VOLVO

Construction Equipment

Service Information

Document Title: **Description, steering system**	Function Group: **600**	Information Type: **Service Information**	Date: **2014/6/26**
Profile:			

Description, steering system

The steering system consists of two engine-dependent hydraulic pumps that supply oil to the directional valve for the steering and tipping systems via the left non-return valve block.

The steering system is also equipped with a ground-dependent hydraulic pump that supplies oil to the steering valve via the right non-return valve block.

If the two engine dependent hydraulic pumps should malfunction, the ground-dependent pump will function as pump for secondary steering.

The steering valve is controlled by the steering wheel via the rack and pinion gear and linkage system, see hydraulic diagram on next page. The steering valve leads oil to the steering cylinders when the steering wheel is turned and the linkage system moves the steering valve slide from the neutral position.
Since the linkage system is connected to the steering joint, the steering valve slide is returned to the neutral position when the machine has changed direction according to the movement of the steering wheel. Conversely, the steering valve slide is moved out of the neutral position when the steering angle is altered by external forces and the steering wheel position remains unchanged. The movement of the steering valve slide is max. 7.5 mm (0.30 in) and is limited by mechanical stops.
For the construction of the hydraulic system, see Section 9.

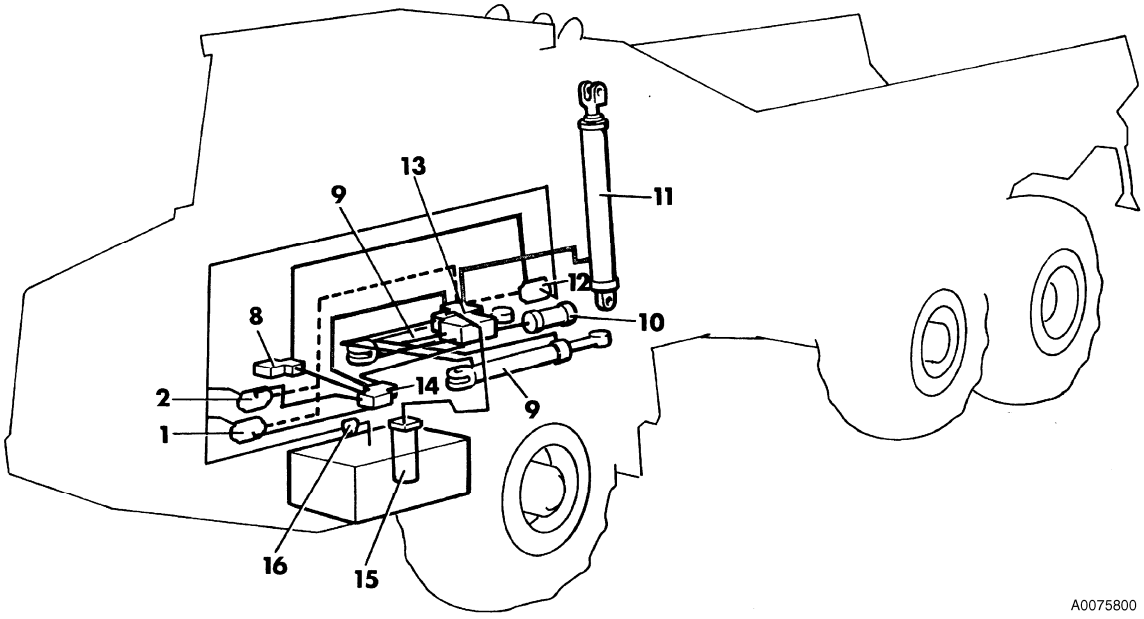

Figure 1
Hydraulic system for steering and tipping, component locations

1	Hydraulic pump for steering and tipping hydraulics
2	Hydraulic pump for steering and tipping hydraulics
8	Non-return valve block with test outlet for ground-dependent pump, see Pos. 12
9	Hydraulic cylinders for steering
10	Damping cylinder for steering
11	Hydraulic cylinder for tipping load body
12	Hydraulic pump, ground-dependent for steering system

