

# INSTALLATION, OPERATING MAINTENANCE INSTRUCTIONS

**PowerSafe®**

type RL ..., RM ..., RN ..., RH ...

Battery voltage:

Capacity (5 h):

Type of cell:

Number of cells:

Assembled and commissioned by:

Date:

## Warning!

The gases emitted during charging are explosive. The electrolyte (potassium hydroxide, KOH) is highly corrosive. Exposed metal parts of the battery always conduct a voltage and are electrically active parts. Precautions in accordance with **DIN EN 50272, Part 2** have to be observed.



Observe the instructions for use and place them visibly close to the battery! Work only on batteries after receiving instruction from qualified personnel!



Warning: Risk of fire, explosion, or burns! Avoid any short circuit! Metallic parts under voltage on the battery, do not place tools or items on top of the battery!



When working on batteries wear safety glasses and protective clothing. All metallic personal objects, such as rings, watches, bracelets etc. shall be removed before starting work on the battery! Only use insulated tools! Comply strictly with the accident prevention regulations and your national Health and Safety standards as well as **DIN EN 50272, Part 1**.



Electrolyte is highly corrosive!



Cells are heavy!  
Make sure they are safely installed!  
Only use suitable transport equipment!



Electrolyte is harmful to skin and eyes. Therefore, after an accidental contact with the electrolyte flood the eyes immediately with large quantities of clean water for an extended period of time of at least 15 minutes. In all cases, consult a doctor immediately!  
Clothing contaminated with electrolyte should be washed in water immediately!



No smoking! Do not allow naked flames, embers or sparks near the battery due to the risk of explosion or fire!

The Installation, Operation and Handling Instructions must be strictly observed. Non-compliance with the Maintenance and Handling Instructions, replacing with unoriginal spares, usage other than specified, use of additives to the electrolyte and unauthorized tampering will invalidate any entitlement to warranty.



Ni-Cd

Used batteries with this symbol are reusable products and have to be put into a recycling system. Used batteries must be disposed of as special waste in accordance with all standards.



Cd

**WARNING!**  
**Never use sulphuric acid or acidic water.**  
**Acid will damage the battery!**

## 1. Receiving the battery

The cells are not to be stored in packaging, therefore, unpack the battery immediately after arrival. Do not overturn the package. The battery cells are equipped with a blue plastic transport plug. The battery can be delivered:

- **Filled and charged/** the battery is ready for installation. Replace the transport plug with the vent cap included in our accessories just before use;
- **Filled and discharged/** Replace the transport plug with the vent cap included in our accessories just before use; or
- **Unfilled and discharged/** do not remove the transport plug until ready to fill the battery.

**The battery must not be charged with the transport plug in the cells as this can damage the battery.**

## 2. Storage

The rooms provided for storing the batteries must be clean, dry, cool (+10 °C to 30 °C - in compliance with IEC 60623) and well ventilated. The cells are not to be stored in closed packaging and must not be exposed to direct sunlight or UV-radiation.

**If the cells are delivered in plywood boxes, open the boxes before storage and remove the packing material on the top of the cells. If the cells are delivered on pallets remove the packing material on the top of the cells.**

### 2.1 Uncharged and unfilled cells

Provided the correct storage conditions are met then the cells and batteries can be stored for long periods without damage if they are deeply discharged, drained and well sealed. It is very important that the cells are sealed with the plastic transport plug tightly in place. It is necessary to check after receipt and at least every year. Leaky plugs allow the carbon dioxide from the atmosphere to infiltrate the cell, which will result in carbonation of the plates. This may influence the capacity of the battery.

### 2.2 Charged and filled cells/ discharged and filled cells

Filled cells can be stored for up to 12 months from the time of delivery. Storage of filled cells at a temperature above +30 °C results in loss of capacity of approximately 5% per 10% year. It is very important that the cells are sealed with the plastic transport plugs tightly in place. In case of loss of electrolyte during transportation, refill the cell with distilled water to the "MAX" mark before storage.

## 3. Installation

EN 50272-2:2001 "Accumulators and battery installations, stationary battery installations" is binding for the setting up and operation of battery installations. For non stationary installations specific standards are valid.

### 3.1 Location

Install the battery in a dry and clean room. Avoid direct sunlight and heat in all cases. The battery will give the optimal performance and maximum service life if the ambient temperature lies between + 10 °C and + 30 °C.

### 3.2 Ventilation

During the last part of charging the battery, gases (oxygen and hydrogen mixture) are emitted. At normal float charge the gas evolution is very small but some ventilation is necessary. **Special regulations for ventilation might be required in your area for certain applications. If no regulations are fixed DIN EN 50272, Part 2:2001 should be met.**

### 3.3 Setting up

Always follow the assembly drawings, circuit diagrams and other separate instructions. The transport plugs have to be replaced by the vent caps included in the accessories. If batteries are supplied "filled and charged" , all the electrolyte levels should be checked and, if necessary, topped up as described in point 3.4.

Cell connectors and/or flexible cables should be checked to ensure they are tightly seated. Terminal nuts, screws and connectors must be tightly seated. If necessary, tighten with a torque wrench.

