

SECTION 5 STEERING SYSTEM

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SECTION 5 STEERING SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. OUTLINE

The steering system of this machine consists of a fixed-displacement pump supplying a load sensing steering system and an open center loader system.

The components of the steering system are :

- Steering pump(1st pump)
- Steering unit
- Overload valve block
- Priority valve
- Steering cylinders

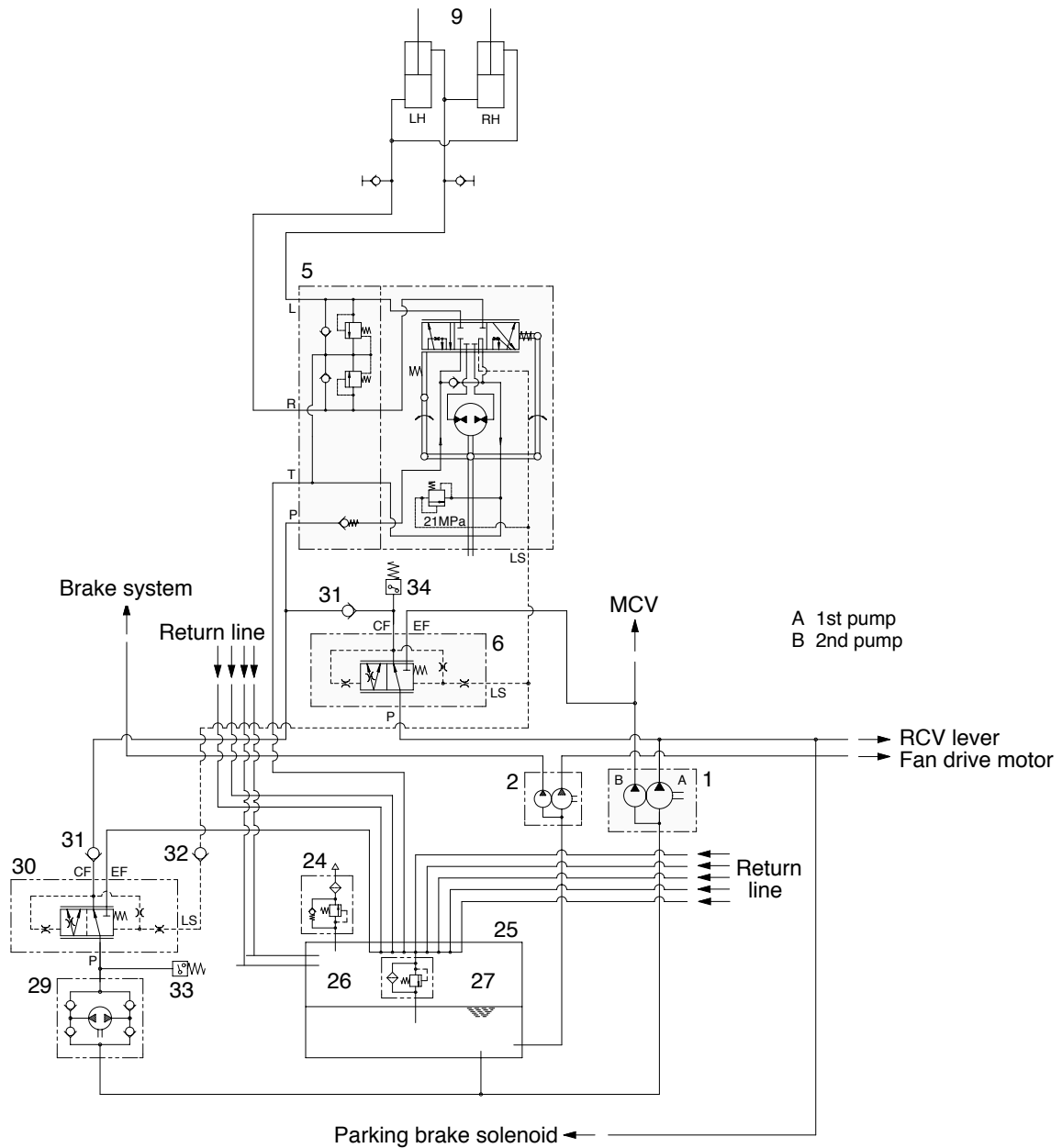
The steering pump, the first pump of main pump, draws hydraulic oil from the hydraulic tank.

Outlet flow from the pump flows to the priority valve. The priority valve preferentially supplies flow, on demand, to the steering unit. When the machine is steered, the steering unit routes flow to the steering cylinders to articulate the machine.

When the machine is not being steered, or if pump flow is greater than steering flow, the priority valve supplies flow to the loader system.

That is, output flow from the steering pump enters into the first pump of main pump for the operation of the attachment.

