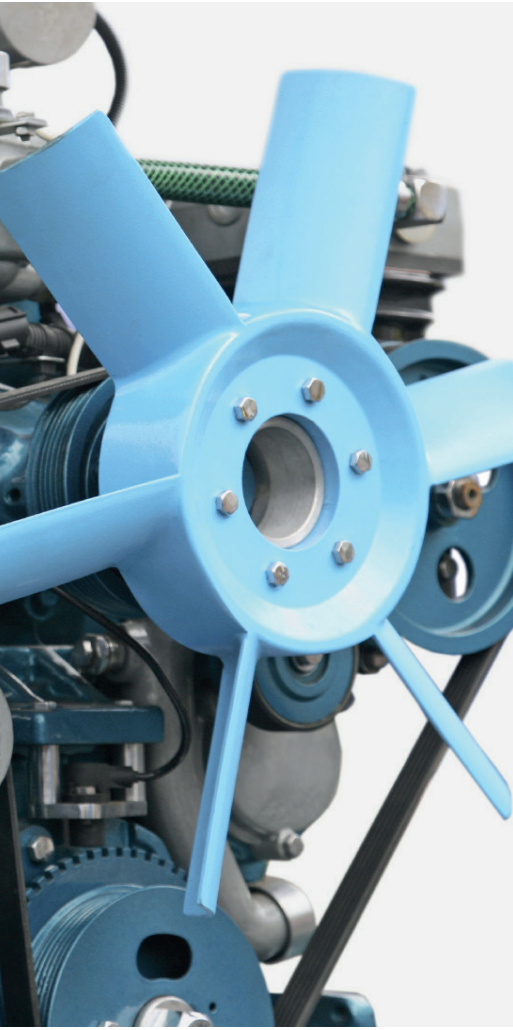


# Nickel Cadmium Batteries

**BLOCK TYPE**



**NICA**



# POWER BACK-UP WITH NICA

## **NICA your long term partner for power back-up challenges**

Nica has been a trusted battery for the world's leading industrial players for over 100 years, with a range of well proven solutions that deliver secure energy for stationary applications.

Nica's products are designed to meet the reliability, safety and security challenges of today's industrial landscape where they provide power back-up, starting power and bulk energy storage. Nica's commitment to Research and Development and innovative engineering ensures that our nickel-cadmium (Ni-Cd) batteries offer the very latest in design, quality and industrial process technology. They also come with comprehensive through-life global service support, from initial consultancy to volume delivery, including training, maintenance and expert technical back-up.

## **Reliable and robust batteries for a wide range of industrial applications**

Stationary batteries are used in

- refineries,
- power plants,
- onshore & offshore oil and gas industries,
- substations,
- airports & building infrastructure

Locations where it is absolutely critical to have batteries that will work when they should, even under extreme operating conditions.

Power is absolutely vital to Uninterruptible Power Supply (UPS) systems, switching and transmission functions, emergency and security systems, industrial fire monitors and alarms, process control installations, substation switchgear, signaling systems and more.

If the primary power source for these applications is suddenly unavailable, a back-up system provides a temporary source of power until primary power re-engages or while systems operators perform a controlled shutdown. However, back-up power is only as good as the stationary battery that enables it!

# NICA LE/M/H Block battery range

## Built with the highest quality, safety and environmental standards

### Electrical characteristics:

- Certified IEC 60623 - Secondary cells and batteries containing alkaline or other non-acid electrolytes - vented nickel-cadmium prismatic rechargeable single cells.

### Safety:

- Complies with EN 50272-2/ IEC 62485-2 - Safety requirements for secondary batteries and battery installations - Part 2: Stationary batteries - The protective covers for terminals and connectors, the insulated cables are compliant with IP2 level protection against electrical shocks according to safety standard.
- Complies with UL 1989 - Section 7 : Flame arrester vent cap tests - UL standard for safety for standby batteries.

### Quality:

- ISO 9001 and ISO 14001
- Nica world class continuous programme

### Environment & recycling

- Fully recyclable
- RoHS - Although batteries and accumulators are not within the scope of the RoHS directive, Nica has taken voluntary measures to make sure that the substances forbidden by RoHS are not present in the battery, with the exception of the electro- chemical core.
- REACH - Nica has adopted internal procedures to ensure conformity with the European REACH (Registration, Evaluation, Authorization and Restriction of Chemical Substances) Regulations.

## Instant starting power

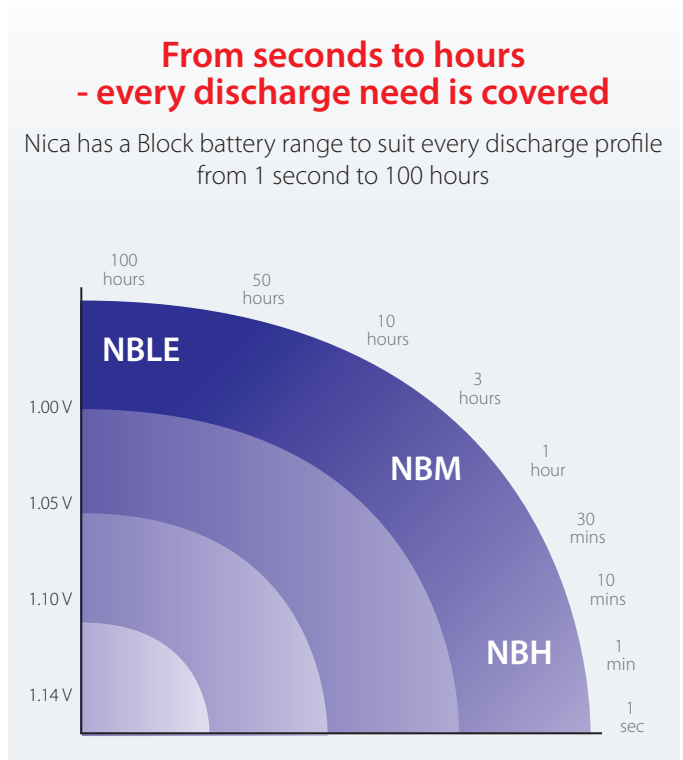
Cranking up an emergency generator or switching on heaters, pumps or other equipment requires batteries that are very reliable, offer high discharge capabilities and function properly in extreme temperatures. Nica batteries recover their voltage instantaneously, making them the ideal choice for starting applications.

	LE Type	M Type	H Type
Capacity steps	58	68	51
Capacity	7.5 - 1690 Ah	11 - 1445 Ah	8.3 - 920 Ah
Performance	For low rate discharge over long periods between 1 and 100 hours	For varied loads with low and high discharge rates between 30 minutes and 3 hours	For high rate discharge over short periods less than 30 minutes
Applications	Power back-up applications		Power back-up and starting applications

## A wide choice of capacity and performance

Nica has developed the NBLE, NBM and MBH ranges of block batteries to offer the optimum, flexible solution for all stationary applications. The choice of low, medium and high capacity types makes it easy to select the ideal battery, based on required discharge time and end of discharge voltage. Thanks to the robust and reliable Nica pocket plate technology they resist electrical abuse, shock and vibrations.

Furthermore, a generous reserves for electrolyte means that the block batteries need only basic maintenance, while operating across a wide range of fluctuating temperatures. This ensures an optimized Total Cost of Ownership (TCO) over a life cycle that can last 20 years or more.





## NICA Ni-Cd Technology

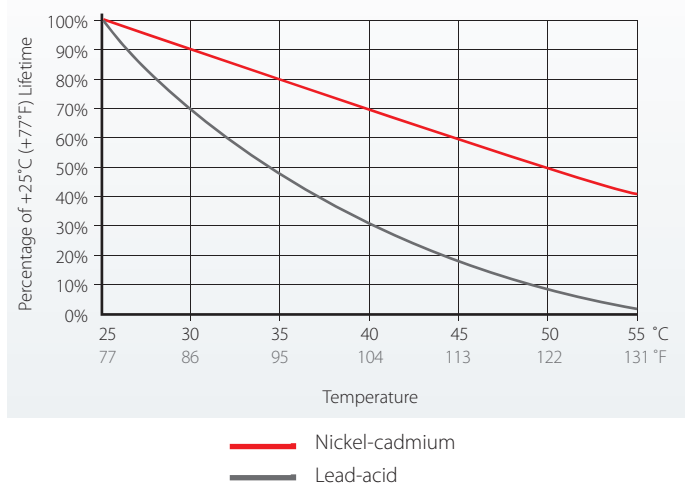
the proven advantages of a safe and robust design

### Ni-Cd means proven reliability

Nica's robust Ni-Cd technology sets the benchmark for industrial batteries operating in difficult and demanding conditions.

- Delivers performance, reliability, and a long, totally predictable, service life - with no risk of sudden death failure.
- Ensures a 20-year plus service life at +25°C (+77°F).
- Even at +35°C (+95°F), lifetime falls by just 20% compared with a 50% reduction for a lead-acid battery.

Effect of temperature on lifetime



# NICA Block battery construction

## The ideal battery for every application

- Performance optimized for each application according to plate thickness.
  - : **LE type**
    - Thicker plates
    - High energy
    - Low cost per Amp at low rates.
  - : **M type**
    - Thinner plates
    - Medium power
    - Optimized between H and L design for mixed loads
  - : **H type**
    - Thinnest plate
    - High power
    - Low cost per Amp at high rates
- Optimized design boost electrical performance by up to 10% depending on discharge time.
- Twice the number of capacity steps compared with previous designs enables accurate matching with calculated amp-hour requirements.

