Service Manual

Compact loader

501s

Machine model	**501s**
Edition	**2.1**
Language	**en**
Article number	**1000155663**

WACKER NEUSON

1.2 Identification of warnings and dangers

Important indications regarding the safety of the personnel and the machine are identified in this service manual with the following terms and symbols:

Danger!

Failure to observe the instructions identified by this symbol can result in personal injury or death for the operator or other persons.

☞ *Measures for avoiding danger*

Caution!

Failure to observe the instructions identified by this symbol can result in damage to the machine.

☞ *Measures for avoiding danger for the machine*

Notice!

This symbol identifies instructions for a more efficient and economical use of the machine.

Environment!

Failure to observe the instructions identified by this symbol can result in damage to the environment. The environment is in danger if environmentally hazardous material (e.g. waste oil) is not subject to proper use or disposal.

1.11 Instrument panel legend

Pos.	Designation
11	Air filter indicator light (red)
12	Fuel indicator light (yellow)
13	Cold starter indicator light (yellow)
14	Indicator light (red) – pump pressure
15	Hydraulic oil filter indicator light (red)
16	Alternator charge function indicator light (red)
17	Parking brake indicator light (red)
18	Engine oil pressure indicator light (red)
19	Coolant temperature indicator light (red)
20	Turn indicator light (green)
21	Not assigned
22	Hour meter
23	Front working lights
24	Hazard warning system (option)
25	Rear working light (option)
26	Rotating beacon (option)
27	Parallel bucket lift (option)
28	Not assigned
29	Left/right turn indicators (option)
30	Parking brake
31	Locking the work hydraulics

Fuel injection pump

Type	YPD-MP2
Design	Single piston distributor injection pump
Injection pressure	196 – 206 bar (2843 – 2988 psi)
Engine speed control	Mechanical
Lubrication system	Engine oil lubrication

Capacity

Capacities	l (gal)
Fuel tank	45 (11.9)
Engine oil (max./effect.)	6.7/2.8 (1.8/0.74)
Coolant (without radiator)	5 (1.3)
Radiator	2 (0.5)
Expansion tank	0.3 (0.08)

Tightening torque

Tightening torques	Nm/ft.lbs.
Cylinder-head bolt	85.3 – 91.1/62.9 – 67.2 (M10x1.25) lubricated
Connecting rod bearing screw	44.1 – 49.0/32.5 – 36.1 (M9x1) lubricated
Main bearing screw	93.2 – 98.1/68.7 – 72.4 (M12x1.5) lubricated
Flywheel screw	83.3 – 88.2/61.4 – 65.1 (M10x1.25) lubricated

2.3 Travelling drive

Variable displacement pump	Model 501s	Model 501s with hydraulic pilot control
Design	Infinitely variable axial piston pump	
Displacement	0 – 24.6 cm³/rev (0 – 1.5 in³/rev)	0 – 28 cm³/rev (0 – 1.7 in³/rev)
Max. operating pressure	250 bar (3626 psi)	275 bar (3989 psi)
Starting speed	1450 rpm	
Boost pump	**Model 501s**	**Model 501s with hydraulic pilot control**
Design	Gear (external)	Gear (internal)
Displacement	14.0 cm³/rev (0.85 in³/rev)	11.6 cm³/rev (0.71 in³/rev)
Charging/boost pressure	18 bar (261 psi)	25 bar (363 psi)
Driving direction	Mechanical	Hydraulic
Hydraulic motor	**Model 501s**	**Model 501s with hydraulic pilot control**
Design	Gerotor	
Max. capacity	161.1 cm³/rev (9.8 in³/rev)	
Drive speed	10.5 kph (6.5 mph)	
Traction force	18 kN (4046.5 lbf)	

Maintenance

Stationary fuel pumps

General

Only refuel from stationary fuel pumps. Fuel from barrels or cans is usually dirty.
Even the smallest particles of dirt can cause

- Increased engine wear
- Malfunctions in the fuel system and
- Reduced effectiveness of the fuel filters.

Refuelling from barrels

If refuelling from barrels cannot be avoided, note the following points (see fig. 2):

- Barrels must neither be rolled nor tilted before refuelling.
- Protect the suction pipe opening of the barrel pump with a fine-mesh screen.
- Immerse it down to a max. 15 cm (6") above the floor of the barrel.
- Only fill the tank using refuelling aids (funnels or filler pipes) with integral microfilter.
- Keep all refuelling containers clean at all times.

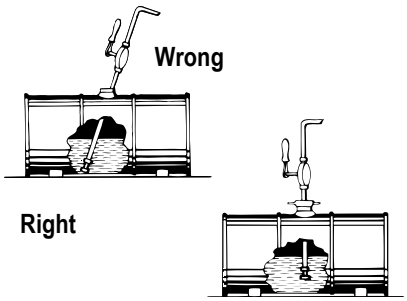


Fig. 2: Refuelling from a barrel

Diesel fuel specification

Use only high-grade fuels.

Grade	Use
• 2-D ASTM D975 – 94 • 1-D ASTM D975 – 94	USA
• EN 590: 96	EU
• ISO 8217 DMX	International
• BS 2869 – A1 • BS 2869 – A2	England

Bleeding the fuel system

Danger!

If the fuel, as it drains, comes into contact with hot engine parts or the exhaust system, there is an increased

Fire hazard!