#### **Torque loading for:**

M10: 8 Nm

M16: 20 Nm

M20: 25 Nm

#### **Female thread:**

M 8: 20 – 25 Nm

M10: 25 – 30 Nm

The connectors and terminals should be corrosion-protected by coating with a thin layer of anti-corrosion grease.

### 3.4 Electrolyte

The electrolyte for NiCd batteries consists of diluted caustic potash solution (specific gravity 1.20 kg/litre ± 0.01 kg/litre) with a lithium hydroxide component, in accordance with IEC 60993. The caustic potash solution is prepared in accordance with factory regulations. The specific gravity of the electrolyte does not allow any conclusion to be drawn on the charging state of the battery. It changes only slightly during charging and discharging and is only minimally related to the temperature.

- **Battery delivered unfilled and discharged/** if the electrolyte is supplied dry, it is to be mixed to the enclosed mixing instruction. Remove the transport plugs from the cell just before filling. Fill the cells up to 20 mm above the lower level mark "MIN". Steel cased cells have to be filled up to the top edge of the plates. When using battery racks fill cells before installing. Only use genuine electrolyte.
- **Battery delivered filled and charged or discharged/** check electrolyte level. It should not be less than 20 mm below the upper level mark "MAX" (see 5.2).

### 3.5 Commissioning

A good commissioning is very important. The following instructions are valid for commissioning while 20 °C to 30 °C. For different conditions please contact the manufacturer. Charging at constant current is preferable. If a site test is requested it has to be carried out in accordance with IEC 60623.

**According to IEC 60623, 0.2 C<sub>5</sub>A is also expressed as 0.2 I<sub>t</sub>A. The reference test current I<sub>t</sub> is expressed as:**

$$I_t A = \frac{C_n Ah}{1 h}$$

#### **Example:**

0.2 I<sub>t</sub>A means:

20 A for a 100 Ah battery or

100 A for a 500 Ah battery

#### 3.5.1 Commissioning with constant current

**Battery delivered unfilled and discharged /**after a period of 5 hours from filling the electrolyte, the battery should be charged for 15 hours at the rated charging current 0.2 I<sub>t</sub>A. Approximately 4 hour after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark "MAX" by using only genuine electrolyte. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

**Battery delivered filled and discharged /**the battery should be charged for 15 hours at the rated charging current 0.2 I<sub>t</sub>A. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark "MAX" by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level".

During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.

**Battery delivered filled and charged and stored for more than 12 months/** the battery should be charged for 15 hours at the rated charging current 0.2 I<sub>t</sub> A. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark “MAX” by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the “Instruction for the control of electrolyte level”. **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.**

**Battery delivered filled and charged/** a 5 hour charge at the rated charging current 0.2 I<sub>t</sub> A must be carried out before putting the battery into operation. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark “MAX” by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the “Instruction for the control of electrolyte level”. **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.**

### 3.5.2 Commissioning with constant voltage

If the charger’s maximum voltage setting is too low to supply constant current charging, divide the battery into two parts that will be charged individually.

**Battery delivered unfilled and discharged /** after a period of 5 hours from filling the electrolyte, the battery should be charged for 30 hours at the rated charging voltage of 1.65 V/cell. The current limit should be 0.2 I<sub>t</sub> A maximum. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark “MAX” by using only genuine electrolyte. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the “Instruction for the control of electrolyte level”. **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.**

**Battery delivered filled and discharged/** the battery should be charged for 30 hours at the rated charging voltage of 1.65 V/cell. The current limit should be 0.2 I<sub>t</sub> A maximum. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark “MAX” by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the “Instruction for the control of electrolyte level”. **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.**

**Battery delivered filled and charged and stored for more than 12 months/** the battery should be charged for 30 hours at the rated charging voltage of 1.65 V/cell. The current limit should be 0.2 I<sub>t</sub> A maximum. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark “MAX” by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the “Instruction for the control of electrolyte level”. **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.**

**Battery delivered filled and charged/** a 10 hour charge at the rated charging voltage of 1.65 V/cell must be carried out before putting the battery into operation. The current limit should be 0.2 I<sub>t</sub> A maximum. Approximately 4 hours after the end of charging, the electrolyte level should be adjusted to the upper electrolyte level mark “MAX” by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the “Instruction for the control of electrolyte level”. **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the “MIN” mark.**

## 4. Charging in Operation

### 4.1 Continuous battery power supply (with occasional battery discharge)

Recommended charging voltage for ambient temperatures + 20 °C to + 25 °C. Do not remove the vent caps during float-, boost charge and buffer operation. The current limit should be 0.3 I<sub>t</sub> A maximum in general.

### 4.1.2 Two level charge

Floating: 1.40 – 1.42 V/cell  
Boost charge: 1.55 – 1.70 V/cell

A high voltage will increase the speed and efficiency of recharging the battery.

### 4.1.3 Single level charge

1.45 – 1.50 V/cell

### 4.2 Buffer operation

Where the load exceeds the charger rating.

