Workshop literature

Electric trucks

RX20-14
RX20-16
RX20-18
RX20-20

CE

6219 6220 6221 6222 6223 6224
6225 6226 6227 6228 6229 6230
6231

first in intralogistics

56368010001 EN - 05/2018

Jacking up the truck, front

General

The truck has to be jacked up for various maintenance tasks.

⚠ DANGER

If the truck is not jacked up correctly, the truck can fall and cause fatal injuries.

- Park the truck securely.
- When jacking up the truck, always secure it against rolling away or tipping over by using the appropriate supports (e.g. wedges or supporting blocks).
- Use only hoists with sufficient load capacity.
- Only jack up the truck on a level surface.
- Only jack the truck up at the specified points.

⚠ WARNING

Risk of injury!

Apply the parking brake and set the key switch to OFF before jacking up the truck.

Jacking up the truck

- Park the truck securely on level ground.
- Turn the key switch to OFF.
- Apply the parking brake.
- Remove the forks or push them together in the middle.

For a good level of stability, support blocks must be placed under the chassis on both sides. For this reason proceed as described one side after the other.

- Lift the fork carriage so that the hydraulic jack can be placed on the outer mast.
- Jack up the truck until the wheels are no longer in contact with the ground.

▷

Maintenance - 3000 hours/every two years

At operating hours													Carried out	
3000		6000		9000		12000		15000					✓	✖
Note														
Perform all 1000-hour maintenance work.														
Power unit														
Change the gearbox oil in the drive wheel unit.														
Replace the bleeder screws on the drive wheel units.														
Hydraulics														
Change the hydraulic oil.														
Replace the return line filter and the breather filter.														
Variant: Replace the high-pressure filter.														

Working with DiaMon

Reading out and clearing the error list

– Connect the notebook to the truck and start the truck diagnostics, see the chapter entitled "Introduction to DiaMon":

F2: Diagnosis

▼

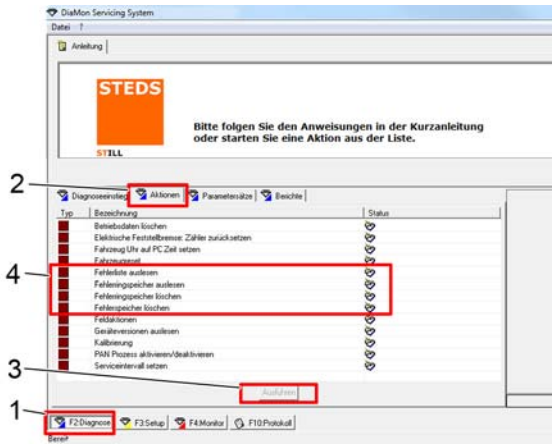
Jobs

▼

Select action (4)

▼

Execute



1 F2: Diagnosis
2 Jobs
3 Execute

Error lists

4 Read error list
4 Clear error list
4 Read error ring buffer

Read error list

Various types of error lists are available for selection:

1 Active errors

Lists all errors that are currently active

2 Errors since the last reset

Lists all errors that have occurred since the truck was switched on.

3 All stored errors

Lists all errors that have occurred since the error list was last cleared

The relevant error list is then displayed, depending on the type of error list selected. All errors from all control units are displayed in this list. It is not possible to select individual controllers.

Clear error list

The error list for all controllers will be deleted. It is not possible to select individual controllers.

Read error ring buffer

The option to read out the error ring buffer depends on the software version installed in the truck. More information about this can be found in the "Truck software overview" document

- Error ring buffer: general

  The latest 256 errors from the truck control unit (MCU, TCU are displayed (error group A).

- Error ring buffer: converter

  The latest 256 errors from the converter are displayed (error groups D and E).

For more information, see chapter "60 - Error ring buffer"

Traction motor

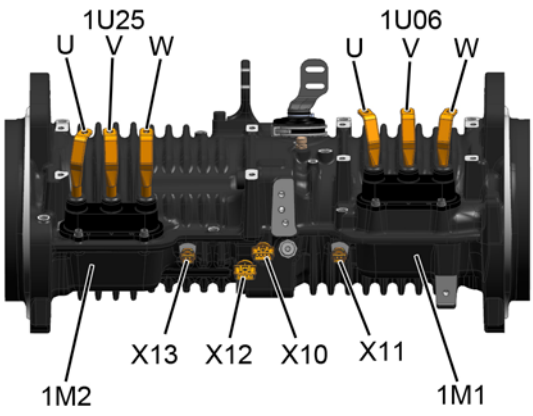
General technical data

Traction motor		6219 - 6131
Manufacturer		Linde (LIPO)
Designation		EM112-01A65F28 A54
Weight of left-hand traction motor	[kg]	75.5
Weight of right-hand traction motor	[kg]	73.7
Operating voltage	[V]	48
Motor type		Three-phase asynchronous motor with cage rotor
Circuit		Delta
Rated voltage (nominal)	[V]	28
Rated current (nominal)	[A]	195
Rated speed (nominal)	[rpm]	2310
Maximum speed	[rpm]	5900
Rated output (nominal)	[kW]	6.5
Peak output	[kW]	9.7
Mode of operation (nominal)		S2 (60 min)
Protection type		IP 54
Insulation class		F
Cooling		Convection
Sensor system		
Temperature sensor		NTC type Z-
Speed sensor		Pin sensor

Electrical connections

AE18-11

Plug	Designation
1M2	**Traction motor, left (FM2)**
1U25/U-V-W	Twin converter, left
X12	Speed sensor on 1U25
X13	Temperature sensor on 1U25
1M1	**Traction motor, right (FM1)**
1U06/U-V-W	Converter, right
X10	Speed sensor on 1U06
X11	Temperature sensor on 1U06



Drive axle AE18-11

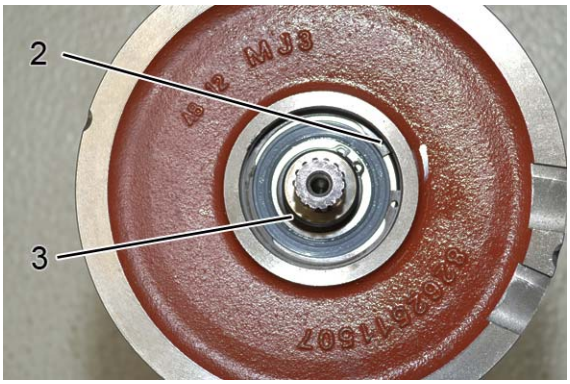
General technical data

Drive axle		
Manufacturer		Linde (LIPO)
Drive axle		**AE18-11**
Drive wheel unit		**GR2E-07**
Traction motor		EM112-01A65F28 A54
Total weight	[kg]	204
Permissible axle load	[kg]	4884
Maximum speed	[km/h]	20
Tyres (alternative)		200/50-10
Dynamic tyre radius	[mm]	229
Track width	[mm]	942 / 990
Maximum wheel speed	[rpm]	232
Gear ratio	[i]	25.45
Brakes		
Clearance	[mm]	$0.8^{+0.2}$, set under an assembly force of 60 Nm (6 kg)
Brake lever for bearing axle	[Nm]	25
Static braking torque	[Nm]	4200
With force F1	[N]	1700
Dynamic braking torque	[Nm]	According to characteristic curve
With force F2	[N]	According to characteristic curve
Oil content	[l]	$0.2^{+0.02}$
Brake oil		Shell Spirax S4 ATF HDX
Oil change interval		No oil change necessary. Oil is suitable for lifetime use

