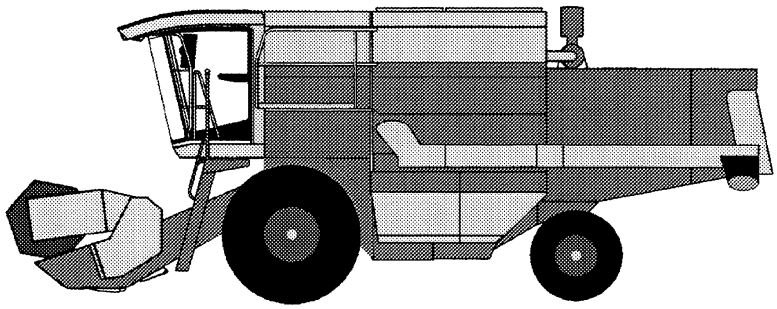
Hydraulics
Electrics

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

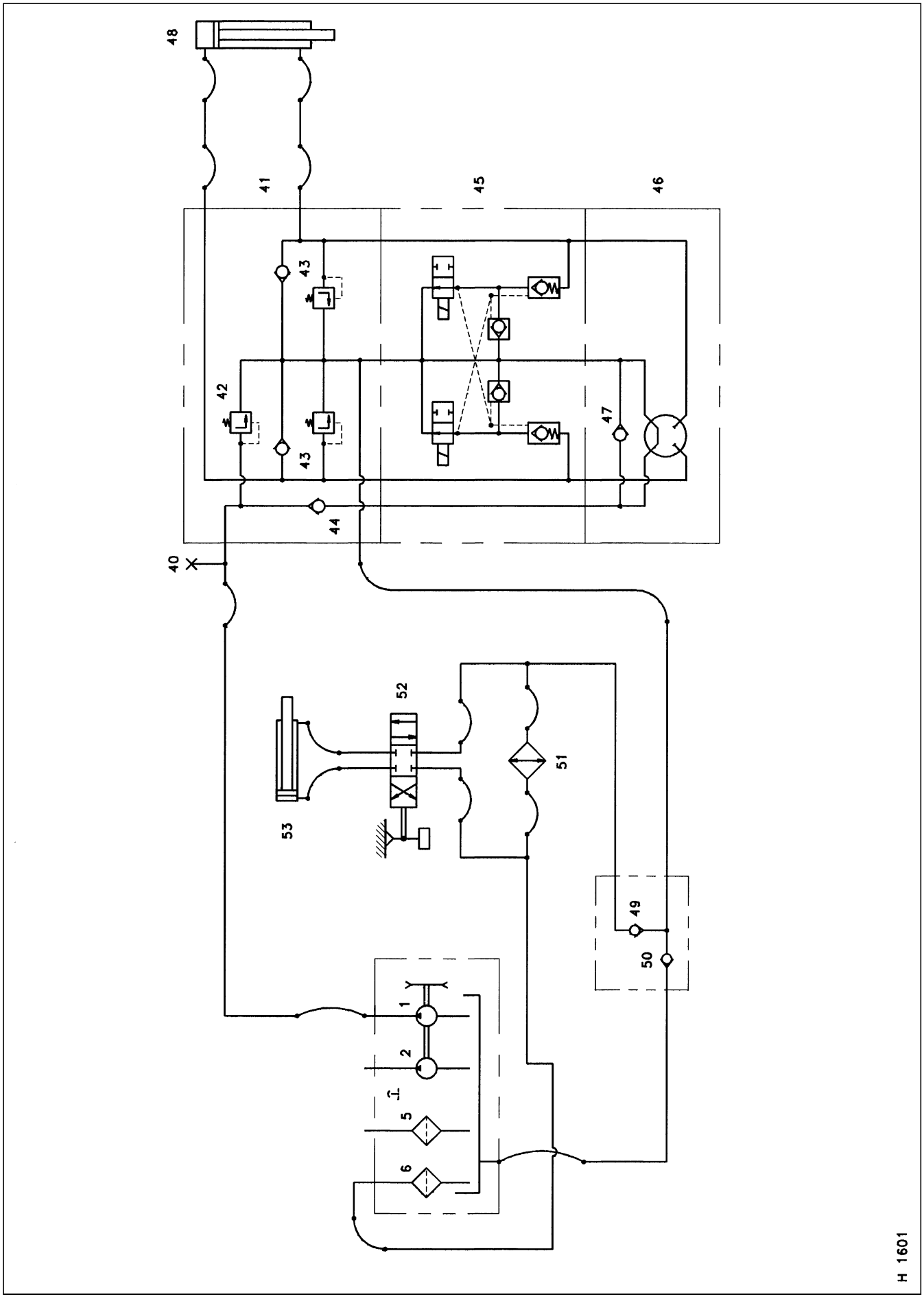
Pump fails to deliver full output

- 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

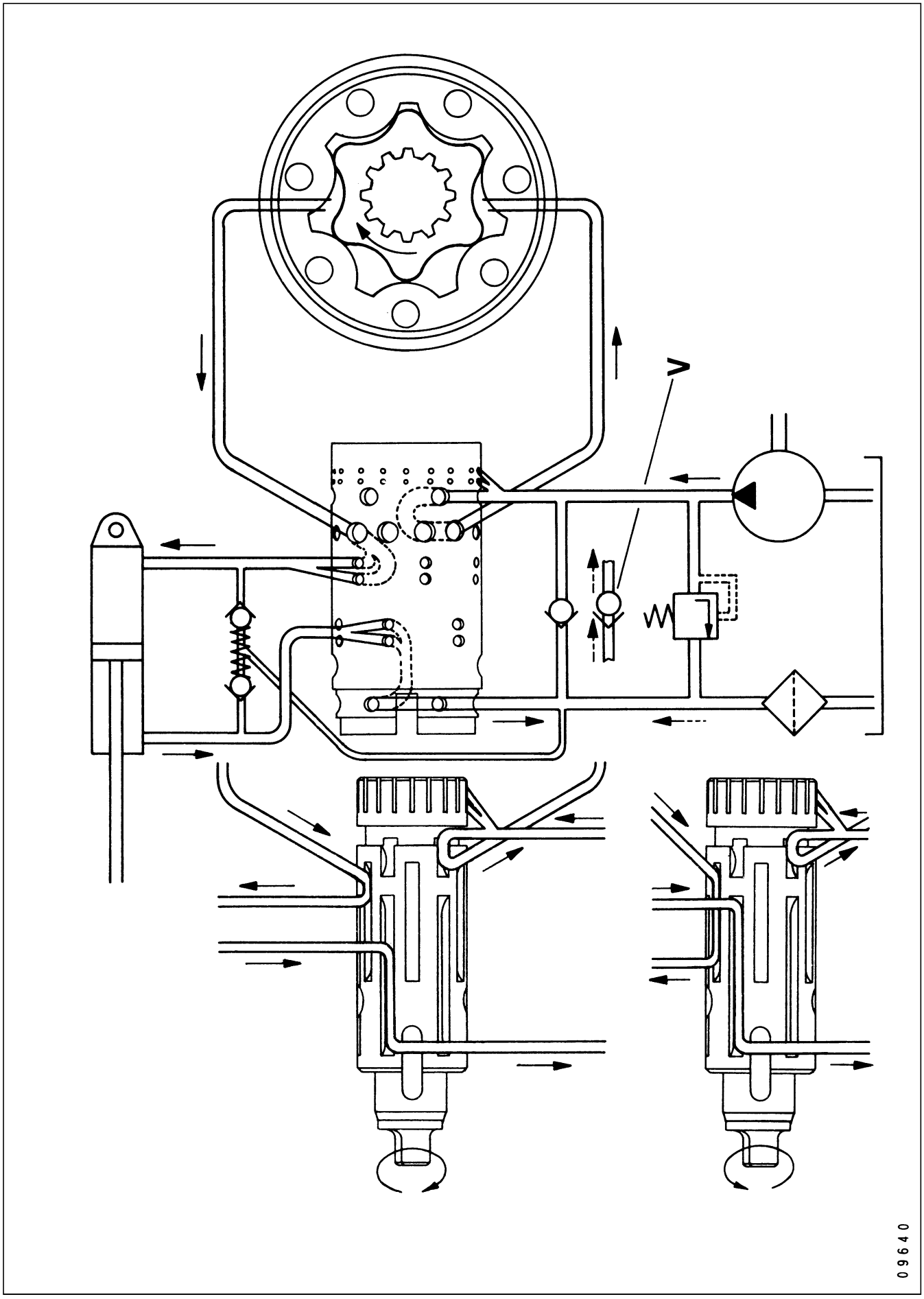
Circuit diagram, DANFOSS hydraulic steering system, CLAAS 3-D top sieve

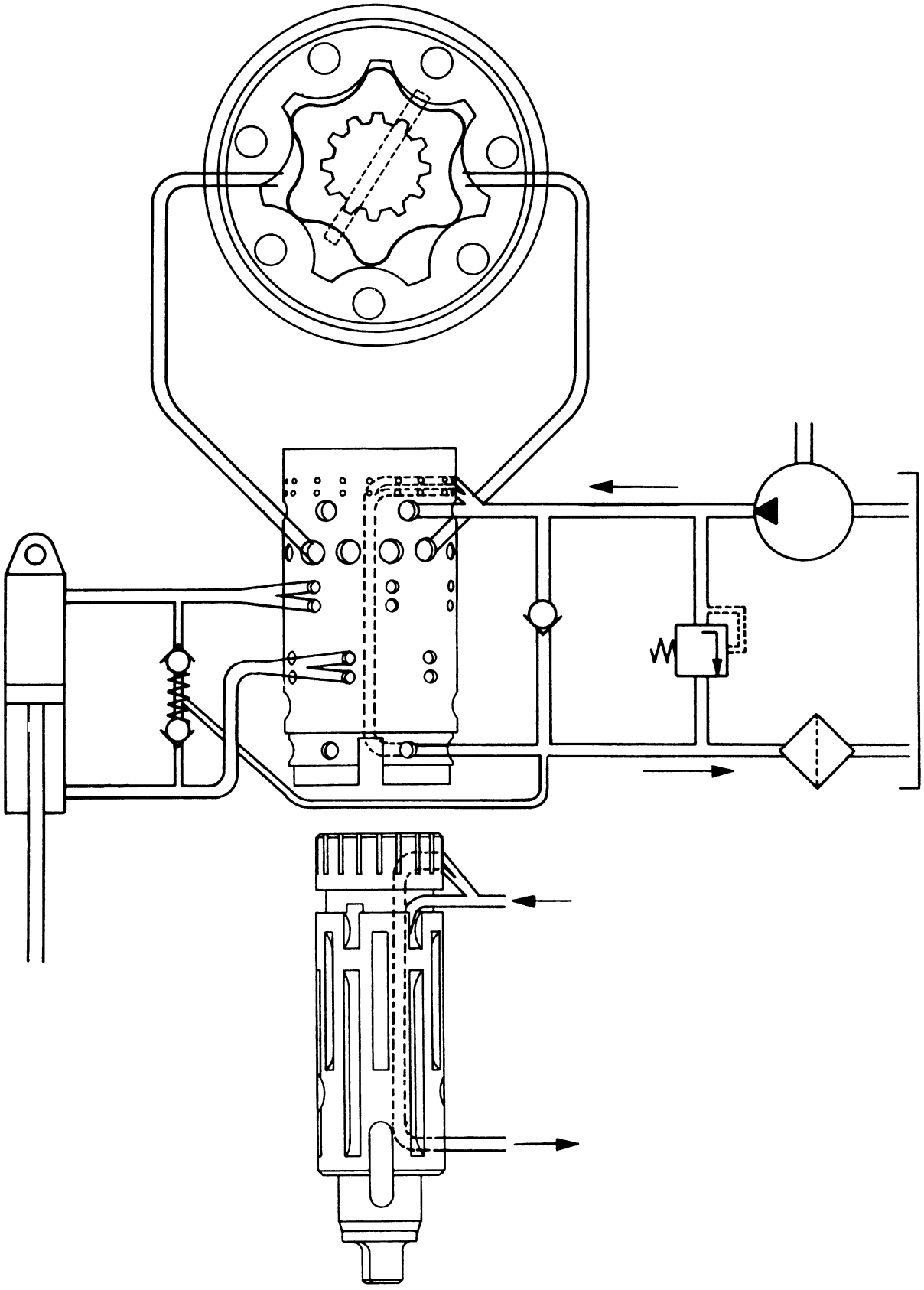


Key to circuit diagram

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.

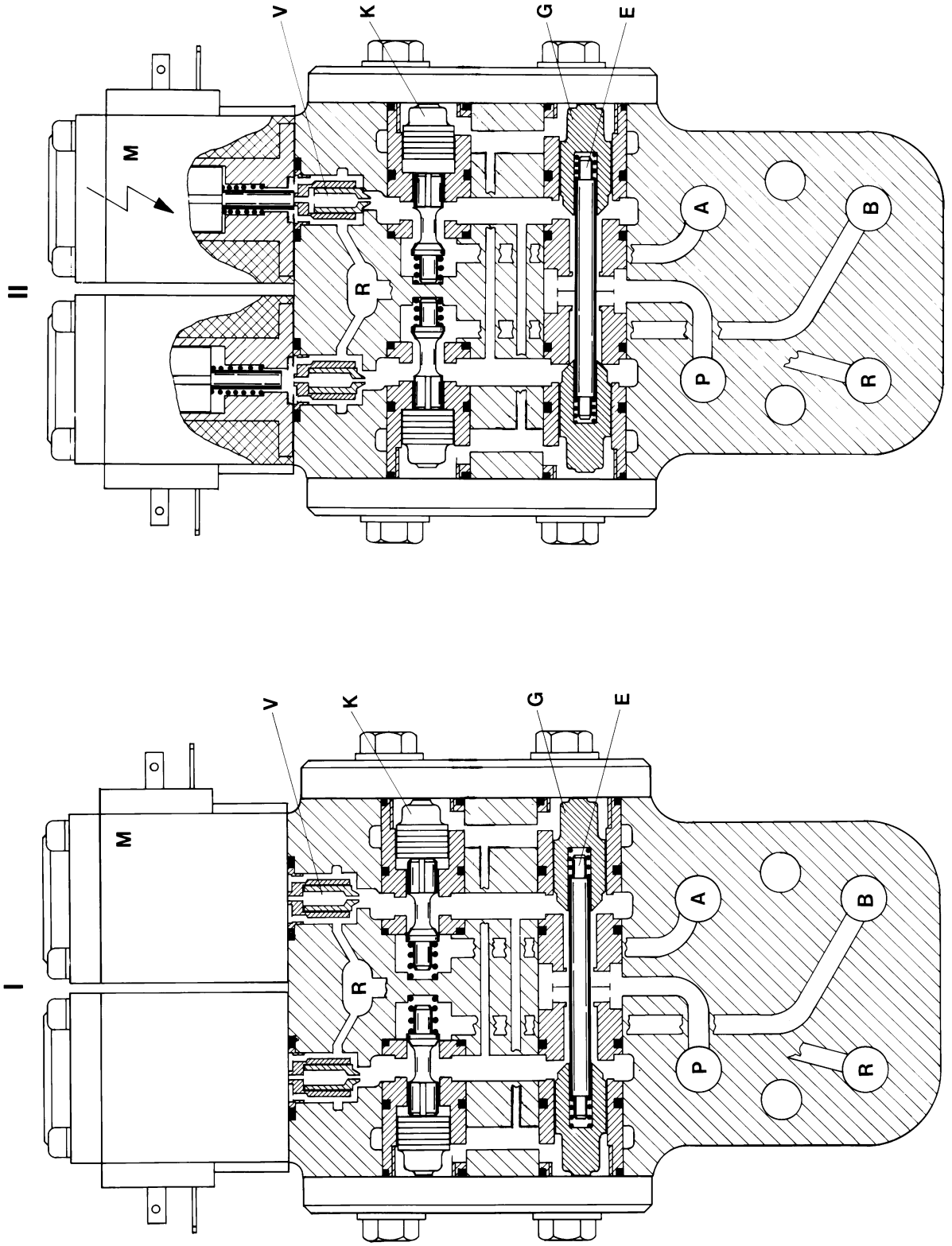
  Disconnect both hydraulic hoses from the steering cylinder and securely plug them with the screw plugs.

  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.

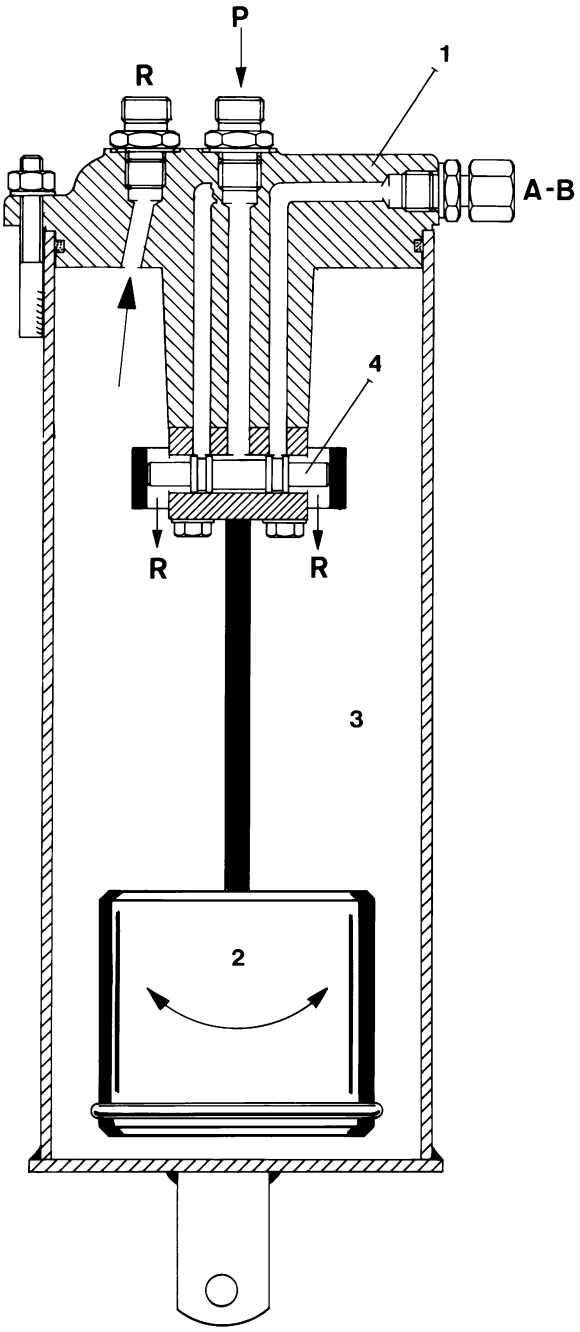
- Check pilot valve (V). (Plunger sticking or drilling clogged with dirt.)
- Check blocking piston (G) or piston (K).
- Check restrictor drilling (D).

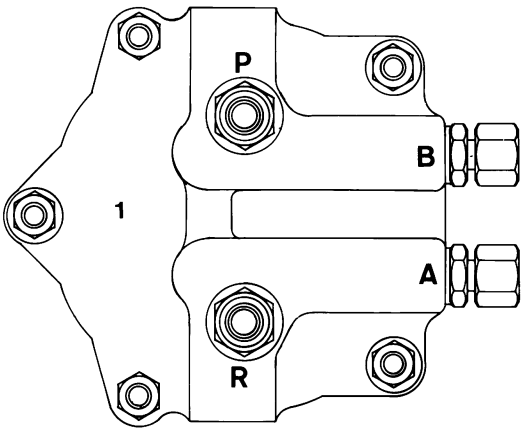
Steering response considerably reduced (Autopilot is switched off)

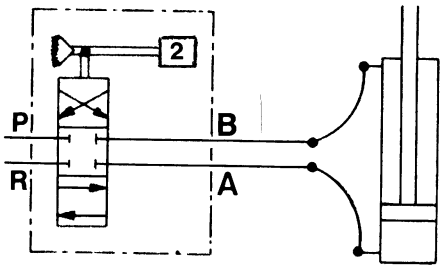
- Check one way valve with built-in piston (K).
- Check O-ring of valve housing (K).

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

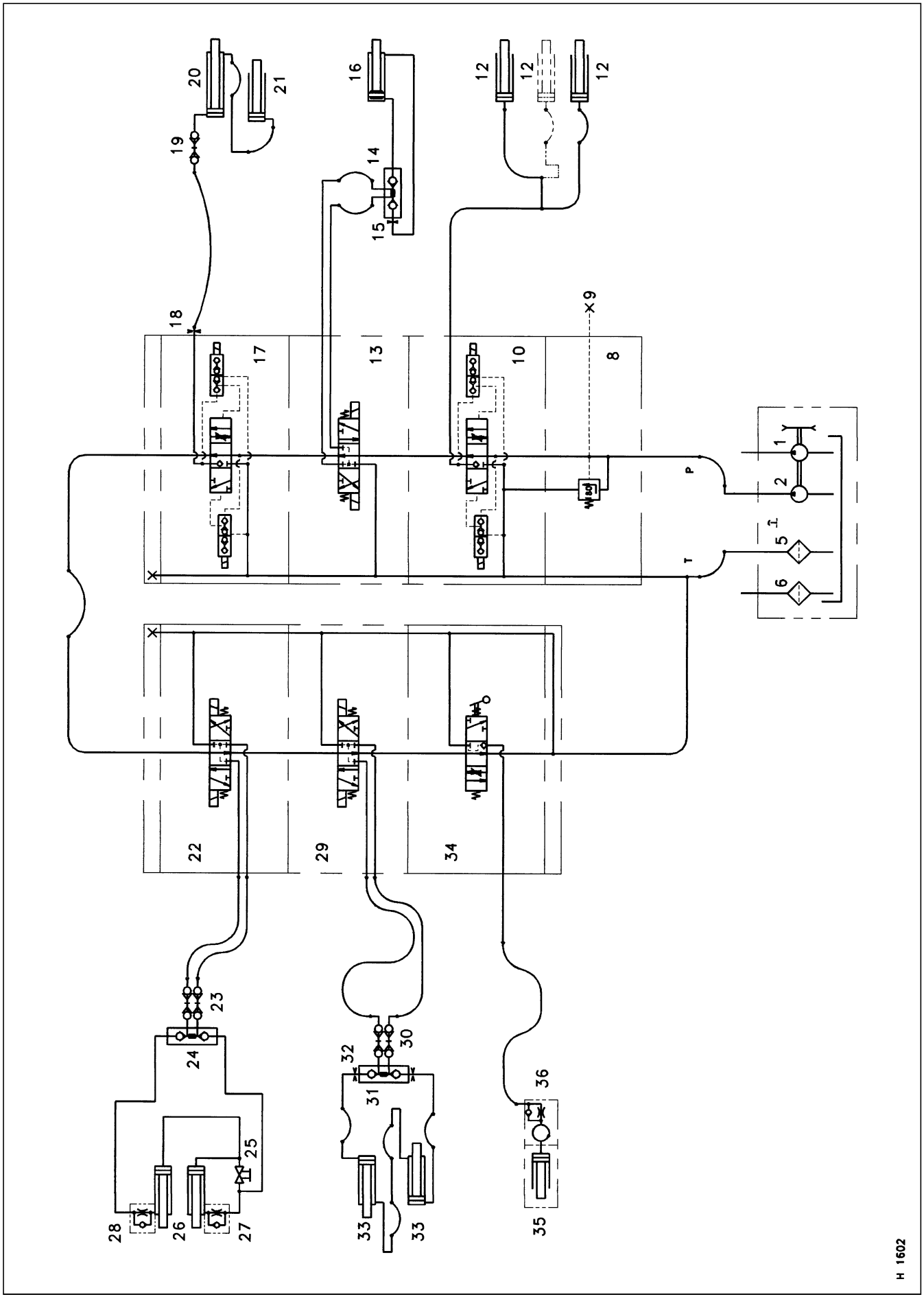
FUNCTION

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

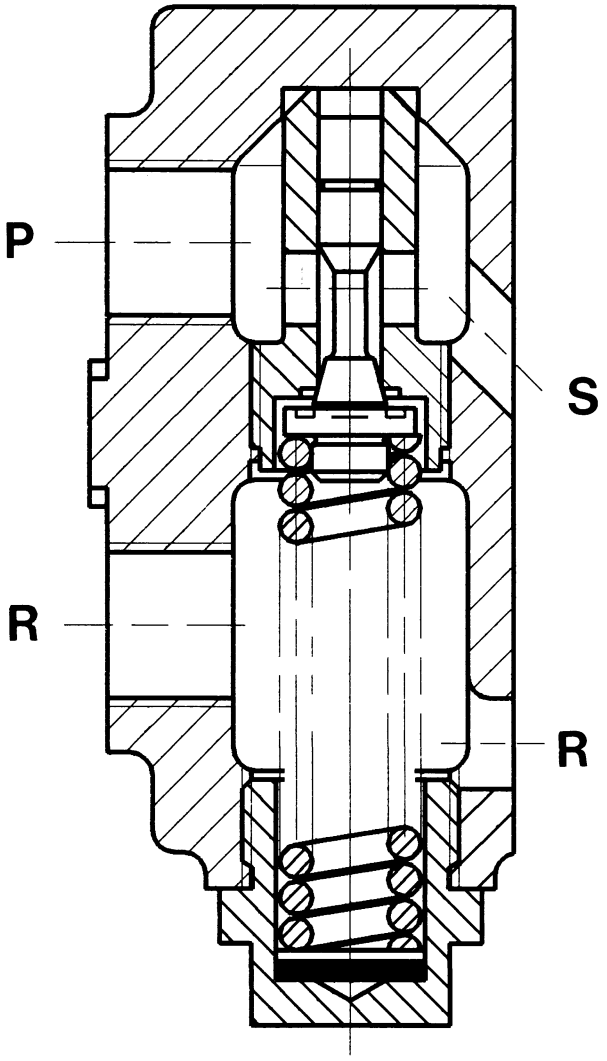
Working hydraulic system

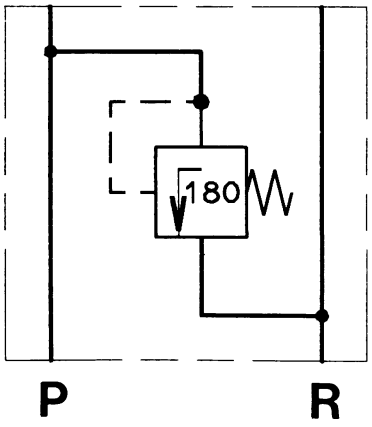
Circuit diagram, working hydraulic system MEGA 202/203/204/208/218



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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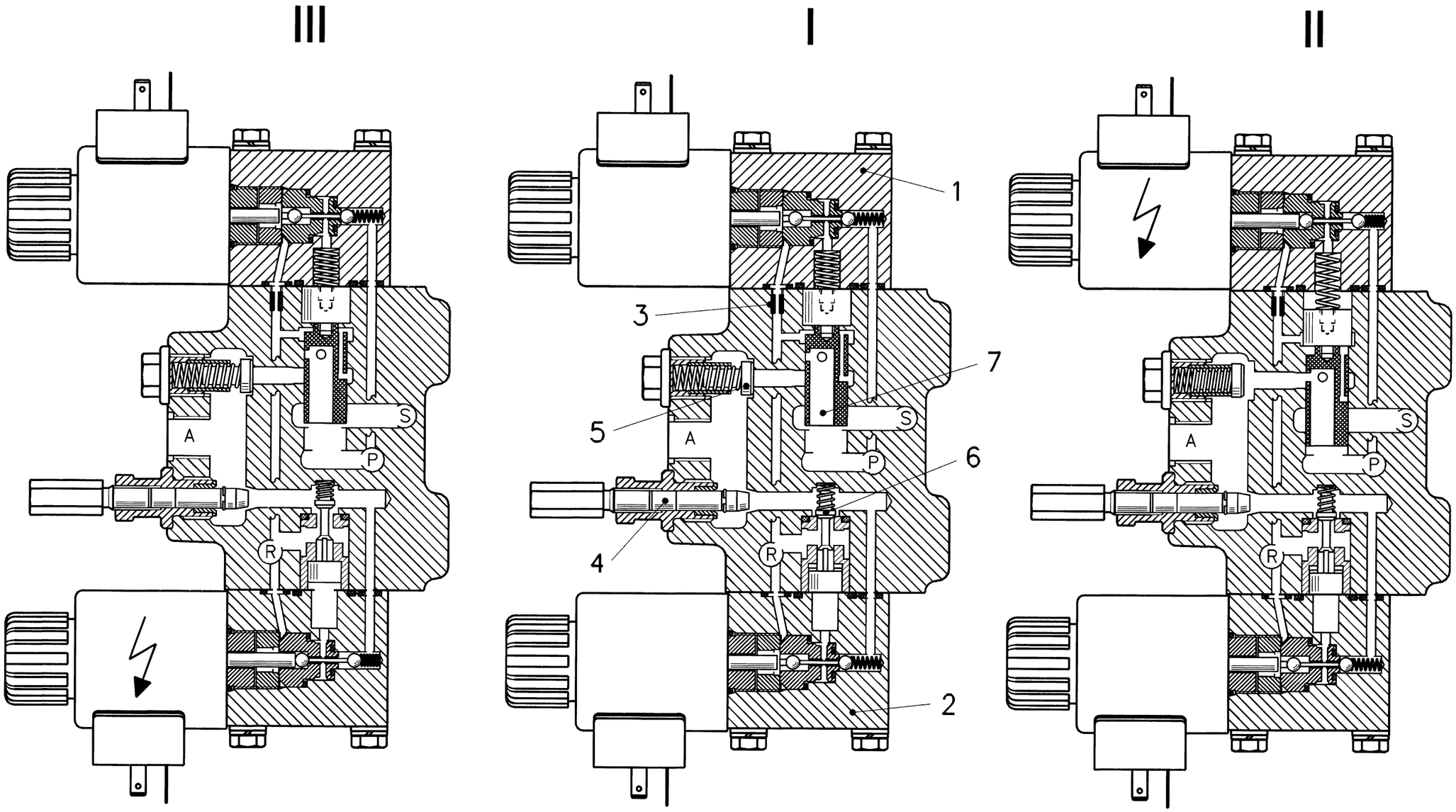
Pressure relief valve	Spring-loaded seated valve with damping, directly controlled.
Specifications	Valve setting = 175^{+15} bar, adjustable by shims 10 x 16 x 0.5.
	Valve seating secured with self-locking fluid.
	When dismantling the valve use special wrench for slotted nuts part No.181934.2 and heat 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.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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).

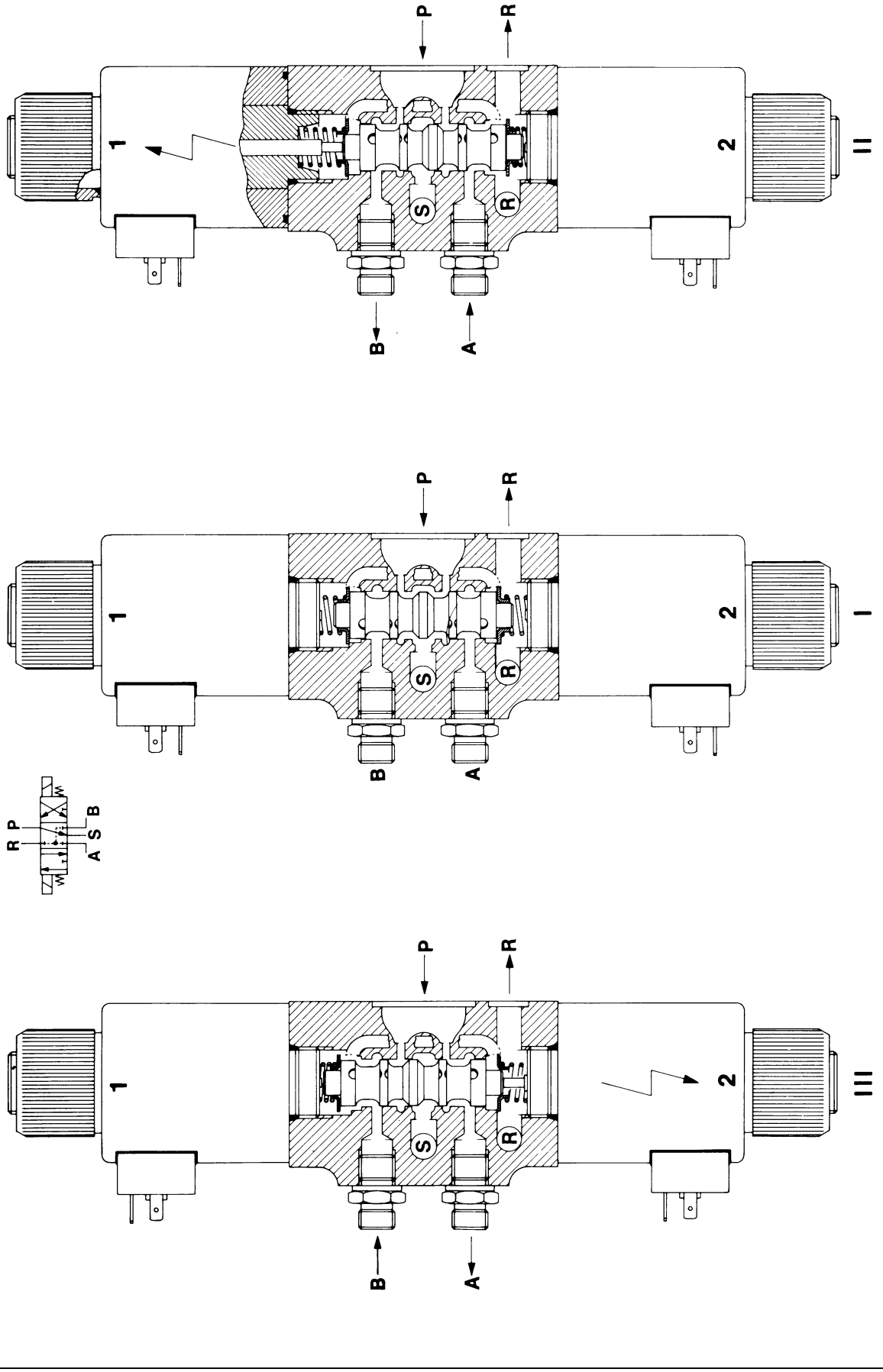
Raise (II)

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.

Solenoid-controlled 4/3 directional control valve



Key

I = Neutral position
II = Raise
III = Lower
1 = Solenoid 1
2 = Solenoid 2

Specifications

4/3 directional control valve with seperate, direct return flow to the reservoir. Spool valve for double-acting cylinder, direct control.

Spool with chamferred slots in edges, progressive overlap of spool lands to allow smooth movement of spool.
Internal leakage takes place.
Solenoids = 12 Volts, 60 % ED (continuous rated), 4,5 Amperes

FUNCTION

I Neutral position

Both solenoid valves are deenergized.

Oil is allowed to flow from P to S around the machined grooves in the spool. The annual grooves to the ports A and B are connected to R by way of the machined grooves in the spool and pressure balancing drillings.

II Raise

Solenoid valve 1 activates the spool. This allows oil flow from P to B and from A to R. Connection S is blocked.

III Lower

Solenoid valve 2 moves the spool. Oil from the bottom spring cavity can flow through the balancing drillings to R. Connections are made from P to A and from B to R. Connection S is blocked.

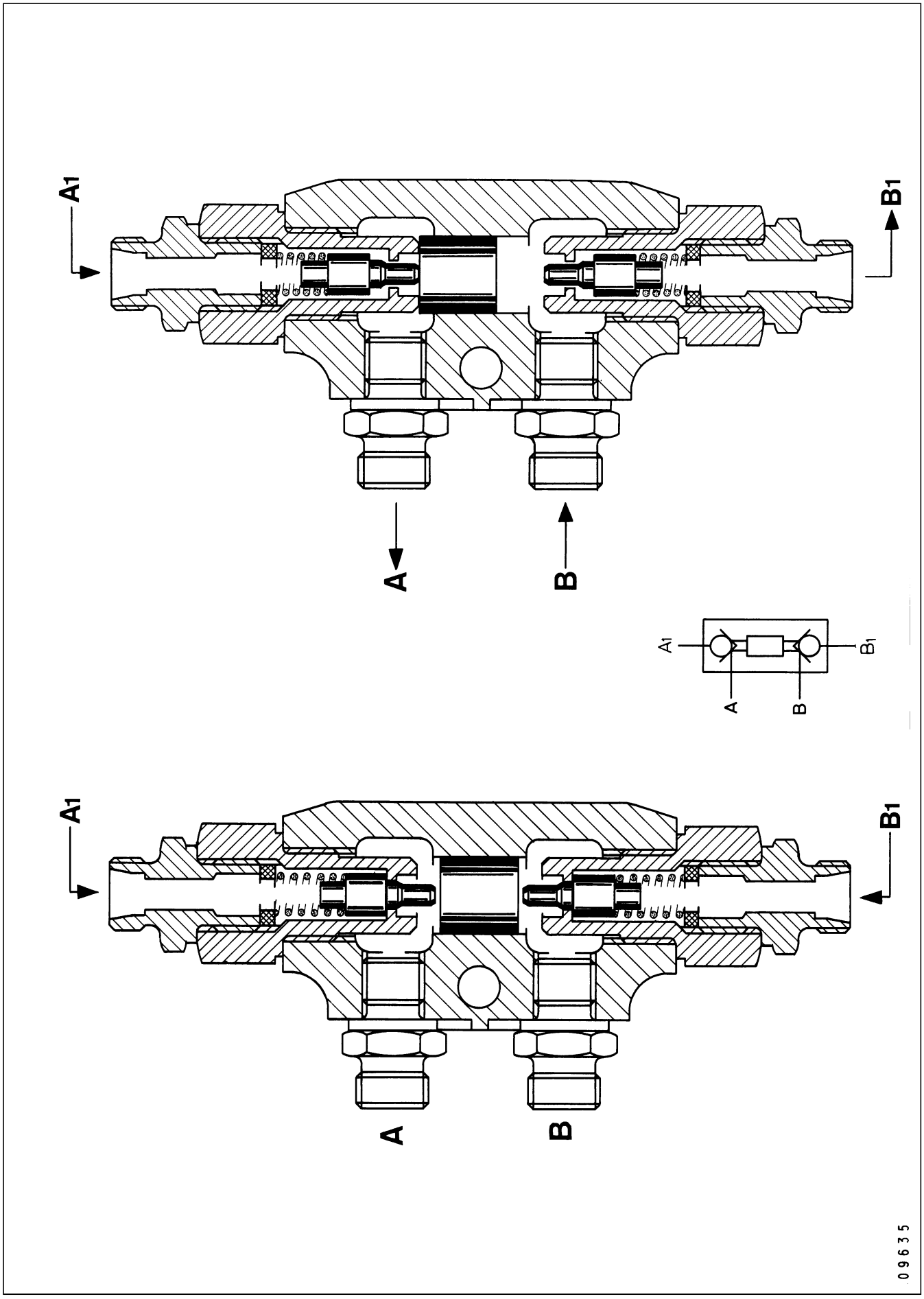
PROBLEM

Cylinder will not move

- Check that the solenoids are switched (see section that deals with electrical faults).
- Check restrictor plates in lock-up valve unit.
- Check that the quick release couplings have opened.

Cylinder drifts

- One way valves in lock-up valve unit leaking.
- Oil leaking past the grooved seal in the cylinder.


A1
B1
A
B
A1
B1
A
B
A1
B1
A
B
09635

FUNCTION

When closed, the one way valves hold the cylinder steady in one position.

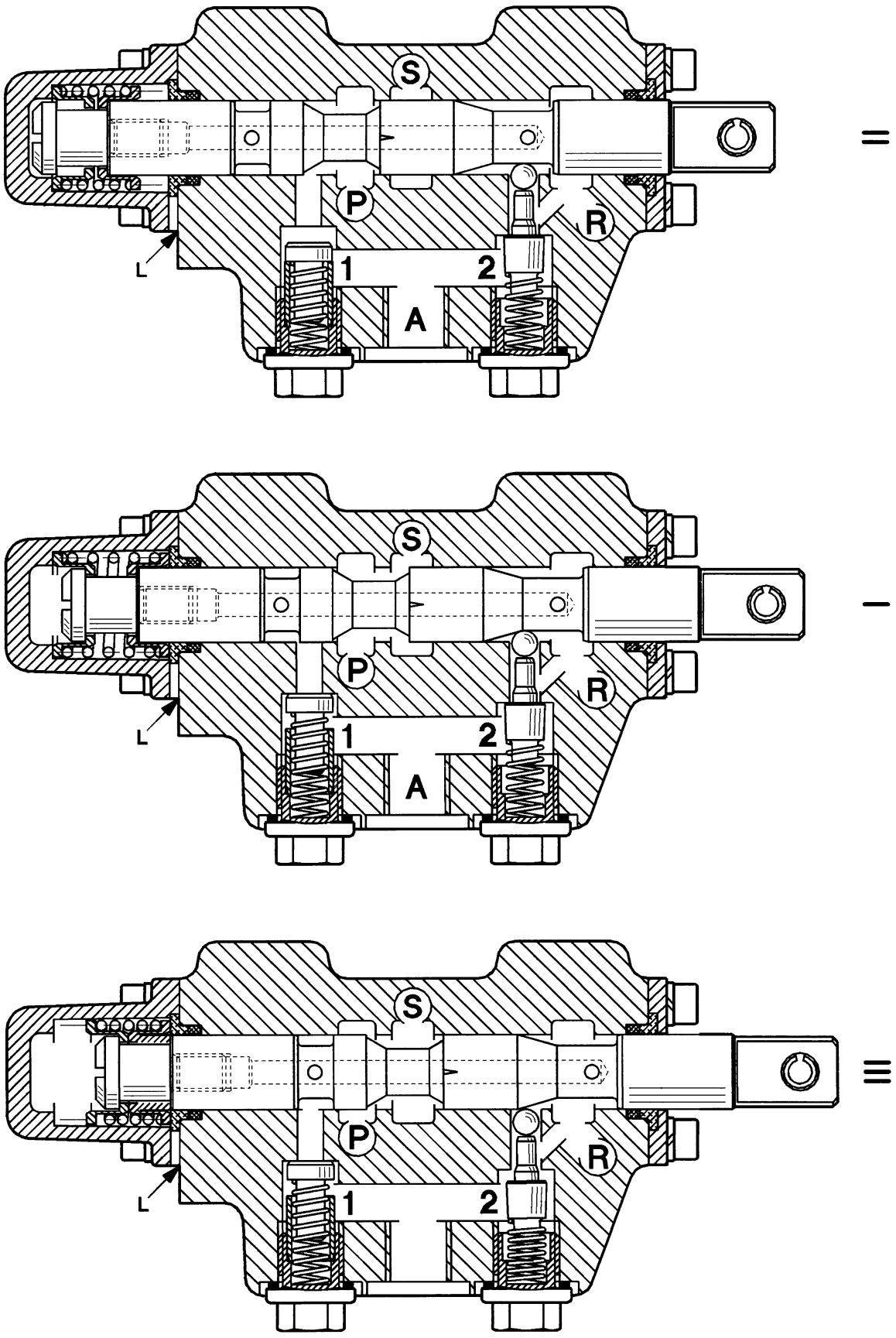
When oil enters connection B (pressure build-up), the oil will first act on the larger surface area of the piston which opens the one way valve at the opposite end. This connects A1 with A (return flow). Only after the return flow valve has opened, does the bottom valve open by oil pressure, allowing oil flow from B to B1. When oil enters connection A, first connection is made between B1 and B and then between A and A1.

To limit the oil flow to the cylinder, the connections on the lock-up valve have restrictor plates fitted (slow swing). See hydraulic circuit.

PROBLEM

Cylinder will not extend or retract	– Swing mechanism binding or seized. – Restrictor plates in cylinder connections blocked. – Oil leaking past the grooved seals of the cylinder. – Piston in lock-up valve sticking.
Cylinder moves in or out without being actuated	– One way valves in lock-up valve leaking. – Oil leaking past the grooved seals of cylinder. – Oil leaking past the thread of the seal carrier (piston), thread is sealed with self-locking fluid.

3/3 directional control valve, drum speed variation



H 8006

Key

I = Neutral position
II = Fast
III = Slow
1 = Delivery valve
2 = Return valve

Specifications

Spool valve with one-way valves for single-acting cylinder, no leak back of oil.

Screwed end cap in spool secured with self-locking fluid.

Spool clearance = 7 – 10 µm
Ball diameter = 5,5 mm
In neutral position, clearance between ball and valve stem = 0,2 – 0,4 mm

FUNCTION

Neutral

Oil is allowed to flow from P to S around a machined groove in the spool. Passage to port A is closed by a one-way valve, so that there is no leak back of oil. Operating a subsequent function causes a build-up of pressure from S to P. Leak back oil is drained through the leakage oil passage to R.

Position “fast”

The spool allows oil flow from P to A. At the same time connection S will be closed (the rising pressure opens the one-way valve (1)).

Position “slow”

By operating the spool in the other direction the chamber of the spool acts on the ball which opens the one-way valve (2). This allows oil to flow from A to R. Oil can still flow from P to S through the valve.

PROBLEM

External leakages (a trace of moisture on the cover is normal)

– Leaking spool seals.

Variable speed pulleys creep to the slow speed position.

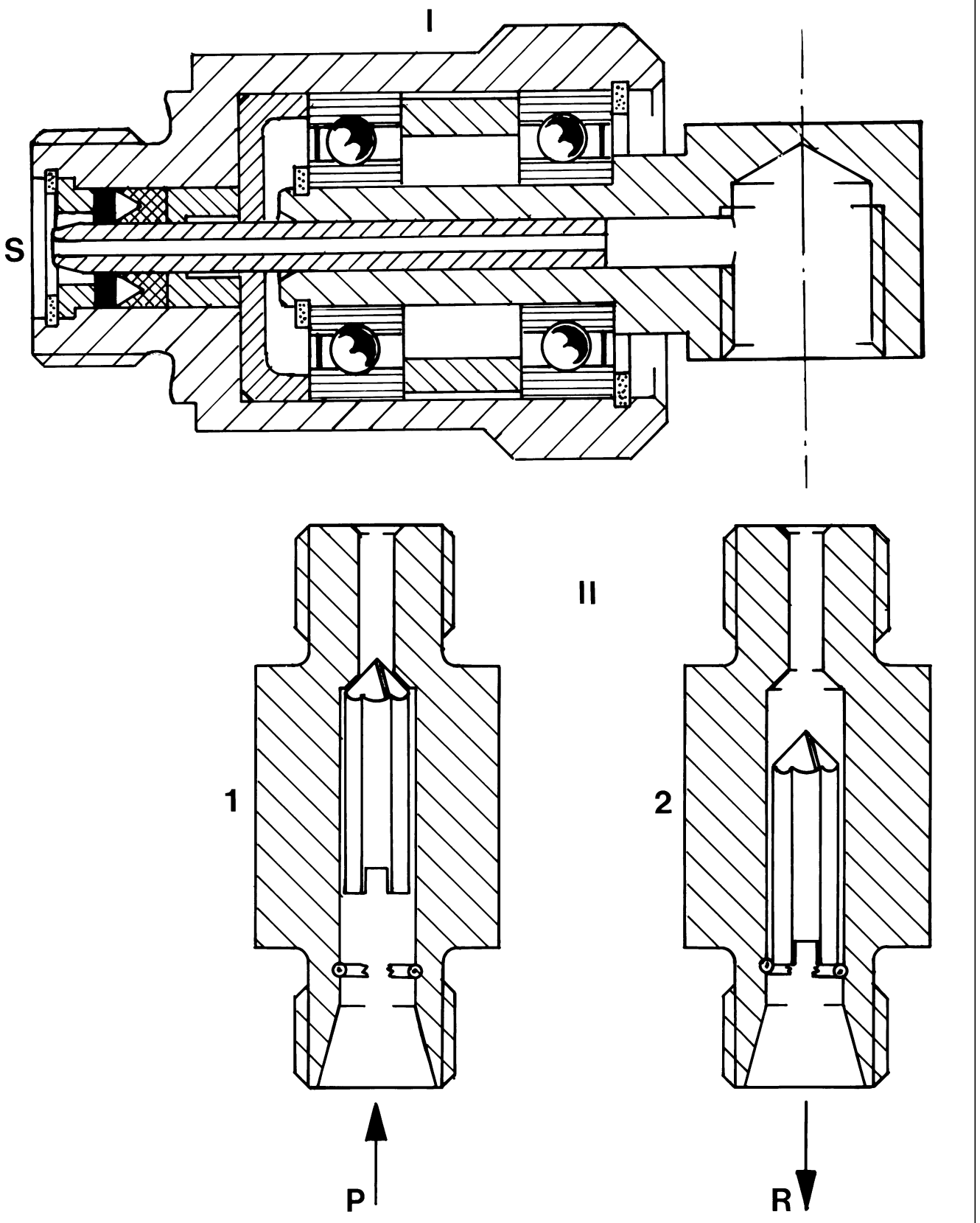
– Delivery or return valve leaking.
– No clearance between ball and valve stem of return valve (2) (0,2 – 0,4 mm).

NOTE! When dismantling the return valve, care must be taken to see that the ball is not lost.

Variable speed pulleys will not move to the high speed position

– Check one way restrictor valve (restrictor pin worn off).

Oil feed connection with one way restrictor valve



12171

Key

I = Oil feed connection
II = One way restrictor valve
1 = Restricted oil flow
2 = Unrestricted oil flow

FUNCTION

Restricted oil flow (drawing 1)

The oil flow from P to S is restricted. The cone with lateral flats is pushed against its seating by the flow of oil. The oil can only flow to the cylinder through the groove in the cone.

Full oil flow (drawing 2)

The oil flow from S to R is unrestricted. Oil is allowed to return to the reservoir. The cone is pushed back as the oil flows from S to R. The cone's lateral flats allow unrestricted flow of oil to the reservoir.

IMPORTANT! The different restrictor valves are marked to indicate the number of grooves:
2 = two grooves
3 = three grooves

PROBLEM

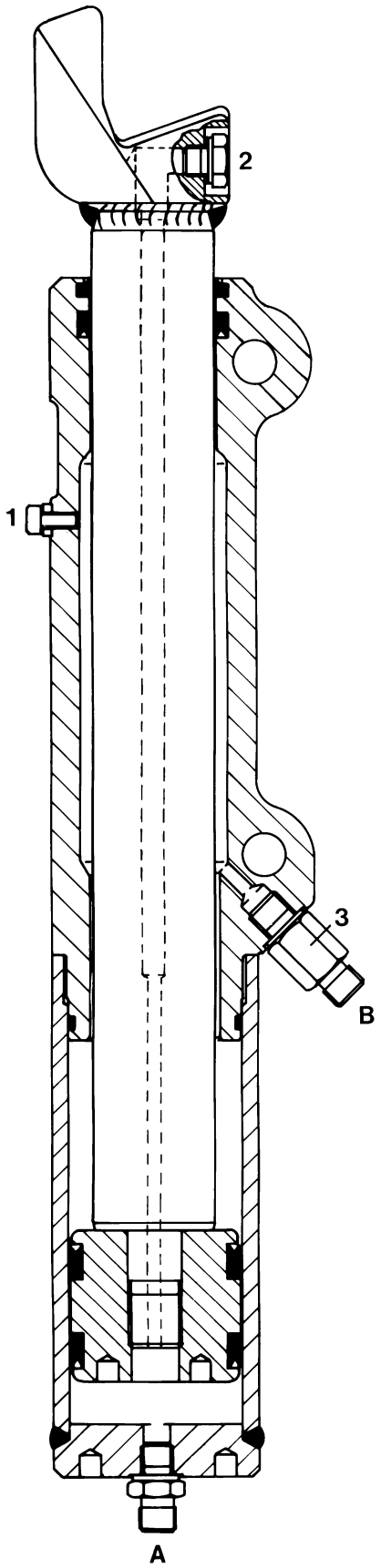
The variable speed drive cannot or can only be slowly operated to the high speed position, or the clutch cannot be engaged

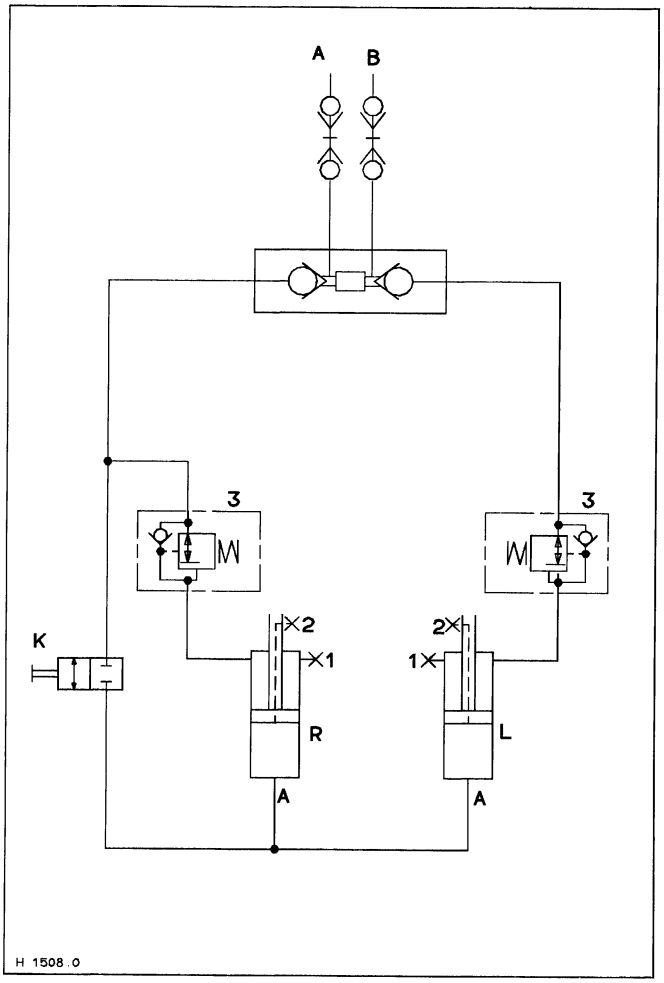
– The cone is worn blocking the groove.

External leakage on oil feed connection

– Oil leaking past the seal.
Note: The pin must be straight and not be worn.

