

Sanyo Rechargeable
CADNICA Batteries

Cadnica®



Internationally renowned for quality, compact dimensions and lightweight design, Sanyo CADNICA batteries accommodate space-saving requirements perfectly.

The development of Sanyo CADNICA batteries represents a major breakthrough in battery technology. In 1963, based on the company's proprietary technology, Sanyo succeeded in the commercialization of sealed rechargeable nickel cadmium batteries under the brand name "CADNICA". Over the years, CADNICA batteries have gained considerable renown for their outstanding technological features and excellent quality. Sanyo Electric Co., Ltd. has received ISO9000s accreditation for its industrial sealed Ni-Cd battery, an international quality guarantee standard. CADNICA batteries are designed to withstand continuous overcharging and overdischarging in a sealed environment. Moreover, their excellent performance is approved even in the field of space development for satellite applications. The Company's efforts towards increasing capacity and reducing size and weight have made possible an extensive lineup of Sanyo CADNICA batteries consisting of over 52 models with ratings from 110mAh to 20,000mAh. This means there is a CADNICA battery to suit a wide range of applications, even when only a very small space is available.



ISO9000 Series:

1. Quality activities to assure the product quality
2. Organization for the quality activities
3. Standardization and documentation of the quality activities
4. Quality control over the manufacturing process and finished product
5. Evidence of implementation under the standard

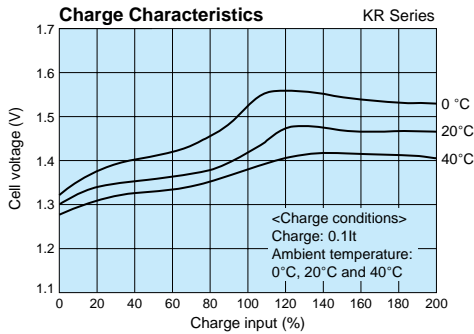
The ISO9000 series prove the well established quality control and effective quality activities.



General Characteristics of CADNICA Batteries

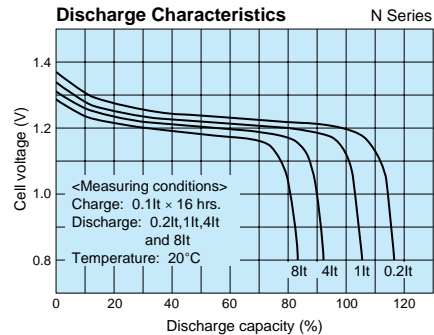
Charge characteristics

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



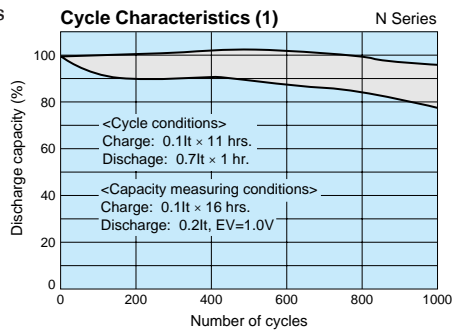
Discharge characteristics

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



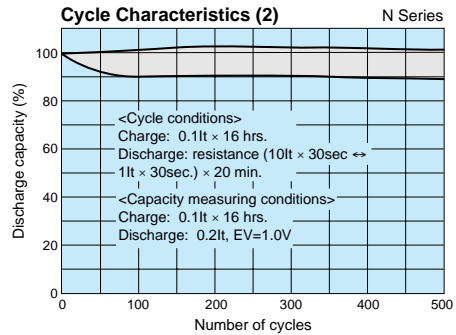
Cycle characteristics (1)

It is difficult to correctly measure the service life of a battery since this depends on the conditions of use. However, under normal usage conditions, standard CADNICA batteries can withstand over 500 charge/discharge cycles.



Cycle characteristics (2)

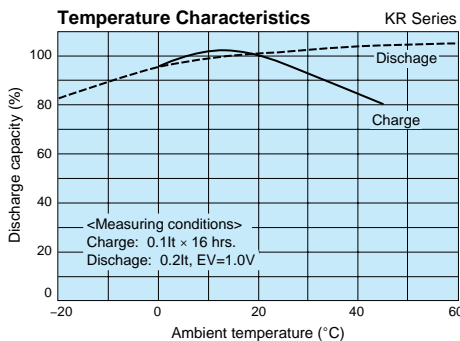
CADNICA batteries can be expected to provide a long service life of over 500 cycles, even under high-rate pulse discharge conditions, similar to actual use conditions of radio control units, power tools, etc.



