



Short operating manual for maintenance-free batteries (VRLA)

- ACUMAX® of the AML series
- ALARMTEC of the BP series
- the FGB series

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EN*

1. Safety:

Always follow the manufacturer's instructions and safety instructions. The battery should only be operated by qualified persons with appropriate permissions.

- Due to the risk of explosion or fire, no smoking, open fire and sources of ignition are allowed in the room where the battery pack (cells) is installed.

- **Hydrogen in the air can produce an explosive mixture. Therefore, proper air exchange (natural ventilation - gravity or forced) in the place of use of the batteries (cells) should be ensured.**

- When operating the batteries, wear protective clothing and goggles! Be sure to follow accident prevention the rules of and DIN VDE 0510 and VDE 0105 Part 1.

- In case of contact of acid with skin, wash the burn with water and seek medical help. Stains on clothing should be rinsed with water.

- There is a risk of fire and explosion and short circuits should be avoided. Metal parts of the battery are always under voltage; neither instruments nor tools should be placed on them.

- There is a risk of electric shock. Batteries (cells) accumulate a large amount of energy electricity and even when discharged can force the flow of short circuit current. It is necessary to prevent the possible short circuits of positive (+) and negative (-) terminals (poles) of a single battery (cell) or the whole battery pack (batteries consisting of multiple cells can have a voltage dangerous to life). Before operating the batteries, remove all jewelry and metal ornaments and use only insulated tools.

- The electrolyte is highly corrosive. Under normal operating conditions there is virtually no possibility of contact with the electrolyte. The electrolyte may leak through the safety valves in case of overcharging or mechanical damage to the container. In case of contact with the electrolyte, immediately rinse the place with plenty of water.

- The batteries (cells) are very heavy. Therefore, both suitable fastening equipment and transport equipment should be provided.

In case of failure to comply with the instruction manual, repairs using non-original parts or other prohibited actions (e.g. opening valves) - the warranty will be void.

2. Recycling:

The relevant provisions on the disposal of hazardous waste should be applied. The batteries (cells) marked with the disposal symbol should be delivered to recycling facilities or - if so agreed - returned to the manufacturer. Used batteries must not be mixed with chemical or household waste.

3. Operating parameters:

a) Charging:

Maintenance-free batteries must be charged using constant voltage limiting initial charging current (IU characteristic). The initial charging current should not exceed **0.3 C [A]** (C- battery capacity) that is, for example, **8.4 [A]** for the **EP 28-12** model. The recommended initial charging current is **0.1** of the battery capacity, that is **2.8 [A]** for the EP 28-12 model.

The charging voltage during buffer operation (emergency power) should be in the range from **2.25 to 2.30 [V / cell]** (**2,275 [V / cell]** recommended), that is from **13.50 to 13.80 [V]** for the battery with a voltage of **12 [V]** (6 cells) and from **243.00 to 248.4 [V]** for 18 batteries connected in series (battery 220 V, 108 cells).

During cyclic operation (repeated charge / discharge cycles), when the battery is the primary power source, the charging voltage should be in the range from **2.40 to 2.50 [V / cell]** that is from **14.40 to 15.00 [V]** for the battery with a voltage of 12 [V] (6 cells). At high operating temperature fluctuations, a power supply fitted with voltage temperature compensation system - reducing the charging voltage with increasing temperature- should be used. Temperature compensation coefficient is **minus 3 [mV / ° C / cell]** from 25 [° C].

The charging voltage should be well regulated and its ripple should not exceed 1.5 [%].

Each cell of maintenance-free battery (6 volt - 3 cell, 12 volt - 6 cells) is fitted with one way, self-sealing valve that opens when the pressure increase inside the battery (e.g. overload) and releases gases to the outside, protecting the container against explosion. Therefore, do not charge maintenance-free batteries in sealed enclosures; the battery space needs efficient natural (gravity) ventilation.

b) Operating temperature:

The rated operating temperature of maintenance free batteries is **25 [° C]**. Operation of maintenance free batteries at elevated temperatures leads to a **significant** reduction in **battery life**. Battery life is reduced **by half** for each sustained temperature rise of **8 [° C]** above nominal operating temperature. This means that the battery operated at 33 [° C] will retain 50 [%] while the battery operated at 41 [° C], only 25 [%] of the projected service life. For maximum battery life (buffer operation) perform the following steps:

- place the battery away from heat source devices (e.g. transformer, heat sink),
- keep at least 1.5 cm of free space around the battery and use the devices fitted with ventilation holes in the housing to allow free air circulation,
- use effective natural or forced ventilation or air conditioning,
- use a power supply with **temperature-compensated charging voltage** if the operating temperature exceed 25 [° C].

