# EFG 535 - 550

10.09 -

Operating instructions

GB

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EFG 535
EFG 540
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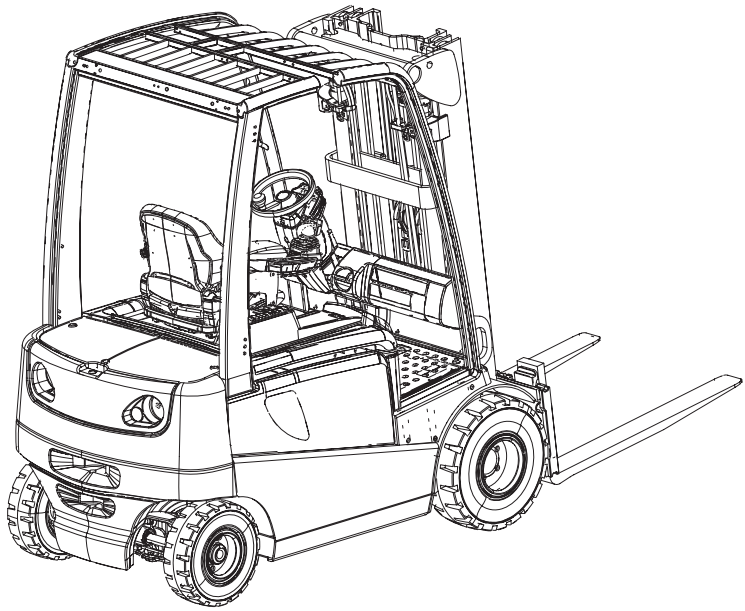

JUNGHEINRICH

Machines. Ideas. Solutions.

# Declaration of Conformity

Jungheinrich AG, Am Stadtrand 35, D-22047 Hamburg
Manufacturer or agent acting in the European Union

| Type | Option | Serial no. | Year of manufacture |
|---|---|---|---|
| EFG 535<br>EFG 540<br>EFG 545<br>EFG 550 | | | |

**Additional information**

**On behalf of**

**Date**

**(GB) EU Conformity Declaration**

The undersigned hereby declare that the powered industrial truck described below in detail complies with the European Directives 2006/42/EC (Machinery Directive) and 2004/108/EEC (Electromagnetic Compatibility - EMC) including amendments as well as the legislative decree to incorporate the directives in national law. The signatories are in each case individually authorized to compile the technical documents.

# Foreword

**Notes on the operating instructions**

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

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

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

**Safety notices and text mark-ups**

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

**⚠ DANGER!**

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

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**⚠ WARNING!**

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

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**⚠ CAUTION!**

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

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***NOTE***

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

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➔ Used before notices and explanations.

- ● Indicates standard equipment
- ○ Indicates optional equipment

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# Contents

# Appendix

# JH Traction Battery Operating Instructions

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

# A Correct Use and Application

## 1 General

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

## 2 Correct application

***NOTE***

The maximum load and load distance are indicated on the capacity plate and must not be exceeded.
The load must rest on the load handler or be lifted by an attachment approved by the manufacturer.
The load must be fully raised,see "Lifting, transporting and depositing loads" on page 92.

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

# 3 Approved application conditions

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

**⚠ WARNING!**

**Use under extreme conditions**

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

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

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

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

# 4 Proprietor responsibilities

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

***NOTE***

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

# 5 Adding attachments and/or optional equipment

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

# B Truck Description

## 1 Application

The EFG 535 - 550 is a four-wheel electric sit-down forklift truck. It is a cantilever counterbalanced truck which can lift, transport and deposit loads using the load handler attached in front.
Closed bottom pallets can also be lifted.

### 1.1 Truck models and rated capacity

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

EFG 535

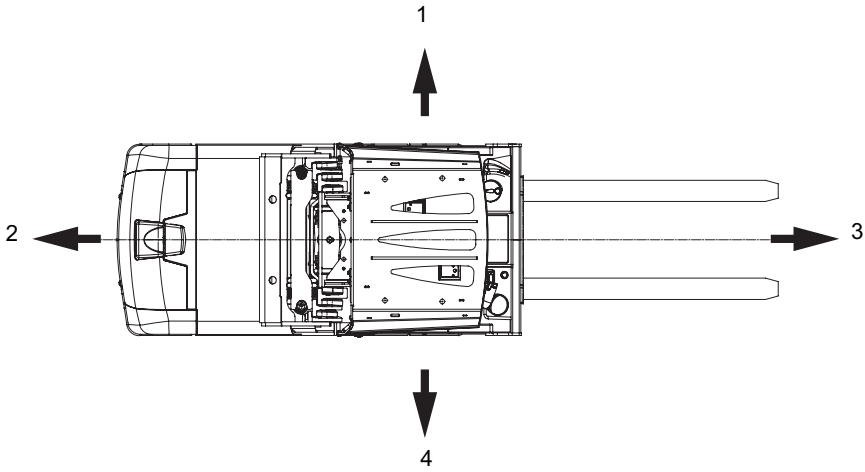
| | |
|---|---|
| EFG | Model name |
| 5 | Series |
| 35 | Rated capacity x 100 kg |

The rated capacity does not generally match the permissible capacity. The capacity can be found on the load chart attached to the rack.

# 2 Assemblies and Functional Description

## 2.1 Travel direction definition

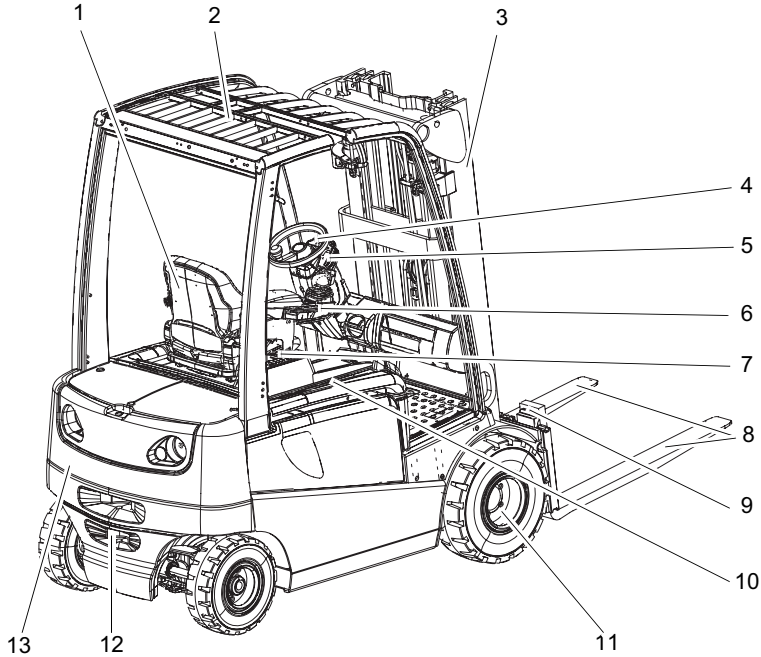
The following determinations have been made for travel direction specification:




The following conventions have been agreed for travel direction specification:

| Item | Travel direction |
|---|---|
| 1 | Left |
| 2 | Reverse |
| 3 | Forward |
| 4 | Right |

## 2.2 Assembly Overview




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

## 2.3 Functional Description

### Chassis

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

### Operator position and overhead guard

The overhead guard comes in a range of models and protects the operator from falling objects and other external
influences. All the controls are ergonomically arranged. The steering column and driver's seat can be adjusted individually.

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

### Steering

The steer cylinder of the hydrostatic steering is integrated in the steer axle (12) and is controlled by the power steering. The steer axle is fully floating in the chassis to ensure excellent grip even on non-level surfaces.

### Wheels

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

### Drive system and brakes

The front drive provides maximum traction to the drive wheels at all times. The hydraulic oil bath multi-plate brakes form the operating brake and are practically maintenance-free. The transmission encapsulation allows the truck to be used even in hostile environments. The drive motor also decelerates to a halt. This minimizes energy consumption.

The parking brake applies approx. 15 seconds when the truck comes to a halt or 1 to 15 seconds (adjustable) after the driver’s seat has been vacated.
The parking brake is automatically released again when the accelerator pedal is pressed.

**Hydraulic system**

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

**Mast**

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

**Attachments**

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

# 3 Technical Specifications

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

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

## 3.1 Performance data

EFG 535-540

| | Description | EFG | | |
|---|---|---|---|---|
| | | **535** | **540** | |
| Q | Rated capacity (where C = 500 mm)[1)] | 3500 | 4000 | kg |
| C | Load centre of gravity | 500 | 500 | mm |
| | Travel speed w / w.o. load *) | 16 / 17 | 15 / 17 | km/h |
| | Lift speed w / w.o. load | 0,38 / 0,50 | 0,35 / 0,47 | m/s |
| | Lowering speed w / w.o. load | 0,58 / 0,55 | 0,55 / 0,50 | m/s |
| | Gradeability (30 min) with / without load *) | 8,5 / 14,5 | 8 / 13,5 | % |
| | Max. gradeability [2)] (5 min) with / without load | 15,5 / 25 | 14 / 23,5 | % |
| | Acceleration (10 m) with / without load *) | 4,8 / 4,2 | 5,0 / 4,4 | s |
| | Max. operating pressure | 200 | 200 | bar |
| | Oil flow for attachments | 30 | 30 | l/min |

[1)] for vertical mast.

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

EFG 545-550

| | Description | EFG | | |
|---|---|---|---|---|
| | | **545** | **550** | |
| Q | Rated capacity (where C = 500 mm)[1)] | 4500 | 4990 | kg |
| C | Load centre of gravity | 500 | 500 | mm |
| | Travel speed w / w.o. load *) | 15 / 16,5 | 15 / 16 | km/h |
| | Lift speed w / w.o. load | 0,33 / 0,45 | 0,31 / 0,45 | m/s |
| | Lowering speed w / w.o. load | 0,55 / 0,50 | 0,55 / 0,50 | m/s |
| | Gradeability (30 min) with / without load *) | 7 / 12 | 6,5 / 12 | % |
| | Max. gradeability [2)] (5 min) with / without load | 12,5 / 21,5 | 12 / 21 | % |
| | Acceleration (10 m) with / without load *) | 5,5 / 4,8 | 5,8 / 5,2 | s |
| | Max. operating pressure | 200 | 200 | bar |
| | Oil flow for attachments | 30 | 30 | l/min |

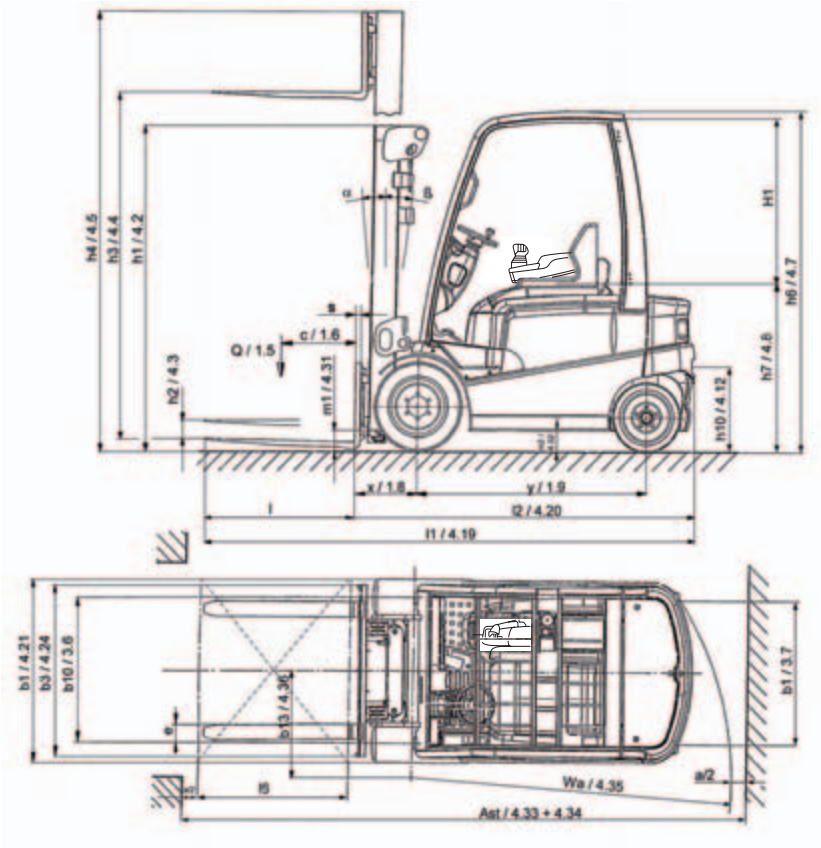
[1)] for vertical mast.

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

## 3.2 Dimensions

EFG 535-540

| | Description | EFG | | |
|---|---|---|---|---|
| | | **535** | **540** | |
| a/2 | Safety distance | 100 | 100 | mm |
| $h_1$ | Mast height retracted* | 2228 | 2405 | mm |
| $h_2$ | Free lift* | 150 | 150 | mm |
| $h_3$ | Lift* | 3100 | 3000 | mm |
| $h_4$ | Mast height extended* | 3883 | 3830 | mm |
| $h_6$ | Overhead guard height* | 2320 | 2320 | mm |
| $h_7$ | Seat height* | 1165 | 1165 | mm |
| $h_{10}$ | Coupling height | 390/500 | 390/500 | mm |
| α | Mast tilt, fwd. | 6 | 6 | ° |
| β | Mast tilt, back | 8 | 8 | ° |
| $L_1$ | Length including forks* | 3975 | 3980 | mm |
| $L_2$ | Headlength* | 2830 | 2830 | mm |
| $b_1$ | Overall width* | 1340 | 1340 | mm |
| $b_3$ | Fork width* | 1120 | 1260 | mm |
| $m_1$ | Ground clearance with load below mast | 120 | 120 | mm |
| $m_2$ | Ground clearance centre wheelbase | 160 | 160 | mm |
| Ast | Working aisle width<br>800 x 1200 longitudinal pallets | 4180 | 4360 | mm |
| Ast | Working aisle width<br>1000 x 1200 traverse pallets | 3980 | 4160 | mm |
| Wa | Turning radius | 2300 | 2450 | mm |
| x | Load distance | 510 * | 510 * | mm |
| y | Wheelbase | 1855 | 2000 | mm |


h4 / 4.5
h3 / 4.4
h1 / 4.2
h2 / 4.3
α
β
s
c / 1.6
Q / 1.5
m1 / 4.31
H1
h6 / 4.7
h7 / 4.8
h10 / 4.12
x / 1.8
y / 1.9
l
l2 / 4.20
l1 / 4.19
b1 / 4.21
b3 / 4.24
b10 / 3.6
b13 / 4.36
e
b1 / 3.7
l5
Wa / 4.35
a/2
Ast / 4.33 + 4.34

EFG 545-550

| | Description | EFG | | |
|---|---|---|---|---|
| | | 545 | 550 | |
| a/2 | Safety distance | 100 | 100 | mm |
| $h_1$ | Mast height retracted* | 2405 | 2405 | mm |
| $h_2$ | Free lift* | 150 | 150 | mm |
| $h_3$ | Lift* | 3000 | 3000 | mm |
| $h_4$ | Mast height extended* | 3830 | 3830 | mm |
| $h_6$ | Overhead guard height* | 2320 | 2320 | mm |
| $h_7$ | Seat height* | 1165 | 1165 | mm |
| $h_{10}$ | Coupling height | 390/500 | 390/500 | mm |
| α | Mast tilt, fwd. | 6 | 6 | ° |
| β | Mast tilt, back | 8 | 8 | ° |
| $L_1$ | Length including forks* | 3980 | 3980 | mm |
| $L_2$ | Headlength* | 2830 | 2830 | mm |
| $b_1$ | Overall width* | 1340 | 1340 | mm |
| $b_3$ | Fork width* | 1120 | 1260 | mm |
| $m_1$ | Ground clearance with load below mast | 120 | 120 | mm |
| $m_2$ | Ground clearance centre wheelbase | 160 | 160 | mm |
| Ast | Working aisle width<br>800 x 1200 longitudinal pallets | 4360 | 4360 | mm |
| Ast | Working aisle width<br>1000 x 1200 traverse pallets | 4160 | 4160 | mm |
| Wa | Turning radius | 2450 | 2450 | mm |
| x | Load distance | 510 * | 510 * | mm |
| y | Wheelbase | 2000 | 2000 | mm |

## 3.3 Weights

All dimensions in kg.

EFG 535-550

| Description | EFG | | | |
|---|---|---|---|---|
| | 535 | 540 | 545 | 550 |
| Net weight<br>(including battery) | 5800 | 6600 | 6950 | 7300 |
| Front axle load (without lifting load) | 3000 | 3700 | 3700 | 3700 |
| Front axle load (with lifting load) | 8350 | 9700 | 10400 | 11200 |
| Rear axle load (without lifting load) | 2800 | 2900 | 3250 | 3600 |

EFG 535-550

| Description | EFG | | | |
|---|---|---|---|---|
| | **535** | **540** | **545** | **550** |
| Rear axle load (with lifting load) | 950 | 900 | 1050 | 1100 |

## 3.4 Mast versions

All dimensions in mm.

EFG 535-540

| VDI 3596 Description | Lift $h_3$ | Free lift $h_2$ | | Height mast retracted $h_1$ | | Height mast extended $h_4$ | |
|---|---|---|---|---|---|---|---|
| | | EFG 535 | EFG 540 | EFG 535 | EFG 540 | EFG 535 | EFG 540 |
| ZT | 2750 | 150 | | | 2280 | | 3580 |
| | 3000 | | | | 2405 | | 3830 |
| | 3100 | | | 2228 | | 3883 | |
| | 3500 | | | 2428 | 2655 | 4283 | 4330 |
| | 4000 | | | 2678 | 2905 | 4783 | 4830 |
| | 4500 | | | 2978 | 3155 | 5283 | 5330 |
| | 5000 | | | 3228 | 3405 | 5783 | 5830 |
| | 5500 | | | | 3655 | | 6330 |
| | 6000 | | | | 3905 | | 6830 |
| | 6500 | | | | 4155 | | 7330 |
| ZZ | 2700 | | 1376 | | 2080 | | 3404 |
| | 2950 | | 1501 | | 2205 | | 3654 |
| | 3450 | | 1751 | | 2455 | | 4154 |
| | 3950 | | 2001 | | 2705 | | 4654 |
| | 4450 | | 2251 | | 2955 | | 5154 |
| | 4950 | | 2501 | | 3205 | | 5654 |
| | 5450 | | 2751 | | 3455 | | 6154 |
| DZ | 3800 | | 1376 | | 2080 | | 5405 |
| | 4175 | | 1501 | | 2205 | | 4879 |
| | 4700 | 1430 | | 2193 | | 5463 | |
| | 4925 | | 1751 | | 2405 | | 5629 |
| | 5000 | 1530 | | 2293 | | 5763 | |
| | 5300 | | 1871 | | 2580 | | 6004 |
| | 5500 | 1730 | | 2493 | | 6263 | |
| | 5675 | | 2001 | | 2705 | | 6379 |
| | 6000 | 1930 | | 2693 | | 6763 | |
| | 6425 | | 2251 | | 2955 | | 7159 |
| | 6500 | 2130 | | 2893 | | 7263 | |
| | 7175 | | 2521 | | 3205 | | 7879 |

Special trucks are not included in this overview.

EFG 545-550

| VDI 3596 Description | Lift $h_3$ | Free lift $h_2$ | | Height mast retracted $h_1$ | | Height mast extended $h_4$ | |
|---|---|---|---|---|---|---|---|
| | | EFG 545 | EFG 550 | EFG 545 | EFG 550 | EFG 545 | EFG 550 |
| ZT | 2750 | 150 | | 2280 | 2280 | 3580 | 3580 |
| | 3000 | | | 2405 | 2405 | 3830 | 3830 |
| | 3500 | | | 2655 | 2655 | 4330 | 4330 |
| | 4000 | | | 2905 | 2905 | 4830 | 4830 |
| | 4500 | | | 3155 | 3155 | 5330 | 5330 |
| | 5000 | | | 3405 | 3405 | 5830 | 5830 |
| | 5500 | | | 3655 | 3655 | 6330 | 6330 |
| | 6000 | | | 3905 | 3905 | 6830 | 6830 |
| | 6500 | | | 4155 | 4155 | 7330 | 7330 |
| ZZ | 2700 | 1376 | 1227 | 2080 | 2080 | 3404 | 3553 |
| | 2950 | 1501 | 1352 | 2205 | 2205 | 3654 | 3803 |
| | 3450 | 1751 | 1602 | 2455 | 2455 | 4154 | 4303 |
| | 3950 | 2001 | 1852 | 2705 | 2705 | 4654 | 4803 |
| | 4450 | 2251 | 2102 | 2955 | 2955 | 5154 | 5303 |
| | 4950 | 2501 | 2352 | 3205 | 3205 | 5654 | 5803 |
| | 5450 | 2751 | 2602 | 3455 | 3455 | 6154 | 6303 |
| DZ | 3800 | 1376 | 1227 | 2080 | 2080 | 5405 | 4653 |
| | 4175 | 1501 | 1352 | 2205 | 2205 | 4879 | 5023 |
| | 4925 | 1751 | 1602 | 2405 | 2405 | 5629 | 5773 |
| | 5300 | 1871 | 1727 | 2580 | 2580 | 6004 | 6153 |
| | 5675 | 2001 | 1852 | 2705 | 2705 | 6379 | 6523 |
| | 6425 | 2251 | 2102 | 2955 | 2955 | 7159 | 7273 |
| | 7175 | 2521 | 2352 | 3205 | 3205 | 7879 | 8023 |

Special trucks are not included in this overview.

## 3.5 Tyre type

***NOTE***

When replacing tyres/rims fitted at the factory, always use original spare parts or tyres approved by the manufacturer. Otherwise the manufacturer's specification cannot be guaranteed.
If you have any queries please contact the manufacturer's customer service department.

EFG 535-550

| Description | | EFG 535-545 | EFG 550 |
|---|---|---|---|
| Front tyres | SE *) | 250 / 70 R15 | 28 x 12.5 - 15 |
| | Full rubber*) | 28 x 10 x 22 | 28 x 12 x 22 |
| | Pneumatic*) | 250 / 70 R15 | - |
| | Tyre pressure bar | 10 | - |
| | Torque (Nm) | 430 | |
| Rear tyres | SE *) | 21 x 8 - 9 | |
| | Full rubber*) | 21 x 7 - 15 ⅛" | |
| | Pneumatic*) | 250 / 70 R15 | 21 x 8 - 9 |
| | Tyre pressure bar | 10 | 10 |
| | Torque (Nm) | 220 | 220 |

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

## 3.6 Engine Data

| Description | EFG535-550 |
|---|---|
| Drive motor | 18 kW |
| Lift motor | 23,5 kW |

## 3.7 EN norms

**Noise emission level**

– EFG 535-550: 75 dB(A)

*+/- 3 dB(A) depending on the truck's equipment

in accordance with 12053 as harmonised with ISO 4871.

