valve regulated
sealed lead acid type
rechargeable battery

sunbattery®

INSTRUCTION MANUAL

Maintenance-free lead acid batteries
in valve regulated lead acid (VRLA/AGM)

DESCRIPTION / TYPE: **SUN BATTERY**

Nominal values

Nominal voltage UN:	2 V Cells	6 V Blocks	12 V Blocks
Nominal capacity C20:	20 hr discharge		
Nominal temperature TN:	20°C		
Reduction factors:	as per EN 50272-2, Section 8		
Nominal discharge:	IN=120	CN/20h	

Battery manufacturer: **SUN BATTERY** Type: **SUN**

Assembled by: _____ on: _____

Installation by: _____ on: _____

Safety markings by: _____ on: _____

- Refer to the instruction manual and keep it in a visible place near to the batteries!
- Only carry out works to a battery under supervision from qualified staff!

- Smoking prohibited! To avoid the risk of fire and explosions, keep naked flames, sparks and burning/glowing materials away from the battery!

- When working on batteries, wear safety goggles and protective clothing!
- Take note of the accident prevention regulations, such as EN 50272-2, Section 8!

- If acid sprays onto the eye or skin, rinse it off with plenty of clean water. Then contact a doctor immediately. Wash any clothing that has come into contact with acid in water!

- Risk of fire and explosions! Avoid short circuits! Attention! A battery's metal parts are subject to constant voltage, so do not put foreign objects or tools on the battery!

- Electrolyte is highly corrosive! In normal operating conditions, there is almost no risk of coming into contact with the electrolyte. If you do come into contact with the electrolyte, contact a doctor immediately!

- Battery blocks / cells are heavy, even when empty! Make sure they are solidly installed!
- Only use suitable means of transport.

- The guarantee is void if the instruction manual is not observed, if non-original parts are used for repair, or if you undertake invasive repairs yourself.

- **Returns to the manufacturer!** Used batteries bearing this sign are a recyclable item and must be recycled. Used batteries that are not recycled must be disposed of as hazardous waste in full accordance with the regulations.

Sealed lead batteries consist of cells that do not need to be filled up with water for their entire working lives. Pressure relief valves function as plugs, and any attempt to open them will cause damage.

1. Before Service

Before being brought into service, all banks should be checked: for mechanical damage; that the polarity is correct; and that the connectors are firmly attached. The following torque settings apply to screw connectors.

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

2. Operation

Refer to EN 50272-1 for operating and installation guidelines for these batteries. The battery should be installed to avoid temperature shifts of > 3K.

2.1 Discharge

Do not discharge the battery below its cutoff voltage for its designated discharge current. Unless the manufacturer specifies otherwise, do not draw more than the nominal capacity. After discharge – even partial discharge – the battery must be charged immediately (it may be necessary to lift the pole covers). Before charging the battery, make sure the charger is turned off, polarity is correct (positive pole connected to the positive connector) and separate loads are connected to a direct current power source. Turn the charger on and begin charge as follows in point 2.2.

2.2 Charging

All charging procedures where the maximum and minimum values correspond to DIN 41773 and 1 (I-U charging curve) may be used. Depending on the make of the charger used and its charging curve, alternating currents superposed to the direct current may flow through the battery (< 0.1 C(A) ripple factor). The superposed alternating currents and the contrary action of loads can cause the battery to heat up abnormally and put additional strain on the electrodes – and cause possible damage (see point 2.5). Depending on the battery set-up, the following charging methods can be used (corresponding to the diagram in DIN VDE 510 Part 1 draft). Batteries are not allowed to be charged upside down!

a) Continuous parallel supply and buffer supply.

In this case, the loads, direct current source and battery are continuously connected in parallel. At the same time the charging voltage is equal to the battery's operating

voltage and installation voltage. In continuous supply, the direct current source can always supply the maximum load current plus the battery charging current. The battery only supplies electricity if the direct current source fails. The correct charging voltage is 2.275 V ± 0.005 V (20°C) x the number of cells connected in series, measured at the battery's terminal posts. In the case of buffer charging, the direct current source is not able to supply the total load current at any time. There are times when the load current exceeds the nominal current of the direct current source. During these times, the battery supplies power. It is not always fully-charged, though the float voltage of 2.275 V/cell (20°C) x the number of cells is sufficient to ensure recharge in a series connection. A load-and-cell-quantity-dependent calibration should be provided, in any specific instance, by the manufacturer.

b) On-off operation

Whilst being charged, the battery is disconnected from its load. To decrease recharging time, the battery can be charged at 2.45-2.5 V during its first charging phase before the charging current is reduced to 0.07 C(A) (t1). The first charging phase lasts until this value is reached. In the second charging phase, a voltage of 2.45-2.5 V/cell is used. The charging duration of this phase should be 50% of the first (t2=0.5T1). If the value of t > t1 + 0.5t1 is exceeded, the charging voltage is reduced to 2.275 V/cell (± 0.005 V) at 20°C.

c) Battery operation (charging / discharging cycle)

The load is only charged from the battery. The correct charging procedure depends on the user and should be clarified with the manufacturer.

