Document Management

Document History

Version	Date	Responsible party	Reason for change
000	08.10.2012	Th. Schreckenberg	First Issue
001	06.02.2013	Th. Schreckenberg	Material Numbers added, expressions modified
002	19.02.2013	Th. Schreckenberg	Mat. No. for 110VAC waterfilling cart added
003	12.12.2017	I. Fuhrmann	Additions regarding the quality of the water
004	14.06.2018	I. Fuhrmann	Fine-tuning in chapter 4 and 6
005	30.01.2019	I. Fuhrmann	Note on checking the electrolyte level chapter 4

Contents

1 Safety notes

It is assumed that qualified personnel only shall be deployed for the operation and maintenance of the components available. Qualified personnel are individuals who, on the basis of their education, experience and training, and their knowledge of the relevant standards, regulations, accident prevention guidelines and operating conditions, are authorised by those responsible for the safety of the components/system to perform the respective necessary activities, and thereby identify and prevent any potential hazards. Among other things, knowledge of first aid measures and the local emergency services is required.

Failing to observe the operating instructions, not using original replacement parts when carrying out repairs, performing unauthorised actions, or introducing additives to the electrolyte, shall invalidate the warranty.

The following precautionary measures relate to the handling of Ni-Cd batteries and must always be observed with respect to all the work instructions given in these operating instructions.

Observe and follow the assembly and installation instructions and make them visibly available at the installation site.
Only trained personnel may perform work on batteries. The instructions for use must always be accessible to the persons in charge of handling the rechargeable batteries.

When working on batteries, wear safety goggles and protective clothing. The accident prevention regulations must be observed and followed.

Smoking is prohibited! No open flames, embers or sparks are allowed in the vicinity of the battery as they pose an explosion and fire hazard.

Explosion and fire hazard; avoid short circuits.
Caution! As all metal parts contained within the battery cell are constantly energised, do not place any foreign objects or tools on the battery. Adequate ventilation must be provided in the battery room so that the explosive gases generated during charging are removed (DIN EN 50272-2).

Keep an eye rinsing bottle ready at hand. Rinse eyes or skin sprayed with alkali with plenty of clean water. Consult a doctor immediately. Wash clothing contaminated with alkali with water.

Electrolyte is highly corrosive. During normal operation it is not possible to come into contact with the electrolyte. Electrolyte can get released only if the cell housing gets damaged.

Do not tilt the battery. The cells are very heavy. Use only approved lifting and transportation equipment, e.g. lifting gear. Lifting hooks must not cause damage to cells, connectors or cables.

Dangerous electrical voltage. Use only tools and measuring instruments that are suitable and appropriate.

Ni-Cd batteries or cells fall under the fire class E (see DIN EN 2). In the event of electrical fires, it may happen that the devices and equipment are live! Water and foam used for extinguishing fires are ideal electrical conductors. You may suffer electric shocks. Electrical fires must be extinguished using fire extinguishing powder or carbon dioxide, CO_2.

2 First-Aid Measures

Eye contact with the electrolyte

- Rinse immediately with plenty of water for at least 10 minutes.
- Rinse the eyes with boric acid solution if it is available.
- Get comprehensive instructions at an eye clinic.

Skin contact with the electrolyte

- Remove clothing soaked with the electrolyte immediately and wash off the main body parts affected with plenty of water. In case of complaints, consult a doctor.
- Skin that has come into contact with the electrolyte shows a soapy consistency, which means that it must continue to be rinsed with water until this condition is eliminated.

Swallowing electrolyte

- Gargle with plenty of water and drink large quantities of water repeatedly.
- Do not cause vomiting. Call for an emergency doctor promptly.

3 System Description

3.1 Waterfilling plugs

The plugs used to top up distilled water work without any moving parts. The water is pumped with a steady flow rate into the top-up system and flows into the cells one after the other. In the process, the air inside the cells escapes through the vertical tube. As soon as this tube gets submerged when the electrolyte reaches the maximum level, air can no longer escape and water intake is prevented.
The waterfilling plug is sealed off from the cell with two O-rings so that air may escape through the plug but not directly from the cell. This is absolutely necessary for the cell to work.