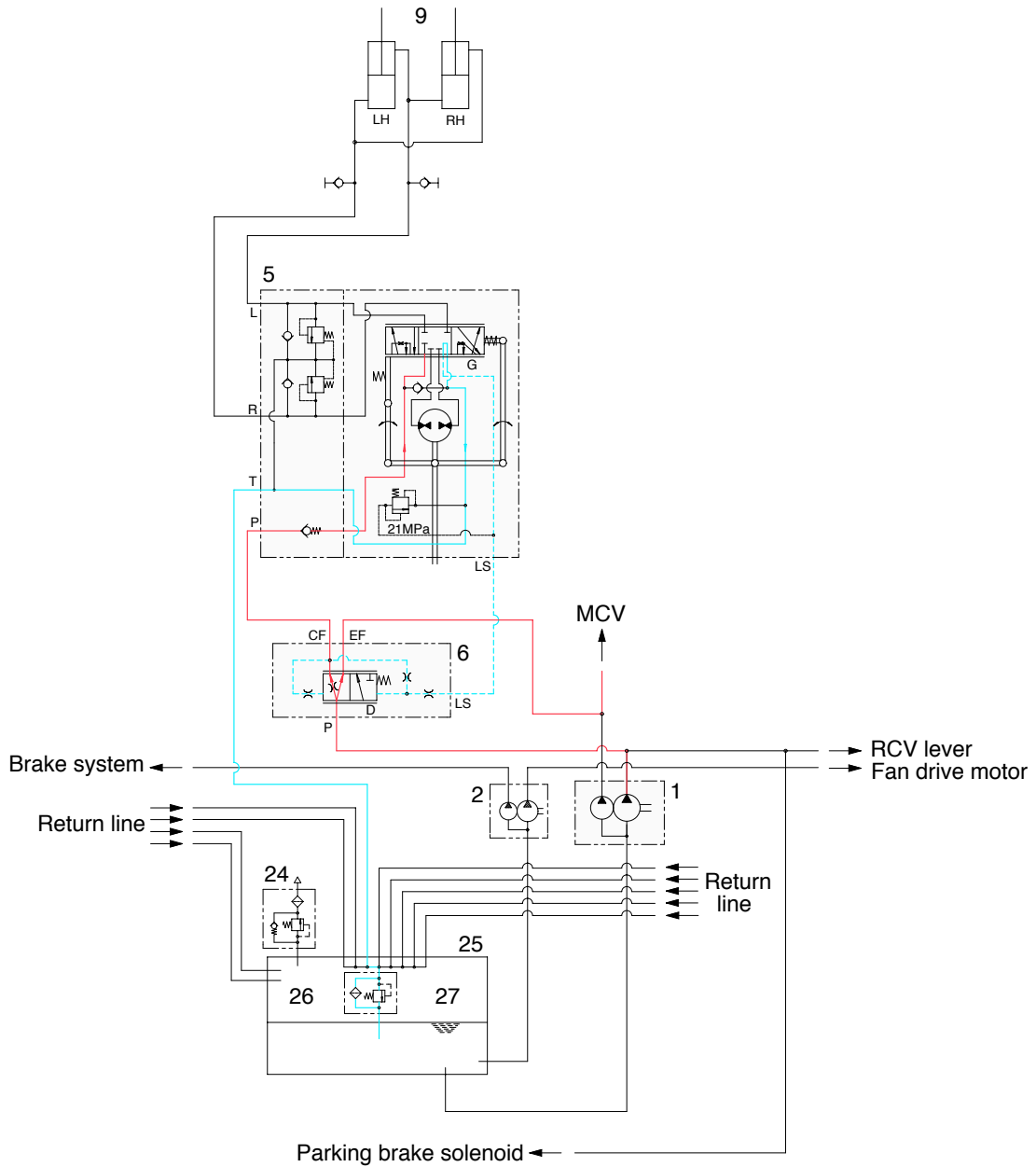
2. HYDRAULIC CIRCUIT



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- | | | | | | |
|---|-------------------|----|----------------------------|----|-------------------------|
| 1 | Main pump | 24 | Air breather | 30 | Priority valve(option) |
| 2 | Brake & fan pump | 25 | Hydraulic tank | 31 | Check valve(option) |
| 5 | Steering unit | 26 | Return filter | 32 | Check valve(option) |
| 6 | Priority valve | 27 | By pass valve | 33 | Pressure switch(option) |
| 9 | Steering cylinder | 29 | Emergency pump kit(option) | 34 | Pressure switch(option) |

