EMC 110 / EMC B10

11.14 -

Operating instructions

GB

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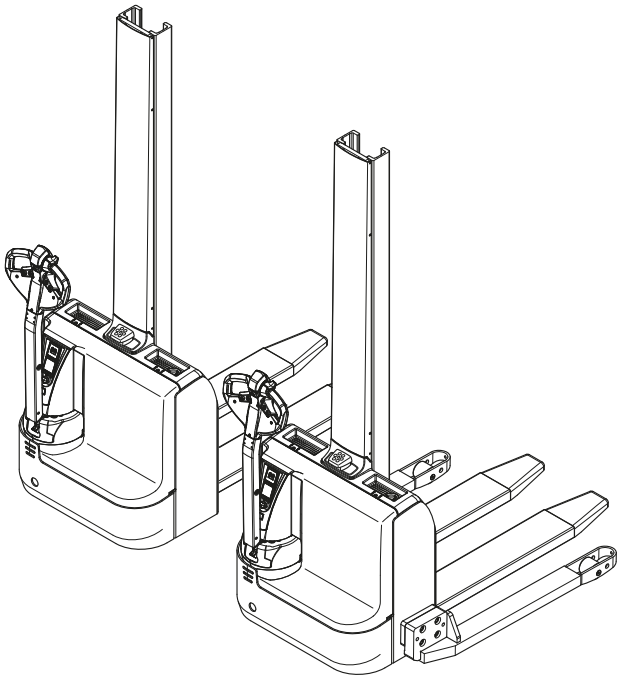
EMC 110
EMC B10
EMC 110 RK



JUNGHEINRICH
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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

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

Copyright

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Contents

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 "Raising a load" on page 72.

The following operations are in accordance with regulations and are permitted:

– Lifting and lowering of loads.
– Stacking and retrieving loads.
– Transporting lowered loads.

The following operations are prohibited:

– Travelling with a raised load (>500 mm).
– Carrying and lifting passengers.
– Pushing or pulling loads.

3 Approved application conditions

– Operation in industrial and commercial environments.
– 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.

3.1 Internal Operation Combined with Brief External or Cold Store Operation

In addition to the permissible application conditions in industrial and commercial environments, the truck may also be used in outdoor environments, cold stores and fresh food areas. Secure parking is only permissible indoors or in a cold store environment.

– Permissible temperature range -10°C to 40°C.
– Secure parking is only permissible at +5°C to 40°C.
– Maximum air humidity 95% non-condensing.
– The application areas can be changed, but in general this should be minimised due to thawing and possible corrosion.
– Thawing is permissible only if the truck can be subsequently dried thoroughly.
– Do not charge the battery below +5°C.

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 EMC 110 / EMC B10 is a four-wheel, tiller-operated electric stacker with a steered drive wheel.
It is designed for use on level floors to lift and transport goods. Open bottom pallets or roll cages can be lifted. The rated capacity is shown on the data plate. The capacity with respect to lift height and load centre of gravity is indicated on the capacity plate.

On the EMC 110 RK the additional cylinders in the support arms increase the ground clearance of the truck, improving its ability to travel on uneven surfaces and over changes of gradient.

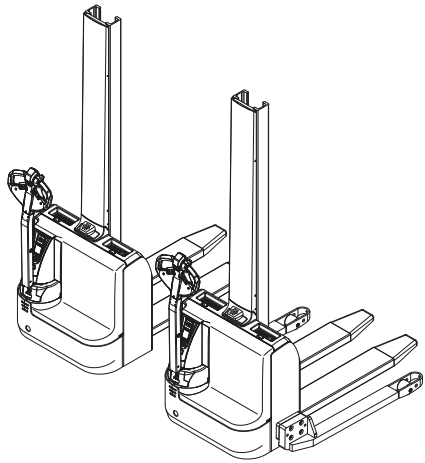
➔ The EMC is designed for light-duty operations; the maximum continuous operation time is two hours.

1.1 Truck models and rated capacity

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

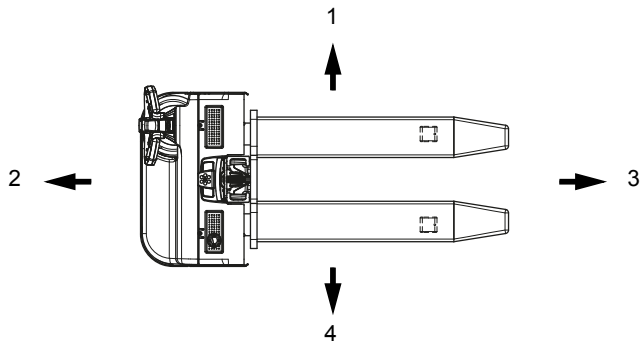
EMC	Model name
1	Series
10	Rated capacity x 100 kg

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 Travel direction definition

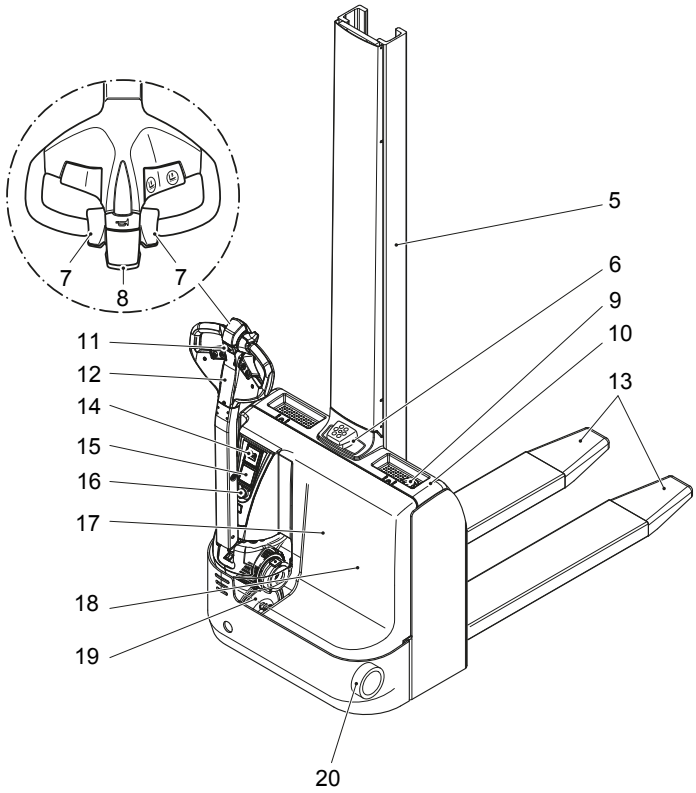
The following determinations have been made for travel direction specification:



Item	Travel direction
1	Left
2	Drive direction
3	Load direction
4	Right

3 Assemblies and Functional Description

3.1 Assembly Overview



Item		Component	Item		Component
5	●	Mast panel	14	●	Battery charge / discharge indicator
6	●	Emergency Disconnect switch		○	Display (2 Inch)
7	●	Travel switch	15	○	Keypad
8	●	Collision safety switch		○	Transponder reader
9	●	Mains plug	16	●	Key switch
10	●	Battery cover	17	●	Front panel
11	●	Slow travel button	18	●	Traction controller and charger
12	●	Tiller and tiller head	19	●	Drive wheel
13	●	Forks	20	●	Support wheel
● = Standard equipment			○ = Optional equipment		

3.2 Functional Description

Safety mechanisms

An enclosed, smooth truck geometry with rounded edges ensures safe handling of the truck. The wheels are surrounded by a solid skirt.

The long tiller provides a maximum safety distance to the truck. When it is released and in hazardous situations a gas pressure spring forces the tiller up into the brake position. The collision safety switch in the tiller head responds to body contact, the travel direction changes and the truck moves away from the operator.

Activating the Emergency Disconnect switch rapidly cuts out all electrical functions in hazardous situations.

Emergency Stop safety feature

The emergency stop is activated by the traction controller. Each time the truck is switched on the system performed a self diagnosis. If an error is detected, the truck automatically brakes to a halt. Event messages in the display unit (○) indicate the emergency stop.

⚠ CAUTION!

The truck brakes automatically

If the truck detects that signals which are required have not been received, or if it detects an error, the system reacts by triggering an emergency stop, either by braking the truck to a halt or until a valid signal status has been reached.

▶Remain at a suitable distance from the truck during operation.

Hydraulic system

Pressing the lifting button starts the pump unit, supplying hydraulic oil from the oil reservoir to the lift cylinder. Pressing the lifting button raises the load handler at a constant speed; pressing the lowering button lowers the load handler.

Drive system

An AC threephase motor actuates the drive wheel via a spur gear. The electronic traction controller ensures smooth drive motor speed control and hence smooth starting, powerful acceleration and electrically controlled braking with energy recovery. The driver can choose from 3 travel programs depending on the load and the environment: from high performance to energy-saving.

Tiller

The driver steers with an ergonomic tiller. All travel and lift operations can be performed sensitively without having to reach. The tiller has a steer angle of 180°.

Electrical system

The truck has an electronic traction controller. The operating voltage of the truck's electrical system is 24 volts.

Controls and displays

Ergonomic controls ensure fatigue-free operation for sensitive application of the travel and hydraulic operations. The display unit (○) shows the key operator information such as travel program, service hours, battery capacity and event messages.

Mast

The fork carriage runs on permanently-lubricated and hence maintenance-free angled rollers.

Load backrest (○)

A load backrest is recommended as an additional protective mechanism to move low or small item loads. The load backrest is mounted on the load handler and protects the operator and truck against falling loads.

➔ The extended mast height (h4) increases according to the load backrest mounted on the load handler.

⚠ WARNING!

Risk of injury from falling loads

Low or small item loads protruding over the load backrest can fall, endangering the operator and truck.

▶ Secure low or small item loads protruding over the load backrest, e.g. by wrapping them in film.

Forks

Optionally, the truck can be fitted with 2A forks.

3.2.1 Hourmeter

➔ Prepare the truck for operation, see "Preparing the truck for operation" on page 53.

Service hours are counted while the truck is operational and one of the following controls is applied:

– Tiller in travel zone "F", see "Travel" on page 62.
– "Slow travel button", see page 64.
– "Lift" button, see page 68.
– "Lower" button, see page 69.

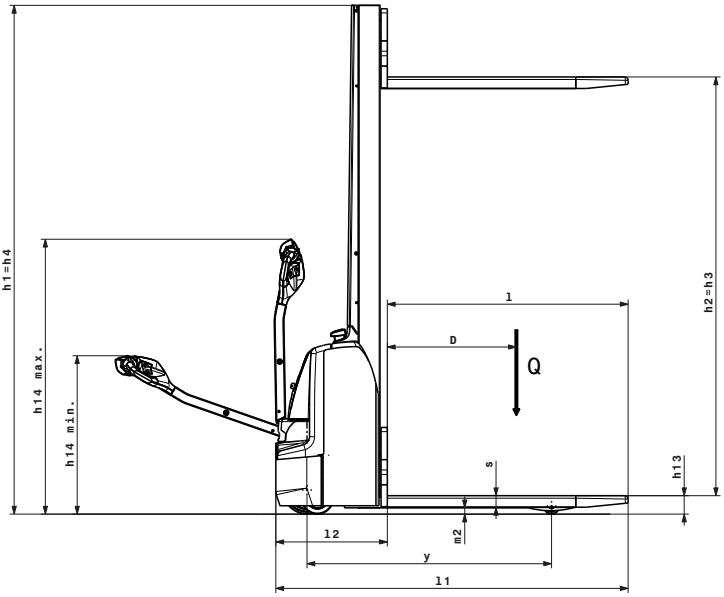
4 Technical Specifications

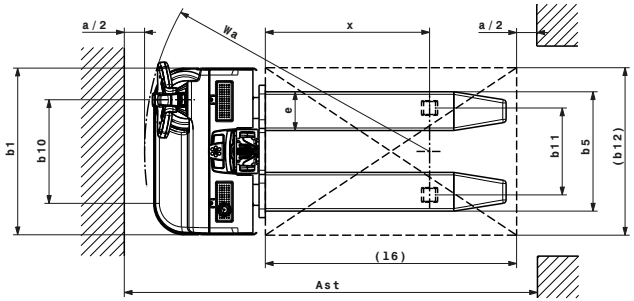
The technical specifications comply with the German "Industrial Truck Data Sheet" Guidelines.
Technical modifications and additions reserved.

4.1 Performance data

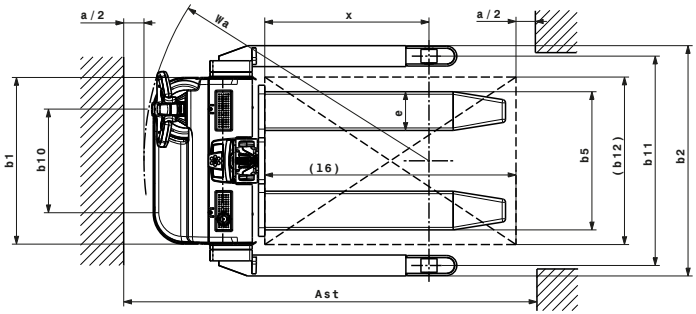
	Component	EMC 110 / EMC 110 RK	EMC B10	
Q	Rated capacity	1000	1000	kg
D	Load centre distance with standard fork length	600	600	mm
	Travel speed with / without rated load	4.2 / 5.0	4.2 / 5.0	km/h
	Lift speed with / without rated load	0.09 / 0.16	0.09 / 0.16	m/s
	Lowering speed with / without rated load	0.12 / 0.12	0.12 / 0.12	m/s
	Max. gradeability with / without rated load	3.5 / 15	3.5 / 15	%
	Drive motor, output S2 60 min	0.5	0.5	kW
	Lift motor, output at S3 10%	1.5	1.5	kW

4.2 Dimensions





EMC 110



EMC B10

	Component	EMC 110 / EMC 110 RK	EMC B10	
h1	Overall height	1970 / 2430 [1]	1970 / 2430 [1]	mm
h2	Free lift	1540 / 2000 [1]	1540 / 2000 [1]	mm
h3	Lift	1540 / 2000 [1]	1540 / 2000 [1]	mm
h4	Mast height extended	1970 / 2430 [1]	1970 / 2430 [1]	mm
h13	Forks lowered	88	88	mm
h14	Tiller height in min./max. travel position.	821 / 1305	821 / 1305	mm
y	Wheelbase	1168	1168	mm
l1	Overall length	1685	1685	mm
l2	Headlength	535	535	mm
x	Load distance	784	784	mm
b1	Truck width	800	1100 - 1470	mm
b5	Width across forks	570	570 / 660	mm
b10	Track width, rear	510	510	mm
b11	Track width, front	415	1000/1170/1370	mm
e	Fork width	185	185	mm
m2	Ground clearance	30	40	mm
Ast	Working aisle width* 1000x1200 crossways [2,3]	1945 [4]	1945 [4]	mm
Ast	Working aisle width* 800x1200 lengthways [2,5]	1995 [6]	1995 [6]	mm
Wa	Turning radius [2]	1378	1378	mm

1. High mast version (+460 mm)
2. Tiller upright (slow travel)
3. l6 = 1150; b12 = 1200 (forks protruding)
4. Diagonal in accordance with VDI +272 mm
5. l6 = 1200; b12 = 800
6. Diagonal in accordance with VDI +160 mm

* including safety distance a = 200 mm

4.3 Weights

	Component	EMC 110 / EMC 110 RK	EMC B10	
	Truck weight	490 / 510 [1]	535 / 555 [1]	kg
	Axle load with load at front	500 / 515 [1]	530 / 545 [1]	kg
	Axle load with load at rear	990 / 995 [1]	1005 / 1010 [1]	kg
	Axle load without load at front	350 / 365 [1]	390 / 405 [1]	kg
	Axle load without load at rear	140 / 145 [1]	145 / 150 [1]	kg

1. High mast version (+460 mm)

4.4 Tyre type

	Description	EMC 110	EMC B10	
	Tyre size, front	230x70		mm
	Tyre size, rear	77x75		mm
	Additional wheels (dimensions)	150x54	140x54	mm
	Wheels, number front / rear (x = driven)	1x+1/2 or 4		

	Component	EMC 110 RK	
	Tyre size, front	230x70	mm
	Tyre size, rear	77x75	mm
	Additional wheels (dimensions)	150x54	mm
	Wheels, number front / rear (x = driven)	1x+1/2	

4.5 EN norms

Noise emission level

– EMC 110 / EMC B10: 70 dB(A)

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.

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.

⚠ 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 a doctor or the manufacturer of the medical equipment to clarify whether it can be used near the industrial truck.