Temperature characteristics

Sanyo CADNICA batteries can be used over an wide temperature range. As cell characteristics vary slightly depending on the temperature, use within the temperature range given below in order to obtain optimum performance.

- Charge: 0~+45°C
- Discharge: -20~+60°C
- Storage: -30~+50°C (-30~+35°C for long periods)

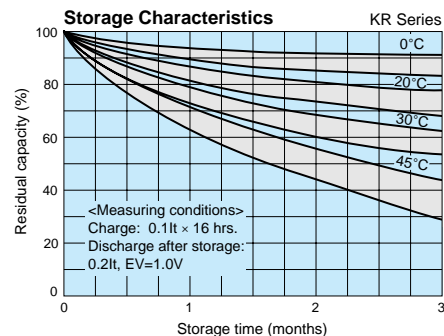


* Although the above figure shows the relationship between the cell capacity and temperature, the difference in capacity due to temperature change is temporary, and the original performance is restored when the temperature returns to normal.

Storage characteristics

The cell voltage and capacity of ordinary dry batteries are usually reduced after storage. With Sanyo CADNICA batteries, self-discharge accelerates as the temperature increases.

However, CADNICA batteries have minimal deterioration in battery performance even after long-term storage. Moreover, the cell capacity decreased through discharging during storage can easily be restored to its original level by recharging.



* {It} is a standard shall be express as:

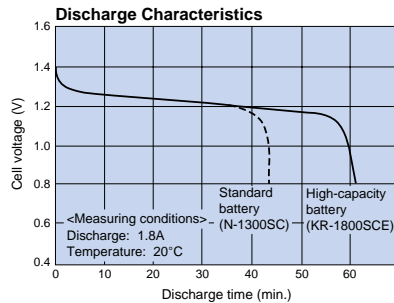
$$It (A) = C_s (Ah) / 1 (h)$$

$$C_s$$
 is the rated capacity of the cell or battery, in ampere-hours.

(Characteristics of Special Purpose Batteries)

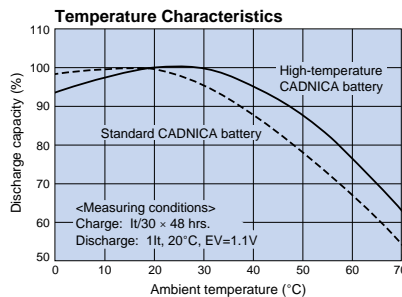
■ High-capacity CADNICA batteries (E Series)

High-capacity CADNICA batteries feature a capacity almost 40% higher than conventional CADNICA batteries, thanks to the use of high-density electrode plates and a new design concept. This results in more energy density compared to batteries of the same size.



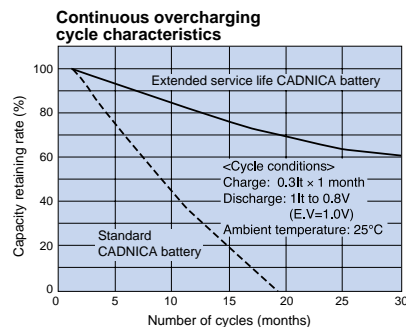
■ High-temperature CADNICA batteries for trickle charge use (H Series)

With considerably improved trickle-charge characteristics at high temperatures, high-temperature CADNICA batteries feature superior charge efficiency and discharge capacity, in addition to an impressively increased service life.



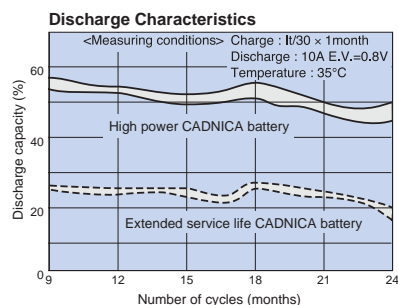
■ Extended service life CADNICA batteries (C Series)

Incorporating newly developed separator, these batteries exhibit superior performance for a long period in the continuous charging and cycle modes. They achieve significantly longer service life when compared to conventional batteries.



