PowerSafe®
OPzS and OGi

Flooded Stationary Lead Acid Batteries

Installation, Operation and Maintenance Instructions

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Power/Full Solutions

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VENTED LEAD ACID STANDBY BATTERIES

Important

Please read this manual immediately on receipt of the battery before unpacking and installing. Failure to comply with these instructions will render any warranties null and void.

Care for your safety

Batteries give off explosive gasses. They are filled with dilute sulphuric acid which is very corrosive. When working with sulphuric acid, always wear protective clothing and glasses. Exposed metal parts of the battery always carry a voltage and are electrically live (risk of short circuits). Avoid electrostatic charge. The protective measures according to IEC 62485-2 must be observed.

No smoking. Do not allow open flames, hot objects or sparks near the battery, due to the risk of explosion or fire.

When working on batteries, wear safety glasses and protective clothing.

Note operating instructions.

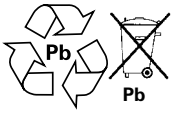
Electrical hazard.

Danger. Cells are heavy. Make sure they are safely installed. Only use suitable transport and lifting equipment.

Wash all acid splash in eyes or on skin with plenty of clean water and seek immediate medical assistance.

Risk of explosion and fire. Avoid short circuits.

Electrolyte is highly corrosive.



Used batteries contain valuable recyclable materials. They must not be disposed of with the Domestic waste but as special waste. Modes of return and recycling shall conform to the prevailing regulations in operation at the site where the battery is located.

Handling
Vented lead acid batteries are supplied in a fully charged state and must be unpacked carefully to avoid short-circuit between terminals of opposite polarity. The cells are heavy and must be lifted with appropriate equipment.

Keep flames away
In case of accidental overcharge a flammable gas can leak off the safety vent.
Discharge any possible static electricity from clothes by touching an earth connected part.

Tools
Use tools with insulated handles.
Do not place or drop metal objects on the battery.
Remove rings, wristwatch and articles of clothing with metal parts that may come into contact with the battery terminals.

California Proposition 65 Warning- Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

Warranty- Any of the following actions will invalidate the warranty: Non-adherence to the Installation, Operating and Maintenance instructions. Repairs carried out with non-approved spare parts. Application of additives to the electrolyte. Unauthorized interference with the battery.

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 it more than

3 months at 20°C (68°F)

2 months at 30°C (86°F)

1 month at 40°C (104°F)

A refreshing charge shall be performed after this time. Failure to observe these conditions may result in greatly 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.

If the batteries are supplied moist charged, the storage time shall not exceed 2 years. For filling, see special instructions on filling and commissioning of moist charged batteries.

Storage of a battery after use

Never store a battery discharged but ensure it is fully charged before storage. Storage times quoted above (before use) also apply after use.

Installation

The electrical protective measures, the accommodation and ventilation of the battery installation must be in accordance with the applicable rules and regulations. Specifically IEC 62485-2 apply.

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 on the rack and arrange the positive and the negative terminals for connection. Battery cells are usually installed in series.

Cells in parallel strings

Vented cells 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. 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, taking care to use the correct torque loading (Tab. 1). To avoid damage to the plastic materials, do not use grease. Fit the covers supplied for protection against inadvertent contact. Make sure that all caps are closed.

Table 1: Torque loadings for terminal screws

	Cell Type	Torque	
		Nm	lbs
Tubular Plate	M-10 Female	24±1	17±1
Flat Plate	OGi	24±1	17±1

Carefully follow the polarity sequence to avoid short circuiting cell groups. A loose connector can make adjusting the charger difficult, create erratic performance and possible damage to the battery and/or even personal injury.

Finally, with the charger switched off, the battery fuses removed and the load disconnected, connect the battery to the D.C. power supply.

Ensure that the polarity is correct- positive terminal of the battery to the positive terminal of the charger. Switch on the charger and charge according to the commissioning charge paragraph below.

The first charge must be monitored to ensure that the limits are not exceeded and that no unacceptable temperatures occur.

The electrolyte level on delivery can vary. The final electrolyte level will be achieved after the commissioning charge. Small quantities (up to 3 mm) can be topped up with distilled water.

Commissioning charge

When commissioning a new battery supplied filled and charged (first charge), follow procedure a) b) or c).

Procedures a) or b) are recommended.

a) IU method (boost charge):
At a raised voltage of 2.33 – 2.40V/cell. The charging time will be 12 to 36 hours depending on the initial charge conditions. The current must be limited to 4 x I10.

b) I method (boost charge):
With a constant current of 2.5-5 A/100 Ah with a final charging voltage of 2.50-2.75 V/cell. The charging must be monitored. The charging time can be 6 to 24 hours. If the maximum temperature of +45°C (113°F) is exceeded, charging must be terminated, continued at a reduced current, or temporarily switched to float charging.

