ETX 513/515
including Cold Store

Operating instructions

52029815
07.08
Foreword

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. Each chapter starts with page 1. The page identification consists of a chapter letter and a page number.
For example: Page B 2 is the second page in chapter B.

The operating instructions detail different truck models. When operating and servicing the truck, make sure that the instructions apply to your truck model.

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

Used before safety instructions which must be observed to avoid danger to personnel.

Used before notices which must be observed to avoid material damage.

Used before notices and explanations.

● Used to indicate standard equipment.

○ Used to indicate optional equipment.

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

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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

The “Guidelines for the Correct Use and Application of Industrial Trucks” (VDMA) are supplied with the truck. The guidelines form part of these operating instructions and must be observed. National regulations apply in full.

The truck described in the present operator manual is an industrial truck designed for lifting and transporting load units. It must be used, operated and serviced in accordance with the present instructions. Any other type of use is beyond the scope of application and can result in damage to personnel, the industrial truck or property. In particular, avoid overloading the truck with loads which are too heavy or placed on one side. The data plate attached to the truck or the load diagram are binding for the maximum load capacity. The industrial truck must not be used in fire or explosion endangered areas, or areas threatened by corrosion or excessive dust.

**Proprietor responsibilities:** For the purposes of the present operator manual the “proprietor” 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 proprietor must ensure that all truck users have read and understood this operator manual.

Failure to comply with the operator manual shall invalidate 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’s customer service department.

**Attaching accessories:** The mounting or installation of additional equipment which affects or supplements the performance of the industrial truck requires the written permission of the manufacturer. In some cases, local authority approval shall be required. Approval of the local authorities however does not constitute the manufacturer’s approval.
B Truck Description

1 Application

The ETX 513/515 is an electric three-way stockpicker. It is designed to be used on level surfaces in accordance with DIN 15185 to transport goods. Open bottom pallets or pallets with transverse boards can be lifted beyond the load wheel area.

Loads can be stacked and unstacked and transported over long distances.

If the ETX 513/515 is used for assembly work with an appropriate working platform, the working platform must be supplied or approved by the manufacturer.

The racks must be suitable for the ETX 513/515. The safety distances stipulated by the manufacturer (e.g. EN 1726-2 item 7.3.2) must be observed. The ground surface must comply with DIN 15185. Guide rails must be provided in the narrow aisles for the rail guidance system.

Vulkollan guide rollers attached to the truck chassis guide the truck between the guide rails.

A guidance wire must be routed in the ground for the inductive guidance system. The signals from the wire are received on the chassis and processed in the on-board computer.

The ETX 513/515 can travel freely outside the narrow aisle, depending on the lift height and with certain travel speed restrictions.

The capacity is shown on the data plate.

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity</th>
<th>Load centre of gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETX 513</td>
<td>1,250 kg</td>
<td>600 mm</td>
</tr>
<tr>
<td>ETX 515</td>
<td>1,500 kg</td>
<td>600 mm</td>
</tr>
</tbody>
</table>

Travel direction definition

The following determinations have been made for travel direction specification.

Left

Right

Drive direction

Load direction
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mast</td>
</tr>
<tr>
<td>2</td>
<td>Control panel</td>
</tr>
<tr>
<td>3</td>
<td>Driver's position</td>
</tr>
<tr>
<td>4</td>
<td>Chassis</td>
</tr>
<tr>
<td>5</td>
<td>Load handler</td>
</tr>
</tbody>
</table>

= Standard equipment  ○ = Optional Equipment
2.1 Truck

Safety mechanisms:
An enclosed truck geometry with rounded edges ensures safe handling of the truck. The overhead guard protects the driver from falling objects. The Emergency Disconnect switch immediately cuts out all truck movements in hazardous situations. Travelling can only be activated when the foot switch is pressed.

Drive:
Vertically mounted, heavy duty AC motor (asynchronous). The motor is directly attached to the single-wheel driving gear, ensuring rapid and trouble-free maintenance.

Brake system:
The truck can be braked gently and wear-free by taking your foot off the accelerator or switching to the opposite travel direction. This feeds energy into the battery (operating brake).
In addition, the truck can be braked via a brake pedal which acts on the hydraulic brake shoes in the load wheels.
For wire guidance trucks a spring loaded brake is also applied to the hydraulic brake shoes in the load wheels. This brake only acts during an emergency stop.
The electromagnetic spring pressure brake acting on the drive motor serves as a parking brake and handbrake.

Steering:
Particularly smooth steering with threephase drive system. The handy steering wheel is integrated within the control panel. The position of the steered drive wheel is shown in the control panel display unit. The steering angle is +/- 90°, offering maximum manoeuvrability in narrow aisles.
With the mechanical rail guidance system the drive wheel is set to the forward position at the press of a button.
In wire guidance mode, steering is automatically assumed by the truck controller when it detects the guidance wire, and manual steering is deactivated.

Driver’s position:
The generous driver’s cab, designed to suit the working environment, with a comfortable seat and the ergonomic arrangement of the controls ensure fatigue-free operation. The driver’s seat together with the control panel and accelerator pedals can be infinitely rotated in the load direction by approx. 30° and in the drive direction by approx. 10° at the press of a button while gently applying the accelerator. The driver’s seat is cushioned and individually adjustable to body size and weight. The control panel and arm rest can be height and length-adjusted.

ETX 513/515 Cold Store only:
With the ETX 513/515 Cold Store the driver’s cab also has a heated comfortable seat. In addition, the driver’s cab has heated windows and two independent heaters.

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In addition, the driver’s cab has heated windows and two independent heaters.
Controls and displays:
The functions are activated via ergonomic thumb movement to ensure fatigue-free operation without stressing the wrists; sensitive application of travel and hydraulic movements to spare and position the goods precisely.
Integrated information display unit for all important driver information such as steering wheel position, overall lift, truck status reports (e.g. faults), service hours, battery capacity, time and inductive guidance status etc.

Hydraulic system:
All hydraulic movements are controlled by a maintenance-free AC motor with a flanged low emission gear pump. Oil is distributed via magnetic switch valves. The varying oil requirements are controlled by the speed of the motor. During a lowering operation the hydraulic pump drives the motor which then acts as a generator (regenerative lowering). The energy produced is then fed back to the battery.

Rack height select (O):
Rack height select can be used both to lift and lower the load as well as for stacking and retrieving. With rack height select, the drive can select the required lift height via a keypad. When the required lift height is reached, lifting automatically ends. Rack height select is designed for a range of warehouse areas with different rack heights.

Electrical System:
Service laptop connection interface:
– To configure all the key truck data (end position damping, lift cutout, retardation and acceleration patterns, reach speeds, cut-outs etc.) rapidly and reliably.
– To read off the error log to analyse fault causes.
– To simulate and analyse program operations.
– Simple functional extension by releasing code numbers.
The controller is fitted with a CAN Bus and a continually measuring sensor system.
The controller provide smooth start-up and braking of the load in all limit positions through limit position and intermediate cushioning.
Highly efficient threephase technology with energy retention for the drive and lift motors provides high travel and lift speeds and better use of energy.
The MOSFET threephase controller provides smooth starting for all movements.
For drive battery options see chapter D.

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For drive battery options see chapter D.
3 Standard Version Specifications

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

3.1 Performance data

<table>
<thead>
<tr>
<th>Description</th>
<th>ETX 513</th>
<th>ETX 515</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (where C = 600 mm)</td>
<td>1250</td>
<td>1500</td>
</tr>
<tr>
<td>Load centre of gravity distance</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Travel speed without load (RG)</td>
<td>10.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Travel speed with load (RG)</td>
<td>10.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Travel speed without load (IG)</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Travel speed with load (IG)</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Lift speed without load</td>
<td>0.46</td>
<td>0.46</td>
</tr>
<tr>
<td>Lift speed with load</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Lowering speed without load</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Lowering speed with load</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Traverse speed w/ w.o. load</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>
### 3.2 Dimensions (as per data plate)

<table>
<thead>
<tr>
<th>Description</th>
<th>ETX 513</th>
<th>ETX 515</th>
</tr>
</thead>
<tbody>
<tr>
<td>h₁ Mast height (retracted) ¹&lt;sub&gt;1&lt;/sub&gt;</td>
<td>3820</td>
<td>3920</td>
</tr>
<tr>
<td>h₃ Lift ¹&lt;sub&gt;1&lt;/sub&gt;</td>
<td>5500</td>
<td>5500</td>
</tr>
<tr>
<td>h₄ Mast height (extended) ¹&lt;sub&gt;1&lt;/sub&gt;</td>
<td>6650</td>
<td>6750</td>
</tr>
<tr>
<td>h₆ Height above overhead guard</td>
<td>2461</td>
<td>2461</td>
</tr>
<tr>
<td>h₇ ISO seat height</td>
<td>1280</td>
<td>1280</td>
</tr>
<tr>
<td>Ast Working aisle width for pallets</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>1200 x 1200 traverse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b₂ Width over load axle</td>
<td>1450</td>
<td>1450</td>
</tr>
<tr>
<td>b₅ Distance between forks, outer</td>
<td>845</td>
<td>845</td>
</tr>
<tr>
<td>(PAL width 1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b₆ Width across guide rollers</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>l₁ Overall length w.o. load</td>
<td>3492</td>
<td>3780</td>
</tr>
<tr>
<td>(PAL width 1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l₂ Length including fork shank – HK</td>
<td>3176</td>
<td>3475</td>
</tr>
<tr>
<td>truck (PAL width 1200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l Fork length</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>W₉ Turning radius</td>
<td>2135</td>
<td>2460</td>
</tr>
<tr>
<td>m₂ Ground clearance centre wheelbase</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Net weight incl. battery, w.o. load</td>
<td>6540</td>
<td>7530</td>
</tr>
</tbody>
</table>

¹<sub>1</sub> ZT mast performance data measured for 550 ZT

### 3.3 Mast version

<table>
<thead>
<tr>
<th>Description</th>
<th>ZT</th>
<th>DZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>h₁ Collapsed height</td>
<td>2670 - 5720</td>
<td>3200 - 5800</td>
</tr>
<tr>
<td>h₃ Lift</td>
<td>3000 - 9000</td>
<td>6000 - 13000</td>
</tr>
<tr>
<td>h₄ Extended height</td>
<td>4250 - 10250</td>
<td>7250 - 14250</td>
</tr>
<tr>
<td>h₆ Height above overhead guard</td>
<td>2461</td>
<td></td>
</tr>
</tbody>
</table>
3.4 EN norms

ETX 513/515 ETX 513/515 Cold Store

Noise emission: 65 dB(A) 73 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 driver’s ear.

ETX 513/515 ETX 513/515 Cold Store

Vibration: 1.11 m/s² 0.44 m/s²

in accordance with EN 13059

The vibration acceleration acting on the body in the operating position is, in accordance with standard procedures, the linearly integrated, weighted acceleration in the vertical direction. It is calculated when travelling over bumps at constant speed.

Electromagnetic compatibility (EMC)

The manufacturer confirms that equipment complies with tolerance levels for electromagnetic emissions and resistance as well as static electricity discharge testing in accordance with EN 12895 including the normative procedures contained therein.

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

For the ETX 513/515:

Ambient temperature
- operating at 0 °C to 40 °C

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

The truck is not authorised for use in cold stores.

The truck may only be used in closed areas. The following applies:
- Ambient temperature in 24-hour mode: max. 25 °C
- max. air humidity (inside) 70%, non-condensing.

For the ETX 513/515 Cold Store:

The temperature range in the cold store or freezer area is:
- T min cold range -10 °C
- T min cold range -28 °C
- T max -2 °C

The truck should only be removed from the cold store / freezer environment for extensive service work and battery charging.

The service work should be performed in a well ventilated, dry area. The duration of stay outside the cold store / freezer environment is at least 8 hours.

It is not permitted for the truck to be operated in a shock freezer (temperature range -28 °C to -40 °C).
Identification points and data plates

Warning and information labels, such as capacity diagrams, attachment points and identification plates, must be readable at all times or be replaced, if necessary.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Data plate</td>
</tr>
<tr>
<td>7</td>
<td>Capacity plate</td>
</tr>
<tr>
<td>8a</td>
<td>“Read operating instructions” notice</td>
</tr>
<tr>
<td>8b</td>
<td>Test sticker (○)</td>
</tr>
<tr>
<td>9</td>
<td>Crane hook notice</td>
</tr>
<tr>
<td>10</td>
<td>“No passengers” notice</td>
</tr>
<tr>
<td>11</td>
<td>Tipover notice</td>
</tr>
<tr>
<td>12</td>
<td>Safety belt decal (option)</td>
</tr>
</tbody>
</table>
Item | Description
--- | ---
13 | "Laser beam" warning
14 | Decal: Do not step onto or beneath the load, risk of trapping
15 | Jacking point notice
16 | Serial number (engraved in chassis underneath the battery cover)
17 | "Emergency drain" decal
18 | "Low voltage electronics system" warning
19 | "Add hydraulic oil" notice
4.1 Truck data plate

For queries relating to the truck or spare parts orders, please state the truck serial no. (21).

4.2 Capacity

The plate (7) gives the capacity (Q in kg) of the truck as a function of the load centre of gravity distance (D in mm) and lift height (H in mm) in tabular form.
C Transport and Commissioning

1 Transport

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

– Vertically, with mast and load handler assembled (for low heights)
– Vertically, with mast and load handler disassembled (for large heights)

⚠️ Only personnel trained by the manufacturer may assemble the truck on site, commission it and instruct the driver.

2 Lifting by crane

⚠️ Only use lifting gear with sufficient capacity (for truck weight see truck data plate. See Chapter B).

⚠️ The truck must only be lifted by crane with the battery removed.

– Parking the truck securely (see Chapter E).

⚠️ Attach the crane slings to the strap points (1-3) so that the truck cannot slip.

Transportation by Crane without a Mast  Transportation by Crane with a Mast

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Transportation by Crane without a Mast  Transportation by Crane with a Mast
2.1 Crane points

When the mast is removed the crane points (1) are at the front of the chassis, where the mast is bolted onto.

The crane points (2) are the eyes in the overhead guard.

The crane points (3) are the eyes at the top of the mast.

When lifting by crane, use the following crane points:

– Crane points for complete truck with mast assembled:
  points (2) and (3) (weight 6,000 kg)

– Crane points for the basic truck:
  points (1) and (2) (weight 2,500 kg)

– Crane points for the mast:
  points (1) (weight 3,500 kg)

2.2 Lifting the battery by crane

When lifting the battery with a crane attach suitable lifting gear to the four eyes of the battery container (for weight see battery data plate).

For battery removal see Chapter D, Section 4.

3 Securing the truck during transport

The truck must be securely fastened when being transported on a lorry or a trailer. The lorry / trailer must have fastening rings.

Loading shall be carried out by staff especially trained for that purpose in accordance with recommendations contained in Guidelines VDI 2700 and VDI 2703. In each case correct measurements shall be determined and appropriate safety measures adopted.
3.1 Transport locking of the basic truck without the mast assembled

⚠️ The mast must only be disassembled by the manufacturer's authorised service department.

