EFG 110-115

10.09

Operating instructions

51151449

11.14



EFG 110k EFG 110 EFG 113 EFG 115





Declaration of Conformity



Jungheinrich AG, Friedrich-Ebert-Damm 129, 22047 Hamburg, Germany Manufacturer or agent acting in the European Union

Model	Option	Serial no.	Year of manufacture
EFG 110k			
EFG 110			
EFG 113			
EFG 115			

Additional information

On behalf of

Date

(GB) EC Declaration of Conformity

The undersigned hereby declare that the powered industrial truck described below in detail complies with the European Directives 2006/42/EG (Machinery Directive) and 2014/30/EU (Electromagnetic Compatibility - EMC) including amendments as well as the legislative decree to incorporate the directives in national law. The signatories are in each case individually authorised to compile the technical documents.

Foreword

Notes on the operating instructions

The present ORIGINAL OPERATING INSTRUCTIONS are designed to provide sufficient instruction for the safe operation of the industrial truck. The information is provided clearly and concisely. The chapters are arranged by letter and the pages are numbered continuously.

The operator manual details different industrial truck models. When operating and servicing the industrial truck, make sure that the particular section applies to your truck model.

Our trucks are subject to ongoing development. We reserve the right to alter the design, equipment and technical features of the system. No guarantee of particular features of the truck should therefore be assumed from the present operating instructions

Safety notices and text mark-ups

Safety instructions and important explanations are indicated by the following graphics:

↑ DANGER!

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

↑ WARNING!

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

↑ CAUTION!

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.

- Used before notices and explanations.
 - Indicates standard equipment
 - Indicates optional equipment

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Appendix

JH Traction Battery Operating Instructions

These operating instructions apply only to Jungheinrich battery models. If using another brand, refer to the manufacturer's operating instructions.

A Correct Use and Application

1 General

The truck must be used, operated and serviced in accordance with the present instructions. All other types of use are beyond its scope of application and may result in damage to personnel, the industrial truck or property.

2 Correct application

NOTE

The maximum load and load distance are indicated on the capacity plate and must not be exceeded.

The load must rest on the load handler or be lifted by an attachment approved by the manufacturer.

The load must be fully raised, see page 86.

- Lifting and lowering loads.
- Transporting lowered loads over short distances.
- Do not travel with a raised load (>30 cm).
- Do not carry or lift passengers.
- Do push or pull load units.
- Occasional towing of trailer loads.
- When towing trailer loads the load must be secured on the trailer.
- The permissible trailer load must not be exceeded.

3 Approved application conditions

- Operation in industrial and commercial environments.
- Permissible temperature range -20°C to 40°C.
- Operation only on secure, level surfaces with sufficient capacity.
- Do not exceed the permissible surface and spot load limits on the travel routes.
- Operation only on routes that are visible and approved by the operating company.
- Negotiating inclines up to a maximum of 15 %.
- Do not travel across or at an angle on inclines. Travel with the load facing uphill.
- Operation in partially public traffic.

↑ WARNING!

Use under extreme conditions

Using the truck under extreme conditions can result in malfunctions and accidents.

- ► Special equipment and authorisation are required if the truck is to be constantly used in extreme conditions, especially in dusty or corrosive atmospheres.
- ▶ The truck cannot be used in areas at risk of explosion.
- ► In adverse weather conditions (thunder, lightning) the industrial truck must not be operated outside or in endangered areas.

4 Proprietor responsibilities

For the purposes of the present operating instructions the "operating company" is defined as any natural or legal person who either uses the industrial truck himself, or on whose behalf it is used. In special cases (e.g. leasing or renting) the proprietor is considered the person who, in accordance with existing contractual agreements between the owner and user of the industrial truck, is charged with operational duties. The proprietor must ensure that the industrial truck is used only for the purpose it is intended for and that danger to life and limb of the user and third parties are excluded. Furthermore, accident prevention regulations, safety regulations and operating, servicing and repair guidelines must be followed. The operating company must ensure that all users have read and understood these operating instructions.

NOTE

Failure to comply with the operating instructions invalidates the warranty. The same applies if improper work is carried out on the truck by the customer or third parties without the permission of the manufacturer.

5 Adding attachments and/or optional equipment

The mounting or installation of additional equipment which affects or enhances the performance of the industrial truck requires the written permission of the manufacturer. Local authority approval may also need to be obtained. Local authority approval however does not constitute the manufacturer's approval.

B Truck Description

1 Application

The EFG 110 - 115 is a three-wheel electric sit-down forklift truck. It is a cantilever counterbalanced truck which can lift, transport and deposit loads using the load handler attached in front.

Closed bottom pallets can also be lifted.

1.1 Truck models and rated capacity

The rated capacity depends on the model. The rated capacity can be derived from the model name.

EFG110

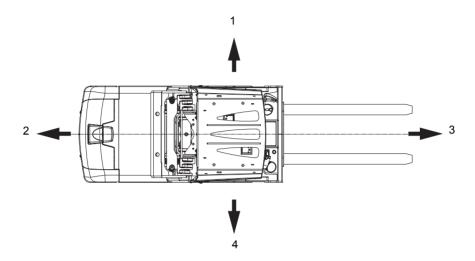
EFG	Model name
1	Series
10	Rated capacity x 100 kg

The rated capacity is not generally the same as the permissible capacity. The capacity can be found on the capacity plate attached to the truck.

2 Assemblies and Functional Description

2.1 Travel direction definition

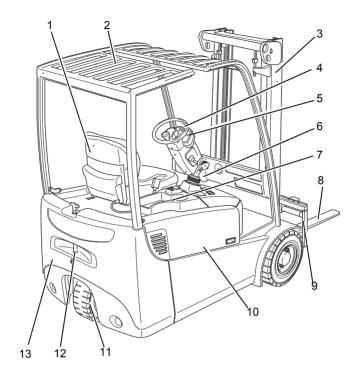
The following determinations have been made for travel direction specification:



The following conventions have been agreed for travel direction specification:

Item	Travel direction
1	Left
4	Reverse
2	Forward
3	Right

2.2 Assembly Overview



Item		Component					
1	•	Driver's seat					
2	•	Overhead guard					
3	•	Mast					
4	•	Steering wheel					
5	•	Control and display unit					
6	•	Lifting mechanism control					
7	•	Emergency Disconnect switch					
8	•	Forks					
9	•	Fork carriage					
10	•	Battery cover					
11	•	Drive					
12	•	Trailer coupling					
13	•	Counterweight					
	•	Standard equipment					

2.3 Functional Description

Chassis

The chassis, in conjunction with the counterweight, forms the supporting base structure of the truck. It is used to support the main components.

Operator position and overhead guard

The overhead guard comes in a range of models and protects the operator from falling objects and other external

influences. All the controls are ergonomically arranged. The steering column and driver's seat can be adjusted individually.

The controls and warnings on the control and display unit enable the system to be monitored during operation, thereby ensuring a very high level of safety.

Steering

A low steer effort of 15 N as well as a favourable transmission ratio of 5 steering wheel revolutions for an 180° steer angle. A hydraulic steer motor actuates the drive wheel via a gear wheel pair. Efficient energy deployment through the load sensing system. The steering column is adjustable.

Wheels

There is a choice of super elastic or fully rubber tyres as well as optional pneumatic tyres.

Brake System

The hydraulically activated drum servo brake acting on both front wheels provides effective deceleration with minimal pedal force. The truck also brakes to a halt regeneratively via the traction motor. This makes the foot brake virtually redundant, minimising energy consumption and brake wear.

Drive system

The entire drive unit is enclosed in the counterweight. The steered rear wheel is also the drive wheel. A fixed, low-noise three-phase motor is driven via a transmission. The electronic traction controller ensures the smooth rotation of the drive motor and as a result consistently smooth travel, powerful acceleration and electrically controlled braking with energy recovery. With steer angle detection (o) the system automatically reduces the travel speed as a function of the steer angle.

Hydraulic system

A multi-pilot valve allows for sensitive operation of the functions via the controls. A speed-controlled hydraulic pump ensures a proportionate and efficient supply to the hydraulic functions.

Mast

Two or three-stage masts, optionally with free lift function; narrow mast sections ensure excellent visibility of the forks and attachments. Fork carriage and mast run on permanently lubricated and hence maintenance-free support rollers.

Attachments

The trucks can be optionally fitted with mechanical and hydraulic attachments.

3 Technical Specifications

All technical details refer to standard trucks. Values indicated with *) may vary, depending on the types of equipment used (e.g. mast, cabin, tyres etc.).

Technical data specified in accordance with VDI 2198. Technical modifications and additions reserved.

3.1 Performance data

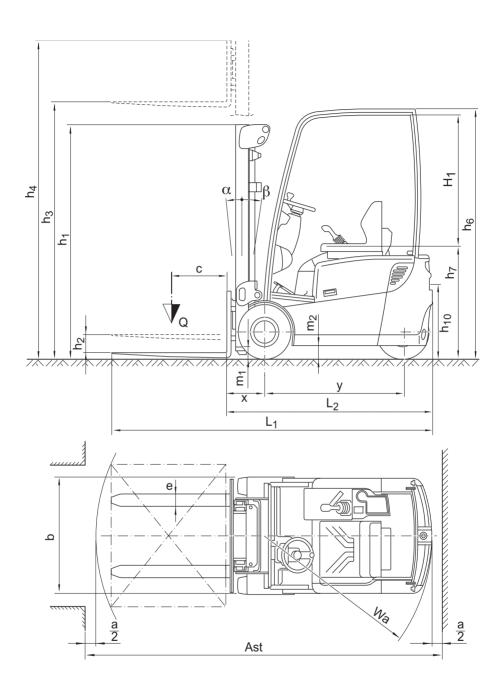
	Model	EFG 110k	EFG 110	EFG 113	EFG 115	
Q	Rated capacity (where C = 500 mm) ¹)	1000	1000	1250	1500	kg
С	Load centre distance	500	500	500	500	mm
	Travel speed, w. / w.o. load *)	12/12.5	12/12.5	12/12.5	12/12.5	km/h
	Lift speed, with / without load *)	0.28/0.50	0.29/0.50	0.25/0.50	0.24/0.50	m/s
	Lowering speed with / without load *)	0.58/0.60	0.58/0.60	0.58/0.60	0.58/0.60	m/s
	Gradeability (30 min) w. / w.o. load *)	8.5/12	8/11.5	7/11	6.5/10.5	%
	Max. gradeability (5 mins) w / w.o. load *)	13/18	12.5/17.5	11/16.5	10/16	%
	Acceleration (10 min) w / w.o. load *)	5.1/4.6	5.1/4.6	5.4/4.7	5.6/4.8	s
	Max. operating pressure	160	160	185	210	bar
	Oil flow for attachments	14	14	14	14	l/min

¹⁾ for vertical mast.

²⁾ The values shown represent the maximum gradeability to overcome short differences in height and surface unevenness (surface edges). The truck must not operate on inclines of more than 15%.

3.2 Dimensions

	Description	EFG 110k	EFG 110	EFG 113	EFG 115	
a/2	Safety distance	100	100	100	100	mm
h ₁	Mast height retracted *)	2000	2000	2000	2000	mm
h ₂	Free lift *)	150	150	150	150	mm
h ₃	Lift *)	3000	3000	3000	3000	mm
h_4	Mast height extended *)	3550	3550	3550	3550	mm
h ₆	Overhead guard height *)	2090	2090	2090	2090	mm
h ₇	Seat height *)	900	900	900	900	mm
h ₁₀	Coupling height	635	635	635	635	mm
α	Mast tilt, fwd.	5	5	5	5	0
β	Mast tilt, back	6	6	6	6	0
L ₁	Length including forks *)	2719	2773	2881	2935	mm
L ₂	Headlength*)	1569	1623	1731	1785	mm
b	Overall width *)	990	990	990	990	mm
е	Fork width *)	100	100	100	100	mm
m ₁	Ground clearance with load below mast	90	90	90	90	mm
m ₂	Ground clearance centre wheelbase	100	100	100	100	mm
Ast	Aisle width for pallets 800 x 1200 longit.	3020	3074	3182	3236	mm
Ast	Aisle width for pallets 1200 x 1000 longit.	2898	2952	3060	3114	mm
Wa	Turning radius	1239	1293	1401	1455	mm
Х	Load distance *)	330	330	330	330	mm
У	Wheelbase	984	1038	1146	1200	mm



3.3 Weights

All dimensions in kg.

Model	EFG 110k	EFG 110	EFG 113	EFG 115
Net weight *) (including battery)	2490	2570	2760	2870
Front axle load (without lifting load) *)	1095	1145	1235	1270
Front axle load (with lifting load) *)	2940	2945	3390	3805
Rear axle load (without lifting load) *)	1395	1425	1525	1600
Rear axle load (with lifting load) *)	550	625	620	565

3.4 Mast versions

All dimensions in mm.

EFG 110k/110/113/115 mast table						
VDI 3596	Lift	Free lift	Collapsed height	Extended height		
Description	h ₃	h ₂	h ₁	h_4		
	2300	150	1650	2850		
	3000	150	2000	3550		
	3100	150	2050	3650		
	3300	150	2150	3850		
ZT	3600	150	2300	4150		
	4000	150	2500	4550		
	4500	150	2800	5050		
	5000	150	3050	5550		
	5500	150	3400	6050		
	2300	1055	1605	2850		
	3000	1405	1955	3550		
ZZ	3100	1455	2005	3650		
	3300	1555	2105	3850		
	3600	1705	2255	4150		
	4000	1905	2455	4550		
	4350	1405	1955	4900		
	4500	1455	2005	5050		
	4800	1555	2105	5350		
DZ	5000	1630	2180	5550		
	5500	1805	2355	6050		
	6000	2005	2555	6550		
	6500	2255	2805	7050		

Special trucks are not included in this overview.

3.5 Tyre type

NOTE

When replacing tyres/rims fitted at the factory, always use original spare parts or tyres approved by the manufacturer. Otherwise the manufacturer's specification cannot be guaranteed.

If you have any queries please contact the manufacturer's customer service department.

	Description	EFG 110	EFG 113	EFG 115
	SE *)	18 x 7-8		
	Full rubber*)	18 x 6 x 12 1/8"		
Front tyres	Pneumatic*)	180 / 7	0-8; Diagonal, 10	6PR;
	Tyre pressure bar	10		
	Torque (Nm)	170		
	SE*)	18 x 7-8		
	Full rubber*)	18 x 6 x 12 1/8"		
Rear tyres	Pneumatic*)	180 / 70-8; Diagonal, 16PR;		
	Tyre pressure bar	10		
	Torque (Nm)	170		

^{*)} The models listed in the table correspond to the standard version. Other tyres can be used depending on the truck's equipment.

3.6 Engine Data

Model	EFG110-115	
Drive motor	4 kW	
Lift motor	6 kW	

3.7 EN norms

Noise emission level

- EFG 110-115: 63 dB(A)
- *+/- 3 dB(A) depending on the truck's equipment

in accordance with 12053 as harmonised with ISO 4871.

The noise emission level is calculated in accordance with standard procedures and takes into account the noise level when travelling, lifting and when idle. The noise level is measured at the level of the driver's ear.

Vibration

- EFG 110-115: 0.62m/s2

in accordance with EN 13059.

The vibration acceleration acting on the body in the operating position is, in accordance with standard procedures, the linearly integrated, weighted acceleration in the vertical direction. It is calculated when travelling over thresholds at constant speed (standard truck version). These recordings were taken on a single occasion and must not be confused with the human vibrations of the "2002/44/EC/Vibrations" operator directive. The manufacturer offers a special service to measure these human vibrations, see page 152.

Electromagnetic compatibility (EMC)

The manufacturer confirms that the truck adheres to the limits for electromagnetic emissions and resistance as well as the static electricity discharge test in accordance with EN 12895 as well as the standardised instructions contained therein.

No changes to electric or electronic components or their arrangement may be made without the written agreement of the manufacturer.

\triangle

WARNING!

Medical equipment can be damaged by non-ionised radiation

Electrical equipment on the truck emitting non-ionised radiation (e.g. wireless data transmission) can affect operators' medical equipment (pacemakers, hearing aids etc.) and result in malfunctions. Consult with a doctor or the medical equipment manufacturer to clarify whether it can be used near the industrial truck.

3.8 Conditions of use

Ambient temperature

- operating at -20°C to 40°C



Special equipment and authorisation are required if the truck is to be used continually in conditions of extreme temperature or condensing air humidity fluctuations.

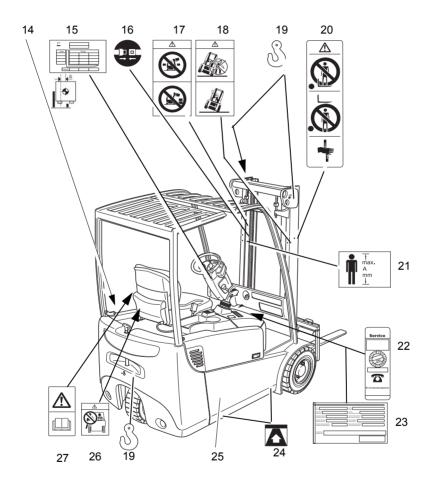
3.9 Electrical requirements

The manufacturer certifies compliance with the requirements for the design and manufacture of electrical equipment, according to EN 1175 "Industrial Truck Safety - Electrical Requirements", provided the truck is used according to its purpose.

4 Identification points and data plates

4.1 Indication Points

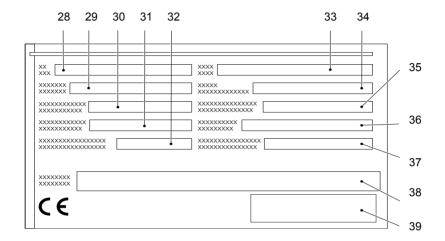
Warnings and notices such as capacity charts, strap points and data plates must be legible at all times. Replace if necessary.



Item	Component
14	Serial number, on chassis below the battery cover
15	Capacity (or reduced capacity)
16	Wear seat belt
17	Do not travel with raised load or mast forward tilt with raised load
18	Tipover warning
19	Strap points for crane lifting
20	Do not step onto or beneath the load, risk of trapping with moving mast
21	Max. body size
22	Test plaque (○)
23	Data plate
24	Jack contact points
25	Model description
26	Do not carry passengers warning
27	Read operating instructions

4.2 Data plate

The illustration shows the standard version for EU member states. The data plate may differ in other countries.



Item	Description	Item	Description
28	Туре	34	Year of manufacture
29	Serial number	35	Load centre (mm)
30	Rated capacity (kg)	36	Output
31	Battery voltage (V)	37	Min./max. battery weight (kg)
32	Net weight w.o. battery (kg)	38	Manufacturer
33	Option	39	Manufacturer's logo

For queries regarding the truck or ordering spare parts always quote the truck serial number (29).

4.3 Truck capacity plate

↑ CAUTION!

Accident risk from fork replacement

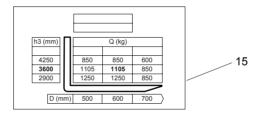
If you replace the forks with ones that differ from the originals, the capacity will change.

- ▶ When replacing the forks you must attach an additional capacity plate to the truck.
- ► Trucks supplied without forks are given a capacity plate for standard forks (length: 1150 mm).

The capacity plate (15) gives the capacity (Q in kg) of the truck for a vertical mast. The maximum capacity is shown as a table with a given load centre of gravity D (in mm) and the required lift height H (in mm).

The capacity plate (15) of the truck indicates the truck's capacity with the forks as originally supplied.

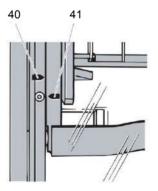
Example of how to calculate the maximum capacity:



For a load centre of gravity D of 600 mm and a max. lift height h_3 of 3600 mm the maximum capacity Q is 1105 kg.

Lift height restriction

The arrow shaped markings (40 and 41) on the inner and outer masts show the operator when the prescribed lift limits have been reached.



4.4 Attachment capacity plate

The attachment capacity plate is next to the truck's capacity plate and gives the truck's capacity Q (in kg) in conjunction with the respective attachment. The serial number for the attachment indicated on the capacity plate must match the data plate of the attachment.

5 Stability

The truck's stability has been tested according to latest technological standards. These take into account the dynamic and static tipover forces that can occur if used correctly.

Stability can also be affected by the following factors:

- Tyre type
- Mast
- Attachment
- Transported load (size, weight and centre of gravity)



WARNING!

Loss of stability can cause accidents

Changing the components can alter the stability.

C Transport and Commissioning

1 Transport

Transport can be carried out in two different ways, depending on the height of the mast and the local conditions.

- Vertically, with the mast assembled (for low heights)
- Vertically, with the mast dismantled (for large heights), all mechanical connections and hydraulic lines between the basic truck and the mast separated.

2 Truck laden

2.1 Centre of gravity of the truck

↑ WARNING!

