

Solar Range

Delivering quality

ALCAD

ALCAD Solar Range

Low maintenance Ni-Cd batteries for stand-alone hybrid systems

Battery systems have a difficult job maintaining reliable service in isolated locations and hostile environments. Demands upon them fluctuate widely and charging depends entirely on irregular and unpredictable weather patterns.

For renewable energy applications

In remote outdoor installations, Alcad Solar is the natural choice for –

- photovoltaic applications
- stand-alone hybrid systems
- renewable energy applications

The solution is Alcad Solar

Alcad Solar storage batteries are purpose built to operate in these conditions. The range provides totally reliable service and very low maintenance which achieves a low life-cycle cost.

Efficient and reliable in tough conditions

Managing complex charging patterns is essential for efficient running of a hybrid system. Alcad Solar will continue to operate at any state of charge.

Over-compensation for unpredictable charging conditions with high charging voltages is unnecessary.

Alcad Solar's typical charging voltage of 1.5 V per cell minimises water-consumption, eliminating unscheduled service calls. The battery reaches a high state of charge without boost or reconditioning charges.

Alcad Solar range Ni-Cd batteries are compatible with all current photovoltaic charge regulators and conventional industrial battery chargers.

Extreme operating temperature

Alcad Solar's robust construction and stable electrochemistry enable it to operate comfortably within a temperature range of -20°C (-4°F) to $+50^{\circ}\text{C}$ ($+122^{\circ}\text{F}$) and will tolerate extremes of -50°C (-58°F) to $+70^{\circ}\text{C}$ ($+158^{\circ}\text{F}$).

For operation in temperatures below -20°C (-4°F), a special, higher density electrolyte is used.

Alcad Solar will deliver 80% capacity for a 120 hour discharge even at -40°C (-40°F).

Long-term low maintenance

The low life-cycle cost Alcad Solar range battery is a reliable long-term investment. It is constructed to resist electrical and physical abuses and therefore requires very low maintenance. In return it will provide totally reliable service at a predictable cost over 20 years.

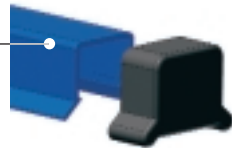
Additionally, Alcad Solar's reliability reduces demands on expensive diesel generators, thereby contributing to the overall system running cost reduction.

Low life-cycle cost

Long maintenance intervals, Ni-Cd's inherent safety and total reliability combine to make Alcad Solar an exceptionally low life-cycle cost solution.



Connector cover
In line with EN 50272-2 (safety) with IP2 level.



Flame arresting vent
With transport seal protection.

Plate group bus
Connects the plate tabs with the terminal post. Plate tabs and terminal posts are projection welded to the plate group bus.

Plate tab
Spot welded to the plate side frames, to the upper edge of the pocket plate and to the plate group bus.

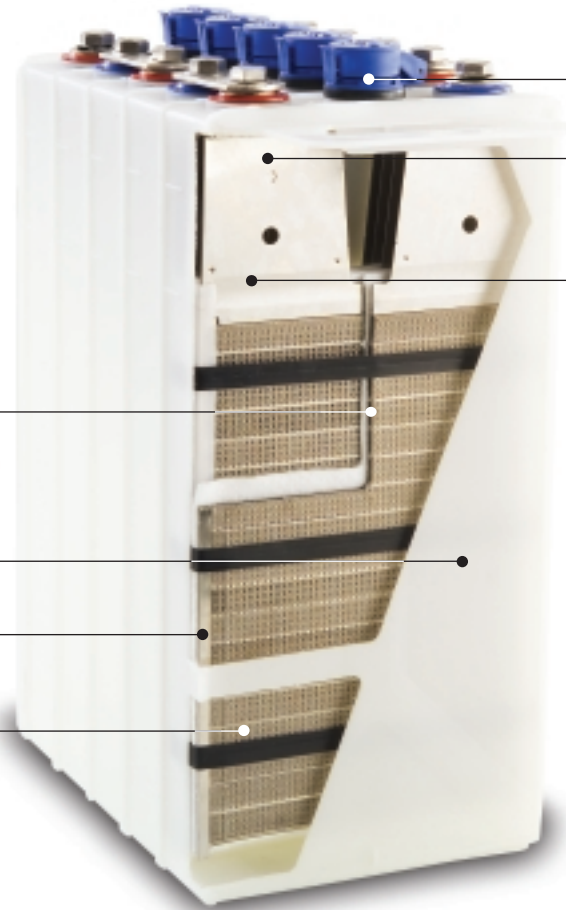
Handles
Moulded polypropylene handles allow Solar Range batteries to be easily manoeuvred and installed.

