

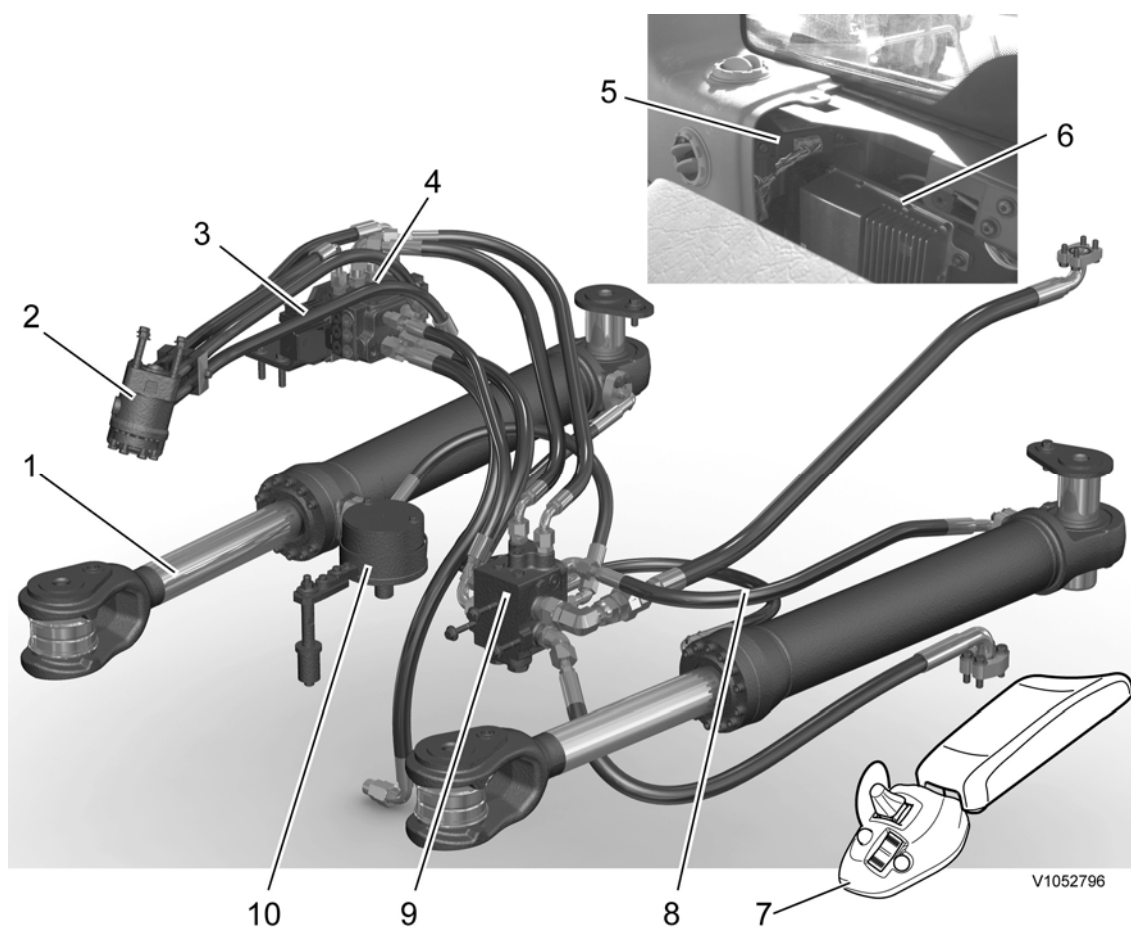
Document Title: Steering, description	Function Group: 600	Information Type: Service Information	Date: 2014/3/20
Profile: WLO, L350F [GB]			

Steering, description

Component description

The steering system consists of hydraulic pump (P2) and the components given below, see figure.

P2 provides the steering system with oil. If all oil is not required, P2 provides oil to other systems, see [910 Working hydraulic system, function description](#) and [500 Braking system, description](#).



V1052796

Figure 1

1. Steering cylinder
2. Steering valve
3. PVED with EMC-protection
4. EHPS-valve
5. SWM (gateway)
6. V2-ECU
7. Comfort Drive Control, arm rest
8. Steering accumulators, engagement
9. Shift valve
10. Angle sensor SE6401

The steering valve works as a pilot control valve and distributes the oil according to steering wheel movements to the EHPS-

valve by connecting to the minus side on the cylinder located on the side to which the machine is being steered.