⚠️ Only use belts with a rated capacity of >9 tonnes on the ETX 513/515.

⚠️ When transporting, always relieve the drive wheel by placing the entire surface of a wooden beam (8) underneath the counterweight (minimum chassis width). In addition, secure the load wheels with wedges (9).

⚠️ If the truck’s battery is supplied in the chassis, disconnect the battery.

Fastening belts (5, 6) should be attached to at least 4 different lorry / truck eyes / attachment points (7).

Belts placed over “sharp” edges must be protected by a suitable support material, e. g. foam.

To ensure secure transport of an ETX 513/515, use the following prescribed attachment points for fastening/quick release belts.

– To secure the truck 2 belts (5,6) are tensioned from the driver’s cab to the front (load direction) and to the rear (drive direction) respectively.
– The load axle can also be secured with a belt (4).

⚠️ Note the cable routing and cover sharp edges with a suitable material.

Belts placed over “sharp” edges must be protected by a suitable support material, e. g. foam.

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– The load axle can also be secured with a belt (4).

⚠️ Note the cable routing and cover sharp edges with a suitable material.
3.2 Mast transport safety

⚠️ Use a transport retaining device (10) to prevent the fork carriage from sliding.

If the mast is stored on a pallet(s), fasten them securely to the mast (11). The traverse/pivot frame must also be secured.

Route the belts under the lift cylinder / chains (ZT / DZ) and attach them to the lorry/truck eyes/attachment points (12).

⚠️ Belts placed over the lift chains and “sharp” edges must be protected with suitable materials.

Any parts supplied (forks, guide rollers etc.) can be packaged separately on a pallet (13).
3.3 Transport safety device for trucks with the mast assembled

Only use belts with a rated capacity of >9 tonnes on the ETX 513/515.

When transporting, always relieve the drive wheel by placing the entire surface of a wooden beam (18) underneath the counterweight (minimum chassis width). In addition, secure the load wheels with wedges (19).

If the truck’s battery is supplied in the chassis, disconnect the battery.

Fastening belts (15, 16) should be attached to at least 4 different lorry / truck eyes / attachment points (17).

Belts placed over “sharp” edges must be protected by a suitable support material, e. g. foam.

To ensure secure transport of an ETX 513/515, use the following prescribed attachment points for fastening/quick release belts.

– To secure the truck 2 belts (16) are tensioned from the driver’s cab to the rear left and right (drive direction) respectively.
– In the load direction the truck is tensioned with a belt from the left and right hand sides of the mast eccentric respectively (15).

Avoid damaging the battery panel.

Note the cable routing and cover sharp edges with a suitable material.

If the truck is to stand at the front of the transporter, use wooden beams (14) to ensure a positive fit.
4 Commissioning

4.1 Moving the truck without a battery

This operation must only be performed by suitably trained maintenance personnel.

This operation is forbidden on slopes and inclines (no brakes).

See also chapter E, “Recovering the truck from a narrow aisle / Moving the truck without a battery”.

4.2 Installing and removing the mast

This operation must only be performed by the manufacturer or a customer service team authorised by the manufacturer.

There is an additional risk of trapping when reaching and traversing in the traverse/reach section of the attachment.

5 Starting the truck for the first time

Operate the truck only with battery current. Rectified AC current will damage the electronic components. The battery leads (tow cable) must be less than 6m long.

To prepare the truck after delivery or after transport, proceed as follows:
– Install and charge the battery if necessary (see Chapter D, Sections 4 and 3).
– Commission the truck as per instructions (See Chapter E, Section 3).

With the ETX 513/515 an anti-tipover device (21) is fitted, depending on the tipover test. When a tipover retaining device is used, an X (20) is engraved on the truck chassis on the right hand side of the battery compartment, after the serial number.

Before operating, check the trucks to ensure the tilt safety devices (21) are present (if required).

Check that all safety devices are present and operational.
D Battery Maintenance, Charging & Replacement

1 Safety regulations for handling acid batteries

Park the industrial truck securely before carrying out any work on the batteries (see Chapter E).

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

Fire protection: Smoking and naked flames must be avoided when working with batteries. Wherever an industrial truck is parked for charging there shall be no inflammable material or lubricants capable of creating sparks within 2 metres around the truck. The area must be well ventilated. Fire protection equipment must be provided.

Battery maintenance: The battery cell covers must be kept dry and clean. The terminals and cable shoes must be clean, secure and have a light coating of dielectric grease.

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

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

Batteries contain an acid solution which is poisonous and corrosive. Therefore, always wear protective clothing and eye protection when carrying out work on batteries. Above all avoid any contact with battery acid. Nevertheless, should clothing, skin or eyes come in contact with acid the affected parts should be rinsed with plenty of clean water - where the skin or eyes are affected call a doctor immediately. Immediately neutralise any spilled battery acid.

Only batteries with a sealed battery container may be used.

The weight and dimensions of the battery have a considerable effect on the operational safety of the industrial truck. Battery equipment may only be replaced with the agreement of the manufacturer.
2 Battery types

ETX 513/515:
The ETX 513/515 can be fitted with a variety of battery types. All battery types comply with DIN 43531-A. The following table shows which combinations can be included as standard:

<table>
<thead>
<tr>
<th>Battery type</th>
<th>Battery type</th>
<th>Truck type</th>
</tr>
</thead>
<tbody>
<tr>
<td>80V</td>
<td>3 E PzS 420</td>
<td>ETX 513</td>
</tr>
<tr>
<td>80V</td>
<td>4 E PzS 560</td>
<td>ETX 515</td>
</tr>
<tr>
<td>80V</td>
<td>5 E PzS 700</td>
<td>ETX 515</td>
</tr>
<tr>
<td>80V</td>
<td>5 E PzS 700 L</td>
<td>ETX 515</td>
</tr>
<tr>
<td>80V</td>
<td>5 E PzS 760 XL</td>
<td>ETX 515</td>
</tr>
</tbody>
</table>

The battery weights can be taken from the battery data plate.

The weight and dimensions of the battery have a considerable effect on the operational safety of the industrial truck. Battery equipment may only be replaced with the agreement of the manufacturer.

ETX 513/515 Cold Store:
The ETX 513/515 Cold Store can be fitted with a variety of battery types. All battery types comply with DIN 43531-A. The following table shows which combinations can be included as standard:

<table>
<thead>
<tr>
<th>Battery type</th>
<th>Battery type</th>
<th>Truck type</th>
</tr>
</thead>
<tbody>
<tr>
<td>80V</td>
<td>5 E PzS 700</td>
<td>ETX 515</td>
</tr>
<tr>
<td>80V</td>
<td>5 E PzS 700 L</td>
<td>ETX 515</td>
</tr>
</tbody>
</table>

The battery weights can be taken from the battery data plate.

For trucks where the batteries remain on the truck during charging, only batteries with Aquamatic systems are used.

The weight and dimensions of the battery have a considerable effect on the operational safety of the industrial truck. Battery equipment may only be replaced with the agreement of the manufacturer.
2.1 **Fully open the battery panel.**

Park the truck securely (see Chapter E).

- Turn key switch (3) to "0" (zero).
- Set the driver’s seat together with the control panel and accelerator pedals to neutral (at right angles to the travel direction) – see Driver's Position Setting in Chapter E.
- Unfold the handles (5) from the battery panel (6) and fully open the battery panel (6).
- Attach the battery panel (6) to the mast (8) using the clip (7).

**STEP**

Always open or close the battery panel (6) with care.

**STEP**

All covers and connections must be restored to the normal operating condition before the truck is started up for work.

**STEP**

All covers and connections must be restored to the normal operating condition before the truck is started up for work.
3 Charge the battery

3.1 ETX 513/515

Park the truck securely (see Chapter E).

- Turn key switch (3) to "0" (zero).
- Fully open the battery panel (see "Fully Opening the Battery Panel" in chapter D).

Only connect and disconnect the battery connector and the socket when the mains and charger are switched off.

- Disconnect the battery.
- If necessary, remove the insulating mat from the battery.

When charging, the tops of the battery cells must be exposed to provide sufficient ventilation. Do not place any metal objects on the battery. Before charging, check all cables and plug connections for visible signs of damage.

- Connect the charger lead of the battery charger station with the battery connector.
- Switch on the charger.
- Charge the battery in accordance with the battery and charging station manufacturers' instructions.

It is essential to follow the safety regulations of the battery and charger station manufacturers.
3.2 ETX 513/515 Cold Store

If the truck remains in the cold store while the battery is being charged, certain components must be kept at operating temperature. This prevents any thawing and resultant condensing.

- Park the truck securely (see Chapter E).
  - Turn key switch (3) to "0" (zero).
  - Fully open the battery panel (see “Fully Opening the Battery Panel” in chapter D).
- Only connect and disconnect the battery connector and the socket when the mains and charger are switched off.
  - Disconnect the battery.
  - If necessary, remove the insulating mat from the battery.
- When charging, the tops of the battery cells must be exposed to provide sufficient ventilation. Do not place any metal objects on the battery. Before charging, check all cables and plug connections for visible signs of damage.
  - Connect the charger lead of the battery charger station with the battery connector.
  - Switch on the charger.
  - Charge the battery in accordance with the battery and charging station manufacturers’ instructions.

It is essential to follow the safety regulations of the battery and charger station manufacturers.

3.2.1 Charging the battery in a cold store

Preconditions:
1. The cab must be heated to defroster temperature (+5 °C) via a heating fan with an external energy source.
2. The truck controller must be kept on standby through an external energy source (with DC transformer) – see Standby Mode (○) in chapter D).
3. The hydraulic reservoir and rotary cylinder must be heated.
4. Jack up the drive wheel to relieve it.
5. The battery must be removed from the truck and charged in a charging station outside the cold store range (see “Battery Removal and Installation” in chapter D).
3.2.2 Standby Mode

Specific functions can be kept operational and heated via an external power supply and a special switch.

380 volt AC / 80 volt DC 27amp supply
- 380 volt / 32 amp mains connector
- Battery connector
- Main switch

To do this:
- Turn key switch (3) to "0" (zero).
- Fully open the battery panel (see "Fully Opening the Battery Panel" in chapter D).
- Connect the battery to the charger and switch on the charger.
- Connect the power supply (10) to the mains.
- Connect the power supply lead (11) to the truck's battery connector.
- Turn on the main switch (9).
- Press the Emergency Disconnect (2) on the truck and set the key switch (3) to "1".
- Set the cabin heating to the first level.
- Switch on the window and seat heating.
- The hydraulic reservoir and the rotate cylinder are automatically connected and heated.

The truck cannot perform any travelling or hydraulic movements when the power supply is connected.

3.2.3 Charging the Battery outside the Cold Store

There must be a room specially designed for this purpose.

Preconditions:
1. The room must be heated and be at least +15 °C.
2. There must be hot air fans above the charging station to dry the truck during charging.

3.2.3 Charging the Battery outside the Cold Store

There must be a room specially designed for this purpose.

Preconditions:
1. The room must be heated and be at least +15 °C.
2. There must be hot air fans above the charging station to dry the truck during charging.
Battery removal and installation

Only batteries with insulated cells and terminal connectors may be used. When replacing a battery always use the same battery type. Extra weights must not be removed and must remain in the same position.

The truck must be horizontal in order to prevent the battery from falling out when the battery retainer is removed.

Only connect and disconnect the battery connector and the socket when the mains and charger are switched off.

Installing and removing a battery with a battery trolley:

– Turn key switch (3) to "0" (zero).
– Fully open the battery panel (see “Fully Opening the Battery Panel” in chapter D) and disconnect the battery (12).
– Lift out the left and right hand battery panels.
– Undo the battery retainer (15) by moving the lever (14) down and remove the retainer.
– Pull the battery (13) onto the side of the prepared battery trolley.

Make sure the battery trolley is properly secured.

After replacing/fitting the battery, make sure that the battery is well secured in the battery compartment.

The battery retainers (15,16) can swap positions. This means that they can both be fitted in either the left or right side of the truck’s chassis.

Assembly is the reverse order.

To avoid pushing the battery (13) through on assembly, the battery retainer (16) must first be plugged in on the opposite side.

After installing again, check all cables and connectors for signs of visible damage and before using the truck again check that:

– the battery retainer (15) is fitted and secured by the lever (14).
– the left and right hand battery panels are inserted and the battery panel (6) is properly closed once the clip (7) has been undone.
Installing/removing batteries in the battery replacement trolley with a forklift:

– Turn key switch (3) to “0” (zero).
– Fully open the battery panel (see “Fully Opening the Battery Panel” in chapter D).
– Lift out the left and right hand battery panels (21).
– Remove the battery connector (17) from the left and right-hand side of the battery compartment.
– Remove the battery retainers (19) from the left and right-hand side of the battery compartment.
– Carefully pull out the batteries (18) from the left or right hand side using a forklift truck. To do this, enter the forklift’s load handler into the fork shoes (20) of the battery replacement carriage.

Assembly is the reverse order.

When fitting the batteries (18) in the battery replacement carriage, make sure that the load handler of the forklift truck used for assembly is located in the fork shoes (20) of the battery frame. In addition, the fork tips of the load handler must not project beyond the battery replacement carriage.

After replacing/fitting the battery, make sure that the battery is well secured in the battery compartment.

After installing again, check all cables and connectors for signs of visible damage and before using the truck again check that:

– the battery retainers (19) are inserted and are secure,
– the battery panels (6, 21) are properly closed.
5 Battery – checking condition and acid level

- The battery manufacturer’s maintenance instructions apply.
- Check the battery housing for cracks and any spilled acid.
- Remove any oxidation remains from the battery terminals and apply an acid-free grease to the battery terminals.
- Unscrew the stops and check the acid level.
  The acid level should be at least 10-15 mm above the top of the plates.
- If necessary, re-charge the battery.

5 Battery discharge indicator

When you turn the EMERGENCY DISCONNECT switch and turn the key in the key switch clockwise, the battery discharge indicator will show the residual capacity available. The display flashes at a residual capacity of 30%. Lift cut-out occurs at a 20% capacity display.

For maintenance-free and special batteries the display and cutout points can be adjusted by authorised personnel by assigning parameters.
1 Safety Regulations for the Operation of Forklift Trucks

Driver authorisation: The forklift 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.

Driver’s rights, obligations and responsibilities: 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 operator manual. The driver shall be afforded all due rights.

Unauthorised Use of Truck: The driver is responsible for the truck during the time it is in use. He shall prevent unauthorised persons from driving or operating the truck. It is forbidden to carry passengers or lift personnel.

Damage and Faults: The supervisor must be immediately informed of any damage or faults to the forklift truck. Trucks not safe for operation (e.g. wheel or brake problems) must not be used until they have been rectified.

Repairs: The driver must not carry out any repairs or alterations to the forklift truck without the necessary training and authorisation to do so. On no account may the driver disable or adjust safety mechanisms or switches.

Hazardous area: A hazardous area is defined as the area in which a person is at risk due to truck movement, lifting operations, the load handler (e.g. forks or attachments) or the load itself. This also includes areas which can be reached by falling loads or lowering operating equipment.

Unauthorised persons must be kept away from the hazardous area. Where there is danger to personnel, a warning must be sounded in good time. If unauthorised personnel are still within the hazardous area the truck shall be brought to a halt immediately.

