

Assembly and Installation Instructions

Stationary Nickel-Cadmium Batteries with FNC cells

(Batteries / Racks / Cabinet)

It is assumed that only qualified personnel are engaged in assembly and installation of the components provided. Qualified personnel are persons who, on the strength of their training, experience and instruction, together with their knowledge of the relevant standards, provisions, accident prevention regulations and operating conditions, have been authorised by those responsible for the safety of the components / installation, to carry out the relevant necessary work, with the ability to recognise and avoid possible hazards. Amongst other things, knowledge of First Aid and of local rescue equipment are also necessary.



Failure to observe the instructions on use, repair with non-original parts, unauthorised intervention, or use of additives to the electrolyte shall render the warranty void.

Safety instructions

The following safety measures relate to the handling of batteries and are to be observed in connection with all operating instructions contained in these instructions.



Observe assembly and installation instructions and display visibly at point of installation. Work on batteries only after instruction by qualified staff. The operating instructions must always be accessible to personnel responsible for dealing with batteries.



Wear eye protection and protective clothing when working with batteries. Observe accident prevention regulations.



No smoking. No open flame, embers or sparks in the vicinity of the battery, to avoid risk of explosion and fire.



Explosion and fire risk, avoid short-circuits. Warning! Metal parts of the battery cells are always live. Never place objects or tools on the battery. Ensure adequate ventilation of the battery room, so that explosive gases produced during charging are drawn off (see DIN EN 50272-2).



Have eye rinsing bottle ready at hand. If electrolyte splashes into the eyes or onto the skin, rinse with plenty of clear water and seek immediate medical advice. Clothing contaminated with electrolyte is to be washed thoroughly.



Electrolyte is highly corrosive. In normal operation there is no possibility of contact with the electrolyte. Electrolyte is released only if the cell housing is destroyed.



Do not tilt the battery. Use only approved lifting and conveying equipment e.g. lifting gear. Lifting hooks must not cause damage to cells, connectors or connection cables.



Dangerous electrical voltage. Use only suitable tools and measuring instruments.

First Aid measures

Electrolyte in contact with the eyes:

- Rinse immediately with plenty of water for at least 10 minutes.
- If available, rinse the eyes with boric acid solution.
- Immediately visit the eye clinic/eye casualty department.

Electrolyte in contact with the skin:

- Immediately remove clothing contaminated by electrolyte, and wash affected areas of skin with plenty of water. Visit doctor if any problems occur.
- Skin which has been in contact with electrolyte has a soapy consistency. Continue rinsing with water until normal skin condition has been restored.

If electrolyte is swallowed:

- Rinse out mouth immediately with plenty of water, and repeatedly drink large amounts of water.
- Do not induce vomiting. Call emergency medical service immediately.

Protection against dangerous body contact currents

In stationary battery installations, measures must be taken to guard against direct and indirect contact. For battery installations this protection can take the form of obstacles or distance. Battery installations with a rated voltage of more than 120 V must be accommodated in enclosed, electrical operating areas. Doors of battery rooms and cubicles count as obstacles when they are identified by the following warning plates (fitted externally):

- Warning plate "Dangerous Voltage", if the battery voltage exceeds 60 V (see ISO 3864)

- Prohibition sign: "No fire, naked flame or smoking"
- Warning plate "Battery Room" to indicate electrolyte, explosive gases, dangerous voltages and currents.

Protection against direct contact may be provided through the insulation of live parts, by covering or enclosure, or by obstacles or distance. Batteries with a rated voltage of less than 60 V require no protection against direct contact. If covering or enclosure is chosen for protection against direct contact for a battery with a rated voltage in excess of 60 V, then at least protection type IP2X or IPXXB must be used.

Protection against indirect contact may be provided by means of automatic disconnection, by the use of equipment of protection class II or by isolation. In particular applications this protection may also be provided by the use of non-conductive areas or by earth-free, localised potential equalisation.

Certain protective measures require a protective conductor. These protective conductors may contain no switches or overcurrent devices. Battery racks or battery cubicles made of metal must be either connected to the protective conductor or else isolated from the battery and the point of installation. If overcurrent devices are used, then disconnection of the connected equipment must take place within five seconds.