2.3 Maintaining full charge (float charging)

Appliances fitting the criteria set out in DIN 41773 and DIN 41773-1 should be used. They should be set up so that the average cell voltage is 2.275 V ± 0.005 V.

2.4 Top-up or equalisation charging

To prolong battery life, it is advisable to do a top-up charge before running the batteries, providing the batteries have been stored for more than 6 months – but not longer than 9 months – with reference to the date of manufacture.The batteries should also have a terminal voltage of less than 2.1 V/cell. The top-up charge should be carried out

using the values specified. For batteries retrofitted to form a replacement battery bank for standard float charging, no equalisation charging is needed to bring the terminal voltage in line with the other batteries.

2.5 Superposed alternating currents

In the case of the operating scenarios outlined in point 2.2, the effective value of the alternating current can temporarily rise to 0.1 C(A) whilst being recharged at up to 2.4 V/cell. After recharging and ongoing charging (float charging) in a continuous battery power supply or float battery supply, the effective value of the alternating current should not exceed a nominal capacity of 5 A / 100 AH.

2.6 Charging currents

In continuous battery supplies and float battery supplies, there is no charging current limit if there is no recharging stage. The charging current should be 10 to 20 A for every 100 AH of nominal capacity (Benchmark).

2.7 Temperature

The recommended operating temperature range for lead batteries is 10°C to 30°C. The ideal temperature range is 20°C ±5. Higher temperatures decrease battery life. The technical specifications apply to a nominal temperature of 20°C. Lower temperatures decrease available capacity. Exceeding the maximum allowable temperature from 50°C is prohibited. Persistent operating temperatures above 40°C should be avoided.

2.8 Temperature-based float charging voltage and rapid discharge

The float charging voltage of 2.275 V/cell ± 0.005 V/cell applies to a temperature of 20°C. A temperature-based recalibration of the float charging voltage is required to avoid over-charging at higher temperatures and under-charging at lower temperatures. The recommended recalibration factor is -3 mV/cell/V°C in a float charging situation. To avoid a "thermal runaway", for temperatures above 40°C the float charging voltage must be

Storage duration in relation to the date of manufacture.	Charging voltage per cell at 20°C	Charging time
Less than 9 months	2,28 V/cell	Longer than 72 hours
Up to a year	2,35 V/cell	48 to 144 hours
1 to 2 years	2,35 V/cell	72 to 144 hours

recalibrated to the temperature. A power-charging procedure can then be used if a rapid recharge is needed. In this case, the charging current should not exceed 0.01 C(A) and constantly decreases until it's below 0.01 C(A). Once a level of ±0.1 V/cell has been reached, it should be switched to float voltage charging.

Temperature (°C)	Charging voltage	Float charging voltage
-10	2.58	2.36
0	2.53	2.33
10	2.48	2.30
20	2.45	2.28
30	2.40	2.24
40	2.34	2.21

2.9 Electrolyte
The electrolyte is diluted sulphuric acid suspended in mats.

3. Battery care and inspection
The battery must always be kept in a clean and dry condition to avoid leakage currents.

The battery should be cleaned according to the ZVEI information leaflet "Cleaning of Batteries". The battery's plastic parts should only be cleaned using water without additives; using organic cleaning products is not recommended. The following should be checked and recorded at least every 6 months:
- Battery voltage
- Voltage of some individual cells/ battery blocks
- Surface temperature of some cells
- Battery room temperature

If the cell voltage differs from the average float charging voltage by ±0.1 V/cell, or if the surface temperature of different cells/blocks differ from each other by more than 5 K, please contact customer services. The following must be measured and recorded yearly:
- Voltage of all cells/battery blocks
- Surface temperature of all cells
- Battery room temperature
- Leakage resistance according to EN 60896-1

Annual visual inspection:
- Screw connections. Unfixed screw connections should be checked that they are firmly attached.
- The battery rack / storage area
- Ventilation (both aeration and extraction)

4. Inspections
Inspections should be carried out according to EN 60896-1. Please also refer to additional guidelines e.g. DIN VDE 0107 and DIN VDE 0108. Refer to the aforementioned EN. In order to ensure a reliable power

supply, the whole battery should be replaced once its expected service life – given its operating conditions and temperature – has expired.

