

SECTION 6 WORK EQUIPMENT

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SECTION 6 WORK EQUIPMENT

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC SYSTEM OUTLINE

The loader and backhoe hydraulic system is a open center system which is supplied with flow from the fixed displacement double gear pump.

The backhoe hydraulic system is a pilot operated and the loader hydraulic system is operated by linkage.

Oil is drawn from the hydraulic tank by the hydraulic pump. The pump has two sections, P1 and P2.

The hydraulic pump is mounted on the rear of the transmission and is driven by the engine via a driveshaft.

Oil from pump section P1 flows direct to the loader control valve. Oil from the small section P2, flows to steering unit, and in neutral circuit flows through the priority valve in pump to the loader control valve and then to join the flow from P1 at the loader control valve.

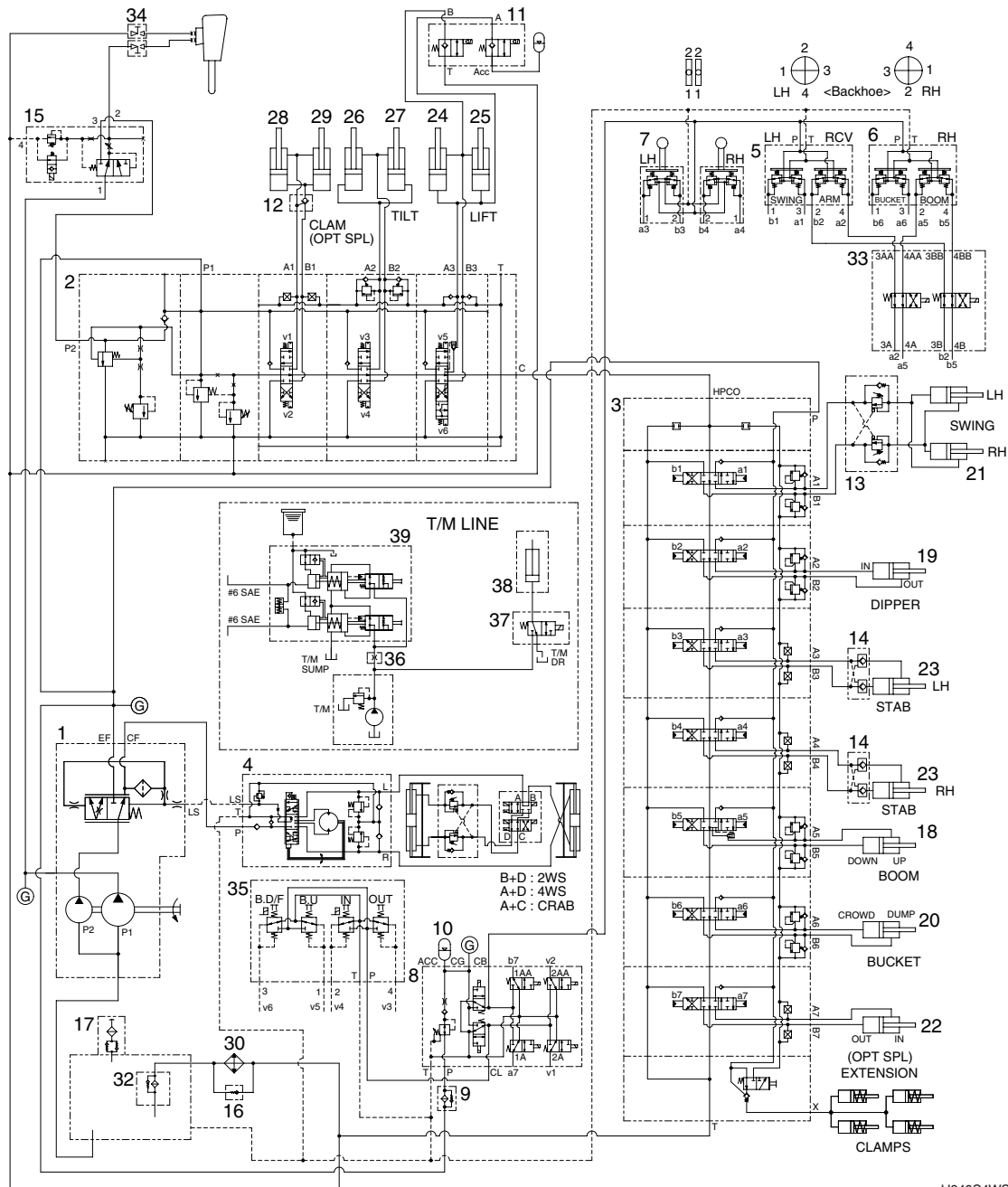
From the loader control valve neutral gallery, oil flows via a high pressure carry-over line to the backhoe valve.

Some of the exhaust oil flows directly back to the tank through a filter and some of the exhaust oil returns to tank via the hydraulic oil cooler.

To help prevent backhoe dipper cylinder and loader lift cylinder cavitation, there is a check valve fitted to the return line. The check valve raises approximately 5 bar (75 lbf/in²) of pressure in the line, which improves the operation of the respective anti-cavitation valves.

The hydraclamp exhaust hose is fitted. The hose connects the hydraclamp spool directly into the exhaust circuit. This prevents the clamp from **locking-up** when the sideshifting operation is required.

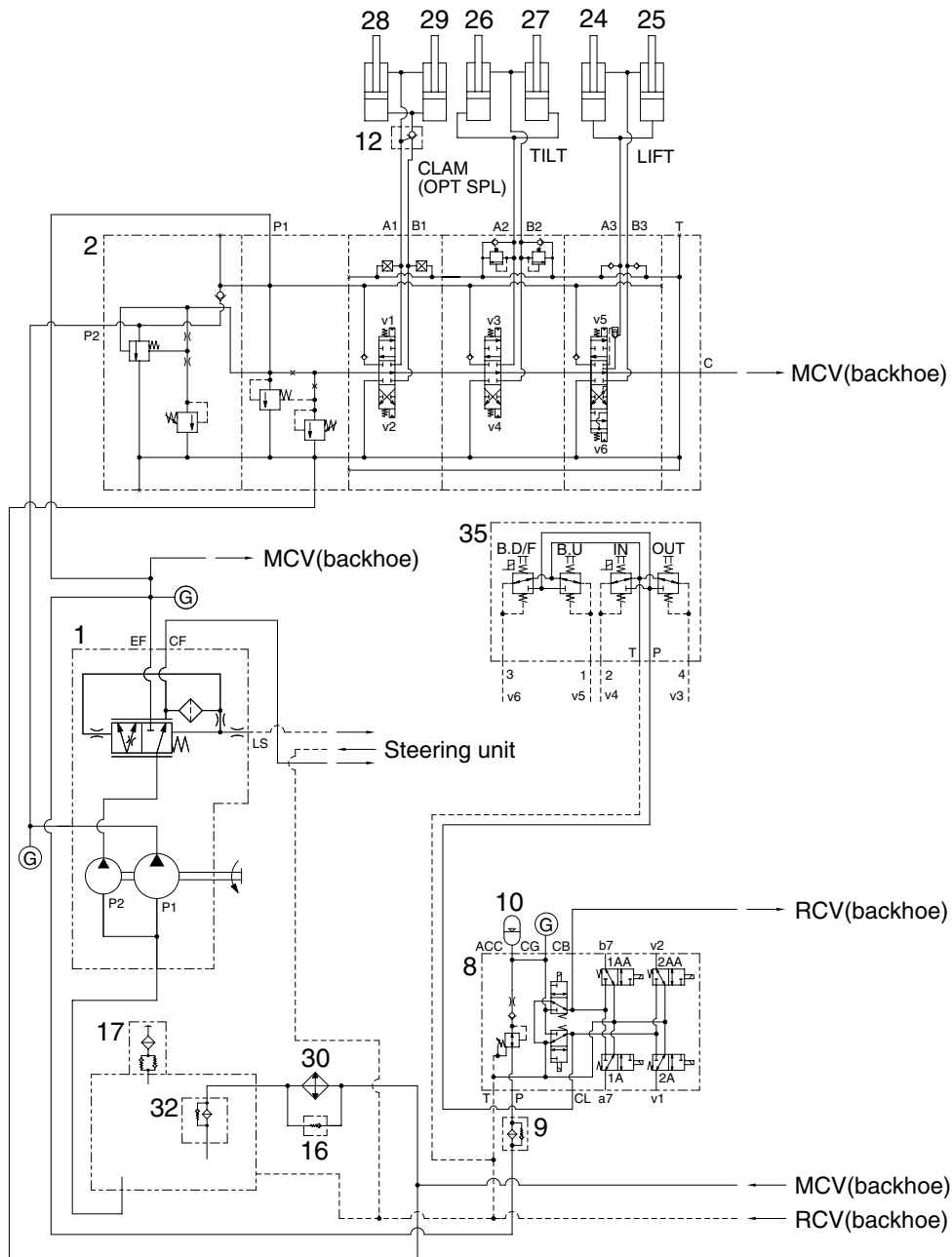
2. HYDRAULIC CIRCUIT



H940S4WS6WE01

- | | | | | | |
|----|------------------------------|----|---------------------------|----|-------------------------------|
| 1 | Main pump | 13 | Swing damping valve (opt) | 26 | Loader bucket cylinder-LH |
| 2 | Main control valve (loader) | 14 | Double pilot check valve | 27 | Loader bucket cylinder-RH |
| 3 | Main control valve (backhoe) | 15 | Breaker valve (opt) | 28 | Clam cylinder-LH (opt) |
| 4 | Steering unit | 16 | By-pass check valve | 29 | Clam cylinder-RH (opt) |
| 5 | Remote control valve-LH | 17 | Air breather | 30 | Oil cooler |
| 6 | Remote control valve-RH | 18 | Boom cylinder | 32 | Return filter |
| 7 | Stabilizer lever | 19 | Dipper cylinder | 33 | Pattern exchanger valve (opt) |
| 8 | Pilot supply unit | 20 | Bucket cylinder | 34 | Stop valve (opt) |
| 5- | cartridge sol valve (opt) | 21 | Swing cylinder | 35 | Remote control lever (loader) |
| 9 | Line filter | 22 | Extension cylinder (opt) | 36 | Orifice |
| 10 | Accumulator | 23 | Stabilizer cylinder | Ⓒ | Gauge port |
| 11 | Ride control valve (opt) | 24 | Loader boom cylinder-LH | | |
| 12 | Pilot check valve (opt) | 25 | Loader boom cylinder-RH | | |

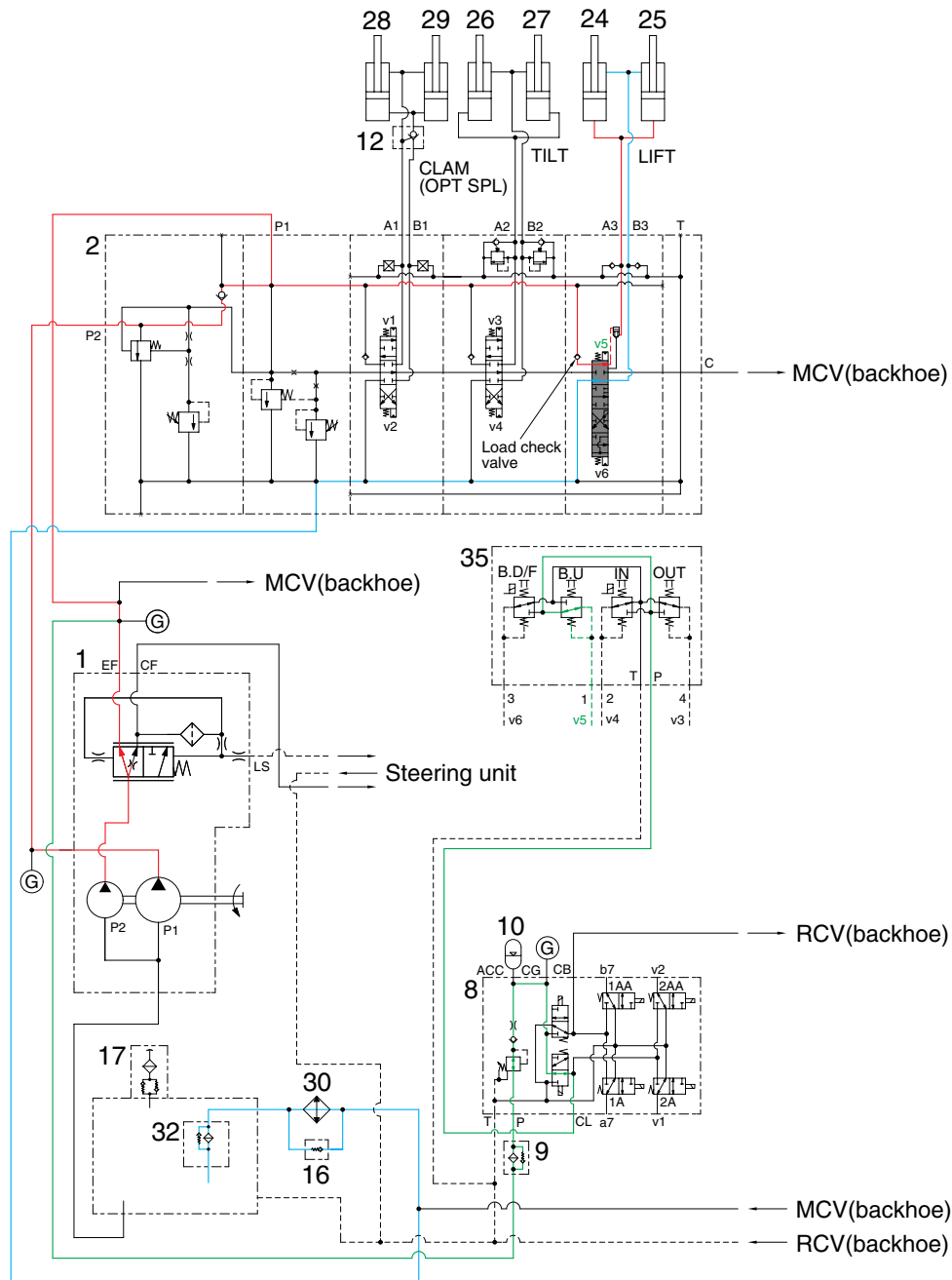
3. LOADER HYDRAULIC CIRCUIT



H940S4WS6WE02

- | | | | | | |
|----|------------------------------|----|---------------------------|----|-------------------------------|
| 1 | Main pump | 16 | By-pass check valve | 28 | Clam cylinder-LH (opt) |
| 2 | Main control valve (loader) | 17 | Air breather | 29 | Clam cylinder-RH (opt) |
| 8 | Pilot supply unit | 24 | Loader boom cylinder-LH | 30 | Oil cooler |
| | 5- cartridge sol valve (opt) | 25 | Loader boom cylinder-RH | 32 | Return filter |
| 9 | Line filter | 26 | Loader bucket cylinder-LH | 35 | Remote control lever (loader) |
| 10 | Accumulator | 27 | Loader bucket cylinder-RH | ⓐ | Gauge port |
| 12 | Pilot check valve (opt) | | | | |

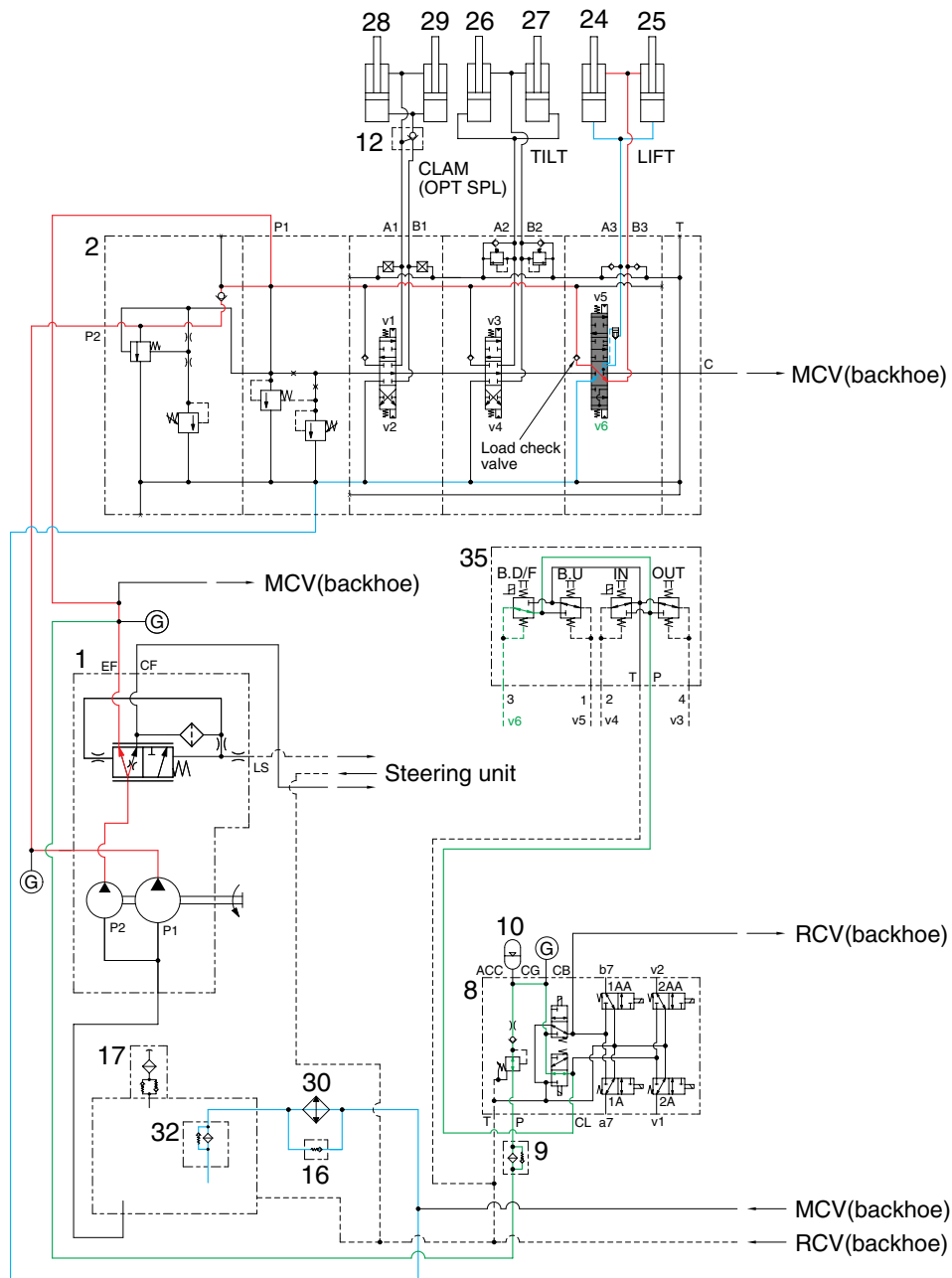
1) WHEN THE RCV LEVER IS IN THE RAISE POSITION



H940S4WS6WE03

- When the loader RCV lever is pulled back, the boom spool is moved to raise position.
- The oil from main pump (1) flows into loader main control valve (2) and then goes to the large chamber of boom cylinder (24, 25) by pushing the load check valve of the boom spool.
- The oil from the small chamber of boom cylinder (24, 25) returns to hydraulic oil tank through the boom spool at the same time.
- When this happens, the boom goes up.

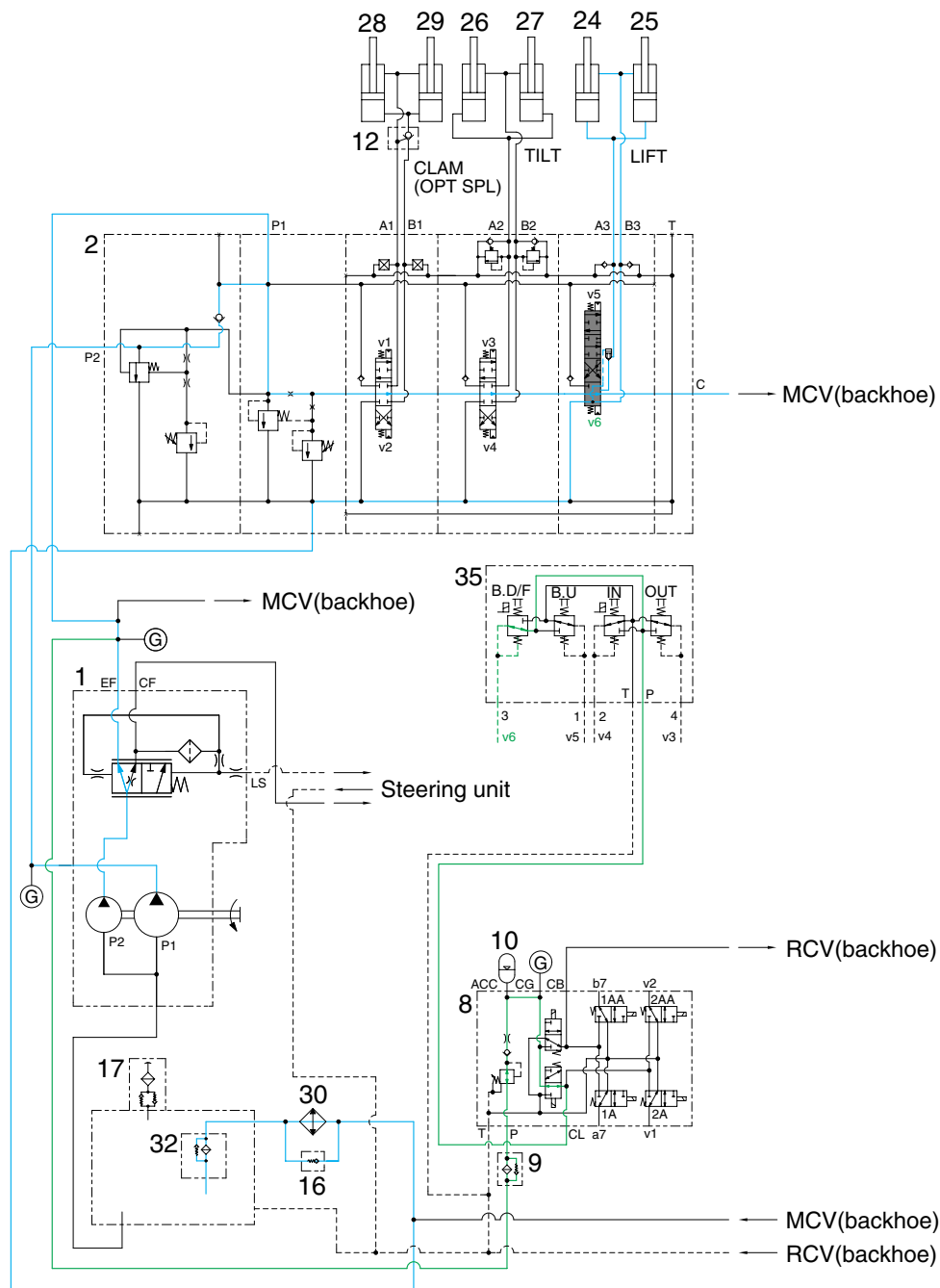
2) WHEN THE RCV LEVER IS IN THE LOWER POSITION



H940S4WS6WE04

- When the loader RCV lever is pushed forward, the boom spool is moved to lower position.
 - The oil from main pump (1) flows into loader main control valve (2) and then goes to small chamber of boom cylinder (24, 25) by pushing the load check valve of the boom spool.
 - The oil returned from large chamber of boom cylinder (24, 25) returns to hydraulic tank 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.

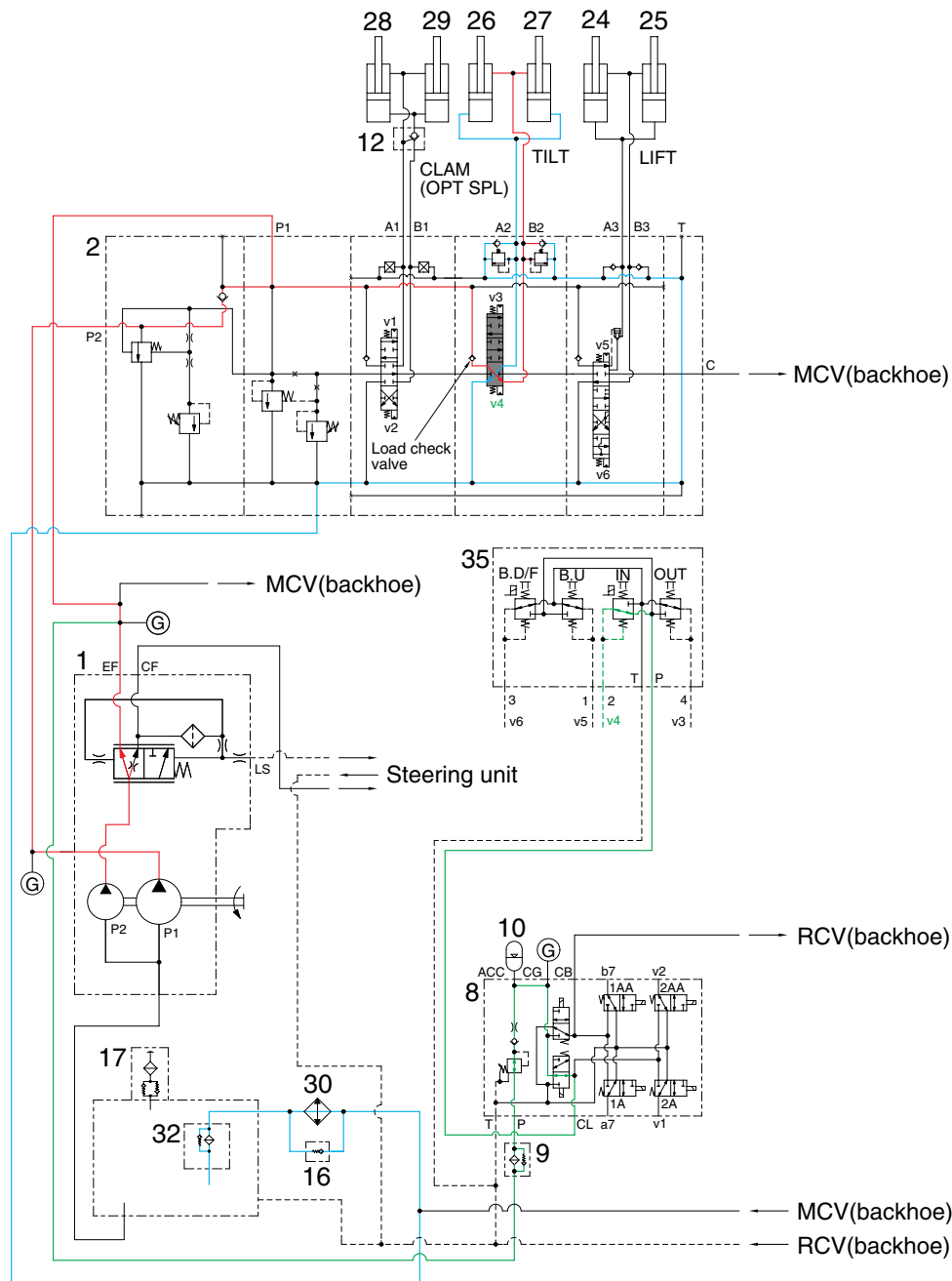
3) WHEN THE RCV LEVER IS IN THE FLOAT POSITION



H940S4WS6WE05

- When the loader RCV lever is pushed further forward from the lower position, the boom spool is moved to floating position.
- The work ports (A3), (B3) and the small chamber and the large chamber are connected to the return passage, so the boom will be lowered due to its own weight.
- In this condition, when the bucket is in contact with the ground, it can be moved up and down in accordance with the shape of the ground.

