en **Service manual**

Wheel loader

Document ID

Order number: --
Issued: 2020-08-28
Version: 00
Author: LBH / Technical Documentation Department

Product ID

Manufacturer: Liebherr-Werk Bischofshofen GmbH
Valid for: L 509-1778

Contact

Liebherr-Werk Bischofshofen GmbH
Dr. Hans Liebherr-Straße 4
A – 5500 Bischofshofen

	030.3.5.3	Minimum quality requirement	030-17
030.3.6	Refrigerant *L509-1778;*		030-18
030.3.7	Coolant *L509-1778;*		030-18
	030.3.7.1	Requirements for the water used	030-18
	030.3.7.2	Antifreeze and corrosion inhibitor	030-18
	030.3.7.3	Minimum quality requirement	030-18
030.3.8	Hydraulic oil *L509-1778;*		030-19
	030.3.8.1	Liebherr recommendation	030-19
	030.3.8.2	Minimum quality requirement	030-19
	030.3.8.3	Oil analysis	030-19
	030.3.8.4	Oil change	030-20
030.3.9	Transmission *L509-1778;*		030-20
	030.3.9.1	Liebherr recommendation	030-20
	030.3.9.2	Minimum quality requirement	030-20
030.3.10	Axle oil *L509-1778;*		030-20
	030.3.10.1	Liebherr recommendation	030-20
	030.3.10.2	Minimum quality requirement	030-21
030.3.11	Brake oil *L509-1778;*		030-21
	030.3.11.1	Liebherr recommendation	030-21
030.3.12	Lubrication grease *L509-1778;*		030-21
	030.3.12.1	Liebherr recommendation	030-21
	030.3.12.2	Minimum quality requirement	030-21
030.3.13	Lubrication grease for sliding surface on telescopic lift arms *L509-1778;*		030-22
	030.3.13.1	Liebherr recommendation	030-22
	030.3.13.2	Minimum quality requirement	030-22
030.3.14	Windscreen washer fluid *L509-1778;*		030-22
	030.3.14.1	Liebherr recommendation	030-22
	030.3.14.2	Minimum quality requirement	030-22
030.3.15	Refrigerant oil for air conditioning compressor *L509-1778;*		030-23

LBH/-/00/211-20200828_082818/en

090 Steering system 090-1

090.1 Steering system overview
L509-1778; 090-2

090.2 Servostat
L509-1778; 090-4

100 Brake system 100-1

100.1 Overview of brake system
L509-1778; 100-2

100.2 Service brake 100-7

100.2.1 Inch/brake unit
L509-1778; 100-7

100.2.2 Inching function angle sensor
L509-1778; 100-13

100.2.3 Brake light pressure switch
L509-1778; 100-15

100.2.4 Drum brake
L509-1778; 100-16

100.3 Parking brake 100-21

100.3.1 Valve block for parking brake and differential lockout
L509-1778; 100-21

100.3.2 Orifice bypass solenoid valve
L509-1778; 100-23

110 Electrical system 110-1

110.1 Electronic control unit 110-2

110.1.1 Central control unit (Master5 Mini)
L509-1778; 110-2

110.1.2 Modules 110-4

110.1.2.1 Compact module
L509-1778; 110-5

110.2 Electrical components of the driver's cab 110-11

110.2.1 Fuse boards
L509-1778; 110-11

110.2.2 Door contact switch
L509-1778; 110-13

110.3 Electrical components in the rear section 110-14

110.3.1 Battery installation
L509-1778; 110-14

LBH-/00/211-20200828_082818/en

010.1.2.5 Disposal

Danger to life

Unapproved disposal of gas containers and pressure vessels

- Before disposal, completely depressurise pressure vessel.
- Before disposal, professionally empty pressure vessel.
- Adhere to safety instructions of pressure vessel manufacturer.

Unapproved disposal of refrigerant

- Have refrigerant disposed of by refrigerant recycling point.
- Adhere to safety data sheet of refrigerant during disposal.

Environmental pollution

Unapproved disposal of machine

- Make sure that the individual elements of the machine are disposed of correctly after the service life.
- Dispose of elements of machine in line with valid country-specific waste disposal guidelines and relevant valid laws.
- Remove fuels, operating fluids and lubricants from all components before disposal.
- Collect and store fuels, operating fluids and lubricants in suitable containers before disposal.
- Adhere to instructions of relevant manufacturer when disposing of fuels, operating fluids and lubricants.
- Have fuels, operating fluids and lubricants disposed of by old oil recycling point.

010.1.3 Description of staff

010.1.3.1 Personal protective equipment

Operators, assistants and maintenance staff are responsible for the following:
- Wearing personal protective equipment
- Regular cleaning and care of protective equipment
- Immediate replacement of damaged parts of protective equipment

The protective equipment consists of following elements:
- Protective helmet
- Safety glasses
- Hearing protection
- Breathing equipment
- Protective gloves
- Warning clothing (reflective, in signal colour)
- Safety boots
- Special protective clothing
  - To prevent burns
  - To prevent freezing
  - To prevent acid burns
  - To prevent stabbing and cutting injuries

LBH-/00/211-20200828_082818/en

- Use viewing devices if necessary to observe areas around the machine that cannot be seen directly.
- Position working attachment so that sufficient visibility is ensured.
- Work with spotter if visibility is restricted.
- Agree on which hand signs to use.
- If necessary communicate via radio.
- Make sure that spotter is outside danger zone.
- In conditions of poor visibility use illumination in accordance with the applicable regulations.
- Work with extra care and attention in poor visibility and changing weather.
- Only use sun visors if field of vision is not restricted.

Incorrect operation

- Comply with national regulations regarding sufficient visibility in the operator's cab.
- Before operation, check viewing devices for function, cleanliness and correct setting.
- Adjust mirrors so that the best possible all-round visibility is guaranteed.
- Immediately repair defective viewing devices or have them replaced.
- Clean dirty cab windows.
- Avoid covering of visual aids by working attachment.

Damage

Incorrect changes

- Make sure that modifications to the machine do not impair visibility.
- Perform risk analysis again.
- Test machine according to current standards.
- Test machine according to regulations applicable at place of use.
- Depending on the test result, take appropriate measures.
- Inform operator about modifications.

010.1.6.7 Protection against vibration

Injuries

Incorrect working method

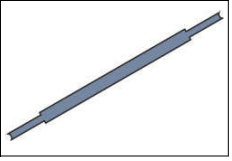
- Use machine, working attachment and working tool adapted to the task.
- Check condition of machine (tyre pressure, brakes, steering, mechanical connections, ...).
- Ensure that operator's seat is functional and complies with national regulations.
- Adjust operator's seat to weight and size of operator.
- Adjust shock absorption to weight and size of operator.
- Do not use jerky movements to steer, brake, accelerate and shift gears.
- Do not use jerky movements to move and load working attachment.

Incorrect travel

- Adapt speed to route.
- Travel slowly on rough terrain.
- Travel around obstacles and very rough terrain.
- Travel over longer distances (for example, on public roads) at a suitable (medium) speed.

LBH-/00/211-20200828_082818/en

010.2.5 Special tools for the service brake

Designation	Item code	Remark	Fig.
Feeler gauge 4.3 mm4.5 mm	8145535	For checking the brake discs for wear	

Tab. 8: Special tools for the service brake

010.2.6 Special tools for the electrical system

Designation	ID number	Remark	Fig.:
Digital multimeter	10018500	For measuring voltage, current, resistance and frequency	
Test probe, red	884191214	For measurements at plug connections	
Test probe, black	884191114	For measurements at plug connections	
Solenoid tester	10028268	For testing solenoid valves	
Battery plug tool	11839123	For opening the plugs on the battery cells	

Metric standard threads and fine threads				Metric standard threads and fine threads			
At least one element of the bolted joint (bolts, washers, nuts etc.) with the following surface: flZn = zinc flake coating (LH standard 10021432, LH standard 10215295 flZnnc-480h-L valid ≥M6)				All elements of the bolted joint (bolts, washers, nuts etc.) with the following surface: Black oxide or phosphated Galvanised (LH standard 10215295 Fe// ZnNi(12)5//Cn//T2)			
Minimum total coefficient of friction μ_G= 0.09				Minimum total coefficient of friction μ_G= 0.11			
Thread	Strength class	Assembly prestressing forces F_M in kN	Tightening torques M_A in Nm	Thread	Strength class	Assembly prestressing forces F_M in kN	Tightening torques M_A in Nm
M 22 x 1.5	8.8	180	480	M 22 x 1.5	8.8	180	570
	10.9	270	700		10.9	260	830
	12.9	310	820		12.9	310	970
M 24	8.8	190	570	M 24	8.8	185	660
	10.9	280	840		10.9	270	970
	12.9	320	980		12.9	320	1140
M 24 x 1.5	8.8	220	620	M 24 x 1.5	8.8	215	730
	10.9	320	910		10.9	320	1080
	12.9	380	1070		12.9	370	1250
M 24 x 2	8.8	210	600	M 24 x 2	8.8	205	710
	10.9	310	890		10.9	300	1040
	12.9	360	1040		12.9	350	1220
M 27	8.8	245	830	M 27	8.8	240	970
	10.9	360	1230		10.9	360	1450
	12.9	420	1450		12.9	420	1650
M 27 x 1.5	8.8	280	900	M 27 x 1.5	8.8	280	1060
	10.9	410	1300		10.9	410	1550
	12.9	480	1550		12.9	480	1850
M 27 x 2	8.8	270	880	M 27 x 2	8.8	260	1030
	10.9	400	1300		10.9	390	1500
	12.9	460	1500		12.9	460	1800
M 30	8.8	300	1140	M 30	8.8	290	1300
	10.9	440	1650		10.9	430	1950
	12.9	520	1950		12.9	510	2250
M 30 x 1.5	8.8	350	1240	M 30 x 1.5	8.8	350	1450
	10.9	520	1800		10.9	510	2150
	12.9	610	2150		12.9	590	2500
M 30 x 2	8.8	340	1220	M 30 x 2	8.8	330	1450
	10.9	500	1800		10.9	490	2100
	12.9	580	2100		12.9	570	2450

020.10 Gearbox 020-33

020.10.1 Transmission
L509-1778; 020-33

020.10.2 Output B101 speed sensor
L509-1778; 020-33

020.10.3 Hydro accumulator for external servo pressure and service brake
L509-1778; 020-33

020.11 Axles and drive shafts 020-34

020.11.1 Front axle with engageable differential lockout
L509-1778; 020-34

020.11.2 Rear axle when front axle has engageable differential lockout
L509-1778; 020-34

020.11.3 Drive shaft
L509-1778; 020-34

020.11.4 Tyres
L509-1778; 020-34

020.11.4.2 Special tyres 020-35

020.12 Working attachment 020-37

020.12.1 Quick coupler locking hydraulic cylinder
L509-1778; 020-37

020.13 Operator's cab, heating and air conditioning 020-38

020.13.1 Dryer
L509-1778; 020-38

020.13.2 Pressure switches
L509-1778; 020-38

020.14 Lubrication system 020-39

020.14.1 Central lubrication pump EP1
L509-1778; 020-39

020.14.2 Progressive distributor
L509-1778; 020-39

020.14.2.1 MX-F 020-39

020.14.2.2 MX-F 25 020-39

020.14.2.3 MX-F 45 020-39

020.14.2.4 MX-F 75 020-40

020.14.2.5 MX-F105 020-40

LBH--/00/211-20200828_082818/en

Load curve for pallet, other

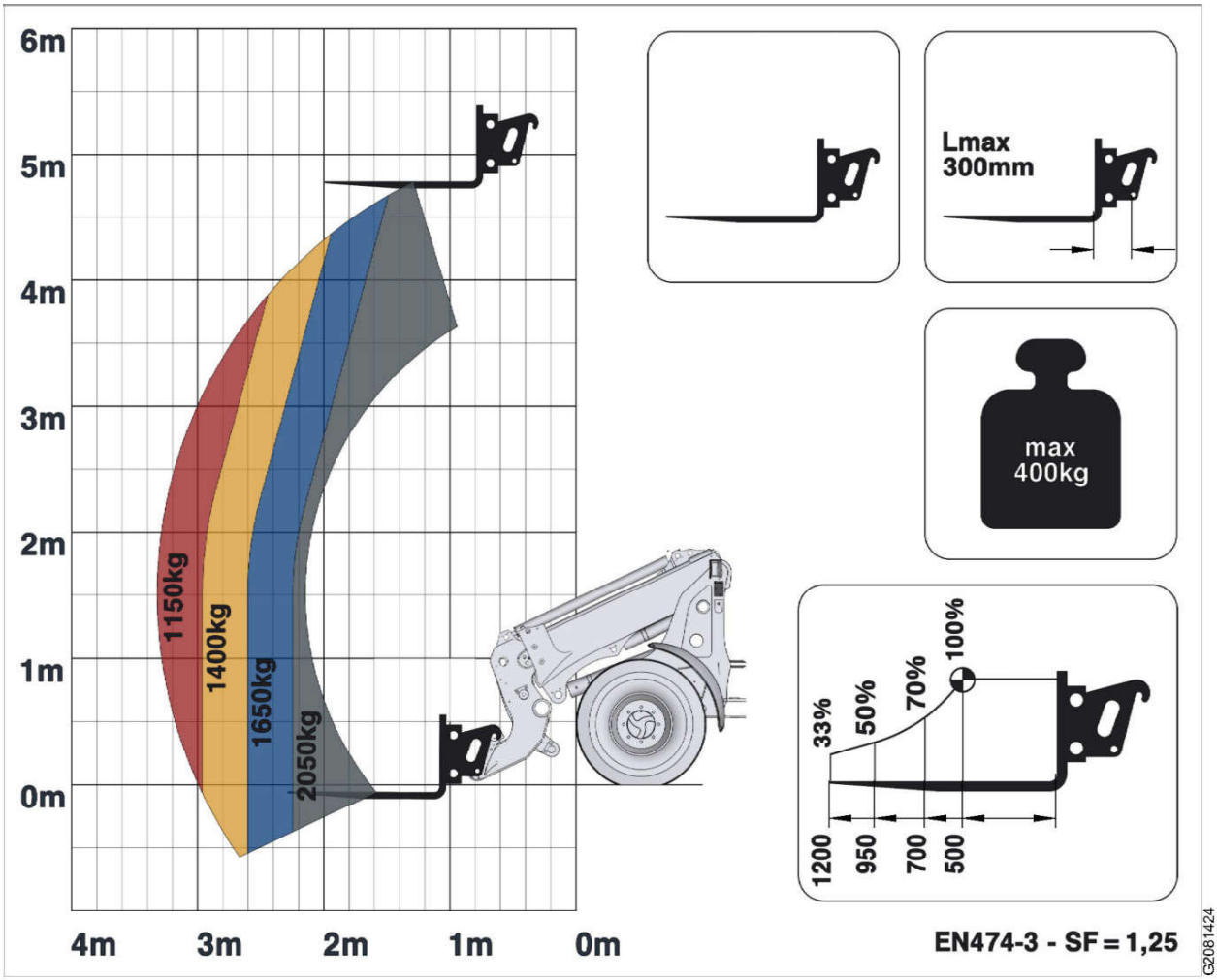


Fig. 67: Load curve for pallet, other

020.4 Working hydraulics

020.4.1 Working pump

Valid for: L509-1778;

Description	Unit	Value
Type		KP25.38D0
Direction of rotation		Clockwise
Displacement per turn	cm^3	38
Maximum displacement	l/min	94
Weight	kg	14

020.4.2 Pilot control hydro accumulator

Valid for: L509-1778;

Description	Unit	Value
Volume	l	0.32
Nitrogen filling pressure at 21 °C	bar	15 $^{\pm 1}$
Weight	kg	1.39

020.4.3 Stabilisation module

Valid for: L509-1778;

This equipment is optional.

Description	Unit	Value
Type		RSM2-10B2X
Weight	kg	4.7

020.4.4 Ride control hydro accumulator

Valid for: L509-1778;

This equipment is optional.

Description	Unit	Value
Number		1
Volume	l	0.75
Gas-side oil filling	cm^3	70
Weight	kg	4

LBH-/00/211-20200828_082818/en

020.10 Gearbox

020.10.1 Transmission

Valid for: L509-1778;

Description	Unit	Value
Type		367
1st gear ratio		2.75
2nd gear ratio		1.31
Weight	kg	76

020.10.2 Output B101 speed sensor

Valid for: L509-1778;

Description	Unit	Value
Type		Hall sensor
Number of teeth at the measuring point		48

020.10.3 Hydro accumulator for external servo pressure and service brake

Valid for: L509-1778;

Description	Unit	Value
Volume	l	0.32
Weight	kg	1.3

LBH-/00/211-20200828_082818/en

	030.4.4.5	Diesel engine: changing V-belt *L509-1778;*	030-63
	030.4.4.6	Diesel engine: checking valve clearance *L509-1778;*	030-64
	030.4.4.7	Fuel tank: draining condensate and sediment *L509-1778;*	030-68
	030.4.4.8	Draining off condensate from the fuel pre-filter *L509-1778;*	030-69
	030.4.4.9	Changing fuel pre-filter element *L509-1778;*	030-70
	030.4.4.10	Changing fuel fine filter element *L509-1778;*	030-71
	030.4.4.11	Cleaning the service cover and dust discharge valve of the air filter system *L509-1778;*	030-73
	030.4.4.12	Checking air filter vacuum switch function *L509-1778;*	030-74
	030.4.4.13	Cleaning or changing main element of air filter system *L509-1778;*	030-76
	030.4.4.14	Changing safety element of air filter system *L509-1778;*	030-78
	030.4.4.15	Checking that diesel engine intake and exhaust system is in good condition and not loose or leaking *L509-1778;*	030-79
	030.4.4.16	Cleaning or changing diesel particulate filter *L509-1778;*	030-82
030.4.5	Cooling system		030-88
	030.4.5.1	Cooling system: checking coolant level *L509-1778;*	030-88
	030.4.5.2	Coolant: checking anti-freeze and corrosion protection agent concentration *L509-1778;*	030-90
	030.4.5.3	Cleaning the cooling system *L509-1778;*	030-97
	030.4.5.4	Changing coolant in cooling system *L509-1778;*	030-98
030.4.6	Hydraulic components		030-101
	030.4.6.1	Checking oil level in hydraulic tank *L509-1778;*	030-101
	030.4.6.2	Draining off condensate and sediment from hydraulic tank *L509-1778;*	030-103
	030.4.6.3	Hydraulic tank: changing filter cartridge in return-suction filter *L509-1778;*	030-104

LBH-/00/211-20200828_082818/en

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
			❍	❍	❍	✦		Fill windscreen washer fluid in the windscreen washer system.		030-147
			❍	❍	❍			Lubricate locking mechanism and cylinder of operator's cab with penetrating oil.		030-148
				❍	❍	✦		Clean and maintain the seals of the operator's cab.		030-149
			❍	❍	❍			Air conditioning (option): check V-belt.		030-150
					❍			Air conditioning (option): change V-belt (at least every 2 years)		030-152
			❍	❍	❍			Check the indicator bead in the air conditioning dryer-collector unit.		030-154
			❍	❍	❍			Heating and air conditioning unit (option): test function.		030-155
Lubrication system										
☐		●	❍	❍	❍			Check level in grease reservoir of central lubrication system (option).		030-156
☐		●	❍	❍	❍			Central lubrication system (option): check pipes, hoses and lubrication points for leaks and damage.		030-157
☐		●	❍	❍	❍			Central lubrication system (option): check lubrication of bearings.		030-158

LBH-/00/211-20200828_082818/en

030.3.15 Refrigerant oil for air conditioning compressor

Valid for: L509-1778;

030.3.15.1 Liebherr recommendation

Designation
ZXL 100 PG (PAG Oil)

Tab. 53: Liebherr recommendation

LBH-/00/211-20200828_082818/en

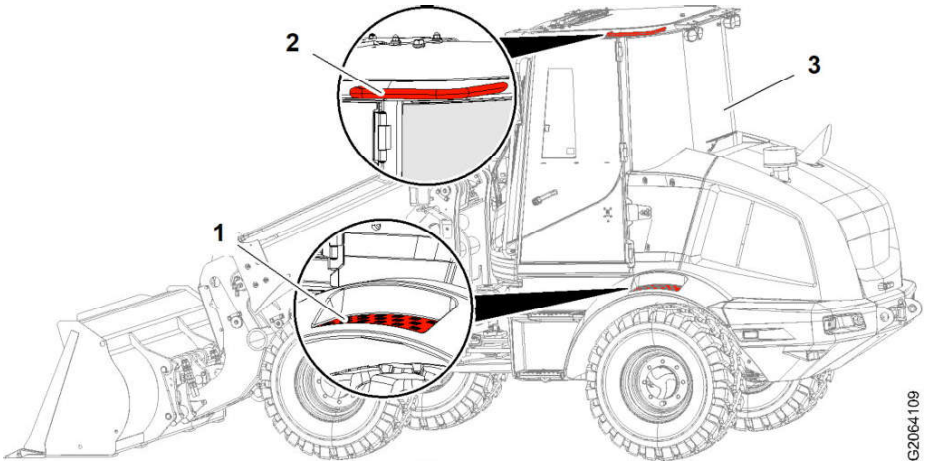


Fig. 83: Cleaning rear screen of operator's cab

1 Footplate
2 Handrail
3 Rear screen

WARNING
Access to the rear window:
Injury.

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

▶ Access to the rear screen: use footplate **1**, handrail **2** and suitable climbing aids.

▶ Use commercial glass cleaner.

▶ Use lint-free cleaning cloths.

030.4.3.4 Replacing VCI capsules

Valid for: L509-1778;

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

Make sure the following material is ready:
❑ 5 VCI capsules of type VC1-1 (item code: 8145869).
❑ A sticker for noting that they have been changed (enclosed with the VCIcapsules).

LBH-/00/211-20200828_082818/en

Note

See Section 030.2 for filling quantities

Specifications for sampling

▶ Enter component of consumed fuel.

Machine location / remark

If machine is operated on site with difficulty factors:
▶ Enter difficulty factor.

Examples of difficulty factors:
– Working in extreme climates
– Working in elevations and depressions
– Working in water
– Working in dust-intensive use

Customer specifications

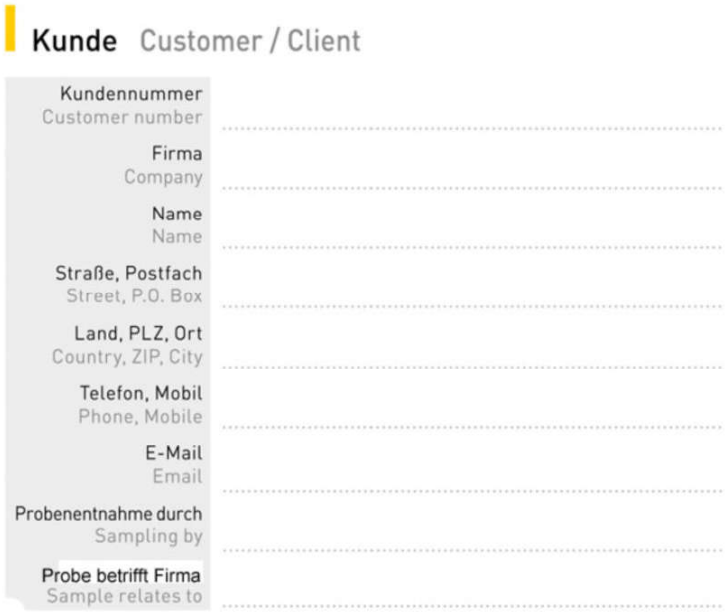


Fig. 119: Customer specifications

▶ Enter customer specifications.

CAUTION
Hot fluids!
Burns.

▶ Avoid skin contact with fluids.

▶ Connect test line **1** to high pressure test connection **PA** on control valve block.

▶ Drain at least 0.2 l of hydraulic oil into receptacle.
▷ Test line **1** is flushed.

▶ Fill sample container **2**.

▶ Disconnect test line **1** from high pressure test connection **PA**.

▶ Turn off diesel engine.

▶ Prepare sample container for shipping. (For more information see: Preparing sample container for shipping, page 030-38)

Gear oil

Coolant sample is taken from transmission.

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

Make sure that following tools are ready:
❑ Hand pump
❑ Sampling hose
❑ Analysis set (For more information see: Analysis set, page 030-36)

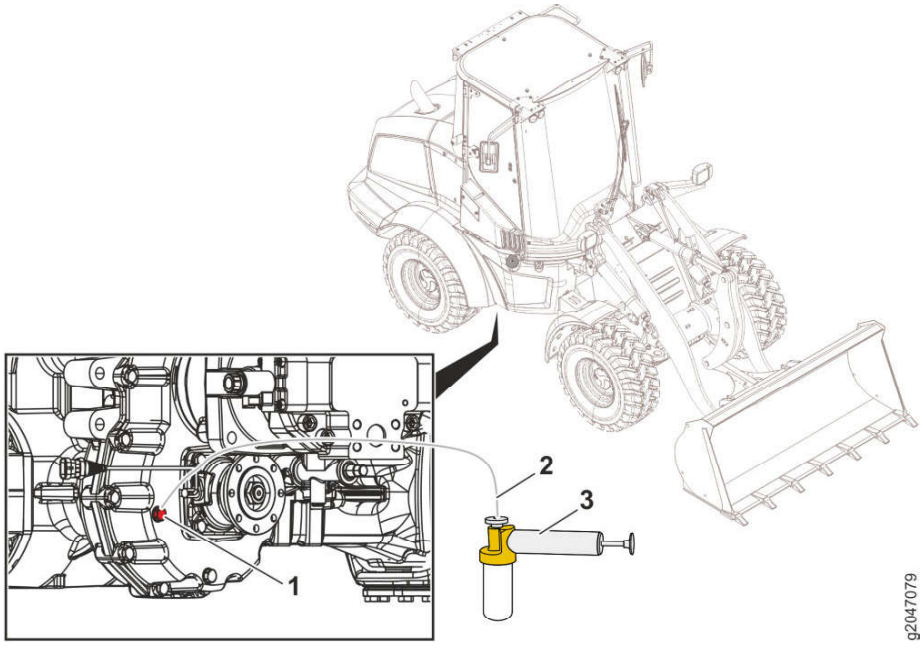


Fig. 150: Sampling point on transmission

1 Filling plug
2 Sampling hose
3 Hand pump

- ▶ Loosen nut **2** and screw **1**.
- ▶ Adjust V-belt tension with screw **3**.
- ▶ Tighten nut **2** and screw **1**.
- ▶ Check V-belt tension and correct if necessary.
- ▶ Start diesel engine and let it run for 5 minutes.
- ▶ Turn off diesel engine.
- ▶ Put machine in maintenance position 1.

WARNING
Hot components!
Risk of injury.

- ▶ Do not open the service hatch until the engine has cooled down.

- ▶ Check V-belt tension again and correct it if necessary.

030.4.4.5 Diesel engine: changing V-belt

Valid for: L509-1778;

Changing V-belt

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

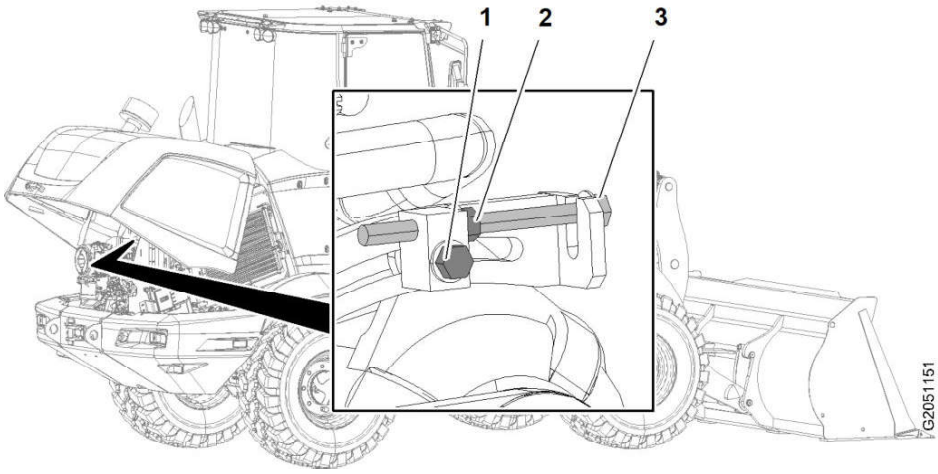


Fig. 160: Setting V-belt tension

1 Screw
2 Counter nut
3 Adjusting screw

- ▶ Loosen nut **2** and screw **1**.
- ▶ Relieve V-belt with screw **3**.
- ▶ Remove V-belt.

030.4.4.11 Cleaning the service cover and dust discharge valve of the air filter system

Valid for: L509-1778;

Note
If the valve is damaged, the dust discharge function is impaired and the filters become clogged more quickly.

▶ With the diesel engine running at lower idle speed, you should clearly feel air pulsating at the dust discharge valve.

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

Cleaning the service cover

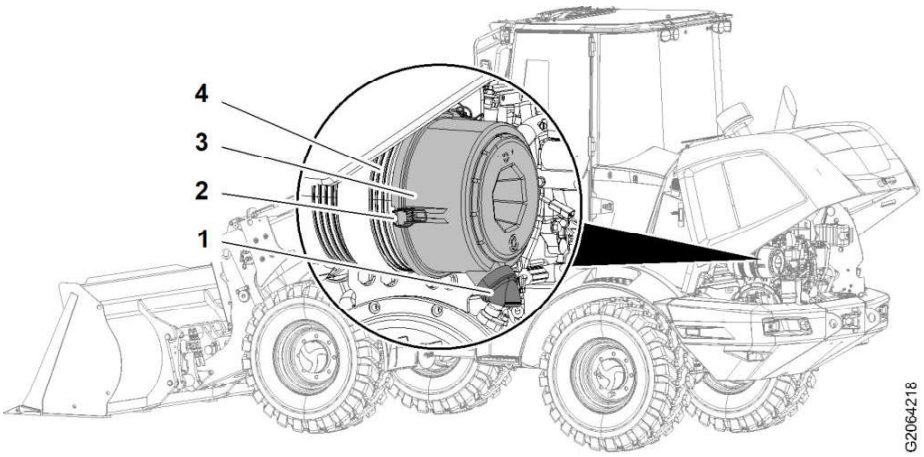


Fig. 170: Clean the service cover and dust discharge valve of the air filter system.

1	Dust discharge valve	**3**	Service cover
2	Fixing clips	**4**	Filter housing

▶ Open fixing clips **2** and take off the service cover **3**.

▶ Clean the service cover **3** and place it back onto the filter housing **4**.
▷ The dust discharge valve **1** must face down.

▶ Place the service cover **3** fully over the filter housing **4**.

▶ Close the fixing clips **2**.

Cleaning the dust discharge valve

Note
When using the machine in dusty conditions:

▶ Check and empty the dust discharge valve more often.

LBH-/00/211-20200828_082818/en

- ▶ Remove fastening bolts **5** around circumference of diesel particulate filter **2**.
- ▶ Remove output module **3**.
- ▶ Remove diesel particulate filter **2**.
- ▶ Attach new metal seals to new diesel particulate filter.
- ▶ Fit a new diesel particulate filter.
- ▶ Replace the bolts and nuts around the diesel particulate filter.
- ▶ Screw the new diesel particulate filter on to the diesel oxidation catalyst and the output module again.
- ▶ Install differential pressure line **4** to diesel particulate filter.
- ▶ Start diesel engine.

WARNING
Rotating parts!
Risk of injury.

- ▶ Do not touch rotating parts of the engine.

WARNING
Hot components!
Risk of injury.

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

- ▶ Check that diesel particulate filter does not leak.
- ▶ Turn off diesel engine.
- ▶ Confirm that diesel particulate filter has been changed with the Yanmar SMARTASSIST diagnostic software.

Confirm that diesel particulate filter has been changed with the Yanmar SMARTASSIST diagnostic software.

Make sure that following requirements are met:
❑ Machine is in maintenance position 1.

Make sure that following tools are ready:
❑ Laptop Yanmar SMARTASSIST diagnostic software
❑ Diagnostic cable for Yanmar SMARTASSIST diagnostic software

- ▶ Connect the Yanmar SMARTASSIST diagnostics software with diesel engine.

LBH-/00/211-20200828_082818/en

▷ Amount of pure antifreeze and corrosion inhibitor to top up = 6,5 l.

Example 2:

▶ Identified freezing point = -58 °C.

▶ Total capacity of the cooling system = 60 l.
▷ Freezing point too low.
▷ Amount of pure water to top up = 6.5 l.

Correcting the antifreeze and corrosion inhibitor concentration

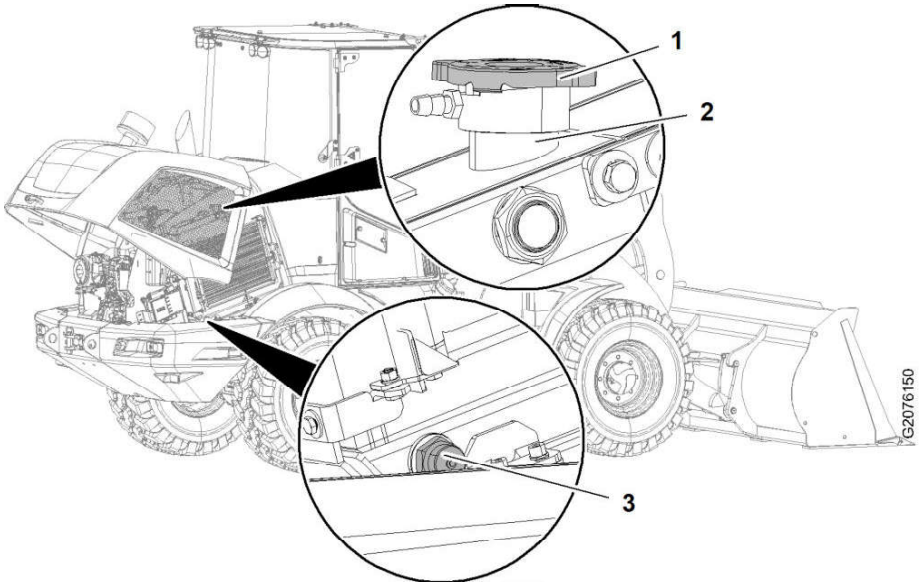


Fig. 192: Correcting the antifreeze and corrosion inhibitor concentration

1 Cap of water cooler
2 Water cooler
3 Drain valve

▶ Place a receptacle under the machine.

▶ Unscrew the cap from the drain valve **3**.

▶ Screw drain hose onto drain valve **3**.
▷ Coolant flows out.

▶ Drain off as much coolant as the amount to be topped up.

▶ Unscrew drain hose from drain valve **3**.

▶ Screw the cap onto the drain valve **3**.

NOTICE
Non-approved coolant!
Damage to the engine and cooling system.

▶ Only use coolant that meets the Liebherr specifications.

▶ Do not mix coolants with and without silicates.

▶ Completely fill water cooler **2** **2** with pure anti-freeze and corrosion protection agent or pure water.

▶ Close cap of water cooler **1**.

▶ Start diesel engine.

030.4.6.2 Draining off condensate and sediment from hydraulic tank

Valid for: L509-1778;

Make sure that following requirements are fulfilled:
- ❑ Machine has not been started for at least an hour.
- ❑ Machine is in maintenance position 1.
- ❑ Service access is open.

Make sure that following tools are ready:
- ❑ Drain hose
- ❑ Receptacle

Note
To completely drain condensate and sediment, impurities must settle on bottom of hydraulic tank.

▶ Do not start the machine for at least an hour.

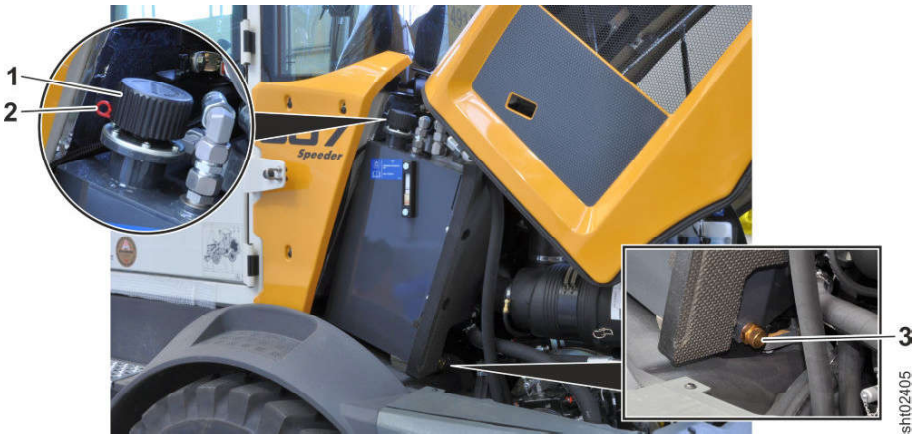


Fig. 202: Draining off condensate and sediment from the hydraulic tank

1 Breather filter
2 Plug
3 Drain valve

▶ Insert plug **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.

▶ Place a receptacle under the machine.

▶ Unscrew the cap from the drain valve **3**.

▶ Screw the drain hose onto the drain valve **3**.
▷ Condensate and sediment drain off.

▶ Let condensate and sediment drain into receptacle.

When clean hydraulic oil comes out:

▶ Unscrew drain hose from drain valve **3**.

▶ Screw the cap onto the drain valve **3**.

▶ 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.

▶ Check the oil level in the hydraulic tank.

LBH/-/00/211-20200828_082818/en

Description	Unit	Value
Minimum thickness **s1** of each brake lining	mm	2.0

If required value is not reached:
▶ Replace brake shoes.

If required value is reached:
▶ Check gap.

Checking gap

Fig. 213: Checking gap

1 Brake lining (2x) **s2** Gap (2x)

▶ Use a feeler gauge to check that both gaps **s2** are correct.

Description	Unit	Value
Gap **s2**	mm	0.55 $^{+0.30}$

If required value is not reached:
▶ Check adjuster.

If required value is reached:
▶ Put plugs back in inspection openings.

030.4.8.4 Service brake: checking brake plates for wear

Valid for: L509-1778;

WARNING
Changes in braking performance are a sign that brake discs are worn!
Accidents.

▶ If there are changes in braking performance, check gap and wear on brake discs.

WARNING
Longer braking distance!
Accidents.

▶ Replace brake discs before they become too worn.

▶ Fill axle oil up to bottom of opening. (For more information see: 030.2.1 Lubricant filling quantity, page 030-14)

If the oil level is correct:

▶ Screw in filling plug **1** and tighten it to 45 $^{\pm 5}$ Nm.

▶ Repeat procedure on the rear axle.

▶ Check oil level in wheel hubs.

Checking oil level in wheel hubs

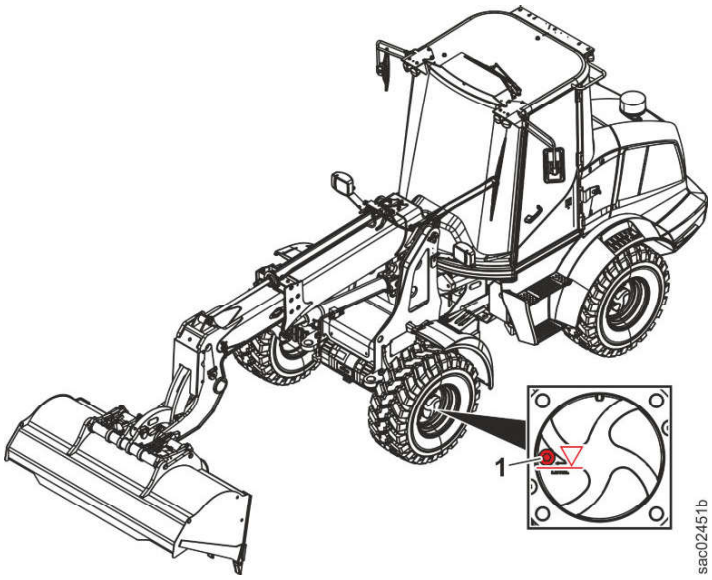


Fig. 221: Checking oil level in wheel hubs

1 Maintenance plug (4x)

▶ Park machine so that oil level marking on left wheel hub of front axle is horizontal (maintenance plug **1** at 9 o'clock).

▶ Put machine in maintenance position 2.

▶ Carefully open maintenance plug **1** on left wheel hub of front axle.

▶ Check that the oil level is up to bottom of the opening.

If oil level is too low:

▶ Check wheel hub for leaks.

▶ Fill axle oil up to bottom of opening. (For more information see: 030.2.1 Lubricant filling quantity, page 030-14)

If oil level is correct:

▶ Screw in maintenance plug **1** and tighten it to 45 $^{\pm 5}$ Nm.

▶ Repeat process for the other wheel hubs.

030.4.11.2 Changing axle oil

Valid for: L509-1778;

Make sure that following requirements are fulfilled:

❑ Oil is at operating temperature.

❑ Machine is in maintenance position 2.

LBH-/00/211-20200828_082818/en

▶ Apply silicon spray to the seal **1**.

▶ (For more information see: Opening service hatches, page 030-26)

030.4.13 Working attachment

030.4.13.1 Quick coupler: checking function

Valid for: L509-1778;

Make sure the following preconditions are met:
❑ Diesel engine has started.
❑ The lift arms have been lowered.
❑ The working attachment is tilted in.

WARNING
Persons in the danger area!
Risk of injury.

▶ Make sure there is nobody in the danger area.

▶ Unlock quick coupler and lock it again.
▷ This prevents the locking pins from jamming and preventing the quick coupler from being released.

▶ For safety reasons, check that quick coupler is locked again.

030.4.13.2 Lubricating telescopic lift arms and working attachment

Valid for: L509-1778;

For jobs that require daily cleaning, lift arms and working attachment must be lubricated every day.

Make sure that following requirements are fulfilled:
❑ Machine is in maintenance position 2.
❑ The working attachment is disconnected for lubricating points near the bucket coupling, which are difficult to access.
❑ The lubricating point has been cleaned.

LBH-/00/211-20200828_082818/en

▶ Remove energy chain **5**: loosen screws **6**.

▶ Change slide elements. (For more information see: Changing slide elements, page 030-144)

Changing slide elements at top rear

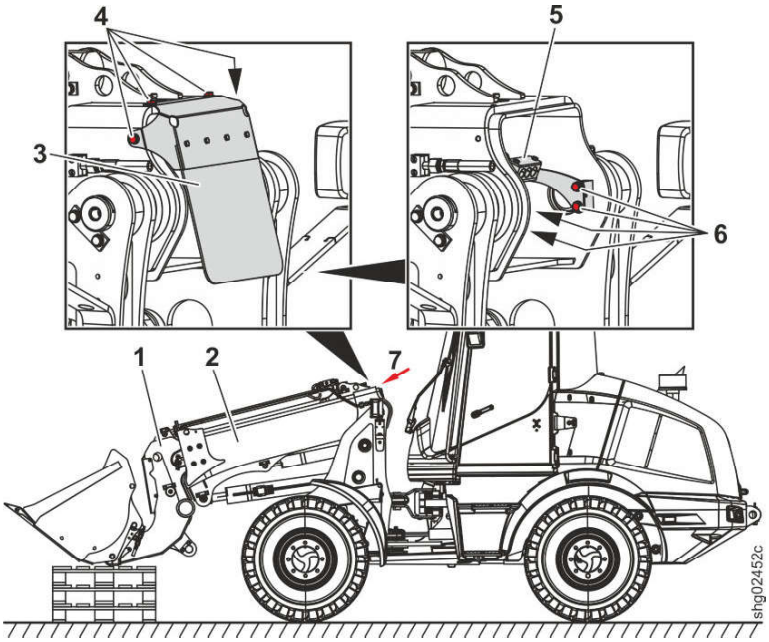


Fig. 243: Supporting lift arms for changing slide elements at top rear

1 Extension
2 Base section
3 Protective flap
4 Screw (4x)
5 Energy chain
6 Screw (4x)
7 Rear top slide element (4x)

▶ Turn steering wheel as far as it will go.
▷ Slide elements are more accessible.

▶ Retract extension **1** to stop.

NOTICE
Improper support of lift arms!
Damage to working attachment.

▶ Ensure that no hydraulic hoses get caught and pinched.

▶ Make sure that linkage is not touching.

▶ Support lift arms with supporting material on extension **1**.
▷ Slide elements at top rear are relieved.

▶ Turn off diesel engine and take out ignition key.

▶ Remove protective flap **3**: loosen screws **4**.

▶ Remove energy chain **5**: loosen screws **6**.

▶ Change slide elements. (For more information see: Changing slide elements, page 030-144)

LBH/-/00/211-20200828_082818/en

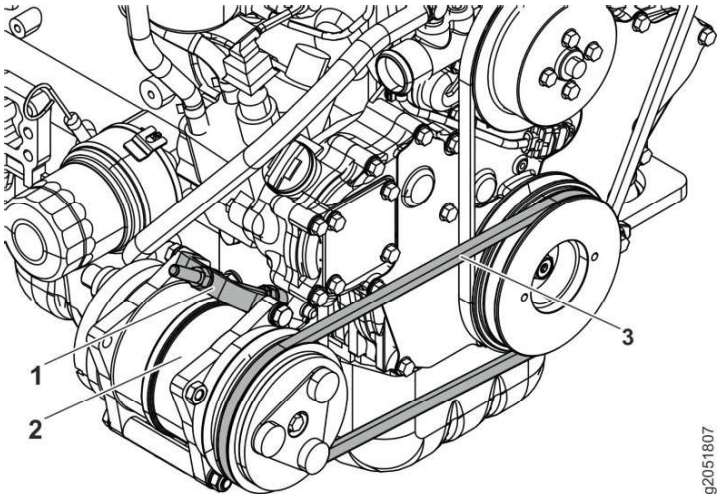


Fig. 254: Setting V-belt tension

1 Tensioning device

2 Air conditioning compressor

3 V-belt of compressor magnetic coupling

▶ Relieve V-belt **3** with tensioning device **1**.

▶ Remove V-belt **3**.

▶ Install new V-belt.

▶ Set V-belt tension. (For more information see: Setting V-belt tension, page 030-153)

Setting V-belt tension

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

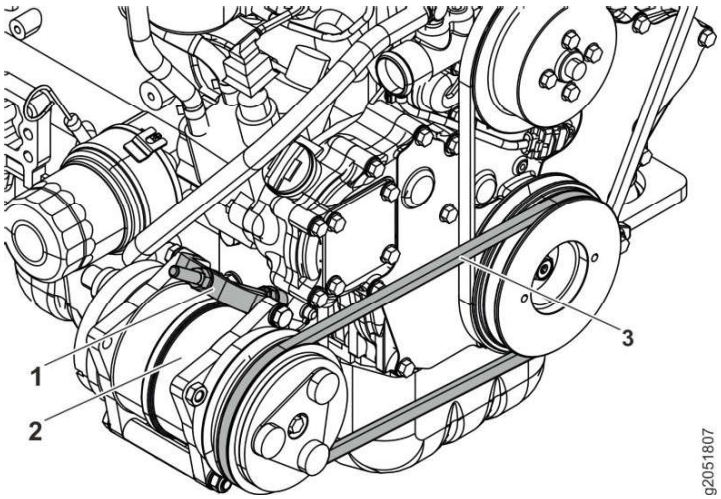


Fig. 255: Setting V-belt tension

1 Tensioning device

2 Air conditioning compressor

3 V-belt of compressor magnetic coupling

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. 79: Key

LBH-/00/211-20200828_082818/en

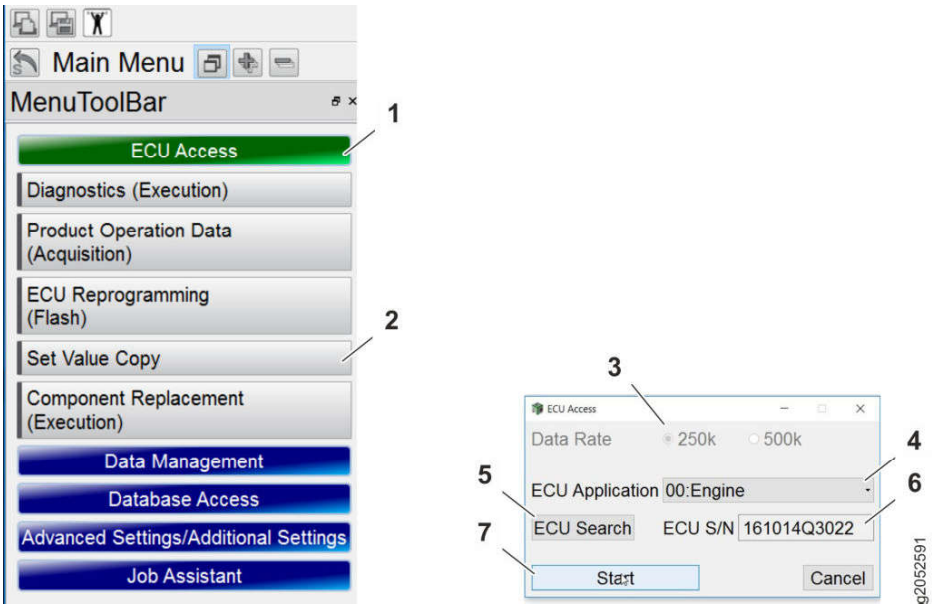


Fig. 267: Connecting SMARTASSIST-Direct diagnostics software to diesel engine

1 *ECU Access* tab
2 *Set Value Copy* function
3 *Data Rate* function
4 *Engine* function
5 *ECU Search* function
6 Serial number of ECU
7 *Start* function

- ▶ Switch on battery main switch.
- ▶ Switch on ignition.
- ▶ Run SMARTASSIST-Direct diagnostic software.
- ▶ Select *ECU Access* tab **1**.
- ▶ Select *Set Value Copy* function **2**.
- ▶ For the *Data Rate* function **3** select a connection speed of 250k.
- ▶ Select *Engine* function **4**.
- ▶ Select *ECU Search* function **5**.
  ▷ Serial number of ECU **6** is displayed.
- ▶ Select *Start* function **7**.
  ▷ Connection is made to engine control unit (ECU).

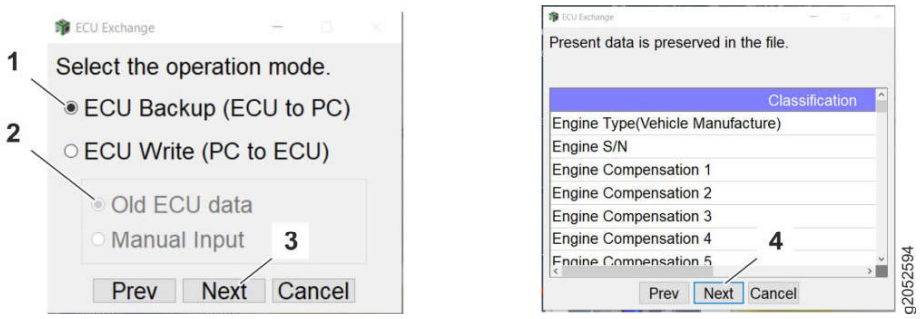


Fig. 268: Saving data

1 *ECU Backup (ECU to PC)* function
2 *Old ECU data* function
3 *Next* function
4 *Next* function

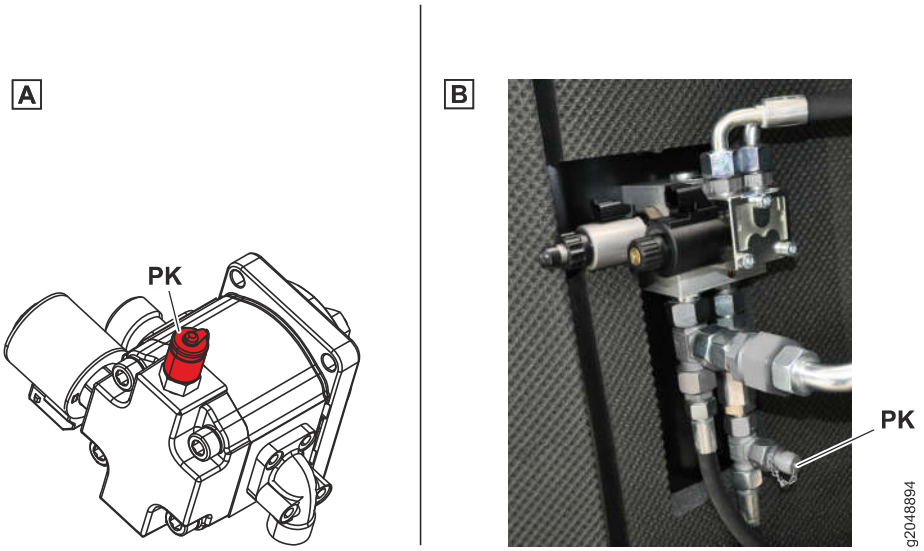


Fig. 284: Test connection for standard version / test connection for version with reversible fan drive

PK Cooling system high pressure test connection

Preparations

NOTICE
Pressure peak when automatically switching on the reversible fan drive!
Damage to the fan motor.

▶ Make sure the reversible fan drive is deactivated.

▶ 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.

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.

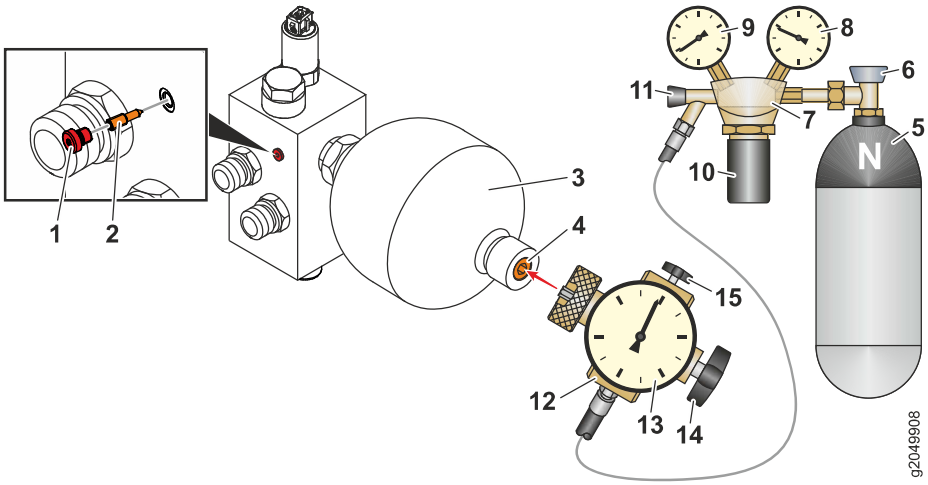


Fig. 288: Ride control hydro accumulator: nitrogen filling

1	Screw plug for relief valve	**9**	Outlet pressure gauge
2	Relief valve	**10**	Pressure control valve
3	Ride control hydro accumulator	**11**	Outlet valve for pressure reducer
4	Screw plug for hydro accumulator	**12**	Testing and filling device
5	Nitrogen cylinder	**13**	Pressure gauge for hydro accumulator filling pressure
6	Cylinder valve	**14**	Handwheel
7	Pressure reducer	**15**	Drain valve
8	Cylinder pressure gauge		

▶ Unscrew screw plug for relief valve **1** from stabilisation module.

WARNING
Descending lift arms!
Injury.

▶ Make sure that the full weight of the lift arms rests on the ground.

▶ Unscrew relief valve **2** by one turn.
▷ Hydraulic pressure in hydro accumulator **3** is relieved into hydraulic tank.

▶ Install vacuum pump. (For more information, see Liebherr service documentation on removing and installing components)

▶ Place collecting pan under hydro accumulator **3**.

▶ Remove hydro accumulator **3**.
▷ Oil side of hydro accumulator **3** is depressurised.

▶ Unscrew protective cap on hydro accumulator **3**.

Note
Hydro accumulator **3** does not have an integrated check valve.

▶ Only loosen screw plug for hydro accumulator **4** before attaching testing and filling device.

▶ Only screw on screw plug for hydro accumulator **4** with testing and filling device.

▶ Loosen screw plug for hydro accumulator **4**.

▶ Screw testing and filling device **12** onto hydro accumulator.

LBH/-/00/211-20200828_082818/en

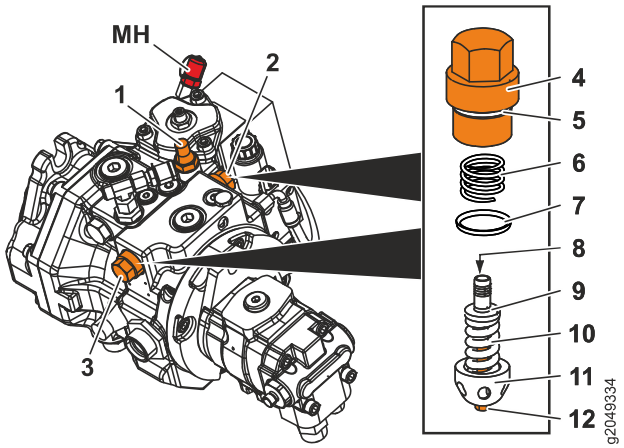


Fig. 298: Travel pump: high pressure relief valves

1	Pressure cut-off valve	**8**	Lock screw
2	Reverse travel direction high pressure relief valve	**9**	Valve insert
3	Forward travel direction high pressure relief valve	**10**	High pressure relief compression spring
4	Screw plug	**11**	Valve seat
5	O-ring	**12**	Adjusting screw
6	Replenishing function compression spring	**MH**	Travel pump high pressure test connection
7	O-ring		

Preparations

- ▶ Connect a pressure gauge (600 bar) to the high pressure test connection **MH** on the travel pump.
- ▶ Turn adjusting screw on pressure cut-off valve **1** by exactly one turn clockwise.
  - ▷ Opening pressure of pressure cut-off is above opening pressure of high pressure relief valves.

Checking and adjusting

- ▶ Start diesel engine.
- ▶ Connect Sculi diagnostic software to machine.
- ▶ In the variables editor, select the ***Block curve calibration*** folder.
- ▶ Set variable ***MXdrBlockMan*** to ***1***.
  - ▷ Machine is in blocked condition.

Note
Variable ***MXdrBlockMan*** is automatically reset to its original value ***0*** when ignition is switched **OFF**.

- ▶ If necessary, reset value to ***1*** when repeating test.

Make sure that following requirements are fulfilled:
❑ Machine is in maintenance position 2.

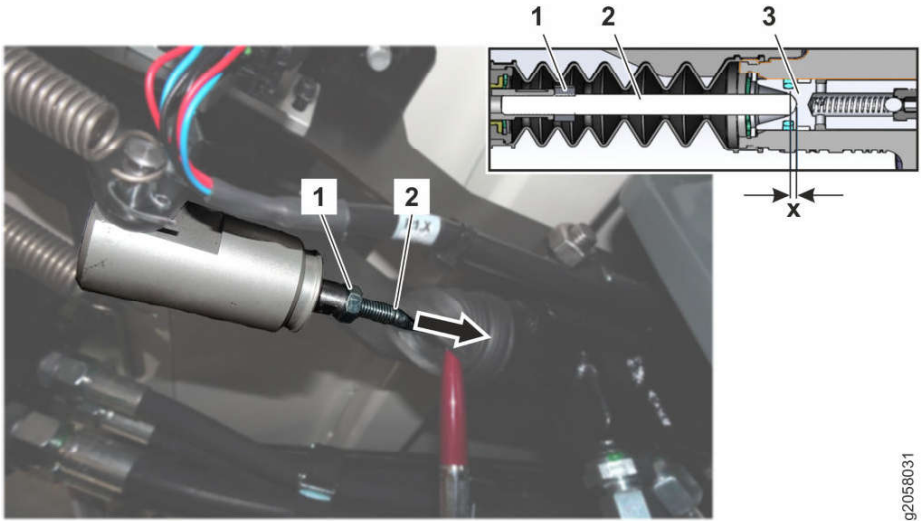


Fig. 303: Inching brake pedal: basic setting

1	Counter nut	**3**	Pressure regulator piston
2	Threaded rod	**x**	Play (0.5 mm to 1 mm)

▶ Start diesel engine.

WARNING
Unintended movement of machine!
Injury.

▶ Make sure that parking brake is activated.

▶ Make sure there is nobody in operator's cab.

▶ Remove bellows.

▶ Unscrew counter nut **1**.

▶ Turn threaded rod **2** by hand up to stop on actuator piston **3**.
▷ Threaded rod **2** is in contact with actuator piston **3**.

▶ Unscrew threaded rod **2** by half a turn.
▷ Play **x** between threaded rod **2** and actuator piston **3** is about 0.5 mm to 1 mm.

▶ Tighten counter nut **1**.

To check basic setting, inching brake pedal must be actuated by hand. If inching brake pedal is actuated by hand, light play must be felt before first action point.

▶ Actuate inching brake pedal by hand up to first action point.

▶ Check whether light play is present before reaching first action point.

If there is no light play before first action point:
▶ Repeat basic setting.

If there is a light play before first action point:
▶ Install bellows.

▶ Select “New” function **1**.

▶ Select “PME 1 address book” address book **2**.

▶ Select “Master 5 Ethernet” address **3**.

▶ Select “Connect” function **4**.
▷ Connection to central control unit (Master5) is established.

Checking connections settings

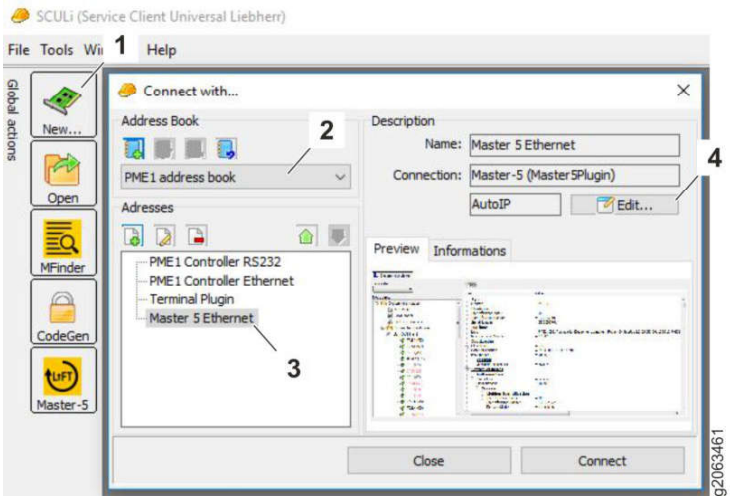


Fig. 318: Checking connections settings

1	“New” function	**3**	“Master 5 Ethernet” address
2	“PME1 address book” address book	**4**	“Edit” function

▶ Run Sculi diagnostic software.

▶ Select “New” function **1**.

▶ Select “PME1 address book” address book **2**.

▶ Select “Master 5 Ethernet” address **3**.

Troubleshooting
If “Master 5 Ethernet” address is not present:

▶ Create “Master 5 Ethernet” address. (For more information see: Creating “Master 5 Ethernet” address, page 030-224)

▶ Select “Edit” function **4**.

LBH/-/00/211-20200828_082818/en

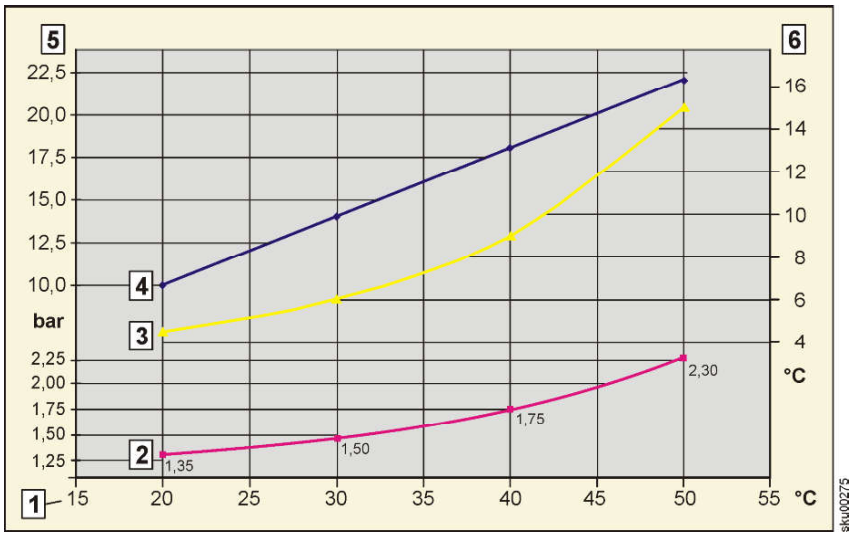


Fig. 329: Temperature/pressure diagram for air conditioning unit

1	Ambient temperature in °C	**4**	High pressure range depending on the ambient temperature
2	Low pressure range depending on the ambient temperature	**5**	High and low pressure in bar
3	Outlet temperature depending on the ambient temperature	**6**	Outflow temperature in °C

- ▶ Connect pressure gauge strip to the quick couplings.
- ▶ Start diesel engine.
- ▶ Switch on air conditioning unit (maximum cooling).
- ▶ Set heater fan to maximum.
- ▶ Allow air conditioning compressor to run for 3 to 5 minutes.
- ▶ Measure outflow temperature at left driver-level nozzle.
- ▶ Read the values from the pressure gauge strip and compare with the temperature/pressure diagram.
  - ▷ The values must agree with the diagram.

If the values do not agree:

- ▶ Remedial measures see service docu: Documentation_Wheel-Loaders_Repair-instructions_Other_air conditioning_Basics of air conditioning

030.6.13 Options

030.6.13.1 LiDAT: connecting to LiDAT module

Valid for: L509-1778;

Make sure that following requirements are fulfilled:
- ❑ Ignition is switched off.

LBH-/00/211-20200828_082818/en

040 Drive group

Contents

040.1	Engine		040-2
040.1.1	Diesel engine overview *L509-1778;*		040-2
040.1.2	Electrical components of diesel engine *L509-1778;*		040-10
040.1.3	Fuel system		040-11
	040.1.3.1	Overview of fuel system *L509-1778;*	040-12
	040.1.3.2	Fuel level sensor *L509-1778;*	040-14
	040.1.3.3	Fuel pre-filter *L509-1778;*	040-15
	040.1.3.4	Fuel fine filter *L509-1778;*	040-16
040.1.4	Air filter system		040-17
	040.1.4.1	Air filter *L509-1778;*	040-17
	040.1.4.2	Vacuum switch for air filter *L509-1778;*	040-18
040.1.5	Exhaust system		040-18
	040.1.5.1	Overview of diesel particulate filter *L509-1778;*	040-19

LBH-/00/211-20200828_082818/en

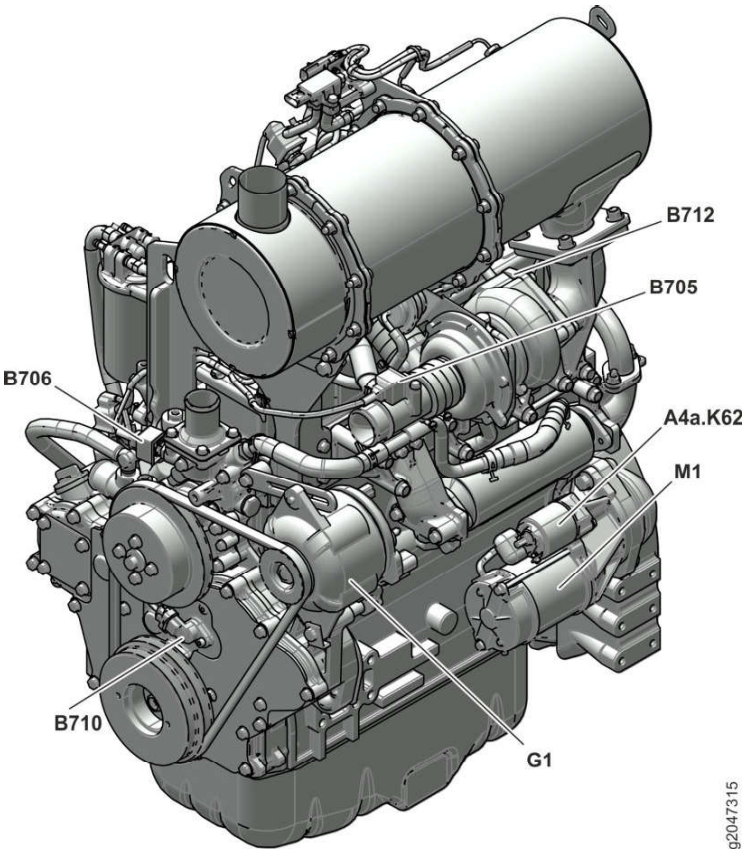


Fig. 352: Electrical components of diesel engine

A4a.K62	Relay for starter	**B712**	Exhaust gas temperature sensor
B705	Charge air temperature sensor	**G1**	Alternator
B706	Sensor for coolant temperature	**M1**	Starter
B710	Camshaft speed sensor		

040.1.3 Fuel system

Regeneration type	Description	Soot particles in grammes per litres (g/L)	Passive or active regeneration
Assisted regeneration (Assist Regeneration)	Exhaust gas temperature regulation via throttle valve and EGR valve. Exhaust gas temperature increased by injecting more fuel. Exhaust gas temperature remains below 350 °C.	From 8 g/L	Active regeneration
Reset regeneration (Reset Regeneration)	Every 100 service hours. Exhaust gas temperature regulation via throttle valve and EGR valve. Exhaust gas temperature increased by injecting more fuel. Exhaust gas temperature above 350 °C	0 g/L to 8 g/L	Active regeneration
Manual regeneration (Stationary Regeneration)	Manually initiated. Exhaust gas temperature regulation via exhaust throttle valve and EGR valve. Exhaust gas temperature increased by injecting more fuel. Increased engine speed. Exhaust gas temperature above 350 °C	From 10 g/L	Active regeneration
Service regeneration (Recovery Regeneration)	Activated using SMARTASSIST diagnostic software or *regenerate diesel particulate filter* switch/button. Exhaust gas temperature regulation via throttle valve and EGR valve. Exhaust gas temperature increased by injecting more fuel. Increased engine speed. Exhaust gas temperature above 350 °C	From 12 g/L	Active regeneration
DPF-Reinigen	Remove and clean DPF.		Active regeneration

Tab. 85: Regeneration types

2 Function

2.1 Basic function

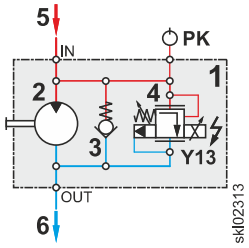


Fig. 381: Fan motor: hydraulic diagram (diesel engine is running)

1 **Fan pump**
2 Gear motor
3 Replenishing valve
4 Fan speed proportional solenoid valve
5 Oil supply via fan pump
6 Return flow to travel motor (housing flushing / cooling) and hydraulic oil cooler

Name	Test point
PK	Cooling system high pressure

Tab. 93: Test points

BMK	Function
Y13	Fan speed proportional solenoid

Tab. 94: Equipment codes

The fan motor drives the fan blade.

2.2 Fan speed proportional solenoid valve

The fan speed proportional solenoid valve **4** controls the fan speed by directing oil past the gear motor **2**. The more oil that flows through the bypass, the lower the output speed. To do this, the central control unit energises the fan speed proportional solenoid **Y13**.

If the fan speed proportional valve **Y13** fails, the bypass remains closed. This means the maximum quantity of oil flows through the gear motor **2**, and the fan turns at maximum speed. This prevents the cooling fluids from overheating in the event of a system fault (fail-safe behaviour).

The fan speed proportional solenoid **4** valve thus protects the fan system from excessive pressure. If the pressure exceeds the maximum permitted level, the fan speed proportional solenoid valve **4** also opens the bypass.

LBH-/00/211-20200828_082818/en

10	**Filter separator plate**	**23**	Return flow from control valve block	**39**	Hydraulic oil drain valve
11	Bypass valve 2.0 bar	**24**	Diesel engine	**40**	Hydraulic oil cooler
12	Screen for replenishing pump 125 µm	**25**	Fan pump		
13	Preload valve 0.5 bar	**26**	In-line filter 80 µm		

Name	Test point
PK	Cooling system high pressure

Tab. 103: Test points

BMK	Function	BMK	Function	BMK	Function
B8	Hydraulic oil temperature sensor	**Y13**	Fan speed proportional solenoid	**Y50**	Fan reversal solenoid

Tab. 104: Equipment codes

If the reversible fan drive is activated, the central control unit energises the fan reversal solenoid **Y50**. The oil supply and return flow on the fan motor **34** are thus switched and the fan changes its direction of rotation.

The proportional solenoid valve for fan speed **31** works in the same way as the standard version.

050.4.2 Fan reversal valve block

Valid for: L509-1778;

1 Layout

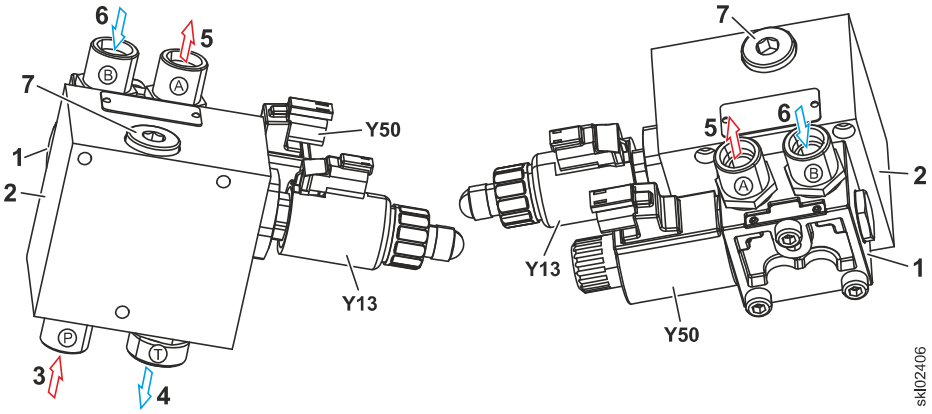


Fig. 389: Valve block for fan reversal (from front left and from rear right)

1	Solenoid valve for fan reversal	**5**	Connection for fan motor (high pressure when fan reversal deactivated)
2	Fan reversal valve block	**6**	Connection for fan motor (high pressure when fan reversal activated)
3	Oil supply via fan pump	**7**	Feeder valve

See next page for continuation of the image legend

When it is not energised, there is no connection to pilot control unit and control block.

060.6 Pipe break protection

060.6.1 Pipe break protection: overview

Valid for: L509-1778;

This equipment is optional for lift cylinders and tilt cylinders.

1 Layout

LBH-/00/211-20200828_082818/en

070 Travel hydraulics

Contents

070.1 Overview of travel hydraulics
L509-1778; 070-2

070.2 Travel pump
L509-1778; 070-9

070.3 Travel motors 070-25

070.3.1 Travel motor
L509-1778; 070-25

LBH/-/00/211-20200828_082818/en

Name	Test point	Name	Test point	Name	Test point
G	Replenishing pressure	**MH**	Travel pump high pressure	**X1**	Control pressure for forward travel direction

Tab. 136: 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. 137: Equipment codes

The travel pump is attached together with the working pump to the diesel engine (tandem arrangement).

The travel pump is a Axial piston variable displacement pump for the closed circuit with an internal gear pump as a replenishing pump.

LBH-/00/211-20200828_082818/en

2.6 Control of swivel angle by the control pressure proportional valve

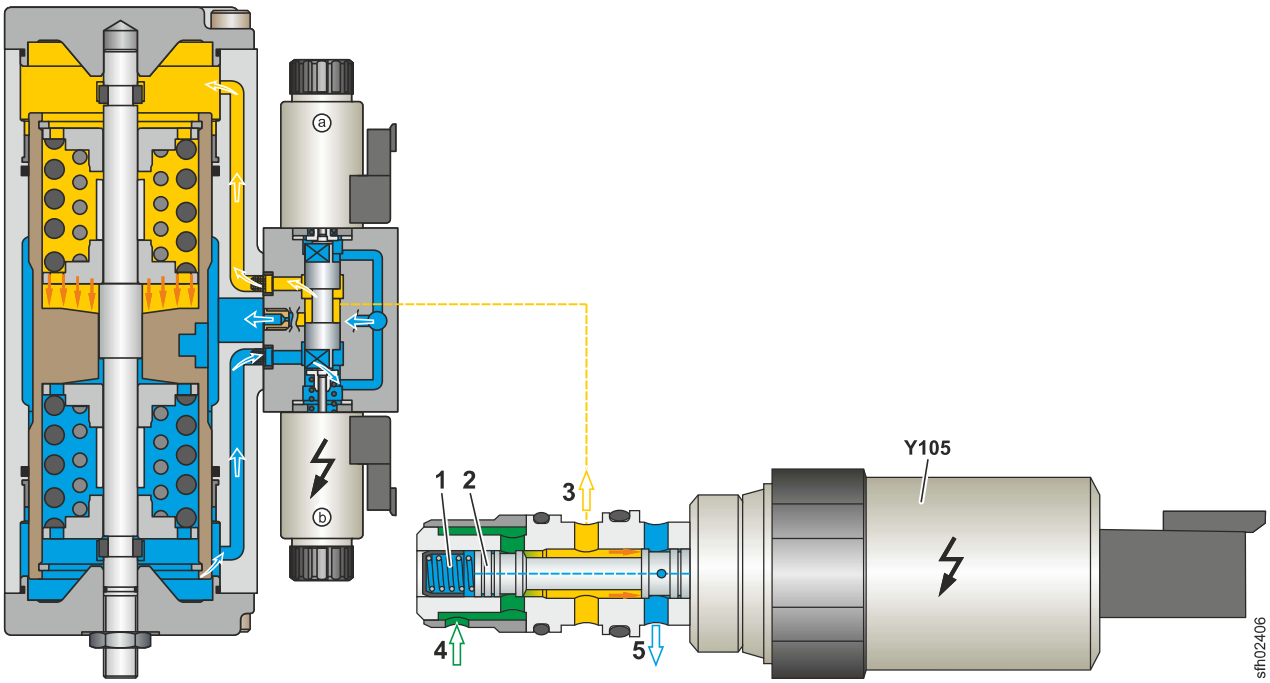


Fig. 430: Control of swivel angle by the control pressure proportional valve (forward travel direction)

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. 142: 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**.

LBH/-/00/211-20200828_082818/en

BMK	Function
Y106	Servo pressure proportional solenoid (travel motor)

Tab. 151: 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**.

2.3.1 Gear changes

During a gear change, swivel angle of travel motor is adjusted in order to synchronise output speed with new transmission ratio. Because at this point no high pressure is available for adjustment, oil is fed from hydro accumulator for external servo pressure and service brake via external servo pressure solenoid. (For more information see: Function, page 120-10) (For more information see: Gearshift strategy, page 120-19)

2.4 Discharge (cooling)

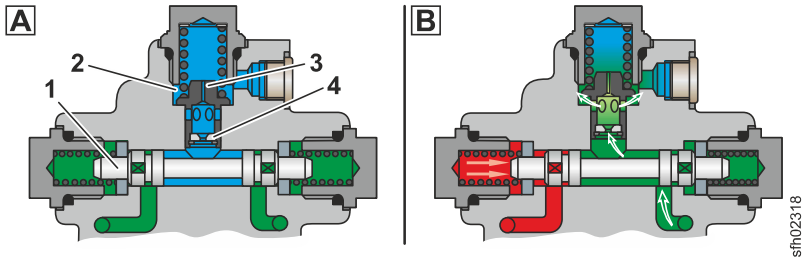


Fig. 439: Discharge if no travel direction is selected / discharge for forward travel direction

1	Discharge valve	**3**	Pressure relief valve
2	Connection to motor housing	**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.

2 Function

2.1 Basic function

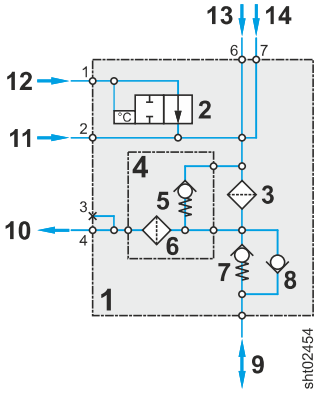


Fig. 445: Return-suction filter: hydraulic diagram

1	**Return suction filter**	**8**	Feeder valve
2	Temperature valve	**9**	Connection to steel tank
3	Filter element 10 µm	**10**	Replenishing pump suction port
4	**Filter separator plate**	**11**	Return flow from servostat, inch/ braking unit and solenoid valve for transmission control unit
5	Bypass valve 2.0 bar	**12**	Return flow from hydraulic oil cooler (uncooled)
6	Screen for replenishing pump 125 µm	**13**	Return flow from hydraulic oil cooler (cooled)
7	Preload valve 0.5 bar	**14**	Return flow from control valve block

Return suction filter collects and filters oil returning from hydraulic components. Oil then flows into steel tank.

Replenishing pump draws oil through strainer **6** directly from return suction filter.

LBH-/00/211-20200828_082818/en

7 **Return suction filter**
8 Temperature valve
9 Filter element
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
15 Steel tank
16 Hydraulic oil drain valve
17 Fan pump suction port
18 Sight glass for hydraulic oil level
26 Gear pump
27 Priority valve
28 Throttle
29 Fine filter
30 Throttle
31 Throttle
32 Travel pump
33 Diesel engine
34 Oil supply for control valve block
35 Return flow from transmission control solenoid valve
36 Return flow from inch/brake unit
40 **Servostat**
47 Chamber isolation for steering right (emergency steering function)
48 Check valve
49 Feeder valve for steering to left
50 Feeder valve for steering to the right
51 Secondary pressure relief valve for steering to left
52 Secondary pressure relief valve for steering to right
53 LS pressure relief valve
54 Throttle
55 Throttle check valve
56 Steering cylinder

BMK	Function
B8	Hydraulic oil temperature sensor

Tab. 156: Equipment codes

The steering system is an open circuit. This means that, after leaving the consumer, the oil flows to the hydraulic tank rather than directly back to the pump.

Working pump **25** draws oil from hydraulic tank **1** and transports it via priority valve **27** to control block **34** and servostat **40**. Priority valve **27** distributes oil to two systems. Steering system has priority of supply.

Servostat **40** delivers a measured quantity of oil to steering cylinder **56** with every turn of steering wheel. The servostat **56** also generates a load sensing signal which regulates priority valve **27**.

Oil returning from steering cylinder **56** flows through return suction filter **7** back into hydraulic tank **1**.

LBH-/00/211-20200828_082818/en

13 Preload valve 0.5 bar
14 Feeder valve
15 Steel tank
16 Hydraulic oil drain valve
17 Working pump suction port
18 Fan pump suction port
19 Sight glass for hydraulic oil level
34 Flushing orifice 1,0 mm
35 **Valve block for parking brake and differential lockout**
36 Check valve 1
37 Check valve 2
38 Flushing throttle 1.5 mm
39 Parking brake solenoid valve
40 Solenoid valve for differential lockout
58 Spring accumulator brake piston for parking brake
59 Brake piston for service brake (1st brake circuit)
60 **Drum brake**
61 Brake piston for service brake (2nd brake circuit)
62 Return flow from servostat
63 Return flow from pilot control unit
64 Return flow from transmission control solenoid valve

Name	Test point	Name	Test point
G	Replenishing pressure (2x)	**M4**	Brake pressure in 1st brake circuit (front axle)

Tab. 161: Test points

Name	Test point
G	Replenishing pressure (2x)

Tab. 162: Test points

BMK	Function	BMK	Function	BMK	Function
B8	Hydraulic oil temperature sensor	**R1**	Inching function angle sensor	**Y11**	Orifice bypass solenoid
B12	Brake light pressure switch	**Y10**	Parking brake solenoid	**Y55**	Solenoid for differential lockout

Tab. 163: Equipment codes

2.1.1 Service brake

The service brake is a dual-circuit brake. The braking effect in the 1st brake circuit is generated by the wet disc brake on the front axle **55**.

The braking effect in the 2nd brake circuit is generated in the drum brake **61**, which is flange-mounted on the front axle **55**. Because there is no differential in the gearbox, the drum brake acts on both axles.

When the inching brake pedal is pressed, only the inching brake pedal **R1** is activated during the first two thirds of the pedal displacement. (For more information see: Position of inching brake pedal, page 070-22) Inching hydrostatically brakes machine. Service brake itself is not activated until final third of pedal displacement.

2.1.1.1 Braking sequence in the 1st brake circuit

The replenishing pump **26** supplies inch/brake unit **45** with oil. The service brake pressure control piston **46** directs oil to service brake pistons **57** and **59**. The service brake pistons **57** and **59** thus actuate the wet disc brake in front axle **55**. The pressure transmitted is proportional to the force applied to the pedal.

2.1.1.2 Braking sequence in 2nd brake circuit

The main brake cylinder **47** pushes oil out of the equalizing reservoir **49** into the service brake piston **61** in the drum brake **60**.

100.2.3 Brake light pressure switch

Valid for: L509-1778;

1 Layout

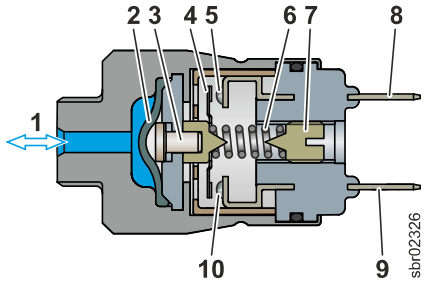


Fig. 470: Brake light pressure switch: sectional view

1	Brake pressure from inch/brake unit	**6**	Compression spring
2	Membrane	**7**	Adjusting screw
3	Pin	**8**	Connection contact
4	Contact plate	**9**	Connection contact
5	Switch contact	**10**	Switch contact

The brake light pressure switch B12 is mounted on the main service brake cylinder.

2 Function

2.1 Basic function

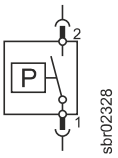


Fig. 471: Brake light pressure switch: equivalent circuit diagram

The brake light pressure switch closes at a brake pressure of $10^{\pm 1}$ bar. This causes the brake light to light up when braking.

110 Electrical system

Contents

110.1	Electronic control unit		110-2
110.1.1	Central control unit (Master5 Mini) *L509-1778;*		110-2
110.1.2	Modules		110-4
	110.1.2.1	Compact module *L509-1778;*	110-5
110.2	Electrical components of the driver's cab		110-11
110.2.1	Fuse boards *L509-1778;*		110-11
110.2.2	Door contact switch *L509-1778;*		110-13
110.3	Electrical components in the rear section		110-14
110.3.1	Battery installation *L509-1778;*		110-14

LBH-/00/211-20200828_082818/en

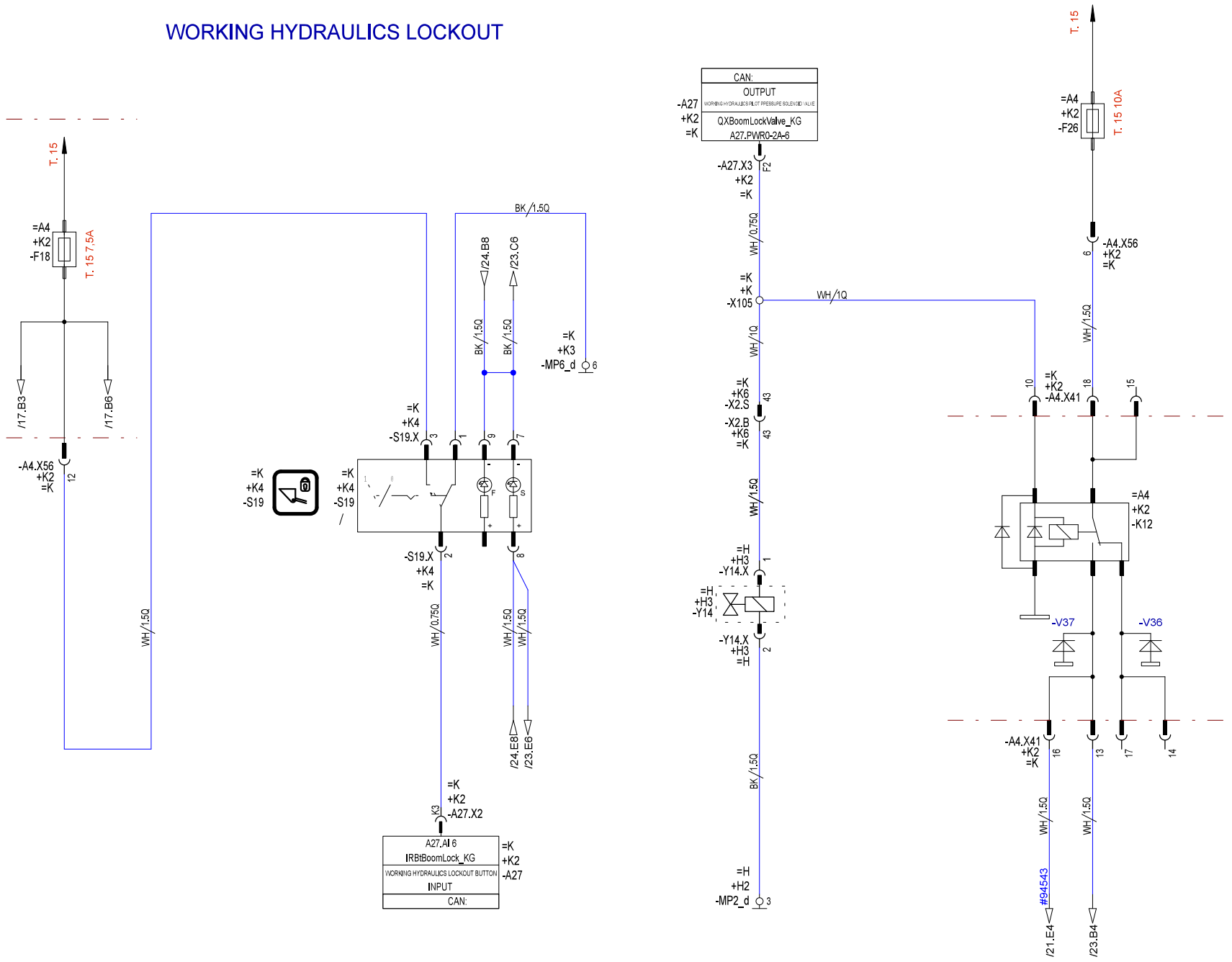
ITEM CODE	13442271	DRAWING INDEX	000	
PROJECT	L509T-1778	DRAWING NUMBER	1778 00090 01 00	

BMK	SYSTEM	LOCATION	FUNCTION	PAGE
-MP6_c	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/44.F3
-MP6_d	=H	+H2	REAR SECTION GROUNDING POINT	/23.F7
-MP6_d	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/45.F3
-Mp6_e	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/60.B2
-MP6_f	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/33.A2
-Mp6a	=H	+H2	GROUNDING POINT REAR SECTION	/89.F2
-Mp6b	=H	+H4	REAR SECTION GROUNDING POINT	/18.D7
-MP7_a	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/44.F6
-Mp7_b	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/37.E2
-MP7_j	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/25.E3
-MP7_k	=K	+K3	OPERATOR'S CAB GROUNDING POINT	/26.F5
-Mp8_a	=K	+K	GROUNDING POINT PIPE BREAK PROTECTION	/23.F2
-Mp177	=K	+K	OPERATOR'S CAB GROUNDING POINT	/64.F2
-Mp184	=K	+K3	GROUNDING POINT COOLANT PREHEATER	/66.F7
-MP B25	=H	+H2	GROUND FUEL LEVEL SENSOR	/89.B2
-MP ECU	=M	+M	GROUNDING POINT ENGINE CONTROL UNIT	/80.F3
-MP TANK	=H	+H2	GROUND FUEL LEVEL SENSOR	/89.B2
-MPR	=K	+K3	GROUNDING POINT ANTENNA	/44.D6
-P30	=M	+M	HEATER FLANGE PRE-HEAT SYSTEM	/81.D3
-R1	=K	+K6	INCHING FUNCTION ANGLE SENSOR	/27.D3
-R1.X	=K	+K6	CONNECTOR INCHING FUNCTION ANGLE SENSOR	/27.D3
-R1a	=K	+K	MANUAL INCHING ANGLE SENSOR	/28.D5
-R1a.X	=K	+K	CONNECTOR MANUAL INCHING ANGLE SENSOR	/28.D4
-R5	=K	+K6	ACCELERATOR PEDAL ANGLE SENSOR	/27.D6
-R5.X	=K	+K6	CONNECTOR ACCELERATOR PEDAL ANGLE SENSOR	/27.E6
-R6a	=K	+K3	MIRROR HEATER LEFT	/45.E1
-R6a.X	=K	+K3	CONNECTOR MIRROR HEATER LEFT	/45.D1
-R6b	=K	+K3	MIRROR HEATER RIGHT	/45.E2
-R6b.X	=K	+K3	CONNECTOR MIRROR HEATER RIGHT	/45.D2
-R9a	=A4	+K2	EXCITATION RESISTOR 100 OHM	/17.B4
-R9b	=A4	+K2	EXCITATION RESISTOR 220 OHM	/17.B5
-R10	=M	+M	FUEL PREHEATING	/66.C7
-R10.X	=M	+M	CONNECTOR FUEL PREHEATING	/66.D7
-R11	=K	+K3	REAR WINDOW HEATER	/45.E3
-R11.X1	=K	+K3	CONNECTOR REAR WINDOW HEATER	/45.D3
-R11.X2	=K	+K3	CONNECTOR REAR WINDOW HEATER	/45.E3

BMK	SYSTEM	LOCATION	FUNCTION	PAGE
-R16	=K	+K2	SERIES RESISTOR	/71.B7
-R120	=K	+K2	TERMINATING RESISTOR CONTROL LEVER	/31.B5
-R_H47	=K	+K2	SERIES RESISTOR	/17.D7
-S1	=K	+K4	STARTING SWITCH	/16.A4
-S1.X1	=K	+K4	CONNECTOR STARTING SWITCH	/16.A5
-S1.X1.6	=K	+K4	CONNECTOR OPTION IMMOBILISER	/16.A8
-S1.X2	=K	+K4	CONNECTOR STARTING SWITCH	/16.B5
-S2b	=K	+K	CONTROL LEVER	/31.E5
-S2b.X	=K	+K	CONNECTOR CONTROL LEVER	/31.E3
-S2b.X1049	=K	+K	CONNECTOR CONTROL LEVER	/31.E4
-S3	=K	+K1	STEERING COLUMN SWITCH	/41.E1
-S3.X1	=K	+K1	CONNECTOR STEERING COLUMN SWITCH	/41.E1
-S3.X2	=K	+K1	CONNECTOR STEERING COLUMN SWITCH	/41.D2
-S4	=K	+K	HAZARD WARNING SYSTEM SWITCH	/41.A2
-S4.X	=K	+K	CONNECTOR HAZARD WARNING SYSTEM SWITCH	/41.A2
-S6	=K	+K	PARKING LIGHT AND LOW BEAM SWITCH	/36.B1
-S6.X	=K	+K	CONNECTOR PARKING LIGHT AND LOW BEAM SWITCH	/36.A2
-S7	=K	+K	FRONT WORKING HEADLIGHTS SWITCH	/37.A6
-S7.X	=K	+K	CONNECTOR FRONT WORKING HEADLIGHTS SWITCH	/37.B6
-S7a	=K	+K4	SWITCH ADDITIONAL HEADLIGHT REAR	/39.B4
-S7a.X	=K	+K4	CONNECTOR SWITCH ADDITIONAL HEADLIGHT REAR	/39.B4
-S8	=K	+K4	REAR WORKING HEADLIGHTS SWITCH	/38.B7
-S8.X	=K	+K4	CONNECTOR REAR WORKING HEADLIGHTS SWITCH	/38.B6
-S8a	=K	+K4	REAR WORKING HEADLIGHTS SWITCH MULTIFUNCTIONAL	/38.B4
-S8a.X	=K	+K4	CONNECTOR REAR WORKING HEADLIGHTS SWITCH MULTIFUNCTIONAL	/38.B4
-S9	=K	+K4	FLASHING BEACON SWITCH	/40.C3
-S9.X	=K	+K4	CONNECTOR FLASHING BEACON SWITCH	/40.D3
-S9a	=K	+K4	FLASHING BEACON SWITCH MULTIFUNCTIONAL	/40.C5
-S9a.X	=K	+K4	CONNECTOR FLASHING BEACON SWITCH MULTIFUNCTIONAL	/40.C5
-S13	=K	+K	REAR WINDOW WASHER SYSTEM SWITCH	/43.B3
-S13.X	=K	+K	CONNECTOR REAR WINDOW WASHER SYSTEM SWITCH	/43.C3
-S14	=K	+K4	BUCKET RETURN-TO-DIG SWITCH	/21.C6
-S14.X	=K	+K4	CONNECTOR BUCKET RETURN-TO-DIG SWITCH	/21.C6
-S15	=H	+H4	BATTERY MAIN SWITCH	/18.C7
-S16	=K	+K4	RIDE CONTROL BUTTON	/22.C7
-S16.X	=K	+K4	CONNECTOR RIDE CONTROL BUTTON	/22.D7

MACHINE TYPE	SERIAL NUMBER		BMK-INDEX	PAGE 10	OF
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	ELECTRICAL SCHEMATIC	CREATION DATE	23.07.2020 13:12

WORKING HYDRAULICS LOCKOUT

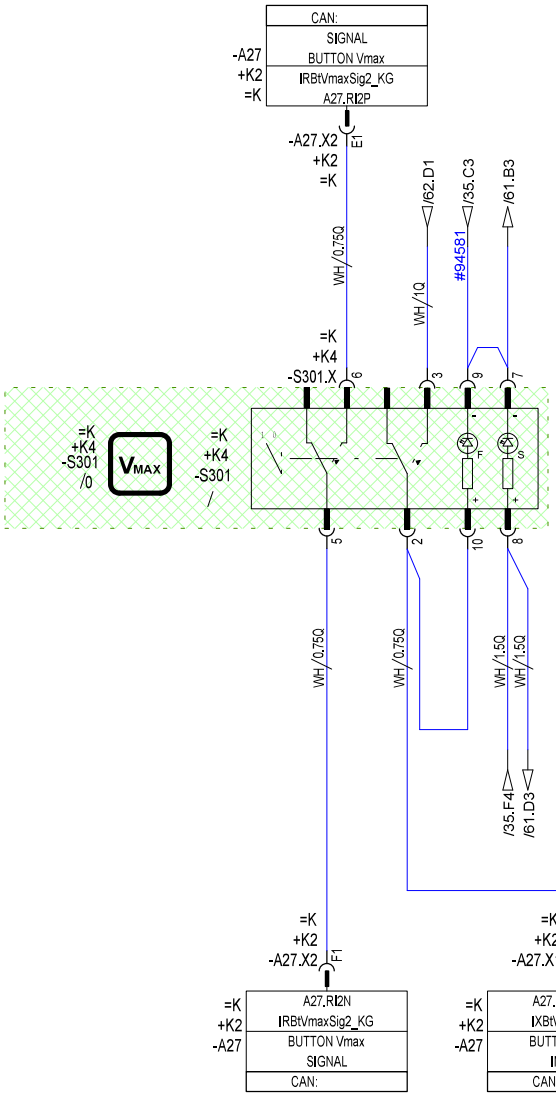


ITEM CODE	13442271
DRAWING INDEX	000
PROJECT	L509T-1778
DRAWING NUMBER	1778 00090 01 00

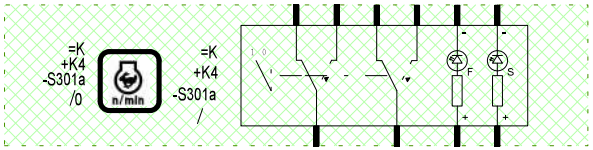
MACHINE TYPE **LIDOS Gerät**	SERIAL NUMBER **XXXXX**	**LIEBHERR** **FACTORY LBH**	WORKING HYDRAULICS LOCKOUT ELECTRICAL SCHEMATIC	PAGE 20 OF CREATION DATE 23.07.2020 13:12

ITEM CODE 13442271
DRAWING INDEX 000
PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00

OPTION Vmax

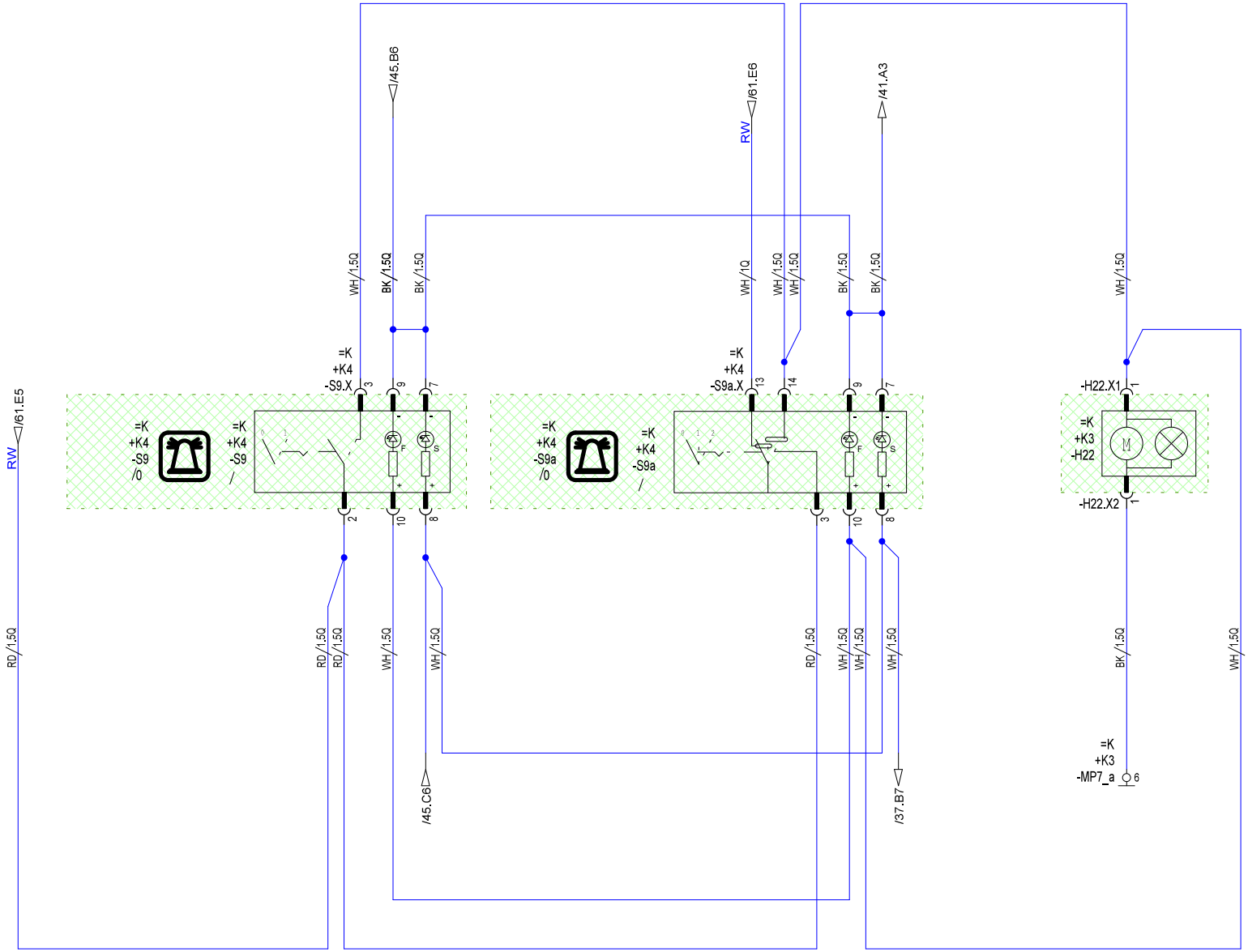


OPTION SPEED



MACHINE TYPE	SERIAL NUMBER			
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	OPTION Vmax OPTION SPEED ELECTRICAL SCHEMATIC	PAGE 30 OF
				CREATION DATE 23.07.2020 13:12

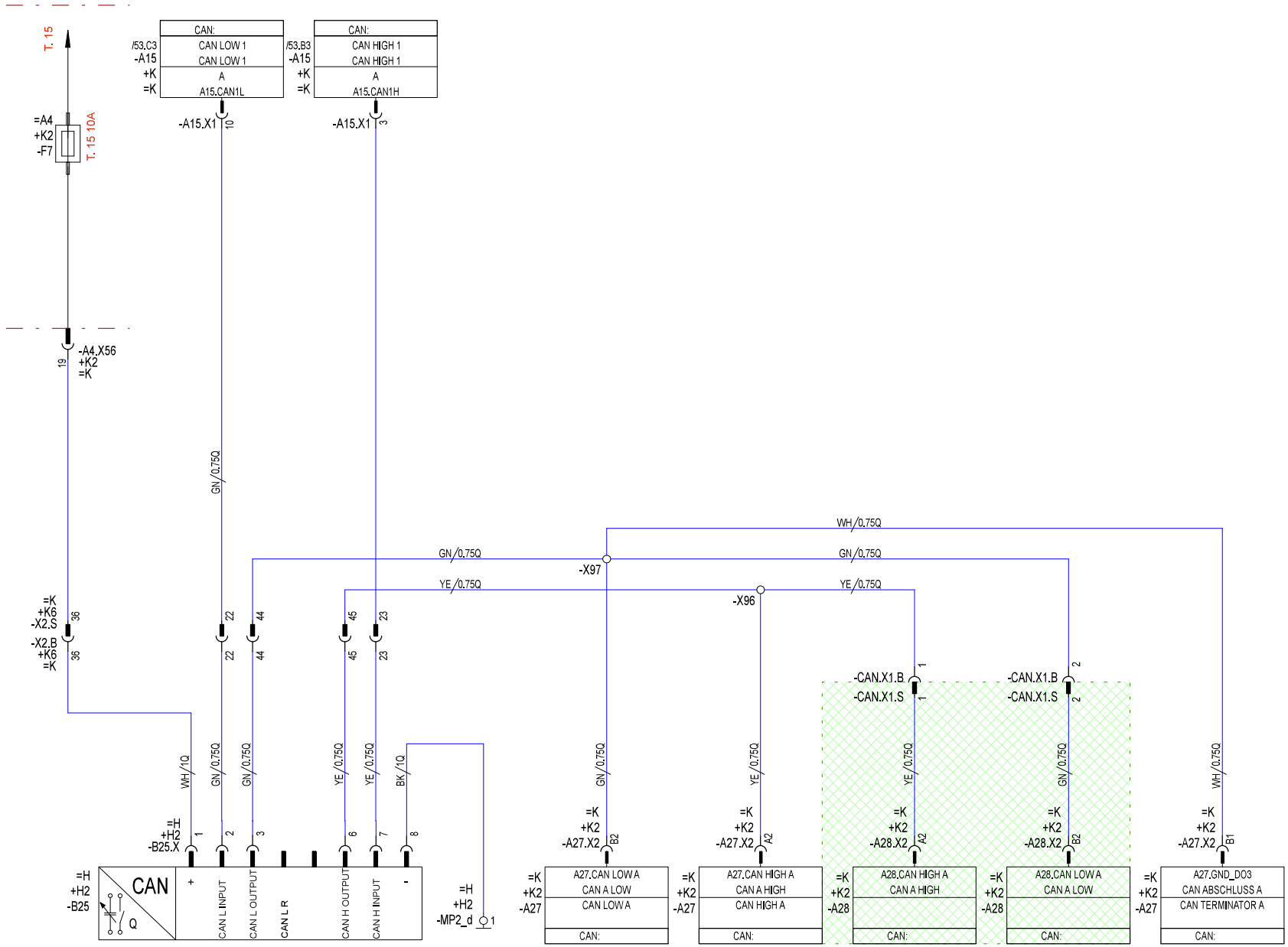
OPTION BEACON



PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00
ITEM CODE 13442271
DRAWING INDEX 000

MACHINE TYPE	SERIAL NUMBER		
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	OPTION BEACON ELECTRICAL SCHEMATIC

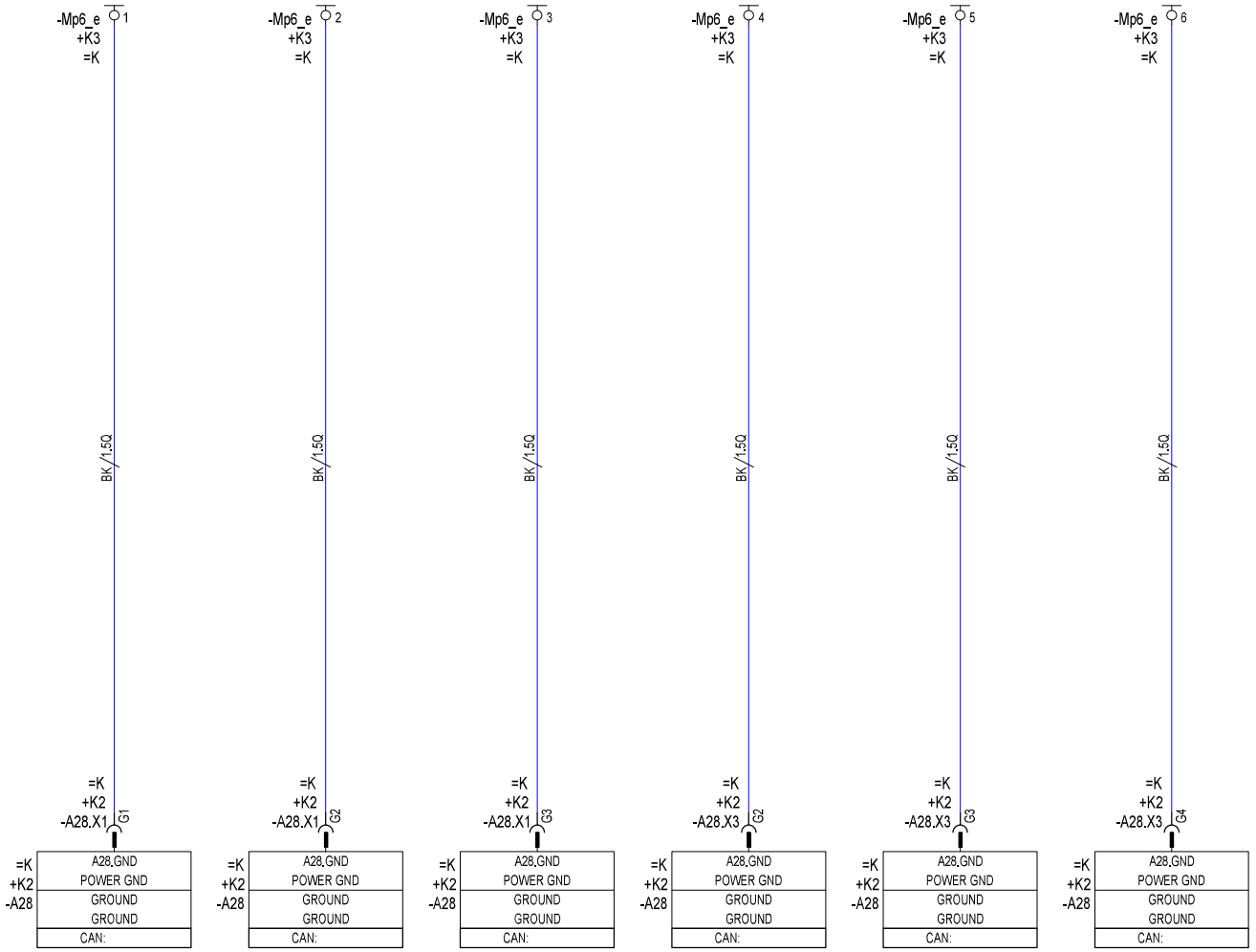
PAGE 40 OF
CREATION DATE 23.07.2020 13:12



PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00
ITEM CODE 13442271
DRAWING INDEX 000

MACHINE TYPE	SERIAL NUMBER		FUEL LEVEL SENSOR	PAGE 50 OF
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	ELECTRICAL SCHEMATIC	CREATION DATE 23.07.2020 13:12

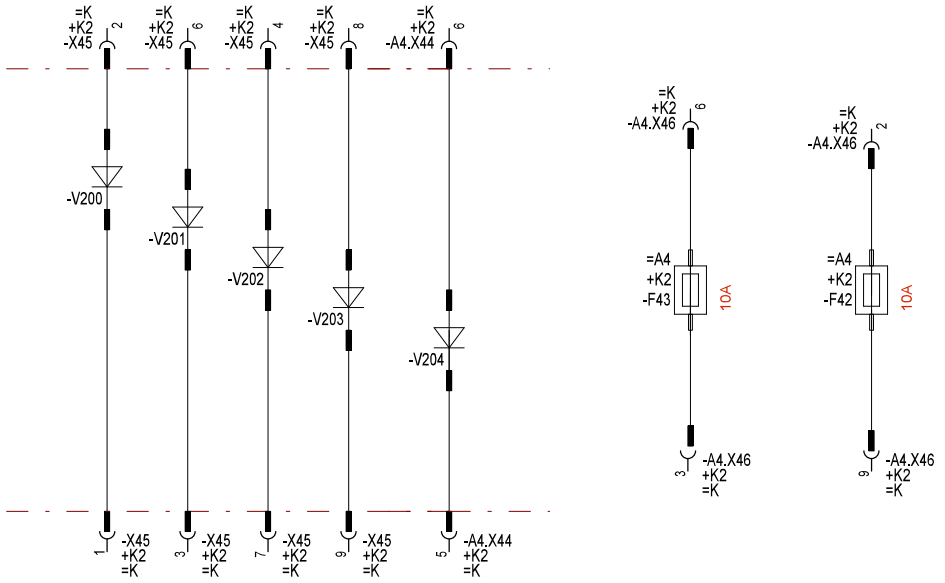
GROUND COMPACT MODULE A28



PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00
ITEM CODE 13442271
DRAWING INDEX 000

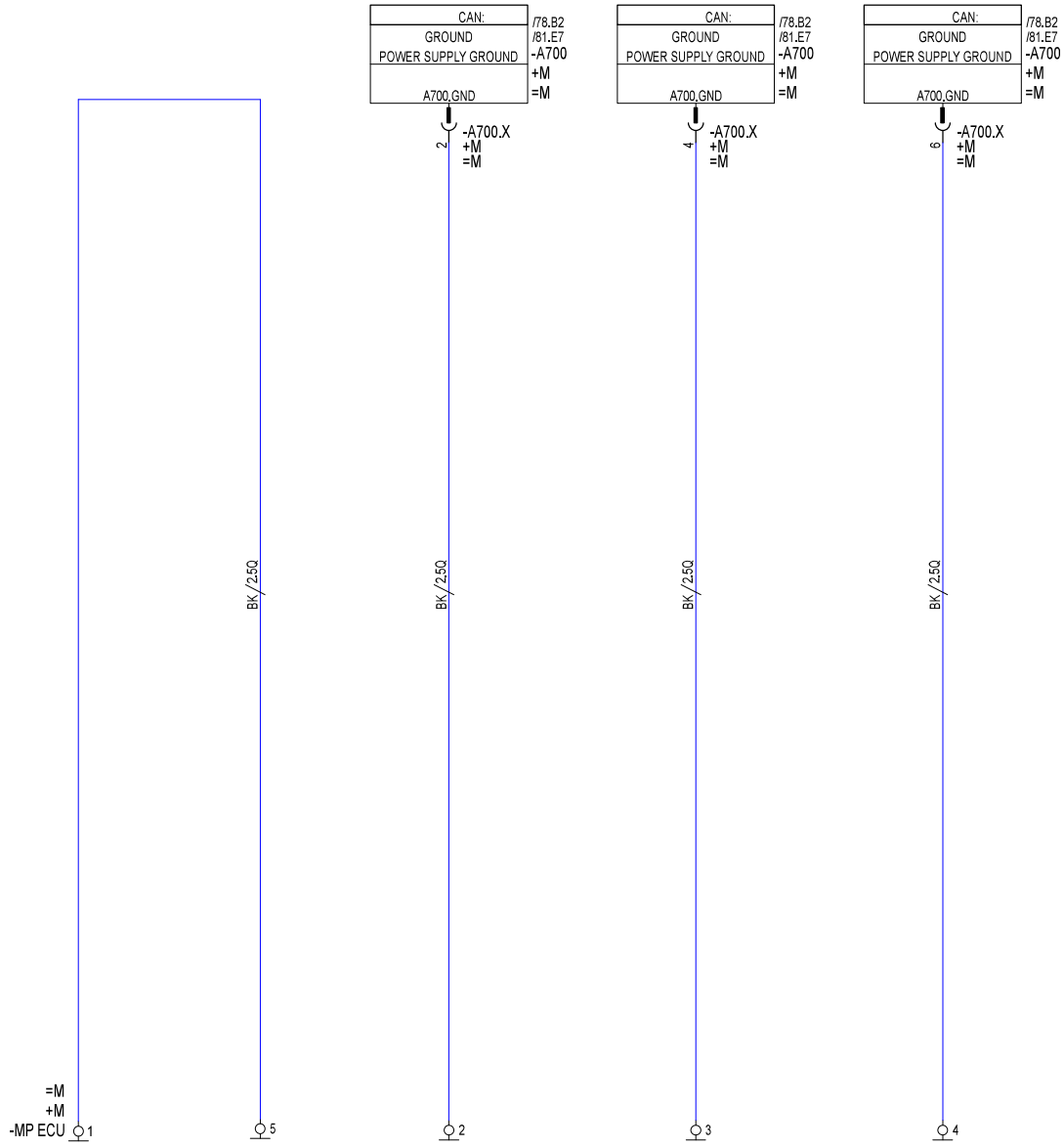
MACHINE TYPE	SERIAL NUMBER			
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	GROUND COMPACT MODULE A28 ELECTRICAL SCHEMATIC	PAGE 60 OF
				CREATION DATE 23.07.2020 13:12

PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00
ITEM CODE 13442271
DRAWING INDEX 000



MACHINE TYPE	SERIAL NUMBER		RESERVE FUSE RESERVE RELAY	PAGE 70 OF
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	ELECTRICAL SCHEMATIC	CREATION DATE 23.07.2020 13:12

GROUND ENGINE CONTROL UNIT



PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00
ITEM CODE 13442271
DRAWING INDEX 000

MACHINE TYPE	SERIAL NUMBER			PAGE 80 OF
LIDOS Gerät	XXXXX	LIEBHERR FACTORY LBH	GROUND ENGINE CONTROL UNIT ELECTRICAL SCHEMATIC	CREATION DATE 23.07.2020 13:12

OVERVIEW DIAGNOSIS CLAAS

=K	-A30.a	Modul Nr.:	
+K2		Modulname:	CLAAS/TELEMETRIE

ADDRESS	PAGE	EA	DESCRIPTION	CONNECTOR	PIN	ADDRESS	PAGE	EA	DESCRIPTION	CONNECTOR	PIN
A30.a.1	/91.F3		CAN LOW 0		1						25
A30.a.2	/91.F2		CAN HIGH 0		2						26
A30.a.3			CAN LOW 1		3						27
A30.a.4			CAN HIGH 1		4						28
A30.a.5			RS232 TX		5						29
A30.a.6			RS232 RX		6						30
A30.a.7	/91.F5		POWER SUPPLY T. 15		7						31
A30.a.8	/91.F4		GROUND		8						32
					9						33
					10						34
					11						35
					12						36
					13						37
					14						38
					15						39
					16						40
					17						41
					18						42
					19						
					20						
					21						
					22						
					23						
					24						

PROJECT L509T-1778
DRAWING NUMBER 1778 00090 01 00
ITEM CODE 13442271
DRAWING INDEX 000

110.2 Electrical components of the driver’s cab

110.2.1 Fuse boards

Valid for: L509-1778;

1 Fuse board A4

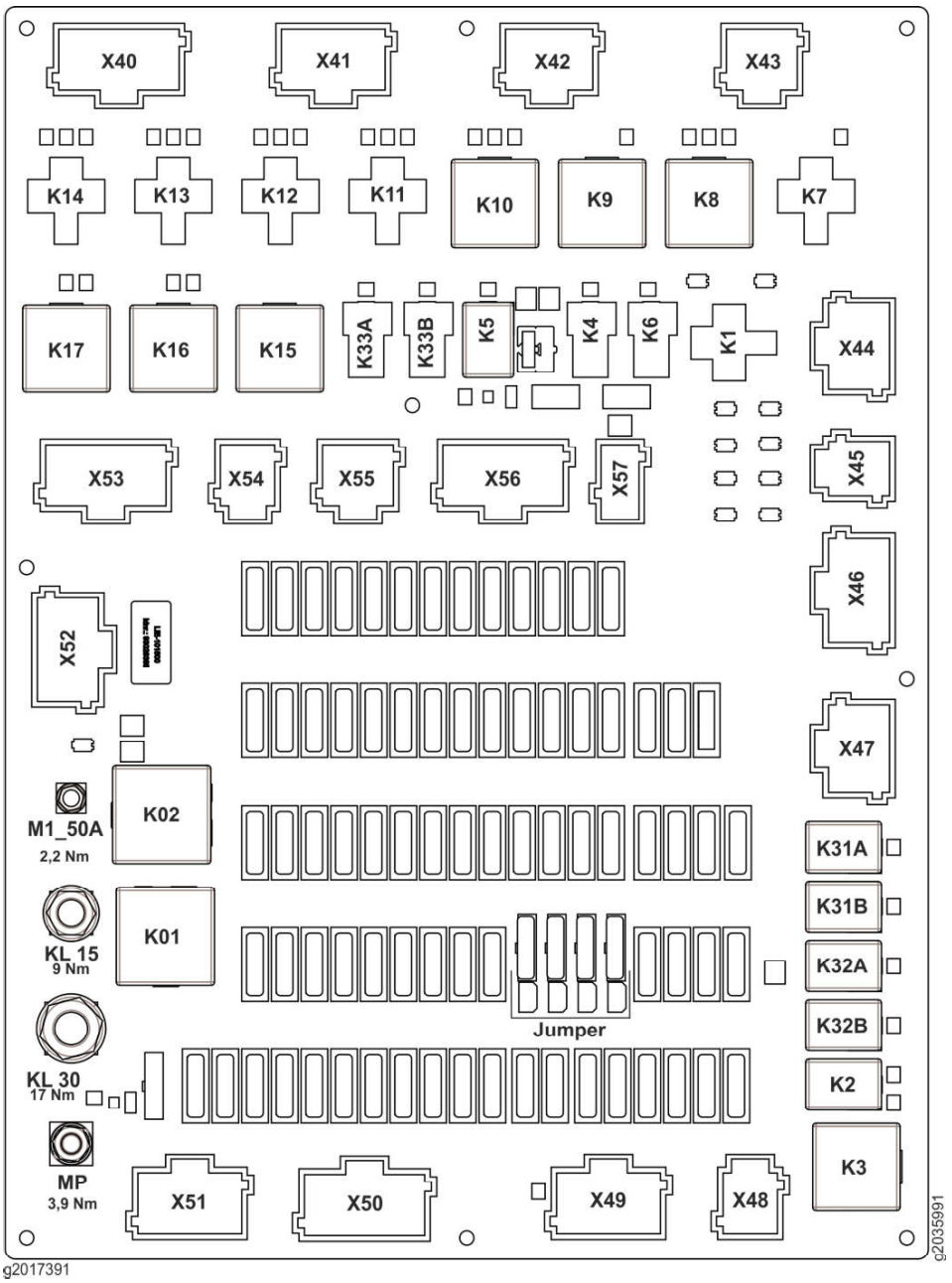


Fig. 491: Fuse board

Name	Description	Name	Description	Name	Description
SD1	Shifting unit with synchro unit	**Z2**	Gearwheel 2 (66 teeth)	**Z4**	Gearwheel 4 (51 teeth)

Tab. 191: Key

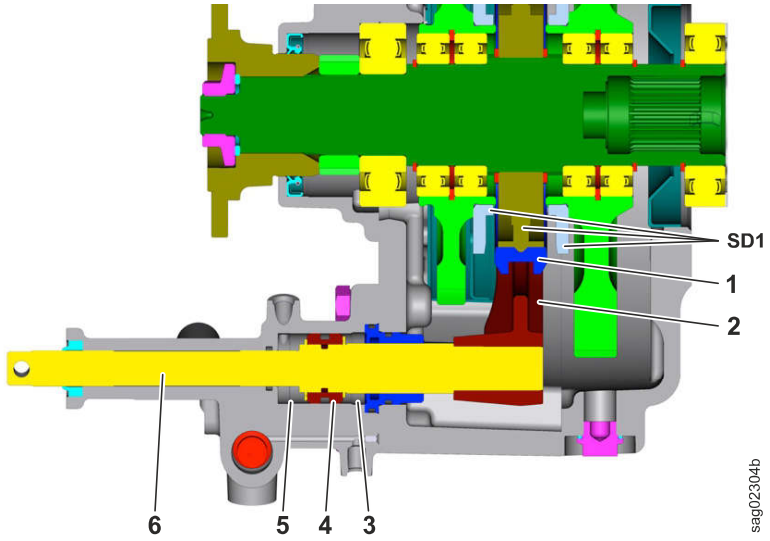


Fig. 500: Gear shifting: sectional view (in neutral position (For more information see: Neutral position, page 120-13))

1 Shift sleeve
2 Shift fork
3 Pressure chamber for 2nd gear
4 Pressure chamber for 1st gear
5 Piston
6 Shift rod

Name	Description
SD1	Shifting unit with synchro unit

Tab. 192: Key

Name	Test point
PF	External servo pressure

Tab. 204: Test points

BMK	Function
Y104	Solenoid for external servo pressure

Tab. 205: Equipment codes

Valve block for external servo pressure is installed in vehicle frame, on right next to travel motor.

2 Function

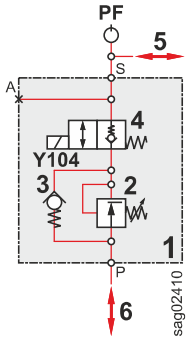


Fig. 509: Valve block for external servo pressure: hydraulic diagram (travel direction is selected)

1 **Valve block for external servo pressure**
2 External servo pressure reducing valve
3 Check valve for external servo pressure
4 Solenoid valve for external servo pressure
5 Connection to hydro accumulator for external servo pressure
6 Connection to travel motor

Name	Test point
PF	External servo pressure

Tab. 206: Test points

BMK	Function
Y104	Solenoid for external servo pressure

Tab. 207: Equipment codes

Pressure reducing valve block **1** is always supplied with high pressure from travel hydraulics via travel motor **6**, regardless of travel direction.

External servo pressure reducing valve **2** reduces high pressure of oil from travel hydraulics to 210 bar and directs it via external servo pressure solenoid valve **4** to external servo pressure hydro accumulator **5**.

LBH/-/00/211-20200828_082818/en

2 Function

2.1 Basic function

The axle performs the following functions:
- Transmitting torque and engine speed to the wheels.
- Increasing the output torque by gearing down in the crown wheel and planetary gear.
- Braking machine using wet disc brake (service brake).

2.2 Engageable differential lockout

The differential can be 100% locked by pressing a button on the control lever. A claw coupling locks the differential and in this way connects the two output sides of axle to each other. (For more information see: Overview of engageable differential lockout, page 130-6)

2.3 Wet disc brake (service brake for 1st brake circuit and parking brake)

The wet disc brake contains several brake discs arranged in succession. The brake discs have a non-twisting connection alternately with the output and axle housing. The brake discs rotate in axle oil to cool them.

During braking, the service brake piston or the parking brake piston clamps the brake discs. The friction between the discs generates the braking effect.

The force of the service brake piston is generated with oil from the inch/brake unit.

The force of the parking brake piston is generated by cup springs. The parking brake is opened hydraulically.

2.4 Drum brake (service brake for 2nd brake circuit)

(For more information see: 100.2.4 Drum brake, page 100-16)

2.5 Wheel hub

There is a planetary gear in the wheel hub. The planetary gear reduces the speed and increases the torque.

LBH-/00/211-20200828_082818/en

The bearing is fastened by the bearing covers bolted onto both sides. The bearing pins are held firmly in place in the bearing holes of the rear and front sections by tensioners.

Sealing rings protect the bearing points from dirt.

140.1.2 Articulation lock

Valid for: L509-1778;

1 Layout

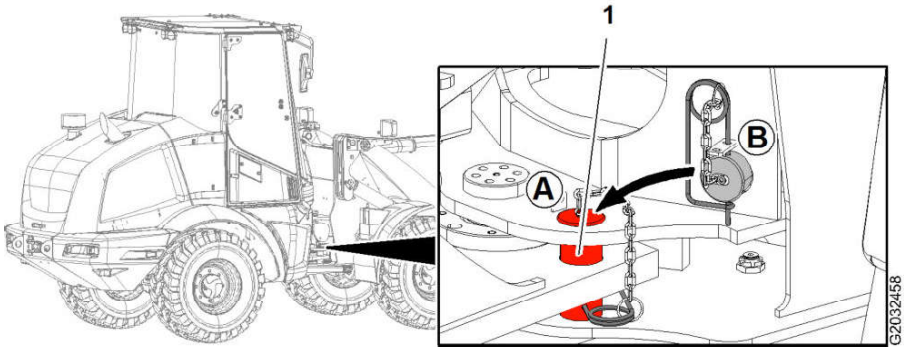


Fig. 524: Releasing articulation lock

1 Retaining pin
A Articulation lock engaged
B Articulation lock open

The articulation bearing is fitted between the front and rear sections.

2 Function

The articulation lock creates a rigid connection between the front and rear sections. Steering is no longer possible.

This means the steering is blocked, for example, when transporting the machine or for maintenance.

LBH-/00/211-20200828_082818/en

Malfunction	Cause	Remedy
High-pressure switch switches off	Too much refrigerant in the air conditioning circuit	Correct the refrigerant level
	Air in the air conditioning circuit	Evacuate and refill the air conditioning system
	Condenser blocked	Check the condenser
Low-pressure switch switches off	Not enough refrigerant in the air conditioning circuit	Correct the refrigerant level
	Expansion valve blocked	Check the expansion valve
Bubbles in the sight glass	Too much refrigerant in the air conditioning circuit	Correct the refrigerant level
	Not enough refrigerant in the air conditioning circuit	Correct the refrigerant level
Not enough cooling	Not enough refrigerant in the air conditioning circuit	Correct the refrigerant level
	Air in the air conditioning circuit	Evacuate and refill the air conditioning system
	Expansion valve blocked	Check the expansion valve
	Condenser blocked	Check the condenser
	Valve plates in the air conditioning compressor are defective	Check the valve plates

Tab. 220: Air conditioning troubleshooting table

2.4 Cab air filter

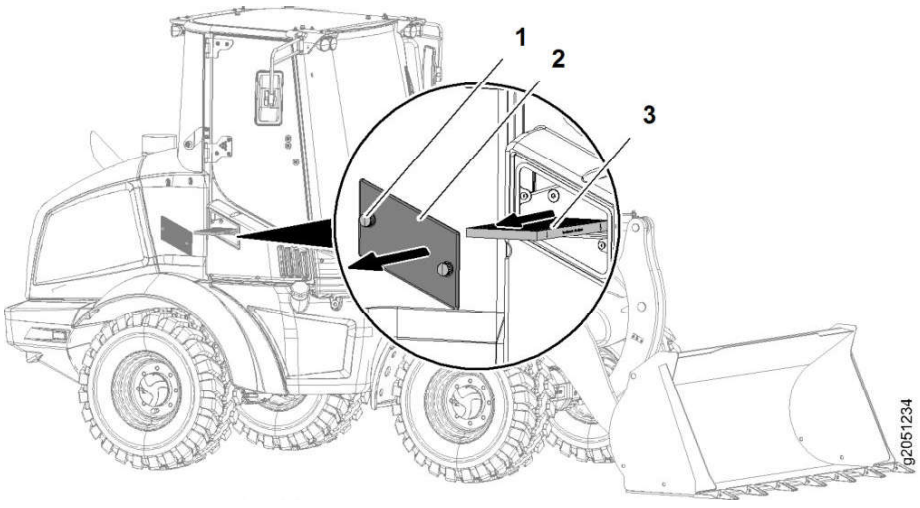


Fig. 530: Cab air filter

1 Screws
2 Cover
3 Cab air filter

2.1.1 Indicator bead and filling level bead

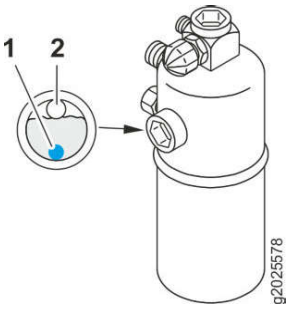


Fig. 538: Indicator bead and filling level bead

1 Indicator bead **2** Filling level bead

The smaller bead is the indicator bead **1**. The indicator bead is coloured. If the indicator bead becomes transparent, there is too much water in the refrigerant.

The filling level bead **2** shows the current refrigerant level in the refrigerant circuit.

The refrigerant level varies according to the operating status of the air conditioning system. This means that the filling level bead does not necessarily indicate that there is enough refrigerant left in the circuit.

160.3.5 Air conditioning pressure switch

Valid for: L509-1778;

1 Layout

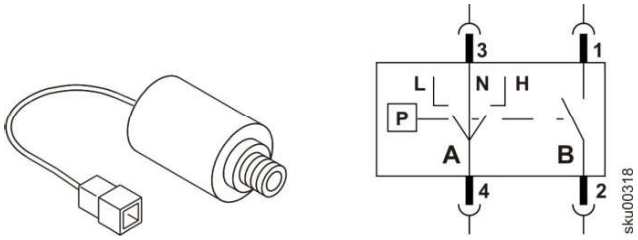


Fig. 539: Air conditioning pressure switch with equivalent circuit diagram

A High and low pressure monitor pressure switch **B** Pressure switch (not used)

The air conditioning pressure switch (B27) is attached to the dryer of the air conditioning circuit.

The air conditioning pressure switch consists of two pressure switches that are activated by the same pressure level.

The pressure switch **B** is not used.

2.1 Basic function

The high and low pressure monitor pressure switch **A** monitors the pressure in the air conditioning circuit. If the pressure is too low or too high, it deactivates the magnetic coupling and therefore the air conditioning compressor.

If the pressure is too low or too high, there is a risk of damaging the components of the air conditioning circuit.

LBH/--/00/211-20200828_082818/en

190 Options

Contents

190.1	LiDAT		190-2
	190.1.1	Overview of LiDAT *L509-1778;*	190-2
	190.1.2	LiDAT on machine *L509-1778;*	190-4
	190.1.3	LiDAT module (LiTU3) *L509-1778;*	190-5

LBH/-/00/211-20200828_082818/en