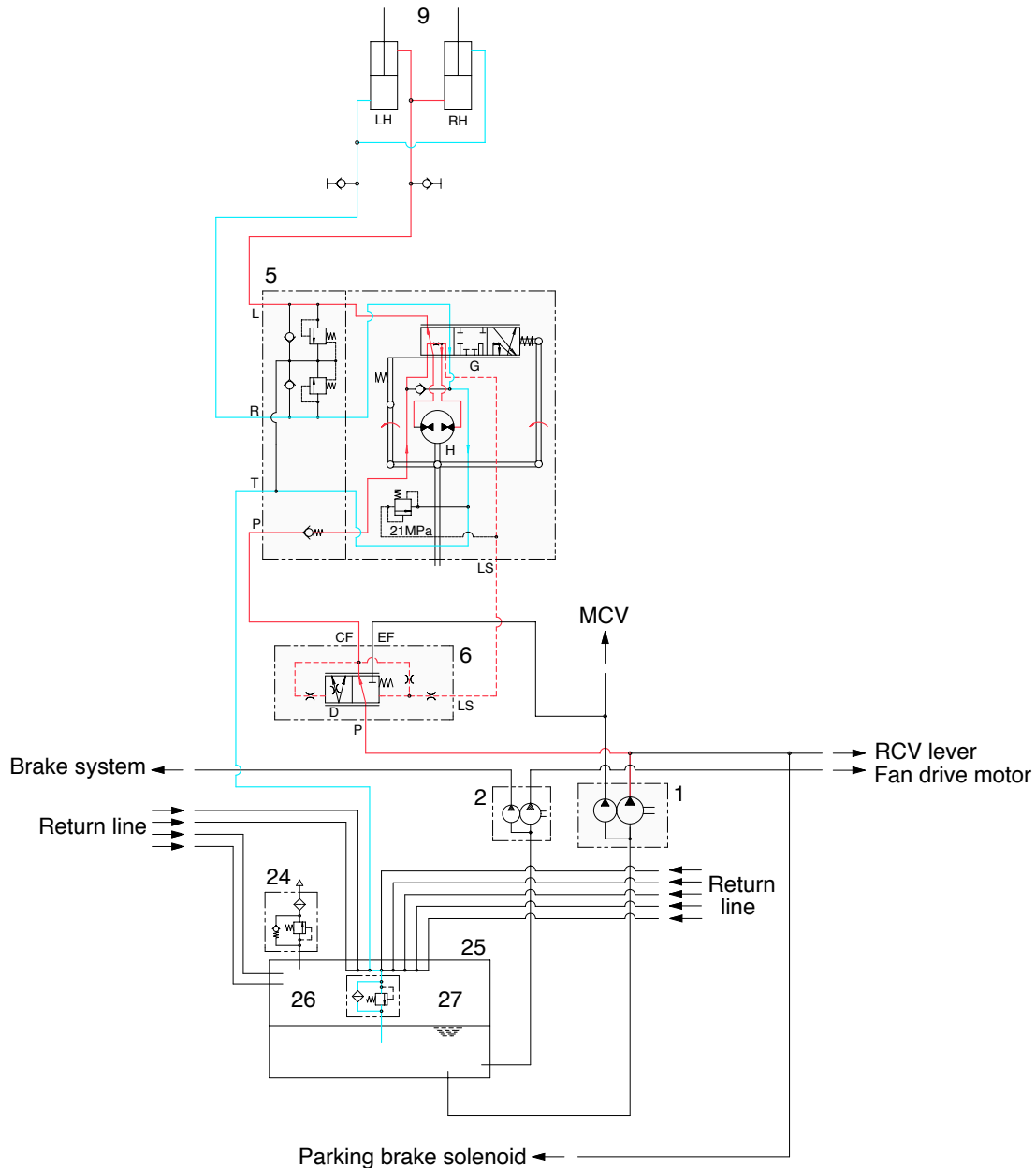
1) NEUTRAL



7407SE02

The steering wheel is not being operated so control spool(G) does not move.
 The oil from the steering pump enters port P of the priority valve and the inlet pressure oil moves the spool(D) to the right.
 Oil flow into LS port to the hydraulic tank(25) through orifice and return filter.
 So, the pump flow is routed to the loader system(Main control valve) through the EF port.

2) LEFT TURN



7407SE03

When the steering wheel(E) is turned to the left, the spool(G) within the steering unit(5) connected with steering column turns in left hand direction.