5. Problems

If you identify errors with the battery or the charging set-up, contact customer services without delay. The measurement specifications in point 3 enable easier fault-checking and troubleshooting. A maintenance contract helps with the timely identification of problems.

6. Storage and decommissioning

If cells/batteries are put in storage or taken out of service for a significant amount of time, they should be kept in a dry, frost-free room. To avoid damage, maintenance charging should be carried out as specified in point 2.4.

7. Transport

Sun batteries are not hazardous materials as long as they are secured against short circuits, slipping, falling over and damage (Hazardous Material Act, GGVS, volume No. 2801a). This applies to transport by road, rail, sea and air, and to IATA rules (Rule A67), ADR (Rule 598), IMDG (Rule 238.2), and UN 2800 special provisions. The transported goods should not carry any dangerous traces of acid. All sealed lead batteries and cells whose containers are no longer leak-proof or damaged are subject to the corresponding special provisions.

8. Technical specifications

Capacities (Cn) at various discharge times (tn) until the relevant cutoff voltage (US) at a temperature of 25°C.

Description	20 hr	10hr	5hr	3hr	1hr
SUN model	1.80 V/c	1.80 V/c	1.75 V/c	1.75 V/c	1.60 V/c
SB6-1,2	1,2 Ah	1,12 Ah	1,01 Ah	0,882 Ah	0,728 Ah
SB6-12	12 Ah	11,2 Ah	10,2 Ah	9,2 Ah	7,54 Ah
MB12-0,8	0,8 Ah	0,74 Ah	0,67 Ah	0,588 Ah	0,486 Ah
SB12-1,2	1,2 Ah	1,12 Ah	1,01 Ah	0,882 Ah	0,728 Ah
SB12-2,1	2,3 Ah	2,14 Ah	1,93 Ah	1,69 Ah	1,40 Ah
SB12-3,4	3,4 Ah	3,16 Ah	2,89 Ah	2,60 Ah	2,14 Ah
SB12-7,2	7,2 Ah	6,7 Ah	6,12 Ah	5,37 Ah	4,49 Ah
SB12-7,2L	7,2 Ah	6,70 Ah	6,12 Ah	5,37 Ah	4,49 Ah
SB12-12L	12,7 Ah	12,0 Ah	10,4 Ah	9,48 Ah	7,38 Ah
SB12-18	18 Ah	16,7 Ah	15,3 Ah	13,4 Ah	11,2 Ah
SB12-24	24 Ah	22,3 Ah	20,4 Ah	18,4 Ah	15,1 Ah
SB12-26	26 Ah	24,2 Ah	22,1 Ah	19,9 Ah	16,3 Ah
SB12-38	38 Ah	36,1 Ah	31,1 Ah	28,2 Ah	22 Ah
SB12-45	45 Ah	42 Ah	36,6 Ah	32,7 Ah	26 Ah
SB12-55	58,8 Ah	55 Ah	47,9 Ah	42,9 Ah	34,1 Ah
SB12-65	69,6 Ah	65 Ah	56,5 Ah	50,7 Ah	40,3 Ah
SB12-65S	65.0 Ah	61.0 Ah	51,5 Ah	46.8 Ah	36.6 Ah
SB12-75	78 Ah	75 Ah	64,5 Ah	58,5 Ah	45,8 Ah
SB12-80	75 Ah	70 Ah	60,9 Ah	54,6 Ah	43,4 Ah
SB12-100	100 Ah	93,5 Ah	81,5 Ah	72,9 Ah	57,9 Ah
SB12-120	128,4 Ah	120 Ah	104,5 Ah	93,6 Ah	74,4 Ah
SB12-150	160,5 Ah	150 Ah	130,5 Ah	117 Ah	93,0 Ah
SB12-200	214 Ah	200 Ah	174,0 Ah	156 Ah	124,0 Ah
MB12-50HC	46,8 Ah	45,0 Ah	38,7 Ah	35,1 Ah	27,5 Ah
MB12-75HC	80,4 Ah	75,0 Ah	65,8 Ah	59,6 Ah	48,5 Ah
MB12-5HR	6,1 Ah	5 Ah	4,47 Ah	4,05 Ah	3,74 Ah
MB12-7HR	7,8 Ah	7,23 Ah	6,45 Ah	5,67 Ah	5,41 Ah
SB12-110A FT	106 Ah	100 Ah	95,2 Ah	87 Ah	63,7 Ah
SB12-150A FT	158,8 Ah	150 Ah	142,4 Ah	130,5 Ah	95,9 Ah