☞ *Never bleed the fuel system if the engine is hot.*

Bleed the fuel system in the following cases:

- After removing and fitting the fuel filter, prefilter or the fuel lines back on again
- After running the fuel tank empty
- After running the engine again, after it has been out of service for a longer period of time.

☞ *Bleed the fuel system as follows:*

- Fill up the fuel tank.
- Turn the ignition key to the first position.
- Wait about 5 minutes while the fuel system bleeds itself automatically.
- Start the engine.

If the engine runs smoothly for a while and then stops, or if it does not run smoothly:

- Stop the engine
- Bleed the fuel system again as described above
- Have this checked by authorized personnel if necessary

3.9 Air filter

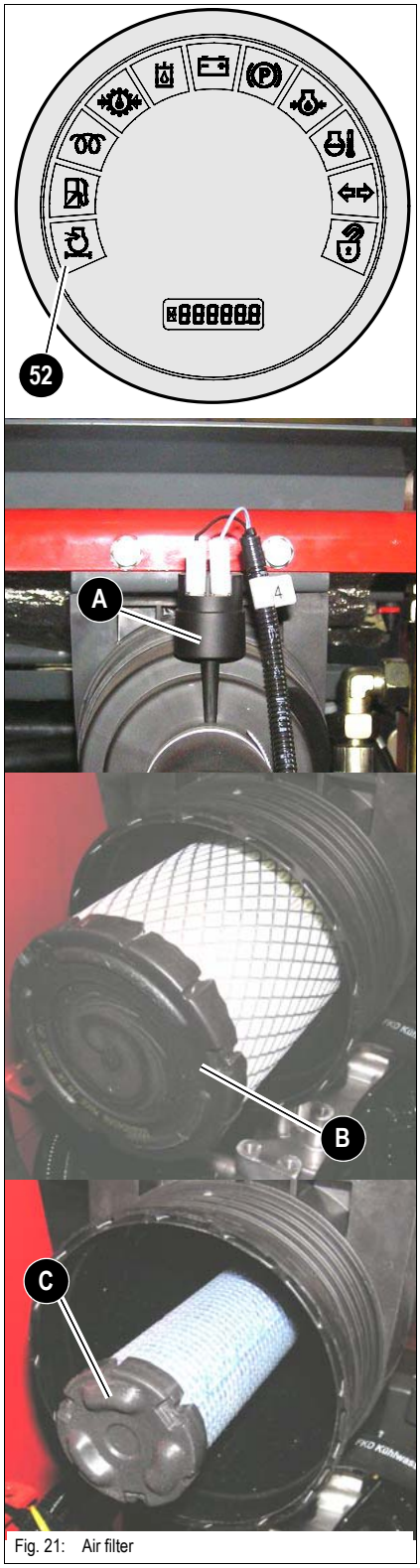


Fig. 21: Air filter

Caution!

The filter cartridge is damaged if it is washed or brushed out.
Bear in mind the following to avoid premature engine wear:

☞ *Do not clean the filter cartridge.*

☞ *Replace the filter cartridge when the indicator light comes on.*

☞ *Never reuse a damaged filter cartridge.*

☞ *Ensure cleanliness when replacing the filter cartridge.*

Maintenance switch **A** on the air filter activates indicator light **52** on the round display element which monitors the filter cartridge.

☞ *Replace outside filter **B** and inside filter **C**:*

- If indicator light **52** in the round display element comes on.
- According to the maintenance plan.

Notice!

For **applications in especially dusty environment**, the air filter is fitted with an extra inside filter **C**. Do not clean inside filter **C**.

Caution!

Filter cartridges degrade prematurely when in service in acidic air for longer periods of time. This risk is present for example in acid production facilities, steel and aluminium mills, chemical plants and other nonferrous-metal plants.

☞ *Replace outside filter **B** and inside filter **C** at the latest after 50 service hours.*

General instructions for air filter maintenance:

- Store filters in their original packaging and in a dry place.
- Do not knock the filter against other objects as you install it.
- Check air filter attachments, air intake hoses and air filters for damage, and immediately repair or replace if necessary.
- Check the screws at the induction manifold and the clamps for tightness.
- Check the function of the dust valve, replace if necessary.

Checking the hydraulic oil level

Caution!

Do not add oil if the oil level is above the **FULL** mark, otherwise the hydraulic system can be damaged and escaping oil can cause serious injuries.

☞ *Check the hydraulic oil level each time the machine is put into operation or once a day.*

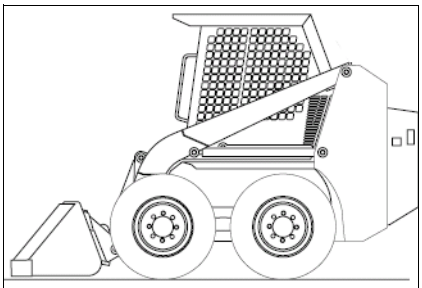


Fig. 35: Parking the loader

- If the attachment is not positioned as shown:

☞ Start the engine and let it run at idling speed.

☞ Retract the loader unit ram, lower the bucket to the ground.

☞ Stop the engine again.