Separators
These separate the plates and insulate the plate frames from each other. This special type of separator improves the internal recombination.

Cell container
Made of tough polypropylene.

Plate frame
Seals the plate pockets and serves as a current collector.

Plate
Horizontal pockets of double-perforated steel strips.



Ni-Cd endures...

Alcad Solar batteries are built around Alcad's proven Ni-Cd pocket plate technology.

Active materials and nickel-plated steel components plus gas recombination technology give maintenance intervals of more than 4 years, reducing operating costs to a minimum.

... where lead acid cannot

Nickel-cadmium technology is inherently safe and resistant to over-, under- and complete discharging. Even at temperatures below -20°C (-4°F), Alcad Solar continues to perform without risk of corrosion or sulphation when cycled at low state of charge.

Alkaline electrolyte will not freeze and remains stable during operation. Lead acid batteries suffer from plate degradation, shortened life and risk of sudden death in similar conditions.

Alcad Solar Ni-Cd continues operating in conditions where lead acid cannot.

Alcad recycle

Alcad recycle old batteries as part of their responsibility to safeguard the environment.

Automated water filling system

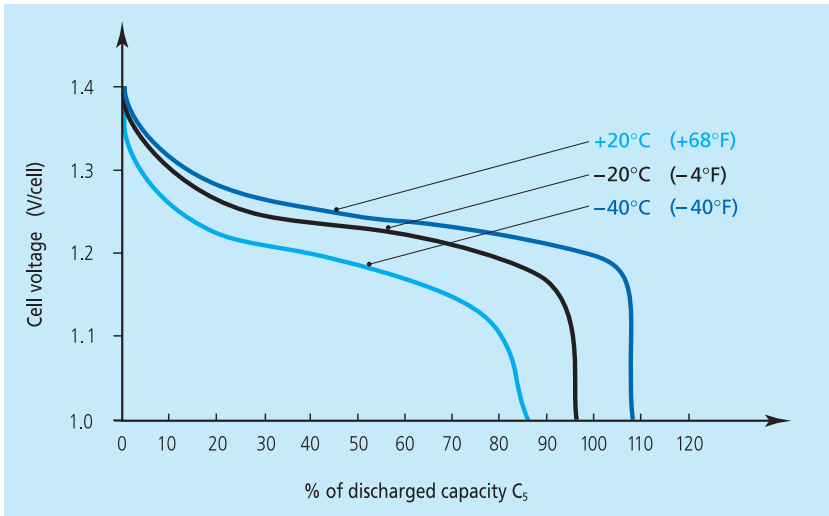
Alcad's water filling system is available as an option for Solar Range cell types 185 Ah to 1110 Ah. It enables automatic, fast and accurate topping-up, further extending maintenance intervals.

Meeting international standards

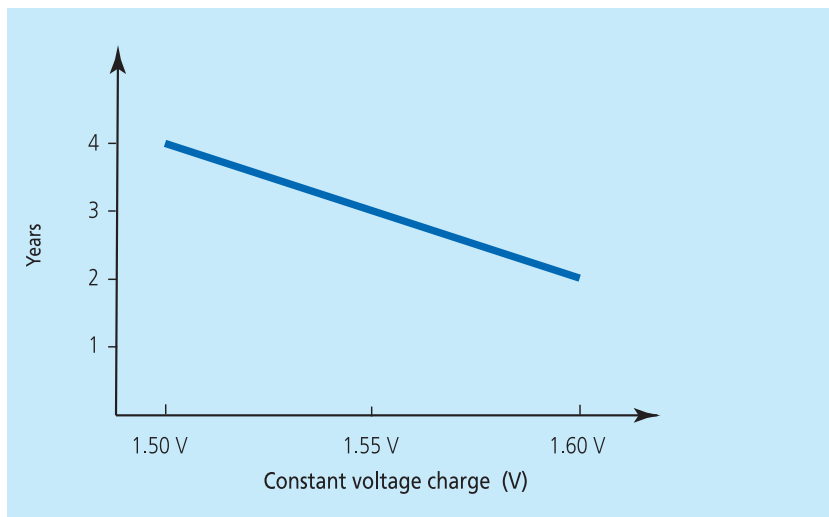
Alcad Solar has been developed in line with the safety requirements of EN 50272-2, and components used (such as insulated cable connectors and end lug covers) are defined to ensure high protection against electric shocks (IP2 level).

