

## 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**

- 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.
- 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.
- Never charge any battery type except rechargeable batteries. Ensure the device's circuit design prevents current intrusion from other power sources.
- When charging batteries, use approved battery chargers only and observe battery-charging usage conditions specified by Panasonic. When charging batteries in other charging conditions (undesigned temperatures, undesigned 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Some batteries incorporate a gas-venting structure to discharge internal gases. For this reason, do not deform the positive electrode.
- 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**

- To avoid accidental ingestion of small batteries, keep devices and batteries out of reach of children. If swallowed, seek emergency medical care immediately.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- When discarding used batteries, follow all relevant government laws and regulations in your country or region.

### **⚠ CAUTION**

- 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.
- 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, rupture, and/or fire.
- 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 rupture, or reduce battery performance and lifespan.
- Be sure to read instruction manual before use. Keep it in a safe place and refer to it when needed.
- Carefully read the instruction manual(s) of the dedicated charger to learn how to properly and safely charge batteries.
- 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.
- 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.
- Do not put flammable substances on batteries or cover them during charging or discharging. This may result in heat-generation, rupture, and/or fire.
- 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.
- 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 rupture.

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# Panasonic INDUSTRY

Lithium Batteries  
Nickel-Metal Hydride Batteries  
Dry Batteries  
Catalog



Please visit our website for the latest information: <https://industrial.panasonic.com/>

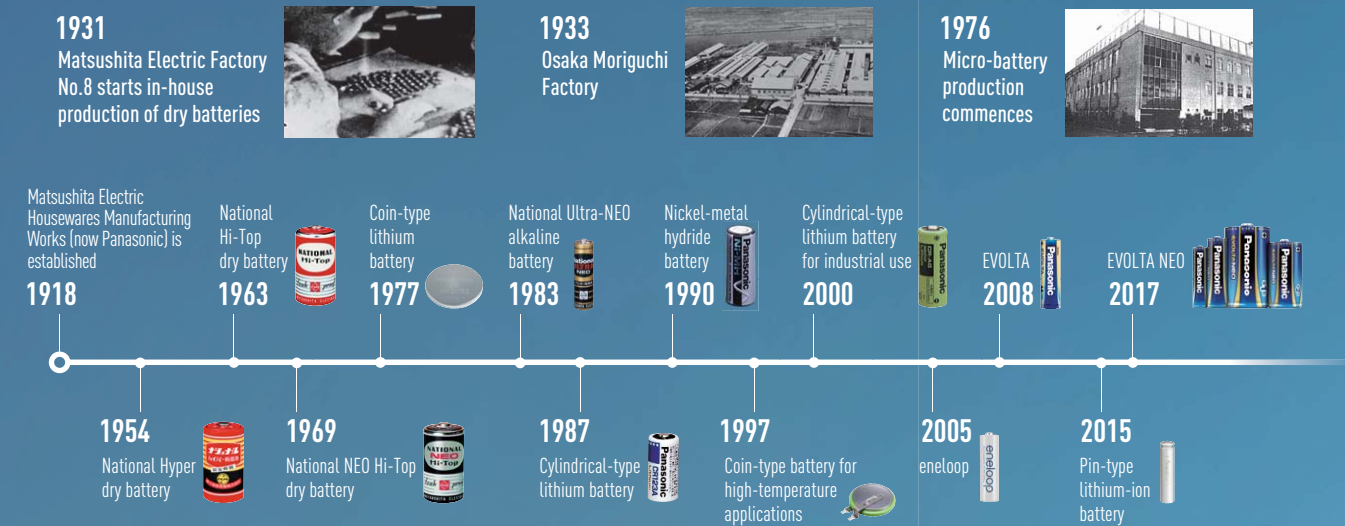


Connected Society,  
Connected Future.  
Industrial Batteries

# 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



## Production Bases

Production bases: **13** factories  
 Domestic: 1 factory Overseas: 12 factories

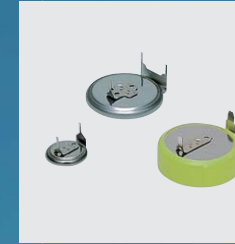
Employees: **7,498** people  
 Domestic: 742 people Overseas: 6,756 people \* As of March 2019.



## 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
- MS Series Manganese Silicon 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

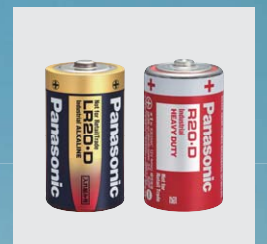
### Pin-type Lithium-ion Batteries

Panasonic's pin-type lithium-ion series comprises rechargeable batteries suitable for tiny appliances such as hearing aids, wireless earphones, and insulin pens. They are not only small and light, but also deliver high reliability and strong performance from a selection of slimline products for pen-type devices and wearable technology such as smart glasses.



### Dry Batteries

Dry batteries deliver excellent all-round performance with long endurance, extended storage life, and effective leakage protection to meet user needs. Expect high reliability and stability from a family of products to suit a wide variety of devices, from high-capacity batteries for high-drain devices to low-capacity designs for low-current applications.



- Alkaline Batteries
- Manganese 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
- Alkaline Dry Batteries

### » Construction Machinery



### » Medical Devices



### » Agricultural Machinery



### » Water-level Sensors



## Batteries for Wearables and Small Medical Devices **Wearables**

Pin-type lithium-ion batteries are perfectly adapted power-sources for small portable devices. The super-small slimline batteries not only enable more compact, stylish device design, but also deliver high output, excellent levels of safety, and extended reliability. They are used in wearable technology and in small medical appliances such as hearing aids. Panasonic pin-type lithium-ion batteries play an important role in product development and are already expanding application possibilities in these markets.