Hydraulic cylinder, lateral levelling of cutterbar



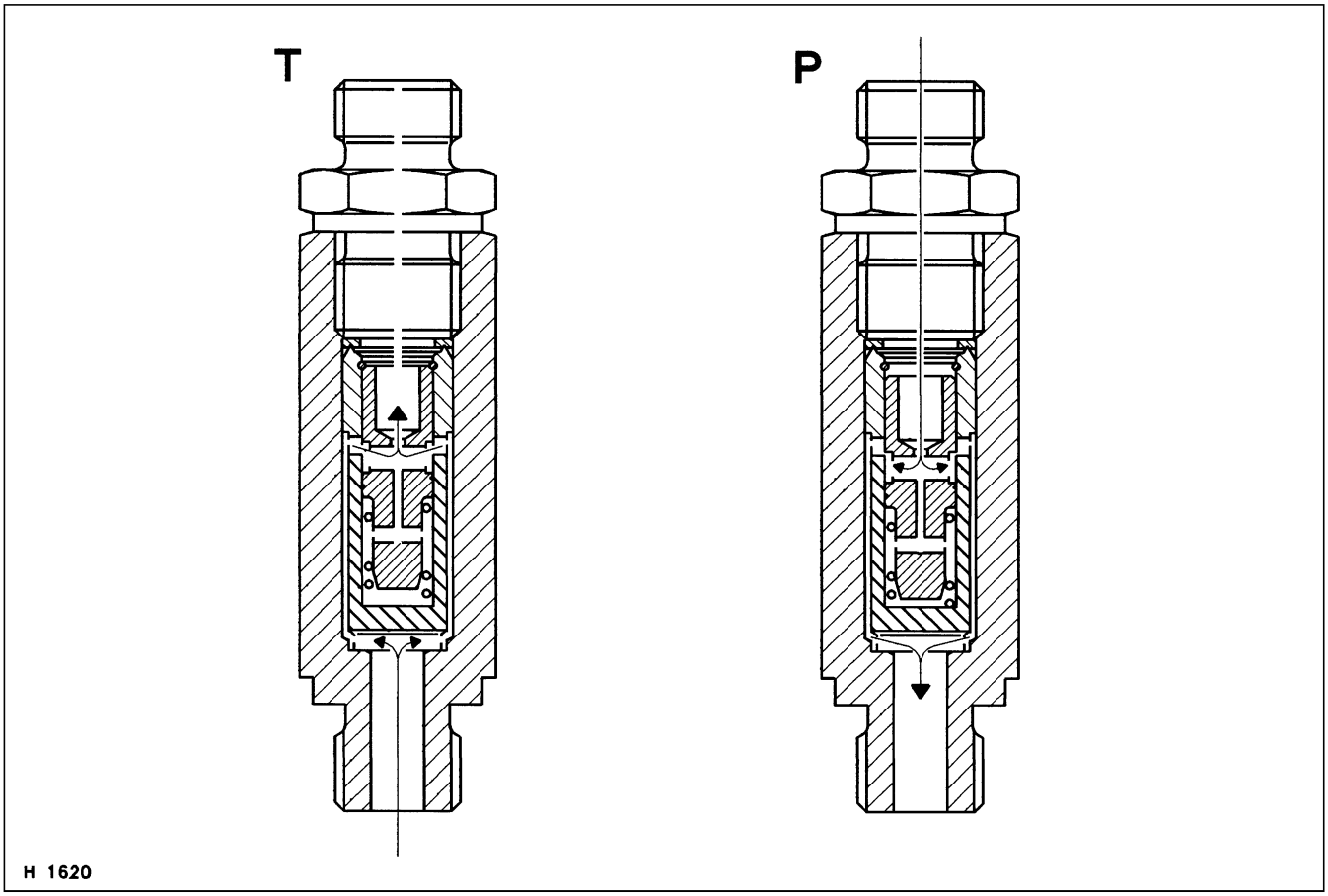


020034

Key

1 – Bleed screw
2 – Bleed screw (on coupling lug)
3 – Flow control valve
K – Shut-off valve
R – Right-hand hydraulic cylinder
L – Left-hand hydraulic cylinder
A/B – Connection to solenoid-operated 4/3 directional control valve

Flow control valve (lateral levelling of cutterbar)



Bleeding the hydraulic cylinders

- Open the lock valve (K)
- Open the bleed screw (2) on both cylinders
- Open the bleed screw (1) on the right hand cylinder (R)
- Operate the manual control switch to the right, so causing both cylinders to extend
- Once all the air has been extracted, close the bleed screw (1 and 2).
- With both cylinders extended, open the bleed screw (1) on the left hand cylinder (L)
- Operate the manual control switch in the opposite direction as before
- Once all the air has been extracted, close the bleed screw (1). The left cylinder is now retracted)
- Close shut-off valve (K). With the manual control switch operate the cylinders in alternate directions

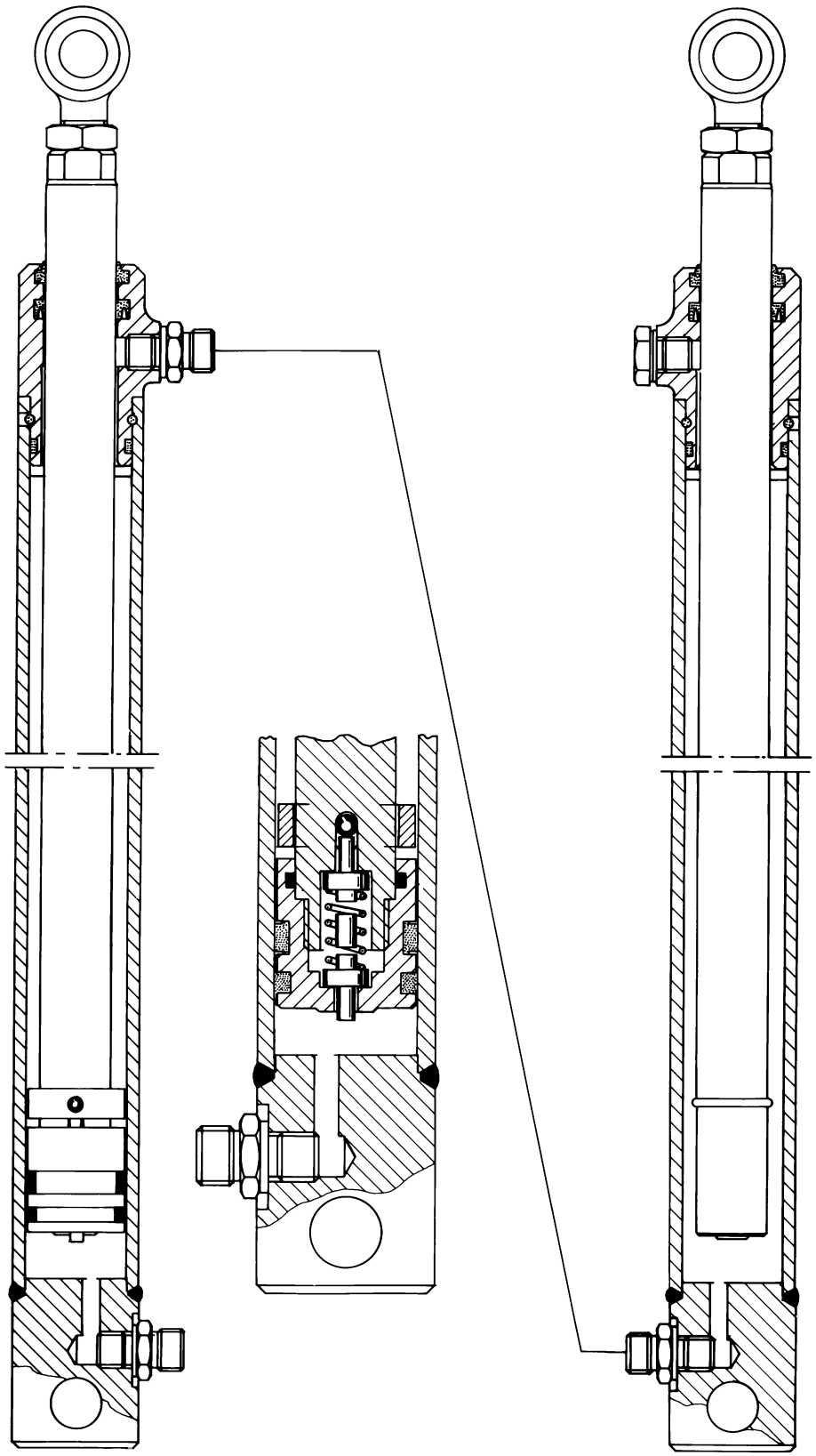
Lowering both cylinders to their lowest position
(for attachment of maize headers)

- Attach the header
- Operate the manual control switch so that the header drops on the right hand side (left cylinder (L) extended, right cylinder (R) retracted)
- Open the shut-off valve (K)
- Operate the manual control switch in the opposite direction (left cylinder (L) retracts)
- Close shut-off valve (K)

Setting the cylinder position.
Fitting cutterbar or when both cylinders are not level in the middle position

- Remove the header
- Open the shut-off valve (K)
- Operate the manual control switch so that both cylinders extend to their maximum position
- Operate the manual control switch so that the left cylinder retracts fully
- Close the shut-off valve (K).
- Operate the manual control switch until both cylinders are in the same position
- Attach the cutterbar

Reel lift cylinders



1 2 1 7 6

FUNCTION

Synchronized cylinders lift and lower the reel.
Left = Equalizing cylinder (with valves)
Right = Positive displacement cylinder
(The other way around on 6,00 m (20 ft) cutterbars and over.)

In the position “Lift reel” oil is fed into the bottom chamber of the left-hand cylinder raising the piston. The piston is sealed at both ends (seals, valves).

During the upward stroke of the piston, oil is pushed out of the top chamber and into the right hand cylinder (displacement). In this manner a uniform lift and lowering of both ends is achieved despite the differing loads on the cylinders.

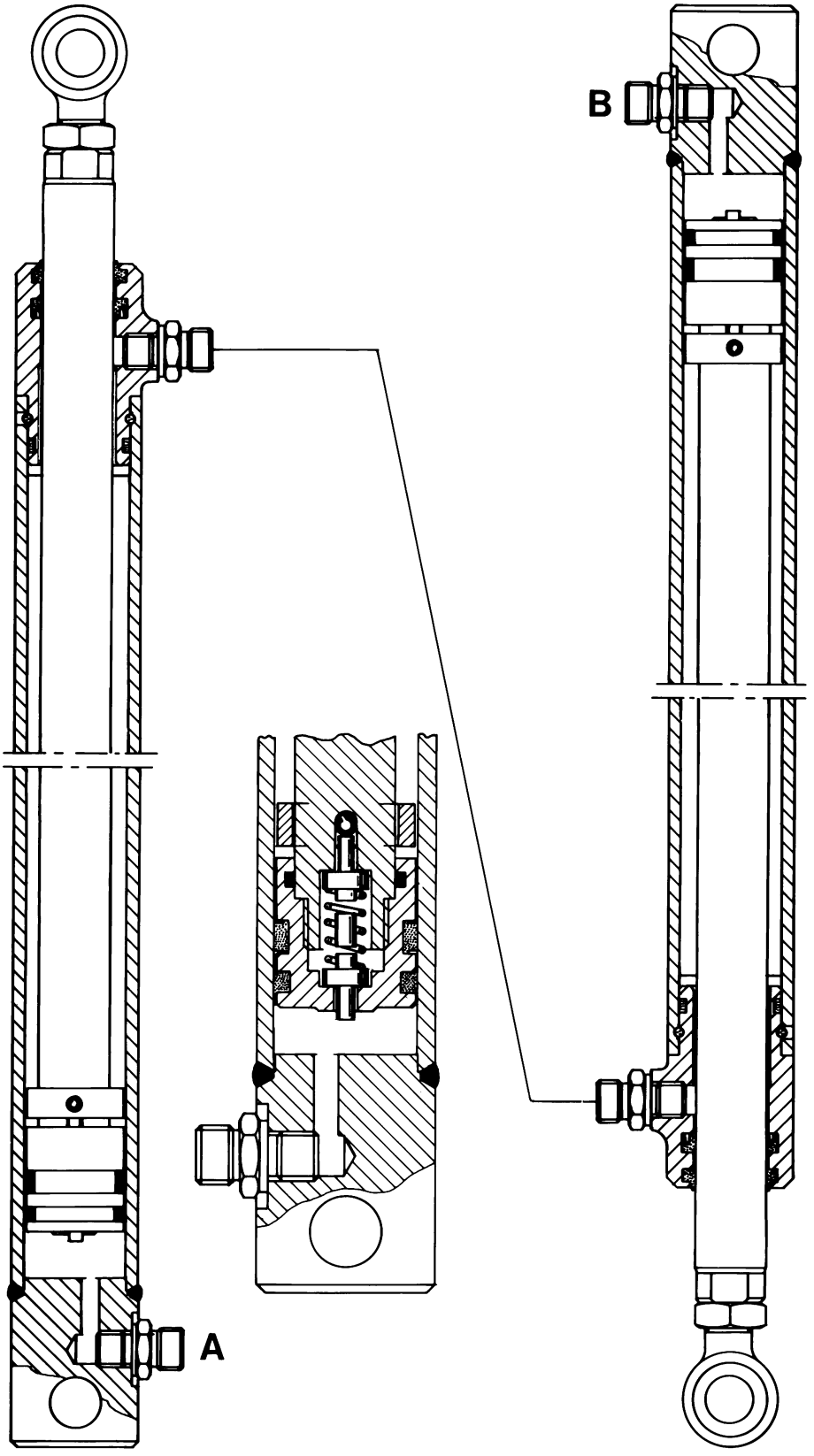
The top valve in the left hand cylinder permits oil to transfer to the right cylinder only when the left cylinder is fully extended (top valve opens mechanically).

Bleeding is necessary following assembly. For this purpose the reel must be in the fully raised position.

PROBLEM

Reel positioned lower on side of displacement cylinder	– System has not been bled. – External leakages. **NOTE!** Check screw connections of hydraulic lines.
Reel positioned lower on side of equalizing cylinder	– Seal or valves of equalizing cylinder leaking.
Reel will not lift (pressure relief valve opens)	– Valve in quick-release coupling not open. – 1,2 mm dia. restrictor blocked. **NOTE!** The restrictor is located in the service port of the solenoid-operated 3/3 directional control valve.

Reel cylinders – fore and aft adjustment



12173

FUNCTION

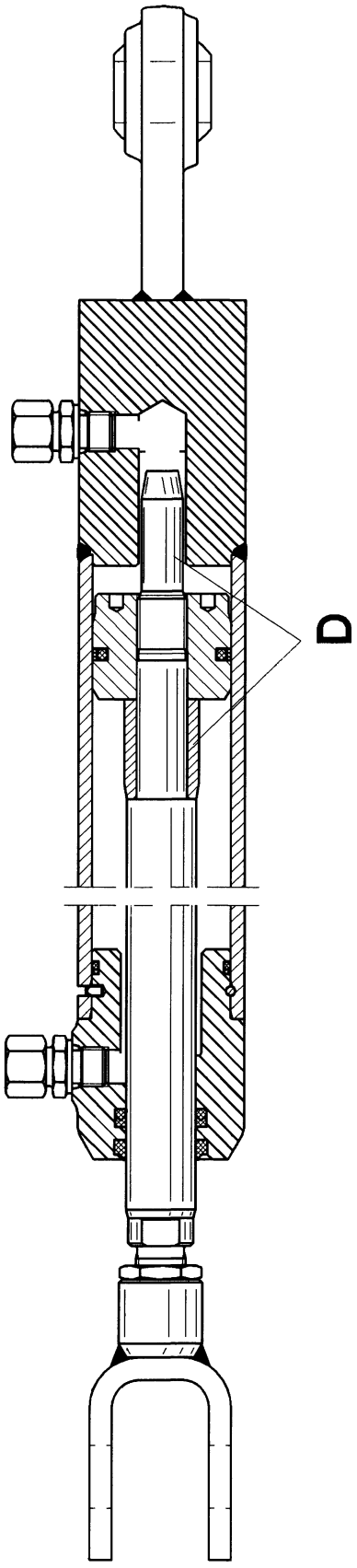
The two double acting cylinders on the reel operate in double (opposed) motion. The pistons accomodated in the cylinders are sealed at both ends (seals and valves).

If one cylinder takes in oil fed form a 4/3 directional valve, the piston rod extends. The oil displaced in this manner in the upper chamber is forced into the second cylinder which retracts. The oil displaced from this cylinder flows back to the tank through the 4/3 directional valve.

FAULTS

Reel does not move in parallel	– Air in the system – to bleed the reel, move into the fore and aft end positions for about 15 to 20 sec. in each case; the piston-mounted valses open. – Seals or piston-mounted valves leak.
Reel cannot be moved forward or backward	– Quick-release couplings not connected or do not open. – Restrictors in lock-up valve blocked. – See fault 4/3 directional valve.
Reel creeps forward or backward by itself	– Lock-up valves leaking.

Hydraulic cylinder, swivel grain tank unloading tube

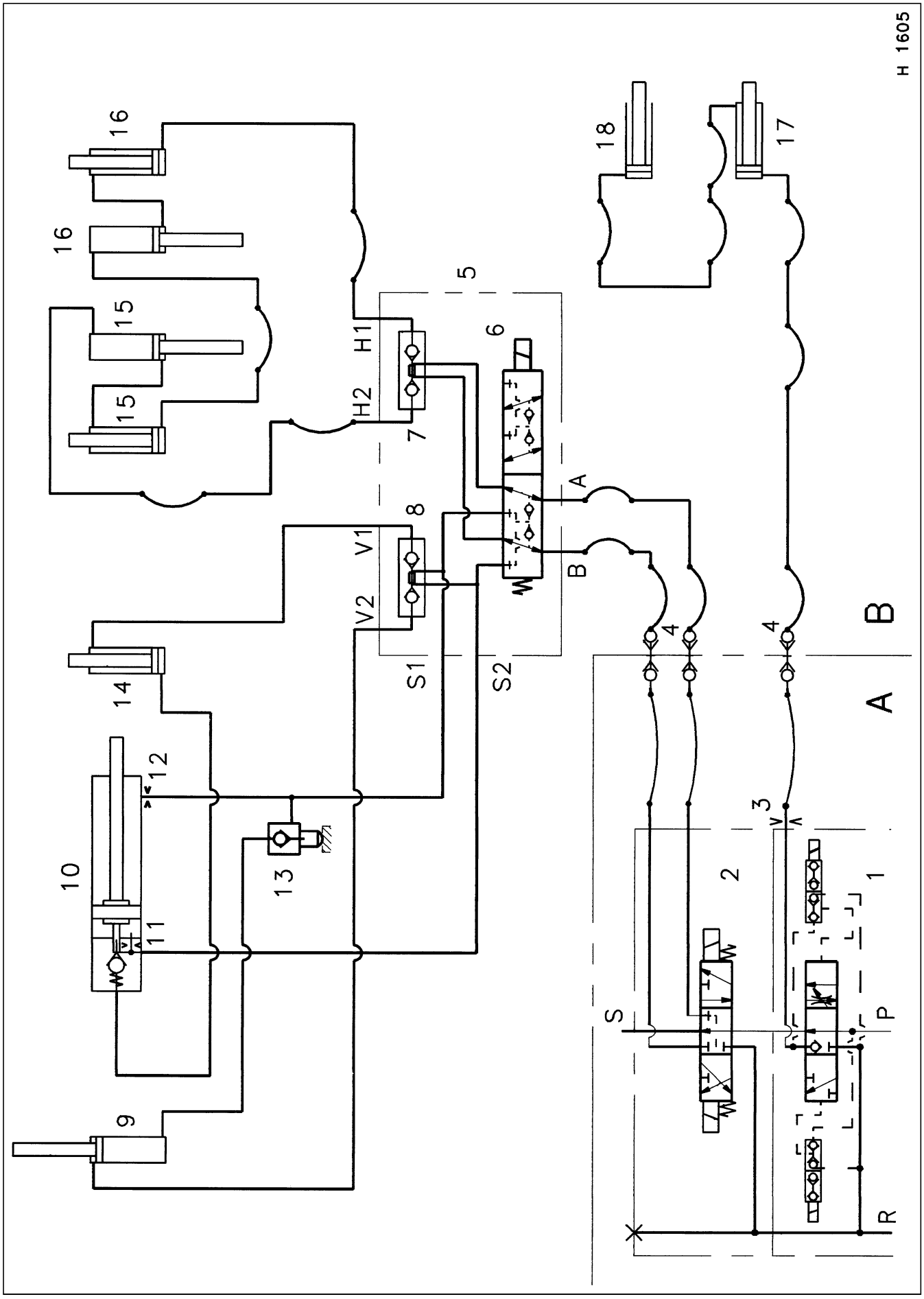


H 1615

4

Front attachments: Folding cutterbar Maize picker head

Hydraulic circuit for the folding cutterbar



Key

1 – Solenoid-operated 3/3 directional control valve, reel up/down
2 – Solenoid-operated 4/3 directional control valve, reel fore and aft adjustment and folding the cutterbar
3 – 1,2 mm diameter restrictor
4 – Couplings
5 – Change-over valve
6 – Solenoid-operated 6/2 directional control valve
7 – Lock-up valve, fore and aft reel adjustment
8 – Lock-up valve, folding the cutterbar
9 – Hydraulic cylinder, locking cutterbar in working position
10 – Hydraulic cylinder, cutterbar folding
11 – 0,8 mm diameter restrictor
12 – 0,8 mm diameter restrictor
13 – Mechanically-opened one-way valve
14 – Hydraulic cylinder, locking the cutterbar in transport position
15 – Hydraulic cylinder, fore and aft reel adjustment, L/H side
16 – Hydraulic cylinder, fore and aft reel adjustment, R/H side
17 – Double-acting hydraulic cylinder, reel up/down
18 – Single-acting hydraulic cylinder, reel fore and aft adjustment

H1 – Connection, hydraulic cylinder, fore and aft reel adjustment, R/H side
H2 – Connection, hydraulic cylinder, fore and aft reel adjustment, L/H side
V1 – Connection, hydraulic cylinder (rod end), locking cutterbar in transport position
V2 – Connection, hydraulic cylinder (rod end), locking cutterbar in working position
S1 – Connection to hydraulic cylinder for folding cutterbar and to mechanically opened one-way valve
S2 – Connection, hydraulic cylinder for folding cutterbar
A – Connection from solenoid-operated 4/3 directional control valve
B – Connection from solenoid-operated 4/3 directional control valve

FUNCTION

Reel height adjustment

As we know, the reel is raised or lowered by way of the solenoid-operated 3/3 directional control valve (1) and the hydraulic cylinders (17 and 18).

Reel fore and aft adjustment

The reel is moved fore and aft, as we know, by way of the solenoid-operated 4/3 directional control valve (2), the deenergized solenoid-operated 6/2 directional control valve (6), the lock-up valve (7) and the hydraulic cylinders (15 and 16). As the reel is in two halves (split in the centre), reel movement is obtained by 4 double-acting cylinders. These cylinders are connected in series and operate simultaneously.

Swinging the cutterbar to working width

- The cutterbar must not touch the ground as it is being moved to working width. Watch the touch sensors!
- Fully lower the reel.
- Manually unlock the cutterbar making sure that the handle securely engages in the vertical position.
- Move out the L/H crop divider.
- Remove the light board and the protective guards for crop lifters and knives, respectively.
- Move out the R/H crop divider.
- Operate the reel all the way backward.
- Press the buttons that activate the solenoid-operated 4/3 directional control valve (2) and the solenoid-operated 6/2 directional control valve (6).

Oil flows from the solenoid-operated 4/3 directional control valve (2) via connections (B) and (V2) to the rod end of hydraulic cylinder (9). The mechanically opened one-way valve (13) still remains closed.

At the same time, oil flow is permitted from connection (S2) through the one-way valve of the hydraulic cylinder (10) to the face end of hydraulic cylinder (14). The piston rod extends and unlocks the cutterbar.

The oil displaced from the rod end of hydraulic cylinder (14) returns to the tank.

With locks released, the cutterbar swings wide to working position.

One-way valve (13) is mechanically opened at the end of the stroke. This allows oil from the face end of hydraulic cylinder (9) to return to the tank. The piston rod retracts and locks the cutterbar.

Restrictors (11) and (12) cause the piston rod of cylinder (10) to retract or extend slowly.

- Operate the reel fully forward.
- Install the R/H universal drive shaft.
- Engage the security bracket for fore and aft reel adjustment
- Manually lock the cutterbar in position (handle downward).
- Install the L/H universal drive shaft

Folding the cutterbar to transport position

- The cutterbar must not touch the ground as it is being folded. Watch the touch sensors.
- Fully lower the reel.
- Manually unlock the cutterbar.
- Disengage the security bracket for fore and aft reel adjustment.
- Disconnect the L/H universal drive shaft.
- Disconnect the R/H universal drive shaft.
- Operate the reel fully back.
- Press the buttons that operate the solenoid-operated 4/3 directional control valve (2) and the solenoid-operated 6/2 directional control valve (6).

Oil flows from the solenoid-operated 4/3 directional control valve (2) through connections (A) and (S1) and through the open one-way valve (13) to the face end of hydraulic cylinder (9).

The piston rod of cylinder (9) extends and unlocks the cutterbar. The oil from the rod end of the cylinder returns to the tank.

At the same time oil flows from connection (S1) to the rod end of hydraulic cylinder (10).

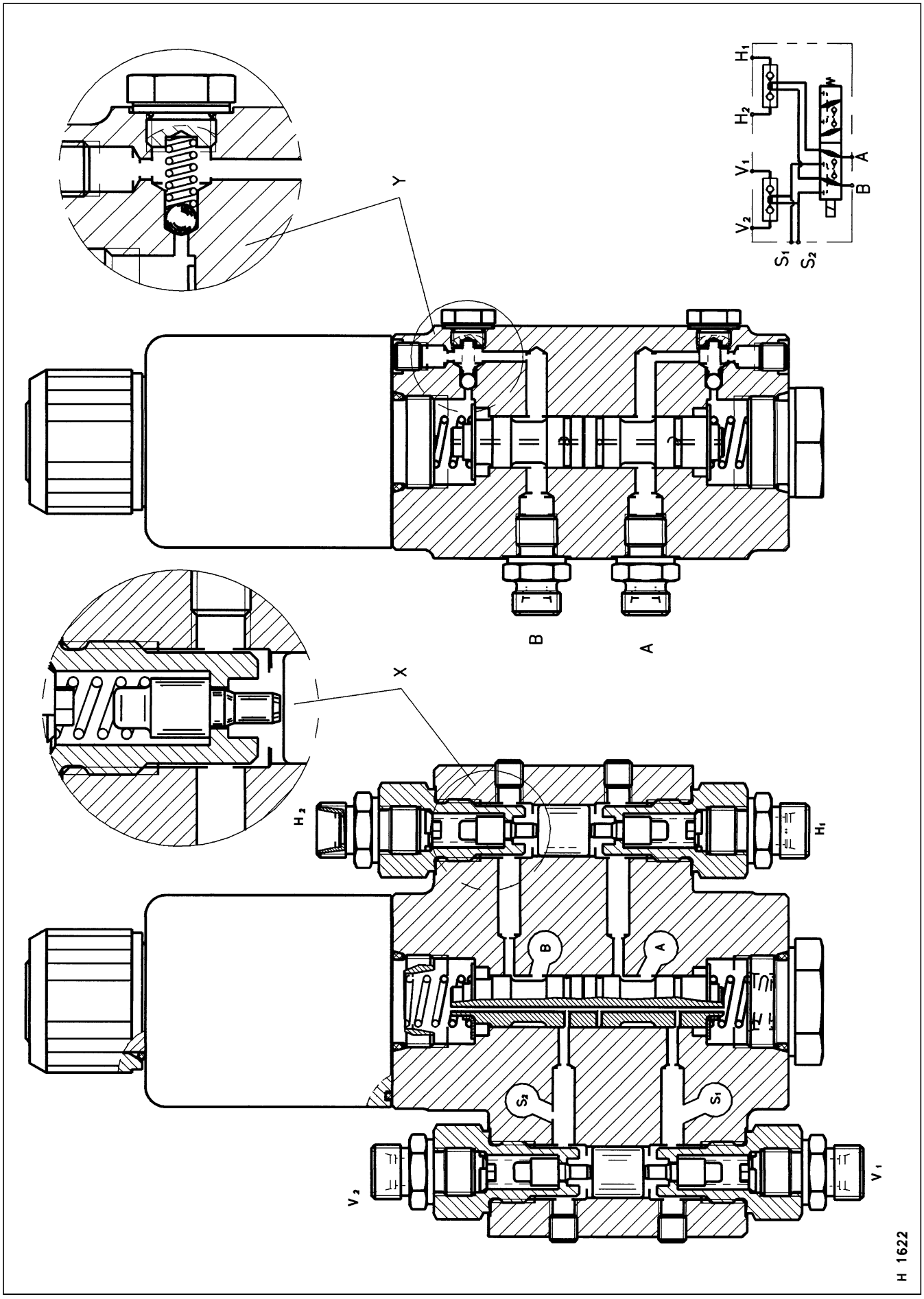
The piston rod of cylinder (10) retracts.

With locks released, the cutterbar folds to transport position.

When the piston rod of cylinder (10) reaches the end of its stroke, the one-way valve inside the hydraulic cylinder (10) is opened. This allows the oil from the face end of hydraulic cylinder (14) to return to the tank. The piston rod of the cylinder retracts and locks the cutterbar in position.

- Move the R/H crop divider inwards.
- Attach and connect the light board.
- Install the protective guards for crop lifters and knives, respectively.
- Move the L/H crop divider inwards.

Change-over valve (solenoid-operated 6/2 directional control valve with lock-up valves), folding cutterbar



Key

H1 – Connection, hydraulic cylinder, fore and aft reel adjustment, R/H side
H2 – Connection, hydraulic cylinder, fore and aft reel adjustment, L/H side
V1 – Connection, hydraulic cylinder (rod end), locking cutterbar in transport position
V2 – Connection, hydraulic cylinder (rod end), locking cutterbar in working position
S1 – Connection to hydraulic cylinder for folding cutterbar and to mechanically opened one-way valve
S2 – Connection, hydraulic cylinder for folding cutterbar
A – Connection from solenoid-operated 4/3 directional control valve
B – Connection from solenoid-operated 4/3 directional control valve

FUNCTION

Change-over valve not energized

Port (A) is connected with port (H1) through the one-way valve, or port (B) is connected with port (H2) through the one-way valve (see detail X).
Also refer to Function in section Lock-up valve.

Ports (S1) or (S2) are connected through the centre bore of the spool and through the one-way valve (see detail Y) to the relevant return sides.

Change-over valve energized

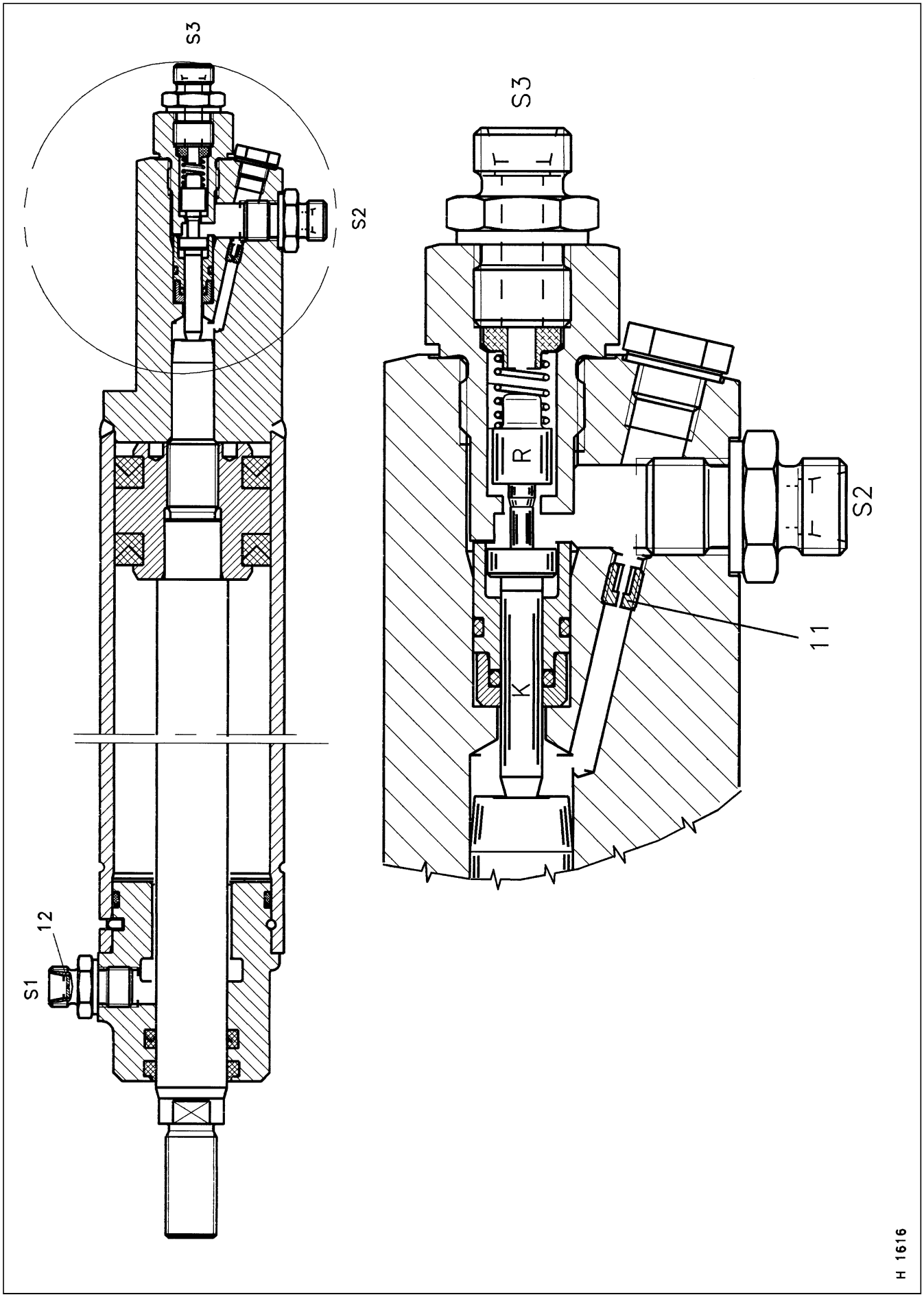
Port (A) is connected with ports (S1) and (V1) or port (B) is connected with ports (S2) and (V2).

Return valves (detail Y)

Leakage oil that collects in the spring cavities of the main spool is directed through the one-way valves (detail Y) back to the tank.

This prevents automatic opening of the one-way valves inside the lock-up valves.

Hydraulic cylinder, folding cutterbar



Key

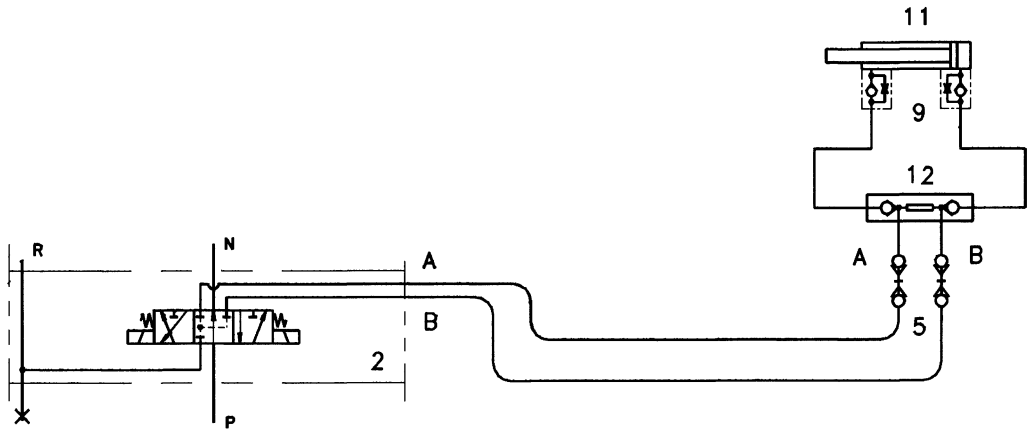
S1 – Connection to hydraulic cylinder for folding cutterbar and to mechanically opened one way valve
S2 – Connection, hydraulic cylinder for folding cutterbar
S3 – Connection, hydraulic cylinder, cutterbar locking (rod end)
K – Plunger
R – One way valve
11 – 0,8 mm diameter restrictor
12 – 0,8 mm diameter restrictor

FUNCTION

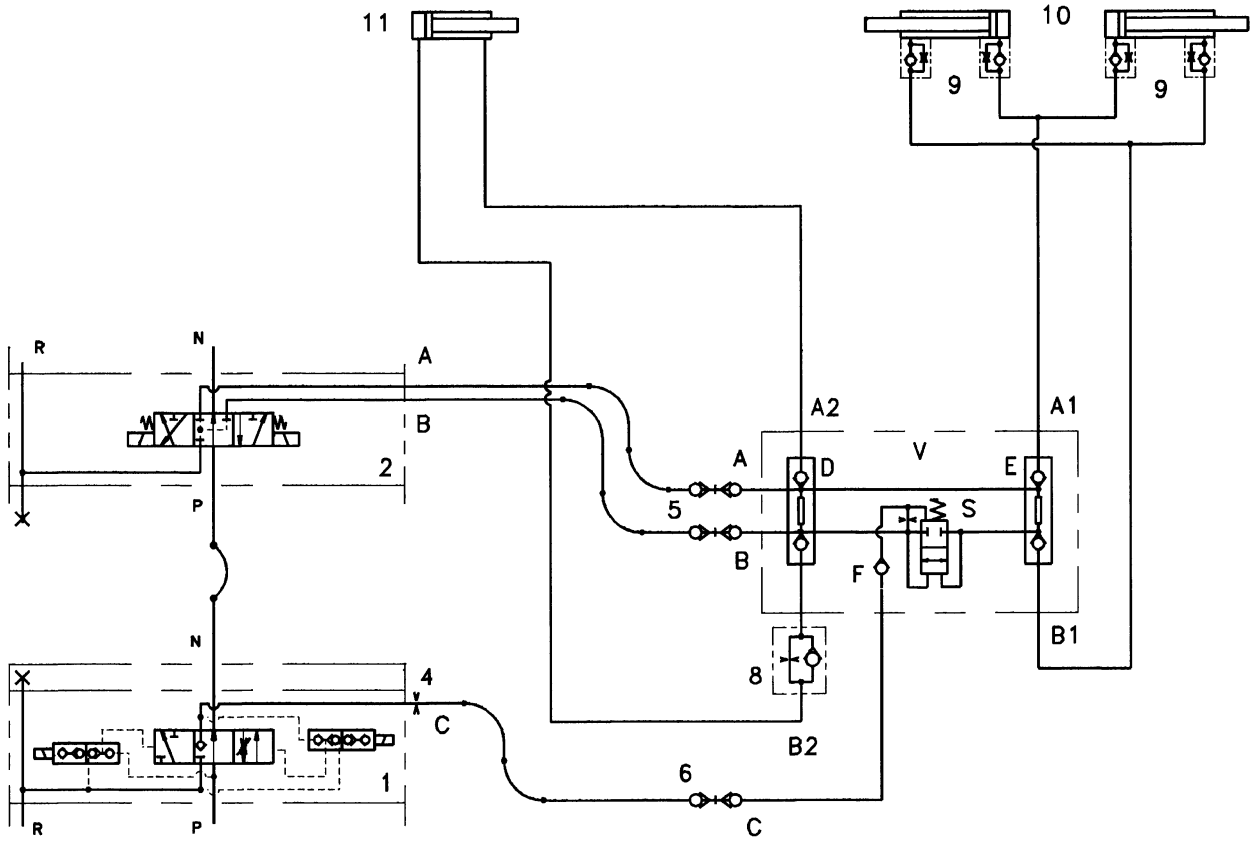
When the piston rod is retracted, the one way valve (R) is mechanically held open by plunger (K). Oil can flow from (S3 to S2). The restrictors (11 and 12) slow down the rate of speed at which the piston rod retracts and extends, respectively.

Hydraulic circuit, maize picker head – folding the snapping units, snapping plate adjustment

I



II



H 1604

Key

1 – Solenoid-operated 3/3 directional control valve, snapping plate adjustment
2 – Solenoid-operated 4/3 directional control valve, folding the snapping units
4 – 1,2 mm diameter restrictor
5 – Couplings
6 – Couplings
8 – One-way restrictor valve
9 – One-way restrictor valves
10 – Hydraulic cylinder, folding the snapping units
11 – Hydraulic cylinder, snapping plate adjustment
12 – Lock-up valve

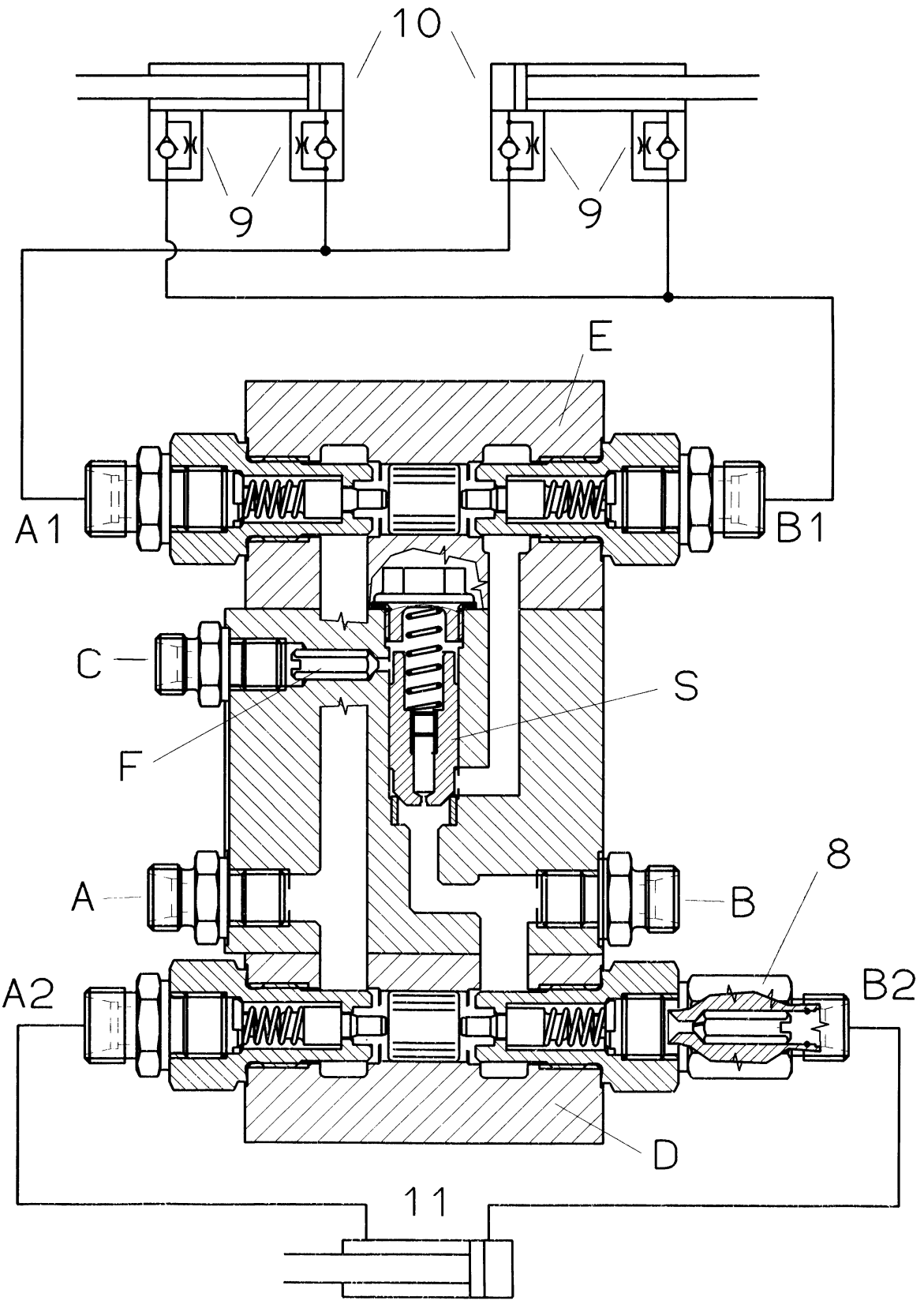
I – Maize picker head SL (cannot be folded)
II – Multimaster, folding

V – Valve block, comprising:
E – Lock-up valve, folding the snapping units
F – One-way valve
D – Lock-up valve, snapping plate adjustment
S – Spool with restrictor

A – Port, to solenoid-operated 4/3 directional control valve (blue)
B – Port, to solenoid-operated 4/3 directional control valve (red)
C – Port, to solenoid-operated 3/3 directional control valve

A_1 – Connection, folding snapping units out
B_1 – Connection, folding snapping units in
A_2 – Connection, adjusting snapping plates closer together
B_2 – Connection, adjusting snapping plates wider apart

Valve block – folding maize picker head



017712

Key

A – Port, to solenoid-operated 4/3 directional control valve (blue)
B – Port, to solenoid-operated 4/3 directional control valve (red)
C – Port, to solenoid-operated 3/3 directional control valve (without colour marking)
D – Lock-up valve, snapping plate adjustment
E – Lock-up valve, folding the snapping units
F – One-way valve
S – Spool with restrictor
A_1 – Connection, folding snapping units out
B_1 – Connection, folding snapping units in
A_2 – Connection, adjusting snapping plates closer together
B_2 – Connection, adjusting snapping plates wider apart
8 – One-way restrictor valve
9 – One-way restrictor valves
10 – Hydraulic cylinder, folding the snapping units
11 – Hydraulic cylinder, snapping plate adjustment

FUNCTION

Folding snapping units out

Oil flows from the solenoid-operated 4/3 directional control valve through port (A) to lock-up valves (D and E). As pressure builds up, the valves open. Oil is allowed through port (A_1) to the double-acting cylinders of the snapping units.

The oil displaced by the pistons flows through port (B_1) to spool (S). The spool is opened against the spring force. The oil inside the spring chamber is displaced through the restrictor and flows with oil from port (B_1) to (B), and then circulates through the solenoid-operated 4/3 directional control valve back to the tank.

While the snapping units fold out, oil is directed through port (A_2) to the hydraulic cylinder for snapping plate adjustment. The piston retracts. The oil displaced by the piston flows through the restrictor of one-way valve (8) to port (B).

Folding snapping units in

Oil flows from the solenoid-operated 4/3 directional control valve through port (B), lock-up valve (D), one-way restrictor valve (E) and port (B_2) to the hydraulic cylinder for snapping plate adjustment. Its piston extends and adjusts the snapping plate wider apart.

Pressure acts on both ends of spool (S).The spring forces the spool shut.

By operating the solenoid-operated 3/3 directional control valve to “lower”, oil pressure drops once the oil has passed the restrictor of the spool and is past port (C). The spool opens, allowing oil to flow through lock-up valve (F), port (B_1) and on to the hydraulic cylinders. The snapping units are folded together.

The oil displaced by the pistons flows through ports (A_1), (A) and through the solenoid-operated 4/3 directional control valve back to the tank.

Adjusting the snapping plates

The snapping plates can only be adjusted when the snapping units are folded out. Operate the solenoid-operated 4/3 directional control valve to activate the hydraulic cylinder that adjusts the snapping plates.

IMPORTANT! Whenever the snapping units have been folded out, the snapping plates must be adjusted again.

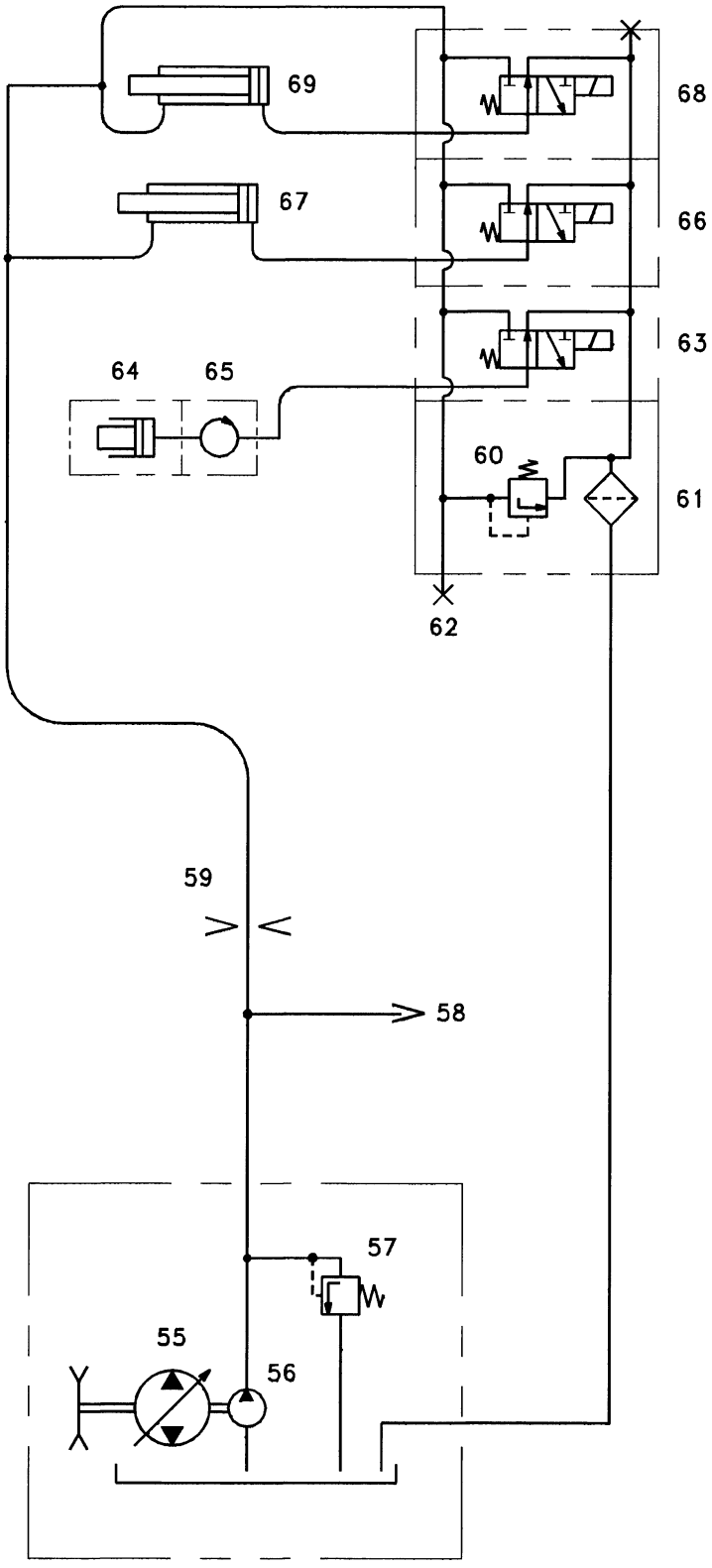
IMPORTANT! If the maize picker head is to be attached to a “Six” range combine, the restrictor in spool (S) must be closed with a screw (too little oil capacity on these models).

If this maize picker head is then used on an “Eight” range combine again, that screw must be removed or the solenoid-operated 3/3 directional control valve must be operated 3/3 directional control valve must be operated too whenever the snapping units are folded in or out.

5

Low-pressure hydraulic system

Circuit diagram for low-pressure hydraulic system

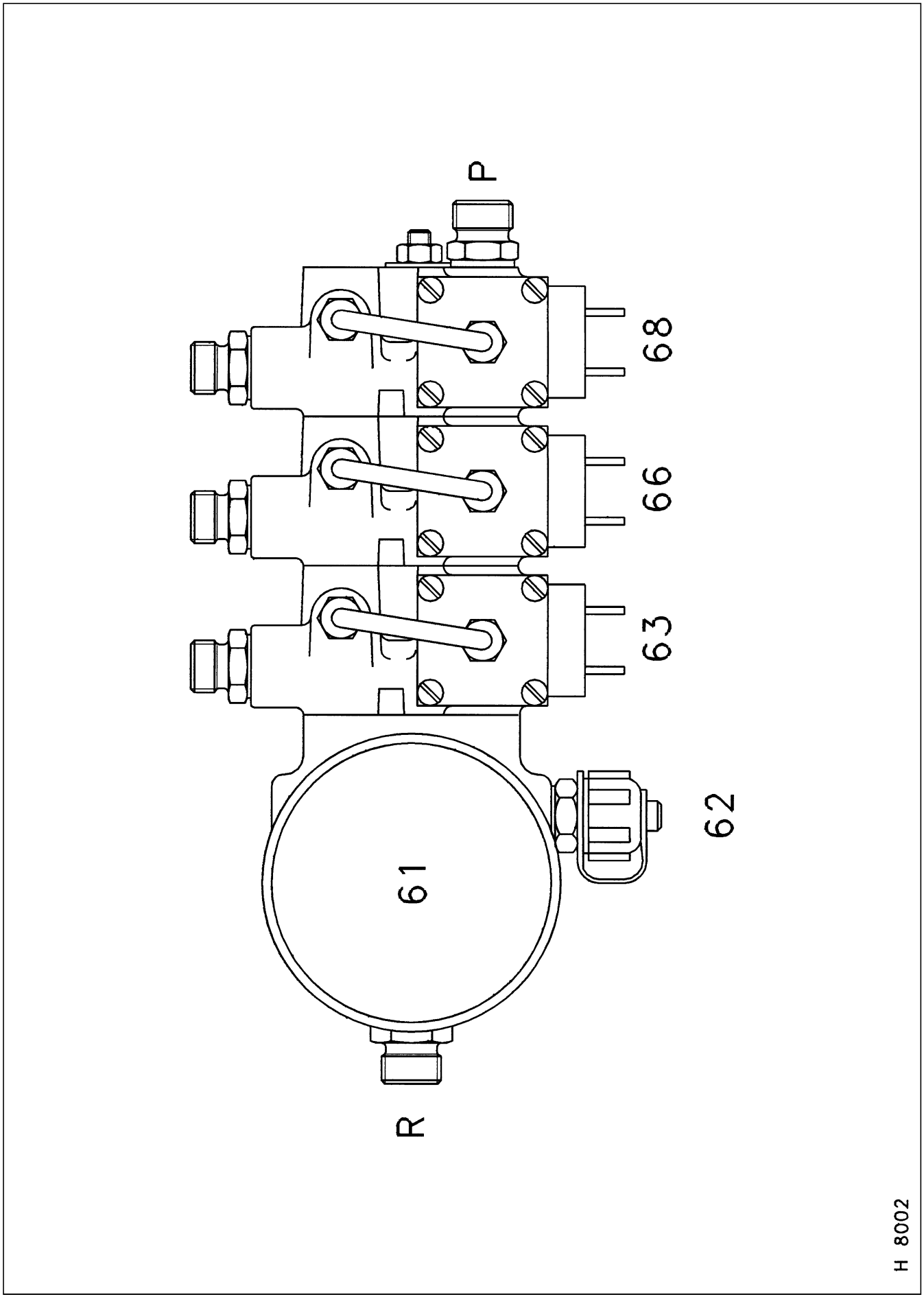


H 1603

Key

55 – Hydrostatic variable-displacement pump
56 – Charge pump
57 – Charging circuit, pressure relief valve
58 – Branch to oil cooler
59 – Restrictor, 2 mm diameter
60 – Pressure relief valve 19^{+4} bar
61 – Filter
62 – Connection for measuring instrument
63 – Solenoid-operated 3/2 directional control valve, cutterbar O/I
64 – Hydraulic cylinder, cutterbar O/I
65 – Rotating grommet
66 – Solenoid-operated 3/2 directional control valve, threshing mechanism O/I
67 – Hydraulic cylinder, threshing mechanism O/I
68 – Solenoid-operated 3/2 directional control valve, grain tank unloading O/I
69 – Hydraulic cylinder, grain tank unloading O/I

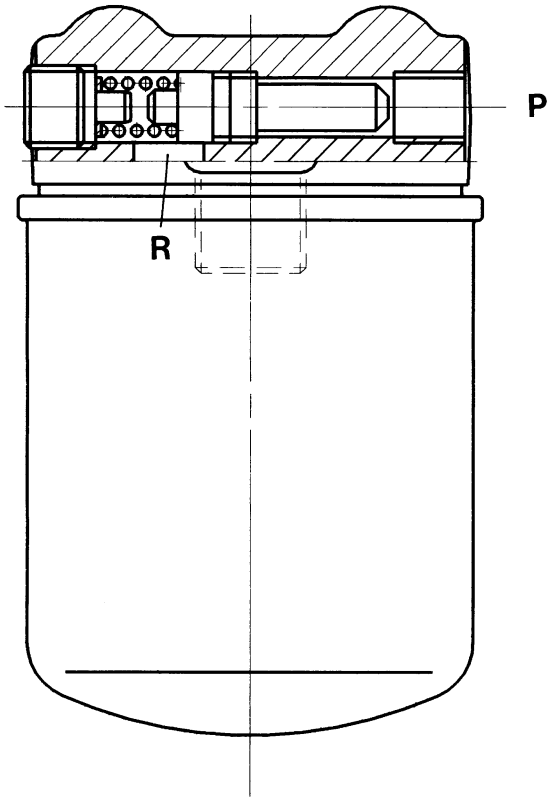
Solenoid-operated valve block



Key

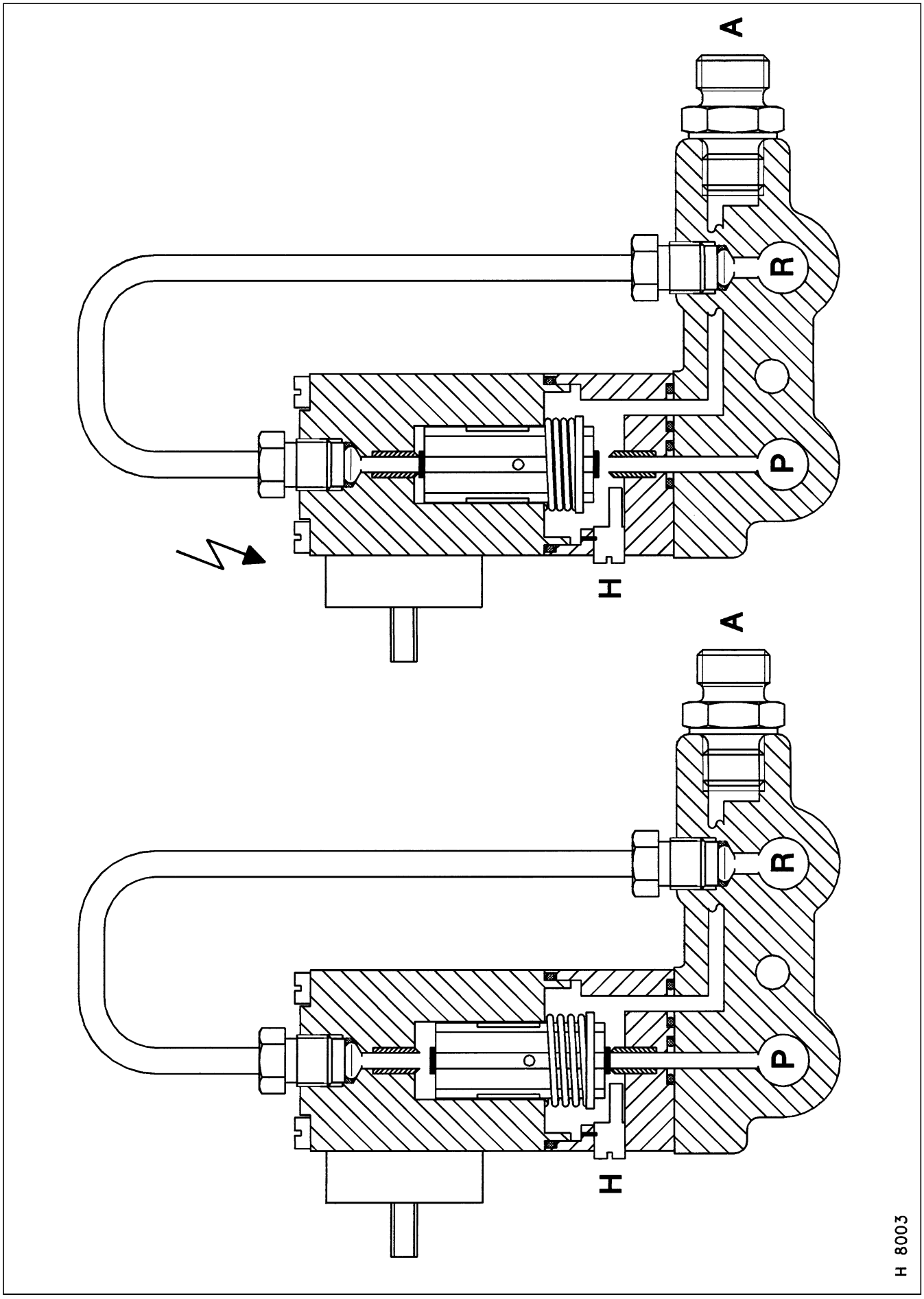
61 – Filter
62 – Connection for measuring instrument
63 – Solenoid-operated 3/2 directional control valve, cutterbar O/I
66 – Solenoid-operated 3/2 directional control valve, threshing mechanism O/I
68 – Solenoid-operated 3/2 directional control valve, grain tank unloading O/I

P – Pump connection
R – Return flow



020001

Solenoid-operated 3/2 directional control valve



Key

P – Pump
R – Return flow
A – Working cylinder
H – Threaded pin

FUNCTION

Solenoid valve de-energized

The solenoid core (E) is pressed down by the spring and closes the bore from P.

