instruction manual

Maintenance-free, stationary lead batteries in fleece technology (AGM/VRLA)

safety instructions

- Observe the instructions for use and place them visibly near the battery!
- Work on the battery only after instruction by qualified personnel!

- No smoking! Do not bring naked flame, embers or sparks near the battery, as there is a risk of explosion and fire!

- Wear safety glasses and protective clothing when working on batteries!
- Observe the accident prevention regulations and DIN EN 50 272-2 Section 8!

- Acid splashes in the eye or on the skin should be rinsed out with plenty of clear water. Then immediately consult a doctor. Clothes contaminated with acid should be washed with water!

- Risk of explosion and fire, avoid short circuits! Attention! Metal parts of the batteries are always live, therefore do not place any foreign objects or tools on the battery!

- Electrolyte is highly corrosive! During normal operation, contact with the electrolyte is practically impossible. Electrolyte can only escape through improper handling, e.g. through overcharging, at the valves or at the housing as a result of mechanical damage. If you have come into contact with electrolyte, please rinse generously with water and consult a doctor!

- Block batteries/cells have a high dead weight! Ensure safe installation! Only use suitable transport equipment.

Non-observance of the instructions for use, repair with non-original spare parts or unauthorized intervention will void the warranty.

Used batteries with this symbol are recyclable assets and must be recycled. Used batteries which are not sent for recycling must be disposed of as hazardous waste in accordance with all regulations.

General information

Sealed lead-acid batteries consist of cells in which no refilling of water is permitted over the entire period of use. Pressure relief valves which cannot be opened without destruction are used as sealing plugs.

1. commissioning

Before commissioning, all blocks must be checked for mechanical damage, correct polarity and tight fit of the connectors. If necessary, the pole covers must be fitted.

Connect the battery to the DC power supply with the charger switched off and the loads disconnected (positive pole to positive terminal), switch on the charger and charge as described in point 2.2. The following torques apply to the screw connections:

M5	M6	M8
4 Nm	5 Nm	12 Nm

2. operation

DIN EN 50110-1 applies to the construction and operation of these batteries.
The battery must be positioned in such a way that an ambient temperature difference of >3K cannot occur between individual blocks.

2.1 Discharge

The final discharge voltage of the battery assigned to the discharge current must not fall below this value. Unless otherwise specified by the manufacturer, no more than the nominal capacity may be taken. After discharges, also partial discharges, charge immediately.

2.2 Charging

All charging methods are applicable with their limit values according to DIN 41773 (IU characteristic curve). Depending on the charger version and charger characteristic curve, alternating currents flow through the battery during the charging process, which are superimposed on the direct charging current (< 0.1C(A) effective ripple). These superimposed alternating currents and the reactions of consumers lead to additional heating of the battery and loading of the electrodes with possible consequential damage (see point 2.5). Depending on the system, charging is possible in the following operating modes (acc. to DIN VDE 0510 part I draft).

a) Standby parallel and buffer operation
The loads, the direct current source and the battery are permanently connected in parallel. The charging voltage is the operating voltage of the battery and at the same time the system voltage. In standby parallel operation, the direct current source is always able to supply the maximum load current and the battery charging current. The battery only supplies power when the DC power source fails. The charging voltage to be set is 2.275 V±0.005V (20°C) x number of cells with series connection, measured at the end poles of the battery. In buffer mode, the DC source is not able to supply the maximum load current at all times. The load current temporarily exceeds the rated current of the DC source. During this time the battery supplies current. It is not fully charged at all times, but the float charge voltage of 2.275 V/cell at 20°C x number of cells in series connection is sufficient to ensure recharging. A consumer and cell number dependent adjustment should be made in individual cases with the battery manufacturer.

b) Switching mode
When charging, the battery is disconnected from the consumer. To shorten the recharge time, the battery can be charged with a voltage of 2.45 - 2.5 V/cell in a first charging stage until the charging current drops to 0.07 C(A) (t1). The charging time of the first phase is measured to reach this value. During a second phase of recharging, a voltage of 2.45-2.5 V/cell is applied, whereby the recharging time of the second phase should be 50% of the first phase (t2 = 0.5t1). If t > t1 + 0.5t1 is exceeded, the voltage is reduced to the float voltage of 2.275 V/cell (± 0.005V) at 20°C.

c) Battery operation (charge/discharge operation)
The consumer is only supplied from the battery. The charging procedure depends on the user and must be agreed with the battery manufacturer.

2.3 Maintaining the full charge state (trickle charge)

Devices with the specifications according to DIN 41773 must be used. They must be set so that the average cell voltage is 2.275V±0.005V.

2.4 Supplementary + equalisation charging

In order to achieve an optimum service life, it is advisable to charge the batteries before commissioning, provided that

the batteries have been stored for more than 6 months, are not older than 9 months from the date of production, and show an open terminal voltage of less than 2.1 V/cell. The supplementary charge should be carried out in accordance with the values listed.