An altered centre of gravity can result in tipovers when cornering.

The overall centre of gravity can vary depending on the truck's equipment (especially the mast version).

For trucks without a mast the centre of gravity will move significantly in the direction of the counterweight.

▶ Drive carefully and with modified speed to avoid tipping over.

The picture shows the approximate centre of gravity location.



2.2 Lifting the truck by crane

↑ WARNING!

All persons involved in loading by crane must be trained

Incorrect crane loading procedures due to untrained personnel can cause the truck to fall. There is a risk of injury to personnel and a risk of material damage to the truck.

▶ Loading must only be performed by specialist personnel trained for this purpose. The specialist personnel must be instructed in securing loads on road vehicles and handling load securing devices. In each case correct measurements must be taken and appropriate safety measures applied.

↑ DANGER!

Crane slings can tear, resulting in accidents

- ▶ Only use crane lifting gear with sufficient capacity.
- ▶ Loading weight = Net weight of truck (+ battery weight for electric trucks).
- ▶ The mast must be tilted back fully.
- ▶ The crane lifting gear on the mast must have a minimum clear length of 2 m.
- ► Crane slings should be fastened in such a way that they do not come into contact with any attachments or the overhead guard when lifting.
- ▶ Do not stand under a swaying load.
- ►The truck should only be handled by people who are trained in using lifting slings and tools.
- ► Wear safety shoes when lifting the truck by crane.
- ▶ Do not walk into or stand in a hazardous area.
- ► Always attach the crane lifting gear to the prescribed strap points and prevent them from slipping.
- Truck net weight: see page 29.

Lifting the truck by crane

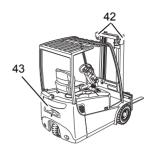
Requirements

- Park the truck securely, see page 77.

Procedure

- Secure the crane slings to the attachment points (42) and (43.
- · Raise and load the truck.
- Lower and deposit the truck carefully (see page 77).
- Secure the truck with wedges to prevent it from rolling away.

This concludes the loading by crane.



2.3 Loading with another industrial truck

↑ WARNING!

The truck can be damaged

The truck to be loaded can be damaged when loading with another industrial truck.

- ▶ Only trained specialist personnel should load the truck.
- ► Use only trucks with sufficient capacity for loading.
- ▶ Only for loading and unloading.
- ▶ The forks of the second industrial truck must be sufficiently long
- ► Transporting over long distances prohibited.

Loading the truck with a second industrial truck

Requirements

- Park the truck securely, see page 77.

Procedure

- Raise the truck with the forks at the side between the axles.
- Raise the truck slightly and make sure it is securely positioned on the forks. If necessary adjust or secure the forks with stops.
- · Carefully load/unload the truck, see page 86.
- · Lower the truck slowly onto the ground and prevent it from rolling away.

The truck is now loaded.

3 Securing the truck during transport

MARNING!

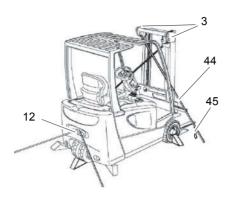
Accidental movement during transport

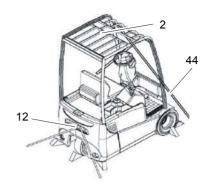
Improper fastening of the truck and mast during transport can result in serious accidents.

- ▶ Loading must be carried out by specially trained staff in accordance with recommendations contained in Guidelines VDI 2700 and VDI 2703 In each case correct measurements must be made and appropriate safety measures adopted.
- ▶ The truck must be securely fastened when transported on a lorry or a trailer.
- ► The loading area must have clamp rings and a wooden floor to secure the retaining wedges.
- ► Use wedges to prevent the truck from moving.
- ▶ Use only tensioning belts or tie-down straps or with sufficient strength.

Securing with a mast

Securing without a mast





Securing the industrial truck for transport

Requirements

- Position the industrial truck securely on a lorry or trailer, see page 77.

Tools and Material Required

- 2 fastening belts with a tensioner
- Retaining wedges.

Procedure

- Secure the truck with the fastening belt (44) at the top cross member of the mast (3) and the trailer coupling (12) or on the overhead guard (2) and the trailer coupling (12).
- Tighten the fastening belt (44) with the tensioner (45).

The truck is now secured for transport.

4 Using the Truck for the First Time

Safety instructions for assembly and commissioning

♠ WARNING!

Incorrect assembly can result in accidents

The assembly of the truck at the application site, commissioning and operator training must only be performed by the manufacturer's customer service representatives who have been specially trained for these tasks.

- ▶The hydraulic lines may only be connected to the basic truck / mast interface when the mast has been properly assembled.
- ▶ Only then can the truck be started.
- ► If several trucks have been delivered, make sure that the serial numbers of the load handlers, masts and basic trucks always match.

↑ WARNING!

The use of unsuitable energy sources can be hazardous

Rectified AC current will damage the assemblies (controllers, sensors, motors etc.) of the electronic system.

Unsuitable cable connections (too long, insufficient wire cross-section) to the battery (tow cables) can overheat, setting the truck and battery on fire.

- ▶ The truck must only be operated with battery current.
- ► Cable connections to the battery (tow leads) must be less than 6 m long and have a minimum cross-section of 6 yd² (50 mm²).

Preparing the truck for operation after delivery or transport

Procedure

- Check the equipment is complete.
- Check the hydraulic oil level, see page 137.
- Check the transmission oil level, see page 138.
- Install the battery if necessary, see page 48.
- Charge the battery, see page 62.

The truck can now be started, see page 62.

To operate the truck without its own drive system, see page 116.

Battery - Servicing, Recharging, Replacement

1 Safety Regulations Governing the Handling of Lead-Acid **Batteries**

Maintenance personnel

Batteries may only be charged, serviced or replaced by trained personnel. This operator manual and the manufacturer's instructions concerning batteries and charging stations must be observed when carrying out the work.

Fire Protection

Do not smoke and avoid naked flames when handling batteries. Wherever an industrial truck is parked for charging there must be no inflammable material or consumables capable of creating sparks within a minimum distance of 2 m from the truck. The room must be ventilated. Fire protection equipment must be available.

↑ CAUTION!

The use of unsuitable fire protection equipment can result in scalding

Extinguishing fires with water can cause a reaction with the battery acid. This can result in scalding from the acid.

- ► Use powder extinguishers.
- ► Never extinguish a burning battery with water.

Battery maintenance

The battery cell covers must be kept dry and clean. Terminals and cable shoes must be clean, lightly greased with terminal grease and must be securely tightened. Batteries with non insulated terminals must be covered with a non slip insulating mat.

↑ CAUTION!

Before closing the battery panel make sure that the battery cable cannot be damaged. There is a risk of short circuits with damaged cables.

Battery disposal

Batteries may only be disposed of in accordance with national environmental protection regulations or disposal laws. The manufacturer's disposal instructions must be followed.

1.1 General notes on handling batteries

↑ WARNING!

Batteries can be hazardous

Batteries contain an acid solution which is poisonous and corrosive. Avoid contact with battery acid at all times.

- ▶ Dispose of used battery acid in accordance with regulations.
- ▶ Always wear protective clothing and goggles when working with batteries.
- ► Do not let battery acid come into contact with skin, clothing or eyes. If necessary, rinse with plenty of clean water.
- ► In the event of physical damage (e.g. skin or eye contact with battery acid) call for a doctor immediately.
- ▶ Spilled battery acid should be neutralised immediately with plenty of water.
- ▶ Only batteries with a sealed battery container may be used.
- ► Follow national guidelines and legislation.

↑ WARNING!

Unsuitable batteries that have not been approved for the truck by the manufacturer can be hazardous

The design, weight and dimensions of the battery have a considerable effect on the operational safety of the truck, in particular its stability and capacity. The use of unsuitable batteries that have not been approved for the truck by the manufacturer can lead to a deterioration of the braking system during energy recovery operations and also cause considerable damage to the electrical control system. The use of batteries that have not been approved by the manufacturer can therefore affect the health and safety of personnel.

- ▶ Only manufacturer-approved batteries may be used on the truck.
- ▶ Battery equipment may only be replaced with the agreement of the manufacturer.
- ► When replacing/installing the battery make sure the battery is securely located in the battery compartment of the truck.
- ▶ Do not use batteries that have not been approved by the manufacturer.

Park the truck securely before carrying out any work on the batteries (see page 77).

2 Battery types

⚠ CAUTION!

Always use batteries with insulated covers or live components.

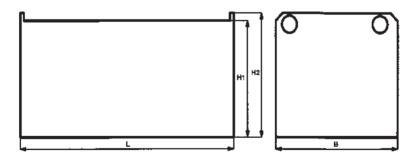
The battery weights are indicated on the battery data plate.

The truck will be equipped with different battery models, depending on the application. The following table shows which combinations are included as standard:

Truck model	Description	Capacity
EFG 110k	24 V - 4PzS	440L Ah
EFG 110	24 V - 5PzS	550L Ah
EFG 113	24 V - 7PzS	770L Ah
EFG 115	24 V - 8PzS	880L Ah

2.1 Battery dimensions

24 volt drive battery					
		Dimension (mm)			Rated weight
Truck	L max.	B max.	H1 +/-	H2 +/-	
			2mm	2mm	(-5/+8%)in kg
EFG 110k	830	273	612	627	372
EFG 110	830	327	612	627	445
EFG 113	830	435	612	627	600
EFG 115	830	489	612	627	676



3 Exposing the battery

⚠ CAUTION!

The drive motor operating temperature can cause injury

When you open the battery cover the high operating temperature of the drive motor > 80° can result in injuries.

▶ Do not touch the drive motor, and allow it to cool down.

Exposing the battery with the SOLO-PILOT

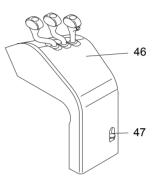
Requirements

- Park the truck securely, see page 77.
- Load handler lowered.
- Key switch set to OFF.
- Key removed.
- Set the Emergency Disconnect OFF.

Procedure

- Press the lever (47) to unlock the cover (46) and move it forward.
- Carefully lift back the battery cover and the driver's seat as far as the stop (opening angle = 90°).

The battery is now exposed.



Exposing the battery with the MULTI-PILOT (\mathcal{O})

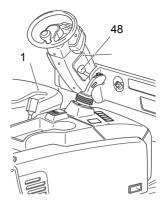
Requirements

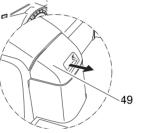
- Park the truck securely, see page 77.
- Load handler lowered.
- Key switch set to OFF.
- Key removed.
- Set the Emergency Disconnect OFF.

Procedure

- Release the steering column lock (48), push the steering column forward and secure it in this position.
- Pull the panel (49) forward until it engages.
- Carefully lift back the battery cover and the driver's seat (1) as far as the stop (opening angle = 90°).

The battery is now exposed.





On trucks with a rear window / canvas cover, open the rear window / canvas cover before opening the battery cover.

4 Charging the battery

MARNING!

The gases produced during charging can cause explosions

The battery produces a mixture of oxygen and hydrogen (electrolytic gas) during charging. Gassing is a chemical process. This gas mixture is highly explosive and must not be ignited.

- ➤ Switch the charging station and truck off first before connecting/disconnecting the charging cable of the battery charging station to/from the battery connector.
- ►The charger must be adapted to the battery in terms of voltage and charge capacity.
- ▶ Before charging, check all cables and plug connections for visible signs of damage.
- ▶ Ventilate the room in which the truck is being charged.
- ▶The battery cell surfaces must be exposed during charging to ensure adequate ventilation.
- ▶ Do not smoke and avoid naked flames when handling batteries.
- ► Wherever an industrial truck is parked for charging there shall be no inflammable material or lubricants capable of creating sparks within 2 m around the truck.
- ► Fire protection equipment must be on hand.
- ▶ Do not lay any metallic objects on battery.
- ▶It is essential to follow the safety regulations of the battery and charger station manufacturers.

4.1 Charging the battery with a stationary charger

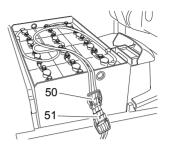
Requirements

- Park the truck securely, see page 77.
- Battery exposed.
- Charger switched off.
- Disconnect the battery connector (50) from the truck connector (51).

Procedure

 Connect the battery connector (50) to the charging cable (51) of the stationary charger and turn on the charger.

The battery is now charged.



Battery removal and installation 5

WARNING!

Accident risk during battery removal and installation

Due to the battery weight and acid there is a risk of trapping or scalding when the battery is removed and installed.

- ▶ Note the "Safety regulations for handling acid batteries" section in this chapter.
- ▶ Wear safety shoes when removing and installing the battery.
- ▶ Use only batteries with insulated cells and terminal connectors.
- ▶ Park the truck on a level surface to prevent the battery from sliding out.
- ► Make sure the crane slings have sufficient capacity to replace the battery.
- ► Use only approved battery replacement devices (battery roller stand, replacement trolley etc.).
- ▶ Make sure the battery is securely located in the truck's battery compartment.



↑ CAUTION!

Trapping hazard

Trapping hazard when replacing the battery.

- ▶ When replacing the battery do not reach between the battery and the chassis.
- ► Wear safety shoes.

Battery removal and installation

Requirements

- Park the truck securely, see page 77.
- Battery exposed, see page 44.
- Battery disconnected.

Tools and Material Required

- Crane lifting gear

Procedure

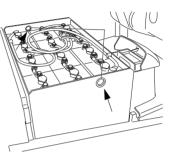
 Attach the crane lifting gear through the overhead guard recess so that it is vertical above the battery container.



Hooks must be fitted in such a way that when the crane lifting gear is slackened, they do not fall onto the battery cells.

 With the crane lifting gear raise the battery above the chassis in the right hand travel direction and then move it out sideways.

The battery is now removed.



6 Closing the battery cover

Closing the battery cover with the Solo Pilot

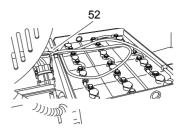
Requirements

- The battery cable is in the cable guide (52).

Procedure

- · Close the battery cover with the driver's seat.
- Move the cover (46) back until it engages.

The battery cover is now closed.



Closing the battery cover with the Multi Pilot (optional)

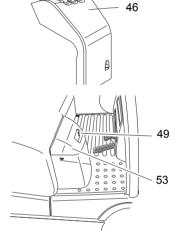
Requirements

- The battery cable is in the cable guide (52).

Procedure

- Push the cover (49) back with force.
- Engage the lock (53).

The battery cover is now closed.



E Operation

1 Safety Regulations for the Operation of the Forklift Truck

Driver authorisation

The truck may only be used by suitably trained personnel, who have demonstrated to the proprietor or his representative that they can drive and handle loads and have been authorised to operate the truck by the proprietor or his representative.

Operator's rights, obligations and responsibilities

The operator must be informed of his duties and responsibilities and be instructed in the operation of the truck and shall be familiar with the operating instructions.

Unauthorised use of truck

The operator is responsible for the truck during the time it is in use. The operator must prevent unauthorised persons from driving or operating the truck. Do not carry passengers or lift other people.

Damage and faults

The supervisor must be informed immediately of any damage or faults to the truck or attachment. Trucks which are unsafe for operation (e.g. wheel or brake problems) must not be used until they have been rectified.

Repairs

The operator must not carry out any repairs or alterations to the truck without authorisation and the necessary training to do so. The operator must never disable or adjust safety mechanisms or switches.

Hazardous area

MARNING!

Risk of accidents/injury in the hazardous area of the truck

A hazardous area is defined as the area in which people are at risk due to travel or lifting operations of the truck, its load handler or the load. This also includes the area within reach of falling loads or lowering/falling operating equipment.

- ▶ Instruct unauthorised persons to leave the hazardous area.
- ▶ In case of danger to third parties, give a warning signal in good time.
- ▶If unauthorised persons are still within the hazardous area, stop the truck immediately.

↑ WARNING!

Falling objects can cause accidents

Falling objects can injure the operator while the truck is being operated.

► The operator must remain within the protected area of the overhead guard while the truck is being operated.

Safety devices, warning signs and warning instructions

Safety devices, warning signs (see page 27) and warning instructions in the present operating instructions must be strictly observed.

Λ

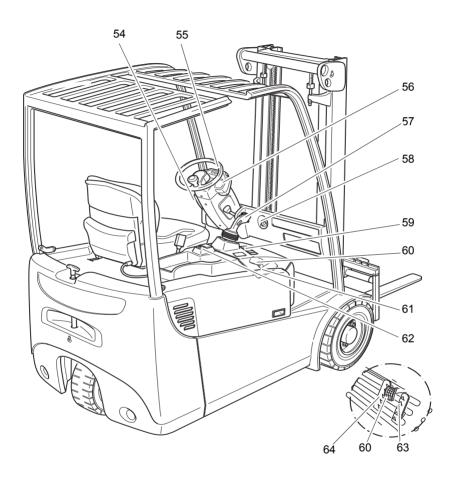
CAUTION!

Reduced headroom can cause injuries

Trucks with reduced headroom are equipped with a warning label within the operator's line of sight.

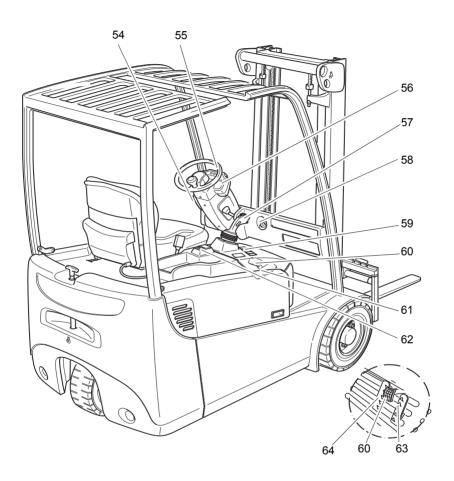
- ►The max. recommended body size indicated on this warning sign must be observed.
- ▶ The headroom is also reduced when you wear a protective helmet.

2 Displays and Controls

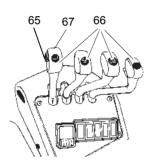


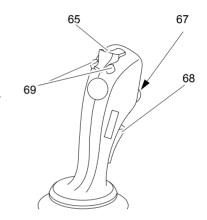
Item	Control / Display		Function
54	Parking brake lever	•	Applies / releases parking brake
55	Steering wheel	•	Steers the truck.
56	Control panel with display unit	•	Displays the battery capacity, service hours, errors, key warning indicators, wheel position and travel direction.
57	SOLO-PILOT	•	Operates the following functions:
	MULTI-PILOT	0	 Fwd/rev. travel direction Lift/lower load handler Mast forward / reverse tilt Horn button Sideshifter left / right (○) Auxiliary hydraulics (○)
58	Key switch	•	Switches control current on and off. Removing the key prevents the truck from being switched on by unauthorized personnel.
	ISM access module	0	Switches the truck on.
	Code lock		
59	Side compartment control panel	•	Switches electric options on and off
60	Brake pedal	•	Provides infinitely variable braking control.
61	Accelerator pedal	•	Infinite travel speed control
62	Emergency Disconnect switch		Switches power supply on and off.
63	"Forward" accelerator twin pedal control	0	Applying the accelerator pedal moves the truck forwards. The travel speed is infinitely controlled.
64	"Reverse" accelerator double pedal control	0	Applying the accelerator pedal reverses the truck. The travel speed is infinitely controlled.

^{*}If the truck is equipped with an ISM access module or Can Code refer to the "ISM Access Module" or "CanCode" operator manuals.



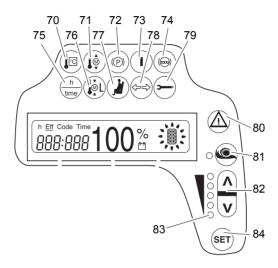
Item	Control / display		Function
65	Travel direction switch (not available with dual pedal control)	•	Selects travel direction / neutral position.
66	Lever	•	Lever for operating the hydraulic functions.
67	"Horn" button	•	Activates an audible warning.
68	Additional hydraulic function release button	0	Activates the additional hydraulic functions or hydraulics that require acknowledgement.
69	Button	0	Hydraulic auxiliary function control button.





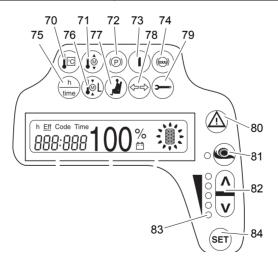
2.1 Control panel with display unit

The control panel display unit shows the operating data, the battery charge, the service hours and error details and information. Pictograms in the left top section of the control panel act as warning indicators.