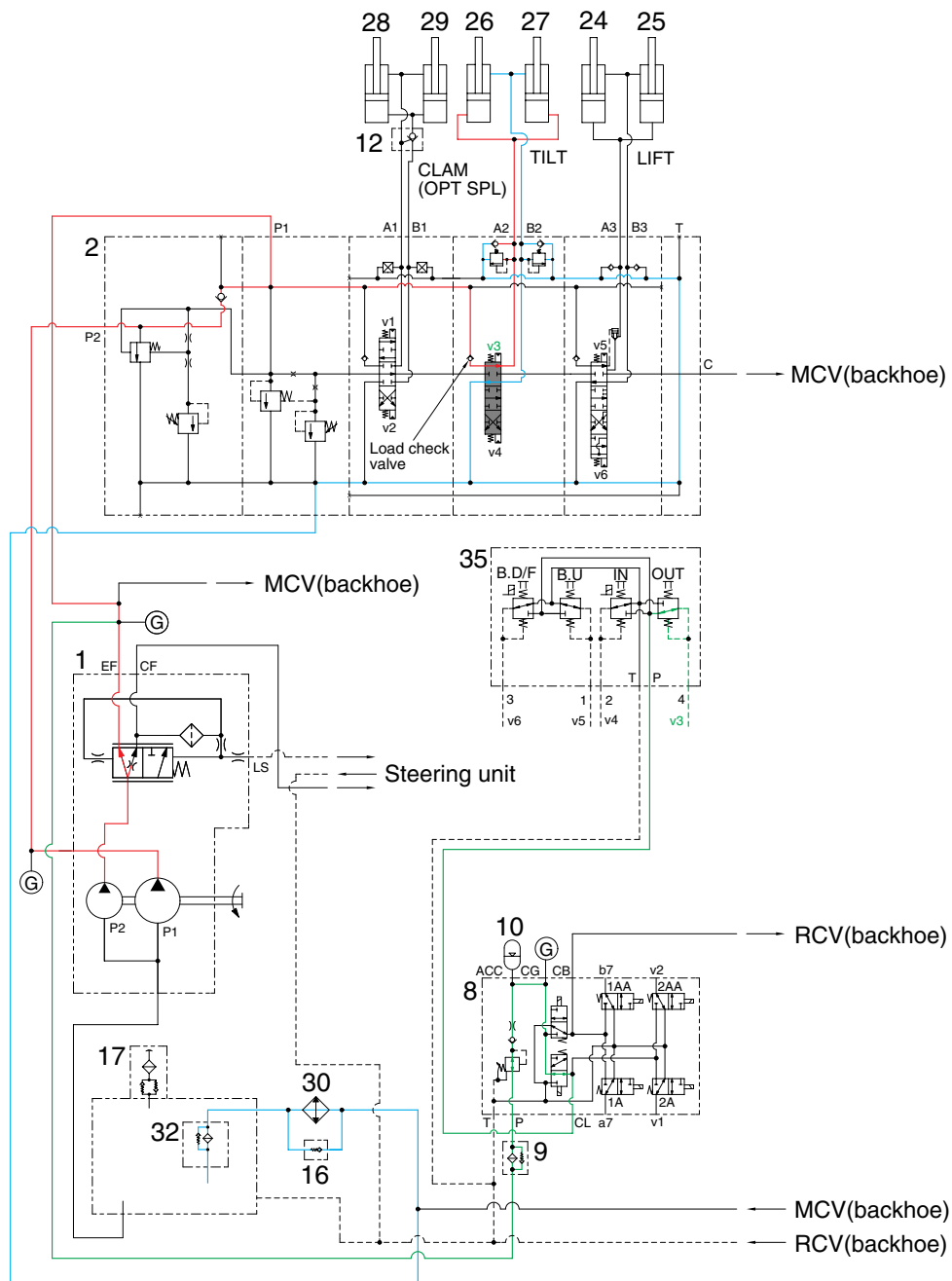
4) WHEN THE RCV LEVER IS IN THE DUMP POSITION



H940S4WS6WE07

- If the loader RCV lever is pushed right, the bucket spool is moved to dump position.
- The oil from main pump (1) flows into loader main control valve (2) and then goes to the large chamber of bucket cylinder (26, 27) by pushing the load check valve of the bucket spool.
- The oil at the small chamber of bucket cylinder (26, 27) returns to hydraulic tank through the bucket spool.
- When this happens, the bucket is dumped.
- When the dumping speed of bucket is faster, the oil returned 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 dump speed.

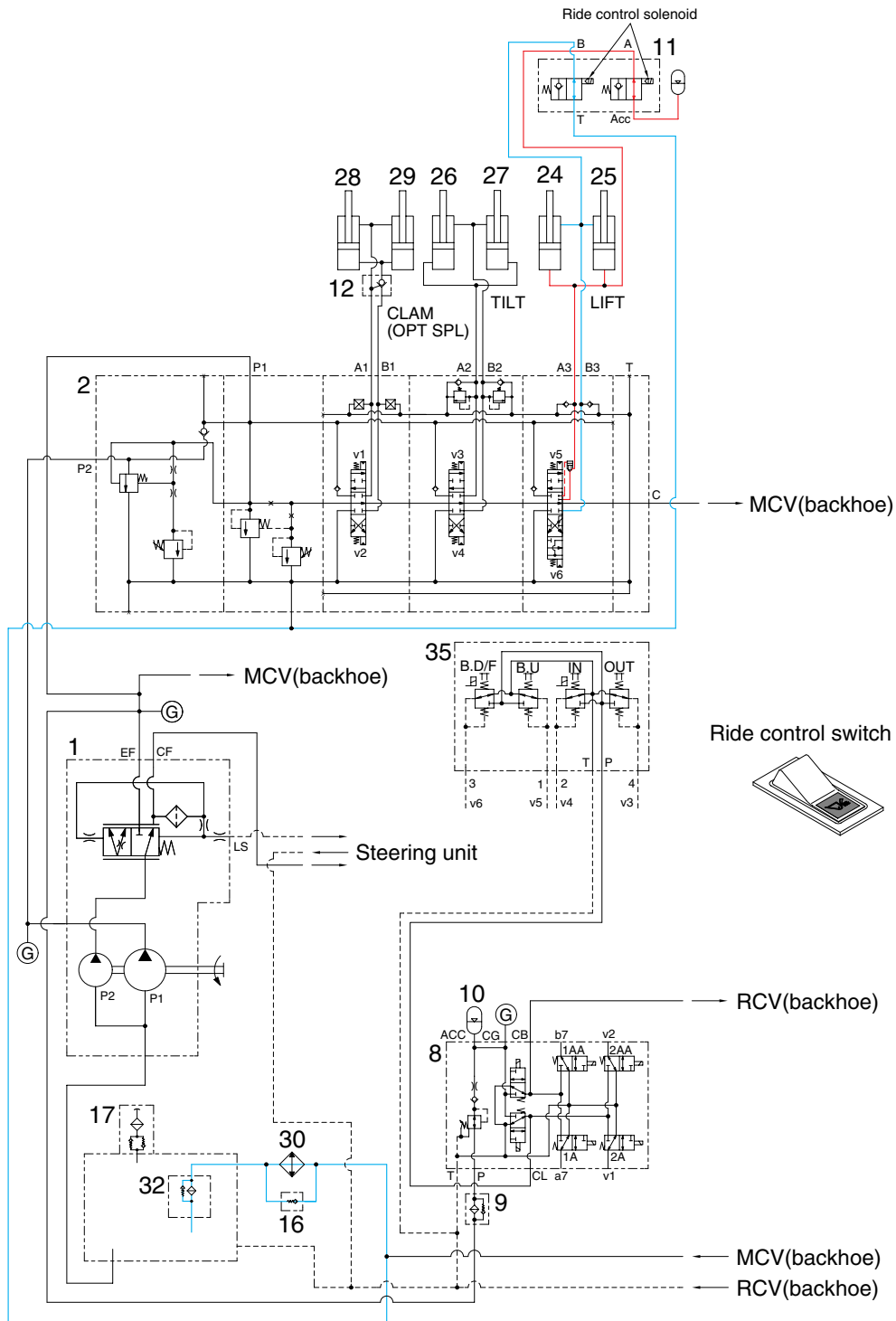
5) WHEN THE RCV LEVER IS IN THE ROLL BACK (retract) POSITION



H940S4WS6WE06

- If the loader RCV lever is pulled left, the bucket spool is moved to roll back position.
- The oil from main pump (1) flows into loader main control valve (2) and then goes to the small chamber of bucket cylinder (26, 27) by pushing the load check valve of the bucket spool.
- The oil at the large chamber of bucket cylinder (26, 27) returns to hydraulic tank.
- When this happens, the bucket roll back.
- When the rolling speed of bucket is faster, the return oil 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 rolling speed.

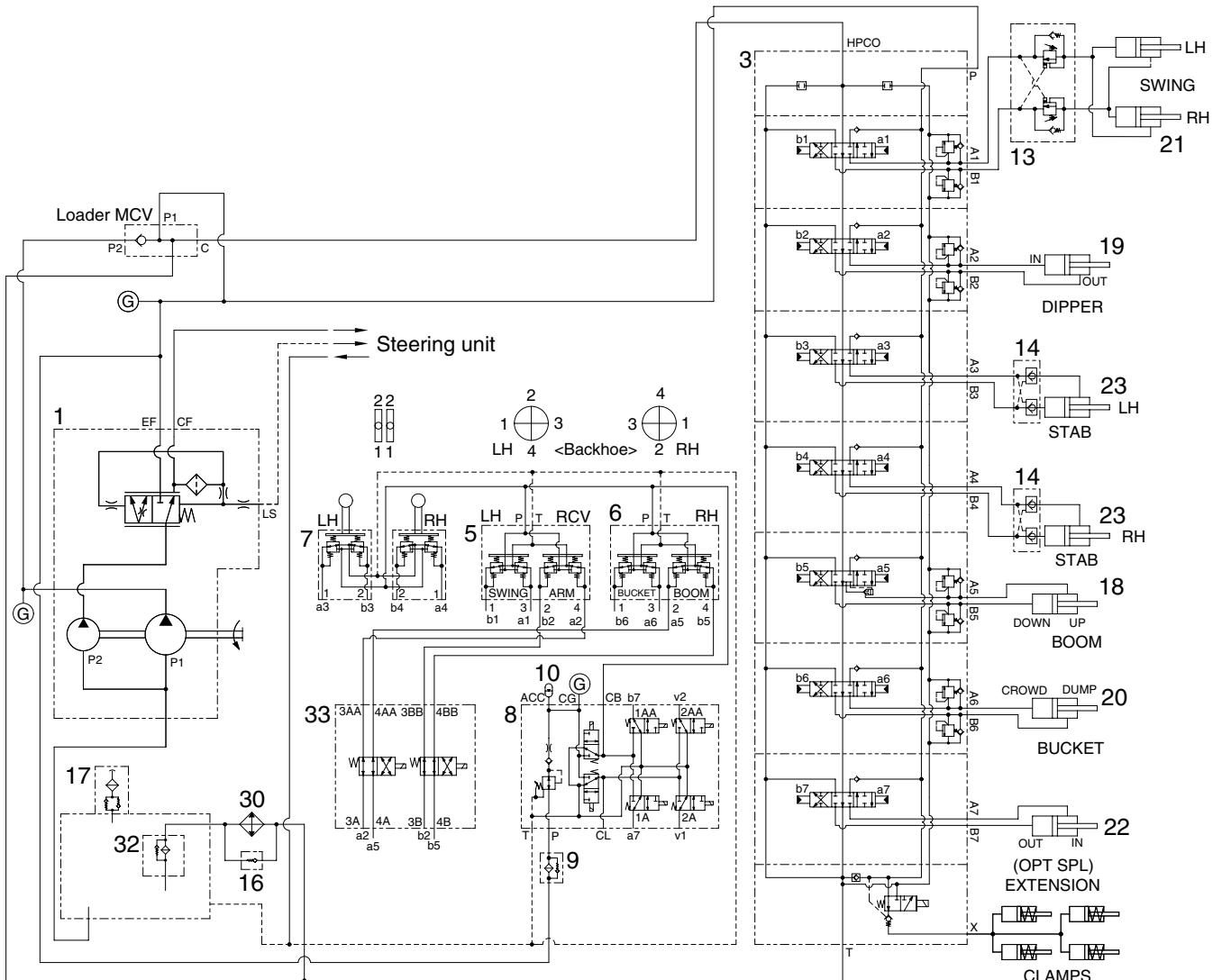
6) RIDE CONTROL FUNCTION (OPTION)



H940S4WS6WE147

- When the ride control switch is operated, the solenoids on the ride control valve (11) are energized.
- Hydraulic oil from the large chamber of boom cylinder is dead ended at the loader control valve and is connected to the accumulator. Hydraulic oil from the small chamber of boom cylinder is connected to tank to make up or dissipate oil as required.

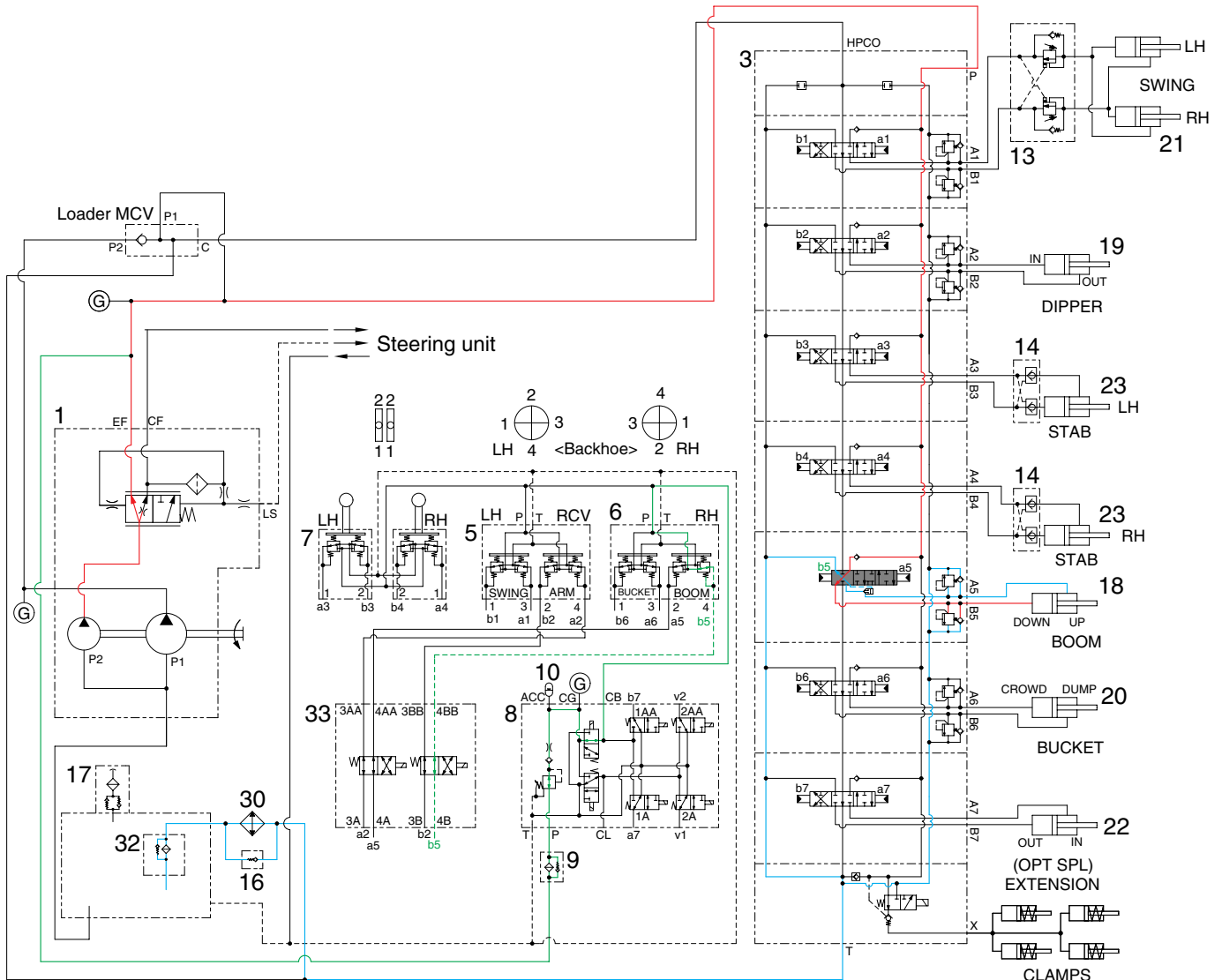
4. BACKHOE HYDRAULIC CIRCUIT (PILOT CONTROL)



H940S4WS6WE08

- | | | | | | |
|---|------------------------------|----|---------------------------|----|-------------------------------|
| 1 | Main pump | 10 | Accumulator | 21 | Swing cylinder |
| 3 | Main control valve (backhoe) | 13 | Swing damping valve (opt) | 22 | Extension cylinder (opt) |
| 5 | Remote control valve-LH | 14 | Double pilot check valve | 23 | Stabilizer cylinder-RH |
| 6 | Remote control valve-RH | 16 | By-pass check valve | 24 | Stabilizer cylinder-LH |
| 7 | Stabilizer lever | 17 | Air breather | 30 | Oil cooler |
| 8 | Pilot supply unit | 18 | Boom cylinder | 32 | Return filter |
| | 5- cartridge sol valve (opt) | 19 | Dipper cylinder | 33 | Pattern exchanger valve (opt) |
| 9 | Line filter | 20 | Bucket cylinder | Ⓒ | Gauge port |

1) BOOM UP OPERATION

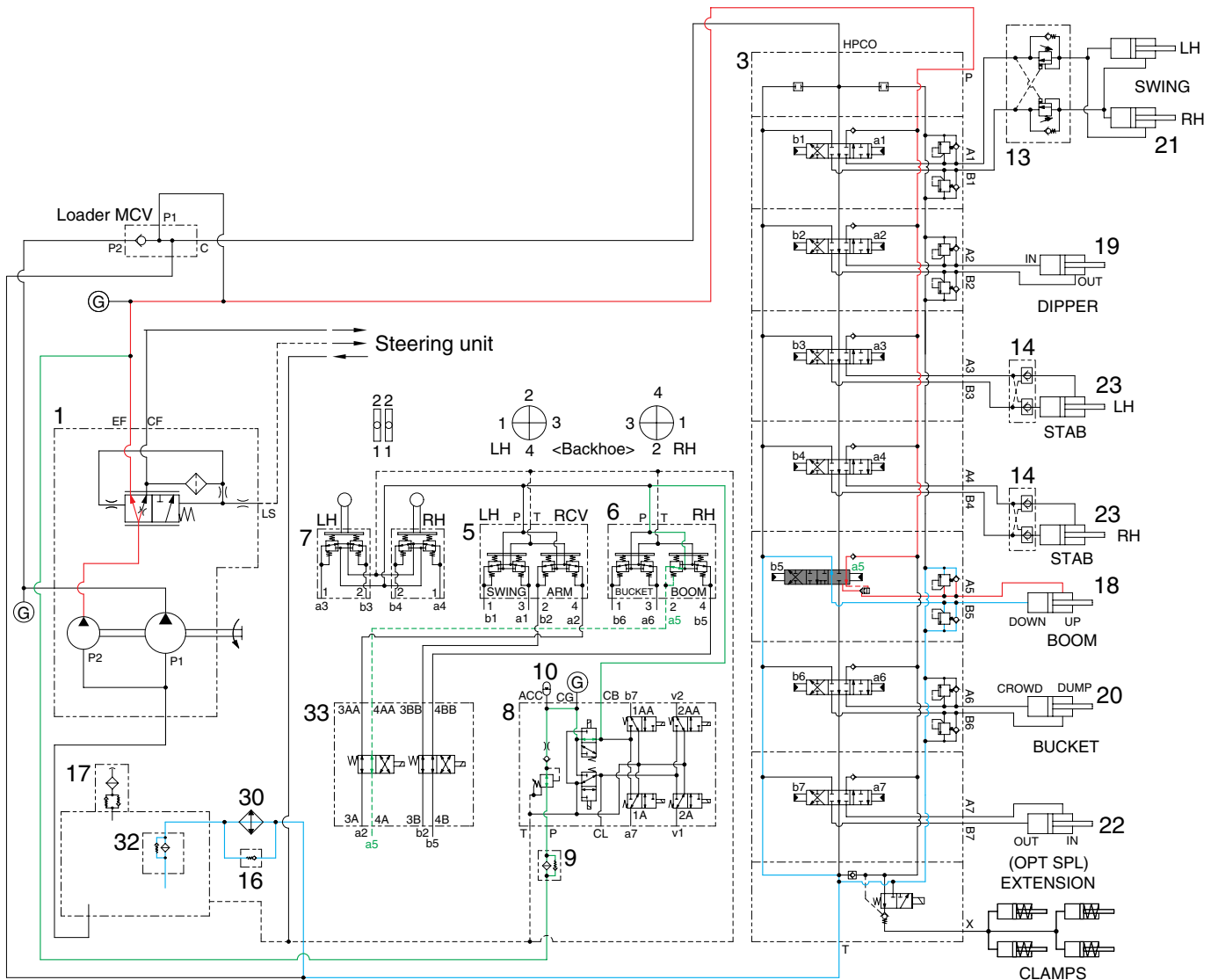


H940S4WS6WE09

When the backhoe right control lever is pulled back, the boom spool in the main control valve (3) is moved to the up position by the pilot oil pressure from the remote control valve (6).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder rod end circuit is prevented by relief valve.

2) BOOM DOWN OPERATION



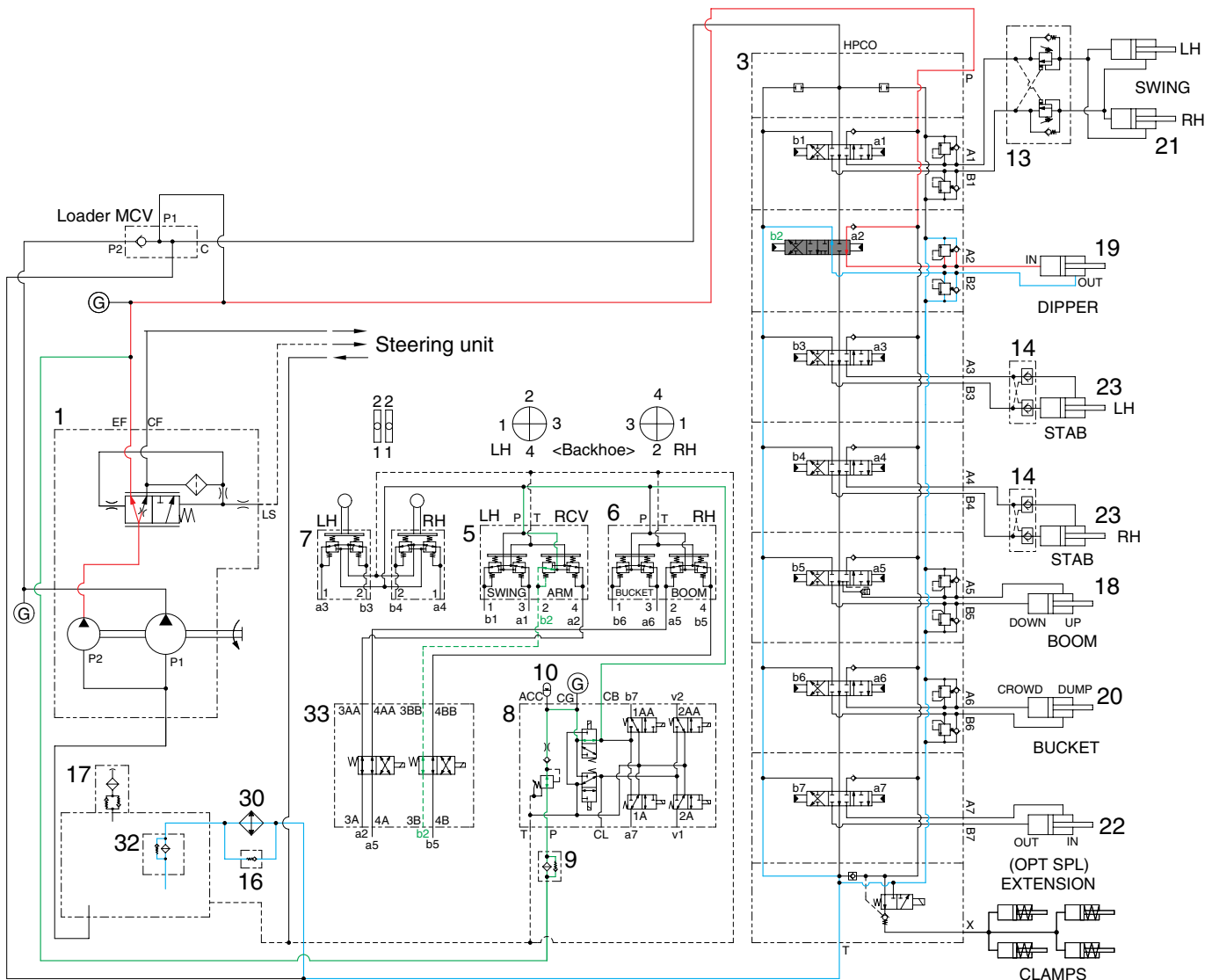
H940S4WS6WE10

When the backhoe right control lever is pushed forward, the boom spool in the main control valve (3) is moved to the down position by the pilot oil pressure from the remote control valve (6).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic tank through the boom spool in the main control valve.

The excessive pressure in the boom cylinder bottom end circuit is prevented by the relief valve.

3) DIPPER ROLL IN OPERATION



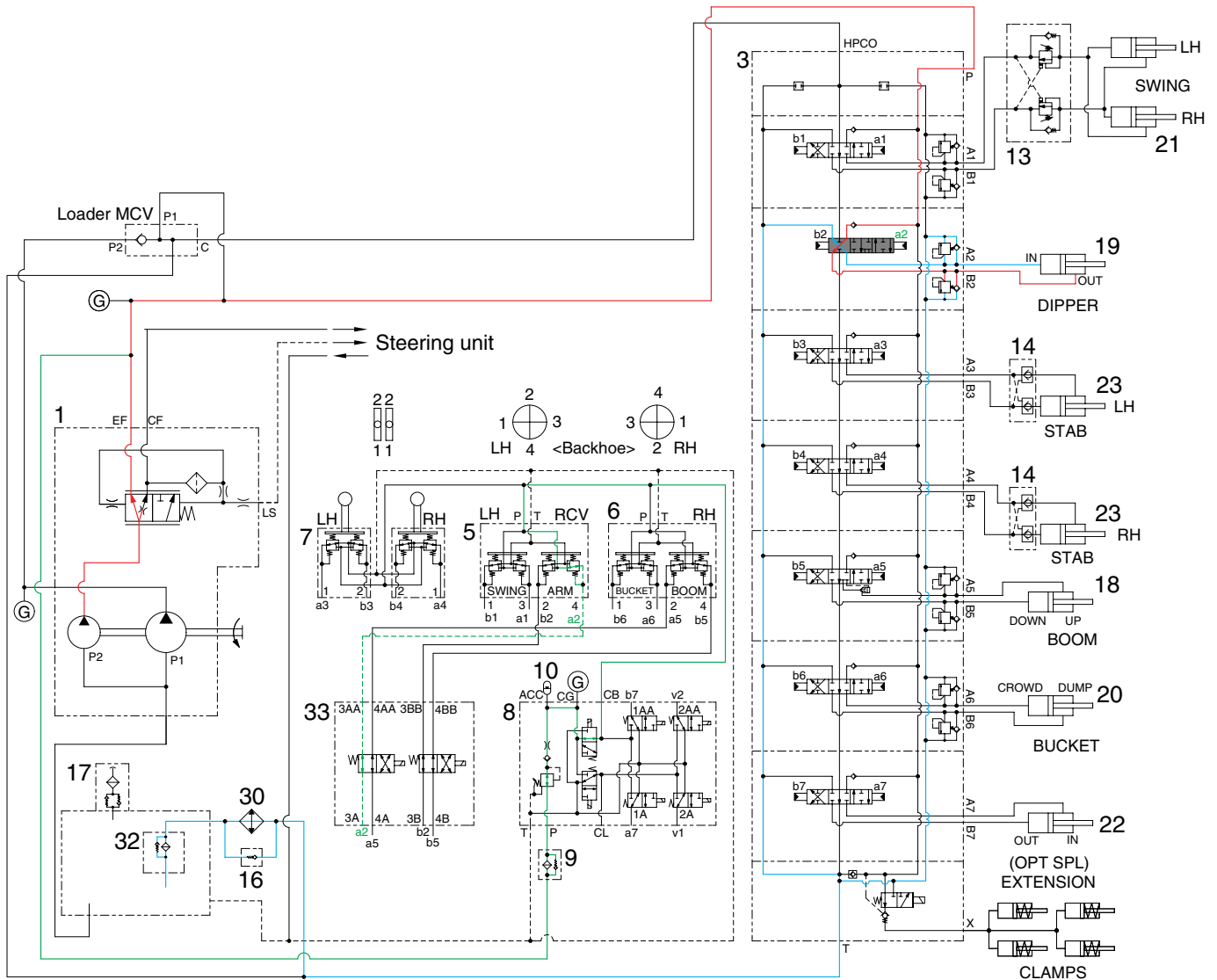
H940S4WS6WE11

When the backhoe left control lever is pulled back, the dipper spool in the main control valve (3) is moved to the roll in position by the pilot oil pressure from the remote control valve (5).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the large chamber of dipper cylinder.

At the same time, the oil from small chamber of dipper cylinder returns to the hydraulic oil tank through the dipper spool in the main control valve. When this happens, the dipper rolls in.

4) DIPPER ROLL OUT OPERATION



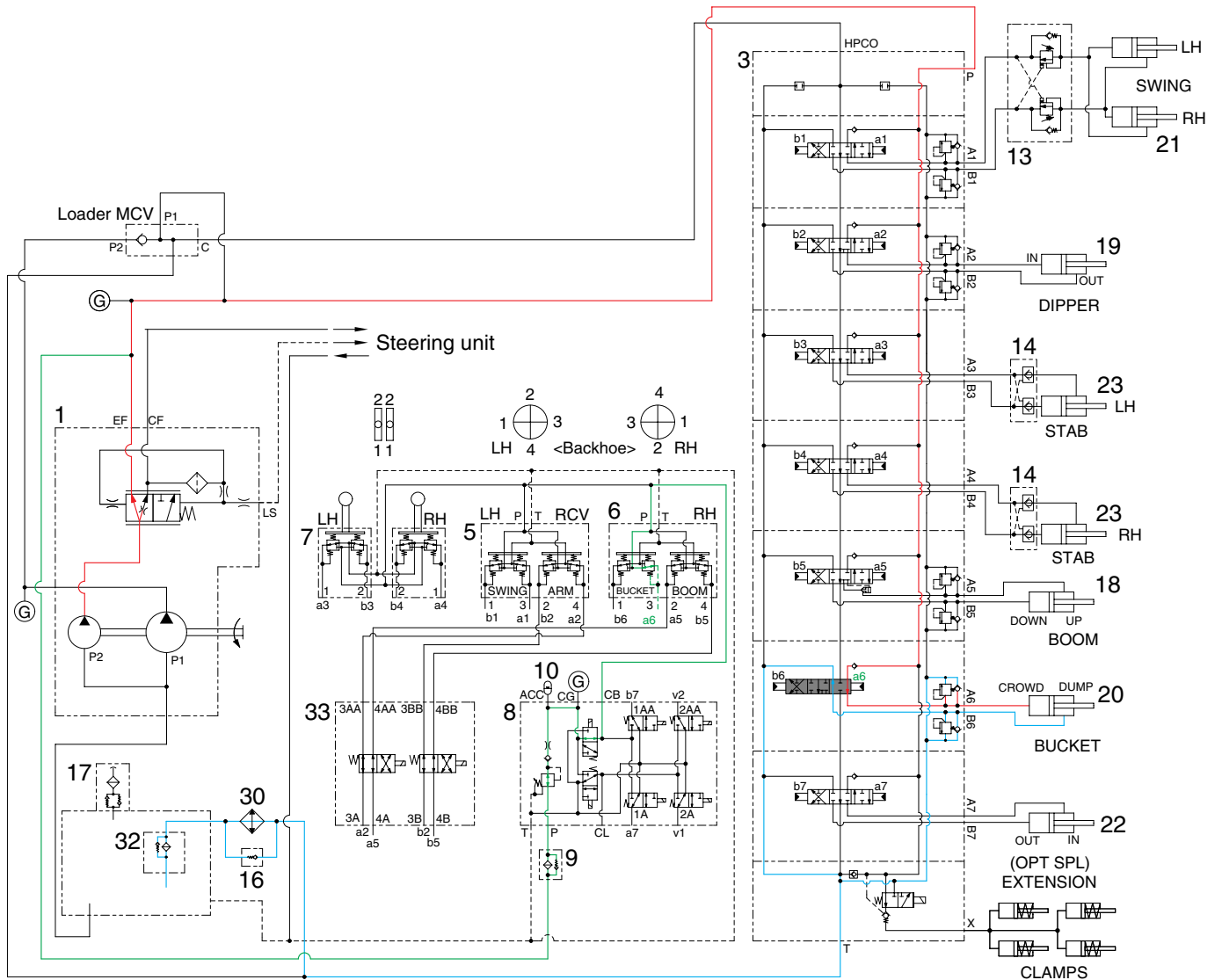
H940S4WS6WE12

When the backhoe left control lever is pushed forward, the dipper spool in the main control valve (3) is moved to the roll out position by the pilot oil pressure from the remote control valve (5).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the small chamber of dipper cylinder.

