Installation & Operating Instructions

Stationary vented lead acid batteries with TUBULAR positive plates
OPzS-LA types according to DIN 40736 (cells) & DIN 40737 (blocks)

Rating Data

Nominal battery capacity	OPzS: C10 (I10x10h) / OPzS-Solar: C120 (I120x120h) - See type plate	
Nominal battery voltage	2,0 V x No of cells in series	
Cell / block type	See type plate	
Nominal electrolyte S.G. OPzS	1,24 ± 0,01 kg/l	Serial No. ……
Nominal electrolyte S.G. OPzS-Solar	1,25 ± 0,01 kg/l	
Rated temperature	20°C	Date of Commissioning ……

HBL OPzS - LA batteries are vented batteries with liquid electrolyte. Unlike conventional batteries, the positive plates are of TUBULAR type with Low Antimony lead alloy (LA). They are distinguished by their high tolerance to cycling, operational safety, long life and very low maintenance / long topping up intervals.

Pay attention to the operation instructions and position them close to the battery.
Work on batteries to be carried out by skilled personnel only!

Use protective glasses, gloves and clothes when working on batteries.
Pay attention to the accident prevention rules as well as EN 50272-2 and EN 501110-1.

No smoking! Do not expose batteries to naked flames, glowing embers or sparks, as it may cause the battery to explode.

Acid splashes into the eyes or on the skin must be washed with abundant water. In case of accident after flushing with plenty of water consult a doctor immediately! Clothing contaminated by acid should be washed in water without delay.

Risk of explosion and fire due to explosive gases (hydrogen-oxygen) escaping from the battery. Avoid short circuits!
Caution: Metal parts of the battery are always live, therefore do not place tools or other metal objects on the battery!
Do not remove the safety vent plugs of the cells.

Electrolyte (approx. 30% diluted sulphuric acid) is highly corrosive. Under normal operating conditions vented batteries in vertical position do not release electrolyte. Should the casing be destroyed, the liquid electrolyte released is highly corrosive.

Batteries and cells are extremely heavy. Ensure secure installation! Use only suitable handling equipment and lifting tools.
Direct sunlight must not fall on cells.

Dangerous electrical voltage! Metal parts of the battery are always live.

Pay attention to the hazards due to the batteries.

Installing and using the battery not in compliance with the instructions, repairing with non-original parts, using improper electrolyte, using additions in the electrolyte or topping-up with improper de-ionised water can invalidate any claim for warranty. All failures, malfunctions or defaults of the battery, the charger or any other accessories, must be notified to our Customer Care at Contact@hbl.in and the defect battery should be sent to HBL or any HBL representative.

1. INSTALLATION

1.1. Unpacking and inspection of delivered goods

Unpack batteries and inspect for possible damage in shipment. Make sure that small packages are not thrown out together with the packing material. Check that all material has been received and inform HBL in case of any damage or shortages in the consignment. Shipping can be done in two ways:

- Dry charged, with electrolyte in separate plastic containers.
  In this condition the battery can be stored indefinitely. If stored for more than 1 year the commissioning charge should be done acc. to par. 2.3.B.
- Filled and charged for immediate use. Max. recommended storage time is 3 months at 25°C, 2 months at 35°C or 1 month at 45°C ambient temp.

1.2. Battery room

Battery room must conform to EN 50272-2. Please pay attention to:

- Floor load capacity and nature
- Resistance of floor coating against electrolyte corrosion
- Any source of sparks or flame (lamps, switches, etc)
- Ventilation conditions (forced or natural) and room temperature

1.3. Rack installation

Align the rack according to installation drawing EN 50272-2 specifications. Rack should be horizontally aligned, using levelling parts or adjustable insulators. Check rack stability and ensure all screw connections.

1.4. Connection of cells/blocks

Place each cell/block vertically onto the rack respecting the polarity: The positive pole [+, red colour] should be connected to the negative pole [-, blue colour] of the adjacent cell.
Position cells/blocks leaving a distance of approx. 10 mm between them.
For large cells we recommend you to start from the middle of the rack.
If needed, clean the contact surface of poles and connectors with damp cloth. Do not use any kind of cleaning chemicals.
Fit the connectors, adjusting if needed, the distance between cells/blocks, so that poles are not stressed at all. Put in place connection accessories (first the washer, then the grower and finally the bolt) and tighten them with an insulated torque wrench at 24 ± 1 Nm. Avoid mechanical stresses on poles.
Fit the insulating pieces or caps on all connectors and end-poles.
Affix nameplate, end-terminals polarity labels and safety markings.
When battery sets are connected in parallel special care should be taken so that the same thermal environment and the same electrical connections resistance are applied in all parallel strings. Max. no. of parallel strings is 4.
If cells/blocks are installed into a cabinet (instead of a rack), please take into consideration that only cells in filled condition should be used, since it is not recommended to fill the cells inside the cabinet.
For dry charged battery condition follow the instructions for electrolyte filling.

