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Operating Manual

Low Pressure Water Refilling System for HOPPECKE FNC and HNCS rail cells



Version overview

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	2024-08-23	Approved	Dr. D. Mahl		

Foreword

Dear Customer,

Thank you very much for having decided in favour of a product bearing our brand name.

Please read this documentation carefully before working on the water refilling system of the battery-system. It contains important information on safe and proper operation and maintenance of the water refilling system and the corresponding FNC® / HNCS rail batteries.

Amendments to this documentation are subject to change without prior notice. Our products undergo continuous advanced development. As a result, there may be deviations between the illustrations given in this documentation and the purchased product. This operation manual is not covered by any change service.

Keep this documentation in such a manner that it is available immediately to all those who need to carry out work in connection with the battery system or its components.

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1. Using this manual

This operation manual is intended to assist with the optimal operation and maintenance of the HOPPECKE nickel-cadmium batteries (FNC® / HNCS rail cells). This is the only way in which a maximum service life can be achieved.

Please contact your local authorised dealer if:

- You have any queries on this documentation
- There are local regulations or provisions that are not covered by this documentation or are contrary to its contents

1.1. Target group of this document

All work on the water refill system and the FNC® / HNCS rail cells may only be carried out by trained, fully qualified, authorised personnel (ideally by qualified electricians):

- Personnel authorised by the safety officer of the train manufacturer
- Personnel authorised by the safety officer of the train operator
- Personnel authorised by HOPPECKE Batterie Systeme GmbH
- HOPPECKE experts

Untrained personnel may not carry out any work on the FNC® / HNCS rail cells.

1.2. Icons and signal words

The following icons and signal words are used in this operating manual:



DANGER!

Denotes an immediate hazard with a high level of risk that could lead to death or severe physical injury if it is not prevented.



WARNING!

Denotes a potential hazard with a medium level of risk that could lead to death or severe physical injury if it is not prevented.



CAUTION!

Denotes a hazard with a low level of risk that could lead to minor or medium degree of physical injury if it is not prevented.



Note

Denotes important instructions to make best use of the product.

1.3. Graphical symbols / pictograms on the battery system

The following graphic symbols are used in this operating manual and on the product:



EN ISO 7010 - W012
Warning of electrical voltage



EN ISO 7010 - W026
Warning of danger from batteries



EN ISO 7010 - W023
Warning of corrosive substances



EN ISO 7010 - W002
Warning of explosive substances



EN ISO 7010 - P003
No fire, open light or smoking



EN ISO 7010 - M002
Follow the instructions for use



EN ISO 7010 - M004
Use eye protection



EN ISO 7010 - M009
Use hand protection



EN ISO 7010 - M010
Use protective clothing

2. Safety instructions

Observe the safety instructions when handling the battery system and its components.

2.1. Hazards

2.1.1. Explosive gas mixture

Each time the batteries are charged, water is decomposed. This can form a hydrogen-oxygen gas mixture (oxyhydrogen gas), which explodes even at low energy input.

There is danger through:

- Explosions
- Fires
- Pressure waves
- Hot or molten substances flying around

These hazards may be caused by the following ignition sources:

- Short circuits
- Electrostatic charges and discharges
- Smoking
- Open flames / fire, embers and sparks near batteries
- Electrical sparks through switches or fuses
- Hot surfaces with temperatures above 300 °C

There is an immediate, high risk situation which, if not avoided, will result in death or serious injury.

Measures to avert the danger:

- Work with insulated, non-sparking tools.
- Ensure sufficient ventilation of the battery room in accordance with DIN EN IEC 62485-2 so that the potentially explosive gas mixture is discharged.
- Avoid electrostatic charging:
 - Do not rub batteries with plastic housings with a dry cloth or a cloth made of synthetic material.
 - Only clean batteries with a cotton cloth moistened with water. Wiping with a cotton cloth moistened with water does not generate any electrical charge.
 - Wipe batteries damp (with water) before removing or tearing off a label.
 - Wear shoes and clothing which, due to their special surface resistance, prevent the formation of electrostatic charges. ([see 2.2 Personal protective equipment on page 13](#)).
- Use hand lamps with mains cable without switch (protection class II) or hand lamps with battery (protection class IP54).

2.1.2. Electrical voltage

Metal parts of the batteries are always live. High currents flow in the event of a short circuit.

There is danger through:

- Voltages
- Electric shocks

There is an immediate, high risk situation which, if not avoided, will result in death or serious injury.

Measures to avert the danger:

- Be very careful when working on the batteries.
- Never place tools or other metal objects on a battery.
- Remove watches and jewellery before working on the batteries.
- Do not touch bare battery parts, connectors, terminals and poles.

2.1.3. Electrolyte

FNC® / HNCS rail cells are NiCd cells and contain potassium hydroxide (KOH) as electrolyte with an addition of lithium hydroxide (LiOH).

The following dangers exist:

- When working on open FNC® / HNCS rail cells, contact with the electrolyte may occur.
- Electrolyte may escape as a result of damage to the housing of a cell.
- Polarity reversal of the battery or of individual cells can result in overheating and thus leakage of electrolyte.
- The electrolyte can cause severe skin burns and eye damage.

There is a potentially hazardous medium-risk situation which, if not avoided, could result in death or serious injury.

Measures to avert the danger:

- Always wear protective goggles and gloves when working on batteries.
- Wash clothes contaminated with electrolyte with water.
- Check correct polarity before making connections.

Take the following actions if you have come into contact with the electrolyte:

Electrolyte solution on the skin or in the hair

- Dab it with a cotton or paper-based cloth, but do not wipe it off.
- Remove pieces of clothing that have been contaminated, and while doing so, avoid contact with the affected parts of the body as far as possible.
- Rinse off the affected parts for a longer period of time under flowing water.

Electrolyte in the eyes

- Gently rinse off the eye for up to 15 minutes with an eyewash or wash the eye in flowing water. Avoid excessive water pressure when doing so. Remove any contact lens as far as possible and continue to rinse off the eye.
- Consult an eye specialist immediately.

Electrolyte in the body

- Rinse the mouth with water. DO NOT induce vomiting.
- Contact a doctor immediately or look for a hospital.

2.1.4. Toxic substances

Nickel-cadmium batteries contain toxic substances:

- Battery cells contain more than 0.1% cadmium (Cd)

There is a low-risk hazard which, if not avoided, could result in minor or moderate injury.

Measures to avert the danger:

- Avoid contact with toxic substances.
- Wear personal protective equipment ([see 2.2 Personal protective equipment on page 13](#)).

2.1.5. Fire

In the event of fire there is danger through:

- Hot or molten substances
- Short circuits
- Open flames / fire, embers and sparks
- Hot surfaces with temperatures above 300 °C

There is an immediate, high risk situation which, if not avoided, will result in death or serious injury.

Measures to avert the danger:

- Wear personal protective equipment against alkaline solutions ([see 2.2 Personal protective equipment on page 13](#)), also use breathing protection with self-sufficient breathing air supply for large battery systems. In case of contact with water, there is a risk of reactions with the electrolyte (caustic solution) and consequently of violent spraying.
- Disconnect the battery electrically.
- Extinguish incipient fires with CO₂.
- When extinguishing electric fires with water in low-voltage systems (up to 1 kV), maintain a spray jet distance of 1 m and a full jet distance of 5 m.
- Extinguish at short intervals. Otherwise there is danger of explosion due to possible static charging on the battery housing.

2.1.6. Improper transport

The batteries may be damaged during improper transport. Falling batteries can cause personal injury.

If the batteries are improperly transported, there is a risk of damage:

- Suspended loads
- Dropping batteries or parts of batteries
- Leaking electrolyte

There is an immediate, high risk situation which, if not avoided, will result in death or serious injury.

Measures to avert the danger:

- Use safety shoes and goggles.
- Do not tilt batteries.
- Always lift the batteries by the handles or lifting points provided for lifting devices and never carry them by the poles of the battery or cells.
- Only use approved lifting and transport equipment, e.g. lifting gear. Lifting hooks must not cause damage to cells, connectors or connecting cables.
- Always carefully remove batteries to avoid damage.
- Use suitable transport equipment.
- Carefully secure the charge during transport to prevent damage to the battery housing.

2.2. Personal protective equipment

Always wear the following personal protective equipment when working on the batteries or their components:

- Safety glasses
- Safety gloves
- Protective clothing, preferably made of cotton to prevent the development of electrostatic charge on clothes and the body
- Safety boots

In this way, you can prevent or at least mitigate injuries in the event of an accident.

The conductivity of textiles and shoes must have the following characteristics to prevent electrostatic charge:

- An insulation resistance $\geq 10^5 \Omega$
- A surface resistance $< 10^8 \Omega$

3. Use of the product

3.1. Intended use

The HOPPECKE water refilling system and the HOPPECKE water refilling cart are designed to simplify the refilling of deionized / distilled water at certain maintenance intervals.

Intended use includes the following requirements:

- Maintenance must only be carried out if the unit is in impeccable condition:
 - the battery
 - the water refilling system on the battery
 - the water refilling cart
- Compliance with all instructions in this operating manual

3.2. Unintended use



DANGER!

Unintended use of the water refilling system and the water refilling cart can lead to personal injuries or damage to property.

In case of unintended use, HOPPECKE Batterie Systeme GmbH shall not assume any liability for personal injuries or damage to property that result directly or indirectly from handling the batteries. The operator shall be solely responsible for the risks arising from unintended use.

Any use other than that described under "Intended Use" is not intended and hence, not permissible.