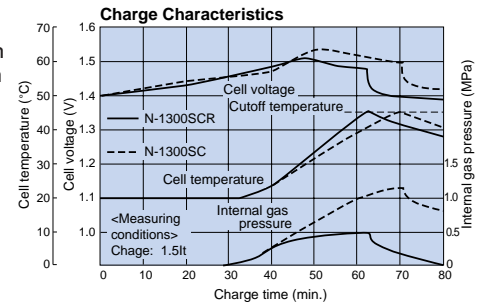
■ Heat-resistant and High power CADNICA batteries for back-up use (B series)

We have new Cadnica B series which were improved from Extended service life C series. Cadnica. B series are suitable for heat-resistant and high power back-up applications.



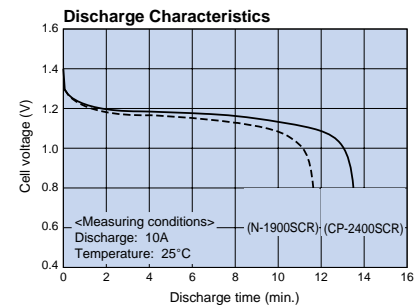
■ Fast-charge CADNICA batteries (R Series)

Fast-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 in comparison with conventional CADNICA batteries. Moreover, the sharp cell temperature rise makes detection simple.



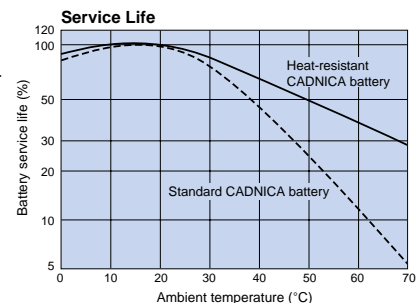
■ Fast-charge CADNICA batteries (CP Series)

Cobalt Power Series have been improved on the basis of usual R type. They are the batteries which we have accomplish to raise their capacity much higher by combining the original technology such as the adoption of the new way of adding cobalt compounds and the new development about the way of processing and the parts.




■ Heat-resistant CADNICA batteries for cycle use (K Series)

Heat-resistant CADNICA batteries are specially designed for superior durability under the severe conditions of fast charging (three-hour rate charge without any limitation) at temperatures as high as 70°C.



(Ratings of CADNICA Batteries)

■General-use CADNICA batteries (N Series/KR Series)

Type	Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
			Minimum ^{*1)}	Typical ^{*2)}	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
										Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	N-110AA	1.2	110	120	11	—	33	4~6	30	14.5 ⁰ _{-0.5}	17.5 ⁰ ₋₁	14.0±0.2	16.7±0.3	8
	N-1200SCL	1.2	1200	1250	120	—	—	—	6.2	22.9 ⁰ ₋₁	34.0 ⁰ _{-1.2}	22.0±0.3	33.0±0.3	42
	KR-600AAL	1.2	600	650	60	—	—	—	24	14.3 ⁰ _{-0.5}	48.9 ⁰ ₋₁	13.8±0.2	48.2±0.3	19
	KR-1000SCL	1.2	1000	1100	100	—	—	—	7.6	22.9 ⁰ ₋₁	34.0 ⁰ _{-1.2}	22.0±0.3	33.0±0.3	37
	KR-1200SCL	1.2	1200	1350	120	—	—	—	5.8	22.9 ⁰ ₋₁	34.0 ⁰ _{-1.2}	22.0±0.3	33.0±0.3	39
	KR-1300SC	1.2	1300	1450	130	—	—	—	4.8	22.9 ⁰ ₋₁	43.0 ⁰ _{-1.2}	22.0±0.3	42.0±0.3	45
	KR-1500SCT	1.2	1500	1550	150	—	—	—	5.5	22.9 ⁰ ₋₁	43.0 ⁰ _{-1.2}	22.0±0.3	42.0±0.3	47
	KR-4400D	1.2	4400	4800	440	—	—	—	3.8	33.2 ⁰ _{-0.9}	61.1 ⁰ _{-1.5}	32.3±0.3	60.0±0.4	146
	KR-7000F	1.2	7000	7700	700	—	—	—	3.4	33.2 ⁰ _{-0.9}	91.0 ⁰ _{-1.4}	32.3±0.3	90.0±0.4	224
	KR-10000M	1.2	10000	12000	1000	—	—	—	2.6	43.1 ⁰ ₋₁	91.0 ⁰ _{-1.4}	42.1±0.3	90.0±0.4	395


Operating temperature range; Charge: 0~45°C (standard), 10~45°C (quick), discharge: -20~60°C, storage: -30~50°C (-30~35°C for long periods)

Note: Consult Sanyo concerning operating conditions for quick charging of N-1200SCL higher models.

