OPERATING INSTRUCTIONS

STATIONARY VALVE-REGULATED LEAD ACID BATTERIES **OPzV, OGiV and OGiV HP**

Assembly and CE-marking by..... Number of cells/blocks:

..... date..... .....

Commissioning by..... date..... Type:.....

	Observe operating instructions and position them within sight of the battery! Work only on batteries under instruction of skilled personnel!
	When working on batteries wear safety glasses and protective clothing! Comply with accident prevention rules as well as with DIN VDE 0510, VDE 0105 part 1!
	No smoking! Do not expose the battery to an open flame, a glowing fire or sparks as explosion and fire hazards exist.
	Acid splashes in the eyes or on the skin must be washed out or off with plenty of water. Then see a doctor immediately. Clothing exposed to acid should be washed out with water without delay.
	Explosion and fire hazard due to explosive gases escaping from the battery. Caution! Metal parts of the battery are always live, therefore do not place items or tools on the battery! Avoid short circuits!
	The electrolyte (diluted sulphuric acid) is highly corrosive. Under normal operating conditions contact with electrolyte is prevented. In case of damage of the container contact with the gelled sulphuric acid has to be avoided. It is highly corrosive as well.
	Block batteries or cells are heavy! Ensure secure installation! Only use suitable transport equipment!
	Dangerous voltage !
 Pb	Used batteries with this symbol are reusable goods and must be returned to the recycling process. Used batteries which are not returned to the recycling process must be disposed of as special waste in accordance with all the regulations. 

GENERAL

Valve-regulated lead acid batteries must not be topped up with water through their entire life. The valves must not be opened, because access of oxygen discharges the cells. During charging the cells will release hydrogen through the valve. Observe the ventilation instruction DIN VDE 0510 part 2.

Protect batteries from direct sunlight.

For the assembly and operation of stationary battery installations DIN VDE 0510 part 1 and 2 apply. The battery must be installed and operated in such a way that the ambient temperature differences between the cells/blocks of one battery is < 3K.

1. Installing the battery

Install the racks or cabinets provided for the installation in the correct location. Inspect all cells/blocks for mechanical damage.

Cells/blocks may be operated in upright or in horizontal position. Having partial batteries connected in parallel, care must be taken that the same thermal environment and the same electric connection resistance is applied. Therefore normally not more than 4 partial batteries are connected in parallel.

Set up the cells/blocks with the correct polarity. The distance between cells/blocks should be 10mm. If necessary the surface of the poles and connectors have to be cleaned. The connectors have to be firmly seated by tightening the terminal screws M10 with a torque of 22 Nm.

2. Commissioning

Connect the battery to the DC power supply, with the charger switched off, battery fuses removed and the load disconnected, ensuring that the polarity is correct: Positive terminal of the battery to the positive terminal of the charger.

If the cells/blocks have been stored for more than 4 weeks, check the open-circuit voltage (OCV) before start of charging to ascertain the optimum commissioning charge:

- Charging according to 3.2c, if the cells have OCV's >2,08V.
- If the cells have OCV's < 2.08V charging according to 3.2a or 3.2b. In case of 3.2a charge one day per month storage time to equalise the state of charge of the cells/blocks.
- If cells have an OCV < 0,02V below average, contact the battery manufacturer.

The first charge should be monitored to ensure that limits are not exceeded and that no unacceptable temperatures occur. When charging is finished switch off the charger or switch over to float charging as per 3.3a.

3. Operation

3.1 Discharging

Discharge capacities, currents and voltages are specified in the last page. Never discharge the battery below the specified final voltages. No more than specified capacities are to be discharged. Charge immediately after discharge as well as after partial discharge.

3.2 Charging a new battery

Charging must only be carried out with direct current. Chargers with IU- or IUI-characteristics according to DIN 41 773 may be used. The limits for charging currents and ripple currents (see 3.6) must not be exceeded. Following procedures can be applied:

a) Using chargers with IU characteristics at an increased voltage of 2,33 - 2,40V/cell with automatic switching to the operating voltage (see 3.3). The complete charging time will be minimum 1 day.

b) Using chargers with IUI-characteristics up to a charging voltage of (2,33 - 2,40V) x number of cells and continued with an additional charging current of max. 1,5A per $100Ah_{10}$. The battery voltage will reach (2,60 - 2,75V) x number of cells. Check if loads have to be switched off. If temperatures higher than 45°C occur, the charging has to be interrupted. The fully charged state is reached, when the cell voltages have not risen for a period of 2h. The complete charging time is approximately 8 to 12 hours.

c) Using the normal operating voltage (see 3.3). 95% of the capacity will be established after approximately 4 weeks.

