

Maintenance and Handling Instructions of NiCd-Accumulators

Battery voltage:	Capacity (5h):
Type of cells:	Number of cells:
Assembly and commissioning by:	Date:

Warning!

The gasses given off when charging are explosive. The electrolyte (potash lye) is strong etching. Exposed metal parts of the battery always carry a voltage and are electrically live. Protective measures in accordance with DIN VDE 0510 Part 2 must be adopted.



Observe the instructions for use and position them visibly near the battery! Only work on batteries after instruction by expert personnel!



When working on batteries wear safety glasses and protective clothing! Comply with the accident prevention regulations and also with DIN VDE 0510, VDE 0105 P.1



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



Flush splashes of lye out of the eyes or off the skin with copious amounts of clean water. Then get to a doctor without delay. Clothing contaminated by lye should be washed in water with minimum delay!

Risk of explosion and fire - avoid short circuits! Warning! Metal parts of the battery are always live so never place objects or tools on the battery!



Electrolyte is strong etching!



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

Non-compliance with the Instructions for Maintenance and Handling, repairing with non-genuine spares, usage outside that specified, use of additives to the electrolyte and unauthorised tampering will invalidate any entitlement to warranty.



Return to the manufacturer:

Old batteries with this symbol are reusable products and must be put into the recycling system.

Old batteries which are not put into the recycling system must be disposed of as special waste in accordance with all the regulations.



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

General

Cells and batteries are to be used to supply power to electrical equipment in accordance with the directions.

1. Set up / commissioning

VDE 0510 Part 2 "Accumulators and battery installations, stationary battery installations" must be complied with when setting up and operating battery equipment. For non stationary installations specific standards are valid.

Always comply with the assembly drawings, circuit diagrams and other separate instructions. Any plugs which are fitted to the cell opening for transportation must be removed. Where batteries are supplied "filled and charged" the electrolyte level should be checked first and if necessary topped up as directed in point 7.

Cell connectors and/or flexible cables should be checked to ensure they are firmly seated.

Terminal nuts and connectors must be firmly seated. If necessary tighten with a torque spanner (Torque loading for M10: 8 Nm; M16: 20 Nm; M20: 25 Nm; female thread M10: 25 – 30 Nm).

For batteries which are supplied filled and charged, a 5 hour charge at the rated charging current I_5 must be carried out before putting the battery into service for the first time.

Where batteries are supplied "unfilled and uncharged" the cells will need to be filled up to the lower electrolyte level marking with the appropriate electrolyte before putting the battery into service for the first time. Cells with steel cases are to be filled up to the top edge of the plates.

After a standing period of 5 hours the battery should be charged for 15 hours at the rated charging current I_5 . Approximately one hour after the end of charge the electrolyte level should adjusted so that it is at the upper electrolyte level marking. On cells with steel cases the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level".

After the cells have been in transport or storage for long periods the battery should be charged after assembly for 15 hours at the rated charging current I_5 and then discharged at the rated current to 1,0 V/cell. Following this it should be charged again for 15 hours at the rated charging current. During the charge the electrolyte temperature should be observed – see point 10.

2. Storage 2.1. Discharged and empty cells

Cells and batteries can be stored for long periods without damage if they are deeply discharged, drained

and well sealed under attention of the correct conditions.

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

It is very important that the cells are sealed with the plastic transport seals firmly in place. It is necessary to check after receipt and at last yearly. Failure of seal will cause the enter of carbon dioxide from the atmosphere in the cell and which will result in carbonation of the plates and can affect the capacity of the battery.

2.2. Charged and filled cells / Discharged and filled cells

Filled cells are permitted to store at most 12 month from time of delivery.

The rooms provided for this must be clean, dry, cool and well ventilated $(+10^{\circ}C \text{ to } 30^{\circ}C \text{ - in compliance with IEC 60623}).$

Storage of filled cells at a temperature above +30°C result in loss of capacity. This can be as approximate 5% per 10 degree when the temperature exceed above +30°C.

The cells are not allowed to store in the packaging and must not be exposed to direct sunlight or UV-radiation respectively.

It is very important that the cells are sealed with the plastic transport seals firmly in place.

This is necessary to check after receipt of goods. In case of lost of electrolyte during transport, refill the cell until the "MIN" mark with electrolyte before storage.

3. Charging

3.1. Charging to W-characteristic curve (DIN 41775)

With this method of charging the charging current and its progression are essentially dependent on the time available for charging. Charging should be ended as soon as 140 % (charging factor 1.4) of the current previously taken out has been put back in by charging. The charging process is switched off either manually or automatically at approximately 1.55 volts per cell. The duration of the charge is determined by the initial charging current and also by the initial charging current and also by the progression of the characteristic curve of the charger. The initial charging current is to be restricted to a maximum of $1.5 \times I_5$. This will keep the temperature of the electrolyte and the gassing of the battery within reasonable limits.

The cell caps remain closed during the charge.

3.2. Charging in accordance with the IU-characteristic curve (DIN 41773 Part 2)

Here the rising battery charging voltage is limited to a value of 1,55 to 1,65 volts per cell. On reaching this cell voltage the charging current must be restricted to a maximum of 1,5 x I_5 . The charger must be suited to the special charging characteristics for NiCd batteries and upon reaching the above final charging voltage must switch off or switch over to float charging.