- Pin-type Lithium-ion Batteries

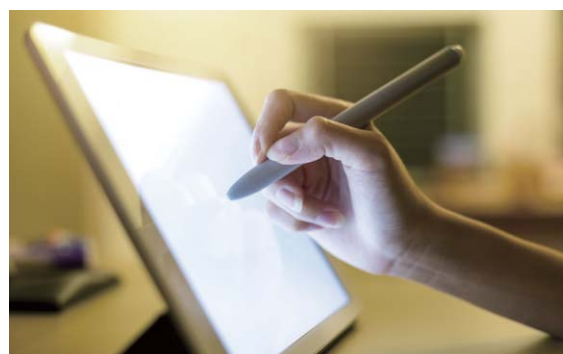
### » Hearing Aids



### » Wireless Earphones



### » Stylus Pens



### » Smart Glasses (Electric Photochromatic Sunglasses, Electric Bifocal Glasses, etc.)



## 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

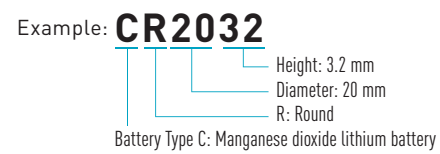
### (3) Durable Performance in Tough Conditions

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

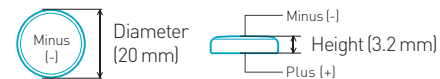


Primary Lithium Batteries (Non-chargeable)	Coin-type Lithium Batteries	CR Series (Manganese Dioxide Lithium Batteries)
		BR Series (Poly-carbonmonofluoride Lithium Batteries)
	Cylindrical-type Lithium Batteries	CR Series (Manganese Dioxide Lithium Batteries)
		BR Series (Poly-carbonmonofluoride Lithium Batteries)
	Pin-type Lithium-ion Batteries	BR Series (Poly-carbonmonofluoride Lithium Batteries)
	Rechargeable Lithium Batteries	Coin-type Rechargeable Lithium Batteries
ML Series (Manganese Rechargeable Lithium Batteries)		
MS Series (Manganese Silicon 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)



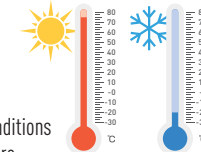
Size



## Nickel-Metal Hydride Battery Features

### (1) Works in a Range of Temperatures

Stable performance in harsh conditions with a wide operating temperature



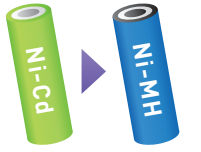
### (2) Eco-friendly Power

Reusable designs limit wastage for reduced environmental impact



### (3) Ideal Replacement for Nickel-Cadmium Batteries

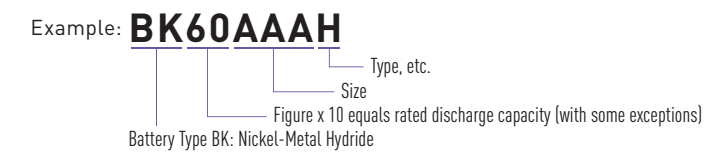
A longer-lasting alternative to nickel-cadmium batteries



	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
<b>U</b> Infrastructure Backup (Long-life Type)		●		●	●	●
<b>H</b> Infrastructure Backup (General Type)		●		●		●
<b>PH</b> Infrastructure Backup (High-rate Discharge Type)	●	●		●		●
<b>V</b> Large-type for Infrastructure Applications	●			●		●
<b>W</b> Automotive Backup		●		●		●
<b>B</b> Button Top		●				
<b>N</b> Standard		●				
<b>P</b> 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



Size

- AAA • SC
- AA • C
- A • F

## Pin-type Lithium-ion Battery Features

### (1) Ultra Small, Super Slim Batteries

Tiny slimline batteries support stylish device design with high power output



### (2) High Safety and Reliability

High-strength stainless exterior case enhances safety and reliability

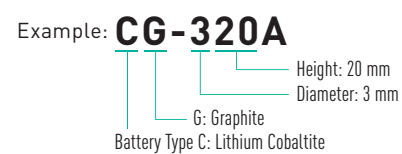


### (3) Supports Rapid Charging

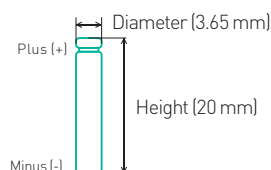
Faster recharge times make portable devices easier to use



Example Pin-type Lithium-ion Battery Model-Number Composition



Size



## Dry Battery Features

### (1) A Tradition of Quality and Reliability

Panasonic continues to innovate on a foundation of almost 90 years' experience in battery design and now production on a global scale

### (2) Excellent Reliability in Various Devices

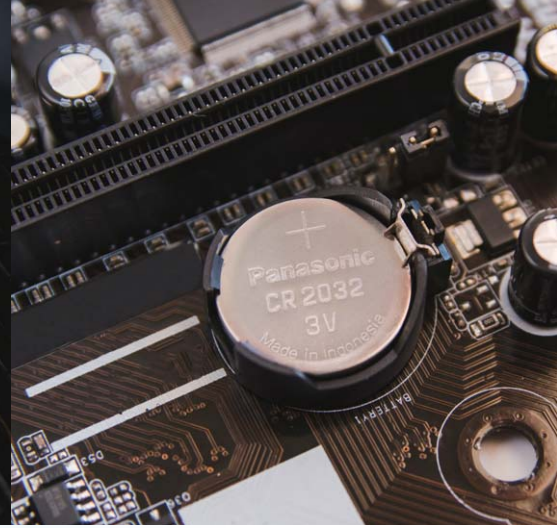
High- to low-rate discharge recommended for use in a wide variety of devices