4.6 Conditions of use

Ambient temperature

– operating at -10°C to 40°C, see "Approved application conditions" on page 12.

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

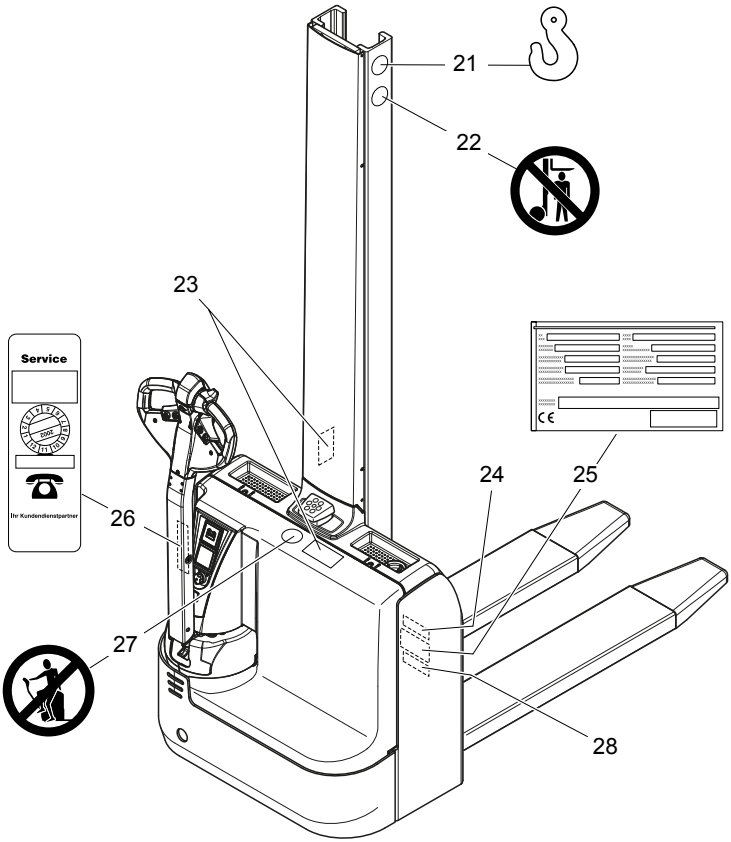
4.7 Electrical Requirements

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.

5 Identification Points and Data Plates

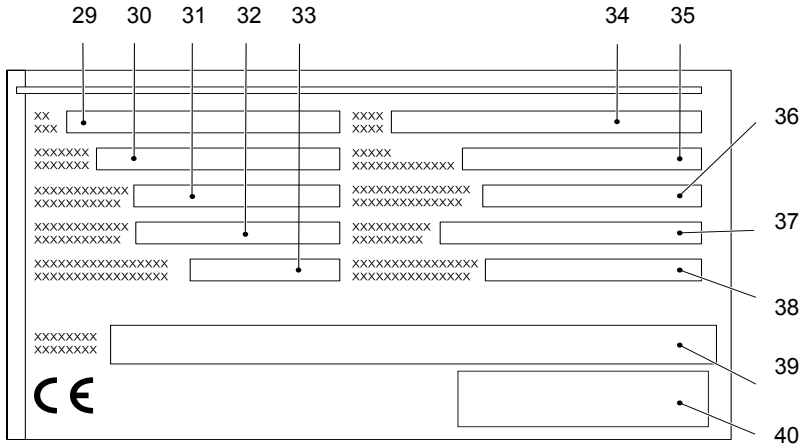
Warnings and notices such as capacity charts, strap points and data plates must be legible at all times. Replace if necessary.

5.1 Indication Points



Item	Component
21	Strap point for crane lifting
22	Warning: “Do not step under the load handler”
23	Capacity plate
24	Serial number (etched into the truck chassis)
25	Truck data plate
26	Test plaque
27	Warning: “No passengers”
28	Full service no.

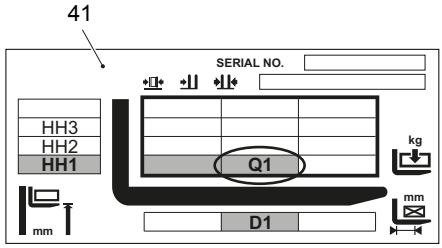
5.2 Data plate



Item	Description	Item	Description
29	Type	35	Year of manufacture
30	Serial number	36	Load centre (mm)
31	Rated capacity (kg)	37	Output
32	Battery voltage (V)	38	Min./max. battery weight (kg)
33	Net weight w.o. battery (kg)	39	Manufacturer
34	Option	40	Manufacturer’s logo

For queries regarding the truck or ordering spare parts always quote the truck serial number (30).

5.3 Truck capacity plate



The capacity plate (41) indicates the maximum capacity Q (in kg) for a given load centre distance D (in mm) and corresponding lift height H (in mm) for the truck with a horizontal load.

Example of how to calculate the maximum capacity:
At a load centre distance D1 and a lift height HH1, the maximum load capacity is Q1.

5.4 Wind loads

Wind forces can affect the stability of a truck when lifting, lowering and transporting loads with large surface areas.

Light loads must be especially secured when they are subjected to wind forces. This will prevent the load from sliding or falling.

Stop the truck in both cases.

C Transport and Commissioning

1 Lifting 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.

⚠ WARNING!

Incorrect lifting by crane can result in accidents

Improper use or use of unsuitable lifting gear and can cause the truck to fall when being lifted by crane.

Prevent the truck from hitting other objects during lifting, and avoid uncontrolled movements. If necessary, secure the truck with guide ropes.

- ▶ The truck should only be loaded by personnel trained in the use of lifting slings and tools.
- ▶ Wear personal protective equipment (e. g. safety shoes, safety helmet, hi-vis jacket, protective gloves, etc.) when loading by crane.
- ▶ Do not stand under suspended loads.
- ▶ Do not enter or stand in a hazardous area.
- ▶ Always use lifting gear with sufficient capacity (for truck weight see truck rating plate).
- ▶ Always attach the crane lifting gear to the prescribed strap points and prevent them from slipping.
- ▶ Use the lifting slings only in the prescribed loading direction.
- ▶ Crane slings should be fastened in such a way that they do not come into contact with any attachments when lifting.

The strap point (21) on the mast is for loading the truck with crane lifting gear.

Lifting the truck by crane

Requirements

– Park the truck securely, see "Parking the truck securely" on page 55.

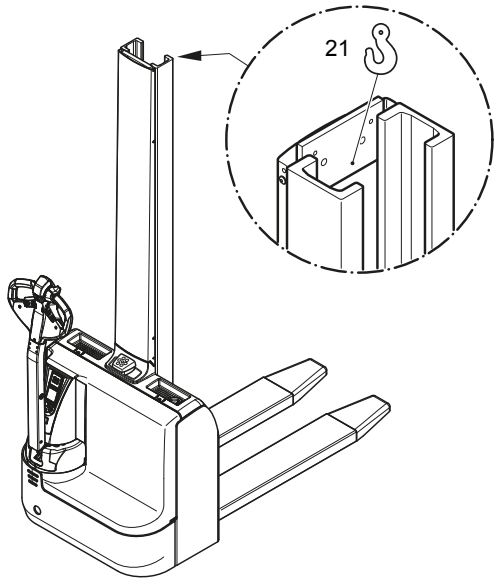
Tools and Material Required

– Lifting gear
– Crane lifting gear

Procedure

• Secure the lifting slings to the strap point (21).

The truck can now be lifted by crane.



2 Transport

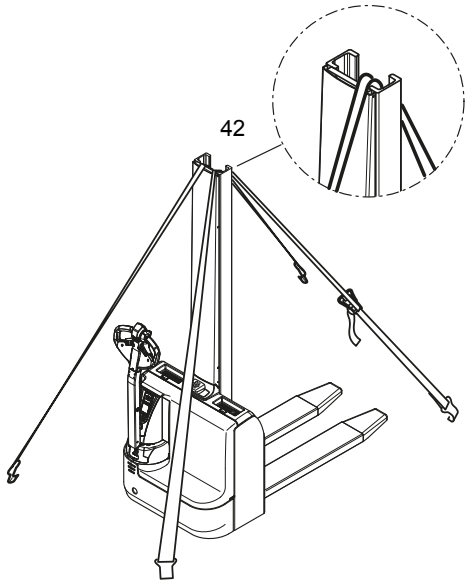
⚠ WARNING!

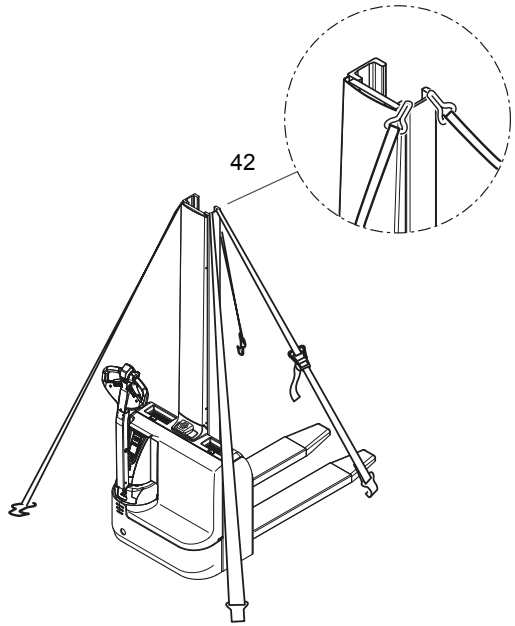
Accidental movement during transport

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

- ▶ 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.
- ▶ The truck must be securely fastened when transported on a lorry or a trailer.
- ▶ The lorry or trailer must have fastening rings.
- ▶ Use wedges to prevent the truck from moving.
- ▶ Use only fastening belts with sufficient strength.
- ▶ Use non-slip materials to securing the load aids (pallet, wedges, ...) e. g. non-slip mats.

The truck can be made safe for transporting in two ways.





Securing the industrial truck for transport

Requirements

– Load the truck.
– Park the truck securely, see "Parking the truck securely" on page 55.

Tools and Material Required

– Lashing straps

Procedure

• Attach the lashing straps (42) to the industrial truck and the transport vehicle and tension sufficiently.

The truck can now be transported.

3 Using the Truck for the First Time

⚠ 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 50 mm².

Procedure

- Check the equipment is complete.
- If necessary, install the battery, see "Battery removal and installation" on page 43.
- Charge the battery, see "Charging the battery" on page 38.

The truck can now be started, see "Preparing the Truck for Operation" on page 52.

NOTE

Do not lift loads if the truck is operated via a tow lead with an external battery.

Wheel flattening

If the truck has been parked for a long period, the wheel surfaces may tend to flatten. This flattening has a negative effect on the safety and stability of the truck. Once the truck has covered a certain distance, the flattening will disappear.

D 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. These operating instructions 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. The terminals and cable shoes must be clean, secure and have a light coating of dielectric grease.

⚠ CAUTION!

Short circuits can cause fires

Damaged cables can cause a short circuit, setting the truck and the battery on fire.

▶ Before closing the battery cover make sure that the battery cables cannot be damaged.

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 observed.

⚠ 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 "Parking the truck securely" on page 55).

2 Battery types

The truck is equipped with two 12 V / 69 Ah maintenance-free batteries.

Battery type	Capacity (Ah)	Min. weight (kg)	Max. dimensions (mm)
12 volt battery	69	30	250X150X400

➔ Optimum battery useful life is achieved at battery temperatures from 25°C to 30°C. Low temperatures reduce the available battery capacity, high temperatures reduce the battery useful life.

NOTE

45°C is the maximum temperature for batteries and no longer permissible as the operating temperature.

➔ When the truck is parked securely, the battery can be electrically separated from the truck by pressing the emergency disconnect switch. The truck should not be stored without battery equalisation charging for more than 3 months at 20°C or 2 months at 30°C.

3 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.

- ▶ 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.
- ▶ 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.
- ▶ Fire control 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 truck settings must match the battery type.

3.1 Charging the battery with an on-board charger

⚠ WARNING!

Risk of electric shock and burning

Damaged and unsuitable cables can cause electric shocks and can overheat, resulting in fires.

- ▶ Always use mains cables with a maximum length of 30 m. Local regulations must be observed.
- ▶ Unwind the cable reel fully when using it.
- ▶ Always use original manufacturer's mains cables.
- ▶ Insulation safety, acid and caustic ratings must comply with the manufacturer's mains lead.
- ▶ The charging connector must be dry and clean when used.

NOTE

Improper use of the on-board charger can cause material damage

The on-board charger consisting of a battery charger and battery controller must not be opened. If faulty, contact the manufacturer's customer service department.

- ▶ The charger must only be used for batteries supplied by Jungheinrich or other approved batteries provided it has been adapted by the manufacturer's customer service department.
- ▶ Batteries must never be swapped from truck to truck.
- ▶ Do not connect the battery to two chargers simultaneously.

Starting to charge with the on-board charger

Mains connection

Mains supply: 230 V / 110 V (±10%)
Mains frequency: 50 Hz / 60 Hz(±4%)

The EMC is fitted as standard with an on-board charger. The charger detects the mains voltage and adapts automatically.
The mains cable of the charger (9) is contained in the front panel can be accessed from the outside.

NOTE

The battery temperature rises by approx. 10°C during charging. Battery charging should only start when the battery temperature is below +35°C. The battery temperature before charging should be at least +5°C as otherwise it will affect the charge.

Charging the battery

Requirements

– Park the truck securely, see "Parking the truck securely" on page 55.

Procedure

- Attach the mains connector (9) to a mains socket.
- Pull the Emergency Disconnect switch (6) up.
  The flashing LED indicates the charge status or a fault (for flashing codes see “LED Display” table).

The battery is now charged.

➔ When the mains connector (9) is attached to the mains, all the truck’s electrical functions are disconnected (electric immobilizer). The truck cannot be operated.

Completing the battery charge, restoring the truck to operation

NOTE

If charging has been interrupted, the full battery capacity will not be available

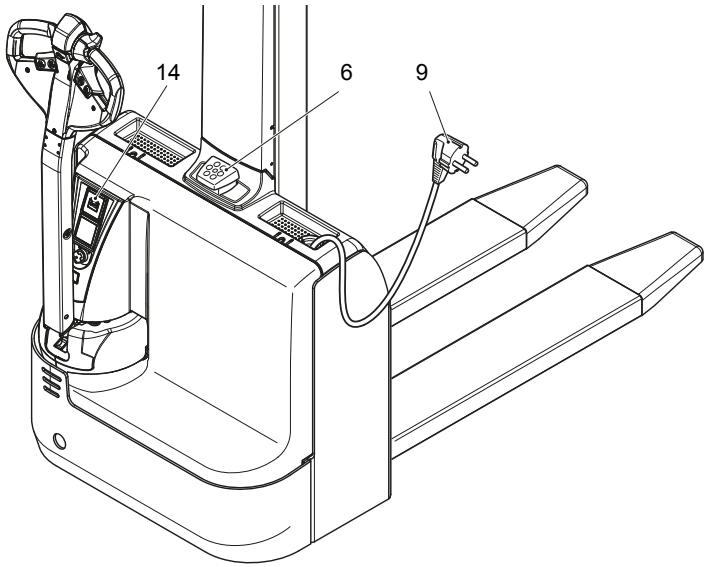
Requirements

– Battery charging is complete.

Procedure

• Remove the mains connector (9) from the socket and store it in the battery compartment with the cable.

The truck is now ready for operation.



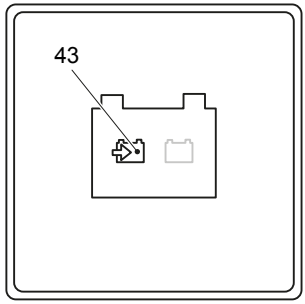
Charging times

The duration of charge depends on the battery capacity.

➔ Charging continues automatically after a mains failure. Charging can be interrupted by removing the mains connector and continued as partial charging.

LED display (43)

Green LED (charge status)	
Lit	Charging complete, battery full. (Charge interval, float or compensation charge).
Slow flash	Charging.
Rapid flash	Display at beginning of charge or after setting a new characteristic curve. Number of flash pulses corresponds to the characteristic curve set.



Red LED (fault)	
Lit	Overtemperature. Charging is interrupted.
Slow flash	Safety charging time exceeded. Charging is cancelled. Mains must be disconnected for charging to restart.
Rapid flash	Invalid characteristic curve setting.

Trickle charge

The compensation charge starts automatically when charging is complete.

Partial charging

The charger is designed to automatically adapt to partially charged batteries. This keeps battery wear to a minimum.

4 Battery removal and installation

⚠ 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. If necessary cover them with a rubber mat.
- ▶ Park the truck on a level surface.
- ▶ Make sure the crane lifting gear has sufficient capacity to replace the battery.
- ▶ Make sure the battery is securely located in the truck's battery compartment.

