en

Service manual

Wheel loader

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Manufacturer: Liebherr-Werk Bischofshofen GmbH
Valid for: L 514-1583

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Symbol	Meaning
—	**List** Identifies individual items of a list.

Tab. 3: Symbols

010.1.2 Intended use

010.1.2.1 Laws, rules, guidelines and safety regulations

To ensure safe operation:
- Ask work site manager for safety regulations at place of use.
- Adhere to safety regulations at place of use.
- Adhere to traffic regulations.
- Adhere to valid guidelines from insurers (for example employers' professional liability insurance companies, accident insurance et cetera).
- Avoid working methods that can endanger safety.
- Adhere to all intervals specified for recurrent checks and inspections in this operator's manual.

010.1.2.2 Intended use

Wheel loader is used to pick up, move and dump following materials:
- Soil
- Stones
- Broken rocks
- Bulk materials

This applies to a standard machine in normal operating conditions. Special applications are described in a separate options operator's manual.

To ensure intended use:
- Adhere to operator's manual.
- Adhere to maintenance intervals.
- Observe inspection and maintenance tasks.
- Adhere to specifications in the technical data.
- When using machine on public roads, make sure it complies with applicable national regulations.
- Only lift loads with intended working attachments (fork prongs, crane boom), which must be fitted and functioning.
- Make sure that machines used underground (mining and tunnel construction) are fitted with systems to reduce exhaust emissions (such as diesel particulate filters).
- Adhere to individual country's requirements for underground operation.
- For special uses use special working attachments and if necessary special safety equipment.
- Exclusively mount and use special working attachments with approval and as per stipulations of manufacturer of basic machine.
- Only use approved tyres.
- A suitably equipped workshop is absolutely essential for performing repair work.

Note

▶ Any other use or use beyond the stated use is improper use.

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010.1.6.3 Transporting machine

Danger to life

Machine tipping

- Make sure that the transport vehicle is authorised for the machine weight and machine size.
- Do not manoeuvre while driving on ramps.
- Before driving on ramps, clean mud, snow and ice off tyres or travel gear.
- Make sure that a spotter is available if necessary.
- To load and unload machine, use only sturdy, stable loading ramps.
- Make sure that width and angle of ramps match the gauge and climbing ability of machine.

Incorrect transport

- Park machine on level ground during preparation for transport (disassembly, cleaning).
- Secure machine against rolling away.
- Apply parking brake.
- Pull out ignition key.
- Leave operator's cab.
- All doors, windows and service access points are closed.
- Make sure that nobody is on the machine during transport.
- If necessary, dismantle a portion of working attachment from machine for duration of transport.
- Make sure that the road to be travelled is known.
- Make sure that all applicable limitations for width, height and weight are known.
- Drive carefully under electric cables and bridges.
- Drive carefully through tunnels.

010.1.6.4 Access to machine

Injury

Incorrect entry and exit

- Clean dirt, oil, ice and snow from steps, ladders, anti-slip mats, handrails and handles.
- Enter and exit carefully on muddy roads, ice, snow, traffic on access roads and in narrow conditions.
- Regularly check steps, ladders, anti-slip mats, handrails and handles and have them repaired if necessary.
- Before entering machine, clean mud, grease, ice and snow from shoes and climbing aids.
- Put on gloves for secure grip.
- Do not climb up or down using tyres, wheel hubs or rims.
- When exterior influences (for example wind) make opening and closing the door more difficult: Always guide door with your hand.
- Make sure that the opened or closed door has engaged properly.
- If the machine is still moving: Do not stand up from the operator's seat.
- Never jump off machine.
- Enter and leave the machine exclusively using the access system.
- Do not use control elements as handles.
- Keep your face towards machine during entry and exit.

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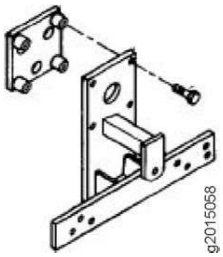
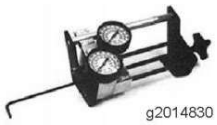
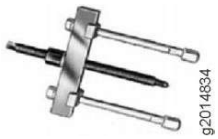
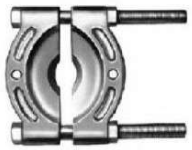
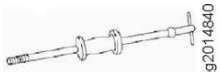
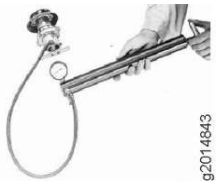
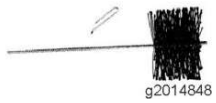
Designation	Item code	Remark	Fig.
Diagnostic data lead 3.0 m (Ethernet)	10513200	For Sculi diagnostic software (data connection between central control unit and laptop)	

Tab. 4: Special tools, general

010.2.2 Special tools for the engine

Designation	ID number	Remarks	Fig.:
Engine adapter	10652208	For attaching to an engine cranking device	 g2015058
Spring tension tester	7090992	For checking the tension of the valve springs For checking the spring force of the oil pressure control valve	 g2014830
Extractor	7091003	For removing the crankshaft gear from the crankshaft.	 g2014834
Extractor attachment	7091002	For removing the crankshaft gear from the crankshaft	 g2014837
Punch extractor	12205221	For removing the crankshaft bearing cover For removing the cylinder bushings	 g2014840
Cooling system pressure pump	7091005	For testing the pressure of the cooler cover and cooling system.	 g2014843
O-ring groove cleaning brush	12205227	For cleaning the O-ring groove of the cylinder bushing in the block.	 g2014848

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010.2.12 Special tools for the central lubrication system (Liebherr)

Designation	Item code	Remark	Fig.:
Liebherr filling press	10009239	For quickly filling the reservoir	
Filling press	10333342	For quickly filling the reservoir	
Liebherr filling port	7029283	For quickly filling the reservoir	

Tab. 15: Special tools for the central lubrication system (Liebherr)

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010.4.3 Putting the machine out of service

Preparation activities for putting out of service:

- Put machines on horizontal, dry, solid surface and secure against rolling. Sink working attachment to a level where the hydraulics are under no remaining pressure.
- Before putting out of service, clean the machine while strictly following the operating instructions.
- The machine must be completely dry before preservation begins. Electronic components and damp areas of the machine must be dried with compressed air.
- If frost temperatures are expected during the intended out of service period, then the fuel tank must be filled with winter fuel. Start the diesel engine and run for a short time so that the winter fuel flows into the fuel circulation. After running the engine, refill the fuel tank completely.

Note
When moving a machine thus protected for loading or transport, the scraper usually removes the grease from the piston rods in the cylinders.

▶ If the machine is being transported, the grease on the piston rods must be rechecked after loading and renewed if necessary.

Note
Despite preservation measures, the machine must be checked after certain time intervals and if necessary greased again. The operator must judge this.

▶ In the case of difficult conditions (cold, heat, proximity to coast, etc.), this inspection should be carried out regularly (monthly).

010.4.3.1 Out of service for up to 2 months

Designation	ID number	Description	Illustration
Optical density tester	**7408922**	To test the battery acid density and the anti-freeze in the cooling agent	 425591
WAXOYL 120-4 anti-corrosion wax	**8504472**	500 ml spray can, long-term protection for up to 2 years	
Ballistol Spray anti-corrosion agent	**10025514**	Area of application: door locks	 bbb00665

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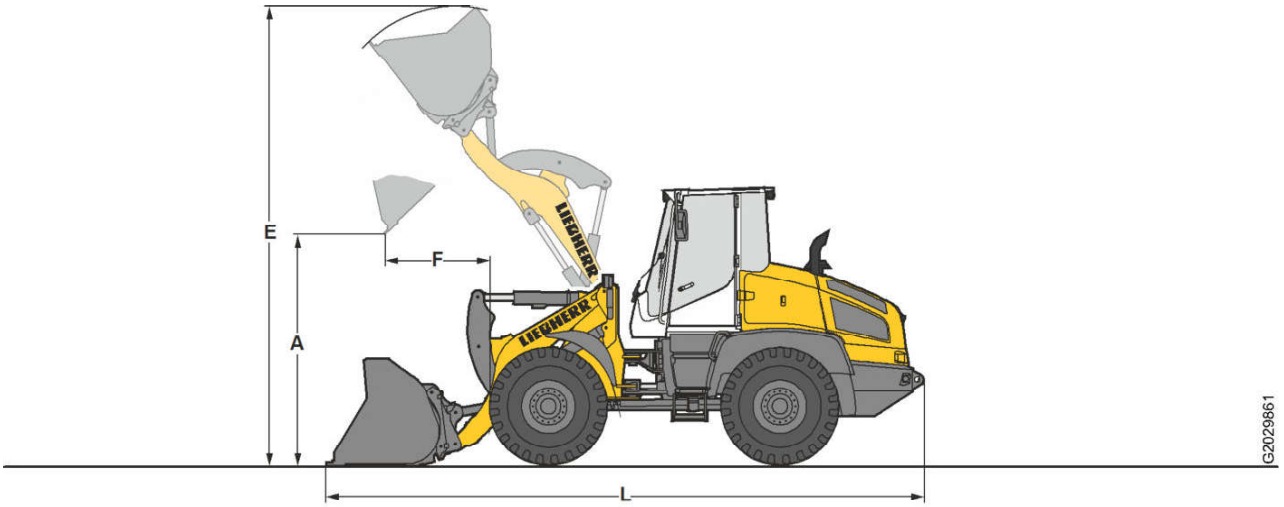

Fig. 83: Working attachment: light material bucket

	Designation	Unit	Value	
	Hydraulic quick coupler		Yes	Yes
	Load geometry		A)	A)
	Cutting tool		B)	B)
	Lift arm length		C)	D)
	Bucket capacity	m^3	2.0	2.0
	Bucket width	mm	2500	2500
	Specific material weight	t/m^3	1.3	1.0
A	Dump height at maximum lifting height	mm	2745	3020
E	Maximum height above bucket upper edge	mm	4970	5265
F	Reach at maximum lifting height	mm	1010	1020
L	Overall length	mm	6540	6865
	Tipping load when straight	kg	5680	4955
	Tipping load when fully articulated (ISO 14397-1)	kg	5200	4535
	Operating weight	kg	9250	9350

Tab. 21: Working attachment: light material bucket

A) Z-bar kinematics
B) Undercut blade
C) Standard lift arm length
D) High lift

020.1.3 Working attachment: high dump bucket

Valid for: L514-1583;

Values stated refer to machine:

– In its standard version

020.4.8 Tilt cylinder

Valid for: L514-1583;

Description	Unit	Value
Piston diameter	mm	110
Piston rod diameter	mm	60
Minimum installation length	mm	855
Stroke length	mm	495
Weight	kg	55.2
Tightening torque of piston rod bearing	Nm	1300
Tightening torque of piston	Nm	2700
Tightening torque of locking bolt for piston	Nm	20

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020.11 Axles and drive shafts

020.11.1 Front axle

Valid for: L514-1583;

Description	Unit	Value
Type		112/554
Self-locking differential level	%	45
Flange size	mm	1920
Overall transmission		19.091
Weight	kg	310

020.11.2 Front axle with engageable differential lockout (optional)

Valid for: L514-1583;

Description	Unit	Value
Type		112/552
Locking value of the engageable differential lockout	%	100
Flange size	mm	1920
Overall transmission		19.091
Weight	kg	317

020.11.3 Rear axle

Valid for: L514-1583;

Description	Unit	Value
Type (with gearbox)		311/212/365
Self-locking differential level	%	45
Flange size	mm	1920
Overall transmission (without gearbox)		19.091
Weight (with gearbox)	kg	439

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Customer:.....Machine type:.....Serial no.:.....Operating hours:.....Date:.....

Maintenance / inspection after service hours								Tasks to be performed		
On handover	All 8-10 h	All 50 h	All 500 h	All 1000 h	All 2000 h	Other intervals	Additional labelling	**By maintenance staff** ■ Once-only activity ● Repeat interval ✦ If necessary ❄ Annually before the winter **By authorised specialist staff** ☐ Once-only activity ❍ Repeat interval ✧ If necessary **Additional labelling** Assistance required Have this task carried out exclusively by a certified electrician	Confirm tasks	See page
Operator's cab, heating and air conditioning										
			❍	❍	❍	✦		Clean operator's cab air filter.		030-130
				❍	❍	✦		Change the cab air filter.		030-131
			❍	❍	❍			Safety belt: check condition and function.		030-132
			❍	❍	❍			Windscreen washer system: test.		030-133
			❍	❍	❍	✦		Fill windscreen washer fluid in the windscreen washer system.		030-133
			❍	❍	❍			Lubricate the locking mechanism and cylinder of the operator's cab with penetrating oil.		030-134
				❍	❍	✦		Clean and maintain the seals of the operator's cab.		030-134
			❍	❍	❍			Check the indicator bead in the air conditioning dryer-collector unit.		030-135
			❍	❍	❍			Heating and air conditioning unit (option): test function.		030-136
Lubrication system										
☐		●	❍	❍	❍			Central lubrication system (option): check level grease reservoir.		030-137
☐		●	❍	❍	❍			Central lubrication system (option): check pipes, hoses and lubrication points for leaks and damage.		030-138
☐		●	❍	❍	❍			Central lubrication system (option): check lubrication of bearings.		030-139

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When using oil from other manufacturers, you must obtain information from the **Liebherr Lubricant Hotline.**

030.3.14 Lubrication grease

Valid for: L514-1583;

030.3.14.1 Liebherr recommendation

Ambient temperature	Designation
Down to -20 °C	Liebherr universal grease 9900
Down to -55 °C	Liebherr Arctic universal grease

Tab. 54: Liebherr recommendation

030.3.14.2 Minimum quality requirement

Thickener	Shelf life	Specification
Soap-based (lithium complex)	At least 3 years	Pumpability as per KP 2 K (DIN 51502)
		VKA weld load: ≥ 6000 N (DIN 51350 / 4 – ASTM D 2596)

Tab. 55: Minimum quality requirement

When using grease from other manufacturers, you must obtain information from the **Liebherr Lubricant Hotline.**

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- ▶ Check all fuel lines, engine oil lines and hydraulic lines (for leaks, loose connections, abrasion and damage).
- ▶ Repair any defects immediately.
- ▶ To displace any water that has penetrated: lubricate all bearings and pin connections again.
- ▶ If necessary, renew the corrosion protection on components and surfaces.

If the diesel engine has been cleaned:
- ▶ Let the diesel engine warm up at idling speed.
  - ▷ This allows the engine to dry better.

Cleaning the interior of the operator's cab

Note

Only clean the interior equipment of the operator's cab with warm water, without any cleaning additives.

- ▶ Wipe surfaces with a soft, damp cloth.

Cleaning the rear window of the operator's cab

The rear window only needs to be cleaned after working in very dirty environments.

Make sure that the following requirements are fulfilled:
- ❑ The machine is in maintenance position 1.
- ❑ The cab door is closed.
- ❑ Suitable climbing aids are available.

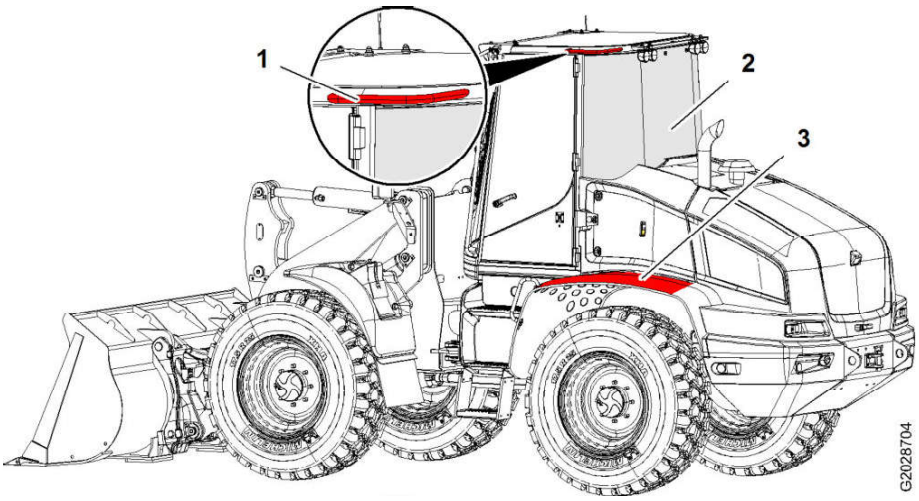

Fig. 97: Cleaning the rear window of the operator's cab

1 Handrail
2 Rear window
3 Footplate

WARNING
Access to the rear window:
Injury.

- ▶ Use the provided footplate, handrail and suitable climbing aids.

030.4.4 Drive group

030.4.4.1 Checking diesel engine oil level

Valid for: L514-1583;

Checking the oil level

Make sure that following requirements are fulfilled:
- ❑ Machine is in maintenance position 1.
- ❑ Service access is open.
- ❑ The diesel engine is level and has been switched off for 10 minutes.
- ❑ Diesel engine has cooled down.

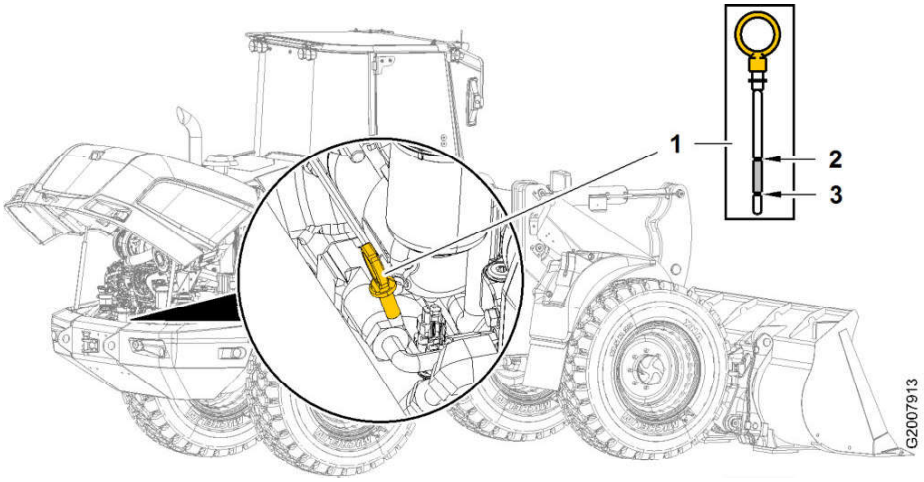

Fig. 106: Checking the oil level

1 Dipstick
2 Maximum oil level
3 Minimum oil level

▶ Pull out the dipstick **1**, wipe it clean, and re-insert it.

▶ Pull out the dipstick **1** once again and read off the oil level.
▷ The oil level on the dipstick **1** must be between the maximum **2** and minimum **3**.

If the oil level is below the minimum **3**:

▶ Put in the dipstick **1**.

▶ Top up engine oil. (For more information see: Topping up the oil, page 030-43)

Troubleshooting
If the oil level is too high:

▶ Contact Liebherr customer service.

Topping up the oil

Make sure that following requirements are fulfilled:
- ❑ Machine is in maintenance position 1.
- ❑ Service access is open.
- ❑ Diesel engine has cooled down.

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▶ Start diesel engine and let it run for 3 minutes at medium idling speed.

WARNING
Hot components!
Risk of injury.

▶ Do not touch components of the exhaust system and the engine.

▶ Check that valve cover and valve cover seal do not leak.

▶ Check that the exhaust system does not leak.

▶ Turn off diesel engine.

030.4.4.7 Diesel engine: changing the oil separator filter cartridge

Valid for: L514-1583;

Make sure that the following requirements are fulfilled:
❑ The machine is in maintenance position 1.
❑ The service access is open.
❑ The diesel engine has cooled down.

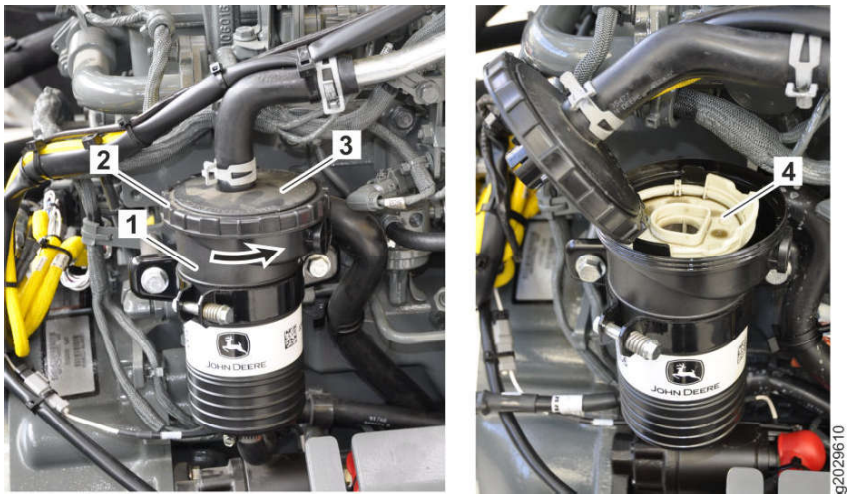

Fig. 118: Diesel engine: changing the oil separator filter cartridge

1 Oil separator
2 Ring nut
3 Cover with hose line
4 Filter cartridge

▶ Unscrew the ring nut **2**.