At the same time, the oil from the large chamber of dipper cylinder returns to the hydraulic oil tank through the dipper spool in the main control valve. When this happens, the dipper rolls out.

5) BUCKET CROWD OPERATION



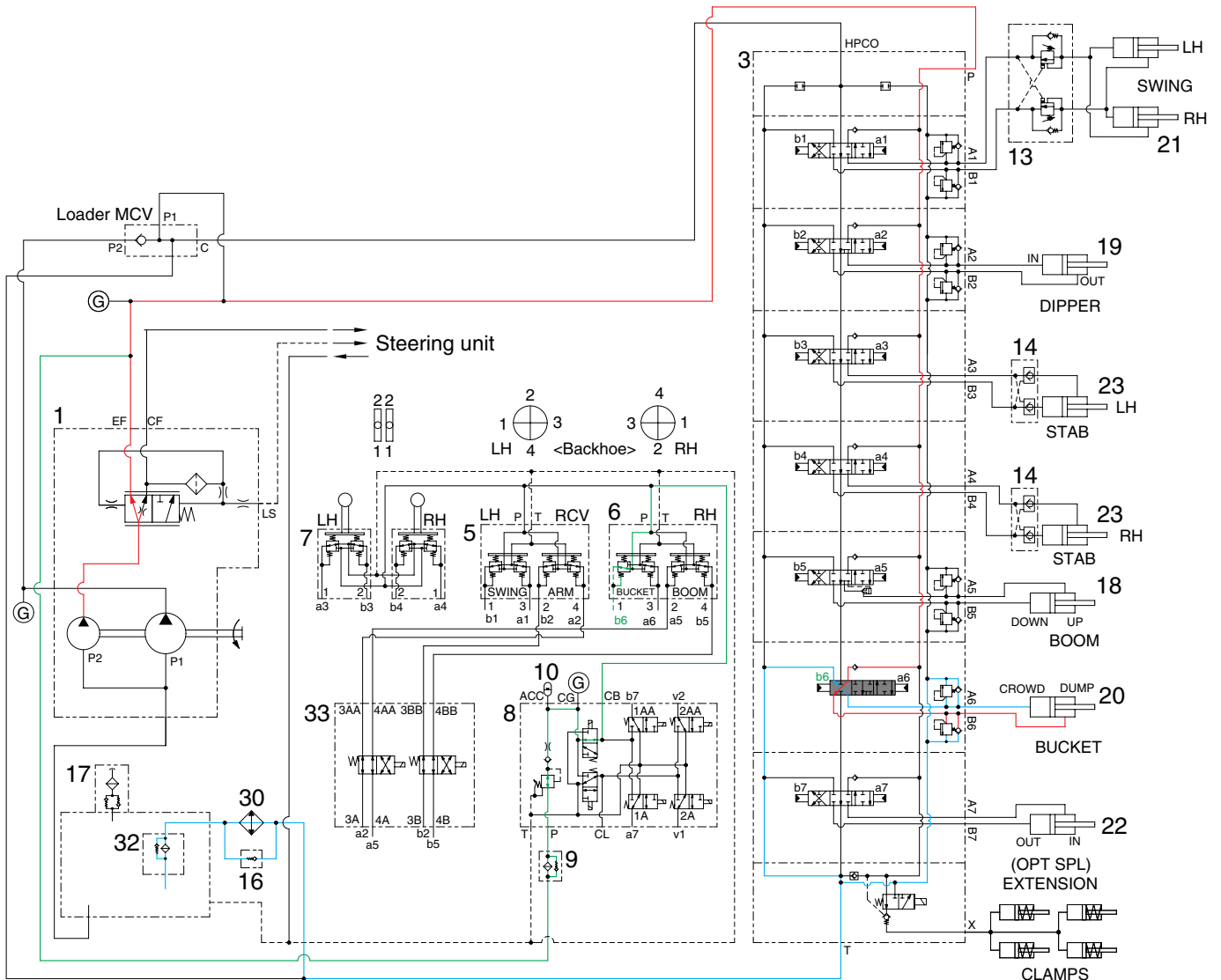
H940S4WS6WE13

When the backhoe right control lever is pulled left, the bucket spool in the main control valve (3) is moved to the crowd position by the pilot oil pressure from the remote control valve (6).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the large chamber of bucket cylinder.

At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the bucket crowd.

6) BUCKET DUMP OPERATION



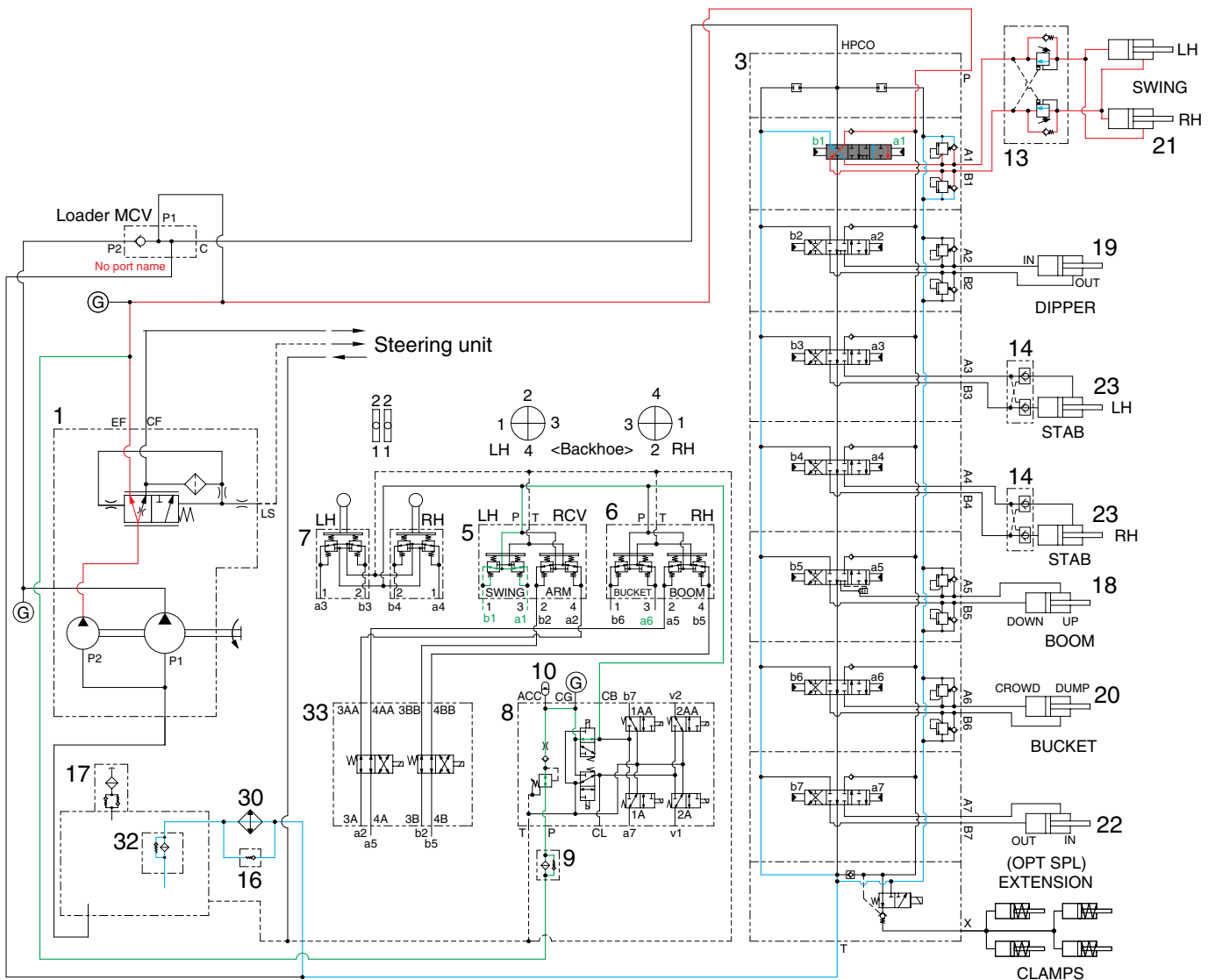
H940S4WS6WE14

When the backhoe right control lever is pushed right, the bucket spool in the main control valve (3) is moved to the dump position by the pilot oil pressure from the remote control valve (6).

The oil from the pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket dump.

7) BOOM SWING OPERATION

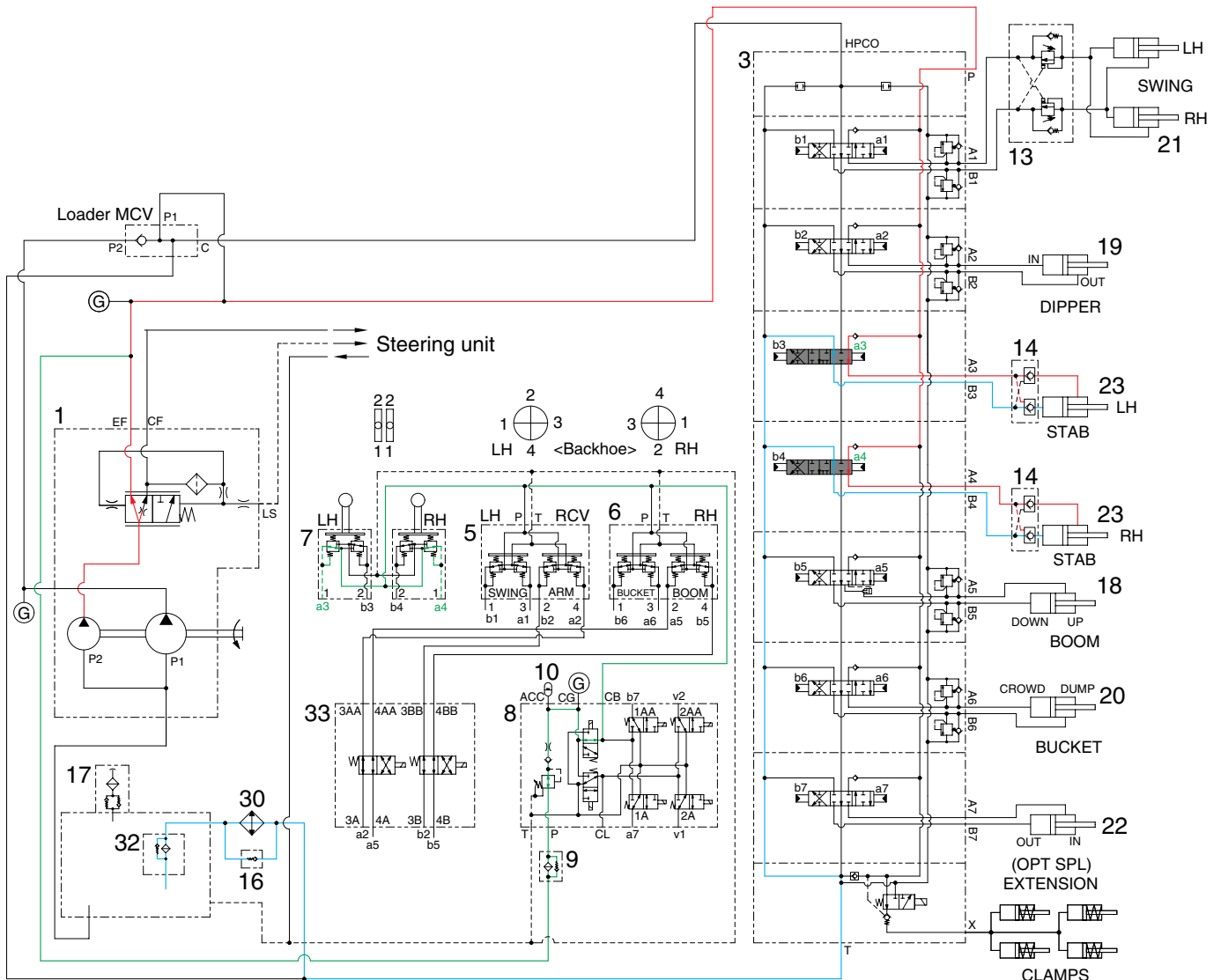


H940S4WS6WE15

When the backhoe left control lever is pushed left or right, the swing spool in the main control valve (3) is moved to the left or right swing position by the pilot oil pressure from the remote control valve (5). The oil from the pump (P1, P2) flows into the main control valve and then goes to the boom swing cylinder.

At the same time, the return oil from the boom swing cylinder returns to the hydraulic oil tank through the boom swing spool in the main control valve. When this happens, the boom swings to the left or right.

8) STABILIZER UP OPERATION



H940S4WS6WE16

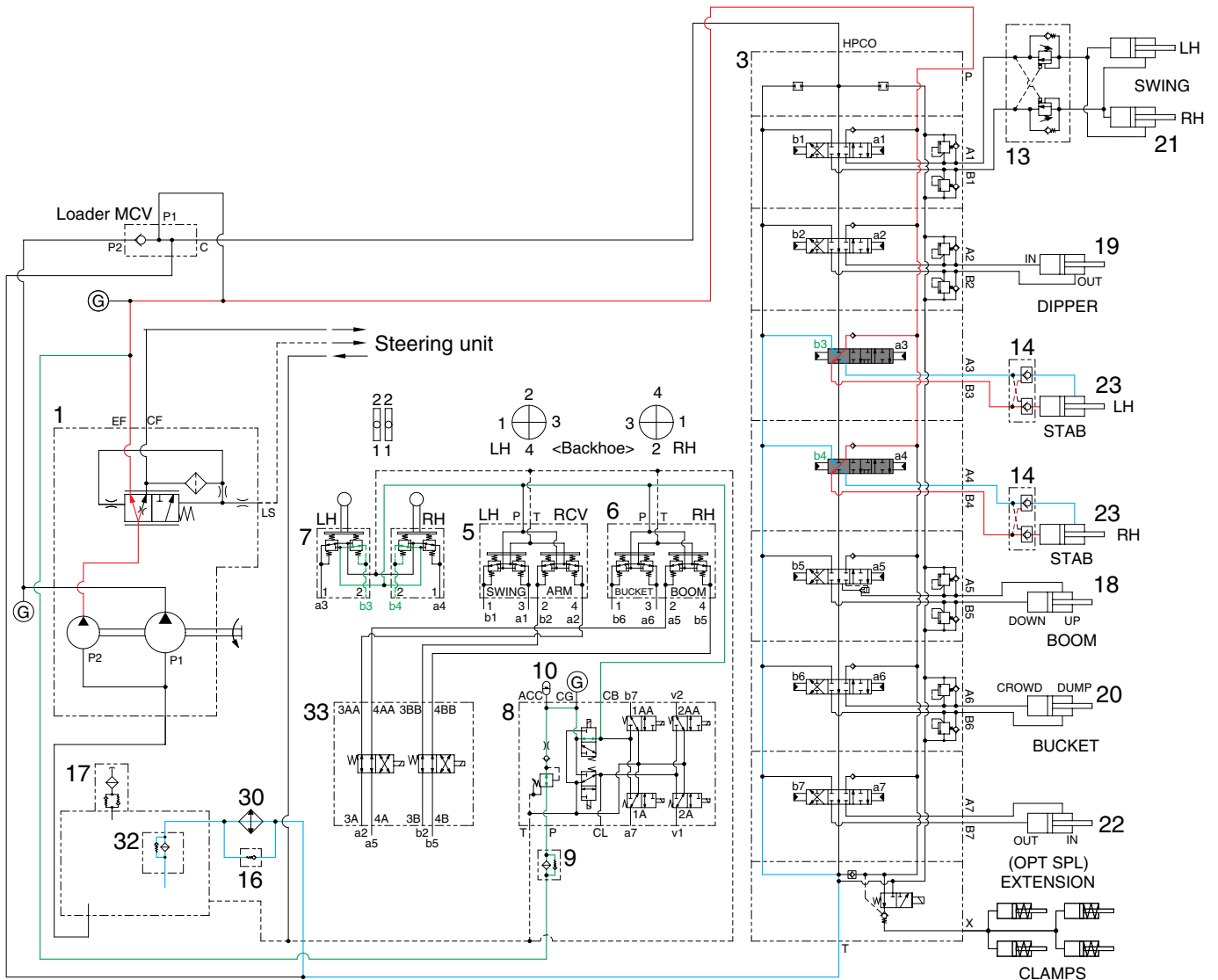
When the stabilizer control levers (7) are pulled back, the spools in the main control valve (3) are moved to the stabilizer up position by the pilot oil pressure from the remote control valve (7).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the small chambers of stabilizer cylinders.

At the same time, the oil from the large chambers of stabilizer cylinders return to the hydraulic oil tank through the spools in the main control valve. When this happens, the stabilizers go up.

Each stabilizer (LH or RH) is operated separately.

9) STABILIZER DOWN OPERATION



H940S4WS6WE17

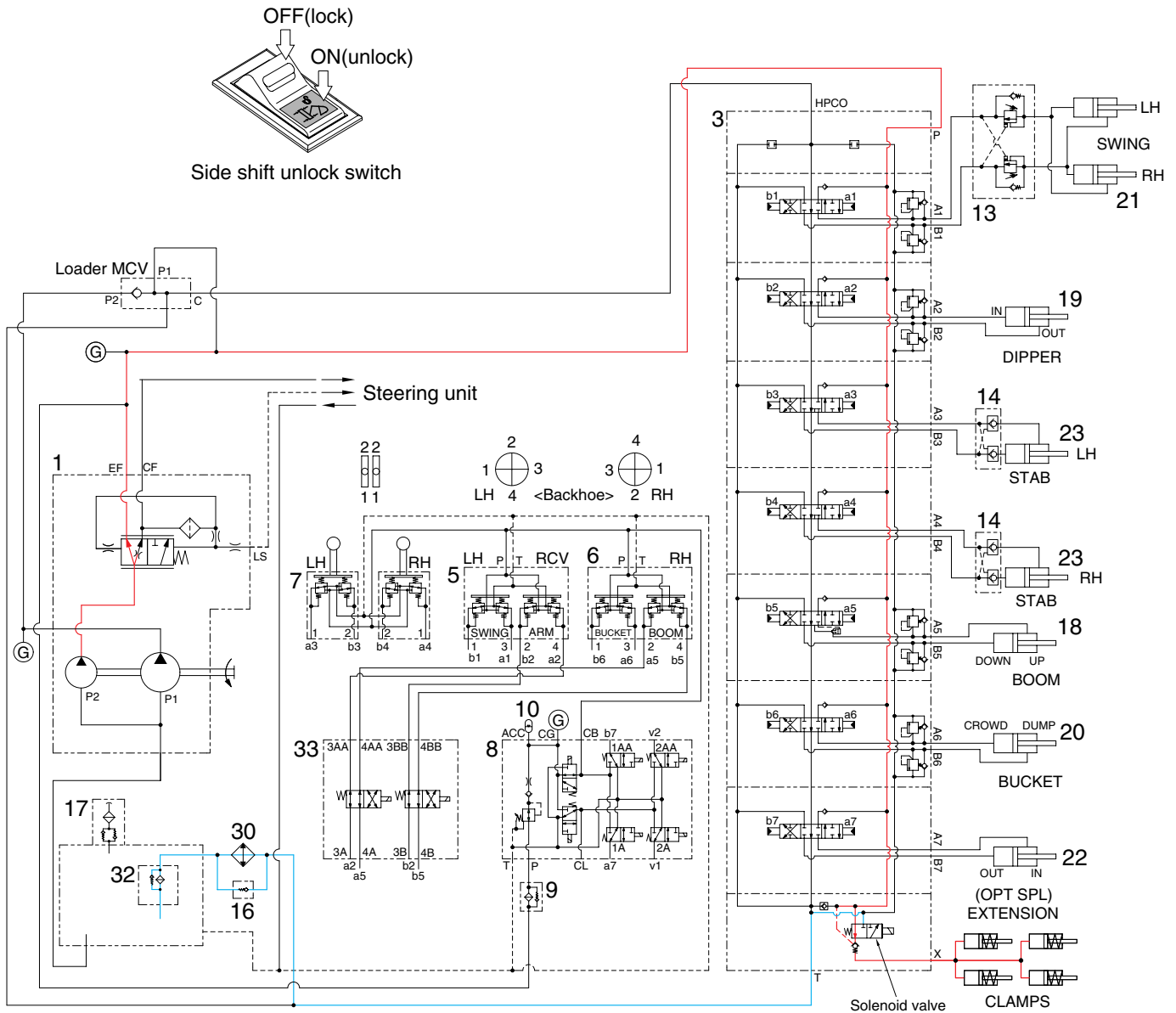
When the stabilizer control levers (7) are pushed forward, the spools in the main control valve (3) are moved to the stabilizer down position by the pilot oil pressure from the remote control valve (7).

The oil from the pump (P1, P2) flows into the main control valve and then goes to the large chambers of stabilizer cylinders.

At the same time, the oil from the small chambers of stabilizer cylinders return to the hydraulic oil tank through the spools in the main control valve. When this happens, the stabilizers go down.

Each stabilizer (LH or RH) is operated separately.

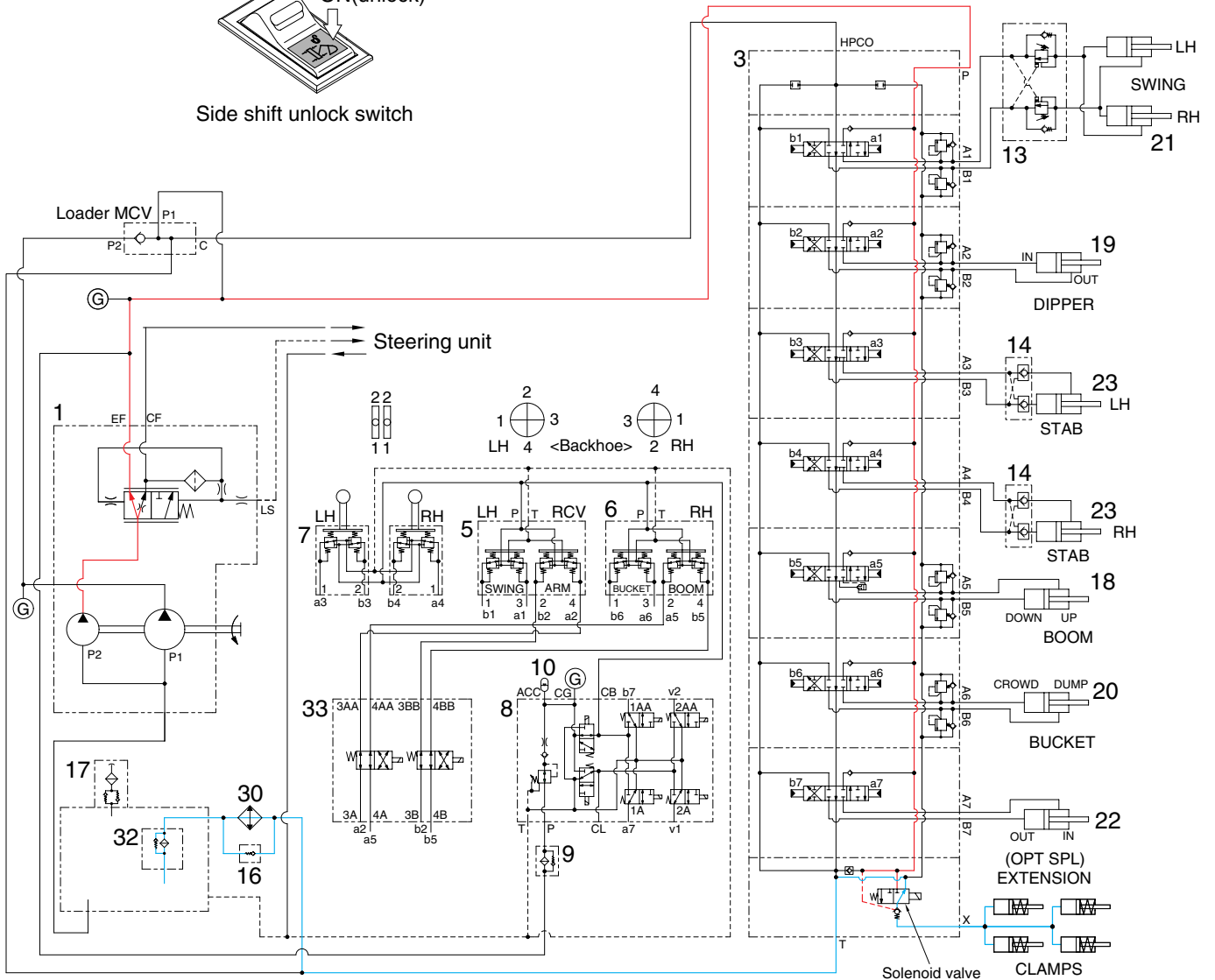
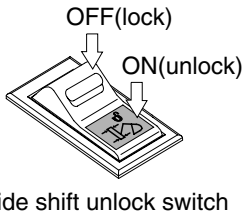
10) CLAMP LOCK OPERATION



H940S4WS6WE20

When the side shift unlock switch is in the OFF position (not pressed), the solenoid valve is deenergized. The solenoid valve opens the pressure passage to clamp cylinder. Then, the clamp is locked.

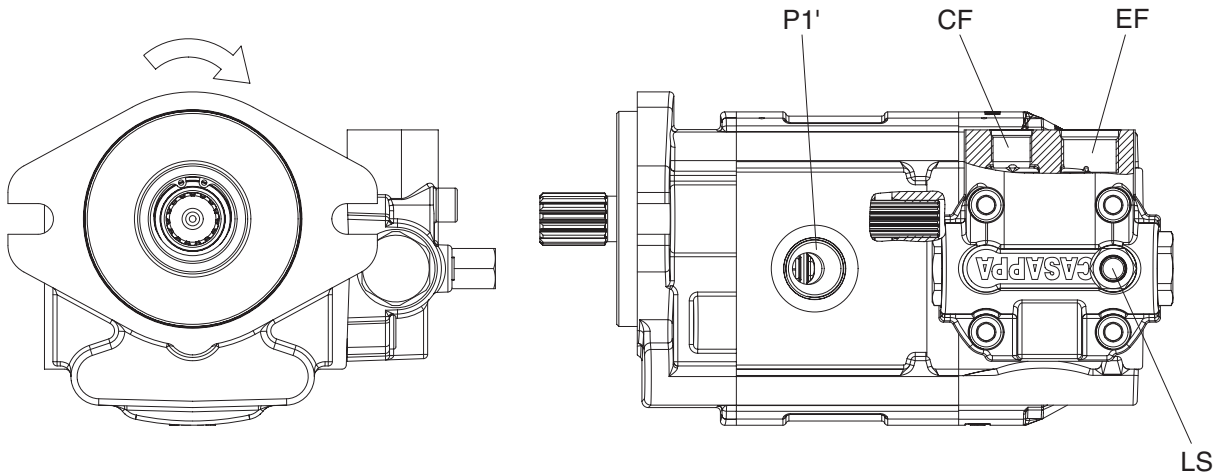
11) CLAMP RELEASE OPERATION



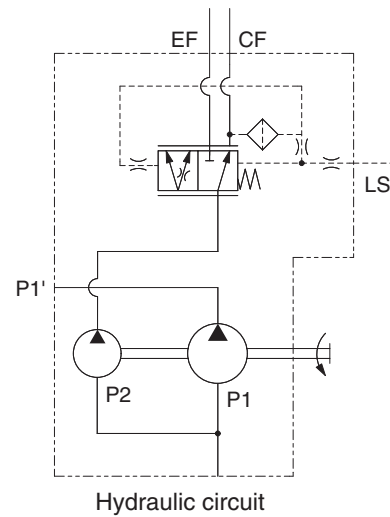
When the side shift unlock switch is in the ON position (pressed down), the solenoid valve is energized. The solenoid valve opens the clamp cylinder to the drain port (tank). Oil from the clamp cylinder is drained to the tank. Then, the clamp is unlocked.

