

## OPERATING INSTRUCTIONS

### (TAB GEL BLOCK BATTERIES)

- Nominal voltage [Vpc]  $U_n = 6V/3\text{cell}, 12V/6\text{cell}$
- Nominal Capacity [Ah]  $C_n = C5$
- Nominal discharge current [A]  $I_n = 15$
- Final discharge voltage [Vpc]  $U_s = 5,10V/3\text{cell}, 10,20V/6\text{cell}$
- Nominal temperature  $T_n = 25^\circ\text{C}$

#### 1. COMMISSINING

Check battery for mechanical damage and correct polarity. VRLA GEL batteries do not require topping-up water. Pressure valves are used for sealing and cannot be opened without destruction.

Connect the battery with the correct polarity to the charger (positive pole to positive terminal). The charger must not be switched on during this process, and the load must not be connected. Switch on charger and start charging following instructions (2.2)

#### 2. OPERATION

The nominal operating battery temperature is  $30^\circ\text{C}$ . Higher temperatures shorten the life of the battery; lower temperatures reduce the available capacity.  $55^\circ\text{C}$  is the upper temperature limit and batteries should not be used above this operating temperature. The battery obtains its full capacity after about 10 charging/discharging cycles.

##### 2.1 DISCHARGE

Vent plugs on the battery must not be sealed or covered. Discharge must not be continued below the voltage recommended for the discharge time. Recharge immediately following complete or partial discharge. Discharge batteries can freeze.

## 2.2 CHARGE

Charging must be carried out according to IU-characteristic with limit values: I-constant: +/- 2%; U-constant: +/- 1%.

Connect the battery only to the correctly assigned charger, suitable for the battery size in order to avoid overloading of the electric cables and contacts. Depending on the charging equipment, specification and characteristic alternating currents flow through the battery. Alternating currents and reactions from loads may lead to an additional temperature increase of the battery and strain the electrodes with possible damages, which can shorten the battery life. Depending on the installation charging may be carried out in following operations.

### *2.2.1 STANDBY PARALLEL OPERATION*

Load, battery and charger are continuously in parallel. Charging voltage is the operating voltage and at the same time the battery installation voltage. With the standby parallel operation, the battery charger is capable, at any time of supplying the maximum load current and the battery charging current. The battery only supplies current when the battery charger fails. The charging voltages should be 2.30Vpc at 20°C measured at the end terminals of the battery.

To reduce the charging time a boost charging stage can be applied in which the charging voltage (2.40 – 2.45) Vpc at 20°C can be adjusted. Automatic change over to charging voltage 2.30Vpc at 20°C should be applied.

### *2.2.2 BUFFER OPERATION*

With buffer operation the battery charger is not able to supply the maximum load current at all times. The load current intermittently exceeds the nominal current of the battery charger. During this period the battery supplies power. These results in the battery not fully charged at all times. Therefore, depending on the load the charge voltage must be (2.30 – 2.35) Vpc at 20°C. This has to be carried out in accordance with the manufacturers' instructions.

### *2.2.3 SWITCH-MODE OPERATION*

Battery is charged separated from the load. Maximum charge voltage of the battery at 20°C must be 2.45 Vpc. The charging process must be monitored. If the charging current reduces to less than 1.5A/100Ah C10 – 2.45Vpc/20°C the mode switches to float charge (2.3)

### *2.2.4 BATTERY OPERATION (CHARGE/DISCHARGE OPERATION)*

The load is only supplied by the battery. The charging process depends on the application and must be carried out in accordance with the recommendations of the battery manufacturer.

### 2.3 FULL CHARGE MAINTINING – FLOAT CHARGE

Charger must be set, so that the average cell voltage is 2.30Vpc at 20°C

### 2.4 EQUALIZING CHARGE

Because it is possible to exceed the permitted load voltages, appropriate measures must be taken (switch of the load). Equalizing charging is required after deep discharges and/or inadequate charges. They can be carried out with 2,45 Vpc at 35A per 100Ah C10 up to 48 hours.

Battery temperature must never exceed 45°C. If it does, stop charging or revert to float charge to allow the temperature to drop.

### 2.5 ALTERNATING CURRENTS

When recharging up to 2.40 Vpc under operation modes 2.2 the actual value of the alternating current is occasionally permitted to reach 10A/100Ah C10. In a fully charged state during float charge or standby parallel operation the actual value of the alternating current must not exceed 5A/100Ah C10.

