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Installation, Operation and Maintenance

OPzV Standby & Solar Batteries

Eternity Technologies OPzV VRLA Standby & Solar Batteries are designed to be used as back-up power to support users that need reliable service continuity in case of power blackouts and outages of the electricity distribution network. They can also be used in off-grid and hybrid installations.

ET/IOM005-0520

OPzV Standby and Solar I&O&M

1. Safety Instructions

Carefully read this manual in all its parts upon receipt of Eternity Technologies OPzV Standby & Solar Batteries. Please refer to the latest edition of the battery room standards, effective at the moment of installation IEC 62485-2.

Lead-acid Standby & Solar Batteries are components of a system and although they are maintenance free, they require suitable precautions and behavioural norms to guarantee safe working conditions and to ensure maximum performance of the battery during its entire life. The Installation, Operation and Maintenance instruction manual supplies the necessary instructions for the correct care, handling, installation, use and maintenance of Eternity Technologies OPzV Standby & Solar Batteries.

The non compliance with the instructions given herein may cause injury to personnel and damage to equipment as well as poor operation and performance of the battery. Any repairs made without authorisation, for example, opening the valves, may render the warranty void.

Store this manual in close proximity to the batteries at all times and ensure it is accessible to the relevant personnel.

No naked flames

Corrosive

Wear safety goggles

Read instructions

First aid / medical assistance

Keep away from children

Explosive

Caution

Electric shock risk

O**bserve the following precautions at all times**

Observe the operating instructions - work on the battery should be carried out by qualified personnel only.

Exposed metal parts of the battery carry a voltage and are electrically live with the risk of short circuits.

Avoid any electrostatic charge; before starting work on the battery, first discharge any possible electricity from yourself by touching an earth-connected part; repeat this action occasionally until work is complete.

Use protective equipment, such as protective clothing, rubber gloves and goggles.

Use insulated tools.

DO NOT place or drop metal objects on top of the battery.

DO NOT wear rings or bracelets.

Remove any articles of clothing with metal parts that might come into contact with the battery terminals.

DO NOT smoke and DO NOT use open flames or create electric sparks.

Take all precaution when using the main supply.

Make sure that the first aid kits and fire extinguishers are easily accessible.

Used batteries contain recyclable materials. They must not be disposed with household waste but as a special waste. Methods of return and recycling must conform to the regulations in operation at the site where battery is located. If in doubt please contact Eternity Technologies.

2. Introduction

Eternity Technologies range of OPzV Standby and OPzV Solar 2V batteries are designed for cyclic and float applications. Examples of these applications are listed below:
a) Base Stations – accessible and remote
b) Solar and wind sites
c) Utility and switchgear
d) UPS
e) Back-up power systems
f) Peak shaving applications
g) Traffic Systems

Eternity Technologies range of OPzV batteries are divided into two product variants:
a) OPzV Standby – Increased capacity, designed for mainly float / back up applications.
b) OPzV Solar – optimized for greater cycle life through the addition of phosphoric acid. For cyclic applications.

Eternity Technologies range of OPzV Standby and OPzV Solar 2V batteries utilise a tubular positive electrode design as well as other robust components designed to withstand all types of use / environments.

The gelled electrolyte is maintenance free throughout the life of the product so no topping up is ever required.

Each gas release valve is 100% tested for functionality as the valve is a critical part of the battery's design and performance.

3. Delivery, Unpacking and storage

Unpack the batteries as soon as they are delivered. Verify that the equipment has been delivered in good condition. Any damage must be reported immediately to the carrier and the damaged items retained for inspection by the carrier's representative.

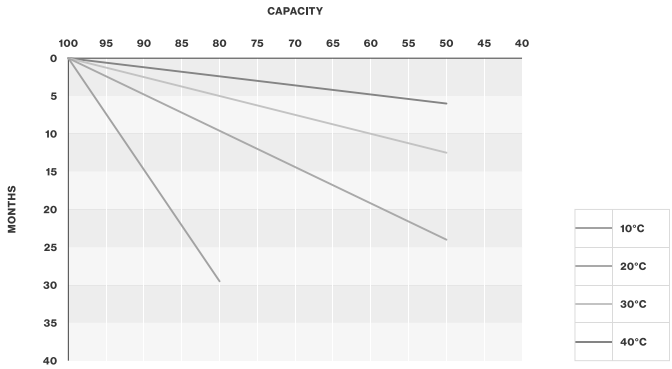
The details on the label should be read carefully and the following points to be observed:

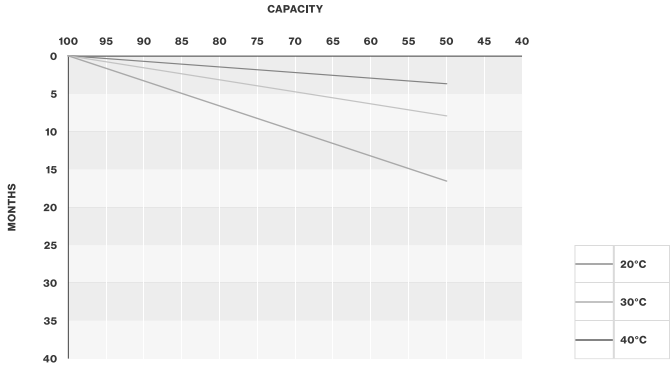
- Cell Type
- Cell Voltage
- Capacity
- Float charge voltage
- Operating Temperature

If the battery cannot be immediately installed, store it in a dry, cool and clean place with adequate air flow. Temperature should be between 10-30°C.

Do not expose the battery to direct sunlight, to avoid any damage to containers and lids.

IMPORTANT NOTE Storage time for charged cells is limited. Please see the self discharge rates at various temperatures below:





During the storage time, the open circuit voltage (OCV) must periodically be checked.
Cells with OCV below 2.07 Vpc must be recharged providing constant voltage of 2.35 Vpc with current limitation of 1.5 x I10 (A), for 24 hours.

The OCV of a fully charged battery should result between 2.12-2.15 Vpc.

Failure to observe the above conditions may result in a greatly reduced capacity and service life or in permanent damage to the cells.

4. Installation

PLEASE REFER TO THE LATEST EDITION OF THE BATTERY ROOM STANDARDS, EFFECTIVE AT THE MOMENT OF THE INSTALLATION OF THE BATTERY.
NORM REF. EN 62485-2

Check that local regulations are also being complied with.

WARNING

The cells are already charged when delivered and should be unpacked with care. Avoid short circuiting terminals of opposite polarity.

Before installing the cells, clean all parts. Remove the short circuit ABS protectors from the terminal posts and clean them with a soft clean cloth.

Before replacing old batteries ensure all electrical loads are switched off.

Battery Room - Points to Consider:

- Ensure the floor is structurally capable of carrying the battery load
- The floor should be resistant to Electrolyte (diluted sulphuric acid)
- There should be no ignitable sources near to the cells
- Ensure there are no unauthorised access points to the battery room
- All rooms should have the correct fire-fighting equipment fitted in case of emergency.

Vertical Installation

Place the cells on the rack (or cabinet) and make sure that the spacing allows the accommodation of the inter-cell connectors (around 10mm). Most batteries have cells connected in a simple series arrangement, so the cells should be arranged to preserve the sequence: positive (+), negative (-), positive (+), negative (-) throughout the whole battery.

WARNING

NEVER LIFT CELLS BY THE TERMINAL POSTS. ALWAYS USE APPROPRIATED DEVICES (SUCH AS LIFTING STRAPS AND SUITABLE MECHANICAL LIFTING DEVICES) TO PREVENT INJURY TO PERSONAL OR DAMAGE TO THE CELLS.

For batteries to be installed on multiple tiers, start by placing the cells on the lower tier on either side of the frame where the stand sections meet. Any unused stand spaces should be on the upper tier.

For batteries on stepped racks, leave any unused space on the back (top) step.

Where multiple racks are arranged end-to-end, adjust the position of the adjacent end cells to accommodate the flexible inter-rack connectors.

Take particular care to preserve the positive to negative sequence when using flexible inter-tier, inter-step or inter-rack connectors between rows of cells. Leave the main positive and negative terminals of the battery free for connection to the charging source.
Check cell alignment.
Prepare the inter-cell connectors by cleaning the contact surfaces with a soft clean cloth.

Fit the inter-cell and inter-tier connectors using approved, insulated bolts and nuts. Ensure all bolts, connectors and cell terminals are free from dust or debris before connecting.

Use insulated wrenches to tighten the parts firmly together, with torque setting of 23 Nm (203 in lbs).
Pay special attention to avoid short-circuiting the cells with any of the battery hardware.

Check tightness and cleanliness.

When all cells have been connected up check the terminal voltage, this should equal to the sum of all the individual cell voltages. If the total voltage is different to the calculated figure, some cells may have been reversed.

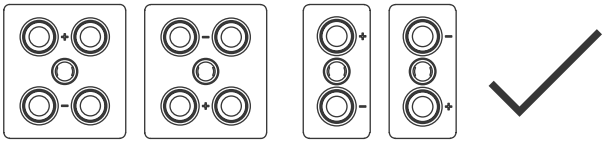
Connect the positive terminal of the battery to the positive terminal of the charger and the battery negative to the charger negative.

Number the cells by using a set of numbering stickers. It is common practice to number the cells beginning with #1 at the positive end of the battery and following the sequence of electrical connection of the cells, through to the negative end of the battery.

Horizontal Installation

All Eternity Technology standby cells can be stored vertically and horizontally.

All Eternity Technology Solar cells up to and including 1200Ah can be stored both vertically and horizontally. If you require larger Solar cells to be stored horizontally please contact Eternity Technologies. When storing horizontally ensure that the internal plates are vertical (to check this is the correct the positive and negative terminals should be above or below each other ie not on the same level as per the diagram below):



5. Charging

a) Commissioning Charge

Batteries lose charge while in transit or during storage. For this reason, a refresh charge should be given before putting the battery into service.

Recommended charge settings - at the ambient temperature range of 20 °C to 25 °C – are as follows:

12 hours at constant voltage of 2.35 Vpc at 20°C (68°F)
{Current limitation 1.5 x I10 Amps}
temperature compensation;
0°C = 2,45 Vpc
10°C = 2,40
20°C = 2,35
30°C = 2,32
35°C = 2,30

b) Float Charge

To maintain the battery in fully charged condition during normal battery operation or, after a discharge, to recover 90% of nominal capacity within 20 hours, a recommended float charge has to be applied.

Recommended float voltage settings are as follows:

Constant voltage 2.25 Vpc at 20°C (68°F) ±1%
{Current limitation 2xI10 Amps}

The float voltage value requires a thermal compensation of -3.5mV/cell/°C for temperature increases. For temperature decreases in the cell the voltage should be increased by 3.5mV/Cell/°C. See graph below. Failure to change these values will lead to capacity problems and reduction in operational life.

c) Equalizing / Boost charge 2.35 – 2.4V

Chargers usually have two adjustable charging voltages: one for the "floating" charge and one for the "equalizing" charge (also known as "boost", "high rate" or "recharge").

The equalizing charge is generally required:

- when the total voltage spread between the cells is greater than 0.04 V under float charging conditions
- after exhaustive discharges
- for fast recharging after a discharge
- when charging cells in standby applications with frequent power outages
- for float charge using voltages below 2.23 Vpc

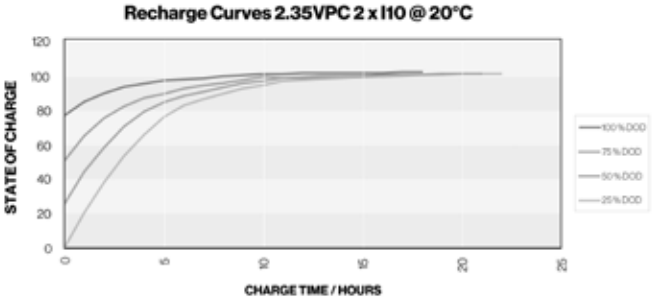
Boost charge voltage is 2.35 – 2.4V per cells for a maximum duration of 48 hours. It can be turned off earlier though if the current has decreased to a value lower than 0.05 x I10.

d) Charge current limit

The limit for the charging current using the float charge voltage after a discharge is limited to 5 x I10

e) Charging Time

Use the graph below for to estimate typical charging times:



f) IU Charging Profile

The IU charge is the most common method for fast recharging or when batteries are charged in cyclic applications. It consists of two phases:

Bulk Charge / Phase 1
The charging current is set to a limit between 2-5 x I10 until it reaches a maximum voltage of 2.35V / cell.

Constant Voltage / Phase 2
Here the voltage is set to 2.35V / cell. During this phase the absorbed current will start to decrease and finally reach a value of 0.05A / Ah. At this point the battery is considered fully charged and the rectifier / charger system should be switched back to the relevant float voltage. The constant Voltage phase of the charge should be limited to a maximum of 10hrs with maximum current of 5A/100Ah.

g) IUI Charging Profile

The IUI charging method is perceived as the best method of charging for a lead acid batteries and will increase the cycle life of the cell. The charging method is similar to the above but an additional constant current phase is added after the Constant voltage phase. The final constant current phase equalises the charge over the individual cells to ensure even finishing. This will help improve the battery efficiency and ultimately increase the cycle life.

Bulk Charge / Phase 1
The charging current is set to a limit between 2-5 x I10 until it reaches a maximum voltage of 2.35V / cell.

Constant Voltage / Phase 2
Here the voltage is set to 2.35V / cell. During this phase the absorbed current will start to decrease and finally reach a value of 0.005A / Ah. At this point the battery is considered fully charged and the rectifier / charger system should be switched back to the relevant float voltage. The constant Voltage phase of the charge should be limited to a maximum of 10hrs with maximum current of <1.2A/100Ah.

I Phase / Phase 3
No voltage limits, but maximum current of <1.2A/100Ah for a duration of maximum 4 hours.

6. Discharge Rate

The discharge rate of the battery in Amps are is calculated in I10.

I10 = current for 10hr discharge to 100% DOD. This will be the basis for all discharge rates across this brochure. For example:

Let's take the Eternity OPZV 10 OPzV 1000
C10 capacity = 1185Ah to an end of discharge voltage of 1.80V @ 20°C
1 x I10 = 1 x (10hr discharge)
1 x I10 = 1 x 118.5 = 118.5A
5 x I10 = 5 x 118.5 = 592.5A

End of Discharge Voltage

Discharging too much capacity from the battery will lead to early failure so the user must ensure that measures are in place to prevent this. The recommended low voltage disconnect settings are mentioned below:

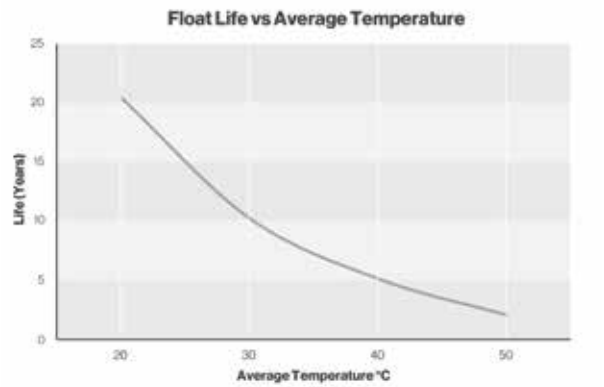
Back up time (h)	U (V) per cell
0,5-1,5	1,70
1,5-3	1,75
>3-24	1,80
24-240	1,85

7. Temperature and Air flow

Temperature effect on float life

Increased temperatures have a great effect on the life of a battery. When the battery is operated at increased temperatures, the corrosion of the positive terminal is accelerated which leads to early failure. When operated at 20°C, Eternity technologies OPzV range of batteries will last for 20 years. For every 10°C increase in the average operating temperature, the battery's life is halved.

The graph below shows the effect of temperature on the float life of the battery.



Temperature effect on cycle life

Eternity Technologies recommends that the operating temperature range for OPzV batteries be within the region of +10°C to + 30°C. Operating in higher temperatures will lead to decreased operational life, operating in lower temperatures will lead to a reduction in available capacity.

Air flow for cooling

When batteries are cycled, they generate heat. Eternity Technologies recommend a minimum gap of at least 10.0mm between cells to allow for the heat to disperse from around the cells. Where natural cooling is not enough to keep the temperature of the battery to a recommended level, a cooling system may be required. We can work out the size of the required cooling by calculation, please see below:

A 48V battery is discharged twice daily, delivering 3 hours back-up and 3kW of power

Heat loss from the battery = 2 (2 discharges/day) x 3kW x 3 hours x 0.15 (15%) = 2.7kWh = 2700Wh per day.

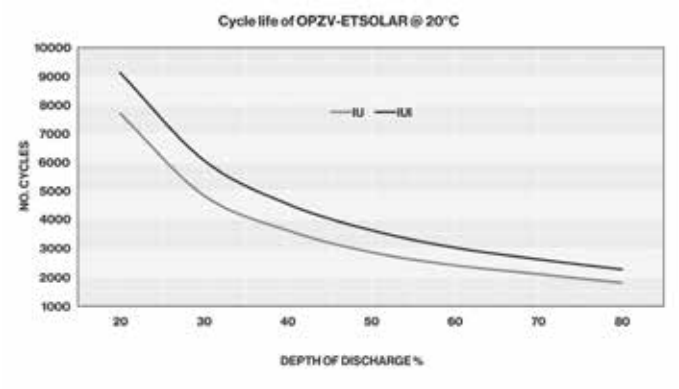
If we calculate the cooling power required to keep the room at a consistent temperature then we take 2700Wh and divide by 24 hours = 112.5W

Air exchange to exhaust Hydrogen
Due to the chemistries involved within Eternity Technologies OPzV battery range, hydrogen evolution and emittance is unavoidable. Although the levels are minimal, if they are allowed to accumulate or there is a fault within the system and hydrogen gas increases to a dangerous level, there is a risk of explosion if a spark or flame becomes present.

In order to avoid a build-up of hydrogen to dangerous levels, the battery room or area needs to be ventilated. We can calculate the required ventilation based on the number of cells and their capacity. Eternity Technologies recommends the international standard for the safety stationary batteries, IEC 62485-2 be consulted.

8. Cycle Life

Please see the graph below showing our maximum number of cycles vs the depth of discharge. There are two lines on the graph. One line states the charging profile with IU charging profile. The other line shows the cycle life with an IUI charging profile. The graph is referenced to 20°C, operating at temperatures either side of this figure will result in a different number of cycles.



9. Hybrid Applications

Eternity Technologies Solar OPzV batteries can be used in a hybrid system alongside a diesel generator where the batteries are used to decrease the run time of the generator. Charging is critical in this application and the user must ensure that the charging time is sufficient to fully charge the battery between cycles. Failure to do this will result in reduced cycle life.

The charging criteria must comply with the figures set out in section 5 of this document.

10. Solar Applications

Batteries used without a generator and no mains power are classified as solar batteries. The important thing here is to limit the charge and discharge currents.

When there is an abundance of sunlight, it is necessary to limit the charge and not overcharge the battery. When there are times of continuous darkness, it is important not to discharge the battery too much. Please use the end of discharge voltage recommendations in this brochure for guidance.

Failure to comply with this will result in reduced capacity and cycle life.

It is recommended to perform a boost charge every 1-3 months in solar applications.

11. Maintenance

Eternity Technologies OPzV are sealed-maintenance free lead-acid batteries and need no water addition.

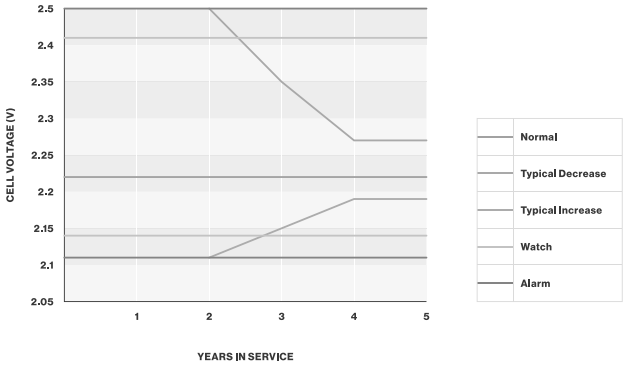
Cleanliness

The containers and lids must be kept dry and free from dust.
Cleaning must be done only with a damp cotton cloth.
Avoid static discharges generated during cleaning.

