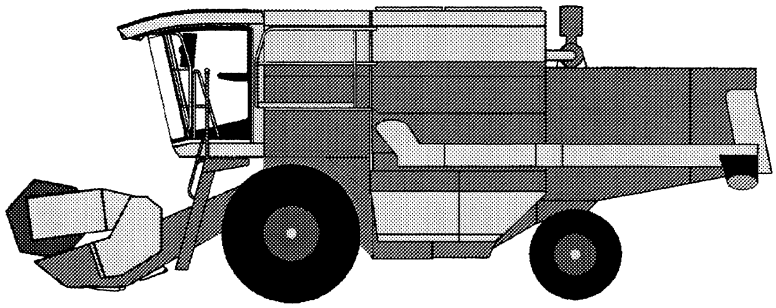
Hydraulics
Electrics

CLAAS



CLAAS
DOMINATOR 218 MEGA II
DOMINATOR 208 MEGA II
DOMINATOR 204 MEGA II
DOMINATOR 203 MEGA II
DOMINATOR 202 MEGA II

Contents

Alpha index

1

Oil types, oil change, oil filters, oil pressure, hydraulic pump

Oil type

Multi-grade hydraulic oil HV (ISO VG 46) conforming to DIN 51524 Part 3

Oil change

Biological oil types: see operator's manual

Oil filters

Initially after 100 working hours, thereafter once a year = 500 working hours. Oil level may only be checked with cutterbar cylinders retracted.
Working hydraulic system = one oil filter, mesh size 60 µm.
Hydraulic steering system = one oil filter, mesh size 25 µm.
Must be cleaned or changed with every oil change.

Important: Do not mistake filters with one another. Marker hole must face up. Also see operator's manual.

Oil pressures

Working hydraulic system	=	175^{+15} bar
Steering system	=	115^{+15} bar
Low pressure hydraulic system	=	19^{+2} bar

PROBLEM, COMPLETE HYDRAULIC SYSTEM

Hydraulic oil overheats

Cause: Excessive circulating flow pressure in the circuits (pump maximum circulating oil pressure < 20 bar).

- Check spools of directional control valves for correct neutral position (centering)
- Check lines and hoses for kinks
- Check return flow filters for cleanliness

HYDRAULIC PUMP

Specifications

MEGA 202/203/204/208/218

Speed of double gear pump		=	2760 rpm
Direction of rotation		=	anti-clockwise
Capacity:			
Working hydraulic system	Pump 1	=	12 cm^3
Hydraulic steering system	Pump 2	=	6 cm^3

Checking pressures

NOTE: Only check hydraulic oil pressures when oil is at operating temperature (approx. 50° C in tank) and with diesel engine at fast idle.

Working hydraulic system

- Connect oil pressure measuring instrument to test connector on pressure relief valve.
- Start diesel engine.
- Fully extend one hydraulic cylinder and hold the lever (or switch) of the appropriate control valve in that position. The hydraulic oil pressure can be read off on the measuring instrument.

Low pressure hydraulic system

- Connect oil pressure measuring instrument to test point (3/2 directional control valve block).
- Start diesel engine.
- Pressure can be read off on measuring instrument.

Hydraulic steering system

- Refer to chapter “Hydraulic Steering System”