Alcad Solar features Alcad's highly efficient internal gas recombination pocket plate technology – meets IEC 62259 – and electrode design optimised for photovoltaic applications.

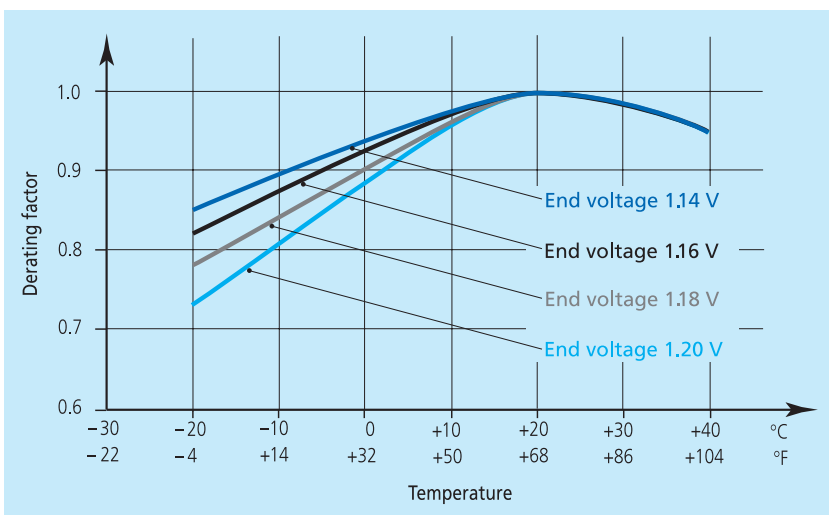
Solar



Discharge curves at $\frac{1}{120} C_{120} A$ according to temperature. Battery fully charged.



Typical water replenishment +20°C (+68°F)



Derating factor according to temperature and end voltage. For typical solar application with 3 or more days back-up time.

Alcad engineers will work with you to calculate the optimum size of battery for your application. They will consider location, operating temperature, anticipated discharge requirements and your system's charging capabilities.

The battery size or Ampere-hours (Ah) required will depend on average load and minimum back-up time or autonomy. Capacity should be sufficient to sustain days of discharge with minimum support from the renewable energy source.

With daily limited time for charging, batteries are not always able to reach full charge. By operating the system so that it approaches, but rarely reaches full capacity, water consumption and maintenance are reduced considerably. By adhering to the recommended charging voltage provided in Table 1, the battery should reach 90% state of charge under average operating conditions.

Initial calculations

Most installations are 12, 24 or 48-volt systems. Typically for these system voltages 9, 18 and 36 cells are used. However, depending on various conditions these numbers may be adjusted by one or two cells.

First, determine the number of cells by establishing –

- Maximum permitted charging voltage
- Daily depth of discharge
- Minimum permitted end voltage

Second, check if “ideal” operating conditions can be established, by consulting Table 1.

Third, check in the cell performance tables the cell type giving the selected current in relation to the end voltage and the back-up time.

Additional sizing considerations

Operating temperature will influence available capacity. While Ni-Cd batteries are less affected by temperature variations than lead acid, it may still be advisable to include derating factors in sizing calculations according to the temperature and end voltage. Refer to derating factor curves on page 4.

Other factors such as design margin, battery aging and future load extension may be included for the battery sizing.