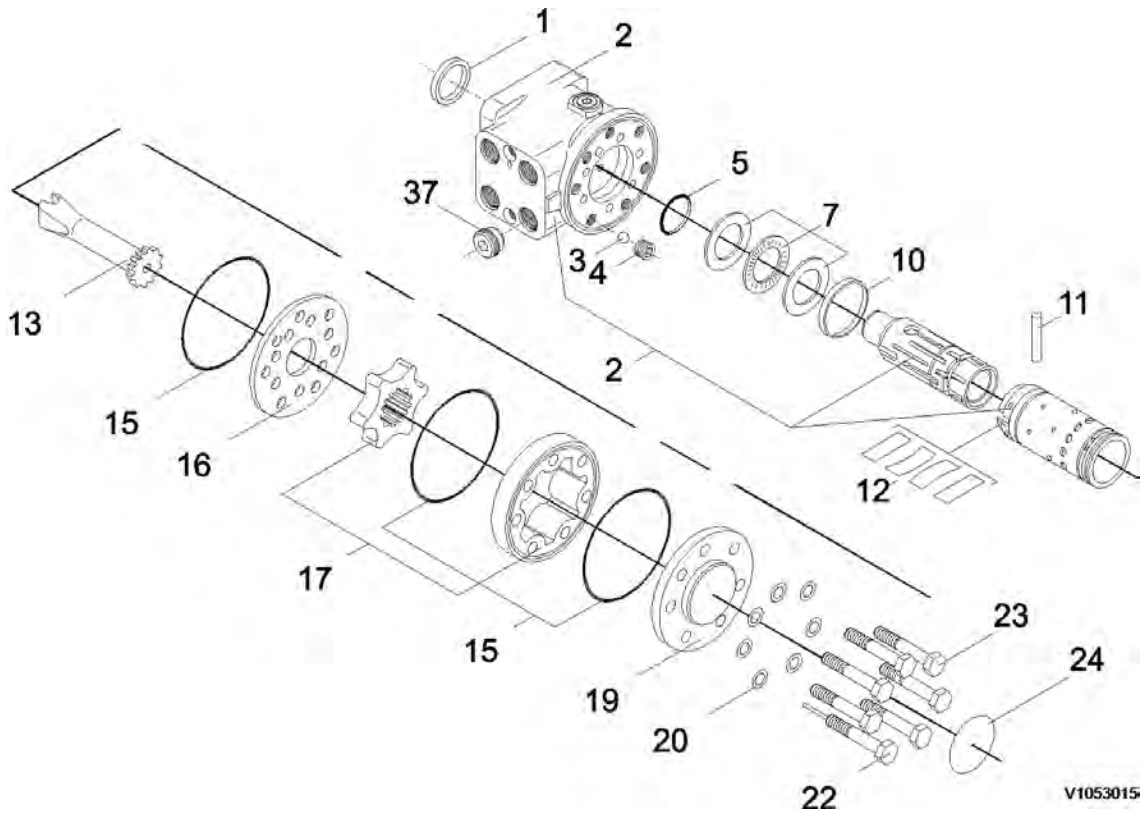
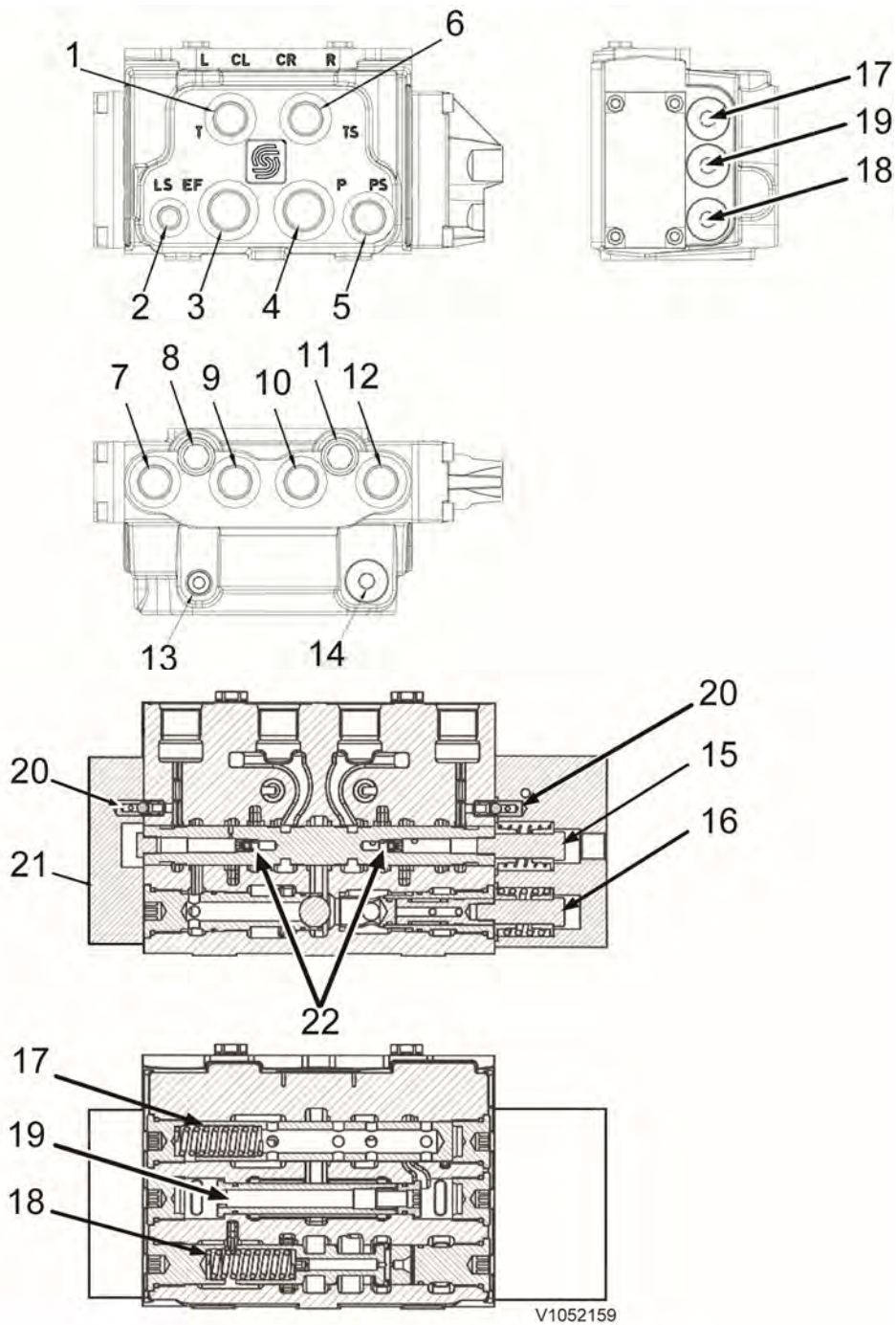


Figure 2

Steering valve

1	Seal	15	O-ring
2	Valve housing, inner and outer valve spool	16	Distribution plate
3	Ball (non-return valve)	17	Rotor, rotor ring
4	Bush	18	O-ring
5	O-ring/back-up ring	19	Cover
7	Bearing kit	20	Washer
9	Ring (carrier)	22	Bolt with guide pin
11	Cross pin	23	Bolt
12	Leaf springs	24	Type plate
13	Rotor shaft	26	Spacer
14	Spacer		

The EHPS-valve (**E**lectro **H**ydraulic **P**ower **S**teering) works as the main steering valve and distributes the oil to the shift valve and the steering cylinders.