PROBLEM

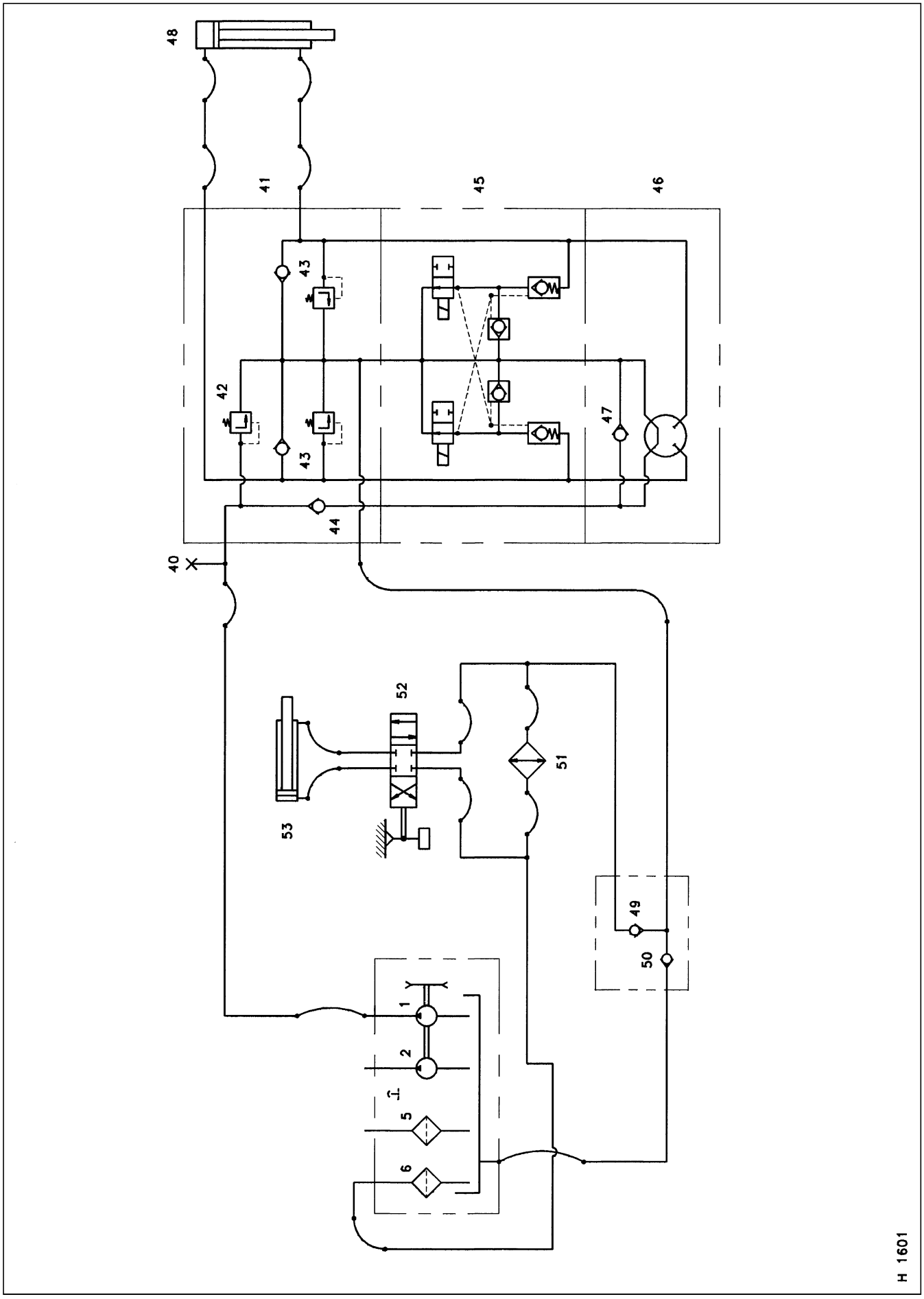
Pump fails to deliver full output

- Pump drive belt not correctly tensioned.
- Pressure-compensating plates corroded/pitted.
- Seal leaking.
- Back-up plate corroded/pitted.
  Pump output can only be accurately measured when a flow meter is used.

2

DANFOSS
hydraulic steering system
CLAAS 3-D top sieve

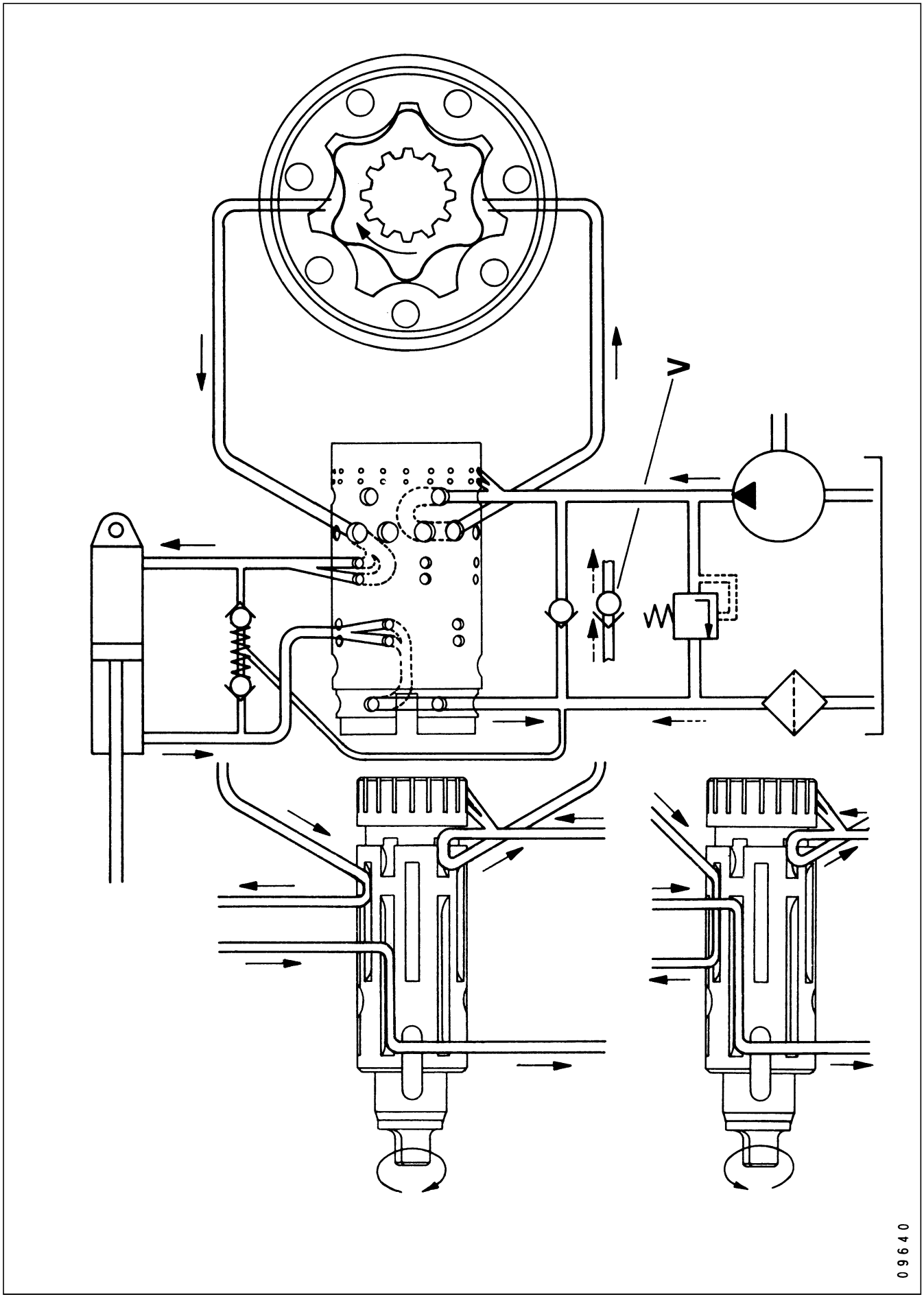
Circuit diagram, DANFOSS hydraulic steering system, CLAAS 3-D top sieve

