
Instruction for use of maintenance-free lead-acid MW Power batteries.

Maintenance-free MW Power batteries are made with the latest technology for VRLA (Valve Regulated Lead Acid), i.e. the self-adjusting safety valves and the internal gas re-combination, thus they do not require special rooms with forced ventilation. We distinguish two technologies for maintenance-free VRLA batteries: with the electrolyte absorbed in a separator made of AGM (Absorbent Glass Mat) and the electrolyte in the form of a dense gel (GEL). The batteries, during normal operation, do not require maintenance. During normal operation, no gases emit, and there is no possibility of leakage. Natural ventilation is sufficient to cool the cells and remove the effects of unexpected overloading. Due to these characteristics, VRLA batteries can be installed in the office rooms and others, in which people stay. In the case of installation of the batteries in closed cabinets, assure adequate ventilation.

Maintenance-free MW Power batteries comply with all the requirements of the Polish and the European standards: PN-EN and IEC for lead-acid batteries. They can be sent by standardized transport and air-transport, because they comply with the requirements of DOT and I.A.T.A.

Recommendations of Occupational Health and Safety

Do not place the batteries in tightly closed containers (without ventilation). During abnormal operating conditions and occurred overloading, the batteries can give off flammable gas, and without possibility of ventilation they can cause explosion.

There is a risk of electric shock during installation, therefore, use the tools with the insulated handles. Do not drop and do not touch metal objects with the poles of the battery. Before starting the works, it is necessary to remove metal clothing items and other elements, such as: watch, wedding ring, chain, etc.

In the event of any leakage of the electrolyte, the leakage space must be thoroughly cleaned, at the same time taking care not to cause a short-circuit of the poles of the battery and burns to the skin. In the event of contact with the electrolyte, immediately rinse the burnt places with plenty of water and seek medical advice.

Storage and operating and storage temperatures of the batteries.

Store the batteries in a dry, cool and clean place. Storage time is limited. Store the battery in a stable position away from metal and other conductive materials, do not expose the battery to water, sunlight and heat sources, as this can result in reduced lifetime, deterioration and corrosion of the terminals. During transport, the battery should be in a vertical position and cannot be subject to large shocks or vibrations.

Maximum storage time will be determined assuming keeping of 50% of the maximum capacity. Approximate time of storage is shown in the table below:

Storage time	At a temperature
6 months	20°C
4 months	30°C
2 months	40°C

After this period, charge the batteries.

Store and use the batteries in compliance with the temperature conditions determined below:
storage from -20 to 40°C (note, in temperatures below zero, the battery capacity drastically decreases)
charging from 0 to 40°C (recommended)
discharging -20 to 50°C

Note. In the case of another range of the operating temperatures, please contact the manufacturer of the batteries.

The nominal operating temperature of the battery in the buffer operation, with which the maximum life span is obtained, is 20-25°C, therefore strictly observe the recommended temperature.

The expected battery life for the buffer operation is reduced by half with each temperature increase by 10°C from the nominal value. Reduced time of life when working in a temperature of 40°C is therefore very significant. For this reason, avoid operating at high temperatures.

Batteries installation.

Before starting, all links must be checked in terms of mechanical damage, correct polarity and correct connections execution. Tighten the screws of the connections between the links with the torque wrench with the force provided by the battery manufacturer. Do not combine different types of the batteries or with different history of use. This threatens to damage and wear. The installed batteries can operate in any position except for charging the batteries in the position of the poles terminals down. In the case of overloading, it can occur that while working in the position of "upside down" there will be a leak of the electrolyte (it is recommended to install the batteries in the normal position of the terminals up).

Dimensions of screws and nuts (mm)		Screw tightening force Nm
Diameter	Thread stroke	
M5	0.8	2.0-2.9
M6	1	4.1-5.2
M8	1.25	8.2-9.9
M10	1.5	14.7-19.2

Charging and discharging the batteries.

Maintenance charging voltage:

Voltage	at a temperature
2.35 V/link	0°C
2.33 V/link	10°C
2.27 V/link	20°C (reference)
2.25 V/link	25°C
2.23 V/link	35°C

The recommended maintenance voltage charging is 2,27V/link for a temperature of 20°C. If the ambient temperature differs by +/- 5°C, it is recommended to select the maintain voltage as in the table. Due to the gas re-combination phenomenon, there can be a difference of +/- 2% of the voltage of a single link. However, the total voltage of the battery should be within the limits mentioned above.

During the cyclic operation, discharging/charging, charging voltage should be between 2.40V/link to 2.50V/link, i.e. from 14.4 to 15.0V/12V.

Charging current.

VRLA batteries should only be used with the adjustable devices for charging constant voltage and current limited to 10% of 20-hour capacity (best life), e.g. 10A for 100Ah battery.

Unacceptable components of the variable charging current can cause damage and reduce the life of the battery. It is advisable to limit the variable components of the charging current to 0.1C20 (in amperes) or $\leq 1\%$ of the rated voltage.

Fast charging (compensation).

Charging compensation is necessary after deep discharges and/or inadequate charging. It can be conducted with max. voltage of 2.40 V/link for up to 24 hours (no more than 4-5 times a year). The charging storage should not exceed 10% of the battery capacity. When the battery temperature exceeds 45°C, charging should be stopped or temporarily switched to maintenance to reduce the temperature.

The charging status can be determined after the measurement at the open terminals of the battery after 24 hours of rest.

Charging status	voltage
100%	2.15 V/link
80%	2.09 V/link
60%	2.06 V/link
40%	2.02 V/link
20%	1.97 V/link

Discharging and cutting-off voltage

Cutting-off voltage, below which discharging of the battery is not allowed, should be limited to the values shown below.

Cutting-off voltage	Discharging time
1.60V/link	up to 15min.
1.65V/link	up to 1h
1.70V/link	up to 5h
1.75V/link	up to 8h
1.80V/link	up to 10-20h

VRLA batteries cannot remain in discharging but must be treated immediately with the maintenance charging. Failure to do so may shorten the battery life.

In the case of complete discharge, when the battery is fully discharged, the consumption of sulphuric acid is complete and the electrolyte consists solely of water. Sulphation of the plates is complete, which greatly increases the internal resistance of the plates. Completely discharged battery should be subjected to charging voltage of 2.27 V/link compulsorily with current of not more than 0.1C20 capacity in order to avoid excessive heating. The minimum charging time should be 96 hours.

Especially in the case of cyclic operation, recharge the battery after each use, do not discharge the battery below the threshold cutting-off voltage and leave (keep it in a discharged state).

Note: The occurrence of the completely discharged battery has a considerable impact on its durability and can be the ground to reject the complaint.

Maintenance/ control

VRLA batteries are the sealed lead-acid batteries and do not need to be filled. The container and the lid should be free from dust and dry. Clean only with a cotton cloth. For the buffer operation of the batteries in sets, it is recommended to keep the records of the battery life, which measured values, discharging tests, power outage, etc. will be saved. Once a year, test the capacity of a set of the batteries.

Special applications

In any situation, where VRLA batteries are used for special applications such as cyclic operation, or in extremely difficult conditions, it is recommended to contact the manufacturer for the service advice.

Environmental protection and recycling

The worn batteries, because they contain harmful substances to the environment, should be, according to the provisions on disposal of hazardous waste, provided to the recycling facilities or to the manufacturer.