S4.5-E
May 2025

Single cell range

LCE/LBE MC/MB HC/HB

Ni-Cd Batteries

Installation and operating instructions

Safety precautions

- **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.**
- **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.**
- **Ventilation, in accordance with the IEC 62485-2 standard, is mandatory during commissioning and operation.**

1. Receiving the shipment

Do not overturn the package. Upon receipt of the goods, any transportation damage, electrolyte spillage or irregularities must be reported to the carrier and to Alcad. If the cells are shipped filled and charged the cells are ready for assembly.

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).

To ensure maximum protection of the cells always store the product in its original packaging. Do not store in direct sunlight or expose to excessive heat.

- **Cells filled by the factory**
  - Cells may be stored filled for a period not exceeding 12 months from date of manufactory. 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**
  - Alcad recommends to store cells empty and discharged. Storage of a 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 can be stored like this for many years.

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 and that the connectors are correctly torqued with the appropriate polarity.
Connections between the battery and the load shall be made with nickel plated cable lugs.Tightening torque for the terminals must be:

- 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, grease (NO-OX) or approved equal.

3.3. Ventilation

During operation the battery emits an amount of gas mixture (oxygen and hydrogen).
Ventilation inside the battery room must be adequately managed, comply with IEC 62485-2 and local regulations.

3.4. Electrolyte

- **Cells delivered filled by the factory:**

If electrolyte is ever spilled from a cell and the level is 30 mm below the minimum (lower) level mark, then refilling with E22 electrolyte is required. Contact your local Alcad 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 between approximately 5 mm below maximum (upper) level mark.

- 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.

If the electrolyte is supplied dry, prepare it according to its separate electrolyte instructions sheet.
The electrolyte to be used is E22.
Fill the cells about 20 mm above the minimum (lower) level mark with electrolyte. Then add 25 ml of the cell oil to each vent hole. Start the commissioning charge within 24 hours but not before 4 hours.

4. Commissioning

Verify that the vents are closed and ventilation, in accordance with the IEC 62485-2 standard, is provided during this operation.

A good commissioning is important and mandatory. Charge at constant current is preferable. 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 www.alcad.com

4.1. 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 up to 6 months:**
  Charge for 10 h at 0.2 C_5 A (seeTables A or B).

- **For cells filled on location or filled and deep discharged or filled and charger or which have been stored more than 6 months:**
  - Charge for 10 h at 0.2 C_5 A (see Tables A or B)
  - Discharge at 0.2 C_5 A to 1.0 V/cell
  - Charge for 10 h at 0.2 C_5 A (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.

4.2. Constant voltage charge

- **For cells filled and charged by the factory and stored up to 6 months:**
  Charge for 24 h at 1.65 V/cell, current limited to 0.2 C_5 A or charge for 48 h at 1.55 V/cell, current limited to 0.2 C_5 A (see Tables A or B).

- **For cells filled on location or filled and deep discharged or filled and charger or which have been stored more than 6 months:**
  - Charge for 30 h at 1.65 V/cell with current limited to 0.2 C_5 A (see Tables A or B)
  - Discharge at 0.2 C_5 A to 1.0 V/cell
  - Charge for 30 h at 1.65 V/cell with current limited to 0.2 C_5 A or charge for 48 h at 1.55 V/cell current limited to 0.2 C_5 A (see Tables A or B).

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 battery container temperature drops below +40°C (+104°F).

4.3. Electrolyte adjustment after commissioning

After commissioning, when the level is stabilized, the electrolyte level should be between approximately 5 mm below maximum (upper) level mark.

