

# Single cell range

LCE/LBE MC/MB HC/HB

## Ni-Cd Batteries

### Installation and operating instructions

## Safety precautions

- Never allow an exposed flame or spark near the batteries, 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 measurements 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

Do not overturn the package. Inspect cells for any damage and report any to the freight company immediately.

**If the cells are shipped filled and charged,** the cells are ready for assembly.

## 2. Installation

### 2.1. Location

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

### 2.2. 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.

### 2.3. Electrolyte

#### • Cells delivered filled and charged:

Check for spilling. If spilling is noticed, the spilled cells must be refilled with E22 electrolyte, only after assembly (see 2.4 Assembly), to the same level as the other cells in the string.

#### • Cells delivered empty and discharged

**Important: The commissioning charge must start within 24 hours but not before 4 hours after the electrolyte has been filled. After commissioning, the battery shall be charged permanently according to section 4.**

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. Start the commissioning charge within 24 hours but not before 4 hours.

### 2.4. Assembly

Verify that cells are correctly interconnected with the appropriate polarity. The connecting lugs to the battery terminals should be nickel plated.

Recommended torques for terminal bolts are :

- M 6 = 11 ± 1.1 N.m (97.4 ± 9.8 lbf.in)
- M 8 = 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 or NO-OX-ID\*A"

## 3. Commissioning

Verify that the vents are closed and the ventilation is adequate during this operation.

**A good commissioning is important and mandatory. Charge at constant current is preferable. Prior and during commissioning charge, record all data requested in the commissioning report available on [www.alcad.com](http://www.alcad.com)**

### 3.1. Constant current charge

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

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

Charge for 10 h at 0.2 C<sub>5</sub> A recommended (see Tables A or B).

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

- Charge for 10 h at 0.2 C<sub>5</sub> A recommended (see Tables A or B)
- Discharge at 0.2 C<sub>5</sub> A to 1.0 V/cell
- Charge for 10 h at 0.2 C<sub>5</sub> 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.

### 3.2. Constant voltage charge

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

Charge for 24 h at 1.65 V/cell, current limited to 0.2 C<sub>5</sub> A or charge for 48 h at 1.55 V/cell, current limited to 0.2 C<sub>5</sub> A (see Tables A or B).

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

- Charge for 30 h at 1.65 V/cell with current limited to 0.2 C<sub>5</sub> A (see Tables A or B)
- Discharge at 0.2 C<sub>5</sub> A to 1.0 V/cell
- Charge for 30 h at 1.65 V/cell with current limited to 0.2 C<sub>5</sub> A or charge for 48 h at 1.55 V/cell current limited to 0.2 C<sub>5</sub> A (see Tables A or B).

### 3.3. Electrolyte adjustment after commissioning

#### • For cells delivered filled by the factory:

Check the electrolyte level and adjust it to the maximum level mark (upper) by adding distilled or deionized water.

#### • For cells filled on location:

Check the electrolyte level and adjust it to the maximum level mark (upper) by adding: electrolyte. The battery is ready for use.

Note: When full battery performance is required for capacity test purposes, the battery has to be charged in accordance with IEC 60623.

## 4. Charging in service

Maintaining the recommended battery charging voltage is very important to insure long life to the battery. The battery charger must be set to the recommended charging values

### 4.1. 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 (Boost)
  - = 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 and Boost charge are not available):

1.43 - 1.50 V/cell.

