Sonnenschein Batteries

35 0 32200 10

Operating Instruction 32200
Maintenance-free lead acid batteries A200 and A300

Nominal data:

- Nominal voltage U_N : 2.0 V x number of cells
- Nominal capacity $C_N = C_{20}$: 20h discharge (see type plate and technical data in these instructions)
- Nominal discharge current $I_N = I_{20}$: C_N / 20 h
- Final discharge voltage U_S : see technical data in these instructions
- Nominal temperature T_N : 20° C

Assembly by: ___________________________ EXIDE Technologies order no.: _______________________________date: _____________________
Commissioned by: ____ date: _____________________
Security signs attached by: ____ date: _____________________

	• Observe these instructions and keep them located nearby 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 0150 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 shortcircuits! Caution! Metal parts of the battery are always alive, therefore do not place items or tools on the battery!
	• Electrolyte is strongly corrosive! In normal working conditions the contact with electrolyte is impossible. If the housing is damaged the exposed fixed electrolyte is as corrosive as liquid electrolyte.
	• Batteries/cells are heavy! Ensure adequate mounting security and always use suitable handling equipment for transportation!
	• Keep children away from batteries.

Non-compliance with operating instructions, repairs made with other than original parts, or repairs made without authorization (e. g. opening of valves) render the warranty void.

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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.

Sealed lead acid batteries consist of single cells (2V) or blocks (4V- 6V- 8V- 12V). No topping up with water is allowed during the whole lifetime. Pressure values are used for sealing, these cannot be opened without destruction.

1. Start up
Prior to installation the batteries are to be checked for mechanical damages, exact polarity and firmly seated connectors. The following torques apply for screw connectors:

G 5	G 6	A
5 Nm +/- 1	6 Nm +/- 1	8 Nm +/- 1

If needed rubber covers should be attached. 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 with higher voltage.

2. Operation
For the operation of this battery DIN VDE 0510 (as well as EN 50 272-2) is mandatory. In addition according to the usage table 1 is to be applied.

Usage	DIN VDE
Stationary batteries	EN 50 272-2
Traction batteries in electric vehicles	0510 part 3
Starter batteries in automobiles	0510 part 4
Onboard batteries in boats, trains and ground vehicles	0510 part 5
Airplanebatteries	0510 part 6
Equipment-batteries	0510 part 7

Table 1

2.1 Discharge
The final dischargevoltage in relation to the discharge current must not be beyond the level specified. If not further specified by the manufacturer the permissable discharge capacity is according to table 2. Recharge immediately following complete or part discharge. With battery operation in Electric vehicle applications (charge-/discharge operation) it is recommended to avoid a discharge beyond 60% of the nominal capacity for the benefit of an optimum of lifetime.
Discharge beyond 60% of the nominal capacity for this application are <u>deep discharges</u> and shorten the lifetime of the battery. Therefore only by the battery manufacturer recommended charge-condition meters must be used.

2.2 Charging
Applicable is the charging procedure with its limit values according to DIN 41773 (IU-characteristic) or WU-characteristic with a limit value only for the constant voltage-characteristic. According to the charging equipment specification and characteristics alternating currents flow through the battery superimposing onto the direct current during charging operation. These alternating current and the reaction from 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 may be carried out in 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 and the battery charging current. The battery only supplies current when the direct current source fails. The charging voltage should be set at 2.30 V/cell +/- 1% x number of cells meisured at the terminals of the battery. To reduce the charging time boost-charging stage can be applied in which the charging voltage of
2.35 – 2.45 V/cell +/- 1% x number of cells can be used, standby-parallel operation with boost recharging stage). Automatic changeover to 2.30 V/cell +/- 1% x number of cells follows. With **buffer operation** the direct current source is **not** able to supply the maximu load-current at all times. The load-current intermittendly exceeds the nominal current of the direct source.During this period the battery supplies power. The battery is not fully charged at all times.Therefore, depending on the load the charge voltage must be set at 2.30 V/cell +/- 1% to 2.35 V/cell +/- 1% x number of cells. This has to be carried out in accordance with the recommendations of the battery-manufacturer.

b) Switchmode-Operation
When charging, the battery is separated from the load. The charge-voltage of the battery is max. 2.45 V/cell. The charging process must be monitored. If the charge-current sinks´ below 1.5 A/100 Ah with 2.45 V/cell, the mode switches to float-charge acc. to point 2.3 respectively it switches after reaching 2.40 V/cell.