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

**Vibration**

– EFG 535-550: 0,64 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 thresholds at constant speed (standard truck version). These recordings were taken on a single occasion and must not be confused with the human vibrations of the "2002/44/EC/Vibrations" operator directive. The manufacturer offers a special service to measure these human vibrations, see "Human vibration measurement" on page 170.

**Electromagnetic compatibility (EMC)**

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

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

**⚠ WARNING!**

**Medical equipment can be damaged by non-ionised radiation**

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

## 3.8 Conditions of use

**Ambient temperature**

– operating at -20°C to +40°C

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

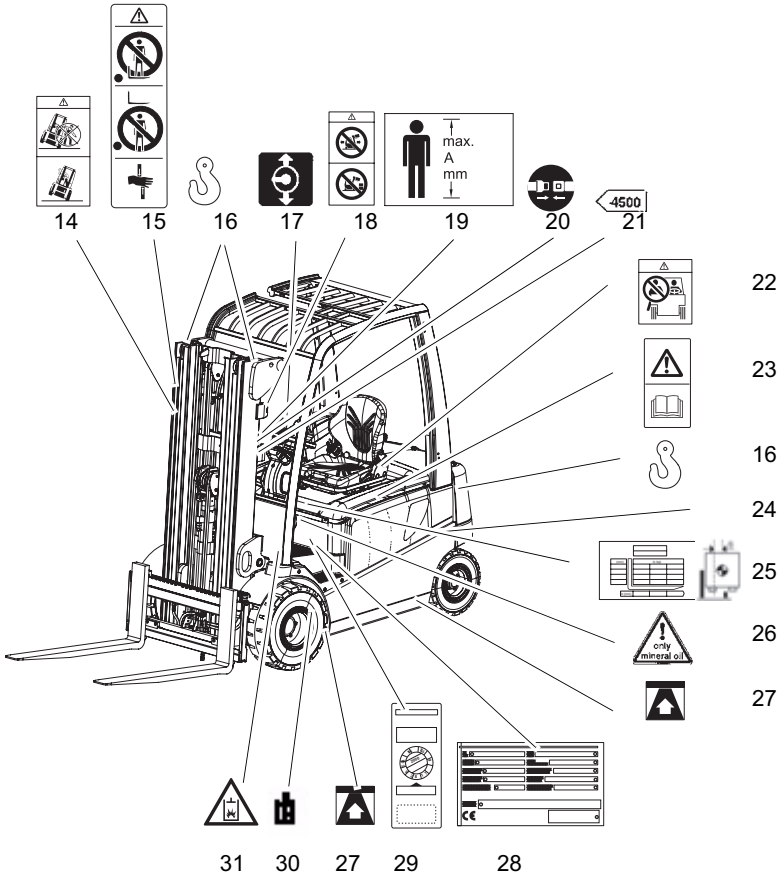
## 3.9 Electrical requirements

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

# 4 Identification points and data plates

## 4.1 Indication Points

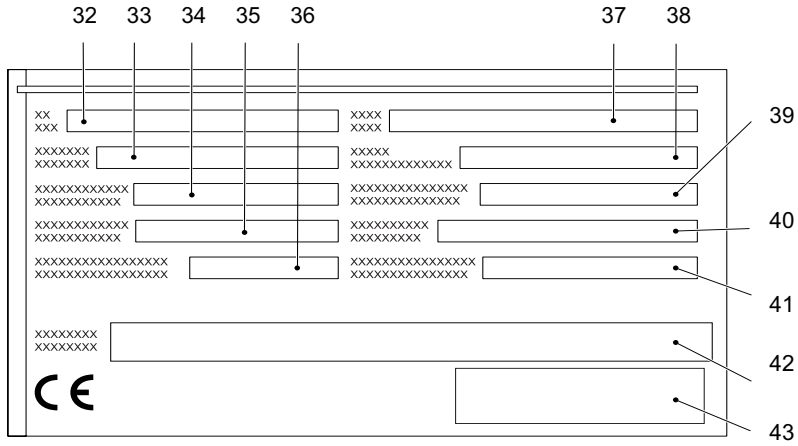
Warnings and notices such as capacity charts, strap points and data plates must be legible at all times. Replace if necessary.



| Item | Component |
|---|---|
| 14 | Procedure when truck in danger of tipover notice |
| 15 | Do not stand on load handler / Do not stand under load handler / Risk of trapping when mast extended |
| 16 | Strap points for crane lifting |
| 17 | Steering column adjustment |
| 18 | Do not travel with raised load or mast forward tilt with raised load |
| 19 | Max. body size |
| 20 | Wear seat belt |
| 21 | Lift limit |
| 22 | Do not carry passengers warning |
| 23 | Read operating instructions |
| 24 | Serial number, on chassis below side panel |
| 25 | Capacity (or reduced capacity) |
| 26 | Mineral oil |
| 27 | Jack contact points |
| 28 | Data plate |
| 29 | Plaque (○) |
| 30 | Add hydraulic oil |
| 31 | Cylinder internal pressure |

## 4.2 Data plate

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




| Item | Description | Item | Description |
|---|---|---|---|
| 32 | Type | 38 | Year of manufacture |
| 33 | Serial number | 39 | Load centre (mm) |
| 34 | Rated capacity (kg) | 40 | Output |
| 35 | Battery voltage (V) | 41 | Min./max. battery weight (kg) |
| 36 | Net weight w.o. battery (kg) | 42 | Manufacturer |
| 37 | Option | 43 | Manufacturer’s logo |

For queries regarding the truck or ordering spare parts always quote the truck serial number (33).

## 4.3 Truck capacity plate

**⚠ CAUTION!**

**Accident risk from fork replacement**

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

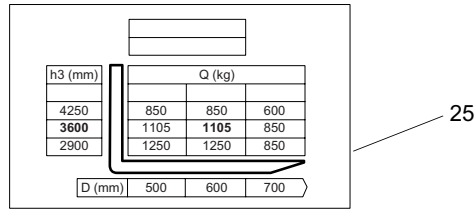
- ▶ When replacing the forks you must attach an additional capacity plate to the truck.
- ▶ Trucks supplied without forks are given a capacity plate for standard forks (length: 1150 mm).

---

The capacity plate (25) gives the capacity (Q in kg) of the truck for a vertical mast. The maximum capacity is shown as a table with a given load centre of gravity D (in mm) and the required lift height H (in mm).

The capacity plate (25) of the truck indicates the truck's capacity with the forks as originally supplied.

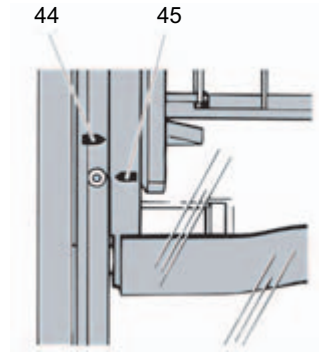
**Example of how to calculate the maximum capacity:**




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

**Lift height restriction**

The arrow shaped markings (44 and 45) on the inner and outer masts show the operator when the prescribed lift limits have been reached.



## 4.4 Attachment capacity plate

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

# 5 Stability

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

Stability can also be affected by the following factors:
– Tyre type
– Mast
– Attachment
– Transported load (size, weight and centre of gravity)

**⚠ WARNING!**

**Loss of stability can cause accidents**
Changing the components can alter the stability.

# C Transport and Commissioning

## 1 Transport

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

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

## 2 Truck laden

### 2.1 Centre of gravity of the truck

**⚠ WARNING!**

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

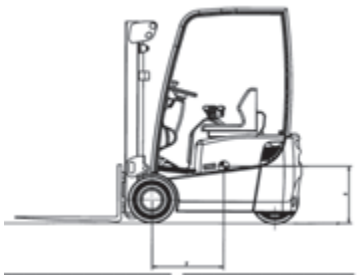
The overall centre of gravity can vary depending on the truck's equipment (especially the mast version).

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

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

---

The picture shows the approximate centre of gravity location.



## 2.2 Lifting the truck by crane

**⚠ WARNING!**

**All persons involved in loading by crane must be trained**

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

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

---

**⚠ DANGER!**

**Crane slings can tear, resulting in accidents**

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

---

Truck net weight: see "Data plate" on page 33.

***Lifting the truck by crane***

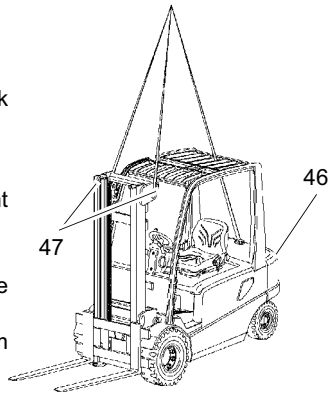
*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81.

*Procedure*

- Secure the crane slings to the attachment points (46) and (47.
- Raise and load the truck.
- Lower and deposit the truck carefully (see "Parking the truck securely" on page 81).
- Secure the truck with wedges to prevent it from rolling away.

*This concludes the loading by crane.*



## 2.3 Loading with another industrial truck

**⚠ WARNING!**

**The truck can be damaged**

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

▶ Only trained specialist personnel should load the truck.

▶ Use only trucks with sufficient capacity for loading.

▶ Only for loading and unloading.

▶ The forks of the second industrial truck must be sufficiently long

▶ Transporting over long distances prohibited.

---

***Loading the truck with a second industrial truck***

*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81.

*Procedure*

- Raise the truck with the forks at the side between the axles.
- Raise the truck slightly and make sure it is securely positioned on the forks. If necessary adjust or secure the forks with stops.
- Carefully load/unload the truck, see "Lifting, transporting and depositing loads" on page 92.
- Lower the truck slowly onto the ground and prevent it from rolling away.

*The truck is now loaded.*

# 3 Securing the truck during transport

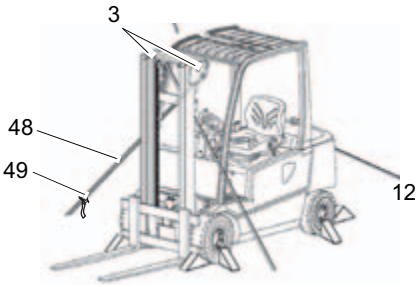
**⚠ WARNING!**

**Accidental movement during transport**

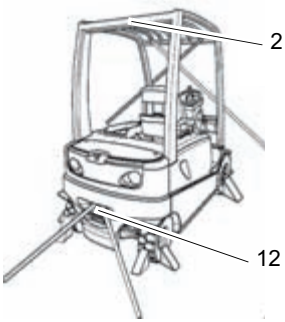
Improper fastening of the truck and mast during transport can result in serious accidents.

- ▶ Loading must only be performed by specialist personnel trained for this purpose. The specialist personnel must be instructed in securing loads on road vehicles and handling load securing devices. In each case correct measurements must be taken and appropriate safety measures applied.
- ▶ The truck must be securely fastened when transported on a lorry or a trailer.
- ▶ The lorry or trailer must have fastening rings.
- ▶ Use wedges to prevent the truck from moving.
- ▶ Use only fastening belts with sufficient strength.
- ▶ Use non-slip materials to securing the load aids (pallet, wedges, ...) e. g. non-slip mats.

Securing with a mast




Securing without a mast



***Securing the industrial truck for transport***

*Requirements*

– Position the industrial truck securely on a lorry or trailer, see "Parking the truck securely" on page 81.

*Tools and Material Required*

– 2 fastening belts with a tensioner
– Retaining wedges.

*Procedure*

- Secure the truck with the fastening belt (48) at the top cross member of the mast (3) and the trailer coupling (12) or on the overhead guard (2) and the trailer coupling (12).
- Tighten the fastening belt (48) with the tensioner (49).

*The truck is now secured for transport.*

# 4 Using the Truck for the First Time

**Safety Instructions for Assembly and Commissioning**

**⚠ WARNING!**

**Incorrect assembly can result in accidents**

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

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

---

**⚠ WARNING!**

**The use of unsuitable energy sources can be hazardous**

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

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

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

---

***Preparing the truck for operation after delivery or transport***

*Procedure*

- Check the equipment is complete.
- Check the hydraulic oil level, see "Checking the hydraulic oil level" on page 154.
- Check the transmission oil level, see "Check the gear oil level" on page 156.
- Install the battery if necessary, see "Battery removal and installation" on page 52.
- Charge the battery, see "Preparing the Truck for Operation" on page 66.

*The truck can now be started, see "Preparing the Truck for Operation" on page 66.*

→ To operate the truck without its own drive system, see "Operating the truck without its own drive system" on page 133.

# D Battery - Servicing, Recharging, Replacement

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

**Maintenance personnel**

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

**Fire Protection**

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

**⚠ CAUTION!**

**The use of unsuitable fire protection equipment can result in scalding**

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

▶ Use powder extinguishers.

▶ Never extinguish a burning battery with water.

---

**Battery maintenance**

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

**⚠ CAUTION!**

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

---

**Battery disposal**

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

## 1.1 General notes on handling batteries

**⚠ WARNING!**

**Batteries can be hazardous**

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

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

---

**⚠ WARNING!**

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

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

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

---

Park the truck securely before carrying out any work on the batteries (see "Parking the truck securely" on page 81).

# 2 Battery types

**⚠ CAUTION!**

Always use batteries with insulated covers or live components.

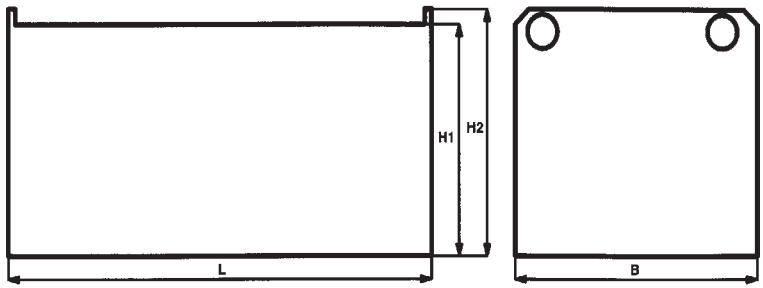
The battery weights are indicated on the battery data plate.

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

| Truck model | Description | Capacity |
|---|---|---|
| EFG 535 | 80V - 5PzS | 700 Ah |
| EFG 540-550 | 80V - 6PzS | 840 Ah |

## 2.1 Battery dimensions

| Drive battery 80 volts | | | | | |
|---|---|---|---|---|---|
| Truck | Dimension (mm) | | | | Rated weight (-5/+8%) in kg |
| | L max. | B max. | H1+/- 2 mm | H2 +/- 2 mm | |
| EFG 535 | 1028 | 855 | 769 | 784 | 1863 |
| EFG 540-550 | 1028 | 999 | 769 | 784 | 2178 |



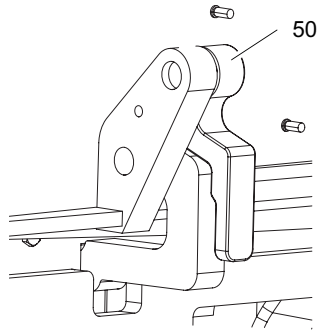
# 3 Exposing the battery

**⚠ CAUTION!**

**Accident risk when the battery cover is open**

If the battery cover is open there is a risk of injury if it accidentally closes.

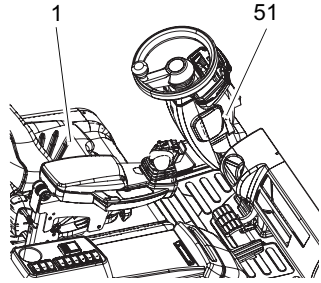
▶ After opening the battery cover engage the lever (50) to prevent the cover from accidentally closing.




***Exposing the battery***

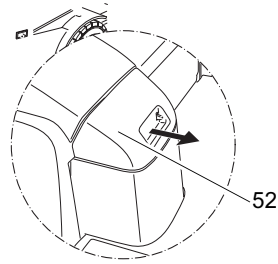
*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81.
– Load handler lowered.
– Key switch set to OFF.
– Key removed.
– Set the Emergency Disconnect OFF.




*Procedure*

- Release the steering column lock (51), push the steering column forward and secure it in this position.
- Carefully lift up the rear window slightly. Push and hold down on the lever on the left-hand gas spring (viewed in the travel direction).
- Carefully open up the rear window.
- Pull the panel (52) forward until it engages.
- Carefully lift back the battery cover and the driver's seat (1) as far as the stop (opening angle = 90°).
- Engage the lever (50) to prevent the cover from accidentally closing.




On trucks with a steel cab, before opening the battery cover push the driver's seat back and open the rear window.

# 4 Charging the battery

**⚠ WARNING!**

**The gases produced during charging can cause explosions**

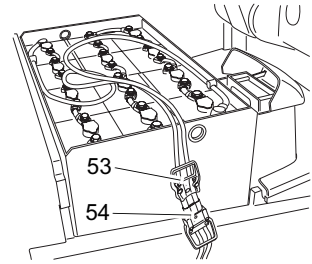
The battery produces a mixture of nitrogen and hydrogen (electrolytic gas) during charging. Gassing is a chemical process. This gas mixture is highly explosive and must not be ignited.

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

## 4.1 Charging the battery with a stationary charger

*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81.
– Battery exposed.
– Charger switched off.
– Disconnect the battery connector (53) from the truck connector (51).



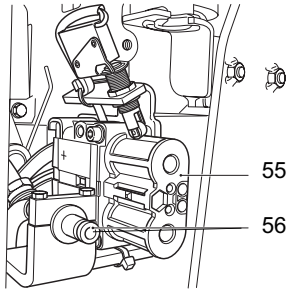

*Procedure*

• Connect the battery connector (53) to the charging cable (54) of the stationary charger and turn on the charger.

*The battery is now charged.*

## 4.2 Charging the battery with a charger socket (○)

**Charging**




**⚠ WARNING!**

**The gases produced during charging can cause explosions**

▶ Always check the fans each time you charge.

*Requirements*

– Truck parked securely, see "Parking the truck securely" on page 81.

*Procedure*

- Connect the charger lead of the battery charger station to the charger socket (55).

➔ Test the fan. If the fan is not working, open the cover to ventilate the battery compartment.

- Depending on the battery you may need to attach the water connection (56) to the battery charger station.
- Switch on the battery charging station and charge the battery in accordance with the battery and charging station manufacturers' instructions.

➔ After charging, test the fans and remove the connector. If the fan is not working, open the cover to ventilate the battery compartment.

➔ Use only chargers with a max. 160 A charging current.

*Battery is charged.*

# 5 Battery removal and installation

**⚠ WARNING!**

**Accident risk during battery removal and installation**

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

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

---

**⚠ CAUTION!**

**Trapping hazard**

Trapping hazard when replacing the battery.

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

---

***Battery removal and installation***

*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81.
– Battery exposed, see "Exposing the battery" on page 49.
– Battery disconnected.

*Tools and Material Required*

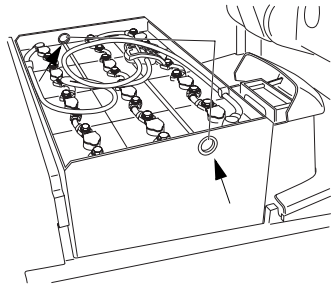
– Crane lifting gear

*Procedure*

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

  Hooks must be fitted in such a way that when the crane lifting gear is slackened, they do not fall onto the battery cells.
- With the crane lifting gear raise the battery above the chassis in the right hand travel direction and then move it out sideways.

*The battery is now removed.*

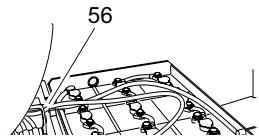


# 6 Closing the battery cover

***Closing the battery cover***

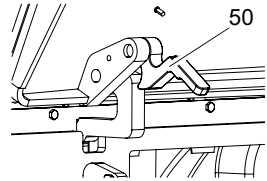
*Requirements*

– The battery cable is in the cable guide (56).



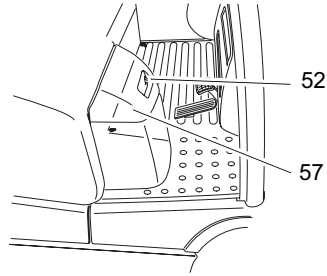

*Procedure*

- Pull up the lever (50) preventing the battery cover from accidentally closing.
- Close the battery cover slowly




- Push the cover (52) back with force.
- Engage the lock (57).
- Carefully bring the rear window down and lock it.

*The battery cover is now closed.*



# E Operation

## 1 Safety Regulations for the Operation of the Forklift Truck

**Driver authorisation**

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

**Operator's rights, obligations and responsibilities**

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

**Unauthorised use of truck**

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

**Damage and faults**

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

**Repairs**

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

**Hazardous area**

**⚠ WARNING!**

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

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

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

---

**⚠ WARNING!**

**Falling objects can cause accidents**

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

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

---

**Safety devices, warning signs and warning instructions**

Safety devices, warning signs (see "Indication Points" on page 31) and warning instructions in the present operating instructions must be strictly observed.