### (3) Designed for Global Users

Our exclusive industrial batteries are labeled in English, Japanese, and Chinese



Dry Batteries	Alkaline Batteries
	Manganese Batteries



# 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



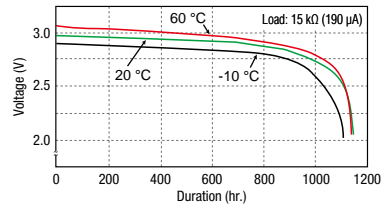
### Features

- 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) <sup>*1</sup>	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range <sup>*2</sup>
				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		12.5	2.0	0.9	
CR1616		55		16.0	1.6	1.0	
CR1620		75		16.0	2.0	1.3	
CR1632		140		16.0	3.2	1.9	
CR2012		55		20.0	1.2	1.4	
CR2016		90		20.0	1.6	1.6	
CR2025		165		20.0	2.5	2.3	
CR2032		225		20.0	3.2	2.8	
CR2330		265		23.0	3.0	3.7	
CR2354		560		23.0	5.4	5.7	
CR2412		100		24.5	1.2	2.0	
CR2450		620		24.5	5.0	6.2	
CR2477		1,000		24.5	7.7	10.5	
CR3032		500		30.0	3.2	6.9	

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

## BR Series Poly-carbonmonofluoride Lithium Batteries



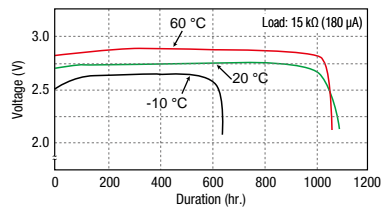
### Features

- 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) <sup>*1</sup>	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range
				Diameter	Height		
BR1220	3	35	0.03	12.5	2.0	0.7	-30 °C to 80 °C
BR1225		48		12.5	2.5	0.8	
BR1632		120		16.0	3.2	1.5	
BR2032		200		20.0	3.2	2.6	
BR2325		165		23.0	2.5	3.0	
BR2330		255		23.0	3.0	3.2	
BR3032		500		30.0	3.2	5.7	

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

## CR Series Manganese Dioxide Lithium Batteries for High Temperatures



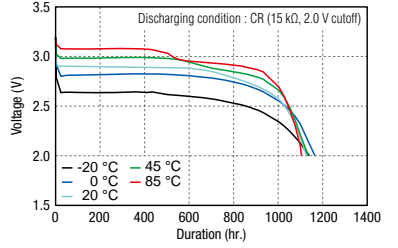
### Features

- 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.

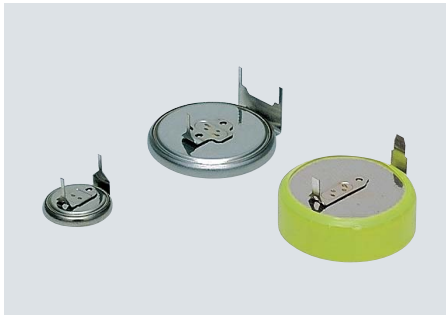
Discharge temperature characteristics (Example: CR2032A)



Model No. <sup>*1</sup>	Nominal voltage (V)	Nominal capacity (mAh) <sup>*2</sup>	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					3.2		-40 °C to 120 °C
CR2050A					5.0		-40 °C to 125 °C
CR2050B2		5.0		-40 °C to 120 °C			
CR2450A		24.5		6.2	-40 °C to 105 °C		
CR2450A		24.5		6.2	-40 °C to 105 °C		

<sup>\*1</sup> Tabbed-type batteries only. <sup>\*2</sup> 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



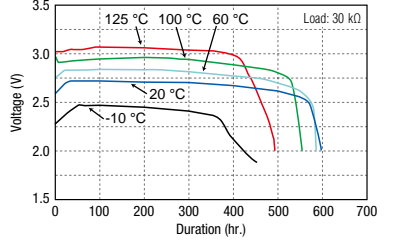
### Features

- 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

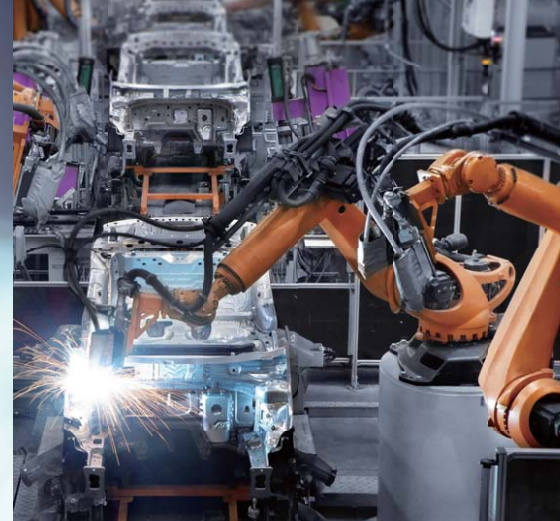
Automotive electronic components (TPMS, ETC), hot water and electricity meters, memory backup (host computers, FA equipment), etc.

