

# Panasonic

ideas for life

2012

## Nickel Cadmium Battery General Catalog



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Rechargeable Battery Series

# Cadnica

Nickel Cadmium battery

In 1964, we began mass production of nickel-cadmium batteries using our proprietary technology. Having exceptional discharge performance and durability, Cadnica batteries are well-suited to tough conditions, including power tools and emergency lighting systems.

## Standard Cadnica (KR series)

Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions (mm)				Weight (approx.g)
		Minimum *1	Typical *2	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
									Diameter (D)	Height (H)	Diameter (D)	Height (H)	
KR-7000F	1.2V	7700	7000	700	14	—	—	3.4	33.2 <sup>0</sup> <sub>-0.9</sub>	91.0 <sup>0</sup> <sub>-1.4</sub>	32.3 ±0.3	90.0 ±0.4	224
KR-10000M	1.2V	12000	10000	1000	16	—	—	2.6	43.1 <sup>0</sup> <sub>-1</sub>	91.0 <sup>0</sup> <sub>-1.4</sub>	42.1 ±0.3	90.0 ±0.4	395

Operating temperature range: Charge: 0~45°C (standard), 10~45°C (rapid) | Discharge: -20~60°C | Storage: -30~50°C (short-term), -30~35°C (long-term)  
 Note: For rapid charging, please consult Panasonic on conditions of use. For assembled batteries, special considerations (such as a rise in cell temperature) must be made.

## Extended Life Cadnica (C series)

Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions (mm)				Weight (approx.g)
		Minimum *1	Typical *2	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
									Diameter (D)	Height (H)	Diameter (D)	Height (H)	
N-600AAC	1.2V	650	600	60	14 16	180	4 6	12	14.3 <sup>0</sup> <sub>-0.5</sub>	50.2 <sup>0</sup> <sub>-1</sub>	13.8 ±0.2	49.5 ±0.3	22
N-700AAC	1.2V	750	700	70		210		16	14.3 <sup>0</sup> <sub>-0.5</sub>	50.2 <sup>0</sup> <sub>-1</sub>	13.8 ±0.2	49.5 ±0.3	23
N-600AACL	1.2V	650	600	60		180		14	14.3 <sup>0</sup> <sub>-0.5</sub>	48.9 <sup>0</sup> <sub>-1</sub>	13.8 ±0.2	48.2 ±0.3	22
N-700AACL	1.2V	750	700	70		210		16	14.3 <sup>0</sup> <sub>-0.5</sub>	48.9 <sup>0</sup> <sub>-1</sub>	13.8 ±0.2	48.2 ±0.3	23

Operating temperature range: Charge: 0~45°C (standard), 10~45°C (rapid) | Discharge: -20~60°C | Storage: -30~50°C (short-term), -30~35°C (long-term)

## Rapid-charge Cadnica (R series)

Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		1-hour rate charge current (mA)	Internal resistance (mΩ)	External dimensions (mm)				Weight (approx.g)
		Minimum *1	Typical *2	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)			Including tube		Bare cell		
										Diameter (D)	Height (H)	Diameter (D)	Height (H)	
N-1250SURL	1.2V	1250	1200	125	14 16	380	4 6	1900	5.0	22.9 <sup>0</sup> <sub>-1</sub>	34.0 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	33.0 ±0.3	43
N-1300SCR	1.2V	1400	1300	130		390		2000	4.0	22.9 <sup>0</sup> <sub>-1</sub>	43.0 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	42.0 ±0.3	51
N-1700SCR	1.2V	1850	1700	170		—		2600	4.0	22.9 <sup>0</sup> <sub>-1</sub>	43.0 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	42.0 ±0.3	55
N-3000CR	1.2V	3200	3000	300		—		4500	3.4	26.0 <sup>0</sup> <sub>-0.8</sub>	50.0 <sup>0</sup> <sub>-1.3</sub>	25.2 ±0.3	49.0 ±0.3	86

Operating temperature range: Charge: 0~45°C (standard), 10~45°C (rapid), 5~40°C (1 hr) | Discharge: -20~60°C | Storage: -30~50°C (short-term), -30~35°C (long-term)  
 Note: For rapid charging of N-1700SCR or other higher capacity batteries, please consult Panasonic on conditions of use. Also, consult Panasonic on 1-hour or 30-minute rapid charging.