Item	Control /	Function
	Display	
70	Warning indicator Controller overtemperature	Lights up to indicate controller overtemperature Performance is continuelly reduced in
		 Performance is continually reduced in relation to the temperature
71	Warning indicator Drive motor overtemperature	 Monitors the temperature of the drive motor Performance is reduced if the temperature is excessive
72	Parking brake indicator	Comfort feature, displayed when the parking brake indicator (72) lights up. Truck prevented from rolling away but not
		parked securely. Parking brake is automatically activated after a
		set time when the truck stops. The parking brake is automatically released
		when the accelerator pedal is applied.
73	Truck in operation indicator	Key switch ON
74	Insufficient brake fluid	 The brake fluid level can be checked through sensors on the brake fluid reservoir

Item	Control / Display	Function
75	Hourmeter / time toggle switch	 Truck key switch ON service hours "Eff" service hours can be switched ON or OFF via a code Time display
76	Warning indicator Pump motor, power steering overtemperature	 Monitors the temperature of the pump motor and the power steering motor Performance is reduced if the temperature is excessive
77	Seat switch warning indicator	Seat switch not closed - Truck operational, but driver's seat not occupied
78	Travel direction display indicator lamp	Right / left indicator lamps activated
79	Service display	 Service interval exceeded (1000 operating hours) or annual FEM test due (flashing indicator).
80	WARNING	WARNING - Flashes for faults, an audible warning sounds - Flashes when battery capacity is less than 10%
81	Slow travel button	 Switches slow travel on and off
82	Program selector	Selects the travel program (moves up or down a level in the travel program list.)
83	Operating program display	 Displays the selected travel program (1 to 5)
84	Set button	 Confirms the entries



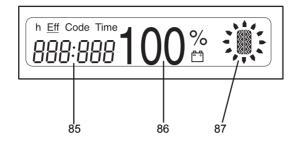
2.2 Side compartment control panel switch (O)

	Function
	Rear window heating
>	Inching speed
	Beacon
L	Seat heating
	Work lights
Ī	Lift cutout override
	Window washer system

2.3 Instrument panel switches (O)

Function
Truck lighting

2.4 Display



Item	Function
85	Hourmeter display
	Error display:
	 If an error (Err) or a warning (Inf) occurs, the error or info code is displayed.
	 If several errors occur they are displayed alternately at 1.5 second intervals. A warning is sounded.
86	Battery capacity display
	 Battery discharge status
87	Travel direction and wheel position display
	 Indicates the pre-selected travel direction (forward or reverse) or the position of the steered wheels.
	 Flashing direction arrow = no travel direction selected

2.4.1 Battery discharge indicator

NOTE

Full discharge can damage the battery

The standard setting for the battery discharge indicator is based on standard batteries. When using maintenance-free batteries (gel batteries), the display must be reset.

- ▶This adjustment should only be made by the manufacturer's customer service department.
- ▶ The battery discharge indicator shows the battery's residual capacity.
- ► Charge the battery, see page 46.

The battery charge status is shown through a battery icon (86) in the truck display in 10% increments (100% = 100% battery capacity, 0% = 20% battery capacity).

2.4.2 Battery discharge monitor

If the residual capacity falls below the required level, lifting is inhibited and the travel speed is reduced. An message appears in the display. Lifting is only released when the battery connected is at least 40% charged.

In order to complete the lift cycle, the key switch must be turned off and on again. Lifting is then enabled for 30 to 40 seconds.

2.4.3 Hourmeter

The service hours are counted when the truck is switched on and the seat switch is closed.

3 Preparing the Truck for Operation

3.1 Checks and operations to be performed before starting daily operation

↑ WARNING!

Damage and other truck or attachment (optional equipment) defects can result in accidents.

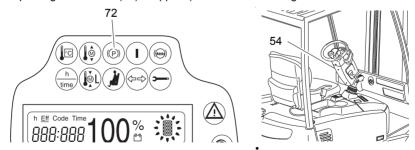
If damage or other truck or attachment (optional equipment) defects are discovered during the following checks, the truck must be taken out of service until it has been repaired.

- ▶ Report any defects immediately to your supervisor.
- ► Mark defective truck and take out of service.
- ► Do not return the industrial truck to service until you have identified and rectified the fault.

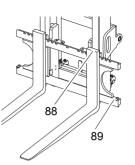
Checks before daily operation

Procedure

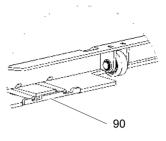
- Visually inspect the entire truck (in particular wheels, wheel bolts and load handler) for damage.
- Check the fork stop (88) and fork retainer (89).
- Visually inspect the hydraulic system in the visible area for damage and leaks.
- · Make sure the driver's seat is locked in position.
- Test the horn and reversing buzzer (O) where applicable.
- Check that the capacity plate and warning labels are legible.
- · Test the controls and displays.
- · Test the steering.
- Check the steer angle display (\bigcirc), turn the steering wheel in both directions as far as the stop and check that the wheel position is displayed on the control panel.
- · Make sure the load chains are evenly tensioned.
- Test the seat belt. (The belt should jam if extracted suddenly.)
- Test the seat switch: when the driver's seat is vacated it should not be possible to activate the hydraulic functions.
- Test the restraint system (○).
- Test the Drive Control (○).
 - Raise the fork carriage without load beyond the reference point on the mast. The slow travel symbol lights up on the display.
 - Slowly apply the accelerator pedal on a clear route with good visibility. The maximum speed should be reduced to walking pace (3 km/h).
- Test the lift/lower, tilt and if applicable the attachment hydraulic control functions.
- Apply the accelerator pedal several times to test its freedom of movement with the
 parking brake is applied (the parking brake indicator in the display (72) lights up and
 the parking brake lever (54) is applied) and to test the idling function.



- · Visually inspect the battery attachment and cable connections.
- · Check the battery lock is present and working.



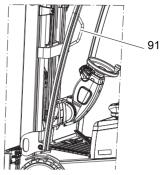
- On trucks with lateral battery removal, check the left and right stops (90) in the battery compartment for damage.
- Check the fluid level of the window washer system, see page 139.



3.2 Entry and exit

Procedure

- Open the cab door (○).
- To enter and exit the cab, hold onto the handle (91). Always face the truck when entering and exiting.



An additional step is provided for the driver position extension (O).

3.3 Trucks with reduced headroom (O)

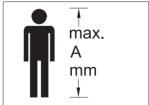
↑ WARNING!

An unsuitable workplace can damage your health

Failure to observe the recommended body size can cause stress and endanger the operator and may lead to lasting ill health due to an unhealthy posture and excessive strain on the operator.

- ► The operating company must ensure that truck operators do not exceed the maximum body size indicated.
- ►The operating company must check that the operators can sit in a normal and upright position without having to strain.





3.4 Setting up the operator position

↑ WARNING!

Accidents can occur if the driver's seat, steering column and armrest are not engaged

The driver's seat, steering column and armrest can accidentally adjust during travel and therefore cannot be operated safely.

▶ Do not adjust the driver's seat, steering column or armrest while travelling.

Procedure

- Before starting to travel, adjust the driver's seat, steering column and armrest (if necessary) so that all the controls are within reach and can be applied without having to strain.
- Adjust the visibility aid equipment (mirrors, camera systems etc.) so that the working environment can be clearly seen.

3.4.1 Adjusting the driver's seat

↑ WARNING!

Risk of accidents and damage to health

An incorrectly adjusted driver's seat can result in accidents and damage to health.

- ▶ Do not adjust the driver's seat while travelling.
- ▶ The driver's seat should lock in position after adjustment.
- ▶ Check and adjust the individual driver's seat setting before starting up the truck.
- ► Hold the weight setting lever only by the recess, do not reach through underneath the lever.

Adjusting the driver's weight

NOTE

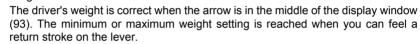
To achieve optimal seat cushioning the driver's seat must be set to the driver's weight.

Set the driver's weight when the seat is occupied.

Procedure

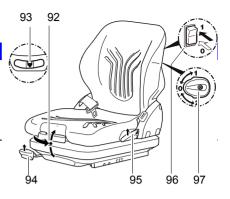
- Fold out the weight adjustment lever (92) as far as it will go in the arrow direction
- Move the weight adjustment lever (92) up and down to set the seat to a higher weight.
- Move the weight adjustment lever (92) up and down to set the seat to a lower weight.

 The driver's weight is correct when the arrow is in the middle of the display window.



· After setting the weight, move the lever (92) back in full.

The driver's weight is now set.



Adjusting the backrest

Procedure

- · Sit on the driver's seat.
- · Pull the lever (95) to adjust the backrest.
- · Adjust the backrest tilt.
- Release the lever (95) again. The backrest is locked.

The backrest is now set.



Hold the weight setting lever (92) only by the recess, never reach through underneath the lever.

Adjusting the seat position



An unsecured driver's seat can cause injury

An unsecured driver's seat can slide out of its guide during travel, resulting in accidents.

- ▶ The driver's seat must be locked in position.
- ▶ Do not adjust the driver's seat while travelling.

Procedure

- · Sit on the driver's seat.
- Pull up the driver's seat locking lever94 in the direction of the arrow.
- Push the driver's seat forwards or backwards to the desired position
- Engage the driver's seat locking lever (94) in position.

The seat position is now correctly set.

3.4.2 Adjusting the steering column

Adjusting the steering column

Procedure

- Release the steering column stop (48).
- Set the steering column to the required position (height and angle).
- Fix the steering column stop (48) in position.

The steering column is now positioned.



3.4.3 Adjusting the arm rest

Procedure

- Loosen the screw (98) and tilt the armrest up or down.
- Re-tighten the screw (98).
- Loosen the screw (99) and set the armrest vertical.
- Re-tighten the screw (99).
- Loosen the screw (100) and set the armrest horizontal.
- Re-tighten the screw (100).

The armrest is now positioned.



3.5 Seat Belt

↑ WARNING!

Travelling without a seat belt increases the risk of injury.

Accidents or personal injury can result if the seat belt is not worn or is modified.

- ▶ Always put the seat belt on before starting the industrial truck.
- ▶ Do not modify the seat belt.
- ▶ Damaged or non-operational seat belts must be replaced by trained personnel.
- ▶ Seat belts must always be replaced after an accident.
- ▶ Only original spare parts must be used for retrofits or repairs.
- ▶ Report any defects immediately to your supervisor.
- ▶ Remove the truck from service until a functional seat belt has been fitted.



Protect the seat belt from contamination (e.g. cover it when the truck is idle) and clean it regularly. Frozen belt locks or pulleys must be thawed out and dried to prevent them from freezing up again.

The temperature of the warm air should not exceed +60 °C!

Starting the industrial truck on steep slopes

The automatic blocking system locks the belt in the retractor when the truck is positioned on a steep slope. This prevents the belt from being pulled out of the retractor.



Carefully drive the truck off the slope and then put on the belt.

⚠ DANGER!

A faulty seat belt can cause injury

Using a faulty seat belt can result in injury.

- ► Only operate the truck with the seat belt intact. A faulty seat belt should be replaced immediately.
- ▶ The truck must remain decommissioned until a functional seat belt has been fitted.

Checking the seat belt

Procedure

- · Check the attachment points for wear and damage.
- · Check the cover for damage.
- Pull the belt out fully from the retractor and check for damage (loose seams, fraying and nicks).
- Test the belt buckle and make sure the belt returns correctly into the retractor.

Check the automatic locking system

Procedure

- · Park the truck on a level surface.
- · Jerk the seat belt out suddenly.



The locking system should prevent the belt from coming out.

The seat belt has now been checked.

4 Industrial Truck Operation

4.1 Safety regulations for truck operation

↑ WARNING!

Electromagnetic influence can result in accidents

Strong magnets can cause electronic components such as Hall sensors to become damaged, resulting in accidents.

▶ Do not use magnets in the operating area of the truck. Exceptions to this rule are commercial, weak clamping magnets for attaching notices.

Travel routes and work areas

Only use lanes and routes specifically designated for truck traffic. Unauthorised third parties must stay away from work areas. Loads must only be stored in places specially designated for this purpose.

The truck must only be operated in work areas with sufficient lighting to avoid danger to personnel and materials. Additional equipment is necessary to operate the truck in areas of insufficient lighting.

↑ DANGER!

Do not exceed the permissible surface and point loading on the travel lanes.

At blind spots get a second person to assist.

The driver must ensure that the loading dock /dock leveller cannot be removed or come loose during loading/unloading.

NOTE

Loads must not be deposited on travel or escape routes, in front of safety mechanisms or operating equipment that must be accessible at all times.

Travel conduct

The operator must adapt the travel speed to local conditions. The truck must be driven at slow speed when negotiating bends or narrow passageways, when passing through swing doors and at blind spots. The operator must always observe an adequate braking distance between the forklift truck and the vehicle in front and must be in control of the truck at all times. Abrupt stopping (except in emergencies), rapid U turns and overtaking at dangerous or blind spots are not permitted. Do not lean out or reach beyond the working and operating area.

Do not use a mobile phone or walkie-talkie without a handsfree device while operating the truck.

Hazardous situations

If the truck is about to tip over, do not loosen the seat belt. The operator must not jump off the truck. The operator must lean his upper body over the steering wheel and hold on with both hands. Tilt your body in the opposite direction of fall.

Travel visibility

The operator must look in the direction of travel and must always have a clear view of the route ahead. If the truck is carrying loads that affect visibility, the truck must travel against the load direction. If this is not possible, a second person must walk alongside the truck as a lookout to observe the travel route while maintaining eye contact with the operator. Proceed only at walking pace and with particular care. Stop the truck as soon as you lose eye contact.

Negotiating slopes and inclines

Negotiating slopes and inclines up to 15% is only permitted if they are specifically designed as travel routes, are clean and have a non-slip surface and providing they can be safely travelled along in accordance with the truck's technical specifications. The truck must always be driven with the load facing uphill. The industrial truck must not be turned, operated at an angle or parked on inclines and slopes. Inclines must only be negotiated at slow speed, with the driver ready to brake at any moment. Particular care is required when travelling near slopes and guay walls.

Negotiating lifts, loading ramps and docks

Lifts may only be negotiated if they have sufficient capacity, are suitable for driving on and authorised for truck traffic by the owner. The driver must satisfy himself of the above before entering these areas. The truck must enter lifts with the load in front and must take up a position which does not allow it to come into contact with the walls of the lift shaft. Persons riding in the lift with the forklift truck must only enter the lift after the truck has come to a rest and must leave the lift before the truck. The driver must ensure that the loading ramp / dock cannot move or come loose during loading / unloading.

Type of loads to be carried

The operator must make sure that the load is in a satisfactory condition. Loads must always be positioned safely and carefully. Use suitable precautions to prevent parts of the load from tipping or falling down. Prevent liquid loads from sloshing out.

Inflammable liquids (e.g. fused metal etc.) may only be transported with suitable auxiliary equipment. Contact the manufacturer's customer service department.

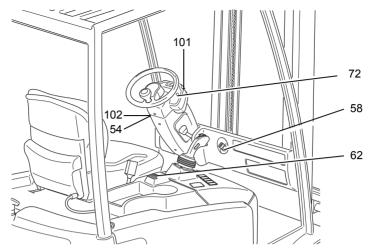


For safety instructions on the nature of loads to be carried with attachments,see page 86.

Towing trailers

The truck may only be used occasionally to tow trailers, see page 104

4.2 Preparing the truck for operation



Switching on the truck

Requirements

 For checks and operations to be performed before starting daily operation, see page 62.

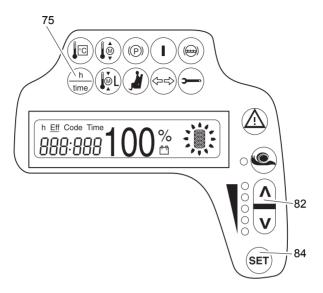
Procedure

- Unlock the Emergency Disconnect switch (62) to do this
 - Press the rocker in (1) and pull it up until you feel the Emergency Disconnect switch engaging.
- Insert the key in the key switch (58) and turn it clockwise as far as it will go to the "I" position.
- Test the brake pedal and parking brake (parking brake indicator (72) lights up and parking brake lever (54) applied).

Truck is operational. The display (101) shows the remaining battery capacity.

When you have pulled the EMERGENCY DISCONNECT and turned the key switch to the right, the truck carries out a self test for approx. 3-4 seconds (tests the controllers and motors). During this time the truck cannot move or lift. If the accelerator or a lift mechanism lever is applied during this time, an information message will be displayed.

4.3 Setting the time



Setting the time

Procedure

- Press the "h/time" (75) and up (82) keys simultaneously.
- The time is displayed. The first digit flashes.
 Press the up/down key (82) to increase or decrease the flashing digit.
- Use the SET (84) key to toggle to the next digit. After the last digit the number is accepted.

The time is now set.

Keep pressing the Up and Down keys to set the time and to change between 24 hour and 12 display (SET HOUR 24 H <-> SET HOUR 12 H).

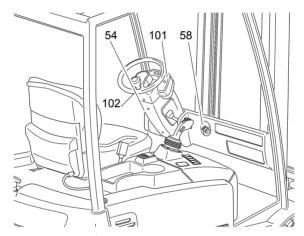
4.4 Parking the truck securely

↑ WARNING!

An unsecured truck can cause accidents

Parking the truck on an incline, without the brakes applied or with a raised load / load handler is dangerous and is strictly prohibited.

- ► Always park the truck on a level surface. In special cases the truck may need to be secured with wedges.
- ► Always fully lower the mast and load handler.
- ▶ Tilt the mast forward.
- ▶ Always apply the parking brake lever before parking the truck.
- ► Choose a place to park where no other people are at risk of injury from lowering forks
- ▶ Do not park and abandon a truck on an incline.



Parking the truck securely

Procedure

- Pull the parking brake lever (102) back.
- Turn the key in the key switch (58) to the "0" position.
- Remove the key from the key switch (58).
- Press the Emergency Disconnect switch (62) down.

The truck is now parked securely.

4.5 Emergency Disconnect

↑ CAUTION!

Applying maximum braking can result in accidents

Applying the Emergency Disconnect switch during travel will cause the truck to decelerate to a halt at maximum force. This may cause the load to slide off the load handler. There is a higher risk of accidents and injury.

- ▶ Do not use the Emergency Disconnect switch as a service brake.
- ▶ Use the Emergency Disconnect switch during travel only in emergencies.

⚠ CAUTION!

Faulty or non-accessible Emergency Disconnect switches can cause accidents

A faulty or non-accessible Emergency Disconnect switch can cause accidents. In dangerous situations the operator cannot bring the truck to a halt in time by applying the Emergency Disconnect switch.

- ▶The operation of the Emergency Disconnect switch must not be affected by any objects placed in its way.
- ▶ Report any defects on the Emergency Disconnect switch immediately to your supervisor.
- ► Mark defective truck and take out of service.
- ▶ Do not return the industrial truck to service until you have identified and rectified the fault.

Applying the Emergency Disconnect

Procedure

· Press the Emergency Disconnect (62).

All electrical functions are deactivated. The truck brakes to a halt.



Releasing the Emergency Disconnect

Procedure

Press the rocker in (1) and pull the Emergency Disconnect switch (62) up until you
feel the Emergency Disconnect (62) switch engaging.

All electrical functions are enabled and the truck is operational again (assuming the truck was operational before the Emergency Disconnect was pressed).

4.6 Travel

↑ WARNING!

Improper travel can result in accidents

- ▶ Do not get up from the driver's seat during travel.
- ▶ Do not drive the truck unless your are wearing a seat belt and the panels and doors are properly locked.
- ▶ Do not lean out of the truck while travelling.
- ► Make sure that the travel area is clear.
- ▶ Adapt your travel speed to the route conditions in the work area and the load.
- ▶ Tilt the mast back and raise the fork carriage approx. 200 mm.
- ► Make sure you have sufficient visibility when reversing.

Travel

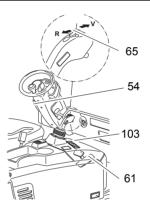
Requirements

- Truck prepared for operation, see page 75.

Procedure

- Release the parking brake lever (54).
- Select the travel direction with the travel direction switch (65).
- Select the travel speed if necessary, to do this press the slow travel button (103).
- · Raise the fork carriage approx. 200 mm.
- · Tilt the mast back.
- Apply the accelerator pedal (61). The travel speed is governed by the accelerator (61).

The truck travels in the direction selected.



Dual pedal (optional equipment)

Requirements

- Truck prepared for operation, see page 75.

Procedure

→ Fo

For trucks with a dual pedal the travel direction is selected via the accelerator pedals (63;64). When the driver leaves the truck, the truck is automatically set to "Neutral".

- Release the parking brake (54).
- · Raise the fork carriage approx. 200 mm.
- · Tilt the mast back.
- Apply the accelerator pedal (63) to travel forward. The travel speed is governed by the accelerator (63).
- Apply the accelerator pedal (64) to reverse.
 The travel speed is governed by the accelerator (64).

The truck travels in the direction selected.





Changing direction during travel

Procedure

• Set the travel direction switch (65) to the opposite direction while travelling.

The truck decelerates until it starts to travel in the opposite direction.