Oil is allowed to return from hydraulic cylinder A to return line R.

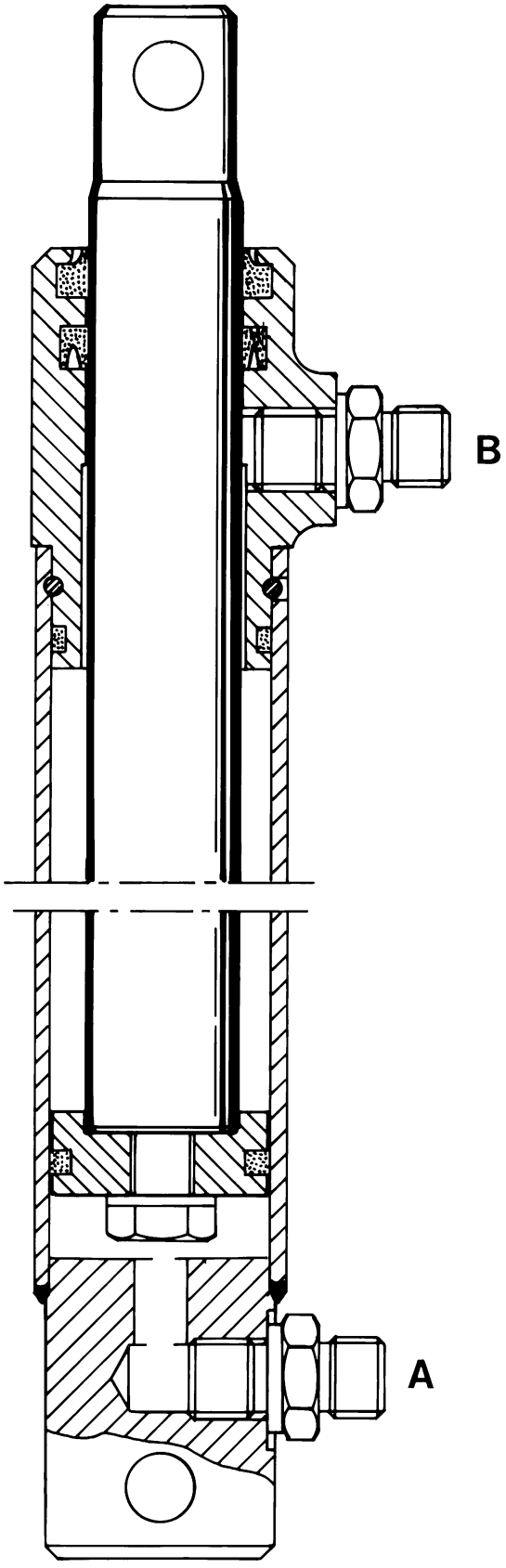
Solenoid valve energized

The solenoid core (E) is pulled up against the spring and closes the bore to R.

Oil is returned to flow from pressure line P to hydraulic cylinder A.

The solenoid core can be operated by hand by turning the eccentric spigot with set screw (H). In this way it can be determined whether the fault is in the electrics or hydraulics.

Double-acting hydraulic cylinder



12179

Key

A – Solenoid valve connection
B – Pump connection

FUNCTION

With the solenoid valve energized, equal pressure is present at A and B. Due to the larger piston surface area at A, the piston extends.

Low pressure hydraulics failure

NOTE! Only check hydraulic oil pressures when the hydraulic oil is at working temperature (approx. 50° C) and the engine is running at fast idle speed.

Total failure of low pressure hydraulic system

- If during repair work the two lines (P and R) are joined, the low pressure hydraulic system is out of operation (no build-up of pressure).
- Connect measuring instrument to port (P) of the pump (pressure relief valve is fitted to the pump). Reading on measuring instrument must be 19^{+4} bar, otherwise check pressure relief valve or pump.
- Connect a flow meter to the pump. Lead the return flow directly into the tank. With diesel engine at fast idle speed, the flow rate at 18 bar should not be less than 7 litres/min. If the rated flow of oil is not delivered, check pump.

Hydraulic pressure below 18 bar

- Engage every service individually.
- If pressure rises as any of the drives is engaged, carry out the following checks:
  - Check the seal of the appropriate cylinder.
  - Check the lower seal of the core of the solenoid-operated 3/2 directional control valve.

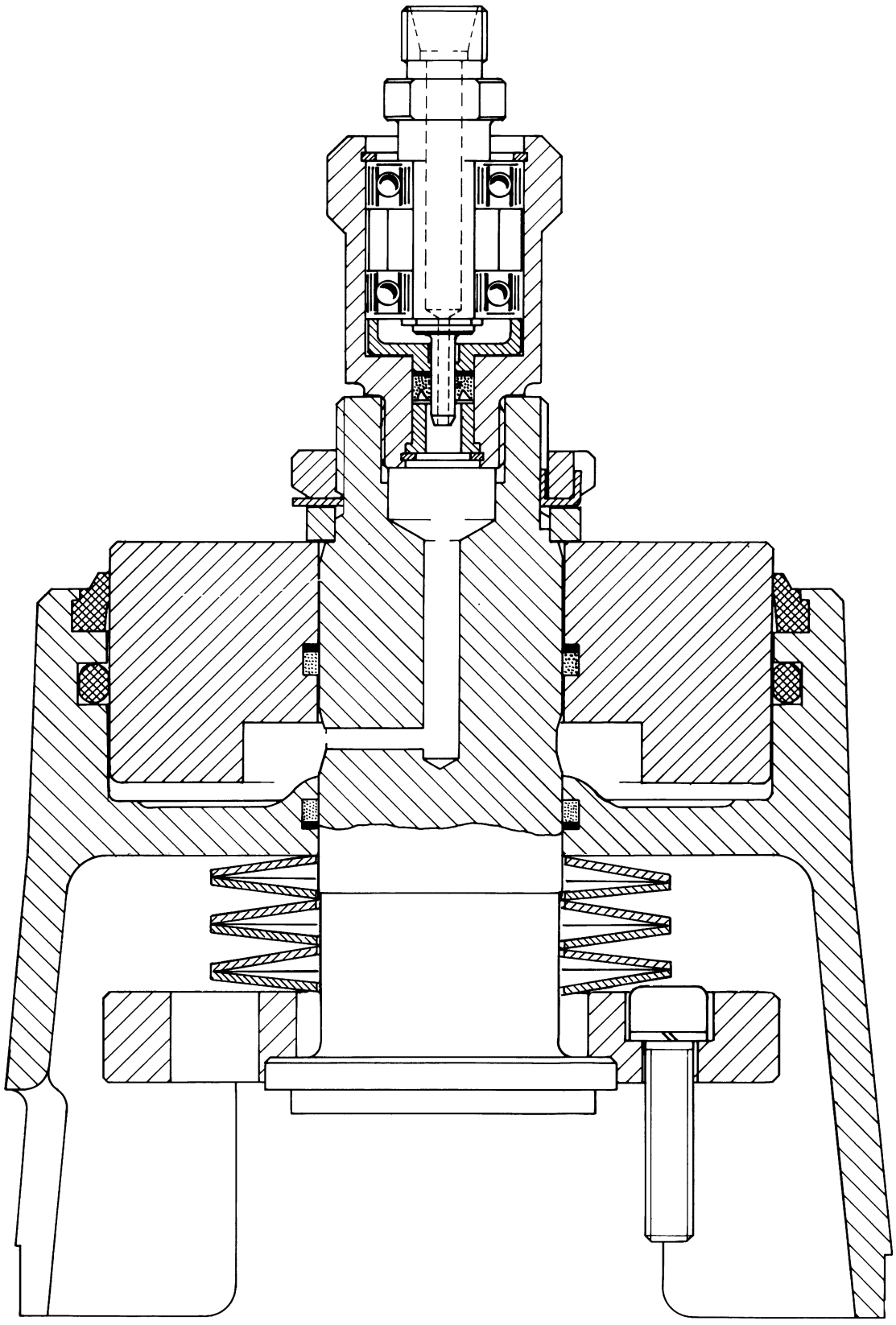
Pressure drops when a service is engaged

- Check the upper seal of the solenoid core.

Grain tank unloading system, threshing mechanism or cutterbar drive cannot be engaged

- Check whether cylinder is mechanically jammed.
- Operate the solenoid manually. If the cylinder moves, see electric faults.
  If the cylinder does not move, check pressure or flow.
- Check solenoid core and spring in the solenoid.

Engagement/disengagement cylinder (cutterbar drive)



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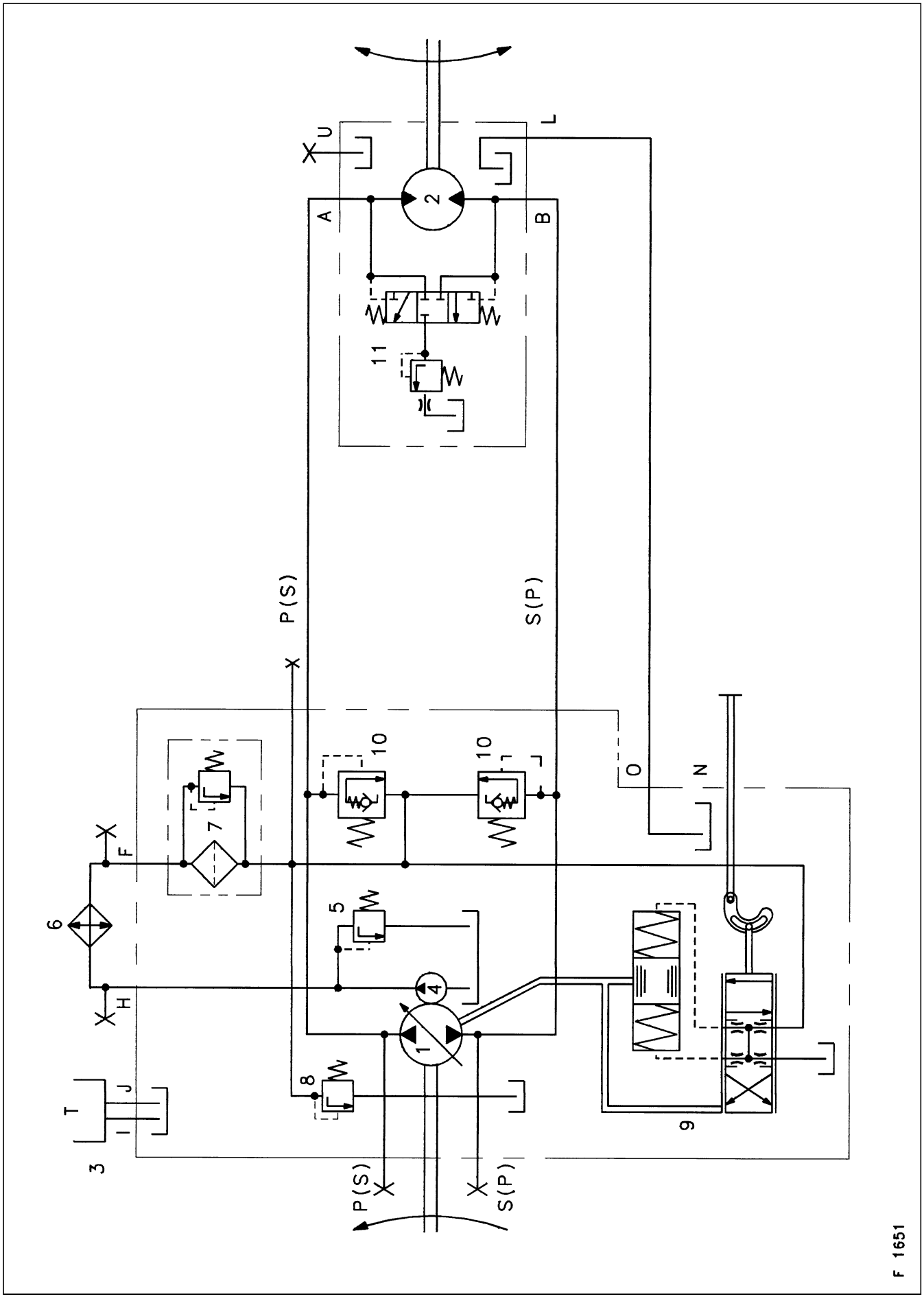
LINDE hydraulic ground drive system

Circuit diagram for LINDE hydraulic ground drive system



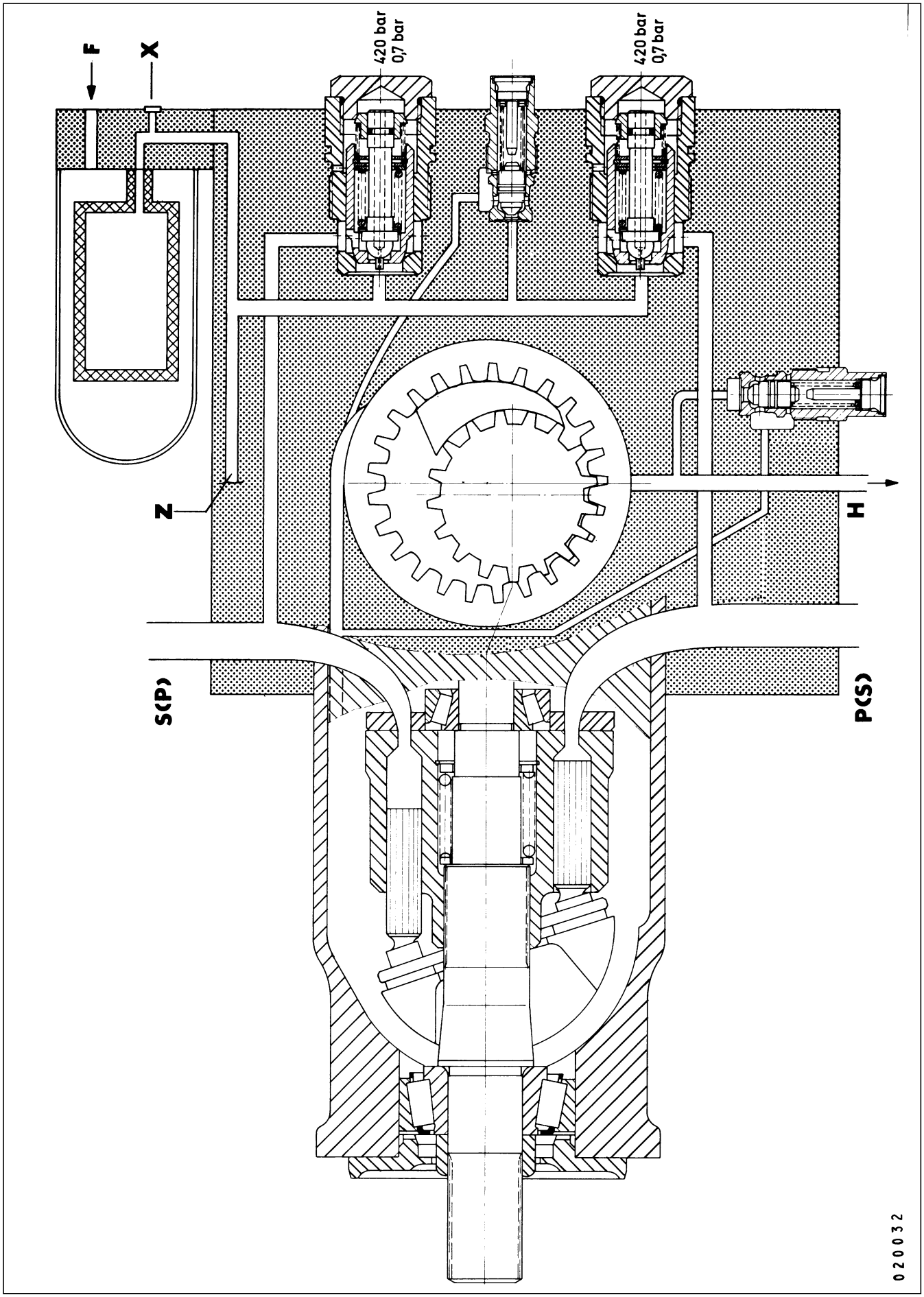
Key

1 – Variable displacement pump
2 – Fixed displacement motor
3 – Reservoir (oil supply in case of leakage)
4 – Charge pump
5 – Cold start valve (protects the oil cooler) $25^{+2,5}$ bar ...
6 – Oil cooler
7 – Disposable filter with bypass valve
8 – Charge pressure valve 18^{+1} bar ...
9 – Hydraulic servo control
10 – Combined charge and high-pressure relief valve
11 – Scavenger (purge) valve (consisting of shuttle valve and relief valve)

Applications and speeds of hydrostatic ground drive systems

Machine type	Hydrostat pump	Hydrostat motor	Max. pump speed (rpm)	Motor speed at 20 km/h (rpm)	Motor speed at 25 km/h (rpm)
MEGA 218/208	LINDE BPV 100 S	LINDE BMF 105	2830	2000	2500
MEGA 204/203	SAUER 90 R 075	SAUER 90 M 075	3120	1850*	2400*
MEGA 202	SAUER 90 R 075	SAUER 90 M 075	2830	2100	2660

* Set value = 5/6 of speed


F
X
420 bar
0,7 bar
420 bar
0,7 bar
Z
H
S(P)
P(S)
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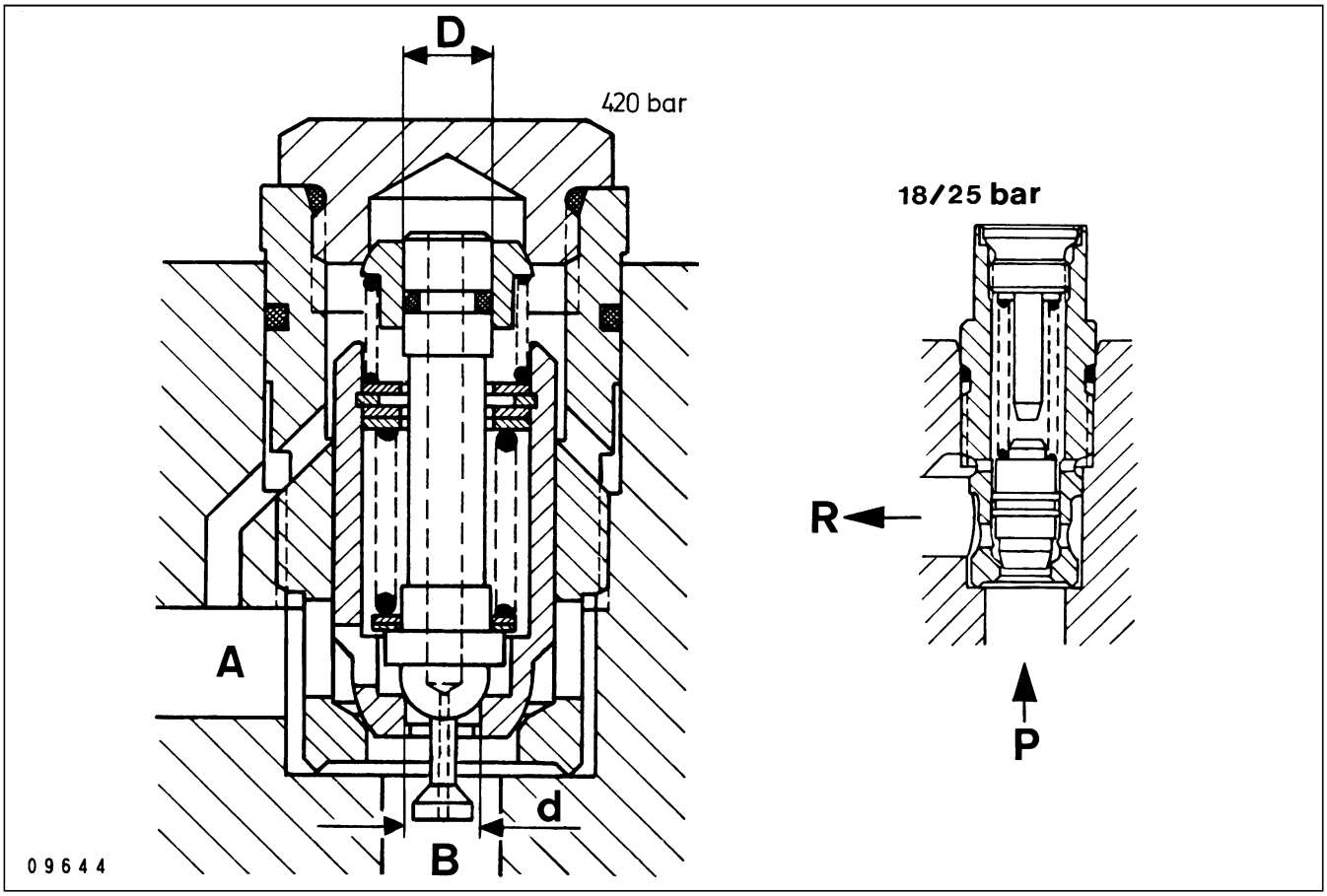
Key

H = to cooler
F = from cooler
X = Scavenge (purge) oil port
Z = to servo control

Linde BPV pressure valves
High pressure relief valve and charge valve unit



Function as charge valve

Flow from B to A:
The large spring-loaded check cone lifts together with its integral components and allows oil to pass through.

Function as high pressure relief valve

Flow from A to B:
High pressure acts on the differential area D-d and lifts the valve body, which has a sliding seal on its top end, off its seat (diameter d) and allows flow from A to B.

Charge pressure and cold start valve

Flow from P to R.

LINDE hydraulic ground drive system (swash plate system)

Contents

1. How the system works

The hydrostatic system transfers the power required for propelling the machine from the diesel engine via main transmission to the change-speed transmission.

The hydrostatic variable displacement pump is driven by a power band belt from the main transmission. Pump speed is constant during operation.

The hydrostatic fixed displacement motor is attached to the change-speed transmission and drives the traction wheels via three speed ranges.

The ground speed lever operates the pump's servo control device by Bowden cable. The servo control device tilts the swash plate and the nine pistons. With the swash plate in neutral position no axial movement of pistons takes place and thus no oil is displaced.

By operating the tilt mechanism, direction of oil flow and thus direction of travel of the machine is controlled. The swash plate can be tilted from 0 to a maximum of 18 degrees. The volume of oil displaced depends on the angle the swash plate is tilted.

The oil flow from the pump is delivered to the hydrostatic fixed motor which converts the fluid force into rotational motion. This closed high pressure circuit is monitored on both sides by high pressure valves which are set at 420 bar.

2. Lines

High pressure hydraulic lines connect the variable displacement pump with the fixed displacement motor (closed high pressure circuit).These lines are high pressure hoses to prevent damage to pump and motor flanges from twisting forces or knocks.

The pump housing is connected to a reservoir by two transparent hoses (the reservoir provides an oil supply in case of leakage, and allows fluid expansion with rising temperatures).

Oil delivered by the charge pump flows from pump port H through the oil cooler and returns to pump port F (cooler circuit).

The scavenging portion of oil and the leakage oil from the motor (connection L) flows back to the pump and enters the pump housing at connection 0 (scavenging circuit).

3. Variable displacement pump

Specifications

see page 6.3

B = series
PV = pump with variable displacement
70/100 = rated displacement in cm^3/rev
S = swash plate

Descripition

Axial piston pump, swash plate design for application to closed circuit.

Drive components

- 9 pistons, one-piece drive shaft.
- Force of pistons transmitted to swash plate by slippers.
- Retainer plate prevents slippers moving away from swash plate.
- Tilting swash plate supported by rigid needle roller bearings attached directly to the casing.
- Preload of cylinder block against port plate by spring pressure.

Besides driving the hydrostatic transmission, the pump drive shaft also rotates the charge pump (internal gear pump). The charge pump sucks oil from inside the pump casing and transfers it through the cooler from where it returns to the pump. The suction port of the charge pump is protected by a screen filter.

The cold start valve (24 bar) protects the cooler. It is activated when flow resistance becomes excessive (i.e. when starting at low abient temperatures).

The entire flow of oil delivered by the charge pump and coming from the cooler passes through a 10 micron disposable filter.

After entering the pump again, the oil flows to the charge valves and to the servo mechanism.

The excess oil, not required to make up for leakage, is discharged through the charge pressure valve (16 bar) into the return side. This way correct charge pressure and full return flow on the return side of the high pressure system is maintained.

Depending on the direction of tilt of the swash plate, high pressure oil flows to the corresponding port (becoming the high pressure port), which at the same time closes the integral charge valve. Replenishing oil will then only be introduced through the charge valve on the low pressure side of the system.

If high pressure exceeds the rated maximum value of the combined charge and high pressure relief valve, oil flows through the connecting passage, passes through the opposite charge valve and enters the lows pressure side of the system.

Combined charge and high pressure relief valve

– Function as charge valve – see drawing

– Function as high pressure relief valve – see drawing

Charge pressure valve and cold start valve

– Factory-set, spring-loaded poppet valves

Charge pump = Internal gear pump (18,3 cm^3/per revolution)

Disposable filter = WD 10 µm (miron) 950/2

Hydraulic servo control

The hydraulic servo control mechanism is built into the pump cover. The swash plate is moved by 2 x 2 servo pistons which prevents misalignment of the swash plate.

The movement of the adjusting lever is limited by an adjustable stop bolt which thus controls maximum speed. The stop bolt is factory-set and lead sealed.

4. Fixed displacement motor

BMF 105/75
B = series
MF = motor with fixed displacement
75 = rated displacement in cm^3/rev

Description:

Inclined axial piston pump, swash plate fixed at a 28° angle. Oil flow from the pump enters the motor and turns the drive shaft in a rotary motion.

Drive components

– 7 pistons, one-piece drive shaft

– Cylinder block is forced by spring pressure against a port plate.

Scavenger (purge) valve

The scavenger (purge) valve is built into the motor's valve plate and consists of: Shuttle valve and relief valve.
Exchange portion of oil: maximum 17 litres per minute

These valves purge oil out of the closed circuit when the system is operated in FORWARD or RESERVE. The charge pump delivers oil to the charge pressure control valves which introduce replenishing oil into the closed circuit and lowers the temperature of the operating oil flow.

The scavenger valve (purge valve) is out of function:

a) when no pressure difference exists within the high pressure circuit (e.g. when the machine is stationary with Diesel engine running),

b) when the carge pressure drops below 5 bars (e.g. because of lack of charge oil).

5. Operating the system

– Operate ground speed control lever only with engine running.

– When starting the machine at low temperatures (thick oil), run the system a few minutes at slow idle until oil has warmed up. Only then should full load be applied to the drive.

– When operating under normal driving conditions, select speed range 2. In severe conditions select speed range 1.

– If the machine slows down on hillsides return the ground speed lever to its neutral position.

6. Service and maintenance

- Oil and filter change – see operator's manual
- Ensure that the pump drive belts are correctly tensioned

7. Filling with oil for the first time after repairs

- Position oil cooler so that it is horizontal.
- Engage third gear.
- Engage hand brake.
- Connect pressure measuring instrument (0 – 600 bar) to ports M1 and M2.
- Fill tank with oil.
- Start diesel engine and switch off again immediately (slow idle speed).
- Check oil level and top up with oil if necessary.
- Repeat procedure until a pressure increase of at least 15 bar is noted on the pressure measuring instrument and the oil level in the tank remains constant.
- Let diesel engine run at low idle speed.
- When pressure increase is noted, load hydraulic system in both directions:

a) Set ground travel lever to forward travel until a high pressure of 50 – 150 bar is reached. Hold the specified pressure for approx. 1 minute.

b) Set ground travel lever to reverse travel until a high pressure of 50 – 150 bar is reached. Hold the specified pressure for approx. 1 minute.

- Check oil level and top up with oil if necessary.
- Shift gear shift lever to neutral.
- Run diesel engine at low idle speed.
- Run dhydrostatic system forwards for approx. 2 minutes and then reverse for approx. 2 minutes.
- Check oil level again.

Note: If the hydraulic motor or hydraulic pump has been replaced, the scavenging pressure must be checked and corrected if necessary. See section Testing high pressures and charge pressures.

Machines with CLAAS 4-Trac system

- 4-Trac system remains disengaged until the above steps have been completed.
- Jack up steering axle on both sides.
- Engage third gear.
- Engage hand brake.
- Run diesel engine at low idle speed.
- Switch on 4-Trac system.
- Run hydrostatic system forwards for approx. 1 minute and then reverse for approx. 1 minute.
- Both driven rear wheels must rotate. The high pressure must be equal to max. 150 bar during this procedure.
- Check oil level and correct if necessary.

Flushing the system

The lines (high pressure circuit) must be flulshed when foreign objects have entered the main circuit. When replacing one component and another is left on the machine, the remaining component must be flushed too.

NOTE! When pistons inside the motor are broken it is essential to also inspect the gears of the change-speed transmission.

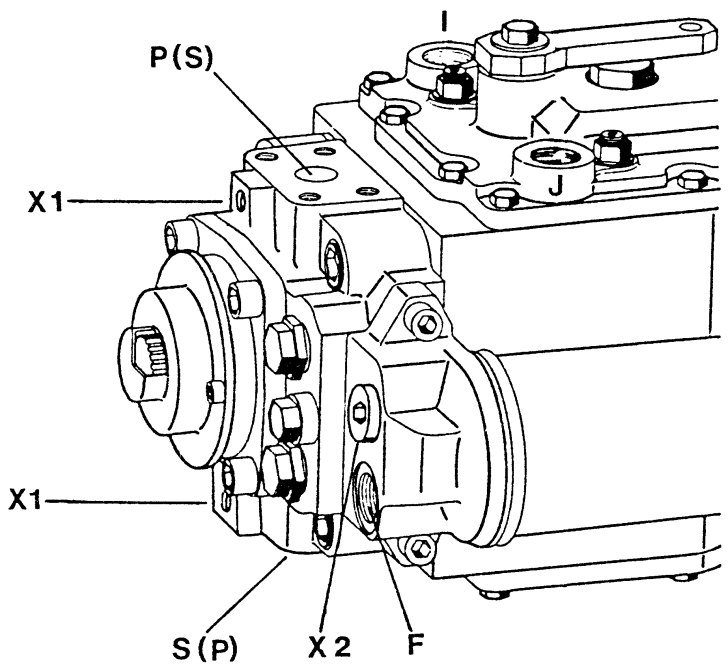
8. Checking high pressure and charge pressure

- Connect low pressure gauge 0 – 60 bar to existing T-union (connection F, Circuit diagram).
- Install high pressure gauge 0 – 600 bar to connections P or S on pump.
- Start the DIesel engine and apply a little load to tilt the system until the operating temperature of approx. 50 degrees C has been reached.
- With transmission in 3rd gear and foot brakes hard on, operate the system to the desired direction of travel. Note readings on both pressure gauges.

  a) Specified charge pressure is 18^{+1} bar, measured at the connection F with Diesel engine running full throttle and ground travel lever in neutral.

  b) Specified high pressure limit is 420 to 450 bar (absolute), measured at ports P and S (whichever is appropriate) with system for forward and reverse operation respectively, 3rd gear engaged, brakes hard on and Diesel engine running at full throttle.

NOTE! Fluid must only be momentarily be allowed to pass over the relif valves (otherwise the system will overheat).



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9. Adjustment of servo control mechanism

- With pump in neutral position, detach Bowden cable at servo control.
- Jack up and securely support the front, l.h. side of the machine, engage low gear and start Diesel engine. Run engine at fast idle. If a full stop of the l.h. traction wheel is not obtained, first carry out the tests described in the following two steps.
- Checking mechanical neutral:

  a) Remove the cover which has the adjusting mechanism built in,

  b) use depth gauge and check that the top edge of the swash plate is parallel with the edge of the housing. Adjust the eccentric bolts on the lower cover as necessary. After adjustment has been carried out, the mark on the outside end of the eccentric bolts must always point to the centre of the pump, i.e. towards the Linde logo.
- Checking the hydraulic neutral: Jack up and securely support the machine so that drive wheels clear the ground. Run the machine and move the adjusting lever in both directions to find the neutral dwell position. Adjust the large eccentric in the centre of the upper cover as necessary.
- Attach the Bowden cable and then adjust the cable so that the hand lever neutral coincides with the servo neutral.
- Adjust outer cable so that the hand lever has as little play as possible.
- With transmission gear shift lever in neutral, Diesel engine at fast idle and hydrostatic drive set to full forward speed.

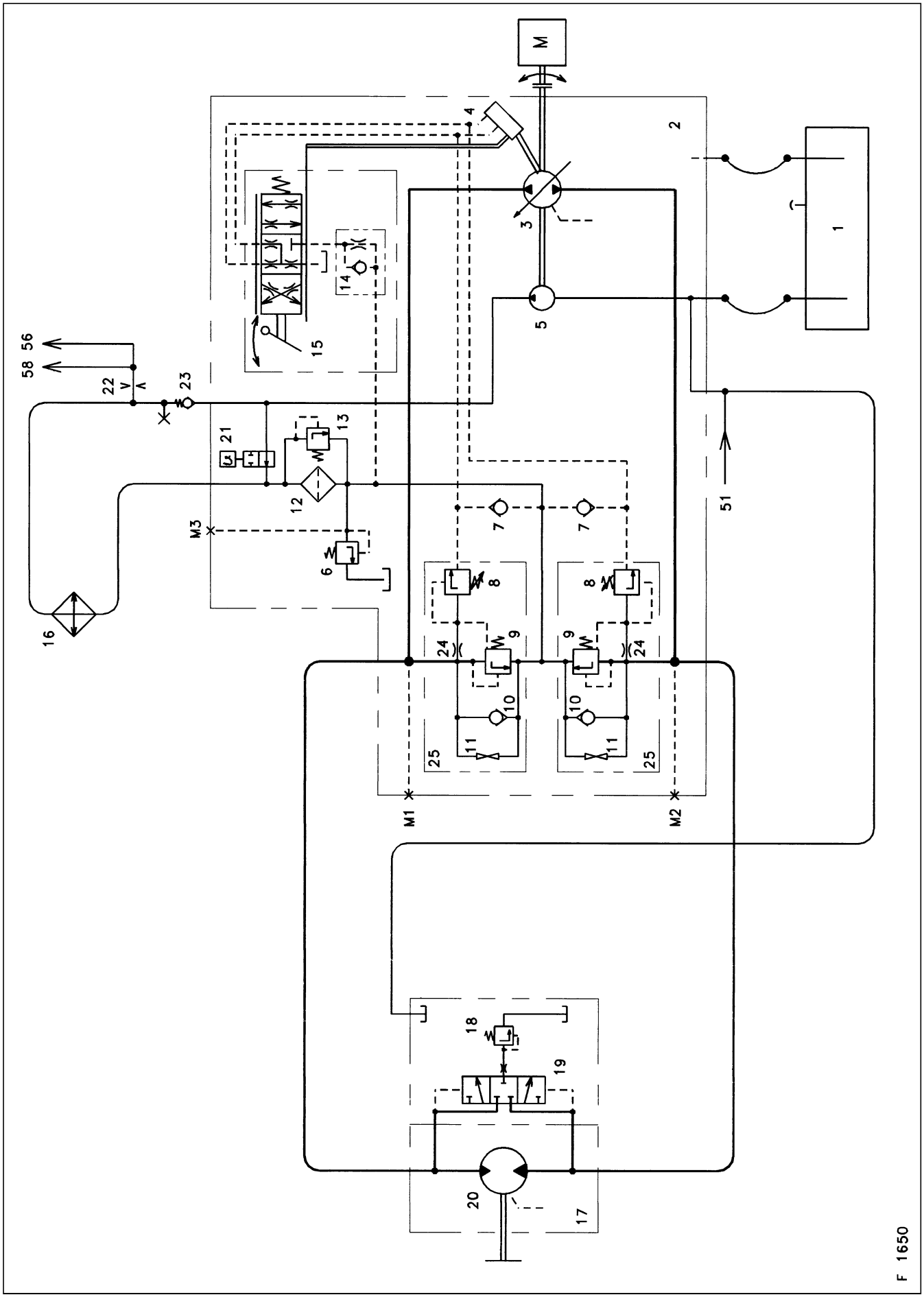
  The following readings must be shown on the transmission tachometer: see page 6.3.

  If necessary, reposition and re-adjust the Bowden cable at the hand lever, then readjust the lead sealed stop bolt for the adjusting lever.

7

SAUER hydraulic ground drive system

Circuit diagram for SAUER series 90 hydraulic ground drive system



Key

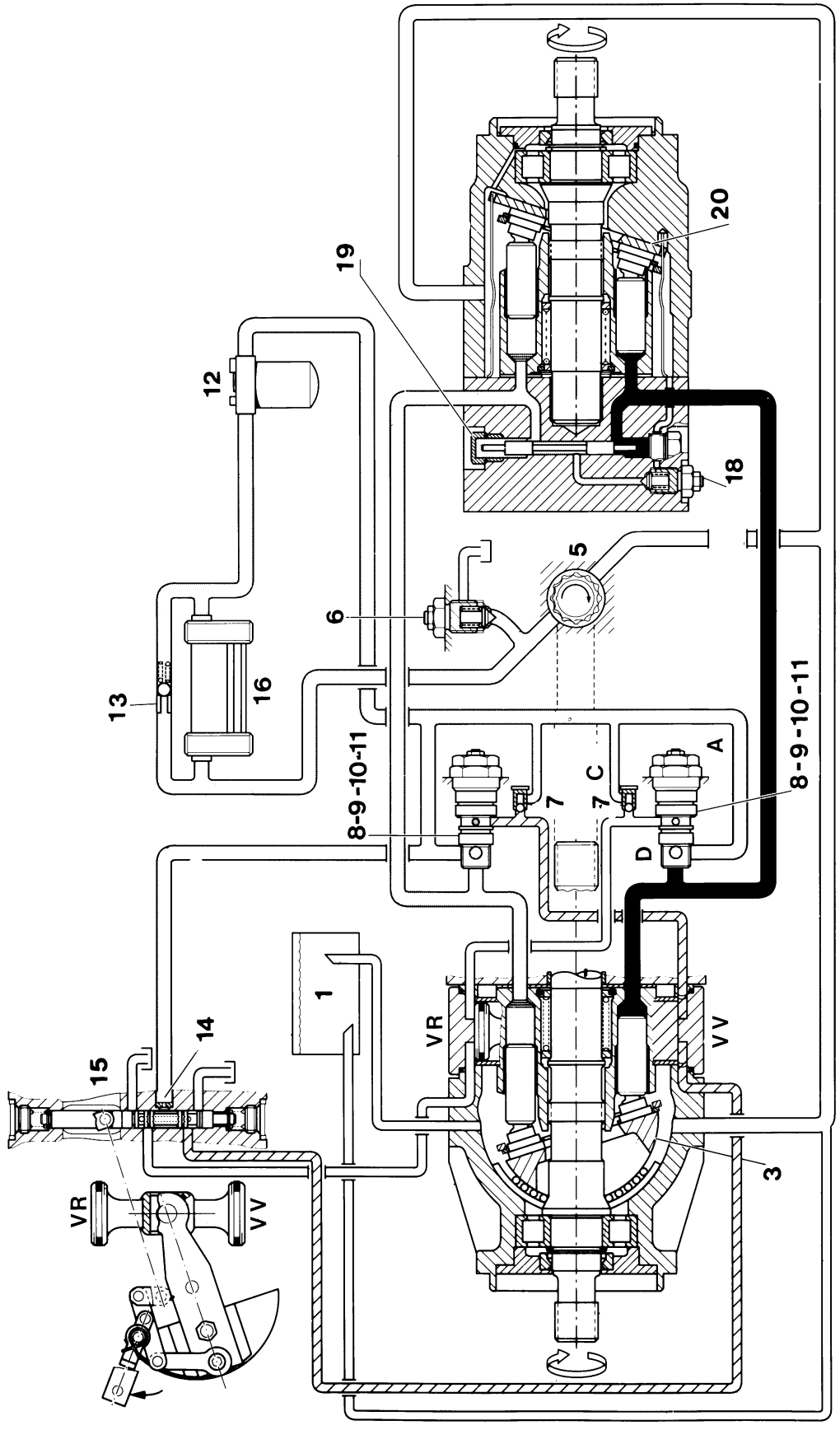
1 – Oil reservoir
2 – Pump housing
3 – Variable displacement pump
4 – Servo cylinder
5 – Charge pump
6 – Charge circuit pressure relief valve
7 – Control pressure relief valve
8 – Pressure override valve (POR)
9 – High pressure relief valve
10 – Charge valve
11 – Short-circuit valve
12 – Filter
13 – Bypass valve (3 bar) with contamination indicator
14 – One way restrictor valve
15 – Servo control valve
16 – Cooler
17 – Motor housing
18 – Charge pressure relief valve
19 – Shuttle valve
20 – Fixed displacement motor
21 – Thermostat
22 – Restrictor, 2 mm dia.
23 – One-way valve
24 – Restrictor
25 – Multi-function valve assy.
51 – Return flow, low-pressure hydraulics
56 – Feed flow, low-pressure hydraulics
58 – Feed flow, low-pressure hydraulics

Applications and speeds of hydrostatic ground drive systems

Machine type	Hydrostat pump	Hydrostat motor	Max. pump speed (rpm)	Motor speed at 20 km/h (rpm)	Motor speed at 25 km/h (rpm)
MEGA 218/208	LINDE BPV 100 S	LINDE BMF 105	2830	2000	2500
MEGA 204/203	SAUER 90 R 075	SAUER 90 M 075	3120	1850*	2400*
MEGA 202	SAUER 90 R 075	SAUER 90 M 075	2830	2100	2660

* Set value = 5/6 of speed

Function schematic of SAUER series 90 hydrostatic ground drive system



Key

1 – Oil reservoir
3 – Variable displacement pump
5 – Charge pump
6 – Charge circuit pressure relief valve
7 – Control pressure relief valve
8 – Pressure override valve (POR)
9 – High pressure relief valve
10 – Charge valve
11 – Short-circuit valve
12 – Filter
13 – Bypass valve (3 bar) with contamination indicator
14 – One way restrictor valve
15 – Servo control valve
16 – Cooler
17 – Motor housing
18 – Charge pressure relief valve
19 – Shuttle valve
20 – Fixed displacement motor

A – Multi-function valve, forwards
C – Control pressure relief valve
D – Drilling
VR – Variable piston (rearward drive, when under pressure)
W – Variable piston (forward drive, when under pressure)

Note: The function schematic merely illustrates the functional principle of the hydrostatic system. The cooling circuit does not correspond to that actually installed in the machine. Refer to the circuit diagram on page 7.2.

Contents

1. Specifications

See page 7.3

2. Piping System

The variable displacement pump is linked to the fixed motor by high pressure lines (closed-centre high pressure circuit). The lines consist of high-pressure hoses to avoid transmitting torsion and jolts to the pump and motor flanges.

The oil from the motor housing (purge and leakage oil) is returned via an oil line to the pump housing.

The charge pump draws in the majority of the oil via a line from the pump housing and a smaller amount via a circulation line from the tank. The oil delivered by the charge pump is returned to the pump housing via the oil cooler and filter.

The oil cooler is protected by a bypass valve (3 bar pressure difference).

An oil line runs up from the reservoir to the pump housing.

3. Variable Displacement Pump

Description

Axial piston pump of swashplate design with variable piston displacement for closed circuit hydrostatic ground drive system.

Driving components

- 9 pistons
- piston forces are transmitted to the swashplate by slippers
- the swashplate is mounted in rolling bearings in the pump housing
- precompression of the cylinder block to the vlave plate by spring pressure

Depending on the direction in which the swashplate tilts, oil is delivered to the corresponding side and builds up high pressure. The closed circuit is protected on both sides by pressure relief valves (multi-function valves on the pump).

The charge pump is also driven by the drive shaft of the variable displacement pump.

The charge pump has the function of preloading the working lines, replenishing the leakage oil from the pump and motor as well as the purged oil and to supply oil to the servo valve.

The charge pump draws in most of its oil from the pump housing and a small part from the reservoir via a circulation line and delivers it via the cooler, filter and charge valves to the servo valve.

The circuit is protected by the charge circuit pressure relief valve, which also discharges any excess oil into the pump housing.

When the oil is cold, the oil cooler is protected by a bypass valve (with a 3 bar pressure difference).

The oil flow in to the closed circuit is provided by the corresponding charge check valve (integrated into the multi-function valve) on the low pressure side.

Servo valve

The swashplate is moved by one of the two pistons. Precompressed spring packs hold the swashplate in the neutral position (no axial stroke – no oil delivery).

When oil pressure is applied to one of the pistons, the other piston retracts and the swashplate moves out of the neutral position.

An adjustable set screw limits the travel of the control handle and thus the final speed.

After adjustment, the set screw is lead-sealed in the factory.

Apart from this, every pump is limited by the manufacturer to a maximum swashplate angle of 17°.

4. Multi-function valve and zero-stroke regulator (Pressure override)

Overpressure Protection

The pump is equiped with a sequencing valve which activates in sequence a zero-stroke pressure regulator and a pressure relief valve (see figure). If the preset pressure is reached, the zero-stroke pressure regulator reduces the delivery of the pump very quickly to limit the system pressure.

The pressure relief valve serves to protect the system in the event of exceptionally rapid increases in pressure. In this case, the zero-stroke pressure regulator acts as a pilot control unit for the valve piston of the pressure relief valve.

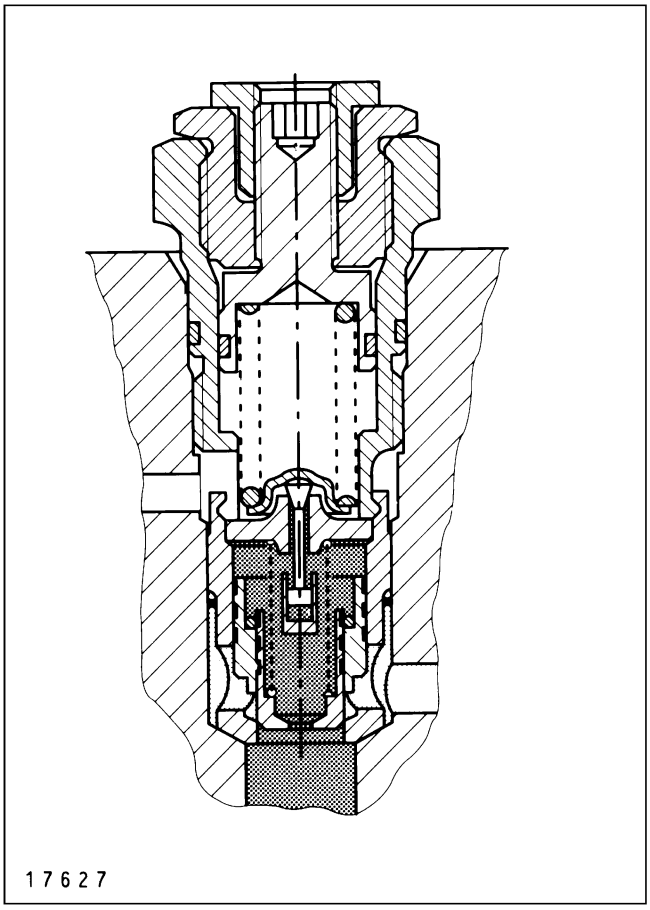
The pressure relief valve, whose opening pressure is higher than that of the zero-stroke pressure regulator, is activated when the zero-stroke pressure regulator cannot reduce the pump delivery quickly enough in the event of a very rapid rise in pressure. Zero-stroke pressure regulator and high pressure relief valve are installed together in the multi-function valve in the pump housing.

The zero-stroke function prevents overheating of the system, whilst the high pressure relif valve relieves pressure peaks.

Function of the Zero-Stroke Regulator
(see diagram no. 17629)

When the setting pressure of the pressure controller is exceeded, the hydraulic oil flows via pressure valve (A) and through an orifice in the regulating piston into channel (D) and allows the pressure on the servo side to increase where low pressure still exists.

The low pressure relief valve in channel (C) limits this pressure to a reasonable level. The zero-stroke regulator overrides the signal for the delivery volume adjustment and balances the pressure at both servo cylinders. The swashplate return moments change the stroke volume until the system pressure has returned to the setting pressure.



To circuit diagram from Serial No. ...
(Drawing No. Z 1506.0)

A thermostatically controlled valve (21) ist installed on these machines. The valve is open below 60° C. The oil from the charge pump flows via the thermostatically controlled valve to the filter. The operating temperature is reached more quickly.

The valve is closed above 60° C. The oil from the charge pump flows via the cooler to the filter. The oil is cooled.

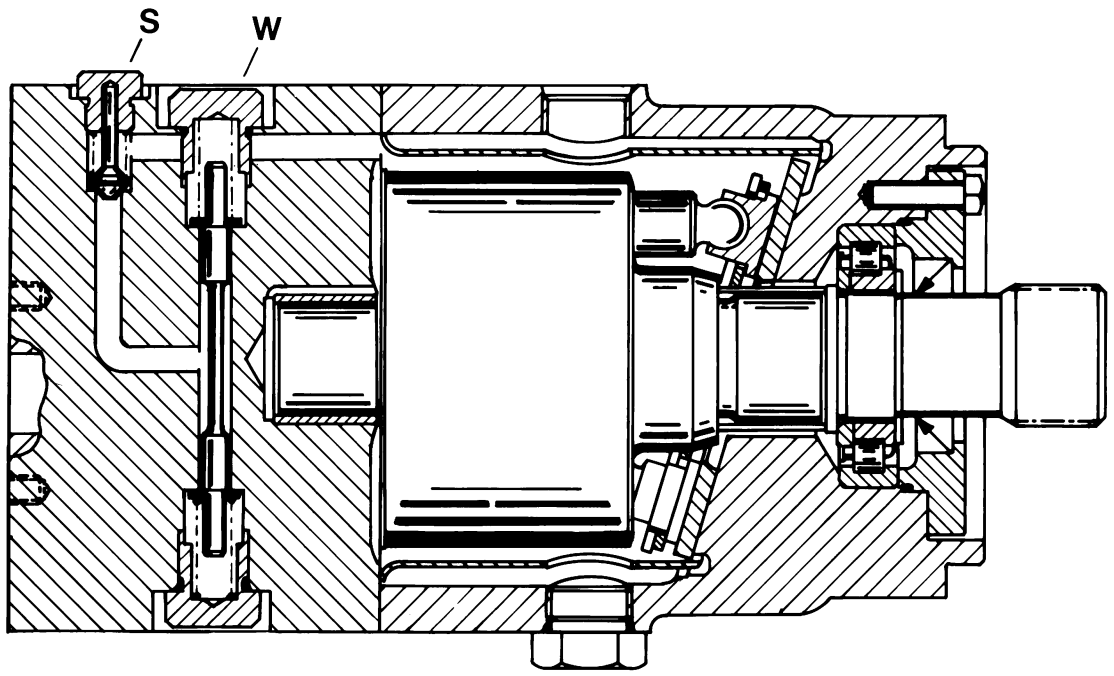
Non-return valve (23) functions internally only to charge the system.

5. Fixed Displacement Motor

Axial piston motor of swashplate design

Driving components

- 9 pistons
- Swashplate with 17° swashplate angle
- Precompression of the cylinder block against the valve plate by spring force
- Shuttle valve and purge pressure relief valve are installed in the motor housing. The purging volume during both forward and reverse travel is approx. 18 – 23 l/min.



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6. Operating the Transmission

- Move the ground speed control lever only with the diesel engine running.
- When starting the machine at low temperatures (viscous oil), allow the unit to warm up by idling for a few minutes before placing the drive under full load.
- When operating under normal driving conditions, select speed range 2. Under difficult driving conditions, select speed range 1.