13 Steering and tipping valve
14 Non-return valve block with two test outlets for hydraulic pumps, pos. 1 and pos. 2
15 Oil filter for return oil
16 Shut-off valve for hydraulic oil

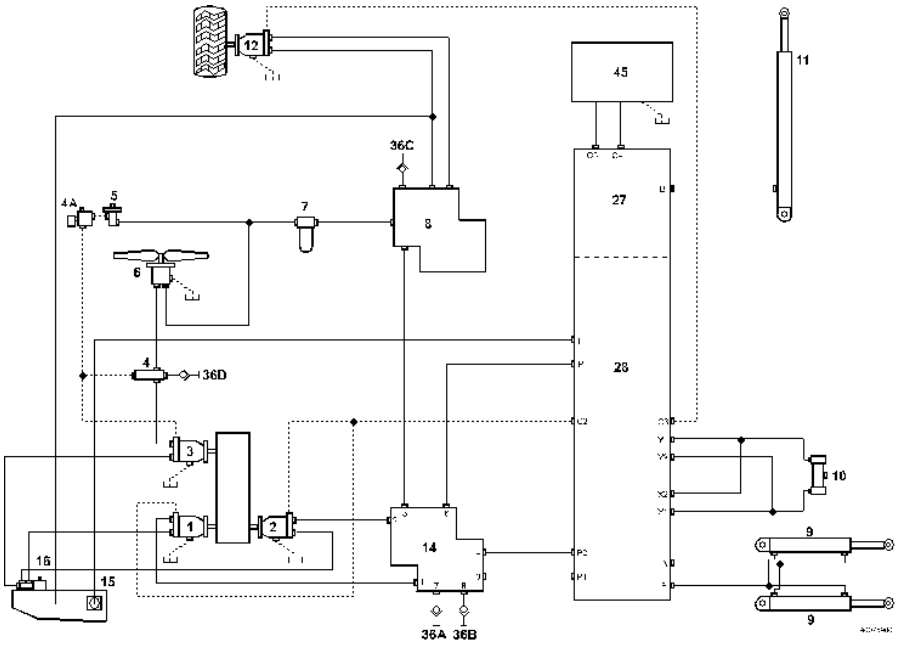

Figure 2
Hydraulic system

36A Test outlet for hydraulic pump 1
36B Test outlet for hydraulic pump 2
36C Test outlet for ground-dependent pump (12)
36D Test outlet for fan drive
1 Hydraulic pump for steering and tipping systems (R)
2 Hydraulic pumps for steering and tipping systems (L)
3 Hydraulic pump for fan motor (R)
4 Restricting valve for fan motor with pump test outlet
4A Solenoid valve for fan drive
5 Thermostat valve for fan drive
6 Hydraulic motor for fan drive
7 Oil filter for oil from fan motor
8 Non-return valve block with test outlet for ground-dependent pump 12
9 Hydraulic cylinders for steering
10 Damping cylinder for steering
11 Hydraulic cylinder for tipping load body
12 Hydraulic pump, ground-dependent for steering

14 Non-return valve block with two test outlets for hydraulic pumps 1 and 2
15 Oil filter for return oil to tank with filler plug
16 Shut-off valve for hydraulic oil
27 Tipping valve
28 Steering valve
45 Pressure limiting valve M2

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Service Information

Document Title: **Pressure accumulation, engine dependent pumps 1 and 2**	Function Group: **640**	Information Type: **Service Information**	Date: **2014/6/26**
Profile:			

Pressure accumulation, engine dependent pumps 1 and 2

The numbers refer to the hydraulic diagram, [Invalid linktarget] .

Engine running and machine parked. Oil from pumps 1 and 2 is forced to steering valve 28 (neutral position) and through it to tipping valve 27. The pumps 1 and 2 are connected to each other by pipes and passages in valve block 14. Pump 1 and tipping valve 27 are also interconnected for the steering function and are therefore also connected to the steering valve at its connection P2.

