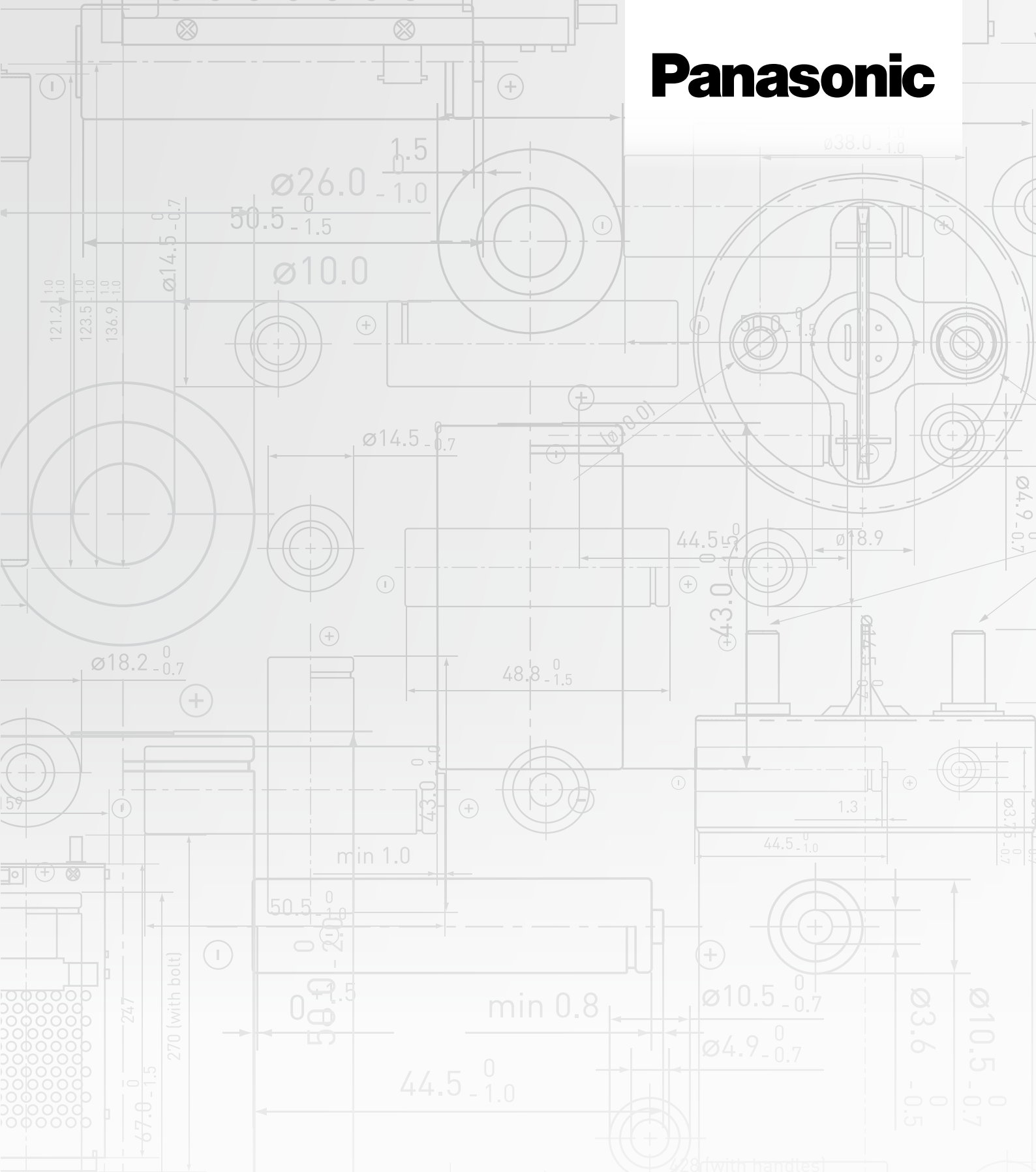


**Panasonic**



# Ni-MH

TECHNICAL HANDBOOK INDUSTRIAL BATTERIES FOR PROFESSIONALS



# WORLD'S LARGEST BATTERY MANUFACTURER

249,500  
EMPLOYEES



57  
BILLION  
SALES\*<sup>1</sup>



## PANASONIC ENERGY

Panasonic offers a wide range of power solutions for portable and stationary applications. Our product range includes high reliability batteries such as Lithium-Ion, Lithium, Nickel-Metal Hydride, Nickel-Cadmium, Valve-Regulated-Lead-Acid (VRLA), Alkaline, and Zinc-Carbon. With this breadth and depth to the portfolio, we can power your business in virtually all applications.

Panasonic began manufacturing batteries in 1931 and is today the most diversified global battery producer worldwide, with an extensive network of manufacturing companies. The company employees are dedicated to research, development and production of batteries for an energised world.

## PANASONIC AUTOMOTIVE & INDUSTRIAL SYSTEMS EUROPE GMBH (PAISEU)

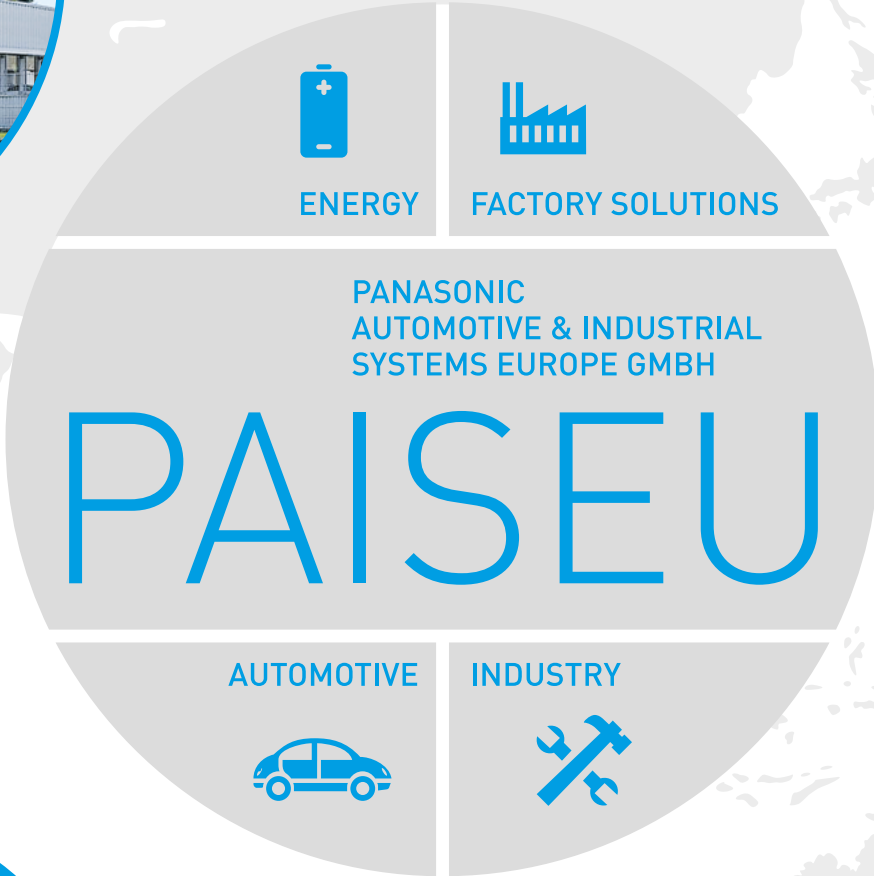
Panasonic Corporation, founded in Osaka 1918, is one of the world's largest manufacturers of quality electronic and electrical equipment. Its subsidiary, Panasonic

Automotive & Industrial Systems Europe GmbH (PAISEU), markets a diverse portfolio of industrial products throughout Europe. Formed in 2014 to strengthen Panasonic's pan-European industry operations, the company is now active in Automotive, Industry, Factory Solutions, and Energy.

In October 2014, Panasonic Automotive & Industrial Systems Europe GmbH (PAISEU), Sanyo Component Europe GmbH (SCE) and Panasonic Industrial Devices Sales Europe GmbH (PIDSEU) merged and now operate



OFFICE PAISEU  
IN HAMBURG



### CERTIFICATIONS

'Quality is our Business' – this is what Panasonic stands for. It is the principle for all our batteries and supporting services. This commitment is confirmed by numerous certifications.



as one AIS (Automotive & Industrial Systems) company. In addition, Panasonic Electric Works Europe AG (PEWEU) became a wholly owned subsidiary of PAISEU in October 2014. This new organisation reinforces Panasonic's position in the market, creating a stronger business partner for customers, who benefit from the capabilities and technical solutions of the combined product and service portfolios.

Our production facilities use leading-edge manufacturing processes that meet the toughest quality standards. All our factories are certified to ISO standards – with ISO 9000 and ISO 14000 being the minimum benchmarks. This means each factory has its own quality and environmental management, delivers products that measure up to toughest standards of reliability.

# FIND THE RIGHT BATTERY FOR YOUR APPLICATION

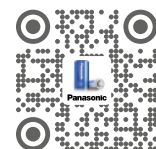


## BATTERY FINDER APP 3.0 FOR PROFESSIONALS

Designed for engineers, electronics specialists and developers who need batteries for their projects, the Battery Finder App provides an overview of what's available in the Panasonic range of industrial batteries, gives a recommendation on the type of battery that's best suited to the user's application. It also offers a wealth of information, graphics and videos on battery technology.

The features include:

- Completely redesigned version 3.0 (NEW)
- Improved intuitive usability
- Search for batteries using three different tools:
  - Parametric Search (NEW)
  - Application Search
  - Model Number Search
- Current Panasonic range: now 250 batteries – including new Ni-Cd series and Lithium-Ion pin type battery
- Easy usage due to 'Drawer' menu (NEW)
- Pictures and technical drawings of all products
- Product datasheets
- Favorites selection and sending to interested person
- Personal notes function (NEW)
- Function for comparing up to 3 batteries based on technical details (only online application) (NEW)
- Function for requesting product material in hardcopy or PDF format
- Function for recommendation
- Function for sending an inquiry
- Function to save images to smartphone gallery
- Extensive information on battery technology ('What is' glossary)
- Videos showing battery structure
- Direct link to Panasonic Battery Channel on YouTube
- Information about Panasonic company
- All contact details for Panasonic Automotive & Industrial Systems Europe GmbH



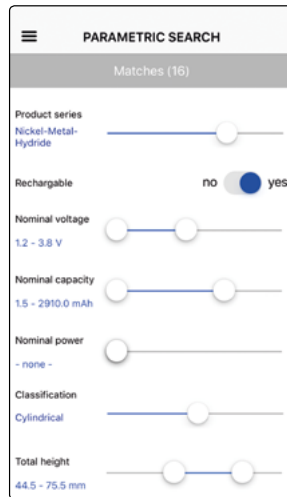




## SMARTPHONE APP



Home screen

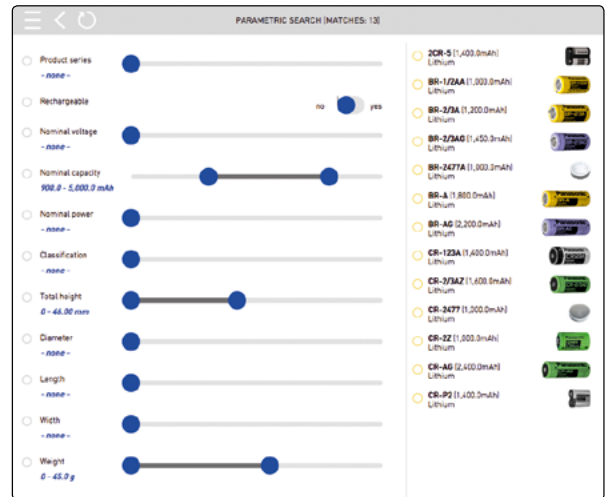


Parametric Search

Version 3.0 of the Battery Finder Smartphone App has been fully revised and is packed with a host of practical new features. The new home screen navigates users even faster to the functions they're looking for. Thanks to the Parametric Search, it's easier than ever to locate the right battery – and parameters can even be combined. There's also an enhanced battery information screen, with options to make and save notes. And last but not least, Battery Finder 3.0 makes it more intuitive and faster to locate applications. These are just a few examples of the many new possibilities.

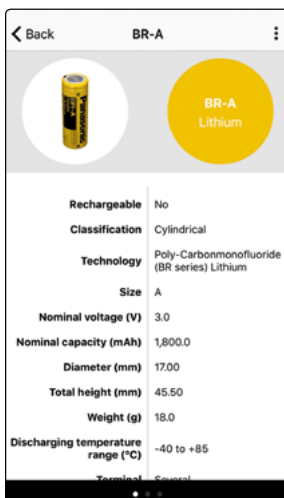


## HTML APP



Parametric Search

The newly designed Battery Finder HTML App 3.0 also has plenty of innovative features in store. The design is identical to that of the smartphone app, making it easier for users to switch seamlessly between mobile devices and PCs. The battery information screen provides all the available information on the selected battery, with a layout that ensures clarity of presentation. The Parametric Search makes it easier to locate the right battery; there is a wide choice of parameters, and options can also be combined. The extended favorites function now offers detailed comparisons of up to three batteries. All in all – it's now easier than ever to find the right battery!



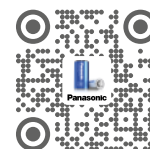
Battery information screen



Application Search



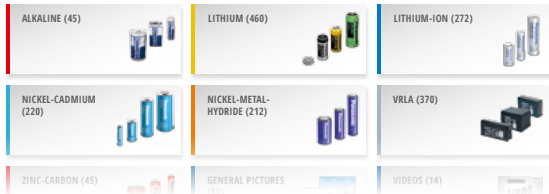
Battery information screen





## MEDIAPOOL

DOWNLOAD THE RIGHT BATTERY MEDIA FILES



The Panasonic Mediapool is a complete online library of Panasonic battery images, videos, press releases and white papers, providing you with just the right material for all sorts of projects. The Mediapool is open to all visitors to the Panasonic website, and offers material for both print and web. The image files differ with respect to their resolution (image size) and color space (CMYK or RGB). For each product, there is a version without shadow (suitable for use on white, colored or grey background). The library contains images in three formats: TIF, AI and PNG.

### NEW

- Videos and press releases now available
- New files appear in the folder 'New files' for three months

You can assemble as many files as you need and download them directly to your computer. Here's an overview of what you can do:

- Locate the material you need by product name or by clicking through the categories
- Preview file details – the preview function tells you the full name of the file, its size, format and resolution
- Select the files you wish to download. You can take files from multiple folders, or select all the material in a particular folder or category in one-click operation – there's no need to select each one individually
- Preview your personal 'Download bag' of the files you have selected
- The Mediapool zips your data into a file, which you then download to your computer. You unzip the file to the location of your choice simply by double-clicking the file name. The material is then ready for use.



## YOUTUBE CHANNEL

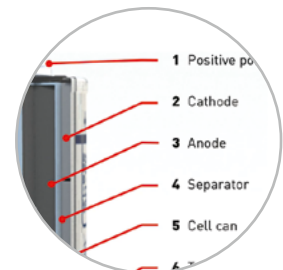
FIND THE RIGHT BATTERY VIDEO



Please find a comprehensive selection of Panasonic battery videos at our YouTube Channel. You can discover videos about the inner structure of our different battery chemistries, a video which gives you a clear insight about 'green' battery applications and last but not least a video which explains the working of our Battery Finder App in detail. Find out how we can power your business!



Panasonic Battery Finder Update 3.0 – App & Online Version



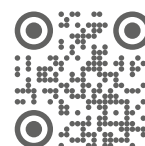
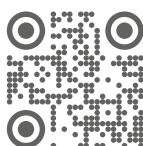
Panasonic Alkaline product video for professionals



Panasonic Good Energy – Smoke detector



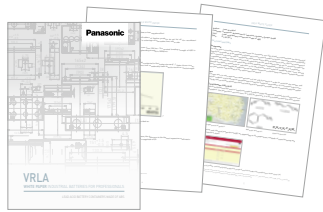
Panasonic Ni-MH product video for professionals





## WHITE PAPER

FIND THE RIGHT  
TECHNICAL INFORMATION



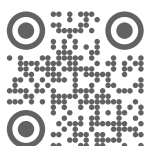
Panasonic is offering a new service: our white papers provide detailed, unbiased insights into various aspects of battery technology.

White papers are publicly available documents written by specialists on a specific technical issue. As such, they are of considerable value to professional users. White papers can be downloaded and freely disseminated. They are also routinely quoted in technical publications, and contain not only explanatory text, but also images and graphics, tables, charts and links.

Our white papers give developers and technical professionals the opportunity to leverage the expertise of our specialists for their own projects. We have been manufacturing batteries for a number of decades, and over this time have accumulated considerable knowledge and experience that we wish to share.

The first white paper is titled 'Lead acid battery containers made of ABS' and takes a detailed look at the experience of our engineers with the material ABS for VRLA containers. One of the issues addressed is the extent to which tensioned mounting straps can have a negative impact on the battery container. As well as a full description, the document provides valuable recommendations on the subject.

In the near future there will be a whole series of white papers with detailed insights into battery technology. We will let you know when the next one is out!

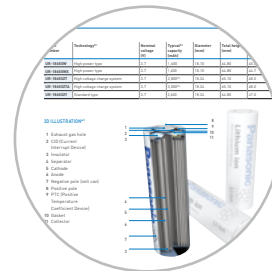


## SHORT FORM CATALOG AND HANDBOOKS

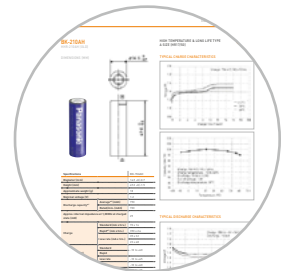
GET THE RIGHT PRODUCT OVERVIEW



Our range of digital tools to help you in your daily work are complemented by our 'classics' on paper: the Short Form Catalog and the handbooks on the various battery product groups. These remain popular with customers as valuable reference aids.



Short Form Catalog – a compact summary of all the batteries



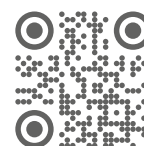
Ni-MH handbook – details about all the batteries of this particular chemistry



Short Form Catalog – an overview of latest news and innovations



Short Form Catalog – QR codes provide fast access to relevant information



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In order to take full advantage of the properties of Ni-MH batteries and also to prevent problems due to improper use, please note the following points during the use and design of battery operated products.

### CHARGING

#### Charging temperature

Charge batteries within an ambient temperature range of 0°C to 45°C. Ambient temperature during charging affects charging efficiency. As charging efficiency is best within a temperature range of 10°C to 30°C, whenever possible place the charger (battery pack) in a location within this temperature range.

At temperatures below 0°C the gas absorption reaction is not adequate, causing gas pressure inside the battery to rise, which can activate the safety vent and lead to leakage of Alkaline gas and deterioration in battery performance.

Charging efficiency drops at temperatures above 40°C. This can disrupt full charging and lead to deterioration in performance and battery leakage.

#### Parallel charging of batteries

Sufficient care must be taken during the design of the charger when charging batteries connected in parallel. Consult Panasonic when parallel charging is required.

#### Reverse charging

Never attempt reverse charging. Charging with polarity reversed can cause a reversal in battery polarity causing gas pressure inside the battery to rise, which can activate the safety vent, lead to Alkaline electrolyte leakage, rapid deterioration in battery performance, battery swelling or battery rupture.

#### Overcharging

Avoid overcharging. Repeated overcharging can lead to deterioration in battery performance. ('Overcharging' means charging a battery when it is already fully charged.)

#### Rapid charging

To charge batteries rapidly, use the specified charger (or charging method recommended by Panasonic) and follow the correct procedures.

#### Trickle charging (continuous charging)

Trickle charging cannot be used with Ni-MH batteries, except specific high temperature batteries (please contact Panasonic to get more information). However, after applying a refresh charge using a rapid charge, use a trickle charge of 0.033It to 0.05It. Also, to avoid overcharging with trickle charge, which could damage the cell characteristics, a timer measuring the total charge time should be used.

#### Note: 'It'

During charging and discharging, 'It' is a value indicating current and expressed as a multiple of nominal capacity. The current are expressed as multiples of It A, where It A = C<sub>5</sub> Ah/1h. For example, for a 1,500mAh battery of 0.033It, this value is equal to 1/30 x 1,500, or roughly 50mA.

### DISCHARGING

#### Discharge temperature

Discharge batteries within an ambient temperature range of -10°C to 60°C.

Discharge current level (i. e. the current at which a battery is discharged) affects discharging efficiency. Discharging efficiency is good within a current range of 0.1It to 2It.

Discharge capacity drops at temperatures below -10°C or above 45°C. Such decreases in discharge capacity can lead to deterioration in battery performance.

#### Overdischarge (deep discharge)

Since overdischarging (deep discharge) damages the battery characteristics, do not forget to turn off the switch when discharging, and do not leave the battery connected to the equipment for long periods of time. Also, avoid shipping the battery installed in the equipment.

#### High-current discharging

As high-current discharging can lead to heat generation and decreased discharging efficiency, consult Panasonic before attempting continuous discharging or pulse discharging at currents larger than 2It.

### STORAGE

#### Storage temperature and humidity (short-term)

Store batteries in a dry location with low humidity, no corrosive gases, and at a temperature range of -20°C to 45°C. Storing batteries in a location where humidity is extremely high or where temperatures fall below -20°C or rise above +45°C can lead to the rusting of metallic parts and battery leakage due to expansion or contraction in parts composed of organic materials.

#### Long-term storage (1 year, -20°C to 35°C)

Because long-term storage can accelerate battery self-discharge and lead to the deactivation of reactants, locations where the temperature ranges between 10°C and 30°C are suitable for long-term storage.

When charging for the first time after long-term storage, deactivation of reactants may lead to increased battery voltage and decreased battery capacity. Restore such batteries to original performance by repeating several cycles of charging and discharging.



## PRECAUTIONS FOR DESIGNING DEVICES WITH Ni-MH BATTERIES

When storing batteries for more than 1 year, charge at least once a year to prevent leakage and deterioration in performance due to self-discharging.

### SERVICE LIFE OF BATTERIES

#### Cycle life

Batteries used under proper conditions of charging and discharging can be used 500 cycles or more. Significantly reduced service time in spite of proper charging means that the life of the battery has been exceeded.

Also, at the end of service life, an increase in internal resistance, or an internal short-circuit failure may occur. Chargers and charging circuits should therefore be designed to ensure safety in the event of heat generated upon battery failure at the end of service life.

#### Service life with long-term use

Because batteries are chemical products involving internal chemical reactions, performance deteriorates not only with use but also during prolonged storage.

Normally, a battery will last 2 years (or 500 cycles) if used under proper conditions and not overcharged or overdischarged. However, failure to satisfy conditions concerning charging, discharging, temperature and other factors during actual use can lead to shortened life (or cycle life) damage to products and deterioration in performance due to leakage and shortened service life.

### DESIGN OF PRODUCTS WHICH USE BATTERIES

#### Connecting batteries and products

Never solder a lead wire and other connecting materials directly to the battery, as doing so will damage the battery's internal safety vent, separator, and other parts made of organic materials. To connect a battery to a product, spot-weld a tab made of Nickel or Nickel-plated steel to the battery's terminal strip, then solder a lead wire to the tab. Perform soldering in as short a time as possible. Use caution in applying pressure to the terminals in cases where the battery pack can be separated from the equipment.

#### Material for terminals in products using the batteries

Because small amounts of Alkaline electrolyte can leak from the battery seal during extended use or when the safety vent is activated during improper use, a highly Alkaline-resistant material should be used for a product's contact terminals in order to avoid problems due to corrosion.

High Alkaline-resistant metals	Low Alkaline-resistant metals
Nickel, stainless steel, Nickel-plated steel, etc.	Tin, Aluminum, Zinc, Copper, Brass, etc.

(Note that stainless steel generally results in higher contact resistance.)

#### Temperature related position of batteries in products

Excessively high temperatures (i.e. higher than 45°C) can cause Alkaline electrolyte to leak from the battery, thus damaging the product and shorten battery life by causing deterioration in the separator or other battery parts. Install batteries far from heat-generating parts of the product. The best battery position is in a battery compartment that is composed of an Alkaline-resistant material which isolates the batteries from the product's circuitry. This prevents damage that may be caused by a slight leakage of Alkaline electrolyte from the battery.

#### Discharge end voltage

The discharge end voltage is determined by the formula given below. Please set the end voltage of each battery at 1.1 volts or less.

Number of batteries arranged serially	
1 to 6	(Number of batteries x 1.0) V
7 to 12	[(Number of batteries - 1) x 1.2] V

#### Overdischarge (deep discharge) prevention

Overdischarging (deep discharging) or reverse charging damages the battery characteristics. In order to prevent damage associated with forgetting to turn off the switch or leaving the battery in the equipment for extended periods, preventative options should be incorporated in the equipment. At the same time, it is recommended that leakage current is minimised. Also, the battery should not be shipped inside the equipment.

### PROHIBITED ITEMS REGARDING THE BATTERY HANDLING

Panasonic assumes no responsibility for problems resulting from batteries handled in the following manner.

#### Disassembly

Never disassemble a battery, as the electrolyte inside is strong Alkaline and can damage skin and clothes.

#### Short-circuiting

Never attempt to short-circuit a battery. Doing so can damage the product and generate heat that can cause burns.

### **Throwing batteries into a fire or water**

Disposing of a battery in fire can cause the battery to rupture. Also avoid placing batteries in water, as this causes batteries to cease to function.

### **Soldering**

Never solder anything directly to a battery. This can destroy the safety features of the battery by damaging the safety vent inside the cap.

### **Inserting the batteries with their polarities reversed**

Never insert a battery with the positive and negative poles reversed as this can cause the battery to swell or rupture.

### **Overcharging at high currents and reverse charging**

Never reverse charge or overcharge with high currents (i.e. higher than rated). Doing so causes rapid gas generation and increased gas pressure, thus causing batteries to swell or rupture.

Charging with an unspecified charger or specified charger that has been modified can cause batteries to swell or rupture. Be sure to indicate this safety warning clearly in all operating instructions as a handling restriction for ensuring safety.

### **Installation in equipment (with an airtight battery compartment)**

Always avoid designing airtight battery compartments. In some cases, gases (oxygen, hydrogen) may be given off, and there is a danger of the batteries bursting or rupturing in the presence of a source of ignition (sparks generated by a motor, switch, etc.).

### **Use of batteries for other purposes**

Do not use a battery in an appliance or purpose for which it was not intended. Differences in specifications can damage the battery or appliance.

### **Short-circuiting of battery packs**

Special caution is required to prevent short circuits. Care must be taken during the design of the battery pack shape to ensure batteries cannot be inserted in reverse. Also, caution must be given to certain structures or product terminal shapes which can make short-circuiting more likely.

### **Using old and new batteries together**

Avoid using old and new batteries together. Also avoid using these batteries with ordinary dry-cell batteries, Ni-Cd batteries or with another manufacturer's batteries. Differences in various characteristic values, etc. can cause damage to batteries or the product.

### **OTHER PRECAUTIONS**

Batteries should always be charged prior to use. Be sure to charge correctly.

### **Ni-MH BATTERY TRANSPORTATION SITUATION\*<sup>1</sup>**

#### **Transport by sea**

UN 3496 takes place under IMDG-Code Special Provision 963. Ni-MH batteries are classified as dangerous goods in class 9. Batteries shall be securely packed and protected from short circuit.

When loaded in a cargo transport unit with 100kg gross mass or more, special stowage is requested away from heat source. Furthermore an information on the IMO (International Maritime Organisation) document is required.

#### **Transport by air**

UN 3496 takes place under IATA DGR. A806 informs that UN 3496 is only valid for sea freight. This means that there are no restrictions for air freight.

#### **Transport by road**

As of today there are no fixed regulations for the worldwide transportation of Ni-MH batteries by road.

### **FINAL POINT TO KEEP IN MIND**

In order to ensure safe battery use and to prolong the battery performance, please consult Panasonic regarding charge and discharge conditions for use and product design prior to the release of a battery-operated product.

\*<sup>1</sup> The aforementioned information is subject to change without any notice.

PRODUCT SAFETY DATA SHEET\*1

**Manufacturer**

Name of Company: Panasonic Corporation Energy Company  
 Address: 1-1, Matsushita-cho, Moriguchi, Osaka 570-8511 Japan  
 Document number: PMH-PSDS-100129E  
 Issued: Jan, 17<sup>th</sup>, 2017

Name of product: Nickel-Metal Hydride Storage Battery  
 (Model Name) The models described as BK-\*\*\*\*\*

**Substance identification**

Substance: Nickel-Metal Hydride Storage Battery  
 CAS No.: Not Specified.  
 UN Class: UN Class: UN 3496 (only valid under IMDG for sea freight above 100kg each container)

[Special Provision 304] (UN Recommendations on the TRANSPORT OF DANGEROUS GOODS Model Regulations Volume 1. 19<sup>th</sup> revised edition revised edition) Battery, dry, containing corrosive electrolyte which will not flow out of the battery if the battery case is cracked are not subject to these Regulations provided the batteries are securely packed and protected against short-circuits. Examples of such batteries are: Alkali-Manganese, Zinc-Carbon, Nickel-Metal Hydride and Nickel-Cadmium batteries.

**Ecological information**

Heavy metal	Hg < 0.5ppm	Measurement Analysis: Atomic Absorption Spectrometer
quantity for cell:	Cd < 5.0ppm	Measurement Analysis: Atomic Absorption Spectrometer
	Pb < 40ppm	Measurement Analysis: Atomic Absorption Spectrometer

**Transport information**

1. During the transportation of a large amount of batteries by ship, trailer or railway, do not leave them in the places of high temperatures and do not allow them to be exposed to dew condensation.
2. Avoid transportation with the possibility of the collapse of cargo piles and the packing damage.
3. Protect the terminals of batteries and prevent them from short circuit so as not to cause dangerous heat generation.

**Regulatory information**

- IATA Dangerous Goods Regulations 58<sup>th</sup> Edition effective 1 January - 31 December 2017
- ICAO Technical Instructions for the safe transport of dangerous goods by air
- IATA (A806) for air shipment
- IMDG (Special Provision) for sea shipment under UN3496

**Other references**

- Ni-Cd, Ni-MH Panasonic Catalog and technical handbook.
- Recommendations on the TRANSPORT OF DANGEROUS GOODS Model Regulations Volume 1. 19<sup>th</sup> revised edition.
- IATA Dangerous Goods Regulations 58<sup>th</sup> Edition effective 1 January - 31 December 2017

# IDEAL FOR LESS COMPLEX AND COST-SENSITIVE APPLICATIONS



SUITABLE FOR NEARLY EVERY APPLICATION

HIGH QUALITY AND RELIABILITY

GOOD BALANCE IN TERMS OF CAPACITY AND LIFETIME

EXCELLENT DISCHARGE CHARACTERISTICS



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series video.



## OVERVIEW

More and more electric products with sophisticated functions require extremely compact and light battery solutions delivering a high level of energy density. To meet these needs Panasonic Ni-MH batteries have been developed and manufactured with Nickel hydroxide for the positive electrode and hydrogen absorbing alloys, capable of absorbing and releasing hydrogen at high-density levels, for the negative electrode. The Ni-MH battery technology is the Ni-Cd (Nickel-Cadmium) successor technology for rechargeable and portable devices. All of our Ni-MH batteries are Cadmium-free, in order not to be harmful to human beings and our environment.

