

Ni-Cd batteries Installation and operating instructions

Single cell range

Including LCE P - LBE P

Important recommendations

- Never allow an exposed flame or spark near the batteries, particularly while charging.
- Never smoke while performing any operation on the battery.
- 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.

1. Receiving the shipment

Unpack the cells immediately upon arrival.

Do not overturn the package. Transport seals are located under the cover of the vent plug.

- If the cells are shipped filled and charged, the cells are ready for assembly. Remove the plastic transport seals only before use.
- If the cells are shipped empty and discharged, do not remove the plastic transport seals until ready to fill the cells.

The cells must never be charged with the transport seals in place as this can cause permanent damage.

2. Storage

Store the battery indoors in a dry, clean, cool location (0°C to +30°C / +32°F to +86°F) and well ventilated space on open shelves.

Do not store in direct sunlight or expose to excessive heat.

■ Cells filled and charged

- If cells are stored filled, they must be fully charged prior to storage.
- Cells may be stored filled and charged for a period not exceeding 12 months from date of dispatch from factory. Storage of a filled battery at temperatures above +30°C (+86°F) can result in loss of capacity. This can be as much as 5% per 10°C (18°F) above +30°C (+86°F) per year.

■ Cells empty and discharged

- Alcad recommends to store cells empty and discharged. This ensures compliance with IEC 60623 section 4.9 (storage).
- Cells can be stored like this for many years.
- When deliveries are made in cardboard boxes, store without opening the boxes.
- When deliveries are made in plywood boxes, open the boxes before the storage. The lid and the packing material on top of the cells must be removed.

3. Electrolyte/cell oil

■ Cells delivered filled and charged:

Check the level of electrolyte. It should not be more than 20 mm below the maximum level mark (upper). If this is not the case, adjust the level with distilled or deionized water. Cells delivered filled have already the cell oil in place.

In case of spillage of electrolyte during the transport, the cells have to be topped-up with E22 electrolyte. Fill the cells about 20 mm above the minimum level mark (lower) with electrolyte. Wait 4 hours and adjust if necessary before commissioning.

■ Cells delivered empty and discharged:

If the electrolyte is supplied dry, prepare it according to its separate instructions sheet. The electrolyte to be used is E22. Remove the transport seals just before filling.

Fill the cells about 20 mm above the minimum level mark (lower) with electrolyte. Wait 4 to 24 hours and adjust if necessary before commissioning.

It is recommended to add the cell oil after the commissioning charge, with the syringe, according to the quantity indicated in Tables A & B.

4. Installation

4.1. 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).

4.2. Ventilation

During the last part of charging, the battery is emitting gases (oxygen and hydrogen mixture). At normal float-charge the gas evolution is very small but some ventilation is necessary.

Note that special regulations for ventilation may be valid in your area depending on the application.

4.3. Mounting

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

Recommended torques for terminal bolts are:

- M 6 = 11 ± 1.1 N.m (97.4 ± 9.7 lbf.in)
- M 8 = 20 ± 2 N.m (177.0 ± 17.7 lbf.in)
- M 10 = 30 ± 3 N.m (265.5 ± 26.6 lbf.in)

The connectors and terminals should be corrosion-protected by coating with a thin layer of anti-corrosion oil.

Remove the transport seals and close the vent plugs.

5. Commissioning

Verify that the transport seals are removed, the vents are closed and the ventilation is adequate during this operation.

A good commissioning is important. Charge at constant current is preferable.

If the current limit is lower than indicated in Tables A & B, charge for a proportionally longer time.

■ For cells filled and charged by the factory and stored less than 6 months:

• Constant current charge:

Charge for 10 h at 0.2 C₅ A recommended (see Tables A or B).

Note: At the end of the charge, the cell voltage may reach the level of 1.85 V per 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 into two parts to be charged individually.

• Constant voltage charge:

Charge for 24 h at 1.65 V/cell, current limited to 0.2 C₅ A or charge for 48 h at 1.55 V/cell, current limited to 0.2 C₅ A (see Tables A or B).

■ For cells filled on location or for filled cells which have been stored more than 6 months:

• Constant current charge:

a) Charge for 10 h at 0.2 C₅ A recommended (see Tables A or B)

b) Discharge at 0.2 C₅ A to 1.0 V/cell

c) Charge for 10 h at 0.2 C₅ A recommended (see Tables A or B).

Note: At the end of the charge, the cell voltage may reach the level of 1.85 V per 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 into two parts to be charged individually.

