Nickel Cadmium Batteries

SINGLE CELL TYPE

NICA

NICA your long term partner for power back-up solutions

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.

NICA Single Cell battery

Versatile • Reliable • Secure

Reliability for backup power application

If primary power sources fail, NICA batteries enable your backup system to provide vital systems support to keep operations moving until primary power is restored or a controlled shutdown can be performed, including for:

- UPS (Uninterruptible Power Supply)
- switching and transmission
- emergency and security
- industrial fire monitors and alarms
- process control
- substation switchgear
- signaling

NICA battery use by most industry:

NICA Single Cell nickel-cadmium (Ni-Cd) batteries offer the versatility to industries where reliable performance is crucial, even under extreme operating conditions, for examples in :

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

Reliable starting applications:

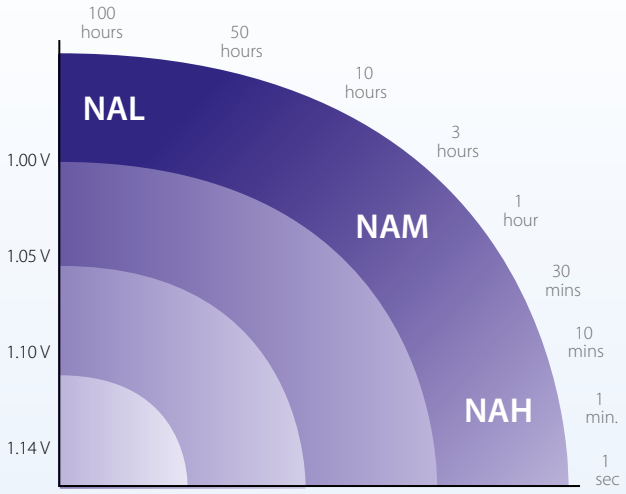
For generator starting or switching on heaters, pumps and other essential equipments in an emergency, NICA batteries can meet the specific need for high discharge, instant voltage recovery and reliable operation, even in extreme temperatures.

Complete range and high reliability performance

NICA Single Cell is available in low discharge rate (NAL type), medium discharge rate (NAM type), & high discharge rate (NAH type) and offers:

- Simple maintenance
- 20+ years life expectancy
- wide temperature range operations
- resistance to electrical abuse, shock and vibration
- low life cycle cost

From seconds to hours - every discharge need is covered



NICA has a Single Cell battery range to suit every discharge profile from 1 second to 100 hours

	NAL	NAM	NAH
Capacity steps	58	68	47
Capacity	10 - 375 Ah	9 - 335 Ah	9 - 210 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

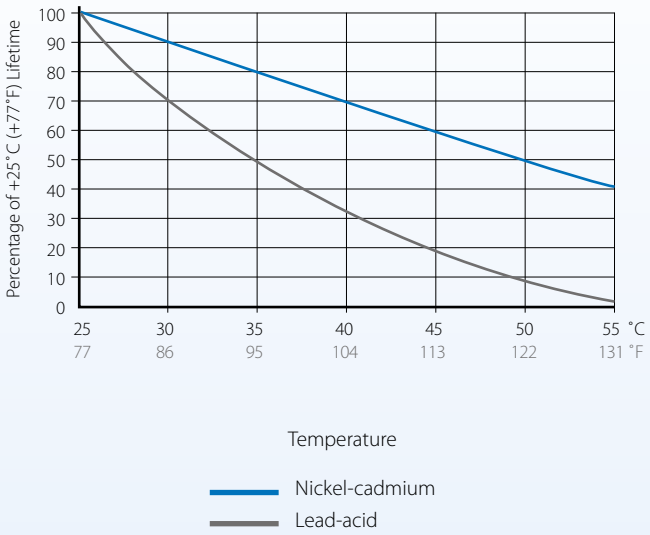
NICA Ni-Cd TECHNOLOGY

The proven advantages of a safe and robust design

NICA's robust Ni-Cd pocket plate technology is particularly well suited to the complex requirements of installations in difficult and demanding conditions, and in remote and inaccessible locations.

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

Effect of temperature on lifetime



NICA range enables the battery to size to the exact requirement to save cost

- Performance optimized for each application according to plate thickness.

  : **NAL range**
  - Thickest plates
  - High energy
  - Low cost per Ampere at low rates.

  : **NAM range**
  - Thinner plates
  - Medium power
  - Optimized between H and L design for mixed loads

  : **NAH range**
  - Thinnest plates
  - High power
  - Low cost per Ampere at high rates

- Optimized design boosts electrical performance by up to 10% depending on discharge time.

- More capacity steps than previous designs enables the battery to be sized more closely to exact requirements.

Single Cell Construction

- The steel pocket plate structure does not suffer from "sudden death" or internal corrosion since there is no interaction between the active material and the electrolyte.

- Tough polypropylene casing ensure 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 solution is available for extremely low temperature applications.

- A specially designed flame arresting flip top vent ensure the battery does not produce corrosive emissions.

- Single Cell batteries offer a long shelf life when stored under NICA's recommended conditions and are easy to install.

NICA Single Cell battery Design for durability and reliability

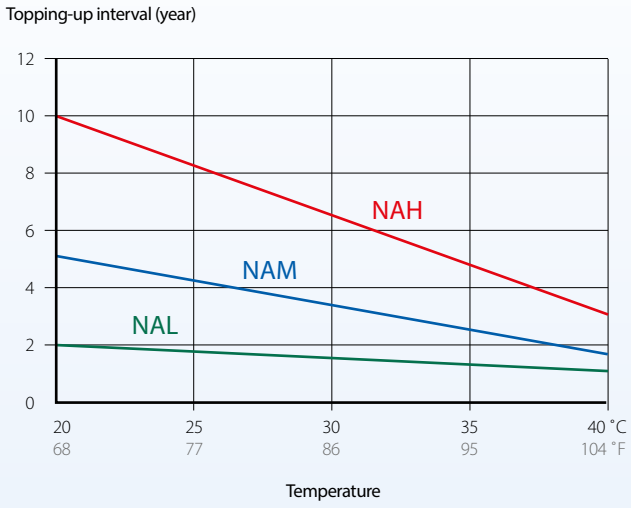
1. **Protective cover**
   In line with IEC 62485-2 / EN 50272-2 (safety) with IP2 level.
2. **Flame-arresting vents**
   Compliant with UL 1989 - Section 7 - Flame arrester vent cap tests.
3. **Plate group bus**
4. **Plate tab**
5. **Plate frame**
6. **Separating grids**
7. **Cell container**
8. **NICA pocket plate technology**

Note : NICA Single Cell ranges fully comply with the requirements of the IEC 60623 standard.

Design for lower maintenance and longer battery life

- 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 inspection is recommended to check correct functioning of the charging system, battery and the auxiliary 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 the recommended charge voltage



Higher chargeability to minimize down time

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

Recommended charging voltage:

a) **For two levels charge**:

- Float level :
  1.42 ± 0.01 V/cell for NAL
  1.40 ± 0.01 V/cell for NAM and NAH

- High level :
  1.47 - 1.70 V/cell for NAL
  1.45 - 1.70 V/cell for NAM and NAH
  A high voltage will increase the speed and efficiency of the recharging.

b) **For single level charge** :

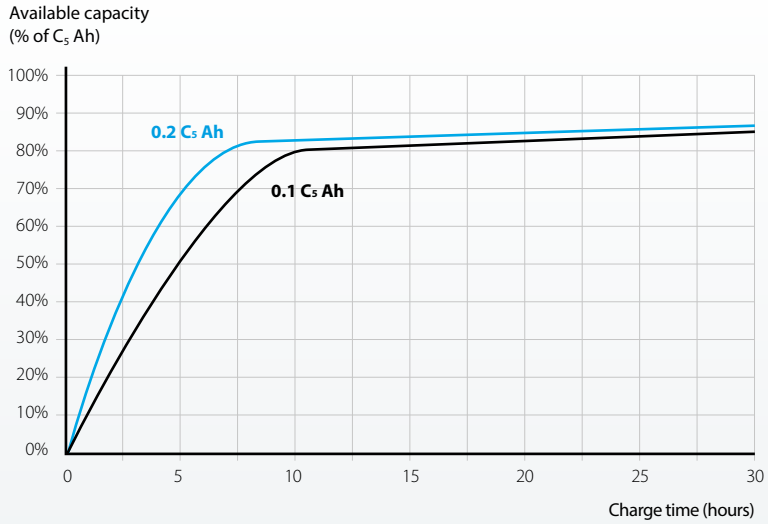
- 1.43 - 1.50 V/cell.

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

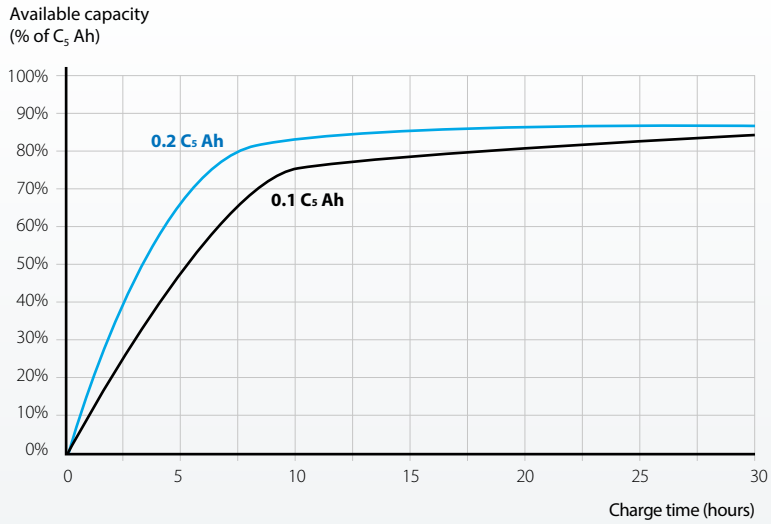
Constant current charging

- Normal charging: 0.2 C_5 Ah for 10 hrs.

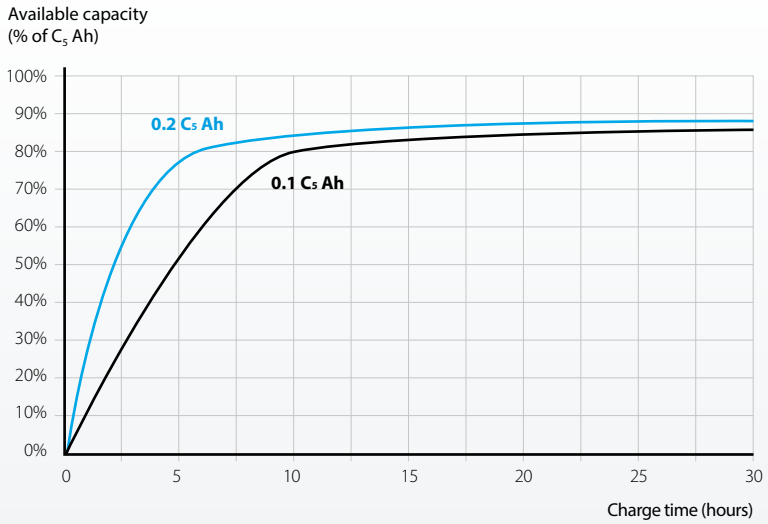
NAL Range - Available capacity after constant voltage charge at 1.42 V at +20˚C (+ 68˚F)



NAM Range - Available capacity after constant voltage charge at 1.40 V at +20˚C (+ 68˚F)



NAH Range - Available capacity after constant voltage charge at 1.40 V at +20˚C (+ 68˚F)



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
- ISO 14001
- IEC
- ROHS

Environment & recycling

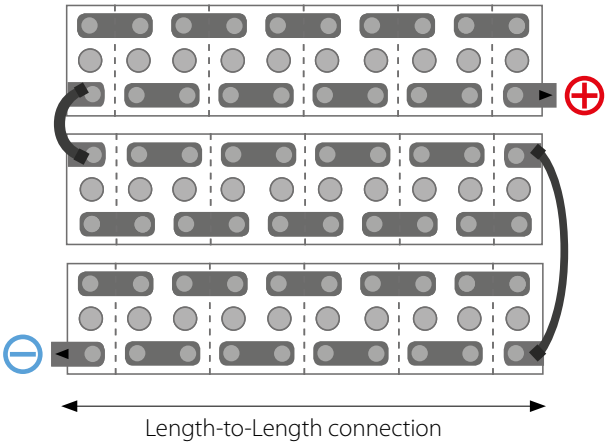
- Fully recyclable
- RoHS - Although batteries and accumulators are not within the scope of the RoHS directive, NICA has taken voluntary measures to make sure that the substances forbidden by RoHS are not present in the battery, with the exception of the electro- chemical core.
- REACH - NICA has adopted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

NICA battery range configuration

	Normal connection
NAL	NAL 10 → NAL 375
NAM	NAM 9 → NAM 335
NAH	NAH 9 → NAH 210

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.

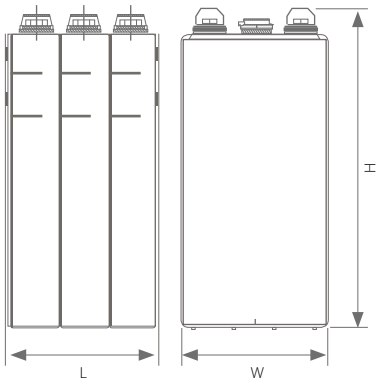


Dimensions

The dimensions of all available cell types are tabulated on the following pages.

