EJE M13/M15

04.16

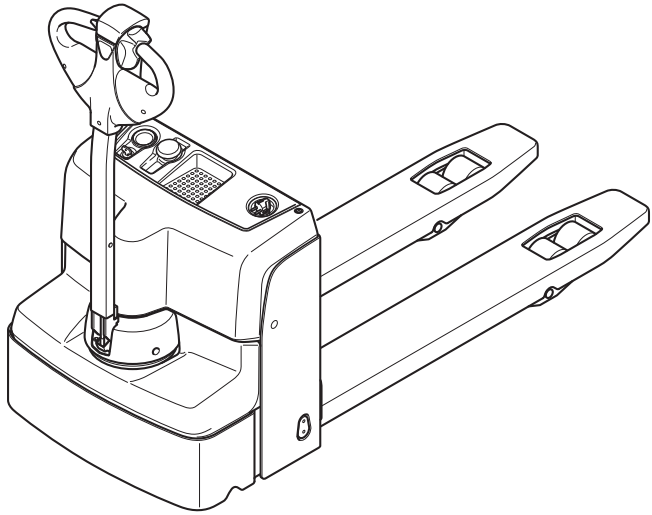
Operating instructions

GB

51477216

04.16

EJE M13
EJE M15



JUNGHEINRICH
Machines. Ideas. Solutions.

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
EJE M13/M15			

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 in front of notices and explanations.

- ● Indicates standard equipment
- ○ Indicates optional equipment

Jungheinrich Aktiengesellschaft

Friedrich-Ebert-Damm 129
22047 Hamburg - Germany

Tel: +49 (0) 40/6948-0

www.jungheinrich.com

04.16 EN

Table of 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 page 56.

The following operations are in accordance with regulations and are permitted:
– Lifting and lowering loads.
– Transporting lowered loads.

The following operations are prohibited:
– Carrying and lifting passengers.
– Pushing or pulling loads.

3 Approved application conditions

– Operation in industrial and commercial environments.
– Permissible temperature range 5°C to 40°C.
– Operation only on secure, level surfaces with sufficient capacity.
– Do not exceed the permissible surface and spot load limits on the travel routes.
– Operation only on routes that are visible and approved by the operating company.
– Negotiating inclines up to a maximum of 4 % / 10 % (4 % with load).
– Do not travel across or at an angle on inclines. Travel with the load facing uphill.
– Operation in partially public traffic.

⚠ WARNING!

Use under extreme conditions

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

▶ Special equipment and authorisation are required if the truck is to be constantly used in extreme conditions, especially in dusty or corrosive atmospheres.

▶ The truck cannot be used in areas at risk of explosion.

▶ In adverse weather conditions (thunder, lightning) the industrial truck must not be operated outside or in endangered areas.

4 Proprietor responsibilities

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

NOTE

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

5 Adding attachments and/or optional equipment

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

B Truck Description

1 Application

The industrial truck is an electric, tiller operated three-wheel truck with a steered drive wheel. Support wheels in the drive compartment ensure stability when steering.
It is designed for use on level surfaces to lift and transport palletised goods. Open bottom pallets or roll cages can be lifted.
The rated capacity of the truck is shown on the data plate or capacity plate Qmax.

➔ The EJE M13 / EJE M15 is designed for light-duty operations; the maximum continuous operation time is 2 hours.

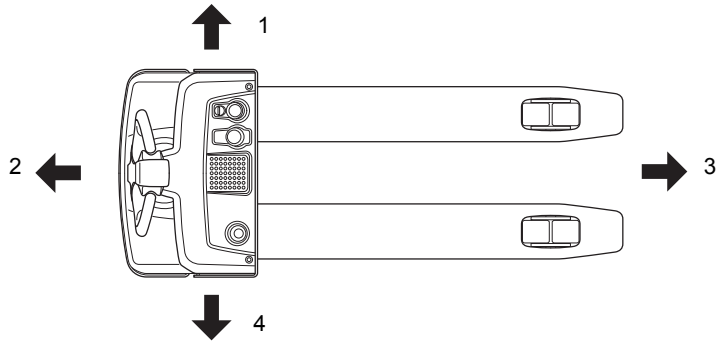
The rated capacity depends on the model. The rated capacity can be derived from the model name.

EJE	Model name
M	Series
13	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

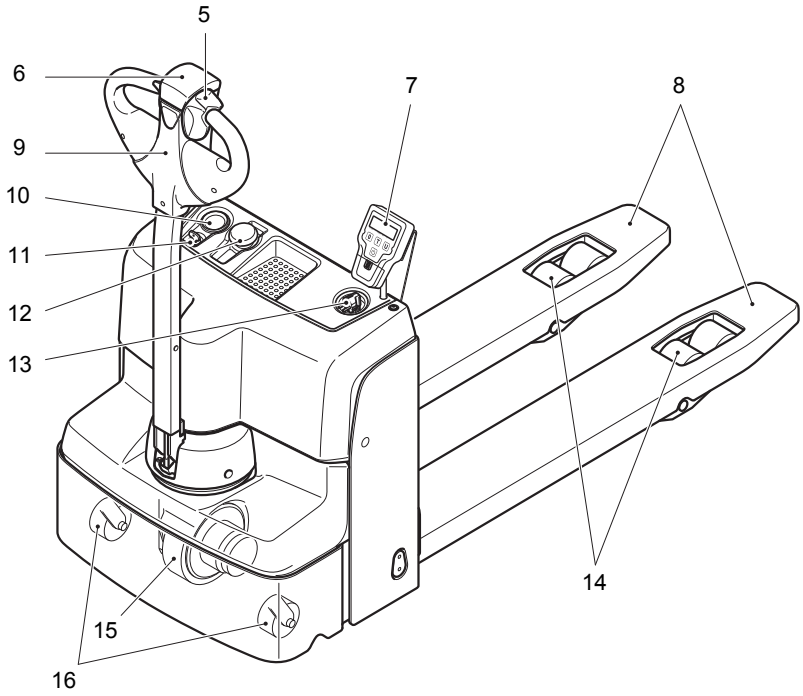
The following determinations have been made for travel direction specification:



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	●	Travel switch	11	●	Key switch
6	●	Collision safety switch	12	●	Emergency Disconnect Switch
7	○	Weighing device	13	●	Mains plug
8	●	Load handler	14	●	Load wheels
9	●	Tiller and tiller head	15	●	Drive wheel
10	●	Battery discharge indicator	16	●	Support wheels

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

Hydraulic system

– Lifting and lowering are activated via the lift and lower buttons.
– When lifting is activated, the pump unit starts to operate, supplying hydraulic oil from the oil reservoir to the lift cylinder.

Drive system

– An electric motor actuates the drive wheel via a multi-stage transmission.The electronic traction controller ensures smooth drive motor speed control and hence smooth travel, powerful acceleration and electrically controlled braking.

Tiller

The user steers with an ergonomic tiller. All travel and lift operations can be performed sensitively without taking a hand from the tiller.

Controls and displays

Ergonomic controls ensure fatigue-free operation for sensitive application of the travel and hydraulic operations. The battery discharge indicator displays the service hours and the available battery capacity.

Electrical systems

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

4 Technical Specifications

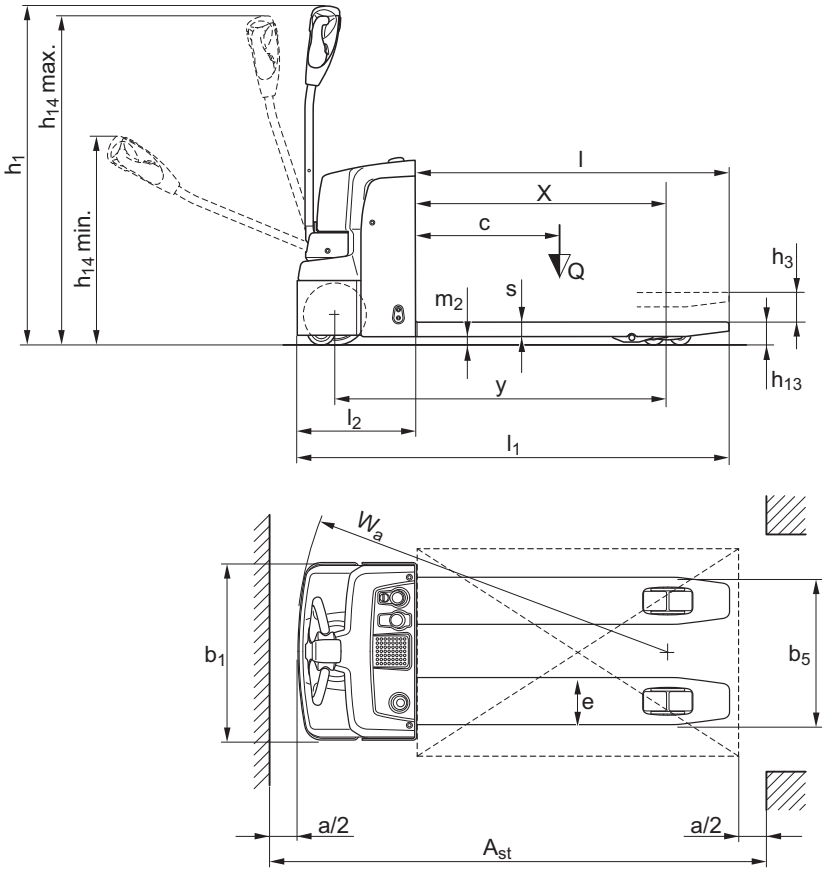
The technical specifications comply with the German "Industrial Truck Data Sheet" Guidelines.
Technical modifications and additions reserved.

4.1 Performance data

	Description	EJE M13	EJE M15	
Q	Rated capacity	1300	1500	kg
c	Load centre distance with standard fork length	600	600	mm
	Travel speed with / without load	4.5 / 5.0	4.5 / 5.0	km/h
	Lift speed with / without load	40 / 60	40 / 60	mm/s
	Lowering speed with / without load	80 / 40	80 / 40	mm/s
S2	Gradient performance with / without load	4 / 10	4 / 10	%

4.2 Dimensions

	Description	EJE M13	EJE M15	
h3	Lift	120	120	mm
h13	Forks lowered	85	85	mm
h14	Tiller height in min./max. travel position.	740 / 1190	740 / 1190	mm
h1	Overall height	1247	1247	mm
y	Wheelbase	1212	1212	mm
l1	Overall length	1585	1585	mm
l2	Headlength	435	435	mm
x	Load distance lowered / raised	914	914	mm
b1	Truck width	650	650	mm
b5	Width across forks	540	540	mm
s	Fork height	55	55	mm
e	Fork width	172	172	mm
l	Fork length	1150	1150	mm
m2	Ground clearance	35	35	mm
Ast	Working aisle width 1000x1200 transv.	1643	1643	mm
Ast	Aisle width 800x1200 longit.	1843	1843	mm
Wa	Turning radius	1357	1357	mm
	truck weight	see truck data plate	see truck data plate	


h1
h14 max.
h14 min.
l
X
c
Q
h3
m2
s
h13
y
l2
l1
Wa
b1
b5
e
a/2
a/2
Ast

4.3 Weights

Weights and axle loads vary depending on truck features. For Truck weight see page 24.

