 15 | Drive shaft |
| 3 | Flange | 10 | Front body | 16 | Cover |
| 4 | O-ring | 11 | Splined coupling | 17 | Washer |
| 5 | Seal | 12 | O-ring | 18 | Stud assy |
| 6 | Seal | 13 | Center body | 34 | Dowel |
| 7 | Balance plate | | | | |

## 2) OPERATION



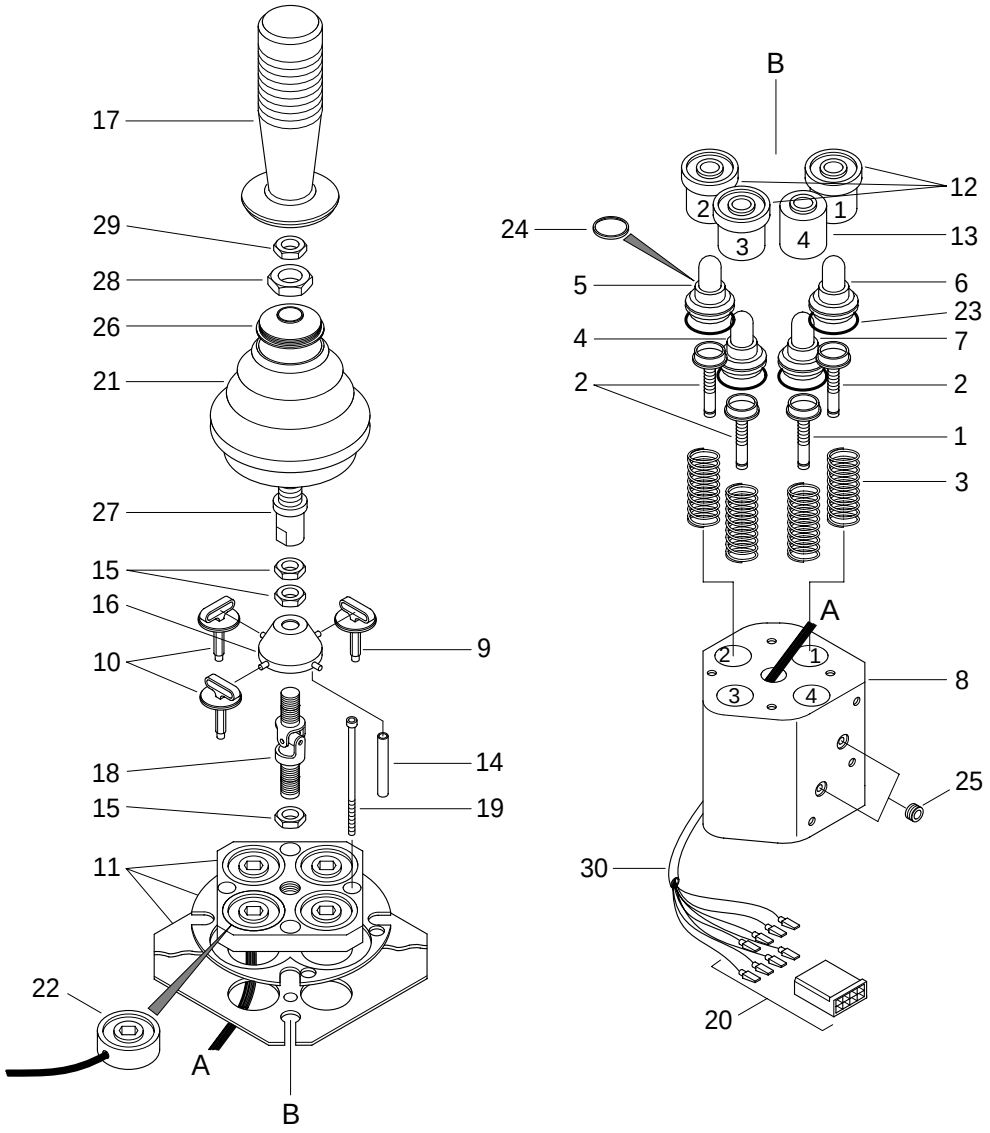

The main hydraulic pump is a fixed displacement gear type pump. The pump is drive at engine speed by the transmission. The pump shafts are supported by bushings in the flange assembly(3), front body(10), center body(13) and cover(16).

As the drive gear(9) and shaft(15) turns the idler gears(8, 14), the gear teeth come out of mesh. Oil flows from the hydraulic tank through the inlet into the cavity between the gear teeth. As the gears continue to rotate, the oil becomes trapped between the gear teeth and the balance plates(7).
The trapped oil is then carried to the pump outlet. Oil is forced out the outlet to supply the hydraulic function. As the gears re-mesh, they form a seal to prevent oil from flowing between the gears and back to the inlet.

The pump uses outlet pressure oil to load the balance plates(7) against the gear faces. This controls internal leakage to maintain pump displacement.
Outlet pressure fills the area bounded by the seals(5, 6) to force the pressure plate against the high pressure area or the gear faces. Pump shaft lubrication is achieved by routing outlet pressure oil into the area between the gear shafts and the bushings. The oil is collected at the end of the shafts in the hollow areas in the port and flange plates and routed back to return.

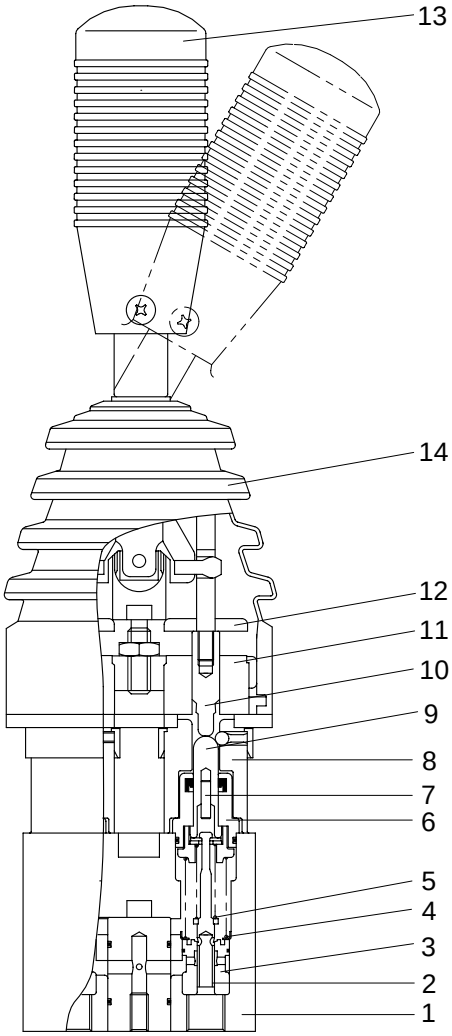
## 4. REMOTE CONTROL VALVE

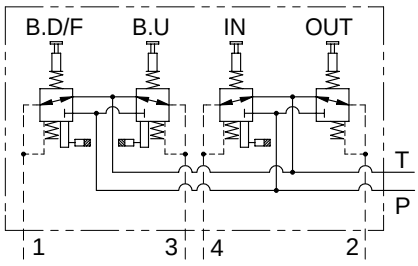
### 1) STRUCTURE




| | | | | | |
|---|---|---|---|---|---|
| 1 | Spring | 11 | Detent | 21 | Rubber boot |
| 2 | Spring | 12 | Prefeel cage assy | 22 | Coil |
| 3 | Spring | 13 | Spindle retainer | 23 | O-ring |
| 4 | Plunger assy | 14 | Spindle | 24 | Wiper seal |
| 5 | Plunger assy | 15 | Nut | 25 | Plug |
| 6 | Plunger assy | 16 | Lever assy | 26 | Boot retainer collar |
| 7 | Plunger assy | 17 | Handle assy | 27 | Handle adapter |
| 8 | Body | 18 | Universal joint | 28 | Nut |
| 9 | Prefeel | 19 | Socket screw | 29 | Nut |
| 10 | Prefeel | 20 | Connector assy | 30 | Tube |

**2) OPERATION**



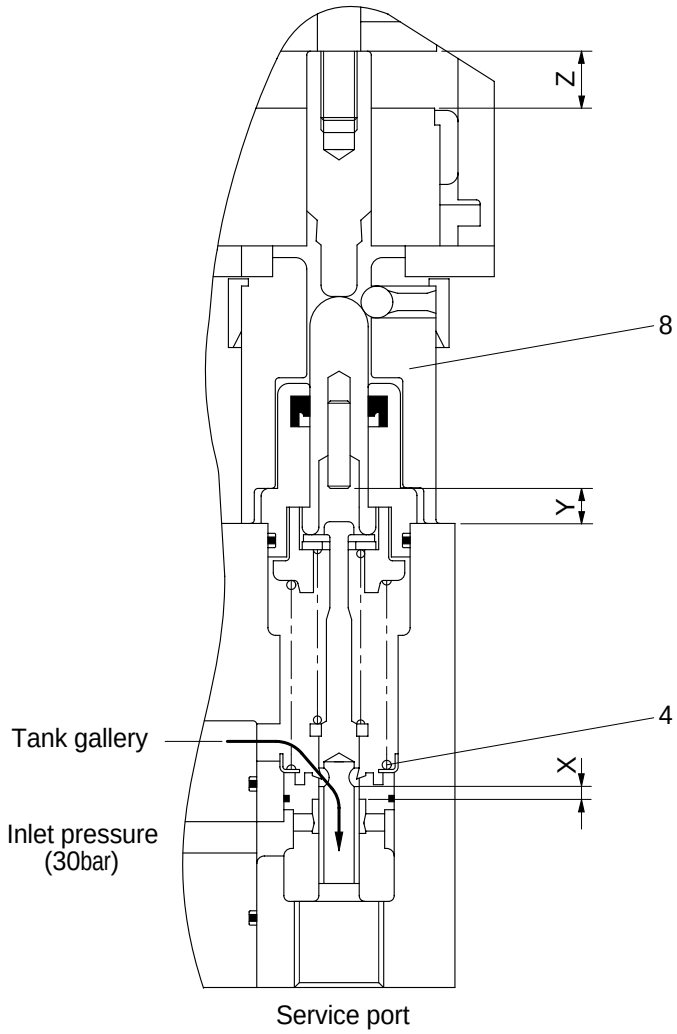




HYDRAULIC CIRCUIT

| Port | Port name | Port size |
|---|---|---|
| 1 | Boom down | 1/4 BSPP |
| 2 | Bucket dump | 1/4 BSPP |
| 3 | Boom raise | 1/4 BSPP |
| 4 | Bucket crowd | 1/4 BSPP |
| P | Supply pressure | 1/4 BSPP |
| T | Tank | 1/4 BSPP |

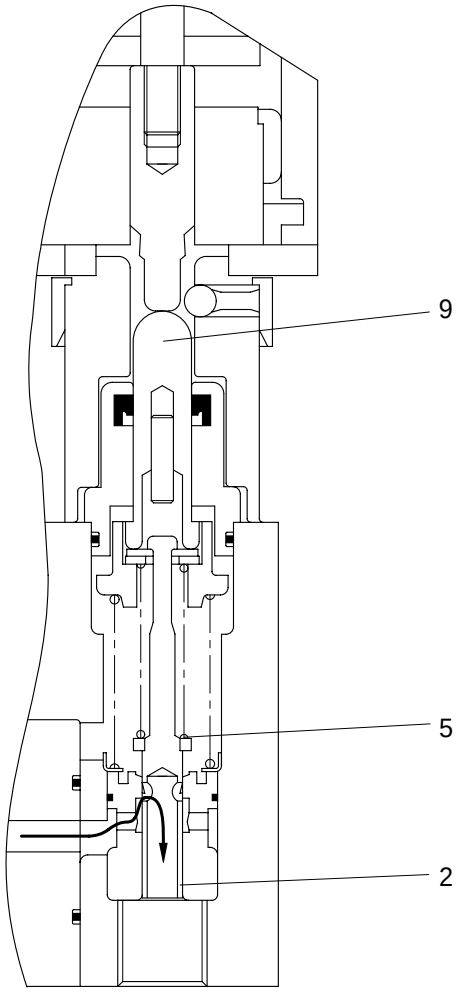
| | | | | | |
|---|---|---|---|---|---|
| 1 | Aluminum body | 6 | Plunger guide | 11 | Hold coil |
| 2 | Pressure reducing spool | 7 | Roll pin | 12 | Armature plate |
| 3 | Pressure reducing body | 8 | Prefeel ball carrier | 13 | Control lever |
| 4 | Return spring | 9 | Plunger | 14 | Rubber boot |
| 5 | Metering spring | 10 | Prefeel spindle | | |

**(1) Neutral position**




The rubber boot(14) fitted between the control lever(13) and the valve protects the working parts from external contamination. The return spring(4) holds the plunger(8) in its most upwardly position keeping the lever vertical. In this position all four service ports are connected to the tank gallery and hence to the tank port.