7. Service and maintenance

- Oil and filter change – see operator's manual
- Ensure that the pump drive belts are correctly tensioned

8. Filling with oil for the first time after repairs

- Position oil cooler so that it is horizontal.
- Engage third gear.
- Engage hand brake.
- Connect pressure measuring instrument (0 – 600 bar) to ports M1 and M2.
- Fill tank with oil.
- Start diesel engine and switch off again immediately (slow idle speed).
- Check oil level and top up with oil if necessary.
- Repeat procedure until a pressure increase of at least 15 bar is noted on the pressure measuring instrument and the oil level in the tank remains constant.
- Let diesel engine run at low idle speed.
- When pressure increase is noted, load hydraulic system in both directions:

  a) Set ground travel lever to forward travel until a high pressure of 50 – 150 bar is reached. Hold the specified pressure for approx. 1 minute.

  b) Set ground travel lever to reverse travel until a high pressure of 50 – 150 bar is reached. Hold the specified pressure for approx. 1 minute.
- Check oil level and top up with oil if necessary.
- Shift gear shift lever to neutral.
- Run diesel engine at low idle speed.
- Run hydrostatic system forwards for approx. 2 minutes and then reverse for approx. 2 minutes.
- Check oil level again.

Note: If the hydraulic motor or hydraulic pump has been replaced, the scavenging pressure must be checked and corrected if necessary. See section Testing high pressures and charge pressures.

Machines with CLAAS 4-Trac system

- 4-Trac system remains disengaged until the above steps have been completed.
- Jack up steering axle on both sides.
- Engage third gear.
- Engage hand brake.
- Run diesel engine at low idle speed.
- Switch on 4-Trac system.
- Run hydrostatic system forwards for approx. 1 minute and then reverse for approx. 1 minute.
- Both driven rear wheels must rotate. The high pressure must be equal to max. 150 bar during this procedure.
- Check oil level and correct if necessary.

Flushing the system

The pipe lines (high pressure circuit) must always be flushed if foreign objects have entered the main circuit. In addition, the components remaining on the machine must also be flushed when one component is replaced.

NOTE! When pistons in the motor are broken, it is essential to also inspect the gears of the change-speed transmission.

9. Checking the high pressures and charge pressures

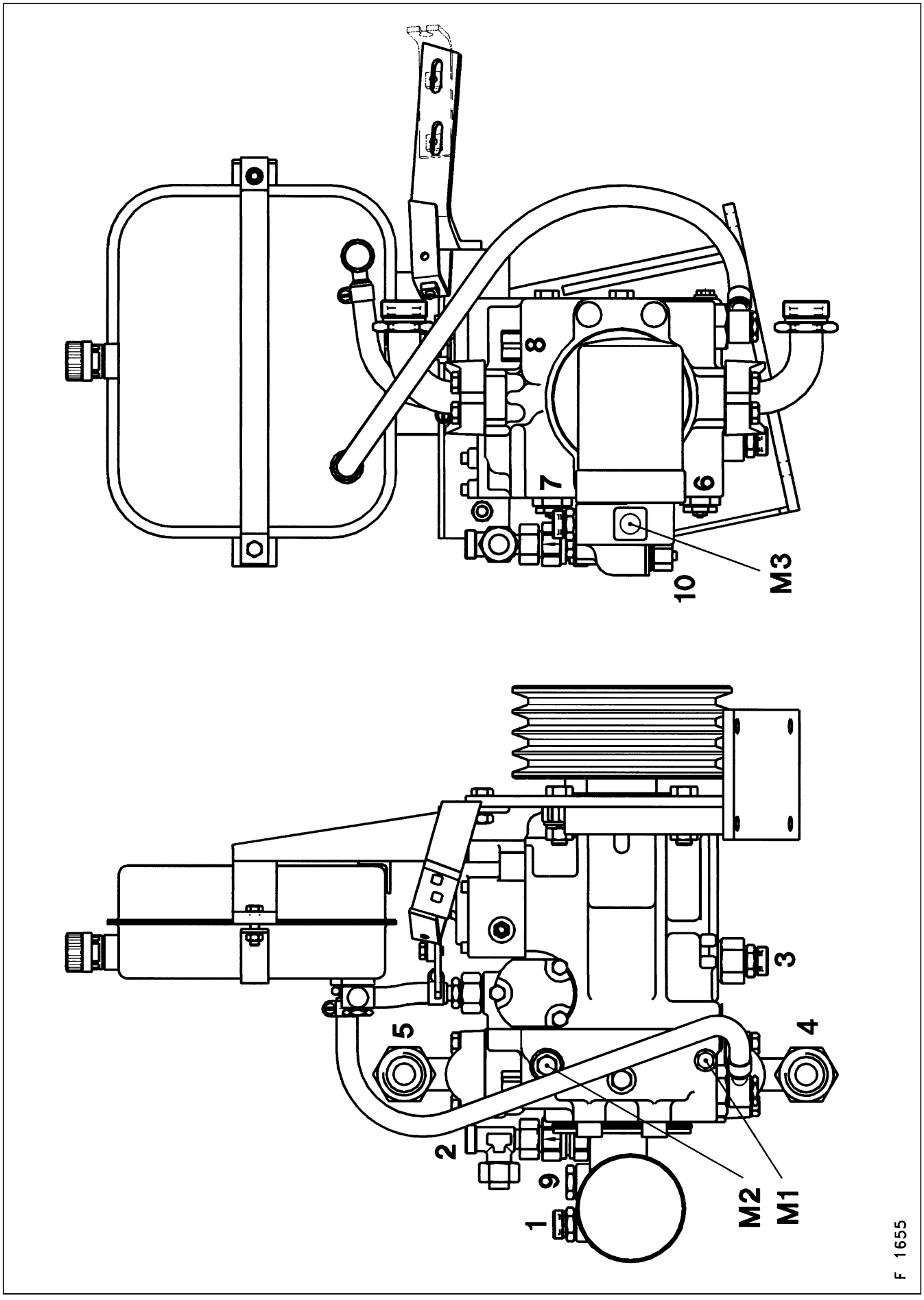
- Connect low pressure gauge 0 – 60 bar to the gauge port provided (M3 on the pump housing)
- Connect the high pressure gauge 0 – 600 bar to the gauge port M1 or M2.
- Start the diesel engine; if necessary, place a light load on the system until the operating temperature (50 – 55° C in the reservoir) is reached.

  a) Specified charge pressure = 21^{+1} bar measured at M3 with diesel engine running at full throttle and ground travel lever in neutral.

  b) Specified purge pressure = 2.5 – 3 bar lower than a). Measured at M3 with diesel engine running at full throttle, ground travel lever at full range and change-speed transmission in neutral.

  c) Specified maximum pressure (zero-stroke pressure) = 420 – 450 bar (absolute) measured at M1 and M2 during forward and reverse operation respectively, with 3rd gear engaged, brakes hard on and with the diesel engine running at full throttle.

Gauge port arrangement



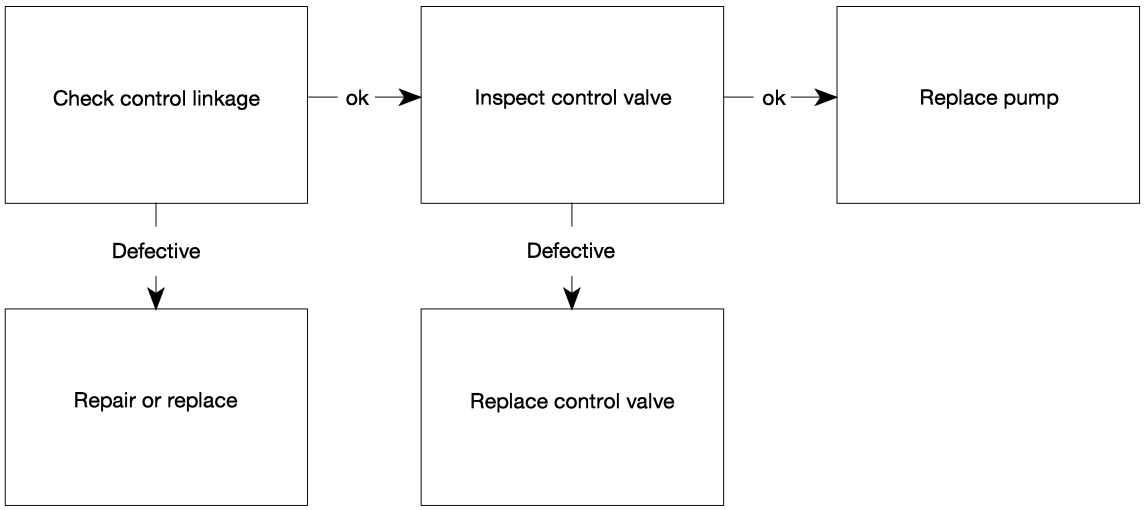
9. Gauge ports

M1 (Measuring instrument = 0 – 600 bar)	High pressure M10 x 1 (CLAAS part No.: 667 137.0)
M2 (Measuring instrument = 0 – 600 bar)	High pressure 9/16 – 18 UNF 2 B, O-ring seal (CLAAS part No.: 667 186.0)
M3 (Measuring instrument = 0 – 60 bar)	Charge pressure 9/16 – 18 UNF 2 B, O-ring seal

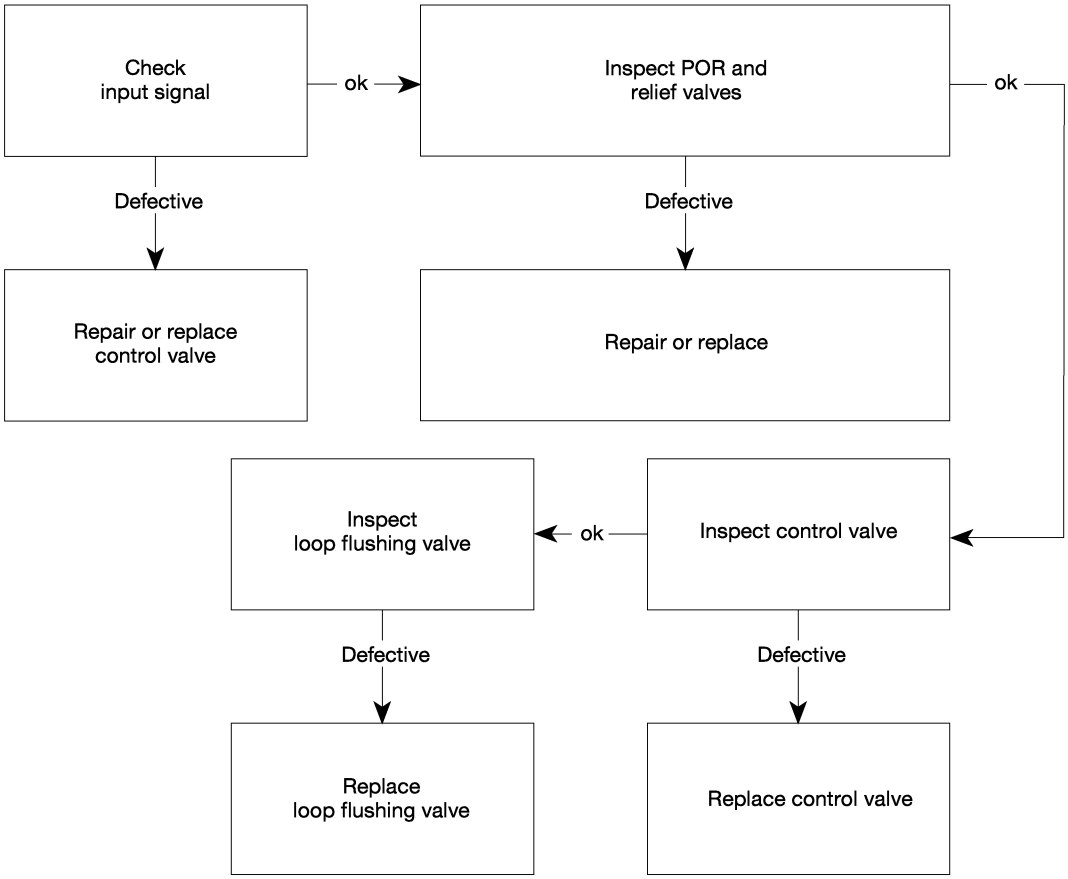
1 – Cooler, return flow M22x1,5 – 15 deep
2 – Cooler, inflow M22x1,5 – 15 deep
3 – Leakage oil or purge oil connection from engine
4 – High pressure line, forwards
5 – High pressure line, rearwards
6 – Feed and high pressure relief valve, forwards, 450 bar
7 – Feed and high pressure relief valve, rearwards, 450 bar
8 – Charge pressure relief valve, 21^{+1} bar
9 – Thermostat valve (cooler protection)
10 – Filter contamination indicator

Filter contamination indicator	The filter bypass valve opens and a red indicator appears in the sightglass when the filter is clogged.
Adjustment of the charge circuit pressure relief valve	Loosen locknut. Turn adjusting screw clockwise to increase the charge pressure and counterclockwise to decrease the charge pressure (one turn corresponds to approx. 3,5 bar).
Adjustment of the system pressure (high pressure)	Turn the pressure adjusting screw clockwise to increase the pressure setting and counterclockwise to decrease the pressure setting. Each full turn of the screw changes the pressure setting by approx. 93 bar.

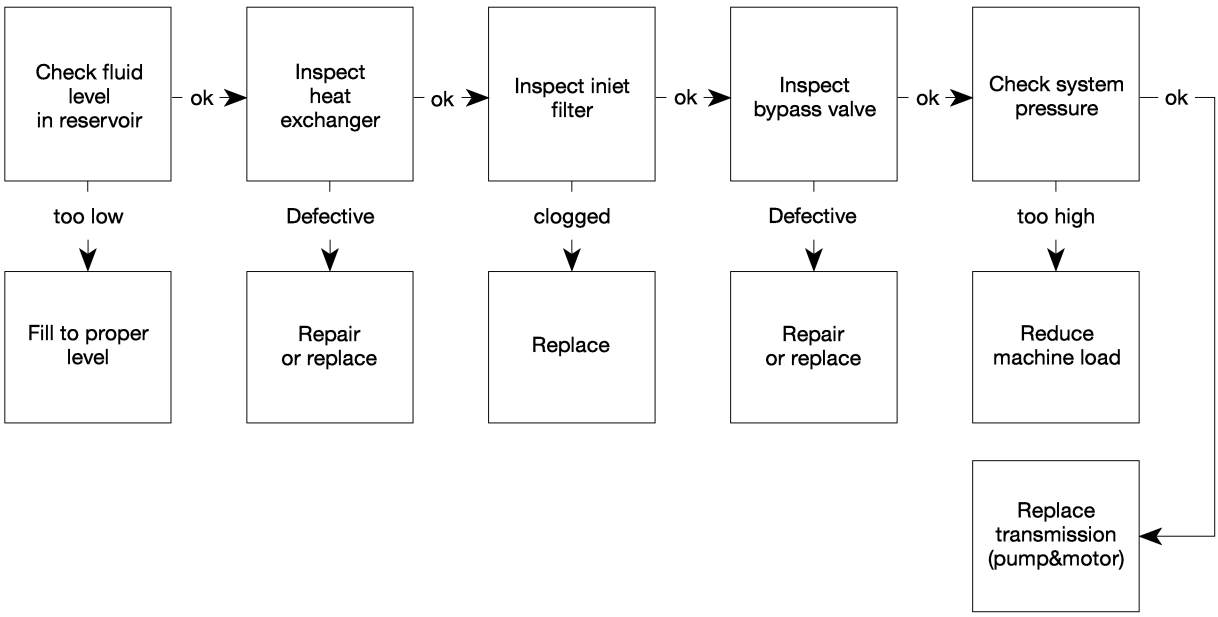
Neutral Difficult Or Impossible To Find



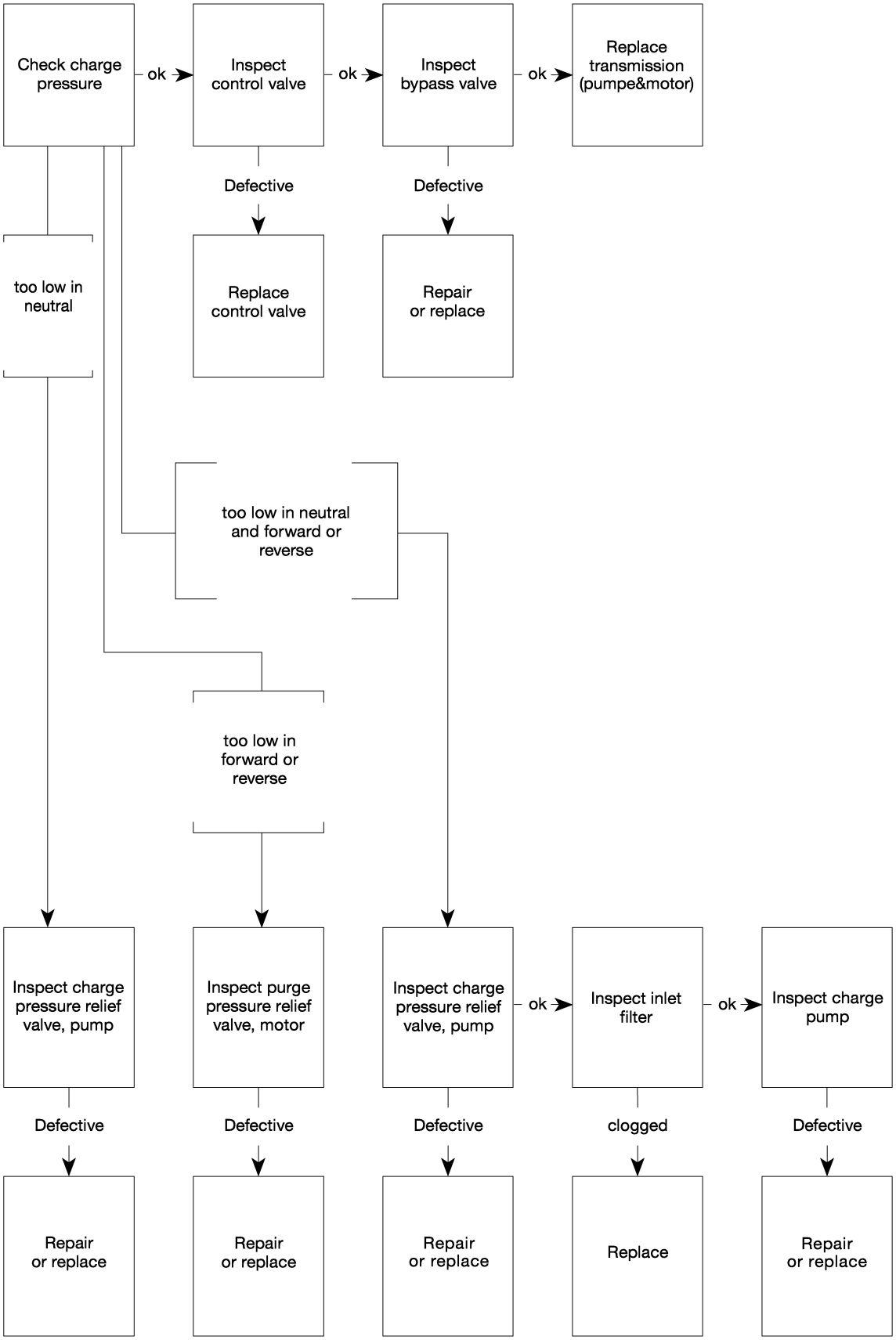
Transmission Operates In One Direction Only



System Operating Hot



System Response Sluggish

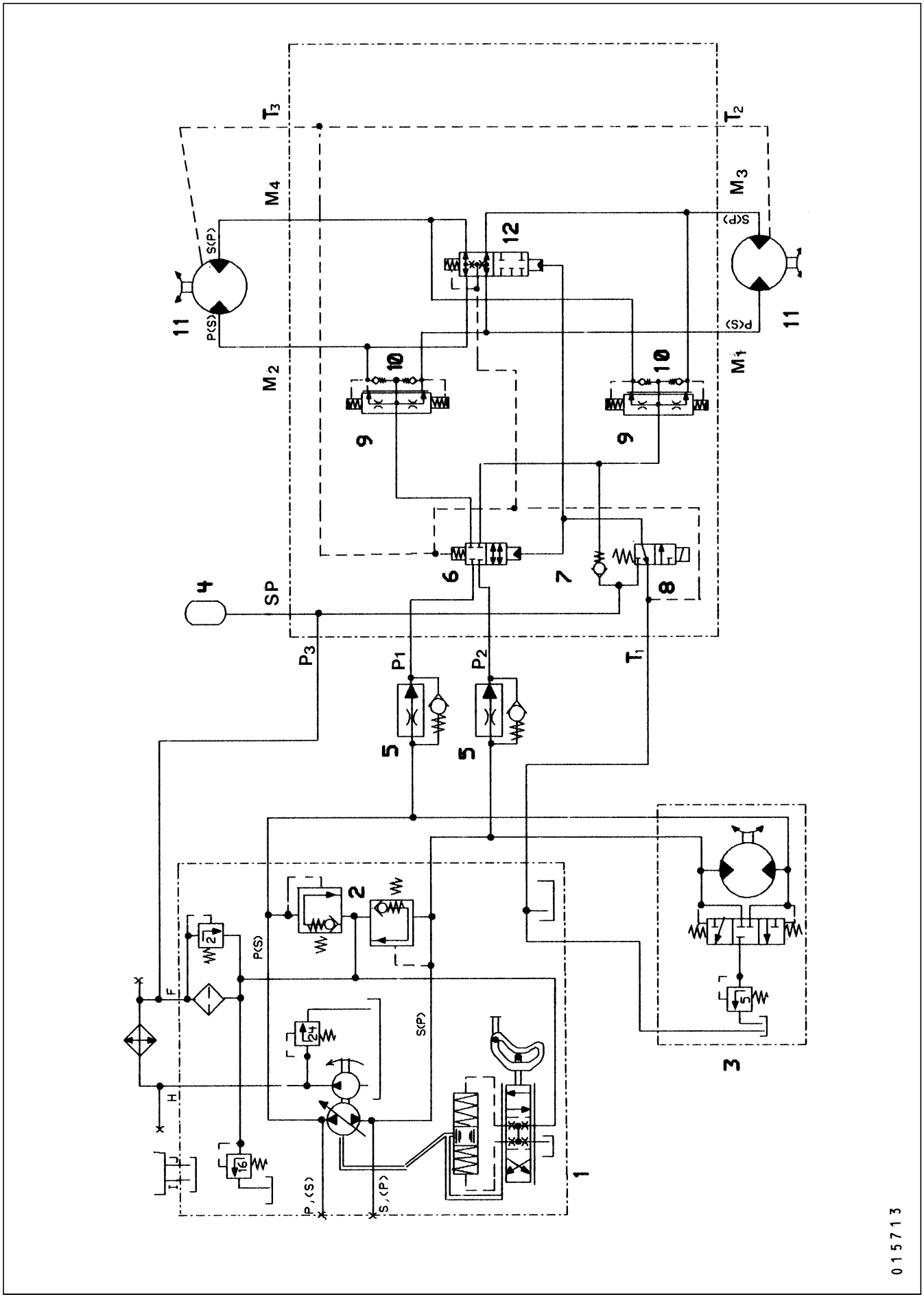


System Will Not Operate In Either Direction

8

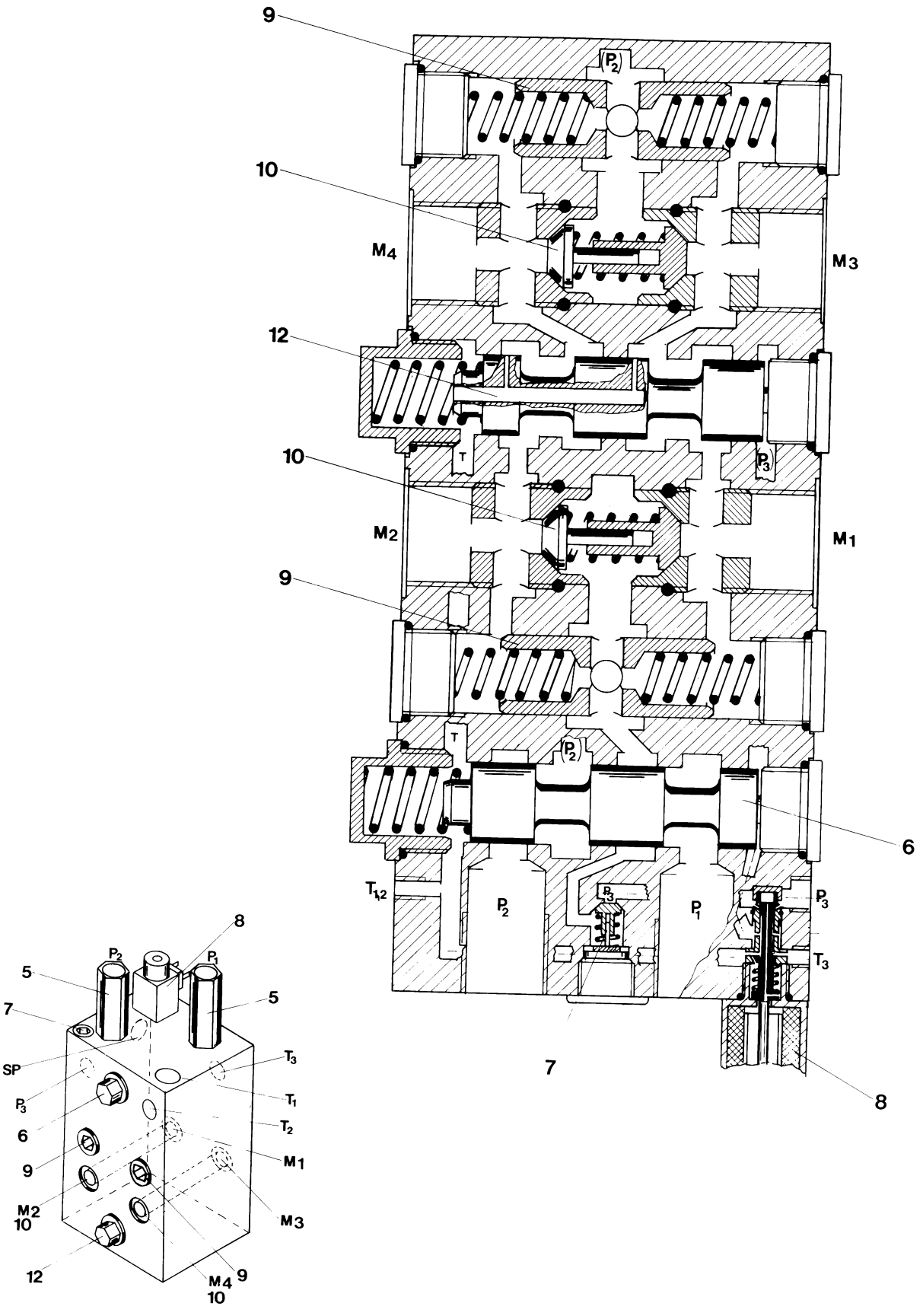
CLAAS 4-Trac System

Hydraulic circuit, rear wheel drive, CLAAS 4-Trac System



Key

1 – Variable displacement pump
2 – Combined charge and high pressure relief valve
3 – Fixed variable displacement motor
4 – Accumulator
(0,5 litres [0,44 Imp. qt; 0,53 U.S. qt])
5 – Flow control valve
(110 litres per minute [96,8 Imp. qt; 116,2 U.S. qt])
6 – 4/2 directional control valve (engagement spool)
7 – One way valve (0,2 bar)
8 – 3/3 Solenoid valve (on-off selector valve)
9 – Flow divider
10 – One way valve
11 – Hydrostatic motor (on rear axle)
12 – 5/2 directional control valve (bypass valve)



0 1 5 7 2 7

Key

1 – Variable displacement pump
2 – Combined charge and high pressure relief valve
3 – Fixed variable displacement motor (on change-speed transmission)
4 – Accumulator (0,5 litres [0,44 Imp. qt; 0,53 U.S. qt])
5 – Flow control valve (110 litres per minute [96,8 Imp. qt; 116,2 U.S. qt])
6 – 4/2 directional control valve (engagement spool)
7 – One way valve (0,2 bar)
8 – Solenoid-operated 3/3 directional control valve (on-off selector valve)
9 – Flow divider
10 – One-way valve
11 – Hydrostatic motor (on rear axle)
12 – 5/2 directional control valve (bypass valve)

Specifications

Rear wheel drive	=	Messrs. Lohmann and Stolterfoth, Witten
Gear ratio	=	1 : 22,54
Drive speed	=	3317 rpm
Drive torque	=	368 speed-related Nm (271,4 ft lb)
Hydrostatic motor	=	Rexroth A 4 F 35 (35 cm^3 [2,14 cu.in] per minute)

FUNCTION

Rear axle drive disengaged

The 4/2 directional control valve (6) blocks the high pressure lines from the variable displacement pump (P1, P2).

Bypass valve (12) is open. The wheel motor circuits (11) are kept open by the bypass valve (12). (M1, M2, M3, M4).

Leakage oil from the motors is allowed to the housing of variable displacement pump (1).

Low oil supply is made up for by the charge pump (connection F) via one way valve (7) and the lower flow divider (9).

The accumulator (4) is preloaded to the charge pressure.

When the machine is being towed (no charge pressure), the hydrostatic motors are protected from over-speeding by disengaging the motors mechanically: re-bolt the mounting bolts into the tapped holes (offset by 90°) until the disengaging sleeve locates against the stop.

Torque the bolts to 2,5 da Nm (18,4 ft lb).

Engaging rear axle drive

The solenoid shifts selector valve (8). Now 4/2 directional control valve (6) and bypass valve (12) are shifted by charge pressure. Boost oil from the accumulator (4) ensures positive, prompt shifting of both the valves.

The open circuits of wheel motors (11) are now being closed by bypass valve (12).

The 4/2 directional control valve (6) allows oil from the high pressure lines to the wheel motors.

The oil supplied by variable displacement pump (1) flows to the fixed displacement motor (3) and to the hydrostatic motors (11).

The flow rate to the hydrostatic motor (11) is limited to 110 litres per minute (96,8 Imp. qt; 116,2 U.S. qt) by the respective flow control valves (5). This way the displacement motor (3) gets oil also in severe operating conditions.

The appropriate flow divider (9) divides or regulates the flow of oil to hydrostatic motors (11), depending on the individual motor's power requirement.

Oil from the motors passes through the one way valves (10) of the other flow divider and returns to the pump.

9

Electrics

NOTE! The voltage supplied by the vehicle to operate the electrical and electronic systems must range between 12 and 14,5 Volts. To ensure correct function of the electrical and electronic systems, a higher or lower voltage must not be applied.

Testing and measuring electrical circuits

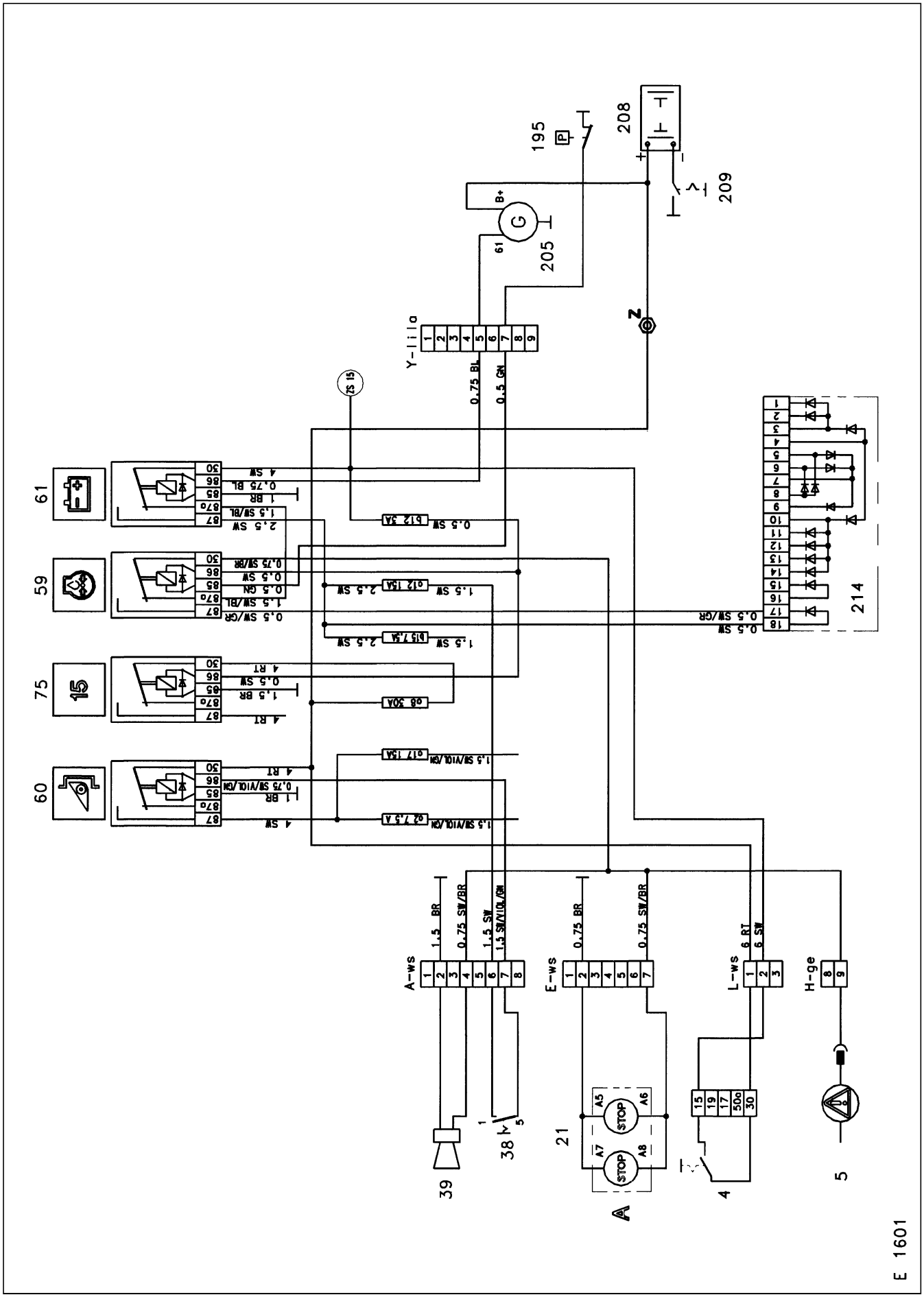
Description and data	Testing method	Tester setting	Test connections	Set point value
Remote switch relay 12 V, 20/30 A, “A”-version **ET-No. 744 071.1**	R coil	Ω	85 – 86	65 – 75 Ω
Remote switch relay 12 V, 20/30 A, “A”-version **ET-No. 013 055.0**	R coil	Ω	85 – 86	80 – 85 Ω
Starter relay 12 V, 40 A, “B”-version	R coil	Ω	85 – 86	70 – 75 Ω
Solenoid coil 3/3-way directional control solenoid valve, CLAAS Autopilot solenoid valve, 12 V, 3,3 A, 60 % duty cycle	R	Ω	Input – Output Input – Housing	3,6 Ω ∞ Ω
Solenoid coil 4/3-way directional control solenoid valve 12 V, 4,5 A, 60 % duty cycle	R	Ω	Input – Output Input – Housing	2,7 Ω ∞ Ω
Solenoid coil 3/2-way directional control solenoid valve (low pressure hydraulics) 12 V, 2 A, 100 % duty cycle	R	Ω	Input – Output Input – Housing	6,0 Ω ∞ Ω
Solenoid coil CLAAS-4-Trac 12 V, 45 W	R	Ω	Input – Output Input – Housing	3,0 Ω ∞ Ω
Solenoid coil Automatic engine cut-off 12 V, 3,75 A, 100 % duty cycle	R	Ω	Input – Output Input – Housing	3,2 Ω ∞ Ω
Solenoid coil E-magnetic clutch compressor-type air conditioner	R	Ω	Input – Output Input – Housing	3,4 Ω ∞ Ω
Magnetic pick-up	R	Ω	Input – Output Input – Housing	1000 – 1200 Ω ∞ Ω
Adjustable resistor sender cutting height, indic. spring setting, indic. fuel gauge	R	Ω	Sender case is earth	10 Ω to 190 Ω

Description and data	Testing method	Tester setting	Test connections	Set point value
Linear motor reel speed fan speed	 I I	 A A	Connect in series Unloaded Fully loaded	 2 – 4 A 12 – 15 A
Pair of potentiometers DKG – (control console) CAC – (control console)	R	Ω	 On connector On connector	 0 – 11 kΩ 0 – 11 kΩ
Auto-Contour button	R	Ω	On connector Slider impedance	4,7 kΩ 1,7 kΩ
Indicator: SW spring pretension Feeder housing setting	R	Ω	 Pole 1 – 2 Pole 3 – 4	 200 Ω 200 Ω

NOTE! Deviations on any of the above values may be due to varying internal resistance and voltages of the measuring instrument (±10% is normal).

∞ = Indefinitely great (very large)

Main relay circuit 59-60-61-75



Key

4 – Ignition switch
5 – Vehicle information unit
21 – “Stop” indicator lights
38 – Master switch, lift hydraulic system (red)
39 – Buzzer
59 – Oil pressure relay
60 – Master relay – cutterbar
61 – Relay – alternator
75 – Relay No. 15 – cab
195 – Oil pressure switch, engine
205 – Alternator
208 – Battery
209 – Battery isolating switch
214 – Diode plate

FUNCTION

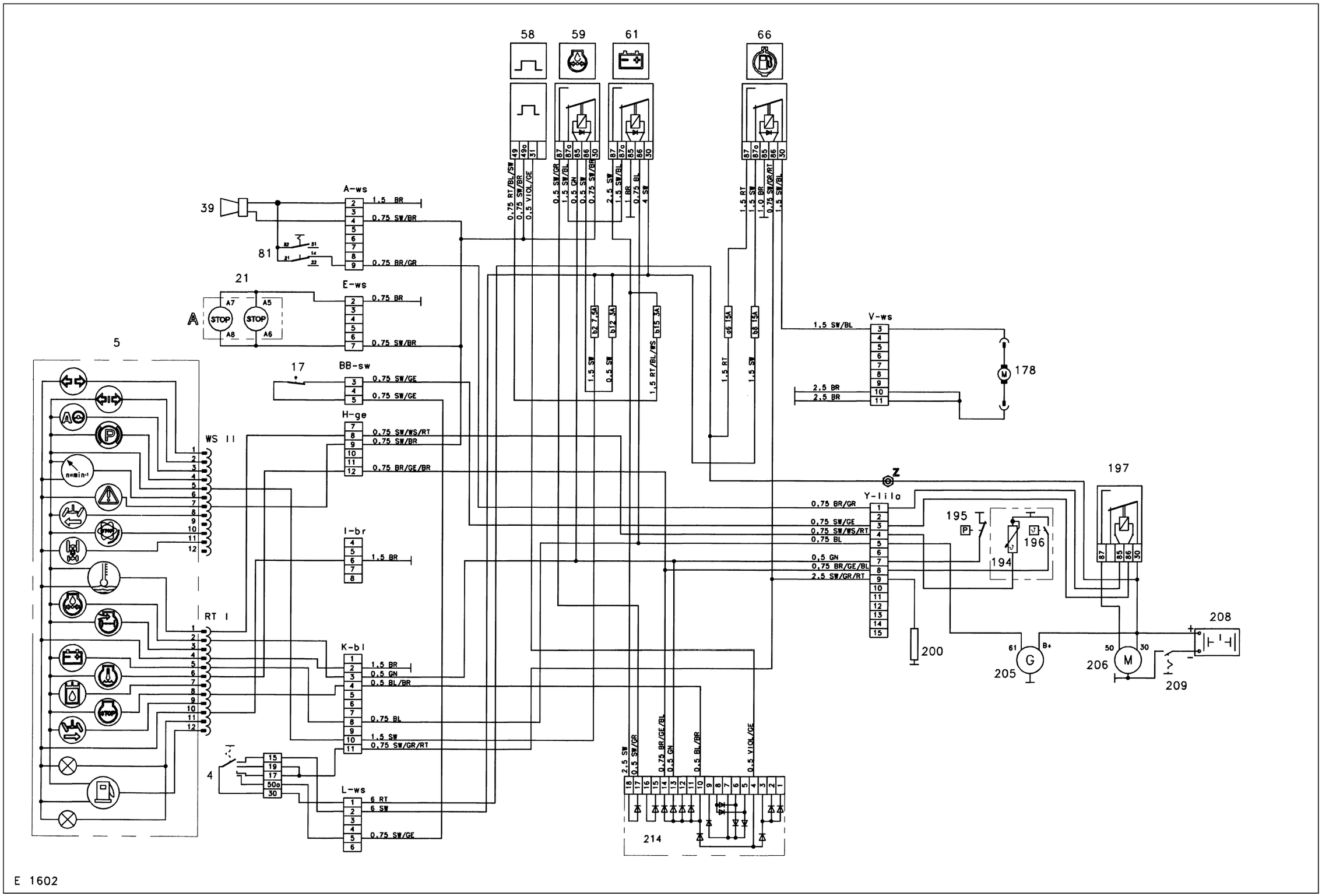
Ignition switched on

- Positive from the ignition switch (4), terminal 15 is supplied to relay (61) on terminal 30, and via the fuse (b12) to terminal 86 on relay (59).
- Relay (61) is not switched. Positive is supplied from terminal 30 to 87a and from there to terminal 87a on relay (59).
- Relay (59) is switched (earth circuit is completed) from oil pressure switch (195) to terminal (85).

Engine running

- Positive is supplied from the alternator (205) via terminal 61 to relay (61). Relay (61) is now switched on, terminal (85) is connected to the negative supply. From terminal 30, positive is supplied to the diode plate (214) via terminal 87 and from there to terminal 87 on relay (59). Relay (59) is not switched. (No negative supply from oil pressure switch).
- Should the oil pressure drop, the oil pressure switch (195) will switch negative to terminal 85 on relay (59). Positive from terminal 87 is supplied to the function monitor via terminal 30. The buzzer (39) has a continuous warning tone and the lights (5 and 21) glow continuously.
- Should the fan belt for the alternator break, then the positive supply from the alternator to terminal (86) of relay (61) is broken. The relay is then switched. From the ignition switch the positive is supplied via relay (61) terminal 30 to 87a, to terminals 87a and 30 on relay (59). This switches the function on the function monitor. The function monitor gives continuous audible warning and lights (5 and 21) glow continuously.
- From the switched relay (61) positive is supplied via fuse (a12) to the master switch (38) of the lift hydraulics. When switch (38) is switched, positive is supplied to specific functions via relay (60), e.g. the cutterbar can only be lowered with the engine running.

Starting the Diesel engine, 12 Volts, Diesel engine oil pressure switch, temperature gauging/warning



E 1602

Key

4 – Ignition switch
5 – Vehicle information unit
17 – Switch, starter safety switch
21 – “Stop” indicator lights
39 – Buzzer
58 – Pulse generator
59 – Relay – oil pressure
61 – Relay – alternator
66 – Relay – fuel pump
81 – Master switch, thresher
178 – Fuel pump
194 – Temperature gauge sender
195 – Oil pressure switch, engine
196 – Water temperature alarm switch
197 – Starter motor relay, 40 A
200 – Flame-type glow plug (Perkins only)
205 – Alternator
206 – Starter
208 – Battery
209 – Battery isolating switch
214 – Diode plate

FUNCTION

Starting the engine

IMPORTANT! When starting please observe the following switch positions.

- Threshing mechanism must be switched off (switch 81).
- The hydrostatic drive lever must be in neutral position (switch 17).
- Turn the ignition switch to the stop (glow phase for perkins engines), depress and turn further.
- The starting relay must be plugged in.

Checking the starting unit

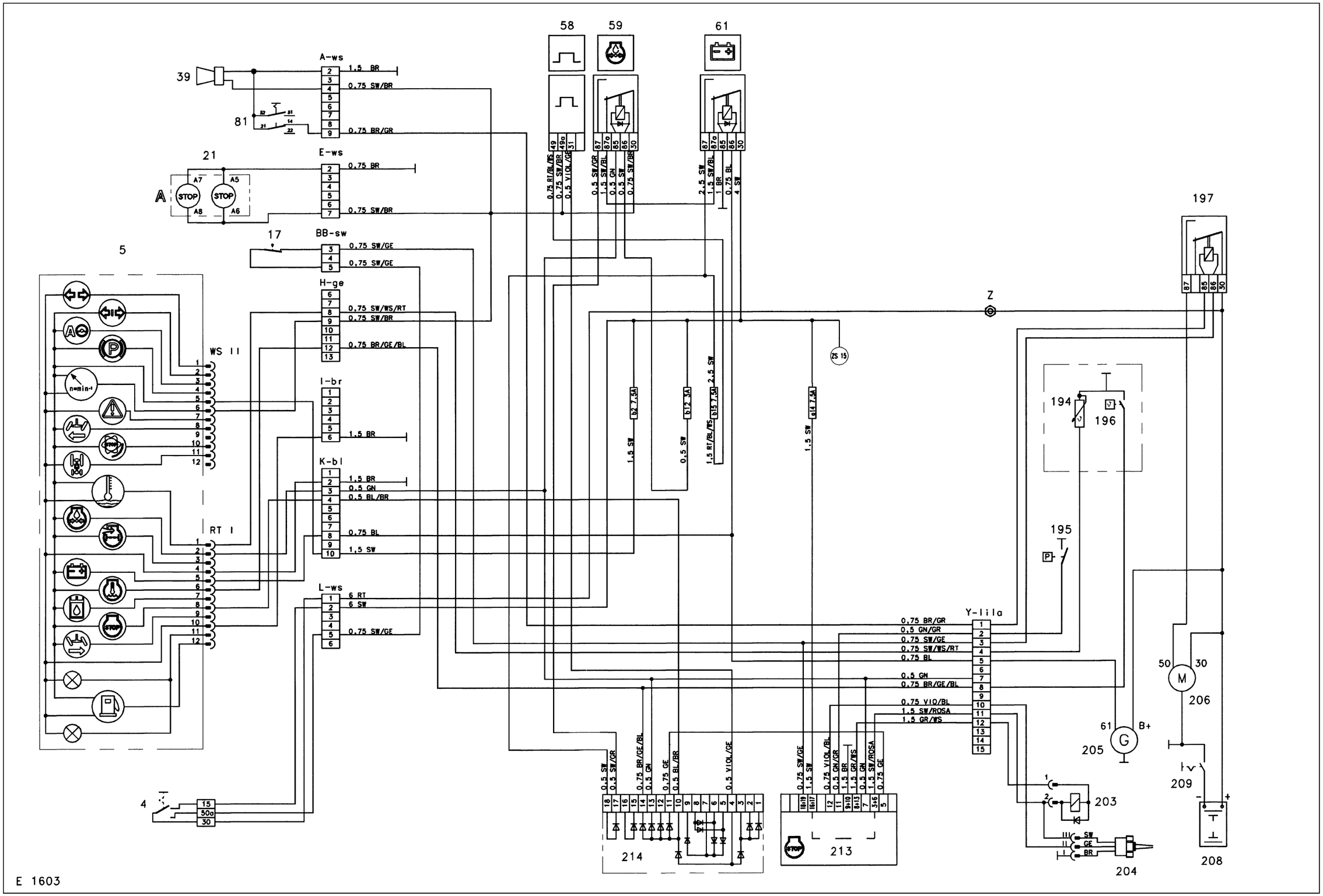
- Remove the starting relay (197).
- Check that (+) positive is applied to the relay base, terminal (30) using a continuity tester. Terminal No. can be identified from disconnected relay. If not:
- Check battery terminals and polarity.
- Check that (–) negative is applied to relay base, terminal 85.

  If not:
- Check plug connections (A ws).
- Check switch (81).
- Check plug connections (Y).
- Check that (+) positive is applied to relay base, terminal 86 when ignition key is in the “Start” position.

  If not:
- Check connections Y, BB and L.
- Check switch (17).
- Check ignition switch (4).
- Check starting relay.
- Check starter motor (206).

Note: Items 194 and 196 are combined in a single switch.

Starting the diesel engine 12 V, diesel engine oil pressure switch, temperature gauging/warning, engine cutoff system



Key

4 – Ignition switch
5 – Vehicle information unit
17 – Switch, starter safe switch
21 – Stop indicator lights
39 – Buzzer
58 – Pulse generator
59 – Relay – oil pressure
61 – Relay – alternator
81 – Master switch, thresher
194 – Temperature gauge sender
195 – Oil pressure switch (normally open contact)
196 – Water temperature alarm switch
197 – Starter motor relay, 40 A
203 – Engine cut-off solenoid 12 V, 3,75 A, 100 % continuous rated, coil resistance 3,2 Ω
204 – Water level sender
20 – Alternator
206 – Starter
208 – Battery
209 – Battery master switch
213 – Module for automatic engine cut-off system
214 – Diode plate

Automatic engine cut-off

FUNCTION

IMPORTANT! The oil pressure switch (195) of the automatic engine cut-off system is a normally open contact.

The gn (green) wire from the oil pressure switch is connected to terminal 2 of the lilac connector.

When the ignition is switched on, power is supplied via fuse a14 to the engine cut-off module.

The module activates the solenoid, which releases the injection pump stop cable.

The earth circuit from the module to the oil pressure indicator light in the vehicle information unit is completed at the same moment. The light comes on.

The module incorporates a relay that will deenergize the solenoid after a delay of 7 seconds. The stop light in the vehicle information unit will then come on.

When the diesel engine is to be started, the solenoid is reenergized and the timing element in the module reset to 0. The 7 sec. timing period starts after releasing the ignition key.

If following the engine start the oil pressure has not built up after 7 sec., the solenoid is deenergized and the engine stopped. Oil pressure and stop lamp light up.

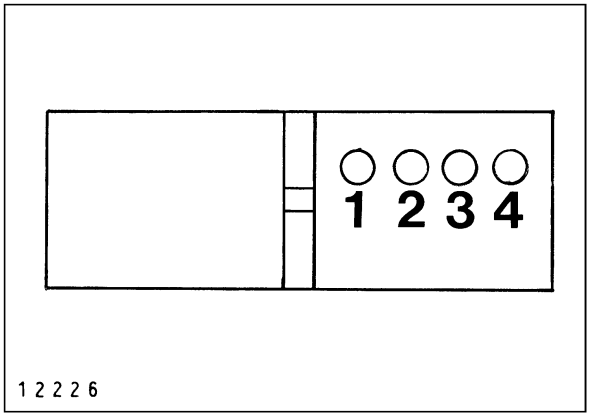
When the cooling water level is low, the engine will only run briefly, because the solenoid will stall the engine immediately. The stop light comes on.

When the engine has started, oil pressure switch (195) closes and earths the module. This breaks the earth circuit from the module to the indicator light in the vehicle information unit. The light goes out.

The automatic engine cut-off system stops the engine when there is not enough water in the cooling system and when the oil pressure is low.

Engine cut-off module

The light-emitting diodes (LED) in the engine cut-off module indicate the following conditions:



From module 010065.3

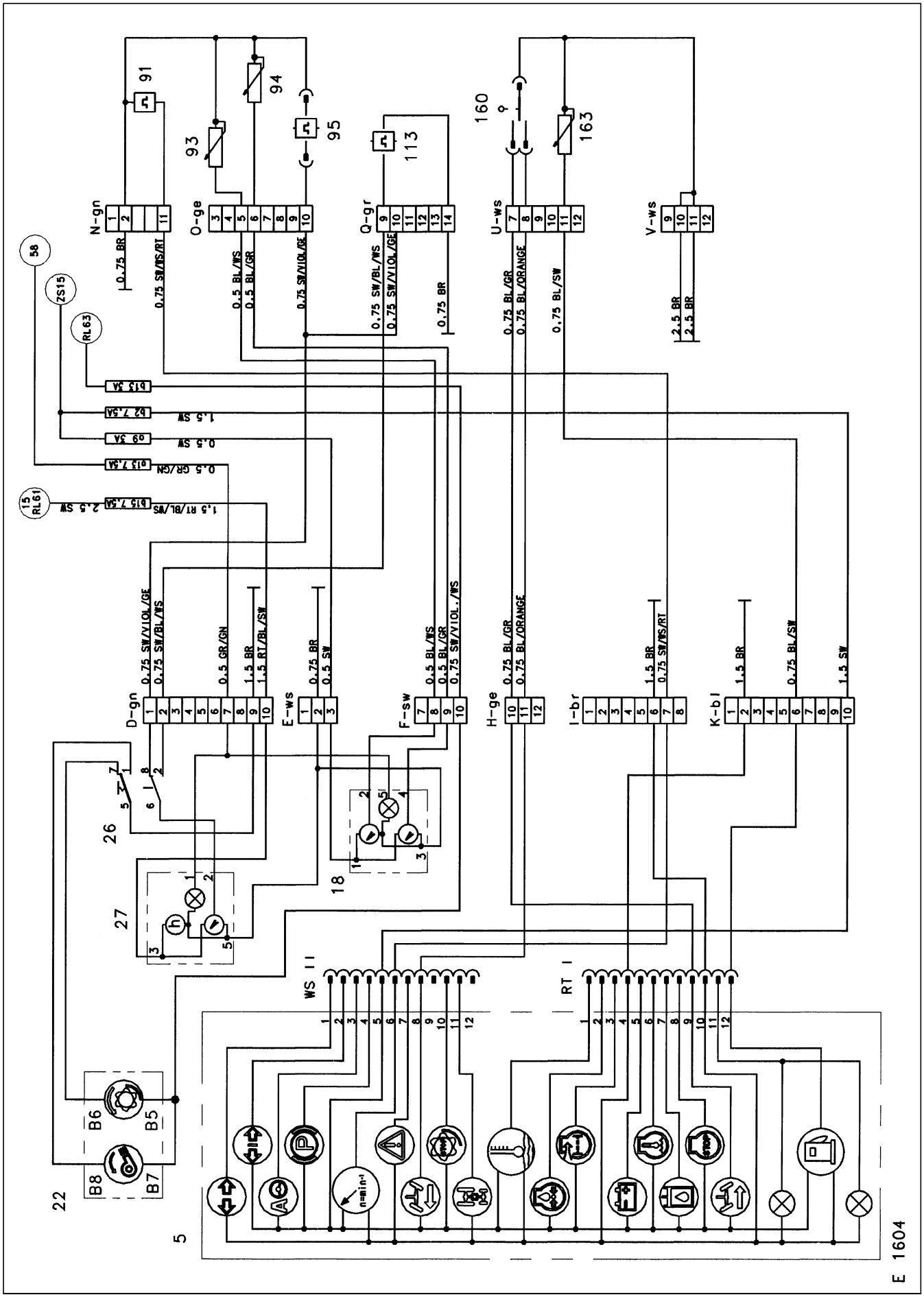
1 = water level – yellow = water present
2 = oil pressure – yellow = oil pressure present
3 = time delay – red = time elapses
4 = operating voltage – green = ignition on

The Diesel engine can only be stopped with the ignition switched off.

