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OPERATING INSTRUCTIONS

for stationary vented lead-acid OPzS, Ca OPzS, SPgBG, OGi, UPS and SOLAR (TOPzS) batteries

Nominal data:
Nominal voltage UN : 2.0 V x number of cells
Nominal capacity CN = C10: 10-hour discharge (see plate type)
Nominal discharge current: IN = 110= CN /10
Final discharge voltage Us: 1,80V/cell
Nominal temperature TN: 20°C
"LA"antimony content: < 2% in the grids
Nominal S.G. of electrolyte: 1,24 +/- 0,01 kg/l

Bat. Type: _____
Assembled by: _____
Date: _____
Start-up by:_____
Date:_____

Observe operating instructions and affix close within sight of the battery!
Work on batteries only under instructions of skilled personel!

Smoking prohibited! Do not expose battery to open flame, glowing fire or sparks as explosion and fire hazard exists!

When working on batteries wear protective glasses and clothing!

Explosion and fire hazard! Avoid short circuits!
Caution! Metal parts of the battery cells are always live, therefore do not place items or tools on the battery!

Electrolyte is strongly corrosive!

Monoblock batteries / cells are very heavy! Ensure secure installation! Only use suitable transport equipment!

Dangerous voltage!

Acid splashes in the eyes or on the skin must be washed out or off with plenty of water. Then see a doctor immediately. Acid on clothing should be washed out with water!

Safety requirements according to EN 50272-3.

Non-compliance with operating instructions, repairs made with other than original parts, use of additives for the electrolyte (alleged "enhancing agents") render the warranty null and void.

1. Commissioning

a) Filled and charged batteries

Before commissioning all blocks must be inspected for mechanical damage, cells must be connected with the correct polarity and connectors firmly seated. The following torque apply for M10 screw connectors is:

20 ± 1 Nm

If necessary the terminal covers must be put on. Check the electrolyte level in all cells. If necessary top up to maximum level with purified water as under DIN 43530 Part 4. Before putting the battery in operation, plastic transport vent caps must be removed and replaced with ceramic cell plugs. With charger off and loads isolated connect battery to the direct current power supplies maintaining correct polarity (positive terminal to positive post). Switch on the charger and charge as under section 2.2.

b) Dry charged (DC) batteries

Instructions for the initial charging of a dry charged stationary OPzS, Ca OPzS and SOLAR (TOPzS) batteries:

- Unscrew the sealed vent plugs and fill the cells with pure dilute sulphuric acid, specific gravity 1,230 0,01kg/1 read at 20 (68 F), up to about 25 mm below top of lid for SPgBG multi-block hard rubber containers and 50 mm below of lid for OPzS translucent containers or max level marked on the label. The temperature of the filling acid should be between 10°C and 25°C (50 - 77 F).
- Insert the original plastic vent plug with removed sealing foil on the top or place the special ceramic vent plug.
- Start charging for not less than 2 and not more than 12 hours elapsed after the last cell has been filled with the acid.
- Apply the 0,5 x 110(5A/100Ah) current.
- Charge for 8 hours and then keep the battery on open circuit for 1-2 hours.
- Continue the charging for a few hours, until the battery is fully charged, i.e. until constant voltage and constant specific gravity have been reached. The specific gravity of the acid in a fully charged celi is 1,240 0,01 kg/l read at 20°C (68 F), If during the charging the temperature of the acid exceeds 55°C (131 F) reduce the charging current by 50%.
- 0,5 h after charging discharge the battery at 10 hour rate of current until the cell voltage drops to average value 1.80 Volts. Allowable minimum voltage of a single cell is 1,70V.
- Recharge the battery according to the operating instructions 2.2.
- 24 hours after recharging adjust electrolyte level to the "max" mark on the label. Activation and test results must be kept as part of battery documentation. Non-compliance with this request renders the warranty null and void.

2. Operation

For the operation of stationary battery, installations EN 50272-2 apply

2.1 Discharging

Never allow the final discharge voltage of the battery to drop below that assigned for the discharge current. Charge immediately after discharge as well as partial discharge. Recommended DOD (Depth Of Discharge) for normal operating is up to 80% of CN.