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Figure 3
EHPS-valve

1	Tank	12	Steering valve (R)
2	LS-pressure	13	Pressure adjustment, LS-pressure
3	Working hydraulics	14	Non-return valve
4	Pump pressure	15	Spool
5	Steering valve (PS)	16	Pressure-reducing valve
6	Steering valve (TS)	17	Pressure back-up valve
7	Steering valve (L)	18	Priority valve
8	Shock and anti-cavitation valve (left, L)	19	Sleeve
9	Steering cylinder via shift	20	Shuttle valves

	valve (left)	
10	Steering cylinder via shift 21 valve (right)	PVED, position
11	Shock and anti-cavitation 22 valve (right, R)	Non-return valves

PVED (**P**roportional **V**alve **E**lectrical actuator **D**igital) works as an electrical pilot control valve. PVED is mounted on the EHPS-valve and contains:

- CU6401
- Solenoid valves
- Strainer
- Adjusting screw for adjusting spool position in EHPS
- Position sensor for spool position in EHPS

On PVED there is an EMC filter (protection) (CU6402) mounted, in a shielded box.

NOTE!

To ensure the function of the steering system, it is very important that the EMC filter is intact. If damage is suspected, the filter should be replaced.

The parts in PVED cannot be replaced. For adjusting sideways VCADS-Pro must be used.

CU6401 controls the solenoid valves which in turn control the spool which distributes oil to the steering cylinders.

The shift valve provides increased steering force when high pressure is required.

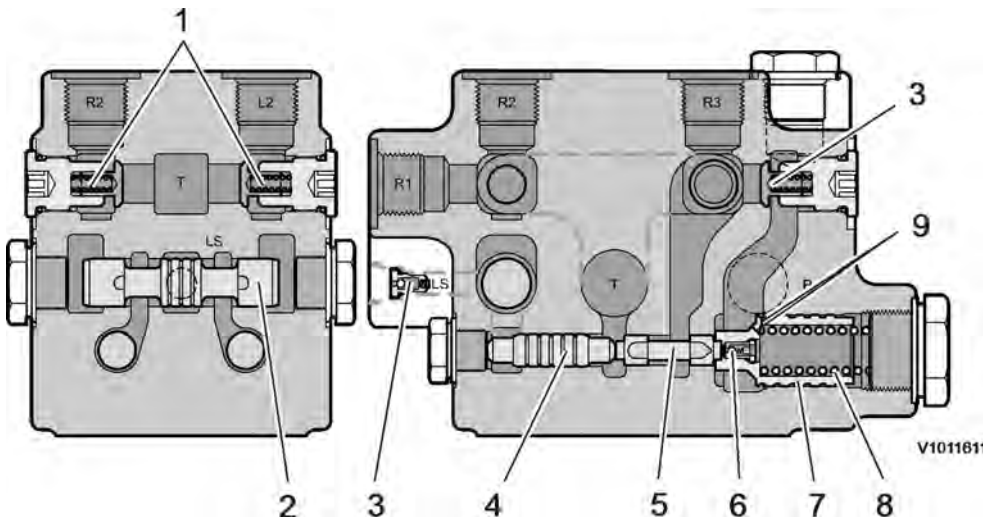


Figure 4
Shift valve

1. Anti-cavitation valve
2. Directional spool
3. Non-return valve
4. Piston
5. Control spool
6. Non-return valve
7. Damping piston
8. Spring
9. Restriction

The angle sensor, which is located at the frame joint, registers the frame joint angle, see [660 Comfort Drive Control \(CDC\), description](#).

Communication between CU6401 and the other control units, e.g., V2-ECU, takes place via a gateway (SWM).

The accumulators are located between the piston ends of the steering cylinders and the shift valve. Their purpose is to

provide a slower pressure build-up, which means that the steering will be smoother. They also work as dampers against sideways jerking, regardless of if the steering is used or not.

The machine may be provided with secondary steering [1] ⓘ, see [647 Secondary steering description](#).

See also [600 Steering system description](#), [990 Hydraulic diagram complete](#) and [370 Wiring diagram 603](#).

[1]Optional equipment

SE6401
 SE6601
 CU6401
 CU6402

Angle sensor, frame joint
 Sensor, steering lever (joystick)
 Control unit PVED
 EMC-protection

Neutral position

Pump 2 (P2) gives priority to the steering, but if the steering system does not require any oil (or if the steering system has received all the oil it needs), the flow from pump P2 is used by the working hydraulic system (via priority valves (A), (B) in the EHPS-valve and the central valve) as well as by the servo and brake systems (via the central valve).

When the steering wheel is not actuated, the steering valve and the spool (C) in the EHPS-valve are in neutral position. P2 only delivers stand-by pressure since the LS-pressure is low for as long the steering or working hydraulics are not used.

P2 feeds oil to EHPS. The priority spool (B) in EHPS changes position and opens the connection to the working hydraulics via port EF and via the shuttle valve to spool (C), which is closed when neither the steering wheel nor the Comfort Drive Control (CDC) is used. Part of the oil flow passes via pressure-reducing valve (D) to the steering valve, which also is closed in a non-actuated position.

