en **Service manual**

Wheel loader

Document ID

Order number: 11827693
Issued: 08-2018
Version: 04
Author: LBH / Technical Documentation Department

Product ID

Manufacturer: Liebherr Machinery (Dalian) Co. Ltd.
Valid for: L 538-1493

Contact

Liebherr Machinery (Dalian) Co. Ltd.
No.30, Wanli Street
Dalian

LBH/11827693/04/211-20180814_111345/en

LBH/11827693/04/211-20180814_111345/en

8. Run the diesel engine until both it and the hydraulic oil are at operating temperature. Low oil temperatures lead to sluggish performance.
9. Check that the controls of the working attachment are working properly.
10. Carefully drive the machine to open ground and check the service brake, the steering, the signals and lighting.

010.1.6 Instructions for safe working

1. Before starting work, familiarise yourself with the features of the site, as well as any special regulations and warning signals.
   The working environment includes obstacles in the working area and on access roads, the firmness of the terrain and any protective barriers to prevent the public from entering the site.
2. Always keep a safe distance from overhangs, drops, slopes and unsafe terrain.
3. Be particularly careful with variable terrain conditions, poor visibility and changeable weather.
4. Find out where the supply pipes to the site are, and take particular care when working near them. If necessary, notify the relevant authorities.
5. Keep a safe distance away from overhead power lines.
   When working near overhead power lines, keep the working attachment well away from these.
   - There is a risk of **FATAL INJURY**.
   - Find out about the safety clearances to be observed.

   If the machine comes into contact with live power lines:
   - Do not get out of the machine.
   - If possible, move the machine to a safe distance away from the danger area.
   - Warn any bystanders not to approach or touch the machine.
   - Arrange for the power to be switched off.
   - Only get out of the machine when you are sure that the power line you have touched or damaged has been switched off.
6. Before driving or working with the machine, check that the accessories are safely stowed away.
7. When driving on public roads, paths and spaces, observe the traffic regulations, and make sure the machine is in a fit condition to use public roads if this is not already the case.
8. Always switch on the lights in darkness and poor visibility.
9. Do not take passengers on the machine.
10. Only work when seated and wearing a safety belt.
11. Report any malfunctions and make sure that any necessary repairs are completed immediately.
12. Check personally to ensure that no-one is endangered when the machine starts moving.
13. Before starting work, check the brake system as instructed in the **operator's manual**.
14. Never get out of the operator's seat while the machine is still in motion.
15. Never leave the machine unattended with the diesel engine running.
16. When driving the machine, lower the working attachment to the transport position and carry the load as close as possible to the ground.
17. Avoid movements which could cause the machine to tip over.
    If the machine does start to tip over or slide sideways, put down the working attachment immediately and point the machine downhill.
    Wherever possible, work up or downhill and not sideways to the slope.
18. Drive carefully on rocky or slippery terrain and on slopes.
19. Only drive downhill within the permitted speed limit, otherwise you could lose control of the machine.

LBH/11827693/04/211-20180814_111345/en

The following factors influence the size of the danger area:
– The travel speed and movement of the machine
– The working attachment installed
– The type of loading material
– The risk of the loading material falling

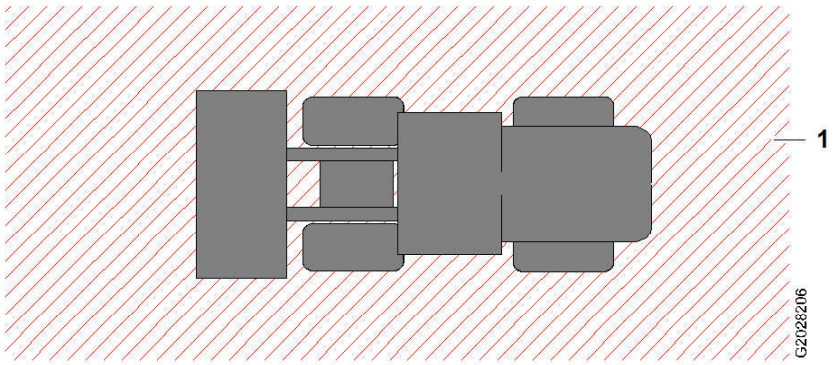


Fig. 1: Danger area of the machine (top view)

1 Danger area

LBH/11827693/04/211-20180814_111345/en

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 7	8.8	15.3	13.9*	M 7	8.8	15.0	16.1
	10.9	22.5	20.4*		10.9	22.0	23.6
	12.9	26	23.9*		12.9	26	28
M 8	8.8	19.3	20.6*	M 8	8.8	18.9	23.8
	10.9	28	30*		10.9	28	35
	12.9	33	35*		12.9	32	41
M 8 x 1	8.8	21.0	21.7*	M 8 x 1	8.8	20.5	25
	10.9	31	32*		10.9	30	37
	12.9	36	37*		12.9	35	43
M 9 x 1	8.8	27	31*	M 9 x 1	8.8	27	36
	10.9	40	46*		10.9	39	53
	12.9	47	53*		12.9	46	62
M 10	8.8	31	40	M 10	8.8	30	47
	10.9	45	59		10.9	44	68
	12.9	53	69		12.9	52	80
M 10 x 1	8.8	35	44	M 10 x 1	8.8	34	51
	10.9	51	64		10.9	50	75
	12.9	60	75		12.9	59	88
M 10 x 1.25	8.8	33	42	M 10 x 1.25	8.8	32	49
	10.9	48	62		10.9	47	72
	12.9	56	72		12.9	55	84
M 12	8.8	45	69	M 12	8.8	44	80
	10.9	66	102		10.9	64	118
	12.9	77	119		12.9	75	140
M 12 x 1.25	8.8	50	74	M 12 x 1.25	8.8	49	86
	10.9	73	109		10.9	71	125
	12.9	85	125		12.9	84	150
M 12 x 1.5	8.8	47	72	M 12 x 1.5	8.8	46	83
	10.9	69	105		10.9	68	122
	12.9	81	123		12.9	79	145

No.	Preload torque	Piston		Piston nut		Thread
WN 4121..	[Nm]	Path of torsion [mm]	Angle of torsion ~[°]	Path of torsion [mm]	Angle of torsion ~[°]	M [mm]
104	100	12^{+1}	28	-	-	50x2
108	100	16^{+1}	37	-	-	50x2
111	100	16^{+1}	33	18^{+1}	37	56x2
112	100	17^{+1}	35	18^{+1}	37	56x2
113	100	17^{+1}	35	19^{+1}	39	56x2
114	100	19^{+1}	39	-	-	56x2
115	100	18^{+1}	37	-	-	56x2
116	100	19^{+1}	39	-	-	56x2
117	100	17^{+1}	35	-	-	56x2
118	100	15^{+1}	31	-	-	56x2
119	100	17^{+1}	35	-	-	56x2
121	150	15^{+1}	29	19^{+1}	36	60x2
123	150	17^{+1}	32	19^{+1}	36	60x2
125	150	18^{+1}	34	-	-	60x2
126	150	14^{+1}	27	-	-	60x2
127	150	22^{+1}	42	-	-	60x2
128	150	20^{+1}	38	-	-	60x2
129	150	14^{+1}	27	19^{+1}	36	60x2
131	150	15^{+1}	28	-	-	60x2
132	150	17^{+1}	32	-	-	60x2
151	150	15^{+1}	27	19^{+1}	34	65x2
152	150	20^{+1}	35	19^{+1}	34	65x2
153	150	20^{+1}	35	-	-	65x2
156	150	17^{+1}	30	-	-	65x2
157	150	20^{+1}	35	-	-	65x2
160	150	20^{+1}	35	-	-	65x2
161	150	14^{+1}	25	-	-	65x2
171	150	12^{+2}	20	18^{+1}	30	68x2
172	150	21^{+2}	35	18^{+1}	30	68x2
173	150	19^{+2}	32	18^{+1}	30	68x2
174	150	25^{+2}	42	18^{+1}	30	68x2
175	150	25^{+2}	42	18^{+1}	30	68x2
176	150	19^{+2}	32	18^{+1}	30	68x2
177	150	19^{+2}	32	18^{+1}	30	68x2
179	150	11^{+2}	19	18^{+1}	30	68x2

LBH/11827693/04/211-20180814_111345/en

020 Technical data

Contents

LBH/11827693/04/211-20180814_111345/en

020.3.10 P kinematics tilt cylinder

Valid for: L538-1493/31405-;

Description	Unit	Value
Piston diameter	mm	90
Piston rod diameter	mm	50
Stroke length	mm	935
Minimum installation length	mm	1240
Tilt-out (unloaded)		3.5 seconds
Weight	kg	57.5

LBH/11827693/04/211-20180814_111345/en

020.9 Gearbox

020.9.1 Transmission

Valid for: L538-1493/31405-;

Description	Unit	Value
Type		319
Travel motor 1 ratio		1.55
Travel motor 2 ratio		3.83
Output speed at 40 km/h	rpm	2795

020.9.2 Output speed sensor B1 and travel motor 2 speed sensor B2

Valid for: L538-1493/31405-;

Description	Unit	Value
Type		Hall sensor
Resistance at 20 °C	ohms	$1050^{\pm 100}$
Teeth at output speed sensor B1		76
Teeth at travel motor 2 speed sensor B2		34

LBH/11827693/04/211-20180814_111345/en

LBH/11827693/04/211-20180814_111345/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
						✦		Checking the seals on the driver's cab		030-114
			❍	❍	❍			Checking the indicator bead in the air conditioning dryer-collector unit (option)		030-114
			❍	❍	❍			Testing the air conditioning unit		030-115
Lubrication system										
☐		●	❍	❍	❍			Checking the lubrication system grease reservoir level		030-116
☐		●	❍	❍	❍			Checking the pipes, hoses and lubrication points of the lubrication system		030-116
☐		●	❍	❍	❍			Checking whether metered quantities are adequate at the bearing points (grease collars) of the lubrication system		030-117

LBH/11827693/04/211-20180814_111345/en

Liebherr oils

Liebherr recommends **Liebherr Hydraulic Plus** for the machine.

Third-party manufacturer oils

If you are unable to purchase this oil locally, only oils based on fully saturated synthetic ester (HEES) may be used after consultation with your local customer service.

When using synthetic esters, we recommend changing the hydraulic hoses after 4000 service hours or after four years at the latest.

Vegetable oils are not permitted because of their poor resistance to high temperatures.

030.3.7.5 Changing the oil, analysing the oil, changing filters

Oil change

Oil type	Oil change		
	Not used as bio oil		Bio application (only permitted with oil analysis[A])
	Without oil analysis	With oil analysis[A] (optional)	
Liebherr mineral oil	Every 3000 h	Every 6000 h	–[B]
Liebherr Hydraulic Basic 68			
Liebherr Hydraulic Basic 100			
Liebherr Hydraulic HVI			
Liebherr PAO (polyalphaolefin)	Every 4000 h	Every 8000 h	Every 8000 h
Liebherr Hydraulic Plus			
Third-party product - mineral oil	Every 2000 h	Every 2000 h	–[B]
Third-party product - fully saturated synthetic ester	–[B]	–[B]	Every 2000 h

Tab. 32: Oil change intervals

A) If the result of the oil analysis is positive, the oil may be used for longer. If the result of the oil analysis is negative, the oil must be changed immediately.
B) Combination not permitted

Bio application means that the use of biodegradable or environmentally friendly hydraulic oil is prescribed at the operating site of the machine.

If a machine is operated for less than 1000 hours a year, an oil sampling is required once a year. Hydraulic oil staying for a long time in the machine should, however, be changed at the latest after four years (mineral oils and fully saturated synthetic esters) and at the latest after six years (Liebherr-Plus oils).

If a machine is inactive for longer than six months, an oil analysis is required before resuming operation.

Note
Ensure safe machine operation.

▶ Remove any loose parts, coarse dirt, mud, ice, snow etc.

▶ Carefully clean the machine with a high-pressure cleaner.
▷ (For more information see: Cleaning the machine, page 030-33)

030.4.3.3 Cleaning the machine

Valid for: L538-1493/31405-;

Thoroughly clean the machine of all dirt and deposits in the following situations:
– After completing each job
– Before maintenance
– Before repairs

NOTICE
Beware of corrosive materials and working environments.
Corrosion may damage the machine or impair its functions (for example when in contact with corrosive materials or when working in corrosive environments).

▶ Thoroughly clean the machine at the end of the job.

Thorough cleaning prevents dirt and foreign particles from entering the machine. Clean oil, fuel and maintenance products from all connections and bolts.

The machine must be particularly cleaned after the following jobs:
– Working in salty environments (in winter, after contact with road salt during transport on icy roads, when working near the sea or at ports etc.)
– Working with alkaline or acidic compounds
– Working with corrosive materials (lime compounds, cement etc.)

Note
High-pressure cleaners (steam cleaners) can damage the paintwork.

▶ Do not use high-pressure cleaners in the first two months of using the machine (or after a respray).

▶ Observe the operating instructions for the high-pressure cleaner. Note the information on the pressure and the distance from the high-pressure nozzle to the object to be cleaned.

Washing the machine

CAUTION
Risk of accidents from the high-pressure jet of the high-pressure cleaner.

▶ Wear appropriate protective clothing and safety glasses.

Electrical devices such as the emergency steering pump, refuelling pump, sensors and electric components are not watertight.

Every time you clean the machine with a high-pressure cleaner, regrease all lubrication points on the machine.

LBH/11827693/04/211-20180814_111345/en

Topping up the engine oil

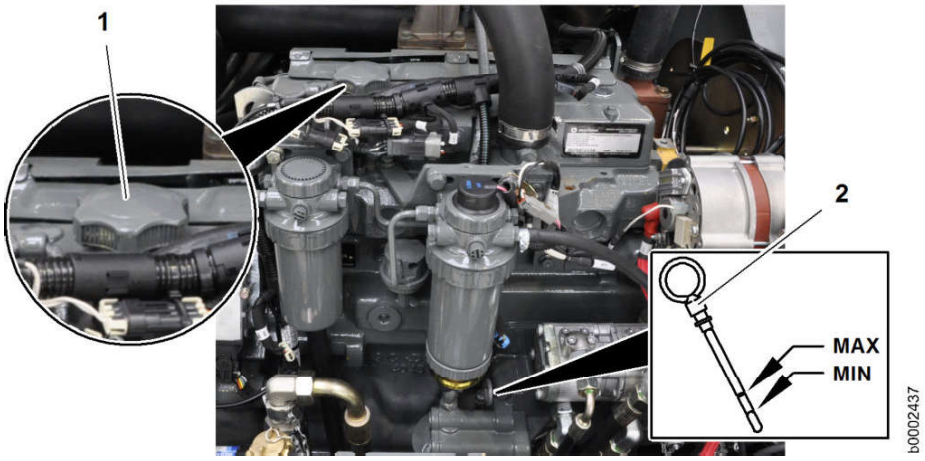


Fig. 42: Topping up the engine oil

1 Filler neck **2** Dipstick

▶ Pour new engine oil into the filler neck **1** to between the MIN and MAX markings on the dipstick **2.** (For more information see: 030.3.4 Lubricating oils for diesel engines, page 030-18)

▶ Clean the filler cap, place it on the filler neck **1** and tighten it.

▶ Start the engine and check the oil pressure.

▶ Turn off the engine.

▶ After 2 to 3 minutes, check the oil level on the dipstick **2.**
▷ Top up with oil if necessary.

030.4.4.3 Changing the engine oil filter

Valid for: L538-1493/31405-;

The oil filter is installed in the centre of the engine compartment.

Make sure that the following requirements are fulfilled:
❑ The machine is in maintenance position 1.
❑ The engine compartment hood is open.
❑ You have a strap wrench ready.
❑ You have a suitable receptacle and genuine Liebherr oil filter cartridges ready.

LBH/11827693/04/211-20180814_111345/en

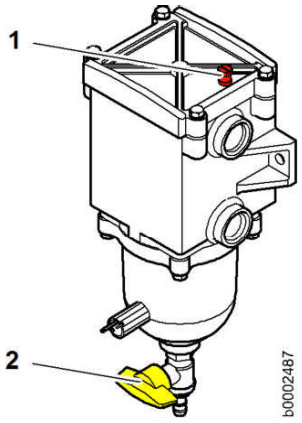


Fig. 54: Draining off condensate from the Separ fuel pre-filter

1 Bleeder screw **2** Drain valve

Note
To prevent condensate flowing back into the fuel tank:

▶ Open the bleeder screw in front of the drain valve.

▶ Place a receptacle under the Separ fuel pre-filter.

▶ Open the bleeder screw **1**.

▶ Open the drain valve **2** until clean fuel flows out.

When clean fuel flows out:

▶ Close the drain valve **2**.

▶ Close the bleeder screw **1** with a tightening torque of 6 Nm.

030.4.4.11 Draining off condensate from the fuel pre-filter

Valid for: L538-1493/31405-;

When the water level probe in the fuel pre-filter is activated (the service code is displayed), the water collector tank must be drained.

Make sure that the following requirements are fulfilled:

❑ The machine is in maintenance position 1.
❑ The service access is open.
❑ You have a suitable receptacle ready.
❑ The engine has cooled down.

DANGER
Beware of fire

▶ Naked flames and smoking are prohibited.

LBH/11827693/04/211-20180814_111345/en

NOTICE
Do not use a damaged filter element
Otherwise the engine may be damaged.

▶ Replace damaged filter elements.

▶ Release the lock **3** on the service cover **2**.

▶ Turn the service cover **2** anticlockwise and remove it.

▶ Remove the main element **4** and check it for damage before cleaning it.

