# EFG 213-320

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Operating Instructions

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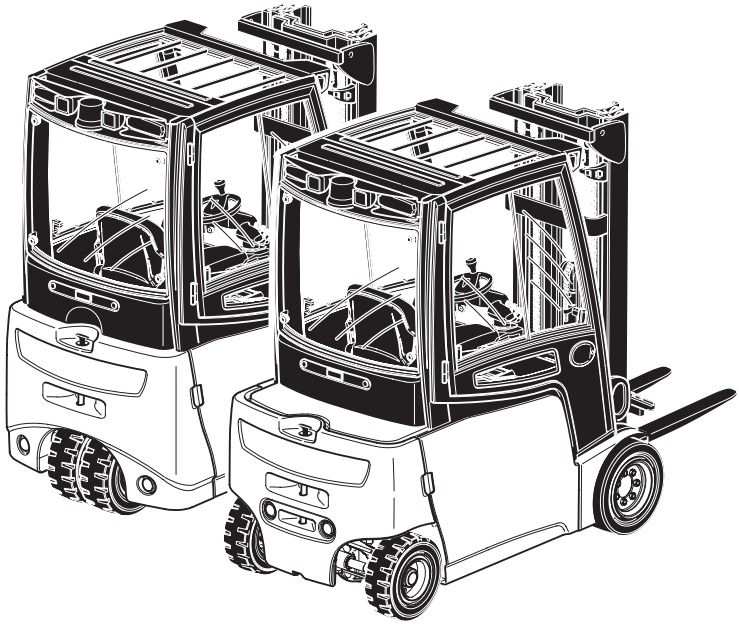

JUNGHEINRICH

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# Declaration of Conformity

CE

Jungheinrich AG, Am Stadtrand 35, D-22047 Hamburg
Manufacturer or his authorized representative in the Community

| Type | Option | Serial No. | Year of construction |
|---|---|---|---|
| EFG 213<br>EFG 215<br>EFG 216k<br>EFG 216<br>EFG 218k<br>EFG 218<br>EFG 220<br>EFG 316k<br>EFG316<br>EFG318k<br>EFG 318<br>EFG 320 | | | |

**Additional information**

**Authorised signatory**

**Date**

**(GB) EU Declaration of Conformity**

The signatories hereby certify that the specified powered industrial truck conforms to the EU Directive 2006/42/EC (Machine Directive) and 2004/108/EEC (Electro-Magnetic Compatibility, EMC) including their amendments as translated into national legislation of the member countries. The signatories are individually empowered in each case to compile the technical documentation.

# Foreword

The present ORIGINAL OPERATING INSTRUCTIONS are designed to provide sufficient instruction for the safe operation of the industrial truck. The information is provided clearly and concisely. The chapters are arranged by letter. Each chapter starts with page 1. The page identification consists of a chapter letter and a page number.
For example: Page B 2 is the second page in chapter B.

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

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


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

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

Used before notices and explanations.

● Used to indicate standard equipment.

○ Used to indicate optional equipment.

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



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## D Battery Maintenance, Charging & Replacement



## E Operation

# F Industrial Truck Maintenance

# 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.

If using a battery with closed EPzV and EPzV ironclad plates, this must first be discussed with the manufacturer.

# A Correct Use and Application

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

The truck described in the present operating instructions is an industrial truck designed for lifting and transporting loads.
It must be used, operated and serviced in accordance with the present instructions. All other types of use lie beyond the scope of application and can result in damage to personnel, the truck or property. In particular, avoid overloading the truck with loads which are too heavy or placed on one side. The data plate attached to the truck and the load diagram are binding with regard to the maximum load capacity. The owner must ensure that any damaged and/or illegible load diagrams are replaced. The industrial truck must not be used in fire or explosion endangered areas, or areas threatened by corrosion or excessive dust.

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

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

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

**Trailing and towed loads:** The truck may only be used for trailing or towed loads for which the truck has been approved.

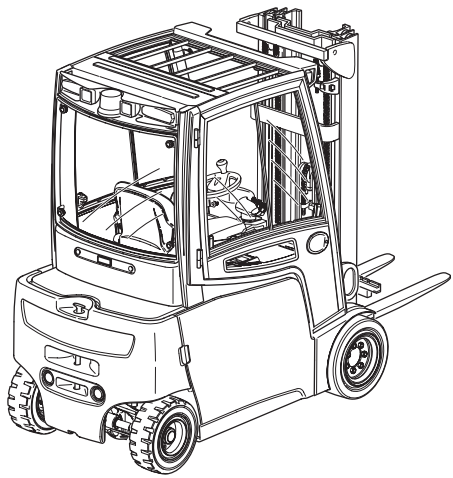
# B Truck Description

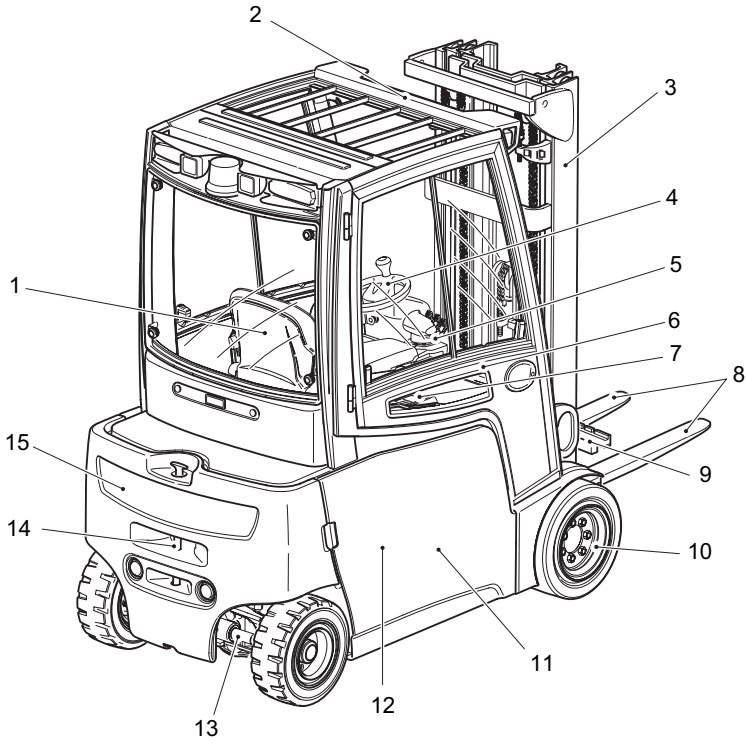
## 1 Application

The EFG is a three- or four-wheel electric sit-down counterbalanced truck. It is cantilevered and the load handler mounted on the front of the truck can unload lorries without hindrance and deposit the load on ramps or in aisles. Closed bottom pallets can also be lifted.

Truck models and maximum capacity:

| Type | Max. capacity | Load centre of gravity |
|---|---|---|
| EFG 213 | 1,300 kg | 500 mm |
| EFG 215 | 1500 kg | 500 mm |
| EFG 216k | 1600 kg | 500 mm |
| EFG 216 | 1600 kg | 500 mm |
| EFG 218k | 1800 kg | 500 mm |
| EFG 218 | 1800 kg | 500 mm |
| EFG 220 | 2000 kg | 500 mm |
| EFG 316k | 1600 kg | 500 mm |
| EFG 316 | 1600 kg | 500 mm |
| EFG 318k | 1800 kg | 500 mm |
| EFG 318 | 1800 kg | 500 mm |
| EFG 320 | 2000 kg | 500 mm |






| Item | | Description | Item | | Description |
|---|---|---|---|---|---|
| 1 | ● | Driver's seat | 8 | ● | Load handler |
| 2 | ● | Overhead guard | 9 | ● | Fork carriage |
| 3 | ● | Mast | 10 | ● | Drive axle |
| 4 | ● | Steering wheel | 11 | ● | Battery door |
| | ○ | Multifunction steering wheel | 12 | ○ | On-board charger (in battery compartment) |
| 5 | ● | SOLOPILOT | 13 | ● | Steering axle |
| | ○ | MULTIPILOT | 14 | ● | Trailer coupling |
| 6 | ● | Dashboard control panel | 15 | ● | Counterweight |
| 7 | ● | EMERGENCY DISCONNECT switch | | | |

● = Standard equipment ○ = Optional equipment

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## 2.1 Truck

**Safety mechanisms:** The overhead guard (2) protects the driver from falling objects. Pressing the EMERGENCY DISCONNECT switch rapidly disconnects all electrical functions in hazardous situations. Travelling and lifting can only be activated when the driver is seated. The dashboard control panel (6) displays the truck information.

**Steering:** The travel speed reduces as a function of the steering angle ("CurveControl"). The steering angle is shown in the display.

**Operator position:** The driver's seat (1) is a "comfort" seat, the steering column is adjustable. There are storage facilities for paper and the driver's personal items.
The control and warning displays on the dashboard control panel (6) enable the system to be monitored during operation, thereby ensuring a very high level of safety.

**Electrical/Electronic System:** The driver can choose from five travel programs, depending on the load and the environment: from maximum performance to energy saving. The latest threephase system using a CAN Bus allows for rapid troubleshooting. The advanced controller is simple, safe and flexible.

**Drive System and Brakes:** The 2-motor front drive provides maximum traction to the drive wheels at all times. Each motor receives the exact power it requires in proportion to the steering angle. The wheels do not spin and energy is converted efficiently.
The mechanical disk brake which acts as a service brake is maintenance-free. Encapsulated, it allows the truck to be used even in hostile environments. The truck also brakes to a halt regeneratively via the traction motors. This minimizes energy consumption.
The parking brake is electrically actuated. It is also used for emergency braking. A warning indicator appears when the parking brake is applied.
Brake system faults are shown on the driver's display.

**Emergency Stop Safety Feature:** The emergency stop is controlled by the steering and traction controllers. If an error is detected the truck automatically brakes to a halt. Control displays on the driver's display indicate the emergency stop. Every time the truck is switched on, the system performs a self-diagnosis which only releases the parking brake (emergency stop) if the functionality test is positive.

**Hydraulic System:** All functions must be performed sensitively. To ensure greater efficiency, a hydraulic unit and a steering motor operate independently of each other. The micro pressure filter can be replaced from the top (without spilling hydraulic oil).

**Mast:** The maximum strength steel sections are narrow, allowing for good fork visibility in particular with the three-stage mast. The lift rails and the fork carriage run on permanently-lubricated and hence maintenance-free angled rollers.

## 3 Standard Version Specifications

Technical specification details in accordance with VDI 2198. Technical modifications and additions reserved.

### 3.1 EFG 213-220 performance data

| | Description | EFG | | | | | |
|---|---|---|---|---|---|---|---|
| | | 213 | 215 | 216k<br>216 | 218k<br>218 | 220 | |
| Q | Capacity<br>(where C = 500 mm) *) | 1300 | 1500 | 1600 | 1800 | 2000 | kg |
| C | Load centre of gravity distance | 500 | 500 | 500 | 500 | 500 | mm |
| | Travel speed<br>with / without load | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | km/h |
| | Raise lift speed<br>with / without load | 0.48/0.60 | 0.46/0.60 | 0.49/0.60 | 0.44/0.55 | 0.40/0.55 | m/s |
| | Lower lift speed<br>with / without load | 0.55/0.55 | 0.55/0.55 | 0.55/0.55 | 0.55/0.55 | 0.55/0.55 | m/s |
| | Gradeability<br>(30 min)<br>with / without load | 7.6/12.5 | 7.3/12.3 | 7.3/12.3<br>7.0/11.5 | 6.2/10.7<br>5.9/10.5 | 5.7/10.4 | % |
| | Max. gradeability<br>(5 min)<br>with / without load | 28.0/35.0 | 27.0/35.0 | 27.0/35.0 | 26.0/35.0<br>25.0/35.0 | 24.0/35.0 | % |
| | Acceleration (10m)<br>with / without load | 3.6/3.2 | 3.8/3.4 | 3.8/3.4 | 3.9/3.5 | 4.0 / 3.5 | s |

*) with vertical mast

### 3.2 EFG 316-320 performance data

| | Description | EFG | | | | | |
|---|---|---|---|---|---|---|---|
| | | **316k** | **316** | **318k** | **318** | **320** | |
| Q | Capacity (where C = 500 mm) *) | 1600 | 1600 | 1800 | 1800 | 2000 | kg |
| C | Load centre of gravity distance | 500 | 500 | 500 | 500 | 500 | mm |
| | Travel speed with / without load | 17.0/17.0 | 17.0/17.0 | 17.0/17.0 | 17.0/17.0 | 17.0/17.0 | km/h |
| | Raise lift speed with / without load | 0.49/0.60 | 0.49/0.60 | 0.44/0.55 | 0.44/0.55 | 0.40/0.55 | m/s |
| | Lower lift speed with / without load | 0.55/0.55 | 0.55/0.55 | 0.55/0.55 | 0.55/0.55 | 0.55/0.55 | m/s |
| | Gradeability (30 min) with / without load | 7.3/12.3 | 7/11.5 | 6.2/10.7 | 5.9/10.5 | 5.7/10.4 | % |
| | Max. gradeability (5 min rating) with / without load | 27/35 | 27/35 | 26/35 | 25/35 | 24/35 | % |
| | Acceleration (10m) with / without load | 3.8/3.4 | 3.8/3.4 | 3.9/3.5 | 3.9/3.5 | 4/3.5 | s |

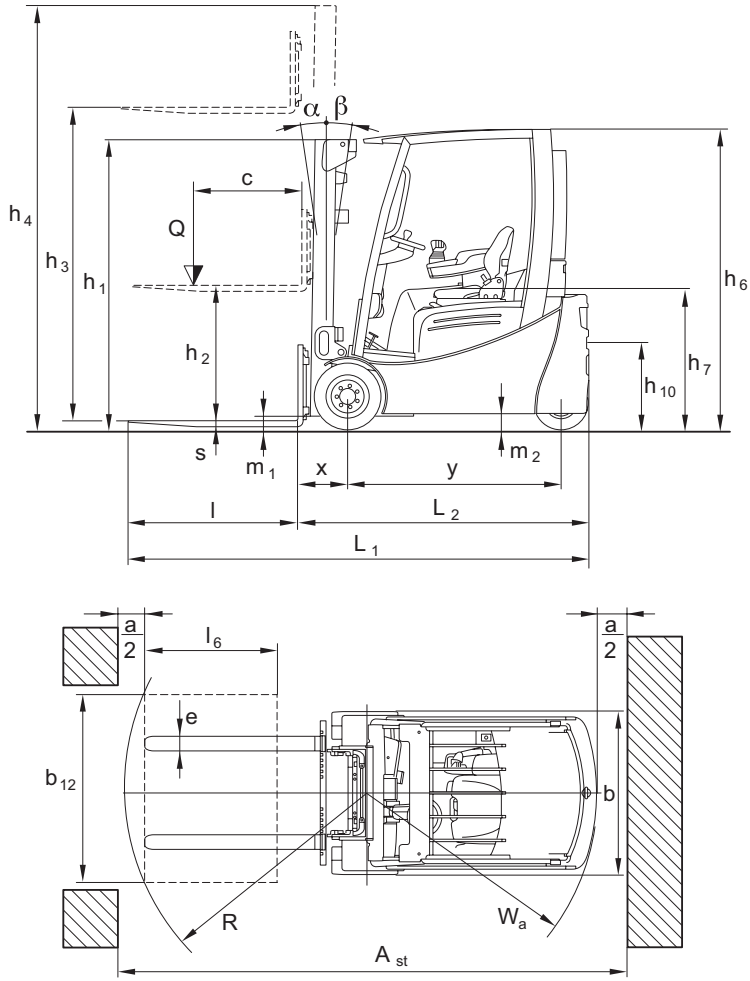
*) with vertical mast

### 3.3 EFG 213-220 dimensions

All dimensions in mm

| | Description | EFG | | | | |
|---|---|---|---|---|---|---|
| | | 213 | 215 | 216k<br>216 | 218k<br>218 | 220 |
| $h_1$ | Mast height retracted | 2000 | 2000 | 2000 | 2000 | 2000 |
| $h_2$ | Free lift | 150 | 150 | 150 | 150 | 150 |
| $h_3$ | Lift | 3000 | 3000 | 3000 | 3000 | 3000 |
| $h_4$ | Mast height extended | 3560 | 3560 | 3560 | 3587 | 3587 |
| $h_6$ | Overhead guard height | 2040 | 2040 | 2040 | 2040 | 2040 |
| $h_7$ | Seat height | 920 | 920 | 920 | 920 | 920 |
| $h_{10}$ | Tow height | 560 | 560 | 560 | 560 | 560 |
| $L_1$ | Length including forks | 2924 | 2924 | 3037<br>3145 | 3037<br>3145 | 3145 |
| $L_2$ | Length incl. fork shank [1)] | 1774 | 1774 | 1887<br>1995 | 1887<br>1995 | 1995 |
| b1 | Overall width | 1060 | 1060 | 1060 | 1120 | 1120 |
| e | Fork width | 100 | 100 | 100 | 100 | 100 |
| $m_1$ | Ground clearance<br>with load below mast | 80 | 80 | 80 | 80 | 80 |
| $m_2$ | Centre wheel base ground clearance | 100 | 100 | 100 | 100 | 100 |
| Ast | Working Aisle Width<br>800 x 1200 longitudinal pallets | 3226 | 3226 | 3339<br>3446 | 3339<br>3446 | 3446 |
| Ast | Working Aisle Width<br>1000 x 1200 traverse pallets | 3104 | 3104 | 3216<br>3323 | 3216<br>3323 | 3323 |
| $W_a$ | Turning radius | 1440 | 1440 | 1548<br>1655 | 1548<br>1655 | 1655 |
| x | Load distance [1)] | 335 | 335 | 340 | 340 | 340 |
| y | Wheel base | 1249 | 1249 | 1357<br>1465 | 1357<br>1465 | 1465 |