Discharge temperature characteristics (Example: BR1225A)



Model No. <sup>*1</sup>	Nominal voltage (V)	Nominal capacity (mAh) <sup>*2</sup>	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		24.5	7.7	7.9	

<sup>\*1</sup> Tabbed-type batteries only. <sup>\*2</sup> 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)



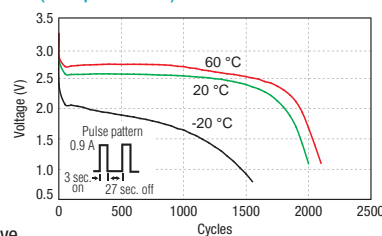
### Features

- 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) <sup>*1</sup>	Continuous drain (mA)	Dimensions (mm)			Mass (g)	Operating temperature range <sup>*3</sup>
				Diameter	Height			
CR2	3	850	20	15.6	27.0		11	-40 °C to 70 °C
CR123A		1,550		17.0	34.5			
Model No.	Nominal voltage (V)	Nominal capacity (mAh) <sup>*2</sup>	Continuous drain (mA)	Length	Width	Height	Mass (g)	Operating temperature range <sup>*3</sup>
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	

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

## BR Series Poly-carbonmonofluoride Lithium Batteries



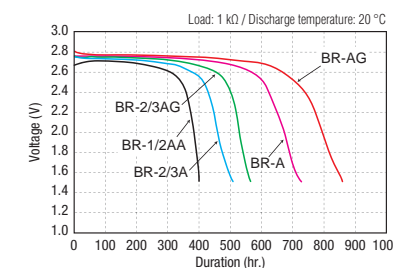
### Features

- 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. <sup>*1</sup>	Nominal voltage (V)	Nominal capacity (mAh) <sup>*2</sup>	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					
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		

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

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



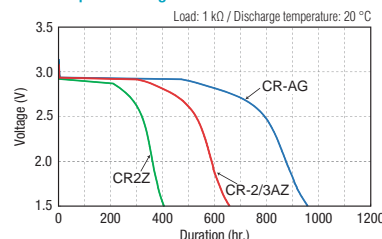
### Features

- 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

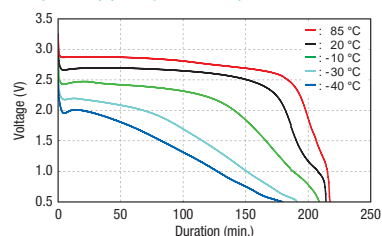
### Applications

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. <sup>*1</sup>	Nominal voltage (V)	Nominal capacity (mAh) <sup>*2</sup>	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Operating temperature range <sup>*3</sup>
				Diameter	Height		
NEW CR-AGZ	3	2,700	2.5	17.0	45.5	23	-40 °C to 85 °C
CR-AG		2,400					
CR-2/3AZ		1,600					
CR2Z		1,000		15.6	27.0	11	
CR2U		1,800					
CR-AAU	1,800	14.5	50.5	18			
CR-AAK	1,650				100		

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

# Pin-type Lithium Batteries

## BR Series Poly-carbonmonofluoride Lithium Batteries



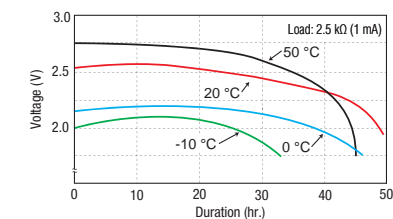
### Features

- 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) <sup>*1</sup>	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		

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

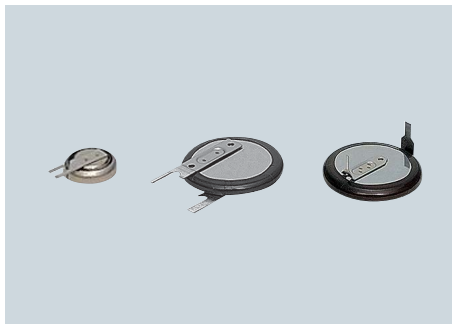


# Coin-type Rechargeable Lithium Batteries

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



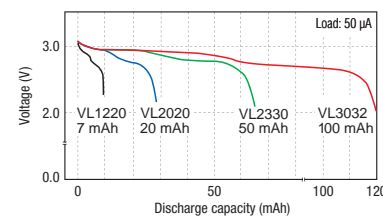
### Features

- Retains high-discharge voltage performance

### Applications

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

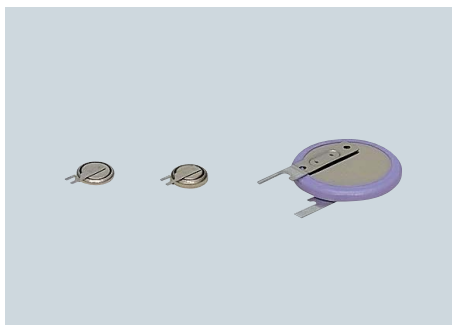
Example discharge characteristics



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			
VL621	3	1.5	0.01	6.8	2.1	0.21	3.25 to 3.55	-20 °C to 60 °C
VL1220		7.0	0.02	12.5	2.0	0.80		
VL2020		20.0	0.07	20.0	2.0	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



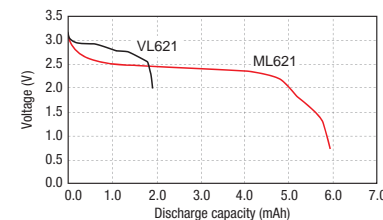
### Features

- 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 (Example: ML621)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Charge voltage (V)	Operating temperature range
				Diameter	Height			
ML421	3	2.3	0.005	4.8	2.1	0.10	2.8 to 3.2	-20 °C to 60 °C
ML614		3.4	0.01	6.8	1.4	0.16		
ML621		5.0			2.1	0.22		
ML920		11.0	0.03	9.5	2.0	0.39		
ML1220		17.0				0.80		
ML2020	45.0	2.0				2.20		

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

## MS Series Manganese Silicon Rechargeable Lithium Batteries



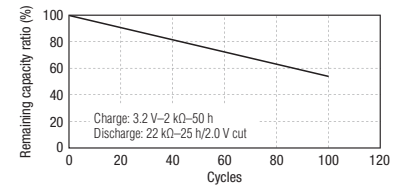
### Features

- Supports more than 100 complete charge-discharge cycles

### Applications

Memory backup (cameras), etc.