### 4.2. 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.

## Reliability inside

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Table A: Standard range

LCE/LBE Range Cell type	Charging current 0.2 C 5A (A)	Electrolyte per cell		Cell connect. bolt per pole	LCE/LBE Range Cell type	Charging current 0.2 C 5A (A)	Electrolyte per cell		Cell connect. bolt per pole	LCE/LBE Range Cell type	Charging current 0.2 C 5A (A)	Electrolyte per cell		Cell connect. bolt per pole
		Liquid (l)	Solid* (kg)				Liquid (l)	Solid* (kg)				Liquid (l)	Solid* (kg)	
LCE10P	2,0	0,80	0,26	M 6	MC9P	1,8	0,80	0,26	M6	HC9P	1,8	0,70	0,23	M6
LCE15P	3,0	0,70	0,23	M 6	MC14P	2,8	0,60	0,19	M6	HC12P	2,4	0,70	0,23	M6
LCE22P	4,4	0,70	0,23	M 6	MC22P	4,4	0,60	0,19	M6	HC17P	3,4	0,60	0,19	M6
LCE30P	6,0	0,60	0,19	M 6	MC31P	6,2	0,60	0,19	M6	HC21P	4,2	1,10	0,36	M6
LCE40P	8,0	1,10	0,36	M 6	MC39P	7,8	1,10	0,36	M6	HC25P	5,0	1,10	0,36	M6
LCE47P	9,4	1,10	0,36	M 6	MC47P	9,4	1,00	0,32	M6	HC29P	5,8	1,00	0,32	M8
LCE55P	11	1,00	0,32	M 6	MC50P	10	0,90	0,29	M6	HC34P	6,8	0,90	0,29	M8
LCE62P	12	1,00	0,32	M 6	MC55P	11	0,90	0,29	M6	HC40P	8,0	2,70	0,87	M10
LCE70P	14	2,70	0,87	M 8	MC60P	12	2,60	0,84	M8	HC50P	10	2,60	0,84	M10
LCE75P	15	2,70	0,87	M 8	MC70P	14	2,60	0,84	M8	HC60P	12	2,50	0,81	M10
LCE85P	17	2,40	0,78	M 10	MC80P	16	2,50	0,81	M8	HC70P	14	2,40	0,78	M10
LCE90P	18	2,40	0,78	M 10	MC90P	18	2,50	0,81	M8	HC80P	16	2,20	0,71	M10
LCE100P	20	2,40	0,78	M 10	MC100P	20	2,30	0,75	M8	HC90P	18	3,40	1,10	M10
LCE110P	22	2,40	0,78	M 10	MC110P	22	2,30	0,75	M8	HC100P	20	3,30	1,07	M10
LCE125P	25	2,10	0,68	M 10	MC115P	23	2,10	0,68	M10	HC110P	22	3,20	1,04	2 x M10
LCE145P	29	2,10	0,68	M 10	MC130P	26	2,10	0,68	M10	HC120P	24	3,10	1,00	2 x M10
LCE150P	30	3,20	1,04	M 10	MC140P	28	3,20	1,04	M10	HC130P	26	3,90	1,26	2 x M10
LCE165P	33	3,20	1,04	M 10	MC145P	29	3,20	1,04	M10	HC145P	29	3,70	1,20	2 x M10
LCE185P	37	3,20	1,04	M 10	MC150P	30	3,20	1,04	M10	HC155P	31	3,60	1,17	2 x M10
LCE200P	40	2,90	0,94	M 10	MC165P	33	3,10	1,00	M10	HC170P	34	5,20	1,68	2 x M10
LCE220P	44	2,90	0,94	M 10	MC185P	37	2,90	0,94	M10	HC185P	37	5,00	1,62	2 x M10
LCE235P	47	3,70	1,20	M 10	MC190P	38	3,80	1,23	M10	HC210P	42	4,70	1,52	3 x M10
LCE255P	51	3,40	1,10	M 10	MC200P	40	3,60	1,17	M10	HB230P	46	5,90	1,91	2 x M10
LCE280P	56	3,40	1,10	M 10	MC215P	43	3,60	1,17	M10	HB255P	51	5,50	1,78	2 x M10
LCE300P	60	4,80	1,56	2 x M 10	MC220P	44	3,30	1,07	M10	HB270P	54	6,10	1,98	3 x M10
LCE330P	66	4,80	1,56	2 x M 10	MC240P	48	3,30	1,07	M10	HB280P	56	6,70	2,17	2 x M10
LCE360P	72	4,40	1,43	2 x M 10	MC250P	50	4,80	1,56	2 x M10	HB305P	61	6,40	2,07	3 x M10
LCE375P	75	4,40	1,43	2 x M 10	MC260P	52	4,80	1,56	2 x M10	HB325P	65	7,50	2,43	3 x M10
LBE400P	80	4,70	1,52	2 x M 10	MC285P	57	4,80	1,56	2 x M10	HB345P	69	8,80	2,85	3 x M10
LBE415P	83	4,70	1,52	2 x M 10	MC310P	62	4,60	1,49	2 x M10	HB365P	73	8,60	2,79	3 x M10
