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# Sonnenschein A 400

## Operating Instruction 31400

### 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 and technical data in these instructions)
- Nominal discharge current  $I_N = I_{10}$  :  $C_N / 10h$
- 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 only be carried out by qualified personnel!



- 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 the contact with electrolyte is impossible. If the cell container is damaged do not touch the exposed electrolyte because it is corrosive.



- Blocs 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!



- 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.



#### 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 sealed maintenance free lead acid batteries do not require any maintenance (therefore water topping up is not required). Pressure valves are used for sealing and cannot be opened without destruction.

#### 1. Start Up

Check all blocs for mechanical damage, exact polarity and firmly seated connectors. The following torques apply for screw connectors:

G 5	G 6 / M 6	A / M 8	F 10
5 Nm ± 1	6 Nm ± 1	8 Nm ± 1	20 Nm ± 1

Before installation the supplied rubber covers should be fitted to both ends of the connector cables (pole covers).

Control of insulation resistance:

New batteries: > 1M Ω  
Used batteries: > 100 Ω/Volt

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 stationary batteries EN 50 272-2 is mandatory.

Battery installation should be made such that temperature differences between individual units do 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 part discharge.

#### 2.2 Charging

Applicable are all charging procedures with their limit values according to DIN 41773 (U-characteristic). According to the charging equipment specification and characteristics alternating currents flow through the battery superimposing onto the direct current during to be carried out in accordance with the recommendations of the battery-manufacturer.

#### a) Standby Parallel Operation

Here the load, direct current source and battery 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 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 2.27 V/cell ± 1% x number of cells measured at the terminals of the battery. To reduce the charging time a boost-charging stage can be applied in which the charging voltage of 2.33 - 2.4 V/cell ± 1% x number of cells can be used (standby-parallel operation with boost recharging stage). Automatic change over to 2.27 V/cell ± 1% x number of cells follows.

#### b) Buffer Operation

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. Therefore, depending on the load the charge voltage must be set at 2.27 V/cell ± 1% to 2.30 V/cell ± 1% x number of cells. This has superimposing onto the direct current during to be carried out in accordance with the recommendations of the battery-manufacturer.

#### c) Switchmode-Operation

When charging, the battery is separated from the load. The charge-voltage of the battery is max. 2.35 V/cell. The charging process must be monitored. If the charge-current sinks below 1.5 A/100 Ah with 2.35 V/cell, the mode switches to float-charge acc. to point 2.3 (switches after reaching 2.35 V/cell).

#### d) 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 2.27 V/Z ± 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 exhaustive discharges and/or inadequate charges. They have to be carried out as follows: Up to 48 hours of max. 2.4 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 2.4 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 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. (approx. Value)

### 2.7 Temperature

The nominal 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. All technical data are produced for a nominal temperature of 20° C. 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 25° C is not necessary. Is the operating temperature constantly outside this range the charge-voltage has to be adjusted. During float-charge the following temperature related charge voltages should be used:

Battery temperature °C	Charge voltage [VpC]
-10	2.37
0	2.37
10	2.32
20	2.27
30	2.27
40	2.25

### 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 blocs
- surface temperature of several blocs
- battery-room temperature

If the difference of the average float charge voltage is exceeding values shown in the table

blocs	upper	lower
12V	+0.490	-0.251
6V	+0.346	-0.261

and or is the surface temperature-difference between cells/blocs exceeding 5 K, the service-agent should be contacted.

#### Annual measurement and recording:

- voltage of all cells/blocs
- surface temperature of all cells/blocs
- 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

### 8. Technical data

#### 8.1 Capacities at different discharge times until the final discharge voltage at 20° C. Stationary lead acid batteries A 400 with pos. and neg. grid plates.

discharge time	10 min	30 min	1 h	3 h	5 h	10 h	
capacity	C <sub>1/6</sub>	C <sub>1/2</sub>	C <sub>1</sub>	C <sub>3</sub>	C <sub>5</sub>	C <sub>10</sub> /C <sub>n</sub>	
	Ah	Ah	Ah	Ah	Ah	Ah	
A406/165	52.98	80.10	95.1	132.0	143.5	165.0	
A412/5.5	1.83	2.80	3.4	4.5	5.0	5.5	
A412/8.5	2.67	3.85	4.7	6.3	7.0	8.5	
A412/12.0	3.67	5.50	6.8	9.0	10.5	12.0	
A412/20.0	6.50	9.10	11.5	15.0	16.5	20.0	
A412/32.0	11.25	16.55	20	26.7	29.0	32.0	
A412/50.0	15.95	24.00	29.4	40.8	44.5	50.0	
A412/65.0	19.38	28.95	41.7	51.9	57.5	65.0	
A412/85.0	27.70	42.65	52.2	68.4	74.5	85.0	
A412/90.0	24.23	37.50	43.7	58.8	66.0	90.0	
A412/100.0	30.52	45.65	53.3	72.3	85.0	100.0	
A412/120.0	38.08	55.90	70.6	87.9	98.0	120.0	
A412/180.0	53.03	79.25	95.8	138.0	152.0	180.0	
19"	A412/26.0	9.00	13.00	16.00	21.00	23.00	26.00
	A412/37.0	12.20	17.00	21.00	29.00	31.00	37.00
	A412/48.0	17.00	25.00	30.00	40.00	43.00	48.00
23"	A412/85.0	27.00	40.00	51.00	68.00	75.00	85.00
	A412/110.0	35.00	52.00	66.00	88.00	97.00	110.00
	V	V	V	V	V	V	
U <sub>r</sub> (6 V Bloc) in Volt	4.8	4.8	4.95	5.1	5.1	5.4	
U <sub>r</sub> (12 V Bloc) in Volt	9.6	9.6	9.9	10.2	10.2	10.6	

### 4. Tests

Tests have to be carried out according to IEC 896-1 + 2. Special instructions like DIN VDE 0107 and DIN VDE 0108 have to be observed.

### 5. Faults

Call the service agents immediately in case of faults in the battery or the charging until. The availability of the recorded data described in point 3. will be very helpful to find the cause of failure.

A service contract simplifies troubleshooting.

### 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 damages 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.

### 7. Transport

Blocs 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. Blocs may be suitable stacked and secured on pallets (ADR an 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.

Blocs whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN no. 2794.