4.4 Battery Weights

Battery weights depending on truck features. For Battery weight see page 24.

4.5 Tyre type

Tyre size, front	230 x 65	mm
Tyre size, rear (tandem)	d80 x 70	mm
Additional wheels (dimensions)	80 x 40	mm
Wheels, number front / rear (x = driven)	1x +2/4	

4.6 EN standards

Noise emission level

– EJE M13/M15: 66 dB(A)

in accordance with EN 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.

➔ Noise levels can fluctuate depending on the floor composition and wheel lining.

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.

4.7 Conditions of use

Ambient temperature

– operating at 5°C to 40°C

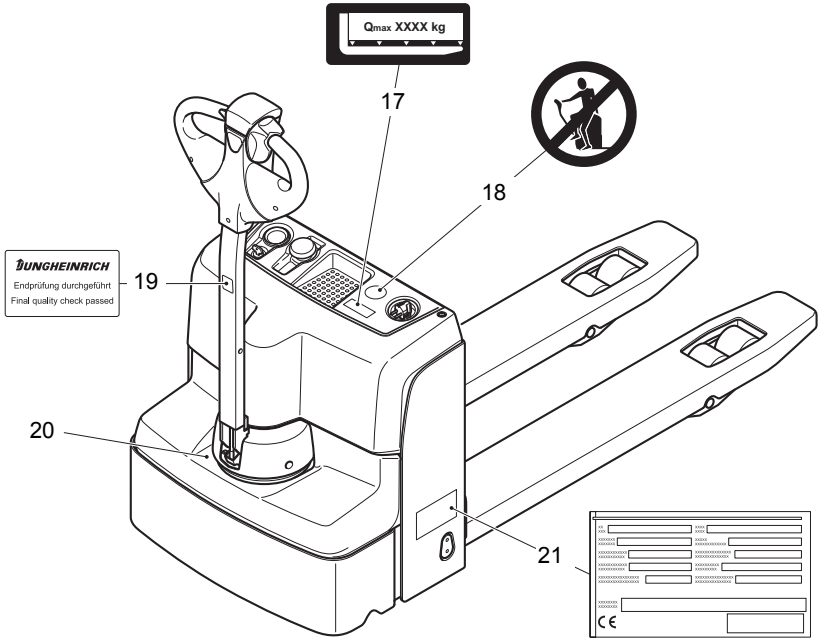
➔ Special equipment and authorisation are required if the truck is to be used continually in conditions of extreme temperature or condensing air humidity fluctuations.

4.8 Electrical Requirements

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

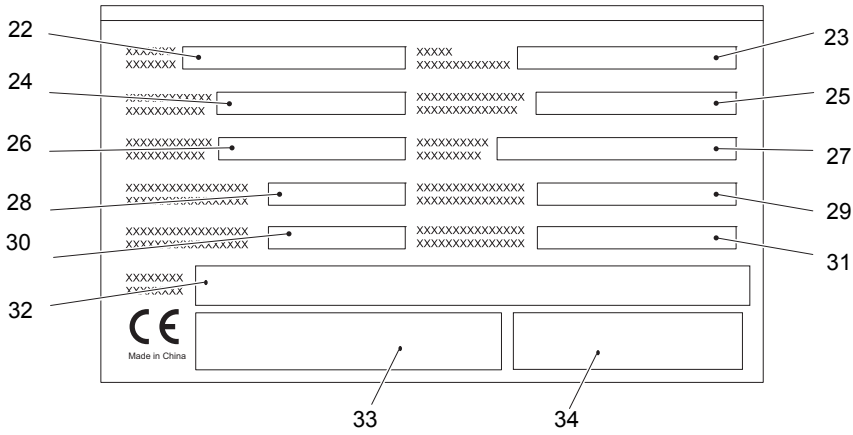
4.9 Identification points and data plates

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



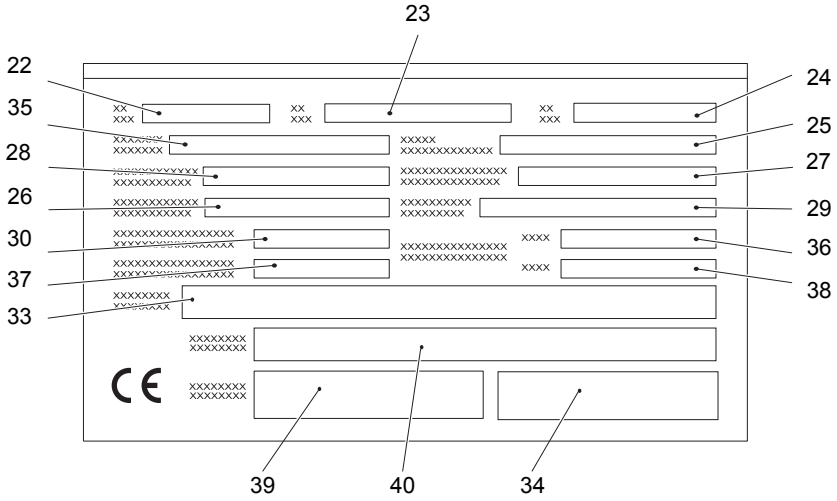
Item	Component
17	Capacity Qmax, distribute load evenly
18	“No passengers” warning notice
19	Test plaque
21	Truck data plate
20	Serial number

4.9.1 Data plate



Item	Description	Item	Description
22	Type	23	Option
24	Serial Number	26	Rated capacity (kg)
28	Battery voltage (V)	30	Net weight w.o. battery (kg)
25	Date of manufacture	27	Load centre (mm)
29	Output	33	Manufacturer
34	Manufacturer's logo	31	Battery weight min/max (kg)
32	Production address		

For queries regarding the truck or ordering spare parts always quote the truck serial number (24).



Item	Description	Item	Description
22	Type	23	Option
24	Serial Number	26	Rated capacity (kg)
28	Battery voltage (V)	30	Net weight w.o. battery (kg)
25	Date of manufacture	27	Load centre (mm)
29	Output	36	Min. battery weight (kg)
33	Manufacturer	34	Manufacturer's logo
35	Name	37	Net weight with battery (kg)
38	Max. battery weight (kg)	39	Production license
40	Production address		

For queries regarding the truck or ordering spare parts always quote the truck serial number (24).

4.9.2 Truck load chart

The capacity plate (17) indicates the maximum capacity Q (in kg) for a given load centre C (in mm).

C Transport and Commissioning

1 Lifting by crane

⚠ DANGER!

All persons involved in loading by crane must be trained

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

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

⚠ DANGER!

Incorrect lifting by crane can result in accidents

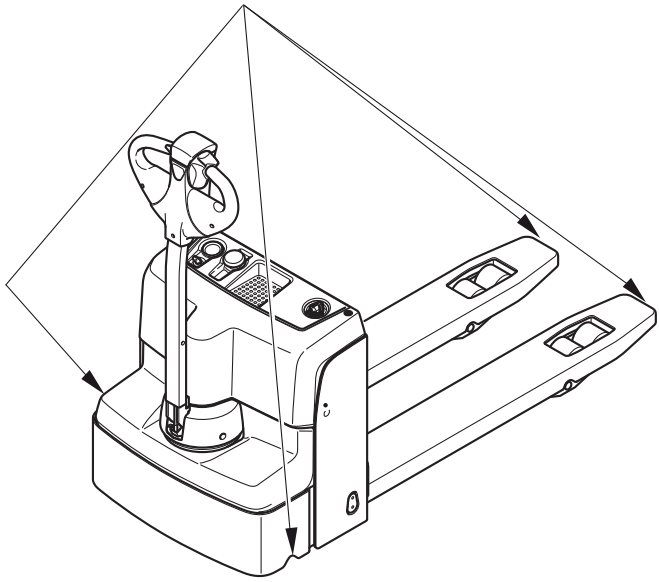
Improper use or use of unsuitable lifting gear can cause the truck to fall when being lifted by crane.

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 (see page 27) 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 points (41) under the chassis and at the fork tips are intended for lifting the truck with crane lifting gear.

41



Lifting the truck by crane

Requirements

– Park the truck securely, see page 47.

Tools and Material Required

– Lifting gear
– Crane lifting gear

Procedure

• Attach the crane lifting gear to the strap point (41).

The truck can now be lifted by crane.

2 Transport

⚠ WARNING!

Uncontrolled movement during transport

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

- ▶ Loading is only to be carried out by specially trained staff. The specialist personnel must be instructed in the securing of loads on road vehicles and in the use of load-securing equipment. When securing the truck, the appropriate measures must be determined and applied for each individual case.
- ▶ The truck must be securely fastened when transported on a lorry or a trailer.
- ▶ The lorry or trailer must have lashing rings.
- ▶ Use wedges to prevent the truck from moving.
- ▶ Use only lashing straps with sufficient load rating.
- ▶ Use anti-slip material to secure loading aids (pallets, wedges,...), e. g. anti-slip mats.

Securing the industrial truck for transport

Requirements

– Load the truck.
– Park the truck securely, see page 47.

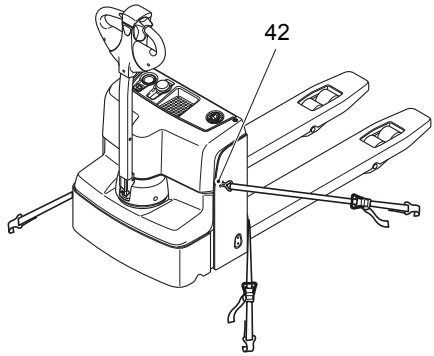
Tools and Material Required

– Tensioning belts / tie down straps

Procedure

- Sling the tensioning belt (42) around the truck and attach it to the fastening rings of the transporting vehicle.
- Tighten the tensioning belt with the tensioner.