4.1 Changing the battery from the top

NOTE

The batteries must always be replaced in pairs. When replacing a battery always use the same battery type.

Removing the battery

Requirements

– Truck parked securely, see "Parking the truck securely" on page 55.
– Remove the front panel, see "Front cover disassembly" on page 115.

Procedure

- Remove the battery panel screws on the fork side.
- Carefully lift off the battery panel and put it to one side.

  The mains cable remains in the battery panel.
- Undo the terminal screws and remove the battery cable from the terminals.
- Lift out batteries individually.

Installation is the reverse order. When reinstalling the batteries, make sure they are installed in the correct position and properly connected.

– Use terminal screws with washers and torque to 9 Nm.
– After installing the battery again, check all cables and plug connections for visible signs of damage.

⚠ CAUTION!

Before starting, close and screw tight the battery panel and front panel!

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, responsibilities and rules of conduct

The driver 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. Safety shoes must be worn on pedestrian-operated trucks.

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

⚠ WARNING!

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.

Safety devices, warning signs and warning instructions

Safety devices, warning signs (see "Identification Points and Data Plates" on page 25) and warning instructions in the present operating instructions must be strictly observed.

⚠ WARNING!

Removing or disabling safety devices can cause accidents

Removing or disabling safety devices such as the Emergency Disconnect switch, key switch, buttons, horn, strobe lights, mast protection pane, mast grille, sensors, panels etc. can result in accidents and injury.

- ▶ 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.

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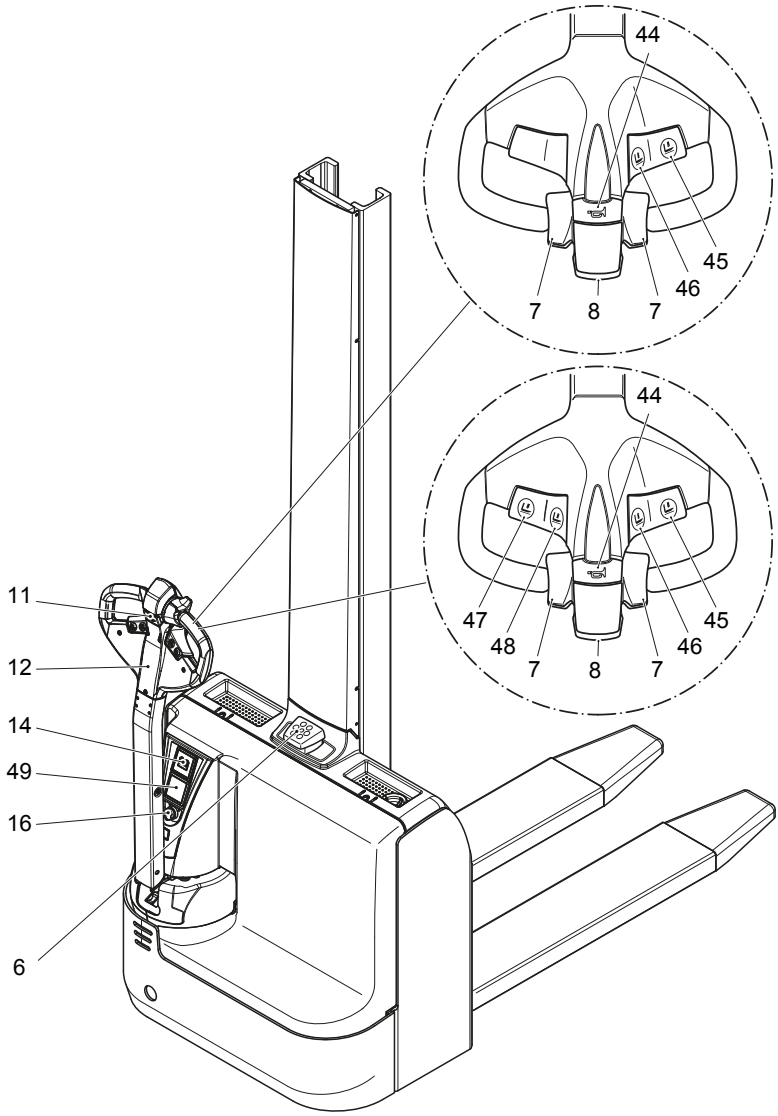
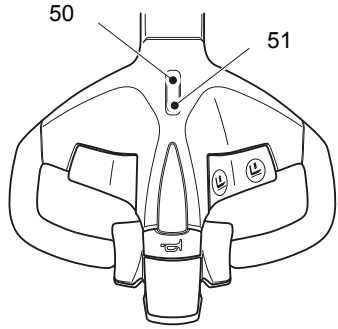
2 Displays and Controls



Item	Control /Display	EMC Premium	Function
6	Emergency Disconnect switch	●	Disconnects the battery supply – All electric functions are cut out and the industrial truck decelerates.
7	Travel switch	●	– Controls the direction of travel as well as the travel speed.
8	Collision safety switch	●	Safety feature, drive direction travel only – When applied the truck travels for approx. 3 seconds in the load direction. The parking brake then applies. The truck remains switched off until the travel switch is set to neutral.
11	Slow travel button	●	– If the tiller is in the upper braking zone, braking can be overridden by pressing the switch, and the truck can move at reduced speed (slow travel), see "Slow travel" on page 64.
12	Tiller	●	– Used for steering and braking.
14	Charge status indicator	●	– Indicates the charge/discharge status of the battery.
	Display unit	○	Display for: – Battery charge status – Service hours – Event messages – Operating program
	Soft keys under the display unit		Selection of – Operating program – Options Input of – master and access codes to switch on the truck
16	Key switch and key	●	Switches the truck on. Removing the key prevents the truck from being switched on by unauthorized personnel.
44	Warning signal button (horn)	●	– Warning signal button
45	Load handler lower button	●	Lowers the load handler.
		○	Lowering the load handler (2 stage): – The first half of the button stroke is used to lower at a reduced speed. The second half of the button stroke is used to lower at full speed.
46	Load handler raise button	●	Raises the load handler.

Item	Control /Display	EMC Premium	Function
47	Load handler lower button (2nd hand)	○	Lowers the load handler.
		○	Lowering the load handler (2 stage): – The first half of the button stroke is used to lower at a reduced speed. The second half of the button stroke is used to lower at full speed.
48	Load handler raise button (2nd hand)	○	Raises the load handler.
49	Keypad	○	Replaces the key switch – Provided only as a supplement to the display unit – To enter master and access codes
	Transponder reader	○	Replaces the key switch – Provided only as a supplement to the display unit – Activates the truck via a card/ transponder

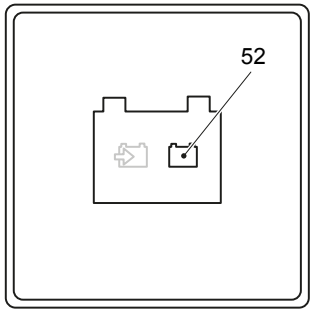
Special features of the EMC 110 RK tiller



Item	Control /Display		Function
50	Changeover to Ramp Comfort	●	Rocker switch in the "Ramp Comfort" position – Lifting and lowering the support arms
51	Changeover to mast lift	●	Rocker switch in the "Mast lift" position – Lifting and lowering the load handler

2.1 Battery discharge indicator

After the truck has been started, the charge status of the battery is shown. The LED (52) colours represent the following conditions:



LED colour	Charge status
Green	40 - 100%
Orange	30 - 40 %
Green/orange flashes 1 Hz	20 - 30 %
Red	0 - 20 %

If the LED is lit red, load can no longer be lifted. Lifting is only enabled when the battery connected is at least 70% charged.

If the LED flashes red and the truck is not ready for operation, inform the manufacturer's customer service department. Red flashing is a truck controller code. The flashing sequence indicates the type of fault.

2.2 Battery discharge monitor

The standard setting for the battery discharge indicator / discharge monitor is based on standard batteries. When using maintenance-free or special batteries, the display and cut-out points of the battery discharge monitor must be set by manufacturer's service department. If this adjustment is not made, the battery may become damaged due to deep discharge.

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.

Charge the battery see "Charging the battery" on page 38.

If the residual capacity falls below the required level, lifting is inhibited. An alternating display (52) appears. Lifting is only released when the battery connected is at least 70% charged.

3 Preparing the Truck for Operation

3.1 Checks and Operations to Be Performed Before Starting Daily Work

⚠ 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.

Inspection before daily operation

Procedure

- Check the whole of the outside of the truck for signs of damage and leaks. Damaged hoses must be replaced immediately.
- Check the load handler for visible signs of damage such as cracks, bent or severe wear.
- Check the drive wheel and load wheels for damage.
- Check that the markings and labels are present, clean and legible, see "Identification Points and Data Plates" on page 25.
- Check the protection screen / grille and their attachments are secure and undamaged.
- Make sure the drive panels and covers are secure and check for damage.
- With the load handler lowered, check the mast chains are tensioned and secured correctly.
- Check tiller return function.
- Check the controls automatically return to the neutral position after use.

3.2 Preparing the truck for operation

Switching on the truck

Requirements

– For checks and operations to be performed before starting daily operation, see "Checks and Operations to Be Performed Before Starting Daily Work" on page 52.

Procedure

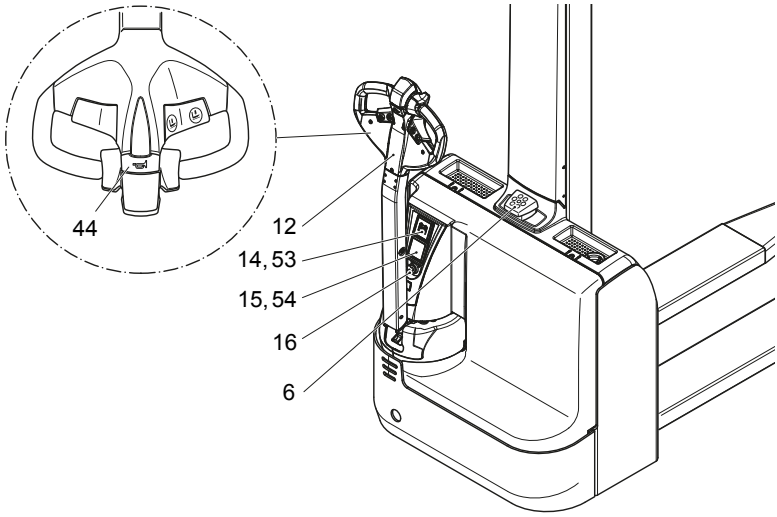
- Pull the emergency disconnect switch (6) to switch it on.
- Switch on the truck, to do this
  - Insert the key in the key switch (16) and turn it as far to the right as it will go.
  - Enter the code in the display unit (○) (53).
  - Enter the code in the keypad (○) (15).
  - Hold the card or transponder in front of the transponder reader (○) (54).

➔ The tiller (12) must be in the upper braking position "B". If event message "E-0914" is shown in the display unit (○), set the tiller to the upper braking zone "B", see "Travel" on page 62.

Truck is operational.

● The charge status indicator (14) shows the current battery charge status.

○ The display unit (53) indicates the current battery charge status and the service hours.



3.3 Checks and operations to be carried out when the truck is operational

⚠ WARNING!

Risk of accident due to damage to or other defects in the truck and optional features

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.

Procedure

- Test warning indicators and safety devices:
  - Test the emergency disconnect function by pressing the emergency disconnect switch. The main circuit is disconnected and no truck operations can be performed. Now pull the Emergency Disconnect switch to unlock it.
  - Test the buzzer (●) or horn (○) by pressing the "warning signal" button.
  - Check braking efficiency, see "Brakes" on page 65.
  - Test the steering, see "Steering" on page 65.
  - Test the hydraulic system, see "Load handler raise/lower" on page 67.
  - Test travel operations, see "Travel" on page 62.
  - Test the "collision safety switch" by depressing it whilst driving in the drive direction.
- Test the controls and displays and check for damage, see "Displays and Controls" on page 47.

3.4 Parking the truck securely

⚠ WARNING!

An unsecured truck can cause accidents

Do not leave an unsecured truck.

▶ Park the truck securely when leaving it.

▶ Exception: If the operator intends to remain in the immediate vicinity and is leaving the truck for only a short while, the applied parking brake is sufficient to hold the truck, see page 66. Immediate vicinity is when the operator is able respond to malfunctions or attempts to use the truck by unauthorised persons immediately.

⚠ WARNING!

An unsecured truck can cause accidents

Do not park the truck on an incline. Do not park the truck without the brakes engaged. Do not park and leave the truck with the load handler raised.

▶ Park the truck on a level surface. In special cases the truck may need to be secured with wedges.

▶ Fully lower the load handler when leaving the truck.

▶ Select a place to park where no other people are at risk of injury from the lowered load handler.

▶ If the brakes are not working, place wedges underneath the wheels of the truck to prevent it from moving.

Parking the truck securely

Procedure

- Park the truck on a level surface.
- Fully lower the load handler (26):
  - Press the lower button (45).
- Using the tiller (12) turn the drive wheel to "forward travel".
- Switch off the truck, to do this:
  - Turn the key in the key switch (16) anti-clockwise as far as it will go. Remove the key from the key switch (16).
- Press the Emergency Disconnect switch (6).

The truck is parked.

→ On the EMC 110 RK also lower the support arms, see page 70.

4 Industrial Truck Operation

4.1 Safety regulations for truck operation

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.

⚠ WARNING!

Do not exceed the permissible surface and spot load limits on the travel routes.
At blind spots get a second person to assist.

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.

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 when they are recognised lanes. The slopes and inclines must be clean, have a non-slip surface, and negotiating them safely must be within the technical specifications of the truck. 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 or slopes. Inclines must only be negotiated at slow speed, with the driver ready to brake at any moment.

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.

⚠ 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.

⚠ WARNING!

Removing or disabling safety devices can cause accidents

Removing or disabling safety devices such as the emergency disconnect switch, key switch, buttons, horn, strobe lights, sensors, panels, etc. can result in accidents and injury.

▶ Report any defects immediately to your supervisor.

▶ Mark defective truck and take it out of service.

▶ Do not return the truck to service until you have identified and rectified the fault.

4.2 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.

Press the Emergency Disconnect switch

Procedure

- Press the Emergency Disconnect (6).

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

➔ Press the Emergency Disconnect switch on in emergencies.

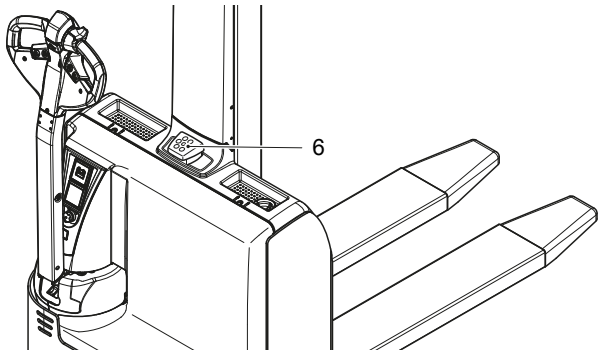
Releasing the Emergency Disconnect switch

Procedure

- Pull the Emergency Disconnect switch (6) to unlock it.

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

➔ If the truck is not equipped with a key switch, the truck is not operational after the emergency disconnect switch has been released. Prepare the truck for operation, see page 53.



4.3 Automatic braking

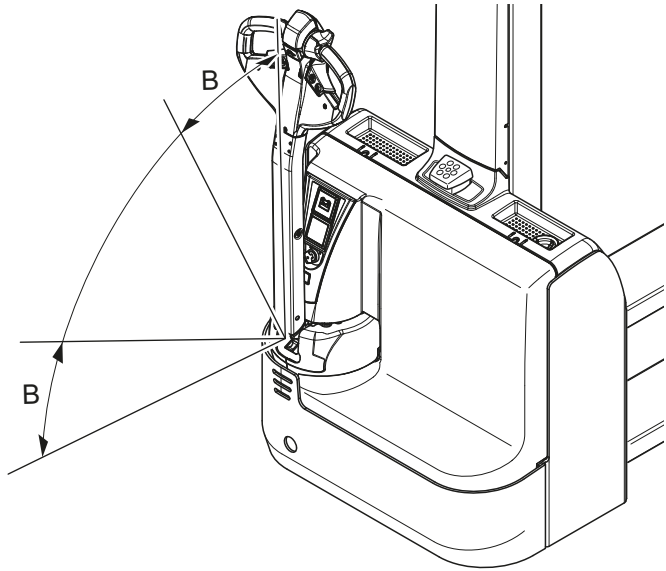
When the tiller is released, it returns automatically to the upper brake zone (B) and the brakes are applied automatically.

