

Solar Range

Ni-Cd Batteries

Installation and operating instructions

Important recommendations

- **WARNING:** Risk of fire, explosion, or burns. Do not disassemble, heat above +70°C, or incinerate.
- Never smoke while performing any operation on the battery.
- Never allow an exposed flame or spark near the batteries, particularly while charging
- For protection, wear rubber gloves, long sleeves, and appropriate splash goggles or face shield.
The electrolyte is harmful to skin and eyes. In the event of contact with skin or eyes, wash immediately with plenty
- of water. If eyes are affected, flush with water, and obtain immediate medical attention.
- Remove all rings, watches and other items with metal parts before working on the battery.
- Use insulated tools.
- Avoid static electricity and take measures for protection against electric shocks.
- Discharge any possible static electricity from clothing and/or tools by touching an earth-connected part "ground" before working on the battery.
- Ventilation, in accordance with the IEC62485-2 standard, is mandatory during commissioning and operation.

1. Receiving the shipment

Do not overturn the package. Check the packages and cells for transport damage.
The battery is shipped filled and charged, and is ready for immediate use. Storage of cells must not exceed the maximum storage time indicated on the packing case.

2. Storage

The battery must be stored in a dry and clean indoor location, on open, well ventilated shelves away from direct sunlight between 0°C and +30°C (+32°F and 86°F).

If stored in the shipping crates, the lid and top packing must be removed to allow ventilation. Do not store in direct sunlight or expose to excessive heat.

Solar Range batteries are supplied filled with electrolyte and charged. They can be stored in this condition for maximum 24 months from date of shipment in accordance with the recommendations set forth in this I&O.

Storage of a filled battery at temperatures above +30°C (+86°F) can result in permanent change and loss of product performance, depending on the duration of the storage above the maximum recommended temperature.

Never drain the electrolyte from the cells.
To ensure maximum protection of the cells always store the product in its original packaging.

3. Installation

3.1. Location

Install the battery in a dry and clean room. Avoid direct sunlight and heat. The battery will give the best performance and maximum service life when the ambient temperature is between +10°C to +30°C / +50°F to +86°F.

For cells with handles, both must be used when lifting and moving. To prevent electrolyte spillage, do not tip cells.

3.2. Mounting

Verify that cells are correctly interconnected with the appropriate polarity and that the connectors are correctly torqued. The battery connection to load should be with nickel plated cable lugs.

Recommended torques for terminal bolts are:

- M6 = 11 ± 1.1 N.m (97.4 ± 9.8 lbf.in)
- M8 = 20 ± 2 N.m (177.0 ± 17.7 lbf.in)
- M10 = 30 ± 3 N.m (265.0 ± 26.6 lbf.in)

The connectors and terminals should be corrosion protected by coating with a thin layer of anti-corrosion oil, anti-corrosion grease (NO-OX) or approved equal.

If a central water filling system is used as an option, refer to the corresponding installation and operating instructions sheet.

3.4. Electrolyte

When checking electrolyte levels, a fluctuation in level between cells is normal. This is caused by a small difference in internal pressure in each cell and due to the varying amounts of gas held in the separators of each cell. The level is normally at least 15 mm above the minimum (5/8") above the minimum level mark (lower) and there should be no need to adjust it.

If electrolyte is ever spilled from a cell and the level is 30 mm below the minimum mark (lower), then refilling with E22 electrolyte is required. Contact your local Saft representative for more details.

Do not top up with deionized or distilled water prior to initial charge to avoid overfilling a cell. After commissioning, when the level is stabilized, the electrolyte level should be approximately 5 mm below maximum mark (Upper).

4. Commissioning

Verify that ventilation, in accordance with the IEC 62485-2 standard, is provided during this operation. Commissioning the battery is important: Charging at constant current is preferable.

If the current limit is lower than indicated in the table A, extend the charge time proportionally. After commissioning, the battery shall be charged permanently according to section 5.
Prior and during commissioning charge, record all data requested in the commissioning report available on

4.1. Cells stored up to 6 months:

Charge at constant current is preferable.
A commissioning charge is normally not required and the cells are ready for immediate use. However, the product's full performance will only be achievable after six months of charging in service (see section 7.3 charge acceptance of Technical manual).
If the published performance is required immediately, please refer to Section 4 and the procedure dedicated to cells stored more than 1 to 3 months and up to 2 years.