Improved performance and more capacity steps allow you to select the best, cost-effective battery for your application.

### 1. Protective cover

In line with IEC 60485-2 / EN 50272-2 (safety) with IP2 level.

### 2. Flame-arresting vents

Compliant with UL 1989 - Section 7 - Flame arrester vent cap tests.

### 3. Plate group bus

### 4. Plate tab

### 5. Plate frame

### 6. Separating grids

### 7. Cell container

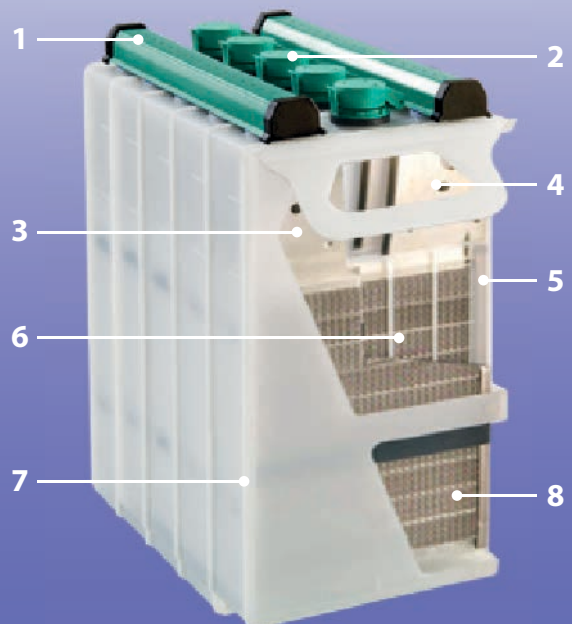
### 8. Nica pocket plate technology

**Note :** The cells are welded together to form rugged blocks of 1-6 cells depending on the cell size and type. Nica cells fully comply with the requirements of the IEC 60623 standard.

## The essential features

- The steel pocket plate structure does not suffer from “sudden death” or internal corrosion since there is no interaction between the active material and electrolyte.
- Tough polypropylene casing ensures structural integrity throughout a long life.
- An engineered electrolyte solution delivers optimum performance without causing degradation of plate materials.
- Plenty of space is allowed for a good reserve of electrolyte.
- A special electrolyte is available for extremely low temperature applications.
- A specially designed flame arresting flip top vent ensures the battery does not produce corrosive emissions.
- The Black battery offers a long shelf life when stored under Nica’s recommended conditions and it is easy to install.

### NICA Block battery Design for durability and reliability



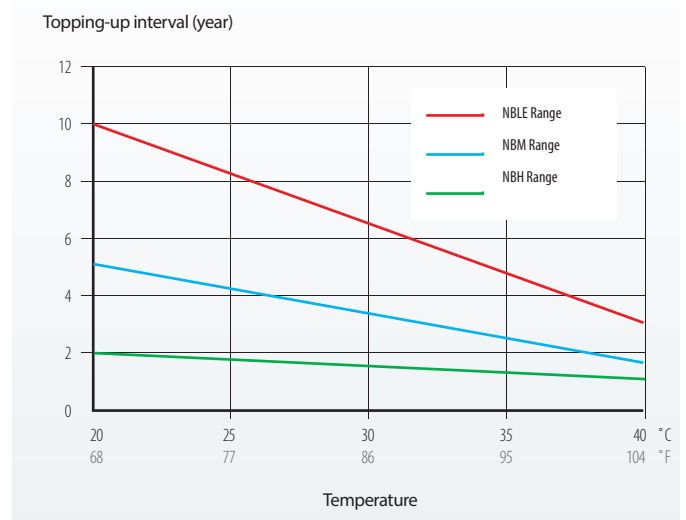


## NICA the benchmark for industrial batteries

### Low maintenance means lower lifetime costs

- Topping-up intervals are now up to two times longer under standard conditions at +20°C (+68°F) and at float voltage.
- A simple annual maintenance exercise is recommended to check correct functioning of the charging system, battery and the auxilliary electronics.
- Easy maintenance thanks to :
  - Visible electrolyte level
  - Simple bolted connector for fast installation and allowing the battery to be quickly commissioned

### Typical topping up intervals at recommended charge voltage



# Higher chargeability minimizes down time

Faster recharge time enables at least 80% recovery of capacity from fully discharged conditions in 15 hours at float voltage level.

Constant voltage charging (+20°C to +25°C or +68°F to +77°F)

Continuous parallel operation, with occasional battery discharge. Recommended charging voltages:

**a) For two levels charge:**

- Float level :  
1.42 ± 0.01 V/cell for NBLE  
1.40 ± 0.01 V/cell for NBM and NBH
- High level :  
1.47 - 1.70 V/cell for NBLE  
1.45 - 1.70 V/cell for NBM and NBH  
A high voltage will increase the speed and efficiency of the recharging.

**b) For single level charge :**

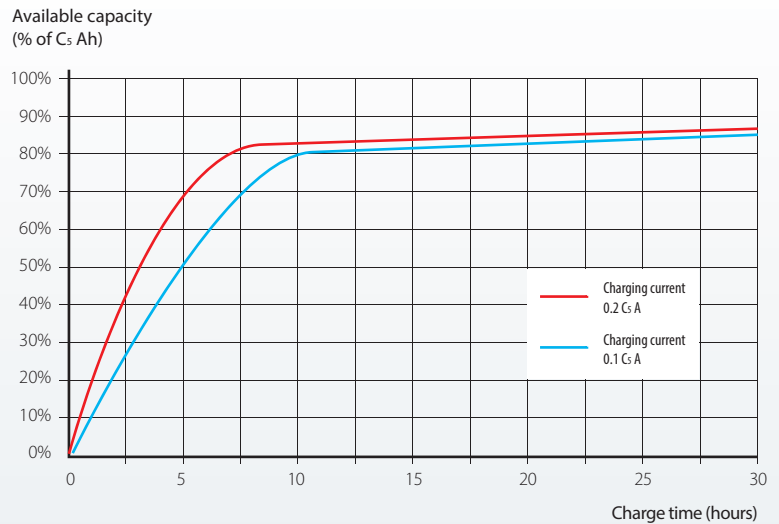
- 1.43 - 1.50 V/cell

Buffer operation, where the load exceeds the charger rating. Recommended charging voltage: 1.50 - 1.60 V/cell.

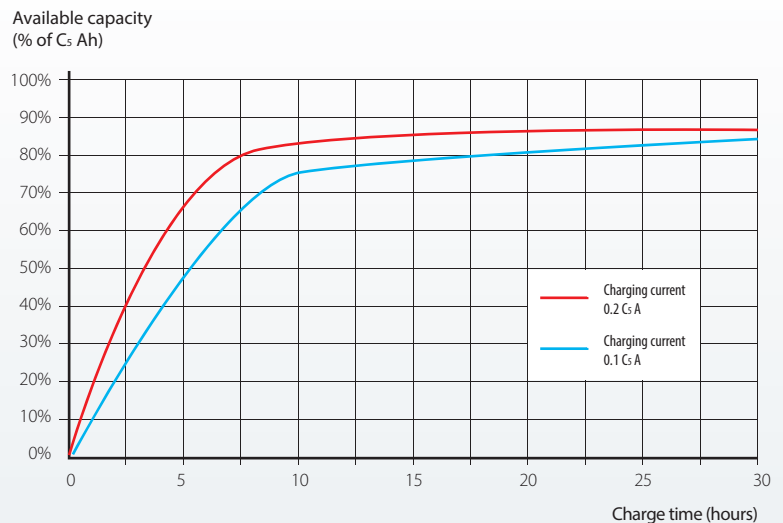
**Constant current charging**

- Normal charging: 0.2 CsA for 10 hrs.