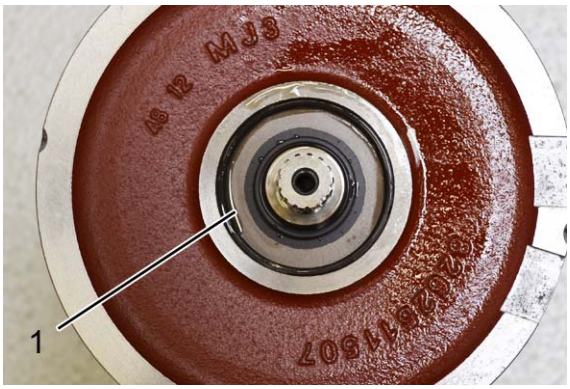
Drive wheel unit			
Slotted nut on drive wheel unit	[Nm]	650^{+50}	Slotted nut M60x2-981 Secured with FK2 WN12612
Mounting screw, 2nd planetary gear	[Nm]	25	1 x M8x20-8.8-4762 socket head screw
Gearbox oil, per side	[l]	0.3	SAE 80W-90 API-GL4
Oil change interval			Once at 1000 hours, then every 3000 hours

Tightening torques and connecting elements			
Wheel screw, per wheel	[Nm]	210	5 x spherical collar bolts
Screw joint between the drive axle and chassis, per side	[Nm]	385	6 x hexagon head screws M20x40-8.8-933 6 x washers 20-FST-A2C
Screw joint in traction motors, central	[Nm]	275	4 x M16 x 60-10.9-4762 socket head screws
Screw joint in drive wheel unit, per side	[Nm]	275	7 x M16 x 45-10.9-4762 socket head screws
Oil top-up on the gearbox	[Nm]	70	M18x1.5–6149-V80
Oil drain on the gearbox	[Nm]	15	M10x1-Y6149-MA
Oil level check on the gearbox	[Nm]	15	2 x M10x1–6149-V80
Bleeder valve for brakes	[Nm]	10	

– Fit the inner retaining ring (3) and outer retaining ring (2).



– Wet the surface of the shaft with brake oil. Press the new shaft seal (1) into the bearing flange.

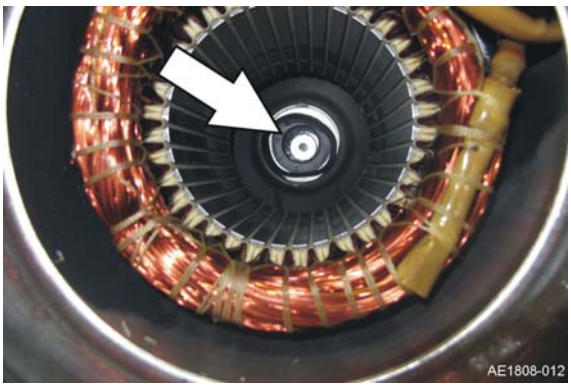


– Press on the front bearing using assembly sleeve WM451. Press the bearing in over the bearing inner ring, otherwise the bearing will be damaged.

Traction motor - Installing the rotor

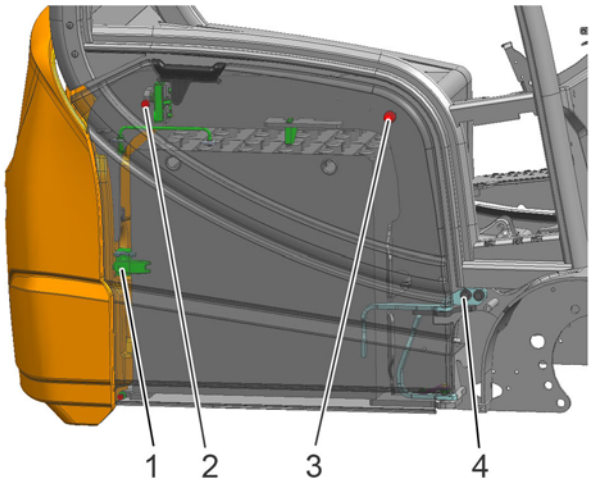
– First, insert the washer and then the shaft washers (2 pieces) into the motor housing.

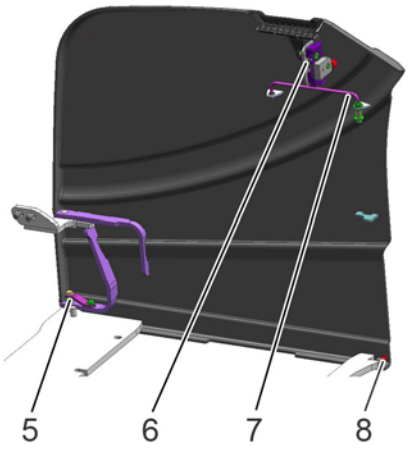
– For the bearing shield installation, mark the position of the rotation lock on the motor housing.



Chassis

Battery door





Frame

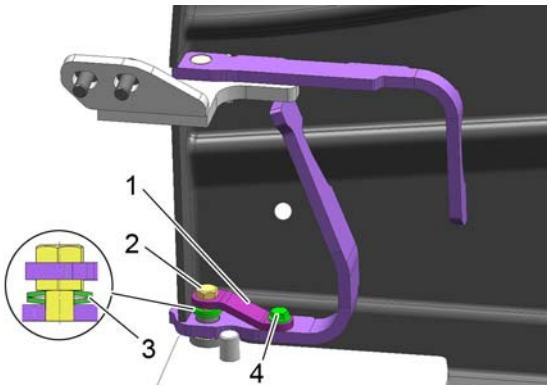
1	Battery lock
2	Catch bolt with spring element
3	Bump stop
4	Hinge

Battery door

5	Door holder
6	Door lock
7	Door opener
8	Spring element

Installing the door holder

- Lightly grease the bolt. Insert the bolt with the conical spring washers into the lower strut. The concave sides of the conical spring washers face each other.
- Tighten the bolt (left-hand thread) to a tightening torque of 40 Nm.
- Engage the multiple toothing on the tappet on the pins in such a way that it lies as close as possible to the threaded hole in the door.
- Continue to the tappet anticlockwise until it fully covers the threaded hole.
- Screw the tappet with the screw and washer to the door.



1	Tappet
2	Bolt
3	Conical spring washers
4	Screw, washer

Hydraulic steering

General technical data

Steering unit

Steering unit		3-wheel	4-wheel
Manufacturer		Danfoss	
Designation		OSPC 50	OSPC 100
Delivery rate	[ccm/rev]	50	100
Pressure relief valve	[bar]	140...150	135...150
Shock valve	[bar]	200...220	200...220
Transmission ratio Steering wheel rotation, stop to stop			
Steering speed	[rpm]	400...800	400...1600

Tightening torques			
P, T, R, L, LS	[Nm]	80_{-4}	Pipe union L10-M18x1.5

Priority valve

Priority valve		
Manufacturer		Danfoss
Designation		OLSP 80
Delivery rate	l/min	80
Pre-load pressure	[bar]	7±1
P, EF, maximum pressure	[bar]	290
CF, LS, maximum pressure	[bar]	175
Load signal		Dynamic

Tightening torques			
P, hydraulic pump	[Nm]	9^{+1}	4 x socket head screws M6x40-8.8
LS, Load Sensing	[Nm]	$30_{-1.5}$	Pipe union M12x1.5/M18x1.5
EF, directional control valve (high-pressure filter)	[Nm]	100_{-5}	
CF, steering	[Nm]	80_{-4}	Pipe union L12ME-ST

Screw in the screw joints up to the blue coating. Then screw the screw joints into position using a minimum of three to a maximum of four revolutions. Do not unscrew the screw joints.