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 2.30 V/cell +/- 1%.

2.4 Equalizing charge
Eqalizing charges are required after exhaustive discharges and/or inadequate charges. They have to be carried out as follows: Up to 48 hours of max. 2,45 V/cell. The charge current must not exceed 10 A/ 100Ah nominal capacity. On exceeding the max. temperature of 45 °C charging must be either stopped or switched to float charge to allow the temperature to drop.

2.5 Alternating currents
On recharging up to 2.40 V/cell under operation modes 2.2 the actual value of the alternating current is occasionally permitted to reach 20 A/ 100 Ah nominal capacity.In a fully charged state during float charge or standby paralleloperation the actual value of the alternating current must not exeed 5 A/ 100 Ah nominal capacity.

2.6 Charging currents
During float charge or standby paralleloperation without rechargingstate the charging currents are not limited. The charging current should range between 5 A to 20 A/ 100 Ah nominal capacity. (approx. value)

2.7 Temperature
The nominal operation temperature range for sealed lead acid batteries is 10 °C to 30 °C. Alltechnical data are produced for a nominal temperature of 20 °C. The ideal temperature range is 20 °C +/- 5 K. Higher temperatures will seriously reduce the service life. Lower temperatures reduce the available capacity. The absolute maximum temperature is 55 °C and should not exeed 45 °C in service.

2.8 Temperature-related charge voltage
A temperature related adjustment of the charge voltage within the operating temperature of 15 °C to 25°C is not necessary. Is the operating temperature constantly outside this range the charge voltage has to be adjusted as follows:

temperature correction factor $-0{,}005 \dfrac{V}{\text{cell x K}}$ and

for the floatvoltagewith $-0{,}003 \dfrac{V}{\text{cell x K}}$

Temperature [°C]	Charge voltage [V/cell]	Float voltage [V/cell]
- 10	2,55	2,39
0	2,50	2,36
10	2,45	2,33
20	2,40	2,30
30	2,35	2,27
40	2,30	2,24

2.9 Electrolyte
The electrolyte is diluted sulphuric acid and fixed in a gel.

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

At least every 6 month 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 is exceeding +0,2 V or --0,1 V or is the surface temperature-difference between cells/blocks exeeding 5 K, the service agent should be contacted.

Annual measurement and recording:
- voltage of all cells/blocks
- electrolyte temperature of all cells/blocs
- battery-room temperature
- insulation-resistance according to DIN 43539 part 1

Annual visual check:
- screw-connections
- screw-connection without locking devices have to be checked for tightness
- battery installation and arrangement
- ventilation

4. Tests
Tests must be carried out according to IEC 896-1+2 Special test requirements i. e. according to DIN VDE 0107 and DIN VDE 0108 have to be acknowledged. To assure the reliability of the current source the complete battery should be replaced after the end of the expected design life.This should be done under consideration of the application and the temperatures.

5. 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 the following charging-methods can be chosen:
1. Annual equalizing-charge acc. to 2.4. In average ambient temperatures of more than 20 °C shorter intervals may be necessary.
2. Float charging as under 2.3.

6. Transport
Cells and batteries are to be transported in upright position. To avoid short-circuits the terminals have to be insulated appropriately. National regulations must be observed.

7. Technical Data (table 2)
Capacities (C_n) according to different discharge times (t_n) until the final discharge voltage (U_S) with the battery temperature at 20°C:

Discharge time t_n	10 min	30 min	1 h	3 h	5 h	10 h	20 h
Capacity C_n	$C_{1/6}$/Ah	$C_{1/2}$/Ah	C_1/Ah	C_3/Ah	C_5/Ah	C_{10}/Ah	C_{20}/Ah
Capacity in % of the nominal capacity C_{20}	40 %	50 %	60 %	75 %	85 %	90 %	100 %
Cut off voltage U_S in V/Zelle	1.6 V/Z	1.7 V/Z	1.74 V/Z	1.78 V/Z	1.79 V/Z	1.80 V/Z	1.75 V/Z

Example:
C_3 (A 212/9.5 S) = 75 % * 9.5 Ah = 7.125 Ah

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