The flow passes from priority spool (B) via the restriction to pressure-reducing valve (E) for LS-pressure and on via port LS in EHPS to port LSS on the central valve and out via the shuttle valve and port LSP to P2. At the same time the LS-pressure passes to spool (C) via the non-return valve. The pressure back-up valve (F) makes sure of maintaining the servo pressure, which, via the strainer, reaches the solenoid valves in PVED.

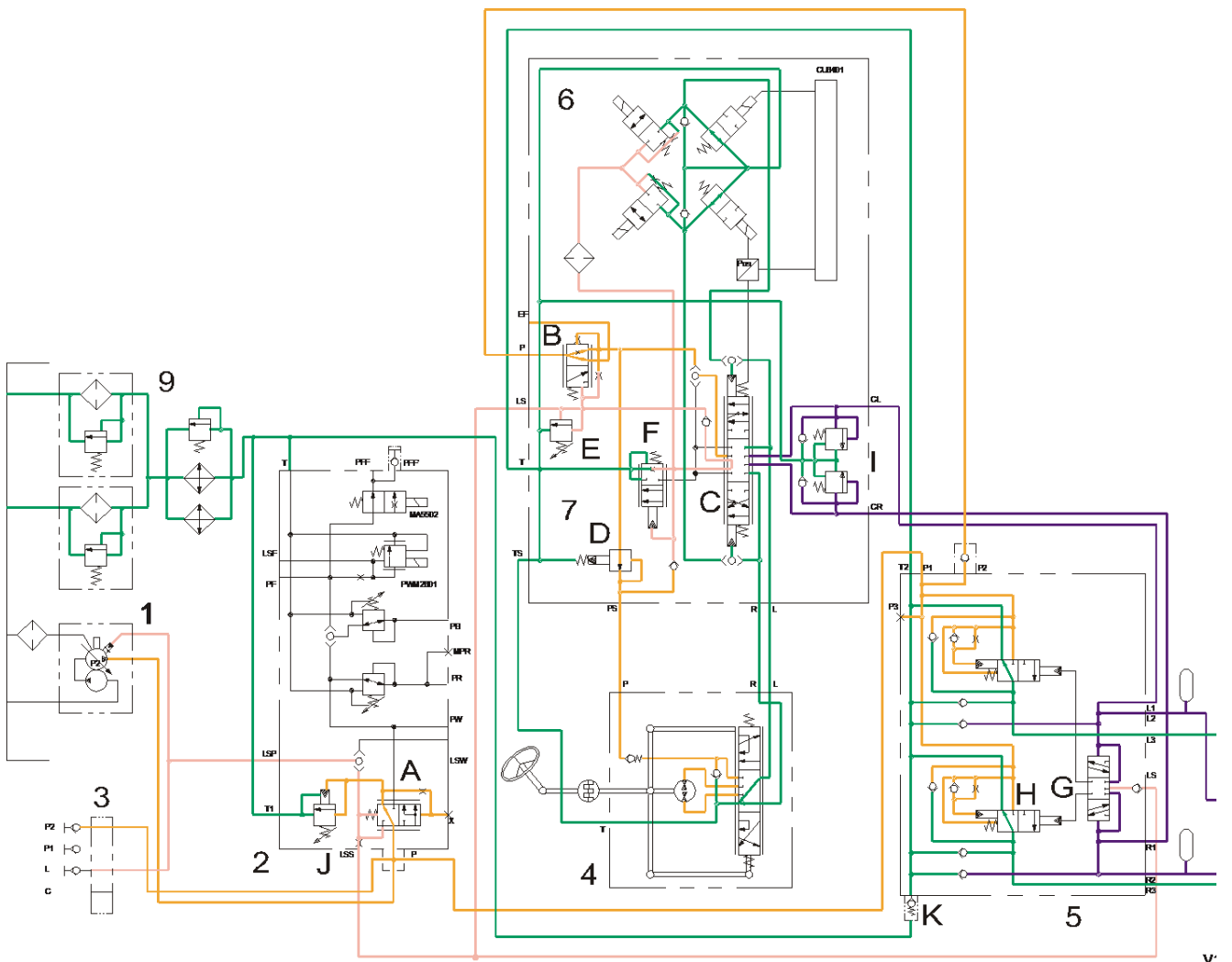


Figure 2
Neutral position

1. Hydraulic pump, P2
2. Central valve

3. Checking point on panel
4. Steering valve
5. Shift valve
6. PVED (positioned on EHPS-valve)
7. EHPS-valve
8. Steering cylinders
9. Hydraulic oil cooler and hydraulic oil filter

- A. Priority valve
- B. Priority valve
- C. Spool
- D. Pressure-reducing valve
- E. Pressure-reducing valve
- F. Pressure back-up valve
- G. Spool
- H. Valve
- I. Shock valves
- J. Shock valve
- K. Pressure back-up valve

Orange	Stand-by pressure / controlled pressure
Green	Return pressure
Blue	Raised return pressure
Pink	LS-pressure
Violet	Trapped pressure

Steering (to the right)

Favourable conditions

When the steering wheel is turned, the pressure from steering valve (4) will cause spool (C) in EHPS to move so that the oil may pass to the plus side of the left cylinder.

Severe conditions

The oil also affects the right spool (G) in the shift valve and moves it upwards. If steering is heavy, the LS-pressure increases. When the LS-pressure becomes high enough to open valve (H) in the shift valve, oil from pump P2 can pass through the shift valve and out to the minus side of the right steering cylinder.

When the steering is used, the LS-pressure rises. The LS-pressure acts on the spring side on the respective priority spools (A), (B) in EHPS and the central valve. The priority spools gives priority to the steering depending on pressure and flow. As spool (C) changes position, the connection between the LS-pressure and PVED is closed. In stead the return pressure from the cylinders feeds PVED.