Notes :

- All the tabulated dimensions are maximum values.
- All the cell height given in the tables include the height of the IP2X terminal cover.

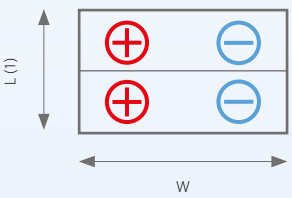


Position of terminals

Single cells, 1 pole bolt per pole

NAL 10 to NAL 280
NAM 9 to NAM 240
NAH 9 to NAH 155

Block of cells with single pole bolt



NAL 10 to NAL 375
NAM 250 to NAM 335
NAH 170 to NAH 210

NAL Range

NAL Range is designed for applications where the battery is required to provide reliable source or energy over relatively log discharge periods. Normally, the current is relatively low in comparison with the total stored energy and the discharges are generally infrequent. Typical uses are power backup and bulk energy storage.

Charging

The NAL type cells can be charged by all normal methods.

- Taper
- Constant Current
- Constant Voltage
- Pulse

The NAL type cells may be operated satisfactorily in any state of charge. For operating conditions other that fully charged.

Capacity

The rated capacity (C_5) of a cell is the capacity available in ampere hours (Ah) at the 5 hour discharge rate to an end voltage of 1.00 volts per cell.

Discharge Rate

The nominal discharge voltage is 1.2 volts per cell.

Constant Current Charging

Standard charge : $0.2C_5$ Amperes for 8 hours.

Fast charge : $0.4C_5$ Amperes for 2.5 hours followed by $0.2C_5$ Amperes for 2.5 hours.

Minimum charge : 2.0mA per Ah.

Constant Voltage Charging

Two levels charging

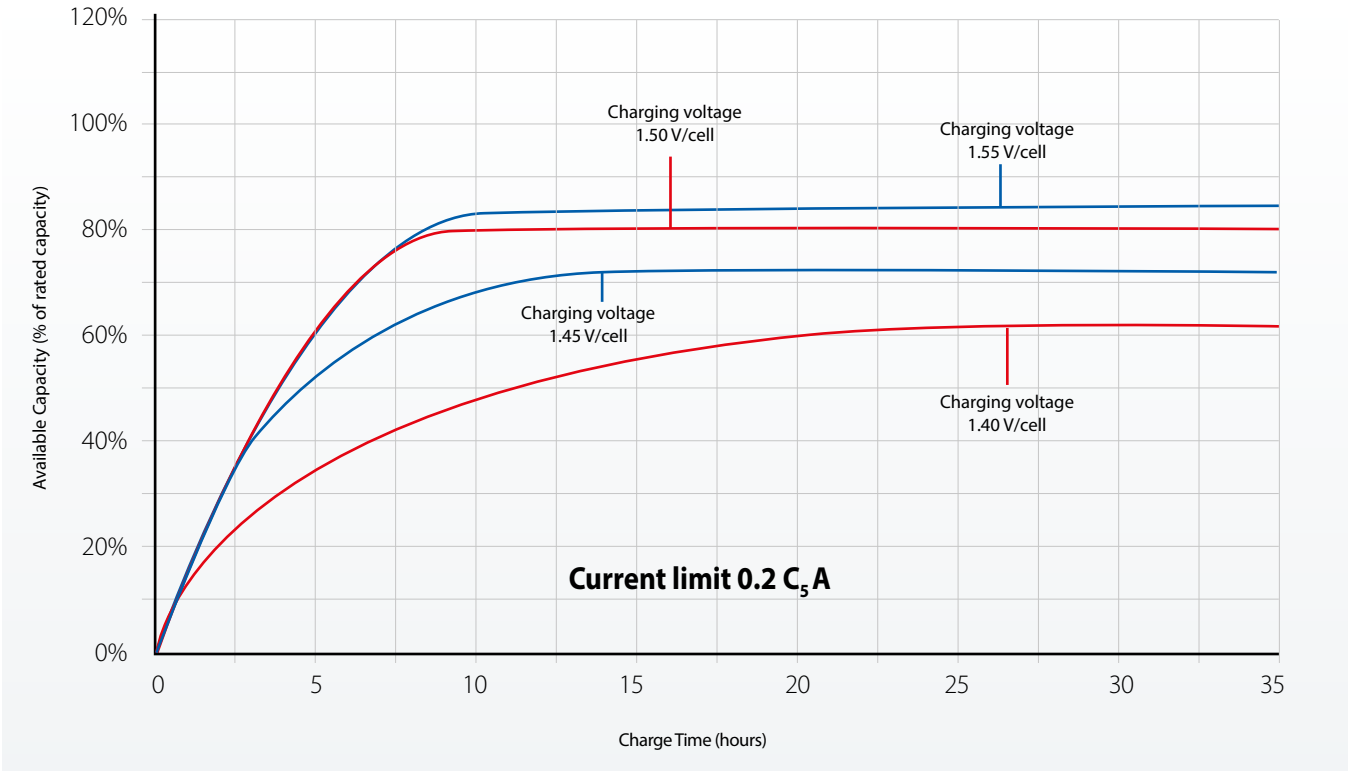
Float voltage : 1.42 V/cell.

Boost voltage : 1.47 - 1.70 V/cell.

Singel level charging
1.43 - 1.50 V/cell.

Cell Data

Short Circuit : Max 10 x C_5 Amps



Time to reach state-of-charging voltages for fully discharge NAL range

NAL Range Cell Performance

Capacities and dimensions

International System of units

Cell type	Capacity C_5 Ah	Overall Height*	Width per cell	Length per cell	Approx. Weight per cell	Approx. electrolyte volume between level marks	Electrolyte per cell		Internal resistance *	Cell connection bolt per pole
							Solid	Liquid		
	Ah	mm	mm	mm	Kg	cm^3	Kg	L	mOhm	
NAL 10	10	270	121	42	1.60	146	0.26	0.80	10.5	M 6
NAL 15	15	270	121	42	1.70	146	0.23	0.70	8.33	M 6
NAL 22	22	270	121	42	1.90	143	0.23	0.70	4.77	M 6
NAL 30	30	270	121	42	2.00	143	0.19	0.60	4.17	M 6
NAL 40	40	270	121	66	3.10	235	0.36	1.10	3.13	M 6
NAL 47	47	270	121	66	3.00	238	0.36	1.10	2.66	M 6
NAL 55	55	270	121	66	3.30	235	0.32	1.00	2.27	M 6
NAL 62	62	270	121	66	3.30	235	0.32	1.00	2.02	M 6
NAL 70	70	357	192	68	6.10	540	0.87	2.70	2.29	M 8
NAL 75	75	357	192	68	6.10	540	0.87	2.70	2.13	M 8
NAL 85	85	357	192	68	6.80	530	0.78	2.40	1.88	M 10
NAL 90	90	357	192	68	6.80	530	0.78	2.40	1.78	M 10
NAL 100	100	357	192	68	6.80	530	0.78	2.40	1.60	M 10
NAL 110	110	357	192	68	6.80	530	0.78	2.40	1.45	M 10
NAL 125	125	357	192	68	7.40	530	0.68	2.10	1.28	M 10
NAL 145	145	357	192	68	7.40	530	0.68	2.10	1.10	M 10
NAL 165	165	357	192	93	9.80	750	1.04	3.20	0.97	M 10
NAL 185	185	357	192	93	9.80	750	1.04	3.20	0.86	M 10
NAL 200	200	357	192	93	10.4	740	0.94	2.90	0.80	M 10
NAL 220	220	357	192	93	10.4	740	0.94	2.90	0.73	M 10
NAL 235	235	413	192	93	11.6	750	1.20	3.70	0.70	M 10
NAL 255	255	413	192	93	12.3	740	1.10	3.40	0.65	M 10
NAL 280	280	413	192	93	12.3	740	1.10	3.40	0.59	M 10
NAL 300	300	413	192	122	15.9	1000	1.56	4.80	0.55	2 x M 10
NAL 330	330	413	192	122	15.9	1000	1.56	4.80	0.50	2 x M 10
NAL 360	360	413	192	122	16.6	990	1.43	4.40	0.46	2 x M 10
NAL 375	375	413	192	122	16.6	990	1.43	4.40	0.44	2 x M 10

Capacities and dimensions

Imperial units

Cell type	Capacity C_5 Ah	Overall Height*	Width per cell	Length per cell	Approx. Weight per cell	Approx. electrolyte volume between level marks	Electrolyte per cell		Internal resistance *	Cell connection bolt per pole
							Solid	Liquid		
	Ah	in	in	in	lbs	in^3	lbs	US Gal.	mOhm	
NAL 10	10	10.6	4.76	1.65	3.53	8.91	0.57	0.21	10.5	M 6
NAL 15	15	10.6	4.76	1.65	3.75	8.91	0.50	0.18	8.33	M 6
NAL 22	22	10.6	4.76	1.65	4.19	8.73	0.50	0.18	4.77	M 6
NAL 30	30	10.6	4.76	1.65	4.41	8.73	0.43	0.16	4.17	M 6
NAL 40	40	10.6	4.76	2.60	6.83	14.3	0.79	0.29	3.13	M 6
NAL 47	47	10.6	4.76	2.60	6.61	14.5	0.79	0.29	2.66	M 6
NAL 55	55	10.6	4.76	2.60	7.28	14.3	0.71	0.26	2.27	M 6
NAL 62	62	10.6	4.76	2.60	7.28	14.3	0.71	0.26	2.02	M 6
NAL 70	70	14.1	7.56	2.68	13.4	33.0	1.93	0.71	2.29	M 8
NAL 75	75	14.1	7.56	2.68	13.4	33.0	1.93	0.71	2.13	M 8
NAL 85	85	14.1	7.56	2.68	15.0	32.3	1.71	0.63	1.88	M 10
NAL 90	90	14.1	7.56	2.68	15.0	32.3	1.71	0.63	1.78	M 10
NAL 100	100	14.1	7.56	2.68	15.0	32.3	1.71	0.63	1.60	M 10
NAL 110	110	14.1	7.56	2.68	15.0	32.3	1.71	0.63	1.45	M 10
NAL 125	125	14.1	7.56	2.68	16.3	32.3	1.50	0.55	1.28	M 10
NAL 145	145	14.1	7.56	2.68	16.3	32.3	1.50	0.55	1.10	M 10
NAL 165	165	14.1	7.56	3.66	21.6	45.8	2.29	0.85	0.97	M 10
NAL 185	185	14.1	7.56	3.66	21.6	45.8	2.29	0.85	0.86	M 10
NAL 200	200	14.1	7.56	3.66	22.9	45.2	2.07	0.77	0.80	M 10
NAL 220	220	14.1	7.56	3.66	22.9	45.2	2.07	0.77	0.73	M 10
NAL 235	235	16.3	7.56	3.66	25.6	45.8	2.64	0.98	0.70	M 10
NAL 255	255	16.3	7.56	3.66	27.1	45.2	2.43	0.90	0.65	M 10
NAL 280	280	16.3	7.56	3.66	27.1	45.2	2.43	0.90	0.59	M 10
NAL 300	300	16.3	7.56	4.80	35.1	61.0	3.43	1.27	0.55	2 x M 10
NAL 330	330	16.3	7.56	4.80	35.1	61.0	3.43	1.27	0.50	2 x M 10
NAL 360	360	16.3	7.56	4.80	36.6	60.4	3.14	1.16	0.46	2 x M 10
NAL 375	375	16.3	7.56	4.80	36.6	60.4	3.14	1.16	0.44	2 x M 10

** Height includes the IP2X terminal cover.*

NAL Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.00V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAL 10	10	1.03	1.27	2.00	3.23	4.37	5.44	6.96	8.50	9.53	10.2	11.2	13.9	16.5	18.3	20.7	21.2
NAL 15	15	1.54	1.91	3.00	4.80	6.45	8.00	10.6	14.2	16.0	17.4	18.7	23.7	26.8	29.7	38.3	43.1
NAL 22	22	2.26	2.81	4.40	7.04	9.50	11.7	15.5	20.8	23.5	25.5	27.4	34.7	39.3	43.6	56.1	63.3
NAL 30	30	3.08	3.83	6.00	9.60	12.9	16.0	21.2	28.4	32.1	34.8	37.4	47.3	53.6	59.5	76.5	86.3
NAL 40	40	4.10	5.10	8.00	12.8	17.2	21.3	28.3	37.8	42.8	46.4	49.9	63.1	71.4	79.3	102	115
NAL 47	47	4.82	5.99	9.40	15.0	20.2	25.1	33.2	44.5	50.3	54.5	58.6	74.1	83.9	93.2	120	135
NAL 55	55	5.64	7.01	11.0	17.6	23.6	29.3	38.9	52.0	58.8	63.8	68.6	86.7	98.2	109	140	158
NAL 62	62	6.36	7.91	12.4	19.8	26.6	33.0	43.8	58.7	66.3	71.9	77.4	97.8	111	123	158	178
NAL 70	70	7.07	8.84	14.0	22.4	30.4	36.9	47.5	60.7	68.6	72.8	76.9	92.4	105	113	144	160
NAL 75	75	7.58	9.47	15.0	24.0	32.6	39.6	50.9	65.1	73.5	78.0	82.3	99.0	113	121	154	171
NAL 85	85	8.59	10.7	17.0	27.2	36.9	44.8	57.7	73.8	83.2	88.4	93.3	112	128	137	175	194
NAL 90	90	9.10	11.4	18.0	28.8	39.1	47.5	61.1	78.1	88.1	93.6	98.8	119	136	145	185	205
NAL 100	100	10.1	12.6	20.0	32.0	43.4	52.8	67.9	86.8	97.9	104	110	132	151	161	205	228
NAL 110	110	11.1	13.9	22.0	35.2	47.8	58.0	74.7	95.5	108	114	121	145	166	177	226	251
NAL 125	125	12.6	15.8	25.0	40.0	54.3	66.0	84.9	108	122	130	137	165	188	202	257	285
NAL 145	145	14.7	18.3	29.0	46.4	63.0	76.5	98.5	126	142	151	159	191	218	234	298	331
NAL 165	165	16.7	20.8	33.0	52.8	71.7	87.1	112	143	162	172	181	218	249	266	339	376
NAL 185	185	18.7	23.4	37.0	59.2	80.4	97.6	126	161	181	192	203	244	279	298	380	422
NAL 200	200	20.2	25.3	40.0	64.0	86.9	106	136	174	196	208	220	264	301	323	411	456
NAL 220	220	22.2	27.8	44.0	70.4	95.6	116	149	191	215	229	242	290	331	355	452	502
NAL 235	235	24.2	29.9	47.0	75.2	100	121	155	200	224	240	258	296	329	353	423	455
NAL 255	255	26.3	32.5	51.0	81.6	109	131	168	217	243	261	280	322	357	383	459	493
NAL 280	280	28.9	35.7	56.0	89.6	120	144	184	238	267	286	308	353	392	420	504	542
NAL 300	300	30.9	38.2	60.0	96.0	128	154	198	255	286	307	330	378	420	450	540	580
NAL 330	330	34.0	42.0	66.0	106	141	170	217	280	314	338	363	416	462	495	594	638
NAL 360	360	37.1	45.9	72.0	115	154	185	237	306	343	368	396	454	504	540	648	697
NAL 375	375	38.6	47.8	75.0	120	160	193	247	319	357	384	412	473	525	563	675	726