3.3 Standby operation / buffer operation

In this case the load, the DC power supply and the battery are connected permanently in parallel. Thereby the charging voltage is the operational voltage of the battery and also the system voltage.

a) During **standby operation (float)** the DC power supply is always able to provide the maximum load current and the battery charging current. The battery only supplies current, if the DC power supply fails**.** The charging voltage at 20°C must be set to (2,23V to 2,25V+- 1%) x number of OPzV- and OGiV-cells respectively (2,27V +- 1%) x number of OGiV HP - cells measured at the batteries' terminals.

b) During **buffer operation** the DC power supply is not always able to provide the maximum load current. The load current temporarily exceeds the rated current of the DC power supply. During this time the battery supplies current. Depending on the load and after having consulted the battery manufacturer, the

charging voltage should be set at (2,23 - 2,30V) x number of cells.

3.4 Recharging

After a discharge the battery can be recharged at the operating voltage (see 3.3a). To reduce the charging time the recharging can be carried out at (2,33 - 2,40V) x number of cells with automatic reduction to the voltage

under 3.3a. The recharging times are dependant on the charging current available; as a rule they run to 12 - 24 hours at initial charging currents between $2*I_{10}$ - $0,5*I_{10}$.

3.5 Equalising charge

After deep discharge or after inadequate recharging equalising charging is necessary. This can be carried out as follows:

a) At an increased voltage of 2,33 - 2,40V/cell up to a maximum of 72 hours.

b) At currents according to the I-characteristics (see 3.6).

Because it is possible to exceed the permitted load voltages, appropriate measures must be taken, e.g. switch off the load. On exceeding the maximum temperature of 45°C, charging must either be stopped or proceed with reduced current or be switched to the float charge to allow the temperature to drop. The equalising charge is completed, when the individual cell voltages no longer increase within 2 hours.

3.6 Charging currents

The charging current is not limited until the battery voltage has reached the gassing voltage

of 2,40V x number of cells. Thereafter the charging current has to be limited:

Limits on charging current per 100Ah nominal capacity above the gassing voltage of 2,40V/c

charging process	charging current	cell voltage
I-characteristic	1,5A	2,60 -2,75V/cell

During recharging up to 2,40 V/cell the RMS value of the AC ripple current may reach temporarily maximum $20A/100Ah_{10}$. After recharging and at standby (float) or buffer operation the RMS value of the ripple current must not exceed $5A/100Ah_{10}$.

3.7 Battery temperature

All technical data apply for the nominal temperature of 20°C. The ideal temperature range is 20°C + 5K. The recommended temperature range is 10°C to 30°C. Higher temperatures reduce the working life. Lower temperatures reduce the available capacity. Exceeding the temperature limit of 45°C up to 55°C is acceptable only for short periods.

3.8 Temperature-related charging voltage

A temperature-related adjustment of the charging voltage within monthly averaged battery temperatures of

10°C to 45°C should not be made. A decrease of the charging voltage at temperatures above 20°C endangers the fully charged state of the cell. Below 10°C in the monthly average the charging voltage should be increased (-0,005V/K per cell) for a faster recharging.

3.9 Electrolyte

The electrolyte is diluted sulphuric acid and fixed as GEL made with microporous SiO_2.

4. Battery Maintenance

To avoid leakage currents and the associated risk of fire keep the battery dry and clean. Cleaning with clean water, no detergents, no solvents. Avoid electrostatic charges.

To be measured and listed every 6 months:

- battery voltage, voltages of some cells/blocks (pilot cells)
- surface temperatures of pilot cells and the room temperature

Every 12 months:

- Voltages and surface temperatures of all cells/blocks have to be measured and listed.
- Connectors, racks and the ventilation have to be checked.

Should the float charge voltage of single cells deviate more than +0,2V or -0,1V from the average value (see 3.3) and should the surface temperatures of different cells/blocks deviate more than 3K, the customer service should be called.

A service contract with BAE or its local agent is recommended.

5. Tests

Tests must be conducted according to DIN 43 539 or IEC 896-2.

Special test instructions e.g. to prove operational safety in accordance with DIN VDE 0107 and DIN VDE 0108 must be observed.

6. Storage and taking out of operation

Should batteries be stored or taken out of operation for extended periods, they must be stored fully charged in a dry frost-free room. To avoid damage one of the two charging methods have to be selected:

a) Equalising charging every 6 months. If the room temperatures are higher than 30°C, shorter intervals are necessary.

b) Float charging as under 3.3a.

7. Transport

BAE cells/batteries are protected against short-circuit. They are not treated as dangerous goods under the road and railway transport regulations (GGVS and GGVE), if they show no damage and are proper packed.

BAE OPzV and BAE OGiV - batteries are leak-proof and secured against short-circuit at the terminals. They comply with the IATA-requirements, the packing instruction 806, as well as A67 of the IATA-resolution 618.