## CONSTRUCTION

Ni-MH batteries consist of a positive plate containing Nickel hydroxide as its principal active material, a negative plate mainly composed of hydrogen absorbing alloys, a separator made of fine fibers, an Alkaline electrolyte, a metal case and a sealing plate provided with a self-resealing safety vent. Their basic structure is identical to that of Ni-Cd batteries. With cylindrical Ni-MH batteries, the positive and negative plates are divided by the separator, wound into a coil, inserted into the case, and sealed by the sealing plate through an electrically insulated gasket, see page 14.

Panasonic expands the line of Ni-MH cells that are superior to standard Ni-MH products in applications with low-rate charge at high temperatures. Improvements were made in existing Panasonic Ni-MH cells to the negative plate alloy and

separator fiber density. A different electrolyte composition was achieved to improve performance. Superior long-life characteristics can be achieved when combined with appropriate intermittent charge control circuitry. The intermittent charge consumes 1/30<sup>th</sup> the electricity compared to trickle charge and more than doubles the expected life of the Ni-MH cells compared to Ni-Cd cells that have been trickle charged.

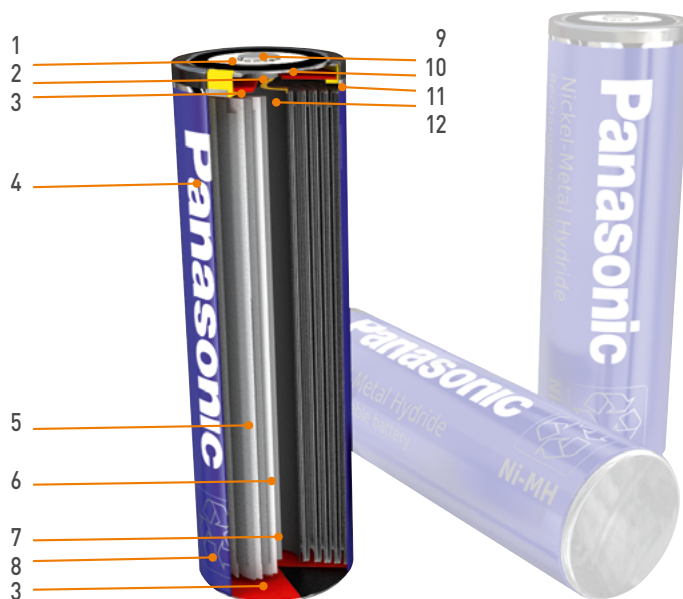
## APPLICATIONS

Ni-MH batteries are suitable for virtually all kinds of application where it matters to reduce complexity and cost. There are seven types of Ni-MH batteries available from Panasonic, all of which deliver a good balance between capacity and battery life, with excellent discharge characteristics. As well as the standard type, Panasonic offers batteries for high ambient temperatures to 75°C (for either high discharge rate or long life), batteries for low temperatures to minus 30°C (designed for outdoor applications), button-top types, high rate discharge and rapid charge batteries, and infrastructure-type batteries which combine high capacity with efficiency even at low temperatures.

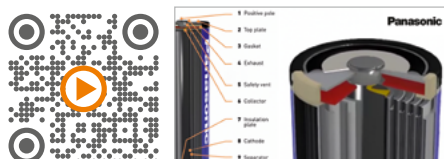
With high performance and reliability throughout, Panasonic Ni-MH batteries are de facto all-rounders, and the applications are correspondingly diverse: transportation, solar energy technology, medical, household and garden equipment, communications equipment, security equipment and cordless power tools are just some of the possible applications powered by Panasonic Ni-MH batteries, see page 23 – 27.

## STRUCTURE OF Ni-MH BATTERIES\*1

- 1 Exhaust gas hole
- 2 Safety vent
- 3 Insulation plate
- 4 Tube
- 5 Anode (hydrogen absorbing alloy)
- 6 Separator
- 7 Cathode (Nickel Hydroxide)
- 8 Negative pole (cell can)
- 9 Positive pole
- 10 Top plate
- 11 Gasket
- 12 Collector



Scan QR code to view 3D animated video.



## THE PRINCIPLE OF ELECTROCHEMICAL REACTION INVOLVED IN Ni-MH BATTERIES

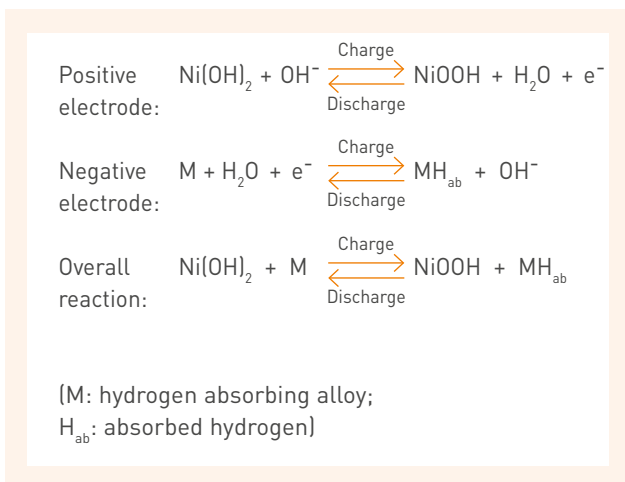
### Hydrogen absorbing alloys

Hydrogen absorbing alloys have a comparatively short history which dates back about 30 years to the discovery of NiFe, MgNi and LaNi<sub>5</sub> alloys. They are capable of absorbing hydrogen equivalent to about a thousand times of their own volume, generating metal hydrides and also of releasing the hydrogen that they absorbed. These hydrogen absorbing alloys combine metal (A) whose hydrides generate heat exothermically with metal (B) whose hydrides generate heat endothermically to produce the suitable binding energy so that hydrogen can be absorbed and released at or around normal temperature and pressure levels. Depending on how metals A and B are combined, the alloys are classified into the following types: AB (TiFe, etc.), AB<sub>2</sub> (ZnMn<sub>2</sub>, etc.), AB<sub>5</sub> (LaNi<sub>5</sub>, etc.) and A<sub>2</sub>B (Mg<sub>2</sub>Ni, etc.). From the perspective of charge and discharge efficiency and durability, the field of candidate

metals suited for use as electrodes in storage batteries is now being narrowed down to AB<sub>5</sub> type alloys in which rare-earth metals, especially metals in the Lanthanum group, and Nickel serve as the host metals; and to AB<sub>2</sub> type alloys in which the Titanium and Nickel serve as the host metals. Panasonic is now focusing its attention on AB<sub>5</sub> type alloys which feature high capacity, excellent charge and discharge efficiency, and excellent cycle life. It has developed, and is now employing its own MmNi<sub>5</sub> alloy which uses Mm (misch metal – an alloy consisting of a mixture of rare-earth elements) for metal A.

Principle of electrochemical reaction involved in batteries  
Ni-MH batteries employ Nickel hydroxide for the positive electrode similar to Ni-Cd batteries. The hydrogen is stored in a hydrogen absorbing alloy for the negative electrode, and an aqueous solution consisting mainly of potassium hydroxide for the electrolyte. Their charge and discharge reactions are shown on the next pages.



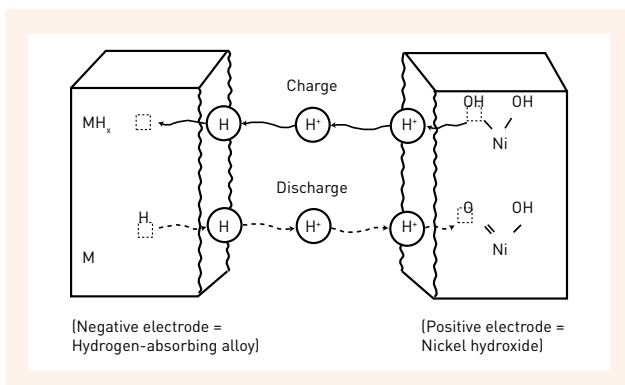


As can be seen by the overall reaction given above, the chief characteristics of the principle behind a Ni-MH battery is that hydrogen moves from the positive to the negative electrode during charge and reverse during discharge, with the electrolyte taking no part in the reaction; which means that there is no accompanying increase or decrease in the electrolyte. A model of this battery's charge and discharge mechanism is shown in the figure on the following pages. These are the useful reactions taking place at the respective boundary faces of the positive and negative electrodes, and to assist one in understanding the principle, the figure shows how the reactions proceed by the transfer of protons (H+).

The hydrogen absorbing alloy negative electrode successfully reduces the gaseous oxygen given off from the positive electrode during overcharge by sufficiently increasing the capacity of the negative electrode which is the same method employed by Ni-Cd batteries.

By keeping the battery's internal pressure constant in this manner, it is possible to seal the battery.

**Schematic discharge of Ni-MH battery\*1**



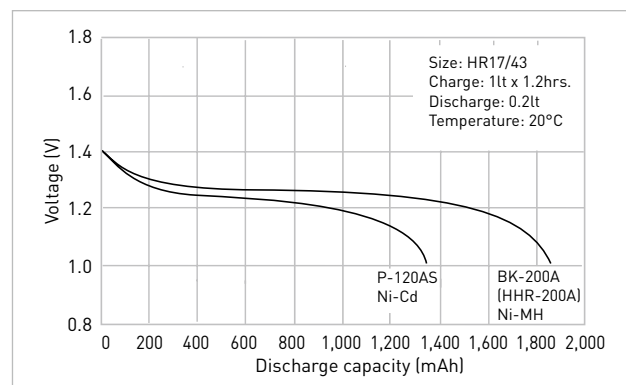
**FEATURES**

**Similarity with Ni-Cd batteries**

These batteries have similar discharge characteristics to those of Ni-Cd batteries.

**Double the energy density of conventional batteries**

Ni-MH batteries have approximately double the capacity compared with Panasonic's standard Ni-Cd batteries.



**Cycle life performance**

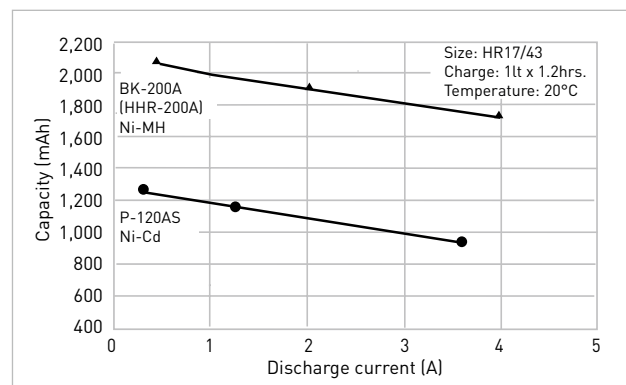
Like Ni-Cd batteries, Ni-MH batteries can be repeatedly charged and discharged for about 500 up to 1,000 cycles. Depending on the battery type even more than 1,800 cycles are available.

**Rapid charge in approx. 1 hour**

Ni-MH batteries can be rapidly charged in about an hour using a specially designed charger.

**Excellent discharge characteristics**

Since the internal resistance of Ni-MH batteries is low, continuous high-rate discharge up to 2lt is possible.



\*1 The graphic shows only a simplified version of the chemical concept.

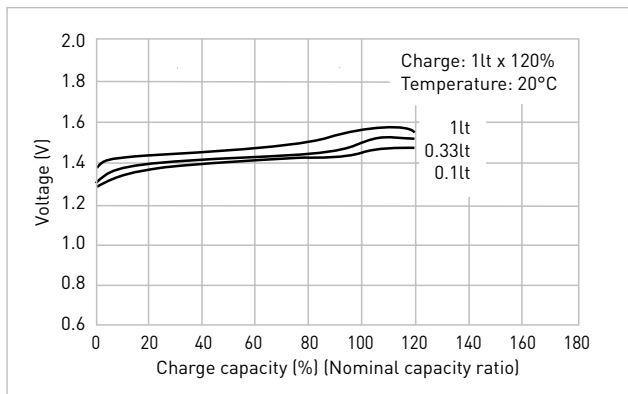
**FIVE MAIN CHARACTERISTICS**

As with Ni-Cd batteries, Ni-MH batteries have five main characteristics: charge, discharge, storage life, cycle life, and safety.

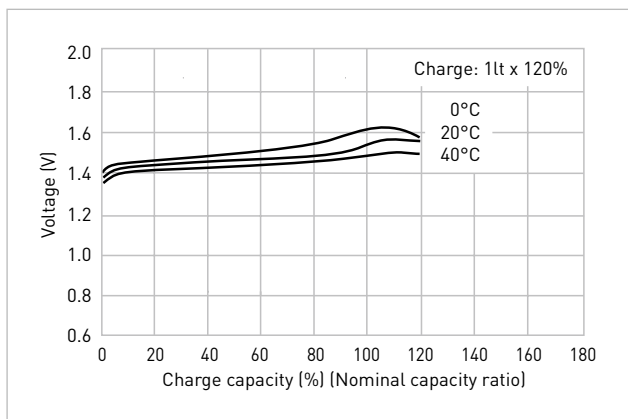
**1. Charge characteristics**

The charge characteristics of Ni-MH batteries are affected by current, time and temperature. The battery voltage rises when the charge current is increased or when the temperature is low. The charge efficiency differs depending on the current, time, temperature and other factors. Ni-MH batteries should be charged at a temperature ranging from 0°C to 40°C using a constant current of 1It or less. The charge efficiency is particularly good at a temperature of 10°C to 30°C. Repeated charge at high or low temperatures causes the battery performance to deteriorate. Furthermore, repeated overcharge should be avoided since it will downgrade the battery performance. Refer to the section on recommended charge methods for details on how to charge the batteries, see page 20 – 21.

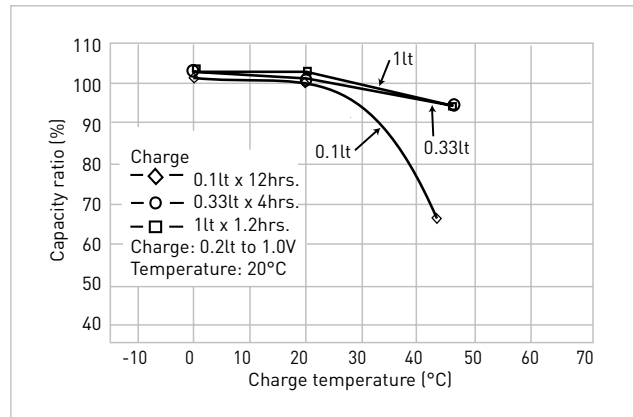
**Charge characteristics**



**Charge temperature characteristics at 1It charge**



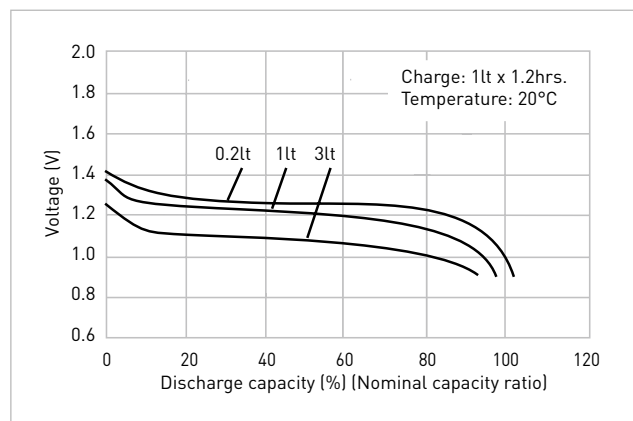
**Charge temperature characteristics at various charge rates**



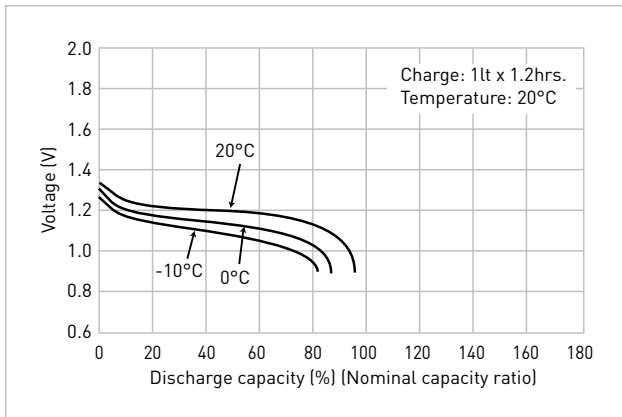
**2. Discharge characteristics**

The discharge characteristics of Ni-MH batteries are affected by current, temperature, etc., and the discharge voltage characteristics are flat at 1.2V, which is almost the same as for Ni-Cd batteries. The discharge voltage and discharge efficiency decrease in proportion as the current rises or the temperature drops. As with Ni-Cd batteries, repeated charge and discharge of these batteries under high discharge cut-off voltage conditions (more than 1.1V per cell) causes a drop in the discharge voltage (which is sometimes accompanied by a simultaneous drop in capacity). The discharge characteristics can be restored by charge and discharge to a discharge end voltage of down to 1.0V per cell.

**Discharge characteristics**



**Discharge temperature characteristics at 1lt discharge**

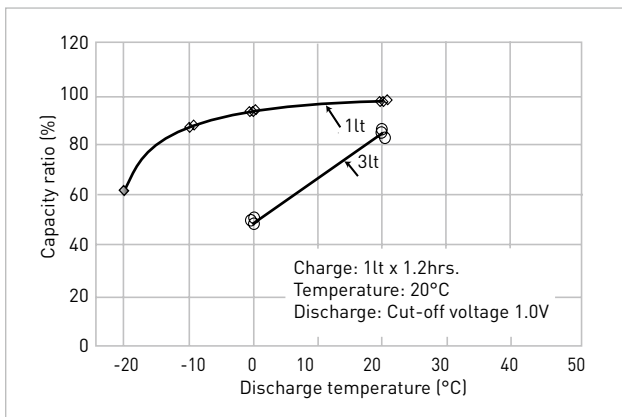


Self-discharge is affected by the temperature at which the batteries are left standing and the length of time during which they are left standing. It increases in proportion as the temperature or the shelf-standing time increases. Panasonic's Ni-MH batteries have excellent self-discharge characteristics.

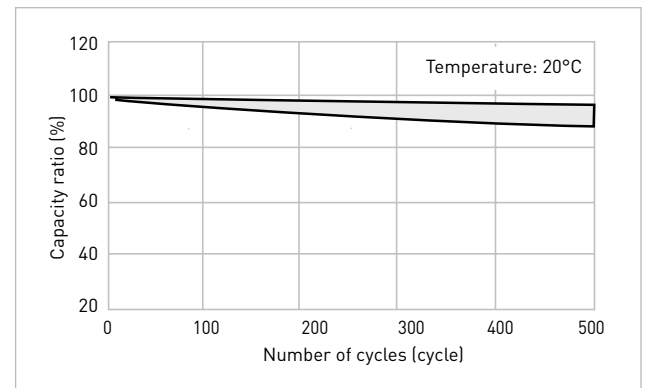
**4. Cycle life characteristics**

The cycle life of these batteries is governed by the conditions under which they are charged and discharged, temperature and other conditions of use. Under proper conditions of use (example: IEC charge and discharge conditions), these batteries can be charged and discharged for more than 500 cycles.

**Discharge temperature characteristics**



**Cycle life characteristics**



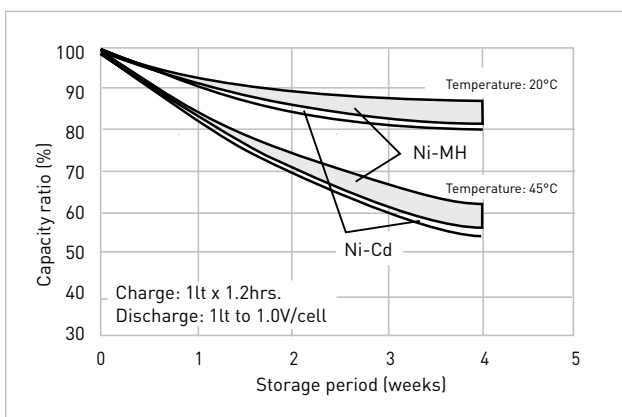
**3. Storage characteristics**

These characteristics include self-discharge characteristics and restoration characteristics after long-term storage. When batteries are left standing, their capacity generally drops due to self-discharge, but this is restored by charge.

**5. Safety**

When the internal pressure of these batteries rises due to overcharge, short-circuiting, reverse charge or other abuse or misuse, the self-sealing safety vent is activated to prevent battery damage.

**Self-discharge characteristics**

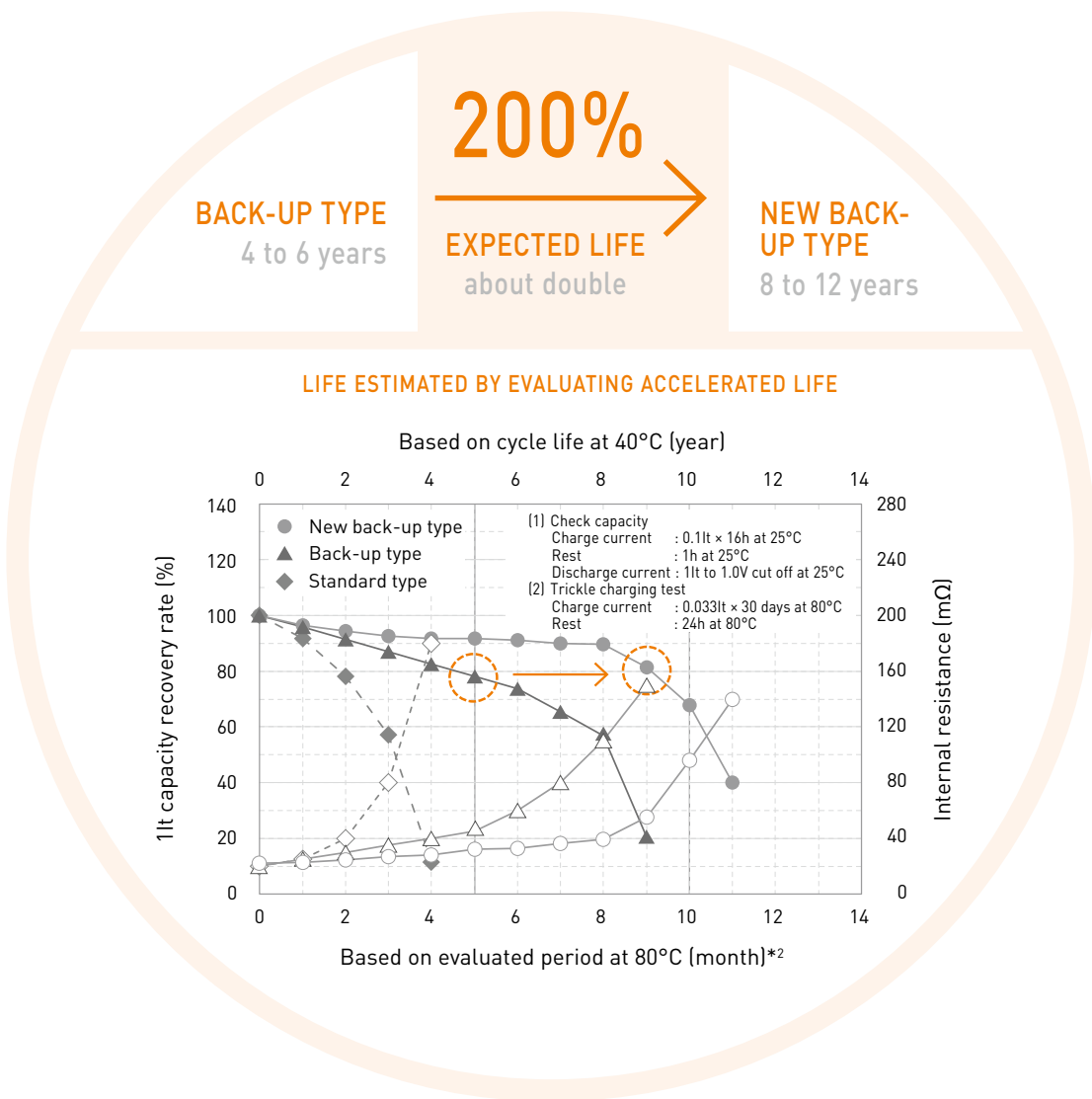


Ni-MH TECHNOLOGIES

NEW BACK-UP TYPE (E.G. BK-120AAHU)\*1

New battery type which provides high temperature durability and long-life adapted to the IEC-U standard.

- Excellent charging and discharging performance in different environments (-20°C to 75°C)
- Long-life in trickle charging (most suitable for replacing Nickel-Cadmium batteries)
- Fit well for various equipments and applications
- Small, light-weight and space-saving

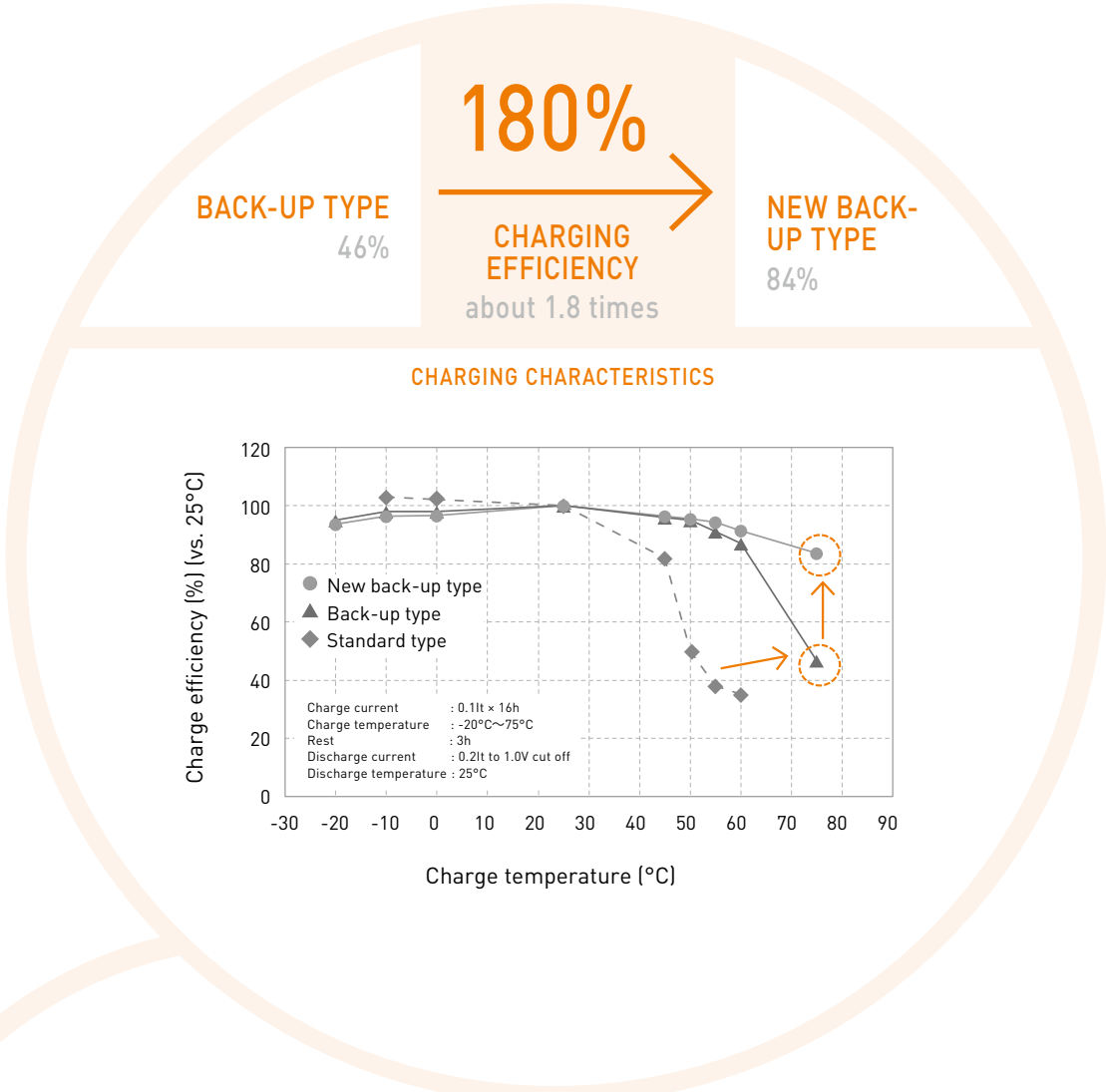


LONG-LIFE (IN TRICKLE CHARGING)

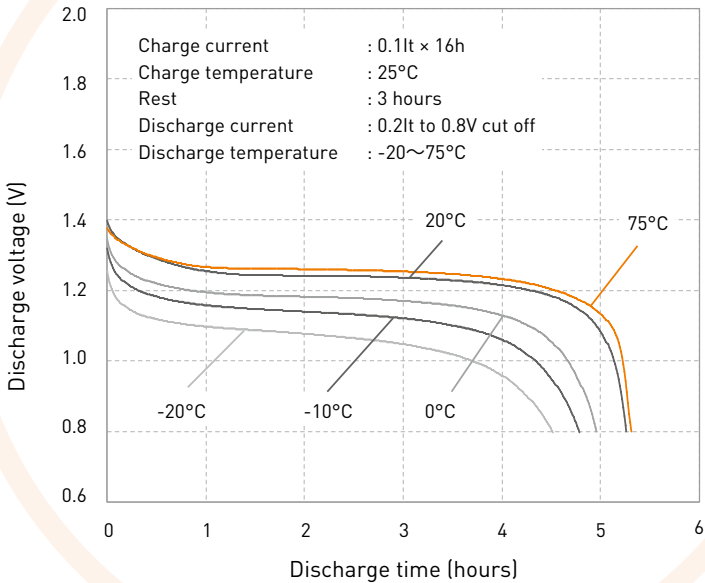
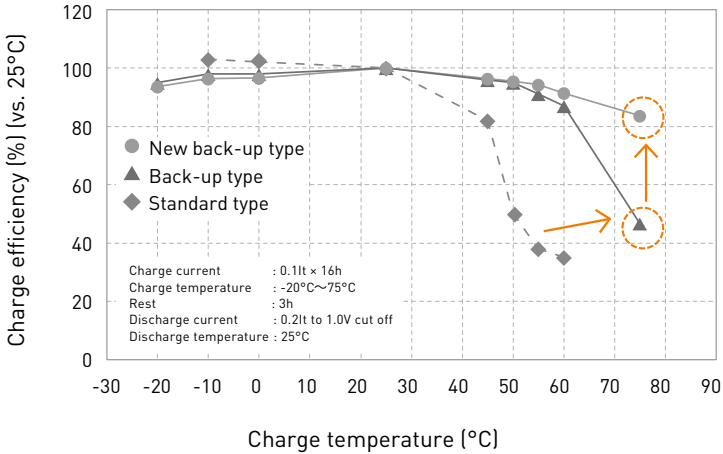
\*1 New back-up type which can be operated at high ambient temperatures up to 75 °C. The mass production of one battery type has already started. The production of the other batteries will follow.

\*2 It is accelerated evaluation on the condition that trickle charging current is 0.033It at 80°C.

EXCELLENT CHARGING PERFORMANCE AT HIGH TEMPERATURE ENVIRONMENT UP TO 75°C



CHARGING CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



### CHARGE METHODS

Charge is the process of restoring a discharged battery to its original capacity. In order for a battery to be usable for a long period of time, it must be charged via the proper charge method. Various methods are used to charge rechargeable cells, but Panasonic recommends the charge methods described below to charge its Ni-MH batteries.