[1)] = + 25 mm DZ mast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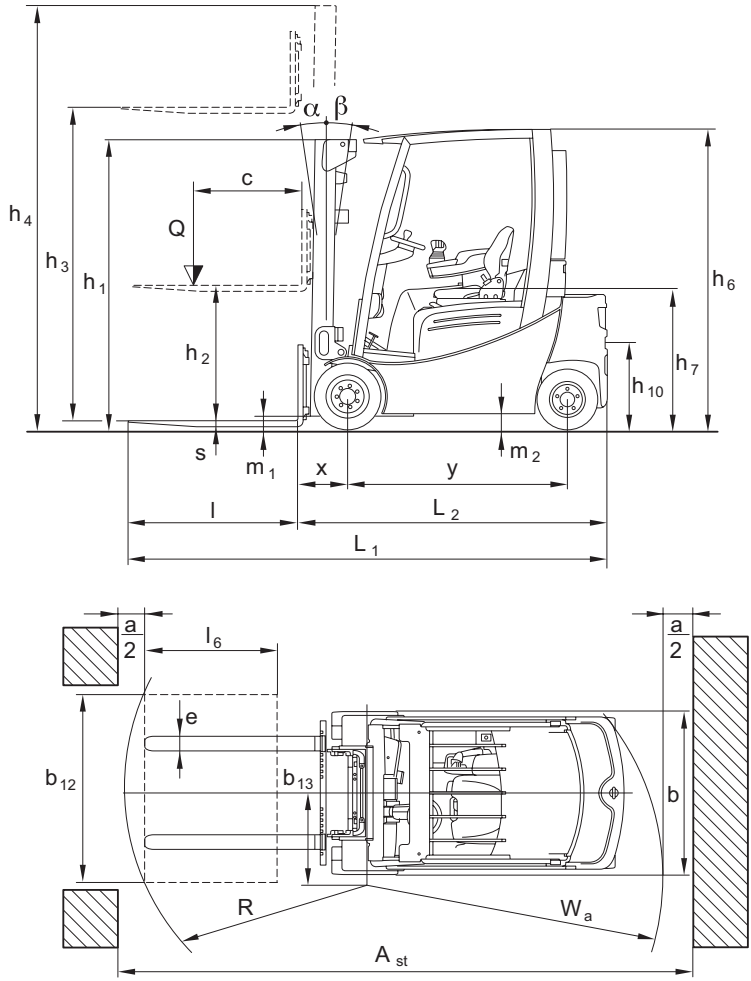
### 3.4 EFG 316-320 dimensions

All dimensions in mm

| | Description | EFG | | | | |
|---|---|---|---|---|---|---|
| | | **316k** | **316** | **318k** | **318** | **320** |
| $h_1$ | Mast height retracted | 2000 | 2000 | 2000 | 2000 | 2000 |
| $h_2$ | Free lift | 150 | 150 | 150 | 150 | 150 |
| $h_3$ | Lift | 3000 | 3000 | 3000 | 3000 | 3000 |
| $h_4$ | Mast height extended | 3560 | 33560 | 3587 | 3587 | 3587 |
| $h_6$ | Overhead guard height | 2040 | 2040 | 2040 | 2040 | 2040 |
| $h_7$ | Seat height | 920 | 920 | 920 | 920 | 920 |
| $h_{10}$ | Tow height | 410/ 580 | 410/ 580 | 410/ 580 | 410/ 580 | 410/ 580 |
| $L_1$ | Length including forks | 3140 | 3248 | 3140 | 3248 | 3248 |
| $L_2$ | Length including fork shank | 1990 | 2098 | 1990 | 2098 | 2098 |
| $b_1$ | Overall width | 1060 | 1060 | 1120 | 1120 | 1120 |
| e | Fork width | 100 | 100 | 100 | 100 | 100 |
| $m_1$ | Ground clearance with load below mast | 80 | 80 | 80 | 80 | 80 |
| $m_2$ | Centre wheel base ground clearance | 100 | 100 | 100 | 100 | 100 |
| Ast | Working Aisle Width 800 x 1200 longitudinal pallets | 3599 | 3725 | 3599 | 3701 | 3701 |
| Ast | Working Aisle Width 1000 x 1200 traverse pallets | 3403 | 3526 | 3403 | 3526 | 3526 |
| $W_a$ | Turning radius | 1859 | 1985 | 1859 | 1985 | 1985 |
| x | Load distance [1)] | 340 | 340 | 340 | 340 | 340 |
| y | Wheel base | 1400 | 1508 | 1400 | 1508 | 1508 |

[1)] = + 25 mm DZ mast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### 3.5 EFG 213-220 weights

All dimensions in kg

| Description | EFG | | | | |
|---|---|---|---|---|---|
| | 213 | 215 | 216k<br>216 | 218k<br>218 | 220 |
| Truck weight (including battery) | 2733 | 2978 | 3000<br>3057 | 3256<br>3207 | 3382 |
| Front axle load (without lifting load) | 1326 | 1310 | 1411<br>1496 | 1409<br>1520 | 1501 |
| Front axle load (with lifting load) | 3545 | 3870 | 4052<br>4060 | 4380<br>4405 | 4706 |
| Rear axle load (without lifting load) | 1407 | 1668 | 1589<br>1561 | 1846<br>1686 | 1881 |
| Rear axle load (with lifting load) | 488 | 608 | 548<br>597 | 675<br>602 | 676 |

### 3.6 EFG 316-320 weights

All dimensions in kg

| Description | EFG | | | | |
|---|---|---|---|---|---|
| | 316k | 316 | 318k | 318 | 320 |
| Truck weight (including battery) | 3035 | 3001 | 3175 | 3141 | 3306 |
| Front axle load (without lifting load) | 1380 | 1493 | 1385 | 1499 | 1489 |
| Front axle load (with lifting load) | 4004 | 4043 | 4336 | 4367 | 4676 |
| Rear axle load (without lifting load) | 1655 | 1508 | 1790 | 1642 | 1817 |
| Rear axle load (with lifting load) | 631 | 558 | 638 | 574 | 630 |

### 3.7 EFG 213-220 tyres

| Description | | EFG 213-216 | EFG 218 | EFG 220 |
|---|---|---|---|---|
| Tyre size, front | SE | 18 x 7 - 8, 16 PR | 200/50 - 10 | |
| | Rubber | 18 x 7 x 12 1/8“ | | |
| | Pneumatic | 180/70 - 8<br>Diagonal,<br>16 PR; 7 bar | not available | |
| Tyre size, rear | SE | 140/55 - 9 | | |
| | Rubber | 15 x 5 x 11 1/4” | | |
| | Pneumatic | 15 x 4.5 - 8<br>Diagonal,<br>12 PR; 7 bar | not available | |

Permissible tyres: See chapter F “Forklift Truck Maintenance”. For any queries please contact your Jungheinrich customer adviser.

### 3.8 EFG 316-320 tyres

| Description | | EFG 316 | EFG 318 | EFG 320 |
|---|---|---|---|---|
| Tyre size, front | SE | 18 x 7 - 8, 16 PR | 200/50 - 10 | |
| | Rubber | 18 x 7 x 12 1/8” | 18 x 8 x 12 1/8” | |
| | Pneumatic | 180/70 - 8<br>Diagonal,<br>16 PR; 7 bar | not available | |
| Tyre size, rear | SE | 16 x 6 - 8 | | |
| | Rubber | 16 x 5 x 10 1/2” | | |
| | Pneumatic | 150/75 - 8<br>Diagonal,<br>16 PR; 7 bar | not available | |

Permissible tyres: See chapter F “Forklift Truck Maintenance”. For any queries please contact your Jungheinrich customer adviser.

### 3.9 EFG 213-320 mast versions

All dimensions in mm

| VDI 3596<br>Description | Lift<br>$h_3$ | Free lift<br>$h_2$ | | Height retracted<br>$h_1$ | Height extended<br>$h_4$ | |
|---|---|---|---|---|---|---|
| | | EFG 213/ 215/216k/ 216/316/ 316k | EFG 218k/ 218/220/ 318/318k/ 320 | | EFG 213/ 215/216k/ 216/316/ 316k | EFG 218k/ 218/220/ 318/318k/ 320 |
| ZT | 2300 | 150 | | 1650 | 2850 | 2885 |
| | 3000 | 150 | | 2000 | 3550 | 3585 |
| | 3100 | 150 | | 2050 | 3650 | 3685 |
| | 3300 | 150 | | 2150 | 3850 | 3885 |
| | 3600 | 150 | | 2300 | 4150 | 4185 |
| | 4000 | 150 | | 2500 | 4550 | 4585 |
| | 4500 | 150 | | 2800 | 5050 | 5085 |
| | 5000 | 150 | | 3050 | 5550 | 5585 |
| | 5500 | 150 | | 3400 | 6050 | 6085 |
| ZZ | 2300 | 1055 | 990 | 1605 | 2850 | 2915 |
| | 3000 | 1405 | 1340 | 1955 | 3550 | 3615 |
| | 3100 | 1455 | 1390 | 2005 | 3650 | 3715 |
| | 3300 | 1555 | 1490 | 2105 | 3850 | 3915 |
| | 3600 | 1705 | 1640 | 2255 | 4150 | 4215 |
| | 4000 | 1905 | 1840 | 2455 | 4550 | 4615 |
| DZ | 4350 | 1405 | 1340 | 1955 | 4900 | 4965 |
| | 4500 | 1455 | 1390 | 2005 | 5050 | 5115 |
| | 4800 | 1555 | 1490 | 2105 | 5350 | 5415 |
| | 5000 | 1630 | 1565 | 2180 | 5550 | 5615 |
| | 5500 | 1805 | 1740 | 2355 | 6050 | 6115 |
| | 6000 | 2005 | 1940 | 2555 | 6550 | 6615 |
| | 6500 | 2255 | 2190 | 2805 | 7050 | 7115 |

### 3.10 EN norms

EFG 213-220
noise emission level: 66 dB(A)

EFG 316-320
noise emission level: 67 dB(A)

in accordance with EN 12053 as harmonised with ISO 4871.

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

EFG 213-220 vibration: 0.53 $m/s^2$

EFG 316-320 vibration: 0.51 $m/s^2$

In accordance with EN 13059.

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

Electromagnetic compatibility (EMC)

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

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

### 3.11 Conditions of use

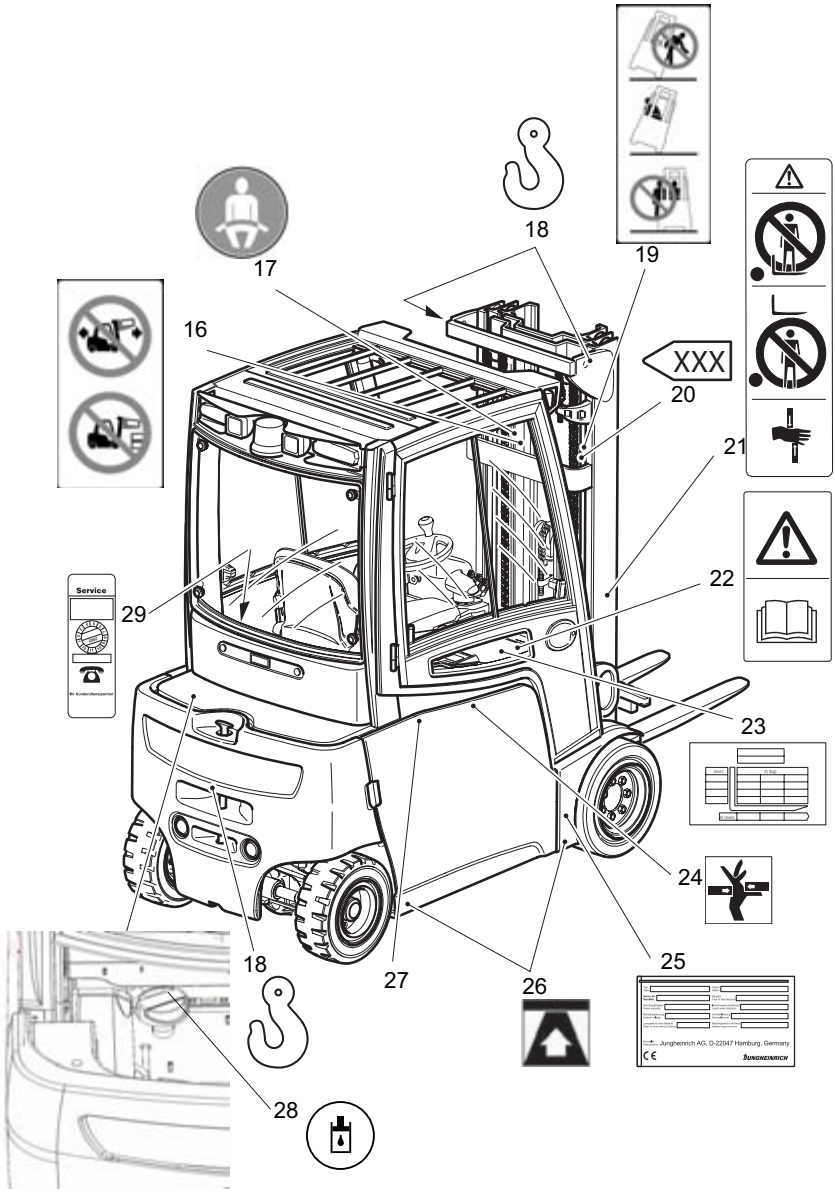
Ambient temperature

- operating at -20 °C to 40 °C

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

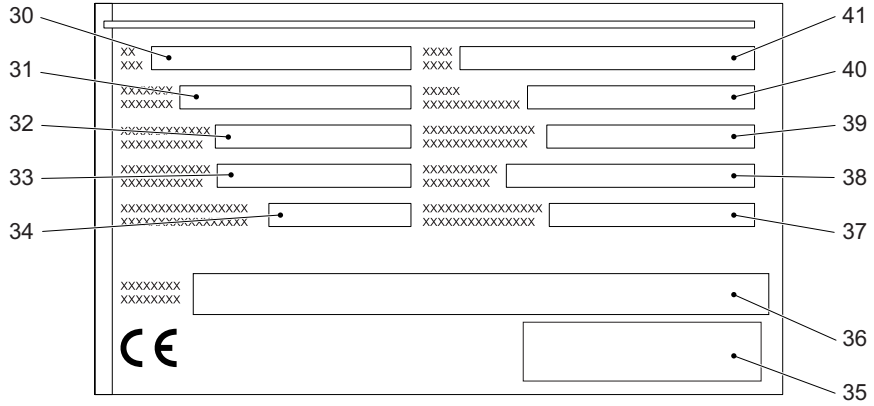
## 4 Identification points and data plates

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



| Item | Description |
|---|---|
| 16 | Do not travel with raised load or mast forward tilt with raised load |
| 17 | Wear seatbelt |
| 18 | Strap points |
| 19 | Tipover caution, no passengers |
| 20 | Lift limit |
| 21 | Do not step onto or beneath the load, risk of trapping |
| 22 | Read the operating instructions |
| 23 | Capacity |
| 24 | Risk of trapping, in chassis behind the battery door |
| 25 | Data plate |
| 26 | Jack contact points |
| 27 | Serial number, on chassis behind the battery door |
| 28 | Add hydraulic oil |
| 29 | Test sticker (○) |

## 4.1 Truck data plate




| Item | Description | Item | Description |
|---|---|---|---|
| 30 | Type | 36 | Manufacturer |
| 31 | Serial no. | 37 | Min./max. battery weight (kg) |
| 32 | Rated capacity (kg) | 38 | Output (kW) |
| 33 | Battery: Voltage (V) | 39 | Load centre of gravity (mm) |
| 34 | Net weight w.o. battery (kg) | 40 | Year of manufacture |
| 35 | Manufacturer's logo | 41 | Option |

For queries regarding the truck or ordering spare parts always quote the truck serial number (31).

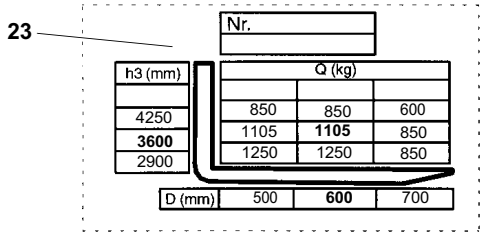
## 4.2 Truck load chart

The capacity plate (23) gives the capacity (Q) of the truck in kg 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).

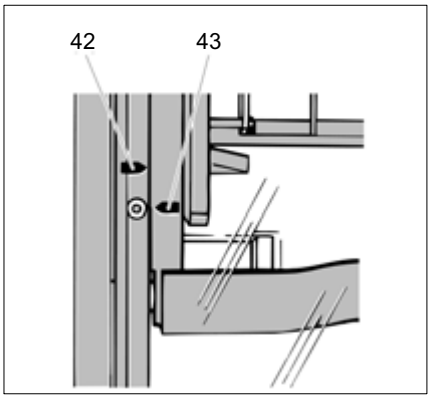
**Example of how to calculate the maximum capacity:**

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

**Example:**

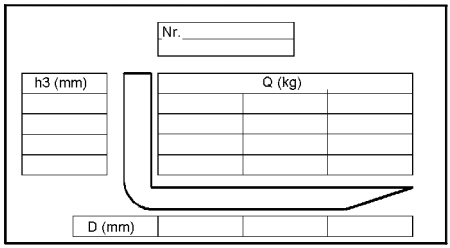


The arrow shape markings (42 and 43) on the inner and outer masts show the driver when the prescribed lift limits have been reached.




## 4.3 Fork load diagram (basic model)

The fork load diagram give the truck's capacity Q in kg. The maximum capacity for the various load centres of gravity (D in mm) is shown in chart form.




## 4.4 Attachment load chart

The attachment load chart gives the truck's capacity Q in combination with the respective attachment in kg. The serial number specified in the load chart must match the data plate of the attachment, as the capacity for each truck is specifically indicated by the manufacturer. It is shown in the same way as the truck's capacity and can be determined accordingly.

➔ For loads with a centre of gravity above 500 mm upward, the capacities are reduced by the difference of the altered centre of gravity.

