ETM/V 214-325

09.11

Operating instructions

GB

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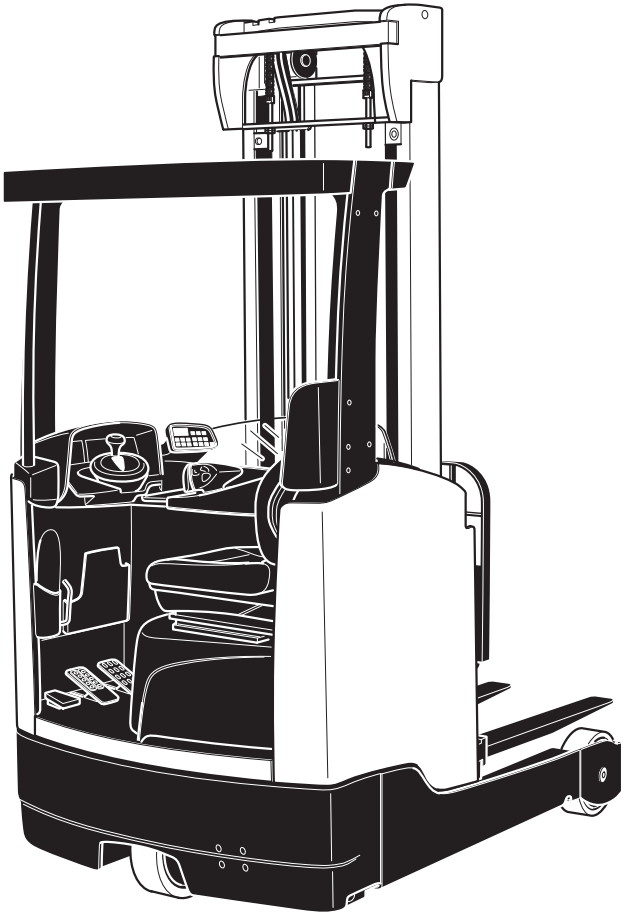
03.16

ETM 214
ETM 216
ETV 214
ETV 216
ETV 318
ETV 320
ETV 325
ETM 325



JUNGHEINRICH

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Declaration of Conformity

Jungheinrich AG, Friedrich-Ebert-Damm 129, 22047 Hamburg, Germany
Manufacturer or agent acting in the European Union

Model	Option	Serial no.	Year of manufacture
ETM 214 ETM 216 ETV 214 ETV 216 ETV 318 ETV 320 ETV 325 ETM 325			

Additional information

On behalf of

Date

(GB) EC Declaration of Conformity

The undersigned hereby declare that the powered industrial truck described below in detail complies with the European Directives 2006/42/EG (Machinery Directive) and 2014/30/EU (Electromagnetic Compatibility - EMC) including amendments as well as the legislative decree to incorporate the directives in national law. The signatories are in each case individually authorised to compile the technical documents.

03.16 EN

Important notes on transporting and mounting load lifting devices to reach trucks

Transport

Depending on the overall height of the lifting mast and the local conditions transport can be performed in three different ways

– Standing, with the lifting mast mounted (for trucks with low overall height)
– Standing, with martially mounted lifting mast tilted towards the overhead guard (for trucks with medium overall height). Hydraulic line for the lifting function is interrupted.
– Standing, with the lifting mast dismounted (for trucks with large overall height)

Safety Instructions for Assembly and Commissioning

The assembly of the truck on site, commissioning the truck and instructing the driver must be carried out by personnel trained and authorised by the manufacturer

Connect the hydraulic lines to the basic machine / mast interface and commission the truck only after having installed the mast as per the instructions.

Foreword

Notes on the operating instructions

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

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

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

Safety notices and text mark-ups

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

⚠ DANGER!

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

⚠ WARNING!

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

⚠ CAUTION!

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

NOTE

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

➔ Used before notices and explanations.

- ● Indicates standard equipment
- ○ Indicates optional equipment

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Contents

Appendix

JH Traction Battery Operating Instructions

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

A Correct Use and Application

1 General

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

2 Correct application

NOTE

The maximum load and load distance are indicated on the capacity plate and must not be exceeded.
The load must rest on the load handler or be lifted by an attachment approved by the manufacturer.
The load must be fully raised, see page 106.

⚠ **CAUTION!**

Loss of stability can cause accidents

Extended mast sections when the truck is travelling with or without load will reduce the truck's stability.

▶ Always travel with the mast holder retracted, the mast tilted back and the load handler lowered.

The following operations are permitted:

– Lifting and lowering loads.
– Transporting lowered loads.

The following operations are prohibited:

– Travelling with a raised load (>30 cm).
– Transporting hanging loads. If the truck is to be operated with hanging loads, proof of sufficient safety distance under local operating conditions must be obtained from a specialist assessor.
– Carrying and lifting passengers.
– Pushing or pulling load units.

3 Approved application conditions

⚠ DANGER!

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

– Operation in industrial and commercial environments.
– Permissible temperature range -30°C to +40°C.
– Operation only on secure, level surfaces with sufficient capacity.
– Do not exceed the permissible surface and spot load limits on the travel routes.
– Operation only on routes that are visible and approved by the operating company.
– Negotiating inclines up to a maximum of 15 %.
– Do not travel across or at an angle on inclines. Travel with the load facing uphill.
– Operation in partially public traffic.

Floor surface

The floor surface must satisfy the following requirements:

– The supporting floor must comply with relevant regulations.
– The floor must be resistant to oil and grease.
– The floor insulation resistance RE must not exceed 10^6 Ω (in accordance with DIN 51953).
– The capacity data indicated on the truck apply to floor surfaces that conform to DIN 18202 Table 3, Row 3.

⚠ WARNING!

Use under extreme conditions

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

▶ Special equipment and authorisation are required if the truck is to be constantly used in extreme conditions, especially in dusty or corrosive atmospheres.
▶ The truck cannot be used in areas at risk of explosion.
▶ In adverse weather conditions (thunder, lightning) the industrial truck must not be operated outside or in endangered areas.

The permissible operating conditions change if the truck is equipped with a lithium-ion battery (○), see the manufacturer's operating instructions.

4 Proprietor responsibilities

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

NOTE

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

5 Adding attachments and/or optional equipment

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

B Truck Description

1 Application

The ETM/V 214-325 is a three-wheel electric side seat, clear view reach truck. It is designed to lift and transport goods on level surfaces. Open bottom pallets or pallets with transverse boards can be lifted inside or outside the area of the load wheels or roll cage. Loads can be stacked, unstacked and transported over long distances.

The ETM/V 214-325 is designed to transport and pick goods on level surfaces in accordance with the VDMA guideline.

2 Truck models and rated capacity

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

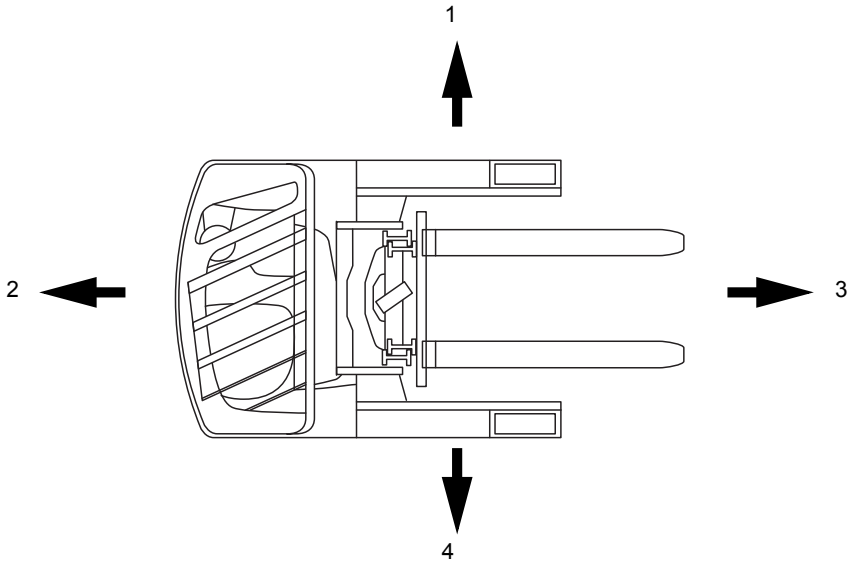
ETM214

ETM	Model name
2	Series
14	Rated capacity x 100 kg

The rated capacity is not generally the same as the permissible capacity. The capacity can be found on the capacity plate attached to the truck.

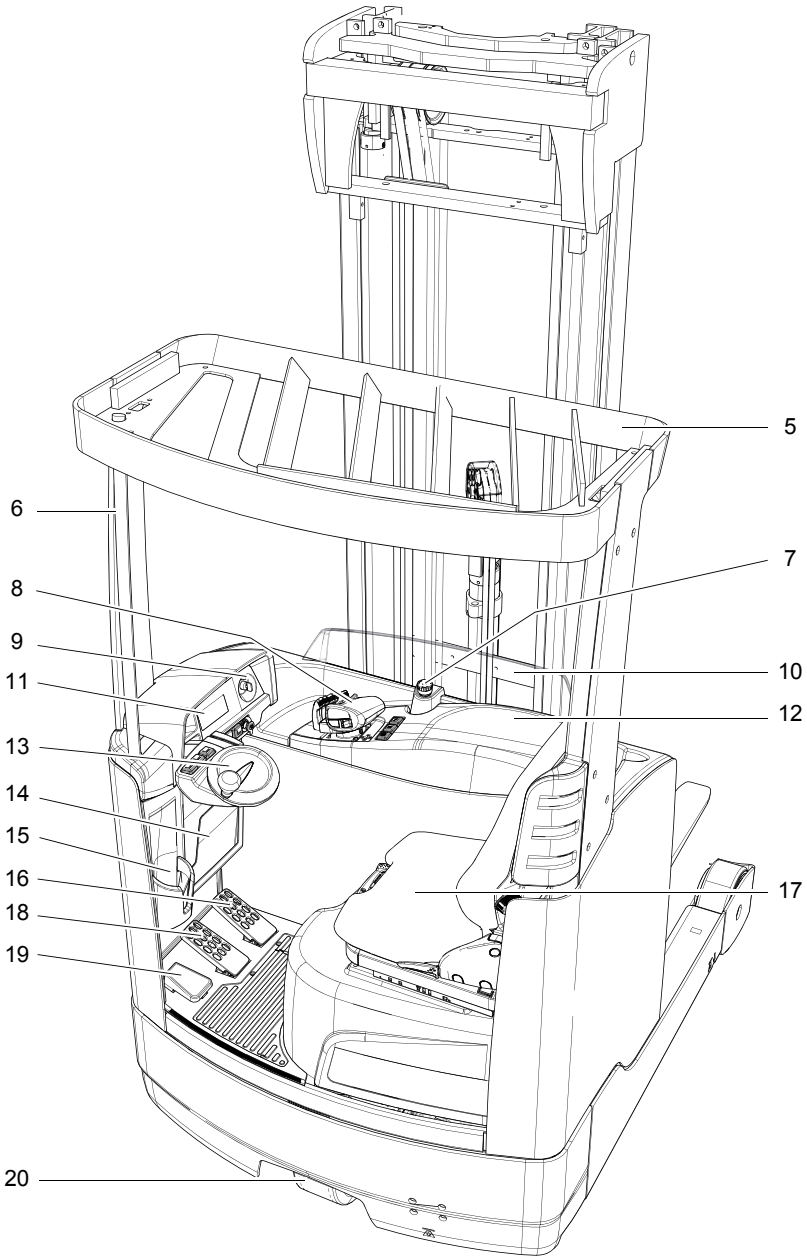
3 Travel direction definition

The following determinations have been made for travel direction specification:

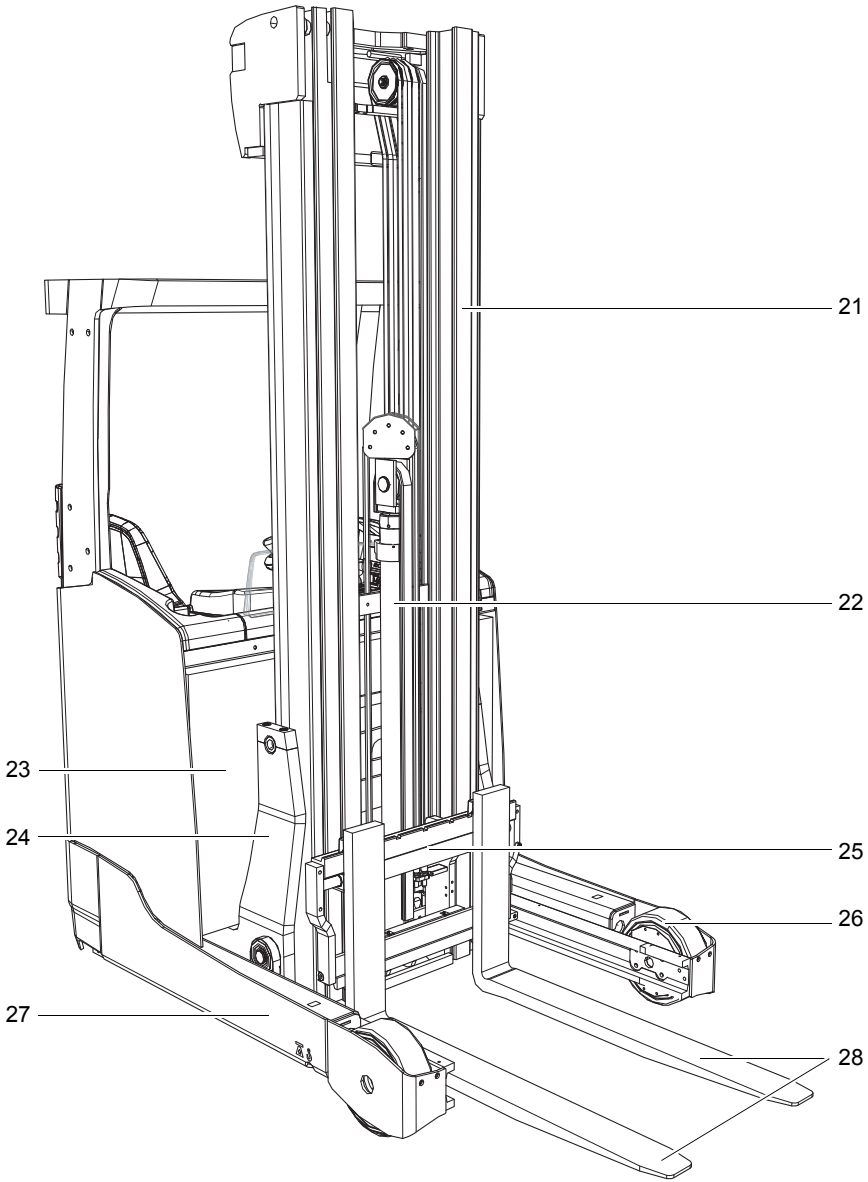


Item	Travel direction
1	Left
2	Drive direction
3	Load direction
4	Right

4 Assembly description



Item		Component	Item		Component
5	●	Overhead guard	12	●	Armrest
6	●	Entry grab handle	13	●	Steering wheel
7	●	Emergency Disconnect switch	14	●	Paper compartment
8	●	Solo-Pilot	15	●	Bottle holder
	○	Multi-Pilot	16	●	Accelerator pedal
9	●	Key switch	17	●	Driver's seat
	○	CanCode	18	●	Brake pedal
	○	ISM access module	19	●	Deadman switch
10	●	Mast protection pane	20	●	Drive wheel
11	●	Control and display unit			
	●	Standard equipment		○	Optional equipment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Item		Component	Item		Component
21	●	Mast	25	●	Fork carriage
22	●	Free lift cylinder	26	●	Load wheels
23	●	compartment	27	●	Wheel arms
24	●	Mast holder	28	●	Forks
	●	Standard equipment		○	Optional equipment

5 Functional Description

Safety mechanisms

An enclosed truck perimeter with rounded edges ensures safe handling of the ETM/ V 214-325. The driver is protected by the overhead guard (5). The drive wheel (20) and load wheels (26) are protected by a solid skirt.

➔ A slight danger remains for third parties, even when a drive wheel cover is used.

Pressing the EMERGENCY DISCONNECT switch (7) rapidly disconnects all electrical functions in hazardous situations.

Line brake safety devices in the lift cylinders limit the load lowering speed in the event of a hydraulic system failure.

Emergency Stop safety feature

If a fault is identified the Emergency Stop automatically brakes the truck until it comes to a halt. Control displays on the control and display unit indicate the Emergency Stop. Whenever the truck is switched on, the system performs a self-diagnosis which only releases the parking brake (emergency stop) if the functional test is positive.

Deadman switch

The deadman switch (19) in the left leg well must be depressed to allow the driver to operate the truck. Lifting and travel are inhibited if the driver takes his foot off the deadman switch (19). Steering and braking remain enabled. The deadman switch can be adjusted so that when the deadman switch (19) is released the parking brake applies after a set time (prevents the truck from accidentally rolling away).

Operator position

The operator position is ergonomically designed with ample legroom. To achieve the correct seated position, the driver's seat and steering head can be adjusted by the driver. The accelerator pedal and brake pedal (16, 18) are of "automotive" design.

Curve Control

Automatic speed reduction for cornering. Curve Control limits the speed and acceleration when cornering. This reduces the risk of oscillations or tipovers.

Drive system

The entire drive unit is bolted onto the chassis of the truck. A fixed AC threephase motor controls the drive wheel (20) via a bevel spur gearbox.
The electronic traction current controller ensures a smooth drive motor speed and as a result smooth start-up, powerful acceleration and electronically controlled braking with energy recovery.

Controls and displays

Controls and displays are clearly arranged in the driver's cab. The logically designed SOLO-PILOT (8) enables single handed operation of travel direction, lift/lowering, forward / reverse reach, mast tilt, sideshift left or right and auxiliary hydraulics HF5 (○).

Displays

Control and display unit (11) with residual time display, battery discharge indicator, lift and travel profile settings and steer angle mode display. The battery discharge indicator and hourmeter are combined on the control and display unit (11). The discharge indicator is designed as a monitor which cuts out lifting when the battery is discharged, in order to avoid depletion.

Brake system

The electric braking system consists of up to three independent braking systems. Applying the brake pedal (18) results in inversion braking (plugging) in the traction motor. The load wheel brakes, if applicable, are applied via the truck's brake control system.

The parking brake is electrically released and actuated through spring pressure. The parking brake acts on the drive system. It is also used for emergency braking. A warning indicator appears when the brake is applied. Faults in the steering and brake systems (which trigger an emergency stop) are shown on the control and display unit.

Steering

Electrical steering which turns the transmission via a spur gear. The infinitely adjustable steering wheel acts as a steering transmitter. The steering can be operated in two modes.

– 180° (●)
– 360° endless (○)

A key (○) can be used to change between 180° and 360° steering.

Steering with defined knob position

When the truck is travelling straight ahead, the defined knob position always fixes the steering wheel knob at the "9 o'clock" position. The function is independent of the 180°/360° operating mode.

Electrical system

48 volt, twin cable system. Standard electronic drive, lift and steering control system. The electronic drive controller provides infinite travel speed control and allows the truck to plug when changing direction. Travel and lift parameters can be set as required via the control and display unit (11). Warning displays, operator errors and service functions can also be shown on the control and display unit.
Battery types see page 57.

Mast

The trucks are equipped with fork tilt devices or telescopic clear view masts positioned in the mast support. Adjustable side rollers and slide pieces take up the lateral pressure exerted on the fork carriage if the load is positioned on one side. The forks are fitted to the fork carriage and are adjustable. With the two-stage triplex mast (DZ) a free lift cylinder (22) initially lifts the load carriage (free lift) without changing the overall height of the truck.

Hydraulic system

The hydraulic system is driven by a pump unit with a threephase motor and a quiet running precision high pressure pump. The hydraulic system is controlled via the Solo-Pilot (8).

Mast support

The mast support is mounted on support rollers. A single telescopic reach cylinder extends and retracts the support. The mast support rails are bolted on to the outriggers (27).

Mast reach damping (○)

Damping of vibration of extended mast and speed reduction to inching when the load is extended beyond free lift.

Free lift (○) speed increase

On trucks with Lift Control or Lift Plus the traverse and tilt speeds in the free lift range are increased to improve throughput. These high speeds cannot be achieved for mast lift. When you change from free lift to mast lift, the traverse and tilt speeds are automatically reduced.

Anti-slip control (ASR)(○)

The anti-slip control system prevents the drive wheel from locking during braking. This improves the truck's steering during braking and reduces tyre wear. When the truck accelerates it prevents the drive wheel from spinning uncontrollably on smooth surfaces. In some circumstances the stopping distance may be extended.

➔ The stopping distance may be extended when the reversing brake is used and the maximum speed may be restricted immediately after replacing a wheel.

Attachments

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

6 Technical Specifications

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

6.1 Performance data

	Component	ETM 214	ETV 214	
Q	Capacity (where c = 600 mm)	1400	1400	kg
	Travel speed with/without load[1]	11.0 / 11.0 14.0 / 14.0	11.0 / 11.0 14.0 / 14.0	km/h
	Lift speed with / without load[2]	0.51 / 0.70	0.48 / 0.70	m/s (±10%)
	Lowering speed with / without load	0.55 / 0.55	0.55 / 0.55	m/s (-15%)
	Traverse speed with / without load[3]	0.24 / 0.24	0.24 / 0.24	m/s
	Gradeability with / without load	9 / 13	9 / 13	%
	Max. gradeability (5 min on-time rating) with / without load	10 / 15	10 / 15	%
	Acceleration with / without load[1]	4.6 / 4.3	4.6 / 4.3	S
	Drive motor, output S2 60 min[1]	6.0 / 8.5	6.0 / 8.5	kW
	Lift motor, output S3 15%[2]	13.3 / 15.5	13.3 / 15.5	kW

1. Second value for Drive Plus option
2. Lift Plus option
3. Mast-dependent: over h3 = 6200 mm: 0.1 m/s, h3 = 8000: 0.08 m/s

	Model	ETM 216	ETV 216	
Q	Capacity (where c = 600 mm)	1600	1600	kg
	Travel speed with / without load[1]	11.0 / 11.0 14.0 / 14.0	11.0 / 11.0 14.0 / 14.0	km/h
	Lift speed with / without load[2]	0.48 / 0.70	0.48 / 0.70	m/s (±10%)
	Lowering speed with / without load	0.55 / 0.55	0.55 / 0.55	m/s (-15%)
	Reach speed with / without load[3]	0.24 / 0.24	0.24 / 0.24	m/s
	Gradeability with / without load	8 / 12	8 / 12	%
	Max. gradeability (5 min on time rating) with / without load	10 / 15	10 / 15	%
	Acceleration w / w.o. load[1]	4.6 / 4.3	4.6 / 4.3	S
	Drive motor, output S2 60 min	6.9	6.9	kW
	Lift motor, output at S3 15%[2]	14.0	14.0	kW

1. Second speed for Drive Plus option
2. Lift Plus option
3. Mast-dependent: over h3 = 6200 mm: 0.1 m/s, h3 = 8000: 0.08 m/s

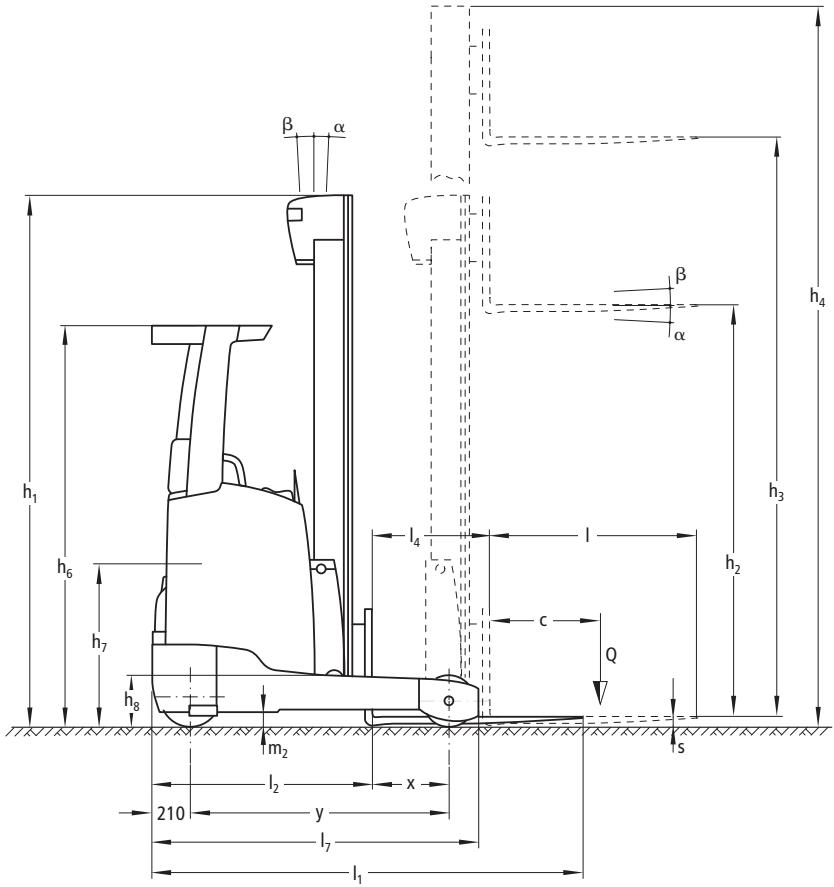
	Model	ETV 318	ETV 320	
Q	Capacity (where c = 600 mm)	1800	2000	kg
	Travel speed with / without load[1]	14.0 / 14.0	14.0 / 14.0	km/h
	Lift speed with / without load[2]	0.38 / 0.64	0.38 / 0.64	m/s (±10%)
	Lowering speed with / without load	0.55 / 0.55	0.55 / 0.55	m/s (-15%)
	Reach speed with / without load[3]	0.2	0.2	m/s
	Gradeability with / without load	7 / 11	7 / 11	%
	Max. gradeability (5 min on time rating) with / without load	9 / 13	10 / 15	%
	Acceleration w / w.o. load[1]	4.6 / 4.2	4.6 / 4.2	S
	Drive motor, output S2 60 min	6.9	6.9	kW
	Lift motor, output at S3 15%[2]	11.5 / 14.0	11.5 / 14.0	kW

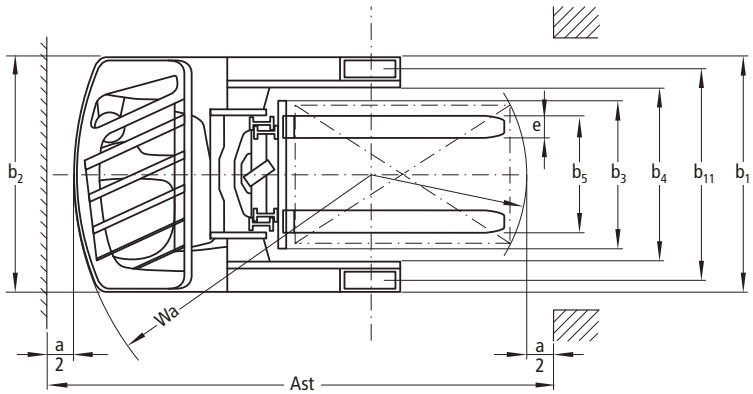
1. Drive Plus option
2. Lift Plus option
3. Mast-dependent: over h3 = 6200 mm: 0.1 m/s, h3 = 8000: 0.08 m/s

	Description	ETM 325	ETV 325	
Q	Capacity (where c = 600 mm)	2500	2500	kg
	Travel speed with / without load	14.0 / 14.0	14.0 / 14.0	km/h
	Lift speed with / without load	0.35 / 0.64	0.35 / 0.64	m/s (±10%)
	Lowering speed with / without load	0.55 / 0.55	0.55 / 0.55	m/s (-15%)
	Traverse speed with / without load[1]	0.2 / 0.2	0.2 / 0.2	m/s
	Gradeability with / without load	7 / 11	7 / 11	%
	Max. gradeability (5 min on-time rating) with / without load	10 / 15	10 / 15	%
	Acceleration with / without load	5.4 / 4.8	5.4 / 4.8	S
	Drive motor, output S2 60 min	6.9	6.9	kW
	Lift motor, output S3 15%	14.0	14.0	kW