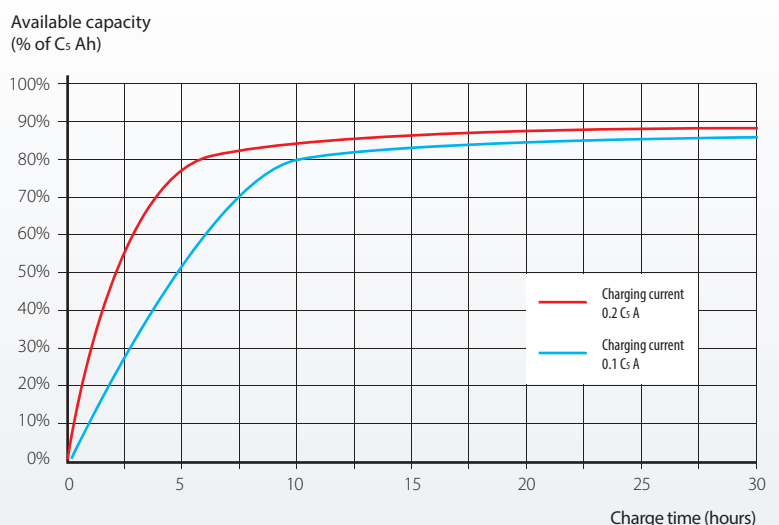
**NBLE Range** - Available capacity after constant voltage charge at 1,42 V at +20°C (+ 68°F)



**NBM Range** - Available capacity after constant voltage charge at 1,40 V at +20°C (+ 68°F)



**NBH Range** - Available capacity after constant voltage charge at 1,40 V at +20°C (+ 68°F)



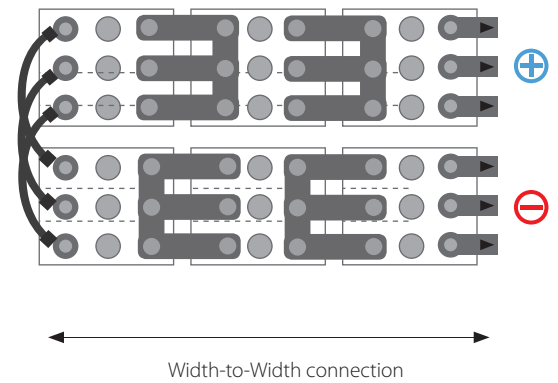
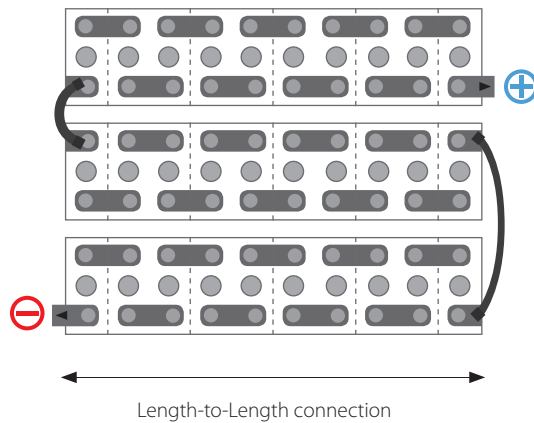
# NICA Battery Layout for optimum efficiency

## Standard layouts

Nica has developed a series of standard layouts for ordering a battery. Whether the battery is being installed on a rack, in a cabinet or is simply freestanding, the same configuration principals can be applied.

## Two ways to configure the battery

	Normal connection	Crosswise connection
NBLE	7.5 → 510	550 → 1690
NBM	11 → 392	415 → 1445
NBH	8.3 → 157	177 → 920



The cell is turned through 90° and then connected width-to-width. This is referred to as "crosswise" mounted and its purpose is to minimize the installation's over-all length. The cell's width is used to calculate the row length.

## Dimensions

The dimensions of all available cell types are listed in the tables. The block length is determined by the cell length and the number of cells in the block.

## Notes :

- All the tabulated dimensions are maximum values.
- All block types with a cell weight exceeding 8.4 kg (18.5 lbs) have handles.  
The tabulated block length includes 6mm for handles for these types.
- All the cell heights given in the tables include the height of the IP2X terminal cover.

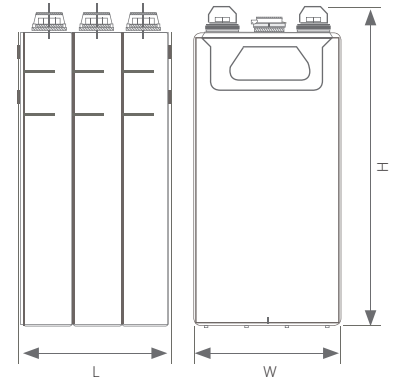


# Dimensions

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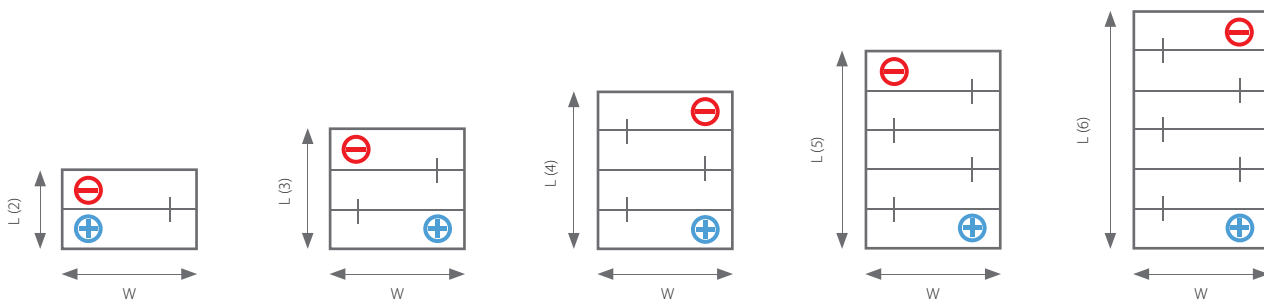
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- All the cell heights given in the tables include the height of the IP2X terminal cover.



## Position of terminals

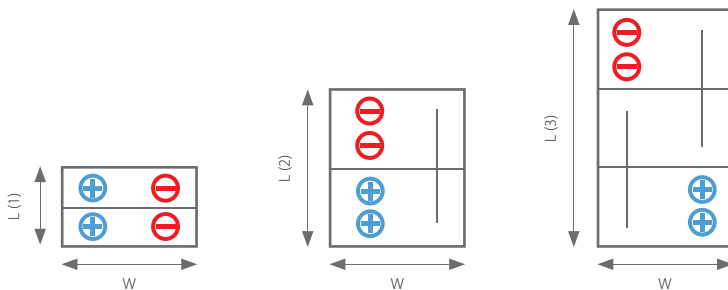
### Block of cells with single pole bolt



NBLE 7.5 → 62

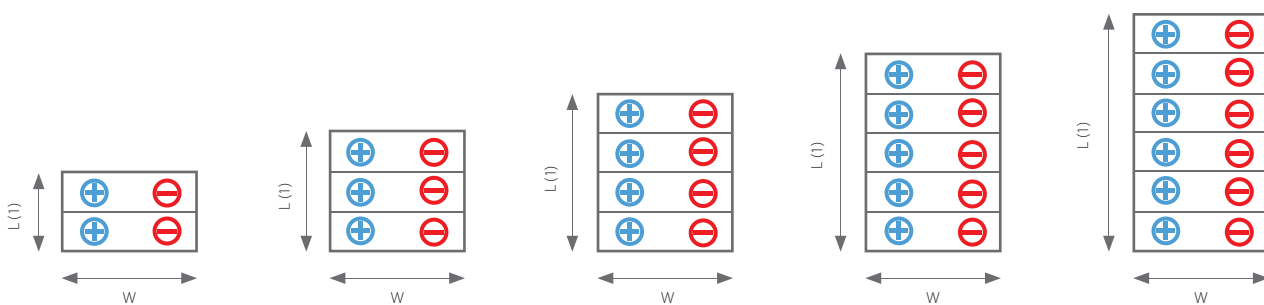
NBLE 75 → 275  
 NBM 11 → 241  
 NBH 8.3 → 118