Figure 1: Waterfilling plugs

3.2 Flame arrestor

Hydrogen and oxygen formed while charging are fed through the hose pipes to a central de-gasification facility with flame arrestor and, thus, released into the environment in a controlled manner.

Figure 2: Flame arrestor

3.3 Waterfilling system

The waterfilling plugs are provided with two hosepipe connections each. The individual plugs are connected to one another with hose pipes and, in this manner, connected virtually in series to a water top-up chain. A hosepipe with a quick coupler is fixed at the first and last plug in the series. The flame arrestor is installed during normal operation. To fill up the battery, it is removed and the waterfilling cart is connected to the battery with the help of the quick couplers. The topping up procedure may be started using the appropriate button and then runs completely automatically. Water is pumped with a steady flow rate into the system starting from the first plug and flows back into the waterfilling cart when all cells have been topped up one after another. The water flows into an internal intermediate tank from there. If this tank is full, the excess water is extracted from the top-up system and the internal tank and pumped into the external residual water tank. The top-up procedure is completed with this step. The waterfilling cart may now be disconnected from the battery at the quick couplers and the flame arrestor system may be reinstalled.

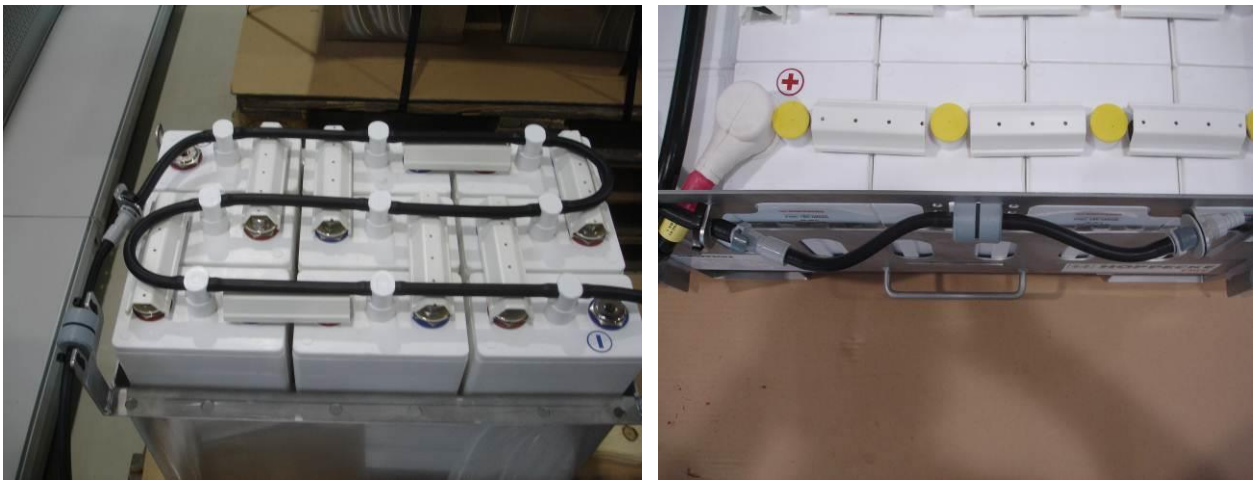


Figure 3: Battery completely assembled and connected with hose pipes / Water connection with the flame arrestor installed

3.4 Waterfilling cart

The waterfilling cart with a 60 litre tank enables simple topping up of the batteries at site. The cart may be pulled easily with the handle. The cart is provided with an internal rechargeable battery in order to ensure the maximum degree of portability.