1. Mast-dependent: over h3 = 6200 mm: 0.1 m/s, h3 = 8000: 0.08 m/s

6.2 Dimensions





	Model	ETM 214	ETV 214	
s/e/l	Fork dimensions	40/120/1150	40/120/1150	mm
c	Load centre distance	600	600	mm
x	Load distance, mast retracted[1]	353	423	mm
x_1	Load distance, mast extended	205	205	mm
y	Wheelbase	1410	1410	mm
h_6	Overhead guard height (cabin)	2190	2190	mm
h_7	Seat height / standing height	1057	1057	mm
h_8	Wheel arm height [2]	285	285	mm
l_1	Overall length [1]	2418	2346	mm
l_2	Length incl. fork shank [1]	1268	1198	mm
l_4	Reach[1]	558	628	mm
l_7	Length across wheel arms	1780	1780	mm
b_1/ b_2	Overall width	1120/1120	1270/1270	mm
b_3	Fork carriage width	830	830	mm
b_4	Inside straddle	780	940	mm
b_5	Width across forks (min/max)	335/560	335/730	mm
b_{11}	Track width, rear	986	1136	mm
Wa	Turning radius	1620	1620	mm
Ast	Aisle width [1] 1000 x 1200 pallets, length	2702	2652	mm
Ast	Aisle width [1] for 800 x 1200 pallets, transverse	2757	2694	mm
m_2	Ground clearance, centre wheelbase	80	80	mm
	Mast tilt α/β[3]	1/3		°
	Net weight see truck data plate			

1. Different battery sizes and masts will affect this value
2. With load wheel guard + 30 mm
3. Mast-dependent

	Model	ETM 216	ETV 216	
s/e/l	Fork dimensions	40/120/1150	40/120/1150	mm
c	Load centre distance	600	600	mm
x	Load distance, mast retracted[1]	403	413	mm
x_1	Load distance, mast extended	205	205	mm
y	Wheelbase	1460	1460	mm
h_6	Height of overhead guard	2190	2190	mm
h_7	Seat height / standing height	1057	1057	mm
h_8	Wheel arm height[2]	285	285	mm
l_1	Overall length [1]	2418	2408	mm
l_2	Length incl. fork shank [1]	1268	1258	mm
l_4	Reach[1]	608	618	mm
l_7	Length across wheel arms	1830	1830	mm
b_1/ b_2	Overall width	1120/1120	1270/1270	mm
b_3	Fork carriage width	830	830	mm
b_4	Inside straddle	780	940	mm
b_5	Width across forks (min/max)	335/560	335/730	mm
b_{11}	Track width, rear	986	1136	mm
Wa	Turning radius	1670	1670	mm
Ast	Aisle width [1] 1000 x 1200 pallets, length	2716	2709	mm
Ast	Aisle width [1] for 800 x 1200 pallets, transverse	2762	2753	mm
m_2	Ground clearance, centre wheelbase	80	80	mm
	Mast tilt α/β [3]	1/3		°
	Net weight see truck data plate			

1. Different battery sizes and masts will affect this value
2. With load wheel guard + 30 mm
3. Mast-dependent

	Model	**ETV 318**	**ETV 320**	
s/e/l	Fork dimensions	40/120/1150	50/140/1150	mm
c	Load centre distance	600	600	mm
x	Load distance, mast retracted[1]	364	412	mm
x_1	Load distance, mast extended	205	230	mm
y	Wheelbase	1460	1518	mm
h_6	Height of overhead guard	2190	2190	mm
h_7	Seat height / standing height	1057	1057	mm
h_8	Wheel arm height[2]	285	355	mm
l_1	Overall length [1]	2418	2459	mm
l_2	Length incl. fork shank [1]	1306	1316	mm
l_4	Reach[1]	569	624	mm
l_7	Length across wheel arms	1842	1920	mm
b_1/ b_2	Overall width	1270/1270	1290/1270	mm
b_3	Fork carriage width	830	830	mm
b_4	Inside straddle	940	940	mm
b_5	Width across forks (min/max)	335/730	356/750	mm
b_{11}	Track width, rear	1136	1155	mm
Wa	Turning radius	1663	1710	mm
Ast	Aisle width [1] 800 x 1200 pallets, length	2790	2794	mm
Ast	Aisle width [1] for 1000 x 1200 pallets, transverse	2737	2750	mm
m_2	Ground clearance centre wheelbase	30/80	30/95	mm
	Mast tilt α/β [3]	1/5		°
	Net weight see truck data plate			

1. Different battery sizes and masts will affect this value
2. With load wheel guard + 30 mm
3. Mast-dependent

	Model	ETM 325	ETV 325	
s/e/l	Fork dimensions	50/140/1150	50/140/1150	mm
c	Load centre distance	600	600	mm
x	Load distance, mast retracted[1]	389	487	mm
x_1	Load distance, mast extended	230	230	mm
y	Wheelbase	1673	1673	mm
h_6	Height of overhead guard	2190	2190	mm
h_7	Seat height / standing height	1057	1057	mm
h_8	Wheel arm height[2]	355	355	mm
l_1	Overall length [1]	2547	2547	mm
l_2	Length incl. fork shank [1]	1494	1396	mm
l_4	Reach[1]	703	736	mm
l_7	Length across wheel arms	2075	2075	mm
b_1/ b_2	Overall width	1198/1120	1348/1270	mm
b_3	Fork carriage width	830	830	mm
b_4	Inside straddle	790	940	mm
b_5	Width across forks (min/max)	356/580	356/750	mm
b_{11}	Track width, rear	1034	1184	mm
Wa	Turning radius	1865	1865	mm
Ast	Aisle width [1] 800 x 1200 pallets, length	2969	2883	mm
Ast	Aisle width [1] for 1000 x 1200 pallets, transverse	2921	2854	mm
m_2	Ground clearance centre wheelbase	30/95	30/95	mm
	Mast tilt α/β [3]	1/5		°
	Net weight see truck data plate			

1. Different battery sizes and masts will affect this value
2. With load wheel guard + 30 mm
3. Mast-dependent

6.2.1 Standard mast version dimensions

	Component	Tilting mast Hot rolled GE DZ	Tilting mast Cold rolled GE DZ	Tilting fork GNE DZ	
h_1	Collapsed height	2050 - 3000	2700 - 3540	2200 - 4100	mm
h_2	Free lift	1338 - 2288	1988 - 2828	1488 - 3388	mm
h_3	Lift	4550 - 7400	6500 - 9110	5000 - 13000	mm
h_4	Extended height	5190 - 8042	7142 - 9856	5642 - 13744	mm

6.3 Weights

Model	ETM 214	ETV 214	ETM 216	ETV 216	
Net weight including battery[1]	2975	3000	3110	3136	kg
Axle loading, unladen front/rear[1]	1785/1190	1830/1170	1835/1275	1882/1254	kg
Axle loading, forks fwd. laden front/rear[1]	481/3894	572/3828	518/4192	521/4215	kg
Axle loading forks back laden front/rear[1]	1531/2844	1628/2772	1649/3061	1658/3078	kg

1. Different battery sizes will affect this value

Model	ETV 318	ETV 320	ETM 325	ETV 325	
Net weight including battery[1]	3522	3650	3895	3700	kg
Axle loading, unladen front/rear[1]	2074/1448	1842/1228	2274/1621	2264/1436	kg
Axle loading forks fwd. laden front/rear[1]	446/4876	560/4110	366/6029	602/5598	kg
Axle loading forks back laden front/rear[1]	1805/3517	1681/2989	2057/4338	2032/4168	kg

1. Different battery sizes will affect this value

6.4 Tyre type

Component	ETV 214/216	ETM 214/216	
Tyre size, front (drive wheel)	343 x114		mm
Tyre size, rear (load wheels)	285 x 100		mm
Wheels, number front / rear (x = driven)	1x/2		

Component	ETV 318	ETV 320	ETM/V 325	
Tyre size, front (drive wheel)	343 x114	343 x114	343 x140	mm
Tyre size, rear (load wheels)	285 x 100	355 x 106	355 x 135	mm
Wheels, number front / rear (x = driven)	1x/2	1x/2	1x/2	

6.5 Battery

Approved battery types see page 57.

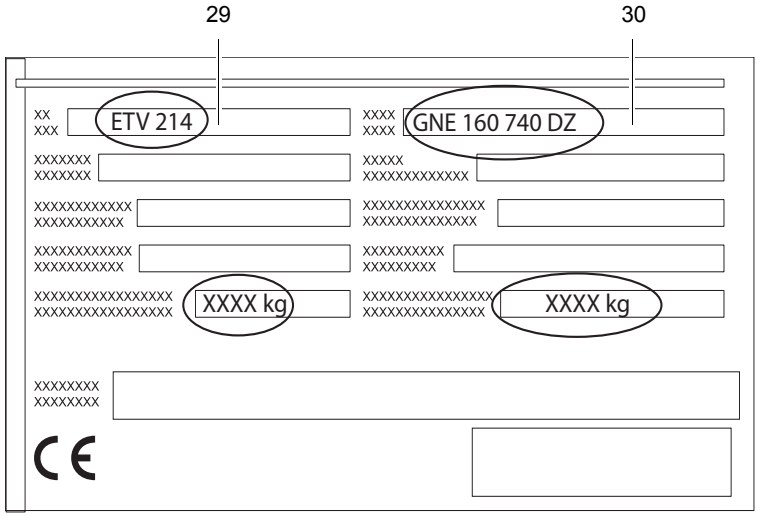
6.6 Hydraulics

Component	ETV 214/325	ETM 214/325	
Available working pressure for attachments	150	150	bar
Oil flow for attachments	20	20	l/min

6.7 Mast weights

The weight of the mast can be calculated using the formulae given below. The necessary details such as truck name, model and length of the extended mast (lift height) can be taken from the data plate. The weight of the truck and the battery can be found on the data plate.

6.7.1 Mast weight calculation example



– Truck name (29): ETV 214
– Mast (30): GNE DZ
– Mast weight = 0.94 x lift height (30) + 412 kg
– Mast weight = 0.94 * 740 + 412 kg = 1108 kg

6.7.2 Overview of formulae to be applied

Truck series	Design	Calculation
ETM/V 214-216	GE DZ to 590	Weight = 0.78 x lift height + 339 kg
ETM/V 214-216	GE DZ from 620	Weight = 1.00 x lift height + 311 kg
ETM/V 214-216	GNE DZ	Weight = 0.94 x lift height + 412 kg
ETM/V 318-325	GE DZ	Weight = 1.0 x lift height + 415 kg
ETM/V 318-325	GNE DZ	Weight = 1.2 x lift height + 435 kg

6.8 EN norms

Noise emission level

– ETM/V 214-325: 68 dB(A)

in accordance with EN 12053 as harmonised with ISO 4871.

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

Vibration

Model name	Driver's seat	Vibration
ETM/V 214/216	MSG 20	0,48 m/s²
ETM/V 214/216	MSG 65	0,33 m/s²
ETM/V 318	MSG 20	0,48 m/s²
ETM/V 318	MSG 65	0,38 m/s²
ETM/V 320	MSG 20	0,53 m/s²
ETM/V 320	MSG 65	0,37 m/s²
ETM/V 325	MSG 20	0,58 m/s²
ETM/V 325	MSG 65	0,40 m/s²

in accordance with EN 13059

➔ The vibration acceleration acting on the body in the operating position is, in accordance with standard procedures, the linearly integrated, weighted acceleration in the vertical direction. It is calculated when travelling over thresholds at constant speed. These recordings were taken on a single occasion for the industrial truck and must not be confused with the human vibrations of the "2002/44/EC/Vibrations" operator directive. The manufacturer offers a special service to measure these human vibrations, see page 190.

➔ The internal accuracy of the measuring chain for at 21°C at ± 0,02 m/s². Further deviations may occur in particular through the positioning of the sensor and different driver weights.

Electromagnetic compatibility (EMC)

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

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

⚠ WARNING!

Medical equipment can be damaged by non-ionised radiation

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

6.9 Conditions of use

Ambient temperature

– operating at -30°C to +40°C

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

➔ Special equipment and authorisation are required if the truck is to be constantly used in 0 °C.

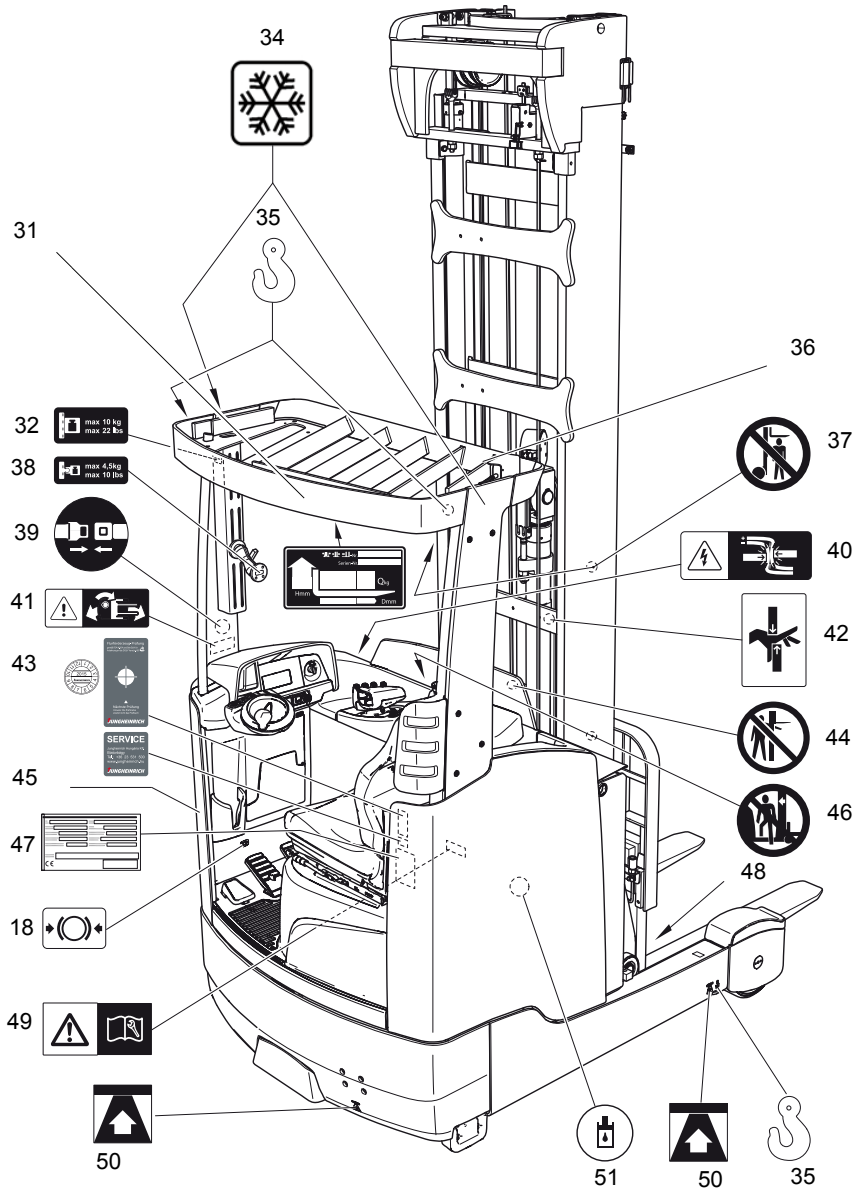
➔ The permissible operating conditions change if the truck is equipped with a lithium-ion battery (○), see the manufacturer's operating instructions.

6.10 Electrical Requirements

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

7 Identification Points and Data Plates

7.1 Overview of marking points



32

38

⚠ CAUTION!

Overload through bolt-on components

M device and universal joints can only withstand the weights indicated on the capacity plates.

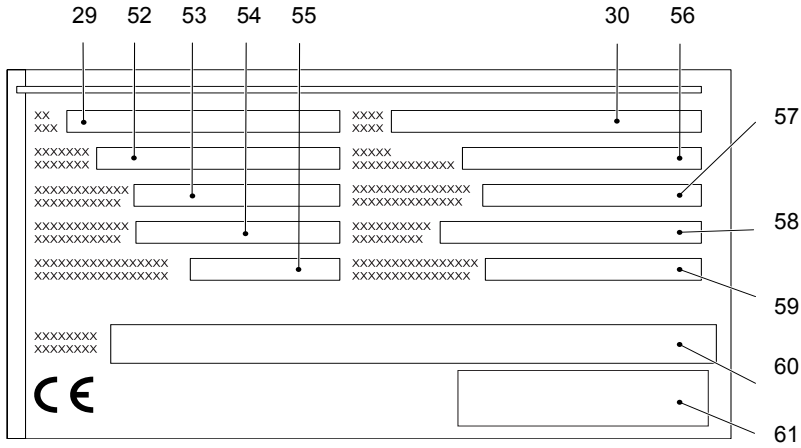
▶Note the maximum weights for M device (32) and universal joints (38).

Item	Description
18	Brake pedal
34	Cold store (○)
31	Capacity plate
35	Attachment points for loading by crane
32	"M device max. 10 kg (22 lb)" capacity warning notice (○)
36	"Final inspection completed" label
37	Prohibition plate: "No standing under the load handler"
38	"Universal joints max. 4.5 kg (10 lb)" capacity warning notice (○)
39	Wear seat belt (○)
40	"Damaged battery cables are hazardous" warning notice
41	Travel direction, steering wheel angle, synchronous steering (○)
42	"Trapping hazard when closing and opening the battery cover" warning notice
43	Inspection plaque (○)
44	"Do not reach through the mast" prohibition plate
45	Overview of electronic component part numbers
46	"Do not step into the reach mechanism" prohibition plate
47	Truck data plate
48	Truck serial no.
49	Attention: Read operating instructions!
50	Jack attachment points (both support arms)
51	"Add hydraulic oil" notice
64	Side shift capacity plate

Item	Description
47	Truck data plate

7.2 Data plate

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



Item	Description	Item	Description
29	Type	56	Year of manufacture
52	Serial number	57	Load centre (mm)
53	Rated capacity (kg)	58	Output
54	Battery voltage (V)	59	Min./max. battery weight (kg)
55	Net weight w.o. battery (kg)	60	Manufacturer
30	Option	61	Manufacturer’s logo

For queries regarding the truck or ordering spare parts always quote the truck serial number (52).

7.2.1 Serial number position

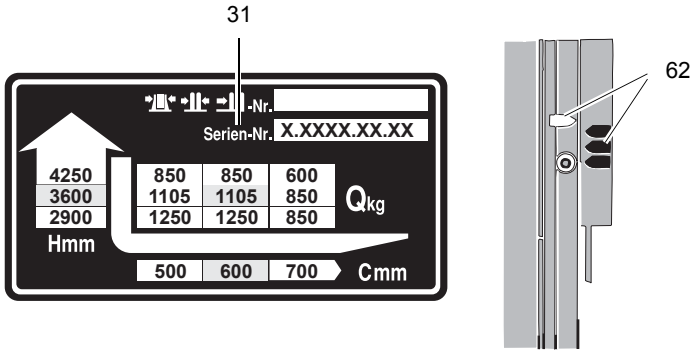
The serial number is located on the traverse wall at the bottom left of the battery compartment (48)

7.3 Truck capacity plate

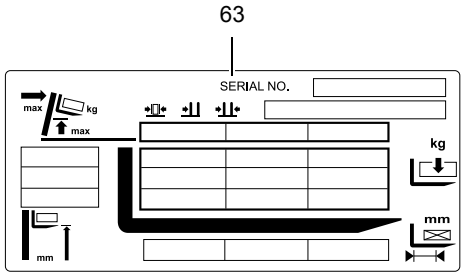
7.3.1 Capacity plate

The capacity plate (31) gives the capacity (Q) of the truck in kg for a vertical mast. The maximum capacity is shown as a table with a standard load centre of gravity distance * C (in mm) and the required lift height H (in mm). The arrow shape markings (62) on the inner and outer masts show the driver when the specified lift limits have been reached.

*)The standard load centre of gravity distance takes into account the width as well as the height of the load.



Capacity plate version in accordance with Australian guidelines (63)



Example of how to calculate the maximum capacity

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

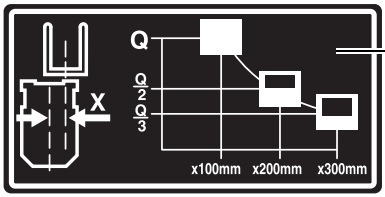
7.3.2 Attachment load chart

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

For loads with a centre of gravity above 600 mm (measured from the top of the forks), the capacities are reduced by the difference of the altered centre of gravity.

7.3.3 Sideshifter capacity plate

The capacity plate (64) gives the reduced capacity Q (in kg) when the sideshift is extended.



64

7.3.4 Jack contact points

The "Jack contact point" decal (50) indicates where the truck may be lifted and jacked up (see page 165)

50

8 Stability

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

Stability can also be affected by the following factors:
– Battery size and weight
– Tyre type
– Mast
– Attachment
– Transported load (size, weight and centre of gravity)
– Ground clearance, e.g. modification of the support columns
– Position of the mast holder stops

Changing the components can alter the stability.

Batteries that are pushed forward or unlocked can alter the stability.

If the ground conditions do not comply with DIN 18202 Table 3, Row 3, the truck capacity ratings (see page 25) may differ.

8.1 Wind loads

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

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

Stop the truck in both cases.

C Transport and Commissioning

1 Transport

Depending on the height of the mast and local conditions, the truck can be transported in three different ways:

– Vertically, with the mast assembled (for low heights)
– Vertically, with the mast partially assembled and leaning against the overhead guard (for medium heights), lifting hydraulic line disconnected.
– Horizontally, with the mast dismantled (for large heights), all mechanical connections and hydraulic lines between the basic truck and the mast separated.

Safety instructions for assembly and commissioning

⚠ WARNING!

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

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

2 Lifting by crane

⚠ WARNING!

Improper loading by crane can result in accidents

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

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

- ▶ The truck may be loaded only by people who are trained in using lifting accessories and lifting gear.
- ▶ Wear personal protective equipment (e.g. safety shoes, safety helmet, hi-vis jacket, protective gloves) when loading by crane.
- ▶ Do not stand under suspended loads.
- ▶ Do not walk into or stand in a hazardous area.
- ▶ Always use lifting gear with sufficient capacity (for truck weight, see truck data plate).
- ▶ Always attach the crane lifting gear to the prescribed attachment points and prevent them from slipping.
- ▶ Use the lifting accessories only in the prescribed load direction.
- ▶ Crane lifting gear must be fastened in such a way that it does not come into contact with any attachments when lifting.

2.1 Lifting the truck by crane

⚠ CAUTION!

The mast can get damaged

- ▶ Loading by crane is only intended for the initial transport before the truck is used for the first time.
- ▶ Loading must be carried out by specially trained staff in accordance with recommendations contained in Guidelines VDI 2700 and VDI 2703

⚠ DANGER!

Crane slings can tear, resulting in accidents

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

Lifting the truck by crane

Requirements

– Truck parked securely, see page 120.

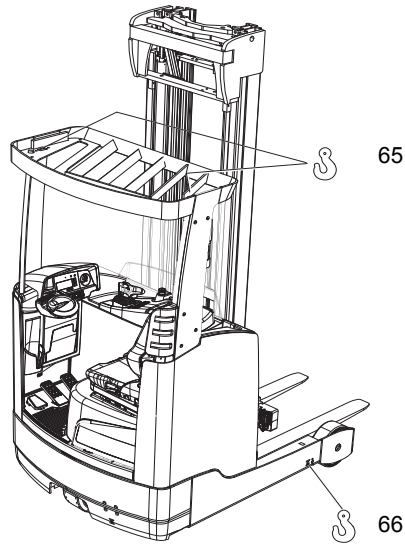
Tools and Material Required

– Crane lifting gear
– Lifting slings
– Wedges

Procedure

- Route rope slings around the two strap points (65) of the overhead guard strut.
- Secure crane lifting gear to the two strap points (66) on the wheel arms.
- Load the truck.
- Park the truck securely, see page 120.
- Secure the truck with wedges to prevent it from rolling away.

The truck is now loaded.



Lifting the truck and cab by crane

Requirements

– Truck parked securely, see page 120.

Tools and Material Required

– Sufficiently wide cross member
– Crane lifting gear with hook
– Wedges

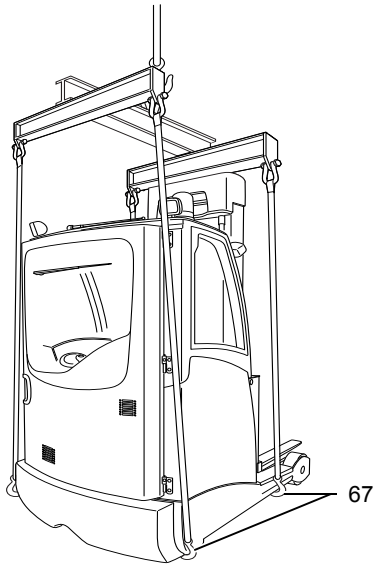
Procedure

- Secure the crane lifting gear to the strap points (67).

➔ The lifting of trucks with a weather-proof cab (○) or cold store cab (○) is subject to restrictions. Because of the risk to the window, the crane lifting gear and rope slings must not pass over the front door.

- Load the truck.
- Park the truck securely, see page 120.
- Secure the truck with wedges to prevent it from rolling away.

The truck is now loaded.



3 Securing the truck during transport

⚠ WARNING!

Accidental movement during transport

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

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

Securing the industrial truck for transport

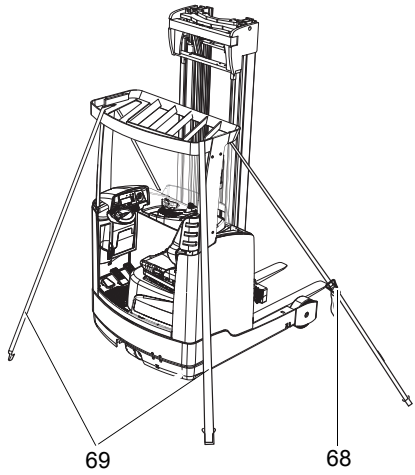
Requirements

– 2 tensioning belts

Procedure

- Pull the tensioning belts (69) through the overhead guard over the strut.
- Secure the tensioning belts (69) to the fastening rings.
- Tighten the tensioning belts (69) with the tensioner (68).

The truck is now secured for transport.



4 Using the Truck for the First Time

⚠ WARNING!

Incorrect assembly can result in accidents

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

⚠ WARNING!

The use of unsuitable energy sources can be hazardous

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

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

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

Procedure

- Check the equipment is complete.
- If necessary, install the battery, see page 64. Do not damage the battery cable.
- Charge the battery, see page 62.

  The truck settings must match the battery model (if the customer is charging the battery).
- Check the hydraulic oil level and top up if necessary (see page 179).
- Start up the truck (see page 91).

Truck is operational.

Wheel flattening

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

D Battery - Servicing, Recharging, Replacement

For use of lithium-ion batteries (○), see the manufacturer's operating instructions.

1 Safety Regulations Governing the Handling of Lead-Acid Batteries

Maintenance personnel

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

Fire Protection

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

⚠ CAUTION!

The use of unsuitable fire protection equipment can result in scalding

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

▶ Use powder extinguishers.

▶ Never extinguish a burning battery with water.

Battery maintenance

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

⚠ CAUTION!

When retracting the battery cover make sure that the battery cable cannot be damaged. Damaged cables can result in short circuits.

Battery disposal

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

1.1 General notes on handling batteries

⚠ WARNING!

Batteries can be hazardous

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

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

⚠ WARNING!

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

The design, weight and dimensions of the battery have a considerable effect on the operational safety of the truck, in particular its stability and capacity. The use of unsuitable batteries that have not been approved for the truck by Jungheinrich, can lead to a deterioration of the braking characteristics of the truck during energy recovery, causing considerable damage to the electric controller and resulting in serious danger to the health and safety of individuals.

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

Park the truck securely before carrying out any work on the batteries (see page 120).

2 Battery types

⚠ CAUTION!

Always use batteries with insulated covers or live components.

The battery weights are indicated on the battery data plate.

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

Battery type	Capacity	Performance-enhanced	Weight [kg][1]
48 V - 2PzS	280 Ah	310 Ah	570
48 V - 3PzS	420 Ah	465 Ah	770
48 V - 4PzS	560 Ah	620 Ah	970
48 V - 5PzS	700 Ah	775 Ah	1170
48 V - 6PzV	840 Ah	930 Ah	1360
EP 48460 CWT-R3-E	448 Ah	-	1170
EP 48310 CWT-R2-E	308 Ah	-	970

1. Tolerance +/- 5%

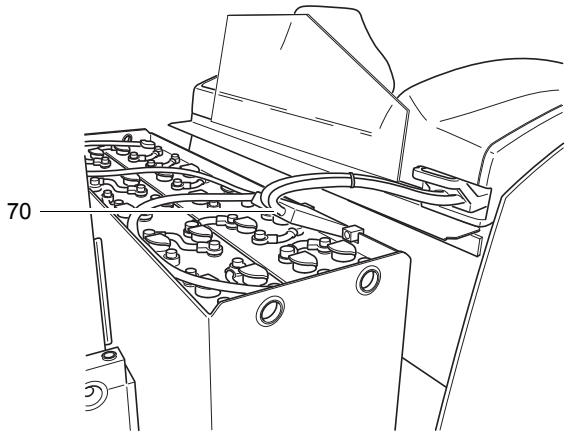
3 Exposing the battery

⚠ CAUTION!