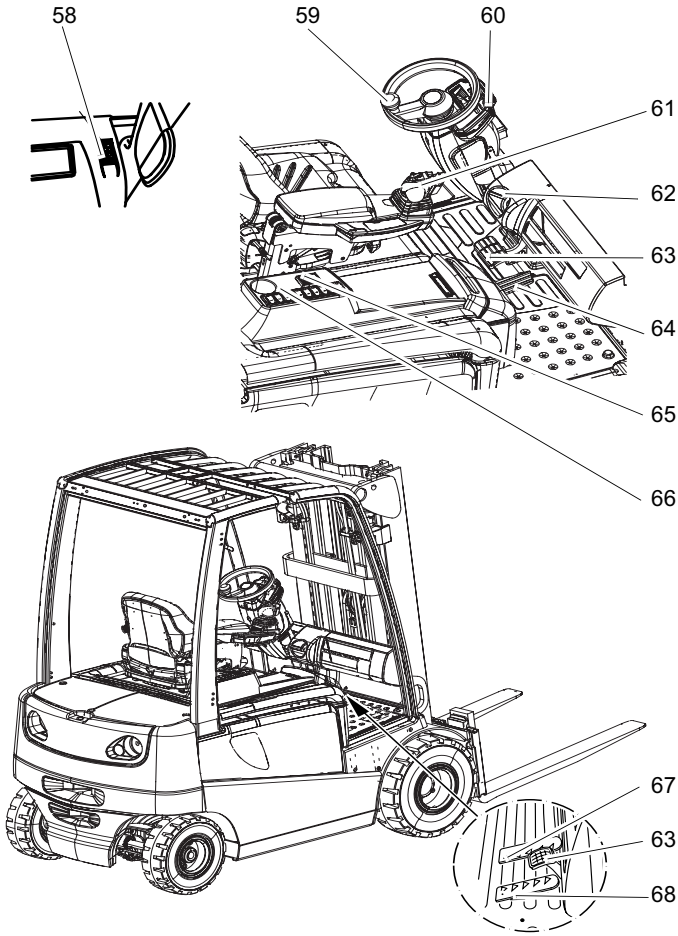
**⚠ CAUTION!**

**Reduced headroom can cause injuries**

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

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

---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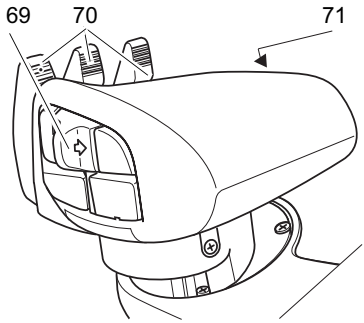
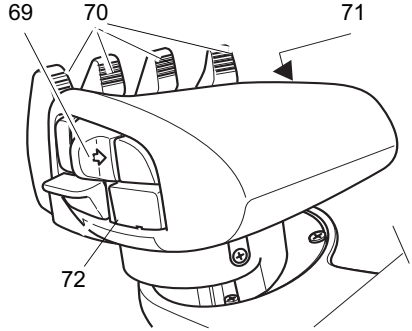
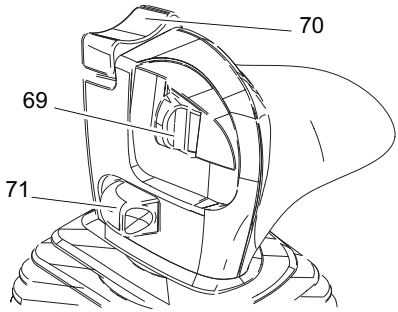
| Item | Control / display | | Function |
|---|---|---|---|
| 58 | Parking brake switch | ● | Activates / deactivates the parking brake.<br><br>When the parking brake is activated the parking brake indicator (76) in the display and the indicator on the parking brake switch (58) both light up red simultaneously.<br><br>When the parking brake is deactivated the parking brake indicator (76) in the display lights up red and the indicator on the parking brake switch (58) lights up green. |
| 59 | Steering wheel | ● | Steers the truck. |
| 60 | Control panel with display unit | ● | Displays the battery capacity, service hours, errors, key warning indicators, wheel position and travel direction. |
| 61 | Solo-Pilot | ● | Controls the following functions:<br><br>– Fwd/rev. travel direction<br>– Load handler lift / lower<br>– Mast forward / reverse tilt<br>– Horn button<br>– Sideshifter left / right (○)<br>– Auxiliary hydraulics (○) |
| | Multi-Pilot | ○ | |
| 62 | Key switch | ● | Switches control current on and off. Removing the key prevents the truck from being switched on by unauthorized personnel. |
| | ISM access module* | ○ | Switches the truck on. |
| | Code lock* | | |
| 63 | Brake pedal | ● | Provides infinitely variable braking control. |
| 64 | Accelerator pedal | ● | Provides infinitely variable travel speed control |
| 65 | Emergency Disconnect switch | | Switches power supply on and off. |
| 66 | Side compartment control panel | ● | Switches electric options on and off |
| 67 | Twin pedal control “Reverse” accelerator pedal | ○ | The truck reverses when the accelerator pedal is applied.<br>Provides infinitely variable travel speed. |
| 68 | Twin pedal control “Forward” accelerator pedal | ○ | The truck travels forward when the accelerator pedal is applied.<br>Provides infinitely variable travel speed. |

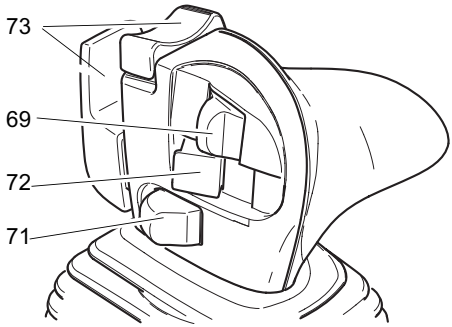
*If the truck is equipped with an ISM access module or Can Code refer to the “ISM Access Module” or "CanCode" operator manuals.

| Item | Control / display | | Function |
|---|---|---|---|
| 69 | Travel direction switch (not available with dual pedal control) | ● | Selects travel direction / neutral position. |
| 70 | Lever | ● | Lever for operating the hydraulic functions. |
| 71 | "Horn" button | ● | Activates an audible warning. |
| 72 | Additional hydraulic function release button | ○ | Activates the additional hydraulic functions or hydraulics that require acknowledgement. |
| 73 | Button | ○ | Hydraulic auxiliary function control button. |



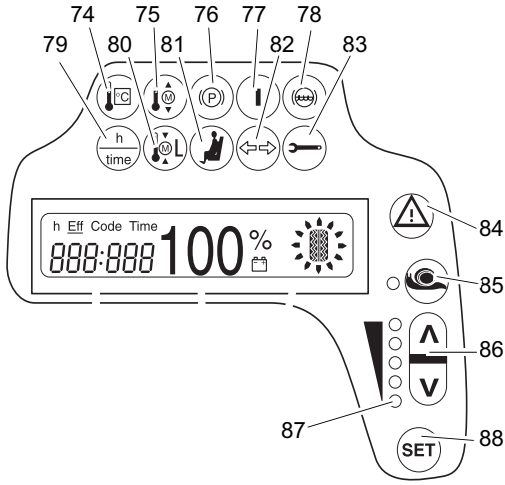



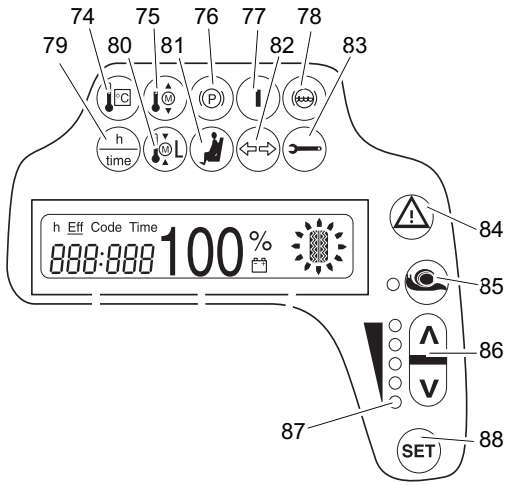
## 2.1 Control panel with display unit

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




| Item | Control / display | Function |
|---|---|---|
| 74 | Warning indicator Controller overtemperature | – Lights up to indicate controller overtemperature<br>– Performance is continually reduced in relation to the temperature |
| 75 | Warning indicator Drive motor overtemperature | – Monitors the temperature of the drive motor<br>– Performance is reduced if the temperature is excessive |
| 76 | Parking brake indicator | Comfort feature, displayed when the parking brake indicator (76) lights up.<br>Truck prevented from rolling away but not parked securely.<br>Parking brake is automatically activated after a set time (1 - 15 sec) when the truck stops. The parking brake is automatically released when the accelerator pedal is applied. |
| 77 | Truck in operation indicator | – Key switch ON |
| 78 | Insufficient brake fluid | – The brake fluid level can be checked through sensors on the brake fluid reservoir |

| Item | Control / display | Function |
|---|---|---|
| 79 | Hourmeter / time toggle switch | – Truck key switch ON service hours<br>– "Eff" service hours can be switched ON or OFF via a code<br>– Time display |
| 80 | Warning indicator Pump motor, power steering overtemperature | – Monitors the temperature of the pump motor and the power steering motor<br>– Performance is reduced if the temperature is excessive |
| 81 | Seat switch warning indicator | Seat switch not closed<br>– Truck operational, but driver's seat not occupied |
| 82 | Travel direction display indicator lamp | – Right / left indicator lamps activated |
| 83 | Service display | – Service interval exceeded (1000 operating hours) or annual FEM test due (flashing indicator). |
| 84 | WARNING | WARNING<br>– Flashes for faults, an audible warning sounds<br>– Flashes when battery capacity is less than 10% |
| 85 | Slow travel button | – Switches slow travel on and off |
| 86 | Program selector | – Selects the travel program (moves up or down a level in the travel program list.) |
| 87 | Operating program display | – Displays the selected travel program (1 to 5) |
| 88 | Set button | – Confirms the entries |



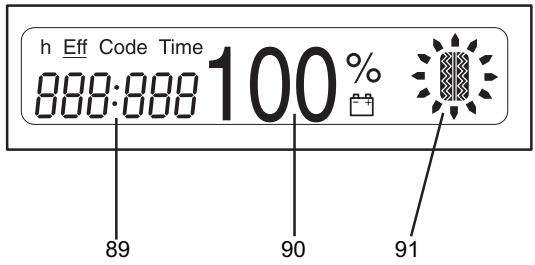
## 2.2 Side compartment control panel switch (○)

| | Function |
|---|---|
|  | Slow travel |
|  | Seat heating |
|  | Lift cutout override |
|  | Rear window heating |
|  | Rear windscreen wiper<br>– Press 1x > intermittent,<br>– 2x > fast,<br>– 3x > off<br>– Hold down on the button > Switch on the windscreen washing system |
|  | Front windscreen wipers<br>– Press 1x > intermittent,<br>– 2x > fast,<br>– 3x > off<br>– Hold down on the button > Switch on the windscreen washing system |
|  | Beacon |
|  | Work lights |

## 2.3 Instrument panel switches (○)

| | Function |
|---|---|
|  | Parking light |
|  | Warning indicator |
|  | Truck lighting |

## 2.4 Display




| Item | Function |
|---|---|
| 89 | Hourmeter display<br><br>Error display:<br>– If an error (Err) or a warning (Inf) occurs, the error or info code is displayed.<br>– If several errors occur they are displayed alternately at 1.5 second intervals. A warning is sounded. |
| 90 | Battery capacity display<br>– Battery discharge status |
| 91 | Travel direction and wheel position display<br>– Indicates the pre-selected travel direction (forward or reverse) or the position of the steered wheels.<br>– Flashing direction arrow = no travel direction selected |

### 2.4.1 Battery discharge indicator

***NOTE***

**Full discharge can damage the battery**

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

- ▶ This adjustment should only be made by the manufacturer's customer service department.
- ▶ The battery discharge indicator shows the battery's residual capacity.
- ▶ Charge the battery, see "Charging the battery" on page 50.

---

The battery charge status is shown through a battery icon (90) in the truck display in 10% increments (100% = 100% battery capacity, 0% = 20% battery capacity).

### 2.4.2 Battery discharge monitor

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

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

### 2.4.3 Hourmeter

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

# 3 Preparing the Truck for Operation

## 3.1 Checks and operations to be performed before starting daily operation

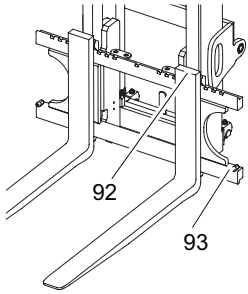
**⚠ WARNING!**

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

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

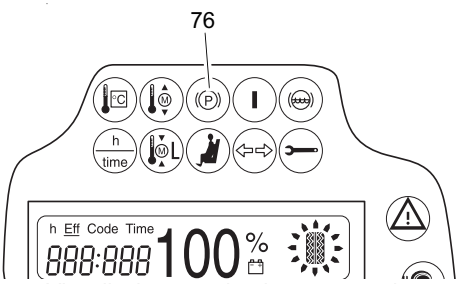
- ▶ Report any defects immediately to your supervisor.
- ▶ Mark defective truck and take out of service.
- ▶ Do not return the industrial truck to service until you have identified and rectified the fault.

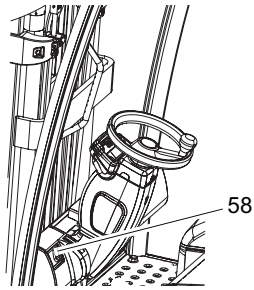
***Checks before daily operation***




*Procedure*

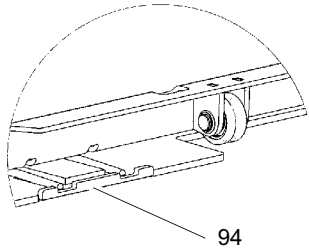
- Visually inspect the entire truck (in particular wheels, wheel bolts and load handler) for damage.
- Check the fork stop (92) and fork retainer (93).
- Visually inspect the hydraulic system in the visible area for damage and leaks.
- Make sure the driver's seat is locked in position.
- Test the horn and reversing buzzer (○) where applicable.
- Check that the capacity plate and warning labels are legible.
- Test the controls and displays.
- Test the steering.
- Check the steer angle display (○), turn the steering wheel in both directions as far as the stop and check that the wheel position is displayed on the control panel.
- Make sure the load chains are evenly tensioned.
- Test the seat belt. (The belt should jam if extracted suddenly.)
- Test the seat switch: when the driver's seat is vacated it should not be possible to activate the hydraulic functions.
- Test the restraint system (○).
- Test the Drive Control (○).
  - Raise the fork carriage without load beyond the reference point on the mast. The slow travel symbol lights up on the display.
  - Slowly apply the accelerator pedal on a clear route with good visibility. The maximum speed should be reduced to walking pace (3 km/h).
- Test the lift/lower, tilt and if applicable the attachment hydraulic control functions.
- Apply the accelerator pedal several times to test its freedom of movement with the parking brake is applied (the parking brake indicator in the display (76) and the indicator on the parking brake switch (58) both light up red simultaneously) and to test the idling function.




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

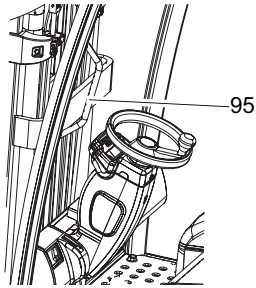
- On trucks with lateral battery removal, check the left and right stops (94) in the battery compartment for damage.
- Check the fluid level of the window washer system, see "Adding window washer system fluid" on page 158.



## 3.2 Entry and exit

*Procedure*

- Open the cab door (○).
- To enter and exit the cab, hold onto the handle (95). Always face the truck when entering and exiting.




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

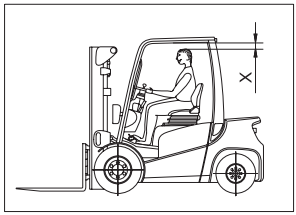
## 3.3 Trucks with reduced headroom (○)

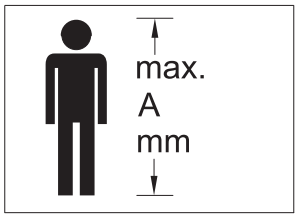
**⚠ WARNING!**

**An unsuitable workplace can damage your health**

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

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



## 3.4 Setting up the operator position

**⚠ WARNING!**

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

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

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

---

*Procedure*

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

### 3.4.1 Adjusting the driver’s seat

**⚠ WARNING!**

**Risk of accidents and damage to health**

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

▶ Do not adjust the driver’s seat while travelling.

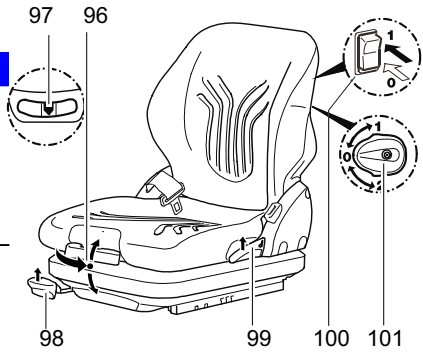
▶ The driver’s seat should lock in position after adjustment.

▶ Check and adjust the individual driver's seat setting before starting up the truck.

▶ Hold the weight setting lever only by the recess, do not reach through underneath the lever.

---

### *Adjusting the driver's weight*




**NOTE**

To achieve optimal seat cushioning the driver's seat must be set to the driver's weight.
Set the driver's weight when the seat is occupied.

*Procedure*

- Fold out the weight adjustment lever (96) as far as it will go in the arrow direction
- Move the weight adjustment lever (96) up and down to set the seat to a higher weight.
- Move the weight adjustment lever (96) up and down to set the seat to a lower weight.

The driver's weight is correct when the arrow is in the middle of the display window (97). The minimum or maximum weight setting is reached when you can feel a return stroke on the lever.

- After setting the weight, move the lever (96) back in full.

*The driver's weight is now set.*

### *Adjusting the backrest*

*Procedure*

- Sit on the driver's seat.
- Pull the lever (99) to adjust the backrest.
- Adjust the backrest tilt.
- Release the lever (99) again. The backrest is locked.

*The backrest is now set.*

Hold the weight setting lever (96) only by the recess, never reach through underneath the lever.

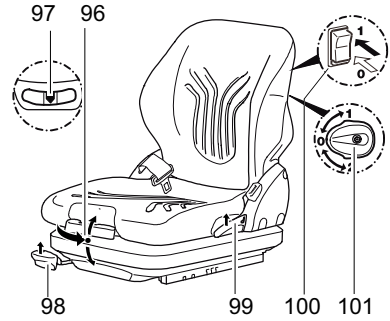
### *Adjusting the seat position*

**⚠ CAUTION!**

**An unsecured driver's seat can cause injury**

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

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




*Procedure*

- Sit on the driver's seat.
- Pull up the driver's seat locking lever98 in the direction of the arrow.
- Push the driver's seat forwards or backwards to the desired position
- Engage the driver's seat locking lever (98) in position.

*The seat position is now correctly set.*

### *Switching the seat heating on and off*

*Procedure*

- Press the seat heating switch (100).
  Switch setting 1 = Seat heating on.
  Switch setting 0 = Seat heating off.

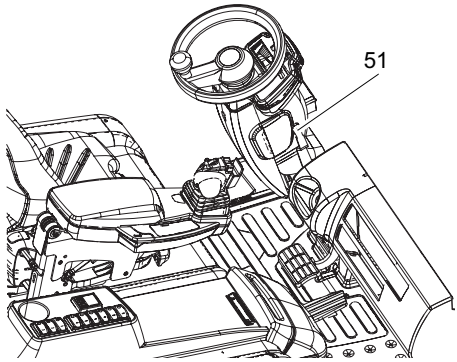
### *Adjusting the lumbar vertebrae support (○)*

*Procedure*

- Turn the hand wheel (101) to the required position.
  Position 0 = no warping in lumbar vertebrae area.
  Position 1 = increasing warping in upper lumbar vertebrae area.
  Position 2 = increasing warping in lower lumbar vertebrae area.

*The lumbar vertebrae support is now set.*

### 3.4.2 Adjusting the steering column



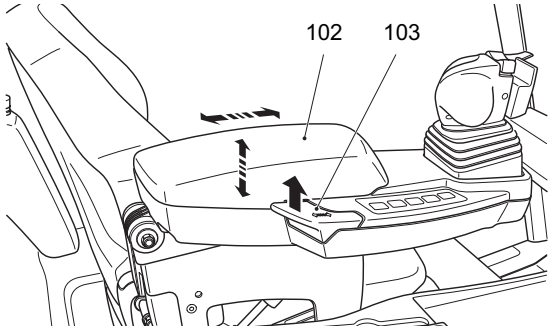

***Adjusting the steering column***

*Procedure*

- Release the steering column stop (51).
- Set the steering column to the required position (height and angle).
- Fix the steering column stop (51) in position.

*The steering column is now positioned.*

### 3.4.3 Adjusting the arm rest




***Adjusting the arm rest***

*Procedure*

- Pull up the lock (103) and hold it in this position.
- Move the armrest (102) vertically and horizontally.
- Release the lock (103) at the desired position.
- Push the armrest slightly forward or back until it locks in position.

*The armrest is now positioned.*

## 3.5 Seat Belt

**⚠ WARNING!**

**Travelling without a seat belt increases the risk of injury.**

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

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

---

➔ Protect the seat belt from contamination (e.g. cover it when the truck is idle) and clean it regularly. Frozen belt locks or pulleys must be thawed out and dried to prevent them from freezing up again.
The temperature of the warm air should not exceed +60 °C!

**Starting the industrial truck on steep slopes**

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

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

**⚠ DANGER!**

**A faulty seat belt can cause injury**

Using a faulty seat belt can result in injury.

▶ Only operate the truck with the seat belt intact. A faulty seat belt should be replaced immediately.

▶ The truck must remain decommissioned until a functional seat belt has been fitted.

---

***Checking the seat belt***

*Procedure*

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

***Check the automatic locking system***

*Procedure*

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

  The locking system should prevent the belt from coming out.

*The seat belt has now been checked.*

# 4 Industrial Truck Operation

## 4.1 Safety regulations for truck operation

**⚠ WARNING!**

**Electromagnetic influence can result in accidents**

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

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

---

**Travel routes and work areas**

Only use lanes and routes specifically designated for truck traffic. Unauthorised third parties must stay away from work areas. Loads must only be stored in places specially designated for this purpose.
The truck must only be operated in work areas with sufficient lighting to avoid danger to personnel and materials. Additional equipment is necessary to operate the truck in areas of insufficient lighting.

**⚠ DANGER!**

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

---

***NOTE***

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

---

**Travel conduct**

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

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

**Hazardous situations**

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

**Travel visibility**

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

**Negotiating slopes and inclines**

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

**Negotiating lifts, loading ramps and docks**

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

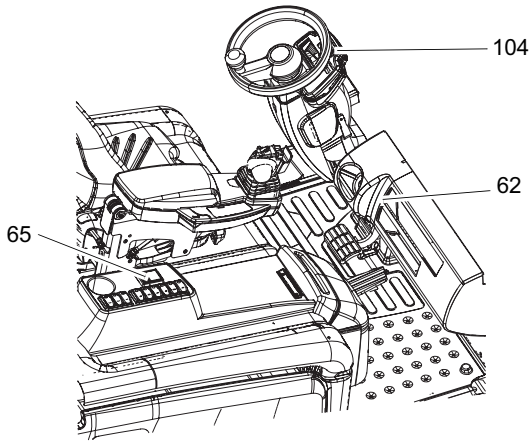
**Type of loads to be carried**

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

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

For safety instructions on the nature of loads to be carried with attachments,see "Lifting, transporting and depositing loads" on page 92.