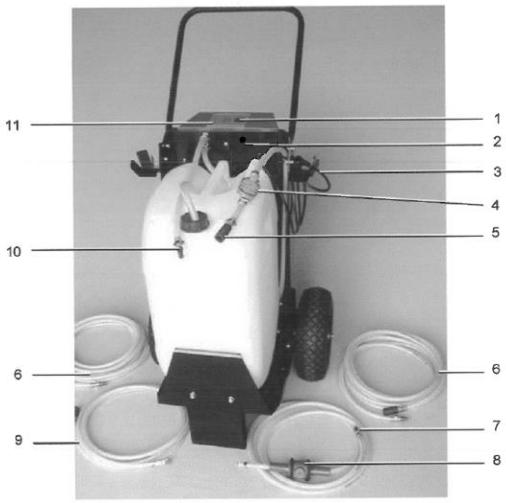


Figure 4: Waterfilling carte, front view

Caution:
The waterfilling cart must be stored and operated at temperatures > 0°C in order to prevent the distilled water from freezing in the tank and inside the carriage. It may get damaged otherwise.

Caution:
Required quality of the water:
IEC EN 60 993

1: Start button
2: On/Off switch
3: Power supply 230V
4: Filter
5: Return flow quick coupler
6: Extension hosepipe (2 pieces, 6 m each)
7: Return flow hosepipe, 4 m
8: Ventilation valve
9: Inlet hosepipe, 4 m
10: Inlet quick coupler
11: Display
12: Residual water tank

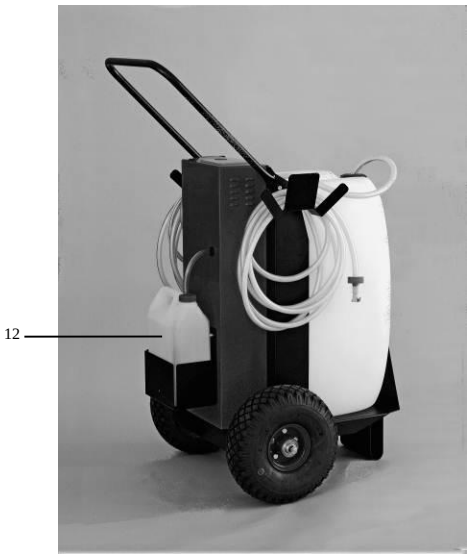
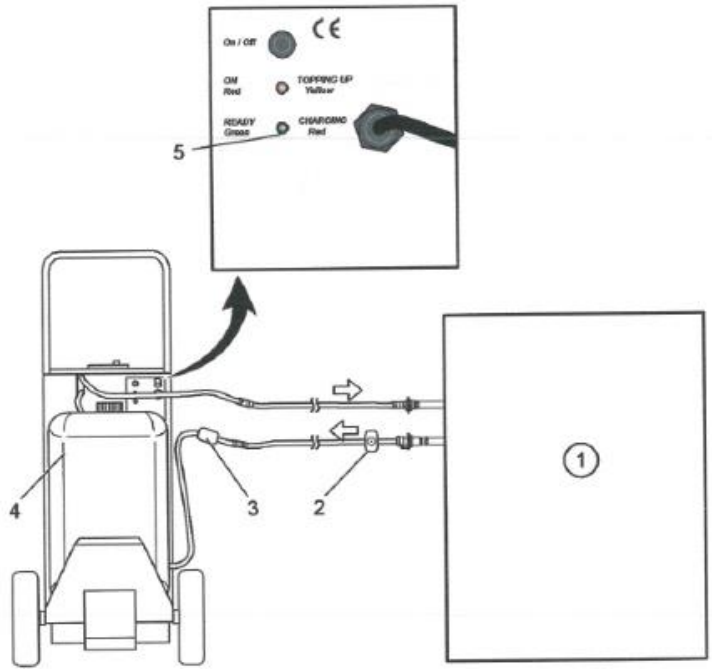


Figure 5: Waterfilling cart, side view

4 Filling up the battery with distilled water

4.1 Prior to Filling



1: Battery
2: Ventilation valve
3: Filter
4: Water tank
5: Pilot lamp

Figure 6: Connecting the waterfilling cart

- Before refilling distilled water, check the electrolyte levels. Refer to the battery system's project-specific documentation for instructions
- Ensure that the battery of the waterfilling cart is charged (LED 5 lights up in green colour).
- The storage tank must be filled up sufficiently.
- The residual water tank must be empty.