Safety Devices and Warning Signs: Safety devices, warning signs and warning instructions in the present operating instructions shall be strictly observed.
## Operating and Display Equipment

### 2.1 Operating and display equipment on control panel

<table>
<thead>
<tr>
<th>Item</th>
<th>Control or Display</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Steering wheel</td>
<td>Steers truck in desired direction.</td>
</tr>
<tr>
<td>2</td>
<td>&quot;Cancel sub-menu&quot; switch</td>
<td>Sets the menu to standard display</td>
</tr>
<tr>
<td>3</td>
<td>Display unit</td>
<td>Operating information and warning message display</td>
</tr>
<tr>
<td>4</td>
<td>Switch</td>
<td>Activates or confirms the function related to the symbol displayed above it</td>
</tr>
<tr>
<td>5</td>
<td>Rack height select ( )</td>
<td>Area selection.</td>
</tr>
<tr>
<td>6</td>
<td>Rack height select ( )</td>
<td>Shelf selection.</td>
</tr>
<tr>
<td>7</td>
<td>Travel direction switch</td>
<td>Pre-selects required direction.</td>
</tr>
<tr>
<td>8</td>
<td>Rotary seat switch</td>
<td>Turns the operator position</td>
</tr>
<tr>
<td>9</td>
<td>Switch switch</td>
<td>Switches control current on and off. Removing the switch prevents the truck from being switched on by unauthorised personnel.</td>
</tr>
<tr>
<td>10</td>
<td>EMERGENCY DISCONNECT switch</td>
<td>Interrupts the main power supply, all truck movements are disabled.</td>
</tr>
<tr>
<td>11</td>
<td>Warning switch</td>
<td>Activates a warning.</td>
</tr>
<tr>
<td>12</td>
<td>Hydraulic control button</td>
<td>Main lift raise and lower, load fork traverse and rotate.</td>
</tr>
<tr>
<td>13</td>
<td>&quot;Fork carriage rotate&quot; switch</td>
<td>Changes the hydraulic control button to the “Fork carriage rotate” function</td>
</tr>
<tr>
<td>14</td>
<td>&quot;Attachment traverse&quot; switch</td>
<td>Changes the hydraulic control button to the “Attachment traverse” function</td>
</tr>
</tbody>
</table>

- ● = Standard equipment
- ○ = Optional Equipment
### 2.2 Foot controls

<table>
<thead>
<tr>
<th>Item</th>
<th>Control or Display</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Deadman switch (foot switch)</td>
<td>• Release parking brake. When activated, releases the spring pressure brake and travel. Releasing the deadman switch causes the truck to brake immediately until it comes to a halt.</td>
</tr>
<tr>
<td>16</td>
<td>Brake pedal</td>
<td>• Applies the load wheel brake</td>
</tr>
<tr>
<td>17</td>
<td>Accelerator pedal</td>
<td>• Infinite travel speed control</td>
</tr>
</tbody>
</table>

= Standard equipment  ○ = Optional Equipment
## Display unit controls and displays

### Upper range symbols

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Control / Display</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td><img src="turtle.png" alt="Turtle symbol" /> <img src="rabbit.png" alt="Rabbit symbol" /></td>
<td>Displays possible travel speeds: Turtle Rabbit Creep mode Max. travel speed</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td><img src="wg.png" alt="WG symbol" /></td>
<td>&quot;Guidance wire recognition&quot; display</td>
<td>Sensors which have recognised the guidance wire have a dark background</td>
</tr>
<tr>
<td>20</td>
<td><img src="rg.png" alt="RG symbol" /> <img src="ig.png" alt="IG symbol" /> <img src="wg.png" alt="WG symbol" /></td>
<td>Steering angle display changes with display</td>
<td>Indicates the current steering angle with reference to the centre position After selecting &quot;Rail guidance&quot; the steering angle display permanently shows the centre position The steering angle display fades and is replaced by guidance wire symbols</td>
</tr>
<tr>
<td></td>
<td><img src="wg.png" alt="WG symbol" /> <img src="wg.png" alt="WG symbol" /> <img src="wg.png" alt="WG symbol" /></td>
<td>- &quot;Tracking in progress&quot; - &quot;Automatically guided&quot; - &quot;Deviation from guidance wire&quot;</td>
<td></td>
</tr>
</tbody>
</table>

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</tr>
<tr>
<td>Item</td>
<td>Symbol</td>
<td>Control / Display</td>
<td>Function</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td>21</td>
<td>![Symbol]</td>
<td>Display “Overall lift” “Referencing required” display: Main lift - raise Main lift - lower</td>
<td>Requests Main lift to raise Requests Main lift to lower Displays the height of the forks</td>
</tr>
<tr>
<td>22</td>
<td>![Symbol]</td>
<td>“Time” display</td>
<td>Time display</td>
</tr>
<tr>
<td>23</td>
<td>![Symbol]</td>
<td>Display service hours</td>
<td>Displays the number of service hours since the truck was commissioned</td>
</tr>
<tr>
<td>24</td>
<td>![Symbol]</td>
<td>Battery discharge indicator</td>
<td>Displays the battery charge status (residual capacity as a percentage)</td>
</tr>
</tbody>
</table>
### 2.4 Lower range symbols and switches

Press switches (4) under the respective symbols (25) displayed or confirm the related function. The symbol will be given a dark background.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Control or Display</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Fwd./Rev. travel only</strong> display</td>
<td>Displayed when lift cutout is activated due to low battery capacity and only forward or reverse travel is possible.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Acknowledge lift cutout due to battery discharge</strong> switch</td>
<td>Confirms lift cutout due to low battery capacity and releases travel (the Fwd./Rev. Travel Only display has a dark background).</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Lift height dependent lift cutout</strong> display</td>
<td>Displayed when the lift height dependent lift cutout is activated.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Height dependent lift cutout bypass</strong> switch</td>
<td>Bypasses the height dependent lift cutout (display has a dark background). Observe the maximum passage heights.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Lower limit</strong> display</td>
<td>Indicates that the automatic lowering limit has been activated.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Lowering limit override</strong> switch</td>
<td>Overrides the lowering limit, controlled by hydraulic control button.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Travel cutout</strong> display</td>
<td>Indicates that automatic, height dependent travel cutout has been activated.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Travel cutout override</strong> switch</td>
<td>Overrides the automatic, height dependent travel cutout.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Personalsafety system</strong> display (PSS)</td>
<td>Indicates that the personal safety system has identified persons or objects in the aisle. The truck brakes.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Personalsafety system</strong> switch (PSS)</td>
<td>Bypasses the protective function and enables creep mode if there is sufficient distance from the obstacle. If a personal safety system is fitted, read the accompanying operator manual.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>Select “Warning sub-menu” display</td>
<td>Indicates that several warnings (e.g. slack chain safety device height dependent lift cutout) have been issued.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>Quit “warnings” sub-menu</td>
<td>Displays individual warnings.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>Quit “warnings” sub-menu</td>
<td>Indicates that the sub-menu can be quit.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>“Cancel warnings sub-menu” switch</td>
<td>Sets the “warnings” sub-menu to the standard menu.</td>
</tr>
</tbody>
</table>

---

### 2.4 Lower range symbols and switches

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<td><strong>Fwd./Rev. travel only</strong> display</td>
<td>Displayed when lift cutout is activated due to low battery capacity and only forward or reverse travel is possible.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Acknowledge lift cutout due to battery discharge</strong> switch</td>
<td>Confirms lift cutout due to low battery capacity and releases travel (the Fwd./Rev. Travel Only display has a dark background).</td>
</tr>
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<td><strong>Lift height dependent lift cutout</strong> display</td>
<td>Displayed when the lift height dependent lift cutout is activated.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Height dependent lift cutout bypass</strong> switch</td>
<td>Bypasses the height dependent lift cutout (display has a dark background). Observe the maximum passage heights.</td>
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<td>![Warning Symbol]</td>
<td><strong>Lower limit</strong> display</td>
<td>Indicates that the automatic lowering limit has been activated.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Lowering limit override</strong> switch</td>
<td>Overrides the lowering limit, controlled by hydraulic control button.</td>
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</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Personalsafety system</strong> display (PSS)</td>
<td>Indicates that the personal safety system has identified persons or objects in the aisle. The truck brakes.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td><strong>Personalsafety system</strong> switch (PSS)</td>
<td>Bypasses the protective function and enables creep mode if there is sufficient distance from the obstacle. If a personal safety system is fitted, read the accompanying operator manual.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>Select “Warning sub-menu” display</td>
<td>Indicates that several warnings (e.g. slack chain safety device height dependent lift cutout) have been issued.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>Quit “warnings” sub-menu</td>
<td>Displays individual warnings.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>Quit “warnings” sub-menu</td>
<td>Indicates that the sub-menu can be quit.</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>“Cancel warnings sub-menu” switch</td>
<td>Sets the “warnings” sub-menu to the standard menu.</td>
</tr>
<tr>
<td>Symbol</td>
<td>Control or Display</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td><img src="guidance_on.png" alt="Guidance on display" /></td>
<td>Guidance on display not active</td>
<td>Displays automatic guidance in the aisle: Rail guidance display (drive wheel set to forward position)</td>
</tr>
<tr>
<td><img src="guidance_on_active.png" alt="Guidance on display, when active" /></td>
<td>Guidance on display, when active</td>
<td>Displays automatic guidance in the aisle: Rail guidance display (drive wheel set to forward position)</td>
</tr>
<tr>
<td><img src="guidance_on_switch.png" alt="Guidance on switch" /></td>
<td>Guidance on switch</td>
<td>Sets the drive wheel to forward position</td>
</tr>
<tr>
<td><img src="select_frequency.png" alt="Displays “Select Frequency 1” (similar to other frequencies)" /></td>
<td>Displays “Select Frequency 1” (similar to other frequencies) (&quot;Guidance on&quot; sub-menu)</td>
<td>Indicates that guidance is possible via frequency 1</td>
</tr>
<tr>
<td><img src="select_frequency_switch.png" alt="“Select Frequency 1” switch (similar to other frequencies)" /></td>
<td>“Select Frequency 1” switch (similar to other frequencies) (&quot;Guidance on&quot; sub-menu)</td>
<td>Activates guidance via frequency 1 (submenu is quit automatically after 1 sec.)</td>
</tr>
</tbody>
</table>

**Attachment fork operation**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Control or Display</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="synchronised_rotate_menu.png" alt="“Synchronised rotate menu change” display" /></td>
<td>“Synchronised rotate menu change” display</td>
<td>Changes the display unit menu to “synchronised rotate” functions</td>
</tr>
<tr>
<td><img src="synchronised_rotate_menu_switch.png" alt="“Synchronised rotate menu change” switch" /></td>
<td>“Synchronised rotate menu change” switch</td>
<td>Activates synchronised rotate menu change</td>
</tr>
<tr>
<td><img src="fork_left_rotate.png" alt="Fork synchronised left rotate” display" /></td>
<td>Fork synchronised left rotate&quot; display</td>
<td>Indicates that the fork synchronised left rotate – right traverse is possible</td>
</tr>
<tr>
<td><img src="fork_left_rotate_switch.png" alt="Fork synchronised left rotate” switch" /></td>
<td>Fork synchronised left rotate&quot; switch</td>
<td>Activates fork left rotate, simultaneous control of LAM right traverse via the hydraulic control button</td>
</tr>
<tr>
<td><img src="automatic_left_rotate.png" alt="Automatic fork synchronised left rotate” display" /></td>
<td>Automatic fork synchronised left rotate&quot; display</td>
<td>Indicates that automatic fork synchronous left rotate – right traverse is possible</td>
</tr>
<tr>
<td><img src="automatic_left_rotate_switch.png" alt="“Automatic fork synchronised left rotate” switch" /></td>
<td>“Automatic fork synchronised left rotate” switch</td>
<td>Activates fork left rotate with simultaneous LAM right traverse</td>
</tr>
<tr>
<td><img src="fork_right_rotate.png" alt="Fork synchronised right rotate” display" /></td>
<td>Fork synchronised right rotate&quot; display</td>
<td>Indicates that the fork synchronised right rotate – left traverse is possible</td>
</tr>
<tr>
<td><img src="fork_right_rotate_switch.png" alt="Fork synchronised right rotate” switch" /></td>
<td>Fork synchronised right rotate&quot; switch</td>
<td>Activates fork right rotate, simultaneous control of LAM left traverse via the hydraulic control button</td>
</tr>
<tr>
<td>Symbol</td>
<td>Control or Display</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td><img src="image" alt="Automatic fork synchronised right rotate* display" /></td>
<td>Indicates that automatic fork synchronised right rotate – left traverse is possible</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Automatic fork synchronised right rotate* switch" /></td>
<td>Activates fork right rotate with simultaneous automatic LAM left traverse</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Fork synchronised rotate to centre position* display" /></td>
<td>Indicates that the forks can be set to the centre position (forks facing forwards)</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Fork synchronised rotate to centre position* switch" /></td>
<td>Activates rotating with automatic fork stop in centre position, control of LAM traverse with hydraulic control button</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Automatic fork synchronised rotate to centre position* display" /></td>
<td>Indicates that the forks can be automatically set to the centre position (forks facing forwards)</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Automatic fork synchronised rotate to centre position* switch" /></td>
<td>Activates rotating with automatic fork stop in centre position, simultaneous automatic LAM traversing with stop at centre position</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Telescopic fork* display" /></td>
<td>Indicates that the telescopic forks can be operated</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Telescopic fork* switch" /></td>
<td>Activates the telescopic forks, controlled via the hydraulic control button</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Telescopic table* display" /></td>
<td>Indicates that the telescopic table can be operated</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Telescopic table* switch" /></td>
<td>Activates the telescopic table, controlled via the hydraulic control button</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="2nd stacking depth* display" /></td>
<td>Indicates that the 2nd stacking depth is possible</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="2nd stacking depth* switch" /></td>
<td>Activates the 2nd stacking depth, controlled via the hydraulic control button</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Fork tilt* display" /></td>
<td>Indicates that fork tilt is possible</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Fork tilt* switch" /></td>
<td>Activates the fork tilt, controlled via the hydraulic control button</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Special attachment* display" /></td>
<td>Indicates that the special attachment can be controlled</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Special attachment* switch" /></td>
<td>Activates control of the special attachment, controlled via the hydraulic control button</td>
<td></td>
</tr>
<tr>
<td>Symbol</td>
<td>Control or Display</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Symmetrical fork adjustment&quot; display</td>
<td>Indicates that fork adjustment can be operated</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Symmetrical fork adjustment&quot; switch</td>
<td>Activates fork adjustment with simultaneous operation of hydraulic control button. Right turn = forks turn in; Left turn = forks turn out</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Asymmetrical fork adjustment menu change&quot; display</td>
<td>Indicates that the &quot;Asymmetrical fork adjustment&quot; menu can be changed</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Asymmetrical fork adjustment menu change&quot; switch</td>
<td>Changes the display unit menu to &quot;asymmetrical fork adjustment&quot; functions</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Fork adjustment, left only&quot; display</td>
<td>Indicates that left only fork adjustment is possible</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Fork adjustment, left only&quot; switch</td>
<td>Activates left only fork adjustment, controlled via the hydraulic control button</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Fork adjustment, right only&quot; display</td>
<td>Indicates that right only fork adjustment is possible</td>
</tr>
<tr>
<td>![Icon]</td>
<td>&quot;Fork adjustment, right only&quot; switch</td>
<td>Activates right only fork adjustment, controlled via the hydraulic control button</td>
</tr>
</tbody>
</table>

- ○ = Standard equipment
- ● = Optional Equipment
- RG = Rail guidance
- WG = Wire guidance
2.5 Truck operational status symbols

The operational status of the truck when it is switched on is indicated by symbols in the display unit.