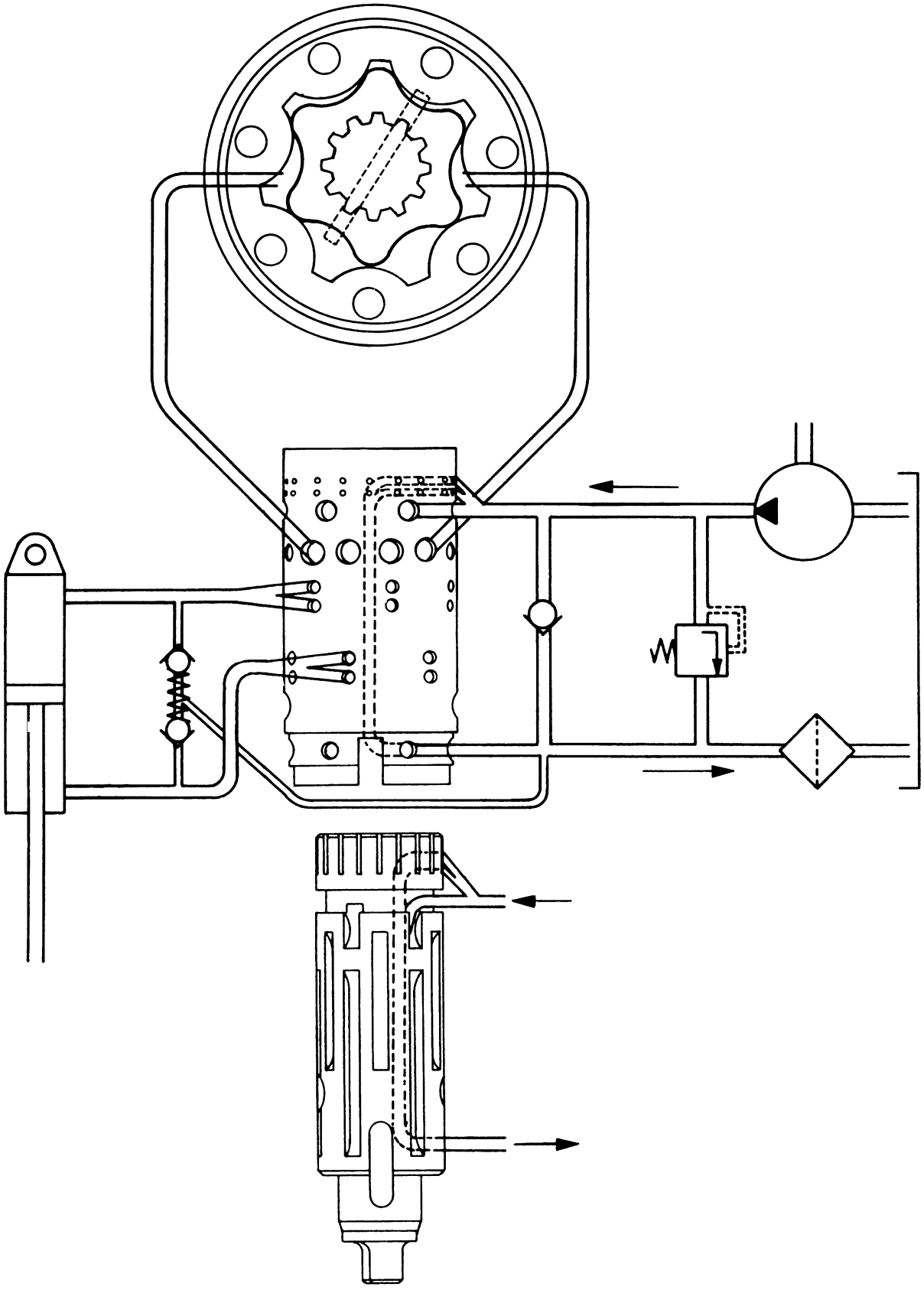


Key to circuit diagram

1 – Pump, steering system
2 – Pump, working hydraulic system
5 – Oil filter – working hydraulic system, mesh size 60 µm
6 – Oil filter – steering system, mesh size 25 µm
40 – Connection for measuring instrument, hydraulic steering system
41 – Valve block, DANFOSS
42 – Pressure relief valve 115^{+15} bar
43 – Double shock valve 200 bar
44 – Check valve
45 – Solenoid valve, CLAAS Autopilot
46 – DANFOSS steering valve
47 – Ball-type check valve (emergency steering)
48 – Hydraulic cylinder, steering system
49 – One-way valve, emergency steering, 0,2 bar
50 – One-way valve, emergency steering, 0,2 bar
51 – Hydraulic oil cooler
52 – 4/3-way directional control valve, pendulum-controlled, 3-D top sieve
53 – Hydraulic cylinder, pendulum-controlled, 3-D top sieve

Right-hand and left-hand turn – V = valve opens only when emergency steering is used.





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Description of system

The steering system is fully hydrostatic. This means that the steering motion is transmitted hydraulically with no mechanical linkage between the steering wheel and the rear wheels.

Steering axle
(depending on version)

Steering cylinder	55 mm dia. cylinder with 24 mm dia. piston rod 63 mm dia. cylinder with 25 mm dia. piston rod

DANFOSS steering valve and valve block

Steering valve	OSPB 125
Valve block	OVP 20

Designations:

O	–	Orbitrol
S	–	Steering
P	–	Pump
B	–	Version with multi-splined shaft
125	–	Oil displacement in cm^3 per revolution
V	–	Valve block
20	–	Double shock valve = 200 bar
ON	–	Open Centre – non reaction
Open centre	=	With steering controls in neutral, the oil from the pump circulates through the steering unit back to the tank
Non reaction	=	With steering controls in neutral, shock loads acting the rear wheels will cause no reaction on the steering wheel.

Pressure settings

OVP 20	=	Pressure relief valve = 115^{+15} bar Double shock valve = 200 bar

NOTE! The steering units are TUV-approved

Checking the pressure

- Connect oil pressure gauge to test connector (pressure line feeding steering unit).
- Start diesel engine.
- Turn steering wheel to full lock and hold it there. The gauge will show the hydraulic oil pressure reading.

Important!

- With all hydraulic control valves in neutral position, hydraulic oil at operating temperature and engine at maximum speed, flow pressure of circulating oil must not exceed approx. 20 bar. Flow pressure of circulating oil has to be taken into account when carrying out initial pressure settings. Example: OVP 20
- Setting of pressure relief valve = 115 $^{+15}$ bar
  Measured flow pressure of circulating oil = 12 bar
  Required setting = 115 $^{+15}$ bar + 12 bar = 132^{+15} bar

NOTE! If flow pressure of circulating oil is excessive, the system will overheat.

How the steering unit works

The orbitrol unit consists of a rotor assembly (metering unit) with rotating steering valve (inner and outer spool).

The rotor assembly consists of rotor ring and rotor. The rotor ring is stationary and has 7 cavities. The rotor (6 lobes) revolves around the centreline of the housing as its lobes engage the cavities of the ring. The steering spindle drives the rotor by way of the cardan shaft and also actuates the steering valve. By rotating the rotor inside the ring, cavities are being opened and closed.

Oil flow from the pump is directed by the steering valve into the open cavities. Oil forced out of the rotor unit as cavities are being closed, is directed by the steering valve to one side of the steering cylinder. Oil forced from the opposite end of the steering cylinder flows back to the reservoir.

Oil displacement

1/7 of a turn of the steering wheel corresponds to 1/7 of a turn of the rotor hub. This displaces oil from 6 cavities. One full turn of the steering wheel equals one complete revolution of the rotor hub which causes the oil to be displaced 6 x 7 = 42 cavities.