Cleaning the main element

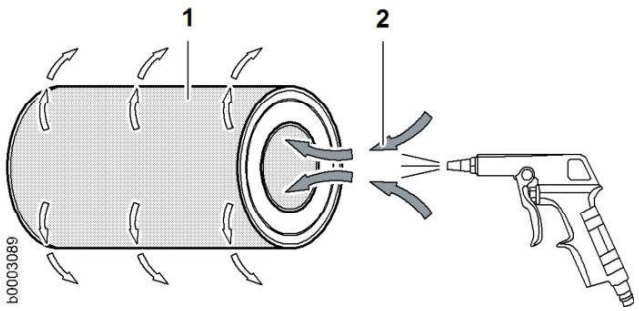


Fig. 64: Cleaning the main element

1 Main element
2 Compressed air

NOTICE
Always carry out cleaning correctly
Take care not to damage the main element.

▶ Do not use compressed air at too high a pressure.

▶ Clean the main element with clean, oil-free compressed air.

▶ Do not knock out the main element.

▶ Clean the main element **1** from the inside out with compressed air **2**.

Cleaning the service cover and filter housing

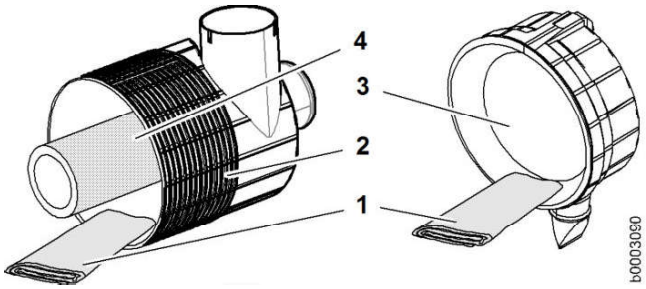


Fig. 65: Cleaning the service cover and filter housing

1 Cloth
2 Filter housing
3 Service cover
4 Safety element

NOTICE
Beware of damage to the cooling system
Careless handling can damage the cooler fins.

▶ Do not use hard objects or excessive water pressure for cleaning.

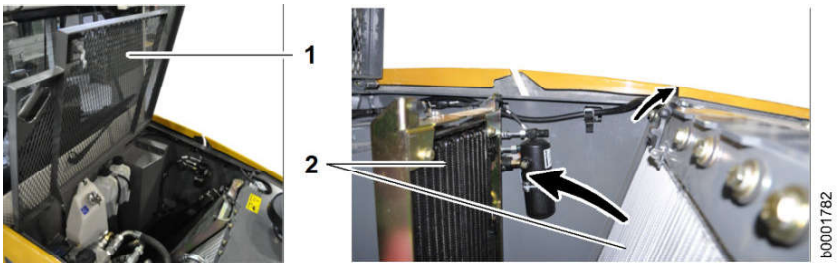


Fig. 76: Cleaning the cooling system

1 Cooling system grille
2 Cooler unit

▶ Open the cooling system grille **1**.

▶ Clean the cooler unit **2** with a high-pressure cleaner or compressed air.

▶ Close the cooling system grille **1**.

030.4.5.4 Changing the coolant

Valid for: L538-1493/31405-;

Make sure the following preconditions are met:
- ❑ The machine is cold.
- ❑ The machine is in maintenance position 1.
- ❑ The service hatches are open.
- ❑ You have a drain hose ready.
- ❑ You have a suitable collecting pan ready.
- ❑ The specified coolant is available. (For more information see: 030.2.2 Recommended operating fluids, page 030-15)

Draining the coolant

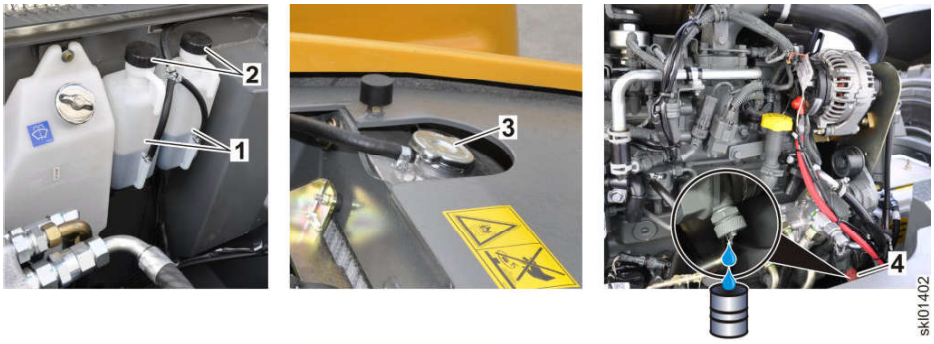


Fig. 77: Draining the coolant

1 Equalising reservoir
2 Equalising reservoir sealing caps
3 Cooler cap
4 Drain valve for coolant

LBH/11827693/04/211-20180814_111345/en

Draining hydraulic oil

Fig. 89: Draining hydraulic oil

1	Breather filter	**3**	Cover of return strainer
2	Plug	**4**	Hydraulic tank drain valve

- ▶ Insert the plug **2** in the breather filter **1**.
  - ▷ The anti-twist device of the breather filter is released.
- ▶ Unscrew the bleeder filter **1**.
  - ▷ The tank preload pressure is released.
- ▶ Unscrew the cap of the hydraulic tank drain valve **4**.

CAUTION
Risk of scalding due to hot hydraulic oil.

- ▶ Avoid contact with the skin.
- ▶ Wear protective clothing (oil-proof gloves and goggles).

- ▶ Screw the drain hose on to the drain valve of the hydraulic tank **4**.
- ▶ Drain the hydraulic oil into the collecting pan.
- ▶ Unscrew the drain hose and screw on the sealing cap.
- ▶ Unscrew the return strainer cover **3**.
- ▶ Take out the return strainer.
- ▶ Check the return strainer for excessive dirt and coarse particles.

Note
Excessive dirt and coarse particles in the return strainer indicate damage in the hydraulic system.

- ▶ Check the hydraulic system for damage if the return strainer is very dirty.

- ▶ Clean the return strainer.
- ▶ Put in the return strainer.

LBH/11827693/04/211-20180814_111345/en

CAUTION
Beware of fires caused by the heat of the working floodlights.

▶ Observe the minimum interval of 1 m to persons and material.

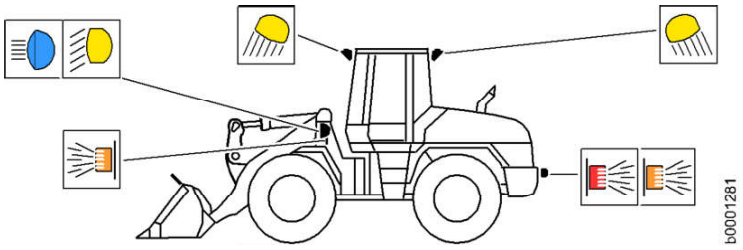


Fig. 99: Checking the lights

▶ Turn on all the lights.

▶ Check all the lights work properly.

When checking the brake lights:
▶ Press the inch/brake pedal.

To check the reversing headlights:

▶ Start the machine.

▶ Release the parking brake.

▶ Select “reverse” travel direction.

▶ Check the reversing headlights.

If lights have to be adjusted or defective bulbs replaced:
▶ Contact Liebherr customer service.

030.4.10.2 Checking the batteries, fluid level and terminals

Valid for: L538-1493/31405-;

The batteries are installed in the right ballast weight.

The batteries must always be in perfect condition in order for the machine to work reliably.

Make sure the following preconditions are met:
❑ The machine is in maintenance position 1.
❑ The battery main switch is off.
❑ Safety glasses and acid-proof protective gloves are available.
❑ The engine compartment hood is open.

LBH/11827693/04/211-20180814_111345/en

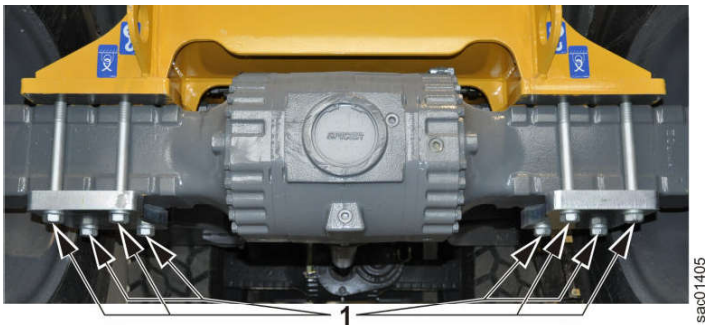


Fig. 109: Front axle fastening bolts

▶ Check the tightening torque of 850 Nm on all fastening bolts **1** (spanner size 36 mm) on the front axle.

030.4.12.4 Checking the cardan shafts

Valid for: L538-1493/31405-;

Make sure that the machine is in maintenance position 1.

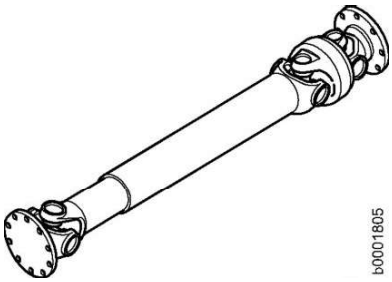


Fig. 110: Checking the cardan shafts

▶ Check the play of the drive shaft in the bearings.

▶ Check the rubber sleeve for leaks and damage.

030.4.12.5 Checking the tyre pressure

Valid for: L538-1493/31405-;

Make sure that the following requirements are fulfilled:
- ❑ The machine is in maintenance position 1.
- ❑ You have the recommended tyre pressures from the manufacturer or dealer at hand.

LBH/11827693/04/211-20180814_111345/en

▶ Put in a new filter.

▶ Close the bracket.

030.4.15.3 Checking the condition and function of the safety belt

Valid for: L538-1493/31405-;

Make sure that the machine is in maintenance position 1.

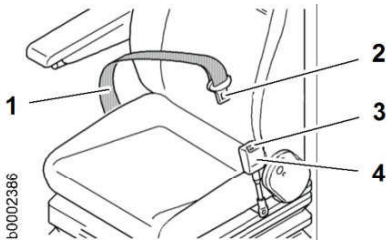


Fig. 124: Checking the condition and function of the safety belt

1	Strap	**3**	Unlock button
2	Lug	**4**	Belt lock

▶ Check the condition and function of the driver's safety belt.

▶ Replace damaged parts.

030.4.15.4 Checking and topping up the windscreen washer reservoir

Valid for: L538-1493/31405-;

The reservoir is behind the driver's cab below the grille of the cooling system.

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

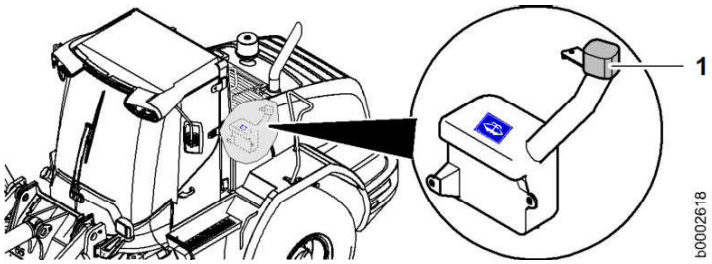


Fig. 125: Checking and topping up the windscreen washer reservoir

1 Cap

The filling quantity is approximately 3.5 l.

▶ Open the cap **1** on the reservoir.

▶ Top up with standard windscreen washer fluid as necessary.

NOTICE
Ice can damage the windscreen washer system.
Icing up can damage the windscreen washer system and cause it to fail.

▶ You must protect the windscreen washer system using antifreeze.

030.6 Testing and adjustment tasks

All work must be carried out by **specialist technicians** or under their supervision and responsibility.

Specialists technicians are people who:
- Have the requisite training and experience in operating and servicing earth-moving machinery
- Are familiar with the statutory accident prevention regulations and national guidelines
- Are able to judge whether earthmoving machinery is safe to operate
- Can carry out the required work without endangering themselves or others

030.6.1 Safety precautions

Valid for: L538-1493/31405-;

Observe the relevant **safety instructions** when carrying out all maintenance, inspection or repair work. Local health and safety regulations, accident prevention regulations and national laws must be observed.

(For more information see: 010.1.11 Measures for ensuring safe maintenance, page 010-9)

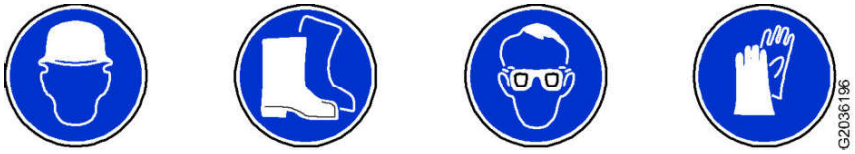


Fig. 130: Safety precautions

Make sure that following requirements are fulfilled:
- ❑ Suitable protective equipment is present.
- ❑ The driver and maintenance staff are in visual contact.

Protective equipment must be worn for some tasks:
- Hard hat
- Safety footwear
- Safety glasses
- Protective gloves

WARNING
Persons in the danger area!
Risk of injury.

▶ Make sure there is nobody in the danger area.

▶ Wear appropriate working clothing.

▶ Always maintain visual contact with the maintenance staff.

LBH/118276930/04/211-20180814_111345/en

▶ Check that the standby pressure **P** is correct.

Description	Unit	Value
Standby pressure **P**	bar	$32^{\pm 2}$

If the required value is not reached:
▶ Turn off the engine and take out the ignition key.
▶ Adjust the adjusting screw of the flow regulator **1**.

Note
To adjust the flow regulator:
▶ Turning the adjusting screw clockwise increases the standby pressure.
▶ Turning the adjusting screw anticlockwise reduces the standby pressure.

▶ Repeat the procedure and adjustment until the required value is attained.

If the required value is reached:
▶ Turn off the engine and take out the ignition key.
▶ Disconnect the pressure gauge from the high pressure test connection **P**.

030.6.5.2 Z kinematics control valve block secondary pressure relief valves

Valid for: L538-1493/31405-;

To check the secondary pressure relief valves, some of them must be set to a lower value. (For more information see: Preparatory tasks, page 030-134)

Make sure the following preconditions are met:
❑ The machine is in the maintenance position for testing and adjustment.
❑ The service hatches are open.

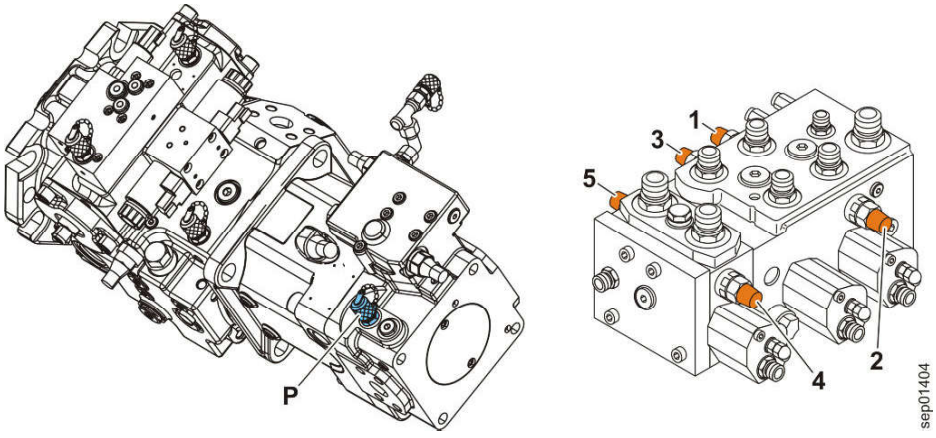


Fig. 140: Z kinematics control valve block secondary pressure relief valves

1 Secondary pressure relief valve for tilting in
2 Secondary pressure relief valve for tilting out
3 Secondary pressure relief valve for raising lift arms
4 Secondary pressure relief valve for 3rd function A3 (optional)
5 Secondary pressure relief valve for 3rd function B3 (optional)
P Working hydraulics pump high pressure test connection

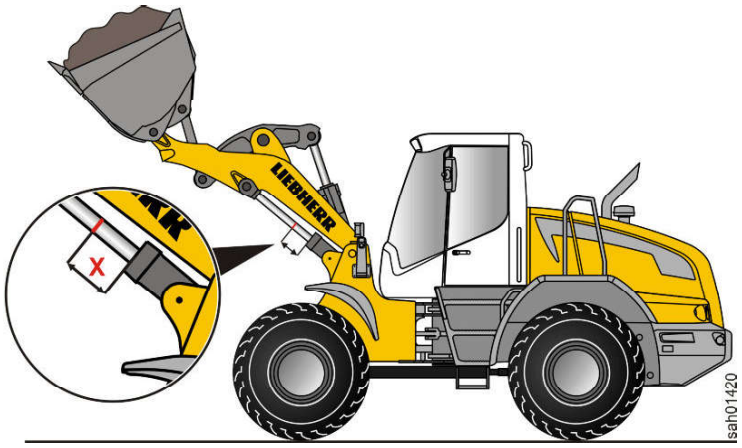


Fig. 147: Marking the position of the lift cylinder

- ▶ On the piston rod of a lift cylinder, mark the distance **X** = 100 mm to the piston rod bearing.
- ▶ Wait 10 minutes.
- ▶ Measure the distance **X** between the piston rod bearing and the mark.

Description	Unit	Value
The distance **X** must be at least	mm	64

If the distance **X** is less than the minimum:
- ▶ Check the secondary pressure relief valves for leaks (check visually, interchanging if necessary).
- ▶ Contact the technical customer service department.

If the distance **X** is more than the minimum:
- ▶ The leakage is within the tolerance range. Disconnect the pressure gauge from the load sensing pressure test connection **LS**.

Checking the tilt cylinder spool (P kinematics only)

Note

For z kinematics, the tilt cylinder spool has a low-leak valve (valve to prevent leakage). The tilt cylinder spool can therefore not be tested with Z kinematics.

LBH/11827693/04/211-20180814_111345/en

▶ Select forward or reverse travel direction and increase the engine speed to the maximum.

▶ Check that the high pressure **MH** is correct.

Description	Unit	Value
High pressure **MH** in forward travel direction **1**	bar	$495^{\pm 10}$
High pressure **MH** in reverse travel direction **2**	bar	$495^{\pm 10}$

If a required value is not reached:

▶ Turn off the engine and take out the ignition key.