Boost charging must be immediately switched off or switched to float charging when the fully charged state is reached.

c) Float charge:
With the recommended float voltage according to table 5. Full capacity will be obtained after a longer period of 4 to 6 weeks depending on the state of charge.

The fully charged condition has been achieved when, for a period of 2 hours, the cell voltages do not continue to increase and the charging current does not continue to decrease.The nominal electrolyte specific gravity (S.G.) shall be achieved at the end of charge (tolerance: ± 0.01).

For minimum end of charge voltages using the constant current characteristic see table 2.

Table 2: End of charge voltages

Charging current	25°C (77°F)	35°C (95°F)	45°C (113°F)
0.50 x I_{10}	2.65 V/c	2.60 V/c	2.55 V/c
0.25 x I_{10}	2.60 V/c	2.55 V/c	2.50 V/c

For the commissioning charge of moist charged cells, please refer to the specific moist charged instructions.

Standby Operation/Float Charge

Float Voltage

The recommended float / charge voltage is 2.23 V/cell remove per cell at 20°C (68°F) depending on the specific type (see table 5). The charger voltage amounts to Uflo per cell x no. of cells (tolerance ± 1 %).

If the average battery temperature exceeds the recommended operating temperature range of +10°C (50°F) to +30°C (86°F), the float charge voltage shall be reduced by (Tcell- 30) x 0.003V/ cell when the temperature exceeds +30°C (86°F) (but not less than 2.18V/c) and shall be increased by (10 – Tcell) x 0.003V/cell when the temperature is less +10°C (50°F).

Deviations of individual cell voltages of –0.05 to +0.10 V/c may be observed. However the total voltage of the battery shall be within the limits stated above.

Charging Current

Limitation of the charging current is not required under float charge condition.

At higher charge voltages up to 2.40 V/c the charge current shall be limited to 4 x I_{10}.

After reaching the gassing voltage of 2.40 V/c a current limit of 2.5 to 5 A/100 Ah is recommended (see Table 3).

Table 3: Limits of charging current

Charging process	Maximum charge current per 100 Ah	Cell Voltage	Temperature Limits
IU-method	5A to 40A (recommended)	2.33 V/c to 2.40 V/c	+45C° (113°F) resp -10°C (50°F)
I-method (above 2.40 V/c)	2.5A to 5A	2.50 V/c to 2.75 V/c	

Boost Charge

To reduce the recharge time the battery may be recharged at 2.33 – 2.40 V/cell with a current limited to 4 x I_{10}. Boost charging must be switched to float charging when the fully charged state is reached.

Ripple Current

In the standby operation mode the effective value of the A.C. ripple current must not exceed 5 A per 100 Ah C10, otherwise reduced operational life must be expected.

Temperature

The permissible operating temperature range is-10°C (50°F) to +45°C (113°F).

The recommended operating temperature range is +10°C (50°F) to +30°C (86°F). All technical data relates to the rated temperature of +20°C (68°F).

Higher temperatures reduce the operational life. Lower temperatures reduce the available capacity.

Do not expose cells to direct sunlight.

Effect of temperature on capacity

If the battery operating temperature is different from 20°C (68°F), a correcting factor is to be applied to capacity value taking into account discharge time.

Table 4: Temperature correcting factors (°C)

Discharge time	-10	0	5	10	15	20	25	30	35	40
5 - 59 minutes	.36	.60	.71	.81	.91	1	1.05	1.08	1.10	1.12
1- 24 hours	.66	.80	.86	.91	.96	1	1.03	1.05	1.07	1.08

Example: A battery with a capacity of 200 Ah at 20°C (68°F) for a 5 hour discharge will have a capacity of 182 Ah when discharged at 10°C (50°F) (200 x 0.91).

Electrolyte

The electrolyte is diluted sulphuric acid.

The nominal S.G. of the electrolyte at 20°C is as follows to table 5.

Table 5: End charge voltages

Tubular plate	OPzS
Flat plate	OGi
Nominal S.G. at 20°C (68°F)	1.240kg/l
Electrolyte level	Maximum
Float voltage at 20°C (68°F)	2.23 V/c

Table 6: S.G. values according to electrolyte level (at 20°C (68°F) in kg/l)

Tubular Positive Plate Cells			
	Electrolyte Level		
Type	**Minimum**	**Medium**	**Maximum**
OPzS	1.260	1.250	1.240

Flat Positive Plate Cells			
	Electrolyte Level		
Type	**Minimum**	**Medium**	**Maximum**
OGi	1.260	1.250	1.240

Nominal Level

Correction of S.G. according to temperature

Electrolyte S.G. varies with temperature. If temperature is above or below 20°C (68°F), specific gravity readings must be corrected.