# 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 hydraulic lines between the basic truck and the mast separated.

**Safety Instructions for Assembly and Commissioning**

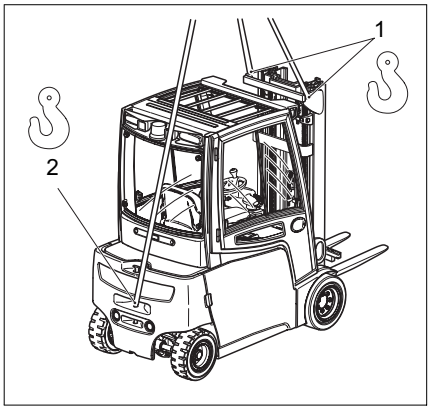
STOP On site assembly of the truck, commissioning and driver instruction may only be carried out by personnel trained and authorised by the manufacturer

The hydraulic lines may only be connected to the basic truck / mast interface and the truck commissioned when the mast has been properly assembled.

## 2 Lifting by crane

⚠ Only use lifting gear with sufficient capacity
(transport weight = net. weight + battery weight, see truck data plate).

– Park the truck safely
(see Chapter E).
– Attach the crane slings to the top cross member of the mast (1) and the trailer coupling (2).




⚠ Always attach the crane belts or chains to the eyes of the upper cross member (mast) and the trailer hitch.
The mast must be tilted back fully.
The crane belt or the chain on the mast must be at least 2 m long.

⚠ Lifting slings should be fastened to the harness in such a way that they do not come into contact with any attachments or the overhead guard when it is being raised.

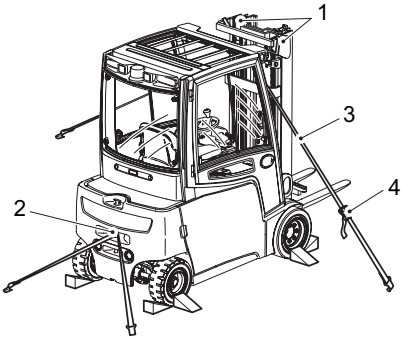
## 3 Securing the truck during transport

STOP The truck must be securely fastened when transported on a lorry or a trailer. The lorry / trailer must have fastening rings and a wooden floor.

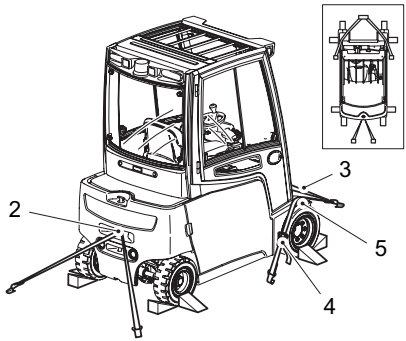
– To fasten the truck attach the tensioning belt (3) to the upper cross member of the mast (1) or over the mudguard (5) and attach it to the trailer hitch (2).
– Tighten the tensioning belt (3) with the tensioner (4).

⚠ Loading must be carried out by specially trained staff in accordance with recommendations contained in Guidelines VDI 2700 and VDI 2703. In each case correct measurements must be made and appropriate safety measures adopted.

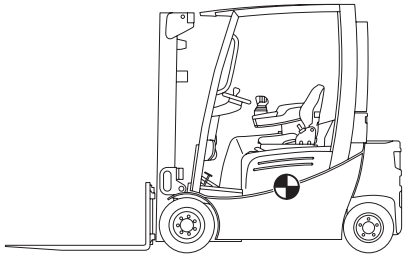
Attaching with a mast




Attaching without a mast




The following illustration shows the approximate centre of gravity.



## 4 Using the truck for the first time

Commissioning and driver instruction must be performed by trained personnel. If several trucks have been delivered, make sure that always the serial numbers of the load handlers, masts and basic trucks match each other.

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

To prepare the truck for operation after delivery or transport the following tasks must be carried out:

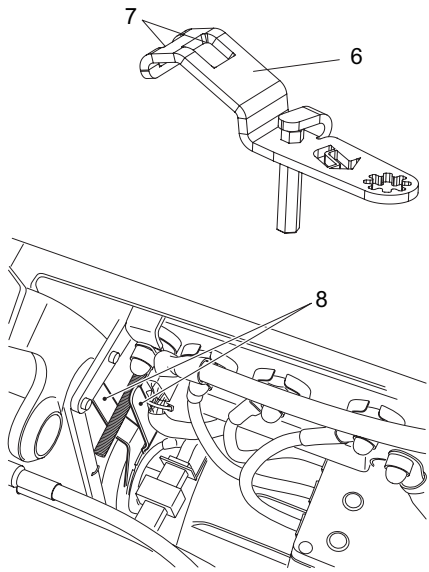
- Fit and charge the battery if required,
  see “Battery removal and installation” and “Charging the battery” in Chapter D.
- Start up the truck as indicated.
  see “Starting up the truck” in chapter E.

## 5 Operating the truck without its own drive system

To move the truck without power supply, the brake must be released as follows

Before the driver leaves the truck with the brake released, the truck must be prevented from accidentally rolling away by using suitable means.

- Place the auxiliary tool (6) on the lever (8) with the notches (7) (Jungheinrich symbol can be read from the left hand side of the truck).
- Pull the lever (6) forward (forks direction) or backward (towards the operator position) and lock it in position. The lever should engage. The drive wheels are no longer blocked / braked by the brake.




The auxiliary tool (6) to apply the lever (8) is located in the document pocket in the backrest of the seat.

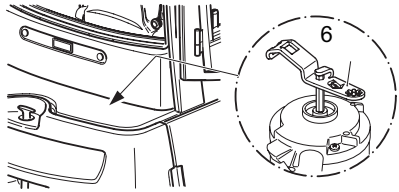
Before starting the truck again, the lever (6) must be restored to the centre “travel” position. The truck can only operate in the travel position.

## 6 Moving the truck when the electric/hydraulic steering has failed

⚠ The truck cannot be steered if the steering hydraulic system or the truck electronics are damaged.

To steer the truck without power, apply the steering as follows.

– Turn the EMERGENCY DISCONNECT switch and key switch off.
– Secure the truck to prevent it from rolling away
– Undo the sensor connector above the motor shaft (pull the red unlocking lever) and place the auxiliary tool (6) on the hex. socket screw and turn the drive to the required steering position.




## 7 Towing the Truck

To tow the truck, proceed as follows:

– Attach the tow bar / rope to the trailer coupling of the recovery vehicle and the truck to be recovered.
– Disconnect the battery.
– Release the parking brake.
– Steer the truck as indicated in “Moving the truck when the electric/hydraulic steering has failed”.

# D Battery Maintenance, Charging & Replacement

## 1 Safety regulations for handling acid batteries

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

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

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

**Battery maintenance:** The battery cell covers must be kept dry and clean. The terminals and cable shoes must be clean, secure and have a light coating of dielectric grease. Batteries with non insulated terminals must be covered with a non slip insulating mat.

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

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


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

Only batteries with a sealed battery container may be used.


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

## 2 Battery types

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

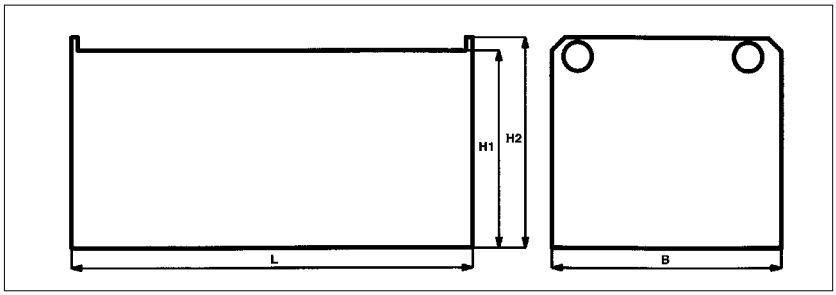
| | |
|---|---|
| EFG 213 | 48 V - 4PzS 460 Ah battery |
| EFG 215 | 48 V - 4PzS 460 Ah battery |
| EFG 216k | 48 V - 5PzS - 575 Ah battery |
| EFG 216 | 48 V - 6PzS 690 Ah battery |
| EFG 218k | 48 V - 5PzS - 575 Ah battery |
| EFG 218 | 48 V - 6PzS 690 Ah battery |
| EFG 220 | 48 V - 6PzS – 690 Ah battery |

| | |
|---|---|
| EFG 316k | 48 V - 5PzS - 575 Ah battery |
| EFG 316 | 48 V - 6PzS 690 Ah battery |
| EFG 318k | 48 V - 5PzS - 575 Ah battery |
| EFG 318 | 48 V - 6PzS 690 Ah battery |
| EFG 320 | 48 V - 6PzS 690 Ah battery |

The battery weights are indicated on the battery data plate.

STOP When replacing/installing the battery make sure the battery is securely located in the battery compartment of the truck.

| 48 volt drive battery | | | | | | similar to DIN 43531 |
|---|---|---|---|---|---|---|
| Truck | Dimension inch (mm) | | | | Rated weight (-5/+8%) in (kg) | |
| | L max. | W max. | H1 +/- 2 mm | H2 +/- 2 mm | | |
| EFG 213/215 | 830 | 522 | 612 | 627 | 715 | 400 - 480 Ah |
| EFG 216k/ 218k/ 316k/318k | 830 | 630 | 612 | 627 | 855 | 500 - 630 Ah |
| EFG 216/ 218/220/ 316/318/320 | 830 | 738 | 612 | 627 | 1025 | 600 - 720 Ah |

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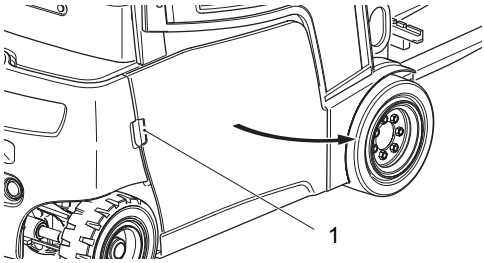
## 3 Battery removal and installation

To prevent short circuits, batteries with exposed terminals or connectors must be covered with a rubber mat. When replacing a battery with a crane, make sure the crane has sufficient capacity (see battery weight on the battery data plate on the container).
The battery plug and socket may only withdrawn or connected when the main switch and the charging equipment are switched off.

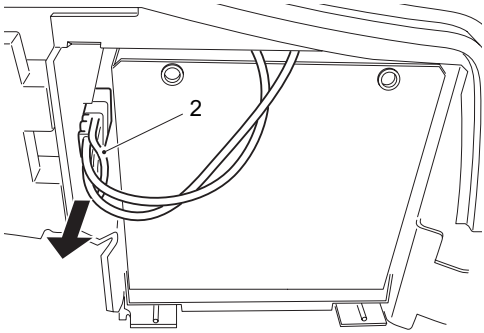
Park the truck securely, see “Parking the Truck Securely” in Chapter E.

### 3.1 Removal and installation using a multi-adapter (○)

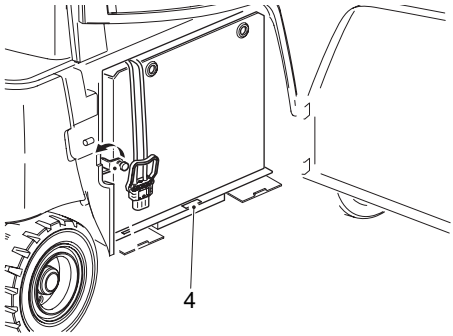
– Open the battery door (1) as far as the stop.



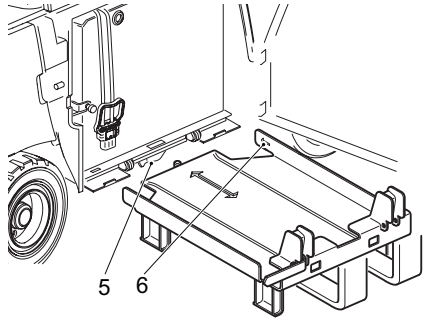

– Disconnect the battery.



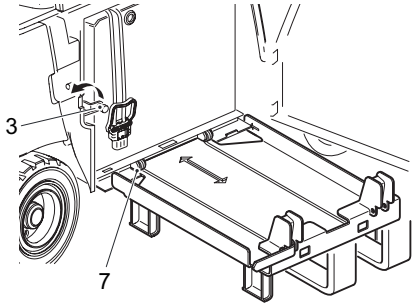

On trucks with a long battery lead fit the battery connector to the battery connector bracket (4).



– Push the lift truck with the multi-adapter as far as the stop (5) underneath the battery.
– Set the multi-adapter to the straight-ahead position using the alignment (6).



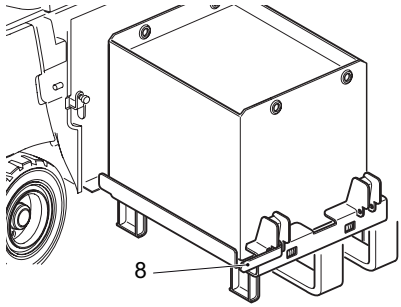

– Raise the lift truck until the multi-adapter is up to the height stop (7).
– Prevent the lift truck from rolling away.
– Undo the battery lock (3).




– Remove the battery.

⚠ The battery must engage fully with the safety catch (8).

– Lower the lift truck slightly to move it.
– Bring the battery to the charging station for charging.




Battery assembly is the reverse order.

➔ Insert the battery in the battery compartment and at the same time undo the safety catch (8) with your foot.

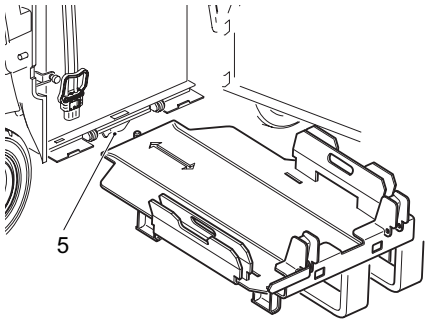
⚠ After inserting the battery close the battery lock and then lower the lift truck.

### 3.2 Removal and installation using a worktable for crane loading (○)

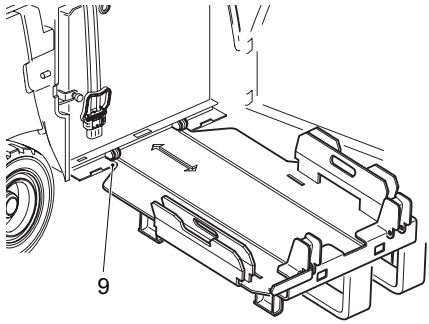
– Open the battery door as far as the stop.
– Disconnect the battery connector.

→ See “Removal and installation using a multi-adapter” (○)

– Push the lift truck with the worktable as far as the stop (5) underneath the battery.




– Raise the lift truck and worktable up to the height stop (9).

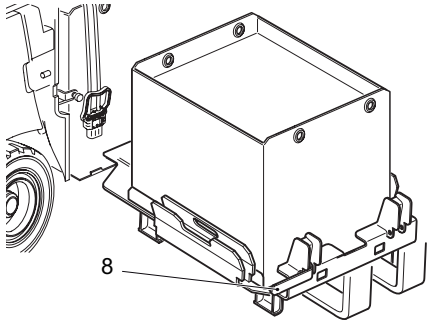



– Undo the battery lock.

– Remove the battery.

→ The battery must engage fully with the safety catch (8).

– Strap the crane lifting harness to the battery container. The hooks must be fitted in such a way that when the crane lifting harness is slackened, they do not fall onto the battery cells.
– Undo the safety catch (8) and lift out the battery for transporting to the charger station.




Battery assembly is the reverse order.

→ Insert the battery in the battery compartment and at the same time undo the safety catch (8) with your foot.

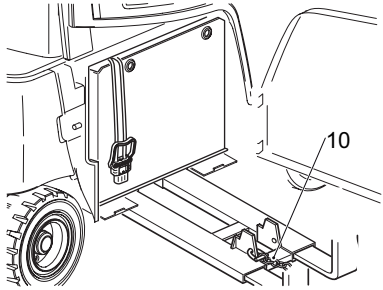
→ After inserting the battery close the battery lock and then lower the lift truck.

### 3.3 Removal and installation using a fork shoe (○)

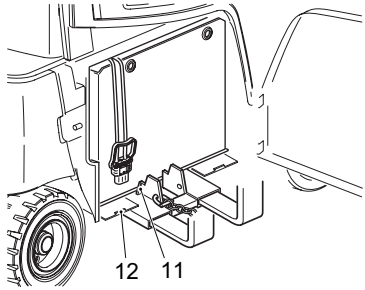
– Open the battery door as far as the stop.
– Disconnect the battery connector.
– Undo the battery lock.

→ See “Removal and installation using a multi-adapter” (○)

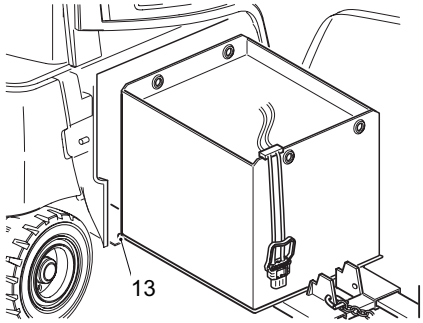
– Place the fork shoe onto the forks of a second lift truck with a minimum 1000 kg capacity and secure it to the fork carriage with a chain (10).
– Tilt the mast forward.



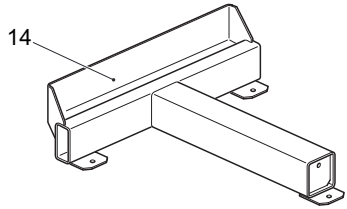

– Move the fork shoe up to the stop (11) underneath the battery.
– Raise the fork carriage until the battery is resting on the forks.
– Pull out the battery as far as the stop (12) on the truck chassis.




– Raise the fork carriage.
– Tilt the mast back fully and bring the battery to the charging station to be charged.




– Place the battery carefully onto the charging station (14).



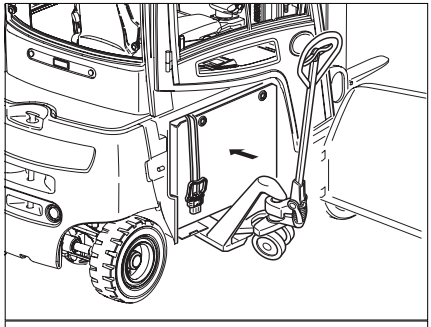

→ Installation is the reverse order of removal. Make sure the rollers (13) on the battery are inserted into the guides in the battery compartment.

### 3.4 Removal and assembly for maintenance

– Open the battery door as far as the stop.
– Disconnect the battery connector.
– Undo the battery lock.