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

Reliability inside

ALCAD

Cell Type	Capacity	Charging Current	Approx. electrolyte per cell		Cell connection bolt per pole
	C5 Ah	0.2 C5 (A)	Solid kg	Liquid lb	
LCE 10P	10	2,0	0,24	0,77	M6
LCE 15P	15	3,0	0,23	0,72	M6
LCE 22P	22	4,4	0,21	0,67	M6
LCE 30P	30	6,0	0,19	0,58	M6
LCE 34P	34	6,8	0,39	1,2	M6
LCE 40P	40	8,0	0,34	1,1	M6
LCE 47P	47	9,4	0,33	1,03	M6
LCE 55P	55	11,0	0,3	1	M6
LCE 62P	62	12,4	0,3	0,9	M6
LCE 70P	70	14,0	0,86	2,7	M8
LCE 75P	75	15,0	0,86	2,58	M8
LCE 85P	85	17,0	0,78	2,4	M10
LCE 90P	90	18,0	0,78	2,27	M10
LCE 100P	100	20,0	0,78	2,1	M10
LCE 110P	110	22,0	0,78	2,27	M10
LCE 125P	125	25,0	0,7	3,2	M10
LCE 145P	145	29,0	0,7	1,96	M10
LCE 149P	149	29,8	0,68	2,1	M10
LCE 150P	150	30,0	0,7	3	M10
LCE 165P	165	33,0	1,03	3,2	M10
LCE 176P	176	35,2	1,04	3,2	M10
LCE 185P	185	37,0	1,03	2,98	M10
LCE 200P	200	40,0	0,96	2,9	M10
LCE 220P	220	44,0	0,96	2,67	M10
LCE 235P	235	47,0	1,22	4,12	M10
LCE 255P	255	51,0	1,11	3,4	M10
LCE 280P	280	56,0	1,11	3,64	M10
LCE 285P	285	57,0	1,11	3,4	M10
LCE 300P	300	60,0	1,59	4,8	2xM10
LCE 330P	330	66,0	1,59	5,28	2xM10
LCE 334P	334	66,8	1,56	4,8	2xM10
LCE 344P	344	68,8	1,43	4,4	2xM10
LCE 360P	360	72,0	1,48	4,4	2xM10
LCE 375P	375	75,0	1,48	4,8	2xM10
LBE 400P	400	80,0	1,57	4,7	2xM10
LBE 415P	415	83,0	1,57	4,3	2xM10
LBE 425P	425	85,0	1,53	4,7	2xM10
LBE 440P	440	88,0	1,73	5,2	2xM10
LBE 460P	460	92,0	1,73	4,6	2xM10
LBE 470P	470	94,0	1,69	5,2	2xM10
LBE 480P	480	96,0	1,86	5,6	2xM10
LBE 500P	500	100,0	1,86	5,6	2xM10
LBE 510P	510	102,0	1,86	5,2	2xM10
LBE 550P	550	110,0	1,99	5,8	2xM10
LBE 570P	570	114,0	1,95	6	2xM10
LBE 600P	600	120,0	2,28	6,3	3xM10
LBE 620P	620	124,0	2,21	6,8	3xM10
LBE 650P	650	130,0	2,44	6,6	3xM10
LBE 700P	700	140,0	2,59	6,9	3xM10
LBE 750P	750	150,0	2,72	7,5	3xM10
LBE 762P	762	152,4	2,72	8,1	3xM10
LBE 800P	800	160,0	2,85	8,5	3xM10
LBE 830P	830	166,0	2,99	8,7	3xM10
LBE 855P	855	171,0	2,89	8,9	3xM10
LBE 890P	890	178,0	3,3	9,8	4xM10
LBE 905P	905	181,0	3,18	9,8	4xM10
LBE 925P	925	185,0	3,45	9,2	4xM10
LBE 980P	980	196,0	3,58	10,7	4xM10
LBE 1000P	1000	200,0	3,72	11,1	4xM10
LBE 1020P	1020	204,0	3,72	10,4	4xM10
LBE 1070P	1070	214,0	3,85	11,5	4xM10
LBE 1100P	1100	220,0	3,98	11,6	4xM10
LBE 1125P	1125	225,0	3,87	11,9	4xM10
LBE 1150P	1150	230,0	4,31	12,9	5xM10
LBE 1200P	1200	240,0	4,45	12,1	5xM10
LBE 1250P	1250	250,0	4,58	13,6	5xM10
LBE 1300P	1300	260,0	4,69	13,6	5xM10
LBE 1350P	1350	270,0	4,84	14,4	5xM10
LBE 1400P	1400	280,0	4,98	14,5	5xM10
LBE 1450P	1450	290,0	5,31	15,8	6xM10
LBE 1500P	1500	300,0	5,58	15,6	6xM10
LBE 1550P	1550	310,0	5,71	17	6xM10
LBE 1600P	1600	320,0	5,84	16,8	6xM10
LBE 1660P	1660	332,0	5,97	17,4	6xM10
LBE 1690P	1690	338,0	5,97	17,8	6xM10
LBE 1710P	1710	342,0	5,78	17,8	6xM10

