Sonnenschein

EXIDE TECHNOLOGIES
INDUSTRIAL ENERGY

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Sonnenschein A 600 (OPzV)
Operating Instruction 31605
Stationary valve regulated lead acid batteries

Nominal data

- Nominal voltage U_N : 2.0 V x number of cells
- Nominal capacity $C_N = C_{10}$: 10h discharge (see type plate on cells and technical data in these instructions)
- Nominal discharge current $I_N = I_{10}$: $I_{10} = C_{10} / 10h$
- Final discharge voltage U_f : see technical data in these instructions
- Nominal temperature T_N : 20° C

Assembly by: _____ EXIDE Technologies order no.: _____ date: _____

Commissioned by: _____ date: _____

Safety signs attached by: _____ date: _____

- Observe these Instructions and keep them located near the battery for future reference.
- Work on the battery should be carried out by qualified personnel only.

- Do not smoke.
- Do not use any naked flame or other sources of ignition. Risk of explosion and fire.

- While working on batteries wear protective eye-glasses and clothing.
- Observe the accident prevention rules as well as EN 50272-2, VDE 0105 Part 1.

- Any acid splashes on the skin or in the eyes must be flushed with plenty of clean water immediately. Then seek for medical assistance. Spillages on clothing should be rinsed out of water.

- Explosion and fire hazard, avoid short circuits.

- Electrolyte is very corrosive. In normal working conditions contact with the electolyte is impossible. If the cell container is damaged do not touch the exposed electrolyte because it is corrosive.

- Cells are heavy! Always use suitable handling equipment for transportation. Handle with care because cells are sensitive to mechanical shock.

- Caution! Metal parts of the battery are always alive, therefore do not place items or tools on the battery.

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.

Disposal of Batteries

Batteries marked with the recycling symbol should be processed via a recognised recycling agency. By agreement, they may be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste.

Stationary valve regulated lead acid batteries do not require topping-up water. Pressure valves are used for sealing and can not be opened without destruction.

1. Start up

Check all cells for mechanical damage, correct polarity and firmly seated connectors. For M8 screw connectors, use the torque value (20±1)Nm.

Rubber covers shall be fitted to both ends of the connector cables (pole covers) before installation.

Control of insulation resistance:
New batteries: > 1 MΩ
Used batteries: > 100 Ω/Volt

Connect the battery with the correct polarity to the charger (pos. pole to pos. 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 item 2.2.

2. Operation

For the installation and operation of stationary batteries EN 50272-2 is mandatory.
Battery installation should be made such that temperature differences between individual cells do not exceed 3 degrees Celcius (Kelvin).

2.1 Discharge

Discharge must not be continued below the voltage recommended for the discharge time. Deeper discharges must not be carried out unless specifically agreed with the manufacturer. Recharge immediately following complete or partial discharge.

2.2 Charging

All charging must be carried out acc. to DIN 41773 (IU-characteristic). According to the charging equipment, specification and characteristics alternating currents flow through the battery superimposing onto the direct current during charge operation.

Alternating currents and the reaction from the loads may lead to an additional temperature increase of the battery, and strain the electrodes with possible damages (see 2.5), which can shorten the battery life. Depending on the installation, charging may be carried out in following operations.

a) Standby Parallel Operation

Here, the load, battery and battery charger are continuously 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 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 voltage should be set at 2.25 Vpc (Volt per cell) ± 1% x number of cells 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 (2.33 - 2.40) Vpc ± 1% x number of cells can be adjusted (standby parallel operation with boost recharging stage). Automatic change over to 2.25 Vpc ± 1% x number of cells should be applied.

b) Buffer Operation

With the 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. This results in the battery not fully charged at all times. Therefore, depending on the load the charge voltage must be set at (2.27 - 2.30) Vpc ± 1% x number of cells. This has to be carried out in accordance with the manufacturers instructions.

c) Switchmode Operation

When charging, the battery is separated from the load. The charge voltage of the battery is max. 2.35 Vpc ± 1%. The charging process must be monitored. If the charge current reduces to less than 1.5 A/100 Ah with 2.35 Vpc ± 1%, the mode switches to float charge acc. to item 2.3 (switches after reaching 2.35 Vpc ± 1%)

d) Battery Operation (charge/discharge operation)

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

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 2.25 Vpc ± 1%.

2.4 Equalizing charge
Because it is possible to exceed the permitted load voltages, appropriate measures must be taken, e.g. switch off the load. Equalizing charges are required after deep discharges and/or inadequate charges. They have to be carried out as follows: Up to 48 hours at max. 2.4 Vpc. The charge current must not exceed 35A/100Ah nominal capacity. The cell 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 2.4 Vpc under operation modes 2.2 the actual value of the alternating current is occasionally permitted to reach 10A (RMS) / 100 Ah nominal capacity. In a fully charged state during float charge or standby parallel operation the actual value of the alternating current must not exceed 5A (RMS) / 100Ah nominal capacity.