**1. Rapid charge current:** 1It (rapid charge temperature range: 0°C to 40°C). In order to exercise proper control to stop rapid charge, it is recommended that batteries be charged at over 0.5It but less than 1It. Charging batteries at a current in excess of 1It may cause the safety vent to be activated by a rise in the internal pressure of the batteries, thereby resulting in electrolyte leakage. When the temperature of the batteries is detected by a thermistor or other type of sensor, and their temperature is under 0°C or over 40°C at the commencement of the charge, then trickle charge, rather than rapid charge, must be performed. Rapid charge is stopped when any one of the values among the types of control described in 4., 5., 6., and 11. reaches the prescribed level.

**2. Allowing a high current:** to flow to excessively discharged or deep-discharged batteries during charge may make it impossible to sufficiently restore the capacity of the batteries. To charge excessively discharged or deep-discharged batteries, first allow a trickle current to flow, and then proceed with the rapid charge current once the battery voltage has risen.

**3. Rapid charge start voltage:** Approx. 0.8V/cell rapid charge transition voltage restoration current: 0.2 ~ 0.3It

**4. Upper battery voltage limit control:** Approx. 1.8V/cell. The charge method is switched over to trickle if the battery voltage reaches approximately 1.8V/cell due to trouble or malfunctioning of some kind.

**5.  $\Delta V$  value:** 5 to 10mV/cell. When the battery voltage drops from its peak to 5 to 10mV/cell during rapid charge, rapid charge is stopped, and the charge method is switched over to trickle charge.

**6.  $dT/dt$  value:** Approx. 1 to 2°C/min. When a rise in the battery temperature per unit time is detected by a thermistor or other type of temperature sensor during rapid charge, and the prescribed temperature rise is sensed, rapid charge is stopped and the charge method is switched over to trickle charge.

**7. Temperature cut-off (TCO):** The TCO is different compared to the Ni-MH battery series respectively types and therefore depends on each battery characteristic. Thus cycle life and other characteristics of batteries are impaired if the batteries are allowed to become too hot during charge. In order to safeguard against this, rapid charge is stopped and the charge method is switched over to trickle charge when the battery temperature has reached the prescribed level.

**8. Initial delay timer:** to 10min. This prevents the  $-\Delta V$  detection circuit from being activated for a specific period of time after rapid charge has commenced. However, the  $dT/dt$  detection circuit is allowed to be activated during this time. As with Ni-Cd batteries, the charge voltage of Ni-MH batteries may show signs of swinging (pseudo  $-\Delta V$ ) when they have been kept standing for a long time or when they have discharged excessively, etc. The initial delay timer is needed to prevent charge from stopping (to prevent malfunctioning) due to this pseudo  $-\Delta V$ .

**9. Trickle current:** 0.033 to 0.05It. When the trickle current is set higher, the temperature rise of the batteries is increased, causing the battery characteristics to deteriorate.

**10. Rapid charge transfer timer:** 60min.

**11. Rapid charge timer:** 90min. (at 1It charge)

**12. Total timer:** 10 to 20 hours. The overcharging of Ni-MH batteries, even by trickle charging, causes a deterioration in the characteristics of the batteries. To prevent overcharging by trickle charging or any other charging method, the provision of a timer to regulate the total charging time is recommended.

**Note:** The temperature and voltage of Ni-MH batteries varies depending on the shape of the battery pack, the number of cells, the arrangement of the cells and other factors. Therefore Panasonic should be consulted for more detailed information on the referenced charge control values. The charge methods described previously can be applied also when Ni-MH batteries are employed in a product, but Panasonic should be consulted for the control figures and other details.

**Recommended Ni-MH battery charge system\*1**

1. Rapid charge current	Max. 0.5It to 1It
2. Rapid charge transition voltage restoration current	0.2 to 0.3It
3. Rapid charge start voltage	Approx. 0.8V/cell
4. Charge terminating voltage	1.8V/cell
5. ΔV value	5 to 10mV/cell
6. Battery temperature rising rate dT/dt value	1 to 2°C/min.
7. Maximum battery temperature cut-off (TCO)	The TCO is different compared to the Ni-MH battery series respectively types and therefore depends on each battery characteristic.
8. Initial -ΔV detection disabling timer	5 to 10min.
9. Trickle current (after rapid charge)	0.033 to 0.05It
10. Rapid charge transfer timer	60min.
11. Rapid charge timer	90min. (at 1It charge)
12. Total timer	10 to 20 hours (h)
13. Rapid charge temperature range	0° to 40°C

**Ni-MH HIGH-TEMPERATURE SERIES RECOMMENDED CHARGE FOR BACK-UP APPLICATIONS**

The optimal charge system for the Ni-MH back-up or high temperature applications is an intermittent timer charge. An intermittent timer charge improves charge efficiency, extends battery life (-vs- trickle charge) and reduces electricity consumption up to 97% compared to trickle charge\*2.

**Intermittent timer charge:** (See diagram) At the beginning of the charge, an IC timer is started and charging is activated at a current of 0.1It until the timer stops and the charge is terminated. When the batteries self discharge down to a set point (1.3V), the timer charge is reactivated.

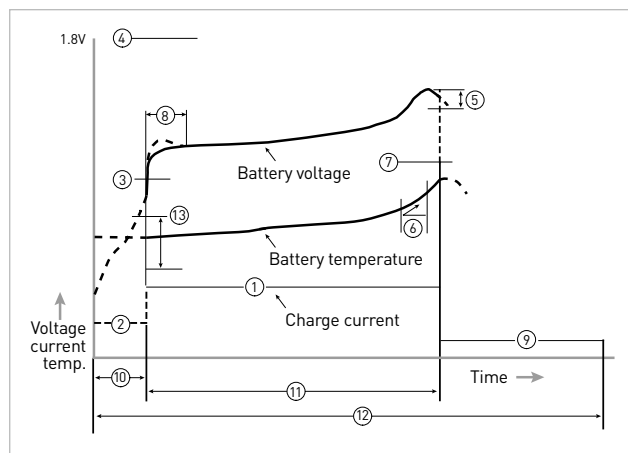
**Example of intermittent timer charger system:**

Average charge current: 0.1ItA

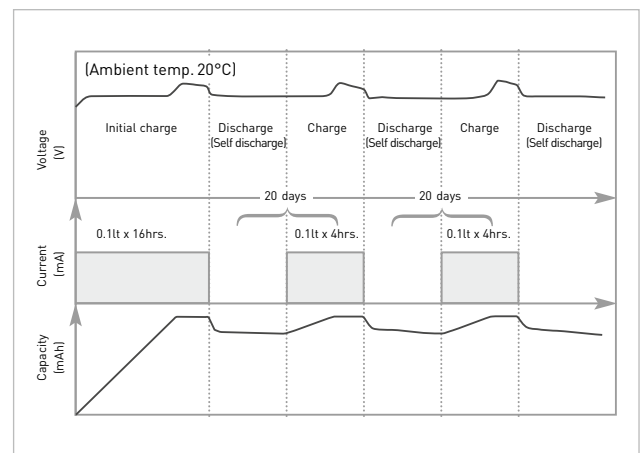
Re-charge time: 4 hours

Pulse charging can be used

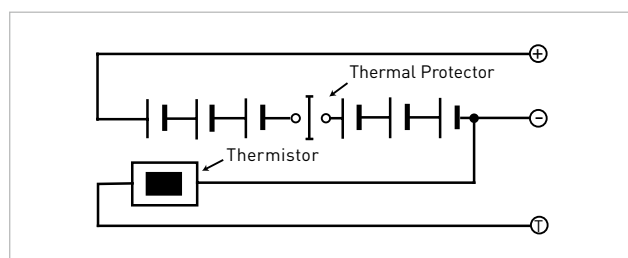
**Example of a rapid charge system**



**Intermittent charge**



**Basic pack configuration circuit**



\*1 Matching test is required because these values vary depending on rapid charge current, number of cells, configuration of battery pack, etc.

\*2 Trickle charge is not recommended in general for Ni-MH batteries. Please consult Panasonic on any Ni-MH applications requiring trickle charge.

# BATTERY SELECTION

## THE STEPS FOR SELECTING A TYPE OF BATTERY FOR USE AS THE POWER SUPPLY OF A DEVICE ARE SHOWN BELOW

### Study of the proposed required specifications

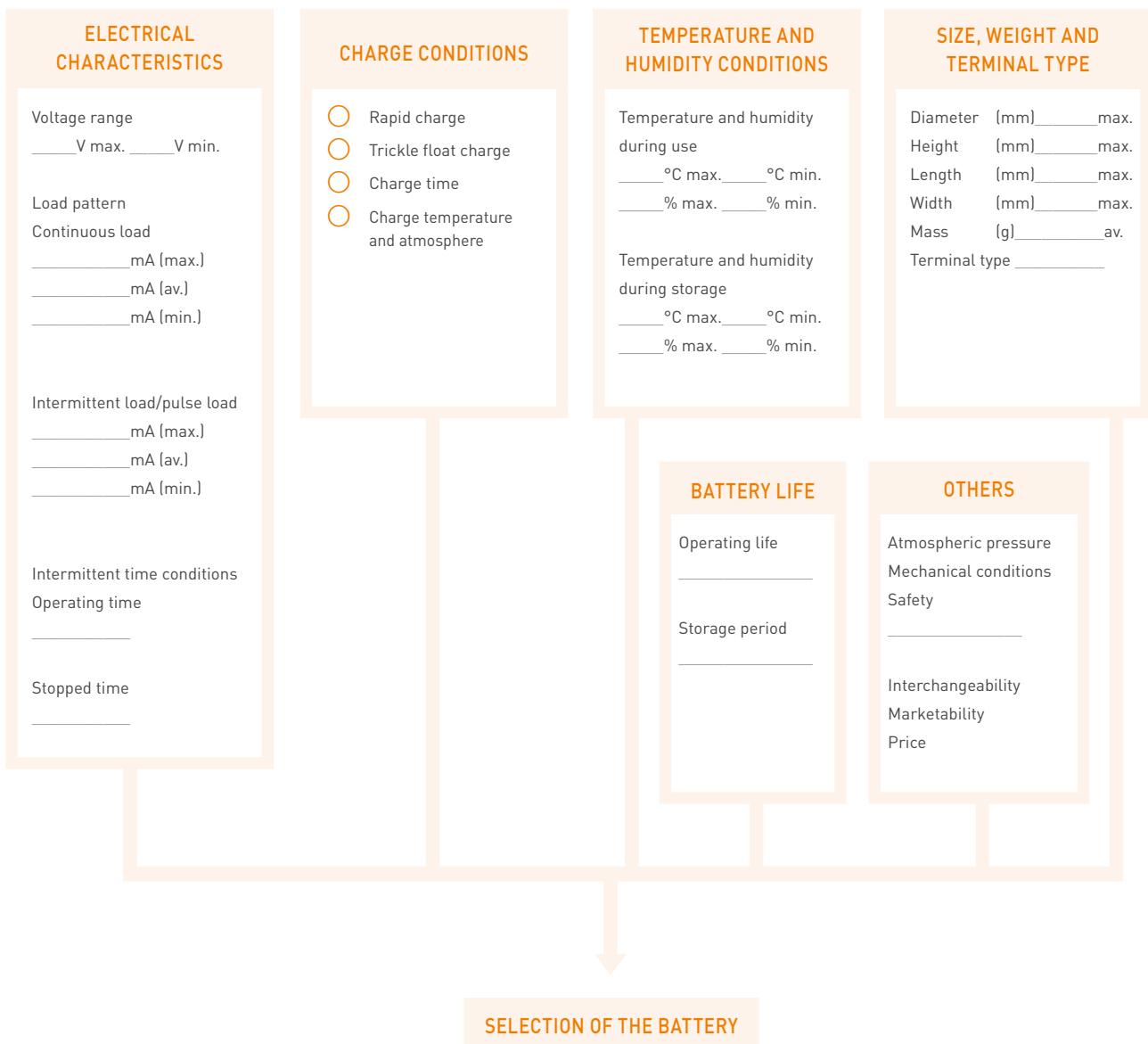
Verify the battery specifications required for the power supply of the device and use those conditions as the standards for battery selection. For reference, the technological factors concerning battery selection are shown below.

### Battery selection

Using the catalogs and data sheets for the batteries currently produced and marketed, narrow down the number of candidates to a few battery types. From those candidates,

select the one battery that most closely satisfies the ideal conditions required. In actual practice, the selection of a battery is rarely completed as easily as this. In most cases it is necessary to consider eliminating or relaxing some of the proposed specifications, and then select the most suitable battery from among those currently available to meet the adjusted conditions. This process makes it possible to select more economical batteries. If you have any doubts at this stage, consult closely with a battery engineer. In some cases, newly improved or newly developed batteries that are not yet listed in the catalog may be available. Normally the required specifications are also finalised at this stage.

## TECHNOLOGICAL FACTORS CONCERNING BATTERY SELECTION





## HIGH TEMPERATURE & LONG-LIFE TYPE

**H** TYPE

The expected life of these back-up batteries is about 6 to 10 years and therefore approximately twice the lifetime compared to standard Ni-MH batteries. In addition they are capable of delivering excellent charge characteristics at high temperature (60°C). Recommended applications are for example emergency light, vending machines and back-up for base station.

### FEATURES

- High charge efficiency at elevated temperatures
- Small size and light weight
- Long lifetime when using intermittent charge
- Most suitable for exchanging with Nickel-Cadmium batteries\*1
- Long-life and excellent charging performance at 75°C\*1

### APPLICATIONS

- Emergency call (E-Call)
- Medical equipment
- Emergency lighting
- Ticketing machine
- POS system
- Solar window shutter
- Shaver
- Guidance light\*2
- LED light\*2, etc.

### MODEL NUMBER (EXAMPLE)

**BK - 60 AAA H**

											High temperature & long-life type
											Diameter: AAA, AA, A, F
											Multiply this by 10 to obtain the rated capacity (some exceptions)
											Nickel-Metal Hydride battery

	Model number	Old model number	Diameter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
	<b>BK-60AAA H</b>	HHR-60AAA H	AAA	AAA	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	13	HR11/45	28
<b>NEW</b>	<b>BK-60AAA H*1</b>	-	AAA	AAA	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	12	HR11/45	29
	<b>BK-70AA H</b>	HHR-70AA H	AA	AA	1.2	700	750	14.5 +0/-0.7	49.0 +0/-1.5	18	HR15/49	30
	<b>BK-110AA H</b>	-	AA	AA	1.2	1,100	1,180	14.5 +0/-0.7	50.5 +0/-1.5	24	HR15/51	31
<b>NEW</b>	<b>BK-120AA H U</b>	-	AA	AA	1.2	1,200	1,280	14.5 +0/-0.7	50.5 +0/-1.5	24	HR15/51	32
	<b>BK-150AA H</b>	-	AA	AA	1.2	1,450	1,530	14.5 +0/-0.7	50.5 +0/-1.5	25	HR15/51	33
	<b>BK-160A H</b>	-	A	4/5A	1.2	1,600	1,720	17.0 +0/-0.7	43.0 +0/-1.5	29	HR17/43	34
	<b>BK-210A H</b>	HHR-210A H	A	A	1.2	1,900	2,050	17.0 +0/-0.7	50.0 +0/-2.0	36	HR17/50	35
	<b>BK-370A H</b>	HHR-370A H	A	LFat/A	1.2	3,500	3,700	18.2 +0/-0.7	67.5 +0/-1.5	60	-	36
<b>NEW</b>	<b>BK-1100F H U*1</b>	-	F	F	1.2	11,000	12,000	33.0 +0/-1.0	91.0 +0/-2.5	250	HR33/91	37



## HIGH RATE DISCHARGE & HIGH TEMPERATURE TYPE

**PH** TYPE

These state-of-the-art back-up batteries deliver excellent current discharge characteristics at high temperature (60°C). They are able to power applications such as back-up for UPS, POS systems and solar window shutter.

### FEATURES

- Excellent large current discharge characteristics at 60°C
- Small size and light weight
- Energy saving
- Making large discharging current possible, long-life and excellent charging performance at 75°C\*1

### APPLICATIONS

- Medical equipment
- Power tool
- Garden tool
- Robot cleaner
- Electric vehicle
- Motive power\*3
- Elevator\*3
- Emergency light\*3, etc.

\*1 New back-up type which can be operated at high ambient temperatures up to 75 °C. Not in mass production yet.

\*2 New back-up battery types BK-60AAA H U and BK-120AAA H U are particular designed to power this application.

\*3 New back-up battery types BK-220S CH U and BK-310C H U are particular designed to power this application.

MODEL NUMBER (EXAMPLE)

**B K - 3 3 0 A P H**

High rate discharge & high temperature type  
 Diameter: A, SC, C  
 Multiply this by 10 to obtain the rated capacity  
 (some exceptions)  
 Nickel-Metal Hydride battery

Model number	Old model number	Dia-meter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
<b>BK-330APH</b>	HHR-330APH	A	LFat/A	1.2	3,200	3,300	18.2 +0/-0.7	67.5 +0/-1.5	60	-	38
<b>NEW</b> BK-220SCHU*1	-	SC	SC	1.2	2,200	2,350	23.0 +0/-1.0	43.0 +0/-1.5	52	HR23/43	39
<b>BK-250SCH</b>	HHR-250SCH	SC	SC	1.2	2,500	2,650	23.0 +0/-1.0	43.0 +0/-1.5	55	HR23/43	40
<b>BK-310CH</b>	-	C	C	1.2	3,100	3,300	25.8 +0/-1.0	50.0 +0/-2.0	80	HR26/50	41
<b>NEW</b> BK-310CHU*1	-	C	C	1.2	3,100	3,300	25.8 +0/-1.0	50.0 +0/-2.0	80	HR26/50	42



BUTTON TOP TYPE

**B** TYPE

The Panasonic button type batteries are compatible with dry batteries such as Alkaline and can be used up to 1,800 times based on IEC\*2 standards. Besides they provide a high capacity level and a low self-discharge. Last but not least they can power applications which require superior low temperature characteristics.

FEATURES

- Offers long charge / discharge cycle life, about 1,800 times
- High capacity level and low self-discharge (still have 90% capacity after storage for 1 year)
- Offers excellent temperature characteristics especially in low temperature

APPLICATIONS

- Flash light
- Personal digital assistant
- Toothbrush
- Shaver
- Remote control, etc.

MODEL NUMBER (EXAMPLE)

**B K - 8 0 A A A B**

Cap shape: button top type  
 Diameter: AAA, AA  
 Multiply this by 10 to obtain the rated capacity  
 (some exceptions)  
 Nickel-Metal Hydride battery

Model number	Old model number	Dia-meter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
<b>BK-65AAAB*3</b>	-	AAA	AAA	1.2	650	700	10.5 +0/-0.7	44.5 +0/-1.0	12	HR11/45	43
<b>BK-80AAAB*3</b>	HHR-80AAAB	AAA	AAA	1.2	750	780	10.5 +0/-0.7	44.5 +0/-1.0	13	HR11/45	44
<b>BK-110AAB*4</b>	HHR-110AAB	AA	AA	1.2	1,000	1,050	14.5 +0/-0.7	50.5 +0/-1.0	20	HR15/51	45
<b>BK-200AAB*4</b>	-	AA	AA	1.2	1,900	2,000	14.5 +0/-0.7	50.5 +0/-1.0	29	HR15/51	46

\*1 New back-up type which can be operated at high ambient temperatures up to 75 °C. The mass production of one battery type has already started. The production of the other batteries will follow.

\*2 IEC: standard 61951-2 (2017) / 7.5.1.2 \*3 Compatible with consumer AAA size. \*4 Compatible with consumer AA size.





**MODEL NUMBER (EXAMPLE)**

**B K - 3 0 0 S C P**

High rate discharge & rapid charge type  
 Diameter: SC  
 Multiply this by 10 to obtain the rated capacity  
 (some exceptions)  
 Nickel-Metal Hydride battery

Model number	Old model number	Dia-meter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
BK-200SCP*1	HHR-200SCP	SC	4/5SC	1.2	1,900	2,100	23.0 +0/-1.0	34.0 +0/-1.5	42	HR23/34	59
BK-260SCP*1	HHR-260SCP	SC	SC	1.2	2,450	2,700	23.0 +0/-1.0	43.0 +0/-1.5	55	HR23/43	60
BK-300SCP*1	HHR-300SCP	SC	SC	1.2	2,800	3,050	23.0 +0/-1.0	43.0 +0/-1.5	57	HR23/43	61



**LOW TEMPERATURE TYPE**



This Panasonic battery type is especially designed for low temperature discharge down to -30°C. Thus these batteries are ideal to power two way radios and other outdoor applications.

**FEATURES**

- Designed for applications which require low temperature discharge down to -30°C

**APPLICATIONS**

- Two way radio
- Construction sites signaling
- UPS, etc.

**MODEL NUMBER (EXAMPLE)**

**B K - 2 5 0 A**

Diameter: A  
 Multiply this by 10 to obtain the rated capacity  
 (some exceptions)  
 Nickel-Metal Hydride battery

Model number	Old model number	Dia-meter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
BK-250A	-	A	A	1.2	2,450	2,600	17.0 +0/-0.7	50.0 +0/-2.0	40	HR17/50	62



**WIDE TEMPERATURE TYPE**



This new Panasonic Ni-MH battery series is particularly designed for e-call systems and outdoor applications such as garden tools. The long life reliability and the high discharge capability make these batteries ideal for these demanding applications. On the top our new batteries are eco-friendly designed and non-flammable.

**FEATURES**

- High discharge performance
- Wide operating temperature range: -30°C ~ +85°C
- Especially designed for high safeness
- Long life reliability: 6 ~ 8 years at 40°C

**APPLICATIONS**

- E-call
- Garden tools
- Data logger etc,

\*1 For high power use application such as power tools.

MODEL NUMBER (EXAMPLE)

**B K - 6 0 A A A W**

				Wide temperature type
				Diameter: AAA, AA
				Multiply this by 10 to obtain the rated capacity (some exceptions)
				Nickel-Metal Hydride battery

	Model number	Old model number	Dia-meter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
<b>NEW</b>	<b>BK-60AAAW</b>	-	AAA	AAA	1.2	500	550	10.5 +0/-0.7	44.5 +0/-1.5	13	HR11/45	63
<b>NEW</b>	<b>BK-120AAW</b>	-	AA	AA	1.2	1,200	1,280	14.5 +0/-0.7	50.5 +0/-1.5	26	HR15/51	64



INFRASTRUCTURE TYPE

These battery types offer high capacity on the one hand and an outstanding efficiency even at low temperature environments on the other. They are particular designed for power storage and auto-mated guided vehicles (AGV).

FEATURES

- Realisation of lightweight and space-saving
- Alternative compared to VRLA batteries
- By using Nickel-Metal Hydride battery, power supply provides high efficiency even at a low temperature

APPLICATIONS

- UPS
- Green energy
- Solar window shutter
- Wind turbine
- Energy storage
- Floating machine, etc.

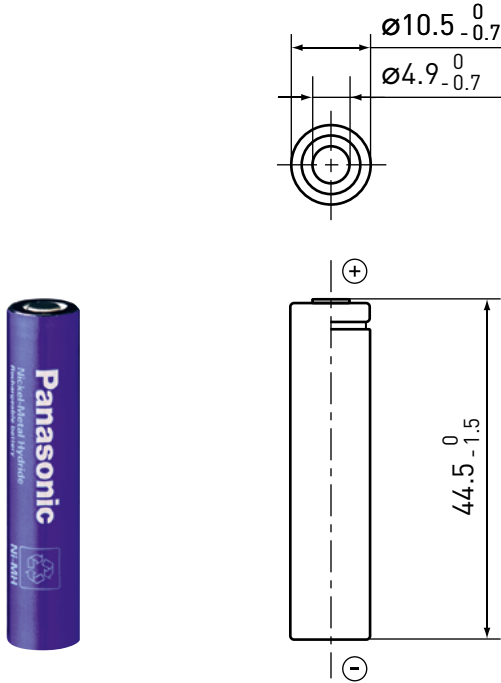
	Model number	Old model number	Dia-meter	Size	Nominal voltage (V)	Nominal capacity (mAh)	Typical capacity (mAh)	Diameter (mm)	Total height (mm)	Weight (g)	IEC	Page
<b>NEW</b>	<b>BK-06V1S1</b>	-	V	V	1.2	60,000	65,000	62.6 +1.0/-1.0	136.9 +1.0/-1.0	1,100	-	65
	<b>BK-10V1S</b>	-	V	V	1.2	90,000	95,000	62.6 +1.0/-1.0	188.7 +1.0/-1.0	1,700	-	66
<b>NEW</b>	<b>BK-06V10T1</b>	-	Pack	Pack	12.0	60,000	63,000	428.0 x 159.0	220.0	19,000	-	67
	<b>BK-10V10T</b>	HHR-10V10T	Pack	Pack	12.0	90,000	95,000	428.0 x 159.0	270.0	23,000	-	68

**BK-60AAAH**  
HHR-60AAAH (OLD)

HIGH TEMPERATURE & LONG LIFE TYPE  
AAA SIZE (HR11/45)

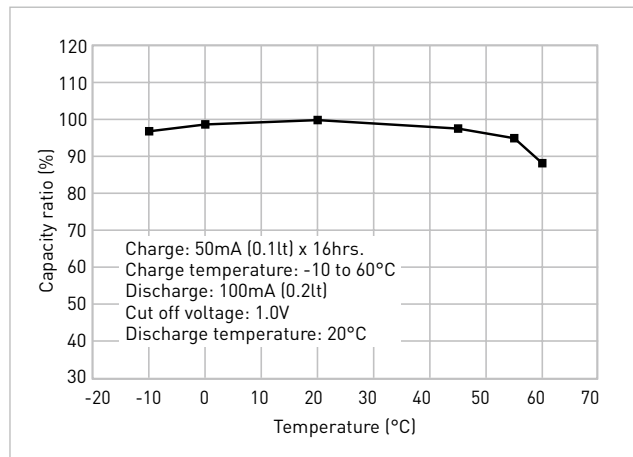
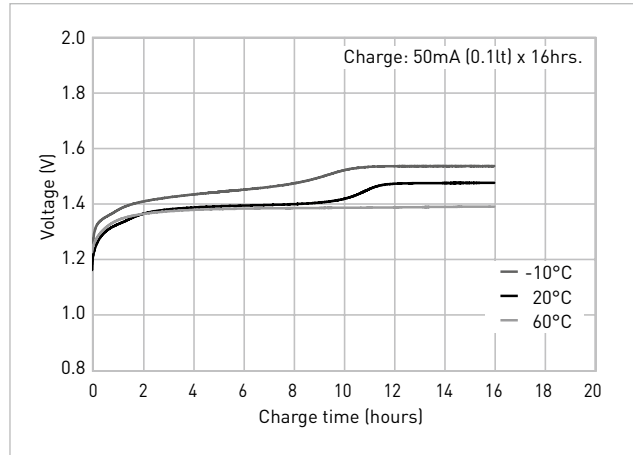


DIMENSIONS (MM)

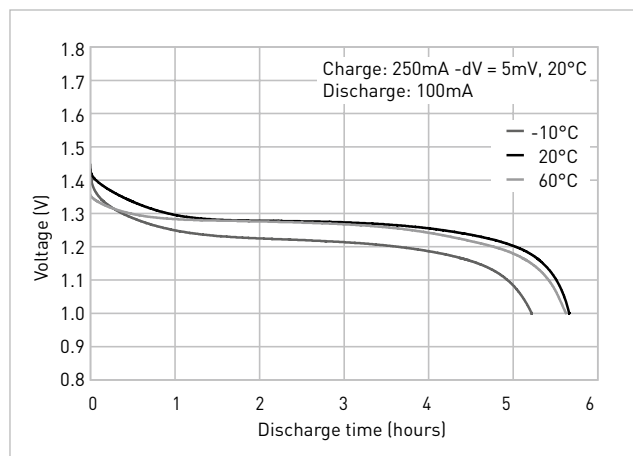


Specifications		BK-60AAAH
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.5
Approximate weight (g)		13
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	550
	Nominal capacity*3 (mAh)	500
Approx. internal impedance at 1,000Hz at charged state (mΩ)		35
Charge	Standard (mA x hrs.)	50 x 16
	Rapid*4 (mA x hrs.)	250 x 2.4
	Low rate (mA x hrs.)	25 x 32
Charge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Discharge (°C)		-10 to 60
Ambient temperature	Storage (°C)	<1 year: -20 to 35
		<6 months: -20 to 45
		<1 month: -20 to 55
		<1 week: -20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.