## High Temperature Cadnica (H series)

Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions (mm)				Weight (approx.g)
		Minimum *1	Typical *2	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
									Diameter (D)	Height (H)	Diameter (D)	Height (H)	
KR-AAH	1.2V	650	600	20	48 16	60	14 16	15	14.3 <sup>0</sup> <sub>-0.5</sub>	48.9 <sup>0</sup> <sub>-1</sub>	13.8 ±0.2	48.2 ±0.3	23
KR-SCH (1.2)	1.2V	1300	1200	40		120		8.5	22.9 <sup>0</sup> <sub>-1</sub>	43.0 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	42.0 ±0.3	47
KR-SCH (1.6)	1.2V	1650	1600	53		160		6.8	22.9 <sup>0</sup> <sub>-1</sub>	43.0 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	42.0 ±0.3	49
KR-CH (2.0)	1.2V	2100	2000	67		200		6.5	26.0 <sup>0</sup> <sub>-0.8</sub>	50.0 <sup>0</sup> <sub>-1.3</sub>	25.2 ±0.3	49.0 ±0.3	72
KR-CH (2.5)	1.2V	2600	2500	83		250		6.5	26.0 <sup>0</sup> <sub>-0.8</sub>	50.0 <sup>0</sup> <sub>-1.3</sub>	25.2 ±0.3	49.0 ±0.3	75
KR-CH (3.0)	1.2V	3050	2900	100		300		5.9	26.0 <sup>0</sup> <sub>-0.8</sub>	50.0 <sup>0</sup> <sub>-1.3</sub>	25.2 ±0.3	49.0 ±0.3	78
KR-FH	1.2V	7700	7000	233		700		3.5	33.2 <sup>0</sup> <sub>-0.9</sub>	91.0 <sup>0</sup> <sub>-1.4</sub>	32.3 ±0.3	90.0 ±0.4	224
KR-MH	1.2V	12000	10000	200		80		1000	2.6	43.1 <sup>0</sup> <sub>-1</sub>	91.0 <sup>0</sup> <sub>-1.4</sub>	42.1 ±0.3	90.0 ±0.4
KR-5/3MH	1.2V	22000	20000	400	2000	2.6	43.1 <sup>0</sup> <sub>-1</sub>	146.1 <sup>0</sup> <sub>-1.5</sub>	42.1 ±0.3	145.0 ±0.4	648		

Operating temperature range: Charge: 0~70°C (trickle, standard) | Discharge: -20~70°C | Storage: -30~70°C (short-term), -30~45°C (long-term)  
 Note: For assembled batteries consisting of KR-DHL or other higher capacity batteries, special considerations (such as a rise in cell temperature) must be made.