Alcad's optimum sizing method is:

$$\begin{aligned}
 & \text{I load} \\
 & \times \\
 & \text{1/temperature derating factor} \\
 & \times \\
 & \text{1/charge derating factor*} \\
 & \times \\
 & \text{requested design margin} \\
 & = \\
 & \text{current value to select in the} \\
 & \text{performance table}
 \end{aligned}$$

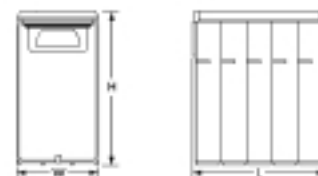
*The typical value is 90% when using the recommended charge voltage

Table 1. Recommended charging voltage

Battery system	12 V	24 V	48 V
Number of cells	9	18	36
5-10% daily depth of discharge	13.5 V	27 V	54 V
10-15% daily depth of discharge	13.95 V	27.9 V	55.8 V
15-25% daily depth of discharge	14.4 V	28.8 V	57.6 V

Solar type	Capacity		Height H		Width W		Length per block L														Approx. weight per cell					
	C ₁₂₀ 120 h 1.0 V	C ₅ 5 h 1.0 V	mm	in	mm	in	1 cell		2 cells		3 cells		4 cells		5 cells		6 cells		8 cells		9 cells		10 cells		kg	lb
	Ah	Ah					mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in		
PV 45	45	43	405	15.95	195	7.68					88	3.46	113	4.49	137	5.39	162	6.38	212	8.35	237	9.33	261	10.28	3.2	7.1
PV 90	90	85	405	15.95	195	7.68					121	4.76	157	6.18	192	7.56	228	8.98	300	11.81	336	13.23	371	14.61	4.9	10.8
PV 105	105	100	405	15.95	195	7.68					157	6.18	205	8.07	252	9.92	300	11.81	396	15.59	444	17.48			6.2	13.7
PV 140	140	128	405	15.95	195	7.68					157	6.18	205	8.07	252	9.92	300	11.81	396	15.59					6.7	14.8
PV 185	185	171	405	15.95	195	7.68					193	7.60	253	9.96	312	12.28	372	14.65							8.4	18.5
PV 230	230	213	405	15.95	195	7.68					159	6.26	232	9.13	305	12.01	377	14.84							9.9	21.8
PV 275	275	256	405	15.95	195	7.68					183	7.21	268	10.55	353	13.90	437	17.21							11.5	25.4
PV 320	320	300	405	15.95	195	7.68					228	8.98	336	13.23											15.1	33.3
PV 370	370	341	405	15.95	195	7.68					252	9.92	372	14.65											16.8	37.0
PV 415	415	384	405	15.95	195	7.68	146	5.75	278	10.95															18.3	40.4
PV 460	460	427	405	15.95	195	7.68	159	6.26	304	11.97															19.8	43.7
PV 505	505	469	405	15.95	195	7.68	171	6.73	328	12.91															21.4	47.2
PV 555	555	512	405	15.95	195	7.68	183	7.21	353	13.90															23.0	50.7
PV 645	645	597	405	15.95	195	7.68	219	8.62																	28.2	62.2
PV 735	735	682	405	15.95	195	7.68	244	9.61																	31.3	69.0
PV 830	830	768	405	15.95	195	7.68	268	10.55																	34.5	76.1
PV 920	920	853	405	15.95	195	7.68	304	11.97																	39.6	87.3
PV 1110	1110	1024	405	15.95	195	7.68	352	13.86																	46.0	101

Solar range complies with IEC 62259 standard.



Cell performance

Solar

For fully charged cells after a constant current charge according to IEC 62259 standard.