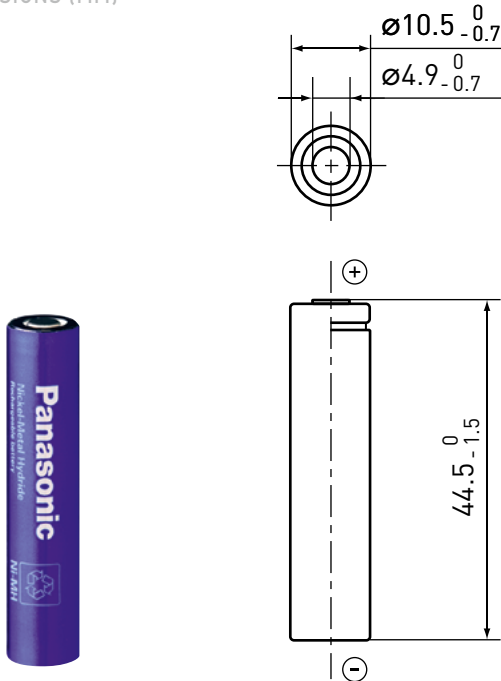
Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

**NEW** BK-60AAAHU

HIGH TEMPERATURE & LONG LIFE TYPE  
AAA SIZE (HR11/45)

**H** TYPE

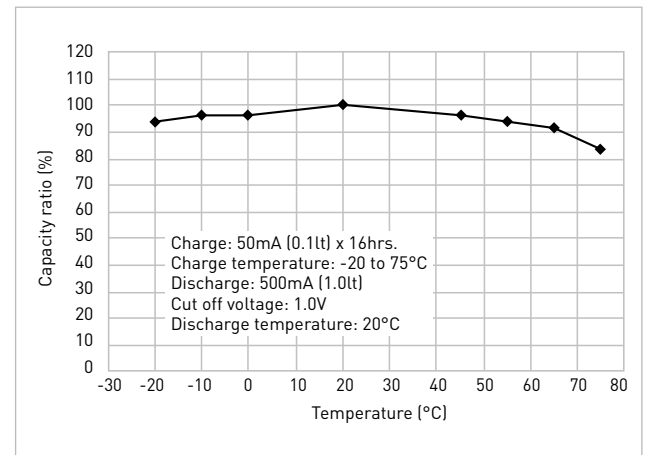
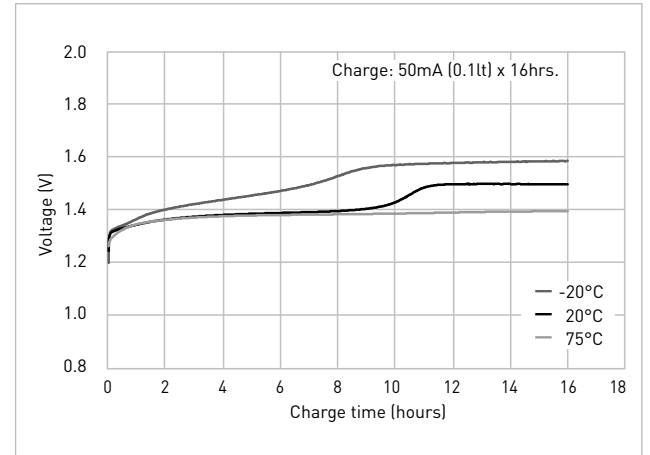
DIMENSIONS (MM)



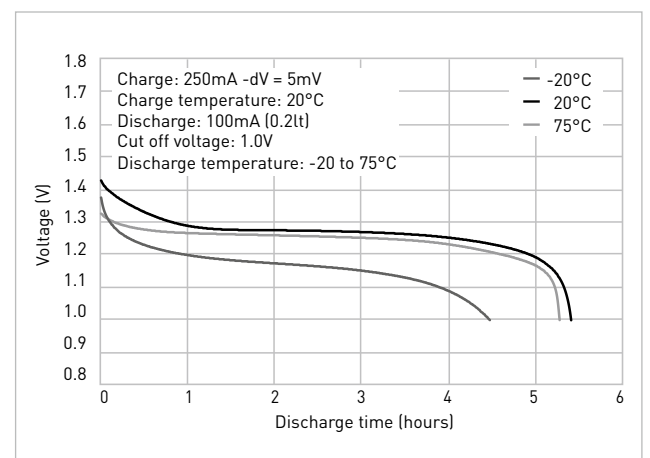
Specifications		BK-60AAAHU
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.5
Approximate weight (g)		12
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	550
	Nominal capacity*3 (mAh)	500
Approx. internal impedance at 1,000Hz at charged state (mΩ)		35
Charge	Standard (mA x hrs.)	50 x 16
	Rapid*4 (mA x hrs.)	250 x 2.4
	Low rate (mA x hrs.)	25 x 32
Charge (°C)	Low rate	-20 to 75
	Standard	-20 to 60
	Rapid	-20 to 75
Discharge (°C)	Low rate	-20 to 75
	Standard	-20 to 75
	Rapid	-20 to 75
Storage (°C)	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



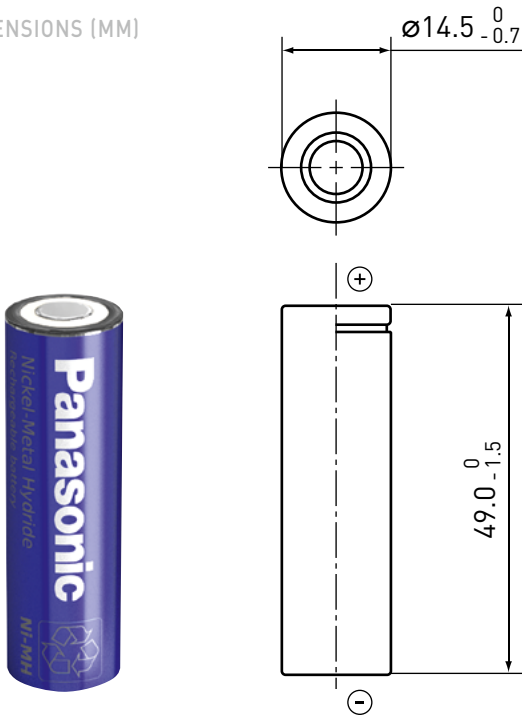
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**BK-70AAH**  
HHR-70AAH (OLD)

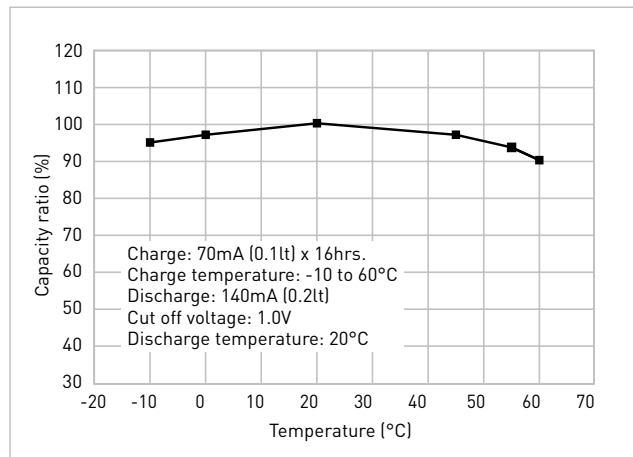
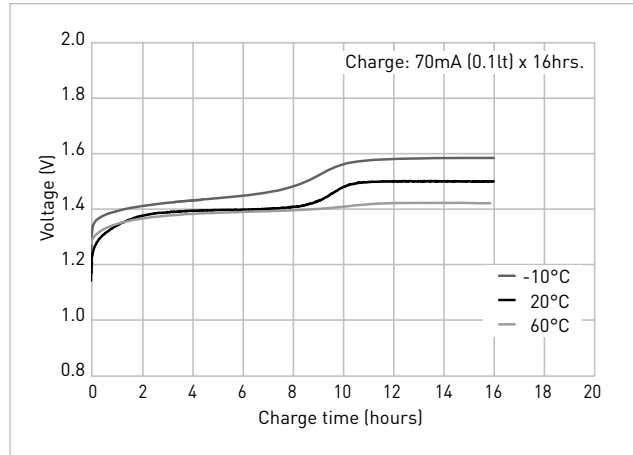
HIGH TEMPERATURE & LONG LIFE TYPE  
AA SIZE (HR15/49)



DIMENSIONS (MM)

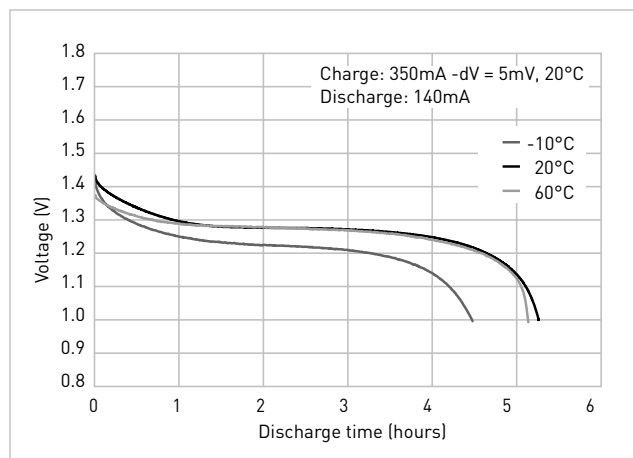


TYPICAL CHARGE CHARACTERISTICS



Specifications		BK-70AAH
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		49.0 +0/-1.5
Approximate weight (g)		18
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	750
	Nominal capacity*3 (mAh)	700
Approx. internal impedance at 1,000Hz at charged state (mΩ)		25
Charge	Standard (mA x hrs.)	70 x 16
	Rapid*4 (mA x hrs.)	350 x 2.4
	Low rate (mA x hrs.)	35 x 32
Charge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Discharge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Ambient temperature	Storage (°C)	<1 year: -20 to 35 <6 months: -20 to 45 <1 month: -20 to 55 <1 week: -20 to 65

TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.

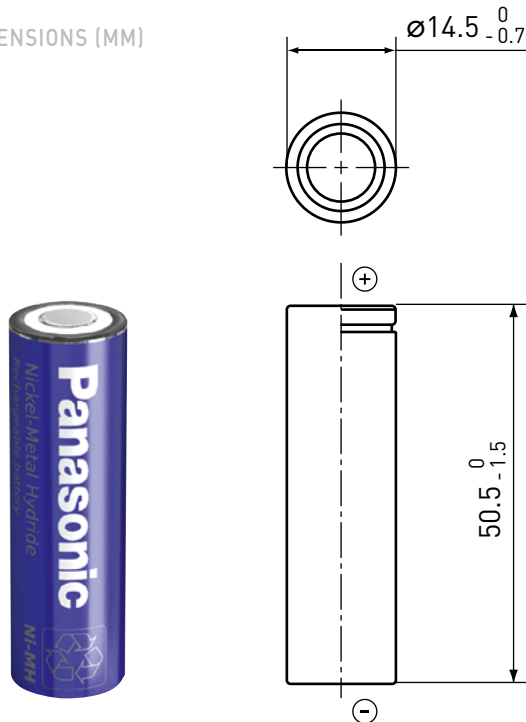
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# BK-110AAH

HIGH TEMPERATURE & LONG LIFE TYPE  
AA SIZE (HR15/51)

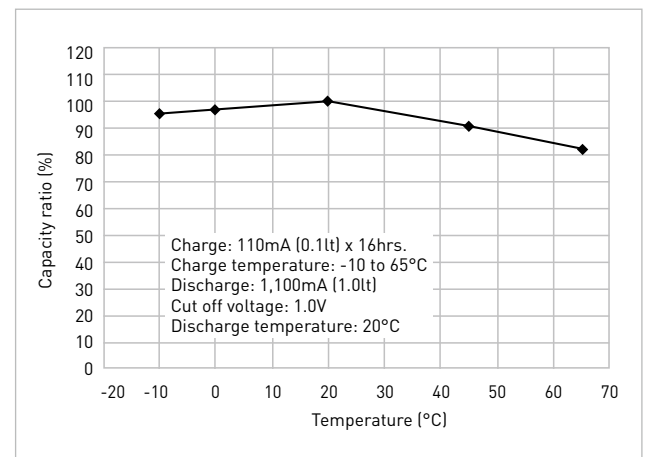
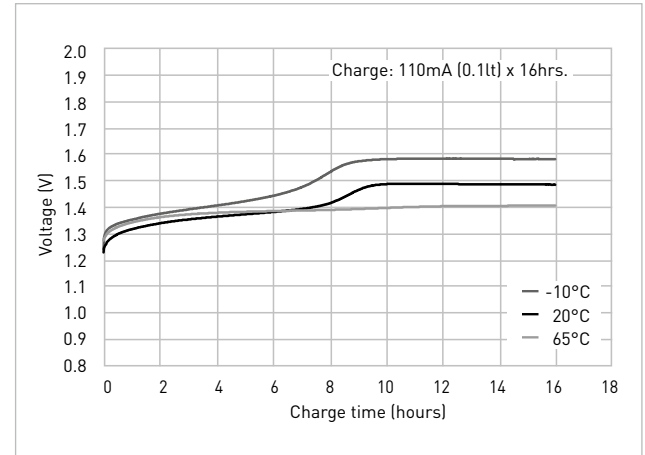


DIMENSIONS (MM)

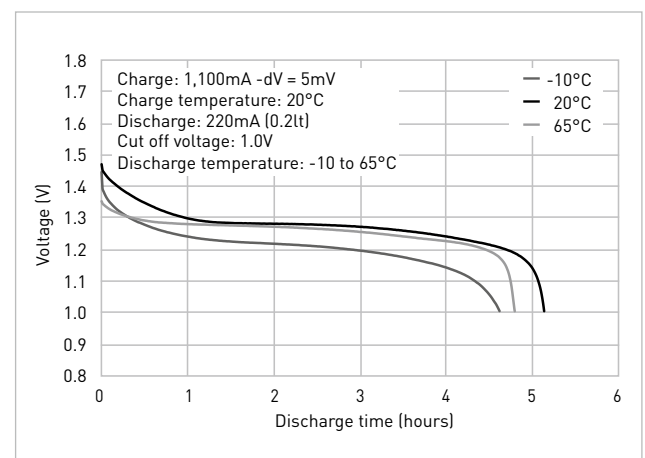


Specifications		BK-110AAH	
Diameter (mm)		14.5 +0/-0.7	
Total height (mm)		50.5 +0/-1.5	
Approximate weight (g)		24	
Nominal voltage (V)		1.2	
Discharge capacity*1	Typical capacity*2 (mAh)	1,180	
	Nominal capacity*3 (mAh)	1,100	
Approx. internal impedance at 1,000Hz at charged state (mΩ)		17	
Charge	Standard (mA x hrs.)	110 x 16	
	Rapid*4 (mA x hrs.)	1,100 x 2.4	
	Low rate (mA x hrs.)	55 x 32	
Ambient temperature	Charge (°C)	-10 to 60	
	Discharge (°C)	Standard	-10 to 45
		Rapid	-10 to 60
Storage (°C)	<1 year	-20 to 35	
	<6 months	-20 to 45	
	<1 month	-20 to 55	
	<1 week	-20 to 65	

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

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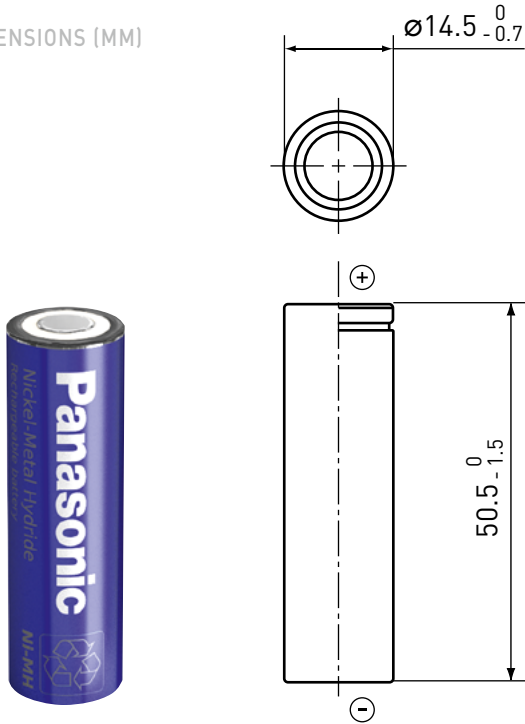


**NEW** BK-120AAHU

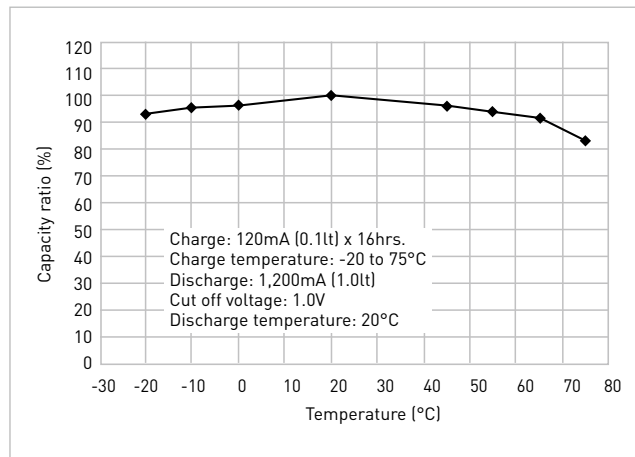
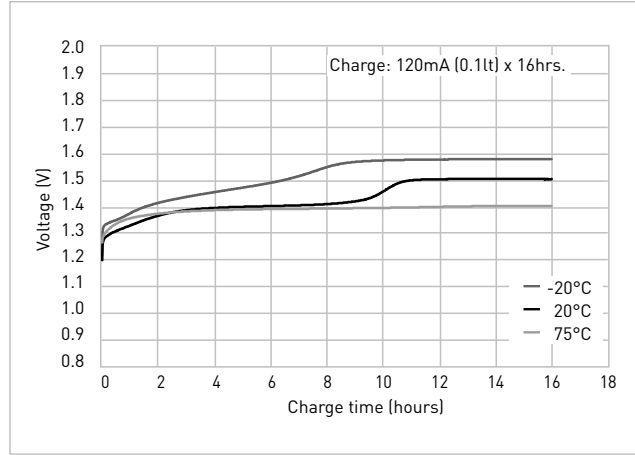
HIGH TEMPERATURE & LONG LIFE TYPE  
AA SIZE (HR15/51)

**H** TYPE

DIMENSIONS (MM)

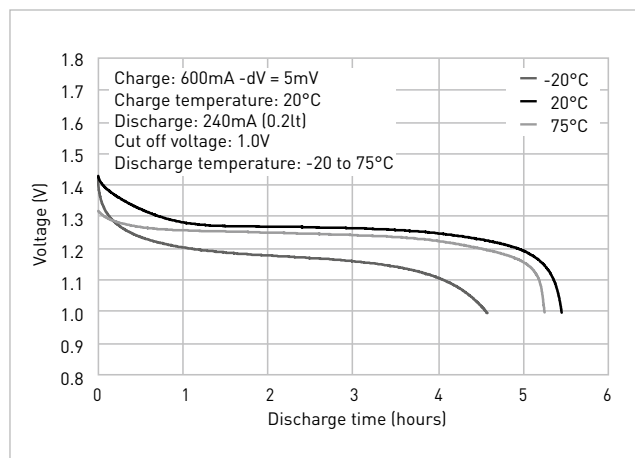


TYPICAL CHARGE CHARACTERISTICS



Specifications		BK-120AAHU
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.5
Approximate weight (g)		24
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,280
	Nominal capacity*3 (mAh)	1,200
Approx. internal impedance at 1,000Hz at charged state (mΩ)		17
Charge	Standard (mA x hrs.)	120 x 16
	Rapid*4 (mA x hrs.)	600 x 2.4
	Low rate (mA x hrs.)	60 x 32
Ambient temperature	Low rate	40 x 48
	Charge (°C)	-20 to 75
	Standard	-20 to 75
Rapid	Discharge (°C)	-20 to 60
	Low rate	-20 to 75
	Standard	-20 to 75
Storage (°C)	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.

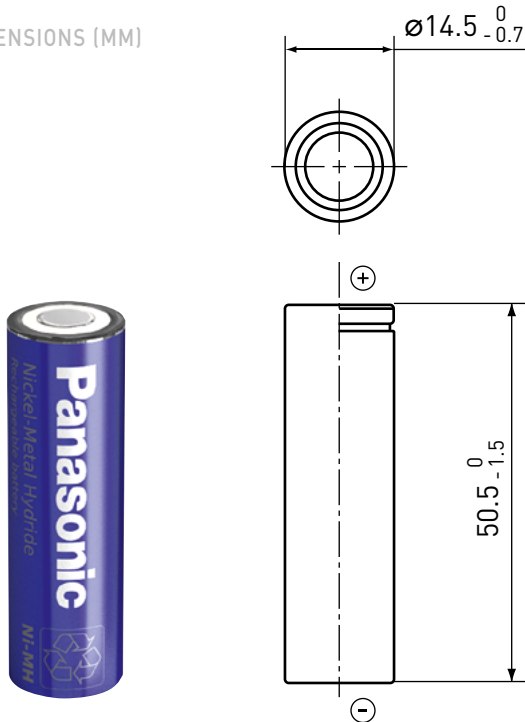
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# BK-150AAH

HIGH TEMPERATURE & LONG LIFE TYPE  
AA SIZE (HR15/51)

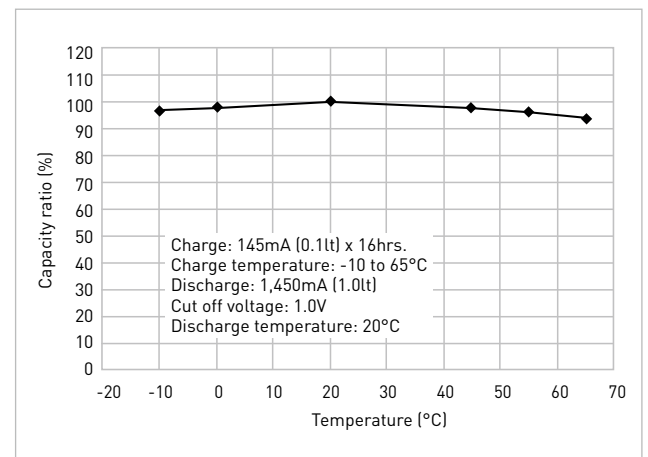
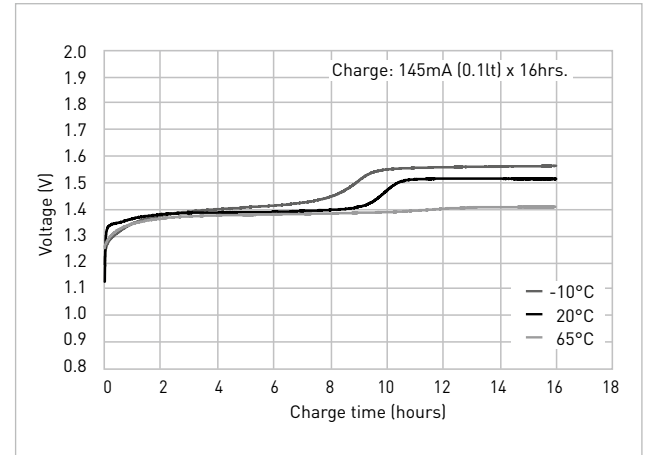


DIMENSIONS (MM)

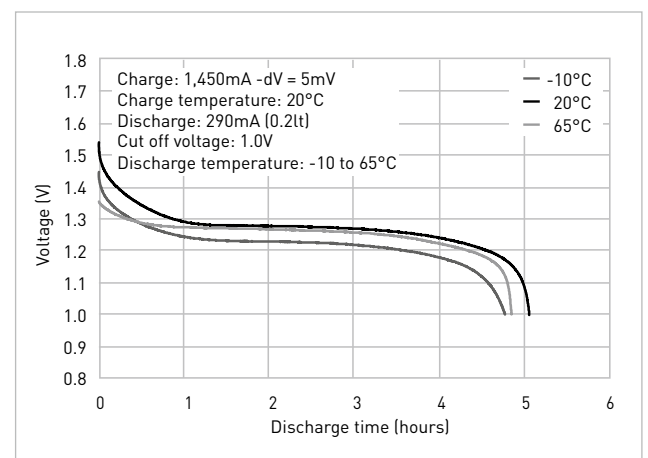


Specifications		BK-150AAH	
Diameter (mm)		14.5 +0/-0.7	
Total height (mm)		50.5 +0/-1.5	
Approximate weight (g)		25	
Nominal voltage (V)		1.2	
Discharge capacity*1	Typical capacity*2 (mAh)	1,530	
	Nominal capacity*3 (mAh)	1,450	
Approx. internal impedance at 1,000Hz at charged state (mΩ)		17	
Charge	Standard (mA x hrs.)	145 x 16	
	Rapid*4 (mA x hrs.)	1,450 x 1.2	
	Low rate (mA x hrs.)	73 x 32	
Ambient temperature	Charge (°C)	-10 to 60	
	Discharge (°C)	Standard	-10 to 45
		Rapid	-10 to 60
Storage (°C)	<1 year	-20 to 35	
	<6 months	-20 to 45	
	<1 month	-20 to 55	
	<1 week	-20 to 65	

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

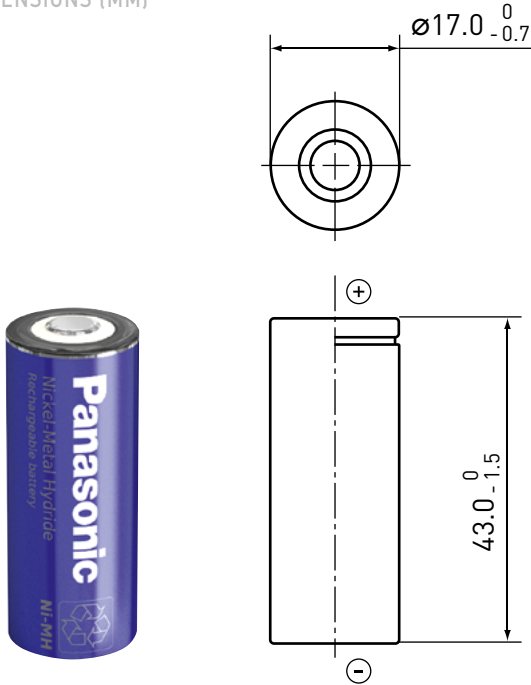
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# BK-160AH

HIGH TEMPERATURE & LONG LIFE TYPE  
4/5A SIZE (HR17/43)

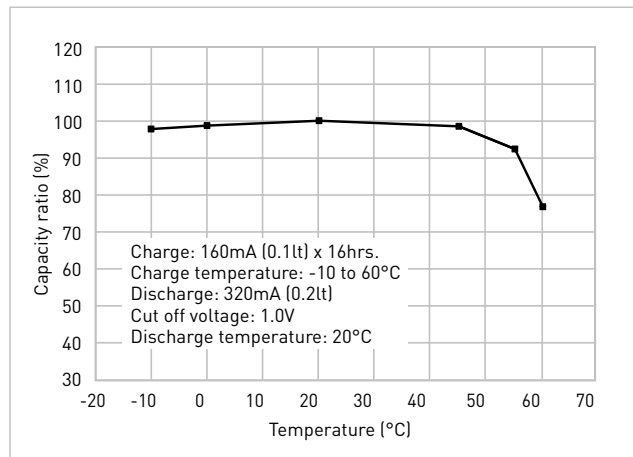
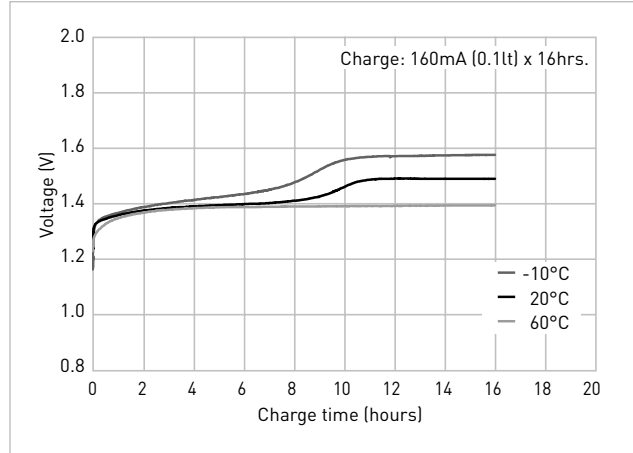


DIMENSIONS (MM)

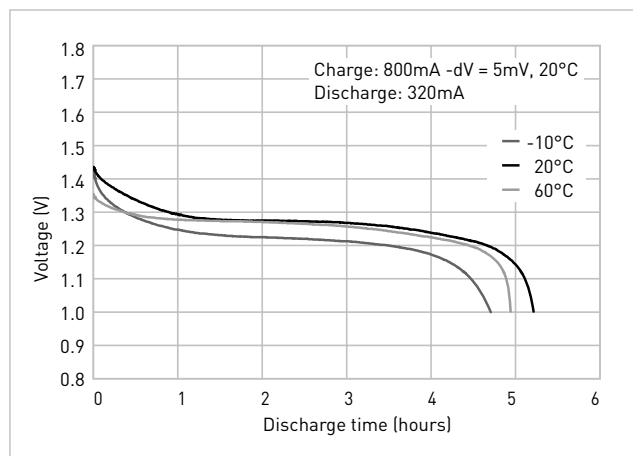


Specifications		BK-160AH
Diameter (mm)		17.0 +0/-0.7
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		29
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,720
	Nominal capacity*3 (mAh)	1,600
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	160 x 16
	Rapid*4 (mA x hrs.)	800 x 2.4
	Low rate (mA x hrs.)	80 x 32
Charge (°C)	Standard	53 x 48
	Rapid	-10 to 60
	Low rate	-10 to 45
Discharge (°C)		-10 to 60
Ambient temperature	Storage (°C)	<1 year: -20 to 35
		<6 months: -20 to 45
		<1 month: -20 to 55
		<1 week: -20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

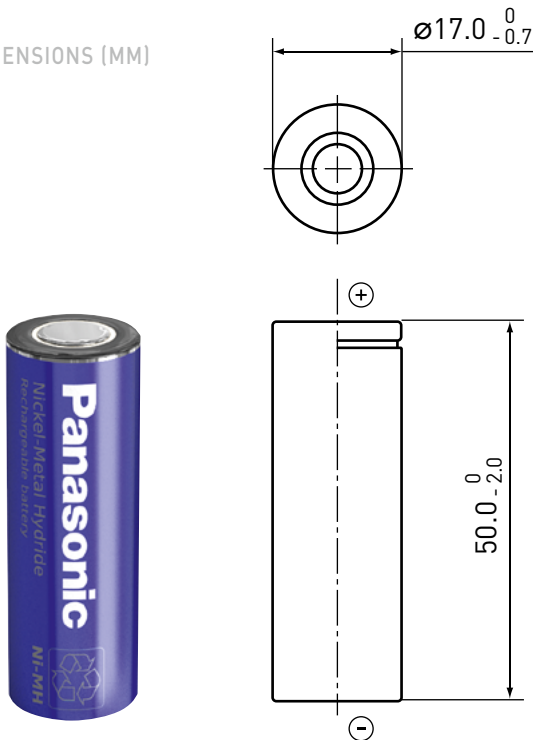
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**BK-210AH**  
HHR-210AH (OLD)

HIGH TEMPERATURE & LONG LIFE TYPE  
A SIZE (HR17/50)

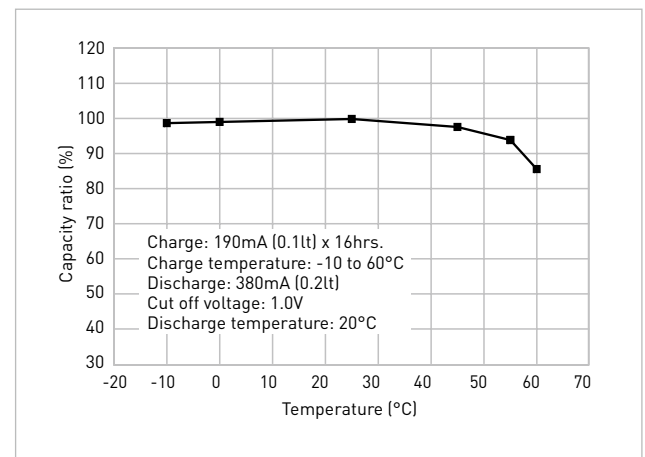
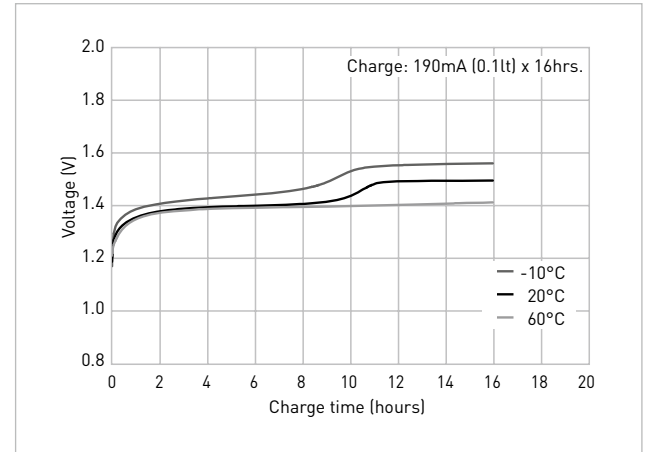


DIMENSIONS (MM)

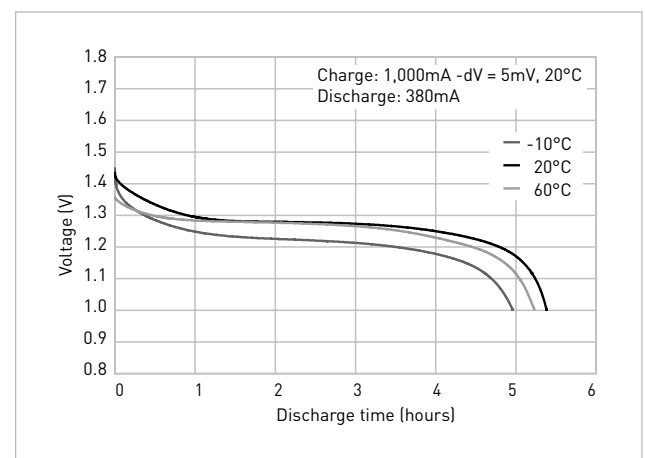


Specifications		BK-210AH	
Diameter (mm)		17.0 +0/-0.7	
Total height (mm)		50.0 +0/-2.0	
Approximate weight (g)		36	
Nominal voltage (V)		1.2	
Discharge capacity*1	Typical capacity*2 (mAh)	2,050	
	Nominal capacity*3 (mAh)	1,900	
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20	
Charge	Standard (mA x hrs.)	190 x 16	
	Rapid*4 (mA x hrs.)	1,000 x 2.3	
	Low rate (mA x hrs.)	105 x 32	
Ambient temperature	Charge (°C)	-10 to 60	
	Discharge (°C)	Standard	-10 to 60
		Rapid	-10 to 45
Storage (°C)	<1 year	-20 to 35	
	<6 months	-20 to 45	
	<1 month	-20 to 55	
	<1 week	-20 to 65	

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

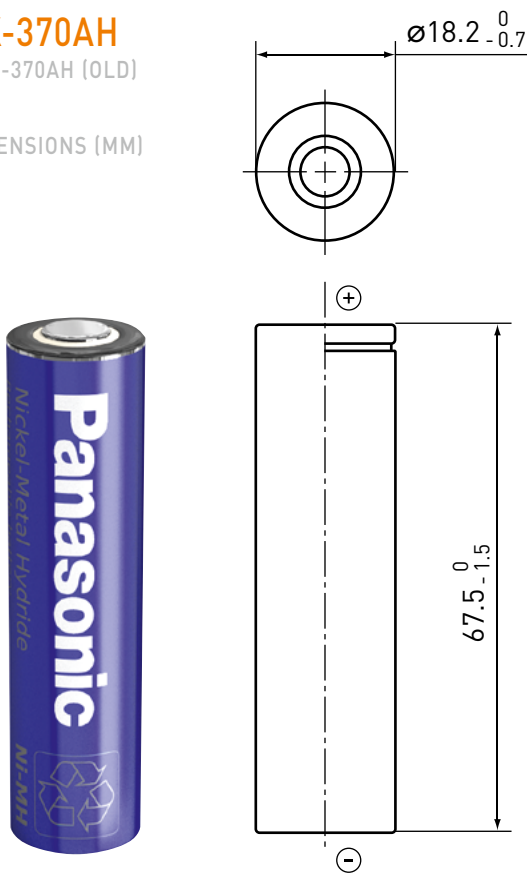


\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.

Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

**BK-370AH**  
HHR-370AH (OLD)

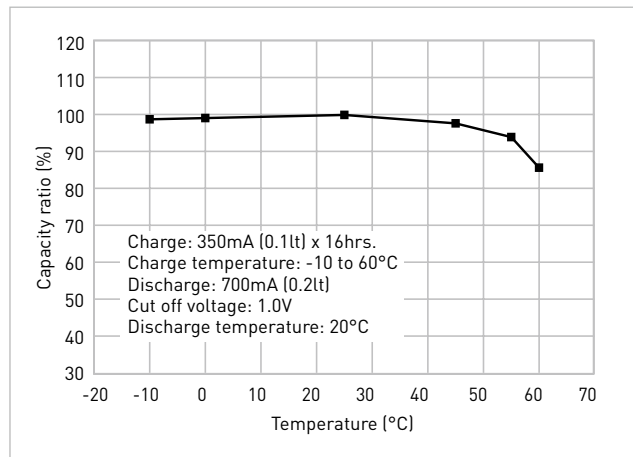
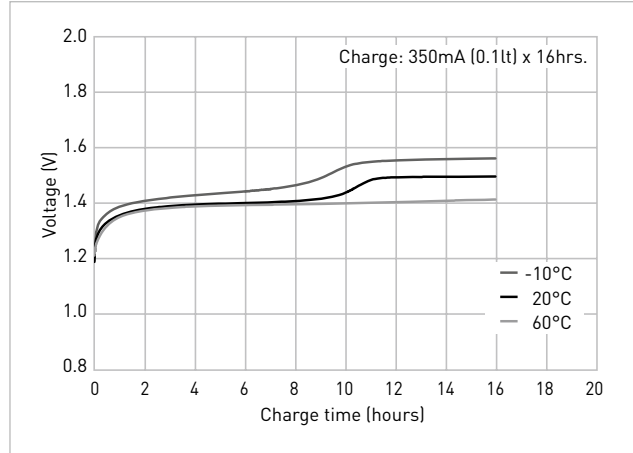
DIMENSIONS (MM)



HIGH TEMPERATURE & LONG LIFE TYPE  
LFAT/A SIZE

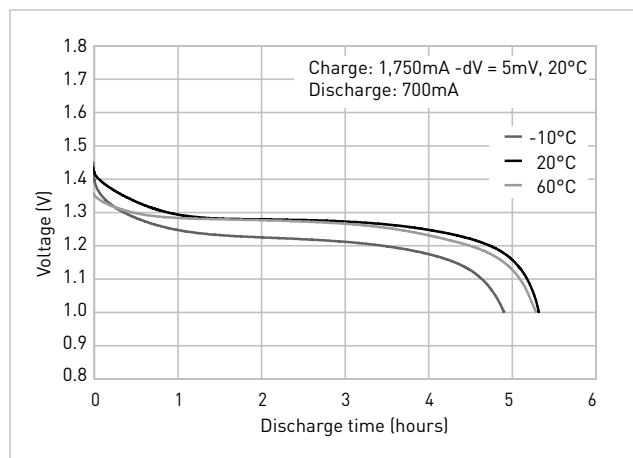


TYPICAL CHARGE CHARACTERISTICS



Specifications		BK-370AH
Diameter (mm)		18.2 +0/-0.7
Total height (mm)		67.5 +0/-1.5
Approximate weight (g)		60
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	3,700
	Nominal capacity*3 (mAh)	3,500
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	350 x 16
	Rapid*4 (mA x hrs.)	3,000 x 1.4
	Low rate (mA x hrs.)	185 x 32
Charge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Discharge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Storage (°C)	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL DISCHARGE CHARACTERISTICS

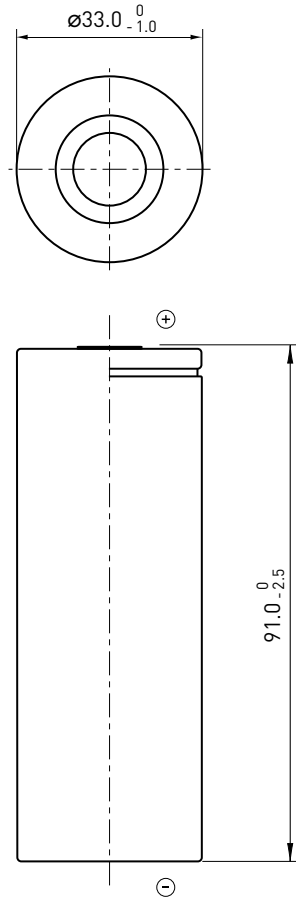


\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

**NEW BK-1100FHU**

DIMENSIONS (MM)



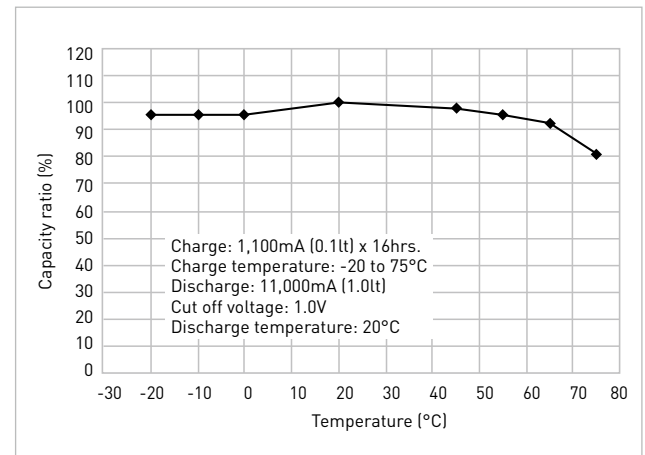
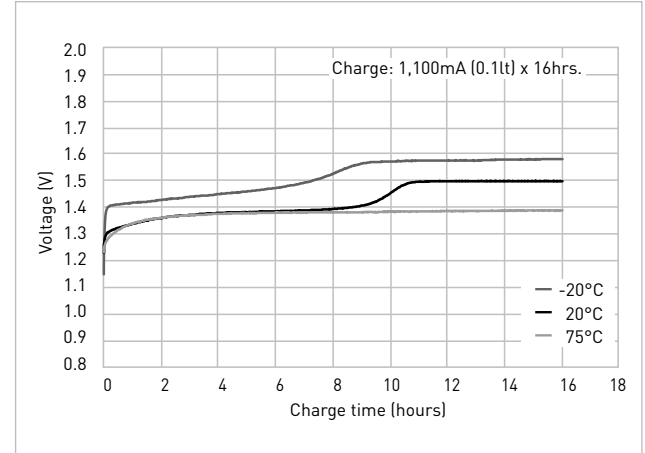
Specifications		BK-1100FHU	
Diameter (mm)		33.0 +0/-1.0	
Total height (mm)		91.0 +0/-2.5	
Approximate weight (g)		250	
Nominal voltage (V)		1.2	
Discharge capacity*1	Typical capacity*2 (mAh)	12,000	
	Nominal capacity*3 (mAh)	11,000	
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5	
Charge	Standard (mA x hrs.)	1,100 x 16	
	Rapid*4 (mA x hrs.)	5,500 x 2.4	
	Low rate (mA x hrs.)		550 x 32
			367 x 48
Ambient temperature	Charge (°C)	Low rate	-30 to 75
		Standard	-30 to 75
	Discharge (°C)	Rapid	-30 to 60
			-40 to 85
Storage (°C)	<1 year	-20 to 35	
	<6 months	-20 to 45	
	<1 month	-20 to 55	
	<1 week	-20 to 65	

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

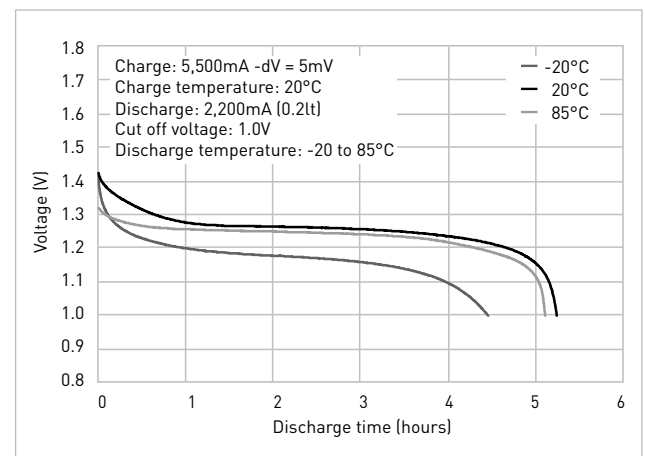
HIGH TEMPERATURE & LONG LIFE TYPE  
F SIZE

**H** TYPE

TYPICAL CHARGE CHARACTERISTICS



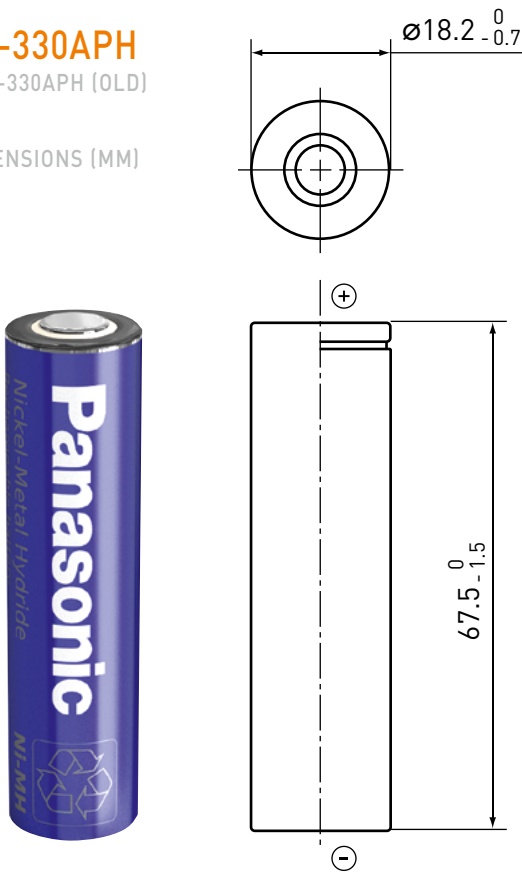
TYPICAL DISCHARGE CHARACTERISTICS



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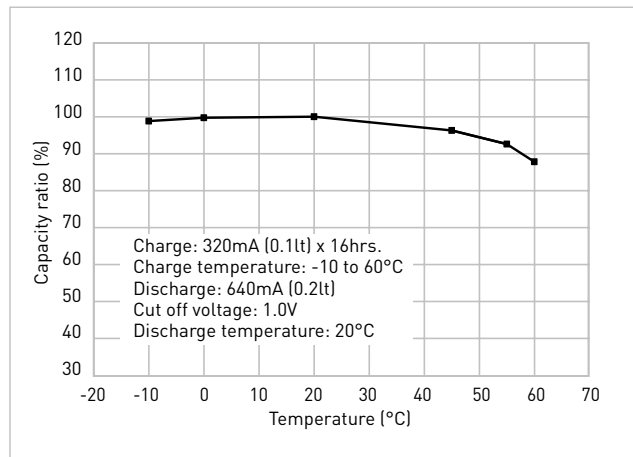
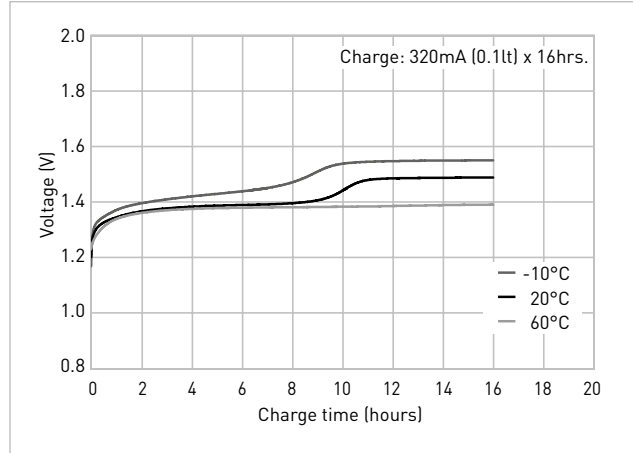
**BK-330APH**  
HHR-330APH (OLD)

DIMENSIONS (MM)



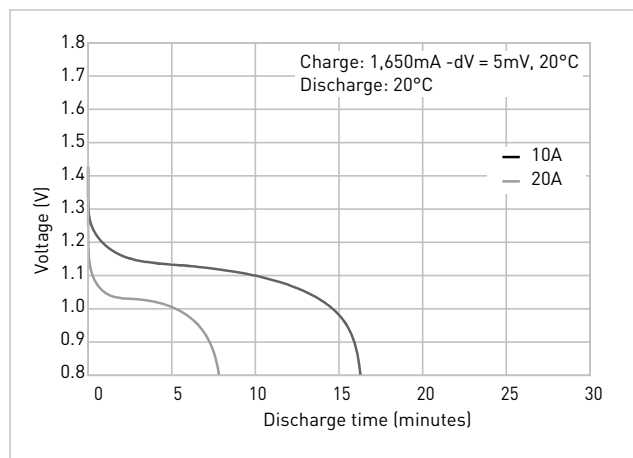
HIGH RATE DISCHARGE & HIGH TEMPERATURE TYPE **PH** TYPE  
LFAT/A SIZE

**TYPICAL CHARGE CHARACTERISTICS**



Specifications		BK-330APH
Diameter (mm)		18.2 +0/-0.7
Total height (mm)		67.5 +0/-1.5
Approximate weight (g)		60
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	3,300
	Nominal capacity*3 (mAh)	3,200
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5.5
Charge	Standard (mA x hrs.)	320 x 16
	Rapid*4 (mA x hrs.)	1,650 x 2.4
	Low rate (mA x hrs.)	165 x 32
Charge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Discharge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Storage (°C)	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

**TYPICAL DISCHARGE CHARACTERISTICS**



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.

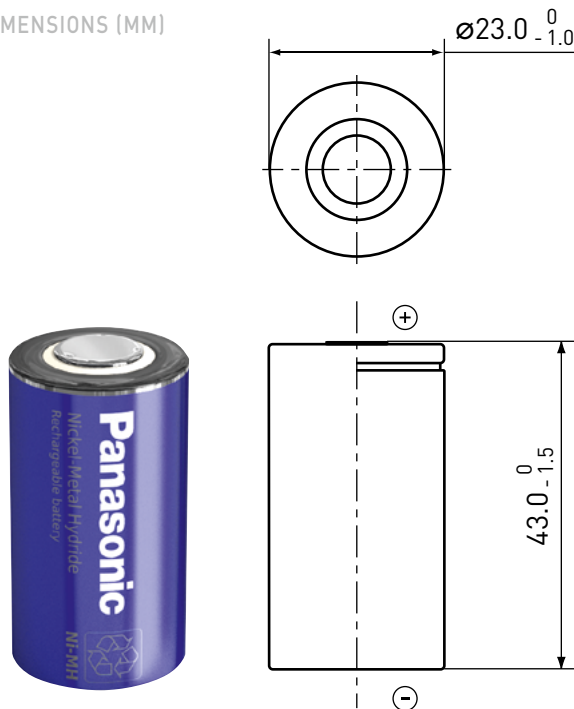
Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.



**NEW** BK-220SCHU

HIGH RATE DISCHARGE & HIGH TEMPERATURE TYPE **PH** TYPE  
SC SIZE (HR23/43)

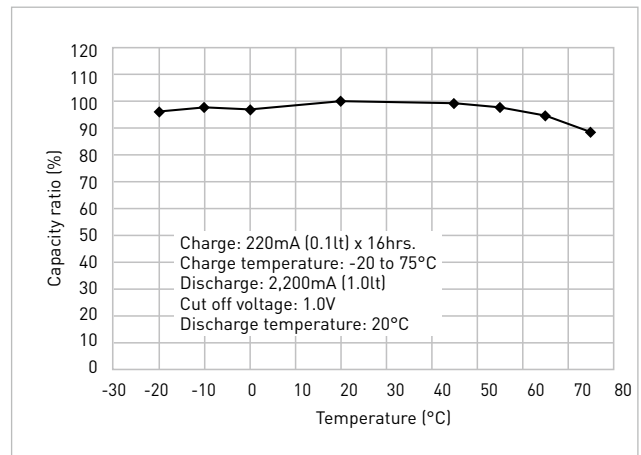
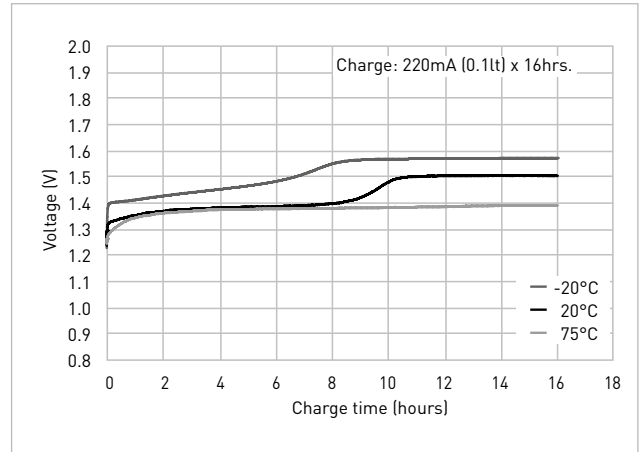
DIMENSIONS (MM)



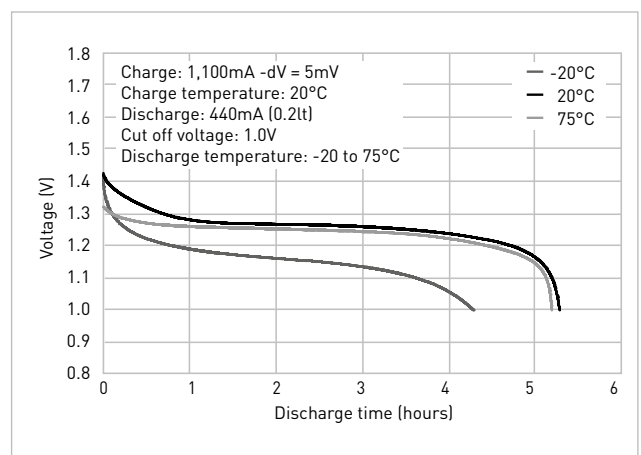
Specifications		BK-220SCHU
Diameter (mm)		23.0 +0/-1.0
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		52
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,350
	Nominal capacity*3 (mAh)	2,200
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5
Charge	Standard (mA x hrs.)	220 x 16
	Rapid*4 (mA x hrs.)	1,100 x 2.4
	Low rate (mA x hrs.)	110 x 32
Charge (°C)	Low rate	-20 to 75
	Standard	-20 to 75
	Rapid	-20 to 60
Discharge (°C)		-20 to 75
Ambient temperature	Storage (°C)	<1 year -20 to 35 <6 months -20 to 45 <1 month -20 to 55 <1 week -20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

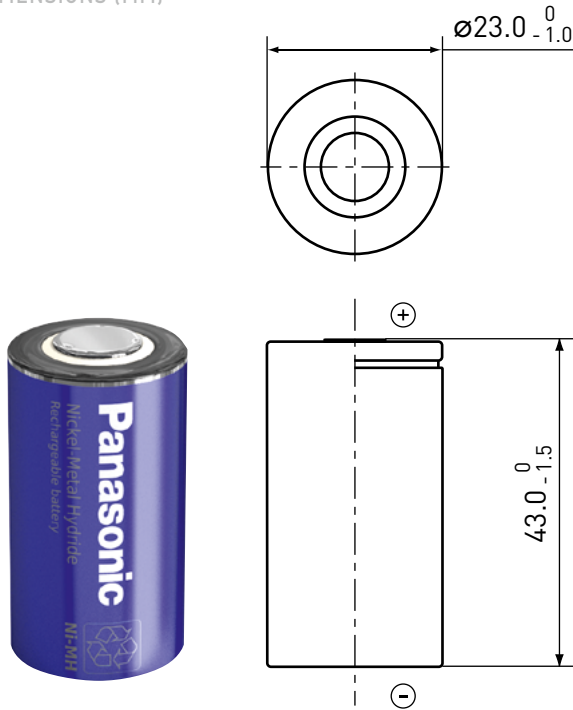


Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

**BK-250SCH**  
HHR-250SCH (OLD)

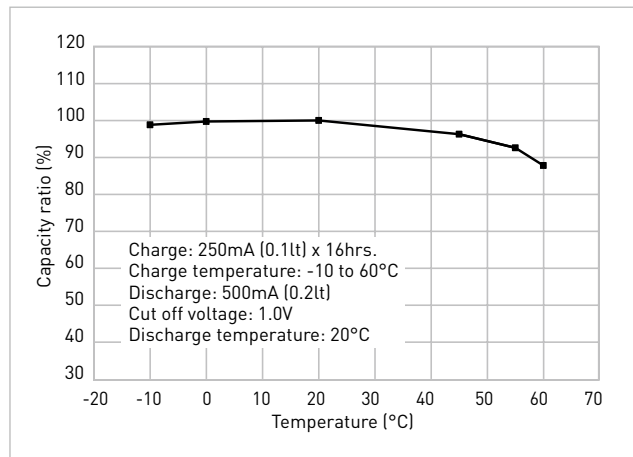
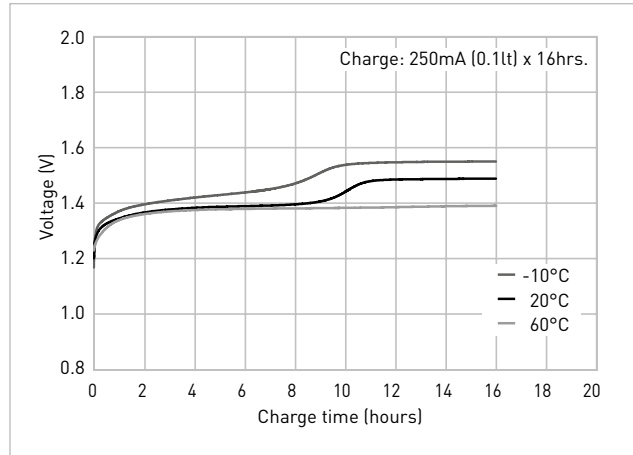
HIGH RATE DISCHARGE & HIGH TEMPERATURE TYPE **PH** TYPE  
SC SIZE (HR23/43)

DIMENSIONS (MM)

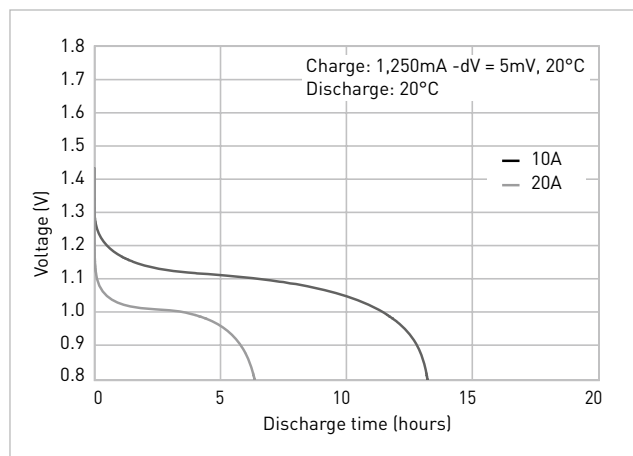


Specifications		BK-250SCH
Diameter (mm)		23.0 +0/-1.0
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		55
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,650
	Nominal capacity*3 (mAh)	2,500
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5
Charge	Standard (mA x hrs.)	250 x 16
	Rapid*4 (mA x hrs.)	1,250 x 2.4
	Low rate (mA x hrs.)	125 x 32 83 x 48
Charge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
	Low rate	-10 to 60
Discharge (°C)		-10 to 60
Ambient temperature	Storage (°C)	<1 year: -20 to 35 <6 months: -20 to 45 <1 month: -20 to 55 <1 week: -20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

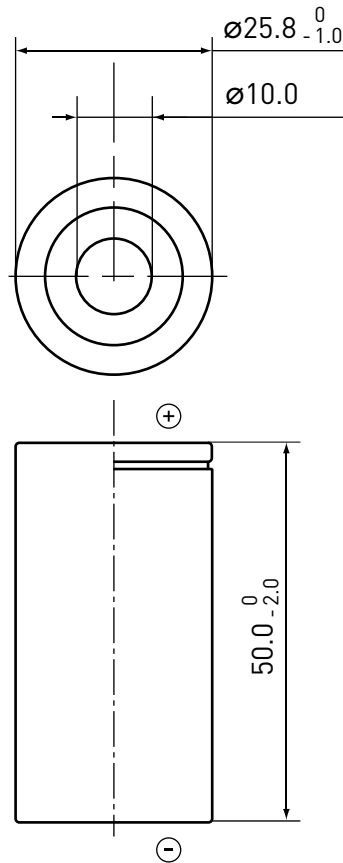


\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.