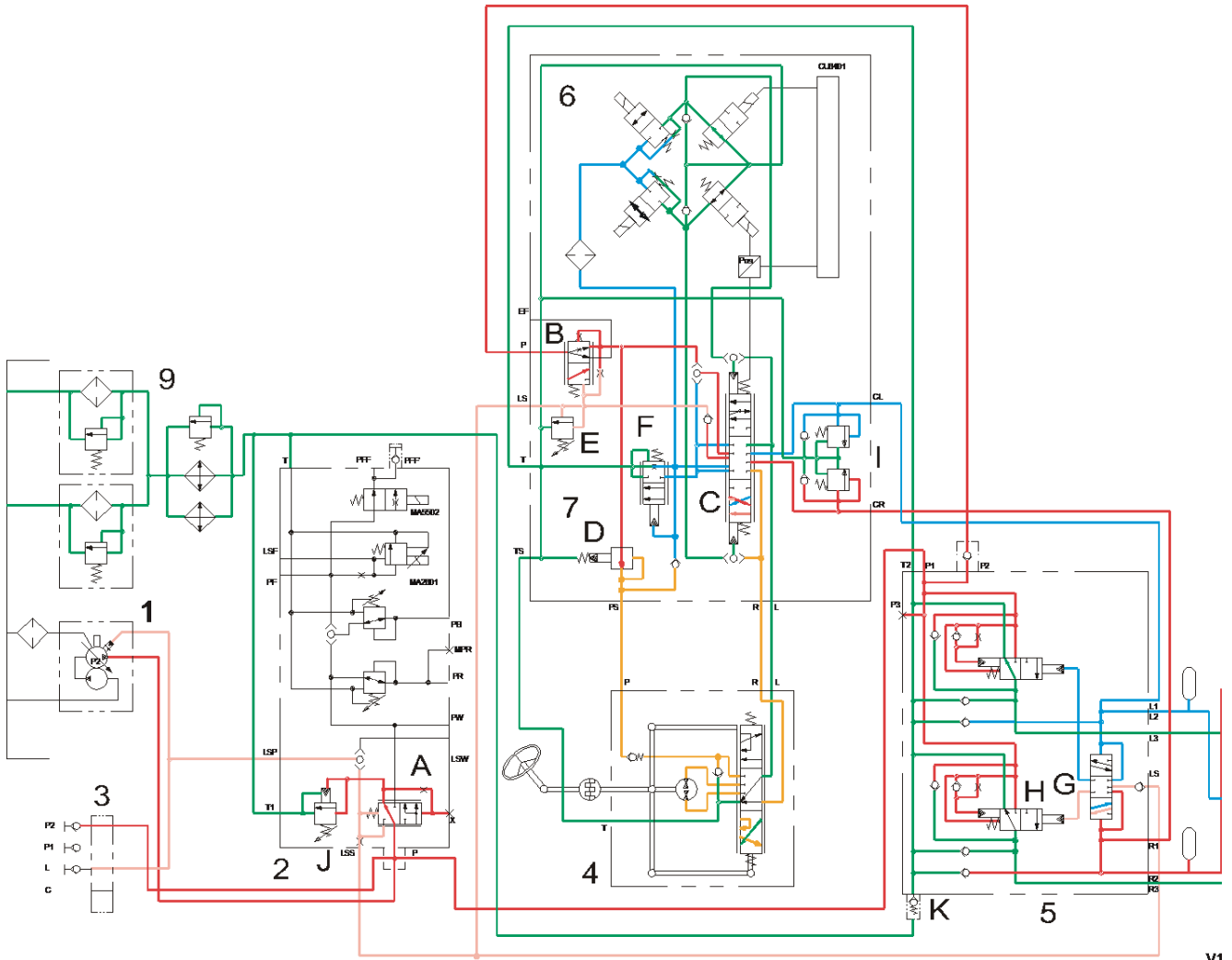


Figure 3
Steering (to the right), favourable conditions

- 1. Hydraulic pump, P2
- 2. Central valve
- 3. Checking point on panel
- 4. Steering valve
- 5. Shift valve
- 6. PVED (positioned on EHPS-valve)
- 7. EHPS-valve
- 8. Steering cylinders
- 9. Hydraulic oil cooler and hydraulic oil filter

- A. Priority valve
- B. Priority valve
- C. Spool
- D. Pressure-reducing valve
- E. Pressure-reducing valve
- F. Pressure back-up valve
- G. Spool
- H. Valve
- I. Shock valves
- J. Shock valve
- K. Pressure back-up valve

Red Working pressure

Green	Return pressure
Blue	Raised return pressure
Pink	LS-pressure
Orange	Stand-by pressure / controlled pressure