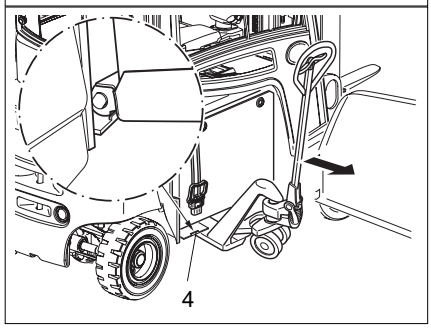
→ See “Removal and installation using a multi-adapter” (○)

– Place a standard hand pallet truck (800 mm fork length) under the battery.



→ If the forks are longer they must be inserted 950 mm underneath the battery, measured from the fork tip. This must be indicated on the forks before removing the battery.

– Raise the battery with the hand pallet truck until the battery is resting on the forks and is not in contact with the chassis.
– Remove the battery for maintenance.




→ The battery is guided on rollers. Remove the rollers as far as the stop (4).

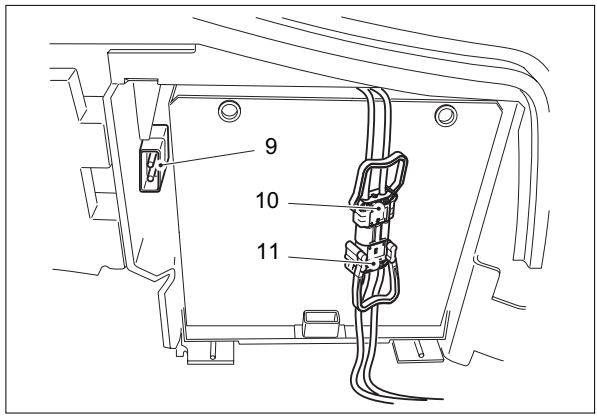
Installation is the reverse order of removal.

## 4 Charging the battery

Only connect and disconnect the battery and charger when the charger is switched off.
To charge the battery, the truck must be dry and parked in closed and properly ventilated rooms. The battery door must remain at least 200 mm open to ensure adequate ventilation. Do not place any metal objects on the battery.
Before charging, check all cables and plug connections for visible signs of damage.
All safety instructions as provided by the battery supplier and battery charger supplier must be strictly observed.

### 4.1 Charging the battery with a stationary charger

– Disconnect the battery connector (10) from the truck connector (9).
– Connect the battery connector (10) with the charging lead (11) of the stationary charger and turn on the charger.



## 4.2 Charging the battery with an on-board charger

The on-board charger consisting of a battery charger and battery controller must not be opened. If damaged, it must be replaced.
The charger must only be used for batteries supplied by Jungheinrich or other approved batteries provided it has been adapted by the manufacturer's service department. Batteries must never be swapped from truck to truck.

**Mains connection**

The mains lead may vary depending on the size of the on-board charger.

On-board charger with 65 Ah: 16 A; 230 V; 3 pin

On-board charger with 130 Ah: 16 A; 400 V; 5 pin

Only use mains leads with a maximum length of 30 m. If a cable reel is being used, it must be fully rolled up.
Only use original manufacturer’s mains leads.
Insulation safety, acid and caustic ratings must comply with the manufacturer's mains lead.

**Charging**

– Open the battery door.
– Connect the on-board charger to the local mains socket using the mains cable.
– Charging begins automatically.
– When the truck is switched on the charging status and the residual capacity are shown on the display.

**Battery charger LED displays**

| Green LED | Meaning |
|---|---|
| Flashing | Charging |
| Lit | Charging complete |

| Red LED | Meaning |
|---|---|
| Flashing | Error |

**Battery controller LED displays**

| White LED | Meaning |
|---|---|
| Flashing | Radio network activated |

| Blue LED | Meaning |
|---|---|
| Lit | Electrolyte level too low (measured after each charge) |

| Yellow LED | Meaning |
|---|---|
| Flashing rolling | Charging |
| Lit | Charge status |

| Red LED | Meaning |
|---|---|
| Flashing | Error |

→ For display messages see “Pictograms and Display” in chapter E.

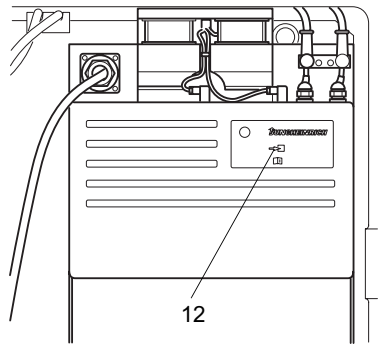
**Float charge:**

The float charge starts automatically when charging is complete.

**Partial charging:**

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

→ If you need to interrupt a charge, press button (12). Remove the mains connector only when the green LED goes out.
Charging recommences when the mains lead is connected back to the mains socket.

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# E Operation

## 1 Safety Regulations for the Operation of Forklift Trucks

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

**Driver's rights, obligations and responsibilities:** The driver must be informed of his duties and responsibilities and be instructed in the operation of the truck and shall be familiar with the operator manual. The driver shall be afforded all due rights.
Safety shoes must be worn for pedestrian operated trucks.

**Unauthorised use of truck:** The driver is responsible for the truck during the time it is in use. The driver 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 immediately informed of any damage or faults to the forklift 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 driver must not carry out any repairs or alterations to the industrial truck without the necessary training and authorisation to do so. The driver must never disable or adjust safety mechanisms or switches.

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

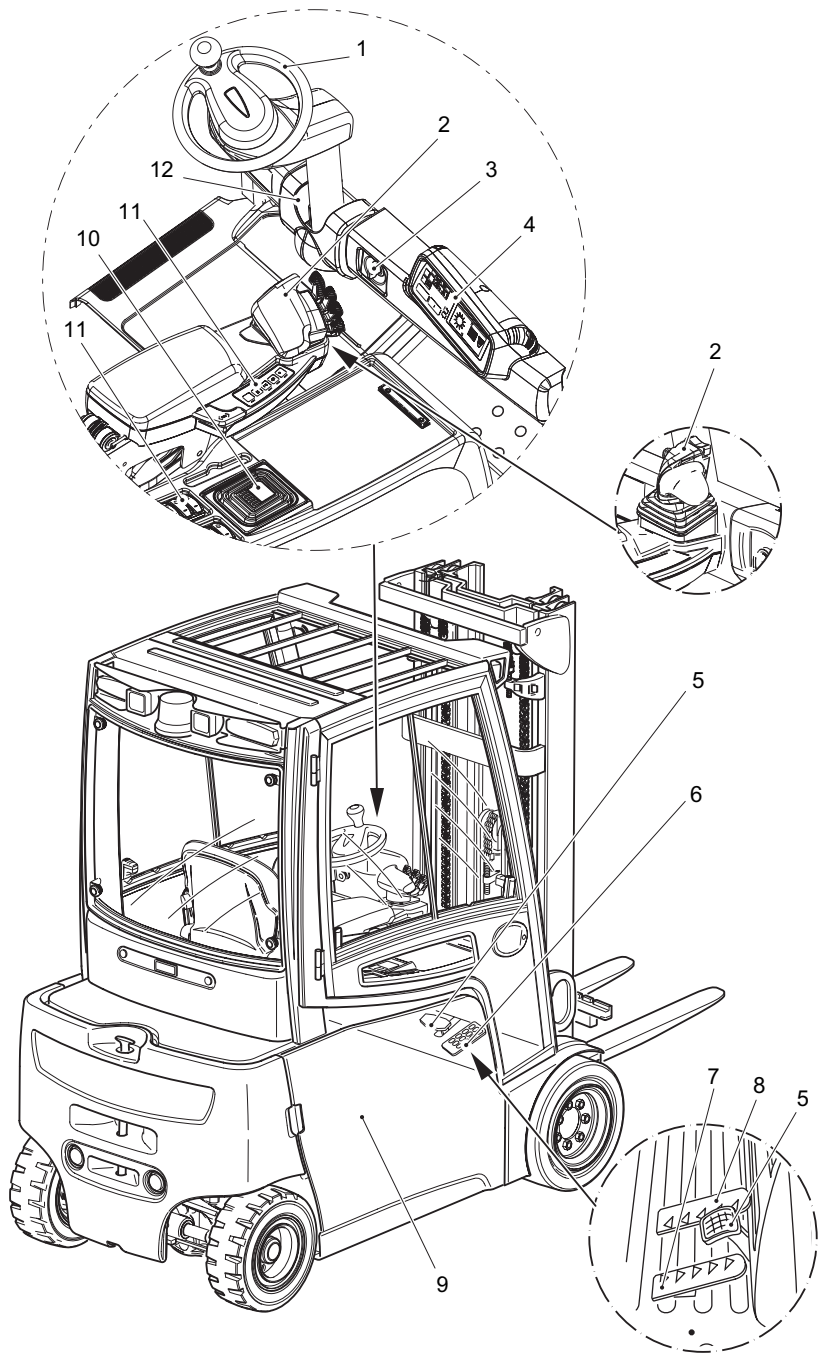

Unauthorised persons must be kept away from the hazardous area. Where there is danger to personnel, a warning must be sounded with sufficient notice. If unauthorised personnel are still within the hazardous area the truck shall be brought to a halt immediately.

**Safety devices and warning signs:** Safety devices, warning signs and warning instructions shall be strictly observed.

## 2 Controls and Displays

| Item | Control / Display | | Function |
|---|---|---|---|
| 1 | Steering wheel | ● | Steers the truck. |
| 2 | SOLOPILOT | ● | Operating the functions:<br>– Forward / reverse travel direction<br>– Lift/lower load handler<br>– Mast forward / reverse tilt<br>– Horn switch<br>– Side shift left / right (○)<br>– Aux. hydraulics (○) |
| | MULTIPILOT | ○ | |
| 3 | Key switch | ● | Switches control current on and off. Removing the key prevents the truck from being switched on by unauthorised personnel. |
| | ISM Access Module | ○ | Powers up the truck. |
| 4 | Dashboard control panel | ● | Displays the battery capacity, service hours, errors, key warning indicators, wheel position and travel direction. |
| 5 | Brake pedal single pedal control | ● | Provides infinitely variable braking control. |
| | Brake pedal twin pedal control | ○ | |
| 6 | Accelerator pedal | ● | Provides infinite control of travel speed. |
| 7 | Twin pedal control “Forward” accelerator pedal | ○ | Truck travels forward when actuated.<br>The travel speed is infinitely controlled. |
| 8 | Twin pedal control “Reverse” accelerator pedal | ○ | Truck reverses when actuated.<br>The travel speed is infinitely controlled. |
| 9 | On-board charger | ○ | Charges the truck. |
| 10 | EMERGENCY DISCONNECT switch | ● | Switches power supply on and off. |
| 11 | Armrest / side pocket control panel | ○ | Options |
| 12 | Steering column stop | ● | Adjusts and fixes the steering column at the required distance and height. |

● = Standard equipment ○ = Optional equipment


1
2
12
3
11
4
10
11
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5
6
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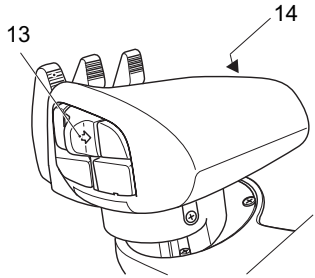
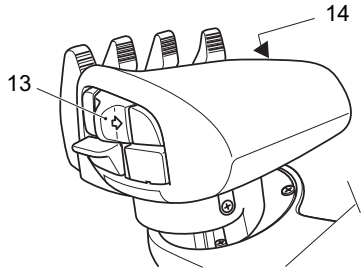
8
5
9

## 2.1 SOLOPILOT / MULTIPILOT

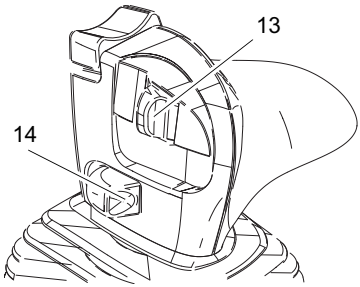
SOLOPILOT (●)



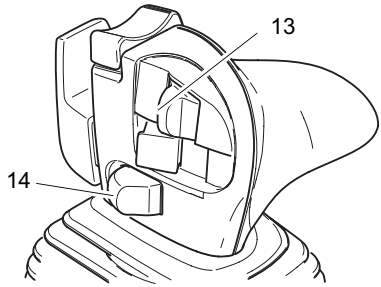

SOLOPILOT (○)




MULTIPILOT (○)




MULTIPILOT with ZH1-ZH3(○)




| Item | Control / Display | Function |
|---|---|---|
| 13 | Travel direction switch | Selects travel direction / neutral position |
| 14 | Horn | Activates the horn |

● **Travel direction switch**

– To select forward gear, push the direction switch (13) forward.
– To select reverse gear, push the direction switch (13) backward.

○ If a travel direction has been pre-selected before the truck starts, set the truck first to neutral and then in the required direction.
Otherwise, travel will be inhibited.

● **Horn**

– Press the horn button (14) to sound the horn.

## 2.2 Armrest control panel switch (○)

| | Function |
|---|---|
|  | Work lights |
|  | 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 |
|  | 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 |
|  | Sideshift centre position |
|  | Lift cutout override |

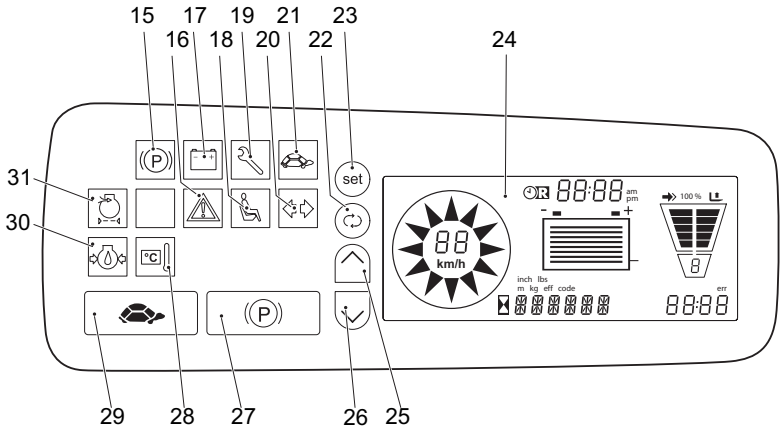
## 2.3 Side pocket control panel switch (○)

| | Function |
|---|---|
|  | Rear window heating |
|  | Beacon |
|  | Truck lighting |
|  | Warning indicator |
|  | Parking light |
|  | Lift cutout override |

## 2.4 Dashboard control panel and driver's display

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

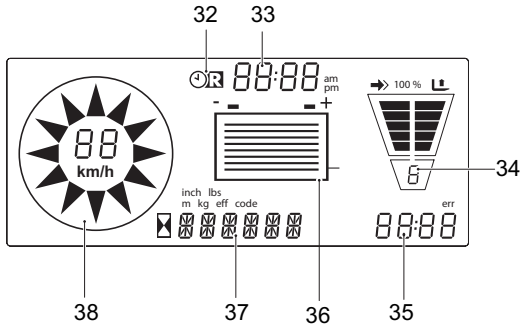
**Pictograms**




| Item | | Control / Display | | Function |
|---|---|---|---|---|
| 15 | (P) | Parking brake indicator | ● | Parking brake active<br>– Truck operational, parking brake active |
| 16 | ⚠ | WARNING | ● | WARNING<br>– Lights up to indicate error<br>– Flashes when battery capacity is less than 10% |
| 17 | | Battery indicator | ● | WARNING<br>– Electrolyte level too low<br>– Battery cells faulty<br>– Battery temperature too high |
| | | | ○ | On-board charger on radio network |
| 18 | | Seat switch indicator | ● | Seat switch not closed<br>– Truck operational but driver's seat not occupied |
| | | Seat belt lock indicator (flashing symbol) | ○ | – Truck operational, belt lock not closed |

| Item | | Control / Display | | Function |
|---|---|---|---|---|
| 19 |  | Service display | ● | Service interval exceeded (1000 service hours) or annual UVV test due (flashing indicator). |
| 20 |  | Flashing indicator | ○ | Function of right/left flashing indicators (○) |
| 21 |  | Crawl speed indicator | ● | Crawl speed activated |
| 22 |  | Toggle button | ● | Changes the display |
| 23 |  | SET button | ● | Confirms entries |
| 24 | | Driver's display | ● | Shows the operating data, see displays. |
| 25 |  | Program selector | ● | Selects the travel program (moves up a ○ level in the travel program list.) |
| 26 |  | Program selector | ● | Selects the travel program (moves down a level in the travel program list.) |
| 27 |  | Parking brake button | ● | Button for applying / releasing the parking brake |
| 28 |  | Control and motor overtemperature indicator | ● | – Lights up when the controllers and motor overheat.<br>– Performance continually reduces with respect to the temperature. |
| 29 |  | Inching button | | Travel speed max. 6 km/h (adjustable). |
| 30 |  | | | No function |
| 31 |  | | | No function |

**Displays**




| Item | Function |
|---|---|
| 32 | Residual time display with on-board battery (hours : minutes)<br>Residual charging time (○) |
| 33 | Time display (hours : minutes) |
| 34 | Travel program display<br>– Displays the travel program in use |
| 35 | 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 intervals of 1.5 seconds. A warning is sounded. |
| 36 | Battery capacity display<br>– Battery discharge status<br>– Charge status display for on-board charger (○) |
| 37 | Hourmeter display |
| 38 | Travel direction, speed 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 |

**Driver's display information messages**

The information messages have a four-digit code. The first digits refers to the functional assembly, the remaining three digits designate the error.

| Function group | Meaning |
|---|---|
| 0 | General message |
| 1 | General message |
| 2 | Travel |
| 3 | Steering |
| 4 | Lift |
| 5 | Battery management |

| Display | Meaning |
|---|---|
| 1901 | Accelerator pedal pressed during power-up |
| 1904 | No travel direction selected when travel switch applied. |
| 1908 | Seat switch not closed<br>– Truck operational, but driver's seat not occupied |
| 1909 | Accelerator pressed while parking brake applied |
| 5915 | Truck not operational but battery door open (○) |
| 1917 | Accelerator pedal and brake pedal pressed simultaneously. |
| 1918 | Truck operational but cabin door open (○) |
| 2951 | Hydraulic function applied during power-up |
| 5990 | Electrolyte level too low (○) |

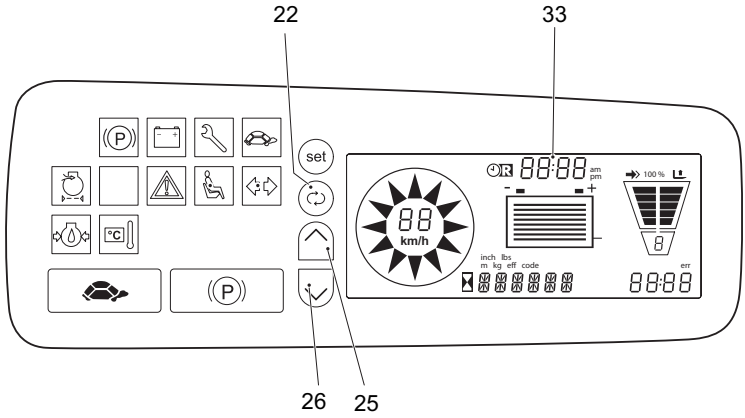
**Set time:**

– Press the toggle button (22) for 3 seconds.

The display (33) via the battery shows the current time. This allows you to toggle the display between the time and the residual time.

– Press toggle button (22) for 8 seconds until the "Set Time" menu is displayed.
– Set the hours with the “Up” (25) & “Down” (26) keys.
– Confirm with the toggle button (22).
– Set the minutes with the “Up” (25) & “Down” (26) keys.
– Press the toggle button (22) to return to the normal operating mode.

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).



## 2.5 Battery Discharge Indicator, Battery Discharge Monitor, Hourmeter

**Battery Discharge Indicator:** The charge status of the battery (36) is shown on the driver's display. The lower section of the battery symbol is shown as being empty. It indicates the residual capacity of the battery which cannot be used to avoid damaging the battery.

⚠ The standard setting for the battery discharge indicator / discharge monitor is based on standard batteries.
If using maintenance-free batteries, the display must be re-set. This setting must be carried out by the service department. If this adjustment is not made the battery may become damaged through excessive depletion.

When a battery is discharged to the permissible discharge level, the battery symbol is displayed empty.

**Battery Discharge Monitor:** If the residual capacity falls below the required level, lifting is inhibited. A message will be indicated on the driver's display unit.

➔ Lifting is only released when the battery connected is at least 40% charged.
To complete the lifting operation, turn the key switch off and on again. You can then continue to raise for another 30 - 40 seconds.

**Residual time display:** The time remaining to reach the residual capacity is displayed.
To display the residual time (residual charge time ○) the display above the battery can be switched by holding down the toggle button (22) for three seconds.

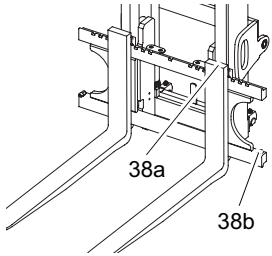
➔ This allows you to toggle the display between the time and the residual time.

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

## 3 Starting up the truck

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

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

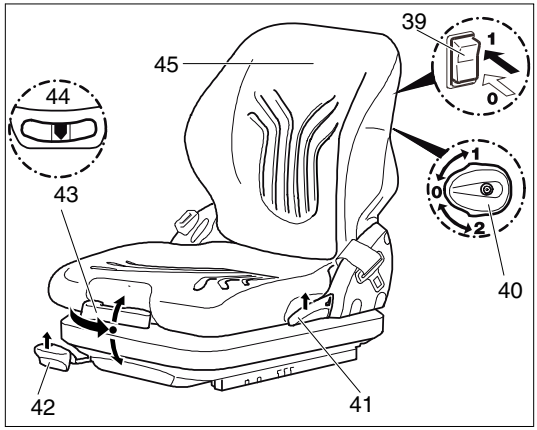



– The entire truck (in particular wheels and load handler) must be inspected for damage.
– Make sure the load chains are evenly tensioned.
– Visually inspect the battery attachment and cable connections.
– Test the seat belt.
– Test the seat switch.
– Test the Drive-Control (○), the truck should travel slowly when the load is raised.
– Check the fork stop (38a) and fork retainer (38b).

### 3.2 Adjusting the driver's seat

→ To avoid risk to health and property, check and adjust the individual driver's seat setting before starting up the truck.
The driver's seat must be occupied in order to adjust to the driver's weight.

Adjusting the driver's weight:




– Move the lever (43) as far as it will go in the arrow direction. To adjust, move the lever up or down and then restore it to its home position.
– Move the lever up and down to set the seat to a higher weight.
– Move the lever down and up to set the seat to a lower weight.

→ The driver's weight is correct if the arrow is in the middle of the display window (44).
The min. or max. weight setting is reached when you can feel a return stroke on the lever.

– After adjusting the weight, move the lever back fully until it engages.

Adjusting the backrest:

STOP The backrest must be securely engaged in the set position. The backrest setting must not be changed during travel!

– Lift up the locking lever (41) and adjust the incline of the backrest.
– Release locking lever (41) to lock the backrest in position.

Adjusting the seat position:

STOP Hold the locking lever (42) only in the recess, do not reach through underneath the lever.
The driver's seat must be securely engaged in the set position. The driver's seat setting must not be changed during travel!
Do not lift the locking lever with your leg or thighs!

– Pull up the locking lever (42) of the driver's seat lock in the direction of the arrow and push the seat forwards or backwards to the desired position.
– Engage locking lever (42) in position again.

Seat heating (○):

Apply the switch (39): **1** = seat heating ON; **0** = seat heating OFF

Lumbar vertebrae support (○):

Hand wheel (40) in position **0** = no bending in lumbar vertebrae area.

Turn hand wheel (40) to position **1** = Increased bending in upper lumbar vertebrae area.

Turn hand wheel (40) to position **2** = Increased bending in lower lumbar vertebrae area.

### 3.3 Safety restraint belt

Fit the safety restraint belt each time before starting the industrial truck.
The belt protects you from serious injury!

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

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

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

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

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

**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.

**Hazardous situations**

If the truck is about to tip over, do not undo the restraint belt and try to jump out.
This will only increase the risk of injury!

**Correct procedure:**

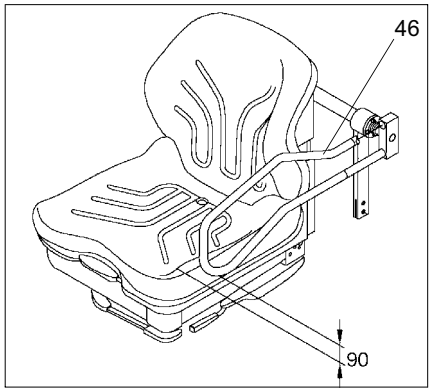
- Lean your upper body over the steering wheel.
- Grip the steering wheel with both hands and brace feet.
- Tilt your body in the opposite direction of fall.

### 3.4 Mechanical safety restraint system (○)

Test the restraint system before starting the truck.

- Never use the truck with a non-functional restraint system.
- After an accident, have the restraint system system checked by specialist personnel from the manufacturer's service department.
- Do not alter the restraint system.
- When the driver's seat is occupied, maintain a 90 mm gap between the gate (46) and the seat to ensure safety.

– Push the safety gate out and lift it up.
– When the gate has been released, it automatically drops down and locks.




**Hazardous situations**

If the truck is in danger of tipping over, do not try to jump out. This will only increase the risk of injury.

**Correct procedure**

– Lean your upper body over the steering wheel.
– Grip the steering wheel with both hands and brace feet.
– Tilt your body in the opposite direction of fall.

### 3.5 Adjusting the steering column

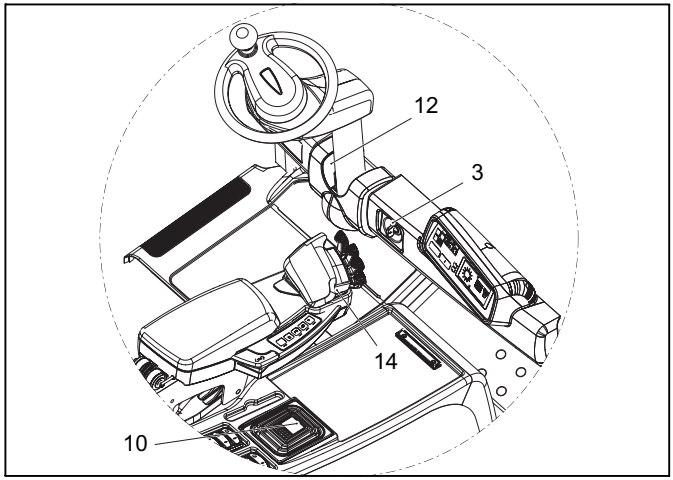
– Release the steering column lock (12) and set the steering wheel to the required position (height and tilt).
– Now fix the steering column lock again.

### 3.6 To prepare the truck for operation

– Unlock the EMERGENCY DISCONNECT switch (10).
  To do this:
  Press the rocker in (⬇) and pull it up until you feel the EMERGENCY DISCONNECT engaging.
– Insert the key in the key switch (3) and turn it clockwise as far as it will go to the “I” position.
– Test the horn (14).

STOP Test the brake pedal and parking brake.

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 control lever is applied during this time, an information message will be displayed.



# 4 Industrial Truck Operation

## 4.1 Safety regulations for truck operation

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

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

**Travel visibility:** The driver must look in the direction of travel and must always have a clear view of the route ahead. Loads that affect visibility must be positioned at the rear of the truck. If this is not possible, a second person must walk in front of the truck as a lookout.

**Negotiating slopes and inclines:** Negotiating slopes or inclines is only permitted if such roads are clean and have a non-slip surface and providing such journeys are safely undertaken in accordance with the technical specifications for the truck in question. The truck must always be driven with the load unit facing uphill. The industrial truck must not be turned, operated at an angle or parked on inclines or slopes. Inclines must only be negotiated at slow speed, with the driver ready to brake at any moment.

**Negotiating lifts and docks:** Lifts and docks must only be used 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. People travelling in the lift with the forklift truck must only enter the lift after the truck has come to a halt and must exit the lift before the truck.

**Type of loads to be carried:** The operator must make sure that the load is in a satisfactory condition. Only carry loads that are positioned safely and carefully. Use suitable precautions to prevent parts of the load from tipping or falling down.

**Towing trailers** or the truck itself being towed are only permitted occasionally, on secure, level routes, with a maximum deviation of +/- 1% and at a max. speed of 5 km/h. The truck must not be permanently used with trailers.
There must be no load on the forks when the truck is being pulled.
Do not exceed the maximum trailer load specified for the forklift truck for trailers with or without brakes. The specified trailer load only applies for the auxiliary coupling in the counterbalance of the forklift. If a different trailer coupling is used on the truck, the instructions of the coupling manufacturer must be observed.
After coupling and before starting the driver shall ensure that the trailer coupling cannot become detached.
Trucks pulling a load must be operated in such a manner that the trailing vehicle is driven safely and can be stopped at all times.

## 4.2 Travel, steering, braking

### 4.2.1 Emergency Disconnect

– Press the EMERGENCY DISCONNECT switch (10) down.

All electrical functions are deactivated.

STOP The operation of the EMERGENCY DISCONNECT switch must not be affected by any objects placed in its way.

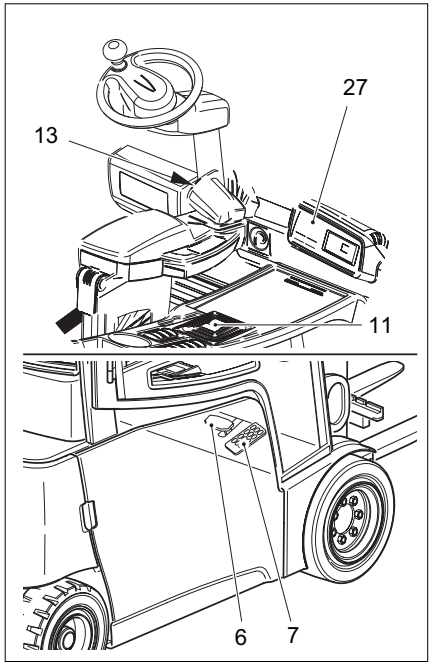
### 4.2.2 Travel

**Safety switch, driver's seat**

If the driver's seat is not occupied (seat belt (○) not closed) travel is inhibited by the seat switch.

STOP Do not drive the truck unless the panels and doors are closed and properly locked.
Travel routes must be free of obstacles.
Adapt the travel speed to the conditions of the travel lane, the work area and the load.

– Set the travel direction switch (13) to neutral.
– Raise the fork carriage approx. 200 mm so that the fork tines are clear of the ground.
– Tilt the mast fully backward.




**Travelling with a single pedal ●**

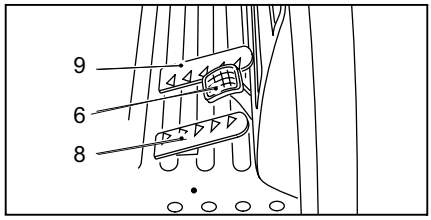
STOP Make sure that the travel area is clear.

– Release the parking brake (27).
– Apply the travel direction switch (13).
– Slowly apply the accelerator pedal (7) until you reach the required travel speed.

**Forward travel (twin pedal ○)**

STOP Make sure that the travel area is clear.

– Release the parking brake (27)
– Slowly apply the accelerator pedal (8)




➔ There is no travel direction switch on trucks with a twin pedal.

### 4.2.3 Steering

⚠ Very minimal steering effort is required for the electric steering, therefore turn the steering wheel sensitively.

**Negotiating right hand bends**

– Turn the steering wheel clockwise according to the required steering radius.

**Negotiating left hand bends**

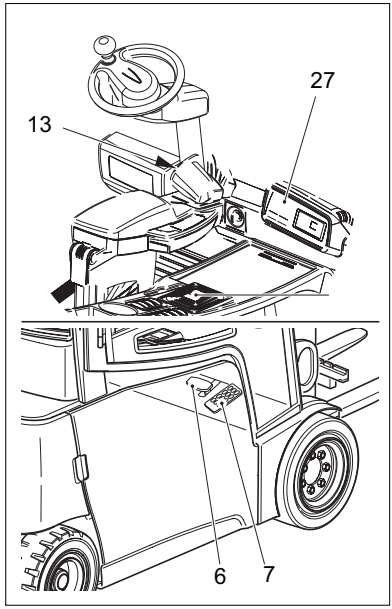
– Turn the steering wheel anti-clockwise according to the required steering radius.

### 4.2.4 Braking

STOP The braking pattern depends largely on the ground conditions. The driver must take this into consideration when handling the truck. Brake with care to prevent the load from slipping.
If you are travelling with an attached load you must increase the braking distance.

There are four ways of braking:

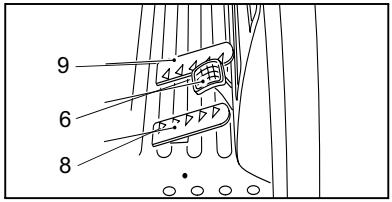
– Service brake
– Coasting brake
– Reversing brake
– Parking brake




**Service brake:**

– Depress the brake pedal (6) until you feel the brake pressure.

**Coasting brake:**




– Take your foot off the accelerator pedal (7) (8/9). The truck brakes regeneratively via the traction controller.

➔ This method saves energy.

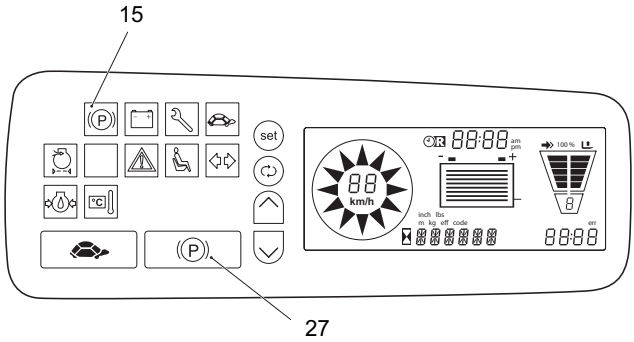
**Reversing brake (single pedal):**

– Set the travel direction button (13) to the opposite direction while travelling. The truck brakes regeneratively via the traction controller until the truck starts to travel in the opposite direction.

**Parking brake:**

– Apply the parking brake (27).

➔ You cannot travel against the parking brake; the parking brake indicator (15) will be displayed.




The parking brake applies approx. 5 seconds (adjustable) after the truck has come to rest.
When you stop on the ramp the truck is held electrically until the parking brake applies.
When you set off, before the parking brake is released, a torque builds up on the drive motor to prevent the truck from rolling back.

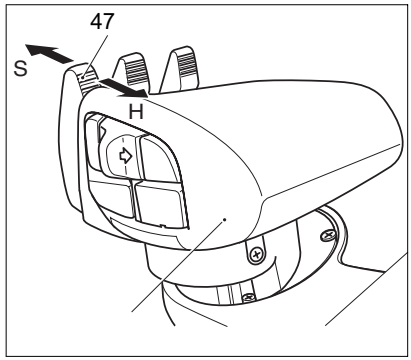
STOP The parking brake will hold the truck with maximum load, on a clean ground surface, on inclines of up to 15%.

## 4.3 Operating the lift mechanism and attachments (SOLOPILOT ●)

STOP Do not lift other people with the lifting mechanism and do not allow anyone to stand under a raised load.

The SOLOPILOT must only be operated from the driver's seat. The driver must be trained to handle the lift mechanism and the attachments.

**Lifting**




– Pull the control lever (47) in direction (H).

➔ The lift speed is determined by the inclination of the control lever.

– Activate the control lever until the desired height is reached.

➔ When the limit position is reached (there will be a noise from the pressure relief valve) set the control lever back to its starting position.