Charge/discharge cycle characteristics (Example: MS614)



Model No.	Nominal voltage (V)	Nominal capacity (mAh)*1	Continuous drain (mA)	Dimensions (mm)		Mass (g)	Charge voltage (V)	Operating temperature range
				Diameter	Height			
MS614	3	2.7	0.01	6.8	1.4	0.20	2.8 to 3.3	-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



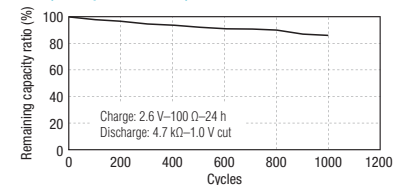
### Features

- 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.

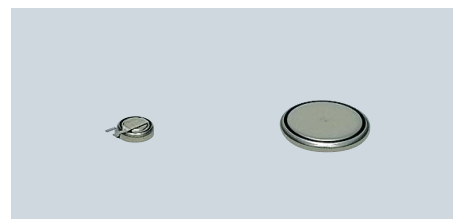
Charge/discharge cycle characteristics (Example: CTL920F)



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	0.15	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



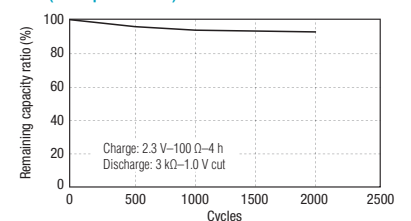
### Features

- 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.





# Pin-type Lithium-ion Batteries

This battery type is ideal for wearable devices and other nominal-drain applications. Our range delivers safe, stable output in a small, slim form.



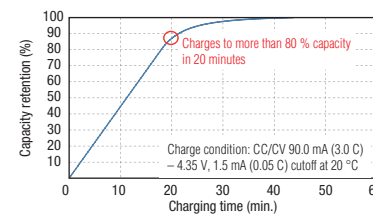
## Features

- Small, slim battery design enables high output in smaller, more stylish products
- High-strength stainless casing boosts safety and reliability
- Rapid charging improves usability of portable devices

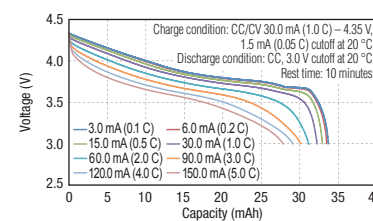
## Applications

Hearing aids, small medical devices, wireless earphones, stylus pens, smart glasses, wristband devices, etc.

### 3C rapid charge characteristics (Example: CG-425A)



### Discharge characteristics by rate of discharge (Example: CG-425A)

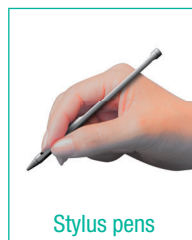


Model No.*1	Nominal voltage (V)	Maximum charge voltage (V)	Maximum charge current (mA)	Capacity (mAh) (typ.)	Dimensions (mm)		Mass (g)	Operating temperature range	
					Diameter	Height		Charge	Discharge
NEW CG-320B	3.8	4.35	11.2 (0.75 C)	16	3.65	20.0	0.5	0 °C to 60 °C	-20 °C to 60 °C
NEW CG-420A*2			66.0 (3 C)	23	4.7	0.8			
CG-425A			90.0 (3 C)	32	25.0	1.0			

\*1 Tabbed-type batteries only. \*2 Mass production from April, 2020.

## 1 Super-small and slim high-output battery for stylish devices

Tiny, vibration-resistant form-factor lets designers make their products smaller, lighter, and more stylish with power to support Bluetooth® Low Energy and other functions that demand strong discharge stability



## 2 High-strength stainless case, high safety, high reliability

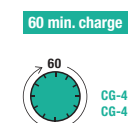
No swelling, no leaks, no explosions, no fire. Certified to IEC62133/UL1642 standards (mass-produced models only)

\* Panasonic testing



## 3 Rapid charging makes everyday devices user-friendly

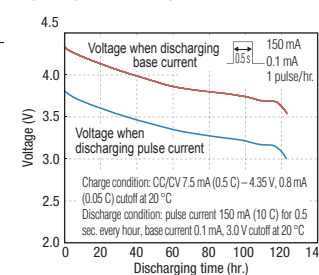
3 C charging achieves 80% capacity in 20 minutes (CG-425A/420A only)



\* Size comparison



### Pulse discharge characteristics (Example: CG-320B)



# Lithium Batteries

## Lithium Batteries with Terminals

Tabbed Type				Lead Wire Type	
F-type	G-type	Mount Type	Hook Type	Connector-lead Wire Type	
H-type	V-type	Pin 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 at <https://industrial.panasonic.com/ww/products/batteries/primary-batteries/lithium-batteries>



# Pin-type Lithium-ion Batteries

## Pin-type Lithium-ion Batteries with Terminals

Through-hole Type	Surface-mount Type

\* All Models have stainless steel tab with tin (Sn) plating.