When the truck changes direction it can start travelling at high speed in the opposite direction unless the accelerator pedal is released in time. Changing direction results in braking deceleration

4.7 Steering

Requirements

- Truck ready for operation, see page 75

Procedure

- To negotiate a right-hand bend:
 - Turn the steering wheel clockwise to match the desired steering radius.
- To negotiate a left-hand bend:
 - Turn the steering wheel anti-clockwise to match the desired steering radius.

4.8 Brakes

The truck can brake in three different ways:

- Service brake
- Coasting brake

and for secure parking:

- Parking brake

↑ WARNING!

Accident risk

The brake pattern of the truck depends largely on the ground conditions.

- ▶ The operator must take into account the travel route conditions when braking.
- ▶ Brake with care to prevent the load from slipping.
- ▶ Allow for increased braking distance when travelling with an attached load.
- ▶ Use the service brake in emergencies.

4.8.1 Service brake

Braking with the service brake

Procedure

• Depress the brake pedal (60) until you feel the brake pressure.

The truck decelerates depending on the brake pedal position.

4.8.2 Coasting Brake

Braking with the coasting brake

Procedure

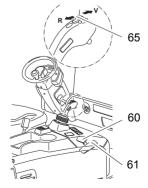
• Take your foot off the accelerator pedal (61).

The truck decelerates.

↑ WARNING!

Immediately after the battery has been charged the brake power of the coasting brake may reduce of their own accord after long periods of application, e.g. ramp operation.

- ► The operator must instruct people to leave the hazardous area.
- ▶ The operator must perform test braking.



4.8.3 Parking brake

↑ DANGER!

Accident risk

- ► The parking brake will hold the truck with maximum load on a clean ground surface, on inclines of up to 15%.
- ▶ Do not park and abandon the truck on an incline.
- ▶ Applying the parking brake during travel will cause the truck to brake to a halt at maximum force. This may cause the load to slide off the forks. There is a greater risk of accidents and injury.

The parking brake has two functions:

- Truck prevented from rolling away (parking brake automatically activated) When the truck stops the parking brake is automatically activated after a set time, prevents the truck from rolling away and the parking brake indicator (72) lights up. When the accelerator pedal is applied the parking brake is automatically released and the parking brake indicator (72) goes out.

This function of the parking brake prevents the truck from rolling away on inclines up to a maximum of 15%. The truck accelerates when the accelerator pedal is applied.

- Park the truck securely (parking brake lever (54) applied)

Pulling the parking brake lever (54) disables travel, the truck is secured. Pushing the parking brake button (102) and the parking brake lever (54) forward releases the parking brake and enables travel.

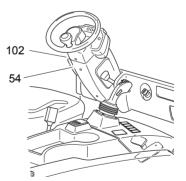
This function of the parking brake ensures that the truck is parked securely. The truck will not accelerate when the accelerator pedal is applied.

Parking brake

Procedure

- Press the button (102) and push the parking brake lever (54) forward, the parking brake is now released.
- Pull the parking brake lever (54) back, the parking brake is now applied.

The truck is now secure.



→

The parking brake will hold the truck with maximum load on a clean ground surface, on inclines of up to 15%.

Do not park and exit the truck on inclines.

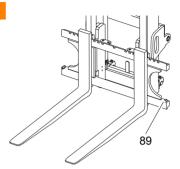
4.9 Adjusting the forks

↑ WARNING!

Unsecured and incorrectly adjusted forks can cause accidents

Before adjusting the forks make sure the retaining bolts (89) are fitted.

- ► Adjust the forks so that both forks are equidistant from the outside edge of the fork carriage.
- ► Engage the locking pin in a groove to prevent the forks from moving accidentally.
- ►The load centre of gravity must be located centrally between the forks.



Adjusting the forks

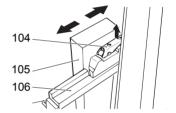
Requirements

- Park the truck securely, see page 77.

Procedure

- Lift up the locking lever (104).
- Push the forks (105) into the correct position on the fork carriage (106).
- **→**

To lift the load securely, the forks (105) must be spread as far apart as possible and positioned centrally with respect to the fork carriage. The load centre of gravity must be centrally aligned between the forks (105).



 Lift the locking lever down (104) and move the forks until the locking pin engages in a slot.

The forks are now adjusted.

4.10 Replacing the forks

↑ WARNING!

Unsecured forks can cause injury

You can injure your legs when replacing the forks.

- ▶ Never pull the forks towards your body.
- ► Always push the forks away from your body.
- Secure heavy forks with lifting slings and a crane before pushing them down from the fork carriage.
- ► After replacing the forks fit the retaining bolts (89) and make sure the bolts are seated correctly. Retaining bolt torque: 85 Nm.

Replacing the forks

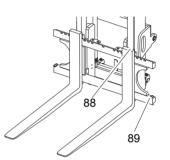
Requirements

 Load handler lowered and forks not touching the ground.

Procedure

- Disassemble the retaining bolts (89).
- · Loosen the fork stop (88).
- · Carefully push the forks off the fork carriage.

The forks are now dismantled from the fork carriage and can be replaced.



4.11 Lifting, transporting and depositing loads

↑ WARNING!

Unsecured and incorrectly positioned loads can cause accidents.

Before lifting a load the operator must make sure that it has been correctly palletised and does not exceed the truck's capacity.

- ▶ Instruct other people to move out of the hazardous area of the truck. Stop working with the truck if people do not leave the hazardous area.
- ▶ Only carry loads that have been correctly secured and positioned. Use suitable precautions to prevent parts of the load from tipping or falling down.
- ▶ Do not transport loads other than on the authorised load handler.
- ▶ Damaged loads must not be transported.
- ▶ If the stacked load obscures forward visibility, then you must reverse the truck.
- ▶ Do not exceed the maximum loads specified on the capacity plate.
- ▶ Check the fork spread before lifting the load and adjust if necessary.
- ▶ Insert the forks as far as possible underneath the load.

Lifting loads

Requirements

- Load correctly palletised.
- Fork spread for the pallet checked and adjusted if necessary.
- Load weight matches the truck's capacity.
- Forks evenly loaded for heavy loads.

Procedure

- Drive the truck carefully up to the pallet.
- · Set the mast vertical.
- · Slowly insert the forks into the pallet until the fork shank touches the pallet.
- · Raise the load handler.
- Reverse carefully and slowly until the load is outside the storage area. Make sure
 you have enough clear space to reverse into.

NOTE

Loads must not be deposited on travel or escape routes, in front of safety mechanisms or operating equipment that must be accessible at all times.

Transporting loads

Requirements

- Load raised correctly.
- Load handler lowered for transport (approx. 150 - 200 mm above the ground).
- Mast tilted back fully.

Procedure

- On slopes and inclines always carry the load facing uphill, never approach at an angle or turn.
- · Accelerate and decelerate with care.
- Adapt your travel speed to the conditions of the route and the load you are transporting.
- · Watch out for other traffic at crossings and passageways.
- · Always travel with a lookout at blind spots.

Depositing load units

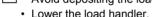
Requirements

- Warehouse location suitable for storing the load.

Procedure

- · Set the mast vertical.
- · Drive carefully up to the storage location.
- Press the "Lower load handler" button until the forks are clear of the load.

 Avoid depositing the load to avoid damaging the load and the load handler.



· Carefully remove the forks from the pallet.

The load unit is lowered.



4.12 Operating the lift mechanism and integrated attachments

↑ WARNING!

Operating the lifting device and integrated attachments can be hazardous

Other people can be injured in the truck's hazardous area.

The hazardous area is defined as the area in which people are at risk from the truck movement, the load handler, attachments etc. This also includes areas which can be reached by falling loads or lowering operating equipment.

Apart from the operator (in the normal operating position) there should be no other people in the truck's hazardous area.

- ▶ Instruct other people to move out of the hazardous area of the truck. Stop working with the truck if people do not leave the hazardous area.
- ► If people do not leave the hazardous area despite the warning, prevent the truck from being used by unauthorised people.
- ▶ Only carry loads that have been correctly secured and positioned. Use suitable precautions to prevent parts of the load from tipping or falling down.
- ▶ Do not exceed the maximum loads specified on the capacity plate.
- ▶ Do not stand underneath a raised load handler.
- ▶ Do not stand on the load handler.
- ▶ Do not lift other people on the load handler.
- ▶ Do not reach through the mast.
- ▶ The controls should only be operated from the driver's seat, and never suddenly.
- ▶ The operator must be trained to handle the lift mechanism and the attachments.

4.12.1 Operating the lift mechanism with the SOLO PILOT

Lifting and lowering

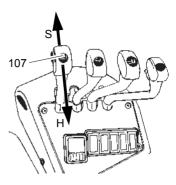
Requirements

To prepare the truck for operation, see page 75

Procedure

- Pull the Solo-Pilot lever (107) in direction H to raise the load.
- Push the Solo-Pilot lever (107)in direction S to lower the load.

The load is now raised / lowered.



→

When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

Tilting the mast forward | backward

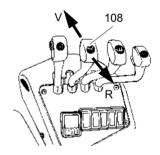
Requirements

 To prepare the truck for operation, see page 75

Procedure

- Pull the Solo-Pilot lever (108) in direction R to tilt the mast back.
- Push the Solo-Pilot lever (108) in direction V to tilt the mast forward.

The mast is now tilted back / forward.



→

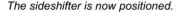
Positioning the integrated sideshift (option)

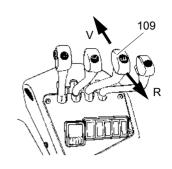
Requirements

- Truck prepared for operation, see page 75.

Procedure

- Pull the SOLO-PILOT lever (109) in direction R to move the load handler to the right (from the driver's viewpoint).
- Push the SOLO-PILOT lever (109) in direction V to move the load handler to the left (from the driver's viewpoint).





110

107

→

When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

Positioning the forks with an integrated fork positioner (option)



CAUTION!

Do not use the fork positioner to clamp loads.

Requirements

- Truck prepared for operation, see page 75.

Procedure

- Press the toggle switch (110) and at the same time pull the SOLO-PILOT (107) in direction Z: the forks will move towards each other.
- Press the toggle switch (110) and at the same time push the SOLO-PILOT (107) in direction A: the forks will spread apart.

The forks are now positioned.

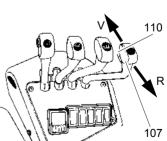
Synchronising the alignment of the fork tines with an integrated fork positioner (optional equipment)

Requirements

- Truck prepared for operation, see page 75.
- The fork tines are no longer aligned.

Procedure

 Press the toggle switch (110) and at the same time push the SOLO-PILOT (107) in direction
 A and spread the fork tines apart as far as they will go.



• Press the toggle switch (110) and at the same time pull the SOLO-PILOT (107) in direction Z and bring the fork tines as close to each other as they will go.

The fork tines are now synchronised.



4.12.2 Operating the lift mechanism with the Multi Pilot

Lifting and lowering

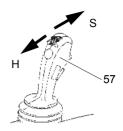
Requirements

To prepare the truck for operation, see page 75

Procedure

- Pull the Multi-Pilot (57) in direction H to raise the load.
- Push the Multi Pilot (57) in direction S to lower the load.

The load is now raised I lowered.



→ When

When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

Tilting the mast forward | backward

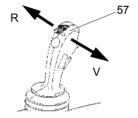
Requirements

- Truck prepared for operation, see page 75.

Procedure

- Push the Multi-Pilot lever (57) in direction V to tilt the mast forward.
- Push the Multi-Pilot lever (57) in direction R to tilt the mast back.

The mast is now tilted back / forward.



Twin operation

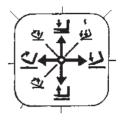
Requirements

- To prepare the truck for operation, see page 75

Procedure

- To lower the load handler and tilt the mast forward at the same time, push the Multi Pilot forward and to the right.
- To lift the load handler and tilt the mast back at the same time, push the Multi Pilot back and to the left.
- To lower the load handler and tilt the mast back at the same time, push the Multi Pilot forward and to the left.

The mast is now tilted back / forward.



Positioning the integrated sideshifter (option)

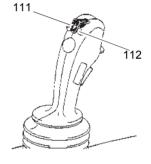
Requirements

- Truck prepared for operation, see page 75.

Procedure

- Press the (112) button to move the load handler to the right (from the driver's viewpoint).
- Press the (111) button to move the load handler to the left (from the driver's viewpoint).

The sideshifter is now positioned.





Positioning the forks with an integrated fork positioner (option)

↑ CAUTION!

Do not use the fork positioner to clamp loads.

Requirements

- Truck prepared for operation, see page 75.

Procedure

- · Press the (68) button and at the same time turn the MULTI-PILOT (57) anticlockwise, the forks will spread apart.
- · Press the (68) button and at the same time turn the MULTI-PILOT (57) anticlockwise, the forks will move together.

The forks are now positioned.

Synchronising the alignment of the fork tines with an integrated fork positioner (optional equipment)

Requirements

- Truck prepared for operation, see page 75.
- The fork tines are no longer aligned.

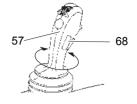
Procedure

- · Press the (68) button and at the same time turn the MULTI-PILOT (57) anti-clockwise, the forks will spread apart.
- Press the (68) button and at the same time turn the MULTI-PILOT (57) anticlockwise, the forks will move together.

The fork tines are now synchronised.



When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.



68

4.13 Safety instructions for operating additional attachments



Optionally, trucks can be fitted with one or more auxiliary hydraulic functions to operate attachments. The auxiliary hydraulics are indicated with ZH1, ZH2 and ZH3.

Auxiliary hydraulic functions for exchangeable equipment are fitted with replacement couplings on the fork carriage. To fit exchangeable equipment see page 102.

⚠ DANGER!

Attaching exchangeable equipment can result in accidents.

Other people can be damaged by attaching exchangeable equipment. Use only exchangeable equipment which has been deemed safe after a risk analysis carried out by the owner.

- ▶ Only use attachments with a CE mark.
- ▶ Only use attachments that have been designed by the attachment manufacturer for use with the respective industrial truck.
- ▶ Only use attachments that have been fitted for the purpose by the owner.
- ► Make sure the operator has been instructed in the use of the attachment and that he uses it for its correct purpose.
- ▶ Re-assess the residual capacity of the truck and if it has been altered, attach an additional capacity plate to the truck.
- ▶ Note the attachment manufacturer's operating instructions.
- ▶ Only use attachments that do not restrict visibility in the travel direction.



If visibility in the travel direction is impaired, the operating company must determine and apply suitable measures to ensure the safe operation of the truck. A lookout may have to be used or certain hazardous areas may have to be cordoned off. The truck can also be equipped with optional visual aids such as a camera system or mirrors. Travelling with visual aids requires plenty of practice at slow speed.

Safety instructions for sideshifter and fork positioner attachments

↑ WARNING!

Restricted visibility and reduced tilt resistance can cause accidents

When using sideshifters and fork positioners, the change in centre of gravity can result in reduced lateral tilt resistance and accidents. Note that this affects visibility as well.

- ► Adapt the travel speeds to the visibility and load.
- ► Make sure you have sufficient visibility when reversing.

Safety instructions for clamping attachments (e.g. baling clamps, barrel clamps, grabs etc.)

↑ WARNING!

Falling loads can cause accidents

This can result in malfunctions and the load can fall accidentally.

- ► Clamping attachments may only be added to trucks which have a button to enable additional hydraulic functions.
- ► Clamping attachments must only be operated on trucks will auxiliary hydraulics ZH1, ZH2 or ZH3.
- ► When connecting the attachment make sure that the hydraulic lines of the attachment are connected to the right ports, see page 102.

Safety instructions for rotary attachments

↑ WARNING!

A non-centred load centre of gravity can result in accidents

When using rotary devices and non-centred loads, the centre of gravity can be displaced from the centre with a high risk of accidents.

- ► Adapt the travel speed to the load.
- ▶ Lift the load from the centre.

Safety instructions for telescopic attachments

↑ WARNING!

Accident risk from increased tipover hazard and reduced residual capacity

There is a greater risk of tipover with extended telescopic attachments.

- ▶ Do not exceed the maximum loads specified on the capacity plate.
- ▶ Only use the telescopic function for stacking and retrieving.
- ▶ Retract the telescopic attachment fully during transport.
- ▶ Adapt the travel speed to changed load centre of gravity.

Safety instructions for attachments when transporting suspended loads

⚠ WARNING!

Swinging loads and a reduced residual capacity can result in accidents.

Transporting hanging loads can reduce the stability of the truck.

- ▶ Adapt the travel speed to the load, less than walking pace.
- ► Secure swinging loads for example with lifting slings.
- ▶ Reduce the residual capacity and have it certified by a expert.
- ▶ If the truck is to be operated with hanging loads, proof of sufficient safety distance under local operating conditions must be obtained from a specialist assessor.

Safety instructions for using loading buckets as attachments

↑ WARNING!

Increased mast loading can cause accidents.

► When carrying out the daily checks and operations before starting, see page 62, check in particular check the fork carriage, mast rails and mast rollers for damage.

Fork extension safety instructions

↑ WARNING!

Unsecured and oversized fork extensions can cause accidents.

- ► For fork extensions with an open cross sectional area, carry only loads that are resting along the entire length of the fork extension.
- ► Use only fork extensions with the same fork cross section and minimum fork length of the truck and which comply with the details on the fork extension data plate.
- ▶ The basic fork length must be at least 60% of the length of the fork extension.
- ▶ Lock the fork extensions onto the basic forks.
- ► When carrying out the daily checks and operations before starting, see page 62, check also the fork extension lock.
- ► Mark any fork extensions with an incomplete or faulty lock and take them out of service.
- ▶ Do not use trucks with an incomplete or faulty fork extension lock. Replace the fork extension.
- ▶ Only restore the fork extension to service when the fault has been rectified.
- ▶ Use only fork extensions which are free of dirt and foreign bodies near the entry opening point. Clean the fork extensions as required.

4.14 Operating additional attachments for the SOLO-PILOT

↑ WARNING!

Incorrect symbols can cause accidents

Symbols on controls that do not depict the function of the attachments can cause accidents.

- ▶ Mark the controls with symbols that indicate their function.
- ► Specify the attachments' direction of movement in accordance with ISO 3691-1 so that they match the controls' direction of movement.

4.14.1 Solo Pilot with control of ZH1 hydraulic port

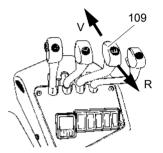


Depending on the attachments used the lever (109) is assigned the function of the attachment. Levers that are not required are void. For connections see page 102.

Procedure

Operating the hydraulic port ZH1:
 Move the lever (109) in direction V or R.

The attachment's function is performed.



4.14.2 Solo Pilot with control of ZH1 and ZH2 hydraulic ports

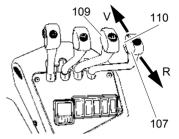


Depending on the attachments used the lever / button (107, 109, 110) is assigned the function of the attachment. Unused levers have no function. For connections see page 102.

Procedure

- Operating the hydraulic port ZH1:
 Move the lever (109) in direction V or R.
- Operating the hydraulic port ZH2: Press the toggle switch (110) and at the same time move the lever (107) in the V or R direction.

The attachment's function is performed.



4.15 Operating additional attachments for the Multi Pilot

↑ WARNING!

Incorrect symbols can cause accidents

Symbols on controls that do not depict the function of the attachments can cause accidents.

- ▶ Mark the controls with symbols that indicate their function.
- ► Specify the attachments' direction of movement in accordance with ISO 3691-1 so that they match the controls' direction of movement.

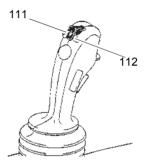
4.15.1 Multi Pilot with control of ZH1 hydraulic port

Depending on the attachments used the (112, 111) buttons are assigned the function of the attachment. Unused buttons have no function. For connections see page 102.

Procedure

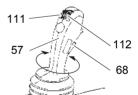
 Operating hydraulic port ZH1: Press the (112) button or the (111) button.

The attachment performs its operation.



4.15.2 Multi Pilot with control of ZH1 and ZH2 hydraulic ports

Depending on the attachments used the buttons (112, 111) and the lever (57) are assigned the function of the attachment. Levers that are not required are void. For connections see page 102.



Procedure

- Operating hydraulic port ZH1: Press the (112) button or the (111) button.
- Operating hydraulic port ZH2:
 Set the MULTI-PILOT (57) to neutral and then turn it clockwise or anti-clockwise while at the same time pressing the button (68).

The attachment performs its operation.

4.16 Fitting additional attachments

↑ WARNING!

Incorrectly connected attachments can cause accidents.

Attachments with incorrectly connected hydraulic attachments can result in accidents.

- Attachments must only be assembled and commissioned by trained, specialist personnel.
- ▶ Observe the manufacturer's operating instructions.
- ▶ Before starting, check the fasteners are positioned correctly and securely and make sure they are complete.
- ▶ Before starting, make sure the attachment is working correctly.

