Operating Instructions

Stationary Vented Lead Acid Batteries

OPzS cells and OPzS blocks

Assembly and CE-marking by ..... Number of cells/blocks:

..... Date .....

Commissioning by ..... Date ..... Type: .....

Safety Instructions

Read the instructions carefully and place them close to the battery.

Work on batteries to be carried out by skilled personnel only!

While working on batteries wear safety glasses, goggles and protective clothing!
Comply with accident prevention rules as well as with EN 50 272-2, VDE 0105 part 1!

No smoking!

Do not expose batteries to naked flames, glowing embers or sparks, as it may cause an explosion.

Acid splashes in the eyes or on the skin must be washed with water. In case of accident consult a doctor immediately!

Clothing contaminated by acid should be washed in water.

Risk of explosion and fire.
Caution: Metal parts of the battery are always under voltage. Do not place tools or other metal objects on the battery!
Avoid short circuits!

Electrolyte is highly corrosive.

Batteries and cells are heavy.
Ensure secure installation!
Use only suitable handling equipment e.g. lifting gear in accordance with VDI 3616.

Dangerous voltage!

Batteries with this symbol can be recycled.

Treat batteries as special waste.
Do not mix them with other industrial or household waste.
Recycling can be achieved through a recognized company for battery recycling or by returning them to the manufacturer, depending on the agreement you have made.

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Usage of the battery which does not comply with the OPERATING INSTRUCTIONS, repairs carried out with non-approved spare parts, use of additives in the electrolyte or unauthorised interference with the battery will invalidate any claim for warranty.

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1. Delivery and Storage

Inspect for signs of damage or missing components. Store the battery in a dry, clean and preferably cool and frost-free location. Do not expose the cells to direct sunlight as damage to the container and cover may occur.
As the batteries are supplied charged, storage time is limited.
In order to easily charge the batteries after prolonged storage, it is advised not to store them longer than 3 months at 20°C, 2 months at 30°C, 1 month at 40°C. A refreshing charge shall be performed after this period. Failure to observe these conditions may result to significantly reduced capacity and service life.
The refreshing charge shall be carried out according to clause a) of the Commissioning Charge paragraph below.
Alternatively cells can be float charged at the recommended float voltage (see table 5) during storage.
For commissioning of dry charged batteries, see separate instructions!

2. Installation

Handling:
Lifting of cells or blocks above 25 kg has to be made with handling devices. Do not lift the cells by their terminals. The electrical protective measures, the accommodation and ventilation of the battery installation must be in accordance with IEC 62485-2 regulation. The battery should be installed in a clean, dry area. Avoid placing the battery in a warm place or in direct sunlight. The layout of the charging room must allow easy access to the batteries. Approved battery racks are recommended for proper installation. Place the cells or monoblocks on the rack and arrange the positive and the negative terminals for connection according to the wiring diagram. Battery cells are usually installed in series, having ensured the correct polarity.
Cells in parallel strings:
Vented cells and monoblocks may be connected in parallel to give higher current capability. In the case of parallel connected strings, use batteries of the same capacity, design and age only with a maximum of 4 parallel strings. If more than 4 parallel strings are required, consult MASTER BATTERY, S.L. The resistance of the cables in each string must be the same, e.g. same cross-section, same length. Connect the battery strings in parallel at the end terminals. Check that all contact surfaces are clean. If required, clean with a brass brush. Tighten the terminal screws, using the correct torque loading of 22 Nm.

3. Commissioning of Filled and Charged Batteries

Check the cells/blocks in regards to their polarity. The open-circuit voltages of a battery's individual cells must not deviate from average more than +0.03 V. Should greater deviations occur, consult the supplier.
Check the electrolyte level in all cells. If necessary, top up with purified water all cells having lower level of electrolyte, as specified under DIN 43 530 part 4. Be aware that the electrolyte level will increase during charging.
Connect the battery to the DC power supply, with the charger switched off, battery fuses removed and the load disconnected, ensuring that the polarity is correct (Positive terminal of the battery to the positive terminal of the charger).
Switch on the charger and charge as per point 4.2. The first charge must be monitored to ensure that limits are not exceeded and that no unacceptable temperatures occur. When charging is finished, switch off the charger or switch over to operating voltage, as per point 4.3.

4. Operation

For the operation of stationary battery installations, standard EN 50 272-2 applies.