Rack or cubicle assembly

Before commencing rack or cubicle assembly:

Before starting assembly it must be ensured that the battery room is clean and dry and has a door which can be closed. The battery room must, as described above in the section "Protection against dangerous body contact currents", be provided with warning signs conforming to DIN EN 50272-2. Particular attention should also be paid to the following:

- Ensure correct floor loading and floor quality (access routes and battery room)
- Ensure that the mounting surface (floor of the battery room or electrolyte tray) is resistant to electrolyte
- Protection against sources of ignition (naked flame, glowing matter, electrical switches) in the vicinity of the cell opening, 500 mm "filament distance" as specified in DIN EN 50272-2

- Ensure adequate ventilation
- Agreement with other persons working in the same room (ensures trouble-free installation).

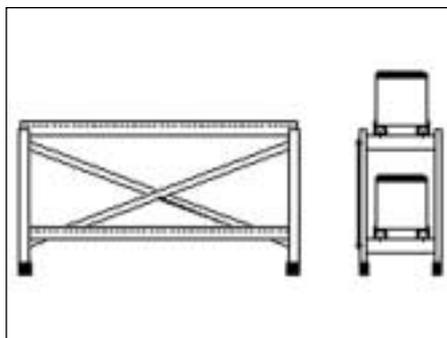
HOPPECKE will be pleased to help you in procuring suitable racking.

Scope of delivery of racks/ cabinets and documentation

The goods delivered should be checked for completeness and for any signs of damage. All parts should be cleaned if necessary. The accompanying documentation should be noted and followed. This documentation should comprise an assembly drawing for the rack or cubicle, together with battery connection instructions. If the documents required for correct assembly of the rack are missing, they should be requested before starting assembly. Only undamaged cells may be used, since otherwise the whole battery may be adversely affected by escaping electrolyte.

Rack assembly

The rack is assembled in accordance with the instructions supplied (example below).



We recommend that the individual side elements are assembled first. The side elements are then erected and the diagonal connectors are bolted to the reverse. The horizontal support rails on which the cells will subsequently stand are then assembled and screwed into place. The spacing of the support rails should correspond to the cell dimensions. Finally check the stability of the rack, and that all screw and clip connections are secure.

The rack is then brought into its final position and aligned using a spirit level and the spacer material supplied (e.g. adjustable insulators).

Setting-up the rack

The rack is set up in accordance with the erection drawing supplied. The follo-

wing minimum clearances are to be observed:

- Clearance between rack and wall: min. 50 mm
- Clearance between cell and wall: min. 100 mm
- Aisles between racks: min. 500 mm



If component voltages in excess of 120 V are reached or if the rated voltage of the battery is above this value, then a minimum distance of 1.5 m is to be maintained between non-insulated connections or connectors and earthed parts (e.g. water pipes, heating) and between the end terminals of the battery.

Setting-up the cabinets

Normally battery cubicles are supplied fully assembled. If however the cubicle is supplied in separate parts, then it should be assembled in accordance with the assembly drawing supplied, as for the racks. The following minimum clearances are to be observed:

- Clearance between cubicle and wall: min. 50 mm
- Aisles between cubicles: min. 500 mm



HOPPECKE FNC (fibre-structured) nickel-cadmium cells are designed for use solely in the upright position. These cells may never be installed in a lying position or tilted at an angle.

Ventilation requirements

It is essential to ensure that the battery room or cubicle has adequate ventilation. In subsequent operation, the ventilation of the battery room should keep the hydrogen concentration during battery charging below the threshold of 4% by volume, in accordance with DIN EN 50272-2.

The volume of air which must be changed hourly may be calculated by the following formula:

$$Q = 0.05 * n * I$$

Q = volume of air in m³/h

n = number of individual cells in the battery

I = charging current in A

The battery room or battery cabinet may be ventilated by natural or forced means. If natural ventilation (airflow

0.1 m/s) is used, then the inlet and outlet vents should have a minimum cross-section, which is calculated as follows:
 $A = 28 * Q$
 A = cross-section of vent in cm²
 Q = volume of air in m³ / h

The inlet and outlet vents are to be provided at suitable locations to obtain the most advantageous conditions for exchange of air.

Installation of the battery

Use insulated tools and wear suitable clothing! Do not wear rings, watches or metal objects when working on the battery installation.