Unintended use particularly includes the following:

- Operation in potentially explosive zones
- Operation in safety-related applications, provided that these applications are not expressly specified or permitted in the product documentation
- Operation without permanent / inadequate fixture
- Operation beyond the technical specifications
- Operation or storage outside the environmental conditions specified

4. Directives, legislation and standards

Please observe the latest edition of the following rules and regulations:

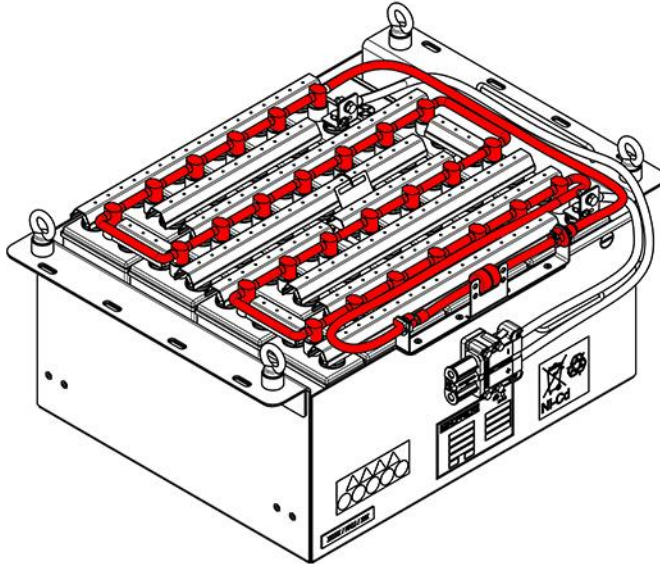
- Accident prevention regulations, especially DGUV Regulation 1: Accident prevention regulation; Principles of prevention
- DIN EN ISO 20345 ("Personal safety gear – Safety boots")
- DIN EN 60993/IEC 60993 ("Electrolyte for vented nickel-cadmium cells")
- DIN 43530-4 ("Water and refilling water for lead acid batteries and alkaline batteries")
- Ordinance on the supervision of waste and residual materials (German Federal Law Gazette, 1996)

In addition, observe and follow all applicable territorial, corporate and project-specific regulations.

5. System description

The central water refilling system from HOPPECKE Batterie Systeme enables fast and reliable refilling of the cells with water up to the maximum level.

Example of a water refill system (coloured red) mounted on a battery in a tray:



The central water refilling system consists of following components:

- Water refilling plugs
- Connecting tubes
- Quick couplings
- Backfire protection

For filling you need a HOPPECKE water refilling cart (accessory).

5.1. Water refilling plug

Hoppecke Mat.Nr.: 4144000112 - WATER REFILLING PLUG F. FNC-CELLS



The plugs used to refill deionized / distilled water work without moving parts. The water is pumped with a constant flow rate into the refill system and flows successively into the cells. The air inside escapes through a riser tube. As soon as it dips into the electrolyte when the maximum electrolyte level is reached, no further air can escape and the further supply of water is stopped.

The water refill plug is sealed against the cell with two O-rings so that air can only escape through the plug but not directly out of the cell. This is essential for the function.

The O-rings are also available separately for repair purposes.

Hoppecke Mat.Nr.: 4144000034 - O-RING 18x2 EPDM70

5.2. Connecting tubes

Hoppecke Mat.Nr.: 4144000357 - TUBE EPDM ID 8x2,5MM BLACK

Hoppecke Mat.Nr.: 4144000356 - TUBE EPDM ID 6x2MM BLACK



The connecting tubes transport the deionized / distilled water to the connected cells during the filling process. While the vehicle is in operation, the battery system is charged and the resulting hydrogen and oxygen are led through the tubing to a central degassing system with backfire protection (see below).

5.3. Quick couplings

Hoppecke Mat.Nr.: 4144000313 - IN-LINE HOSE BUSH 3/8"ID EFC22612



Hoppecke Mat.Nr.: 4144000337 -IN-LINE HOSE BUSH 3/8"ID EFCX17612

Hoppecke Mat.Nr.: 4144000335 - IN-LINE HOSE BUSH 1/4"ID EFCX17412



Hoppecke Mat.Nr.: 4144000312 - IN-LINE HOSE BUSH 1/4"ID EFC22412



Hoppecke Mat.Nr.: 4144000336 - HOSE BARB VALVED PANEL MOUNT EFCX16612



The quick couplings are used to connect the water refill cart to the battery system.

5.4. Backfire protection

Hoppecke Mat.Nr.: 4144000314 - STRAIGHT-RUN FILTER D30 -TABA- 244FP



Hydrogen and oxygen produced during charging is led through the tubing to a central degassing system with backfire protection and is thus released into the environment in a controlled manner.

5.5. Water refilling cart

Hoppecke Mat.Nr.: 4147000230 - WATERFIL.TROL. BEMA60L/230V/LOW-PRE.-CPC

Hoppecke Mat.Nr.: 4147000235 - WATERFIL.TROL. BEMA60L/115V/LOW-PRE.-CPC



The HOPPECKE water refilling cart with a 60 litre tank makes it easy to refill the batteries on site. The cart can be easily pulled by the handle. The cart is equipped with an internal rechargeable lead-acid battery to ensure maximum mobility.



Note

For technical reasons, correct filling is only possible with HOPPECKE water refill carts.



Note

The water refilling cart weights 49 kg in empty condition. The dimensions are 800 x 600 x 1200 mm.



CAUTION!

Damage to the water refilling cart due to frost.

The water refilling cart must be stored and operated at temperatures > 0°C to prevent the water in the tanks and inside the cart from freezing.