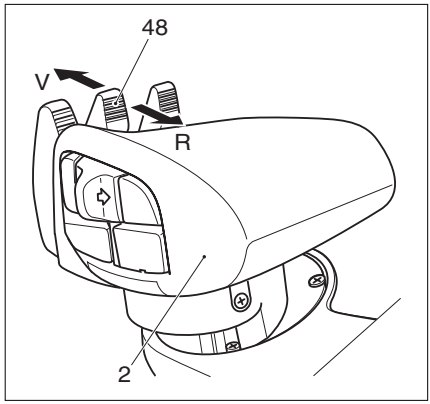
**Lowering**

– Push the control lever (47) in direction (S).

➔ The lift speed is determined by the inclination of the control lever.

⚠ Avoid dropping the load abruptly, in order to protect the load and the rack surface.

**Tilting the mast forward / backward**



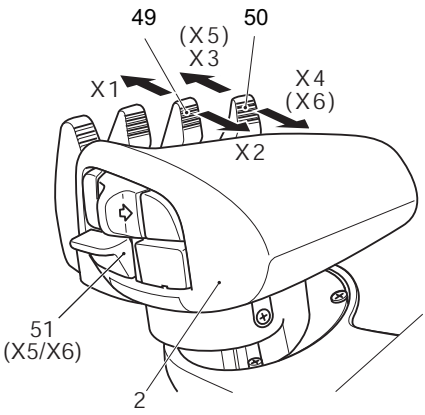

STOP When tilting the mast back, keep all parts of your body from between the mast and the front wall.

– Push the control lever (48) in direction (V) to tilt forward.
– To tilt back, pull the control lever (48) in direction (R).

**Operating attachments (○)**

Note the manufacturer's operating instructions and the capacity of the attachment.

The control levers (49 and 50) are used to operate auxiliary hydraulics I and II. Auxiliary hydraulics III are operated by control lever (50) in conjunction with button (51). The integrated sideshift (ISS) is operated with control lever (49) as described below.




**Operating the integrated sideshift (ISS)**

The references to left and right are based on the load handler as viewed from the operator's position.

**Sideshift left (from driver's position):**

– Push the control lever (49) in direction (X1).

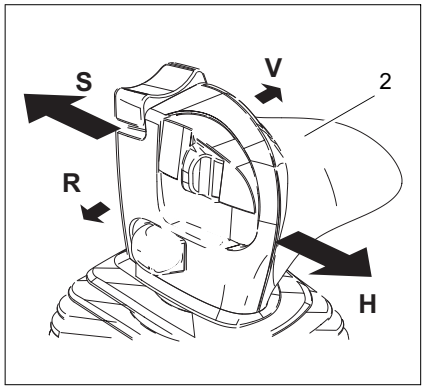
**Sideshift right (from driver's position):**

– Pull the control lever (49) in direction (X2).

## 4.4 Operating the lift mechanism and attachments (MULTIPILOT ○)

STOP Do not lift other people with the lifting mechanism and do not allow anyone to stand under a raised load.

The MULTIPILOT must only be operated from the driver's seat. The driver must be instructed in how to handle the lift mechanism and the attachments!




**Lifting**

– Pull the MULTIPILOT (2) in direction (H).

➔ The lift speed is determined by the inclination of the control lever.

– Activate the control lever until the desired height is reached.

➔ When the limit position is reached (there will be a noise from the pressure relief valve) set the control lever back to its starting position.

**Lowering**

– Push the MULTIPILOT (2) in direction (S).

➔ The lowering speed is determined by the inclination of the control lever.

⚠ Avoid dropping the load abruptly, in order to protect the load and the rack surface.

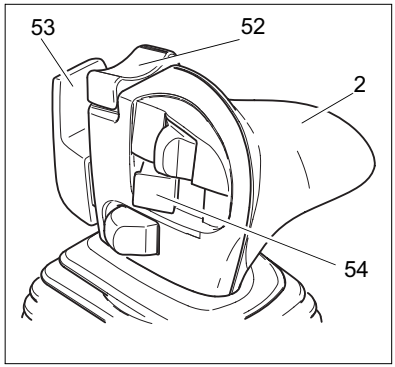
**Tilting the mast forward / backward**

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

– To tilt forward, push the MULTIPILOT (2) in direction (V).
– To tilt back, pull the MULTIPILOT (2) in direction (R).

**Operating the integrated sideshift (ISS)**

The references to left and right are based on the load handler as viewed from the operator's position.




**Sideshift left (from driver's position):**

– Press the left button (52).

**Sideshift right (from driver's position):**

– Press the right button (52).

**Aux. hydraulics II**

Note the manufacturer's operating instructions and the capacity of the attachment.

– Pull or push the button (53) to control the attachment.

**Auxiliary hydraulics III**

– Using button (54) change to auxiliary hydraulics III.
– Pull or push the button (53) to control the auxiliary hydraulic function.

**Controlling the speed of the lifting device**

Tilting the MULTIPILOT controls the speed of the hydraulic cylinder.

When the control lever is released it automatically reverts to neutral and the lifting device remains in the position it has reached.

Always apply the control lever sensitively, never with a sudden jerk. Release the MULTIPILOT as soon as the lifting device reaches the limit position.

## 4.5 Emergency lowering

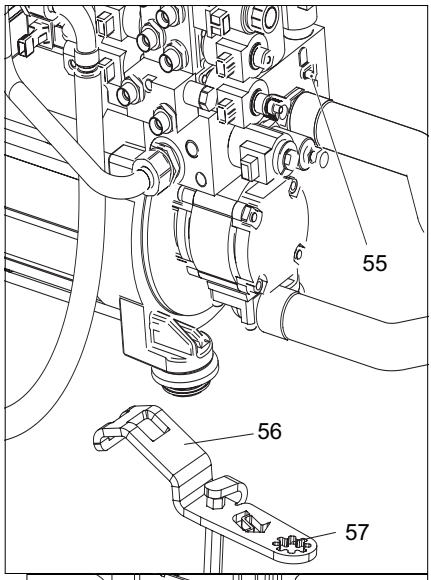
Keep all personnel out of the hazardous area when applying emergency lowering.

If the mast does not lower due to a fault in the lift controller, apply the emergency lowering valve (55) on the valve block below the floor board.

Never reach through the mast!
Do not stand underneath the load.

- Turn the EMERGENCY DISCONNECT switch and key switch off.
- Disconnect the battery connector.
- Place the auxiliary tool (56) on the emergency lowering valve (55) with the recess 57 (Jungheinrich symbol visible).
- Release the emergency lowering valve (55) in the forks direction.
- The mast and load handler will lower.
- If necessary the load can be stopped by closing the valve.

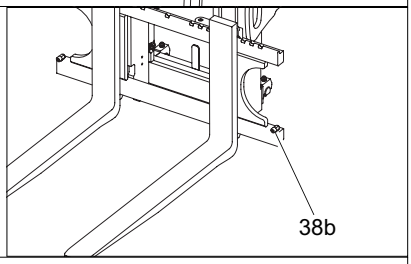
Do not operate the truck until the fault has been rectified.




## 4.6 Adjusting the forks

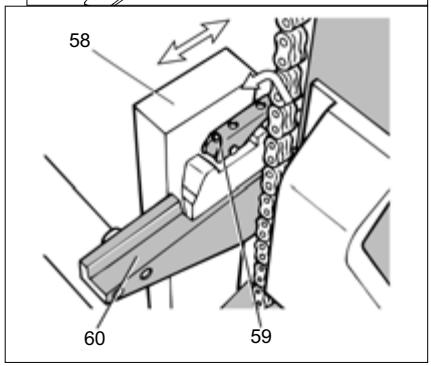
Unsecured and incorrectly adjusted forks can cause accidents

Before adjusting the forks make sure the retaining bolts (38b) are fitted.




Adjust the fork tines in such a way that both are equally distanced from the outer edge of the fork carriage and the load centre of gravity lies in the middle of the fork tines.

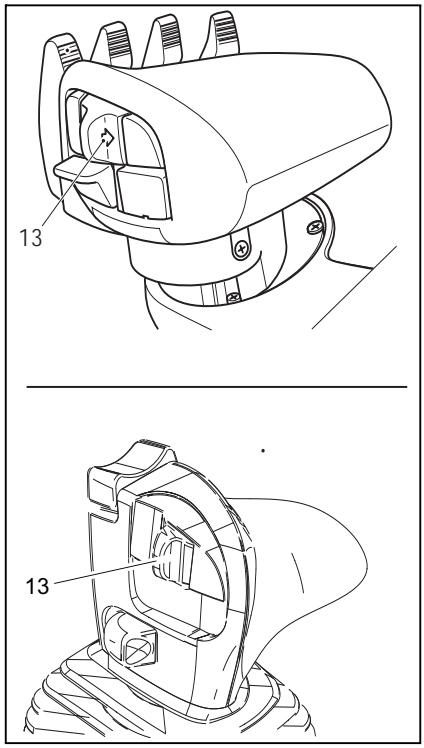
- Raise the locking lever (59).
- Push the forks (58) into the correct position on the fork carriage (60).
- Turn the locking lever down and move the fork tine until it engages in a slot.



## 4.7 Collecting, Lifting and Transporting Loads.

STOP Only move the truck with or without a load when the mast is tilted back and the load handler lowered.
Do not exceed the capacity of the truck.
Note the load chart!
Do not lift other people with the lifting mechanism and do not allow anyone to stand under a raised load.

– Approach the load with care.
– Set the travel direction switch (13) to neutral.
– Set the mast vertical.
– Raise the forks to the correct height for the load unit.
– Set the travel direction switch to forward travel.
– Insert the forks under the load
– Set the travel direction switch (13) to neutral.
– Lift the load unit clear.
– Set the travel direction switch to reverse.




STOP Make sure you have enough space to reverse into.

– Reverse carefully and slowly until the load unit is outside the storage area.

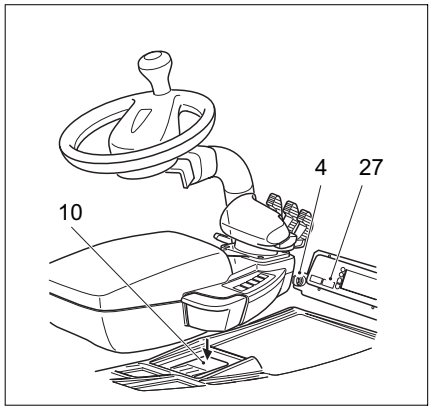
STOP Never reach through the mast!

– Tilt the mast fully backward.
– Bring the load unit into the transport position (approx. 150...200 mm).
– Transport the load unit.
– Set the travel direction switch (13) to neutral.
– Set the mast vertical.
– Position the load unit at the correct height
– Set the travel direction switch (13) to forward.
– Carefully enter the storage area.
– Slowly lower the load unit until the forks are free.

## 4.8 Parking the truck safely

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

– Drive the truck onto a level surface.
– Apply the parking brake button (27).
– Fully lower the load forks and tilt the mast forward.




Never park and abandon a truck with a raised load.

– Turn the key in the key switch (4) to “0”.
– Remove the key from the key switch (4).
– Press the EMERGENCY DISCONNECT switch (10) down.

## 4.9 Towing trailers

The truck can occasionally be used to tow a light trailer on a dry, level and well maintained surface.

The max. tow load is the capacity indicated on the capacity data plate (see decals diagram in chapter B).

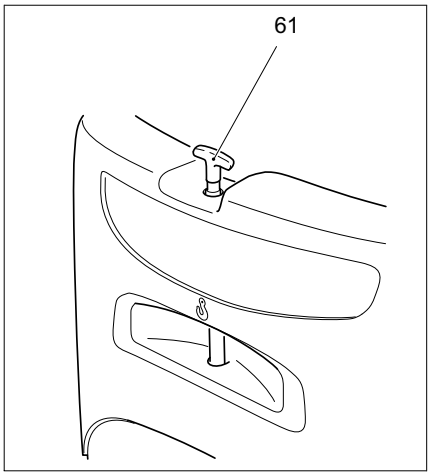
The tow load consists of the weight of the trailer and the stated capacity.
If a load is transported on the forks, the tow load must be reduced by the same amount.

STOP Important notes for safe towing

- A truck must not be continually operated with trailers.
- No supporting loads are permitted.
- The maximum speed is 5km/h.
- Towing must only be performed on level, secure travel routes.
- Follow the instructions of the coupling manufacturer if using special trailer couplings.
- 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**

– Push the tow pin (61) down and turn it 90 degrees.
– Pull the tow pin up and insert the tiller of the trailer vehicle into the opening.
– Insert the tow pin, push it down, turn it 90 degrees and engage it.



## 5 Troubleshooting

This chapter allows the user to identify and rectify basic faults or the effects of incorrect operation. When trying to locate a fault, proceed in the order shown in the table.

| Fault | Probable Cause | Action |
|---|---|---|
| Truck does not start | – Battery connector not plugged in | – Check battery plug and plug in if necessary. |
| | – EMERGENCY DISCONNECT pressed. | – Unlock the EMERGENCY DISCONNECT |
| | – Key switch in "0" position. | – Set key switch to “I” |
| | – Battery charge too low | – Check battery charge, charge battery if necessary |
| | – Battery door open / on-board charger active | – Finish charge / close door |
| | – Faulty fuse | – Check fuses |
| Load cannot be lifted | – Truck not operational | – Carry out all measures listed under “Truck does not move” |
| | – Hydraulic oil level too low | – Check hydraulic oil level |
| | – Faulty fuse | – Check fuses |
| Error message displayed | – 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 |

⚠ If the fault cannot be rectified after carrying out the above procedures, notify the manufacturer’s service department, as further troubleshooting can only be performed by specially trained and qualified service personnel.

### 5.1 Temperature control

If a temperature switch applies the power is reduced. This operates as a function of the temperature:
for crawl speed,
for the “half lift speed” hydraulic function,
for the “continual power deacitvation” controllers.

# F Industrial Truck Maintenance

## 1 Operational Safety and Environmental Protection

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

Any modification to the forklift truck assemblies, in particular the safety mechanisms, is prohibited. Do not alter the trucks' operating speeds under any circumstances.

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

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

## 2 Maintenance Safety Regulations

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

**Lifting and jacking up:** When an industrial truck is to be lifted, the lifting gear must only be secured to the points specially provided for this purpose. When jacking up the truck, take appropriate measures to prevent the truck from slipping or tipping over (e.g. wedges, wooden blocks). You may only work underneath a raised load handler if it is supported by a sufficiently strong chain.

For jack points see Chapter B.

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

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

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

**Electrical System:** Only suitably trained personnel may operate on the truck's electrical system. Before working on the electrical system, take all precautionary measures to avoid electric shocks. For battery-operated trucks, also de-energise the truck by removing the battery connector.

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

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

**Tyres:** The quality of tyres affects the stability and performance of the truck. When replacing tyres fitted at the factory, only use the manufacturer's original spare parts. Otherwise the data sheet specifications of the truck cannot be guaranteed. When changing wheels and tyres, ensure that the truck does not slew (e.g. when replacing wheels always left and right simultaneously).

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

**Hydraulic hoses:** The hoses must be replaced every six years. When replacing hydraulic components, also replace the hoses in the hydraulic system.

## 3 Servicing and Inspection

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

⚠ The application conditions of an industrial truck have a considerable impact on the wear of the service components.
We recommend that a Jungheinrich customer adviser carries out an application analysis on site to work out specific service intervals to prevent damage due to wear. The service intervals stated are based on single shift operation under normal operating conditions. They must be reduced accordingly if the truck is to be used in conditions of extreme dust, temperature fluctuations or multiple shifts.

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

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

➔ W service intervals must be performed by the owner.

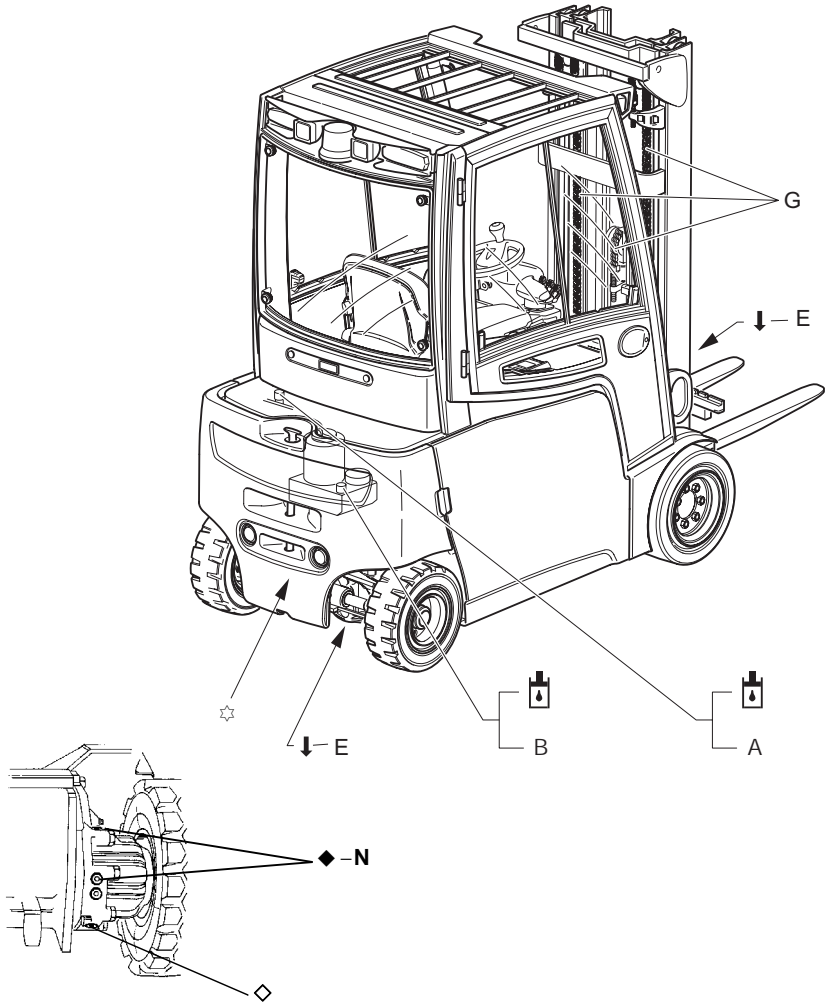
During the run-in period – after approx. 100 service hours – the owner must check the wheel nuts/bolts and re-tighten if necessary.

## 4 Maintenance checklist

| | | | Maintenance Intervals | | | |
|---|---|---|---|---|---|---|
| | | | W | A | B | C |
| | | Standard = ● | | | | |
| **Brakes** | 1.1 | Check air gap | | | ● | |
| | 1.2 | Test service and parking brakes | | | ● | |
| | | | | | | |
| **Electrical system** | 2.1 | Test instruments, displays and control switches | | | ● | |
| | 2.2 | Test warning and safety device | | | ● | |
| | 2.3 | Check fuse ratings | | | | ● |
| | 2.4 | Make sure wire connections are secure and check for damage | | | ● | |
| | 2.5 | Test micro switch setting | | | ● | |
| | 2.6 | Check contactors and relays | | | ● | |
| | 2.7 | Test for frame leakage | | | ● | |
| | 2.8 | Test cable and motor attachments | | | ● | |
| | 2.9 | Check lighting | | | ● | |
| | | | | | | |
| **Power supply** | 3.1 | Visually inspect battery | | | ● | |
| | 3.2 | Check battery cable connections are secure, grease terminals if necessary. | | | ● | |
| | 3.3 | Check acid density, acid level and battery voltage | | | ● | |
| | | | | | | |
| **Travel** | 4.1 | Check transmission for noise and leakage | | | ● | |
| | 4.2 | Check travel mechanism, adjust and lubricate if necessary | | | ● | |
| | 4.3 | Check wheels for wear and damage | | | ● | |
| | 4.4 | Check wheel suspension and attachments | | | ● | |
| | | | | | | |
| **Truck structure** | 5.1 | Check mast attachment | | | ● | |
| | 5.2 | Check chassis for damage. | | | ● | |
| | 5.3 | Check labels | | | ● | |
| | 5.4 | Make sure overhead guard is secure and check for damage | | | ● | |
| | 5.5 | Check driver’s seat | | | ● | |
| | 5.6 | Test restraint systems | | | ● | |

| | | | Maintenance Intervals | | | |
|---|---|---|---|---|---|---|
| | | | Standard = ● | W | A | B | C |
| | | | | | | | |
| **Hydraulic operation** | 6.1 | Check mast bearings. | | | | ● | |
| | 6.2 | Check setting of slide pieces and stops, and adjust if necessary | | | | ● | |
| | 6.3 | Visually inspect mast rollers and check contact surface wear level | | | | ● | |
| | 6.4 | Check lateral clearance of mast connections and of fork carriage | | | | | ● |
| | 6.5 | Check load chain setting and tighten if necessary | | | | ● | |
| | 6.6 | Check forks and fork carriage for wear and damage | | | | ● | |
| | 6.7 | Check tilt cylinder | | | | ● | |
| | 6.8 | Check mast tilt angle | | | | ● | |
| | 6.9 | Test hydraulic system. | | | | ● | |
| | 6.10 | Check that hose and pipe lines and their connections are secure, check for leaks and damage. | | | | ● | |
| | 6.11 | Check cylinders and piston rods for damage and leaks, and make sure they are secure | | | | ● | |
| | 6.12 | Check hydraulic oil level | | | | ● | |
| | 6.13 | Replace hydraulic oil. (This may have to be performed via a specialist environmental service truck) *) | | | | | |
| | 6.14 | Replace the hydraulic oil filter | | | | | ● |
| | 6.15 | Check the attachment | | | | ● | |
| | | | | | | | |
| **Agreed performance levels** | 7.1 | Lubricate truck in accordance with Lubrication Schedule. | | | | ● | |
| | 7.2 | Test run | | | | ● | |
| | 7.3 | Demonstration after servicing | | | | ● | |
| | | | | | | | |
| **Steering system** | 8.1 | Test electric steering | | | | ● | |
| | 8.2 | Check the swivelling bolster | | | | ● | |

*) Every 2000 service hours or at least every 2 years.




▼ Contact surfaces

⬇ Grease nipple

Hydraulic oil filler neck

☼ Hydraulic oil drain plug

◆ Transmission oil filler neck

◇ Transmission oil drain plug

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## 5.1 Consumables

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

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

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

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

| Code | Order no. | Quantity | Description | Used for |
|---|---|---|---|---|
| A | 50426072 | 440AH = 18L<br>550AH = 23L<br>660AH = 28L | HLPD 32 [1] | Hydraulic system |
| | 50429647 | | HLPD 22 [2] | |
| | 50124051 | | HV 68 [3] | |
| | 51082888 | | Plantosyn 46 HVI (BIO hydraulic oil) | |
| B | 50426072 | 2,5 l | HLPD 32 [1] | Steering system (EFG316-320) |
| | 50429647 | | HLPD 22 [2] | |
| | 50124051 | | HV 68 [3] | |
| | 51082888 | | Plantosyn 46 HVI (BIO hydraulic oil) | |
| E | 50157382 | | Lubrication grease K-L 3N [3] | Steering axle (EFG 316-320) |
| G | 29201280 | | Chain spray | Chains |
| N | 50468784 | 2 x 0.35 l | Transmission oil, Shell Spirax MA 80 W | Transmission |

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

STOP The trucks are filled at the factory with H-LPD 22/32 hydraulic oil or Plantosyn 46 HVI BIO hydraulic oil.
You cannot change from "Plantosyn 46 HVI" BIO hydraulic oil to H-LPD 22. The same applies to changing from H-LPD 22 hydraulic oil to Plantosyn 46 HVI BIO hydraulic oil.
Furthermore you cannot mix H-LPD 22 hydraulic oil with Plantosyn 46 HVI BIO hydraulic oil.

**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 |

## 6 Maintenance Instructions

### 6.1 Preparing the truck for maintenance and repairs

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

– Park the truck securely (see Chapter E).
– Disconnect the battery so that the truck cannot be started by unauthorised persons (refer to chapter D).

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

### 6.2 Opening the rear panel

– Undo the two quick release locks, pull the rear panel back and remove it.

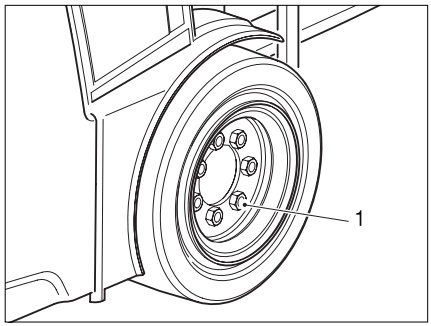
The fuses, steer motor and other electrical components can now be reached.

### 6.3 Checking the wheel attachments.

– Park the truck securely (see Chapter E).
– Tighten the wheel nuts (1) crosswise with a torque wrench.

**Torque**

| | |
|---|---|
| Drive wheels | $M_A$ = 240 Nm |
| Rear wheels | $M_A$ = 240 Nm |




### 6.4 Rear wheel rated condition

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

The tyres must always be replaced in pairs. Always use tyres of the same make, model and profile, see chapter B.

## 6.5 Checking the hydraulic oil level

Fully lower the load handler.

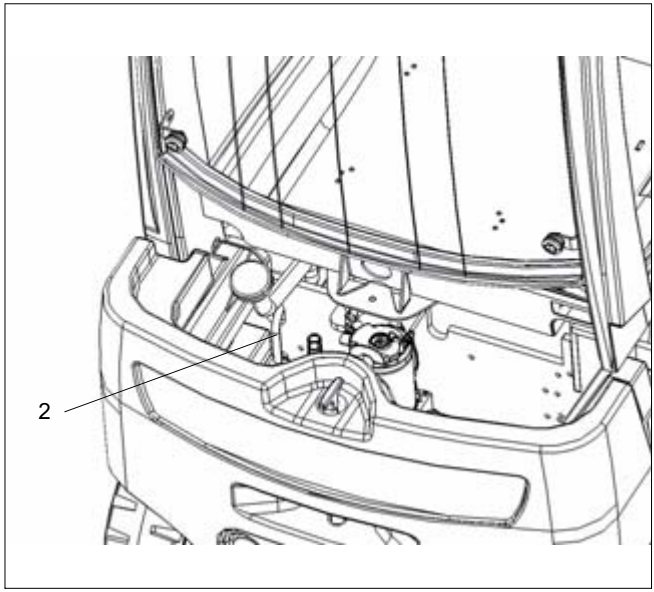
– Park the truck on a horizontal surface.
– Prepare the truck for maintenance and repairs (see Sections 6.1 and 6.2).
– Visually inspect the hydraulic oil level on the hose (2).

If the reservoir is filled sufficiently, the hose will be approx. 1 cm full from the bottom.

– Add hydraulic oil if necessary until the oil can be seen in the hose

You can damage the system by adding more oil to the hydraulic reservoir.
Used consumables must be disposed of in accordance with the relevant environmental protection regulations.

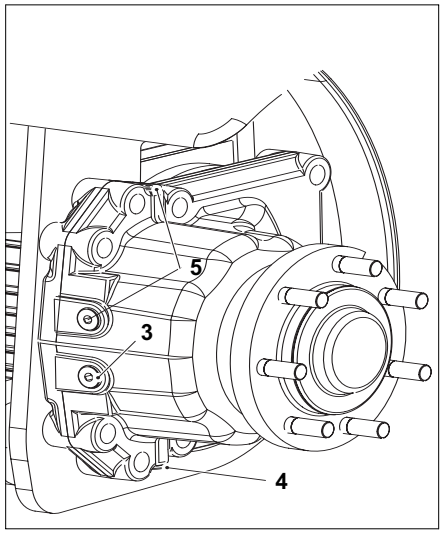
.




Trucks with bio hydraulic oil have a warning notice on the hydraulic reservoir: “Fill only with hydraulic oil”. Use only bio hydraulic oil, see “Lubricants” section.

### 6.6 Check transmission oil level

Transmission oil must never enter the ground; therefore place a collection tray underneath the gear unit.




- Park the truck securely (see Chapter E).
- Unscrew the oil dipstick (3).
- Check transmission oil level, top up if necessary

The oil level should reach the bottom mark of the oil check hole (3).

Used consumables must be disposed of in accordance with the relevant environmental protection regulations.

### 6.7 Draining the oil

- Drain oil at operating temperature.
- Prepare an oil collection tray underneath.
- Unscrew the oil drain plug (4) and drain the transmission oil.

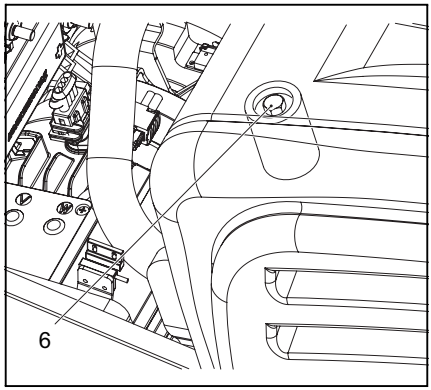
To ensure swift and complete draining of the transmission oil, unscrew the oil dipstick (3).

### 6.8 Adding oil

- Insert the oil drain plug (4).
- Unscrew the oil dipstick (3) and add new transmission oil in the filler hole (5).

### 6.9 Replacing the hydraulic oil filter

- Unscrew the hydraulic oil filter cap (6). 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.



### 6.10 Seat belt maintenance

– Pull out the belt completely and check for fraying
– Test the belt buckle and make sure the belt returns correctly into the retractor.
– Check the cover for damage.

**Testing the automatic blocking system:**

– Park the truck on a horizontal surface
– Pull out the seat belt with a jerk

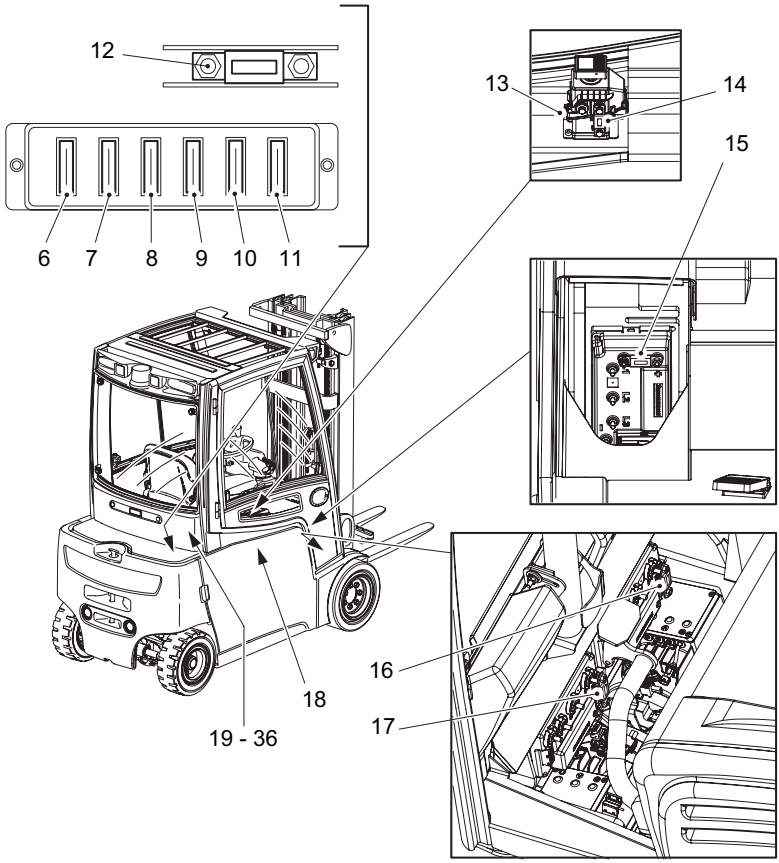
The interlock must prevent the belt from coming out.

Do not operate the truck with a faulty seat belt. Replace it immediately.

## 6.11 Checking electrical fuses

– Prepare the truck for maintenance and repairs.
– Open the rear panel.
– Unscrew the cover.
– Check condition and rating of the fuses in accordance with the table.

STOP To avoid damaging the electrical system, only use fuses with the correct ratings.



Electrical system fuses

| Item | Description | Electric circuit | Rating / type |
|---|---|---|---|
| 6 | 3F10 | Steering threephase controller fuse | 40A |
| 7 | F23 | Control fuse 48V | 5A |
| 8 | 7F1 | Magnetic brake control fuse | 7.5A |
| 9 | 1F9 | Travel/Lift electronics control fuse | 5A |
| 10 | 4F1 | Horn control fuse | 3A |
| 11 | F18 | Power on contactor control fuse | 3A |
| 12 | F1 | Overall control circuit fuse | 63A |

EMERGENCY DISCONNECT fuses

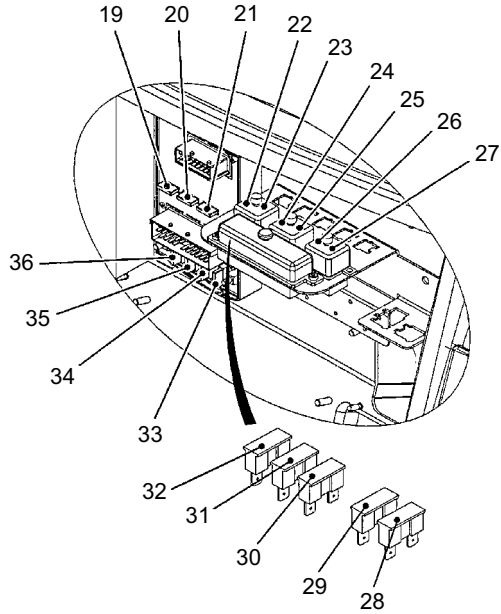
| Item | Description | Electric circuit | Rating / type |
|---|---|---|---|
| 13 | F4 | Main contactor control fuse | 5A |
| 14 | F8 | Positive wire main fuse | 425A |

Traction and lift controller fuses

| Item | Description | Electric circuit | Rating / type |
|---|---|---|---|
| 15 | 2F1 | Hydraulic motor fuse | 250A |
| 16 | 1F2 | RH drive motor fuse | 250A |
| 17 | 1F1 | LH drive motor fuse | 250A |

On-board charger fuse (○)

| Item | Description | Electric circuit | Rating / type |
|---|---|---|---|
| 18 | F10 | On-board charger fuse | 170A |




Options fuses (○)

| Item | Description | Electric circuit | Rating / type |
|---|---|---|---|
| 19 | 9F1 | Windscreen wiper control fuse | 5A |
| 20 | 9F33 | Windscreen washer pump fuse | 5A |
| 21 | 9F14 | Rear windscreen wiper control fuse | 5A |
| 22 | 7F3 | DC/DC converter control fuse | 20A |
| 23 | 7F4 | DC/DC converter control fuse | 20A |
| 24 | 5F1 | Searchlight control fuse | 10A |
| 25 | 4F14 | Strobe control fuse | 5A |
| 26 | F14 | 48 volt heating fuse | 40A |
| 27 | F14.1 | 24 volt heating fuse | 15A |
| 28 | F24 | Output card fuse | 20A |
| 29 | 9F5 | Windscreen heating fuse | 7.5A |
| 30 | 9F2 | Seat heating control fuse | 5A |
| 31 | 4F4 | Beacon control fuse | 5A |
| 32 | 5F5 | Lighting control fuse | 15A |
| 33 | 5F11.3 | Rear RH work lights fuse | 5A |
| | 5F3.2 | RH reverse lights fuse | |
| 34 | 5F11.2 | Rear LH work lights fuse | 5A |
| | 5F3.1 | LH reverse lights fuse | |
| 35 | 5F11.1 | Front RH work lights fuse | 5A |
| 36 | 5F11 | Front LH work lights fuse | 5A |

### 6.12 Recommissioning

The truck may only be restored to service after cleaning or repair work, once the following operations have been performed:

- Test horn.
- Test main switch operation.
- Test brakes.
- Lubricate the truck in accordance with the lubrication chart.

## 7 Decommissioning the industrial truck

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

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

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

### 7.1 Prior to decommissioning

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

➔ In addition, follow the battery manufacturer's instructions.

- Spay all exposed electrical contacts with a suitable contact spray.

### 7.2 During decommissioning

**Every 2 months:**

- Charge the battery (see Chapter D).

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

### 7.3 Returning the truck to operation after decommissioning

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

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

STOP Perform several brake tests immediately after re-commissioning the truck.