2.2 Charging

All charging procedures with their limit values may be employed as stated below:
DIN 41773 (IU characteristic)
DIN 41774 (W characteristic)
DIN 41776 (I characteristic).
Depending on charger type and charging characteristic alternating currents flow through the battery superimposing onto the direct current. These alternating currents and the reaction of the loads lead to an additional warming of the battery and strain on the electrodes with possible resultingdamage(see 2.5). Depending on the system at hand, charging may be carried out under the following modes:

a) Stand-by parallel operation and floating operation.
Here the load, direct current and battery are continuously connected in parallel. There by the charging voltage is at the same time the operating voltage of the system.
With stand-by-parallel operation the direct current is at any time capable of supplying the maximum load current and the battery charging current. The battery only supplies current when the direct current source fails. The charge volt age should be set at 2,23 V +/-1% x number of cells measured at the battery's terminals. To reduce the recharging time a charging stage can be applied in which the charging voltage is 2,35 to 2,4 V x number of cells (stand-by parallel operation with recharging stage).
Automatic changeover to the charging voltage of 2,23 V+/- 1% x number of cells follows after few hours on the voltage 2,35-2,4 V x number of cells. With the floating operation the direct current source is not able to supply the maximum load current at all times.
The load current intermit tently supersedes the nominal current of the direct current source. During this period the battery supplies power. It is not fully charged at all times. Therefore, depending on the load the charge voltage must be set at 2.23 to 2.30 V x number of cells.

b) Switch mode operation
When charging the battery is separated from the load. Towards the end of the charging process the charge voltage of the battery is 2,6 - 2,75 V/cell. The charging process and parameters must be monitored (see Sections 2.4, 2.5 and 2.6). On reaching a fully charged state the charging process must be stopped or switched to float charge as under Section 2.3.

c) Battery operation (charge/discharge operation)

Only the battery supplies the load. Hereby the charge voltage of the battery towards the end of the charging process is 2,6-2,75 V/ cell. The charging process and parameters must be monitored (see Sections 2.4, 2.5 and 2.6).
When reaching a fully charged state the charging process must be switched off. The battery can be switched to the load as necessary.

2.3 Maintaining the full charge (float charging)

Devices complying with the stipulations under DIN 41773 (IU characteristic) must be used. They are to be set so that the average cell voltage is 2,23V +/- 1% (2,25 V +/- 1% for UPS) cell at 20°C and the electrolyte density does not decrease over a protracted period (otherwise see 2.8).

2.4 Equalizing charge

Equalizing charges are required after exhaustive discharges and after inadequate charges; they can be carried out as follows:
- Up to 72 hours at constant voltage of max. 2.4 V/ cell,
- With the I or W characteristic as under 2.6.

If during equalizing charging permitted load voltages are exceeded, appropriate measures must be taken, e. g. disconnection of the load. If exceeding the maximum temperature of 55°C the charging must either be stopped, proceed with reduced current, or be switched to float charge to allow the temperature to drop. The equalizing charge is completed when the electrolyte densities no longer increases within a period of 2 hours.

2.5 Alternating currents with periodic deviations

On recharging up to 2,4 V/cell as under operation modes a) to c) the actual value of the alternating current is occasionally permitted to reach max. 20 A per 100 Ah nominal capacity. Above 2,4 V/cells 10 A per 100 Ah nominal capacity may not be exceeded. In a fully charged state with a charge voltage of 2,23 to 2,30 V/cell the actual value of the alternating current must not exceed 5 A per 100 Ah nominal capacity.

2.6 Charging currents

The charging currents are not limited up to 2,4 V/ cell. When exceeding the charging voltage of 2,4 V/cell, greater water decomposition occurs. The charging currents per 100 Ah nominal capacity shown in Table 1 must not be exceeded.

Charging procedure	Cell model	Cell voltage
I-charact.	5,0 A	2,6 - 2,75
W-charact.	7,0 A 3,5 A	at 2,4 V at 2,65 V

2.7 Temperature

The recommended operating temperature for Lead-acid batteries is 10°C to 30°C. The technical data apply for the nominal temperature 20°C. The ideal operating temperature is 20 +/- 5°C. Higher temperatures shorten the service life. Lower temperatures reduce the available capacity. The maximum temperature of 55°C must not be exceeded.