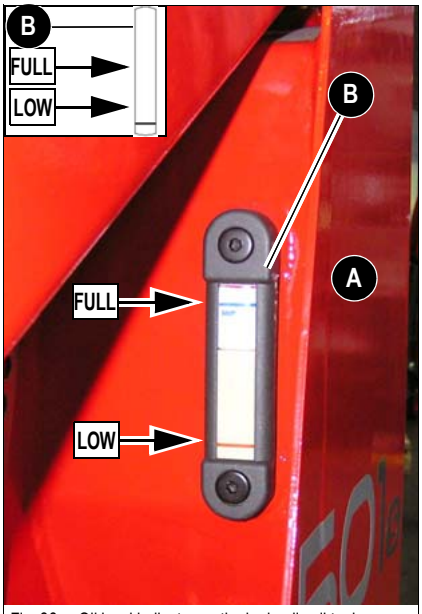


Fig. 36: Oil level indicator on the hydraulic oil tank

☞ *Proceed as follows:*

- Park the machine on level ground.
- Stop the engine.
- Raise the safety bar.
- Sight glass 36/**B** is located on hydraulic oil tank 36/A.
- Check the oil level on sight glass **B**.
- The oil level must be at the **FULL** level.
  - A gauge element in sight glass **B** indicates the oil level.

If the oil level is lower,

- Add hydraulic oil.

The oil level varies according to the machine's operating temperature:

Machine condition	Hydraulic oil temperature	Oil level
• Before putting into operation	Between 10 and 30 °C (50 and 86 °F)	**LOW** mark
• Normal operation	Between 50 and 90 °C (122 and 194 °F)	**FULL** mark

Notice!

Measure the oil level of the hydraulic system only after the machine reaches its operating temperature.

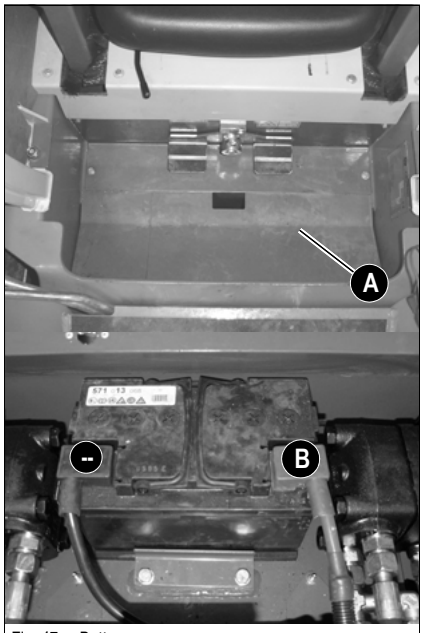


Fig. 47: Battery

The battery is located in the legroom area underneath footrest plate **A**. The battery is “maintenance-free”. However have the battery checked at regular intervals to ensure that the electrolyte level is between the MIN and MAX marks.

Checking the battery requires it to be removed and must be performed by an authorized workshop.

Always follow the specific battery safety instructions.

Notice!

Do not disconnect the battery while the engine is running.

Jump-starting the engine

☞ Check whether both batteries have the same voltage (12 volts).

☞ Drive the jump-starting vehicle to within a short distance of the batteries.

☞ Start and let the jump-starting vehicle run.

☞ Connect the positive terminals with the red clamps, the machine with the flat battery first.

☞ First connect the black cable to the negative terminal of the jump-starting battery and then connect it to a sheet-metal part (bodywork) far away from the battery of the machine with the flat battery (do not connect it to the negative terminal of the flat battery, otherwise explosive oxyhydrogen gas can ignite when the contact is made/ removed).

☞ Slightly increase the engine speed of the jump-starting vehicle to improve alternator output. Wait a few minutes.

☞ Try starting the machine with the flat battery.

☞ After the machine has started, first remove the clamp on the bodywork that is the far away from the battery.

☞ Caution when touching the clamps, they can be hot due to high currents. Remove the remaining clamps.

4.5 Checking the injection nozzles

Pressure check

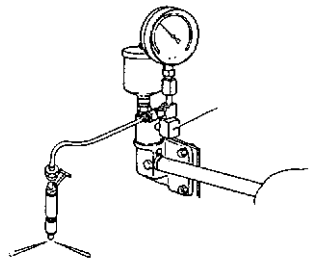


Fig. 3: Nozzle tester

☞ *Remove the injection line and the injection nozzle.*

☞ *Connect the injection nozzle with the high pressure line of the nozzle tester.*

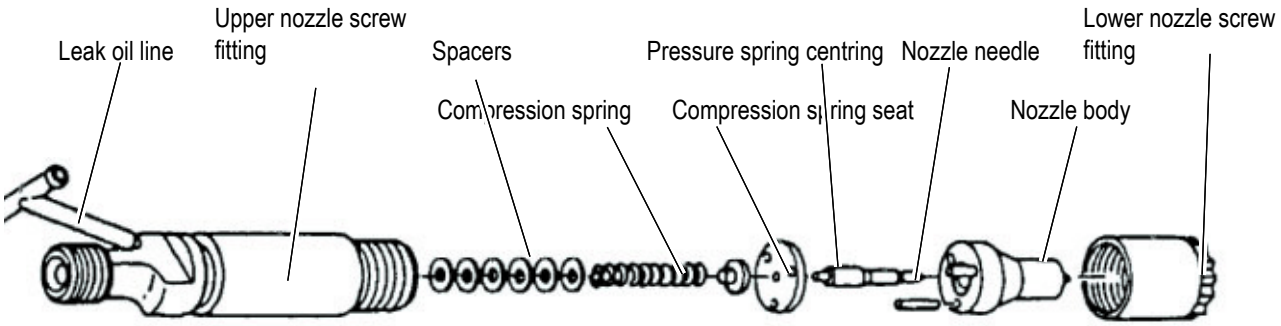
☞ *Slowly increase pressure until the nozzle ejects fuel and read the pressure off the pressure gauge.*