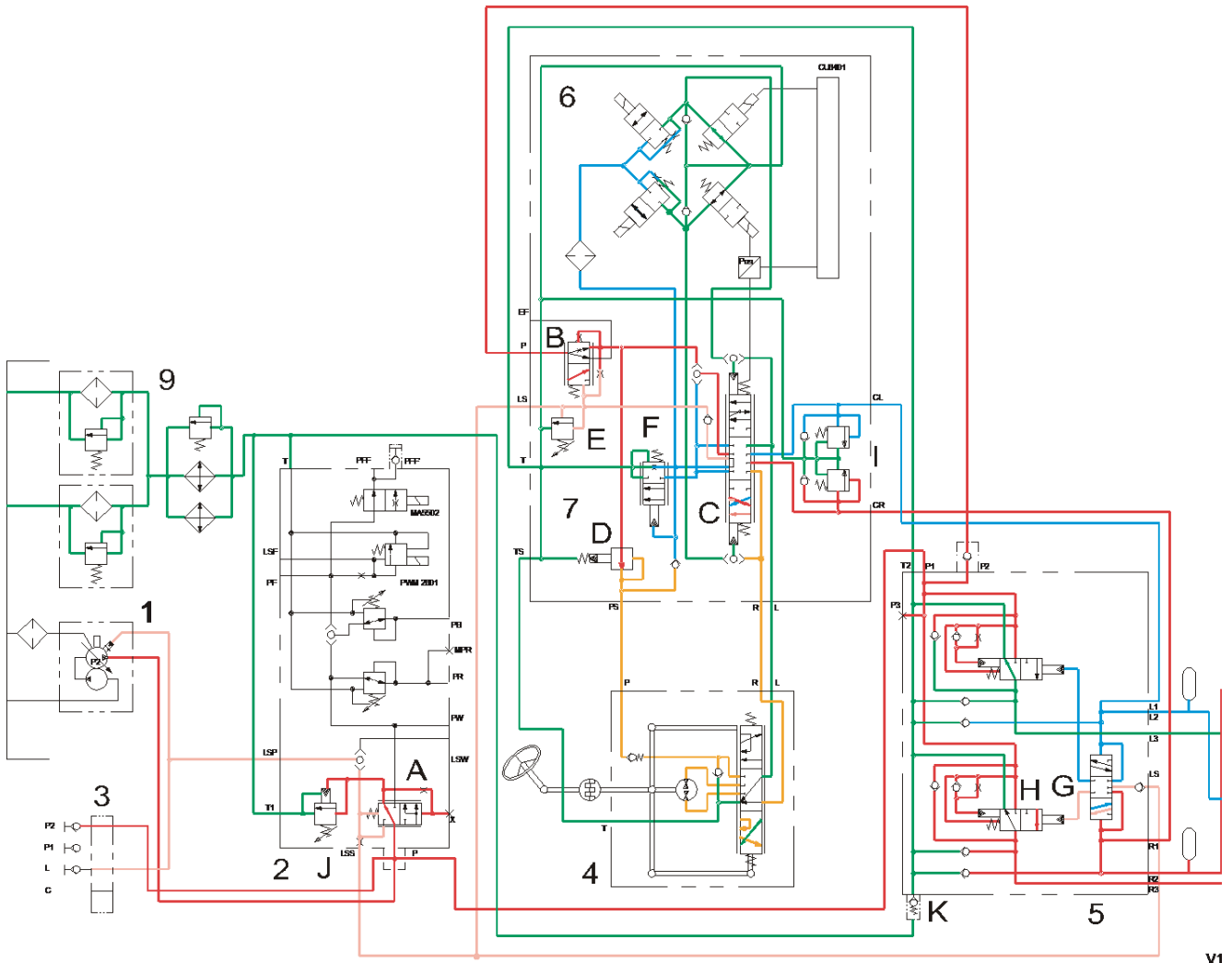


Figure 4
Steering (to the right), severe conditions

1. Hydraulic pump, P2
 2. Central valve
 3. Checking point on panel
 4. Steering valve
 5. Shift valve
 6. PVED (positioned on EHPS-valve)
 7. EHPS-valve
 8. Steering cylinders
 9. Hydraulic oil cooler and hydraulic oil filter
-
- A. Priority valve
 - B. Priority valve
 - C. Spool
 - D. Pressure-reducing valve
 - E. Pressure-reducing valve
 - F. Pressure back-up valve
 - G. Spool
 - H. Valve

- I. Shock valves
- J. Shock valve
- K. Pressure back-up valve

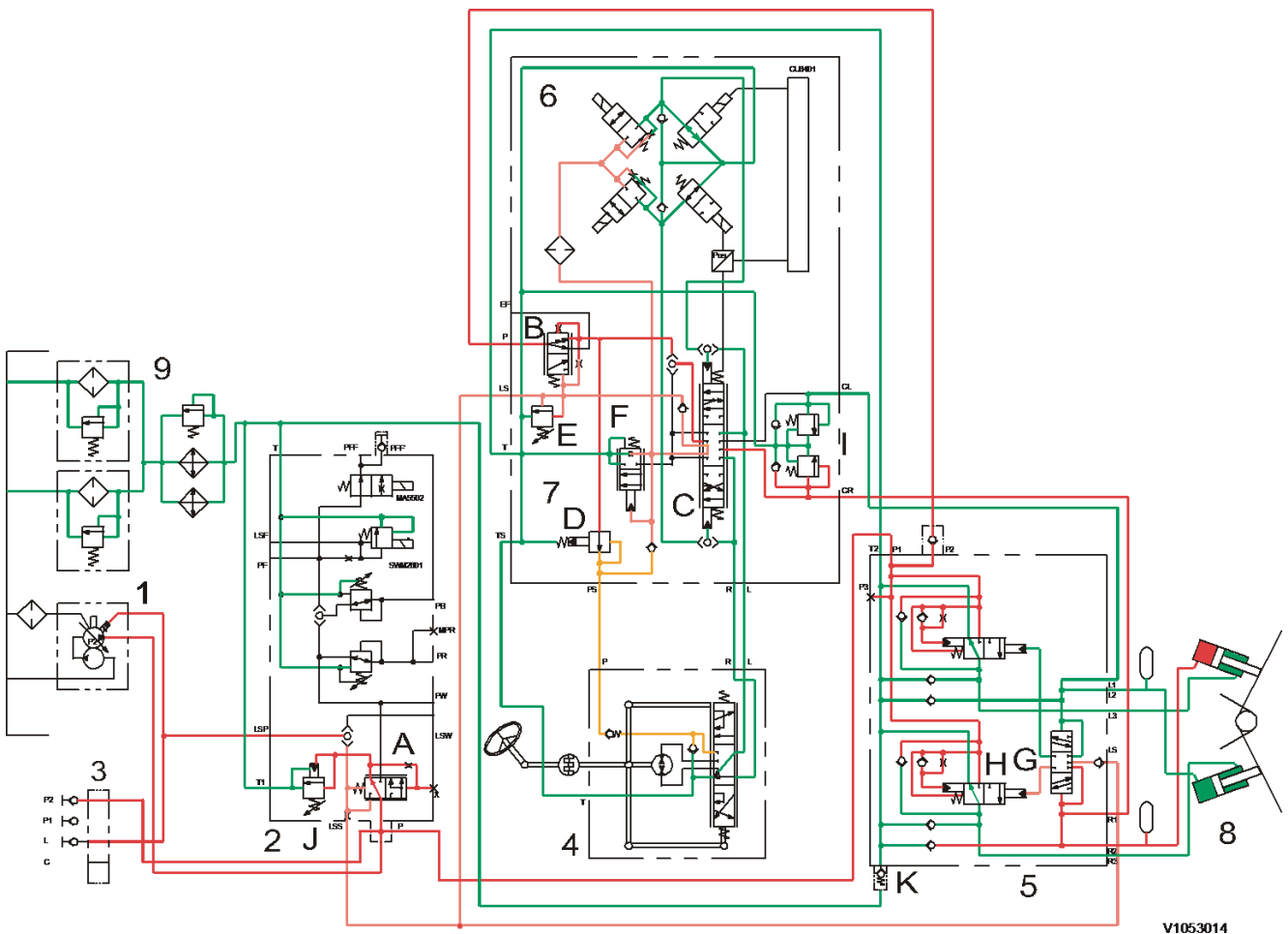
Red	Working pressure
Green	Return pressure
Blue	Raised return pressure
Pink	LS-pressure
Orange	Stand-by pressure / controlled pressure