## 4.2 Preparing the truck for operation




***Switching on the truck***

*Requirements*

– For checks and operations to be performed before starting daily operation, see "Checks and operations to be performed before starting daily operation" on page 66.

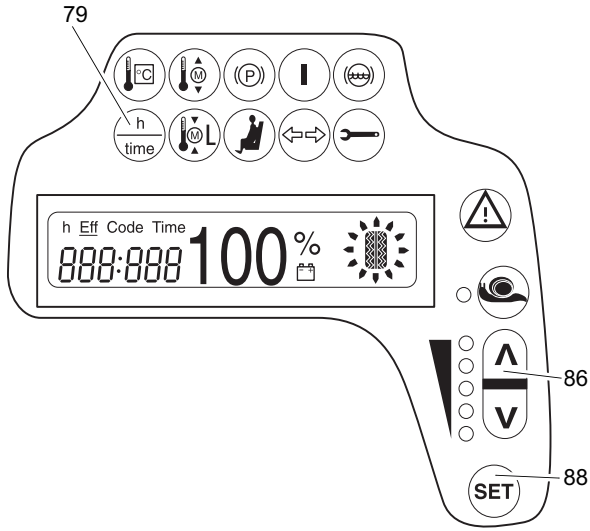
*Procedure*

- Unlock the Emergency Disconnect switch (65) to do this
  - Press the rocker in (⬇) and pull it up until you feel the Emergency Disconnect switch engaging.
- Insert the key in the key switch (62) and turn it clockwise as far as it will go to the “I” position.
- Test the brake pedal and parking brake (109 and 76 lit simultaneously).

*Truck is operational. The display (104) shows the remaining battery capacity.*

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

## 4.3 Setting the time




***Setting the time***

*Procedure*

- Press the “h/time” (79) and up (86) keys simultaneously.
- The time is displayed. The first digit flashes.
  Press the up/down key (86) to increase or decrease the flashing digit.
- Use the SET (88) key to toggle to the next digit. After the last digit the number is accepted.

*The time is now set.*

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

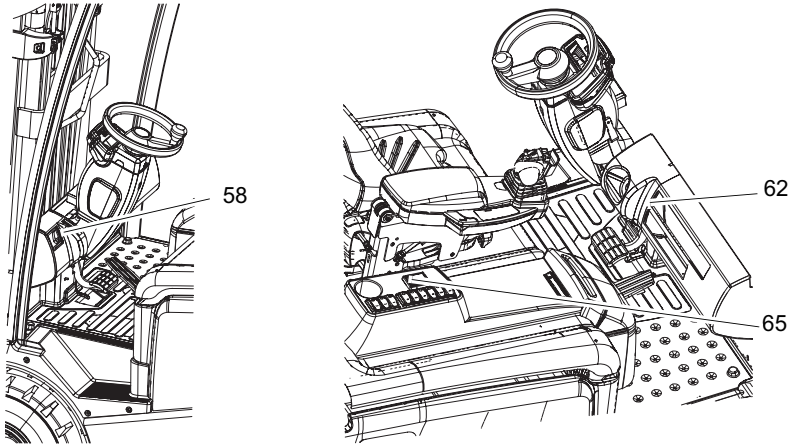
## 4.4 Parking the truck securely

**⚠ WARNING!**

**An unsecured truck can cause accidents**

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

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




***Park the truck securely***

*Procedure*

- Apply the parking brake switch (58). The indicator on the parking brake switch (58) lights up red.
- Turn the key in the key switch (62) to the “0” position.
- Remove the key from the key switch (62).
- Press the Emergency Disconnect switch (65) down.

*The truck is now parked securely.*

## 4.5 Emergency Disconnect

**⚠ CAUTION!**

**Applying maximum braking can result in accidents**

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

▶ Do not use the Emergency Disconnect switch as a service brake.

▶ Use the Emergency Disconnect switch during travel only in emergencies.

---

**⚠ CAUTION!**

**Faulty or non-accessible Emergency Disconnect switches can cause accidents**

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

▶ The operation of the Emergency Disconnect switch must not be affected by any objects placed in its way.

▶ Report any defects on the Emergency Disconnect switch immediately to your supervisor.

▶ Mark defective truck and take out of service.

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

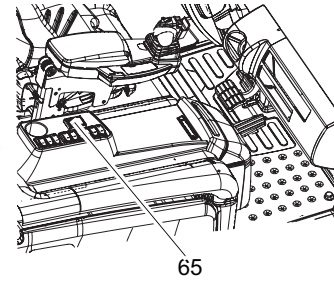
---

***Applying the Emergency Disconnect***

*Procedure*

- Press the Emergency Disconnect (65).

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




***Releasing the Emergency Disconnect***

*Procedure*

- Press the rocker in (⬇) and pull the Emergency Disconnect switch (65) up until you feel the Emergency Disconnect (65) switch engaging.

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

## 4.6 Travel

**⚠ WARNING!**

**Improper travel can result in accidents**

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

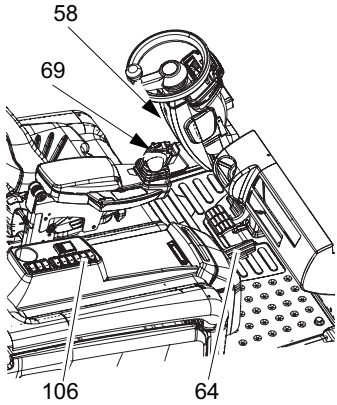
***Travel***

*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

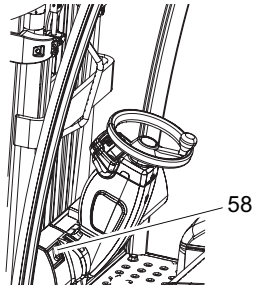
*Procedure*

- Deactivate the parking brake switch (58). The indicator on the parking brake switch (58) lights up green.
- Select the travel direction with the travel direction switch (69).
- Select the travel speed if necessary, to do this press the slow travel button (106).
- Raise the fork carriage approx. 200 mm.
- Tilt the mast back.
- Apply the accelerator pedal (64). The travel speed is governed by the accelerator (64).




*The truck travels in the direction selected.*

***Dual pedal (optional equipment)***



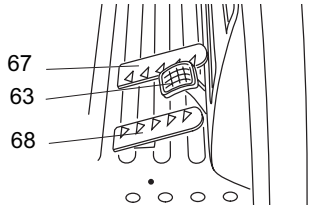

*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

*Procedure*

For trucks with a dual pedal the travel direction is selected via the accelerator pedals (68;67). When the driver leaves the truck, the truck is automatically set to “Neutral”.

- Deactivate the parking brake switch (58). The indicator on the parking brake switch (58) lights up green.
- Raise the fork carriage approx. 200 mm.
- Tilt the mast back.




- Apply the accelerator pedal (68) to travel forward. The travel speed is governed by the accelerator (68).
- Apply the accelerator pedal (67) to reverse. The travel speed is governed by the accelerator (67).

*The truck travels in the direction selected.*

***Changing direction during travel***

*Procedure*

- Set the travel direction switch (69) to the opposite direction while travelling.

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

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

## 4.7 Steering

*Requirements*

– Truck ready for operation, see "Preparing the truck for operation" on page 79

*Procedure*

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

## 4.8 Brakes

The truck can brake in three different ways:
– Service brake
– Coasting brake

and for secure parking:
– Parking brake

**⚠ WARNING!**

**Accident risk**
The brake pattern of the truck depends largely on the ground conditions.
▶ The operator must take into account the travel route conditions when braking.
▶ Brake with care to prevent the load from slipping.
▶ Allow for increased braking distance when travelling with an attached load.
▶ Use the service brake in emergencies.

### 4.8.1 Service brake

***Braking with the service brake***

*Procedure*
• Depress the brake pedal (63) until you feel the brake pressure.

*The truck decelerates depending on the brake pedal position.*

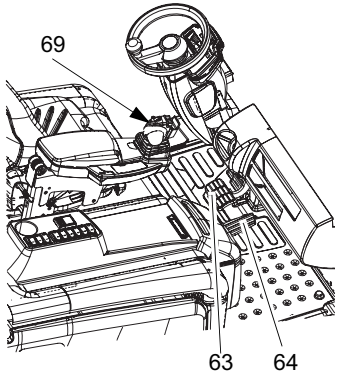
### 4.8.2 Coasting brake

***Braking with the coasting brake***

*Procedure*

- Take your foot off the accelerator pedal (64).

*The truck decelerates.*




**⚠ WARNING!**

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

▶ The operator must instruct people to leave the hazardous area.

▶ The operator must perform test braking.

### 4.8.3 Parking brake

**⚠ DANGER!**

**Accident risk**

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

---

**The parking brake has two functions:**

– **Truck prevented from rolling away (parking brake automatically activated)**
When the truck stops the parking brake is automatically activated after a set time (1 - 15 sec), prevents the truck from rolling away and the parking brake indicator (76) in the display lights up red. When the accelerator pedal is applied the parking brake is automatically released and the parking brake indicator in the display (76) goes out.
**This function of the parking brake prevents the truck from rolling away on inclines up to a maximum of 15%. The truck accelerates when the accelerator pedal is applied.**

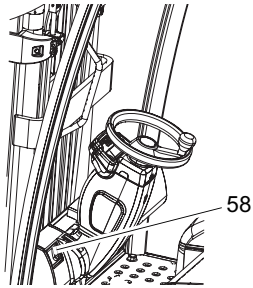
– **Park the truck securely (parking brake activated by parking brake switch (58))**
Pressing the parking brake switch (58) disables travel. The truck is switched off securely and the LED on the parking brake switch (58) lights up red. Pressing the parking brake switch (58) again deactivates the parking brake, travel is enabled and the LED on the parking brake switch (58) lights up green.
**This function of the parking brake ensures that the truck is parked securely. The truck will not accelerate when the accelerator pedal is applied.**

***Parking brake***

*Procedure*

- Deactivate the parking brake (58). The indicator on the parking brake switch (58) lights up green.
- Apply the parking brake (58). The indicator on the parking brake switch (58) and the parking brake indicator in the display (76) light up red.

*The truck is now secure.*



## 4.9 Adjusting the forks

**⚠ WARNING!**

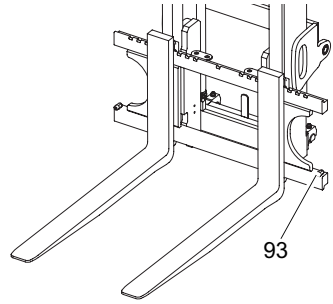
**Unsecured and incorrectly adjusted forks can cause accidents**

Before adjusting the forks make sure the retaining bolts (93) are fitted.

▶ Adjust the forks so that both forks are equidistant from the outside edge of the fork carriage.

▶ Engage the locking pin in a groove to prevent the forks from moving accidentally.

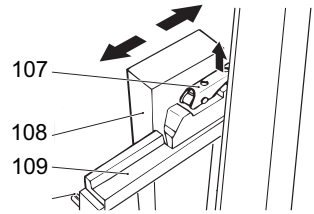
▶ The load centre of gravity must be located centrally between the forks.




***Adjusting the forks***

*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81.




*Procedure*

- Lift up the locking lever (107).
- Push the forks (108) into the correct position on the fork carriage (109).

To lift the load securely, the forks (108) must be spread as far apart as possible and positioned centrally with respect to the fork carriage. The load centre of gravity must be centrally aligned between the forks (108).

- Lift the locking lever down (107) and move the forks until the locking pin engages in a slot.

*The forks are now adjusted.*

## 4.10 Replacing the forks

**⚠ WARNING!**

**Unsecured forks can cause injury**

You can injure your legs when replacing the forks.

▶ Never pull the forks towards your body.

▶ Always push the forks away from your body.

▶ Secure heavy forks with lifting slings and a crane before pushing them down from the fork carriage.

▶ After replacing the forks fit the retaining bolts (93) and make sure the bolts are seated correctly. Retaining bolt torque: 85 Nm.

***Replacing the forks***

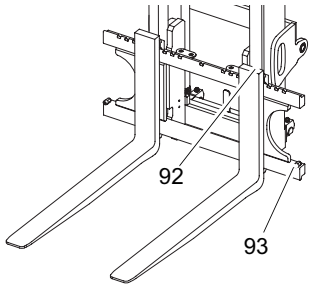
*Requirements*

– Load handler lowered and forks not touching the ground.

*Procedure*

- Disassemble the retaining bolts (93).
- Loosen the fork stop (92).
- Carefully push the forks off the fork carriage.

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



## 4.11 Lifting, transporting and depositing loads

**⚠ WARNING!**

**Unsecured and incorrectly positioned loads can cause accidents.**

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

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

---

***Lifting loads***

*Requirements*

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

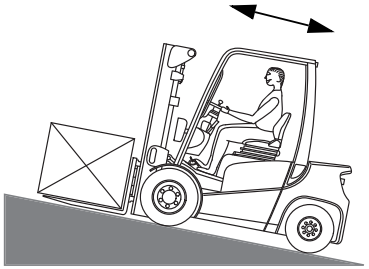
*Procedure*

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

**NOTE**

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

***Transporting loads***



*Requirements*

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

*Procedure*

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

***Depositing loads***

*Requirements*

– Storage location suitable for storing the load.

*Procedure*

- Set the mast vertical.
- Drive the truck carefully up to the storage location.
- Carefully lower the load handler so that the forks are clear of the load.
  Avoid depositing the load to prevent damage to the load and the load handler.
- Lowers the load handler.
- Carefully remove the forks from the pallet.

*The load is deposited.*

## 4.12 Operating the lift mechanism and integrated attachments

**⚠ WARNING!**

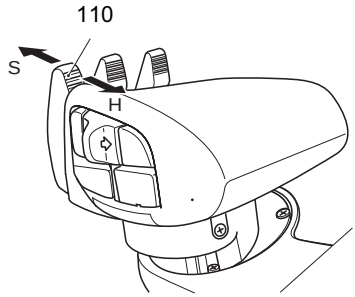
**Operating the lifting device and integrated attachments can be hazardous**

Other people can be injured in the truck's hazardous area.
The hazardous area is defined as the area in which people are at risk from the truck movement, the load handler, attachments etc. This also includes areas which can be reached by falling loads or lowering operating equipment.
Apart from the operator (in the normal operating position) there should be no other people in the truck's hazardous area.

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

### 4.12.1 Operating the lift mechanism with the SOLO PILOT

***Lifting and lowering***




*Requirements*

– To prepare the truck for operation, see "Preparing the truck for operation" on page 79

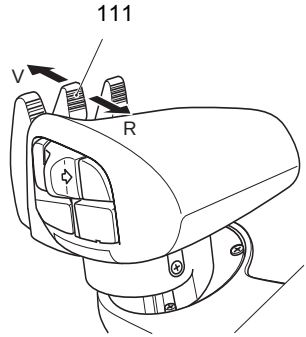
*Procedure*

- Pull the Solo-Pilot lever (110) in direction H to raise the load.
- Push the Solo-Pilot lever (110)in direction S to lower the load.

*The load is now raised / lowered.*

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

***Tilting the mast forward / backward***




*Requirements*

– To prepare the truck for operation, see "Preparing the truck for operation" on page 79

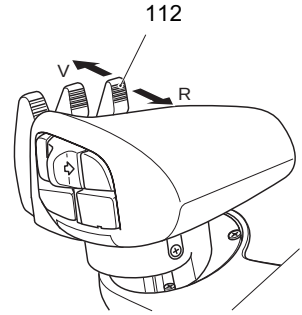
*Procedure*

- Pull the Solo-Pilot lever (111) in direction R to tilt the mast back.
- Push the Solo-Pilot lever (111) in direction V to tilt the mast forward.

*The mast is now tilted back / forward.*

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

***Positioning the integrated sideshift (option)***




*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

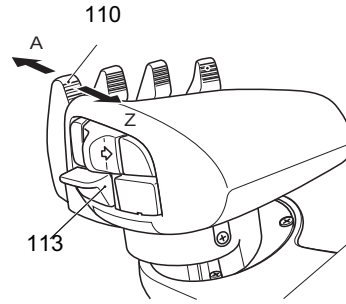
*Procedure*

- Pull the SOLO-PILOT lever (112) in direction R to move the load handler to the right (from the driver's viewpoint).
- Push the SOLO-PILOT lever (112) in direction V to move the load handler to the left (from the driver's viewpoint).

*The sideshifter is now positioned.*

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

***Positioning the forks with an integrated fork positioner (option)***




**⚠ CAUTION!**

Do not use the fork positioner to clamp loads.

*Requirements*

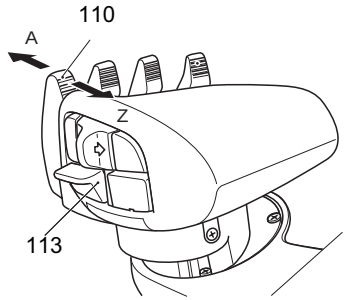
– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

*Procedure*

- Press the toggle switch (113) and at the same time pull the SOLO-PILOT (110) in direction Z: the forks will move towards each other.
- Press the toggle switch (113) and at the same time push the SOLO-PILOT (110) in direction A: the forks will spread apart.

*The forks are now positioned.*

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




*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.
– The fork tines are no longer aligned.

*Procedure*

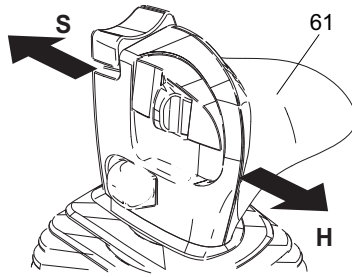
- Press the toggle switch (113) and at the same time push the SOLO-PILOT (110) in direction A and spread the fork tines apart as far as they will go.
- Press the toggle switch (113) and at the same time pull the SOLO-PILOT (110) in direction Z and bring the fork tines as close to each other as they will go.

*The fork tines are now synchronised.*

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

### 4.12.2 Operating the lift mechanism with the Multi Pilot

***Lifting and lowering***




*Requirements*

– To prepare the truck for operation, see "Preparing the truck for operation" on page 79

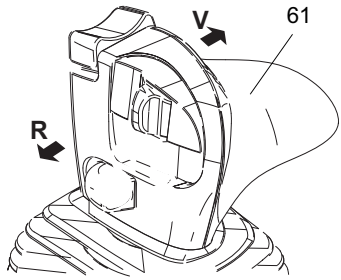
*Procedure*

- Pull the Multi-Pilot (61) in direction H to raise the load.
- Push the Multi Pilot (61) in direction S to lower the load.

*The load is now raised / lowered.*

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

***Tilting the mast forward / backward***




*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

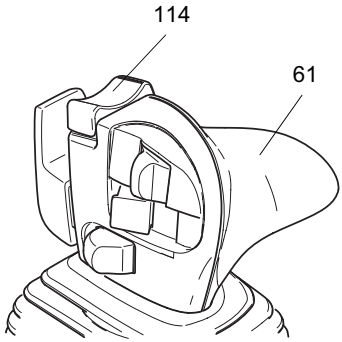
*Procedure*

- Push the Multi-Pilot lever (61) in direction V to tilt the mast forward.
- Push the Multi-Pilot lever (61) in direction R to tilt the mast back.

*The mast is now tilted back / forward.*

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

***Positioning the integrated sideshift (option)***




*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

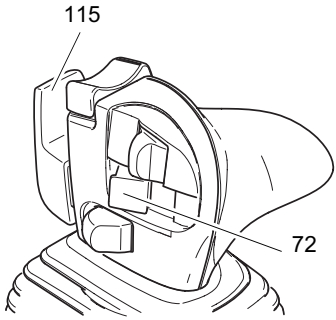
*Procedure*

- Press the button (114) to the left to move the load handler to the left (from the driver's viewpoint).
- Press the button (114) to the right to move the load handler to the right (from the driver's viewpoint).

*The sideshifter is now positioned.*

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

***Positioning the forks with an integrated fork positioner (option)***




**⚠ CAUTION!**

Do not use the fork positioner to clamp loads.

*Requirements*

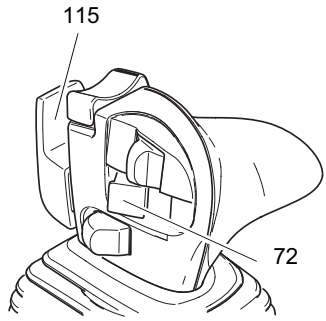
– Truck prepared for operation, see "Preparing the truck for operation" on page 79.

*Procedure*

- Press the (115) button while at the same time pressing the (72) button, the forks will spread apart.
- Pull the (115) button while at the same time pressing the (72) button, the forks will move together.

*The forks are now positioned.*

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




*Requirements*

– Truck prepared for operation, see "Preparing the truck for operation" on page 79.
– The fork tines are no longer aligned.

*Procedure*

- Press the (115) button whiel at the same time pressing the (72) button, the forks will spread apart.
- Pull the (115) button while at the same time pressing the (72) button, the forks will move together.

*The fork tines are now synchronised.*

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

## 4.13 Safety instructions for operating additional attachments

Optionally, trucks can be fitted with one or more auxiliary hydraulic functions to operate attachments. The auxiliary hydraulics are indicated with ZH1, ZH2 and ZH3.
Auxiliary hydraulic functions for exchangeable equipment are fitted with replacement couplings on the fork carriage. To fit exchangeable equipment see "Fitting additional attachments" on page 109.

**DANGER!**

**Attaching exchangeable equipment can result in accidents.**

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

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

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

**Safety instructions for sideshifter and fork positioner attachments**

**⚠ WARNING!**

**Restricted visibility and reduced tilt resistance can cause accidents**

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

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

---

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

**⚠ WARNING!**

**Falling loads can cause accidents**

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

- ▶ Clamping attachments may only be added to trucks which have a button to enable additional hydraulic functions.
- ▶ Clamping attachments must only be operated on trucks will auxiliary hydraulics ZH1, ZH2 or ZH3.
- ▶ When connecting the attachment make sure that the hydraulic lines of the attachment are connected to the right ports, see "Fitting additional attachments" on page 109.

---

**Safety instructions for rotary attachments**

**⚠ WARNING!**

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

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

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

---

**Safety instructions for telescopic attachments**

**⚠ WARNING!**

**Accident risk from increased tipover hazard and reduced residual capacity**

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

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

---

**Safety instructions for attachments when transporting suspended loads**

**⚠ WARNING!**

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

Transporting hanging loads can reduce the stability of the truck.