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.05V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAL 10	10	1.03	1.27	1.99	2.89	3.99	4.79	5.86	7.52	8.44	9.09	10.0	11.1	13.7	14.8	17.1	17.7
NAL 15	15	1.53	1.89	2.94	4.65	5.78	6.87	8.98	12.1	14.1	15.2	16.8	17.1	21.6	24.3	31.7	35.6
NAL 22	22	2.24	2.78	4.31	6.82	8.48	10.1	13.2	17.7	20.7	22.3	24.6	25.0	31.7	35.6	46.4	52.3
NAL 30	30	3.06	3.79	5.88	9.30	11.6	13.7	18.0	24.1	28.2	30.3	33.6	34.1	43.2	48.5	63.3	71.3
NAL 40	40	4.08	5.05	7.84	12.4	15.4	18.3	23.9	32.2	37.6	40.5	44.8	45.5	57.6	64.7	84.4	95.0
NAL 47	47	4.79	5.93	9.21	14.6	18.1	21.5	28.1	37.8	44.1	47.5	52.6	53.5	67.7	76.0	99.2	112
NAL 55	55	5.61	6.94	10.8	17.1	21.2	25.2	32.9	44.2	51.7	55.6	61.6	62.6	79.2	89.0	116	131
NAL 62	62	6.32	7.83	12.2	19.2	23.9	28.4	37.1	49.9	58.2	62.7	69.4	70.5	89.3	100	131	147
NAL 70	70	7.00	8.75	13.7	21.9	26.9	31.6	39.2	51.4	58.4	62.4	67.7	73.0	84.7	93.3	119	131
NAL 75	75	7.50	9.38	14.7	23.5	28.8	33.9	42.0	55.1	62.6	66.9	72.5	78.2	90.7	100	127	140
NAL 85	85	8.50	10.6	16.7	26.6	32.6	38.4	47.5	62.4	71.0	75.8	82.2	88.6	103	113	144	159
NAL 90	90	9.00	11.3	17.6	28.2	34.6	40.6	50.3	66.1	75.1	80.2	87.0	93.8	109	120	152	168
NAL 100	100	10.0	12.5	19.6	31.3	38.4	45.1	55.9	73.4	83.48	89.2	96.7	104	121	133	169	187
NAL 110	110	11.0	13.8	21.6	34.5	42.2	49.7	61.5	80.8	91.83	98.1	106	115	133	147	186	205
NAL 125	125	12.5	15.6	24.5	39.2	48.0	56.4	69.9	91.8	104	111	121	130	151	167	212	233
NAL 145	145	14.5	18.1	28.4	45.4	55.7	65.4	81.1	106	121	129	140	151	175	193	246	271
NAL 165	165	16.5	20.6	32.3	51.7	63.4	74.5	92.3	121	138	147	160	172	200	220	279	308
NAL 185	185	18.5	23.1	36.3	58.0	71.0	83.5	103	136	154	165	179	193	224	247	313	345
NAL 200	200	20.0	25.0	39.2	62.7	76.8	90.3	112	147	167	178	193	209	242	267	339	373
NAL 220	220	22.0	27.5	43.1	68.9	84.5	99.3	123	162	184	196	213	229	266	293	373	411
NAL 235	235	24.0	29.8	46.5	72.9	90.9	104	129	169	187	194	215	245	265	289	347	377
NAL 255	255	26.1	32.4	50.4	79.1	98.7	113	141	183	202	210	233	266	287	314	377	409
NAL 280	280	28.6	35.5	55.4	86.8	108	124	154	201	222	231	256	292	315	345	414	449
NAL 300	300	30.7	38.1	59.3	93.0	116	132	165	216	238	247	274	313	338	369	443	481
NAL 330	330	33.7	41.9	65.3	102	128	146	182	237	262	272	302	345	372	406	488	529
NAL 360	360	36.8	45.7	71.2	112	139	159	198	259	286	297	329	376	405	443	532	578
NAL 375	375	38.3	47.6	74.2	116	145	166	207	269	298	309	343	392	422	461	554	602

NAL Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.10V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAL 10	10	1.00	1.20	1.75	2.80	3.63	4.24	4.79	6.26	7.03	7.54	8.19	9.49	11.1	12.1	13.5	13.9
NAL 15	15	1.50	1.84	2.82	4.01	5.11	6.09	7.19	9.6	10.7	11.4	12.8	15.1	17.4	20.0	26.2	29.7
NAL 22	22	2.20	2.70	4.14	5.89	7.49	8.94	10.5	14.2	15.7	16.8	18.7	22.1	25.6	29.4	38.4	43.6
NAL 30	30	3.00	3.68	5.65	8.03	10.2	12.2	14.4	19.3	21.5	22.9	25.5	30.1	34.9	40.1	52.4	59.5
NAL 40	40	4.00	4.90	7.53	10.7	13.6	16.2	19.2	25.7	28.6	30.5	34.0	40.2	46.5	53.4	69.8	79.3
NAL 47	47	4.70	5.76	8.85	12.6	16.0	19.1	22.5	30.2	33.6	35.8	40.0	47.2	54.6	62.7	82.0	93.2
NAL 55	55	5.50	6.74	10.4	14.7	18.7	22.3	26.4	35.4	39.4	41.9	46.8	55.3	63.9	73.4	96.0	109
NAL 62	62	6.20	7.60	11.7	16.6	21.1	25.2	29.7	39.9	44.4	47.3	52.8	62.3	72.1	82.8	108	123
NAL 70	70	6.93	8.49	13.1	18.7	23.6	27.7	32.4	41.5	45.7	46.4	51.1	60.3	68.5	76.6	96	107
NAL 75	75	7.43	9.10	14.0	20.0	25.3	29.7	34.7	44.4	49.0	49.7	54.7	64.6	73.4	82.1	103	115
NAL 85	85	8.42	10.3	15.9	22.7	28.6	33.6	39.3	50.4	55.5	56.3	62.0	73.2	83.2	93.0	117	130
NAL 90	90	8.92	10.9	16.8	24.0	30.3	35.6	41.6	53.3	58.8	59.6	65.7	77.5	88.1	98.5	124	138
NAL 100	100	9.91	12.1	18.7	26.7	33.7	39.5	46.3	59.2	65.3	66.3	73.0	86.1	97.9	109	137	153
NAL 110	110	10.9	13.3	20.5	29.3	37.0	43.5	50.9	65.2	71.8	72.9	80.3	94.7	108	120	151	169
NAL 125	125	12.4	15.2	23.3	33.3	42.1	49.4	57.8	74.1	81.6	82.8	91.2	108	122	137	172	192
NAL 145	145	14.4	17.6	27.1	38.7	48.8	57.3	67.1	85.9	94.7	96.1	106	125	142	159	199	222
NAL 165	165	16.3	20.0	30.8	44.0	55.6	65.2	76.3	97.8	108	109	120	142	161	181	227	253
NAL 185	185	18.3	22.4	34.5	49.3	62.3	73.1	85.6	110	121	123	135	159	181	203	254	284
NAL 200	200	19.8	24.3	37.3	53.3	67.4	79.1	92.5	118	131	133	146	172	196	219	275	307
NAL 220	220	21.8	26.7	41.1	58.7	74.1	87.0	102	130	144	146	161	189	215	241	302	337
NAL 235	235	23.5	28.8	44.2	61.3	77.0	88.7	105	131	142	156	171	180	216	235	286	314
NAL 255	255	25.5	31.3	48.0	66.5	83.5	96.3	114	143	154	169	186	195	234	255	310	340
NAL 280	280	28.0	34.3	52.7	73.0	91.7	106	125	157	169	186	204	215	257	280	341	374
NAL 300	300	30.0	36.8	56.5	78.3	98.3	113	134	168	181	199	219	230	275	300	365	400
NAL 330	330	33.0	40.5	62.1	86.1	108	125	147	185	199	219	241	253	303	330	402	440
NAL 360	360	36.0	44.1	67.8	93.9	118	136	160	201	218	239	263	276	330	360	438	481
NAL 375	375	37.5	46.0	70.6	97.8	123	142	167	210	227	249	274	287	344	375	457	501

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.14V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAL 10	10	0.99	1.15	1.53	2.54	3.16	3.49	3.94	5.05	5.69	6.00	6.68	8.03	9.01	9.61	11.3	11.6
NAL 15	15	1.47	1.73	2.48	3.53	4.38	4.92	5.91	7.58	8.53	9.18	9.66	11.0	14.3	16.5	21.6	24.8
NAL 22	22	2.16	2.54	3.64	5.17	6.42	7.21	8.67	11.1	12.5	13.5	14.2	16.2	20.9	24.2	31.7	36.4
NAL 30	30	2.94	3.46	4.97	7.05	8.76	9.83	11.8	15.2	17.1	18.4	19.3	22.1	28.5	33.0	43.3	49.6
NAL 40	40	3.92	4.61	6.62	9.40	11.7	13.1	15.8	20.2	22.8	24.5	25.8	29.4	38.0	44.0	57.7	66.1
NAL 47	47	4.61	5.42	7.78	11.0	13.7	15.4	18.5	23.7	26.7	28.8	30.3	34.6	44.7	51.7	67.8	77.7
NAL 55	55	5.39	6.34	9.10	12.9	16.1	18.0	21.7	27.8	31.3	33.7	35.4	40.5	52.3	60.5	79.3	90.9
NAL 62	62	6.08	7.15	10.3	14.6	18.1	20.3	24.4	31.3	35.3	37.9	39.9	45.6	58.9	68.2	89.4	102
NAL 70	70	6.72	7.90	11.5	16.1	19.8	22.1	25.4	32.0	36.5	36.6	41.9	45.1	56.0	62.0	79.4	89.6
NAL 75	75	7.20	8.46	12.3	17.2	21.3	23.7	27.2	34.3	39.1	39.3	44.9	48.3	60.0	66.4	85.1	96.0
NAL 85	85	8.16	9.59	13.9	19.5	24.1	26.9	30.8	38.9	44.3	44.5	50.8	54.8	68.0	75.3	96.4	109
NAL 90	90	8.64	10.2	14.8	20.6	25.5	28.5	32.6	41.2	46.9	47.1	53.8	58.0	72.0	79.7	102	115
NAL 100	100	9.60	11.3	16.4	22.9	28.4	31.6	36.3	45.8	52.2	52.3	59.8	64.4	80.0	88.5	113	128
NAL 110	110	10.6	12.4	18.0	25.2	31.2	34.8	39.9	50.4	57.4	57.6	65.8	70.9	88.0	97.4	125	141
NAL 125	125	12.0	14.1	20.5	28.7	35.4	39.6	45.3	57.2	65.2	65.4	74.8	80.5	100	111	142	160
NAL 145	145	13.9	16.4	23.8	33.3	41.1	45.9	52.6	66.4	75.6	75.9	86.7	93.4	116	128	165	186
NAL 165	165	15.8	18.6	27.1	37.8	46.8	52.2	59.9	75.5	86.1	86.4	98.7	106	132	146	187	211
NAL 185	185	17.8	20.9	30.3	42.4	52.5	58.5	67.1	84.7	96.5	96.8	111	119	148	164	210	237
NAL 200	200	19.2	22.6	32.8	45.9	56.7	63.3	72.5	91.6	104	105	120	129	160	177	227	256
NAL 220	220	21.1	24.8	36.1	50.5	62.4	69.6	79.8	101	115	115	132	142	176	195	250	282
NAL 235	235	23.0	27.1	38.9	53.1	63.7	70.6	81.4	104	111	116	130	151	176	192	239	265
NAL 255	255	24.9	29.4	42.2	57.7	69.2	76.6	88.3	113	121	125	141	164	191	208	259	287
NAL 280	280	27.4	32.3	46.4	63.3	75.9	84.1	97.0	124	133	138	155	180	209	229	285	315
NAL 300	300	29.3	34.6	49.7	67.8	81.4	90.1	104	133	142	148	166	193	224	245	305	338
NAL 330	330	32.3	38.0	54.7	74.6	89.5	99.1	114	146	156	162	183	212	247	270	336	372
NAL 360	360	35.2	41.5	59.6	81.4	97.6	108	125	159	171	177	199	232	269	294	366	405
NAL 375	375	36.7	43.2	62.1	84.8	102	113	130	166	178	184	208	241	280	307	382	422

NAM Range

NAM Range is designed for applications where the batteries are usually required to sustain electrical loads for between 30 minutes to 3 hours for <<mixed>> loads which involve a mixture of high and low discharge rates. The application can have frequent or infrequent discharges. The range is typically used in power back up applications

Charging

The NAM type cells can be charged by all normal methods.