Shock

If the steering system is subjected to shocks (external forces), e.g., by one of the machine's front wheels being run against a high obstacle, the pressure in the steering system becomes high. To avoid damage to the hydraulic system, the shock pressure from the steering cylinders' minus sides is absorbed by the shock valve in the drive valve if the shift valve is active. If the shift valve is not active, the minus sides are connected to the hydraulic oil tank. The shock valves for the steering cylinders' plus sides are located in the EHPS-valve.

Shock (shift valve not active)

External actuation affects the plus side of the left steering cylinder. The pressure enters the shift valve through port R2 and out through port R1 to EHPS, port CR. There the shock valve (I) opens and drains the oil to the tank. The oil from the minus side enters the shift valve through port R3 and further on via spool (H) and pressure back-up valve (K) and is drained to tank. Because of the pressure back-up valve in the shift valve, the minus side of the left cylinder and the plus side of the right cylinder are topped up.



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Figure 5

- 1. Hydraulic pump, P2
- 2. Central valve

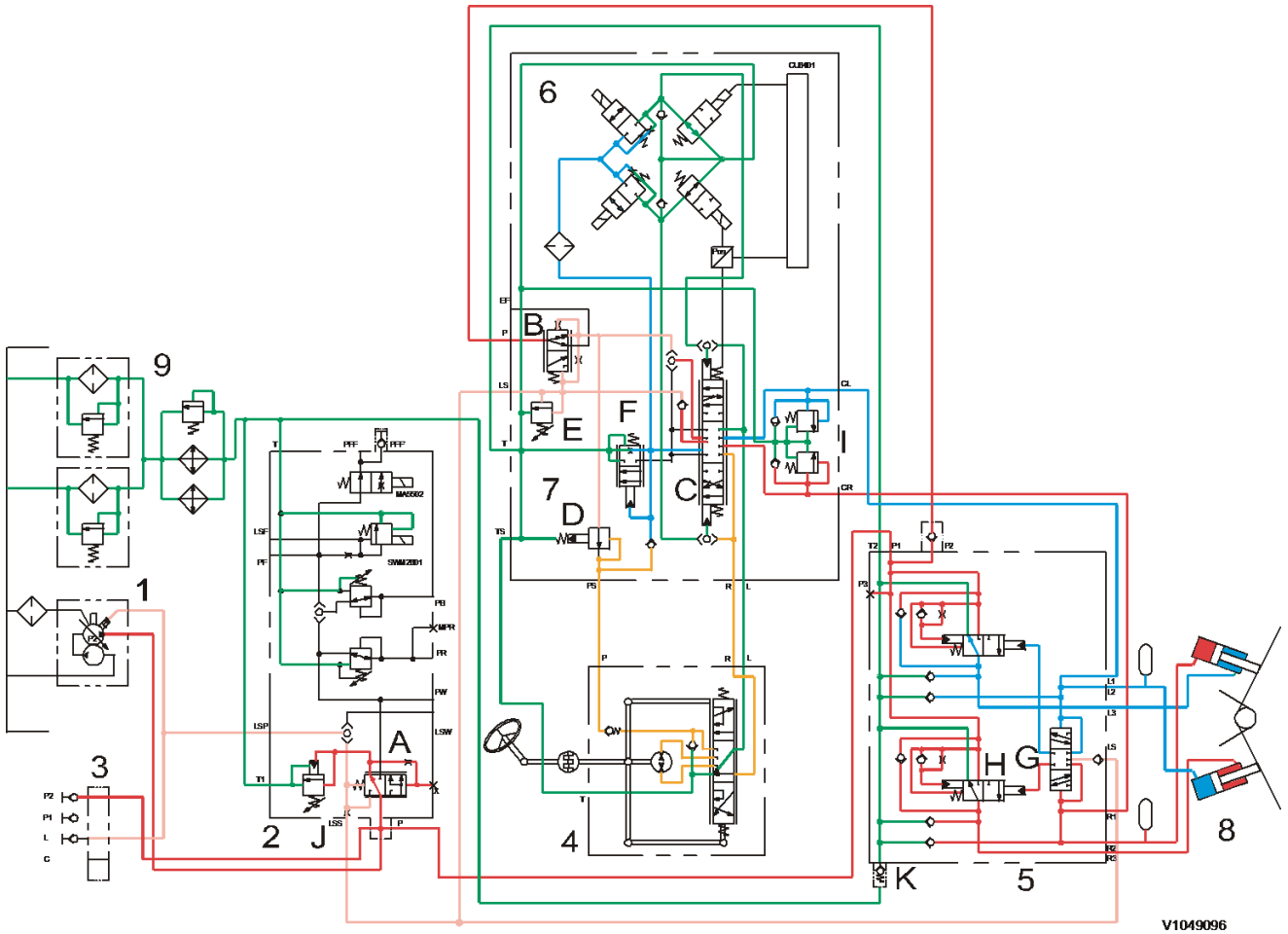
3. Checking point on panel
4. Steering valve
5. Shift valve
6. PVED (positioned on EHPS-valve)
7. EHPS-valve
8. Steering cylinders
9. Hydraulic oil cooler and hydraulic oil filter