▶ Take off the cover with hose line **3**.

▶ Take out the filter cartridge **4**.

▶ Put a new filter cartridge in the housing.

▶ Put the cover with hose line **3** on the oil separator **1**.

▶ Tighten the ring nut **2** hand-tight.

030.4.4.8 Diesel engine: Checking the crankcase bleeder system

Valid for: L514-1583;

Make sure that the following requirements are fulfilled:
❑ The machine is in maintenance position 1.

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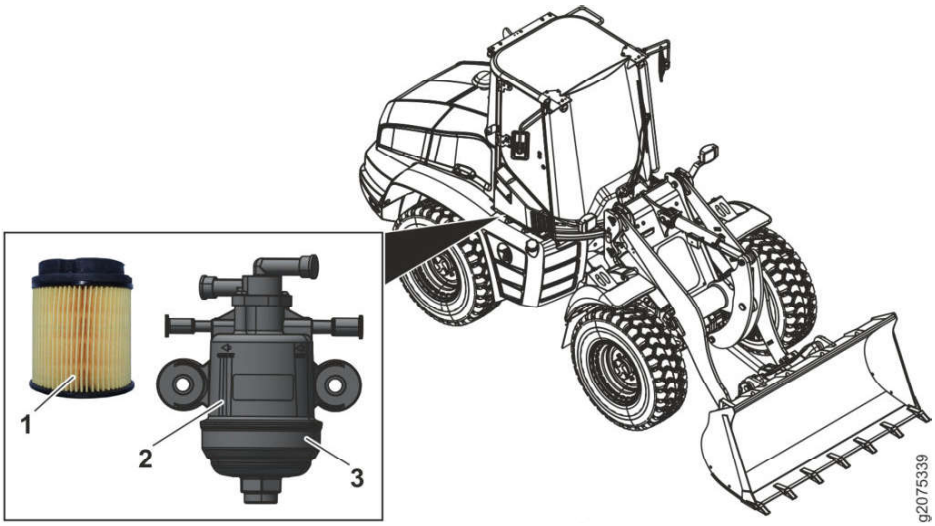

Fig. 128: Changing filter cartridge of diesel exhaust fluid pre-filter

1 Filter cartridge
2 Filter housing
3 Filter cover

- ▶ Unscrew filter cover **3** (anticlockwise).
- ▶ Remove filter cover **3** including filter cartridge **1**.
- ▶ Renew filter cartridge **1** in the filter cover **3**.
- ▶ Screw on filter cover **3** including filter cartridge **1** to a tightening torque of 25 $^{+5}$ Nm (clockwise).

Fig. 129: Installing right rear wheel case

1 Fastening bolt (5x)

Note

Assistance is required to attach this component!

3 Retaining plate

4 Diesel particulate filter module

7 Profile clip for diesel particulate filter module and input module

▶ Remove the retaining plate **3** from the fastening clip **5**.

▶ Open the fastening clip **5**.

▶ Open the exhaust pipe profile clip **1**.

▶ Open the profile clip for the diesel particulate filter module and input module **7**.

▶ Open the profile clip for the diesel particulate filter module and output module **6**.

▶ Remove the output module **2**.

▶ Remove the diesel particulate filter module **4**.

▶ Install a new or cleaned diesel particulate filter module **4**.

Installing a new diesel particulate filter module

Fig. 140: Diesel particulate filter module

1 Diesel particulate filter module

2 Part number

3 Serial number

Note
To confirm the change of the diesel particulate filter in the Service Advisor, diagnostic software, the part number **2** and the serial number **3** are required.

▶ Make a note of the part number and the serial number.

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CAUTION
Hot. pressurised liquid!
Beware of burns.

▶ Let the engine cool down.

▶ Carefully open cap of water cooler **1**.

Checking corrosion inhibitor concentration

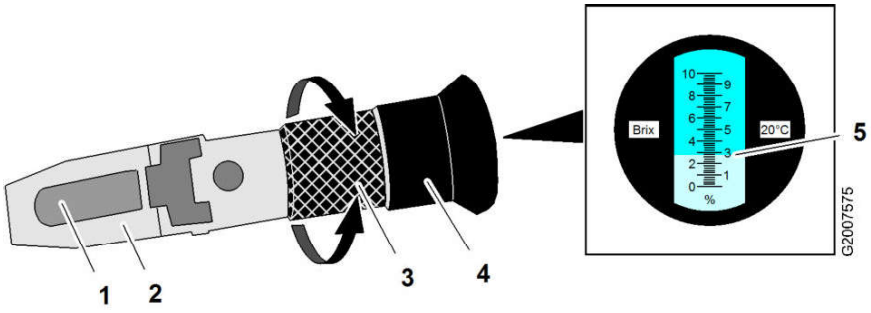

Fig. 149: Checking the corrosion inhibitor concentration

1 Prism
2 Cover
3 Adjusting ring
4 Eyepiece
5 Dividing line

▶ Carefully clean the prism **1** and cover **2** of the refractometer.

▶ Place one or two drops of coolant on the prism **1**.

▶ Close the cover **2**.
▷ The fluid spreads out.

▶ Look through the eyepiece **4** against a light background and focus the scale using the adjusting ring **3**.

▶ Read the Brix value on the dividing line **5**.

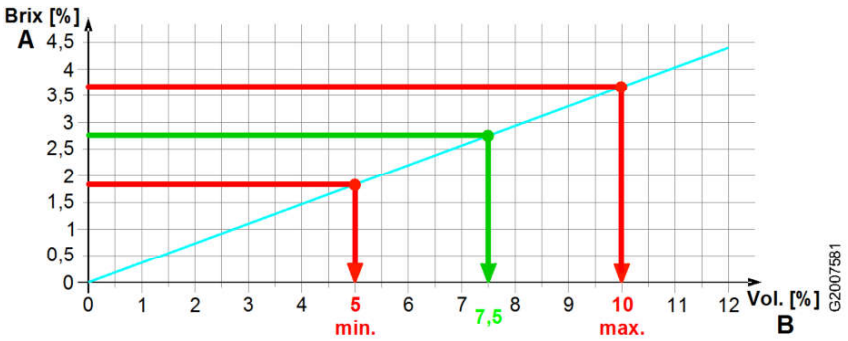

Fig. 150: Converting the Brix value to the corrosion inhibitor concentration

A Brix value
B Corrosion inhibitor concentration

▶ Convert the Brix value **A** on the diagram to the corrosion inhibitor concentration **B**.

▶ Check whether corrosion inhibitor concentration **B** matches specified value.

Note
Incorrectly fitted sealing ring on the filter cover!
Leaks.

- ▶ Clean the sealing ring before fitting it.
- ▶ Install the sealing ring when dry.
- ▶ Observe the tightening torque for the filter cover.

- ▶ Clean the sealing ring on the filter cover **3** with a clean cloth.
- ▶ Screw on the filter cover **3** and tighten it to 25 Nm.
- ▶ Tighten the breather filter **1**.
- ▶ Pull out the plug **2** and keep it in a safe place.
  ▷ The breather filter is protected from accidental opening.

030.4.7.4 Hydraulic tank: changing filter cartridge in return-suction filter

Valid for: L514-1583/57749-;

Make sure that following requirements are fulfilled:
- ❑ Machine is cold.
- ❑ Machine is in maintenance position 1.
- ❑ Service access is open.

Make sure that following tools are ready:
- ❑ Torque wrench

Fig. 160: Hydraulic tank: changing filter cartridge in return-suction filter

1	Breather filter	**4**	Filter separator plate
2	Plug	**5**	Filter cartridge
3	Filter cover		

- ▶ Remove side cover for better access.
- ▶ Insert plug connection **2** in breather filter **1**.
  ▷ The anti-twist device is released.
- ▶ Unscrew the breather filter **1** by two turns.
  ▷ The tank preload pressure is released.
- ▶ Unscrew filter cover **3** until you can hear air flowing into filter.
  ▷ Oil level in filter housing sinks.
- ▶ Unscrew filter cover **3** and carefully lift it off.

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Preparations

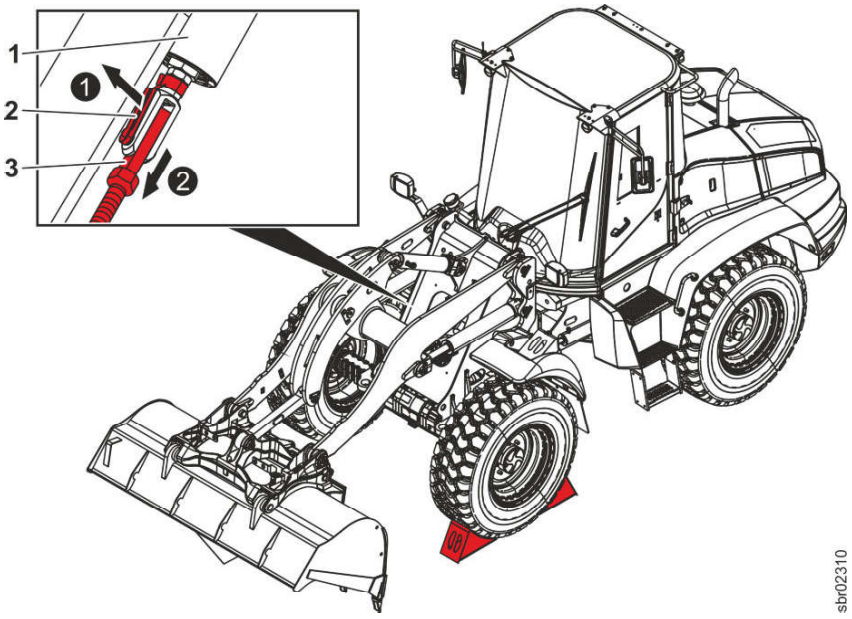

Fig. 170: Detaching brake cable

1 Spring accumulator cylinder
2 Retaining pin
3 Brake cable

▶ Use chocks to secure machine against rolling away.

▶ Start diesel engine.

▶ Release parking brake.

WARNING
Unintended movement of machine!
Danger to life.

▶ Make sure no-one can enter operator's cab.

▶ Remove the retaining pin **2**.

▶ Detach brake cable **3**.
▷ Parking brake does not work.

▶ Turn off diesel engine.

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Note
Information on oil specification:

- See “Lubricants and fuels: Transmission lubricants”. (For more information see: 030.3.11 Transmission, page 030-21)

NOTICE
Incorrectly mixed gear oils!
Damage to transmission.

- Do not mix gear oils.

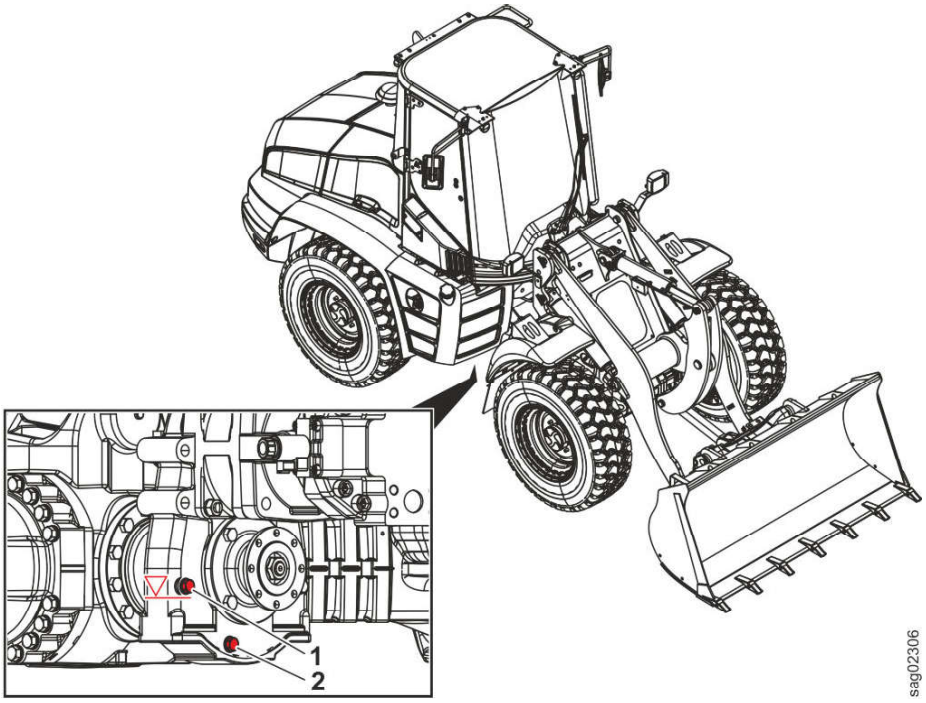

Fig. 180: Changing transmission oil

1 Filling plug **2** Drain plug

Draining oil

WARNING
Hot, pressurised fuel and operating fluids!
Beware of burns.

- Carefully open filling plug and drain plug.
- Wear safety glasses.
- Avoid skin contact with fuel and operating fluids.

- Carefully unscrew filling plug **1** on transmission housing.
- Check that oil level is up to bottom of opening.
- If oil level is too high (oil comes out of opening): check travel motor for defects (oil coming from travel motor into gearbox).
- If oil level is too low: Check gearbox for leaks.

DANGER
Tyre lock rings coming loose!
Fatal injury.

- ▶ Make sure there is no one in the danger area.
- ▶ Keep a safe distance to the side.
- ▶ Use a sufficiently long filling hose with a self-retaining valve.

- ▶ Check the tyre pressure.

If the tyre pressure is not correct:
- ▶ Correct the tyre pressure.

030.4.12.8 Checking the wheel tightness

Valid for: L514-1583;

Make sure that the following requirements are fulfilled:
- ❑ The machine is in maintenance position 1.

Make sure that the following special tools are ready:
- ❑ A torque wrench with a measuring range of over 650 Nm is available.

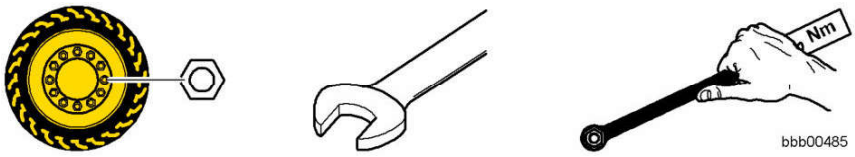

Fig. 190: Checking the wheel tightness

Designation	Value
Spanner size	30 mm
Tightening torque	650 Nm

Tab. 63: Checking the wheel tightness

- ▶ Check that all the nuts on the four wheels have been tightened with the required torque.

030.4.13 Steel parts of the basic machine

030.4.13.1 Lubricating the articulated bearing and rear oscillating bearing

Valid for: L514-1583;

Make sure that the following requirements are fulfilled:
- ❑ The machine is in maintenance position 1.
- ❑ The lubricating point has been cleaned.

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030.4.15.4 Windscreen washer system: testing

Valid for: L514-1583;

Make sure that following requirements are fulfilled:
- ❑ The machine is parked in a safe place.
- ❑ The electrical system of the machine is switched on.

To check the front windscreen washer system:

▶ Activate the windscreen washer system using the steering column switch.
  ▷ Washer fluid is squirted onto the front windscreen.
  ▷ The windscreen wiper is switched on.

To check rear windscreen washer system:

▶ Activate the windscreen washer system using the switch.
  ▷ Washer fluid is sprayed onto the rear windscreen.
  ▷ The windscreen wiper is switched on.

030.4.15.5 Windscreen washer system: filling windscreen washer fluid

Valid for: L514-1583;

The reservoir is behind the operator's cab below the protective guard of cooling system.

Make sure the following preconditions are met:
- ❑ Machine is in maintenance position 1.
- ❑ Service access is open.

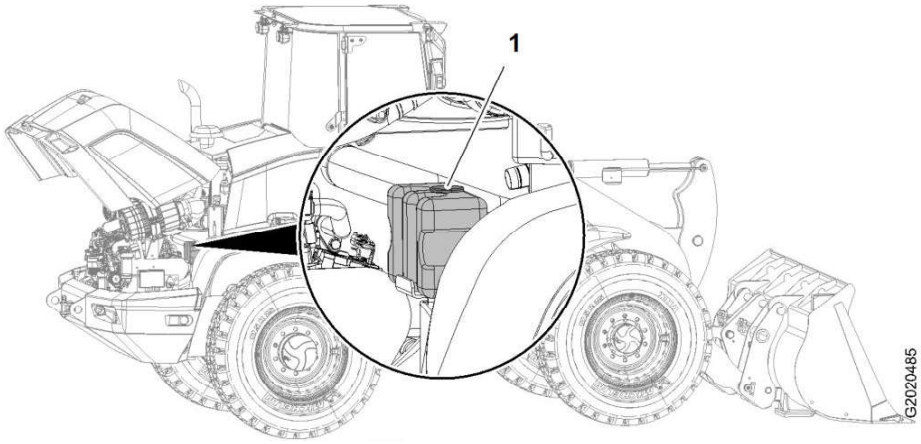

Fig. 203: Checking and topping up windscreen washer fluid

1 Cover

The filling quantity is approximately 2 l.

▶ Open cover **1** on the reservoir.

▶ Top up with standard windscreen washer fluid as necessary.

▶ Use commercial antifreeze windscreen washer.

▶ Add an appropriate quantity of antifreeze windscreen washer before the winter starts.

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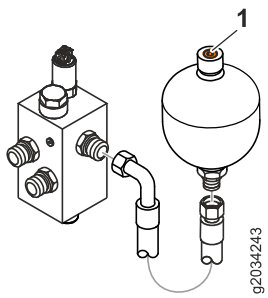
4. Hydro accumulator									
Test / adjustment	**1000 h**	**2000 h**	**Unit**	**Required value**	**Measured**	**Adjusted**	**Adjusting point**	**Test point**	**Figure**
Working hydraulics									
Ride control hydro accumulator (option): nitrogen filling									
Filling pressure at a hydro accumulator temperature of 20 °C	○	○	bar	$25^{\pm 2}$			1	1	

Tab. 68: Hydro accumulator

Remarks:	

Tab. 69: Remarks

Symbol	Meaning	Symbol	Meaning
⇒	Machine in blocked condition		Checkbox
○	Always carry out		Link to the instructions
◊	Only if necessary		Sculi diagnostic software is required
	Entry field		Read the values from the display

Tab. 70: Key

▶ Connect a pressure gauge (250 bar) to cooling system high pressure test connection **PK**.

▶ Start diesel engine.

▶ Connect Sculi diagnostic software to machine.

▶ In variables editor, select ***Check cooling system*** folder.

if machine is equipped with a reversible fan drive (option):

▶ Press *Reversible fan drive* to deactivate it (see operator's manual for more information).

or

Set ***CXFanReverse*** variable to ***0***.

Maximum operating pressure

▶ Force variable ***IRHydrTempSens_KG*** to 0 ohms.
  ▷ This simulates a failure of hydraulic oil temperature sensor.
  ▷ Central control unit energises fan speed proportional solenoid with minimum current.

Note
Variable ***IRHydrTempSens_KG*** is automatically reset to its original value when ignition is switched **OFF**.

▶ If necessary, force value to 0 ohms again when repeating test.

▶ Increase engine speed to maximum.

▶ Check that high pressure **PK** corresponds to required value.

Description	Unit	Value
High pressure **PK**	bar	175 $^{\pm 10}$

If required value is not reached:

▶ Click variable ***CRFCFanCurrMin*** and press *space bar*.
  ▷ Line is coloured pink.
  ▷ A gradual approach towards the required value is possible.

Note
To gradually approach the required value:

▶ Cursor *up/down*: last digit of the value +/- 1

▶ Cursor *left/right*: last digit of the value +/- 5

▶ Page *up/down* button: last digit of the value +/- 10

▶ Gradually adjust value of variable ***CRFCFanCurrMin*** with pedal pressed all way down until value is correct.

If required value is reached:

▶ Unforce variable ***IRHydrTempSens_KG***.

▶ Check pressure relief when proportional solenoid fails.

Pressure relief when proportional solenoid fails

▶ Force variable ***QRFanValve_KG*** to 0 mA.

▶ Document the damage and observe whether the condition deteriorates.

▶ Check the routing of the hydraulic line, correct if necessary.

If the condition deteriorates:
▶ Replace the hydraulic lines.

Moist surfaces, no visible oil leak

Moist spots can be seen on the surface. An oil leak or oil drops are not visible. As long as you do not observe an obvious oil leak, it is classified as minor damage.