Available amperes at +20°C ± 5°C (+68°F ± 9°F)

d = days / h = hours

Solar type	End voltage = 1.14 V										End voltage = 1.16 V									
	2 d 48 h	3 d 72 h	4 d 96 h	5 d 120 h	6 d 144 h	7 d 168 h	8 d 192 h	9 d 216 h	10 d 240 h	2 d 48 h	3 d 72 h	4 d 96 h	5 d 120 h	6 d 144 h	7 d 168 h	8 d 192 h	9 d 216 h	10 d 240 h		
PV 45	0.94	0.64	0.48	0.39	0.33	0.28	0.25	0.22	0.20	0.92	0.63	0.47	0.39	0.33	0.28	0.25	0.22	0.20		
PV 90	1.86	1.26	0.95	0.77	0.65	0.56	0.49	0.44	0.40	1.82	1.25	0.94	0.77	0.64	0.56	0.49	0.44	0.40		
PV 105	2.19	1.49	1.11	0.90	0.76	0.66	0.58	0.52	0.47	2.15	1.47	1.10	0.90	0.76	0.65	0.58	0.52	0.47		
PV 140	2.80	1.90	1.43	1.15	0.98	0.85	0.74	0.66	0.60	2.75	1.88	1.41	1.15	0.97	0.84	0.74	0.66	0.60		
PV 185	3.74	2.54	1.91	1.54	1.31	1.13	0.99	0.89	0.80	3.67	2.52	1.89	1.54	1.29	1.12	0.99	0.89	0.80		
PV 230	4.66	3.17	2.37	1.92	1.63	1.41	1.23	1.10	0.99	4.57	3.14	2.35	1.92	1.61	1.39	1.23	1.10	0.99		
PV 275	5.60	3.80	2.85	2.30	1.96	1.69	1.48	1.33	1.19	5.49	3.77	2.83	2.30	1.94	1.68	1.48	1.33	1.19		
PV 320	6.56	4.46	3.34	2.70	2.29	1.98	1.73	1.56	1.40	6.44	4.42	3.31	2.70	2.27	1.96	1.73	1.56	1.40		
PV 370	7.46	5.07	3.80	3.07	2.60	2.25	1.97	1.77	1.59	7.32	5.02	3.77	3.07	2.58	2.23	1.97	1.77	1.59		
PV 415	8.40	5.71	4.28	3.46	2.93	2.54	2.22	1.99	1.79	8.24	5.65	4.24	3.46	2.91	2.51	2.22	1.99	1.79		
PV 460	9.34	6.35	4.76	3.84	3.26	2.82	2.47	2.21	1.99	9.16	6.29	4.71	3.84	3.23	2.80	2.47	2.21	1.99		
PV 505	10.26	6.97	5.23	4.22	3.58	3.10	2.71	2.43	2.19	10.06	6.90	5.18	4.22	3.55	3.07	2.71	2.43	2.19		
PV 555	11.20	7.61	5.71	4.61	3.91	3.38	2.96	2.65	2.39	10.99	7.54	5.65	4.61	3.88	3.35	2.96	2.65	2.39		
PV 645	13.06	8.87	6.65	5.37	4.56	3.94	3.45	3.10	2.79	12.81	8.79	6.59	5.37	4.52	3.91	3.45	3.10	2.79		
PV 735	14.92	10.14	7.60	6.14	5.21	4.51	3.94	3.54	3.18	14.63	10.04	7.53	6.14	5.16	4.47	3.94	3.54	3.18		
PV 830	16.80	11.41	8.56	6.91	5.87	5.07	4.44	3.98	3.58	16.48	11.31	8.48	6.91	5.81	5.03	4.44	3.98	3.58		
PV 920	18.66	12.68	9.51	7.68	6.52	5.64	4.93	4.42	3.98	18.30	12.56	9.42	7.68	6.46	5.59	4.93	4.42	3.98		
PV 1110	22.40	15.52	11.41	9.22	7.82	6.77	5.92	5.31	4.78	21.97	15.08	11.31	9.22	7.75	6.70	5.92	5.31	4.78		