• Constant voltage charge:

a) Charge for 30 h at 1.65 V/cell with current limited to 0.2 C₅ A (see Tables A or B)

b) Discharge at 0.2 C₅ A to 1.0 V/cell

c) Charge for 30 h at 1.65 V/cell with current limited to 0.2 C₅ A or charge for 48 h at 1.55 V/cell current limited to 0.2 C₅ A (see Tables A or B).

Delivering quality

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Table A: Standard range

LF Range Cell type	Charging current 0.2 C ₅ A (A)	Electrolyte per cell			Quantity of oil ml/vent	Terminal per pole	M Range Cell type	Charging current 0.2 C ₅ A (A)	Electrolyte per cell			Quantity of oil ml/vent	Terminal per pole	H Range Cell type	Charging current 0.2 C ₅ A (A)	Electrolyte per cell			Quantity of oil ml/vent	Terminal per pole
		Liquid (l)	Solid* (kg)	Height** (mm)					Liquid (l)	Solid* (kg)	Height** (mm)					Liquid (l)	Solid* (kg)	Height** (mm)		
LCE 10 P	2.0	0.77	0.25	35	15	M6	MC 9 P	1.8	0.77	0.25	35	15	M6	HC 9 P	1.8	0.73	0.24	35	15	M6
LCE 15 P	3.0	0.72	0.23	35	15	M6	MC 14 P	2.8	0.72	0.23	35	15	M6	HC 12 P	2.4	0.66	0.21	35	15	M6
LCE 22 P	4.4	0.67	0.22	35	15	M6	MC 22 P	4.4	0.62	0.20	35	15	M6	HC 17 P	3.4	0.60	0.19	35	15	M6
LCE 30 P	6.0	0.58	0.19	35	15	M6	MC 31 P	6.2	0.53	0.17	35	15	M6	HC 21 P	4.2	1.1	0.36	35	25	M6
LCE 40 P	8.0	1.1	0.36	35	25	M6	MC 39 P	7.8	1.0	0.32	35	25	M6	HC 25 P	5.0	1.1	0.36	35	25	M6
LCE 47 P	9.4	1.0	0.33	35	25	M6	MC 47 P	9.4	0.94	0.30	35	25	M6	HC 29 P	5.8	0.98	0.32	35	25	M6
LCE 62 P	12	0.90	0.29	35	25	M6	MC 55 P	11	0.84	0.27	35	25	M6	HC 34 P	6.8	0.92	0.30	35	25	M6
LCE 75 P	15	2.6	0.83	50	35	M8	MC 70 P	14	2.4	0.78	50	35	M8	HC 40 P	8.0	2.6	0.84	50	35	M8
LCE 90 P	18	2.3	0.73	50	35	M10	MC 90 P	18	2.1	0.68	50	35	M8	HC 50 P	10	2.4	0.78	50	35	M8
LCE 110 P	22	2.3	0.73	50	35	M10	MC 110 P	22	2.0	0.65	50	35	M10	HC 60 P	12	2.3	0.74	50	35	M10
LCE 145 P	29	2.0	0.63	50	35	M10	MC 130 P	26	1.8	0.58	50	35	M10	HC 70 P	14	2.1	0.68	50	35	M10
LCE 185 P	37	3.0	0.96	50	50	M10	MC 145 P	29	2.9	0.94	50	50	M10	HC 80 P	16	2.0	0.65	50	35	M10
LCE 220 P	44	2.7	0.86	50	50	M10	MC 165 P	33	2.7	0.87	50	50	M10	HC 90 P	18	3.1	1.00	50	50	M10
LCE 235 P	47	4.1	1.33	50	50	M10	MC 185 P	37	2.5	0.81	50	50	M10	HC 100 P	20	3.0	0.97	50	50	M10
LCE 280 P	56	3.6	1.18	50	50	M10	MC 215 P	43	3.7	1.20	50	50	M10	HC 110 P	22	2.8	0.91	50	50	M10