4.2. Cells stored more than 6 months and up to 2 years:
Always conduct a commissioning charge before use.

- Commissioning at ambient temperature between +10°C to +30°C (+50°F to +86°F)

• Constant current charge

Charge for 10 h at 0.2 C₅ A
20 h at 0.1 C₅ A recommended (see Table A).
Notice: At the end of the charge, the cell voltage will reach the level of 1.75 V/cell, thus the charger shall be able to supply such voltage.
When the charger maximum voltage setting is too low to supply constant current charging, divide the battery in two parts to be charged individually at constant current.

• Constant potential charge

Charge at 1.55 V/cell for a minimum of 24 hours with current limited to 0.1 C₅ A. If this voltage level is not available, then charge at 1.50 V/cell for a minimum of 36 h with current limited to 0.2 C₅ A (see the current in Table A).

◁ Commissioning at ambient temperature above +30°C (+86°F)

• Only Constant current charge

Charge for 20 h at 0.1 C₅ A (see Table A).
The battery container temperature is to be monitored during charge. If the temperature exceeds +45°C (+113°F) during charging, then it must be stopped to reduce the temperature. The charging can be resumed when electrolyte temperature drops below +40°C (+104°F).

In the case of remote areas, where the only charger available is the photovoltaic array, the battery should be connected to the system with no connected load and no voltage limit. The battery should then be charged in good sunshine conditions.

During this operation, the Ah charged shall be in the magnitude of 1.6 times the rated capacity, and, in order to limit the risk of electrolyte overflow, it is recommended not to exceed the charge current value specified in Table A.

Following the commissioning charge and after placing the battery in service, check the electrolyte levels as topping-up may be necessary.

4.3. Cell electrolyte after prolonged float charge
Check the electrolyte level and adjust it to the upper level mark by adding distilled or deionized water.

Note: When full battery performance is required for capacity test purposes, the battery has to be charged in accordance with IEC 62259 section 7 (7.1 & 7.2).

Reliability inside

Table A

Cell Type	Capacity		Charging Current	Charging Current	Cell connection bolt per pole
	C120 Ah	C5 Ah	0.2 C5 (A)	0.1 C5 (A)	
PV 50	50	45	9,0	4,5	M6
PV 100	100	95	19,0	9,5	M8
PV 136	136	126	25,2	12,6	M10
PV 150	150	140	28,0	14,0	M10
PV 175	175	163	32,6	16,3	M10
PV 200	200	185	37,0	18,5	M10
PV 235	235	218	43,6	21,8	M10
PV 250	250	235	47,0	23,5	M10
PV 275	275	253	50,6	25,3	M10
PV 305	305	280	56,0	28,0	M10
PV 320	320	294	58,8	29,4	2xM10
PV 355	355	325	65,0	32,5	2xM10
PV 370	370	338	67,6	33,8	2xM10
PV 405	405	375	75,0	37,5	2xM10
PV 415	415	380	76,0	38,0	2xM10
PV 455	455	420	84,0	42,0	2xM10
PV 485	485	450	90,0	45,0	2xM10
PV 505	505	470	94,0	47,0	2xM10
PV 555	555	515	103,0	51,5	2xM10
PV 596	596	547	109,4	54,7	3xM10
PV 610	610	560	112,0	56,0	3xM10
PV 645	645	595	119,0	59,5	3xM10
PV 660	660	610	122,0	61,0	3xM10
PV 710	710	650	130,0	65,0	3xM10
PV 760	760	700	140,0	70,0	3xM10
PV 790	790	729	145,8	72,9	3xM10
PV 810	810	750	150,0	75,0	3xM10
PV 835	835	774	154,8	77,4	3xM10
PV 860	860	800	160,0	80,0	3xM10
PV 910	910	840	168,0	84,0	3xM10
PV 930	930	862	172,4	86,2	4xM10
PV 960	960	890	178,0	89,0	4xM10
PV 1015	1015	940	188,0	94,0	4xM10
PV 1065	1065	980	196,0	98,0	4xM10
PV 1115	1115	1030	206,0	103,0	4xM10
PV 1170	1170	1080	216,0	108,0	4xM10
PV 1215	1215	1120	224,0	112,0	4xM10
PV 1245	1245	1150	230,0	115,0	5xM10
PV 1270	1270	1170	234,0	117,0	5xM10
PV 1320	1320	1220	244,0	122,0	5xM10
PV 1370	1370	1260	252,0	126,0	5xM10
PV 1385	1385	1279	255,8	127,9	5xM10
PV 1420	1420	1300	260,0	130,0	5xM10
PV 1470	1470	1350	270,0	135,0	5xM10
PV 1520	1520	1400	280,0	140,0	5xM10
PV 1570	1570	1450	290,0	145,0	6xM10
PV 1620	1620	1500	300,0	150,0	6xM10
PV 1670	1670	1550	310,0	155,0	6xM10
PV 1720	1720	1600	320,0	160,0	6xM10
PV 1775	1775	1650	330,0	165,0	6xM10
PV 1830	1830	1700	340,0	170,0	6xM10