⚠ WARNING!

Risk of collision due to a defective tiller

Operating the truck with a defective tiller can lead to collisions with persons or objects.

- ▶ If the tiller returns to the brake position slowly or not at all, the truck must be taken out of service until the cause of this fault is be rectified.
- ▶ Contact the manufacturer's customer service department.



4.4 Travel

⚠ WARNING!

Collision hazard when operating the truck

Collisions with personnel and equipment can result if the truck is operated with open panels.

▶ Do not operate the truck unless the panels and covers are closed and properly locked.

▶ When travelling through swing doors etc. make sure that the doors do not activate the collision safety button.

⚠ CAUTION!

Trapping hazard from the truck during pedestrian mode

In pedestrian mode the truck can pose a trapping hazard for the operator and other people.

▶ Wear personal protective equipment (e.g. safety shoes, ...).

▶ The truck must be operated with particular care and attention in pedestrian mode.

▶ Ensure there are no other people standing between the truck and obstacles when operating in pedestrian mode.

Requirements

– Start up the truck, see "Preparing the Truck for Operation" on page 52.

Procedure

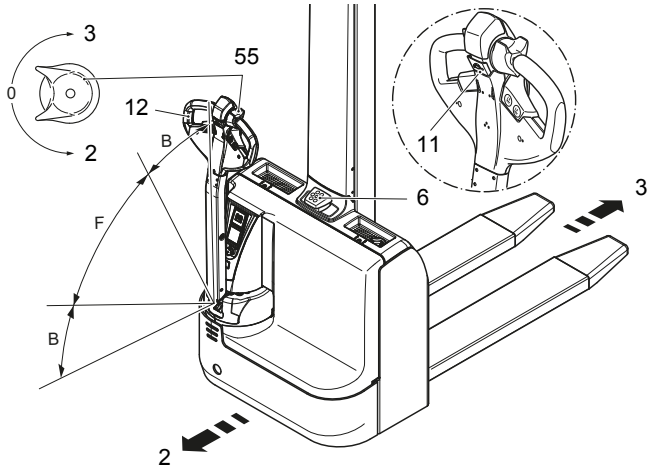
- Set the tiller (12) to the travel zone (F).
- Control the travel direction with the travel switch (55):
  - Rotate the travel switch (55) slowly in the load direction (3):
    Travel in load direction:
  - Rotate the travel switch (55) slowly in the drive direction (2):
    Travel in drive direction:
- Control the travel speed with the travel switch (55):
  - The further the travel switch (55) is rotated, the greater the travel speed.
- Control the travel speed by rotating the travel switch (55) further or less.

➔ After releasing the travel switch (55), it automatically returns to the neutral position (0), and the truck brakes.

The brakes are released and the truck moves in the selected direction.

Anti-roll back device for slow travel on inclines

If the truck does not have sufficient speed to travel up an incline, it may roll back. Rolling back is detected by the truck's controller and the truck brakes to a halt immediately.



4.4.1 Changing direction during travel

⚠ CAUTION!

Danger when changing direction during travel

Changing direction during travel causes the truck to decelerate sharply. When the truck changes direction, it can start travelling at high speed in the opposite direction unless the travel switch is released in time.

- ▶ After setting off in the opposite direction, apply the travel switch gently or not at all.
- ▶ Do not perform any sudden steering operations.
- ▶ Always face in the direction of travel.
- ▶ Maintain an adequate overview of the route you are travelling.

Changing direction during travel

Procedure

- Set the travel switch (55) to the opposite direction while travelling.

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

4.5 Slow travel

⚠ CAUTION!

Risk of accident if the service brake is deactivated

Particular care and attention is required by the operator during slow travel. The service brake is deactivated during slow travel and is only reactivated after the "slow travel" button is released.

▶ In hazardous situations brake by immediately releasing the "slow travel" button and the travel switch.

▶ During slow travel you can only brake by coating braking.

➔ The truck can be operated with an upright tiller (12) (e. g. in confined spaces / elevators).

Switch on the slow travel function

Procedure

- Press and hold down the "slow travel" button (11).
- Rotate the travel switch (55) in the required travel direction.

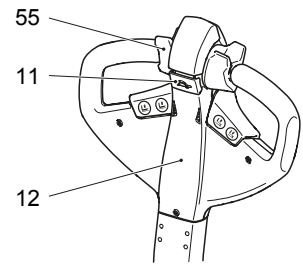
The brake is released. The truck travels at slow speed.

Switching off slow travel

Procedure

- Release the "slow travel" button (11).
  If the tiller is in brake zone "B", the brake applies and the truck stops.
  If the tiller is in brake zone "F" the truck continues at slow travel speed.
- Release the travel switch (55).

Slow travel ends and the truck can now travel again at normal speed.



4.6 Steering

Procedure

- Move the tiller (12) to the left or right.

The truck is steered in the required direction.

4.7 Brakes

⚠ WARNING!

Accident risk while braking

The truck's braking response depends largely on the floor condition and the type of surface. The truck's braking distance increases when the ground is wet or dirty.

▶ The operator must be aware of floor conditions and take them into account when braking.

▶ Brake with care to prevent the load from slipping.

⚠ CAUTION!

▶ In hazardous situations set the tiller to the brake position.

The truck can brake in three different ways:

– By using the service brake (brake zone B).
– With the coasting brake.
– By inversion braking (braking and changing direction).

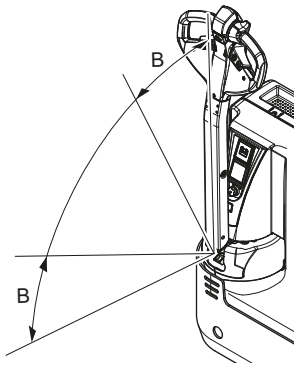
4.7.1 Braking with the service brake

Procedure

- Move the tiller (12) up or down to one of the brake zones (B).

The truck brakes to a halt regeneratively via the service brake.

➔ *When braking regeneratively, energy is returned to the battery, ensuring a longer service time.*



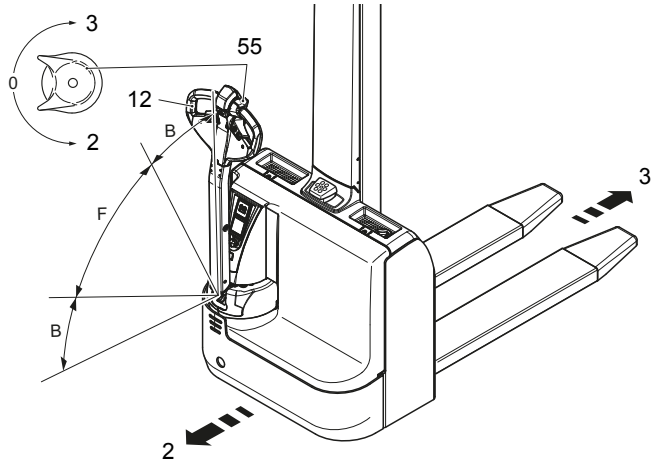
4.7.2 Braking with the coasting brake

Procedure

- If the travel switch (55) is set to (0), the truck automatically brakes regeneratively.

The truck brakes to a halt regeneratively via the coasting brake.

➔ *When braking regeneratively, energy is returned to the battery, ensuring a longer service time.*



4.7.3 Inversion braking

Procedure

- Set the travel switch (55) to the opposite direction while travelling, see "Changing direction during travel" on page 63.

The truck brakes regeneratively until it starts to move in the opposite direction.

4.7.4 Parking brake

➔ The mechanical brake applies automatically when the truck comes to rest.

4.8 Load handler raise/lower

⚠ WARNING!

Accident risk when lifting and lowering

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 movement of the truck including the load handler, etc. This also includes areas which can be reached by falling loads, operating equipment, etc.

Apart from the driver (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 secured and positioned in accordance with regulations. Use suitable precautions to prevent parts of the load from tipping or falling down.
- ▶ Never exceed the maximum loads specified on the capacity plate.
- ▶ Never stand underneath a raised load handler.
- ▶ Do not stand on the load handler.
- ▶ Do not lift other people on the load handler.
- ▶ Never reach or climb into moving truck parts.
- ▶ Do not climb onto parts of the building or other trucks.

NOTE

Adapt a slower speed when stacking and retrieving.

4.8.1 Raising the load handler

Requirements

– Prepare the truck for operation, see "Preparing the truck for operation" on page 53.

Procedure

• Press the “Raise load handler ” button (46) until you reach the desired lift height.

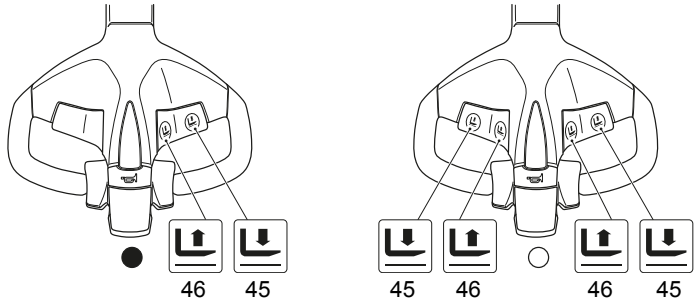
NOTE

Risk of material damage to the hydraulic unit

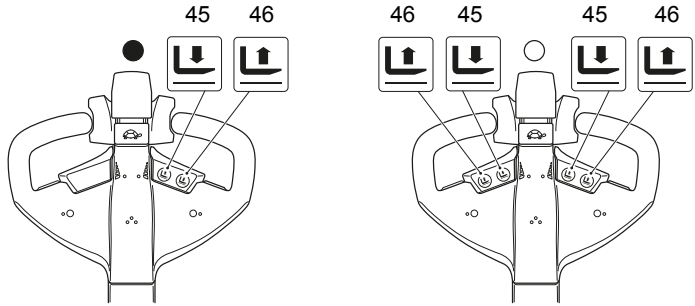
When the mechanical end stop of the load has been reached, release the "Raise load handler" button. Otherwise the hydraulic unit could suffer material damage.

The load handler is raised.

Tiller from above



Tiller from below



Hydraulic unit lag (●)

When the "Raise load handler" button (46) is released the hydraulic unit will continue to run for a while. The load handler continues to lift temporarily and the desired lift height can be exceeded.

Precision lifting (○)

The hydraulic unit lag is minimised. This avoids exceeding the desired lift height.

4.8.2 Lowering the load handler

Requirements

– Prepare the truck for operation, see "Preparing the truck for operation" on page 53.

Procedure

• Press the “Lower load handler” button (45) until you reach the desired lift height.

The load handler is lowered.

Slow lowering (○)

The lowering speed can be controlled in two stages through the button stroke (approx. 8 mm):
A short stroke results in lowering at a reduced speed.
A long stroke results in lowering at full speed.

4.8.3 Raising the wheel arms

EMC 110 RK

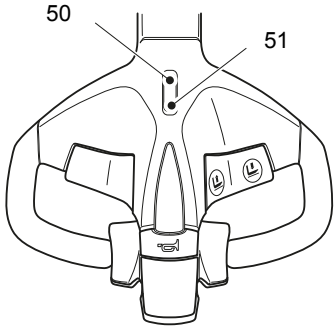
Requirements

– Prepare the truck for operation, see page 53.

Procedure

- Set the rocker switch on the tiller head to "Ramp Comfort" (50).
- Press the "Load handler raise" button (46) until the support arms reach the desired height.

  The support arms have been raised.
- Reset the rocker switch in the tiller head to "Mast lift" (51).



4.8.4 Lowering the wheel arms

EMC 110 RK

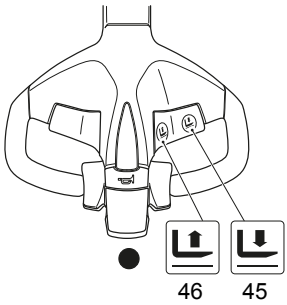
Requirements

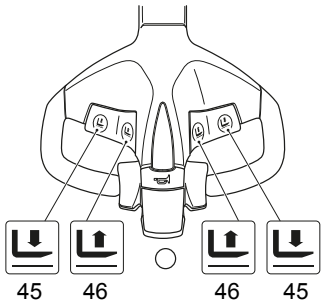
– Prepare the truck for operation, see page 53.

Procedure

- Set the rocker switch on the tiller head to "Ramp Comfort" (50).
- Press the “lower load handler” button (45) until the support arms reach the desired height.

  The support arms have been lowered.
- Reset the rocker switch in the tiller head to "Mast lift" (51).





4.9 Lifting, transporting and depositing loads

⚠ WARNING!

Unsecured and incorrectly positioned loads can cause accidents.

Before lifting a load unit, the driver 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 over or falling off the truck.
- ▶ Damaged loads must not be transported.
- ▶ Never exceed the maximum loads specified on the load diagram.
- ▶ Never stand underneath a raised load handler.
- ▶ Do not stand on the load handler.
- ▶ Do not lift other people on the load handler.
- ▶ Insert the load handler as far as possible underneath the load.

⚠ CAUTION!

- ▶ Do not lift long loads at an angle.

4.9.1 Raising a load

Requirements

– Load correctly palletised.
– Load weight matches the truck's capacity.
– Load handler evenly loaded for heavy loads.

Procedure

- Drive the truck carefully up to the pallet.
- Drive the load handler slowly into the pallet until the pallet is against the back of the load handler (see graphic to the right).

➔ The load must not extend by more than 50 mm beyond the load handler tips.

- Raise the load handler until the desired height is reached, (see page 68).

The load is being raised.

NOTE

Risk of material damage to the hydraulic unit

When the mechanical stops of the load handler have been reached, release the "raise load handler" button. Otherwise the hydraulic unit may suffer material damage.

Hydraulic unit lag (●)

When the "Raise load handler" button (46) is released the hydraulic unit will continue to run for a while. The load handler continues to lift temporarily and the desired lift height can be exceeded.

Precision lifting (○)

The hydraulic unit lag is minimised. This avoids exceeding the desired lift height.

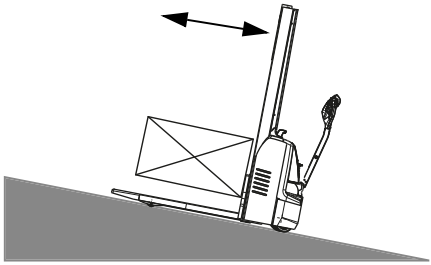
4.9.2 Transporting loads

Requirements

– Load raised correctly.
– Mast lowered for transport (approx. 150 - 200 mm above the ground).
– Good ground conditions.

Procedure

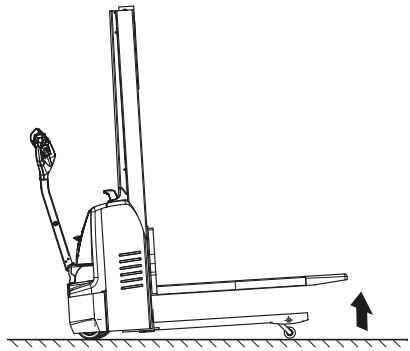
- Accelerate and decelerate with care.
- Adapt your travel speed to the conditions of the route and the load you are transporting.
- Travel at a constant speed.
- Be prepared to brake at all times.
  - Brake gently in normal circumstances.
  - Only stop abruptly in hazardous situations.
- Watch out for other traffic at crossings and passageways.
- Always travel with a lookout at blind spots.
- Do not travel across or at an angle on inclines. Do not turn on slopes and inclines, and always drive with the load facing uphill (see graphic).



Transporting a load with Ramp Comfort

Procedure

- Raise the support arms on changes of gradient and undulating ground, see page 70. The support arm cylinders extend. The ground clearance below the support arms increases.



4.9.3 Depositing a load

⚠ CAUTION!

Loads must not be set down on transport or escape routes, in front of safety installations or factory equipment that must be accessible at all times.

Requirements

– Storage location suitable for storing the load.

Procedure

- Drive the truck carefully up to the storage location.
- Lowers the load handler.

➔ To avoid damaging the load and the load handler, avoid setting the load down abruptly.

- Lower the load handler so that it is clear of the load (see page 69).
- Carefully drive the load handler out from beneath the pallet.

The load is deposited.

➔ The lower speed cannot be adjusted.

NOTE

Avoid depositing the load suddenly to avoid damaging the load, load handler and the rack.

Slow lowering (○)

The lowering speed can be controlled in two stages through the button stroke (approx. 8 mm):
A short stroke results in lowering at a reduced speed.
A long stroke results in lowering at full speed.