Fig. 224: Moist surfaces, no visible oil leak

▶ Document the damage and observe whether the condition deteriorates.

If the condition deteriorates:
▶ Replace the hydraulic lines.

Medium damage to the hydraulic lines

Cracks or cuts up to the steel fabric or steel fabric exposed due to damage to the outer jacket

The damage to the outer jacket (such as cracks, cuts or abrasions) through which the steel fabric is exposed is classified as medium damage if the steel fabric is undamaged. Damage to the steel fabric is classified as severe damage.

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- ▶ Tighten the lock screw **8**.
- ▶ Check the O-ring **5** for damage.
- ▶ If the O-ring **5** is damaged: Replace the O-Ring **5**.
- ▶ Screw in the high pressure relief valve again and tighten it to a torque of 250 Nm.
- ▶ Remove the vacuum pump.
- ▶ Bring the hydraulic oil up to operating temperature.
- ▶ Repeat check and adjustment until required value is reached.

If required value is reached:

- ▶ Turn off diesel engine and take out ignition key.
- ▶ Turn adjusting screw on pressure cut-off valve **1** by exactly one turn anticlockwise.
- ▶ Check and adjust the pressure cut-off valve. (For more information see: Travel pump: pressure cut-off, page 030-173)

030.6.7.4 Travel pump: pressure cut-off

Valid for: L514-1583;

Make sure that following requirements are fulfilled:

- ❑ Hydraulic oil is at operating temperature.
- ❑ Tractive force adjustment (optional) is deactivated.
- ❑ Machine is in maintenance position for adjustment procedures.
- ❑ Service access is open.

Make sure that following tools are ready:

- ❑ Pressure gauge (600 bar)
- ❑ Laptop with Sculi diagnostic software

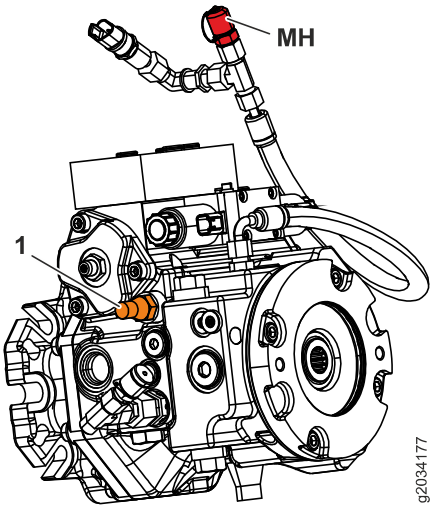

Fig. 233: Travel pump: pressure cut-off

1 Pressure cut-off valve

MH Travel pump high pressure test connection

- ▶ Connect a pressure gauge (600 bar) to the high pressure test connection **MH** on the travel pump.
- ▶ Start diesel engine.

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Files in the service file	Description
service.cor	This file contains information on adjustment data and enabled functions on the machine.
service.err	This file contains service codes and messages from the central control unit.
service.ret	This file contains machine variables.
service.ver	This file can be opened using the Sculi diagnostic software. The information corresponds to the “Info” function in Sculi.
service.varx	This file can be opened using the Sculi diagnostic software. This file contains machine variables and adjustment data.

Tab. 73: Files in the service file

Generating the service file using the “SCOTTI” function on the touch screen display

The following information is required to create a service file:

Designation	Item code	Remark
Memory card	10223095	To save the service file
Memory card reader	11000491	To read the memory card

Tab. 74: Required equipment

Make sure that the following requirements are fulfilled:
❑ The machine is in maintenance position 1.

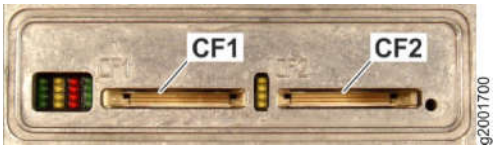


Fig. 238: Slots CF1 and CF2 on the central control unit

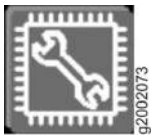
CF1 Slot CF1 **CF2** Slot CF2

▶ Plug an empty memory card into the slot **CF2** on the central control unit.

▶ Switch on the battery main switch.

▶ Switch on the ignition.

▶ Press the *System settings* button.



▶ Press the *Service (SCOTTI)* button.
▷ The “SCOTTI” function is started.

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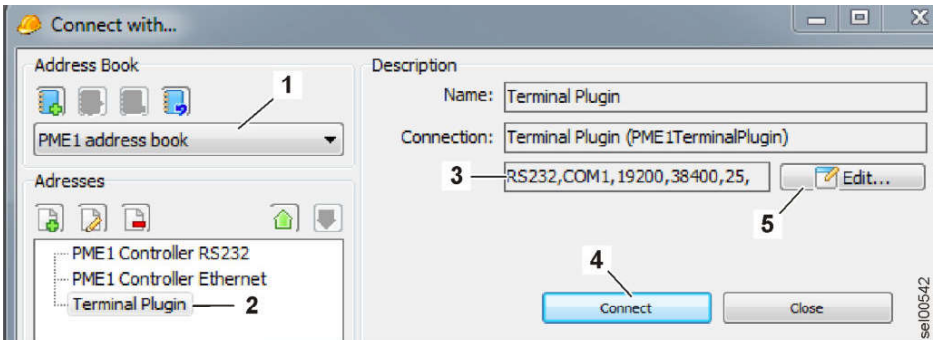

Fig. 257: Establishing the connection

1 PME1 address book
2 Terminal plug-in address
3 Connection settings
4 *Connect* button
5 *Edit* button

▶ Select the PME1 address book **1**.

▶ Select the Terminal plug-in address **2**.

The connection settings **3** can be changed by using the *Edit* button **5**.

The COM 1 interface should be always selected for serial connections (RS-232 plug on the notebook). The correct connection according to the notebook must be selected for a connection using a USB adaptor. The Baudrate should not be higher than 19200.

▶ Check whether the correct connection settings **3** are displayed. Correct the connection settings if necessary.

▶ Select the *Connect* button **4**.
▷ A connection to the central control unit is established and the *Terminal emulator* window opens.

To open the main menu, the text **testsys** must be entered in the open window.
▶ Enter **testsys** and confirm with Enter.
▷ The main menu is displayed.

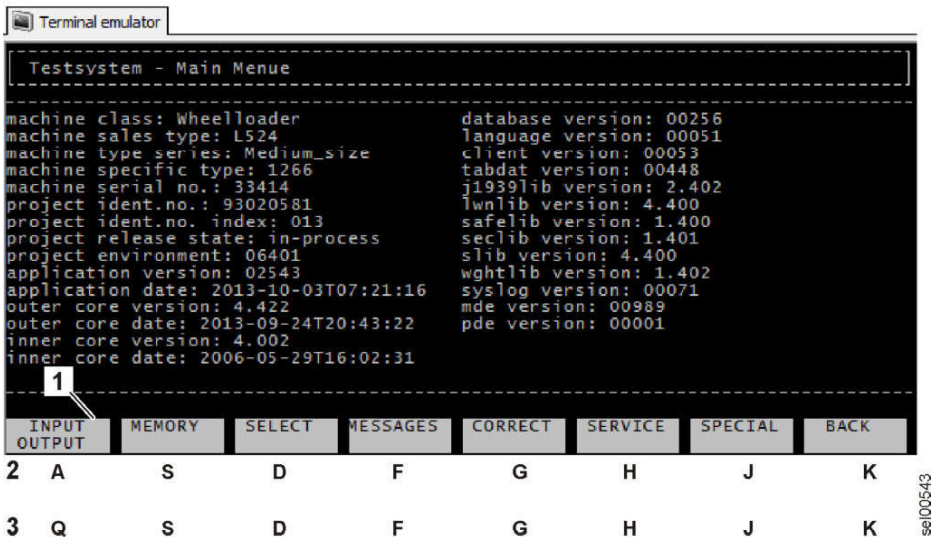

Fig. 258: Main menu

1 Menu bar
3 French keyboard layout

See next page for continuation of the image legend

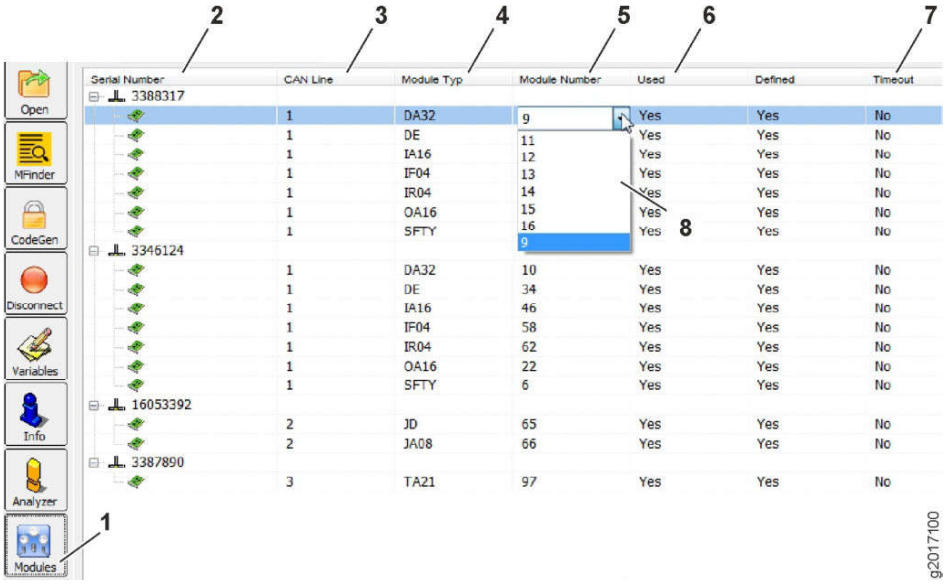

Fig. 272: Module editor in Sculi

1 “Module editor” function
2 Serial number of connected modules
3 CAN line connecting the module to the central control unit
4 Module type
5 Set address of the module
6 Indicates whether the module is used
7 Indicates whether the module is inactive
8 Drop-down window

▶ Select module editor “function” **1**.

▶ Select module and open drop-down window **8**.

▶ Select address and confirm with the Enter key.

Checking system information of CAN modules

The CAN module addresses are checked using the Sculi diagnostic software.

You can check following settings:
– Address
– ***Active*** status
– ***Timeout*** status
– Serial number of module
– Item code of module

The operator's manual contains the following information:
– Motor operation
– Lubricants and fuels
– Maintenance
– Troubleshooting
– Idle position
– Technical data
– etc.

The workshop manual contains the following information:
– Repairing and adjusting the engine
– Function description
– Diagnosis
– Wiring diagram
– Technical data

2.2 Basic function

The integrated diesel engine is a water-cooled, four-stroke in-line engine with common rail direct injection, turbocharger and intercooler.

The diesel engine converts the chemical energy of the fuel into mechanical energy. This energy is transmitted through the flywheel and the torsion absorber of the travel and working hydraulics pumps.

A small part of the power is taken off and used for driving the following gear pumps:
– Fan gear pump
– Brake system gear pump

2.3 Type designation

John Deere						Description
4	045	H	F	L	07	Diesel engine type designation
4						Number of cylinders: 4 = 4 cylinders
	045					Displacement: 045 = 4.5 litres
		H				With turbocharger and air-to-air intercooling
			F			OEM (John Deere Power Systems)
				L		Liebherr
					07	Version with a turbocharger (PWS)

Tab. 77: Description of the type designation

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2.13 Intake control valve (VCV)

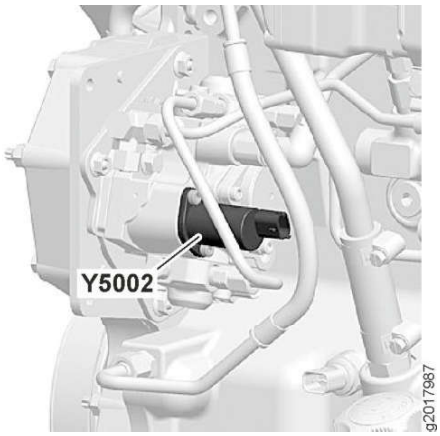

Fig. 295: Intake control valve Y5002

The intake control valve **Y5002** is located on the high pressure fuel pump. The engine control unit sends the intake control valve an electronic signal via the magnetic coil to control the high pressure common rail.

When the intake control valve is de-energised, fuel enters the pump chamber of the high pressure fuel pump. The pressurised fuel is then supplied to the common rail fuel injection system. The engine control unit adjusts the duration of the signal to ensure that the right quantity of fuel is available.

2.14 Pressure relief valve (PCV)

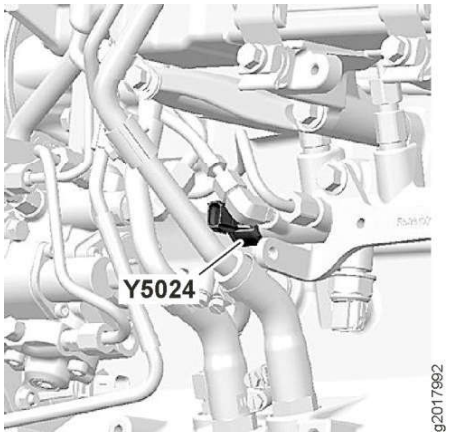

Fig. 296: Pressure relief valve Y5024

The pressure relief valve **Y5024** is located at the end of the high pressure common rail.

In order to regulate the pressure in the high pressure common rail, the engine control unit sends an electronic signal to the magnetic coil of the pressure relief valve.

Activating the pressure relief valve reduces the pressure in the high pressure common rail. This results in fuel flowing back into the tank.

The pressure relief valve together with the intake control valve on the high pressure fuel pump controls the fuel pressure in the high pressure common rail.

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After the diesel oxidation catalyst, the exhaust flows into the diesel particulate filter module. The soot particles in the exhaust are reduced in the diesel particulate filter. The exhaust flows through channels in the ceramic core of the filter. The outlet is blocked on every second channel. The exhaust gases flow through the porous channel walls until they exit the filter through an open outlet. While the exhaust is circulating in the filter, the particles get caught on the walls of the channels. The channel walls are coated with precious metals which cause the particles to oxidise into less harmful exhaust gases.

The differential pressure sensor monitors the differential pressure before and after the diesel particle filter module. If the differential pressure rises above a certain limit value (blockage, overload, etc.), it sends an error message to the engine control unit.

The DPF outlet temperature sensor **2** measures the exhaust temperature at the outlet of the diesel particulate filter.

2.2 Regenerating the diesel particulate filter

The regeneration depends on the load condition of the diesel particulate filter, on the temperatures in the diesel particulate filter and on the temperature of the engine coolant.

The diesel particulate filter is regenerated by burning the deposited particles. The particles prevent the exhaust from being discharged. The exhaust counterpressure rises.

To reduce the exhaust counterpressure, the regeneration must be performed regularly.

There are two types of regeneration: **passive** and **active**.

2.2.2 Passive regeneration

With passive regeneration, the soot particles are converted permanently into carbon dioxide (CO_2) and nitrogen monoxide (NO) when the temperatures are high enough. This procedure takes place when the exhaust temperatures are between 350 °C and 500 °C.

The upstream diesel oxidation catalyst converts the nitrogen oxides (NO_x) in the exhaust, together with the residue oxygen (O_2), into nitrogen dioxide (NO_2). This nitrogen dioxide enables the soot particles collected in the diesel particulate filter to be burned continuously to become carbon dioxide (CO_2) and nitrogen monoxide (NO).

No fuel is injected during the passive regeneration. The diesel particulate filter is regenerated by the discharged exhaust only.

The DPF is regenerated passively, as soon as the machine operates and the exhaust gas temperatures are high enough in the DPF.

2.2.3 Active regeneration

An active regeneration is needed if continuously high exhaust temperatures are not reached for a passive regeneration.

During the active regeneration, fuel is injected into the exhaust system in order to raise the exhaust temperature. A higher exhaust temperature (up to 600 °C) burns more soot particles in the diesel particulate filter.

To reach a higher exhaust temperature, the throttle valve is closed. This increases the load on the diesel engine and the exhaust temperature at the diesel oxidation catalyst (DOC) rises. If the temperature at the DOC is above 300 °C, an active regeneration is started.

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050 Cooling system

Contents

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050.2.4 Fan motor

Valid for: L514-1583;

1 Layout

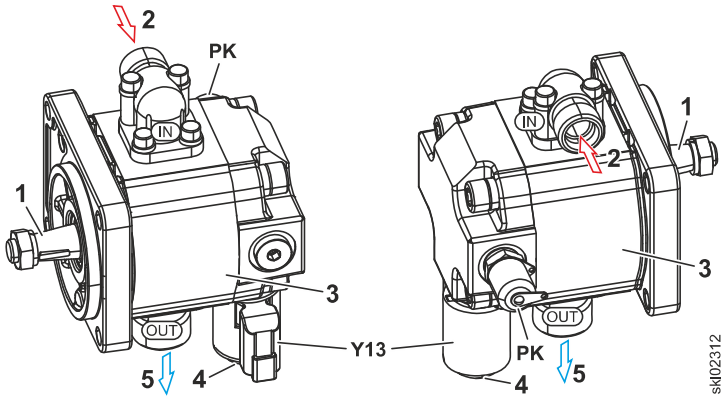

Fig. 326: Fan motor (from front left and from rear right)

1 Output shaft

2 Oil supply via fan pump

3 Gear motor

4 Proportional solenoid valve for fan speed and replenishing valve

5 Return flow to travel motor (housing flushing / cooling) and hydraulic oil cooler

Name	Test point
PK	Cooling system high pressure

Tab. 90: Test points

BMK	Function
Y13	Fan speed proportional solenoid

Tab. 91: Equipment codes

The fan motor is installed behind the operator's cabcab on the cooler unit.

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050.5 Reversible fan drive

050.5.1 Overview of reversible fan drive

Valid for: L514-1583/0-57748;

This equipment is optional.