FUNCTION

In the neutral position oil is allowed to flow freely through the valve (P to T). Turning the steering wheel in one direction, causes rotation of the spools against one another. At 1,5° the oil passages begin to allow oil flow to the cavities. At 4° the neutral position passages will be fully opened. Rotation of spools against one another are limited to ± 8°.

Feeding oil under pressure to the rotor unit results in:

- Rotation of rotor.
- Metered oil flow to steering cylinder. Oil flow is proportional to movement of steering wheel. The cylinder moves to steer the rear wheels.
- Closing of rotor access passages in valve as steering wheel motion is stopped. Neutral positioning of outer spool and rotor is mechanically assisted by built-in leaf springs.

Manual steering (emergency steering)

By turning the steering wheel, the inner spool drives the outer spool by way of the cross pin, whereby the rotor within the rotor ring ist turned by the cardan shaft. The rotor assembly will then act as a hand pump and pumps oil to the steering cylinder. Oil is sucked from the rotor return line through the open non-return valve (ball valve), located between T and P (reservoir and pump). In this case steering will be harder, but full control of steering is maintained.

Relief valve

- Setting = see section “Checking the pressure”

Double shock valve

- Setting = see “Checking pressure” (reduces shock loads)

Valve block

One way valve

- connection P in valve block.
  This valve prevents oil from escaping if the pressure hose ruptures.

The return line (connection T) is directly connected to the reservoir by a replenishing line. This provides sufficient oil for prolonged manual (emergency) steering.

A one way valve is installed in the replenishing line and in the return line.

- 0,2 bar one way valve in the replenishing line, direction of flow is from the reservoir to the steering system.
- 1 bar one way valve in the return line to the filter, direction of flow from the steering system to the filter.

Repairs

A major overhaul of the unit should only be carried out by authorized DANFOSS workshops. Service work should be limited to the installation of new seals and cleaning the steering valve.

Practical service hints

Assembly tool for O-ring and Kin-ring:
CLAAS part no. 178 897.0

Steering valve

- Hold the unit upright when removing the spools, otherwise the pin might slide into an annular groove.
- Renew all seals.
- Install O-ring and Kin-ring by use of assembly tool.
- Install the rotor assembly so that one cavity in the rotor faces the slot of the cardan shaft (see drawing).
- Place the ball of the one-way valve into the correct hole (screw with long pin).
- Fit new washers to screws of end cover. Cross-tighten the screws, working from the first screw to the one opposite. Tighten screws to 30^{+5} Nm.

Valve block

Relief valve

- Valve seating is fitted with Loctite.
- One drop of Loctite is applied to the thread of the adjusting screw.
- Before removing the adjusting screw, measure the depth the screw is screwed in so that the same valve rating is obtained when the valve is re-assembled.
- Check valve rating after installation, using measuring instrument.
- Torque on screwed end cap is $50^{\pm 10}$ Nm

Double shock valve

- Before removing the adjusting screw measure the depth the screw is turned in so that the same valve setting is obtained when the valve is re-assembled. The pressure cannot be checked on the machine.
- The valve seating is fitted with Loctite.
- Torque on screwed end cap is $40^{\pm 10}$ Nm.

One way valve

- Valve seating is fitted with Loctite.

Screwing valve block to steering unit

- Torque socket head cap screws to $65^{\pm 5}$ Nm.

Checking the steering system
(oil at operating temperature, diesel engine running at maximum no-load speed)

- Check tension of pump drive belt.
- Check steering cylinder.

  Note: The grooved seal may seal off completely in the end position, but may allow leakage in mid-way position.

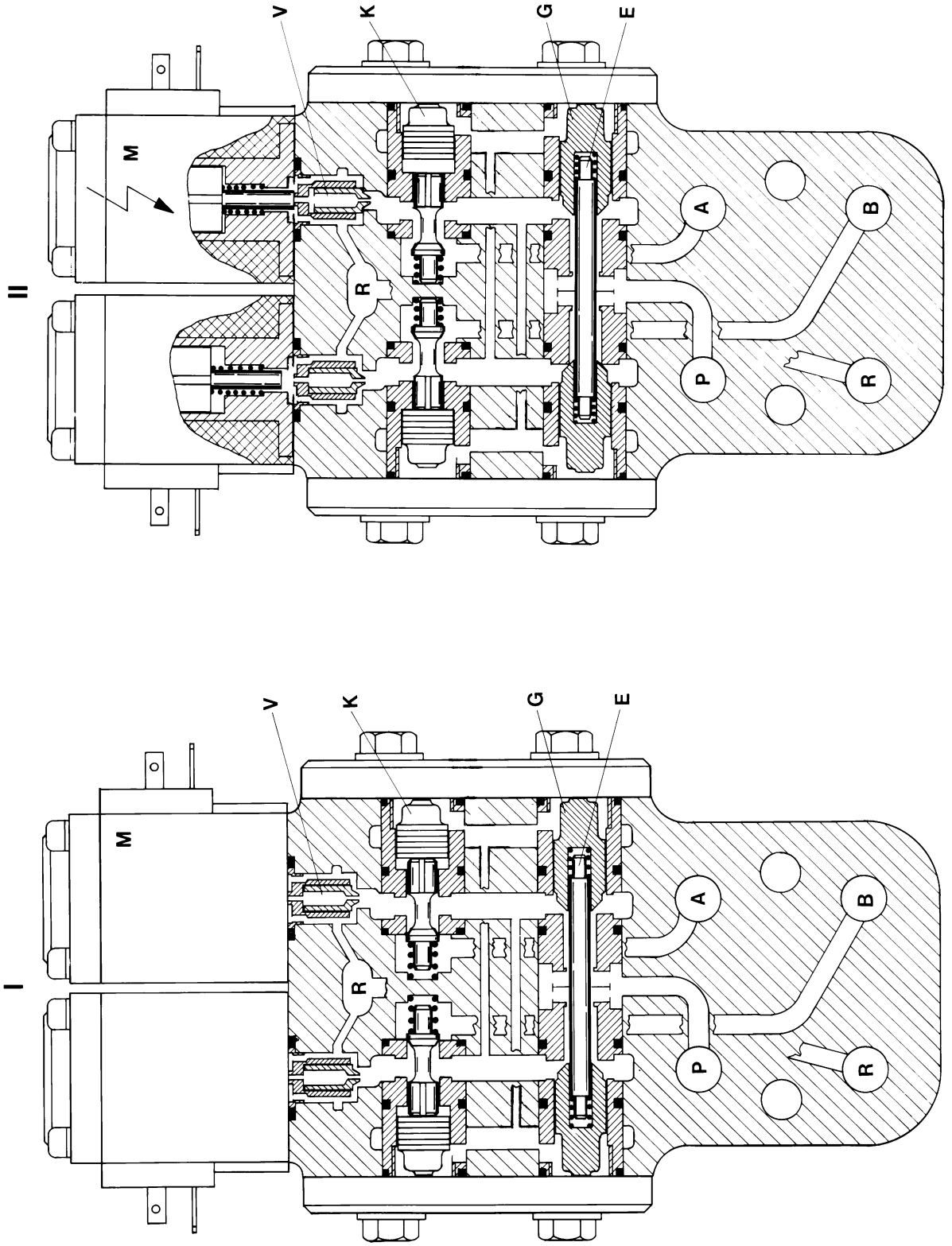
  Disconnect both hydraulic hoses from the steering cylinder and securely plug them with the screw plugs.