4.10 Use as a Lift Work Table

The load handler can remain in a raised position to be used as a lift work table when the truck is switched off, provided the operator is close to the truck.

➔ Immediate vicinity of the truck is when the operator is able to respond to malfunctions or attempts to use the truck by unauthorised persons immediately.

Observe national regulations and local operating conditions.

⚠ WARNING!

A raised load handler can cause accidents

A stationary truck with a raised load handler is potentially hazardous in work areas.

- ▶ Prevent any risk to personnel and materials.
- ▶ Never load or discharge loads manually with a raised load handler in areas that are hazardous, with limited visibility or insufficient lighting.
- ▶ Park the truck securely when leaving it, see page 55.

⚠ WARNING!

Risk of accident when the raised load handler slowly lowers of its own accord

The raised load handler can lower independently due to internal leakage. According to DIN EN ISO 3691-1 the load handler may lower by up to 100 mm during the first 10 minutes at the rated capacity with the hydraulic oil at normal operating temperature.

- ▶ Never stand underneath a raised load handler.

⚠ WARNING!

Lateral support arms can cause accidents

Standing on or climbing over lateral support arms can lead to injury from tripping or slipping.

- ▶ Do not stand on or climb over lateral support arms.
- ▶ Do not load or discharge loads manually from the side when the load handler is raised on trucks with lateral support arms.

⚠ WARNING!

Risk of injury from falling loads

Falling loads can cause injuries.

- ▶ Never stand underneath a raised load handler.
- ▶ Never manually load or unload loads that could fall on the operator without additional safety devices at heights greater than 1800 mm.
- ▶ Always load loads so that they cannot fall off or accidentally shift.
- ▶ Secure low or small-item loads e.g. by wrapping them in film.
- ▶ Do not manually load or unload loads that are not correctly packed or have shifted as well as loads with damaged pallets or damaged stacking containers.

Use as a lift work table

Requirements

– Storage spare suitable for manual loading or discharging of loads.

Procedure

- Drive the truck carefully up to the storage location.
- Press the “Raise load handler ” button (46) until you reach the desired lift height.
- Switch off the truck.

Loads can be loaded or discharged manually with the load handler raised.

5 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.

5.1 Truck does not start

Possible Cause	Remedy
Emergency Disconnect pressed	Unlock the Emergency Disconnect
Key switch set to O	Set the key switch to “I”
Battery charge too low	Check the battery charge and charge battery if necessary
Faulty fuse	Check fuses
Incorrect code entered in display unit (○)	Enter correct code, see page 93
Incorrect code entered in keypad (○)	Enter correct code, see page 97
Incorrect transponder used on transponder reader (○)	Use correct transponder, see page 101
Tiller not in brake position when the truck is switched on (Event message E0914)	Set the tiller to the top or bottom brake zone, see page 65
Lift/lower rocker switch not in home position when truck switched on (Event message E2951)	Do not press the lift/lower rocker switch.
Travel switch not in home position when truck switched on. (Event message E1901)	Do not press the travel switch
Collision safety switch applied when truck switched on (Event message E1914)	Do not apply collision safety switch
Slow travel button pressed when truck switched on (Event message E1925)	Do not press button

5.2 Load cannot be lifted

Possible Cause	Remedy
Truck not operational	Carry out all measures listed under “Truck does not start”
Hydraulic oil level too low	Check the hydraulic oil level
Battery discharge monitor has switched off	Charge battery
Faulty fuse	Check fuses
Excessive load	Note maximum capacity, see data plate
Tiller not in brake position when the truck is switched on (Event message E0914)	Set the tiller to the top or bottom brake zone, see page 65
Lift/lower rocker switch not in home position when truck switched on (Event message E2951)	Do not press the lift/lower rocker button.
Travel switch not in home position when truck switched on. (Event message E1901)	Do not press the travel switch
Collision safety switch applied when truck switched on (Event message E1914)	Do not apply collision safety switch
Slow travel button pressed when truck switched on (Event message E1925)	Do not press button

6 Operating the truck without its own drive system

6.1 Release and activate the drive wheel brake

⚠ WARNING!

Accidental truck movement

When the brakes are de-activated the truck must be parked on a level surface, since the brakes are no longer effective.

▶ Do not release the brake on slopes or inclines.

▶ Do not park the truck with the brake released.

▶ Apply the brake again when you reach your destination.

Release the brake

Tools and Material Required

– Two M5x45 screws

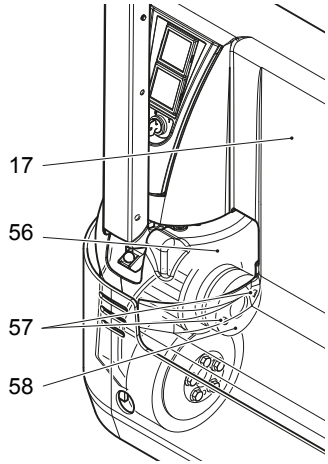
– Spanner wrench

Procedure

- Switch off the truck, to do this:
  - Turn the key in the key switch (16) anti-clockwise as far as it will go. Remove the key from the key switch (2).
- Press the Emergency Disconnect switch (6).
- Prevent the truck from rolling away.
- Remove the front panel (17) and right-hand drive panel (56). see "Industrial Truck Maintenance" on page 105.
- Pull up the anchor plate by screwing in two M5x45 screws (57) as far as the stop.

  The two M5x45 screws (57) are used to tension (unlock) the compression springs which activate the parking brake, so that the truck does not brake when de-energised.
- Remove the wedges.

The brake is now released. The truck can be moved.



Activating the brake

Procedure

- Use wedges to prevent the truck from moving.
- Remove the two M5x45 screws (57) from the brake (58).

⚠ CAUTION!

Open covers can cause injury and accidents

▶ The covers (battery cover, side panels, drive compartment cover etc.) must be closed during operation.

- Fit the right-hand drive panel (56).
- Fit the front panel (17).

The brake has been reactivated. The brake is now be applied without current.

7 Load handler emergency lowering

⚠ WARNING!

Load handler emergency lowering

- ▶ Instruct other people to move out of the hazardous area of the truck during emergency lowering.
- ▶ Never step or stand underneath a raised load handler.
- ▶ Only operate the emergency lowering valve when standing next to the truck.
- ▶ When the load handler is in the racking, emergency lowering is not permitted.
- ▶ 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.

If the mast cannot be lowered any further due to a fault, apply emergency lowering on the hydraulic unit.

Load Handler Emergency Lowering

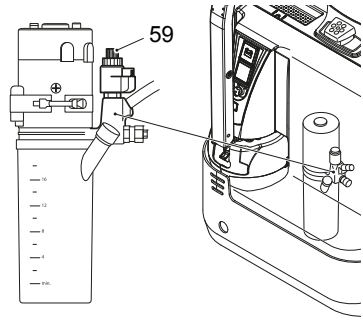
Requirements

– Load handler is not in the rack.

Procedure

- Turn key switch to “0”.
- Press the Emergency Disconnect switch.
- Open the front panel, see "Front cover disassembly" on page 115.
- Undo the screw (59) four even turns.

The load handler is lowered.



After emergency lowering

Procedure

- Insert the screw (59) as far as the stop.

⚠ CAUTION!

Only operate the truck once the fault has been removed.

8 Optional equipment

8.1 Forks

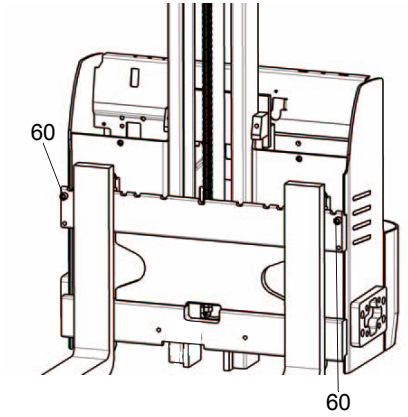
8.1.1 Adjusting the forks

⚠ WARNING!

Unsecured and incorrectly adjusted forks can cause accidents

Before adjusting the forks make sure the retaining bolts (60) are fitted.

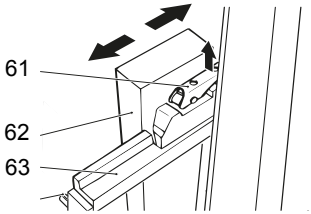
- ▶ Adjust the forks so that both forks are equidistant from the outside edge of the fork carriage.
- ▶ Engage the locking pin in a groove to prevent the forks from moving accidentally.
- ▶ The load centre of gravity must be located centrally between the forks.



Adjusting the forks

Requirements

– Park the truck securely, see "Parking the truck securely" on page 55.



Procedure

- Lift up the locking lever (61).
- Push the forks (62) into the correct position on the fork carriage (63).

➔ To lift the load securely, the forks (62) 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 (62).

- Lift the locking lever down (61) and move the forks until the locking pin engages in a slot.

The forks are now adjusted.

8.1.2 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 (60) and make sure the bolts are seated correctly. Retaining bolt torque: 84 Nm.

Replacing the Forks

Requirements

– Load handler lowered and fork tines not touching the ground.

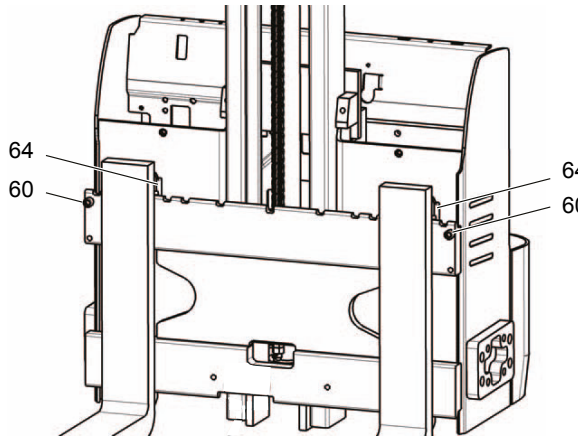
Procedure

- Loosen the fork stop (64).
- Carefully push the forks up to the middle of the fork carriage and lift them out over the recess.

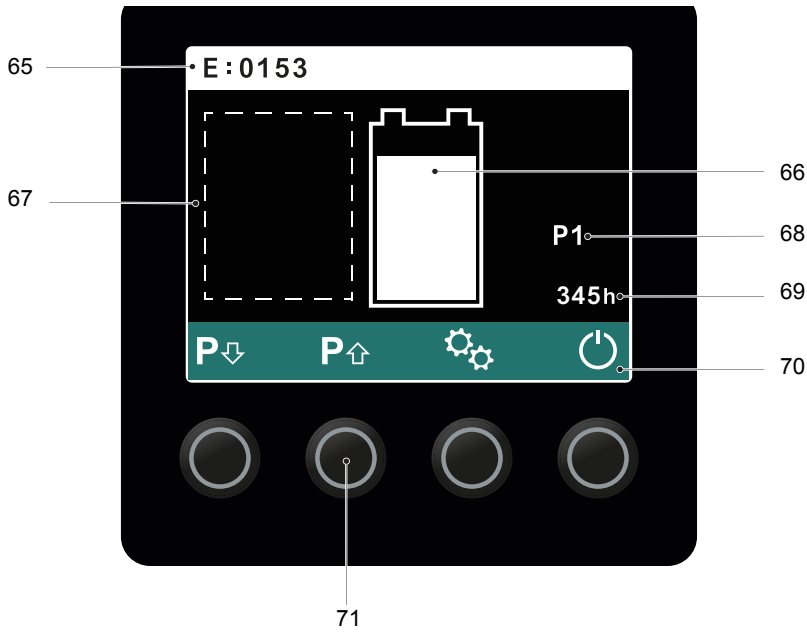
The forks are now dismantled from the load carriage and can be replaced.

⚠ CAUTION!

Use only 2A forks.



8.2 Display (2 Inch)



Item	Control or display	Function
65	Information field	Displays event messages
66	Battery capacity display	Battery discharge status
67	Icon field	Displays the icons, see "Symbols in the display" on page 88.
68	Operating program	Shows the operating program selected.
69	Service hours	see "Hourmeter" on page 19
70	Button allocation	see "Button allocation of the display" on page 86
71	Key	Selection key for the corresponding functions.

8.2.1 Button allocation of the display

Main menu symbols

Symbol	Meaning
	Travel program down: To switch the travel program down
	Travel program up: To switch the travel program up
	Settings: Change to setting mode. Set time and access authorisations (optional). To change to the menu to administer the codes or transponders
	Switching off: Allows the truck to be switched off.

Additional symbols

Symbol	Meaning
	Change master code: To change the master code and to activate the keypad or the transponder reader
	Edit access code / transponder To add or delete access codes or transponders
	Selection up: To select access codes or transponders
	Selection down: To select access codes or transponders
	Delete: To delete access codes or transponders selected
	Add: To add new access codes or new transponders
	Back: Cancels the current procedure and returns to the previous menu.
	Confirm: To confirm an entry or a transponder code

8.2.2 Symbols in the display

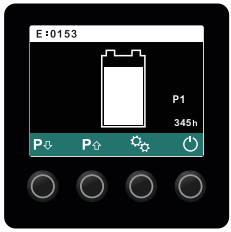
Any number of pictograms can be displayed in the pictogram field (67). Which pictograms are shown in the pictogram field depends on the operating and truck status.

Symbol	Meaning	Colour	Function
	Stop notice	Red	Functions deactivated due to truck malfunction
	Warning	Yellow	Operating error
		Red	Truck malfunction detected. Travel is restricted to slow travel or lift, lower and travel functions are reduced.
	Battery indicator, low residual capacity	Yellow	Residual capacity ≤ 30% [1]
		Red	Residual capacity ≤ 20% [2]
	Overtemperature	Yellow	Overtemperature detected. Lifting, lowering and travel functions reduced.
		Red	Overtemperature detected. Lifting, lowering and travel functions deactivated.
	Slow travel	Green	Lights up when "slow travel" button pressed (travel speed reduction).
	Tiller position	Yellow	Lights up on power-up with tiller in travel zone. Lights up when travel switch applied, tiller in brake zone and slow travel button not pressed.
	Charging process	Green	Battery charge display (on-board charger only): – Flashing: Charging in progress – Steady light: Charging completed
		Red	Charging interrupted

1. The battery must be charged soon.
2. The battery must be charged immediately.

8.3 Keyless Access System

The keyless access system allows an individual operator code to be allocated to each operator or group of operators.



53

15

54

Item	Description
53	Display unit (EasyAccess soft key): – Description see "Display (2 Inch)" on page 85 – Enter 4-digit master and access codes – Up to 10 access codes can be saved – For master and access codes with the numbers 1 to 4
15	Keypad (EasyAccess PINCode): – consists of the keys 0 to 9 and C (delete) – Enter 4-digit master and access codes – Up to 100 access codes can be saved
54	Transponder reader (EasyAccess Transponder): – Up to 100 transponders can be saved

8.4 General Information about the Use of Keyless Access Systems

The default code is to be found on a sticker. When using the truck for the first time, change the master code and remove the sticker!

– Default code: 1-2-3-4
– Default master code: 2-4-1-2

➔ When allocating the codes, ensure the rider trucks are given a different code than pedestrian trucks.

➔ When a valid code is entered or a valid transponder used, a green tick appears in the display unit.
When an invalid code has been entered or a invalid transponder used, a red cross is displayed, and the entry must be repeated.

➔ If the truck is not used for a certain length of time, the display unit switches to standby mode. Pressing any key cancels the standby mode.

The following additional settings can be performed by the manufacturer's customer service department.

8.5 Commissioning the Keypad and the Transponder Reader

If the truck is equipped with a keypad or a transponder reader, it can only be operated using the keys in the display unit. The keypad and the transponder reader have to be activated by the operating company.

8.5.1 Activating the keypad

Procedure

- Release the Emergency Disconnect switch, see page 59.
- Enter the default code 1-2-3-4 with the keys below the display unit (53).

  The truck is switched on.

- Press the key below the "Settings" symbol (72).
- Press the key below the "Change master code" symbol (73).
- Enter master code 2-4-1-2 with the keypad (15).

  The master code entered is displayed.

When starting the truck for the first time, change the master code. The new master code must not be the same as the previously set master code or an access code.

- Press the key below the "Delete" symbol (74).

  The master code is deleted.