5. MAIN PUMP

1) STRUCTURE (1/2)



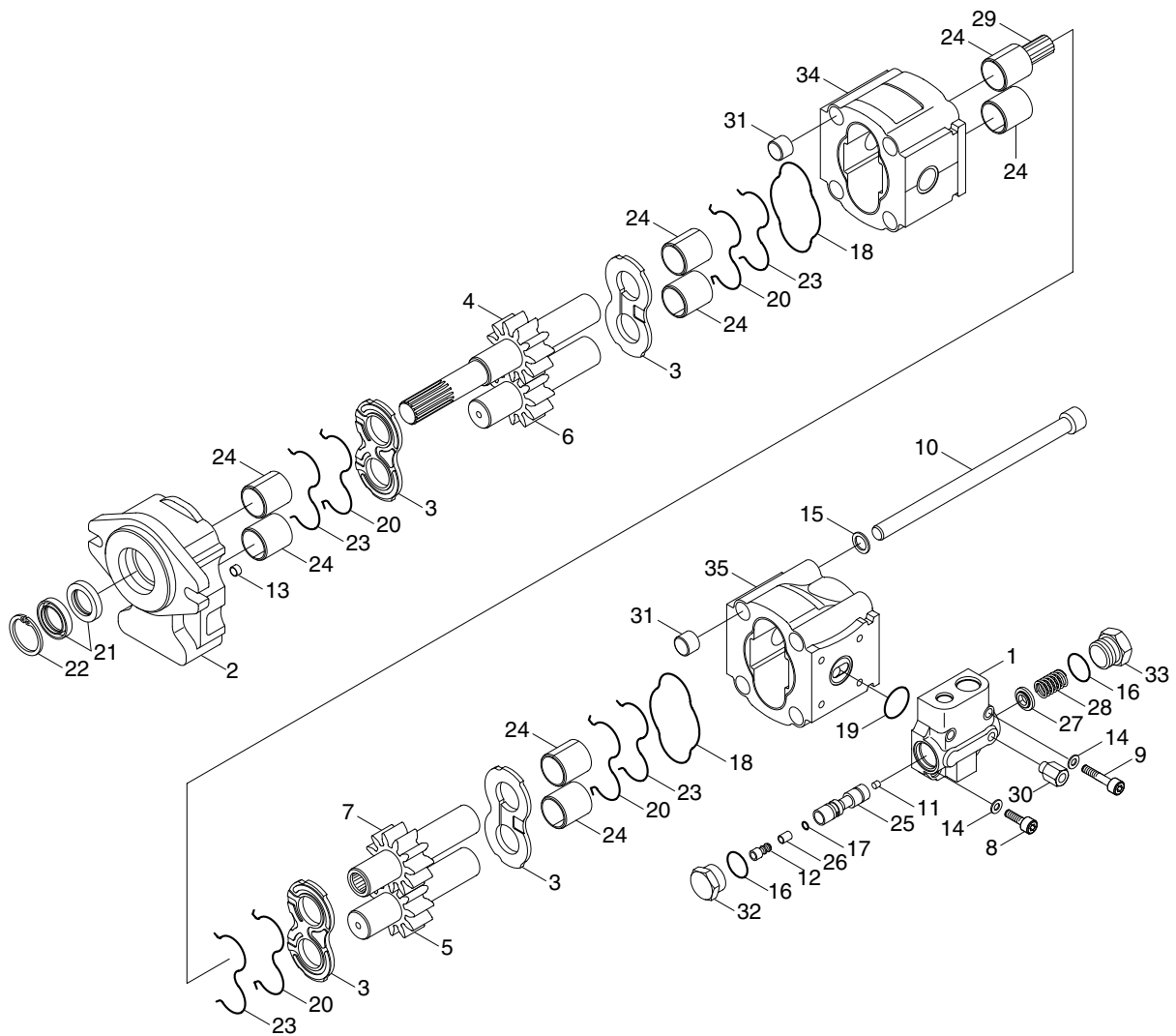
Port	Port name	Port size
DF	To steering unit	3/4-16 UNF
EF	To MCV	1-1/16-12 UN
LS	To steering unit LS port	7/16-20 UNF
P1'	To RCV lever/loader MCV	1-1/16-12 UN



H940C6WE20

Item		Specification
Type		Fixed displacement double gear pump
Capacity	P1 pump	35 cc/rev
	P2 pump	31 cc/rev
Maximum operating pressure		250 kgf/cm ² (3560 psi)
Rated oil quantity	P1 pump	69 l /min (18.2 U.S.gpm)
	P2 pump	147 l /min (38.8 U.S.gpm)
Rated speed		2200 rpm

STRUCTURE (2/2)



H940C6WE21

- | | | | | | |
|----|----------------|----|----------------|----|---------------|
| 1 | Rear end cover | 13 | Screw | 25 | Spool |
| 2 | Front cover | 14 | Washer | 26 | Filter |
| 3 | Thrust plate | 15 | Washer | 27 | Spring seat |
| 4 | Drive shaft | 16 | O-ring seal | 28 | Spring |
| 5 | Driven gear | 17 | O-ring seal | 29 | Hub |
| 6 | Driven gear | 18 | Ring | 30 | Connector |
| 7 | Drive shaft | 19 | O-ring seal | 31 | Steel bushing |
| 8 | Screw | 20 | Seal | 32 | Plug |
| 9 | Screw | 21 | Shaft seal | 33 | Plug |
| 10 | Screw | 22 | Ring | 34 | Body |
| 11 | Screw | 23 | Ring | 35 | Body |
| 12 | Screw | 24 | Sleeve bearing | | |

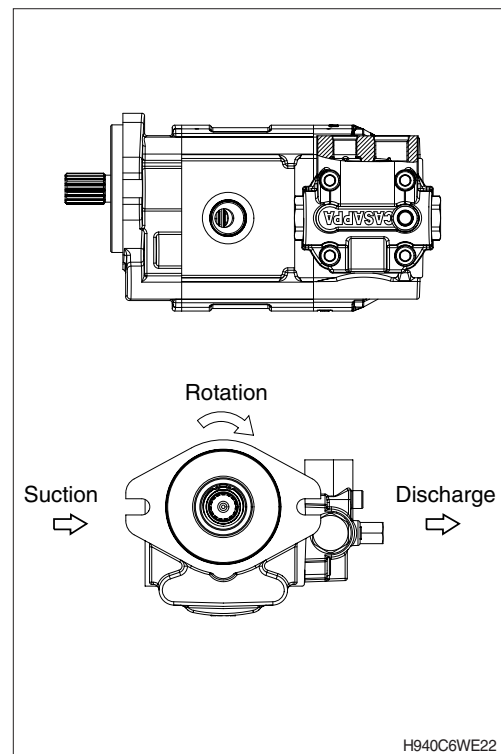
2) INSTRUCTION

Hydraulic pumps used for the work equipment hydraulic units on construction machinery are pressure loaded type gear pumps. This gear pump could run under 250 kgf/cm^2 (3560 psi) maximum.

The pressure loaded type gear pump is designed so that the clearance between the gear and the side plate can be automatically adjusted according to the delivery pressure.

Therefore, the oil leakage from the side plate is less than that in the case of the fixed side plate type under a high discharge pressure.

Consequently, no significant reduction of the pump delivery occurs, even when the pump is operated under pressure.

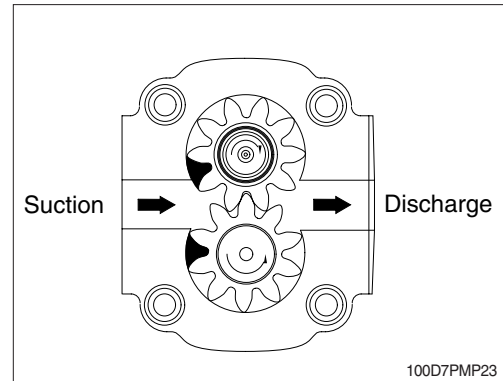


3) PRINCIPLE OF OPERATION

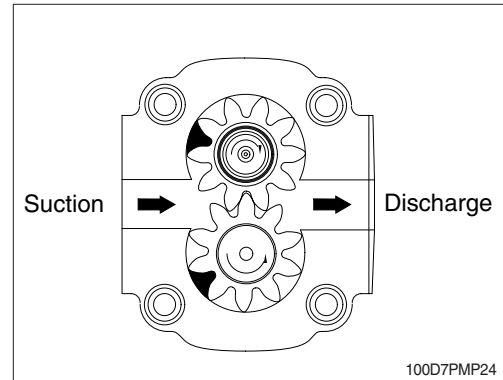
(1) Mechanism for delivering oil

The below drawing shows the operational principle of an external gear pump on which two gears are rotation in mesh.

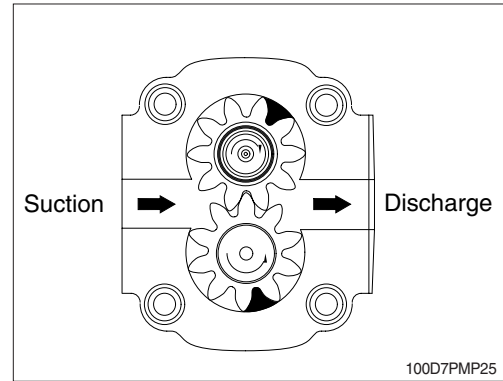
The oil entering through the suction port is trapped in the space between two gear teeth, and is delivered to the discharge port as the gear rotates.



Except for the oil at the above of the gear teeth, is trapped between the gears teeth, the oil trapped between the gear teeth, is prevented from returning to the suction side with the gears in mesh.

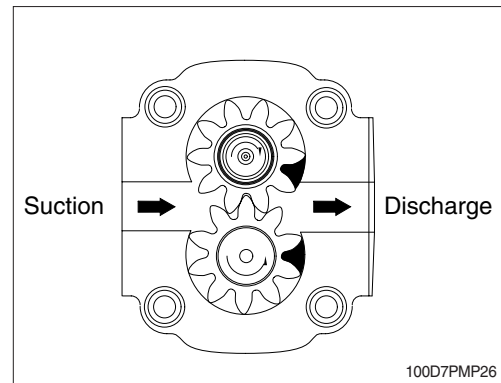


Since the gears are constantly delivering oil, the oil delivered to the discharge port is forced out of the port. The amount of discharge increases with the rotation speed of the gear.



If there is no resistance in the oil passage into which the discharged oil flows, the oil merely flows through the passage, producing no increase in pressure.

If however, the oil passage is blocked with something like a hydraulic cylinder, there will be no other place for the oil to flow, so the oil pressure will rise. But the pressure which rises in this way never to higher, once the hydraulic cylinder piston starts moving because of the oil pressure. As described earlier, the pump produces the oil flow, but not the oil pressure. We can therefore conclude that pressure is a consequence of load. In other words, the pressure depends on a counterpart.



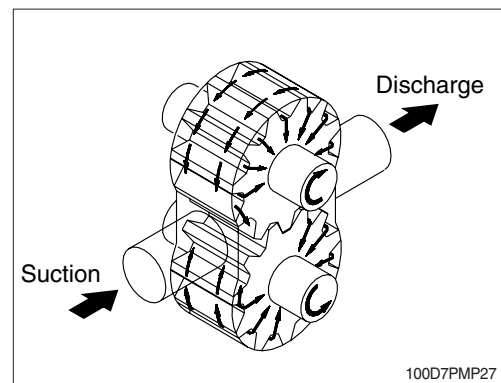
(2) Internal oil leakage

Oil leaks from a place under higher pressure to place under lower pressure, provided that a gap or a clearance exists in between.

In the gear pump, small clearances are provided between the gear and the case and between the gear and the side plate to allow the oil to leak out and to serve as a lubricant so that the pump will be protected from seizure and binding.

The drawing shows how the leaked oil flows in the pump. As such, there is always oil leakage in the pump from the discharge side (under higher pressure) to the suction side. The delivery of the pump is reduced by an amount equal to the pump discharge.

In addition, the delivery of the pump will also decrease as the amount of oil leakage increases because of expanded radial clearance resulting from the wear of pump parts, the lower oil viscosity resulting from increases in the oil temperature, and the initial use of low viscosity oil.



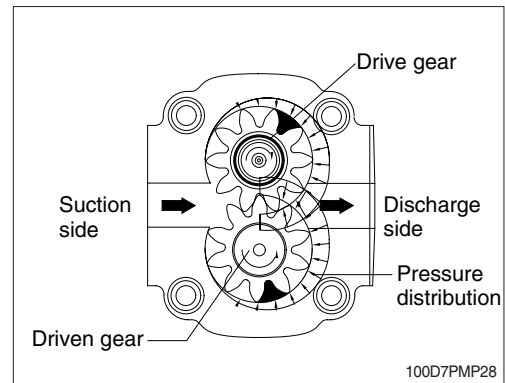
(3) Forces acting on the gear

The gear, whose outer surface is subjected to oil pressure, receives force jointing towards its center. Due to the action of the delivery pressure, the oil pressure in higher on the delivery side of the pump, and due to suction pressure, is lower on the suction side.

In the intermediate section, the pressure will gradually lower as the position moves from the delivery side to the suction side. This phenomenon is shown in the drawing(refer to right figure).

In addition, the gears in mesh will receive interacting forces. These forces pushing the gears toward the suction side are received by the bearings. Since the gears are pressed toward the suction side by these forces, the radial clearance becomes smaller on the suction side in the case. In some pumps, the clearance may become zero, thus allowing the gear teeth and the case to come into light contact.

For this reason, and excessive increase in the delivery pressure must be avoided, since it will produce a large force which will act on the gears, placing an overload on the bearings, and resulting on a shortened service life of the bearing or interference of the gear with the case.



4) GENERAL REFERENCE

(1) Installation

The direction of rotation of single-rotation pumps must be the same as that of the drive shaft. Check that the coupling flange correctly aligns the transmission shaft and the pump shaft. Flexible couplings should be used (never rigid fittings) which will not generate an axial or radial load on the pump shaft.

(2) Starting up

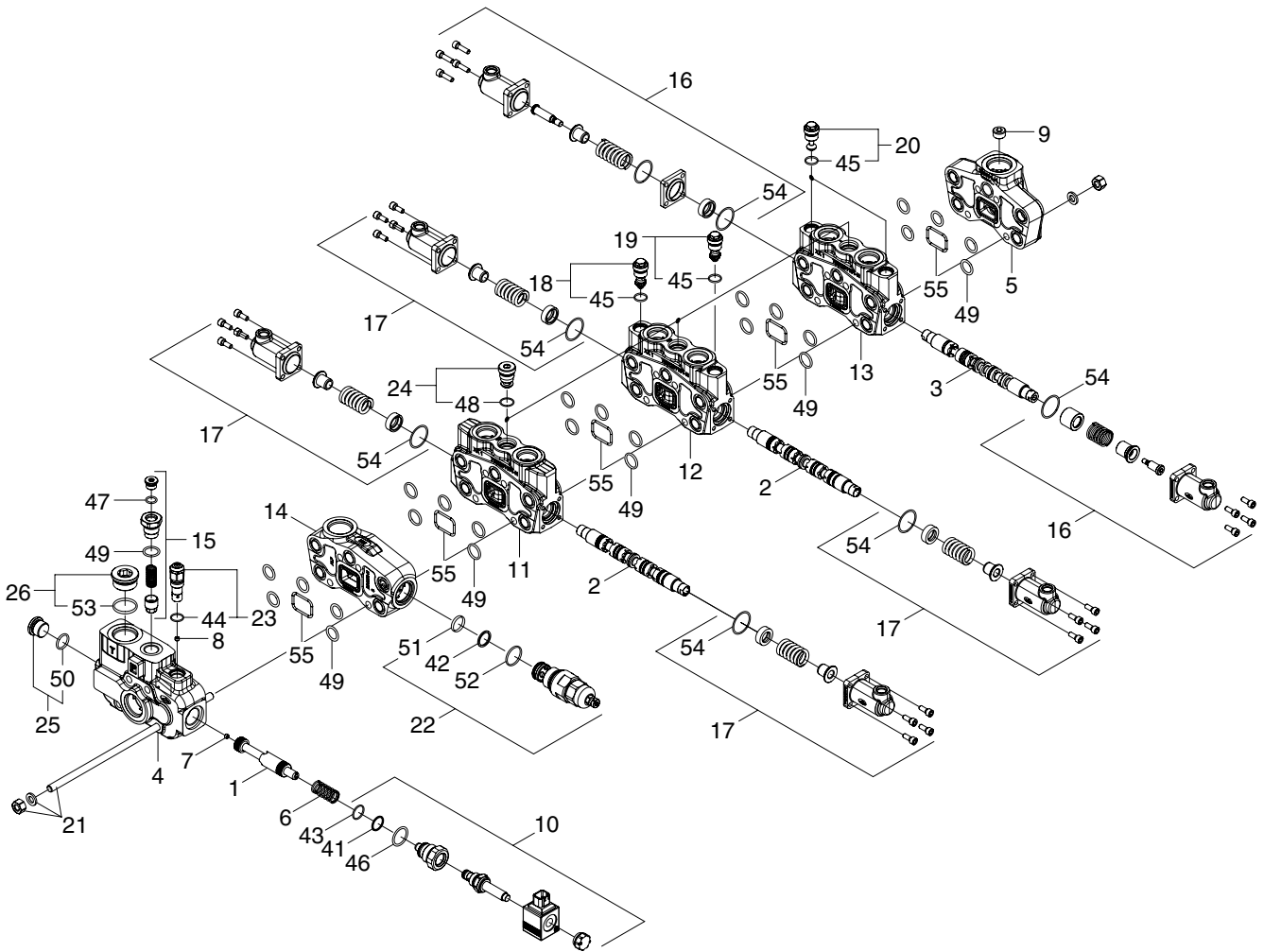
Check that all circuit connections are tight and that entire system is completely clean. Insert the oil in the tank, using a filter. Bleed the circuit assist on filling. Set the pressure relief valves to the lowest possible setting. Turn on the system for a few moments at minimum speed, then bleed the circuit again and check the level of oil in the tank. In the difference between pump temperature and fluid temperature exceeds 10°C, rapidly switch the system on and off to heat it up gradually. Then gradually increase the pressure and speed of rotation until the pre-set operating levels as specified in the catalogue are attained.

(3) Periodical checks-maintenance

Keep the outside surface clean especially in the area of the drive shaft seal. In fact, abrasive power can accelerate wear on the seal and cause leakage. Replace filters regularly to keep the fluid clean. The oil level must be checked and oil replaced periodically depending on the system's operating conditions.

6. LOADER MAIN CONTROL VALVE

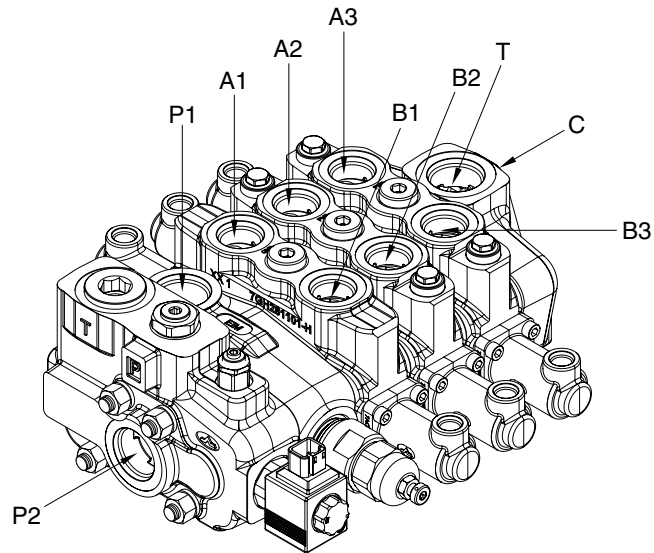
1) STRUCTURE (1/2)



H930ST6WE36

1	Unloader spool	12	Element kit	22	Valve	46	Seal
2	Spool	13	Element kit	23	Cartridge	47	O-ring
3	Spool	14	P1 block kit	24	Kit	48	O-ring
4	Inlet cover	15	Plug kit	25	Plug	49	O-ring
5	Outlet cover	16	Side cap kit	26	Plug	50	O-ring
6	Spring	17	Side cap kit	41	O-ring	51	O-ring
7	Screw	18	Valve	42	Seal	52	Seal
8	Screw	19	Valve	43	O-ring	53	O-ring
9	Conical plug	20	Valve kit	44	O-ring	54	O-ring
10	Valve kit	21	Tie rod kit	45	O-ring	55	O-ring
11	Element kit						

STRUCTURE (2/2)

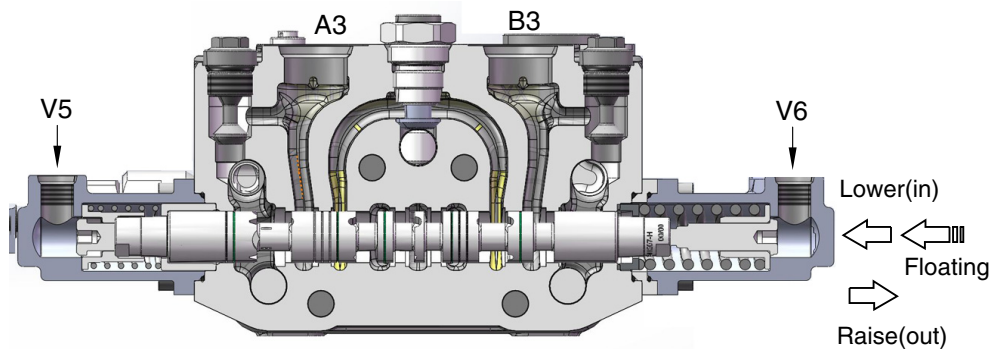
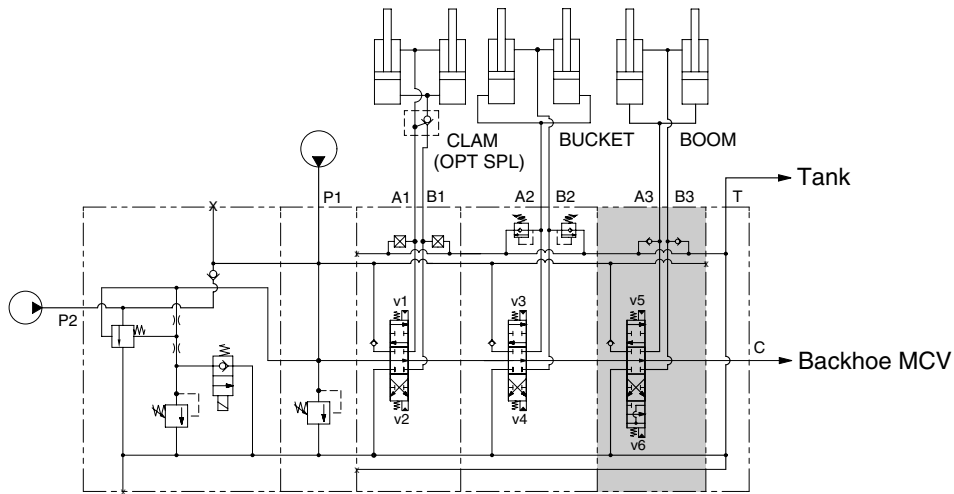


H930ST6WE41

Port	Port name	Port size
P1	From main pump	1 5/16"-12UN
P2	From main pump	1 5/16"-12UN
T	To tank (drain)	1 5/16"-12UN
C	To MCV (backhoe)	1 5/16"-12UN
A1, B1	Auxiliary port	1 1/16"-12UN
A2, B2	Bucket cylinder port	1 1/16"-12UN
A3, B3	Boom cylinder port	1 1/16"-12UN

Item		Specification
Type		2 spool (opt : 3 spool)
Operating method		Pilot control
Main relief valve pressure		250 kgf/cm ² (3560 psi)
Unloading relief valve pressure		220 kgf/cm ² (3130 psi)
Overload relief valve pressure	Bucket out	175 kgf/cm ² (2490 psi)
	Bucket in	300 kgf/cm ² (4270 psi)

2) BOOM SECTION OPERATION



H930ST6WE42

(1) Spool in neutral

If the control lever is not operated, the oil supplied from the pump ports (P1 & P2) passes through the neutral passage of loader MCV to the backhoe MCV and then returns to the tank.

(2) Boom raise position (when the boom lever is pulled back)

When the boom spool out, the pressured oil supplied from the pumps (P1 & P2) flow through the port (A3) into boom cylinder.

The return oil from cylinder port (B3) flows into the tank via the low pressure passage.

(3) Boom lower position (when the boom lever is pushed)

When the boom spool in, the pressured oil supplied from the pumps (P1 & P2) flow through the port (B3) into boom cylinder.

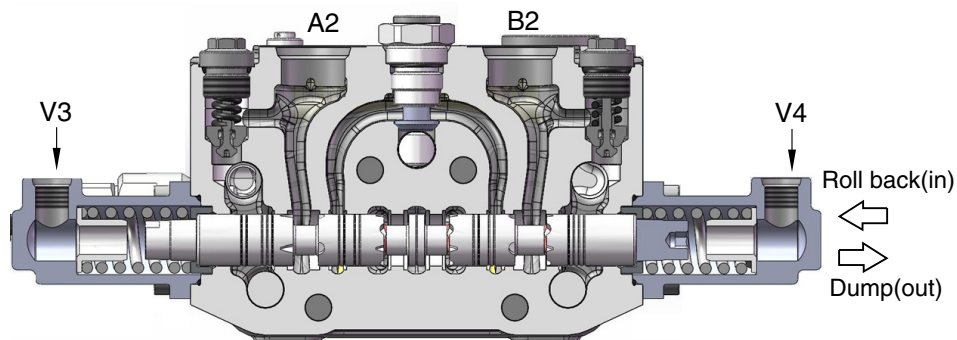
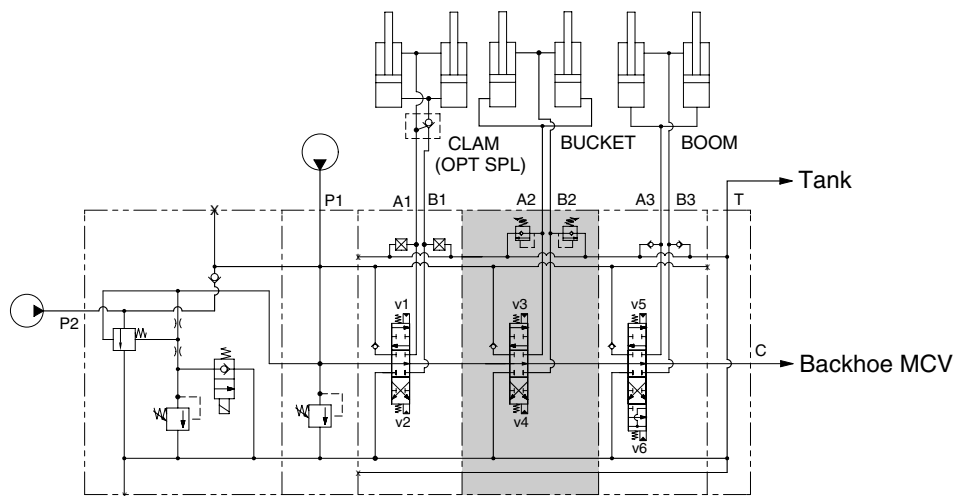
The return oil from cylinder port (A3) flows into the tank via the low pressure passage.

(4) Boom float position (when the boom lever is in the float position)

When the boom spool in 4th position, the pressured oil supplied from the pumps (P1 & P2) flow through the neutral passage of loader MCV to the backhoe MCV and then returns to the tank.

The return oil from cylinder port (A3 & B3) flows into the tank via the low pressure passage.

3) BUCKET SECTION OPERATION



H930ST6WE43

(1) Spool in neutral

If the control lever is not operated, the oil supplied from the pump ports (P1 & P2) passes through the neutral passage of loader MCV to the backhoe MCV and then returns to the tank.

(2) Bucket roll back position (when moving the control lever to your left)

When the bucket spool in, the pressured oil supplied from the pumps (P1 & P2) flow through the port (B2) into bucket cylinder.

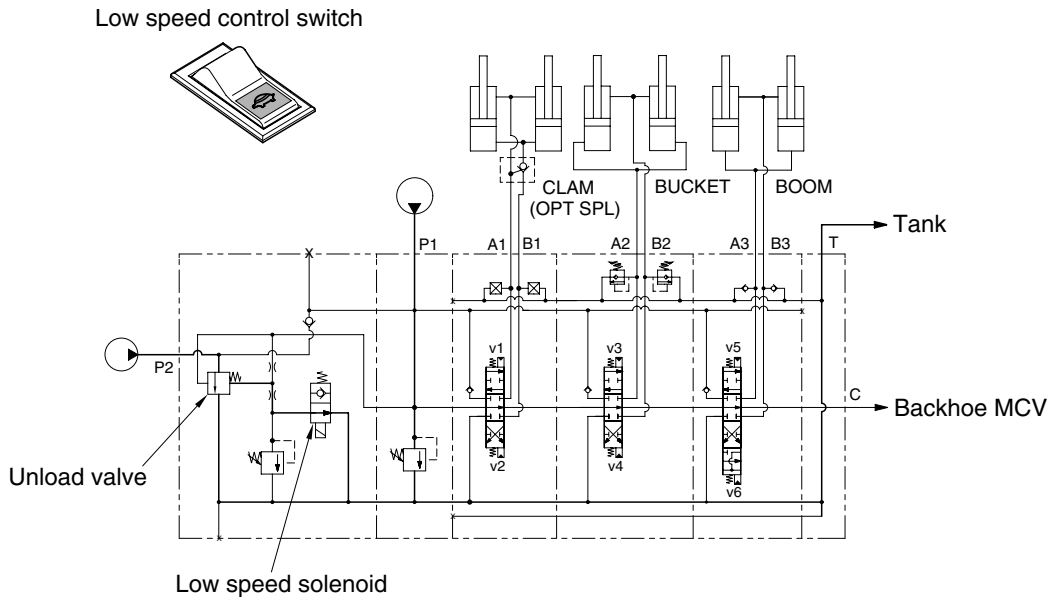
The return oil from cylinder port (A2) flows into the tank via the low pressure passage.