When using assembled batteries consisting of KR-4400D or higher model batteries, consideration must be given to the problem of cell temperature increase.

Sanyo can provide assembled batteries that meet your specific conditions of use.

■High-capacity CADNICA batteries (E Series / U Series)

Type	Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
			Minimum ^{*1)}	Typical ^{*2)}	Current (mA)	Time (hr.)		Including tube		Bare cell		
								Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	KR-600AE	1.2	600	650	60	—	9.5	17.0 ⁰ _{-0.5}	28.5 ⁰ ₋₁	16.5±0.2	27.8±0.3	19
	KR-1100AAU	1.2	1100	1150	110	—	19	14.3 ⁰ _{-0.5}	50.3 ⁰ ₋₁	13.8±0.2	49.5±0.3	24
	KR-1200AAE	1.2	1200	1300	120	—	12	14.3 ⁰ _{-0.5}	65.3 ⁰ ₋₁	13.8±0.2	64.5±0.3	32
	KR-1200AUL	1.2	1200	1300	120	—	12	17.0 ⁰ _{-0.5}	43.0 ⁰ _{-1.2}	16.5±0.2	42.0±0.3	27
	KR-1500AUL	1.2	1500	1550	150	—	16	17.0 ⁰ _{-0.5}	43.0 ⁰ _{-1.2}	16.5±0.2	42.0±0.3	30
	KR-1700AU	1.2	1700	1750	170	—	17	17.0 ⁰ _{-0.5}	49.5 ⁰ _{-1.2}	16.5±0.2	48.5±0.3	35
	KR-1800SCE	1.2	1800	1900	180	—	6.5	22.9 ⁰ ₋₁	43.0 ⁰ _{-1.2}	22.0±0.2	42.0±0.3	49
	KR-5000DEL	1.2	5000	5400	500	—	3.5	33.2 ⁰ _{-0.9}	59.5 ⁰ _{-1.5}	32.3±0.3	58.4±0.4	152


Operating temperature range; Charge: 0~45°C (standard), discharge: -20~60°C, storage: -30~50°C (-30~35°C for long periods)

Note: Consult Sanyo concerning 1-hour charge.

When using assembled batteries consisting of KR-5000DEL, consideration must be given to the problem of cell temperature increase.

Sanyo can provide assembled batteries that meet your specific conditions of use.


■Extended service life CADNICA batteries (C Series / EC Series)

Type	Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
			Minimum ^{*1)}	Typical ^{*2)}	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
										Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	N-270AAC	1.2	270	300	27	—	81	—	18	14.5 ⁰ _{-0.5}	30.3 ⁰ ₋₁	14.0±0.2	29.5±0.3	13
	N-500AC	1.2	500	550	50	—	150	—	9.0	17.0 ⁰ _{-0.5}	28.5 ⁰ ₋₁	16.5±0.2	27.8±0.3	19
	N-600AAC	1.2	600	650	60	—	180	—	12	14.3 ⁰ _{-0.5}	50.2 ⁰ ₋₁	13.8±0.2	49.5±0.3	22
	N-700AAC	1.2	700	750	70	—	210	—	16	14.3 ⁰ _{-0.5}	50.2 ⁰ ₋₁	13.8±0.2	49.5±0.3	23
	N-600AACL	1.2	600	650	60	—	180	—	14	14.3 ⁰ _{-0.5}	48.9 ⁰ ₋₁	13.8±0.2	48.2±0.3	22
	N-700AACL	1.2	700	750	70	—	210	—	16	14.3 ⁰ _{-0.5}	48.9 ⁰ ₋₁	13.8±0.2	48.2±0.3	23
	KR-900AAEC	1.2	900	950	90	—	—	—	19	14.3 ⁰ _{-0.5}	50.3 ⁰ ₋₁	13.8±0.2	49.5±0.3	23
	N-1200SCC	1.2	1200	1350	120	—	360	—	4.2	22.9 ⁰ ₋₁	43.0 ⁰ _{-1.2}	22.0±0.3	42.0±0.3	52