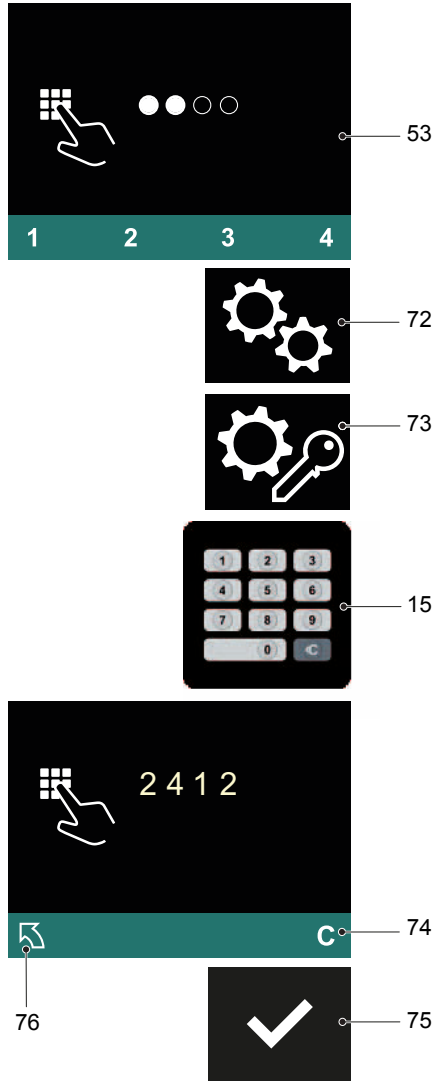
- Enter a new master code with the keypad (15).
- Press the key below the "Confirm" symbol (75).

  The new master code is displayed.

If the new master code was entered incorrectly, the procedure can be repeated using the key below the "Delete" symbol (74).

- To return to the main menu, press the key below the "Back" symbol (76).
- Delete the default code, see "Deleting an access code" on page 100.
- Create access codes, see "Adding a new access code" on page 99.

The keypad is active.



8.5.2 Activating the transponder reader

Procedure

- Release the Emergency Disconnect switch, see page 59.
- Enter the default code 1-2-3-4 with the keys below the display unit (53).
  The truck is switched on.
- Press the key below the "Settings" symbol (72).
- Press the key below the "Change master code" symbol (73).
- Enter the master code 2-4-1-2 with the keys below the display unit (53).
  The master code entered is displayed.
- Press the key below the "Delete" symbol (74).
  The master code is deleted.
- Hold a transponder in front of the transponder reader (54).
  The transponder thus becomes the master transponder.
- Press the key below the "Confirm" symbol (75).
  The master transponder code is displayed.

If the wrong transponder has been used, the procedure can be repeated using the key below the "Delete" symbol (74).

- To return to the main menu, press the key below the "Back" symbol (76).

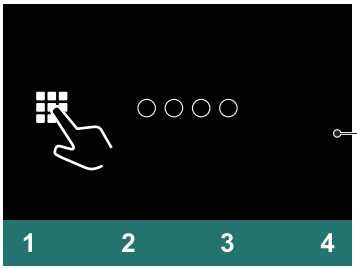
The default code can no longer be used and must be deleted.

- Delete the default code, see "Deleting transponders" on page 104.
- Add new transponders, see "Adding a new transponder" on page 103.

The transponder reader is now active.

8.6 Using the Display:

8.6.1 Switch on the truck with the access code.



Procedure

- Release the emergency disconnect switch, see page 59.
- Enter the access code with the buttons below the display (53).

The truck is switched on.

8.6.2 Switching off the truck

Procedure

- Press the key under the "Switch off" symbol (77) in the display unit.
- Press the Emergency Disconnect switch, see "Emergency Disconnect" on page 59.

The truck is switched off.

8.6.3 Changing the master code

Requirements

– Truck is switched on, see "Switch on the truck with the access code." on page 97.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Change master code" symbol (73).
- Enter the master code with the keys below the display unit (53).

  The master code entered is shown as filled-in circles.

- Press the key below the "Delete" symbol (74).

  The master code is deleted.

- Enter the new master code with the keys below the display unit (53).

  The new master code must be different from existing access codes.

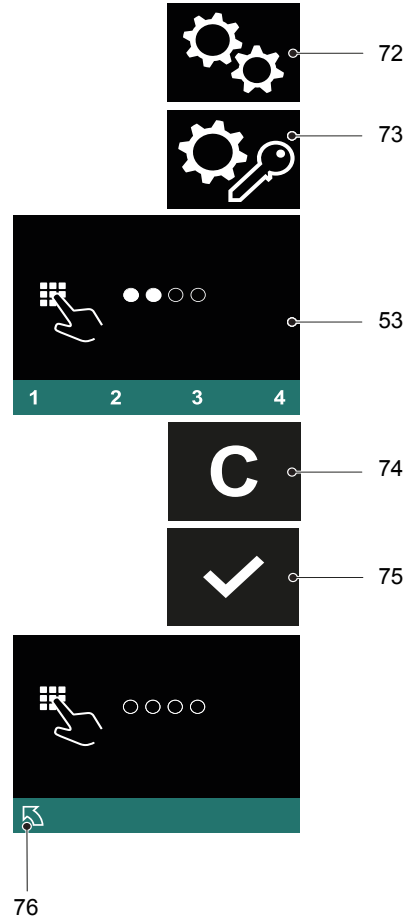
- Press the key below the "Confirm" symbol (75).

  The new master code is displayed.

  If the new master code has been entered incorrectly, delete it and enter the correct master code.

- To return to the main menu, press the key below the "Back" symbol (76).

The master code has been changed.



8.6.4 Adding a new access code

Requirements

– Truck is switched on, see "Switch on the truck with the access code." on page 97.

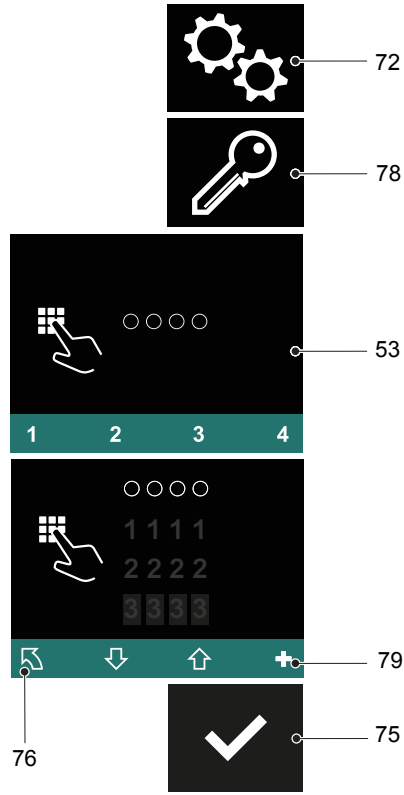
Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Edit access code" symbol (78).
  The master code is requested.
- Enter the master code with the keys below the display unit (53).
  All the access codes are displayed.
- Press the keys below the "Add" symbol (79).
- Enter the new access code with the keys below the display unit (53).

  The new access code must be different from existing access codes.
- Press the key below the "Confirm" symbol (75).
  The new access code is displayed.

  If the new master code has been entered incorrectly, delete it see page 100, and enter the correct access code.
- To return to the main menu, press the key below the "Back" symbol (76).

A new access code has been added.



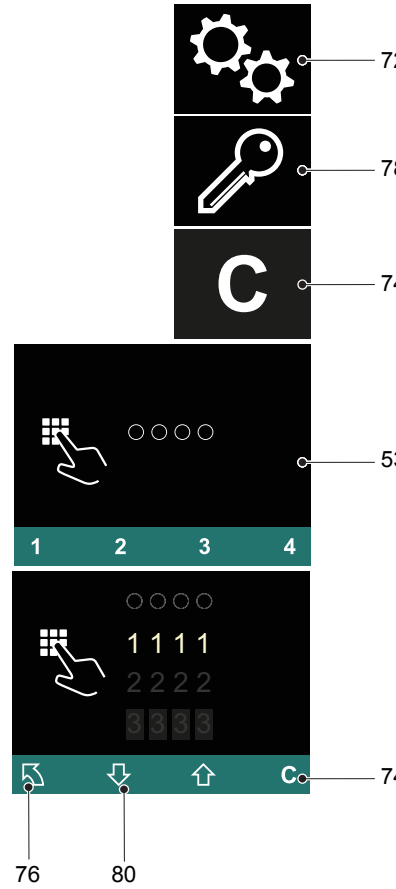
8.6.5 Deleting an access code

Requirements

– Truck is switched on, see "Switch on the truck with the access code." on page 97.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Edit access code" symbol (78).
  The master code is requested.
- Enter the master code with the keys below the display unit (53).
  All the access codes are displayed.
- Select the access code to be deleted with the key below the "Selection down" symbol (80).
- Press the key below the "Delete" symbol (74).
  The access code has been deleted.
- To return to the main menu, press the key below the "Back" symbol (76).



8.7 Using the Keypad

8.7.1 Switch on the truck with the access code.

Procedure

- Release the emergency disconnect switch, see page 59.
- Enter the access code with the keypad (15).

The truck is switched on.

15

8.7.2 Switching off the truck

Procedure

- Press the key under the "Switch off" symbol (77) in the display unit.
- Press the Emergency Disconnect switch, see "Emergency Disconnect" on page 59.

The truck is switched off.

77

8.7.3 Changing the master code

Requirements

– Truck is switched on, see "Switch on the truck with the access code." on page 97.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Change master code" symbol (73).
- Enter the master code with the keypad (15).
  The master code entered is shown in the display unit (53) as filled-in circles.
- Press the key below the "Delete" symbol (74).
  The master code is deleted.
- Enter a new master code with the keypad (15).

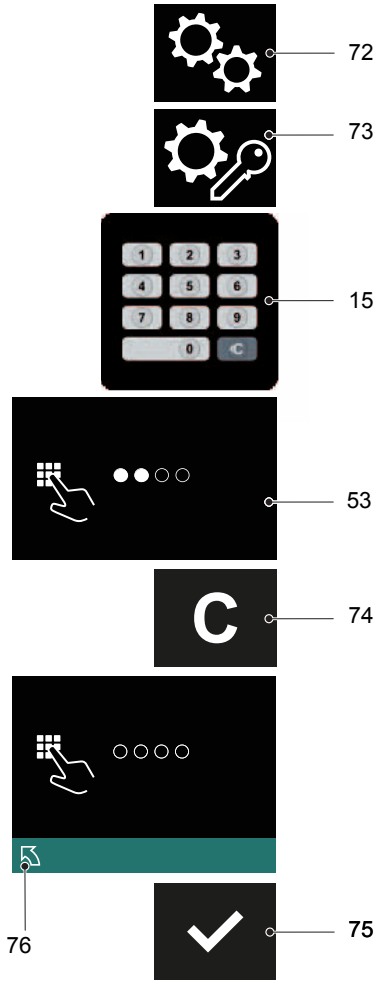
The new master code must be different from existing access codes.

- Press the key below the "Confirm" symbol (75).
  The new master code is displayed.

If the new master code has been entered incorrectly, delete it and enter the correct master code.

- To return to the main menu, press the key below the "Back" symbol (76).

The master code has been changed.



8.7.4 Adding a new access code

Requirements

– Truck is switched on, see "Switch on the truck with the access code." on page 97.

Procedure

- Press the button below the "Settings" symbol (72).
- Press the button below the "Edit access code" symbol (78).
  The master code is requested.
- Enter the master code with the keypad (15).
  All access codes are shown in the display unit (53).
- Press the key below the "Add" symbol (79).
- Enter a new access code with the keypad (15).

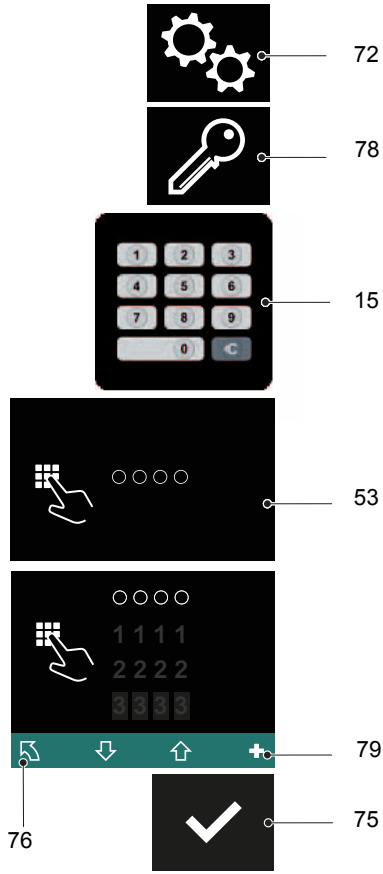
The new access code must be different from existing access codes.

- Press the button below the "Confirm" symbol (75).
  The new access code is shown in the display unit (53).

If the new master code has been entered incorrectly, delete it see page 100, and enter the correct access code.

- To return to the main menu, press the key below the "Back" symbol (76).

A new access code has been added.



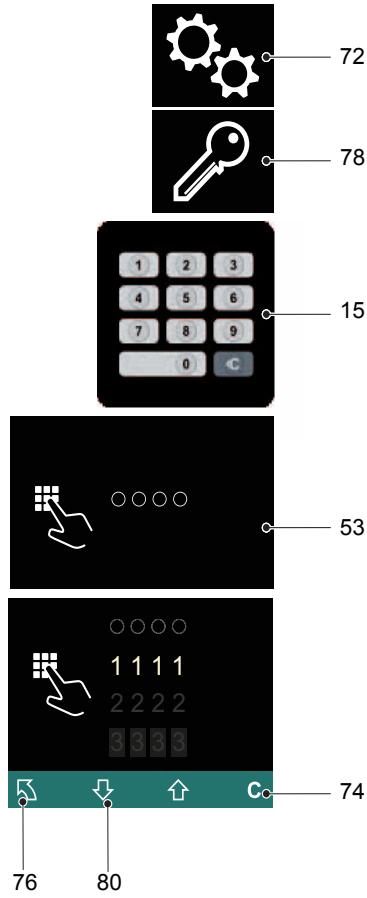
8.7.5 Deleting an access code

Requirements

– Truck is switched on, see "Switch on the truck with the access code." on page 97.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Edit access code" symbol (78).
  The master code is requested.
- Enter the master code with the keypad (15).
  All access codes are shown in the display unit (53).
- Select the access code to be deleted with key below the "Selection down" symbol (80).
- Press the key below the "Delete" symbol (74).
  The access code has been deleted.
- To return to the main menu, press the key below the "Back" symbol (76).



8.8 Using the Transponder Reader

NOTE

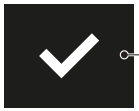
Take care not to damage the transponder. If the transponder is damaged, the truck cannot be switched on.

8.8.1 Switching on the truck with the transponder

Procedure

- Release the Emergency Disconnect switch, see page 59.
- Hold the transponder in front of the transponder reader (54).
  A green tick appears and remains until the transponder has been confirmed. If there is no confirmation within 20 seconds the access prompt appears.
- Press the button below the "Confirm" symbol (75).

The truck is switched on.



The truck can only be switched on when the display unit (53) is lit. If the display unit is in standby the code or transponder will not be recognised. Pressing any key cancels standby mode.

8.8.2 Switching the truck off (transponder reader)

Procedure

- Press the key under the "Switch off" symbol (77) in the display unit.
- Press the Emergency Disconnect switch, see "Emergency Disconnect" on page 59.

The truck is switched off.

8.8.3 Changing the master transponder

Requirements

– Truck is switched on, see "Switching on the truck with the transponder" on page 101.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Change master code" symbol (73).
- Place the master transponder on the transponder reader (54).
  The master transponder code is shown in the display unit (53).
- Press the key below the "Delete" symbol (74).
  A dashed line is shown.
- Place a new master transponder on the transponder reader (54).

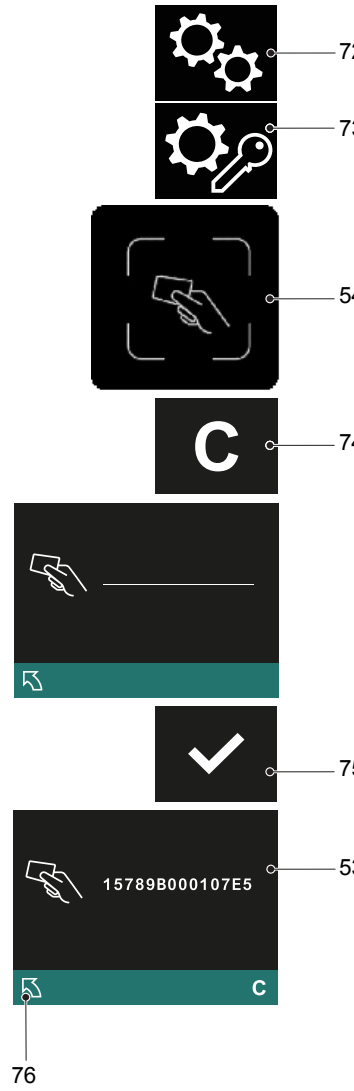
➔ The new master transponder code must be different from existing master transponder code.