### Block of cells with 2 pole bolt per poles



NBLE 300 → 510  
 NBM 250 → 392  
 NBH 137 → 157

### Block of cells with 2 - 6 poles bolt per poles



NBLE 550  
 NBM 415 → 482  
 NBH 177 → 256  
 NBH 270 → 281  
 NBH 307

NBLE 600 → 830  
 NBM 505 → 723  
 NBH 265 / 294  
 NBH 323 → 383  
 NBH 400 → 460

NBLE 890 → 1100  
 NBM 740 → 940  
 NBH 393 / 471  
 NBH 510 → 560  
 NBH 600 → 615

NBLE 1150 → 1400  
 NBM 1009 → 1181  
 NBH 471 / 590NBH  
 640 → 765

NBLE 1450 → 1690  
 NBM 965  
 NBH 1220 → 1445  
 NBH 800 → 920

# NBLE Capacities and dimensions - International System of units

Connection	Cell type	Capacity (C: Ah)	Height* (mm)	Width (mm)	Length per bock (mm)						Approx. weight per cell (kg)	Approx. electrolyte volume between level marks (cm <sup>3</sup> )	Electrolyte per cell		Internal resistance (mOhm)	Cell connection bolt per pole
					1 cell	2 cells	3 cells	4 cells	5 cells	6 cells			Solid (kg)	Liquid (L)		
NORMAL CONNECTION	NBLE 7,5	7.5	190	123	-	-	-	101	125	149	0,80	80	0,08	0,24	14,0	M 6
	NBLE 15	15	260	123	-	-	-	101	125	149	1,10	80	0,11	0,35	8,33	M 6
	NBLE 22	22	260	123	-	-	-	143	178	212	1,70	120	0,17	0,53	5,68	M 6
	NBLE 30	30	260	123	-	-	-	143	178	212	1,80	120	0,15	0,46	4,17	M 6
	NBLE 40	40	260	195	-	-	-	239	298	356	3,00	200	0,29	0,90	3,13	M 6
	NBLE 47	47	260	195	-	-	-	191	238	284	2,50	160	0,19	0,59	2,66	M 6
	NBLE 62	62	260	195	-	-	-	239	298	356	3,20	200	0,23	0,70	2,02	M 6
	NBLE 75	75	350	195	-	79,0	115	-	-	-	4,10	290	0,32	1,00	2,13	M 8
	NBLE 85	85	406	195	-	79,0	115	-	-	-	4,90	290	0,45	1,40	1,94	M 8
	NBLE 95	95	406	195	-	79,0	115	-	-	-	4,90	290	0,45	1,40	1,74	M 8
	NBLE 110	110	350	195	-	103	151	-	-	-	5,60	390	0,49	1,50	1,45	M 10
	NBLE 125	125	406	195	-	103	151	-	-	-	6,70	390	0,58	1,80	1,32	M 10
	NBLE 140	140	406	195	-	103	151	-	-	-	6,70	390	0,58	1,80	1,18	M 10
	NBLE 165	165	406	195	-	127	187	-	-	-	8,40	490	0,71	2,20	1,00	M 10
	NBLE 185	185	406	195	-	127	187	-	-	-	8,40	490	0,71	2,20	0,89	M 10
	NBLE 200	200	406	195	-	159	232	-	-	-	10,2	610	0,84	2,60	0,83	M 10
	NBLE 215	215	406	195	-	159	232	-	-	-	10,2	610	0,84	2,60	0,77	M 10
	NBLE 230	230	406	195	-	159	232	-	-	-	10,2	610	0,84	2,60	0,72	M 10
	NBLE 255	255	406	195	-	183	268	-	-	-	11,9	710	0,97	3,00	0,65	M 10
	NBLE 275	275	406	195	-	183	268	-	-	-	11,9	710	0,97	3,00	0,60	M 10
	NBLE 300	300	406	195	-	229	337	-	-	-	14,8	890	1,26	3,90	0,55	2 × M 10
	NBLE 325	325	406	195	-	229	337	-	-	-	14,8	890	1,26	3,90	0,51	2 × M 10
	NBLE 355	355	406	195	-	253	373	-	-	-	16,5	990	1,39	4,30	0,46	2 × M 10
	NBLE 365	365	406	195	-	253	373	-	-	-	16,5	990	1,39	4,30	0,45	2 × M 10
	NBLE 375	375	406	195	-	253	373	-	-	-	16,5	990	1,39	4,30	0,44	2 × M 10
	NBLE 395	395	406	195	146	279	-	-	-	-	18,0	1110	1,52	4,70	0,42	2 × M 10
	NBLE 415	415	406	195	146	279	-	-	-	-	18,0	1110	1,52	4,70	0,40	2 × M 10
	NBLE 435	435	406	195	159	305	-	-	-	-	19,8	1220	1,68	5,20	0,38	2 × M 10
	NBLE 460	460	406	195	159	305	-	-	-	-	19,8	1220	1,68	5,20	0,36	2 × M 10
	NBLE 475	475	410	195	171	329	-	-	-	-	21,8	1320	1,81	5,60	0,34	2 × M 10
NBLE 500	500	410	195	171	329	-	-	-	-	21,8	1320	1,81	5,60	0,33	2 × M 10	
NBLE 510	510	410	195	171	329	-	-	-	-	21,8	1320	1,81	5,60	0,32	2 × M 10	
CROSSWISE CONNECTION	NBLE 550	550	410	195	183	-	-	-	-	-	23,4	1430	1,94	6,00	0,30	2 × M 10
	NBLE 600	600	410	195	206	-	-	-	-	-	26,1	1610	2,20	6,80	0,28	3 × M 10
	NBLE 650	650	410	195	219	-	-	-	-	-	27,6	1720	2,37	7,30	0,25	3 × M 10
	NBLE 700	700	410	195	232	-	-	-	-	-	29,4	1830	2,49	7,70	0,24	3 × M 10
	NBLE 750	750	410	195	244	-	-	-	-	-	31,4	1930	2,62	8,10	0,22	3 × M 10
	NBLE 790	790	410	195	256	-	-	-	-	-	33,4	2040	2,75	8,50	0,21	3 × M 10
	NBLE 830	830	410	195	268	-	-	-	-	-	35,0	2140	2,88	8,90	0,20	3 × M 10
	NBLE 890	890	410	195	292	-	-	-	-	-	37,2	2330	3,18	9,80	0,19	4 × M 10
	NBLE 925	925	410	195	305	-	-	-	-	-	39,0	2440	3,34	10,3	0,18	4 × M 10
	NBLE 980	980	410	195	317	-	-	-	-	-	41,0	2550	3,47	10,7	0,17	4 × M 10
	NBLE 1000	1000	410	195	329	-	-	-	-	-	43,0	2650	3,60	11,1	0,17	4 × M 10
	NBLE 1020	1020	410	195	329	-	-	-	-	-	43,0	2650	3,60	11,1	0,16	4 × M 10
	NBLE 1070	1070	410	195	341	-	-	-	-	-	45,0	2750	3,73	11,5	0,15	4 × M 10
	NBLE 1100	1100	410	195	353	-	-	-	-	-	46,6	2860	3,86	11,9	0,15	4 × M 10
	NBLE 1150	1150	410	195	378	-	-	-	-	-	48,6	3050	4,18	12,9	0,14	5 × M 10
	NBLE 1200	1200	410	195	390	-	-	-	-	-	50,6	3160	4,31	13,3	0,14	5 × M 10
	NBLE 1250	1250	410	195	402	-	-	-	-	-	52,6	3260	4,41	13,6	0,13	5 × M 10
	NBLE 1300	1300	410	195	413	-	-	-	-	-	54,8	3360	4,54	14,0	0,13	5 × M 10
	NBLE 1350	1350	410	195	426	-	-	-	-	-	56,6	3470	4,67	14,4	0,12	5 × M 10
	NBLE 1400	1400	410	195	438	-	-	-	-	-	58,2	3570	4,80	14,8	0,12	5 × M 10
NBLE 1450	1450	410	195	463	-	-	-	-	-	60,2	3770	5,12	15,8	0,11	6 × M 10	
NBLE 1500	1500	410	195	487	-	-	-	-	-	64,2	3980	5,38	16,6	0,11	6 × M 10	
NBLE 1560	1560	410	195	499	-	-	-	-	-	66,2	4080	5,51	17,0	0,11	6 × M 10	
NBLE 1600	1600	410	195	511	-	-	-	-	-	68,1	4190	5,64	17,4	0,10	6 × M 10	
NBLE 1660	1660	410	195	523	-	-	-	-	-	69,8	4290	5,77	17,8	0,10	6 × M 10	
NBLE 1690	1690	410	195	523	-	-	-	-	-	69,8	4290	5,77	17,8	0,10	6 × M 10	

\* Height including the IP2X terminal cover - The dark line distinguishes the normal mounted cells from the crosswise cells.