Connecting attachments hydraulically

Requirements

- Non-pressurised hydraulic hoses.
- The exchange ports on the truck are marked ZH1, ZH2 and ZH3.
- Attachment directions of movement defined to match the controls' direction of movement

Procedure

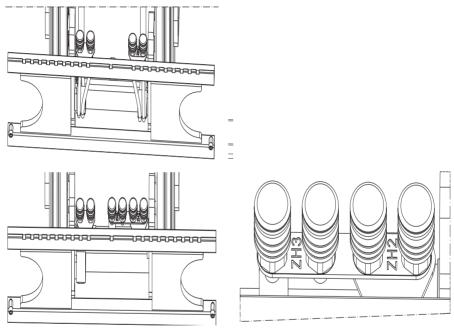
- · Non-pressurised hydraulic hoses
 - · Switch off the truck and wait a few minutes.
- · Attach the plug connector and engage it in position.
- · Mark the controls with symbols that indicate their function.

The attachment is now hydraulically connected.

↑ WARNING!

Hydraulic ports for clamping attachments

- ► Clamping attachments may only be added to trucks which have a button to enable additional hydraulic functions.
- ► On trucks with auxiliary hydraulics ZH2 the clamping function should only be attached to the coupling pair marked ZH2.
- ► On trucks with auxiliary hydraulics ZH3 the clamping function should only be attached to the coupling pair marked ZH3.



Spilled hydraulic oil must be set using a suitable agent and disposed of in accordance with environmental regulations.

If hydraulic oil comes into contact with the skin, wash it off immediately with soap and water. If it comes into contact with the eyes rinse them immediately with flowing water and call for a doctor.

5 Towing trailers

Inappropriate speeds and excessive trailer loads can be dangerous

If you do not adapt your speed and / or use an excessive trailer load, the truck can pull apart when cornering and braking.

- ▶ The truck should only be used occasionally to tow trailers.
- ▶The overall weight of the trailer should not exceed the capacity indicated on the capacity plate, see page 27. If a load is also transported on the load handler, the trailer load must be reduced by the same amount.
- ▶ Do not exceed the maximum speed of 5 km/h km/h.
- ► A truck must not be continually operated with trailers.
- ▶ Do not use supporting loads.
- ▶ Towing must only be performed on level, secure travel routes.
- ▶The owner must test trailer operation with the permissible tow load by means of a trial run under the applicable operating conditions on site.

Attaching the trailer

↑ CAUTION!

Trapping hazard

There is a trapping risk when you attach a trailer.

- ▶ Follow the instructions of the coupling manufacturer if using special trailer couplings.
- ▶ Secure the trailer to prevent it from rolling away before coupling it.
- ▶ Do not get caught between the truck and the tiller when coupling the trailer.
- ▶ The tiller must be horizontal, tilted down by no more than 10° and never facing up.

Attaching the trailer

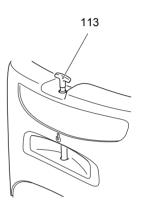
Requirements

- Truck and trailer are on a level surface.
- Trailer prevented from rolling away.

Procedure

- Push the tow pin (113) down and turn it 90°.
- Pull the tow pin up and insert the tiller of the trailer into the opening.
- Insert the tow pin, push it down, turn it 90 degrees and engage it.

The trailer is now attached to the truck.



6 Optional Equipment

6.1 Assistance systems

The Access, Drive and Lift Control systems help the driver operate the truck with regard to safety regulations, see page 72 of the present operating instructions.

Travel conduct

The operator must adapt the travel speed to local conditions. The truck must be driven at slow speed when negotiating bends or narrow passageways, when passing through swing doors and at blind spots. The operator must always observe an adequate braking distance between the forklift truck and the vehicle in front and must be in control of the truck at all times. Abrupt stopping (except in emergencies), rapid U turns and overtaking at dangerous or blind spots are not permitted. Do not lean out or reach beyond the working and operating area.

6.1.1 Access Control

The truck is only released for operation if:

- 1)The operator is seated.
- 2)The truck is switched on via the key switch (ISM \bigcirc / CanCode \bigcirc).
- 3)He is wearing the seat belt.
- If the driver vacates the seat for a short while, the truck can be operated again when he returns (seat occupied) and puts the seat belt back on again, without having to apply the key switch again.
- If travel is not enabled, an information message is issued. Items 1 to 3 must be carried out again.

6.1.2 Drive Control

This option restricts the travel speed of the truck irrespective of the steer angle. From a factory-set lift height the maximum travel speed is reduced to walking pace (approx. 3 km/h) and the slow travel indicator is activated. When the forks fall below this height, the truck accelerates at reduced levels to the speed prescribed by the accelerator pedal to prevent sudden acceleration when changing from slow travel to normal travel. Normal acceleration is only activated again when the speed prescribed by the accelerator pedal has been reached.

- **→**
- In addition to the daily checks before starting, see page 62 the driver must carry out the following checks:
- Lift the empty load handler beyond the reference lift height and check if the slow travel display lights up.
- Steering when the truck is stationary: check if the steering wheel display is working.

6.1.3 Lift Control

This option includes Drive Control and also monitors and controls the mast functions:

Tilt speed reduction as a function of the lift height (from approx. 1.5 m lift height).

 When the load handler is lowered below the limit height, the tilt speed increases again.

Optional:

- Tilt angle display, see page 111.

In addition to the daily checks before starting, the driver must carry out the following checks:

Procedure

- Lift the empty load handler beyond the reference lift height and check if the slow travel display lights up and the tilt speed is clearly reduced.
- Steering when the truck is stationary: check if the steering wheel display is working.
- Check the tilt angle display by tilting forward and back.

6.2 BODYGUARD

↑ CAUTION!

An open door can cause accidents (115)

- ▶Do not travel with an open door (115). When opening the door make sure there is nobody in the door's swing range.
- ► Always close the door tightly and make sure it is locked
- Closing the door does not release the driver from his responsibility to wear a seat belt, see page 70.



Procedure

- Pull the handle (114) towards the operator position, the door swings open.
- Pull the door (115) towards the driver; the door closes.

6.3 Panel door

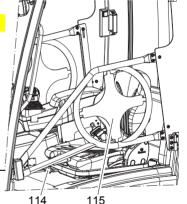
↑ CAUTION!

An open door can cause accidents (115)

- ► Do not travel with an open door (115). When opening the door make sure there is nobody in the door's swing range.
- ► Always close the door tightly and make sure it is locked.
- ► Closing the door does not release the driver from his responsibility to wear a seat belt, see page 70.

Requirements

 On trucks with a door monitoring sensor, travel is only enabled when the panel door is closed (○).



- Pull the handle (114) towards the operator position, the door swings open.
- Pull the door (115) towards the operator; the door closes.

6.4 Adjusting the driver's seat

Adjusting the backrest extension

⚠ CAUTION!

Accident risk when adjusting the backrest during travel

▶ Do not adjust the backrest extension while travelling.

Procedure

- The backrest extension height can be adjusted by changing the detent.
- · Pull the backrest up and lock it in place to extend the backrest.
- Push the backrest down and lock it in place to shorten the backrest.

6.5 Removable load backrest

↑ CAUTION!

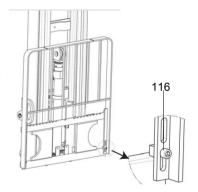
Trapping hazard and heavy load backrest weight

- ▶ Wear safety gloves and safety shoes when carrying out this operation.
- ▶ Two people are required to remove and attach the load backrest.

Load backrest disassembly

Procedure

- · Loosen the screws (116).
- Remove the load backrest from the fork carriage and put it down securely.
- · Fit the fork retaining screws.



Load backrest assembly

- · Attach the load backrest to the top rail of the fork carriage.
- · Fit the bolts and tighten them with a torque wrench.



6.6 Lift cutout override

→

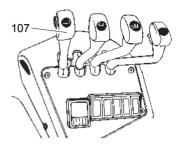
A lift cutout device can be factory fitted when working in areas of restricted height. This interrupts lifting.

To continue lifting:

Procedure

- Press the lift cutout override button (see page 59).
- Pull the control lever (107).

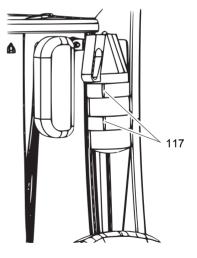
Lift cutout is deactivated until the button is pressed again or the fork carriage is lowered below the height limit setting.



6.7 Fire extinguisher

- Open the fasteners (117)
- Pull the fire extinguish out of its bracket

 To operate, refer to the illustrations on the fire extinguisher

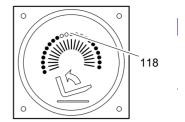


6.8 Tilt angle display

NOTE

The current tilt angle is shown in an additional display that is attached on the right of the dashboard.

- The green LED (118) indicates the vertical position to the ground.



119

Rockinger coupling with hand lever or remote control 6.9

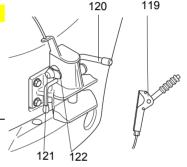
→

Refer to the instructions for towing trailers, see page 104.

CAUTION!

Incorrectly coupled trailers can cause accidents

- ► Make sure the coupling is engaged securely before starting the truck.
- ► The contro pin (121) must be flush with the control sleeve (122).



Rockinger coupling operation (attaching trailers)

Procedure

- · Prevent the trailer from rolling away.
- Adjusting the trailer pull rod to the height of the coupling.
- Pull the hand lever (120) / remote control (119) (\bigcirc) up.



- The remote control (119) (O) is located in the overhead guard, depending on the truck model.
- · Slowly reverse the truck until the coupling engages.
- Push the hand lever (120) / remote control (119) (○) down.

Rockinger coupling operation (disconnecting trailers)

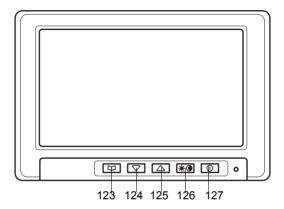
- Prevent the trailer from rolling away.
- Pull the hand lever (120) / remote control (119) (\bigcirc) up.
- · Drive the truck forward.
- Push the hand lever (120) / remote control (119) (○) down.

6.10 Camera system

↑ CAUTION!

Accident risk from hidden work areas

- ▶The camera system acts as an aid to assist safe operation.
- ▶ Practice travelling and working with the camera system.
- ▶ Align the camera so that the hidden work area can be seen.
- When using the camera to reverse, the monitor automatically switches on when you engage reverse gear.



Using the camera system

- Press the button (127) on the monitor to switch the camera system on or off.
- Press the button (126) to lighten or darken the screen (day / night settings).
- Press the button (123) to open the menu.
- Pressing the button several times changes the menu item (contrast, brightness, colour saturation, language, video, light reflection) or quits the menu.

Adjusting the menu items

- Press the button (125) to go one step forward.
- Press the button (124) to go one step back.
- Clean a dirty screen or vent slots with a soft cloth or brush.

6 11 Control layout "N"

WARNING!

Persons standing under or on a raised load handler are at risk of accidents

Do not allow anyone to stand under or on a raised load.

- ▶ Do not stand on the load handler.
- ▶ Do not lift any persons on the load handler.
- ▶ Instruct other people to move out of the hazardous area of the truck.
- ▶ Do not stand underneath a raised and unsecured load handler



With control layout "N", the lift and tilt functions are swapped compared with the standard operation. The Multipilot must only be operated from the driver's seat. The operator must be trained to handle the lift mechanism and the attachments.

NOTE

▶ The lift/lower and tilt speeds are determined by the inclination of the Multipilot. Do not deposit the load handler suddenly to avoid damaging the load and the racking.

Lifting

Procedure

- Push the Multipilot to the right (direction H) to raise the load.
- Push the Multipilot to the left (direction S) to lower the load.

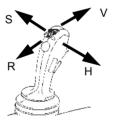
Tilting



↑ CAUTION!

Trapping hazard from inclined mast

► When tilting the mast back, keep all parts of your body from between the mast and the front wall.



Procedure

- Push the Multipilot forward (direction V) to tilt the load forward.
- Pull the Multipilot back (direction R) to tilt the load back.



When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

7 Troubleshooting

7.1 Troubleshooting

This chapter enables the operator to localize and rectify basic faults or the results of incorrect operation himself. When trying to locate a fault, proceed in the order shown in the remedy table.



If, after carrying out the following remedial action, the truck cannot be restored to operation or if a fault in the electronics system is displayed with a corresponding error code, contact the manufacturer's service department.

Troubleshooting must only be performed by the manufacturer's customer service department. The manufacturer has a service department specially trained for these tasks.

In order for customer services to react quickly and specifically to the fault, the following information is essential:

- Truck serial number
- Event message from the display unit (if applicable)
- Error description
- Current location of truck.

Info messages

Meaning		
Traction or lift controller temperature above 83°C		
Accelerator pedal zero position		
 Message can be set via parameters: either the zero position is only checked after power up or after every change of seat switch status from open to closed. 		
Hydraulics zero position		
 Message can be set via parameters: message displayed or not. 		
Overtemperature		
 Traction or lift motor above 145?. 		
Travel against parking brake		
 Accelerator pressed while parking brake applied. 		
 Seat switch not occupied and parking brake not applied. 		
Hydraulics zero position on truck power up		
 A hydraulic function applied during power up. The hydraulic function applied will not be performed. 		

Fault	Possible Cause	Remedy
Truck does not start	 Battery connector not plugged in. Emergency Disconnect switch pressed. Key switch set to O. Battery charge too low. Faulty fuse. 	 Check battery connector and plug in if necessary. Unlock the Emergency Disconnect Set the key switch to "I". Check battery charge, charge battery if necessary. Check the fuses.
Load cannot be lifted	 Truck not operational. Hydraulic oil level too low. Battery discharge monitor has switched off. Faulty fuse. Load is too heavy. 	 Carry out all measures listed under "Truck does not start". Check hydraulic oil level. Charge the battery Check the fuses (○). Note the maximum capacity, see page 30.
Fault displays	 Truck not operational. 	 Press the EMERGENCY DISCONNECT isolator or turn key switch to 0, after approx. 3 seconds try to perform the desired operation again

7.2 Operating the truck without its own drive system

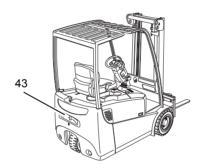
7.2.1 Towing the truck

↑ WARNING!

Accident risk

Other people can be injured if the truck is towed incorrectly.

- ▶ Only use vehicles to tow the truck which have sufficient tow and brake forces for the trailer load without its own braking system.
- ► Always use a pull rod to tow.
- ► Always tow the truck at walking pace.
- ▶ Do not park the truck with the parking brake released.
- ▶ One person must be seated in the recovery truck to steer it and one person must be seated on the towed truck.



Towing the truck

Requirements

- Park the truck securely.
- Disconnect the battery.

Procedure

- Connect the pull rod to the trailer coupling (43) of the towing truck and attach it to the truck to be towed.
- · Release the parking brake.
- · Tow the truck to its destination.
- Apply the parking brake.
- · Undo the tow connection.

The truck has now reached its destination.

7.3 Emergency lowering

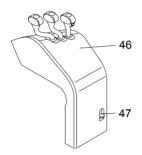
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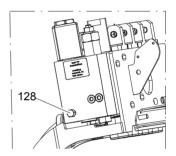
The mast can be lowered manually if a fault occurs in the hydraulic system.

↑ WARNING!

Lowering the mast can result in injuries

- ►Instruct other people to move out of the hazardous area of the truck during emergency lowering.
- ▶ Never stand underneath a raised load handler.
- ▶ Only operate the emergency lowering valve when standing next to the truck.
- ► Emergency lowering of the mast cannot be applied when the load handler is in the rack.
- ▶ Report any defects immediately to your supervisor.
- ▶ Tag out and decommission a faulty lift truck.
- ▶ Only return the truck to service when you have identified and rectified the fault.





Emergency mast lowering - Solo Pilot

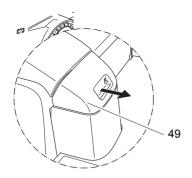
Requirements

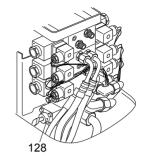
- Load handler is not in the rack.
- Turn the Emergency Disconnect switch and key switch off.
- Disconnect the battery.
- Remove the panel, press the lever (47) to unlock the cover (46) and move the cover forward.

Procedure

- Slowly turn the emergency lowering valve (128); the mast and load handler will lower
- Turn the emergency lowering valve (128) in the opposite direction as far as the stop; the lowering process stops.

The mast is now lowered.





Emergency mast lowering - Multi Pilot

Requirements

- Load handler is not in the rack.
- Turn the Emergency Disconnect switch and key switch off.
- Disconnect the battery.
- Remove the panel, push the steering column forward and pull the cover (49) forward until it engages.

Procedure

- Slowly turn the emergency lowering valve (128); the mast and load handler will lower.
- Turn the emergency lowering valve (128) in the opposite direction as far as the stop; the lowering process stops.

The mast is now lowered.

↑ WARNING!

Only return the truck to service when you have identified and rectified the fault.

F Industrial Truck Maintenance

1 Operational Safety and Environmental Protection

The checks and servicing operations contained in this chapter must be performed in accordance with the maintenance checklist service intervals.

Risk of accidents and component damage

Any modification to the truck, in particular the safety mechanisms, is prohibited.

Exception: Owners should only make changes or have changes made to powered industrial trucks if the truck manufacturer is no longer operating in the field and there is no successor to the business: owners must however:

- Ensure that the changes to be made are planned, tested and performed by a specialist engineer in industrial trucks taking safety into account.
- keep permanent graphic records of the plans, tests and completion of the changes
- carry out and have authorised the respective changes to the capacity data plates, decals and stickers as well as the operator and service manuals.
- attach permanent and clearly visible marking to the truck indicating the types of changes made, the date of the changes and the name and address of the organisation responsible for the work.

NOTE

Only original spare parts are subject to the manufacturer's quality control. To ensure safe and reliable operation, use only the manufacturer's spare parts.



On completion of inspection and service work, carry out the operations listed in the "Recommissioning the truck after cleaning or maintenance work" section (see page 147).

Maintenance and repair personnel



The manufacturer has a service department specially trained for these tasks. A maintenance contract with the manufacturer will ensure trouble-free operation.

Truck maintenance and repair work must only be carried out by specially trained personnel. The following operations are assigned to the following target groups.

Customer Services

Customer Services are specially trained in the use of the truck and are able to carry out maintenance and repairs independently. Customer Services are aware of the relevant standards, guidelines and safety regulations as well as potential risks.

Operating company

The maintenance personal of the operating company has the technical expertise and experience to perform the activities in the maintenance check list for the operating company. The maintenance and repair work to be performed by the operating company are also written down, see page 119.

2.1 Consumables and used parts

↑ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

▶ Note the safety regulations when handling these materials.

2.2 Wheels

↑ WARNING!

The use of tyres that do not match the manufacturer's specifications can result in accidents.

The quality of tyres affects the stability and performance of the truck.

Uneven wear affects the truck's stability and increases the stopping distance.

- ▶When replacing tyres make sure the truck is not skewed.
- ▶ Always replace tyres in pairs, i.e. left and right at the same time.
- When replacing rims and tyres fitted at the factory, only use the manufacturer's original spare parts. Otherwise the manufacturer's specifications cannot be ensured.

2.3 Lift Chains

↑ WARNING!

Non-lubricated and incorrectly cleaned lift chains can cause accidents

Lift chains are safety-critical parts. They must not contain any serious contamination. Lift chains and pivot pins must always be clean and well lubricated.

- ► Lift chains should only be cleaned with paraffin derivatives e.g. petroleum or diesel fuels.
- ▶ Do not clean lift chains with high pressure jets or chemical cleaning agents.
- Immediately after cleaning, dry the lift chain with compressed air and apply a chain spray.
- ► Always lubricate a chain when it is discharged.
- Lubricate a lift chain with particular care around the pulleys.

Diesel fuel can be hazardous

- ▶ Diesel fuel can cause irritation if it comes into contact with the skin. Rinse any affected areas thoroughly.
- ▶ If it comes into contact with the eyes rinse them immediately with flowing water and call for a doctor.
- ► Wear safety gloves when handling diesel fuels.

2.4 Hydraulic system

↑ WARNING!

Leaky hydraulic systems can result in accidents

Hydraulic oil can escape from leaky and faulty hydraulic systems.

- ▶ Report any defects immediately to your supervisor.
- ► Mark defective truck and take out of service.
- ► Do not return the industrial truck to service until you have identified and rectified the fault.
- ▶ Remove any spilled hydraulic immediately with an appropriate bonding agent.
- ▶The bonding agent / consumable mixture must be disposed of in accordance with regulations.

Faulty hydraulic hoses can result in injury and infection

Pressurised hydraulic oil can escape from fine holes or hairline cracks in the hydraulic hoses. Brittle hydraulic hoses can burst during operation. People standing near the truck can be injured by the hydraulic oil.