  Turn the steering wheel with a force of 25 Nm (18.4 ft lb) until resistance is felt. The steering wheel can turn up to 4 revolutions per minute (check in both directions).

  If the steering wheel can be turned less than 4 revolutions per minute (past the resistance), the steering valve is O.K., i.e. check the cylinder.

  If the steering wheel can be turned more than 4 revolutions per minute (past the resistance), the steering valve is faulty. In that case check:
  a) the shock valve for leakage,
  b) the rotor or spool for wear.
- Ensure that the piston rod of the cylinder is straight.
- Check king pin for smooth movement.
- Check steering column. There must be a clearance of approx. 1 mm between the splined end of the steering spindle and the mating end of the inner spool of the DANFOSS steering unit. (Adjust by positioning shims between the circlip and the steering column.)
  Height clearance of steering spindle = 0,1 – 0,3 mm.
- The steering wheel must automatically return to the neutral position after it has been turned (check with diesel engine stopped.)
- Connect measuring instrument to test connection and check the pressure. If the pressure is too low:
  a) adjust the pressure setting,
  b) check the pressure relief valve (probably leaking).
- Check pump with a flow meter.

NOTE! Whenever the steering system and/or its lines have been serviced, the hydraulic lines must be bled with the engine running.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Key

I – Neutral position
II – Working position
M – Solenoid 12 V, 60 % duty cycle continuous-rated, 3,5 A
V – Pilot valve
K – One-way valve with piston
G – Blocking piston
E – Spring-loaded pin

The solenoid valve is installed between the steering unit and the valve block. The return flow from the steering unit is fed to the solenoid valve through P. In this way the steering unit receives the oil first to ensure that manual steering is always possible. (The graphic representation does not correspond with the original in this point).

The return oil R from the solenoid valve flows straight back to the reservoir. With manual steering (Autopilot switched off) both the spring-loaded one-way valves (K) in the solenoid valve are closed. The pressure developed in the cylinder then builds up at the one-way valves (K).

FUNCTION

Neutral (I)

Both solenoids are deenergized. Oil enters at P, passes the spring-loaded pin (E) and is directed left and right to the pistons (G). The flow restricting edges ensure that the oil is equally divided to both sides. Both blocking pistons (G) are opened by the oil flow and the oil flows through to the pilot valves (V). Both pilot valves (V) are opened. The oil can return directly to the reservoir via R.

Working position (II)

The solenoid valve is energized. The solenoid's core closes the escape drilling of the pilot valve (V). Pressure builds up in the pilot valve (V).The pilot piston closes the bore R. This builds up pressure that moves piston (K) and the blocking piston (G) on the left-hand side. The piston (K) opens the return valve and releases the return flow from the working cylinder to the reservoir (B to R). The piston (G) blocks the connection between P and R. The return valve (right) is opened hydraulically. The oil flows from P to A.

If the other solenoid is switched the effect is exactly as described above, but in the opposite direction.

PROBLEMS

Solenoid valve will not operate

Operate the solenoid concerned by hand. This way you can find out whether the hydraulics or the electrics are at fault.

NOTE! Raise the rear axle so that the wheels are just off the ground.

Run the diesel engine at full speed.

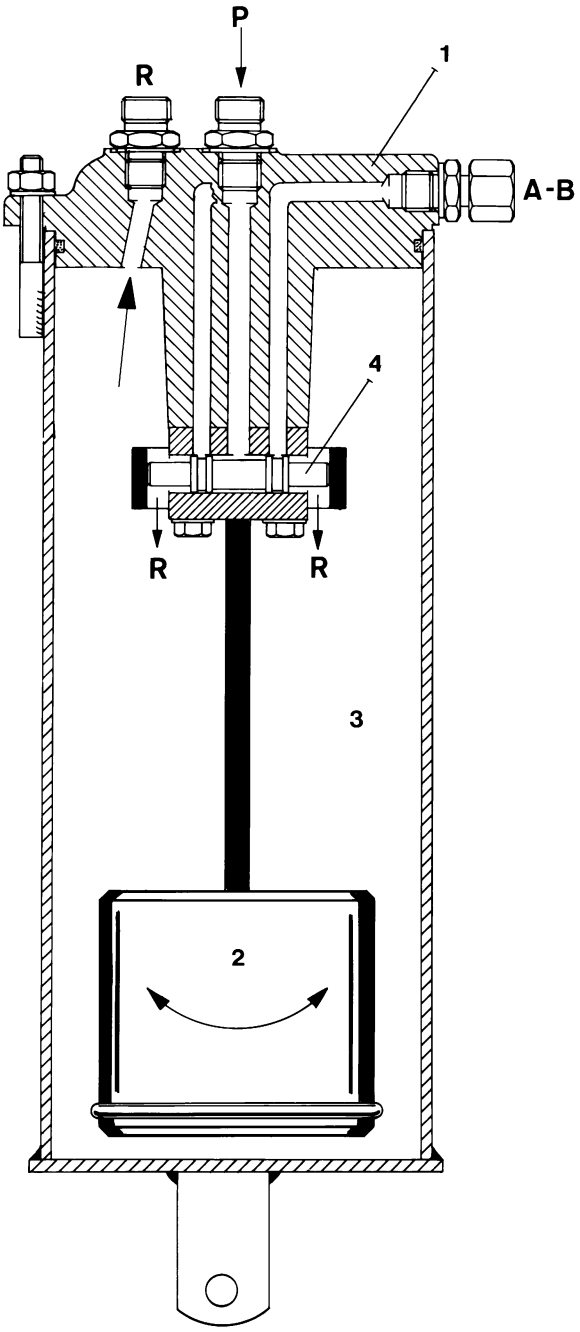
- Check pilot valve (V). (Plunger sticking or drilling clogged with dirt.)
- Check blocking piston (G) or piston (K).
- Check restrictor drilling (D).