Cell Type	Capacity	Charging Current	Approx. electrolyte per cell		Cell connection bolt per pole
	C5 Ah	0.2 C5 (A)	Solid kg	Liquid lb	
MC 9P	9	1,8	0,24	0,77	M6
MC 14P	14	2,8	0,23	0,72	M6
MC 22P	22	4,4	0,2	0,62	M6
MC 31P	31	6,2	0,18	0,53	M6
MC 39P	39	7,8	0,34	1,03	M6
MC 47P	47	9,4	0,32	0,94	M6
MC 50P	50	10,0	0,29	0,9	M6
MC 55P	55	11,0	0,29	0,84	M6
MC 60P	60	12,0	0,86	2,6	M8
MC 70P	70	14,0	0,85	2,44	M8
MC 80P	80	16,0	0,8	2,5	M8
MC 90P	90	18,0	0,8	2,14	M8
MC 100P	100	20,0	0,75	2,3	M10
MC 110P	110	22,0	0,75	2,01	M10
MC 115P	115	23,0	0,7	2,1	M10
MC 130P	130	26,0	0,7	1,79	M10
MC 140P	140	28,0	1,08	3,2	M10
MC 145P	145	29,0	1,08	2,9	M10
MC 150P	150	30,0	1,08	3,2	M10
MC 165P	165	33,0	1,02	2,67	M10
MC 170P	170	34,0	1,02	3,1	M10
MC 185P	185	37,0	0,97	2,45	M10
MC 190P	190	38,0	1,26	3,8	M10
MC 200P	200	40,0	1,2	3,6	M10
MC 215P	215	43,0	1,2	3,72	M10
MC 220P	220	44,0	1,13	3,3	M10
MC 240P	240	48,0	1,13	3,38	M10
MC 250P	250	50,0	1,62	4,8	2xM10
MC 260P	260	52,0	1,62	4,8	2xM10
MC 277P	277	55,4	1,62	4,8	2xM10
MC 285P	285	57,0	1,62	5,08	2xM10
MC 300P	300	60,0	1,53	4,7	2xM10
MC 310P	310	62,0	1,55	4,74	2xM10
MC 323P	323	64,6	1,46	4,5	2xM10
MC 335P	335	67,0	1,49	4,4	2xM10
MB 350P	350	70,0	1,62	4,8	2xM10
MB 360P	360	72,0	1,73	5	2xM10
MB 370P	370	74,0	1,81	4,8	2xM10
MB 382P	382	76,4	1,72	5,3	2xM10
MB 390P	390	78,0	1,99	5,3	2xM10
MB 404P	404	80,8	1,92	5,9	2xM10
MB 415P	415	83,0	2,16	5,8	2xM10
MB 430P	430	86,0	2,31	6,4	3xM10
MB 440P	440	88,0	2,09	5,8	2xM10
MB 450P	450	90,0	1,98	6,1	2xM10
MB 460P	460	92,0	2,03	5,7	2xM10
MB 480P	480	96,0	2,03	5,9	2xM10
MB 505P	505	101,0	2,47	6,5	3xM10
MB 525P	525	105,0	2,47	7,3	3xM10
MB 540P	540	108,0	2,59	7,5	3xM10
MB 555P	555	111,0	2,72	7,2	3xM10
MB 575P	575	115,0	2,72	8	3xM10
MB 575P	575	115,0	2,72	8,6	4xM10
MB 600P	600	120,0	2,89	8,5	3xM10
MB 625P	625	125,0	3,24	8,7	3xM10
MB 645P	645	129,0	3,24	9,5	3xM10
MB 670P	670	134,0	3,18	9,3	3xM10
MB 690P	690	138,0	3,04	8,6	3xM10
MB 703P	703	140,6	2,96	9,1	3xM10
MB 720P	720	144,0	3,04	8,9	3xM10
MB 720P	720	144,0	3,04	10	4xM10
MB 740P	740	148,0	3,63	9,6	4xM10
MB 765P	765	153,0	3,63	10,6	4xM10
MB 790P	790	158,0	3,8	11,2	4xM10
MB 808P	808	161,6	3,8	11,7	4xM10
MB 830P	830	166,0	4,32	11,7	4xM10
MB 849P	849	169,8	4,03	12,4	4xM10
MB 865P	865	173,0	4,32	12,7	4xM10
MB 890P	890	178,0	4,26	12,5	4xM10
MB 900P	900	180,0	4,06	12,5	5xM10
MB 920P	920	184,0	4,06	11,8	4xM10
MB 940P	940	188,0	4,12	12	4xM10
MB 965P	965	193,0	4,28	11,4	6xM10
MB 1000P	1000	200,0	4,88	14,3	5xM10
MB 1040P	1040	208,0	5,4	14,6	5xM10
MB 1080P	1080	216,0	5,4	16,7	5xM10
MB 1100P	1100	220,0	5,34	15,6	5xM10
MB 1150P	1150	230,0	5,07	15,7	5xM10
MB 1180P	1180	236,0	5,14	15	5xM10
MB 1220P	1220	244,0	6,31	16,9	6xM10
MB 1250P	1250	250,0	5,85	18	6xM10
MB 1270P	1270	254,0	6,31	18,5	6xM10
MB 1320P	1320	264,0	6,42	18,8	6xM10
MB 1390P	1390	278,0	6,09	17,4	6xM10
MB 1440P	1440	288,0	6,09	17,7	6xM10
MB 1465P	1465	293,0	6,09	17,7	6xM10

Cell Type	Capacity	Charging Current	Approx. electrolyte per cell		Cell connection bolt per pole
	C5 Ah	0.2 C5 (A)	Solid kg	Liquid lb	
HC 9P	9	1,8	0,23	0,73	M6
HC 12P	12	2,4	0,21	0,66	M6
HC 17P	17	3,4	0,19	0,6	M6
HC 21P	21	4,2	0,35	1,11	M6
HC 25P	25	5,0	0,33	1,05	M6
HC 29P	29	5,8	0,31	0,98	M6
HC 34P	34	6,8	0,29	0,92	M6
HC 40P	40	8,0	0,87	2,58	M8
HC 50P	50	10,0	0,83	2,42	M8
HC 60P	60	12,0	0,84	2,26	M10
HC 70P	70	14,0	0,75	2,1	M10
HC 80P	80	16,0	0,71	1,95	M10
HC 90P	90	18,0	1,1	3,12	M10
HC 100P	100	20,0	1,06	2,96	M10
HC 110P	110	22,0	1,02	2,8	M10
HC 120P	120	24,0	0,98	2,65	M10
HC 130P	130	26,0	1,25	4,09	M10
HC 145P	145	29,0	1,2	3,85	M10
HC 155P	155	31,0	1,15	3,6	M10
HC 170P	170	34,0	1,68	5,2	2xM10
HC 185P	185	37,0	1,63	5,26	2xM10
HC 190P	190	38,0	1,56	4,8	2xM10
HB 195P	195	39,0	1,52	4,4	2xM10
HB 205P	205	41,0	1,47	4,6	2xM10
HC 210P	210	42,0	1,53	4,76	2xM10
HB 218P	218	43,6	1,75	5,4	2xM10
HB 230P	230	46,0	1,89	5,6	2xM10
HB 235P	235	47,0	1,76	5,7	2xM10
HB 244P	244	48,8	1,88	5,8	2xM10
HB 255P	255	51,0	1,79	5,2	2xM10
HB 265P	265	53,0	2,4	6,8	3xM10
HB 270P	270	54,0	1,98	6,1	2xM10
HB 280P	280	56,0	2,17	6,6	2xM10
HB 293P	293	58,6	2,14	6,6	2xM10
HB 295P	295	59,0	2,28	6,5	3xM10
HB 305P	305	61,0	2,07	6,5	2xM10
HB 325P	325	65,0	2,42	7,5	3xM10
HB 334P	334	66,8	2,66	8,2	3xM10
HB 345P	345	69,0	2,84	8,4	3xM10
HB 355P	355	71,0	2,63	8,6	3xM10
HB 365P	365	73,0	2,79	8,6	3xM10
HB 375P	375	75,0	2,76	8,5	3xM10
HB 385P	385	77,0	2,69	7,8	3xM10
HB 395P	395	79,0	3,03	8,7	4xM10
HB 400P	400	80,0	2,88	8,9	3xM10
HB 410P	410	82,0	3,09	9,5	3xM10
HB 420P	420	84,0	3,26	9,8	3xM10
HB 440P	440	88,0	3,21	9,9	3xM10
HB 450P	450	90,0	3,18	9,8	3xM10
HB 460P	460	92,0	3,11	9,7	3xM10
HB 470P	470	94,0	3,51	11,4	4xM10
HB 473P	473	94,6	3,83	11,8	4xM10
HB 484P	484	96,8	3,77	11,6	4xM10
HB 490P	490	98,0	3,79	10,9	5xM10
HB 510P	510	102,0	3,58	10,4	4xM10
HB 523P	523	104,6	3,8	11,7	4xM10
HB 537P	537	107,4	4	12,3	4xM10
HB 560P	560	112,0	4,34	13,1	4xM10
HB 576P	576	115,2	4,32	13,3	4xM10
HB 589P	589	117,8	4,29	13,2	4xM10
HB 590P	590	118,0	4,39	14,3	5xM10
HB 600P	600	120,0	4,19	12,9	4xM10
HB 615P	615	123,0	4,15	13	4xM10
HB 630P	630	126,0	4,55	14	5xM10
HB 640P	640	128,0	4,48	13	5xM10
HB 655P	655	131,0	4,67	14,4	5xM10
HB 670P	670	134,0	4,86	15	5xM10
HB 680P	680	136,0	5,07	15,6	5xM10
HB 690P	690	138,0	5,3	16,3	5xM10
HB 705P	705	141,0	5,43	16,4	5xM10
HB 725P	725	145,0	5,36	16,5	5xM10
HB 753P	753	150,6	5,33	16,4	5xM10
HB 765P	765	153,0	5,18	16,2	5xM10
HB 785P	785	157,0	5,59	17,2	6xM10
HB 800P	800	160,0	5,52	17	6xM10
HB 825P	825	165,0	6,08	18,7	6xM10
HB 840P	840	168,0	6,27	19,3	6xM10
HB 865P	865	173,0	5,92	18,1	6xM10
HB 890P	890	178,0	6,34	19,5	6xM10
HB 910P	910	182,0	6,27	19,3	6xM10
HB 920P	920	184,0	6,22	19,2	6xM10

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Data in this document are subject to change without notice and become contractual only after written confirmation by Alcad.

5. 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

5.1. Continuous parallel operation, with occasional battery discharge

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

Single level charge: 1.43 - 1.50 V/cell.

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 rate (boost) 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.

5.2. 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.

6. Preventive maintenance

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 caps can be rinsed in clean water if necessary.
- Check the charging voltage. It is important that the recommended charging voltage remains unchanged. The charger should be checked and recorded at least once yearly. If a cell float is found below 1.35 V, high rate charge is recommended to apply to the cell concerned.
- 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 and adjust as required.
- Visually check the electrolyre level. Never let the level fall below the minimum level mark. Use only distilled or deionized water to top-up. Topping up of the battery **shall be carried out when battery is fully charged.** Experience will tell the time interval between topping-up.

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'.

- Ensure all terminals and connectors are coated with a thin layer of anti-corrosion oil, anti-corrosion grease (NO-OX) or approved equal.

6.1. 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. Environment

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

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