☞ *If the injection pressure is too low, replace the spacer in the nozzle by a thicker one. If the pressure is too high, replace the spacer by a thinner one.*

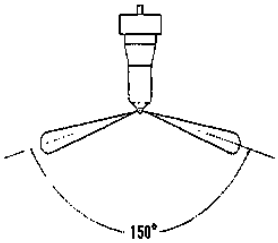
➥ Injection pressure: **220 – 230 bar (3191 – 3336 psi)**

- Spacer thickness of 0.1 mm (0.004") corresponds to modification by 19 bar (276 psi).
- Check the injection nozzle for drips after it has ejected fuel.

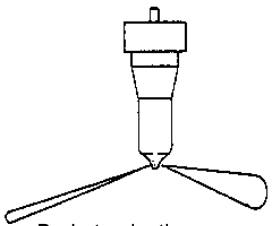
☞ Create a pressure of about 20 bar (290 psi) below injection pressure and check whether fuel drips from the nozzle.



4.6 Checking the nozzle jet



Normal atomization



Bad atomization

Fig. 4: Nozzle jet

☞ *Remove the injection lines and the injection nozzles.*

☞ *Connect the injection nozzle with the high pressure line of the nozzle tester.*

☞ *Quickly create pressure until the nozzle ejects fuel (ejection 3 – 4 times).*

☞ *Hold a white sheet of paper about 30 cm (12") away from the nozzle and let the nozzle eject fuel.*

☞ *The nozzle jet must create a shape on the paper as shown in* **fig. 5/1**.

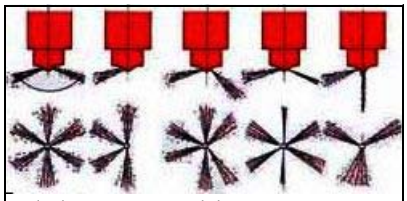
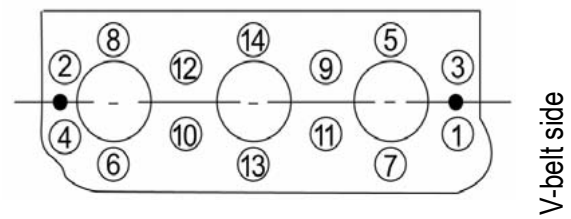


Fig. 5: Shape of nozzle jet

4.18 Tightening order for cylinder head bolts

☞ *Order for removing the cylinder-head bolts*



☞ *Install the cylinder-head bolts.*

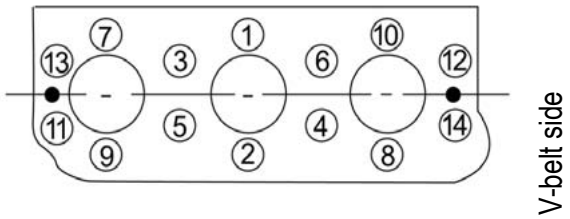
➥ Tightening torques:

- 1st pass **42.6 – 45.5 Nm (31.4 – 33.6 ft.lbs.)**
- 2nd pass **85.3 – 91.1 Nm (62.9 – 67.2 ft.lbs.)**

Caution!

Bear in the mind the order for tightening the cylinder-head bolts.

☞ *See figure below*



Notice!

Apply oil to the threads and contact surfaces before installing.

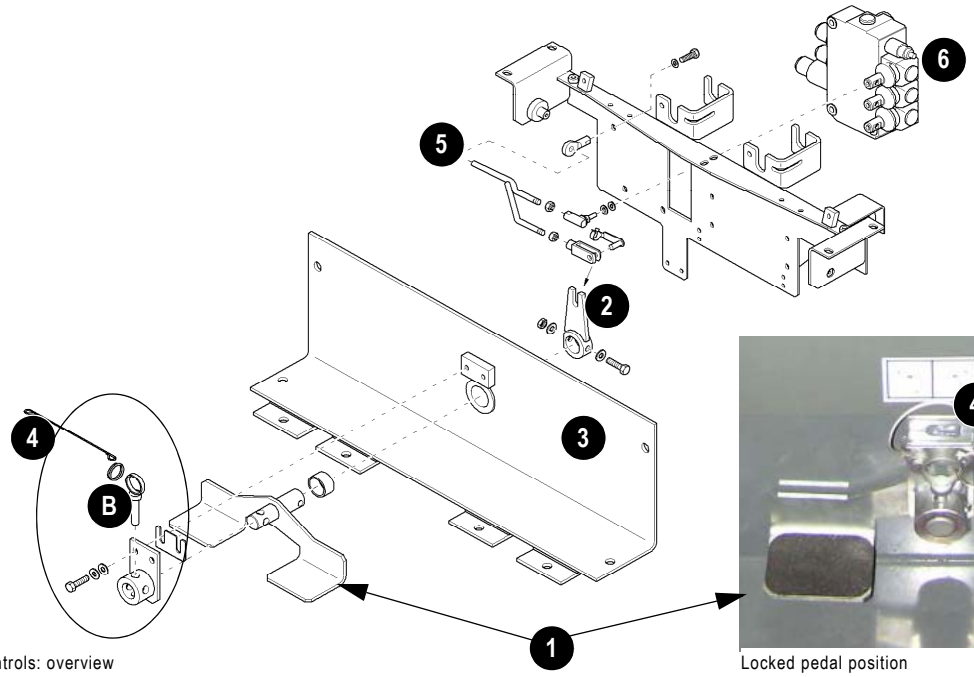
Notice!