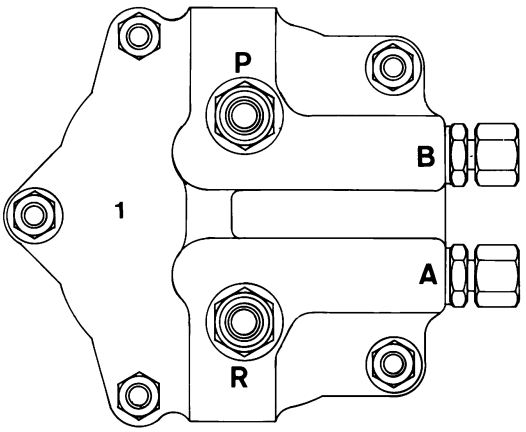
Steering response considerably reduced (Autopilot is switched off)

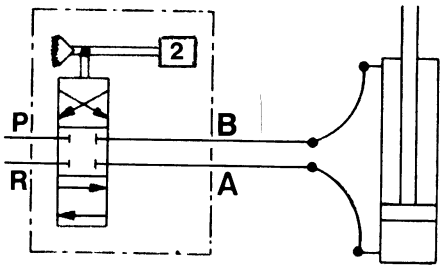
- Check one way valve with built-in piston (K).
- Check O-ring of valve housing (K).

Machine turns to left or right on its own

- Check grooved seal in steering cylinder.
- Check spring of the respective one way valve (K).
- Check plunger in pilot valve.







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Key

1 = control head
2 = pendulum
3 = container
4 = control spool

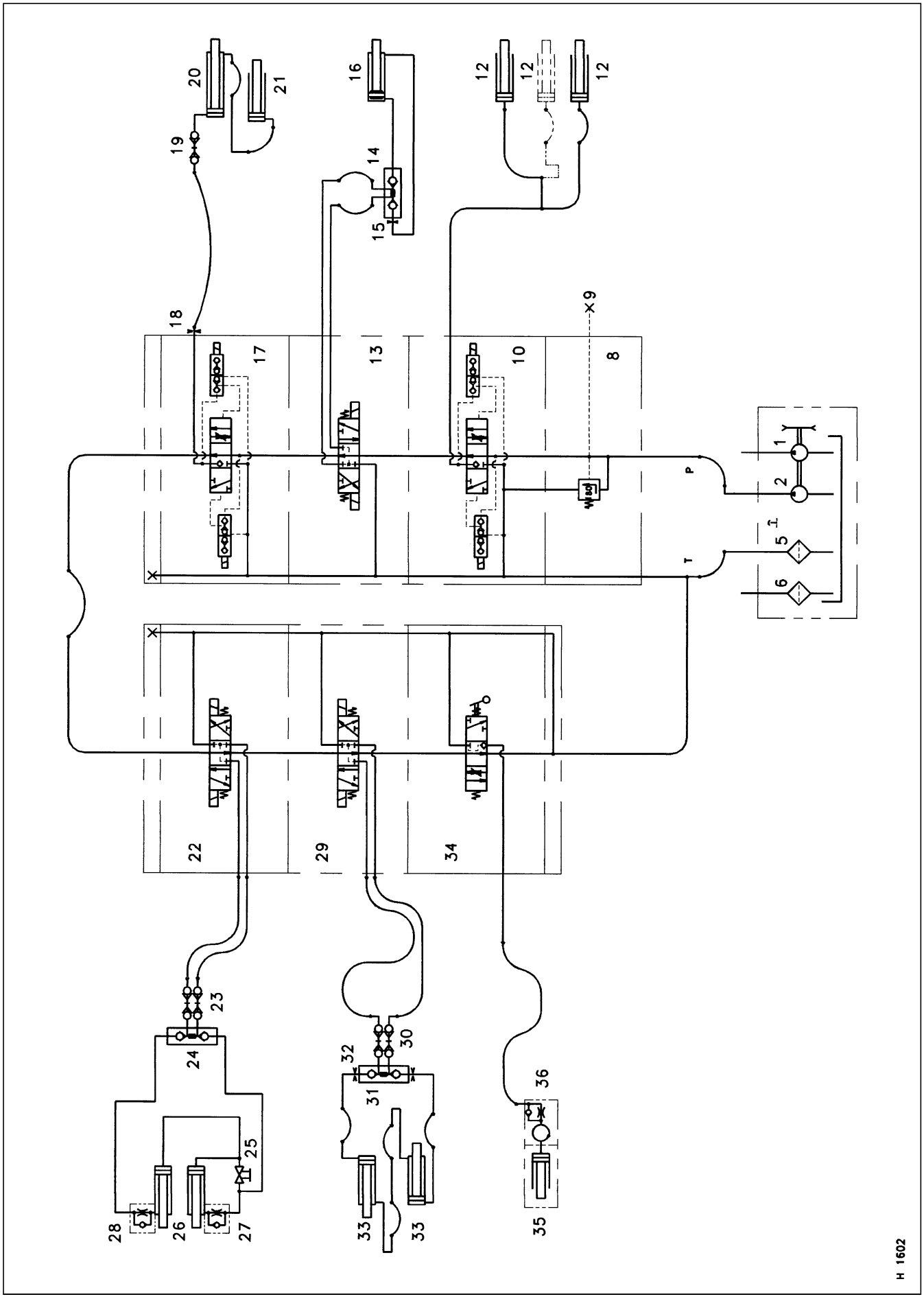
FUNCTION

The oil supply is fed into port P of the control head. In the middle setting of pendulum 2, P is blocked. If the pendulum position changes in relation to the container either to the left or right, the control spool 4 moves. In this manner, depending on the direction of pendulum deflection, P and A are connected as well as B and R or in the other direction P an B are connected as well as A and R.