- Press the key below the "Confirm" symbol (75).
  The new master transponder code is displayed.

➔ If the wrong transponder has been used, the procedure can be repeated using the key below the "Delete" symbol (74).

- To return to the main menu, press the key below the "Back" symbol (76).

The master transponder has been changed.



8.8.4 Adding a new transponder

Requirements

– Truck is switched on, see "Switching on the truck with the transponder" on page 101.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Edit transponder" symbol (78).
  The master transponder is requested.
- Place the master transponder on the transponder reader (54).
  All transponder codes are shown in the display unit (53).
- Press the key below the "Add" symbol (79).
- Place a new transponder on the transponder reader (54).

The new transponder code must be different from existing transponder code.

- Press the key below the "Confirm" symbol (75).
  The new code is displayed.

If the wrong transponder has been used, delete it, see page 104, and add a correct transponder.

- To return to the main menu, press the key below the "Back" symbol (76).

A new transponder has been added.

The transponder codes saved are sorted first of all numerically and then alphabetically.

8.8.5 Deleting transponders

Requirements

– Truck is switched on, see "Switching on the truck with the transponder" on page 101.

Procedure

- Press the key below the "Settings" symbol (72).
- Press the key below the "Edit transponder" symbol (78).
  The master transponder is requested.
- Place the master transponder on the transponder reader (54).
  All transponder codes are shown in the display unit (53).
- Select the transponder code to be deleted with key below the "Selection down" symbol (80).
- Press the key below the "Delete" symbol (74).
  The transponder has been deleted.
- To return to the main menu, press the key below the "Back" symbol (76).

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.

⚠ WARNING!

Risk of accidents and component damage

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

Exception: Operating companies should only make changes or have changes made to powered industrial trucks if the manufacturer is no longer operating in the field and there is no successor to the business; operating companies 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 "Restoring the truck to service after maintenance and repairs" on page 124).

2 Maintenance Safety Regulations

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 "Maintenance and repairs" on page 114.

2.1 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 "Parking the truck securely" on page 55).
- ▶ Disconnect battery.
- ▶ Remove any rings, metal wristbands etc.

2.2 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. Oil changes should be carried out by the manufacturer's customer service department, whose staff are specially trained for this task.

- ▶ Note the safety regulations when handling these materials.

2.3 Wheels

⚠ WARNING!

The use of wheels that do not comply with the manufacturer's specifications can result in accidents

The quality of wheels affects the stability and driving characteristics of the truck.

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

- ▶ After replacing wheels, make sure the truck is not skewed.
- ▶ Always replace wheels in pairs, i.e. the left- and right-hand wheels at the same time.

When replacing wheels fitted at the factory, only use the manufacturer's original spare parts. Otherwise the manufacturer's specification will not be adhered to.

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.

⚠ WARNING!

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. 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.

2.5 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.

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.

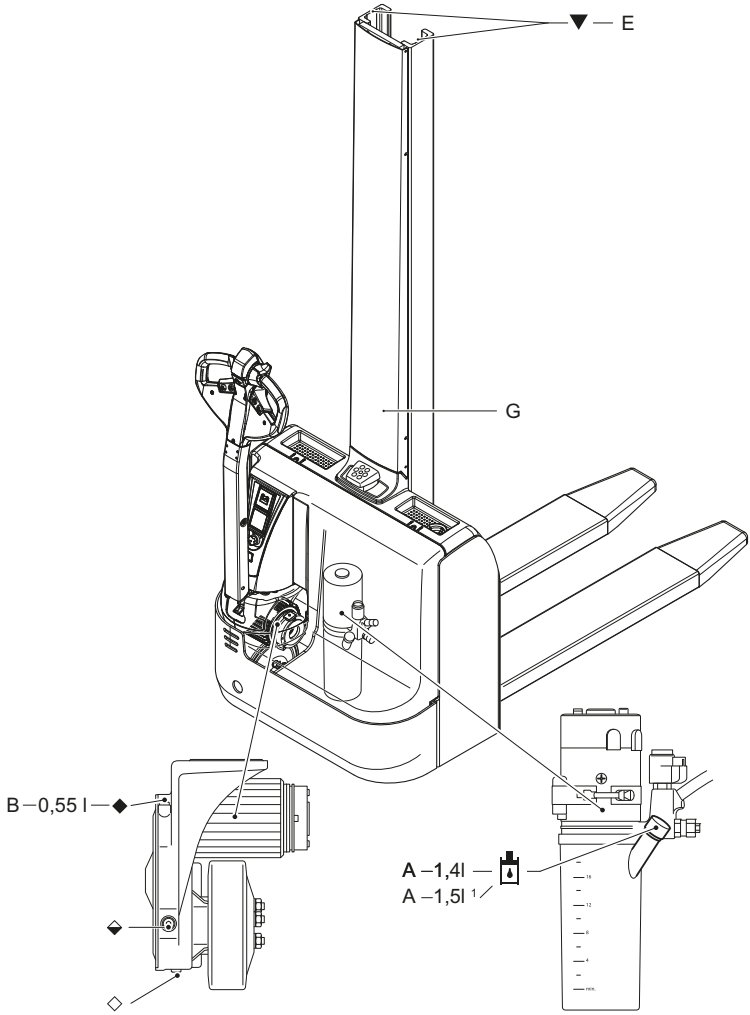
⚠ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable environmental-protection regulations. Oil changes should be carried out by the manufacturer's customer service department, whose staff are specially trained for this task.

- ▶ Note the safety regulations when handling these materials.

3.2 Lubrication Schedule



▼	Running surfaces	◆	Transmission oil filler neck
◇	Transmission oil drain plug	◆	Transmission oil overflow and control plug
	Hydraulic oil filler plug		

1 version with high mast (+460 mm) (○)

3.3 Consumables

Code	Order no.	Package quantity	Component	Used for
A	51 132 827	5.0 l	Jungheinrich hydraulic oil HVLP 32	Hydraulic System
	51 132 826*	1.0 l		
B	50 380 904	5.0 l	Titan Cytrac HSY 75W-90	Transmission
E	29 202 050	1.0 kg	Polylube GA 352P	Lubrication
G	29 201 280	0.4 l	Chain spray	Chains

* The trucks are supplied from the factory with a special hydraulic oil (Jungheinrich hydraulic oil with a blue colouration). The Jungheinrich hydraulic oil is available only from the Jungheinrich service department. The named alternative hydraulic oil is permitted but can lead to reduced functionality. The Jungheinrich hydraulic oil can be mixed with the named alternative hydraulic oil.

Grease guidelines

Code	Saponification	Dew point °C	Worked penetration at 25 °C	NLG1 class	Application temperature °C
E	Lithium	>220	280 - 310	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:

Procedure

- Park the truck securely, see "Parking the truck securely" on page 55.
- Press the Emergency Disconnect switch, see "Emergency Disconnect" on page 59.
- Disconnect the batteries before carrying out maintenance and repairs with the covers open or disassembled.

⚠ WARNING!

Risk of accidents when working under the load handler and lift truck

▶ When working under a raised load handler or a raised truck, secure them to prevent the truck from from lowering, tipping or sliding away.

▶ When raising the truck, follow the instructions, see "Transport and Commissioning" on page 29. When working on the parking brake, prevent the truck from accidentally rolling away (e.g. with wedges).

4.2 Front cover disassembly

Front cover disassembly

Requirements

– Prepare the truck for maintenance and repairs, see "Preparing the truck for maintenance and repairs" on page 114.

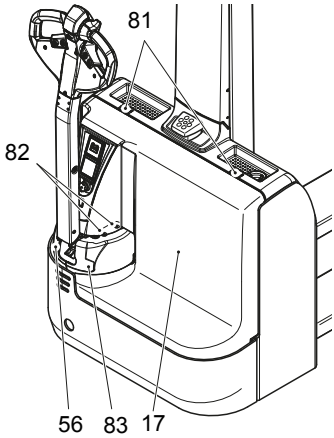
Tools and Material Required

– Hexalobular key size T45 (M8)

Procedure

- Remove the screws (81) with the hexalobular key.
- Lift and remove the front panel (17).
- Place the front panel (17) safely to one side.

The front cover has been removed.



4.3 Drive panel disassembly and assembly

The drive panel consists of two halves (56 and 83).

Drive panel disassembly

Tools and Material Required

– M6-Hexalobular key

Procedure

- Turn the tiller to the right limit position.
- Undo the 2 screws (82).
- Carefully remove the first half (56).
- Turn the tiller to the left limit position.
- Unscrew the second half (83) and carefully remove it.

The drive panel is now disassembled.

4.4 Lifting and jacking up the truck safely

⚠ WARNING!

Lifting and jacking up the truck safely

In order to raise the truck, the lifting gear must only be secured to the points specially provided for this purpose.

You may only work under a raised load handler if it has been secured with a sufficiently strong chain or the fastening bolt.

In order to raise and jack up the truck safely, proceed as follows:

- ▶ Jack up the truck only on a level surface and prevent it from moving accidentally.
- ▶ Always use a jack with sufficient capacity. When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).
- ▶ In order to raise the truck, the lifting gear must only be secured to the points specially provided for this purpose, see "Transport and Commissioning" on page 29.
- ▶ When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

4.5 Cleaning

4.5.1 Cleaning the truck

⚠ CAUTION!

Fire hazard

Do not use flammable liquids to clean the industrial truck.

- ▶ Press the Emergency Disconnect switch 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 "Identification Points and Data Plates" on page 25).
- ▶ Do not clean the truck with pressurised water.

Cleaning the truck

Requirements

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 114).

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:
  - Window(s)
  - 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 "Restoring the truck to service after maintenance and repairs" on page 124).

The truck is now clean.

4.5.2 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 "Preparing the truck for maintenance and repairs" on page 114).

Tools and Material Required

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

Procedure

- Expose the electrical system, see "Front cover disassembly" on page 115.
- 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 "Front cover disassembly" on page 115.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see "Restoring the truck to service after maintenance and repairs" on page 124).

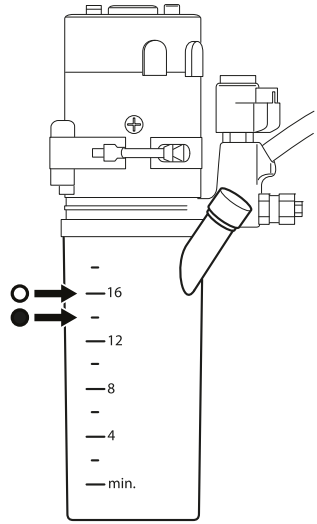
The electrical system assemblies are now clean.

4.6 Checking the hydraulic oil level

NOTE

There are markings on the hydraulic reservoir. Always check the hydraulic oil level when the load handler is lowered.

Check oil level



Requirements

– Fully lower the load handler.
– Prepare the truck for maintenance and repairs, see "Preparing the truck for maintenance and repairs" on page 114.
– Remove the front panel, see "Front cover disassembly" on page 115.

Procedure

- Check the oil level in the hydraulic reservoir.

➔ When the load handler is lowered the hydraulic oil level in the hydraulic reservoir must not exceed mark 18.

➔ Short mast version (●): When the load handler is lowered the hydraulic oil level in the hydraulic reservoir should be slightly above mark 14 (between 12 and 16). The hydraulic oil level should not be below mark 12.

➔ High mast version (○): When the load handler is lowered the hydraulic oil level in the hydraulic reservoir should be slightly above mark 16. The hydraulic oil level should not be below mark 15.

- If necessary add hydraulic oil of the correct grade, see "Consumables" on page 113.

➔ To bring the hydraulic oil up from mark 12 to 14 requires approx. 0,18 l of hydraulic oil.

➔ To bring the hydraulic oil up from mark 15 to 16 requires approx. 0,14 l of hydraulic oil.

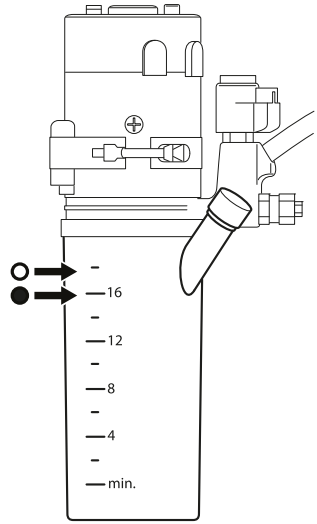
The oil level has now been checked.

4.7 Checking the Hydraulic Oil Level EMC 110 RK

NOTE

There are markings on the hydraulic reservoir. Always check the hydraulic oil level when the load handler is lowered.

Check oil level



Requirements

– Fully lower the load handler, see "Lowering the load handler" on page 69.
– Fully lower the support arms, see "Lowering the wheel arms" on page 70.
– Prepare the truck for maintenance and repairs, see "Preparing the truck for maintenance and repairs" on page 114.
– Remove the front panel, see "Front cover disassembly" on page 115.

Procedure

- Check the oil level in the hydraulic reservoir.

➔ When the load handler is lowered, the hydraulic oil level in the hydraulic reservoir must not exceed mark 18.

➔ Version with short mast (●) and Ramp Comfort: When the load handler is lowered, the hydraulic oil level in the hydraulic reservoir must not exceed mark 16. The hydraulic oil level should not be below mark 14.

➔ Version with high mast (○) and Ramp Comfort: When the load handler is lowered, the hydraulic oil level in the hydraulic reservoir must not exceed mark 18. The hydraulic oil level should not be below mark 16.

- If necessary, add hydraulic oil of the correct grade, see "Consumables" on page 113.

The oil level has now been checked.

4.8 Check wheel attachment and wear

⚠ CAUTION!

Replace the wheels if the wear limit (84) has been reached.

Checking the wheel attachments

Requirements

– To prepare the truck for maintenance and repairs, see "Preparing the truck for maintenance and repairs" on page 114

Tools and Material Required

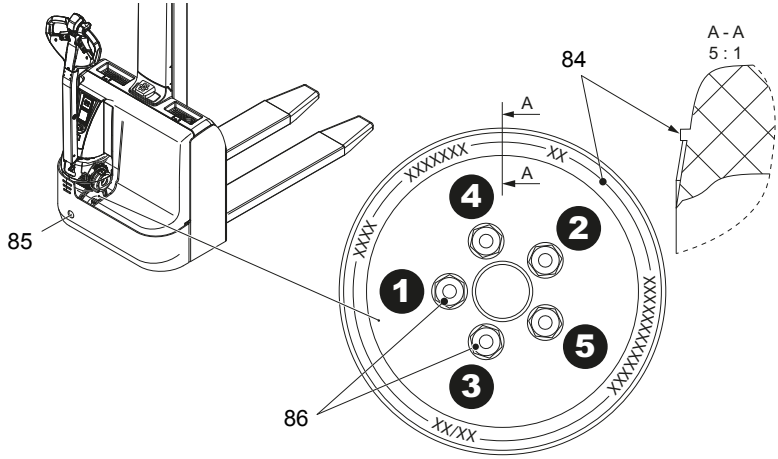
– Torque wrench

Procedure

- Remove the front panel, see "Front cover disassembly" on page 115.
- Torque the wheel bolts (86) crosswise with a torque wrench through the hole (85) in the skirt.

  Drive wheel bolt torques:
  - Step 1: Torque to 10 Nm in the order indicated.
  - Step 2: Torque to 150 Nm in the order indicated.

Wheel attachments checked.



4.9 Checking electrical fuses

Check fuses

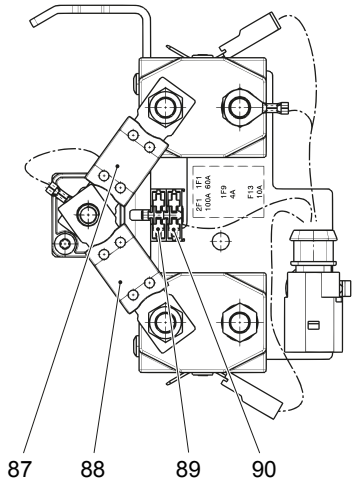
Requirements

– Truck prepared for maintenance and repairs, see "Preparing the truck for maintenance and repairs" on page 114.
– Front cover removed, see "Front cover disassembly" on page 115.

Procedure

• Check the fuse ratings against the table and replace if necessary.

The fuses are now checked.



Item	Component	To protect	Rating
87	1F1	Drive motor fuse	60 A
88	2F1	Pump motor fuse	100 A
89	1F9	Travel / lift electronics control fuse	4 A
90	F13	Solenoid / magnetic brake control fuse	10 amps

4.10 Restoring the truck to service after maintenance and repairs

Procedure

- Thoroughly clean the truck, see "Cleaning" on page 117.
- Lubricate the truck according to the lubrication schedule, see "Lubrication Schedule" on page 112.
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, see "Charging the battery" on page 38.
- 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 "Preparing the Truck for Operation" on page 52.