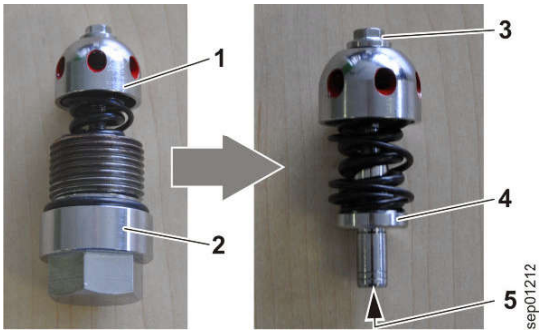


Fig. 159: High pressure relief valve

1 Valve insert
2 Plug
3 Adjusting screw
4 Valve bearing
5 Lock screw

CAUTION
Risk of scalding due to hot hydraulic oil.

▶ Avoid contact with the skin.

▶ Wear safety glasses and oil-proof protective gloves.

Note
Use a vacuum pump to prevent loss of oil.

▶ Connect the vacuum pump to the hydraulic tank, at the opening of the breather filter.

▶ Unscrew the relevant high pressure relief valve.

▶ Detach the drain plug **2** from the valve insert **1**.

▶ Unscrew the lock screw **5**.

▶ Clamp the valve bearing **4** in a vice with protective jaws.

▶ Adjust the spring preload by turning the adjusting screw **3** (a quarter turn corresponds to about 20 bar).

▶ Tighten the lock screw **5**.

▶ Screw in the high pressure relief valve.

▶ Check and repeat the adjustment until the value is correct.

LBH/11827693/04/211-20180814_111345/en

▷ Once the cut-in pressure is reached, the accumulator charge pressure **M3** increases again.

▶ Check that the cut-in pressure is correct.

Description	Unit	Value
Cut-in pressure	bar	$130^{\pm 10}$

▶ Check whether the accumulator charge pressure **M3** increases up to the cut-off pressure.

Description	Unit	Value
Cut-off pressure	bar	$160^{\pm 10}$

If the required values are not reached:

▶ Turn off the engine and take out the ignition key.

▶ Adjust the adjusting screw of the pressure balance pilot valve **1**.

Note

To adjust the cut-in pressure and cut-out pressure:

▶ Turning the adjusting screw clockwise increases the cut-in pressure and cut-out pressure.

▶ Turning the adjusting screw anticlockwise reduces the cut-in pressure and cut-out pressure.

▶ Repeat the procedure and adjustment until the required value is attained.

If the required values are reached:

▶ Turn off the engine and take out the ignition key.

▶ Disconnect the pressure gauge from the accumulator charge pressure test connection **M3**.

030.6.9.2 Service brake pressure

Valid for: L538-1493/31405-;

Make sure that the machine is in the maintenance position for testing and adjustments.

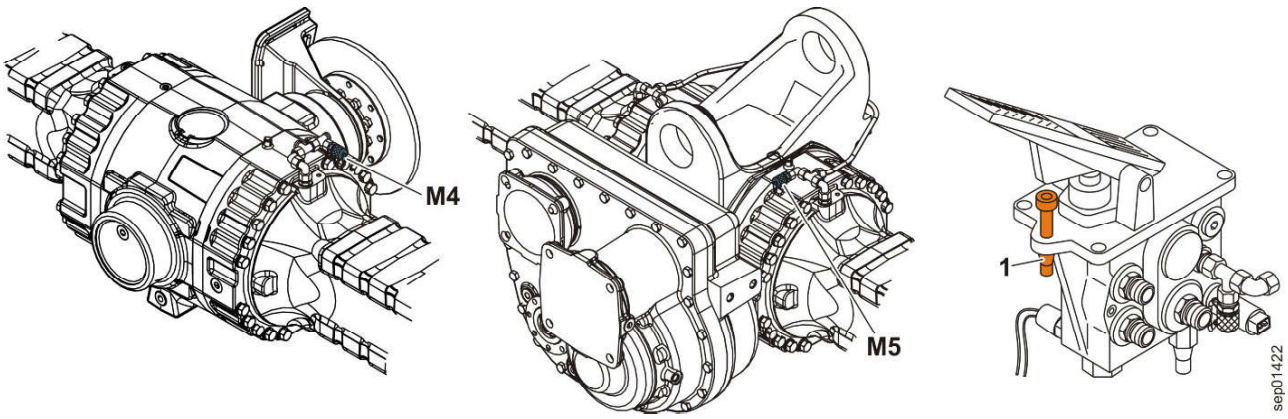


Fig. 167: Service brake pressure

Connecting to the central control unit via Terminal Plugin and changing the authorisation level to “Service”

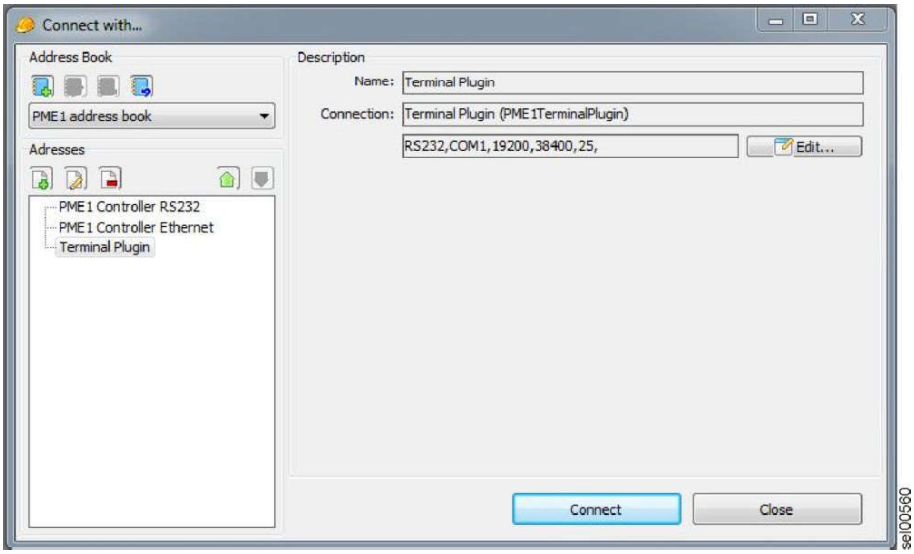


Fig. 181: Connecting to the central control unit via Terminal Plugin

▶ Start the Sculi diagnostic software and connect to the central control unit via Terminal Plugin.
▷ The login window opens.

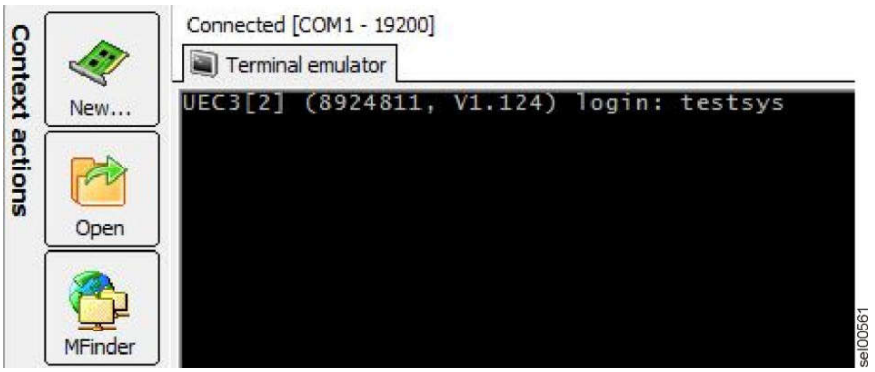


Fig. 182: Entering testsys

▶ Enter **testsys** and press “Enter” to confirm.
▷ A connection is made to the central control system.

LBH/11827693/04/211-20180814_111345/en

2.2 Documentation

Note
The operating manual and workshop manual on the diesel engine can be found in the John Deere Service Advisor or the Liebherr Service documentation.

▶ Documentation -> Diesel engines -> John Deere -> Wheel loaders -> Tier 3 -> Stage III-A -> CD4045

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 diesel engine
– Function description
– Diagnosis
– Other aids
– Technical data

2.3 Type designation

John Deere							Description
40	**45**	**H**	**F**	**2**	**8**	**6**	**Diesel engine type designation**
40							Number of cylinders: 40 = 4 cylinders
	45						Displacement: 45 = 4.5 litres
		H					With turbo charger and air-to-air intercooling
			F				OEM (John Deere Power Systems)
				2			Valves per cylinder
					8		Emission stage: 8 = Tier 3
						6	Manufacturer’s internal designation

Tab. 54: Description of the type designation

040.1.5.2 Fuel pre-filter

Valid for: L538-1493/31405-;

1 Layout

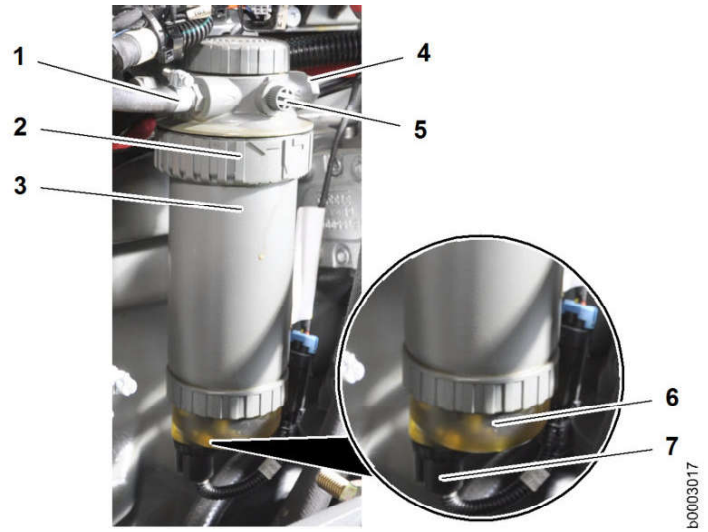


Fig. 204: Fuel pre-filter

1	Fuel inlet	**5**	Bleeder screw
2	Snap ring	**6**	Water separator container
3	Filter cartridge	**7**	Drain valve
4	Fuel outlet		

The fuel pre-filter is mounted on the engine.

2 Function

The fuel pre-filter protects the fuel system of the engine (fuel pre-delivery pump, pump elements, injection valves, pistons and valves) from most dirt and water ingress. The fuel pre-filter is installed between the Separ fuel pre-filter and the fuel pre-delivery pump. The separated water must be regularly drained via the drain valve **7** (see the maintenance and inspection schedule).

To ensure trouble-free operation, the water separator tank **6** must be cleaned if it becomes dirty.

A water sensor is integrated in the drain valve. This sensor measures the water content of the fuel which is drawn from the fuel tank.

LBH/11827693/04/211-20180814_111345/en

2 Function

2.1 Basic function

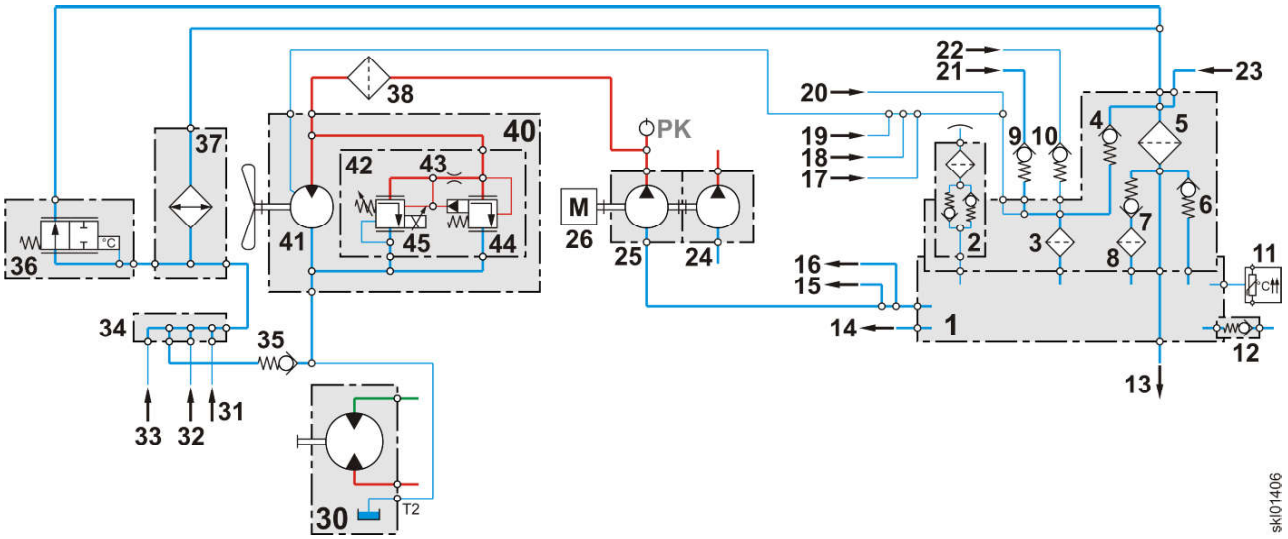


Fig. 213: Hydraulic diagram of the cooling system

1	**Hydraulic tank**	**15**	Brake system gear pump intake connection	**32**	Discharge in travel motor 2
2	Breather filter	**16**	Emergency steering pump intake connection	**33**	Travel motor 2 leak oil
3	Return strainer	**17**	Transmission return flow	**34**	Collector pipe
4	Bypass valve	**18**	Compact brake valve return flow	**35**	0.25 bar check valve
5	Return suction filter	**19**	Pilot control unit return flow	**36**	Temperature valve
6	Pre-tension valve	**20**	Working hydraulics pump leak oil	**37**	Hydraulic oil cooler
7	Feeding valve	**21**	Servostat return flow	**38**	80 µm inline filter
8	Strainer	**22**	Travel pump leak oil	**40**	**Fan gear motor**
9	9 bar check valve	**23**	Control valve block return flow	**41**	Gear motor
10	2.5 bar bypass valve	**24**	Brake system gear pump	**42**	Proportional pressure relief valve
11	Hydraulic oil temperature sensor B8	**25**	Fan gear pump	**43**	Restrictor
12	Drain valve	**26**	Engine	**44**	Primary piston
13	Replenishing pump intake connection	**30**	**Travel motor 1**	**45**	Secondary piston with proportional solenoid Y13
14	Working hydraulics pump intake connection	**31**	Travel pump leak oil	**PK**	Cooling system high pressure

The fan gear pump **25** draws up oil from the hydraulic tank **1** and pumps it to the fan gear motor **40**.

Some of the oil returning from the fan gear motor **40** flows to travel motor 1 for flushing the bearings. The rest of the returning oil goes to the collector pipe **34**.

The return flow from the following components is collected in the collector pipe **34**:
- Fan gear motor return flow
- Travel pump leak oil
- Discharged oil from travel motor 2
- Travel motor 2 leak oil

050.3.4 Charge air temperature sensor

Valid for: L538-1493/31405-;

1 Layout

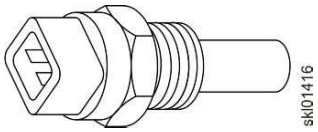


Fig. 224: Charge air temperature sensor B5205

Sensor element consists of an encapsulated thin-film nickel resistor.

2 Function

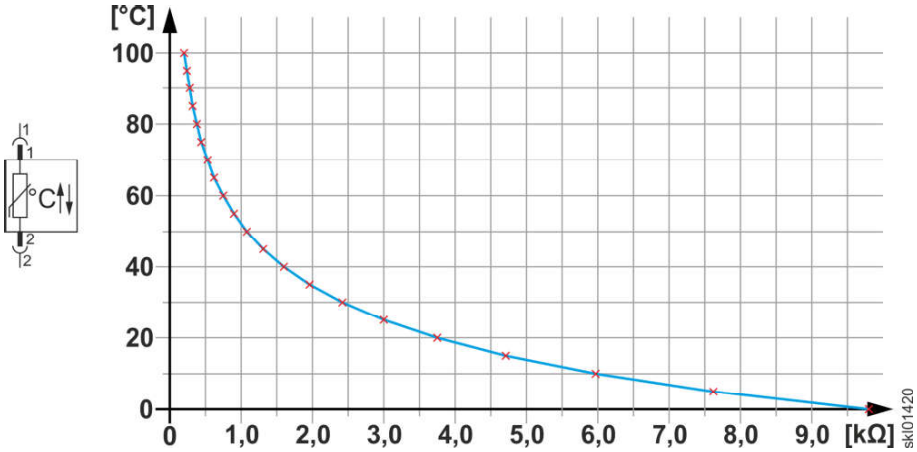


Fig. 225: Wiring diagram and characteristic

Temperature	Resistance
0 °C	9795.0 Ω
5 °C	7616.0 Ω
10 °C	5970.0 Ω
15 °C	4712.0 Ω
20 °C	3747.0 Ω
25 °C	3000.0 Ω
30 °C	2417.0 Ω
35 °C	1959.0 Ω
40 °C	1598.0 Ω
45 °C	1311.0 Ω
50 °C	1081.0 Ω
55 °C	895.9 Ω
60 °C	746.4 Ω

LBH/11827693/04/211-20180814_111345/en

060.1 Overview of z kinematics working hydraulics

Valid for: L538-1493/31405-;