**(2) Metering position**

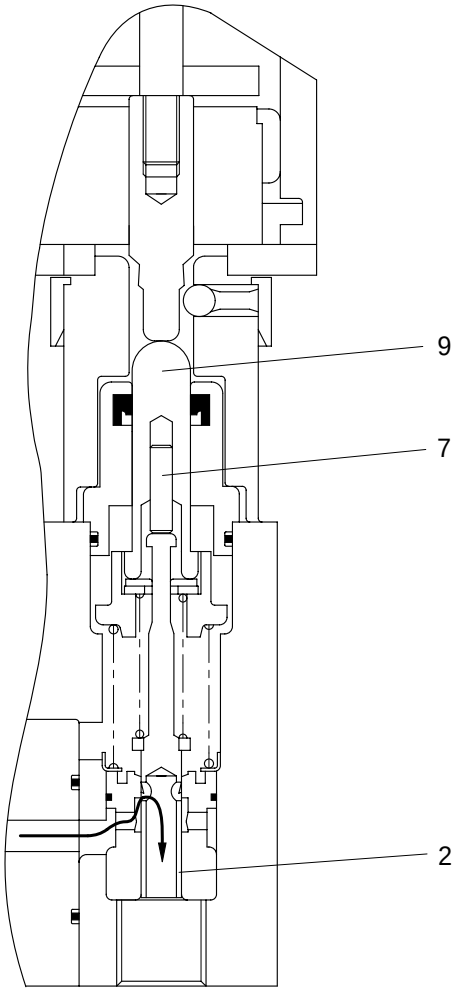



By selecting the control lever(13) the plunger(9) is progressively selected until the spool(2) deadband X is taken up. During this interval the service port is still connected to the tank gallery. Any further selection of the control lever(13) will ;

① Cause the four metering holes in the spool(2) to open slightly, allowing pressure to be raised at the service port. This increase in pressure then counteracts the load produced by the metering spring(5) closing off the opening until an equilibrium is maintained. The pressure raised at the service port is proportional to the rate of the metering spring. The initial jump in pressure is caused by the preload in the metering spring(5) and can be altered as required simply by adjusting the shimming.

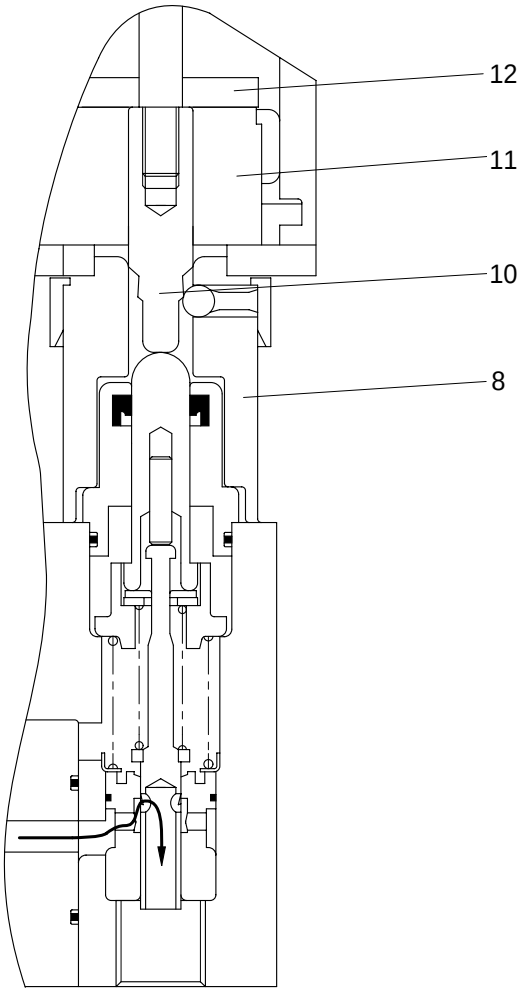
② Cause the service port to shut off to the rank gallery.

**(3) End of metering**




After the plunger(9) has been displaced a distance of X+Y, the plunger roll pin(7) is just contacting the top of the spool(2). Any further selection of the control lever(13) will cause the four metering holes in the spool(2) to open independently of the pressure.
Thus any selection of the control lever(13) past X+Y will cause the service pressure to increase immediately to inlet pressure.

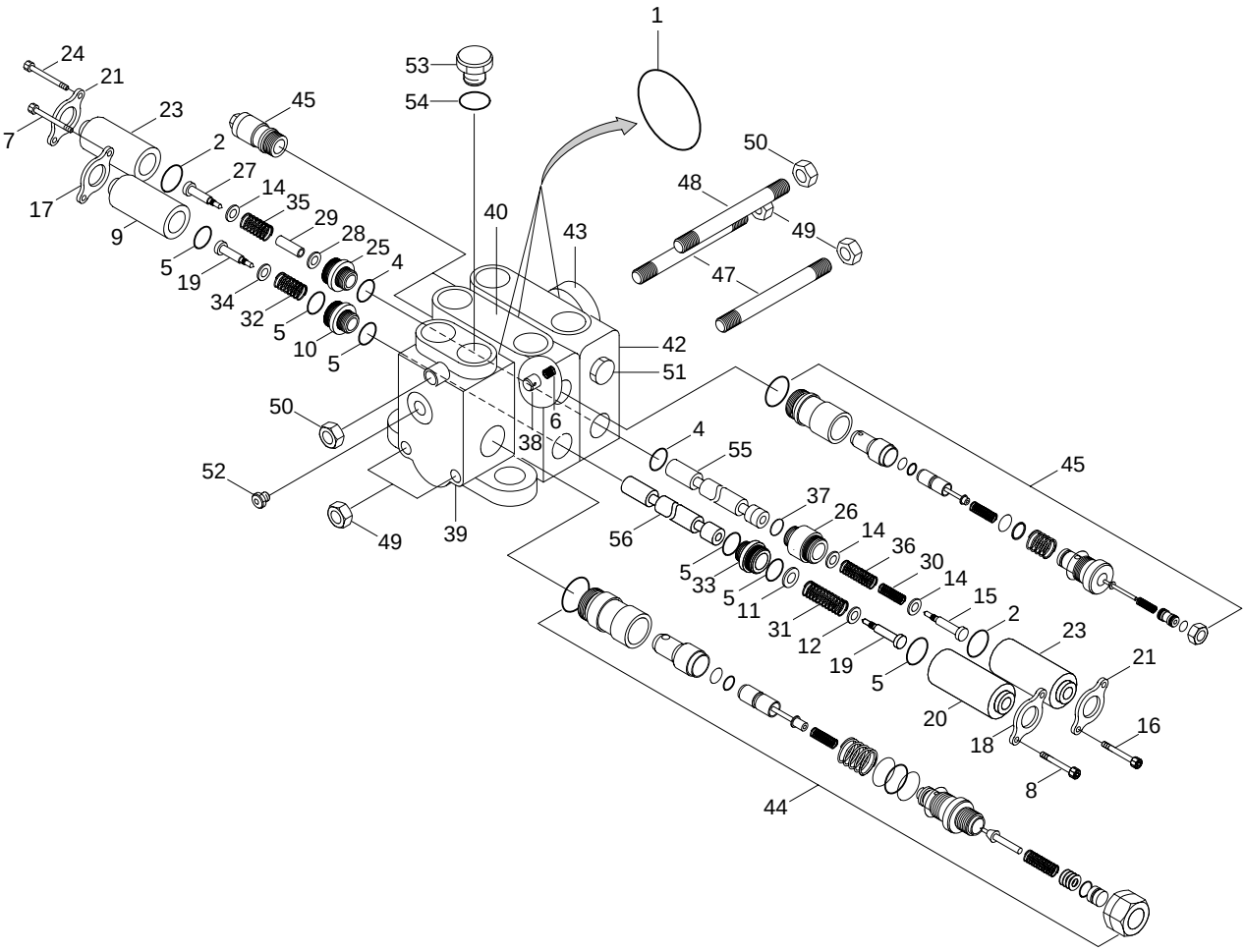
**(4) Fully selected**




Selecting the control lever(13) now will maintain the service port pressure at inlet until the armature plate(12) contacts on the hold coil(11). However, just prior to this, the ramp on the prefeel spindle(10) reacts against the three springs in the prefeel ball carrier(8).
This produces a sharp increase in operator load(Prefeel), ensuring that the service is not accidentally selected through to detent.

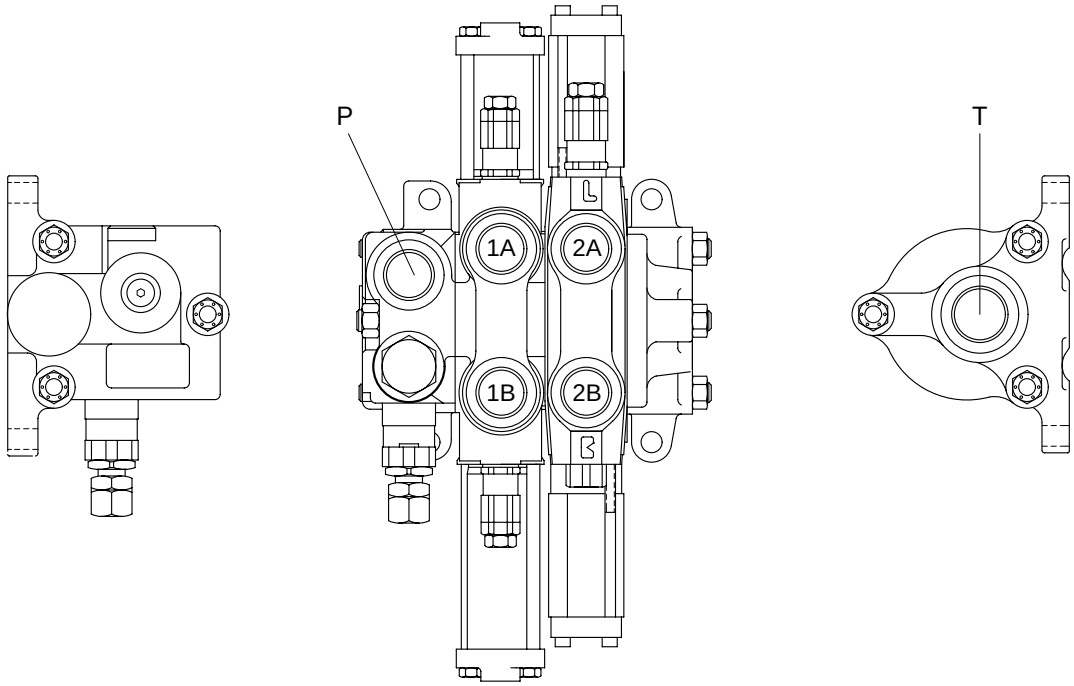
## 5. MAIN CONTROL VALVE

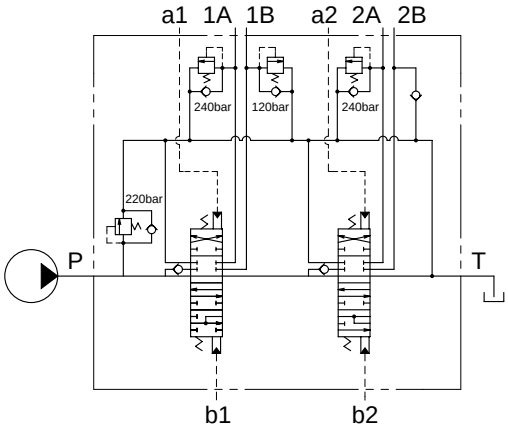
### 1) STRUCTURE




| | | | | | |
|---|---|---|---|---|---|
| 1 | O-ring | 20 | Tube | 38 | Poppet |
| 2 | O-ring | 21 | Retainer | 39 | Inlet section assy |
| 4 | O-ring | 23 | Spool cap | 40 | Bucket spool section assy |
| 5 | O-ring | 24 | Cap screw | 42 | Boom spool section assy |
| 6 | Spring | 25 | Cap retainer | 43 | Outlet section assy |
| 7 | Cap screw | 26 | Cap retainer | 44 | Main relief valve |
| 8 | Cap screw | 27 | Shoulder screw | 45 | Port relief valve |
| 9 | Tube | 28 | Flat washer | 47 | Tie rod |
| 10 | Retainer | 29 | Spacer | 48 | Tie rod |
| 11 | Spacer | 30 | Spring | 49 | Special nut |
| 12 | Washer | 31 | Spring | 50 | Special nut |
| 14 | Flat washer | 32 | Spring | 51 | Anti void assy |
| 15 | Shoulder screw | 33 | Spacer cap | 52 | Plug |
| 16 | Cap screw | 34 | Flat washer | 53 | Plug |
| 17 | End cap | 35 | Spring | 54 | O-ring |
| 18 | End cap | 36 | Spring | 55 | Spool |
| 19 | Shoulder screw | 37 | Back up ring | 56 | Spool |

