

F Industrial Truck Maintenance

1 Operational Safety and Environmental Protection

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



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



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

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

2 Maintenance Safety Regulations

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

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



For jack points see Chapter B.

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



If the truck is to be cleaned with a water jet or a high-pressure cleaner, all electrical and electronic components must be carefully covered beforehand as moisture can cause malfunctions.

Do not clean with pressurised water.

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

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

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

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

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

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

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

3 Servicing and Inspection

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



The application conditions of an industrial truck have a considerable impact on the wear of the service components.

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

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

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



W service intervals must be performed by the owner.

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

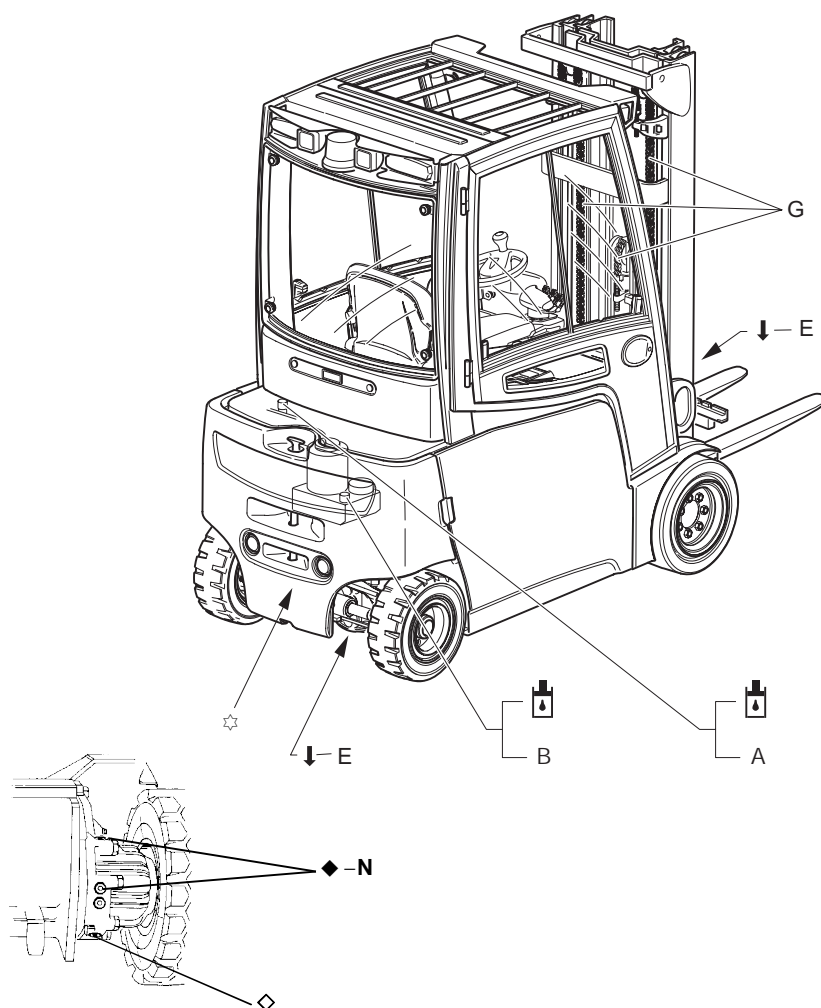
4 Maintenance checklist

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

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

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

5 Lubrication Schedule



- ▼ Contact surfaces
- ↓ Grease nipple
- 🛢 Hydraulic oil filler neck

- ☆ Hydraulic oil drain plug
- ◆ Transmission oil filler neck
- ◇ Transmission oil drain plug

5.1 Consumables

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



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

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

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

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

¹⁾ applicable for temperatures -5/+30 °C

²⁾ applicable for temperatures -20/-5 °C

³⁾ applicable for temperatures +30/+50 °C



The trucks are filled at the factory with H-LPD 22/32 hydraulic oil or Plantosyn 46 HVI BIO hydraulic oil.