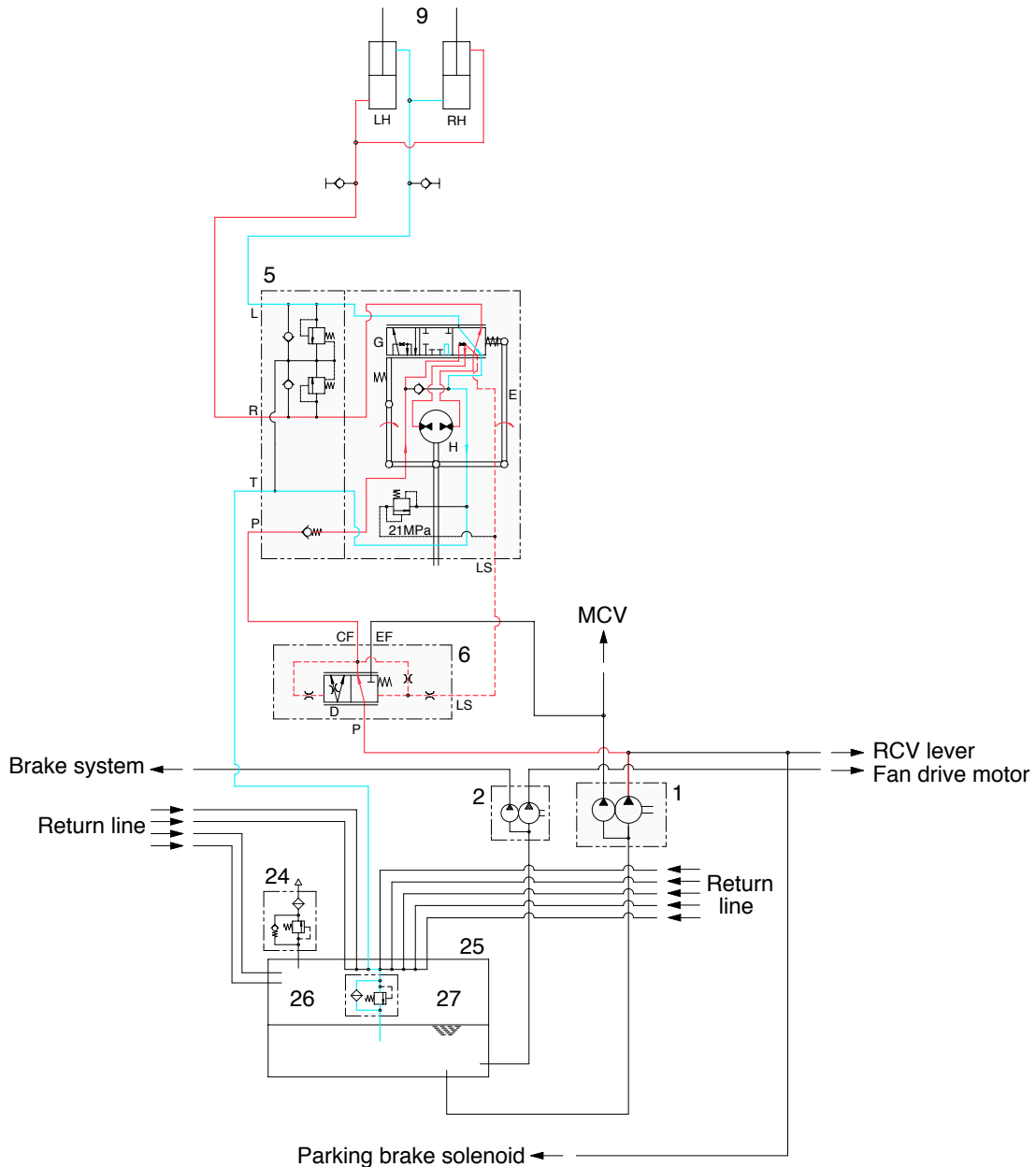
At this time, the oil discharged from the steering pump flows into the spool(G) of the steering unit(5) through the spool(D) of priority valve(6) and flows into the gerotor(H).

Oil flow from the gerotor flows back into the spool(G) where it is directed out the left work port(L) to the respective chamber of the steering cylinders(9).

Oil returned from left and right cylinder returns to hydraulic tank through the spool of the steering unit.

When the above operation is completed, the machine turns to the left.

3) RIGHT TURN



7407SE04

When the steering wheel(E) is turned to the right, the spool(G) within the steering unit(5) connected with steering column turns in right hand direction.

At this time, the oil discharged from the steering pump flows into the spool(G) of the steering unit(5) through the spool(D) of priority valve(6) and flows into the gerotor(H).