**STRUCTURE**



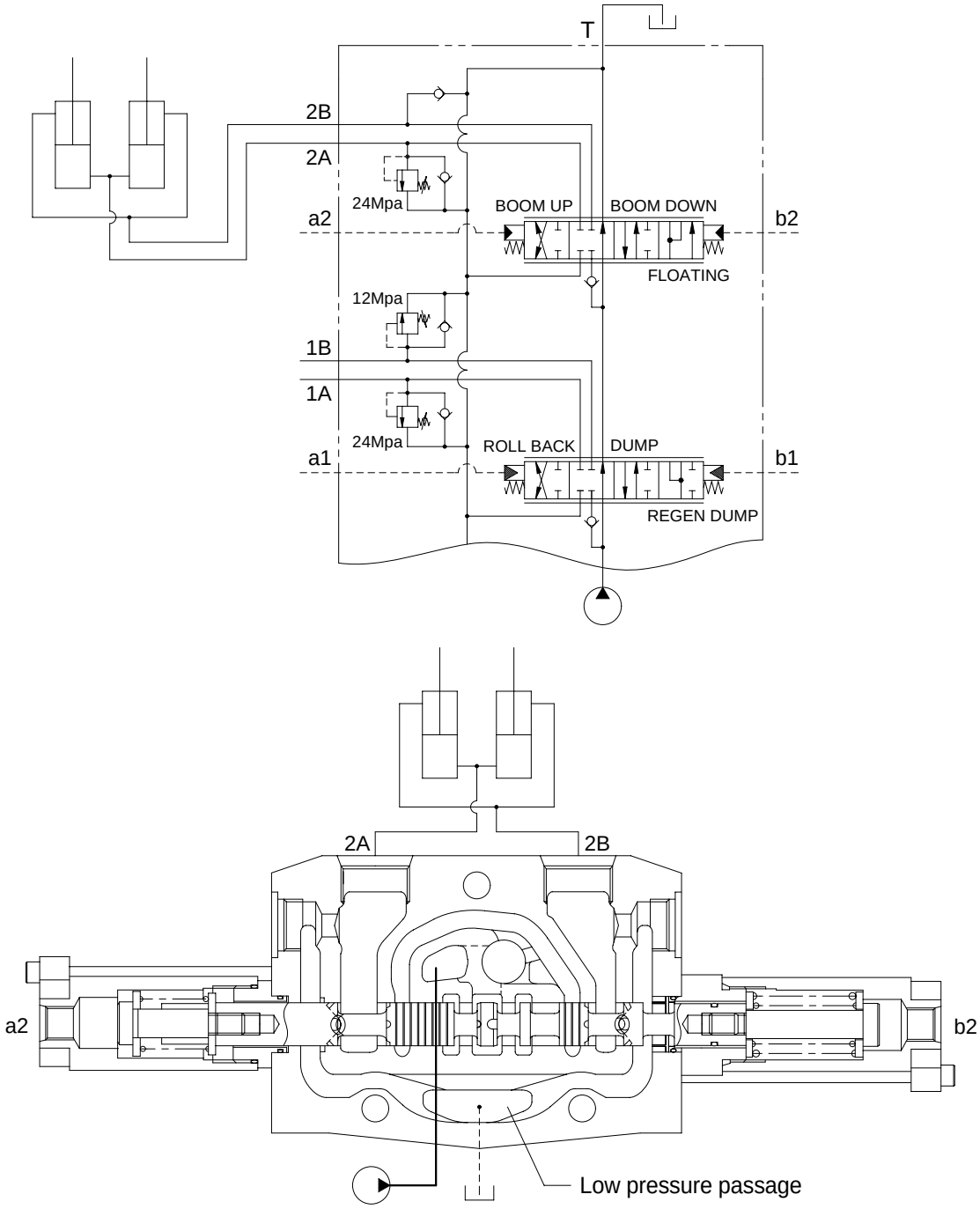




HYDRAULIC CIRCUIT

| Port | Port name | Port size |
|---|---|---|
| P | From main pump | 1 3/16-12UN |
| T | To hydraulic tank | 1 5/16-12UN |
| 1A, 1B | To bucket cylinder port | 1 5/16-12UN |
| 2A, 2B | To boom cylinder port | 1 3/16-12UN |
| $a_1$, $b_1$ | Bucket pilot port | 9/16-18UNF |
| $a_2$, $b_2$ | Boom pilot port | 9/16-18UNF |

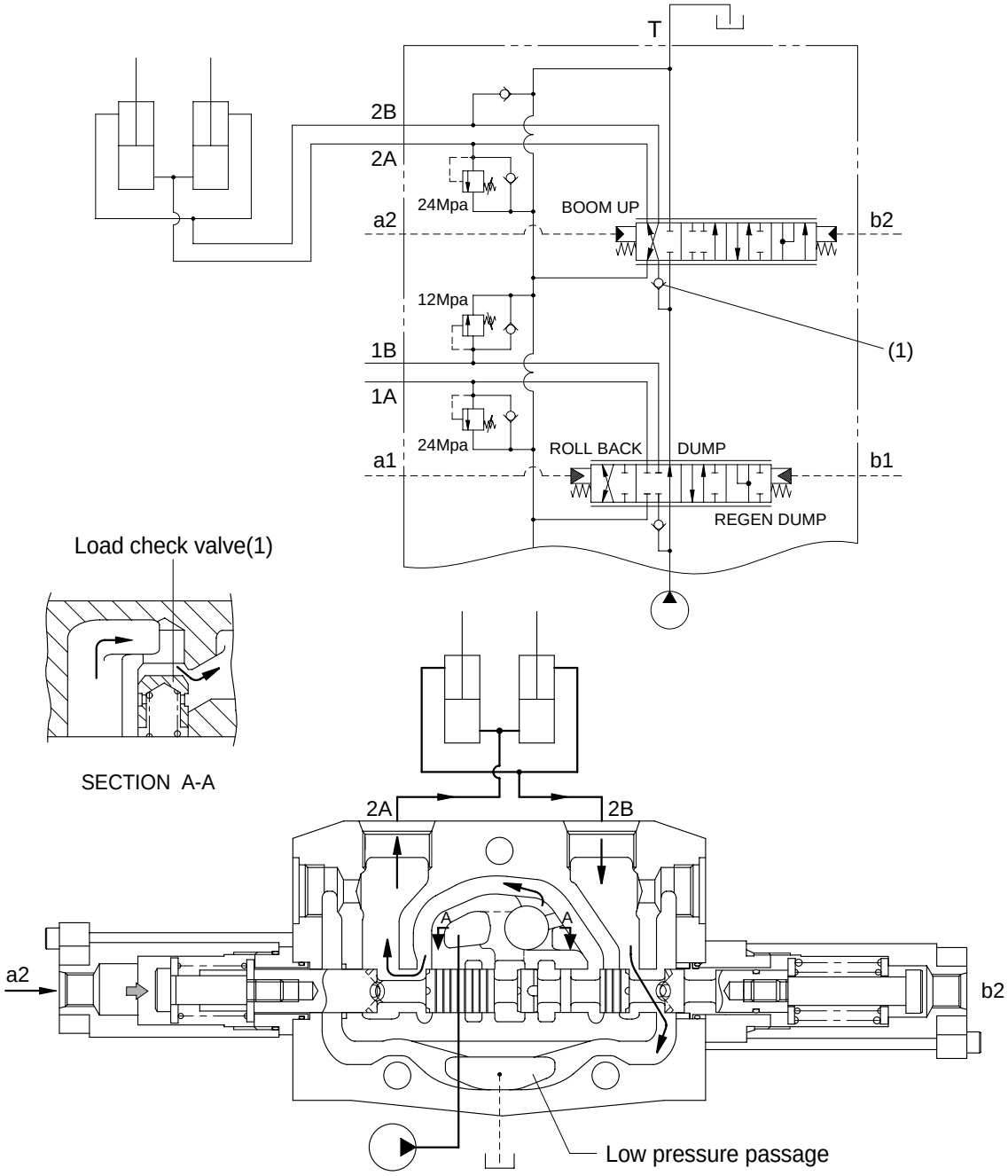
**2) BOOM SECTION OPERATION**

**(1) Spool in neutral**



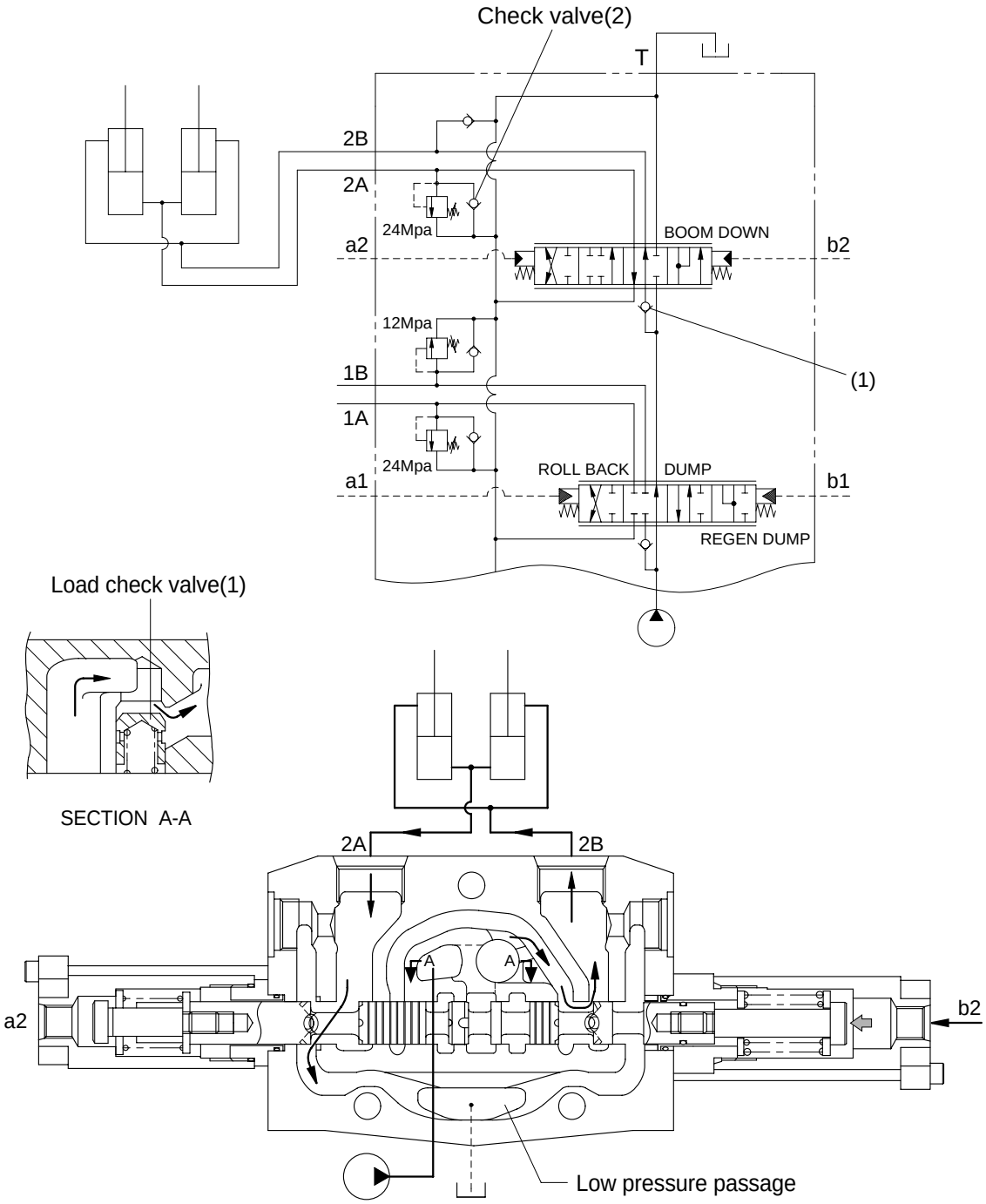

If the remote control valve is not operated, the oil supplied from the pump port passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port.

**(2) Boom raise position**




When the pilot pressure from remote control valve is supplied to the pilot port(a2), the spool moves to the right and the neutral passage is closed.
The oil supplied from the pump pushes up the load check valve(1) and flow into boom cylinder port(2A).
The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.
The return oil from cylinder port(2B) flows into the tank via the low pressure passage.