The temperature correction factor for S.G. is –0.0007 per °C.

Example: S.G. of 1.230 kg/l at +35°C (95°F) corresponds to a S.G. of 1.240 kg/l at +20°C (68°F).

Discharging

End of Discharge Voltage

The battery must not be discharged more than the capacity specified in the performance tables. Deeper discharges may damage the battery and shorten its operational life. As a general rule the end of discharge voltage shall be limited to the values listed below:

Table 7: End voltages

Discharge time	End voltage
5 min < t < 59 min	1.60 V/c
1h < t < 5h	1.70 V/c
5h < t < 8h	1.75 V/c
8h < t < 24h	1.80 V/c

Individual cell voltages may fall below UE by not more than 0.2 V/c. A low voltage disconnect is recommended to prevent deep discharge. Special attention should be given to small loads that are not automatically disconnected at the end of discharge.

Discharged Cells

Batteries must not be left in a discharged condition after supplying the load, but must be immediately returned to recharge mode. Failure to observe these conditions may result in greatly reduced service life and unreliability.

Important notice:

Each deep discharge is abusive and could affect the life expectancy of the battery.

Testing

Capacity tests are to be carried out in accordance with EN 60896-11. Check that the battery is fully charged. Before testing new batteries it must be ensured that a sufficient commissioning charge has been applied, the S.G. is relating to the nominal value (± 0.01 kg/l) and the battery is fully charged. Lower S.G. results in lower capacity.

Recharge

After a discharge the battery can be recharged at the operating voltage (float charge voltage).

To reduce the charging time the recharging can be carried out with the boost charge voltage of 2.33 to 2.40 V/c. The recharging times depend on the charging procedure and on the charging current available. Generally 10 to 20 hours duration can be expected at charging currents between 5 A and 40 A per 100 Ah nominal capacity. Recharge 1.2 times the discharged capacity.

During recharging up to 2.40 V/cell the effective value of the A.C. ripple current can reach a temporary maximum 10 A per 100 Ah nominal capacity.

Equalizing Charge
After a deep discharge or after inadequate recharging, an equalizing charge is necessary. This can be carried out as follows:

a) at constant boost charge voltage of 2.33 – 2.40 V/cell for a maximum of 72 hours.

b) with I charge method according to the commissioning charge paragraph above, clause b).

If the maximum temperature of 45°C (113°F) is exceeded, charging must be terminated or continued at a reduced current or temporarily switched to float charging. The end of equalizing charge is reached when the S.G. of the electrolyte and the cell voltages have not risen for a period of 2 hours.

Because the permissible system voltage level may be exceeded when charging at increased voltages, suitable measures should be taken to protect the load circuits, e.g. charging «off line».

Maintenance Checks

Water topping
Top up the electrolyte level to the nominal level, but without exceeding the « Max » mark. Only demineralized or distilled water (purity grade: max. conductivity 10 µS/cm) shall be used.

After topping-up an equalizing charge can be applied to reduce the time for homogenization of the electrolyte density.

Cleaning

Keep containers and lids dry and free from dust. Cleaning must be undertaken with a damp cotton cloth without man-made fibres.

WARNING- Do NOT use any type of oil, solvent, detergent, petroleum-based solvent or ammonia solution to clean the battery containers or lids. These materials will cause permanent damage to the battery container and lid and will invalidate the warranty.

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 static discharges generated during cleaning.

Plugs

Leak-resistant plugs with a frit or flame arrestor plugs with a ceramic funnel must not be cleaned with water or positioned up side down. Should the frit be moistened with electrolyte, the plug must be replaced during regular maintenance. Standard plugs without frit can be cleaned with purified water if necessary. Dry them thoroughly before fitting them back onto the battery.

Readings – Log book

Every 6 months, check the total voltage at the battery terminals. Also check the voltage, S.G., and the temperature of pilot cells and record the room temperature.

Once a year, in addition to the above, take readings of individual voltages and S.G. of the electrolyte. Measure the S.G. either before topping up water or after boost charge.

Keep a logbook in which the measured values can be noted as well as power cuts, discharge tests, equalizing charges, topping up dates, storage times and conditions, etc.

Special Applications

Whenever the battery cells or monoblocs are to be used for special applications such as repeated cycling or under extreme ambient conditions please contact your SALES OFFICE.

For further information please visit our website: www.enersys.com

EnerSys World Headquarters
2366 Bernville Road
Reading, PA 19605, USA
Tel: +1-610-208-1991 /
+1-800-538-3627

EnerSys EMEA
EH Europe GmbH
Baarerstrasse 18
6300 Zug
Switzerland

EnerSys Asia
152 Beach Road
#11-08 Gateway East Building
Singapore 189721
Tel: +65 6416 4800

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