2. COMMISSIONING

2.1. Electrolyte filling

The electrolyte for the filling of cells is diluted sulphuric acid in de-ionised water (for density see "Rating Data") and conforms to VDE0510/DIN43530. Do not use improper electrolyte.

Electrolyte temperature before filling should be 5 to 35°C.

Respect safety rules, wear protective glasses and clothes and use only plastic jug / funnel for the filling of cells with electrolyte. In case of accident , after flushing with plenty of water consult a doctor immediately!

- Remove the transport plugs
- Fill the cells with electrolyte up to MAX level indication
- Fit the operation plugs
- After 1 hour, top-up with electrolyte to MAX level, if applicable

The commissioning charge of a dry-charged battery should start no less than 2 hours and no more than 12 hours from the completion of filling.

2.2. Verification of installation quality

Before starting the commissioning charge make the following controls:

- Measure individual cell Open Circuit Voltage (O.C.V.). Nominal values are given at 20°C. For other temperatures dU/dT = -0,0005 V/°C applies.
  If battery was delivered filled and charged:
  Nominal OCV OPzS 2,08 ± 0,01 V/c
  Nominal OCV OPzS-Solar 2,09 ± 0,01 V/c
  If battery was delivered dry charged, 2 hours after filling with electrolyte:
  Nominal OCV OPzS 2,06 ± 0,01 V/c
  Nominal OCV OPzS-Solar 2,07 ± 0,01 V/c
  In case the cell voltages are below the indicated values and deviations, then the battery commissioning charge should be done acc. to par. 2.3.B.
  In case of cells having OCV with deviation of more than ± 0,02 V from average cell voltage (Vbat / no. of cells), please inform HBL.
- Measure the total battery OCV – this is a very important control.
  It should be equal to individual cell OCV x no. of cells in series.
  In case a cell has been installed with reverse polarity then the total battery OCV will be approximately 4V less.
  In case a block has been installed with reverse polarity then total OCV will be approx. [2 x Vnom] less, where Vnom is the nominal block voltage.
  The cell/block installed with reversed polarity should be disconnected and connected again with correct polarity before starting the commissioning charge. Cells/blocks charged with reverse polarity will be destroyed.

2.3. Commissioning charge

The following methods can be used:

Method A:

With IUoU or IU characteristics acc. to DIN 41772-3, where Imax = 2 x I10, Uo (boost) = 2,35 - 2,40 V/c (current-limited duration) and U (float) = 2,23 V/c ± 1% (float). Using this method, 95% of battery capacity will be attained within 1 month and the full capacity will be attained later on.

Method B:

With IUoU characteristic, where Imax = 2 x I10, Uo (boost) = 2,40 V/c (time-limited duration) and U (float) = 2,23 V/c ± 1%.

The total time of the Uo phase should be set to 72 hours without interruption. In case of stand-alone system (i.e. photovoltaic) where the charge regulator uses IU curve, then U = 2,40 V/c, the time for the completion of the 72 h should be calculated as the sum of hours of peak power of PV array and the load should not be connected until the completion of the charge.

Using this method the full battery capacity is attained at the end of it.

3. OPERATION

EN 50272-2 "Safety requirements for secondary batteries and battery installations Part 2: Stationary batteries" is the applicable standard.

3.1. Standby systems (float / buffer applications) parallel operation mode

In these systems the DC supply provides power to load and the battery is under float voltage. Battery delivers power to load only at AC net breakdown, when DC supply fails or when the load exceeds DC supply max current - so in this case the battery acts as a "buffer".

Charging characteristics are IUoU or IU (2.3.A). In case of "buffer" operation then, depending of the load profile and after consulting HBL, the float voltage can be set to higher value (i.e. at 2,25 V/c or even higher).

Discharging should be done according to the installation specifications. Recommended max depth of discharge is 80% of battery nominal capacity. Proper sizing of the installation should safeguard that the battery is not discharged more than 80% (known as deep discharge). This means that the battery cut-off voltage should be set according to the load and in comparison with the battery performance tables in different discharge rates. The battery should never be discharged at a voltage below the specified voltage for the appropriate discharge rate.