CAUTION!

Limitation of the efficiency and damage of the battery system by e.g. tap water.

The quality of the refill water must comply with the IEC EN 60 993 standard.

6. Use of the water refilling cart

6.1. Checking the electrolyte level

Checking the electrolyte level is different for:

- FNC® rail cells, see [6.1.1 Checking the electrolyte level on FNC® rail cells on page 20.](#)
- HNCS rail cells, see [6.1.2 Checking the electrolyte level on HNCS rail cells on page 22.](#)

6.1.1. Checking the electrolyte level on FNC® rail cells

Target: The electrolyte level of the battery cells is checked.

When a battery is overcharged, electrolysis decomposes the electrolyte water into gases (H₂ and O₂). This causes the electrolyte level to drop. The amount of decomposed water depends on the charging voltage, the charging time per day and the temperature.



WARNING!

When checking the electrolyte level, contact with the electrolyte may occur.

There is a potentially hazardous medium-risk situation which, if not avoided, could result in death or serious injury.

Potassium hydroxide solution can cause severe skin burns and eye damage.

Wear protective goggles and gloves (five-finger latex or PVC gloves) when working on the batteries.

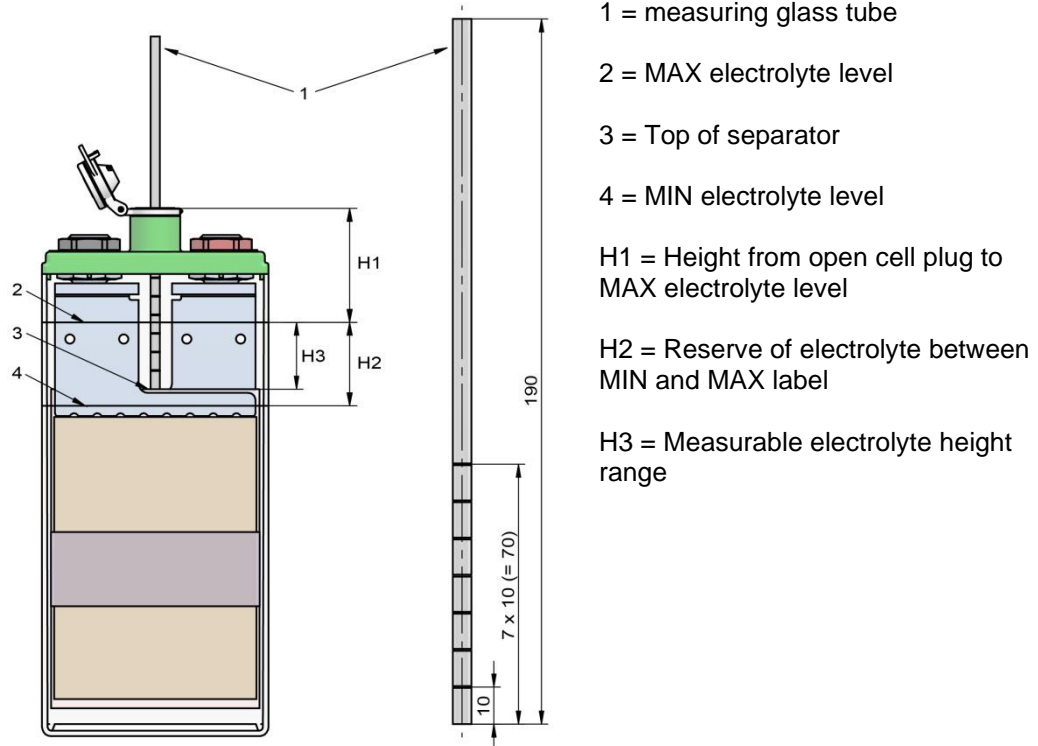
Required Tools:

- Measuring glass tube

Cells for use in railway vehicles often have flame-retardant polypropylene vessels (PP-V0) through whose walls the electrolyte levels are not visible. With translucent standard polypropylene vessels (PP) and polyethersulfone vessels (PES), individual electrolyte levels may not be visible due to the installation situation. In these cases, the measuring glass tube available from HOPPECKE (material number: 4144140010) must be used as an aid for electrolyte level control.

1. Remove the water refilling plugs from 10% of randomly selected cells of the entire battery system. For example, 8 cells in an 80-cell battery.

2. Keep the upper opening of the measuring glass tube free and insert it into the respective cell until it encounters resistance.
 - Close the upper opening of the measuring glass tube with your index finger.
 - Remove the measuring glass tube from the cell until the scale is visible.



3. Read off the electrolyte level in the cell using the electrolyte remaining in the measuring glass tube and allow the electrolyte in the measuring glass tube to flow back into the cell.



Note

The rings count upwards from the lower edge of the measuring glass tube.

- If the electrolyte level is more than 2 rings (R2 and R3) or more than 3 rings (R4), you don't have to fill up deionized / distilled water. With step 4 the process is completed for this maintenance interval.
- If the electrolyte level in one of the FNC® cells is less or equal 2 rings (R2 and R3) or less or equal 3 rings (R4), you must top up deionized / distilled water to the maximum level, after you have remounted the plugs. ([see 6.2 Refilling deionized / distilled water on page 24](#))
- If the electrolyte levels of the FNC® cells differ by more than 2 rings, contact HOPPECKE service.