– Mount the wheels.
– Lower the truck.
– Tighten the wheel nuts.
– Guide the cable for plug X29 upwards into the counterweight.
– Connect plug X29.
– Fit the sheet metal cover.
– Install the battery in the truck.

Bleeding the steering

– Warm up the truck.
– Then steer fully from stop to stop at least five times.

– Slide the washer (46) onto the wheel shaft and knock in the slotted spring pin (3).

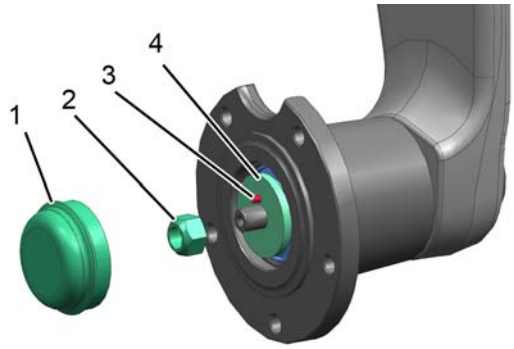
– Tighten the new prevailing torque nut (2).

⚠ CAUTION

Observe the specified tightening torque.

The thread of the wheel shaft and prevailing torque nut must be clean and free of grease!

– Fill the hubcap (1) completely with grease. Fit the hubcap on the wheel hub and knock it in using a soft-faced hammer.



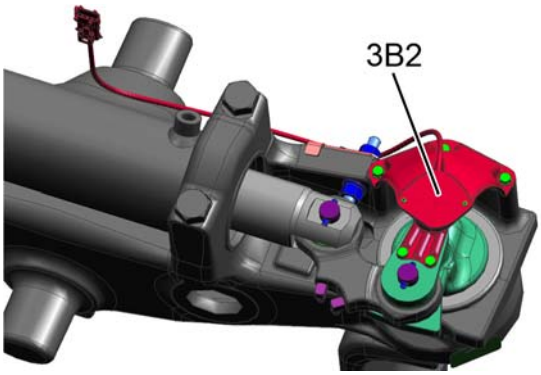
Disassembling the steering cylinder and track rod

Disassembly

– Remove the steering axle. See the chapter entitled "Removing/installing the steering axle".

– Place the steering axle on a suitable pad. Set the steering to the straight-ahead position.

– On the right-hand side, unscrew the steering angle sensor together with the transmitter.

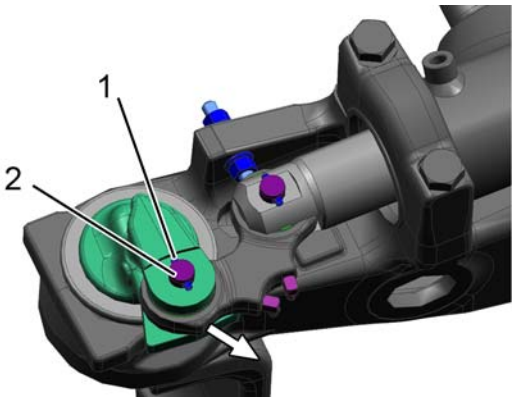


– Knock out the upper slotted spring pin (1) on both sides. Press out the bolt (2).

NOTE

When pushing out the bolt, support the steering arm from below to prevent it from being damaged.

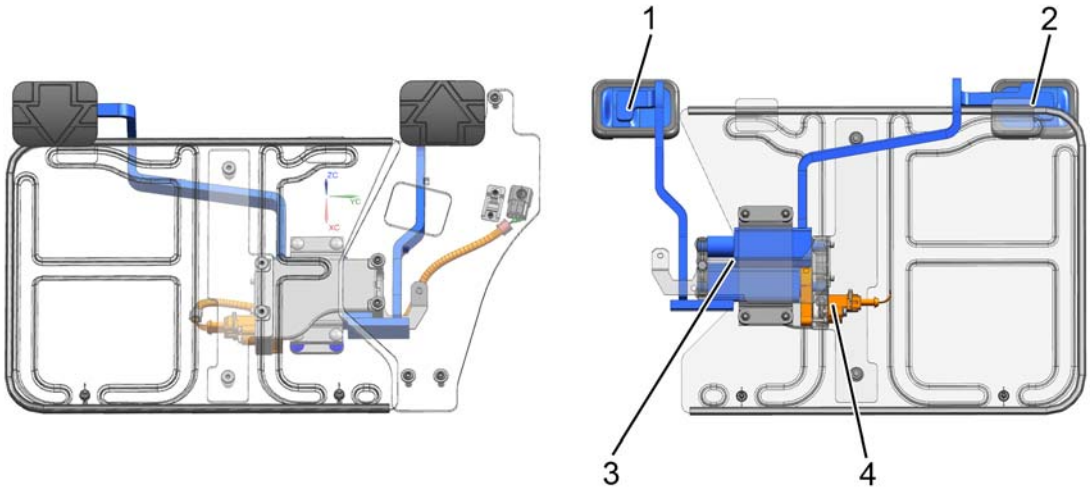
– Unscrew the track rods with the spherical bearings and seals from the steering arms.



Errors	
Voltage increase too small	The maximum speed is not reached
Voltage increase too large	No problem for the evaluation ► The maximum speed is reached but not exceeded. ► The controller ignores the end range of the voltage increase (dead travel)
Voltage increase significantly too large	Detection of breakdown with corresponding error message

Dual pedal, generation 2

Accelerator



1 Pedal, forwards
2 Pedal, reverse
3 Lubrication points for maintenance
4 Potentiometer 1B3

The accelerator comprises two mechanically connected accelerator pedals that move in opposite directions. When the accelerator pedal is pressed, the potentiometer 1B3 regulates the driving speed.

Technical data

Plug	6-pin MQS (AMP)
Supply voltage	5 V ± 10%
Protection class	IP64
Temperature range	-40°...+65°C

Electrical connections

1B3/1	GND	1B1/1	X47/49
		1B1/2	
		1B1/3	
1B3/3	Accelerator signal, channel 2	1B1/4	X47/15