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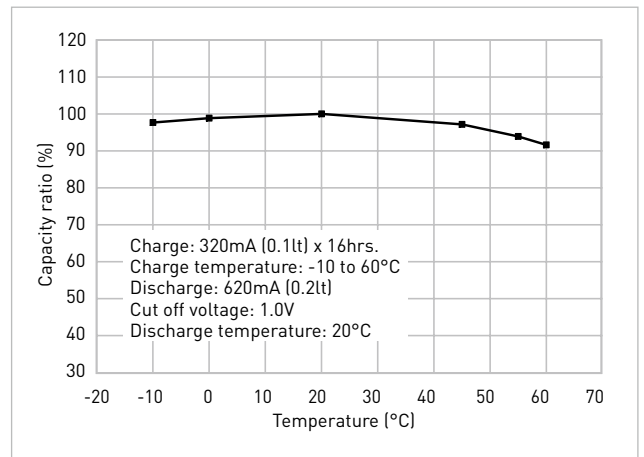
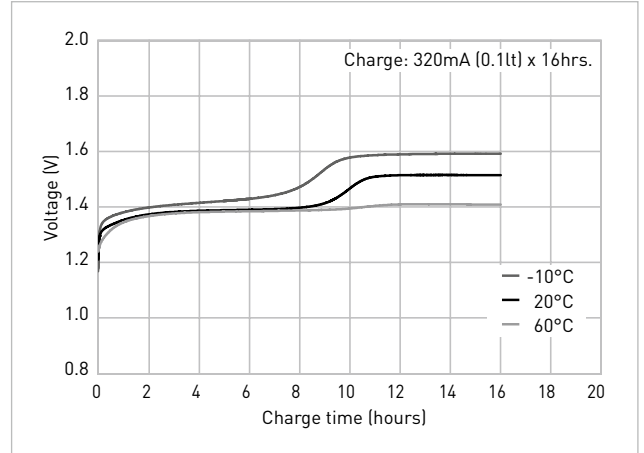
# BK-310CH

DIMENSIONS (MM)



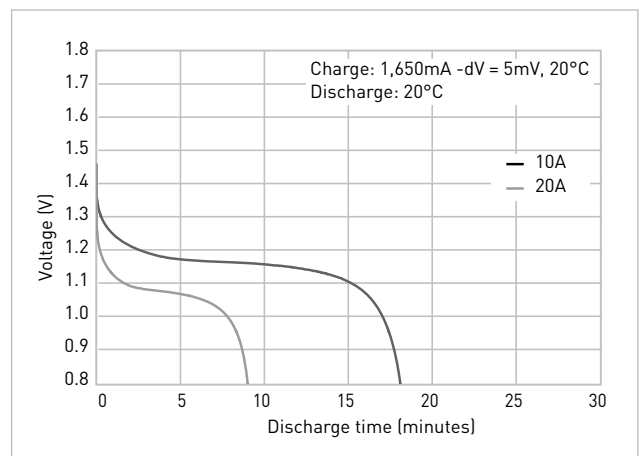
HIGH RATE DISCHARGE & HIGH TEMPERATURE TYPE **(PH)** TYPE  
C SIZE (HR26/50)

## TYPICAL CHARGE CHARACTERISTICS



Specifications		BK-310CH	
Diameter (mm)		25.8 +0/-1.0	
Total height (mm)		50.0 +0/-2.0	
Approximate weight (g)		80	
Nominal voltage (V)		1.2	
Discharge capacity*1	Typical capacity*2 (mAh)	3,300	
	Nominal capacity*3 (mAh)	3,100	
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5	
Charge	Standard (mA x hrs.)	310 x 16	
	Rapid*4 (mA x hrs.)	1,550 x 2.4	
	Low rate (mA x hrs.)	150 x 32	
		100 x 48	
Charge (°C)	Standard	-10 to 60	
	Rapid	-10 to 45	
	Low rate	-10 to 60	
Discharge (°C)		-10 to 60	
Ambient temperature	Storage (°C)	<1 year	-20 to 35
		<6 months	-20 to 45
	Storage (°C)	<1 month	-20 to 55
		<1 week	-20 to 65

## TYPICAL DISCHARGE CHARACTERISTICS

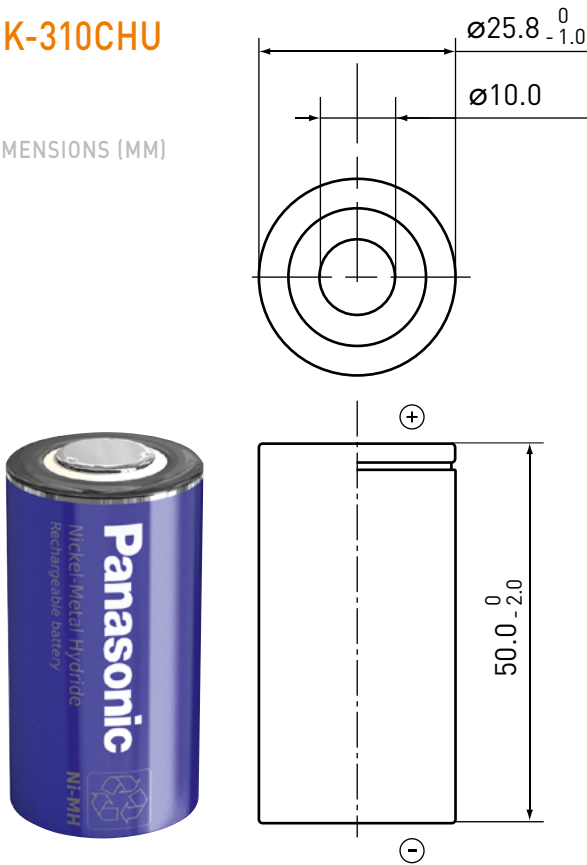


\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

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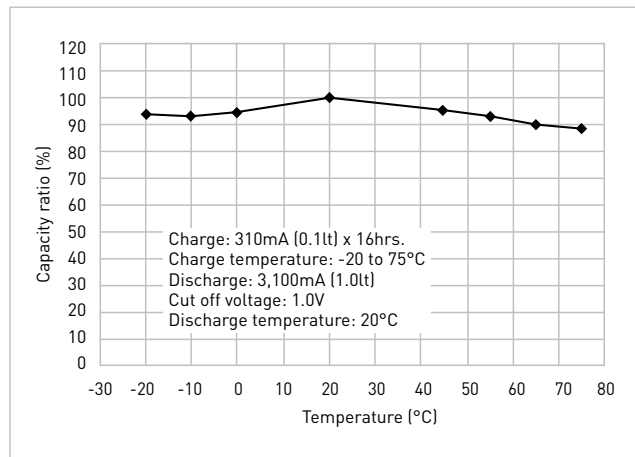
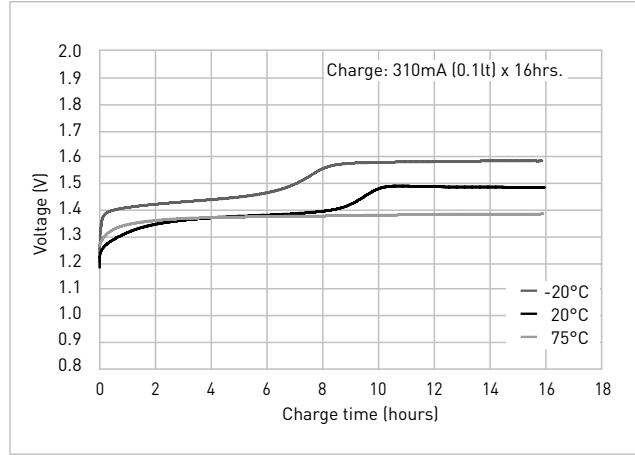
**NEW BK-310CHU**

DIMENSIONS (MM)



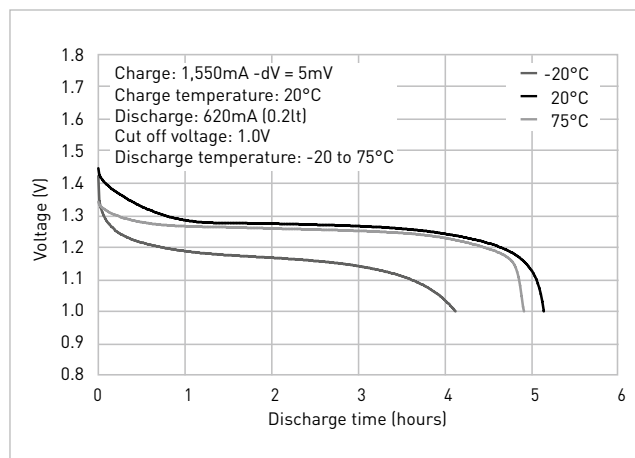
HIGH RATE DISCHARGE & HIGH TEMPERATURE TYPE **PH** TYPE C SIZE (HR26/50)

**TYPICAL CHARGE CHARACTERISTICS**



Specifications		BK-310CHU
Diameter (mm)		25.8 +0/-1.0
Total height (mm)		50.0 +0/-2.0
Approximate weight (g)		80
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	3,300
	Nominal capacity*3 (mAh)	3,100
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5
Charge	Standard (mA x hrs.)	310 x 16
	Rapid*4 (mA x hrs.)	1,550 x 2.4
	Low rate (mA x hrs.)	155 x 32
Ambient temperature	Low rate	-20 to 75
	Standard	-20 to 60
	Rapid	-20 to 75
Discharge (°C)		-20 to 75
Storage (°C)	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

**TYPICAL DISCHARGE CHARACTERISTICS**



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

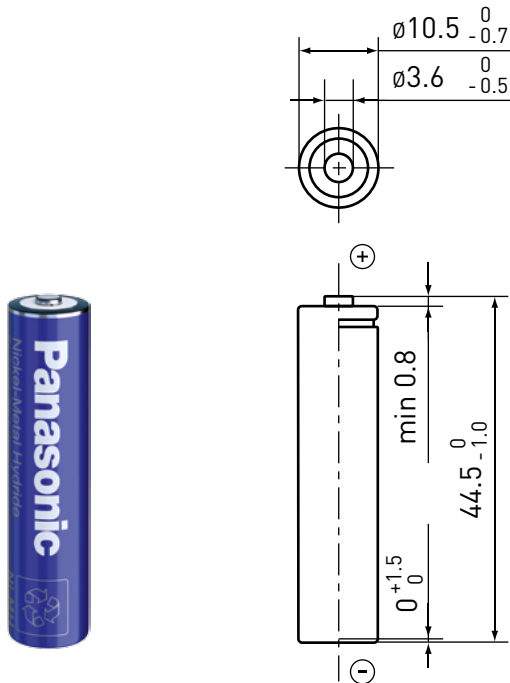
Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

# BK-65AAAB

BUTTON TOP TYPE  
AAA SIZE (HR11/45)



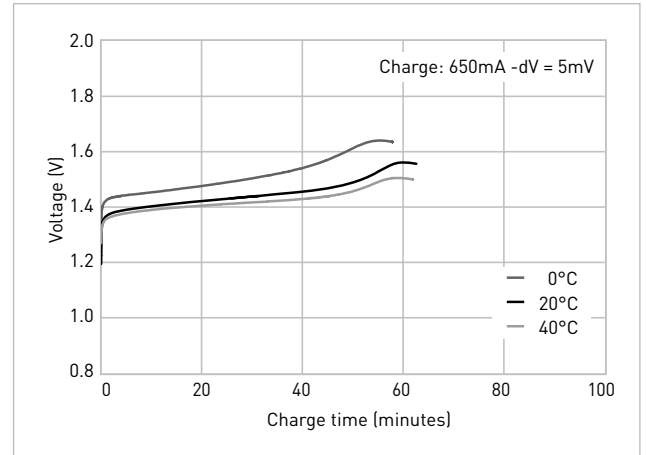
## DIMENSIONS (MM)



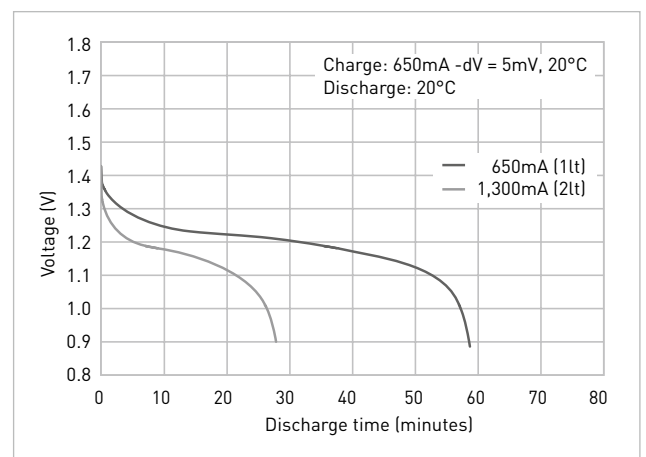
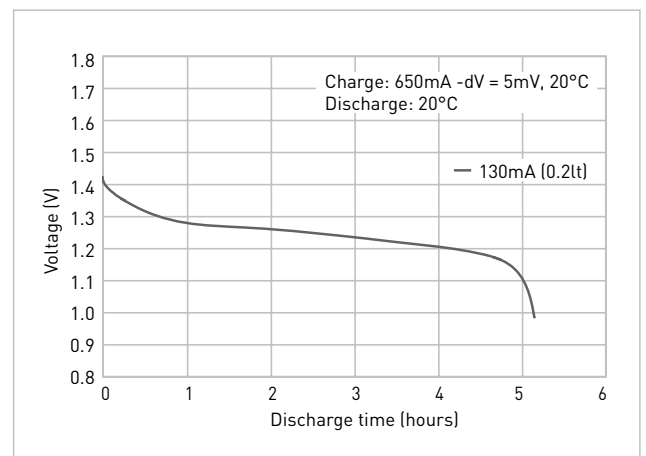
Specifications		BK-65AAAB
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.0
Approximate weight (g)		12
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	700
	Nominal capacity*3 (mAh)	650
Approx. internal impedance at 1,000Hz at charged state (mΩ)		30
Charge	Standard (mA x hrs.)	65 x 16
	Rapid*4 (mA x hrs.)	650 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS



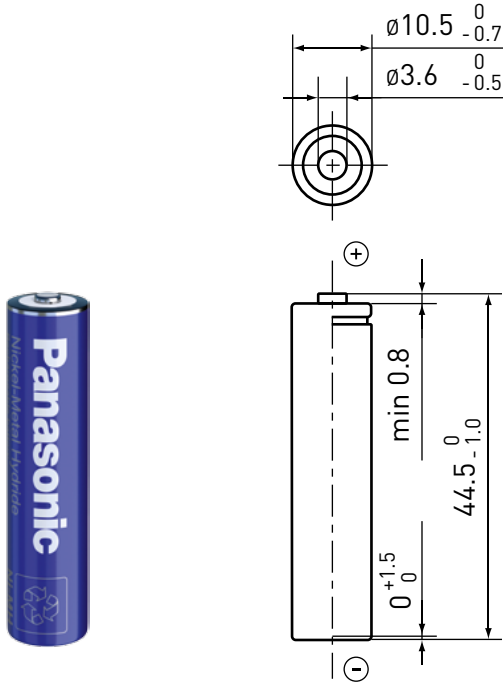
**BK-80AAAB**

HHR-80AAAB (OLD)

BUTTON TOP TYPE  
AAA SIZE (HR11/45)



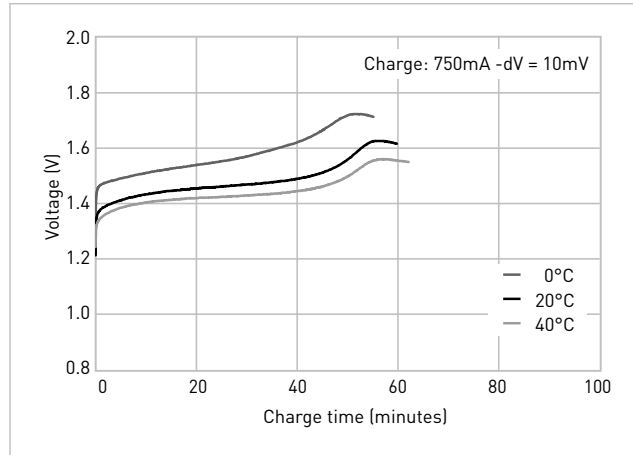
DIMENSIONS (MM)



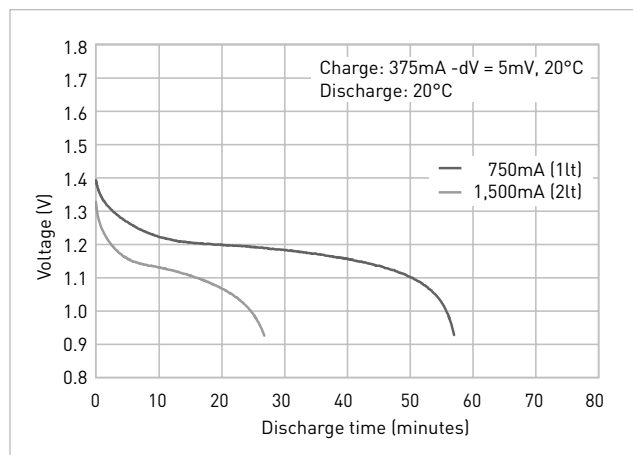
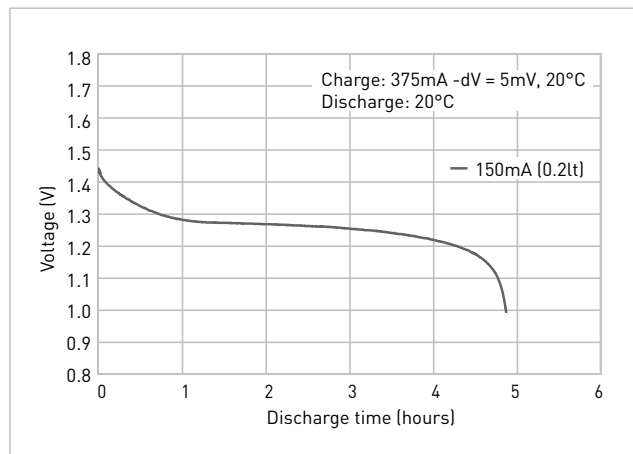
Specifications		BK-80AAAB
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.0
Approximate weight (g)		13
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	780
	Nominal capacity*3 (mAh)	750
Approx. internal impedance at 1,000Hz at charged state (mΩ)		30
Charge	Standard (mA x hrs.)	75 x 16
	Rapid*4 (mA x hrs.)	750 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

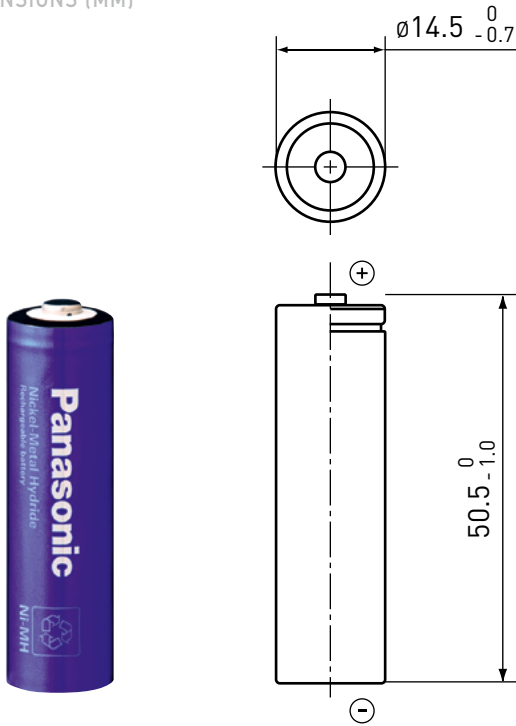


**BK-110AAB**  
HHR-110AAB (OLD)

BUTTON TOP TYPE  
AA SIZE (HR15/51)

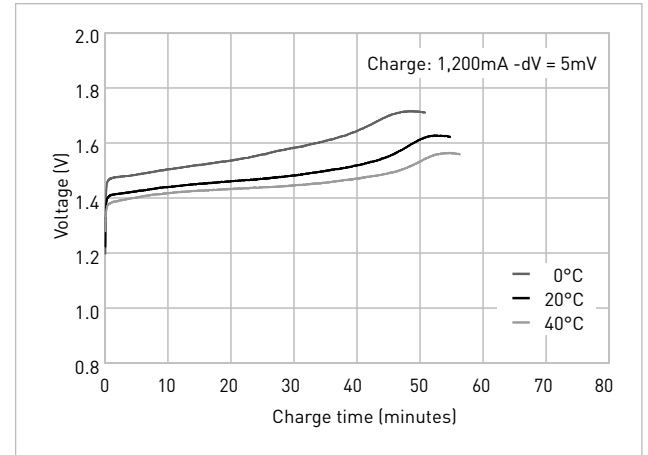


DIMENSIONS (MM)

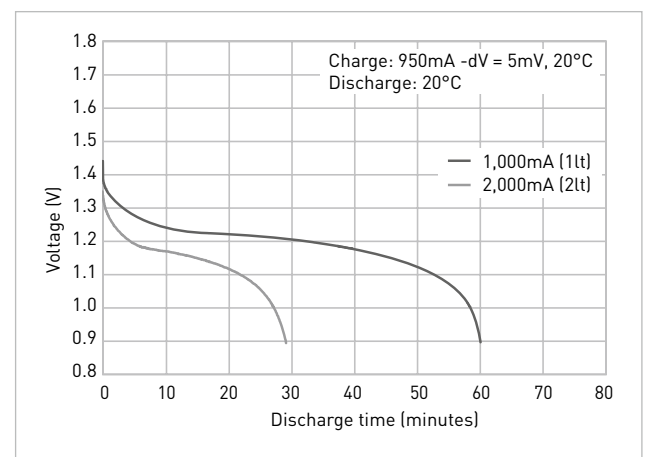
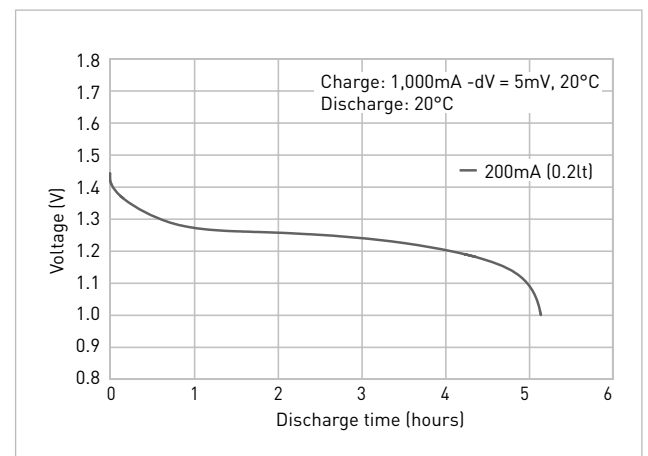


Specifications		BK-110AAB
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.0
Approximate weight (g)		20
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,050
	Nominal capacity*3 (mAh)	1,000
Approx. internal impedance at 1,000Hz at charged state (mΩ)		30
Charge	Standard (mA x hrs.)	100 x 16
	Rapid*4 (mA x hrs.)	1,200 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

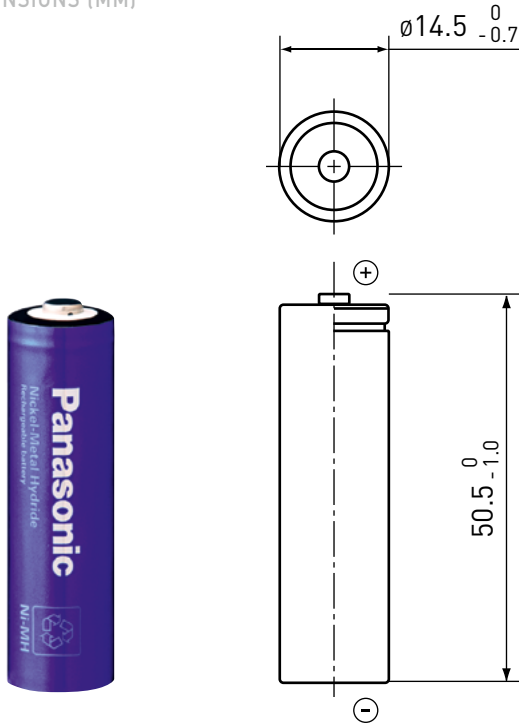


# BK-200AAB

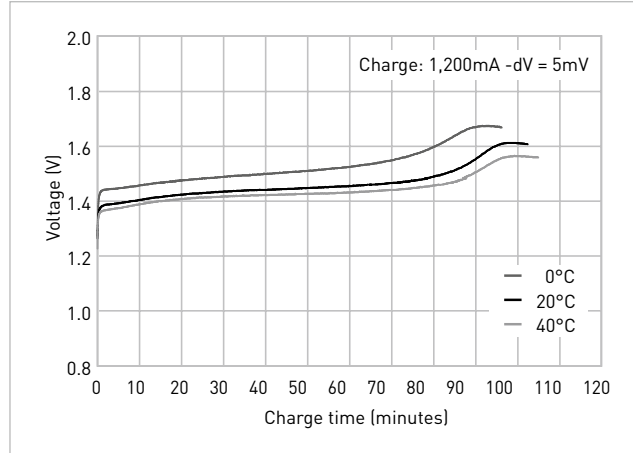
BUTTON TOP TYPE  
AA SIZE (HR15/51)

**B** TYPE

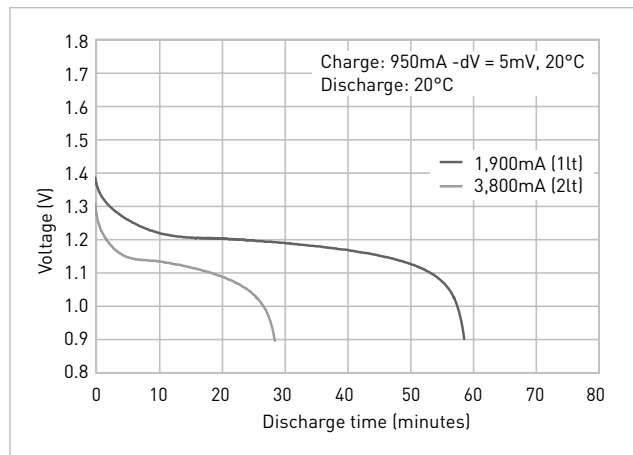
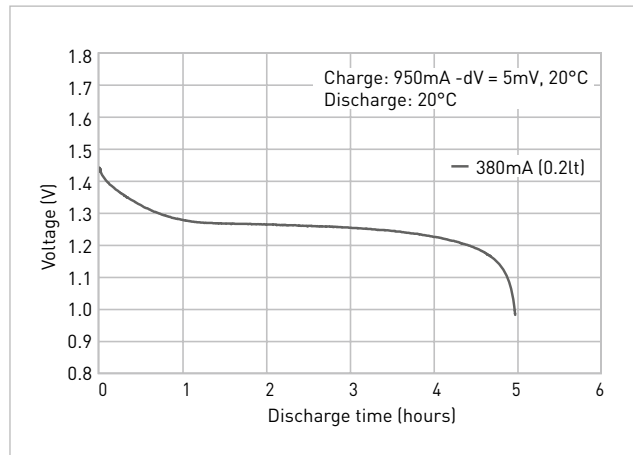
DIMENSIONS (MM)



TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



Specifications		BK-200AAB
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.0
Approximate weight (g)		29
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,000
	Nominal capacity*3 (mAh)	1,900
Approx. internal impedance at 1,000Hz at charged state (mΩ)		25
Charge	Standard (mA x hrs.)	190 x 16
	Rapid*4 (mA x hrs.)	1,200 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

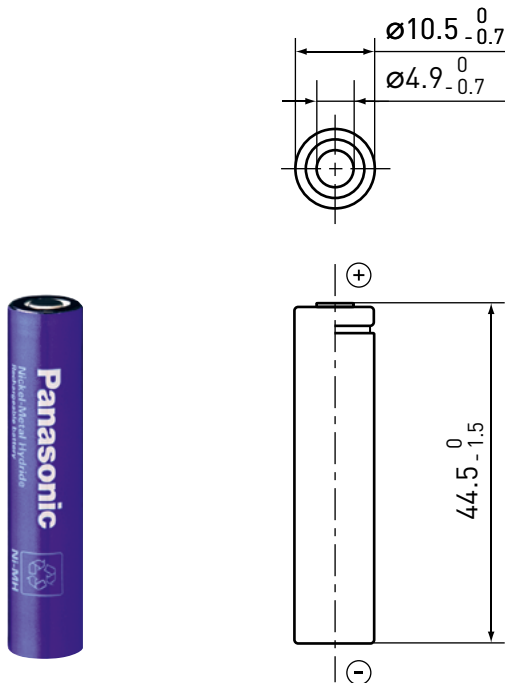
# BK-65AAAK

HHR-65AAAK (OLD)

STANDARD TYPE  
AAA SIZE (HR11/45)

**N** TYPE

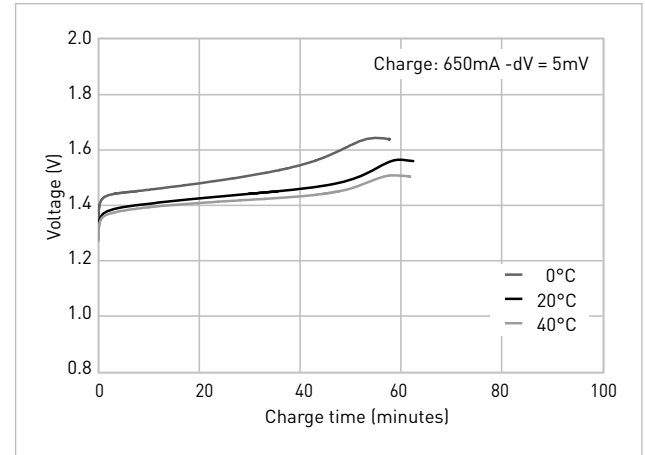
## DIMENSIONS (MM)



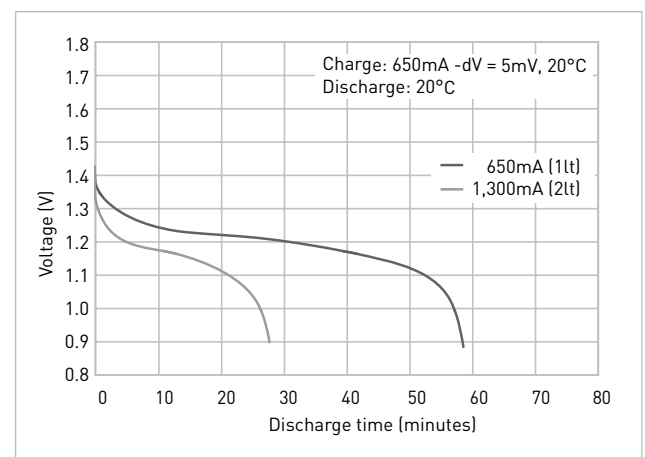
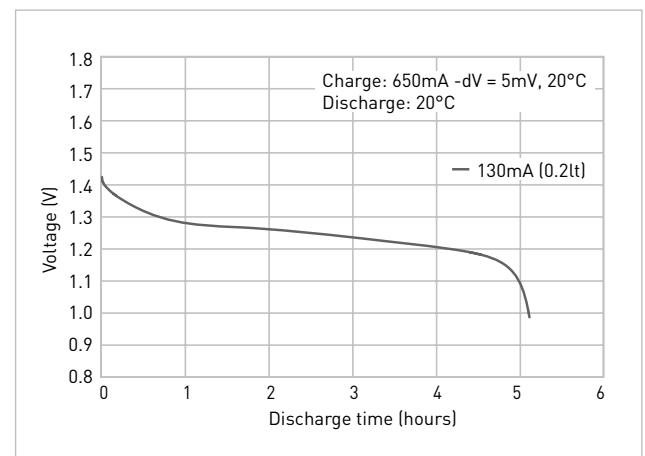
Specifications		BK-65AAAK
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.5
Approximate weight (g)		12
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	700
	Nominal capacity*3 (mAh)	650
Approx. internal impedance at 1,000Hz at charged state (mΩ)		30
Charge	Standard (mA x hrs.)	65 x 16
	Rapid*4 (mA x hrs.)	650 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS

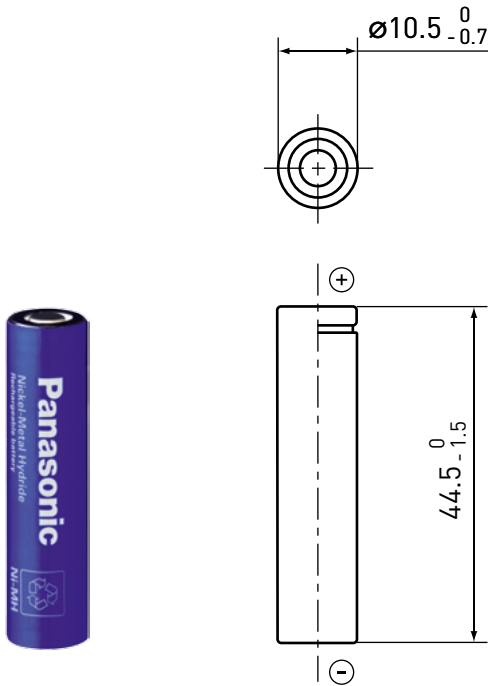


**BK-70AAAJ**  
HHR-70AAAJ (OLD)

STANDARD TYPE  
AAA SIZE (HR11/45)

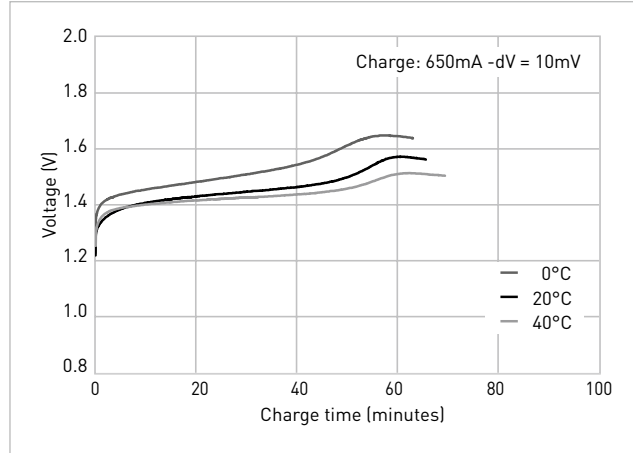


DIMENSIONS (MM)

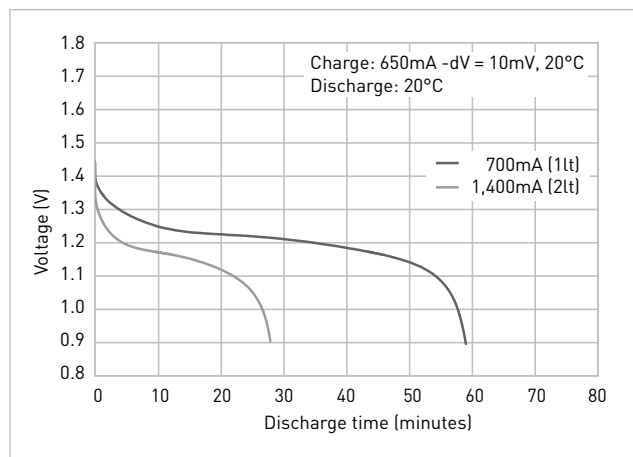
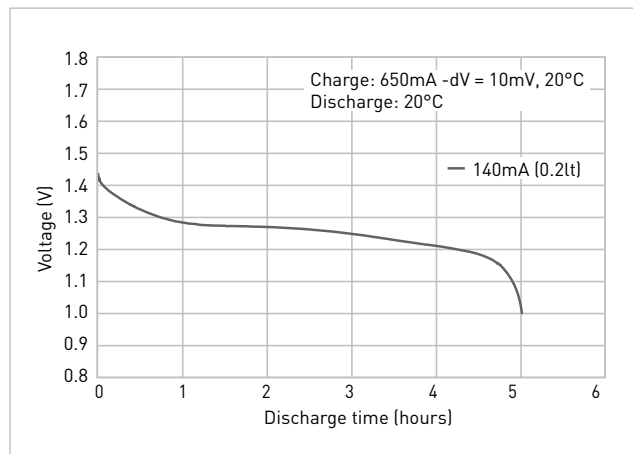