1 Layout

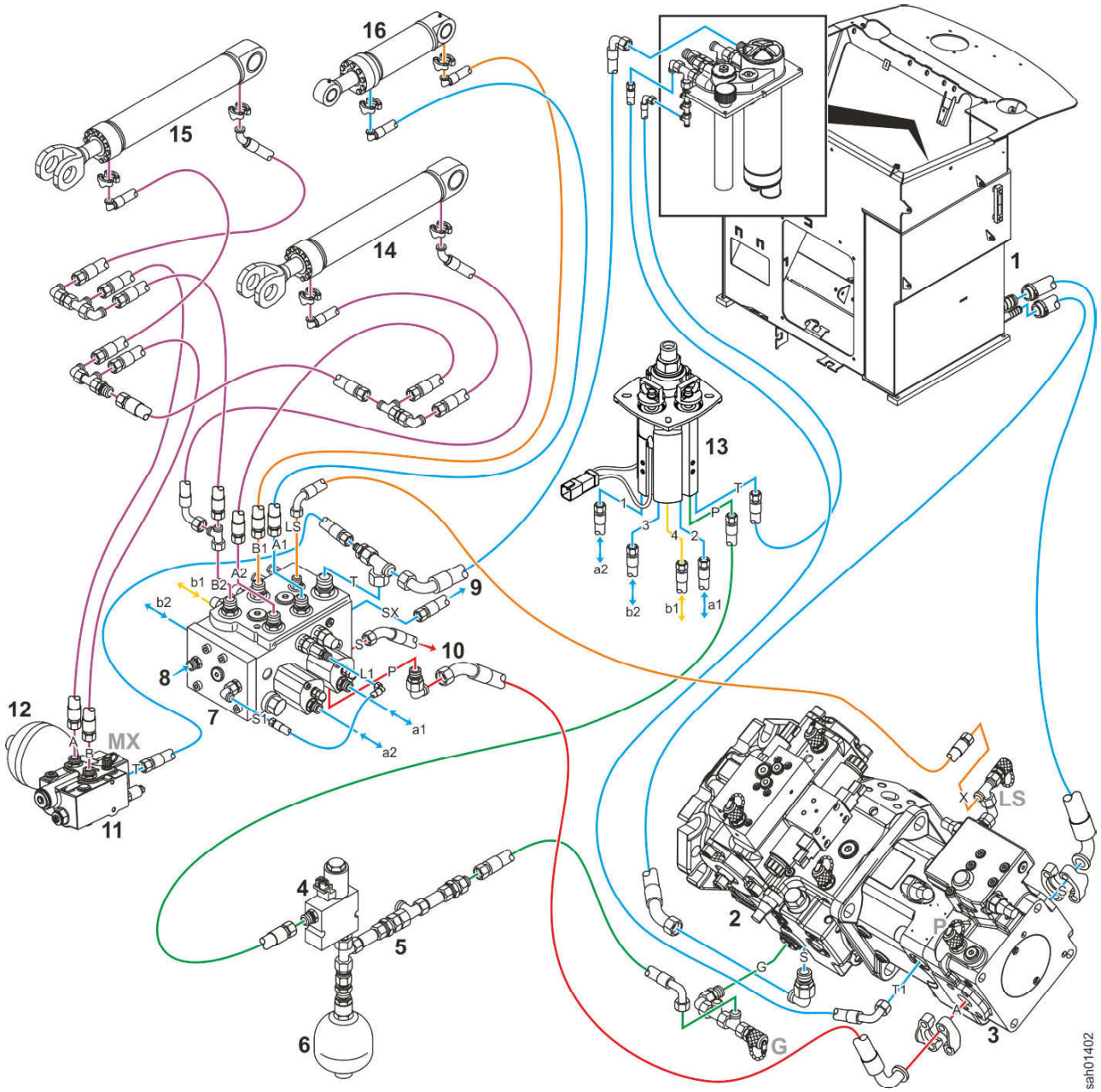


Fig. 232: Main components of the working hydraulics for z-bar kinematics

1 Hydraulic tank

8 Compact brake valve (housing preheating)

15 Right lift cylinder

See next page for continuation of the image legend

060.3 Working hydraulics pump

Valid for: L538-1493/31405-;

1 Layout

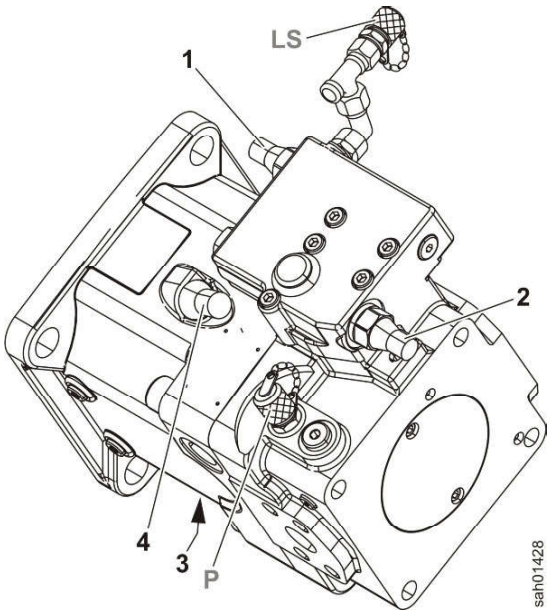


Fig. 236: Working hydraulics pump

1	Flow regulator	**4**	Q_{min} adjusting screw
2	Power regulator	**LS**	Load sensing pressure test connection
3	Q_{max} adjusting screw	**P**	High pressure test connection

The working hydraulics pump is flange-mounted on the drive shaft of the travel pump.

The following components are integrated in the working hydraulics pump:
- Swash plate variable displacement pump (axial piston pump)
- Flow regulator
- Power regulator
- Servo piston
- Return piston

LBH/118276693/04/211-20180814_111345/en

060.5 Control valve block for P kinematics

Valid for: L538-1493/31405-;

1 Layout

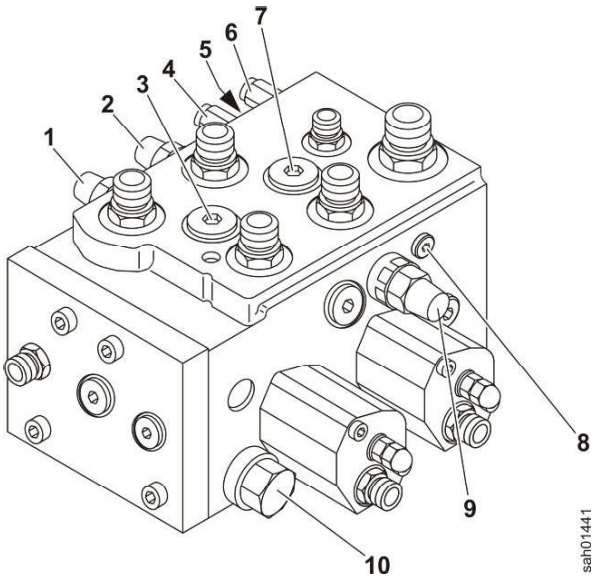


Fig. 247: Control valve block for P kinematics

1	Secondary pressure relief valve for lifting	**6**	LS steering pressure cut-off
2	Secondary pressure relief valve for tilting in	**7**	Tilt cylinder pressure balance
3	Lift cylinder pressure balance	**8**	Flow regulating valve
4	LS working hydraulics pressure cut-off	**9**	Secondary pressure relief valve for tilting out
5	Priority valve	**10**	Pre-tension valve

The control valve block has the following components and functions:
- Spool valves for the lift cylinder, tilt cylinder and 3rd function (optional) with pressure balances
- Working hydraulics pressure protection (working hydraulic LS pressure cut-off and secondary pressure relief valves)
- Steering system pressure protection (steering system LS pressure cut-off)
- Feeding function
- Float position function
- Priority valve

LBH/11827693/04/211-20180814_111345/en

2.3 Retaining magnets

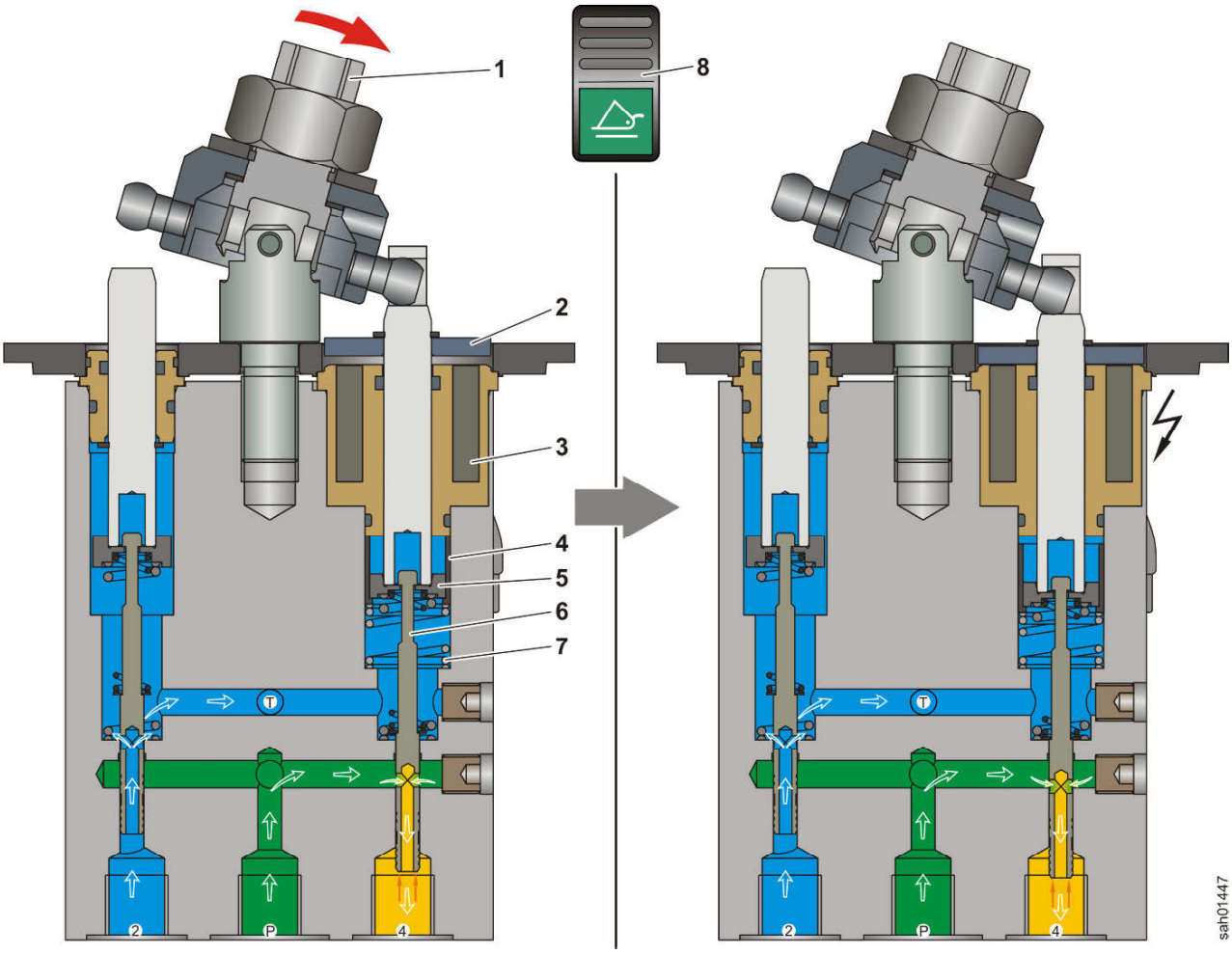


Fig. 258: Retaining magnet not active / active

1	Control lever	**4**	Retaining magnet spring bushing	**7**	Retaining magnet compression spring
2	Retaining plate	**5**	Regulating spring cup	**8**	*Bucket return-to-dig* switch
3	Bucket return-to-dig retaining magnet Y9	**6**	Tilt in valve		

The retaining magnets are electromagnets that hold the control lever in the maximum position.

The pilot control unit has retaining magnets for the following functions:
- Float position
- Lift kick-out (optional)
- Bucket return-to-dig

When the function is activated, the central control unit energises the corresponding retaining magnet.

If the control lever **1** is only moved so far that the regulating spring cup **5** touches the retaining magnet spring bushing **4**, the retaining plate **2** does not yet touch the retaining magnet **3**.

Only when the spring force of the retaining magnet compression spring **7** is overcome does the retaining plate **2** touch the retaining magnet **3**. The retaining

060.8 Hydraulic cylinders of the working hydraulics

060.8.1 Hydraulic cylinders for Z kinematics

060.8.1.1 Z kinematics lift cylinder

Valid for: L538-1493/31405-;

1 Layout

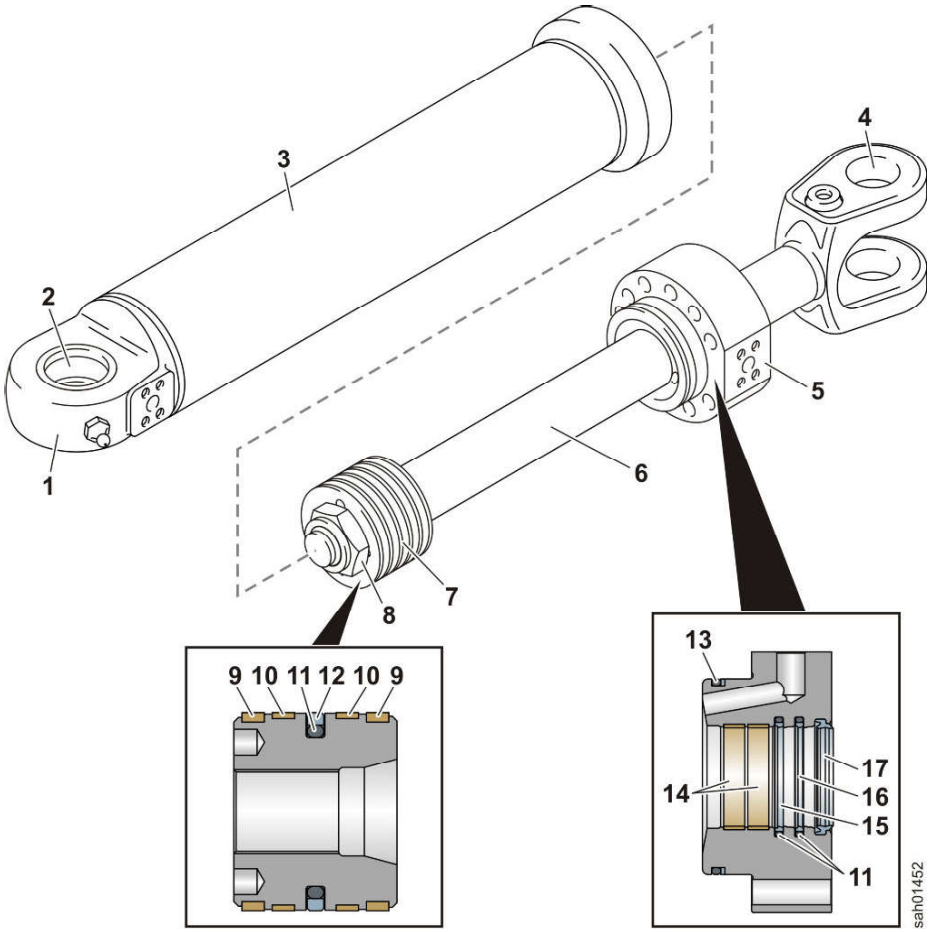


Fig. 272: Lift cylinder

1	Piston-side cylinder bearing	**10**	Slide rings
2	Bearing bushing	**11**	Support rings
3	Cylinder tube	**12**	Glyd Ring seal
4	Ring-side cylinder bearing	**13**	O-ring
5	Piston rod bearing	**14**	Slide rings
6	Piston rod	**15**	Stepseal
7	Piston	**16**	Rimseal

See next page for continuation of the image legend

3	Travel motor 2	**9**	Fan gear motor	**MH**	Travel pump high pressure test connection
4	Orifice Ø1.0 mm	**10**	Collector pipe	**M1**	Travel motor 1 servo pressure test connection
5	Travel motor 1	**11**	Hydraulic oil cooler	**M2**	Travel motor 2 servo pressure test connection
6	Orifice Ø1.0 mm	**12**	Temperature valve	**PK**	Cooling system high pressure test connection

The travel hydraulics consist of the following components:
- Hydraulic tank (For more information see: 080.1.1 Overview of the hydraulic tank, page 080-2)
- Travel pump (For more information see: 070.3 Travel pump, page 070-12)
- Travel motor 1 (For more information see: 070.5.2 Travel motor 1, page 070-43)
- Travel motor 2 (For more information see: 070.5.3 Travel motor 2, page 070-50)
- Cooling system