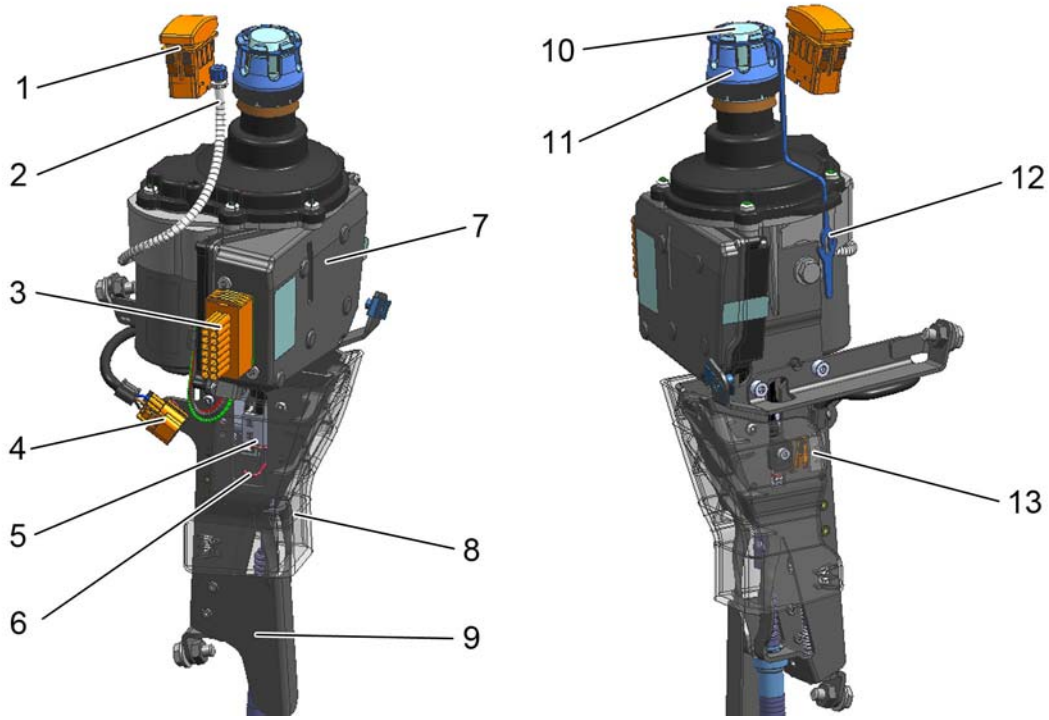
Electric parking brake

Function and layout

The electric parking brake (ELF 2) actuates the mechanical multi-disc brake on the drive axle via a brake cable. It makes sure that the brake is applied automatically when the operator leaves the truck.

The ELF 2 can be released and applied via the toggle switch (1). All the necessary enable flags, such as seat switch and switch lock, must be present in order to release the brake. The ELF 2 also offers automatic driver assistance functions, which apply and release the brake automatically in certain situations. In emergency operation or during transport without a battery, the ELF 2 can be operated manually via the hand wheel (11).

Layout



1	Toggle switch 9S26 with LED	7	Controller
2	Hose with grease supply for continuous lubrication	8	Panelling
		9	Console
3	Plug X506	10	Tappet
4	Plug 1S3	11	Hand wheel for emergency actuation
5	Automatic cable adjustment	12	Joining plate
6	Safety clip	13	Limit switch 1S3

The ELF 2 consists of a drive unit with integrated controller (7). The ELF 2 is attached to the front structure of the truck by means of two screws.

Joystick 4Plus

Layout

The Joystick 4Plus is an operating device built into the right-hand armrest of the driver's seat. Within the Joystick 4Plus there are various controls that that the driver can activate using his right hand.

NOTE

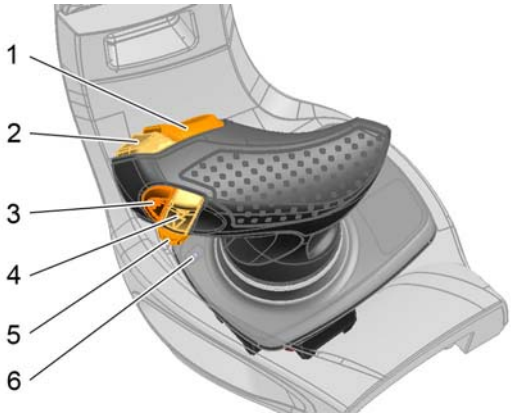
Modified control functions:

- *Lighting in line with the German road traffic licensing regulations always only with travel direction selector and indicator module.*
- *The emergency off switch is located in the steering column as standard.*

1 Joystick
2 LED display
3 Housing inlay
4 Support for the display and operating unit
5 Panel
6 Upper shell
7 Control symbols
8 Lower shell

Functions

The **shift key F** can be assigned different functions during the parameterisation process. For example, switching over the control axles. The switchover can be performed only when all axles are in the neutral position. The 5th hydraulics can then be actuated, for example.



1 Horizontal rocker button
2 Horn button
3 Shift key F
4 Drive direction
5 Slider
5 LED display for clamp release

Technical data

CAN bus	CAN open as standard; integrated into the red CAN bus
Sensors	1 Hall sensor per axle
Software	Device ID "I"
Protection class	IP 65
Temperature range	-30 °C to +85 °C

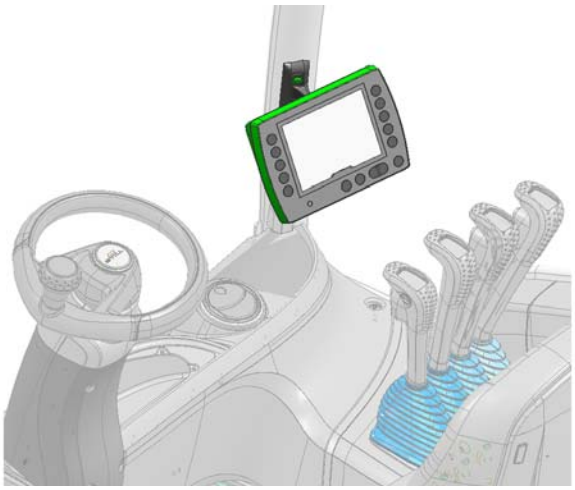
Electrical connections

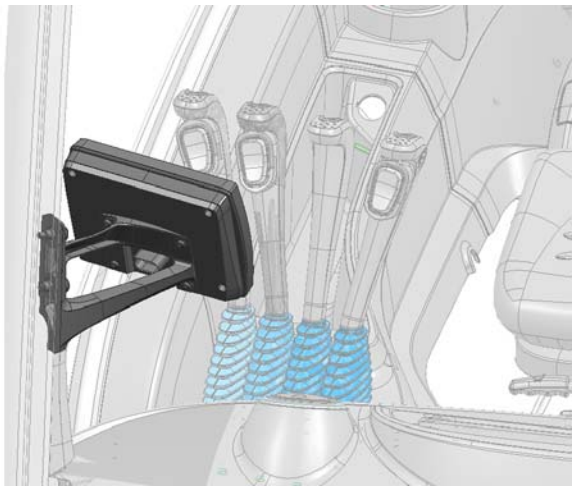
X100	
X100/1	CAN_rt_H
X100/2	CAN_rt_L
X100/3	CAN_rt_GND
X100/4	12 V
X100/5	Unassigned
X100/6	Unassigned

Display

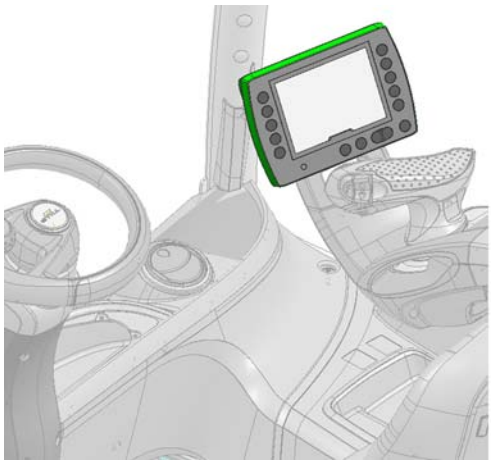
Display and operating unit ABE 3

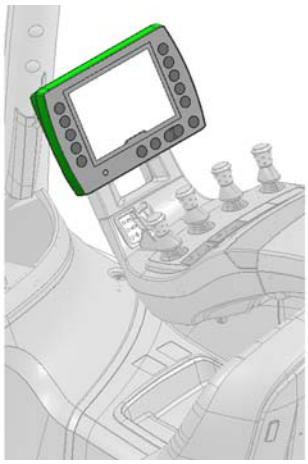
ABE 3 for trucks with hand lever

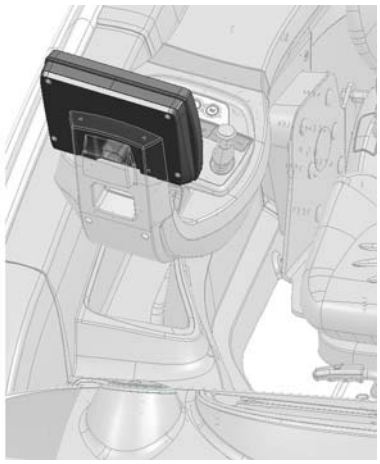




ABE 3 for trucks with servo hydraulics







Technical data

CAN bus	CAN open as standard ABE CAN bus (orange)
Software	Device ID "J"
Operating voltage	12 V (9...18 V)
Current draw	0.5 A
Current draw with display heating activated	1.5 A
Protection class	
Temperature range	-35...+75 C
Mounting on armrest	4x M5x10-08.8-ZNB 2.1 Nm
Mounting on A-column	

