OPERATING INSTRUCTION

Batteries …NSV…

Revision	Prepared by	Approved by	
			State, Incorporated changes
01-07/2009	M. Holz-häuser	S. Droll	Initial

Nominal data:

Nominal voltage UN:	Cells 2V:	Blocks 6V:	Blocks 12V:
Nominal capacity C20	20h discharge		
Nominal temperature TN:	20°C		
Factors of reduction:	For ventilation (draft DIN/VDE 0510 part 1) factor f1 = 0,5, f2 = 0,5		
Nominal discharge current: $I_N = I_{20}$	C_N / 20h		

Battery manufacturer:	Type:
Assembly by:	Date:
Introduction by:	Date:
Security signs attached by:	Date:

	• Observe instructions and keep them located near by the battery for future reference! • Work on the battery should only be carried out by qualified personnel!
	• Do not smoke! Do not use any naked flame or other sources of ignition. Explosion and fire hazards are present!
	• While working on batteries wear protective eye-glasses and clothing! • Observe the accident prevention rules as well as DIN VDE 0510, VDE 0105 part 1.
	• Any acid splashes on the skin or in the eyes must be flushed with plenty of water immediately. Then seek medical assistance. Spillages on clothing should be rinsed out with water!
	• Explosion and fire hazard, avoid short circuits! Caution! Metal parts of the battery are always under voltage, therefore do not place items or tools on the battery!
	• Electrolyte is strongly corrosive and acidic. In normal working conditions the contact with electrolyte is nearly impossible; electrolyte may leak from the vent valves in case of over charging the battery or in case of mechanical damage to the container. In case of any contact with electrolyte please flush with water abundantly and get in touch with a physician.
	• Batteries/cells are heavy! Ensure adequate mounting security and always use suitabel handling equipment for transportation.
	• **Disposal of batteries!** Batteries marked with the recycling symbol should be processed via a recognised recycling agency. By agreement, they might be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste.
!	• Non-compliance with the operating instruction, repair with non-original spare parts or arbitrary intervention expires the warranty claim.

Valve-regulated lead acid batteries consist of cells which do not require water topping during the operation. For plugs there are used pressure control valves, which can not be opened without destruction.

1. Start up

Check all cells/blocks for mechanical damage, correct polarity and firmly seated connectors. The following torques apply for screw connectors:

M5	M6	M8	M10
2 - 3 Nm	4 - 5,5 Nm	5 - 6 Nm	14 - 22 Nm

If necessary the terminal cover are to be raised. Connect the battery with the correct polarity to the charger. The charger should not be switched on during this process, the load should not be connected (pos. pole to pos. terminal). Switch on charger and start charging following instruction no 2.2.

2. Operation

For the installation and operation of the batteries DIN VDE 0510 is mandatory. Battery installation should be made such that temperature difference between individual units does not exceed 3 degrees Celsius/Kelvin.

2.1 Discharge

Discharge must not be continued beyond the level specified for the specific discharge current. Deeper discharges must not occur unless specifically agreed with the manufacturer. Recharge immediately following complete or partial discharge.

2.2 Charging

Applicable are all charging procedures with their limit values according to DIN 41773 (IUU0-characteristic). According to the charging equipment specification and characteristics, alternating currents (< 0,1C(A)) flow through the battery superimposing into the direct current during charging operation. These alternating current and the reaction form the loads lead to an additional temperature increase of the battery and strain the electrodes with possible damages (see 2.5). Depending on the installation, charging (acc. to DIN VDE 0510 part 1, draft) may be carried out in the following operations.

a) Standby Parallel Operation and Buffer Operation

Here the load, direct current source and battery are continously in parallel. Thereby the charging voltage is the operation voltage and at the same time the battery installation voltage. With the standby parallel operation, the direct current source is at any time capable of supplying the maximum load current. The battery only supplies current when the direct current source fails. The charging voltage should be set at 2,275V ± 0,005V (20°C) x number of cells in series measured at the terminals of the battery. With buffer operation, the direct current source is not able to supply the maximum load-current at all times. The load current intermittently exceeds the nominal current of the direct source. During this period the battery supplies power. The battery is not fully charged at all times but the float-charge of 2,275 V/cell ±0,005V (20°C) x number of cells in series provides a reasonable recharge duration under normal conditions. Dependent on load and number of cells in series, it is recommended to consult the battery manufacturer in any doubtful case.

b) Switchmode-Operation

When charging, the battery is separated from the load. To reduce the charging time, a three phase boost charge mode can be applied by charging the battery at 2,45 - 2,5 V/cell until the charging current drops to 0,07 C(A) (trip point for the first phase of charging t1). The duration of charging of the first phase is measured by a timer so that the second phase should be half of the first phase (t2 = 0,5 t1) when the batteries are kept on charger at 2,45-2,5V/cell. After the total charging of t=t1+0,5t1 has elapsed, the charger reduces the voltage to a normal float-charge level of 2,275V/cell (±0,005V) at 20°C.

c) 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 Maintaining the full charge (float charge)

Devices complying with the stipulations under DIN 41773 must be used. They are to be set so that the average cell voltage is 2.275V±0,005V.