The cell caps remain closed during the charge.

3.3. Charging in accordance with the WU-characteristic curve

This process corresponds in principle to the charging with the IU characteristic curve.

3.4. Charging in accordance with the *I*-characteristic curve (DIN 41776)

Here the battery will be charged for 7 hours at constant charging current at ${\rm I}_{\rm 5}$.

140 % (charging factor 1.4) of the capacity (Ah) previously taken out must be put back in by charging.

The process is ended when the terminal voltage at constant charging current is no longer rising. Guide figure: 1.65 to 1.75 volts per cell, measurement interval: 0.5 h.

The voltage which is present at the end of the charge is influenced by the type of cell construction and the temperature of the electrolyte. Charging is switched off either by hand or automatically.

The cell caps remain closed during the charge.

3.5. Charging time

The charging time required to bring back the capacity is calculated by the following formula:

1,4 x rated capacity [Ah]

t [h] = -------mean charging current [A]

4. Equalising charge

The equalising charge is a through charge to retain the capacity and to stabilise the voltage levels of all the cells. The equalising charge is carried out over 15 hours at I_5 or with the boost charging stage to suit the characteristic curve of the available charger.

After an equalising charge check the electrolyte level.

5. Float charge (standby parallel mode)

Float charging compensates for the losses from the battery due to self discharge, thus maintaining its fully charged state. The charging current occurring due to

this should be app. 1 mA/Ah at 20 °C. Adherence to the above currents during float charging is based on the assumption that no current is being taken from the battery. The float charge voltage is 1.40 - 1.42 volts per cell.

5.1. Buffer operation

Buffer operation also compensates for the losses from the battery due to self discharge and in addition compensates for any short term discharges. The charging voltage is around 1.45 - 1.55 volts per cell. The reference temperature for the above voltage figures is 20 °C.

Do not open the cell caps during float charging or buffer operation.

6. Electrolyte

The electrolyte for NiCd batteries consists of dilute caustic potash solution (specific gravity 1,20 kg/litre \pm 0,01 kg/litre) with a lithium hydroxide component, in accordance with DIN – IEC 993. 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 state of charge of the battery. It changes only insignificantly during charging and discharging and is only minimally related to temperature.

7. Topping up with electrolyte or purified water

The electrolyte level must only be topped up using purified or distilled water complying with DIN – IEC 993.

Refilling with electrolyte is only permissible if spilled electrolyte has to be replaced. If during refilling or topping up the electrolyte is splashed onto the cell cover or between the cell cases it is imperative to clean this off and then dry the area.

See points 11 and 12.

8. Filling with electrolyte / replacing the electrolyte

Filling should always be carried out using genuine electrolyte.

The time for replacing the electrolyte is largely dependent on the operating and the ambient conditions.

A carbonate enrichment of the electrolyte, and thus a reduction in capacity, occurs due to the carbon dioxide in the atmosphere. It is recommended that the electrolyte be changed when a carbonate content of 75 g/litre is reached. It is possible to test the electrolyte in the works 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 applicable hazardous goods regulations. It is best to take the sample of electrolyte half an hour after charging has ended and from several of the cells in a

battery. It is pointless to 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 corrosive! Comply with point 12.

9. Discharging

The level of the discharge current is limited only by the temperature of the electrolyte as long as there is no other restriction with respect to the voltage drop. Deep discharges below 0.6 volts per cell must be avoided. If necessary an equalising charge as described under point 4 should be carried out after a deep discharge.

10. Temperature

The temperature of the electrolyte should never exceed 45 °C as higher temperatures have a detrimental effect on the functioning and life of the cells. In the course of charging an electrolyte temperature of 35 °C should be aimed for. If this is exceeded the charging current should be reduced or charging temporarily broken off. The temperature measurements are made on one of the cells at the centre of the battery.

Low ambient or electrolyte temperatures down to -25 °C have no lasting detrimental effect on the battery, they simply cause a temporary reduction in capacity.

11. General maintenance

The directions on the handling and operation of batteries in VDE 0510 Part 2, VDE 0100 and VDE 0105 must be complied with.

The battery and also its container and installation equipment must always be kept clean and dry. The nuts on the battery terminals must be checked at regular intervals to ensure they are seated firmly, i. e. around every 6 months. Clean cell caps regularly. Defective seals and cell caps should be replaced.

All bright metal parts on the cells such as battery terminals and cell connectors must be smeared at regular intervals with diluted, acid-free Vaseline. The cell cases are not included in this. Take care that the diluted Vaseline is not applied to plastic parts of the battery. Solvent based cleaning agents must not be used.

NiCd batteries must not be used 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 NiCd 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.

12. Warning Notes

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 assembly of the battery – <u>Risk of injury!</u>

Open the lid of the tray or container during charging so that the charging gases can escape. The charging gases from batteries are explosive. Do not allow naked flames or red-hot objects into the vicinity of the battery – <u>Risk of explosion!</u>

Caution – caustic potash solution is corrosive!

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

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

13. First aid measures

Contact with the eyes: Flush out immediately with copious 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 copious amounts of water. If it given trouble consult a doctor.

Swallowing: Wash out the mouth immediately with copious amounts of water and keep drinking large amounts of water. Do not bring about vomiting. Call an emergency doctor immediately.

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