(3) Bucket dump position (when moving the control lever to your right)

When the bucket spool out, the pressured oil supplied from the pumps (P1 & P2) flow through the port (A2) into bucket cylinder.

The return oil from cylinder port (B2) flows into the tank via the low pressure passage.

4) INLET SECTION WITH UNLOAD OPERATION



H930ST6WE40

(1) Switch in neutral

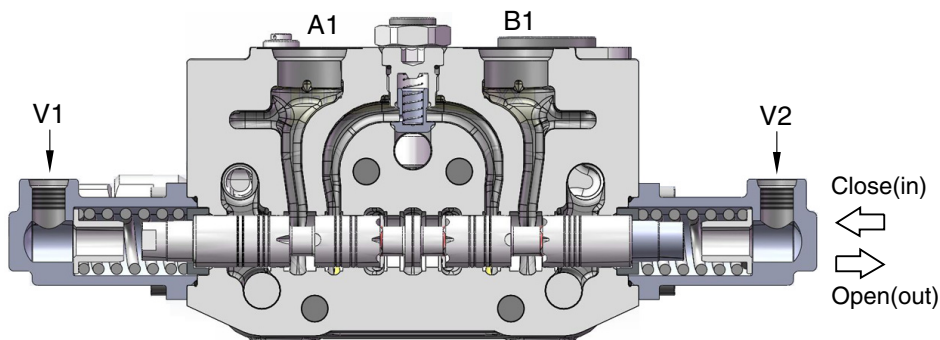
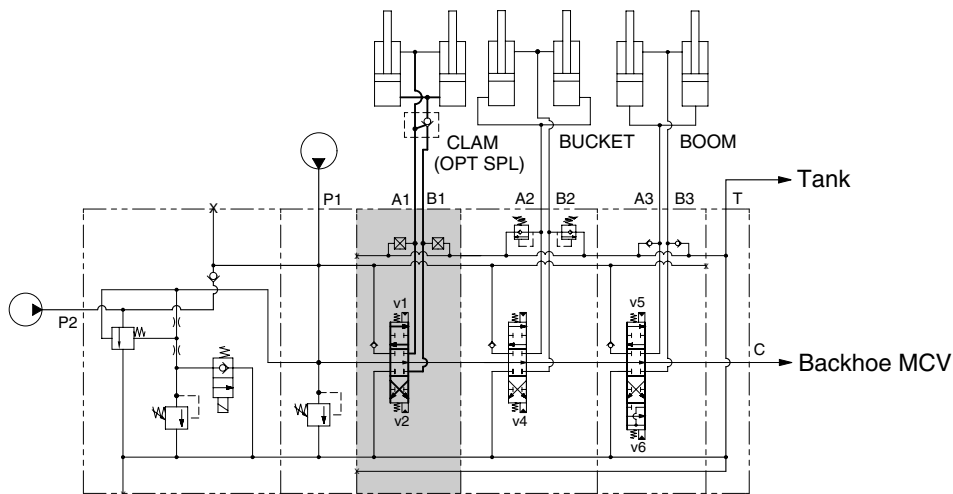
If the low speed control switch at the side console is not operated, the oil supplied from the pump ports (P1 & P2) is joined and passes through the neutral passage of loader MCV to the backhoe MCV and then returns to the tank.

(2) Unloading position (when pushed the switch)

If the switch at the side console is operated, the oil supplied from the pump port (P1) passes through the neutral passage of loader MCV to work port.

On the other hand, the oil supplied from the pump port (P2) passes through the unload valve in inlet section returns to the tank.

5) AUXILIARY SECTION OPERATION (CLAM, OPTION)



H930ST6WE45

(1) Spool in neutral

If the control lever is not operated, the oil supplied from the pump ports (P1 & P2) passes through the neutral passage of loader MCV to the backhoe MCV and then returns to the tank.

(2) Clam open position (when the clam lever is pushed)

When the clam spool out, the pressured oil supplied from the pumps (P1 & P2) flow through the port (A1) into clam cylinder.

The return oil from cylinder port (B1) flows into the tank via the low pressure passage.

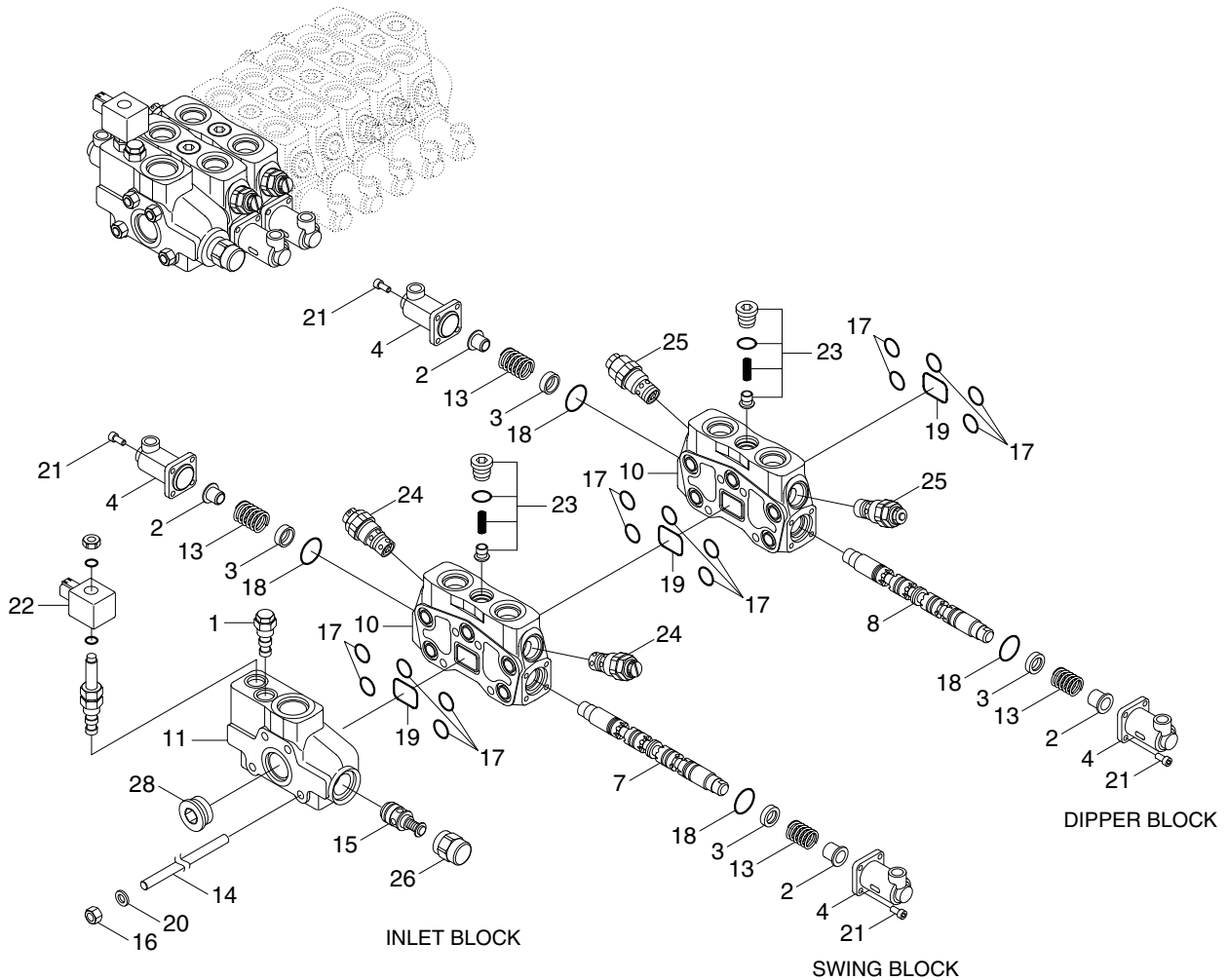
(3) Clam close position (when the clam lever is pulled back)

When the clam spool in, the pressured oil supplied from the pumps (P1 & P2) flow through the cylinder port (B1) into clam cylinder.

The return oil from cylinder port (A1) flows into the tank via the low pressure passage.

7. BACKHOE MAIN CONTROL VALVE

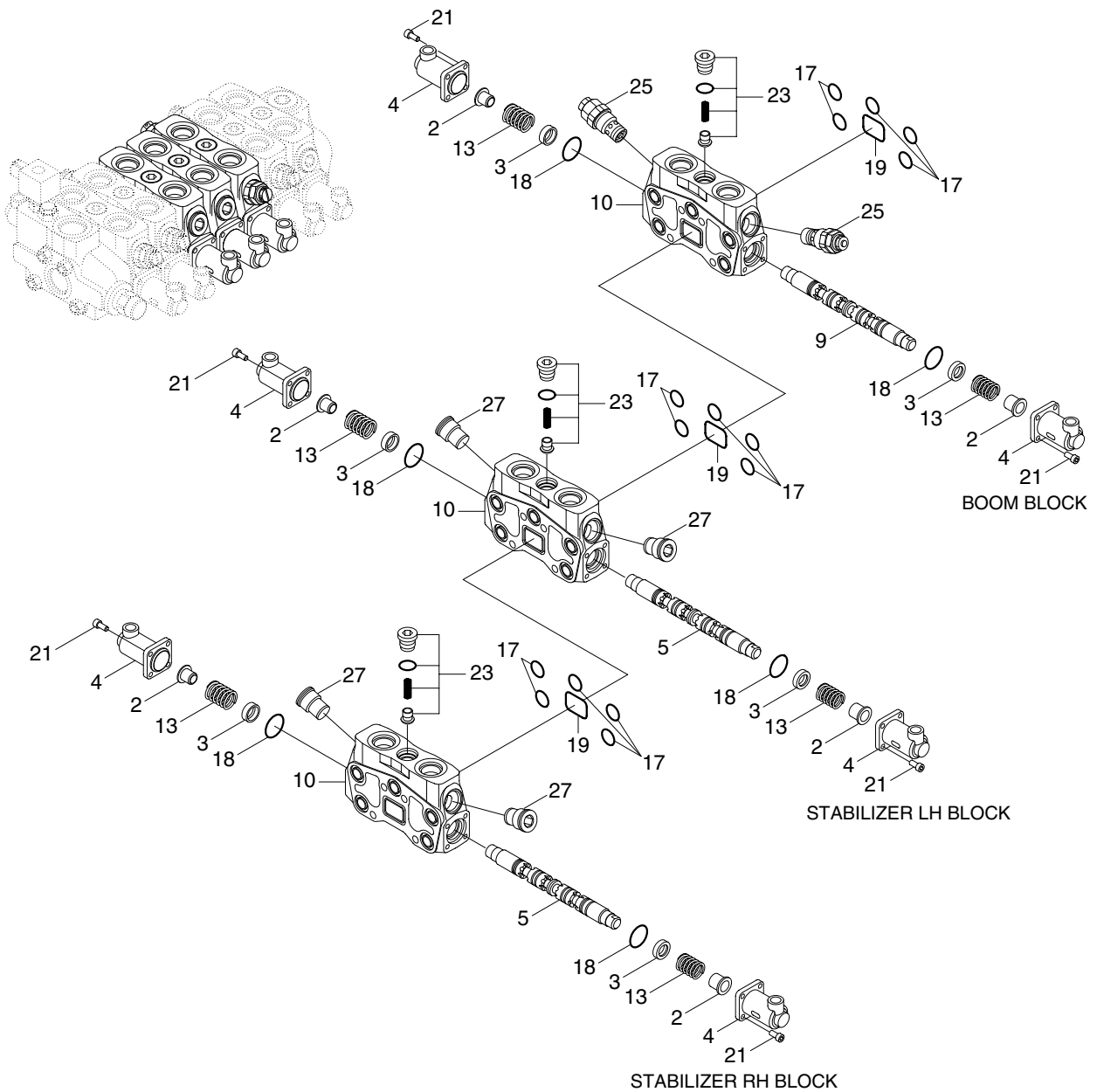
1) Pilot control (1/3)



- | | | | | | |
|----|-------------|----|---------------|----|---------------|
| 1 | Cartridge | 13 | Spring | 21 | Bolt |
| 2 | Spring cap | 14 | Tie rod | 22 | Check valve |
| 3 | Bushing | 15 | Valve kit | 23 | Relief valve |
| 4 | End cap | 16 | Nut | 24 | Relief valve |
| 7 | Spool | 17 | O-ring | 25 | Relief valve |
| 8 | Spool | 18 | O-ring | 26 | Plug assembly |
| 10 | Block | 19 | O-ring | 28 | Plug |
| 11 | Inlet cover | 20 | Spring washer | | |

H940S6WE40

Pilot control (2/3)



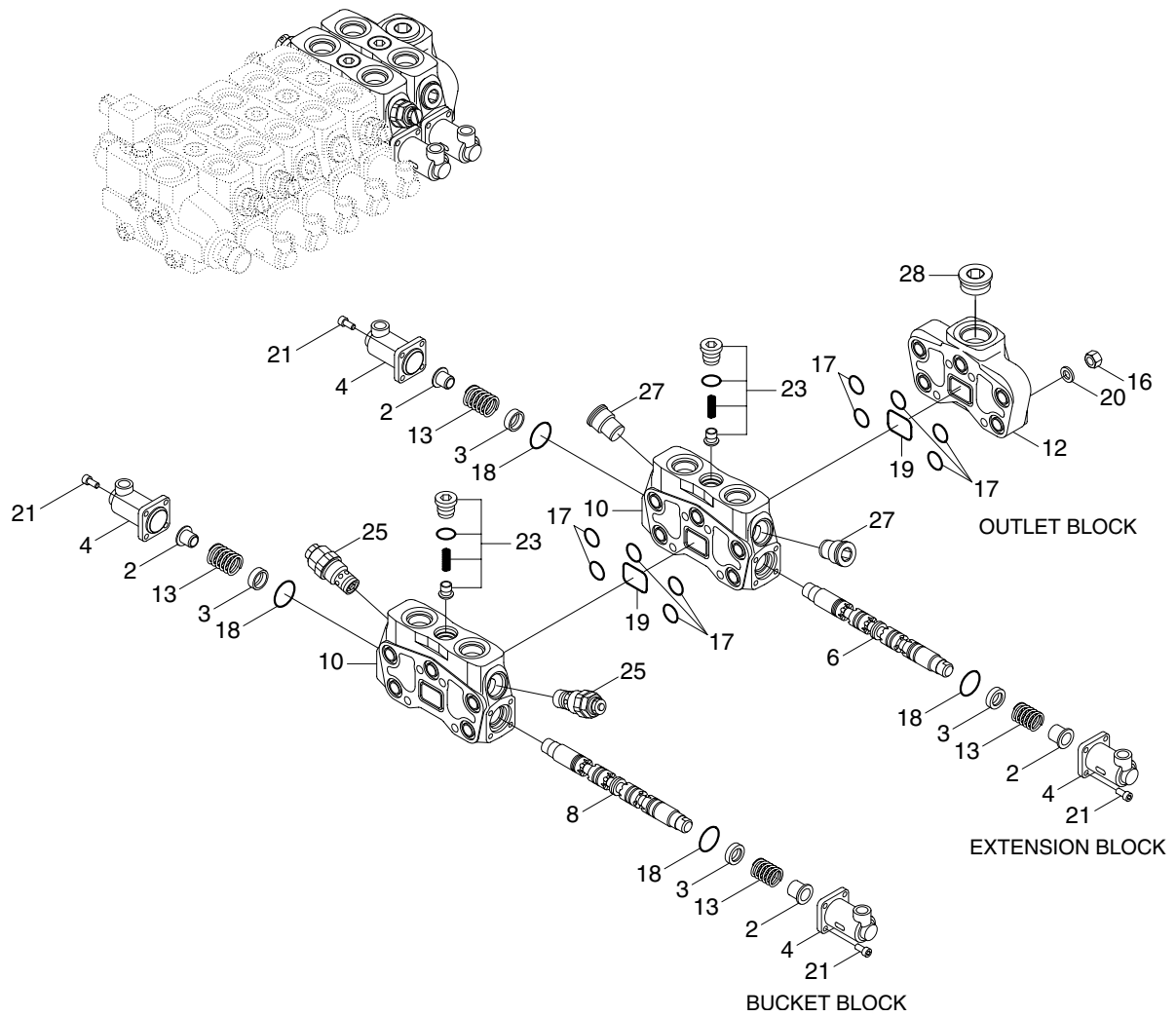
- 2 Spring cap
- 3 Bushing
- 4 End cap
- 5 Spool
- 9 Spool

- 10 Block
- 13 Spring
- 17 O-ring
- 18 O-ring
- 19 O-ring

- 21 Bolt
- 23 Check valve
- 25 Relief valve
- 27 Plug

H940S6WE41

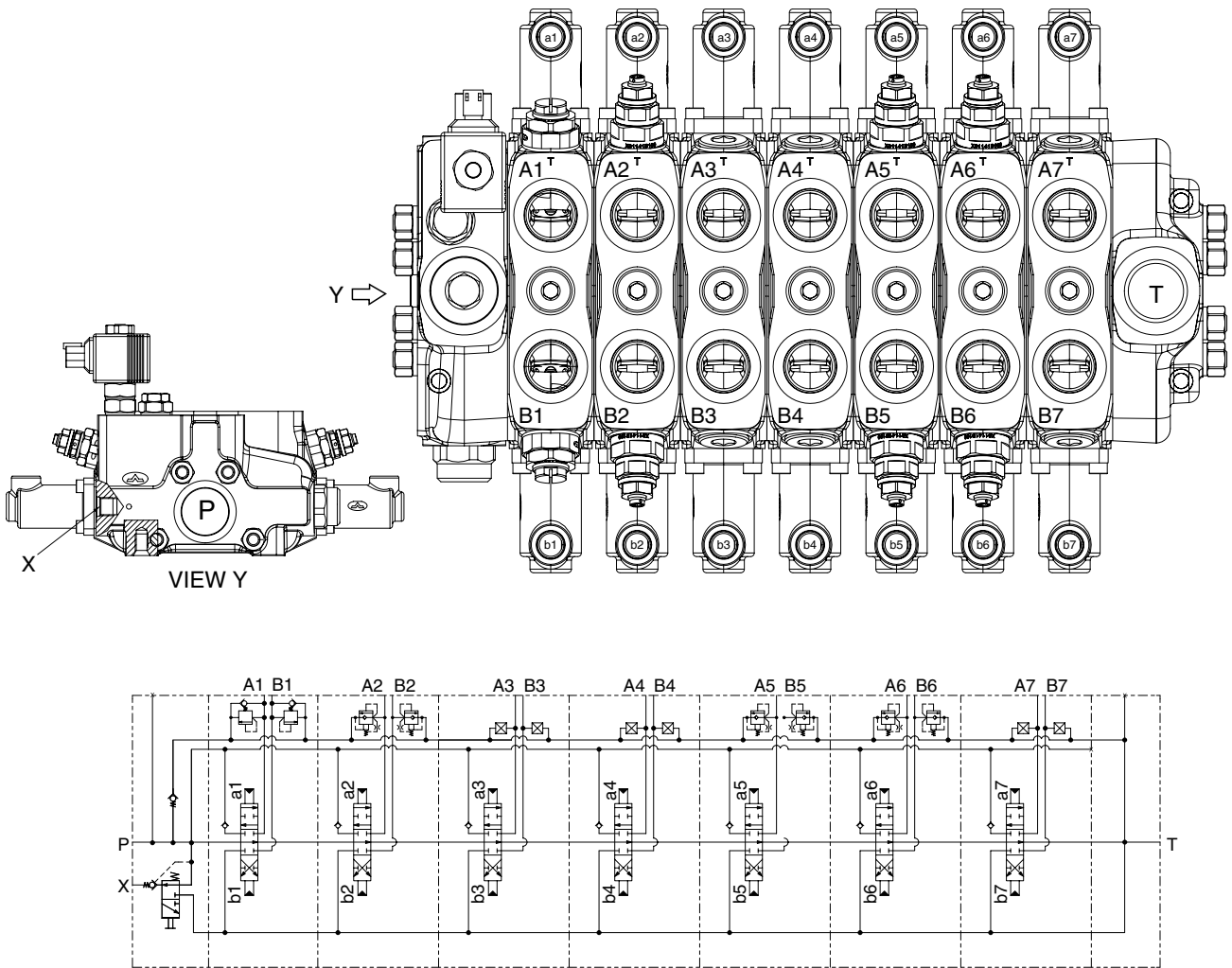
Pilot control (3/3)



- | | | | | | |
|----|------------|----|--------------|----|---------------|
| 2 | Spring cap | 12 | Outlet cover | 20 | Spring washer |
| 3 | Bushing | 13 | Spring | 21 | Bolt |
| 4 | End cap | 16 | Nut | 23 | Check valve |
| 6 | Spool | 17 | O-ring | 25 | Relief valve |
| 8 | Spool | 18 | O-ring | 27 | Plug |
| 10 | Block | 19 | O-ring | 28 | Plug |

H940S6WE42

STRUCTURE (2/2)



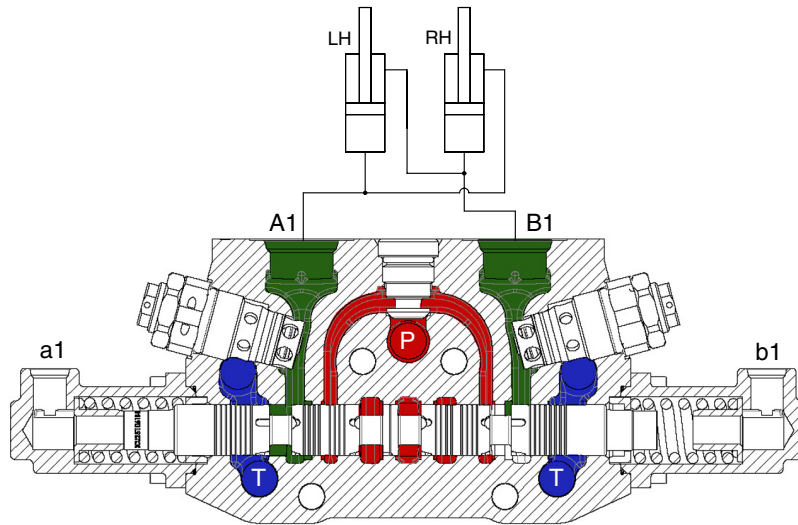
H940S6WE46

Port	Port name	Port size
P	From main pump	1-5/16"-12UN
T	To tank (return)	1-5/16"-12UN
A1, B1	Boom swing cylinder port	1-1/16"-12UN
A2, B2	Dipper cylinder port	1-1/16"-12UN
A3, B3	Stabilizer cylinder port-LH	1-1/16"-12UN
A4, B4	Stabilizer cylinder port-RH	1-1/16"-12UN
A5, B5	Boom cylinder port	1-1/16"-12UN
A6, B6	Bucket cylinder port	1-1/16"-12UN
A7, B7	Dipper extension cylinder port	1-1/16"-12UN
X	Clamp cylinder port	9/16"-18UNF

Item	Specification	
Type	6 spool (opt : 7 spool)	
Operating method	Hydraulic pilot control	
Main relief valve pressure	250 kgf/cm ² (3560 psi)	
Overload relief valve pressure	Boom up	280 kgf/cm ² (3980 psi)
	Boom down	280 kgf/cm ² (3980 psi)
	Swing LH, RH	250 kgf/cm ² (3560 psi)
	Bucket in	280 kgf/cm ² (3980 psi)
	Bucket out	280 kgf/cm ² (3980 psi)
	Dipper in	280 kgf/cm ² (3980 psi)
	Dipper out	280 kgf/cm ² (3980 psi)

2) SWING SECTION OPERATION

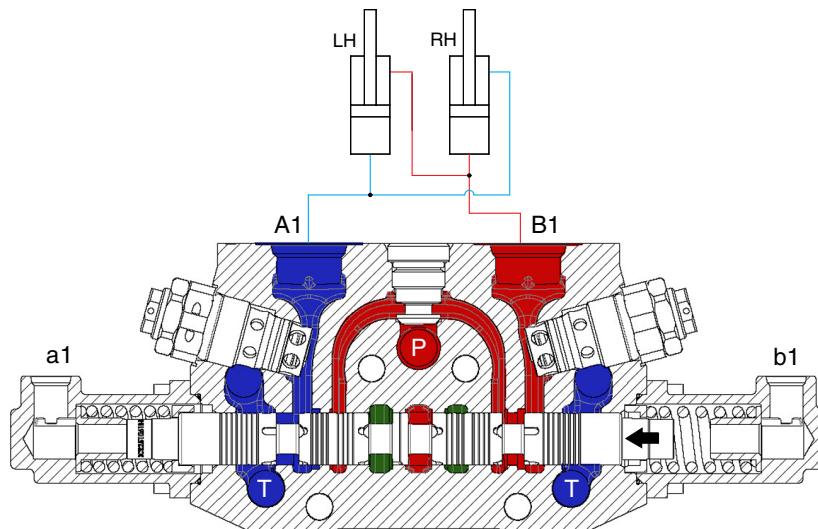
(1) Spool in neutral



H940C6WE50

If the control lever is not operated, the oil supplied from the pump port (P) passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port (T).

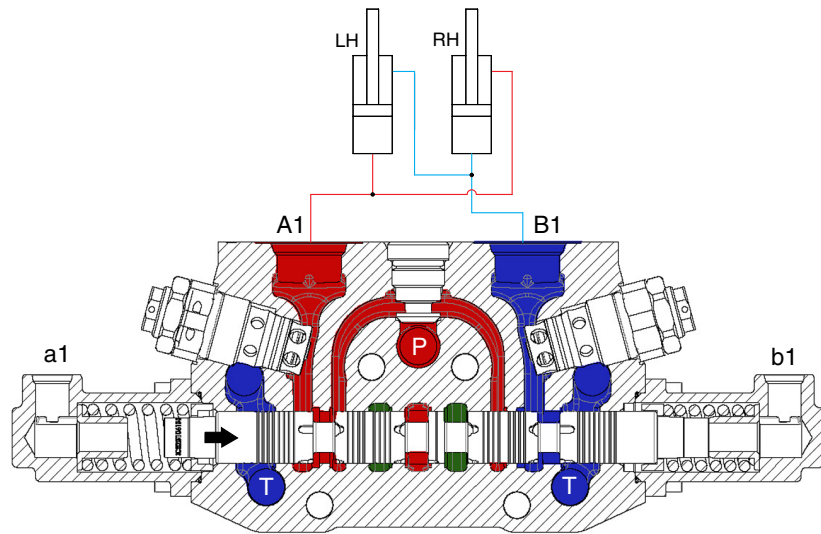
(2) Swing left position (when moving the swing lever to your left)



H940C6WE51

When the swing spool moves to the left, the pressure oil supplied from the pump flow through cylinder port (B1) into swing cylinders. The return oil from cylinder port (A1) flows into the tank via the low pressure passage.

(3) Swing right position (when moving the swing lever to your right)



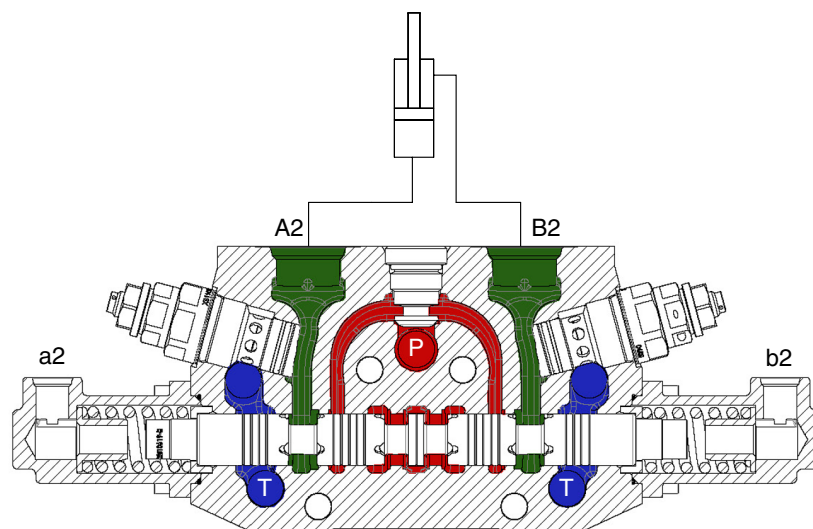
H940C6WE52

When the swing spool moves to the right, the pressure oil supplied from the pump flow through cylinder port (A1) into swing cylinder.

The return oil from cylinder port (B1) flows into the tank via the low pressure passage.

3) DIPPER SECTION OPERATION

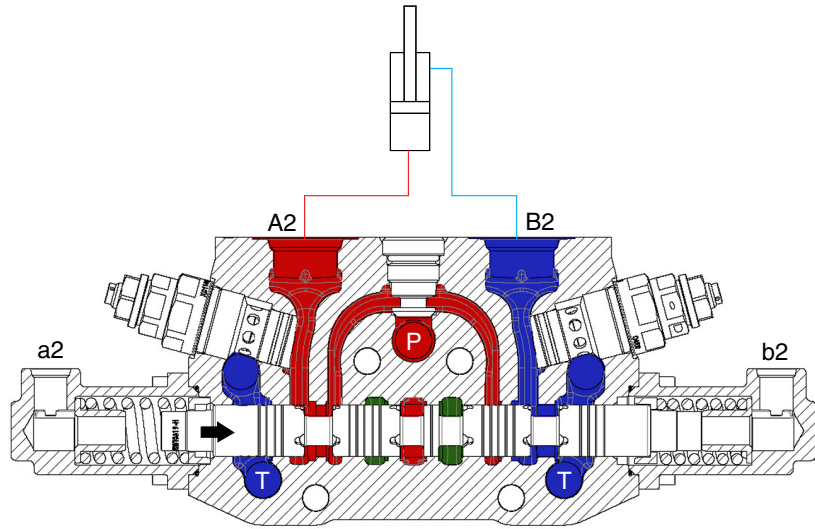
(1) Spool in neutral



H940C6WE53

If the control lever is not operated, the oil supplied from the pump port (P) passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port (T).