**(3) Boom lower position**




When the pilot pressure from remote control valve is supplied to the pilot port(b2), the spool moves to the left and the neutral passage is closed.

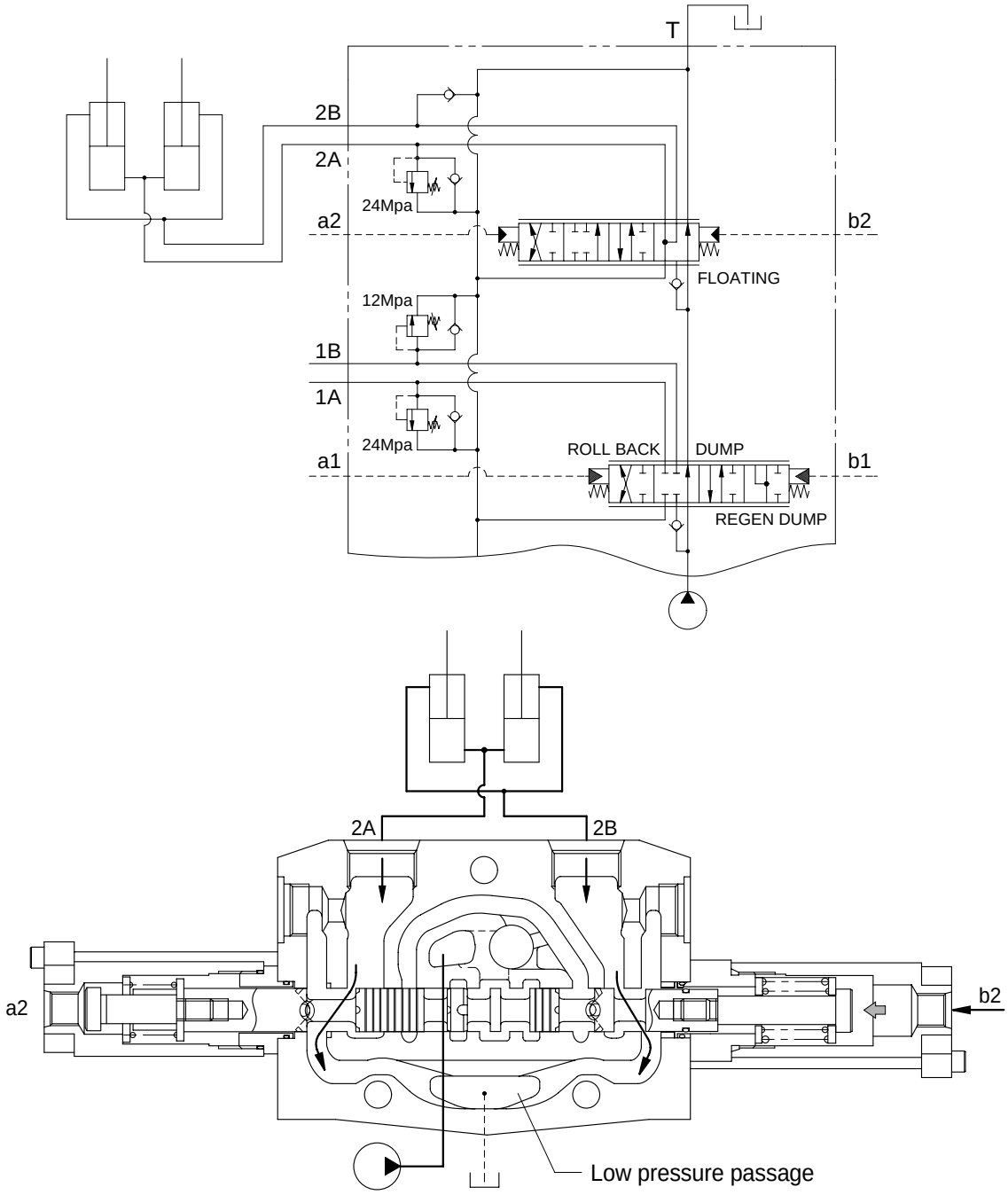
The oil supplied from the pump pushes up the load check valve(1) and flow into boom cylinder port(2B).

The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.

The return oil from cylinder port(2A) flows into the tank via the low pressure passage.

When the lowering speed of boom is faster, the return oil from the large chamber of boom cylinder combines with the oil from the pump through the check valve(2), and flows into the small chamber of cylinder. This prevents cylinder cavitation by the negative pressure when the pump flow cannot match the boom lowering speed.

**(4) Boom float position**



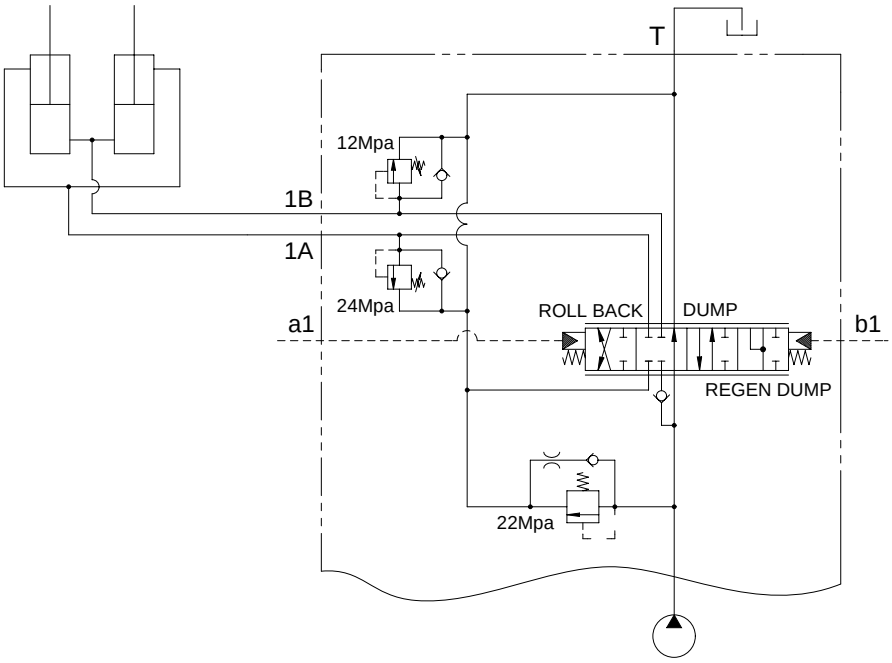

If the remote control lever pushes further more, the pilot pressure from remote control valve rises over 13-15bar and then the boom lowering spool is pushed to the boom floating position, opening up the neutral passage to tank and simultaneously(2A), (2B) → T.

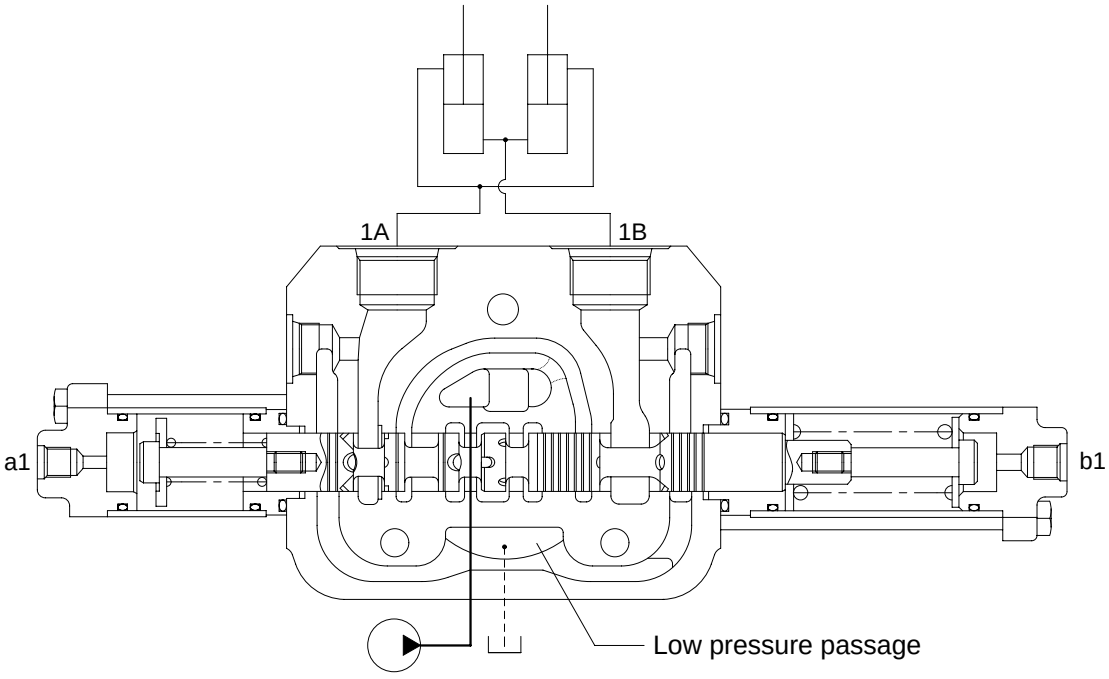
In float position the boom drops quickly due to its own weight.

When the bucket touches the ground and the wheeled loader is moving, the bucket raised or lowered following the unevenness of the ground due to the (2A), (2B) → T connecting.