Equipping the rack or cabinets

FNC cells are basically supplied sealed by yellow transport plugs. These cells may be filled and charged (GUG) or unfilled and uncharged (UUU). The yellow transport plugs remain on the cells until completion of connection and installation of the battery (important to avoid atmospheric oxygen coming into contact with the electrodes!).



In principle, when handling the cells during installation of the batteries, the yellow transport plugs should be used for sealing. Unfilled cells in particular should always be sealed with a yellow transport plug. After removal of the yellow transport plug, the cell should be filled with electrolyte immediately.

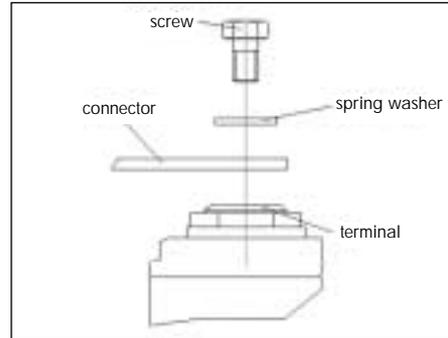
If the cells are unfilled (UUU), then they should be filled only after the battery has been installed and connected. Before the cells are placed on the rack or in the cubicle, they should be individually checked and cleaned. In particular the contact surfaces of the terminals and the connectors should be in a clean and perfect condition. The polarity of the cells should also be checked with a suitable voltmeter. Place the individual cells on the rack or in the cubicle one after the other, with correct polarity and as shown on the connection drawing, and at right-angles to the horizontal support rails. It is not necessary to maintain a distance between the individual cells.

Connection of the battery

After fitting in place, the individual cells are connected into groups. Connection

may be made with both insulated and non-insulated connectors. Only original HOPPECKE accessories may be used for this inter-connection.

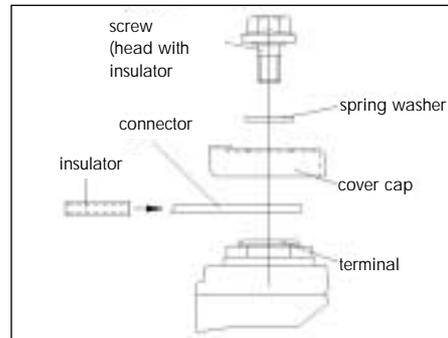
Non-insulated connectors



The contacts must be clean and free from any traces of corrosion. Principally, spring washers are used. These spring washers ensure, when the screws are tightened with the correct torque, a lasting and secure fit of the connectors on the terminal posts.

For tightening the terminal screws with the correct torque, only torque spanners with sockets may be used. Insulated terminal screws in particular may be damaged through the use of ring or jaw spanners.

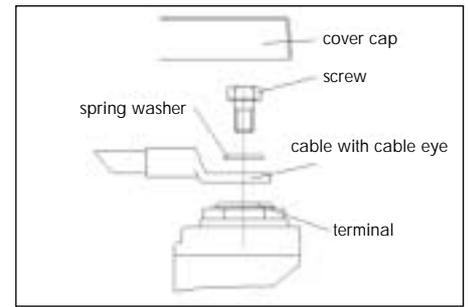
Insulated connectors



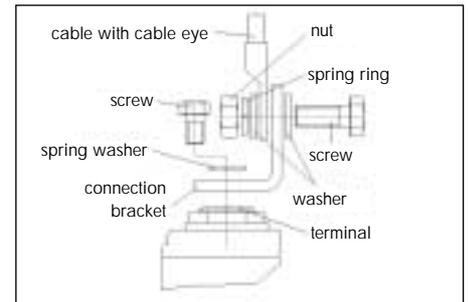
When using insulated connectors, care has to be taken during assembly to avoid the clamping of plastic parts between conductive metal parts lying on top of one another. An appropriate check is to see that there is slight play between the plastic terminal caps and the plastic insulation of the connectors when they are moved gently to and from in a horizontal direction. Only then can correct assembly be ensured. Without this play there could be clamped plastic parts which may melt or scorch when current flows. This can lead to reduced performance and increased risk of fire. After the individual cells have been interconnected by means of connectors, the individual rows, levels and tiers are connected. The individual cell groups

are interconnected. Here, care should be taken with regard to the cross-section of the group connectors. Only approved cable types should be used.

Group or end connectors



Group or end connectors with connection bracket:



The wiring of the group and end connectors should be proof against short-circuits. This means that the wiring used should have a dielectric strength of at least 3 kV, or else an air gap of at least 10 mm should be maintained between the wiring and electrically conductive parts. Alternatively, additional insulation may be used. Any mechanical loading of the end terminals is to be avoided by the fixing of the group and end connectors. The connectors ensure the optimal flow of current and therefore require perfect contacts. For this reason a torque spanner should be used for tightening. The starting torque of the screws depends on the thread size of the screws and the design of the terminal screw:

Thread size	Insulated terminal screw	Non-insulated terminal screw
M8	16 Nm ± 1 Nm	20 Nm ± 1 Nm
M10	20 Nm ± 1 Nm	25 Nm ± 1 Nm

Concluding work

After connection of the battery, the yellow transport plugs are removed from all cells. These transport plugs should be stored near the battery for possible reuse. If the cells concerned are unfilled (UUU) then they should be filled with electrolyte up to the level of the min. mark + 10 mm. During filling with electrolyte, slight heating may occur. Top-

ping-up with electrolyte to the max. mark takes place after the battery has been brought into operation for the first time. The cells must be filled with electrolyte as soon as possible (within 1 hour) after removal of the transport plugs. The cells should never remain empty when they are not fully discharged, otherwise they will be permanently damaged. The electrolyte is a solution of potassium hydroxide (KOH) in distilled or demineralised water with an addition of lithium hydroxide (LiOH) and is designed for a use in temperatures of between -25°C and +45°C. The lithium hydroxide in the electrolyte varies between the different cell types (H, M, L). Production of the electrolyte is governed by DIN IEC 993. When the cells are retracted, the density of the electrolyte is normally 1.19 kg/l ± 0.01 kg/l at the reference temperature of 20° Celsius (electrolyte density may be higher on delivery) With nickel-cadmium cells, electrolyte density is not an indication of the state of charge. For most FNC products HOPPECKE will supply on request a special electrolyte which allows operation in low temperatures down to -45° Celsius.



Only electrolyte approved and recommended by HOPPECKE should be used. Observe the safety instructions for dealing with electrolyte. Sulphuric acid should never be used!

Immediately after filling the cells should be closed using the standard vent plugs supplied (hinged lid plugs) or else AquaGen® vent plugs.

Electrolyte residues should be removed without using cleaning agents. We recommend using a damp cloth. Plastic parts of the battery, in particular cell containers, may be cleaned only with water with no additives.

Marking of the battery

Polarity plates must be affixed visibly to the end terminals of the battery. If necessary the cells may be provided with consecutive numbers (from the positive to the negative terminal of the battery) at a clearly visible point. Since 1.1.97, in accordance with the Low Voltage Directive 73/23/EEC, batteries with a rated voltage in excess of 75 V must be provided with the CE mark. This marking also includes the provision of an EU declaration of conformity. By this declaration the installer confirms that the batteries have been set up in accordance with the applicable standard (DIN EN 50272-2). In general, the fitter is also the installer.

Testing of the battery installation

As a final test of battery installation, the open-circuit voltage of the filled battery must be measured using a suitable voltmeter. The open-circuit voltage of the battery is the total of the individual open-circuit voltages of the cells.



Dangerous contact voltages are possible.

At an electrolyte temperature of 20° Celsius, the cells have a minimum open-circuit voltage of 1.27 V. This measurement may be used to determine whether the polarity of individual cells has been reversed during installation. The measurement can of course only be made with filled cells. If the cells were supplied unfilled and uncharged (UUU), then a 12 hour waiting period should elapse between filling and initial operation.



Further action, in particular bringing the battery into operation for the first time, is described in the instructions "Commissioning of stationary nickel-cadmium batteries with fibre-structured (FNC) electrodes". These instructions are supplied with the battery, and it is essential that they are observed.



Cd

Used batteries with this mark are recyclable goods and must be sent for recycling. Used batteries which are not sent for recycling are to be disposed of as special waste, observing all the applicable regulations. HOPPECKE has a "closed loop recycling system" for NiCd batteries, please contact your local HOPPECKE dealer for any questions according recycling of batteries.