Solar type	End voltage = 1.18 V										End voltage = 1.20 V									
	2 d 48 h	3 d 72 h	4 d 96 h	5 d 120 h	6 d 144 h	7 d 168 h	8 d 192 h	9 d 216 h	10 d 240 h	2 d 48 h	3 d 72 h	4 d 96 h	5 d 120 h	6 d 144 h	7 d 168 h	8 d 192 h	9 d 216 h	10 d 240 h		
PV 45	0.89	0.62	0.47	0.38	0.32	0.28	0.24	0.22	0.20	0.82	0.57	0.43	0.36	0.31	0.27	0.24	0.21	0.19		
PV 90	1.75	1.22	0.93	0.76	0.64	0.55	0.48	0.43	0.39	1.61	1.13	0.86	0.71	0.61	0.53	0.46	0.42	0.38		
PV 105	2.06	1.43	1.09	0.89	0.75	0.65	0.57	0.51	0.46	1.90	1.33	1.01	0.83	0.72	0.62	0.55	0.49	0.44		
PV 140	2.64	1.83	1.40	1.14	0.96	0.83	0.73	0.65	0.59	2.43	1.71	1.29	1.07	0.92	0.79	0.70	0.63	0.57		
PV 185	3.53	2.45	1.87	1.52	1.28	1.11	0.97	0.87	0.78	3.24	2.28	1.73	1.43	1.22	1.06	0.94	0.84	0.76		
PV 230	4.39	3.05	2.33	1.90	1.60	1.38	1.21	1.08	0.98	4.04	2.84	2.15	1.78	1.52	1.32	1.16	1.05	0.94		
PV 275	5.28	3.66	2.80	2.28	1.92	1.66	1.45	1.30	1.17	4.85	3.41	2.59	2.13	1.83	1.58	1.40	1.26	1.13		
PV 320	6.19	4.29	3.28	2.68	2.25	1.95	1.70	1.53	1.38	5.69	4.00	3.03	2.50	2.15	1.86	1.64	1.47	1.33		
PV 370	7.03	4.88	3.73	3.04	2.56	2.21	1.94	1.74	1.56	6.46	4.55	3.45	2.84	2.44	2.11	1.86	1.67	1.51		
PV 415	7.92	5.49	4.20	3.42	2.88	2.49	2.18	1.96	1.76	7.28	5.12	3.88	3.20	2.75	2.38	2.10	1.88	1.70		
PV 460	8.81	6.11	4.67	3.81	3.20	2.77	2.42	2.17	1.96	8.10	5.69	4.31	3.56	3.05	2.64	2.34	2.10	1.89		
PV 505	9.67	6.71	5.13	4.18	3.52	3.04	2.66	2.39	2.15	8.89	6.25	4.74	3.91	3.35	2.90	2.56	2.30	2.07		
PV 555	10.56	7.32	5.60	4.57	3.84	3.32	2.91	2.61	2.35	9.71	6.83	5.17	4.27	3.66	3.17	2.80	2.51	2.26		
PV 645	12.31	8.54	6.53	5.32	4.48	3.87	3.39	3.04	2.74	11.32	7.96	6.03	4.98	4.27	3.70	3.26	2.93	2.64		
PV 735	14.07	9.76	7.46	6.08	5.12	4.42	3.87	3.47	3.13	12.93	9.09	6.89	5.68	4.88	4.22	3.73	3.35	3.01		
PV 830	15.84	10.99	8.40	6.85	5.76	4.98	4.36	3.91	3.52	14.56	10.24	7.76	6.40	5.49	4.75	4.20	3.77	3.39		
PV 920	17.59	12.20	9.33	7.61	6.40	5.53	4.84	4.34	3.91	16.17	11.37	8.62	7.11	6.10	5.28	4.66	4.19	3.77		
PV 1110	21.12	14.65	11.20	9.13	7.68	6.64	5.81	5.21	4.69	19.41	13.65	10.35	8.53	7.32	6.34	5.60	5.03	4.52		

P2.2 Edition : May 2006.

Produced by Arthur Associates.
Map design: C. Patrick Reising/Alamy,
Mark Sykes/Alamy, PhotoDisc.
Data in this document are subject to change without notice and
become contractual only after written confirmation by Alcad.

Alcad Limited

Sweden

Telephone: +46 491 68 100

Facsimile: +46 491 68 110

Alcad Sales Offices



United Kingdom

Telephone: +44 1279 772 555

Facsimile: +44 1279 420 696

Middle East

Telephone: +357 25 871 816

Facsimile: +357 25 343 542

Asia

Telephone: +65 6 7484 486

Facsimile: +65 6 7484 639

USA

Telephone: +1 203 234 8333

Facsimile: +1 203 234 8255

www.alcad.com

Delivering quality

ALCAD