(2) Dipper in position (when dipper lever is pulled back)

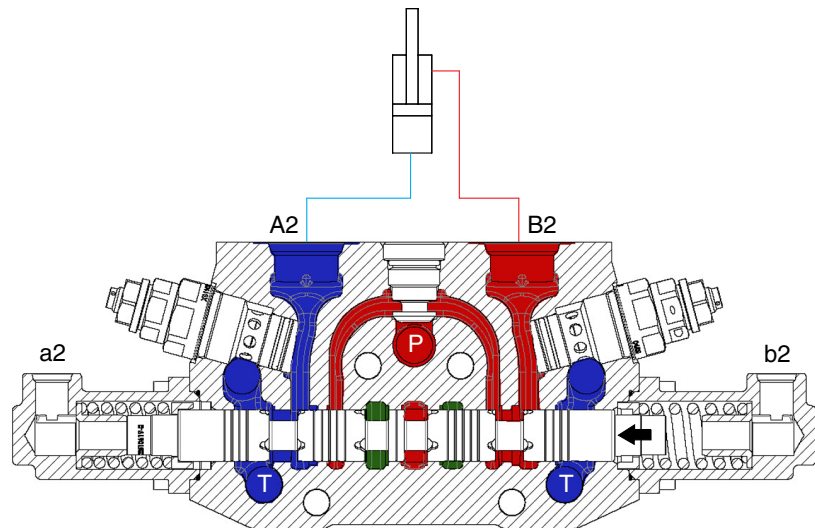


H940C6WE54

When the dipper spool moves to the right, the pressure oil supplied from the pump flow through cylinder port (A2) into dipper cylinder.

The return oil from cylinder port (B2) flows into the tank via the low pressure passage.

(3) Dipper out position (when dipper lever is pushed)



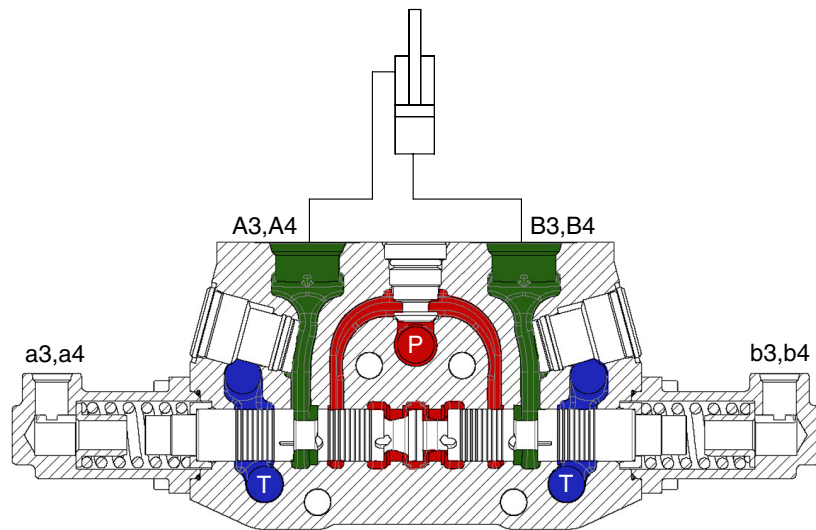
H940C6WE55

When the dipper spool moves to the left, the pressure oil supplied from the pump flow through cylinder port (B2) into dipper cylinder.

The return oil from cylinder port (A2) flows into the tank via the low pressure passage.

4) STABILIZER SECTION OPERATION

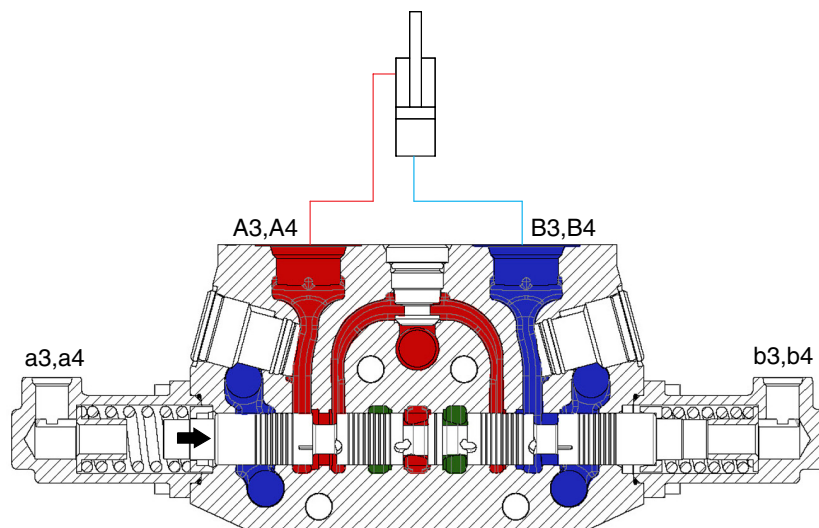
(1) Spool in neutral



H940C6WE56

If the control lever is not operated, the oil supplied from the pump port (P) passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port (T).

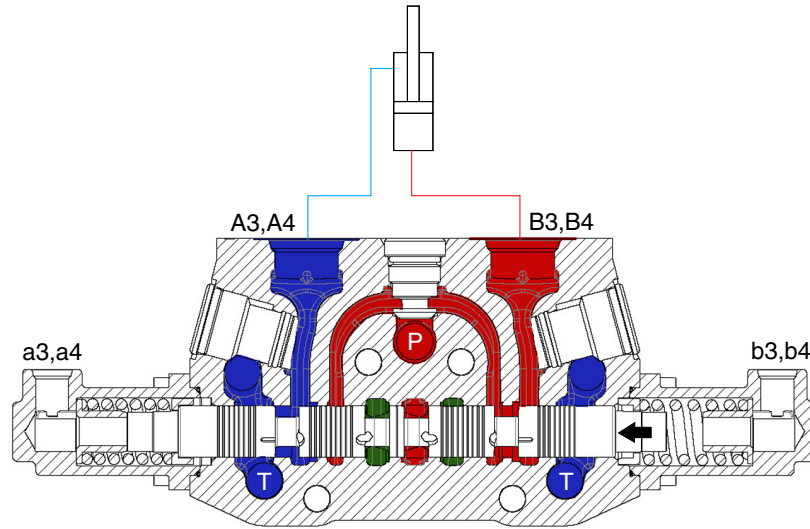
(2) Stabilizer up position (when stabilizer lever is pulled back)



H940C6WE57

When the stabilizer spool moves to the right, the pressure oil supplied from the pump flow through cylinder port (A3, A4) into stabilizer cylinder. The return oil from cylinder port (B3, B4) flows into the tank via the low pressure passage.

(3) Stabilizer down position (when stabilizer lever is pushed forward)



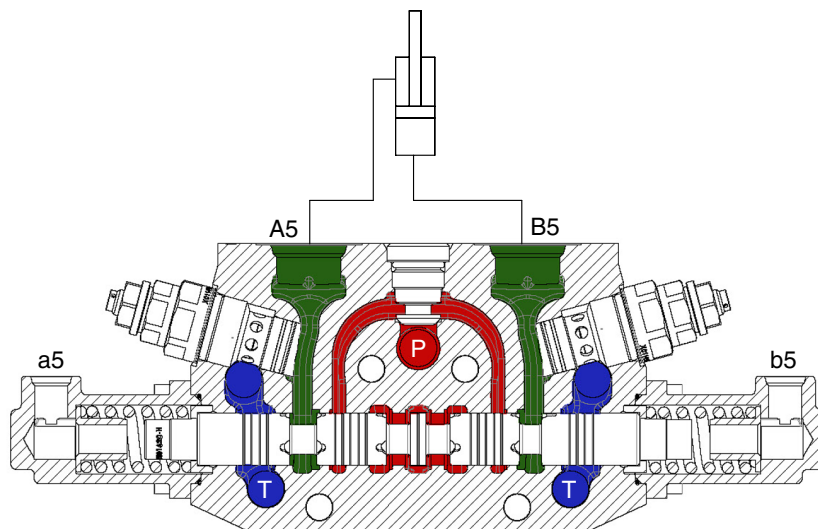
H940C6WE58

When the stabilizer spool moves to the left, the pressure oil supplied from the pump flow through cylinder port (B3, B4) into stabilizer cylinder.

The return oil from cylinder port (A3, A4) flows into the tank via the low pressure passage.

5) BOOM SECTION OPERATION

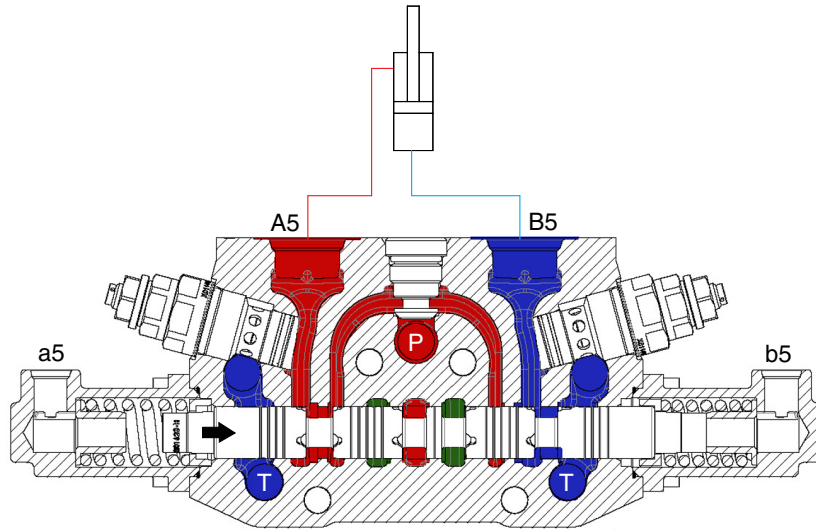
(1) Spool in neutral



H940C6WE59

If the control lever is not operated, the oil supplied from the pump port (P) passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port (T).

(2) Boom up position (when boom lever is pulled back)

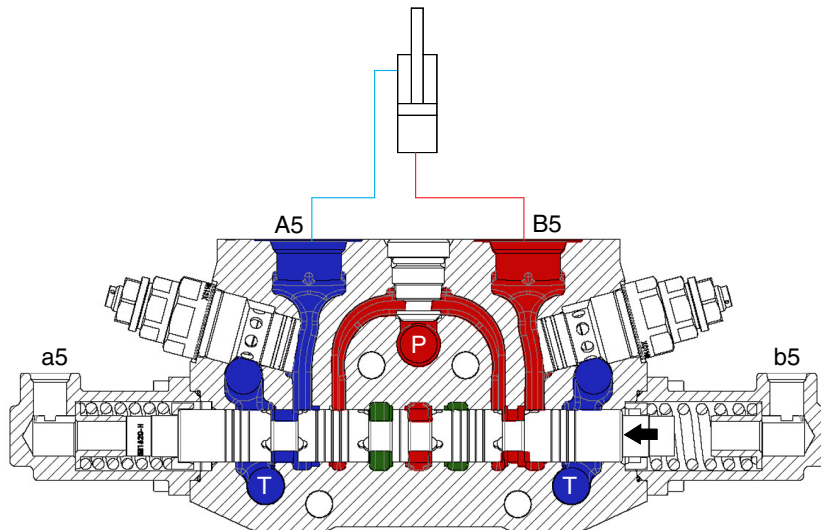


H940C6WE60

When the boom spool moves to the right, the pressure oil supplied from the pump flow through cylinder port (A5) into boom cylinder.

The return oil from cylinder port (B5) flows into the tank via the low pressure passage.

(3) Boom down position (when boom lever is pushed forward)



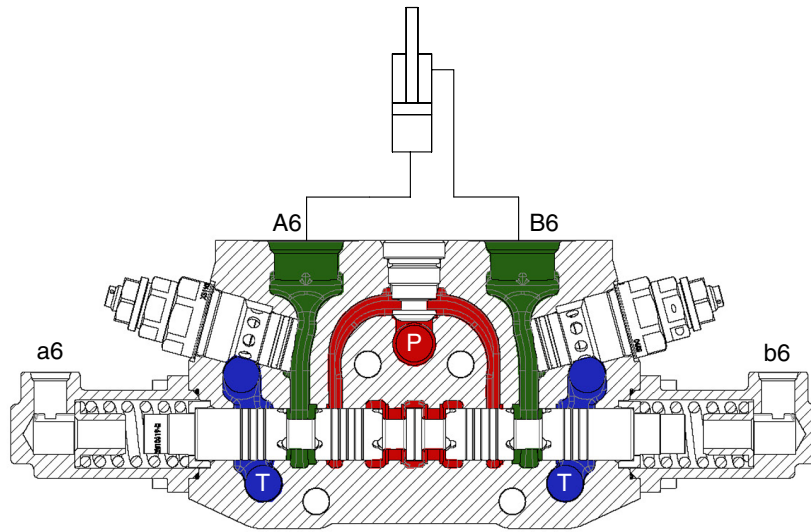
H940C6WE61

When the boom spool moves to the left, the pressure oil supplied from the pump flow through cylinder port (B5) into boom cylinder.

The return oil from cylinder port (A5) flows into the tank via the low pressure passage.

6) BUCKET SECTION OPERATION

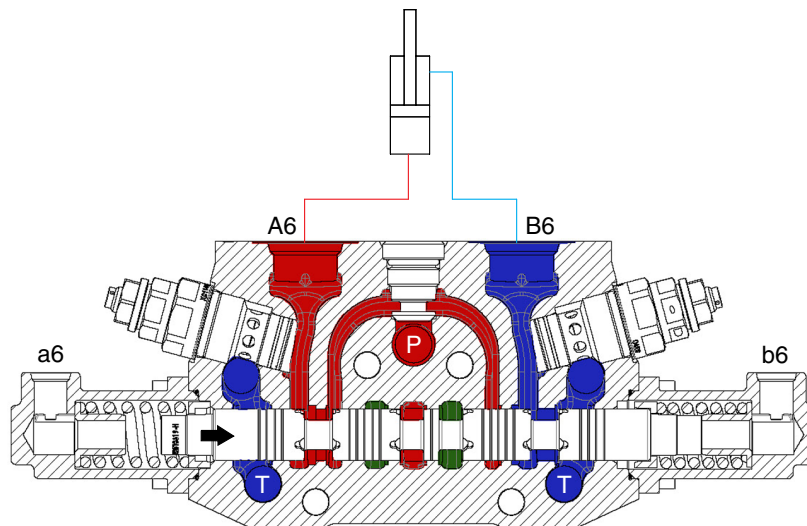
(1) Spool in neutral



H940C6WE65

If the control lever is not operated, the oil supplied from the pump port (P) passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port (T).

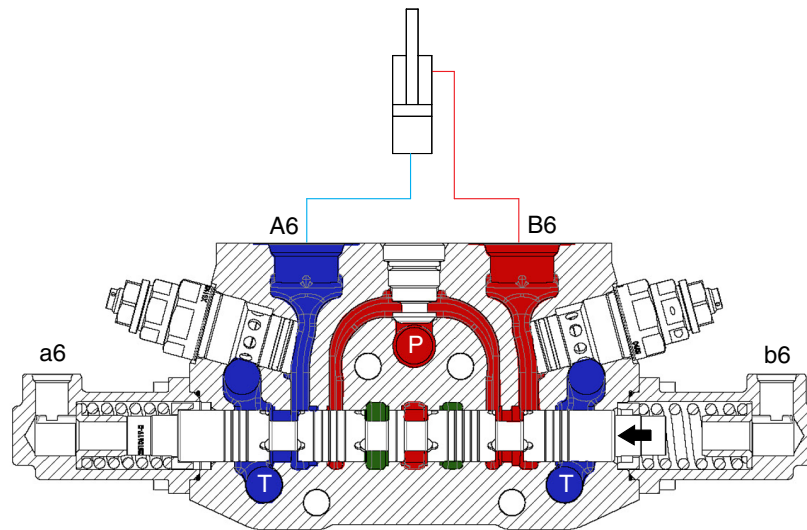
(2) Bucket crowd position (when moving the bucket lever to your left)



H940C6WE66

When the bucket spool moves to the right, the pressure oil supplied from the pump flow through cylinder port (A6) into bucket cylinder.
The return oil from cylinder port (B6) flows into the tank via the low pressure passage.

(3) Bucket dump position (when moving the bucket to your right)



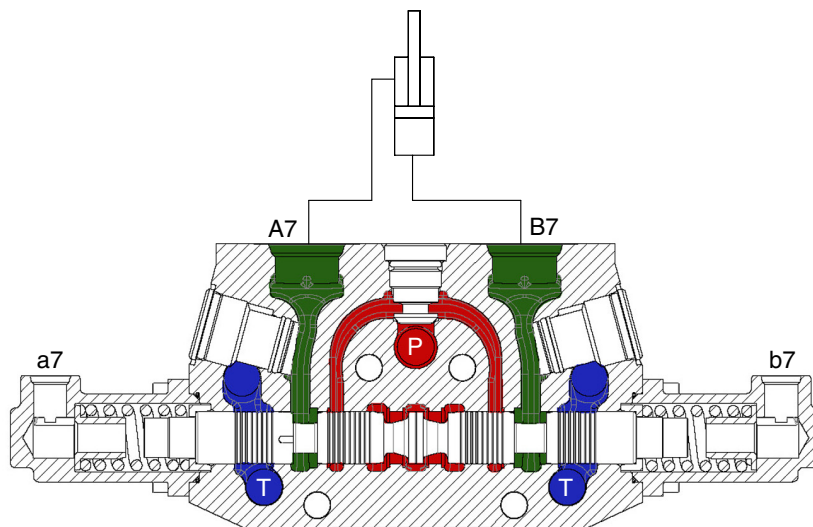
H940C6WE67

When the bucket spool moves to the left, the pressure oil supplied from the pump flow through cylinder port (B6) into bucket cylinder.

The return oil from cylinder port (A6) flows into the tank via the low pressure passage.

7) EXTENDED DIPPER SECTION OPERATION

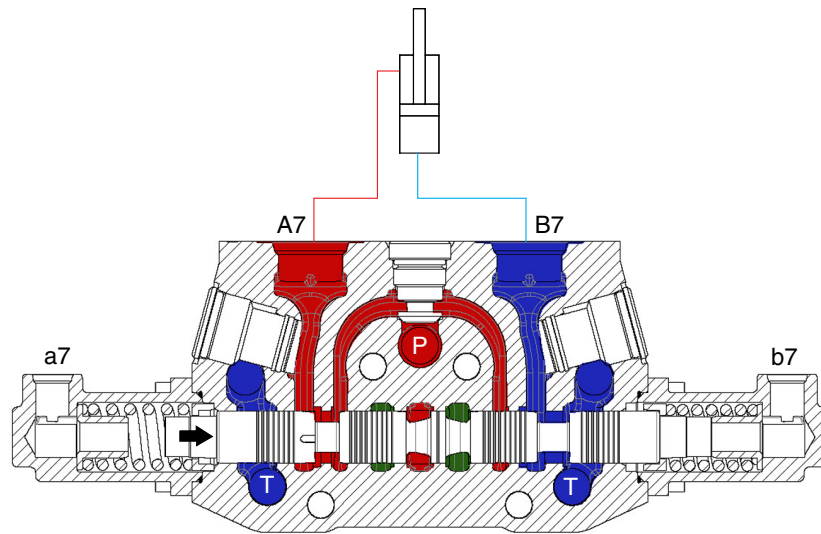
(1) Spool in neutral



H940C6WE62

If the control lever is not operated, the oil supplied from the pump port (P) passes through the neutral passage to the low pressure passage at the outlet section, and then returns to the tank port (T).

(2) Extended dipper in position (when the left side of pedal is pressed)

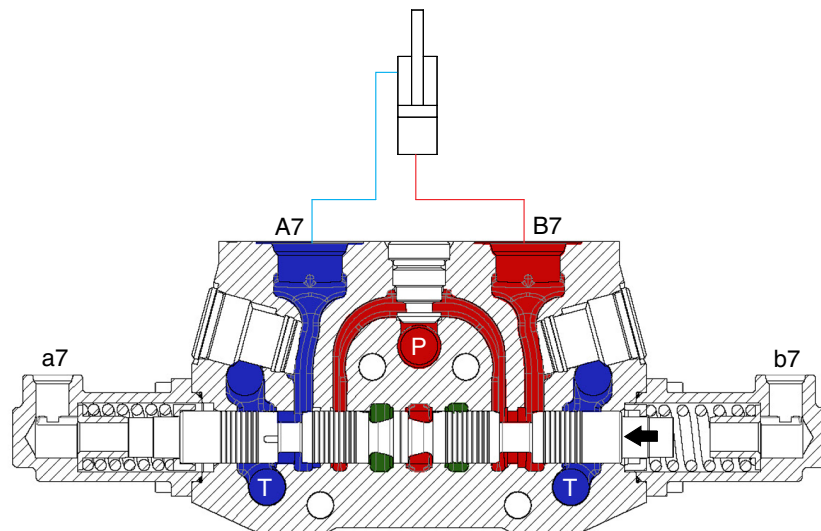


H940C6WE63

When the extended spool moves to the right, the pressure oil supplied from the pump flow through cylinder port (A7) into extended cylinder.

The return oil from cylinder port (B7) flows into the tank via the low pressure passage.

(3) Extended dipper out position (when right side of pedal is pressed)

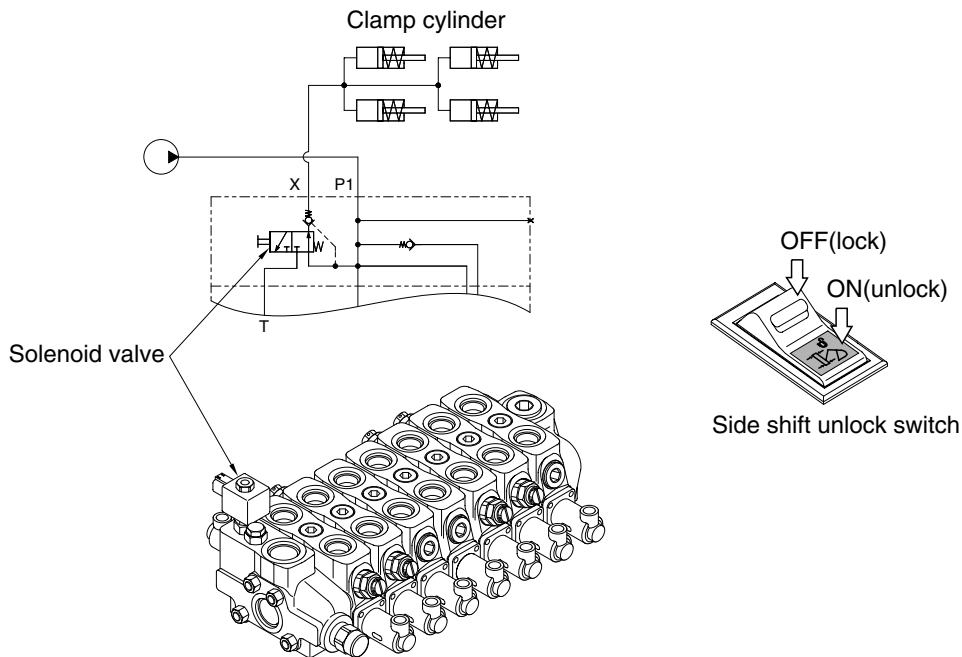


H940C6WE63

When the extended spool moves to the left, the pressure oil supplied from the pump flow through cylinder port (B7) into extended dipper cylinder.

The return oil from cylinder port (A7) flows into the tank via the low pressure passage.

8) CLAMP SECTION OPERATION



H940S6WE124

※ When the backhoe is being used for excavating duties, the carriage assembly must be **clamped** to the side shift rearframe.

The clamp control valve assembly is positioned in the inlet section of backhoe control valve block and is connected directly to the pressure passage.

The valve operates in conjunction with solenoid valve housed in the side of the MCV block.

(1) Clamps pressurized position

When the side shift unlock switch is in the OFF position (not pressed), the solenoid valve is de-energized. The solenoid valve open the pressure passage to clamp cylinder.

When an backhoe service is operated, pressure is generated in pressure passage, then the clamp is locked.

(2) Clamps released position - Not precision control machines

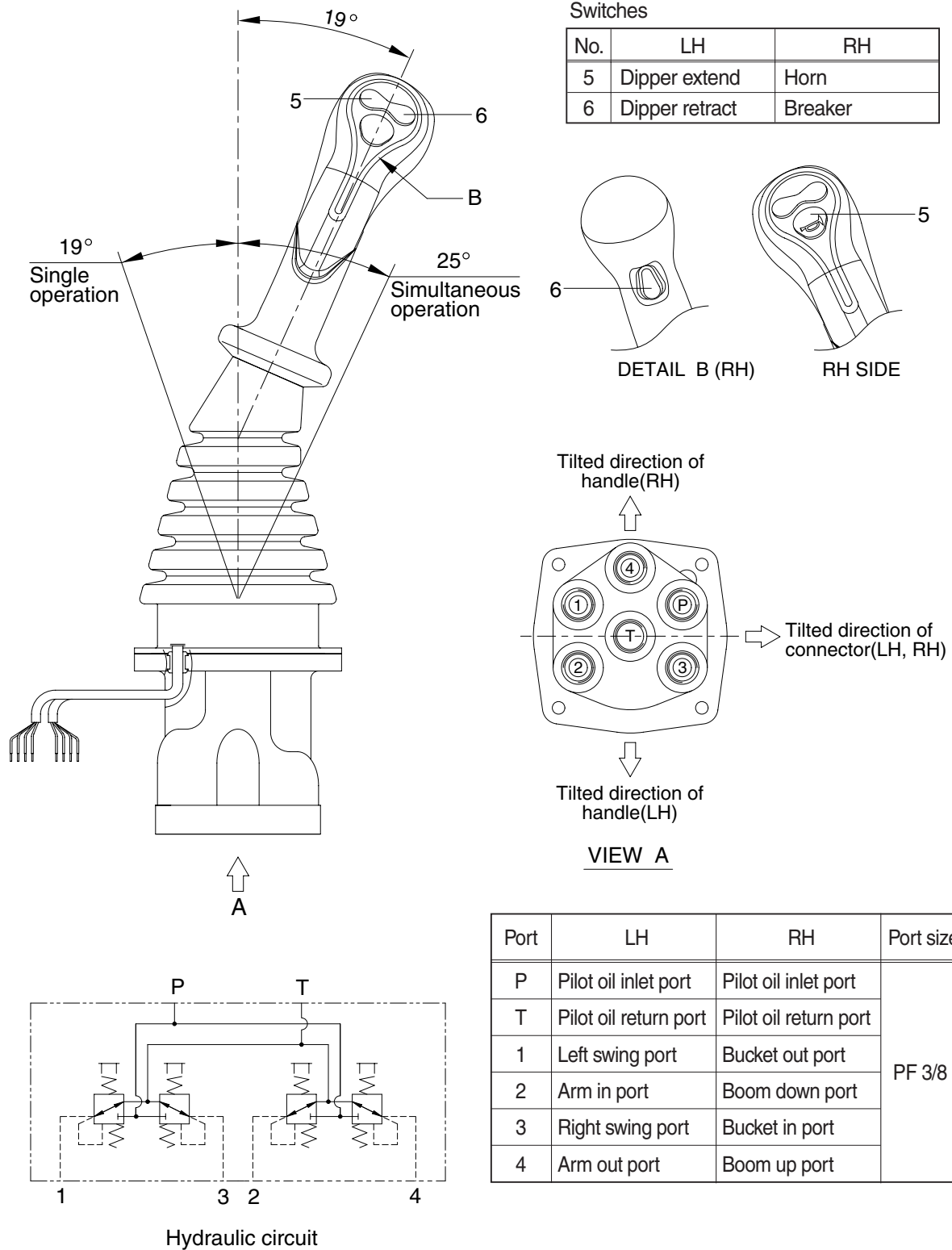
When the side shift unlock switch is in the ON position (pressed down), the solenoid valve is energized. The solenoid valve open the clamp cylinder to the drain port (tank).

Oil from the clamp cylinder is drained to tank. Then, the clamp is unlocked.