### 3) BUCKET SECTION OPERATION

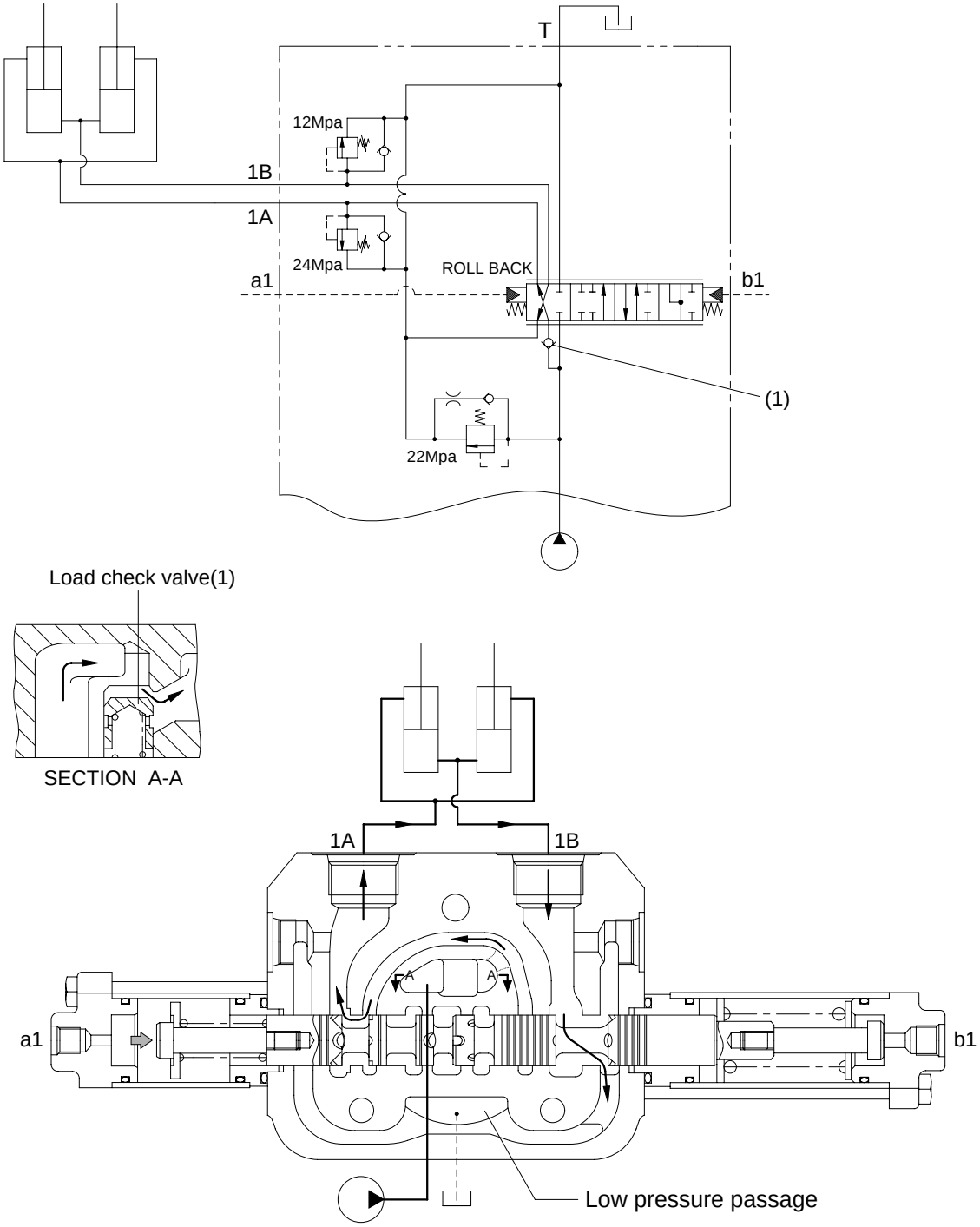
#### (1) Spool in neutral



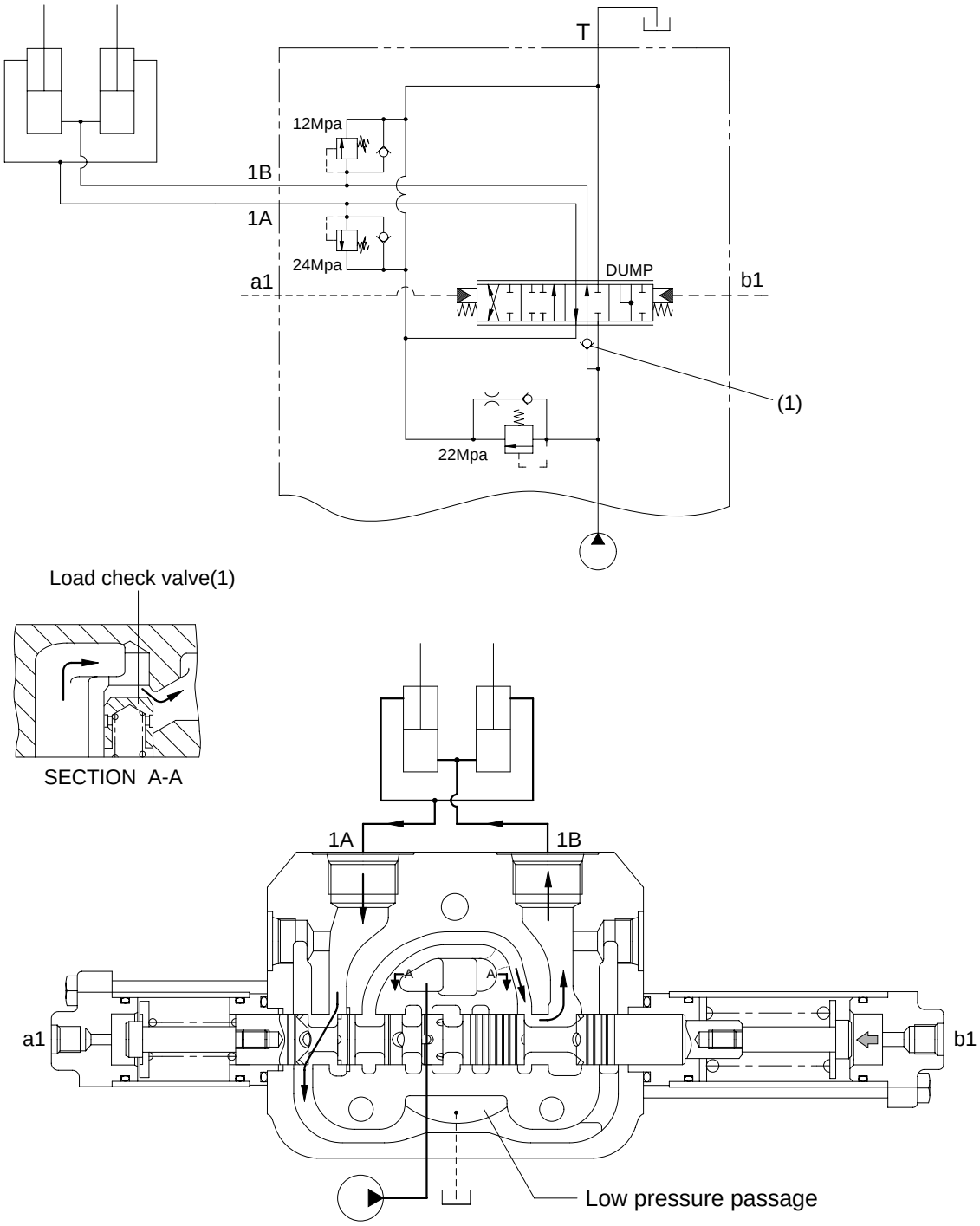

If the remote control valve is not operated, the oil supplied from the pump port passage through the neutral passage to the low pressure passage at the outlet section, and then return to the tank port.

**(2) Retract(Roll back) position**



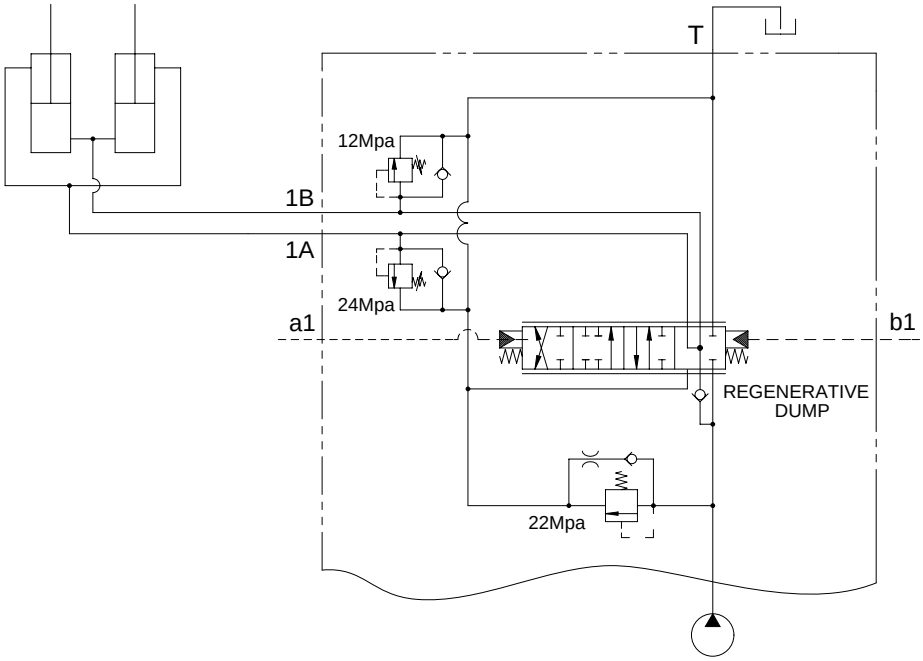

When the pilot pressure from remote control valve is supplied to the pilot port(a1), the spool moves to the right and the neutral passage is closed.
The oil supplied from the pump pushes up the load check valve(1) and flow into boom cylinder port(1A).
The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.
The return oil from cylinder port(1B) flows into the tank via the low pressure passage.

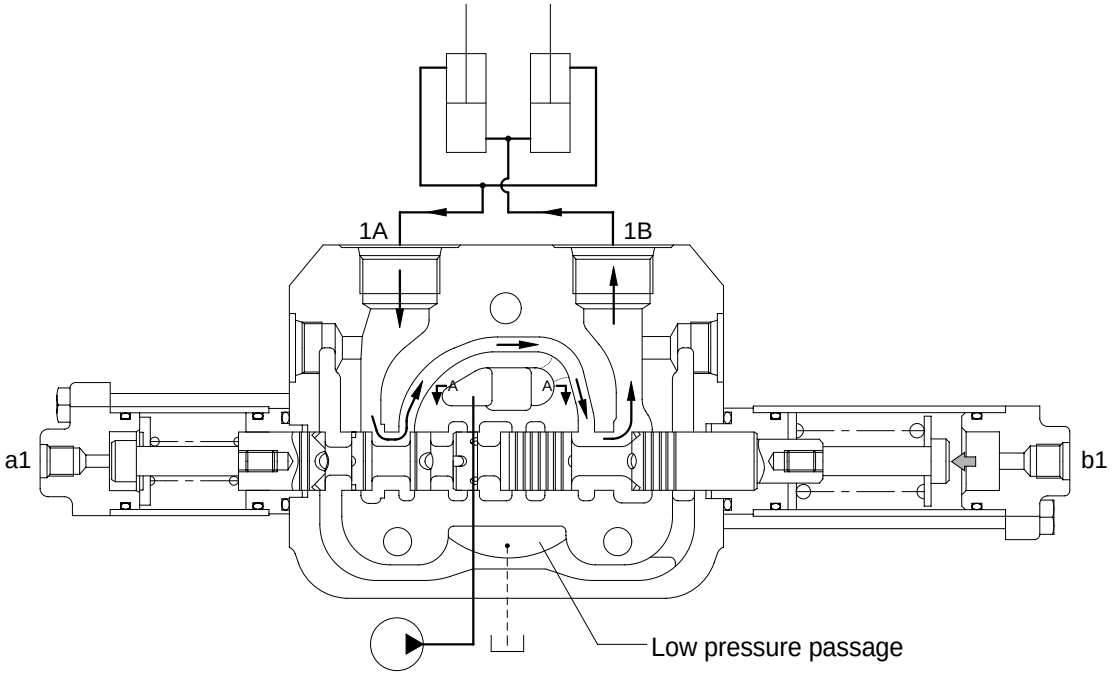
**(3) Dump position**




When the pilot pressure from remote control valve is supplied to the pilot port(b1), the spool moves to the left and the neutral passage is closed.
The oil supplied from the pump pushes up the load check valve(1) and flow into boom cylinder port(1B).
The pump pressure reaches proportionally the load of cylinder and fine control finished by shut off of the neutral passage.
The return oil from cylinder port(1A) flows into the tank via the low pressure passage.

**(4) Regenerative dump position**




If the remote control lever pushes further more, the bucket dump spool is pushed to the regenerative dump position.

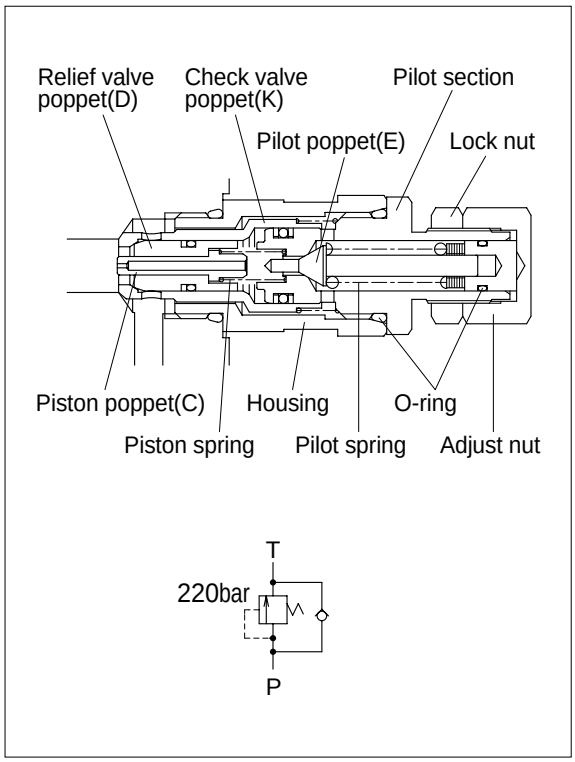
When the spool is moved to the regenerative dump position, both ends of the cylinder are connected to the pump port passage. This pressurizes both ends of the cylinder with equal pressure. Since the head end of the piston has a larger area than the rod end, a greater force is exerted to extend the cylinder. As the cylinder extends, the return oil from the rod end flows back to the valve, combines with the oil form the pump, and flows out to the head end of the cylinder. This provides a faster bucket dump cycle time but reduces the cylinder force.

### 4) PRESSURE SETTING

A good pressure gage must be installed in the line which is in communication with the work port relief. A load must be applied in a manner to reach the set pressure of the relief unit.

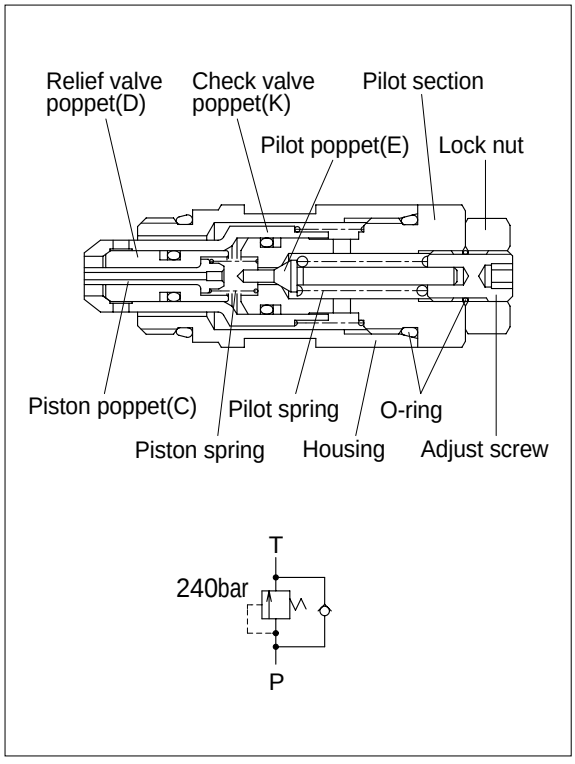
**(1) Main relief valve**

① Loosen lock nut.
② Set adjusting nut to desired pressure setting.
③ If desired pressure setting cannot be achieved, add or remove shims as required.
④ Tighten lock nut.
⑤ Retest in similar manner as above.