Checking the water level sensor without removing the sensor from the machine

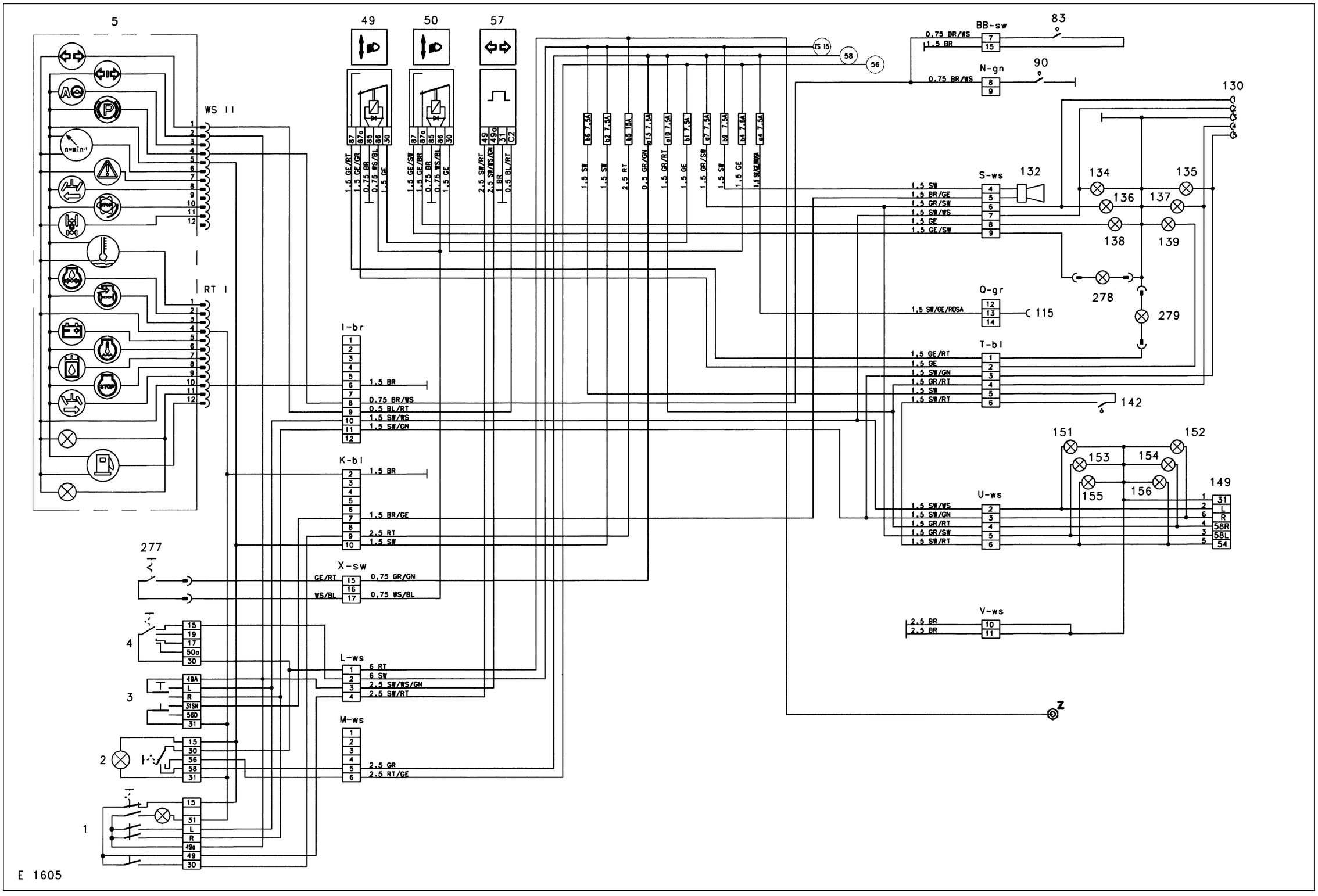
- Disconnect the 3-pin connector to the water level sensor.
- Bridge brown (br) and purple/blue (vi/blue) wires at machine end.
- Start Diesel engine – if engine is no longer being switched off, then: check first power supply to sensor (wire in connector).
- If the wire is live, replace the sensor.

Tachometer, hourmeter, spring pressure indicator, cutting height indicator, fuel gauge, rear wheel steering indicator



Key

5 – Vehicle information unit
18 – Cutterbar spring pressure indicator and cutting height indicator
22 – Indicator lamp unit B
26 – Selector switch, speed indicator
27 – Tachometer and hourmeter
91 – Pulse generator, change-speed transmission
93 – Sender, cutterbar spring pressure (10-190 Ω)
94 – Sender, feeder housing position (10-190 Ω)
95 – Pulse generator, fan speed
113 – Pulse generator, drum speed
160 – Sender, rearwheel steering indicator
163 – Fuel gauge sender (10-190 Ω)

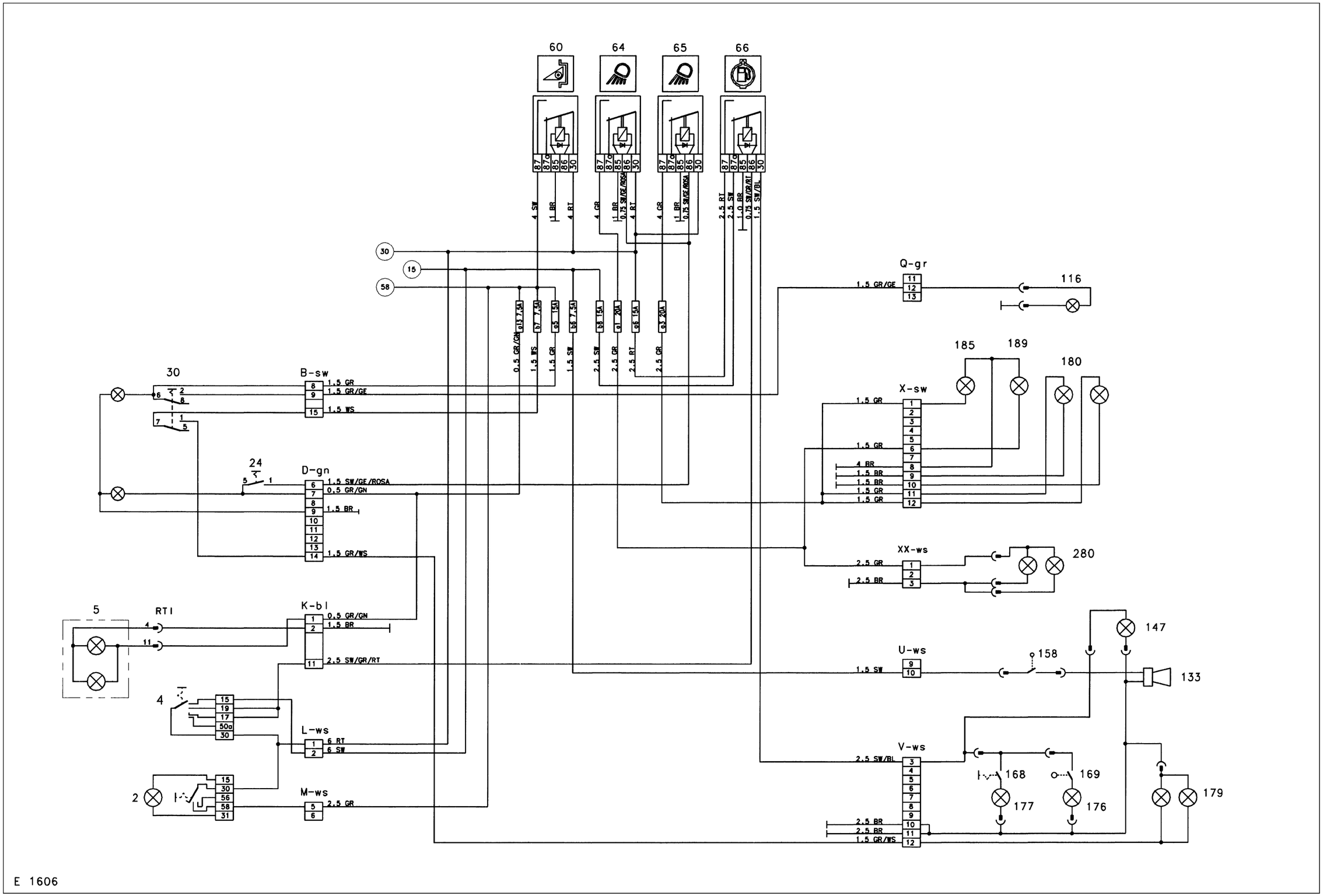

5
49
50
57
WS II
RT I
I-br
K-bl
X-sw
L-ws
M-ws
277
BB-sw
N-gn
S-ws
Q-gr
T-bl
U-ws
V-ws
83
90
130
132
134
135
136
137
138
139
278
279
115
142
151
152
153
154
155
156
149
Z
E 1605

Key

1 – Hazard warning flasher switch
2 – Light switch
3 – Turn flasher switch
4 – Ignition switch
5 – Vehicle information unit
49 – Relay, headlight changeover
50 – Relay, headlight changeover
57 – Relay – turn flasher light
83 – Switch, parking brake
90 – Disc brake warning
115 – Connection for warning light (D sign)
130 – Connection folding cutterbars
132 – Horn
134 – L/H turn flasher light, front
135 – R/H turn flasher light, front
136 – L/H side light, front
137 – R/H side light, front
138 – L/H headlight
139 – R/H headlight
142 – Warning contact switch – foot brake
149 – Connection – trailer socket
151 – L/H rear turn flasher light
152 – R/H rear turn flasher light
153 – L/H rear side light
154 – R/H rear side light
155 – L/H rear brake light
156 – R/H rear brake light
208 – Battery
277 – Headlight change-over switch
278 – Top mounted headlights
279 – Top mounted headlights

Note: Items 277, 278, 279 only applicable in conjunction with the variant “Top mounted headlights”

Work lamps, rear shining lamps, sieve pan lamp, returns light, grain tank lamp, reversing horn

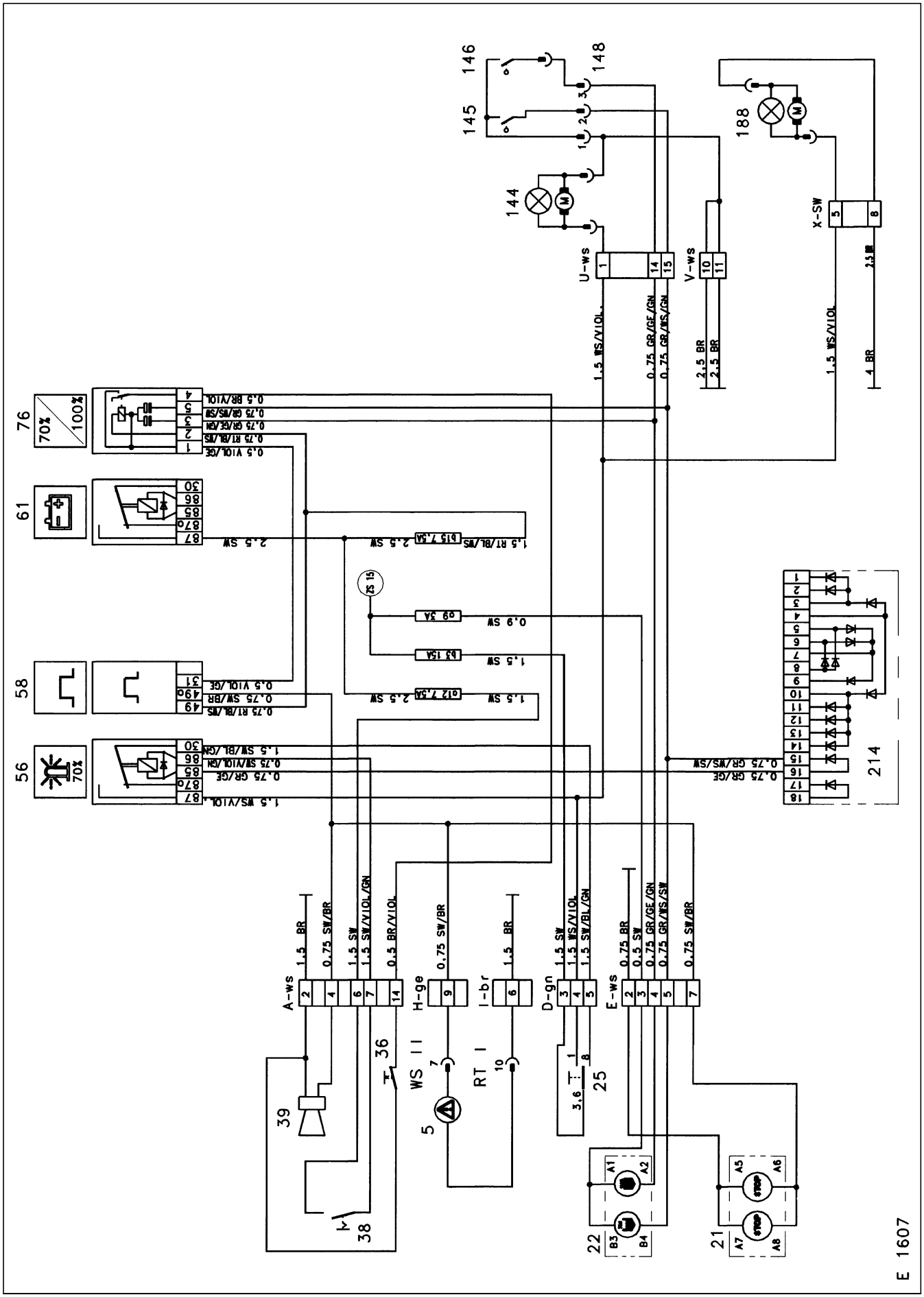


E 1606

Key

2 – Light switch
4 – Ignition switch
5 – Vehicle information unit
24 – Switch, worklamps
30 – Selector switch – worklamp
60 – Relay – lift hydraulics
64 – Relay – worklamps
65 – Relay – worklamps
66 – Relay – fuel pump
116 – Work lamp, unloading auger
133 – Reversing horn
147 – Grain tank lamp
158 – Switch – reversing horn
168 – Switch – sieve pan lamp
169 – Switch, returns light
176 – Returns light
177 – Sieve pan lamp
179 – Rear shining lamp
180 – Extra lights
185 – Work lamp, top
189 – Work lamp, top
280 – Wide-beam work lamp

Grain tank fill indicator, warning beacon



Key

5 – Vehicle information unit
21 – Indicator lights, stop
22 – Indicator lights, grain tank full warning
25 – Switch, warning beacons
36 – Switch, cancel acoustic alarm
38 – Master switch, lift hydraulic system (red)
39 – Buzzer
56 – Relay, warning beacons
58 – Pulse generator
61 – Relay – alternator
76 – Grain tank full warning relay
144 – Rear warning beacon
145 – Grain level switch – grain tank 70 % full
146 – Grain level switch – grain tank 100 % full
148 – Connector – R/H engine compartment panel
188 – Front warning beacon
214 – Diode plate

FUNCTION

Grain tank 70 % full

Relay 76, pin 4 connects to ground via the closed switch 36. Plus is connected from relay 61 via fuse b15 to relay 76, pin 2 and pulse generator 58, pin 49.

When grain tank 70 % full is signalled, switch 145 closes. The circuit to ground is completed from switch 145 to relay 76, pin 5 and the capacitor. Relay 76 switches to selfholding. This completes the ground circuit from pin 4 to pin 1 to pulse generator 58. Pulse generator 58 intermittently switches power to buzzer 39 and warning lights 5 and 21.

The ground connection to relay 76, pin 4 is interrupted by pressing switch 36, thus cancelling the self-holding function. The buzzer and warning lamps go out.

Note: The capacitors in relay 76 are discharged after a certain time by a resistor connected in parallel.

Grain tank 100 % full

Switch 146 closes and completes the circuit to ground to relay 76, pin 3. The rest of the circuitry is as for the grain tank 70 % full signal.

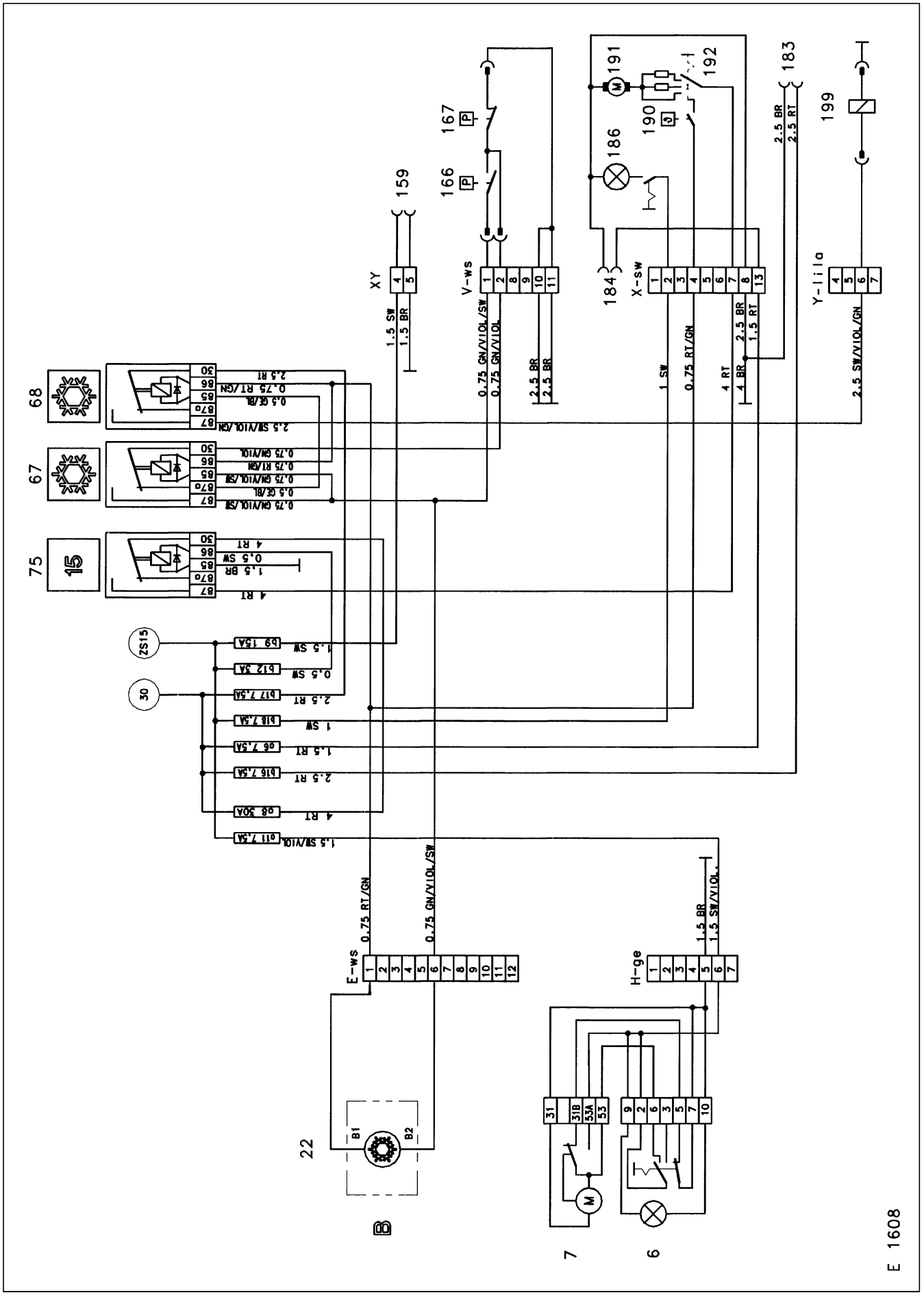
Warning beacon for grain tank 70 % full

Switch 38 closes. => Power from a12 to relay 56, pin 86. When switch 25 is switched to position 3-8, => power flows via fuse b3 to relay 56 pin 30.

Switch 145 closes when the grain tank is 70 % full.

=> Circuit to ground completed via diode plate 214 to relay 56 pin 85. The relay switches power from 30 to 87 to the warning beacons 144 and 188.

Cab, air conditioner, connection for radio and CB radio, connection for ancillary equipment, windscreen wiper



Key

6 – Switch for windscreen wiper/washer
7 – Motor for rotary windscreen wiper
22 – Indicator light – air condition malfunction
67 – Relay – air conditioning
68 – Relay – air conditioning
75 – Relay No.15
159 – Driver's seat compressor connection
166 – Safety switch, air conditioner (high pressure)
167 – Safety switch, air conditioner (low pressure)
183 – Connection for ancillary equipment (cigar lighter)
184 – Connection for radio and CB radio
186 – Interior lighting
190 – Thermostat switch
191 – Cab fan motor
192 – Cab fan motor switch
199 – Electro-magnetic clutch (coil resistor = 3,4 Ω)

FUNCTION

Power is supplied to relay 68, terminal 30, via fuse (b17). The circuit to earth is completed via the closed low pressure safety switch (167), relay (67), terminal 30 to 87a, and relay (68), terminal 85. When the ignition is turned on, relay (75) is switched.

Power is supplied to fan switch (192) via fuse (a8) and the energized relay (75).

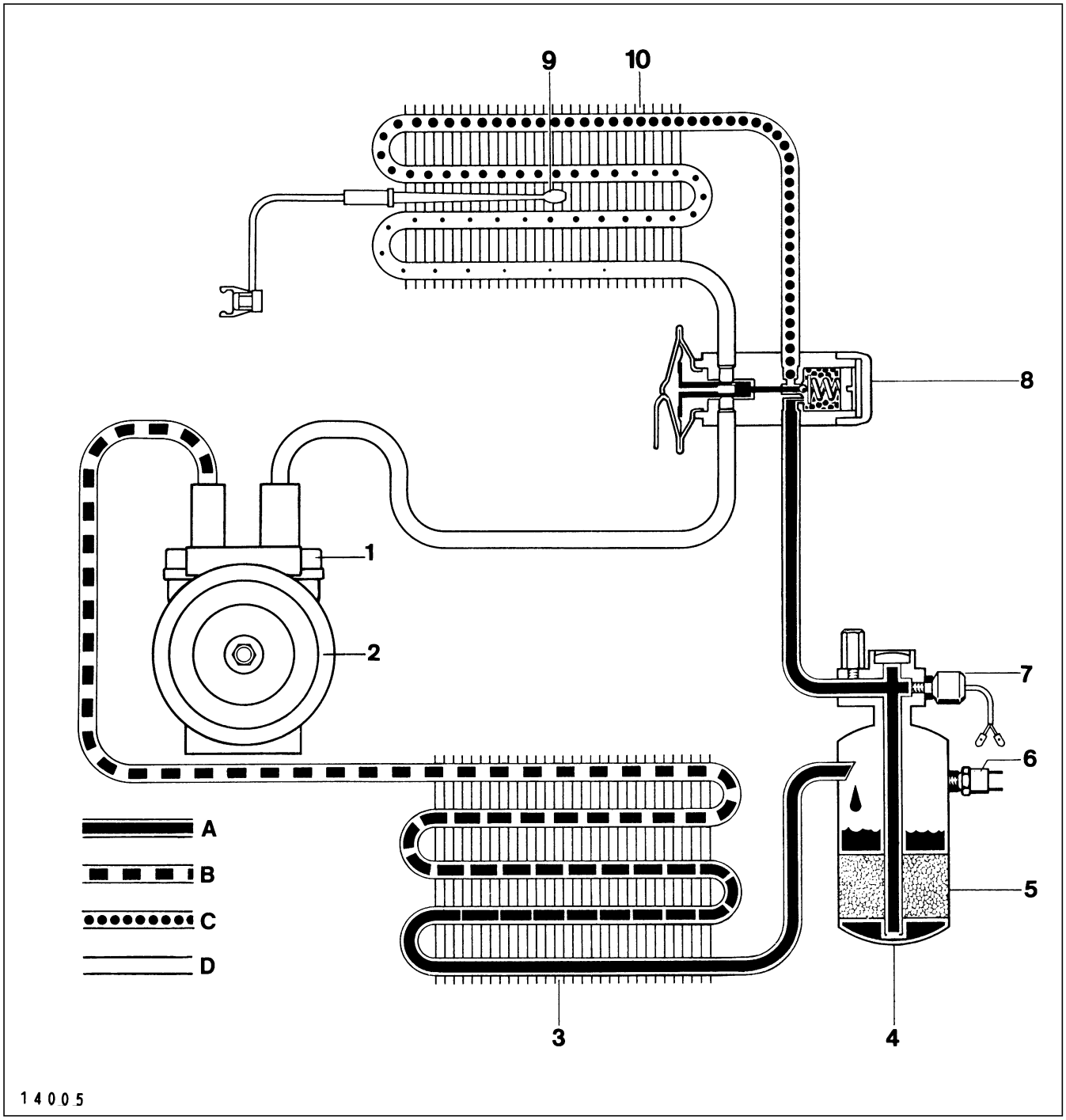
If the fan switch is turned on, power is supplied from the energized thermostat (190) to relays (67) and (68), terminals 86, and to the malfunction light (22) in the operations display screen.

The relay (68) switches from 30 to 87. The electro-magnetic clutch (199) of the compressor engages.

As soon as the high pressure switch (166) closes, earth is switched to malfunction light (22) and to relay (67), terminals 87 and 85. The red malfunction light (22) shows, and relay (67) is switched and interrupts the circuit to earth from its terminal 87a to relay (68), terminal 85. Relay (68) disengages the electro-magnetic clutch.

The safety switch (160) switches when, for instance, the expansion valve is icing up or the evaporator gets clogged with dirt.

When the high pressure safety switch (166) cuts in again, relay (67) stays in the self-holding mode through connection to earth via its terminals 85 and 30-87. The air conditioner can only be turned on again by momentarily switching the unit off and on again (to cancel the self-holding mode of relay (67).



Key

1 – Compressor
2 – Electric-magnetic clutch
3 – Condenser
4 – Filter receiver drier
5 – Filter element
6 – Low pressure switch
7 – High pressure switch
8 – Expansion valve
9 – Temperature sensor
10 – Evaporator
A – High pressure liquid
B – High pressure gas
C – Low pressure liquid (suction pressure)
D – Low pressure gas (suction pressure)

CONTENTS

1. Fundamentals of air conditioning

- Fluids absorb heat when changing from liquid to gas.
- Fluids give off heat when changing from gas to liquid.
- Heat always moves from the hotter substance to the colder substance.
- The temperature at which a liquid will turn to gas depends on the pressure to which the fluid is subjected.
- Refrigerant fluids must have a low boiling point and absorb and give off heat rapidly for optimum heat exchange.
- Basic refrigeration cycle is compression, condensation, expansion and evaporation.

  a) Compression heats up the gas.
  b) Condensation changes gas to liquid and releases heat.
  c) Expansion reduces pressure.
  d) Evaporation changes liquid to gas and absorbs heat.

2. Refrigerant

R 134a (amount required = 1,3 kg)

CAUTION! Always observe safety pre-cautions when working with refrigerant (refer to fitting and operating instructions manual).

3. How a compressor-type air conditioning system works

The closed circuit of an air conditioning system contains the refrigerant.

It is circuited through the actual components of the system: compressor, condenser (which changes gas to liquid), filter receiver drier (stores liquid refrigerant, removes moisture and foreign substances), expansion valve, evaporator (converts liquid to gas). After leaving the evaporator the refrigerant is returned to the compressor.

The compressor sends gaseous, high pressure refrigerant to the condenser, where heat is dissipated to the ambient air. The refrigerant is thereby changed from gas to liquid.

The filter receiver drier removes moisture and foreign substances (if present) from the refrigerant. The high-pressure refrigerant is passed through the expansion valve which causes the pressure and temperature of the refrigerant to drop.

In the evaporator the liquid vaporizes, thereby absorbing heat from the ambient air. In this way, the moisture in the ambient air collects into the drain pan and is drained away. The cool ambient air produced in this manner is blown into the cab to affect the desired cooling.

After leaving the evaporator, the refrigerant vapour is sucked in by the compressor and is once again compressed to a high pressure.

4. Compressor

The purpose of the compressor is to circulate the refrigerant under pressure through the system and thereby to move the heat-energy, which was absorbed in the evaporator, to the condenser.

Compressor
= York ET 206 R
n = 3200 rpm

Power is taken from Diesel engine via an electromagnetic clutch. Max. capacity = 3,7 kW (5 DIN HP)

5. Electro-magnetic clutch

The electro-magnetic clutch transmits engine power to the compressor. The clutch consists of field coil, pulley with bearing and armature plate: The magnetic clutch is mounted directly to the compressor. The armature plate is mounted on the compressor crankshaft and the pulley with bearing connects with the armature plate. The belt-driven pulley always rotates.

When the field coil is energized, the armature plate is pulled against the pulley and the compressor operates.

When the field coil is de-energized, the armature plate and pulley separate and compressor operation is stopped.

6. Condenser (Changes gas to liquid)

The condenser changes the high pressure gas flow from the compressor to liquid. This is accomplished by heat exchange (heat flows from the warmer substance to the cooler substance). The refrigerant, which then has a temperature of more than 60° C (140° F), is forced into the condenser. Tubes and fins take up the heat. Outside air is blown through the condenser. The outside air warms up, heat is removed from the gaseous refrigerant, it condenses to liquid.

The process of condensing is affected:

a) by pressure acting on the refrigerant,
b) by air flow through the condenser radiator.

The condenser is cooled by the Diesel engine fan.

7. Expansion valve

The expansion valve lowers the pressure of the liquid refrigerant. The refrigerant vaporizes and becomes a gas. The expansion valve also controls the amount of refrigerant entering the evaporator. The amount of refrigerant passing through the valve is determined by the suction pressure in the suction line to the compressor and by the temperature on the outlet side of the evaporator.

8. Evaporator

The evaporator works opposite to the condenser. The liquid refrigerant is sprayed into the evaporator. The heat required to change the liquid refrigerant to gas is absorbed by the refrigerant from the air, which is blown through the evaporator fins. This way the air is cooled.

9. Filter-receiver-drier

The filter drier acts as an expansion vessel and supply container for the refrigerant. In the receiver the refrigerant flows through a solid-state drier. Dirt is filtered out and moisture absorbed (6-10 g dependent on temperature). The quantity circulating can be checked at the sight glass provided on the receiver. The white ball will float when the fluid level is correct.

Refrigerant must be replenished and the filter drier replaced if necessary when the ball in the sight glass is at the bottom.

Note: The filter drier must be replaced when the indicator bead turns pink.

10. Thermostat

Opening and closing of the electrical contact in the thermostat is controlled by a diaphragm that is sensitive to temperature. As the evaporator gets warmer or colder a gas in a capillary tube changes its volume. This causes the diaphragm or bellows to expand or contract which, in turn, controls a spring-loaded pivoting frame. The electrical contacts are connected to the pivoting frame and to the thermostatic switch housing.

11. Lines (hoses)

The diver can adjust for desired cooling (spring load and contact clearance are changed)

The recommended hose qualities must be used, e.g. Aeroquip type GH 414.

Two charging and test valves are installed in the lines.

12. Safety switches

High pressure switch:
The high pressure switch protects the system if pressure rises excessively. It closes at 24 bar, it opens at 18 bar.

Low pressure switch:
The low pressure switch protects the compressor from damage when refrigerant loss takes place. The low pressure switch is set to open at 2 bar and to close at 2,25 bar.

13. Maintenance

Ensure that the caps are always screwed onto the charging and test valves.

The filter drier must be replaced when the indicator bead turns pink.

The gas must be evacuated for this purpose and subsequently renewed.

The oil level in the compressor must be checked at the same time.

Only top up with Esteröl-Retrofix II (refer to the section headed “Oil types”).

14. Evacuating the air conditioning system

If there is still any refrigerant in the system, the refrigerant has to be discharged by use of the correct recovery equipment.

– Connect the manifold gauge hoses to the charging and test valves.

  Red = high side, hose goes to the condensator

  Blue = low side, hose comes from the evaporator.

– Connect the hose from the middle manifold gauge (yellow) to the intake port of the vacuum pump.

– Open the vacuum pump (see decal on pump).

– Fully open both manifold gauge set valves.

– Switch on the vacuum pump. The low side pressure gauge must show a vacuum reading of up to approx. 0,9 bar = 13,05 psi within 5 minutes. If not, check the connections for leaks.

– After approx. 10 minutes close both manifold gauge hand valves and turn off the vacuum pump. Check if the vacuum is holding.

– If the vacuum reading remains constant for approx. 5 minutes, turn the vacuum pump on again and open both hand valves of the manifold gauge set. Evacuate the system for about 45 to 60 minutes.

  NOTE! If vacuum will not hold, again check connections. Possibly charge system with refrigerant and check system for leaks using leak detector.

– Close both hand valves on the manifold gauge set, shut off and disconnect the vacuum pump.

Charging the evacuated System

Note: Check the oil level in the compressor before charging the system.

- The system should be charged as soon as possible after evacuating the compressor-type air conditioning system.
- Connect the hose from the centre connection (yellow) of the manifold gauge set to the refrigerant container. Keep refrigerant container in upright position with valves at the top (charge with gaseous refrigerant).
- Open the dispensing valve on the refrigerant container. Loosen the yellow centre service hose connection to the manifold centre port in order to purge the hose of air (a hiss is heard).
- Open the low side hand valve on the manifold gauge set. Allow the gas to enter the system until a pressure of 3,4 bar is obtained (low pressure switch closes). With ignition on, blower on and thermostat actuated, the electromagnetic clutch must now engage. If the pressure of 3,4 bar is not obtained due to cold weather, warm up the refrigerant container by placing it in a receptacle containing warm water (max. 50° C = 122° F).

  WARNING! Only gaseous refrigerant must be sucked in by the compressor. No liquid refrigerant must be allowed to enter the suction side, as otherwise the compressor will be damaged.
- Run the engine at idling speed and charge the system until the white ball floats on the top in the sight glass of the filter receiver drier. Required quantity of refrigerant: 1,3 kg (2,86 lb)
- Close the low pressure valve of the manifold gauge set and the valve on the refrigerant container.
- Unscrew the connections of the manifold gauge set from the compressor.
- Check the system for leaks using a leak detector.

SCHRADER filler valve

On compressors with Schrader valve the hose used must have a valve core depressor. As the hose is screwed on the valve, the valve core is depressed and the valve opened. When the hose is removed the valve colses automatically. Screw on the protective caps again.

Checking and curing faults

- Check the V-belt tension of the compressor drive.
- Check that the condenser is clean.
- Check the refrigerant level. With Diesel engine running and the system switched on and operating for 15 minutes, the white ball must float in the sight glass.
- Turn fan control to all speed settings and check if fan operates correctly.
  - If it does not operate correctly, check fuse (b9). Check live wire and earth wire on connector (X) for continuity and check connectors in cab roof.
  - Check fan switch and fan motor.
- Turn temperature switch to “max. cooling”. With the fan switched on, the electro-magnetic clutch switches with an audible click.
- If not: check fuse (b17), relay (64), the thermostat switch, safety switch, connectors (see wiring diagram), the electromagnetic clutch.
- Connect the manifold gauge set to the service valves, check condensing and intake pressure.
- Close the door and windows of the cab. Run the diesel engine at max. speed.
- Turn the fan 3-position switch to high (position 3) and turn the AC thermostatic switch to “max”.
- Hold the thermometer in front of an air louvre in the cab roof. The pressures shown by the low side and high side gauges of the manifold gauge set should almost agree with the pressures specified in the chart.

  Differences of 1,5 bar on average may occur in the high-pressure circuit and 0,4 bar on average in the low-pressure circuit.

  (Due to changes in outside temperature and atmospheric humidity) After 15 minutes of operation, the white ball must float at the top of the sight glass. The high-pressure side of the compressor cooling system must be warm and the low-pressure side cool.
- Check the pressure at the inlet and outlet of the filter receiver drier. If the temperatures differ, the unit is not in working order.

PROBLEM	
No cooling. Air from air louvres not cooled.	– Check fuse b9 and b17. – Compressor not pumping refrigerant. Expansion valve frozen. Replace the filter-receiver-drier (discharge/evacuate the system and recharge). – Cable connections loose. Tighten disconnected cables. – Magnetic clutch on compressor not engaging. Inspect clutch and replace if necessary.
Compressor fails shortly after the system has been charged.	– Compressor cooling system not charged correctly. Check charge pressure. The white ball in the filter drier must float at the top. – Evacuate any excess refrigerant. – Condenser dirty.
Loss of refrigerant in system	– Refrigerant line or fittings leaking. – Compressor oily. Fit new seals.
Air conditioner provides cool air for a time and after a short while discharges warm air again.	– Ice forming in the expansion valve. Filter-receiver-drier saturated. The blue ball in the sight glass has turned pink. Replace the filter-receiver-drier. – Ice forming in the expansion valve. Filter drier saturated. Blue indicator bead has turned pink. Replace filter drier.
Air conditioner system automatically shuts down. Warning and indicator lights in the operations display screen come on.	– Extremely high outside temperature. Allow the system to cool down, then turn on again. Close the door and windows.
Cool air blown through air louvres into cab. But air flow is insufficient for cooling the cab.	– Evaporator blocked. Clean evaporator. – Refrigerant level too low. Check for correct refrigerant level and recharge system if necessary. – Outside air gets into the cab. Completely shut windows and door.
Double fan not operating at full capacity.	– Check cable connections.
Compressor too noisy.	– Oil level in compressor too low (indicated by external leakage). Attend to compressor, have trouble remedied.
Moisture in cab. Water dripping from air louvres.	– Water drain hoses blocked or not properly routed. Ensure that drain water can pass freely through the hoses, blow through with compressed air, if required.

Reference chart (guideline values)

Refrigerant R 134a
Machine in the shade
Door and windows closed
Compressor at max. speed
Fan at speed 3 = max.
The refrigerant compressor must not be switched off via the control switch during measurement.

Outside temperature	Low pressure intake pressure in compressor	High pressure in compressor	Air discharge temperature at rear louvre	Temperature at compressor intake valve
°C	**bar**	**bar**	**°C**	**°C**
20	0,8	9,0	–	–
25	0,85	11,0	2,0	30,0
30	0,9	13,0	3,0	34,0
35	0,95	15,0	4,0	38,0
40	1,0	17,0	5,5	43,0
45	1,5	19,0	7,0	49,0

Fault diagnosis for pressure variations

Condensing pressure (HP) \ Suction pressure (LP)	Too high	Too low
Too low	– Compressor valve plate seal or valve plate defective. – Excessive clearance or piston ring defective.	– Moisture or foreign substances in system thus expansion valve blocked. – Insufficient refrigerant in system.
Too normal	– Expansion valve defective or incorrectly set. – Expansion valve sensor loose or poorly insulated.	– Evaporator iced up or dirty or filter plugged.
Too high	– Excessive amount of refrigerant in system. – Condenser dirty or fan defective.	– Compressor generates too much capacity, wrong electro-magnetic clutch or belt pulley fitted.

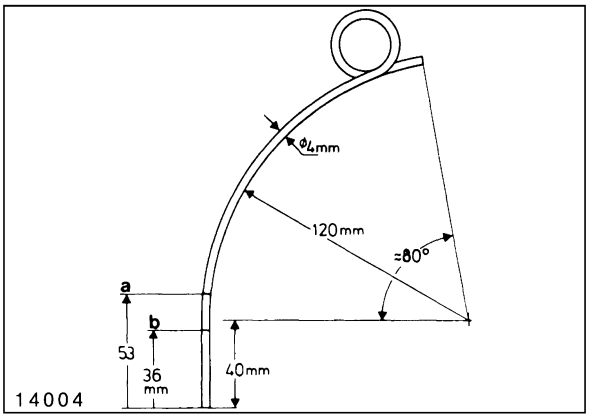
Note when carrying out repairs:

- Exercise care and cleanliness when breaking into refrigerant circuit, immediately seal off all openings air tight.
- Exchange the filter-receiver-drier whenever the refrigerant circuit is interfered with, e.g. changing a part.
- The refrigerant cannot be reused after being drained (evacuated).

Checking the compressor oil level

Note: Replacement compressors are supplied by the manufacturer with oil filled in.

- The oil level in the compressor can only be checked when repairs are carried out or before charging the compressor system initially. Check the oil level with the dipstick, made from a 4 mm copper, brass or bronze rod. Top up as required.
- Capacity:
  a = 0,475 litres initial fill of a new system
  b = 0,37 litres oil level check mark



Oil types (special refrigeration oil)

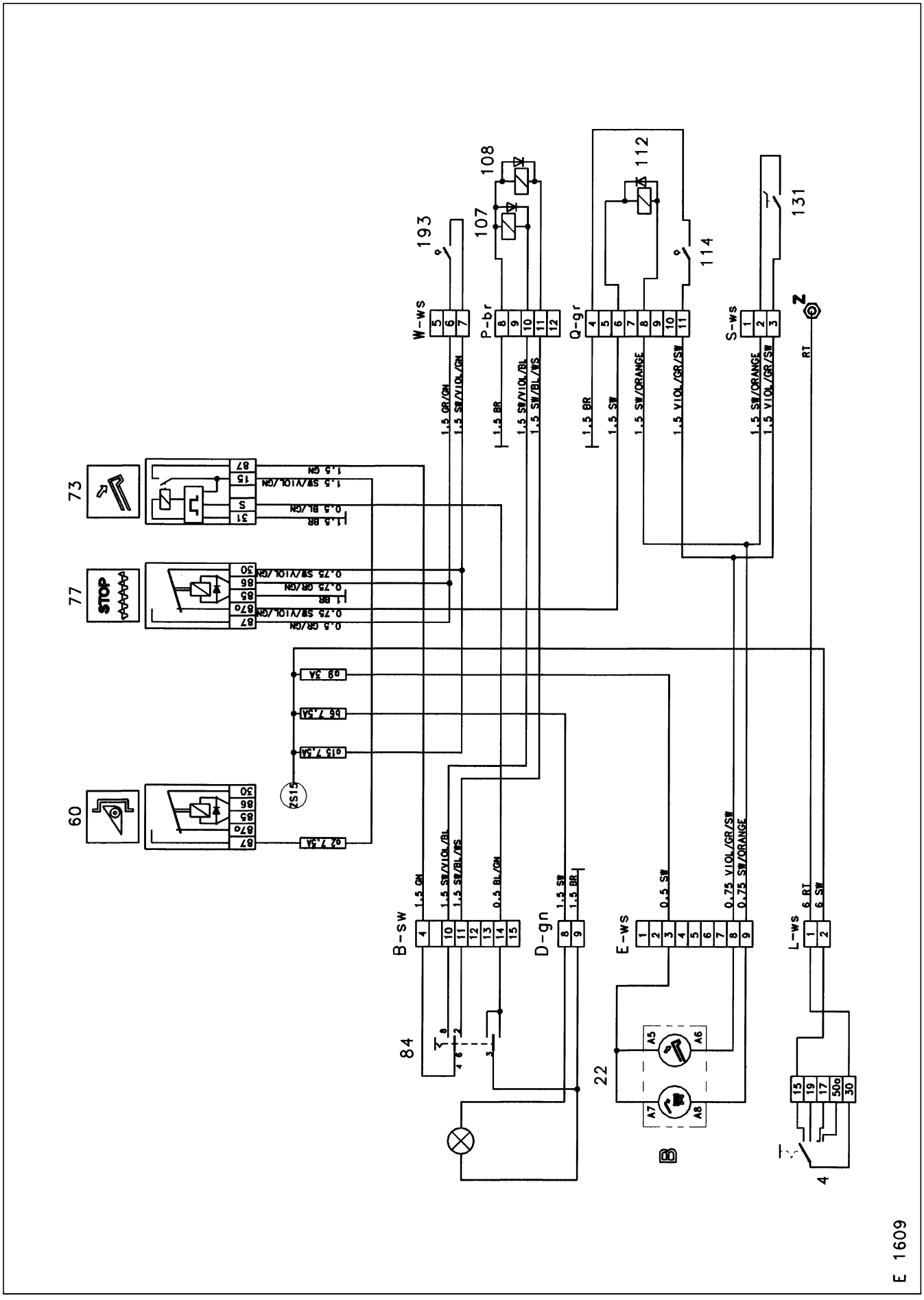
Esteröl-Retrofix II (CLAAS part No. 241 706.0)

Fit a new gasket on the filler plug.
Torque to 15 Nm.

10

Electrics

Grain tank unloading tube in/out, grain tank unloading auger drive



Key

4 – Ignition switch
22 – Indicator lights
60 – Relay-lift hydraulic system
73 – Time delay relay – unloading auger position
77 – Relay, grain tank unloading STOP
84 – Switch, unloading auger position
107 – Solenoid valve, unloading auger – out
(12 V, 4,5 A 60% continuous rated, Resistance = 2,7 Ω)
108 – Solenoid valve, unloading auger – in
(12 V, 4,5 A, 60% continuous rated, Resistance = 2,7 Ω)
112 – Solenoid valve, unloading auger drive
(12 V, 2 A, 100% continuous rated, Resistance = 6 Ω)
114 – Switch, unloading auger swung out
131 – Foot switch, grain tank unloading
193 – Switch, threshing mechanism,
grain tank unloading STOP

FUNCTION

Swing out grain tank unloading auger tube

- Switch on the ignition and start the combine engine. Switch on the lift hydraulics master switch.
- When relay (60) is switched, positive is switched via fuse (a2) to the solenoids (107 and 108) and to relay (73), pole 15
- Turn switch 84 to swing grain tank unloading auger tube in or out.
- Relay 73, pole S is grounded via the switch. Relay (73) latches and connects plus potential from pole 15 via pole 87 and then via switch 84 to solenoids (107 or 108), depending on the position of switch 84. The unloading auger tube swings in or out.
- Time delay relay (73) switches back after 20 seconds.
- The auger tube swing can be interrupted by turning switch (84) to the middle position.

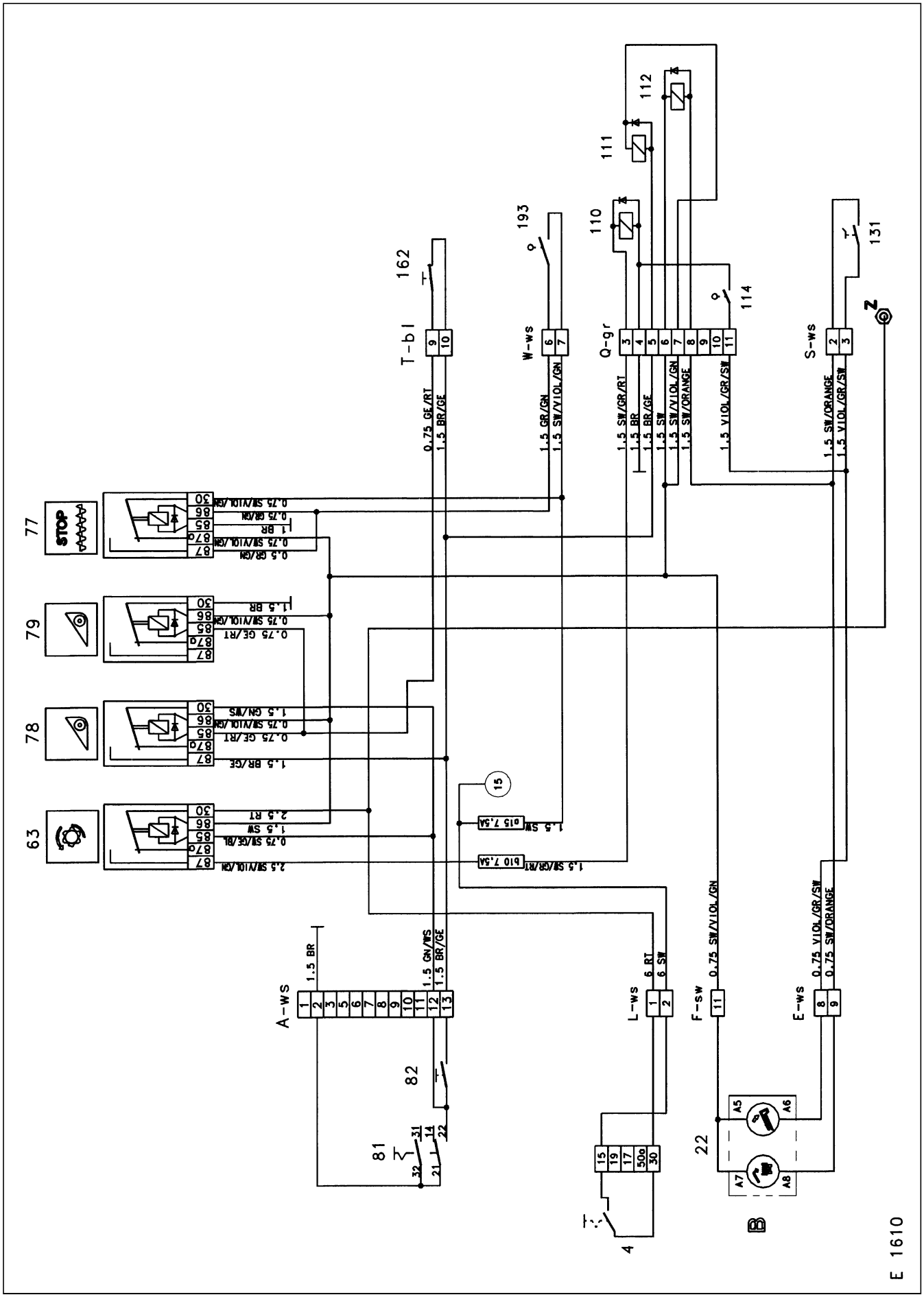
Engage grain tank unloading auger
Grain tank extension raise

- Positive is switched from fuse (a15) via relay 77, pole 30 – 87a to solenoid (112).
- The grain tank unloading auger tube must be swung out. Switch 114 is closed.
- Depress foot switch (131).
- From connecting Q-, pole 4, solenoid (112) is earthed via the switches (114 and 131). The unloading auger is switched on.
- Indicator lights (22) signal that the grain tank unloading auger tube is swung out and that the unloading auger is engaged.

Safety circuit

- If switch 193 (rear access) closes while unloading the grain tank, plus potential is switched to relay 77, pole 86 and 87.
- The relay latches.
- The threshing mechanism and grain tank unloading function cut out.
- The drives can only be restarted by switching the ignition off and on again.

Threshing mechanism drive, cutterbar drive, rear ladder step safety switch (immediate stop of grain tank unloading auger and threshing mechanism)



Key

4 – Ignition switch
22 – Indicator light unit B
63 – Threshing mechanism relay
77 – Relay – grain tank unloading stop
78 – Relay, cutterbar off
79 – Relay, cutterbar off
81 – Switch – threshing mechanism function enable (with low-pressure hydraulics)
82 – Switch – cutterbar function enable (with low-pressure hydraulics)
110 – Solenoid valve – threshing mechanism drive (12 V, 2 A,100 % CDF, coil resistance = 6 Ω)
111 – Solenoid valve- cutterbar drive (12 V, 2 A,100 % CDF, coil resistance = 6 Ω)
112 – Solenoid valve – grain tank unloading drive
114 – Switch – grain tank unloading tube swung out
131 – Foot switch – grain tank unloading drive
162 – Foot switch – cutterbar immediate stop
193 – Switch – threshing mechanism and grain tank unloading auger stop

FUNCTION

Threshing mechanism drive

– Plus from the battery to relay (63), terminal 30.
– Plus from fuse (al 5) via de-energized relay (77) to relay (63), terminal 86.
– Turn on switch (81). Relay (63), terminal 85 is earthed. Plus is switched via energized relay (63), terminal 87 via fuse (b10) to solenoid (110). (Earth from snap-on connection Q, terminal 4). The threshing mechanism is switched on.

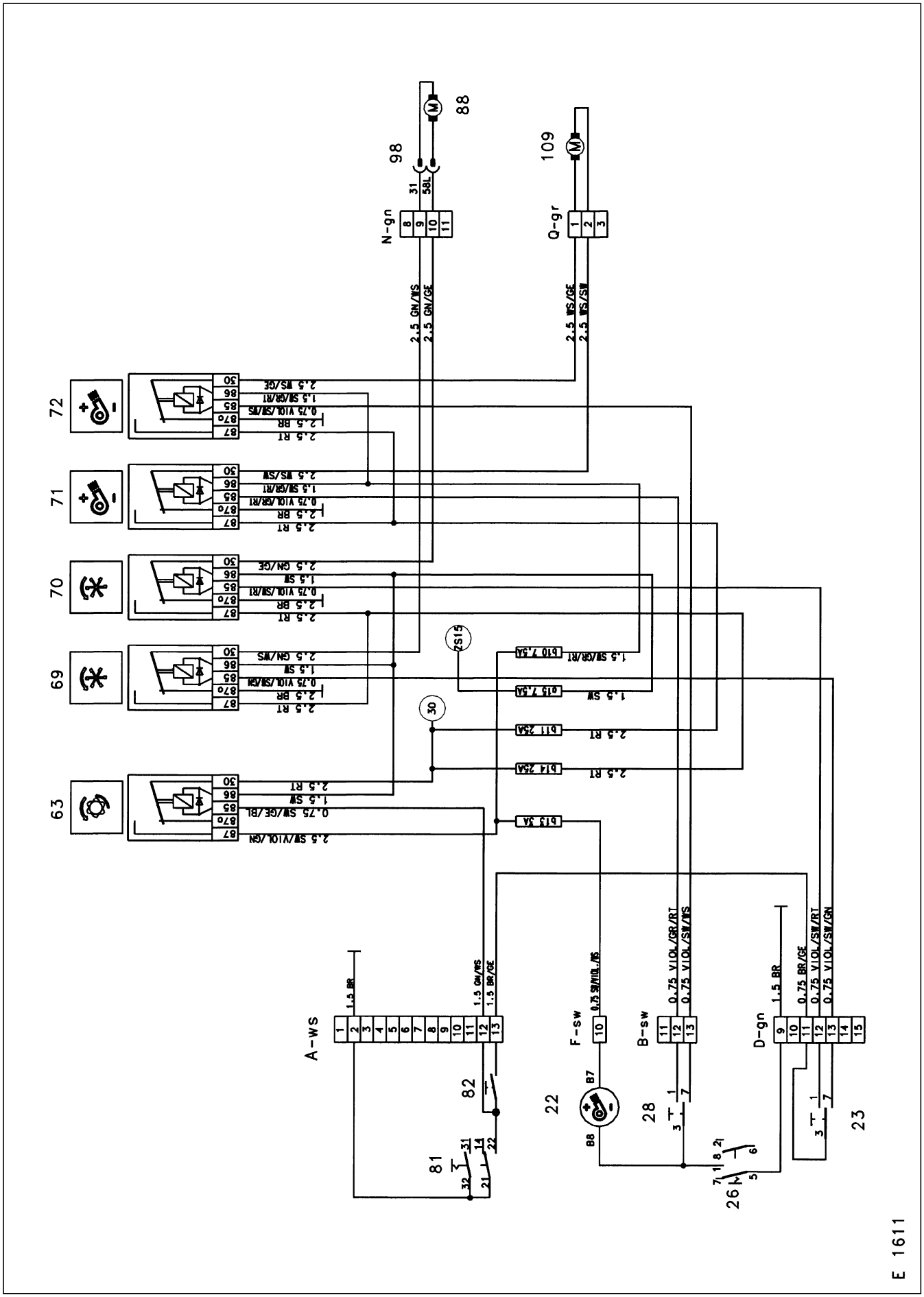
Cutterbar drive

– Plus from fuse a15 to solenoid 111 via relay 77, pole 30 – 87a.
– Turn on switches (81 and 82).
– Solenoid (111) is earthed from snap-on connection (BB) via switched (81 and 82).The cutterbar is switched on.

Climb-on protection

– Plus is switched from fuse (A-ws) to switch (193) and via de-energized relay (77) to relay (63) and solenoid (112).
– Relay (77), terminal 85 is earthed.
– If switch (193) is closed (a second person climbs onto the rear of the machine), plus is switched to relay (77), terminal 86. The relay latches. Plus to relay (63) and to solenoid (112) is interrupted. The threshing mechanism is switched off.
– The ignition must be switched off before the threshing mechanism can be switched on again.
– If the grain tank unloading auger is operating, it will also be switched off if switch (193) is closed.