Pressure is built up for the steering valve, the tipping valve and non-return valve 30 in non-return valve block 8. The sensor 31 in non-return valve block 14 receives pressure on both sides, the spring keeps the switch open. Sensor 31 in non-return valve block 8 receives pressure on one side, the spring is compressed and the switch is closed. The pump compensator valve is actuated via internal passages and the pump angles down. Standby pressure now exists at the valves. The pressure at this stage is approx. 24 bar (348 psi) and is determined only by the spring force in the compensator valve as there is still no pressure from the steering system for the compensator C-connection.

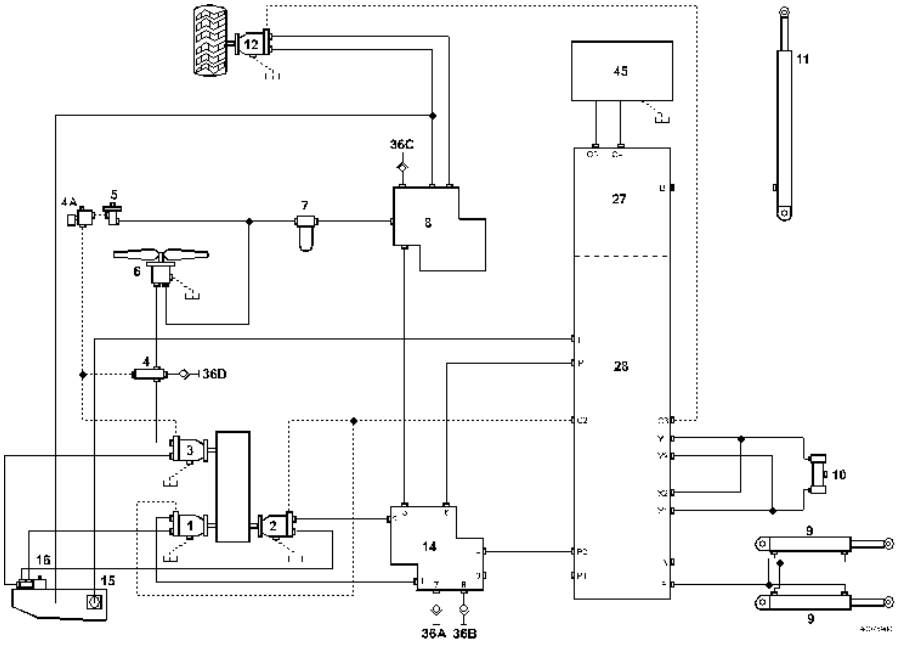

Figure 1

Hydraulic system

In the neutral position, the steering valve allows a small, controlled flow of oil between its connection P2 and connections A and B for the steering cylinders. An equal flow of oil is also allowed between connections A – B and connection T4 for the tank line. Pressure builds up to the steering cylinders 9, damping cylinder 10, shock valves 20 – 21, anti-cavitation valves 22 – 23 and cross-over valves 17 – 18 – 19. Pressure also builds up via cross-over valves 17 and 26 to the compensator C-connection on pumps 1 – 2 and 12, and the pressure in pumps 1 and 2 increases proportionally. Oil is simultaneously forced out of the steering valve connections A and B to its connection T4 and is returned to the tank via non-return valve 29 against its opening pressure of approx. 12 bar (174 psi).