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.

Procedure

- Check if the equipment is complete.
- Charge the battery, see page 36.

The truck can now be started, see page 44.

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.

⚠ 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 by the manufacturer for the truck 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 Jungheinrich, can lead to a deterioration of the braking characteristics of the truck during energy recovery, causing considerable damage to the electric controller and resulting in serious danger to the health and safety of individuals.

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

Park the truck securely before carrying out any work on the batteries (see page 47).

2 Battery types

The EJE M13 / EJE M15 is equipped with two 12 volt / 65 Ah (K20) maintenance-free batteries.

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

NOTE

40°C is the maximum temperature for batteries at which point the truck cannot be operated.

➔ When the industrial truck is parked securely the battery can be electrically separated from the industrial truck by pushing the emergency switch (connector). The industrial truck should not be stored without a battery compensation charge for more than 3 months at 20°C or 2 months at 30°C.

3 Exposing the battery

⚠ CAUTION!

Trapping hazard

▶ Make sure there is nothing between the battery cover and the truck when you fit the battery cover.

⚠ WARNING!

An unsecured truck can cause accidents

Parking the truck on an incline or with a raised load handler is dangerous and is strictly prohibited.

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

▶ Fully lower the load handler.

▶ 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.

Requirements

– Park the truck on a level surface.

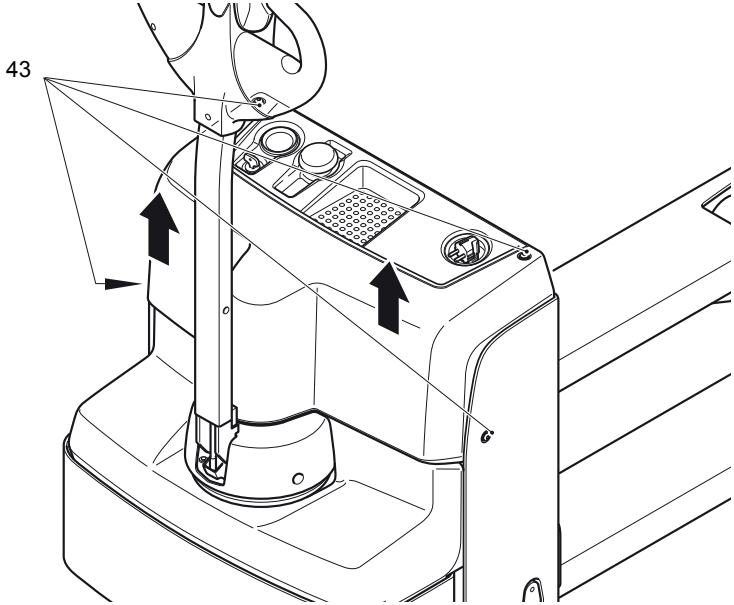
– Park the truck securely, see page 47.

Procedure

• Remove the 4 screws (43).

• Lift the panel up.

The battery is now exposed.


43

4 Charging the battery

⚠ WARNING!

The gases produced during charging can cause explosions

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

- ▶ 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 shall be no inflammable material or lubricants within 2 m around the truck.
- ▶ Fire protection equipment must be on hand.
- ▶ Do not lay any metallic objects on battery.
- ▶ It is essential to follow the safety regulations of the battery and charger.

4.1 Charging the battery with the integrated on-board charger

⚠ DANGER!

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 mains plug must be dry and clean when used.

⚠ CAUTION!

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 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 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 EJE M13 / EJE M15 is fitted as standard with an on-board charger. The charger detects the mains voltage and adapts automatically.
The mains cable of the charger is contained in the front panel can be accessed from the outside.

⚠ CAUTION!

The on-board charger must not be opened!

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 15°C as otherwise it will affect the charge.

---

5 Battery removal and installation

Removing the battery may only be performed by manufacturer´s customer service department.The manufacturer has a service department specially trained for these tasks.

5.1 Battery charging/discharging indicator / hourmeter

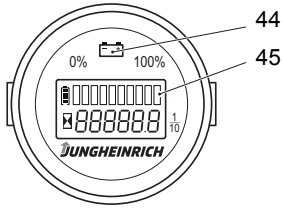
Battery charging indicator

The red LED (44) in the battery symbol indicates that the battery is charging.

Battery discharging indicator

The battery discharge status is indicated by 10 LEDs (45) on the battery discharge indicator/hourmeter.

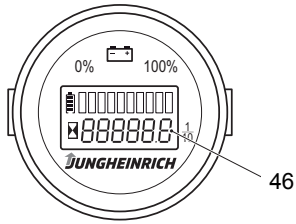
➔ One LED corresponds to 10% of the battery capacity.



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

➔ Charge the battery at least every 2 month, see page 36

The hourmeter (46) shows the running time of the truck. The service hours are counted only during travel and lifting. The running time is continually stored and is not deleted when the batteries are disconnected.



The last digit on the LCD display indicates tenths of an hour.

E Operation

1 Safety Regulations for the Operation of Forklift Trucks

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!

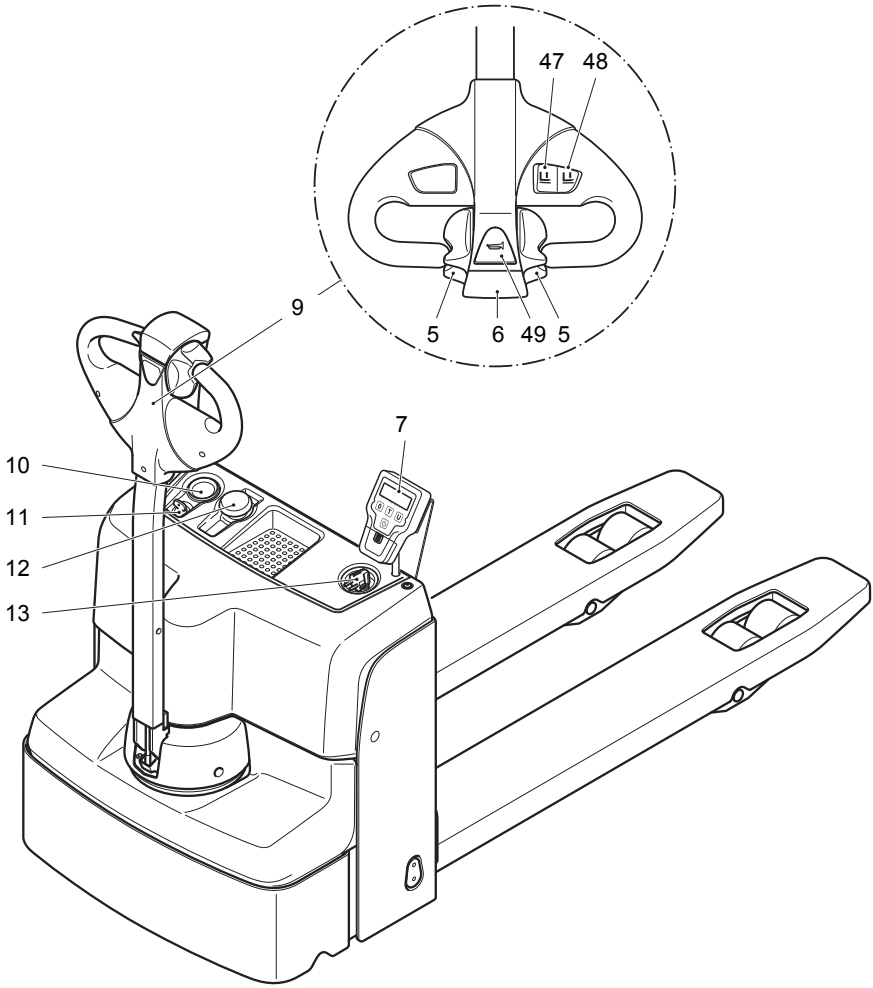
Risk of accidents/injury in the hazardous area of the truck

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 page 23) and warning instructions in the present operating instructions must be strictly observed.


47
48
9
5
6
49
5
7
10
11
12
13

Item	Control /Display	EJE M13 EJE M15	Function
5	Travel switch	●	Controls travel direction and speed.
6	Collision safety switch	●	Safety feature. When pressed the truck travels for approx 3 seconds in the fork direction. The parking brake then applies. The truck remains switched off until the controller is briefly restored to neutral.
7	Weighing device	○	Weighs the load, see page 59.
9	Tiller	●	Used for steering and braking.
10	Battery discharge indicator/ hour meter	●	Battery charge status. Displays the service hours.
11	Key switch	●	Activates the truck. Removing the key prevents the truck from being switched on by unauthorised personnel.
12	Emergency Disconnect Switch	●	Disconnects the battery supply. All electric functions are deactivated and the truck decelerates
13	Mains plug	●	Charges the truck's batteries.
47	Load handler raise button	●	Raises the load handler.
48	Load handler lower button	●	Lowers the load handler.
49	Warning signal button (horn)	●	Warning button

3 Starting up the truck

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.

Pre-start inspections

Procedure

- Check the whole of the outside of the truck for signs of damage and leaks. Damaged hoses must be replaced immediately.
- Test hydraulic system.
- Check the battery attachment and wire connections for damage and make sure they are secure.
- Check the load handler for visible signs of damage such as cracks, bent or severely worn forks.
- Check the drive wheel and load wheels for damage.
- Check that the markings and labels are present, clean and legible, see page 23.
- Check the control handle (damper) is restored to its normal position.
- Check the controls are automatically restored to zero after being applied.
- Test the warning signal.
- Test the brakes.
- Test the collision safety switch and Emergency Disconnect switch.
- Check doors and/or covers.
- Make sure the drive panels and covers are secure and check for damage.