- ▶ Call for a doctor immediately in the event of an injury.
- ▶ Do not touch pressurised hydraulic hoses.
- ▶ Report any defects immediately to your supervisor.
- ► Mark defective truck and take it out of service.
- ► Do not return the industrial truck to service until you have identified and rectified the fault.

NOTE

Testing and replacing hydraulic hoses

Hydraulic hoses can become brittle through age and must be checked at regular intervals. The application conditions of the industrial truck have a considerable impact on the ageing of the hydraulic hoses.

- ▶ Check the hydraulic hoses at least annually and replace if necessary.
- ► If the operating conditions become more arduous the inspection intervals must be reduced accordingly.
- ▶In normal operating conditions a precautionary replacement of the hydraulic hoses is recommended after 6 years. The owner must carry out a risk assessment to ensure safe, prolonged use. The resulting protection measures must be observed and the inspection interval reduced accordingly.

3 Lubricants and Lubrication Schedule

3.1 Handling consumables safely

Handling consumables

Consumables must always be handled correctly. Follow the manufacturer's instructions.

⚠ WARNING!

Improper handling is hazardous to health, life and the environment

Consumables can be flammable.

- ▶ Keep consumables away from hot components and naked flames.
- ► Always keep consumables in prescribed containers.
- ► Always fill consumables in clean containers.
- ▶ Do not mix up different grades of consumable. The only exception to this is when mixing is expressly stipulated in the operating instructions.

↑ CAUTION!

Spilled consumables can cause slipping and endanger the environment

Risk of slipping from spilled consumables. The risk is greater when combined with water.

- ▶ Do not spill consumables.
- ► Spilled consumables must be removed immediately with an appropriate bonding agent.
- ▶The bonding agent / consumable mixture must be disposed of in accordance with regulations.

↑ WARNING!

Improper handling of oils can be hazardous

Oils (chain spray / hydraulic oil) are flammable and poisonous.

- ▶ Dispose of used oils in accordance with regulations. Store used oil safely until it can be disposed of in accordance with regulations.
- ▶ Do not spill oil.
- ▶ Spilled oils must be removed immediately with an appropriate bonding agent.
- ▶The mixture consisting of the bonding agent and oil must be disposed of in accordance with regulations.
- ▶ Observe national regulations when handling oils.
- ► Wear safety gloves when handling oils.
- ▶ Prevent oil from coming into contact with hot motor parts.
- ▶ Do not smoke when handling oil.
- ► Avoid contact and digestion. If you swallow oil do not induce vomiting but seek medical assistance immediately.
- ▶ Seek fresh air after breathing in oil fumes or vapours.
- ▶ If oil has come into contact with your skin, rinse your skin with water.
- ▶ If oil has come into contact with your eyes, rinse them with water and seek medical assistance immediately.
- ▶ Replace oil-soaked clothing and shoes immediately.

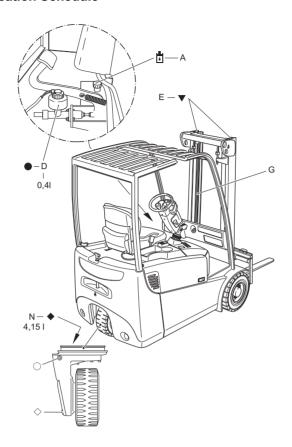
↑ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

▶ Note the safety regulations when handling these materials.

3.2 Lubrication Schedule



•	Contact surfaces	Σ,3	Hydraulic oil drain plug
ţ	Grease nipple	•	Gear oil filler neck
ı	Hydraulic oil filler neck	♦	Gear unit oil drain plug
•	Brake fluid filler neck	0	Gear oil control screw

3.3 Consumables

Code	Order no.	Package quantity	Capacity	Description	Used for
	51 132 827*	51	14.51	Jungheinrich hydraulic oil	
	50 426 072	201		HLPD 32 1)	l le ralace e li c
Α	50 429 647	201		HLPD 22 ²⁾	Hydraulic system
	50 124 051	51		HV 68 ³⁾	System
	51 082 888	51		Plantosyn 46 HVI (BIO hydraulic oil)	
D	29 201 570	11	0.25	Brake fluid SAE J 1703 4) FMVSS 116 DOT 3 and DOT 4	Hydraulic brake system
E	50 157 382	1kg		Lubrication grease K-L 3N 3)	Front wheel bearings, steering transmission
G	29 201 280	400ml		Chain spray	Chains
N	50 468 784	11	4.15 l	Transmission oil EP 80	Transmission

¹⁾ Valid for temperatures -5/+30 °C

³⁾ Valid for temperatures +30/+50 °C



*The trucks are factory-equipped with a special manufacturer's hydraulic oil (the dealer hydraulic oil with a blue colouration) or the Plantosyn 46 HVI bio hydraulic oil. This special hydraulic oil can only be obtained from the manufacturer's customer service department. The use of named alternative hydraulic oils is not prohibited but may lead to a decline in functionality. This hydraulic oil may be mixed with one of the named alternative hydraulic oils.

↑ WARNING!

Industrial trucks are factory-equipped with "HLP D22/32" hydraulic oil or "+ 2% Plantosyn 46 HVI" BIO hydraulic oil.

You cannot change from "Plantosyn 46 HVI" BIO hydraulic oil to the manufacturer's hydraulic oil. The same applies to changing from the manufacturer's hydraulic oil to "Plantosyn 46 HVI" bio hydraulic oil.

Do not mix the Plantosyn 46 HVI bio hydraulic oil with the manufacturer's hydraulic oil or one of the named alternative hydraulic oils.

²⁾ Valid for temperatures -20/-5 °C

Grease guidelines

Code	Saponification	°C .	Worked penetration at 25 °C	NLG1 class	Application temperature °C
E	Lithium	185	265 - 295	2	-35/+120

4 Maintenance and repairs

4.1 Preparing the truck for maintenance and repairs

All necessary safety measures must be taken to avoid accidents when carrying out maintenance and repairs. The following preparations must be made:

- Park the truck securely, see page 77.
- Fully lower the load handler.
- · Disconnect the battery to prevent the truck from being switched on accidentally.

4.2 Lifting and jacking up the truck safely

↑ WARNING!

A truck tipover can cause accidents

In order to raise the truck, use only suitable lifting gear at the points specially provided for this purpose.

- ▶ Note the weight of the truck on the data plate.
- ► Always use a jack with a minimum capacity of 2500 kg kg.
- ▶ Raise the unladen truck on a level surface.
- ► When raising the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

Raising and jacking up the truck securely

Requirements

- Prepare the truck for maintenance and repairs (see page 129).

Tools and Material Required

- Jack
- Hard wooden blocks

Procedure

- Place the jack against the contact point.
- Jack contact point, see page 27.
- · Raise the truck.
- · Support the truck with hard wooden blocks.
- · Remove the jack.

The truck is now securely raised and jacked up.

4.3 Opening the battery panel

Open the battery cover with the SOLO-PILOT

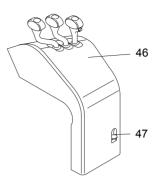
Requirements

- Park the truck securely, see page 77.
- Load handler lowered.
- Key switch set to OFF.
- Key removed.
- Set the Emergency Disconnect OFF.

Procedure

- Press the lever (47) to unlock the cover (46) and move it forward.
- Carefully lift back the battery cover and the driver's seat as far as the stop (opening angle = 90°).

The battery cover is now open. The fuses and other electrical components can now be reached.



Opening the battery cover with the MULTI-PILOT (O)

Requirements

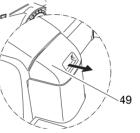
- Park the truck securely, see page 77.
- Load handler lowered.
- Key switch set to OFF.
- Key removed.
- Set the Emergency Disconnect OFF.

Procedure

- Release the steering column lock (48), push the steering column forward and secure it in this position.
- Pull the panel (49) forward until it engages.
- Carefully lift back the battery cover and the driver's seat (1) as far as the stop (opening angle = 90°).

The battery cover is now open. The fuses and other electrical components can now be reached.





On trucks with a rear window / canvas cover, open the rear window / canvas cover before opening the battery cover.

4.4 Checking the wheel attachments.

↑ WARNING!

Using different tyres can cause accidents

The quality of tyres affects the stability and performance of the truck.

- ▶ The diameter of the wheels must differ by no more than 15 mm.
- ► Always replace tyres in pairs. After replacing the tyres check the wheel nuts are secure after 10 service hours.
- ▶ Always use tyres of the same make, model and profile.

Checking the wheel attachment

Requirements

 Prepare the truck for maintenance and repairs (see page 129).

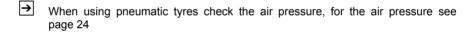
Tools and Material Required

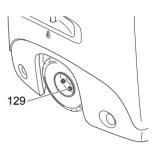
- Torque wrench

Procedure

• Torque the wheel nuts (129) crosswise with a torque wrench, for torques see page 24.

The wheel attachment is now checked.





4.5 Replacing wheels

↑ WARNING!

A truck tipover can cause accidents

In order to raise the truck, use only suitable lifting gear at the points specially provided for this purpose.

- ▶ Note the weight of the truck on the data plate.
- ► Always use a jack with a minimum capacity of 2500 kg kg.
- ▶ Raise the unladen truck on a level surface.
- ► When raising the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

Falling wheels can cause injury

- ▶ The wheels of the truck are very heavy. A single wheel can weigh up to 150 kg.
- ▶ Always replace wheels with a suitable tool and protective equipment.

Dismantle the wheels

Requirements

 Prepare the truck for maintenance and repairs (see page 129).

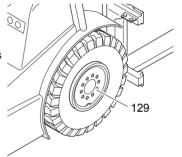
Tools and Material Required

- Jack
- Hard wooden blocks
- Mounting lever
- Torque wrench

Procedure

- Place the jack against the contact point.
- Jack contact point, see page 27.
 - · Raise the truck.
 - · Support the truck with hard wooden blocks.
 - Undo the wheel attachment (129).
 - · Disassemble the wheel, using a suitable mounting lever if necessary.

The wheel is now disassembled.

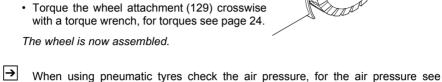


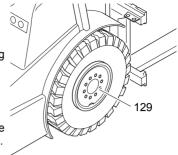
Fitting the wheels

Procedure

- Assemble the wheel, using a suitable mounting lever if necessary.
- · Fit the wheel attachment.
- Remove the hard wooden blocks.
- · Lower the truck.

page 24





4.6 Hydraulic system

↑ CAUTION!

The hydraulic oil is pressurised during operation and is a hazard to health and to the environment.

- ▶ Do not touch pressurised hydraulic lines.
- ▶ Dispose of used oil in accordance with regulations. Store used oil safely until it can be disposed of in accordance with regulations.
- ▶ Do not spill hydraulic oil.
- ▶ Remove any spilled hydraulic immediately with an appropriate bonding agent.
- ▶The bonding agent / consumable mixture must be disposed of in accordance with regulations.
- ▶ Observe national regulations when handling hydraulic oil.
- ▶ Wear safety gloves when handling hydraulic oil.
- ▶ Prevent hydraulic oil from coming into contact with hot motor parts.
- ▶ Do not smoke when handling hydraulic oil.
- ► Avoid contact and digestion. If you swallow oil do not induce vomiting but seek medical assistance immediately.
- ▶ Seek fresh air after breathing in oil fumes or vapours.
- ▶ If oil has come into contact with your skin, rinse your skin with water.
- If oil has come into contact with your eyes, rinse them with water and seek medical assistance immediately.
- ▶ Replace oil-soaked clothing and shoes immediately.

⚠ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

▶ Note the safety regulations when handling these materials.

4.6.1 Checking the hydraulic oil level

Checking the hydraulic oil level and adding hydraulic oil

Requirements

- Park the truck on a level surface.
- Prepare the truck for maintenance and repairs (see page 129).
- Battery cover open, see page 131.

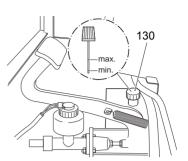
Procedure

- Unscrew the air filter and dipstick (130).
- Visually inspect the hydraulic oil level on the dipstick.

 If the reservoir is sufficiently full, the hydraulic oil level will be at the top mark (max.).

 If necessary add hydraulic oil up to the level indicated (20 mm on the dipstick corresponds to approx. 1 I < hydraulic oil).

The hydraulic oil level is now checked.



Λ

CAUTION!

The use of unsuitable hydraulic oils can cause damage

Trucks with bio hydraulic oil have a warning notice on the hydraulic reservoir: "Add hydraulic oil only".

►Use only BIO hydraulic oil.



47 Replacing the hydraulic oil filter

Replace oil filter

Requirements

- Park the truck securely, see page 77

Procedure

- Unscrew the hydraulic oil filter cap (131). The filter element is located on the cap.
- · Replace the filter insert: if the O ring is damaged it will also need to be replaced. Apply a thin layer of oil to the O ring on assembly.
- Refit the cap with the new filter element in place.

4.8 Check the gear oil level



CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

▶ Note the safety regulations when handling these materials.

Check the gear oil level

Requirements

- Park the truck securely, see page 77

Tools and Material Required

- Oil sump

Procedure

- Place the oil sump underneath the transmission.
- Unscrew the oil dipstick (134).
- Check gear oil level, top up if necessary through the filler hole (133). **|→**|

The oil level should reach the bottom mark of the oil check hole (134).

The transmission oil level is now checked.

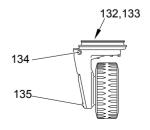
Draining the oil

Procedure

- Drain oil at operating temperature.
- · Place the oil sump underneath the transmission
- · Unscrew the oil drain plug (135) and drain the transmission oil.

→

To ensure swift and complete draining of the transmission oil, unscrew the oil dipstick (134).



The oil is now drained.

Adding oil

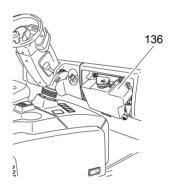
Procedure

- Insert the oil drain plug (135).
- Remove the cap (132).
- Turn the steering axle wheel until the filler bore (133) is visible.
- Unscrew the oil control screw (134) and add new gear oil in the filler hole (133).

The oil has now been added.

4.9 Adding window washer system fluid

- Make sure there is sufficient window fluid in the container (136).
- · If necessary top up with anti-freeze.



4.10 Checking electrical fuses

↑ WARNING!

Electric currents can cause accidents

Make sure the electrical system is voltage-free before starting work on it. Before starting maintenance on the electrical system:

- ▶ Park the truck securely (see page 77).
- ▶ Press the Emergency Disconnect.
- ▶ Disconnect the battery.
- ▶ Remove any rings or metal bracelets etc. before working on electrical components.

↑ CAUTION!

The use of incorrect fuses can cause fire and damage components

The use of incorrect fuses can damage the electrical system and result in fire. The safety and functionality of the truck cannot be ensured.

▶ Use only fuses with the prescribed rated current, see page 141.

Checking electrical fuses

Requirements

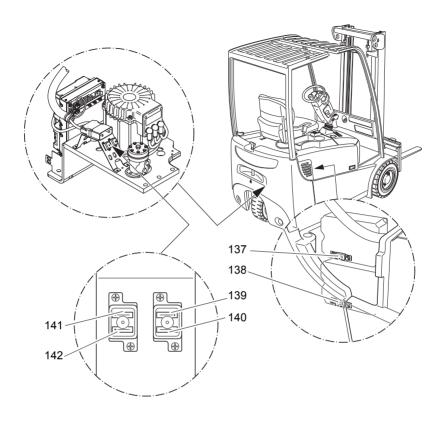
- Prepare the truck for maintenance and repairs (see page 129).

Procedure

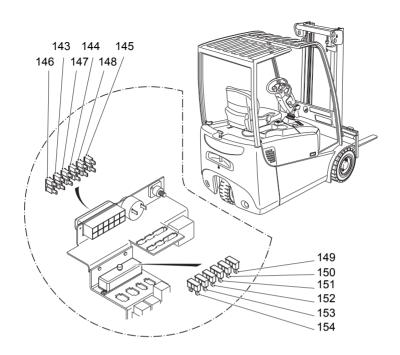
- Open the battery panel, see page 131.
- · Remove the electrical system cap.
- · Check condition and rating of the fuses in accordance with the table.
- Replace any damaged fuses in accordance with the table.
- · Close the electrical system cap.
- · Close the truck's battery cover.

The electrical fuses are now checked.

4.10.1 Fuse ratings



Item	Description	Electric circuit	Rating / type
137	1F	Drive motor fuse	250 A
138	2F1	Hydraulic motor fuse	250 A
139	F3.1	Control fuse 24 V	40 A
140	1F9	Travel / lift electronics fuse	10 A
141	4F1	Horn control fuse	10 A
142	F4	Main contactor control fuse	5 A



Fuses for optional equipment

Item	Description	Electrical circuit	Rating/type
143	5F3	Fuse, reversing lights or rear work lights	10 A
144	5F1	Fuse, front work lights	10 A
145	9F2	Control fuse, seat heating	10 A
146	4F6	Fuse, brake light	10 A
147	4F4	Control fuse, warning beacon	5 A
148	5F6	Control fuse, front/rear windscreen wiper and rear windscreen heater	10 A
149	F1.1	Fuse, indicator relay	5 A
150	5F5.2	Control fuse, reversing light	5 A
151	5F4	Control fuse, RH tail light	5 A
152	5F4.1	Control fuse, LH tail light	5 A
153	5F5	Control fuse, RH lighting	5 A
154	5F5.1	Control fuse, LH lighting	5 A

4.11 Cleaning

4.11.1 Cleaning the truck

Λ

CAUTION!

Fire hazard

Do not use flammable liquids to clean the industrial truck.

- ▶ Disconnect the battery before starting cleaning work.
- ► Carry out all necessary safety measures to prevent sparking before cleaning (e.g. by short-circuiting).



CAUTION!

Risk of component damage when cleaning the truck

Cleaning with a pressure washer can result in malfunctions due to humidity.

- ► Cover all electronic system assemblies (controllers, sensors, motors etc.) before cleaning the truck with a pressure washer.
- ▶ Do not hold the jet of the pressure washer by the marked points to avoid damaging them (see page 27).
- ▶ Do not clean the truck with pressurised water.

Cleaning the truck

Requirements

- Prepare the truck for maintenance and repairs (see page 129).

Tools and Material Required

- Water-based solvents
- Sponge or cloth

Procedure

- Clean the surface of the truck with water-based solvents and water. Use a sponge or cloth to clean.
- · In particular, clean the following areas:
 - Windows
 - · All walk-on areas
 - · Oil filler ports and their surroundings
 - Grease nipples (before lubrication)
- Dry the truck after cleaning, e.g. with compressed air or a dry cloth.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see page 150).

The truck is now clean.

4.11.2 Cleaning the electrical system assemblies

↑ CAUTION!

Risk of electrical system damage

Cleaning the assemblies (controllers, sensors, motors etc.) of the electronic system with water can damage the electrical system.

- ▶ Do not clean the electrical system with water.
- ► Clean the electrical system with weak suction or compressed air (use a compressor with a water trap) and not a conductive, anti-static brush.

Cleaning the electrical system assemblies

Requirements

- Prepare the truck for maintenance and repairs (see page 129).

Tools and Material Required

- Compressor with water separator
- Non-conductive, antistatic brush

Procedure

- · Expose the electrical system, see page 131.
- Clean the electrical system assemblies with weak suction or compressed air (use a compressor with a water trap) and not a conductive, anti-static brush.
- Fit the electrical system panel, see page 131.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see page 150).

The electrical system assemblies are now clean.

4.12 Working on the electrical system

↑ WARNING!

Electrical current can cause accidents

Make sure the electrical system is voltage-free before starting work on it. The capacitors in the controller must be completely discharged. The capacitors are completely discharged after approximately 10 minutes. Before starting maintenance on the electrical system:

- ▶ Only suitably trained electricians may operate on the truck's electrical system.
- ▶ Before working on the electrical system, take all precautionary measures to avoid electric shocks.
- ▶ Park the truck securely (see page 77).
- ▶ Disconnect the battery.
- ▶ Remove any rings, metal wrist bands etc.

4.13 Restoring the truck to service after maintenance and repairs

Procedure

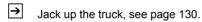
- Thoroughly clean the truck, see page 143.
- · Lubricate the truck according to the lubrication schedule, see page 126.
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, see page 46.
- Replace transmission oil. Condensation water could have formed.
- Replace hydraulic oil. Condensation water could have formed.

 The manufacturer's customer service department is specially trained to carry out these operations.
 - Start up the truck, see page 62.

5 Decommissioning the industrial truck

If the truck is to be out of service for more than a month, it must be stored in a frost-free and dry room. All necessary measures must be taken before, during and after decommissioning as described hereafter.

When the truck is out of service it must be jacked up so that all the wheels are clear of the ground. This is the only way of ensuring that the wheels and wheel bearings are not damaged.