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

---

**Safety instructions for using loading buckets as attachments**

**⚠ WARNING!**

**Increased mast loading can cause accidents.**

- ▶ When carrying out the daily checks and operations before starting, see "Checks and operations to be performed before starting daily operation" on page 66, check in particular check the fork carriage, mast rails and mast rollers for damage.

---

### Fork extension safety instructions

**⚠ WARNING!**

**Unsecured and oversized fork extensions can cause accidents.**

- ▶ For fork extensions with an open cross sectional area, carry only loads that are resting along the entire length of the fork extension.
- ▶ Use only fork extensions with the same fork cross section and minimum fork length of the truck and which comply with the details on the fork extension data plate.
- ▶ The basic fork length must be at least 60% of the length of the fork extension.
- ▶ Lock the fork extensions onto the basic forks.
- ▶ When carrying out the daily checks and operations before starting, see "Checks and operations to be performed before starting daily operation" on page 66, check also the fork extension lock.
- ▶ Mark any fork extensions with an incomplete or faulty lock and take them out of service.
- ▶ Do not use trucks with an incomplete or faulty fork extension lock. Replace the fork extension.
- ▶ Only restore the fork extension to service when the fault has been rectified.
- ▶ Use only fork extensions which are free of dirt and foreign bodies near the entry opening point. Clean the fork extensions as required.

## 4.14 Operating additional attachments for the SOLO-PILOT

**⚠ WARNING!**

**Incorrect symbols can cause accidents**

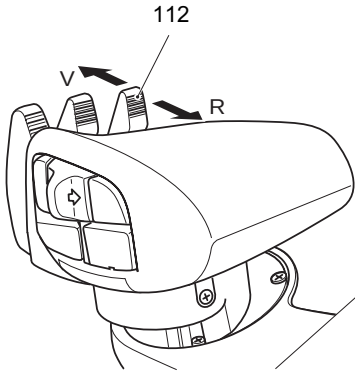
Symbols on controls that do not depict the function of the attachments can cause accidents.

▶ Mark the controls with symbols that indicate their function.

▶ Specify the attachments' direction of movement in accordance with ISO 3691-1 so that they match the controls' direction of movement.

### 4.14.1 Solo Pilot with control of ZH1 hydraulic port

Depending on the attachments used the lever (112) is assigned the function of the attachment. Levers that are not required are void. For connections see "Fitting additional attachments" on page 109.



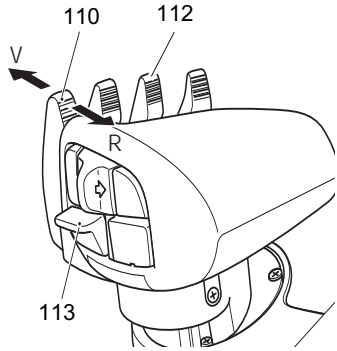

*Procedure*

- Operating the hydraulic port ZH1:
  Move the lever (112) in direction V or R.

*The attachment's function is performed.*

### 4.14.2 Solo Pilot with control of ZH1 and ZH2 hydraulic ports

Depending on the attachments used the lever / button (110, 112, 113) is assigned the function of the attachment. Unused levers have no function. For connections see "Fitting additional attachments" on page 109.



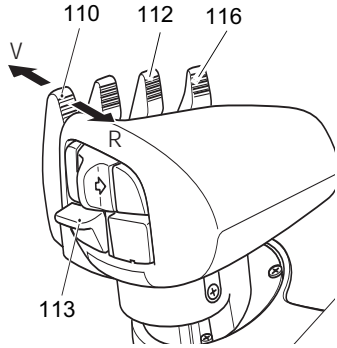

*Procedure*

- Operating the hydraulic port ZH1:
  Move the lever (112) in direction V or R.
- Operating the hydraulic port ZH2:
  Press the toggle switch (113) and at the same time move the lever (110) in the V or R direction.

*The attachment's function is performed.*

### 4.14.3 Solo Pilot with control of ZH1, ZH2 and ZH3 hydraulic ports

Depending on the attachments used the levers / buttons (110, 112, 113, 116) are assigned the respective functions. Unused levers have no function. For connections see "Fitting additional attachments" on page 109.




*Procedure*

- Operating the hydraulic port ZH1:
  Move the lever (112) in direction V or R.
- Operating the hydraulic port ZH2:
  Move the lever (116) in direction V or R.
- Operating the hydraulic port ZH3:
  Press the toggle switch (113) and at the same time move the lever (110) in the V or R direction.

*The attachment's function is performed.*

## 4.15 Operating additional attachments for the Multi Pilot

**⚠ WARNING!**

**Incorrect symbols can cause accidents**

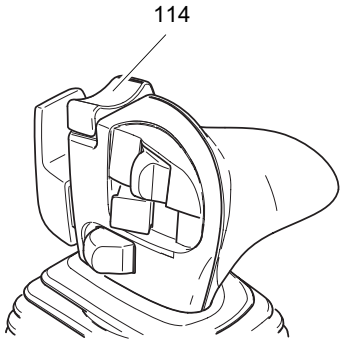
Symbols on controls that do not depict the function of the attachments can cause accidents.

▶ Mark the controls with symbols that indicate their function.

▶ Specify the attachments' direction of movement in accordance with ISO 3691-1 so that they match the controls' direction of movement.

### 4.15.1 Multi Pilot with control of ZH1 hydraulic port

Depending on the attachments used the (114) button is assigned the function of the attachment. Unused levers have no function. For connections see "Fitting additional attachments" on page 109.

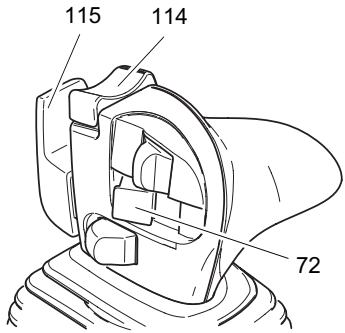



*Procedure*

- Operating hydraulic port ZH1:
  Press the (114) button to the left or right.

*The attachment performs its operation.*

### 4.15.2 Multi Pilot with control of ZH1 and ZH2 hydraulic ports



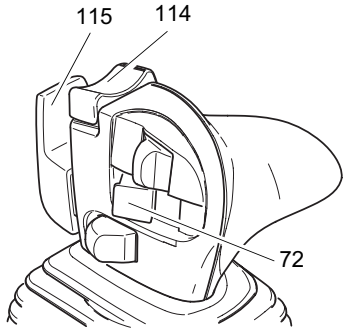

Depending on the attachments used the lever / button (114,115,72) is assigned the function of the attachment. Unused levers have no function. For connections see "Fitting additional attachments" on page 109.

*Procedure*

- Operating hydraulic port ZH1:
  Press the (114) button to the left or right.
- Operating hydraulic port ZH2:
  Push or pull the (115) lever while at the same time pressing the (72) button.

*The attachment performs its operation.*

### 4.15.3 Multi Pilot with control of ZH1, ZH2 and ZH3 hydraulic ports




Depending on the attachments used the levers / buttons (114, 115, 72) are assigned the respective functions. Unused levers have no function. For connections see "Fitting additional attachments" on page 109.

*Procedure*

- Operating hydraulic port ZH1:
  Press the (114) button to the left or right.
- Operating hydraulic port ZH2:
  Push or pull the lever (115).
- Operating hydraulic port ZH3:
  Push or pull the (115) lever while at the same time pressing the (72) button.

*The attachment performs its operation.*

## 4.16 Fitting additional attachments

**⚠ WARNING!**

**Incorrectly connected attachments can cause accidents.**

Attachments with incorrectly connected hydraulic attachments can result in accidents.

▶ Attachments must only be assembled and commissioned by trained, specialist personnel.

▶ Observe the manufacturer's operating instructions.

▶ Before starting, check the fasteners are positioned correctly and securely and make sure they are complete.

▶ Before starting, make sure the attachment is working correctly.

---

***Connecting attachments hydraulically***

*Requirements*

– Non-pressurised hydraulic hoses.

– The exchange ports on the truck are marked ZH1, ZH2 and ZH3.

– Attachment directions of movement defined to match the controls' direction of movement.

*Procedure*

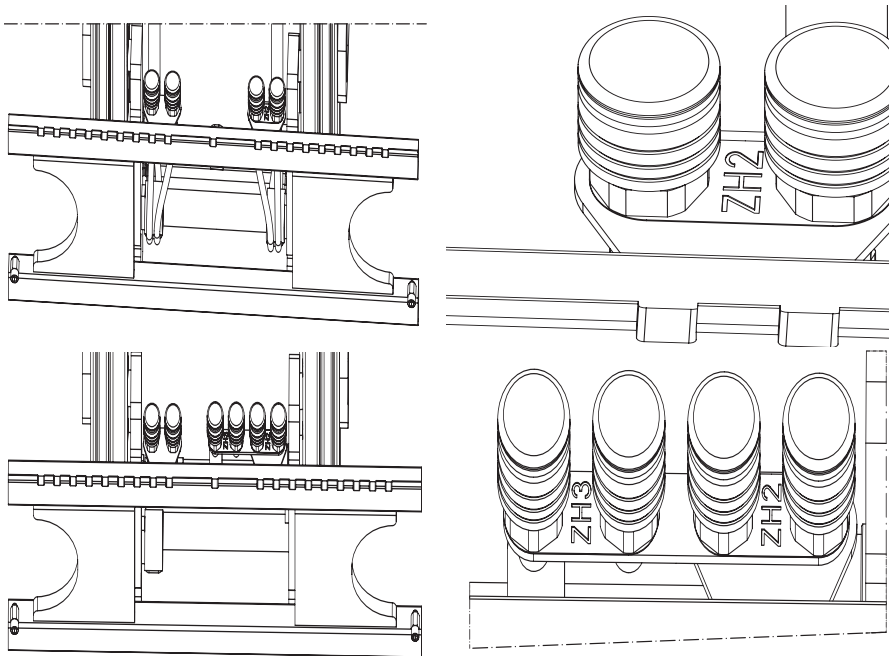
- Non-pressurised hydraulic hoses
  - Switch off the truck and wait a few minutes.
- Attach the plug connector and engage it in position.
- Mark the controls with symbols that indicate their function.

*The attachment is now hydraulically connected.*

**⚠ WARNING!**

**Hydraulic ports for clamping attachments**

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




Spilled hydraulic oil must be set using a suitable agent and disposed of in accordance with environmental regulations.
If hydraulic oil comes into contact with the skin, wash it off immediately with soap and water. If it comes into contact with the eyes rinse them immediately with flowing water and call for a doctor.

# 5 Towing trailers

**⚠ DANGER!**

**Inappropriate speeds and excessive trailer loads can be dangerous**

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

- ▶ The truck should only be used occasionally to tow trailers.
- ▶ The overall weight of the trailer should not exceed the capacity indicated on the capacity plate, see "Identification points and data plates" on page 31. If a load is also transported on the load handler, the trailer load must be reduced by the same amount.
- ▶ Do not exceed the maximum speed of 5 km/h km/h.
- ▶ A truck must not be continually operated with trailers.
- ▶ Do not use supporting loads.
- ▶ Towing must only be performed on level, secure travel routes.
- ▶ The owner must test trailer operation with the permissible tow load by means of a trial run under the applicable operating conditions on site.

## Attaching the trailer

**⚠ CAUTION!**

**Trapping hazard**

There is a trapping risk when you attach a trailer.

▶ Follow the instructions of the coupling manufacturer if using special trailer couplings.

▶ Secure the trailer to prevent it from rolling away before coupling it.

▶ Do not get caught between the truck and the tiller when coupling the trailer.

▶ The tiller must be horizontal, tilted down by no more than 10° and never facing up.

---

### *Attaching the trailer*

*Requirements*

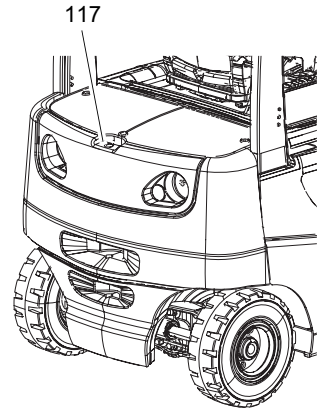
– Truck and trailer are on a level surface.

– Trailer prevented from rolling away.

*Procedure*

- Push the tow pin (117) down and turn it 90°.
- Pull the tow pin up and insert the tiller of the trailer into the opening.
- Insert the tow pin, push it down, turn it 90 degrees and engage it.

*The trailer is now attached to the truck.*

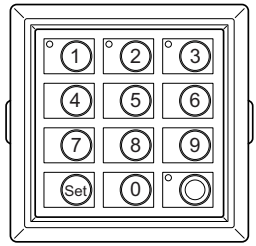


# 6 Optional equipment

## 6.1 CanCode keypad

### CanCode keypad

The keypad consists of 10 digit keys, a Set key and a ○ key.




The O key indicates the follow operating statuses via a red / green LED:

– Code lock function (starting up the truck).
– Setting and changing parameters.

### 6.1.1 Code lock

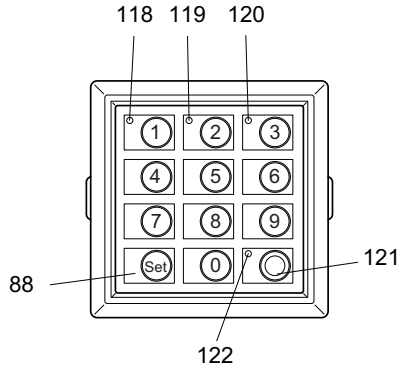
When the correct code is entered, the truck is ready for use. You can allocate an individual code to each truck, operator or group of operators. When originally supplied from the factory, the code is indicated on a sticker. Change the master and operator codes when using the truck for the first time.

➔ When the truck is originally supplied, the operator code for the driver's display and CANCODE (○) is 2-5-8-0.

***Commissioning***

*Procedure*

- Switch on the Emergency Disconnect.
  *The LED (122) lights up red.*
- Enter the code.
  *When you enter the correct operator code the LED (122) turns green. If the LED (122) flashes red this means the wrong code has been entered. Try again.*




*The truck is switched on*

➔ The Set key (88) has no function in operating mode.

***Switching the truck off***

*Procedure*

- Press the O key.

*The truck is switched off.*

➔ The truck can switch off automatically after a set time. To do this the relevant code lock parameters must be entered, see "Parameter Settings" on page 114. This additional safety mechanism in no way discharges the owner from his obligation to prevent the truck from being used by unauthorized parties before leaving the truck. The owner must therefore apply the power-down key each time the truck is left.

### 6.1.2 Parameter Settings

To change the access code you must enter the master code.

➔ The master code factory setting is 7-2-9-5. Change the master code the first time you use the truck.

***Changing the truck settings***

*Procedure*

- Press the O key (121).
- Enter the master code.
- Enter the three-digit parameter number.
- Confirm with the SET key (88).
- Enter the setting as per parameter list.

➔ If the entry is incorrect, the LED (122) of the O key (121) turns red.

  - Enter the parameter number again.
  - Enter the setting again or change it.

- Confirm with the SET key (88).
- Repeat the procedure for other parameters.
- Then press the O key (121).

*The settings are now saved.*

| No. | Function | Setting range | Standard setting | Procedure |
|---|---|---|---|---|
| 000 | Change master code: The length (4-6 digits) of the master code also determines the length of the operator code (4-6 digits). Provided the operator codes are programmed, only new codes of the same length can be entered. If you wish to change the code length, you must first delete all the operator codes. | 0000 - 9999<br>or<br>00000 - 99999<br>or<br>000000 - 999999 | 7295 | – (LED 118 flashes) Enter current code<br>– confirm (Set 88)<br>– (LED 119 flashes) Enter new code<br>– confirm (Set 88)<br>– (LED 120 flashes) Repeat new code<br>– confirm (Set 88) |
| 001 | Add code (max. 250) | 0000 - 9999<br>or<br>00000 - 99999<br>or<br>000000 - 999999 | 2580 | – (LED 119 flashes) Code entry<br>– confirm (Set 88)<br>– (LED 120 flashes) repeat code entry<br>– confirm (Set 88) |
| 002 | Change code | 0000 - 9999<br>or<br>00000 - 99999<br>or<br>000000 - 999999 | | – (LED 118 flashes) Enter current code<br>– confirm (Set 88)<br>– (LED 119 flashes) Enter new code<br>– confirm (Set 88)<br>– (LED 120 flashes) code re-entry<br>– confirm (Set 88) |
| 003 | Delete code | 0000 - 9999<br>or<br>00000 - 99999<br>or<br>000000 - 999999 | | – (LED 119 flashes) Enter a new code<br>– confirm (Set 88)<br>– (LED 120 flashes) repeat code entry<br>– confirm (Set 88) |
| **LEDs 118-120 are located in keypads 1-3.** | | | | |

| No. | Function | Setting range | Standard setting | Procedure |
|---|---|---|---|---|
| 004 | Delete code log (deletes all codes) | 3265 | | – 3265 = delete<br>– other entries = do not delete |
| 010 | Automatic timeout | 00-31 | 00 | – 00 = No timeout<br>– 01 - 30 = Timeout in minutes<br>– 31 = Timeout after 10 seconds |
| **LEDs 118-120 are located in keypads 1-3.** | | | | |

**Keypad event messages**

The LED (122) flashes red to indicate the following events:
– New master code is already in use.
– New code is already the master code
– Code to be changed does not exist
– Attempt to change the code to one that already exists.
– Attempt to delete a code that does not exist
– Code memory full.

## 6.2 Assistance systems

The Access, Drive and Lift Control systems help the driver operate the truck with regard to safety regulations, see "Safety regulations for truck operation" on page 76 of the present operating instructions.

**Travel conduct**

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

### 6.2.1 Access Control

The truck is only released for operation if:

1) The operator is seated.
2) The truck is switched on via the key switch (ISM ○ / CanCode ○).
3) He is wearing the seat belt.

➔ If the driver vacates the seat for a short while, the truck can be operated again when he returns (seat occupied) and puts the seat belt back on again, without having to apply the key switch again.

➔ If travel is not enabled, an information message is issued. Items 1 to 3 must be carried out again.

### 6.2.2 Drive Control

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

In addition to the daily checks before starting, see "Checks and operations to be performed before starting daily operation" on page 66 the driver must carry out the following checks:

– Lift the empty load handler beyond the reference lift height and check if the slow travel display lights up.
– Steering when the truck is stationary: check if the steering wheel display is working.

### 6.2.3 Lift Control

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

Tilt speed reduction as a function of the lift height (from approx. 1.5 m lift height).
– When the load handler is lowered below the limit height, the tilt speed increases again.

Optional:
– Tilt angle display, see "Tilt angle display" on page 126.

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

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

## 6.3 Steel cab

For trucks fitted with a steel cabin, both doors can be closed.

**⚠ CAUTION!**

**An open door can cause accidents (123)**

▶ Do not travel with an open door (123). When opening the door make sure there is nobody in the door's swing range.

▶ Always close the door tightly and make sure it is locked.

▶ Closing the door does not release the driver from his responsibility to wear a seat belt, see "Seat Belt" on page 74.

---

**⚠ CAUTION!**

**Cabin doors can pose a trapping hazard**

You can trap hands or feet when the cab doors are opened and closed.

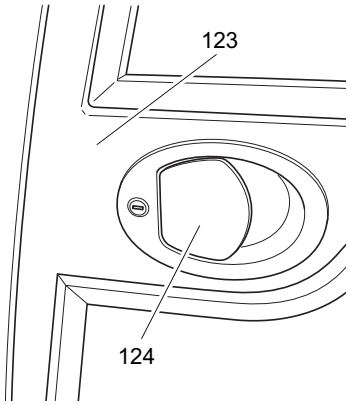
▶ Make sure there is nothing between the cab chassis / leg well and the cab doors when the doors are opened and closed.

---

***Opening and closing the door***

*Procedure*

- To unlock the cabin door turn the key anti-clockwise.
- To lock the cabin door turn the key clockwise.
- To open the cabin door, unlock the door and pull out the handle (124).



## 6.4 Sliding windows

**⚠ CAUTION!**

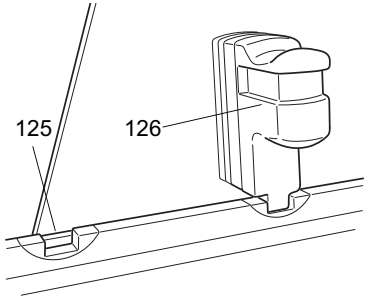
**An unlocked sliding window can cause accidents**

▶ The sliding windows must be locked at all times.

***Opening and closing the windows***

*Procedure*

- Push the lock (126) up.
- Move the window forward or back.
- Insert the lock in the stop (125).

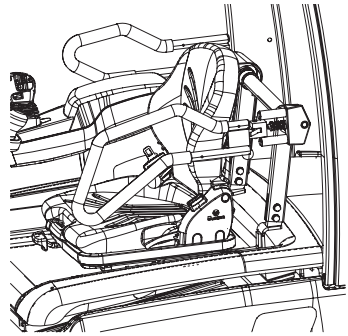


## 6.5 Automatic / mechanical folding gate

**⚠ CAUTION!**

**A faulty folding gate can cause accidents**

- ▶ Never use the truck with a non-functional folding gate. Have the folding gate checked by authorised specialist personnel after an accident. Do not modify the folding gate.
- ▶ Closing the folding gate does not release the driver from his responsibility to wear a seat belt, see "Seat Belt" on page 74.



**Hazardous situations**

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

***Mechanical folding gate operation***

*Procedure*

- To open, push the left gate in and at the same time lift it up.
- When the gate is released, it automatically moves forward and locks in position.

***Automatic folding gate operation***

*Procedure*

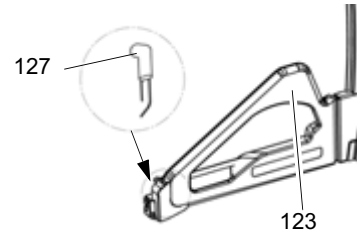
- To open, push the left gate in and at the same time lift it up. This prevents the truck from travelling.
- Travel is activated again when the system has been closed.

## 6.6 BODYGUARD

**⚠ CAUTION!**

**An open door can cause accidents (123)**

- ▶ Do not travel with an open door (123). When opening the door make sure there is nobody in the door's swing range.
- ▶ Always close the door tightly and make sure it is locked.
- ▶ Closing the door does not release the driver from his responsibility to wear a seat belt, see "Seat Belt" on page 74.