Moving parts can cause accidents

The mast moves when the battery is exposed. This constitutes a risk of accidents and trapping in the hazardous area.

- ▶ Instruct any persons to leave the hazardous area.
- ▶ Make sure there is nothing between the battery and the mast holder when you move the mast holder.

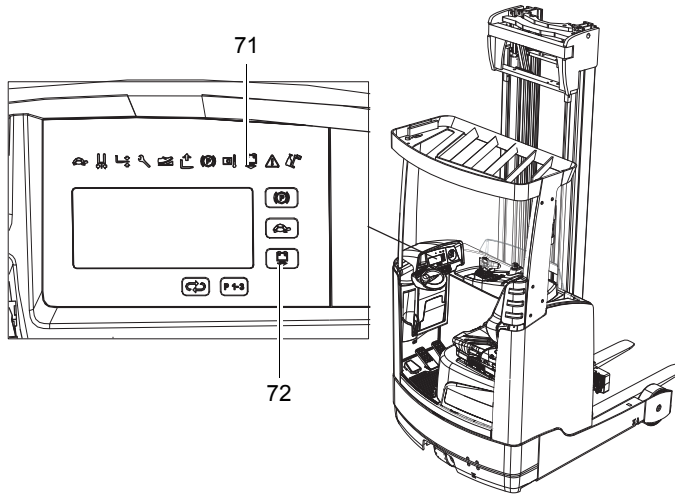


NOTE

Trapped battery cables can cause damage

When the battery is inserted the battery cable can be damaged if fitted without a cable duct.

- ▶ Always install the battery with a cable duct (70).
- ▶ The cable duct (70) must match the battery used. The battery cable length depends on the battery type.
- ▶ Contact the manufacturer's service department when replacing the factory-fitted battery.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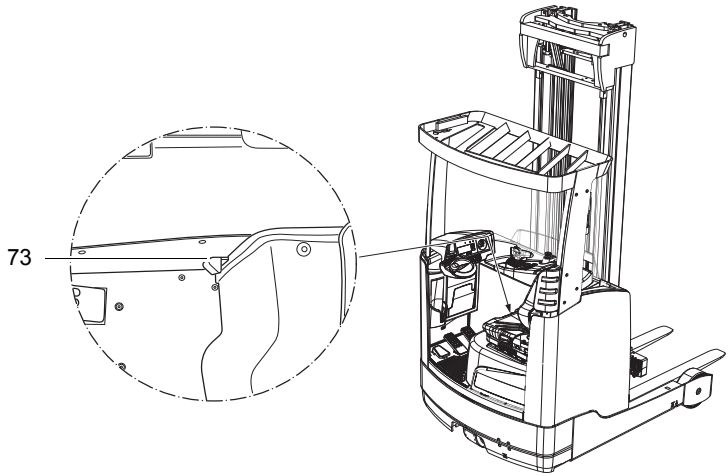
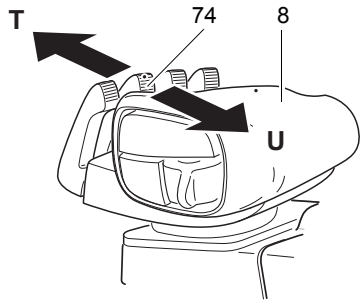
72


73

Exposing the battery



Requirements

– Truck prepared for operation, see page 80.

Procedure

- Press the battery unlock button (72) button until the battery trolley reaches its unlocking position.
- Release the battery unlock button pedal (72).
- Press the battery unlock pedal (73) with your right foot and hold it in this position.

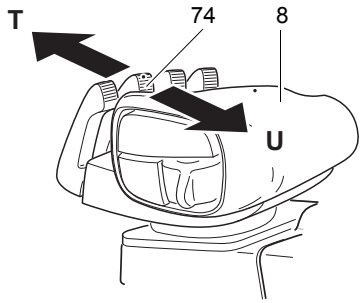
➔ The “battery unlocked” button (71) lights up on the display unit.

- Move the SOLO-PILOT lever (74) in the direction of the arrow (T) and extend the mast support with the coupled battery trolley until the battery is exposed for maintenance.
- Release the battery unlatch pedal (73).
- Turn the Emergency Disconnect switch and key switch off.

➔ The battery unlatch safety switch only allows for travel at crawl speed if the battery trolley is unlatched and the indicator (71) is still on. Before starting up the truck again, the battery trolley must be restored to its initial position in order to uncouple the battery trolley and the mast support. The indicator (71) must be off

The battery is exposed.

Battery retracted



Requirements

– Truck prepared for operation, see page 80.
– Battery exposed.

Procedure

- Pull the SOLO-PILOT lever (74) in the direction of the arrow (U) and retract the mast holder.

➔ The “battery unlocked” (red graphic symbol) (71) goes out on the display unit.

➔ The battery unlatch safety switch only allows for travel at crawl speed if the battery trolley is unlatched and the indicator (71) is still on. Before starting up the truck again, the battery trolley must be restored to its initial position in order to uncouple the battery trolley and the mast support. The indicator (71) must be off

The battery is now retracted.

4 Charging the battery

⚠ WARNING!

The gases produced during charging can cause explosions

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

- ▶ Switch the charging station and truck off first before connecting/disconnecting the charging cable of the battery-charging station to/from the battery connector.
- ▶ The charger must be adapted to the battery in terms of voltage and charge capacity.
- ▶ The battery charger must comply with national regulations.
- ▶ Before charging, check all cable connections and plug connections for visible signs of damage.
- ▶ Sufficiently ventilate the room in which the truck is being charged (observe national regulations).
- ▶ The battery cell surfaces must be exposed during charging to ensure adequate ventilation.
- ▶ Do not smoke and avoid naked flames when handling batteries.
- ▶ Wherever an industrial truck is parked for charging, there must be no inflammable material or consumables capable of creating sparks within a minimum distance of 2 m from the truck.
- ▶ Fire control equipment must be available.
- ▶ Do not place any metallic objects on the battery.
- ▶ Always follow the safety regulations of the battery and charger station manufacturers.

Charge the battery

Requirements

– Battery exposed, see page 58.
– Remove any insulating mats from the battery.

Procedure

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

Battery is charged.

⚠ WARNING!

Risk of accidents and injuries when handling lithium-ion batteries

Improper use can result in overheating, fire or explosion.

▶ Do not expose the lithium-ion battery for charging.

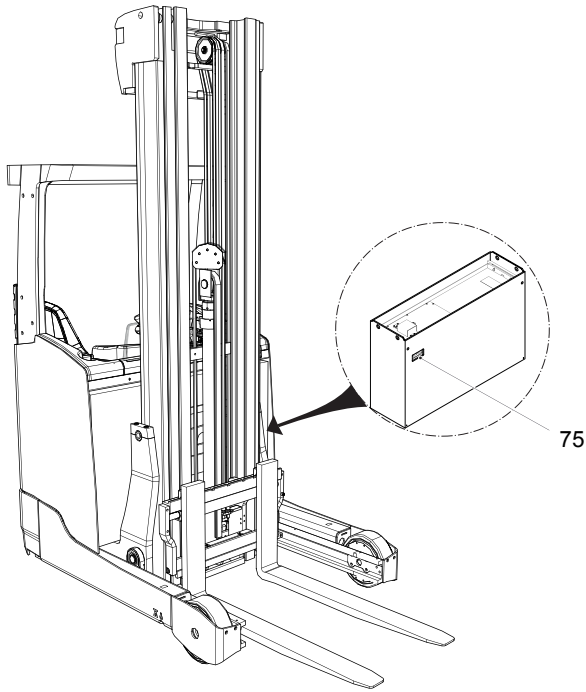
▶ Observe the operating instructions for charging the lithium-ion battery.

▶ Do not use the lithium-ion battery control line for charging. The control line is permanently connected to the truck.

▶ Do not place any metallic objects on the lithium-ion battery.

Procedure

- Connect the charger cable of the deactivated charger to the battery connection (75).
- Switch on the battery charger.
- Charge the lithium-ion battery, see the manufacturer's operating instructions.
  The battery is charging.



5 Battery removal and installation

⚠ WARNING!

Accident risk during battery removal and installation

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

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

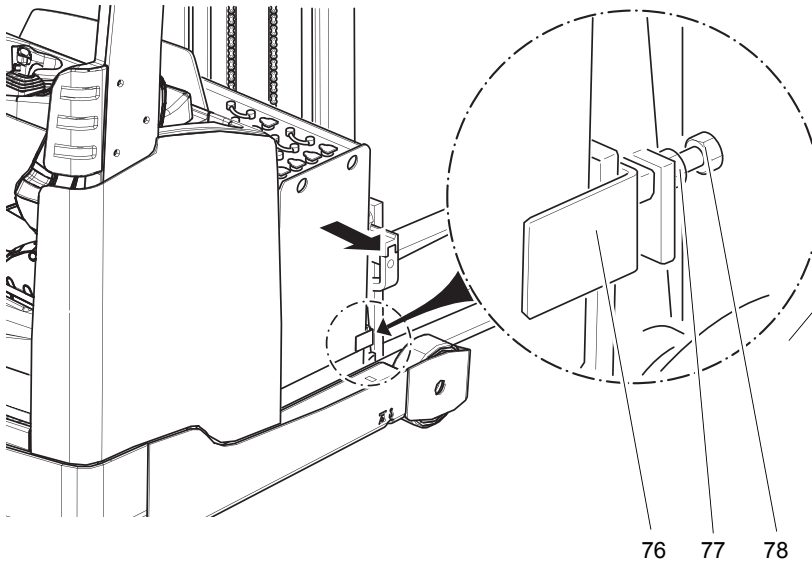
⚠ CAUTION!

Risk of accidents and injury from electrical voltage

When installing and removing the lithium-ion battery, there is a risk of accidents and injury from electrical voltages.

- ▶The lithium-ion battery may only be installed and removed by trained experts.

5.1 Removing the battery



Removing the battery

Requirements

– Battery exposed, see page 58.

Tools and Material Required

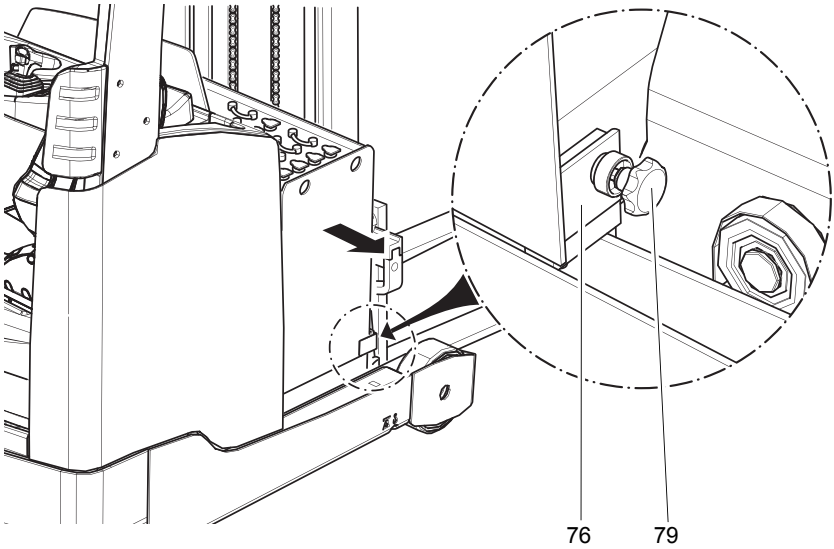
– Crane lifting gear

Procedure

- Loosen the jam nut (77) on the battery lock (76).
- Undo the retaining screw (78).
- Pull out the battery stop (76).
- Remove the battery cover.
- Strap the crane lifting gear to both sides of the battery container.

  The hooks must be fitted in such a way that when the crane lifting gear is slackened, they do not fall onto the battery cells. The lifting gear must exert a vertical pull so that the battery container is not compressed.
- Lift the battery clear and move out to the side.

The battery is now removed.



Removing the battery with the battery trolley (○)

Requirements

– Battery exposed, see page 58.

Tools and Material Required

– Battery trolley

Procedure

⚠ CAUTION!

An unsecured battery can result in accidents

When the battery stop (76) is removed, the battery can roll out if the truck is not horizontal.

▶Park the truck on a level surface.

- Release the handle (○) (79).
- Pull out the battery stop (76).
- Remove the battery cover.
- Pull the battery out to the side onto the battery trolley.

The battery is now removed.

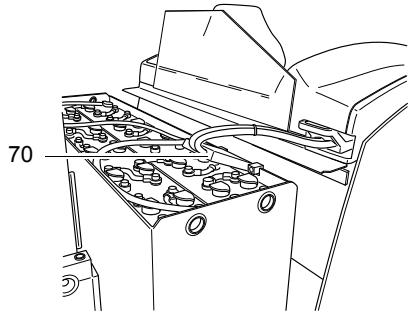
5.2 Battery installation

NOTE

Trapped battery cables can cause damage

When the battery is inserted the battery cable can be damaged if fitted without a cable duct.

- ▶ Always install the battery with a cable duct (70).
- ▶ The cable duct (70) must match the battery used. The battery cable length depends on the battery type.
- ▶ Contact the manufacturer's service department when replacing the factory-fitted battery.



Battery installation

Requirements

– Battery removed.
– Battery cover removed.

Tools and Material Required

– Crane lifting gear

Procedure

- Strap the crane lifting gear to both sides of the battery container.
- Lift the battery with the crane lifting gear, lift it in from the side and lower it.
- Insert the battery stop (76).
- Tighten the retaining screw (78) and jam nut (77) or handle (79) on the battery stop (76).
- Attach the battery connector to the truck connector.
- Fit the battery cover.

The battery is now assembled.

Installing the battery with the battery trolley (○)

Requirements

– Battery removed.
– Battery cover removed.

Tools and Material Required

– Battery trolley

Procedure

- Bring the battery trolley with the battery up to the truck.
- Push the battery off the trolley into the battery compartment.
- Insert the battery stop (76).
- Tighten the retaining screw (78) and jam nut (77) or handle (79) on the battery stop (76).
- Attach the battery connector to the truck connector.
- Fit the battery cover.

The battery is now assembled.

E Operation

1 Safety Regulations for the Operation of Forklift Trucks

Driver authorisation

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

Operator's rights, obligations and responsibilities

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

Unauthorised use of truck

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

Damage and faults

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

Repairs

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

Hazardous area

⚠ WARNING!

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

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

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

⚠ WARNING!

Falling objects can cause accidents

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

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

⚠ WARNING!

The use of mobile phones can result in lack of attention and ultimately accidents

Using a mobile phone while operating the truck can result in accidents.

- ▶ Observe national regulations on the use of mobile phones while operating the truck.

Safety devices, warning signs and warning instructions

Safety devices, warning signs (see page 39) and warning instructions in the present operating instructions must be strictly observed.

⚠ CAUTION!

Reduced headroom can cause injuries

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

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

⚠ CAUTION!

Loss of stability can cause accidents

Extended mast sections when the truck is travelling with or without load will reduce the truck's stability.

▶ Always travel with the mast holder retracted, the mast tilted back and the load handler lowered.

⚠ CAUTION!

Risk of accident due to ceiling installations

Ceiling installations such as cable raceways, piping and sprinkler systems are easy to overlook.

▶ Maintain a sufficient safety distance from ceiling installations.

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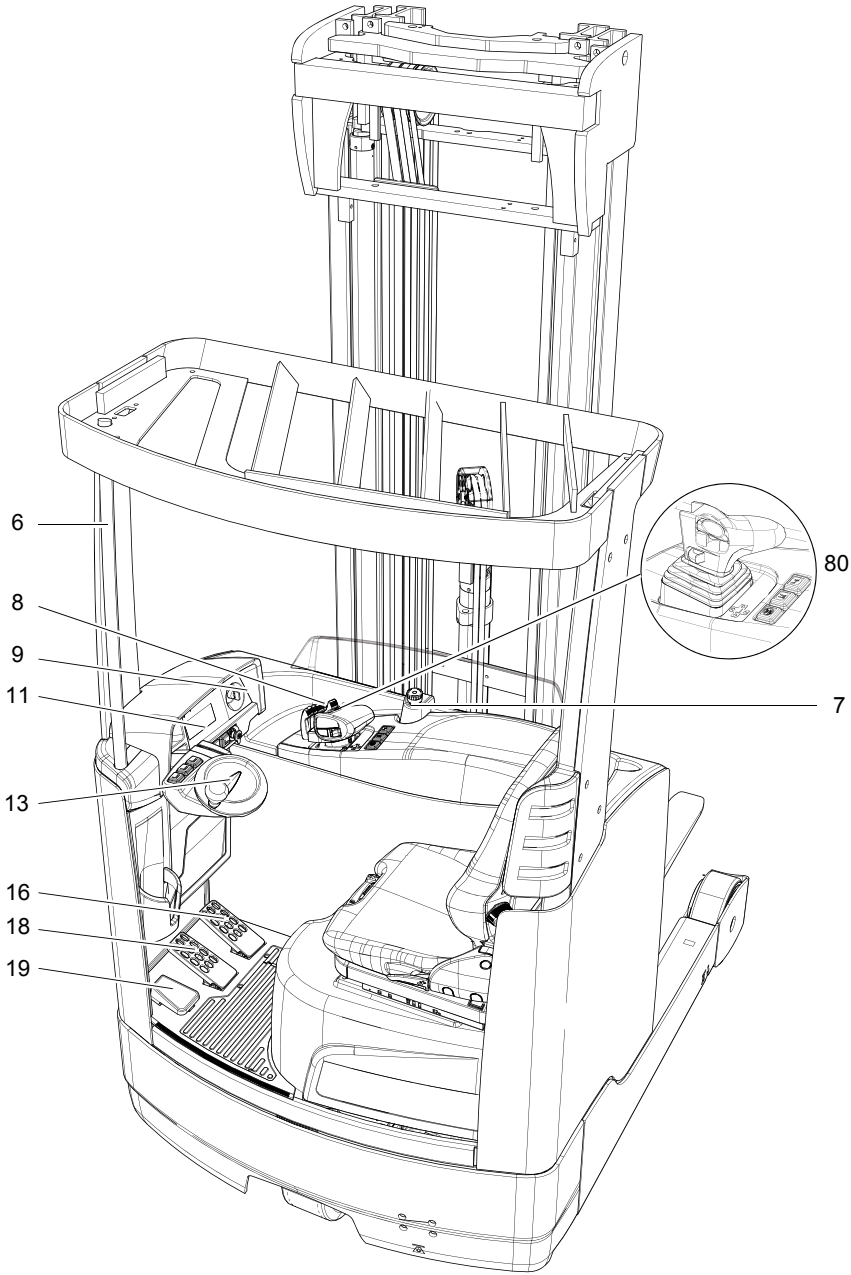
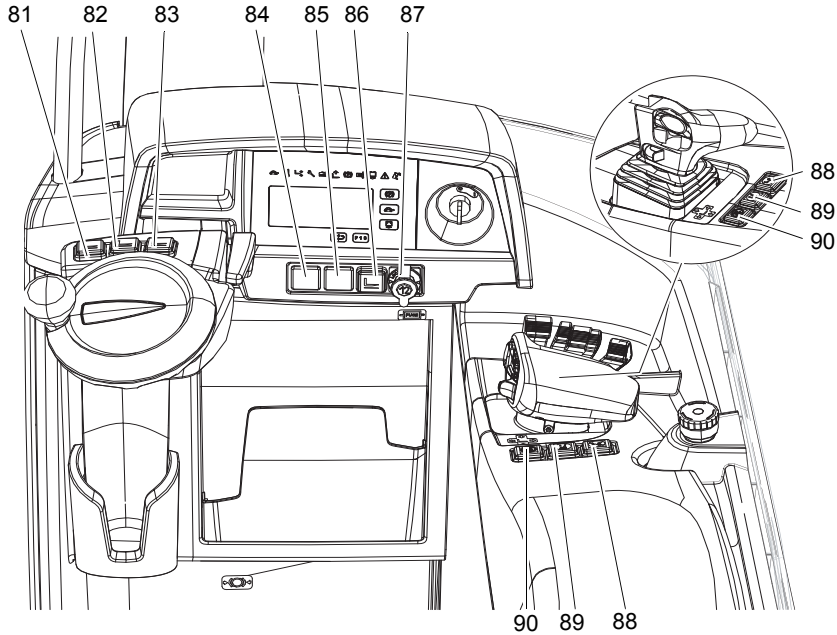
2 Displays and Controls



Item	Control and Display		Function
6	Grab handle	●	
7	Emergency Disconnect switch	●	Switches power supply on and off.
8	Solo-Pilot	●	Controls the following functions: – Fwd/rev. travel direction – Load handler lift / lower – Mast forward / reverse tilt – Horn button – Sideshift left / right – Auxiliary hydraulics (○) – Mast reach forward / reverse
80	Multi-Pilot	○	
9	Key switch	●	Switches control current on and off. Removing the key prevents the truck from being switched on by unauthorized personnel.
	ISM Access Module	○	Switches the truck on.
	Code lock		
11	Control and display unit	●	Displays steering modes, warnings, incorrect operation notes and service displays
13	Steering wheel	●	Sets the travel direction
16	Accelerator pedal	●	Provides infinitely variable travel speed control
18	Brake pedal	●	Provides infinitely variable braking control.
19	Deadman switch	●	– Not applied: Travel and hydraulic functions inhibited, truck decelerates. – applied: Travel and hydraulic functions enabled.



Item	Control and Display		Function
81	Two-hand operation / clamp function button	○	“Clamp function release” button
82	Limit switch system and lift height display override button	○	Prevents damage to the truck and the load
83	Weighing button	○	Weighs the load
126	Steering column stop	●	
84	Work lights button	○	Switches the work lights on/off in drive direction
85	Beacon / warning indicator button	○	Switches beacon / warning indicator on/off
86	Work lights button	○	Switches work lights on/off in forks direction
87	Socket supply 12 V	○	
88	Forks horizontal button	○	Allows the load handler to be aligned horizontally.
89	Sideshifter centre position button	○	Moves the sideshifter to the centre position.
90	Steering selector button	○	Changes the steering mode between 180° and 360°.

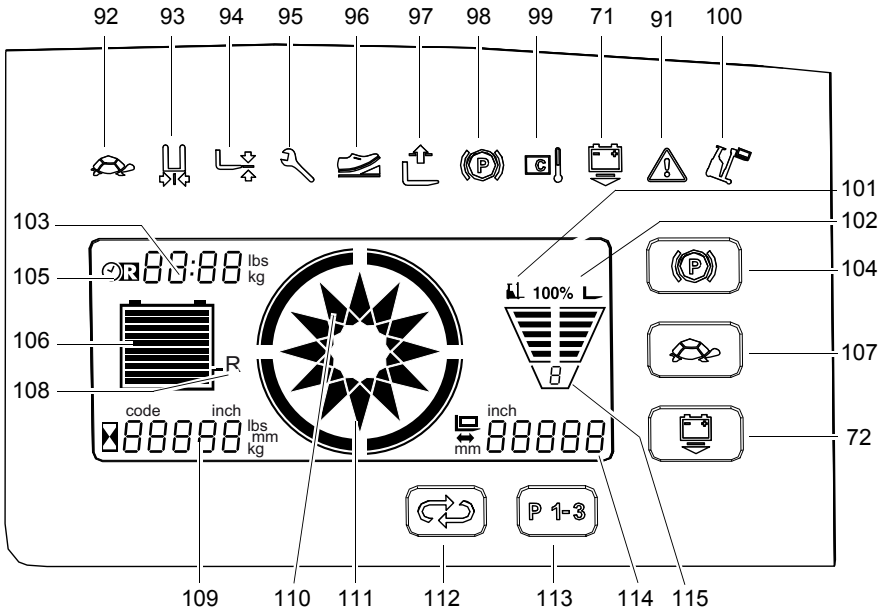
2.1 Display unit

Description

The driver's display unit represents the operator-truck interface. It acts both as a display and control unit for the operator.

Adjustments to the truck can be made by pressing the four keys (107, 104, 112, 113). The LEDs of the 11 luminous buttons (71, 91-100) can show 3 conditions: on, flashing or off.

The display unit gives information on the travel direction, steer angle, battery charge condition and other selected truck parameters.



Item		Description	Function
71		Battery-lock display	The red icon lights up when the battery is unlocked.
72		Battery-lock button	Button for moving the battery in the unlocked position
91		Warning-symbol display	Red icon – lights up when faults occur. – flashes when system messages appear in the display.
92		Slow travel display	The green icon lights up when slow travel is set. The travel speed is restricted.
93		"Sideshift centre position" display	The green icon lights up when the sideshifter is centred.
94		"Forks horizontal" display	The green icon lights up when the load handler is horizontal.
95		Service mode	Yellow icon – flashes rapidly when the service PC and truck are connected.
96		Dead man's switch	Yellow icon – lights up if the dead man's switch is not pressed. The truck is not operational. – flashes if the dead man's switch is pressed while the system starts up.
97		Lift-limit display	Yellow icon – lights up when the lift limit is reached. – flashes when the height is below the safety height.
98		Parking-brake display	Red icon lights up when the parking brake is applied.
99		Overtemperature	Red icon lights up for motor or controller overtemperature.
100		Tilt-limit reached	Graphic symbol lights up when the assistance system detects the tilt limit.

Item		Description	Function
101		Travel-speed display	Shows the speed setting (drive direction) for current profile (in bars from 1 to 5).
102		Lift-speed display	Shows the speed setting (lift) for current profile (in bars from 1 to 5).
103		Time / residual-time / load-weight display	Display – Time display (hours:minutes) – Battery residual time – Load weight
104		Parking-brake button	Parking-brake activation/deactivation button.
105		Residual-time display	Displays the residual run time with on-board battery (hours:minutes)
106		Charge-status display	Shows the battery-charge status.
107		Slow travel	Travel-mode setting button.
108		Discharge indicator	Shows the battery-charge status.
109		Display Information and event-message display	Display – Load weight – Lift height – Service hours – Event messages
110		Steering angle	Displays the steering angle in 30° increments.
111		Direction display	Displays travel direction and steer mode – Semi-circle = 180° – Circle = 360° endless steering
112		Shift key	Display-change button.
113		Performance-setting button	Button to select performance level 1, 2 or 3.
114		Lift-height load centre distance	Displays the load centre distance or the lift height.
115		Performance setting number	Displays the performance setting number (1,2 or 3).

2.1.1 Adjusting the display unit

Setting the time

Procedure

- Press the Shift key (112) for approx. 8 seconds to change to setting mode.
- Set the hours. To do this, press the parking brake button (104) to increase the hours and press the slow travel button (107) to reduce the hours.
- Press the Shift key (112) briefly.
- Set the minutes. To do this, press the parking brake button (104) to increase the minutes and press the slow travel button (107) to reduce the minutes.
- Press the Shift key (112) briefly.

The time is now set.

Changing time / residual time display mode

Procedure

- Press the Shift key (112) for approx. 3 seconds to change to display mode.

The time / residual time indicator is shown.

Changing the time format

Procedure

- Press the Shift key (112) for approx. 11 seconds to change the time display format from 12h am/pm to 24h.

Time display format changed.

2.1.2 Battery discharge indicator

The battery charge status is shown on the truck display via a battery symbol (106). When a battery is discharged to the permissible discharge level, the battery symbol (106) is displayed empty.

➔ The standard setting for the battery discharge indicator (108) is based on standard batteries.

2.1.3 Battery discharge monitor

If the residual capacity falls below the required level, lifting is inhibited. An alternating display (109) appears. Lifting is only released when the battery connected is at least 70% charged.

2.1.4 Hourmeter

➔ Prepare the truck for operation, see page 94 or see page 130.

Service hours are counted while the truck is operational and the deadman button is pressed.

3 Preparing the Truck for Operation

3.1 Checks and Operations to Be Performed Before Starting Daily Work

⚠ WARNING!

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

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

▶ Report any defects immediately to your supervisor.

▶ Mark defective truck and take out of service.