Note: Batteries are shipped with tabs or lead wires. Please consult your Panasonic sales representative if tab customization is required. For more information, please visit: <https://industrial.panasonic.com/ww/products/batteries/secondary-batteries/pin-li-ion>

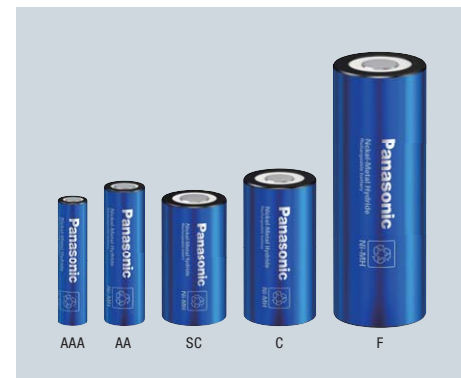


# Nickel-Metal Hydride Batteries

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

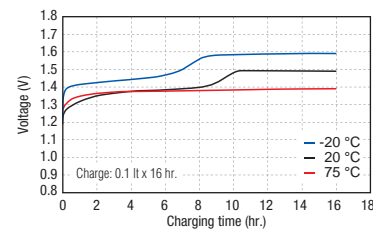
### Applications

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

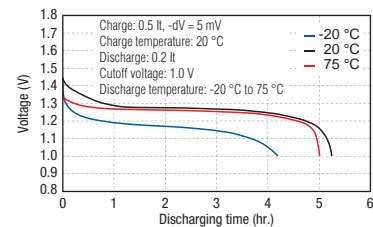
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
NEW AAA	BK60AAAHU	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	12	-10 °C to 75 °C	-20 °C to 75 °C
AA	BK120AAHU		1,200	1,280	14.5 +0/-0.7	50.5 +0/-1.5	24		
NEW 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 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

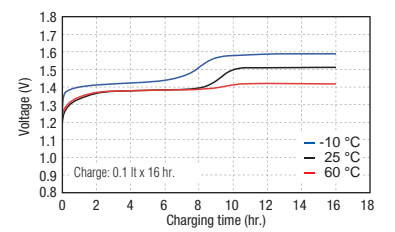
### Applications

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

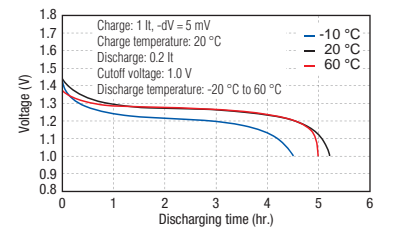
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
SC	BK250SCH	1.2	2,500	2,650	23.0 +0/-1.0	43.0 +0/-1.5	53	-10 °C to 60 °C	-10 °C to 60 °C
Lfat/A	BK330APH		3,200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

\*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.)

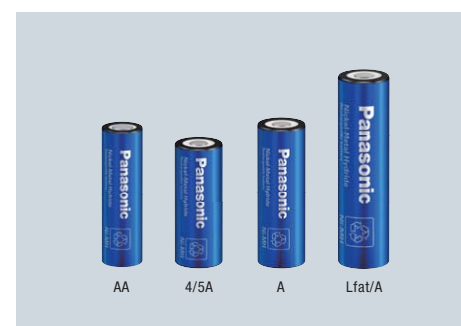
### Example charge characteristics



### Example discharge characteristics



## 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

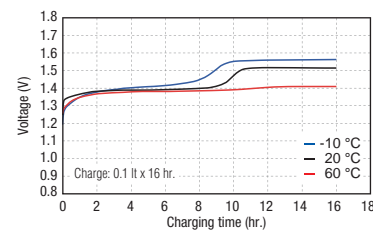
### Applications

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

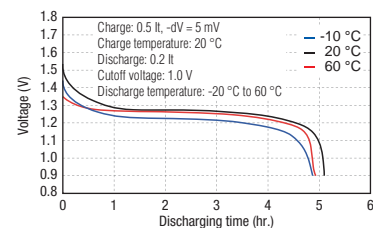
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AA	BK70AAH	1.2	700	750	14.5 +0/-0.7	49.0 +0/-1.5	18	-10 °C to 60 °C	-10 °C to 60 °C
AA	BK110AAH		1,100	1,180	14.5 +0/-0.7	50.5 +0/-1.5	24		
AA	BK150AAH		1,450	1,530	14.5 +0/-0.7	50.5 +0/-1.5	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



## 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.

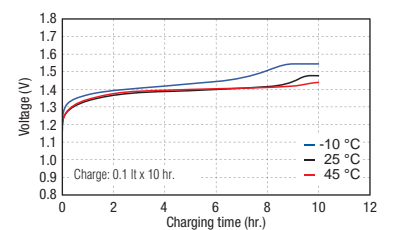
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with stud bolts (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
V	BK-10V1S	1.2	90,000	95,000	62.6 +1.0/-1.0	188.7 +1.0/-1.0	1,700	-20 °C to 60 °C	-20 °C to 60 °C

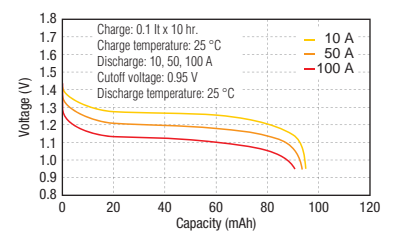
Size	Model No.	Nominal voltage (V)	Rated (min.)	Maximum continuous discharge current (A)	Dimensions (mm)			Mass (kg)	Operating temperature range	
					Width	Depth	Height		Charge	Discharge
-	BK-10V10T	12	90,000	100	428	159	270	23	-20 °C to 60 °C	-20 °C to 60 °C

\*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

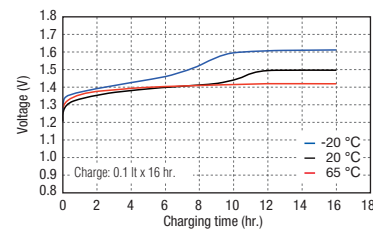
### Applications

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

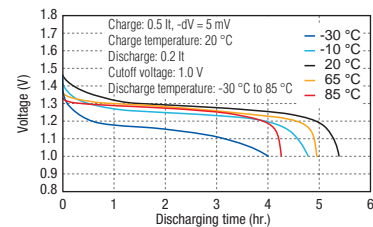
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AAA	BK60AAAW	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	12	-20 °C to 45 °C*2	-30 °C to 85 °C*4
AA	BK120AAW							1,200	1,280

\*1 0.2 It discharge capacity after charging at 0.1 It for 16 hours. \*2 Temperature range where 0.5 to 1 It rapid charge is enabled. \*3 Temperature range where 0.1 It charge is enabled. \*4 Temperature range where 0.2 It discharge is enabled. \*5 Temperature range where 1 It discharge is enabled. Note: 1 It (A) = rated capacity (Ah)/(hr.)

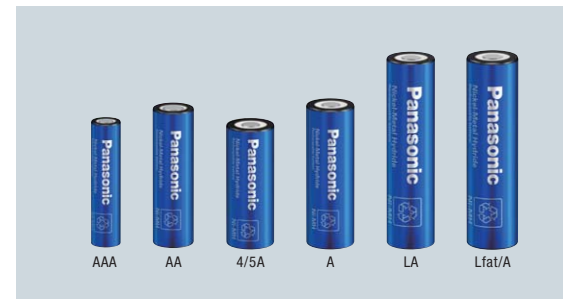
■ Example charge characteristics



■ Example discharge characteristics



## N Standard



### Features

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

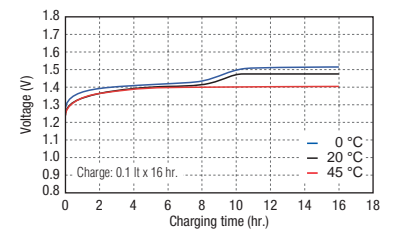
### Applications

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

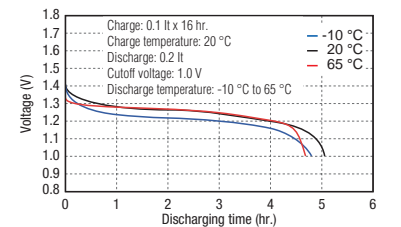
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range		
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge	
AAA	BK70AAAJ	1.2	700	730	10.5 +0/-0.7	44.5 +0/-1.5	12	0 °C to 45 °C		
	BK70AA									780
AA	BK110AAO	1,100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

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

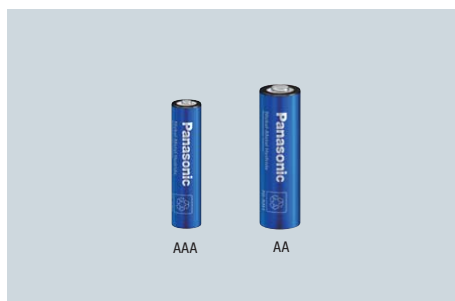
■ Example charge characteristics



■ Example discharge characteristics



## 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

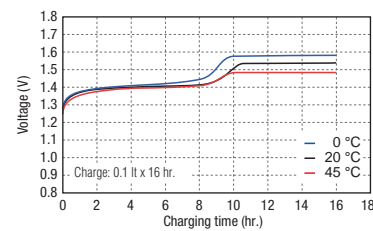
### Applications

Electric toothbrushes, electric shavers, remote controllers, etc.

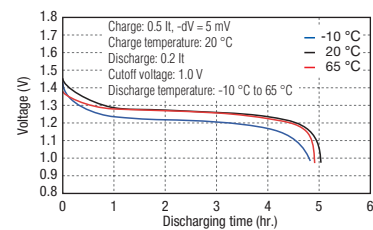
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
AAA*3	BK80AAAB	1.2	750	780	10.5 +0/-0.7	44.5 +0/-1.0	12	0 °C to 45 °C	-10 °C to 65 °C
AA*4	BK200AAB								

\*1 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



## P High-rate Discharge



### Features

- Excellent high-current discharge characteristics
- Rapid charging capability

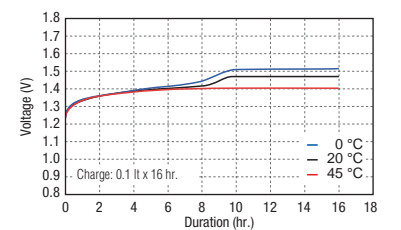
### Applications

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

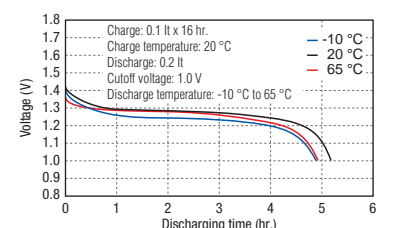
Size	Model No.	Nominal voltage (V)	Discharge capacity (mAh)*1		Dimensions with tube (mm)		Mass (g)	Operating temperature range	
			Rated (min.)	Average (typ.)	Diameter	Height		Charge	Discharge
SC	BK260SCP	1.2	2,450	2,700	23.0 +0/-1.0	43.0 +0/-1.5	55	0 °C to 45 °C	-10 °C to 65 °C
	BK300SCP		2,800	3,050					