Electrical connections

ABE 3	
X49/1	CAN or H (orange)
X49/2	CAN or L (orange)
X49/3	12 V
X49/4	CAN or GND (orange)
X49/5	X50/5, enable diagnostics
X49/6	X50/6, TRX-P
X49/7	X50/7, TRX-M
X49/8	—
X49/9	—
X49/10	—

LED-X27 or LED X93 LED (4) illuminate in red and go out slowly.

– Use the multimeter to check the voltage in the intermediate circuit.

If the voltage is below 3 V, the intermediate circuit is discharged.

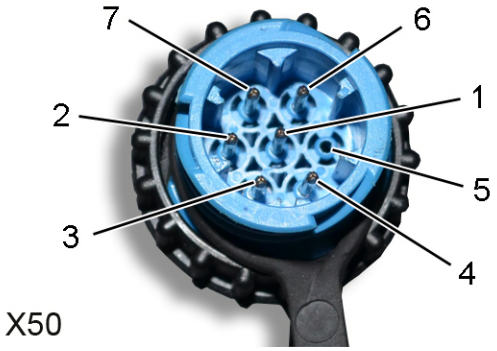
Components		CAN bus	Terminal resistance and measurement		12-V supply
X89	Lithium-ion battery	Green	120 Ω	not possible	12 V_X46:104
X88	VDI 4458 interface	Violet	120 Ω	not possible	12 V_1F8_X47:26

Diagnostic connector X50

Technical data

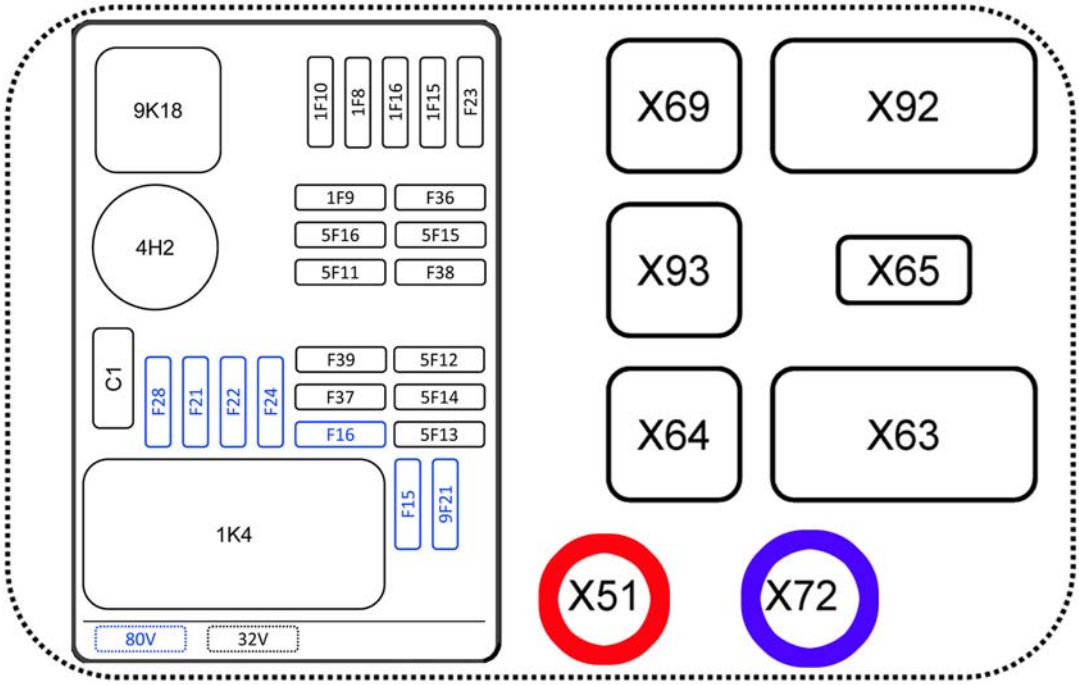
X50	Assignment
X50/1	CAN ge H (yellow)
X50/2	CAN ge L (yellow)
X50/3	12V_1F8_Bus
X50/4	CAN ge GND (yellow)
X50/5	X49/5, enable diagnostics
X50/6	X49/6, TRX-P
X50/7	X49/7, TRX-M

The pins X49/5 .... X49/7 are intended for quick loading of the ABE parameters. Quick loading via an Ethernet connection. This function is currently active only for the production variant. The Ethernet connection is not yet available for the servicing variant



Fuses

Fuse box



The fuse box is fitted with 32-V and 80-V fuses. All of the 80-V fuses are located in the battery voltage circuit. The 32-V fuses are located in the on-board power supply circuit.

NOTE

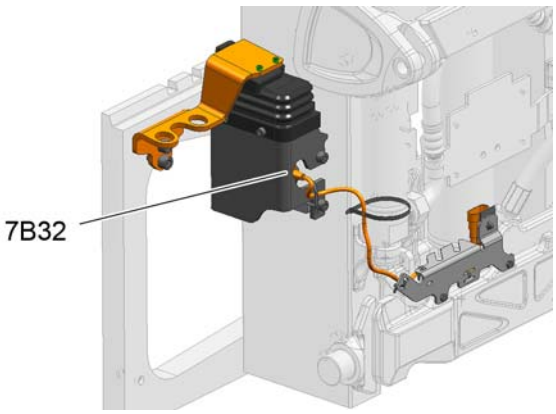
Observe the voltage range of the fuses!

Fuse			Connection
F15	30 A / 80 V	Green	12-V reserve
F16	5 A / 80 V	Brown	Fan
F21	20 A / 80 V	Yellow	Voltage converter U2
F22	20 A / 80 V	Yellow	Voltage converter U3
F23	5 A / 32 V	Brown	Voltage converter, emergency off switch
F24	20 A / 80 V	Yellow	Voltage converter U4
F28	15 A / 80 V	Blue	Voltage converter U1
F36	10 A / 32 V	Red	MMI 12 V
F37	10 A / 32 V	Red	MMI 24 V (after voltage converter U4)
F38	30 A 32 V	Green	CPP 4
F39	10 A / 32 V	Red	24-V reserve for restraint system Sauermann
1F8	5 A / 32 V	Brown	MCU, 12-V CAN bus, red
1F9	5 A / 32 V	Brown	12-V CAN bus, blue
1F10	10 A / 32 V	Red	12-V CAN bus, red
1F15	5 A / 32 V	Brown	12-V relay 1K18, 1K4 (ABE 3, TDU)
1F16	20 A / 32 V	Yellow	12 V for servo hydraulics (FIT), switchover of release valve
5F11	30 A 32 V	Green	CPP 1

LED lift height sensor 6B32

Function

Not yet available



NOTE

If the truck is to be converted to use optical lift height sensor 6B32, the lift height switch 7B41 and the support must be removed from the outer mast.

