Safety Precautions and Usage Guidance

Some batteries contain flammable substance which, if misused or mishandled, may result in electrolyte leakage, deformation, heat-generation, rupture, and/or fire. Please be sure to observe the following safety precautions.

⚠ DANGER: READ BEFORE USE

1. Do not expose batteries to fresh water, seawater, beverages, or any other liquid, or allow batteries to get wet. Built-in safety equipment may be compromised, potentially resulting in heat-generation, smoke-generation, rupture, and/or fire.
2. Do not use or leave batteries near fires, stoves, or other high-temperature objects 80 °C or over. If the plastic separator gets damaged due to heat exposure, short-circuiting inside batteries may cause heat-generation, smoke-generation, rupture, and/or fire.
3. Never charge any battery type except rechargeable batteries. Ensure the device's circuit design prevents current intrusion from other power sources.
4. When charging batteries, use approved battery chargers only and observe battery-charging usage conditions specified by Panasonic. When charging batteries in other charging conditions (undesignated temperatures, undesignated voltage, current, or modified chargers), over-charging, charging with abnormal current flow, an abnormal chemical reaction inside batteries may occur, resulting in heat-generation, smoke-generation, rupture, and/or fire.
5. Every battery has a predetermined polarity. If a battery does not fit comfortably in a battery charger or appliance, do not insert the battery by force. Instead, check the battery's polarity. In case of reverse connection, batteries may charge backwards causing an abnormal chemical reaction which may result in leakage, heat-generation, smoke-generation, rupture, and/or fire.
6. Do not attach batteries to an AC outlet or directly to a vehicle's electrical outlet. This may result in electric shock, voltage spikes, and excessive current flow within the battery, potentially causing leakage, heat-generation, smoke-generation, rupture, and/or fire.
7. Using batteries for unapproved applications may affect battery performance or reduce battery life. Usage in some devices may damage batteries due to abnormal current flow, resulting in heat-generation, smoke-generation, rupture, and/or fire.
8. Do not incinerate batteries or heat them to high temperatures. This will melt the insulator, damaging the gas valve and other safety measures, or ignite the electrolyte, resulting in heat-generation, smoke-generation, rupture, and/or fire.
9. Do not connect the positive terminal and negative terminal of a battery with any metal object. Also, do not store or carry batteries where they could contact keys, hairpins, paper clips, jewelry, etc. This may cause short-circuiting and excessive current flow resulting in heat-generation, smoke-generation, rupture, and/or fire, or heat the contacted metals.
10. Do not subject batteries to high impact or shock. This may result in leakage, heat-generation, smoke-generation, rupture, and/or fire. If built-in safety equipment gets damaged, batteries may charge abnormally, causing an abnormal chemical reaction inside they battery which may result in heat-generation, smoke-generation, rupture, and/or fire.
11. Do not penetrate batteries with nails, strike with a hammer, etc. This will destroy safety equipment, cause battery deformation, or short-circuit the battery, resulting in heat-generation, smoke-generation, rupture, and/or fire.
12. Do not directly solder batteries or drop batteries into a solder bath. Heat may melt the insulation or cause damage to the safety valve and related equipment, resulting in heat-generation, smoke-generation, rupture, and/or fire.
13. Never disassemble, modify, or twist batteries inside the pack. Built-in safety equipment or protective mechanisms in the battery or battery pack may be compromised, potentially resulting in heat-generation, smoke-generation, rupture, and/or fire.
14. Do not peel or scratch off the protective outer tube of a battery. Doing so can easily cause the batteries to leak, generate heat, or explode.
15. Do not charge batteries near fires or inside cars in hot weather. In high-temperature locations, a safety mechanism works to prevent danger but may impede charging or destroy the safety mechanism, resulting in heat-generation, smoke-generation, rupture, and/or fire due to charging via abnormal current flow/voltage or abnormal chemical reaction inside the battery.
16. Some batteries incorporate a gas-venting structure to discharge internal gases. For this reason, do not deform the positive electrode.
17. Some batteries cannot be installed in hermetically sealed equipment. Doing so may cause gas buildup inside the device, which may result in rupture or explosion if ignited.
18. Some batteries contain alkaline electrolyte. Accidental exposure may result in loss of eyesight. If contact occurs, do not rub the eye, but immediately wash with clean water and seek medical assistance as soon as possible.

⚠ WARNING

1. To avoid accidental ingestion of small batteries, keep devices and batteries out of reach of children. If swallowed, seek emergency medical care immediately.
2. Do not place batteries in microwave ovens, high-pressure containers, or induction cookware. This may suddenly heat batteries or compromise their seal, resulting in heat-generation, smoke-generation, rupture, and/or fire.
3. Keep new batteries separate from used batteries, and never mix batteries of different capacities, types, or brands. This may result in heat-generation, smoke-generation, rupture, and/or fire due to over-discharging or over-charging and other abnormal chemical reactions inside the batteries when in use.
4. If an abnormal odor, temperature, discoloration, deformation, or other unusual symptom is detected when using, charging, or storing batteries, take them out of the device or charger, and do not use them. Using them as-is may result in heat-generation, smoke-generation, rupture, and/or fire.
5. When charging exceeds the specified replenishment time, stop charging the battery as soon as possible. Failing to do so may cause over-charging or result in heat-generation, smoke-generation, rupture, and/or fire.
6. Take extreme care to prevent batteries from contacting fire if leakage or unusual smell is detected. Leaked electrolyte may ignite, resulting in smoke-generation, rupture, and/or fire.
7. If leaked electrolyte contacts eyes, do not rub them. Immediately wash the affected area with clean water and consult a doctor. Exposure to electrolyte may result in loss of eyesight if left untreated.
8. Secure in strong packaging so batteries inside a case do not move during transit. Failure to do so may cause damage or short-circuit the metal terminals.
9. When discarding used batteries, follow all relevant government laws and regulations in your country or region.

⚠ CAUTION

1. Do not place batteries in direct sunlight, use, or store batteries inside cars in hot weather. This may result in battery leakage, heat-generation, and/or smoke-generation. Product performance and lifespan may be also be reduced.
2. Do not use batteries where static electricity greater than 100 V may damage built-in battery safety mechanisms, resulting in battery leakage, heat-generation, smoke-generation, rapture, and/or fire.
3. Regarding temperature range when charging batteries, contact your Panasonic sales representative or dealer for more details. Charging batteries outside the designated temperature range may result in battery leakage, heat-generation, and/or rapture, or reduce battery performance and lifespan.
4. Be sure to read instruction manual before use. Keep it in a safe place and refer to it when needed.
5. Carefully read the instruction manual(s) of the dedicated charger to learn how to properly and safely charge batteries.
6. If you notice oxidization, abnormal odor, excessive heat, or other unusual symptoms when using batteries for the first time after purchasing, do not use them and return them to point of purchase.
7. When batteries are likely to be used by small children, caregivers should provide advice on safe usage based on the user manual and provide adequate supervision to ensure the batteries are properly used.
8. Do not put flammable substances on batteries or cover them during charging or discharging. This may result in heat-generation, rupture, and/or fire.
9. If leaked electrolyte ever contacts skin or clothes, immediately wash the affected area with clean water. Failure to do so may result in rashes or other skin conditions.
10. Secure the battery terminals with adhesive tape or similar when wire leads or other metal terminals are exposed. Failure to do so may cause short-circuiting, resulting in heat-generation, fire, and/or rapture.

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https://energy.panasonic.com/global/business

The contents of this catalog are valid as of June, 2025

Panasonic
ENERGY

Lithium Batteries
Nickel-Metal Hydride Batteries
Catalog

Please visit our website for the latest information

Energy that changes the future.

Panasonic Energy Device Business Division

Panasonic commenced in-house dry battery production in 1931. For almost 90 years, we've developed countless batteries and overcome the challenges of mass-production to deliver a cumulative total of over 200 billion units to more than 120 countries. Panasonic batteries play a vital role in the automotive industry, where our products contribute to on-road safety; in commercial infrastructure where 5G/LPWA wireless networks are deployed; and in IoT-based medical equipment. We will continue creating high quality batteries that support healthy society while contributing to the growth of our customers' businesses.

History of Energy Device Business Division

1931
Matsushita Electric Factory No.8 starts in-house production of dry batteries

1933
Osaka Moriguchi Factory

1976
Micro-battery production commences

1918
Matsushita Electric Housewares Manufacturing Works (now Panasonic) is established

1963
National Hi-Top dry battery

1977
Coin-type lithium battery

1983
National Ultra-NEO alkaline battery

1990
Nickel-metal hydride battery

2000
Cylindrical-type lithium battery for industrial use

2008
EVOLTA

2017
EVOLTA NEO

1954
National Hyper dry battery

1969
National NEO Hi-Top dry battery

1987
Cylindrical-type lithium battery

1997
Coin-type battery for high-temperature applications

2005
eneloop

2015
Pin-type lithium-ion battery

Production Bases

Production bases: **9** factories
Domestic: 1 factory Overseas: 8 factories

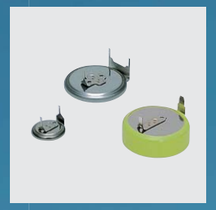
Employees: **7,059** people
* As of March 2022.

- Thailand — Bangkok
- Indonesia — Jakarta
- U.S.A. — Columbus
- India — Peetampur
- China — Wuxi
- Costa Rica — San Jose
- India — Chennai
- Japan — Osaka
- Brazil — Sao Paulo

Product Lineup

Coin-type Lithium Batteries

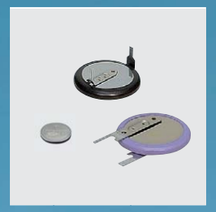
Businesses and end-users depend on Panasonic coin-type lithium batteries to work reliably behind the scenes under the most challenging conditions. Coin-type lithium has won a stellar reputation not only as a high-performance primary power supply, but also as a backup power-source for applications in the automotive industry and in other various electronic devices.
Our lineup covers models optimized for high capacity through to batteries engineered for stable, long-lasting operation in high-temperature environments.



- CR Series Manganese Dioxide Lithium Batteries
- BR Series Poly-carbonmonofluoride Lithium Batteries
- CR Series Manganese Dioxide Lithium Batteries for High Temperatures
- BR Series Poly-carbonmonofluoride Lithium Batteries for High Temperatures

Coin-type Rechargeable Lithium Batteries

Coin-type rechargeable batteries are designed for long-life stability. These robust cells make ideal memory-backup power supplies for industrial devices, medical equipment, and wireless communications devices, or as energy storage devices for solar-powered watches.



- VL Series Vanadium Rechargeable Lithium Batteries
- ML Series Manganese Rechargeable Lithium Batteries
- CTL Series Cobalt Titanium Rechargeable Lithium Batteries
- MT Series Manganese Titanium Rechargeable Lithium Batteries

Nickel-Metal Hydride Batteries

Nickel-metal hydride batteries are eco-friendly rechargeable cells designed to maintain long-life performance in the most demanding environments. This battery-type plays an important role in industrial and commercial applications with versatility to serve as a main power supply in smaller devices, or as a backup power supply for emergency situations.

- Infrastructure Backup
- Large-type for Infrastructure Applications
- Automotive Backup
- Button Top
- Standard
- High-rate Discharge

Cylindrical-type Lithium Batteries

With strong durability and reliability, Panasonic cylindrical lithium batteries make ideal power sources for meters such as intelligent gas meters, which automatically shut off the gas if abnormalities are detected.
Cylindrical-type Lithium offers an extended product lifespan without need of maintenance.

- CR Series Manganese Dioxide Lithium Batteries (Standard Type)
- CR Series Manganese Dioxide Lithium Batteries (Long-life Type)
- BR Series Poly-carbonmonofluoride Lithium Batteries

Batteries for Automotive Applications

Automotive

Panasonic batteries for automotive applications, such as anti-theft security systems and eCall systems (emergency call systems), can be counted on to function reliably in emergencies. They are safe, long-lasting, and ideally suited to automotive backup applications.

- Coin-type Lithium Batteries / Rechargeable Lithium Batteries
- Nickel-Metal Hydride Batteries

» Remote Keyless Entry / Anti-theft Security Systems

» eCall Systems (Emergency Call Systems)

» Event Data Recorder (EDR)

» Tire Pressure Monitoring Systems (TPMS)

Batteries to Support Infrastructure

Infrastructure

We offer a range of batteries developed for infrastructure support where they serve as main power sources in smaller devices or as emergency backup supplies. They are engineered to sustain long-life performance in the toughest environments. Infrastructure-type batteries contribute to a comfortable, safe, and secure society by supplying requisite electricity in a way that protects people and the environment.

- Coin-type Lithium Batteries / Rechargeable Lithium Batteries
- Cylindrical-type Lithium Batteries
- Nickel-Metal Hydride Batteries

» Emergency Lights / Guide Lights

» Elevators

» Gas Meters / Water Meters

» Fire Alarms

Batteries for IoT / LPWA

IoT/LPWA

IoT devices connected to LPWA networks enable data communication over long distances with minimal power consumption and are usually installed in difficult-to-access locations, meaning cell replacement should be infrequent. Batteries for IoT / LPWA applications must therefore possess outstanding endurance. Panasonic offers a variety of long-lasting battery types designed for stable discharge over long periods.

- Coin-type Lithium Batteries
- Cylindrical-type Lithium Batteries
- Nickel-Metal Hydride Batteries

» Construction Machinery

» Medical Devices

» Agricultural Machinery

» Water-level Sensors

Panasonic ENERGY

Lithium Battery Features

(1) Wide Product Range

We provide a wide selection of different products engineered to suit an even wider range of applications from primary power-supply to backup power insurance in emergency situations

(2) Proven Reliability

We possess more than 40 years' experience in lithium battery design, innovation, product development, and mass production techniques with a proven track record for safety and reliability

(3) Durable Performance in Tough Conditions

Expect dependable performance in the harshest conditions and excellent resistance to extremes in temperature—a welcome characteristic when deployed in meters that are in use for extended periods

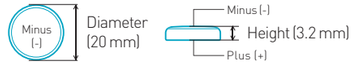
Primary Lithium Batteries (Non-chargeable)	Coin-type Lithium Batteries	CR Series (Manganese Dioxide Lithium Batteries)
		BR Series (Poly-carbonmonofluoride Lithium Batteries)
	Cylindrical-type Lithium Batteries	CR Series (Manganese Dioxide Lithium Batteries)
		BR Series (Poly-carbonmonofluoride Lithium Batteries)
	Pin-type Lithium-ion Batteries	BR Series (Poly-carbonmonofluoride Lithium Batteries)
Rechargeable Lithium Batteries	Coin-type Rechargeable Lithium Batteries	VL Series (Vanadium Rechargeable Lithium Batteries)
		ML Series (Manganese Rechargeable Lithium Batteries)
		CTL Series (Cobalt Titanium Rechargeable Lithium Batteries)
		MT Series (Manganese Titanium Rechargeable Lithium Batteries)

Example Lithium Battery Model-Number Composition (Coin Type)

Example: **CR2032**

- Height: 3.2 mm
- Diameter: 20 mm
- R: Round
- Battery Type C: Manganese dioxide lithium battery

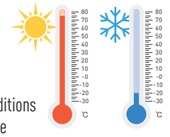
Size



Nickel-Metal Hydride Battery Features

(1) Works in a Range of Temperatures

Stable performance in harsh conditions with a wide operating temperature

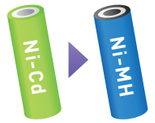


(2) Eco-friendly Power

Reusable designs limit wastage for reduced environmental impact

(3) Ideal Replacement for Nickel-Cadmium Batteries

A longer-lasting alternative to nickel-cadmium batteries



		High-Current Discharge	Rapid Charging*1	Ultra-Rapid Charging*2	High Temp. (60 °C) Recharging*3	High Temp. (75 °C) Recharging*3	Long Life*4
Nickel-Metal Hydride Batteries	U Infrastructure Backup (Long-life Type)		●		●	●	●
	H Infrastructure Backup (General Type)		●		●		●
	PH Infrastructure Backup (High-rate Discharge Type)	●	●		●		●
	V Large-type for Infrastructure Applications	●			●		●
	W Automotive Backup		●		●		●
	B Button Top		●				
	N Standard		●				
	P High-rate Discharge	●	●	●			

*1 1–2 hours (dT/dt value). *2 Charge time within 1 hour (step-control charge system). Note: For charging specifications, please consult your Panasonic sales representative. *3 Standard model (0 °C to 45 °C).
*4 Approximately 2,000 cycles (under Panasonic's recommended charge/discharge conditions).

Example Nickel-Metal Hydride Battery Model-Number Composition

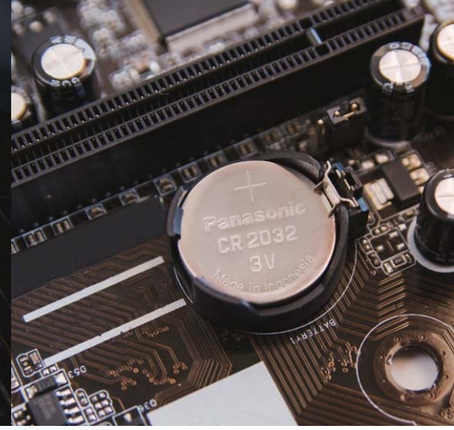
Example: **BK60AAAH**

- Type, etc.
- Size
- Figure x 10 equals rated discharge capacity (with some exceptions)
- Battery Type BK: Nickel-Metal Hydride

Size

- **AAA**
- **AA**
- **A**
- **SC**
- **C**
- **F**



Coin-type Lithium Batteries

Panasonic Coin-type Lithium is renowned for stellar performance in small electric appliances and for flexible implementation in memory-backup applications in temperatures as high as 125 °C. Select from a CR or BR chemistries, a choice of sizes, and a range of capacities up to 1,000 mAh.

CR Series Manganese Dioxide Lithium Batteries

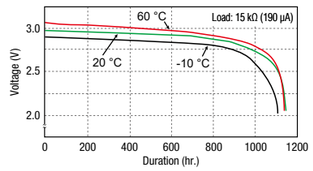
Features

- Offers high-rate pulse discharge
- Available in a range of compact sizes and capacities, from thin-type to high-capacity models
- Excellent low-temperature performance enhanced by manganese-dioxide positive pole

Applications

Remote keyless entry, card remote controls, memory backup, security price tags, smart transmitter tags, etc.

■ Discharge temperature characteristics (Example: CR2032)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range*2
				Diameter	Height		
CR1025	3	30	0.1	10.0	2.5	0.6	-30 °C to 85 °C
CR1216		25		12.5	1.6	0.7	
CR1220		35			2.0	0.9	
CR1616		55		16.0	1.6	1.0	
CR1620		75			2.0	1.3	
CR1632		140			3.2	1.9	
CR2012		55		20.0	1.2	1.4	
CR2016		90			1.6	1.6	
CR2025		165	0.2		2.5	2.3	
CR2032		225			3.2	2.8	
CR2330		265		23.0	3.0	3.7	
CR2354		560			5.4	5.7	
CR2412		100		24.5	1.2	2.0	
CR2450		620			5.0	6.2	
CR2477		1,000			7.7	10.5	
CR3032		500		30.0	3.2	6.9	

*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.
*2 Please consult your Panasonic sales representative when anticipating usage in operating temperatures of 70 °C or above.

BR Series Poly-carbonmonofluoride Lithium Batteries

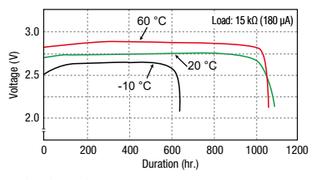
Features

- BR Series batteries developed with exclusive Panasonic technology
- Exhibits stable performance after long periods in storage due to low self-discharge characteristics
- Primarily used for memory-backup power in low-drain applications

Applications

Commercial equipment (communication/measurement devices), electricity meters, memory backup (security cameras, security sensors), automotive electronic components (ETC), etc.

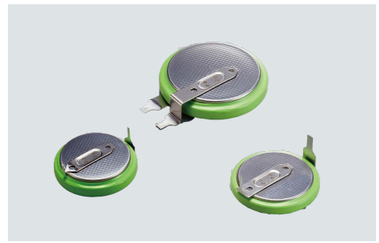
■ Discharge temperature characteristics (Example: BR2032)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range*2
				Diameter	Height		
BR1220	3	35	0.03	12.5	2.0	0.7	-30 °C to 85 °C
BR1225		48			2.5	0.8	
BR1632		120		16.0	3.2	1.5	
BR2032		200		20.0		2.6	
BR2325		165		23.0	2.5	3.0	
BR2330		255			3.0	3.2	
BR3032		500		30.0	3.2	5.7	

*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.
*2 Please consult your Panasonic sales representative when anticipating usage in operating temperatures of 80 °C or above.

CR Series Manganese Dioxide Lithium Batteries for High Temperatures



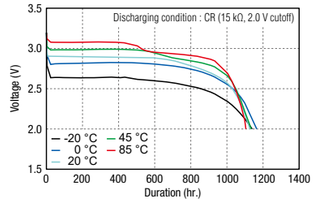
Features

- Superior discharge characteristics
- Engineered for use in equipment operating in high-temperature environments (max. 125 °C)

Applications

Automotive electronic components (TPMS, ETC), hot water and electricity meters, etc.

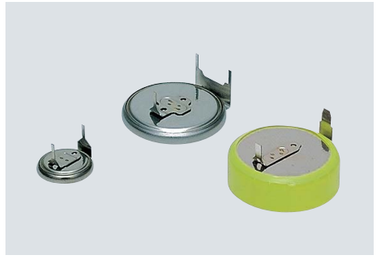
■ Discharge temperature characteristics (Example: CR2032A)



Model No.*1	Nominal voltage (V)	Nominal capacity (mAh)*2	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range
				Diameter	Height		
CR2032A	3	210	0.2	20.0	3.2	3.0	-40 °C to 125 °C
CR2032B							-40 °C to 120 °C
CR2050A		345			5.0	4.1	-40 °C to 125 °C
CR2050B2							-40 °C to 120 °C
NEW CR2450A		**550**	**0.4**	24.5		6.2	-40 °C to 125 °C
CR2450B		560					-40 °C to 105 °C

*1 Tabbed-type batteries only. *2 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.

BR Series Poly-carbonmonofluoride Lithium Batteries for High Temperatures



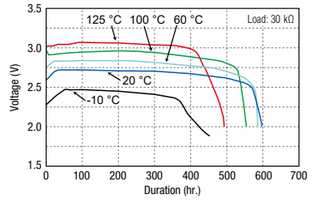
Features

- In addition to the appeal of our BR Series coin-type lithium batteries, poly-carbonmonofluoride cells can operate in temperatures up to 125 °C

Applications

Automotive electronic components (TPMS, ETC), hot water and electricity meters, memory backup (host computers, FA equipment), etc.

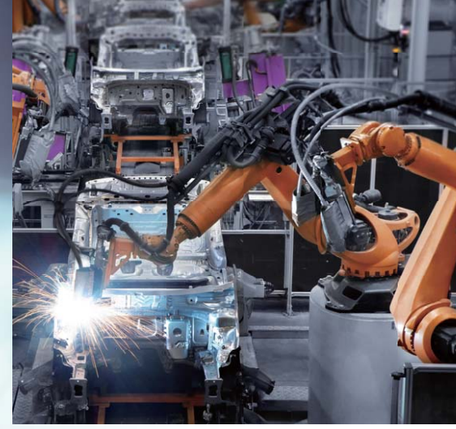
■ Discharge temperature characteristics (Example: BR1225A)



Model No.*1	Nominal voltage (V)	Nominal capacity (mAh)*2	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range
				Diameter	Height		
BR1225A	3	48	0.03	12.5	2.5	0.8	-40 °C to 125 °C
BR1632A		120		16.0	3.2	1.5	
BR2330A		255		23.0	3.0	3.2	
BR2450A		550		24.5	5.0	4.9	
BR2477A		1,000			7.7	7.9	

*1 Tabbed-type batteries only. *2 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.



Cylindrical-type Lithium Batteries

CR Series Cylindrical-type Lithium is available in standard or long-life variants, the former for devices requiring sustained high-drain discharge (cameras, flashlights, and AEDs), and the latter for security devices or main/backup power in meters. BR Series, meanwhile, offers reliable performance in meters or memory-backup over very long periods.

CR Series Manganese Dioxide Lithium Batteries (Standard Type)

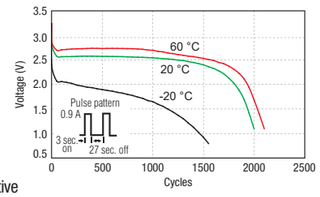
Features

- Offers super-high-rate discharge with ample power and extended life when used in cameras, lights, etc.
- Also available in the consumer marketplace

Applications

Lights, security devices (electronic door-locks, fire alarms), automotive electronic components (eCall systems), medical equipment (AEDs), etc.

■ Pulse discharge characteristics (Example: CR123A)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range*3
				Diameter	Height		
CR2	3	850	20	15.6	27.0	11	-40 °C to 70 °C
CR123A		1,550		17.0	34.5	16	
Model No.	**Nominal voltage (V)**	**Nominal capacity (mAh)*2**	**Continuous drain (mA)**	**Length**	**Width**	**Height**	**Mass (g)**	**Operating temperature range*3**
2CR5	6	1,550	20	34.0	17.0	45.0	38	-40 °C to 70 °C
CR-P2				35.0	19.5	36.0	37	

*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C. *2 Nominal capacity shown above is based on standard drain and cutoff voltage down to 4.0 V at 20 °C.
*3 Please consult your Panasonic sales representative when anticipating usage in operating temperatures between -40 °C and -20 °C, or 60 °C and 70 °C.

CR Series Manganese Dioxide Lithium Batteries (Long-life Type)

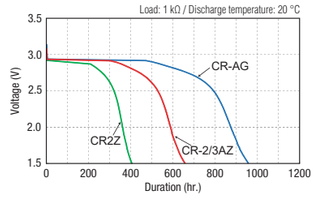
Features

- Long-life batteries exhibiting excellent discharge stability for long-term use
- The superior choice for in-vehicle apparatus with compact design and outstanding discharge performance at very low temperatures

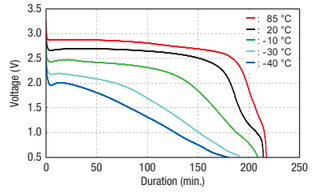
Applications

Security devices (electronic door locks, fire alarms), automotive electronic components (tracking systems, security alarms), meters (gas, water, electricity), medical equipment (AEDs), etc.

■ Example discharge characteristics



■ Fixed-current electrical discharge characteristics (500 mA) (Example: CR-AAK)



Model No.*1	Nominal voltage (V)	Nominal capacity (mAh)*2	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range*3
				Diameter	Height		
CR2Z	3	1,000	2.5	15.6	27.0	11	-40 °C to 85 °C
CR2U							
CR-2/3AU		1,600		17.0	33.5	16	
CR-2/3AZ							
CR-AAK		1,650	100	14.5	50.5	18	
CR-AAU		1,800					
CR-AG		2,400	2.5	17.0	45.5	22	
CR-AGZ		2,700				23	
NEW CR-LAZ		3,000			50.5	26	
NEW CR-LAS		3,500		17.5	50.0	28	

*1 Provided with terminals or lead wire and connectors. *2 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.
*3 Please consult your Panasonic sales representative when anticipating usage in operating temperatures of 70 °C or above.

BR Series Poly-carbonmonofluoride Lithium Batteries

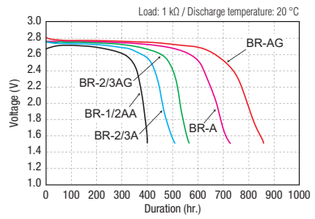
Features

- Uncommonly long storage-life to suit metering devices and memory-backup

Applications

Commercial equipment (communication/measurement devices), meters (gas, water, electricity, hot water), memory backup (large FA equipment), automotive electronic components (security alarms), etc.

■ Example discharge characteristics



Model No.*1	Nominal voltage (V)	Nominal capacity (mAh)*2	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range
				Diameter	Height		
BR-1/2AA	3	1,000	2.5	14.5	25.5	8	-40 °C to 100 °C
BR-2/3A		1,200		17.0	33.5	13	-40 °C to 85 °C
BR-2/3AG		1,450					
BR-A		1,800			45.5	18	
BR-AG		2,200					
BR-C		5,000	5.0	26.0	50.5	41	

*1 Provided with terminals or lead wire and connectors. *2 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.

Pin-type Lithium Batteries

BR Series Poly-carbonmonofluoride Lithium Batteries

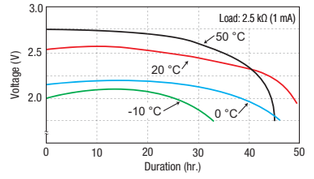
Features

- Panasonic original battery design
- Tiny device that can generate continuous power for LED lights, etc.

Applications

Electrical fishing-float lights, small transmitters, etc.

■ Discharge temperature characteristics (Example: BR435)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range
				Diameter	Height		
BR425	3	25	0.5	4.2	25.9	0.5	-30 °C to 80 °C
BR435		50	1.0		35.9	0.8	

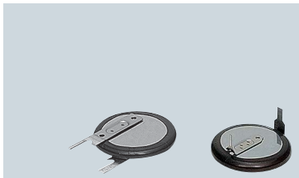
*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.




Coin-type Rechargeable Lithium Batteries

Coin-type rechargeable lithium is intended for applications where battery replacement is inconvenient, or the device's construction renders replacement impractical. These batteries are ideal for memory backup or solar watches.

VL Series Vanadium Rechargeable Lithium Batteries



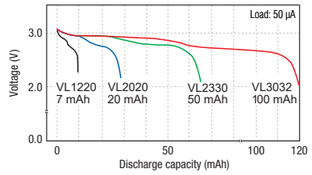
Features

- Retains high-discharge voltage performance

Applications

Memory backup (printers, composite machines, medical equipment, FA equipment), remote keyless entry, fire alarms, etc.

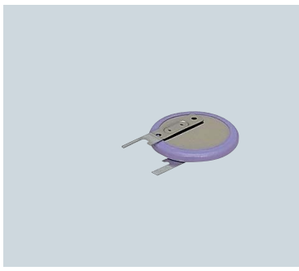
■ Example discharge characteristics



Model No.*1	Nominal voltage (V)	Nominal capacity (mAh)*2	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Charge voltage (V)	Operating temperature range
				Diameter	Height			
VL1220	3	7.0	0.02	12.5	2.0	0.80	3.25 to 3.55	-20 °C to 60 °C
VL2020		20.0	0.07	20.0		2.10		
VL2330		50.0	0.10	23.0	3.0	3.50		
VL3032		100.0	0.20	30.0	3.2	6.30		

*1 Tabbed-type batteries only. *2 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.5 V at 20 °C.

ML Series Manganese Rechargeable Lithium Batteries



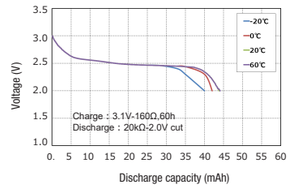
Features

- Ideal for long-term memory backup with extra-high capacity

Applications

Memory backup (drive recorders, PCs, communication/radio, medical equipment, FA equipment), etc.

■ Discharge characteristics



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Charge voltage (V)	Operating temperature range
				Diameter	Height			
ML2020	3	45.0	0.12	20.0	2.0	2.20	2.8 to 3.2	-20 °C to 60 °C

*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 2.0 V at 20 °C.

CTL Series Cobalt Titanium Rechargeable Lithium Batteries

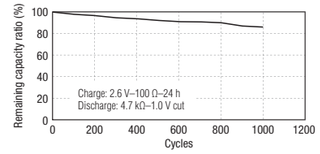
Features

- Rechargeable batteries with excellent charge-discharge cycle stability
- Compared to MT Series, CTL Series retains a higher voltage (2.3 V)
- Long-term reliability proved by applications in many solar watch designs

Applications

Digital/solar watches, sensing devices, etc.

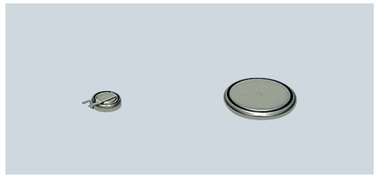
■ Charge/discharge cycle characteristics (Example: CTL920F)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Charge voltage (V)	Operating temperature range
				Diameter	Height			
CTL621F	2.3	3.6	0.02	6.8	2.1	0.25	2.5 to 2.7	-20 °C to 60 °C
CTL920F		7.7	0.05	9.5	2.0	0.45		
CTL1616F		13.0	0.10	16.0	1.6	1.00		

*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 1.0 V at 20 °C.

MT Series Manganese Titanium Rechargeable Lithium Batteries



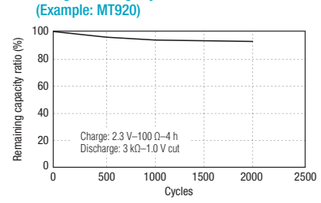
Features

- High-current 1.5 V lithium rechargeable battery with sustained discharge endurance

Applications

Watches, etc.

■ Charge/discharge cycle characteristics (Example: MT920)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Charge voltage (V)	Operating temperature range
				Diameter	Height			
MT516F	1.5	1.8	0.025	5.8	1.6	0.14	1.8 to 2.6	-10 °C to 60 °C
MT621		2.5	0.05	6.8	2.1	0.23		
MT920		5.0		9.5	2.0	0.41		

*1 Nominal capacity shown above is based on standard drain and cutoff voltage down to 1.0 V at 20 °C.

Panasonic ENERGY

Lithium Batteries

■ Lithium Batteries with Terminals

Tabbed Type

F-type

G-type

H-type

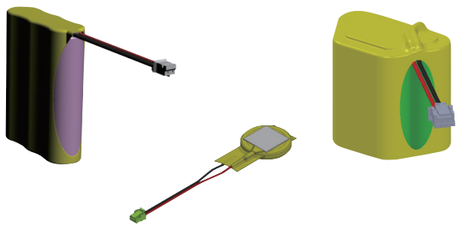
V-type

Mount Type

Hook Type

Lead Wire Type

Connector-lead Wire Type



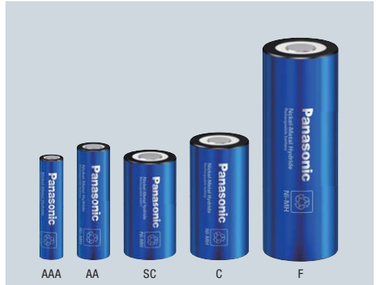
Note: Panasonic lithium batteries are available in a selection of terminal shapes to meet your needs in a variety of applications. Typical types are shown above.
For the latest technical and product information, please visit our website.




Nickel-Metal Hydride Batteries

Reusable, eco-friendly nickel-metal hydride batteries are widely used to support infrastructure. A long-lasting variant with efficient charging in high temperatures is available for backup applications together with high-capacity types and more.

U Infrastructure Backup (Long-life Type)



Features

- Long 8–10-year operational life*2
- Excellent recharging performance in high temperatures (up to 75 °C)
- High-rate discharge (3 to 5 It discharge/20 °C)
- Great alternative to other nickel-cadmium batteries

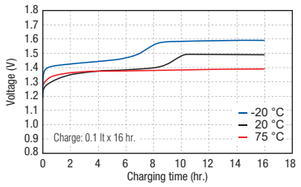
Applications

Emergency lights, guidance lights, LED lights, wireless base-stations, servers, elevators, ATMs, POS equipment, vending machines, medical equipment, etc.

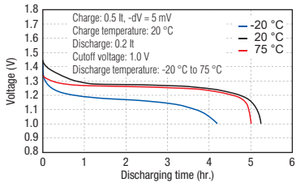
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AAA	BK60AAAHU	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	12	-10 °C to 75 °C	-20 °C to 75 °C
AA	BK120AAHU		1,200	1,280	14.5 +0/-0.7	50.5 +0/-1.5	24	-20 °C to 75 °C	
SC	BK220SCHU		2,200	2,300	23.0 +0/-1.0	43.0 +0/-1.5	52		
C	BK310CHU		3,100	3,300	25.8 +0/-1.0	50.0 +0/-2.0	78		
F	BK1100FHU		11,000	12,000	33.0 +0/-1.0	91.0 +0/-2.5	245		-20 °C to 85 °C*3

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours. *2 Lifespan compared to Panasonic standard-type battery life cycle (3 to 5 years) charged using intermittent charging method.
*3 Please consult your Panasonic sales representative when anticipating usage in operating temperatures between 75 °C and 85 °C.
Note: 1 It (A) = rated capacity (Ah)/(hr.)

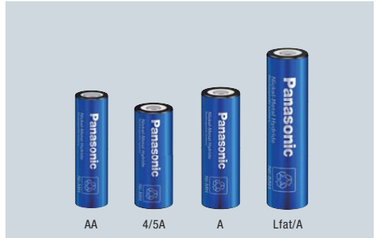
■ Example charge characteristics



■ Example charge characteristics



H Infrastructure Backup (General Type)



Features

- Long 4–6-year operational life*2
- Stable performance in a wide range of temperatures (-10 °C to 60 °C)
- Ideal substitute for nickel-cadmium batteries

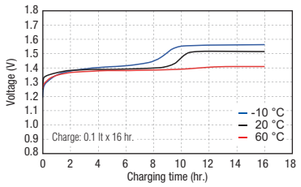
Applications

Emergency lights, guidance lights, LED lights, wireless base-stations, servers, elevators, ATMs, POS equipment, vending machines, medical equipment, etc.

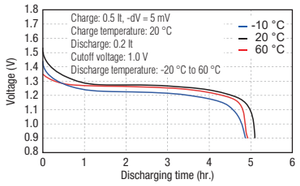
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AA	BK70AAH	1.2	700	750	14.5 +0/-0.7	49.0 +0/-1.5	18	-10 °C to 60 °C	-10 °C to 60 °C
AA	BK110AAH		1,100	1,180	14.5 +0/-0.7	50.5 +0/-1.5	24		
AA	BK150AAH		1,450	1,530			25		
4/5A	BK160AH		1,600	1,720	17.0 +0/-0.7	43.0 +0/-1.5	29		
A	BK210AH		1,900	2,050	17.0 +0/-0.7	50.0 +0/-2.0	35		
Lfat/A	BK370AH		3,500	3,700	18.2 +0/-0.7	67.5 +0/-1.5	60		

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours.
*2 Lifespan compared to Panasonic standard-type battery life cycle (3 to 5 years) charged using intermittent charging method.
Note: 1 It (A) = rated capacity (Ah)/(hr.)

■ Example charge characteristics



■ Example discharge characteristics



PH Infrastructure Backup (High-rate Discharge Type)

Features

- Long 4–6-year operational life*2
- High-rate discharge (5 It discharge/20 °C)
- Ideal substitute for nickel-cadmium batteries

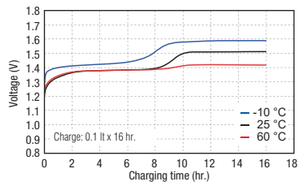
Applications

Elevators, automated guided vehicles, UPS systems, POS equipment, ATMs, streetlights, road studs, etc.

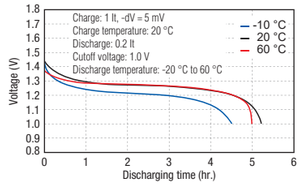
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
SC	BK250SCH	1.2	2,500	2,650	23.0 +0/-1.0	43.0 +0/-1.5	53	-10 °C to 60 °C	-10 °C to 60 °C
Lfat/A	BK330APH		3,200	3,300	18.2 +0/-0.7	67.5 +0/-1.5	59		
F	**BK850FPH**		8,500	8,950	33.0 +0/-1.0	91.0 +0/-2.5	220	-20℃ to 75℃	-20℃ to 85℃

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours.
*2 Lifespan compared to Panasonic standard-type battery life cycle (3 to 5 years) charged using intermittent charging method.
Note: 1 It (A) = rated capacity (Ah)/(hr.)

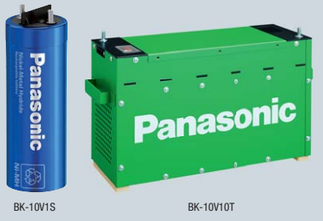
■ Example charge characteristics



■ Example discharge characteristics



V Large-type for Infrastructure Applications



Features

- Designed for extra-large power capacity
- Highly efficient power supply even in low temperatures
- 5-stage LED indicates remaining battery life (BK-10V10T)

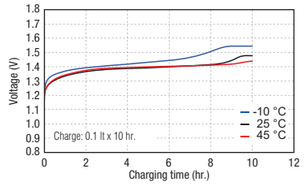
Applications

Automated guided vehicles, rail vehicles, wireless base-stations, UPS systems, etc.

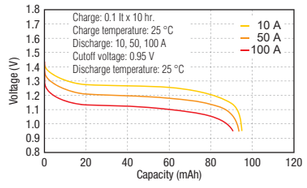
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with stud bolts (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
V	BK-10V1S	1.2	90,000	95,000	62.6 +1.0/-1.0	188.7 +1.0/-1.0	1,700	-20 °C to 60 °C	-20 °C to 60 °C
Size	Model No.	Nominal voltage (V)	Rated (min.)	Maximum continuous discharge current (A)	Dimensions (mm)			Mass (kg)	Operating temperature range	
					Width	Depth	Height		Charge	Discharge
-	BK-10V10T	12	90,000	100	428	159	270	23	-20 °C to 60 °C	-20 °C to 60 °C

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours.
Note: 1 It (A) = rated capacity (Ah)/(hr.)

■ Charge characteristics (Example: BK-10V1S)



■ Discharge characteristics (Example: BK-10V1S)






Nickel-Metal Hydride Batteries

Panasonic nickel-metal hydride batteries provide for safety and longevity in automotive backup applications as well as devices that suit button-top and high-rate-discharge battery types.

W Automotive Backup

Features

- Stable power delivery in a wide range of temperatures (-30 °C to 85 °C)
- Installable in tough environments as electrolyte solution is aqueous
- Easy charging and battery health checks

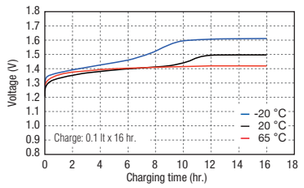
Applications

TCU, eCall systems, dashboard cameras, anti-theft security systems, etc.

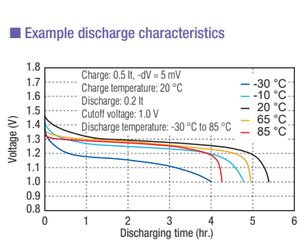
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AAA	BK60AAAWS	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	11	-20 °C to 45 °C*2	-20 °C to 60 °C※4 -30 °C to 85 °C※5
AA	BK120AAWS		1,100	1,180	14.5 +0/-0.7	50.5 +0/-1.5	24	-20 °C to 60 °C*3	-30 °C to 60 °C※4 -40 °C to 85 °C※5

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours. *2 Temperature for rapid charge. *3 Temperature for standard charge.
*4 Recommended temperature.
*5 It depends on usage conditions. Please contact Panasonic. Note: 1 It (A) = rated capacity (Ah)/(hr.)

■ Example charge characteristics



■ Example discharge characteristics



B Button Top

Features

- Offers extended charge/discharge life of about 1,800 cycles*2
- Low self-discharge and long storage-life
- Excellent temperature resistance especially in freezing conditions

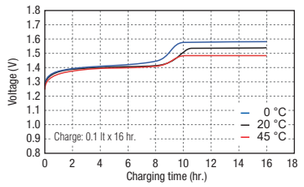
Applications

Electric toothbrushes, electric shavers, remote controllers, etc.

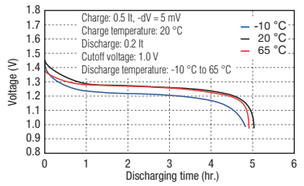
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AAA*3	BK80AAAB	1.2	750	780	10.5 +0/-0.7	44.5 +0/-1.0	12	0 °C to 45 °C	-10 °C to 65 °C
AA*4	BK200AAB		1,900	1,980	14.5 +0/-0.7	50.5 +0/-1.0	28		

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours.
*2 Measured under conditions complying with JIS C8708 2013 (7.5.1.1). Actual capacity depends on usage conditions. *3 AAA-size compatible. *4 AA-size compatible.
Note: 1 It (A) = rated capacity (Ah)/(hr.)

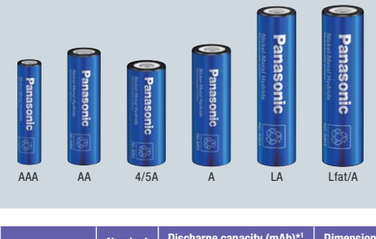
■ Example charge characteristics



■ Example discharge characteristics



N Standard



Features

- Secure and safe performance with proven reliability
- Offers a wide range of models to suit various applications

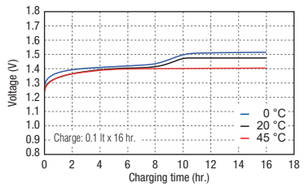
Applications

Radios, intercommunication systems, cordless phones, medical equipment, etc.

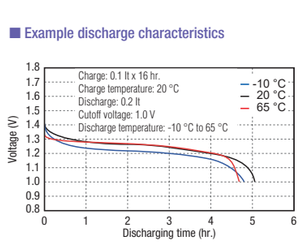
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AAA	BK70AAAJ	1.2	700	730	10.5 +0/-0.7	44.5 +0/-1.5	12	0 °C to 45 °C	-10 °C to 65 °C
AA	BK70AA			780	14.5 +0/-0.7	49.0 +0/-1.5	18		
	BK110AAO		1,100	1,180		50.5 +0/-1.5	24		
	BK150AA		1,500	1,580			25		
	BK200AAP		1,900	1,980			28		
4/5A	BK200A		2,000	2,040	17.0 +0/-0.7	43.0 +0/-1.5	32		-30 °C to 65 °C
A	BK210A		2,100	2,200		50.0 +0/-2.0	36		
	BK250A		2,450	2,600			37		
LA	BK380A		3,700	3,800		67.0 +0/-2.0	53		-10 °C to 65 °C
Lfat/A	BK450A		4,200	4,500	18.2 +0/-0.7	67.5 +0/-1.5	61		

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours.
Note: 1 It (A) = rated capacity (Ah)/(hr.)

■ Example charge characteristics



■ Example discharge characteristics



P High-rate Discharge

Features

- Excellent high-current discharge characteristics
- Rapid charging capability

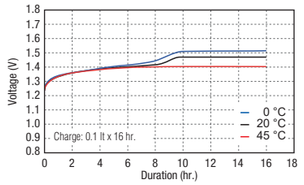
Applications

Power tools, cordless cleaners, electric toys (e.g. radio-controlled cars), etc.

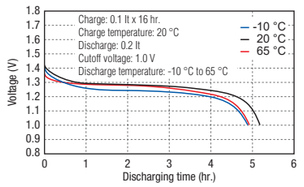
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
SC	BK260SCP	1.2	2,450	2,700	23.0 +0/-1.0	43.0 +0/-1.5	55	0 °C to 45 °C	-10 °C to 65 °C
	BK300SCP		2,800	3,050			57		

*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours.
Note: 1 It (A) = rated capacity (Ah)/(hr.)
Please use appropriate voltage and temperature management to control battery temperature near the end of rapid charging.

■ Example charge characteristics

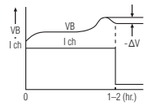
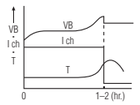
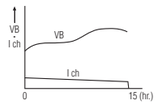
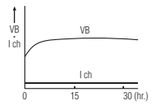
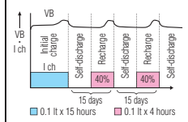


■ Example discharge characteristics



General Comparison of Various Charging

Note: 1 It (A) = rated capacity (Ah)/(hr.)

Charge system	Cycle (repetitive) use			Standby (backup) use	
	Constant-current charge		Semi-constant-current charging method*2	Trickle-charging method	Intermittent charging method
	-ΔV cutoff charging method	dT/dt cutoff charging method*1			
Operation overview VB: Battery voltage I ch: Charge current T: Battery surface temperature CV: Constant voltage					
Features	Most common rapid-charging method	Charging-circuit cost is comparatively higher, but can prevent overcharge, extending cycle life in comparison to the -ΔV cutoff charging method	Charging circuit is simple and affordable	• Charging circuit is simple and affordable • Applicable to devices requiring continuous charging for long periods	Charging circuit cost is comparatively higher but supports longer service life than trickle-charging
Charge time	1–2 hr.	1–2 hr.	15 hr.	30 hr. or longer	15 hr. or longer
Charge current	0.5–1 It	0.5–1 It	Max. 0.1 It	—	0.1–0.5 It
Trickle-charge current	1/30–1/20 It	1/30–1/20 It	—	1/30–1/20 It	—
Charge level at charge control	Approx. 100–120 %	Approx. 100–110 %	—	—	Approx. 120 %
Infrastructure backup type	○	◎	○	○	◎
Button-top type	◎	○	—	—	○
Standard type	◎	◎	—	—	○
High-capacity type	○	◎	—	—	○
Automotive backup type	—	—	—	—	○

◎ Recommended charging method: enables full Panasonic battery performance. ○ Acceptable charging method: usable depending on conditions and equipment.

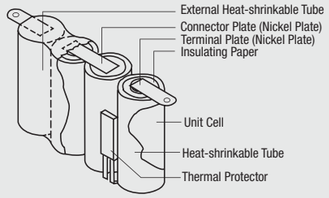
*1 Battery-pack construction allowing temperature detection element (sensor) to reliably detect battery temperature is required.

*2 Where charge-rate exceeds 0.1 It, overcharge performance and temperature rise characteristics will vary according to the battery type. Consult Panasonic before defining product specifications. If multiple cells or high-capacity cells are used, or if heat-dissipation from the battery-pack is poor, batteries may generate heat even at 0.1 It. If this is the case, the device's battery installation should be redesigned to facilitate heat dissipation or the charging current lowered. Design should be such that temperature rise at saturation is no higher than 50 °C.

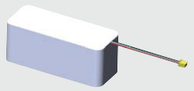
Battery Pack

Many of our industrial batteries are sold in packs. When battery packs are installed, the battery type, number of cells, pack shape, and constituent parts are determined by the application. Considerations include voltage and current; charging specifications; available space; and usage conditions. We design and manufacture to the most common industrial applications to best meet customer needs while maintaining safety, quality, and reliability as our central focus.

Basic Construction



Simulated image of battery pack

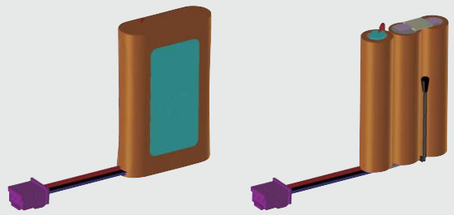


Installation of a thermistor (temperature detection), a thermal protector or PTC element (temperature rise protection), and protective measures against short-circuiting is recommended when deploying nickel-metal hydride battery-packs in devices. Protective safety circuitry is also required.

Reliable Battery Packs for Automotive Applications

Compared to the consumer market, a higher standard of quality and reliability is expected in industrial battery applications, particularly where batteries are intended for vehicles where harsh vibration and huge temperature fluctuations are commonplace. To ensure quality and reliability in this environment, Panasonic selects components for battery packs with utmost care and applies stringent controls for structural assembly and battery production. Suitability for automotive use is evidenced by PPAP (Production Part Approval Process) certification and IATF16949 compliance.

Simulated image of battery pack for automotive applications



Panasonic ENERGY