If the electrolyte level of one or more cells exceeds 5 rings (R2 and R3) or 7 rings (R4), contact HOPPECKE service.

4. Reinsert the water refilling plugs.
5. Note activities in a maintenance report.

Result: Now the electrolyte level of the battery cells has been checked.

6.1.2. Checking the electrolyte level on HNCS rail cells

Target: The electrolyte level of the battery cells was checked.

When a battery is overcharged, electrolysis decomposes the electrolyte water into gases (H₂ and O₂). This causes the electrolyte level to drop. The amount of decomposed water depends on the charging voltage, the charging time per day and the temperature.



WARNING!

When checking the electrolyte level, contact with the electrolyte may occur.

There is a potentially hazardous medium-risk situation which, if not avoided, could result in death or serious injury.

Potassium hydroxide solution can cause severe skin burns and eye damage.

Wear protective goggles and gloves (five-finger latex or PVC gloves) when working on the batteries.

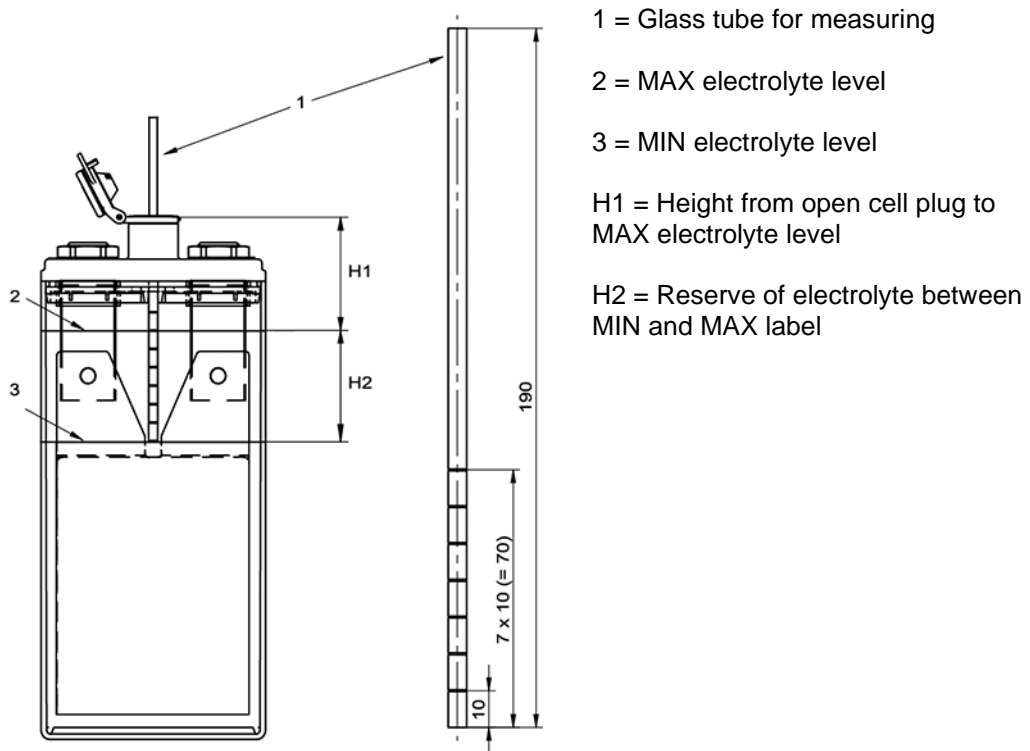
Required Tools:

- Measuring glass tube

Cells for use in railway vehicles often have flame-retardant polypropylene vessels (PP-V0) through whose walls the electrolyte levels are not visible. With translucent standard polypropylene vessels (PP) and polyethersulfone vessels (PES), individual electrolyte levels may not be visible due to the installation situation. In these cases, the measuring glass tube available from HOPPECKE (material number: 4144140010) must be used as an aid for electrolyte level control.

1. Remove the water refilling plugs from 10% of randomly selected cells of the entire battery system. For example, 8 cells in an 80-cell battery.

2. Keep the upper opening of the measuring glass tube free and insert it into the respective cell until it encounters resistance.
 - Close the upper opening of the measuring glass tube with your index finger.
 - Remove the measuring glass tube from the cell until the scale is visible.



3. Read off the electrolyte level in the cell using the electrolyte remaining in the measuring glass tube and allow the electrolyte in the measuring glass tube to flow back into the cell.



Note

The rings count upwards from the lower edge of the measuring glass tube.

- If the electrolyte level is more than 4 rings, no deionized / distilled water should be added. Continue with step 4.
- If the electrolyte level in one of the HNCS cells is less than or equal to 4 rings, top up deionized / distilled water to the maximum level. (see [6.2 Refilling deionized / distilled water on page 24](#))
- If the electrolyte levels of the HNCS cells differ by more than 2 rings, contact HOPPECKE Service.
- If the electrolyte level of one or more cells exceeds 7 rings, contact the HOPPECKE service.