*Procedure*

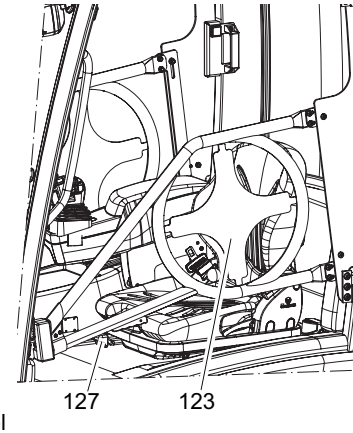
- Pull the handle (127) towards the operator position, the door swings open.
- Pull the door (123) towards the driver; the door closes.

## 6.7 Panel door

**⚠ CAUTION!**

**An open door can cause accidents (123)**

- ▶ Do not travel with an open door (123). When opening the door make sure there is nobody in the door's swing range.
- ▶ Always close the door tightly and make sure it is locked.
- ▶ Closing the door does not release the driver from his responsibility to wear a seat belt, see "Seat Belt" on page 74.




*Requirements*

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

*Procedure*

- Pull the handle (127) towards the operator position, the door swings open.
- Pull the door (123) towards the operator; the door closes.

## 6.8 Operator position extension

**⚠ DANGER!**

**Altering the tilt resistance can be dangerous**

The lateral tilt resistance reduces with a higher truck centre of gravity.

The height above the overhead guard ($h_6$) increases by 300 mm, see "Dimensions" on page 22.

▶Adapt the travel speed of the truck, in particular when cornering.

For entry and exit see "Entry and exit" on page 69.

## 6.9 Adjusting the driver's seat

***Adjusting the backrest extension***

**⚠ CAUTION!**

**Accident risk when adjusting the backrest during travel**

▶Do not adjust the backrest extension while travelling.

*Procedure*

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

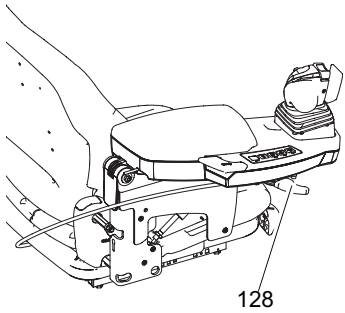
***Adjusting the swivel seat***

*Procedure*

- Pull the locking lever (128) back while simultaneously turning the seat to the required position.
- Engage the lock.

*The swivel seat is not adjusted and locked in position.*

*Operate the truck only when the swivel seat is locked in position.*

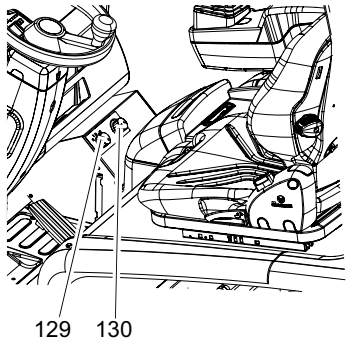


## 6.10 Heating

***Heating operation***

*Procedure*

- Turn the controller (129) to switch on the fan.
- Turn the temperature controller (130) to the right to increase the cab temperature.
- Turn the temperature controller (130) to the left to decrease the cab temperature.

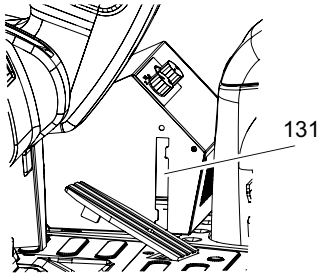



***Replacing the air conditioning filter***

*Procedure*

- Pull out the air conditioning filter (131).
- Insert a new air conditioning filter (131) and make sure it is securely attached.

*The filter cassette is now replaced.*




Check the filter after 500 operating hours and replace it at the latest after 1000 operating hours.

## 6.11 Removable load backrest

**⚠ CAUTION!**

**Trapping hazard and heavy load backrest weight**

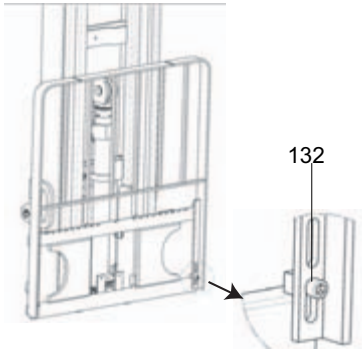
▶Wear safety gloves and safety shoes when carrying out this operation.

▶Two people are required to remove and attach the load backrest.

***Load backrest disassembly***

*Procedure*

- Loosen the screws (132).
- Remove the load backrest from the fork carriage and put it down securely.
- Fit the fork retaining screws.




***Load backrest assembly***

*Procedure*

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

➔ Torque = 85 Nm

## 6.12 Lift cutout override

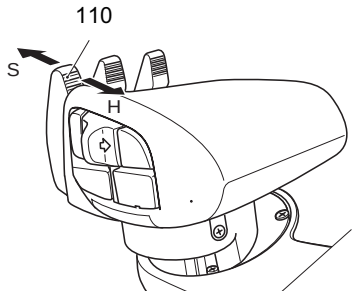
➔ A lift cutout device can be factory fitted when working in areas of restricted height. This interrupts lifting.

***To continue lifting:***

*Procedure*

- Press the lift cutout override button (see "Side compartment control panel switch (○)" on page 63) .
- Pull the control lever (110).

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

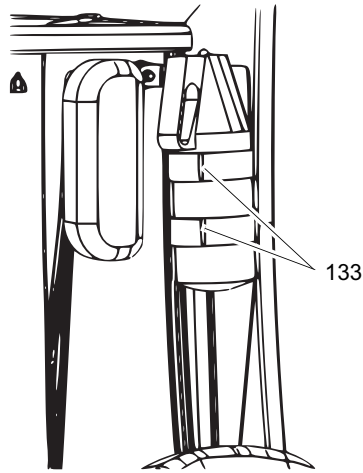


## 6.13 Fire extinguisher

*Procedure*

- Open the fasteners (133)
- Pull the fire extinguish out of its bracket

To operate, refer to the illustrations on the fire extinguisher

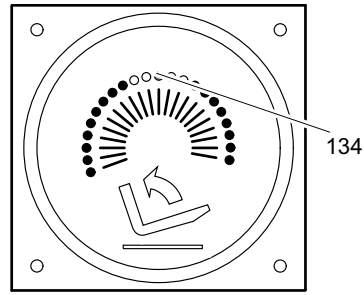



## 6.14 Tilt angle display

**NOTE**

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

– The green LED (134) indicates the vertical position to the ground.



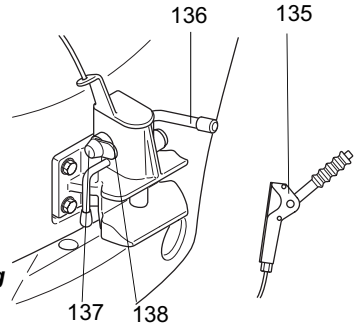
## 6.15 Rockinger coupling with hand lever or remote control

Refer to the instructions for towing trailers, see "Towing trailers" on page 111.

**⚠ CAUTION!**

**Incorrectly coupled trailers can cause accidents**

- ▶ Make sure the coupling is engaged securely before starting the truck.
- ▶ The contro pin (137) must be flush with the control sleeve (138).




***Rockinger coupling operation (attaching trailers)***

*Procedure*

- Prevent the trailer from rolling away.
- Adjusting the trailer pull rod to the height of the coupling.
- Pull the hand lever (136) / remote control (135) (○) up.

  The remote control (135) (○) is located in the overhead guard, depending on the truck model.
- Slowly reverse the truck until the coupling engages.
- Push the hand lever (136) / remote control (135) (○) down.

***Rockinger coupling operation (disconnecting trailers)***

*Procedure*

- Prevent the trailer from rolling away.
- Pull the hand lever (136) / remote control (135) (○) up.
- Drive the truck forward.
- Push the hand lever (136) / remote control (135) (○) down.

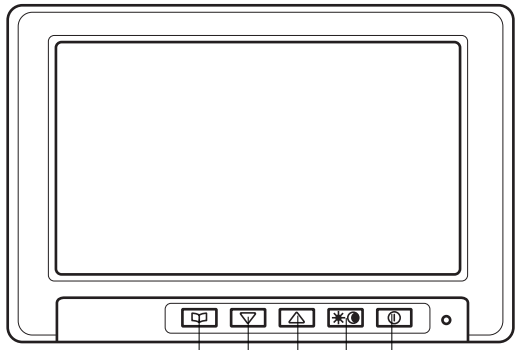
## 6.16 Camera system

**⚠ CAUTION!**

**Accident risk from hidden work areas**

▶ The camera system acts as an aid to assist safe operation.
▶ Practice travelling and working with the camera system.
▶ Align the camera so that the hidden work area can be seen.

When using the camera to reverse, the monitor automatically switches on when you engage reverse gear.




**Using the camera system**

– Press the button (143) on the monitor to switch the camera system on or off.
– Press the button (142) to lighten or darken the screen (day / night settings).
– Press the button (139) to open the menu.

Pressing the button several times changes the menu item (contrast, brightness, colour saturation, language, video, light reflection) or quits the menu.

Adjusting the menu items

– Press the button (141) to go one step forward.
– Press the button (140) to go one step back.

Clean a dirty screen or vent slots with a soft cloth or brush.

## 6.17 Control layout “N”

**⚠ WARNING!**

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

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

▶ Do not stand on the load handler.

▶ Do not lift any persons on the load handler.

▶ Instruct other people to move out of the hazardous area of the truck.

▶ Do not stand underneath a raised and unsecured load handler.

---

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

***NOTE***

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

---

***Lifting***

*Procedure*

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

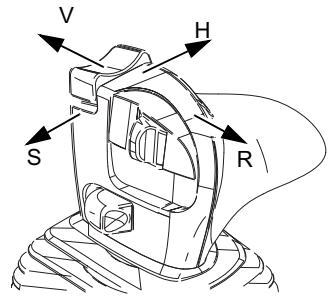
***Tilting***

**⚠ CAUTION!**

**Trapping hazard from inclined mast**

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

---




*Procedure*

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

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

# 7 Troubleshooting

## 7.1 Troubleshooting

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

If, after carrying out the following remedial action, the truck cannot be restored to operation or if a fault in the electronics system is displayed with a corresponding error code, contact the manufacturer's service department.
Troubleshooting must only be performed by the manufacturer's customer service department. The manufacturer has a service department specially trained for these tasks.
In order for customer services to react quickly and specifically to the fault, the following information is essential:
- Truck serial number
- Error number on the display unit (if applicable)
- Error description
- Current location of truck.

Info messages

| Display | Meaning |
|---|---|
| INFO 02 | – No direction selected when the truck is powered up, no wheel position displayed.<br>– Travel direction changed to neutral setting during operation, wheel position display alternates between forward and reverse. |
| INFO 05 | (optional setting for travel cutout input)<br>Lift cutout active / independent of other conditions. |
| INFO 16 | (optional setting for travel cutout input)<br>Travel cutout active / independent of other conditions. |
| INFO 35 | Accelerator pedal zero position<br>– Message can be adjusted to suit preference – either the zero position is only checked after power up or after every transition of the seat switch from the open to closed position. |
| INFO 36 | Hydraulics zero position<br>– Message can be adjusted to suit preference - message displayed or not. |
| INFO 40 | Overtemperature<br>– Traction or lift controller above 83° C.<br>– Traction or lift controller above 145° C. |
| INFO 90 | Travel with handbrake on<br>– Accelerator pedal applied while the handbrake switch is set to parking position. |
| INFO 96 | Hydraulics zero position on power up<br>– A hydraulic function applied during power up.<br>– The hydraulic function applied will not be performed. |

| Fault | Possible Cause | Remedy |
|---|---|---|
| Truck does not start | – Battery connector not plugged in.<br>– Emergency Disconnect switch pressed.<br>– Key switch set to O.<br>– Battery charge too low.<br>– Faulty fuse. | – Check battery connector and plug in if necessary.<br>– Unlock the Emergency Disconnect<br>– Set the key switch to “I”.<br>– Check battery charge, charge battery if necessary.<br>– Check the fuses. |
| Load cannot be lifted | – Truck not operational.<br>– Hydraulic oil level too low.<br>– Battery discharge monitor has switched off.<br>– Faulty fuse.<br>– Load is too heavy. | – Carry out all measures listed under “Truck does not start”.<br>– Check hydraulic oil level.<br>– Charge the battery<br>– Check the fuses (○).<br>– Note the maximum capacity, see "Data plate" on page 33. |
| Fault displays | – Truck not operational. | – Press the EMERGENCY DISCONNECT isolator or turn key switch to 0, after approx. 3 seconds try to perform the desired operation again |

## 7.2 Operating the truck without its own drive system

### 7.2.1 Towing the truck

**⚠ WARNING!**

**Accident risk**

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

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

***Towing the truck***

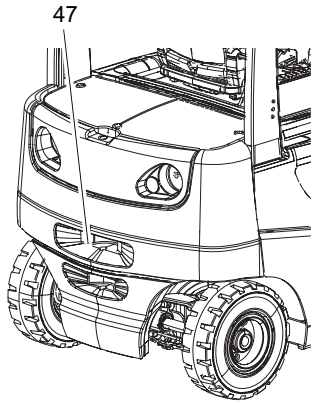
*Requirements*

– Park the truck securely.
– Disconnect the battery.

*Procedure*

- Connect the pull rod to the trailer coupling (47) of the towing truck and attach it to the truck to be towed.
- Release the parking brake.
- Tow the truck to its destination.
- Apply the parking brake.
- Undo the tow connection.

*The truck has now reached its destination.*



### 7.2.2 Operating the truck without its own drive system

**⚠ WARNING!**

**Uncontrolled truck movement**

The truck can roll away if the spring pressure brake is released and if there is insufficient protection.

▶ Release the spring pressure brake to move the truck without power.

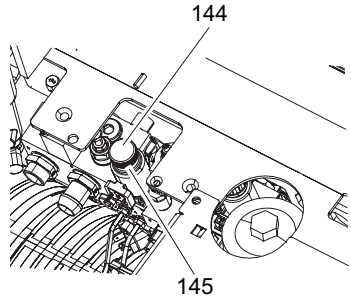
▶ Suitable measures must first be taken to prevent the truck from rolling away.

---

***Releasing the parking brake***

*Requirements*

– Turn the Emergency Disconnect switch and key switch off.
– Disconnect the battery.
– Prevent the truck from rolling away.
– Remove the floor plate by undoing the floor plate mounting screws.




*Procedure*

- Loosen the screw (144).
- Unlock and remove the magnetic coil (145).
- Insert the screw (144); this will activate the valve mechanically.
- Rotate the steering wheel approx. 2 turns.

➔ The accumulator is pumped up and the brake released.

- Tow the truck to its destination using the pull rod.

*The truck has now reached its destination.*

***Applying the parking brake***

*Procedure*

- Loosen the screw (144).
- Place the magnetic coil (145) on the valve and lock it.
- Insert the screw (144). The drive wheels are blocked / decelerated by the brake.
- Fit the floor plate.

*Park the truck securely.*

## 7.3 Emergency lowering

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

**⚠ WARNING!**

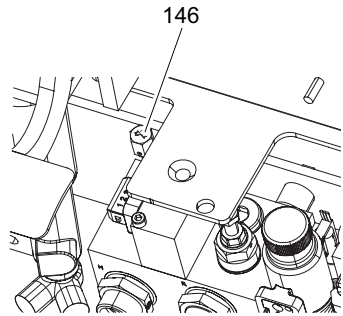
**Lowering the mast can result in injuries**

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

***Mast emergency lowering***

*Requirements*

– Load handler is not in the rack.
– Turn the Emergency Disconnect switch and key switch off.
– Disconnect the battery.
– Remove the floor plate by undoing the floor plate mounting screws.




*Procedure*

- Slowly turn the emergency lowering valve (146); the mast and load handler will lower.
- Turn the emergency lowering valve (146) in the opposite direction as far as the stop; the lowering process stops.

*The mast is now lowered.*

**⚠ WARNING!**

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

# F Industrial Truck Maintenance

## 1 Operational Safety and Environmental Protection

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

**⚠ WARNING!**

**Risk of accidents and component damage**

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

---

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

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

***NOTE***

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

---

➔ On completion of inspection and service work, carry out the operations listed in the “Recommissioning the truck after cleaning or maintenance work” section (see "Restoring the truck to service after maintenance and repairs" on page 165).

# 2 Maintenance Safety Regulations

**Maintenance and repair personnel**

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

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

Customer Services

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

Operating company

The maintenance personal of the operating company has the technical expertise and experience to perform the activities in the maintenance check list for the operating company. The maintenance and repair work to be performed by the operating company are also written down, see "Industrial Truck Maintenance" on page 137.

## 2.1 Consumables and used parts

**⚠ CAUTION!**

**Consumables and used parts are an environmental hazard**

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

▶ Note the safety regulations when handling these materials.

## 2.2 Wheels

**⚠ WARNING!**

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

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

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

▶ When replacing tyres make sure the truck is not skewed.

▶ Always replace tyres in pairs, i.e. left and right at the same time.

When replacing rims and tyres fitted at the factory, only use the manufacturer’s original spare parts. Otherwise the manufacturer’s specifications cannot be ensured.

## 2.3 Lift Chains

**⚠ WARNING!**

**Non-lubricated and incorrectly cleaned lift chains can cause accidents**

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

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

**⚠ WARNING!**

**Diesel fuel can be hazardous**

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

## 2.4 Hydraulic system

**⚠ WARNING!**

**Brittle hydraulic hose lines can cause accidents**

The hoses must be replaced every six years. The manufacturer's customer service department is specially trained to carry out these operations.

▶ Observe the date of manufacturer on the hydraulic hoses.

---

**⚠ WARNING!**

**Leaky hydraulic systems can result in accidents**

Hydraulic oil can escape from leaky and faulty hydraulic systems.

▶ Report any defects immediately to your supervisor.

▶ Mark defective truck and take out of service.

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

▶ Remove any spilled hydraulic immediately with an appropriate bonding agent.

▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.

---

**⚠ WARNING!**

**Holes or hairline cracks in the hydraulic hoses can cause injury and infection**

Pressurised hydraulic oil permeating through fine holes or hairline cracks in the hydraulic hoses can penetrate the skin, causing severe injury.

▶ Call for a doctor immediately if you are injured.

▶ Do not touch pressurised hydraulic hoses.

▶ Report any defects immediately to your supervisor.

▶ Mark defective truck and take out of service.

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

▶ Remove any spilled hydraulic immediately with an appropriate bonding agent.

▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.

---

# 3 Lubricants and Lubrication Schedule

## 3.1 Handling consumables safely

### Handling consumables

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

**⚠ WARNING!**

**Improper handling is hazardous to health, life and the environment**

Consumables can be flammable.

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

**⚠ CAUTION!**

**Spilled consumables can cause slipping and endanger the environment**

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

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

**⚠ WARNING!**

**Improper handling of oils can be hazardous**

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

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

---

**⚠ CAUTION!**

**Consumables and used parts are an environmental hazard**

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

- ▶ Note the safety regulations when handling these materials.

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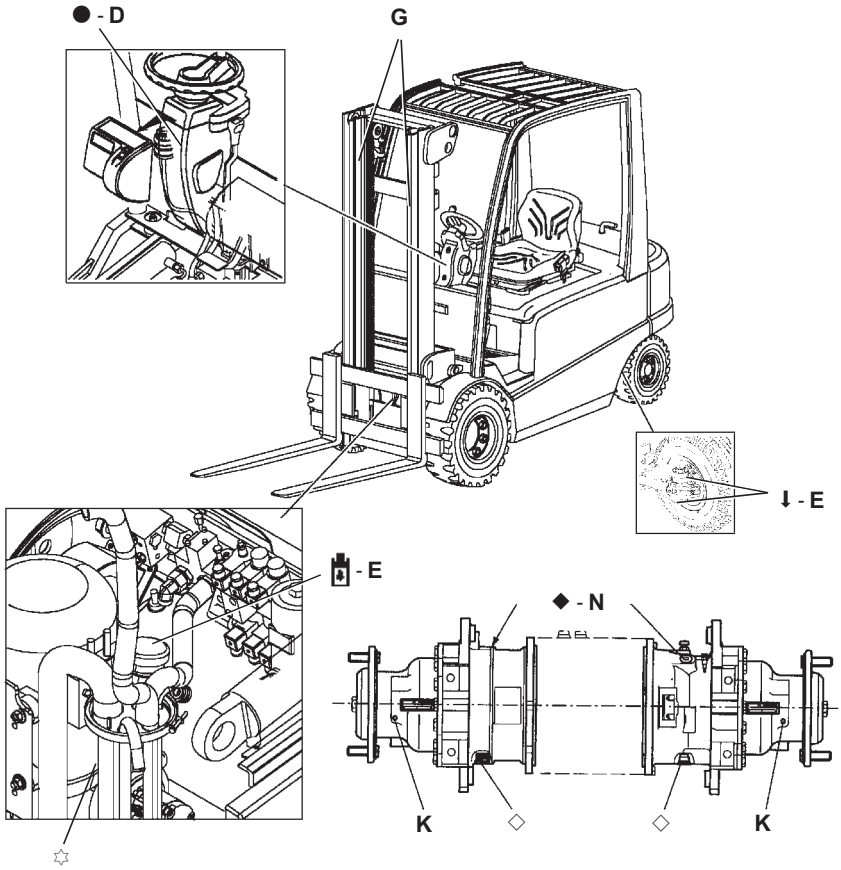
## 3.2 Lubrication Schedule




| | | | |
|---|---|---|---|
| ▼ | Contact surfaces | ☼ | Hydraulic oil drain plug |
| ⬇ | Grease nipple | ◆ | Transmission oil filler neck |
| | Hydraulic oil filler neck | ◇ | Transmission oil drain plug |
| ● | Brake fluid filler neck | K | Oil level dipstick |

## 3.3 Consumables

| Code | Order no. | Package quantity | Capacity | Description | Used for |
|---|---|---|---|---|---|
| A | 51 132 827* | 5l | 35 l | Jungheinrich hydraulic oil | Hydraulic system |
| | 50 426 072 | 20l | | Renolin 32[1] HLPD | |
| | 50 429 647 | 20l | | Renolin 22[2] HLPD | |
| | 50 124 051 | 5l | | HV 68 [3] | |
| | 51 082 888 | 5l | | Plantosyn 46 HVI (BIO hydraulic oil) | |
| D | 50 429 647 | 20l | 0.25 l | Renolin 22 | Hydraulic brake system |
| E | 14 038 650 | 400g | | Lubrication grease KP 2 K[3] | Front and rear wheel bearings |
| G | 29 201 280 | 400ml | | Chain spray | Chains |
| N | 50 137 755 | 5l | 2x approx. 1.3 l (for new filling 2 x 1.4 l) | Shell Donax TC 50 Universal | Transmission |

[1] Valid for temperatures -5/+30 °C
[2] Valid for temperatures -20/-5 °C
[3] Valid for temperatures +30/+50 °C

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

**⚠ WARNING!**

Industrial trucks are factory-equipped with "HLP D22" hydraulic oil or "+ 2% Plantosyn 46 HVI" BIO hydraulic oil.
You cannot change from "Plantosyn 46 HVI" BIO hydraulic oil to the manufacturer's hydraulic oil. The same applies to changing from the manufacturer's hydraulic oil to "Plantosyn 46 HVI" bio hydraulic oil.
Do not mix the Plantosyn 46 HVI bio hydraulic oil with the manufacturer's hydraulic oil or one of the named alternative hydraulic oils.