## Heat-resistant Cadnica (K series) / Heat-resistant, High Power Cadnica (B series)

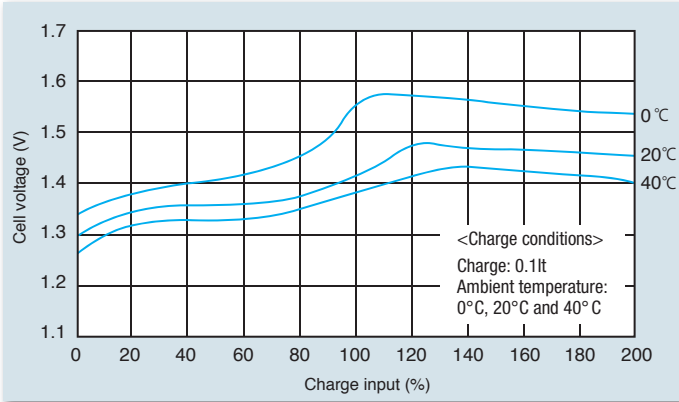
Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions (mm)				Weight (approx.g)
		Minimum *1	Typical *2	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
									Diameter (D)	Height (H)	Diameter (D)	Height (H)	
N-600AAK	1.2V	650	600	60	14 16	180	4 6	12	14.3 <sup>0</sup> <sub>-0.5</sub>	50.2 <sup>0</sup> <sub>-1</sub>	13.8 ±0.2	49.5 ±0.3	22
N-1200SCK	1.2V	1350	1200	120		360		4.2	22.9 <sup>0</sup> <sub>-1</sub>	43.0 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	42.0 ±0.3	52
N-1600SCB	1.2V	1700	1550	160		480		4.1	22.9 <sup>0</sup> <sub>-1</sub>	42.9 <sup>0</sup> <sub>-1.2</sub>	22.0 ±0.3	42.0 ±0.3	57
N-2000CB	1.2V	2300	2000	200		600		3.3	26.0 <sup>0</sup> <sub>-0.8</sub>	50.0 <sup>0</sup> <sub>-1.3</sub>	25.2 ±0.3	49.0 ±0.3	85

Operating temperature range: Charge: 0~70°C (standard), 10~70°C (rapid) | Discharge: -20~70°C | Storage: -30~70°C (short-term), -30~45°C (long-term)

\*1) Typical capacity when a single cell is discharged at a 0.2It rate after being charged at 0.1It for 16 hours. \*2) Minimum capacity when a single cell is discharged at a 0.2It rate after being charged at 0.1It for 16 hours.

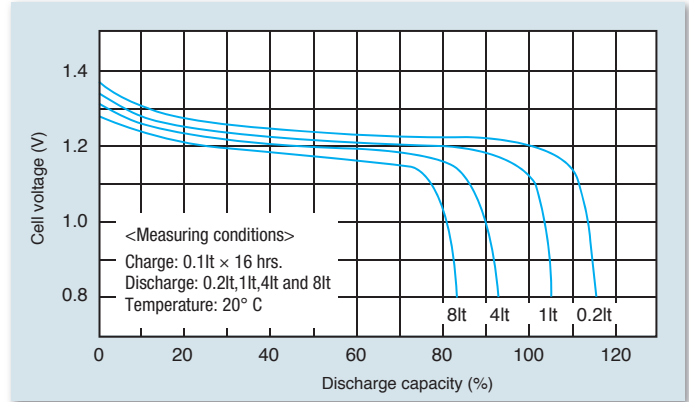
# General Characteristics of Cadnica Batteries

## Charge Characteristics



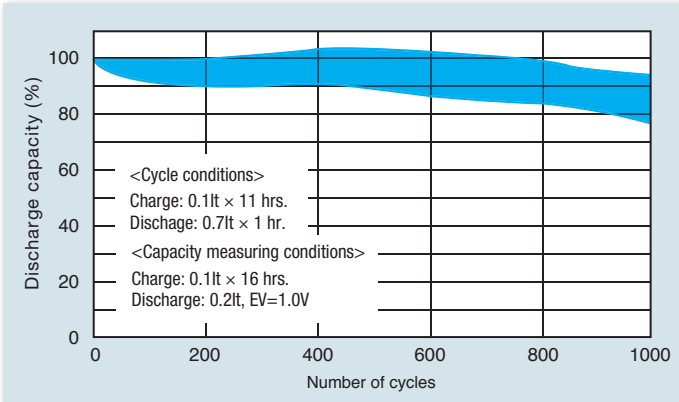
During charging, cell voltage increases as charging proceeds. It then decreases slightly in the final stage due to heat generation within the cell, eventually reaching an equilibrium. Cell voltage varies widely according to ambient temperature.