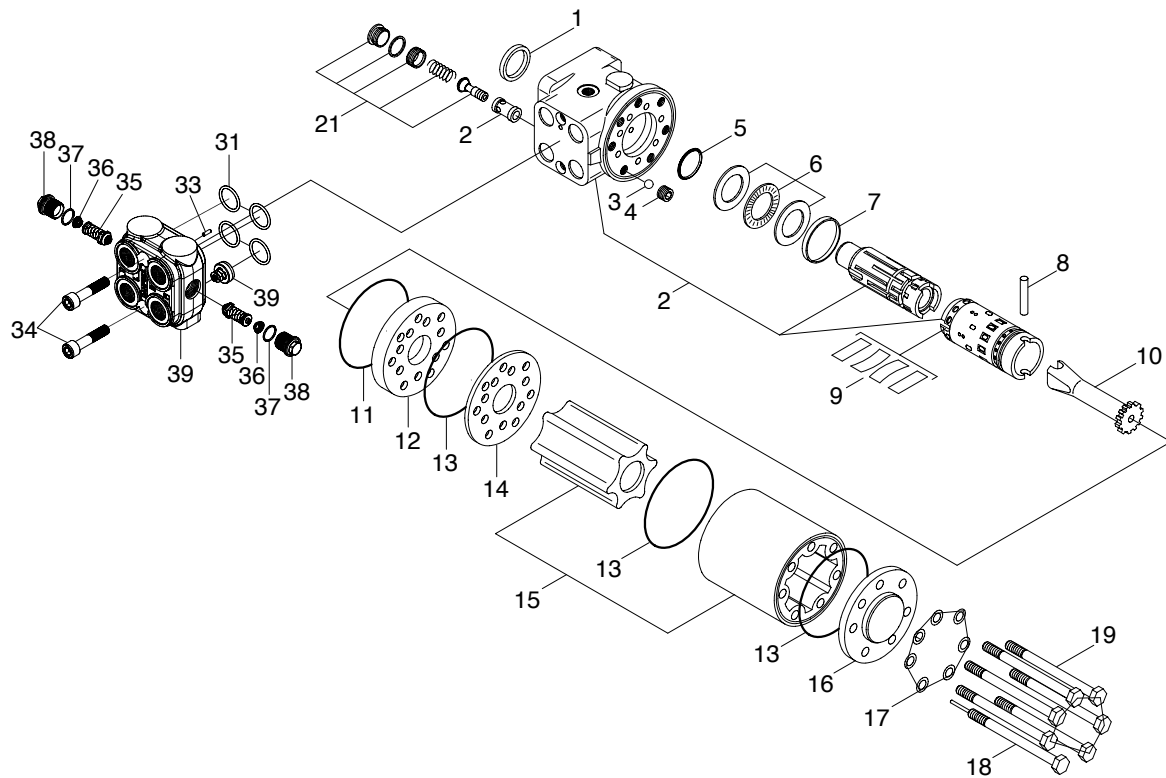
Oil flow from the gerotor flows back into the spool(G) where it is directed out the right workport to the respective chamber of the steering cylinders(9).

Oil returned from left and right cylinder returns to hydraulic tank through the spool of the steering unit.

When the above operation is completed, the machine turns to the right.

3. STEERING UNIT

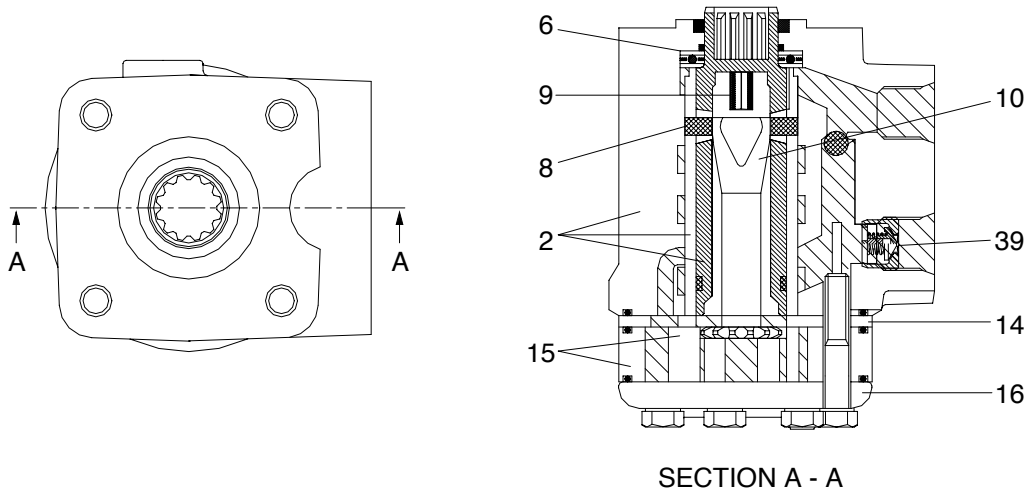
1) STRUCTURE



7407SE05

- | | | | | | |
|----|------------------------|----|--------------------|----|------------------------------------|
| 1 | Dust seal ring | 11 | O-ring | 21 | Complete relief valve without seat |
| 2 | Housing, spool, sleeve | 12 | Intermediate plate | 31 | Set of o-rings |
| 3 | Ball | 13 | O-ring | 33 | Rolled pin |
| 4 | Thread bushing | 14 | Distributor plate | 34 | Screw |
| 5 | Roto glyd ring | 15 | Gearwheel set | 35 | Shock valve |
| 6 | Bearing assembly | 16 | End cover | 36 | Spring |
| 7 | Ring | 17 | Washer | 37 | O-ring |
| 8 | Cross pin | 18 | Screw with pin | 38 | Plug |
| 9 | Set of spring | 19 | Screw | 39 | Housing, check valve |
| 10 | Cardan shaft | | | | |

2) OPERATION



7407SE06

The steering unit consists of a rotary valve and a rotary meter.

Via a steering column the steering unit is connected to the steering wheel of the machine.

When the steering wheel is turned, oil is directed from the steering system pump via the rotary valve (spool and sleeve) and rotary meter (gear wheel set) to the cylinder ports L or R, depending on the direction of turn. The rotary meter meters the oil flow to the steering cylinder in proportion to the angular rotation of the steering wheel.