If the truck is to be out of service for more than 6 months, agree further measures with the manufacturer's customer service department.

5.1 Prior to decommissioning

Procedure

- · Thoroughly clean the truck, see page 143.
- · Prevent the truck from rolling away accidentally.
- Check the hydraulic oil level and replenish if necessary, see page 137.
- Apply a thin layer of oil or grease to any non-painted mechanical components.
- Lubricate the truck according to the lubrication schedule, see page 126.
- Charge the battery, see page 46.
- Disconnect the battery, clean it and grease the terminals. In addition, follow the battery manufacturer's instructions.

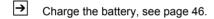
5.2 During decommissioning

NOTE

Full discharge can damage the battery

Self-discharge can cause the battery to fully discharge. Full discharge shortens the useful life of the battery.

► Charge the battery at least every 2 months.



5.3 Restoring the truck to service after decommissioning

Procedure

- Thoroughly clean the truck, see page 143.
- Lubricate the truck according to the lubrication schedule, see page 126.
- Clean the battery, grease the terminals and connect the battery.
- · Charge the battery, see page 46.
- · Replace transmission oil. Condensation water could have formed.
- Replace hydraulic oil. Condensation water could have formed.

 The manufacturer's customer service department is specially trained to carry out
 - Start up the truck, see page 62.

these operations.

6 Safety tests to be performed at intervals and after unusual incidents

→

Perform a safety check in accordance with national regulations. The manufacturer recommends the truck be checked to FEM guideline 4.004. The manufacturer has a service department specially trained for these tasks.

The truck must be inspected at least annually (refer to national regulations) or after any unusual event by a qualified inspector. The inspector shall assess the condition of the system from purely a safety viewpoint, without regard to operational or economic circumstances. The inspector must be sufficiently instructed and experienced to be able to assess the condition of the truck and the effectiveness of the safety mechanisms based on the technical regulations and principles governing the inspection of forklift trucks.

A thorough test of the truck must be undertaken with regard to its technical condition from a safety aspect. The truck must also be examined for damage caused by possible improper use. A test report shall be produced. The test results must be kept for at least the next 2 inspections.

The proprietor is responsible for ensuring that faults are immediately rectified.

→

A test plaque is attached to the truck as proof that it has passed the safety inspection. This plaque indicates the due date for the next inspection.

7 Final de-commissioning, disposal

Final de-commissioning or disposal of the truck in must be performed in accordance with the regulations of the country of use. In particular, regulations governing the disposal of batteries, consumables and electronic and electrical systems must be observed.

The truck must only be disassembled by trained personnel in accordance with the procedures as specified by the manufacturer.

8 Human vibration measurement

Vibrations that affect the operator over the course of the day are known as human vibrations. Excessive human vibrations will cause the operator long term health problems. The European "2002/44/EC/Vibration" operator directive has therefore been established to protect operators. To help operators to assess the application situation, the manufacturer offers a service of measuring these human vibrations.

G Maintenance and Inspection

↑ WARNING!

Lack of maintenance can result in accidents

Failure to perform regular servicing can lead to truck failure and poses a potential hazard to personnel and equipment.

▶Thorough and expert servicing is one of the most important requirements for the safe operation of the industrial truck.

The application conditions of an industrial truck have a considerable impact on component wear. The following service intervals are based on single-shift operation under normal operating conditions. They must be reduced accordingly if the equipment is to be used in conditions of extreme dust, temperature fluctuations or multiple shifts.

NOTE

To prevent damage due to wear, the manufacturer recommends an on-site application analysis to agree on appropriate service intervals.

The following maintenance checklist lists the activities to be performed and the respective intervals to be observed. Maintenance intervals are defined as:

W = Every 50 service hours, at least weekly

A = Every 500 service hours

B = Every 1000 service hours, or at least annually

C = Every 2000 service hours, or at least annually

= Standard maintenance interval

* = Cold store maintenance interval (in addition to standard maintenance interval)

→

"W" maintenance interval operations should be performed by the operating company.

1 Maintenance checklist

1.1 Owner

1.1.1 Standard equipment

Brake		Α	В	С	
1	Test the brakes.	•			

	Test warning and safety devices in accordance with operating instructions.		W	Α	В	С
	1	, ,	•			
ľ	2	Test the emergency disconnect switch.	•			

Pow	er supply	W	Α	В	С
1	Check battery and battery components.	•			
2	Check battery cable connections are secure, check for dirt and grease terminals if necessary.	•			
3	Check acid level and add demineralised water if necessary.	•			
4	Check battery connector for damage, test it and make sure it is secure.	•			

Ī	Drivir	9	W	Α	В	С
	1	Check wheels for wear and damage.				

Chas	ssis and superstructure	W	Α	В	С
1	Check doors and/or covers.	•			
2	Check labels are legible, complete and plausible.	•			
3	Test the gas pressure dampers on the battery panel and check for damage.	•			
4	Check overhead guard and/or cabin are secure and check for damage.	•			
5	Test the driver's seat restraint system and check for damage.	•			

Hydr.	movements	W	Α	В	С
1	Check the lubrication of the load chains and lubricate the load chains if necessary.	•			
2	Check the contact surfaces of the mast for wear and damage, and lubricate if necessary.	•			
3	Check cylinders, hydraulic ports, lines and hoses for leaks and damage.	•			
4	Test hydraulic system.	•			
5	Check hydraulic oil level and top up if necessary.	•			
6	Check forks or load handler for wear and damage.	•			

1.1.2 Optional equipment

Fork adjuster

Hydr.	movements	W	Α	В	С
1	Check attachment lubrication; clean and lubricate if necessary.	•			

Clamping device

Hydr.	movements	W	Α	В	С
1	Check attachment lubrication; clean and lubricate if necessary.	•			

Sideshifter

Hydr.	movements	W	Α	В	С
1	Check attachment lubrication; clean and lubricate if necessary.	•			

Telescopic forks

Hydr.	movements	W	Α	В	С
1	Check attachment lubrication; clean and lubricate if necessary.	•			

Wiper/washer system

Chas	sis and superstructure	W	Α	В	С	
- 1	Check windscreen washer reservoir for leaks and check volume; top up if necessary.	•				

Road traffic approval

Elect	rics	W	Α	В	С
1	Test the lighting.				

Work lights

	Elect	ics	W	Α	В	С
ĺ	1	Test the lighting.	•			

Weather proofing

Chas	sis and superstructure	W	Α	В	С
1	Test the doors and check for damage.	•			

Optional equipment

Chas	sis and superstructure	W	Α	В	С
1	Check that optional equipment such as mirrors, storage facilities, grips, windscreen wipers and windscreen washing system, etc. are working correctly and check for damage.	•			

Strobe light / beacon

Elect	rics	W	Α	В	С
1	Test the strobe light/beacon and check for damage.	•			

1.2 Customer Service

1.2.1 Standard equipment

Brake	es	W	Α	В	С
1	Test the brakes.			•	
2	Check brake mechanism, adjust and lubricate if necessary.			•	
3	Check brake fluid level in the compensation tank and top up if necessary.			•	
4	Check water component of brake fluid and replace if necessary.			•	
5	Note: Replace the brake fluid after 2000 service hours or every two years. Bleed the brake system.				
6	Check brake lining.			•	

Elect	rics	W	Α	В	С
1	Check the cables and motor mounting are secure.			•	
2	Test warning and safety devices in accordance with operating instructions.			•	
3	Test the displays and controls.			•	
4	Test microswitches and adjust if necessary.			•	
5	Test the emergency disconnect switch.			•	
6	Check contactors and/or relays.			•	
7	Test fan and check for dirt and damage.			•	
8	Check fuse ratings.			•	
9	Carry out a chassis insulation-resistance test.			•	
10	Check electrical wiring for damage (insulation damage, connections).			•	
	Make sure cable connections are secure.				

Pow	er supply	W	Α	В	С
1	Check acid density, acid level and battery voltage.			•	
2	Check battery and battery components.			•	
3	Check battery cable connections are secure, check for dirt and grease terminals if necessary.			•	
4	Check acid level and add demineralised water if necessary.			•	
5	Check battery connector for damage, test it and make sure it is secure.			•	

Drivi	ng	W	Α	В	С
1	Check transmission for noise and leakage.			•	
2	Check transmission oil level or grease filling of the transmission and top up if necessary.			•	
3	Replace the transmission oil.			•	
4	Check the wheels for wear and damage. Make sure they are secure and check the air pressure if necessary.			•	
5	Check wheel suspension and attachment.			•	

Chas	sis and superstructure	W	Α	В	С
1	Check chassis connections and screw connections for damage.			•	
2	Check doors and/or covers.			•	
3	Check labels are legible, complete and plausible.			•	
4	Check the condition of the driver's seat.			•	
5	Check the mounting and adjustment of the driver's seat.			•	
6	Test the gas pressure dampers on the battery panel and check for damage.			•	
7	Check mast mounting/bearings.			•	
8	Check trailer coupling stop or tow mechanism stop.			•	
9	Check operator mat and steps are non-slip and free of damage.			•	
10	Check overhead guard and/or cabin are secure and check for damage.			•	
11	Test the driver's seat restraint system and check for damage.			•	

Hydr.	movements	W	Α	В	С
1	Test "hydraulic" controls and make sure their labels are legible, complete and plausible.			•	
2	Test hydraulic controls and check they are assigned to the correct functions.			•	
3	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			•	
4	Test the hose guide and check for damage.			•	
5	Check settings and wear levels of slide pieces and stops and adjust or replace the slide pieces as required.			•	
6	Check load chain setting and tension if necessary.			•	
7	Check the lubrication of the load chains and lubricate the load chains if necessary.			•	
8	Check the load chain fasteners and check the chain bolts for wear and damage.			•	
9	Check lateral clearance of the mast connections and the fork carriage.			•	
10	Visually inspect the mast rollers and check the running surfaces for wear.			•	

Hydr.	movements	W	Α	В	С
11	Check the contact surfaces of the mast for wear and damage, and lubricate if necessary.			•	
12	Check cylinders, hydraulic ports, lines and hoses for leaks and damage.			•	
13	Replace hydraulic oil filter and breather filter.			*	•
14	Test hydraulic system.			•	
15	Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage.			•	
16	Test emergency lowering system.			•	
17	Check hydraulic oil level and top up if necessary.			•	
18	Replace the hydraulic oil.				•
19	Test the pressure relief valve and adjust if necessary.			•	
20	Check forks or load handler for wear and damage.			•	
21	Check tilt cylinders and mounting.			•	

Δ	gree	ed performance	W	Α	В	С
	1	Carry out a test run with the rated load and, if necessary, with a customer-specific load.			•	
	2	Demonstration after maintenance.			•	
	3	Lubricate the truck according to the lubrication schedule.			•	

Stee	ring	W	Α	В	С
1	Test hydraulic steering and its components.			•	
2	Check steering hoses and lines.			•	
3	Check the mechanical parts of the steering column.			•	
4	Check steering block for wear and damage			•	

1.2.2 Optional equipment

Electrolyte circulation

	Powe	r supply	W	Α	В	С
Ī	1	Check hose connections and test the pump.			•	
	2	Replace air-filter wadding.			•	

Aquamatik

Powe	r supply	W	Α	В	С	
1	Test Aquamatik plug, hose connections and float and check for leaks.			•		
2	Test flow indicator and check for leaks.			•		

Load backrest

Hydr.	movements	W	Α	В	С	Ì
1	Check the load backrest for damage and make sure it is secure.					l

Battery refill system

Powe	r supply	W	Α	В	С	
1	Test battery refill system and check for leaks.					

Boom

Hydr.	movements	W	Α	В	С
	Check the attachment is properly secured to the truck and check the			•	
	load-bearing components.				

Fork adjuster

Hydr.	movements	W	Α	В	С
1	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			•	
2	Check attachment lubrication; clean and lubricate if necessary.			•	
3	Check axial play of the front and rear rollers and adjust if necessary.			•	
4	Check sliding blocks are complete.			•	
5	Check the attachment is properly secured to the truck and check the load-bearing components.			•	
6	Test operation and setting of the attachment. Check attachment for damage.			•	
7	Check hydraulic ports and tighten if necessary.			•	
8	Test the fork positioner and check for damage.			•	
9	Check cylinder piston rods and bushings.			•	
10	Check cylinder seals.			•	

Clamping device

Hydr.	movements	W	Α	В	С
1	Test the acknowledgement key.			•	
2	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			•	
3	Check attachment lubrication; clean and lubricate if necessary.			•	
4	Check axial play of the front and rear rollers and adjust if necessary.			•	
5	Check sliding blocks are complete.			•	

Hydr.	movements	W	Α	В	С
6	Check the attachment is properly secured to the truck and check the load-bearing components.			•	
7	Test operation and setting of the attachment.				
'	Check attachment for damage.				
8	Check hydraulic ports and tighten if necessary.			•	
9	Check cylinder piston rods and bushings.			•	
10	Check cylinder seals.			•	

Sideshifter

Hydr.	movements	W	Α	В	С
1	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			•	
2	Check attachment lubrication; clean and lubricate if necessary.			•	
3	Check axial play of the front and rear rollers and adjust if necessary.			•	
4	Check sliding blocks are complete.			•	
5	Check the attachment is properly secured to the truck and check the load-bearing components.			•	
6	Test operation and setting of the attachment. Check attachment for damage.			•	
7	Check hydraulic ports and tighten if necessary.			•	
8	Test the sideshifter, check settings and check for damage.			•	
9	Check cylinder piston rods and bushings.			•	
10	Check cylinder seals.			•	

Telescopic forks

Hydr	. movements	W	Α	В	С
1	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			•	
2	Check attachment lubrication; clean and lubricate if necessary.			•	
3	Check the attachment is properly secured to the truck and check the load-bearing components.			•	
4	Test operation and setting of the attachment. Check attachment for damage.			•	
5	Check hydraulic ports and tighten if necessary.			•	
6	Check cylinder seals.			•	
7	Check piston and piston rods for damage, check setting and adjust if necessary.			•	
8	Check that the hydraulic connections, hoses and piping are secure, and check for leaks and damage.			•	

Crane hook

Hyd	r. movements	W	Α	В	С
1	Check the attachment is properly secured to the truck and check the load-bearing components.			•	

Wiper/washer system

(Chas	sis and superstructure	W	Α	В	С
	7	Check windscreen washer reservoir for leaks and check volume; top up if necessary.			•	
	2	Test the windscreen wipers and check for damage, replace if necessary.			•	

Trailer coupling

Chas	sis and superstructure	W	Α	В	С
1	Check trailer coupling stop or tow mechanism stop.			•	

Seat heating

Ī	Elect	rics	W	Α	В	၁
		Check electrical wiring for damage (insulation damage, connections).			•	
		Make sure cable connections are secure.				

Shock sensor / data recorder

EI	lect	rics	W	Α	В	С
	1	Check shock sensor / data recorder are secure and check for damage.			•	

Data radio

Syste	em components	W	Α	В	С
1	Test scanner and terminal, check for damage and make sure they are secure and clean.			•	
2	Check fuse ratings.			•	
3	Check wiring is secure and check for damage.			•	

Road traffic approval

Elect	rics	W	Α	В	С
1	Test the lighting.			•	

Video system

Syst	em components	W	Α	В	С
1	Check wiring is secure and check for damage.			•	
2	Test camera, make sure it is secured and clean.			•	
3	Test the monitor, make sure it is secured and clean.			•	

Work lights

	Electi	rics	W	Α	В	С
Ī	1	Test the lighting.			•	

Fire extinguisher

Agree	ed performance	W	Α	В	С	
1	Check fire extinguisher is present, secure and check test interval.				•	

Weigher sensors / switches

Elect	rics	W	Α	В	С
1	Test weigher system and check for damage.			•	

Access module

Elec	etrics	W	Α	В	С
1	Test the access module, check for damage and make sure it is secure.			•	

Weather proofing

Elect	ics	W	Α	В	С
1	Check fuse ratings.			•	

	Chas	sis and superstructure	W	Α	В	С
Ī	1	Test the window heating and check for damage.			•	
Ī	2	Test the doors and check for damage.			•	

Electrical optional equipment

Elec	trics	W	Α	В	С
1	Test the electrical optional equipment and check for damage.			•	

Optional equipment

Chas	sis and superstructure	W	Α	В	С
1	Check that optional equipment such as mirrors, storage facilities, grips, windscreen wipers and windscreen washing system, etc. are working correctly and check for damage.			•	

Strobe light / beacon

Elect	rics	W	Α	В	С	
1	Test the strobe light/beacon and check for damage.			•		

Overhead guard cover

Chas	sis and superstructure	W	Α	В	С
1	Check overhead guard cover is present, check for damage and make sure it is secure.			•	

Audible warning devices

Elect	rics	W	Α	В	С
1	Test the buzzer/warning alarm, check for damage and make sure it is secure.			•	

Belt lock control

Chas	sis and superstructure	W	Α	В	С
1	Test the belt lock control and check for damage.			•	

Automatic crawl speed

Drivir	ng	W	Α	В	С
1	Check that sensors / switches are secured, not damaged, clean and operational.			•	

Discharge strap

Elect	rics	W	Α	В	С	
1	Check anti-static discharge strap/chain is present and not damaged.					

Restraint system / SUN protector

Ele	ctrics	W	Α	В	С
1	Check electrical wiring for damage (insulation damage, connections).			•	
	Make sure cable connections are secure.				

Chas	ssis and superstructure	W	Α	В	С
1	Check electrical connections are secure and not damaged.			•	
2	Make sure restraint system is complete, test operation and check for damage.			•	
3	Test restraint system sensor system and check for damage.			•	

Restraint system / SUN protector

Cha	ssis and superstructure	W	Α	В	С
1	Make sure restraint system is complete, test operation and check for			•	
	damage.				

Cold-store application

l	Driving		W	Α	В	С
	1	Replace the transmission oil in the cold-store application.				•

Hydr. movements		W	Α	В	С	
ĺ		Note:				
		In cold-store applications, we recommend replacing the hydraulic oil every 1000 service hours or once a year.				

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Foreword

Notes to the operating instructions

The present ORIGINAL OPERATING INSTRUCTIONS are designed to provide sufficient instruction for the safe operation of the traction battery. The information is presented in a precise and clear manner. The chapters are arranged by letter and the pages are numbered continuously.

The operating instructions detail different battery variants and their optional equipment. When operating and servicing the battery, make sure that the particular section applies to your battery model.

Our traction batteries and their optional equipment are subject to ongoing development. We reserve the right to alter the design, features and technical aspects of the equipment. No guarantee of particular features of the traction battery should therefore be assumed from the present operating instructions.

Safety notices and text mark-ups

Safety instructions and important explanations are indicated by the following graphics:

↑ DANGER!

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

↑ WARNING!

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

↑ CAUTION!

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.

- Used before notices and explanations.
 - Indicates standard equipment
 - Indicates optional equipment

Copyright

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11	Disposal

A Traction battery

1.4 1.17 11

1 Correct Use and Application

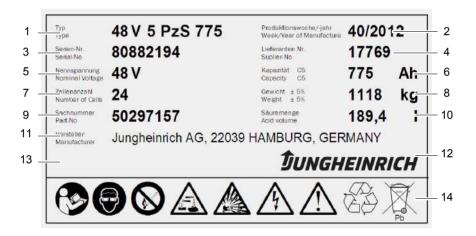
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This appendix does not apply to trucks with lithium-ion batteries. Further documentation for lithium-ion batteries can be obtained from the supplied documents.

Failure to observe the operating instructions, carrying out repairs with non-original spare parts, tampering with the battery or using electrolyte additives will invalidate the warranty.

Observe the instructions for maintaining the safety rating during operation for batteries in accordance with Ex I and Ex II (see relevant certification).

2 Data plate



1	Model (battery name)	
2	Production week / production year	
3	Serial number	
4	Supplier number	
5	Rated voltage	
6	Capacity	
7	Number of cells	
8	Weight	
9	Part no.	
10	Acid quantity	
11	Manufacturer	
12	Manufacturer's logo	
13	CE mark (for batteries above 75 V only)	

3 Safety Instructions, Warning Indications and other Notes



Used batteries must be treated as hazardous waste.

These batteries are marked with the recycling symbol and the sign showing a crossed-out rubbish bin, and should not be disposed of with ordinary household waste.



Buy-back terms and type of recycling are to be agreed with the manufacturer as described in § 8 of the battery legislation.



Do not smoke!

No naked flames, glowing embers or sparks near the battery - fire and explosion hazard!



Avoid fire and explosion hazards and short circuits due to overheating!

Keep away from naked flames and strong heat sources.



Always wear protective clothing (e.g. safety goggles and safety gloves) when working on cells and batteries.

Always wash your hands after completing the work. Use only insulated tools. Do not mechanically machine the battery, strike, crush, compress, notch, dent or modify it in any way.