LBH/11827693/04/211-20180814_111345/en

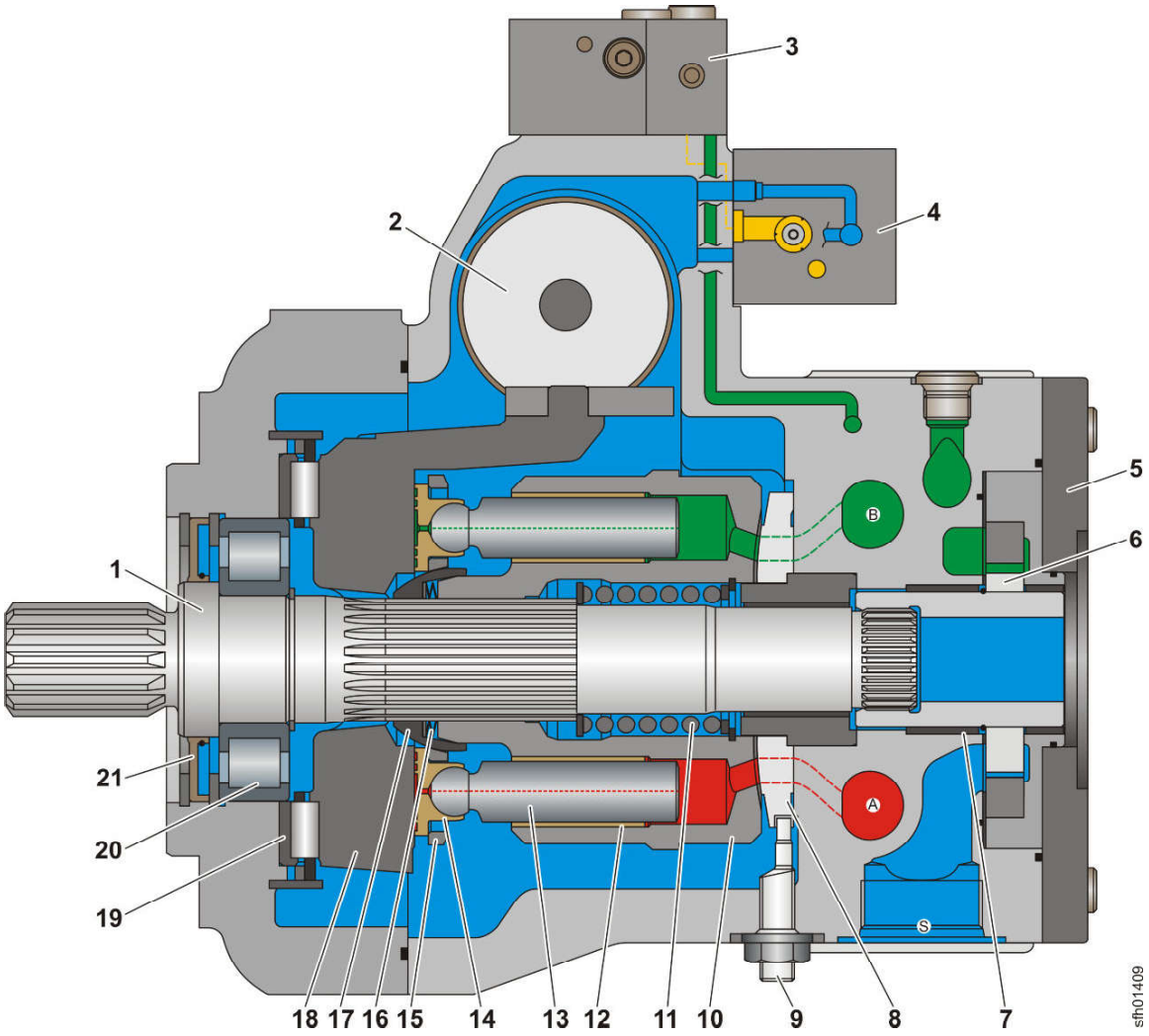


Fig. 281: Sectional view of rotary group

1	Drive shaft	**8**	Control lens	**15**	Return plate
2	Servo cylinder	**9**	Eccentric adjusting screw	**16**	Cup springs
3	Control system housing	**10**	Rotary group cylinder	**17**	Return ball
4	Travel direction valve	**11**	Compression spring	**18**	Swivel plate
5	Working hydraulics pump connection flange	**12**	Sliding bushing	**19**	Swivel plate bearing
6	Replenishing pump	**13**	Piston	**20**	Roller bearing
7	Bearing bushing	**14**	Glide shoe	**21**	Shaft seal ring

LBH/11827693/04/211-20180814_111345/en

The more current the proportional solenoid receives, the further the valve piston is pushed.

2.6.2.1 Accelerator pedal position

The central control unit registers that the accelerator pedal is being pressed through the angle sensor R5 on the accelerator pedal.

If the accelerator pedal is pressed and the engine speed is above 900 rpm, the central control unit increases the current to the control pressure proportional solenoid. The current is regulated according to the engine speed.

2.6.2.2 Inching function

The central control unit registers that the inching brake pedal is being pressed through the angle sensor R1 on the inching brake pedal.

When the inching brake pedal is pressed, the central control unit reduces the current to the control pressure proportional solenoid. The travel pump pivots in. The machine is thereby hydrostatically braked.

2.6.2.3 Excessive engine speed or road speed

If the maximum speed permitted for the travel range is exceeded, the central control unit reduces the current to the control pressure proportional solenoid progressively down to 200 mA.

2.6.2.4 Excessive temperature of the hydraulic oil

If the temperature of the hydraulic oil exceeds 90 °C, the central control unit reduces the current to the control pressure proportional solenoid gradually down to 40% of the maximum current (at a hydraulic oil temperature of 95 °C). The travel pump pivots in. The power consumed is thereby reduced. The decreased power output reduces the temperature.

The control pressure proportional solenoid is energised normally again when the temperature is back in the normal range.

2.6.2.5 Travel pump load limiting function

If the travel pump has been moved to the maximum swivel angle and the central control unit registers a major drop in engine speed under load, the travel pump load limiting function is activated.

The central control unit reduces the current to the control pressure proportional solenoid. The travel pump pivots in. The power consumed is thereby reduced. The load on the engine is decreased.

2.6.3 Regulation by operating pressure

The high pressure acts on the pistons in the rotary group cylinder. The pistons rest on the swivel plate and push it towards a smaller angle.

LBH/11827693/04/211-20180814_111345/en

2.4 Variable displacement pump

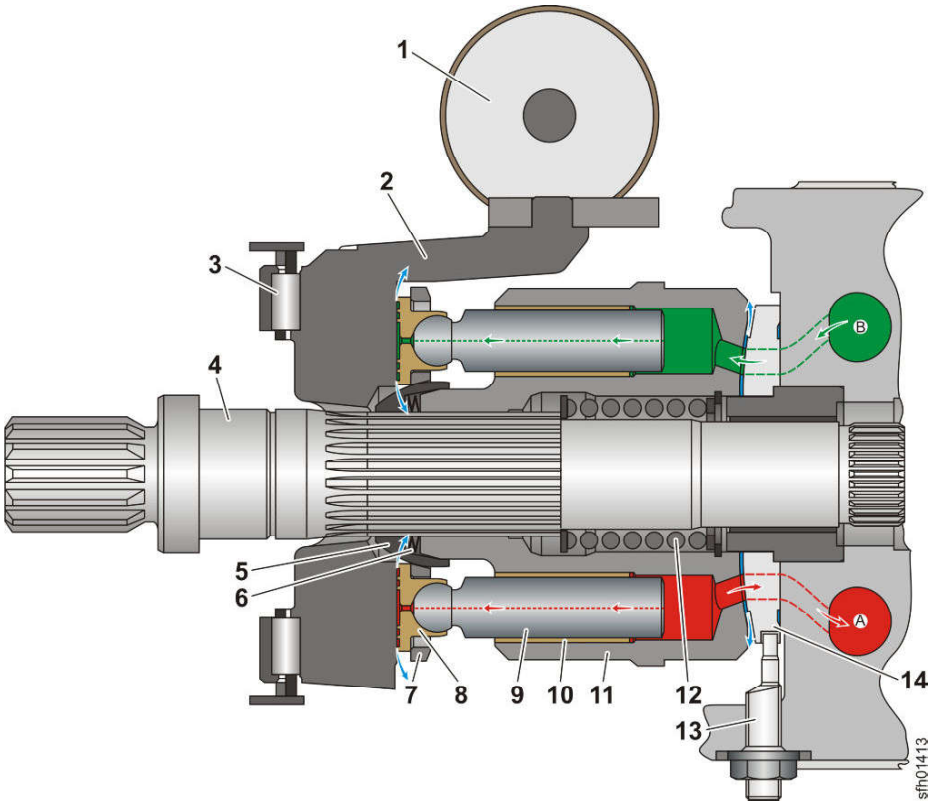


Fig. 304: Variable displacement pump

1	Servo cylinder	**8**	Glide shoe
2	Swivel plate	**9**	Piston
3	Swivel plate bearing	**10**	Sliding bushing
4	Drive shaft	**11**	Rotary group cylinder
5	Return ball	**12**	Compression spring
6	Cup spring	**13**	Eccentric adjusting screw
7	Return plate	**14**	Control lens

The variable displacement pump delivers oil to the travel motor. The returning oil flows directly to the suction side of the variable displacement pump (closed circuit).

The flow rate depends on:
– Plate angle
– Engine speed

2.4.1 Rotary group

The rotary group cylinder **11** is rigidly connected to the drive shaft **4**. The rotary group cylinder contains nine pistons **9**, which rotate along with it. The pistons slide up and down in the sliding bushings **10** and are guided by glide shoes **8** and the return plate **7**.

The swivel plate **2** and the control lens **14** do not move.

Oil is pumped through a hole in the pistons **9** into the space between the glide shoe and swivel plate. This means the slide shoe floats on a film of oil and slides over the swivel plate without mechanical contact.

The rotary group also slides on a film of oil. This is produced by the leakage between the control lens and the rotary group cylinder.

LBH/11827693/04/211-20180814_111345/en

070.5.2 Travel motor 1

Valid for: L538-1493/31405-;

1 Layout

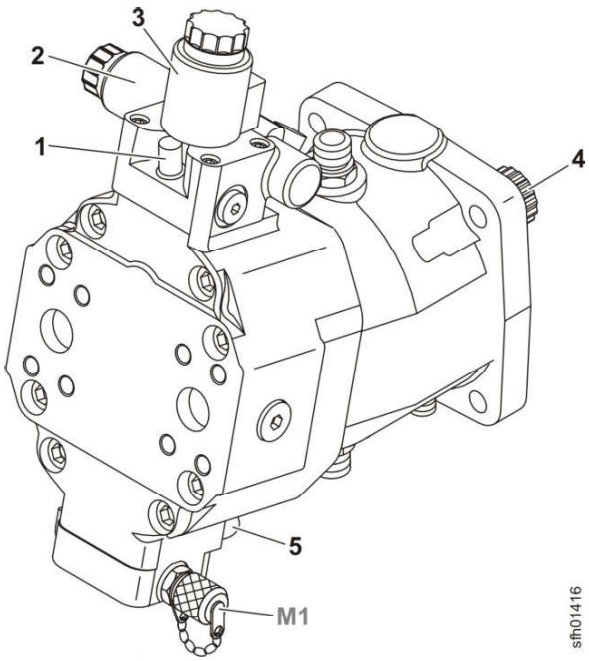


Fig. 314: Travel motor 1

1	Adjusting screw for start of regulation	**4**	Output shaft
2	Travel direction solenoid valve Y26	**5**	Q_{min} adjusting screw
3	Travel range 1 solenoid valve Y58	**M1**	Travel motor 1 servo pressure test connection

Travel motor 1 is flange-mounted on the transmission. The speed and torque are transmitted from there to the axles.

Travel motor 1 consists of the following components:
- Positioning piston
- Swash plate variable displacement motor (axial piston motor)
- Control piston
- Travel range 1 function

LBH/11827693/04/211-20180814_111345/en

2 Function

2.1 Basic function

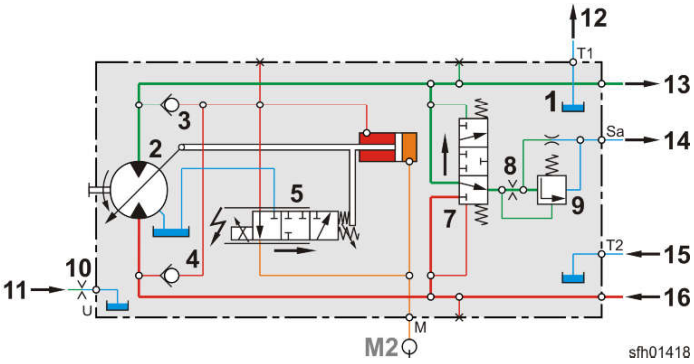


Fig. 324: Hydraulic diagram of travel motor 2 (forward travel direction)

1	**Travel motor 2**	**10**	Orifice Ø 1.0 mm
2	Swash plate variable displacement motor (axial piston motor)	**11**	Travel motor bearing flushing
3	Check valve	**12**	Leak oil to collector pipe
4	Check valve	**13**	Low pressure to travel pump
5	Proportional valve and control piston Y57	**14**	Discharged oil to collector pipe
6	Servo piston	**15**	Leak oil from travel motor 1
7	Discharge valve	**16**	High pressure from travel pump
8	Orifice	**M2**	Travel motor 2 servo pressure
9	Pressure relief valve		

The travel motors are driven by the travel pump in the closed circuit. This means that the oil that drives the travel motors flows back directly to the travel pump.

To change the travel direction, the high pressure **16** and low pressure **13** are swapped. The travel motors thereby change the direction of rotation.

2.1.1 Output speed and output torque

The output speed depends on two factors:
– High pressure
– Swivel plate angle

The output speed depends on two factors:
– Oil quantity supplied
– Swivel plate angle

At a small angle, the variable displacement motor **2** has a low displacement. The output speed is high, because only a little oil is required for each revolution. At the same time, the output torque is low, due to the shallow angle of the pistons to the output shaft.

At a large angle, the variable displacement motor has a high displacement. The output speed is low, because a lot of oil is required for each revolution. At the same time, the output torque is high, due to the large angle of the pistons to the output shaft.

LBH/11827693/04/211-20180814_111345/en

The oil from the following components is filtered by the return strainer:
- Transmission return flow
- Compact brake valve return flow
- Pilot control unit return flow
- Fan gear motor leak oil
- Working hydraulics pump leak oil
- Servostat return flow
- Travel pump leak oil (only if the hydraulic oil cooler is blocked)

When the bypass valve is open, the entire oil quantity flows through the return strainer.

2.3 Filtering function of the return suction filter

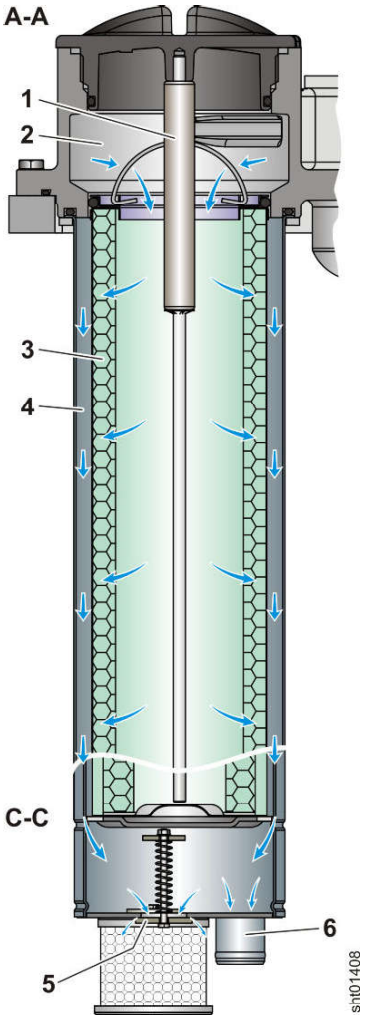


Fig. 332: Filtering function of the return suction filter

1	Magnetic rod	**4**	Filter casing
2	Collection chamber	**5**	Pre-tension valve
3	Filter element	**6**	Replenishing pump intake connection

In the return suction filter, impurities with a minimum size of 10 µm are filtered out of the oil.

4 Control valve block

5 Compact brake valve (housing preheating)

9 Steering damper hydro accumulator (optional)

10 Steering damper hydro accumulator (optional)

P1 Steering system high pressure test connection

LS Load sensing pressure test connection

The steering system consists of the following components:

- Hydraulic tank (For more information see: 080.1.1 Overview of the hydraulic tank, page 080-2)
- Working hydraulics pump (For more information see: 060.3 Working hydraulics pump, page 060-13)
- Control valve block with priority valve (For more information see: 060.4 Control valve block for Z-bar kinematics, page 060-17)
- Servostat (For more information see: 090.3 Servostat, page 090-10)
- Steering cylinder (For more information see: 090.4.2 Steering cylinder overview, page 090-16)
- Emergency steering (For more information see: 090.5.1 Emergency steering overview, page 090-19)

LBH/11827693/04/211-20180814_111345/en

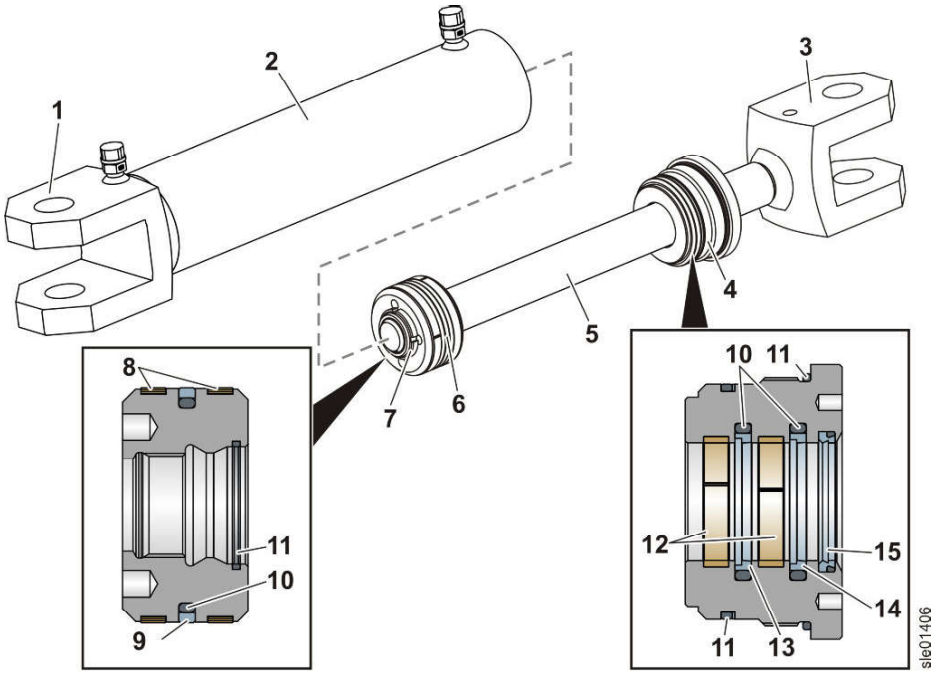


Fig. 352: Steering cylinder

1	Piston-side cylinder bearing	**9**	Glyd Ring seal
2	Cylinder tube	**10**	Support rings
3	Ring-side cylinder bearing	**11**	O-rings
4	Piston rod bearing	**12**	Slide rings
5	Piston rod	**13**	Stepseal
6	Piston	**14**	Rimseal
7	Nut	**15**	Scraper ring
8	Sliding ring	**16**	Sealing lip

The piston-side cylinder bearing **1** and the ring-side cylinder bearing **3** are designed as forks.