**(2) Port relief valve**

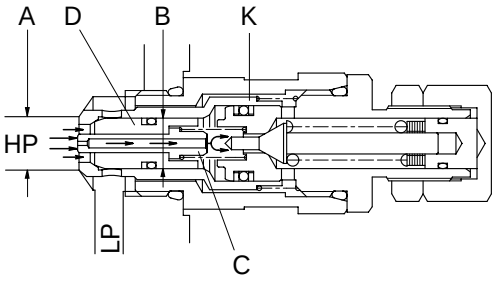
① Loosen lock nut.
② Set adjusting screw to desired pressure setting.
③ Tighten lock nut.
④ Retest in similar manner as above.



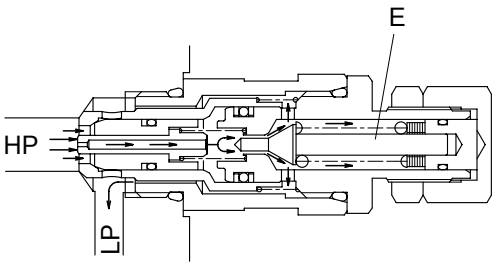
### 5) MAIN RELIEF VALVE

#### (1) As relief

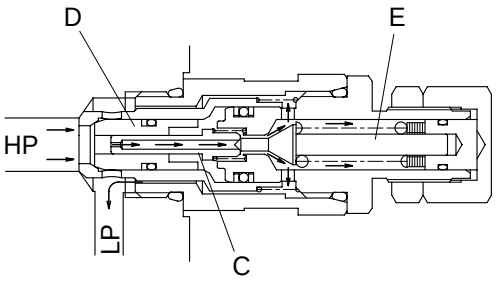
The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown in the first step.



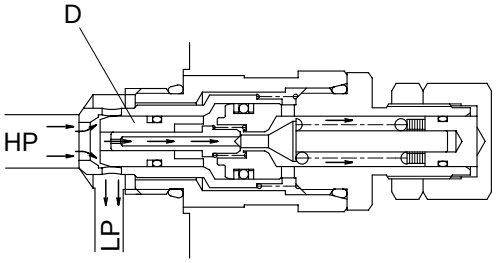

The oil pressure in the high pressure port HP has reached the setting of the pilot poppet spring force and unseats the pilot poppet E and oil flows around the poppet through the cross drilled holes and to the low pressure area LP.




The loss of oil behind poppet C, effected by the opening of pilot poppet E, causes poppet C to move back and seat against pilot poppet E. This shuts off the oil flow to the area behind relief valve poppet D, and causes a low pressure area internally.

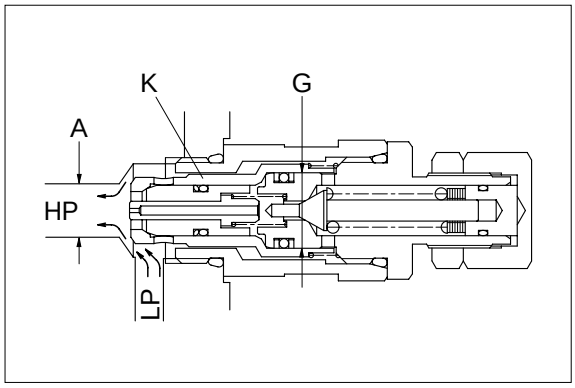



The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.



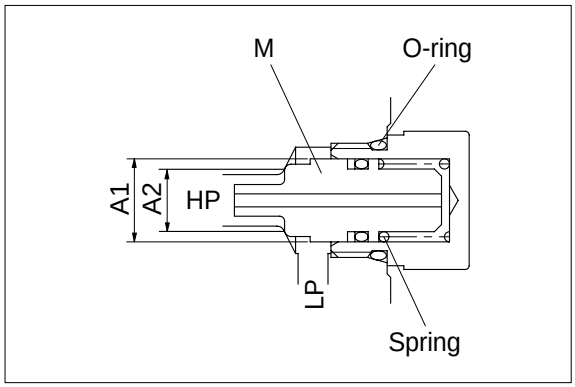
**(2) As anti void**

The anti-void unit supplies oil to the high pressure port HP when cavitation has occurred. A lower pressure exists in the port HP compared to the low pressure chamber LP. The difference between the effective area of diameter A and G causes imbalance of the check valve poppet K which unseats, thus allowing oil from the low pressure chamber LP to enter the port HP and fill the void.




**(3) As separate anti void**

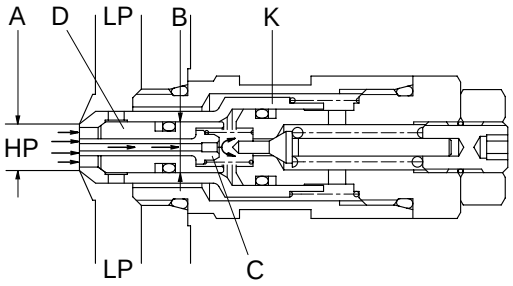
The anti-void check valve opens when cavitation occurs in the high pressure port HP and supplies oil from the reservoir LP to help fill this void. The poppet M is held on its seat by the port pressure HP, acting on the larger area behind the O-ring. When pressure HP drops below atmosphere, the tank pressure LP operating on the annular area A1-A2 will overcome the port pressure HP and the spring force to open the poppet. When the void is eliminated the spring will return the poppet which will then be tightly seated by the port pressure HP.



### 6) PORT RELIEF VALVE

#### (1) As relief

The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown in the first step.

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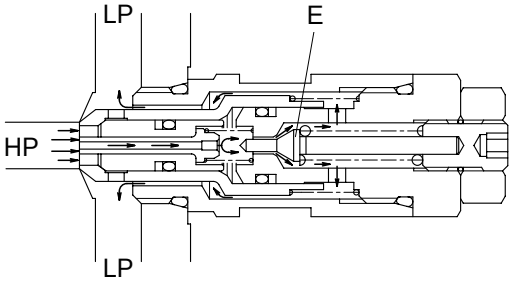


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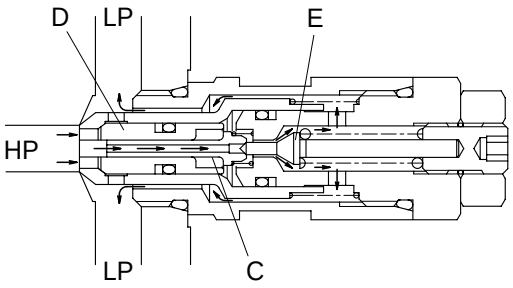
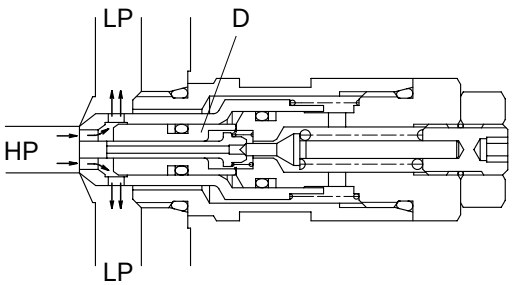



The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.



**(2) As anti void**

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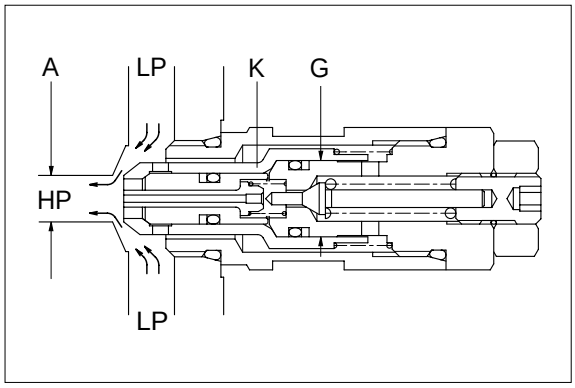
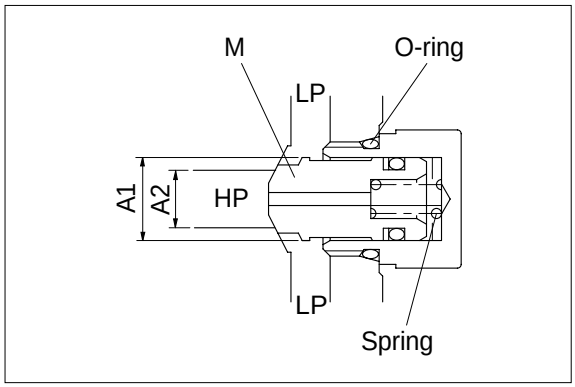


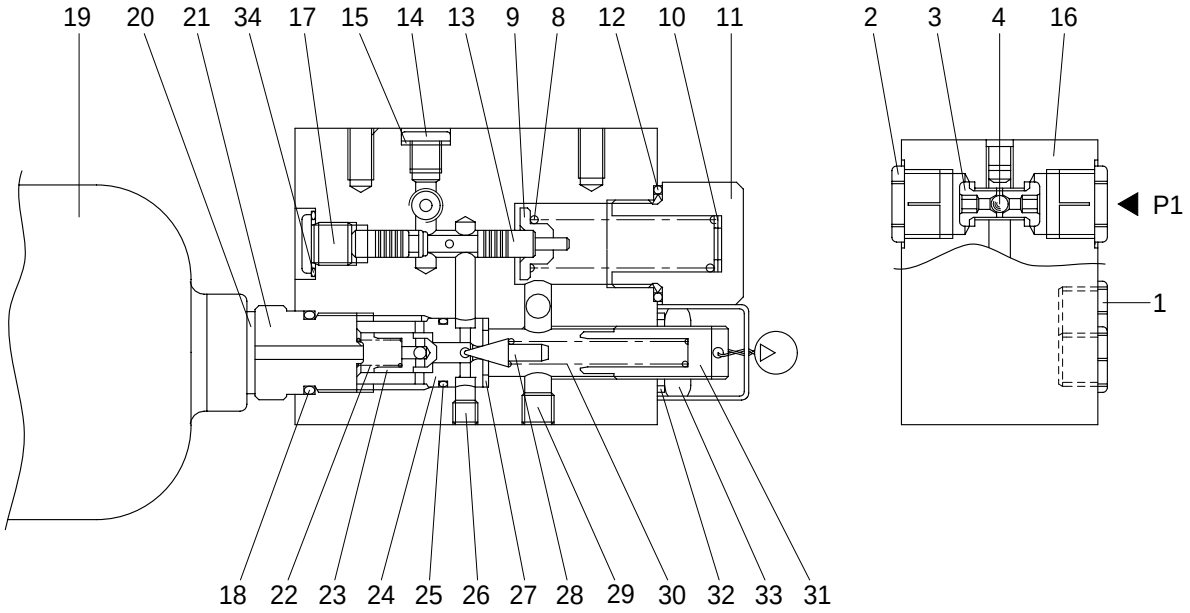

**(3) As separate anti void**

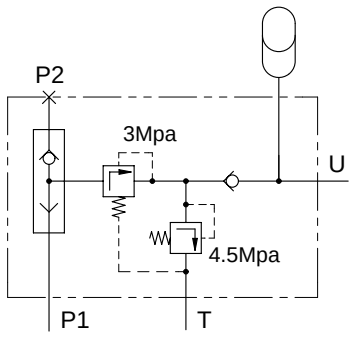
The anti-void check valve opens when cavitation occurs in the high pressure port HP and supplies oil from the reservoir LP to help fill this void. The poppet M is held on its seat by the port pressure HP, acting on the larger area behind the O-ring. When pressure HP drops below atmosphere, the tank pressure LP operating on the annular area A1-A2 will overcome the port pressure HP and the spring force to open the poppet. When the void is eliminated the spring will return the poppet which will then be tightly seated by the port pressure HP.