LBE460P	92	5,20	1,68	2 x M 10	MC335P	67	4,40	1,43	2 x M10	HB385P	77	8,30	2,69	3 x M10
LBE500P	100	5,60	1,81	2 x M 10	MB350P	70	4,80	1,56	2 x M10	HB400P	80	8,90	2,88	4 x M10
LBE510P	102	5,60	1,81	2 x M 10	MB370P	74	5,30	1,72	2 x M10	HB420P	84	10,1	3,27	3 x M10
LBE550P	110	6,00	1,94	2 x M 10	MB390P	78	5,90	1,91	2 x M10	HB440P	88	9,90	3,21	3 x M10
LBE600P	120	6,80	2,20	3 x M 10	MB415P	83	6,40	2,07	2 x M10	HB460P	92	9,60	3,11	3 x M10
LBE650P	130	7,30	2,37	3 x M 10	MB440P	88	6,10	1,98	2 x M10	HB510P	102	11,0	3,56	3 x M10
LBE700P	140	7,70	2,49	3 x M 10	MB460P	92	5,90	1,91	2 x M10	HB560P	112	13,4	4,34	4 x M10
LBE750P	150	8,10	2,62	3 x M 10	MB480P	96	5,90	1,91	2 x M10	HB600P	120	12,9	4,18	5 x M10
LBE800P	160	8,50	2,75	3 x M 10	MB505P	101	7,30	2,37	3 x M10	HB615P	123	12,8	4,15	4 x M10
LBE830P	166	8,90	2,88	3 x M 10	MB525P	105	7,30	2,37	3 x M10	HB640P	128	13,8	4,47	4 x M10
LBE890P	178	9,80	3,18	4 x M 10	MB555P	111	8,00	2,59	3 x M10	HB655P	131	14,4	4,67	5 x M10
LBE925P	185	10,3	3,34	4 x M 10	MB575P	115	8,00	2,59	3 x M10	HB670P	134	15,0	4,86	4 x M10
LBE980P	196	10,7	3,47	4 x M 10	MB600P	120	8,50	2,75	3 x M10	HB705P	141	16,7	5,41	4 x M10
LBE1000P	200	11,1	3,60	4 x M 10	MB625P	125	9,50	3,08	3 x M10	HB765P	153	16,0	5,18	5 x M10
LBE1020P	204	11,1	3,60	4 x M 10	MB645P	129	9,50	3,08	3 x M10	HB800P	160	17,0	5,51	5 x M10
LBE1070P	214	11,5	3,73	4 x M 10	MB670P	134	9,30	3,01	3 x M10	HB865P	173	18,2	5,90	5 x M10
LBE1100P	220	11,9	3,86	4 x M 10	MB690P	138	8,90	2,88	3 x M10	HB920P	184	19,1	6,19	5 x M10
LBE1150P	230	12,9	4,18	5 x M 10	MB720P	144	8,90	2,88	3 x M10					
LBE1200P	240	13,3	4,31	5 x M 10	MB740P	148	10,6	3,43	4 x M10					
LBE1250P	250	13,6	4,41	5 x M 10	MB765P	153	10,6	3,43	4 x M10					
LBE1300P	260	14,0	4,54	5 x M 10	MB790P	158	11,2	3,63	4 x M10					
LBE1350P	270	14,4	4,67	5 x M 10	MB830P	166	12,7	4,11	4 x M10					
LBE1400P	280	14,8	4,80	5 x M 10	MB865P	173	12,7	4,11	4 x M10					
LBE1450P	290	15,8	5,12	6 x M 10	MB890P	178	12,5	4,05	4 x M10					
LBE1500P	300	16,6	5,38	6 x M 10	MB920P	184	11,8	3,82	4 x M10					
LBE1550P	310	17,0	5,51	6 x M 10	MB940P	188	12,0	3,89	4 x M10					
LBE1600P	320	17,4	5,64	6 x M 10	MB965P	193	12,5	4,05	6 x M10					
LBE1660P	332	17,8	5,77	6 x M 10	MB1000P	200	14,3	4,63	5 x M10					
LBE1690P	338	17,8	5,77	6 x M 10	MB1040P	208	15,9	5,15	5 x M10					
					MB1080P	216	15,9	5,15	5 x M10					
					MB1100P	220	15,6	5,05	5 x M10					
					MB1150P	230	14,7	4,76	5 x M10					
					MB1180P	236	15,0	4,86	5 x M10					
					MB1220P	244	18,5	5,99	6 x M10					
					MB1270P	254	18,5	5,99	6 x M10					
					MB1320P	264	18,8	6,09	6 x M10					
					MB1390P	278	17,7	5,73	6 x M10					
					MB1440P	288	17,7	5,73	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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 Data in this document are subject to change without notice and become contractual only after written confirmation by Alcad.