- Foot switch not pressed

- Attachment in home position (see “Attachment in Home position” section in Chapter E)

When the following symbols are displayed you must carry out a reference movement in accordance with the display, i.e. the Main lift must be lifted approx. 10 cm and then lowered again. This is the only way for the controller to release all the truck movements at full speed.

- Referencing: Main lift - raise

- Referencing: Main lift - lower

- Load Handler Referencing
  
  If the truck is switched off and the sideshifter or the LAM rotation is adjusted, error 183 or 203 will be displayed when the trucks is switched on again and rotating and traversing must be referenced.

  Sideshifting is referenced by moving the sideshifter over the index (centre of the attachment).

  The rotary sensor system (LAM / fork attachment) is referenced by carrying out at least one complete rotation with the LAM.

  Referencing is successful if the appropriate symbol goes out.

- Rotating reference operation
- Traversing reference operation

- If neither of the symbols goes out, contact the manufacturer’s service department.

2.5 Truck operational status symbols

The operational status of the truck when it is switched on is indicated by symbols in the display unit.

- Foot switch not pressed

- Attachment in home position (see “Attachment in Home position” section in Chapter E)

When the following symbols are displayed you must carry out a reference movement in accordance with the display, i.e. the Main lift must be lifted approx. 10 cm and then lowered again. This is the only way for the controller to release all the truck movements at full speed.

- Referencing: Main lift - raise

- Referencing: Main lift - lower

- Load Handler Referencing
  
  If the truck is switched off and the sideshifter or the LAM rotation is adjusted, error 183 or 203 will be displayed when the trucks is switched on again and rotating and traversing must be referenced.

  Sideshifting is referenced by moving the sideshifter over the index (centre of the attachment).

  The rotary sensor system (LAM / fork attachment) is referenced by carrying out at least one complete rotation with the LAM.

  Referencing is successful if the appropriate symbol goes out.

- Rotating reference operation
- Traversing reference operation

- If neither of the symbols goes out, contact the manufacturer’s service department.
3 Starting up the truck

Before the truck can be commissioned, operated or a load unit lifted, the driver must ensure that there is nobody within the hazardous area.

Checks and operations to be performed before starting daily work

– Check the whole of the outside of the truck for signs of damage and leaks.
– Check the battery attachment and wire connections for damage, make sure they are secure.
– Check the battery connector is secure.
– Check the overhead guard for damage.
– Check the load handler for visible damage such as cracks, bent or severely worn load forks.
– Check the load wheels for damage.
– Make sure the load chains are evenly tensioned.
– Make sure all safety mechanisms are correct and working.
– Test the operating and parking brakes.
– Check brake fluid.
– For rail guidance systems check the guide rollers are smooth and not damaged.

3.1 Truck entry and exit

Hold onto the grab handle (26) when getting on and off the truck. Exit the truck facing towards it.
3.2 Adjusting the driver's seat

To achieve optimal seat cushioning the driver's seat must be adjusted according to the driver's weight. Seat cushioning setting range: 50 kg to 130 kg.

Adjusting the seat cushioning:

– Take your weight off the driver's seat.
– Pull the seat cushioning adjusting lever (29) in the direction of the arrow as far as the stop and then return it.

The previous weight setting is reset to the minimum value.

– Pull the seat cushioning adjusting lever (28) once more in the direction of the arrow until the corresponding weight has been reached on the driver's seat weight display (28), and return the seat cushioning adjusting lever again.
– Sit on the driver's seat.

Adjusting the backrest:

– Lift up the backrest adjuster (27) and tilt the backrest to the desired position.
– Engage the backrest adjuster.

Adjusting the seat position:

– Pull up the longitudinal adjuster (30) and push the driver's seat forwards or backwards to the desired position.
– Engage the driver's seat adjuster again.

The driver's seat must be securely located in the desired position. The driver's seat setting must not be changed during travel.

Adjusting the backrest:

– Lift up the backrest adjuster (27) and tilt the backrest to the desired position.
– Engage the backrest adjuster.

Adjusting the seat position:

– Pull up the longitudinal adjuster (30) and push the driver's seat forwards or backwards to the desired position.
– Engage the driver's seat adjuster again.

The driver's seat must be securely located in the desired position. The driver's seat setting must not be changed during travel.
3.3 Safety restraint belt (○)

Always put on the safety restraint belt (31) before you start the industrial truck. The belt protects you from serious injury.

Protect the belt from contamination (e.g. cover it when the truck is idle) and clean it regularly.

Do not alter the belt setting. This will increase the risk of malfunctions.

– Always replace the safety restraint belt after an accident.
– Only original spare parts must be used for retrofits or repairs.

Damaged or non-operational belts must only be replaced by contractual dealers or branches.

Procedure in unusual situations

If the truck is about to tip over, never undo the restraint belt and try to jump out. This will only increase the risk of injury.

Correct procedure:

– Grip the steering wheel with both hands and brace feet.

– Tilt your body in the opposite direction of fall.

Procedure in unusual situations

If the truck is about to tip over, never undo the restraint belt and try to jump out. This will only increase the risk of injury.

Correct procedure:

– Grip the steering wheel with both hands and brace feet.

– Tilt your body in the opposite direction of fall.
Restraint belt instructions

Before starting the truck, pull the belt smoothly out of the retractor, tight to your body over your thigh and place the latch in the lock.

The belt must not be twisted when fastened.

When operating the industrial truck (e.g. travelling, lifting, lowering, etc.), sit back as far as possible so that your back is against the backrest.

The automatic locking retractor allows sufficient freedom of movement on the seat.

If you sit on the front edge of the seat less protection is afforded as the belt is too long.

The belt is only to be used to secure one person.

– To undo the safety belt press the switch on the lock and manually guide the latch back to the retractor.

If the latch is struck against the housing the automatic blocking system can be triggered. This will prevent the belt from being extracted.

Deactivating the blocking system:

– Pull out the belt using a sudden movement 10mm – 15mm out of its housing.
– Feed the belt back in to undo the automatic blocking system.

The belt can now be extracted again.
3.4 Control panel adjustment
The control panel can be vertically and longitudinally adjusted.

Height adjustment:
– Grab onto the control panel and at the same time release the lever (33).
– Set the control panel to the correct height and pull the lever tight again.

Longitudinal adjustment:
– Pull up the lever (32).
– Set the control panel to the right position.
– Engage locking lever (32) in position again.

3.5 To prepare the truck for operation
– Turn the EMERGENCY DISCONNECT switch (10) to undo it.
– Put the switch in the switch switch (9) and turn it clockwise.
– Test the warning device (horn) (11).
– Test the operating and parking brakes.
– Carry out a test movement on the lift mast to adjust the height display (see page E10).

Press the EMERGENCY DISCONNECT switch immediately if the truck starts to move or lift when it is switched on.

Brief steering movements arising from steering referencing are permissible.
3.6 Operator Position Adjustment

The operator position together with the control panel and accelerator pedals can be infinitely rotated approx. 30° in the load direction and approx. 10° in the drive direction at the press of a button.

– Depress the accelerator pedal (17) gently and then push the toggle switch to position 34.
– Turning the operator position in the drive direction
– Depress the accelerator pedal (17) gently and then push the toggle switch to position 35.
– Turning the operator position in the load direction

If the foot switch is applied when you adjust the operator position, the truck can move.

3.7 Setting the time

Selecting the “Set Time” menu:

Press switch 35, the display changes to the sub menu.

Truck movements are inhibited in this sub-menu.

Now press switch 36 twice; the “Set Time” menu now appears in the display unit.

Setting the time:

Simultaneously press switches 36
– and 37: to set the time forward by an hour.
– and 38: to set the time back by an hour.
– and 39: to set the time forward by a minute.
– and 40: to set the time back by a minute.

The set time (41) is then shown in the display unit.

Quitting the “Set Time” menu:

Press switch 35, the display changes to the sub menu.

Now press switch 40, the display changes to the “Truck Functions” sub menu.
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 persons must stay away from work areas. Loads must only be stored in places specially designated for this purpose.

Driving conduct: The driver 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 driver 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. It is forbidden to lean out of or reach beyond the working and operating area.

Visibility when travelling outside the narrow aisle: The driver must look in the direction of travel and must always have a clear view of the route ahead. When carrying loads which affect visibility, these must be stored at the rear of the truck. If this is not possible, a second person must walk in front of the truck as a lookout.

Negotiating slopes and inclines: It is forbidden to negotiate slopes and inclines.

Negotiating lifts: 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.

Type of loads to be carried: The operator must make sure that the load is in a satisfactory condition. Do not carry loads unless they are positioned safely and carefully. Use suitable precautions to prevent parts of the load from tipping or falling down.
4.2 Travelling, Steering, Braking

**EMERGENCY DISCONNECT**

Press the EMERGENCY DISCONNECT switch (10) down.
All truck movements are inhibited.
The operation of the switch must not be affected by any objects placed in its way.

---

**Travel**

The truck can be driven in 3 modes:
Free travel, with wire or rail guidance.
The operating mode employed depends on the guidance system of the racking system operated.

⚠️ Do not drive the truck unless the panels are closed and properly locked.
The foot switch must be kept depressed for travel.
– Turn the EMERGENCY DISCONNECT switch (10) to undo it.
– Put the switch in the switch switch (9) and turn it clockwise;
– Apply the foot switch (15).
– Carry out a test run, see page E10.
– Lift the Main lift with the hydraulic control button (12) until the forks are clear of the ground.
– Set travel direction switch (7) to the required direction
– Press the foot switch (15) and slowly depress the accelerator (17) until you reach the required speed.

The travel speed is infinitely variable. The further the accelerator is pressed, the greater the travel speed.

– Use the steering wheel (1) to steer the truck in the required direction.
Steering

Use the steering wheel to steer the truck outside narrow aisles. The position of the drive wheel is shown in the display unit (20).

Brakes

The truck’s braking characteristics depend largely on the ground conditions. The driver must take this into consideration when handling the truck.

- The truck can be braked in four different ways:
  - with the operating brake
  - with the brake pedal
  - with the foot switch.
  - with the EMERGENCY DISCONNECT switch

Braking with the operating brake

During travel, the traction controller brakes the truck either when you take your foot off the accelerator or by setting the travel switch to the opposite direction.

Braking with the brake pedal

The truck is braked via the hydraulic brake shoes in the load wheels when you apply the brake pedal.

Braking with the foot switch

Releasing the foot switch causes the truck to brake.

Braking with the EMERGENCY DISCONNECT switch

Applying the EMERGENCY DISCONNECT switch will cause the truck to brake to a halt.

⚠️ The EMERGENCY DISCONNECT switch must only be used in dangerous situations.

Brakes

The truck’s braking characteristics depend largely on the ground conditions. The driver must take this into consideration when handling the truck.

- The truck can be braked in four different ways:
  - with the operating brake
  - with the brake pedal
  - with the foot switch.
  - with the EMERGENCY DISCONNECT switch

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During travel, the traction controller brakes the truck either when you take your foot off the accelerator or by setting the travel switch to the opposite direction.

Braking with the brake pedal

The truck is braked via the hydraulic brake shoes in the load wheels when you apply the brake pedal.

Braking with the foot switch

Releasing the foot switch causes the truck to brake.

Braking with the EMERGENCY DISCONNECT switch

Applying the EMERGENCY DISCONNECT switch will cause the truck to brake to a halt.

⚠️ The EMERGENCY DISCONNECT switch must only be used in dangerous situations.
Negotiating narrow aisles

It is forbidden for unauthorised personnel to enter narrow aisles (truck lanes in racking systems with safety distances < 500 mm) or for personnel to cross through them. These work areas must be marked and identified accordingly. Carry out a daily inspection of the safety mechanisms on the truck or the racking system to avoid hazards and protect personnel. These must not be rendered ineffective, misused, adjusted or removed. Immediately report and rectify any faulty safety devices.

Observe the instructions of DIN 15185 Part 2.

Before entering a narrow aisle, the driver must look for people or other trucks in the aisle. Never enter a narrow aisle where there are people or other trucks. If there are people in the aisle, stop the truck immediately.

Only enter narrow aisles in trucks which are designated for this purpose. If a narrow aisle is equipped with a guidance wire for wire guidance and the system is faulty or switched off, the truck may only be removed from the narrow aisle at crawl speed.

Rail guidance truck

Rail guidance trucks are equipped with sensors which activate aisle recognition when they enter narrow aisles.

– Approach the aisle at reduced speed so that the truck is aligned with the narrow aisle and is within the demarcation.

Observe the notices attached along the route.

– Slowly enter the narrow aisle.

Ensure that the truck guide rollers enter the narrow aisle guidance rails.

– Press the “guidance on” (38) switch.
– The “guidance on” display light (42) changes to active mode.
– The drive wheel is automatically set forward. The steering angle display (20) shows the steering angle permanently in the centre position after alignment. Manual steering is disabled.
– Applying the accelerator (17) affects the travel speed, applying the travel direction switch (7) changes the travel direction.
– Continue to travel along the narrow aisle at your required speed.

Press the push button (38) to leave the guidance wire. The display (42) changes to non-active mode. The truck is now also free to move.
When starting or continuing the truck after the wire guidance has been deactivated, note the position of the drive wheel as manual steering is now activated again.

If an automatically guided truck is switched off, the wire guidance is no longer active when it is switched on again. Risk of accidents! When you continue to travel a warning is sounded and the speed is reduced. Use push button (38) to re-activate the wire guidance (“Guidance on” light (42) goes on in active mode) and re-align the truck.

During alignment, the rear part may veer out when it reaches the guidance wire (45). Approach the guidance wire (44) at an angle and at reduced speed.

When aligning, the truck should not be parallel to the guidance wire. The optimum approach angle is between 10° and 50°.

The attachment should be in the home position (see “Attachment in Home position” section in Chapter E), otherwise it will be outside of the truck’s geometry. The travel speed remains limited to reduced speed.

Tracking should preferably be in the load direction, as this involves less time and distance.

– When the truck is close to the guidance wire, switch on the wire guidance with push button (38). The “guidance on” display light (42) changes to active mode.

When the guidance wire has been reached the truck is automatically guided.

When the guidance wire is reached tracking automatically ensues at reduced speed. The steering angle display (20) changes to “Tracking On” (46). The audible tracking signal is sounded.

When the truck is close to the guidance wire, switch on the wire guidance with push button (38). The “guidance on” display light (42) changes to active mode.

When the guidance wire has been reached the truck is automatically guided.