Specifications		BK-70AAAJ
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.5
Approximate weight (g)		12
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	730
	Nominal capacity*3 (mAh)	700
Approx. internal impedance at 1,000Hz at charged state (mΩ)		35
Charge	Standard (mA x hrs.)	70 x 16
	Rapid*4 (mA x hrs.)	650 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



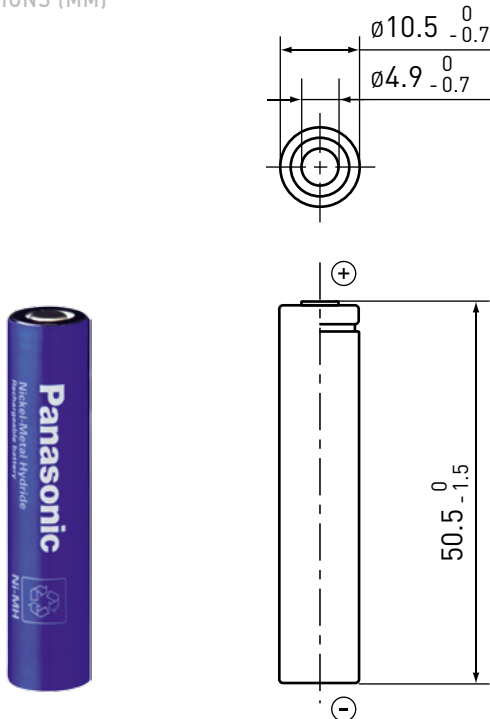
\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

# BK-90AAA

STANDARD TYPE  
L-AAA SIZE (HR11/67)



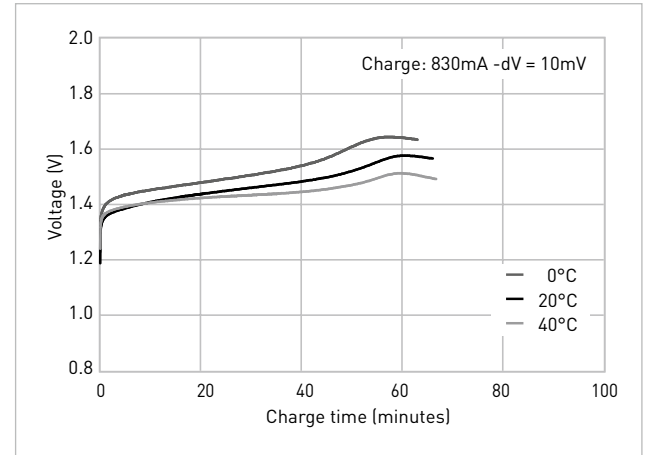
DIMENSIONS (MM)



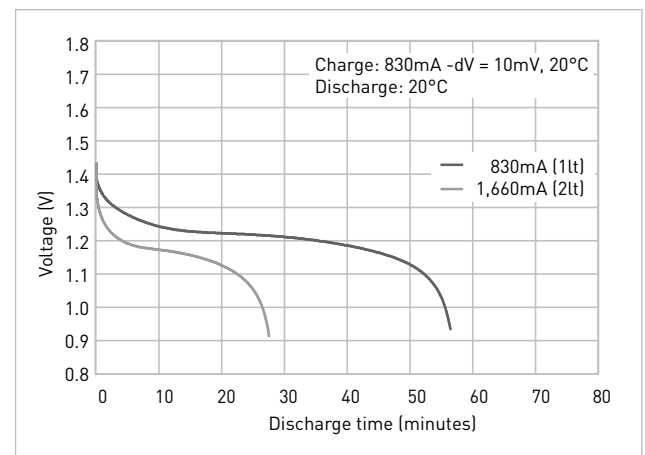
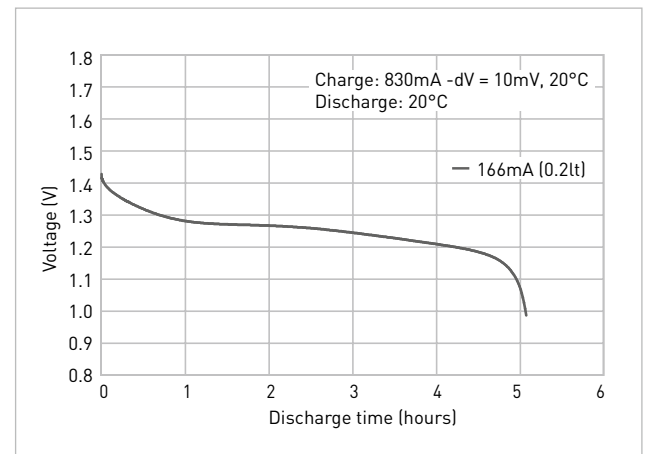
Specifications		BK-90AAA
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		50.5 +0/-1.5
Approximate weight (g)		14
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	880
	Nominal capacity*3 (mAh)	830
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	83 x 16
	Rapid*4 (mA x hrs.)	830 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS



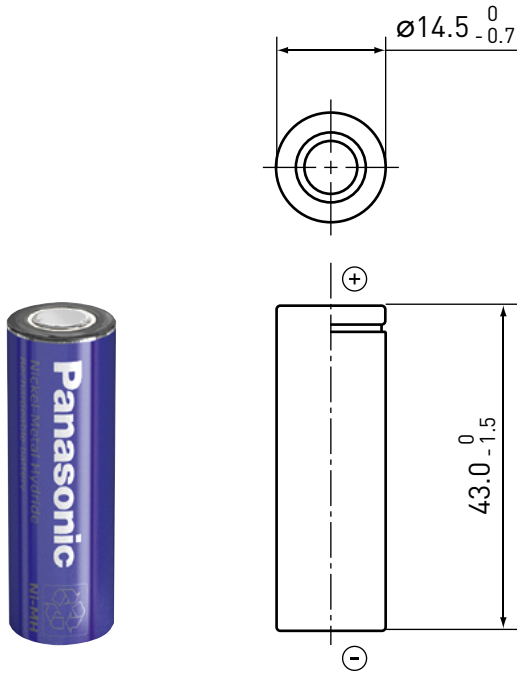
**BK-120AA**

HHR-120AA (OLD)

STANDARD TYPE  
4/5AA SIZE (HR15/43)



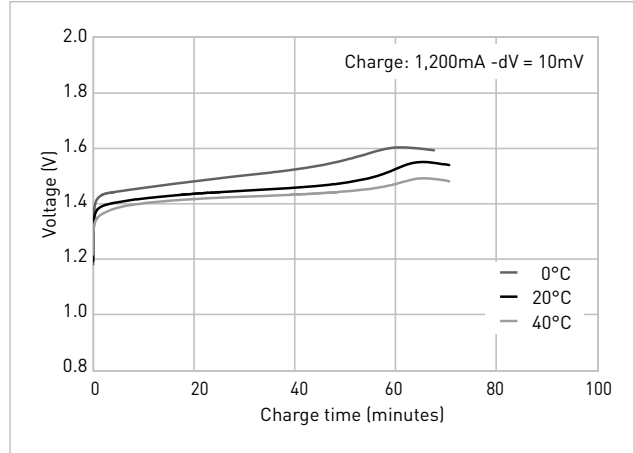
DIMENSIONS (MM)



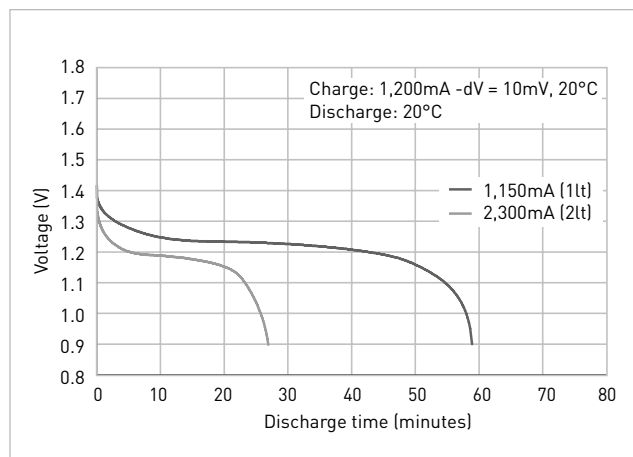
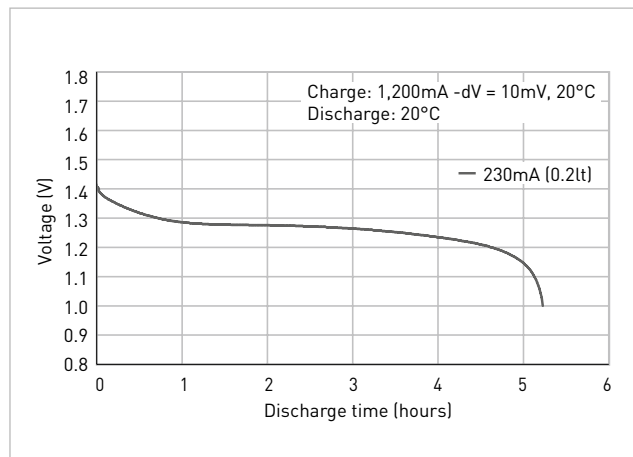
Specifications		BK-120AA
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		23
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,220
	Nominal capacity*3 (mAh)	1,150
Approx. internal impedance at 1,000Hz at charged state (mΩ)		19
Charge	Standard (mA x hrs.)	115 x 16
	Rapid*4 (mA x hrs.)	1,200 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

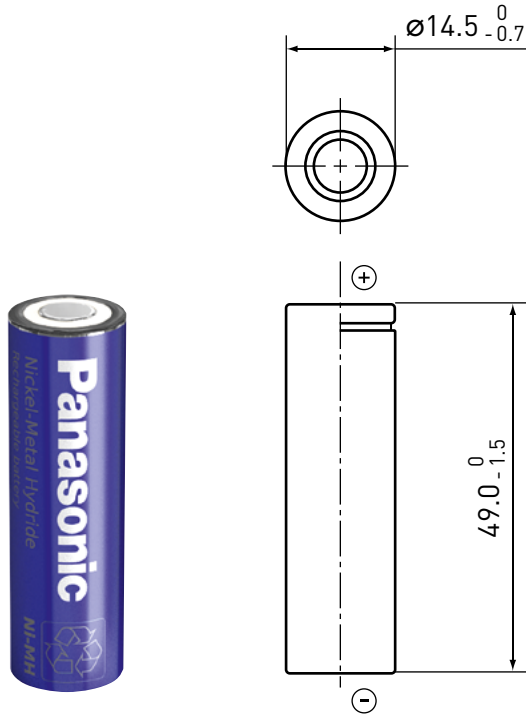


**BK-70AA**  
HHR-70AA(OLD)

STANDARD TYPE  
AA SIZE (HR15/49)



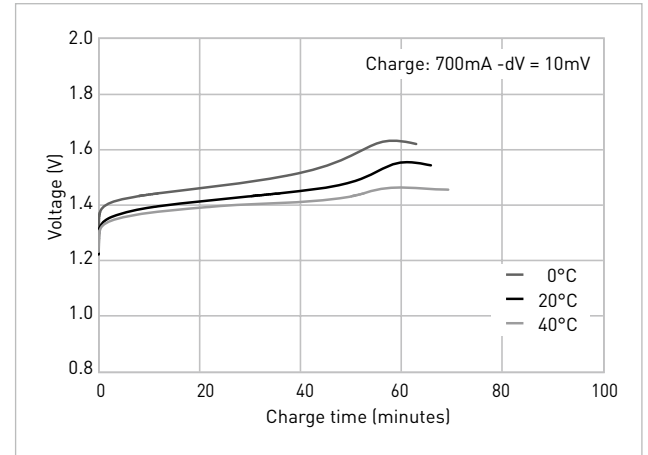
DIMENSIONS (MM)



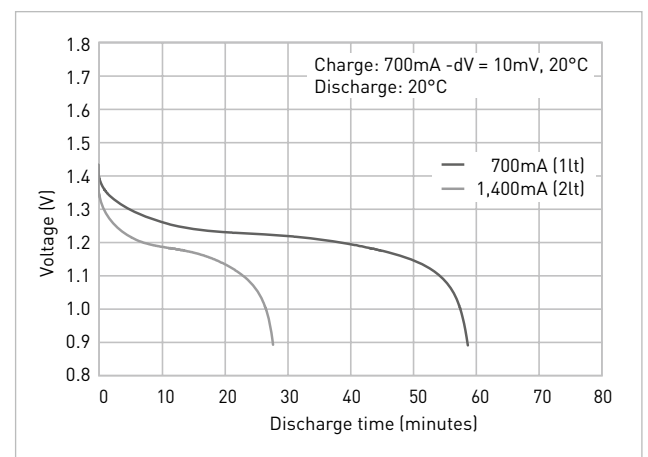
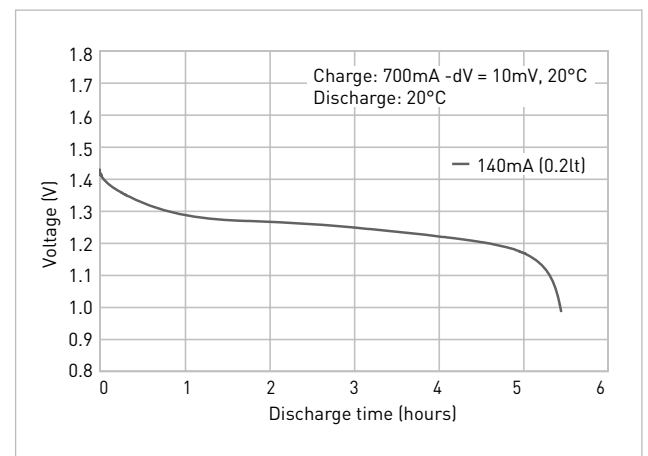
Specifications		BK-70AA
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		49.0 +0/-1.5
Approximate weight (g)		18
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	780
	Nominal capacity*3 (mAh)	700
Approx. internal impedance at 1,000Hz at charged state (mΩ)		25
Charge	Standard (mA x hrs.)	70 x 16
	Rapid*4 (mA x hrs.)	700 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



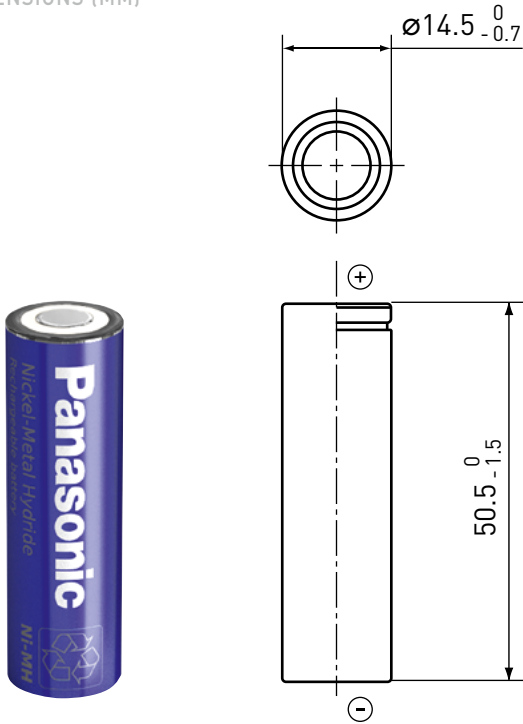
**BK-110AAO**

HHR-110AAO (OLD)

STANDARD TYPE  
AA SIZE (HR15/51)



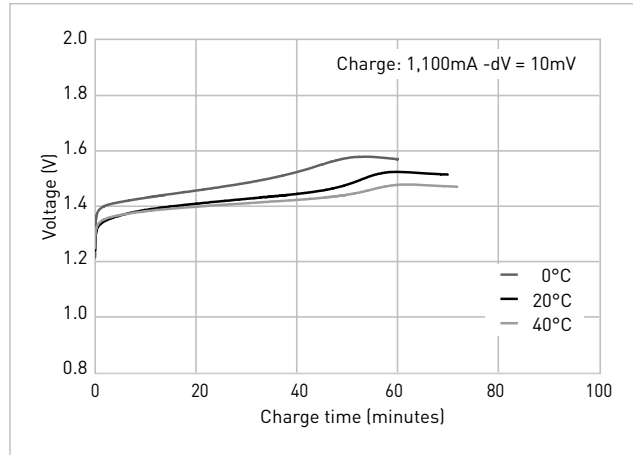
DIMENSIONS (MM)



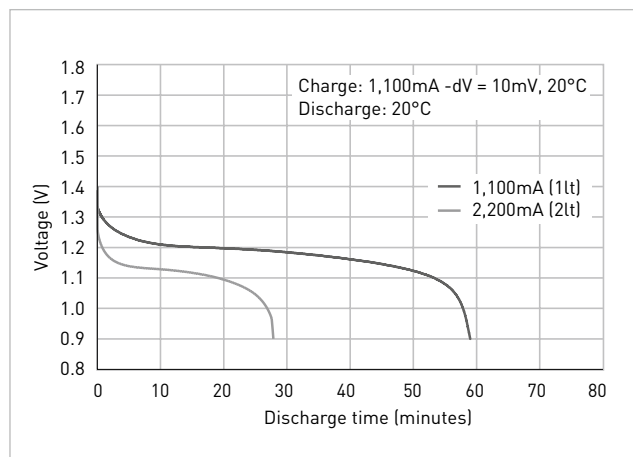
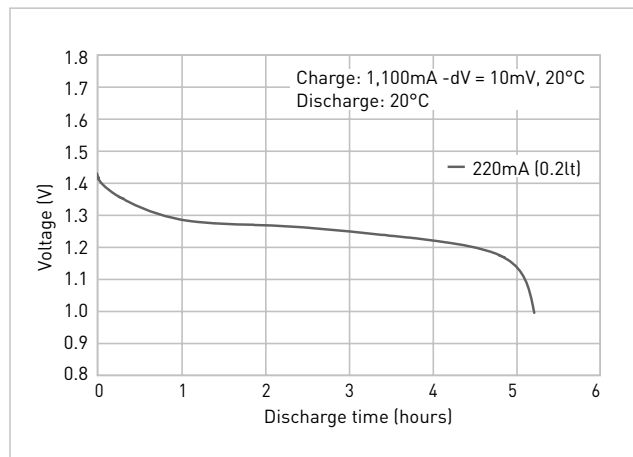
Specifications		BK-110AAO
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.5
Approximate weight (g)		26
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,180
	Nominal capacity*3 (mAh)	1,100
Approx. internal impedance at 1,000Hz at charged state (mΩ)		16
Charge	Standard (mA x hrs.)	110 x 16
	Rapid*4 (mA x hrs.)	1,100 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



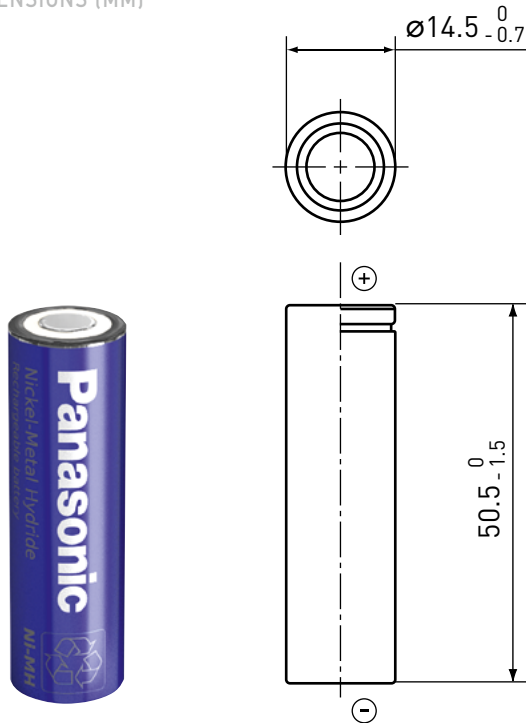


**BK-150AA**  
HHR-150AA (OLD)

STANDARD TYPE  
AA SIZE (HR15/51)



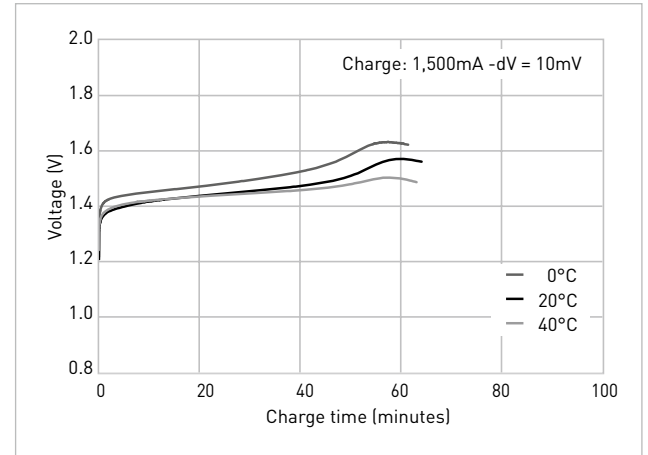
DIMENSIONS (MM)



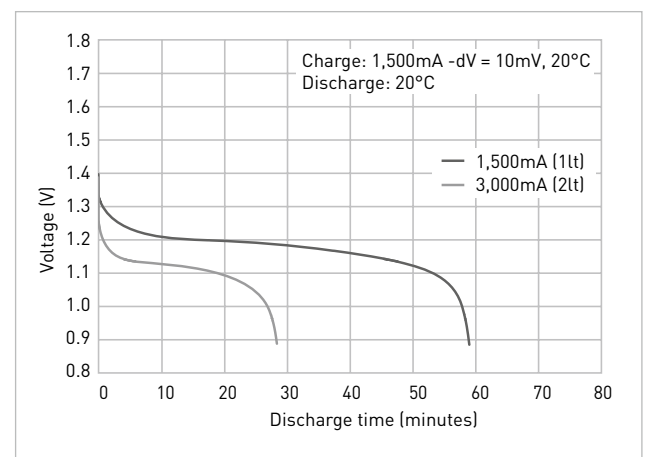
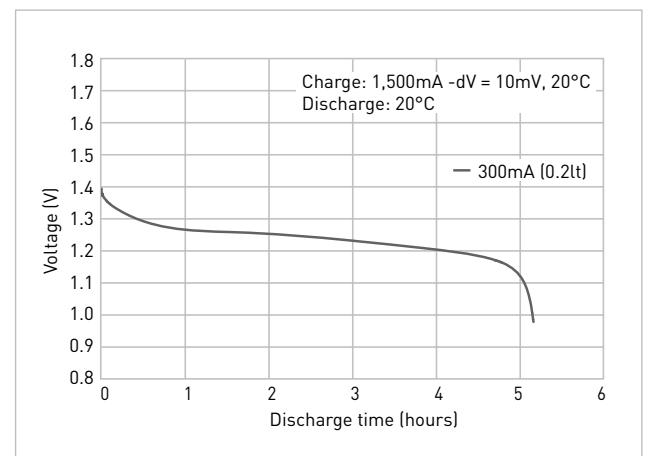
Specifications		BK-150AA
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.5
Approximate weight (g)		26
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,580
	Nominal capacity*3 (mAh)	1,500
Approx. internal impedance at 1,000Hz at charged state (mΩ)		23
Charge	Standard (mA x hrs.)	150 x 16
	Rapid*4 (mA x hrs.)	1,500 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

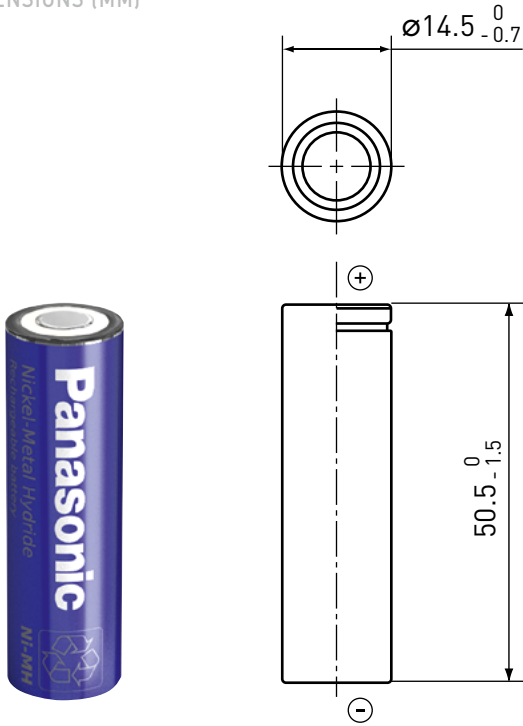


**BK-200AAP**

STANDARD TYPE  
AA SIZE (HR15/51)

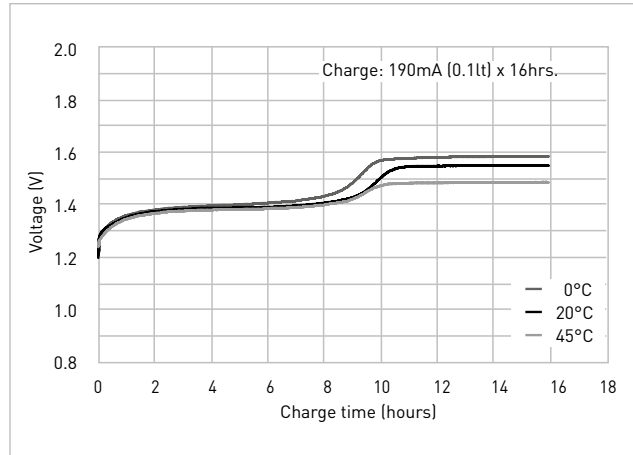


DIMENSIONS (MM)

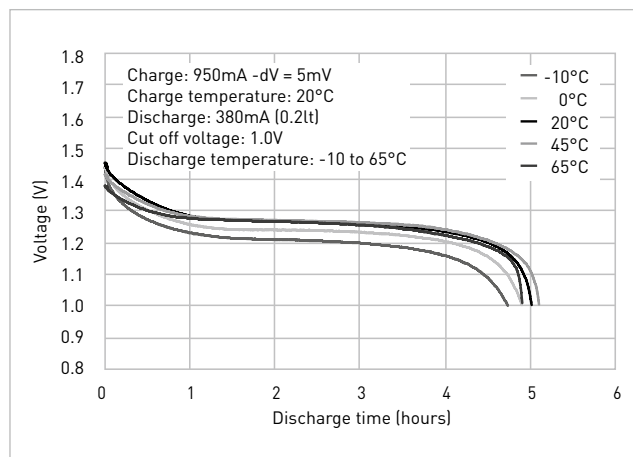
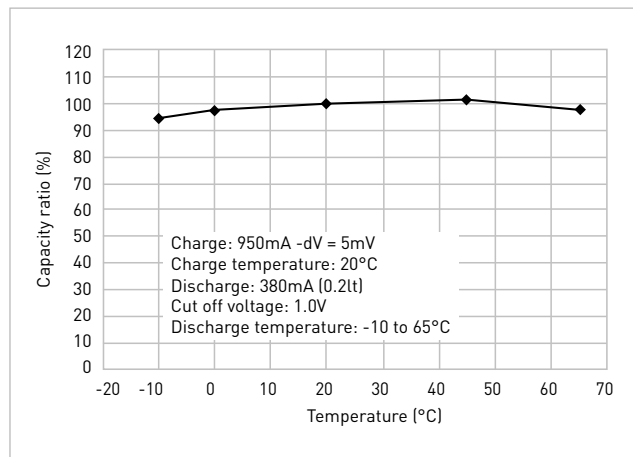


Specifications		BK-200AAP
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.5
Approximate weight (g)		27
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,980
	Nominal capacity*3 (mAh)	1,900
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	190 x 16
	Rapid*4 (mA x hrs.)	1,900 x 1.2
Charge (°C)	Standard	-10 to 60
	Rapid	-10 to 45
Discharge (°C)		-10 to 60
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

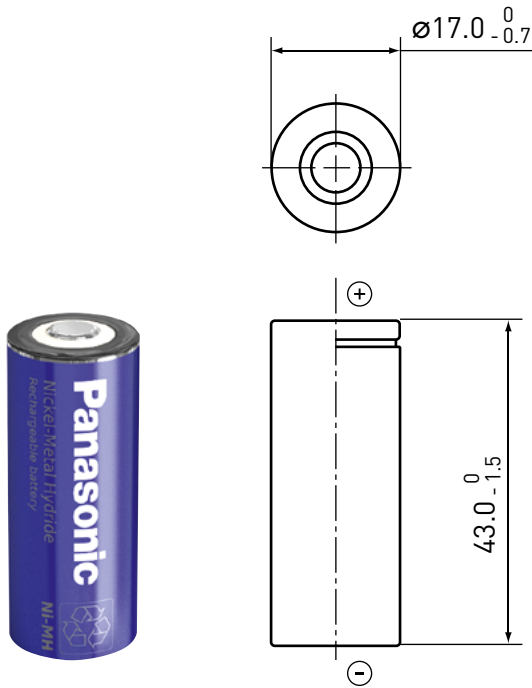
# BK-200A

HHR-200A (OLD)

STANDARD TYPE  
4/5A SIZE (HR17/43)

**N** TYPE

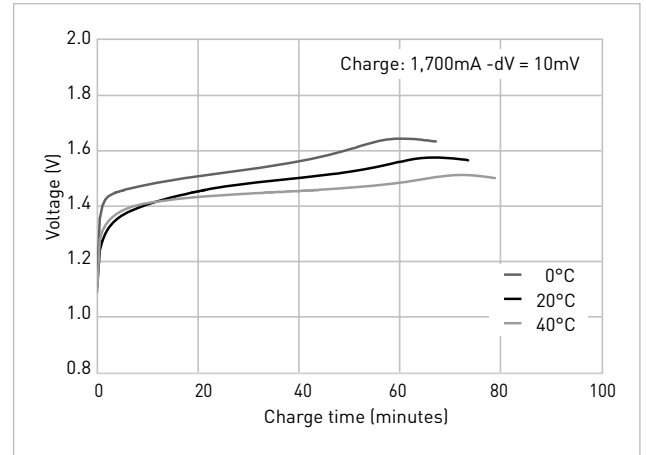
## DIMENSIONS (MM)