8. BACKHOE 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.



H940C6WE70

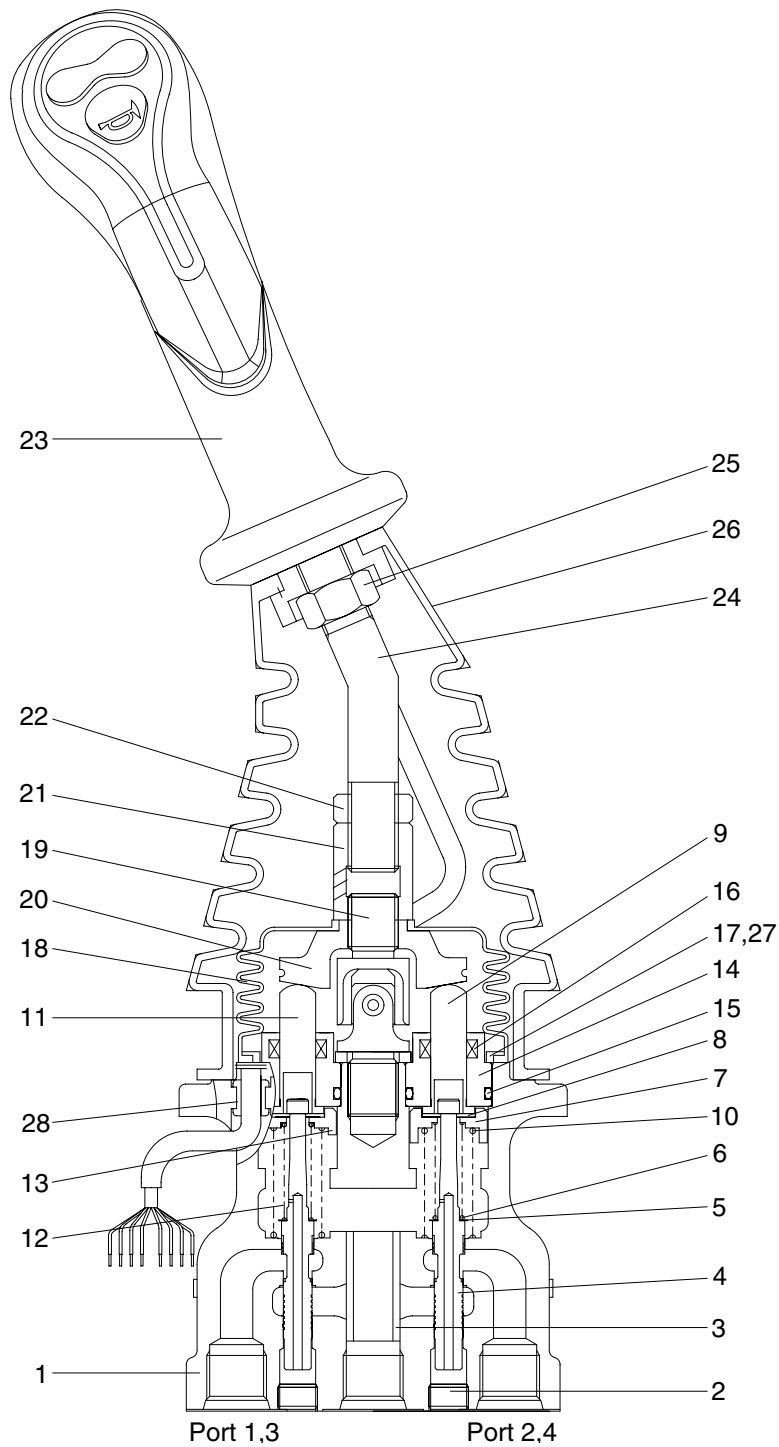
CROSS SECTION

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/cm² (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



H940C6WE71

- | | | | |
|---------------|----------------|-------------------|--------------------|
| 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 Spring pin |
| 7 Spring seat | 14 Plug | 21 Adjusting nut | 28 Bushing |

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.

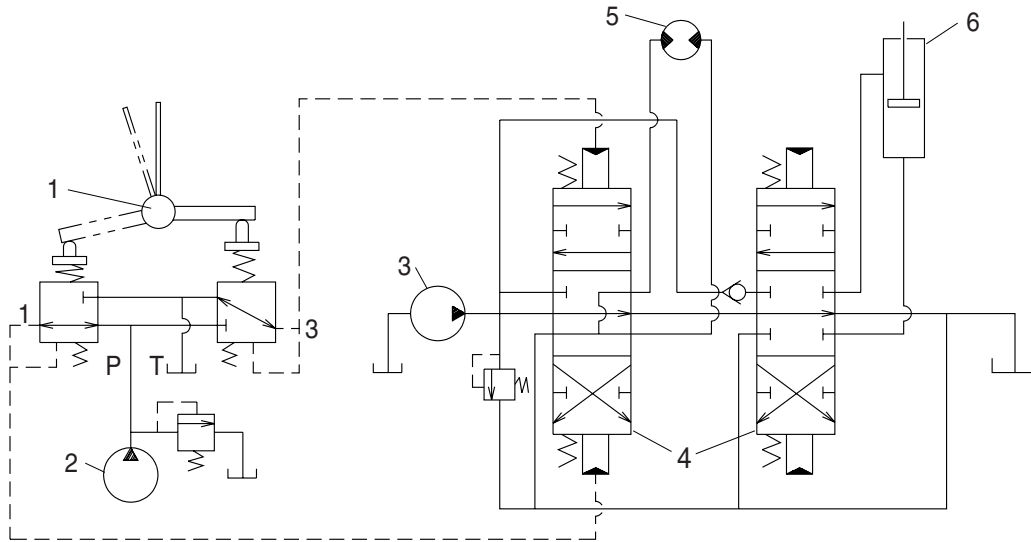
The spring (10) works on the case (1) and spring seat (7, 13) and tries to return the push rod (9,11) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.



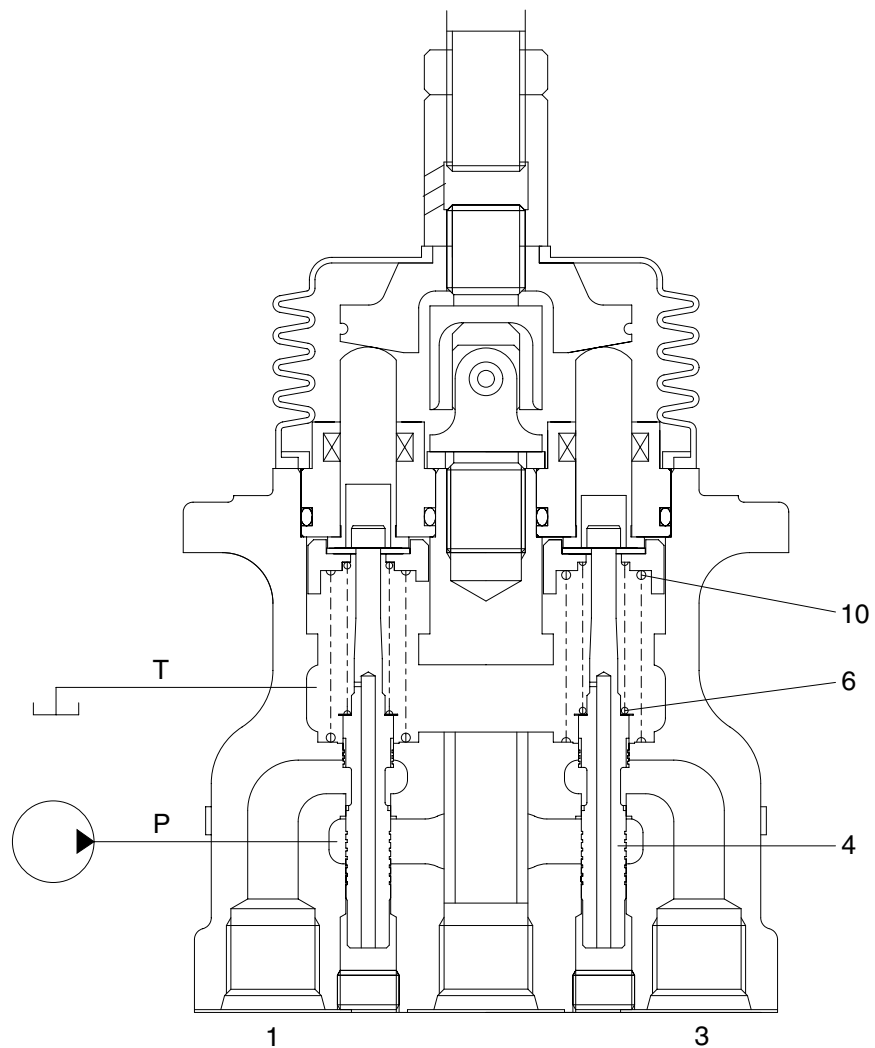
2-70

- 1 Pilot valve
- 2 Pilot pump

- 3 Main pump
- 4 Main control valve

- 5 Hydraulic motor
- 6 Hydraulic cylinder

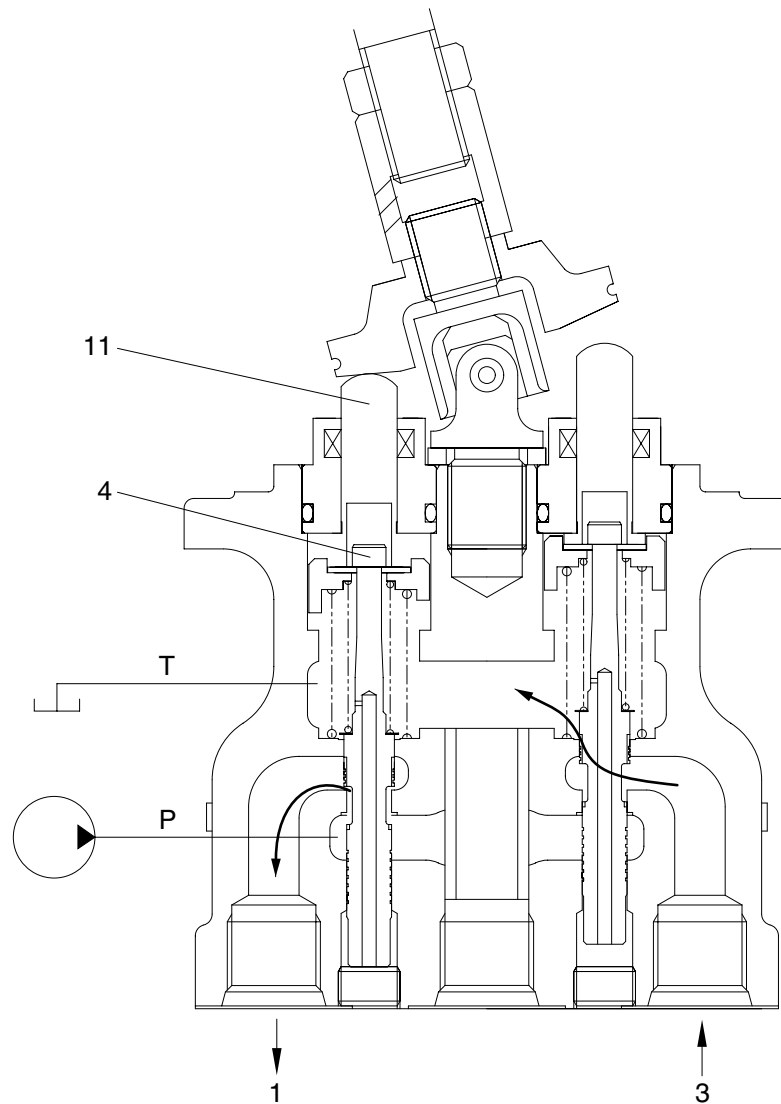
(1) Case where handle is in neutral position



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.

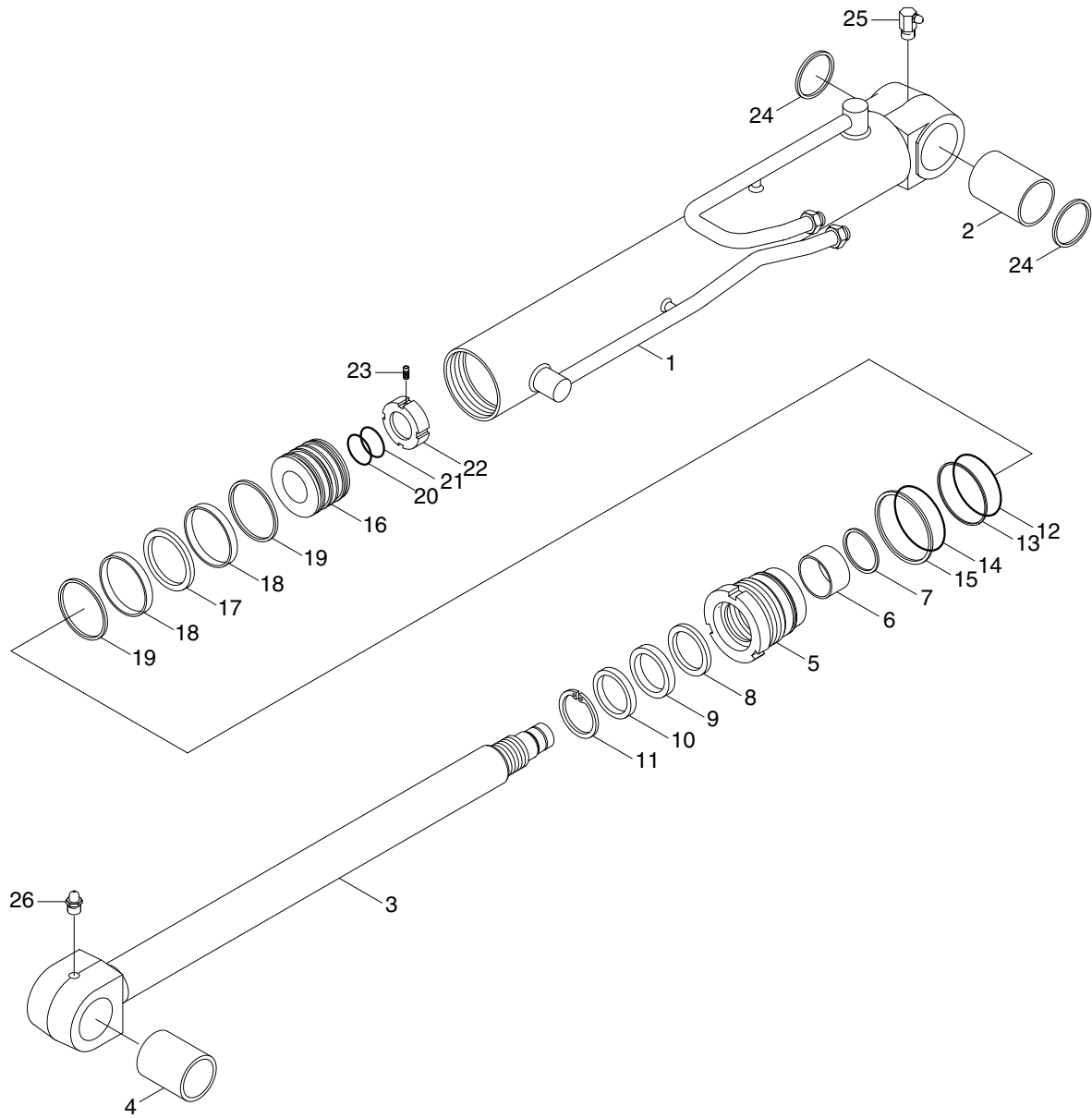
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected 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.

9. LOADER CYLINDERS

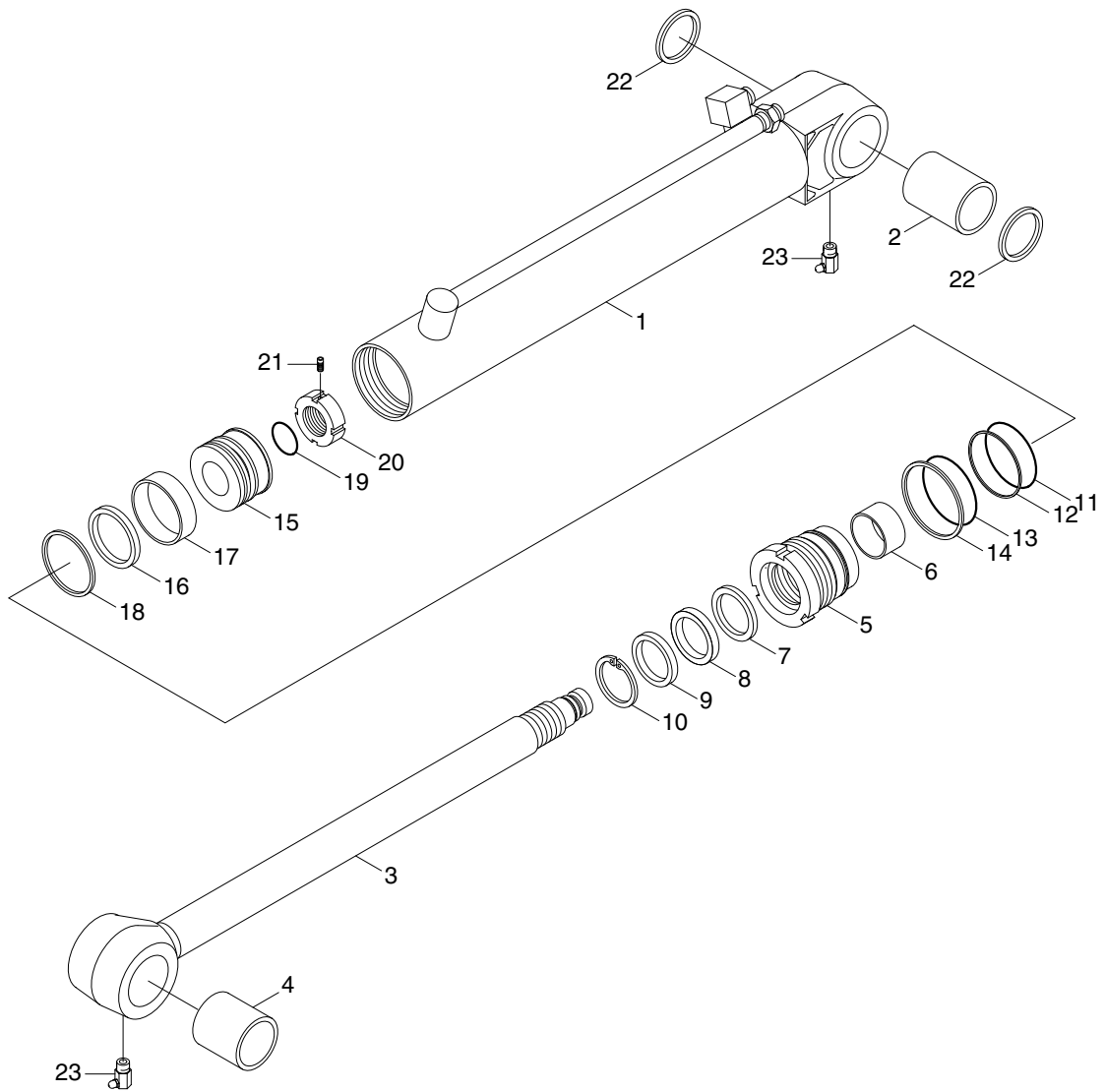
1) BOOM CYLINDER



H940C6WE135

- | | | | | | |
|---|----------------|----|----------------|----|---------------|
| 1 | Tube assembly | 10 | Dust wiper | 19 | Dust ring |
| 2 | Pin bushing | 11 | Retaining ring | 20 | O-ring |
| 3 | Rod assembly | 12 | O-ring | 21 | Back up ring |
| 4 | Pin bushing | 13 | Back up ring | 22 | Piston nut |
| 5 | Rod cover | 14 | O-ring | 23 | Set screw |
| 6 | Rod bushing | 15 | Washer | 24 | Pin wiper |
| 7 | Retaining ring | 16 | Piston | 25 | Grease nipple |
| 8 | Buffer seal | 17 | Piston seal | 26 | Grease nipple |
| 9 | U-packing | 18 | Wear ring | | |

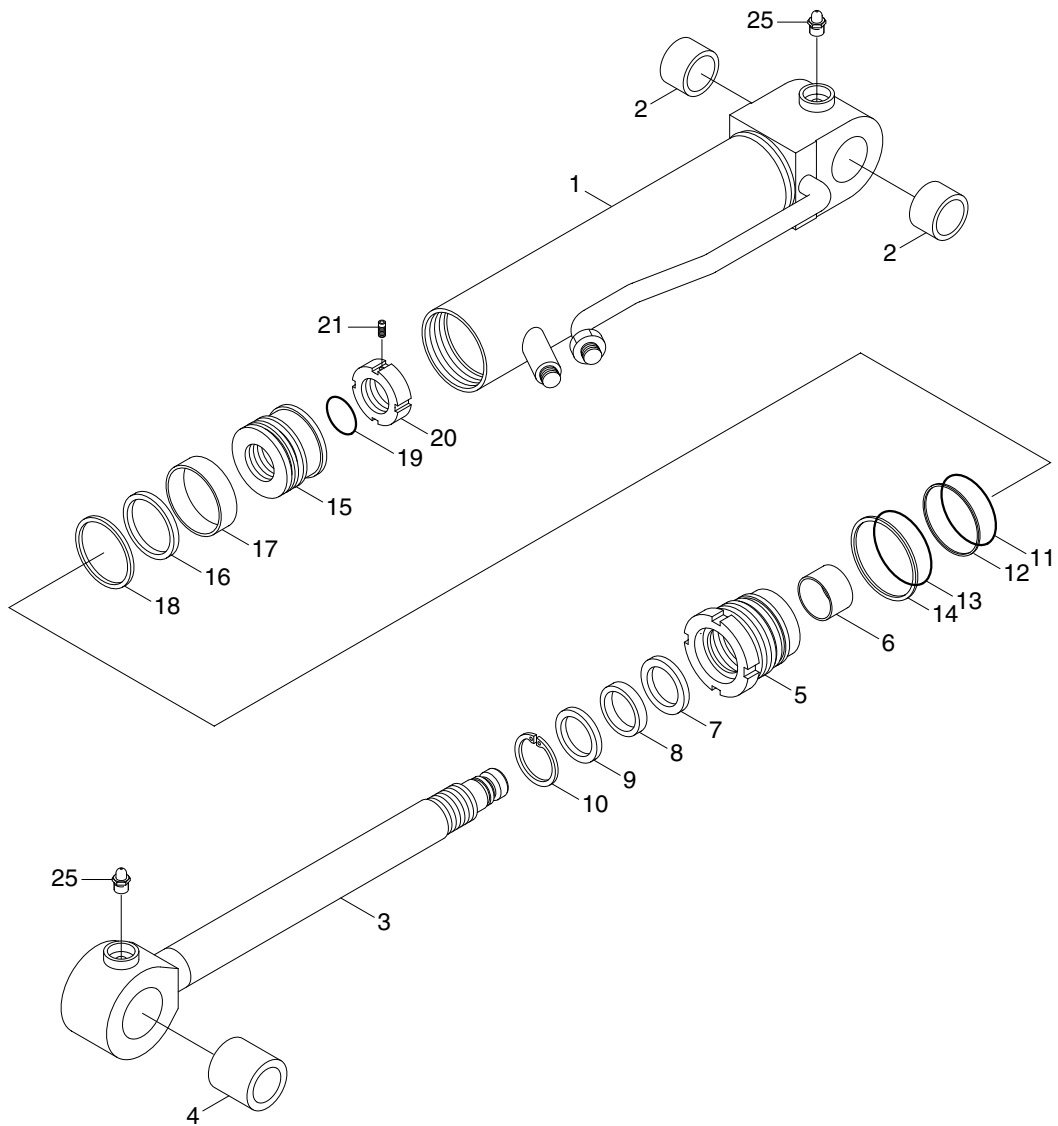
2) BUCKET CYLINDER



H940C6WE136

- | | | | | | |
|---|---------------|----|----------------|----|---------------|
| 1 | Tube assembly | 9 | Dust wiper | 17 | Wear ring |
| 2 | Pin bushing | 10 | Retaining ring | 18 | Dust ring |
| 3 | Rod assembly | 11 | O-ring | 19 | O-ring |
| 4 | Pin bushing | 12 | Back up ring | 20 | Piston nut |
| 5 | Rod cover | 13 | O-ring | 21 | Set screw |
| 6 | Rod bushing | 14 | Washer | 22 | Pin wiper |
| 7 | Buffer seal | 15 | Piston | 23 | Grease nipple |
| 8 | U-packing | 16 | Piston seal | | |

3) CLAM CYLINDER (OPTION)

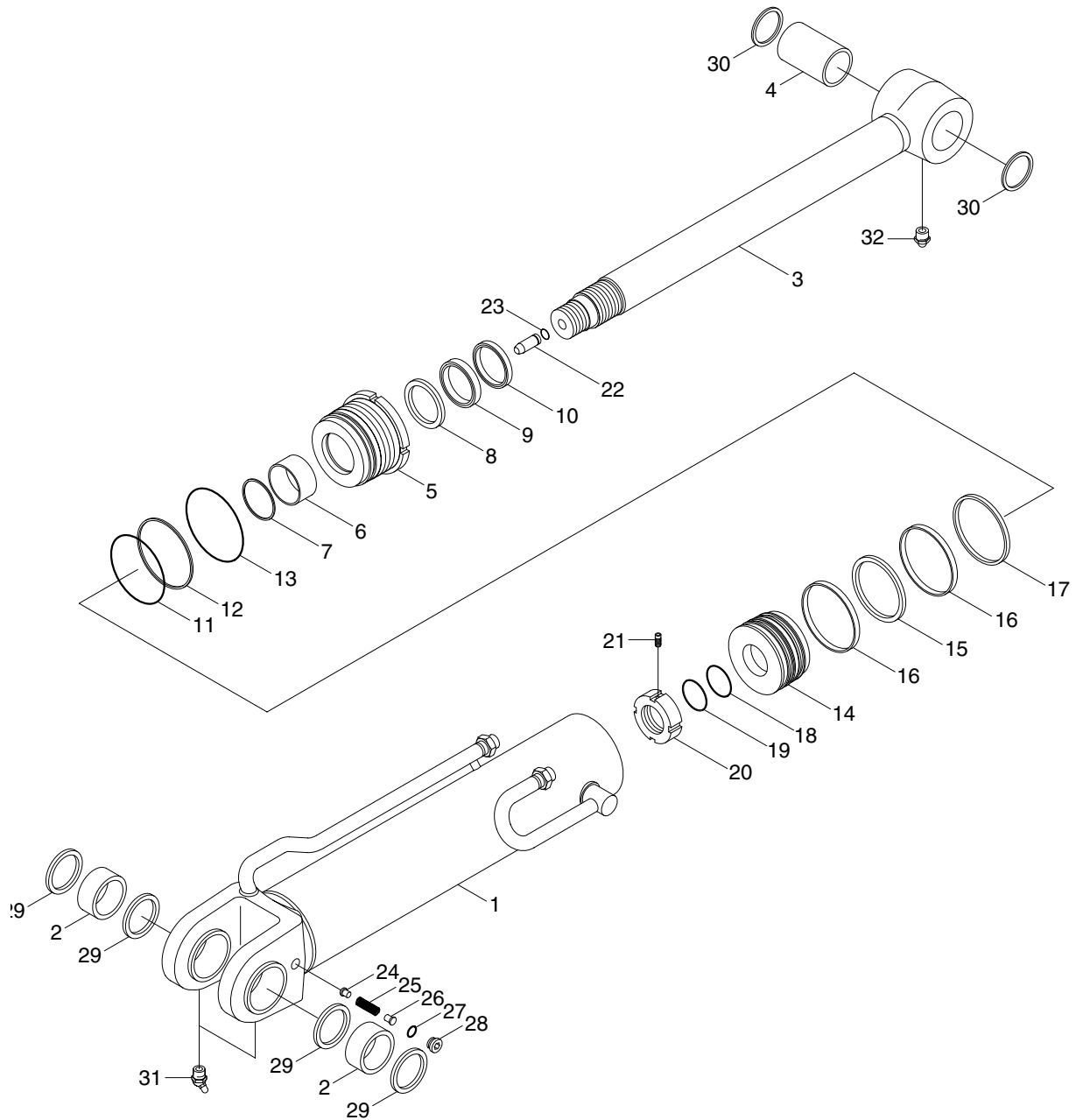


H940C6WE137

- | | | | | | |
|---|---------------|----|----------------|----|---------------|
| 1 | Tube assembly | 9 | Dust wiper | 17 | Wear ring |
| 2 | Pin bushing | 10 | Retaining ring | 18 | Dust ring |
| 3 | Rod assembly | 11 | O-ring | 19 | O-ring |
| 4 | Pin bushing | 12 | Back up ring | 20 | Piston nut |
| 5 | Rod cover | 13 | O-ring | 21 | Set screw |
| 6 | Rod bushing | 14 | Washer | 25 | Grease nipple |
| 7 | Buffer seal | 15 | Piston | | |
| 8 | U-packing | 16 | Piston seal | | |