1 Layout

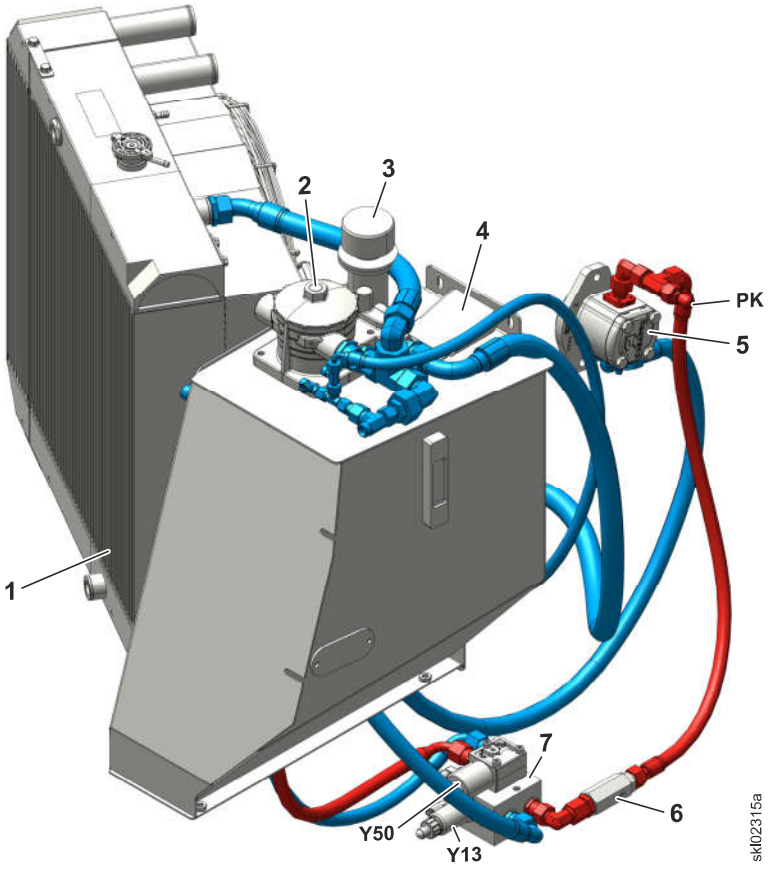

Fig. 336: Reversible fan drive (diesel engine running) (from front left)

1 Hydraulic oil cooler
2 Return suction filter
3 Breather filter
4 Hydraulic tank
5 Fan pump
6 In-line filter 80 µm
7 Fan reversal valve block

Name	Test point
PK	Cooling system high pressure

Tab. 102: Test points

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060 Working hydraulics

Contents

LBH/12204901/11/211-20200724_133931/en

2 Function

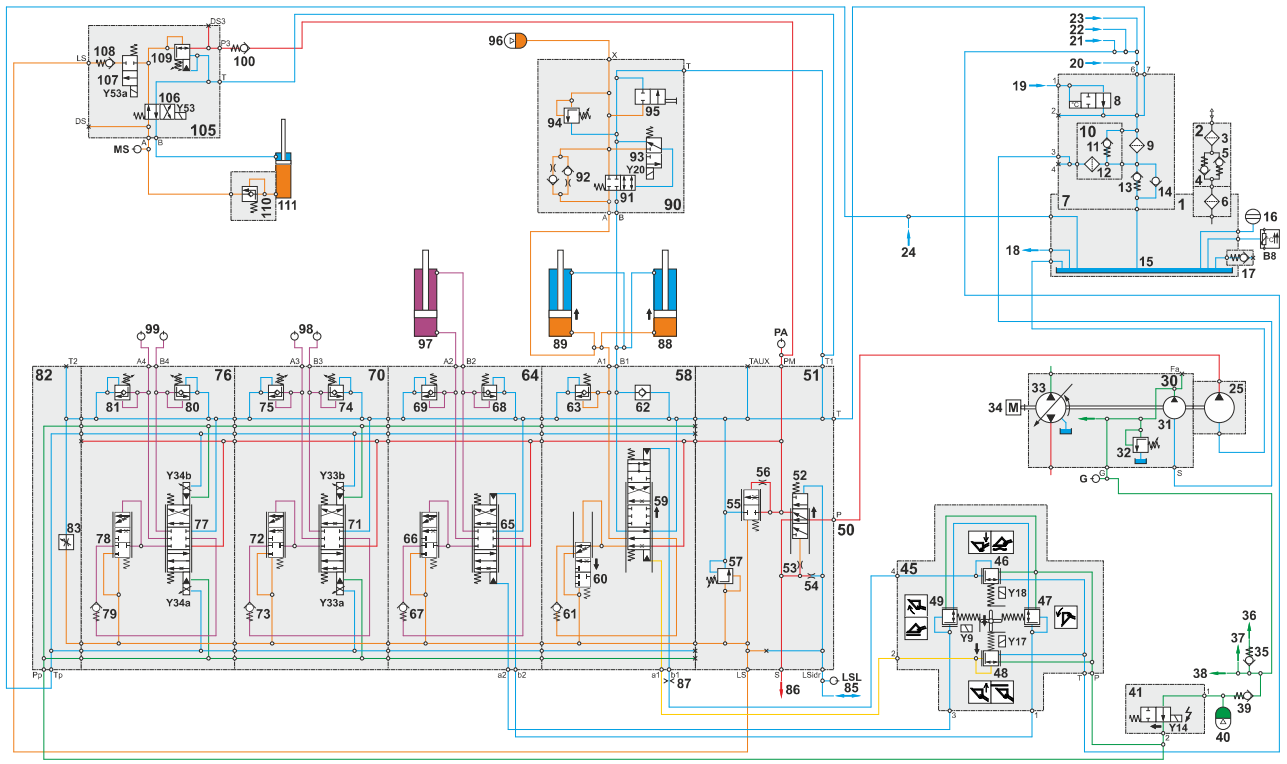

Fig. 349: Hydraulic diagram of working hydraulics with quick coupler (lifting function actuated)

1	**Hydraulic tank**	**38**	Oils supply for parking brake	**74**	Secondary pressure relief valve for 3rd function B3
2	**Breather filter**	**39**	Check valve	**75**	Secondary pressure relief valve for 3rd function A3
3	Fine filter	**40**	Pilot control hydro accumulator	**76**	**Control valve block section for 4th function (option)**
4	Outlet valve 0.35 bar	**41**	Pilot pressure solenoid valve	**77**	Spool valve for 4th function
5	Inlet valve 0.03 bar	**45**	**Pilot control unit**	**78**	Pressure balance for 4th function
6	Filler strainer 800 µm	**46**	Pilot control valve for lowering	**79**	Load retaining valve for 4th function
7	**Return suction filter**	**47**	Pilot control valve for tilting out	**80**	Secondary pressure relief valve for 4th function B4
8	Temperature valve	**48**	Pilot control valve for lifting	**81**	Secondary pressure relief valve for 4th function A4
9	Filter element 10 µm	**49**	Pilot control valve for tilting in	**82**	**End section**
10	**Filter separator plate**	**50**	**Control block**	**83**	Flow regulating valve
11	Bypass valve 2.0 bar	**51**	**End section**	**85**	Load sensing signal from servostat
12	Screen for replenishing pump 125 µm	**52**	Priority valve	**86**	Oil supply to servostat
13	Preload valve 0.5 bar	**53**	Throttle 1.0 mm	**87**	Orifice 0.6 mm
14	Feeder valve	**54**	Throttle 1.0 mm	**88**	Right lift cylinder
15	Steel tank	**55**	Pressure circuit balance	**89**	Left lift cylinder
16	Sight glass for hydraulic oil level	**56**	Throttle 0.8 mm	**90**	**Stabilisation module (option)**

See next page for continuation of the image legend

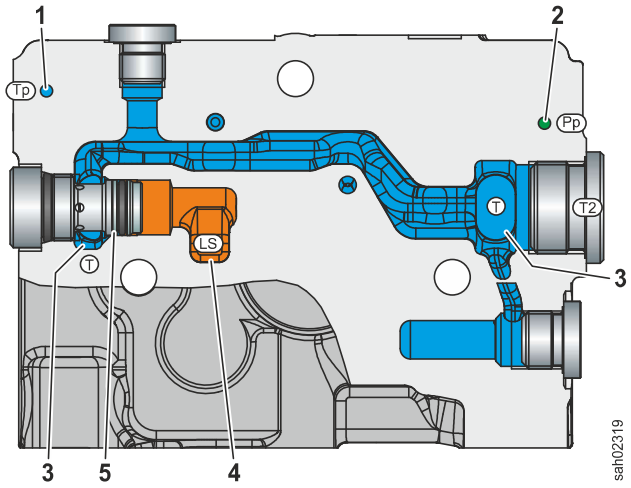

Fig. 358: End section: sectional view

1 Control oil return flow to hydraulic tank
2 Control oil from replenishing pump
3 Return flow to return suction filter (2x)
4 Load sensing signal for working hydraulics
5 Flow regulating valve

2 Function

2.1 Basic function

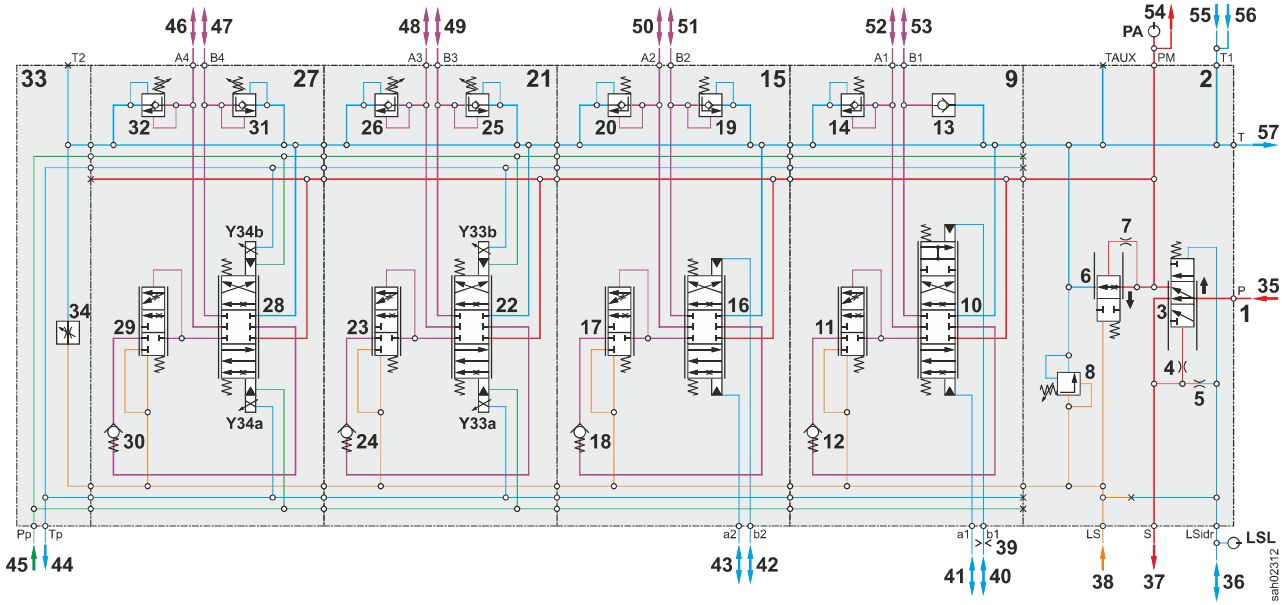

Fig. 359: Control valve block: hydraulic diagram (diesel engine is running)

1 **Control block**
2 **End section**
3 Priority valve
20 Secondary pressure relief valve for tilting in
21 **Control valve block section for 3rd function (option)**
22 Spool valve for 3rd function
39 Orifice 0.6 mm
40 Pilot control connection for lowering
41 Pilot control connection for lifting

See next page for continuation of the image legend

The control lever **1** is attached to the pilot control unit.

2 Function

2.1 Basic function

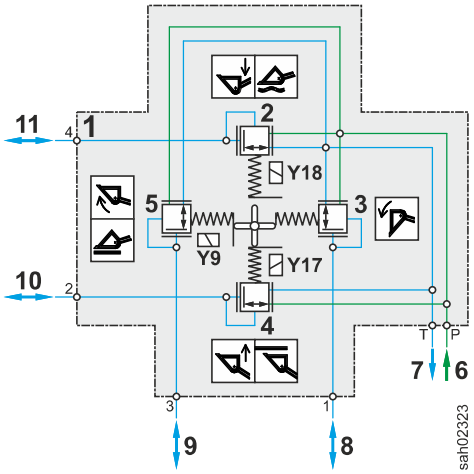

Fig. 364: Pilot control unit: hydraulic diagram (working hydraulics lockout is deactivated)

1 **Pilot control unit**
2 Pilot control valve for lowering
3 Pilot control valve for tilting out
4 Pilot control valve for lifting
5 Pilot control valve for tilting in
6 Oil supply from the replenishing pump (via the servo pressure solenoid valve)
7 Return flow to return suction filter
8 Pilot control connection for tilting out
9 Pilot control connection for tilting in
10 Pilot control connection for lifting
11 Pilot control connection for lowering

BMK	Function	BMK	Function
Y9	Bucket return-to-dig retaining magnet (option)	**Y18**	Float position retaining magnet
Y17	Lift kick-out retaining magnet (option)		

Tab. 139: Equipment codes

2.2 Servo pressure

If the control lever is not moved, the readjusting springs hold it in the zero position.

When the control lever is moved, the pilot control valves **2**, **3** **4** and **5** are actuated by means of compression springs. As a result, oil flows from the replenishing pump **6** via the relevant pilot control valve to the control block. The pilot pressure that this generates pushes against the spool in the control block and moves it against its readjusting springs. At the same time, the pilot pressure acts against the relevant pilot control valve. If the pilot pressure is high enough, it moves the pilot control valve against the spring force of the compression spring and closes it again.

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2 Function

2.1 Basic function

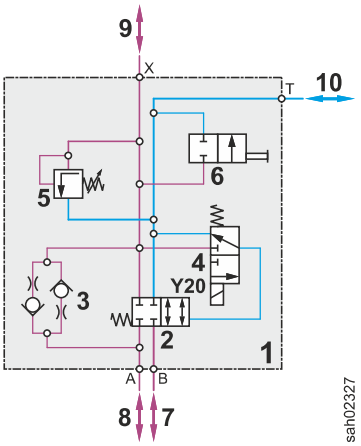

Fig. 375: Stabilisation module: hydraulic diagram

1	**Stabilisation module**	**6**	Hydro accumulator relief valve
2	Ride control valve spool	**7**	Connection to ring side of lift cylinder
3	Restrictor check valve	**8**	Connection to piston side of lift cylinder
4	Ride control solenoid valve	**9**	Ride control hydro accumulator connection
5	Safety valve	**10**	Return flow to the return suction filter (via the control valve block)

BMK	Function
Y20	Solenoid for ride control

Tab. 150: Equipment codes

The stabilisation module **1** performs the following tasks:
- Charging the ride control hydro accumulator **9** aand protecting from pressure peaks and excess pressure
- Connecting the lift cylinder ring side **7** to the hydraulic tank **10** (when ride control is active)
- Connecting the lifting cylinder piston side **8** to the ride control hydro accumulator **9** (when ride control is active)

2.2 Charging and protecting the ride control hydro accumulator

The throttle check valve **3** connects the ride control hydro accumulator **9** to the lift cylinder piston side **8**. The ride control hydro accumulator **9** is thus charged with the working pressure of the lifting function.

The safety valve **5** protects the ride control hydro accumulator **9** from pressure peaks and excess pressure.

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BMK	Function	BMK	Function
B102	Travel pump high pressure sensor	**Y3**	Reverse travel direction solenoid
Y2	Forward travel direction solenoid	**Y106**	Servo pressure proportional solenoid (travel motor)

Tab. 158: Equipment codes

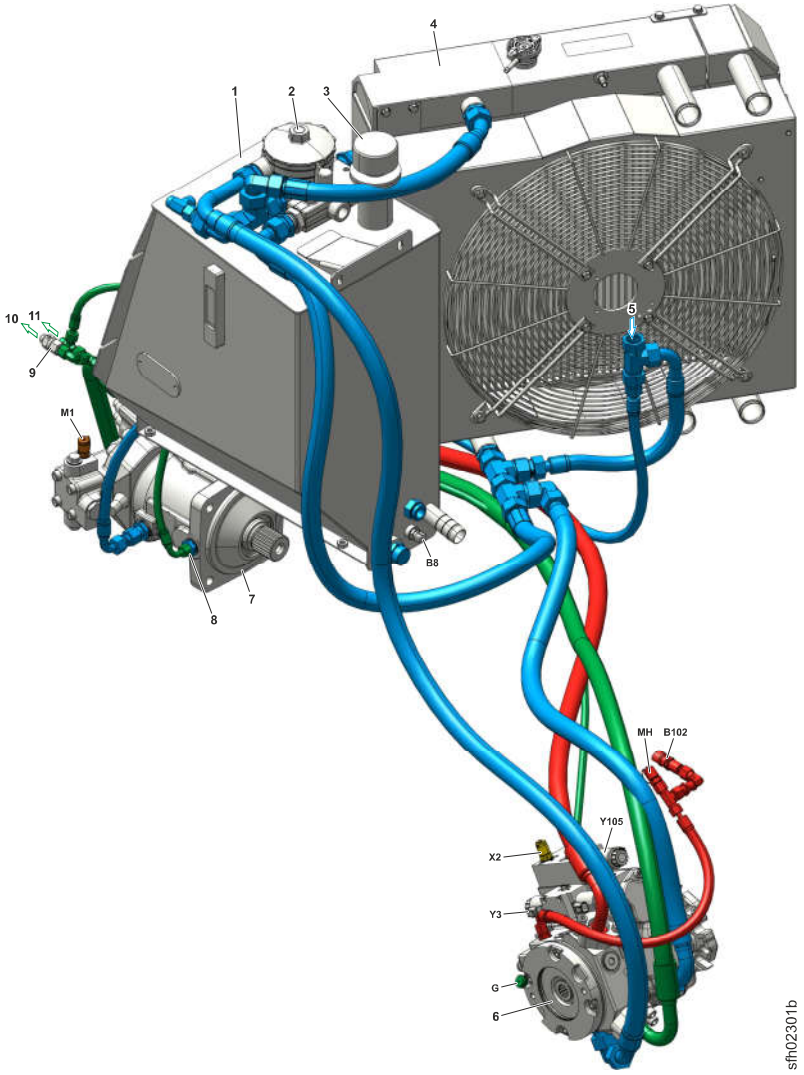

Fig. 382: Travel hydraulics (forward travel direction) (from rear left)

1 Hydraulic tank
2 Return suction filter
3 Breather filter
4 Hydraulic oil cooler
5 Fan motor return line (cooling)
6 Travel pump
7 Travel motor
8 Orifice 1.0 mm
9 Check valve
10 Oil supply for pilot control
11 Oils supply for parking brake

Name	Test point	Name	Test point
G	Replenishing pressure	**M1**	Travel motor servo pressure

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Name	Test point	Name	Test point	Name	Test point
G	Replenishing pressure	**MH**	Travel pump high pressure	**X2**	Control pressure for forward travel direction

Tab. 169: Test points

BMK	Function	BMK	Function
B102	Travel pump high pressure sensor	**Y3**	Reverse travel direction solenoid
Y2	Forward travel direction solenoid	**Y105**	Control pressure proportional solenoid (travel pump)

Tab. 170: Equipment codes

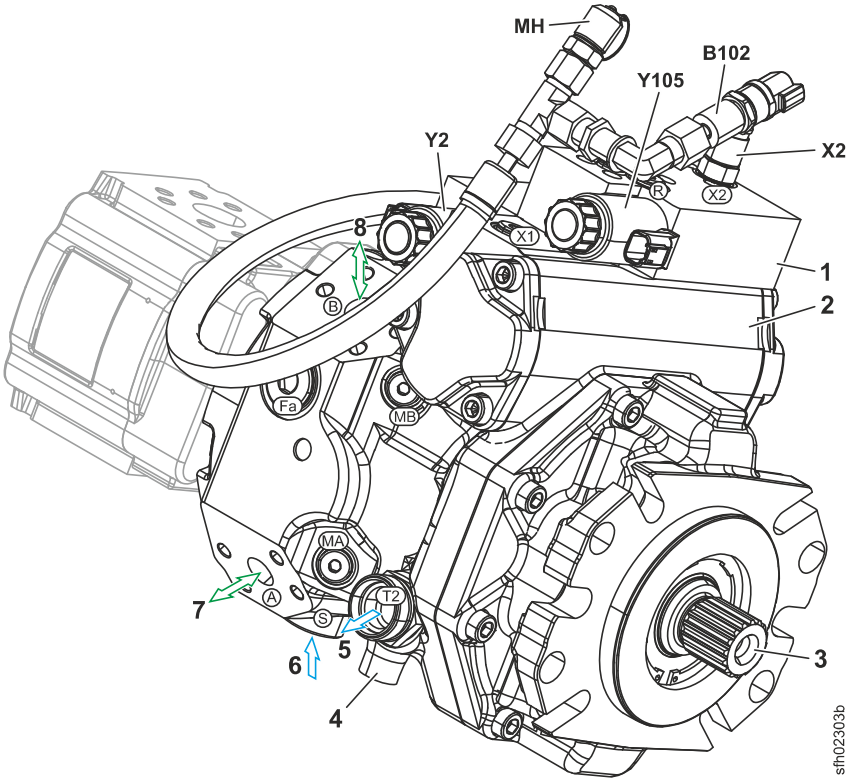

Fig. 388: Travel pump (from rear right)

1 Control pressure valve block
2 Positioning piston
3 Drive shaft
4 Eccentric adjusting screw
5 Leak oil to hydraulic oil cooler
6 Suction port of replenishing pump of return suction filter
7 Oil supply for travel motor (reverse travel direction high pressure)
8 Oil supply for travel motor (forward travel direction high pressure)

Name	Test point	Name	Test point
MH	Travel pump high pressure	**X2**	Control pressure for forward travel direction

Tab. 171: Test points

2.6 Control of swivel angle by the control pressure proportional valve

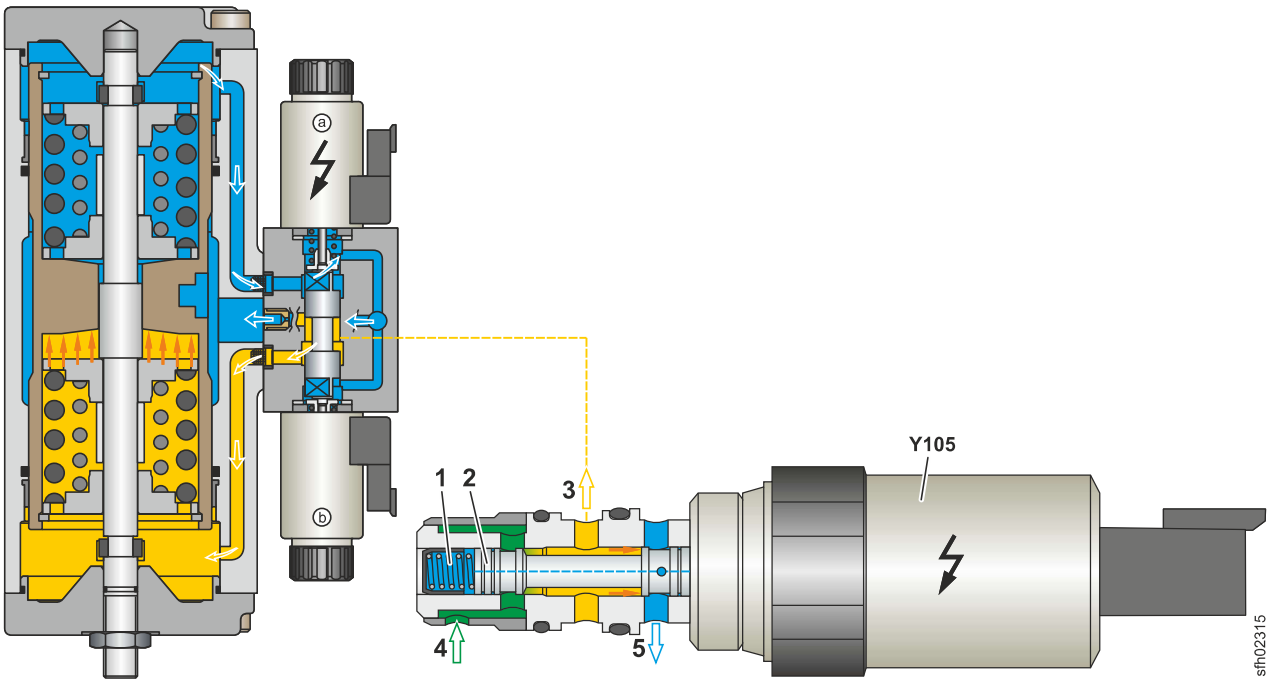

Fig. 398: Control of swivel angle by the control pressure proportional valve (forward travel direction)

1 Regulating spring

2 Control pressure proportional valve

3 Connection to the positioning piston

4 Oil from the replenishing pump

5 Connection to pump housing

BMK	Function
Y105	Control pressure proportional solenoid (travel pump)

Tab. 178: Equipment codes

The control pressure proportional valve **2** generates the control pressure that moves the variable displacement pump. To do this, the central control unit energises the control pressure proportional solenoid **Y105** via the compact module.