3

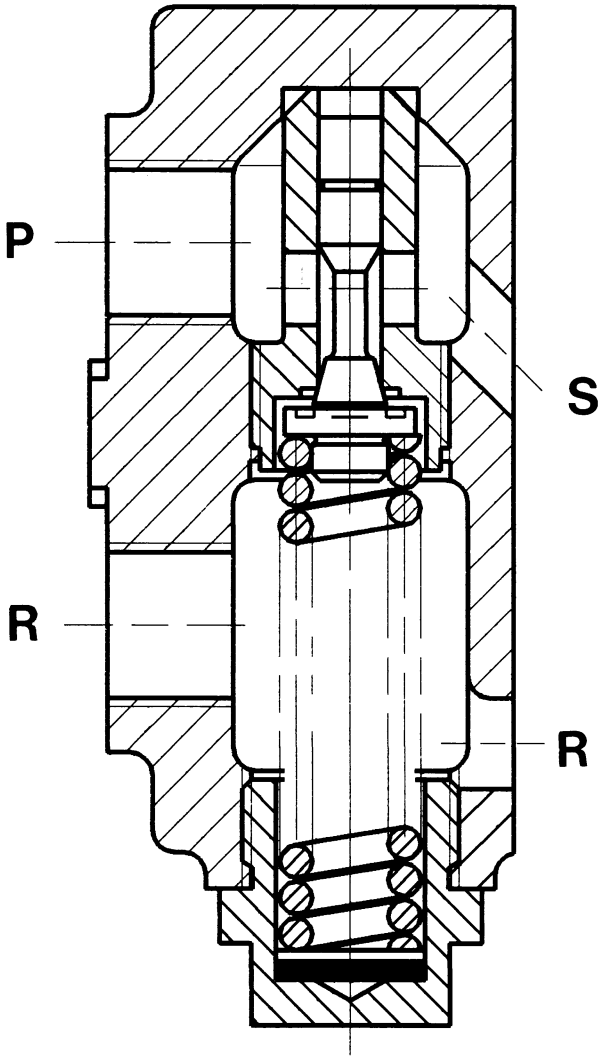
Working hydraulic system

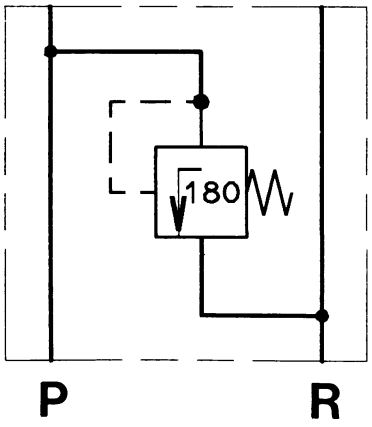
Circuit diagram, working hydraulic system MEGA 202/203/204/208/218



Key

1 – Pump, steering system
2 – Pump, working hydraulic system
5 – Oil filter, working hydraulic system, mesh size 60 µm
6 – Oil filter, steering system, mesh size 25 µm
8 – Pressure relief valve, working hydraulic system
9 – Connection for measuring instrument, working hydraulic system
10 – Solenoid-operated 3/3 directional control valve, cutterbar up/down
12 – Hydraulic cylinders, cutterbar
13 – Solenoid-operated 4/3 directional control valve, grain tank unloading tube
14 – Lock-up valve, unloading tube
15 – Restrictor plate, diameter 0,8 mm
16 – Hydraulic cylinder, grain tank unloading tube
17 – Solenoid-operated 3/3 directional control valve, reel up/down or snapping plate adjustment (maize picker head)
18 – Restrictor plate, 1,2 mm diameter
19 – Quick-release coupling
20 – Double-acting hydraulic cylinder, reel up/down
21 – Single-acting hydraulic cylinder, reel up/down
22 – Solenoid-operated 4/3 directional control valve, lateral levelling of cutterbar
23 – Quick-release couplings
24 – Lock-up valve
25 – Shut-off valve
26 – Hydraulic cylinders, lateral levelling of cutterbar
27 – Flow control valve
28 – Flow control valve
29 – Solenoid-operated 4/3 directional control valve, reel fore and aft adjustment or folding the snapping units (maize picker head)
30 – Quick-release couplings
31 – Lock-up valve
32 – Restrictor plates, 1,2 mm diameter, reel fore and aft adjustment
33 – Hydraulic cylinders, reel fore and aft adjustment
34 – Solenoid-operated 3/3 directional control valve, drum speed variation
35 – Hydraulic cylinder, drum speed variation
36 – One-way restrictor valve





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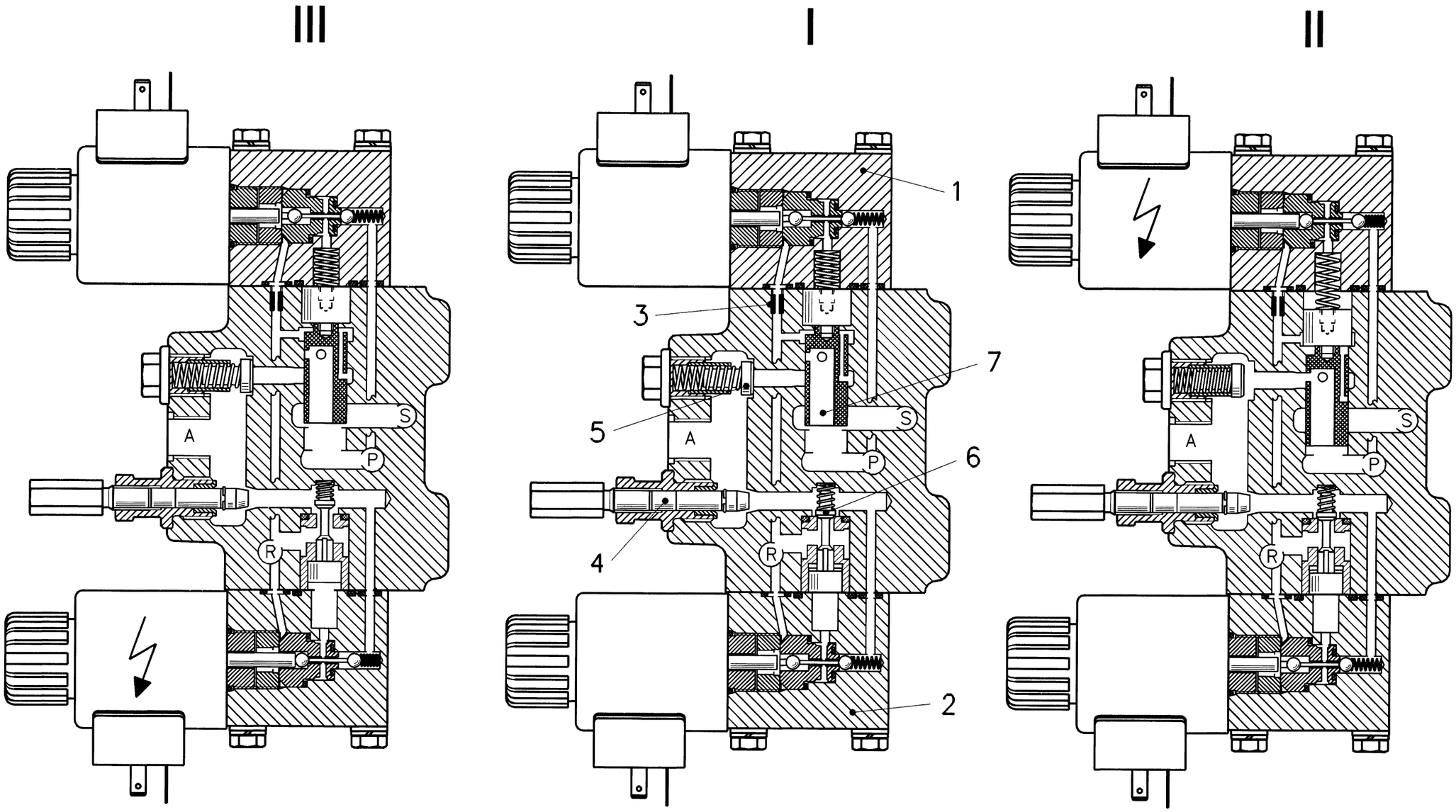
Pressure relief valve	Spring-loaded seated valve with damping, directly controlled.
Specifications	Valve setting = 175^{+15} bar, adjustable by shims 10 x 16 x 0.5.
	Valve seating secured with self-locking fluid.
	When dismantling the valve use special wrench for slotted nuts part No.181934.2 and heat the housing.
	Torque setting = 30 Nm
	Springs = up to 200 bar – 3.6 mm dia. – L = 64 mm free length.

PROBLEM

Little or no pressure build-up at test point	– Spring setting incorrect. – Spring broken.
Pressure raised above rated setting	– Valve seat loose.


III
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Key

I = Neutral position
II = Raise
III = Lower
1 = Pilot control valve, raise
2 = Pilot control valve, lower
3 = Restrictor, 0,6 mm dia.
4 = Drop rate restrictor (adjustable)
5 = Delivery valve
6 = Return valve
7 = Control spool

Specifications

Pilot-controlled unit, one way valves prevent leakback of oil.
Solenoid heads = electrical parts from Uhldingen/Bodensee (12 V, 3,5 A, 60 % duty cycle)
The solenoid heads have plus, ground contact is provided via the switch in the ground speed control lever.
Diameter of balls in the pilot control valves = 4,5 mm
Diameter of needles in the pilot control valves = 1,2 mm dia. – 8,8 mm long
Restrictor bore = 0,6 mm
Spool fit = 7 – 10 µm

The drop rate restrictor (Item 4) is no longer used for the function raise/lower reel. The housing bore is closed with a screw plug.

FUNCTION

Neutral (I)

Both solenoids are deenergized. Oil is allowed from P to S. The oil flow from P forces the split spool back, against the pressure of the spring. The spring cavity is connected with connection R through the pilot valve “raise”. One ball is thereby forced against its seating by the flow of oil from P. A needle between the two balls keeps the other ball in the open position.

Connection A is blocked by the delivery valve, the return valve and the ball in the pilot valve “lower”. The cavity behind the plunger that opens the return valve is connected with the connection R by way of the unseated ball in the pilot valve “lower” (ball-needle).

Raise (II)

The solenoid of the pilot valve “raise” is being energized. The solenoid pin seats the ball. The needle moves and unseats the other ball. Flow is now allowed from P to either end of the split spool. But because of the difference in surface area and because of the pressure exerted by the spring, the spool is moved towards P. This closes passage S. Oil flows through the centre holes of the spool and through the delivery valve to A.

When the valve is deenergized, the spring seats the ball and the needle unseats the opposite ball. The fluid pressure on the spring-loaded end of the split spool decreases slowly as the oil passes through the 0,6 mm restrictor. The unit returns to its neutral mode.

Position “lower” (III)	The solenoid of the pilot valve “lower” is being energized. The solenoid pin seats the ball. The needle moves and unseats the other ball. Oil pressure from A operates a plunger (proportional surface area) and opens the return valve. Oil can now flow from A through the open return valve to R. When the solenoid is deenergized, the spring seats the ball and the needle unseats the opposite ball. The fluid pressure in front of the plunger decreases. This closes the outlet valve. Drop speed can be adjusted with the adjustable restrictor.
PROBLEM	
Front attachment drops	– Check delivery valve in solenoid valve. – Check condition of seating of return valve cone and of return valve O-ring. – Check ball seating in the pilot valve “lower”.
Front attachment cannot be raised by means of solenoid valve	– Check that the master switch RAISE/LOWER is switched on. – Check if the solenoid is switched (see wiring diagram). – Check if the spool 7 in the solenoid valve sticks. – Check needle and ball seating in pilot valve “raise”. – Check iron core in solenoid.
Front attachment keeps raising a little bit or raises to full height after the push button switch “raise” has been operated	– 0,6 mm dia. restrictor in solenoid valve clogged. – Sticking spool in solenoid valve.
Front attachment cannot be lowered with solenoid valve	**CAUTION!** Front attachment can only be lowerd with the engine running. – Check that the master switch RAISE/LOWER is switched on. – Check if the solenoid is switched. – Inspect the needle in the pilot valve “lower”. – Check that the drop rate restrictor is open. – Check iron core in solenoid. – Check return valve 6.