Reel and fan speed adjustment



Key

22 – Indicator light unit B
23 – Switch – reel speed adjustment
26 – Selector switch – speed display
28 – Switch – fan speed adjustment
63 – Threshing mechanism relay
69 – Reel speed adjustment relay
70 – Reel speed adjustment relay
71 – Fan speed adjustment relay
72 – Fan speed adjustment relay
81 – Treshing mechanism master switch
82 – Cutterbar master switch
88 – Reel speed adjustment motor
98 – Cutterbar socket
109 – Fan speed adjustment motor

FUNCTION

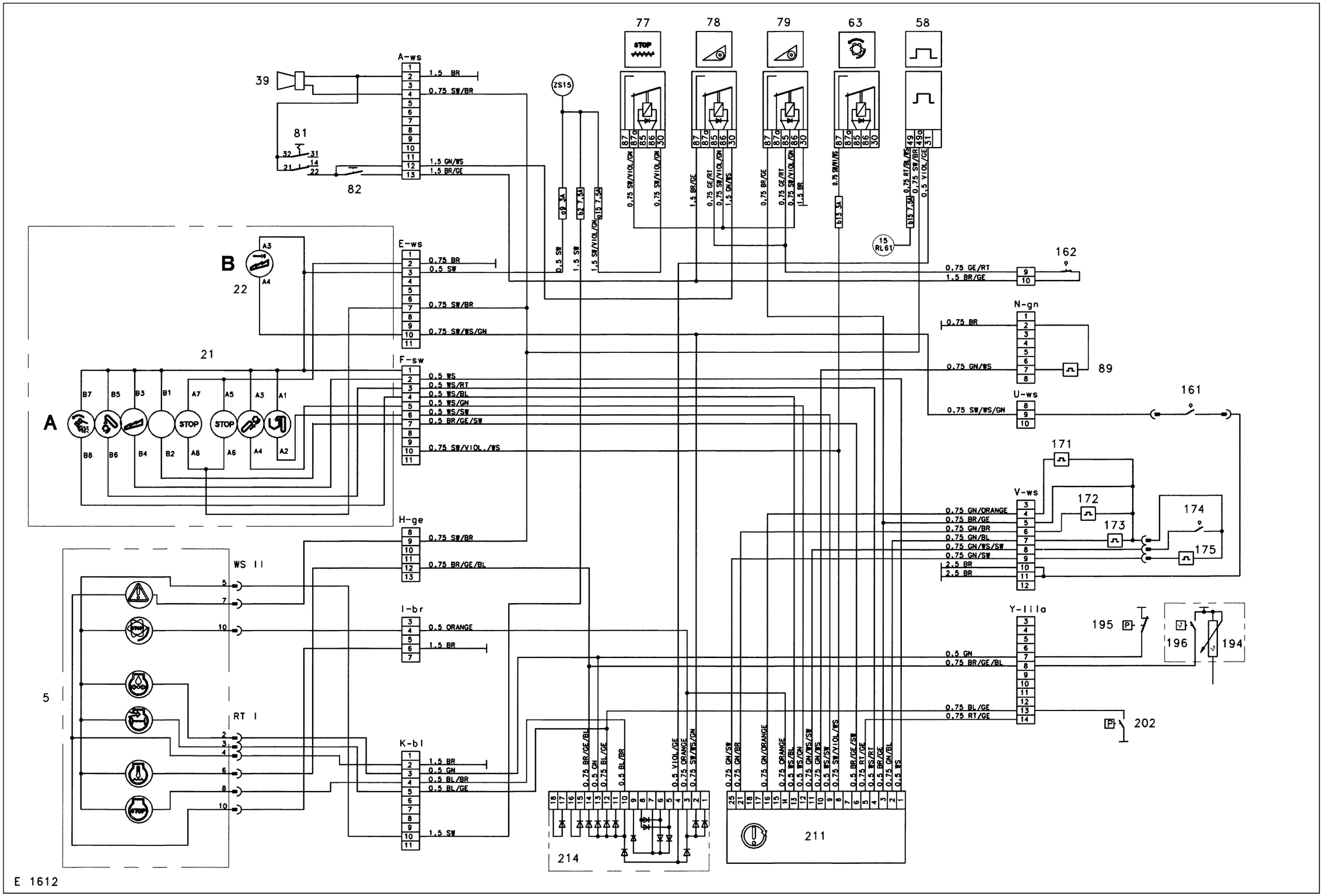
Reel speed adjustment

- Switch on switches (81 and 82). Switch (23) is earthed.
- Plus is switched from fuse (b14) to relays (69 and 70), terminals 87. Plus is also switched from fuse (a15) to relays (69 and 70), terminals 86.
- From terminal 87a of both relays (69 and 70), motor (88) is earthed via terminals 30.
- When switch (23) is switched from terminal 3 to 1, relay (70), terminal 85 is earthed. The switched relay (70) switches plus from terminal 87 via terminal 30 to the motor. The motor starts to run.
- If switch 23 is switched (closed) from pole 3 to pole 7, relay 69 is switched and the motor runs in the opposite direction.

Fan speed adjustment

- With the threshing mechanism engaged, plus is switched to relays (71 and 72), terminals 86, via switched relay (63) and fuse (b10).
- Plus is also switched from fuse (b11) to relay (71 and 72), terminals 87.
- From terminal 87a of both relays (71 and 72), motor (109) is earthed via terminals 30.
- The selector switch (26) for the speed indicator must be turned to the fan speed" position (from terminal 5 to terminal 1).
- When switch (28) is switched from terminal 3 to 1, relay (71), terminal 85 is earthed. The switched relay (71) switches plus from terminal 87 via terminal 30 to the motor. The motor starts to run.
- If switch (28) is switched in the other direction (from terminal 3 to terminal 7), relay (72) is switched and the motor runs in the opposite direction.

Functions monitor, air cleaner warning and straw build up warning (straw walkers)



Key

5 – Vehicle information unit
21 – Indicator lights A
22 – Indicator lights B
39 – Buzzer
58 – Pulse generator
63 – Relay – thresher
77 – Relay – grain tank unloading stop
78 – Relay – cutterbar off
79 – Relay – cutterbar off
81 – Master switch, thresher
82 – Master switch, cutterbar
89 – Magnetic pick-up, feeder housing (R = 1000 – 1200 Ω)
161 – Straw build up warning switch
162 – Foot switch – cutterbar immediate stop
171 – Magnetic pick-up, returns elevator (R = 1000 – 1200 Ω)
172 – Magnetic pick-up, clean grain elevator (R = 1000 – 1200 Ω)
173 – Magnetic pick-up, straw walkers (R = 1000 – 1200 Ω)
174 – Limit switch, straw chopper
175 – Magnetic pick-up, straw chopper (R = 1000 – 1200 Ω)
194 – Temperature gauge sender
195 – Oil pressure switch, engine
196 – Water temperature alarm switch
202 – Air cleaner warning contact switch (-50 mbar)
211 – Plug-in module – speed monitor
214 – Diode plate

FUNCTION

Switch on the ignition. From fuse (a9) positive is supplied to the indicator lamps in the operations display screen.

Switch on the master switch for the threshing mechanism (81). From the switched relay (63) terminals 30 and 87, positive is supplied via fuse (b13) to the shaft speed monitor module (211) on terminal (8).

Switch on the cutterbar master switch 82. Relays 78 and 79, terminals 85, are grounded via the closed switch 162. Pol 86 of both relays receive plus potential from fuse a15 via relay 77, poles 87-30. Relay 78 latches. Relay 79 connects ground potential to module 211 via pole 3 and the magnetic pick-ups of the returns elevator 171, clean grain elevator 172, straw walkers 173 and straw chopper 175. The magnetic pick-up on the feeder housing 89 is directly connected to ground.

Should one of the speeds drop, the alternating voltage from the respective pick-up will decrease. From the module (211) a negative signal is then supplied to the relative indicator lamp, which then glows. A negative signal from the module (211) terminal 14 is also supplied to the pulse generator (58) on terminal 31 via the diode plate (214, in 3 out 4).

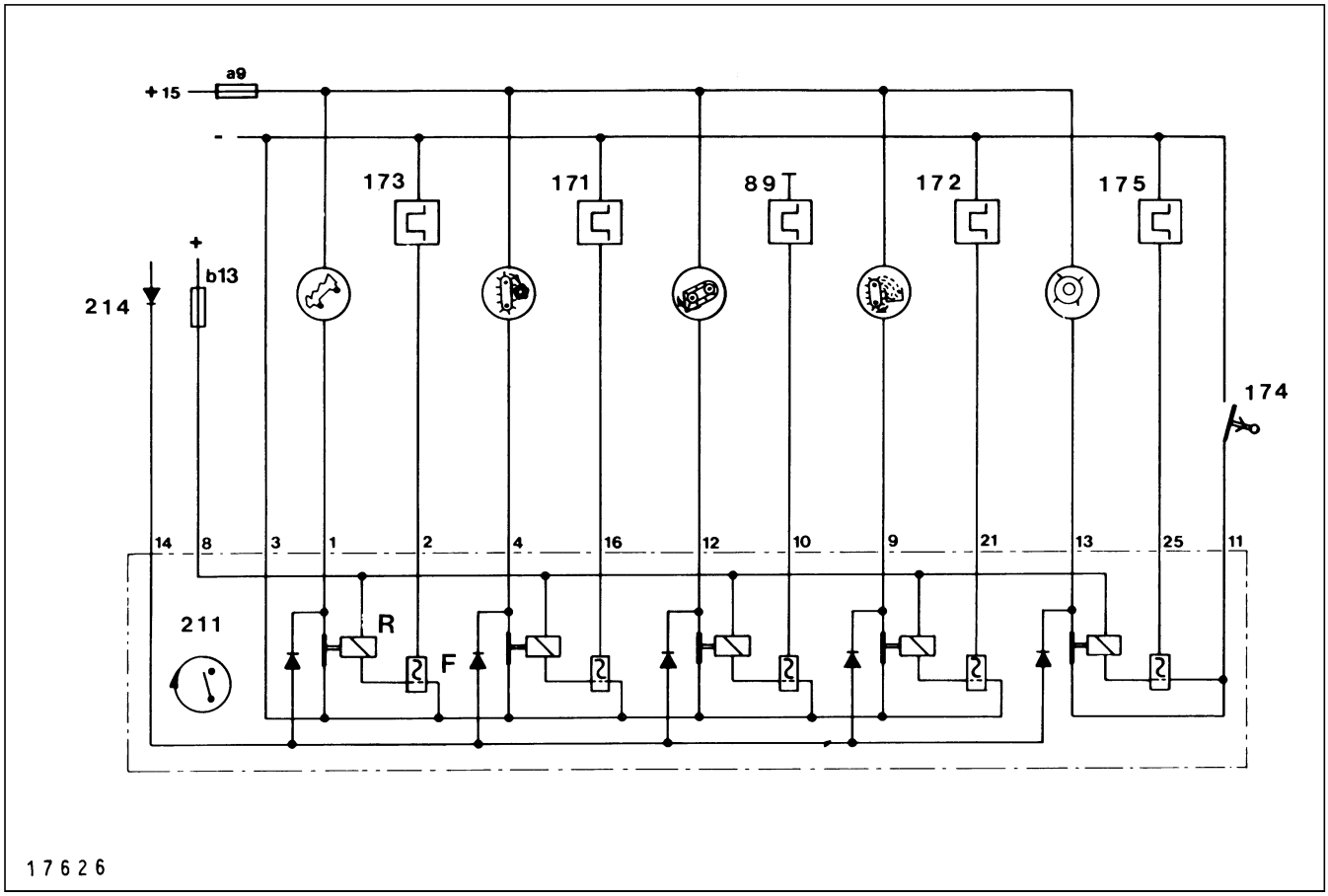
The pulse generator is supplied positive via fuse (b15) and relay (61) when the engine is running.

The pulse generator switches on the buzzer (39), the stop lamp in the operations display screen and the warning lamp in the vehicle information unit.

It the chopper is not used, then by tilting the chopper feed plate the chopper limit switch (174) is actuated (opened). The chopper monitor does not function.

Speed-loss plug-in module

	Rotational speed set point rpm	Switch operates at rpm
Straw walkers	220	174
Returns elevator	308	230
Clean grain elevator Mega 202-204 Mega 208-218	 380 450	 260 260
Feed rake Straw chopper with 2-cam-type wheel 4-cam-type wheel (maize)	520 3300 1920	385 2820 1410



Simplified function representation

Positive is supplied to the indicator lamp (e.g. straw walker). If the magnetic pick-up (e.g. 173 for walkers) produces no or insufficient frequency impulses, negative is not supplied between the frequency switch (F) and relay coil (R). The relay is not activated (position shown).

The relay switches negative to the indicator lamp. The lamp lights up. Simultaneously the negative is switched to the diode plate through the diode, thus also activating the general warning device.

If sufficient frequency impulses are produced by the magnetic pick-up, the frequency switch (F) connects the negative to the relay coil (R). The relay switches, negative is no longer connected to the indicator lamp. The indicator lamp is extinguished, the rotational speed is o.k.

PROBLEMS

When switching on the cutterbar the functions monitor is not connected.

The functions monitor is only switched on when the treshing mechanism and cutterbar are switched on.

- Check fuse (a9).
- Check switches (81) or (82) for continuity.
- Remove module (211). Check with a continuity tester that negative is being switched from switches (81 and 82) to terminal 3.
- Replace module by new one.

All indicator lamps are illuminated despite full engine rpm (straw chopper lamp, with straw chopper switches on).

- Check fuse (b13).
- Check engine speed.

With engine under full load individual lamps light up.

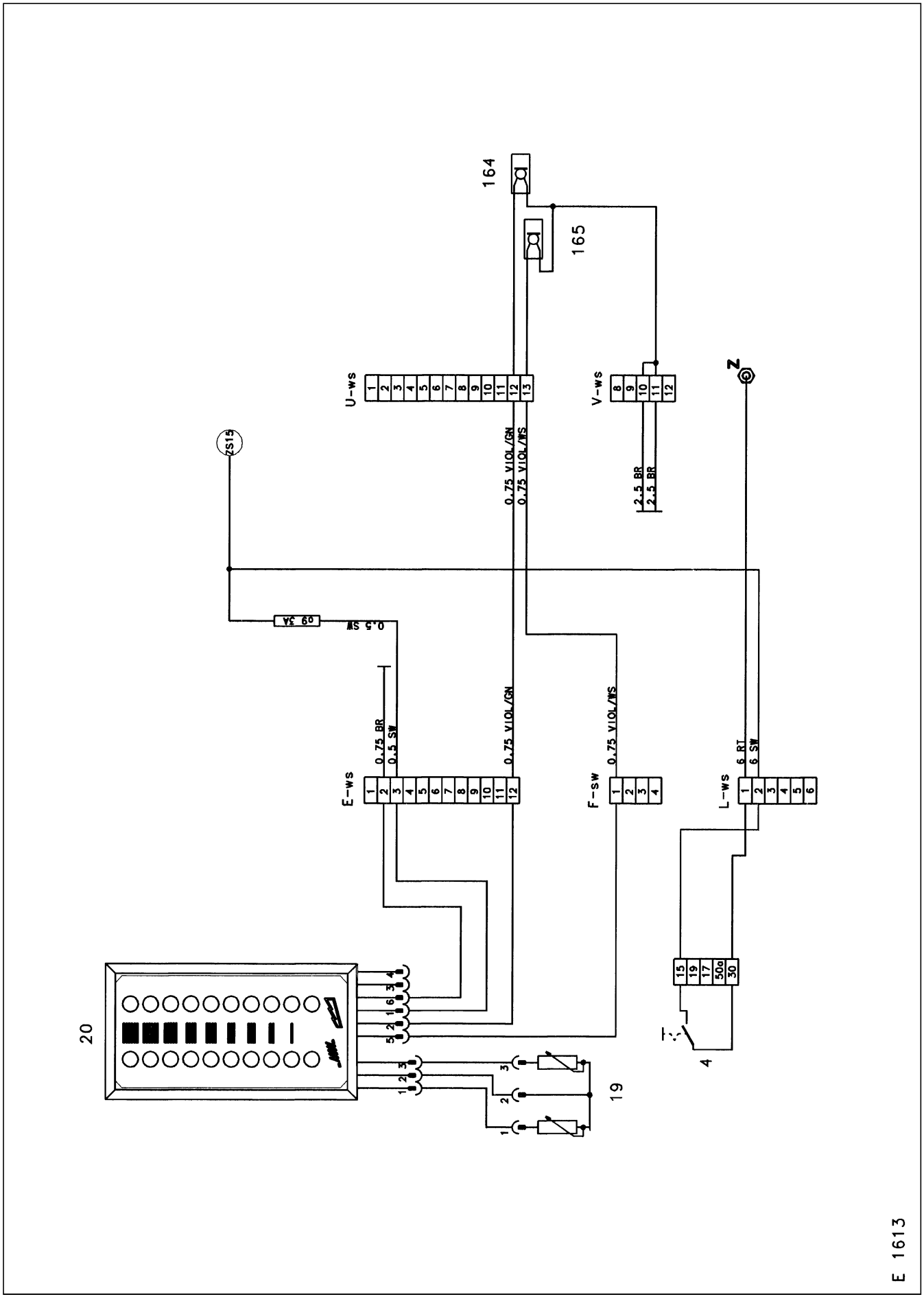
- Check individual unit drives.
- Check spacing between magnetic pick-up and cam wheels (set point value = 1 ± 0,5 mm).
- Check the cable in connector V-ws (white) for continuity.
- Exchange the module (211).

The lamps in the operations display screen are illuminated; buzzer, stop lamp and warning lamp in the vehicle information are not functioning.

NOTE! Buzzer, stop lamp and warning lamp only function with the diesel engine running (alternator relay 61 switched).

- Check pulse generator (58).
- Check diodes on the diode plate (214) for continuity:

Note: Buzzer, stop lamp and warning light are connected to the following circuits:
Speed-loss monitor circuit
Oil pressure circuit
Air cleaner circuit
Cooling water temperature monitoring circuit
Rear hood monitoring circuit
Automatic engine cut-off switch


164
165
U-ws
V-ws
Z
ZS15
0.75 VIOL/GN
0.75 VIOL/WS
2.5 BR
2.5 BR
0.5 SW
0.75 BR
0.5 SW
0.75 VIOL/GN
0.75 VIOL/WS
6 RT
6 SW
E-ws
F-sw
L-ws
15
19
17
50a
30
20
19
4
E 1613

Key

4 – Ignition switch
19 – Potentiometer, sensitivity selector – performance monitor (22 kΩ)
20 – Combine performance monitor
164 – Sensor panel, straw walkers, with selector switch
165 – Sensor panel, sieve pan, with selector switch

FUNCTION

A piezocrystal plate is cemented to the underside of the sensor panel and connected to an electric amplifier. A 3step switch on the amplifier allows the sensitivity to be adjusted to suit the type of crop. If crop falls onto the sensor panel, the crystals are moved by the vibrations and the vibrations are converted into a voltage. This voltage is amplified by the amplifier. Small vibrations caused by pieces of straw are filtered out.

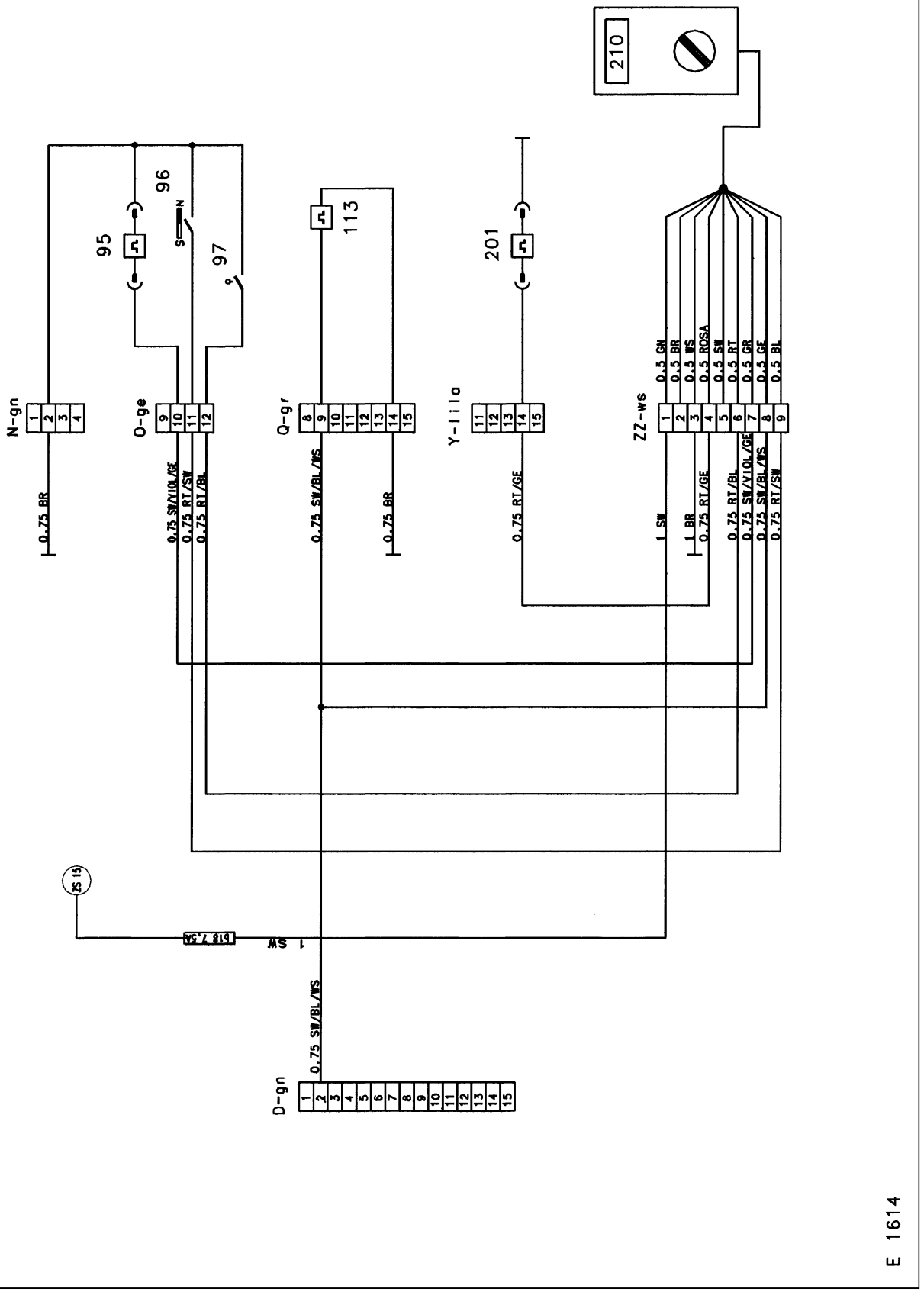
MALFUNCTION

The display unit has no display. When the ignition is switched on, the appropriate lower lamp of the light band comes on. The lamp may, however go out again.

- Check fuse (a9).
- Check the plug connections as per wiring diagram.
- Check that the cable connections to the sensor are tight.
- Rub the corresponding sensor with a screw driver or similar tool: The lamps of the display must light up.
- If the lamps do not light up, pull the cable from the sensor and rub it against ground. If the lamps light up now, the sensor is defective.
- If the lamps still do not light up, connect an additional cable directly to the display unit and rub it against ground. White cable = Sieve pan, green cable = Straw walkers. If the lamps still do not light up, replace the display unit.

The display unit shows incorrect values

- Check whether the sensor is soiled with green crop.
- Check whether the switch on the sensor is set to the correct step.
- Check whether the sensor can oscillate freely in the rubberized metal blocks.
- Check whether the cable under the sensor is loose in its guide (must not flap).
- Replace the sensor.

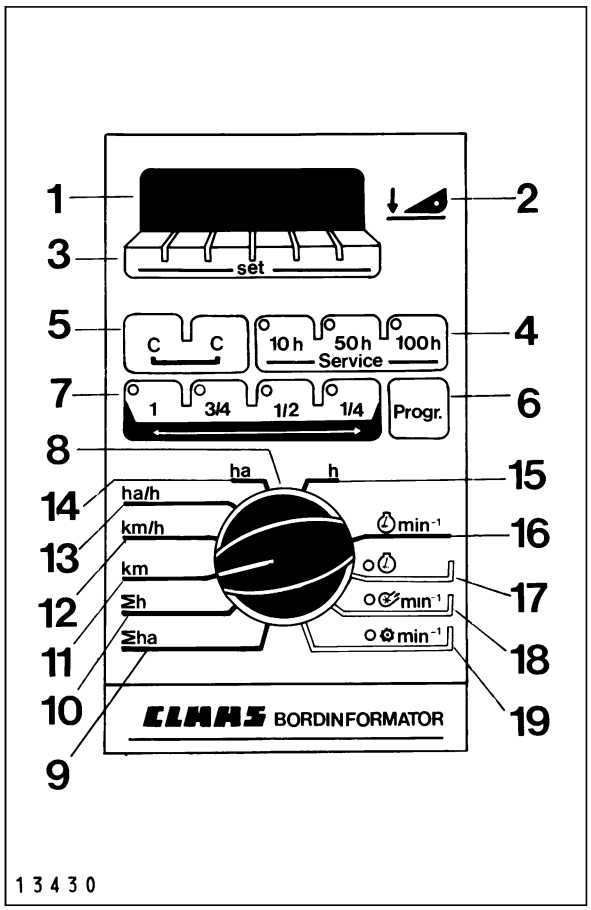

210
95
96
97
113
201
N-gn
O-ge
Q-gr
Y-lila
ZZ-ws
0.75 BR
0.75 SW/VIOL/GE
0.75 RT/SW
0.75 RT/BL
0.75 SW/BL/WS
0.75 BR
0.75 RT/GE
1 SW
1 BR
0.75 RT/GE
0.75 RT/BL
0.75 SW/VIOL/GE
0.75 SW/BL/WS
0.75 RT/SW
0.5 GN
0.5 BR
0.5 WS
0.5 ROSA
0.5 SW
0.5 RT
0.5 GR
0.5 GE
0.5 BL
D-gn
E 1614

Key

95 – Magnetic pick-up, fan speed
(Resistance = 1000 – 1200 Ω)
96 – Reed contact switch, ground speed
97 – Limit switch
(pull switch on feeder housing)
113 – Drum speed magnetic pick-up
(Resistance = 1000 – 1200 Ω)
201 – Engine speed magnetic pick-up
(Resistance = 1000 – 1200 Ω)
210 – Fieldwork computer

1 – Digital display
2 – Light indicating operating position
3 – 'Set' keys for machine constants
4 – Key with light, indicating service intervall
5 – 'Clear' keys
6 – Programming keys
7 – Keys with light, indicating cutter bar width
8 – Rotary switch function
9 – Total area harvested (ha)
10 – Total working hours
11 – km covered
12 – Ground speed (km/h)
13 – Rate of work (ha/h)
14 – Area harvested (ha)
15 – Working hours
16 – Engine rpm
17 – Engine loading
18 – Fan rpm and cracker rpm, respectively
19 – Threshing drum rpm and cutting cylinder rpm, respectively

IMPORTANT! For programming and operation please refer to the instruction manual.



Settings

Reed contact switch (96) (ground speed)

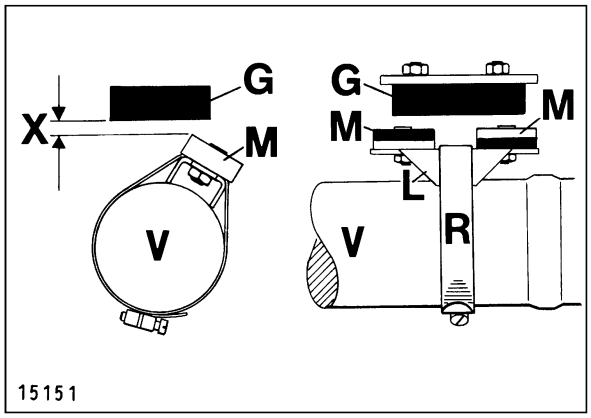
Install magnets (M) and the reed contact switch (G) according to drawing.

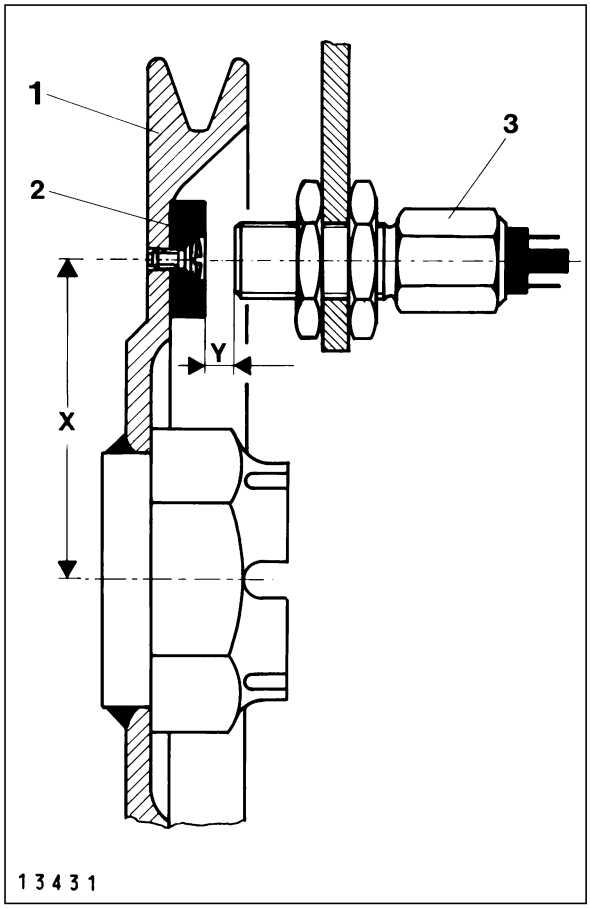
Width across corners (X) must be 3 ± 2 mm.

Magnets must be fastened with brass screws and mounted so that their poles face opposite directions.

Pull switch (97)

Lower the cutterbar until there is a distance of about 400 mm to the ground. Pull the actuating pin of the pull switch all the way out and attach the chain so that the pin is maintained in this position.





Magnetic pick-up 201 (engine rpm)

1 – V-belt pulley
2 – Magnet
3 – Magnetic pick-up

Dimension X = 67 mm
Dimension Y = 6 ± 2 mm

IMPORTANT! The magnet must be fastened with a brass screw.

Magnetic pick-up 95 (fan speed)

Correct spacing between cams and magnetic pick-up is 1 ± 0,1 mm

Magnetic pick-up 113 (threshing drum speed)

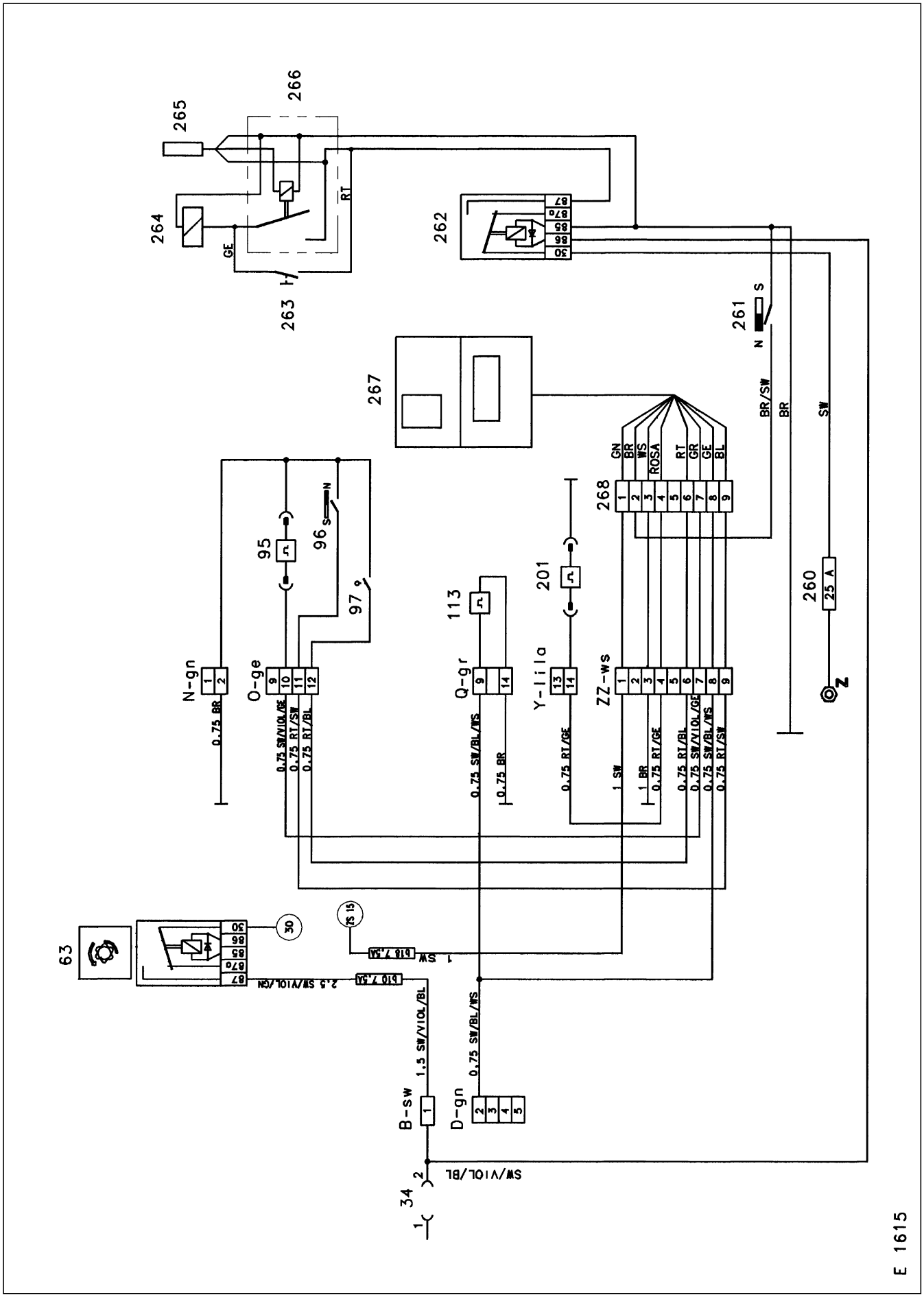
Correct spacing between cams and magnetic pick-up is 2 ± 1 mm

Operational check

- Connect the fieldwork computer.
- Switch on the ignition. The indicator lamps in the fieldwork computer and the beeper of the computer come on briefly.
- Program the fieldwork computer (see operator's manual).
- Lower the feeder housing, the green indicator light "cutterbar" comes on.
- Start the engine, lift the feeder housing. The green indicator light "cutterbar" goes out.
- Check the engine rpm display. To do this run the engine at max. speed – no load. For correct engine rpm please refer to the operator's manual. If deviation exceeds the permissable rate, check for correct spacing of magnetic pick-up at engine output pulley.
- Check km display. To do this set the selection switch to "kilometre". Drive the machine and compare the distance travelled with the km display. If deviation exceeds the permissable rate –
  a) Check magnetic and reed switch.
  b) Determine and enter new distance factor – see operator's manual.

PROBLEMS

Fieldwork indicator lamps do not light up when the ignition is switched on.	– Check fuse (b18). – Check wires on connectors as per wiring diagram.
Engine rpm not shown or reading shown too high.	– Check actual engine rpm using tachometer. – Check for 6 ± 2 mm spacing between magnetic pick-up and magnet. – Check mounting screws of magnet – must be brass. – Check wires and wire connections as per wiring diagram. – Check magnetic pick-up with Ohm-tester (1000 – 1200 Ohm)
The area harvested, the rate of work and the total area harvested are not displayed or incorrectly displayed.	– Front attachment width not properly entered. – Check setting of chain-operated pull-switch. – Check reed switch and magnet on intermediate shaft (see drawing). – Check mounting screw of magnet – must be brass. – Check wiring connections as per wiring diagram.
Km covered and ground speed not displayed or incorrectly displayed.	– Check reed switch and magnet on intermediate shaft (see drawing). – Check wiring connections as per wiring diagram.
Digital reading deviations when operating at high speeds (e.g. 18 ± 1 km/h)	– This reading is o.k. The accuracy of rad-out is set for lower ground speeds.
Working hours and total working hours not displayed or incorrectly displayed.	**NOTE!** Hours are only shown with threshing drum engaged. – Check setting of threshing drum magnetic pick-up (2 ± 1 mm). – Check magnetic pick-up with Ohm-tester (1000 – 1200 Ohm). – Check wiring connections as per wiring diagramm.
LEDs of fan rpm, threshing drum rpm and engine loading will not light up.	**NOTE!** The LEDs only light up when the drives are engaged and the front attachment is lowered. – rpm of individual units are not entered at all or incorrectly entered (see operator's manual). – Belt slip (1 – 3 %) and operational rpm (5 %) not entered at all or incorrectly entered.


265
266
264
263
262
261
267
268
95
96
97
113
201
260
25 A
63
34
N-gn
O-ge
Q-gr
Y-lila
ZZ-ws
B-sw
D-gn
GN
BR
WS
ROSA
RT
GR
GE
BL
BR/SW
BR
SW
0.75 BR
0.75 SW/VIOL/GE
0.75 RT/SW
0.75 RT/BL
0.75 SW/BL/WS
0.75 RT/GE
1 SW
1 BR
0.75 SW/VIOL/GE
0.75 SW/BL/WS
1.5 SW/VIOL/BL
2.5 SW/VIOL/GN
E 1615

Key

34 – Attachment connection
63 – Threshing mechanism relay
95 – Alternator/fan
(R = 1000 – 1200 Ω)
96 – Reed contact switch – ground travel speed
97 – Pull switch – feeder housing
113 – Drum speed generator
(R = 1000 – 1200 Ω)
201 – Engine speed generator
(R = 1000 – 1200 Ω)
260 – Fuse 25 A
261 – Reed contact switch
262 – Relay
263 – Switch
264 – Electromagnetic clutch
265 – Filling height sensor
266 – Electronics
267 – UNI-Control unit
268 – Cable extension
269 – Cable extension

Setting of reed contact switch (261)

Distance between reed contact switch and magnets on drive sprocket = 4 – 6 mm

Setting of filling height sensor (265)

Installation depth = 25 mm (face of sensor – elevator head plate).

Switch (263)

The filling height sensor always maintains a given amount of grain above the vane wheel. As soon as the grain covers the face of the sensor, the sensor trips the electro-magnetic clutch. The vane wheel is driven, the sensor is uncovered again and the electro-magnetic clutch is disengaged again.

The sensitivity of the sensor is variable.

– Switch on ignition and theshing mechanism.
– The setting is correct when placing your finger 13 – 15 mm in front of the face of the sensor trips the electro-magnetic clutch (LED in sensor comes on).

Adjustment = Remove the black plastic screw and adjust the uncovered brass screw.

Turning the screw to the right increases the sensitivity of the sensor.

For yield measurement, switch (263) must be OFF.

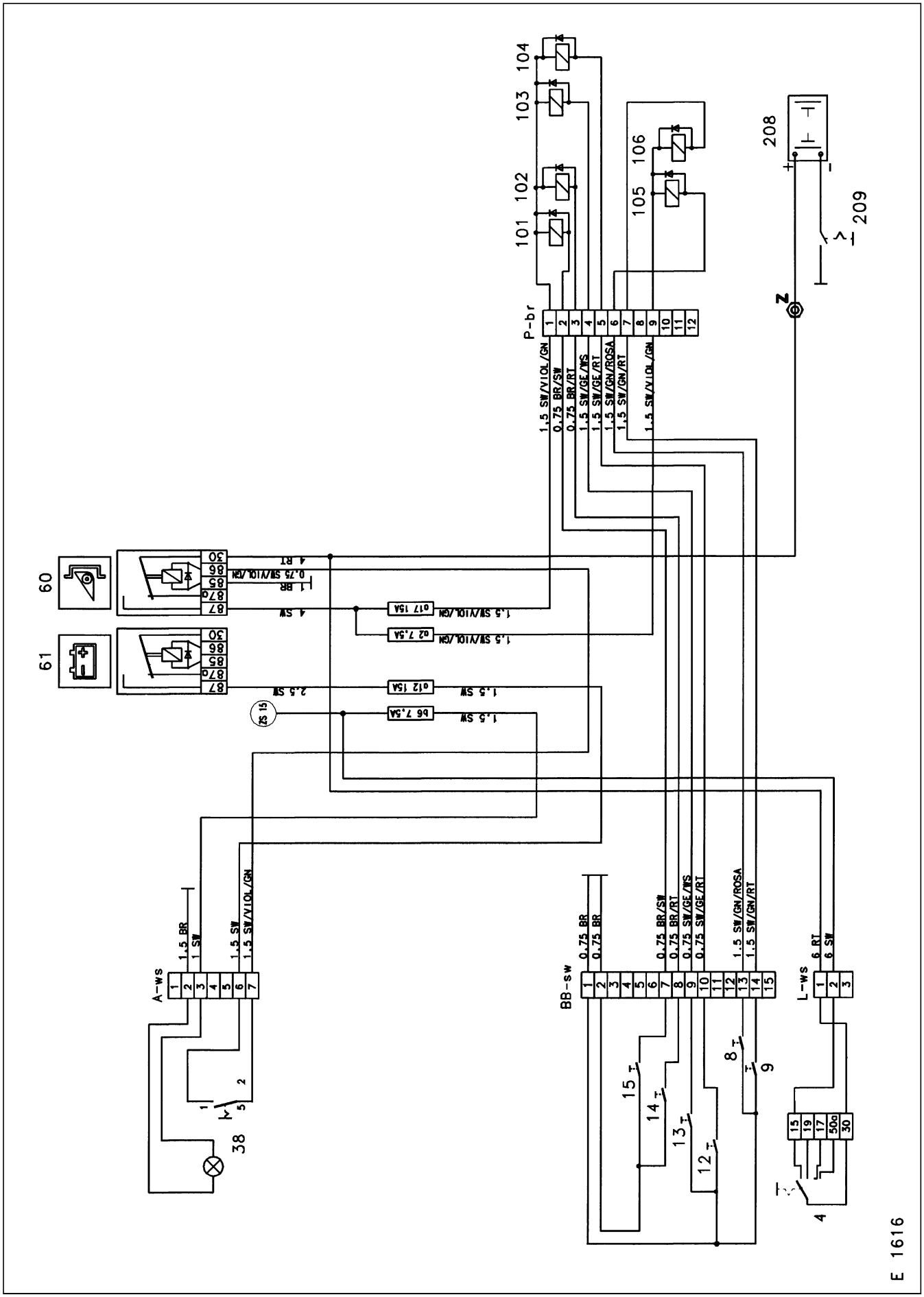
Turning on the switch automatically engages the electro-magnetic clutch, e.g. the elevator head is to be emptied or for threshing without yield measurement.

Further adjustments = see fieldwork computer

11

Electrics

Cutterbar raise/lower, reel raise/lower, reel forward/backward



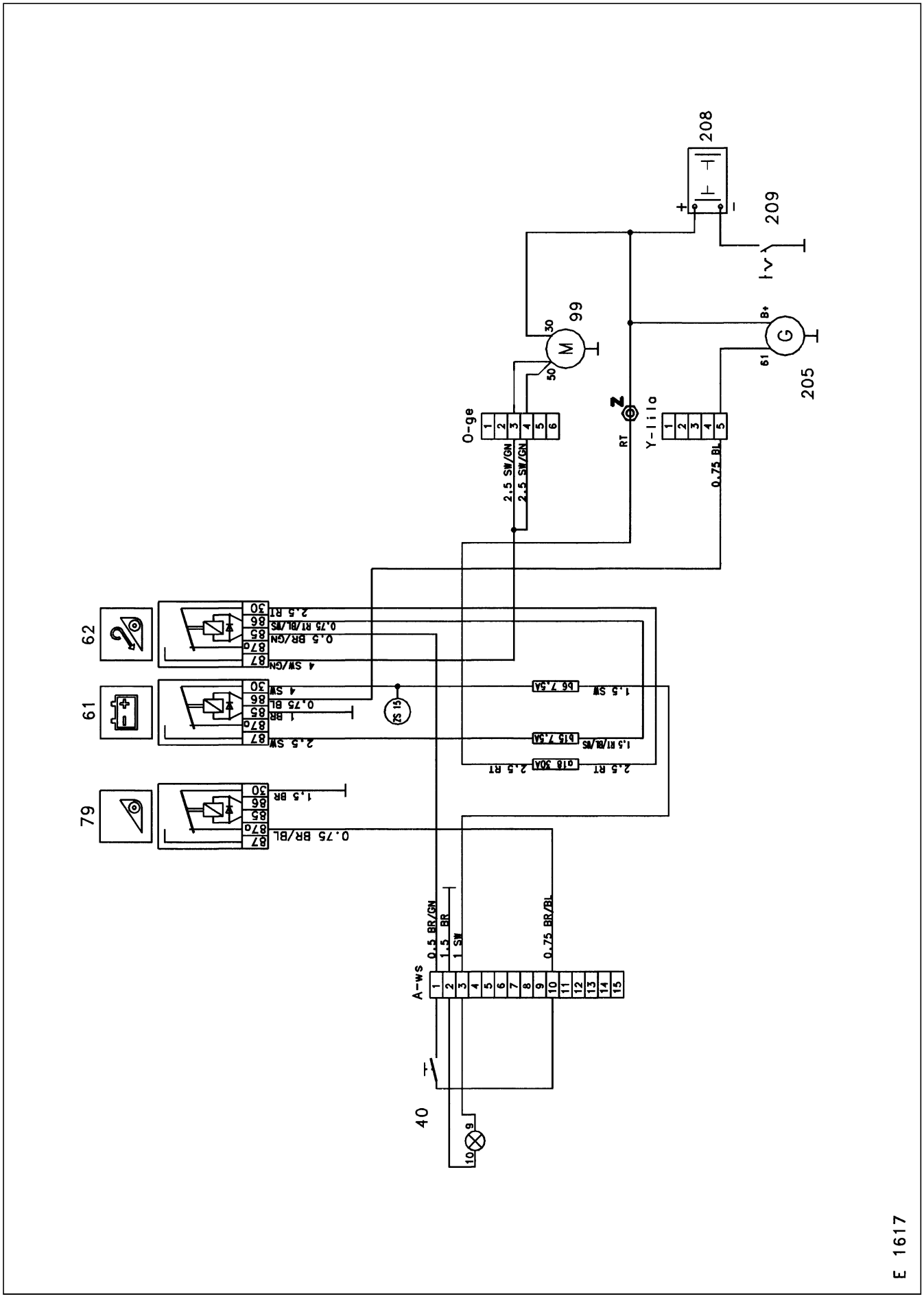
Key

4 – Ignition switch
8 – Switch, reel forward
9 – Switch, reel backward
12 – Switch, reel down
13 – Switch, reel up
14 – Switch, cutterbar down
15 – Switch, cutterbar up
38 – Master switch, lift hydraulic system (red)
60 – Master relay – cutterbar
61 – Relay – alternator
101 – Solenoid valve, front attachment – raise (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,6 Ω)
102 – Solenoid valve, front attachment – lower (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,6 Ω)
103 – Solenoid valve, reel – raise (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,6 Ω)
104 – Solenoid valve, reel – lower (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,6 Ω)
105 – Solenoid valve, reel – forward (12 V, 4,5 A, 60 % continuous rated, coil resistance = 2,7 Ω)
106 – Solenoid valve, reel – backward (12 V, 4, 5A, 60 % continuous rated, coil resistance = 2,7 Ω)
208 – Battery
209 – Battery isolating switch

FUNCTION

– Turn on ignition and switch (38). Power is switched from relay (61) via fuse (a12), switch (38) to relay (60), terminal 86. Relay (60) switches positive from terminal 87 via fuse (a17) to solenoids 101, 102, 103, 104 and via fuse (a2) to solenoids 105 and 106.

  Ground potential is connected to the corresponding solenoid when one of the switches 8, 9, 12, 13, 14 or 15 is operated.


208
209
205
99
M
G
B+
30
50
61
O-ge
Y-lila
RT
2.5 SW/GN
2.5 SW/GN
0.75 BL
62
61
79
40
A-ws
0.5 BR/GN
1.5 BR
1 SW
0.75 BR/BL
1.5 SW
1.5 RT/BL/WS
2.5 RT
2.5 RT
4 SW/GN
2.5 SW
1 BR
1.5 BR
0.75 BR/BL
E 1617

Key

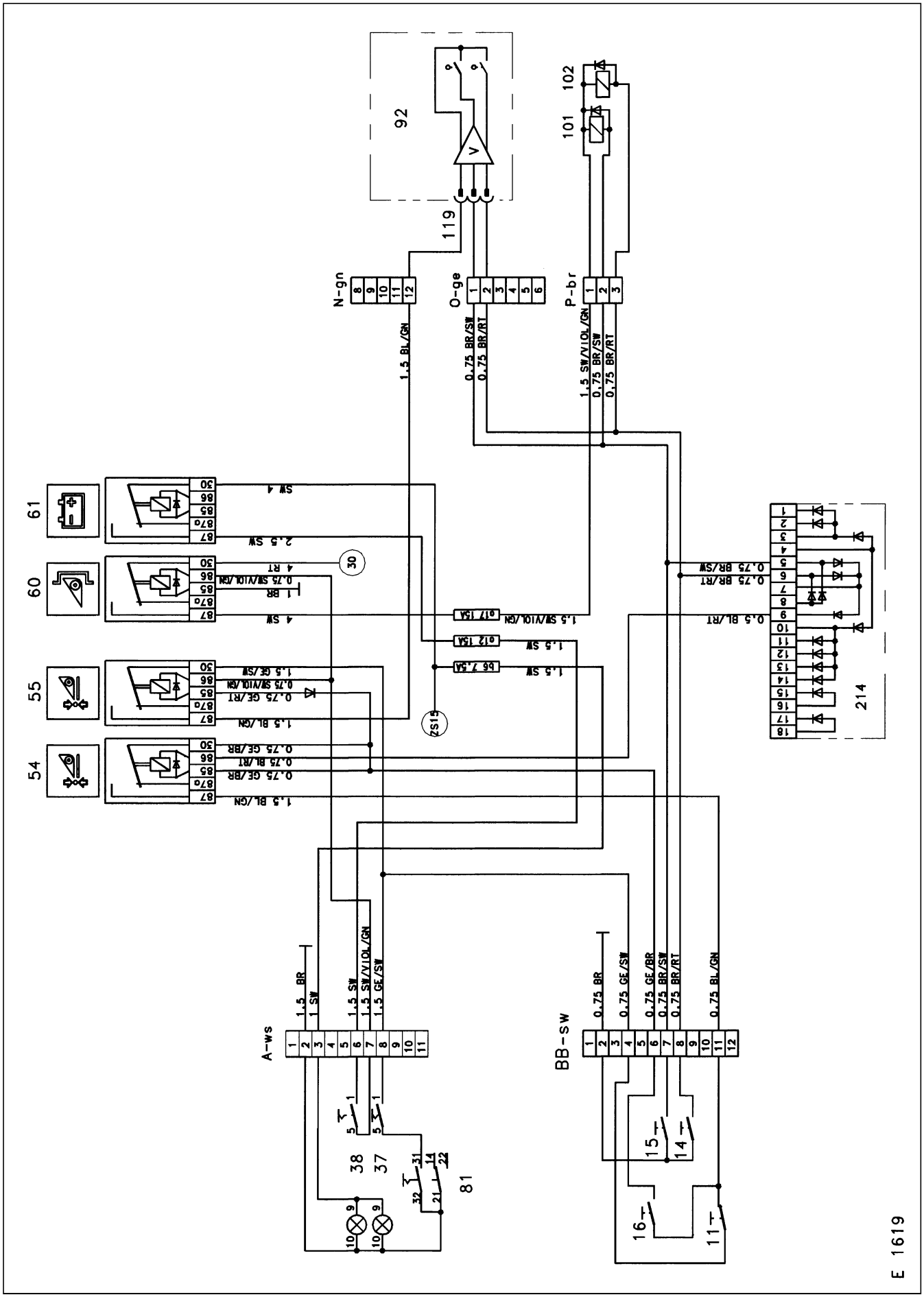
40 – Switch, cutterbar reverser
61 – Relay – alternator
62 – Relay – reverser
79 – Relay, cutterbar off
82 – Master switch, cutterbar
99 – Reverser motor
205 – Alternator
208 – Battery
209 – Battery isolating switch

FUNCTION

IMPORTANT! The cutterbar reverser only operates when the engine is running and the cutterbar is disengaged. Relay 79 is deenergized.

- Positive is supplied from relay (61) via fuse (b15) to relay (62), terminal 86.
- Positive is supplied to terminal 30 of relay (62) via fuse (a18).
- Switch (40) is grounded via relay 79, pole 30-87a.
- By depressing switch (40), negative is supplied to relay (62) terminal 85, which is then switched. From relay (62) positive is supplied to the reversing motor (99). The whole cutterbar then reverses.

  Caution: Only reverse for a short period (5 sec. approx.) otherwise the motor will be overloaded.


92
102
101
119
N-gn
O-ge
P-br
1.5 BL/GN
0.75 BR/SW
0.75 BR/RT
1.5 SW/VIOL/GN
61
60
55
54
214
A-ws
BB-sw
38
37
81
15
14
16
11
E 1619

Key

11 – Switch, cutterbar pre-set height on
14 – Switch, lower cutterbar
15 – Switch, raise cutterbar
16 – Switch, ground pressure control
37 – Master switch, Contour System
38 – Master switch (red)
54 – Relay – Contour System
55 – Relay – Contour System
60 – Master relay – cutterbar
61 – Relay – alternator
81 – Master switch, thresher
92 – Switch, ground pressure sender
101 – Solenoid valve, front attachment – raise (12 V, 3,3 A, 60 % continuous rated, coil resistance = 3,6 Ω)
102 – Solenoid valve, front attachment – lower (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,6 Ω)
119 – Connection for switch – Contour System
214 – Diode plate

FUNCTION

Ground pressure control (cutterbar raised)

– Switch on diesel engine.
– Turn on switches (81), (37) and (38).
– Positive from the fuse (a12) is supplied through switch (38) to the relays (55) and (60). Relay (60) supplies positive to the solenoids (101) and (102) through the fuse (a17). Power is supplied through the windings of solenoid (102) and via the diode plate, here power flow is from terminals 6 to 9, and to terminal 86 on relay (54).
– Ground potential is connected via switch 81 and switch 37 to relay 55, pole 30. Switch 11 is also grounded at the same time.
– The ground pressure switch (92s) is closed.
– Press switch (16) once. Earth (negative) is switched to relay (54), terminals 30 and 85 and to relay (55), terminal 85.
– Both relays switch from 30 to 87 and latch (ground potential from switch 11 to relay 54, pole 87 to 30 to poles 85 of both relays).
– From relay (55), terminal 87, earth is supplied through switch (92s) to the lowering solenoid (102). The cutterbar lowers.
– When the pre-set ground pressure is reached, switch (92s) opens and solenoid (102) is deenergized.
– In undulating conditions, either switch 92s or switch 92h energize solenoid 102 or solenoid 101 to allow the cutterbar to follow ground contours.

NOTE! Switches 14 and 15 must be held down in manual control.

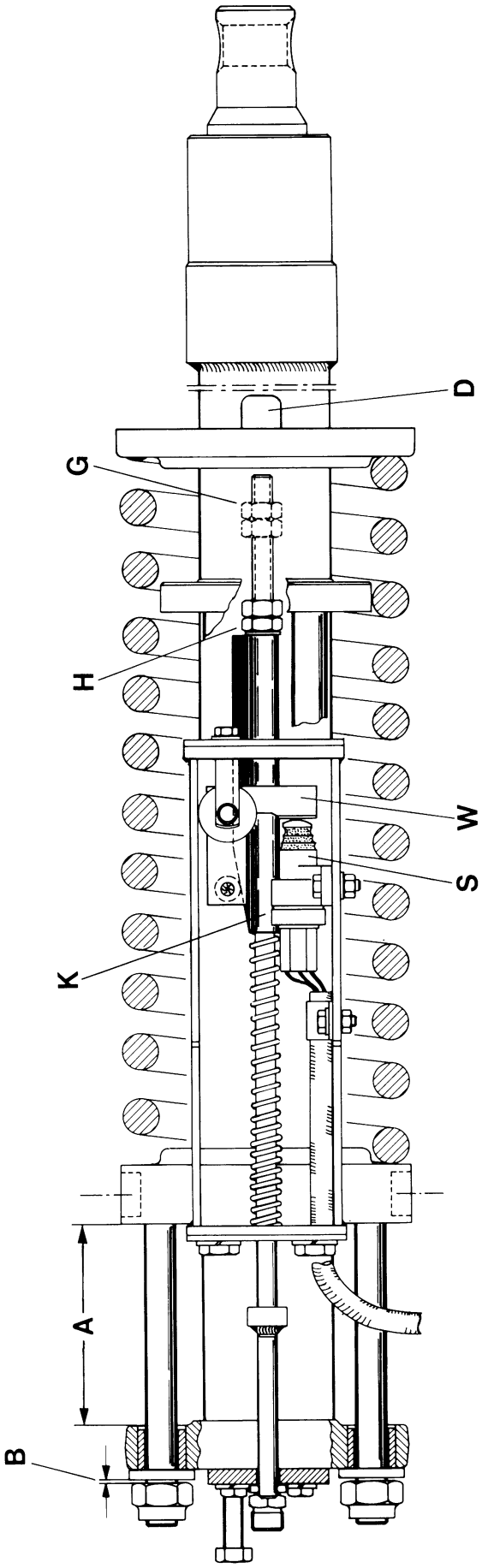
Cutting height control is deactivated when switches 14 and 15 are operated in this mode. If switch 15 is operated, for example, the cutterbar is raised. Switch 92s closes. Both solenoids 101 and 102 are briefly energized. This interrupts the plus potential to relay 54, pole 86 and the relay no longer latches.