## 6. PILOT OIL SUPPLY UNIT

### 1) STRUCTURE



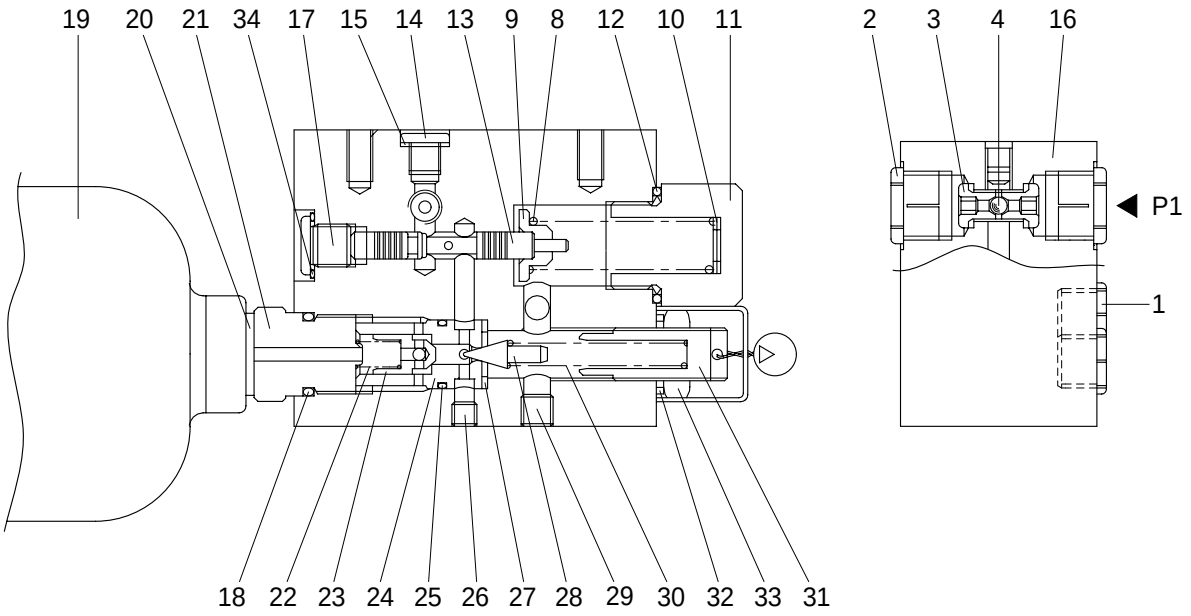




HYDRAULIC CIRCUIT

| Port | Port name | Port size |
|---|---|---|
| P1 | From main pump | 3/4 UNF |
| P2 | Pluging | 3/4 UNF |
| U | Supply to RCV lever | 9/16 UND |
| T | To hydraulic tank | 9/16 UND |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Plug | 14 | Plug | 24 | Valve seat |
| 2 | Plug | 15 | Copper washer | 25 | O-ring |
| 3 | Seat | 16 | Housing | 26 | Plug |
| 4 | Ball | 17 | Plug | 27 | Copper washer |
| 8 | Spring | 18 | O-ring | 28 | Valve poppet |
| 9 | Spring guide | 19 | Accumulator | 29 | Plug |
| 10 | Shim | 20 | Seal | 30 | Spring |
| 11 | Plug | 21 | Adapter | 31 | Adjusting screw |
| 12 | Seal | 22 | Spring | 32 | Washer |
| 13 | Spool | 23 | Check valve | 33 | Nut |

**2) OPERATION**




Pilot oil supply unit are a combination of valves which reduce the pressure of medium and high pressure circuits in order to supply remote control valve with a low pressure supply of oil. They basically consist of the accumulator(19), the housing(16), a seat(3), a direct operated pressure relief valve(28) and a check valve(23).

Fluid flows from the high pressure via the shuttle valve(4) through port P1 into the unit and then to the secondary circuit. The pressure is reduced to the required level by means of spool(13) and passes via the check valve(23) into the accumulator(19) thus ensuring though port U greater control power and-when necessary-emergency operation should the main circuit be switched off or become defective.

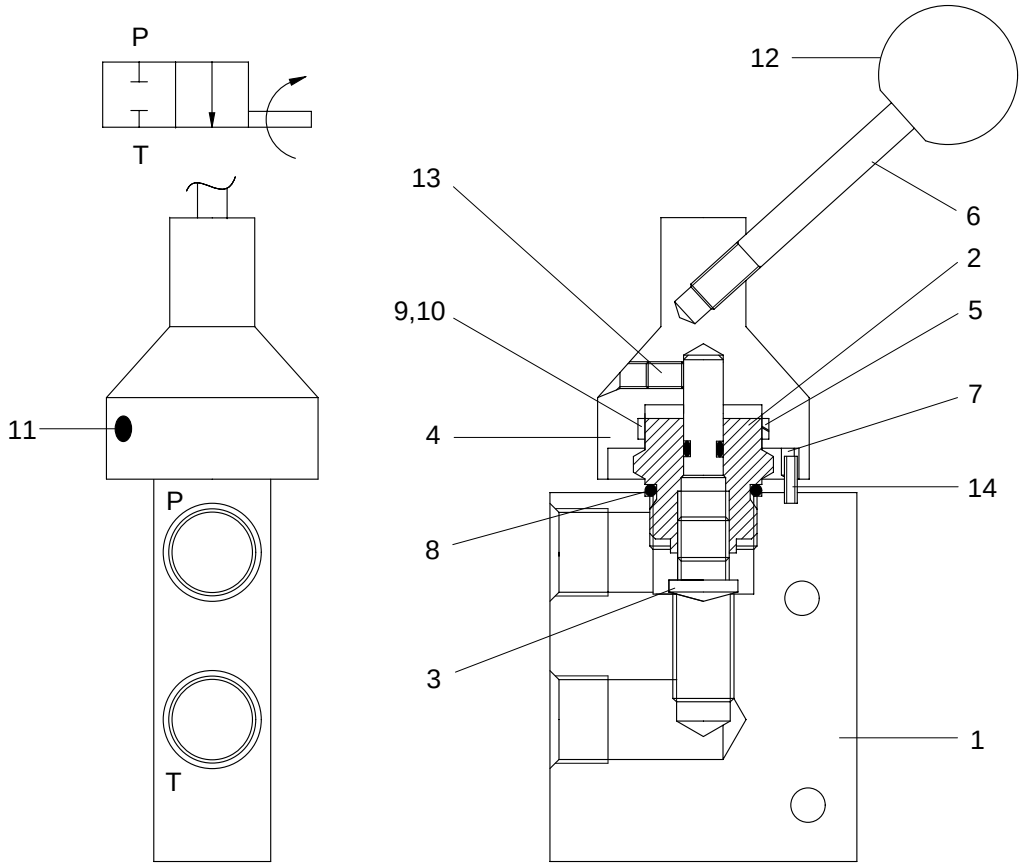
Pressure relief valve(28) protects the pilot circuit should the spool(13) fail to operate. Check valve(23) prevents the accumulator emptying into the primary circuit.

Accumulator satisfies short term peak power demands and is a source of emergency power should the main circuit pressure fail.

## 7. SAFETY VALVE UNIT

### 1) STRUCTURE

The safety valve locks or permits pilot oil flew to the main control valve operation.

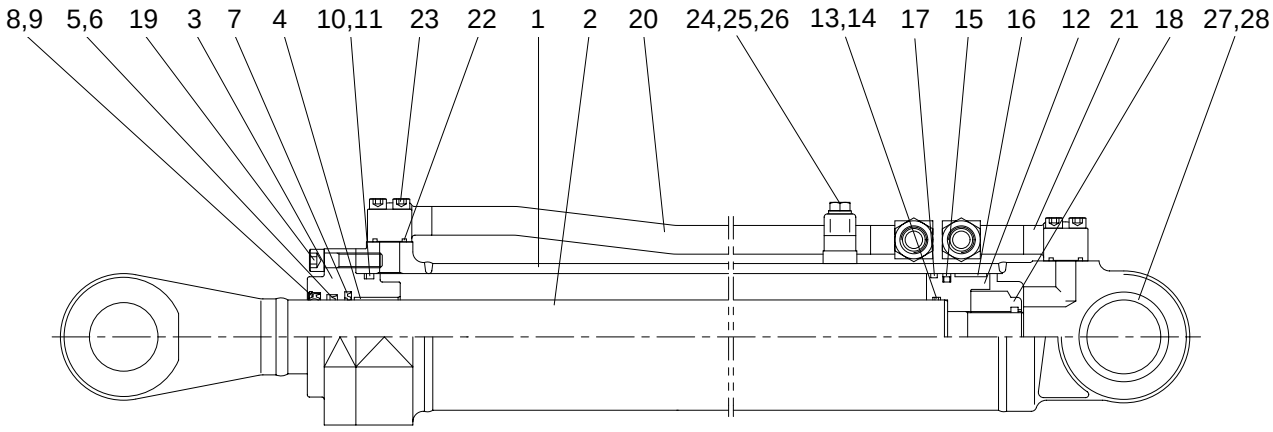



| | | | | | |
|---|---|---|---|---|---|
| 1 | Body | 6 | Handle | 11 | Spring plunger |
| 2 | Retainer | 7 | Spring pin | 12 | Knob |
| 3 | Adjust stem | 8 | O-ring | 13 | Socket set screw |
| 4 | Housing | 9 | O-ring | 14 | Spring pin |
| 5 | Clutch ring | 10 | Back up ring | | |

## 8. CYLINDERS

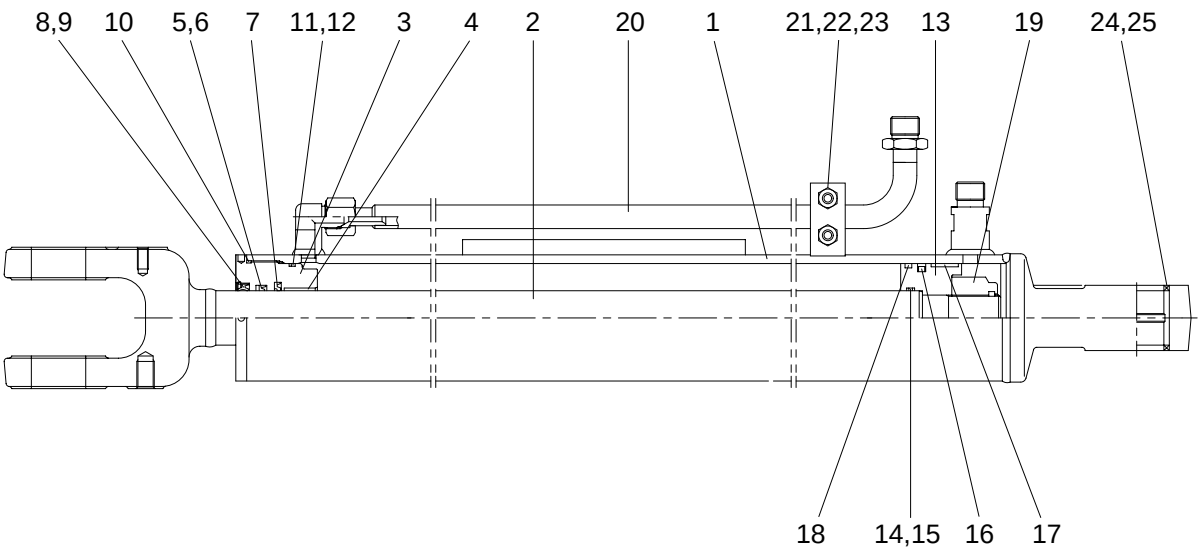
The boom cylinders and the bucket cylinders are two unit. They use a bolt on rod guide.
The piston(12,13) threads on to the rod(2) and is retained by a nylon nut(18,19).
The piston seals against the tube(1) with piston seal(15,16). Two wear rings(16,17) are located on each side of the piston seal.
The gland(3, the rod guide) seals against the tube with an O-ring(10,11). The cylinder thread seals against the rod with a lip type buffer ring(7) and a rod seal(5). A dust wiper(8) cleans the rod when it is retracted.