Recharging should be done immediately after full or partial discharge acc. to par. 2.3.A. Recharge time depends on previous discharge depth, initial charging current and recharge voltage. In case fast recharge is required, the IUoU characteristic with I = 2 x I10 at U = 2,40 V/c can recharge more than 95% of capacity between 3 – 15 hours depending on previous discharge.

Equalising charge is required only after a deep discharge or after prolonged period of battery being in a partial state of charge (in "buffer" operation). Equalising charge should be done according to par. 2.3.B.

3.2. Stand-alone systems (cyclic applications) response mode operation

In these systems the battery is the only direct DC supply to the load. The battery is being charged from an external non-continuous source (such as PV array, a diesel generator or a wind mill) and discharged when such a source is not available (i.e. at night or when cloudy weather at a PV station).

Charging characteristics are usually IU, where I = available current from the external source minus load and U = 2,30 – 2,40 V/c.

If the system is designed for daily discharge of up to 20% of battery nominal capacity then U = 2,30 – 2,35 V/c is recommended.

If the system is designed for daily discharge of 20 - 30% of battery nominal capacity then U = 2,35 – 2,40 V/c is recommended.

At higher daily depth of discharge electrolyte stratification may occur due to poor overcharge and gassing (i.e. measured density at the top electrolyte layer is lower than inner density), which leads to degradation of available capacity if equalising charges are not applied. Stratification can be avoided if cells are equipped with HBL electrolyte circulation system (ECS).

Discharging should be done according to the installation specifications. Recommended max depth of discharge is 80% of battery nominal capacity. Proper sizing of the installation should safeguard that the battery is not discharged more than 80% (known as deep discharge). This means that the battery cut-off voltage should be set according to the load and in comparison with the battery performance tables in different discharge rates. The battery should never be discharged at a voltage below the specified voltage for the appropriate discharge rate. For daily discharges please see charging above.

Recharging: Please see charging above.

Equalising charge is required only after a deep discharge or after prolonged period of battery being in a partial state of charge which, (if battery is sized properly) can occur only when the external power source does not deliver its rated power (i.e. cloudy weather at a PV station). If battery is sized for daily discharges of more than 30% of battery nominal capacity then an equalising charge should be done periodically, to avoid electrolyte stratification.

Equalising charge should be done according to par. 2.3.B. Please note that in this case the load should be disconnected during the whole charge.

4. PERIODICAL INSPECTION & MAINTENANCE

Keep the battery dry and clean to avoid creeping currents and the associated risk of surface corrosion, decarburisation and/or fire.

Use only damp cloth, wetted only with water – without solvents.

During inspection & maintenance avoid any electrostatic discharges, as they can produce sparks – risk of explosion! Use proper clothes and shoes!

Use "pilot cells/blocks" for measurements (see below), the number of which can be specified from 10% to 20% of total no. of battery cell/blocks.

4.1. Standby systems (float / buffer applications)

- Every 6 months inspect, measure and register:
- Total battery voltage and room temperature. If float voltage deviates more than ± 1% from [2,23 x no. of cells] value then adjust it or inform HBL
- Voltage, electrolyte density and temperature of pilot cells/blocks
- Battery room ventilation (see par. 5)
- Condition of vent plugs

- Every 12 months inspect, measure and register:

- Voltage, electrolyte density and temperature of all battery cells/blocks
  If a cell deviates in voltage more than ±0,1 V from mean battery value, in density more than ±0,05 kg/l from nominal or in electrolyte temperature more than ±5°C from mean battery value, please inform HBL
- Condition of racks or cabinets and general condition of battery
- Condition of battery connectors and end-terminals. Check & tighten them with an insulated torque wrench at 24 ± 1 Nm
- Electrolyte level. Top-up to MAX level (if needed) with de-ionised water, which should conform to VDE0510/DIN43530. Do not use improper de-ionised water as this will invalidate any claim for warranty

4.2. Stand-alone systems (cyclic applications)

- Every 3 months inspect and top-up (if needed) electrolyte level – see 4.1.
  Please note that the a.m. top-up interval depends on the special conditions of the installation, such as operating voltage and daily depth of discharge.
- Every 6 months inspect, measure and register:

- Total battery voltage and room temperature
- Voltage, electrolyte density and temperature of pilot cells/blocks. If pilot cell density indicates electrolyte stratification, do an equalising charge
- Battery room ventilation (see par. 5)
- Condition of vent plugs