Voltages

Individual cell voltages will vary greatly when the cells are first put into operation. This is expected and variation will start to decrease within the first 12 months. Monitor these as per below. If there isn't any significant change in the voltages after 12 months, an additional equalisation charge should be performed.

Please see graph below for expected voltage variation vs time.



Every 6 months:
- Check for evidence of damage on the battery and equipment.
- Check and record the total battery float voltage, the voltage on pilot cells* and temperature.

Once a year:
- Check and record individual cell voltages.
- Perform a discharge test according to IEC 60896-21 standard until the battery shows signs of degradation and then every six months thereafter.

Keep a log book to record all maintenance and inspection operations, which will be helpful to monitor long-term changes of the battery condition.

Do not attempt to open the safety valve. Opening could cause damage to the battery.

***Pilot Cell**
For regular monitoring of the battery condition, select one cell near the middle of the battery string as a "pilot" cell (for battery consisting of more than 60 cells, it is advisable to select one pilot cell out of 60).

Additional Information

For any further information on Eternity OPzV VRLA Standby & Solar batteries, please contact:

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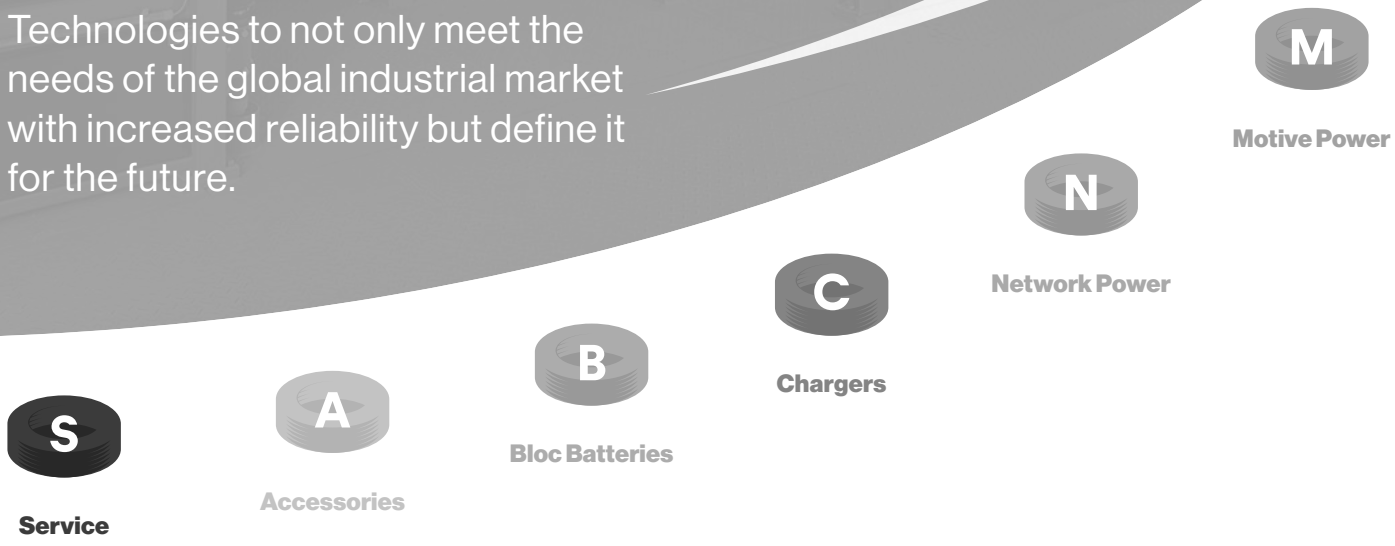
POWER FOR TOMORROW TODAY

The Eternity Technologies range is built using only the highest quality and most efficient production processes at our state-of-the-art manufacturing centre in the UAE.

It is this innovation, modern design criteria and industry-leading machinery that allows Eternity Technologies to not only meet the needs of the global industrial market with increased reliability but define it for the future.



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