STAND BY BULL

Banner
THE POWER COMPANY

Operating instructions

for valve regulated lead acid

1. Commissioning

Prior to commissioning, all cells/blocks must be checked with regard to mechanical damage, correct connection of the terminals and the solid fit of the connector. If necessary, the terminal caps are to be mounted. DIN EN 50272-1 and EN 50272-2 apply to the installation and operation of fix-mounted batteries. The battery is to be installed in a manner that an ambient related temperature difference of >3°C between the individual cells and blocks cannot occur.

The charger should be turned off and consumers separated from the battery prior to it being connected to the d.c. current supply (positive pole to positive terminal). The charger should then be switched on and charged according to Section 2.2.

1.1 Open circuit voltage

Before mounting, the open circuit voltage of each simple cell/bloc has to be controlled.
The minimum guidelines at 20°C are as following

2 volt cell:	u ≥ 2,10 v
6 volt bloc:	u ≥ 6,30 v
12 volt bloc:	u ≥12,60 v

Any higher values for freshly produced batteries are normal, but lower values are not. In case of lower values the cells/blocs have to be recharged.

1.2 Stud torque

The following torque values apply for blocks and cells with inserted screw poles:
M5 2.0 - 3.0 Nm
M6 3.9 - 5.4 Nm
M8 11.0 -14.7 Nm

2. Operation

Sealed batteries are ready for operation when dispatched. Full capacity is attained through charging at a constant voltage of 2.27 -2.30 V/cell (continuous battery power supply) within 4-5 weeks.

If the batteries are used for charging/discharging operations immediately after receipt, prior to the first discharge, they require initial charging with max. 2.35V/cell at 20°C for 24 hours, or with constant current of 1A per 100 Ah for 24 hours. GEL-batteries are in standby parallel operation and buffer operations without cycles partially operational only.

2.1 Discharging

The end point voltage of the discharge current of the battery may not be undercut. Unless otherwise stipulated by the manufacturer, the discharge may not exceed the rated capacity. Charging must take place immediately after both full and partial discharging, or within a period of max. 24 hours.

2.2 Charging

A charging process with limits according to DIN 41 773 (IU-characteristic) may be used.
Depending on the design of the charger and the charging curve, alternating currents flow through the battery, which are superimposed on the d.c. charge. These superimposed alternating currents and the effects of consumers lead to additional warming of the battery and loads on the electrodes, which can cause subsequent damage (see Section 2.4). Depending on the equipment involved (pursuant to DIN/VDE 0510 Part 1 draft), charging can take place during the following types of operation:

a.) Stand by parallel operation and floating operation

In this case, the consumers, the d.c. current source and the battery are subject to constant, simultaneous switching. The charge voltage represents both the operational and the equipment voltage.

With Stand by parallel operation, the a.c. current source is permanently able to supply both the maximum consumer and the battery charge currents. The battery only supplies current should the d.c. current source (charger) fail. The charge voltage setting amounts to 2.25-2.3 V ± 1% per °C x cell number.

In order to reduce the amount of recharging time, a charging stage can be employed with a charging voltage of 2.35 V (in exceptional cases 2.40V) x cell number. The charging current is to be limited to 0.25 x C10 until the charged voltage is attained. Once the maximum charged voltage is achieved, automatic switching to retentive charging at 2.25-2.3 V ± 1% per °C x cell number occurs.

Buffer operation

In the case of buffer operation, the d.c. current source is not always able to supply the maximum consumer current, when this temporarily exceeds the rated current of the d.c. current source. During this period, the battery supplies power and is therefore not fully charged at all times. Accordingly, depending on the consumers, the charging voltage should be set at approx. 2.27-2.30 V x cell number.

b.) Switch mode

During charging with max. 2.35 V/cell, the battery is separated from the consumers. Charging is to be monitored. If at 2.35 V/cell the charging current falls to 1.5 A/100 Ah rated capacity, a switch to retentive charging is made, or switching occurs once 2.35V/cell is reached.

c.) Battery operation (charging/discharging)

The consumer will only be fed from the battery. The charging process must be agreed with Banner in line with the application.

2.3 Equalisation charging

Following a deep discharge and/or insufficient charging, charging must take place at a constant voltage of max. 2.35 V/cell for up to 48 hours. The charging current may not exceed 10A per 100 Ah of rated capacity. Should a maximum temperature of 45°C be reached, charging is to be interrupted, or a switch to retentive charging be made, in order that the temperature falls.

2.4. Superimposed alternating current Ieff

Maximal 1 A per 100 Ah C10 in sealed batteries, like ZVEI information leaflet no. 19.

2.5 Charging currents

Charging currents are not subject to any limits during continuous battery power supply and buffer operation without a recharging stage. Instead the specific battery-related information our data sheets applies.