## Discharge Characteristics



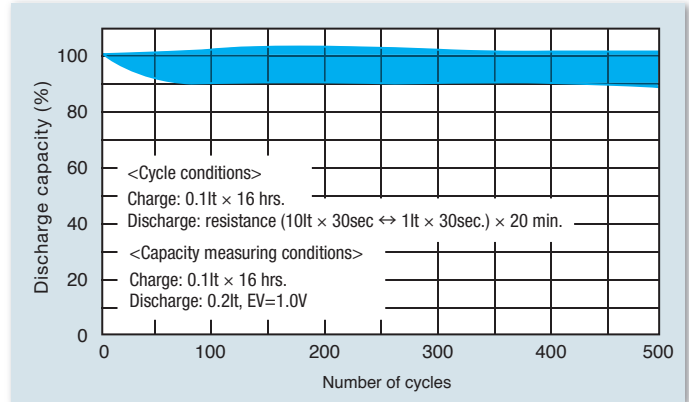
Although operating voltage varies slightly depending on discharge current, it is maintained at approximately 1.2V for 90% of the discharge period.

## Cycle Life Characteristics (1)



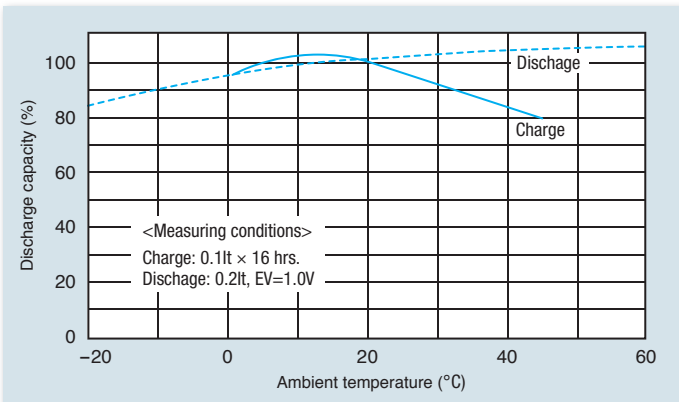
The life of a battery is a challenge to precisely measure, since it depends greatly on the conditions of use. Nevertheless, under normal usage conditions, standard Cadnica batteries can withstand over 500 charge/discharge cycles.

## Cycle Life Characteristics (2)



Even under high-rate pulse discharge conditions like power tools or radio-controlled models, Cadnica batteries can be expected to provide a long life of over 500 cycles.

## Temperature Characteristics

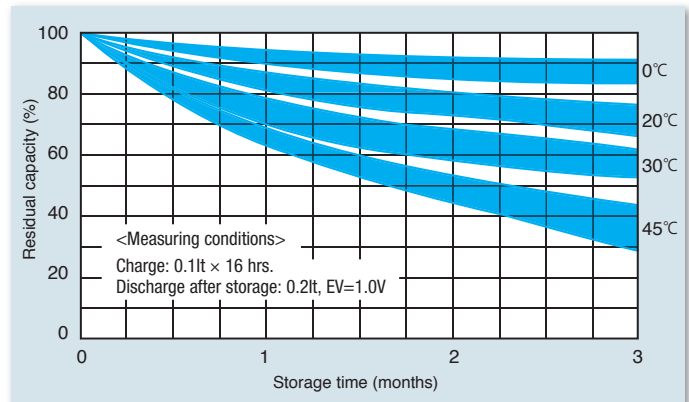


While Cadnica batteries can be used over a wide range of temperatures, cell characteristics will vary slightly depending on temperature. For optimum performance, use within the temperature range shown below.

- Charge: 0°C ~45°C
- Discharge: -20°C ~60°C
- Storage: -30°C ~50°C (for long-term storage, -30°C ~35°C)

\* While the above figure shows the relationship between the cell capacity and temperature, the difference in capacity due to temperature is temporary. Original performance is restored when the temperature returns to normal.