Operating temperature range; Charge: 0~45°C (standard), 10~45°C (quick), discharge: -20~60°C, storage: -30~50°C (-30~35°C for long periods)


Note: Sanyo can provide model N-1700SCC with quick-charge capability depending on your specific conditions of use.

Fast-charge CADNICA batteries (CP Series)

Type	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				Weight (approx.g)
			Minimum ^{※1}	Typical ^{※2}	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)			Including tube		Bare cell		
											Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	CP-1300SCR	1.2	1200	1300	130	14~16	—	—	1950	6.5	22.9 ⁰ ₋₁	26.7 ⁰ _{-0.9}	22.0±0.3	26.0±0.3	35
	CP-1700SCR	1.2	1650	1700	170		—	—	2550	5.5	22.9 ⁰ ₋₁	34.0 ⁰ _{-1.2}	22.0±0.3	33.0±0.3	45
	CP-2400SCR	1.2	2350	2400	240		—	—	3600	4.5	22.9 ⁰ ₋₁	43.5 ⁰ _{-1.2}	22.0±0.3	42.5±0.4	62


Operating temperature range; Charge: 0~45°C (standard), 10~45°C (quick), 5~40°C (1-hour), discharge: -20~60°C, storage: -30~50°C (-30~35°C for long periods)
 Note: Quick charge: Sanyo can provide to meet specific conditions of use.
 1-hour rate charge: Contact Sanyo regarding 30-minutes rate charge.

Fast-charge CADNICA batteries (R Series)

Type	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				Weight (approx.g)
			Minimum ^{※1}	Typical ^{※2}	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)			Including tube		Bare cell		
											Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	N-1250SCL	1.2	1200	1250	125	14~16	380	4~6	1900	5.0	22.9 ⁰ ₋₁	34.0 ⁰ _{-1.2}	22.0±0.3	33.0±0.3	43
	N-1300SCR	1.2	1300	1400	130		390	—	2000	4.0	22.9 ⁰ ₋₁	43.0 ⁰ _{-1.2}	22.0±0.3	42.0±0.3	51
	N-1700SCR	1.2	1700	1850	170		—	—	2600	4.0	22.9 ⁰ ₋₁	43.0 ⁰ _{-1.2}	22.0±0.3	42.0±0.3	55
	N-1900SCR	1.2	1900	2000	190		—	—	2900	4.0	22.9 ⁰ ₋₁	42.9 ⁰ _{-1.2}	22.0±0.3	42.0±0.4	58
	N-3000CR	1.2	3000	3200	300		—	—	4500	3.4	26.0 ⁰ _{-0.8}	50.0 ⁰ _{-1.2}	25.2±0.3	49.0±0.3	86
	N-4000DRL	1.2	4000	4300	400		—	—	6000	2.8	33.2 ⁰ _{-0.9}	59.5 ⁰ _{-1.5}	32.3±0.3	58.4±0.4	160


Operating temperature range; Charge: 0~45°C (standard), 10~45°C (quick), 5~40°C (1-hour), discharge: -20~60°C, storage: -30~50°C (-30~35°C for long periods)
 Note: Quick charge: Sanyo can provide model N-1700SCR or higher model batteries to meet specific conditions of use.
 1-hour rate charge: Contact Sanyo regarding 30-minutes rate charge.
 When using assembled batteries consisting of N-4000DRL, consideration must be given to the problem of cell temperature increase.
 Sanyo can provide assembled batteries that meet your specific conditions of use.