1. Detach the flame arrestor from the battery.

2. Connect both the hose pipes of the waterfilling cart to the battery using the quick couplers.

Caution:
Disconnect the waterfilling cart from the mains supply; it should not be connected to the mains during the filling operation.

4.2 Filling Operation

1. Switch on the waterfilling cart; the software version is displayed for 10 seconds.

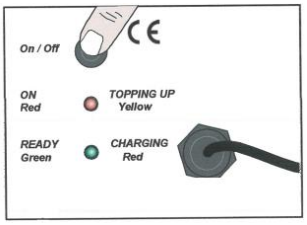


Figure 6: Switching on

2. Start the filling operation with the help of the Start button. The pilot lamp lights up in yellow.

Figure 7: Display of the software version

Note:
The filling operation runs automatically. As soon as all cells have been filled, the waterfilling cart extracts excess water from the connected hose pipes. The filling operation takes a few minutes depending on the number of cells and the water level in the cells.

Note:
Avoid overfilling.
Carry out the refilling activity once only per maintenance interval.
Repeated triggering of the refilling activity at the same maintenance interval can overfill the battery system. This can lead to leakage of electrolyte and a higher pollution of the battery system during operation.
In addition, overfilling will change the electrolyte density and the performance of the battery can be negatively affected.
If cells are filled above maximum level, contact HOPPECKE service.

4.3 After the Filling Operation

After the water refill car has stopped pumping, the battery is fully charged. The display shows the amount of water replenished in litres.

1. Disconnect the hose pipes from the waterfilling cart at the appropriate quick couplers.
2. Reinstall the flame arrestor with the help of the quick couplers.
3. Drain the water extracted from the small tank.
4. Shut down the waterfilling cart and, if required, connect it to the 230V mains supply to charge up the internal rechargeable battery.

Caution:
The water extracted may contain alkaline residues! Please observe and follow the local / relevant provisions for disposal.

5 Service and Maintenance

5.1 General notes:

The water refilling system is almost maintenance-free and does not require any intensive service. Hence, the system is subjected only to visual inspection. If required, individual plugs, hose pipes or fastening material that has become defective may be replaced.

During maintenance, the following points must be attended to:

- Please take special care to ensure that the hosepipe connecting pieces are not contaminated or do not get damaged. Nonetheless, if contamination is found, clean the relevant components with clean water.
- The hosepipe of the waterfilling cart should not get twisted.
- The tank of the waterfilling cart must always be filled up with a sufficient quantity of distilled water (The water quality should conform to IEC EN 60 993).
- The waterfilling plugs on the battery should not be damaged. Any damaged plug must be replaced with a new one. Damaged plugs may lead to overfilling of cells and discharge of water and electrolyte.