1.45 – 1.55 V/cell

## 5. Periodic Maintenance

The battery must be kept clean using only water. Do not use a wire brush or solvents of any kind. Vent caps can be rinsed in clean water if necessary but must be dried before using them again.

Check regularly (approximately every 6 months) that all connectors, nuts and screws are tightly fastened. Defective vent caps and seals should be replaced. All metal parts of the battery should be corrosion-protected by coating with a thin layer of anti-corrosion grease. **Do not coat any plastic part of the battery, for example cell cases!**

Check the charging voltage. If a battery is parallel connected it is important that the recommended charging voltage remains unchanged. The charging current in the strings should also be checked to ensure it is equal. These checks have to be carried out once a year. High water consumption of the battery is usually caused by improper voltage setting of the charger.

### 5.1 Equalizing charge

It is recommended to carry out an equalizing charge once a year to maintain capacity and to stabilize the voltage levels of the cells. The equalizing charge can be carried out for 15 hours at 0.2 I<sub>t</sub> A or with the boost charging stage in conformity with the characteristic curve of the available charging equipment. The electrolyte level must be checked after an equalizing charge.

In order to equalize the floating derating effect, it is recommended to charge the battery once a year for 15 hours at the rated charging current 0.2 I<sub>t</sub> A. Then discharge the battery down to 1.0 V/cell and charge again for 8 hours at the rated charging current 0.2 I<sub>t</sub> A.



## 5.2 Electrolyte check and topping up

Check the electrolyte level and never let the level fall below the lower level mark "MIN". Use only distilled or deionized water to top-up the cells in accordance with IEC 60993. Experience will tell the time interval between topping-up. Refilling with electrolyte is only permissible if spilled electrolyte has to be replaced. If during refilling or topping up electrolyte has been splashed onto the cell cover or between the cell cases, clean this off and then dry the area.

**NOTE: Once the battery has been filled with the correct electrolyte either at the factory or during the battery commissioning, there is no need to check the electrolyte density periodically. Interpretation of density measurements is difficult and could lead to misunderstandings.**

## 5.3 Replacing of electrolyte

In most stationary applications the electrolyte will retain its effectiveness for the total lifetime of the battery. However, under special battery operating conditions, if the electrolyte is found to be carbonated, the battery performance can be restored by replacing the electrolyte. **Only use genuine electrolyte!**

It is recommended to change the electrolyte when reaching a carbonate content of 75 g/litre. It is possible to test the electrolyte in the manufacturer's laboratory. For this, a minimum quantity of 0.2 litres of electrolyte in a clean glass or polyethylene container should be sent in, paying strict attention to the valid dangerous goods regulations. The sample of electrolyte should be taken half an hour after charging has ended and from several cells of the battery. Do not take the samples immediately after topping up. The electrolyte sample and the cells should be closed immediately after the electrolyte has been taken.

**CAUTION – caustic potash solution is highly corrosive!**

## 5.4 Electrolyte temperature

The temperature of the electrolyte should never exceed 45 °C as higher temperatures have a detrimental effect on the function and duration of the cells. In the course of charging, aim for an electrolyte temperature of  $\leq 35$  °C. On exceeding 45 °C the charging should be temporarily interrupted until the electrolyte temperature falls down to 35 °C. The temperature measurements are to be made on one of the cells in the middle of the battery. Low ambient or electrolyte temperatures down to -25 °C do not have any detrimental effect on the battery. They just cause a temporary reduction in capacity.

## 6. Additional Warning notes

NiCd batteries must not be installed or stored in the same room as lead acid batteries. In addition to this, the charging gases from lead acid batteries must be kept away from Ni-Cd batteries by suitable precautions such as ventilation or hermetic isolation of the rooms. Tools for lead acid batteries must not be used for NiCd batteries.

Do not place electrically conductive objects such as tools, etc. on the battery!

**Risk of short circuit and fire!**

No rings or metal bracelets should be worn during the assembly of the battery – **Risk of injury!**

Open the doors of the battery cabinet during charging so that the charging gases can escape. The charging gases from batteries are explosive. Do not allow open fire or ember in the vicinity of the battery!

**Risk of explosion!**

**Caution – potassium hydroxide (KOH) solution is highly corrosive!**

Potassium hydroxide (KOH) solution is used as electrolyte. Potassium hydroxide (KOH) solution is a highly corrosive liquid which can cause severe damage to health if it comes into contact with the eyes or the skin (risk of blinding). If even small quantities are swallowed there is a possibility of internal injuries.

**When working with electrolyte and on cells / batteries rubber gloves, safety goggles with side guards and protective clothing must always be worn!**

**Contact with the eyes:** Flush out immediately with abundant amounts of water for 10 – 15 minutes. If necessary consult an eye clinic.

**Contact with the skin:** Remove splashed clothing immediately and wash the affected skin areas with abundant amounts of water. For any discomforts consult a doctor.

**Swallowing:** Rinse out the mouth immediately with abundant amounts of water and keep drinking large amounts of water. Do not provoke vomiting. Call an emergency doctor immediately.

**In the event of injuries:** Rinse thoroughly for a long period under running water. Consult a doctor immediately.



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