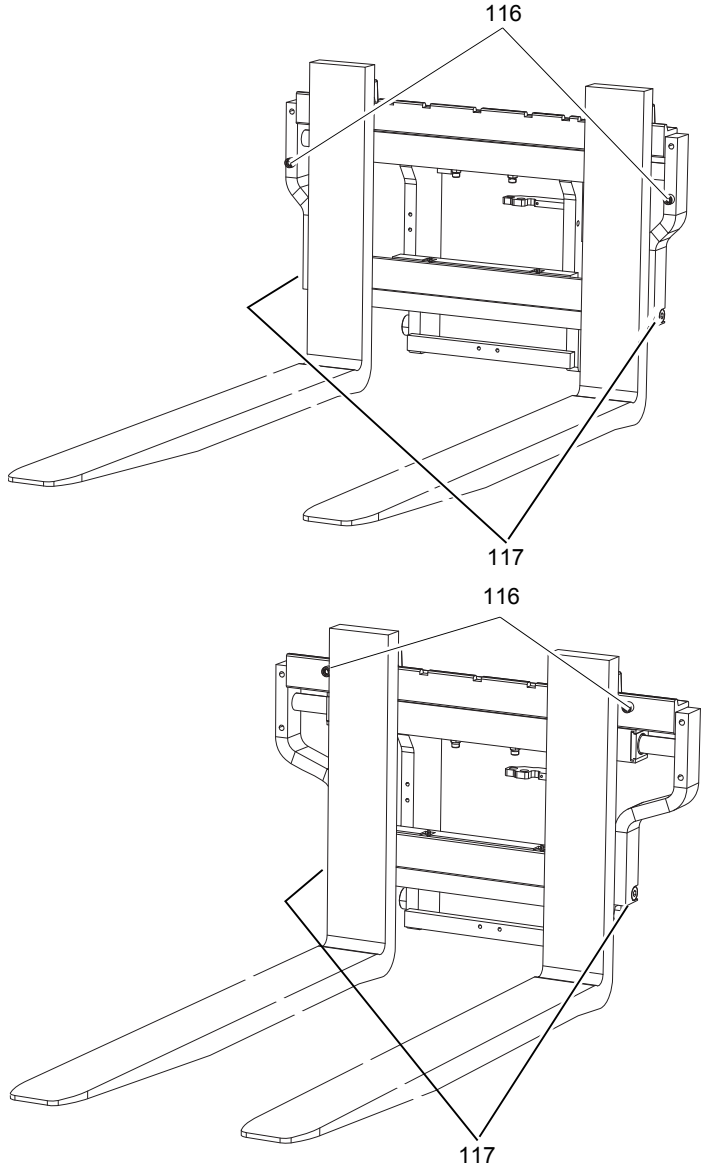
▶ Do not return the industrial truck to service until you have identified and rectified the fault.

Checking the truck before daily operation

Procedure

- Visually inspect the entire truck (in particular wheels and wheel bolts) for damage.
- Check the load handler for visible signs of damage such as cracks, bent or severely worn forks.
- Check the fork stop and fork retainer (116), see page 103.
- Visually inspect the hydraulic system in the visible area for damage and leaks.
- Make sure the driver's seat is locked in position.
- Test the horn and reversing buzzer (○) where applicable.
- Check that the load chart and warning labels are legible.
- Test the controls and displays.
- Test the steering.
- Check the steer angle display, turn the steering wheel in both directions as far as the stop and check that the wheel position is displayed on the control panel.
- Make sure the load chains are evenly tensioned.
- Test the seat belt (○). The belt should jam if extracted suddenly.
- Test the lift/lower, tilt and if applicable the attachment hydraulic control functions.
- Visually inspect the battery attachment and cable connections.
- Check the battery connectors are secure.
- Check that the battery is positioned securely.
- Makes sure the battery is locked.
- Check the mirror (○) is clean and damage-free.

- Integrated side shifter (○): Check the screws on the restraint system and the fork locking system (116) are secure, tighten if necessary. Torque (117): 60 Nm. Torque (116): 85 Nm.



➔ Top illustration: ETV sideshifter, bottom illustration: ETM side shifter.

The truck is now checked.

3.2 Entry and exit

Entry and exit

Requirements

– Truck braked to a halt.

Procedure

- To enter, take hold of the grab handle (6), see page 72.
- Enter or leave the truck.

3.3 Setting up the operator position

Before starting to travel, adjust the driver's seat, steering column and armrest (if necessary) so that all the controls are within reach and can be applied without having to strain.

3.3.1 Adjusting the driver's seat

The procedure for adjusting the driver's seat applies to standard models. For other models, follow the manufacturer's setting instructions. When adjusting, ensure that all controls are within easy reach.

⚠ CAUTION!

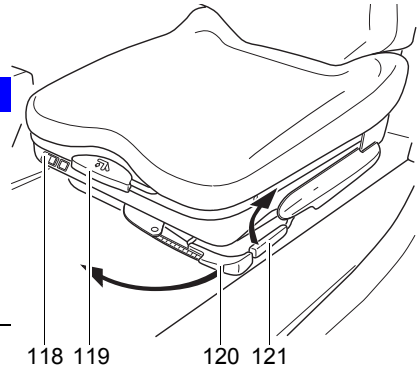
Moving the driver's seat is a trapping hazard

▶ Do not reach between the seat and the side wall or overhead guard when adjusting the seat.

Adjusting the driver's weight

NOTE

To achieve optimal seat cushioning the driver's seat must be set to the driver's weight.
Set the driver's weight when the seat is unoccupied.
Seat cushioning setting range: 50 - 130 Kg.



Procedure

- Pull the weight adjustment lever (120) in the direction of the arrow as far as the stop and then return it.
  The weight setting is set to a minimum value.
- Pull the weight adjustment lever (120) in the arrow direction until you reach the required weight on the scales.
- Restore the weight adjustment lever (120) to its original position.

The driver's weight is now set.

Adjusting the backrest

Procedure

- Sit on the driver’s seat.
- Pull the lever (119) to adjust the backrest.
- Adjust the backrest tilt.
- Release the lever (119) again. The backrest is locked.

The backrest is now set.

Adjusting the seat position

⚠ CAUTION!

An unsecured driver's seat can cause injury

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

▶ The driver's seat must be locked in position.

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

Procedure

- Sit on the driver’s seat.
- Pull up the driver’s seat locking lever (121) in the direction of the arrow.
- Push the driver’s seat forwards or backwards to the desired position.
- Engage the driver’s seat locking lever (121) in position.

The seat position is now correctly set.

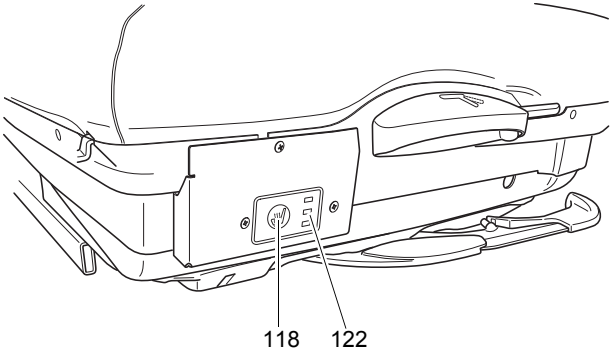
The optional seat heating (118) is operated via the switch on the driver's seat.

Adjust the seat heating (○)

NOTE

Avoid prolonged contact of uncovered / unprotected skin with the heated seat.

Procedure



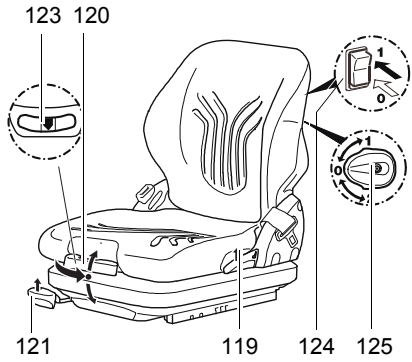
- Press the seat heating button (118) a single time.
  The heating changes to heat mode level 3 (highest level), all LEDs (122) are permanently lit.
- Press the seat heating button (118) again.
  The heating changes to heat mode level 2.
- Press the seat heating button (118) again.
  The heating changes to heat mode level 1.
- Press the seat heating button (118) again.
  The heating changes to operational status (off).

Seat heating set.

→ In the event of an error one or more LEDs (122) next to the switch are lit. Switch off the truck. Switch the truck on again. Call the service department if necessary.

3.3.2 Adjusting the comfort seat (○)

Setting the driver's weight



NOTE

Incorrectly adjusted seat cushioning can damage your health

To achieve optimal seat cushioning, the driver's seat must be adjusted according to the driver's weight.

Set the driver's weight when the seat is occupied.

▶ Hold the weight adjustment lever only by the recess; do not reach through underneath the weight adjustment lever.

Procedure

- Fold out the weight adjustment lever (120) as far as it will go in the arrow direction.
- Move the weight adjustment lever (120) up and down to set the seat to a higher weight.
- Move the weight adjustment lever (120) down and up to set the seat to a lower weight.

→ The driver's weight is correctly set when the arrow is in the middle of the display window (123). The minimum or maximum weight setting is reached when you can feel a return stroke on the lever.

- After setting the weight, fully fold back in the weight adjustment lever (120).

The driver's weight is now set.

Fully automatic weight adjustment (○)

A compressor in the driver's seat adjusts the seat position according to the weight of the driver.

Adjusting the backrest

Procedure

- Sit on the driver's seat.
- Pull the lever (119) to adjust the backrest.
- Adjust the backrest tilt.
- Release the lever (119) again. The backrest is locked.

The backrest is now set.

Adjusting the seat position

⚠ CAUTION!

An unsecured driver's seat can cause injury

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

▶ The driver's seat must be locked in position.

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

Procedure

- Sit on the driver's seat.
- Pull up the driver's seat locking lever121 in the direction of the arrow.
- Push the driver's seat forwards or backwards to the desired position
- Engage the driver's seat locking lever (121) in position.

The seat position is now correctly set.

Switching the seat heating on and off (○)

Procedure

- Press the seat heating switch (124).
  Switch setting 1 = Seat heating on.
  Switch setting 0 = Seat heating off.

Adjusting the lumbar vertebrae support

Procedure

- Turn the hand wheel (125) to the required position.
  Position 0 = no warping in lumbar vertebrae area.
  Position 1 = increasing warping in upper lumbar vertebrae area.
  Position 2 = increasing warping in lower lumbar vertebrae area.

The lumbar vertebrae support is now set.

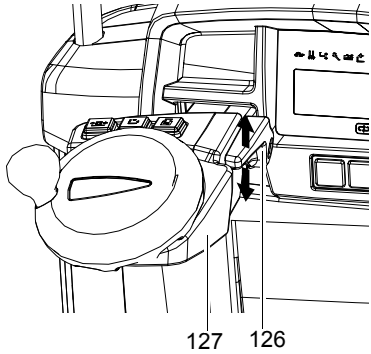
3.3.3 Adjusting the steering column

Adjusting the steering column

Procedure

- Release the steering column stop (126).
- Position the steering head (127).
- Fix the steering column stop (126) in position.

The steering column is now positioned.



3.3.4 Seat belt (○)

NOTE

Seat belt optional equipment

On request from the customer, the truck can be fitted with a seat belt for special applications.

▶ Always put on the seat belt before starting the industrial truck.

▶ Do not modify the seat belt.

▶ Damaged or non-operational seat belts must be replaced by trained personnel.

▶ Seat belts must always be replaced after an accident.

▶ Only original spare parts must be used for retrofits or repairs.

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

Checking the seat belt

Procedure

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

Check the automatic locking system

Procedure

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

➔ The locking system should prevent the belt from coming out.

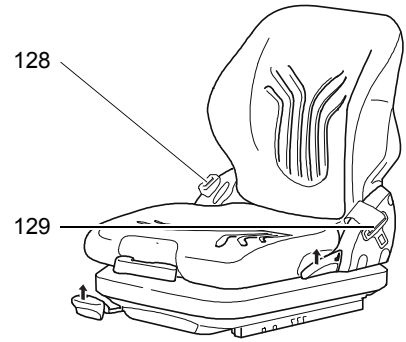
The seat belt has now been checked.

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.

Putting on the seat belt



Procedure

- Sit on the driver's seat so that your back is resting against the backrest.
- Pull the seat belt smoothly out of the retractor.
- Place the seat belt tight against your body. Take care not to twist it.
- Engage the lock tongue (129) in the lock (128).

The seat belt is now in place

Taking off the seat belt

Procedure

- Hold onto the lock tongue (129) with one hand.
- Press the red button on the lock (128).
- Guide the lock tongue (129) manually back into the reel.

The seat belt is now removed.

4 Starting up the truck

4.1 Safety regulations for truck operation

Travel routes and work areas

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

⚠ DANGER!

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

Travel conduct

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

Travel visibility

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

⚠ WARNING!

Electromagnetic influence can result in accidents

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

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

Negotiating slopes and inclines

Negotiating slopes and inclines up to 15 % is only permitted when they are recognised lanes. The slopes and inclines must be clean, have a non-slip surface, and negotiating them safely must be within the technical specifications of the truck. The truck must always be driven with the load facing uphill. The industrial truck must not be turned, operated at an angle or parked on inclines or slopes. Inclines must only be negotiated at slow speed, with the driver ready to brake at any moment.

Negotiating lifts, loading ramps and docks

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

Type of loads to be carried

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

⚠ DANGER!

Tipovers can result in fatal accidents

If the truck is in danger of tipping over, incorrect operator action can result in serious injury and death.

- ▶ Do not jump off the truck if it tips over.
- ▶ Lean your upper body over the steering wheel and hold on with both hands.
- ▶ Tilt your body in the opposite direction of fall.
- ▶ Do not remove the seat belt (○).

⚠ CAUTION!

Loss of stability can cause accidents

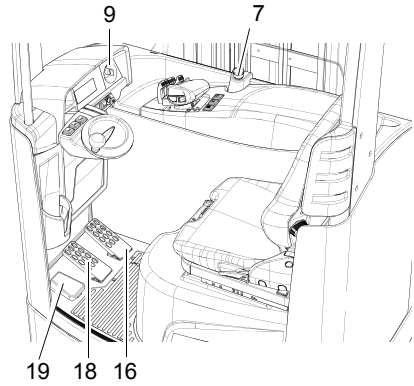
Extended mast sections when the truck is travelling with or without load will reduce the truck's stability.

▶ Always travel with the mast holder retracted, the mast tilted back and the load handler lowered.

Do not park the truck in escape routes, aisles, or in access areas to stairways or safety equipment.

When parking a truck near railway tracks, no part of the truck should be closer than 2 m from the nearest railway track.

4.2 Preparing the truck for operation



The truck carries out a self-test when it is switched on. Do not activate any controls, such as the deadman button, during the self-test.

Switching on the truck

Requirements

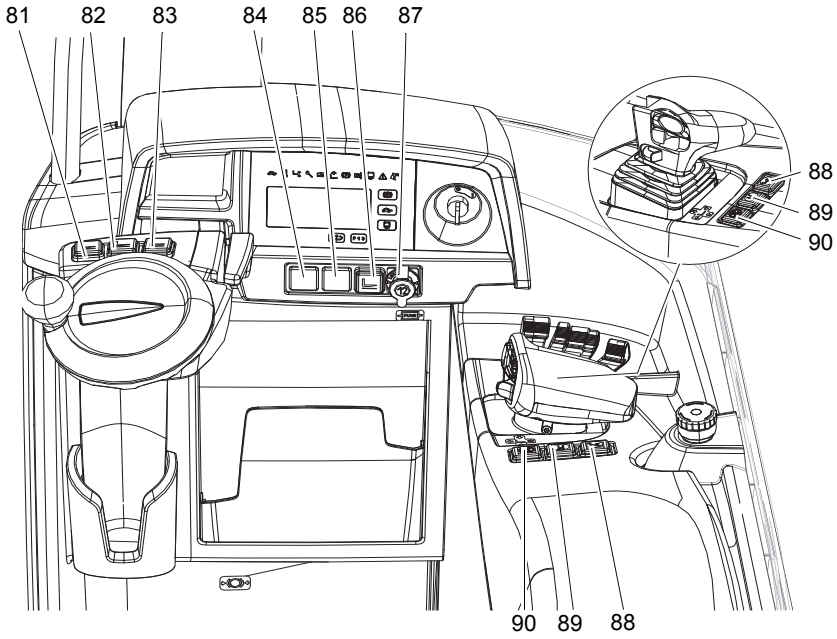
– For checks and operations to be performed before starting daily operation, see page 80.

Procedure

- Pull the Emergency Disconnect (7) to switch it on.
- Switch on the truck, to do this
  - Insert the key in the key switch (9) and turn it as far to the right as it will go, or
  - Enter the code in the code lock (○). Start PIN 2580 or
  - Hold the card or transponder in front of the ISM access module and depending on the setting press the green button on the ISM access module (○).
- Test the steering.
- Test the brakes (18).
- Test the warning signal button.
- Test the deadman switch (19).
- Test the accelerator pedal (16).
- Test lifting operations.

The truck is operational

4.3 Emergency Disconnect



Pressing the Emergency Disconnect switch

Procedure

⚠ CAUTION!

Accident risk

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

➔ Do not use the Emergency Disconnect switch (7) as a service brake.

- Press the Emergency Disconnect (7).

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

Releasing the Emergency Disconnect switch

Procedure

- Pull or turn the Emergency Disconnect switch (7) to unlock it.

All electrical functions are enabled and the truck is operational again (assuming the truck was not operational before the Emergency Disconnect was pressed).
For CanCode and ISM the truck remains switched off.

4.4 Emergency stop

The truck is fitted with an emergency stop device. If a system fault is detected, the truck automatically brakes until it comes to a halt. If a fault is detected in the steering or brake systems, an information message will appear on the display and control unit (11), see page 72.

Re-setting the emergency stop

Procedure

- Press the Emergency Disconnect (7).
- Pull or turn the Emergency Disconnect switch (7) to unlock it.

The emergency stop is reset.

➔ If the emergency stop is shown on the control and display unit (11) after repeatedly resetting the emergency stop, notify the manufacturer's service department.

4.5 Travel

⚠ WARNING!

Improper travel can result in accidents

- ▶Do not get up from the driver's seat during travel.
- ▶Make sure that the travel area is clear.
- ▶Adapt the travel speed to the conditions of the route, the work area and the load.
- ▶Tilt the mast back and raise the fork carriage approx. 200 mm.
- ▶Make sure you have enough visibility when reversing.

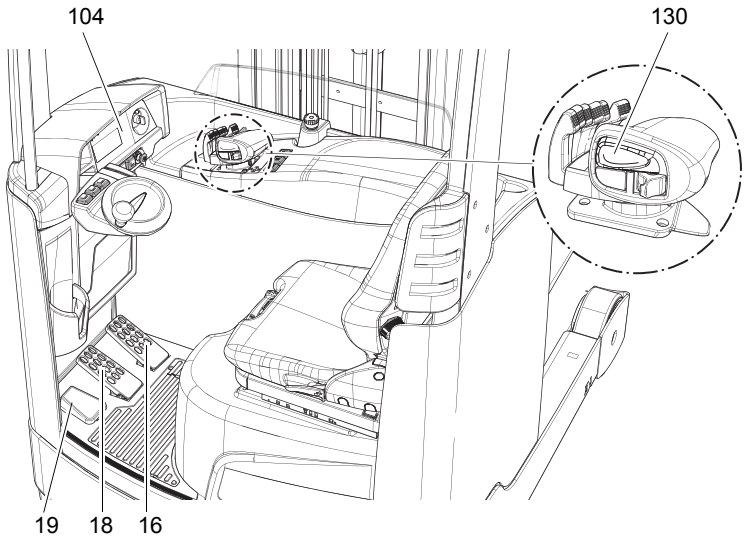
⚠ CAUTION!

Loss of stability can cause accidents

Extended mast sections when the truck is travelling with or without load will reduce the truck's stability.

- ▶Always travel with the mast holder retracted, the mast tilted back and the load handler lowered.

Each time the truck is started the operation of the emergency stop safety switch is tested. The fault display is shown on the display unit for the duration of the safety check. Travel and steering are only enabled if the condition is satisfactory.



Travel

Requirements

– Truck prepared for operation, see page 94.

Procedure

- Release the parking brake, to do this press the parking brake button (104).
- Select the travel direction, to do this
  - Push the direction button (130) up to select travel in the forks direction.
  - Push the direction button (130) down to select travel in the drive direction.
- Press and hold down on the deadman button (19).

➔ The deadman button (19) ensures that the driver's feet do not extend beyond the geometry of the truck during travel. If it is not pressed, travel and lifting are inhibited with the exception of steering, the control and display unit and the horn. The truck coasts according to the coasting brake parameter setting and after a short time comes to a halt via the drive brake.

- Apply the accelerator pedal (16).

➔ The travel speed is governed by the accelerator (16).

The truck travels in the direction selected.

4.6 Brakes

The truck’s brake pattern depends largely on the ground conditions. The driver must take this into consideration when handling the truck.

The truck can brake in three different ways:
– With the service brake
– With the coasting brake
– With the reversing brake

⚠ WARNING!

Individual parameter settings can cause accidents

If the truck is operated by several drivers (e.g. multi-shift operation) and the parameters are individually set, be aware of the different brake and travel patterns.

▶ Test the truck's response on start-up.

⚠ WARNING!

Accident risk

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

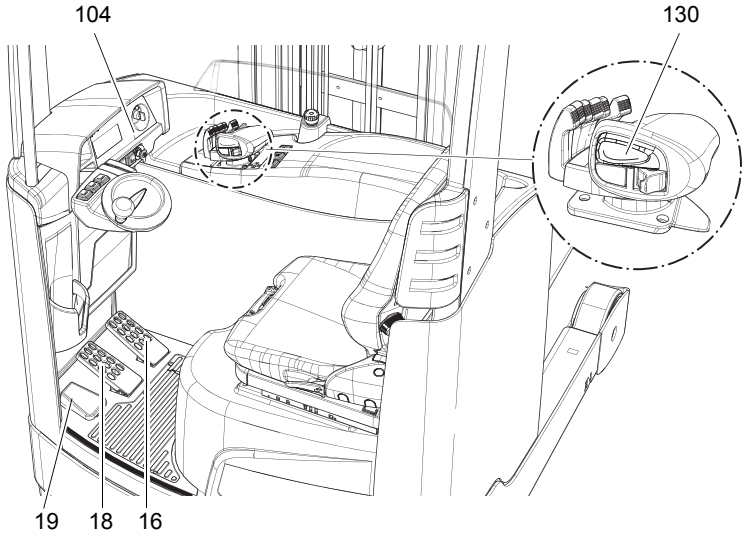
▶ The driver must be aware of travel route conditions and them into account when braking.

▶ Brake with care to prevent the load from slipping.

▶ Allow for increased braking distance when travelling with an attached load.

▶ Use the service brake in emergencies.

4.6.1 Braking with the reversing brake



Braking with the reversing brake

Procedure

- Set the travel direction switch (130) to the opposite direction while travelling.

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

This method reduces energy consumption. Energy is recovered, which is controlled by the traction current controller. The energy recovery is indicated on the control and display unit.

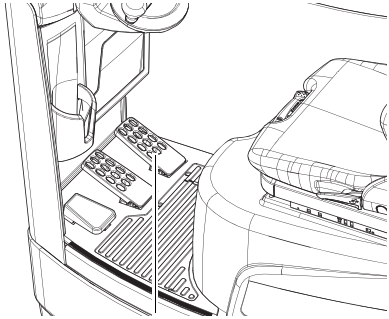
4.6.2 Braking with the coasting brake

Braking with the coasting brake

Procedure

- Take your foot off the accelerator pedal (16).

The truck decelerates.



16

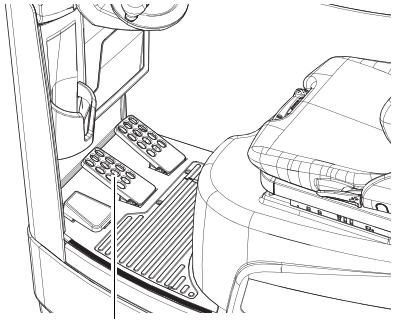
4.6.3 Braking with the service brake

Braking with the service brake

Procedure

- Press down on the brake pedal (18) until you reach the required deceleration.

The truck decelerates depending on the brake pedal position.



18

If the brake pedal is applied suddenly just before the truck stops, the drive brake also applies and is released when the brake pedal is released.

4.7 Steering

4.7.1 Steering type

Reverse steering

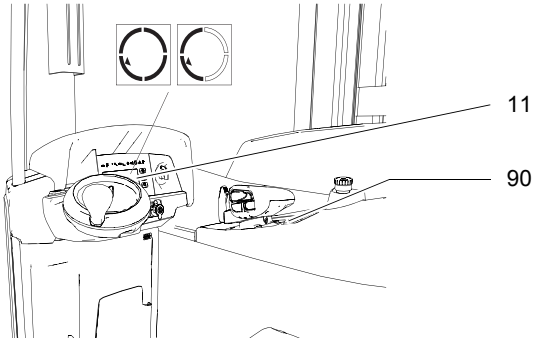
When travelling forward (travel in direction of entry = drive direction) steer left to turn into a left hand bend and right into a right hand bend. The drive wheel position is indicated on the driver's display.

Forward steering (○)

When travelling forward (travel in direction of entry = drive direction) steer left to turn into a right hand bend and right into a left hand bend. The drive wheel position is indicated on the driver's display.

4.7.2 Setting the steering mode (○)

Press the steer mode button (90) to change between 180° and 360° steering. The range selected is shown in the control and display unit (11).



Setting the steering mode

Procedure

- Press the steering mode button (90).

The steering mode is now set.

Steering

Procedure

- Turn the steering wheel in the desired direction.

The truck travels in the required direction.

4.8 Adjusting the forks

⚠ WARNING!

Unsecured forks can cause injury

You can injure your legs when replacing the forks.

- ▶ Never pull the forks towards your body.
- ▶ Always push the forks away from your body.
- ▶ Secure heavy forks with lifting slings and a crane before pushing them down from the fork carriage.
- ▶ After replacing the forks fit the retaining bolts (116) and make sure the bolts are seated correctly. Retaining bolt torque: 85 Nm ± 10 %.

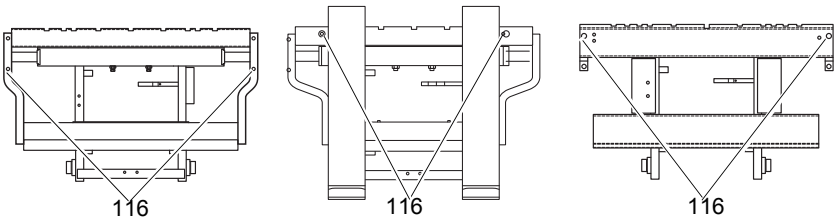
Securing the forks

Procedure

➔ The forks must be prevented from falling with the retaining bolt (116).

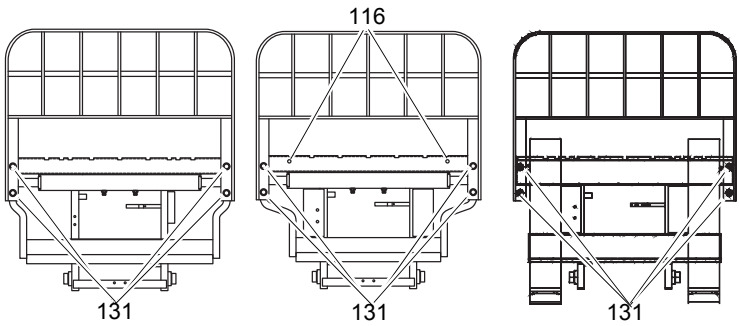
- Ensure the retaining bolt (116) is secure, tighten if necessary.

The forks are now secured.



➔ Retaining bolt torque: 85 Nm ± 10 %.

➔ Shown without load backrest:
Left: ETV, centre: ETM, right: Fork carriage



➔ Shown with load backrest
Left: ETV, centre: ETM, right: fork carriage

➔ Observe the following for ETV and version with fork carriage:

There is no requirement for the retaining bolts (116) when using a load backrest. The forks are secured with the bolts (131). When disassembling the load backrest, the retaining bolts (116) must be refitted.

With ETM, the retaining bolts (116) are still required when using a load backrest.

➔ Retaining bolt torque: 85 Nm ± 10 %.

⚠ WARNING!

Incorrect fork adjustments can cause accidents

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

Adjusting the forks

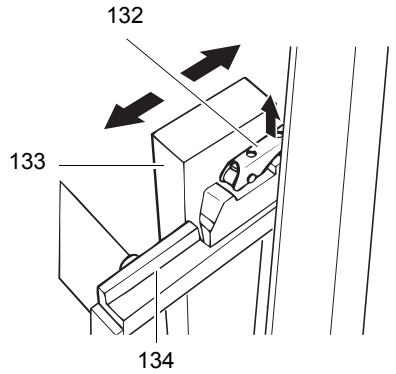
Requirements

– Park the truck securely, see page 120.

Procedure

- Lift up the locking lever (132).
- Push the forks (133) into the correct position on the fork carriage (134).
- Swing the locking lever (132) down and move the fork tines until the locking pin (133) engages in a slot.

The forks are now adjusted.



4.9 Lifting, transporting and depositing loads

⚠ WARNING!