Always perform work on the cylinder head on a cold engine.

Hydraulic system

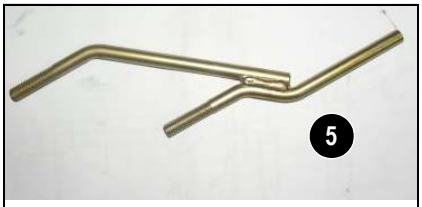
Auxiliary hydraulics control

- Control valve (rocker pedal version)



Controls: overview

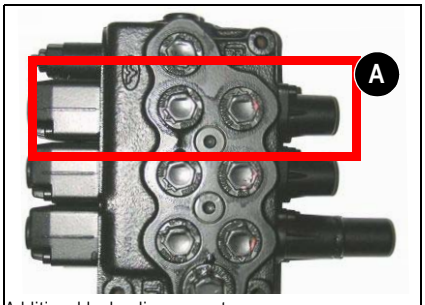
Locked pedal position



Connecting rod

Pos.	Designation
1	Rocker pedal
2	Control lever
3	Cover
4	Lock unit
5	Connecting rod
6	Main valve block

Function



Additional hydraulic segment

Main valve block segment (A) is actuated by means of a connecting rod (B) mounted on control lever (2). Pressing the pedal to the left or right actuates the auxiliary hydraulics segment on the main valve block.

Danger!

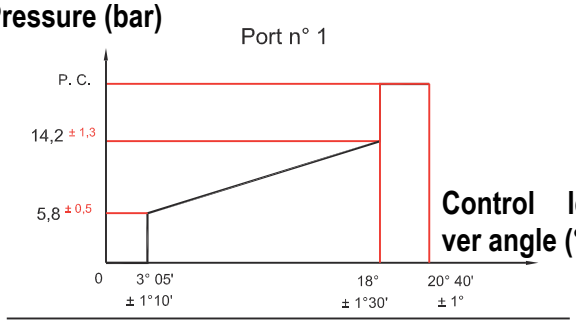
Unintentional actuation of the auxiliary hydraulics pedal –

Danger of accidents!

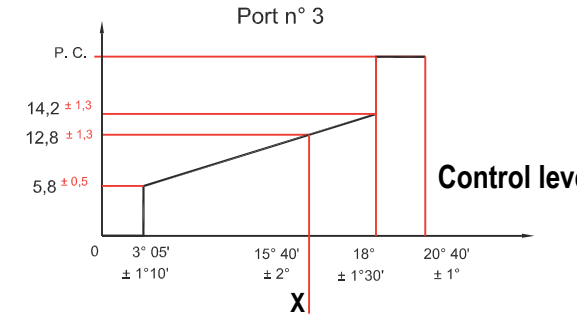
☞ *Always lock the pedal with lock pin (B) if it is not in use.*

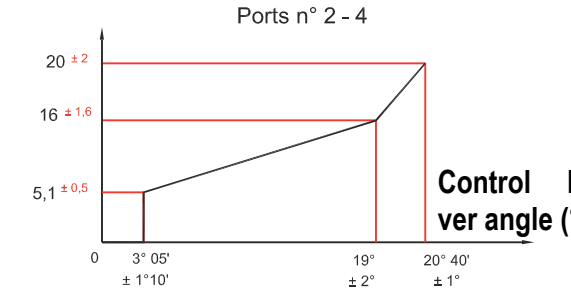
Characteristic curves of H controls option (left-hand control lever):

Pressure (bar)



Control lever angle (°)

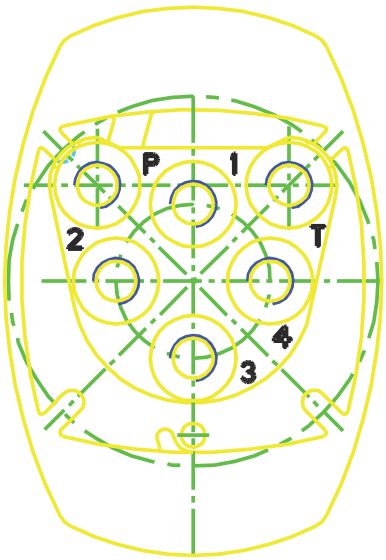


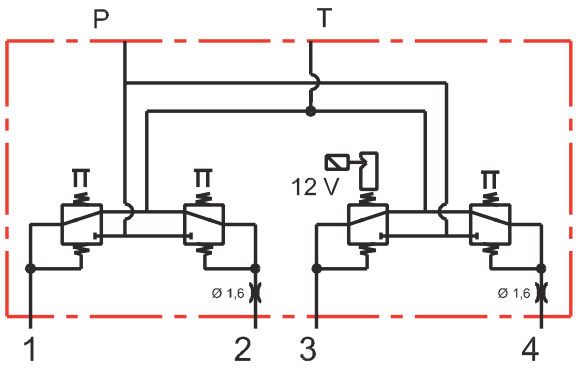


Control lever angle (°)

x...angle from which the float position is active

Ports:



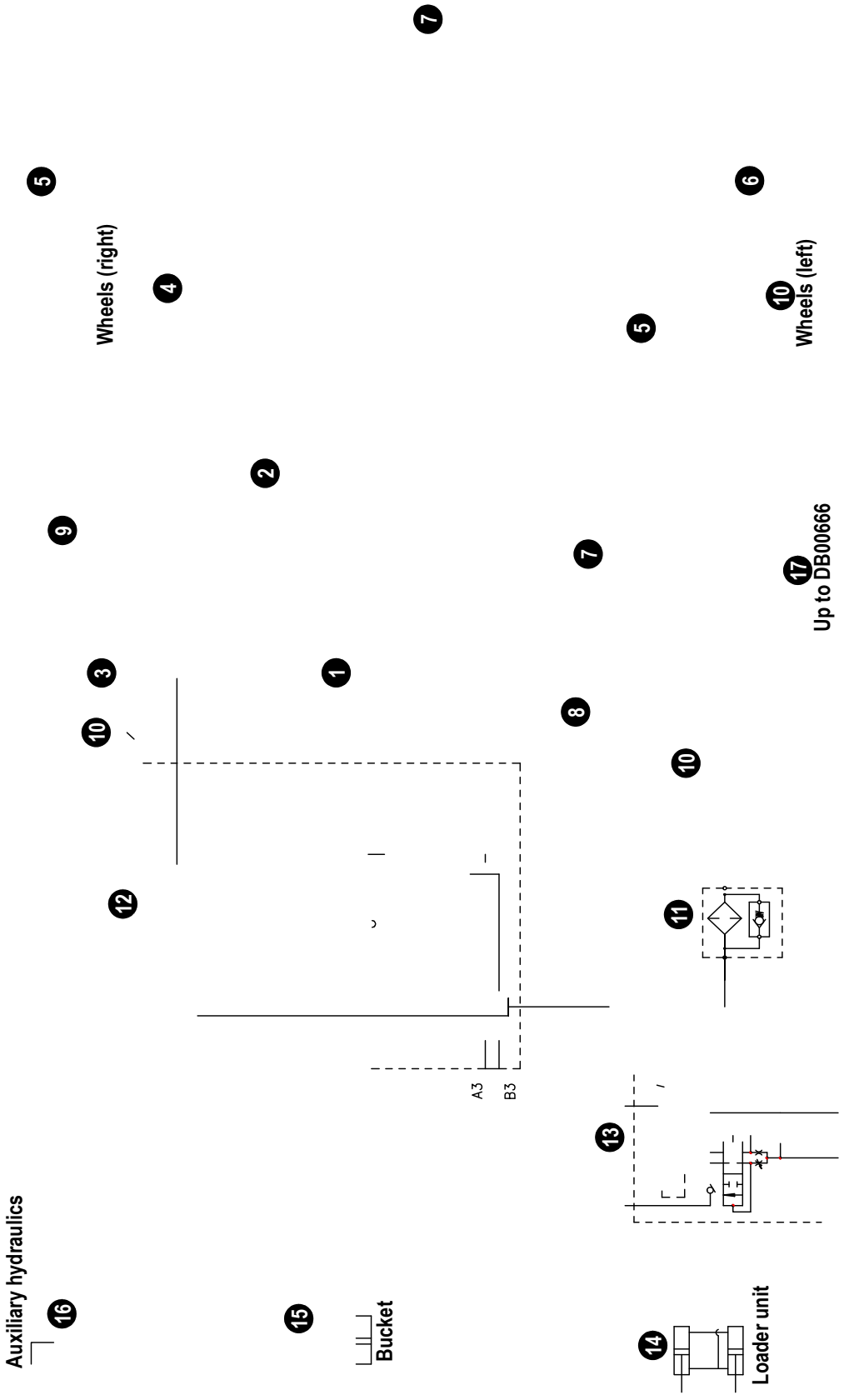


Port	Designation
1	Raise loader unit
2	Travelling drive to the rear left
3	Lower loader unit or float position
4	Travelling drive to the front left
P	Pilot control pressure
T	Tank line

Port	Controlled via port
1	1
2	2
3	3
4	4

5.9 Hydraulics diagram

Up to serial no. DB00692 (mechanically pilot-controlled)



Measuring methods – multifunction measuring device

- Measuring current (ignition switched on):
  - Black cable in COM socket (earth),
  - red cable in A socket or mA socket;
  - connect in series to consumer.
- Measuring voltage (ignition switched on):
  - Black cable in COM socket (earth),
  - red cable in V socket;
  - connect in parallel to consumer.
- Measuring resistance (ignition switched off):
  - Black cable in COM socket (earth),
  - red cable in Ωsocket;
  - connect in parallel to consumer (see measuring voltage).

Test lamp

The test lamp is used to test lines and functions with the ignition switched on.

- Line test (testing voltage):

Connect test lamp between test point (live cable) and machine earth or between test point (earth line) and a live cable.

- Functional check (testing current):

Connect test lamp between a connection on the consumer to be tested and the connection line.