The piston **6** is bolted to the piston rod **5** and secured with the nut **7**.

The piston rod bearing **4** is bolted to the cylinder tube **2**.

2 Function

2.1 Basic function

The steering cylinder is a double-action hydraulic cylinder with a piston rod at one end.

When steering, the servostat pumps oil to the piston side or ring side of the steering cylinder.

2.2 Piston rod guide

The piston rod is guided by the slide rings on the piston and in the piston rod bearing.

2.3 Seals

The piston is sealed with a Glyd Ring seal.

The piston rod bearing is sealed with a Rimseal and a Stepseal. In addition, a scraper ring and a sealing lip prevent dirt from penetrating.

100 Brake system

Contents

LBH/11827693/04/211-20180814_111345/en

If the pedal is pushed down further, the oil pressure also increases in the brake circuits because increased oil pressure is required to push the pressure regulator pistons against the pressure regulator spring again.

2.6 Parking brake

When the parking brake solenoid valve Y10 is energised, oil flows from the parking brake hydro accumulator to the disc brake. The parking brake disengages.

2.7 Brake light

The brake light is switched on by the brake light pressure switch B12 in the 2nd brake circuit. (For more information see: 100.3.3 Brake light pressure switch , page 100-16)

2.7.1 *Brake system accumulator pressure* symbol field

The brake system accumulator pressure symbol field is activated by the accumulator charge pressure switch B19. (For more information see: 100.3.4 Accumulator charge pressure switch, page 100-17)

LBH/11827693/04/211-20180814_111345/en

100.4.2 Disc brake

Valid for: L538-1493/31405-;

1 Layout

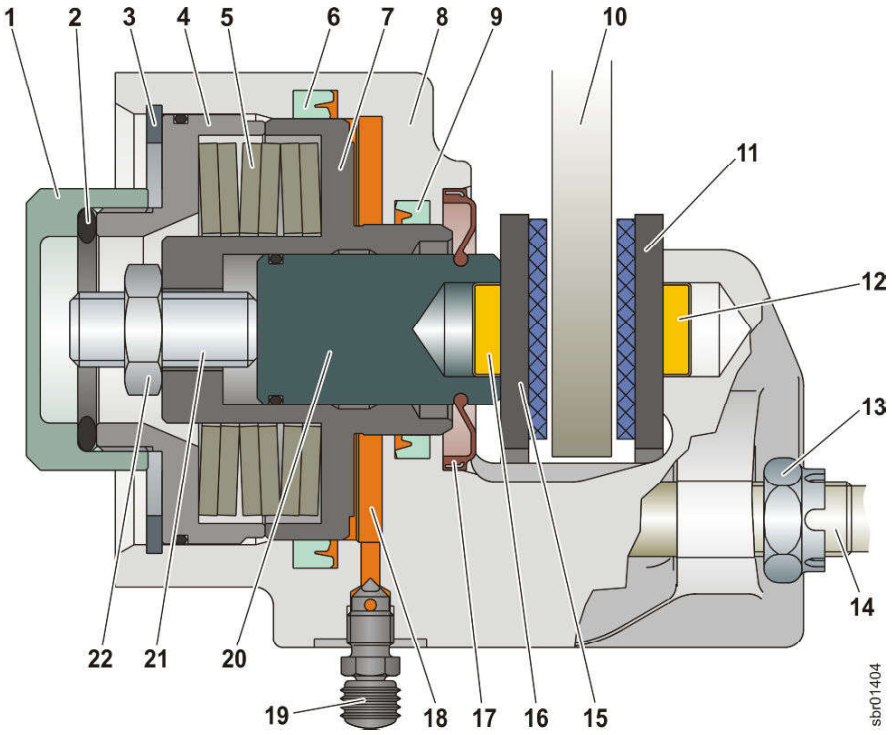


Fig. 390: Disc brake open

1	Cap	**12**	Solenoid
2	Sealing ring	**13**	Castle nut
3	Snap ring	**14**	Guide pin
4	Thrust ring	**15**	Brake shoe
5	Cup springs	**16**	Solenoid
6	Grooved ring packing	**17**	Dust protection ring
7	Brake piston	**18**	Pressure chamber
8	Brake caliper	**19**	Bleeder valve
9	Grooved ring packing	**20**	Thrust pin
10	Brake disc	**21**	Adjusting screw
11	Brake shoe	**22**	Counter nut

The parking brake is a spring accumulator sliding caliper brake.

The parking brake is fitted to the axle input shaft of the front axle. The parking brake also works on the rear axle via the drive shaft and the output of the transmission (drive shaft).

2 Function

2.1 Basic function

The braking force is generated by the brake disc being clamped between the brake shoes. The friction between brake shoes and brake disc generates the braking force.

LBH/11827693/04/211-20180814_111345/en

110.3 Circuit diagrams

Valid for: L538-1493/31405-;

The circuit diagrams for the electrical system show the functional sequences for the entire machine, including optional attachments. Options in the circuit diagrams are shown in green. All components and connectors are correctly labelled and shown with the appropriate symbol so that they can be clearly identified. The key contains an additional list of the components with their designations.

The wiring diagrams can also be called up in the spare parts programme LIDOS under electrical system assemblies. These can be opened in an e3v format via the info button next to assembly circuit diagram.

The circuit diagrams are divided up as follows:
- Overview chart
- Contents
- Key
- BMK list
- Circuit diagrams
- Component overviews

The circuit diagrams contain links that can be activated with a mouse click.

1.1.1 Abbreviations

Abbreviation	Designation
SH	Service hours
EP	Electroproportional
WH	Wiring harness
LED	LED
LFD	Liebherr ride control system
SV	Solenoid valve
PWM	Pulse width modulation (proportional output)
PSV	Proportional solenoid valve
BMK	Equipment code

Tab. 64: Abbreviations

1.1.2 Designation of components with “-”

The designations of the components and connectors are always shown with “-”, e.g.:

Description	Component designation
-A10	Display

Tab. 65: Example of component designation

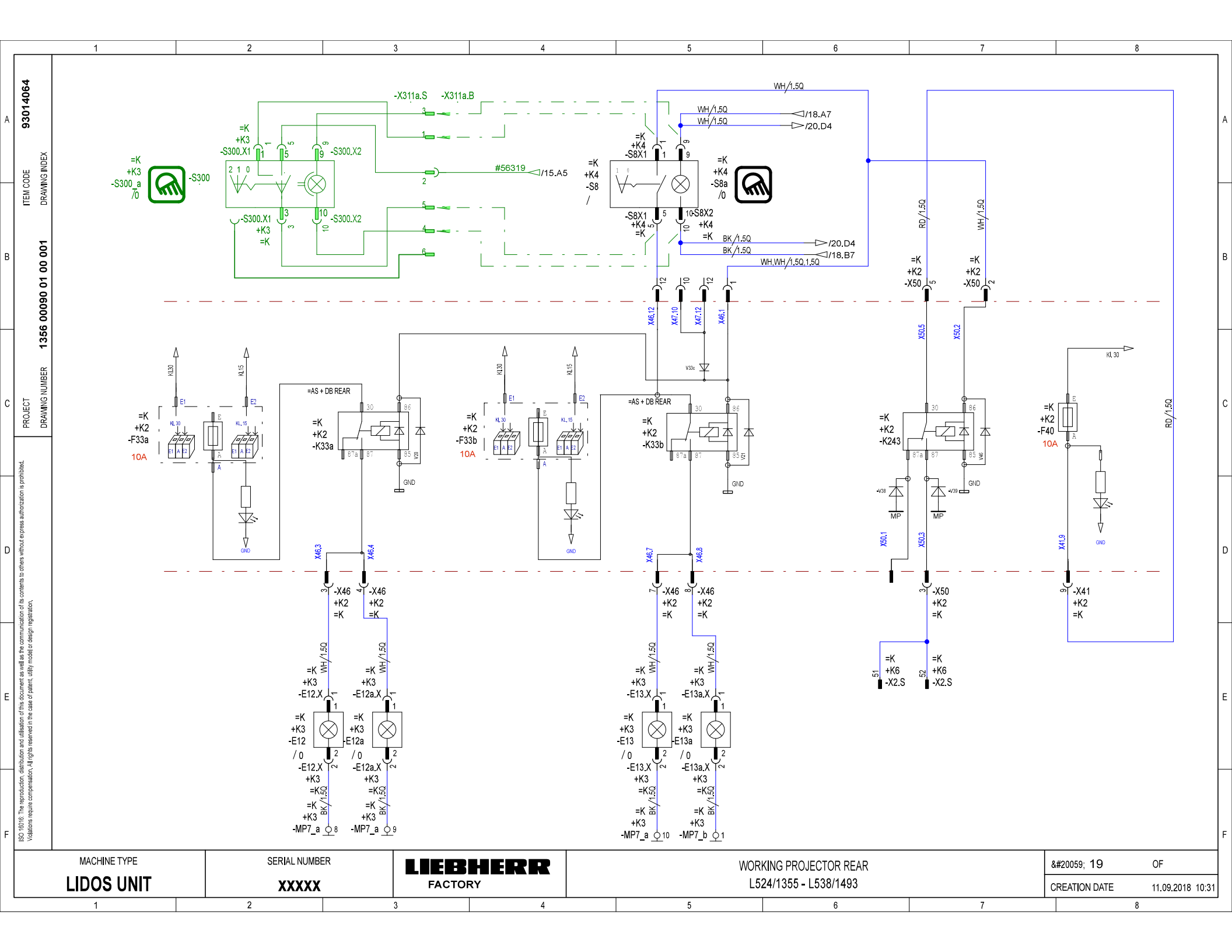
1.1.3 Location code with “+”

Location codes are always shown with “+”. The location code shows where the component is situated in the machine.

LBH/11827693/04/211-20180814_111345/en

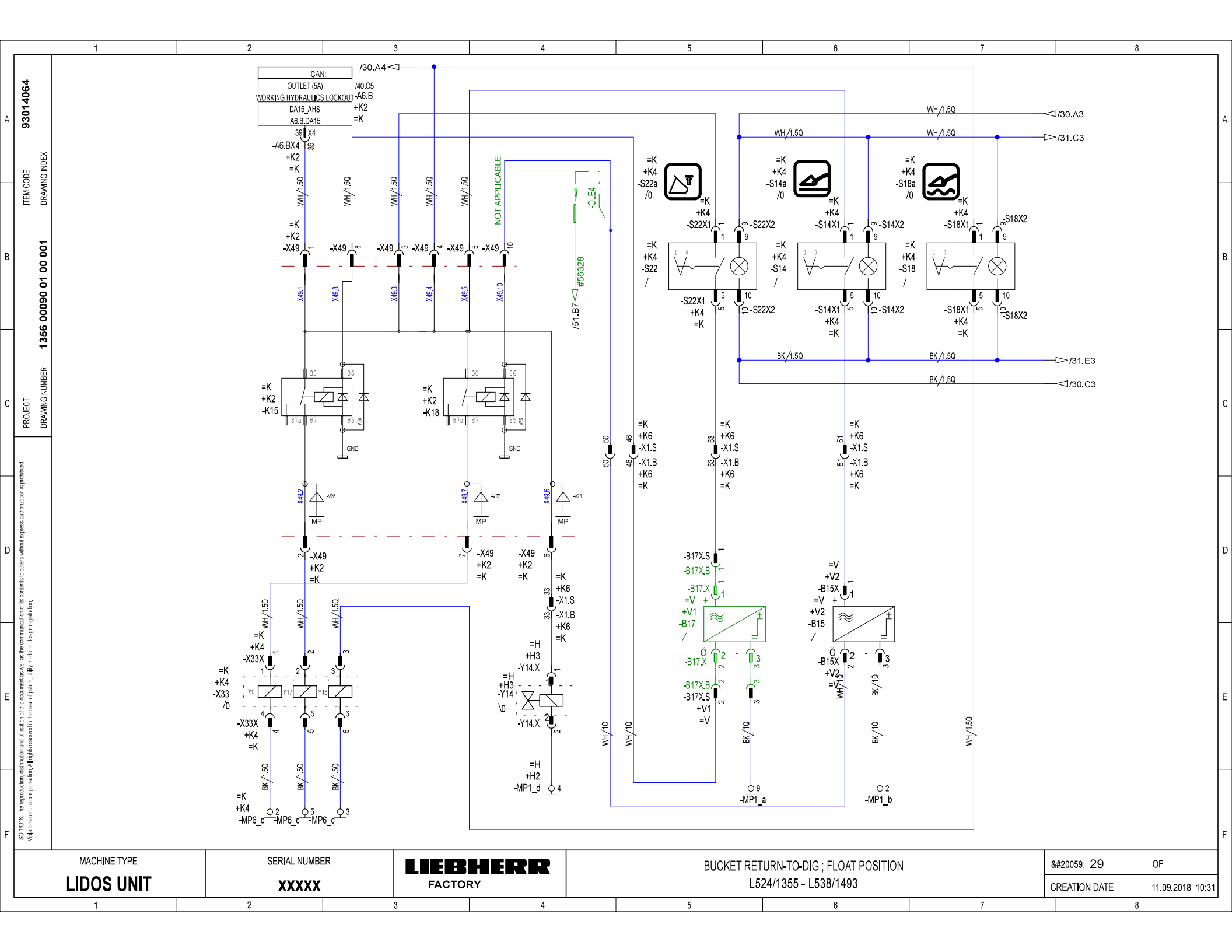
BMK	SYSTEM	PLACE	FUNCTION	SHEET
-S7X1	=K	+K4	PLUG SWITCH	/18.A6
-S7X2	=K	+K4	PLUG SWITCH	/18.A6
-S8	=K	+K4	SWITCH WORKING PROJECTOR REAR	/19.A5
-S8a	=K	+K4	SYMBOL	/19.B5
-S8X1	=K	+K4	SWITCH PLUG	/19.A5
-S8X2	=K	+K4	SWITCH PLUG	/19.A5
-S9 *	=K	+K4	SWITCH BEACONLIGHT	/26.D4
-S9a	=K	+K4	SYMBOL	/26.D3
-S9X1	=K	+K4	PLUG SWITCH	/26.D4
-S9X2	=K	+K4	PLUG SWITCH	/26.D4
-S10	=K	+K2	SWITCH EMERGENCY STEERING PUMP	/34.D7
-S10.X1	=K	+K2	PLUG SWITCH EMERGENCY STEERING PUMP	/34.D7
-S10.X2	=K	+K2	PLUG SWITCH EMERGENCY STEERING PUMP	/34.D7
-S10a	=K	+K2	SYMBOL EMERGENCY STEERING PUMP	/34.E7
-S13	=K	+K4	SWITCH WINDSCREEN WIPER REAR	/17.C2
-S13X1	=K	+K4	PLUG SWITCH	/17.D2
-S13X2	=K	+K4	PLUG SWITCH	/17.C2
-S14	=K	+K4	SWITCH BUCKET RETURN-TO-DIG	/29.B6
-S14a	=K	+K4	SYMBOL	/29.B6
-S14X1	=K	+K4	PLUG SWITCH	/29.B6
-S14X2	=K	+K4	PLUG SWITCH	/29.B6
-S15	=H	+H4	BATTERY MAIN SWITCH	/13.E8
-S18	=K	+K4	SWITCH FLOAT POSITION	/29.B7
-S18a	=K	+K4	SYMBOL	/29.B7
-S18X1	=K	+K4	PLUG SWITCH	/29.B7
-S18X2	=K	+K4	PLUG SWITCH	/29.B7
-S22	=K	+K4	SWITCH LIFT KICK-OUT	/29.B5
-S22a	=K	+K4	SYMBOL	/29.B5
-S22X1	=K	+K4	PLUG SWITCH	/29.B5
-S22X2	=K	+K4	PLUG SWITCH	/29.B5
-S23 *	=K	+K2	SWITCH QUICK-CHANGE DEVICE	/30.B2
-S23.X1 *	=K	+K2	PLUG SWITCH	/30.B2
-S23.X2	=K	+K2	PLUG SWITCH	/30.B3
-S23a *	=K	+K1	SYMBOL	/30.B2
-S43 *	=K	+K4	SWITCH BACK-UP ALARM	/48.C4
-S43.X1 *	=K	+K4	PLUG SWITCH BACK-UP ALARM	/48.C4