You cannot change from "Plantosyn 46 HVI" BIO hydraulic oil to H-LPD 22. The same applies to changing from H-LPD 22 hydraulic oil to Plantosyn 46 HVI BIO hydraulic oil.

Furthermore you cannot mix H-LPD 22 hydraulic oil with Plantosyn 46 HVI BIO hydraulic oil.

Grease guidelines

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

6 Maintenance Instructions

6.1 Preparing the truck for maintenance and repairs

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

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



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

6.2 Opening the rear panel

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

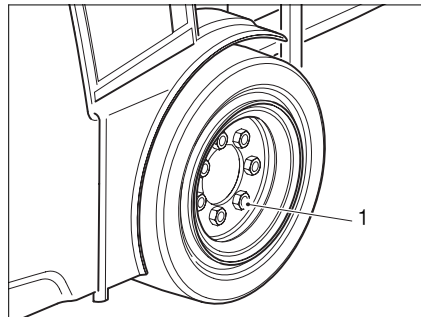
The fuses, steer motor and other electrical components can now be reached.

6.3 Checking the wheel attachments.

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

Torque

Drive wheels	$M_A = 240 \text{ Nm}$
Rear wheels	$M_A = 240 \text{ Nm}$



6.4 Rear wheel rated condition

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

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

6.5 Checking the hydraulic oil level



Fully lower the load handler.

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

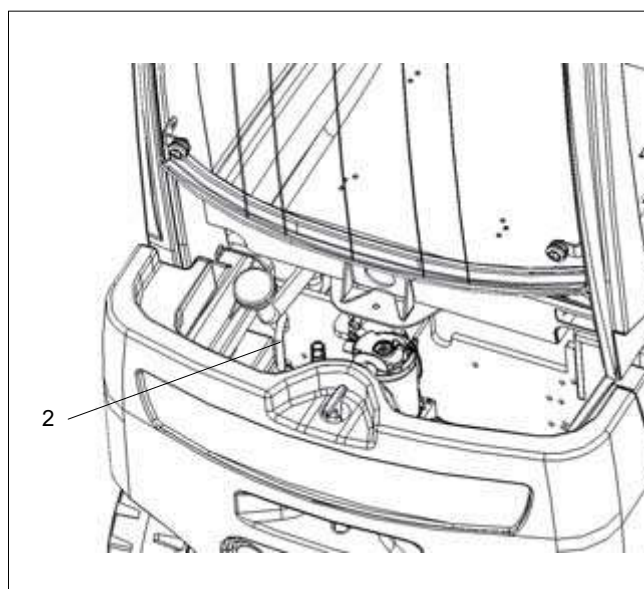


If the reservoir is filled sufficiently, the hose will be approx. 1 cm full from the bottom.

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



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



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



6.6 Check transmission oil level



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

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



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



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

6.7 Draining the oil

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



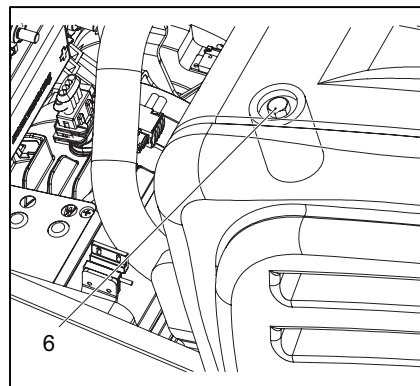
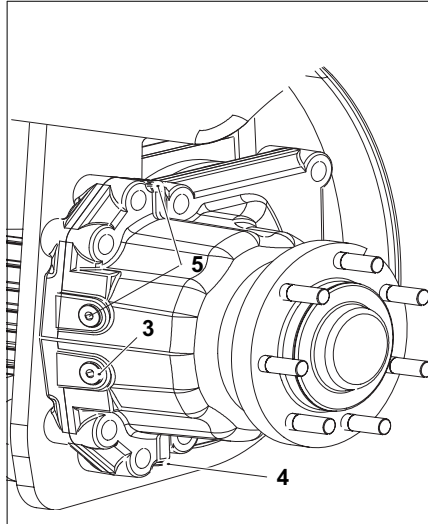
To ensure swift and complete draining of the transmission oil, unscrew the oil dipstick (3).

6.8 Adding oil

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

6.9 Replacing the hydraulic oil filter

- Unscrew the hydraulic oil filter cap (6). The filter element is located on the cap.
- Replace the filter insert; if the O ring is damaged it will also need to be replaced. Apply a thin layer of oil to the O ring on assembly.
- Refit the cap with the new filter element in place.



6.10 Seat belt maintenance

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

Testing the automatic blocking system:

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



The interlock must prevent the belt from coming out.



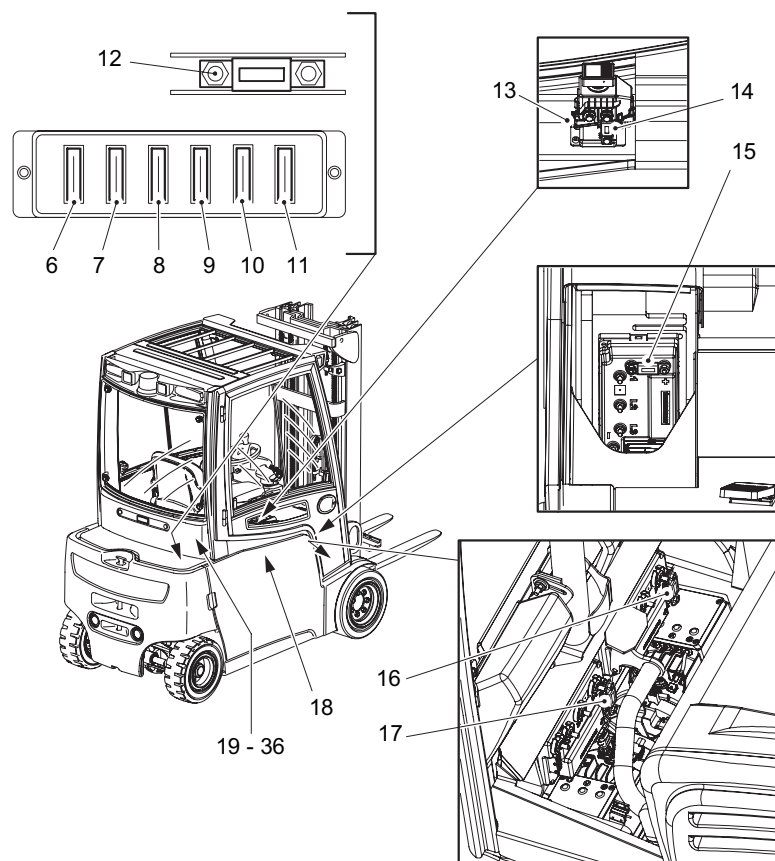
Do not operate the truck with a faulty seat belt. Replace it immediately.

6.11 Checking electrical fuses

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



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



Electrical system fuses

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

EMERGENCY DISCONNECT fuses

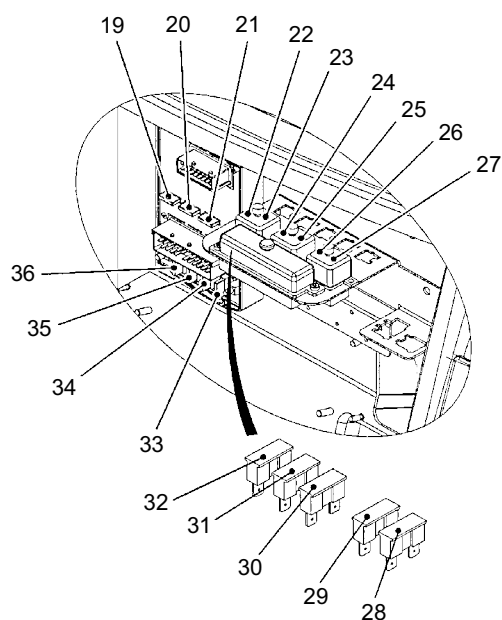
Item	Description	Electric circuit	Rating / type
13	F4	Main contactor control fuse	5A
14	F8	Positive wire main fuse	425A

Traction and lift controller fuses

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

On-board charger fuse (○)

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



Options fuses (○)

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

6.12 Recommissioning

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

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

7 Decommissioning the industrial truck

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



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

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

7.1 Prior to decommissioning

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



In addition, follow the battery manufacturer's instructions.

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

7.2 During decommissioning

Every 2 months:

- Charge the battery (see Chapter D).



Battery powered trucks:

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

7.3 Returning the truck to operation after decommissioning

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



Battery powered trucks:

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



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

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



Carry out the safety check in accordance with national regulations.

Junghenrich recommends checks in accordance with FEM 4.004. Junghenrich has a special safety department with trained personnel to carry out such checks.

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

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

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



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

9 Final de-commissioning, disposal



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

Instructions for use

Jungheinrich traction battery

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1 Jungheinrich traction battery

with positive tubular plates type EPzS and EPzB

Rating Data

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

* Will be reached within the first 10 cycles.



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



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



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



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



- Risk of explosion and fire, avoid short circuits!



- Electrolyte is highly corrosive!



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



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

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

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

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

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

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

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

	steel
M 10	23 ± 1 Nm

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

The battery is then charged as in item 2.2.

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

2. Operation

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

2.1 Discharging

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

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

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

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

2.2 Charging

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

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

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

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

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

2.3 Equalising charge

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

Watch the temperature!

2.4 Temperature

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

2.5 Electrolyte

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

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

3. Maintenance

3.1 Daily

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

3.2 Weekly

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

3.3 Monthly

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

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

3.4 Annually

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

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

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

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

4. Care of the battery

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

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

5. Storage

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

1. a monthly equalising charge as in point 2.3
2. float charging at a charging voltage of $2.23 \text{ V} \times \text{the number of cells}$. The storage time should be taken into account when considering the life of the battery.

6. Malfunctions

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

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



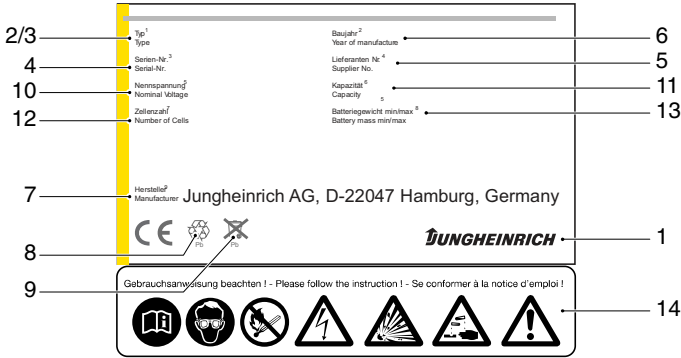
Back to the manufacturer!

Batteries with this sign must be recycled.

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

We reserve the right make technical modification.

7. Type plate, Jungheinrich traction battery



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

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

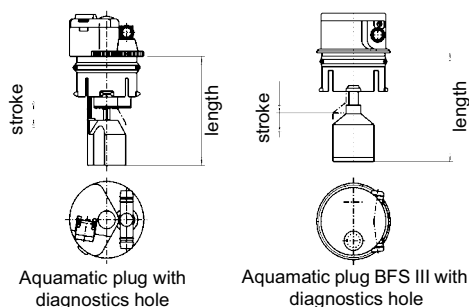
Aquamatic/BFS III water refilling system for Jungheinrich traction battery with EPzS and EPzB cells with tubular positive plates

Aquamatic plug arrangement for the Operating Instructions

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

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

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



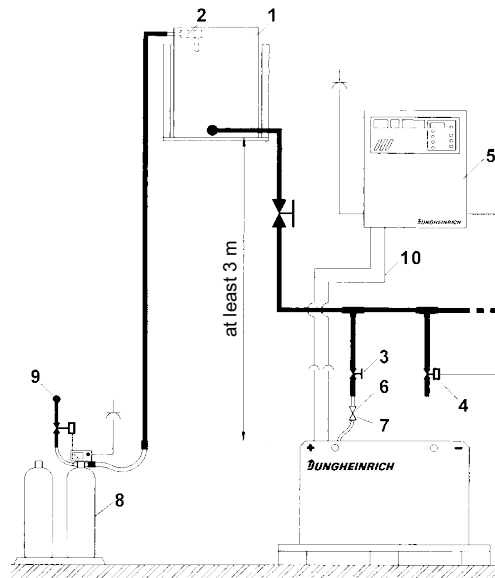
Non-adherence to the operating instructions, repairs carried out with non-original spare parts, unauthorised interference, and the use of additives for the electrolytes (alleged improvement agents) will invalidate any claim for warranty.

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

Diagrammatic view

Equipment for the water refilling system

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



1. Design

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

2. Application

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

3. Function

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

4. Filling (manual/automatic)

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

5. Connection pressure

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

5.1 Falling water

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

5.2 Pressurised water

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

5.3 Water Refill Trolley (serviceMobil)

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

6. Filling duration

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

7. Water quality

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

8. Battery hose connections

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

9. Operating temperature

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

CAUTION:

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

9.1 Diagnostics hole

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

9.2 Float

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

9.3 Cleaning

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

10. Accessories

10.1 Flow indicator

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

10.2 Plug lifter

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

10.2.1 Clamping ring tool

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

10.3 Filter element

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

10.4 Sealing coupler

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

11. Functional data

PS - self-sealing pressure: Aquamatic > 1.2 bars

BFS system none

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

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

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

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

2 Jungheinrich traction batterie

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

Rating Data

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

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

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



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



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



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



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



- Risk of explosion and fire, avoid short circuits!



- Electrolyte is highly corrosive!
- In the normal operation of this batteries a contact with acid isn't possible. If the cell containers are damaged, the immobilised electrolyte (gelled sulphuric acid) is corrosive like the liquid electrolyte.



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



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

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

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

1. Commissioning

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

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

Otherwise battery, vehicle or charger could be destroyed.

The battery has to be charged according to item 2.2

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

	steel
M 10	23 ± 1 Nm

2. Operation

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

2.1 Discharging

Ventilation openings must not be sealed or covered.

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

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

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

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

This also applies to partially discharged batteries.

2.2 Charging

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

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

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

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

Special instructions for the operation of batteries in hazardous areas.

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

2.3 Equalising charge

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

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

Watch the temperature!

2.4 Temperature

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

2.5 Electrolyte

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

3. Maintenance

Don't refill water!

3.1 Daily

Charge the battery immediately after every discharge.

3.2 Weekly

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

3.3 Quarterly

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

- the voltages of the battery
- the voltages of every cells

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

3.4 Annually

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

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

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

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

4. Care of the battery

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

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

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

5. Storage

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

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

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

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

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

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6. Malfunctions

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

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



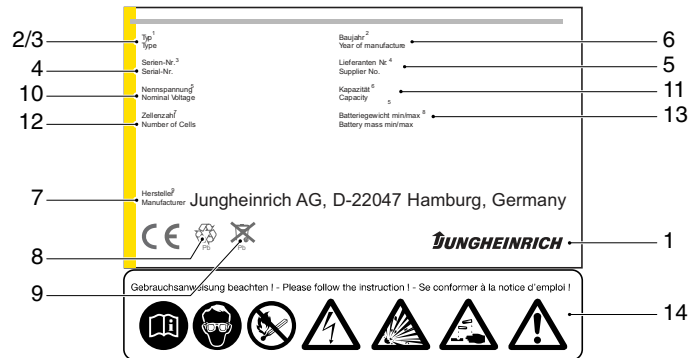
Back to the manufacturer!

Batteries with this sign must be recycled.

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

We reserve the right make technical modification.

7. Type plate, Jungheinrich traction battery



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

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