---

**Grease guidelines**

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

# 4 Maintenance and repairs

## 4.1 Preparing the truck for maintenance and repairs

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

*Procedure*

- Park the truck securely, see "Parking the truck securely" on page 81.
- Fully lower the load handler.
- Disconnect the battery to prevent the truck from being switched on accidentally.

## 4.2 Lifting and jacking up the truck safely

**⚠ WARNING!**

**A truck tipover can cause accidents**

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

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

▶ Always use a jack with a minimum capacity of 5000 kg kg.

▶ Raise the unladen truck on a level surface.

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

---

***Raising and jacking up the truck securely***

*Requirements*

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Tools and Material Required*

– Jack

– Hard wooden blocks

*Procedure*

- Place the jack against the contact point.

  Jack contact point, see "Identification points and data plates" on page 31.
- Raise the truck.
- Support the truck with hard wooden blocks.
- Remove the jack.

*The truck is now securely raised and jacked up.*

## 4.3 Opening the rear panel

***Opening the panel***

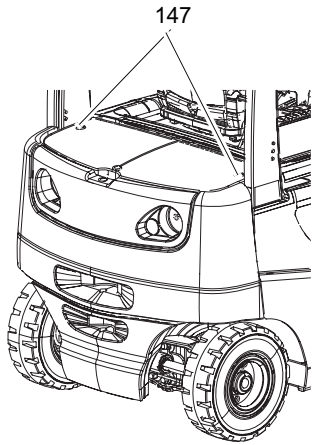
*Requirements*

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Procedure*

- Undo the two quick release fasteners (147).
  - Pull the rear panel back and remove it.

*The rear panel is now open. The fuses and other electrical components can now be reached.*




***Closing the panel***

*Procedure*

- Place the rear panel in position.
  - Secure two quick release fasteners (147).

*The rear panel is now closed.*

## 4.4 Checking the wheel attachments.

**⚠ WARNING!**

**Using different tyres can cause accidents**

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

▶ The diameter of the wheels must differ by no more than 15 mm.

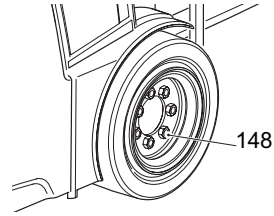
▶ Always replace tyres in pairs. After replacing the tyres check the wheel nuts are secure after 10 service hours.

▶ Always use tyres of the same make, model and profile.

***Checking the wheel attachment***

*Requirements*

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).




*Tools and Material Required*

– Torque wrench

*Procedure*

• Torque the wheel nuts (148) crosswise with a torque wrench, for torques see "Tyre type" on page 28.

*The wheel attachment is now checked.*

When using pneumatic tyres check the air pressure, for the air pressure see "Tyre type" on page 28

## 4.5 Replacing wheels

**⚠ WARNING!**

**A truck tipover can cause accidents**

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

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

▶ Always use a jack with a minimum capacity of 5000 kg kg.

▶ Raise the unladen truck on a level surface.

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

---

**⚠ WARNING!**

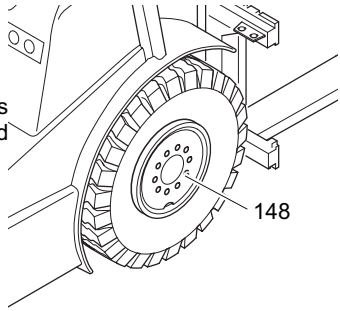
**Falling wheels can cause injury**

▶ The wheels of the truck are very heavy. A single wheel can weigh up to 150 kg.

▶ Always replace wheels with a suitable tool and protective equipment.

---

***Dismantle the wheels***




*Requirements*

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Tools and Material Required*

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

*Procedure*

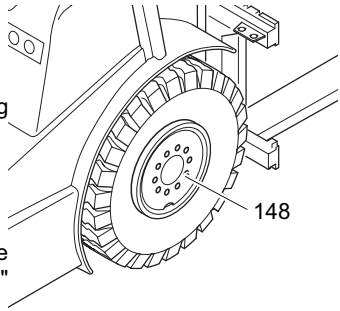
- Place the jack against the contact point.
  Jack contact point, see "Identification points and data plates" on page 31.
- Raise the truck.
- Support the truck with hard wooden blocks.
- Undo the wheel attachment (148).
- Disassemble the wheel, using a suitable mounting lever if necessary.

*The wheel is now disassembled.*

***Fitting the wheels***

*Procedure*

- Assemble the wheel, using a suitable mounting lever if necessary.
- Fit the wheel attachment.
- Remove the hard wooden blocks.
- Lower the truck.
- Torque the wheel attachment (148) crosswise with a torque wrench, for torques see "Tyre type" on page 28.




*The wheel is now assembled.*

When using pneumatic tyres check the air pressure, for the air pressure see "Tyre type" on page 28

## 4.6 Hydraulic system

**⚠ CAUTION!**

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

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

---

**⚠ CAUTION!**

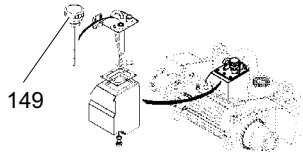
**Consumables and used parts are an environmental hazard**

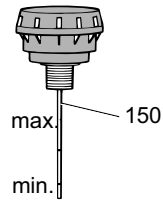
Used parts and consumables must be disposed of in accordance with the applicable environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

- ▶ Note the safety regulations when handling these materials.

---

### 4.6.1 Checking the hydraulic oil level




***Checking the hydraulic oil level and adding hydraulic oil***

*Requirements*

– Park the truck on a level surface.
– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Procedure*

- Unscrew the breather (149) and dipstick (150).
- Visually inspect the hydraulic oil level on the dipstick (150).

If the reservoir is sufficiently full, the hydraulic oil level will be at the top mark (max.).
If necessary add hydraulic oil up to the level indicated (20 mm on the dipstick corresponds to approx. 1,5l hydraulic oil).

*The hydraulic oil level is now checked.*

**⚠ CAUTION!**

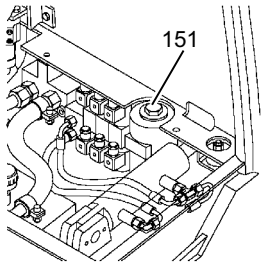
**The use of unsuitable hydraulic oils can cause damage**

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

▶ Use only BIO hydraulic oil.

## 4.7 Replacing the hydraulic oil filter

***Replace oil filter***



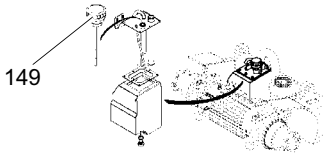

*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81

*Procedure*

- Unscrew the hydraulic oil filter cap (151). The filter element is located on the cap.
- Replace the filter insert; if the O ring is damaged it will also need to be replaced. Apply a thin layer of oil to the O ring on assembly.
- Refit the cap with the new filter element in place.

## 4.8 Replacing the ventilation/discharge filter




*Requirements*

– Park the truck on a level surface.

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

– Remove the floor plate by undoing the floor plate mounting screws.

*Procedure*

- Remove the hydraulic reservoir cover.
- Attach the breather filter (149).
- Replace the breather filter.

Collect any spilled hydraulic oil. Dispose of the hydraulic oil and hydraulic oil filter and fuel in accordance with environmental regulations.

## 4.9 Check the gear oil level

**⚠ CAUTION!**

**Consumables and used parts are an environmental hazard**

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

▶ Note the safety regulations when handling these materials.

***Check the gear oil level***

*Requirements*

– Park the truck securely, see "Parking the truck securely" on page 81

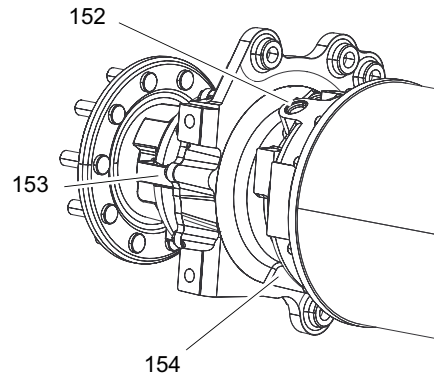
*Tools and Material Required*

– Oil sump

*Procedure*

- Place the oil sump underneath the transmission
- Unscrew the oil dipstick (153).
- Check gear oil level, top up if necessary through the filler hole (152).

➔ The oil level should reach the bottom mark of the oil check hole (153).




*The transmission oil level is now checked.*

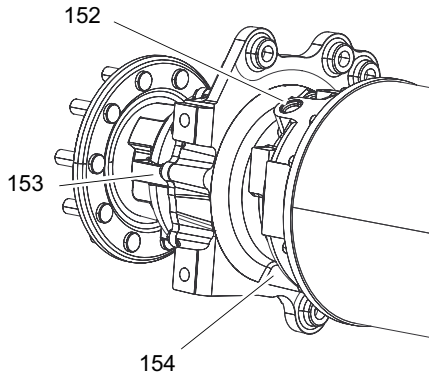
***Draining the oil***

*Procedure*

- Drain oil at operating temperature.
- Place the oil sump underneath the transmission
- Unscrew the oil drain plug (154) and drain the transmission oil.

➔ To ensure swift and complete draining of the transmission oil, unscrew the oil dipstick (153).

*The oil is now drained.*




***Adding oil***

*Procedure*

- Insert the oil drain plug (154).
- Unscrew the oil control screw (153) and add new gear oil in the filler hole (152).

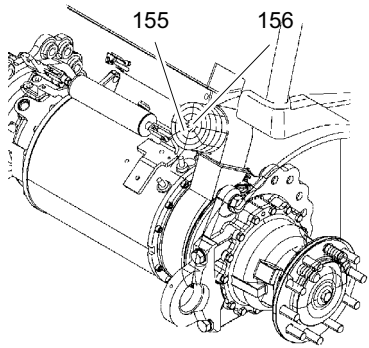
*The oil has now been added.*

## 4.10 Replacing the suction filter of the engine fan

*Procedure*

- Loosen the screw (155).
- Remove the grille (156) from the front
- Replace the filter
- Refit the grille

*The suction filter is now replaced.*



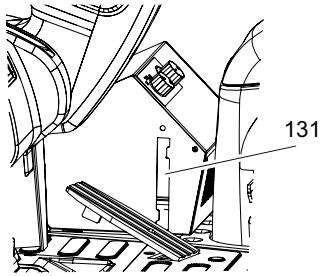
## 4.11 Heating

***Replacing the air conditioning filter***

*Procedure*

- Pull out the air conditioning filter (131).
- Insert a new air conditioning filter (131) and make sure it is securely attached.

*The filter cassette is now replaced.*



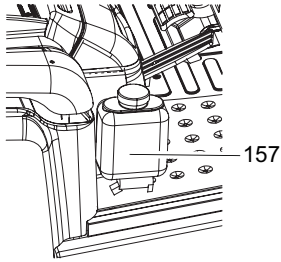

➔ Check the filter after 500 operating hours and replace it at the latest after 1000 operating hours.

➔ Regular servicing is required to ensure the heating can work at a consistently high level, see "Servicing and Inspection" on page 171 or see "Maintenance checklist" on page 172.

## 4.12 Adding window washer system fluid

*Procedure*

- Make sure there is sufficient window fluid in the container (157).
- If necessary top up with anti-freeze.



## 4.13 Checking electrical fuses

**⚠ WARNING!**

**Electric currents can cause accidents**

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

▶ Park the truck securely (see "Parking the truck securely" on page 81).

▶ Press the Emergency Disconnect.

▶ Disconnect the battery.

▶ Remove any rings or metal bracelets etc. before working on electrical components.

**⚠ CAUTION!**

**The use of incorrect fuses can cause fire and damage components**

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

▶ Use only fuses with the prescribed rated current, see "Fuse ratings" on page 160.

***Checking electrical fuses***

*Requirements*

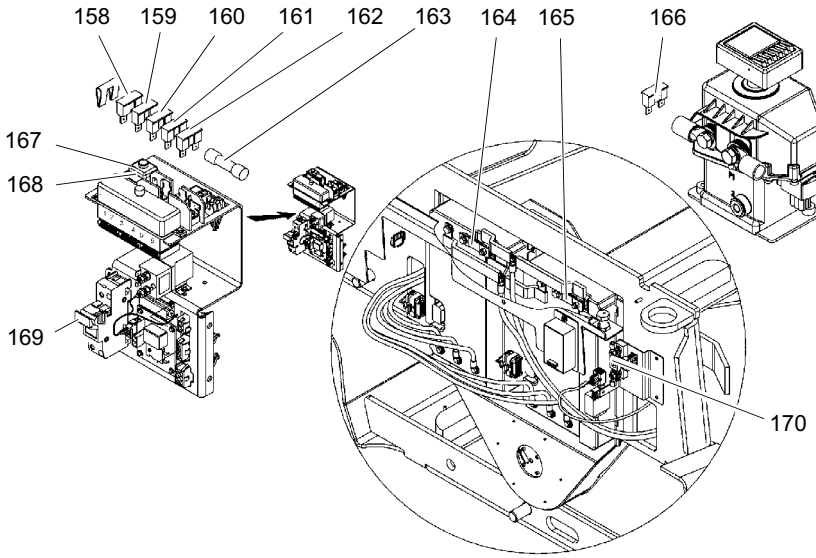
– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Procedure*

- Open the rear cover of the truck, see "Opening the rear panel" on page 149.
- Unscrew the electrical system cap.
- Check condition and rating of the fuses in accordance with the table.
- Replace any damaged fuses in accordance with the table.
- Close the electrical system cap.
- Close the rear cover of the truck.

*The electrical fuses are now checked.*

### 4.13.1 Fuse ratings




Electrical system fuses

| Item | Description | Electric circuit | Rating / type |
|---|---|---|---|
| 158 | F3.1 | DC/DC converter control fuse | 10 A |
| 159 | F4 | Control fuse | 5 A |
| 160 | F1.2 | Control fuse | 15 A |
| 161 | F2.1 | Control fuse | 10 A |
| 162 | 1F9 | Electronic system control fuse | 3 A |
| 163 | F1 | Overall control circuit fuse | 32 A |
| 164 | 2F1 | Hydraulic motor fuse | 355 A |
| 165 | 1F | Drive motor fuse | 355 A |
| 166 | F4 | Main contactor control fuse | 5 A |
| 167 | 5F2 | DC/DC converter control fuse (○) | 10 A |
| 168 | 5F2 | DC/DC converter control fuse (○) | 15 A |
| 169 | 3F1 | Steering auxiliary motor fuse | 40 A |
| 170 | F8 | Positive wire main fuse | 425 A |

## 4.14 Cleaning

### 4.14.1 Cleaning the truck

**⚠ CAUTION!**

**Fire hazard**

Do not use flammable liquids to clean the industrial truck.

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

---

**⚠ CAUTION!**

**Risk of component damage when cleaning the truck**

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

- ▶ Cover all electronic system assemblies (controllers, sensors, motors etc.) before cleaning the truck with a pressure washer.
- ▶ Do not hold the jet of the pressure washer by the marked points to avoid damaging them (see "Identification points and data plates" on page 31).
- ▶ Do not clean the truck with pressurised water.

---

***Cleaning the truck***

*Requirements*

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Tools and Material Required*

– Water-based solvents
– Sponge or cloth

*Procedure*

- Clean the surface of the truck with water-based solvents and water. Use a sponge or cloth to clean.
- In particular, clean the following areas:
  - Windows
  - All walk-on areas
  - Oil filler ports and their surroundings
  - Grease nipples (before lubrication)
- Dry the truck after cleaning, e.g. with compressed air or a dry cloth.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see "Restoring the truck to service after decommissioning" on page 168).

*The truck is now clean.*

### 4.14.2 Cleaning the electrical system assemblies

**⚠ CAUTION!**

**Risk of electrical system damage**

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

▶ Do not clean the electrical system with water.

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

---

***Cleaning the electrical system assemblies***

*Requirements*

– Prepare the truck for maintenance and repairs (see "Preparing the truck for maintenance and repairs" on page 147).

*Tools and Material Required*

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

*Procedure*

- Expose the electrical system, see "Opening the rear panel" on page 149.
- Clean the electrical system assemblies with weak suction or compressed air (use a compressor with a water trap) and not a conductive, anti-static brush.
- Fit the electrical system panel, see "Opening the rear panel" on page 149.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see "Restoring the truck to service after decommissioning" on page 168).

*The electrical system assemblies are now clean.*

## 4.15 Working on the electrical system

**⚠ WARNING!**

**Electrical current can cause accidents**

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

- ▶ Only suitably trained electricians may operate on the truck's electrical system.
- ▶ Before working on the electrical system, take all precautionary measures to avoid electric shocks.
- ▶ Park the truck securely (see "Parking the truck securely" on page 81).
- ▶ Disconnect the battery.
- ▶ Remove any rings, metal wrist bands etc.

## 4.16 Restoring the truck to service after maintenance and repairs

*Procedure*

- Thoroughly clean the truck, see "Cleaning the truck" on page 161.
- Lubricate the truck according to the lubrication schedule, see "Lubrication Schedule" on page 144.
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, see "Charging the battery" on page 50.
- Replace transmission oil. Condensation water could have formed.
- Replace hydraulic oil. Condensation water could have formed.

➔ The manufacturer's customer service department is specially trained to carry out these operations.

- Start up the truck, see "Preparing the Truck for Operation" on page 66.

# 5 Decommissioning the industrial truck

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

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

Jack up the truck, see "Lifting and jacking up the truck safely" on page 148.

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

## 5.1 Prior to decommissioning

*Procedure*

- Thoroughly clean the truck, see "Cleaning the truck" on page 161.
- Prevent the truck from rolling away accidentally.
- Check the hydraulic oil level and replenish if necessary, see "Checking the hydraulic oil level" on page 154.
- Apply a thin layer of oil or grease to any non-painted mechanical components.
- Lubricate the truck according to the lubrication schedule, see "Lubrication Schedule" on page 144.
- Charge the battery, see "Charging the battery" on page 50.
- Disconnect the battery, clean it and grease the terminals.

In addition, follow the battery manufacturer's instructions.

## 5.2 During decommissioning

***NOTE***

**Full discharge can damage the battery**

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

▶Charge the battery at least every 2 months.

---

Charge the battery, see "Charging the battery" on page 50.

## 5.3 Restoring the truck to service after decommissioning

*Procedure*

- Thoroughly clean the truck, see "Cleaning the truck" on page 161.
- Lubricate the truck according to the lubrication schedule, see "Lubrication Schedule" on page 144.
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, see "Charging the battery" on page 50.
- Replace transmission oil. Condensation water could have formed.
- Replace hydraulic oil. Condensation water could have formed.

➔ The manufacturer's customer service department is specially trained to carry out these operations.

- Start up the truck, see "Preparing the Truck for Operation" on page 66.