3.2 Preparing the truck for operation

Starting up the truck

Requirements

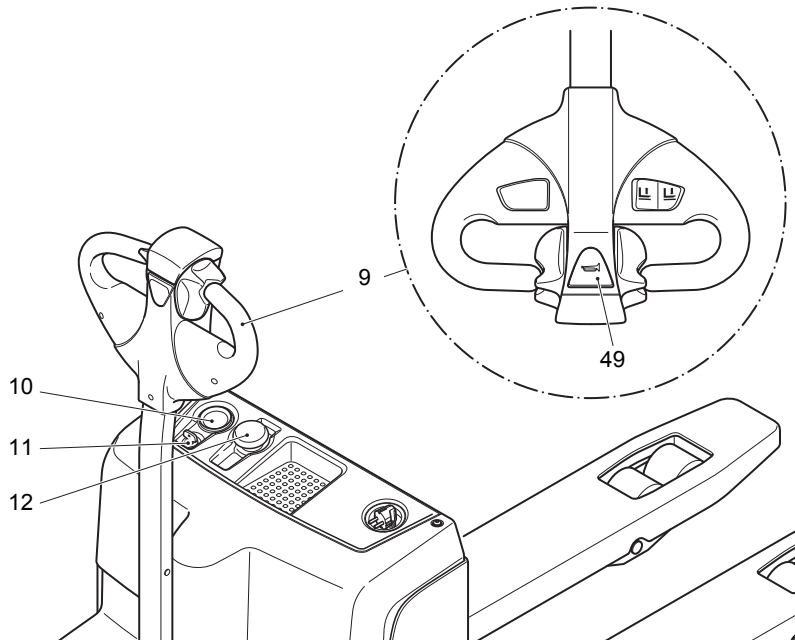
– For checks and operations to be performed before starting daily operation, see page 44.

Procedure

- Pull the Emergency Disconnect (12).
- To switch on the truck, do this
  - Insert the key in the key switch (11) and turn it as far right as it will go.
- Test the warning signal button (49).
- Test lifting operations.
- Test the steering.
- Test the brake function of the tiller (9).

Truck is operational.

➔ The battery discharge indicator/hourmeter (10) shows the current battery charge status and the service hours.


9
49
10
11
12

3.3 Parking the truck securely

⚠ DANGER!

An unsecured truck can cause accidents

Parking the truck on an incline with a raised load or load handler is dangerous and is strictly prohibited.

- ▶ Park the truck on a level surface. In special cases the truck may need to be secured with wedges, see page 29.
- ▶ Fully lower the load handler.
- ▶ 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

- Fully lower the load handler.
- Turn the key in the key switch (11) to the left as far as the stop and remove the key.
- Press down the Emergency Disconnect (12).

The industrial truck is parked

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.

⚠ DANGER!

Do not exceed the permissible surface and point loading on the travel lanes.
At blind spots get a second person to assist.
The driver must ensure that the loading dock /dock leveller cannot be removed or come loose during loading/unloading.

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 4 % / 10 % 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 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 dock cannot move or come loose during loading / unloading.

⚠ 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.

4.2 Emergency Disconnect

⚠ DANGER!

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.

⚠ DANGER!

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.

Releasing the Emergency Disconnect switch

Procedure

- Pull the Emergency Disconnect switch (12) 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).

4.3 Automatic braking

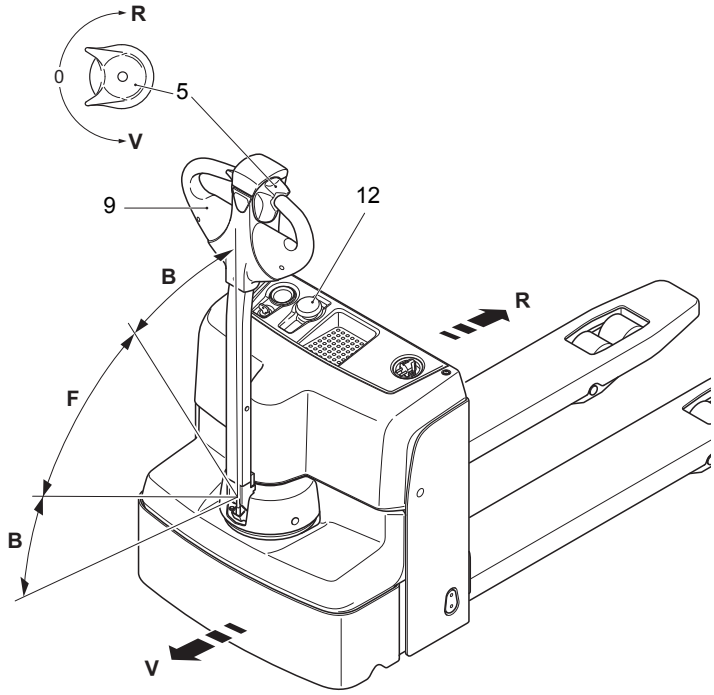
When the tiller is released, it returns automatically to the upper brake zone (B) and the brakes are applied automatically.

⚠ 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.

Requirements

– Start up the truck, see page 44

Procedure

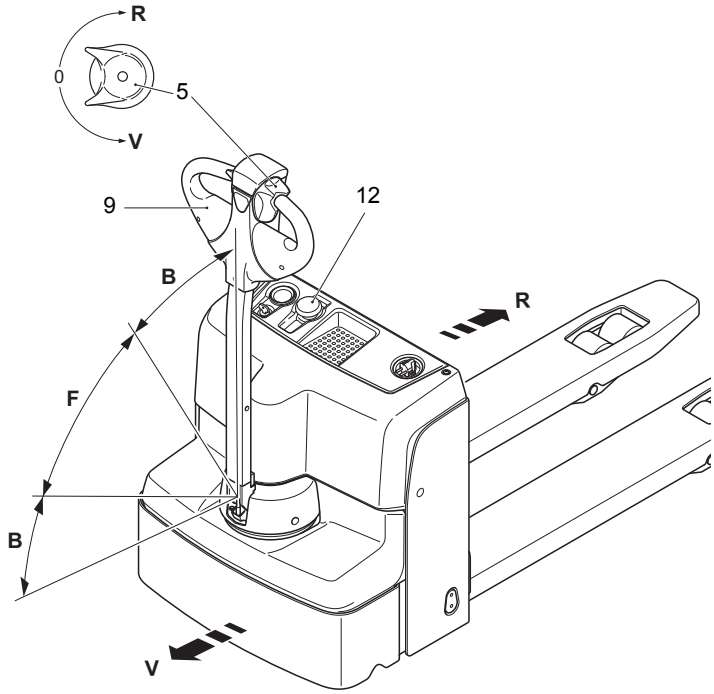
- Set the tiller (9) to the travel range (F) and press the travel switch (5) in the desired direction (fwd. or rev.).
- Control the travel speed with the travel switch (5).

➔ When the travel switch is released it automatically returns to its original position.

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

➔ Preventing the truck from “rolling downhill”:

If the truck rolls backwards on an incline the controller detects the situation and the brake applies automatically after a short movement.



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 (5) to the opposite direction while travelling.

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

4.5 Steering

Procedure

- Move the tiller (9) to the left or right.

The truck is steered in the required direction.

4.6 Brakes

⚠ WARNING!

Accident risk

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

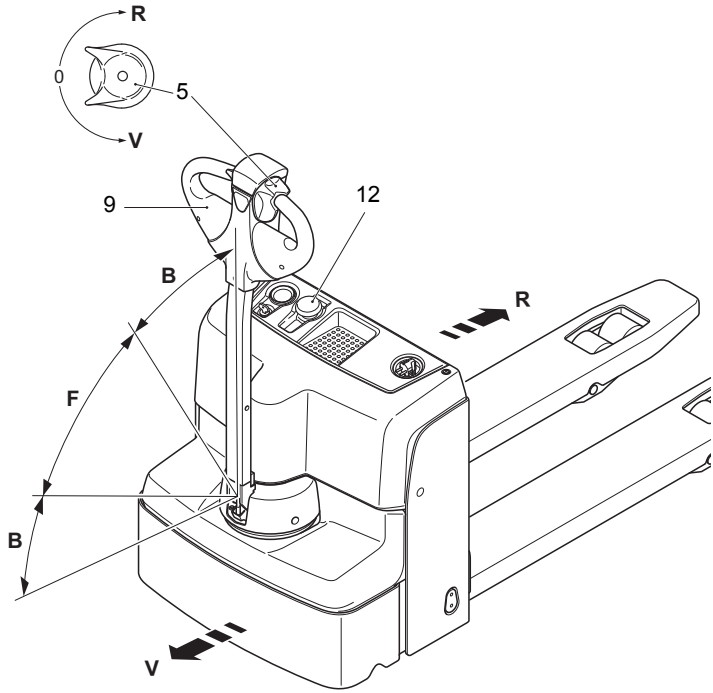
▶ The operator must take into account the travel route conditions when braking.

▶ Brake with care to prevent the load from slipping.

▶ Allow for increased braking distance when travelling with load.

⚠ CAUTION!

▶ In hazardous situations set the tiller to the brake position or press the Emergency Disconnect switch.



Braking with the service brake

Procedure

- Move the tiller (9) up or down to one of the brake zones (B).

➔ Initially the truck brakes regeneratively. The mechanical brake is only applied when this brake fails to achieve the necessary braking force.

The truck will decelerate at the maximum rate and the service brake will apply.

Inversion braking

Procedure

- You can set the travel switch (5) to the opposite direction when travelling.

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

Regenerative braking

Procedure

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

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

➔ With regenerative braking energy is recuperated to the battery, ensuring a longer service time.

Parking brake

➔ The mechanical brake (parking brake) applies when the truck comes to rest.

4.7 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.
- ▶ Take care that the centre of the load have to be between the forks to prevent tilting.

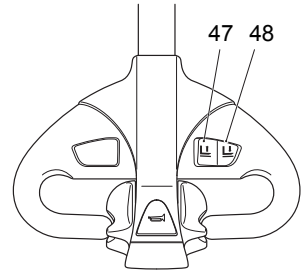
NOTE

Adapt a slower speed when stacking and retrieving.

4.7.1 Raising a load

Requirements

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



Procedure

- Drive the truck carefully up to the pallet.
- Slowly insert the forks into the pallet until the fork shank touches the pallet.

  The load unit must not extend by more than 50 mm beyond the fork tips.
- Press the "Lift" button (47) until you reach the desired lift height.

The load unit is raised.

⚠ CAUTION!

▶ Release the "Lift" button as soon as you reach the load handler limit position.

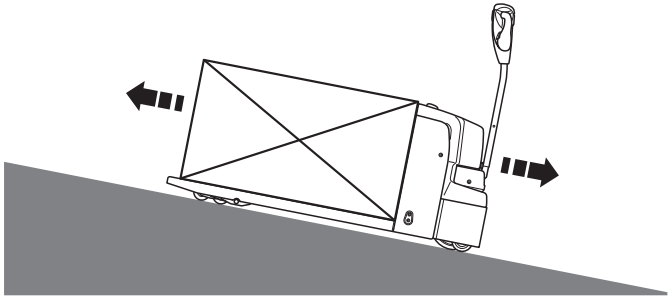
4.7.2 Transporting a load

Requirements

– Load raised correctly.
– Load is not on the ground.
– Perfect 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 suddenly in dangerous 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).