Switching from ground pressure control to pre-set cutterbar height

– Briefly operate switch 11. Relays 54 and 55 no longer latch (switch 11 breaks, relay 54, pole 87 is without ground potential).

  The remainder of the circuitry is as described for the circuit diagram for pre-set cutterbar height.

Cutterbar cylinder



13928

Key

A – Spring travel, approx. 100 mm
B – Clearance, approx. 5 mm
D – Spring pressure adjusting screws – cutterbar cylinders
G – Position shown for low ground pressure
H – Position shown for high ground pressure
K – Actuating cam
S – UP and DOWN sender switch
W – Pivot

Setting

– Set the drop rate restrictor at the 3/3 directional solenoid valve so that the cutterbar drops to the ground from the fully raised position within approx. 5 – 6 seconds. The oil must be at operating temperature.

– Raise the cutterbar so that the skids clear the ground by approx. 100 mm.

– Pre-load the cutterbar springs in accordance with the drawing, using screws (D) to produce a clearance (B) of approx. 5 mm between the washers and the cylinder stop plates. At the same time check full length of spring travel (A, apporox. 100 mm).

– Raise the cutterbar by hand and let it go again – the cutterbar must drop to approx. 100 mm above the ground. If not, possible points of frictional resistance must be overcome by lubricating (e.g. feed rake housing pivoting brackets, guide rods in the cylinder stop plates).

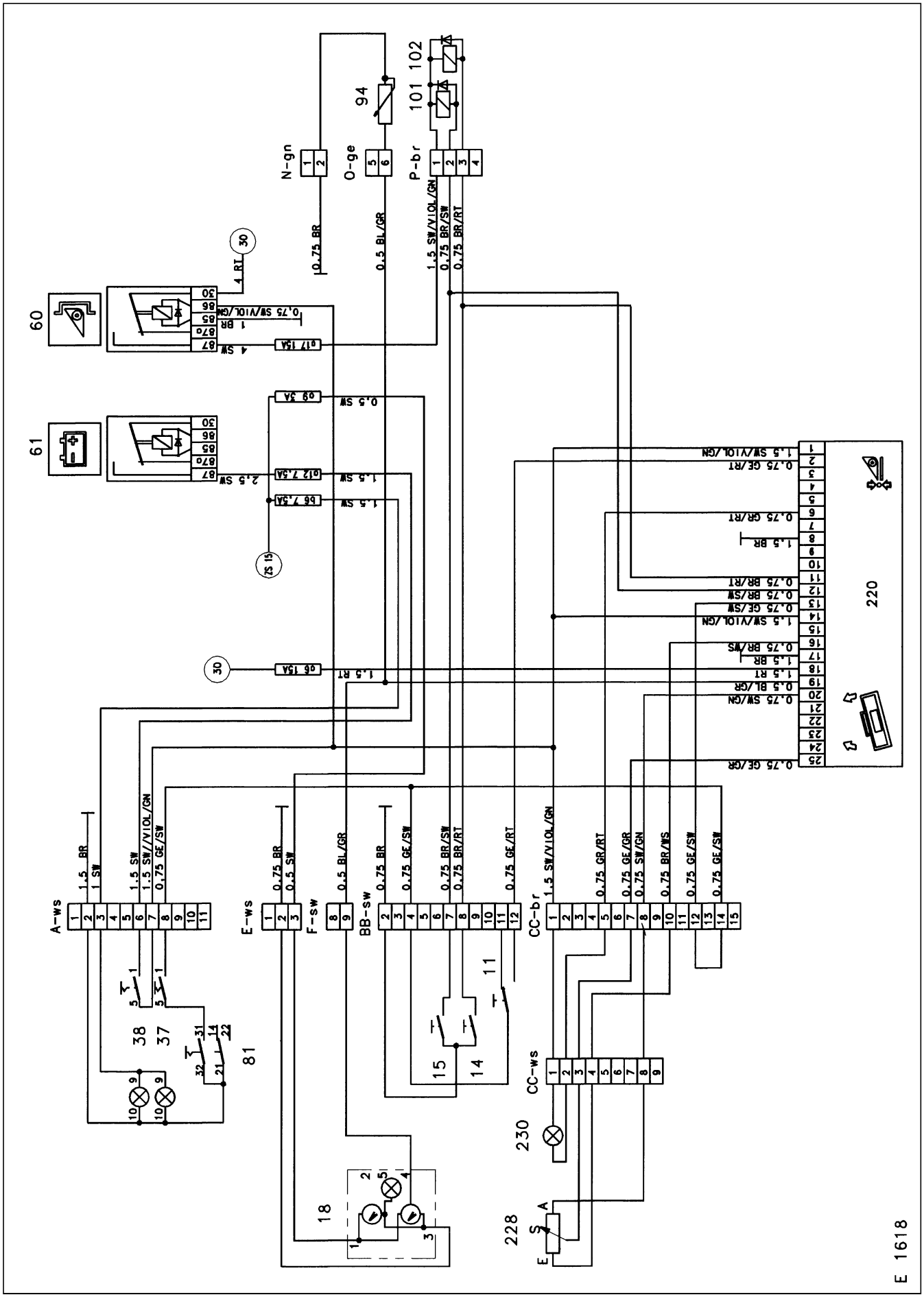
– Start the engine. Engage threshing mechanism and cutterbar. Operate the cutterbar UP/DOWN master safety switch and the Contour System rocker switch. Press push button for automatic ground pressure control once – the cutterbar must now lower to the predetermined ground pressure setting.

  If the cutterbar will not lower to the desired ground pressure setting, readjust actuating cam (K) by tightening nuts (H – G) as required.

  Danger! Beware of personal injury: Always set the cutterbar ram safety lock by lowering it over the piston of the cutterbar cylinder before carrying out adjustments.

– With the automatic ground pressure control switched on it must be possible to lift the cutterbar at the dividers. When lifting the cutterbar, it must be felt that the hydraulic system actuates the cutterbar cylinders accordingly.

Pre-set cutterbar height without CAC



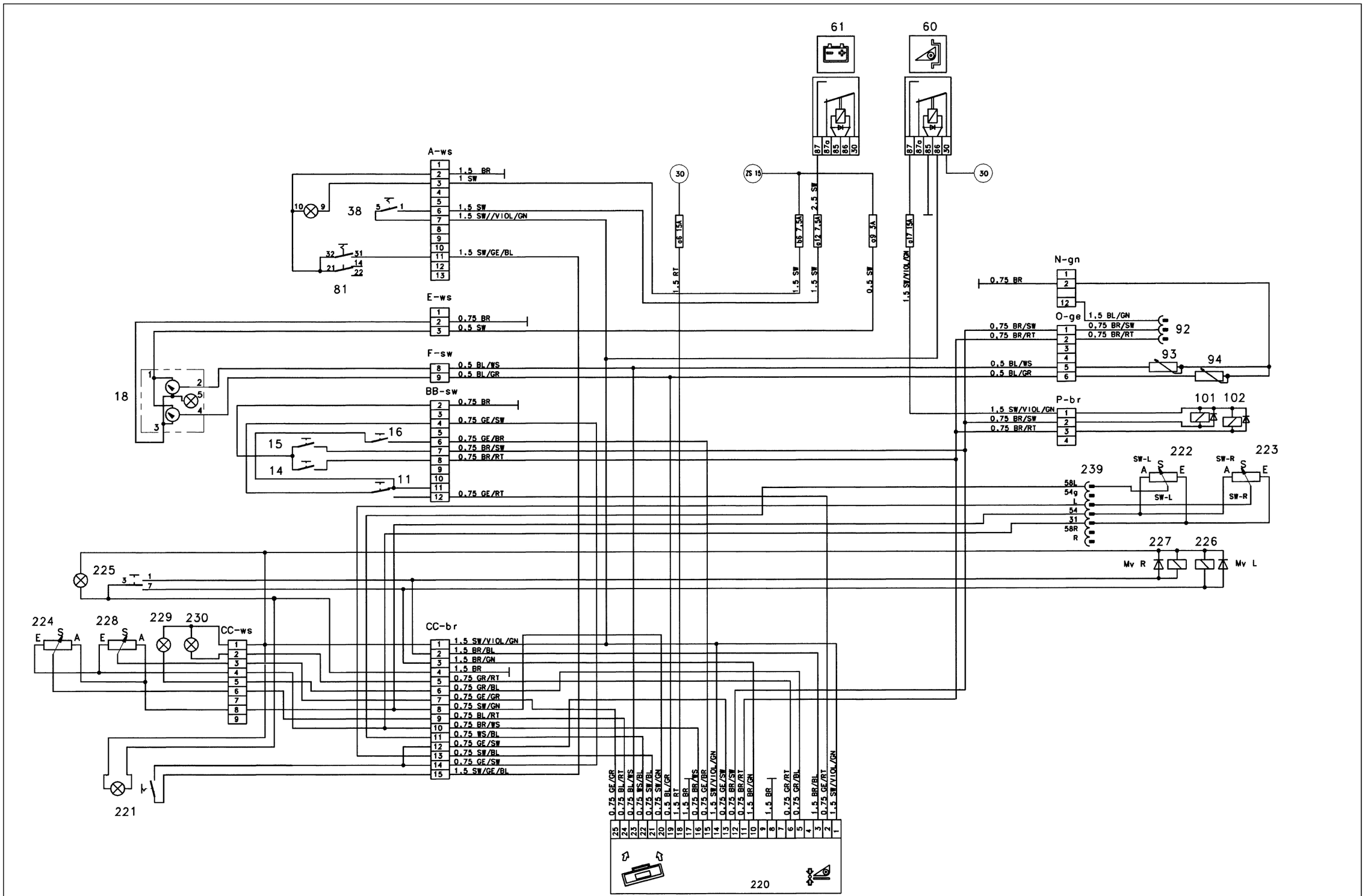
Key

11 – Switch, cutterbar pre-set height ON
14 – Switch, cutterbar down
15 – Switch, cutterbar up
18 – Cutterbar spring pressure indicator and cutterbar pre-set height indicator
37 – Switch, Contour System ON.
38 – Master switch, red, lift hydraulic system
60 – Master relay – lift hydraulic system
61 – Relay – alternator
81 – Master switch
94 – Sender, feeder housing position
101 – Solenoid valve, front attachment – raise (12 V, 3,3 A, 3,6 Ω)
102 – Solenoid valve, front attachment – lower (12 V, 3,3 A, 3,6 Ω)
220 – Module for Auto-Contour
228 – Selector potentiometer – cutterbar pre-set height
230 – Indicator light – cutterbar pre-set height ON

FUNCTION

Cutterbar automatic pre-set height

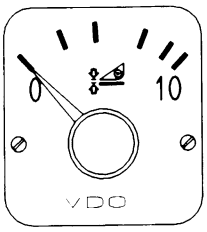
– Start the diesel engine, turn on master switch (38), threshing mechanism (switch 81) and Auto-Contour switch (221).
– Positive is supplied from the switched relay 61 via fuse a12 to switch 38 to plug-in module 220, poles 1 and 14 and to relay 60, pole 86.
– From the switched relay (60), positive is supplied via fuse (a17) to the solenoids (101,102) and via the windings of the solenoids to plug-in module (220), poles 11 and 12.
– Negative is switched from snap-on connection (A-ws) via switches (81, 37) to plug-in module (220), pole 13 and to switch (11).
– A reference voltage (approx. 7 V) is switched from fuse a9 via cutting height indicator 18 to module 220, pole 19 and changes in accordance with the position of sender 94.
– Press switch (11) briefly. The pre-set height system is activated. LED (230) lights up.
– Negative is switched from switch (11) to module (220), pole 2. From module (220), pole 11 or 12, negative is switched to solenoid (102 or 101). The cutterbar lowers or rises.
– The cutting height is preselected at potentiometer (228).
– When the pre-set cutting height is reached during raising or lowering, the raising or lowering process is terminated (signal from sensor 94).
– Several minor adjustments (system pulsing) may be noticed as the cutterbar approaches the pre-set height. This is programmed in the microelectronics and allows the cutting height (setpoint) preselected with potentiometer (228) to be reached more exactly during the final stage of adjustment. The actual cutting height is indicated by the cutting height indicator (18a) (ground potential from sender 94 to indicator).


61
60
A-ws
1.5 BR
1 SW
1.5 SW
1.5 SW//VIOL/GN
1.5 SW/GE/BL
38
81
30
ZS 15
g6 15A
g5 7.5A
g12 7.5A
g9 3A
g17 15A
2.5 SW
1.5 RT
1.5 SW
1.5 SW
0.5 SW
1.5 SW/VIOL/GN
E-ws
0.75 BR
0.5 SW
F-sw
0.5 BL/WS
0.5 BL/GR
BB-sw
0.75 BR
0.75 GE/SW
0.75 GE/BR
0.75 BR/SW
0.75 BR/RT
0.75 GE/RT
15
16
14
11
18
N-gn
0.75 BR
O-ge
1.5 BL/GN
0.75 BR/SW
0.75 BR/RT
92
93
94
0.5 BL/WS
0.5 BL/GR
P-br
1.5 SW/VIOL/GN
0.75 BR/SW
0.75 BR/RT
101
102
222
223
239
SW-L
SW-R
58L
54g
L
54
31
58R
R
227
226
Mv R
Mv L
225
224
228
229
230
CC-ws
CC-br
1.5 SW/VIOL/GN
1.5 BR/BL
1.5 BR/GN
1.5 BR
0.75 GR/RT
0.75 GR/BL
0.75 GE/GR
0.75 SW/GN
0.75 BL/RT
0.75 BR/WS
0.75 WS/BL
0.75 GE/SW
0.75 SW/BL
0.75 GE/SW
1.5 SW/GE/BL
221
220

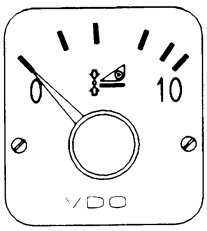
E 1620

Key

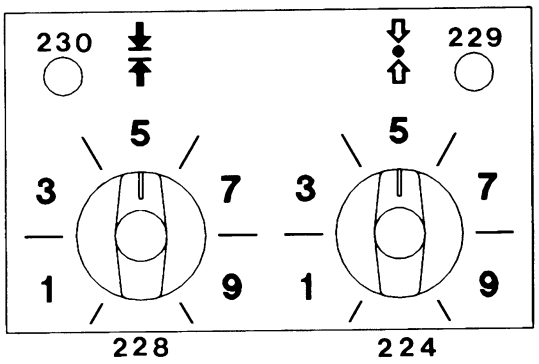
11 – Switch, cutterbar pre-set height ON
14 – Switch, cutterbar down
15 – Switch, cutterbar up
16 – Switch, automatic ground pressure control
18 – Cutterbar spring pressure indicator and cutterbar pre-set height indicator
38 – Master switch, red, lift hydraulic system
60 – Master relay – lift hydraulic system
61 – Relay – alternator
81 – Master switch
92 – Switch, ground pressure sender
93 – Cutterbar spring pressure sender, R = 10-190 Ω
94 – Sender, feeder housing position, R = 10-190 Ω
101 – Solenoid valve, front attachment – raise (12 V, 3,3 A, 3,6 Ω)
102 – Solenoid valve, front attachment – lower (12 V, 3,3 A, 3,6 Ω)
220 – Module for Auto-Contour
221 – Switch for Auto-Contour
222 – L/H sensor band for Auto-Contour (R = 4,3 KΩ)
223 – R/H sensor band for Auto-Contour (R = 4,3 KΩ)
224 – Selector potentiometer – ground pressure control 22 KΩ
225 – Switch – manual lateral levelling control
226 – Solenoid valve for L/H lateral levelling (12 V, 44,5 A, 60 % continuous rated, coil 2,7 Ω
227 – Solenoid valve for R/H lateral levelling (12 V, 44,5 A, 60 % continuous rated, coil 2,7 Ω
228 – Selector potentiometer – cutterbar pre-set height
229 – Indicator light – ground pressure control ON
230 – Indicator light – cutterbar pre-set height ON
239 – Socket – Auto-Contour

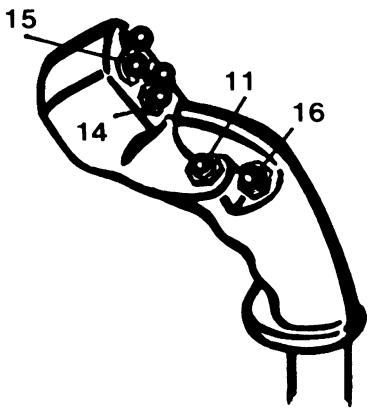


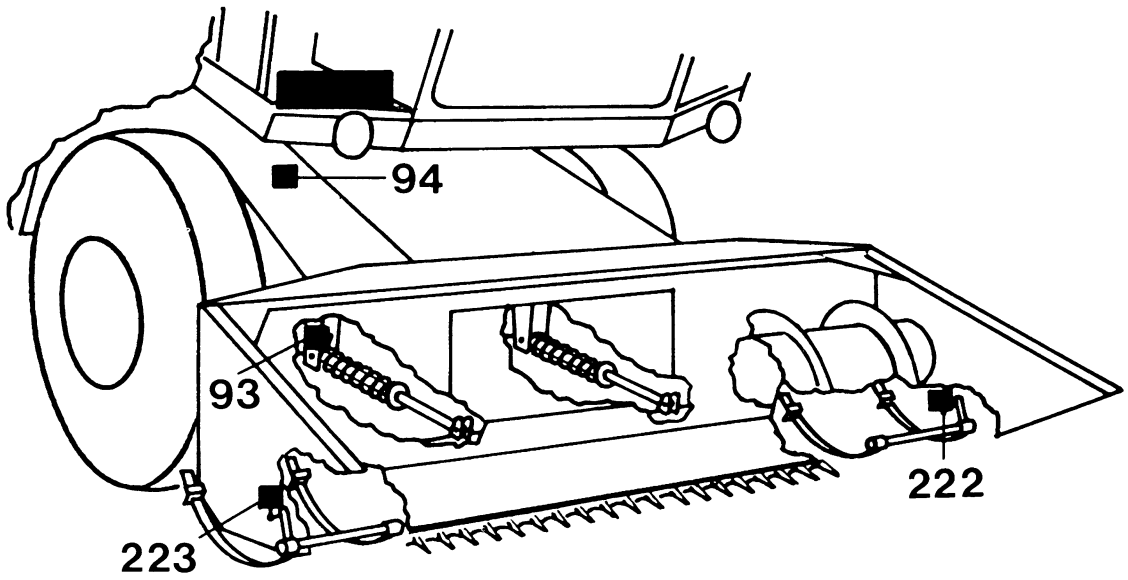
18 a



18 b







17678

FUNCTION

Cutterbar automatic pre-set height

Note: the cutterbar lateral levelling system is active when master switches (38 and 221) are ON.

- Start the diesel engine, turn on master switch (38), threshing mechanism (switch 81) and Auto-Contour switch (37).
- Positive is supplied from the switched relay 61 via fuse a12 to switch 38 to plug-in module 220, poles 1 and 14 and to relay 60, pole 86.
- From the switched relay (60), positive is supplied via fuse (a17) to the solenoids (101, 102) and via the windings of the solenoids to plug-in module (220), poles 11 and 12.
- Negative is switched from snap-on connection (A-ws) via switches (81, 37) to plug-in module (220), pole 13 and to switch (11).
- A reference voltage (approx. 7 V) is switched from fuse a9 via cutting height indicator 18 to module 220, pole 19 and changes in accordance with the position of sender 94.
- Briefly press switch 11. Cutting height pre-selection is now activated. LED 230 lights up.
- Negative is switched from switch (11) to module (220), pole 2. From module (220), pole 11 or 12, negative is switched to solenoid (102 or 101). The cutterbar lowers or rises.
- The cutting height is pre-selected at potentiometer (228).
- When the pre-set cutting height is reached during raising or lowering, the raising or lowering process is terminated (signal from sensor 94).
- Several minor adjustments (system pulsing) may be noticed as the cutterbar approaches the pre-set height. This is programmed in the microelectronics and allows the cutting height (setpoint) preselected with potentiometer (228) to be reached more exactly during the final stage of adjustment.
- The actual cutting height is indicated by the cutting height indicator (18a) (ground potential from sender 94 to indicator).
- If the outer sensing bands of the cutterbar touch the ground, the cutterbar lateral levelling system is activated (switches 222 and 223).
- If cylinders of cutterbar lateral levelling system bottom out, the corresponding solenoid valve of the microelectronics is switched off after 40 seconds in order to prevent overheating of the hydraulics.
- If the sensing bands on both sides are deflected by more than 90 %, e.g. when travelling over undulating ground, the cutterbar will be automatically raised (emergency raising). The Auto Contour system is deactivated.

– The current cutting height is displayed on the cutting height indicator (18a) (ground from sender 94 to the indicator).

– **When the sensing bands just touch the ground, the indicator should be between the 1st and 2nd marks on the scale.**

– When a front attachment is installed on the combine – maize picker head – the guide angle bracket of the sensor spring wire (94) must be installed facing down.

Note: With potentiometer (228) set to “0”, the cutterbar may only be lowered until the sensing bands just touch the ground. Correction is possible only at sensor (94 – feed rake).

Automatic Cutting Height Control (Auto-Contour)
Not for use in maize, cutterbar springs are locked

– An automatic height control of up to approx. 150 mm is possible.

  If switch (16) is pressed briefly, the cutterbar is automatically adjusted both horizontally and vertically to the cutting height preselected on potentiometer (224 – ground pressure). Fully automatic adjustment to the ground contours is provided in this switch position.

– If the skids of the cutterbar are not in contact with the ground (e.g. potentiometer position 9 – 10), only sensors (222 and 223) are active.

  In this case the cutterbar is controlled not only laterally to the direction of ground travel but, when encountering undulating ground, also vertically.

  Note: The cutterbar lateral levelling system reacts more sensitively than the height control system

– The cutting height is adjusted with potentiometer (224). Position 10 = approx. 150 mm cutting height. If the potentiometer setting is reduced, the cutterbar lowers. If the skids contact the ground, the spring pressure sensor (93) is additionally activated. The ground pressure is automatically controlled. The maximum ground pressure is achieved with the potentiometer in position “0”.

  Display 0 = minimum cutting height (high ground pressure)
  Display 10 = maximum cutting height in autmatic control mode (slight or no ground pressure).

– The spring position (ground pressure) is displayed on indicator (18b), the cutting height on indicator (18a).

Note before commissioning

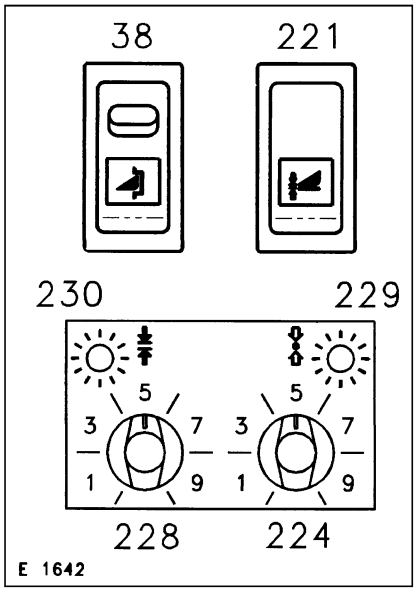
Ensure that the following adjustments and checks are carried out:

- Bleed the hydraulic cylinders of the cutterbar lateral levelling system. The bleed tap must be closed during operation.
- Adjust the cutterbar springs (see page 11.10).
- Check that the sensing bands on the cutterbar move freely.
- Set the drop rate of the cutterbar at the drop rate restrictor of the 3/3-way directional control solenoid valve with the hydraulic oil at operating temperature (5 – 6 seconds).
- The spring wire of the sensors for the spring pressure (93) and feeder housing position (94) must be installed so that they move freely in the lateral guides.
- Check that the bearings of the feeder housing pivots move easily and are adequately lubricated.
- Carry out the machine-specific programming (refer to section “Programming”) .
- Check that, with the potentiometer in position “0” (cutterbar height preselection), the cutting height (measured from cutterbar fingers to the ground) is not less than 150 mm.
- Check function of cutting height indicator and spring position indicator. When the sensing bands just touch the ground, the cutting height indicator should be between the 1st and 2nd marks on the scale.
- With the cutterbar raised (i.e. springs compressed) the spring pressure indicator should indicate 10 and with the cutterbar lowered (springs relieved) 0. If necessary, adjust the spring pressure sensor (93).
- Check that the tires of the driving wheels have the correct air pressure.
- Ensure the proper position of the cutterbar skids.

Programming the Auto-Contour system

Note: The electronic system is programmed by the manufacturer. The standard program corresponds to potentiometer position 5:

Programming the standard program



Required condition:

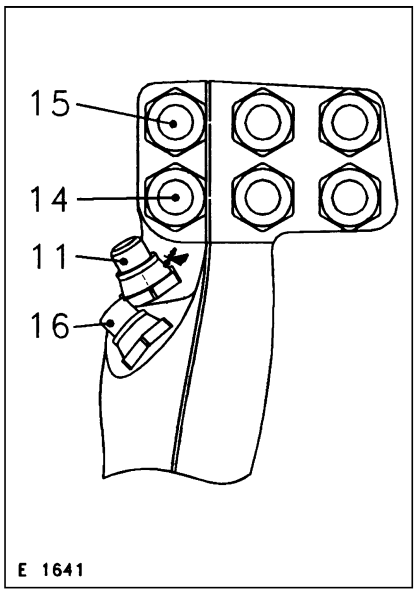
Safety switch 38 (red)	ON
Auto-Contour master switch 221	OFF
Threshing mechanism	ON
Cutterbar	ON
Engine at max. speed – no load	

Press buttons 14 and 15, both at the same time, and hold for approx. 3 seconds, until LEDs 230 and 229 blink.

Now raise cutterbar to full height and wait for approx. 30 seconds.

Then lower fully until **all** load is removed from cutterbar springs and wait again for approx. 30 seconds.

Reprogramming CAC
(modifying the standard program)



Required condition:

Safety switch 38 (red)	ON
Auto-Contour master switch 221	ON
Threshing mechanism	ON
Cutterbar	ON
Engine at max. speed – no load	

Set potentiometer 224 according to the chart below.

Simultaneously press buttons 14 and 15 and hold for 3 approx. seconds, until LEDs C and D blink.

Now lift the cutterbar to fully and wait for approx. 30 seconds.

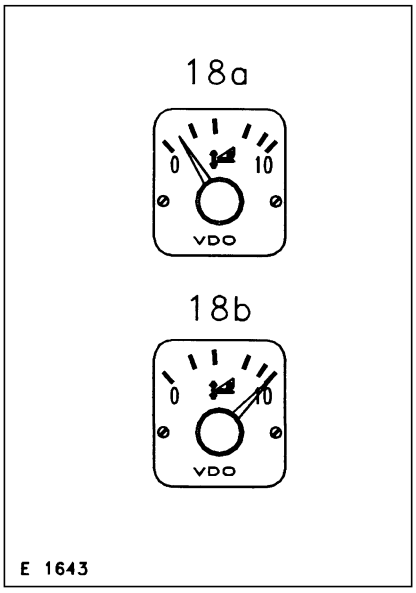
Then lower the cutterbar all the way until **all** load is removed from cutterbar springs and wait again for approx. 30 seconds.

Button 11 = Pre-set height activated (over 150 mm)
LED 230 shows
Button 16 = Auto Contour activated (up to 150 mm)
LED 229 shows

Application	Programming indicator (Potentiometer 224)	Resultant tendencies on functions		LEDs showing
		positive	negative	
Standard	5			
Standing grain (soft ground e.g. 7)	6 to 8,5 (more pulses from sensing bands increased sensitivity)	max. cutting height up to 150 mm	Oscillating up & down, Sensitivity Ground pressure	blink at the same time
Laid grain crops	0 bis 4 (increased spring action)	Sensitivity Ground pressure Oscillating up & down	max. cutting height up to 150 mm	blink at the same time
Soybean cutterbar	8,5 to 10	More sensitive lateral levelling		blink alternately

The controls operate more steady when the distance between the cutterbar skids and the ground is not too great.
When the cutterbar bulldozes (especially when large tyres are fitted), set the adjustable skids lower down.
This ensures more effective cutting height control.

Spring position and cutting height indication



Check correct functioning of cutting height indicator 18a and spring position indicator 18b.

The cutting height indicator 18a should be between the first and second graduation mark when the sensing bands just touch the ground.

The spring position indicator 18b should read 10 when the cutterbar is raised (springs loaded) and 0 when the cutterbar lowered (spring pressure relieved). Readjust the spring position sender 93 if necessary.

TROUBLESHOOTING

Note: In the event of a malfunction, first carry out the following actions and check the points indicated!

- Switch off the Auto-Contour system. Move the cutterbar to its highest and lowest positions.
- Check the pre-set height and spring pressure indicators. (Note also the points under “Note before commissioning”)

Auto Contour has no function No reaction when push-buttons (11 or 16) are pressed. The corresponding LED does not light up.

- Threshing mechanism, cutterbar, switch (38 – lift hydraulics) and master switch (221 – Auto Contour) must be ON.
- Check push-in connector CC-brown (br)

When the automatic cutting height control system is activated, it switches off again after a short time.

- Cutterbar rises too slowly
- Check oil level, hydraulic pump drive, hydraulic pump and hydraulic system pressure
- During the cutterbar raising cycle, no signal is transmitted by spring pressure sensor (93). (Cutterbar cylinder locked or cable broken.)

The control range for pre-set height is too high or too low (specification: 150 to approx. 400 mm)

- Sensor (94) on feed rake not correctly adjusted, check spring wire. Adjust sensor (observing cutting height)

When pre-set height is activated, the cutterbar swings

- Cutting height must be set higher on potentiometer (228) (the sensing bands are bent by more than 90 %, e.g. on soft ground the combine sinks in further)
- Check sensing bands (may be sticking in upper position)
- Check sensors (222, 223) on left and right of cutterbar
- Check sensor (94), cable connections and spring wire
- Check cutterbar rate of drop (specification: 5 – 6 seconds)

The lateral levelling system does not bring the cutterbar to the horizontal position

- Sensing band sticking
- Check the cable connections at the sensors.

LED (230) flashes

- Connection to sensor (94) interrupted.

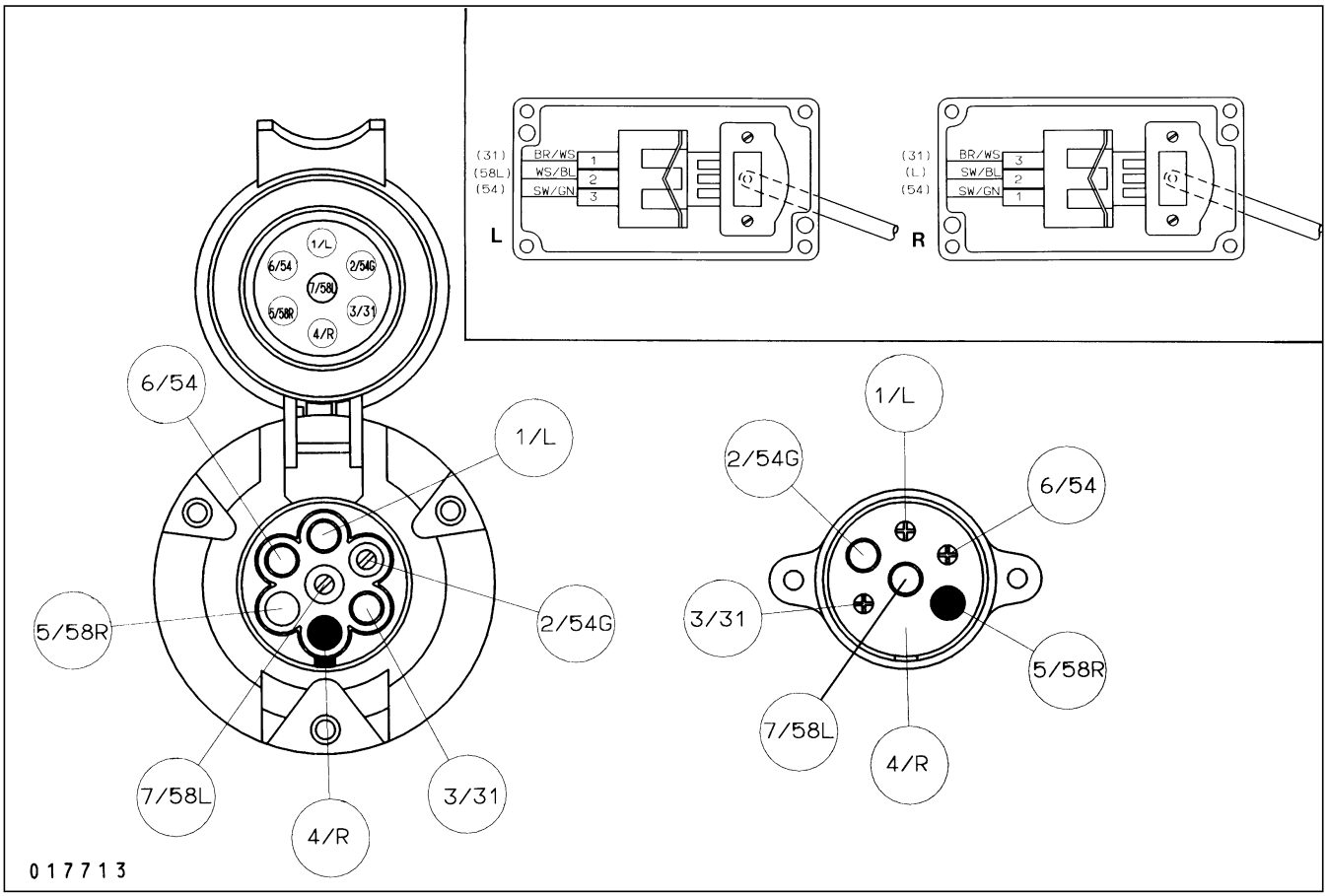
After activation of pre-set height or the automatic cutting height control system, the cutterbar lowers normally. If the sensing bands touch the ground on both sides, a sudden and rapid swinging of the lateral levelling system occurs.

- Check one way restrictors on cylinders of lateral levelling system (valve insert sticking)

Resistance values of sensors and potentiometers

Note: The resistance must increase and decrease uniformly throughout the entire control range when checking the sensors and potentiometers.

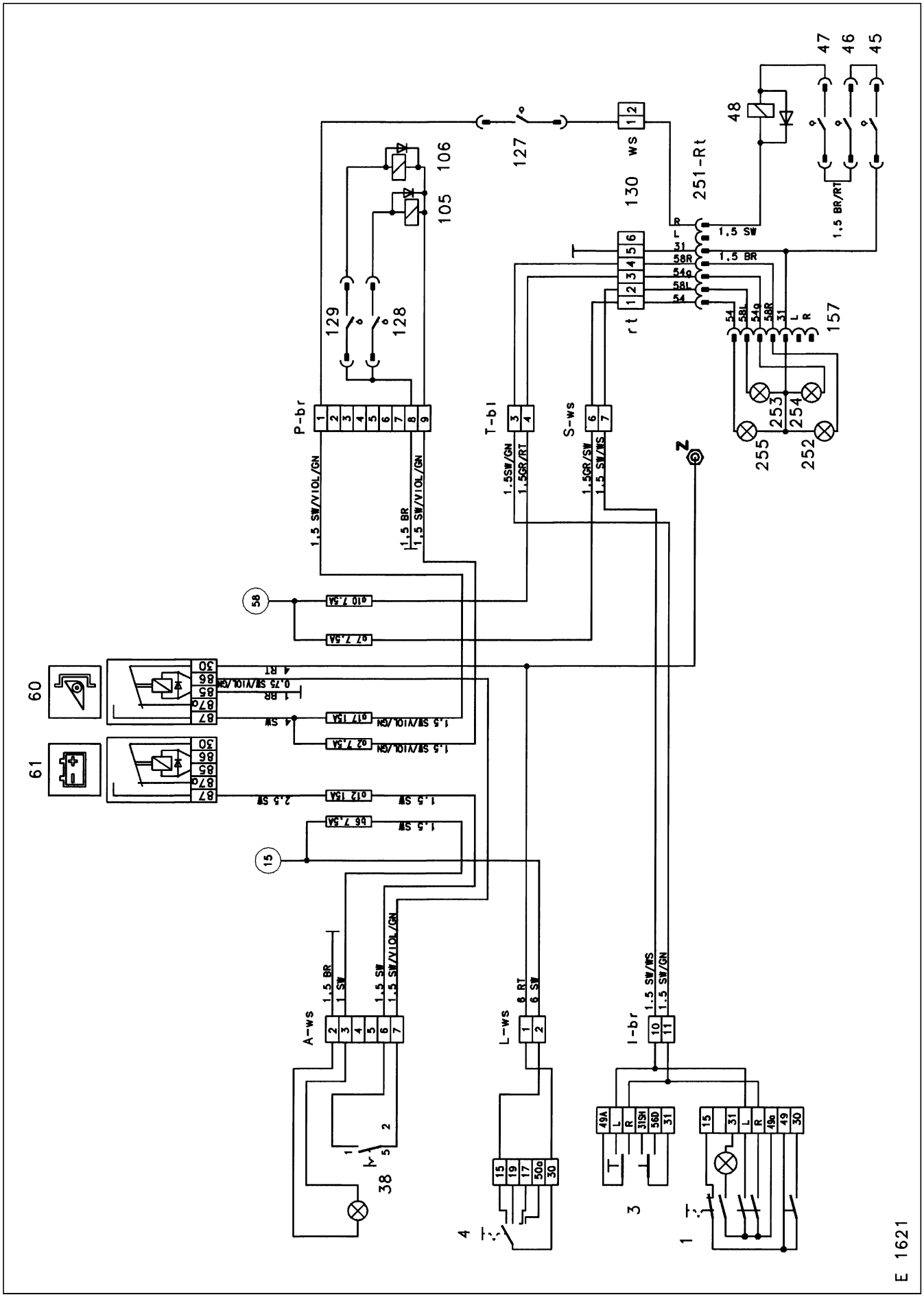
Sensor, spring position 93	10-190	Ω ± 20 %
Sensor, feeder housing position 94	10-190	Ω ± 20 %
Sensor, L/H sensing band 222	4,3	kΩ ± 20 %
Sensor, R/H sensing band 223	4,3	kΩ ± 20 %
Potentiometer, ground pressure 224	22	kΩ ± 20 %
Potentiometer, cutting height 228	22	kΩ ± 20 %
Total resistance of potentiometers 224 and 228	11	kΩ ± 20 %



Use of the soybean cutterbar (without CAC)

Note: When using a soybean cutterbar on machines **without** Claas Auto-Contour system, the ground pressure switch 92 is disconnected from terminal 119 or relays 54 and 55 are disconnected. The 7-pin connector of the cutterbar is plugged into coupling 239 of the feed rake. The potentiometers on the R/H and L/H side of the cutterbar must be mechanically connected via the sensor shaft under the cutterbar trough, since lateral adjustment is not possible on machines without CAC.

Folding cutterbar, folding the unit to transport and working position



Key

1 – Hazard warning flasher light
3 – Turn indicator switch
4 – Ignition switch
38 – Master switch (red), lift hydraulic system
45 – Switch, cutterbar locking
46 – Switch – reel in lowest position
47 – Switch – reel in backward position
48 – Solenoid valve, changeover valve
60 – Relay, lift hydraulic system
61 – Relay, alternator
105 – Solenoid valve, reel forward
(12 V, 4,5 A, 60 % continuous rated, coil resistance 2,7 Ω)
106 – Solenoid valve, reel backward
(12 V, 4,5 A, 60 % continuous rated, coil resistance 2,7 Ω)
127 – Switch, cutterbar folding (changeover valve)
128 – Switch, reel forward (folding cutterbar)
129 – Switch, reel backward (folding cutterbar)
130 – Connection, folding front attachments
157 – Connector, folding cutterbar lighting
252 – R/H turn indicator
253 – L/H turn indicator
254 – R/H side light
255 – L/H side light

FUNCTION

Adjust cutterbar to working position

Note: Positions shown = cutterbar folded to transport position and locked.

The locking bar must be upright. The reel must be in the lowest and rearmost position. Switches 45, 46 and 47 are closed.

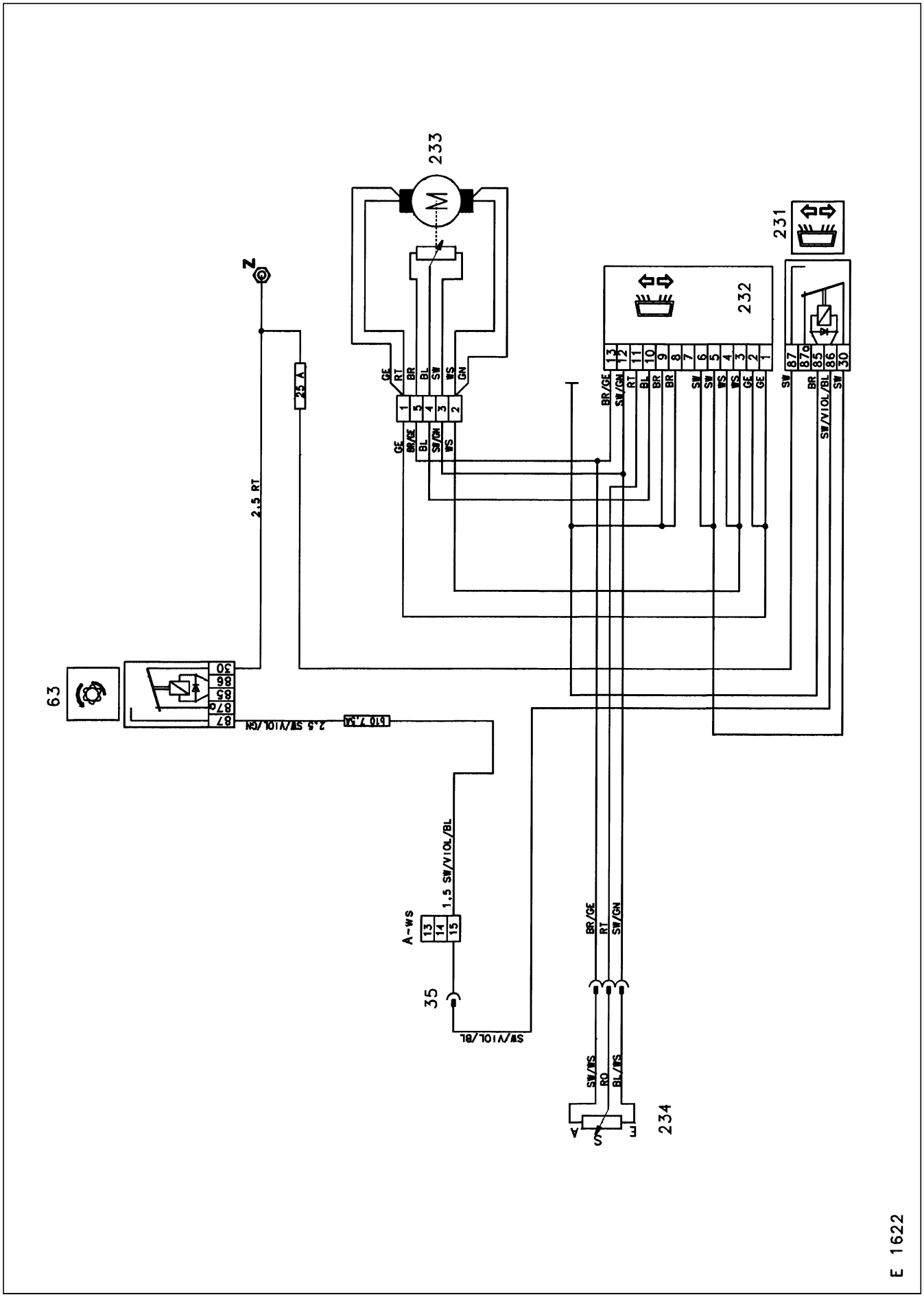
Press switches (127 and 129) simultaneously. This activates the solenoid (48) of the change-over valve and solenoid (106) of the 4/3 directional control valve. Hydraulic pressure builds up, the cutterbar swings to working width.

Adjust cutterbar to transport position

Lower the reel as far as it will go and adjust fully backward. Switches (46 and 47) close. Unlock the cutterbar, switch (45) closes.

Operate switches (127 and 128) simultaneously. This activates the solenoid (48) and solenoid (105) of the 4/3 directional control valve. Hydraulic pressure builds up, the cutterbar folds to transport position.

Electric adjustment of deflectors (straw chopper)



Key

35 – Connection, ancillary equipment
63 – Relay – thresher
231 – Relay (40 A, type B)
232 – Module – electric adjustment of deflectors (straw chopper)
233 – Electric motor with potentiometer (1 KΩ)
234 – Selector switch (1 KΩ)

FUNCTION

- Engage the thresher.
- Positive is switched to relay (231), pole 86 via switched relay (63) of fuse (b10). Pole 85 is earthed. Relay (231) is switched.
- From the central positive pole (Z), positive is switched via fuse (25 A) and the switched relay (231) to module (232).
- A value is preselected with selector switch (234). From module (232), positive is switched e.g. via poles 1 + 2 to motor (233) which is earthed via poles 3 + 4 (or earthed via poles 1 + 2 and switched to positive via poles 3 + 4).
- The motor runs in clockwise or counterclockwise direction, the deflectors are adjusted.

MALFUNCTION

The deflectors cannot be adjusted

NOTE: The deflectors can only be adjusted when the thresher is switched on.

- Check the deflectors for free movement.
- Check the fuse (25 A) and fuse (b10).
- Check relay (231), 40 A – type B.
- Check the cable connections as per the wiring diagram and for tightness.

Check the motor with potentiometer (233)

- Disconnect the plug connector at the potentiometer.
- Run the motor to retract rod: Resistance measured

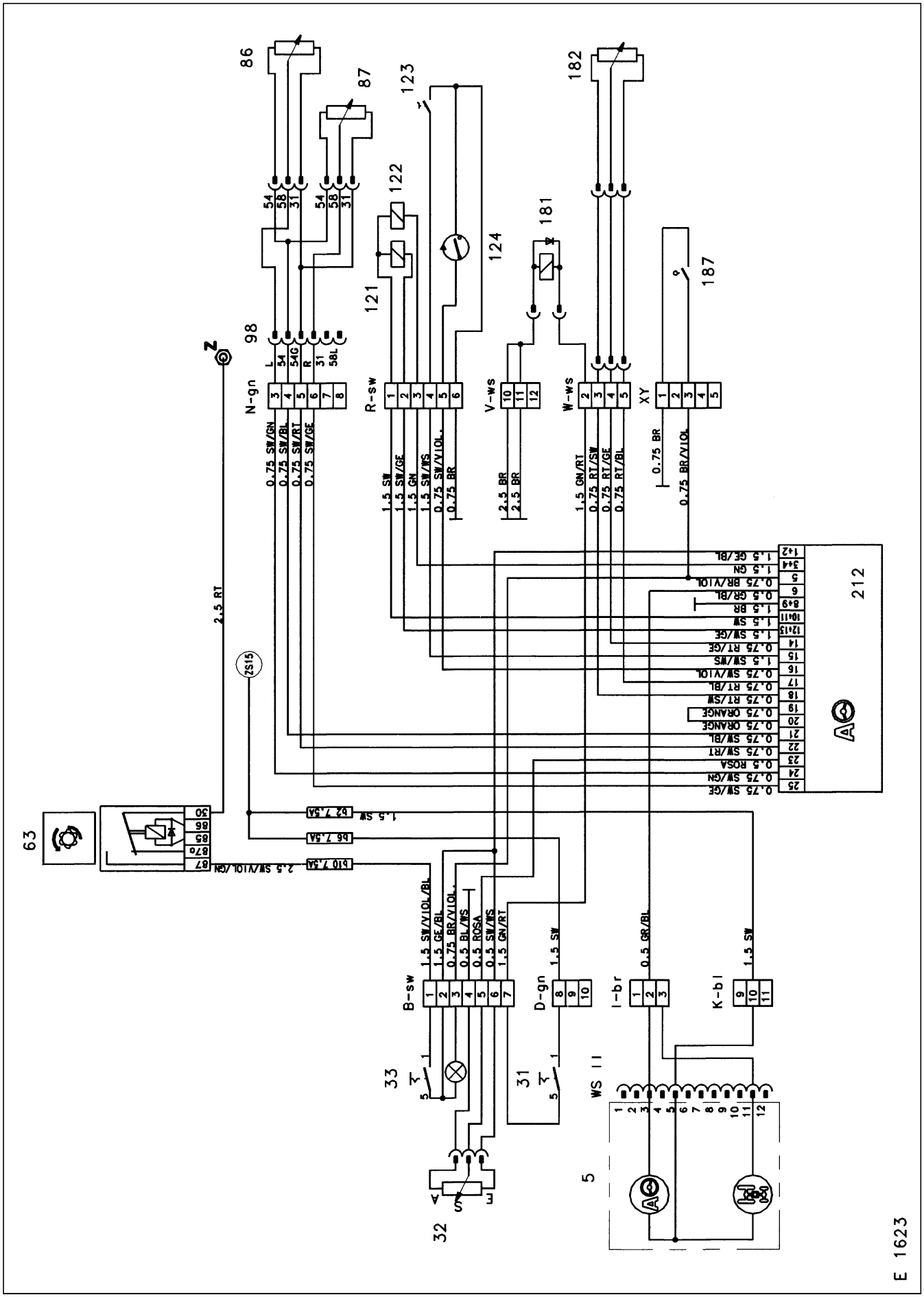
  between poles 3 and 4 = 0 Ohm
  between poles 4 and 5 = 1000 Ohm (± 20 Ohm)
- Run the motor to extend spindle rod. Resistance values are reversed.

Adjusting the motor

- Switch on ignition and engage thresher.
- Turn selector switch (234) to retract spindle rod of motor.
- Remove the screw from the spindle rod of the adjustment linkage.
- Screw in the spindle further by hand until the motor just starts to rotate the spindle rod out. Then back off the spindle by one turn.
- Reinsert the screw.

Checking selector switch (234)

- Disconnect the plug connector at selector switch (234).
- It must be possible to regulate the resistance between the two poles 1 and 2 or between the poles 2 and 3 from 0 to approx. 1000 Ohm.


86
87
123
182
122
181
124
187
121
98
N-gn
R-sw
V-ws
W-ws
XY
212
63
ZS15
2.5 RT
B-sw
D-gn
I-br
K-bl
33
31
32
WS II
5
E 1623

Key

5 – Ignition switch
31 – Switch, 4-Trac system
32 – Centralizing switch (10 KΩ)
33 – Autopilot Switch
63 – Relay – thresher
86 – Autopilot, sensor L/H
87 – Autopilot, sensor R/H
98 – Cutterbar socket
121 – Solenoid valve – Autopilot (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,4 Ω)
122 – Solenoid valve – Autopilot (12 V, 3,5 A, 60 % continuous rated, coil resistance = 3,4 Ω)
123 – Foot switch – Autopilot ON
124 – Reed switch (overrider switch) – Autopilot
181 – MV 4-Trac system
182 – Rear wheel steering indicator
187 – Seat switch – Autopilot (when operator dismounts)
212 – Module for Autopilot

Basic components of the CLAAS Autopilot (automatic steering mechanism)

1. Touch sensor system, left and right
2. Rear wheel position indicator
3. Electronic control unit (plug-in module)
4. Foot switch
5. Overrider switch
6. Centralizing switch
7. Solenoid
8. Master switch, safety cut-out when dismounting operator's platform, wiring
9. Problems and testing the system

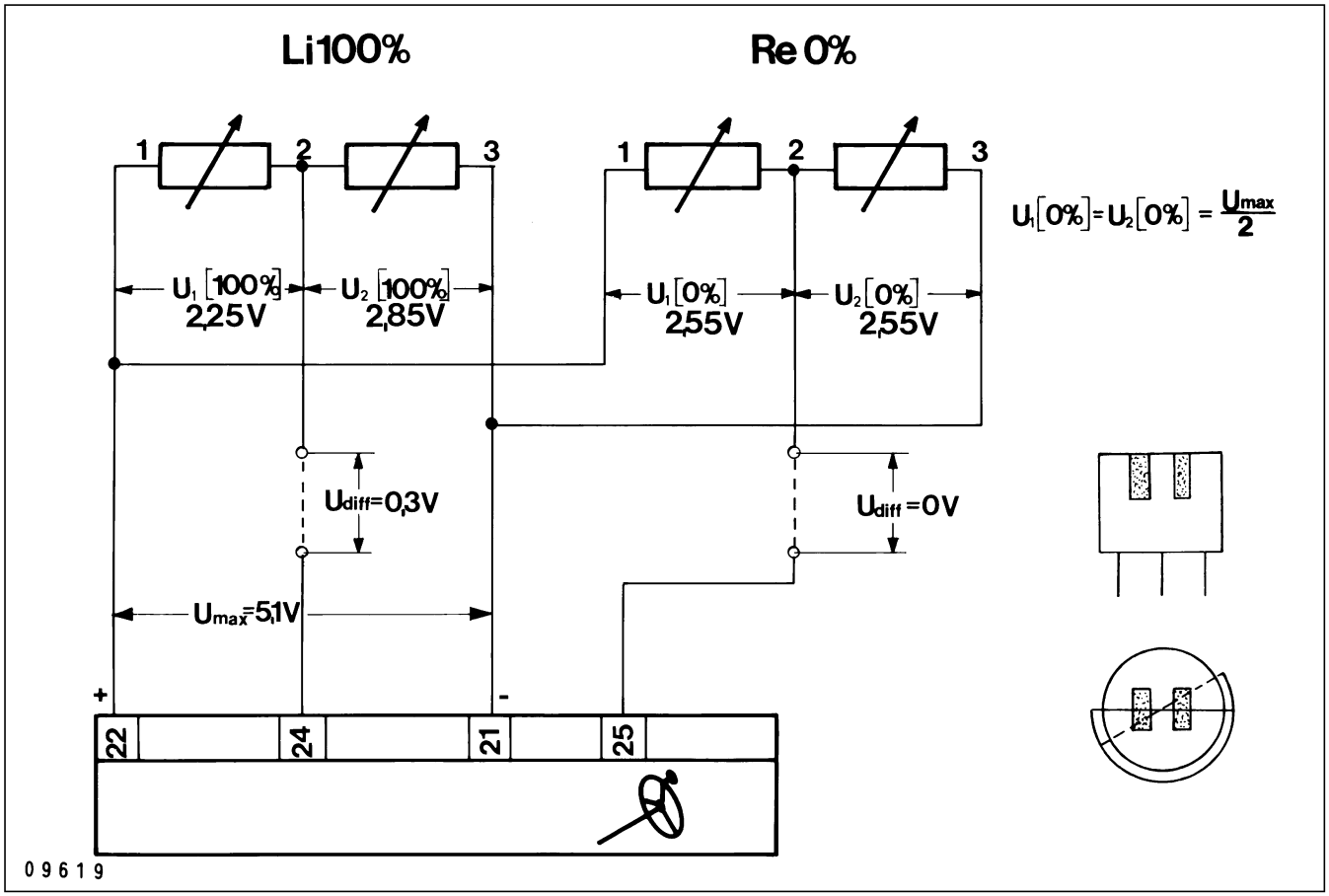
1. Touch sensor system

A differential field-dependent resistor is located inside a tube in the touch sensor housing. The field-dependent resistor has three connections on one end. Two equal-rated magnetic-variable semi-conductor resistors are mounted on the other end of the field-dependent resistor.