### 1) BOOM CYLINDER




| | | | | | |
|---|---|---|---|---|---|
| 1 | Tube assy | 11 | Back up ring | 21 | Pipe assy |
| 2 | Rod assy | 12 | Piston | 22 | O-ring |
| 3 | Gland | 13 | O-ring | 23 | Socket bolt |
| 4 | Bushing | 14 | Back up ring | 24 | Pipe clamp |
| 5 | Rod seal | 15 | Piston seal | 25 | Hexagon bolt |
| 6 | Back up ring | 16 | Wear ring | 26 | Spring washer |
| 7 | Buffer ring | 17 | Dust ring | 27 | Bushing |
| 8 | Dust wiper | 18 | Nylon nut | 28 | Dust seal |
| 9 | Snap ring | 19 | Socket bolt | | |
| 10 | O-ring | 20 | Pipe assy | | |

**2) BUCKET CYLINDER**

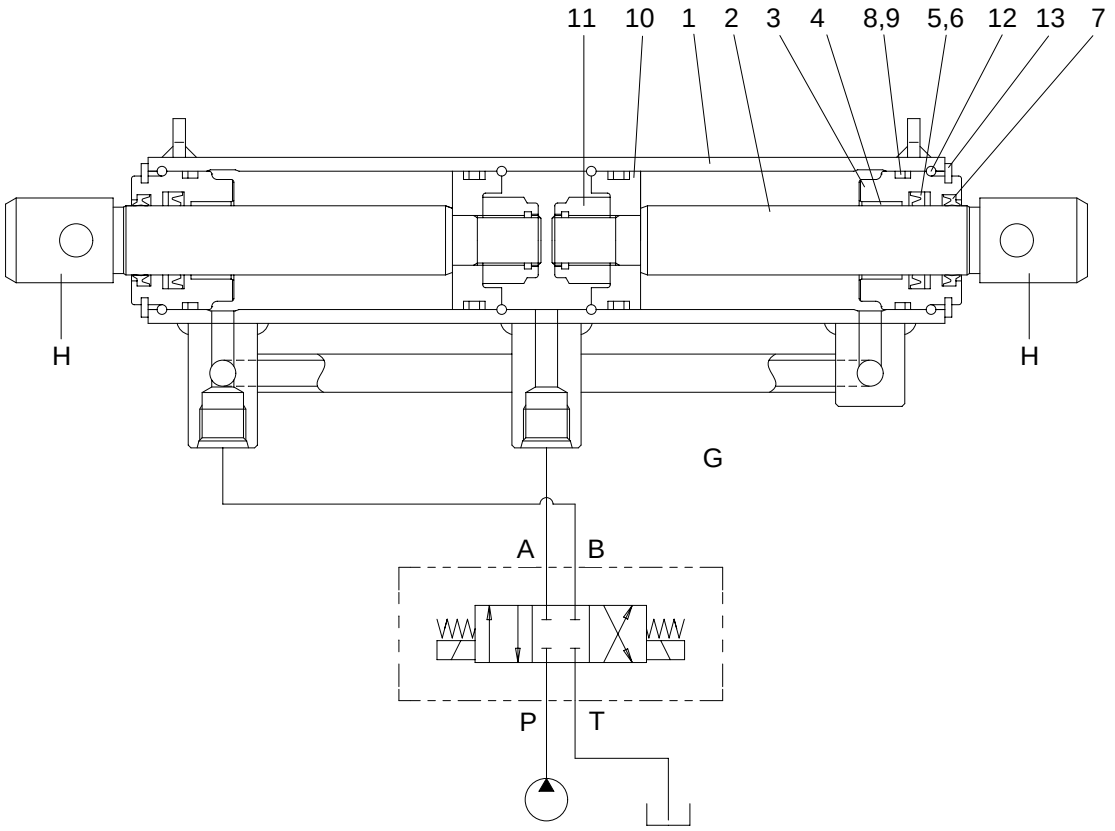



| | | | | | |
|---|---|---|---|---|---|
| 1 | Tube assy | 10 | O-ring | 19 | Nylon nut |
| 2 | Rod assy | 11 | O-ring | 20 | Pipe assy |
| 3 | Gland | 12 | Back up ring | 21 | U-bolt |
| 4 | Bushing | 13 | Piston | 22 | Hexagon bolt |
| 5 | Rod seal | 14 | O-ring | 23 | Spring washer |
| 6 | Back up ring | 15 | Back up ring | 24 | Bushing |
| 7 | Buffer ring | 16 | Piston seal | 25 | Dust seal |
| 8 | Dust wiper | 17 | Wear ring | | |
| 9 | Snap ring | 18 | Dust ring | | |

### 3) COUPLER CYLINDER

Brake pump pressure oil enters the solenoid valve through the pressure port(P).
When the **attachment engage switch** is pressed, the spool moves to the right.
This allows pressure oil to flow out workport(A) to the center of cylinder, holding the pins(H) in the extended position. The cylinder rod ends are joined by pipe(G) to return through workport(B).

When the **attachment disengage switch** is pressed, the spool moves to the left. This allows pressure oil to flow out workport(B) to the rod ends of the cylinder, retracting the pins(H).
Return oil then flows into workport(A) and out return port(T).

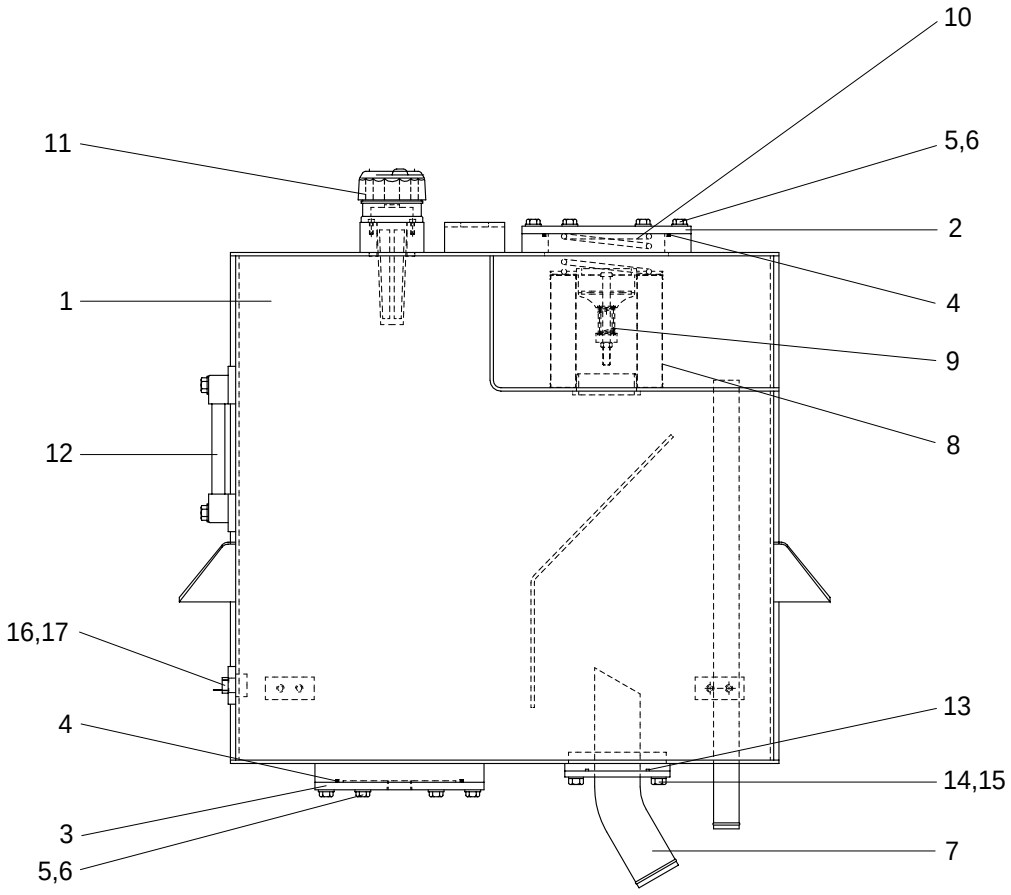



| | | | | | |
|---|---|---|---|---|---|
| 1 | Tube assy | 6 | Back up ring | 11 | Nylon nut |
| 2 | Rod | 7 | Dust wiper | 12 | Stop ring |
| 3 | Gland | 8 | O-ring | 13 | Retainer ring |
| 4 | Bushing | 9 | Back up ring | | |
| 5 | Rod seal | 10 | Piston | | |

## 9. HYDRAULIC OIL TANK

### 1) STRUCTURE

- The oil from the hydraulic tank is sent from the pump through control valve to the cylinders. In the return circuit, the oil from various parts merges.
- A part of oil is cooled in the oil cooler(If equipped), passes through the hydraulic filter and returns to the hydraulic tank(1).
- If the hydraulic return oil filter becomes clogged, return filter bypass valve(9) acts to allow the oil to return directly to the hydraulic tank(1). This prevents damage to the hydraulic filter(8). The bypass valve(9) is also actuated when negative pressure is generated in the circuit.



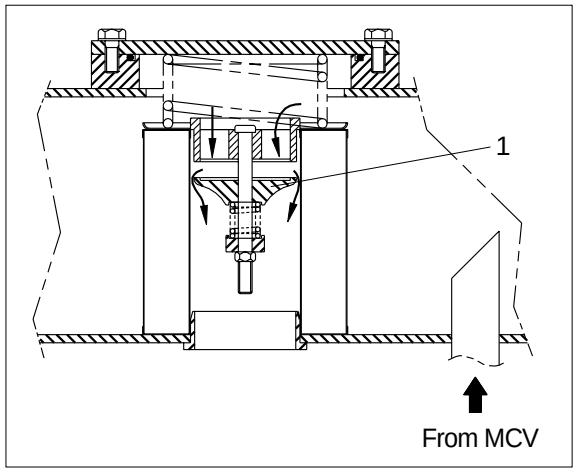

| | | | | | |
|---|---|---|---|---|---|
| 1 | Hydraulic tank | 7 | Pipe | 13 | O-ring |
| 2 | Cover | 8 | Element | 14 | Bolt |
| 3 | Cover | 9 | Bypass valve | 15 | Hardened washer |
| 4 | O-ring | 10 | Spring | 16 | Overheat switch |
| 5 | Bolt | 11 | Air breather | 17 | O-ring |
| 6 | Hardened washer | 12 | Level gauge | | |

**2) RETURN OIL FILTER BYPASS VALVE**

**(1) When the filter is clogged**

Bypass valve(1) is opened and the oil returns directly to the tank without passing through the filter.

Bypass valve set pressure : 1.36kg/cm$^2$ (19.3psi)



### 3) AIR BREATHER

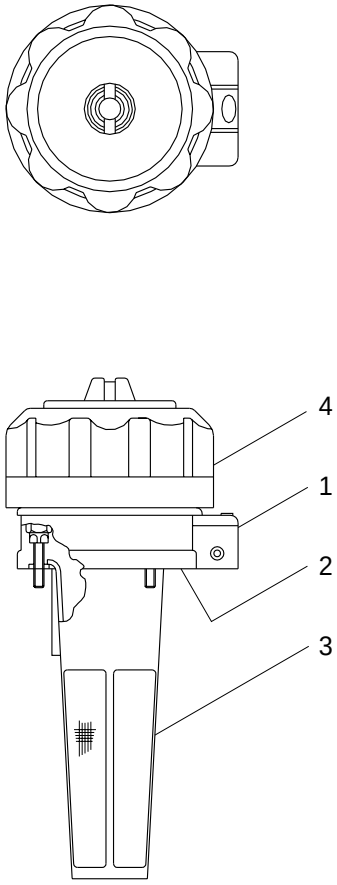
The air breather is equipped with the capacity to perform three functions simultaneously-as an air filter, breathing valve, and as a lubrication opening.

**(1) Preventing negative pressure inside the tank**

The tank is a pressurized sealed type, so negative pressure is formed inside the hydraulic tank when the oil level drops during operations. When this happens, the difference in pressure between the tank and the outside atmospheric pressure opens the poppet in the breather, and air from the outside is let into the tank or prevent negative pressure.

**(2) Preventing excessive pressure inside the tank**

When the hydraulic cylinder is being used, the oil level in the hydraulic system increases and as temperature rises. If the hydraulic pressure rises above the set pressure, breather is actuated to release the hydraulic pressure inside the tank.

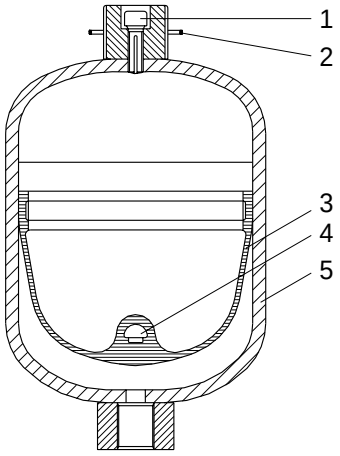



| | | | |
|---|---|---|---|
| 1 | Body | 3 | Strainer |
| 2 | Element | 4 | Cap |

## 10. ACCUMULATOR

The accumulator is installed at the pilot oil supply unit. When the boom is left the raised position, and the control levers are operated with the engine stopped the pressure of the compressed nitrogen gas inside the accumulator sends pilot pressure to the control valve to actuate it and allow the boom and bucket to come down under their own weight.

| | |
|---|---|
| Type of gas | Nitrogen gas($N_2$) |
| Volume of gas | 0.75 ℓ (0.2 U.S.gal) |
| Charging pressure of gas | 16kg/cm²(228psi) |
| Max actuating pressure | 30kg/cm²(427psi) |




1 Screw plug
2 Sealing ring
3 Diaphragm
4 Closure button
5 Steel pressure vessel