6.17 Wiring diagram from serial no. DB00168 (legend)

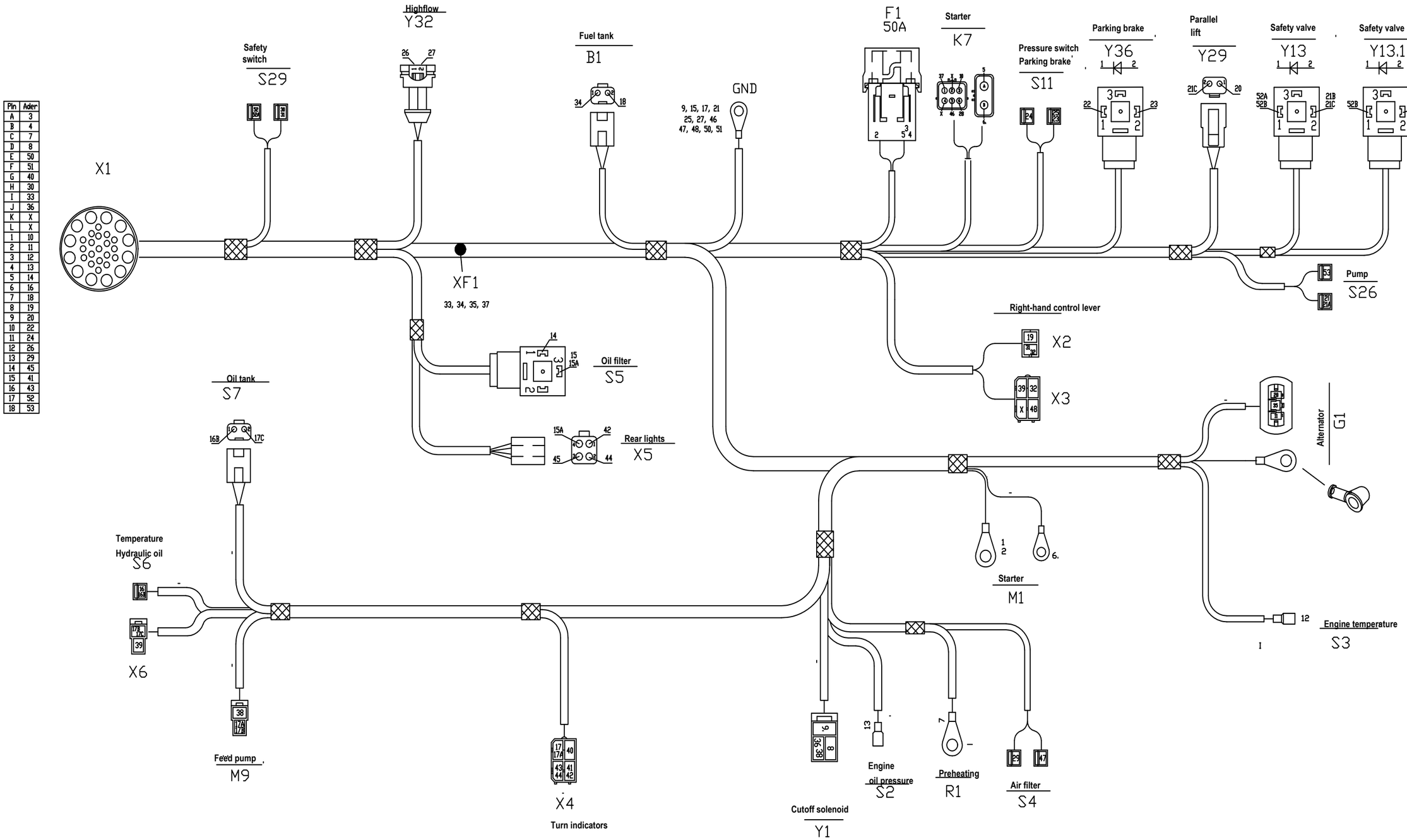
No.	Designation	Section	
B1	Fuel level indicator	E7	
B2	Horn	C14	
B3	Backup warning system	D11	
B14	Diodes (warning buzzer unit)	E6	
E1	Front right parking light	C14	Option
E2	Rear right light	F13	Option
E3	Front left parking light	C14	Option
E4	Rear left light	F15	Option
E5	High, low beam (right)	C14	Option
E6	High, low beam (left)	C14	Option
E7	Rear working light	B14/15	Option
E14	Interior light	C10	Option
E16	Main fuse: starter, preheating	F14	Option
F1	Main fuse	E1	
F2	Indicating instrument, alternator, tank sensor	A3	
F3	Cutoff solenoid, fuel feed pump	A3/A4	
F4	Valves	A8	
F5	Interior light	A10	
F6	Front lights	A11	
F7	Turn indicators	A12	
F8	Hazard warning system	A13	
F9	Socket, rotating beacon	A13	
G1	Alternator	F2/F3	
G2	Battery	F1	
H1	High beam indicator light	C1	
H2	Preheating indicator light	C1	
H3	Engine temperature indicator light	C1	
H4	Engine oil pressure indicator light	B1	
H5	Alternator charge function indicator light	B1	
H6	Air filter indicator light	B1	
H7	Hydraulic oil filter indicator light	B1	
H8	Hydraulic oil temperature indicator light	B1	
H9	Overload indicator light	C1	
H18	Parking brake indicator light	B1	
H22	Turn indicator light	C1	
H24	Front right turn indicator	H25	Option