Risk of accident due to unsecured and incorrectly positioned loads

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

- ▶ Instruct other people to move out of the hazardous area of the truck. Stop using the truck if people do not vacate the hazardous area.
- ▶ Only carry loads that have been correctly secured and positioned. Use suitable precautions to prevent parts of the load from tipping or falling down.
- ▶ Do not transport loads other than on the authorised load handler.
- ▶ Damaged loads must not be transported.
- ▶ Never exceed the maximum loads specified on the load chart.
- ▶ Never stand underneath a raised load handler.
- ▶ Do not stand on the load handler.
- ▶ Do not lift other people on the load handler.
- ▶ Do not reach through the mast.
- ▶ Check the fork spread before lifting the load and adjust if necessary.
- ▶ Bring the forks under the load such that at least 75% of the load is on the forks.
- ▶ No one is permitted in the adjacent aisles when there is a risk of displaced stored pallets or other loads.
- ▶ When transporting high or multiple individual loads, a load backrest must be used.
- ▶ It is forbidden to pick up, transport and set down loads using two trucks.

⚠ CAUTION!

Loss of stability can cause accidents

Extended mast sections when the truck is travelling with or without load will reduce the truck's stability.

- ▶ Always travel with the mast holder retracted, the mast tilted back and the load handler lowered.

Lifting and lowering with the SOLO-PILOT

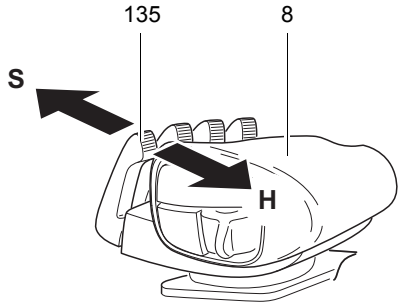
Procedure

- Pull the SOLO-PILOT lever (135) in direction H to raise the load unit.
- Push the SOLO-PILOT lever (135) in direction S to lower the load unit.
- Apply the SOLO-PILOT lever (135) until you reach the required lift height.

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

➔ When you reach the limit position return the control lever to its home position.

The load unit is now raised or lowered.



Lifting and lowering with the MULTI-PILOT

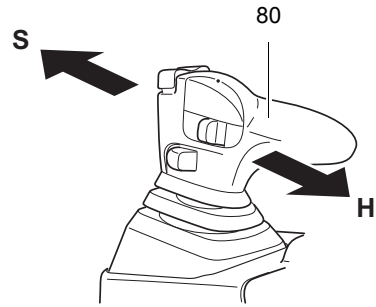
Procedure

- Pull the MULTI-PILOT (80) in direction H to raise the load unit.
- Push the MULTI-PILOT (80) in direction S to lower the load unit.
- Apply the MULTI-PILOT until you reach the required lift height.

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

➔ When you reach the limit stop the pressure relief valve makes a noise. Set the control lever immediately to the home position.

The load unit is now raised or lowered.



Mast lift speed reduction (○)

The mast lift speed reduction safety feature prevents the truck from accelerating accidentally if the load is beyond the free lift range.

After the safety switch has applied, the truck can only operate at crawl speed.

Deactivating the speed reduction

Procedure

- Lower the load handler.
- Set the accelerator pedal to the zero (home) position.

This deactivates the speed reduction and releases normal travel.

⚠ CAUTION!

Risk of trapping from moving parts!

When the mast holder moves you can get trapped between the mast and battery tray.

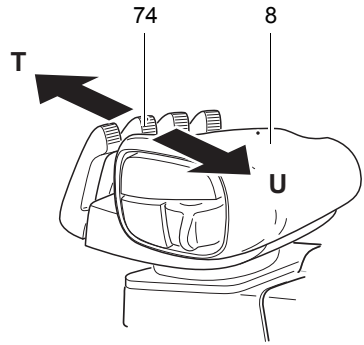
▶ Do not reach between the mast and the battery tray.

Moving the mast holder with the SOLO-PILOT

Procedure

- Push the SOLO-PILOT (74) in direction (T) to extend the mast holder forward.
- Pull the SOLO-PILOT (74) in direction (U) to retract it.

The mast holder is now extended.

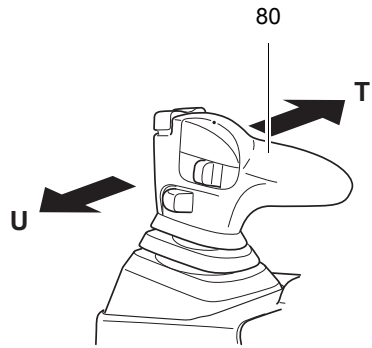


Moving the mast holder with the MULTI-PILOT

Procedure

- Push the MULTI-PILOT (80) in direction (T) to extend the mast holder forward.
- Pull the MULTI-PILOT (80) in direction (U) to retract it.

The mast holder is now extended.

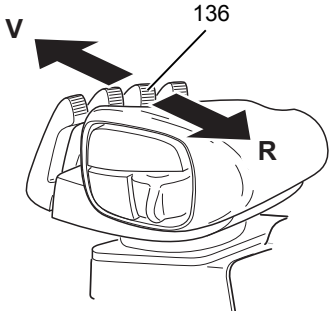


Tilting the mast / fork carriage with the SOLO-PILOT

Procedure

- Push the SOLO-PILOT lever (136) in direction (V) to tilt the mast holder forward.
- Pull the SOLO-PILOT lever (136) in direction (R) to retract it.

The mast / fork carriage is tilted.

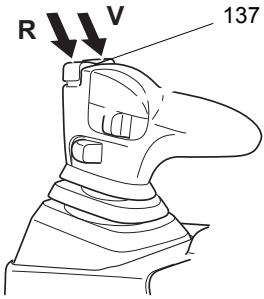


Tilting the mast / fork carriage with the MULTI-PILOT

Procedure

- To tilt forward, push the MULTI-PILOT (137) in direction (V).
- To tilt back, push the MULTI-PILOT (137) in direction (R).

The mast / fork carriage is tilted.



Lifting load units

Requirements

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

Procedure

- Drive the truck carefully up to the pallet.
- Set the mast vertical.
- Extend the mast holder.
- Raise the forks to the correct height.
- Slowly insert the forks into the pallet until the fork shank touches the pallet.
- Raise the load handler.
- Tilt the mast back.
- Retract the mast holder.
- Reverse carefully and slowly until the load unit is outside the storage area. Make sure you have a clear route when travelling in the forks direction.

Load unit raised.

Transporting load units

Requirements

– Load unit positioned correctly on the forks.
– Mast and load section tilted back fully.

Procedure

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

NOTE

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

Depositing load units

Requirements

– Storage location suitable for storing the load.

Procedure

- Set the mast vertical.
- Drive carefully up to the storage location.
- Raise the load unit to the correct height.
- Extend the mast holder.
- Carefully lower the load handler so that the forks are clear of the load.
  Avoid depositing the load to prevent damage to the load and the load handler.
- Lowers the load handler.
- Retract the mast holder. Carefully remove the forks from the pallet.

The load unit is lowered.

4.10 Operating attachments

4.10.1 Safety instructions for operating additional attachments

Optionally, trucks can be fitted with one or more auxiliary hydraulic functions to operate attachments. The auxiliary hydraulics are indicated with HF4 and HF5.
Auxiliary hydraulic functions for exchangeable equipment are fitted with replacement couplings on the fork carriage. To fit exchangeable equipment see page 118.

⚠ DANGER!

Attaching exchangeable equipment can result in accidents.

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

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

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

Safety instructions for side shifter and fork adjuster attachments

⚠ WARNING!

When using multi fork adjusters (multi pallet clamps), restricted visibility and reduced lateral tilt resistance can result in accidents.

▶ Adapt the travel speeds to the visibility and load.

▶ Make sure you have sufficient visibility when travelling in the load direction.

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

⚠ WARNING!

Falling loads can cause accidents

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

▶ Clamping attachments may only be added to trucks which have a button to enable additional hydraulic functions.

▶ Clamping attachments must only be operated on trucks will auxiliary hydraulics HF4 or HF5.

▶ When connecting the attachment make sure that the hydraulic lines of the attachment are connected to the right ports, see page 118.

Safety instructions for rotary attachments

⚠ WARNING!

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

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

▶ Adapt the travel speed to the load.

▶ Lift the load from the centre.

Safety instructions for telescopic attachments

⚠ WARNING!

Accident risk from increased tipover hazard and reduced residual capacity

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

▶ Do not exceed the maximum loads specified on the capacity plate.

▶ Only use the telescopic function for stacking and retrieving.

▶ Retract the telescopic attachment fully during transport.

▶ Adapt the travel speed to changed load centre of gravity.

Safety instructions for attachments when transporting suspended loads

⚠ WARNING!

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

Transporting hanging loads can reduce the stability of the truck.

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

Safety instructions for using loading buckets as attachments

⚠ WARNING!

Increased mast loading can cause accidents.

- ▶ When carrying out the daily checks and operations before starting, see page 80, check in particular check the fork carriage, mast rails and mast rollers for damage.

Fork extension safety instructions

⚠ WARNING!

Unsecured and oversized fork extensions can cause accidents.

- ▶ For fork extensions with an open cross sectional area, carry only loads that are resting along the entire length of the fork extension.
- ▶ Use only fork extensions with the same fork cross section and minimum fork length of the truck and which comply with the details on the fork extension data plate.
- ▶ The basic fork length must be at least 60% of the length of the fork extension.
- ▶ Lock the fork extensions onto the basic forks.
- ▶ When carrying out the daily checks and operations before starting, see page 80, check also the fork extension lock.
- ▶ Mark any fork extensions with an incomplete or faulty lock and take them out of service.
- ▶ Do not use trucks with an incomplete or faulty fork extension lock. Replace the fork extension.
- ▶ Only restore the fork extension to service when the fault has been rectified.
- ▶ Use only fork extensions which are free of dirt and foreign bodies near the entry opening point. Clean the fork extensions as required.

4.10.2 Integral sideshifter (SOLO-PILOT)

The directions "left" and "right" refer to the load handler when viewed from the operator position.

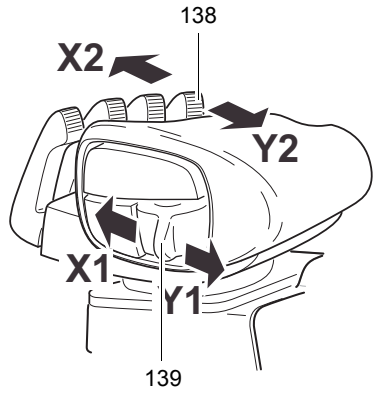
Moving the sideshifter

Procedure

- Press the button (139) in direction (X1). The sideshifter moves to the left.
- Press the button (139) in direction (Y1). The sideshifter moves to the right.

Note the capacity reduces when traversing.

The sideshifter is now moved.

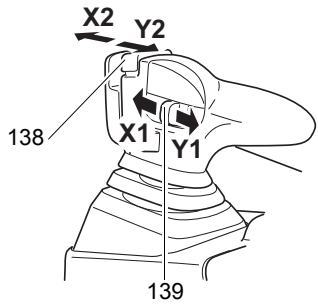


4.10.3 Operating additional attachments for the SOLO-PILOT

The control lever (138) has functions (X2) and (Y2) to operate hydraulic attachments connected to the terminal HF5 (see manufacturer's operator manual).

4.10.4 Integral sideshifter (MULTI-PILOT)

The directions "left" and "right" refer to the load handler when viewed from the operator position.



Moving the sideshifter

Procedure

- Press the button (139) in direction (X1). The sideshifter moves to the left.
- Press the button (139) in direction (Y1). The sideshifter moves to the right.

Note the capacity reduces when traversing.

The sideshifter is now moved.

4.10.5 Operating additional attachments for the Multi Pilot

The control lever (138) has functions (X2) and (Y2) to operate hydraulic attachments connected to the terminal HF5 (see manufacturer's operator manual).

4.11 Fitting additional attachments

⚠ WARNING!

Incorrectly connected attachments can cause accidents.

Attachments with incorrectly connected hydraulic attachments can result in accidents.

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

▶ Observe the manufacturer's operating instructions.

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

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

Connecting attachments hydraulically

Requirements

– Non-pressurised hydraulic hoses.
– The exchange ports on the truck are marked HF4 and HF5.
– Attachment directions of movement defined to match the controls' direction of movement.

Procedure

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

The attachment is now hydraulically connected.

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

4.12 Emergency lowering

The load handler can be lowered manually if a fault occurs in the hydraulic controller.

⚠ WARNING!

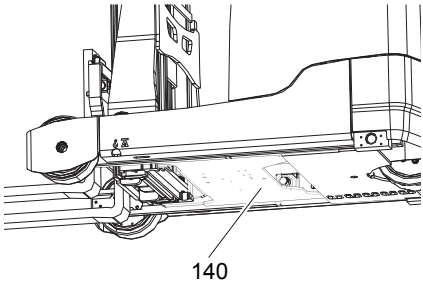
Lowering the mast can result in injuries

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

Mast emergency lowering

Requirements

– Load handler is not in the rack.
– Turn the Emergency Disconnect switch and key switch off.
– Disconnect the battery.



Procedure

- Release the emergency lowering valve (140) underneath the truck by max. 1/2 a turn anti-clockwise with the4 mm Allen screw.
- The mast and load handler will lower slowly. If necessary the lowering speed can be reduced by turning clockwise or the load can be stopped.
- When the load has been lowered, close the emergency lowering valve with a torque of 2,5 Nm.

The mast is now lowered.

⚠ WARNING!

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

4.13 Parking the truck securely

⚠ WARNING!

An unsecured truck can cause accidents

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

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

Parking the truck securely

Procedure

- Fully lower the load handler and tilt it forward.
- Retract the mast holder fully.
- Switch off the truck. To do this:
  - For a key switch, turn the key in the key switch left as far as the stop and remove the key.
  - For ISM, press the red button.
  - For CanCode, press the O button.
- Press the Emergency Disconnect.

The truck is parked.

5 Troubleshooting

5.1 Recovering the truck

⚠ CAUTION!

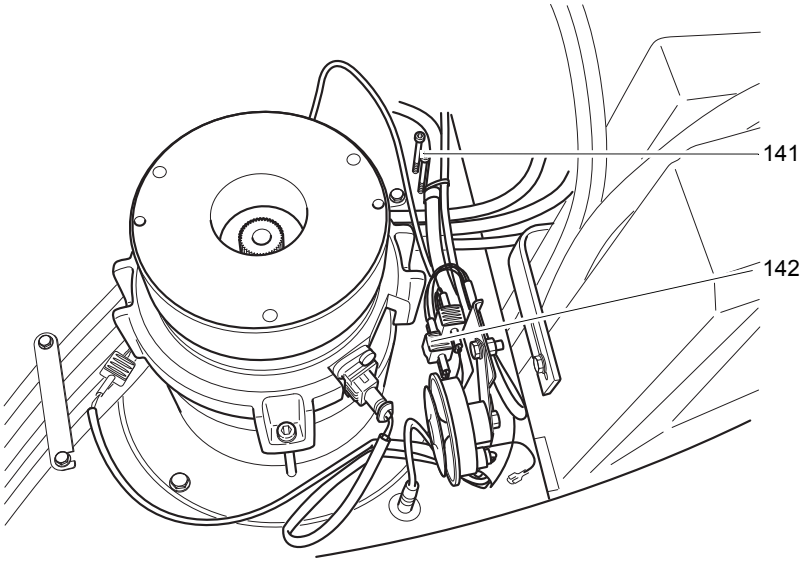
This operation must only be performed by suitably trained maintenance personnel. When the brakes are de-activated the truck must be parked on a level surface, since the brakes are no longer effective.

Preparing to move the truck without its own drive system

Procedure

- Turn the Emergency Disconnect switch and key switch off.
- Disconnect the battery.
- Prevent the truck from rolling away.
- Remove the seat panel, see page 178.

Truck prepared.



Releasing the magnetic brake

Tools and Material Required

– Screws (2 x M6) (141)
– Allen key

Procedure

- Disconnect the two-pin connector (142) from the magnetic brake.
- Remove the screws (2 x M6) (141) from the drive plate and insert them in the magnetic brake holes.

The magnetic brake is now released.

Aligning the drive wheel

Procedure

- Remove the protective cap over the centre screw.

⚠ CAUTION!

Tensioned tyres can cause accidents

When steering in the standing position the driving wheel band is under tension. Releasing the Allen key or steering crank can create a correcting moment.

▶ Release the Allen key or steering crank carefully.

Only adjust the position of the steering wheels when the truck is stationary.

- Place the Allen key or steering crank (143) on the steering transmission and turn the drive wheel to the required steering position.

The drive wheel is now aligned.

The steering wheel setting can only be adjusted when the truck is stationary.

Towing the truck

⚠ WARNING!

An unsecured truck can cause accidents

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

- ▶ Park the truck on a level surface. In special cases the truck may need to be secured with wedges.
- ▶ Fully lower the load handler.
- ▶ Select a place to park where no other people are at risk of injury from the lowered load handler.
- ▶ If the brakes are not working, place wedges underneath the wheels of the truck to prevent it from moving.

⚠ WARNING!

Accident risk

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

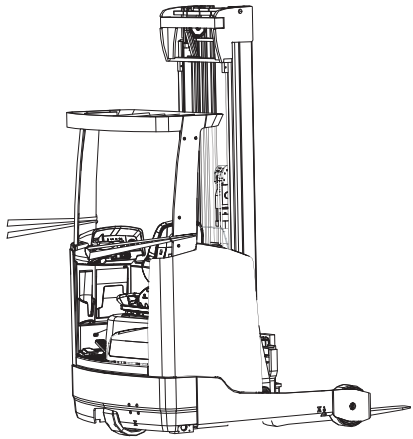
- ▶ Only use vehicles to tow the truck which have sufficient tow and brake forces for the trailer load without its own braking system.
- ▶ Always tow the truck at walking pace.
- ▶ Do not park the truck with the parking brake released.

Tools and Material Required

– Tow rope, tow force > 5 to

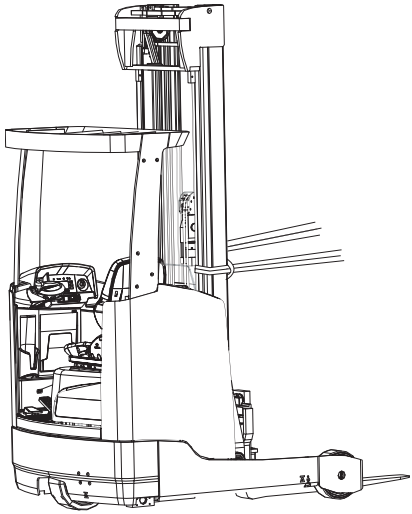
Procedure

- Guide the tow rope around the struts of the overhead guard as shown in the diagram to tow the truck in the drive direction.



- Guide the tow rope around the mast as shown in the diagram to tow the truck in the forks direction.
- Tow the truck carefully and slowly.
- When the truck reaches its destination, restore the brake system to its operating condition.

The truck has now been towed.



Activating the magnetic brake

Tools and Material Required

– Screws 2 x M6
– Allen key

Procedure

- Remove the screws (2 x M6) from their holes in the magnetic brake and insert them in the drive plate.
- Connect the two-pin connector to the magnetic brake.

Magnetic brake is activated.

5.2 Warning messages

Display	Cause	Action
1901	During system start-up, the accelerator pedal zero position could not be determined.	Do not press the accelerator pedal during system start-up.
1904	Accelerator pedal pressed, but no travel direction selected.	Take your foot off the accelerator pedal, select a travel direction and set off.
1909	Accelerator pedal pressed and parking brake not released via parking brake button.	Release the parking brake by pressing the parking brake button.
1917	Accelerator and brake pedals pressed simultaneously.	Press one pedal at a time only.
2951	Lift function activated on multi-/ soloPILOT during system start-up. No zero position sensing possible.	Do not apply the multi-/ soloPILOT during system start-up. – Switch off the truck. – Switch the truck on again. – Call the service department if necessary.
1952	Travel direction switch pressed during system start-up.	Do not press the travel direction switch during system start-up
9961	ISM (option) has detected a shock event in the vertical direction	Obtain acknowledgement from authorised person (warehouse manager) and arrange for the truck to be started up again
9962	ISM (option) has detected a shock event in the horizontal direction	Obtain acknowledgement from authorised person (warehouse manager) and arrange for the truck to be started up again
5990	The electrolyte level sensor check (battery-management option) on the battery has detected a lack of electrolyte	Add electrolyte.
5992	After switching on the truck, no radio network could be established with the battery management	– Switch off the truck. – Switch the truck on again. – Check battery management connection. – Call service department.
5408/ 5409	Lithium-ion battery overtemperature	Stop work.
5413	Lithium-ion battery low temperature	Move truck to warm environment.

→ For all other warning messages switch the truck off and on again. If the warning message appears again call the service department.

6 Optional equipment

6.1 Keypad (CanCode) (○)

6.1.1 Code lock

The code lock enables an operator or a group of operators to be assigned an individual user code. The user code is configured with a master code and is outlined in the following sections of this chapter.

When you have entered the valid user code the truck will be operational. The truck will be able to perform travel, steering and hydraulic operations.

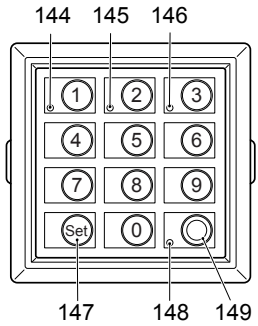
When you have entered the valid master code the truck will be switched on. Travel operations are inhibited. The truck will be able to perform steering and hydraulic operations. The code lock is in programming mode. When you enter one of the following parameters the settings in the code lock can be changed.

Parameters	Description
0-0-0	– To change the master code (see page 131)
0-0-1	– To add user codes (see page 133)
0-0-2	– To change a user code (see page 135)
0-0-3	– To clear a user code (see page 137)
0-0-4	– To clear all user codes (see page 139)
0-1-0	– To set the automatic cutout of the truck (see page 141)

Newly supplied trucks have the code indicated on a sticker. When using the truck for the first time change the master and user codes and remove the sticker.

– User code factory setting: 2-5-8-0
– Master code factory setting: 7-2-9-5

The keypad consists of 10 digit keys, a Set key (147) and a ○ key (149).



Digit keys

The digit keys are used to enter the user or master codes.

○ key

Pressing the ○ key switches the truck off and sets it to the "non operational" status.

The ○ key indicates the follow operational statuses via a red / green LED (148):
– Code lock function (commissioning the truck).
– Setting and changing parameters.

SET key

When you change the parameters the SET key (147) acts as a confirmation key.

6.1.2 Preparing the truck for operation with the keypad (CanCode)

Preparing the truck for operation by entering a valid user code

Procedure

- Pull the Emergency Disconnect to unlock it, see page 95.
  The LED (148) lights up red.
- Enter the user code with the digit keys.
  When you enter a valid user code the LED (148) turns green.

➔ If the LED (148) flashes red this means the wrong user code has been entered. Enter the user code again.
The Set key (147) has no function in operating mode.

6.1.3 Switching off the truck with the keypad (CanCode)

Switching off the truck

Procedure

- Press the O key (149).

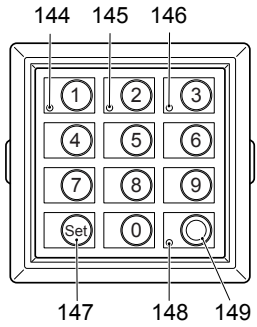
The truck is switched off and the LED (148) is lit red.

➔ The truck can cut out automatically after a specified time. If no travel, steering or hydraulic operations are performed within a set time, the truck switches off automatically. When you enter a valid code again the truck will be operational. The code lock parameter responsible for automatic cutout must be set, see page 141.

➔ This additional safety mechanism in no way discharges the operator from his obligation to prevent the truck from being used by unauthorized parties before leaving the truck. The operator must therefore apply the power-down key each time the truck is left.

6.1.4 Changing the master code

To change the length of the master code you must follow the procedure in "Choose length of the new master code (4-6 digit) and add user codes", see page 140. If there are still user codes stored in the code lock, the master code to be changed must be the same length as the saved user codes.



Requirements

– To prepare the truck for operation, see page 130.

Procedure

- Press the O key (149).
- Enter the valid master code with the digit keys.
  When you enter the valid master code the LED (148) flashes green.
- Enter the parameters 0-0-0 with the digit keys.
- Confirm with the SET key (147).
  The LEDs (144,148) flash green.
- Enter the valid master code again with the digit keys.
- Confirm with the SET key (147).
  The LEDs (145,148) flash green.
- Enter the valid master code with the digit keys.
  The new master code must be different from existing user codes.
- Confirm with the SET key (147).
  The LEDs (146,148) flash green.
- Enter the new master code again with the digit keys.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green. The setting is saved.
- Press the O key (149).
  The truck is switched off and the LED (148) is lit red.
- Check the new master code:
  - Switch on the truck with the new master code, see page 130
    When you enter the valid master code the LED (148) flashes green.
  - Press the O key (149).

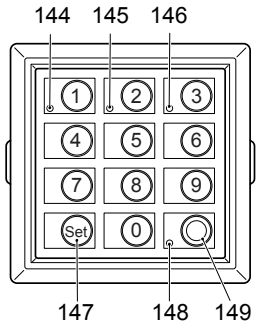
  The truck is switched off and the LED (148) is lit red.

Error displays changing the master code

For the following events the LED (148) flashes red:

Cause	Remedy
– New master code is already occupied by a user code	– Switch off the truck, see page 130. – Choose a different master code, see page 131. – Change the user code so that the required master code can be used, see page 135. – Delete the user code so that the required master code can be used, see page 137.
– The master codes to be changed do not match	– Switch off the truck, see page 130. – Enter the master code again, see page 131.
– The master code entered is not the same length as the user code	– Switch off the truck, see page 130. – Repeat the entry, making sure that the length of the master code matches that of the user code.

6.1.5 Add operator code



Requirements

– To prepare the truck for operation, see page 130.

Procedure

- Press the O key (149).
- Enter the valid master code with the digit keys.
  When you enter the correct master code the LED (148) flashes green.
- Enter the 0-0-1 parameter with the digit keys.
- Confirm with the SET key (147).
  The LEDs (145,148) flash green.
- Enter the new user code with the digit keys.

  The length (4-6 digit) of the new user code must be the same as the master code entered previously. The new user code must also be different from the existing master code.
- Confirm with the SET key (147).
  The LEDs (146,148) flash green.
- Enter the new user code again with the digit keys.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green. The setting is saved.
- Press the O key (149).
  The truck is switched off and the LED (148) lights up red.
- To check the new user code:
  - Switch on the truck with the new user code, see page 130
    When you enter a valid user code the LED (148) turns green.
  - Press the O key (149).

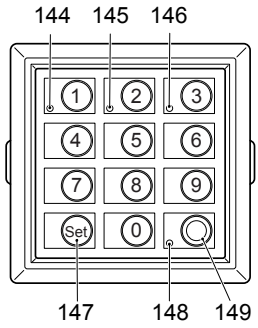
  The truck is switched off and the LED (148) lights up red.

Error displays adding a user code

For the following events the LED (148) flashes red:

Cause	Remedy
– The user code entered is not the same length as the master code	– Switch off the truck, see page 130. – Repeat the entry, making sure that the master code is the same length as the user code.
– New user code is already occupied by a master code	– Switch off the truck, see page 130. – Choose a different user code, see page 133.
– The newly entered user codes do not match	– Switch off the truck, see page 130. – Add the user code again, see page 133.
– Code log full.	– Switch off the truck, see page 130. – Delete individual user codes, see page 137. – Delete all user codes, see page 139.

6.1.6 Change operator code



Requirements

– To prepare the truck for operation, see page 130.

Procedure

- Press the O key (149).
- Enter the valid master code with the digit keys.
  When you enter the correct master code the LED (148) flashes green.
- Enter the 0-0-2 parameter with the digit keys.
- Confirm with the SET key (147).
  The LEDs (144,148) flash green.
- Enter the user code to be changed with the digit keys.
- Confirm with the SET key (147).
  The LEDs (145,148) flash green.
- Enter the new user code with the digit keys.

  The length (4-6 digit) of the new user code must be the same as the master code entered previously. The new user code must also be different from the existing master code.
- Confirm with the SET key (147).
  The LEDs (146,148) flash green.
- Enter the new user code again with the digit keys.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green. The setting is saved.
- Press the O key (149).
  The truck is switched off and the LED (148) lights up red.
- To check the new user code:
  - Switch on the truck with the new user code, see page 130
    When you enter a valid user code the LED (148) turns green.
  - Press the O key (149).

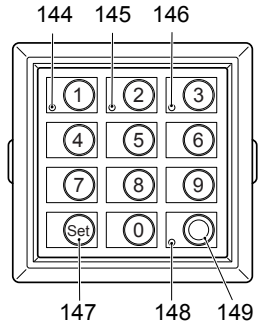
  The truck is switched off and the LED (148) lights up red.