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 10 A to 35 A / 100 Ah nominal capacity. (guide values).

2.7 Temperature
The recommended operation temperature range for lead acid batteries is 10° C to 30° C (best 20° C ± 5 K). Higher temperatures will seriously reduce service life. Lower temperatures reduce the available capacity. The absolute maximum temperature is 55° C and should not exceed 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 35° C is not necessary. If the operating temperature is constantly outside this range, the charge voltage has to be adjusted. The temperature correction factor is -0.005 Vpc x K. For float charge operation, for instance, the following related voltages shall be used:

Battery temperature [° C]	Charge voltage [Vpc]
-10	2.35
0	2.35
10	2.28
20	2.25
30	2.25
40	2.23

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
– Surface temperature of several cells
– Battery-room temperature
If the cell voltages differs from the average float charge voltage by more than +0.2 V respectively -0.1 V or if the surface temperature difference between cells exceeds 5 K, the service agent should be contacted.

In addition, annual measurement and recording:
– Voltage of all cells
– Surface temperature of all cells
– Battery-room temperature

Annual visual check:
– Screw connections
– 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 IEC 896-2, DIN 43539 part 1 and 100 (draft). Special instructions like DIN VDE 0107 and DIN VDE 0108 have to be observed.

Capacity test, for instance, acceptance test on site: In order to make sure the battery is fully charged, the following IU-charge methods must be applied: Option 1: 2.25 Vpc, ≥ 72 hours. Option 2: 2.40 Vpc, ≥ 16 hours (max. 48 hours) followed by 2.25 Vpc, ≥ 8 hours. The current available to the battery must be between 10 A /100 Ah and 35 /100 Ah of the nominal capacity.

5. Faults
Call the service agent 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 a service contract is taken out with your agent.

6. Storage and taking out of operation
To store or decommission cells for a longer period of time they should be fully charged and stored in a dry and cold but frost-free room, away from direct sun light. To avoid damage the following charging methods can be chosen:

1. Maximum storage time is 24 months at ≤ 20° C. Equalizing charges will be required at higher temperatures, for instance, after 12 months at 30° C
2. Float charging as detailed in 2.3.

7. Transport
Cells (also A 600 WE) must be transported in an upright position. Batteries without any visible damage are not defined as dangerous goods under the regulations for transport of dangerous goods by road (ADR) or by railway (RID). They must be protected against short circuits, slipping, upsetting or damaging. Cells may 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 the exteriors of the packing unit.
Cells whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN no. 2794.

8. Technical data
The nominal voltage, the number of cells, the nominal capacity ($C_{10} = C_N$) and the battery type are described on the label. Other capacities (C_n) at different discharge currents (I_n) and discharge times (t_n) can be calculated with the help of table 8.2. below and the example in item 8.1 below.

8.1 Example:
Calculation of the 5h discharge data:
Type plate on cell: 6 OPzV 600
Code : with single cells the nominal voltage is not shown
6 = n = Number of positive plates (pl)
OPzV = Type = Stationary/tubular/valve regulated
600 = nominal capacity in Ah (C_{10}), capacity at discharge with 10 h-current (I_{10}) for a time of 10 h (t_{10})

Calculation of the plate type:

$C_{10}/n = 600$ Ah/6 pl = 100 Ah/pl

Calculation of the 5h capacity (C_5) of the battery:

$C_5 = (C_5/pl) \times n = 86$ Ah/pl x 6 = 516 Ah

Calculation of the 5h discharge current (I_5):

$I_5 = C_5/t_5 = 516$ Ah/5 h = 103.2 A

Calculation of the final discharge voltage (U_f): The final discharge cell voltage U_f (1.77V) at a discharge time of $t_n = 5$ h is listed in the table.

8.2 Capacities at different discharge times and final discharge voltage. All technical data refer to 20° C

Stationary lead acid batteries OPzV (DIN 40742) with pos. tubular plates and neg. grid plates

discharge time	1 h	3 h	5 h*	10 h
capacity/plate	C_1	C_3	C_5	C_{10}
50 Ah	26.5 Ah	37.5 Ah	43.0 Ah	50.0 Ah
70 Ah	37.0 Ah	52.5 Ah	60.0 Ah	70.0 Ah
100 Ah *	52.0 Ah	75.0 Ah	86.0 Ah	100.0 Ah
125 Ah	62.0 Ah	93.0 Ah	105.0 Ah	125.0 Ah
U_f (cell) *	1.67 V	1.75 V	1.77 V	1.80 V

* Values for calculation example

NXSA60E10000404 · Hellersche Druckerei · Printed in Germany · Subject to change

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State: May 2004

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