Note: When full battery performance is required for capacity test purposes, the battery has to be charged in accordance with IEC 62259 section 7 (7.1 & 7.2).

5. Charging in service

The photovoltaic array converts solar irradiance into DC electrical power at a pre-determined range of voltages whenever sufficient solar radiation is available. Unlike a main connected system, the output from a photovoltaic array is variable and, to obtain the best efficiency from the system, it is quite normal to have some form of charge control.

Two main techniques for charging the batteries are generally used in photovoltaic systems.

These are those which have a constant voltage limitation based on the PWM techniques and those with several voltage steps charging where the battery, by switching means, is charging up to a high pre-set voltage (boost or float threshold), then drops to a lower voltage level (battery reconnect threshold) and then back to the high pre-set voltage and so on.

Recommended charging voltages for a typical photovoltaic application sized for 5 days or more back-up time.

- Case of constant voltage limitation (PWM regulator system or similar):
 - Float: 1.50 V/cell
 - Boost (not mandatory): 1.65 V/cell

- Case of regulators based on the switching principle
 - Boost threshold (not mandatory): 1.65 V/cell
 - Float threshold: 1.55 V/cell
 - Battery reconnect threshold: 1.45 V/cell

To minimize the need for topping-up maintenance at high temperatures and increases the charge acceptance at low temperatures. Temperature Compensated Voltage (TCV) is generally mandatory. The conditions to apply TCV depend on ambient operating temperature. For optimum charging, TCV charging is mandatory from from -20°C to 0°C (-4°F to +32°F). The TCV control value is -3 mV/°C/cell (-1.7 mV/°F/cell), starting from +0°C (+32°F).

6. Periodic maintenance

Alcad Solar Range batteries require the minimum of attention.

However, it is good practice with any system to carry out an inspection of the system once per year or at the recommended topping-up interval period to ensure that the charging system, the battery and the ancillary electronics are all functioning correctly. Additionally, follow your standard preventative maintenance procedures.

- Keep the battery clean using only water. Do not use a wire brush or solvents of any kind. Vent plugs can be rinsed in clean water if necessary.

- Check the charging voltage. This should be checked and recorded at least once yearly.
- High water consumption is usually caused by an improper voltage setting or voltage drift that is above the recommended in-service charging voltages. To maximize the topping-up interval check the charging voltage adjust as required.
- Visually check the electrolyte level. Never let the fall below the minimum level mark. Use only distilled or deionized water to top-up (see Table A for the quantity of water per cell). Topping-up of the Sunica. Plus battery shall be carried out when battery is fully charged. Experience will tell the time interval between topping-up.
- Note: There is no need to check the electrolyte density. Electrolyte density measurements do not indicate state of charge or state of health.
- CAUTION: Topping-up should be done only when the Sunica.Plus is in float charge operation mode.
- Ensure all terminals and connectord are coated with a thin layer of anti-corrosion oil, anti-corrosion grease (NO-OX) or approved equal.

7. Environment

To protect the environment all used batteries must be recycled. Contact your local Alcad representative for further information.

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