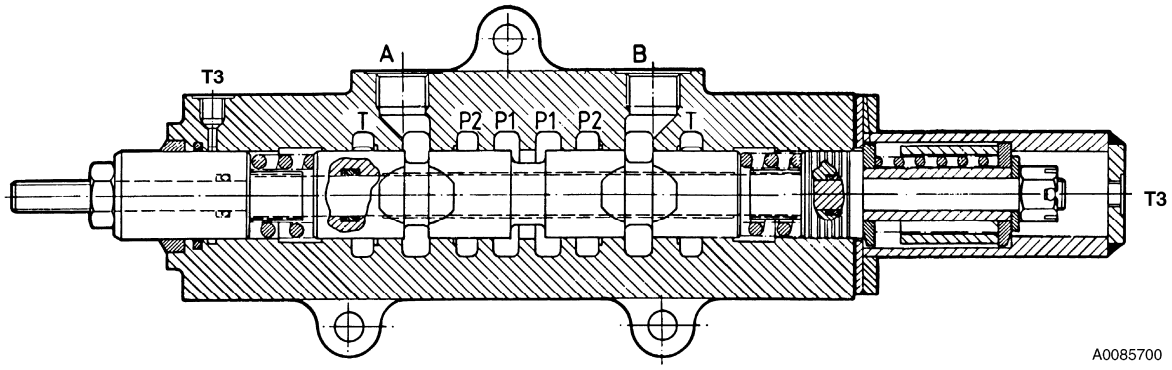

Figure 2
Steering valve

The standby pressure in the sensor line at the compensator C-connection on respective pump is approx. 21 bar (305 psi), which is the sum of the pressure of approx. 12 bar (174 psi) (non-return valve 29) and approx. 9 bar (130 psi), which arises in the tank line between the steering valve and non-return valve 29.

The standby pressure at the outlet of pumps 1 and 2 is approx. 45 bar (653 psi), which is the sum of the sensor pressure 21 bar (305 psi) and the spring pressure in the compensator valve 24 bar (348 psi).

P = C + F

P = pressure at pump outlet
C = pressure at sensor line
F = spring pressure in compensator valve

Pressure accumulation, ground-dependent pump 12

The engine is running and the machine is moving forward. Sensor pressure is applied at the compensator C-connection. When the pump rotates in the correct direction (machine moving forward), the pressure will build up to the non-return valves 30 in the non-return valve block 8 and to the left side of the sensor 31. Its spring will be unloaded and the circuit is opened. The pump compensator valve is actuated via internal passages and the pump angles down as there is no oil flow. The same standby pressure now exists at the outlet of pumps 1 – 2 and 12.

Steering function, engine dependent pumps 1 and 2

The steering valve slide is displaced upwards and connection P2 from pumps 2 and 1 are now connected to the steering cylinders via connection A. The pressure builds up in the cylinders' A-connection and the pistons are actuated on the positive and negative sides. Pressure builds up simultaneously via cross-over valves 18 – 19 to damping cylinder 10 and the end surface of the valve slide: The valve slide is stabilized. The same pressure now also exists in the sensor line to the compensator C-connection. The compensator valve is actuated and adjusts the flow and pressure from the pump to current requirements.

⚠ CAUTION

There is a pressure-drop between the pumps' outlet and the steering cylinders for as long as there is oil flow. (Concerns resp. restrictions in valves). The pressure difference in this system is approx. 14 bar (203 psi). However, there is a static pressure between connection B in the steering valve and the sensor line to the compensator C-connection when there is no oil flow.

The pressure formula P = C + F always applies, regardless of the current pressure demand.

Steering valve connection B is connected to its T-connection. The return oil from the steering cylinders is returned to the tank via non-return valve 29 against its opening pressure of 12 bar (174 psi).

Steering function, ground-dependent pump 12

The ground-dependent pump is connected to the drive wheels; the pump operates when the machine moves forward. If the

pressure from pumps 1 and 2 to the non-return valve 30 in non-return valve block 8 ceases, the non-return valve will be opened by the pressure from pump 12. The oil is led towards the steering valve P2 connection. Pressure is now present only on the upper side of sensor 31 in non-return valve block 14, the spring is compressed and the switch closes.

With the controlled flow of oil in the steering valve between its connection P2 and the connections A and B, the pressure to the steering cylinders, valves, damping cylinder and compensator C-connection on pumps 1 – 2 and 12 can be built up again. The pressure in pump 12 increases proportionally. Oil is simultaneously forced out of steering valve connections A and B to connection T and is returned to the tank via non-return valve 29 against its opening pressure of approx. 12 bar (174 psi).

Steering speed will be limited at low pump speeds since the oil flow is supplied from only one pump.

Restriction 35 limits pump oil flow when operating in the upper speed ranges, thereby protecting the pump from cavitation damage.

The rotational direction of the pump changes when reversing the machine, and the oil will then flow backwards via the left non-return valve 30 in the non-return valve block 8 and the steering function ceases.

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