Table B: Not standard range

LCE/LBE Range Cell type	Charging current 0.2 C 5A (A)	Electrolyte per cell		Cell connect. bolt per pole	LCE/LBE Range Cell type	Charging current 0.2 C 5A (A)	Electrolyte per cell		Cell connect. bolt per pole	LCE/LBE Range Cell type	Charging current 0.2 C 5A (A)	Electrolyte per cell		Cell connect. bolt per pole	Terminal per pole		
		Liquid (l)	Solid* (kg)				Liquid (l)	Solid* (kg)				Height** (mm)					
LC 10 P	2,0	0,77	0,25	35	M6	LC 15 P	3,0	0,72	0,23	35	M6	LC 21 P	4,2	0,67	0,22	35	M6
LC 30 P	6,0	0,58	0,19	35	M6	LC 38 P	7,6	1,0	0,32	35	M6	LC 45 P	9,0	1,0	0,32	35	M6
LC 59 P	12	0,90	0,29	35	M6	LC 70 P	14	2,6	0,84	50	M8	LC 85 P	17	2,3	0,74	50	M10
LC 105 P	21	2,3	0,74	50	M10	LC 135 P	27	2,0	0,65	50	M10	LC 170 P	34	3,0	0,97	50	M10
LC 205 P	41	2,7	0,87	50	M10	LC 220 P	44	4,1	1,33	50	M10	LC 260 P	52	3,6	1,18	50	M10
LC 310 P	62	5,3	1,71	50	2 x M10	LC 355 P	71	4,8	1,55	50	2 x M10	LC 385 P	78	4,2	1,36	50	2 x M10
LB 385 P	86	4,6	1,49	50	2 x M10	LB 430 P	94	5,2	1,68	50	2 x M10	LB 470 P	94	5,2	1,68	50	2 x M10
LB 510 P	102	5,8	1,88	50	2 x M10	LB 600 P	120	6,6	2,14	50	3 x M10	LB 645 P	129	6,9	2,23	50	3 x M10
LB 770 P	154	8,6	2,78	50	3 x M10	LB 860 P	172	9,2	2,98	50	4 x M10	LB 1020 P	204	11,5	3,72	50	4 x M10
LB 1070 P	214	11,5	3,72	50	5 x M10	LB 1280 P	256	14,4	4,66	50	5 x M10	LB 1450 P	290	16,4	5,31	50	6 x M10
LB 1540 P	308	17,3	5,60	50	6 x M10												

\* Value for initial filling (E22).

### 5. Preventive 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 charging voltage. 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 visually the electrolyte level. Never let the level fall below the 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 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 or NO-OX-IDA\*

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

**Note that all these maintenance recommendations followed the IEEE 1106 standard 'Recommended Practice for Installation, Maintenance, Testing and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications'.**

### 6. 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".

### 7. 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. 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 permanent change and loss of product performance, depending on the duration of the storage above the maximum recommended temperature.

#### ● Cells empty and discharged