### 2.6 CHARGING CURRENTS

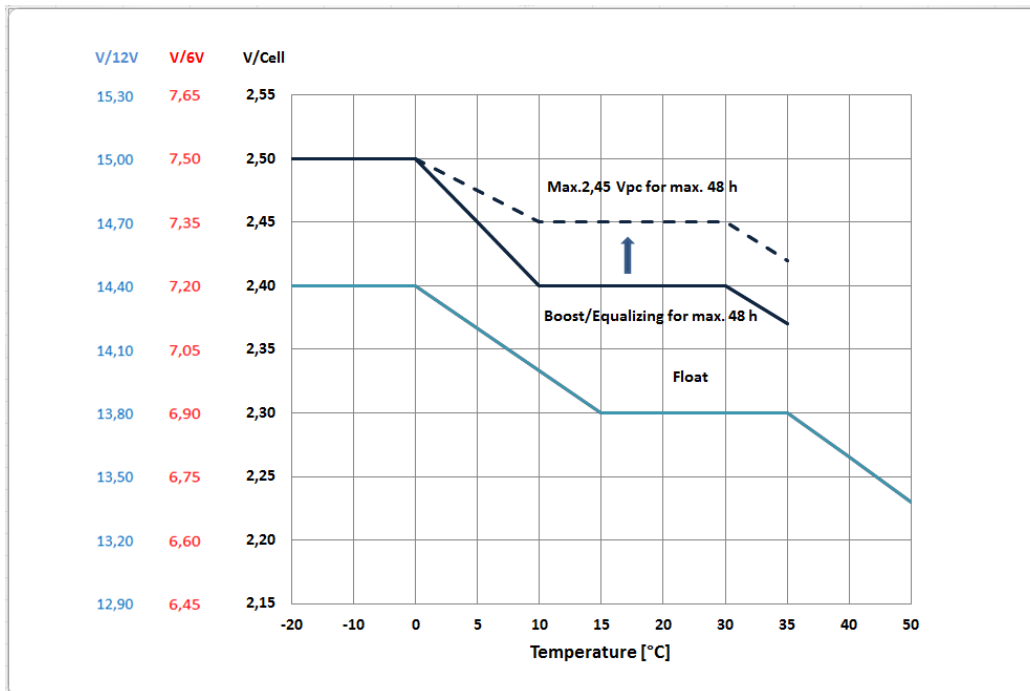
The charging currents are not limited during standby parallel operation or buffer operation without recharging stage. The charging current should range between 10A to 35A per 100Ah C10 (guide value).

### 2.7 TEMPERATURE

The recommended operation temperature range for GEL batteries is 10°C to 35°C. Higher temperatures will seriously reduce service life. Lower temperatures reduce nominal capacity. The absolute maximum temperature is 55°C and should not exceed 45°C in service. All technical data refer to a nominal temperature of 20°C and 25°C respectively.

## 2.8 TEMPERATURE RELATED CHARGE VOLTAGE

The temperature related adjustment has to be carried out according to table\_1. An adjustment of the charge voltage must not be applied within a specified temperature range of 15°C to 35°C.



Table\_1: Charging voltage vs. temperature

## 2.9 ELECTROLYTE

The electrolyte is diluted sulphuric acid and fixed in a GEL.

## 3. BATTERY MAINTANCE AND CONTROL

Keep battery clean and dry to avoid creeping currents. Plastic parts of the battery, especially containers, must be cleaned with pure water without additives.

At least every 6 months measure and record:

- Battery voltage
- Surface temperature of the battery
- Battery-room temperature

If the battery voltage differs from the average float charge voltage by more than the values given in table\_2, or if the surface temperature between batteries exceeds 5°C, the service should be contacted.

6V Battery	12V Battery
+0.35V	+0.49V
-0.17V	-0.24V

Table\_2: Criteria for voltage measurements

Annual measurements and recordings:

- Battery voltage
- Surface temperature of the battery
- Battery-room temperature
- Insulation-resistance according to DIN 43539 part 1

Annual visual check:

- Screw connections
- Screw connections without locking devices have to be checked for tightness
- Battery installation and arrangement
- Ventilation

#### 4. FAULTS

Call the service immediately if faults in the battery or the charging unit are found.

Recorded data as described in item 3, must be made available to the service agent. It is recommended that the service contract is taken out with our service agent.

## 5. STORAGE AND TAKING OUT OF OPERATION

To store or decommission batteries for a longer period of time they should be fully charged and stored in a dry frost-free room.

To avoid damage the following charging methods can be chosen:

- Annual refreshing charge according to item 2.4. TAB GEL batteries can be stored without refreshing charge for maximum 12 months at  $\leq 20^{\circ}\text{C}$ . At average ambient temperature of more than the nominal temperature shorter intervals can be necessary.
- Float charging as detailed in 2.3.

## 6. TRANSPORT

GEL batteries must be transported in an upright position. Batteries without any visible damage are not defined as dangerous goods under the regulation for transport by road (ADR) or by railway (RID). They must be protected against short circuits, slipping, upsetting or damaging. Batteries must be suitable stacked and secured on pallets (ADR and RID, special provision 598). It is prohibited to staple pallets.

No dangerous traces of acid shall be found on exteriors of the packing unit.

Batteries whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN 2794.

In case of air transport, batteries which are part of any equipment must be disconnected at their terminals, terminals must be protected against short-circuits. This is in order to avoid the risk of any incidents like fire etc.

## 8. GENERAL ITEMS

The ventilation of battery rooms and cabinets respectively must be carried out according to EN 50272-2 always. Battery rooms are to be considered as safe from explosions, when by natural or technical ventilation the concentration of hydrogen is kept below 4% in air.

This standard contains also notes and calculations regarding safety distance of battery opening valves to potential source of sparks.

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