10. BACKHOE CYLINDERS

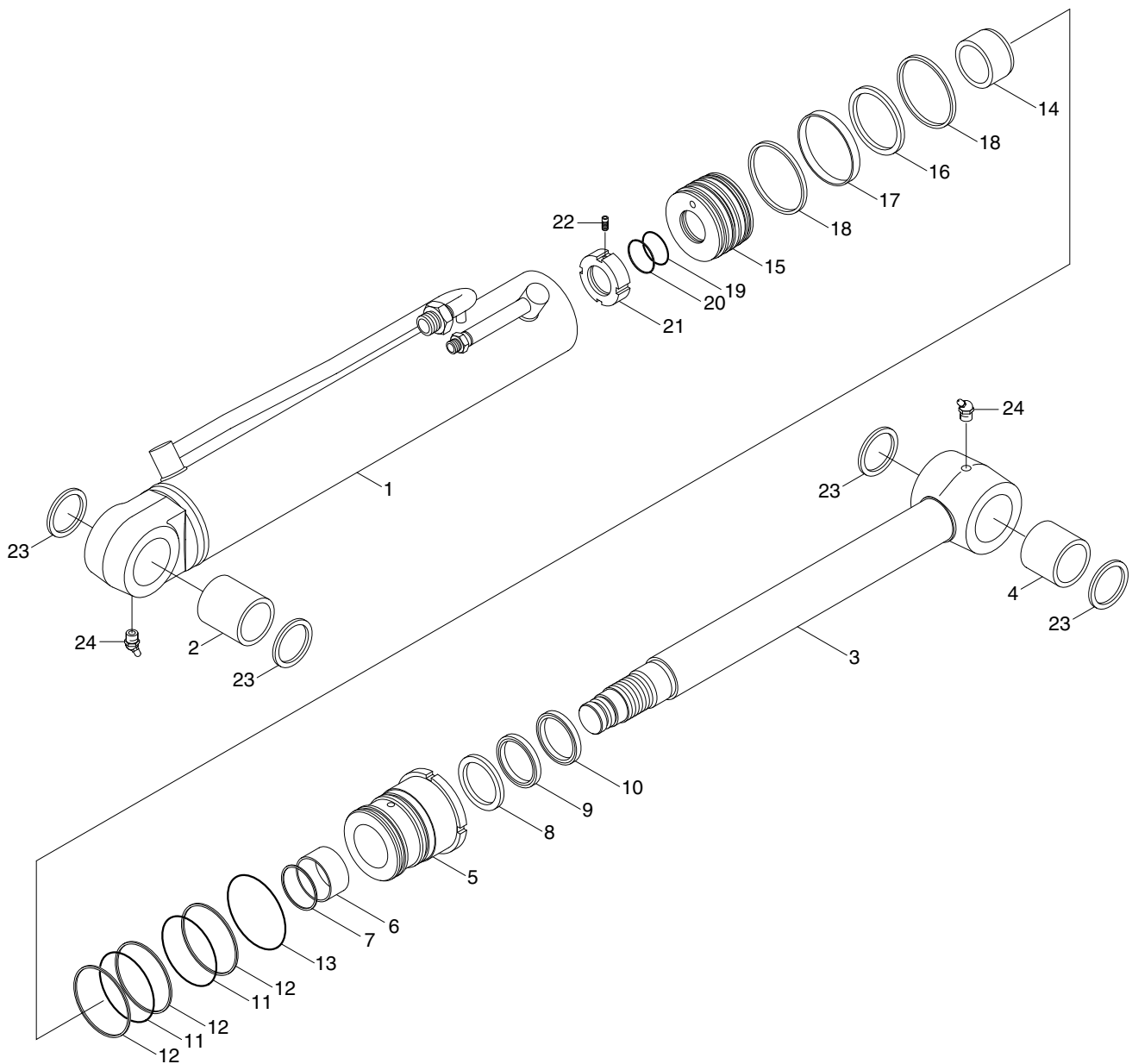
1) BOOM CYLINDER



H940C6WE130

- | | | | | | |
|----|----------------|----|-----------------|----|---------------|
| 1 | Tube assembly | 12 | Back up ring | 23 | Stop ring |
| 2 | Pin bushing | 13 | O-ring | 24 | Check valve |
| 3 | Rod assembly | 14 | Piston | 25 | Spring |
| 4 | Pin bushing | 15 | Piston seal | 26 | Bracket |
| 5 | Rod cover | 16 | Wear ring | 27 | O-ring |
| 6 | Rod bushing | 17 | Dust ring | 28 | Plug |
| 7 | Retaining ring | 18 | O-ring | 29 | Pin wiper |
| 8 | Buffer seal | 19 | Back up ring | 30 | Pin wiper |
| 9 | U-packing | 20 | Piston nut | 31 | Grease nipple |
| 10 | Dust wiper | 21 | Set screw | 32 | Grease nipple |
| 11 | O-ring | 22 | Cushion plunger | | |

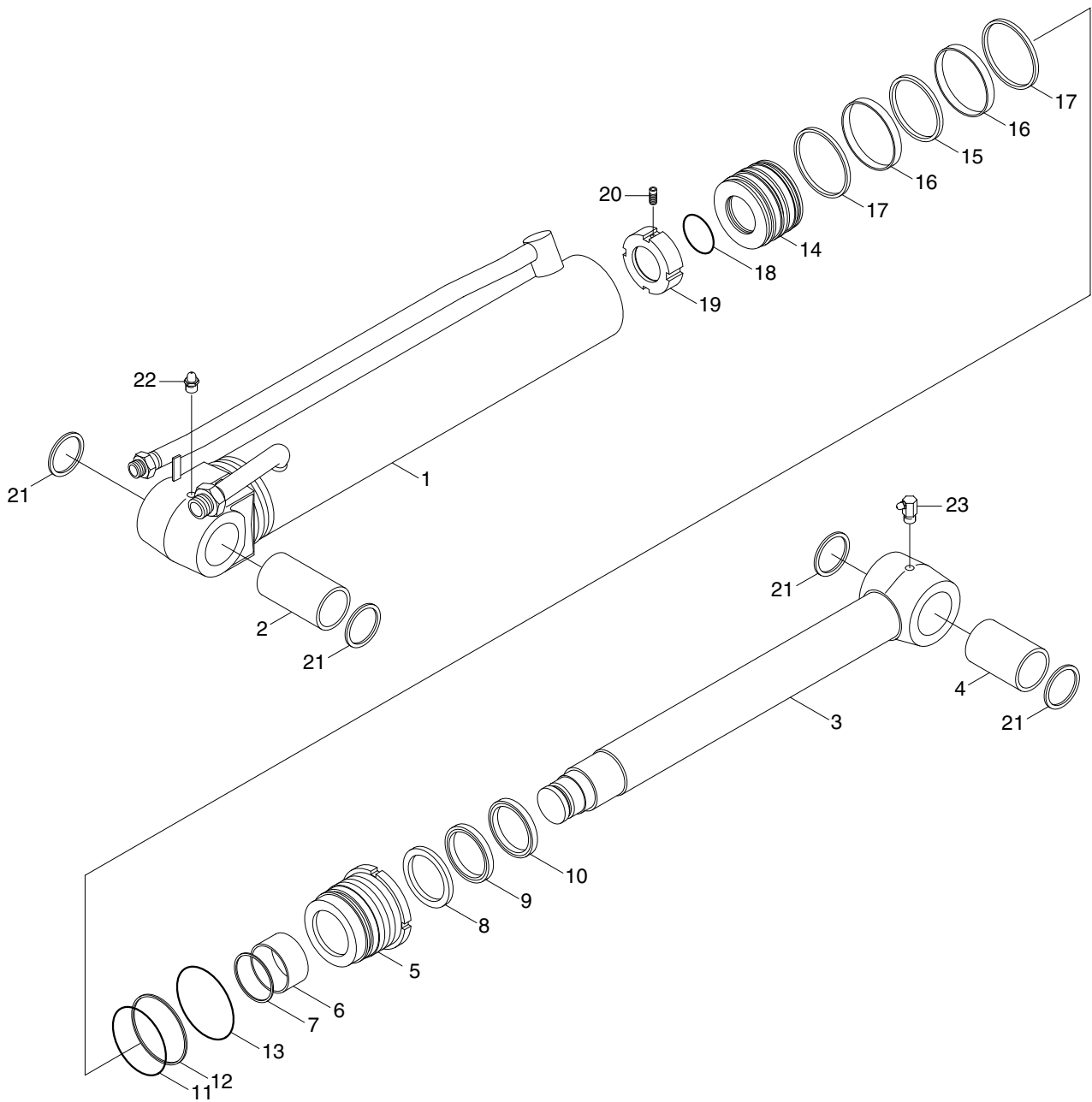
2) DIPPER CYLINDER



H940C6WE131

- | | | | | | |
|---|----------------|----|--------------|----|---------------|
| 1 | Tube assembly | 9 | U-packing | 17 | Wear ring |
| 2 | Pin bushing | 10 | Dust wiper | 18 | Dust ring |
| 3 | Rod assembly | 11 | O-ring | 19 | O-ring |
| 4 | Pin bushing | 12 | Back up ring | 20 | Back up ring |
| 5 | Rod cover | 13 | O-ring | 21 | Piston nut |
| 6 | Rod bushing | 14 | Cushion ring | 22 | Set screw |
| 7 | Retaining ring | 15 | Piston | 23 | Pin wiper |
| 8 | Buffer seal | 16 | Piston seal | 24 | Grease nipple |

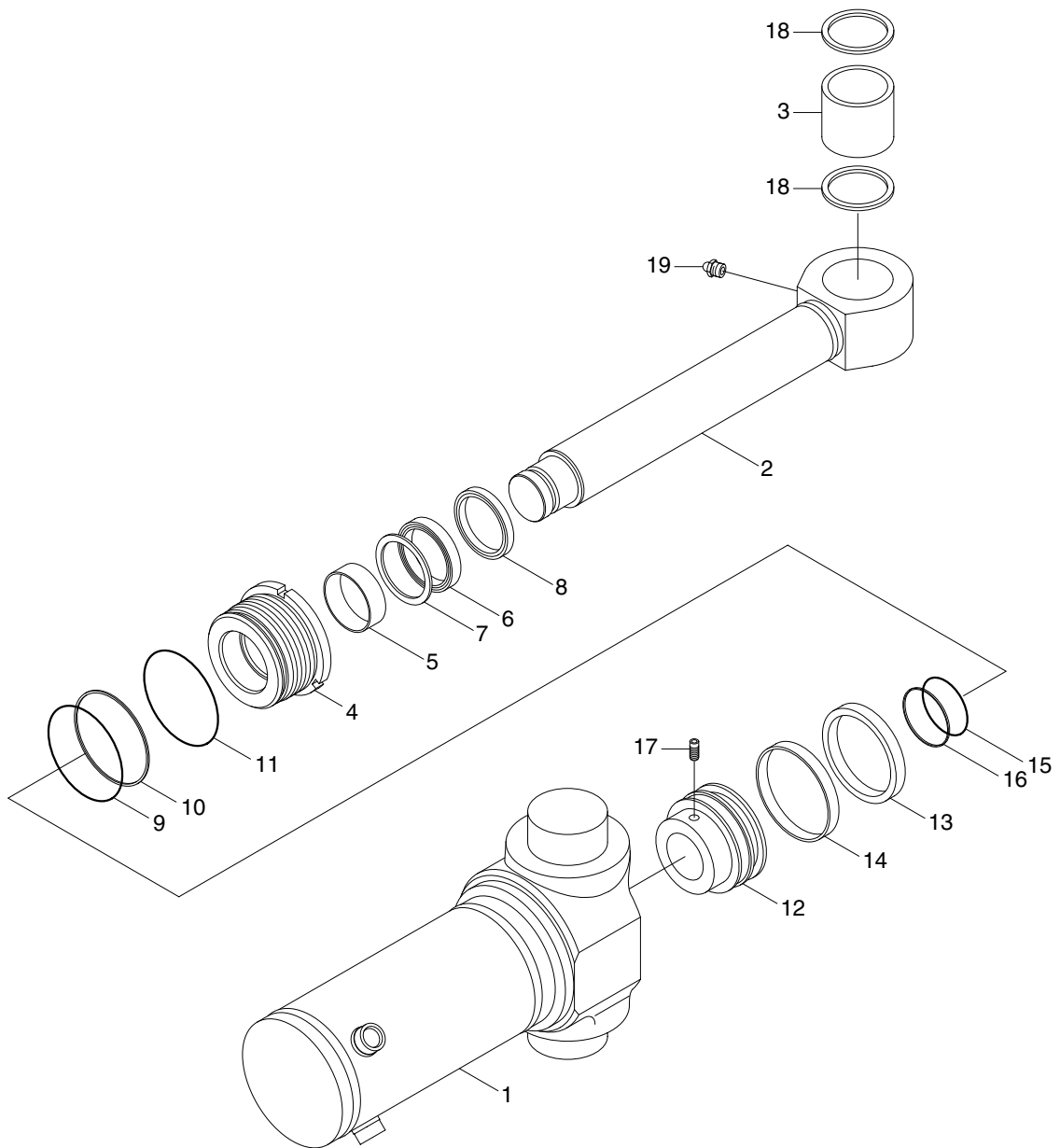
3) BUCKET CYLINDER



H940C6WE132

- | | | | | | |
|---|----------------|----|--------------|----|---------------|
| 1 | Tube assembly | 9 | U-packing | 17 | Dust ring |
| 2 | Pin bushing | 10 | Dust wiper | 18 | O-ring |
| 3 | Rod assembly | 11 | O-ring | 19 | Piston nut |
| 4 | Pin bushing | 12 | Back up ring | 20 | Set screw |
| 5 | Rod cover | 13 | O-ring | 21 | Pin wiper |
| 6 | Rod bushing | 14 | Piston | 22 | Grease nipple |
| 7 | Retaining ring | 15 | Piston seal | 23 | Grease nipple |
| 8 | Buffer seal | 16 | Wear ring | | |

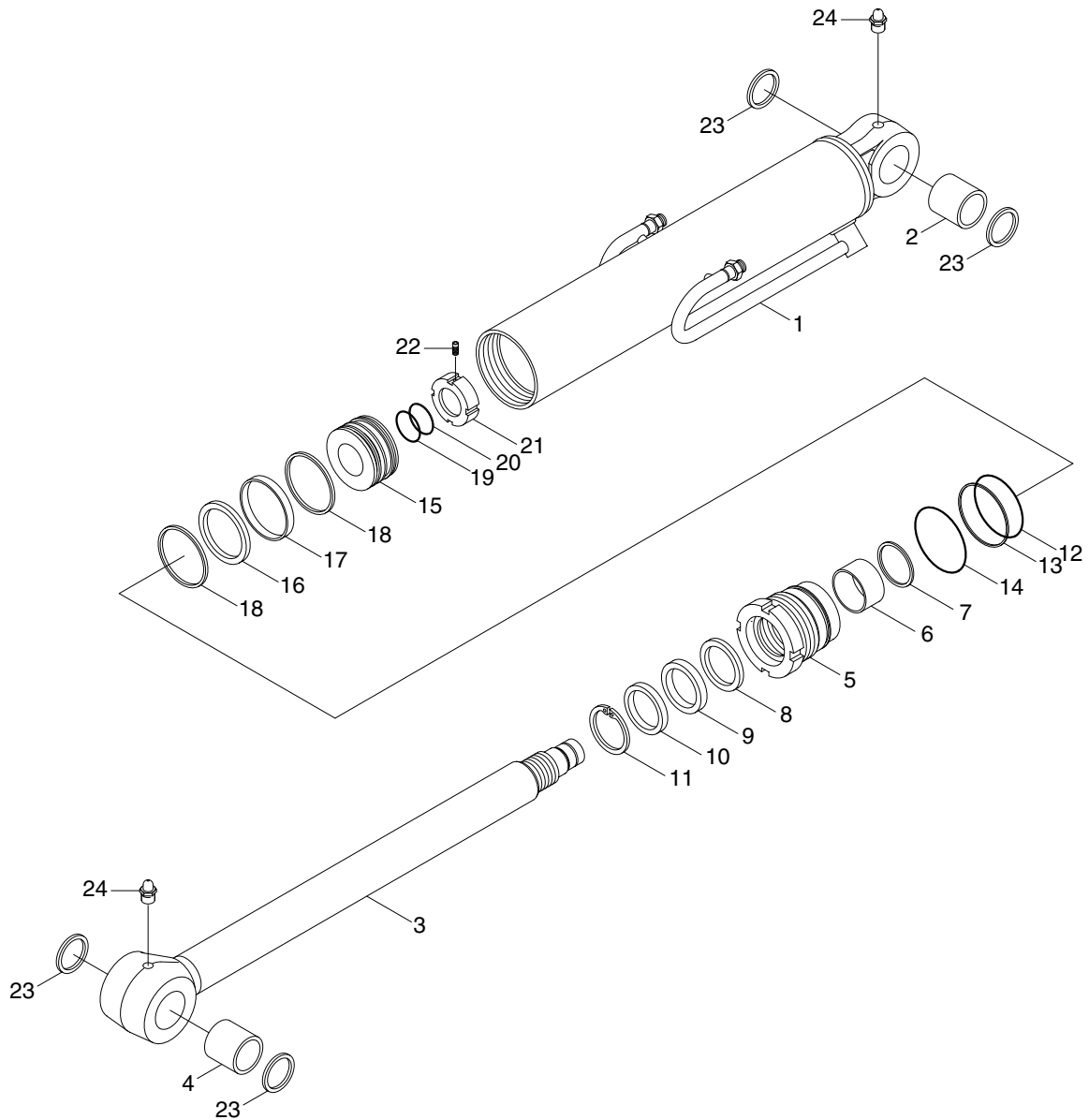
4) BOOM SWING CYLINDER



H940C6WE133

- | | | | | | |
|---|---------------|----|--------------|----|---------------|
| 1 | Tube assembly | 8 | Dust wiper | 14 | Wear ring |
| 2 | Rod assembly | 9 | O-ring | 15 | O-ring |
| 3 | Pin bushing | 10 | Back up ring | 16 | Back up ring |
| 4 | Rod cover | 11 | O-ring | 17 | Set screw |
| 5 | Rod bushing | 12 | Piston | 18 | Pin wiper |
| 6 | U-packing | 13 | Piston seal | 19 | Grease nipple |
| 7 | Back up ring | | | | |

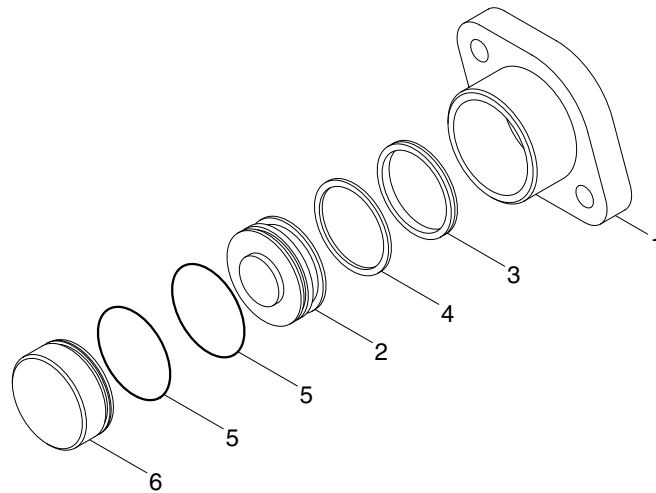
5) STABILIZER CYLINDER



H940C6WE134

- | | | | | | |
|---|----------------|----|----------------|----|---------------|
| 1 | Tube assembly | 9 | U-packing | 17 | Wear ring |
| 2 | Pin bushing | 10 | Dust wiper | 18 | Dust ring |
| 3 | Rod assembly | 11 | Retaining ring | 19 | O-ring |
| 4 | Pin bushing | 12 | O-ring | 20 | Back up ring |
| 5 | Rod cover | 13 | Back up ring | 21 | Piston nut |
| 6 | Rod bushing | 14 | O-ring | 22 | Set screw |
| 7 | Retaining ring | 15 | Piston | 23 | Pin wiper |
| 8 | Buffer seal | 16 | Piston seal | 24 | Grease nipple |

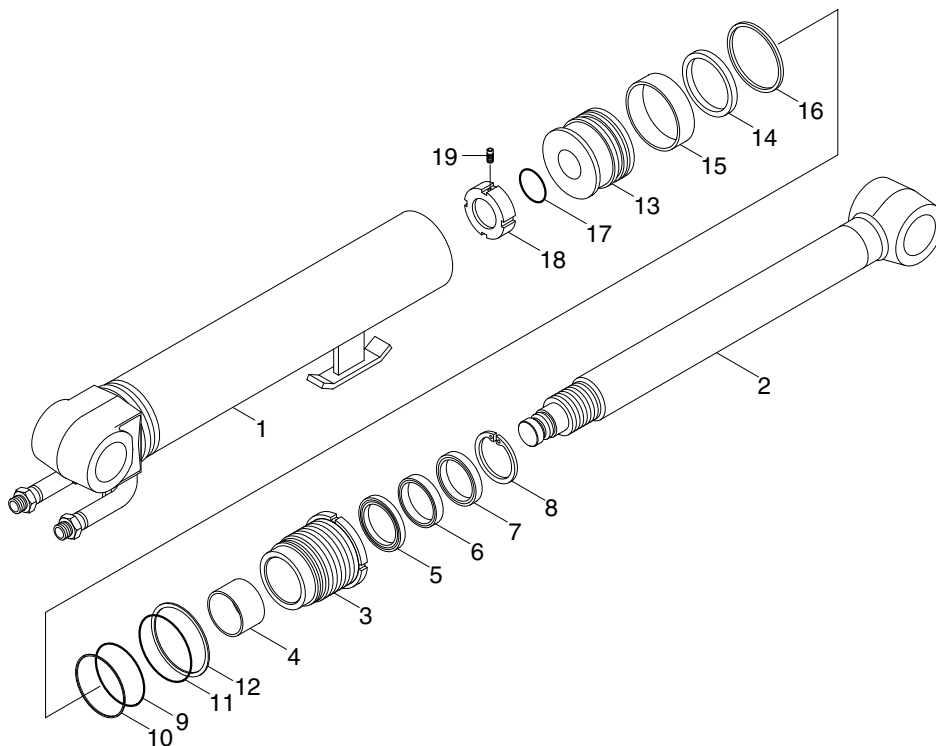
6) CLAMP CYLINDER



H940S6WE135

- | | | | | | |
|---|--------|---|--------------|---|--------|
| 1 | Body | 3 | U-packing | 5 | O-ring |
| 2 | Piston | 4 | Back up ring | 6 | Cover |

7) EXTENSION CYLINDER (OPTION)



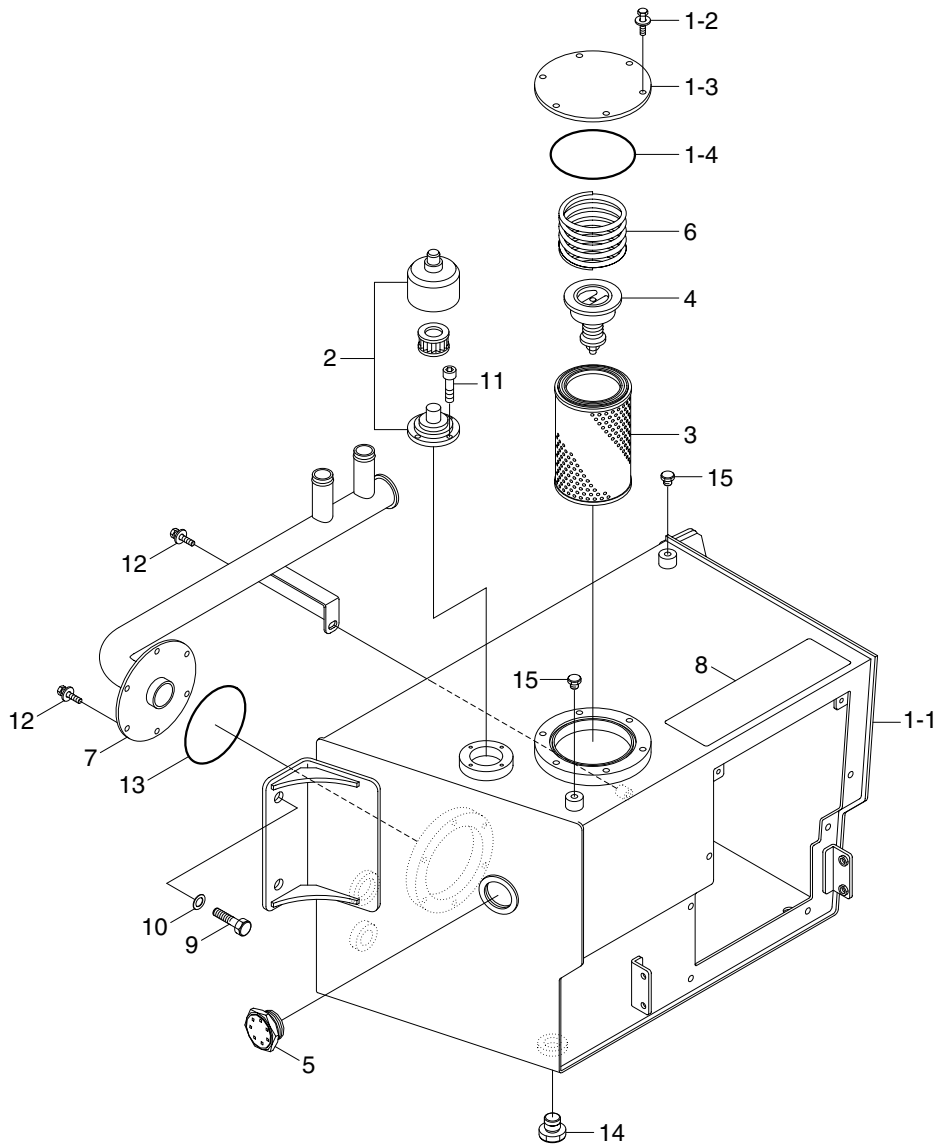
H940S6WE138

- | | | | | | |
|---|---------------|----|----------------|----|------------|
| 1 | Tube assembly | 8 | Retaining ring | 15 | Wear ring |
| 2 | Rod assembly | 9 | O-ring | 16 | Dust ring |
| 3 | Rod cover | 10 | Back up ring | 17 | O-ring |
| 4 | Rod bushing | 11 | O-ring | 18 | Piston nut |
| 5 | Buffer seal | 12 | Washer | 19 | Set screw |
| 6 | U-packing | 13 | Piston | | |
| 7 | Dust wiper | 14 | Piston seal | | |

11. HYDRAULIC OIL TANK

1) STRUCTURE

- The oil from the hydraulic tank is sent from the pump through main 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 (1-1).
- If the hydraulic return oil filter becomes clogged, return filter bypass valve (4) acts to allow the oil to return directly to the hydraulic tank (1-1). This prevents damage to the hydraulic filter (3). The bypass valve (4) is also actuated when negative pressure is generated in the circuit.



H940C6WE72

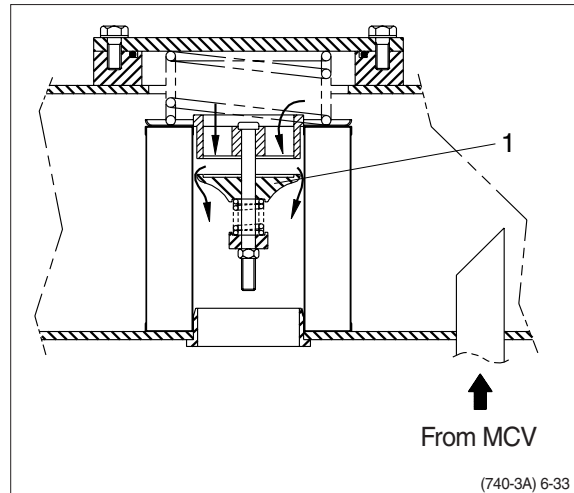
1-1	Hydraulic tank	4	By pass valve	10	Hardened washer
1-2	Bolt	5	Sight gauge	11	Socket bolt
1-3	Cover	6	Spring	12	Bolt
1-4	O-ring	7	Pipe wa	13	O-ring
2	Air breather	8	Non slip tape	14	Plug
3	Element assy	9	Bolt	15	Plug

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 : 1.36 kg/cm²
(19.3 psi)



3) AIR BREATHER

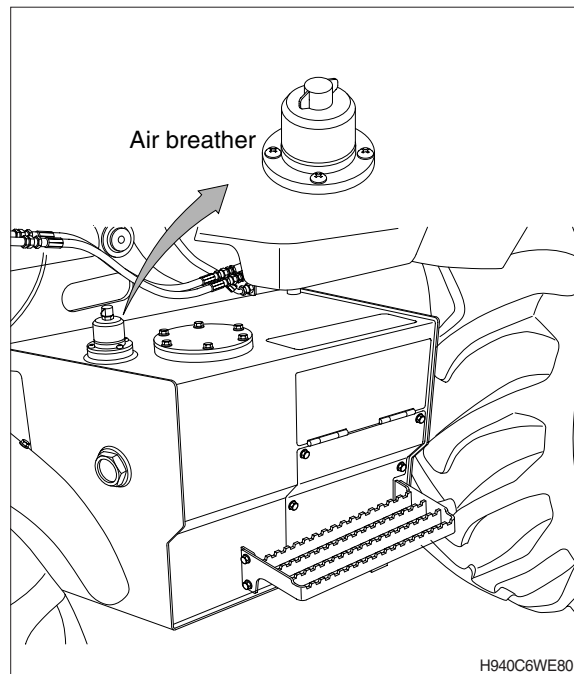
The air breather is equipped with the capacity to perform three functions simultaneously-as an air filter, breathing valve, and as a lubrication opening.

(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

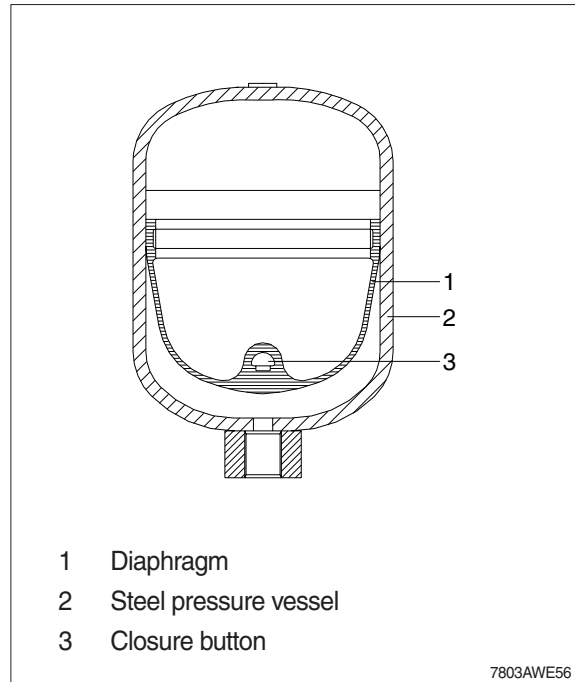
When the hydraulic cylinder is being used, the oil level in the hydraulic system increases and as temperature rises. If the hydraulic pressure rises above the set pressure, breather is actuated to release the hydraulic pressure inside the tank.



12. 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	0.35 l (0.1 U.S.gal)
Charging pressure of gas	15 kg/cm ² (213 psi)
Max actuating pressure	170 kg/cm ² (2420 psi)



13. RIDE CONTROL VALVE

Item	Description
Diameter	125 mm
Mounting height	403 mm
Capacity	1.5 l
Max working pressure	357 kgf/cm ²
Precharge pressure (at 20°C)	31 ± 1 kgf/cm ²
Precharge gas	Nitrogen
Portsize (A, B, T)	3/4-16UNF