Spool is connected directly to the drive shaft (10) of steering wheel. It is connected to sleeve by cross pin (8) (not in contact with the spool when the steering wheel is at neutral) and neutral position spring (9).

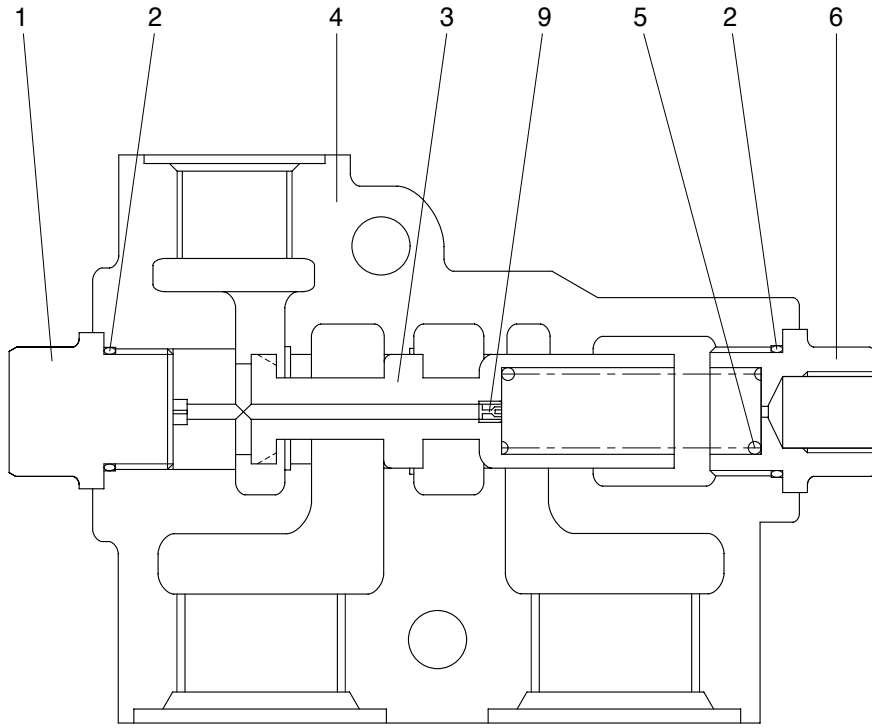
Cardan shaft (10) is meshed at the top with cross pin (8) and forms one unit with sleeve.

At the same time, it is meshed with gear rim of the gerotor set by spline.

There are four ports in valve body. They are connected to the pump circuit, tank circuit, and the head, and left and right steering cylinder. In addition, the pump port and tank port are connected inside the body by the check valve. Therefore, if there is any failure in the pump of engine, oil can be sucked in directly from the tank through the check valve.

4. PRIORITY VALVE

1) STRUCTURE

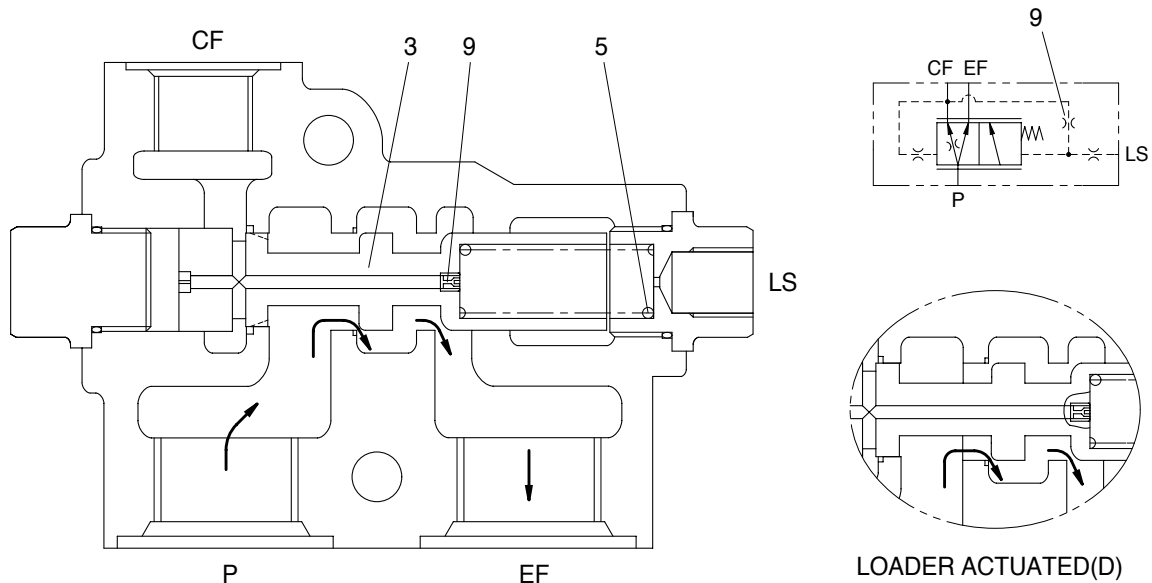


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- | | | | | | |
|---|--------|---|---------|---|-------------|
| 1 | Plug | 4 | Housing | 8 | Drive screw |
| 2 | O-ring | 5 | Spring | 9 | Orifice |
| 3 | Spool | 6 | Plug | | |

2) OPERATION

(1) Neutral



7406S 5-7

The priority valve is a pressure control valve that maintains priority pressure to the closed center steering valve. With the steering valve in neutral, flow through is blocked and all flow through the priority valve is directed out the EF port to the main control valve.