The lines of force of the magnets are cut by an iron core which is turned through the movements of the touch sensor arms.

At zero position the crescent-shaped iron core locates exactly above the two magnetic-variable semi-conductor resistors, so that the lines of force of the two magnets are cut in equal parts.

When the touch sensor arm is actuated, the iron core moves. The magnetic field on one side is more influenced. The magnetic field on the other side is less influenced.



Example:

With pole core (crescent) in central position, voltage between pole 1 and pole 2 = 2,55 V and between pole 2 and pole 3 is also 2,55 V.

When fully displaced to (–)100 %, the voltage between pole 1 and 2 = 2,25 V, and the voltage between pole 2 and 3 = 2,85 V.

When fully displaced to (+)100 %, the opposite effect is obtained. Also refer to illustration.

Adjustment (use tester CLAAS No. 181 904.0 for trimming auto steering system)

The touch sensors are factory set. Reset the sensors only after repair work has been carried out.

Adjust the l.h. touch sensor so that the needle of the tester moves from 0 to (–)100 %, when a 25 mm gauge is placed between the stop roller and housing.

At the r.h. touch sensor the needle must move from 0 to (+)100 %.

Remove cap and connect the tester. Use a screw driver and 10 mm open-ended spanner and adjust to zero (turn nut and iron core, 0 ± 5 %). Install 25 mm gauge and turn the nut only, using a 10 mm open-ended wrench. Turn the nut until the needle moves to 100 % (adjustment of gap between iron core and differential field-dependent variable resistor).

After the system has been set, carry out a few functional tests (zero position and 100 %), and then secure the nut and screw with a fast curing varnish.

The touch sensor arms are made from spring steel and must not be heated during repair work.

NOTE! Install the touch sensors so that there is a distance of approx. 20 mm between the arms (no overlap or contact).

Provision for adjustment by a slot in the sensor housing.

The touch sensor arms must move freely. The sensor arms must not foul each other when the machine is backed up (refer to fitting and operating manual).

With the touch sensor arm travelling a length of 240 mm (measured at the end of the arm), the piston of the steering cylinder must travel a length of 26 – 34 mm to either side.

2. Rear wheel position indicator

The measuring principle of the rear wheel position indicator is similar to that of the touch sensor system. They differ in that the rear wheel indicator's pole core projects like a very small bar which is located 3 mm out of the centre of the differential field-dependent resistor. The pole core on the touch sensor system, on the other hand, is shaped like a crescent. The construction of the position indicator allows the field-dependent resistor to develop a symmetrical potential difference, this being equivalent to +100 %, and a turning angle of 8° in a clockwise direction; or to –100 % and turning angle of 8° in an anti-clock-wise direction.

Functional test with tester, rear wheel position indicator attached to machine

L.h. turn = 0,3 V (+100 %), 26 – 34 mm travel of steering cylinder rod, approx. 8° turning angle

R.h. turn = 0,3 V (–100 %), 26 – 34 mm travel of steering cylinder rod, approx. 8° turning angle

Installation of rear wheel position indicator

When installing the indicator note that the mark on the spindle points toward the cable connection and that there is no tension on the control linkage.

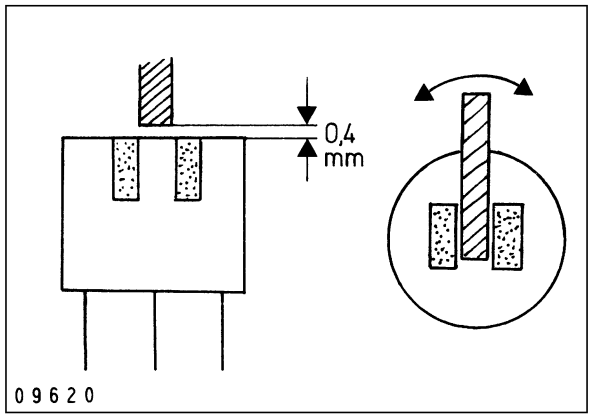
IMPORTANT! Excessive play of linkage can cause the rear wheels to wobble.

With axle under load, there must be a gab of 3 mm between the rear wheel position indicator and the stub axle screw.

Adjustment

Zero adjustment of rear wheel position indicator

- Adjust centralizing switch to centre position
- Loosen the rear wheel position indicator in its support (set screws)
- Drive machine and switch on the automatic system
- Adjust rear wheel indicator (turn it) so that machine travels straight ahead. This adjustment can also be carried out with the tester. To do this jack-up and securely support the steering axle and turn the rear wheels to their straight ahead position.



3. Electronic control unit (plug-in module)

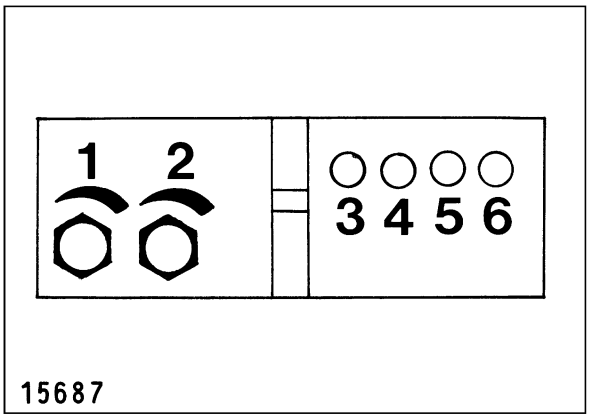
The electronic control unit is the most important component of the Autopilot system.

1 = Steering angle adjustment
2 = sensititvity resistance adjustment
3 = solenoid valve 1 yellow = solenoid energized
4 = solenoid valve 2 yellow = solenoid energized
5 = current cut-off for electronic system – red = short circuit
6 = power indicator – green = Autopilot switched on

When the current cut-off safety device has broken the flow of current and after the fault has been cured, the system must be electrically reset by first shutting of the system. Only then can the system be switched on again.

By operating the master switch (33) and by depressing the foot switch (123) power is fed to the electronic unit and the automatic system is switched on.

This circuit is broken again by means of an overrider switch when the steering wheel is turned one quarter of a turn. The automatic system is switched off again.



Safety shut-off circuit

The safety shut-off circuit ensures that auto steering cannot be switched on with the foot switch unless the threshing mechanism drive is engaged, the Autopilot master switch is switched on and the seat switch is actuated.

When the cab door is opened or when the thresher is disengaged, the safety shut-off system breaks the circuit and switches off automated steering.

When the Autopilot is switched on, the two solenoids of the hydraulic control unit (Orbitrol) are energized. Operation of the touch sensor arms causes a weak voltage of 0,3 volts, which is amplified by the electric control unit, to complete the earth circuit to the solenoid. The hydraulic control unit is actuated accordingly and steers the machine to the left or right until the desired steering angle, determined by the touch sensor arm, is obtained. As the touch sensor arm is released, the rear wheel position indicator returns the machine to straight ahead travel.

Example

When the left touch sensor arm is swung to (–)100 %, the steering cylinder retracts accordingly. The rear wheel position indicator moves to (+)100 %. The machine turns to the left.

When the touch sensor arm is released again, the sensor returns to 0 %. But as the rear wheel position indicator still stands at (+)100 %, a voltage difference exists which is balanced inside the electronic control unit.

Possibilities

The solenoid valve is energized and the machine is returned to straight ahead travel. The voltage difference is fully balanced once the rear wheel position indicator has returned to 0 %.

R/H touch sensor 0 % L/H touch sensor 0 %	Rear wheel position indicator = 0 % straight ahead travel
R/H touch sensor +20 % L/H touch sensor 0 % Voltage +20 %	Rear wheel position indicator = –20 % R/H turn
R/H touch sensor +50 % L/H touch sensor –20 % Voltage +30 %	Rear wheel position indicator = –30 % R/H turn
R/H touch sensor 0 % L/H touch sensor –20 % Voltage –20 %	Rear wheel position indicator = +20 % L/H turn
R/H touch sensor +20 % L/H touch sensor –50 % Voltage –30 %	Rear wheel position indicator = +30 % L/H turn

Adjusting potentiometer (2) for sensitivity resistance (second screw from the front on the plug-in module, as seen in direction of forward travel)

- Raise the rear axle so that the rear wheels are just off the ground.
- Run hydraulic system to warm up oil (60 – 70° C oil temperature).
- Run engine at maximum speed – no load.
- Engage threshing mechanism drive and switch on master switch (Autopilot), and close the safety shut off switch which is activated when the operator dismounts.
- Engage automatic steering by operating the foot switch.
- Adjust centralizer switch to centre position (rear wheels automatically turn to straight ahead position).
- Turn control knob of potentiometer A in anti-clockwise direction to its stop. If, after the touch sensors have been actuated, the rear wheels start to wobble, adjust the control knob in clockwise direction until wheel wobble is stopped with wheels in straight ahead position.

Adjusting potentiometer (1) for rear wheel position indicator (first screw from the front on the plug-in module, as seen in the direction of forward travel)

The touch sensors should always be checked first with the tester and adjusted as necessary and only then should the steering angle be adjusted (see touch sensor adjustment).

- Raise the rear axle until the wheels just touch the ground,
- Run the hydraulic system to warm up oil (60 – 70° temperature).
- Run engine at maximum speed – no load.
- Switch on automatic control.
- Move the l.h. touch sensor up to the stop. At the same time measure travel of piston rod of steering cylinder.
- Move the r.h. cylinder touch sensor up to the stop and measure travel of piston rod of steering cylinder. Each stroke should have a length of 26 – 34 mm.

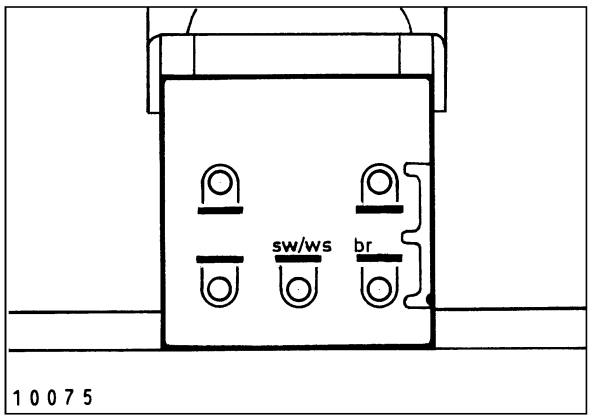
4. Foot switch

The foot switch is used only to switch on the automatic steering controls

Connection P = sw/ws (black/white) to electronic control unit 15
54 = br (brown) to earth

Functional test: Link cables sw/ws and br at foot switch.

If the automatic controls come on then the foot switch is defective.



5. Overrider switch

The overrider switch disengages the automatic system. The switch is fitted to the steering wheel spindle.

Connection = brown wire (br) to earth
black/violet (sw/vi) cable to electronic unit.

Functional test:

- Start engine and switch on auto steering. Indicator light comes on.
- Quickly turn the steering wheel one third of its full turn. The indicator light goes out, automatic system is off.
- Switch on automatic system with foot switch and switch it off by quickly turning the steering wheel. This must be done in both directions.
- If the automatic system will not switch off or will not always switch off when the steering wheel is quickly turned, check overrider switch (e.g. for loose set collar). Replace overrider switch if necessary. To check if overrider switch is defective the two wires can be taken off and scratched against one another. The automatic system should then switch off.

6. Centralizing switch

Side hill operation or curved maize crops may result in one-sided feed of material into the machine and may easily cause the machine to loose the row. In those conditions the machine's centralizing switch can be adjusted to guide the machine so that the maize row passes midway between the sensor arms into the machine.
This ensures rear wheel angling to either side throug the full automatic range when the touch sensors are actuated.

Functional test:

With engine at maximum speed – no load – and automatic control switched on, turn the knob of the centralizing switch to the left and right. According to the direction in which the knob was turned, the rear wheels will move to the left or right by 2° to 3°.

Connection = see wiring diagram

7. Solenoid valve

Solenoids = Elektroteile Uhldingen/Bodensee
12 Volts, 3,5 A, 60 % continuous rated
Function = refer to functional diagram of solenoid valve for auto steering (group "hydraulic steering")

8. Master switch, platform dismount cut-out, wiring

The automatic controls can be switched on when:

- the threshing drive is engaged
- master switch (33) is switched on
- seat contact switch (187) is closed.
  An indicator light shows that the system is ready for operation.
  Wiring = see electric wiring diagram

9. Problem	
Autopilot will not engage	**NOTE!** The main drive must be engaged. – Check fuse (b10). – Check cables of connector B-sw (black) as per wiring diagram. – Check master switch and seat contact switch (33 and 187). – Check cables of connector R-sw (black) and X. – Check foot switch and cable connections on foot switch. – Replace plug-in module.
Autopilot engages, but the indicator light in the vehicle information unit does not come on	– Check indicator light. – Check cables of l-br (brown) connector as per wiring diagram. – Check connectors of vehicle information unit. – Replace plug-in module.
Solenoid valve will not operate (test the magnetic field with a suitable tool, a screw driver, for instance)	– Check power supply plug on solenoid valve. – Check cable connections and the R-sw (black) connector as per wiring diagram. – Check field coil and iron core of solenoid of the solenoid valve. – Replace plug-in type module.
Solenoid valve operates but no regulating action takes place at rear wheels	– Check solenoid vave block, replace if necessary.
Autopilot will not switch off when steering wheel is turned	– Check clamp connector on overrider switch (bridge cable momentarily). – Check that overrider switch is tightly secured to steering column. – Check overrider switch, replace if necessary. – Replace module.
Autopilot switched on; machine will not follow maize row	– Adjust centralizing switch to centre position. – Check connector on centralizing switch as per diagram. – Check cables and connectors on front attachment as per wiring diagram. – Check cables and connectors to rear wheel position indiator (pot). – Check touch sensor units with tester, replace units as necessary. – Check rear wheel position indicator with tester and replace indicator, if necessary. – Replace electronic control unit.

Rear wheels will not reach required steering angle with touch sensor arms in the extreme pushed-back position	– Adjust steering angle (at 1) on plug-in type module. – Check and adjust (if necessary) touch sensor units with tester. Replace touch sensor units if required. – Check rear wheel position indicator (pot) with tester, if necessary, adjust or replace the unit. – Replace plug-in type module.
Autopilot switched on; rear wheels or solenoids wobble (hunt) without touch sensor arms being operated.	– Adjust sensitivity resistance at 2 on the module. – Replace module.

Testing the system

Basic machine without front attachment	– Pull 7-pin connector to front attachment. – Start engine (fast idle, oil at operating temperature). – Turn steering wheel approx. 50 % to the right by hand. – Switch on automatic-controls. The steering wheels must move back to their straight ahead position. – Turn steering wheel approx. 50 % to the left by hand. – Switch on automatic-controls. The steering wheels must move back to their straight ahead position. – Check function of centralizing switch.

PROBLEM

Rear wheels turn to the left (r.h. curve position)	– No continuity from terminal 1 of rear wheel position indicator plug ot terminal 18 of module. – Short circuit of terminals 2 or 3 of rear wheel position indicator plug. – No continuity from terminal 2 of plug of rear wheel position indicator to terminal 14 of module.
Rear wheels turn to the right (l.h. curve position)	– No continuity from terminal 3 of plug of rear wheel position indicator plug ot terminal 17 of module. – Short circuit of terminals 1 or 2 of rear wheel position indicator plug. – No continuity from terminal 2 of plug of rear wheel position indicator to terminal 14 of module.
Rear wheels turned to the left or to the right. After the automatic control has been switched on, the wheels move to the left or right hand lock.	– Wrong plugs connected to solenoid valve. – Terminals 1 and 3 on rear wheel position indicator plug wrongly installed.
Rear wheels will not move to straight ahead position	– Rear wheel position indicator (pot) loose or not correctly adjusted (mark on shaft must point in direction of cable connection). – Check solenoid valve (screw driver test). – Check connection between module and solenoid valve. – Replace module.

Testing the system

Basic machine with front attachment
(System on basic machine is working correctly)

- Plug 7-pin connector into socket.
- Switch on the automatic control system.
- Actuate the r.h. touch sensor. The rear wheels must turn to the left (r.h. curve position).
- Actuate the l.h. touch sensor. The rear wheels must turn to the right (l.h. curve position)

  NOTE! Check the touch sensor with a tester. The touch sensors must work correctly.

PROBLEM (basic machine with front attachment)

No response of rear wheels when the l.h. touch sensor is actuated. Normal response when the r.h. touch sensor is actuated.

- Check connector on touch sensor.
- No continuity from terminal 2 of the l.h. touch sensor plug to terminal 24 of module.

No response of rear wheels when the r.h. touch sensor is actuated. Normal response when the l.h. touch sensor is actuated.

- Check connector on touch sensor.
- No continuity from terminal 2 of the r.h. touch sensor plug to terminal 25 of module.

Automatic control switched on – rear wheels move to the l.h. lock, touch sensor had not been actuated (r.h. curve position)

- Short circuit of terminals 3 and 2 in the touch sensor plugs or in the 7-pin plug.
- Terminal 3 not connected or no continuity.

Automatic control switched on – rear wheels move to the r.h. lock, touch sensor had not been actuated (l.h. curve position)

- Short circuit of terminals 2 and 1 in the touch sensor plugs or in the 7-pin plug.
- Terminal 1 not connected or no continuity.

When touch sensors are being actuated, the rear wheels turn in the wrong direction

- Check rear wheel position indicator (pot) with the tester.

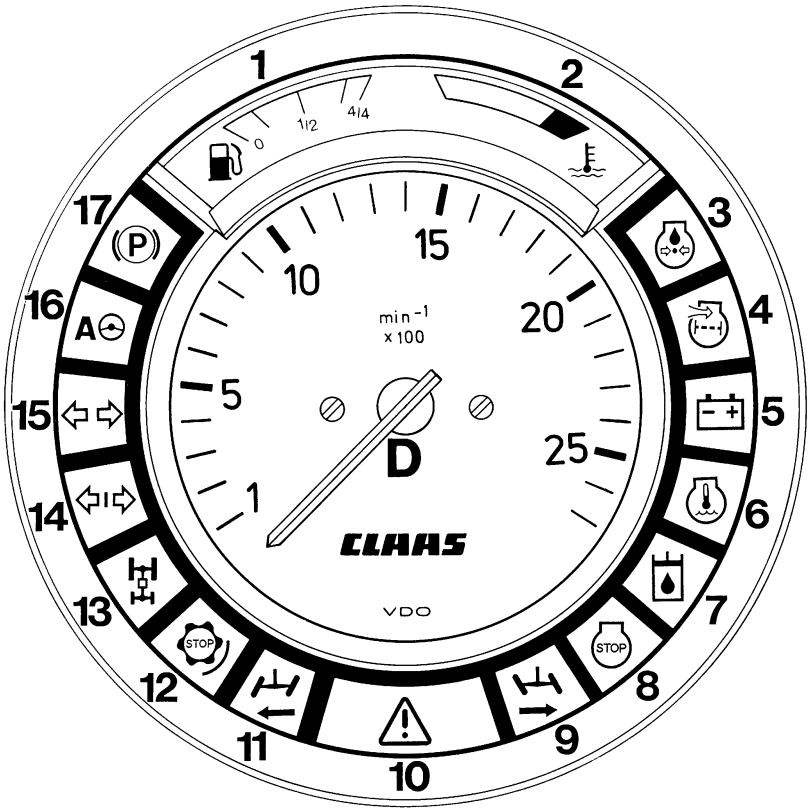
NOTE!

Right hand curve position = minus reading
left hand curve position = plus reading
If not: replace the rear wheel position indicator.

- Interchange the plugs on the solenoid valve.
- Use continuity tester and check cables to touch sensors and to rear wheel position indicator as per diagram.

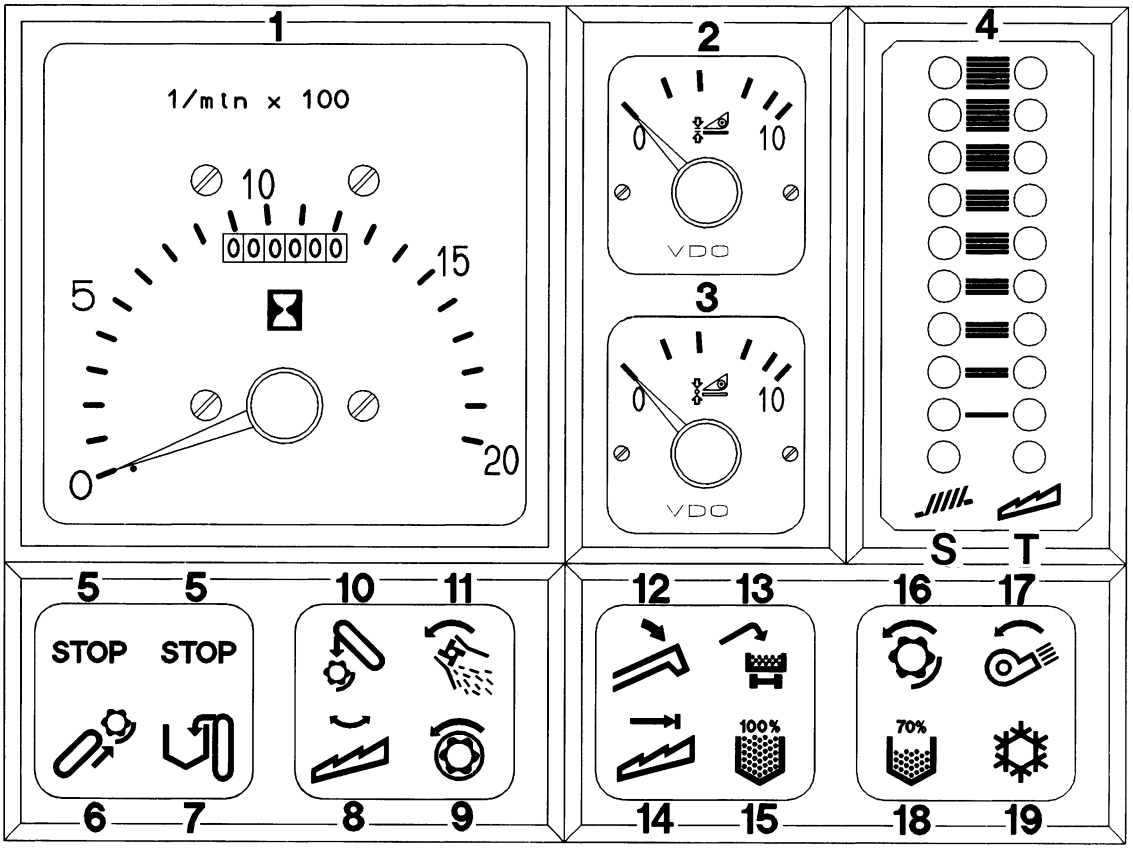
  (The 3-pin plug touch sensor plugs, the 7-pin plug or the rear wheel position indicator (pot) may be incorrectly connected polarity-wise).

Vehicle information unit



17354

Operations display screen



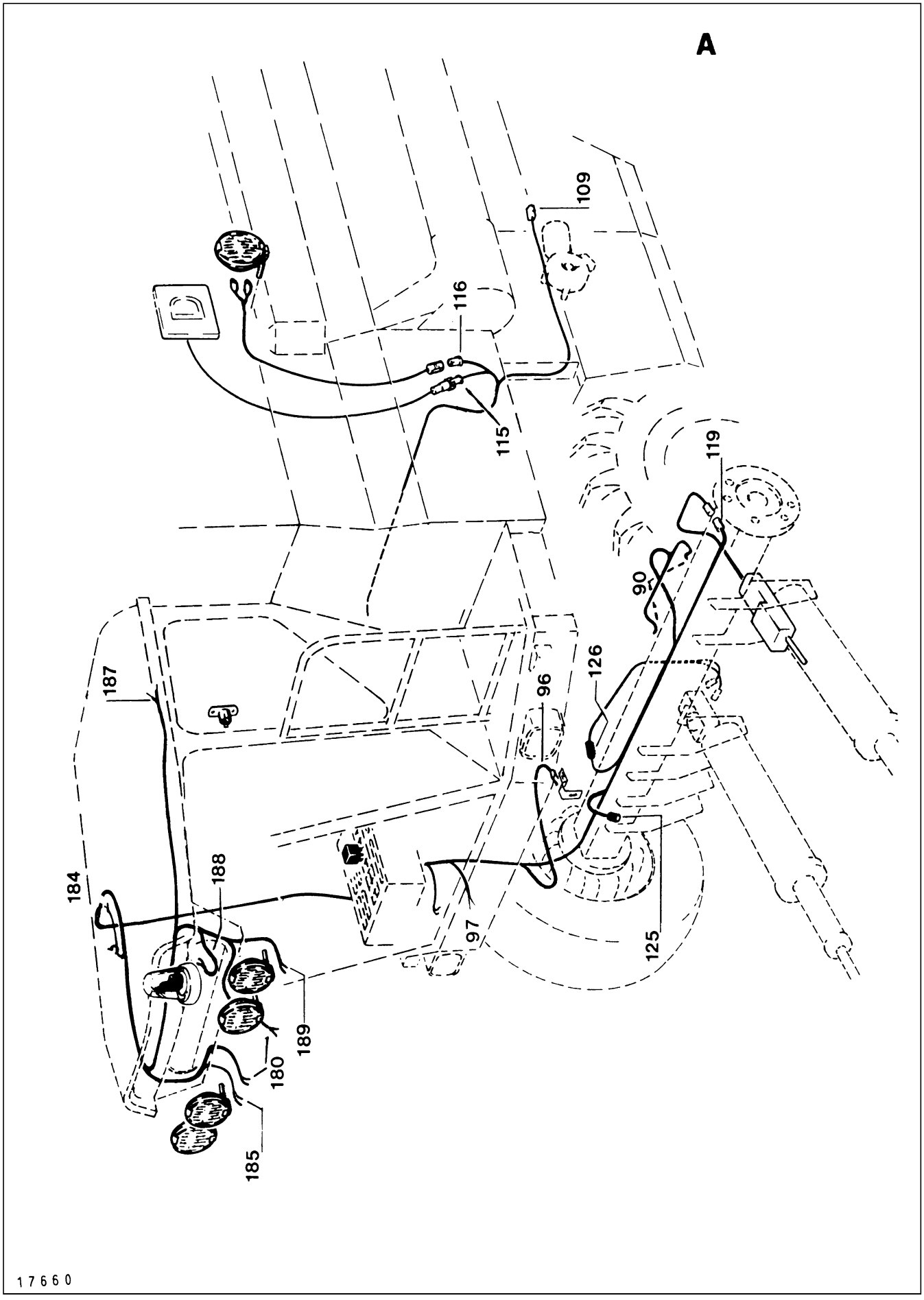
17355

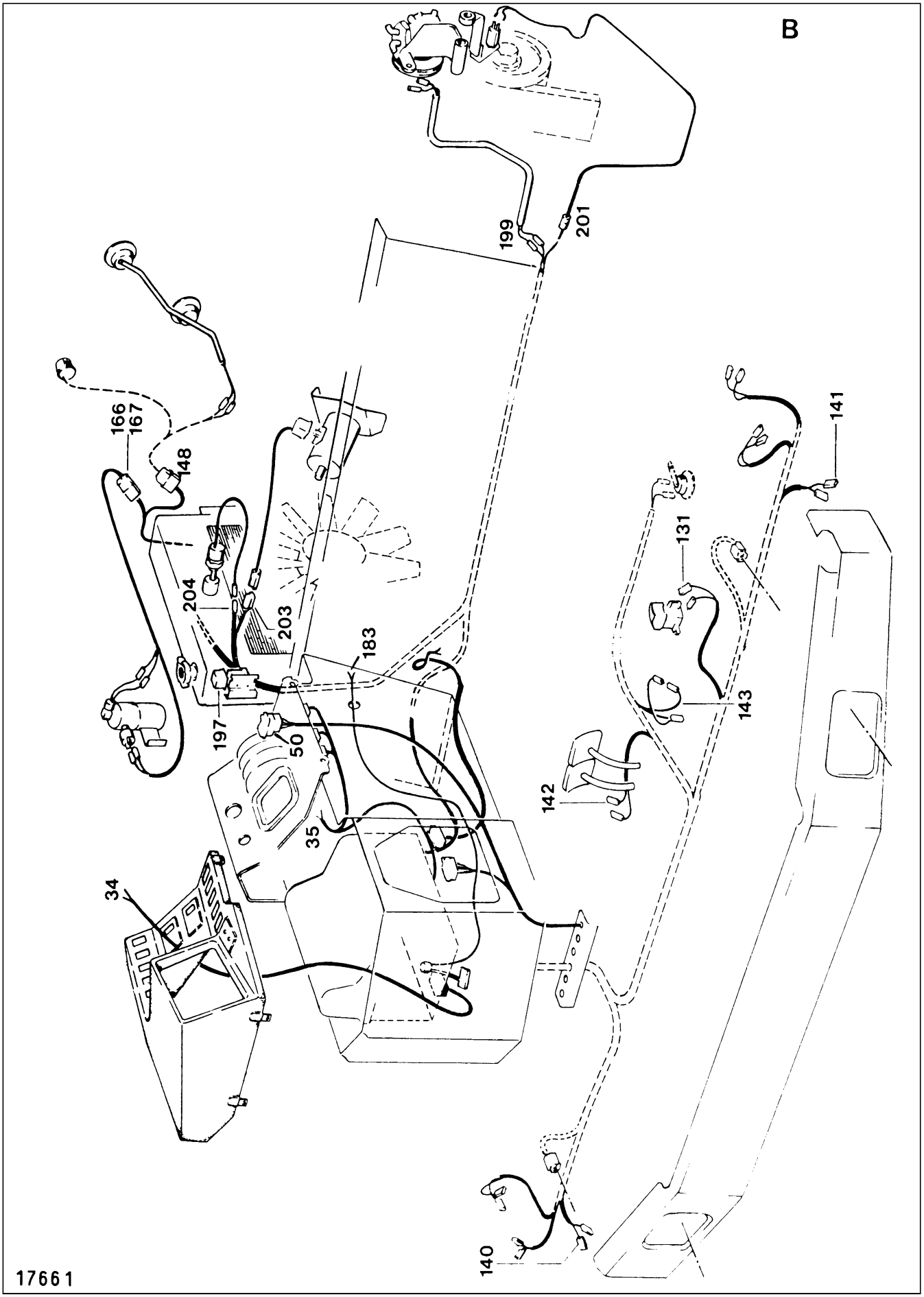
Vehicle information unit

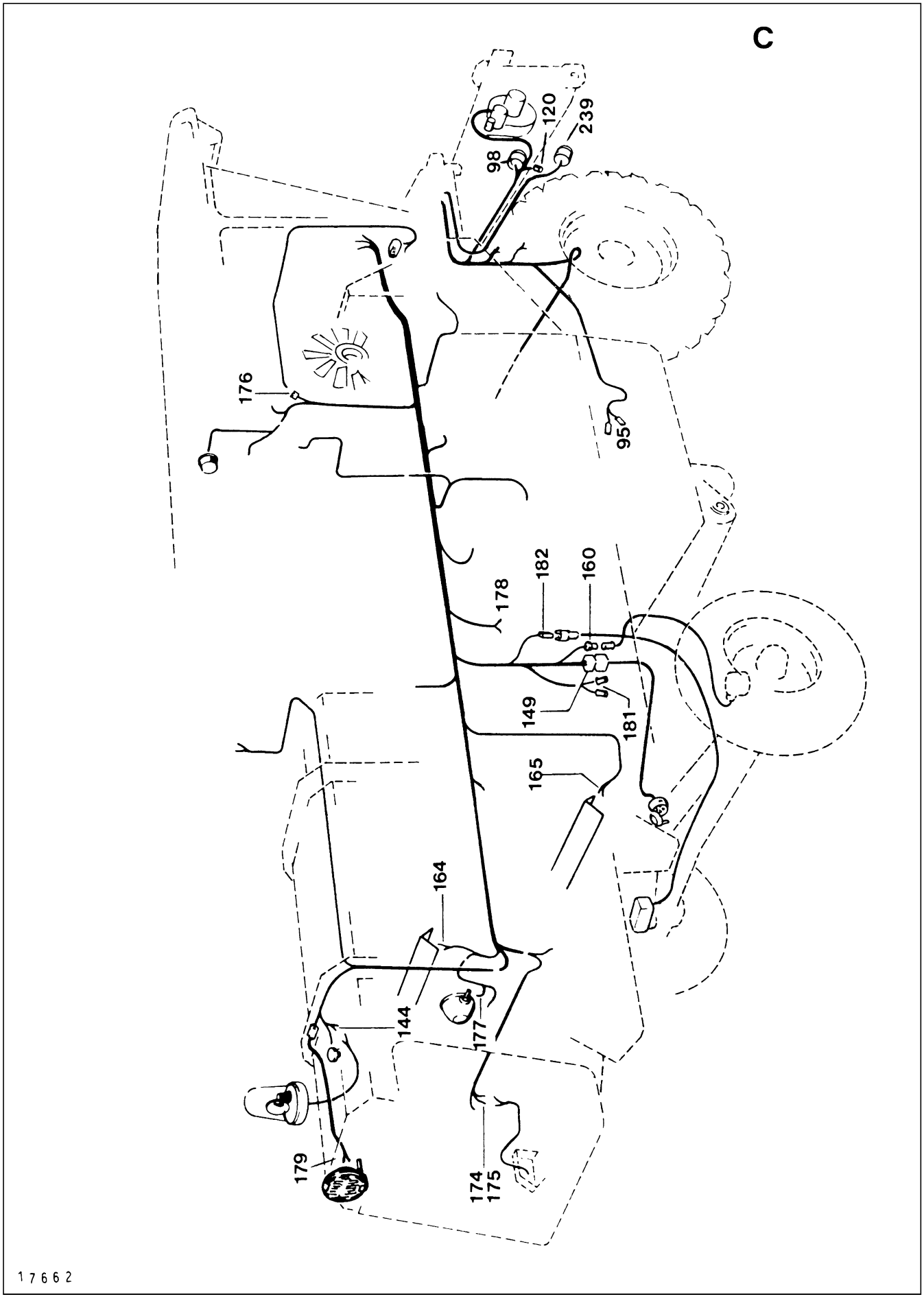
1 – Fuel gauge
2 – Engine temperature gauge
3 – Engine oil pressure, light-red
4 – Air cleaner, light-red
5 – Battery charging, light-red
6 – Coolant temperature, light-red
7 – Spare
8 – Engine warning, light-red
9 – Direction of steering – right, light-red
(only on rice machines)
10 – Hazard warning, light-red
11 – Direction of steering – left, light-red
(only on rice machines)
12 – Threshing mechanism, STOP, light-red
13 – CLAAS 4-Trac system, green
14 – Turning signal, (trailer), green
15 – Turning signal, green
16 – CLAAS-Autopilot, green
17 – Parking brake, light-red

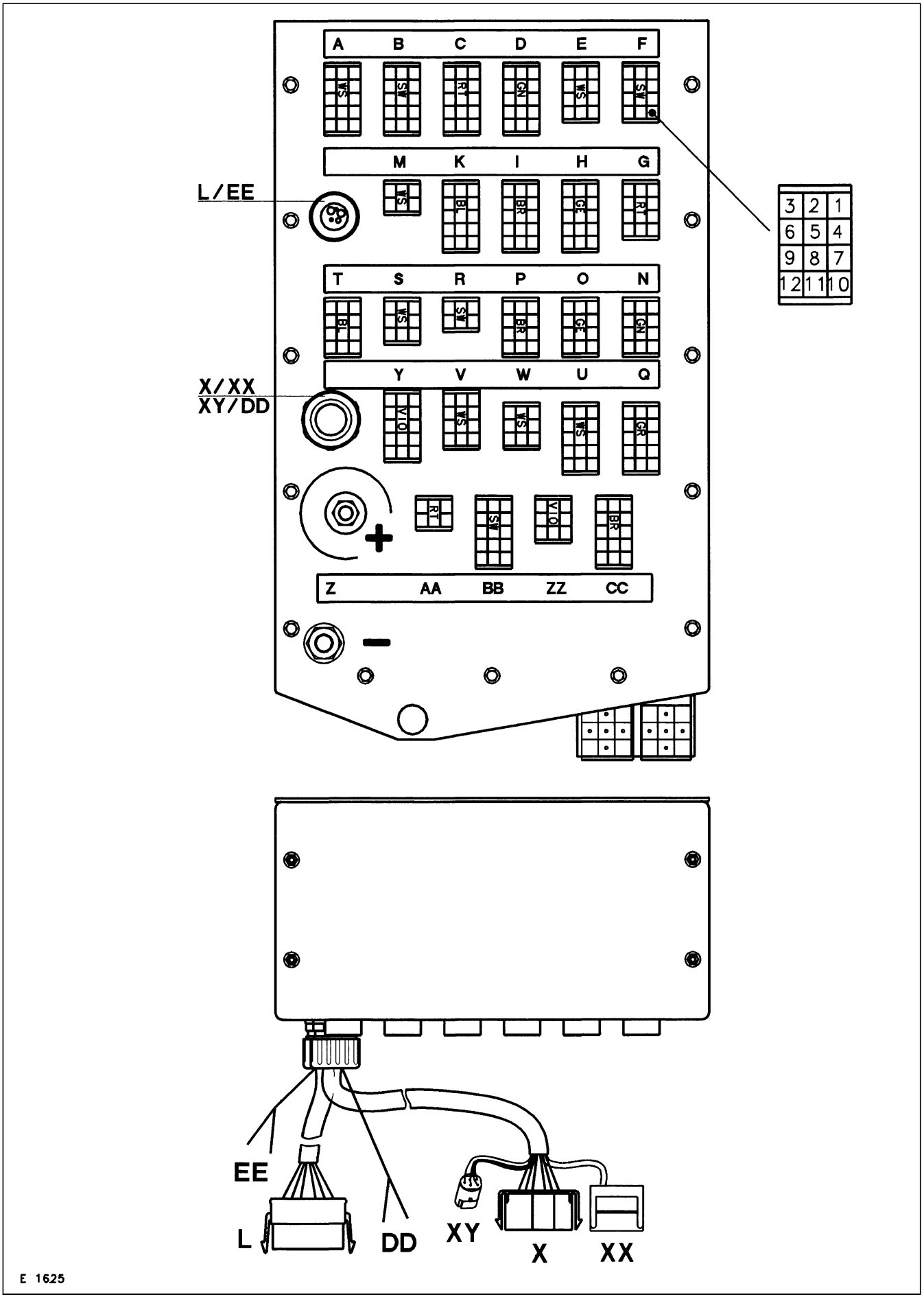
Operations display screen

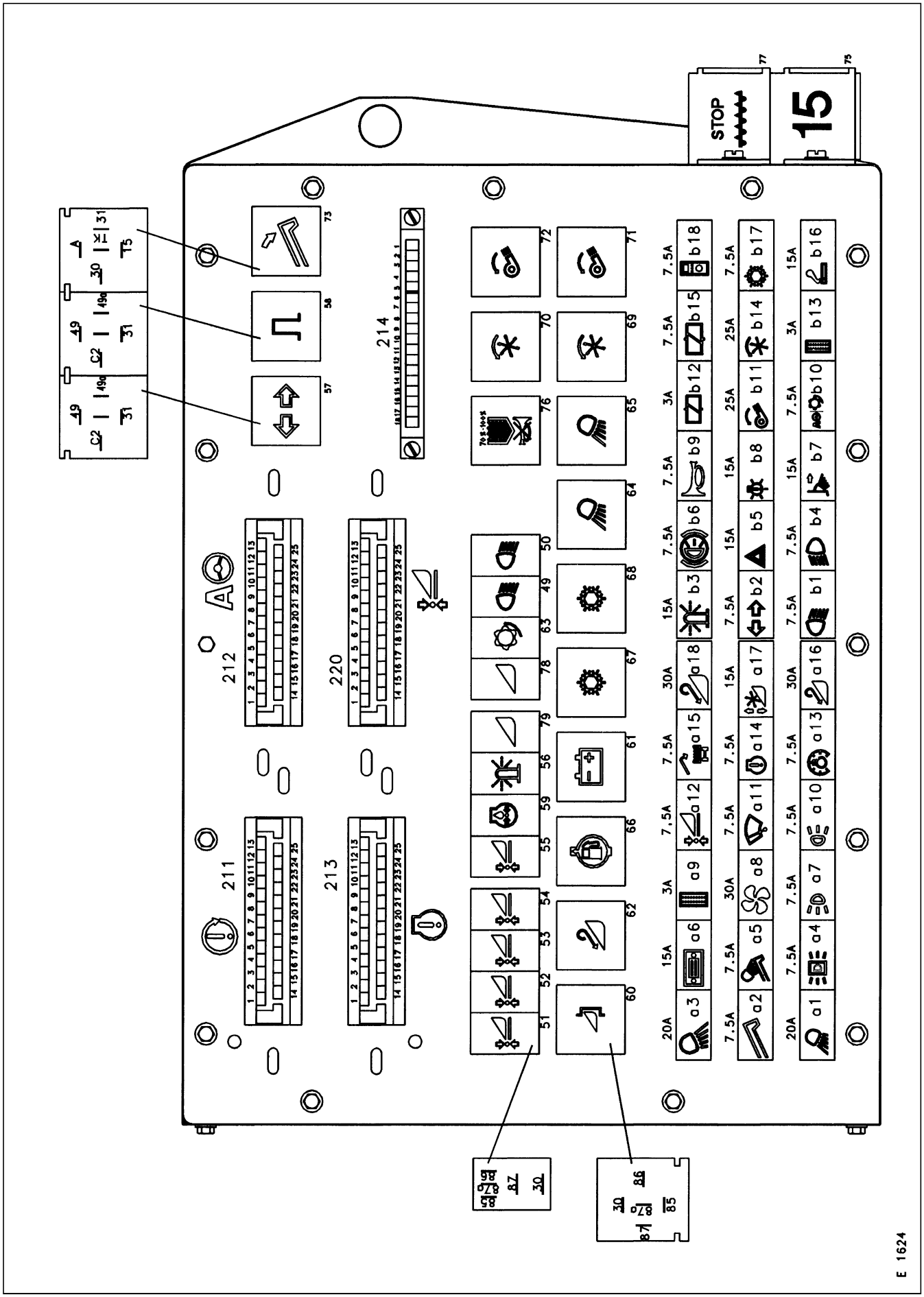
1 – Hourmeter, rev. counter for threshing drum and fan
2 – Cutting height gauge
3 – Ground pressure gauge (Contour System)
4 – Performance monitor
S = Sieve pan
T = Straw walkers (separating system on CS machines)
5 – Warning light, red “Stop”
6 – Warning light, red – feed rake speed-loss monitor
7 – Warning light, red – clean grain elevator speed-loss monitor
8 – Warning light, red – straw walker speed-loss monitor (separation system on CS-machines)
9 – Left spare for other functions
10 – Warning light, red – returns elevator speed-loss monitor
11 – Warning light, red – straw chopper speed-loss monitor
12 – Warning light, red – grain tank discharge tube swung out
13 – Warning light, red – grain tank discharge engaged
14 – Warning light, red – blockage in straw walker compartment (separation cylinder blockages – CS-machines)
15 – Warning light, red – grain tank 100 % full
16 – Indicator light, green – for threshing drum speed
17 – Warning light, green – for fan speed
18 – Indicator light, green – grain tank 70 % full
19 – Warning light, red – problem with air conitioning system


A
109
116
115
119
90
126
96
187
188
184
97
125
189
180
185
17660


B
199
201
166
167
148
204
203
183
197
50
35
34
141
131
143
142
140
17661


C
120
239
98
176
95
182
160
178
149
181
165
164
144
177
179
174
175
17662


A B C D E F
M K I H G
T S R P O N
Y V W U Q
Z AA BB ZZ CC
L/EE
X/XX
XY/DD
3 2 1
6 5 4
9 8 7
12 11 10
EE
L
DD
XY
X
XX
E 1625


STOP
15
211
212
213
214
220
a1 a2 a3 a4 a5 a6 a7 a8 a9 a10 a11 a12 a13 a14 a15 a16 a17 a18
b1 b2 b3 b4 b5 b6 b7 b8 b9 b10 b11 b12 b13 b14 b15 b16 b17 b18
E 1624

Fuses

a 1 – Work lamps, L/H
a 2 – Solenoid valve – unloading auger, relay 73, reel fore and aft
a 3 – Work lamps, R/H
a 4 – Warning light (slow moving vehicle sign, France only)
a 5 – Work lamp, unloading auger, extra lights
a 6 – Radio, CB radio, relay 66, module for Auto Contour, interior cab light
a 7 – Side lights, L/H
a 8 – Cab fan motor
a 9 – Operations display screen, combine performance monitor, cutterbar spring pressure indicator, cutterbar pre-set height indicator
a10 – Side lights R/H
a11 – Windscreen wiper
a12 – Auto Contour (lateral levelling) fuse to relays 56-55-53-52-60, plug-in type module 220
a13 – Fuse to work lamps and indicator lights
a14 – Automatic engine cut-off system
a15 – Solenoid valve – grain tank drive, grain tank unloading, grain tank extension, relays 63-69-70
a16 – Reverser motor

b 1 – Headlight R/H
b 2 – Turn flasher light and vehicle information unit
b 3 – Warning beacon
b 4 – Headlight, L/H
b 5 – Hazard warning flasher lights
b 6 – Foot brake and illumination of controls (switchs), reversing horn
b 7 – Sieve pan lamp, rear shining lamp, extra lights
b 8 – Grain tank lamp, returns light, fuel pump
b 9 – Horn
b10 – Solenoid valve, fuse to relays 71-72, connection for ancillary equipment, Autopilot
b11 – Fan speed motor
b12 – Fuse to relay 59
b13 – Functions monitor
b14 – Reel speed motor
b15 – Fuse to relays 62-58, tachometer, hourmeter
b16 – Ancillary equipment (cigar lighter)
b17 – Air-conditioner
b18 – Fieldwork computer

Electric wiring diagram
CLAAS DOMINATOR 218/208/204/203/202 MEGA

Key to wiring diagrams

1 – Hazard warning flasher switch
2 – Light switch
3 – Turn flasher switch
4 – Ignition switch
5 – Vehicle information unit
6 – Switch for windscreen wiper/washer
7 – Motor for rotary windscreen wiper
8 – Push-button, reel forward
9 – Push-button, reel backward
10 – Seat contact switch, USA
11 – Push-button, cutting height selection on
12 – Push-button, lower reel
13 – Push-button, raise reel
14 – Push-button, lower cutterbar
15 – Push-button, raise cutterbar
16 – Push-button, automatic ground pressure control
17 – Starter safety switch, hydrostatic drive lever
18 – Cutterbar spring pressure indicator and cutterbar pre-set height indicator
19 – Potentiometer, sensitivity selector performance monitor
20 – Combine performance monitor
21 – Indicator lights A
22 – Indicator lights B
23 – Selector switch, reel speed
24 – Switch, work lamps, cab
25 – Switch, warning beacon
26 – Selector switch, speed indicator
27 – Tachometer and hourmeter
28 – Selector switch, fan speed
29 – Switch, cutterbar USA
30 – Switch, work lamps, basic machine
31 – Switch – 4-Trac system
32 – Centralizing switch, Autopilot
33 – Switch – Autopilot
34 – Connection, ancillary equipment
35 – Connection, ancillary equipment
36 – Switch, cancel audible warning
37 – Switch, Contour System ON
38 – Master switch (red), lift hydraulic system
39 – Master switch (red), lift hydraulic system (mechanical drive machines)
40 – Buzzer Switch, cutterbar reverser
41 – Limit switch, preset height control
42 – Switch, cutterbar folding (activating the change-over valve)
43 – Switch, folding cutterbar to transport position
44 – Switch, swinging cutterbar to working width
45 – Switch, cutterbar locking
46 – Switch, reel in low position
47 – Switch, reel in backward position
48 – Solenoid-operated change-over valve
49 – Relay, headlight changeover
50 – Relay, headlight changeover
51 – Relay – Contour System
52 – Relay – Contour System
53 – Relay – Contour System
54 – Relay – Contour System
55 – Relay – Contour System
56 – Relay – warning beacon
57 – Relay – turn flasher light
58 – Pulse generator
59 – Relay – oil pressure
60 – Relay – lift hydraulic system
61 – Relay – alternator
62 – Relay – reverser
63 – Relay – thresher
64 – Relay – work lamps
65 – Relay – work lamps
66 – Relay – fuel pump
67 – Relay – air conditioning
68 – Relay – air conditioning
69 – Relay – reel speed adjustment
70 – Relay – reel speed adjustment
71 – Relay – fan speed adjustment
72 – Relay – fan speed adjustment
73 – Time delay relay – unloading auger swing
74 – Time delay relay, cutterbar electrics, USA
75 – Relay No. 15 – cab
76 – Relay, grain tank fill indicator warning
77 – Relay, grain tank unloading stop
78 – Relay, cutterbar off
79 – Relay, cutterbar off
80 – Relay, cutterbar electrics, USA
81 – Master switch, thresher
82 – Master switch, cutterbar
83 – Switch, parking brake
84 – Switch, unloading auger swing
85 –
86 – Autopilot, sensor L/H
87 – Autopilot, sensor R/H
88 – Motor, reel speed adjustment
89 – Magnetic pick-up, feeder housing (front elevator)
90 – Disc brake warning contact (wear)
91 – Pulse generator, transmission
92 – Switch, ground pressure sender
93 – Sender for cutterbar spring pressure indicator
94 – Sender, feeder housing position
95 – Magnetic pick-up, fan speed
96 – Reed contact switch – ground speed
97 – Limit switch – front attachment, fieldwork computer
98 – Cutterbar socket
99 – Reverser motor, 12 Volts
100 –
101 – Solenoid valve, front attachment – raise
102 – Solenoid valve, front attachment – lower
103 – Solenoid valve, reel – raise
104 – Solenoid valve, reel – lower
105 – Solenoid valve, reel – forward
106 – Solenoid valve, reel – backward
107 – Solenoid valve, unloading auger – out
108 – Solenoid valve, unloading auger – in
109 – Motor, fan speed adjustment
110 – Solenoid valve, threshing drive
111 – Solenoid valve, cutterbar drive
112 – Solenoid valve, unloading auger drive
113 – Magnetic pick-up, drum speed
114 – Switch, unloading auger swung out
115 – Warning light connection (D sign)
116 – Work lamp, unloading auger
117 –
118 –
119 – Connection for switch – Contour System
120 –
121 – Solenoid valve – Autopilot
122 – Solenoid valve – Autopilot
123 – Foot switch – Autopilot ON
124 – Reed switch (overrider switch) – Autopilot
125 –
126 –
127 – Switch, cutterbar folding (changeover valve)
128 – Switch, reel forward (folding cutterbar)
129 – Switch, reel backward (folding cutterbar)
130 – Connection for folding front attachments
131 – Foot switch, grain tank unloading
132 – Horn
133 – Reversing horn
134 – L/H turn flasher light, front
135 – R/H turn flasher light, front
136 – L/H side light, front
137 – R/H side light, front
138 – L/H headlight
139 – R/H headlight
140 –
142 – Warning contact switch – foot brake
143 –
144 – Rear warning beacon
145 – Grain level switch – grain tank 100 % full
146 – Grain level switch – grain tank 70 % full
147 – Grain tank lamp
148 – Connector – R/H engine side panel
149 – Connection – trailer socket
150 –
151 – L/H rear turn flasher light
152 – R/H rear turn flasher light
153 – L/H rear side light
154 – R/H rear side light
155 – L/H rear brake light
156 – R/H rear brake light
157 – Connector, folding cutterbar lighting
158 – Switch, reversing horn
159 – Connection, driver's seat compressor
160 – Sender, rear wheel steering indicator
161 – Straw build up warning switch
162 – Foot -operated switch, cutterbar immediate stop
163 – Fuel gauge sender
164 – Sensor panel, straw walkers/separation cylinders
165 – Sensor panel, sieve pan
166 – High pressure safety switch, air conditioner
167 – Low pressure safety switch, air conditioner
168 – Switch, sieve pan lamp
169 – Switch, returns light
170 –
171 – Magnetic pick-up, returns elevator
172 – Magnetic pick-up, clean grain elevator
173 – Magnetic pick-up, straw walkers/separation cylinders
174 – Limit switch, straw chopper
175 – Magnetic pick-up, straw chopper
176 – Returns light
177 – Sieve pan lamp
178 – Fuel pump
179 – Rear shining lamp
180 – Extra lights
181 – CLAAS 4-Trac System – solenoid valve
182 – Rearwheel steering indicator
183 – Connection for ancillary equipment (cigar lighter)
184 – Connection for radio and CB radio
185 – Work lamp, top
186 – Interior lighting with switch
187 – Seat switch – Autopilot (when operator dismounts)
188 – Front warning beacon
189 – Work lamp, top
190 – Thermostat switch – air conditioner
191 – Cab fan motor
192 – Cab fan motor switch
193 – Switch, threshing mechanism, grain tank unloading stop
194 – Temperature gauge sender
195 – Oil pressure switch, engine
196 – Water temperature alarm switch*
197 – Starter motor relay
198 –
199 – Electro-magnetic clutch for air conditioner
200 – Glow plug (only PERKINS)
201 – Engine speed magnetic pick-up (fieldwork computer)
202 – Air cleaner warning contact switch
203 – Engine cut-off solenoid
204 – Water level sender
205 – Alternator
206 – Starter
207 –
208 – Battery
209 – Battery isolating switch
210 – Fieldwork computer
211 – Module for shaft speed monitor
212 – Module for Autopilot
213 – Module for automatic engine cut-off system
214 – Diode plate
215 –
216 –
217 –
218 –
219 – Connector for R/H sensor, Auto Contour system on folding cutterbar
220 – Module for Auto-Contour
221 – Switch for Auto-Contour
222 – L/H sensor band for Auto-Contour
223 – R/H sensor band for Auto-Contour
224 – Potentiometer, ground pressure
225 – Switch – manual lateral levelling control
226 – Solenoid valve for L/H lateral levelling
227 – Solenoid valve for R/H lateral levelling
228 – Potentiometer, cutting height
229 – LED, ground pressure
230 – LED, cutting height
231 – Relay – electric adjustment of deflectors (straw chopper)
232 – Module – electric adjustment of deflectors (straw chopper)
233 – Motor – electric adjustment of deflectors (straw chopper)
234 – Potentiometer, electrical adjustment of deflectors (straw chopper)
235 –
238 –
239 – Socket – Auto-Contour
240 –
251 – Connector – folding cutterbar lighting or folding maize picker head lighting
252 – Turn flasher light, R/H
253 – Turn flasher light, L/H
254 – Side light, R/H
255 – Side light, L/H
260 – Fuse, 25 A
261 – Reed contact switch
262 – Relay
263 – Switch
264 – Electromagnetic clutch
265 – Fill level sensor
266 – Electronics grain, elevator
267 – UNI Control Unit
268 – Cable extension
269 – Cable extension
270 –
275 –
276 –
277 – Changeover switch, headlight
278 – Top head light
279 – Top head light
280 – Wide-beam work light

* Items 194 and 196 are combined in one sensor.

NOTE! The above listed positions apply to all country and equipment variations.

Cable colours

rt – red
sw – black
br – brown
ws – white
bl – blue
gr – grey
ge – yellow
gn – green
ro – pink
or – orange
viol – violet

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