**NBM** Capacities and dimensions - International System of units

Connection	Cell type	Capacity (C <sub>5</sub> Ah)	Height* (mm)	Width (mm)	Length per block (mm)			Approx. weight per cell (kg)	Approx. electrolyte volume between level marks (cm <sup>3</sup> )	Electrolyte per cell		Internal resistance (mOhm)	Cell connection bolt per pole
					1 cell	2 cells	3 cells			Solid (kg)	Liquid (L)		
NORMAL CONNECTION	NBM 11	11	190	123	-	64,0	93,5	0,90	110	0,10	0,30	5,00	M 6
	NBM 15	15	190	123	-	74,0	109	1,20	120	0,11	0,33	3,67	M 6
	NBM 22	22	260	123	-	64,0	93,5	1,50	110	0,15	0,46	2,82	M 6
	NBM 30	30	260	123	-	74,0	109	1,80	120	0,15	0,46	2,07	M 6
	NBM 43	43	344	195	-	69,0	100	3,60	240	0,32	1,00	1,81	M 6
	NBM 50	50	344	195	-	69,0	100	3,60	240	0,32	1,00	1,56	M 6
	NBM 56	56	400	195	-	69,0	100	4,30	240	0,39	1,20	1,54	M 6
	NBM 65	65	350	195	-	79,0	115	4,40	280	0,36	1,10	1,20	M 8
	NBM 72	72	350	195	-	79,0	115	4,40	280	0,36	1,10	1,08	M 8
	NBM 84	84	406	195	-	79,0	115	5,10	280	0,42	1,30	1,02	M 8
	NBM 93	93	406	195	-	79,0	115	5,10	280	0,42	1,30	0,92	M 8
	NBM 100	100	406	195	-	94,0	138	6,40	340	0,52	1,60	0,86	M 8
	NBM 112	112	406	195	-	94,0	138	6,40	340	0,52	1,60	0,77	M 8
	NBM 118	118	406	195	-	94,0	138	6,40	340	0,52	1,60	0,73	M 8
	NBM 130	130	350	195	-	127	187	7,50	480	0,58	1,80	0,60	M 10
	NBM 138	138	406	195	-	115	169	7,80	430	0,65	2,00	0,62	M 10
	NBM 150	150	350	195	-	159	232	8,90	590	0,75	2,30	0,52	M 10
	NBM 161	161	406	195	-	127	187	8,80	480	0,68	2,10	0,53	M 10
	NBM 168	168	406	195	-	183	268	10,1	700	0,87	2,70	0,46	M 10
	NBM 184	184	406	195	-	159	232	10,5	590	0,87	2,70	0,47	M 10
	NBM 192	192	406	195	-	159	232	10,5	590	0,87	2,70	0,45	M 10
	NBM 200	200	406	195	-	183	268	12,0	700	1,04	3,20	0,43	M 10
	NBM 208	208	406	195	-	183	268	12,0	700	1,04	3,20	0,41	M 10
	NBM 216	216	406	195	-	183	268	12,0	700	1,04	3,20	0,40	M 10
	NBM 231	231	406	195	-	183	268	12,5	690	0,97	3,00	0,37	M 10
	NBM 241	241	406	195	-	183	268	12,5	690	0,97	3,00	0,36	M 10
	NBM 250	250	406	195	-	229	337	15,5	870	1,26	3,90	0,34	2 × M 10
	NBM 260	260	406	195	-	229	337	15,5	870	1,26	3,90	0,33	2 × M 10
	NBM 277	277	406	195	-	229	337	15,5	870	1,26	3,90	0,31	2 × M 10
	NBM 300	300	406	195	-	241	355	16,5	920	1,30	4,00	0,29	2 × M 10
	NBM 323	323	406	195	-	253	373	17,5	970	1,36	4,20	0,27	2 × M 10
	NBM 346	346	406	195	146	279	-	18,8	1 080	1,56	4,80	0,25	2 × M 10
NBM 369	369	406	195	159	305	-	20,4	1 190	1,72	5,30	0,23	2 × M 10	
NBM 392	392	406	195	171	329	-	22,2	1 300	1,91	5,90	0,22	2 × M 10	
CROSSWISE CONNECTION	NBM 415	415	410	195	183	-	-	23,7	1 400	2,07	6,40	0,21	2 × M 10
	NBM 438	438	410	195	183	-	-	24,2	1 390	1,98	6,10	0,20	2 × M 10
	NBM 461	461	410	195	183	-	-	24,7	1 390	1,91	5,90	0,19	2 × M 10
	NBM 482	482	410	195	183	-	-	24,7	1 390	1,91	5,90	0,18	2 × M 10
	NBM 505	505	410	195	213	-	-	27,6	1 630	2,37	7,30	0,17	3 × M 10
	NBM 526	526	410	195	213	-	-	27,6	1 630	2,37	7,30	0,16	3 × M 10
	NBM 555	555	410	195	232	-	-	30,3	1 790	2,59	8,00	0,15	3 × M 10
	NBM 576	576	410	195	232	-	-	30,3	1 790	2,59	8,00	0,15	3 × M 10
	NBM 600	600	410	195	244	-	-	32,1	1 890	2,75	8,50	0,14	3 × M 10
	NBM 625	625	410	195	268	-	-	35,4	2 100	3,08	9,50	0,14	3 × M 10
	NBM 649	649	410	195	268	-	-	35,4	2 100	3,08	9,50	0,13	3 × M 10
	NBM 674	674	410	195	268	-	-	35,9	2 100	3,01	9,30	0,13	3 × M 10
	NBM 690	690	410	195	268	-	-	37,0	2 080	2,88	8,90	0,12	3 × M 10
	NBM 723	723	410	195	268	-	-	37,0	2 080	2,88	8,90	0,12	3 × M 10
	NBM 740	740	410	195	305	-	-	40,2	2 390	3,43	10,6	0,12	4 × M 10
	NBM 768	768	410	195	305	-	-	40,2	2 390	3,43	10,6	0,11	4 × M 10
	NBM 792	792	410	195	317	-	-	42,0	2 490	3,63	11,2	0,11	4 × M 10
	NBM 830	830	410	195	353	-	-	47,1	2 800	4,11	12,7	0,10	4 × M 10
	NBM 866	866	410	195	353	-	-	47,1	2 800	4,11	12,7	0,10	4 × M 10
	NBM 890	890	410	195	353	-	-	47,6	2 800	4,05	12,5	0,10	4 × M 10
	NBM 920	920	410	195	353	-	-	49,2	2 780	3,82	11,8	0,09	4 × M 10
	NBM 940	940	410	195	353	-	-	48,7	2 780	3,89	12,0	0,09	4 × M 10
	NBM 965	965	410	195	373	-	-	51,9	2 910	4,05	12,5	0,09	6 × M 10
	NBM 1009	1009	410	195	402	-	-	53,7	3 200	4,63	14,3	0,09	5 × M 10
	NBM 1040	1040	410	195	438	-	-	58,8	3 510	5,15	15,9	0,08	5 × M 10
	NBM 1082	1082	410	195	438	-	-	58,8	3 510	5,15	15,9	0,08	5 × M 10
	NBM 1107	1107	410	195	438	-	-	59,3	3 500	5,05	15,6	0,08	5 × M 10
	NBM 1150	1150	410	195	438	-	-	61,4	3 470	4,76	14,7	0,07	5 × M 10
	NBM 1181	1181	410	195	438	-	-	60,9	3 480	4,86	15,0	0,07	5 × M 10
	NBM 1220	1220	410	195	511	-	-	69,0	4 110	5,99	18,5	0,07	6 × M 10
	NBM 1274	1274	410	195	511	-	-	69,0	4 110	5,99	18,5	0,07	6 × M 10
	NBM 1324	1324	410	195	523	-	-	71,0	4 200	6,09	18,8	0,06	6 × M 10
NBM 1390	1390	410	195	523	-	-	73,7	4 170	5,73	17,7	0,06	6 × M 10	
NBM 1445	1445	410	195	523	-	-	73,7	4 170	5,73	17,7	0,06	6 × M 10	

\* Height including the IP2X terminal cover - The dark line distinguishes the normal mounted cells from the crosswise cells.