4. Reinsert the water refilling plugs.
5. Note activities in a maintenance report.

Result: Now the electrolyte level of the battery cells has been checked.

6.2. Refilling deionized / distilled water



CAUTION!

Limitation of the efficiency and damage of the battery system by e.g. tap water.
The quality of the refill water must comply with the IEC EN 60 993 standard.

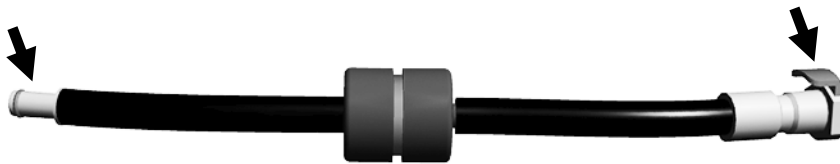
If refilling with deionized / distilled water is necessary according to chapter 6.1, follow the instructions in the following chapters 6.2.1 to 6.2.4.

6.2.1. Preconditions for correct filling

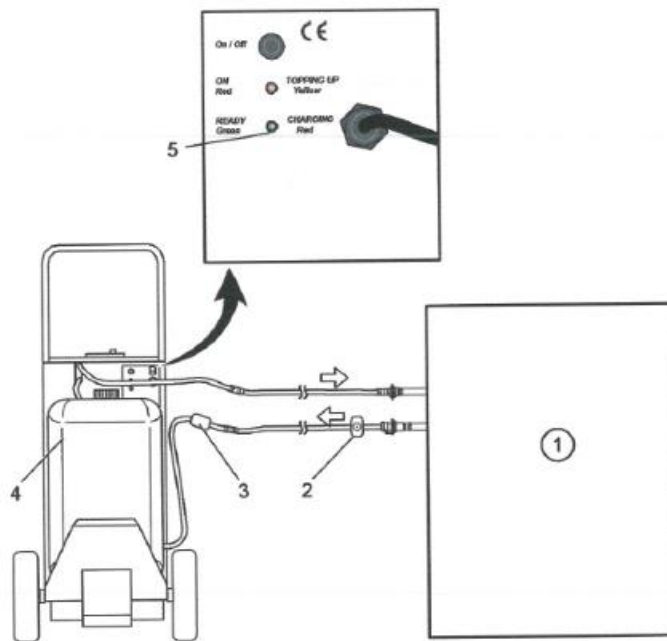
- Take care that the tube connectors are not dirty or damaged. If any contamination is found, clean the components with clean water.
- Do not bend the tubes of the refill cart.
- Always fill the tank of the refilling cart with a sufficient quantity of deionized / distilled water (the water quality must be in accordance with IEC EN 60 993).
- The water refilling plugs on the battery must not be damaged. Replace each damaged plug with a new one. Damaged plugs lead to overfilling of cells and leakage of water and electrolyte.
- Make sure that the water refilling cart is supplied with the correct mains voltage when charging.
- Only store and operate the water refilling cart at temperatures $>0^{\circ}\text{C}$.
- Avoid any constriction of the tubes, otherwise the flow will be reduced. Do not bend the tubes. If 90° angles are required, use appropriate angle connectors. Do not use different tube diameters in one battery.
- Ensure that all tubes are securely seated on the plug sockets and that the plugs are properly mounted in the cell. Leaks due to incorrect installation will affect the functioning of the system and lead to overfilling of the cells and electrolyte leakage.

6.2.2. Preparing the filling procedure

1. Perform a visual inspection of the water refilling cart and the water refilling system.
2. Make sure that the internal lead-acid battery of the water refill cart is charged (LED 5 lights green).
3. The storage tank must be sufficiently filled with refill water in accordance with IEC EN 60993.
4. The residual water tank must be empty.
5. Disconnect the backfire protection from the battery.



6. Connect the two tubes of the water refilling cart to the water refilling system of the battery using the quick couplings.



1: Battery

2: Ventilation valve

3: Filter

4: Water tank

5: Control lamp

**CAUTION!**

The battery may have a height difference upwards to the water refilling cart, limited by the tube length. No difference in height between the water refilling cart and the battery is permitted downwards. Failure to comply with this requirement will result in an unacceptable change in the pressure conditions in the refilling system. This results in incorrect fillings (e.g. overfilling of the cells).

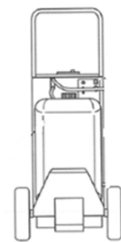
This can lead to electrolyte leakage and increased contamination of the battery system during operation.

In addition, overfilling changes the electrolyte density and the performance of the battery can be negatively affected.

If cells are filled above the maximum level, contact the HOPPECKE service.

Water Refilling Cart

Battery

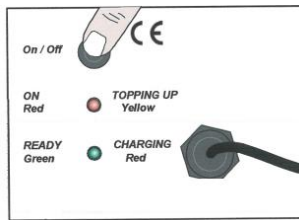


Ground



6.2.3. Filling procedure

1. Switch on the water refilling cart. The software version is displayed for 10 seconds.



2. Start the filling process with the start button. The control lamp lights up yellow.



3. The filling process runs automatically. As soon as all cells are filled, the refilling cart sucks off residual water from the tubing. The filling process takes a few minutes, depending on the number of cells and the filling level of the cells.