Technical data

Technical data	
Supply voltage	12 V
Operating voltage, U_B	10 to 30 V
Interface	CANopen, 250 kBit/s
Measuring range	0.05 to 14 m
Light emitter	LED
Ambient temperature	-35 to +55 °C
Protection type	IP 65

Electrical connection		
4-pin AMP plug		
7B42/1	CAN_rt_H	CAN distributor 6X73/1
7B42/2	CAN_rt_L	CAN distributor 6X73/2
7B42/3	12V_1F10_Bus	CAN distributor 6X73/3
7B42/4	CAN_rt_GND	CAN distributor 6X73/4

Parameterising

The required function must be parameterised for all retrofitting and conversions. Parameterisation is performed using the truck diagnostics on the notebook.

Parameterisation via diagnostics

- `F3: Setup`
  - `Assistance systems`

A truck restart must always be performed after parameterisation.

Calibration

Once calibration is complete, error messages may be displayed.

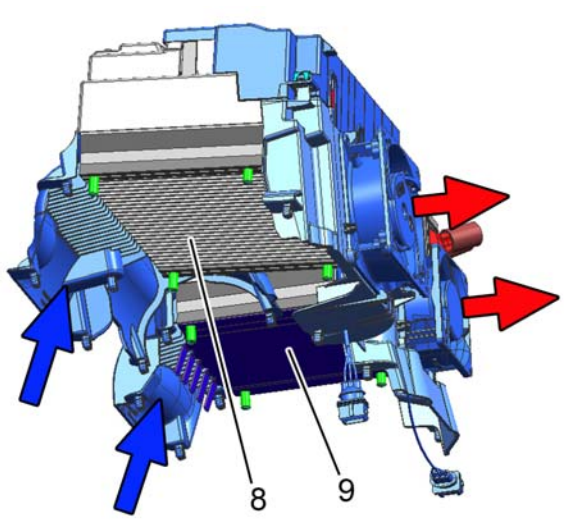
Calibration via the display-operating unit

- Service password level

Calibration via diagnostics

- `F2: Diagnosis`

Since there is no filter to prevent dirt from being drawn in along with the fresh air, it is to be expected that the cooling fins will become dirty. Cleaning with compressed air is harmful to health and is therefore prohibited. At present we are searching for a suitable cleaning method.

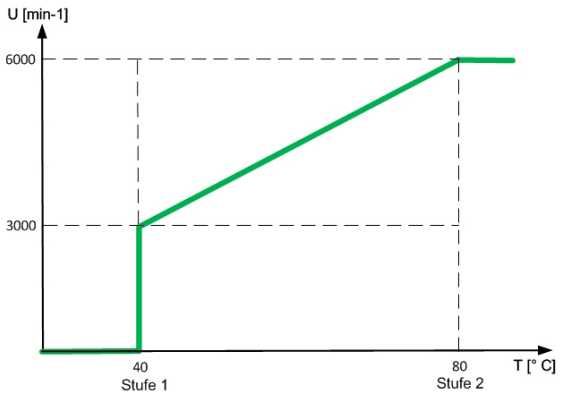


8 Cooling fins
9 Air duct, bottom

Fan controller

The temperatures of the converters and the traction motors are monitored in the MCU. If a raised temperature is detected, the fans are switched to level 1.

The command for the fan control is sent from the MCU as a PWM signal and is forwarded to the converter 1U25. Both fans are switched on and run at the same speed.

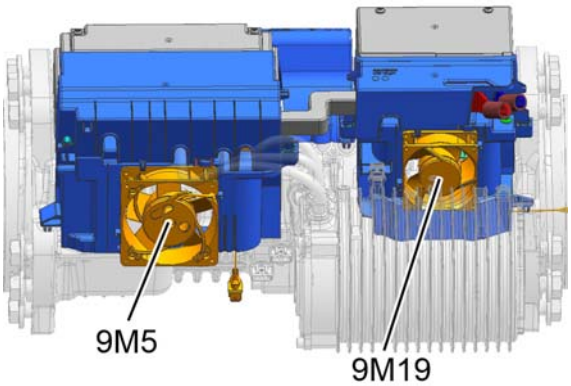


Fan

The fans are engaged in the air duct. Turn the fans 30° anti-clockwise to release them.

NOTE

On some trucks in the pilot series, the left-hand fan is also secured with a screw on the bottom right.



Technical data		
	9M5	**9M19**
Nominal voltage U_N	48 V	48 V
Permissible voltage range	33 to 60 V	33 to 60 V
Maximum volume flow rate	280 m^3/h	130 m^3/h
Revolution speed	6000 rpm	6000 rpm

Temperature-dependent battery capacity

The ideal operating temperature for batteries is between 20°C and 40°C. However, the maximum battery capacity is only reached at an optimum temperature of 27 - 30°C.

A decrease in temperature reduces the battery capacity by 1% for every 1°C. At a temperature of 0°C, the battery has a capacity loss of 27%. Only 73% of the maximum capacity remains available.

Electrolyte temperatures of over 55°C cause permanent damage to the battery and shorten the service life considerably.

Sulphated battery

If the battery is incorrectly handled, lead and sulphur bond together to form a hard lead sulphate. This process is known as permanent or hard sulphation.

Permanent sulphation can be detected by the discolouration of the plates. The positive plates turn light brown and the negative plates turn a matt, off-white colour. Sulphation reduces the capacity of the battery and its ability to be recharged.

Reasons for a sulphated battery:

- Frequent deep discharging
- Full charged incorrectly
- Charging current too low
- Frequent intermediate charging
- Battery temperatures of over 55°C when charging and discharging

Service and maintenance

Always follow the battery manufacturer's notes and rules regarding the correct handling procedure for batteries.

Battery male connector

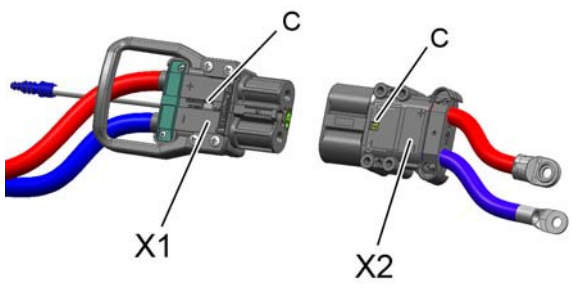
Design

The battery male connector consists of two parts:

- X1: Battery male connector
- X2: appliance plug

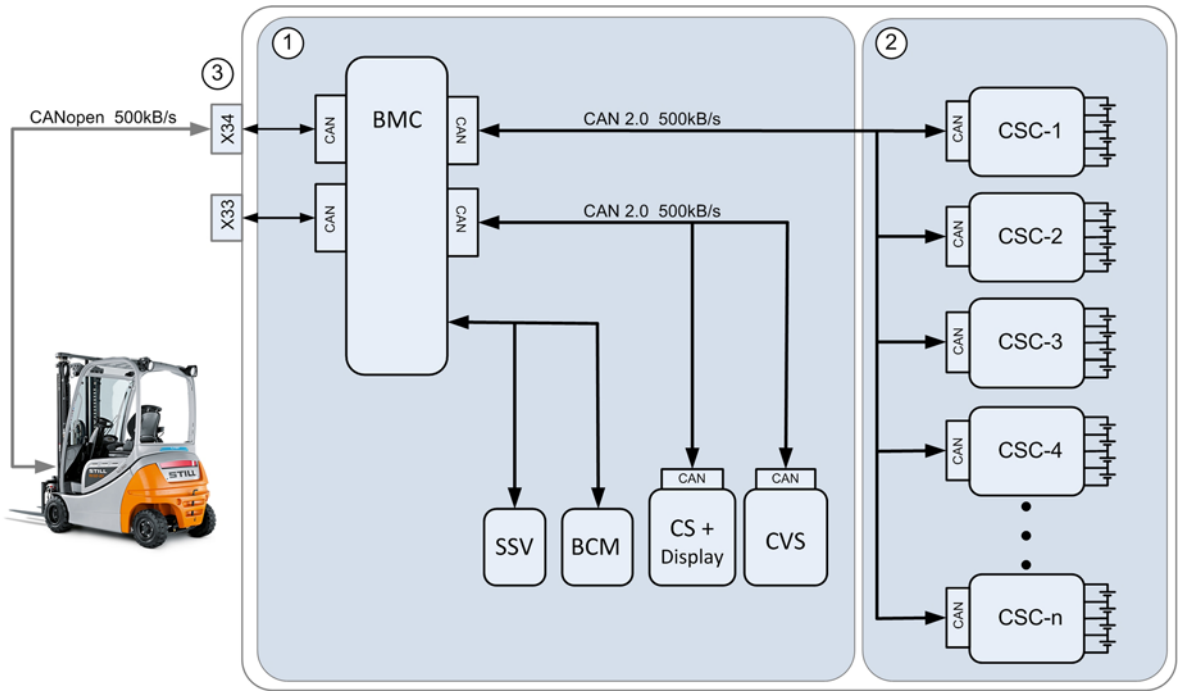
The battery male connector (X1) is equipped with a handle and is securely connected to the battery via contact bushings.

The appliance plug (X2) is mounted on the right-hand side of the chassis below the battery door using a sheet metal holder.



Conformity		
Protection class	IP6K9K	
Fire protection rating	External housing	A2
	13S cell module	B2

Battery management system (BMS)



1. Technology compartment
BMC Battery controller
BCM Brake chopper module
CVS Current/voltage sensor
CS Shock sensor and battery display
SSV Control voltage supply

2. Battery tray
CSC Battery module controllers

3. Interfaces
X34 Communication plug
X33 Diagnostic connector

The battery management system (BMS) contains various controllers that communicate with one another via CAN bus systems. The battery controller (BMC) is the main processor in this system. Each battery module has its own battery module controller (CSC). The BMS is powered by the battery itself.

Tasks of the battery controller (BMC)

- Controlling and monitoring all battery functions
- Communicating with the truck
- Collecting all battery data and formatting it for the truck
- Recording all operating and diagnostic data relating to the battery
- Processing the data supplied by the truck

Task of the battery module controllers (CSC):

- Monitoring the individual battery cells in a battery module
- Sending data to the BMC and retrieving data from the BMC
- Operating the battery module via the internal CAN bus
- Permanent Balancing

The BMS contains independent CAN bus systems for data transfer between the controllers and for communication with the truck.

General

General technical data

Hydraulic speeds

Auxiliary hydraulics			
Maximum speed	rpm	2200	

Hand lever			
Lifting	rpm	2800	
Tilting forwards	rpm	800	Independent of the lift height
Tilting backwards	rpm	660	

Servo hydraulics			
Lifting	rpm	3500	
Tilting forwards	rpm	1100	Independent of the lift height
Tilting backwards	rpm	950	

Hydraulic oil

Hydraulic tank			
Total filling quantity	[l]	23...30	Dependent on the lift mast and lift height
Hydraulic oil	Quality in accordance with DIN 51524/part 3 HVLP or ISO VG 68		

Hydraulic filter

Return line filter			
Manufacturer			Argo Hytos
Degree of filtration	[µm]	20	
Operating pressure (maximum)	[bar]	10	
Triggering pressure, bypass valve	[bar]	3.4 ±0.3	
Maintenance interval	3000 h or 2 years		
Tightening torque			
Maintenance cover	[Nm]	20	Tighten by hand
Mounting of the housing	[Nm]	11	4x nuts M8-8-A2C
Steering return line	[Nm]	40^{10}	Pipe adaptor M18x1.5
Valve block return line	[Nm]	50^{10}	Pipe adaptor M26x1.5
Temperature sensor	[Nm]	20^{2}	M12x1.5, with sealing ring 12x19x1.5
Breather filter with dipstick			
Degree of filtration	[µm]	2, absolute	
Maintenance interval	3000 h or 2 years		

Intake filter			
Manufacturer			Argo Hytos
Degree of filtration	[µm]	250	
Maintenance interval	Maintenance-free		

Technical data	
Plug	2-pin
Mounting	M12x1.5
Tightening torque	20^{+2} Nm

Plug 2R17			
Red	2R17/1	X46/16	Oil temperature
Blue	2R17/2	X46/58	GND

Testing

– Connect a multimeter to the pins on the plug. The negative potential of the multimeter must be connected to the negative terminal (blue) of the temperature sensor.

– Check the resistor using the table.

Reference values for temperature measurement

Temperature [°C]	Resistance [Ω]
-10	9104...9676
0	5727...6056
10	3692...3887
20	2439...2557
25	2009...2102
30	1669...1742
40	1151...1197
50	818...848
60	585...605
70	429...412
80	318...327

Lift mast

General technical data

Lift mast	Profile 108 (1500 - 1800 kg); profile 117 (2000 kg)		
Line break safety valves	[Nm]	60^{+6}	M20 to M23x1.5
	[Nm]	90^{+9}	M26x1.5
Hydraulic line for outer cylinder	[Nm]	60^{+6}	M26x1.5
Bleeder screws	[Nm]		
Support roller play; profile 108 (1500 - 1800 kg)			
Diameter of support roller	[mm]	75.3	Standard dimension
Permissible radial play	[mm]	0.05	Minimum play
	[mm]	0.4 to 0.6	Maximum play
Permissible lateral play	[mm]	0.1	Minimum play
	[mm]	0.3 to 1.1	Maximum play
Middle roller in case of 6-roller fork carriage		The play of the centre roller is 0.2 mm larger than the play of the upper rollers	
Support roller play; profile 117 (2000 kg)			
Diameter of support roller	[mm]	80.9	Standard dimension
Permissible radial play	[mm]	0.05	Minimum play
	[mm]	0.4 to 0.6	Maximum play
Permissible lateral play	[mm]	0.1	Minimum play
	[mm]	0.3 to 1.1	Maximum play
Middle roller in case of 6-roller fork carriage		The play of the centre roller is 0.2 mm larger than the play of the upper rollers	
6-roller fork carriage			
Upper support rollers in case of 6-roller fork carriage	[Nm]	20	M12 screw plug Loctite 243

Lift mast weight

The weights of lift masts vary depending on the model, load-bearing capacity and overall height.

Lift mast	Profile	Load-bearing capacity [kg]	Weight [kg] Without fork carriage, fork arms, attachments
Telescopic	108	1500 - 1800	LM / 1000 x 111.3+72.9
NiHo		1500 - 1600	LM / 1000 x 112.1+83.6
		1800	LM / 1000 x 112.1+82.9
Triplex		1500 - 1600	LM / 1000 x 169.7+99.6
		1800	LM / 1000 x 169.7+99.3
Telescopic	117	2000	LM / 1000 x 139.0+71.4
NiHo			LM / 1000 x 138.5+82.3
Triplex			LM / 1000 x 205.6+114.4

Working on lift masts

Specifications

For the work described, it is important to know the overall weight of the lift mast, as well as the weight of the fork carriage and any attachments.