LCE 330 P	66	5.3	1.71	50	70	2 x M10	MC 240 P	48	3.4	1.09	50	50	M10	HC 120 P	24	2.7	0.87	50	50	M10
LCE 375 P	75	4.8	1.55	50	70	2 x M10	MC 285 P	57	5.1	1.64	50	70	2 x M10	HC 130 P	26	4.1	1.32	50	50	M10
LBE 415 P	83	4.3	1.39	50	45	2 x M10	MC 310 P	62	4.7	1.53	50	70	2 x M10	HC 145 P	29	3.9	1.25	50	50	M10
LBE 460 P	92	4.6	1.49	50	50	2 x M10	MC 335 P	67	4.4	1.42	50	70	2 x M10	HC 155 P	31	3.6	1.16	50	50	M10
LBE 510 P	102	5.2	1.68	50	55	2 x M10	MB 370 P	74	4.8	1.55	50	50	2 x M10	HC 185 P	37	5.3	1.70	50	70	2 x M10
LBE 550 P	110	5.8	1.88	50	60	2 x M10	MB 390 P	78	5.3	1.72	50	60	2 x M10	HC 210 P	42	4.8	1.54	50	70	2 x M10
LBE 600 P	120	6.3	2.04	50	43	3 x M10	MB 415 P	83	5.8	1.88	50	60	2 x M10	HB 230 P	46	5.6	1.81	50	50	2 x M10
LBE 650 P	130	6.6	2.14	50	47	3 x M10	MB 440 P	88	5.8	1.88	50	60	2 x M10	HB 255 P	51	5.2	1.68	50	50	2 x M10
LBE 700 P	140	6.9	2.23	50	50	3 x M10	MB 460 P	92	5.7	1.84	50	60	2 x M10	HB 280 P	56	6.6	2.14	50	60	2 x M10
LBE 750 P	150	7.5	2.43	50	53	3 x M10	MB 505 P	101	6.5	2.10	50	50	3 x M10	HB 305 P	61	6.5	2.10	50	60	2 x M10
LBE 830 P	166	8.7	2.81	50	60	3 x M10	MB 555 P	111	7.2	2.33	50	50	3 x M10	HB 345 P	69	8.4	2.72	50	50	3 x M10
LBE 925 P	185	9.2	2.98	50	50	4 x M10	MB 625 P	125	8.7	2.82	50	60	3 x M10	HB 385 P	77	7.8	2.52	50	50	3 x M10
LBE 1020 P	204	10.4	3.36	50	55	4 x M10	MB 690 P	138	8.6	2.78	50	60	3 x M10	HB 420 P	84	9.8	3.17	50	60	3 x M10
LBE 1100 P	220	11.6	3.75	50	60	4 x M10	MB 740 P	148	9.6	3.11	50	50	4 x M10	HB 460 P	92	9.7	3.14	50	60	3 x M10
LBE 1200 P	240	12.1	3.91	50	52	5 x M10	MB 830 P	166	11.7	3.79	50	60	4 x M10	HB 510 P	102	10.4	3.37	50	50	4 x M10
LBE 1300 P	260	13.3	4.30	50	56	5 x M10	MB 920 P	184	11.8	3.82	50	60	4 x M10	HB 560 P	112	13.1	4.24	50	60	4 x M10
LBE 1400 P	280	14.5	4.69	50	60	5 x M10	MB 965 P	193	11.4	3.69	50	40	6 x M10	HB 615 P	123	13.0	4.21	50	60	4 x M10
LBE 1500 P	300	15.6	5.05	50	55	6 x M10	MB 1040 P	208	14.6	4.72	50	60	5 x M10	HB 640 P	128	13.0	4.21	50	50	5 x M10
LBE 1600 P	320	16.8	5.44	50	58	6 x M10	MB 1150 P	230	14.4	4.66	50	60	5 x M10	HB 705 P	141	16.4	5.31	50	60	5 x M10
LBE 1660 P	332	17.4	5.63	50	60	6 x M10	MB 1220 P	244	17.0	5.50	50	60	6 x M10	HB 765 P	153	16.2	5.24	50	60	5 x M10
							MB 1390 P	278	17.3	5.60	50	60	6 x M10	HB 865 P	173	18.3	5.92	50	57	6 x M10
													HB 920 P	184	19.4	6.28	50	60	6 x M10	