When the guidance wire is reached tracking automatically ensues at reduced speed. The steering angle display (20) changes to “Tracking On” (46). The audible tracking signal is sounded.
Inductive automatic steering takes over the steering of the truck and applies it to the guidance wire.

Tracking is complete once the truck has been led precisely to the guidance wire. “Tracking on” (46) changes to “guidance wire applied” (47). The tracking signal is no longer sounded. The track is now automatically guided.

Press the push button (38) to quit the guidance wire. The display (42) changes to non-active mode. In addition, the “guidance wire applied” (47) display changes to the steering angle display (20). The truck is now free to move again.

Diagonal travel is only possible if the truck is wire or rail guided.

Diagonal travel (simultaneous travel and lifting/lowering) is possible when you press the hydraulic control button (12) while simultaneously depressing the accelerator (17).

You can only change from automatic to manual steering once the truck has fully left the narrow aisle.
4.3 Lifting – Lowering – Traversing - Rotating outside and within narrow aisles

Risk of trapping when traversing or rotating with the forks. Make sure there is nobody present in the danger zone when carrying out traverse, rotating or synchronised rotate movements with the load handler. Risk of injury when lowering the load handler. There must be nobody present in the danger zone.

Lift – Lower (Main Lift)

– Turn the hydraulic control button (12)
  up = Lift
  down = Lower

The lift and lower speeds are proportional to the degree of turn of the hydraulic control button.

Max. lift speed if the attachment home position (see “Attachment in Home Position” section in Chapter E) is shown in the display unit.

If the line break safety device has applied at a non-permitted lowering speed (E 287), determine the cause and if there no leakage in the hydraulic system, briefly raise the Main Lift and then lower it again.

Traverse (LAM attachment)

– Do not apply the foot switch.
– Apply the pressure switch (14) (= attachment traverse)
– Turn the hydraulic control button (12) simultaneously.
  Turn up = Traverse right
  Turn down = Traverse left

The traverse speed is proportional to the amount of turn.

Traverse (fork carriage)

– Do not apply the foot switch.
– Apply the pressure switch (13) (= fork carriage traverse)
– Turn the hydraulic control button (12) simultaneously.
  Turn up = Right rotate
  Turn down = Left rotate

The rotate speed is proportional to the amount of turn of the hydraulic control button.
4.4 Simultaneous LAM traverse and fork carriage rotate

Risk of trapping when traversing or rotating with the forks.
Make sure there is nobody present in the danger zone when carrying out traverse, rotating or synchronised rotate movements with the load handler.

If you move the attachment the fork carriage will rotate simultaneously. The traverse speed cannot be changed. The traverse speed is proportional to the amount of turn of the hydraulic control button.

4.4.1 Manual rotation

– Do not apply the foot switch.
– Press the push button (36). The display in the display unit menu changes from “synchronized rotate menu change” (48) to “Synchronised fork left/right rotate” (49).
– Press the push button (37) while simultaneously turning the hydraulic control button (12) down = rotate the fork carriage right and traverse the LAM left.
– Press the push button (36) while simultaneously turning the hydraulic control button (12) up = rotate the fork carriage left and traverse the LAM right.

4.4.2 Automatic rotation (O)

– Do not apply the foot switch.
– Press the push button (36). The display in the display unit menu changes from “synchronized rotate menu change” (48) to “Synchronised fork left/right rotate” (49).
– Press the push button (37) = Rotate fork carriage right and traverse LAM left.
– Press the push button (36) = Rotate fork carriage left and traverse LAM right.
4.4.3 Synchronised rotate until forks are in centre position (○)

- Do not apply the foot switch.
- Press the push button (36). The display in the display unit menu changes from "synchronized rotate menu change" (48) to "Synchronised rotate until forks in centre position" (50).
- Press the push button (38) = Rotate fork carriage and traverse LAM to centre position.

4.4.4 Attachment telescopic table traverse (○)

- Apply the telescopic table push button (14).
- Turn the hydraulic control button (12) simultaneously:
  - Up = Right traverse
  - Down = Left traverse

The traverse speed is proportional to the amount of turn of the hydraulic control button.

The telescopic table automatically stops in the centre position. If you release the hydraulic control button (12) and press it again, the telescopic table can then be moved either left or right.
4.5 Collecting, transporting and depositing loads

⚠️ Before picking up a load unit the driver must make sure that it has been correctly palletised and does not exceed the truck’s capacity. Observe the load diagram.

- Check the fork distance for the pallet and adjust if necessary.

Adjusting the forks

To pick up the load securely, the forks must be as far apart as possible and centrally positioned with respect to the fork carriage. The load centre of gravity must be centrally aligned between the forks.

- Raise the locking lever (51).
- Push the forks (52) to the correct position on the fork carriage (53).
- Swivel the locking lever (51) down and move the forks until the locking pin engages in a notch.

⚠️ Never remove the stop bolt (54).
Picking up a load from the side.

- Press foot switch.
- Drive the truck carefully up to the storage location.
- Do not apply the foot switch.
- Slowly insert the forks into the pallet until the fork back touches the load or the pallet.
- Raise the load slightly.
- Retract the forks.
Picking up a load from the front.

– Do not apply the foot switch.
– Set the attachment to the centre position and position the forks at right angles (90°) to the truck.
– Press foot switch.
– Drive the truck slowly.
– Slowly insert the forks into the pallet until the fork shank touches the load or the pallet.
– Do not apply the foot switch.
– Raise the load slightly and slowly reverse the truck.
– Do not apply the foot switch.
– Bring the load into the home position.

The ground surface must be in good condition to ensure this works correctly.

Transporting a load

– Press foot switch.
– Always transport a load outside the narrow aisle as low as possible, allowing for ground clearance.
– Always transport loads with both forks. When transporting heavy loads always ensure that both forks carry an equal weight.
– Gradually accelerate.
– Drive at constant speed.
– Always be prepared to brake. Only stop suddenly in dangerous situations.
– Reduce speed accordingly at narrow bends.

Picking up a load from the front.

– Do not apply the foot switch.
– Set the attachment to the centre position and position the forks at right angles (90°) to the truck.
– Press foot switch.
– Drive the truck slowly.
– Slowly insert the forks into the pallet until the fork shank touches the load or the pallet.
– Do not apply the foot switch.
– Raise the load slightly and slowly reverse the truck.
– Do not apply the foot switch.
– Bring the load into the home position.

The ground surface must be in good condition to ensure this works correctly.

Transporting a load

– Press foot switch.
– Always transport a load outside the narrow aisle as low as possible, allowing for ground clearance.
– Always transport loads with both forks. When transporting heavy loads always ensure that both forks carry an equal weight.
– Gradually accelerate.
– Drive at constant speed.
– Always be prepared to brake. Only stop suddenly in dangerous situations.
– Reduce speed accordingly at narrow bends.
Depositing a load

– Drive the truck carefully up to the storage location

⚠️ Before a load can be deposited, the driver must ensure that the storage location is suitable for storing the load (size and capacity).

– Do not apply the foot switch.
– Raise the load handler so that the load can enter the storage location without striking any objects.
– Carefully push the load into its storage location.
– Carefully lower the load handler so that the forks are clear of the load.

⚠️ Avoid placing the load down suddenly to avoid damaging the load and the load handler.
– Retract the forks.
4.6 Rack height select (O)

To lift or deposit loads in pre-selected storage locations, the truck must be adjusted to the warehouse setup. The work required to do this must only be performed by trained field engineers from the manufacturer's service department.

The attachment must be in the home position (see “Attachment in Home position” section in Chapter E).

Area identification (zones)
The zones are entered via the digit switches (6) or via the input switches F1 - F7 (5). When using the digit switches (6), input switch F1 must be pressed before a zone is selected.

Raising or depositing a load in pre-selected warehouse areas with rack height select:
– Drive the truck into the respective narrow aisle.
– Enter the zone via the digit switches (6).
– Enter the shelf number. You enter the shelf number via the digit switches. The shelf number can be entered as a single digit (1 - 9) or 2-digit (01-64). You can delete the entry with the “CE” switch. If height “0” is entered in the chosen shelf, rack height select is not active.

With a single digit input, the current number is transferred on each entry. With a 2-digit input, the first number entered is used as a decimal, the second as a units digit.

To reach the required height, there are various operating modes depending on the parameter setting:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>The hydraulic control button (12) must be pressed and held down until the required height has been reached (automatic stop). The lift / lower speed can be determined by the driver.</td>
</tr>
<tr>
<td>Pre-limit</td>
<td>The hydraulic control button (12) must be pressed shortly before the required height is reached. The lift / lower speed can be determined by the driver.</td>
</tr>
<tr>
<td>Jog mode</td>
<td>The hydraulic control button (12) must be jogged in the desired direction, after which the desired height is automatically approached.</td>
</tr>
</tbody>
</table>

In the “Pre-limit” and “Jog Mode” modes, you can stop the automatic height approach by selecting the opposite travel direction with the hydraulic control button (12).
The following stacking options are possible depending on the model:

<table>
<thead>
<tr>
<th>Stacking procedure</th>
<th>General procedure:</th>
</tr>
</thead>
<tbody>
<tr>
<td>not active</td>
<td>– Unstacking: Extend – Raise - Retract</td>
</tr>
<tr>
<td></td>
<td>– Stacking: Extend – Rest - Lower - Retract</td>
</tr>
</tbody>
</table>

Stacking procedure:

- When the selected height is reached, the rack height select command disappears from the display. Manual stacking and unstacking is now possible (see Lifting – Lowering – Traversing – Rotating outside and within narrow aisles, in Chapter E).

Stacking with push button (14) and hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. Stacking and unstacking is prescribed to the driver in the display unit via the load sensor. The various functions for traversing, lifting and lowering are undertaken by the driver by pressing the push button (14) and/or hydraulic control button (12) see "Lifting – Lowering – Traversing – Rotating outside and within narrow aisles’ in chapter E). On reaching the respective limit position (traverse / lift height reached), the next stage can follow if the hydraulic control button (12) is in neutral. All hydraulic speeds can be determined by the driver.

Manually stacking with the hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. The prescribed direction must be confirmed and adhered to throughout the stacking procedure as follows:
  - Stacking "left" = "Lower" hydraulic control button (12).
  - Stacking "right" = "Raise" hydraulic control button (12).

Semi-automatic stacking with the hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. The extend function should only be carried out by the drive by pressing the hydraulic control button (12) as follows:
  - Extend "left" = "Lower" hydraulic control button (12).
  - Extend "right" = "Raise" hydraulic control button (12).

  After extending, the next stage can only take place if the hydraulic control button (12) is in neutral. Collecting, depositing and retracting the load automatically take place when the hydraulic control button (12) is pressed. The instructions for stacking / unstacking are as follows:
  - "Forks left" = "Lower" hydraulic control button (12).
  - "Forks right" = "Raise" hydraulic control button (12).

Automatic stacking with the hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. Directions must only be given at the start of stacking, as follows:
  - Stacking "left" = "Lower" hydraulic control button (12).
  - Stacking "right" = "Raise" hydraulic control button (12).

The selected stacking mode now starts automatically.

Stacking procedure:

- When the selected height is reached, the rack height select command disappears from the display. Manual stacking and unstacking is now possible (see Lifting – Lowering – Traversing – Rotating outside and within narrow aisles, in Chapter E).

Stacking with push button (14) and hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. Stacking and unstacking is prescribed to the driver in the display unit via the load sensor. The various functions for traversing, lifting and lowering are undertaken by the driver by pressing the push button (14) and/or hydraulic control button (12) see "Lifting – Lowering – Traversing – Rotating outside and within narrow aisles’ in chapter E). On reaching the respective limit position (traverse / lift height reached), the next stage can follow if the hydraulic control button (12) is in neutral. All hydraulic speeds can be determined by the driver.

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- When you have reached the desired height do not press the foot switch. The prescribed direction must be confirmed and adhered to throughout the stacking procedure as follows:
  - Stacking "left" = "Lower" hydraulic control button (12).
  - Stacking "right" = "Raise" hydraulic control button (12).

Semi-automatic stacking with the hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. The extend function should only be carried out by the drive by pressing the hydraulic control button (12) as follows:
  - Extend "left" = "Lower" hydraulic control button (12).
  - Extend "right" = "Raise" hydraulic control button (12).

  After extending, the next stage can only take place if the hydraulic control button (12) is in neutral. Collecting, depositing and retracting the load automatically take place when the hydraulic control button (12) is pressed. The instructions for stacking / unstacking are as follows:
  - "Forks left" = "Lower" hydraulic control button (12).
  - "Forks right" = "Raise" hydraulic control button (12).

Automatic stacking with the hydraulic control button (12):

- When you have reached the desired height do not press the foot switch. Directions must only be given at the start of stacking, as follows:
  - Stacking "left" = "Lower" hydraulic control button (12).
  - Stacking "right" = "Raise" hydraulic control button (12).

The selected stacking mode now starts automatically.
| Single stage stacking with the hydraulic control button (12) | When you have reached the desired height do not press the foot switch. The various functions of traversing, lifting and lowering can only be made by the driver pressing the hydraulic control button (12). On reaching the respective limit position (traverse / lift height reached), the next stage can follow if the hydraulic control button (12) is in neutral. Stacking directions must be given as follows: Stacking “left” = “Lower” hydraulic control button (12). Stacking “right” = “Raise” hydraulic control button (12). |

If during positioning another shelf is selected, this is displayed for approx. 1 second and stored in an intermediate log. After stacking, the shelf is automatically taken from the intermediate log. (this does not apply to the “Stacking not active” variant).

Stacking can be cancelled by pressing the “CE” switch on the keypad (6).
The following symbols appear in the display unit for example for “Left” stacking:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Manual stacking operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stacking Unstacking</td>
</tr>
<tr>
<td></td>
<td>Do not apply the foot switch. Press push button (14) (= Main lift with fork carriage traverse) while simultaneously turning the hydraulic control button (12) down (=traverse left).</td>
</tr>
<tr>
<td></td>
<td>Rest time active:</td>
</tr>
<tr>
<td></td>
<td>Do not apply the foot switch. Turn the hydraulic control button (12): up = Lift (unstack) down = Lower (stack)</td>
</tr>
<tr>
<td></td>
<td>Do not apply the foot switch. Press push button (14) (= Main lift with fork carriage traverse) while simultaneously turning the hydraulic control button (12) up (=rotate right).</td>
</tr>
</tbody>
</table>

When stacking, after the Main lift and attachment have been extended there is an interval to reduce mast vibration.

All automatic stacking procedures can be interrupted by depressing the foot switch.

In an emergency, press the EMERGENCY DISCONNECT.
4.7 Laser beam rack shelf display (●)

The laser beam rack shelf display indicates the correct position of the three-way truck with respect to the rack shelf in the travel direction.

This is a spot light, attached to the mast.

The three-way truck is correctly positioned with respect to the rack shelf when the laser beam from a light meets the rack marking.

⚠️ Laser beam! Do not look into the beam. Laser class 2.

4.8 Parking the truck securely

When you leave the truck it must be securely parked even if you only intend to leave it for a short time.

Do not park the truck on an incline. In special cases the truck may need to be secured with wedges.

Select a parking place where nobody will collide with the forks.

– Always park the truck with the mast completely lowered.
– Lower the forks to the ground.
– Set the attachment to the home (standard) position.
– Set the switch switch to “0” and remove the safety switch.

Attachment in home position

– Push the attachment into the right or left limit position of the sideshift frame (57).
– Set the forks (56) parallel to the sideshift frame (57).
– The display unit now shows the symbol for “Attachment in home position” (55).

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– Set the attachment to the home (standard) position.
– Set the switch switch to “0” and remove the safety switch.

Attachment in home position

– Push the attachment into the right or left limit position of the sideshift frame (57).
– Set the forks (56) parallel to the sideshift frame (57).
– The display unit now shows the symbol for “Attachment in home position” (55).
This chapter enables the user to identify and rectify basic faults and the results of incorrect operation. When locating a fault, proceed in the order shown in the table.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck does not start</td>
<td>Battery plug not connected.</td>
<td>Check the battery plug and connect if necessary.</td>
</tr>
<tr>
<td></td>
<td>EMERGENCY DISCONNECT switch pressed</td>
<td>Unlatch EMERGENCY DISCONNECT switch</td>
</tr>
<tr>
<td></td>
<td>Switch switch in “0” position</td>
<td>Set switch switch to “1”</td>
</tr>
<tr>
<td></td>
<td>Battery charge too low.</td>
<td>Check battery charge, charge battery if necessary.</td>
</tr>
<tr>
<td></td>
<td>Foot switch not pressed</td>
<td>Press foot switch</td>
</tr>
<tr>
<td></td>
<td>Faulty fuse.</td>
<td>Check fuses.</td>
</tr>
<tr>
<td></td>
<td>Travel cutout activated</td>
<td>Press travel cutout override switch</td>
</tr>
<tr>
<td></td>
<td>Travel cutout activated via aisle end safety device</td>
<td>Set foot switch or accelerator to neutral and press it again.</td>
</tr>
<tr>
<td>Load cannot be lifted</td>
<td>Truck not operational</td>
<td>Carry out all measures listed under “Truck does not start”</td>
</tr>
<tr>
<td></td>
<td>Battery charge too low, lift cutout</td>
<td>Check battery charge, charge battery if necessary.</td>
</tr>
<tr>
<td></td>
<td>Hydraulic oil level too low</td>
<td>Check hydraulic oil level and if necessary.</td>
</tr>
<tr>
<td></td>
<td>Check hydraulic oil level</td>
<td>Add hydraulic oil</td>
</tr>
<tr>
<td></td>
<td>Faulty fuse.</td>
<td>Check fuses.</td>
</tr>
<tr>
<td>Rapid travel disabled</td>
<td>Load handler not in home position</td>
<td>Push load handler into home position</td>
</tr>
<tr>
<td></td>
<td>Main lift raised beyond 0.5 m</td>
<td>Lower Main lift to below 0.5 m</td>
</tr>
<tr>
<td></td>
<td>Guidance wire search mode activated</td>
<td>Align truck or turn off WG mode</td>
</tr>
<tr>
<td></td>
<td>No test run performed</td>
<td>Perform lifting and lowering</td>
</tr>
<tr>
<td>Truck cannot be steered</td>
<td>Truck not operational</td>
<td>Carry out all measures listed under “Truck does not start”</td>
</tr>
<tr>
<td></td>
<td>Narrow aisle mode switch pressed</td>
<td>Switch off narrow aisle travel function</td>
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<td>Battery charge too low.</td>
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</tr>
<tr>
<td></td>
<td>Foot switch not pressed</td>
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</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
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<tr>
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<td>Carry out all measures listed under “Truck does not start”</td>
</tr>
<tr>
<td></td>
<td>Battery charge too low, lift cutout</td>
<td>Check battery charge, charge battery if necessary.</td>
</tr>
<tr>
<td></td>
<td>Hydraulic oil level too low</td>
<td>Check hydraulic oil level and if necessary.</td>
</tr>
<tr>
<td></td>
<td>Faulty fuse.</td>
<td>Check fuses.</td>
</tr>
<tr>
<td>Rapid travel disabled</td>
<td>Load handler not in home position</td>
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<tr>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>
If, after carrying out the 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. Additional troubleshooting must only be performed by the manufacturer’s specialist service engineers. The manufacturer has a customer service department specially trained for these tasks.

To provide targeted and rapid response to faults, the following details are useful and important to provide for the customer service department:

- Truck serial number
- Display unit error number (if present)
- Error description
- Current location of truck.

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<tr>
<th>Fault</th>
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<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error 144</td>
<td>- Truck has abandoned guidance wire or is travelling parallel to the guidance wire</td>
<td>Restore wire guidance</td>
</tr>
<tr>
<td>Error 183</td>
<td>- Sidestiff adjusted when the truck is switched off</td>
<td>See “Load Handler Referencing” section in Chapter E</td>
</tr>
<tr>
<td>Error 203</td>
<td>- Rotation adjusted when the truck is switched off</td>
<td>See “Load Handler Referencing” section in Chapter E</td>
</tr>
<tr>
<td>Error 330</td>
<td>- Accelerator pedal pressed during power up test</td>
<td>Do not press accelerator pedal, switch truck off and on again</td>
</tr>
<tr>
<td>Error 331</td>
<td>- Hydraulic control button pressed during power-up test</td>
<td>Do not press hydraulic control button, switch truck off and on again</td>
</tr>
<tr>
<td>Error 332</td>
<td>- During the power-up test a key was pressed below the display unit</td>
<td>Do not press key, switch truck off and on again</td>
</tr>
<tr>
<td>Error 333</td>
<td>- During the power up test a function preselect key (rotate, traverse) was pressed</td>
<td>Do not press function preselect key (rotate, traverse), switch truck off and on again</td>
</tr>
<tr>
<td>Error 334</td>
<td>- Foot switch pressed during power-up test</td>
<td>Do not press foot switch, switch truck off and on again</td>
</tr>
<tr>
<td>Error 334</td>
<td>- Personal safety system</td>
<td>PSS scanner contaminated, clean</td>
</tr>
</tbody>
</table>

Error 183 – Sidestiff adjusted when the truck is switched off
Error 203 – Rotation adjusted when the truck is switched off
Error 330 – Accelerator pedal pressed during power up test
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Error 344 – Personal safety system

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- Truck serial number
- Display unit error number (if present)
- Error description
- Current location of truck.
5.1 Emergency stop device

When the automatic emergency stop mechanism applies (e.g. if the wire guidance is lost, electrical steering fails) the truck brakes to a halt. Before starting again, the cause of the error must be identified and corrected. Start the truck again in accordance with manufacturer’s instructions contained in these operating instructions (see “Starting up the Truck” in Chapter E).

5.2 Load handler emergency lowering

When using emergency lowering, make sure that nobody is present in the danger zone. If a second person is used to lower the load handler via the emergency lowering device, this person must consult with the driver. Both people must be in a safe area to avoid danger.

The truck may only be started again once the error has been localised and rectified.

During emergency lowering make sure the load handler has not got stuck in the rack.

– Open the rear electronic panel (door).
– Slowly open the drain valve (58) using the Allen switch.
– The load handler lowers.

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When the automatic emergency stop mechanism applies (e.g. if the wire guidance is lost, electrical steering fails) the truck brakes to a halt. Before starting again, the cause of the error must be identified and corrected. Start the truck again in accordance with manufacturer’s instructions contained in these operating instructions (see “Starting up the Truck” in Chapter E).

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During emergency lowering make sure the load handler has not got stuck in the rack.

– Open the rear electronic panel (door).
– Slowly open the drain valve (58) using the Allen switch.
– The load handler lowers.
5.3 Travel cutout override (○)

If travel is inhibited from a certain lift height (the “Travel cutout override” symbol (59) appears in the display), but the position of the truck relative to the rack must be adjusted to load or unload goods, press the “unlock travel” switch (60) and apply the accelerator as described in “Travelling”. This allows you to travel at crawl speed.

5.4 Lift cutout (○)

If local conditions require, an automatic lift cutout to apply from a given lift height can be fitted for safety reasons. The display unit shows the "Lift Cutout Override" symbol (61).

⚠ Lift cutout only becomes effective after a test run has been carried out. You can tell when this is the case, because the actual height is shown in the display unit.

Step

When disabling the lift cutout the driver must look out for obstacles when the mast is extended.

Pressing the “lift cutout override” switch (62) disables the lift cutout.

➡ Lift cutout is re-activated each time the mast falls below the lift limit height.

The respective travel and lift limit switches are located in the control panel.
5.5 Aisle end safety device (○)

Trucks with the aisle end safety device brake before the aisle exit or in the transfer aisle. There are two basic versions for this:

1. Braking to a halt
2. Braking to 2.5 km/h

Other variants (affecting the subsequent travel speed, lift height etc.) are available.

1. Braking to a halt:
When the truck passes over the aisle end safety magnets heading for the aisle end, it comes to a halt.

To continue traveling:
– Briefly release the foot switch and then apply it again
The truck can be driven out of the narrow aisle at max. 2.5 km/h.

2. Braking to 2.5 km/h
When the truck passes over the aisle end safety magnets heading for the aisle end, it brakes to 2.5 km/h and can be driven out of the narrow aisle at this speed.

In both cases the braking distance depends on the travel speed.

Aisle end safety braking is an additional function designed to support the operator, but which does not release him from his responsibilities, e.g. to monitor braking at the aisle end and if necessary to apply the brakes.
5.6 Wire guidance emergency mode (IF) (Error 144)

If in a wire guidance system the guiding antenna extends beyond the pre-determined range of the guidance wire, an emergency stop is immediately performed.

If the truck is travelling directly parallel to the guidance wire, travel is not disabled. The “tracking on” display and the audible tracking signal however remain permanently on and hence warn the driver.

**Automatic EMERGENCY STOP**

If during operation one of the monitors for steering control, steering system, wire guidance or the safety cutout for the traction electronic system or power electronic system applies, the truck safety devices will cause the truck to stop.

To enable the truck to travel again after an EMERGENCY STOP, carry out the following:

- Determine the possible cause of the EMERGENCY STOP.
- Press the EMERGENCY STOP switch and turn it again to release it.
- Apply inductive automatic steering.
- Press the travel control button and carefully align the truck with the guidance wire.
- Error E 144 disappears from the display.

If the truck now starts, check that it is operating correctly.

**Manual EMERGENCY STOP**

Manual EMERGENCY STOPS occur when the EMERGENCY STOP button is pressed. The truck is operational again once the EMERGENCY STOP button has been released.

If, after an automatic or manual EMERGENCY STOP and having rectified the problem, you cannot start the truck again, turn the key switch off and on again.

Now perform a referencing action, see “Truck Operational Status Symbols” section in Chapter E.

The truck is now operational again.
5.7 Recovering the truck from a narrow aisle / Moving the truck without a battery

Before recovering the truck from a narrow aisle, disconnect the battery.

This operation must only be performed by suitably trained maintenance personnel.

When the brakes are de-activated the truck must be parked on an even ground as the brakes are no longer effective.

– Fully lower the mast

Seek assistance from another person. The other person must be trained and familiar with recovery operations.

To recover the truck from the aisle, release the brakes.

Release the magnetic brake
– Open the panel (door) at the back of the electronics compartment.
– Screw in the setscrews (63) on the magnetic brake (64) above the traction motor to release it. The screws are to the right of the travel switch sheet.

When using the truck again, check the braking deceleration.
Releasing the load wheel brake

– Open the panel (door) at the back of the electronics compartment.
– Remove the protective cap (67) from the bleed valve (66).
– Remove the cover (70) from the brake fluid retainer (65).
– Push the hose (69) onto the vent connection (68) of the bleed valve (66) and attach the other end of the hose to the brake fluid retainer (65) above it.

The brake fluid is pressurised.
Risk of scalding!
– Open the bleed valve (66) and drain the excess brake fluid into the brake fluid retainer (65).
– Close the bleed valve (66), remove the hose (69) from the vent connection (68) and cover the vent connection with the protective cap (67).
– Close the brake fluid retainer (65) with the lid (70).

→ To restore the brake system to operation power up the truck and apply the foot switch several times.

← When using the truck again, check the braking deceleration.

Adjusting the steering angle

The battery must be disconnected when adjusting the steering angle.

Using an Allen switch set the steered wheel to the required direction via the screw in the steering motor (71).

→ It is advisable to discharge the wheel if setting an angle greater than 4 degrees.
Emergency recovery in drive direction:
– Open the panel (73) at the back of the electronics compartment.

⚠️ Dismantle the panel (73) to avoid damage and injury.
– Guide the tow rope (74), tow force > 9 tonnes, between the counter-weight attachment to the truck chassis (72).
– Carefully and slowly pull the truck out of the narrow aisle.

Recovering the truck in load direction without load
– Guide the tow rope (75), tow force > 9 tonnes, around the traverse/rotate frame (76) of the upper rail.
– Carefully and slowly pull the truck out of the narrow aisle.
Recovering the truck in load direction with load

- Guide the tow rope (77), tow force > 9 tonnes, around the “Rotate” traversing arm (78).
- Carefully and slowly pull the truck out of the narrow aisle.

⚠️ Recovering with load must be performed with particular care, as the truck cannot be pulled from its centre.

⚠️ After recovery, prevent the truck from accidentally moving.
To do this, unscrew the setscrews on the magnetic brake above the drive motor.
If the brake is not working, place wedges underneath the wheels of the truck to prevent it from moving.
F Maintenance of the forklift truck

1 Operational safety and environmental protection

The servicing and inspection duties contained in this chapter must be performed in accordance with the intervals indicated in the servicing checklists.

Any modifications to the forklift truck assemblies, in particular the safety mechanisms, is prohibited. The operating speeds of the truck must not be increased under any circumstances.

Only original spare parts have been certified by our quality assurance department. To ensure safe and reliable operation of the forklift truck, use only the manufacturer’s spare parts. Used parts, oils and fuels must be disposed of in accordance with the relevant environmental protection regulations. For oil changes, contact the manufacturer’s specialist department.

Upon completion of inspection and servicing, the tasks contained in the “Recommissioning” section must be performed (see chapter F).

2 Maintenance Safety Regulations

Maintenance personnel: Industrial trucks must only be serviced and maintained by the manufacturer’s trained personnel. The manufacturer’s service department has field technicians specially trained for these tasks. We therefore recommend a maintenance contract with the manufacturer’s local service centre.

Lifting and jacking up: When an industrial truck is to be lifted, the lifting gear must only be secured to the points specially provided for this purpose. When the truck is to be jacked up, take appropriate measures to prevent the truck from slipping or tipping over (e.g. wedges, wooden blocks). Only work under a raised load handler and cab if they are secured by a chain of sufficient capacity or by the retaining bolt (see “Securing the Load Handler” in Chapter F).

Cleaning: Do not use flammable liquids to clean the industrial truck. Prior to cleaning, all safety measures required to prevent sparking (e.g. through short circuits) must be taken. For battery-operated trucks, the battery connector must be removed. Only weak suction or compressed air and non-conductive antistatic brushes may be used for cleaning electric or electronic assemblies.

If the truck is to be cleaned with a water jet or a high-pressure cleaner, all electrical and electronic components must be carefully covered beforehand as moisture can cause malfunctions. Do not clean with pressurised water.

After cleaning the truck, carry out the activities detailed in the “Recommissioning” section.

F Maintenance of the forklift truck

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After cleaning the truck, carry out the activities detailed in the “Recommissioning” section.
**Electrical System**: Only suitably trained personnel may operate on the truck’s electrical system. Before working on the electrical system, take all precautionary measures to avoid electric shocks. For battery-operated trucks, also de-energise the truck by removing the battery connector.

**Welding**: To avoid damaging electric or electronic components, remove these from the truck before performing welding operations.

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

**Wheels**: The quality of wheels affects the stability and performance of the truck. When replacing factory fitted wheels, only use manufacturer’s original spare parts. Otherwise the truck’s rated performance cannot be ensured. When replacing wheels, ensure that the truck does not slew (e.g. always replace left and right wheels at the same time).

**Lift chains**: Lift chains wear rapidly if not lubricated. The intervals stated in the service checklist apply to normal duty use. More demanding conditions (dust, temperature) require more regular lubrication. The prescribed chain spray must be used in accordance with the instructions. Applying grease externally will not provide sufficient lubrication.

**Hydraulic hoses**: The hoses must be replaced every six years.

**Load Handler / Lifting Device / Frame**: Load handlers are subject to greater stress in extreme cold store conditions (ETX 513/515 Cold Store only). They must therefore be checked separately in accordance with the maintenance checklist.

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3 Servicing and inspection

Thorough and expert servicing is one of the most important requirements for the safe operation of the industrial truck. Failure to perform regular servicing can lead to truck failure and poses a potential hazard to personnel and equipment.

⚠️ The application conditions of an industrial truck considerably affect the wear levels of the service components.

We recommend an application analysis carried out on site by a Jungheinrich customer adviser to establish specific maintenance intervals in order to restrict damage caused by wear.

The service intervals stated are based on single shift operation under normal operating conditions. They must be reduced accordingly if the truck is to be used in conditions of extreme dust, temperature fluctuations or multiple shifts.

The following maintenance checklist states the tasks and intervals after which they should be carried out. Maintenance intervals are defined as:

- **W** = Every 50 service hours, at least weekly
- **A** = Every 500 operating hours
- **B** = Every 1000 operating hours, or at least annually
- **C** = Every 2000 operating hours, or at least annually

⚠️ W service intervals are to be performed by the customer.
## ETX 513/515 Maintenance Checklist including Cold Store

### Chassis/Superstructure:

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<td>1.2 Check screw connections</td>
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<td>1.3 Test the operation of the driver's position and check for damage</td>
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<td>1.4 Check that identification points, data plates and warnings are legible and replace if necessary</td>
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### Drive:

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### Steering:

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<td>4.2 Check the distance between the guide rollers and the rail guidance over the entire length of the rails. The play between the two guide rollers and the rails (measured over the axle) should be 0-5 mm. The rollers should not jam.</td>
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### Brake system:

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### Maintenance intervals

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<td>9.1 Check acid density, acid level and cell voltage</td>
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<td>9.3 Clean battery connections, make sure they are secure</td>
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<td>9.4 Check battery cables for damage, replace if necessary</td>
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</table>

- **Standard version:**
  - Replace hydraulic hoses after 6 years.
  - Replace hydraulic hoses annually.

- **Cold store version:**
  - Replace hydraulic hoses annually.
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<td>12.1 Lubricate the truck according to the lubrication schedule</td>
<td>13.1 Check electrical system for frame leakage</td>
<td>14.1 Test run with rated load</td>
<td>15.1 Using appropriate means check chassis, lifting device and load handler for cracks (e.g. penetration tests, corrosive test). Replace any cracked forks. (ETX 513/515 cold store only)</td>
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</table>

**Attention: Danger of crashing!**

- 10.3 Check lift chains and chain guide for wear, adjust and lubricate
- 10.4 Check mast suspension
- 10.5 Lubricate lift chains
- 10.6 Visually inspect rollers, slide pieces and stops
- 10.7 Check forks and fork carriage for wear and damage

**Attachments:**

- 11.1 Test operation and settings
- 11.2 Check attachment on truck and load bearing components
- 11.3 Check bearings, guides and stops for wear and damage, clean and lubricate; also clean and lubricate toothed racks
- 11.4 Check eccentric bolts and sliding strip adjustment on the traverse/rotate frame, adjust if necessary.
- 11.5 Lubricate rollers, guide rollers and traverse bearings on the traverse rotate fork.

**Lubrication:**

- 12.1 Lubricate the truck according to the lubrication schedule

**General Measurements:**

- 13.1 Check electrical system for frame leakage
- 13.2 Test travel speed and braking distance
- 13.3 Test lift and lowering speeds
- 13.4 Test safety devices and cutouts
- 13.5 IG: Measure current in guide wire, adjust if necessary
- 13.6 Check travel on the guidance wire, check maximum deviation and adjust if necessary e)
- 13.7 Check tracking mode on the guidance wire for aisle tracking. e)
- 13.8 Check wire guidance EMERGENCY STOP operation e)

**Demonstration:**

- 14.1 Test run with rated load
- 14.2 When maintenance is complete, present the truck to the responsible person.

**Additional Cold Store Test:**

- 15.1 Using appropriate means check chassis, lifting device and load handler for cracks (e.g. penetration tests, corrosive test). Replace any cracked forks. (ETX 513/515 cold store only)

**e) IG: inductive guidance trucks**
4.1 Lubrication Schedule

Grease nipple consumable E

Outer mast

Load handler

Inner mast

LAM

Inner mast

Drive

Inner mast

Load handler

Outer mast

LAM

Inner mast

Drive
Contact surfaces
Grease nipple
Hydraulic oil filler neck
Hydraulic oil drain plug
Transmission oil filler neck
Transmission oil drain plug
Brake fluid filler neck
Hydraulic oil filler neck
4.2 Fuels, coolants and lubricants

Handling consumables: Consumables must always be handled correctly. Follow the manufacturer’s instructions.

Improper handling is hazardous to health, life and the environment. Consumables must only be stored in appropriate containers. They may be flammable and must therefore not come into contact with hot components or naked flames.

Only use clean containers when filling up with consumables. Do not mix consumables of different grades. The only exception to this is when mixing is expressly stipulated in the Operating Manual.

Avoid spillage. Spilled liquids must be removed immediately with suitable bonding agents and the bonding agent / consumable mixture must be disposed of in accordance with regulations.

ETX 513/515:

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<td>Front wheel bearings</td>
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* Plus 2% additive 68 ID (order no. 50307735)

The trucks are supplied from the factory with “HLP D22” hydraulic oil or the “Plantohyd 22 S” BIO hydraulic oil + 2 % 68 ID additive.

You cannot change from the Plantohyd 22 S BIO hydraulic oil to HLP D22. The same applies to changing from HLP D22 hydraulic oil to Plantohyd 22 S BIOhydraulic oil. Furthermore, you cannot mix HLP D22 hydraulic oil Plantohyd 22 S BIO hydraulic oil.

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These items are suitable for temperature range -5 to 28°C
* Plus 1.8 litre additive 68 ID (order no. 50307735)

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<td>Load Wheel</td>
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5 Maintenance and Repairs

Load bearing parts of the truck, e.g. chassis and mast, may only be welded after consultation with the manufacturer.

5.1 Prepare the truck for maintenance and repairs

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

– Park the truck securely (see Chapter E).
– Disconnect the battery 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.
– Remove the electronic compartment cover at the back.

When working under a raised fork or a raised industrial truck, secure them to prevent them from lowering, tipping or sliding away. When raising the industrial truck also refer to the instructions in the “Transport and Commissioning” section.

When working on the parking brake, prevent the industrial truck from rolling away.

When working on the parking brake, prevent the industrial truck from rolling away.
5.2 Securing the load handler

The load handler can be secured in the raised position.

– Raise the load handler until the inner mast (1) is above the carriage of the load handling safety device.
– Unscrew the attachment screw (5) and remove the retaining bolt (4) from the carriage (2) on the mast (6).
– Place the retaining bolt (4) on the vertical hole (3) of the carriage and tighten it.
– Very slowly lower the load handler until the inner mast (1) is positioned on the retaining bolt (4).

5.3 Maintaining the lift chains

It is important that all lift chains and pivots are at all times kept clean and well lubricated. Only lubricate discharged chains. A chain must be lubricated with particular care where it passes over a deflection pulley. Lift chains are safety-critical parts. Chains should not have any significant contamination. They should only be cleaned with paraffin derivatives e.g. petroleum or diesel fuels. Never clean chains with steam jet high pressure cleaners, cold or chemical cleaning agents.

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5.4 Inspecting the lift chains

Unauthorised wear and external damage:

In accordance with official regulations, a chain is considered to be worn if it has extended in length by 3% in the section which passes over the deflection pulley. For safety reasons, we advise replacing chains when they elongate by 2%. Chains should also be replaced immediately when visible damage is noted, as such damage leads to permanent breakage after a certain time.

⚠️ If the truck is fitted with two lift chains, both chains must always be replaced. This is the only way to ensure even load distribution over the two chains. When replacing chains the connecting bolts between the chain anchor and the chain must be replaced. Only new original parts may be used.
5.5 Hydraulic oil
– Prepare the truck for maintenance and repairs

Oil must never be allowed to enter the drainage system or the soil. Used oil must be preserved until it can be disposed of in the correct manner.

Draining oil:
Suction off the hydraulic oil with the discharge filter removed (10). If this is not possible, the hydraulic oil can be drained from the bottom of the hydraulic reservoir after the oil drain screw (9) has been unscrewed.

Adding oil:
Screw in the oil drain screw (9). Replenish with new hydraulic oil up to the Max. mark on the dipstick (11a). Screw the discharge filter back on.

Check which hydraulic oil is being added. If Plantohyd 22 S BIO hydraulic oil is being used, the warning: “Only add BIO hydraulic oil” (11b) will be on the hydraulic reservoir. In this case you may only use Hydrauliköl "Plantohyd 22 S BIO hydraulic oil to fill the hydraulic reservoir.

You cannot change from the Plantohyd 22 S BIO hydraulic oil to HLP D22. The same applies to changing from HLP D22 hydraulic oil to Plantohyd 22 S BIO hydraulic oil. Furthermore, you cannot mix HLP D22 hydraulic oil and Plantohyd 22 S BIO hydraulic oil.

Checking the hydraulic oil level
When the mast is fully lowered, check that the hydraulic oil level is between the min. and max. markings on the dipstick (11a). If this is not the case, add new hydraulic oil.

5.6 Hydraulic hoses

Hose lines must be replaced every six years, see Safety Regulations for Hydraulic Hose Lines ZH 1/74.
5.7 Check brake fluid

Brake fluid is poisonous and should therefore only be stored in sealed, original containers. Also bear in mind that brake fluid corrodes the truck paint.

Brake fluid is added in the factory and must be replaced after 12 months at the latest, as it changes over time and loses its original qualities.

The brake fluid container (12) is located in the floor section of the truck and can be accessed by removing the panel. The container should always be filled up to 2 cm below the container seal (note Min. and Max. markings). Only use the prescribed brake fluid. The entire brake system must be sealed at all times.

5.8 Safety Restraint Belt Maintenance

The driver must check the operation and condition of the restraint belt every day before using the industrial truck. Faulty operation can only be detected early through regularly checking.

– Withdraw the belt completely and check the belt for possible fraying.
– Check the belt lock and make sure that the belt enters the retractor correctly.
– Check the cover for damage

Testing the automatic blocking system:

– Park the truck in a horizontal position.
– Forcibly extract the belt.

⚠️ The interlock must prevent the belt from coming out.

⚠️ Do not operate the truck with a faulty restraint belt. Replace it immediately.
5.9 Electric fuses

Electric fuses must only be checked and replaced by authorized personnel.

– Prepare the truck for maintenance and repairs (see chapter F).
– Check the fuse rating and condition in accordance with the table; replace if necessary.

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</table>
5.10 Recommissioning

The truck may only be recommissioned after cleaning or repair work, once the following operations have been performed.

– Test horn.
– Test EMERGENCY DISCONNECT switch.
– Test brake.

6 Decommissioning the industrial truck

If the industrial truck is to be decommissioned for more than one month, e.g. for operational reasons, it must be parked in a frost-free and dry location and all necessary measures must be taken before, during and after decommissioning as described.

⚠️ On decommissioning the truck must be jacked up so that all the wheels are clear of the ground. This is the only way of ensuring that the wheels are not damaged.

If the truck is to be out of service for more than 6 months, further measures must be taken in consultation with the manufacturer’s service department.

6.1 Prior to decommissioning:

– Thoroughly clean the truck.
– Check the brakes.
– Check the hydraulic oil level and replenish as necessary (see Chapter F).
– Apply a thin layer of oil or grease to any non-painted mechanical components.
– Lubricate the truck in accordance with the lubrication schedule (see Chapter F).
– Charge the battery (see Chapter D).
– Disconnect the battery, clean it and apply grease to the terminals.

In addition, follow the battery manufacturer’s instructions.

– Spay all exposed electrical contacts with a suitable contact spray.
6.2 During decommissioning:

Every 2 months:
– Charge the battery (see Chapter D).

⚠️ Battery powered trucks:
The battery must be charged at regular intervals to avoid depletion of the battery through self-discharge. The sulfatisation would destroy the battery.

6.3 Restoring the truck to operation after decommissioning

– Thoroughly clean the truck.
– Lubricate the truck in accordance with the lubrication schedule (see Chapter F).
– Clean the battery, grease the terminals and connect the battery.
– Charge the battery (see Chapter D).
– Check transmission oil for condensed water and replace if necessary.
– Check hydraulic oil for condensed water and replace if necessary.
– Start up the truck (see Chapter E).

➡️ Battery powered trucks:
If there are switching problems in the electrical system, apply contact spray to the exposed contacts and remove any oxide layers on the contacts of the operating controls by applying them repeatedly.

⚠️ Perform several brake tests immediately after re-commissioning the truck.
7 Safety checks to be performed at regular intervals and following any unusual incidents

Carry out a safety check in accordance with national regulations. Junheinrich recommends checks in accordance with FEM Guideline 4.004. Jungheinrich has a special safety department with trained personnel to carry out such checks.

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

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

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

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

8 Final de-commissioning, disposal

Final, proper decommissioning or disposal of the truck must be performed in accordance with the regulations of the country of application. In particular, regulations governing the disposal of batteries, fuels and electronic and electrical systems must be observed.
Instructions for use

Jungheinrich traction battery

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Instruction for use

Jungheinrich traction battery

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2 Jungheinrich traction battery
   Maintenance free traction batteries with positive tubular plates type EPzV
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1 Jungheinrich traction battery
with positive tubular plates type EPzS and EPzB

Rating Data

1. Nominal capacity C5: See type plate
2. Nominal voltage: 2,0 V x No of cells
3. Discharge current: C5/5h
4. Nominal S.G. of electrolyte*
   Type EPzS: 1,29 kg/l
   Type EPzB: 1,29 kg/l
5. Rated temperature: 30° C
6. Nominal electrolyte level: up to electrolyte level mark „max.“

* Will be reached within the first 10 cycles.

- Pay attention to the operation instruction and fix them close to the battery!
- Work on batteries to be carried out by skilled personnel only!
- Use protective glasses and clothes when working on batteries!
- Pay attention to the accident prevention rules as well as DIN EN 50272-3, DIN 50110-1!
- No smoking!
- Do not expose batteries to naked flames, glowing embers or sparks, as it may cause the battery to explode!
- Acid splashes in the eyes or on the skin must be washed with water. In case of accident consult a doctor immediately!
- Clothing contaminated by acid should be washed in water.
- Risk of explosion and fire, avoid short circuits!
- Electrolyte is highly corrosive!
- Batteries and cells are heavy!
- Ensure secure installation! Use only suitable handling equipment e.g. lifting gear in accordance with VDI 3616.
- Dangerous electrical voltage!
- Caution! Metal parts of the battery are always live. Do not place tools or other metal objects on the battery!
Ignoring the operation instructions, repair with non-original parts or using additives for the electrolyte will render the warranty void.

For batteries in classes I and II the instructions for maintaining the appropriate protection class during operation must be complied with (see relevant certificate).

1. Commissioning filled and charged batteries. For commissioning of unfilled batteries see separate instructions!
   The battery should be inspected to ensure it is in perfect physical condition.
   The charger cables must be connected to ensure a good contact, taking care that the polarity is correct. Otherwise battery, vehicle or charger could be damaged.
   The specified torque loading for the polscrews of the charger cables and connectors are:

   | steel |
   | M 10  | 23 ± 1 Nm |

   The level of the electrolyte must be checked. If it is below the antisurge baffle or the top of the separator it must first be topped up to this height with purified water.
   The battery is then charged as in item 2.2.
   The electrolyte should be topped up to the specified level with purified water.

2. Operation
   DIN EN 50272-3 «Traction batteries for industrial trucks» is the standard which applies to the operation traction batteries in industrial trucks.

2.1 Discharging
   Be sure that all breather holes are not sealed or covered.
   Electrical connections (e.g. plugs) must only be made or broken in the open circuit condition.
   To achieve the optimum life for the battery, operating discharges of more than 80% of the rated capacity should be avoided (deep discharge).
   This corresponds to an electrolyte specific gravity of 1.13 kg/l at the end of the discharge. Discharged batteries must be recharged immediately and must not be left discharged. This also applies to partially discharged batteries.

2.2 Charging
   Only direct current must be used for charging. All charging procedures in accordance with DIN 41773 and DIN 41774 are permitted. Only connect the battery assigned to a charger, suitable for the size of battery, in order to avoid overloading of the electric cables and contacts, unacceptable gassing and the escape of electrolyte from the cells.

   In the gassing stage the current limits given in DIN EN 50272-3 must not be exceeded. If the charger was not purchased together with the battery it is best to have its suitability checked by the manufacturers service department. When charging, proper provision must be made for venting of the charging gases.
Battery container lids and the covers of battery compartments must be opened or removed. The vent plugs should stay on the cells and remain closed.

With the charger switched off connect up the battery, ensuring that the polarity is correct. (positive to positive, negative to negative). Now switch on the charger. When charging the temperature of the electrolyte rises by about 10°C, so charging should only begin if the electrolyte temperature is below 45°C. The electrolyte temperature of batteries should be at least +10°C before charging otherwise a full charge will not be achieved.

A charge is finished when the specific gravity of the electrolyte and the battery voltage have remained constant for two hours. Special instructions for the operation of batteries in hazardous areas. This concerns batteries which are used in accordance with EN 50014, DIN VDE 0170/0171 Ex (in areas with a firedamp hazard) or Ex II (in potentially explosive areas). During charging and subsequent gassing the container lids must be removed or opened so that the explosive mixture of gases loses its flammability due to adequate ventilation. The containers for batteries with plate protection packs must not be closed until at least half an hour after charging has past.

2.3 Equalising charge

Equalising charges are used to safeguard the life of the battery and to maintain its capacity. They are necessary after deep discharges, repeated incomplete recharges and charges to an IU characteristic curve. Equalising charges are carried out following normal charging. The charging current must not exceed 5 A/100 Ah of rated capacity (end of charge - see point 2.2).

Watch the temperature!

2.4 Temperature

An electrolyte temperature of 30°C is specified as the rated temperature. Higher temperatures shorten the life of the battery, lower temperatures reduce the capacity available. 55°C is the upper temperature limit and is not acceptable as an operating temperature.

2.5 Electrolyte

The rated specific gravity (S. G.) of the electrolyte is related to a temperature of 30°C and the nominal electrolyte level in the cell in fully charged condition. Higher temperatures reduce the specified gravity of the electrolyte, lower temperatures increase it. The temperature correction factor is -0.0007 kg/l per °C, e.g. an electrolyte specific gravity of 1.28 kg/l at 45°C corresponds to an S.G. of 1.29 kg/l at 30°C.

The electrolyte must conform to the purity regulations in DIN 43530 part 2.
3. Maintenance

3.1 Daily
Charge the battery after every discharge. Towards the end of charge the electrolyte level should be checked and if necessary topped up to the specified level with purified water. The electrolyte level must not fall below the anti-surge baffle or the top of the separator or the electrolyte „min“ level mark.

3.2 Weekly
Visual inspection after recharging for signs of dirt and mechanical damage. If the battery is charged regularly with a IU characteristic curve an equalising charge must be carried out (see point 2.3).

3.3 Monthly
At the end of the charge the voltages of all cells or bloc batteries should be measured with the charger switched on, and recorded. After charging has ended the specific gravity and the temperature of the electrolyte in all cells should be measured and recorded.

If significant changes from earlier measurements or differences between the cells or bloc batteries are found further testing and maintenance by the service department should be requested.

3.4 Annually
In accordance with DIN VDE 0117 at least once per year, the insulation resistance of the truck and the battery must be checked by an electrical specialist.

The tests on the insulation resistance of the battery must be conducted in accordance with DIN EN 60254-1.

The insulation resistance of the battery thus determined must not be below a value of 50 Ω per Volt of nominal voltage, in compliance with DIN EN 50272-3.

For batteries up to 20 V nominal voltage the minimum value is 1000 Ω.

4. Care of the battery
The battery should always be kept clean and dry to prevent tracking currents. Cleaning must be done in accordance with the ZVEI code of practice «The Cleaning of Vehicle Traction batteries».

Any liquid in the battery tray must be extracted and disposed of in the prescribed manner. Damage to the insulation of the tray should be repaired after cleaning, to ensure that the insulation value complies DIN EN 50272-3 and to prevent tray corrosion. If it is necessary to remove cells it is best to call in our service department for this.
5. Storage

If batteries are taken out of service for a lengthy period they should be stored in the fully charged condition in a dry, frost-free room. To ensure the battery is always ready for use a choice of charging methods can be made:

1. a monthly equalising charge as in point 2.3

2. float charging at a charging voltage of 2.23 V x the number of cells. The storage time should be taken into account when considering the life of the battery.

6. Malfunctions

If malfunctions are found on the battery or the charger our service department should be called in without delay. The measurements taken in point 3.3 will facilitate fault finding and their elimination.

A service contract with us will make it easier to detect and correct faults in good time.

Back to the manufacturer!

Batteries with this sign must be recycled.

Batteries which are not returned for the recycling process must be disposed of as hazardous waste!

We reserve the right make technical modification.
**7. Type plate, Jungheinrich traction battery**

<table>
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* CE mark is only for batteries with a nominal voltage greater than 75 volt.
Aquamatic/BFS III water refilling system for Jungheinrich traction battery with EPzS and EPzB cells with tubular positive plates

Aquamatic plug arrangement for the Operating Instructions

<table>
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</thead>
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<td>EPzS</td>
<td>Aquamatic plug</td>
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<tr>
<td>2/120 – 10/600</td>
<td>2/42 – 12/252</td>
</tr>
<tr>
<td>2/160 – 10/800</td>
<td>2/64 – 12/384</td>
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<td></td>
<td>2/84 – 12/504</td>
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<tr>
<td></td>
<td>2/110 – 12/660</td>
</tr>
<tr>
<td></td>
<td>2/130 – 12/780</td>
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<tr>
<td></td>
<td>2/150 – 12/900</td>
</tr>
<tr>
<td></td>
<td>2/172 – 12/1032</td>
</tr>
<tr>
<td></td>
<td>2/200 – 12/1200</td>
</tr>
<tr>
<td></td>
<td>2/216 – 12/1296</td>
</tr>
<tr>
<td></td>
<td>2/180 – 10/900</td>
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<tr>
<td></td>
<td>2/210 – 10/1050</td>
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<td></td>
<td>2/230 – 10/1150</td>
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<tr>
<td></td>
<td>2/250 – 10/1250</td>
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<tr>
<td></td>
<td>2/280 – 10/1400</td>
</tr>
<tr>
<td></td>
<td>2/310 – 10/1550</td>
</tr>
</tbody>
</table>

* The cell series comprise cells with two to ten (twelve) positive plates, e.g. column EPzS. 2/120 - 10/600.

These are cells with the positive plate 60Ah. The type designation of a cell is e.g. 2 EPzS 120.

Non-adherence to the operating instructions, repairs carried out with non-original spare parts, unauthorised interference, and the use of additives for the electrolytes (alleged improvement agents) will invalidate any claim for warranty.

When using batteries which comply with I and II, it is important to follow the instructions on maintaining the respective protection class during operation (see associated certification).
1. Design

The Aquamatic/BFS battery water refilling systems are used for automatically adjusting the nominal electrolyte level. Venting holes are provided for letting off the gases which arise during charging. In addition to the optical level indicator, the plug systems also have a diagnostics hole for measuring the temperature and the electrolyte density. All battery cells of the design series EPzS; EPzB can be equipped with the Aquamatic/BFS filling systems. The water can be refilled by means of a central sealing coupler through the hose connections in the individual Aquamatic/BFS plugs.

2. Application

The Aquamatic/BFS battery water refilling system is used in traction batteries for forklift trucks. The water refilling system is provided with a central water connection for the water supply. Soft PVC hose is used for this connection and for the hose connections for the individual plugs. The hose ends are put onto the hose connection sleeves located on the T or < pieces.

3. Function

The quantity of water required in the refilling process is controlled by the valve located in the plug in combination with the float and the float rods. In the Aquamatic System the existing water pressure at the valve turns off the water supply and ensures that the valve closes securely. When the maximum filling level is reached in the BFS system, the float and the float rods through a lever system close the valve with five times the buoyant force and consequently interrupt the water supply reliably.
4. Filling (manual/automatic)
The batteries should be filled with battery water as soon as possible before the battery charging comes to an end; this ensures that the refilled water quantity is mixed with the electrolyte. In normal operation it is usually sufficient to fill once a week.

5. Connection pressure
The water refilling unit is to be operated in such a way that the water pressure in the water pipe is between 0.3 bars and 1.8 bars. The Aquamatic System has an operating pressure range of between 0.2 bars and 0.6 bars. The BFS system has an operating pressure range of 0.3 bars to 1.8 bars. Deviations from the pressure ranges impair the system's functional reliability. This wide pressure range permits three types of filling.

5.1 Falling water
The height of the tank is chosen to suit whichever water refilling system is used. For the Aquamatic System the installation height is 2 m to 6 m and for the BFS system the installation height is 3 m to 18 m over the battery surface.

5.2 Pressurised water
The pressure-reducing valve in the Aquamatic System is set from 0.2 bars to 0.6 bars and from 0.3 bars to 1.8 bars in the BFS system.

5.3 Water Refill Trolley (serviceMobil)
The submergible pump located in the ServiceMobil's tank generates the necessary filling pressure. No difference in height is permitted between the standing level of the ServiceMobil and the standing level of the battery.

6. Filling duration
The length of time needed to fill the batteries depends on the conditions under which the battery is used, the ambient temperatures and the type of filling and/or the filling pressure. The filling time is approx. 0.5 to 4 minutes. Where filling is manual, the water feed pipe must be separated from the battery after filling.

7. Water quality
Only refilling water which conforms in quality to DIN 43530 part 4 may be used to fill the batteries. The refilling unit (tank, pipelines, valves etc.) may not contain any kind of dirt which could impair the functional reliability of the Aquamatic/BFS plug. For safety reasons it is recommendable to insert a filter element (optional) with a max. passage opening of 100 to 300 µm into the battery's main supply pipe.
8. Battery hose connections
Hose connections for the individual plugs are laid along the existing electric circuit. No changes may be made.

9. Operating temperature
The temperature limit for battery operation is set at 55° C. Exceeding this temperature damages the batteries. The battery filling systems may be operated within a temperature range of > 0° C to a maximum of 55° C.

CAUTION:
Batteries with automatic water refilling systems may only be operated in rooms with temperatures > 0° C (as there is otherwise a danger that the systems may freeze).

9.1 Diagnostics hole
To be able to measure the acid density and temperature easily, the water refilling systems must have a diagnostics hole with a 6.5 mm-diameter (Aquamatic plugs) or a 7.5 mm-diameter (BFS plugs).

9.2 Float
Different floats are used depending on the cell design and type.

9.3 Cleaning
The plug systems may only be cleaned with water. No parts of the plugs may come in contact with soap or fabrics which contain solvents.

10. Accessories
10.1 Flow indicator
To monitor the filling process, a flow indicator can be inserted into the water feed pipe on the battery side. During the filling process, the paddlewheel is turned by the flowing water. When the filling process ends, the wheel stops and this indicates the end of the filling process. (ident no.: 50219542).

10.2 Plug lifter
Only the appertaining special-purpose tool may be used to disassemble the plug systems (plug lifter). The greatest of care must be employed when prising out the plug to prevent any damage to the plug systems.

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10.2.1 Clamping ring tool
The clamping ring tool is used to push on a clamping ring to increase the contact pressure of the hose connection on the plugs’ hose couplings and to loosen it again.

10.3 Filter element
For safety reasons a filter element (ident no.: 50307282) can be fitted into the battery’s main supply pipe for supplying battery water. This filter element has a maximum passage cross-section of 100 to 300 µm and is designed as a bag filter.

10.4 Sealing coupler
The water is supplied to the water refilling systems (Aquamatic/BFS) through a central supply pipe. This is connected to the water supply system at the battery charging station by means of a sealing coupler system. On the battery side a closing nipple (ident no.: 50219538) is mounted and the customer must place a sealing coupler construction on the water supply side (obtainable under ident. no.: 50219537).

11. Functional data
PS - self-sealing pressure: Aquamatic > 1.2 bars
  BFS system none
D - rate of flow in the opened valve when the pressure is 0.1 bars: 350 ml/min
D1 - maximum permissible leakage rate in the closed valve when the pressure is at 0.1 bars: 2 ml/min
T - permissible temperature range: 0° C to a maximum of 65° C
Pa - operating pressure range: 0.2 to 0.6 bars in the Aquamatic system and operating pressure range: 0.3 to 1.8 bars in the BFS system.