Depositing load units

NOTE

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

Requirements

– Storage location suitable for storing the load.

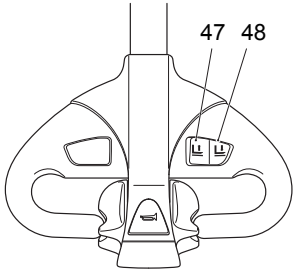
Procedure

- Drive carefully up to the storage location.
- Press the lower load handler button (48).

➔ Avoid depositing the load roughly to prevent damage to the load and the load handler.

- Carefully lower the load handler so that the forks are clear of the load.
- Carefully remove the forks from the pallet.

The load unit is lowered.



4.7.3 Wind loads

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

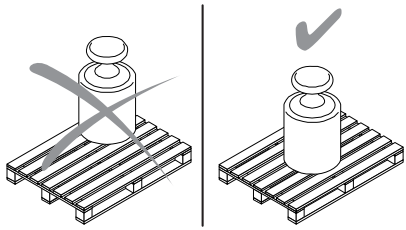
Light loads must be especially secured when they are subjected to wind forces. This will prevent the load from sliding or falling.

Stop the truck in both cases.

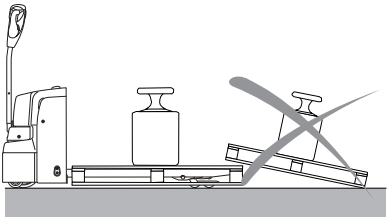
4.8 Weighing device

4.8.1 Avoiding malfunctions

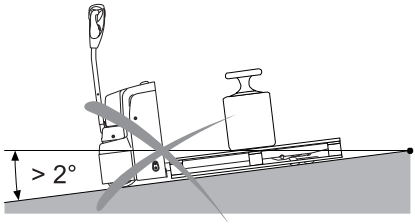
➔ Arrange the load centrally on the pallet.



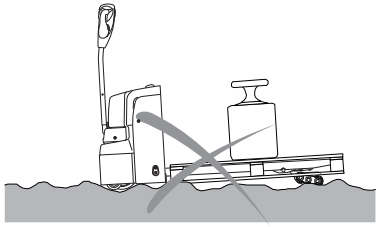
➔ Weighing must not be affected by other objects.



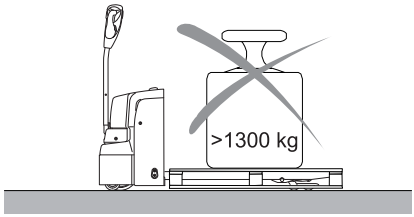
➔ The maximum truck incline when weighing is 2°.



➔ Alwais weigh on secure, level surface.



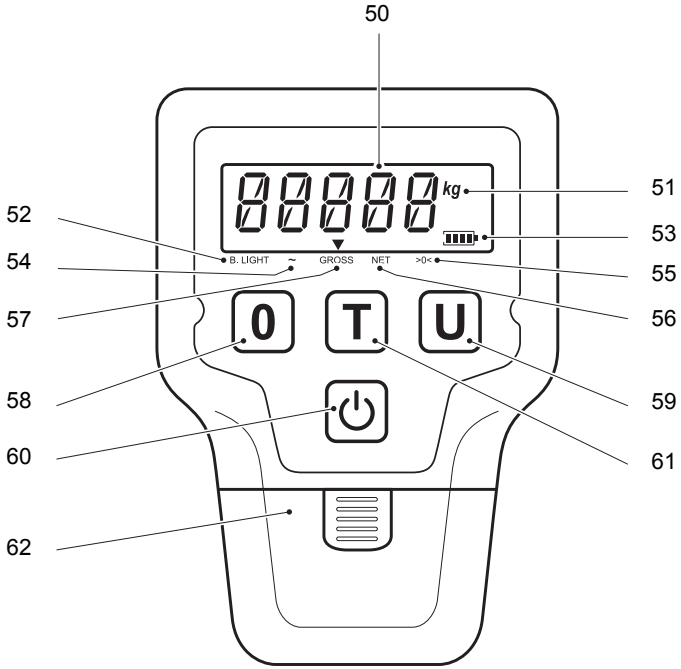
➔ Do not exceed the maximum capacity of the truck. The load must not be raised suddenly (too quickly) or too slowly.



4.8.2 Control and display unit

Major Functions

Basic functions: Zeroing, tare removal as well as switchover and calibration of measurement unit.Back light function: Mode setup and auto off of back lightOther functions: Auto power-off (time setup available) and default setup of measurement unit.



Item	Components	Key Function
50	Weight Display	If any cargo is placed on the frame, its weight is to be displayed after 1 second; once “dynamic cursor” disappears, value as displayed on the screen will be the weight of cargo.
51	MeasurementUnit	
52	Back Light Cursor	
53	Battery Level	
54	Dynamic Cursor	
55	Zero Cursor	
56	Net Weight Cursor	
57	Tare Weight Cursor	

Item	Components	Key Function
58	Zeroing	Reset instrument readings within the permissible range.
59	Unit Switching	It is for circulated switching of measurement unit among KG, T, OZ and LB, representing “kilogram”, “ton”, “ounce” and “pound” respectively.
60	On/Off / Back Light	Once this key is pressed and hold for 2 seconds at ON status, “-----” is to be displayed on the screen before power-off; press the key for a while to t urn o n the back light in the back light mode. Press the key for a while for start-up.
61	Tare removal key	Current weight is taken as the tare weight for tare remove a l based on the gross weight; whereas the instrument is to be switched over to the net weight for display. Recover the tare weight as deducted at the net weight, and switch the instrument to the gross weight for display.
62	Battery Cover	

Parameter Setup Mode

Key	Function
U & 0	Factory resetx
U & T	Press simultaneously in normal display mode to enter the parameter setup mode when “ SETUP ” is displayed on the screen, keys function referred to as:
0	Option selection
T	Option confirmation
U	Option cancellation
⏻	Digit switching in calibration mode.

Description of Items on Screen

Items	Description
BLMOD	Back Light Mode Setup
CALBN	Calibration
CALOK	Calibration OK
FAIL	Plant Calibration Failed
OUTRG	Out of Range
PMODE	Plant Calibration Mode
POWTME	Auto Power-off Time Setup
RESET	Factory Reset
SS CK	Sensor Check
SS OK	Sensor OK
SSERR	Sensor Error
SETUP	Parameter Setup
TARE	Tare Removal
TR ER	Tare Removal Error
UNTARE	Untare
UNIT	Unit Setup
ZERO	Zeroing
ZR ER	Zeroing Error

Display

If any cargo is placed on the frame, its weight is to be displayed after 1 second; once “dynamic cursor” disappears, value as displayed on the screen will be the weight of cargo.

Default Unit Setup

Default unit of the system is kilogram (KG).The first option in parameter setup mode is default unit setup; when “UNIT” is displayed on the screen, press (T) to confirm entry into unit setup mode; press (U) for cancellation to proceed with next setup.Once default unit set up is confirmed, press (U) repeatedly for circulation switching among the units as displayed on the right side of screen: (KG), (T), (OZ) and (LB), representing “kilogram”, “ton”, “ounce” and “pound” respectively; press (T) to confirm the setup, and proceed with next setup.

Back Light Mode Setup

Default back light mode of the system is OFF; short press (⏻) to turn on the back light when back light cursor is displayed on the screen in back light mode.Once default unit setup is completed, proceed with setup of back light; when “BLMOD“ is displayed on the screen, press (T) to confirm back light mode setup; press (U) for cancellation to proceed with next setup.Once back Light mode setup is confirmed, press (0) for circulation switching of items displayed on the screen; “BL ON” and “BL OFF” refer to Back Light On and Off respectively; press (T) to confirm the setup, and proceed with next setup.

Auto Power-off Time Setup

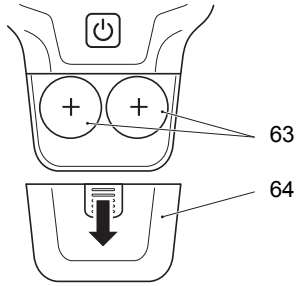
Default auto power-off time of the system is 5 minutes when cargoes remain unchanged.Proceed with auto power-off time setup once back light mode setup is completed; when “POWTM” is displayed on the screen, press (T) to confirm entry into auto power-off time setup; press (U) for cancellation to proceed with next setup.Once auto power-off time setup is confirmed, press (0) for circulated switching among 1-9, representing auto power-off time (minute); press (T) to confirm the setup, and proceed with next setup.

Weighing Calibration

It is applicable to use calibration function to calibrate instrument (calibration unit: kg) if normal weighing is incorrect. One-time calibration is enough for weighing.Proceed with the fourth part, calibration setup, after auto power-off time setup; “CAL BN” is to be displayed on the screen; confirm that there is no cargo on the frame, and press (U) for cancellation; press (T) to confirm user calibration setup; complete user setup, and enter into normal weighing mode (note: user setup only aims at setup of aforesaid options when normal weighing is correct; it is recommended to press (U) to cancel calibration setup at this option to enter into normal weighing mode),Once calibration setup is confirmed, “00000” is to be displayed on the screen after the cursor stops flashing; place calibration counter weight on the frame; it is applicable to press (0) for circulation switching among 0-9 for the cursor position below the figure; press (⏻) to change cursor position below the figure. Press (0) and (⏻) to input weight of counter weight on the frame; press, (T) for confirmation; calibration setup is deemed to be completed once “CALOK” is displayed on the screen.

Battery Replacement

The instrument is provided with 2 CR2447 button cells (63).As shown, it is necessary to slide down instrument battery cover (64) to remove the used battery for replacement; put the new battery into the battery holder, and then close the battery cover.