**NBM** Capacities and dimensions - Imperial units

Connection	Cell type	Capacity (C <sub>5</sub> Ah)	Height* (in)	Width (in)	Length per block (in)			Approx. weight per cell (lbs)	Approx. electrolyte volume between level marks (in <sup>3</sup> )	Electrolyte per cell		Internal resistance (mOhm)	Cell connection bolt per pole
					1 cell	2 cells	3 cells			Solid (lbs)	Liquid (US Gal)		
NORMAL CONNECTION	NBM 11	11	7,48	4,84	-	2,52	3,68	1,98	6,71	0,22	0,08	5,00	M 6
	NBM 15	15	7,48	4,84	-	2,91	4,27	2,65	7,31	0,24	0,09	3,67	M 6
	NBM 22	22	10,2	4,84	-	2,52	3,68	3,31	6,71	0,33	0,12	2,82	M 6
	NBM 30	30	10,2	4,84	-	2,91	4,27	3,97	7,32	0,33	0,12	2,07	M 6
	NBM 43	43	13,5	7,68	-	2,72	3,94	7,94	14,6	0,71	0,26	1,81	M 6
	NBM 50	50	13,5	7,68	-	2,72	3,94	7,94	14,6	0,71	0,26	1,56	M 6
	NBM 56	56	15,7	7,68	-	2,72	3,94	9,48	14,6	0,86	0,32	1,54	M 6
	NBM 65	65	13,8	7,68	-	3,11	4,53	9,70	17,1	0,79	0,29	1,20	M 8
	NBM 72	72	13,8	7,68	-	3,11	4,53	9,70	17,1	0,79	0,29	1,08	M 8
	NBM 84	84	16,0	7,68	-	3,11	4,53	11,2	17,1	0,93	0,34	1,02	M 8
	NBM 93	93	16,0	7,68	-	3,11	4,53	11,2	17,1	0,93	0,34	0,92	M 8
	NBM 100	100	16,0	7,68	-	3,70	5,41	14,1	20,7	1,14	0,42	0,86	M 8
	NBM 112	112	16,0	7,68	-	3,70	5,41	14,1	20,7	1,14	0,42	0,77	M 8
	NBM 118	118	16,0	7,68	-	3,70	5,41	14,1	20,7	1,14	0,42	0,73	M 8
	NBM 130	130	13,8	7,68	-	5,00	7,36	16,5	29,3	1,29	0,48	0,60	M 10
	NBM 138	138	16,0	7,68	-	4,53	6,65	17,2	26,2	1,43	0,53	0,62	M 10
	NBM 150	150	13,8	7,68	-	6,26	9,13	19,6	36,0	1,64	0,61	0,52	M 10
	NBM 161	161	16,0	7,68	-	5,00	7,36	19,4	29,3	1,50	0,55	0,53	M 10
	NBM 168	168	16,0	7,68	-	7,20	10,55	22,3	42,7	1,93	0,71	0,46	M 10
	NBM 184	184	16,0	7,68	-	6,26	9,13	23,1	36,0	1,93	0,71	0,47	M 10
	NBM 192	192	16,0	7,68	-	6,26	9,13	23,1	36,0	1,93	0,71	0,45	M 10
	NBM 200	200	16,0	7,68	-	7,20	10,6	26,5	42,7	2,29	0,85	0,43	M 10
	NBM 208	208	16,0	7,68	-	7,20	10,6	26,5	42,7	2,29	0,85	0,41	M 10
	NBM 216	216	16,0	7,68	-	7,20	10,6	26,5	42,7	2,29	0,85	0,40	M 10
	NBM 231	231	16,0	7,68	-	7,20	10,6	27,6	42,1	2,14	0,79	0,37	M 10
	NBM 241	241	16,0	7,68	-	7,20	10,6	27,6	42,1	2,14	0,79	0,36	M 10
	NBM 250	250	16,0	7,68	-	9,02	13,3	34,2	53,1	2,79	1,03	0,34	2 × M 10
	NBM 260	260	16,0	7,68	-	9,02	13,3	34,2	53,1	2,79	1,03	0,33	2 × M 10
	NBM 277	277	16,0	7,68	-	9,02	13,3	34,2	53,1	2,79	1,03	0,31	2 × M 10
	NBM 300	300	16,0	7,68	-	9,49	14,0	36,4	56,1	2,86	1,06	0,29	2 × M 10
	NBM 323	323	16,0	7,68	-	9,96	14,7	38,6	59,2	3,00	1,11	0,27	2 × M 10
	NBM 346	346	16,0	7,68	-	5,75	11,0	-	41,4	65,9	3,43	1,27	0,25
NBM 369	369	16,0	7,68	-	6,26	12,0	-	45,0	72,6	3,79	1,40	0,23	2 × M 10
NBM 392	392	16,0	7,68	-	6,73	13,0	-	48,9	79,3	4,21	1,56	0,22	2 × M 10
CROSSWISE CONNECTION	NBM 415	415	16,1	7,68	7,20	-	-	52,2	85,4	4,57	1,69	0,21	2 × M 10
	NBM 438	438	16,1	7,68	7,20	-	-	53,4	84,8	4,36	1,61	0,20	2 × M 10
	NBM 461	461	16,1	7,68	7,20	-	-	54,5	84,8	4,21	1,56	0,19	2 × M 10
	NBM 482	482	16,1	7,68	7,20	-	-	54,5	84,8	4,21	1,56	0,18	2 × M 10
	NBM 505	505	16,1	7,68	8,39	-	-	60,8	99,5	5,21	1,93	0,17	3 × M 10
	NBM 526	526	16,1	7,68	8,39	-	-	60,8	99,5	5,21	1,93	0,16	3 × M 10
	NBM 555	555	16,1	7,68	9,13	-	-	66,8	109	5,71	2,11	0,15	3 × M 10
	NBM 576	576	16,1	7,68	9,13	-	-	66,8	109	5,71	2,11	0,15	3 × M 10
	NBM 600	600	16,1	7,68	9,61	-	-	70,8	115	6,07	2,25	0,14	3 × M 10
	NBM 625	625	16,1	7,68	10,6	-	-	78,0	128	6,79	2,51	0,14	3 × M 10
	NBM 649	649	16,1	7,68	10,6	-	-	78,0	128	6,79	2,51	0,13	3 × M 10
	NBM 674	674	16,1	7,68	10,6	-	-	79,1	128	6,64	2,46	0,13	3 × M 10
	NBM 690	690	16,1	7,68	10,6	-	-	81,6	127	6,36	2,35	0,12	3 × M 10
	NBM 723	723	16,1	7,68	10,6	-	-	81,6	127	6,36	2,35	0,12	3 × M 10
	NBM 740	740	16,1	7,68	12,0	-	-	88,6	146	7,57	2,80	0,12	4 × M 10
	NBM 768	768	16,1	7,68	12,0	-	-	88,6	146	7,57	2,80	0,11	4 × M 10
	NBM 792	792	16,1	7,68	12,5	-	-	92,6	152	8,00	2,96	0,11	4 × M 10
	NBM 830	830	16,1	7,68	13,9	-	-	104	171	9,07	3,35	0,10	4 × M 10
	NBM 866	866	16,1	7,68	13,9	-	-	104	171	9,07	3,35	0,10	4 × M 10
	NBM 890	890	16,1	7,68	13,9	-	-	105	171	8,93	3,30	0,10	4 × M 10
	NBM 920	920	16,1	7,68	13,9	-	-	108	170	8,43	3,12	0,09	4 × M 10
	NBM 940	940	16,1	7,68	13,9	-	-	107	170	8,57	3,17	0,09	4 × M 10
	NBM 965	965	16,1	7,68	14,7	-	-	114	178	8,93	3,30	0,09	6 × M 10
	NBM 1009	1009	16,1	7,68	15,8	-	-	118	195	10,2	3,78	0,09	5 × M 10
	NBM 1040	1040	16,1	7,68	17,2	-	-	130	214	11,4	4,20	0,08	5 × M 10
	NBM 1082	1082	16,1	7,68	17,2	-	-	130	214	11,4	4,20	0,08	5 × M 10
	NBM 1107	1107	16,1	7,68	17,2	-	-	131	214	11,1	4,12	0,08	5 × M 10
	NBM 1150	1150	16,1	7,68	17,2	-	-	135	212	10,5	3,88	0,07	5 × M 10
NBM 1181	1181	16,1	7,68	17,2	-	-	134	212	10,7	3,96	0,07	5 × M 10	
NBM 1220	1220	16,1	7,68	20,1	-	-	152	251	13,2	4,89	0,07	6 × M 10	
NBM 1274	1274	16,1	7,68	20,1	-	-	152	251	13,2	4,89	0,07	6 × M 10	
NBM 1324	1324	16,1	7,68	20,6	-	-	157	256	13,4	4,97	0,06	6 × M 10	
NBM 1390	1390	16,1	7,68	20,6	-	-	162	254	12,6	4,68	0,06	6 × M 10	
NBM 1445	1445	16,1	7,68	20,6	-	-	162	254	12,6	4,68	0,06	6 × M 10	

\* Height including the IP2X terminal cover - The dark line distinguishes the normal mounted cells from the crosswise cells.

# NBH Capacities and dimensions - International System of units

Connection	Cell type	Capacity (C <sub>5</sub> Ah)	Height* (mm)	Width (mm)	Length per block (mm)			Approx. weight per cell (kg)	Approx. electrolyte volume between level marks (cm <sup>3</sup> )	Electrolyte per cell		Internal resistance (mOhm)	Cell connection bolt per pole
					1 cell	2 cells	3 cells			Solid (kg)	Liquid (L)		
NORMAL CONNECTION	NBH 8,3	8,3	260	123	-	53,0	77,0	1,10	80	0,12	0,36	3,61	M 6
	NBH 12	12	260	123	-	64,0	93,5	1,50	110	0,14	0,44	2,50	M 6
	NBH 16	16	260	123	-	74,0	109	1,80	120	0,16	0,48	1,88	M 6
	NBH 19	19	344	123	-	57,0	82,0	2,80	190	0,29	0,90	2,05	M 6
	NBH 29	29	344	195	-	69,0	100	3,70	230	0,36	1,10	1,34	M 6
	NBH 39	39	350	195	-	79,0	115	4,50	270	0,39	1,20	1,00	M 8
	NBH 49	49	350	195	-	94,0	138	5,40	340	0,49	1,50	0,80	M 8
	NBH 59	59	350	195	-	103	151	6,20	370	0,52	1,60	0,66	M 10
	NBH 69	69	350	195	-	127	187	7,30	470	0,68	2,10	0,57	M 10
	NBH 79	79	350	195	-	127	187	7,70	470	0,65	2,00	0,49	M 10
	NBH 88	88	350	195	-	159	232	9,10	580	0,81	2,50	0,44	M 10
	NBH 98	98	350	195	-	159	232	9,40	570	0,78	2,40	0,40	M 10
	NBH 110	110	350	195	-	183	268	10,6	680	0,94	2,90	0,35	M 10
	NBH 118	118	350	195	-	183	268	11,0	670	0,87	2,70	0,33	M 10
	NBH 137	137	350	195	-	253	373	14,5	950	1,33	4,10	0,28	2 × M 10
	NBH 157	157	350	195	-	253	373	15,3	940	1,26	3,90	0,25	2 × M 10
	CROSSWISE CONNECTION	NBH 177	177	354	195	159	-	-	17,6	1170	1,59	4,90	0,22
NBH 196		196	354	195	159	-	-	18,3	1150	1,52	4,70	0,20	2 × M 10
NBH 204		204	410	195	133	-	-	18,0	940	1,49	4,60	0,21	2 × M 10
NBH 236		236	354	195	183	-	-	21,4	1350	1,75	5,40	0,17	2 × M 10
NBH 256		256	410	195	159	-	-	21,7	1150	1,78	5,50	0,17	2 × M 10
NBH 265		265	354	195	232	-	-	26,1	1750	2,40	7,40	0,15	3 × M 10
NBH 270		270	410	195	171	-	-	23,4	1260	1,98	6,10	0,16	2 × M 10
NBH 281		281	410	195	183	-	-	24,8	1360	2,17	6,70	0,15	2 × M 10
NBH 294		294	354	195	232	-	-	27,2	1730	2,27	7,00	0,13	3 × M 10
NBH 307		307	410	195	183	-	-	25,6	1350	2,07	6,40	0,14	2 × M 10
NBH 323		323	410	195	206	-	-	28,1	1530	2,43	7,50	0,13	3 × M 10
NBH 345		345	410	195	232	-	-	30,9	1750	2,85	8,80	0,12	3 × M 10
NBH 353		353	354	195	268	-	-	31,8	2020	2,62	8,10	0,11	3 × M 10
NBH 363		363	410	195	232	-	-	31,3	1740	2,79	8,60	0,12	3 × M 10
NBH 383		383	410	195	232	-	-	32,2	1730	2,69	8,30	0,11	3 × M 10
NBH 393		393	354	195	305	-	-	36,1	2310	3,01	9,30	0,10	4 × M 10
NBH 400		400	410	195	244	-	-	33,9	1830	2,88	8,90	0,11	3 × M 10
NBH 422		422	410	195	268	-	-	37,0	2040	3,27	10,1	0,10	3 × M 10
NBH 440		440	410	195	268	-	-	37,4	2040	3,21	9,90	0,10	3 × M 10
NBH 460		460	410	195	268	-	-	38,3	2020	3,11	9,60	0,09	3 × M 10
NBH 471		471	354	195	353	-	-	42,2	2700	3,50	10,8	0,08	4 × M 10
NBH 491		491	354	195	378	-	-	45,1	2890	3,79	11,7	0,08	5 × M 10
NBH 510		510	410	195	305	-	-	42,7	2310	3,56	11,0	0,08	4 × M 10
NBH 560		560	410	195	353	-	-	49,2	2720	4,34	13,4	0,08	4 × M 10
NBH 590		590	354	195	438	-	-	52,6	3370	4,37	13,5	0,07	5 × M 10
NBH 600		600	410	195	353	-	-	50,6	2700	4,18	12,9	0,07	4 × M 10
NBH 615		615	410	195	353	-	-	51,0	2700	4,15	12,8	0,07	4 × M 10
NBH 640		640	410	195	378	-	-	53,2	2890	4,47	13,8	0,07	5 × M 10
NBH 655		655	410	195	390	-	-	55,0	2990	4,67	14,4	0,07	5 × M 10
NBH 670		670	410	195	402	-	-	56,7	3100	4,86	15,0	0,06	5 × M 10
NBH 705	705	410	195	438	-	-	61,5	3410	5,41	16,7	0,06	5 × M 10	
NBH 765	765	410	195	438	-	-	63,7	3370	5,18	16,0	0,06	5 × M 10	
NBH 800	800	410	195	463	-	-	65,9	3560	5,51	17,0	0,05	6 × M 10	
NBH 865	865	410	195	498	-	-	72,6	3850	5,90	18,2	0,05	6 × M 10	
NBH 920	920	410	195	523	-	-	76,4	4050	6,19	19,1	0,05	6 × M 10	

\* Height including the IP2X terminal cover - The dark line distinguishes the normal mounted cells from the crosswise cells.

# NBH Capacities and dimensions - Imperial units

Connection	Cell type	Capacity (C <sub>5</sub> Ah)	Height* (in)	Width (in)	Length per block (in)			Approx. weight per cell (lbs)	Approx. electrolyte volume between level marks (in <sup>3</sup> )	Electrolyte per cell		Internal resistance (mOhm)	Cell connection bolt per pole
					1 cell	2 cells	3 cells			Solid (lbs)	Liquid (US Gal)		
NORMAL CONNECTION	NBH 8,3	8,3	10,2	4,84	-	2,09	3,03	2,43	4,88	0,26	0,10	3,61	M 6
	NBH 12	12	10,2	4,84	-	2,52	3,68	3,31	6,71	0,31	0,12	2,50	M 6
	NBH 16	16	10,2	4,84	-	2,91	4,27	3,97	7,32	0,35	0,13	1,88	M 6
	NBH 19	19	13,5	4,84	-	2,24	3,23	6,17	11,6	0,64	0,24	2,05	M 6
	NBH 29	29	13,5	7,68	-	2,72	3,94	8,16	14,0	0,79	0,29	1,34	M 6
	NBH 39	39	13,8	7,68	-	3,11	4,53	9,92	16,5	0,86	0,32	1,00	M 8
	NBH 49	49	13,8	7,68	-	3,70	5,41	11,9	20,7	1,07	0,40	0,80	M 8
	NBH 59	59	13,8	7,68	-	4,06	5,94	13,7	22,6	1,14	0,42	0,66	M 10
	NBH 69	69	13,8	7,68	-	5,00	7,36	16,1	28,7	1,50	0,55	0,57	M 10
	NBH 79	79	13,8	7,68	-	5,00	7,36	17,0	28,7	1,43	0,53	0,49	M 10
	NBH 88	88	13,8	7,68	-	6,26	9,13	20,1	35,4	1,79	0,66	0,44	M 10
	NBH 98	98	13,8	7,68	-	6,26	9,13	20,7	34,8	1,71	0,63	0,40	M 10
	NBH 110	110	13,8	7,68	-	7,20	10,6	23,4	41,5	2,07	0,77	0,35	M 10
	NBH 118	118	13,8	7,68	-	7,20	10,6	24,3	40,9	1,93	0,71	0,33	M 10
	NBH 137	137	13,8	7,68	-	9,96	14,7	32,0	58,0	2,93	1,08	0,28	2 × M 10
NBH 157	157	13,8	7,68	-	9,96	14,7	33,7	57,4	2,79	1,03	0,25	2 × M 10	
CROSSWISE CONNECTION	NBH 177	177	13,9	7,68	6,26	-	-	38,8	71,4	3,50	1,29	0,22	2 × M 10
	NBH 196	196	13,9	7,68	6,26	-	-	40,3	70,2	3,36	1,24	0,20	2 × M 10
	NBH 204	204	16,1	7,68	5,24	-	-	39,7	57,4	3,29	1,22	0,21	2 × M 10
	NBH 236	236	13,9	7,68	7,20	-	-	47,2	82,4	3,86	1,43	0,17	2 × M 10
	NBH 256	256	16,1	7,68	6,26	-	-	47,8	70,2	3,93	1,45	0,17	2 × M 10
	NBH 265	265	13,9	7,68	9,13	-	-	57,5	107	5,29	1,95	0,15	3 × M 10
	NBH 270	270	16,1	7,68	6,73	-	-	51,6	76,9	4,36	1,61	0,16	2 × M 10
	NBH 281	281	16,1	7,68	7,20	-	-	54,7	83,0	4,79	1,77	0,15	2 × M 10
	NBH 294	294	13,9	7,68	9,13	-	-	60,0	106	5,00	1,85	0,13	3 × M 10
	NBH 307	307	16,1	7,68	7,20	-	-	56,4	82,4	4,57	1,69	0,14	2 × M 10
	NBH 323	323	16,1	7,68	8,11	-	-	61,9	93,4	5,36	1,98	0,13	3 × M 10
	NBH 345	345	16,1	7,68	9,13	-	-	68,1	107	6,29	2,32	0,12	3 × M 10
	NBH 353	353	13,9	7,68	10,6	-	-	70,1	123	5,79	2,14	0,11	3 × M 10
	NBH 363	363	16,1	7,68	9,13	-	-	69,0	106	6,14	2,27	0,12	3 × M 10
	NBH 383	383	16,1	7,68	9,13	-	-	71,0	106	5,93	2,19	0,11	3 × M 10
	NBH 393	393	13,9	7,68	12,0	-	-	79,6	141	6,64	2,46	0,10	4 × M 10
	NBH 400	400	16,1	7,68	9,61	-	-	74,7	112	6,36	2,35	0,11	3 × M 10
	NBH 422	422	16,1	7,68	10,6	-	-	81,6	124	7,21	2,67	0,10	3 × M 10
	NBH 440	440	16,1	7,68	10,6	-	-	82,5	124	7,07	2,62	0,10	3 × M 10
	NBH 460	460	16,1	7,68	10,6	-	-	84,4	123	6,86	2,54	0,09	3 × M 10
	NBH 471	471	13,9	7,68	13,9	-	-	93,0	165	7,71	2,85	0,08	4 × M 10
	NBH 491	491	13,9	7,68	14,9	-	-	99,4	176	8,36	3,09	0,08	5 × M 10
	NBH 510	510	16,1	7,68	12,0	-	-	94,1	141	7,86	2,91	0,08	4 × M 10
	NBH 560	560	16,1	7,68	13,9	-	-	108	166	9,57	3,54	0,08	4 × M 10
	NBH 590	590	13,9	7,68	17,2	-	-	116	206	9,64	3,57	0,07	5 × M 10
	NBH 600	600	16,1	7,68	13,9	-	-	112	165	9,21	3,41	0,07	4 × M 10
	NBH 615	615	16,1	7,68	13,9	-	-	112	165	9,14	3,38	0,07	4 × M 10
NBH 640	640	16,1	7,68	14,9	-	-	117	176	9,86	3,65	0,07	5 × M 10	
NBH 655	655	16,1	7,68	15,4	-	-	121	182	10,3	3,80	0,07	5 × M 10	
NBH 670	670	16,1	7,68	15,8	-	-	125	189	10,7	3,96	0,06	5 × M 10	
NBH 705	705	16,1	7,68	17,2	-	-	136	208	11,9	4,41	0,06	5 × M 10	
NBH 765	765	16,1	7,68	17,2	-	-	140	206	11,4	4,23	0,06	5 × M 10	
NBH 800	800	16,1	7,68	18,2	-	-	145	217	12,1	4,49	0,05	6 × M 10	
NBH 865	865	16,1	7,68	19,6	-	-	160	235	13,0	4,81	0,05	6 × M 10	
NBH 920	920	16,1	7,68	20,6	-	-	168	247	13,6	5,05	0,05	6 × M 10	

\* Height including the IP2X terminal cover - The dark line distinguishes the normal mounted cells from the crosswise cells.

# Maintenance of Batteries

## Cleanliness / Mechanical

Cells must be kept clean and dry at all times, as dust and damp cause current leakage. Terminal and connectors should be kept clean, and any spillage during maintenance should be wiped off with a clean cloth. The battery can be cleaned, using water. Do not use wire brush or a solvent of any kind. Vent caps can be rinsed in clean water, if necessary.

Check that the flame arresting vents are tightly sealed and that there are no deposits on the vent caps.

Terminals should be checked for tightness, and the terminals and connectors should be corrosion protected by coating with a thin layer of neutral grease or anti-corrosion oil.

## Changing electrolyte

In most stationary operations, the electrolyte will retain its effectiveness for the life of the battery. Thus, normally it is not necessary to change the electrolyte.

However, under certain battery operating conditions involving high temperature and cycling, the electrolyte can become excessively carbonated. Under these circumstances, the battery performance can be improved by replacing the electrolyte. Please consult your representative under these conditions.

## Topping up

Check the electrolyte level. Never let the level fall below the lower MIN mark. Use only approved distilled or deionized water to top up. Do not overfill the cells.

Excessive consumption of water indicates operation at too high a voltage or too high temperature. Negligible consumption of water, with batteries on continuous low current or float charge, could indicate undercharging. A reasonable consumption of water is the best indication that a battery is being operated under the correct conditions. Any marked change in the rate of water consumption should be investigated immediately.

## Capacity check

Electrical battery testing is not part of normal routine maintenance, as the battery is required to have the back-up function and cannot be easily taken out-of-service.

However, if a capacity test of the battery is needed, the following procedure should be followed:

- a) Discharge the battery at the rate of  $0.1C_5$  to  $0.2C_5$  amperes (10 to 20 amperes for a 100 Ah battery ) to a final average voltage of 1.0 volts per cell. ( i.e. 92 volts for a 92 cells battery)
- b) Charge 200% ( i.e. 200 Ah for 100 Ah battery at the same rate used as the above paragraph (a)
- c) Discharge at the same rate used in (a), measuring and recording current, voltage and time every hour, and more frequently towards the end of the discharged. This should be continued until a final average voltage of 1.0 volts per cell is reached. The overall state of battery can then be seen, and if individually cell measurements are taken, the state of each cell can be observed.

## Recommended maintenance procedure

In order to obtain the best from your battery, the following maintenance procedures are recommended.

### Yearly

- Check charge voltage settings
- Check cell voltages ( 50 mV deviation from average is acceptable )
- Check floats current of the battery
- Check electrolyte level
- High voltage charge if agreed for application

### Every 2 years

- Clean cell lids and battery area
- Check torque values
- Grease terminals and connectors

### Every 5 years or as required

- Capacity check

### As required

Top-up with water according to defined period ( depend on float voltage, cycles and temperature )

**It is also recommended that a maintenance record be kept which should include a record of the temperature of the battery room.**

# Installation and storage

## Batteries on arrival

On receiving the battery, open the cases and check for any indication of damage in transit.

Remove the cells and any accessories from the packaging, and check that the contents are in order and inspect for any damage in transit.

Damage must be reported immediately to the carrier, and the company or its agent.

If batteries are not put into service immediately they should be stored in a clean, dry, cool and well ventilated storage space on open shelves. Plastic cells should not be exposed to direct sunlight.

Before storage, ensure that:

- a) Cells are kept clean with adequate protective finish, such as neutral grease on post and connectors.
- b) Electrolyte in cells are filled to the correct level.
- c) Vents are correctly seated and vent plugs firmly in position. Keep the transit sealing tape in position.

Note that if excessive loss of electrolyte in transit is found in cells supplied filled, ensure that the cells are correctly filled before storage.

## Cells after storage

All cells after storage must be prepared for service and fully commissioned.

## Cell oil

On top of the electrolyte of filled cells which floats a layer of cell oil to reduce self-discharge and water loss due to evaporation. This layer is approximately 5mm thick, when the cells are delivered empty and must be added to the cells after they have been filled with electrolyte.

## Filled Cells

Filled cells can be stored for up to a maximum of one year. The cells should be sealed with plastic transport seals, supplied with the cells. Check the transport seals upon receipt.

If for unavoidable reasons, filled cells have been stored for more than one year, they must be given maintenance cycles as follows:

- a) Remove transport seals from the cells.
- b) Discharged at the charging current in the Cell Data Tables to 1.0 Volts per cell.
- c) Charge to 10 hours at the charging current in the Cell Data Tables, or equivalent.
- d) Wait for 24 hours for all gassing to stop.
- e) Replace plastic transport seals and return to store.

For batteries stored more than 12 months, at least one discharged/charged cycle as above should be carried out before the commissioning change begins.

## Discharge and empty

Cells discharge and empty can be stored for many years if kept under the correct conditions. They should be stored in a clean, dry, cool ( +10°C to 30°C ) and well ventilated storage space on open shelves. It is important that they are sealed with the transport seals firmly in place. These should be checked at least yearly, and if necessary replaced or refitted. Failure of the seal will result in ingress of carbon dioxide from the atmosphere, which will result in carbonation of plates. This can affect the capacity of the battery.

Storage of the battery at temperatures above +30°C can result in loss of capacity. This can be as much as 5% per 10°C above +30°C per year. Discharged and empty cells should be filled with electrolyte, and then the procedure for filled cells stored more than 1 year must be followed.

## Emplacement

The battery should be installed in a dry and clean location, away from direct sunlight, strong daylight and heat.

Block batteries can be fitted on to stands, floor-mounted or fitted into cabinets. The battery will give the best performance and maximum service life when the ambient temperature is between +10°C and + 35°C.

Local standards or codes normally define the mounting arrangements of batteries, and these must be followed, if applicable. However, if this is not the case, the following comments should be used as a guide. When mounting the battery, it is desirable to maintain an easy access to all blocks; they should be situated in a readily available position.

Distance between stands, and between stands and walls, should be sufficient to give good access to the battery.



## Example

A battery of 98 cells, type NBH 79 on a two step, two tier stand, is placed in a room of dimension 2m x 2m x 3m

The charging system is capable of charging at  $0.1C_5$  and so the charging current is 7.9 amperes.

The volume of hydrogen evolved per hour in this, the worst, case is:

$$\begin{aligned} &= 98 \times 7.9 \times 0.00045 \text{ m}^3 \\ &= 0.35 \text{ m}^3 \end{aligned}$$

The total volume of room is  $2 \times 2 \times 3 = 12 \text{ m}^3$

Approximate volume of battery and stand does not exceed  $1 \text{ m}^3$ , and so, the volume of free air in the room is  $11 \text{ m}^3$ .

Therefore, the concentration of hydrogen gas after charging for 1 hour at full gassing potential at  $0.1 C_5$  will be:  $= 0.35/11 = 3.2\%$

The overall weight of the battery must be considered and the load bearing on the floor taken into account in the selection of the battery accommodation. In case of doubt, please contact your representative for advice.

When mounting the battery, ensure that the cells are correctly interconnected with the appropriate polarity. The battery connection to load should be with nickel-plated cable lugs.

Recommended torque for connecting screws is:

- \* M6  $11 \pm 1.0 \text{ N.m}$
- \* M8  $20 \pm 2 \text{ N.m}$
- \* M10  $30 \pm 3 \text{ N.m}$

To avoid accelerated aging of the plastic due to UV-light, batteries with plastic cell containers should not be exposed to direct sunlight or strong daylight for a prolonged period.

If the battery is enclosed in a cabinet or other such enclosed space, it is important to provide sufficient space to disperse the gasses given off during charging, and also to minimize condensation. It is recommended that at least 200mm be allowed above cell tops, to ensure easy access during inspection and topping up, and that enough space is allowed between cabinet walls and the battery to avoid any risk of short circuits. Flip-top vents may be turned through 180° to achieve the most convenient position for topping-up.

## Ventilation

When the battery is housed in a cubicle or enclosed compartment, it is necessary to provide adequate ventilation.

During the last part of high-rate charging, the battery is emitting gases ( oxygen-hydrogen mixture ).

It is required to establish that the ventilation of the battery room is adequate, and it is necessary to calculate the rate of evolution of hydrogen to ensure that the concentration of hydrogen gas in the room is kept within safe limits.

The normally accepted safe limit for hydrogen is 4%. However, some standards call for more severe levels than this, and levels as low as 1% are sometimes required.

To calculate the ventilation requirements of a battery room, the following method can be used:

1 Ah of overcharge breaks down  $0.366 \text{ cm}^3$  of water, and  $1 \text{ cm}^3$  of water produces 1.865 liters of gas in the proportion 2/3 hydrogen and 1/3 oxygen. Thus 1 Ah of overcharge produces 0.45 liters of hydrogen.

Therefore, the volume of hydrogen evolved from a battery per hour

$$= \text{number of cells} \times \text{charge current} \times 0.45 \text{ liters or}$$

$$= \text{number of cells} \times \text{charge current} \times 0.00045 \text{ m}^3$$

The volume of hydrogen found by this calculation can be expressed as a percentage of the total volume of the battery room, and from this, the number of air changes required to keep the concentration of hydrogen below a certain level can be calculated.

Thus, to maintain a maximum concentration of 2%, the air in the room will need changing  $3.2 = 1.6$  times per hour.

A typical figure for natural room ventilation is about 2.5 air changes per hour, and so, in this case, it would not be necessary to introduce any forced ventilation. In a floating situation, the current flowing is very much lower than when the cell is being charged, and the gas evolution is minimal; it may be calculated in the same way using typical floating currents.

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