## Storage Characteristics

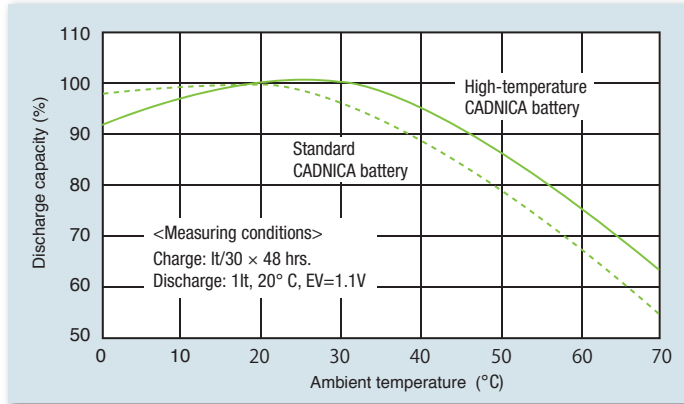


The cell voltage and capacity of a battery are generally reduced after storage. For Cadnica batteries, self-discharge accelerates with higher temperature. However, Cadnica batteries show minimal deterioration in battery performance even after long-term storage.

\* This document defines It according to the following equation:  $It (A) = C_s (Ah) / t (h)$  where  $C_s$  is the rated capacity of the cell in ampere-hours.

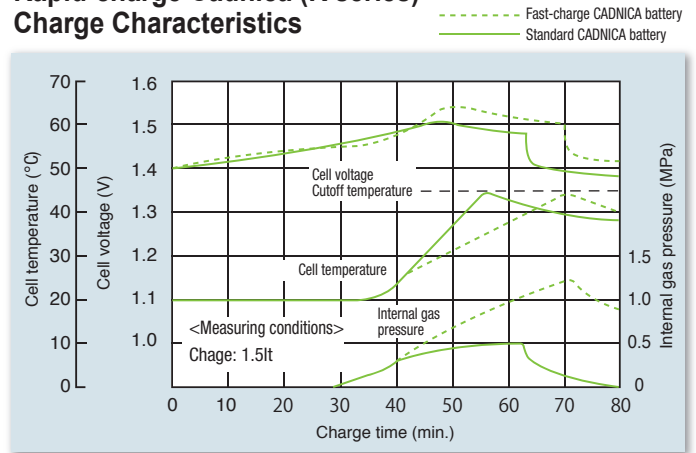
# Characteristics of Special Purpose Batteries

## High Temperature Cadnica (H series) Temperature Characteristics



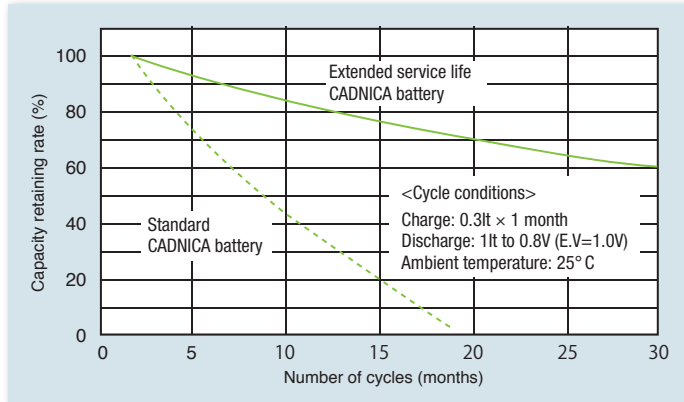
With considerably improved trickle-charge characteristics at high temperatures, high-temperature Cadnica batteries feature superior charge efficiency and a longer life.

## Rapid-charge Cadnica (R series) Charge Characteristics



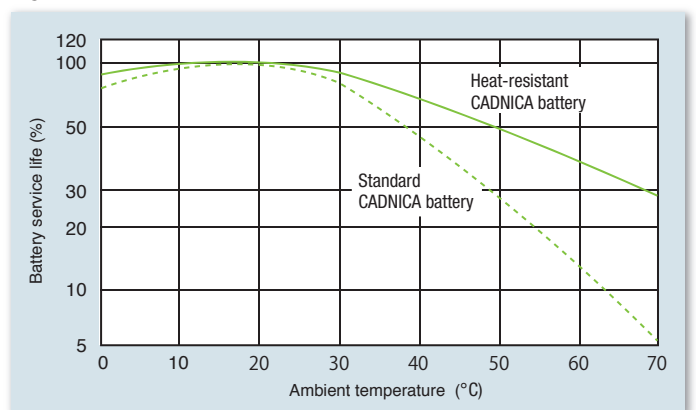
Rapid-charge Cadnica batteries can be charged in just one hour. Because the charger employs a temperature sensor to detect the temperature increase that occurs after the battery has been fully charged, these Cadnica batteries have significantly improved gas recombination compared to conventional Cadnica batteries. Moreover, the sharp temperature rise makes detection simple.