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

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

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

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

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

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

# 7 Final de-commissioning, disposal

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

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

# 8 Human vibration measurement

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

# 9 Servicing and Inspection

**⚠ WARNING!**

**Risk of accident due to neglected maintenance**

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

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

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

***NOTE***

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

---

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

| | | |
|---|---|---|
| W | = | Every 50 service hours, at least weekly |
| A | = | Every 500 service hours |
| B | = | Every 1000 service hours, or at least annually |
| C | = | Every 2000 service hours, or at least annually |
| ● | = | Standard maintenance interval |
| ✳ | = | Cold store maintenance interval (in addition to standard maintenance interval) |

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

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

# 10 Maintenance checklist

## 10.1 Operating company

### 10.1.1 Standard equipment

| Brakes | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test brakes. | ● | | | |
| 2 | Check the brake oil level (mineral oil) | ● | | | |

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test warning and safety devices in accordance with operating instructions. | ● | | | |
| 2 | Test Emergency Disconnect switch. | ● | | | |

| Power Supply | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check battery cable connections are secure, grease terminals if necessary. | ● | | | |
| 2 | Check battery and battery components. | ● | | | |
| 3 | Check acid level and add demineralised water if necessary. | ● | | | |
| 4 | Check battery connector for damage, test it and make sure it is secure. | ● | | | |

| Travel | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check the wheels for wear and damage. Make sure they are tight and check the compressed air if necessary. | ● | | | |

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check doors and/or covers. | ● | | | |
| 2 | Check labels are legible and complete. | ● | | | |
| 3 | Test the gas struts on the battery cover and check for damage. | ● | | | |
| 4 | Check overhead guard and / or cab are secure and check for damage. | ● | | | |
| 5 | Test driver's seat restraint system and check for damage. | ● | | | |

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check load chain lubrication and lubricate if necessary. | ● | | | |

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 2 | Check running surfaces of the mast for wear and damage, and lubricate if necessary. | ● | | | |
| 3 | Test hydraulic system. | ● | | | |
| 4 | Check cylinders, hydraulic ports, lines and hoses for leaks and damage. | ● | | | |
| 5 | Check hydraulic oil level and top up if necessary. | ● | | | |
| 6 | Check forks or load handler for wear and damage. | ● | | | |

### 10.1.2 Optional equipment

**Work lights**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test lighting. | ● | | | |

**Strobe light/beacon**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test strobe light / beacon and check for damage. | ● | | | |

**Heating**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the heating. | ● | | | |
| 2 | Check heating vent filter for contamination and clean if necessary. | ● | | | |

**Clamping device**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment lubrication; clean and lubricate if necessary. | ● | | | |

**Sideshifter**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment lubrication; clean and lubricate if necessary. | ● | | | |

**Road traffic approval (StVZO)**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test lighting. | ● | | | |

**Telescopic forks**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment lubrication; clean and lubricate if necessary. | ● | | | |

**Weather-proof system**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the windscreen heating and check for damage. | ✳ | | | |
| 2 | Test the doors and check for damage. | ● | | | |

**Wiper/washer system**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check wiper water container for leaks and check volume, top up if necessary. | ● | | | |

**Fork positioner**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment lubrication; clean and lubricate if necessary. | ● | | | |

**Optional equipment**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check that optional equipment such as mirrors, storage compartments, grips, windscreen wipers and washing systems etc. are working correctly and check for damage. | ● | | | |

## 10.2 Customer service

### 10.2.1 Standard equipment

| Brakes | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test brakes. | | | ● | |
| 2 | Check brake mechanism, adjust and lubricate if necessary. | | | ● | |
| 3 | Check the brake oil level (mineral oil) | | | ● | |
| 4 | Replace brake system mineral oil. | | | | ● |
| 5 | Check connections and lines for leaks. | | | ● | |

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test cable and motor attachments. | | | ● | |
| 2 | Test warning and safety devices in accordance with operating instructions. | | | ● | |
| 3 | Test displays and controls. | | | ● | |
| 4 | Test micro switch and adjust if necessary. | | | ● | |
| 5 | Test Emergency Disconnect switch. | | | ● | |
| 6 | Check contactors and/or relays. | | | ● | |
| 7 | Test fan and check for dirt and damage. | | | ● | |
| 8 | Check fuse ratings. | | | ● | |
| 9 | Carry out a frame leakage test. | | | ● | |
| 10 | Check electric wiring for damage (insulation damage, connections). Make sure wire connections are secure. | | | ● | |

| Power Supply | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check battery cable connections are secure, grease terminals if necessary. | | | ● | |
| 2 | Check battery and battery components. | | | ● | |
| 3 | Check acid density and battery voltage. | | | ● | |
| 4 | Check battery connector for damage, test it and make sure it is secure. | | | ● | |

| Travel | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check transmission oil level or grease filling of the transmission and top up if necessary. | | | ● | |
| 2 | Test motor fan and check for damage. | | | ● | |
| 3 | Clean suction filter of engine fan. | | | ● | |
| 4 | Check transmission for noise and leakage. | | | ● | |
| 5 | Replace transmission oil. | | | ● | |
| 6 | Check the wheels for wear and damage. Make sure they are tight and check the compressed air if necessary. | | | ● | |
| 7 | Check wheel suspension and attachment. | | | ● | |

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check chassis and screw connections for damage. | | | ● | |
| 2 | Check doors and/or covers. | | | ● | |
| 3 | Check labels are legible and complete. | | | ● | |
| 4 | Check attachment and setting function of the driver's seat. | | | ● | |
| 5 | Check condition of the driver’s seat. | | | ● | |
| 6 | Test the gas struts on the battery cover and check for damage. | | | ● | |
| 7 | Check attachment of the counterweight. | | | ● | |
| 8 | Check mast attachment / mounting. | | | ● | |
| 9 | Check trailer coupling or tow mechanism stop. | | | ● | |
| 10 | Check overhead guard and / or cab are secure and check for damage. | | | ● | |
| 11 | Check operator mat and steps are non-slip and damage-free. | | | ● | |
| 12 | Test driver's seat restraint system and check for damage. | | | ● | |

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test "hydraulic" controls and make sure the labels are present, legible and complete. | | | ● | |
| 2 | Test hydraulic controls and check they are assigned to the correct functions. | | | ● | |
| 3 | Check cylinders and piston rods for damage and leaks, and make sure they are secure. | | | ● | |
| 4 | Test hose guide and check for damage. | | | ● | |
| 5 | Check settings and wear levels of slide pieces and stops and adjust the slide pieces if necessary. | | | ● | |
| 6 | Check load chain setting and tension if necessary. | | | ● | |
| 7 | Check load chain lubrication and lubricate if necessary. | | | ● | |
| 8 | Check lateral clearance of the mast connections and the fork carriage. | | | ● | |
| 9 | Visually inspect the mast rollers and check contact surface wear level. | | | ● | |
| 10 | Check running surfaces of the mast for wear and damage, and lubricate if necessary. | | | ● | |
| 11 | Test hydraulic system. | | | ● | |
| 12 | Replace hydraulic oil filter, ventilation/discharge filter. | | | ✳ | ● |
| 13 | Check cylinders, hydraulic ports, lines and hoses for leaks and damage. | | | ● | |
| 14 | Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage. | | | ● | |
| 15 | Test emergency lowering system. | | | ● | |

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 16 | Check hydraulic oil level and top up if necessary. | | | ● | |
| 17 | Test relief valve and adjust if necessary. | | | ● | |
| 18 | Replace hydraulic oil. | | | | ● |
| 19 | Check forks or load handler for wear and damage. | | | ● | |
| 20 | Check tilt cylinders and mounting. | | | ● | |

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

| Steering | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test hydraulic steering and its components. | | | ● | |
| 2 | Test the hydraulic steering for leaks. | | | ● | |
| 3 | Check steering hoses and lines. | | | ● | |
| 4 | Check steering axle and steering knuckle for wear and damage. | | | ● | |
| 5 | Check stub axle and adjust if necessary. | | | ● | |
| 6 | Check mechanical parts of steering column. | | | ● | |

### 10.2.2 Optional equipment

**Discharge strap**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check anti-static discharge strap is present and not damaged. | | | ● | |

**Audible warning devices**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the buzzer / warning alarm, check for damage and make sure it is secure. | | | ● | |

**Trailer coupling**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check trailer coupling or tow mechanism stop. | | | ● | |

**Aquamatik**

| Power Supply | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test Aquamatik plug, hose connections and float and check for leaks. | | | ● | |
| 2 | Test flow indicator and check for leaks. | | | ● | |

**Work Platform**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |

**Work lights**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test lighting. | | | ● | |

**Battery refill system**

| Power Supply | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test battery refill system and check for leaks. | | | ● | |

**Strobe light/beacon**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test strobe light / beacon and check for damage. | | | ● | |

**Data recorder**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check data recorder is secure and check for damage. | | | ● | |

**Radio data**

| System Components | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test scanner and terminal, check for damage and make sure they are secure and clean. | | | ● | |
| 2 | Check fuse ratings. | | | ● | |
| 3 | Check wiring is secure and check for damage. | | | ● | |

**Optional electrical equipment**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the electrical optional equipment and check for damage. | | | ● | |

**Electrolyte recirculation**

| Power Supply | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Replace air filter wadding. | | | ● | |
| 2 | Check hose connections and test the pump. | | | ● | |

**Overhead guard cover**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check overhead guard cover is present, check for damage and make sure it is secure. | | | ● | |

**Fire extinguisher**

| Agreed performance levels | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check fire extinguisher is present, secure and check test interval. | | | | ● |

**Belt lock control**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the belt lock control and check for damage. | | | ● | |

**Heating**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check exhaust manifold for leaks and damage. | | | ● | |
| 2 | Test diesel heating. | | | ● | |
| 3 | Check electrical connections are secure and check for insulation damage. | | | ● | |
| 4 | Test the heating. | | | ● | |
| 5 | Check fuel pump for leaks and damage and make sure it is secure. | | | ● | |
| 6 | Check heating vent filter for contamination and clean if necessary. | | | ● | |
| 7 | Check hoses for leaks and damage and make sure they are secure. | | | ● | |
| 8 | Check reservoir for leaks and damage and make sure it is secure. | | | ● | |
| 9 | Check warm air outlet element for leaks and damage and make sure it is secure. | | | ● | |
| 10 | Test restraint system sensor system and check for damage. | | | ● | |

**Clamping device**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the acknowledgement key. | | | ● | |
| 2 | Check axial play of the front and rear rollers and adjust if necessary. | | | ● | |
| 3 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |
| 4 | Test attachment, check settings and check for damage. | | | ● | |
| 5 | Check sliding blocks are complete. | | | ● | |

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 6 | Check attachment bearing points, guides and stops for wear and damage, grease and clean these components. | | | ● | |
| 7 | Check attachment lubrication; clean and lubricate if necessary. | | | ● | |
| 8 | Check hydraulic ports and tighten if necessary. | | | ● | |
| 9 | Check cylinder seals. | | | ● | |
| 10 | Check cylinder piston rods and bushings. | | | ● | |

**Crane hook**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |

**Load backrest**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |

**Restraint system / SUN protector**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check electric wiring for damage (insulation damage, connections). Make sure wire connections are secure. | | | ● | |

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check electrical connections are secure and not damaged. | | | ● | |
| 2 | Make sure restraint system is complete, test operation and check for damage. | | | ● | |
| 3 | Test restraint system sensor system and check for damage. | | | ● | |

**Safety restraint system / SUN protector**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Make sure restraint system is complete, test operation and check for damage. | | | ● | |

**Impact sensor**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check impact sensor is secure and check for damage. | | | ● | |

**Sideshifter**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check axial play of the front and rear rollers and adjust if necessary. | | | ● | |
| 2 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |
| 3 | Test attachment, check settings and check for damage. | | | ● | |
| 4 | Check sliding blocks are complete. | | | ● | |
| 5 | Check attachment bearing points, guides and stops for wear and damage, grease and clean these components. | | | ● | |
| 6 | Check attachment lubrication; clean and lubricate if necessary. | | | ● | |
| 7 | Check hydraulic ports and tighten if necessary. | | | ● | |
| 8 | Test the sideshifter, check settings and check for damage. | | | ● | |
| 9 | Check cylinder seals. | | | ● | |
| 10 | Check cylinder piston rods and bushings. | | | ● | |

**Seat heating**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check electric wiring for damage (insulation damage, connections). Make sure wire connections are secure. | | | ● | |

**Road traffic approval (StVZO)**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test lighting. | | | ● | |

**Telescopic forks**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |
| 2 | Test attachment, check settings and check for damage. | | | ● | |
| 3 | Check attachment bearing points, guides and stops for wear and damage, grease and clean these components. | | | ● | |
| 4 | Check attachment lubrication; clean and lubricate if necessary. | | | ● | |
| 5 | Check hydraulic ports and tighten if necessary. | | | ● | |
| 6 | Check cylinder seals. | | | ● | |
| 7 | Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage. | | | ● | |
| 8 | Check piston and piston rod for damage, check setting and adjust if necessary. | | | ● | |

**Boom**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |

**Video system**

| System Components | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check wiring is secure and check for damage. | | | ● | |
| 2 | Test the camera, make sure it is secured and clean. | | | ● | |
| 3 | Test the monitor, make sure it is secured and clean. | | | ● | |

**Weigher sensors / switches**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test weigher system and check for damage. | | | ● | |

**Weather-proof system**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check fuse ratings. | | | ● | |

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test the windscreen heating and check for damage. | | | ● | |
| 2 | Test the doors and check for damage. | | | ● | |

**Wiper/washer system**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check wiper water container for leaks and check volume, top up if necessary. | | | ● | |
| 2 | Test windscreen wipers and check for damage, replace if necessary. | | | ● | |

**Fork adjuster**

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check axial play of the front and rear rollers and adjust if necessary. | | | ● | |
| 2 | Check attachment is properly secured to the truck and the supporting elements. | | | ● | |
| 3 | Test attachment, check settings and check for damage. | | | ● | |
| 4 | Check sliding blocks are complete. | | | ● | |
| 5 | Check attachment bearing points, guides and stops for wear and damage, grease and clean these components. | | | ● | |

| Hydraulic Operations | | W | A | B | C |
|---|---|---|---|---|---|
| 6 | Check attachment lubrication; clean and lubricate if necessary. | | | ● | |
| 7 | Check hydraulic ports and tighten if necessary. | | | ● | |
| 8 | Test the fork positioner and check for damage. | | | ● | |
| 9 | Check cylinder seals. | | | ● | |
| 10 | Check cylinder piston rods and bushings. | | | ● | |

**Access module**

| Electrical System | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Test access module, check for damage and make sure it is secure. | | | ● | |

**Optional equipment**

| Chassis and Superstructure | | W | A | B | C |
|---|---|---|---|---|---|
| 1 | Check that optional equipment such as mirrors, storage compartments, grips, windscreen wipers and washing systems etc. are working correctly and check for damage. | | | ● | |

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# A Traction Battery Appendix

## Contents

# 1 Correct Use and Application

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

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

# 2 Data plate


| | |
|---|---|
| 1 | Battery name |
| 2 | Battery type |
| 3 | Production week/year manf. |
| 4 | Serial number |
| 5 | Supplier number |
| 6 | Rated voltage |
| 7 | Rated capacity |
| 9 | Battery weight in kg |
| 8 | Number of cells |
| 15 | Electrolyte volume in litres |
| 10 | Battery number |
| 11 | Manufacturer |
| 13 | Manufacturer's logo |
| 12 | CE mark only for batteries beyond 75 volts |
| 14 | Safety instructions and warning information |

# 3 Safety Instructions, Warning Indications and other Notes

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

# 4 Lead acid batteries with armour plated cells and liquid electrolyte

## 4.1 Description

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

**Electrolyte**

The rated density of the electrolyte assumes a temperature of 30°C and the rated electrolyte level is fully charged. Higher temperatures will reduce, lower temperatures will increase the electrolyte density. The adjustment factor is ± 0.0007 kg/l per K, e.g. electrolyte density 1.28 kg/l at 45°C corresponds to a density of 1.29 kg/l at 30°C.

The electrolyte must conform to DIN 43530 Part 2 purity regulations.

### 4.1.1 Battery nominal data

| | | |
|---|---|---|
| 1. | Product | Traction battery |
| 2. | Nominal voltage | 2.0 V x no. of cells |
| 3. | Rated capacity C5 | See data plate |
| 4. | Discharge current | C5/5h |
| 5. | Nominal electrolyte density[1] | 1.29 kg/l |
| 6. | Nominal temperature[2] | 30 °C |
| 7. | System rated electrolyte level | up to "Max" electrolyte level marking |
| | Limit temperature[3] | 55°C |

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

## 4.2 Operation

### 4.2.1 Commissioning unfilled batteries

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

### 4.2.2 Commissioning filled and charged batteries

***Checks and operations to be performed before starting daily work***

*Procedure*

- Make sure the battery is in physically good condition.
- Make sure the terminals are correct (positive to positive and negative to negative) and check that contacts on the battery terminal conducting system are secure.
- Check the terminal screw torques (M10 = 23 ±1 Nm) of the terminal conductors and connectors.
- Charge up the battery.
- Check the electrolyte level.

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

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

*Checks completed.*

### 4.2.3 Discharging the battery

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

### 4.2.4 Charging the battery

**⚠ WARNING!**

**The gases produced during charging can cause explosions**

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

- ▶ Always disconnect the charger and truck before connecting or disconnecting the charger and battery.
- ▶ The charger must be adapted to the battery in terms of voltage, charge capacity and battery technology.
- ▶ Before charging, check all cables and plug connections for visible signs of damage.
- ▶ Ventilate the room in which the truck is being charged.
- ▶ Battery cell surfaces must remain exposed during charging in order to ensure sufficient ventilation, see truck operating instructions, chapter D, Charging the Battery.
- ▶ Do not smoke and avoid naked flames when handling batteries.
- ▶ Wherever an industrial truck is parked for charging there must be no inflammable material or consumables capable of creating sparks within a minimum distance of 2 m from the truck.
- ▶ Fire protection equipment must be available.
- ▶ Do not place any metallic objects on the battery.
- ▶ Always follow the safety regulations of the battery and charger station manufacturers.

***NOTE***

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

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

***Charging the battery***

*Requirements*

– Electrolyte temperature min. 10°C to max. 45°C

*Procedure*

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

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

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

*Battery charged*

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

**Compensation charging**

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

➔ Compensation charging should be carried out weekly.

**Trickle charging**

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

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

## 4.3 Servicing lead-acid batteries with armour plated cells

**Water quality**

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

### 4.3.1 Daily

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

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

### 4.3.2 Weekly

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

### 4.3.3 Monthly

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

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

### 4.3.4 Annually

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

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

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

## 5.1 Description

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

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

**Electrolyte**

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

### 5.1.1 Battery nominal data

| | | |
|---|---|---|
| 1. | Product | Traction battery |
| 2. | Nominal voltage | 2.0 V x no. of cells |
| 3. | Rated capacity C5 | See data plate |
| 4. | Discharge current | C5/5h |
| 5. | Rated temperature | 30 °C |
| | Limit temperature[1] | 45°C, not permissible as operating temperature. |
| 6. | Rated density of the electrolyte | Cannot be measured |
| 7. | System rated electrolyte level | Cannot be measured |

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

## 5.2 Operation

### 5.2.1 Commissioning

***Checks and operations to be performed before starting daily work***

*Procedure*

- Make sure the battery is in physically good condition.
- Make sure the terminals are correct (positive to positive and negative to negative) and check that contacts on the battery terminal conducting system are secure.
- Check the terminal screw torques (M10 = 23 ±1 Nm) of the terminal conductors and connectors.
- Re-charge the battery.
- Charge the battery.

*Check completed.*

### 5.2.2 Discharging the battery

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

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

### 5.2.3 Charging the battery

**⚠ WARNING!**

**The gases produced during charging can cause explosions**

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

- ▶Always disconnect the charger and truck before connecting or disconnecting the charger and battery.
- ▶The charger must be adapted to the battery in terms of voltage, charge capacity and battery technology.
- ▶Before charging, check all cables and plug connections for visible signs of damage.
- ▶Ventilate the room in which the truck is being charged.
- ▶Battery cell surfaces must remain exposed during charging in order to ensure sufficient ventilation, see truck operating instructions, chapter D, Charging the Battery.
- ▶Do not smoke and avoid naked flames when handling batteries.
- ▶Wherever an industrial truck is parked for charging there must be no inflammable material or consumables capable of creating sparks within a minimum distance of 2 m from the truck.
- ▶Fire protection equipment must be available.
- ▶Do not place any metallic objects on the battery.
- ▶Always follow the safety regulations of the battery and charger station manufacturers.

***NOTE***

**Charging the battery incorrectly can result in material damage.**

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

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

***Charging the battery***

*Requirements*

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

*Procedure*

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

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

*Battery charged*

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

**Compensation charging**

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

➔ Compensation charging should be carried out weekly.

**Trickle charging**

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

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

➔ Avoid trickle charging with PzV batteries.

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

➔ Do not add water!

### 5.3.1 Daily

– Charge the battery after each discharge.

### 5.3.2 Weekly

– Visually inspect for dirt and physical damage.

### 5.3.3 Every three months

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

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

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

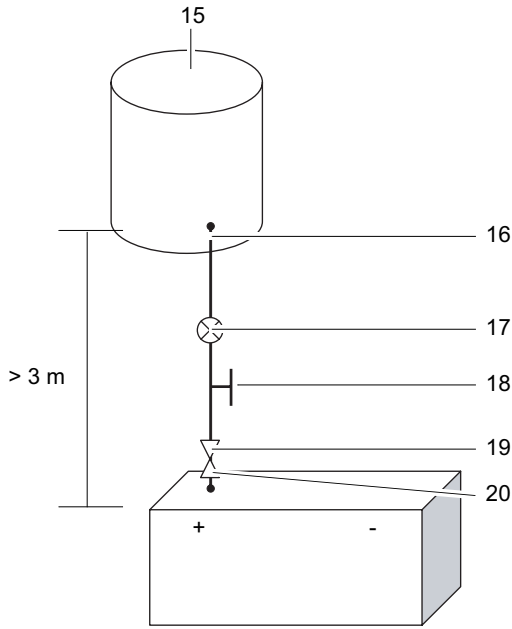
### 5.3.4 Annually

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

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

# 6 Aquamatik water replenishment system

## 6.1 Water replenishment system design




| | |
|---|---|
| 15 | Water container |
| 16 | Tap connection with ball cock |
| 17 | Flow indicator |
| 18 | Shut-off cock |
| 19 | Locking coupling |
| 20 | Battery lock connector |

## 6.2 Functional Description

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

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

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

## 6.3 Adding water

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

## 6.4 Water pressure

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

**Water drop**

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

**Pressure water**

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

## 6.5 Filling time

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

## 6.6 Water quality

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

## 6.7 Battery tubing

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

## 6.8 Operating temperature

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

## 6.9 Cleaning measures

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

## 6.10 Service mobile vehicle

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

# 7 Electrolyte circulation

## 7.1 Functional Description

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

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

**Pump**

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

**Battery connection**

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

**Pressure monitoring module**

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

In the event of malfunctions such as:

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

a visual error message appears on the charger.

***NOTE***

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

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

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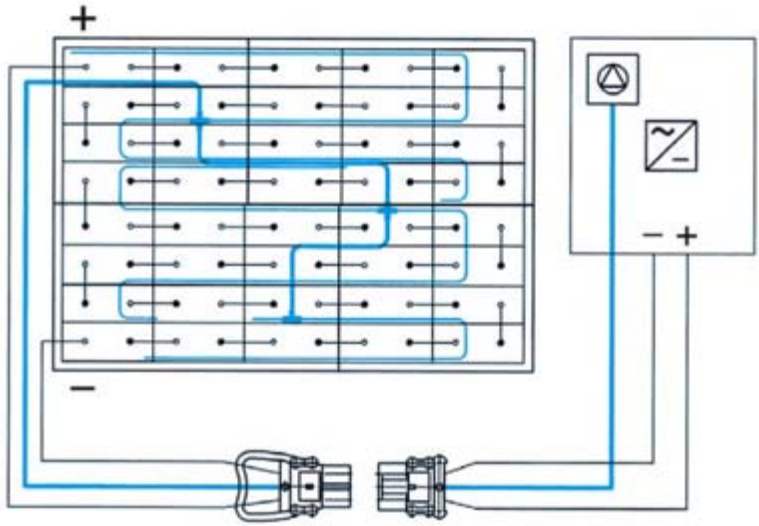
**Schematic illustration**

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



# 8 Cleaning batteries

Batteries and trays must be cleaned in order to

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

When cleaning the batteries make sure that:

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

***Cleaning the battery with a high pressure cleaner***

*Requirements*

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

*Procedure*

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

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

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

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

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

*Battery cleaned.*

# 9 Storing the battery

**NOTE**

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

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

– Monthly compensation charge for PzS and PzB batteries or 3-monthly full charge for PzV batteries.
– Trickle charge for a charge voltage of 2.23 volts x no. of cells for PzS, PzM and PzB batteries or 2.25 volts x no. of cells for PzV batteries.

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

# 10 Troubleshooting

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

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

# 11 Disposal

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

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