Error displays changing a user code

For the following events the LED (148) flashes red:

Cause	Remedy
– The user code entered is not the same length as the master code	– Switch off the truck, see page 130. – Repeat the entry, making sure that the master code is the same length as the user code.
– Operator code to be changed does not exist.	– Switch off the truck, see page 130. – Check the user code entered.
– The user codes to be changed do not match	– Switch off the truck, see page 130. – Change the user code again, see page 135.
– Tried to change the operator code to another user code that already exists.	– Switch off the truck, see page 130. – Choose a different user code, see page 135.

6.1.7 Delete individual user codes



Requirements

– To prepare the truck for operation, see page 130.

Procedure

- Press the O key (149).
- Enter the valid master code with the digit keys.
  When you enter the valid master code the LED (148) flashes green.
- Enter the parameters 0-0-3 with the digit keys.
- Confirm with the SET key (147).
  The LEDs (145,148) flash green.
- Enter the user code to be deleted with the digit keys.
- Confirm with the SET key (147).
  The LEDs (146,148) flash green.
- Enter the user code to be deleted again with the digit keys.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green. The user code is now deleted.
- Press the O key (149).
  The truck is switched off and the LED (148) is lit red.
- Check that the user code has been deleted:
  - Switch the truck on with the user code to be deleted, see page 130
    After entering the user code the LED (148) flashes red and the truck remains switched off.
  - Press the O key (149).

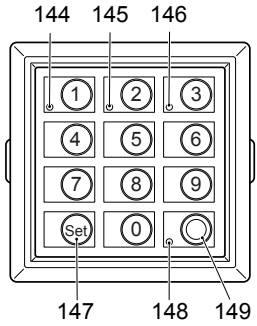
  The truck remains switched off and the LED (148) is lit red.

Error displays deleting individual user codes

For the following events the LED (148) flashes red:

Cause	Remedy
– The user code entered is not the same length as the master code	– Switch off the truck, see page 130. – Repeat the entry, making sure that the master code is the same length as the user code.
– Tried to delete an operator code that does not exist.	– Switch off the truck, see page 130. – Check the user code entered.
– The user codes to be changed do not match	– Switch off the truck, see page 130. – Delete the user code again, see page 137.

6.1.8 Delete all user codes,



Requirements

– To prepare the truck for operation, see page 130.

Procedure

- Press the O key (149).
- Enter the valid master code with the digit keys.
  When you enter the valid master code the LED (148) flashes green.
- Enter the parameters 0-0-4 with the digit keys.
- Confirm with the SET key (147).
  The LEDs (146,148) flash green.
- Enter the code 3-2-6-5 with the digit keys.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green. All user codes are deleted.
- Press the O key (149).
  The truck is switched off and the LED (148) is lit red.
- Check that the user codes have been deleted:
  - Switch on the truck with a previous user code, see page 130.
    After entering the user code the LED (148) flashes red and the truck remains switched off.
  - Press the O key (149).

  The truck remains switched off and the LED (148) is lit red.

6.1.9 Choose length of the new master code (4-6 digit) and add user codes

The master code is factory set to a four-digit entry: If necessary, the four-digit master code can be changed to a five or six-digit entry. Before the master code length can be changed, all user codes must be deleted. The length of the user code (4-6 digit) is always determined by the length of the master code.

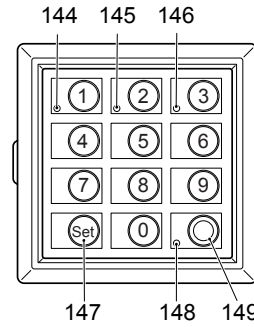
Requirements

– To prepare the truck for operation, see page 130.

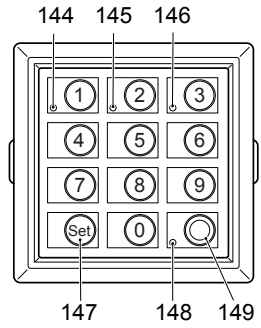
Procedure

- Delete all user codes, see page 139.
- Enter the new master code (4-6 digit), see page 131.
- Add user codes again, see page 133.

The length of the new master code is now changed and user codes have been added.



6.1.10 Setting the automatic truck cutout (timeframe)



Requirements

– To prepare the truck for operation, see page 130.

Procedure

- Press the O key (149).
- Enter the valid master code with the digit keys.
  When you enter the correct master code the LED (148) flashes green.
- Enter the 0-1-0 parameter with the digit keys.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green.
- Set the truck automatic cutout (time period) with the digit keys:
  - 00:
    Automatic truck cutout is deactivated.
  - 01 - 30:
    Set time period (in minutes) after which the truck automatically cuts out (minimum cutout time is 1 minute,
    maximum cutout time is 30 minutes),
  - 31:
    After 10 seconds the truck cuts out automatically.
- Confirm with the SET key (147).
  Wait until the LED (148) flashes green. The setting is saved.
- Press the O key (149).
  The truck is switched off and the LED (148) lights up red.
- Checking the truck's automatic cutout:
  - Switch on the truck with a valid user code, see page 130.
    When you enter a valid user code the LED (148) turns green.
  - Do not perform any travel, steering or hydraulic operations with the truck.
  - Wait until the truck automatically cuts out at the end of the time period.

  The truck is switched off and the LED (148) lights up red.

Error displays setting the automatic cutout period of the truck

For the following events the LED (148) flashes red:

Cause	Remedy
– Cutout time entered is out of range	– Switch off the truck, see page 130. – Enter the time again while making sure it is within range.

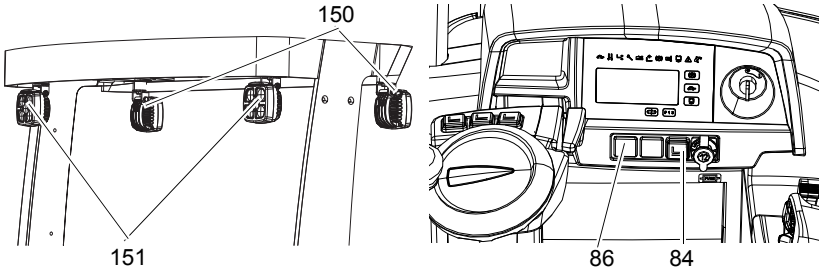
6.2 ISM access module (○)

If the truck is equipped with an ISM access module refer to the “ISM Access Module” operator manual.

6.3 Rack Height Select (○)

If the truck is equipped with Rack Height Select, refer to the "Rack Height Select" operating instructions.

6.4 Work lights



➔ The work lights are fitted with a pivot that can swivel in all directions.

➔ The button (86) switches the work lights (151) in the drive direction on or off. The button (84) switches the work lights (150) in the fork direction on or off. As an option, the work lights can be controlled as a function of the travel direction.

Switching the work lights on and off

Procedure

- Press the work light button (86, 84).

The work lights are switched on / off.

Lighting dependent on the travel direction

Actuate the button (84) or the button (86) several times to switch between the following states:

– Work lights "ON/OFF dependent on the travel direction"
– Work lights "permanently OFF"
– Work lights "permanently ON"

6.5 Camera system

⚠ CAUTION!

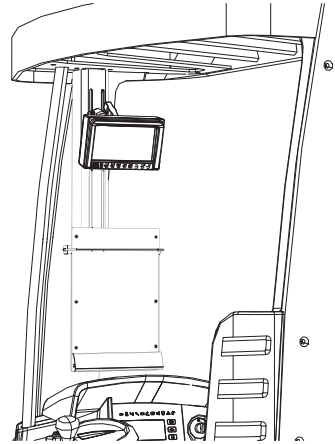
Accident risk from hidden work areas

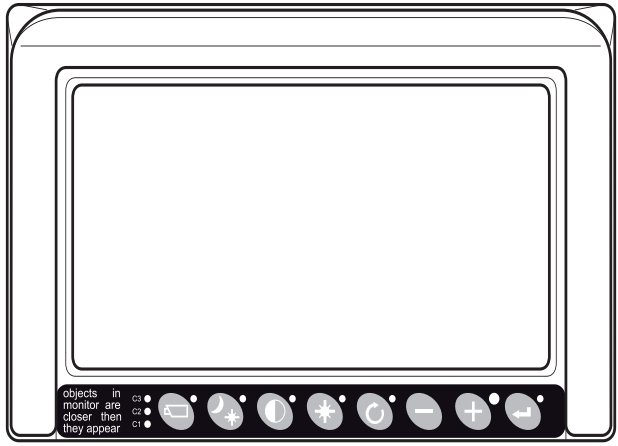
▶The camera system acts as an aid to assist safe operation.

▶Practice travelling and working with the camera system.

▶Align the camera so that the hidden work area can be seen.

The camera is secured to the inside of the right fork. The camera image is displayed via a monitor fitted to the overhead guard. If a fork positioner is attached, the camera system will be equipped with a wide angle camera.





152 153 154 155 156 157 158 159

Item		Component	Function
152		Camera selection	Selects a camera manually. The LED next to the key indicates that camera selection is activated. Press the key again to switch the camera display.
153		Day/night setting	Press the key to change between ABC mode, day and night setting.
154		Contrast	Press the key to activate the setting module. The desired contrast can be set with the plus and minus keys.
155		Brightness	Press the key to activate the setting module. The desired brightness can be set with the plus and minus keys.
154+ 155		Saturation	Press the contrast and brightness keys simultaneously to activate the setting mode. The saturation can be set with the plus and minus keys.
156		Previous menu	When you press the key the monitor shows the previous menu item.
157		Minus	Press the key to change to the next menu item or to move left in the selection.

Item		Component	Function
158		Plus	Press the key to change to the previous menu item or to move right in the selection.
159		Enter	When you press the key the system switches to standby or the option selected in the menu is activated.

6.5.1 Service Menu

Opening the service menu

Procedure

- Press the (152), (157), (158) keys simultaneously.

6.5.2 Camera settings

Opens the camera settings

Requirements

– The service panel is open.

Procedure

- Open the camera settings with the key (150).
- Select the camera settings with the (157) and (158) keys.
- Confirm with the (159) key.
- Select the digit to be changed with the (157) and (158) keys.
- Switch digit or change the digit with the (159) key. If necessary set the desired digit with the (157) and (158) keys.

6.5.3 System settings

Opens the system settings

Requirements

– The service panel is open.

Procedure

- Select the system settings with the (157) and (158) keys.
- Confirm with the (159) key.

6.5.4 Keypad block

Deactivates the keypad

Requirements

– System settings are open.

Procedure

- Select the keypad with the (157) and (158) keys and confirm with (159).
- Select the keypad block with the (157) and (158) keys and confirm with (159).
- In the settings menu select the required keypad block.

6.5.5 User menu

Opens the user menu

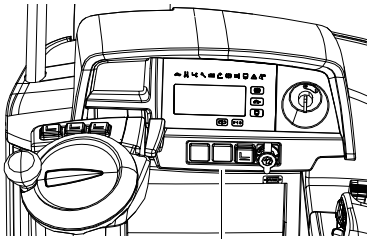
Requirements

– The keypad block is deactivated.

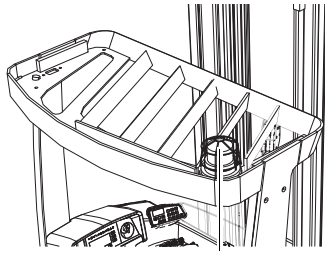
Procedure

- Press the (157) and (158) keys simultaneously.

6.6 Beacon



85



160

Switching the beacon on and off

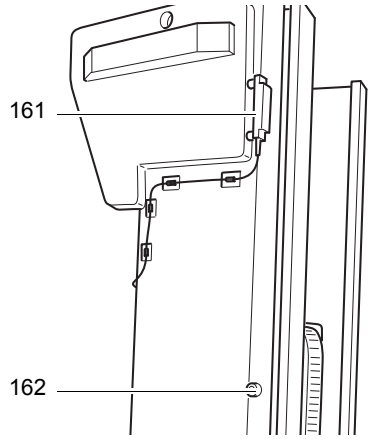
Procedure

- Press the beacon button (85).

The beacon is switched on / off.

6.7 Height cut out

The height cut out feature is an electrical height restriction to limit the maximum lift height in the mast lift range. The cut out height is defined by a magnet (162). If the switch (161) and magnet (162) are at the same height, the pump motor cuts out and lifting is disabled.

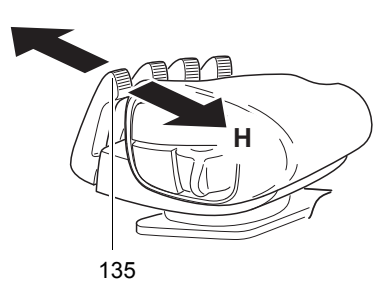


Overriding the lift limit cutout without the override button

Procedure

- Set the SOLO-PILOT lever (135) or MULTI-PILOT (80) to neutral.
- Pull the SOLO-PILOT lever (135) or MULTI-PILOT (80) in direction H, see page 106

The lift limit cutout is now overridden.
Lifting can now be performed at reduced speed.



Overriding the lift limit cutout with the override button

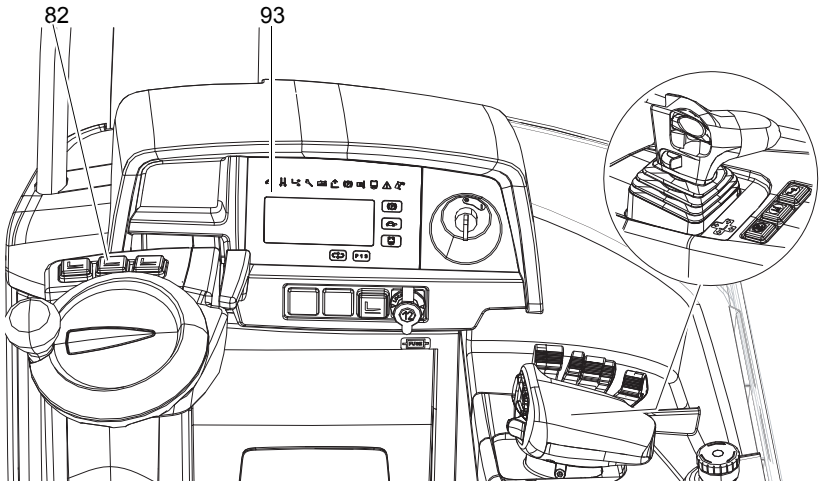
Procedure

- Press the lift limit override button (82) while simultaneously pulling the SOLO-PILOT lever (135) or MULTI-PILOT (80) in direction H, see page 106.

The lift limit cutout is now overridden.
Lifting can now be performed at reduced speed.

6.8 Electric lift limit

The lift limit system comes in versions 1, 2 and 3. The aim of the lift limit system is to prevent damage to the truck and the load near the wheel arms due to incorrect operation.



6.8.1 Lift limit 1

Lift limit 1 is only available for trucks with an integrated side shift.

Operation

Lift limit 1 determines the position of the mast and fork carriage via sensors in the mast. If the mast is fully extended or if the fork carriage is outside the safety range (500 - 600 mm above the wheel arms), Lift Limit 1 releases all hydraulic functions.

If the mast is not fully extended or if the load is near the wheel arms, sideshift, mast reach, lower and hydraulic auxiliary functions are disabled.
If the mast is fully extended and the load is near the wheel arms, only mast reach is inhibited - the mast cannot be retracted.
Lifting and tilting are never disabled.

The disabled hydraulic functions are released automatically without user input.
Automatic centring release allows

- the mast reach to move automatically in the wheel arm area when the sideshift is centred.
- the load to be lowered to the ground when the sideshift is centred.
- the centre position on the control and display unit to be shown via an indicator (93)

6.8.2 Lift limit 2

Lift limit 2 is available for trucks with an integrated side shift and various attachments, such as fork positioner and ball clamps.

Operation

Lift limit 2 determines the position of the mast and forks via sensors in the mast. If the mast is fully extended or if the forks are outside the safety range (500 - 600 mm above the wheel arms), Lift Limit 2 releases all hydraulic functions.

Sideshift, mast reach, lowering and the hydraulic accessory functions are deactivated if the mast is not fully extended or if the load is near the wheel arms.
If the mast is fully extended and the load is near the wheel arms, only mast reach is inhibited, the mast cannot be retracted.
Lifting and tilting are never inhibited.

Releasing hydraulic functions with the override button

Requirements

– The function selected is inhibited. The mast or forks are in the safety range.

Procedure

- Press the Lift Limit override button (82) while simultaneously performing the selected function.

The hydraulic functions are released for as long as the button is pressed.

Releasing hydraulic functions without the override button

Requirements

– The function selected is inhibited. The mast or forks are in the safety range.

Procedure

- Set the control (SOLO-PILOT or MULTI-PILOT) to neutral.
- Set the control (SOLO-PILOT or MULTI-PILOT) back to its original direction. Only the originally applied function is released, at reduced speed.
- Repeat this procedure separately for each function.

The hydraulic function is released.

6.8.3 Lift limit 3

➔ Lift limit 3 is only available for trucks with tilting forks in conjunction with a fork positioner.

Operation

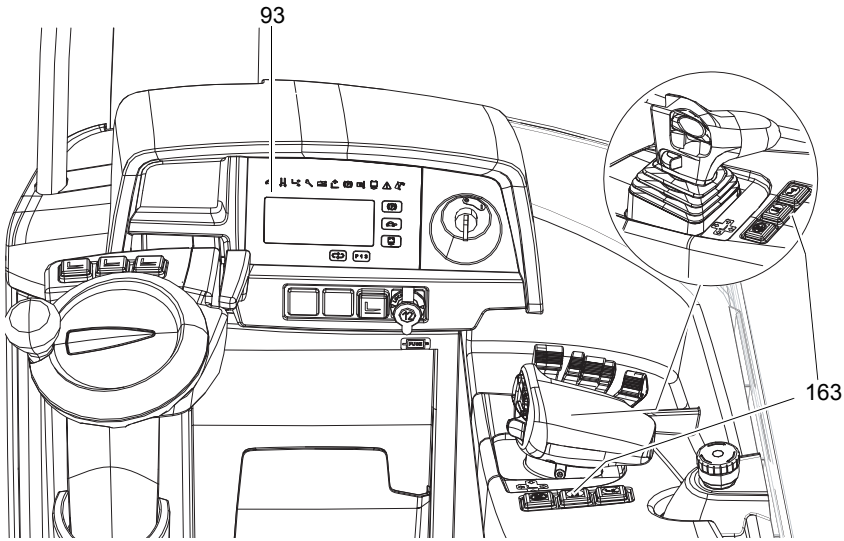
Lift limit 3 determines the position of the mast and forks via sensors in the mast. If the mast is fully extended or if the forks are outside the safety range (500 - 600 mm above the wheel arms), Lift Limit 3 releases all hydraulic functions.

Sideshift, mast reach, lowering and the hydraulic accessory functions are deactivated if the mast is not fully extended or if the load is near the wheel arms.
If the mast is fully extended and the load is near the wheel arms, only mast reach is inhibited, the mast cannot be retracted.
Lifting and tilting are never inhibited.

Lift limit 3 also checks that the forks cannot collide with the wheel arms and are free of the load. If both criteria are met, mast reach and lower are enabled. Sideshift and hydraulic auxiliary functions remain inhibited.

➔ Loads < 100 kg in weight cannot be detected reliably by the system.

6.9 Sideshifter Centre Position



Item	Component
163	"Side shift centre position" button
93	"Side shift centre position" display

Pressing the "sideshift centre position" button (163) allows the side shifter to be centrally positioned during storage and retrieval operations.

Positioning the side shifter centrally

Requirements

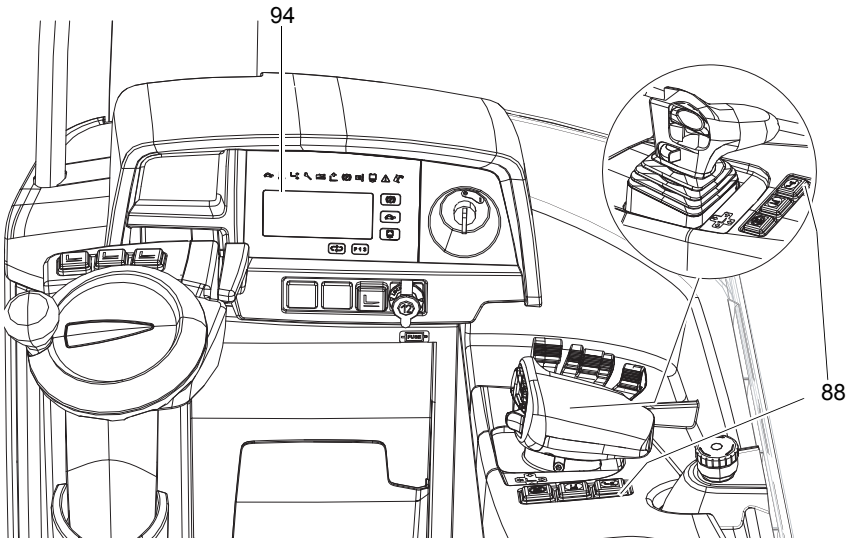
– Mast and forks fully tilted back.
– Reach cylinder fully retracted.

Procedure

• Press the "side shifter centre position" button (163) until the side shifter is centrally positioned. During this procedure, all other hydraulic functions are disabled and the display shows "sideshift centre position" (93).

The side shifter is now centrally positioned.

6.10 Forks horizontal button



Item	Component
88	"Forks horizontal" button
94	"Forks horizontal" display

The forks horizontal button (88) allows the load handler to be aligned horizontally

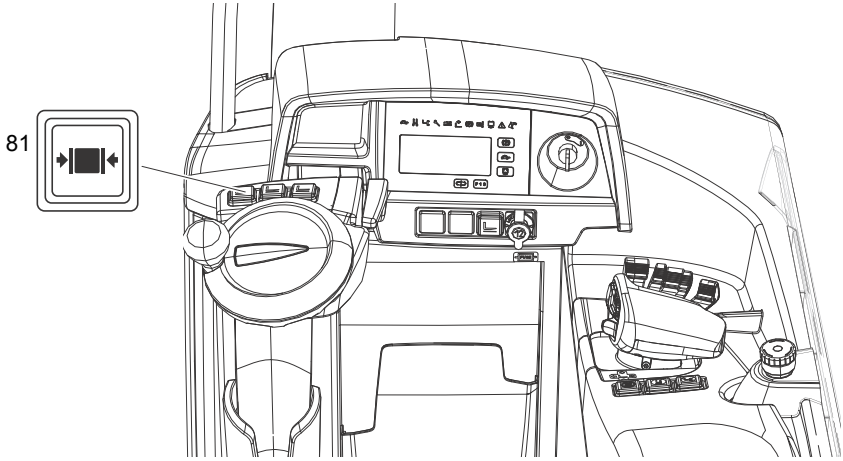
Aligning the load handler horizontally

Procedure

- Press the forks horizontal button (88) until the load handler is aligned horizontally. During this procedure all other hydraulic functions are disabled and the display shows "forks horizontal" (94).

The load handler is aligned horizontally.

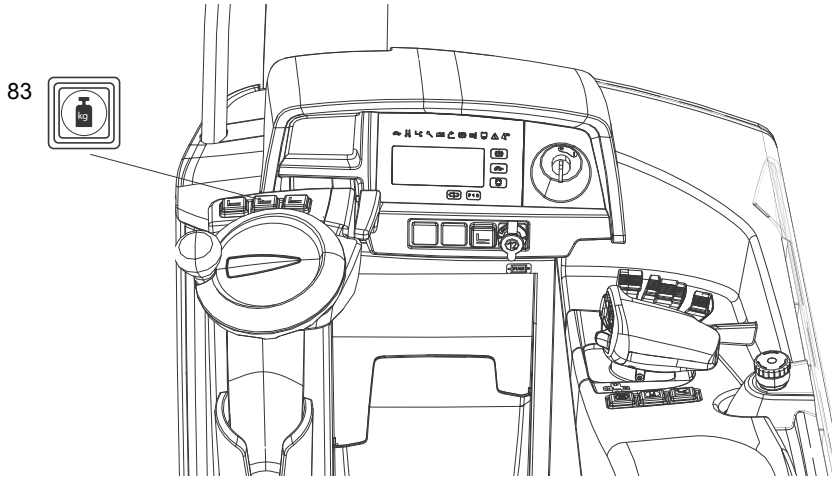
6.11 “Clamp function release” button



Item	Component
81	"Clamp-function release" button

When the "Clamp function release" button is pressed and the corresponding hydraulic function applied simultaneously, the clamp function is activated.

6.12 Weigher



Item	Component
83	"Weigher" button

While the weigher button (83) is pressed, the load is raised approx. 1010 cmcm and then lowered again. This process determines the load weight which is then shown on the driver's display. The weigher function is not a substitute for a calibrated weigher. The weigher function must not be used to lift the load freely. All other hydraulic operations are inhibited during weighing.

Weighing the load

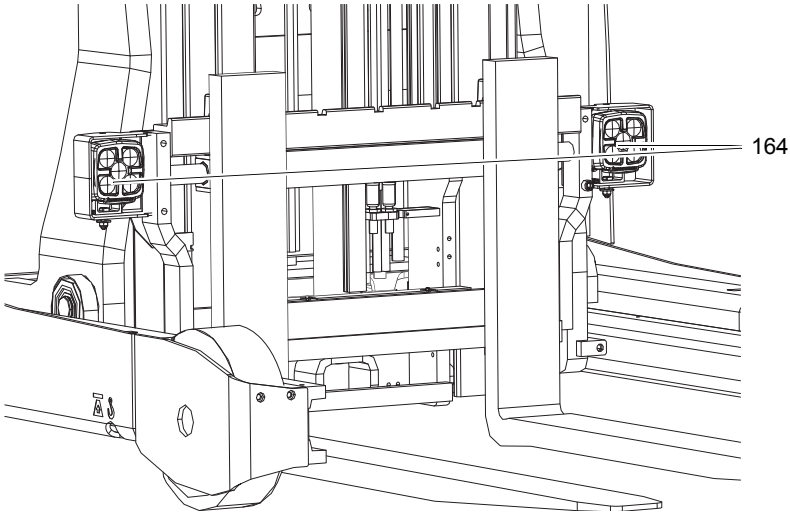
Procedure

- Press and hold down on the weigher button (83) until weighing is completed.

If the button is released before weighing is completed, the weighing procedure is interrupted and no valid readings are obtained. The display shows "- - - - kg".

The load is weighed and shown on the display.

6.13 Load handler work lights LED



Item	Component
164	Load handler work lights LED

Load handler work lights LEDs are available for trucks that work with a sideshifter.

The LED work lights on the load handler are

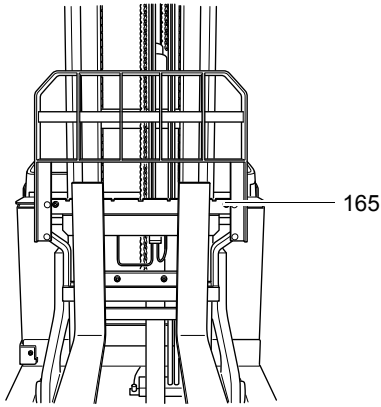
– switched on automatically when a hydraulic function is activated and the travel speed is less than 8 km/h.
– switched off when a hydraulic function is inactive and the travel speed is greater than 4 km/h for t > 2 s.
– switched off when a hydraulic function is inactive for t > 5 min.

6.14 Removable load backrest

⚠ CAUTION!

Trapping hazard and heavy load backrest weight

- ▶ Wear safety gloves and safety shoes when carrying out this operation.
- ▶ Two people are required to remove and attach the load backrest.



Load backrest disassembly

Procedure

- Loosen the screws (165).
- Remove the load backrest from the fork carriage and put it down securely.
- Fit the fork retaining screws.

Load backrest assembly

Procedure

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

→ Tightening torque = 85 Nm

6.15 Operation Control

Operation Control is an assistance system. It maps the truck's capacity and informs the operator when the truck's capacity limit has been reached.

⚠ CAUTION!

Operation Control is an assistance system that only works within tolerance levels. The capacity chart data is always binding for the operator.