2.6 Permitted deviations from the float voltages

This deviation is somewhat larger within the first 6 months after installation than later.
This is due to the different internal conditions each single cell/bloc in terms of recombination and polarization. (following values refer to 20°C and 2,27v/C in standby parallel and buffer operations)

	2 v cells	6 v cells	12 v cells
< 6 months	2,20 - 2,32 V	6,60 - 6,96 V	13,20 - 13,92 V
> 6 months	2,22 - 2,30 V	6,66 - 6,90 V	13,32 - 13,80 V

The ideal temperature range amounts to 20°C ± 5°C (the technical data are based on this temperature). High temperatures cut battery service life, while low temperatures reduce the capacity available. Exceeding the temperature limit of 55°C is not permitted and ongoing operating temperatures <45°C are to be avoided. The temperature differences between the blocks in a plant should not exceed 5°C.

Within an operating temperature range of 15°-25°C, a temperature-dependent adjustment of the charging

voltage is not required. If the operating temperature is constantly outside this temperature range, the voltage should be adjusted accordingly. The corrective temperature factor amounts to -0.005V/cell per °C.

3. Electrolyte
The electrolyte either consists of very pure diluted sulphuric acid, which is fixed in a web, or in gel form. Accordingly, even in the case of mechanical damage, liquid escapes are either impossible, or only occur to a very limited extent.

4. Ventilation
Battery compartments, shelves or cupboards are to have sufficient ventilation pursuant to ÖVE C 10 T" or DIN EN 50272-2. There are no gas emissions under normal charging conditions. Never install batteries in airtight, sealed rooms or containers!

5. Battery care and checks
The battery must be kept clean and dry, in order to prevent creepage current. Battery cleaning should take place in accordance with the ZVEI directive „Cleaning of batteries".

The plastic parts of the battery, particularly the cell containers may only be cleaned with water without any additives.

The following should be measured and noted at least every six months:
- Battery voltage
- The voltage of various cells/block batteries
- The surface temperature of various cells/ block batteries
- Battery room temperature

If the cell voltage deviates by +0.2 V/cell or 0.1V/cell from the average retentive charging voltage and /or the surface temperature of various cells/blocks by more than 5K, then customer service support should be sought.

The following should be measured and noted annually:

- Voltage of all cells/block batteries
- The surface temperature of various cells/block batteries
- Battery room temperature

Annual visual controls:

- The screw connections. The solid fit of unsecured screw connections is to be checked
- The battery installation and surroundings
- Ventilation and air extraction

6. Testing
Testing should be completed according to EN 60896-2. Special testing instructions, e.g. pursuant to DIN VDE 0107 and DIN VDE 0108 should also be observed.
a.) Operational safety of the battery system
In general, the functionality of the battery must be regularly checked using a capacity test in order to guarantee the operational safety of the system. Care must be taken that the capacity test is carried out with the maximum current for which the battery is designed in its highest loading condition. Regular checks of the battery can markedly reduce the risk of unexpected failures. It is thus recommended to carry out professional capacity tests at regular intervals, at least once a year.

7. Defects
If defects in the battery or the charger are identified, customer service support should be requested immediately. Measurement data in line with Section 6 simplifies the search for the defect and its repair. A service contract with Banner also facilitates the timely identification of defects.

8. Storage and mothballing
If cells/batteries are to be stored for a long time or mothballed, they should be kept fully charged in a dry, frost-free room. Direct sunlight is to be avoided. In order to prevent damage, a choice can be made from the following charging measures:

1. Half-yearly equalisation charging in accordance with Section 2.3. In the case of mean room temperatures of over 20°C, shorter intervals may be necessary.

2. Retentive charging in line with Section 2.2. The period of use begins with the ex-works delivery of the filled and charged battery. Storage times are to be included in the period of use in full. In addition, batteries require recharging.

9. Technical data
The rated voltage, the number of cells, the rated capacity and the battery type are all to be read on the rating plate of the equipment.

Installation/Dealer stamp

on/by:

Warnings and safety instructions for lead-acid batteries

- Adhere to the information printed on the batteries, in the instructions for use and the vehicle operating manual.
- Wear eye protection.
- Keep children away from acid and batteries.

Danger of explosions:
- A highly explosive oxyhydrogen gas mixture is created during battery charging.

Open flames, sparks, open lights and smoking are prohibited:
- Avoid sparks when handling cables and electrical devices! Avoid short circuits!

Danger of chemical burns:
- Battery acid can cause severe burns therefore.
- Wear gloves and eye protection!
- Do not tip the battery, as acid can escape from the degassing valves.

First aid:
- In the case of acid splashes in the eyes, immediately rinse out with clean water for several minutes! Then consult a doctor without delay!
- Treat acid splashes on the skin or clothing with an acid neutralizer or soap and rinse with large amounts of water.
- Should acid be swallowed, consult a doctor immediately!

Warning:
- Do not subject batteries to direct daylight.
- Discharged batteries can freeze; therefore use frost-free storage.

Disposal:
- Used batteries should be handed in at a collection point. The information provided under Item 1 should be taken into account during transport. Never dispose of batteries with household waste!

Any warranty claims are null and void should the instructions for use be ignored, non-original spare parts be used for repairs, unauthorised tampering with the battery occur, or additives be introduced into the electrolyte (alleged improvement agents).

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