## 8 Safety checks to be performed at intervals and after unusual events

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

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

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

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

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

## 9 Final de-commissioning, disposal

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

# Instructions for use

## Jungheinrich traction battery

## Table of contents



0506.GB

## 1 Jungheinrich traction battery

with positive tubular plates type EPzS and EPzB

**Rating Data**

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

* Will be reached within the first 10 cycles.

•Pay attention to the operation instruction and fix them close to the battery!
•Work on batteries to be carried out by skilled personnel only!

•Use protective glasses and clothes when working on batteries!
•Pay attention to the accident prevention rules as well as DIN EN 50272-3, DIN 50110-1!

•No smoking!
•Do not expose batteries to naked flames, glowing embers or sparks, as it may cause the battery to explode!

•Acid splashes in the eyes or on the skin must be washed with water. In case of accident consult a doctor immediately!
•Clothing contaminated by acid should be washed in water.

•Risk of explosion and fire, avoid short circuits!

•Electrolyte is highly corrosive!

•Batteries and cells are heavy!
•Ensure secure installation! Use only suitable handling equipment e.g. lifting gear in accordance with VDI 3616.

•Dangerous electrical voltage!
•Caution! Metal parts of the battery are always live. Do not place tools or other metal objects on the battery!

Ignoring the operation instructions, repair with non-original parts or using additives for the electrolyte will render the warranty void.

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

**1. Commissioning filled and charged batteries. For commissioning of unfilled batteries see separate instructions!**

The battery should be inspected to ensure it is in perfect physical condition.

The charger cables must be connected to ensure a good contact, taking care that the polarity is correct. Otherwise battery, vehicle or charger could be damaged.

The specified torque loading for the polscrews of the charger cables and connectors are:

| | steel |
|---|---|
| M 10 | 23 ± 1 Nm |

The level of the electrolyte must be checked. If it is below the antisurge baffle or the top of the separator it must first be topped up to this height with purified water.

The battery is then charged as in item 2.2.

The electrolyte should be topped up to the specified level with purified water.

**2. Operation**

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

**2.1 Discharging**

Be sure that all breather holes are not sealed or covered.

Electrical connections (e.g. plugs) must only be made or broken in the open circuit condition.

To achieve the optimum life for the battery, operating discharges of more than 80% of the rated capacity should be avoided (deep discharge).

This corresponds to an electrolyte specific gravity of 1.13 kg/l at the end of the discharge. Discharged batteries must be recharged immediately and must not be left discharged. This also applies to partially discharged batteries.

**2.2 Charging**

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

In the gassing stage the current limits given in DIN EN 50272-3 must not be exceeded. If the charger was not purchased together with the battery it is best to have its suitability checked by the manufacturers service department. When charging, proper provision must be made for venting of the charging gases.

Battery container lids and the covers of battery compartments must be opened or removed. The vent plugs should stay on the cells and remain closed.

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

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

### 2.3 Equalising charge

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

**Watch the temperature!**

### 2.4 Temperature

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

### 2.5 Electrolyte

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

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

## 3. Maintenance

### 3.1 Daily

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

### 3.2 Weekly

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

### 3.3 Monthly

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

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

### 3.4 Annually

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

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

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

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

## 4. Care of the battery

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

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

**5. Storage**

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

1. a monthly equalising charge as in point 2.3

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

**6. Malfunctions**

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

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

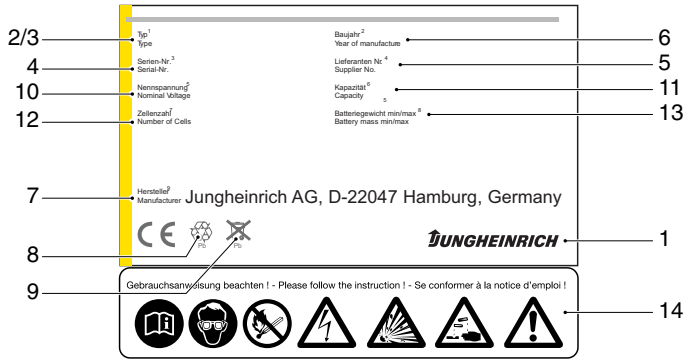

Back to the manufacturer!

Batteries with this sign must be recycled.

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

We reserve the right make technical modification.

## 7. Type plate, Jungheinrich traction battery




| Item | Designation | Item | Designation |
|---|---|---|---|
| 1 | Logo | 8 | Recycling symbol |
| 2 | Battery designation | 9 | Dustbin/material |
| 3 | Battery type | 10 | Nominal battery voltage |
| 4 | Battery number | 11 | Nominal battery capacity |
| 5 | Battery tray number | 12 | Number of battery cells |
| 6 | Delivery date | 13 | Battery weight |
| 7 | Battery manufacturer's logo | 14 | Safety instructions and warnings |

* CE mark is only for batteries with a nominal voltage greater than 75 volt.

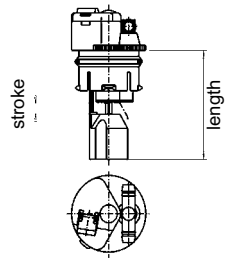
**Aquamatic/BFS III water refilling system for Jungheinrich traction battery with EPzS and EPzB cells with tubular positive plates**

**Aquamatic plug arrangement for the Operating Instructions**

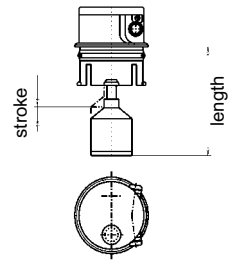
| Cell series* | | Aquamatic plug type (length) | |
|---|---|---|---|
| **EPzS** | **EPzB** | **Frötek** (yellow) | **BFS** (black) |
| 2/120 – 10/ 600 | 2/ 42 – 12/ 252 | 50,5 mm | 51,0 mm |
| 2/160 – 10/ 800 | 2/ 64 – 12/ 384 | 50,5 mm | 51,0 mm |
| – | 2/ 84 – 12/ 504 | 50,5 mm | 51,0 mm |
| – | 2/110 – 12/ 660 | 50,5 mm | 51,0 mm |
| – | 2/130 – 12/ 780 | 50,5 mm | 51,0 mm |
| – | 2/150 – 12/ 900 | 50,5 mm | 51,0 mm |
| – | 2/172 – 12/1032 | 50,5 mm | 51,0 mm |
| – | 2/200 – 12/1200 | 56,0 mm | 56,0 mm |
| – | 2/216 – 12/1296 | 56,0 mm | 56,0 mm |
| 2/180 – 10/900 | – | 61,0 mm | 61,0 mm |
| 2/210 – 10/1050 | – | 61,0 mm | 61,0 mm |
| 2/230 – 10/1150 | – | 61,0 mm | 61,0 mm |
| 2/250 – 10/1250 | – | 61,0 mm | 61,0 mm |
| 2/280 – 10/1400 | – | 72,0 mm | 66,0 mm |
| 2/310 – 10/1550 | – | 72,0 mm | 66,0 mm |

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

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




Aquamatic plug with diagnostics hole




Aquamatic plug BFS III with diagnostics hole

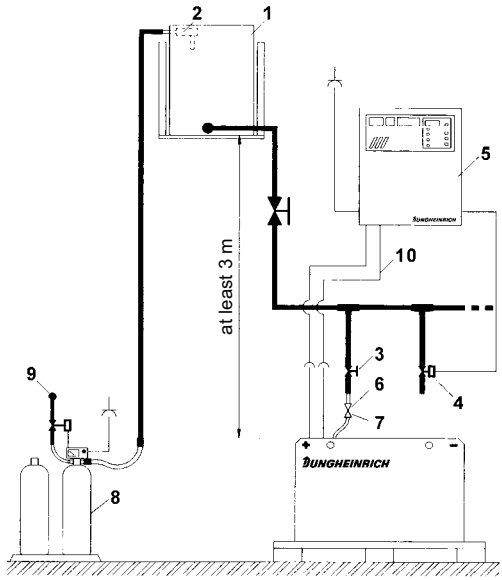
Non-adherence to the operating instructions, repairs carried out with non-original spare parts, unauthorised interference, and the use of additives for the electrolytes (alleged improvement agents) will invalidate any claim for warranty.

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

**Diagrammatic view**

**Equipment for the water refilling system**

1. Water tank
2. Level switch
3. Discharge point with ball valve
4. Discharge point with solenoid valve
5. Charger
6. Sealing coupler
7. Closing nipple
8. Ion exchange cartridge with conductance meter and solenoid valve
9. Connection for untreated water
10. Charging lead




## 1. Design

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

## 2. Application

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

## 3. Function

The quantity of water required in the refilling process is controlled by the valve located in the plug in combination with the float and the float rods. In the Aquamatic System the existing water pressure at the valve turns off the water supply and ensures that the valve closes securely. When the maximum filling level is reached in the BFS system, the float and the float rods through a lever system close the valve with five times the buoyant force and consequently interrupt the water supply reliably.

**4. Filling (manual/automatic)**

The batteries should be filled with battery water as soon as possible before the battery charging comes to an end; this ensures that the refilled water quantity is mixed with the electrolyte. In normal operation it is usually sufficient to fill once a week.

**5. Connection pressure**

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

**5.1 Falling water**

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

**5.2 Pressurised water**

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

**5.3 Water Refill Trolley (serviceMobil)**

The submergible pump located in the ServiceMobil's tank generates the necessary filling pressure. No difference in height is permitted between the standing level of the ServiceMobil and the standing level of the battery.

**6. Filling duration**

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

**7. Water quality**

Only refilling water which conforms in quality to DIN 43530 part 4 may be used to fill the batteries. The refilling unit (tank, pipelines, valves etc.) may not contain any kind of dirt which could impair the functional reliability of the Aquamatic/BFS plug. For safety reasons it is recommendable to insert a filter element (optional) with a max. passage opening of 100 to 300 µm into the battery's main supply pipe.

## 8. Battery hose connections

Hose connections for the individual plugs are laid along the existing electric circuit. No changes may be made.

## 9. Operating temperature

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

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

### 9.1 Diagnostics hole

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

### 9.2 Float

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

### 9.3 Cleaning

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

## 10. Accessories

### 10.1 Flow indicator

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

### 10.2 Plug lifter

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

### 10.2.1 Clamping ring tool

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

### 10.3 Filter element

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

### 10.4 Sealing coupler

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

## 11. Functional data

PS - self-sealing pressure: Aquamatic > 1.2 bars

BFS system none

D - rate of flow in the opened valve when the pressure is 0.1 bars: 350 ml/min

D1 - maximum permissible leakage rate in the closed valve when the pressure is at 0.1 bars: 2 ml/min

T - permissible temperature range: 0° C to a maximum of 65° C

Pa - operating pressure range: 0.2 to 0.6 bars in the Aquamatic system and operating pressure range: 0.3 to 1.8 bars in the BFS system.

## 2 Jungheinrich traction batterie

**Maintenance free Jungheinrich traction batterie with positive tubular plates type EPzV and EPzV-BS**

**Rating Data**

| | |
|---|---|
| 1. Nominal capacity C5: | See type plate |
| 2. Nominal voltage: | 2,0 Volt x No of cells |
| 3. Discharge current: | C5/5h |
| 4. Rated temperature: | 30° C |

EPzV batteries are valve-regulated batteries with an immobilised electrolyte and where a water refilling isn't permitted during the whole battery life. Instead of a vent plug there are valves used, who will be destroyed when they are opened.

When operating valve-regulated lead-acid batteries the same safety requirements as for vented cells apply to protect against hazards from electric current, from explosion of electrolytic gas and in case of the cell container is damaged, from the corrosive electrolyte.

- Pay attention to the operation instruction and fix them close to the battery!
- Work on batteries to be carried out by skilled personnel only!

- Use protective glasses and clothes when working on batteries!
- Pay attention to the accident prevention rules as well as DIN EN 50272, DIN 50110-1!

- No smoking!
- Do not expose batteries to naked flames, glowing embers or sparks, as it may cause the battery to explode!

- Acid splashes in the eyes or on the skin must be washed with water. In case of accident consult a doctor immediately!
- Clothing contaminated by acid should be washed in water.

- Risk of explosion and fire, avoid short circuits!

- Electrolyte is highly corrosive!
- In the normal operation of this batteries a contact with acid isn´t possible. If the cell containers are damaged, the immobilised electrolyte (gelled sulphuric acid) is corrosive like the liquid electrolyte.

- Batteries and cells are heavy!
- Ensure secure installation! Use only suitable handling equipment e.g. lifting gear in accordance with VDI 3616.

- Dangerous electrical voltage!
- Caution! Metal parts of the battery are always live. Do not place tools or other metal objects on the battery!

Ignoring the operation instructions, repair with non-original parts and non authorised interventions will render the warranty void.

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

**1. Commissioning**

The battery should be inspected to ensure it is in perfect physical condition.

The battery end cables must have a good contact to terminals, check that the polarity is correct.

Otherwise battery, vehicle or charger could be destroyed.

The battery has to be charged according to item 2.2

The specified torque loading for the pole screws of the end cables and connectors are:

| | steel |
|---|---|
| M 10 | 23 ± 1 Nm |

**2. Operation**

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

**2.1 Discharging**

Ventilation openings must not be sealed or covered.

Electrical connections (e.g. plugs) must only be made or broken in the open circuit condition.

To achieve the optimum life for the battery, operating discharges of more than 60% of the rated capacity should be avoided (deep discharge).

They reduce the battery life considerable. To measure the state of discharge use only the battery manufacturer recommended discharge indicators.

Discharged batteries must be recharged immediately and must not be left discharged.

This also applies to partially discharged batteries.

**2.2 Charging**

Only direct current must be used for charging. Charging procedures according to DIN 41773 and DIN 41774 must only be applied in the manufacturer approved modifications. Therefore only battery manufacturer approved chargers must be used. Only connect the battery assigned to a charger, suitable for the size of battery, in order to avoid overloading of the electric cables and contacts and unacceptable gassing of the cells. EPzV batteries have a low gas emission.

When charging, proper provision must be made for venting of the charging gases. Battery container lids and the covers of battery compartments must be opened or removed.

With the charger switched off connect up the battery, ensuring that the polarity is correct (positive to positive, negative to negative). Now switch on the charger. When charging the temperature of the battery rises by about 15° C, so charging should only begin if the battery temperature is below 35° C. The battery temperature should be at least +15°C before charging otherwise a full charge will not be achieved. Are the temperatures a longer time higher than +40° C or lower than +15° C, so the chargers need a temperatures regulated voltage.

The correction factor is, in accordance with DIN EN 50272-1, -0,005 V/c and Kelvin.

Special instructions for the operation of batteries in hazardous areas.

This concerns batteries which are used in accordance with EN 50 014, DIN VDE 0170 / 0171 Ex I (in areas with a firedamp hazard) or Ex II (in potentially explosive areas). The attention pictograms has to be respected.

**2.3 Equalising charge**

Equalising charges are used to safeguard the life of the battery and to maintain its capacity. Equalising charges are carried out following normal charging.

They are necessary after deep discharges and repeated incomplete recharges. For the equalising charges has to be used only the battery manufacturer prescribed chargers.

**Watch the temperature!**

**2.4 Temperature**

A battery temperature of 30°C is specified as the rated temperature. Higher temperatures shorten the life of the battery, lower temperatures reduce the available capacity. 45° C is the upper temperature limit and is not acceptable as an operating temperature.

**2.5 Electrolyte**

The electrolyte is immobilised in a gel. The density of the electrolyte can not be measured.

**3. Maintenance**

Don’t refill water!

**3.1 Daily**

Charge the battery immediately after every discharge.

### 3.2 Weekly

Visual inspection after recharging for signs of dirt and mechanical damage.

### 3.3 Quarterly

After the end of the charge and a rest time of 5 h following should be measured and recorded:

• the voltages of the battery

• the voltages of every cells

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

### 3.4 Annually

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

The tests on the insulation resistance of the battery must be conducted in accordance with DIN 43539-1.

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

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

## 4. Care of the battery

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

Any liquid in the battery tray must be extracted and disposed of in the prescribed manner.

Damage to the insulation of the tray should be repaired after cleaning, to ensure that the insulation value complies with DIN EN 50272-3 and to prevent tray corrosion. If it is necessary to remove cells it is best to call our service department for this.

## 5. Storage

If batteries are taken out of service for a lengthy period they should be stored in the fully charged condition in a dry, frost-free room.

To ensure the battery is always ready for use a choice of charging methods can be made:

1. a quarterly full charging like charge as in point 2.2. If any consumer is connected with, e.g. measure or controlling systems, it can be, that this charging is necessary every 14 days.

2. float charging at a charging voltage of 2.25 V x the number of cells.

The storage time should be taken into account when considering the life of the battery.

## 6. Malfunctions

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

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

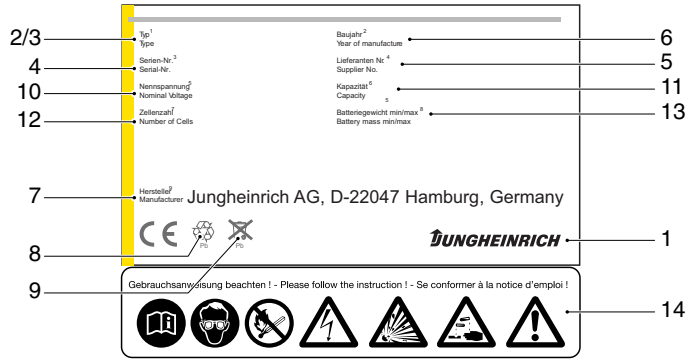

Back to the manufacturer!

Batteries with this sign must be recycled.

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

We reserve the right make technical modification.

## 7. Type plate, Jungheinrich traction battery




| Item | Designation | Item | Designation |
|---|---|---|---|
| 1 | Logo | 8 | Recycling symbol |
| 2 | Battery designation | 9 | Dustbin/material |
| 3 | Battery type | 10 | Nominal battery voltage |
| 4 | Battery number | 11 | Nominal battery capacity |
| 5 | Battery tray number | 12 | Number of battery cells |
| 6 | Delivery date | 13 | Battery weight |
| 7 | Battery manufacturer's logo | 14 | Safety instructions and warnings |

* CE mark is only for batteries with a nominal voltage greater than 75 volt.