2.8 Temperature-related charge voltage

A temperature-related adjustment of the charge voltage within the operating temperature of 15°C to 25°C is not necessary. Should the temperature range be lower than 15°C and/or higher than 25°C a temperature related adjustment of the charge voltage should be made. The temperature correction factor is (-0.004 V/Cell per °K).
Should the temperature constantly rise above 40°C then the factor is (-0.003 V/Celi per °K).

2.9 Electrolyte

The electrolyte is diluted sulphuric acid. The nominal electrolyte density is based on 20°C and the nominal electrolyte level when fully charged with maximum deviation +/ - 0.01 kg/l. Higher temperatures reduce the electrolyte density; lower temperatures increase the electrolyte density. The associated correction factor is 0.0007 kg/l per °K. Example: electrolyte density of 1.23 kg/l at 35°C corresponds to a density of 1.24 kg/l at 20°C or electrolyte density of 1.25 kg/l at 5°C corresponds to a density of 1.24 kg/l at 20°C.

3. Battery maintenance and control

The electrolyte level must be checked regularly. If it dropped to the lowest electrolyte level mark, purified water must be added as under DIN 43530 Part 4, maximum conductivity 30 µS/cm.
To avoid leakage currents keep the battery clean and dry (especially inter cell connections). Plastic battery components, in particular the vent caps, must only be cleaned with water that contains no additives. At least every 6 months the following must be measured and recorded:
- Battery voltage
- Voltage of a few selected cells/mono block batteries
- Electrolyte density of a few selected cells/ mono block batteries
- Electrolyte temperature of a few selected cells/mono block batteries

The following must be measured and recorded annually:
- Voltage of all cells/mono block batteries
- Electrolyte density of all cells/mono block batteries
- Electrolyte temperature of a few selected cells/mono block batteries
- Should the float charge voltage in one celi deviate more than + 0.1 V or - 0.05 V from the average value (see 2.3), equalizing char ging should be done (see 2.4.). Annual visual checks:
- on bolted connectors (check that unsecured bolt connectors are firmly seated)
- on battery installation or arrangement
- on ventilation of battery room.

4. Tests

Tests must be performed on fully charged batteries according to EN 60896-1.
In addition, special test instructions such as EN 50272-2 must be observed.

5. Faults

Should faults be detected in the battery or the charging device, customer services should be called in immediately.
Measurement records under Section 3 are necessary for fast fault detection and removal.

6. Storage and taking out of operation

Should cells/batteries be stored or taken out of operation for a longer period of time, they must be stored fully charged in a dry, frost-free room with max. temperature of 25°C. Direct sunlight or other heat sources must be avoided. To avoid damage the following charging methods can be chosen:
a. Equalizing charges on a quarterly basis as under Section 2.4. In average, ambient temperatures of more than 30°C monthly equalizing charges may be necessary.
b. Float charging as under Section 2.3. above.

7. Transport

Batteries, wet, filled with acid require transport under demands of European Agreement concerning the international carriage of dangerous goods (ADR and RID). ADR special provision No. 598: New batteries are not subject to the requirements of ADR, when:
- they are secured in such a way that they can not slip, fall or be damaged;
- they are provided with carrying devices, unless they are suitably stacked, e.g. on pallets;
- there are no dangerous traces of alkalis or acids on the outside;
- they are protected against short circuits.

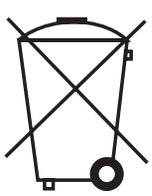
8. Technical data

The nominal voltage, the number of blocks, the nominal capacity (C10 = CN) and the battery type are obtained from the type plate.

8.1 Example

Date on type plate: 6 V 6 OPzS 300
Key:
- 6 V = Nominal voltage of the blocks battery (with individual cells the nominal voltage is 2 V)
- 6 = Number of positive plates
- OPzS = Type
- 300 = Nominal capacity C10 under EN 60896-1. Capacity with discharge period of 10 h (t10) to final discharge voltage 1,80 V/cell.

Other capacities at different discharge currents with the corresponding discharge times and final discharge voltage can be found in technical data list for TAB OPzS stationary batteries



Spent batteries must be collected separately and recycled.

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