5.2 Replacing a waterfilling cart

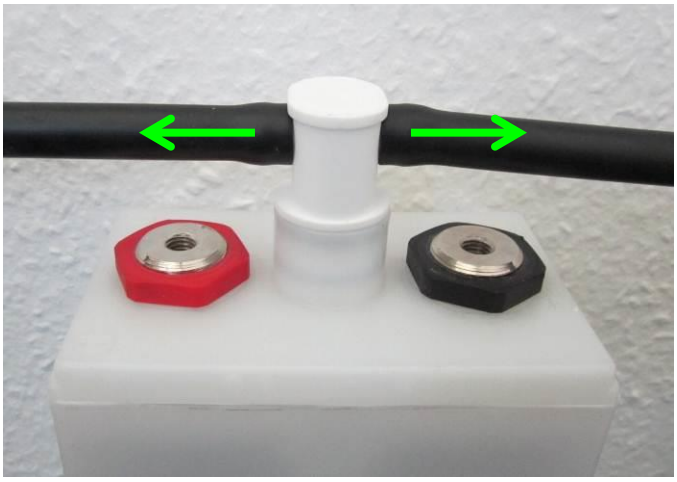


Figure 8: Cell with waterfilling plug installed

1. Pull out the hose pipes from the associated connecting pieces.

Figure 9: Removing the plug

2. Pull the plug out, vertically up from the cell. It should not be tilted while doing so.

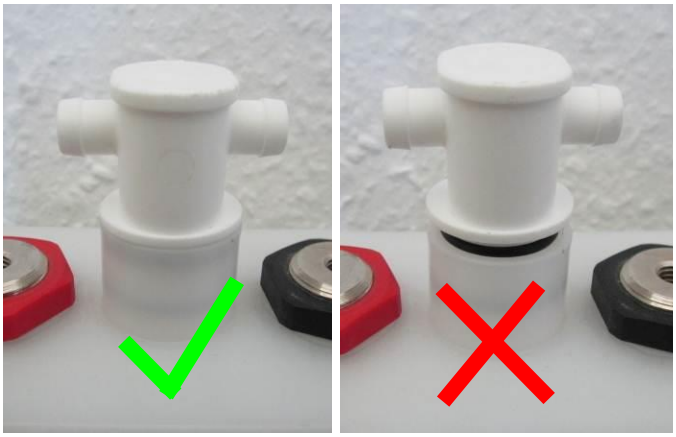


Figure 10: Proper fit of the plug

3. Inserting the new waterfilling plug: The waterfilling plug must be inserted straight into the cell. It must be possible to slide it in by pressing lightly on it with the ball of the hand. The plug should not be hammered in with tools (hammer or something similar) under any circumstances.

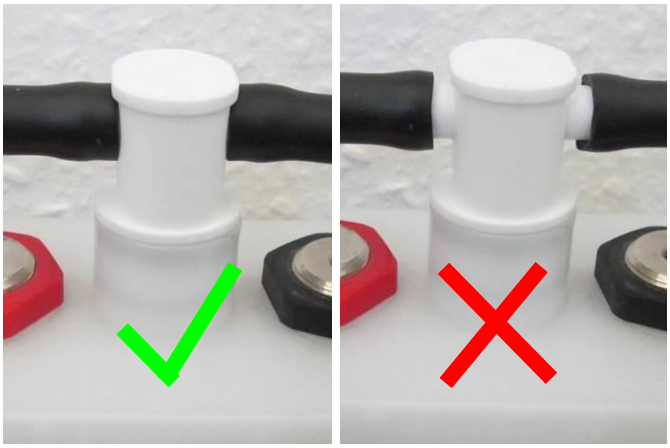


Figure 11: Proper fit of the hose pipes

4. It must be ensured that the waterfilling plug fits completely in the cell.

5. The hose pipes are inserted. Whilst doing so, it must be ensured that they fit completely into the connecting piece for the hosepipe.

6 Components

The water refilling system consists of the following components:

Illustration of the components	Name / Description of the components
	Waterfilling cart, complete 230VAC: 414 700 0230 Optional 110VAC: 414 700 0235

All other components are project-specific and are listed in the illustrated parts list (BOM) of the respective project.

7 Appendix: Important aspects for proper filling

Procedure:

- Repeated start-up of the filling operation may lead to the cells getting overfilled. As soon as the waterfilling cart has shut down, all cells are completely filled.
- Ensure that the waterfilling cart is connected to the proper power supply when charging it.
- While filling, the waterfilling cart should not be connected to the mains supply.
- The waterfilling cart should be stored and operated only at temperatures > 0°C.

Installation:

- Avoid the hose pipes from getting entangled since the flow rate would otherwise get reduced. The hose pipes should not get twisted. If angles of 90° are required, appropriate angular connectors must be used. Hose pipes of different diameters should not be used on one battery.
- Take care to see that all hose pipes fit securely on the connecting pieces of the plugs and that the plugs are installed properly in the cells. Leakages resulting from improper installation affect the proper working of the system and lead to the cells getting overfilled and discharge of the electrolyte.