2.4 Supplementary and Equalizing charge

To ensure maximum service life, a supplementary charge may be required prior to installation on condition that the batteries have been in storage for more than 6 months or more, latest after 9 months age from the date of production and that the open circuit voltage is less than 2,1 Volts per cell. A supplementary charge should be applied in accordance with figures shown in the table:

Storage period	Charge V/c at 20°C	Charge Time
Less than 9 months	2,275 V/cell	More than 72 hours
Up to 1 year	2,35 V/cell	48-144 hours
1-2 years	2,35 V/cell	72-144 hours

Batteries kept at normal float charge level within a string do not require any equalizing charge in case of partial replacement, in order to narrow the bandwidth of open-circuit voltages.

2.5 Alternating currents

On recharging up to 2,4 V/cell under operation modes 2.2 the actual value of the alternating current is for a very short time permitted to reach 0,1C(A) nominal capacity. In a fully charged state during float charge or standby parallel operation the actual value of the alternating current must not exceed 5 A/100 Ah nominal capacity.

2.6 Charging currents

During float charge or standby parallel operation without recharging state the charging currents are not limited. The charging current should range between 10 A to 20 A/100 Ah nominal capacity.

2.7 Temperature

The nominal operation temperature range for lead-batteries is 10°C to 30° C (best 20°C ± 5 K). Higher temperatures will seriously reduce service life. All technical data are produced for a nominal temperature of 20°C. Lower temperatures reduce the available capacity. The absolute maximum temperature is 50°C and should not permanently exceed 40°C in service.

2.8 Temperature-related float charge voltage and boost change

The float charge voltage of 2,275 V/cell ±0,005V/cell refers to a battery temperature of 20°C. Temperature compensated charging is required in order to avoid overcharge at high temperatures and undercharge at low temperatures. The recommended temperature compensation faxtor is -3m V/cell/°C for float charge operation. In order to avoid thermal runaway, it is mandatory to temperaturecomensate the float-charge voltage for temperatures above 40°C.

The boost charge mode can be applied if a quick recharge is required on condition that the charging current does not exceed 0,25C(A) and constantly drops to 0,01C from where normal float charge voltage should be applied.

Temperature (°C)	Boost charging voltage (V/c)	Maintenance charge voltage (V/c)
-10	2,58	2,36
0	2,53	2,33
10	2,48	2,30
20	2,45	2,275
30	2,40	2,24
40	2,34	2,21

2.9 Electrolyte

The electrolyte is diluted sulphuric acid and is absorbed in glass-matt separator.

3. Battery maintenance and control

Keep the battery clean and dry to avoid leakage currents. The cleaning of the battery should be carried out according to the ZVEI-leaflet “Cleaning of batteries”. Plastic parts of the battery must be cleaned with pure water without additives, “Cleaning of batteries”. Plastic parts of the battery must be cleaned with pure water without additives, any organic solvents are prohibited.

At least every 6 months measure and record:

- battery voltage
- voltage of several cells/blocks
- surface temperature of several cells/blocks
- battery-room temperature

If the difference of the average float-chargevoltage/ cell is exceeding ± 0,1 C/cell within a string or if the surface temperature-difference between cells/blocks is exceeding 5 K, the service-agent should be contacted.

Annual measurement and recording:

- voltage of all cells/blocks
- surface temperature of all cells/blocks
- battery-room temperature
- insulation-resistance according to DIN 43539 part 1

Annual visual check:

- screw connections, any screw connections without locking devices have to be checked for tightness
- battery installation and arrangement
- ventilation

4. Tests

Tests have to be carried out according to instructions DIN 43539 part 1 and 100 (draft). Special like DIN VDE 0107 and DIN VDE 0108 have to be observed. To make sure to have a confidental power supply, the whole battery should be exchanged after the utilization is finished. Take also into account the temperatures and the operating conditions.

5. Faults

Call the service agents immediately in case of faults in the battery or the charging unit. The availability of the recorded data described in point 3, will be very helpful to find the cause of failure. A service contract simplifies trouble shooting.

6. Storage and taking out of operation

To store or decommission cells/batteries for a longer period of time, they should be fully charged and stored in a dry frost-free room. To avoid damage, batteries should be regulary subjecdted to supplementary charge cycles in accordance with 2.4.

7. Transport

VRLA batteries, which by no means show any kindof damage, are classified a non-dangerous goods for transportation via rail, lorry or air (according to GGVS GGVE and IATA Regulations) if they are safeguarded during transportation against short-circuiting tossing about, slipping or any damage. Batteries to be classified under aforementioned paragraph must mandatorily not display any traces of electrolyte on the exterior of the battery container.As for VRLA batteries being damaged, assumed to be leaking of electrolyte and to be transported under warranty, or assumed not to be tight in any aspect anymore, they are to be handled in accordance with exeption regulations of dangerous goods transportation rules concerned.

8.Technical Data

The technical data can be found in the accompanying data sheets „5 NSV“ und „4 NSV“.