* Value for initial filling (E22).

** Electrolyte height between Min and Max marks. The cell type shows the rated capacity in ampere hours (Ah)

Table B: not standard range

L Range Cell type	Charging current 0.2 C ₅ A (A)	Electrolyte per cell			Quantity of oil ml/vent	Terminal per pole
		Liquid (l)	Solid* (kg)	Height** (mm)		
LC 10 P	2.0	0.77	0.25	35	15	M6
LC 15 P	3.0	0.72	0.23	35	15	M6
LC 21 P	4.2	0.67	0.22	35	15	M6
LC 30 P	6.0	0.58	0.19	35	15	M6
LC 38 P	7.6	1.0	0.32	35	25	M6
LC 45 P	9.0	1.0	0.32	35	25	M6
LC 59 P	12	0.90	0.29	35	25	M6
LC 70 P	14	2.6	0.84	50	35	M8
LC 85 P	17	2.3	0.74	50	35	M10
LC 105 P	21	2.3	0.74	50	35	M10
LC 135 P	27	2.0	0.65	50	35	M10
LC 170 P	34	3.0	0.97	50	50	M10
LC 205 P	41	2.7	0.87	50	50	M10
LC 220 P	44	4.1	1.33	50	50	M10
LC 260 P	52	3.6	1.18	50	50	M10
LC 310 P	62	5.3	1.71	50	70	2 x M10
LC 355 P	71	4.8	1.55	50	70	2 x M10
LB 385 P	78	4.2	1.36	50	50	2 x M10
LB 430 P	86	4.6	1.49	50	50	2 x M10
LB 470 P	94	5.2	1.68	50	60	2 x M10
LB 510 P	102	5.8	1.88	50	60	2 x M10
LB 600 P	120	6.6	2.14	50	47	3 x M10
LB 645 P	129	6.9	2.23	50	50	3 x M10
LB 770 P	154	8.6	2.78	50	60	3 x M10
LB 860 P	172	9.2	2.98	50	50	4 x M10
LB 1020 P	204	11.5	3.72	50	60	4 x M10
LB 1070 P	214	11.5	3.72	50	50	5 x M10
LB 1280 P	256	14.4	4.66	50	60	5 x M10
LB 1450 P	290	16.4	5.31	50	57	6 x M10
LB 1540 P	308	17.3	5.60	50	60	6 x M10

* Value for initial filling (E22).

** Electrolyte height between Min and Max marks. The cell type shows the rated capacity in ampere hours (Ah)

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Cell oil & electrolyte after commissioning:

Wait for 4 hours after commissioning.

For cells delivered filled by the factory:

- Cell oil is already in place
- Check the electrolyte level and adjust it to the maximum level mark (upper) by adding distilled or deionized water.

For cells filled on location:

- Add the cell oil with the syringe, according to the quantity indicated in the Tables A or B.
- Check the electrolyte level and adjust it to the maximum level mark (upper) by adding: electrolyte.

The battery is ready for use.

For capacity test purposes, the battery has to be charged in accordance with IEC 60623 section 4.

6. Charging in service

Continuous parallel operation, with occasional battery discharge.

Recommended charging voltage (+20°C to +25°C / +68°F to +77°F):

For two level charge:

- float level = 1.42 ± 0.01 V/cell for L cells = 1.40 ± 0.01 V/cell for M cells and H cells
- high level = 1.47 - 1.70 V/cell for L cells = 1.45 - 1.70 V/cell for M cells and H cells.

A high voltage will increase the speed and efficiency of the recharging.

For single level charge:

- float level: 1.43 - 1.50 V/cell.

Buffer operation, where the load exceeds the charger rating.

Recommended charging voltage (+20°C to +25°C / +68°F to +77°F): 1.50 - 1.60 V/cell.

7. Periodic Maintenance

- 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 electrolyte level. Never let the level fall below minimum level mark (lower). Use only distilled or deionized water to top-up. Experience will tell the time interval between topping-up.

Note: Once the battery has been filled with the correct electrolyte either at the battery factory or during the battery commissioning, there is no need to check the electrolyte density periodically. Interpretation of density measurements is difficult and could be misleading.

- Check the charging voltage. If a battery is parallel connected, it is important that the recommended charging voltage remains unchanged. The charging voltage should be checked and recorded at least once yearly. If a cell float voltage is found below 1.35 V, high rate charge is recommended to apply to the cell concerned.

- Check every two years that all connectors are tight. The connectors and terminal bolts should be corrosion-protected by coating with a thin layer of anti-corrosion oil.

- High water consumption of the battery is usually caused by improper voltage setting of the charger.

8. Changing electrolyte

In most stationary battery applications, the electrolyte will retain its effectiveness for the life of the battery. However, under special battery operating conditions, if the electrolyte is found to be carbonated, the battery performance can be restored by replacing the electrolyte.

The electrolyte type to be used for replacement in these cells is: E13.

Refer to "Electrolyte Instructions".

9. Environment

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