- A. Priority valve
- B. Priority valve
- C. Spool
- D. Pressure-reducing valve
- E. Pressure-reducing valve
- F. Pressure back-up valve
- G. Spool
- H. Valve
- I. Shock valves
- J. Shock valve
- K. Pressure back-up valve

Red	Working pressure
Green	Return pressure
Blue	Raised return pressure
Pink	LS-pressure
Orange	Stand-by pressure / controlled pressure

Shock (shift valve active)

External actuation affects the plus side of the left steering cylinder. The pressure spreads into the shift valve via port R2 and out via port R1 to EHPS port CR. There the shock valve (I) opens and drains the oil to the tank. The pressure from the minus side enters the shift valve via port R3, through the non-return valve, at the same time through spool (H) and further on out via port P1. The pressure passes on to port P on the central valve, through priority spool (A) and further on to shock valve (J) for the minus side and the shock valve opens and drains the oil to tank. Because of pressure back-up valve (K), the oil from the plus side of the left cylinder tops up the minus side and the plus side of the right cylinder.



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Figure 6

- 1. Hydraulic pump, P2
- 2. Central valve
- 3. Checking point on panel
- 4. Steering valve
- 5. Shift valve
- 6. PVED (positioned on EHPS-valve)
- 7. EHPS-valve
- 8. Steering cylinders
- 9. Hydraulic oil cooler and hydraulic oil filter

- A. Priority valve
- B. Priority valve
- C. Spool
- D. Pressure-reducing valve
- E. Pressure-reducing valve
- F. Pressure back-up valve
- G. Spool
- H. Valve
- I. Shock valves
- J. Shock valve
- K. Pressure back-up valve

Red	Working pressure
Green	Return pressure
Blue	Raised return pressure
Pink	LS-pressure

Orange Stand-by pressure / controlled pressure

Software

Steering incl. Comfort Drive Control (CDC)		
Input signals	Conditions for output functions	Output functions
<ul style="list-style-type: none"> ○ Engine: On/Off ○ VCADS Pro parameter EDD ○ VCADS Pro parameter HQH ○ VCADS Pro parameter HQF ○ VCADS Pro parameter HQG ○ VCADS Pro parameter HQI ○ VCADS Pro parameter HSC ○ Speed ○ Position monitor, arm rest, SE4218 ○ Switch, activation of lever steering, SW4216 ○ Angle sensor frame joint, SE6401 ○ Comfort Drive Control (CDC), SE6601 	<ul style="list-style-type: none"> ○ Engine: On ○ Speed ≥ 0 km/h (0 mph) ○ Angle sensor frame joint 0–1000 ○ VCADS Pro parameter EDD=ON ○ Speed limitation according to VCADS Pro parameter HKX ○ VCADS Pro parameter HQH=1 ○ VCADS Pro parameter HQI=0–1023 ○ VCADS Pro parameter HSC= ○ Lever for Comfort Drive Control (CDC) 0–1000 ○ Position monitor, arm rest ON ○ Switch, activation of lever steering On 	<ul style="list-style-type: none"> ○ Comfort Drive Control (CDC).
<ul style="list-style-type: none"> ○ VCADS Pro parameter HQF ○ VCADS Pro parameter HQG ○ Lever for Comfort Drive Control (CDC) 0–1000 ○ Angle sensor frame joint 0–1000 	<ul style="list-style-type: none"> ○ VCADS Pro parameter HQF ○ VCADS Pro parameter HQG ○ Lever for Comfort Drive Control (CDC) 0–1000 ○ Angle sensor frame joint 0–1000 	<ul style="list-style-type: none"> ○ End-of-stroke damping
<ul style="list-style-type: none"> ○ Monitoring Speed 	<ul style="list-style-type: none"> ○ System error, open circuit or short circuit See Diagnostics 	<ul style="list-style-type: none"> ○ Amber central warning ○ Check Steering system failure
<ul style="list-style-type: none"> ○ Monitoring SE6401 		
<ul style="list-style-type: none"> ○ Monitoring SE6601 		<ul style="list-style-type: none"> ○ Red central warning ○ Warning Steering system failure
<ul style="list-style-type: none"> ○ Monitoring SE6402 		

The following applies in case of faulty input signals:

Input signal	Assumed value in case of a fault
Speed	30 km/h (19 mph)
VCADS Pro parameter EDD	"OFF"
Position monitor, arm rest, SE4218	Off
Switch, activation of lever steering, SW4216	Off

There will be no end-position damping if SE6401, angle sensor centre hitch, stops working.

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