Troubleshooting

Failure	Possible Cause	Remedy
System Halt		Please remove t h e battery, and refit it again to recover its normal operation in case of system halt.
Start-up Failure	Power run-out	Disassemble the gauge outfit, and use avometer to measure battery voltage; if the voltage is below 3.5 V, it means that battery voltage is extremely low, which may result in start-up failure; replace the old battery with new one in this case.
	Battery connecting line disconnected	Disassemble the gauge outfit, and use avometer to measure battery voltage; if the voltage is over 3.5 V, just check if the red-black connecting line between battery module and instrument panel is disconnected.
	Other problems	Please contact professionals for testing of panel if power supply is normal.
Abnormal Display	Unit switch	If the sensor is proved to be normal through test, just press “unit switching” key for unit switching to check if the data displayed is normal.
	Sensor connection	If display of instrument reading is abnormal, just turn off the machine and turn on it again to check screen display; if “SSERR” is displayed on the screen following display of “SS CK”, it means that connection of sensor is abnormal; in this case, it is necessary to check if connection between the sensor and instrument panel is normal before contacting professionals to check if sensor output is normal.
	Calibration	If abnormal data is still displayed by the instrument following unit switching, just use “unit switching” and “tare removal” in combination to enter the parameter setup mode, and recalibrate at the final setup option (for details, please refer to 3.2.5 of Operation Instructions).

Routine Maintenance

Be sure to replace the battery if power monitoring icon as displayed is blank, and data displayed is indistinct.It is better not to put the instrument into prolonged operation in case of rain and snow; prolonged exposure of instrument to the sunshine is strictly prohibited.It is applicable to clean the instrument shell with soft and clean rag in combination with routine washing solvent; never use industrial solvent for cleaning or directly spray it on the instrument surface.Users are recommended to check the instrument and sensor regularly to ensure its accuracy during use.

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 switch pressed	Unlock the emergency disconnect switch
Key switch set to O	Set the key switch to "I"
Battery charge too low	Check battery charge and Charge the battery as required
Faulty fuse	Check fuses

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	Charging the battery
Faulty fuse	Check fuses
Excessive load	Note maximum capacity, see data plate

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 truck 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 records of plans, tests and completion of 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.

For safety reasons, only components which have been specially agreed by the manufacturer for this truck may be installed near the computer, controllers and wire guidance sensors (antennae). These components (computers, controllers, wire guidance sensors (antennae)) must therefore not be replaced by similar components from other trucks of the same series.

---

2 Maintenance Safety Regulations

Lifting and jacking-up

⚠ 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 lift the truck, the lifting gear must only be secured to the points specially provided for this purpose, see page 27.
- ▶ When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).
- ▶ For jacking the truck, make sure to use structural parts of the truck as contact point for the jack (e.g. truck chassis).

⚠ CAUTION!

Fire hazard

Do not use flammable liquids to clean the industrial truck.

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

Maintenance personnel

The truck should only be serviced and repaired by the manufacturer's specialist customer service personnel who have been trained to do this. We therefore recommend that you enter into a maintenance contract with the manufacturer’s local sales office.

Maintenance personnel

The truck should only be serviced and repaired by the manufacturer's specialist customer service personnel who have been trained to do this. We therefore recommend that you enter into a maintenance contract with the manufacturer’s local sales office.

Electrical system

⚠ WARNING!

Accident risk

- ▶ 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.
- ▶ Always disconnect the battery before starting cleaning operations.

⚠ WARNING!

Electric currents can cause accidents

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

- ▶ Park the truck securely (see page 47).
- ▶ Press the Emergency Disconnect.
- ▶ Disconnect the battery.
- ▶ Remove any rings or metal bracelets etc. before working on electrical components.

⚠ 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.

Welding

Remove electrical and electronic components from the truck before performing welding operations, to avoid damage.

Settings

When repairing or replacing hydraulic, electric or electronic components or assemblies, always note the truck-specific settings.

⚠ 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.

⚠ 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 years. The owner must carry out a risk assessment to ensure safe, prolonged use. The resulting protection measures must be observed and the inspection interval reduced accordingly.

3 Lubricants and Lubrication Schedule

3.1 Handling consumables safely

Handling consumables

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

⚠ WARNING!

Improper handling is hazardous to health, life and the environment

Consumables can be flammable.

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

⚠ CAUTION!

Spilled consumables can cause slipping and endanger the environment

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

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

⚠ WARNING!

Improper handling of oils can be hazardous

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

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

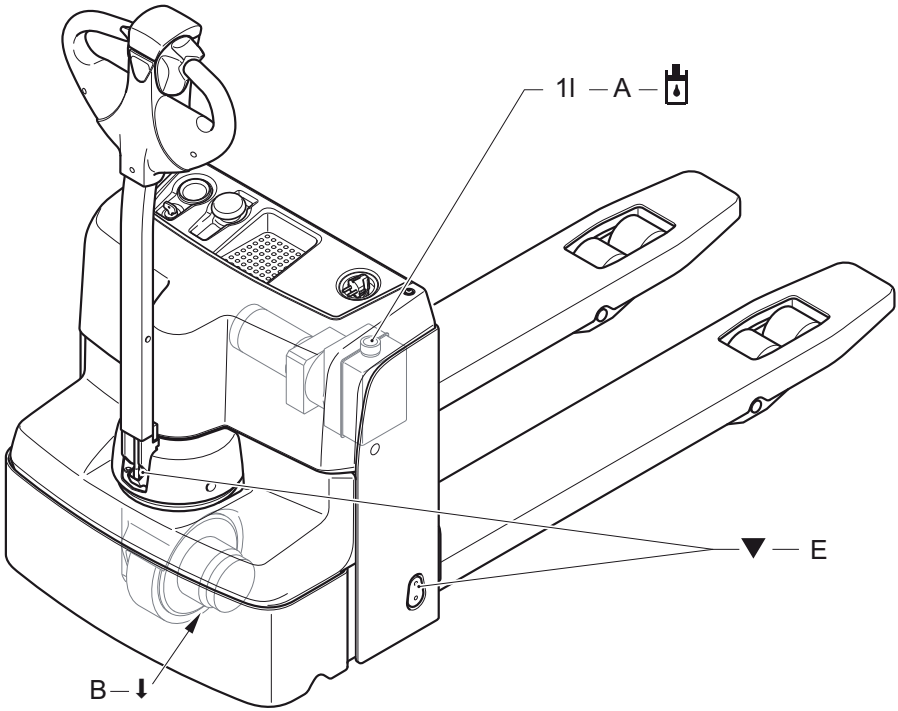
⚠ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable environmental-protection regulations. 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



▼	Contact surfaces
	Hydraulic oil filler neck
⬇	Transmission grease nipples

3.3 Consumables

Code	Order no.	Package quantity	Description	Used for
A	51 374 718	5.0 L	Tellus S3 M 46	Hydraulic System
B	50 157 382	1.0 kg	Alvania Grease RL3	Gear unit
E	29 202 050	1.0 kg	Polylube GA 352P	Lubrication

Grease guidelines

Code	**Saponification**	**Dew point °C**	**Worked penetration at 25 °C**	**NLG1 class**	**Application temperature °C**
B	Lithium	>180	220 - 250	3	-25/+130
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

- Fully lower the load handler.
- Park the truck securely, see page 47.
- Push the emergency switch to prevent the truck from being switched on accidentally.
- When working under a raised lift truck, secure it to prevent it from lowering, tipping or sliding away.

⚠ 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 lowering, tipping or sliding away.

▶ When raising the truck, follow the instructions, see page 27. When working on the parking brake, prevent the truck from accidentally rolling away (e.g. with wedges).

4.2 Lifting and jacking up the truck safely

⚠ DANGER!

A truck tipover can cause accidents

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

▶ Note the weight of the truck on the data plate.

▶ Always use a jack with sufficient capacity.

▶ Raise the unladen truck on a level surface.

▶ When raising the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

Raising and jacking up the truck securely

Requirements

– Prepare the truck for maintenance and repairs (see page 75).

Tools and Material Required

– Jack

– Hard wooden blocks

Procedure

- Place the jack against the contact point.

  For jacking the truck, make sure to use the structural parts of the truck as contact point for the jack (e.g. truck chassis).
- Raise the truck.
- Support the truck with hard wooden blocks.
- Remove the jack.

The truck is now securely raised and jacked up.

4.3 Cleaning

4.3.1 Cleaning the truck

⚠ CAUTION!

Fire hazard

Do not use flammable liquids to clean the industrial truck.

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

⚠ CAUTION!

Risk of component damage when cleaning the truck

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

- ▶ Cover all electronic system assemblies (controllers, sensors, motors etc.) before cleaning the truck with a pressure washer.
- ▶ Do not hold the jet of the pressure washer by the marked points to avoid damaging them (see page 23).
- ▶ Do not clean the truck with a steam cleaner.

Cleaning the truck

Requirements

– Prepare the truck for maintenance and repairs (see page 75).

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 page 83).

The truck is now clean.

4.3.2 Cleaning the electrical system assemblies

⚠ CAUTION!

Risk of electrical system damage

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

▶ Do not clean the electrical system with water.

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

Cleaning the electrical system assemblies

Requirements

– Prepare the truck for maintenance and repairs (see page 75).

Tools and Material Required

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

Procedure

- Expose the electrical system, see page 81.
- 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.
- Cover the electrical system, see page 81.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see page 83).

The electrical system assemblies are now clean.

4.4 Replacing the drive wheel

➔ The drive wheel must only be replaced by authorised service personnel.

4.5 Checking the hydraulic oil level

Check oil level

Requirements

– Lower the load handler.
– Prepare the truck for maintenance and repairs, see page 75.
– Remove the panel, see page 81.

Procedure

• Check oil level on hydraulic reservoir. The oil level should be visible between the MIN and MAX marking.

➔ Add hydraulic oil with the load handler lowered.

• Add the correct grade of hydraulic oil, see page 73.

Oil level is checked.

4.6 Front cover disassembly

Disassembling the panel and cover

Requirements

– Prepare the truck for maintenance and repairs, see page 75.

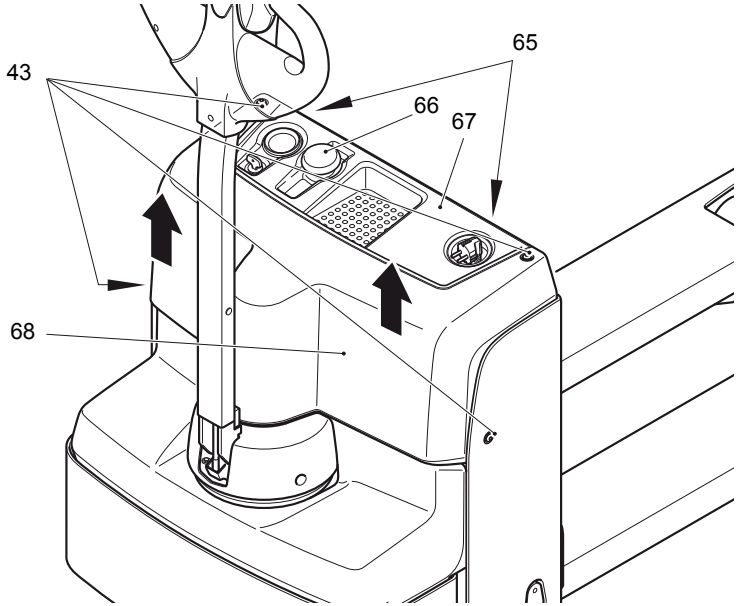
Tools and Material Required

– Allen key

Procedure

- Turn or slightly tilt tiller towards the edge of the truck.
- Remove the screws (43) with the Allen key.
- Carefully lift off the front panel (68) and put it to one side.
- Unscrew the emergency disconnect switch (66).
- Remove the screws (65) with the Allen key.
- Slightly lift off the cover (67).

The front panel is now disassembled.



4.7 Checking electrical fuses

Check fuses

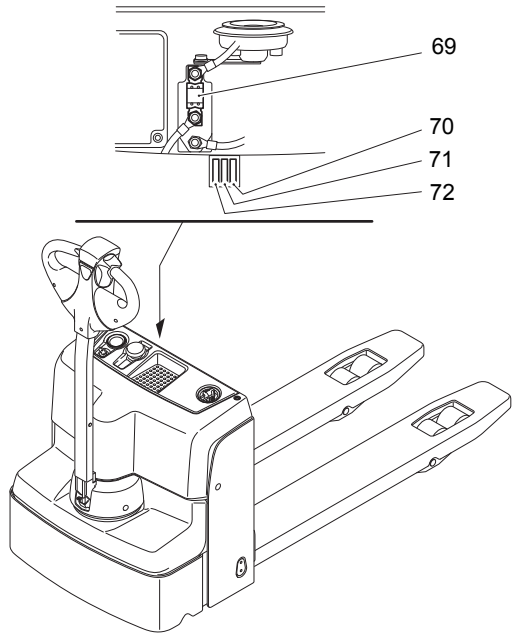
Requirements

– Truck prepared for maintenance and repairs, see page 75.
– Disassemble the panel and the cover, see page 81.

Procedure

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

The fuses are now checked.



Item	To protect	Rating
69	Drive motor / pump motor fuse	150 A
70	Electronic system; Brake	10 A
71	Electronic system; Keyswitch	5 A
72	Electronic system; Display	2 A

4.8 Restoring the truck to service after maintenance and repairs

Procedure

- Thoroughly clean the truck, see page 77.
- Lubricate the truck according to the lubrication schedule, see page 73.
- Clean the battery, grease the terminal screws and connect the battery.
- Charge the battery, see page 36.
- Start up the truck, see page 44.

5 Decommissioning the Industrial Truck

If the truck is to be out of service for more than a month, e.g. for commercial reasons, 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.

⚠ 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.

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 page 27.
- ▶ When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

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

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

5.1 Before Taking the Truck out of Service

Procedure

- Thoroughly clean the truck, see page 77.
- Prevent the truck from rolling away accidentally.
- Check the hydraulic oil level and replenish if necessary, see page 80.
- Apply a thin layer of oil or grease to any non-painted mechanical components.
- Lubricate the truck according to the lubrication schedule, see page 73.
- Charge the battery, see page 36.

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 page 36.

5.3 Restoring the truck to service after decommissioning

Procedure

- Thoroughly clean the truck, see page 77.
- Lubricate the truck according to the lubrication schedule, see page 73.
- Clean the battery, grease the terminal screws and connect the battery.
- Charge the battery, see page 36.
- Start up the truck, see page 44.

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.

G Maintenance and Inspection

⚠ WARNING!

Lack of maintenance can result in accidents

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

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

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

NOTE

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

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

W = Every 50 service hours, at least weekly
A = Every 500 service hours
B = Every 1000 service hours, or at least annually
C = Every 2000 service hours, or at least annually
● = Standard maintenance interval

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

1 Maintenance checklist

1.1 Owner

1.1.1 Standard equipment

Brakes		W	A	B	C
1	Test the brakes.	●			

Electrics		W	A	B	C
1	Test the warning and safety devices in accordance with operating instructions.	●			
2	Test the Emergency Disconnect switch.	●			

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

Driving		W	A	B	C
1	Check the wheel suspension and attachment.	●			
2	Check the wheels for wear and damage.	●			

Chassis and superstructure		W	A	B	C
1	Check the doors and covers.	●			
2	Check labels are legible, complete and plausible.	●			

Hydr. movements		W	A	B	C
1	Test the hydraulic system.	●			
2	Check the hydraulic oil level and top up if necessary.	●			
3	Check forks, load handler (e.g. mandrel) for wear and damage.	●			

1.2 Customer Service

1.2.1 Standard equipment

Brakes		W	A	B	C
1	Test the brakes.			●	

Electrics		W	A	B	C
1	Test the cable and motor attachments.			●	
2	Test the warning and safety devices in accordance with operating instructions.			●	
3	Test the displays and controls.			●	
4	Test the Emergency Disconnect switch.			●	
5	Check the contactors and/or relays.			●	
6	Check the fuse ratings.			●	
7	Carry out a frame leakage test.			●	
8	Check the carbon brushes, replace if necessary. Note: When replacing the carbon brushes, apply pressurised air to the motor.			●	
9	Check the electric wiring for damage (insulation damage, connections). Make sure wire connections are secure.			●	

Power supply		W	A	B	C
1	Check battery and battery cables for damage, contamination and secure mounting.			●	
2	Check battery cable connections are secure, check for dirt and grease terminals if necessary.			●	
3	Check the battery and battery components.			●	
4	Test the battery lock / battery attachment.			●	
5	Check battery voltage.			●	

Driving		W	A	B	C
1	Checking the bedding and attachment of the drive system.			●	
2	Check the transmission for noise and leakage.			●	
3	Make sure sensors are secured, not damaged, operational and clean.				
4	Check the wheel suspension and attachment.			●	
5	Check the wheels for wear and damage. Make sure they are tight and check the compressed air if necessary.			●	

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

Hydr. movements		W	A	B	C
1	Test "hydraulic" controls and make sure their labels are legible, complete and plausible.			●	
2	Check the cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
3	Test the lift mechanism, check for wear, damage and test the settings.			●	
4	Note: The hydraulic oil filter and vent/breather must be changed after 2000 service hours or every two years.			●	
5	Test the hydraulic system.			●	
6	Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage.			●	
7	Check the hydraulic oil level and top up if necessary.			●	
8	Replace the hydraulic oil.			●	
9	Test the pressure relief valve.			●	
10	Check forks, load handler (e.g. mandrel) for wear and damage.			●	
11	Check the tie / plunger rods.			●	

Agreed performance		W	A	B	C
1	Carry out a test run with rated load, if necessary with a customer-specific load.			●	
2	Demonstration after servicing.			●	

Steering		W	A	B	C
1	Check the tiller recuperating function.			●	

Charger		W	A	B	C
1	Check mains connector and mains cable.			●	
2	Check the start-up protection system for trucks with an on-board charger.			●	
3	Check the wires and electrical connections are secure and not damaged.			●	
4	Potential measurement on chassis while charging is in progress.			●	

1.2.2 Optional equipment

Weigher sensors / switches

Electrics		W	A	B	C
1	Test weigher system and check for damage.			●	

Issued on: 05.04.2016 16:05:42

Foreword

Notes to the operating instructions

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

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

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

Safety notices and text mark-ups

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

⚠ DANGER!

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

⚠ WARNING!

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

⚠ CAUTION!

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

NOTE

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

➔ Used before notices and explanations.

- ● Indicates standard equipment
- ○ Indicates optional equipment

Jungheinrich Aktiengesellschaft

Friedrich-Ebert-Damm 129
22047 Hamburg - Germany

Tel: +49 (0) 40/6948-0

www.jungheinrich.com

02.16 EN

Contents

A Traction battery

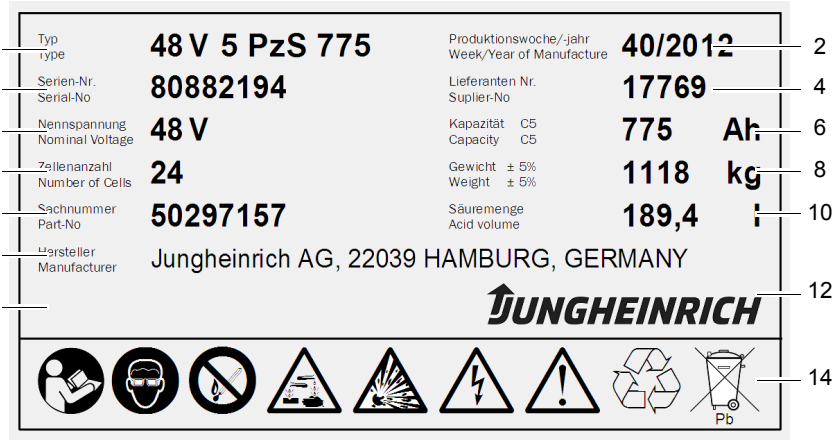
1 Correct Use and Application

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

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

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

2 Data plate



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

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. Buy-back terms and type of recycling are to be agreed with the manufacturer as described in § 8 of the battery legislation.
	Do not smoke! No naked flames, glowing embers or sparks near the battery - fire and explosion hazard!
	Avoid fire and explosion hazards and short circuits due to overheating! Keep away from naked flames and strong heat sources.
	Always wear protective clothing (e.g. safety goggles and safety gloves) when working on cells and batteries. Always wash your hands after completing the work. Use only insulated tools. Do not mechanically machine the battery, strike, crush, compress, notch, dent or modify it in any way.
	Hazardous electric voltage! The metal parts of the battery cells are permanently live. Therefore do not place any foreign objects or tools on the battery. Observe national health and safety regulations.
	If the materials leak, do not inhale the fumes. Wear safety gloves.
	Follow the user instructions and keep them in a visible position in the charging area. Work on the batteries should be performed only as instructed by specialist personnel.

4 Lead acid batteries with armour plated cells and liquid electrolyte

4.1 Description

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

Name	Explanation
PzS	– Lead acid battery with "Standard" armour plated cells and liquid electrolyte – Battery cell width: 198 mm
PzB	– Lead acid battery with "British Standard" armour plated cells and liquid electrolyte – Battery cell width: 158 mm
PzS Lib	– Lead acid battery with "Standard" armour plated cells and liquid electrolyte – Lead acid battery with extended maintenance interval – Battery cell width: 198 mm
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 corresponding 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 comply with the purity regulations of DIN 43530 Part 2.