- Taper
- Constant Current
- Constant Voltage
- Pulse

The NAM type cells may be operated satisfactorily in any state of charge. For operating conditions other that fully charged.

Capacity

The rated capacity (C_5) of a cell is the capacity available in ampere hours (Ah) at the 5 hour discharge rate to an end voltage of 1.00 volts per cell.

Discharge Rate

The nominal discharge voltage is 1.2 volts per cell.

Constant Current Charging

Standard charge : $0.2C_5$ Amperes for 8 hours.

Fast charge : $0.4C_5$ Amperes for 2.5 hours followed by $0.2C_5$ Amperes for 2.5 hours.

Minimum charge : 2.0mA per Ah.

Constant Voltage Charging

Two levels charging

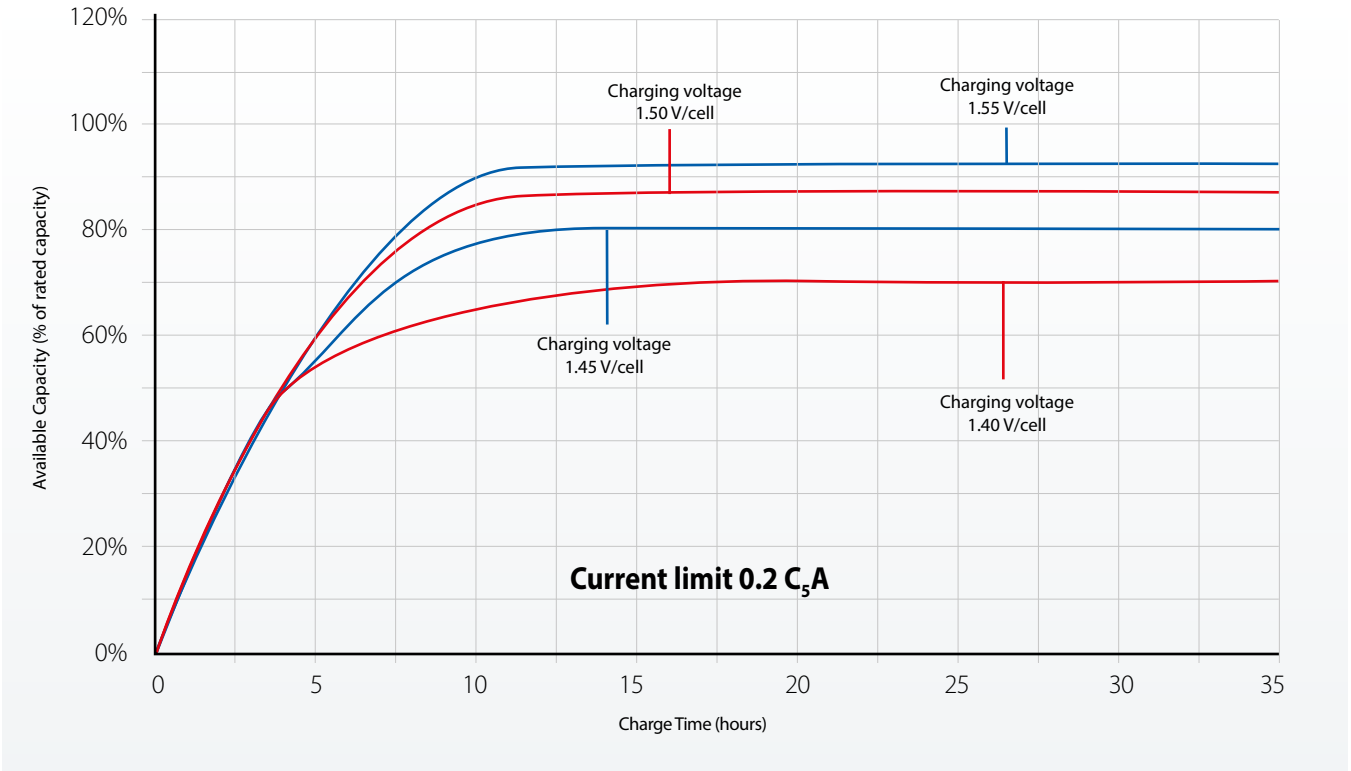
Float voltage : 1.40 V/cell.

Boost voltage : 1.45 - 1.70 V/cell.

Singel level charging
1.43 - 1.50 V/cell.

Cell Data

Short Circuit : Max 15 x C_5 Amps



Time to reach state-of-charging voltages for fully discharge NAM range

NAM Range Cell Performance

Capacities and dimensions

International System of units

Cell type	Capacity C_5 Ah	Overall Height*	Width per cell	Length per cell	Approx. Weight per cell	Approx. electrolyte volume between level marks	Electrolyte per cell		Internal resistance *	Cell connection bolt per pole
							Solid	Liquid		
	Ah	mm	mm	mm	Kg	cm^3	Kg	L	mOhm	
NAM 9	9	270	121	42	1.60	146	0.26	0.80	6.89	M 6
NAM 14	14	270	121	42	1.70	146	0.19	0.60	4.43	M 6
NAM 22	22	270	121	42	1.90	143	0.19	0.60	2.82	M 6
NAM 31	31	270	121	42	2.10	140	0.19	0.60	2.00	M 6
NAM 39	39	270	121	66	3.10	235	0.36	1.10	1.59	M 6
NAM 47	47	270	121	66	3.30	232	0.32	1.00	1.32	M 6
NAM 50	50	270	121	66	3.50	230	0.29	0.90	1.24	M 6
NAM 55	55	270	121	66	3.50	230	0.29	0.90	1.13	M 6
NAM 60	60	357	192	68	6.30	530	0.84	2.60	1.30	M 8
NAM 70	70	357	192	68	6.40	530	0.84	2.60	1.11	M 8
NAM 80	80	357	192	68	6.90	530	0.81	2.50	0.98	M 8
NAM 90	90	357	192	68	6.90	530	0.81	2.50	0.87	M 8
NAM 100	100	357	192	68	7.40	520	0.75	2.30	0.78	M 8
NAM 110	110	357	192	68	7.40	520	0.75	2.30	0.71	M 10
NAM 115	115	357	192	68	7.90	510	0.68	2.10	0.68	M 10
NAM 130	130	357	192	68	7.90	510	0.68	2.10	0.60	M 10
NAM 140	140	357	192	93	10.1	740	1.04	3.20	0.56	M 10
NAM 145	145	357	192	93	10.1	740	1.04	3.20	0.54	M 10
NAM 150	150	357	192	93	10.1	740	1.04	3.20	0.52	M 10
NAM 165	165	357	192	93	10.6	730	1.00	3.10	0.47	M 10
NAM 185	185	357	192	93	11.0	720	0.94	2.90	0.42	M 10
NAM 190	190	413	192	93	11.9	740	1.23	3.80	0.45	M 10
NAM 200	200	413	192	93	12.5	730	1.17	3.60	0.43	M 10
NAM 215	215	413	192	93	12.5	730	1.17	3.60	0.40	M 10
NAM 220	220	413	192	93	13.0	720	1.07	3.30	0.39	M 10
NAM 240	240	413	192	93	13.0	720	1.07	3.30	0.36	M 10
NAM 250	250	413	192	122	16.5	980	1.56	4.80	0.34	2 x M 10
NAM 260	260	413	192	122	16.5	980	1.56	4.80	0.33	2 x M 10
NAM 285	285	413	192	122	16.5	980	1.56	4.80	0.30	2 x M 10
NAM 310	310	413	192	122	17.1	970	1.49	4.60	0.28	2 x M 10
NAM 335	335	413	192	122	17.6	970	1.43	4.40	0.26	2 x M 10

Capacities and dimensions

Imperial units

Cell type	Capacity C_5 Ah	Overall Height*	Width per cell	Length per cell	Approx. Weight per cell	Approx. electrolyte volume between level marks	Electrolyte per cell		Internal resistance *	Cell connection bolt per pole
							Solid	Liquid		
	Ah	in	in	in	lbs	in^3	lbs	US Gal.	mOhm	
NAM 9	9	11	4.8	2	3.53	8.91	0.57	0.21	6.89	M 6
NAM 14	14	11	4.8	2	3.75	8.91	0.43	0.16	4.43	M 6
NAM 22	22	11	4.8	2	4.19	8.73	0.43	0.16	2.82	M 6
NAM 31	31	11	4.8	2	4.63	8.54	0.43	0.16	2.00	M 6
NAM 39	39	11	4.8	3	6.83	14.3	0.79	0.29	1.59	M 6
NAM 47	47	11	4.8	3	7.28	14.2	0.71	0.26	1.32	M 6
NAM 50	50	11	4.8	3	7.72	14.0	0.64	0.24	1.24	M 6
NAM 55	55	11	4.8	3	7.72	14.0	0.64	0.24	1.13	M 6
NAM 60	60	14	7.6	3	13.9	32.3	1.86	0.69	1.30	M 8
NAM 70	70	14	7.6	3	14.1	32.3	1.86	0.69	1.11	M 8
NAM 80	80	14	7.6	3	15.2	32.3	1.79	0.66	0.98	M 8
NAM 90	90	14	7.6	3	15.2	32.3	1.79	0.66	0.87	M 8
NAM 100	100	14	7.6	3	16.3	31.7	1.64	0.61	0.78	M 8
NAM 110	110	14	7.6	3	16.3	31.7	1.64	0.61	0.71	M 10
NAM 115	115	14	7.6	3	17.4	31.1	1.50	0.55	0.68	M 10
NAM 130	130	14	7.6	3	17.4	31.1	1.50	0.55	0.60	M 10
NAM 140	140	14	7.6	4	22.3	45.2	2.29	0.85	0.56	M 10
NAM 145	145	14	7.6	4	22.3	45.2	2.29	0.85	0.54	M 10
NAM 150	150	14	7.6	4	22.3	45.2	2.29	0.85	0.52	M 10
NAM 165	165	14	7.6	4	23.4	44.5	2.21	0.82	0.47	M 10
NAM 185	185	14	7.6	4	24.3	43.9	2.07	0.77	0.42	M 10
NAM 190	190	16	7.6	4	26.2	45.2	2.71	1.00	0.45	M 10
NAM 200	200	16	7.6	4	27.6	44.5	2.57	0.95	0.43	M 10
NAM 215	215	16	7.6	4	27.6	44.5	2.57	0.95	0.40	M 10
NAM 220	220	16	7.6	4	28.7	43.9	2.36	0.87	0.39	M 10
NAM 240	240	16	7.6	4	28.7	43.9	2.36	0.87	0.36	M 10
NAM 250	250	16	7.6	5	36.4	59.8	3.43	1.27	0.34	2 x M 10
NAM 260	260	16	7.6	5	36.4	59.8	3.43	1.27	0.33	2 x M 10
NAM 285	285	16	7.6	5	36.4	59.8	3.43	1.27	0.30	2 x M 10
NAM 310	310	16	7.6	5	37.7	59.2	3.29	1.22	0.28	2 x M 10
NAM 335	335	16	7.6	5	38.8	59.2	3.14	1.16	0.26	2 x M 10