\*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



# Nickel-Metal Hydride Batteries

## 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			
<b>Operation overview</b> VB: Battery voltage I ch: Charge current T: Battery surface temperature CV: Constant voltage					
<b>Features</b>	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	<ul style="list-style-type: none"> <li>Charging circuit is simple and affordable</li> <li>Applicable to devices requiring continuous charging for long periods</li> </ul>	Charging circuit cost is comparatively higher but supports longer service life than trickle-charging
<b>Charge time</b>	1-2 hr.	1-2 hr.	15 hr.	30 hr. or longer	15 hr. or longer
<b>Charge current</b>	0.5-1 It	0.5-1 It	Max. 0.1 It	—	0.1-0.5 It
<b>Trickle-charge current</b>	1/30-1/20 It	1/30-1/20 It	—	1/30-1/20 It	—
<b>Charge level at charge control</b>	Approx. 100-120 %	Approx. 100-110 %	—	—	Approx. 120 %
<b>Infrastructure backup type</b>	○	◎	○	○	◎
<b>Button-top type</b>	◎	○	—	—	○
<b>Standard type</b>	◎	◎	—	—	○
<b>High-capacity type</b>	○	◎	—	—	○
<b>Automotive backup type</b>	—	—	—	—	○

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

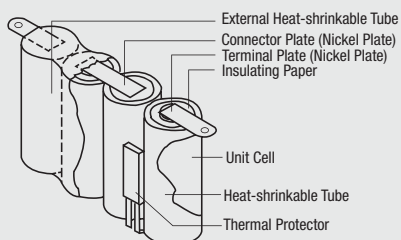
\*1 Battery-pack construction allowing temperature detection element (sensor) to reliably detect battery temperature is required.

\*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

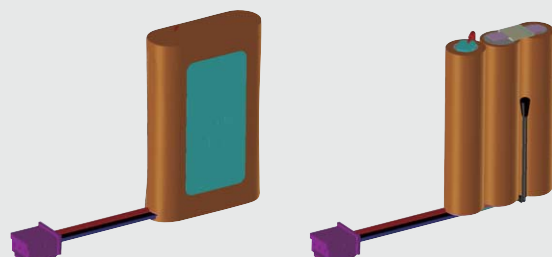


Installation of a thermistor (temperature detection), a thermal protector or PTC element (temperature rise protection), and protective measures against short-circuiting is recommended when deploying nickel-metal hydride battery-packs in devices. Protective safety circuitry is also required.

## 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



## Dry Batteries

Japanese market only

Our industrial dry-battery range features user-friendly labeling in English, Japanese, and Chinese language. These OEM dry batteries are engineered with high quality and easy usability in mind.



## Alkaline Batteries



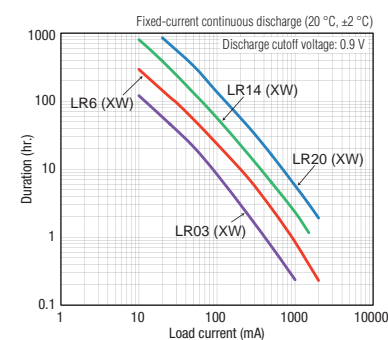
### Features

- Manganese dioxide is used for the cathode material, zinc for the anode's active material, and potassium-hydrate for the electrolyte solution
- An ideal choice for a variety of applications thanks to compatibility with manganese dry batteries

### Applications

Self-kindled gas/oil equipment, electric toys, portable radios, flashlights, wireless mice, electric toothbrushes, wall clocks, clocks, remote controllers, etc.

### Example discharge characteristics



Size	Model No.	Nominal voltage (V)	Dimensions (max.) (mm)		Mass (g)	IEC/JIS	ANSI
			Diameter	Height			
D	LR20XW	1.5	34.2	61.5	133	LR20	13A,13AC
C	LR14XW		26.2	50.0	64	LR14	14A,14AC
AA	LR6XW		14.5	50.5	23	LR6	15A,15AC
AAA	LR03XW		10.5	44.5	11	LR03	24A,24AC

## Manganese Batteries



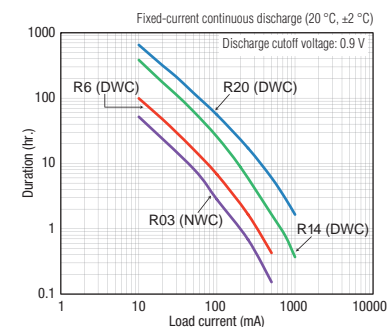
### Features

- Manganese dioxide is used for cathode materials, zinc for the anode's active material, and solutions including zinc chloride as the electrolyte
- Used for general electric device applications such as gas igniters

### Applications

Self-kindled gas/oil equipment, electric toys, portable radios, flashlights, wall clocks, clocks, remote controllers, etc.

### Example discharge characteristics



Size	Model No.	Nominal voltage (V)	Dimensions (max.) (mm)		Mass (g)	IEC/JIS	ANSI
			Diameter	Height			
D	R20DWC R20UWC	1.5	34.2	61.5	95	R20P R20S	13D
C	R14DWC		26.2	50.0	47	R14P	14D
AA	R6NWC R6DWC R6UWC		14.5	50.5	17	R6P R6S	15D
AAA	R03NWC		10.5	44.5	9	R03	24D

Note: Model number suffix and body color indicate battery's characteristic ranking: NWC (black) is highest ranked; DWC (red) second; UWC (blue) third.