## Extended Life Cadnica (C series) Continuous Overcharging Cycle Characteristics



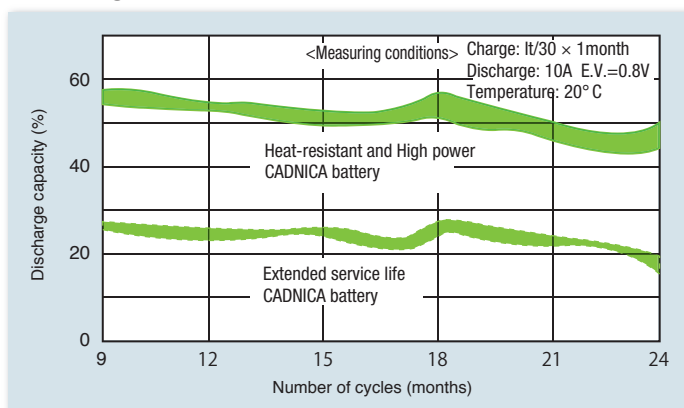
Employing a new separator, these batteries exhibit superior performance over a long period in both continuous charge and cycle modes. They achieve significantly longer life than standard Cadnica batteries.

## Heat-resistant Cadnica (K series) Cycle Life



Heat-resistant Cadnica batteries are specially designed for superior durability under severe rapid-charge conditions (three-hour rate charge without limitations) at temperatures as high as 70°C.

## Heat-resistant, High Power Cadnica (B series) Discharge Characteristics



The B-series Cadnica battery was developed by improving upon the extended life C-series Cadnica battery. The B-series is suitable for backup applications where both high power and heat resistance are critical.

## Types and Applications of CADNICA Batteries

Application For cycle longevity	Type				
	Fast-charge (R Series)	High-temperature (H Series)	Heat-resistant (K Series)	Heat-resistant and High-power (B Series)	Extended service life CADNICA batteries (C Series)
<b>For power tools/For high rate discharge</b>					
<b>Power tools</b> Drills, screwdrivers, grinders, circular saws, jig saws shears, lawn mower etc.	●				
Cordless cleaners	●				
Electric bicycles, Electric assisted bicycles	●				
Electric wheelchairs	●				
Engine starters	●				
Robots (for business use)	●				
Electric transporters (for business use)	●				
<b>For photovoltaic use</b>					
Guide lights			●	●	●
Lighting systems, Safety lights			●	●	●
Road tacked sign			●	●	●
Illuminated traffic signs, Illuminated signboards			●	●	●
Stand-alone systems (with Solar)			●	●	●
<b>Others</b>					
Cordless telephones, pagers				●	●
2-way radios	●		●	●	●
Portable VTR	●				
Search lights, photographic illumination	●				
Printers, word processors				●	●
Electrical shavers, toothbrushes	●			●	●
Medical equipment			●	●	
Measuring instruments			●	●	●
Radio control units, toys	●				

Application For cycle longevity	Type				
	Fast-charge (R Series)	High-temperature (H Series)	Heat-resistant (K Series)	Heat-resistant and High-power (B Series)	Extended service life CADNICA batteries (C Series)
uninterruptible power supply (small/large size) UPS		●			
Back up for base stations		●			
Security products		●			
Emergency lights, guide lights		●			
Car security alarms					
Electronic control circuits, semiconductor					
Memory retention power supplies		●		●	●

\* Typical applications are shown in the table above. For other purposes, consult Panasonic.