** Height includes the IP2X terminal cover.*

NAM Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.00V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAM 9	9	0.91	1.13	1.80	2.95	4.28	5.29	7.38	9.52	11.1	12.1	13.9	16.8	24.1	27.6	34.8	38.3
NAM 14	14	1.42	1.76	2.80	4.58	6.66	8.23	11.5	14.8	17.3	18.9	21.6	26.1	37.5	43.0	54.1	59.6
NAM 22	22	2.23	2.77	4.40	7.19	10.5	13.0	18.2	23.7	27.6	29.8	34.0	40.4	55.7	63.1	75.5	80.2
NAM 31	31	3.14	3.91	6.20	10.1	14.8	18.3	25.7	33.3	38.8	41.9	47.9	56.9	78.5	88.9	106	113
NAM 39	39	3.95	4.91	7.80	12.8	18.6	23.0	32.3	41.9	48.9	52.8	60.2	71.56	98.8	112	134	142
NAM 47	47	4.76	5.92	9.40	15.4	22.4	27.8	39.0	50.5	58.9	63.6	72.6	86.24	119	135	161	171
NAM 50	50	5.07	6.30	10.0	16.4	23.8	29.5	41.5	53.8	62.6	67.6	77.2	91.74	127	143	172	182
NAM 55	55	5.57	6.93	11.0	18.0	26.2	32.5	45.6	59.1	68.9	74.4	85.0	101	139	158	189	200
NAM 60	60	6.09	7.56	12.0	19.7	28.7	35.6	50.4	68.7	79.9	86.9	99.3	118	162	183	223	237
NAM 70	70	7.11	8.82	14.0	22.9	33.5	41.6	58.7	80.2	93.2	101	116	138	189	214	260	277
NAM 80	80	8.12	10.1	16.0	26.2	38.3	47.5	67.1	91.6	106	116	132	157	216	244	297	317
NAM 90	90	9.14	11.3	18.0	29.5	43.1	53.5	75.53	103	120	130	149	177	243	275	334	356
NAM 100	100	10.2	12.6	20.0	32.8	47.8	59.4	83.9	115	133	145	165	197	270	306	371	396
NAM 110	110	11.2	13.9	22.0	36.0	52.6	65.4	92.3	126	147	159	182	216	297	336	408	435
NAM 115	115	11.7	14.5	23.0	37.7	55.0	68.3	96.5	132	153	167	190	226	310	351	427	455
NAM 130	130	13.2	16.4	26.0	42.6	62.2	77.2	109	149	173	188	215	256	351	397	482	515
NAM 140	140	14.2	17.6	28.0	45.9	67.0	83.2	117	160	186	203	232	275	378	428	520	554
NAM 145	145	14.7	18.3	29.0	47.5	69.4	86.2	122	166	193	210	240	285	391	443	538	574
NAM 150	150	15.2	18.9	30.0	49.2	71.8	89.1	126	172	200	217	248	295	404	458	557	594
NAM 165	165	16.8	20.8	33.0	54.1	78.9	98.0	138	189	220	239	273	325	445	504	612	653
NAM 185	185	18.8	23.3	37.0	60.6	88.5	110	155	212	246	268	306	364	499	565	686	732
NAM 190	190	19.3	23.9	38.0	62.1	90.8	113	159	217	251	272	310	365	492	550	656	694
NAM 200	200	20.4	25.2	40.0	65.4	95.5	119	168	228	264	286	326	384	518	579	691	731
NAM 215	215	21.9	27.1	43.0	70.3	103	128	180	245	284	307	351	413	557	622	742	786
NAM 220	220	22.4	27.7	44.0	71.9	105	131	185	251	291	314	359	422	570	636	760	804
NAM 240	240	24.4	30.2	48.0	78.4	115	143	201	274	317	343	391	461	622	694	829	877
NAM 250	250	25.4	31.5	50.0	81.7	119	149	210	285	331	357	408	480	648	723	863	913
NAM 260	260	26.5	32.7	52.0	85.0	124	155	218	297	344	372	424	499	674	752	898	950
NAM 285	285	29.0	35.9	57.0	93.1	136	169	239	325	377	407	465	547	739	824	984	1041
NAM 310	310	31.6	39.0	62.0	101	148	184	260	354	410	443	505	595	803	897	1070	1133
NAM 335	335	34.1	42.2	67.0	109	160	199	281	382	443	479	546	643	868	969	1157	1224

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.05V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAM 9	9	0.91	1.13	1.78	2.90	4.01	5.06	6.47	8.11	9.65	10.6	11.7	14.0	20.8	23.9	29.4	31.8
NAM 14	14	1.41	1.75	2.77	4.51	6.23	7.87	10.1	12.6	15.0	16.4	18.3	21.8	32.3	37.2	45.8	49.5
NAM 22	22	2.21	2.75	4.36	7.08	9.9	12.5	16.0	20.1	23.8	26.0	28.6	33.4	47.5	53.9	63.9	69.1
NAM 31	31	3.12	3.88	6.14	10.0	13.9	17.6	22.6	28.4	33.5	36.6	40.4	47.1	66.9	76.0	90.0	97.3
NAM 39	39	3.93	4.88	7.72	12.6	17.5	22.1	28.4	35.7	42.1	46.1	50.8	59.3	84.2	95.6	113	122
NAM 47	47	4.73	5.88	9.31	15.1	21.0	26.6	34.2	43.0	50.8	55.5	61.2	71.5	101	115	137	148
NAM 50	50	5.03	6.25	9.90	16.1	22.4	28.3	36.4	45.7	54.0	59.1	65.1	76.0	108	123	145	157
NAM 55	55	5.54	6.88	10.9	17.7	24.6	31.2	40.0	50.3	59.4	65.0	71.6	83.6	119	135	160	173
NAM 60	60	6.05	7.50	11.9	19.4	26.9	34.4	45.3	58.4	68.9	74.9	83.6	97.9	139	157	190	203
NAM 70	70	7.05	8.76	13.9	22.6	31.4	40.1	52.9	68.2	80.4	87.4	97.5	114	162	183	221	237
NAM 80	80	8.06	10.0	15.9	25.8	35.9	45.9	60.5	77.9	91.8	100	111	130	186	210	253	271
NAM 90	90	9.07	11.3	17.9	29.1	40.4	51.6	68.0	87.6	103	112	125	147	209	236	285	304
NAM 100	100	10.1	12.5	19.8	32.3	44.9	57.3	75.6	97.4	115	125	139	163	232	262	316	338
NAM 110	110	11.1	13.8	21.8	35.5	49.4	63.1	83.1	107	126	137	153	179	255	288	348	372
NAM 115	115	11.6	14.4	22.8	37.2	51.6	65.9	86.9	112	132	144	160	188	267	301	364	389
NAM 130	130	13.1	16.3	25.8	42.0	58.3	74.5	98.2	127	149	162	181	212	301	341	411	440
NAM 140	140	14.1	17.5	27.8	45.2	62.8	80.3	106	136	161	175	195	228	325	367	443	473
NAM 145	145	14.6	18.1	28.8	46.8	65.1	83.1	110	141	166	181	202	237	336	380	459	490
NAM 150	150	15.1	18.8	29.8	48.5	67.3	86.0	113	146	172	187	209	245	348	393	475	507
NAM 165	165	16.6	20.6	32.7	53.3	74.1	94.6	125	161	189	206	230	269	383	432	522	558
NAM 185	185	18.6	23.1	36.7	59.8	83.0	106	140	180	212	231	258	302	429	485	585	626
NAM 190	190	19.2	23.8	37.7	61.4	85.3	109	144	184	217	236	258	299	418	470	554	597
NAM 200	200	20.2	25.0	39.6	64.6	89.8	115	151	193	228	248	271	315	440	495	583	628
NAM 215	215	21.7	26.9	42.6	69.5	96.5	123	163	208	245	267	292	338	473	532	627	675
NAM 220	220	22.2	27.5	43.6	71.1	98.8	126	166	213	251	273	299	346	484	544	641	691
NAM 240	240	24.2	30.0	47.6	77.6	108	138	181	232	273	298	326	378	528	594	700	754
NAM 250	250	25.2	31.3	49.6	80.8	112	143	189	242	285	310	339	393	550	619	729	785
NAM 260	260	26.2	32.5	51.5	84.0	117	149	197	251	296	323	353	409	572	643	758	816
NAM 285	285	28.8	35.6	56.5	92.1	128	163	216	276	325	354	387	448	627	705	831	895
NAM 310	310	31.3	38.8	61.4	100	139	178	234	300	353	385	421	488	682	767	904	973
NAM 335	335	33.8	41.9	66.4	108	150	192	253	324	382	416	455	527	737	829	977	1052

NAM Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)

Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.10V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAM 9	9	0.89	1.11	1.76	2.71	3.73	4.47	5.31	6.63	8.04	8.42	9.60	11.6	16.5	18.5	21.9	23.4
NAM 14	14	1.39	1.72	2.73	4.21	5.81	6.95	8.27	10.3	12.5	13.1	14.9	18.1	25.6	28.7	34.1	36.4
NAM 22	22	2.18	2.71	4.29	6.61	9.13	10.9	13.0	16.2	19.7	20.6	23.5	28.4	40.3	45.1	53.6	57.3
NAM 31	31	3.07	3.81	6.05	9.32	12.9	15.4	18.3	22.8	27.7	29.0	33.1	40.0	56.8	63.6	75.5	80.7
NAM 39	39	3.86	4.80	7.61	11.7	16.2	19.4	23.0	28.7	34.9	36.5	41.6	50.3	71.4	80.0	95.0	101
NAM 47	47	4.65	5.78	9.17	14.1	19.5	23.3	27.7	34.6	42.0	44.0	50.1	60.7	86.1	96.4	114	122
NAM 50	50	4.95	6.15	9.75	15.0	20.7	24.8	29.5	36.8	44.7	46.8	53.3	64.5	91.6	103	122	130
NAM 55	55	5.45	6.77	10.7	16.5	22.8	27.3	32.5	40.5	49.2	51.4	58.7	71.0	101	113	134	143
NAM 60	60	5.94	7.38	11.7	18.1	25.1	30.4	37.0	46.6	57.0	59.8	68.2	82.8	117	132	157	181
NAM 70	70	6.94	8.62	13.7	21.1	29.3	35.5	43.1	54.3	66.5	69.7	79.6	96.6	137	154	183	211
NAM 80	80	7.93	9.85	15.6	24.1	33.5	40.5	49.3	62.1	76.0	79.7	91	110	156	176	209	242
NAM 90	90	8.92	11.1	17.6	27.1	37.7	45.6	55.5	69.8	85.5	89.7	102	124	176	198	235	272
NAM 100	100	9.91	12.3	19.5	30.1	41.9	50.7	61.6	77.6	95.0	100	114	138	195	220	262	302
NAM 110	110	10.9	13.5	21.5	33.1	46.1	55.7	67.8	85.4	105	110	125	152	215	242	288	332
NAM 115	115	11.4	14.2	22.5	34.6	48.2	58.3	70.9	89.2	109	115	131	159	224	253	301	347
NAM 130	130	12.9	16.0	25.4	39.1	54.5	65.9	80.1	101	124	130	148	179	254	286	340	393
NAM 140	140	13.9	17.2	27.4	42.1	58.7	70.9	86.3	109	133	139	159	193	273	308	366	423
NAM 145	145	14.4	17.8	28.3	43.6	60.8	73.4	89.4	113	138	144	165	200	283	319	379	438
NAM 150	150	14.9	18.5	29.3	45.1	62.8	76.0	92.5	116	143	149	171	207	293	330	392	453
NAM 165	165	16.3	20.3	32.2	49.7	69.1	83.6	102	128	157	164	188	228	322	363	432	498
NAM 185	185	18.3	22.8	36.1	55.7	77.5	93.7	114	144	176	184	210	255	361	407	484	559
NAM 190	190	18.8	23.4	37.0	57.4	79.5	96.2	117	146	178	185	211	253	353	393	464	493
NAM 200	200	19.8	24.6	38.9	60.4	83.7	101	123	154	187	195	222	266	371	414	489	519
NAM 215	215	21.3	26.5	41.8	64.9	90.0	109	132	165	201	209	239	286	399	445	525	558
NAM 220	220	21.8	27.1	42.8	66.4	92.1	111	136	169	206	214	244	293	408	456	538	571
NAM 240	240	23.8	29.6	46.7	72.5	100	121	148	185	225	234	267	320	446	497	586	623
NAM 250	250	24.8	30.8	48.7	75.5	105	127	154	192	234	243	278	333	464	518	611	649
NAM 260	260	25.8	32.0	50.6	78.5	109	132	160	200	243	253	289	346	483	538	635	675
NAM 285	285	28.2	35.1	55.5	86.1	119	144	176	219	267	277	317	380	529	590	696	740
NAM 310	310	30.7	38.2	60.3	93.6	130	157	191	238	290	302	344	413	576	642	757	804
NAM 335	335	33.2	41.3	65.2	101	140	170	206	258	314	326	372	446	622	694	818	869

At 20˚C ± 5˚C (+68˚F ± 9˚F)

Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.14V/cell

Cell type	Capacity (C_5 Ah)	Hours							Minutes						Seconds		
		10	8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAM 9	9	0.87	1.08	1.69	2.55	3.24	3.69	4.25	5.23	5.95	6.48	7.46	9.36	13.2	14.8	17.2	17.8
NAM 14	14	1.35	1.68	2.63	3.96	5.05	5.74	6.62	8.14	9.26	10.1	11.6	14.6	20.5	23.0	26.8	27.7
NAM 22	22	2.13	2.64	4.14	6.23	7.90	9.00	10.4	12.8	14.5	15.8	18.2	22.9	32.3	36.2	42.2	43.6
NAM 31	31	3.00	3.72	5.83	8.8	11.2	12.7	14.7	18.0	20.5	22.3	25.7	32.2	45.5	51.0	59.4	61.4
NAM 39	39	3.77	4.68	7.33	11.0	14.1	16.0	18.4	22.7	25.8	28.1	32.3	40.6	57.2	64.2	74.7	77.3
NAM 47	47	4.54	5.64	8.84	13.3	16.9	19.3	22.2	27.3	31.1	33.9	39.0	48.9	68.9	77.3	90.1	93.2
NAM 50	50	4.83	6.00	9.40	14.2	18.0	20.5	23.6	29.1	33.1	36.0	41.5	52.0	73.3	82.3	95.8	99.1
NAM 55	55	5.32	6.60	10.3	15.6	19.8	22.6	26.0	32.0	36.4	39.6	45.6	57.2	80.7	90.5	105	109
NAM 60	60	5.80	7.20	11.3	17.0	21.6	24.6	28.4	34.9	39.7	43.2	49.7	62.4	88.0	98.7	115	119
NAM 70	70	6.77	8.40	13.2	19.8	25.2	28.7	33.1	40.7	46.3	50.4	58.0	72.8	103	115	134	139
NAM 80	80	7.73	9.60	15.0	22.6	28.8	32.8	37.8	46.5	52.9	57.6	66.3	83.2	117	132	153	159
NAM 90	90	8.70	10.8	16.9	25.5	32.4	36.9	42.5	52.3	59.5	64.8	74.6	93.6	132	148	172	178
NAM 100	100	9.67	12.0	18.8	28.3	36.1	41.0	47.3	58.1	66.1	72.0	82.9	104	147	165	192	198
NAM 110	110	10.6	13.2	20.7	31.1	39.7	45.1	52.0	64.0	72.7	79.2	91.2	114	161	181	211	218
NAM 115	115	11.1	13.8	21.6	32.6	41.5	47.2	54.4	66.9	76.0	82.8	95.4	120	169	189	220	228
NAM 130	130	12.6	15.6	24.4	36.8	46.9	53.3	61.4	75.6	86.0	93.6	108	135	191	214	249	258
NAM 140	140	13.5	16.8	26.3	39.6	50.5	57.4	66.2	81.4	92.6	101	116	146	205	230	268	277
NAM 145	145	14.0	17.4	27.3	41.0	52.3	59.5	68.5	84.3	95.9	104	120	151	213	239	278	287
NAM 150	150	14.5	18.0	28.2	42.5	54.1	61.5	70.9	87.2	99.2	108	124	156	220	247	287	297
NAM 165	165	16.0	19.8	31.0	46.7	59.5	67.7	78.0	95.9	109	119	137	172	242	272	316	327
NAM 185	185	17.9	22.2	34.8	52.4	66.7	75.9	87.4	108	122	133	153	192	271	304	355	367
NAM 190	190	18.3	22.7	35.8	54.0	69.5	80.2	94.2	115	131	142	163	204	285	315	365	376
NAM 200	200	19.3	23.9	37.7	56.8	73.2	84.4	99.2	121	138	150	172	214	299	332	384	395
NAM 215	215	20.7	25.7	40.5	61.1	78.7	90.7	107	130	149	161	185	230	322	357	413	425
NAM 220	220	21.2	26.3	41.4	62.5	80.5	92.8	109	133	152	165	189	236	329	365	422	435
NAM 240	240	23.1	28.7	45.2	68.2	87.8	101	119	145	166	180	206	257	359	398	460	474
NAM 250	250	24.1	29.9	47.1	71.0	91.5	106	124	151	173	187	215	268	374	415	480	494
NAM 260	260	25.1	31.1	49.0	73.8	95.2	110	129	157	180	195	223	279	389	431	499	514
NAM 285	285	27.5	34.1	53.7	80.9	104	120	141	172	197	213	245	305	427	473	547	563
NAM 310	310	29.9	37.1	58.4	88.0	113	131	154	187	214	232	266	332	464	514	595	613
NAM 335	335	32.3	40.1	63.1	95.1	123	141	166	202	231	251	288	359	502	556	643	662

NAH Range

NAH Range uses very thin plates and is designed for application where there is a demand for a relatively high current over short periods, usually 30 minutes in duration. The application can have frequent or infrequent discharges. The range is typically used in starting and power back up applications.

Charging

The NAH type cells can be charged by all normal methods.

- Taper
- Constant Current
- Constant Voltage
- Pulse

The NAH type cells may be operated satisfactorily in any state of charge. For operating conditions other that fully charged.

Capacity

The rated capacity (C_5) of a cell is the capacity available in ampere hours (Ah) at the 5 hour discharge rate to an end voltage of 1.00 volts per cell.

Discharge Rate

The nominal discharge voltage is 1.2 volts per cell.

Constant Current Charging

Standard charge : $0.2C_5$ amperes for 8 hours.

Fast charge : $0.4C_5$ amperes for 2.5 hours followed by $0.2C_5$ amperes for 2.5 hours.

Minimum charge : 2.0mA per Ah.

Constant Voltage Charging

Two levels charging

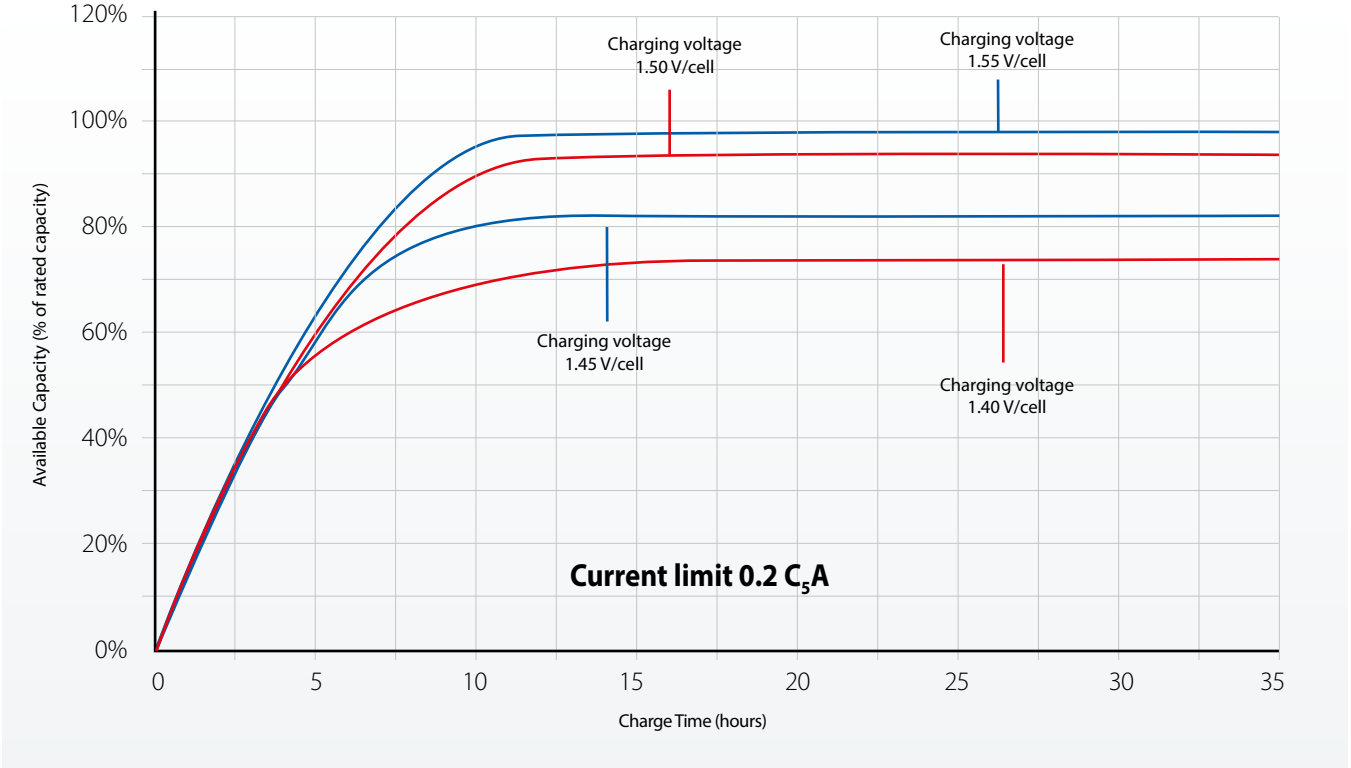
Float voltage : 1.40 V/cell.

Boost voltage : 1.45 - 1.70 V/cell.

Singel level charging
1.43 - 1.50 V/cell.

Cell Data

Short Circuit : Max 25 x C_5 Amps



Time to reach state-of-charging voltages for fully discharge NAH range

NAH Range Cell Performance

Capacities and dimensions

International System of units

Cell type	Capacity C_5 Ah	Overall Height*	Width per cell	Length per cell	Approx. Weight per cell	Approx. electrolyte volume between level marks	Electrolyte per cell		Internal resistance *	Cell connection bolt per pole
							Solid	Liquid		
	Ah	mm	mm	mm	Kg	cm^3	Kg	L	mOhm	
NAH 9	9	270	121	42	1.80	143	0.23	0.70	3.33	M 6
NAH 12	12	270	121	42	1.90	140	0.23	0.70	2.50	M 6
NAH 17	17	270	121	42	2.10	138	0.19	0.60	1.76	M 6
NAH 21	21	270	121	66	3.00	232	0.36	1.10	1.43	M 6
NAH 25	25	270	121	66	3.20	230	0.36	1.10	1.20	M 6
NAH 29	29	270	121	66	3.30	227	0.32	1.00	1.03	M 6
NAH 34	34	270	121	66	3.50	224	0.29	0.90	0.88	M 6
NAH 40	40	357	192	68	6.50	530	0.87	2.70	0.35	M 8
NAH 50	50	357	192	68	6.90	520	0.84	2.60	0.78	M 8
NAH 60	60	357	192	68	7.30	510	0.81	2.50	0.65	M 10
NAH 70	70	357	192	68	7.70	510	0.78	2.40	0.56	M 10
NAH 80	80	357	192	68	8.10	500	0.71	2.20	0.49	M 10
NAH 90	90	357	192	93	10.3	720	1.10	3.40	0.43	M 10
NAH 100	100	357	192	93	10.7	720	1.07	3.30	0.39	M 10
NAH 110	110	357	192	93	11.1	710	1.04	3.20	0.35	M 10
NAH 120	120	357	192	93	11.4	700	1.00	3.10	0.33	M 10
NAH 130	130	413	192	93	12.6	720	1.26	3.90	0.33	M 10
NAH 145	145	413	192	93	13.0	710	1.20	3.70	0.30	M 10
NAH 155	155	413	192	93	13.4	700	1.17	3.60	0.28	M 10
NAH 170	170	413	192	122	16.8	960	1.68	5.20	0.25	2 x M 10
NAH 185	185	413	192	122	17.2	950	1.62	5.00	0.23	2 x M 10
NAH 210	210	413	192	122	18.2	940	1.52	4.70	0.20	2 x M 10

Capacities and dimensions

Imperial units

Cell type	Capacity C_5 Ah	Overall Height*	Width per cell	Length per cell	Approx. Weight per cell	Approx. electrolyte volume between level marks	Electrolyte per cell		Internal resistance *	Cell connection bolt per pole
							Solid	Liquid		
	Ah	in	in	in	lbs	in^3	lbs	US Gal.	mOhm	
NAH 9	9	10.6	4.76	1.65	3.97	8.73	0.50	0.18	3.33	M 6
NAH 12	12	10.6	4.76	1.65	4.19	8.54	0.50	0.18	2.50	M 6
NAH 17	17	10.6	4.76	1.65	4.63	8.42	0.43	0.16	1.76	M 6
NAH 21	21	10.6	4.76	2.60	6.61	14.2	0.79	0.29	1.43	M 6
NAH 25	25	10.6	4.76	2.60	7.05	14.0	0.79	0.29	1.20	M 6
NAH 29	29	10.6	4.76	2.60	7.28	13.9	0.71	0.26	1.03	M 6
NAH 34	34	10.6	4.76	2.60	7.72	13.7	0.64	0.24	0.88	M 6
NAH 40	40	14.1	7.56	2.68	14.3	32.3	1.93	0.71	0.35	M 8
NAH 50	50	14.1	7.56	2.68	15.2	31.7	1.86	0.69	0.78	M 8
NAH 60	60	14.1	7.56	2.68	16.1	31.1	1.79	0.66	0.65	M 10
NAH 70	70	14.1	7.56	2.68	17.0	31.1	1.71	0.63	0.56	M 10
NAH 80	80	14.1	7.56	2.68	17.9	30.5	1.57	0.58	0.49	M 10
NAH 90	90	14.1	7.56	3.66	22.7	43.9	2.43	0.90	0.43	M 10
NAH 100	100	14.1	7.56	3.66	23.6	43.9	2.36	0.87	0.39	M 10
NAH 110	110	14.1	7.56	3.66	24.5	43.3	2.29	0.85	0.35	M 10
NAH 120	120	14.1	7.56	3.66	25.1	42.7	2.21	0.82	0.33	M 10
NAH 130	130	16.3	7.56	3.66	27.8	43.9	2.79	1.03	0.33	M 10
NAH 145	145	16.3	7.56	3.66	28.7	43.3	2.64	0.98	0.30	M 10
NAH 155	155	16.3	7.56	3.66	29.5	42.7	2.57	0.95	0.28	M 10
NAH 170	170	16.3	7.56	4.80	37.0	58.6	3.71	1.37	0.25	2 x M 10
NAH 185	185	16.3	7.56	4.80	37.9	58.0	3.57	1.32	0.23	2 x M 10
NAH 210	210	16.3	7.56	4.80	40.1	57.4	3.36	1.24	0.20	2 x M 10

** Height includes the IP2X terminal cover.*

NAH Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.00V/cell

Cell type	Capacity (C_5 Ah)	Hours						Minutes						Seconds		
		8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAH 9	9	1.13	1.80	2.96	4.39	5.79	8.4	15.3	20.4	23.5	28.0	34.7	46.6	52.7	66.9	70.9
NAH 12	12	1.50	2.40	3.95	5.86	7.73	11.3	20.4	27.2	31.3	37.3	46.3	62.2	70.2	89.3	94.5
NAH 17	17	2.13	3.40	5.59	8.3	10.9	15.9	28.9	38.6	44.4	52.9	65.6	88.1	99.5	126	134
NAH 21	21	2.63	4.20	6.90	10.25	13.5	19.7	35.7	47.6	54.8	65.3	81.0	109	123	156	165
NAH 25	25	3.13	5.00	8.22	12.2	16.1	23.4	42.5	56.7	65.3	77.7	96.5	130	146	186	197
NAH 29	29	3.63	5.80	9.53	14.2	18.7	27.2	49.3	65.8	75.7	90.2	112	150	170	216	228
NAH 34	34	4.25	6.80	11.2	16.6	21.9	31.9	57.8	77.1	88.8	106	131	176	199	253	268
NAH 40	40	5.02	8.00	13.1	19.5	25.7	37.6	69.0	92.7	108	128	159	206	235	296	325
NAH 50	50	6.28	10.0	16.4	24.4	32.1	47.0	86.2	116	135	160	199	258	294	370	407
NAH 60	60	7.53	12.0	19.7	29.3	38.6	56.4	103	139	162	193	239	309	353	444	488
NAH 70	70	8.79	14.0	23.0	34.1	45.0	65.8	121	162	189	225	279	361	411	519	569
NAH 80	80	10.0	16.0	26.3	39.0	51.4	75.2	138	185	216	257	318	412	470	593	651
NAH 90	90	11.3	18.0	29.6	43.9	57.9	84.6	155	208	243	289	358	464	529	667	732
NAH 100	100	12.6	20.0	32.9	48.8	64.3	94.0	172	232	270	321	398	515	588	741	813
NAH 110	110	13.8	22.0	36.1	53.7	70.7	103	190	255	297	353	438	567	647	815	895
NAH 120	120	15.1	24.0	39.4	58.5	77.1	113	207	278	324	385	478	618	705	889	976
NAH 130	130	16.3	26.0	42.9	63.6	83.7	122	222	299	342	405	491	616	695	845	899
NAH 145	145	18.2	29.0	47.9	70.9	93.3	137	248	333	382	451	547	687	776	943	1003
NAH 155	155	19.4	31.0	51.2	75.8	99.8	146	265	356	408	482	585	734	829	1008	1072
NAH 170	170	21.3	34.0	56.1	83.1	109	160	291	391	448	529	642	806	909	1106	1176
NAH 185	185	23.2	37.0	61.1	90.5	119	174	316	425	487	576	698	877	989	1203	1280
NAH 210	210	26.3	42.0	69.3	103	135	198	359	483	553	654	793	995	1123	1366	1453

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.05V/cell

Cell type	Capacity (C_5 Ah)	Hours						Minutes						Seconds		
		8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAH 9	9	1.11	1.77	2.91	4.30	5.68	8.21	14.5	17.4	20.2	23.8	28.5	38.5	45.2	55.2	59.6
NAH 12	12	1.49	2.36	3.89	5.74	7.58	11.0	19.4	23.3	26.9	31.8	37.9	51.3	60.3	73.7	79.5
NAH 17	17	2.10	3.35	5.50	8.13	10.7	15.5	27.4	32.9	38.1	45.0	53.7	72.7	85.4	104	113
NAH 21	21	2.60	4.13	6.80	10.0	13.3	19.2	33.9	40.7	47.0	55.6	66.4	89.8	106	129	139
NAH 25	25	3.09	4.92	8.09	12.0	15.8	22.8	40.3	48.4	56.0	66.2	79.0	107	126	153	166
NAH 29	29	3.59	5.71	9.39	13.9	18.3	26.5	46.8	56.2	65.0	76.8	91.7	124	146	178	192
NAH 34	34	4.21	6.69	11.0	16.3	21.5	31.0	54.8	65.9	76.2	90.1	107	145	171	209	225
NAH 40	40	4.98	7.88	13.0	19.1	25.1	36.3	65.3	80.0	92.3	109	130	176	200	247	265
NAH 50	50	6.22	9.85	16.2	23.9	31.4	45.4	81.6	100	115	137	162	219	250	309	331
NAH 60	60	7.47	11.8	19.5	28.7	37.7	54.5	98.0	120	138	164	195	263	300	370	397
NAH 70	70	8.71	13.8	22.7	33.5	44.0	63.6	114	140	161	192	227	307	350	432	464
NAH 80	80	10.0	15.8	26.0	38.3	50.3	72.7	131	160	185	219	259	351	400	494	530
NAH 90	90	11.2	17.7	29.2	43.1	56.6	81.7	147	180	208	246	292	395	450	556	596
NAH 100	100	12.4	19.7	32.4	47.9	62.9	90.8	163	200	231	274	324	439	500	617	662
NAH 110	110	13.7	21.7	35.7	52.6	69.1	100	180	220	254	301	357	483	550	679	728
NAH 120	120	14.9	23.6	38.9	57.4	75.4	109	196	240	277	328	389	527	600	741	795
NAH 130	130	16.1	25.6	42.2	62.5	81.9	119	211	256	291	343	399	517	583	704	734
NAH 145	145	18.0	28.6	47.1	69.7	91.3	132	235	286	325	382	445	577	651	785	818
NAH 155	155	19.2	30.6	50.3	74.5	97.6	141	252	306	347	409	475	616	696	839	875
NAH 170	170	21.1	33.5	55.2	81.7	107	155	276	335	381	448	521	676	763	920	959
NAH 185	185	23.0	36.5	60.1	88.9	116	169	300	365	415	488	567	736	830	1002	1044
NAH 210	210	26.1	41.4	68.2	101	132	191	341	414	471	554	644	835	942	1137	1185

NAH Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.10V/cell

Cell type	Capacity (C_5 Ah)	Hours						Minutes						Seconds		
		8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAH 9	9	1.09	1.73	2.84	4.17	5.45	7.68	11.7	13.9	15.8	17.9	22.2	30.6	35.6	45.0	47.4
NAH 12	12	1.46	2.30	3.78	5.56	7.26	10.2	15.6	18.6	21.0	23.9	29.6	40.8	47.4	60.0	63.2
NAH 17	17	2.06	3.26	5.36	7.87	10.3	14.5	22.1	26.3	29.8	33.9	41.9	57.8	67.2	85.0	89.5
NAH 21	21	2.55	4.03	6.62	9.73	12.7	17.9	27.3	32.5	36.8	41.9	51.8	71.4	83.0	105	111
NAH 25	25	3.03	4.80	7.88	11.6	15.1	21.3	32.5	38.7	43.8	49.8	61.7	85.0	98.8	125	132
NAH 29	29	3.52	5.56	9.14	13.4	17.5	24.8	37.7	44.9	50.8	57.8	71.6	98.6	115	145	153
NAH 34	34	4.12	6.52	10.7	15.7	20.6	29.0	44.2	52.6	59.6	67.8	83.9	116	134	170	179
NAH 40	40	4.86	7.67	12.6	18.5	24.2	34.5	53.3	64.0	72.1	81.7	101	138	160	196	220
NAH 50	50	6.07	9.59	15.8	23.2	30.3	43.1	66.7	80.0	90.2	102	126	173	200	245	274
NAH 60	60	7.29	11.5	18.9	27.8	36.4	51.7	80.0	96.0	108	123	151	208	240	294	329
NAH 70	70	8.50	13.4	22.1	32.4	42.4	60.3	93.3	112	126	143	176	242	280	343	384
NAH 80	80	9.71	15.3	25.2	37.1	48.5	68.9	107	128	144	163	201	277	320	392	439
NAH 90	90	10.9	17.3	28.4	41.7	54.6	77.6	120	144	162	184	226	311	360	441	494
NAH 100	100	12.1	19.2	31.5	46.3	60.6	86.2	133	160	180	204	252	346	400	490	549
NAH 110	110	13.4	21.1	34.7	51.0	66.7	94.8	147	176	198	225	277	381	440	539	604
NAH 120	120	14.6	23.0	37.8	55.6	72.7	103	160	192	216	245	302	415	480	588	659
NAH 130	130	15.7	25.1	41.1	60.3	78.9	112	171	201	226	255	307	412	469	558	586
NAH 145	145	17.5	28.0	45.8	67.3	88.0	125	191	224	252	284	342	460	523	622	654
NAH 155	155	18.7	29.9	49.0	71.9	94.0	134	204	240	269	304	366	491	559	665	699
NAH 170	170	20.6	32.8	53.7	78.9	103	147	224	263	296	333	401	539	613	730	767
NAH 185	185	22.4	35.7	58.4	85.8	112	160	244	286	322	362	437	586	667	794	834
NAH 210	210	25.4	40.5	66.3	97.5	127	181	277	325	365	411	496	666	757	901	947

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 1.14V/cell

Cell type	Capacity (C_5 Ah)	Hours						Minutes						Seconds		
		8	5	3	2	1.5	1	30	20	15	10	5	1	30	5	1
NAH 9	9	1.05	1.67	2.72	3.81	4.85	6.37	9.32	11.1	12.7	14.6	17.9	24.6	28.7	34.9	41.9
NAH 12	12	1.40	2.22	3.62	5.08	6.47	8.50	12.4	14.9	16.9	19.4	23.9	32.8	38.3	46.5	55.8
NAH 17	17	1.99	3.15	5.13	7.20	9.16	12.0	17.6	21.0	23.9	27.5	33.9	46.4	54.2	65.9	79.1
NAH 21	21	2.45	3.89	6.34	8.89	11.3	14.9	21.7	26.0	29.5	34.0	41.9	57.4	66.9	81.4	97.7
NAH 25	25	2.92	4.63	7.55	10.6	13.5	17.7	25.9	30.9	35.1	40.5	49.9	68.3	79.7	96.9	116
NAH 29	29	3.39	5.37	8.75	12.3	15.6	20.5	30.0	35.9	40.8	47.0	57.8	79.2	92.4	112	135
NAH 34	34	3.97	6.29	10.3	14.4	18.3	24.1	35.2	42.1	47.8	55.1	67.8	92.9	108	132	158
NAH 40	40	4.69	7.39	12.1	17.7	22.9	30.5	41.6	49.6	55.6	63.0	77.1	111	128	160	168
NAH 50	50	5.87	9.23	15.2	22.1	28.7	38.1	52.0	62.0	69.5	78.7	96.3	138	160	200	210
NAH 60	60	7.04	11.1	18.2	26.6	34.4	45.7	62.5	74.4	83.4	94.5	116	166	192	240	252
NAH 70	70	8.21	12.9	21.2	31.0	40.1	53.3	72.9	86.8	97.3	110	135	194	224	280	294
NAH 80	80	9.39	14.8	24.2	35.4	45.9	60.9	83.3	99.1	111	126	154	221	256	320	336
NAH 90	90	10.6	16.6	27.3	39.9	51.6	68.6	93.7	112	125	142	173	249	288	360	378
NAH 100	100	11.7	18.5	30.3	44.3	57.3	76.2	104	124	139	157	193	277	320	400	420
NAH 110	110	12.9	20.3	33.3	48.7	63.1	83.8	115	136	153	173	212	304	352	440	462
NAH 120	120	14.1	22.2	36.4	53.1	68.8	91.4	125	149	167	189	231	332	384	480	504
NAH 130	130	15.3	24.1	39.4	55.4	70.3	92.2	135	161	181	205	250	329	377	443	459
NAH 145	145	17.1	26.9	43.9	61.8	78.4	103	151	180	202	228	279	366	420	494	512
NAH 155	155	18.2	28.7	46.9	66.0	83.8	110	161	192	216	244	299	392	449	528	547
NAH 170	170	20.0	31.5	51.5	72.4	91.9	121	177	211	236	268	327	430	493	580	600
NAH 185	185	21.8	34.3	56.0	78.8	100	131	193	229	257	291	356	468	536	631	653
NAH 210	210	24.7	38.9	63.6	89.5	114	149	219	260	292	331	405	531	608	716	741

NAH Range Cell Performance

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 0.65V/cell

Cell type	Capacity (C_5 Ah)	Minutes		Seconds			
	Ah	1.5	1	30	15	5	1
NAH 9	9	98.4	106	118	129	143	162
NAH 12	12	131	142	158	171	190	216
NAH 17	17	186	201	223	243	270	305
NAH 21	21	230	248	276	300	333	377
NAH 25	25	273	295	328	357	397	449
NAH 29	29	317	343	381	414	460	521
NAH 34	34	372	402	446	486	539	611
NAH 40	40	452	484	532	580	645	718
NAH 50	50	565	605	665	724	806	898
NAH 60	60	678	726	798	869	967	1078
NAH 70	70	791	847	931	1014	1129	1257
NAH 80	80	904	968	1064	1159	1290	1437
NAH 90	90	1017	1089	1197	1304	1451	1616
NAH 100	100	1131	1210	1330	1449	1612	1796
NAH 110	110	1244	1331	1463	1594	1773	1976
NAH 120	120	1357	1452	1596	1739	1935	2155
NAH 130	130	1391	1467	1602	1710	1883	2041
NAH 145	145	1552	1636	1786	1908	2101	2277
NAH 155	155	1659	1749	1909	2039	2246	2434
NAH 170	170	1819	1918	2094	2236	2463	2670
NAH 185	185	1980	2088	2279	2434	2680	2905
NAH 210	210	2247	2370	2587	2763	3042	3298

At 20˚C ± 5˚C (+68˚F ± 9˚F)
Available amperes for fully charged cells after constant current charging to IEC 623

Final voltage : 0.85V/cell

Cell type	Capacity (C_5 Ah)	Minutes		Seconds			
	Ah	1.5	1	30	15	5	1
NAH 9	9	69.5	76.0	84.4	99.2	111	121
NAH 12	12	92.6	101	113	132	148	162
NAH 17	17	131	143	160	187	210	229
NAH 21	21	162	177	197	231	259	283
NAH 25	25	193	211	235	276	309	337
NAH 29	29	224	245	272	320	358	391
NAH 34	34	262	287	319	375	420	458
NAH 40	40	319	343	383	441	494	539
NAH 50	50	398	429	478	551	617	673
NAH 60	60	478	515	574	661	741	808
NAH 70	70	558	601	669	771	864	943
NAH 80	80	637	687	765	882	988	1078
NAH 90	90	717	773	861	992	1111	1212
NAH 100	100	796	859	956	1102	1235	1347
NAH 110	110	876	944	1052	1212	1358	1482
NAH 120	120	956	1030	1148	1322	1482	1616
NAH 130	130	966	1028	1135	1253	1383	1507
NAH 145	145	1078	1146	1266	1398	1543	1681
NAH 155	155	1152	1225	1353	1494	1649	1797
NAH 170	170	1263	1344	1484	1639	1809	1971
NAH 185	185	1375	1463	1615	1783	1968	2145
NAH 210	210	1561	1660	1833	2024	2234	2435

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.

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 form 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 or 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 followed.

Cells after storage

All cells after storage must be prepared for service and fully commissioned as described in page 25.

Cell oil

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

This layer is approximately 5mm thick and, when the cells are delivered empty, must be added to the cells after they have been filled with electrolyte,

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.

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	± 1N.m
* M8	20	± 2N.m
* M10	30	± 3N.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 cm^3 of water, and 1 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

= number of cells x charge current x 0.45 liters or

= number of cells x charge current x 0.00045 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.

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 0.1C5 and so the charging current is 7.9 amperes.

The volume of hydrogen evolved per hour in this, the worst, case is:
= 98 x 7.9 x 0.00045 m^3
= 0.35 m^3

The total volume of room is
2 x 2 x 3 = 12 m^3

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

Therefore, the concentration of hydrogen gas after charging for 1 hour at full gassing potential at 0.1 C5 will be: = 0.35/11 = 2.8%

Thus, to maintain a maximum concentration of 2% (for example), the air in the room will need changing 2.8/2 = 1.4 times per hour.

In practice, 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.

Preparation for service

Filled cells
Check that the cells are extremely clean with adequate protective finish on posts and connectors

Carefully remove the plastic transport seal, and visually check that the electrolyte levels in the opened cells are at the MAX level.

If necessary, adjust by careful addition of approve distilled or demineralised water.

Wipe away any small spillage on cells using a clean cloth and close the flip-top vents to complete preparation for service.

The cells can now be commissioned as described in page 25

Discharge and empty cells

Check that cells are externally clean with adequate protective finish on posts and connectors.

Identify and calculate the electrolyte type and quantity required to fill the cells, from the Cell Data tables. Do not remove the plastic transport seals at this stage.

Prepare new electrolyte to requirement from solid electrolyte or liquid electrolyte, as supplied. When filling the cells, refer to the "Electrolyte instructions" data sheet supplied with electrolyte. Ensure that only demineralised or pure distilled water is used.

Carefully remove the plastic transport seal and leave the flip-top vents open.

Carefully fill the cells using a plastic jug and funnel to a level 5-10 mm below the MAX level. Allow the cells to stand for 24 hours. For large installations, a pump system is recommended.

Add cell oil as described in page 25.

After 24 hours stand, carfully complete filling the cell to the maximum level.

Wipe away any small spillage on cells using a clean cloth and close the flip-top vents to complete preparation for service.

The cells can now be commissioned as described in page 25.

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.

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 0.1C5 to 0.2C5 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 indlvidually cell measurements are taken, the state of each cell can be observed.

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.

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)

Commission charge

It is recommended that a good first charge should be given to the battery. This is a once, only operation, and is long service life. It is also important for discharged and empty cells which have been filled, as they will be in a total discharge state.

A constant current first charge is preferable and this should be such as to supply 300% of the rated capacity of the cell. Thus, a 250 Ah cell will require 750 amperes hours input, e.g. 50 amperes for 15 hours.

Cells which have been stored for less than one year should be charged for 15 hours at the recommended charge current (see Data Tables below) before being placed in service. The battery can now be put into service.

Cells that have been stored for more than one year. or have been filled, should be charged for 15 hours at the recommended charge current (see Data Tables below), discharge to 1.0 volts per cell and then charged for 10 hours at the recommended charge current (see Data Tables below).

In cases where it is not possible to provide constant current charging, it is possible to achieve this with a constant voltage by using a high voltage level, e.g. 1.65 voltage limit may be used for 20 to 30 hours, if the current limit is approximately equivalent to the 5 hour charge current. If the current rating is lower, then the charge time should be increased accordingly.

When the charger maximum voltage setting is too low to supply constant current charging, divide the battery into two parts to be charged individually at a high voltage.

The battery can now be put into service.

Cell type	Charging current 0.2 C_5 (A)	Electrolyte per cell liquid (L)	Electrolyte per cell solid (Kg)	Quantity of oil ml/vent
NAL 10	2	0.80	0.26	15
NAL 15	3	0.70	0.23	15
NAL 22	4.4	0.70	0.23	15
NAL 30	6	0.60	0.19	15
NAL 40	8	1.10	0.36	25
NAL 47	9.4	1.10	0.36	25
NAL 55	11	1.00	0.32	25
NAL 62	12.4	1.00	0.32	25
NAL 70	14	2.70	0.87	35
NAL 75	15	2.70	0.87	35
NAL 85	17	2.40	0.78	35
NAL 90	18	2.40	0.78	35
NAL 100	20	2.40	0.78	35
NAL 110	22	2.40	0.78	35
NAL 125	25	2.10	0.68	35
NAL 145	29	2.10	0.68	35
NAL 165	33	3.20	1.04	50
NAL 185	37	3.20	1.04	50
NAL 200	40	2.90	0.94	50
NAL 220	44	2.90	0.94	50
NAL 235	47	3.70	1.20	50
NAL 255	51	3.40	1.10	50
NAL 280	56	3.40	1.10	50
NAL 300	60	4.80	1.56	70
NAL 330	66	4.80	1.56	70
NAL 360	72	4.40	1.43	70
NAL 375	75	4.40	1.43	70

Cell type	Charging current 0.2 C_5 (A)	Electrolyte per cell liquid (L)	Electrolyte per cell solid (Kg)	Quantity of oil ml/vent
NAM 9	1.8	0.80	0.26	15
NAM 14	2.8	0.60	0.19	15
NAM 22	4.4	0.60	0.19	15
NAM 31	6.2	0.60	0.19	15
NAM 39	7.8	1.10	0.36	25
NAM 47	9.4	1.00	0.32	25
NAM 50	10	0.90	0.29	25
NAM 55	11	0.90	0.29	25
NAM 60	12	2.60	0.84	35
NAM 70	14	2.60	0.84	35
NAM 80	16	2.50	0.81	35
NAM 90	18	2.50	0.81	35
NAM 100	20	2.30	0.75	35
NAM 110	22	2.30	0.75	35
NAM 115	23	2.10	0.68	35
NAM 130	26	2.10	0.68	35
NAM 140	28	3.20	1.04	50
NAM 145	29	3.20	1.04	50
NAM 150	30	3.20	1.04	50
NAM 165	33	3.10	1.00	50
NAM 185	37	2.90	0.94	50
NAM 190	38	3.80	1.23	50
NAM 200	40	3.60	1.17	50
NAM 215	43	3.60	1.17	50
NAM 220	44	3.30	1.07	50
NAM 240	48	3.30	1.07	50
NAM 250	50	4.80	1.56	70
NAM 260	52	4.80	1.56	70
NAM 285	57	4.80	1.56	70
NAM 310	62	4.60	1.49	70
NAM 335	67	4.40	1.43	70

Cell type	Charging current 0.2 C_5 (A)	Electrolyte per cell liquid (L)	Electrolyte per cell solid (Kg)	Quantity of oil ml/vent
NAH 9	1.8	0.70	0.23	15
NAH 12	2.4	0.70	0.23	15
NAH 17	3.4	0.60	0.19	15
NAH 21	4.2	1.10	0.36	25
NAH 25	5	1.10	0.36	25
NAH 29	5.8	1.00	0.32	25
NAH 34	6.8	0.90	0.29	25
NAH 40	8	2.70	0.87	35
NAH 50	10	2.60	0.84	35
NAH 60	12	2.50	0.81	35
NAH 70	14	2.40	0.78	35
NAH 80	16	2.20	0.71	35
NAH 90	18	3.40	1.10	50
NAH 100	20	3.30	1.07	50
NAH 110	22	3.20	1.04	50
NAH 120	24	3.10	1.00	50
NAH 130	26	3.90	1.26	50
NAH 145	29	3.70	1.20	50
NAH 155	31	3.60	1.17	50
NAH 170	34	5.20	1.68	70
NAH 185	37	5.00	1.62	70
NAH 210	42	4.70	1.52	70

Battery racks

NICA product portfolio includes standard and anti-Seismic battery racks (conforming to Uniform Building Code, Seismic Zone 4). These have been designed for all types in the NICA range and are supplied unassembled to allow for easy installation. The purpose-built racks are strong, adaptable and provide good alkali protection. Dimensions are given below for the range of rack layouts; battery lengths should be calculated as detailed on the relevant cell capacities and dimensions pages in this publication.

Dimension for single cell range

Cell type			1 Tier Rack						2 Tiers Rack					
			DEPTH No.of steps			HEIGHT No.of steps			DEPTH No.of steps			HEIGHT No.of steps		
NAL	NAM	NAH	2	3	4	2	3	4	2	3	4	2	3	4
10 to 62	9 to 55	9 to 34	435	650	865	552	652	752	525	740	955	1552	1652	1752
70 to 200	60 to 185	40 to 120	435	650	865	643	743	843	525	740	955	1643	1743	1843
220 to 375	190 to 335	130 to 210	435	650	865	699	799	899	525	740	955	1699	1799	1899

Dimension for single and double tiers, single cell range (Diagram 1 to 6)

Cell type			1 Tier Rack			2 Tiers Rack		
NAL	NAM	NAH	2	3	4	2	3	4
10 to 62	9 to 55	9 to 34	SGL2	SGL3	SGL4	ESGL2	ESGL3	ESGL4
70 to 200	60 to 185	40 to 120	SGL2	SGL3	SGL4	ESGL2	ESGL3	ESGL4
220 to 375	190 to 335	130 to 210	SGL2	SGL3	SGL4	ESLG2	ESGL3	ESGL4

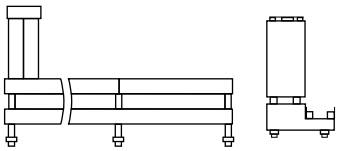


Diagram 1.
1 tier, 2 steps
normal mount

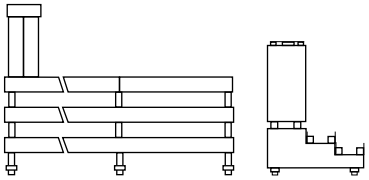


Diagram 2.
1 tier, 3 steps
normal mount

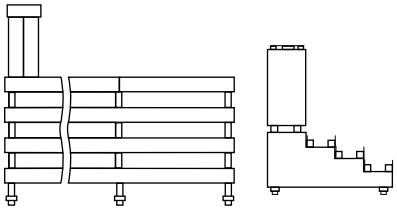


Diagram 3.
1 tier, 4 steps
normal mount

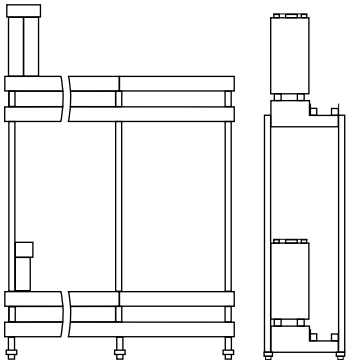


Diagram 4.
2 tiers, 2 steps
normal mount

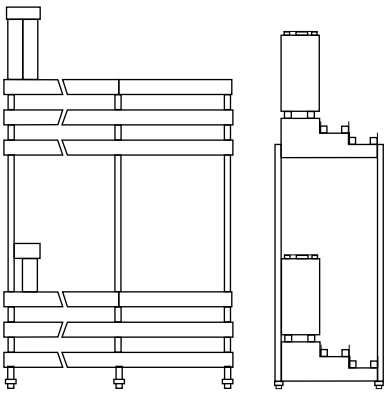


Diagram 5.
2 tiers, 3 steps
normal mount

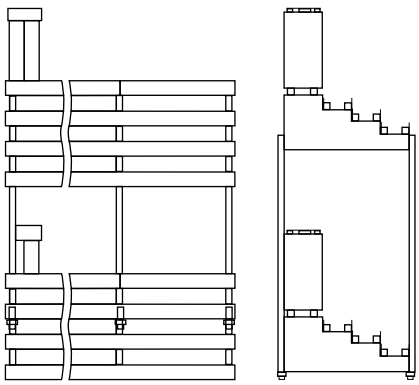


Diagram 6.
2 tiers, 4 steps
normal mount

Nicad Power Pte Ltd
Block 3028A Ubi Road 3, #01-87, Singapore 408657
Tel : +65 6748 7789 • Fax : +65 6744 9929
sales@nicad.com.sg
www.nicadpower.com

Made in Sweden

Edition : April 2018 • Data in this document is subject to change without notice and becomes contractural only after written confirmation.