4.1.1 Battery nominal data

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

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

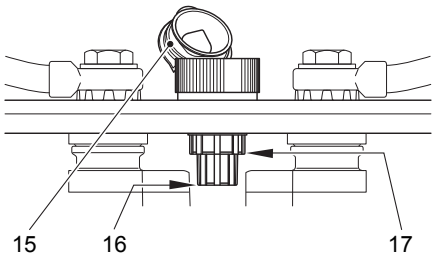
4.2 Operation

4.2.1 Commissioning unfilled batteries

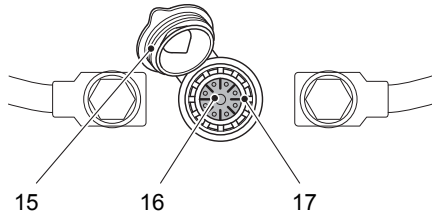
➔ The operations required must be carried out by the manufacturer's customer service department or a customer service organisation authorised by the manufacturer.

4.2.2 Commissioning filled and charged batteries

Battery cell cross section



Top view of a battery cell



Checks and operations to be performed before starting daily work

Procedure

- Make sure the battery is in physically good condition.
- Make sure the terminals are correct (positive to positive and negative to negative) and check that contacts on the battery terminal conducting system are secure.
- Check the M10 terminal screws of the conductors and connectors are secure and if necessary torque to 23 ±1 Nm.
- Charge the battery, see page 13.
- Check the electrolyte level of each battery cell after charging and top up if necessary:
  - Open the plug (15).

    ➔ The electrolyte level should not be less than the "Min" electrolyte marking (16) and must not exceed the "Max" (17) marking.
  - If necessary, add electrolyte with pure water up to the "Max" electrolyte level marking (17), see page 15.
  - Close the plug (15).

The test is now complete.

4.2.3 Discharging the battery

To achieve an optimum useful life avoid operational discharge of more than 80% of nominal capacity (full discharge). This corresponds to a minimum electrolyte density of 1.13 kg/l at the end of the discharge.
Fully or partially discharged batteries must be re-charged immediately and not left unattended.

4.2.4 Charging the battery

⚠ WARNING!

The gases produced during charging can cause explosions

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

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

NOTE

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

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

Charging the battery

Requirements

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

Procedure

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

➔ Deviations are outlined in the truck's operating instructions. The plugs remain on the cells or remain closed.

- Connect the battery to the switched off charger, ensuring the terminals are connect (positive to positive and negative to negative).
- Switch on the charger.

The battery is charged.

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

Compensation charging

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

➔ Compensation charging should be carried out weekly.

Trickle charging

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

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

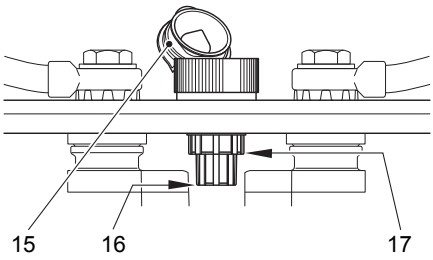
4.3 Servicing lead-acid batteries with armour plated cells

4.3.1 Quality of Water for Adding Electrolyte

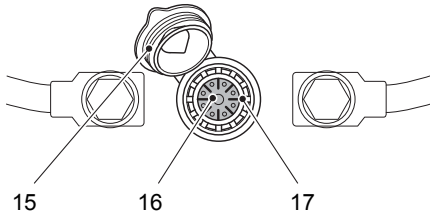
➔ The quality of the water used to add electrolyte must correspond to purified or distilled water. Purified water can be produced through distillation or ion exchangers and is then suitable for the production of electrolyte.

4.3.2 Daily

Battery cell cross section



Top view of a battery cell



– Charge the battery after each discharge.
– After charging, check the electrolyte level of each battery cell and replenish as required:
  – Open the plug (15).
  – If necessary, add electrolyte with pure water up to the "Max" electrolyte level marking (17).
  – Close the plug (15).

➔ The electrolyte level should not be less than the "Min" electrolyte marking (16) and must not exceed the "Max" (17) marking.

4.3.3 Weekly

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

4.3.4 Monthly

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

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

4.3.5 Annually

– Measure the insulation resistance of the truck in accordance with EN 1175-1.
– Measure the insulation resistance of the battery in accordance with DIN EN 1987-1.

➔ In accordance with DIN EN 50272-3 the battery insulation resistance should not be less than 50 Ω per volt of rated voltage.

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

5.1 Description

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

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

Electrolyte

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

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

5.1.1 Battery nominal data

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

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

5.2 Operation

5.2.1 Commissioning

Checks and operations to be performed before starting daily work

Procedure

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

The test is now complete.

5.2.2 Discharging the battery

➔ To achieve an optimum useful life avoid operational discharges of more than 60% of nominal capacity.

➔ If the battery is discharged during operation by more than 80% of rated capacity the useful life of the battery will reduce significantly. Fully or partially discharged batteries must be re-charged immediately and not left unattended.

5.2.3 Charging the battery

⚠ WARNING!

The gases produced during charging can cause explosions

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

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

NOTE

Charging the battery incorrectly can result in material damage.

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

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

Charging the battery

Requirements

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

Procedure

- Open or take off the tray lid or covers from the battery compartment.
- Connect the battery to the switched off charger, ensuring the terminals are connect (positive to positive and negative to negative).
- Switch on the charger.

➔ The electrolyte temperature rises by approx. 10°C during charging. If the temperatures are permanently higher than 40°C or lower than 15°C, a temperature-dependent constant voltage control of the charger is required. The adjustment factor must be applied with -0.004 V/C per °C.

The battery is charged.

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

Compensation charging

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

➔ Compensation charging should be carried out weekly.

Trickle charging

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

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

➔ Avoid trickle charging with PzV batteries.

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

➔ Do not add water!

5.3.1 Daily

– Charge the battery after each discharge.

5.3.2 Weekly

– Visually inspect for dirt and physical damage.

5.3.3 Every three months

– Measure and record the overall voltage.
– Measure and record the individual voltages.
– Compare the results with the previous ones.

➔ Carry out the measurements after full charging and subsequent resting for at least 5 hours.

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

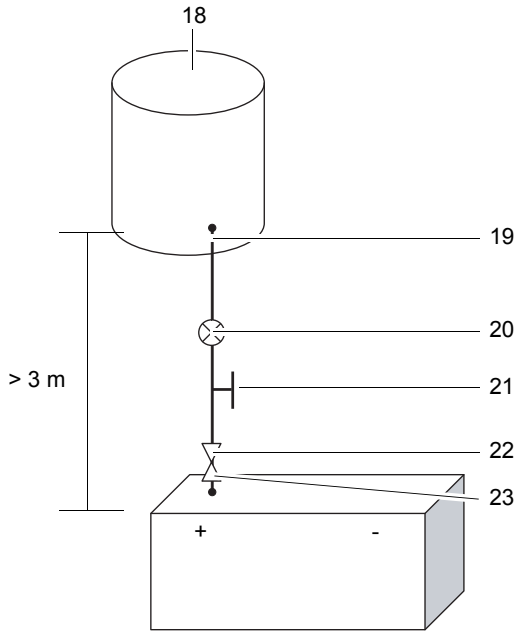
5.3.4 Annually

– Measure the insulation resistance of the truck in accordance with EN 1175-1.
– Measure the insulation resistance of the battery in accordance with DIN EN 1987-1.

➔ In accordance with DIN EN 50272-3 the battery insulation resistance should not be less than 50 Ω per volt of rated voltage.

6 Aquamatik water replenishment system

6.1 Water replenishment system design



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

6.2 Functional Description

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

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

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

6.3 Adding water

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

6.4 Water pressure

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

Water drop

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

Pressure water

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

6.5 Filling time

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

6.6 Water quality

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

6.7 Battery tubing

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

6.8 Operating temperature

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

6.9 Cleaning measures

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

6.10 Service mobile vehicle

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

7 Electrolyte circulation

7.1 Functional Description

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

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

Pump

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

Battery connection

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

Pressure-monitoring module

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

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

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

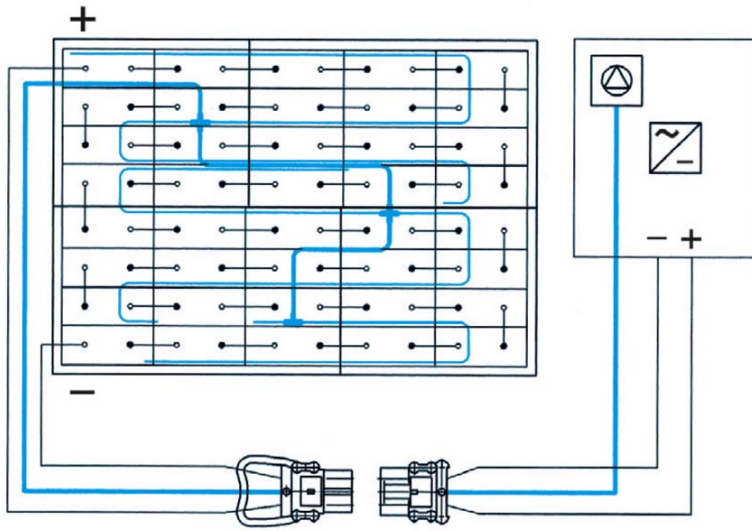
NOTE

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

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

Schematic illustration

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



8 Cleaning batteries

Batteries and trays must be cleaned in order to

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

When cleaning the batteries make sure that:

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

Cleaning the battery with a high pressure cleaner

Requirements

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

Procedure

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

➔ This generally ensures that the temperature does not exceed 60°C at a distance of 30cm behind the outlet nozzle.

- Observe the maximum operating pressure of 50 bar.
- Observe a minimum distance of 30 cm from the top of the battery.
- The battery should be sprayed over its entire surface to avoid localised overheating.

➔ Do not clean one spot for more than 3 seconds with the jet to avoid exceeding the maximum battery surface temperature of 60°C.

- After cleaning dry the battery surface with suitable materials e.g. compressed air or cleaning cloths.

Battery cleaned.

9 Storing the battery

NOTE

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

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

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

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

10 Troubleshooting

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

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

11 Disposal

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

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