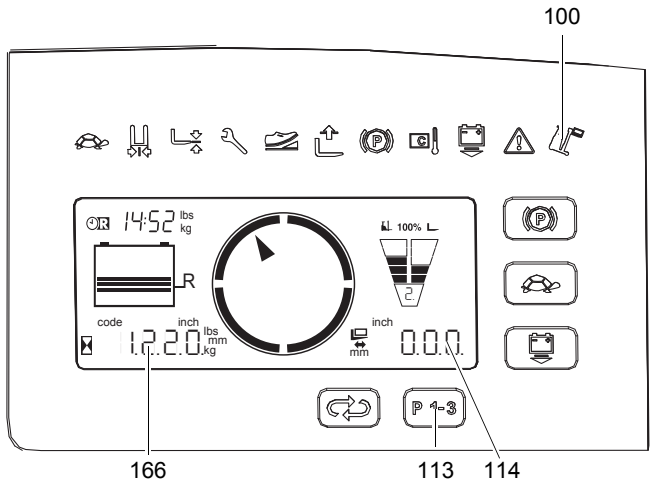
Operation

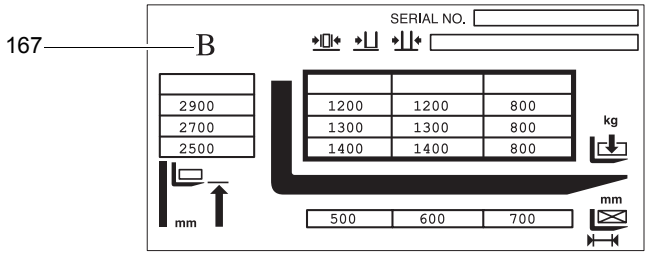
During lifting, when the load comes within less than 1000 mm of the maximum lift height indicated on the load chart, the "tip limit reached" symbol (100) flashes in the display and an audible signal sounds at intervals. As the load continues towards the maximum lift height the interval reduces and the "tip limit reached" symbol (100) flashes more rapidly.

The load centre selected appears in the "lift height" display (114). Each capacity chart covers 3 different load centres of gravity. Up to 3 capacity charts may be attached to the truck at the factory, e.g. basic truck capacity, attachment capacity and min./max. capacity when using telescopic forks. The capacity charts are marked with corresponding letters (167).

The currently selected capacity chart is shown in the display with the letters A, B or C in front of "Lift height load centre" (114), e.g. C 700. The available load centres can only be adjusted by the manufacturer's customer service department.

➔ Loads < 100 kg in weight cannot be detected reliably by the system.





Setting the load centre of gravity

⚠ DANGER!

An incorrectly set load centre can cause a tip over

If the load centre is set too low, the warning will not sound in time. This may endanger the stability of the truck, causing it to tip over.

▶Set the correct load centre.

Procedure

- Record the letters (167) of the capacity chart according to the attachment.
- Select the load centre that is relevant to the current stacking operation. To do this
  - Press the program key (113) for 4 seconds. The load centre then changes between the preset values.

    For example: A 500 =>A 600 =>A 700 =>b 500 =>b 600 =>b 700 =>C 900 =>C 1000 =>C 1200 =>A 500 ...etc.
- The load centre selected appears in the "lift height" display (114).

The load centre is set.

Troubleshooting

Failure of the lift height sensor or the pressure sensor and calculation inconsistencies can cause the Operation Control assistance system to fail. If the Operation Control fails, the load distance symbol and "-----" are shown instead of the load centre in the driver's display (114). An event message is displayed (166).

6.16 Floor spot

The floor spot serves as an auxiliary device and, with the travel direction switch engaged, projects a coloured dot on the floor at a distance of 4,5 m / 4 m.
When the truck travels forward the coloured dot is in front of the truck and when reversing it is behind the truck.

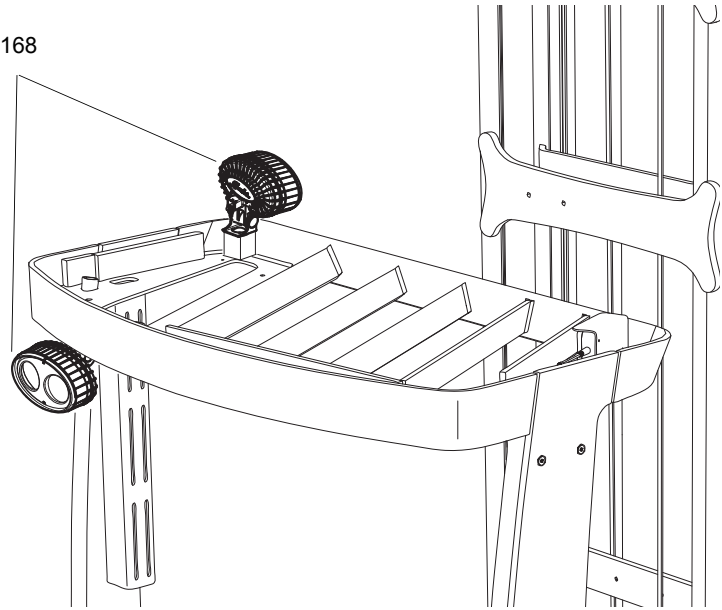
⚠ CAUTION!

Risk of accident due to impaired eyesight

Looking directly at the LED light can dazzle and temporarily impair eyesight.

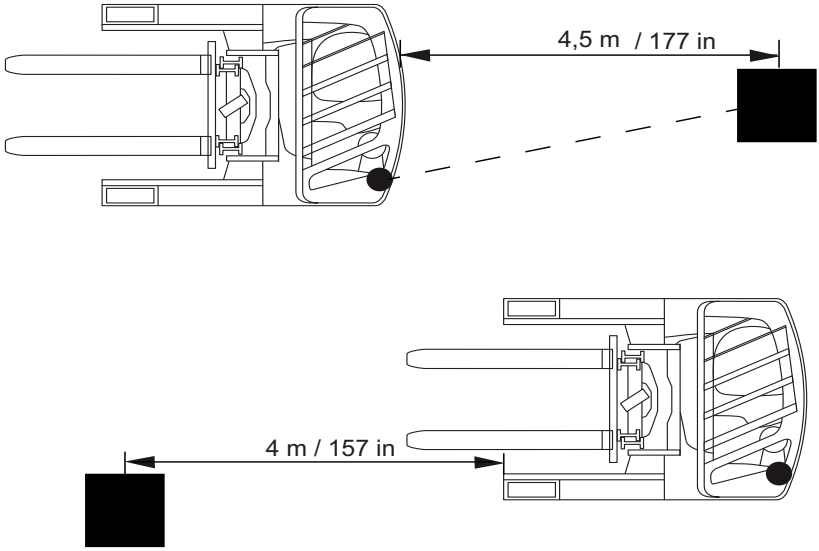
- ▶ Do not look directly at the LED light.
- ▶ Practice travelling and working with the floor spot carefully.
- ▶ Do not change the factory setting.

168



The floor spot (168) is available both in the drive direction underneath the overhead guard and in the load direction above the overhead guard.

The position of the projected floor spot is factory pre-set.


4,5 m / 177 in
4 m / 157 in

F Industrial Truck Maintenance

1 Operational Safety and Environmental Protection

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

⚠ WARNING!

Risk of accidents and damage to components

Any modification to the truck, in particular the safety mechanisms, is prohibited. Do not alter the truck's operating speeds under any circumstances.
Do not bond the front window with adhesive.

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

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

NOTE

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

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

→ On completion of inspection and service work, carry out the operations listed in the “Recommissioning the truck after cleaning or maintenance work” section (see page 188).

⚠ WARNING!

Fire hazard

Welding operations on the truck can damage or ignite components.

▶ Do not performing welding operations on the truck.

---

2 Maintenance Safety Regulations

Maintenance and repair personnel

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

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

2.1 Cleaning

⚠ CAUTION!

Fire hazard

Do not use flammable liquids to clean the industrial truck.

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

⚠ CAUTION!

Risk of electrical system damage

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

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

⚠ CAUTION!

Risk of component damage when cleaning the truck

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

- ▶ Cover all electronic system assemblies (controllers, sensors, motors etc.) before cleaning the truck with a pressure washer.
- ▶ Do not hold the jet of the pressure washer by the marked points to avoid damaging them (see page 39).
- ▶ Do not clean the truck with pressurised water.

After cleaning, carry out the operations detailed in "Recommissioning the truck after cleaning or maintenance work" (see page 188).

2.2 Working on the electrical system

⚠ WARNING!

Electrical current can cause accidents

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

- ▶ Only suitably trained electricians may operate on the truck's electrical system.
- ▶ Before working on the electrical system, take all precautionary measures to avoid electric shocks.
- ▶ Park the truck securely (see page 120).
- ▶ Disconnect the battery.
- ▶ Remove any rings, metal wrist bands etc.

2.3 Consumables and used parts

⚠ CAUTION!

Consumables and used parts are an environmental hazard

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

▶ Note the safety regulations when handling these materials.

2.4 Tyre type

⚠ WARNING!

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

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

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

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

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

When replacing rims and tyres fitted at the factory, only use the manufacturer's original spare parts. Otherwise the manufacturer's specifications cannot be ensured. If you have any queries contact the manufacturer's customer service department.

2.5 Lift Chains

⚠ WARNING!

Non-lubricated and incorrectly cleaned lift chains can cause accidents

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

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

2.6 Hydraulic system

NOTE

Testing and replacing hydraulic hoses

Hydraulic hoses can become brittle through age and must be checked at regular intervals. The application conditions of the industrial truck have a considerable impact on the ageing of the hydraulic hoses.

- ▶ Check the hydraulic hoses at least annually and replace if necessary.
- ▶ If the operating conditions become more arduous the inspection intervals must be reduced accordingly.
- ▶ In normal operating conditions a precautionary replacement of the hydraulic hoses is recommended after 6 years. The owner must carry out a risk assessment to ensure safe, prolonged use. The resulting protection measures must be observed and the inspection interval reduced accordingly.

⚠ **WARNING!**

Leaky hydraulic systems can result in accidents

Hydraulic oil can escape from leaky and faulty hydraulic systems.

- ▶ Report any defects immediately to your supervisor.
- ▶ Mark defective truck and take out of service.
- ▶ Do not return the industrial truck to service until you have identified and rectified the fault.
- ▶ Remove any spilled hydraulic immediately with an appropriate bonding agent.
- ▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.

⚠ **WARNING!**

Faulty hydraulic hoses can result in injury and infection

Pressurised hydraulic oil can escape from fine holes or hairline cracks in the hydraulic hoses. Brittle hydraulic hoses can burst during operation. People standing near the truck can be injured by the hydraulic oil.

- ▶ Call for a doctor immediately in the event of an injury.
- ▶ Do not touch pressurised hydraulic hoses.
- ▶ Report any defects immediately to your supervisor.
- ▶ Mark defective truck and take it out of service.
- ▶ Do not return the industrial truck to service until you have identified and rectified the fault.

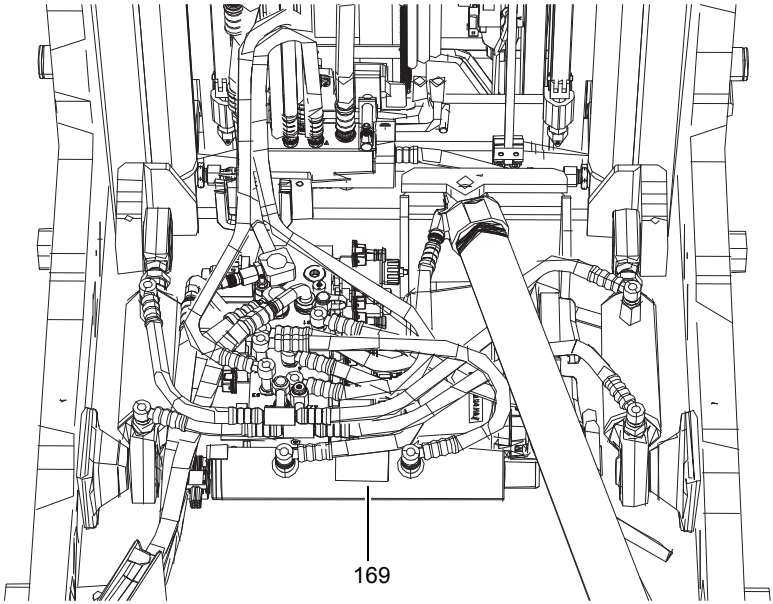
2.7 Energy saving components

⚠ CAUTION!

A high pre-tension can cause accidents

The mast reach damping cylinder (169) contains highly pre-tensioned compression springs. Risk of injury if opened incorrectly.

▶The mast reach damping cylinder (○) must not be opened.



3 Lubricants and Lubrication Schedule

3.1 Handling consumables safely

Handling consumables

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

⚠ WARNING!

Improper handling is hazardous to health, life and the environment

Consumables can be flammable.

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

⚠ CAUTION!

Spilled consumables can cause slipping and endanger the environment

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

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

⚠ WARNING!

Improper handling of oils can be hazardous

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

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

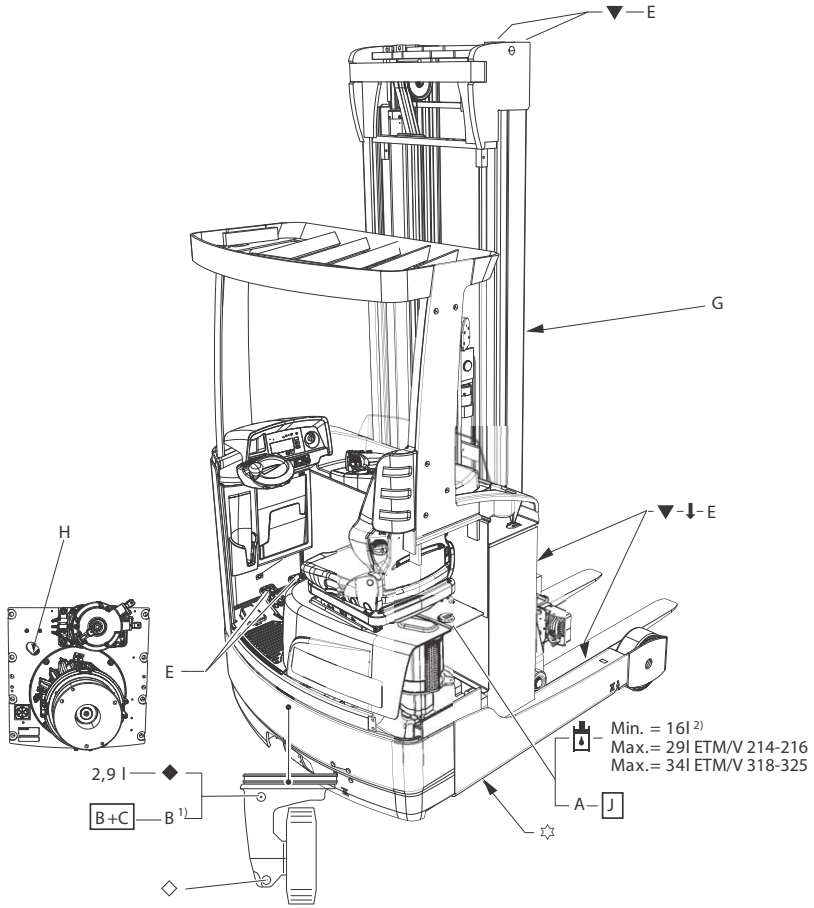
⚠ CAUTION!

Consumables and used parts are an environmental hazard

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

- ▶ Note the safety regulations when handling these materials.

3.2 Lubrication Schedule



▼	Contact surfaces	☆	Hydraulic oil drain plug
⬇	Grease nipple	◆	Transmission oil filler neck
	Hydraulic oil filler neck	◇	Transmission oil drain plug

1 Compound ratio for cold store usage 1:1

2 Capacity, see page 179.

03.16 EN

3.3 Consumables

Code	Order no.	Package quantity	Component	Used for
A	51 132 827*	5.0 l	Jungheinrich hydraulic oil	Hydraulic System
B	29 200 680	5.0 l	CLP 100 DIN 51517	Transmission
C	29 200 810	5.0 l	HLP 10, DIN 51524	Transmission
E	29 201 430	1.0 kg	Grease, DIN 51825	Lubrication
G	29 201 280	400 ml	Chain spray	Chains
H	50 002 004	400 ml	Contact spray	Toothing
J	51 081 875	5.0 l	Renolin MR 310	Cold store hydraulic system

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

Grease guidelines

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

4 Maintenance and repairs

4.1 Preparing the truck for maintenance and repairs

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

Procedure

- Park the truck on a level surface.
- Fully lower the main and auxiliary lift.
- Switch off the truck securely, see page 120.
- Switch off the truck, to do this:
  - Turn the key in the key switch left as far as the stop and remove the key, or
  - CanCode (○) press the O button, or
  - Press the red button on the ISM access module (○).
- Press the Emergency Disconnect switch.
- Disconnect the battery to prevent the truck from being switched on accidentally.
- When working under a raised lift truck, secure it to prevent it from lowering, tipping or sliding away.

⚠ WARNING!

Risk of accidents when working under the load handler, driver's cab and lift truck

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

▶When raising the truck, follow the instructions, see page 47. When working on the parking brake, prevent the truck from accidentally rolling away (e.g. with wedges).

4.2 Lifting and jacking up the truck safely

⚠ WARNING!

A truck tipover can cause accidents

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

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

▶ Always use a jack with sufficient capacity.

▶ Raise the unladen truck on a level surface.

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

Raising and jacking up the truck securely

Requirements

– Prepare the truck for maintenance and repairs (see page 176).

Tools and Material Required

– Jack

– Hard wooden blocks

Procedure

- Place the jack against the contact point.
  Jack contact point, see page 44.
- Raise the truck.
- Support the truck with hard wooden blocks.
- Remove the jack.

The truck is now securely raised and jacked up.

4.3 Removing the seat panel

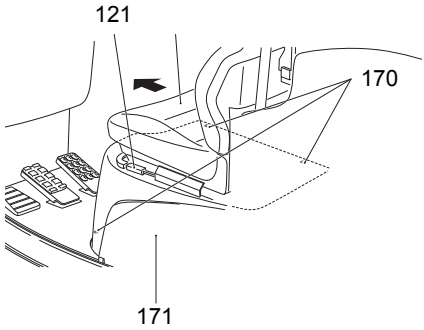
The drive unit and hydraulic aggregate can be made accessible for service by removing the seat panel.

Removing the seat panel

Procedure

- Pull seat locking lever (121) up and pull the seat towards the steering wheel and take it off.
- Disconnect the fan.
- Undo the screws (170) and remove the seat panel (171).
- Assembly is the reverse order.

The seat panel is now removed.



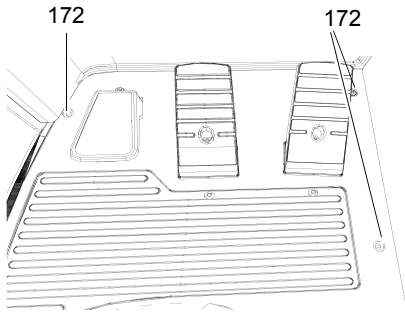
4.4 Removing the floor plate

Removing the floor plate

Procedure

- Loosen and remove the 3 screws (172).
- Open the lock with the Allen key.
- Raise the floor plate carefully.
- Remove the plug connections from the pedal.
- Store the floor plate in a safe place.

Floor plate removed.



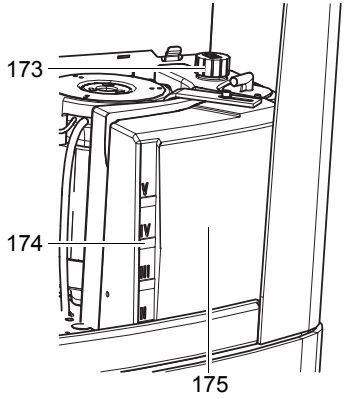
4.5 Checking the hydraulic oil level

⚠ CAUTION!

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

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

Checking the hydraulic oil level



Requirements

– Truck prepared for maintenance and repairs, see page 176.

Procedure

- Push the driver's seat forward.
- Check oil level in hydraulic reservoir (175).

➔ The oil level should only be checked on the hydraulic reservoir (174) or the dipstick (173) when the load is fully lowered.

- If necessary add hydraulic oil of the correct grade in the filler neck.
- Push the seat back into position and engage the locking lever.

The hydraulic oil level is now checked.

ETM/V 214/216

Mast height[1]	ETM	ETV
400 - 499	approx. mark I	approx. separating joint
500 - 599	between marks I and II	approx. mark I
600 - 699	approx. mark II	approx. mark I
700 - 799	approx. mark II	between marks I and II
800 - 899	approx. mark III	between marks I and II
900 - 999	approx. mark IV	approx. mark II
1000 - 1099	-	approx. mark II

1. DZ mast, max. lift height in cm.

ETM/V 318-325

Mast height[1]	ETM	ETV
400 - 499	between marks I and II	approx. separating joint
500 - 599	approx. mark II	approx. mark I
600 - 699	approx. mark II	approx. mark I
700 - 799	approx. mark II	between marks I and II
800 - 899	approx. mark III	between marks I and II
900 - 999	approx. mark IV	approx. mark II
1000 - 1099	-	approx. mark II
1100 - 1202	-	approx. mark III
1203 - 1300	-	approx. mark III

1. DZ mast, max. lift height in cm.

4.6 Checking electrical fuses

Removing the safety cover

Procedure

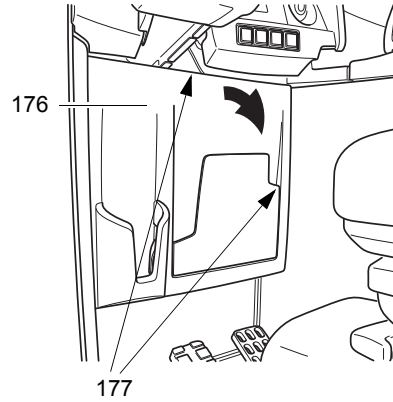
⚠ CAUTION!

Trapping hazard

▶Carefully pull off the cover.

- Forcibly pull off the safety cover (176) from the (177) points at the top left and bottom right and place them to one side.
- Assembly is in the reverse order.

Safety cover removed.



Removing the instrument panel cover

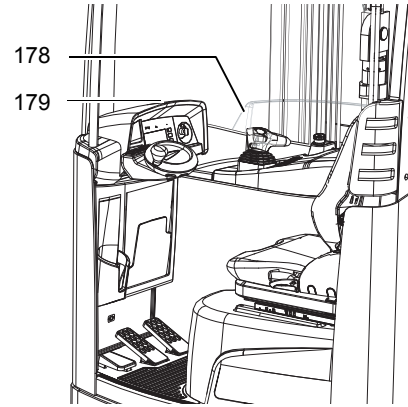
Procedure

- Push the steering wheel towards the seat (outermost position).
- Remove the instrument panel cover (179).
- Remove the side instrument panel (178).

The main fuses are located underneath the side instrument panel (178).

- Assembly is in the reverse order.

Instrument panel cover removed.



Checking electrical fuses

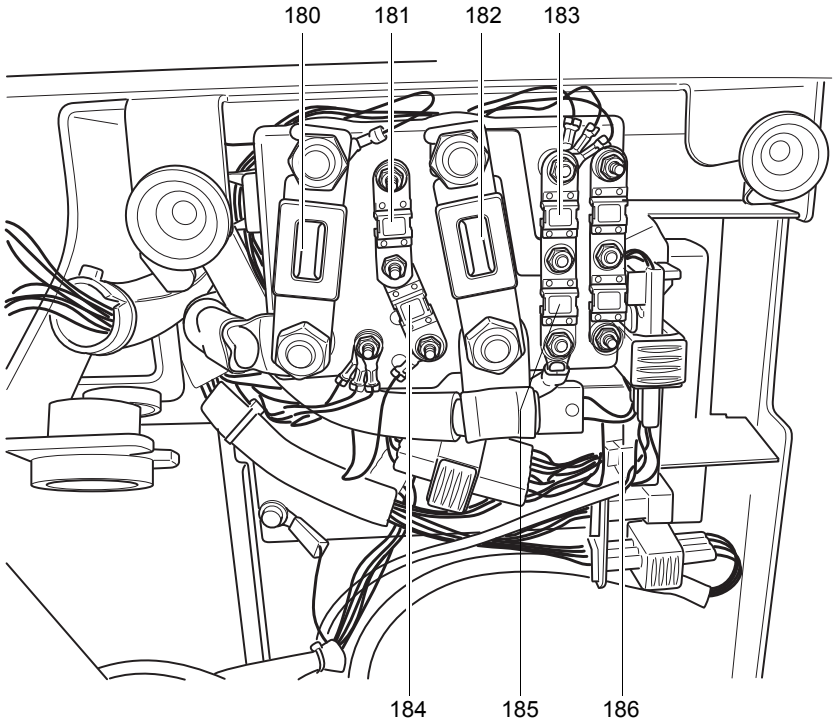
Requirements

– Safety cover removed.
– Instrument panel cover removed.

Procedure

- Check rating of the fuses in accordance with the table and replace if necessary.

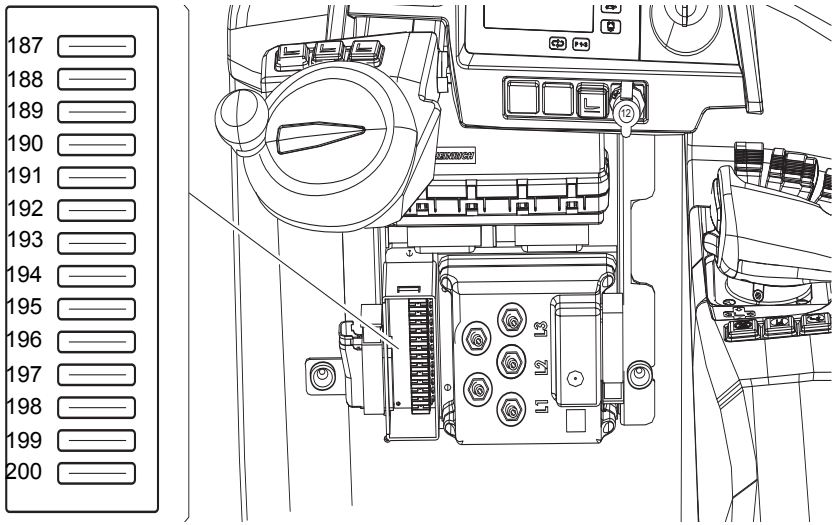
The electrical fuses are now checked.



Fuse ratings

Item	Component	Application	Rating [A]
180	F8	Main fuse	425
181	5F6	Cab	30[1]
182	F15	Travel/lift	355
183	F26	48 V behind main contactor	30
184	F1	Overall control circuit fuse	30
185	3F6	Drive wheel steering	30
186	F4	Main contactor	2

1. Depending on cabin version



Fuse ratings

Item	Component	Application	Rating [A]
187	F17	Data radio	5
188	4F15	Access control	2
189	F27	Traction / lift controller	2
190	5F2	DC/DC converter	7,5
191	9F2	Seat heating	7,5
192	3F11	Drive wheel steering	2
193	4F8	Display and Control Unit	3
194		Not used	
195		Not used	
196	2F17	MFC hydraulics	2
197	1F13	Travel / brake MFC control fuse	7,5
198	1F14	Travel / brake MFC control fuse	5
199	2F18	MFC hydraulics	10
200	F28	MFC travel/braking	5

4.7 Checking the Wheel Mounting

Tightening Torques

Load wheels (1x centre cylinder screw)	120 Nm
Drive wheel	300 -10 Nm

Checking the wheel attachment

Requirements

– Truck prepared for maintenance and repairs, see page 176.

Tools and Material Required

– Torque wrench

Procedure

• Tighten the wheel bolts crosswise with a torque wrench.
  For torque see table:

The wheel attachment is now checked.

5 Decommissioning the Industrial Truck

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

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

➔ Jack up the truck, see page 177.

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

5.1 Prior to decommissioning

Procedure

- Thoroughly clean the truck, see page 166.
- Prevent the truck from rolling away accidentally.
- Check the hydraulic oil level and replenish if necessary, see page 172.
- Apply a thin layer of oil or grease to any non-painted mechanical components.
- Lubricate the truck according to the lubrication schedule, see page 174.
- Charge the battery, see page 62.
- Disconnect the battery, clean it and grease the terminals.

In addition, follow the battery manufacturer's instructions.

5.2 During decommissioning

NOTE

Full discharge can damage the battery

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

▶Charge the battery at least every 2 months.

Charge the battery, see page 62.

5.3 Restoring the truck to service after decommissioning

Procedure

- Thoroughly clean the truck, see page 166.
- Lubricate the truck according to the lubrication schedule, see page 174.
- Clean the battery, grease the terminal screws and connect the battery.
- Charge the battery, see page 62.
- Start up the truck, see page 80.

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

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

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

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

7 Final de-commissioning, disposal

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

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

8 Human vibration measurement

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

G Maintenance and Inspection

⚠ WARNING!

Lack of maintenance can result in accidents

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

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

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

NOTE

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

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

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

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

1 Maintenance checklist ETM/V 214/216

1.1 Owner

1.1.1 Standard equipment

Brakes		W	A	B	C
1	Test the brakes.	●			

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

Power supply		W	A	B	C
1	Check battery and battery components.	●			
2	Check battery cable connections are secure, check for dirt and grease terminals if necessary.	●			
3	Check battery cables and battery cable guide for damage.	●			
4	Check battery connector for damage, test it and make sure it is secure.	●			

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

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

Hydr. movements		W	A	B	C
1	Check the lubrication of the load chains and lubricate the load chains if necessary.	●			
2	Test hydraulic system.	●			
3	Check hydraulic oil level and top up if necessary.	●			
4	Check forks or load handler for wear and damage.	●			

1.1.2 Optional equipment

Cold store cab

Chassis and superstructure		W	A	B	C
1	Test the roof hatch and check for damage.	✳			
2	Check windows for damage.	✳			
3	Test the window heating and check for damage.	✳			
4	Test the doors and check for damage.	●			

Fork adjuster

Hydr. movements		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Clamping device

Hydr. movements		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Wiper/washer system

Chassis and superstructure		W	A	B	C
1	Check windscreen washer reservoir for leaks and check volume; top up if necessary.	●			

Weather proofing

Chassis and superstructure		W	A	B	C
1	Test the window heating and check for damage.	✳			
2	Test the doors and check for damage.	●			

Restraint system

Chassis and superstructure		W	A	B	C
1	Test the driver's seat restraint system and check for damage.	●			

Optional equipment

Chassis and superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage facilities, grips, windscreen wipers and windscreen washing system, etc. are working correctly and check for damage.	●			

Strobe light / beacon

Electrics		W	A	B	C
1	Test the strobe light/beacon and check for damage.	●			

1.2 Customer Service

1.2.1 Standard equipment

Brakes		W	A	B	C
1	Test the brakes.			●	
2	Check the magnetic brake air gap, adjust if necessary.			●	
3	Test the emergency stop brake.			●	
4	Check brake lining.			●	

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

Power supply		W	A	B	C
1	Check acid density, acid level and battery voltage.			●	
2	Check battery and battery components.			●	
3	Check battery cable connections are secure, check for dirt and grease terminals if necessary.			●	
4	Check battery cables and battery cable guide for damage; replace if necessary.			●	
5	Check battery connector for damage, test it and make sure it is secure.			●	

Driving		W	A	B	C
1	Test the deadman switch.			●	
2	Check the attachment of the drive support plate.			●	
3	Check transmission for noise and leakage.			●	
4	Check transmission oil level or grease filling of the transmission and top up if necessary.			●	
5	Replace the transmission oil.			✳	●
6	Check the wheels for wear and damage. Make sure they are secure and check the air pressure if necessary.			●	
7	Check wheel suspension and attachment.			●	

Chassis and superstructure		W	A	B	C
1	Check chassis connections and screw connections for damage.			●	
2	Check doors and/or covers.			●	
3	Check the battery trolley lock setting and test operation			●	
4	Check labels are legible, complete and plausible.			●	
5	Check the condition of the driver's seat.			●	
6	Check the mounting and adjustment of the driver's seat.			●	
7	Check mast mounting/bearings.			●	
8	Check and lubricate rails.			●	
9	Check seat frame is secure and check for damage. Check tightening torques.			●	
10	Check overhead guard and/or cabin are secure and check for damage.			●	
11	Check the supports/tilt safety devices are in place. Check the height- and capacity-related settings.			●	

Hydr. movements		W	A	B	C
1	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
2	Test the lift mechanism; check for wear, damage and correct adjustment.			●	
3	Check the fastening clamps on the mast lift cylinder for wear and damage.			●	
4	Test the hose guide and check for damage.			●	
5	Check settings and wear levels of slide pieces and stops and adjust or replace the slide pieces as required.			●	
6	Check load chain setting and tension if necessary.			●	
7	Check the lubrication of the load chains and lubricate the load chains if necessary.			●	
8	Check the load chain fasteners and check the chain bolts for wear and damage.			●	
9	Check lateral clearance of the mast connections and the fork carriage.			●	
10	Visually inspect the mast rollers and check the running surfaces for wear.			●	
11	Replace hydraulic oil filter and breather filter.			✳	●
12	Test hydraulic system.			●	
13	Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage.			●	
14	Test emergency lowering system.			●	
15	Check hydraulic oil level and top up if necessary.			●	
16	Replace the hydraulic oil.				●
17	Test the pressure relief valve and adjust if necessary.			●	

Hydr. movements		W	A	B	C
18	Check sliding blocks are complete.			●	
19	Check forks or load handler for wear and damage.			●	
20	Test the sideshifter, check settings and check for damage.			●	
21	Check cylinder piston rods and bushings.			●	
22	Check cylinder seals.			●	
23	Check piston rod screw depth and counter fixing / clamp. Where two tilt cylinders with the same stroke length are used, check their setting in respect of each other.			●	
24	Check tilt cylinders and mounting.			●	
25	Check mast holder guide rollers for wear and damage.				●

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

Steering		W	A	B	C
1	Test the electric steering and its components.			●	
2	Check the steering bearings, steering play and steering toothing or steering chain. Lubricate the steering toothing or steering chain.			●	

1.2.2 Optional equipment

Cold store cab

Chassis and superstructure		W	A	B	C
1	Test the roof hatch and check for damage.			●	
2	Check cold store cabin for damage and make sure it is secure.			●	
3	Check windows for damage.			●	
4	Test the window heating and check for damage.			●	
5	Test the doors and check for damage.			●	

Electrolyte circulation

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

Aquamatik

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

Intercom system

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

Fork adjuster

Hydr. movements		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	
2	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			●	
3	Check attachment lubrication; clean and lubricate if necessary.			●	
4	Check axial play of the front and rear rollers and adjust if necessary.			●	
5	Check sliding blocks are complete.			●	
6	Check the attachment is properly secured to the truck and check the load-bearing components.			●	
7	Test operation and setting of the attachment. Check attachment for damage.			●	
8	Check hydraulic ports and tighten if necessary.			●	
9	Test the fork positioner and check for damage.			●	
10	Check cylinder piston rods and bushings.			●	
11	Check cylinder seals.			●	

Clamping device

Hydr. movements		W	A	B	C
1	Test the acknowledgement key.			●	
2	Test the hose reel and check for leaks and damage.			●	
3	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			●	
4	Check attachment lubrication; clean and lubricate if necessary.			●	
5	Check axial play of the front and rear rollers and adjust if necessary.			●	
6	Check sliding blocks are complete.			●	

Hydr. movements		W	A	B	C
7	Check the attachment is properly secured to the truck and check the load-bearing components.			●	
8	Test operation and setting of the attachment. Check attachment for damage.			●	
9	Check hydraulic ports and tighten if necessary.			●	
10	Check cylinder piston rods and bushings.			●	
11	Check cylinder seals.			●	

Crane hook

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

Wiper/washer system

Chassis and superstructure		W	A	B	C
1	Check windscreen washer reservoir for leaks and check volume; top up if necessary.			●	
2	Test the windscreen wipers and check for damage, replace if necessary.			●	

Rack height select

System components		W	A	B	C
1	Test operation and setting of Rack Height Select.			●	

Lift cutout

Hydr. movements		W	A	B	C
1	Test the lift-limit cut-off/lift cut-off, check for damage and make sure it is secure.			●	

Shock sensor / data recorder

Electrics		W	A	B	C
1	Check shock sensor / data recorder are secure and check for damage.			●	

Data radio

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

Video system

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

ABS / ASR

Brakes		W	A	B	C
1	Make sure sensors are secured, not damaged, clean and operational.			●	

Fire extinguisher

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

Weigher sensors / switches

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

Access module

Electrics		W	A	B	C
1	Test the access module, check for damage and make sure it is secure.			●	

Weather proofing

Electrics		W	A	B	C
1	Check fuse ratings.			●	

Chassis and superstructure		W	A	B	C
1	Test the window heating and check for damage.			●	
2	Test the doors and check for damage.			●	

Electrical optional equipment

Electrics		W	A	B	C
1	Test the electrical optional equipment and check for damage.			●	

Restraint system

Chassis and superstructure		W	A	B	C
1	Test the driver's seat restraint system and check for damage.			●	

Optional equipment

Chassis and superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage facilities, grips, windscreen wipers and windscreen washing system, etc. are working correctly and check for damage.			●	

Sideshifter centring

Hydr. movements		W	A	B	C
1	Test sideshifter centring operation.			●	

Strobe light / beacon

Electrics		W	A	B	C
1	Test the strobe light/beacon and check for damage.			●	

Mast reach damping

Hydr. movements		W	A	B	C
1	Test mast reach damping operation and components.			●	

Mast lift retract damping

Hydr. movements		W	A	B	C
1	Test gas pressure dampers on the battery panel and check for damage.			●	

Overhead guard cover

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

Audible warning devices

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

Lift height indicator

System components		W	A	B	C
1	Test the lift-height display and check its components.			●	

Automatic crawl speed

Driving		W	A	B	C
1	Check that sensors / switches are secured, not damaged, clean and operational.			●	

Discharge strap

Electrics		W	A	B	C
1	Check anti-static discharge strap/chain is present and not damaged.			●	

Lift Control

Hydr. movements		W	A	B	C
1	Test "Lift Control" and check plausibility.			●	

Cold-store application

Driving		W	A	B	C
1	Replace the transmission oil in the cold-store application.				●

Hydr. movements		W	A	B	C
1	Note: In cold-store applications, we recommend replacing the hydraulic oil every 1000 service hours or once a year.				

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2 Maintenance checklist ETM/V 318-325

2.1 Owner

2.1.1 Standard equipment

Brakes		W	A	B	C
1	Test the brakes.	●			

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

Power supply		W	A	B	C
1	Check battery and battery components.	●			
2	Check battery cable connections are secure, check for dirt and grease terminals if necessary.	●			
3	Check battery cables and battery cable guide for damage.	●			
4	Check battery connector for damage, test it and make sure it is secure.	●			

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

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

Hydr. movements		W	A	B	C
1	Check the lubrication of the load chains and lubricate the load chains if necessary.	●			
2	Test hydraulic system.	●			
3	Check hydraulic oil level and top up if necessary.	●			
4	Check forks or load handler for wear and damage.	●			

2.1.2 Optional equipment

Cold store cab

Chassis and superstructure		W	A	B	C
1	Test the roof hatch and check for damage.	✳			
2	Check windows for damage.	✳			
3	Test the window heating and check for damage.	✳			
4	Test the doors and check for damage.	●			

Fork adjuster

Hydr. movements		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Clamping device

Hydr. movements		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Wiper/washer system

Chassis and superstructure		W	A	B	C
1	Check windscreen washer reservoir for leaks and check volume; top up if necessary.	●			

Weather proofing

Chassis and superstructure		W	A	B	C
1	Test the window heating and check for damage.	✳			
2	Test the doors and check for damage.	●			

Restraint system

Chassis and superstructure		W	A	B	C
1	Test the driver's seat restraint system and check for damage.	●			

Optional equipment

Chassis and superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage facilities, grips, windscreen wipers and windscreen washing system, etc. are working correctly and check for damage.	●			

Strobe light / beacon

Electrics		W	A	B	C
1	Test the strobe light/beacon and check for damage.	●			

2.2 Customer Service

2.2.1 Standard equipment

Brakes		W	A	B	C
1	Test the brakes.			●	
2	Check the magnetic brake air gap, adjust if necessary.			●	
3	Test the emergency stop brake.			●	
4	Check brake lining.			●	

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

Power supply		W	A	B	C
1	Check acid density, acid level and battery voltage.			●	
2	Check battery and battery components.			●	
3	Check battery cable connections are secure, check for dirt and grease terminals if necessary.			●	
4	Check battery cables and battery cable guide for damage; replace if necessary.			●	
5	Check battery connector for damage, test it and make sure it is secure.			●	

Driving		W	A	B	C
1	Test the deadman switch.			●	
2	Check the attachment of the drive support plate.			●	
3	Check transmission for noise and leakage.			●	
4	Check transmission oil level or grease filling of the transmission and top up if necessary.			●	
5	Replace the transmission oil.			✳	●
6	Check the wheels for wear and damage. Make sure they are secure and check the air pressure if necessary.			●	
7	Check wheel suspension and attachment.			●	

Chassis and superstructure		W	A	B	C
1	Check chassis connections and screw connections for damage.			●	
2	Check doors and/or covers.			●	
3	Check the battery trolley lock setting and test operation			●	
4	Check labels are legible, complete and plausible.			●	
5	Check the condition of the driver's seat.			●	
6	Check the mounting and adjustment of the driver's seat.			●	
7	Check mast mounting/bearings.			●	
8	Check and lubricate rails.			●	
9	Check seat frame is secure and check for damage. Check tightening torques.			●	
10	Check overhead guard and/or cabin are secure and check for damage.			●	
11	Check the supports/tilt safety devices are in place. Check the height- and capacity-related settings.			●	

Hydr. movements		W	A	B	C
1	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
2	Test the lift mechanism; check for wear, damage and correct adjustment.			●	
3	Check the fastening clamps on the mast lift cylinder for wear and damage.			●	
4	Test the hose guide and check for damage.			●	
5	Check settings and wear levels of slide pieces and stops and adjust or replace the slide pieces as required.			●	
6	Check load chain setting and tension if necessary.			●	
7	Check the lubrication of the load chains and lubricate the load chains if necessary.			●	
8	Check the load chain fasteners and check the chain bolts for wear and damage.			●	
9	Check lateral clearance of the mast connections and the fork carriage.			●	
10	Visually inspect the mast rollers and check the running surfaces for wear.			●	
11	Replace hydraulic oil filter and breather filter.			✳	●
12	Test hydraulic system.			●	
13	Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage.			●	
14	Test emergency lowering system.			●	
15	Check hydraulic oil level and top up if necessary.			●	
16	Replace the hydraulic oil.				●
17	Test the pressure relief valve and adjust if necessary.			●	

Hydr. movements		W	A	B	C
18	Check sliding blocks are complete.			●	
19	Check forks or load handler for wear and damage.			●	
20	Test the sideshifter, check settings and check for damage.			●	
21	Check cylinder piston rods and bushings.			●	
22	Check cylinder seals.			●	
23	Check piston rod screw depth and counter fixing / clamp. Where two tilt cylinders with the same stroke length are used, check their setting in respect of each other.			●	
24	Check tilt cylinders and mounting.			●	
25	Check mast holder guide rollers for wear and damage.				●

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

Steering		W	A	B	C
1	Test the electric steering and its components.			●	
2	Check the steering bearings, steering play and steering toothing or steering chain. Lubricate the steering toothing or steering chain.			●	

2.2.2 Optional equipment

Cold store cab

Chassis and superstructure		W	A	B	C
1	Test the roof hatch and check for damage.			●	
2	Check cold store cabin for damage and make sure it is secure.			●	
3	Check windows for damage.			●	
4	Test the window heating and check for damage.			●	
5	Test the doors and check for damage.			●	

Electrolyte circulation

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

Aquamatik

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

Intercom system

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

Fork adjuster

Hydr. movements		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	
2	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			●	
3	Check attachment lubrication; clean and lubricate if necessary.			●	
4	Check axial play of the front and rear rollers and adjust if necessary.			●	
5	Check sliding blocks are complete.			●	
6	Check the attachment is properly secured to the truck and check the load-bearing components.			●	
7	Test operation and setting of the attachment. Check attachment for damage.			●	
8	Check hydraulic ports and tighten if necessary.			●	
9	Test the fork positioner and check for damage.			●	
10	Check cylinder piston rods and bushings.			●	
11	Check cylinder seals.			●	

Clamping device

Hydr. movements		W	A	B	C
1	Test the acknowledgement key.			●	
2	Test the hose reel and check for leaks and damage.			●	
3	Check attachment bearings, guides and stops for wear and damage; grease and clean these components.			●	
4	Check attachment lubrication; clean and lubricate if necessary.			●	
5	Check axial play of the front and rear rollers and adjust if necessary.			●	
6	Check sliding blocks are complete.			●	

Hydr. movements		W	A	B	C
7	Check the attachment is properly secured to the truck and check the load-bearing components.			●	
8	Test operation and setting of the attachment. Check attachment for damage.			●	
9	Check hydraulic ports and tighten if necessary.			●	
10	Check cylinder piston rods and bushings.			●	
11	Check cylinder seals.			●	

Crane hook

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

Wiper/washer system

Chassis and superstructure		W	A	B	C
1	Check windscreen washer reservoir for leaks and check volume; top up if necessary.			●	
2	Test the windscreen wipers and check for damage, replace if necessary.			●	

Rack height select

System components		W	A	B	C
1	Test operation and setting of Rack Height Select.			●	

Lift cutout

Hydr. movements		W	A	B	C
1	Test the lift-limit cut-off/lift cut-off, check for damage and make sure it is secure.			●	

Shock sensor / data recorder

Electrics		W	A	B	C
1	Check shock sensor / data recorder are secure and check for damage.			●	

Data radio

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

Video system

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

ABS / ASR

Brakes		W	A	B	C
1	Make sure sensors are secured, not damaged, clean and operational.			●	

Fire extinguisher

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

Weigher sensors / switches

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

Access module

Electrics		W	A	B	C
1	Test the access module, check for damage and make sure it is secure.			●	

Weather proofing

Electrics		W	A	B	C
1	Check fuse ratings.			●	

Chassis and superstructure		W	A	B	C
1	Test the window heating and check for damage.			●	
2	Test the doors and check for damage.			●	

Electrical optional equipment

Electrics		W	A	B	C
1	Test the electrical optional equipment and check for damage.			●	

Restraint system

Chassis and superstructure		W	A	B	C
1	Test the driver's seat restraint system and check for damage.			●	

Optional equipment

Chassis and superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage facilities, grips, windscreen wipers and windscreen washing system, etc. are working correctly and check for damage.			●	

Sideshifter centring

Hydr. movements		W	A	B	C
1	Test sideshifter centring operation.			●	

Strobe light / beacon

Electrics		W	A	B	C
1	Test the strobe light/beacon and check for damage.			●	

Mast reach damping

Hydr. movements		W	A	B	C
1	Test mast reach damping operation and components.			●	

Mast lift retract damping

Hydr. movements		W	A	B	C
1	Test gas pressure dampers on the battery panel and check for damage.			●	

Overhead guard cover

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

Audible warning devices

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

Lift height indicator

System components		W	A	B	C
1	Test the lift-height display and check its components.			●	

Automatic crawl speed

Driving		W	A	B	C
1	Check that sensors / switches are secured, not damaged, clean and operational.			●	

Discharge strap

Electrics		W	A	B	C
1	Check anti-static discharge strap/chain is present and not damaged.			●	

Lift Control

Hydr. movements		W	A	B	C
1	Test "Lift Control" and check plausibility.			●	

Cold-store application

Driving		W	A	B	C
1	Replace the transmission oil in the cold-store application.				●

Hydr. movements		W	A	B	C
1	Note: In cold-store applications, we recommend replacing the hydraulic oil every 1000 service hours or once a year.				

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Foreword

Notes to the operating instructions

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

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

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

Safety notices and text mark-ups

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

⚠ DANGER!

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

⚠ WARNING!

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

⚠ CAUTION!

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

NOTE

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

➔ Used before notices and explanations.

- ● Indicates standard equipment
- ○ Indicates optional equipment

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Contents

A Traction battery

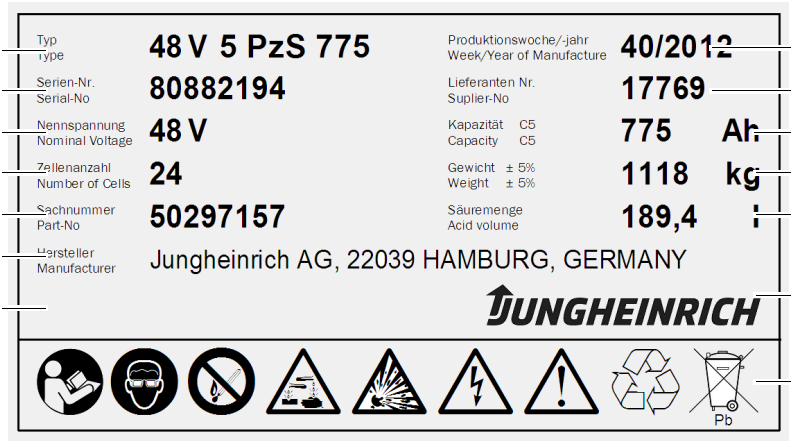
1 Correct Use and Application

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

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

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

2 Data plate



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

14	Safety instructions and warning information

3 Safety Instructions, Warning Indications and other Notes

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

4 Lead acid batteries with armour plated cells and liquid electrolyte

4.1 Description

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

Name	Explanation
PzS	– Lead acid battery with "Standard" armour plated cells and liquid electrolyte – Battery cell width: 198 mm
PzB	– Lead acid battery with "British Standard" armour plated cells and liquid electrolyte – Battery cell width: 158 mm
PzS Lib	– Lead acid battery with "Standard" armour plated cells and liquid electrolyte – Lead acid battery with extended maintenance interval – Battery cell width: 198 mm
PzM	

Electrolyte

The rated density of the electrolyte assumes a temperature of 30°C and the rated electrolyte level is fully charged. Higher temperatures will reduce, lower temperatures will increase the electrolyte density.
The corresponding adjustment factor is ± 0.0007 kg/l per K, e. g. electrolyte density 1.28 kg/l at 45 °C corresponds to a density of 1,29 kg/l at 30 °C.

The electrolyte must comply with the purity regulations of DIN 43530 Part 2.

4.1.1 Battery nominal data

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

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

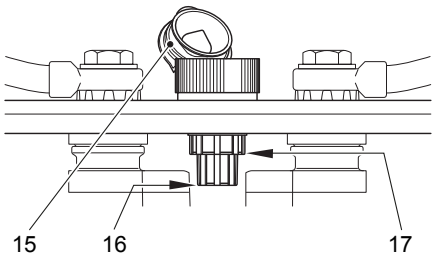
4.2 Operation

4.2.1 Commissioning unfilled batteries

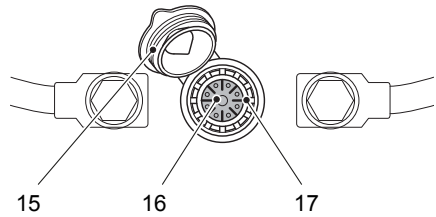
The operations required must be carried out by the manufacturer's customer service department or a customer service organisation authorised by the manufacturer.

4.2.2 Commissioning filled and charged batteries

Battery cell cross section



Top view of a battery cell



Checks and operations to be performed before starting daily work

Procedure

- Make sure the battery is in physically good condition.
- Make sure the terminals are correct (positive to positive and negative to negative) and check that contacts on the battery terminal conducting system are secure.
- Check the M10 terminal screws of the conductors and connectors are secure and if necessary torque to 23 ±1 Nm.
- Charge the battery, see page 13.
- Check the electrolyte level of each battery cell after charging and top up if necessary:
  - Open the plug (15).
    The electrolyte level should not be less than the "Min" electrolyte marking (16) and must not exceed the "Max" (17) marking.
  - If necessary, add electrolyte with pure water up to the "Max" electrolyte level marking (17), see page 15.
  - Close the plug (15).

The test is now complete.

4.2.3 Discharging the battery

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

4.2.4 Charging the battery

⚠ WARNING!

The gases produced during charging can cause explosions

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

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

NOTE

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

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

Charging the battery

Requirements

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

Procedure

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

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

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

The battery is charged.

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

Compensation charging

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

➔ Compensation charging should be carried out weekly.

Trickle charging

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

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

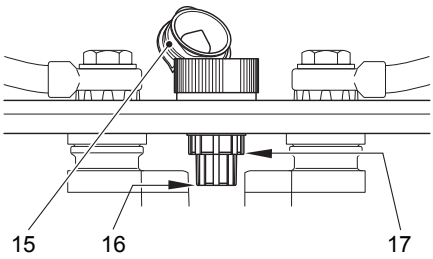
4.3 Servicing lead-acid batteries with armour plated cells

4.3.1 Quality of Water for Adding Electrolyte

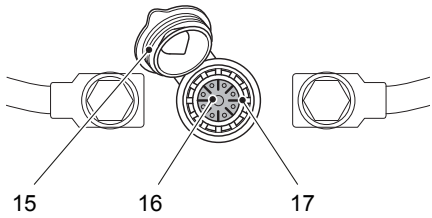
The quality of the water used to add electrolyte must correspond to purified or distilled water. Purified water can be produced through distillation or ion exchangers and is then suitable for the production of electrolyte.

4.3.2 Daily

Battery cell cross section



Top view of a battery cell



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

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

4.3.3 Weekly

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

4.3.4 Monthly

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

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

4.3.5 Annually

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

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

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

5.1 Description

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

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

Electrolyte

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

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

5.1.1 Battery nominal data

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

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

5.2 Operation

5.2.1 Commissioning

Checks and operations to be performed before starting daily work

Procedure

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

The test is now complete.

5.2.2 Discharging the battery

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

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

5.2.3 Charging the battery

⚠ WARNING!

The gases produced during charging can cause explosions

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

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

NOTE

Charging the battery incorrectly can result in material damage.

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

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

Charging the battery

Requirements

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

Procedure

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

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

The battery is charged.

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

Compensation charging

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

➔ Compensation charging should be carried out weekly.

Trickle charging

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

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

➔ Avoid trickle charging with PzV batteries.

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

➔ Do not add water!

5.3.1 Daily

– Charge the battery after each discharge.

5.3.2 Weekly

– Visually inspect for dirt and physical damage.

5.3.3 Every three months

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

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

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

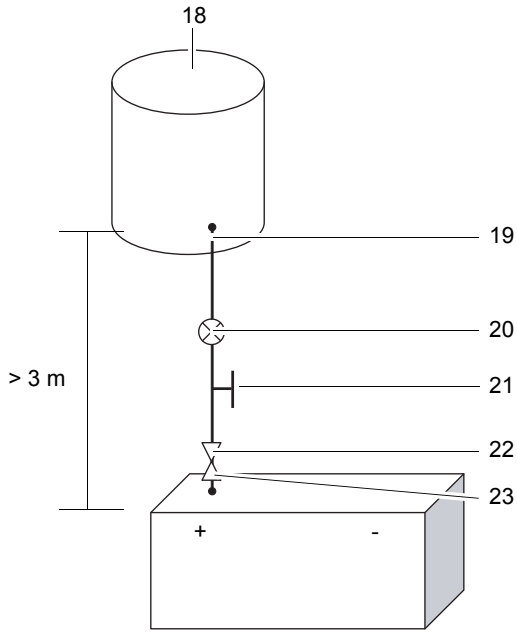
5.3.4 Annually

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

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

6 Aquamatik water replenishment system

6.1 Water replenishment system design



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

6.2 Functional Description

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

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

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

6.3 Adding water

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

6.4 Water pressure

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

Water drop

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

Pressure water

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

6.5 Filling time

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

6.6 Water quality

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

6.7 Battery tubing

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

6.8 Operating temperature

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

6.9 Cleaning measures

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

6.10 Service mobile vehicle

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

7 Electrolyte circulation

7.1 Functional Description

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

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

Pump

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

Battery connection

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

Pressure-monitoring module

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

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

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

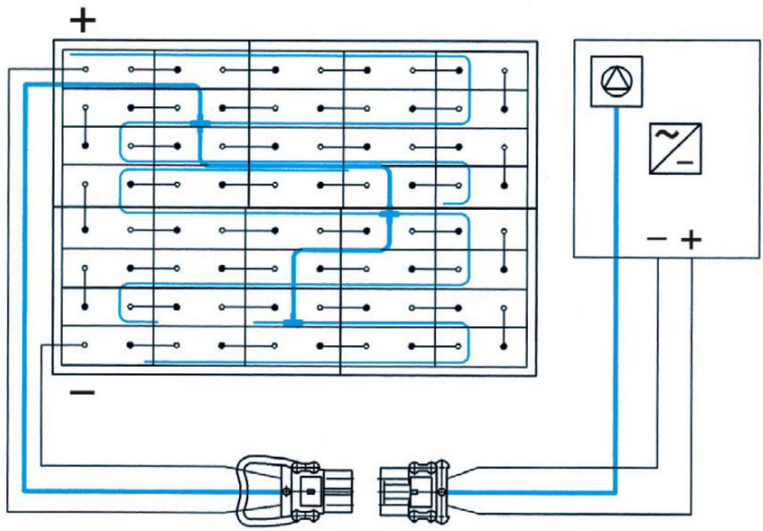
NOTE

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

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

Schematic illustration

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



8 Cleaning batteries

Batteries and trays must be cleaned in order to

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

When cleaning the batteries make sure that:

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

Cleaning the battery with a high pressure cleaner

Requirements

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

Procedure

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

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

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

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

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

Battery cleaned.

9 Storing the battery

NOTE

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

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

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

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

10 Troubleshooting

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

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

11 Disposal

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

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