Charging time in relation to production date	Charging voltage per cell at 20° C	Charging time
Less than 9 months	2,28 V/cell	Longer than 72 hrs.
up to one year	2,35 V/cell	48 to 144 hrs.
1 to 2 years	2,35 V/cell	72 to 144 hrs.

Batteries that are retrofitted into a battery system as a replacement do not require an equalisation charge at normal float charge voltage to match the level of the terminal voltage of other batteries.

2.5 Superimposed alternating currents

During recharging up to 2.4 V/cell according to operating modes item 2.2, the rms value of the alternating current may briefly be 0.1 C(A). After recharging and after further charging (trickle charging) in standby parallel operation or buffer operation, the effective value of the alternating current shall not exceed 5 A/100 Ah rated capacity.

2.6 Charge currents

In standby parallel operation or buffer operation without recharging stage, the charging currents are not limited. The charging current should be 10 A to 20 A per 100 Ah rated capacity (guide value).

2.7 Temperature

The recommended operating temperature range for lead-acid batteries is 10 °C to 30 °C. The ideal operating temperature range is 20 °C ±5. Higher temperatures shorten the service life. The technical data are valid for the nominal temperature of 20 °C. Lower temperatures reduce the available capacity. Exceeding the limit temperature of 50 °C is not permitted. Continuous operating temperatures greater than 40 °C must be avoided.

2.8 Temperature-dependent float charge voltage and rapid charge

The float charge voltage of 2.275 V/cell ±0.005 V/cell refers to a battery temperature of 20 °C. Temperature controlled voltage compensation of the float voltage is required to prevent overcharging at higher temperatures and undercharging at lower temperatures. The recommended compensation factor is -3 mV/cell/V °C for the float state. To avoid a „thermal runaway", the trickle charge voltage must always be compensated in a temperature-controlled manner at temperatures above 40°C. The compensation factor must be set by the manufacturer. The high charge procedure can then be used, when fast charging is required. The charging current should not exceed 0.25 C(A) and should constantly drop below 0.01 C(A). When 0.01 C(A) is reached, the voltage should then be switched over to float charge voltage.

Temperature (°C)	Charging voltage High/fast charge (V/Z)	Float voltage (V/Z)
- 10	2,58	2,36
0	2,53	2,33
10	2,48	2,30
20	2,45	2,28
30	2,40	2,24
40	2,34	2,21

2.9 Elektrolyte

The electrolyte is diluted sulphuric acid and bound in fleece.

3. battery care and control

The battery must always be kept clean and dry to avoid leakage currents.
The battery should be cleaned in accordance with the ZVEI leaflet „Cleaning of Batteries". Plastic parts of the battery may only be cleaned with water without additives; the use of organic cleaning agents is not recommended.
Measure and record at least every 6 months:

- Battery voltage
- Voltage of some cells/block batteries
- Surface temperature of some cells
- Battery room temperature

If the cell voltage deviates from the average float charge voltage by ± 0.1 V/cell or if the surface temperature of different cells/blocks deviates by more than 5 K, call customer service. The following must be measured and recorded annually:

- Voltage of all cells/block batteries
- Surface temperature of all cells
- Battery room temperature
- Insulation resistance according to DIN 43539 T I

Annual visual inspection:

- of the screw connections, unsecured screw connections must be checked for tight fit
- of the battery installation or accommodation
- the aeration and ventilation

4. examinations

Testing shall be carried out in accordance with DIN 43539 Parts 1 and 100 (draft), special testing instructions, e.g. in accordance with DIN VDE 0107 and DIN VDE 0108, shall also be observed. See also the mentioned EN. To ensure a reliable power supply, the entire battery should be replaced after the expected service life, taking into account the operating conditions and temperatures.

5. malfunctions

If faults are found in the battery or the charger, call customer service immediately. Measurement data according to point 3 simplify troubleshooting and troubleshooting. A maintenance contract facilitates the timely detection of faults.

6. storage and decommissioning

If cells or batteries are stored or taken out of operation for a longer period of time, they must be stored fully charged in a dry, frost-free room. To avoid damage, trickle charging should be carried out in accordance with 2.4.

7. transport

AGM batteries are not dangerous goods as long as they are protected against short circuits, slipping, falling over and damage (Dangerous Goods Ordinance GGVS, Volume No. 2801 a). This applies to road, rail, sea freight and air transport as well as to the rules of IATA (rule A67), ADR (rule 598), IMDG (rule 238.2) and UN 2800 Special Provisions.
There shall be no dangerous traces of acid on the outside of the packages. The relevant exemption regulations apply to all sealed batteries and cells whose receptacles are leaking or damaged.