High Temperature CADNICA batteries (H Series)

Type	Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Trickle charge		Standard charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
			Minimum ^{※1}	Typical ^{※2}	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
										Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	KR-AAH	1.2	600	650	20	48~	60	14~16	15	14.3 ^{-0.5}	48.9 ⁰	13.8±0.2	48.2±0.3	23
	KR-SCH (1.2)	1.2	1200	1300	40		120		8.5	22.9 ⁰	43.0 ^{-0.2}	22.0±0.3	42.0±0.3	47
	KR-SCH (1.5)	1.2	1500	1600	50		150		12	22.9 ⁰	43.0 ^{-0.2}	22.0±0.3	42.0±0.3	47
	KR-SCH (1.6)	1.2	1600	1650	53		160		6.8	22.9 ⁰	43.0 ^{-0.2}	22.0±0.3	42.0±0.3	49
	KR-SCH (1.7)	1.2	1700	1800	57		170		6.8	22.9 ⁰	43.0 ^{-0.2}	22.0±0.3	42.0±0.3	49
	KR-CH (2.0)	1.2	2000	2100	67		200		6.5	26.0 ⁰ _{-0.8}	50.0 ^{-0.3}	25.2±0.3	49.0±0.3	72
	KR-CH (2.5)	1.2	2500	2600	83		250		6.5	26.0 ⁰ _{-0.8}	50.0 ^{-0.3}	25.2±0.3	49.0±0.3	75
	KR-CH (3.0)	1.2	2900	3050	100		300		5.9	26.0 ⁰ _{-0.8}	50.5 ^{-0.2}	25.2±0.3	49.0±0.3	78
	KR-DHL	1.2	4000	4500	133		400		4.2	33.2 ⁰ _{-0.9}	59.5 ⁰ _{-1.5}	32.3±0.3	58.4±0.4	146
	KR-FH	1.2	7000	7700	233		700		3.5	33.2 ⁰ _{-0.9}	91.0 ^{-1.4}	32.3±0.3	90.0±0.4	224
	KR-MH	1.2	10000	12000	200		1000		2.6	43.1 ⁰	91.0 ^{-0.4}	42.1±0.3	90.0±0.4	395
	KR-5/3MH	1.2	20000	22000	400		2000		2.6	43.1 ⁰	146.1 ^{-1.5}	42.1±0.3	145.0±0.4	648

Operating temperature range; Charge: 0~70°C (standard), discharge: -20~70°C, storage: -30~70°C (-30~45°C for long periods)
 Note: H Series can meet specific conditions of IEC 61951-1 MT grade.
 When using assembled batteries consisting of KR-DHL or higher model batteries, consideration must be given to the problem of cell temperature increase.
 Sanyo can provide assembled batteries that meet your specific conditions of use.

Heat-resistant CADNICA batteries (K Series)/Heat-resistant and High power CADNICA batteries for back-up use (B series)

Type	Model	Nominal Voltage (V)	Capacity (mAh) at 0.2It rate.		Standard charge		Quick charge		Internal resistance (mΩ)	External dimensions				Weight (approx.g)
			Minimum ^{※1}	Typical ^{※2}	Current (mA)	Time (hr.)	Current (mA)	Time (hr.)		Including tube		Bare cell		
										Diameter (D) (mm)	Height (H) (mm)	Diameter (D) (mm)	Height (H) (mm)	
	N-270AAK	1.2	270	300	27	14~16	81	4~6	15	14.5 ^{-0.5}	30.3 ⁰	14.0±0.2	29.5±0.3	13
	N-600AAK	1.2	600	650	60		180		12	14.3 ^{-0.5}	50.2 ^{-0.1}	13.8±0.2	49.5±0.3	22
	N-1200SCK	1.2	1200	1350	120		360		4.2	22.9 ⁰	43.0 ^{-0.2}	22.0±0.3	42.0±0.3	52
	N-1600SCB	1.2	1550	1700	160		480		4.1	22.9 ⁰	42.9 ^{-0.2}	22.0±0.3	42.0±0.3	57
	N-2000CB	1.2	2000	2300	200		600		3.3	26.0 ⁰ _{-0.8}	50.0 ^{-0.3}	25.2±0.3	49.0±0.3	85

Operating temperature range; Charge: 0~70°C (standard), 10~70°C (quick), discharge: -20~70°C, storage: -30~70°C (-30~45°C for long periods)
 Note: Sanyo can provide model N-1200SCK with quick-charge capability depending on your specific conditions of use.
 Sanyo can provide B series with quick-charge capability depending on your specific conditions of use.

※1 : Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours.
 ※2 : Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours.