

Battery Installation & Operating Instructions

This document provides a guideline for use during transport, receiving, installation and maintenance of NPP Power valve-regulated lead-acid batteries.



Observe these Instructions and keep them located nearby the battery for future reference! Any work on the battery should be carried out by qualified personnel only!



Do not smoke! Do not use any naked flame or other sources of ignition! Risk of explosion and fire.



While working on batteries wear protective eyeglasses and clothing! Observe the accident prevention rules as DIN VDE 0510, VDE 0105 part 1!



Any acid splashes on the skin or in the eyes must be flushed with plenty of clean water immediately, afterwards seek for medical assistance! Spillages on clothing should be rinsed out with water!



Warning: Risk of fire, explosion, or burns! Don't short circuit the posts! Attention! Metal parts are always alive; don't put any items or tools onto the battery! Prevent from electrostatic charges/discharges and any sparks.



Electrolyte is highly corrosive! Electrolyte might be accessible only if the battery is used abusive or the battery container is mechanically damaged. If you get in contact with electrolyte rinse with plenty of water and seek for medical assistance!



Batteries are very heavy! Make sure they are installed securely! Use suitable means of transport only! Handle with care! Do not lift or pull up the batteries on the poles!



Caution! Metal parts of the battery are always alive, therefore do not place any items or tools on the battery!



Keep children away from batteries!

Non-compliance with operating instructions, repairs made with other than original spare parts or repairs made without authorization (e. g. opening of valves) render the warranty void!



Back to the manufacturer! Used batteries must be disposed and recycled to the local regulations to protect the environment!

1. Transport

Batteries without any visible damage are not defined as dangerous goods under the regulations for transport of dangerous goods by road (ADR) or by railway (RID). They must be protected against short circuits, slipping, upsetting, or damaging. Cells/blocks may be suitable stacked and secured on pallets (ADR and RID, special provision 598). No dangerous traces of acid shall be found on the exteriors of the packing unit. In case of air transport, batteries are non-spillable type and secured against short circuits at the posts. They comply to IATA regulations, packaging instruction 872 and regulation A67 of IATA.

2. Receiving the battery

- Unpack the shipment upon receipt.
- Confirm that the shipment contents are all there.
- Inspect the batteries for any structural damages.
- Measure and record the voltages of each battery. If the battery voltage is less than 2,08V/cell (6,24V for a 6V battery or 12,48V for a 12V battery), they should be recharged as soon as possible. If the batteries are at 2V or less, the batteries should not be used, and the supplier should be contacted immediately.

3. Storage

- Store the batteries indoors in a dry, clean, cool location (0°C to 30°C), well-ventilated area.
- Do not store in direct sunlight or expose the batteries to excessive heat.
- Batteries in storage should be given a refreshing charge every 6 months or when their OCV declines to 2,08V/cell.

4. Installation

4.1 Location

Install the battery in a clean and dry room. Avoid direct sunlight and heat. The battery will perform its best and will achieve maximum service life when the ambient temperature is about 20°C – 25°C.

4.2 Ventilation

The VRLA battery is designed to recombine the produced gases up to 98%. This is an extremely low amount of gas evolution, but ventilation is necessary.

Note: Special regulations regarding battery room ventilation may be applicable in your area depending on the application.

4.3 Mounting

- Clean the battery poles from any oxidation that may be present from transport and storage to minimize contact resistance.
- Verify that the cells are correctly interconnected and with correct polarities. Use manufacturer-approved connectors to ensure optimal results.
- Torque the terminal bolts at the following recommended torques in the technical datasheet.
- Make sure to install all the pole covers to avoid any shock risks.
- The batteries should be numbered (starting from the positive output of the system).
- The batteries should be installed with a 1cm space between them to achieve proper ventilation.

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5. Commissioning

Before commissioning, verify the following points:

- Battery polarities.
- Interconnection tightness.
- OCV battery voltage (No of cells x 2.08V minimum).
- Stability of the mounting rack (if present).

After confirming the contents of the above checklist, the batteries may be connected to the battery charger.

Initial Charging Procedure

Constant voltage is the only charging method allowed. Most modern chargers are using constant voltage.

Follow the initial charging directions described below:

Set constant voltage charger to charging voltage of 2.45 ± 0.04 V/Cell (please see the battery datasheet cycle charging voltage), with the initial current set at 0.1C nominal. *Example: For a target charge of 2,45 V/Cell on a 180-cell system, you would set the charger voltage to 441 volts.*

Depending on the battery's state of charge, the charger may go into the current limit at the beginning and decline slowly once the target charge voltage is reached.

Record the elapsed time and current at regular intervals – every hour at a minimum. Continue charging the battery until there is no further decrease in the charge current and it stabilizes at 0,01C nominal. This could take up to 20 hours, depending on the initial state of charge of the battery.

Note: The charging voltage is given at 25°C. If the batteries are to be operated at different temperatures, a compensation factor according is recommended. The minimum voltage is 2.20 V/Cell, as temperature correction does not apply below this voltage. The temperature correction during initial charging should be $-5\text{mV}/^\circ\text{C}/\text{Cell}$.

Float Charging

The initial charge is complete. Charger voltage can now be reduced to float voltage setting 2.25-2.30V/Cell. For a target float charge of 2.27 V/Cell on a 180-cell system, the charger voltage should be set to 408,6V. All the connections should be rechecked after the end of commissioning due to heating during charge. The temperature correction during float charging should be $-3\text{mV}/^\circ\text{C}/\text{Cell}$.

Failure to perform the initial charge within the limit of 6 months will affect the performance and life of the battery and may void the warranty.

6. Maintenance

For optimum reliability, it is recommended that the battery system is monitored quarterly.

If the battery system incorporates an automatic monitoring system that collects electrical and environmental data, the quarterly checks only include evaluation of the collected data and the visual inspection of the battery.

In general, the checks to be made during periodic maintenance include:

- System charging voltage.
- Ambient temperature.
- Inter - unit connection tightness and condition.
- Individual battery float voltage.
- Measurement of the battery float current
- Individual battery internal resistance
- Battery system capacity test (every year).

Required maintenance tools and equipment

1. Digital Voltmeter.
2. IR meter (if available)
3. Insulated socket wrench.
4. Torque wrench.
5. Rubber Gloves
6. Face shield
7. Plastic apron

Maintenance Tasks

- Ensure that the facility's safety equipment is available and functional.
- Ensure that the battery room is clean.
- Ensure that the batteries are clean.
- Measure and record the temperature of the battery room.
- Visually inspect the battery for:
 - Cleanliness.
 - Terminal damage.
 - Container damage.
 - Electrolyte leaks.
 - Signs of overheating.
- Ensure that the poles and the connectors are in good condition (not oxidized or damaged). If there are signs of corrosion, they should be removed.
- The poles should be covered with anti-corrosion oil.
- Ensure the integrity of the battery. If a crack is found, the battery should be replaced immediately.
- Measure the DC float charging voltage at the battery. If possible, measure the AC voltage ripple as well (it should be less than 0,5% RMS of the DC voltage).
- Measure and record the IR of the individual batteries.
- Measure and record all the individual battery voltages. Individual batteries that appear to have on float voltage of 2,16V/cell or less, should be considered shorted and should be removed from the system.
- Measure the DC voltage from each polarity of the complete battery to the ground to detect any ground faults.
- Measure the DC charging current.
- Measure and record the temperature of some random cells. Measure the temperature at the side of a battery or its negative pole. The maximum permissible temperature difference between two different batteries should not exceed 3°C.