With the engine off, the spool(3) is pushed to the left(Viewed from sectional drawing at previous page) by the spring(5). The passage to the EF port is blocked while the passage to the CF port is open.

When the machine is first started, all pump flow is routed to the steering valve which blocks the flow. With the flow blocked, the pressure increases.

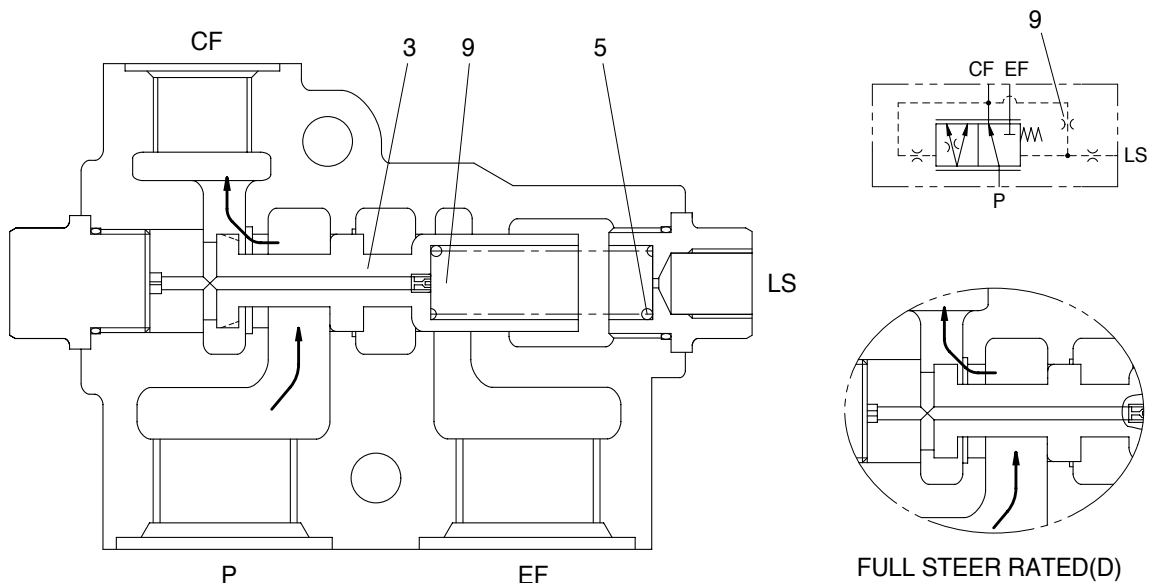
Steering inlet pressure is supplied through the pilot orifice to the left end of the spool. This causes the priority valve spool(3) to shift to the right against the spring and open the EF port.

As long as the steering valve is in neutral, just enough pressure is maintained at the steering valve to keep the priority valve spool shifted to the right.

The operating pressure in the loader system has no effect on the operation of the priority valve. With the loader actuated in relief(D) the priority valve will not shift until the machine is steered.

Flow through the priority valve spool passes from the CF port through the orifice(9) and into the LS port. It flows through the steering valve LS passage which is routed to return when the steering valve is in neutral. This provides a warm-up circuit for the steering valve to prevent binding of the steering valve due to oil temperature extremes.

(2) Midturn



7405S 5-8

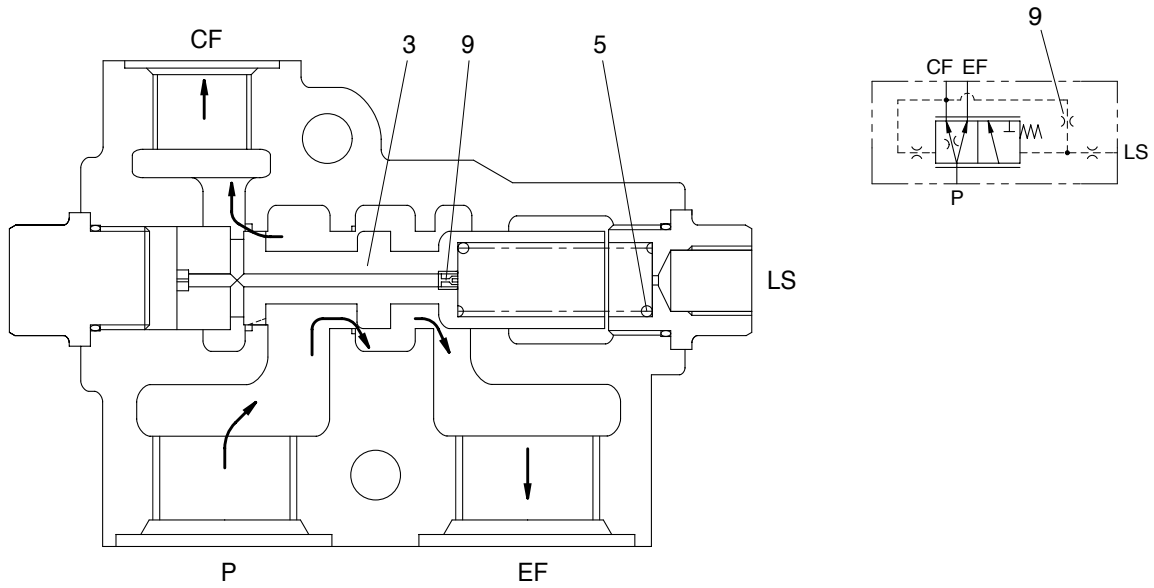
When the machine is steered, load sensing pressure from the steering valve flows through the orifices LS port in the priority valve. Load sensing pressure plus spring(5) force move the spool(3) to the against the pilot pressure on the left end of the spool. This restricts flow to the loader through the EF port while the CF port is opened to the steering valve.

The load sensing circuit is control circuit that routes steering workport pressure to the spring side of the priority valve spool. It allows the priority valve spool to sense the pressure that is required to steer the unit under varying conditions.

During normal steering conditions, oil is entered into the load sensing circuit through an orifice in the steering valve. When steering at the full steer rate(D), the orifice opens to an unrestricted passage. At low engine speed, the spool will shift to the full left position, directing all flow to the steering valve. At high idle, the steering system can use about one-half of the pump flow. Therefore, the excess oil flows to the main control valve.

The load-sensing circuit receives the majority of its flow from the load sensing orifice in the steering valve. Some flow is also supplied from the CF port through orifice(9) in the priority valve spool.

(3) Full turn



7405S 5-9

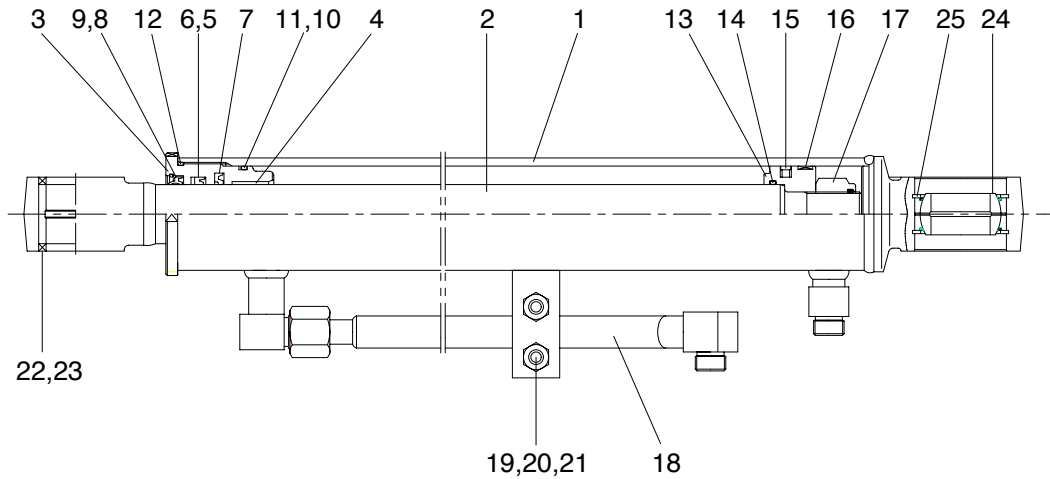
When the machine is steered to a full turn, the frames bottom against the steering stops.

Pressure to the steering valve (Pilot pressure), which is sensed at the left end of the priority valve spool (3), continues to increase until it can move the spool to the right against the load sensing pressure plus spring force. At this time, all oil flows out of the EF port to the loader control valve.

If the loader attachment is being operated while steering, the loader function will slow until the machine reaches the steering stops. At that time, the loader cycle speed will increase until the machine is steered again.

5. STEERING CYLINDER

1) STRUCTURE



7407SE07

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

2) OPERATION

This machine use to cross connected cylinder for steering operation.

The steering cylinder use a gland(3) to remove piston and sealed seals. Dust wiper(8) located on the in side of the gland protects cylinder inner parts from dust. The piston(13) is fastened to the rod(2) by a nut(17).

The piston uses a single wear ring(16) with a piston seal(15) to seal between the piston and tube.

The gland seals against the tube with two O-rings. The rod is sealed against the gland with a rod seal(5).