BMK	SYSTEM	PLACE	FUNCTION	SHEET
-S43.X2 *	=K	+K4	PLUG SWITCH BACK-UP ALARM	/48.D5
-S45	=K	+K4	SWITCH OPTIONAL EQUIPMENT	/20.C4
-S45a	=K	+K4	SYMBOL	/20.D3
-S45X1	=K	+K4	PLUG SWITCH	/20.C4
-S45X2	=K	+K4	PLUG SWITCH	/20.C4
-S46	=K	+K4	SWITCH REAR WINDOW HEATER	/26.D3
-S46a	=K	+K4	SYMBOL	/26.D2
-S46X1	=K	+K4	PLUG SWITCH	/26.D3
-S46X2	=K	+K4	PLUG SWITCH	/26.D3
-S55 *	=F	+F1	CONTROL 100% LOCKOUT	/49.D5
-S55.X1 *	=F	+F1	PLUG SWITCH	/49.C5
-S55.X2 *	=F	+F1	PLUG SWITCH	/49.D5
-S203 *	=K	+K4	SWITCH FAN REVERSAL	/31.D2
-S203.X1	=K	+K4	PLUG SWITCH	/31.D2
-S203.X2	=K	+K4	PLUG SWITCH	/31.D3
-S203a *	=K	+K4	SYMBOL	/31.C2
-S204 *	=H	+H2	SWITCH REFUELLING PUMP	/49.C3
-S300 *	=K	+K3	SWITCH WORKING PROJECTOR REAR OPTIONAL	/19.B2
-S300.B *	=K	+K3	SWITCH BEACONLIGHT OPTIONAL	/26.D6
-S300_a *	=K	+K3	SYMBOL WORKING PROJECTOR REAR OPTIONAL	/19.B1
-S300_c *	=K	+K3	SWITCH FLASHING LIGHT OPTIONAL	/46.B7
-S300b *	=K	+K3	SYMBOL BEACONLIGHT OPTIONAL	/26.D8
-S300c *	=K	+K3	SYMBOL FLASHING LIGHT	/46.A8
-S317 *	=K	+K4	SWITCH 2IN1 STEERING	/53.C4
-S317.X1 *	=K	+K4	PLUG 2IN1 STEERING	/53.C4
-S317.X2 *	=K	+K4	PLUG 2IN1 STEERING	/53.C4
-T1	=K	+K2	VOLTAGE CONVERTER	/24.B6
-T1X	=K	+K2	PLUG VOLTAGE CONVERTER	/24.B6
-T02	=M	+M	TEMPERATURE SENSOR INTAKE AIR	/57.E1
-T02.X	=M	+M	PLUG SENSOR	/57.D1
-T04	=M	+M	TEMPERATURE COOLING WATER	/57.E4
-T04.X	=M	+M	PLUG SENSOR	/57.D4
-T05	=M	+M	TEMPERATURE FUEL	/57.E5
-T05.X	=M	+M	PLUG SENSOR	/57.D5
-V1	=K	+K4	BLOCKING DIODE	/16.A8
-V2	=K	+K4	BLOCKING DIODE	/16.A8



ITEM CODE	93014064
DRAWING INDEX	
PROJECT	
DRAWING NUMBER	1356 00090 01 00 001

MACHINE TYPE	SERIAL NUMBER		WORKING PROJECTOR REAR	乛 19 OF
LIDOS UNIT	XXXXX	LIEBHERR FACTORY	L524/1355 - L538/1493	CREATION DATE 11.09.2018 10:31



ITEM CODE	93014064
DRAWING INDEX	
PROJECT	
DRAWING NUMBER	1356 00090 01 00 001

MACHINE TYPE	SERIAL NUMBER		BUCKET RETURN-TO-DIG ; FLOAT POSITION	乛 29 OF
LIDOS UNIT	XXXXX	LIEBHERR FACTORY	L524/1355 - L538/1493	CREATION DATE 11.09.2018 10:31

CENTRAL CONTROL UEC 3 X3

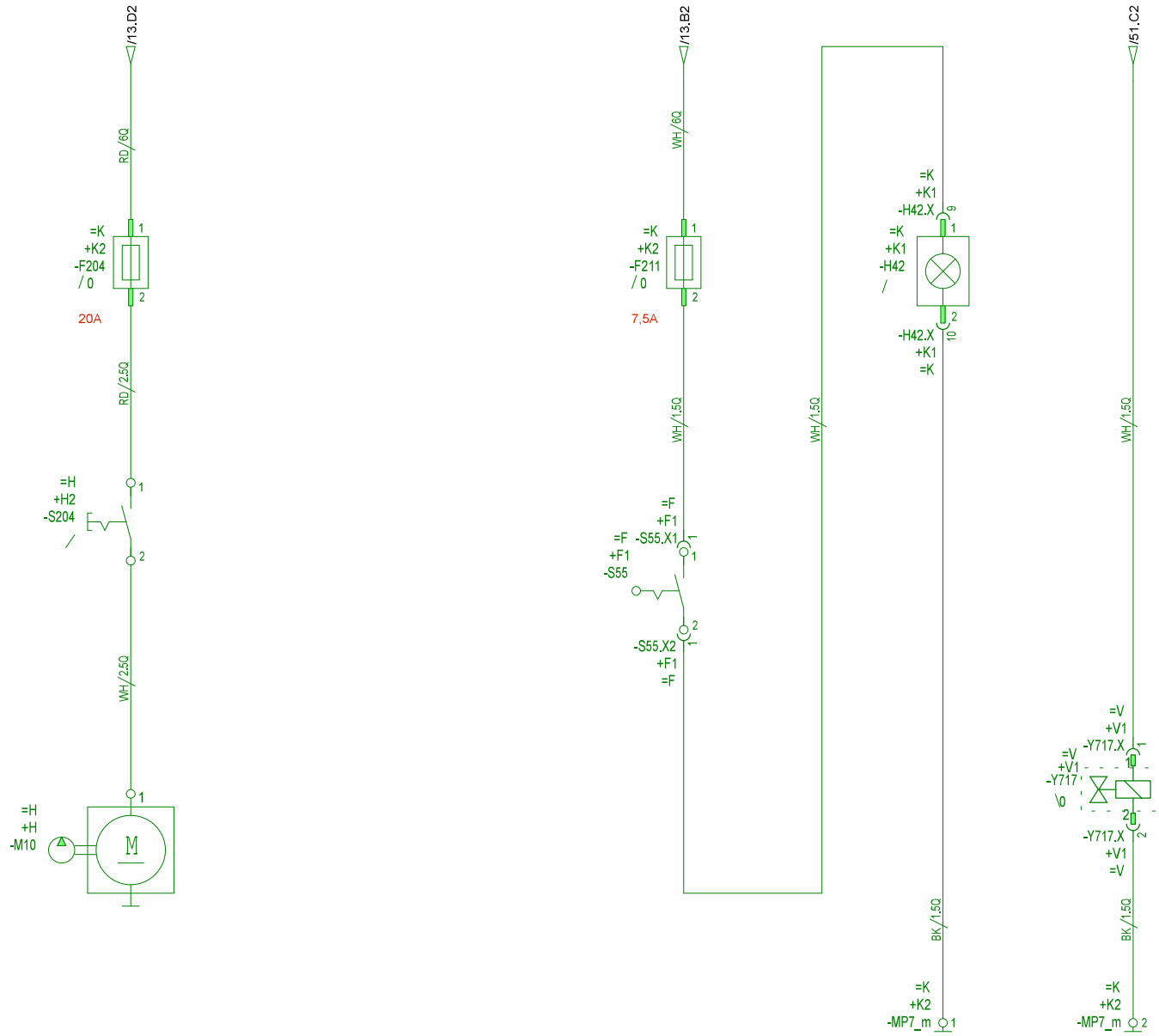
=K -A6.A Modul Nr.:
+K2 Modulname: 8920505_A

Phys. Adr.	Blatt	EA	Beschreibung		Stecker	Pin	Phys. Adr.	Blatt	EA	Beschreibung		Stecker	Pin
A6.A.TxD	/21.A8		RS-232 UEC3	DIAGNOSTIC PLUG		1	A6.A.VCC_EXT			SUPPLY SENSORS	OUTLET 200mA 5V		25
A6.A.BSL_C2	/21.A6		BOOTSTRAP	PIN = EARTH		2	A6.A.E4	/32.A2		HYDRAULIC OIL TEMPERATURE	INPUT		26
A6.A.DAE0	/34.B4		MAIN CIRCUIT NLP	PRESSURE SWITCH		3	A6.A.E6			RESERVE	INPUT		27
A6.A.DAE4	/25.A6		SERVICE BRAKE	PRESSURE SWITCH		4	A6.A.E2	/20.A7		TANK PIPE SENSOR	INPUT		28
A6.A.UDE0	/32.A4		SPEED OUTPUT	INPUT		5	A6.A.DE03	/20.A2		BACKWARDS NC	INPUT		29
A6.A.E3			RESERVE	INPUT		6	A6.A.+27VDC_1	/21.F4		VOLTAGE 1 UEC3	SUPPLY		30
A6.A.E5	/25.A7		RESERVE	INPUT		7	A6.A.CAN1L	/38.A7		LOW1	CAN BUS		31
A6.A.E0	/22.A5		INCH ANGLE SENSOR 1	CURRENT INPUT		8	A6.A.CAN2L	/21.A5		LOW2	CAN BUS		32
A6.A.DE06	/51.A6		INDUCTIVE SWITCH	OPTION		9	A6.A.DAE3	/23.A7		RESERVE	INPUT		33
A6.A.DE05	/20.A1		BACKWARDS NO	INPUT		10	A6.A.DAE7	/43.A2		AIR CONDITIONING COMPRESSOR	ACTIVE		34
A6.A.RxD	/21.A7		RS-232 UEC3	DIAGNOSTIC PLUG		11	A6.A.SGND			SUPPLY SENSORS	EARTH		35
A6.A	/21.A7		RS-232 UEC3	DIAGNOSTIC PLUG		12	A6.A.E4_GND	/32.A3		HYDRAULIC OIL TEMPERATURE	EARTH		36
A6.A.DAE1	/34.B6		CHECK NLP	PRESSURE SWITCH		13	A6.A.E6_GND	/20.D6		EARTH TANK PIPE SENSOR	SUPPLY		37
A6.A.DAE5	/37.A6		CYCLE SIGNAL	CENTRAL LUBRICATION SYSTEM		14	A6.A.DE00	/20.A6		SIGNAL CLAMP 15	INPUT		38
A6.A.UDE1	/32.A5		ENGINE 2	SPEED		15	A6.A.DE04	/20.A4		FORWARD NO	INPUT		39
A6.A.E3_GND			EARTH RESERVE	SUPPLY		16	A6.A.SGND	/23.A7		EARTH UEC3	SUPPLY		40
A6.A.E5_GND			EARTH RESERVE	SUPPLY		17							
A6.A.E1	/22.A4		INCH ANGLE SENSOR 2	CURRENT INPUT		18							
A6.A.DE02	/20.A3		FORWARD NC	INPUT		19							
A6.A.DE01			RESERVE	INPUT		20							
A6.A.CAN1H	/38.A6		HIGH1	CAN BUS		21							
A6.A	/21.A4		HIGH2	CAN BUS		22							
A6.A.DAE2	/55.A5		CLUTCH	PRESSURE LIMITATION		23							
A6.A.DAE6	/37.A7		LEVEL	CENTRAL LUBRICATION SYSTEM		24							

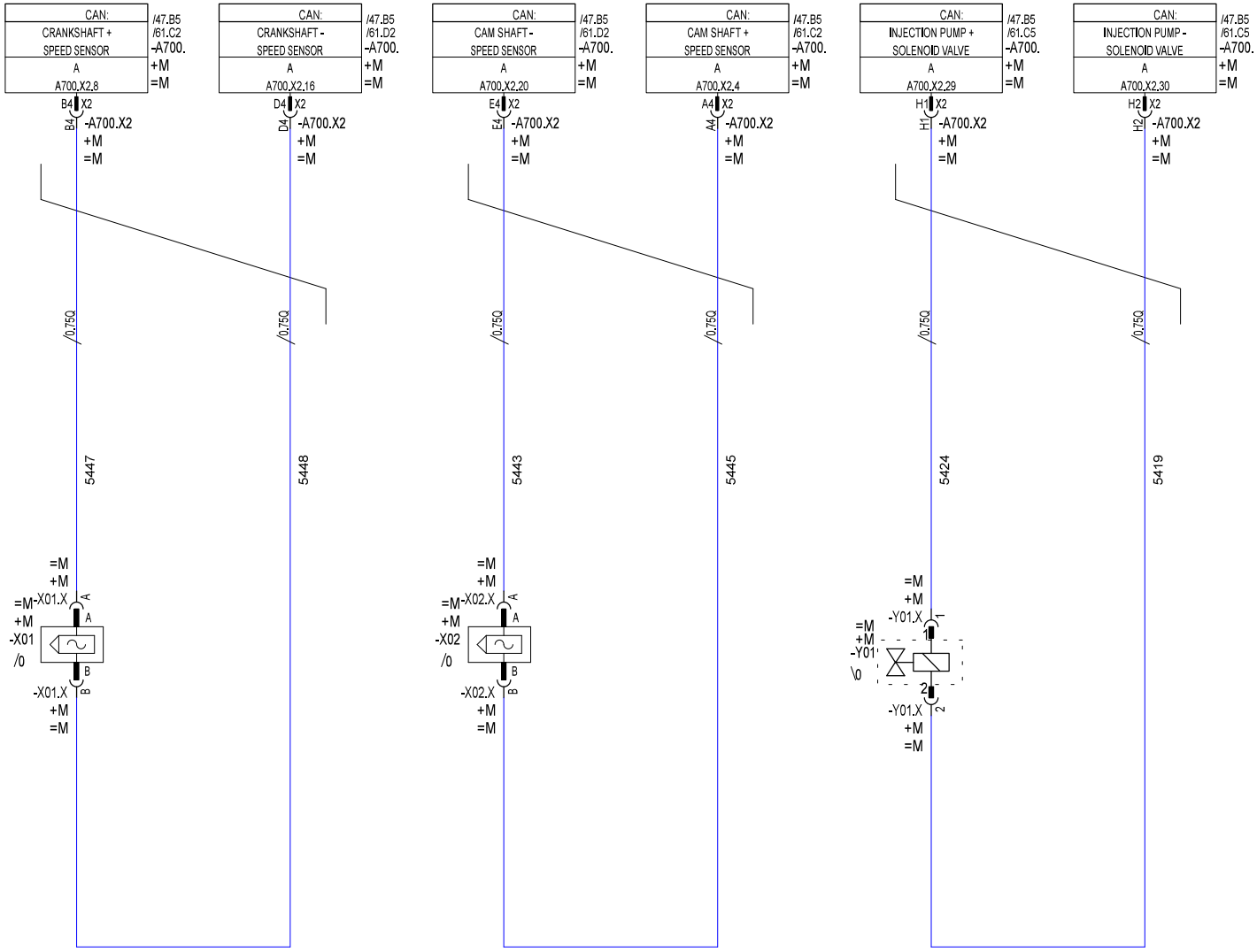
ITEM CODE 93014064
DRAWING INDEX
PROJECT
DRAWING NUMBER 1356 00090 01 00 001

MACHINE TYPE	SERIAL NUMBER			
LIDOS UNIT	XXXXX	LIEBHERR FACTORY	CENTRAL CONTROL UEC3 X3 L524/1355 - L538/1493	乛 39 OF CREATION DATE 11.09.2018 10:31

PROJECT
DRAWING NUMBER 1356 00090 01 00 001
ITEM CODE 93014064
DRAWING INDEX



MACHINE TYPE	SERIAL NUMBER			
LIDOS UNIT	XXXXX	LIEBHERR FACTORY	REFUELLING PUMP DIFFERENTIAL LOCK L524/1355 - L538/1493	乛 49 OF CREATION DATE 11.09.2018 10:31



MACHINE TYPE	SERIAL NUMBER		CIRCUIT DIAGRAM ENGINE	
LIDOS UNIT	XXXXX	LIEBHERR FACTORY	L524/1355 - L538/1493	乛 59 OF
				CREATION DATE 11.09.2018 10:31

2.5 Power supply of inputs

Power supply of inputs			
Power supply	**Input**	**Physical address**	**Pin**
Voltage output 5 VDC / 200 mA (A6.A.VCC_EXT)	Resistance input	A6.A.E3	X3.6
	Resistance input	A6.A.E4	X3.26
	Resistance input	A6.A.E5	X3.7
	Resistance input	A6.A.E6	X3.27
	Frequency input	A6.A.UDE0	X3.5
	Frequency input	A6.A.UDE1	X3.15

Tab. 72: Power supply of inputs

LBH/11827693/04/211-20180814_111345/en

120.2 Mechanical transmission

Valid for: L538-1493/31405-;

1 Layout

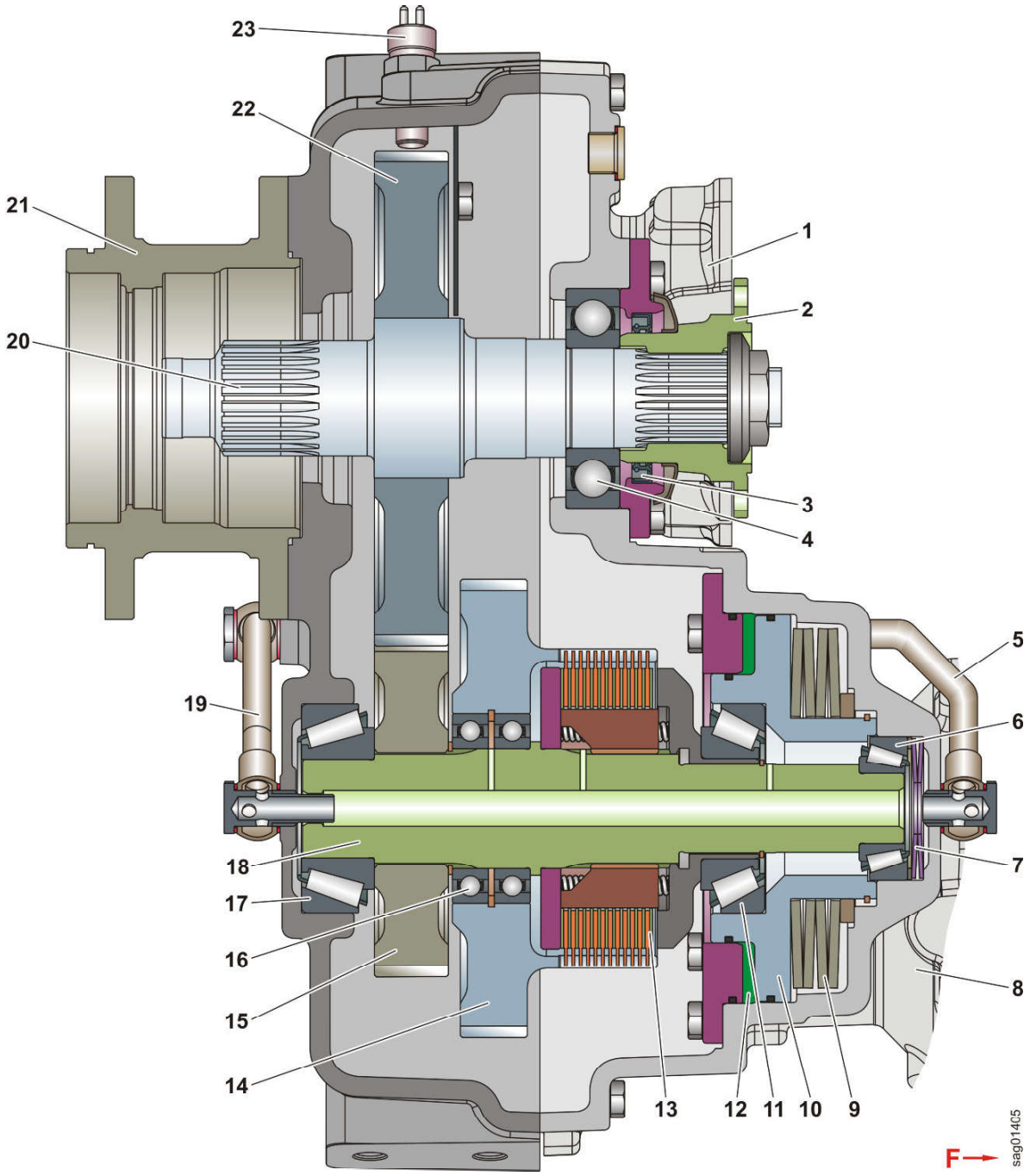


Fig. 410: Sectional view of the transmission (view from below)