CAUTION!

Avoid overfilling.

Perform the refill action only once per maintenance interval.

Repeated triggering of the refilling activity at the same maintenance interval can overfill the battery system. This can lead to electrolyte leakage and increased contamination of the battery system during operation.

In addition, overfilling changes the electrolyte density and the performance of the battery can be negatively affected.

If cells are filled above the maximum level, contact the HOPPECKE service.



CAUTION!

If an irregularity is detected during the filling process (e.g. leaking water at a tube connection or a plug), stop the water refilling process manually by pressing the Start-Stop button. Then check the electrolyte levels of all cells manually and refill them manually up to the maximum mark.

6.2.4. After the filling procedure

After the water refilling cart has stopped pumping, the battery is completely filled up. The display shows the amount of water filled up in litres.

1. Disconnect the tubes from the water refilling cart using the appropriate quick couplings.
2. Reassemble the backfire protection using the quick couplings.
3. Empty the extracted water from the small residual container.
4. Switch off the water refilling cart and connect it to the 230V / 110V power supply to charge the internal lead-acid battery.



Note

The extracted water may contain electrolyte residues! Observe the local / relevant regulations for disposal.

7. Maintenance and repair

The water refill system is almost maintenance-free and requires no intensive service. The system is therefore only subjected to a visual inspection. If necessary, individual defective plugs, tubes or fastening material can be replaced.

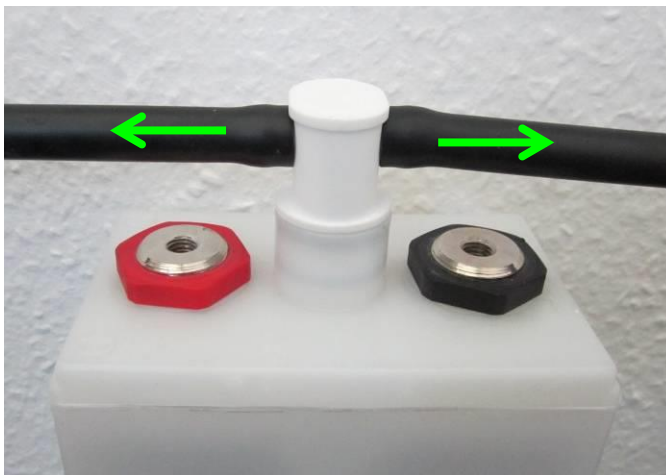
7.1. Visual inspection

The water refilling system must be correctly installed:

- No loose or leaky tubes or plugs
- No bent tubes

7.2. Replacing a water refilling plug

1. Remove the tubes from the tube connections.

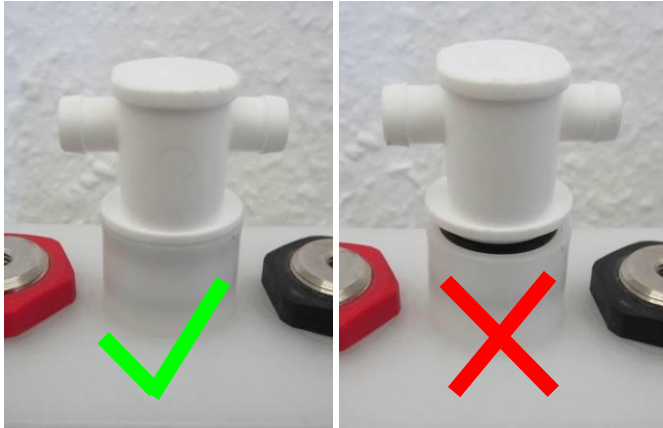


2. Pull the plug straight up out of the cell. It must not be canted.

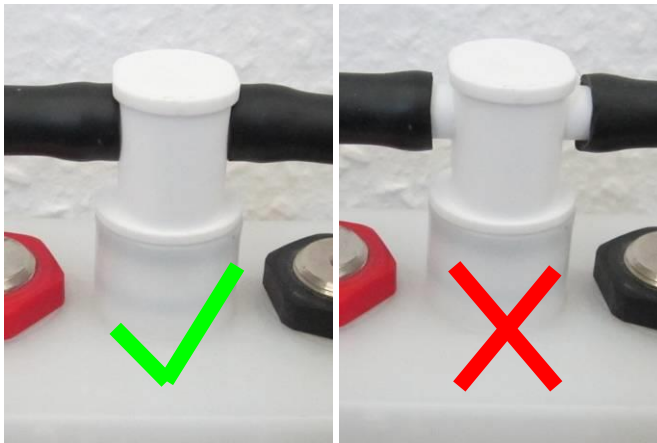


3. Insert the new water refill plug: The water refill plug must be inserted straight into the cell. It must be possible to insert it by applying light pressure with the ball of the thumb. Under no circumstances should the plug be knocked in with tools (hammer or similar).