The central control unit increases the current from the following parameters:
- Position of travelling pedal
- Position of inching brake pedal
- Presence of overspeed or excess travel speed
- Presence of excessive temperature of hydraulic oil
- Active load limiting function
- Set speed limit (V_{max})

When de-energised, the spring force of regulating spring **1** moves the proportional valve **2** so that the control pressure flows into the pump housing **5**.

When the control pressure proportional solenoid **Y105** is energised, it moves the proportional valve **2** against the spring force of regulating spring **1**. As a result, the proportional valve **2** opens the connection to the replenishing pressure duct **4** until the control pressure and the spring force of regulating spring **1** move the proportional valve **2** back against the proportional solenoid **Y105**.

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BMK	Function
Y106	Servo pressure proportional solenoid (travel motor)

Tab. 187: Equipment codes

The swivel angle of axial piston rotary group is regulated by the central control unit via the servo pressure valve **2** electrically and proportionally.

If the proportional solenoid for servo pressure **Y106** is not energised, the servo pressure valve **2** connects the servo pressure **M1** with the motor housing. The high pressure **1** pushes the axial piston rotary group to a smaller swivel angle. Output speed and high pressure rise.

If the central control unit energies the proportional solenoid for servo pressure **Y106**, it moves the servo pressure valve **2** against the spring force of 2nd regulating spring **3**. The servo pressure valve **2** thus connects the positioning piston **7** to the high pressure **1**. Due to the larger surface on the positioning piston **7**, the high pressure **1** swivels the axial piston rotary group to a larger swivel angle. Output speed and high pressure decrease.

As the swivel angle increases, the 1st regulating spring **5** is preloaded more. If the spring force of 1st regulating spring **5** exceeds the force of proportional solenoid for servo pressure **Y106**, the servo pressure valve **2** disconnects the high pressure **1** from the positioning piston **7** again. As a result, the swivel angle is maintained based on the current at the proportional solenoid for servo pressure **Y106**.

2.4 Discharge (cooling)

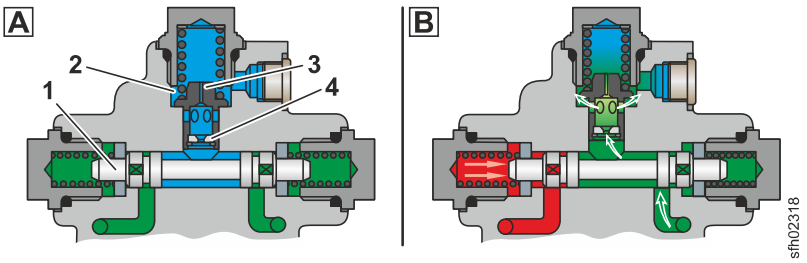

Fig. 407: Discharge if no travel direction is selected / discharge for forward travel direction

1 Discharge valve
2 Connection to motor housing
3 Pressure relief valve
4 Orifice

Oil is constantly drained via the discharge valve **1** and pressure relief valve **3** from the closed circuit to the motor housing **2**. The replenishing pump replaces this oil with cooled oil from the hydraulic tank. The discharge thus cools the entire closed circuit.

The discharge valve **1** connects the low pressure with the pressure relief valve **4**. The orifice **4** of pressure relief valve **3** determines the amount of oil that is discharged.

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The hydraulic tank consists of following components:
- Steel tank
- Return suction filter (For more information see: 080.3.3 Return-suction filter, page 080-12)
- Breather filter (For more information see: 080.3.5 Breather filter, page 080-24)
- Hydraulic oil drain valve
- Hydraulic oil temperature sensor B8

2 Function

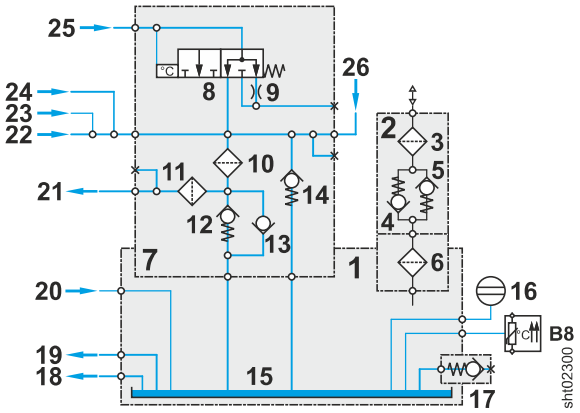

Fig. 411: Hydraulic tank diagram

1 **Hydraulic tank**
2 **Breather filter**
3 Fine filter
4 Outlet valve 0.35 bar
5 Inlet valve 0.03 bar
6 Filler strainer 800 µm
7 **Return suction filter**
8 Temperature valve
9 Throttle
10 Filter element 10 µm
11 Strainer for replenishing pump
12 Preload valve 0.5 bar
13 Feeder valve
14 Bypass valve 2.5 bar
15 Steel tank
16 Sight glass for hydraulic oil level
17 Hydraulic oil drain valve
18 Working pump suction port
19 Fan pump suction port
20 Return flow from parking brake and for pilot control of additional functions (option)
21 Replenishing pump suction port
22 Return flow from servostat
23 Return flow from pilot control unit
24 Return flow from hydraulic oil cooler (cooled)
25 Return flow from hydraulic oil cooler (uncooled)
26 Return flow from control valve block

BMK	Function
B8	Hydraulic oil temperature sensor

Tab. 193: Equipment codes

Hydraulic tank stores hydraulic oil for following systems:
- Fan drive
- Working hydraulics
- Travel hydraulics
- Steering system
- Parking brake

2 Filter housing with temperature valve
3 Filter casing
5 Replenishing pump suction port
6 Return flow to return suction filter
8 Return flow to return suction filter
9 Connection to steel tank

Return suction filter is integrated in steel tank.

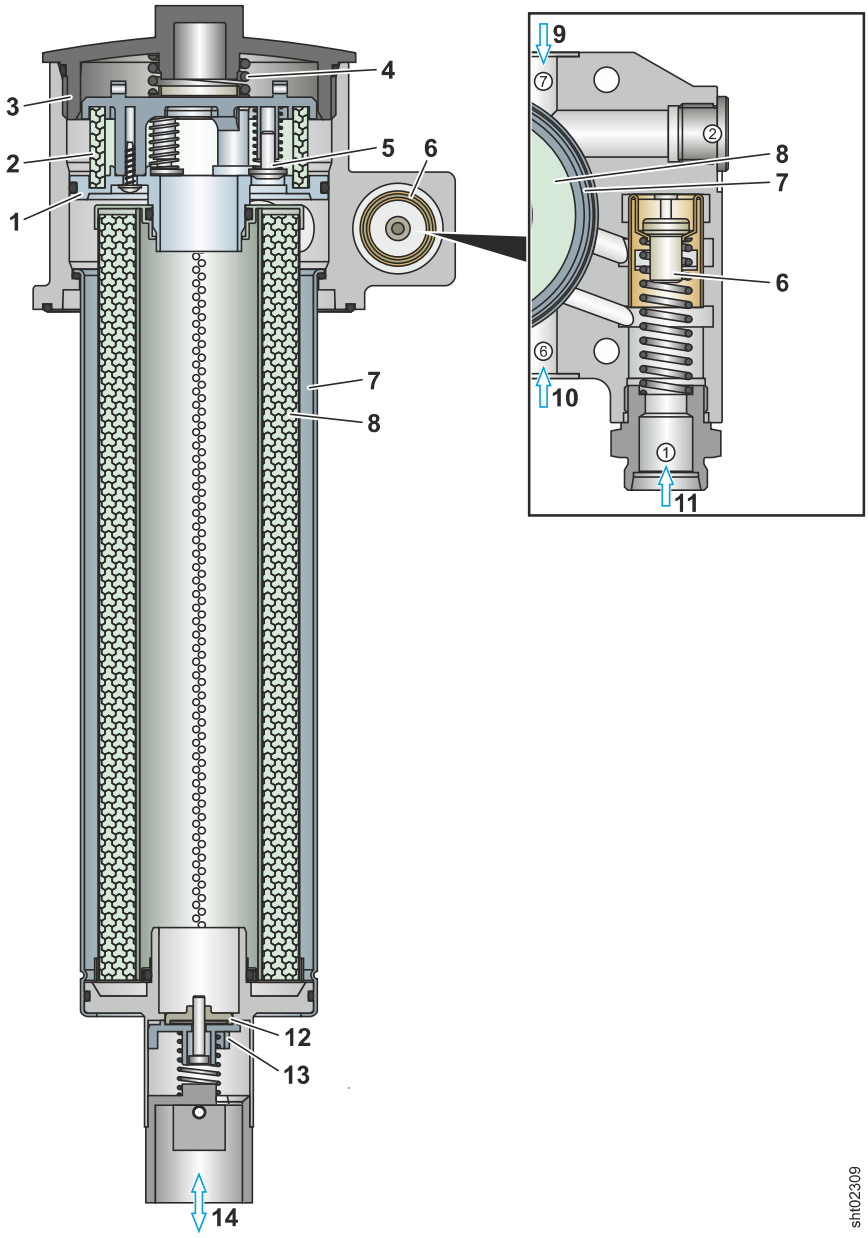

Fig. 422: Return-suction filter: sectional view

1 Filter separator plate
2 Screen for replenishing pump 125 µm
3 Filter cover
4 Compression spring
5 Bypass valve 2.0 bar (3x)
8 Filter element 10 µm
9 Return flow to return suction filter
10 Return flow to return suction filter
11 Return flow to return suction filter (via temperature valve)
12 Feeder valve

See next page for continuation of the image legend

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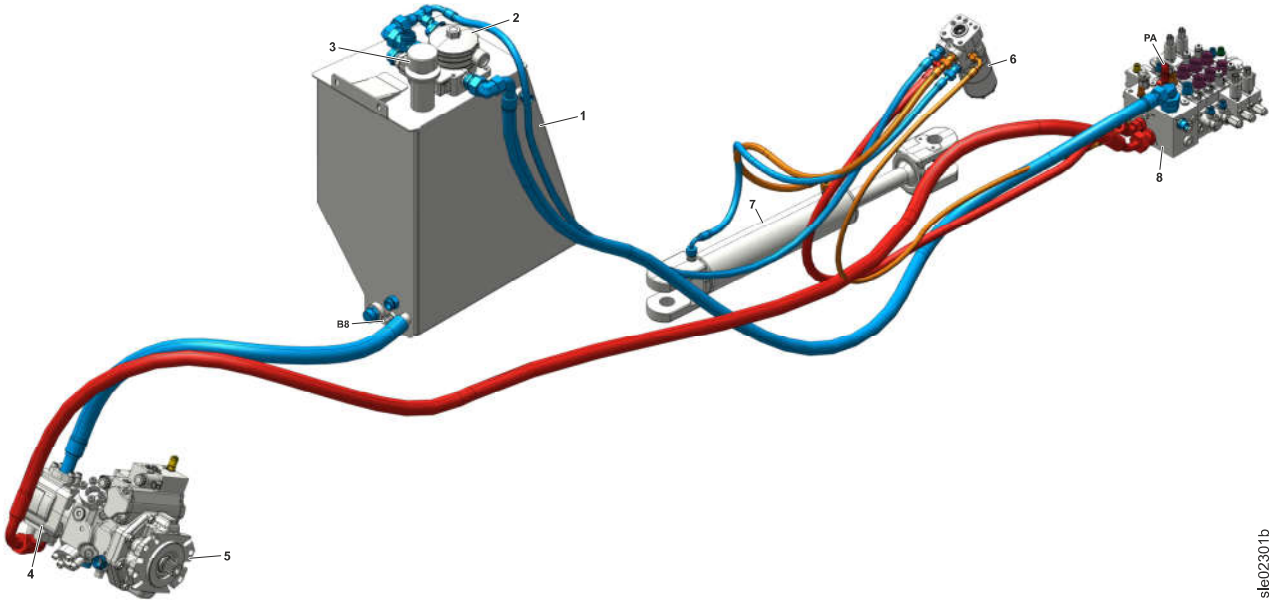

Fig. 433: Steering system (steering to left) (from rear right)

1 Hydraulic tank
2 Return suction filter
3 Breather filter
4 Working pump
5 Travel pump
6 Servostat
7 Steering cylinder
8 Control block

Name	Test point
PA	Working hydraulics high pressure

Tab. 197: Test points

BMK	Function
B8	Hydraulic oil temperature sensor

Tab. 198: Equipment codes

The steering system consists of the following components:
- Hydraulic tank (For more information see: 080.3.1 Overview of hydraulic tank, page 080-8)
- Working pump (For more information see: 060.3 Working pump, page 060-14)
- Control block (For more information see: 060.4 Control block, page 060-15)
- Servostat (For more information see: 090.3 Servostat, page 090-10)
- Steering cylinder

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When the steering wheel is turned, the 1st metering pump **6** delivers oil like a gear pump. The 2nd metering pump **5** is separated from the circuit by the 2nd metering pump cut-off valve **2**. This reduces the amount of force required.

In an emergency steering operation, oil returning from steering cylinder flows via the feeder valve for emergency steering function **4** to 1st metering pump **6**. It then transports oil further to steering cylinder.

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6 Filler strainer 800 µm
7 **Return suction filter**
8 Temperature valve
9 Filter element 10 µm
10 **Filter separator plate**
11 Bypass valve 2.0 bar
12 Screen for replenishing pump 125 µm
13 Preload valve 0.5 bar
14 Feeder valve
20 Return flow from hydraulic oil cooler (uncooled)
21 Return flow from hydraulic oil cooler (cooled)
22 Return flow from pilot control unit
23 Return flow from servostat
24 Return flow from control valve block
25 **Travel pump**
26 Replenishing pump
27 Replenishing pressure relief valve
28 Axial piston rotary group
34 Return flow from pilot control of additional functions (option)
35 **Inch/brake unit**
36 **Main brake cylinder**
37 Brake piston with membrane
38 Equalising reservoir
39 Filler strainer
40 **Drum brake**
41 Brake piston for service brake
42 Spring accumulator cylinder for parking brake

Name	Test point
G	Replenishing pressure

Tab. 216: Test points

BMK	Function	BMK	Function
B8	Hydraulic oil temperature sensor	**R1**	Inching function angle sensor
B12	Brake light pressure switch	**Y10**	Parking brake solenoid

Tab. 217: Equipment codes

2.1.1 Service brake

The service brake is single-circuit brake. The braking effect is generated in the drum brake **40**, which is flange-mounted on the front axle. Because there is no differential in the gearbox, the drum brake acts on both axles.

When the inching brake pedal is pressed, at first only the inching function **R1** is actuated. (For more information see: Position of travelling pedal, page 070-24) Inching hydrostatically brakes machine.

Only when the pedal is pressed further is the service brake actuated. To do this, main brake cylinder **36** pushes oil out of equalizing reservoir **38** into service brake piston **41** in drum brake **40**.

2.1.2 Parking brake

The parking brake is a spring accumulator brake. The braking effect is generated in the drum brake **40**, which is flange-mounted on the front axle. Because there is no differential in the gearbox, the drum brake acts on both axles.

When the parking brake is activated, oil from the spring accumulator cylinder **42** flows via the parking brake solenoid valve **33** to the hydraulic tank **1**. The compression spring in the spring accumulator cylinder **42** then actuates the drum brake **40** via a Bowden cable.

When the parking brake is deactivated, the spring accumulator cylinder **42** is connected via the parking brake solenoid valve **33** to the replenishing pressure. The replenishing pressure pushes the compression spring in the spring accumulator cylinder **42**. The replenishing pressure thus releases the drum brake **40**.

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2.2 Switching the brake light

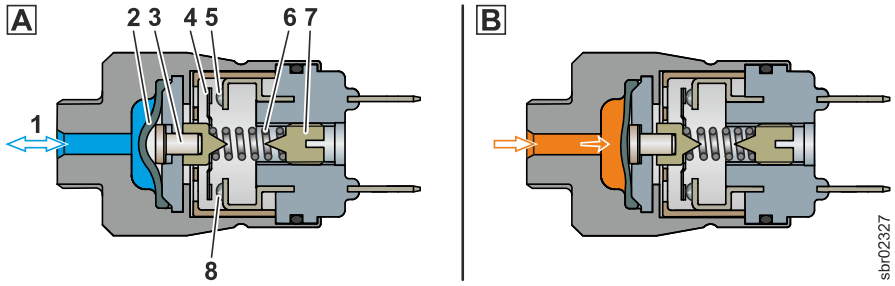

Fig. 460: Brake light pressure switch not actuated / brake light pressure switch actuated

1	Brake pressure from inch/brake unit	**6**	Compression spring
2	Membrane	**7**	Adjusting screw
3	Pin	**8**	Switch contact
4	Contact plate		
5	Switch contact		

When the service brake is operated, the inch/brake unit applies brake pressure **1** to the membrane **2**. If the brake pressure **1** is high enough, the membrane **2** pushes the pin **3** against the compression spring **6** until the contact plate **4** touches the two switch contacts **5** and **8**. This closes the electric circuit.

The brake light pressure switch is normally open. The closing pressure can be set with the adjusting screw **7**.

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110.2 Lighting

Valid for: L514-1583;

1 Layout

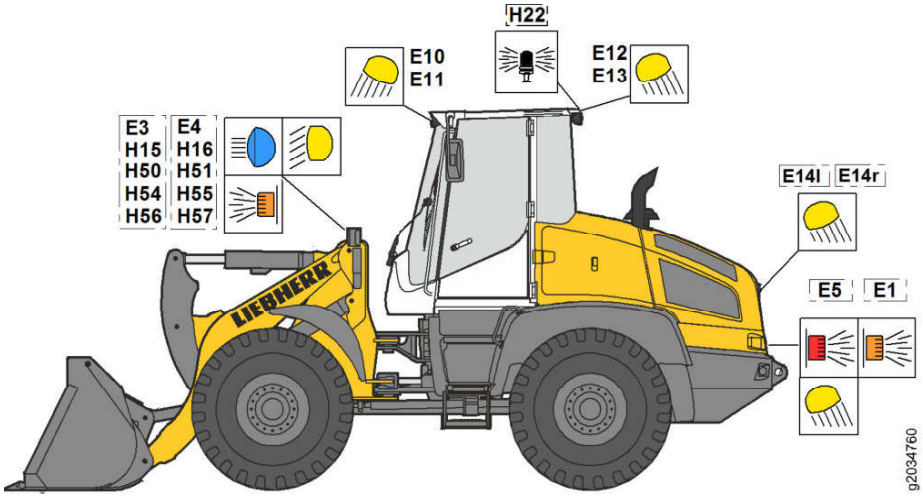

Fig. 470: Overview of lighting

Position	Function	Position	Function
E1	Left reversing light	H15	Front left indicator light
E3	Left driving headlight	H16	Front right indicator light
E4	Right driving headlight	H22	Flashing beacon
E5	Right reversing light	H50	Front left parking light
E10	Front left working headlight	H51	Front right parking light
E11	Front right working headlight	H54	Left low beam
E12	Rear left working headlight	H55	Right low beam
E13	Rear right working headlight	H56	Left high beam
E14l	Left licence plate lighting	H57	Right high beam
E14r	Right licence plate lighting		

Tab. 227: Component designations

2.1 Basic function

The lighting of the machine is controlled via the steering-column switch S3 and via switches in the operator's cab.