Hazardous electric voltage! The metal parts of the battery cells are permanently live. Therefore do not place any foreign objects or tools on the battery.

Observe national health and safety regulations.



If the materials leak, do not inhale the fumes. Wear safety gloves.



Follow the user instructions and keep them in a visible position in the charging area.

Work on the batteries should be performed only as instructed by specialist personnel.

4 Lead acid batteries with armour plated cells and liquid electrolyte

4.1 Description

Jungheinrich traction batteries are lead acid batteries with armour plated cells and liquid electrolyte. The names of the traction batteries are PzS, PzB, PzS Lib and PzM.

Name	Explanation
PzS	Lead acid battery with "Standard" armour plated cells and liquid electrolyte Part and acid battery with 400 arms.
	 Battery cell width: 198 mm
PzB	 Lead acid battery with "British Standard" armour plated cells and liquid electrolyte
	 Battery cell width: 158 mm
PzS Lib	 Lead acid battery with "Standard" armour plated cells and liquid electrolyte
PzM	Lead acid battery with extended maintenance intervalBattery cell width: 198 mm

Electrolyte

The rated density of the electrolyte assumes a temperature of 30°C and the rated electrolyte level is fully charged. Higher temperatures will reduce, lower temperatures will increase the electrolyte density.

The corresponding adjustment factor is \pm 0.0007 kg/l per K, e. g. electrolyte density 1.28 kg/l at 45 °C corresponds to a density of 1,29 kg/l at 30 °C.

The electrolyte must comply with the purity regulations of DIN 43530 Part 2.

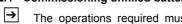
4.1.1 Battery nominal data

1.	Product	Traction battery
2.	Nominal voltage	2.0 V x number of cells
3.	Rated capacity C5	See data plate
4.	Discharge current	C5/5h
5.	Nominal electrolyte density ¹	1.29 kg/l
6.	Nominal temperature ²	30 °C
7.	System rated electrolyte level	up to "Max" electrolyte level marking
	Limit temperature ³	55 °C

- 1. Reached within the first 10 cycles.
- 2. Higher temperatures shorten the useful life, lower temperatures reduce the available capacity.
- 3. Not permissible as operating temperature.

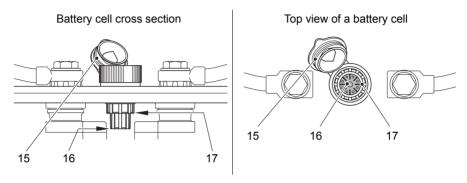
4.2 Operation

4.2.1 Commissioning unfilled batteries



The operations required must be carried out by the manufacturer's customer service department or a customer service organisation authorised by the manufacturer.

4.2.2 Commissioning filled and charged batteries



Checks and operations to be performed before starting daily work

Procedure

- Make sure the battery is in physically good condition.
- Make sure the terminals are correct (positive to positive and negative to negative) and check that contacts on the battery terminal conducting system are secure.
- Check the M10 terminal screws of the conductors and connectors are secure and if necessary torque to 23 ±1 Nm.
- · Charge the battery, see page 13.
- Check the electrolyte level of each battery cell after charging and top up if necessary:
- **→**
- Open the plug (15).
 - The electrolyte level should not be less than the "Min" electrolyte marking (16) and must not exceed the "Max" (17) marking.
- If necessary, add electrolyte with pure water up to the "Max" electrolyte level marking (17), see page 15.
- · Close the plug (15).

The test is now complete.

4.2.3 Discharging the battery



To achieve an optimum useful life avoid operational discharge of more than 80% of nominal capacity (full discharge). This corresponds to a minimum electrolyte density of 1.13 kg/l at the end of the discharge.

Fully or partially discharged batteries must be re-charged immediately and not left unattended.

4.2.4 Charging the battery



WARNING!

The gases produced during charging can cause explosions

The battery gives off a mixture of oxygen and hydrogen (electrolytic gas) during charging. Gassing is a chemical process. This gas mixture is highly explosive and must not be ignited.

- ► Always disconnect the charger and truck before connecting or disconnecting the charger and battery.
- ►The charger must be adapted to the battery in terms of voltage, charge capacity and battery technology.
- ▶ Before charging, check all cables and plug connections for visible signs of damage.
- ▶ Ventilate the room in which the truck is being charged.
- ▶ Battery cell surfaces must remain exposed during charging in order to ensure sufficient ventilation, see truck operating instructions, chapter D, Charging the Battery.
- ▶ Do not smoke and avoid naked flames when handling batteries.
- ► Wherever an industrial truck is parked for charging there must be no inflammable material or consumables capable of creating sparks within a minimum distance of 2000 mm from the truck.
- ► Fire protection equipment must be available.
- ▶ Do not place any metallic objects on the battery.
- ►Always follow the safety regulations of the battery and charger station manufacturers.

NOTE

The battery must only be charged with DC current. All charging procedures in accordance with DIN 41773 and DIN 41774 are permissible.

The electrolyte temperature rises by approx. 10°C during charging. Charging should therefore only begin when the electrolyte temperature is below 45°C. The electrolyte temperature of batteries must be at least +10°C before charging. Otherwise the battery will not charge correctly. Below 10°C the battery is insufficiently charged with standard charging systems.

Charging the battery

Requirements

- Permissible electrolyte temperature 10°C to 45°C).

Procedure

- Open or take off the tray lid or covers from the battery compartment.

 Deviations are outlined in the truck's operating instructions. The plugs remain on the cells or remain closed.
 - Connect the battery to the switched off charger, ensuring the terminals are connect (positive to positive and negative to negative).
 - · Switch on the charger.

The battery is charged.

Charging is considered to be complete when the electrolyte density and battery voltage remain constant for more than 2 hours.

Compensation charging

Compensation charging is used to ensure the useful life and maintain capacity after full discharge and repeated insufficient charging. The maximum compensation charge current is 5 A/100 Ah rated capacity.

Compensation charging should be carried out weekly.

Trickle charging

Battery trickle charging is partial charging that extends the daily application time. Higher average temperatures occur during trickle charging which reduce the useful life of the batteries.

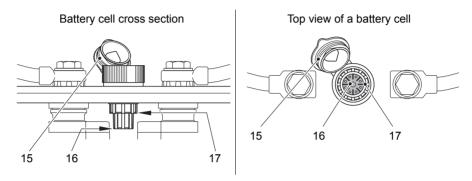
Trickle charges should only be performed when the charge level is below 60 %. Use replacement batteries instead of regular trickle charging.

4.3 Servicing lead-acid batteries with armour plated cells

4.3.1 Quality of Water for Adding Electrolyte

The quality of the water used to add electrolyte must correspond to purified or distilled water. Purified water can be produced through distillation or ion exchangers and is then suitable for the production of electrolyte.

4.3.2 Daily



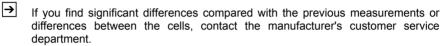
- Charge the battery after each discharge.
- After charging, check the electrolyte level of each battery cell and replenish as required:
 - Open the plug (15).
 - If necessary, add electrolyte with pure water up to the "Max" electrolyte level marking (17).
 - Close the plug (15).
- The electrolyte level should not be less than the "Min" electrolyte marking (16) and must not exceed the "Max" (17) marking.

4.3.3 Weekly

- After re-charging, carry out a visual inspection for dirt and physical damage.
- If the battery is charged regularly according to the IU characteristic, carry out a compensation charge.

4.3.4 Monthly

- Towards the end of the charging process measure and record the voltages of all the cells with the charger switched on.
- After charging measure and record the electrolyte density and the electrolyte temperature in all the cells.
- Compare the results with the previous ones.



4.3.5 Annually

- Measure the insulation resistance of the truck in accordance with EN 1175-1.
- Measure the insulation resistance of the battery in accordance with DIN EN 1987-1.
- In accordance with DIN EN 50272-3 the battery insulation resistance should not be less than 50 Ω per volt of rated voltage.

5 PzV and PzV-BS lead-acid batteries with sealed armour plated cells

5.1 Description

PzV batteries are sealed batteries with fixed electrolytes, to which no water can be added over the entire lifespan of the battery. Relief valves are used as plugs which are destroyed when opened. During operation the same safety requirements apply to the sealed batteries as for batteries with liquid electrolyte. This is to avoid electric shock, explosion of the electrolyte charging gases or hazardous electrolyte burns if the cell vessels are destroyed.

PzV batteries are low gassing, but not gassing-free.

Electrolyte

The electrolyte is sulphuric acid which is fixed in gel. The density of the electrolyte cannot be measured.

Name	Explanation
PzV	 Lead acid battery with "Standard" closed armour plated cells and electrolyte in gel compound Battery cell width: 198 mm
PzV-BS	 Lead acid battery with "British Standard" closed armour plated cells and electrolyte in gel compound Battery cell width: 158 mm

5.1.1 Battery nominal data

1.	Product	Traction battery		
2.	Nominal voltage	2.0 V x number of cells		
3.	Rated capacity C5	See data plate		
4.	Discharge current	C5/5h		
5.	Rated temperature	30°C		
	Limit temperature ¹	45°C, not permissible as operating temperature		
6.	Rated density of the electrolyte	Cannot be measured		
7.	System rated electrolyte level	Cannot be measured		

^{1.} Higher temperatures shorten the useful life, lower temperatures reduce the available capacity.

5.2 Operation

5.2.1 Commissioning

Checks and operations to be performed before starting daily work

Procedure

- · Make sure the battery is in physically good condition.
- Make sure the terminals are correct (positive to positive and negative to negative) and check that contacts on the battery terminal conducting system are secure.
- Check the M10 terminal screws of the conductors and connectors are secure and if necessary torque to 23 ±1 Nm.
- · Charge the battery, see page 18.

The test is now complete.

5.2.2 Discharging the battery

- To achieve an optimum useful life avoid operational discharges of more than 60% of nominal capacity.
- If the battery is discharged during operation by more than 80% of rated capacity the useful life of the battery will reduce significantly. Fully or partially discharged batteries must be re-charged immediately and not left unattended.

5.2.3 Charging the battery

The gases produced during charging can cause explosions

The battery gives off a mixture of oxygen and hydrogen (electrolytic gas) during charging. Gassing is a chemical process. This gas mixture is highly explosive and must not be ignited.

- ► Always disconnect the charger and truck before connecting or disconnecting the charger and battery.
- ▶The charger must be adapted to the battery in terms of voltage, charge capacity and battery technology.
- ▶ Before charging, check all cables and plug connections for visible signs of damage.
- ▶ Ventilate the room in which the truck is being charged.
- ▶ Battery cell surfaces must remain exposed during charging in order to ensure sufficient ventilation, see truck operating instructions, chapter D, Charging the Battery.
- ▶ Do not smoke and avoid naked flames when handling batteries.
- ► Wherever an industrial truck is parked for charging there must be no inflammable material or consumables capable of creating sparks within a minimum distance of 2000 mm from the truck.
- ▶ Fire protection equipment must be available.
- ▶ Do not place any metallic objects on the battery.
- ►Always follow the safety regulations of the battery and charger station manufacturers.

NOTE

Charging the battery incorrectly can result in material damage.

Incorrect battery charging can result in overloading of the electric wires and contacts, hazardous gas formation and electrolyte leakage from the battery cell.

- ► Always charge the battery with DC current.
- ► All DIN 41773 charging procedures are permitted in the format approved by the manufacturer.
- ► Always connect the battery to a charger that is appropriate to the size and type of the battery.
- ▶If necessary have the charger checked by the manufacturer's customer service department for suitability.
- ▶ Do not exceed the limit curents in accordance with DIN EN 50272-3 in the gassing area.

Charging the battery

Requirements

- Electrolyte temperature between +15°C and +35°C

Procedure

- Open or take off the tray lid or covers from the battery compartment.
- Connect the battery to the switched off charger, ensuring the terminals are connect (positive to positive and negative to negative).
- · Switch on the charger.
- The electrolyte temperature rises by approx. 10°C during charging. If the temperatures are permanently higher than 40°C or lower than 15°C, a temperature-dependent constant voltage control of the charger is required. The adjustment factor must be applied with -0.004 V/C per °C.

The battery is charged.

Charging is considered to be complete when the electrolyte density and battery voltage remain constant for more than 2 hours.

Compensation charging

Compensation charging is used to ensure the useful life and maintain capacity after full discharge and repeated insufficient charging.

Compensation charging should be carried out weekly.

Trickle charging

Battery trickle charging is partial charging that extends the daily application time. Higher average temperatures occur during trickle charging which can reduce the useful life of the batteries.

- Trickle charges should only be performed when the charge level is below 50%. Use replacement batteries instead of regular trickle charging.
- Avoid trickle charging with PzV batteries.

5.3 Servicing PzV and PzV-BS lead-acid batteries with sealed armour plated cells

→ Do not add water!

5.3.1 Daily

- Charge the battery after each discharge.

5.3.2 Weekly

- Visually inspect for dirt and physical damage.

5.3.3 Every three months

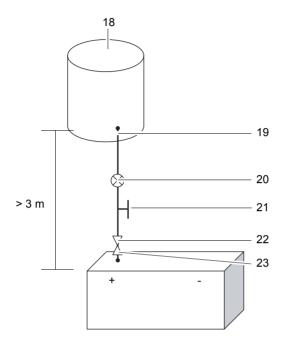
- Measure and record the overall voltage.
- Measure and record the individual voltages.
- Compare the results with the previous ones.
- Carry out the measurements after full charging and subsequent resting for at least 5 hours.
- If you find significant differences compared with the previous measurements or differences between the cells, contact the manufacturer's customer service department.

5.3.4 Annually

- Measure the insulation resistance of the truck in accordance with EN 1175-1.
- Measure the insulation resistance of the battery in accordance with DIN EN 1987-1.
- In accordance with DIN EN 50272-3 the battery insulation resistance should not be less than 50 Ω per volt of rated voltage.

6 Aquamatik water replenishment system

6.1 Water replenishment system design



18	Water container
19	Tap connection with ball cock
20	Flow indicator
21	Shut-off cock
22	Locking coupling
23	Battery lock connector

6.2 Functional Description

The Aquamatik water replenishment system is used to adjust the rated electrolyte level automatically on traction batteries for industrial trucks.

The battery cells are interconnected through hoses and are attached to the water supply (e.g. water container) through a plug connection. When the shut-off cock is opened all the cells are filled with water. The Aquamatik plug controls the amount of water required and, at the relevant water pressures, ensures the water supply is shut off and the valve is closed securely.

The plug systems have an optical level indicator, a diagnostic port to measure the temperature and electrolyte density and a degassing port.

6.3 Adding water

Water should be added to the batteries just before the battery is fully charged. This ensures that the amount of water added is mixed with the electrolyte.

6.4 Water pressure

The water replenishment system must be operated with a water pressure in the water line of 0.3 bar - 1.8 bar. Any deviations from the permissible pressure ranges will affect the operation of the systems.

Water drop

Assembly height above battery surface is between 3 - 18 m. 1 m corresponds to 0.1 bar.

Pressure water

The pressure regulating valve is adjusted to suit the system and must lie between 0.3 - 1.8 bar.

6.5 Filling time

The filling time for a battery depends on the electrolyte level, the ambient temperature and the filling pressure. Filling ends automatically. The water supply line must be disconnected from the battery when the water has been filled.

6.6 Water quality

The quality of the water used to fill up electrolyte must correspond to purified or distilled water. Purified water can be produced through distillation or ion exchangers and is then suitable for the production of electrolyte.

6.7 Battery tubing

The tubing of the individual plugs is in accordance with the existing electric circuit. No changes should be made.

6.8 Operating temperature

Batteries with automatic water replenishment systems should only be stored in rooms with temperatures > 0°C, as otherwise the systems could freeze.

6.9 Cleaning measures

The plug systems must only be cleaned with purified water in accordance with DIN 43530-4. No parts of the plugs must come into contact with solvent-based materials or soap.

6.10 Service mobile vehicle

Mobile water filling vehicle with pump and filling gun to fill individual cells. The immersion pump in the container generates the necessary filling pressure. The service mobile must be at exactly the same height as the battery base.

7 Electrolyte circulation

7.1 Functional Description

Electrolyte circulation ensures the supply of air during charging to mix the electrolyte, thereby preventing any acid layer, shortening the charge time (charge factor approx. 1.07) and reducing the formation of gas during charging. The charger must be suitable for the battery and electrolyte circulation.

A pump in the charger produces the necessary compressed air which is introduced to the battery cells via a hose system. The electrolyte is circulated via the inlet air and the electrolyte density level is constant over the entire length of the electrode.

Pump

In the event of a fault, e.g. if the pressure control system responds for an unknown reason, the filters must be checked and replaced if necessary.

Battery connection

A hose is attached to the pump module which together with the charge leads is routed from the charger to the charging connector. The air is passed on to the battery via the electrolyte circulation coupling ducts in the connector. When routing make sure the hose is not bent.

Pressure-monitoring module

The electrolyte circulation pump is activated when charging begins. The pressure monitoring module monitors the build-up of pressure during charging. This ensures that the required air pressure is provided for electrolyte circulation charging.

In the event of malfunctions, a visual error message appears on the battery charger. Some examples of malfunctions are listed below:

- No connection between the air coupling of the battery and the recirculation module (for separate coupling) or faulty air coupling
- Leaking or faulty hose connections on battery
- Contaminated intake filter

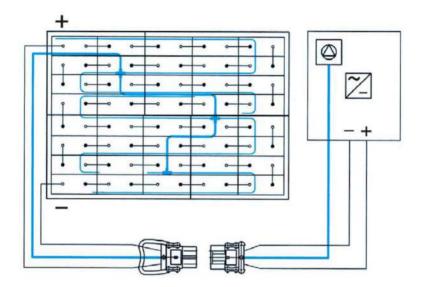
NOTE

If an installed electrolyte circulation system is seldom used or not used at all, or if the battery is subjected to severe temperature fluctuations, the electrolyte may flow back into the hose system.

Attach a separate coupling system to the air inlet line, such as: locking coupling to the battery side and through-coupling to the air supply side.

Schematic illustration

Electrolyte circulation on the battery and air supply via the charger.



8 Cleaning batteries

Batteries and trays must be cleaned in order to

- Maintain cell insulation and protect cells from ground or external conductive parts.
- Avoid damage from corrosion and stray currents.
- Avoid excessive and varying automatic discharge of the individual cells or block batteries due to stray currents.
- Avoid electric sparking due to stray currents.

When cleaning the batteries make sure that:

- The assembly site chosen for cleaning is close to a drainage system for processing the electrolytic rinsing water.
- All health and safety as well as water and waste disposal regulations are observed when disposing of used electrolyte or rinsing water.
- Protective goggles and clothing are worn.
- Cell plugs are not removed or opened.
- Clean the plastic components of the battery, in particular the cell containers, only with water or water-based cloths without any additives.
- After cleaning, the top of the battery is dried with suitable equipment, e.g. compressed air or cloths.
- Any fluid that has entered the battery tray must be suctioned off and disposed of in accordance with the above-mentioned regulations.

Cleaning the battery with a high pressure cleaner

Requirements

- Cell connectors tight, plugged in securely
- Cell plugs closed

Procedure

- Follow the high pressure cleaner's user instructions.
- · Do not use any cleaning additives.
- Observe the permissible cleaning device temperature setting of 140°C.

 This generally ensures that the temperature does not exceed 60°C at a distance of 30cm behind the outlet nozzle.
 - Observe the maximum operating pressure of 50 bar.
 - Observe a minimum distance of 30 cm from the top of the battery.
 - The battery should be sprayed over its entire surface to avoid localised overheating.
- Do not clean one spot for more than 3 seconds with the jet to avoid exceeding the maximum battery surface temperature of 60°C.
 - After cleaning dry the battery surface with suitable materials e.g. compressed air or cleaning cloths.

Battery cleaned.

9 Storing the battery

NOTE

The battery should not be stored for longer than 3 months without charging as otherwise it will no longer be functional.

If the battery is to be taken out of service for a long period, it should be stored fully charged in a dry room protected from frost. To ensure the availability of the battery the following charges can be selected:

- Monthly compensation charge for PzS and PzB batteries or 4-monthly full charge for PzV batteries.
- Trickle charge for a charging voltage of 2.23 V x number of cells for PzS, PzM and PzB batteries or 2.25 V x number of cells for PzV batteries.

If the battery is to be taken out of service for a long period (> 3 months), it should, as far as possible, be charged to 50% of its charge level and stored in a dry room protected from frost.

10 Troubleshooting

If any faults are found on the battery or charger, contact the manufacturer's customer service department immediately.



The operations required must be carried out by the manufacturer's customer service department or a customer service organisation authorised by the manufacturer.

11 Disposal



Batteries marked with the recycling symbol and the sign showing a crossed-out rubbish bin should not be disposed of with ordinary household waste.



Buy-back terms and type of recycling are to be agreed with the manufacturer as described in § 8 of the battery legislation.