The following devices are required for the work described:

- Second truck or crane with a sufficient nominal load
- Safety chains and lifting slings with a sufficient nominal load
- Supporting blocks and europallet
- Hydraulic jack with sufficient nominal load, lifting bag if necessary

⚠ WARNING

Hydraulic oil is hazardous to health. Hydraulic oil is pressurised during operation.

– Do not spill the hydraulic oil.
– Spilt hydraulic oil must be cleaned up immediately using oil-binding agents.
– Comply with statutory regulations for disposal.
– Do not allow hydraulic oil to come into contact with hot engine parts.
– Do not allow hydraulic oil to come into contact with the skin.
– Avoid inhaling spray.
– To avoid injury, use the appropriate protective equipment (protective gloves, protection goggles, skin protection and skin care products).
– Release the pressure from the system before carrying out any work on the hydraulics.

NiHo lift mast

NiHo lift mast NeMaS

Function

The NiHo lift mast is a high-visibility lift mast and consists of an inner mast (2) and an outer mast (3). The mast profile of the outer mast is a U-profile; the profile of the inner mast is a double-T-profile. The outer cylinders (4) are located behind the profile of the outer mast on each side. The piston rods are connected to the crossmember of the inner mast at the top.

The fork carriage and mast profiles are guided by support rollers (1); these also absorb the lateral forces. The lower support roller for the inner mast also passes through a plastic shell. This shell absorbs the force when the load is reversed. This is necessary because the U-profile of the outer mast is larger than the diameter of the support roller. If the lift mast is tilted backwards when the load is raised, the centre of gravity changes to behind the axle. This is called load reversal.

A middle cylinder (7) is installed within the inner mast.

The middle load chain (5) is connected to the middle bridge piece for the inner mast (6) via a clamping bolt. The load chain is redirected by a chain roller on the middle cylinder. The end link of the load chain is connected to the fork carriage.

NOTE

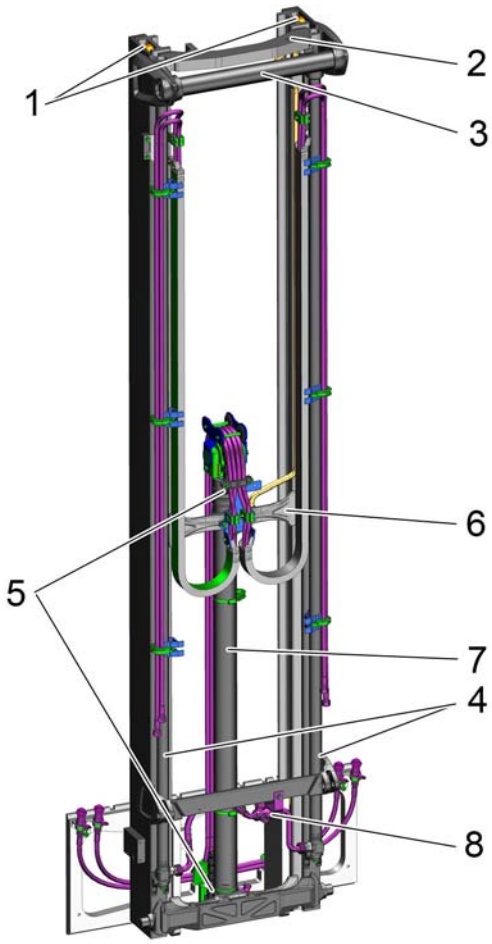
Using a six-roller fork carriage presents an exception in this regard. Even in lift 1, this fork carriage rises a few centimetres above the top of the inner mast, so that the overall height of the truck changes.

When the lift cylinders are supplied with hydraulic oil, the lift piston of the middle cylinder extends first, taking with it the fork carriage via the load chain in lift 1.

When the middle cylinder is in the end position, the lift pistons of the outer cylinder extend, taking with them the inner mast in lift 2.

The end stop is in the cylinders.

A run-out barrier prevents the fork carriage from tilting outwards; see the chapter entitled "Run-out barrier".



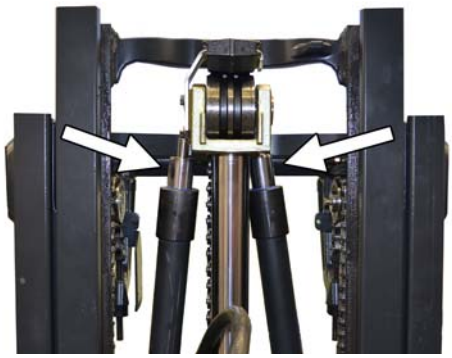
1	Support rollers
2	Inner mast
3	Outer mast
4	Outer cylinder
5	Middle load chain
6	Middle bridge piece for the inner mast
7	Middle cylinder
8	Hydraulic manifold

When replacing the support rollers, the outer cylinders can remain in the lift mast.

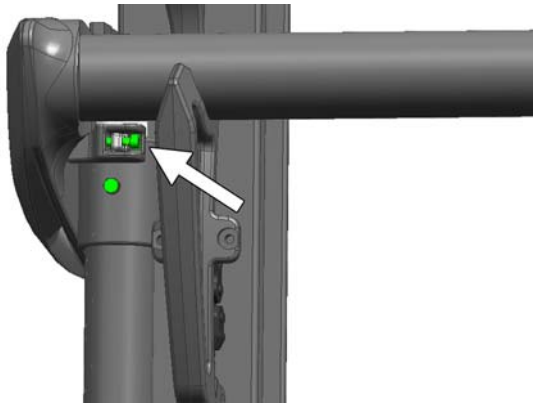
- Remove the tensioning pieces on both sides.
- Pull the outer cylinders down and out of the bearings. Tilt them inwards. Secure them against slipping using long cable ties.

If the outer cylinders are to be completely removed, at this point, the hydraulic lines must be unscrewed.

- Place a collection vessel for hydraulic oil under the outer cylinder.
- Unscrew the hydraulic lines from the outer cylinders. Protect the open connections against contamination.



- Remove the tensioning pieces on both sides.
- Lift the outer cylinder out of the lift mast.



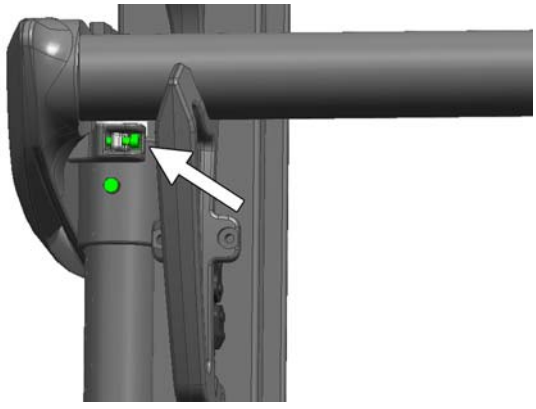
Installing

- Lift the outer cylinders into the bearings from below.

NOTE

The position can be determined by the design of the cylinder. The hydraulic connections point inwards.

- Position the outer cylinders on both sides. Tighten using the tensioning piece.



– Lift the fork carriage. Secure the load chain with the locking screw.
– Remove the supporting blocks. Lower the fork carriage.
– Adjust the middle load chain; see the chapter entitled "Adjusting the middle load chain".