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.

➔ Jack up the truck, see "Lifting and jacking up the truck safely" on page 116.

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 "Cleaning" on page 117.
- Prevent the truck from rolling away accidentally.
- Check the hydraulic oil level and replenish if necessary, see "Checking the hydraulic oil level" on page 120.
- Apply a thin layer of oil or grease to any non-painted mechanical components.
- Lubricate the truck according to the lubrication schedule, see "Lubrication Schedule" on page 112.
- Charge the battery, see "Charging the battery" on page 38.
- 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.

➔ Charge the battery see "Charging the battery" on page 38.

5.3 Restoring the truck to service after decommissioning

Procedure

- Thoroughly clean the truck, see "Cleaning" on page 117.
- Lubricate the truck according to the lubrication schedule, see "Lubrication Schedule" on page 112.
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, see "Charging the battery" on page 38.
- 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 "Preparing the Truck for Operation" on page 52.

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

The truck must be inspected at least annually (refer to national regulations) or after any unusual event by a qualified inspector. The manufacturer offers a safety inspection service which is performed by personnel specifically trained for this purpose.

A complete test must be carried out on the technical condition of the truck with regard to safety. The truck must also be examined thoroughly for damage.

The operating company is responsible for ensuring that faults are rectified immediately.

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.

9 Servicing 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.

During the run-in period,after approx. 100 service hours, the owner must check the wheel nuts/bolts and re-tighten if necessary.

10 Maintenance Checklist EMC 110 / EMC B10

10.1 Operating Company

10.1.1 Standard Equipment

Braking		W	A	B	C
1	Test brakes.	●			

Electrical		W	A	B	C
1	Test warning and safety devices in accordance with operating instructions.	●			
2	Test emergency disconnect switch.	●			

Travel		W	A	B	C
1	Check wheels for wear and damage.	●			

Chassis and superstructure		W	A	B	C
1	Check chassis and screw connections for damage.	●			
2	Check doors and/or covers.	●			
3	Check labels are legible, complete and make sense.	●			

Hydraulic Operations		W	A	B	C
1	Check load chain lubrication and lubricate if necessary.	●			
2	Test hydraulic system.	●			
3	Check the hydraulic oil level and top up if necessary.	●			

Steering		W	A	B	C
1	Check tiller return function.	●			

Battery charger		W	A	B	C
1	Check mains connector and mains cable.	●			

10.2 Customer Service

10.2.1 Standard Equipment

Braking		W	A	B	C
1	Test brakes.			●	
2	Check the air gap of the magnetic brake.			●	

Electrical		W	A	B	C
1	Test cable and motor attachments.			●	
2	Test warning and safety devices in accordance with operating instructions.			●	
3	Test displays and controls.			●	
4	Test micro switch and adjust if necessary.			●	
5	Test emergency disconnect switch.			●	
6	Check contactors and/or relays.			●	
7	Check fuse ratings.			●	
8	Carry out a chassis insulation-resistance test.			●	
9	Check electric wiring for damage (insulation damage, connections). Make sure cable connections are secure.			●	

Power supply		W	A	B	C
1	Check battery cable connections are secure, check for dirt and grease terminals if necessary.			●	
2	Check battery and battery components.			●	
3	Check battery voltage.			●	

Travel		W	A	B	C
1	Check transmission oil level or grease filling of the transmission and top up if necessary.			●	
2	Check that sensors/switches are secured, not damaged, clean and operational.			●	
3	Check drivetrain mountings and bearings.			●	
4	Check transmission for noise and leakage.			●	
5	Note: Replace transmission oil after 10000 service hours.				
6	Check wheels for wear and damage.			●	
7	Check wheel bearings and wheel mounting.			●	

Chassis and superstructure		W	A	B	C
1	Check chassis and screw connections for damage.			●	
2	Check doors and/or covers.			●	
3	Check labels are legible, complete and make sense.			●	
4	Check mast mounting/bearings.			●	

Hydraulic operations		W	A	B	C
1	Test "hydraulic" controls and make sure their labels are legible, complete and plausible.			●	
2	Test lift sensor system in the mast and check for damage.			●	
3	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
4	Check load chain adjustment and tension if necessary.			●	
5	Check load chain lubrication and lubricate if necessary.			●	
6	Visually inspect the mast rollers and check running surface wear level.			●	
7	Test hydraulic system.			●	
8	Replace hydraulic oil filter and breather filter.				●
9	Check that hydraulic connections, hoses and pipes are secure and check for leaks and damage.			●	
10	Test emergency-lowering system.			●	
11	Check the hydraulic oil level and top up if necessary.			●	
12	Test relief valve and adjust if necessary.			●	
13	Replace hydraulic oil.				●
14	Check the forks or load handler for wear and damage.			●	
15	Test lift and lowering speeds.			●	

Agreed Services		W	A	B	C
1	Carry out a test run with rated load, if necessary with a customer-specific load.			●	
2	Lubricate the truck according to the lubrication schedule.			●	
3	Demonstration after maintenance.			●	

Steering		W	A	B	C
1	Check tiller return function.			●	

Battery charger		W	A	B	C
1	Check mains connector and mains cable.			●	
2	Test the immobiliser on trucks with an on-board charger.			●	
3	Check that cables and electrical connections are secure and not damaged.			●	
4	Carry out a potential measurement on the chassis while charging is in progress.			●	

10.2.2 Optional Equipment

Load backrest

Hydraulic Operations		W	A	B	C
1	Check attachment is properly secured to the truck and check the load-bearing components.			●	

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11 Maintenance Checklist EMC 110 RK

11.1 Operating Company

11.1.1 Standard Equipment

Braking		W	A	B	C
1	Test brakes.	●			

Electrical		W	A	B	C
1	Test warning and safety devices in accordance with operating instructions.	●			
2	Test emergency disconnect switch.	●			

Power supply		W	A	B	C
1	Check battery and battery components.	●			
2	Check battery connector for damage, proper function and secure mounting.	●			

Travel		W	A	B	C
1	Check wheels for wear and damage.	●			

Chassis and superstructure		W	A	B	C
1	Check chassis and screw connections for damage.	●			
2	Check doors and/or covers.	●			
3	Check labels are legible, complete and make sense.	●			

Hydraulic Operations		W	A	B	C
1	Check load chain lubrication and lubricate if necessary.	●			
2	Test hydraulic system.	●			
3	Check the hydraulic oil level and top up if necessary.	●			

Steering		W	A	B	C
1	Check tiller return function.	●			

11.1.2 Optional Equipment

ISO fork carriage with forged forks

Hydraulic Operations		W	A	B	C
1	Check the forks or load handler for wear and damage.	●			

11.2 Customer Service

11.2.1 Standard Equipment

Braking		W	A	B	C
1	Test brakes.			●	
2	Check the air gap of the magnetic brake.			●	

Electrical		W	A	B	C
1	Test cable and motor attachments.			●	
2	Test warning and safety devices in accordance with operating instructions.			●	
3	Test displays and controls.			●	
4	Test micro switch and adjust if necessary.			●	
5	Test emergency disconnect switch.			●	
6	Check contactors and/or relays.			●	
7	Check fuse ratings.			●	
8	Carry out a chassis insulation-resistance test.			●	
9	Check electric wiring for damage (insulation damage, connections). Make sure cable connections are secure.			●	

Power supply		W	A	B	C
1	Check battery cable connections are secure, check for dirt and grease terminals if necessary.			●	
2	Check battery and battery components.			●	
3	Check battery voltage.			●	
4	Check battery connector for damage, proper function and secure mounting.			●	

Travel		W	A	B	C
1	Check transmission oil level or grease filling of the transmission and top up if necessary.			●	
2	Check that sensors/switches are secured, not damaged, clean and operational.			●	
3	Check drivetrain mountings and bearings.			●	
4	Check transmission for noise and leakage.			●	
5	Note: Replace transmission oil after 10000 service hours.				
6	Check wheels for wear and damage.			●	
7	Check wheel bearings and wheel mounting.			●	

Chassis and superstructure		W	A	B	C
1	Check chassis and screw connections for damage.			●	
2	Check doors and/or covers.			●	
3	Check labels are legible, complete and make sense.			●	
4	Check mast mounting/bearings.			●	

Hydraulic operations		W	A	B	C
1	Test "hydraulic" controls and make sure their labels are legible, complete and plausible.			●	
2	Test lift sensor system in the mast and check for damage.			●	
3	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
4	Check load chain adjustment and tension if necessary.			●	
5	Check load chain lubrication and lubricate if necessary.			●	
6	Visually inspect the mast rollers and check running surface wear level.			●	
7	Test hydraulic system.			●	
8	Replace hydraulic oil filter and breather filter.				●
9	Check that hydraulic connections, hoses and pipes are secure and check for leaks and damage.			●	
10	Test emergency-lowering system.			●	
11	Check the hydraulic oil level and top up if necessary.			●	
12	Test relief valve and adjust if necessary.			●	
13	Replace hydraulic oil.				●
14	Check the forks or load handler for wear and damage.			●	
15	Test ramp comfort hydraulics, check for leaks and damage.			●	
16	Test lift and lowering speeds.			●	

Agreed Services		W	A	B	C
1	Carry out a test run with rated load, if necessary with a customer-specific load.			●	
2	Lubricate the truck according to the lubrication schedule.			●	
3	Demonstration after maintenance.			●	

Steering		W	A	B	C
1	Check tiller return function.			●	

Battery charger		W	A	B	C
1	Check mains connector and mains cable.			●	
2	Test the immobiliser on trucks with an on-board charger.			●	
3	Check that cables and electrical connections are secure and not damaged.			●	
4	Carry out a potential measurement on the chassis while charging is in progress.			●	

11.2.2 Optional Equipment

ISO fork carriage with forged forks

Hydraulic Operations		W	A	B	C
1	Check the forks or load handler for wear and damage.			●	

Load backrest

Hydraulic Operations		W	A	B	C
1	Check attachment is properly secured to the truck and check the load-bearing components.			●	

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A Traction Battery Appendix

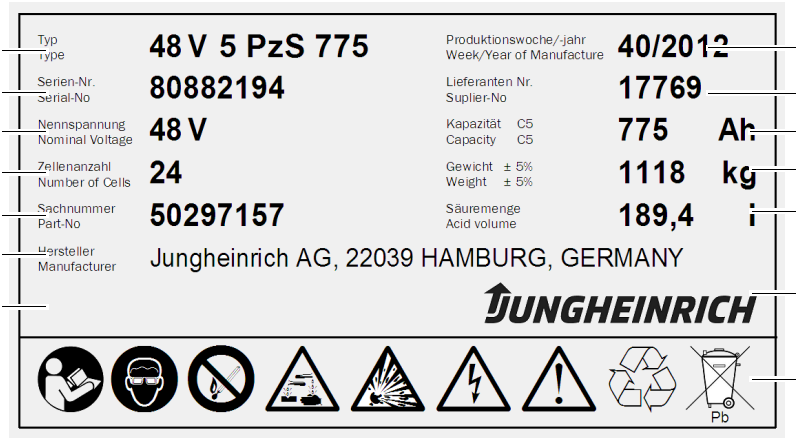
Contents

1 Correct Use and Application

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	Battery name
2	Battery type
3	Production week/year manf.
4	Serial number
5	Supplier number
6	Rated voltage
7	Rated capacity
9	Battery weight in kg
8	Number of cells
15	Electrolyte volume in litres
10	Battery number
11	Manufacturer
13	Manufacturer's logo
12	CE mark only for batteries beyond 75 volts
14	Safety instructions and warning information

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. 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. batteries. Always wash your hands after completing the work. Use insulated tools only. Do not physically alter 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.

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 adjustment factor is ± 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 conform to DIN 43530 Part 2 purity regulations.

4.1.1 Battery nominal data

1.	Product	Traction battery
2.	Nominal voltage	2.0 V x no. 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 terminal screw torques (M10 = 23 ±1 Nm) of the terminal conductors and connectors.
- Charge up the battery.
- Check the electrolyte level.

➔ The electrolyte level must be above the cell baffle or the top of the separator.

- Add electrolyte with distilled water up to the nominal level.

Checks completed.

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. Recharge a discharged battery immediately.

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 2 m 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 processes in accordance with DIN 41773 and DIN 41774 are permissible.

➔ The electrolyte temperature rises by approx. 10 K 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

– Electrolyte temperature min. 10°C to max. 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.

Battery 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

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.

4.3.1 Daily

– Charge the battery after each discharge.
– After charging, check the electrolyte level.
– If necessary, add purified water up to the rated level after charging.

➔ The height of the electrolyte level should not be below the cell baffle or above the top of the separator, or the "Min" and "Max" electrolyte markings respectively.

4.3.2 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.

4.3.3 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.

➔ If you find significant differences compared with the previous measurements or differences between the cells, contact the manufacturer's customer service department.

4.3.4 Annually

– Measure the truck insulation resistance in accordance with EN 1175-1.
– Measure the battery insulation resistance in accordance with 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.

5.1.1 Battery nominal data

1.	Product	Traction battery
2.	Nominal voltage	2.0 V x no. 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 terminal screw torques (M10 = 23 ±1 Nm) of the terminal conductors and connectors.
- Re-charge the battery.
- Charge the battery.

Check completed.

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

⚠ 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 2 m 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 cells.

- ▶ 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 limit currents in the gassing area in accordance with DIN EN 50272-3.

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 K 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 K.

Battery 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.

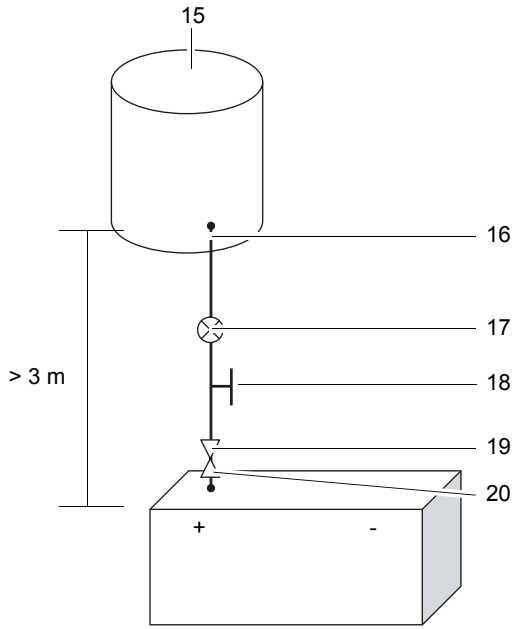
5.3.4 Annually

– Measure the truck insulation resistance in accordance with EN 1175-1.
– Measure the battery insulation resistance in accordance with 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



15	Water container
16	Tap connection with ball cock
17	Flow indicator
18	Shut-off cock
19	Locking coupling
20	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 such as:

– Battery air coupling not connected to circulation module (if coupling is separate) or faulty.
– Leaky or faulty hose connections on battery or
– Intake filter contaminated

a visual error message appears on the charger.

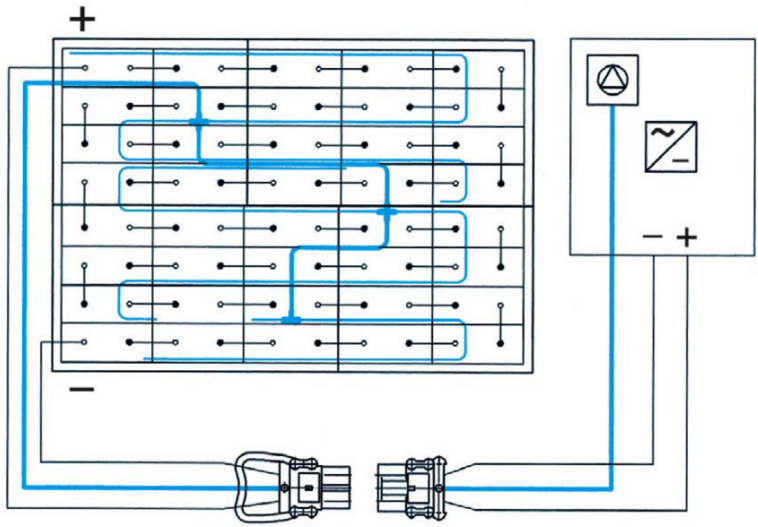
NOTE

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 on the battery side and through-coupling on 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 box 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 3-monthly full charge for PzV batteries.
– Trickle charge for a charge voltage of 2.23 volts x no. of cells for PzS, PzM and PzB batteries or 2.25 volts x no. 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.