The brake lights are controlled by the brake light pressure switch B12 and brake light relay K17.

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BMK	SYSTEM	LOCATION	FUNCTION	PAGE
-E11	=K	+K3	WORKING PROJECTOR FRONT RIGHT	/28.E6
-E11.X	=K	+K3	PLUG WORKING PROJECTOR FRONT RIGHT	/28.F6
-E11a	=K	+K3	WORKING PROJECTOR FRONT RIGHT	/28.E7
-E11a.X	=K	+K3	PLUG WORKING PROJECTOR FRONT RIGHT	/28.F7
-E12	=K	+K3	WORKING PROJECTOR REAR LEFT	/29.E4
-E12.X	=K	+K3	PLUG WORKING PROJECTOR REAR LEFT	/29.E4
-E12a	=K	+K3	WORKING PROJECTOR REAR LEFT	/29.E4
-E12a.X	=K	+K3	PLUG WORKING PROJECTOR REAR LEFT	/29.E4
-E13	=K	+K3	WORKING PROJECTOR REAR RIGHT	/29.E7
-E13.X	=K	+K3	PLUG WORKING PROJECTOR REAR RIGHT	/29.E7
-E13a	=K	+K3	WORKING PROJECTOR REAR RIGHT	/29.E7
-E13a.X	=K	+K3	PLUG WORKING PROJECTOR REAR RIGHT	/29.E7
-E14l	=H	+H1	LICENCE PLATE LIGHT LEFT	/42.E8
-E14l.X	=H	+H1	PLUG LICENCE PLATE LIGHT LEFT	/42.E8
-E14r	=H	+H1	LICENCE PLATE LIGHT RIGHT	/42.E8
-E14r.X	=H	+H1	PLUG LICENCE PLATE LIGHT RIGHT	/42.E8
-E27	=K	+K	PRESELECTOR CLOCK AUXILIARY HEATER (OPTION)	/74.D1
-E27.X13	=K	+K	PLUG PRESELECTOR CLOCK AUXILIARY HEATER	/74.D1
-E28	=H	+H	FUEL PUMP AUXILIARY HEATER (OPTION)	/74.B7
-E28.X1	=H	+H	PLUG FUEL PUMP AUXILIARY HEATER	/74.B7
-E29	=H	+H	AUXILIARY HEATER (OPTION)	/74.C4
-E29.X3	=H	+H	PLUG AUXILIARY HEATER	/74.C7
-E29.X8	=H	+H	PLUG AUXILIARY HEATER	/74.C4
-E100	=H	+H1	FLASHING WARNING LIGHT 1 (OPTION)	/67.A2
-E100.X	=H	+H1	PLUG FLASHING WARNING LIGHT 1	/67.A2
-E101	=H	+H1	FLASHING WARNING LIGHT 2 (OPTION)	/67.B2
-E101.X	=H	+H1	PLUG FLASHING WARNING LIGHT 2	/67.C2
-E700	=H	+H	INDICATOR LAMP DIESEL EXHAUST FLUID LINE	/49.D7
-E700.X	=H	+H	PLUG INDICATOR LAMP DIESEL EXHAUST FLUID LINE	/49.D7
-E5601	=M	+M	UREA HOSE HEATING PRESSURE LINE	/91.E2
-E5601.X	=M	+M	PLUG UREA HOSE HEATING PRESSURE LINE	/91.E2
-E5602	=M	+M	UREA HOSE HEATING SUPPLY	/91.E4
-E5602.X	=M	+M	PLUG UREA HOSE HEATING SUPPLY	/91.E4
-E5603	=M	+M	UREA HOSE HEATING RUNBACK	/91.E6
-E5603.X	=M	+M	PLUG UREA HOSE HEATING RUNBACK	/91.E6
-F1	=A4	+K	FUSE INCH PEDAL	/48.B2

BMK	SYSTEM	LOCATION	FUNCTION	PAGE
-F2	=A4	+K	FUSE LIFT KICK-OUT ; CENTRAL LUBRICATION SYSTEM	/65.C3
-F3	=A4	+K	FUSE SWITCH LIGHTING	/49.B5
-F4	=A4	+K	FUSE MOTOR CONTROL ; INFORMATION KL.15	/16.C7
-F5	=A4	+K	FUSE MASTER CENTRAL CONTROL	/33.D6
-F6	=A4	+K	FUSE RESERVE	/44.B7
-F7	=A4	+K	FUSE FUEL LEVEL SENSOR	/45.A1
-F8	=A4	+K	FUSE COMPACT MODULE A28	/60.B2
-F9	=A4	+K	FUSE COMPACT MODULE A28	/60.B6
-F01	=B	+B2	FUSE EMERGENCY STEERING PUMP (OPTION)	/17.E4
-F02	=B	+B2	SUPPLY RELAY BOARD KL.30	/17.E5
-F02.X	=B	+B2	PLUG SUPPLY RELAY BOARD KL.30	/17.E5
-F03	=B	+B2	FUSE HAZARD WARNING LIGHT KL.30	/17.E5
-F03.X	=B	+B2	CONNECTION FUSE F03	/17.E5
-F04	=B	+B2	FUSE RESERVE	/17.E5
-F10	=A4	+K	FUSE 100% DIFFERENTIAL LOCK	/19.B5
-F11	=A4	+K	FUSE HEAT/AIR CONDITIONING SYSTEM	/26.B4
-F12	=A4	+K	FUSE WINDSCREEN WIPER FRONT ; HORN	/39.C4
-F13	=A4	+K	FUSE BACK-UP ALARM/V MAX	/67.A8
-F14	=A4	+K	FUSE COMPACT MODULE A27	/59.A3
-F15	=A4	+K	FUSE COMPACT MODULE A27	/59.A6
-F16	=A4	+K	FUSE SWITCH REAR WINDOW HEATER /MIRROR HEATING	/44.B8
-F17	=A4	+K	FUSE RESERVE	/62.B4
-F18	=A4	+K	FUSE WORKING HYDRAULICS LOCKOUT	/22.B1
-F19	=A4	+K	FUSE LOGIC SUPPLY	/61.B6
-F20	=A4	+K	FUSE RESERVE	/30.C5
-F21	=A4	+K2	FUSE TRAVEL RANGE RIDE CONTROL	/24.C1
-F22	=A4	+K	FUSE LITU	/69.B3
-F23	=A4	+K	FUSE OPTION REVERSIBLE VENTILATOR	/21.B3
-F24	=A4	+K	FUSE TRACTIVE FORCE DEMAND	/78.C3
-F25	=A4	+K	FUSE SWEEPING MACHINE	/70.B8
-F26	=A4	+K	FUSE WORKING HYDRAULICS LOCKOUT CLEARING	/22.A7
-F27	=A4	+K	FUSE STARTER SOLENOID	/17.C2
-F28	=A4	+K	FUSE PARKING BRAKE	/25.B1
-F29	=A4	+K	FUSE SENSORS TRANSMISSION	/46.A6
-F30	=A4	+K	FUSE LOGIC SUPPLY KL.15	/60.B8
-F31	=A4	+K	FUSE WINDSCREEN WIPER REAR	/40.A2

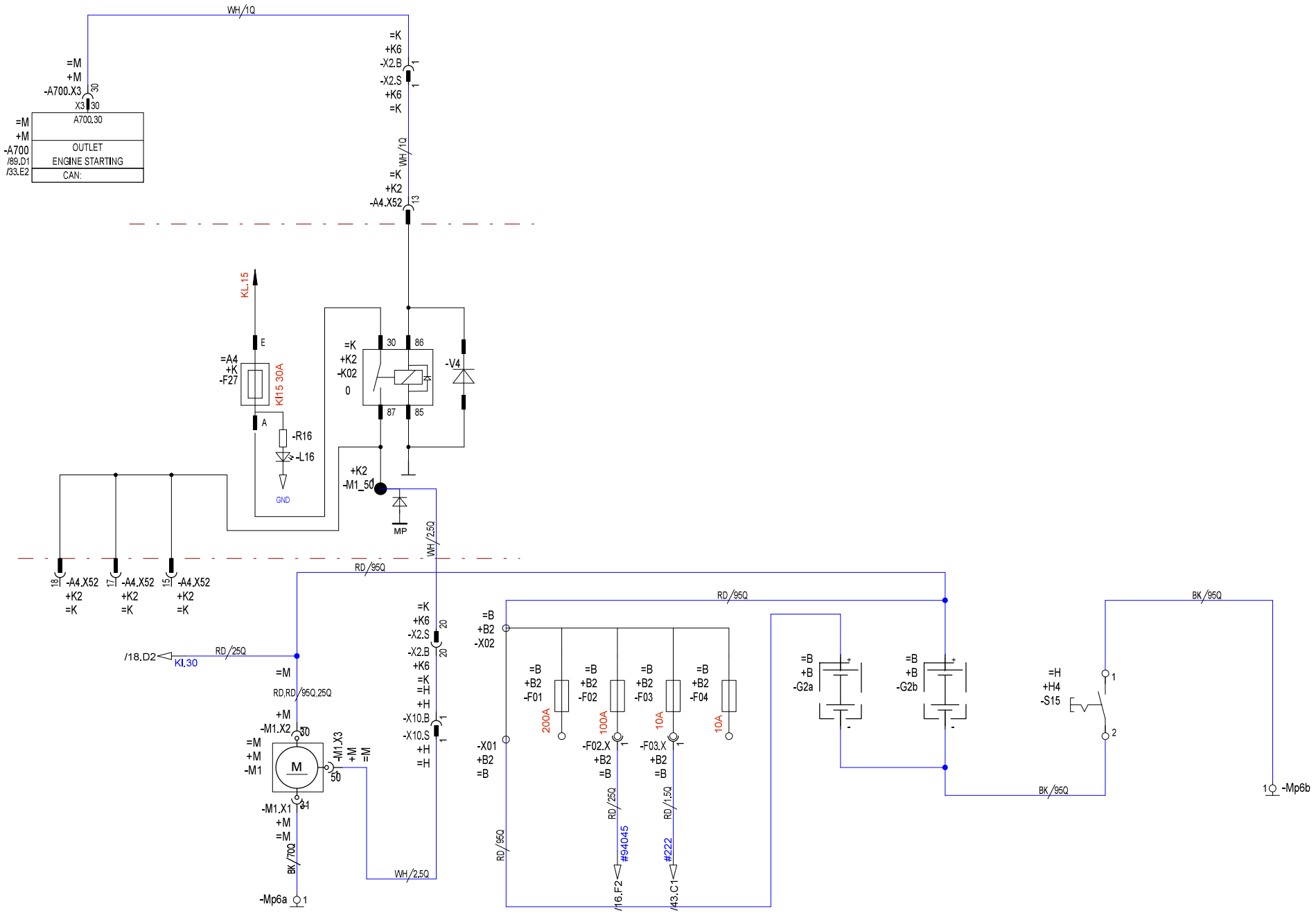
ITEM CODE 12437281
DRAWING INDEX 004
PROJECT SERIE_L514-L518
DRAWING NUMBER 1583 00090 01 00

MACHINE TYPE
LIDOS UNIT

SERIAL NUMBER
XXXXX

LIEBHERR
FACTORY LBH

BMK-INDEX
E PLAN

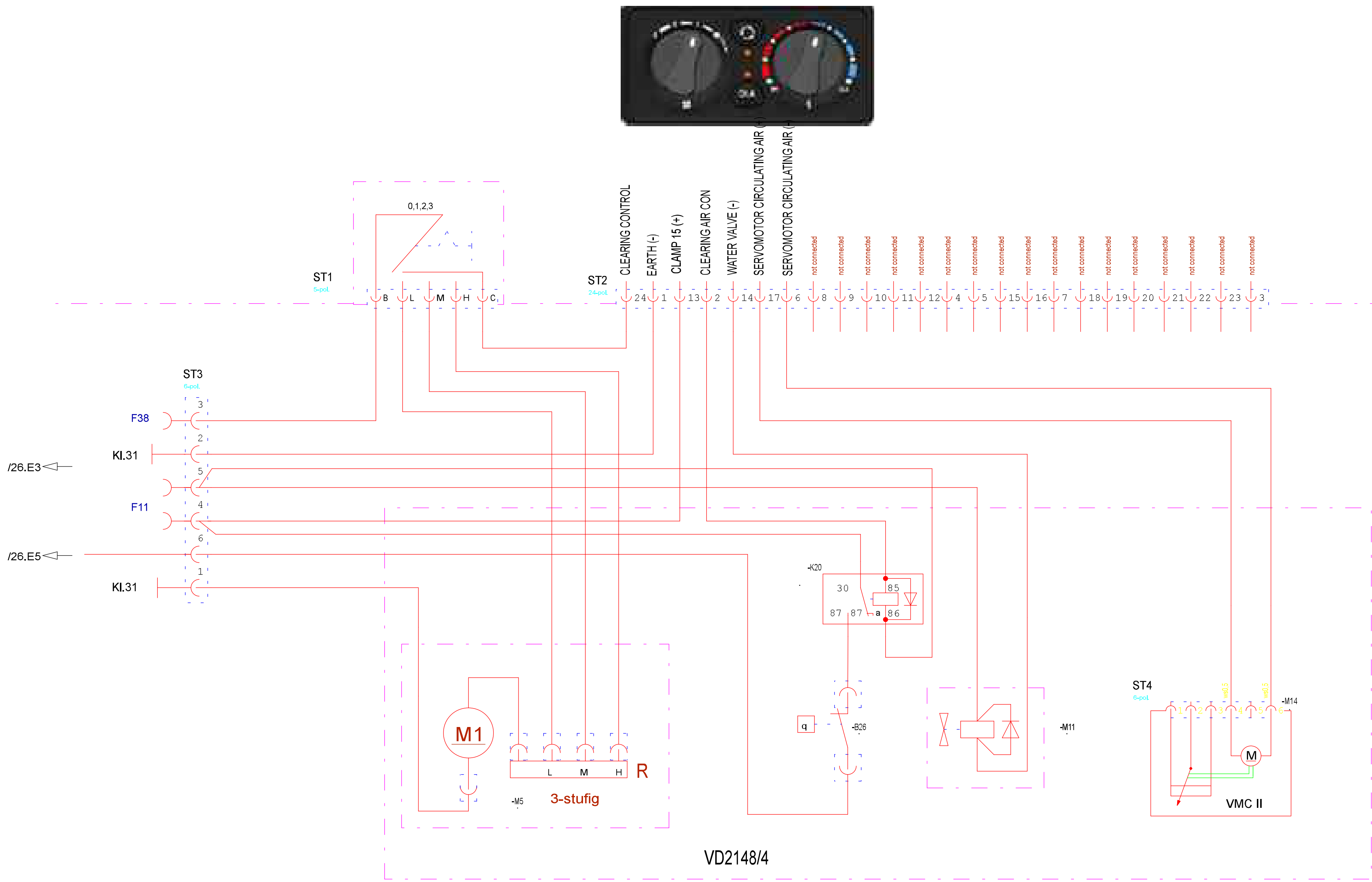


PROJECT SERIE_L514-L518 ITEM CODE 12437281

DRAWING NUMBER 1583 00090 01 00 DRAWING INDEX 004

MACHINE TYPE	SERIAL NUMBER			
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	BATTERIES ; BATTERY MAIN SWITCH ; START E PLAN	PAGE 17 OF CREATION DATE 06.11.2019 12:22

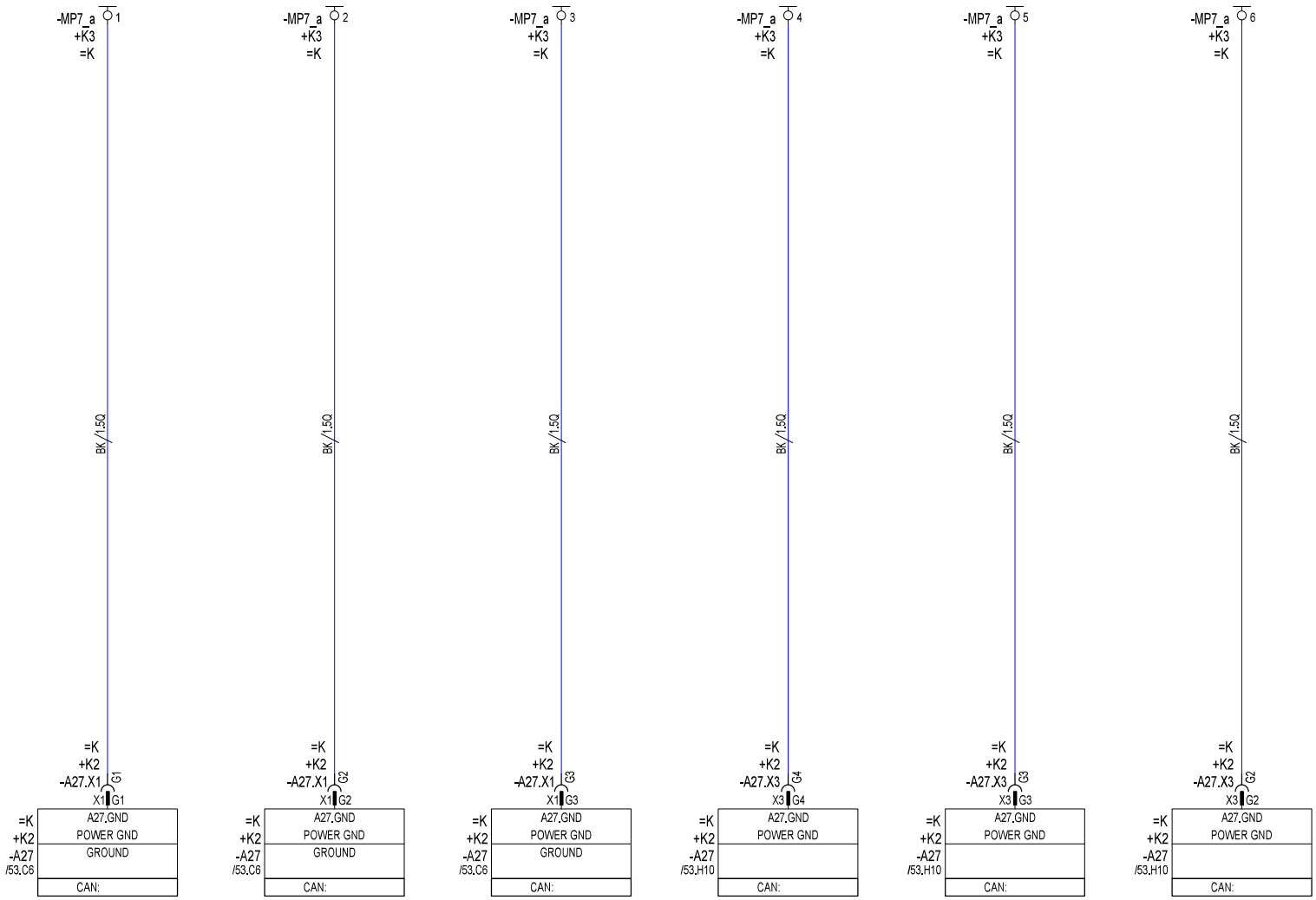
HEAT/AIR CON



PROJECT	SERIE_L514-L518	ITEM CODE	12437281	
DRAWING NUMBER	1583 00090 01 00	DRAWING INDEX	004	

MACHINE TYPE	SERIAL NUMBER	LIEBHERR	HEAT-AIR CONDITIONING SYSTEM (SYSTEM SIDE)	PAGE 27 OF
LIDOS UNIT	XXXXX	FACTORY LBH	E PLAN	CREATION DATE 06.11.2019 12:22

EARTH COMPACT MODULE A27

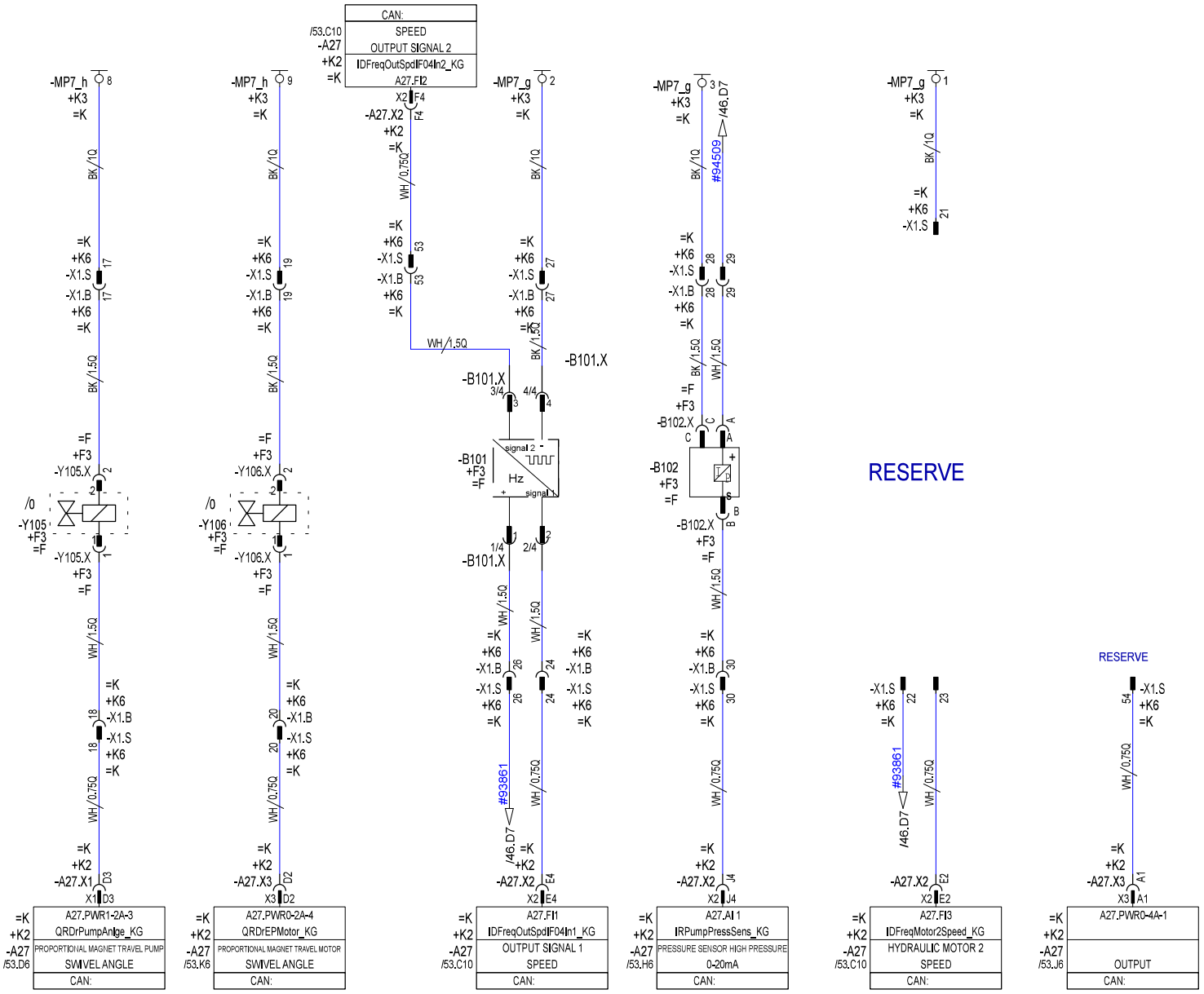


PROJECT SERIE_L514-L518 ITEM CODE 12437281

DRAWING NUMBER 1583 00090 01 00 DRAWING INDEX 004

MACHINE TYPE	SERIAL NUMBER			
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	EARTH COMPACT MODULE A27 E PLAN	PAGE 37 OF CREATION DATE 06.11.2019 12:22

TRANSMISSION

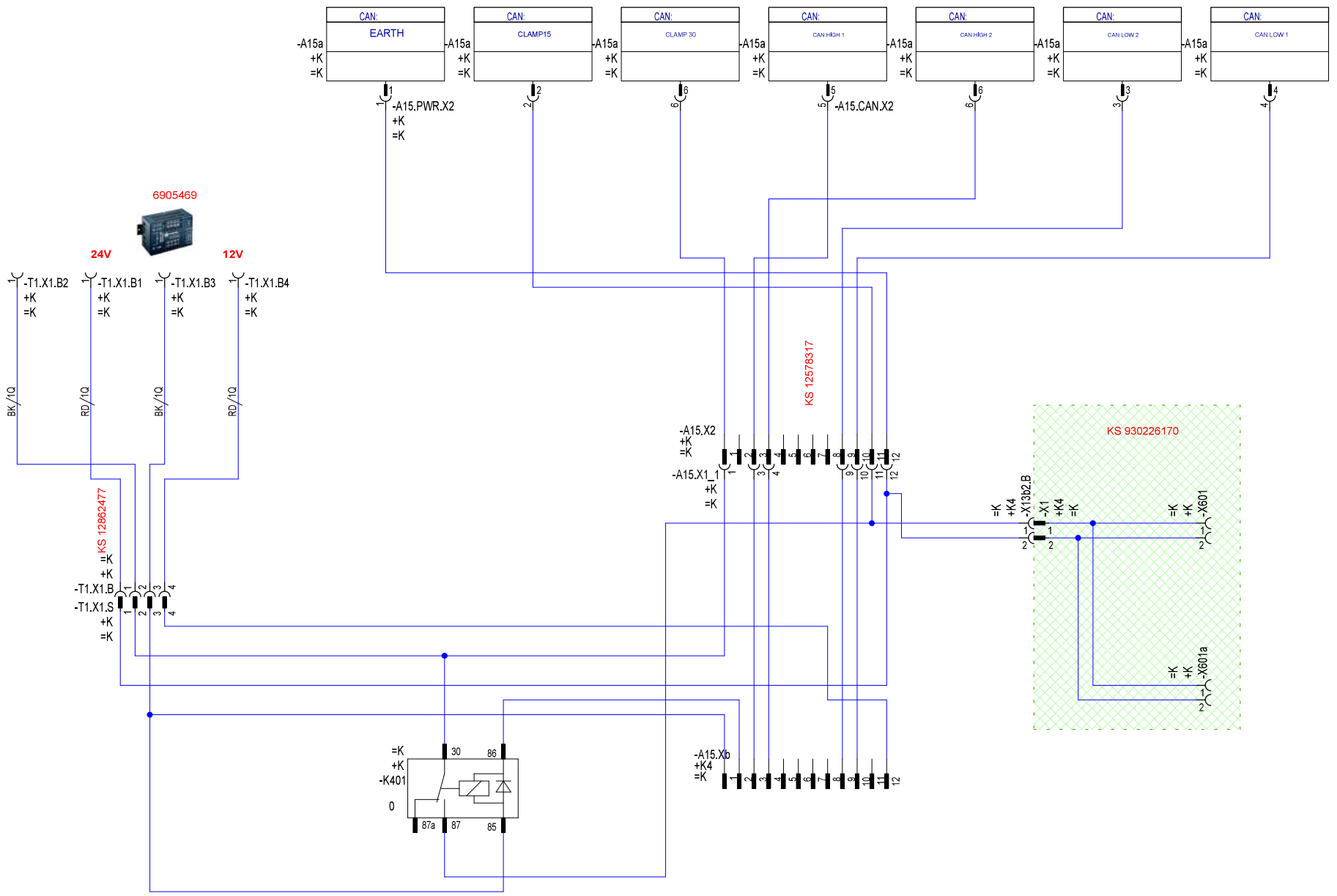


RESERVE

PROJECT SERIE_L514-L518 ITEM CODE 12437281
DRAWING NUMBER 1583 00090 01 00 DRAWING INDEX 004

MACHINE TYPE	SERIAL NUMBER		TRANSMISSION (SPEEDER)	PAGE 47 OF
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	E PLAN	CREATION DATE 06.11.2019 12:22

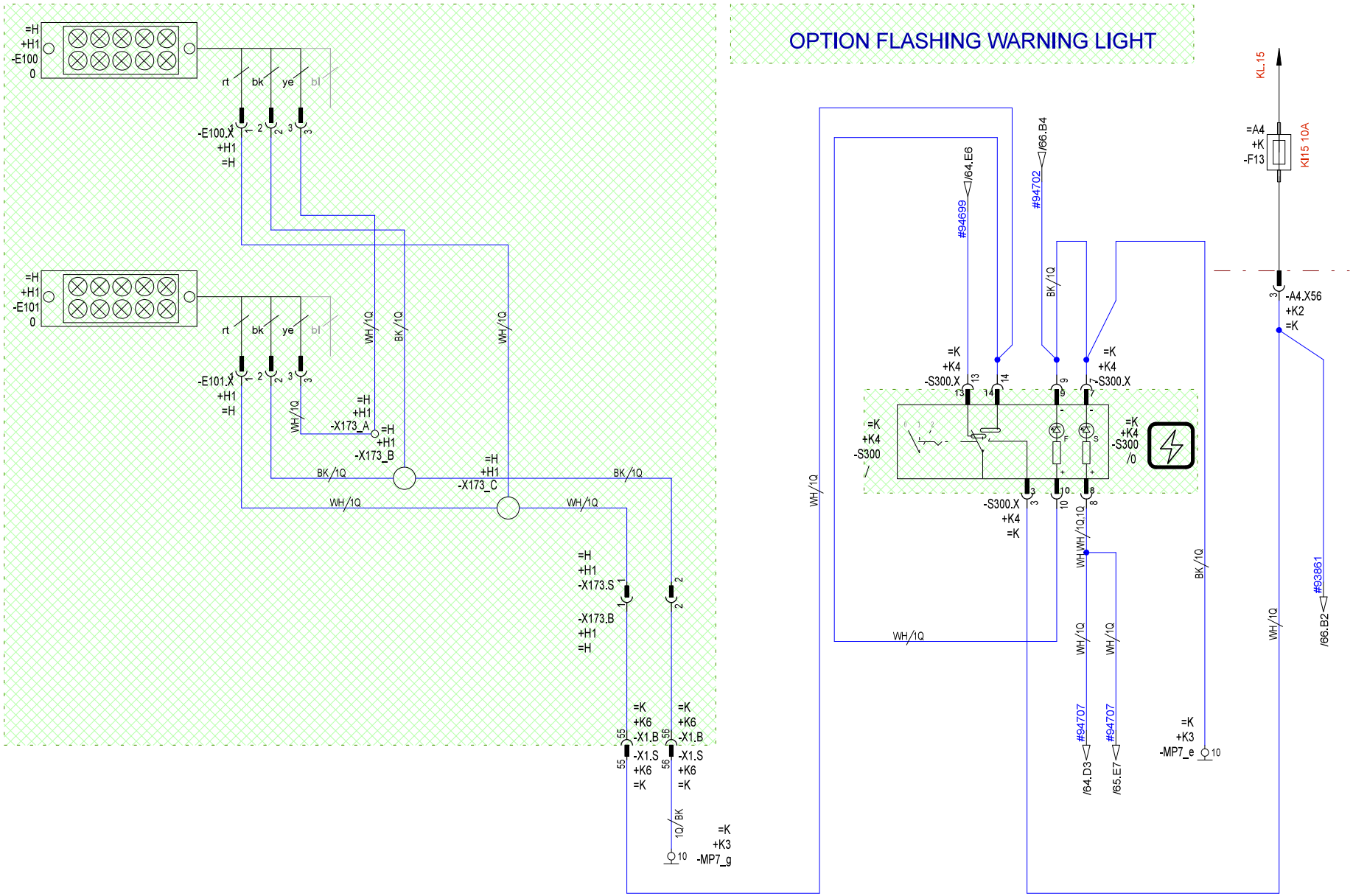
24V SUPPLY MASTER DISPLAY CAMERA



PROJECT	SERIE_L514-L518
DRAWING NUMBER	1583 00090 01 00
ITEM CODE	12437281
DRAWING INDEX	004

MACHINE TYPE	SERIAL NUMBER			
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	24V SUPPLY E PLAN	PAGE 57 OF
				CREATION DATE 06.11.2019 12:22

OPTION FLASHING WARNING LIGHT

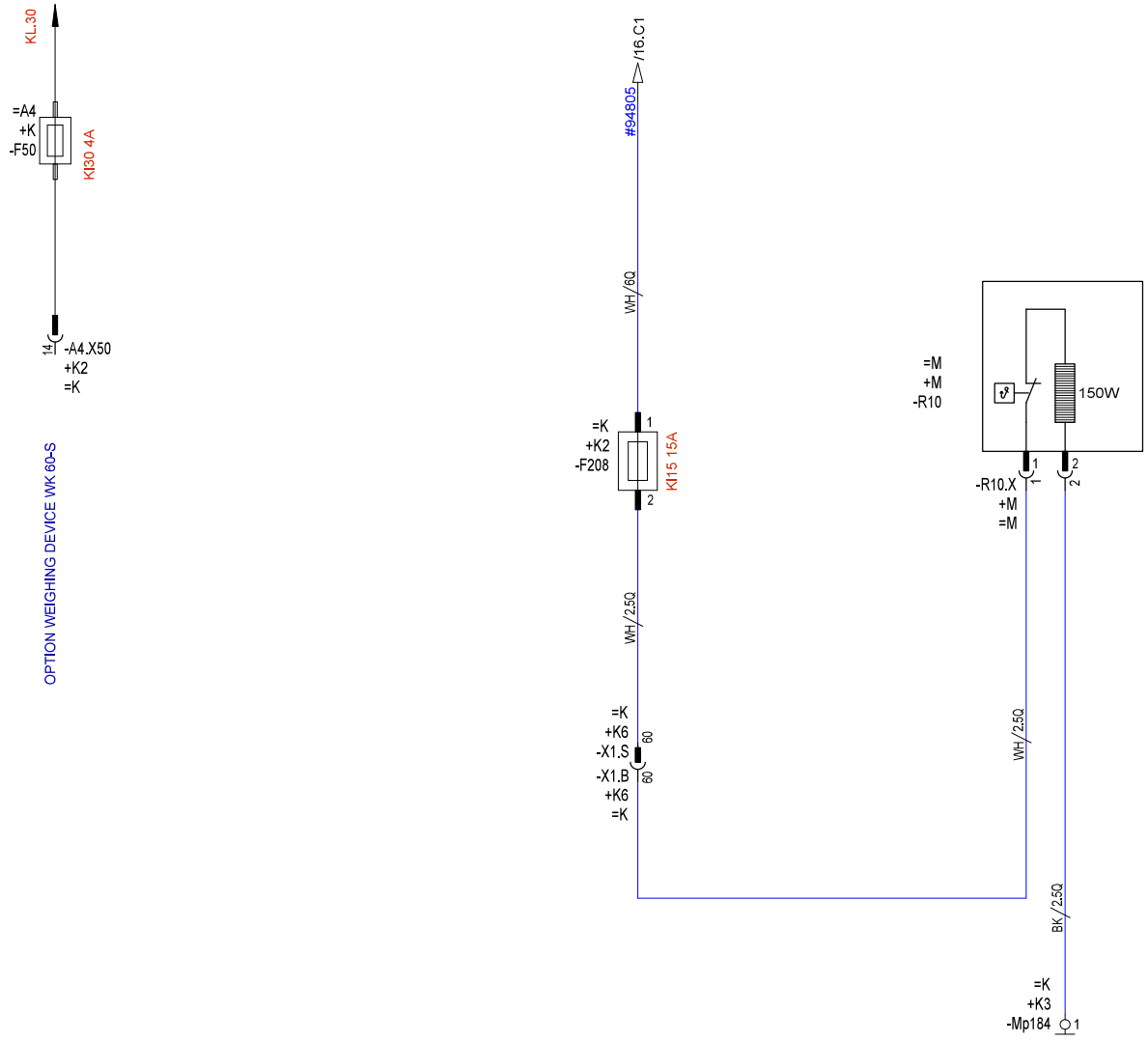


PROJECT	SERIE_L514-L518
DRAWING NUMBER	1583 00090 01 00
ITEM CODE	12437281
DRAWING INDEX	004

MACHINE TYPE LIDOS UNIT	SERIAL NUMBER XXXXX	LIEBHERR FACTORY LBH	OPTION FLASHING WARNING LIGHT E PLAN	PAGE 67 OF CREATION DATE 06.11.2019 12:22

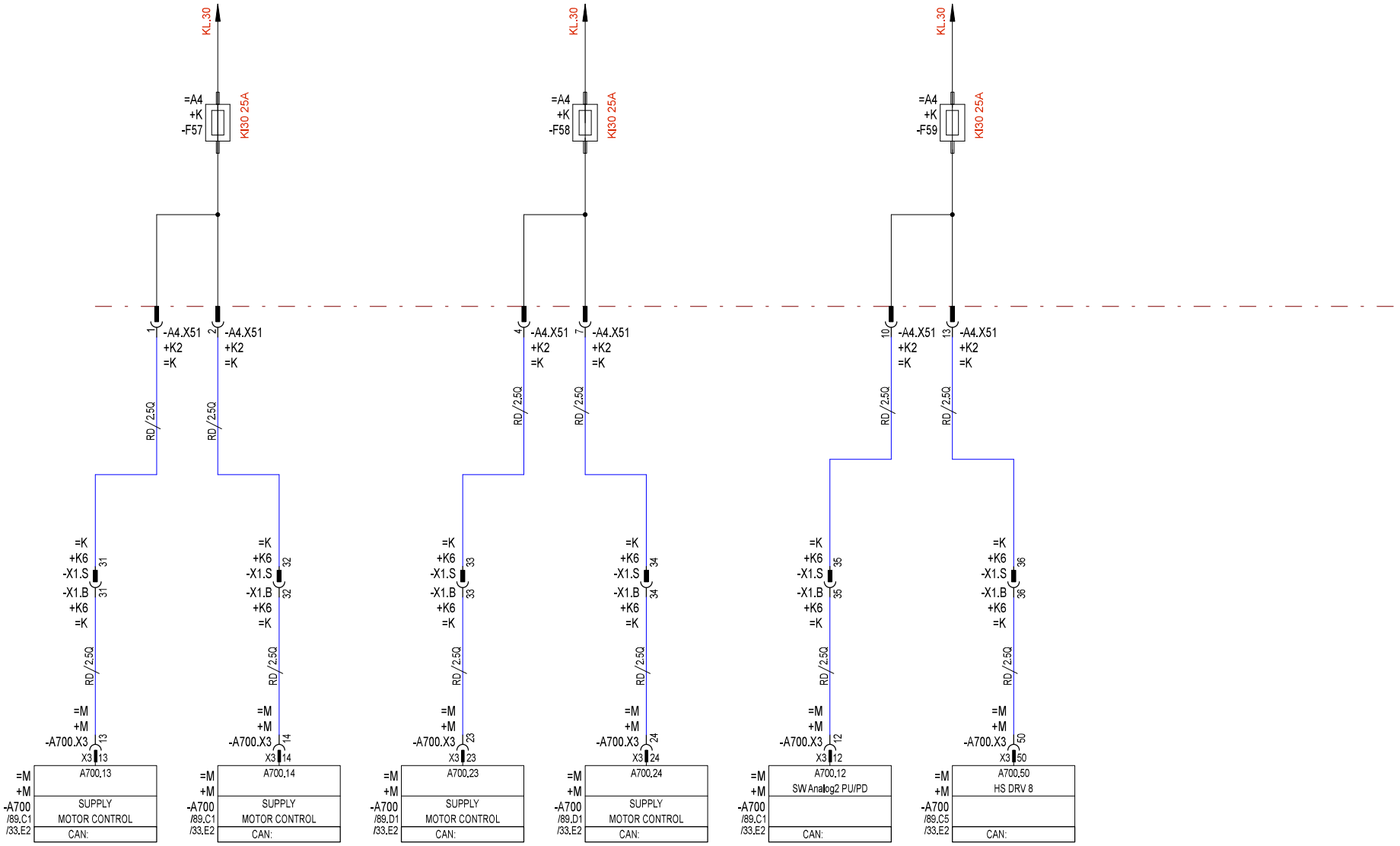
OPTION WEIGHING DEVICE WK 60-S

FUEL PREHEATING



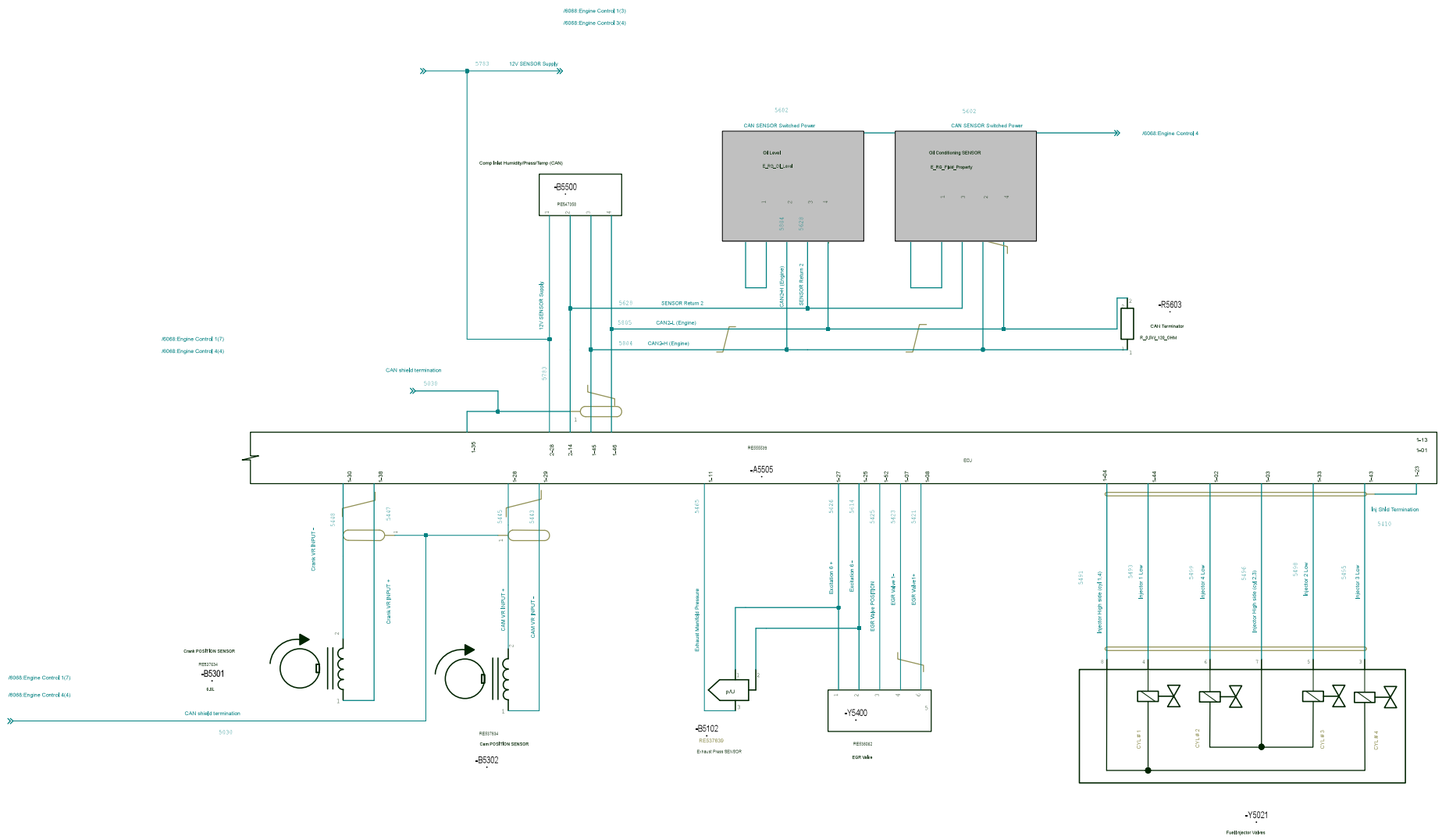
PROJECT	SERIE_L514-L518
DRAWING NUMBER	1583 00090 01 00
ITEM CODE	12437281
DRAWING INDEX	004

MACHINE TYPE	SERIAL NUMBER			
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	OPTION WEIGHING DEVICE ; FUEL PREHEATING E PLAN	PAGE 77 OF CREATION DATE 06.11.2019 12:22



MACHINE TYPE	SERIAL NUMBER			PAGE 87 OF
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	SUPPLY MOTOR CONTROL E PLAN	CREATION DATE 06.11.2019 12:22

PROJECT	SERIE_L514-L518
DRAWING NUMBER	1583 00090 01 00
ITEM CODE	12437281
DRAWING INDEX	004



MACHINE TYPE	SERIAL NUMBER		CIRCUIT DIAGRAM DIESEL ENGINE	PAGE 97 OF
LIDOS UNIT	XXXXX	LIEBHERR FACTORY LBH	E PLAN	CREATION DATE 06.11.2019 12:22

1 Layout

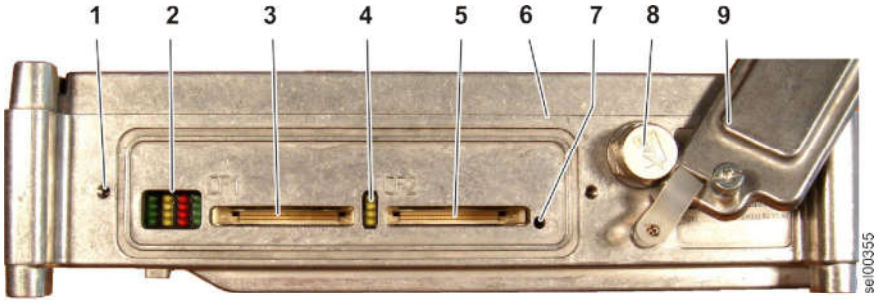


Fig. 476: Central control unit (Master4) A15

1	Cover fastening thread	**6**	Central control unit housing
2	Operating status LEDs	**7**	Green system status LED
3	Slot (CF1) for memory card with application software	**8**	Breather and bleeder screw
4	Memory card status LEDs	**9**	Cover for memory cards
5	Slot (CF2) (optional)		

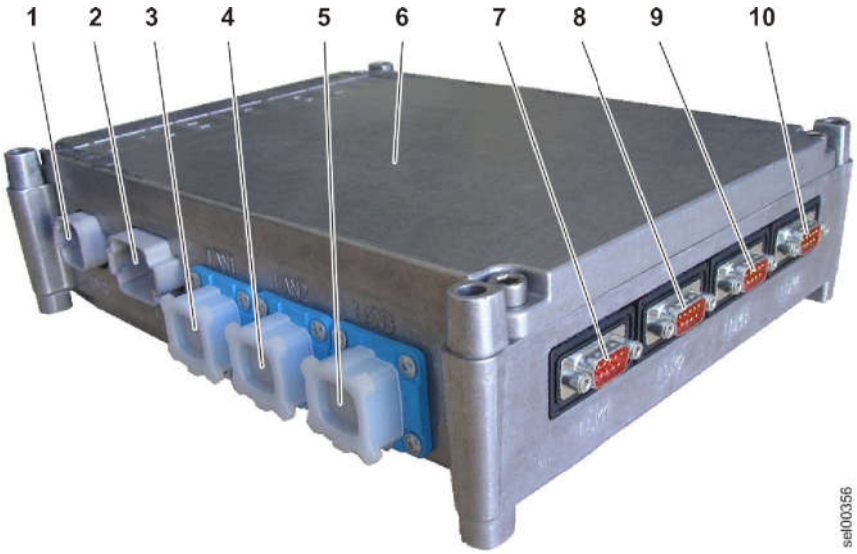


Fig. 477: Plug connections on the central control unit (Master4)

1	PWR.X plug for power supply	**6**	Central control unit housing
2	CAN.X plug for CAN connections	**7**	Connector COM1.X
3	LAN 1 plug (diagnostics)	**8**	Connector COM2.X
4	LAN 2 connector	**9**	Connector COM3.X
5	LAN 3 connector	**10**	Plug COM4.X for diagnostics via RS232

Plug assignment

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2.3 Plug connection X2

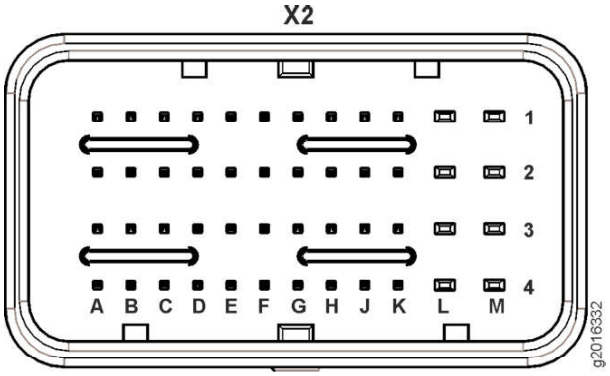

Fig. 491: Plug connection X2

Plug connection X2			
Pin	**Function**	**Pin**	**Function**
A1	CAN shielding	G1	Resistance measurement input 3
A2	CAN A HIGH	G2	Analogue output 1
A3	CAN B HIGH	G3	Earth for analogue outputs
A4	CAN C HIGH	G4	Analogue output 0
B1	CAN A terminating resistor	H1	Earth for resistance measurement inputs 3 and 4
B2	CAN A LOW	H2	Sensor power supply 2 (5V)
B3	CAN B LOW	H3	Earth for sensor power supply
B4	CAN C LOW	H4	Sensor power supply 1 (5V)
C1	Resistance measurement input 1 (P)	J1	Resistance measurement input 4
C2	LIN (LIN)	J2	Analogue input 3
C3	Ethernet (RxP)	J3	Analogue input 2
C4	Ethernet (TxP)	J4	Analogue input 1
D1	Resistance measurement input 1 (N)	K1	Analogue input 4
D2	LIN (GND)	K2	Analogue input 7
D3	Ethernet (RxN)	K3	Analogue input 6
D4	Ethernet (TxN)	K4	Analogue input 5
E1	Resistance measurement input 2 (P)	L1	Analogue input 8
E2	Frequency measurement input 3	L2	Analogue input 11
E3	Earth for frequency measurement inputs 1 and 3	L3	Analogue input 10
E4	Frequency measurement input 1	L4	Analogue input 9
F1	Resistance measurement input 2 (N)	M1	Analogue input 12

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2.2 Batteries

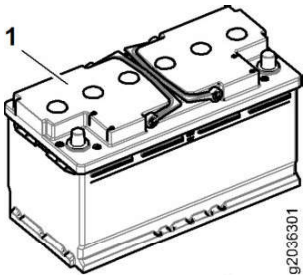

Fig. 500: Battery

1 Battery

The battery consists of six cells, each with 2 volts. These are connected in series and can thus supply an operating voltage of 12 volts.

Charge levels				
Acid density at 27 °C	**Charge level**	**Battery voltage**	**Voltage per cell**	**Remark**
1.28 to 1.26	100%	over 12.60	over 2.10	Battery OK
1.25 to 1.24	75%	12.54 to 12.40	2.10 to 2.07	
1.24 to 1.18	50%	12.40 to 12.18	2.07 to 2.03	Charge battery
1.18 >	25%	12.18 >	2.03 >	Battery not OK

Tab. 248: Table of charge levels

The acid density should be about the same in all 6 cells. If it is much lower in one of the cells, there is probably a short circuit.

When the diesel engine is running, the batteries are charged by the alternator.

If the machine is not started for 4 weeks, there is a risk of sulphate formation and storage deterioration on the battery. During longer standstill periods, the charge level must be regularly checked and the battery must be re-charged if necessary.

If the charge level falls below 50%, there is a risk of permanent damage to the battery.

2.3 Self-discharge of the battery

Even if the battery is not connected to any consumers, after a certain time it will be flat. This phenomenon is called self-discharge and is caused by chemical processes in the battery. The rate of self-discharge depends on the temperature, the acid-to-weight ratio and the battery technology.

After lengthy standstills, the acid level, acid density and battery charge have to be checked.

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130 Axles and drive shafts

Contents

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130.2 Cardan shafts

130.2.1 Drive shaft

Valid for: L514-1583;

1 Layout

Fig. 513: Drive shaft

1 Universal joint (3x)

2 Extension

2 Function

The drive shaft connects the output of the transmission to the input of the front axle.

Drive shaft is maintenance-free.

2.2 Removal and installation

The drive shaft is balanced. When disassembling the extension, it must therefore be ensured that the two drive shaft halves can be reassembled in the original position. The two drive shaft halves must not be installed twisted with respect to one another.

The universal joints must not be bent to stop position.

For additional information, see: removal and installation of components.

150.2.2 Quick coupler hydraulics

150.2.2.1 Overview of quick coupler hydraulics

Valid for: L514-1583/0-51094;

1 Layout

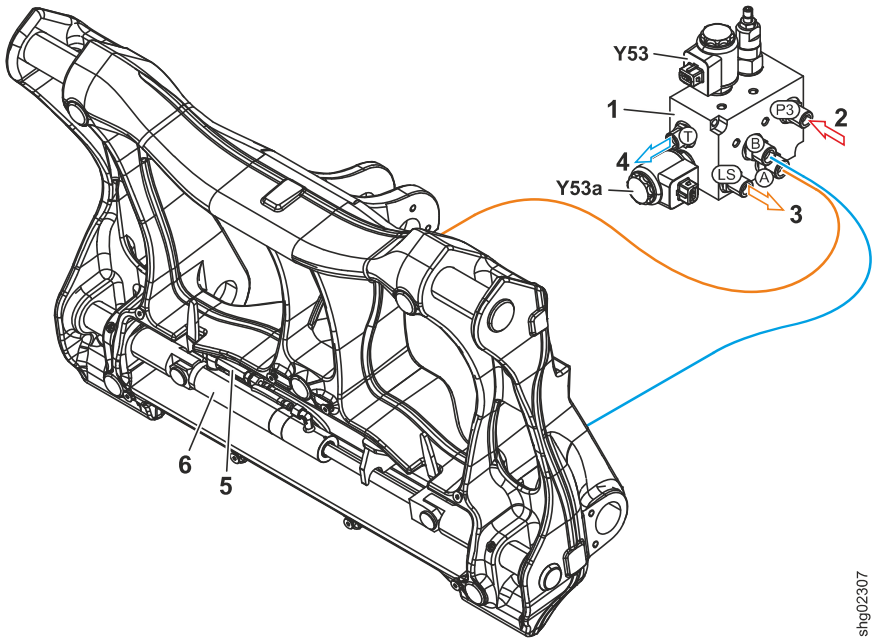

Fig. 518:

1	Valve block for quick coupler	**4**	Return flow to control valve block
2	Oil supply from working pump (via control valve block)	**5**	Preload valve 15 bar
3	Load sensing signal for pressure circuit balance (control valve block)	**6**	Quick coupler locking hydraulic cylinder

BMK	Function	BMK	Function
Y53	Solenoid for opening quick coupler	**Y53a**	Quick coupler load sensing signal solenoid

Tab. 260: Equipment codes

Quick coupler hydraulics consist of following components:
- Valve block for quick coupler (For more information see: Valve block for quick coupler, page 150-9)
- Quick coupler locking hydraulic cylinder

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1 Layout

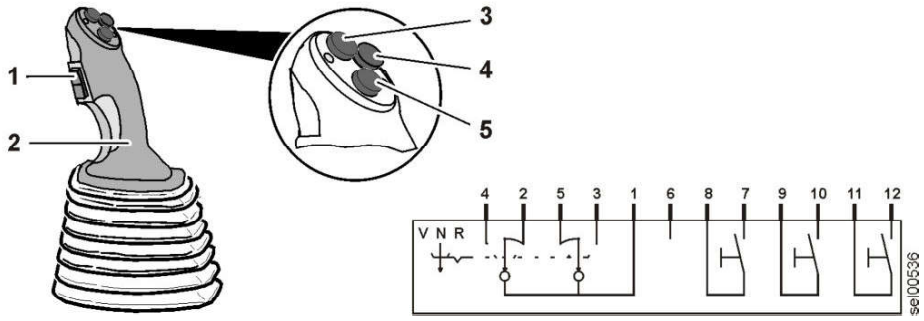

Fig. 526: Control lever with equivalent circuit diagram

1 Travel direction *switch*
2 Control lever
3 Additional equipment 3 *button*
4 Additional equipment 2 *button*
5 Additional equipment 1 *button*

2 Function

2.1 Basic function

After the electrical system has been turned on, the travel drive is set to neutral “N”.

This is shown in the display.

After the parking brake is released, the *travel direction* switch **1** must be set to neutral “N” before a travel direction can be selected.

2.2 Switching the travel direction

Select forward or reverse using the *travel direction* switch **1**.

The forward or reverse travel direction solenoid valves can exclusively be activated when the parking brake is released.

The travel direction is switched to neutral by closing the parking brake or by switching the *travel direction* **1** switch to neutral “N” (middle position).

2.3 Additional equipment button (optional)

If additional equipment is installed or will be installed later, the buttons **3**, **4** and **5** can be used to control additional functions.

2.4 Plug assignment

Deutsch / 12-pin male

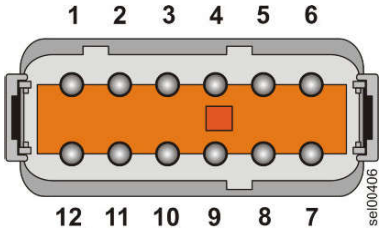

Fig. 527: Connector S2.X

1 Supply voltage
7 *Additional equipment* button

See next page for continuation of the image legend

2 Function

The position of the fresh/recirculated air flap **1** determines whether fresh air from outside or recirculated air from the operator's cab is drawn in by the blower **8**. The position of the fresh/recirculated air flap is controlled by the servo motor **11**. The flap for recirculated air and fresh air **1** is only installed with air conditioning option.

Refrigerant is evaporated in evaporator **2**. The refrigerant absorbs heat from its environment when it evaporates. This cools the evaporator housing.

The anti-icing sensor **3** measures the temperature on the evaporator **2**. The evaporator temperature is measured to prevent the evaporator from icing up. If the temperature on the evaporator falls below -1 °C, the compressor coupling is switched off.

The expansion valve **4** injects refrigerant into the evaporator.

The water valve **7** controls the amount of coolant flowing though the heat exchanger **9**.

The air conditioning function is activated by the relay K1 **12**.

The condensate water collects in the condensate receptacle **13**. The condensate is discharged from heating and air conditioning unit via a drain.

2.2 Expansion valve

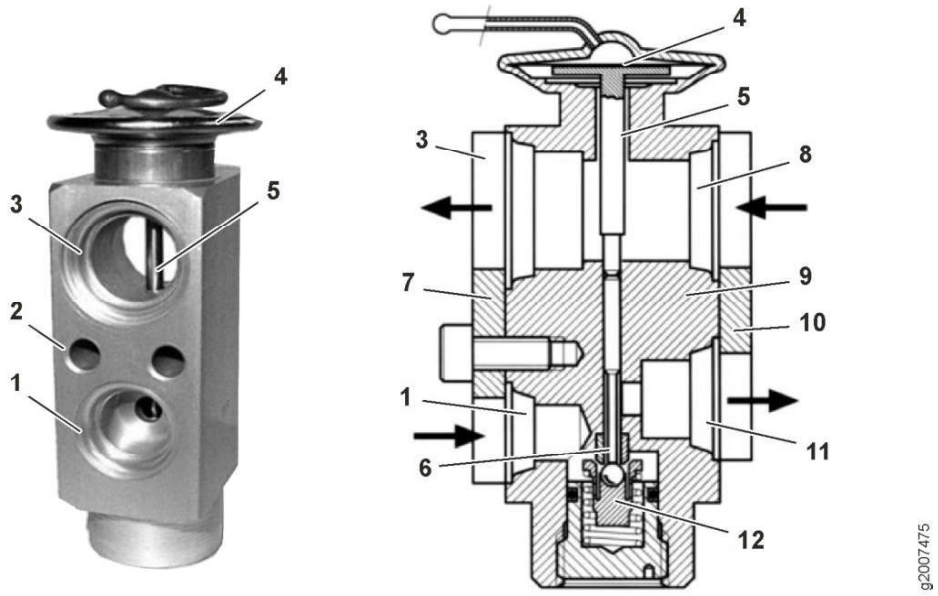

Fig. 535: Expansion valve

1	Refrigerant from the dryer	**7**	Flange fastening
2	Housing	**8**	Refrigerant from the compressor
3	Refrigerant to the air conditioning compressor	**9**	Valve body
4	Membrane	**10**	Flange fastening
5	Thermostatic sensor	**11**	Refrigerant to the compressor
6	Restrictor	**12**	Regulator valve

The expansion valve is mounted on the underside of the heating and air conditioning unit.

The expansion valve controls the flow of refrigerant to the evaporator. The refrigerant flow depends on the refrigerant temperature at the outlet of the evaporator.

170 Lubrication system

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After the piston **III** is moved, the lubricant flows to the left side of the piston **I** (piston position **C**). The piston **I** moves to the right and presses the lubricant out of the right pressure chamber of the piston to outlet **4**.

Then the pistons **II** and **III** pump the lubricant to the outlets **5** and **6**.

After the piston **III** moves, the lubricant flows back to the right side of the piston **I** (piston position **A**) and a new cycle of the progressive distributor starts. This function is repeated for as long as lubricant is pumped to the progressive distributor.

2.1.1 Effects of malfunctions

Malfunctions can occur in the network of lubrication lines or in the distributor.

Malfunctions include:
- Blocked lubrication lines
- Twisted split bushings

These malfunctions interrupt the flow of lubricant. This blocks the distributor.

When the distributor is blocked, lubricant escapes via the pressure relief valve of the central lubrication pump.

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200 Diagnosis

Contents

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