4.1 Discharging

Never discharge the battery below the specified final voltage. No more than the specified capacities are to be discharged. Charge immediately after discharge as well as after partial discharge.

4.2 Charging

Charging must only be carried out with direct current.
Charging procedures with their limit values may be employed as follows:
- DIN 41 773: IU - characteristic
- DIN 41 776: I - characteristic.

The limits for charging currents and the ripple currents (see 4.6) must not be exceeded.
The commissioning charging of a filled and charged battery has to be made as full charge. The fully charged state is reached when the cell voltages and the specific density of the electrolyte have not risen for a period of 2 hours. The acid density in the full charged state is 1,24 ± 0,01kg/l at 20°C and maximum level (see also 4.9). It can be made as mentioned below. Methods a) and b) are recommended.

a) Using chargers with IU characteristics at an increased voltage of (2.33 - 2.40V) x number of cells with automatic switching to the float voltage, see 4.3a. The complete charging time will be minimum 24 hours.
b) Using chargers having a boost charging stage with I characteristic, see 4.6 with the load switched off up to the final charging voltage of (2.60 - 2.75 V) x number of cells. The charging must be monitored and switched off when the fully charged state is reached, or switched over to float charging as per 4.3a. The charging time is about 6 - 8 hours.
c) Using chargers with IU characteristics with float voltage (see 4.3.a), after approximately one month, full charge state will be reach.

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4.3 Stand-by Operation / Buffer Operation

In this case, the load, the DC power supply and the battery are connected permanently in parallel. Thereby the charging voltage is the operational voltage of the battery and also the system voltage.

a) During **stand-by operation (float)** the DC power supply is always able to provide the maximum load current and the battery charging current. The battery only supplies current, if the DC power supply fails. The charge voltage at 20°C must be set for OPzS at (2,23V x number of cells) ± 1% measured at the batteries' terminals.

b) During **buffer operation** the DC power supply is not always able to provide the maximum load current. The load current temporarily exceeds the rated current of the DC power supply. During this time the battery supplies current. The battery is not always fully charged. Depending on the load, the charge voltage should be set at (2,25 to 2,30V) x number of cells.

4.4 Recharging

After a discharge, the battery can be recharged at the operating voltage (see 4.3a). To reduce the charging time, the recharging can be carried out at (2,33V to 2,40V) x number of cells with automatic reduction to the voltage under 4.3a. The recharging times are dependent on the charging procedure selected and on the charging current available; as a rule they run to 12 - 24 hours at charging currents between $2 \bullet I_{10}$ - $0{,}5 \bullet I_{10}$.

4.5 Equalizing Charge

After deep discharge or after inadequate recharging, equalising charge is necessary. These can be carried out as follows:

a) at an increased voltage of (2.33 - 2.40 V) x number of cells for 24 up to maximum 72 hours.

b) at currents according to the I characteristic (see 4.6).

As it is possible to exceed the permitted load voltages, appropriate measures must be taken, e.g. switch off the load. On exceeding the maximum temperature of 45°C, charging must either be stopped or proceed with reduced current or be switched to float charge to allow the temperature to drop. The equalising charge is completed when the electrolyte densities, and the single cell voltages no longer increase within 2 hours.

4.6 Charging Currents

The charging current is not limited as long as the battery voltage is below the gassing voltage of 2,40V x number of cells. Thereafter the charging current has to be limited:

Limits on charging currents above 2,40V x number of cells per 100Ah nominal capacity.

Charging Process	Charging Current per 100Ah	Cell Voltage
I-Characteristic	5.0 A	2.60 - 2.75 V/c

During recharging up to 2.40 V/cell the effective value of the AC ripple current may reach temporarily maximum 20A/100Ah nominal capacity. After recharging and at float charge in stand-by operation or buffer operation the effective value of the AC ripple current must not exceed 5A/100 Ah of nominal capacity.

4.7 Battery Temperature

All technical data apply for the nominal temperature of 20°C. The recommended operating temperature range is 10°C to 30°C. Higher temperatures reduce the working life, whilst lower temperatures reduce the available capacity. A maximum temperature of 55°C must not be exceeded.

4.8 Temperature-related Charging Voltage

A temperature-related adjustment of the charging voltage within monthly averaged battery temperatures of 10°C to 30°C is not necessary. Below 10°C in the monthly average the charging voltage should be increased (+0,003V/C per cell) for a faster recharging. Above 30°C in the monthly average the charging voltage may be reduced (-0,003V/C per cell) to reduce water decomposition and corrosion.

4.9 Electrolyte

The electrolyte is diluted sulphuric acid. The rated specific density of the electrolyte in a fully charged state is based on 20°C and the "MAX" electrolyte level is 1,24 with a maximum deviation ± 0,01kg/l.

Higher temperatures reduce the density of the electrolyte, whilst lower temperatures increase it.

The temperature correction factor is -0,0007 kg/l per K.

Examples:

Electrolyte density 1.23 kg/l at +35°C corresponds to 1.24 kg/l at +20°C. Electrolyte density 1.247 kg/l at +10°C corresponds to 1.24 kg/l at +20°C.

4.10 Light Cyclic Applications (e.g. unstable power network)

The discharges have to be restricted to 80% DOD. After having discharged 3 times at C10, the battery has to be charged back to 100%. At regular discharges up to 0,3*C10, charge with 2,35 to 2,40V/cell.

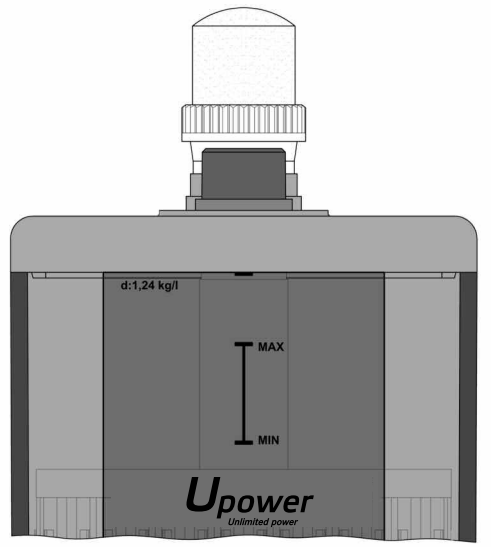
At daily discharges of more than 0,3*C10, a damaging acid stratification occurs, if a gassing charge is not weekly performed.

5. Battery Maintenance

To avoid leakage currents and the associated risk of fire, keep the battery dry and clean. Clean with clear water, no solvents, no detergents as they can cause permanent damage to container and lid. If the battery, cell, lid or container is damp with or shows signs of spilled electrolyte, wipe with a cloth dampened with a solution of sodium bicarbonate and cold water, mixed in the proportions of 1.0 lb/1.0 gal (0.5 kg/5.0 liter) of water.



Follow this by wiping with a cloth dampened in clear water.
Avoid electrostatic charges.
If the electrolyte level has dropped to the„ “MIN” mark, purified water as specified under DIN 43 530 Part 4 (maximum conductivity 30 S/cm) must be used to top up the electrolyte level to the “MAX” mar.



To be checked and listed every 6 months:
- battery voltage
- the voltage of some cells/block batteries (pilot cells)
- the temperature of the electrolyte in some cells/block batteries (pilot cells).

To be checked every 12 months:
- the voltages and densities/temperatures of the electrolyte in all cells/blocks have to be measured and listed.
- connectors, racks and the ventilation have to be checked.

Should the float charge voltage in single cells deviate more than +0,10V or -0,05V from the average value, perform an equalizing charge according to p4.5. If the voltages are still out of limits, contact our Service Dept.

6. Faults

Should faults be detected in the battery or the charging device, call our our Service Dept. immediately. Measured data as described in p5, simplify fault detection and elimination. A service contract with MASTER BATTERY, S.L. is highly recommended.

7. Testing

Tests must be conducted according to IEC 60 896 - 11. Check that the battery is fully charged. Before testing new batteries it must be ensured that a sufficient commissioning charge has been conducted, the S.G. is relating to 1,24 ± 0.01 kg/l and the battery is fully charged. Lower S.G. results in lower capacity.
After capacity test, an over charge of 15 to 20% is required for perfect mixing of the acid. This can take several weeks at float voltage recharging.

8. Storage and Taking out of Operation

If filled lead acid accumulators are to be taken out of operation for a longer period of time, they must be placed fully charged in a dry room (10°-30°C). To avoid damage, periodical equalising chargings (for interval see p1) or permanent float charging has to be made.

9. Transport

Cells and batteries have to be transported upright to avoid spillage of acid. Poles have to be covered to avoid short circuits. If properly packed, batteries are no dangerous goods according to the international regulations for dangerous goods on road and on rail (ADR and RID).