No.	Designation	Section	
H25	Rear right turn indicator	F13	Option
H27	Rear left turn indicator	F15	Option
H28	Rotating beacon	B14/15	Option
K6	Preheating time lag relay	A2	
K7	Start high-current relay	E2	
K8	Cutoff solenoid time lag relay	A5	
K9	Cutoff solenoid switching relay	A4	
K10	Turn indicator relay	C12	Option
M1	Starter	F2	
M9	Fuel pump	F3	
P1	Hour meter	B1	
R1	Glow plug	F4	
S1	Preheating start switch	A1	
S2	Engine oil pressure switch	F5	
S3	Engine temperature switch	F5	
S4	Air filter pressure switch	F10	
S5	Hydraulic oil pressure switch	F6	
S6	Hydraulic oil temperature switch	F7	
S7	Hydraulic oil level switch (701)	F7	
S10	Parking brake switch (spare)	B8/9	
S11	Parking brake pressure switch	F9	
S12	Turn indicator switch (501)	C11	Option
S14	Light switch	B11	Option
S16	Rear working light switch	B10	Option
S18	Rotating beacon switch	B13	Option
S19	Hazard warning switch	C12	
S26	Pump pressure switch	E12	
S27	Backup warning system switch	D12	Option
S28	Work hydraulics lock	D5/6	Option
S29	Safety switch (701)	C7	
S30	Horn tip switch	D10	
S32	Parallel lift switch	B8	Option
S33	Highflow switch	B9	
Y1	Cutoff solenoid	F3	
Y13	Safety valve (701)	F11	
Y29	Parallel lift solenoid	F8	Option
Y32	Highflow solenoid	F9/10	
Y36	Parking brake solenoid	D4-6	

No.	Designation	Section	
X19	Socket	B14	
X3	2 pole main connection	D0	
X4	9 pole connection – drive interlock	C/D1	
X5	7 pole connection – armrest/chassis	D11/12	
X6	5 pole connection – armrest switch	C11/12	
X7	6 pole connection – control lever (right)	C/D 11	
X8	6 pole connection – control lever (left)	D11	
X10	15 pole connection – indicating instrument	B/C3	
X11	2 pole connection – Vario indicator	B6	
X12	9 pole connection – cab	C13/14	
X13	5 pole connection – engine temperature	A3	
X14	2 pole connection – automatic engine speed setting	C/D 3	
X15	1 pole connection – drive alarm	D/E 1	
X16	3 pole connection – drive alarm	E2	
X19	1 pole connection – socket	F7	
XE11	2 pole connection – loader unit working light	E9	
XS41	2 pole connection – safe load indicator	E8	
Y1	Cutoff solenoid	F4	
Y3	High-speed solenoid valve	F9	
Y13	Solenoid valve for safety valve	F11	
Y14	Solenoid valve – automatic idling speed setting	F9	Option
Y15	Solenoid valve – auxiliary hydraulics/ swivel	F10	
Y16	Solenoid valve – additional control circuit	F10	Option
Y17	Solenoid valve – additional control circuit	F11	Option
Y31	Solenoid valve – air conditioning	F12	Option

No.	From	Up to	Colour	mm²
92	S32/10 parallel lift switch	S18/1 rotating beacon switch	blk	1
93	S16/10 rear working light switch	S18/10 rotating beacon switch	blk	1
94	S16/10 rear working light switch	S19/10 hazard warning system switch	blk	1
95	S14/10 light switch	S19/10 hazard warning system switch	blk	1
96	S14/10 light switch	S10/10 parking brake switch	blk	1
97	X10/5 indicating instrument connection	S10/10 parking brake switch	blk	1
98	DNG1 earth	X19 socket	blk	1
99	GND1 earth	X8/7 lights connection	blk	1
100	GND1 earth	E14 interior light	blk	1
101	GND1 earth	K8 cutoff solenoid time lag relay	blk	1
102	K6 preheating time lag relay	K8 cutoff solenoid time lag relay	blk	1
103	K6 preheating time lag relay	V1 diode	blk	1
104	X7/3 terminal strip connection	V1 diode	blk	1
105	GND1 earth	X9/3 rear lights connection	blk	1
106	X9/4 rear lights connection	X9/3 rear lights connection	blk	1
107	GND1 earth	K10/87 turn indicator relay	blk	1

6.33 Engine – chassis A3 wiring harness 1000147293 up to DB00692



7.2 BP-Biohyd SE 46

Properties

Hydraulic ester oil (HEES)

BP Biohyd SE-S is a pressure medium based on saturated synthetic esters and synthetic hydrocarbons.

It can be used in all hydraulic systems.

Viscosity at 40 °C/104 °F	Viscosity at 100 °C/212 °F
46 cSt	9 cSt

7.3 Panolin biodegradable oil

Properties

A fully synthetic, environmentally compatible high-performance hydraulic oil based on saturated esters. A combination of special additives and high-performance base oils greatly reduces the formation of ageing products, deposits and gumming at high operating temperatures.

Viscosity at 40 °C/104 °F	Viscosity at 100 °C/212 °F
48.7 cSt	8.7 cSt

7.4 Immobilizer antitheft protection

Enabling the drive interlock

This automatic system enables the drive interlock 30 seconds after having removed the ignition key or turned it to the ZERO position. The machine can be restarted within 30 seconds without having to disable the drive interlock again.

Disabling the drive interlock

Approach the transponder key about 2 mm (0.08") from the sender and receiver unit to disable the drive interlock. The drive interlock is switched off as soon as the red light goes out. The driver now has 30 seconds to insert the ignition key in the ignition lock and to switch on ignition.

Pos.	Designation
1	Receiver unit
2	LED
3	Electronics