- Every 12 months inspect, measure and register:
- Voltage, electrolyte density and temperature of all battery cells/blocks
  If a cell deviates in voltage more than ±0,1 V from mean battery value, in density more than ±0,05 kg/l from nominal or in electrolyte temperature more than ±5°C from mean battery value, please inform HBL
- Condition of racks or cabinets and general condition of battery
- Condition of battery connectors and end-terminals. Check & tighten them with an insulated torque wrench at 24 ± 1 Nm

5. VENTILATION REQUIREMENTS

The battery installer should follow EN 50272-2 standard specification recommendations regarding ventilation of battery room.

5.1. Gas generation

During float or boost charge gases are emitted from all secondary cells, vented, such as OPzS-LA, or valve-regulated ones. This is a result of water electrolysis by the overcharging current. Gases produced are hydrogen and oxygen. When emitted into the surrounding atmosphere, an explosive mixture may be created if the hydrogen concentration exceeds 4 in volume.

The purpose of ventilating a battery room is to maintain the hydrogen concentration below the a.m. limit.

5.2. Ventilation requirements

The minimum airflow rate for ventilation of a battery room should be calculated by the formula given in EN 50272-2, which takes into consideration all installation parameters.

5.3. Natural ventilation

Battery rooms require an air inlet and an air outlet with a minimum free area of openings, calculated by the formula given in EN 50272-2.

The air inlet and outlet openings should create the best possible conditions for exchange of air.

5.4. Forced ventilation

When the adequate airflow cannot be obtained by natural ventilation, then forced ventilation should be applied. In such a case the battery charger should be interlocked with the ventilation system or an alarm shall be actuated to secure the required airflow.

The air extracted from the battery room shall be exhausted to the atmosphere outside the building.

6. BATTERY LIFE

In addition to proper operation (charging and discharging) and maintenance, the lifetime of the battery depends on the following operating conditions.

6.1. Temperature

All technical data apply for the rated (nominal) temperature of 20°C.

The optimum operational temperature range for the battery is 20 ± 5°C.

Temperatures higher than 25°C reduce working life and lower temperatures than 15°C reduce available capacity (see also technical report IEC 1431).

The maximum recommended temperature range is 20 ± 10°C.

The operational limits of OPzS-LA series are -20°C to +55°C, but the battery installer should take into consideration that exceeding the limit of 40°C up to 55°C is violating EN 50272-2 ventilation calculation formula, so it should be acceptable only for short periods of time.

6.2. Quality of charge current

The superimposed ripple current interaction between charger, battery and load shall be taken into account.

The maximum recommended alternating component of the charger current Ieff (rms) should be limited to the following values, according to EN 50272-2 standard:

Ieff in float = 5 A per 100 Ah rated battery capacity
Ieff in boost = 10 A per 100 Ah rated battery capacity

Higher values of the ripple current will effect the gas generation and the battery life of any secondary lead acid battery, vented, such as OPzS-LA, or valve-regulated.

7. STORAGE

If batteries are taken out of operation for an extended period they should be stored in a fully charged condition in a dry, frost-free room. To ensure the battery is not deeply self-discharged we recommend you to do an equalising charge as per par. 2.3.B., according to storage room mean temperature:

- Every 3 months if storage room temperature is up to 25°C
- Every 2 months if storage room temperature is up to 35°C
- Every month if storage room temperature is up to 45°C

The storage time should be taken into account when considering operational life of the battery.

8. TESTS

All tests should be performed in accordance with test standard EN 60896-1 (IEC 896-1) and manufacturing standards DIN 40736 and 40737.

9. TRANSPORTATION

Transport of secondary cells is covered by international regulations. The following regulations for transport of dangerous goods apply only to filled and charged batteries (dry charged batteries are not considered dangerous).

Road: ADR
Rail (international): CIM Annex A RID
Sea: IMDG Code
Air: IATA - DGR

10. MALFUNCTIONS

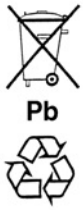
If malfunctions are found on the battery or the charger, HBL service department should be called in without delay.

A service contract with HBL is therefore highly recommended.

Please note our communication details below.

Respect the environment EC Directives must be followed

Used batteries with this symbol are reusable goods and must be returned to the recycling process.
Used batteries, which are not returned to the recycling process, must be disposed of as hazardous waste in accordance with all regulations.



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