Operation at high temperatures (above 40 [° C]) significantly reduces lifetime of batteries and may also lead to their failure.

The temperature rise of batteries causes a reduction in internal resistance, resulting in an increase in charging current. Higher current raises the temperature of the batteries so their resistance decreases. Then the cycle is repeated, leading to the so-called **thermal runaway**, that is lack of thermal stability of the battery. When the battery temperature exceeds 40 [° C], the process occurs rapidly and leads to irreversible damage to the battery (C, in extreme cases - deformation of the housing).

Please note: when the room air temperature is 40 [° C], the temperature of battery located inside the UPS power supply will be from a few to several [° C] higher depending on the operation mode of the battery (buffer charging or high current discharge).

c) The depth of discharge:

Tightly sealed lead-acid batteries are sensitive to excessive (too deep) discharge. Excessive discharge of the battery reduces its energy storage capabilities, capacity and lifetime. Leaving a discharged battery for a longer time without recharging can also result in excessive discharge. Too deeply discharged batteries are damaged by sulphation which results partial irreversible loss of capacity available. The minimum allowable discharge voltage of the battery depends on the discharge current and is specified in the battery discharge characteristics.

4. Maintenance:

For maximum lifetime and reliability of maintenance free batteries connected in series or in parallel to increase their voltage or capacity, periodic inspections of their status and operating parameters should be carried out. Periodic maintenance of batteries should be performed only by qualified and authorized personnel. Presentation of **the results of measurements from all of required periodic maintenances is a condition for warranty claim.**

Every **12 months** (every 6 months recommended) from the date of installation, check and **document** the following:

a) Battery charging voltage - should be in the range between **2.25 and 2.30 [V / cell]** that is, for example: **243.0 to 248.4 [V]** for 18 batteries connected in series (220V battery, 108 cells). The recommended value is **245.7 [V]** (**2,275 [V / cell]**). The charging rectifier should be equipped with a charging voltage temperature compensation system.

b) The charging voltage for each battery - should be in the range between **13,5 and 13,8 [V]**,

c) The internal resistance of all batteries - should not be greater than the internal resistance of the new battery (shown on the data sheet) increased by **30%**.

d) Battery charging current - after a few days of loading it should decrease to **4 [mA] per 1 [Ah]** of battery capacity or lower but should be greater than zero.

e) Operating temperature in the battery space - should be in the range between **15 - 25 [°C]**.

If the measured values exceed the permissible range, please contact the batteries supplier.

Additionally, **the battery capacity test**, involving **partial discharging** with rated current, should be performed **every 12 months**. This is especially important in the case when there were no longer voltage decays for several months and the battery practically did not work. During the test, measure the discharge time, read or measure the value of discharge current at regular intervals (every 15, 30 or 60 minutes, depending on the expected duration of the test) measure and record the decreasing value of the battery voltage and the voltage of each cell. If the battery is fully operational, duration of the test shall be in accordance with the discharge characteristics of the tested battery, while the battery voltage will decrease evenly in all cells.

The time and duration of the battery capacity test should be properly selected to avoid the difficulties in the normal operation resulting from the power loss during battery charging once the test is performed. The battery will reach its full capacity after about 48 hours of charging.

5. Charging after purchase:

If the batteries are not installed within three months from the date of purchase, they should be charged with a voltage of 2.4 [V / C] for 24 hours. The batteries should be charged every three months; otherwise, your warranty may be void.

6. Cautions:

• Undercharged battery:

If the charging voltage is set incorrectly (too low or unmatched to the temperature), the entire battery is undercharged for a long period of time. In case of power failure, the battery may not work properly due to the loss of capacity.

• Overcharged battery:

Charging with higher voltage (which may be caused by not switching from accelerated or equalizing charging to buffer charging or by a malfunction of the charger) can cause serious problems for the entire battery, such as water loss, excessive gassing, a sharp temperature increase, shortened life span or deformation of the battery.

• Improper temperature:

If the temperature of the battery space is too low, the battery's available capacity will decrease. In the case of high temperature, water loss, shortening the life span or the battery deformation can occur.

• Too low discharge voltage:

The depth of discharge of the batteries is a very important parameter. Discharging cells below acceptable levels can lead to partial or complete loss of capacity or cause a significant decrease in charging efficiency, which in turn will lead to a drastic reduction in the lifetime of the entire battery.

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