4. It must be ensured that the water refilling plug is completely seated in the cell.



5. The tubes are fitted, making sure that they are fully seated on the tube connection piece.



7.3. Maintenance of the water refilling cart

The water refilling cart is almost maintenance-free. Regular charging of the internal lead-acid battery is necessary to maintain the function. Charge this internal lead-acid battery while the water refilling cart is not in use, as often as possible after each use. It is also recommended to charge the internal lead-acid battery at least every 3 months for 24 hours.

8. Troubleshooting



Note

Carry out all work on the battery system uninstalled, i.e. mechanically separated from the vehicle.

8.1. Visual inspection

The water refilling system must be correctly installed:

- No loose or leaky tubes or plugs
- No bent tubes

8.2. Pressure testing



WARNING!

When checking the electrolyte level, contact with the electrolyte may occur. Potassium hydroxide solution can cause severe skin burns and eye damage.

Wear protective goggles and gloves (five-finger latex or PVC gloves) when working on the batteries.

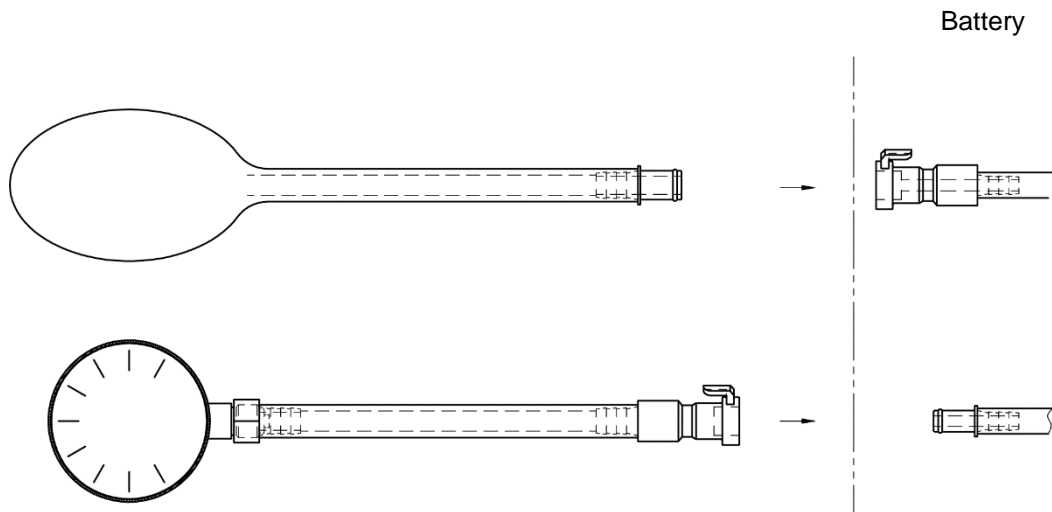
Required tools and aids:

- Pressure tester set consisting of bellows pump and manometer (HOPPECKE Mat. No.: 4151900000)
- Leak detection spray

1. Disconnect the quick connectors with the backfire protection from the battery.



2. Connect the pressure gauge on one side of the water refilling system of the battery to be tested and the bellows pump on the other side, as shown in the figure below.



3. Press the bellows pump several times until the pressure gauge indicates a pressure of 0.2 bar. The pressure must remain stable for at least 30 seconds and must not drop more than 0.02 bar during this time. If this condition is met, the battery system has been successfully tested.



Note

If you cannot build up pressure or the pressure is not stable for more than 30 seconds, carry out a leakage search (e.g. with leakage search spray). Replace leaking components (e.g. tubes and plugs).

4. Disconnect the manometer and the bellows pump from the battery system.



WARNING!

When checking the electrolyte level, contact with the electrolyte may occur. Potassium hydroxide solution can cause severe skin burns and eye damage.

Wear protective goggles and gloves (five-finger latex or PVC gloves) when working on the batteries.

5. Fit the quick connectors with the backfire protection back to the battery system.

8.3. Error messages of the water refilling cart

8.3.1. Error message E1

Flow – no water flow

Corrective actions:

- Control if the water container is empty. Refill with deionized/distilled water if necessary.
- If the flow sensor is damaged, contact the Hoppecke Service.

8.3.2. Error message E2

Pressure – pressure too high

Corrective actions:

- Control if there are bended or blocked hoses and correct if necessary.
- Control for blocked or damaged connector couplings on the battery. Clean or replace the couplings if ne necessary.
- In this case, the current filling process must be interrupted. The electrolyte levels of the battery system must be checked manually and filled up manually to maximum level if necessary. The cart can be used again for the next filling process on another battery system by pressing the start button.

8.3.3. Error message E3

Prism – prism sensor failure (also too short time to fill prism)

Corrective actions:

- If the prism is damaged, contact the Hoppecke Service.

8.3.4. Error message E4

Stop – usage of Stop button during water filling

Corrective actions:

- In this case, the current filling process must be interrupted. The electrolyte levels of the battery system must be checked manually and filled up manually to maximum level if necessary. The cart can be used again for the next filling process on another battery system by pressing the start button.