LBH/11827693/04/211-20180814_111345/en

120.4 Transmission electronics

120.4.1 Overview of the electronic control system

Valid for: L538-1493/31405-;

1 Layout

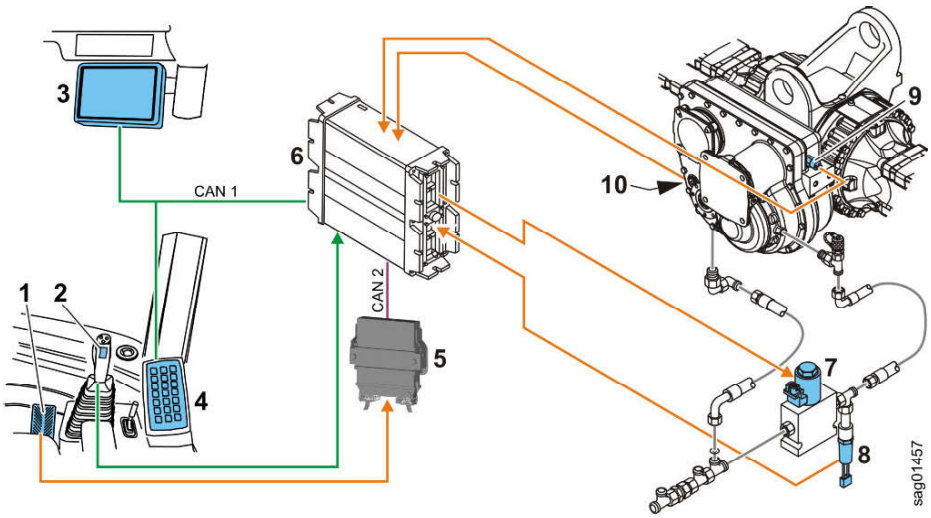


Fig. 420: Electronic transmission control unit

1	Accelerator pedal angle sensor R5	**6**	Central control unit (UEC3) A6
2	*Travel direction* switch S2	**7**	Clutch solenoid valve Y60
3	Display A13	**8**	Clutch pressure switch B100
4	Control unit A11	**9**	Travel motor 2 speed sensor B2
5	Engine control unit (ECU) A700	**10**	Output speed sensor B1

2 Function

2.1 Basic function

The transmission is controlled by the central control unit. (For more information see: 110.4.2 Central control unit (UEC3), page 110-13)

2.2 Gear selection

Three gears are available. (For more information see: Gears, page 120-6)

The gear is selected by the central control unit and engaged.

The central control unit uses the following parameters to calculate the most suitable gear:
- Travel range selected
- Travel speed
- Current to the control pressure proportional valve Y59 on the travel pump
- Current to the proportional valve Y57 on travel motor 2
- Speed from the output speed sensor B1 and from the travel motor 2 speed sensor B2

LBH/11827693/04/211-20180814_111345/en

130.1.2 Rear axle

Valid for: L538-1493/31405-;

1 Layout

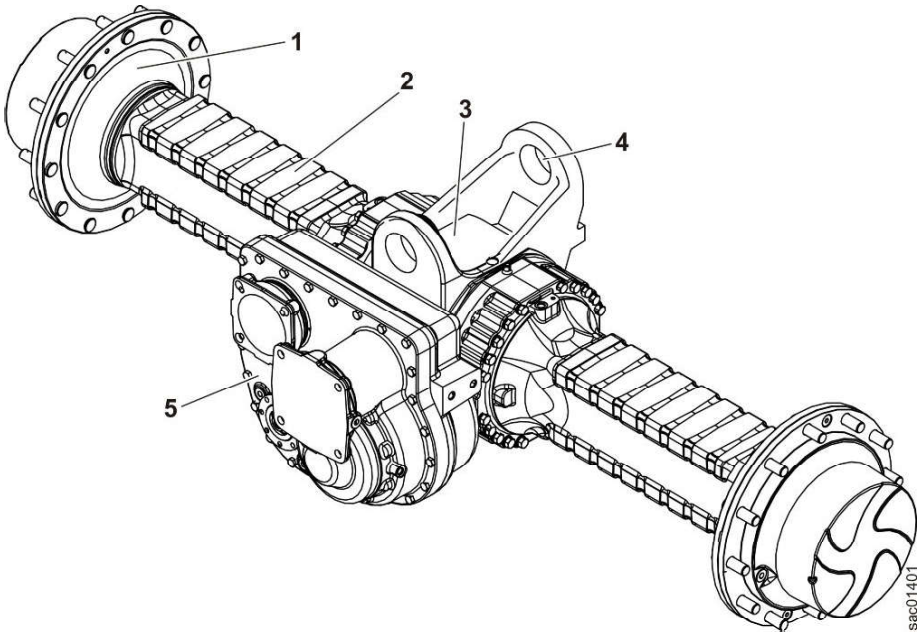


Fig. 428: Rear axle

1	Wheel hub	**4**	Oscillating bearing
2	Axle casing	**5**	Transmission
3	Main housing		

The self-locking differential is inside the main housing **3**.

The service brake **2** is built into the axle casings.

2 Function

The functions of the rear axle correspond with the functions of the front axle. (For more information see: Function, page 130-2)

LBH/11827693/04/211-20180814_111345/en

150.3 Quick coupler

150.3.1 Z kinematics quick coupler

Valid for: L538-1493/31405-;

1 Layout

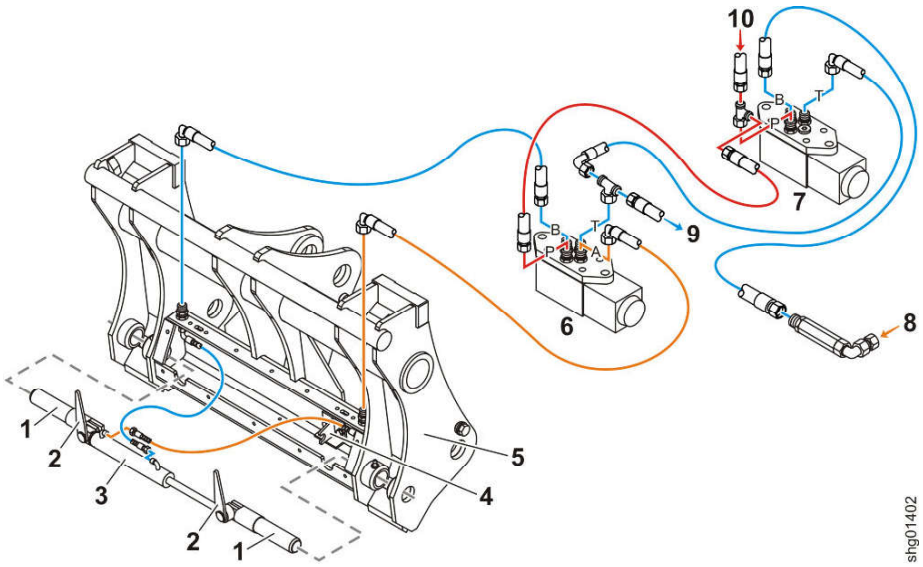


Fig. 435: Unactuated quick coupler

1	Locking pin	**6**	Quick coupler solenoid valve Y53
2	Locking indicator	**7**	Quick coupler solenoid valve LS signal Y53a
3	Hydraulic cylinder quick coupler	**8**	Control valve block (working hydraulics LS connection)
4	Backing plate	**9**	Hydraulic tank
5	Device support	**10**	Control valve block (high pressure working hydraulics connection)

2 Function

2.1 Basic function

With the quick coupler, the working attachment (bucket, forklift, etc.) can be attached and removed without additional tools.

LBH/11827693/04/211-20180814_111345/en

160.1 Overview of the cab, heating and air conditioning unit

Valid for: L538-1493/31405-;

1 Layout

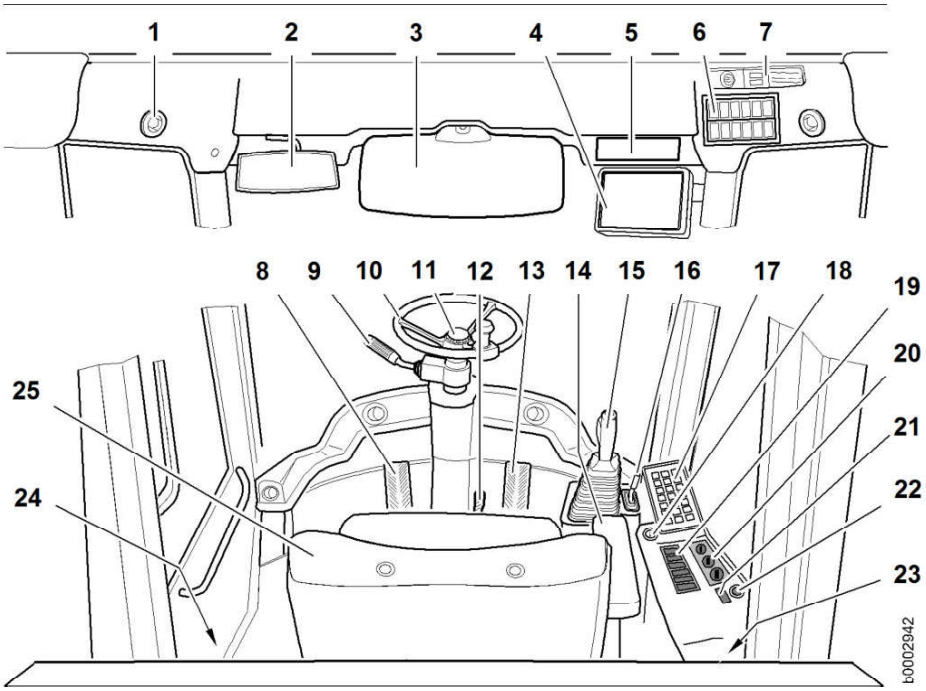


Fig. 441: Driver's cab

1	Heating, ventilation, air-conditioning outlet nozzles	**14**	Adjustable arm rest
2	Interior mirror	**15**	Control lever
3	Sun visor	**16**	Additional control lever (optional)
4	Display A13	**17**	Control unit A11
5	Radio installation	**18**	Starter switch S1
6	Switch panel	**19**	Switch panel
7	Interior lighting	**20**	"Heater/ventilation/air-conditioning" control unit
8	Inch/brake pedal	**21**	Service hours counter (optional)
9	Steering column switch S3	**22**	Cigarette lighter socket X71
10	Steering wheel	**23**	Diagnostic plug X60
11	Steering wheel hub for *steering wheel height adjustment* (optional)	**24**	Fuse box
12	*Steering wheel adjustment* lever	**25**	Driver's seat
13	Accelerator pedal R5		

2.1 Basic function

The driver's cab is mounted on a flexible bearing on the rear section.

The driver's cab is equipped with warm water heating. Optionally, an air conditioning unit can be also installed.

160.3 Heating, ventilation, air conditioning

160.3.1 Overview of the heating, ventilation and air conditioning system

Valid for: L538-1493/31405-;

1 Layout

The driver's cab is equipped with warm water heating. Optionally, an air conditioning unit can be also installed.

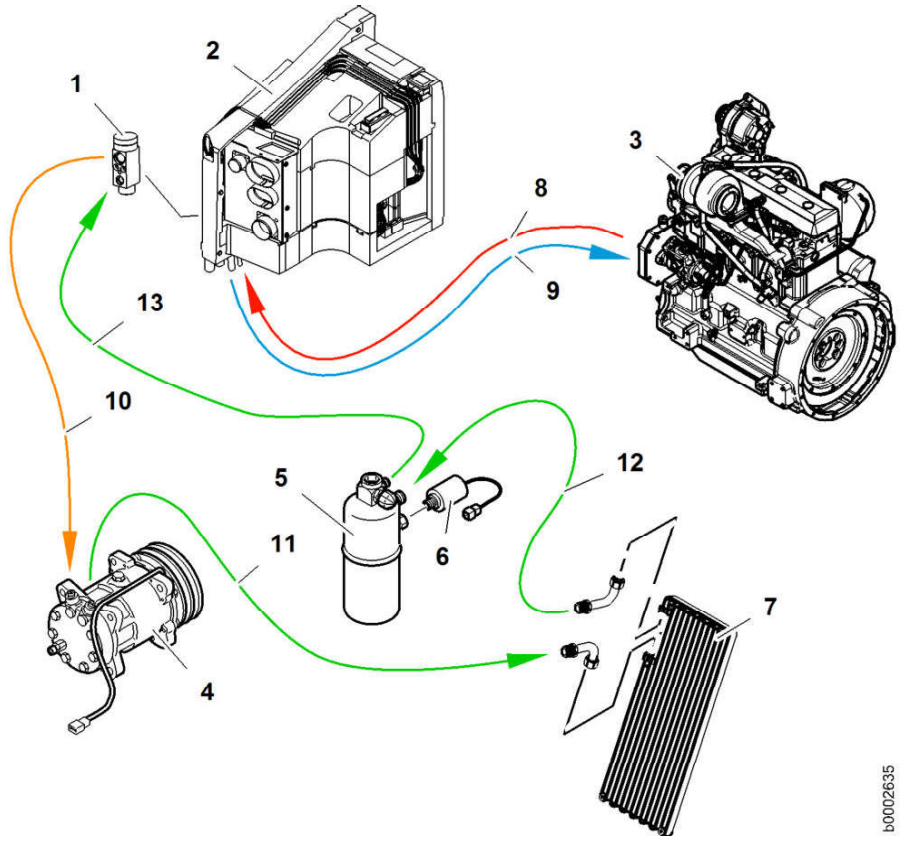


Fig. 450: Overview of the heating, ventilation and air conditioning system

1	Expansion valve	**8**	Coolant forward flow from the engine
2	Heater/blower unit	**9**	Coolant return flow from the heating and air conditioning unit
3	Engine	**10**	Low pressure line from the expansion valve
4	Air conditioning compressor	**11**	High pressure line from the air conditioning compressor
5	Dryer	**12**	High pressure line from the condenser

See next page for continuation of the image legend

LBH/11827693/04/211-20180814_111345/en

160.4.2 Condenser

Valid for: L538-1493/31405-;

1 Layout

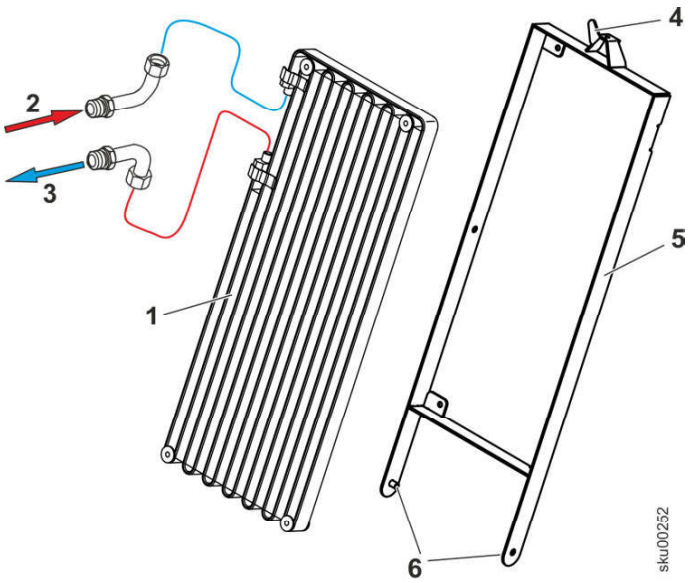


Fig. 461: Condenser with connections

1	Condenser	**4**	Fastener
2	Refrigerant intake (from air conditioning compressor)	**5**	Condenser holding frame
3	Refrigerant outlet (to dryer)	**6**	Swivel bearing for cleaning

The condenser is part of the cooling system.

2 Function

2.1 Basic function

The condenser **1** consists of a serpentine-shaped heating coil that is rigidly connected to fins. A large cooling surface and a good transfer of heat is thereby achieved. The condenser works as a heat exchanger between the ambient air and the refrigerant.

The condenser is subjected to forced ventilation by the fan of the cooling system.

The refrigerant, which has been compressed by the compressor and thereby significantly heated, flows in a gaseous state into the condenser and is cooled down there. The refrigerant condenses while cooling down and becomes liquid.

Cooling down and liquefaction keep the pressure of the refrigerant on the high pressure side (the air conditioning compressor side) low.

The refrigerant flows from the condenser to the dryer.

160.4.3 Dryer

Valid for: L538-1493/31405-;

(For more information see: 020.12.1 Dryer, page 020-25)

LBH/11827693/04/211-20180814_111345/en