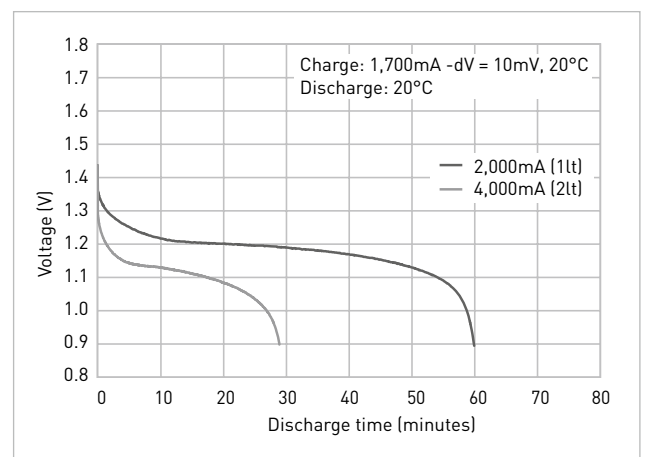
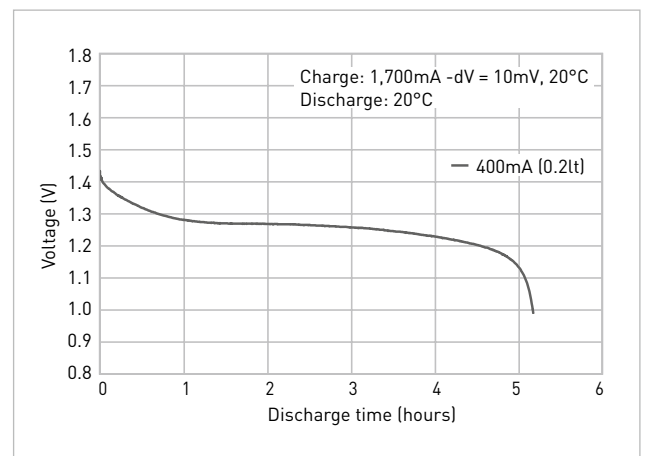
Specifications		BK-200A
Diameter (mm)		17.0 +0/-0.7
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		32
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,040
	Nominal capacity*3 (mAh)	2,000
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	200 x 16
	Rapid*4 (mA x hrs.)	1,700 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS

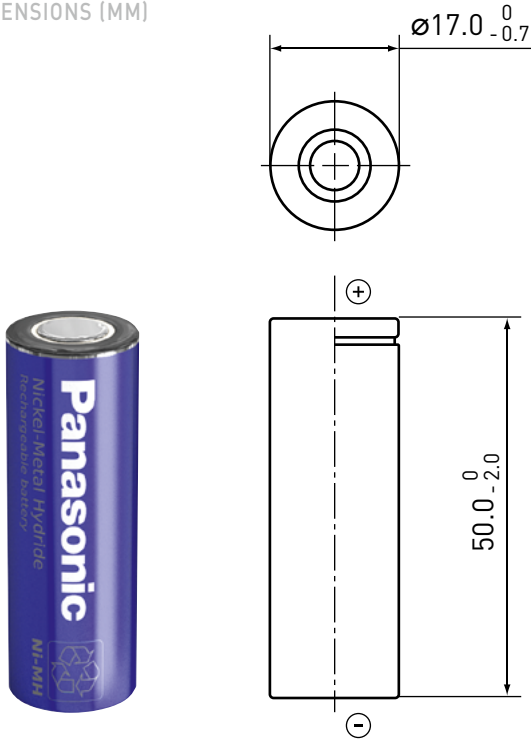


**BK-210A**  
HHR-210A (OLD)

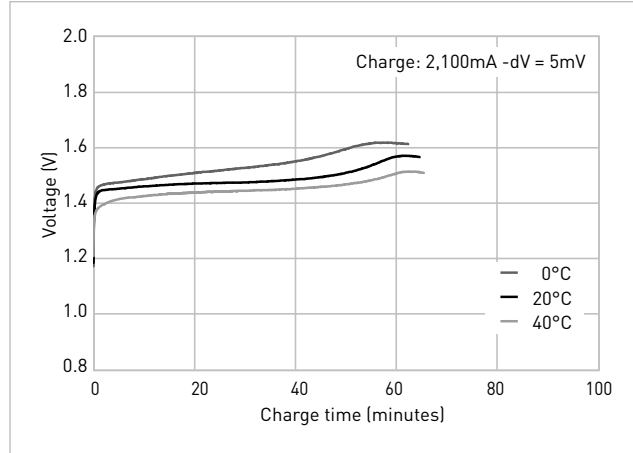
STANDARD TYPE  
A SIZE (HR17/50)



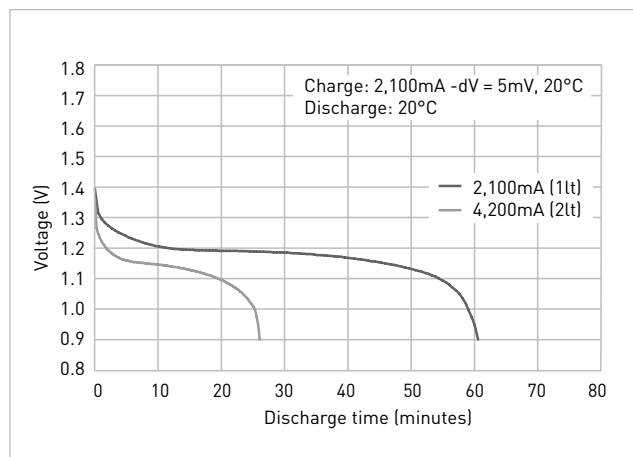
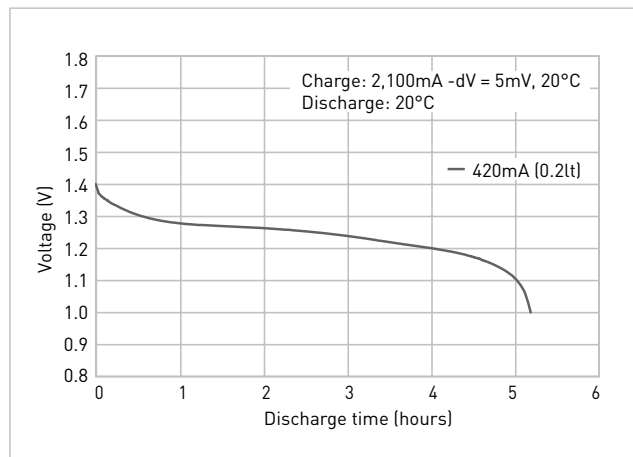
DIMENSIONS (MM)



TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

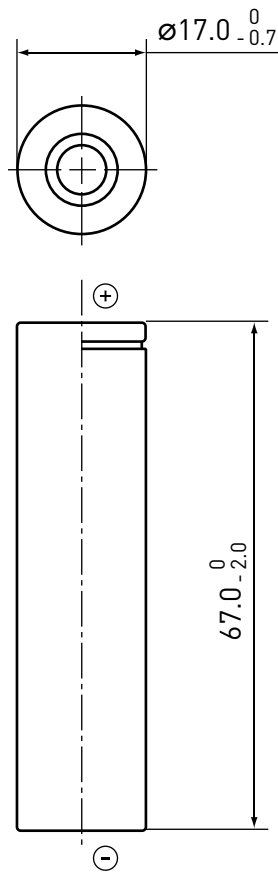


Specifications		BK-210A
Diameter (mm)		17.0 +0/-0.7
Total height (mm)		50.0 +0/-2.0
Approximate weight (g)		38
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,200
	Nominal capacity*3 (mAh)	2,100
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	210 x 16
	Rapid*4 (mA x hrs.)	2,100 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

**BK-380A**  
HHR-380A (OLD)

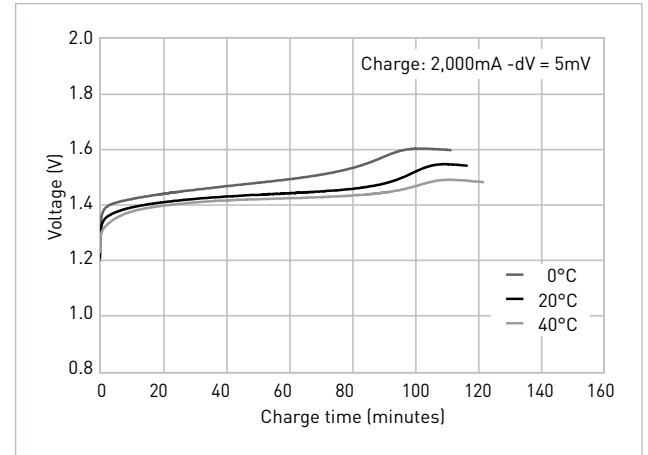
DIMENSIONS (MM)



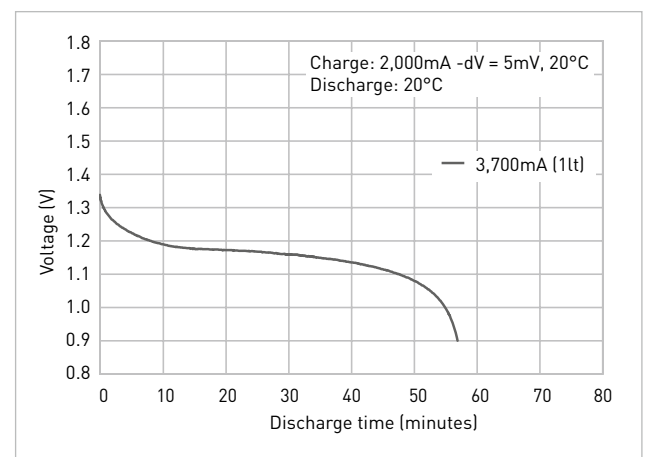
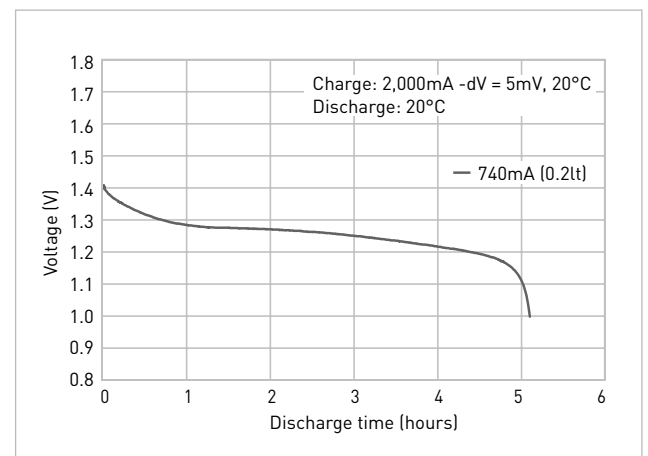
STANDARD TYPE  
L-A SIZE (HR17/67)



TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



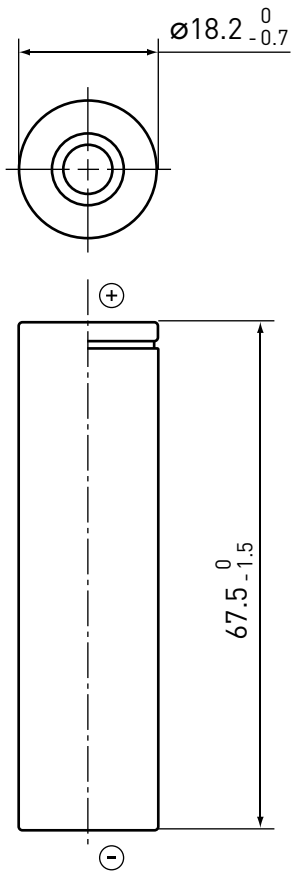
Specifications		BK-380A
Diameter (mm)		17.0 +0/-0.7
Total height (mm)		67.0 +0/-2.0
Approximate weight (g)		53
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	3,800
	Nominal capacity*3 (mAh)	3,700
Approx. internal impedance at 1,000Hz at charged state (mΩ)		25
Charge	Standard (mA x hrs.)	370 x 16
	Rapid*4 (mA x hrs.)	2,000 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

**BK-450A**

HHR-450A (OLD)

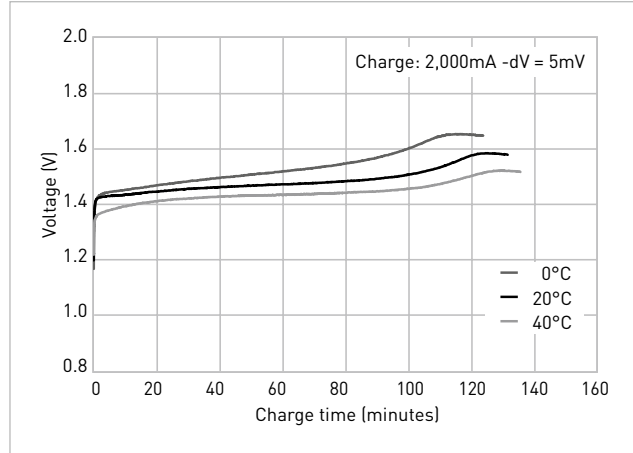
DIMENSIONS (MM)



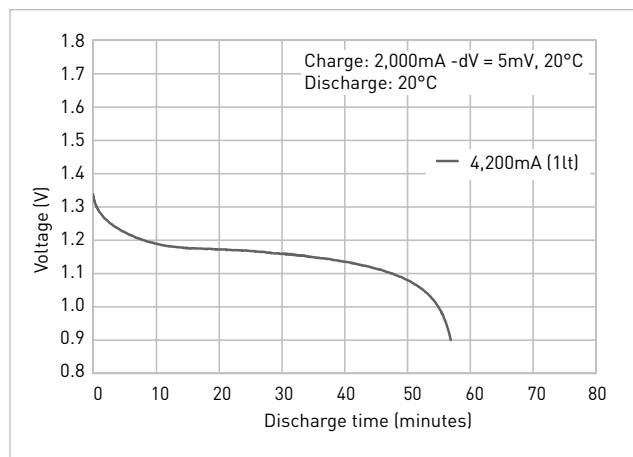
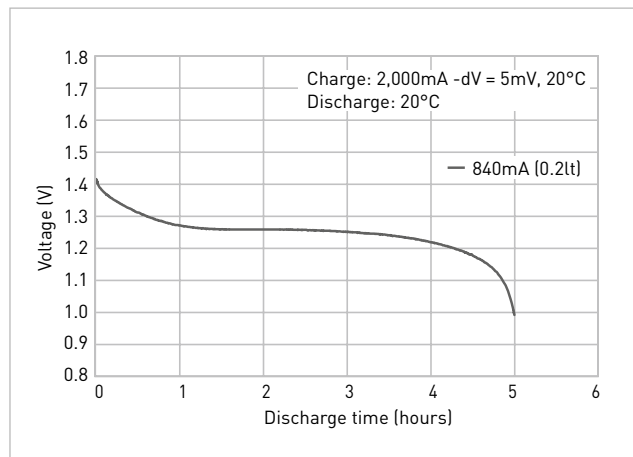
STANDARD TYPE  
LFAT/A SIZE



TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



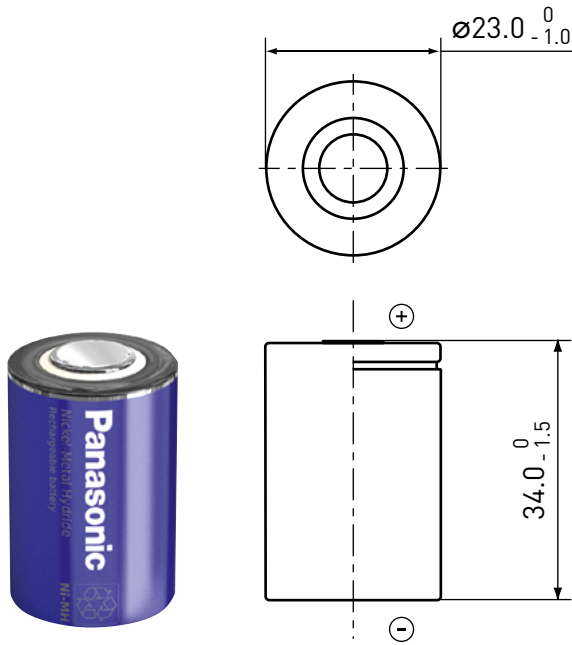
Specifications		BK-450A
Diameter (mm)		18.2 +0/-0.7
Total height (mm)		67.5 +0/-1.5
Approximate weight (g)		60
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	4,500
	Nominal capacity*3 (mAh)	4,200
Approx. internal impedance at 1,000Hz at charged state (mΩ)		25
Charge	Standard (mA x hrs.)	420 x 16
	Rapid*4 (mA x hrs.)	2,000 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

**BK-200SCP**  
HHR-200SCP (OLD)

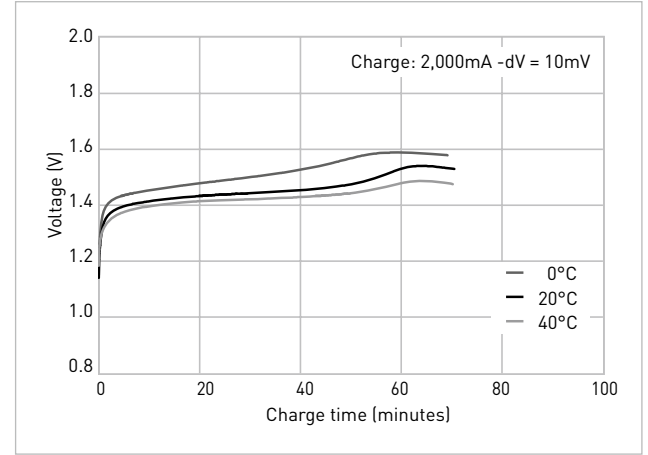
HIGH RATE DISCHARGE & RAPID CHARGE TYPE **P** TYPE  
4/5SC SIZE (HR23/34)

DIMENSIONS (MM)

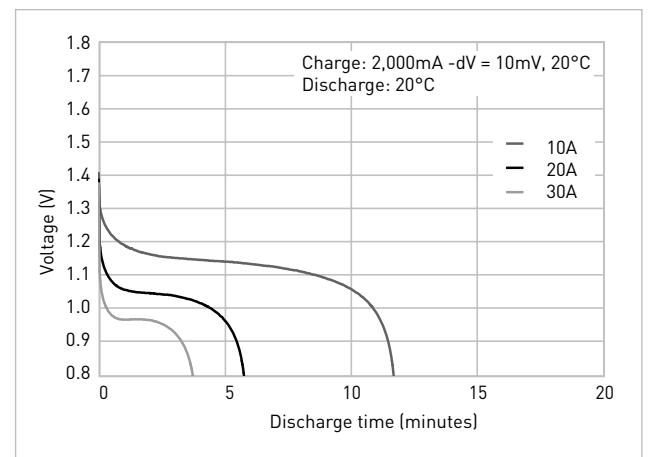
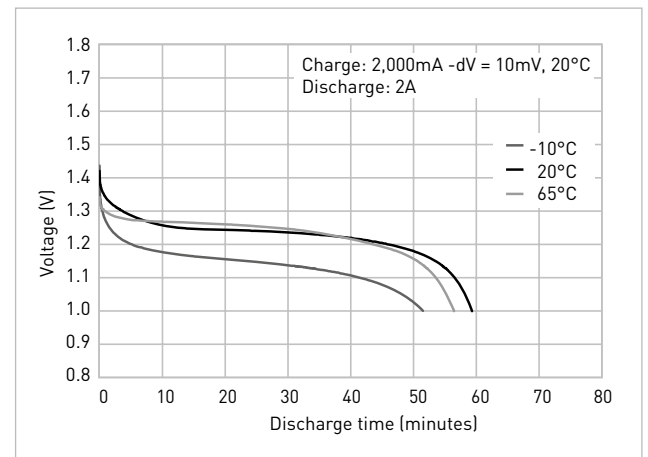


Specifications		BK-200SCP
Diameter (mm)		23.0 +0/-1.0
Total height (mm)		34.0 +0/-1.5
Approximate weight (g)		42
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,100
	Nominal capacity*3 (mAh)	1,900
Approx. internal impedance at 1,000Hz at charged state (mΩ)		5
Charge	Standard (mA x hrs.)	190 x 16
	Rapid*4 (mA x hrs.)	2,000 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



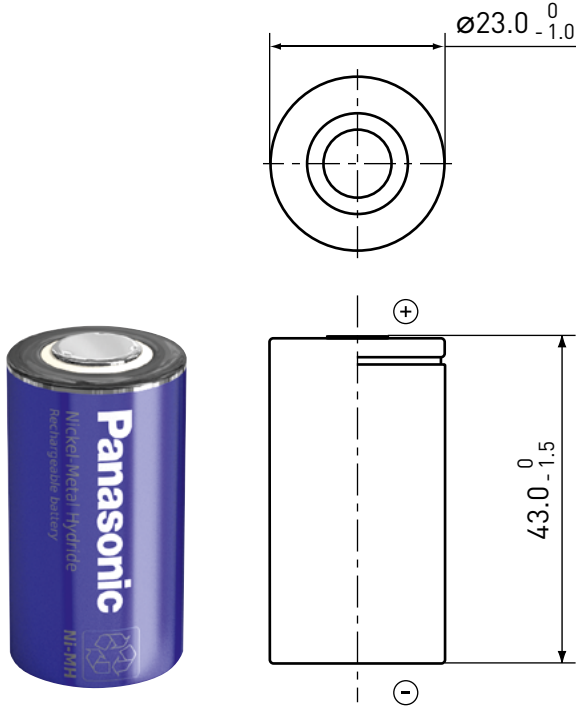
\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
\*2 Average capacity (mAh). For reference only.  
\*3 Rated capacity (mAh).  
\*4 Need specially designed control system. Please contact Panasonic for details.



**BK-260SCP**  
HHR-260SCP (OLD)

HIGH RATE DISCHARGE & RAPID CHARGE TYPE **P** TYPE  
SC SIZE (HR23/43)

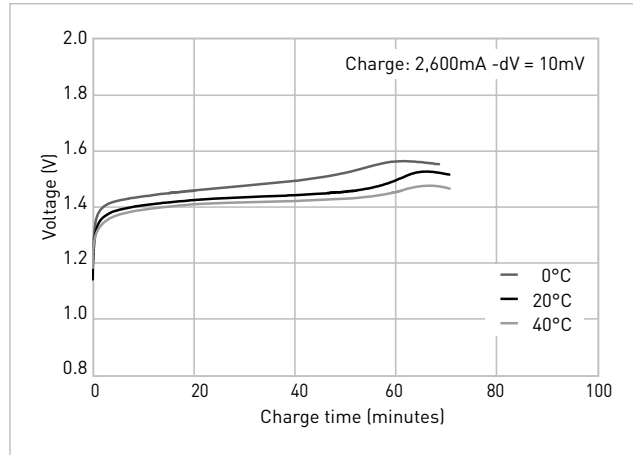
DIMENSIONS (MM)



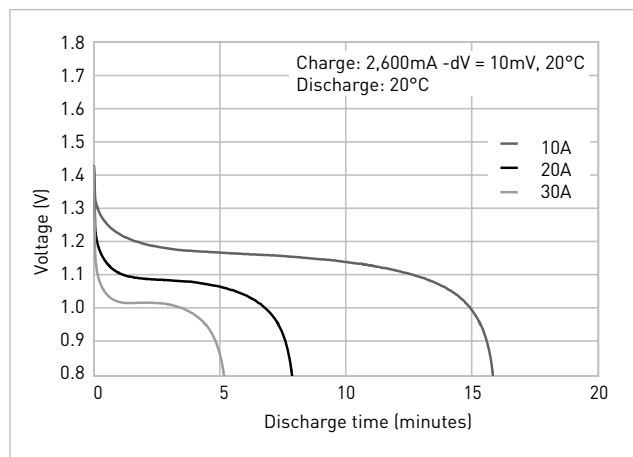
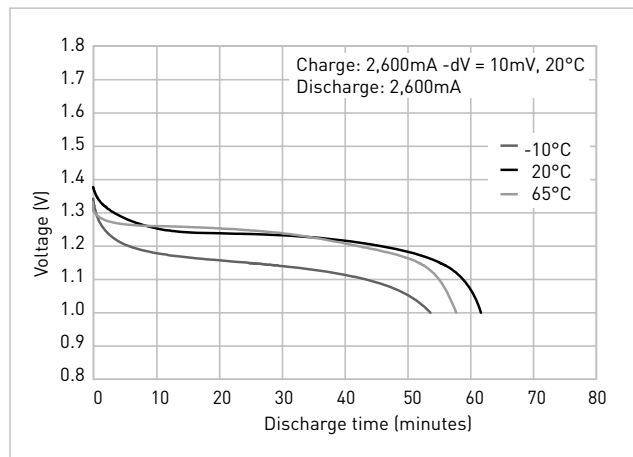
Specifications		BK-260SCP
Diameter (mm)		23.0 +0/-1.0
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		55
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,700
	Nominal capacity*3 (mAh)	2,450
Approx. internal impedance at 1,000Hz at charged state (mΩ)		4
Charge	Standard (mA x hrs.)	245 x 16
	Rapid*4 (mA x hrs.)	2,600 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



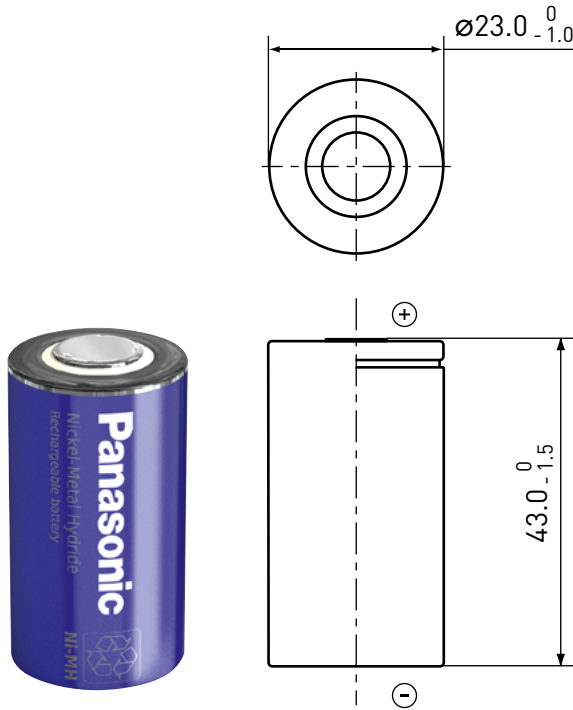
TYPICAL DISCHARGE CHARACTERISTICS



**BK-300SCP**  
HHR-300SCP (OLD)

HIGH RATE DISCHARGE & RAPID CHARGE TYPE **P** TYPE  
SC SIZE (HR23/43)

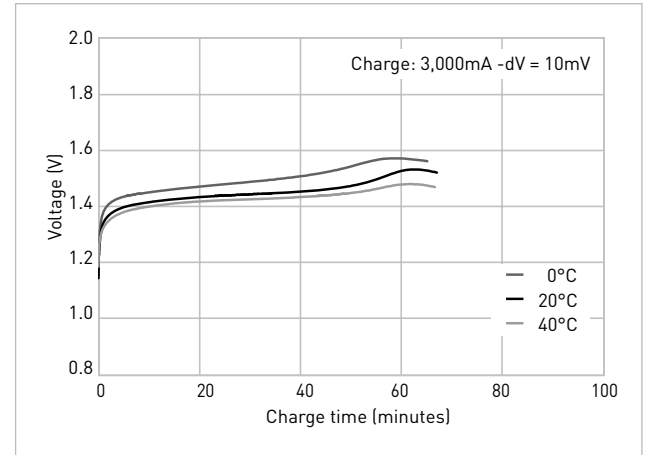
DIMENSIONS (MM)



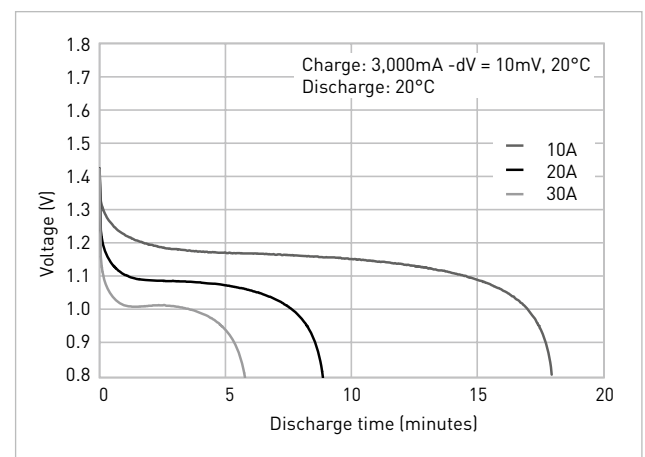
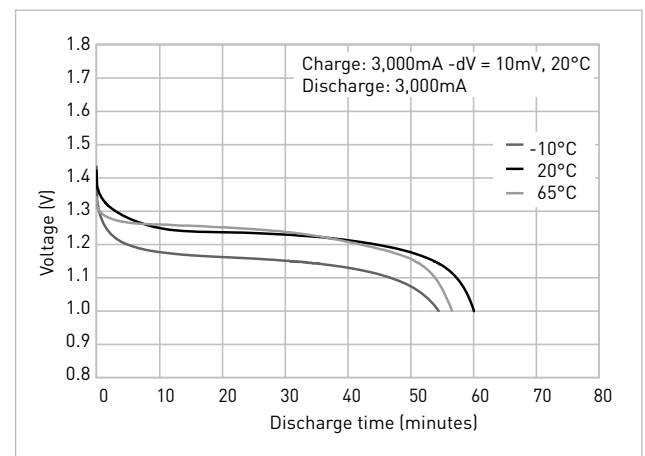
Specifications		BK-300SCP
Diameter (mm)		23.0 +0/-1.0
Total height (mm)		43.0 +0/-1.5
Approximate weight (g)		57
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	3,050
	Nominal capacity*3 (mAh)	2,800
Approx. internal impedance at 1,000Hz at charged state (mΩ)		4
Charge	Standard (mA x hrs.)	280 x 16
	Rapid*4 (mA x hrs.)	3,000 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

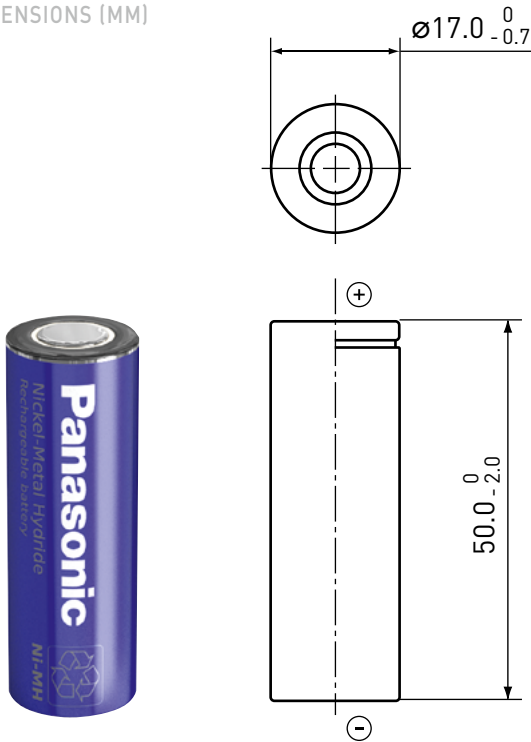


**BK-250A**

LOW TEMPERATURE TYPE  
A SIZE (HR17/50)

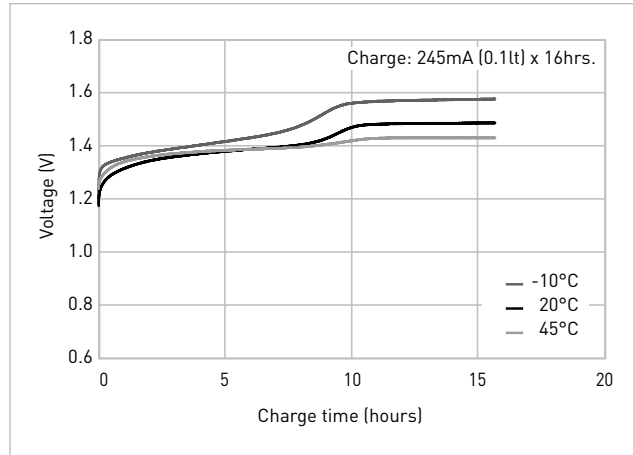


DIMENSIONS (MM)

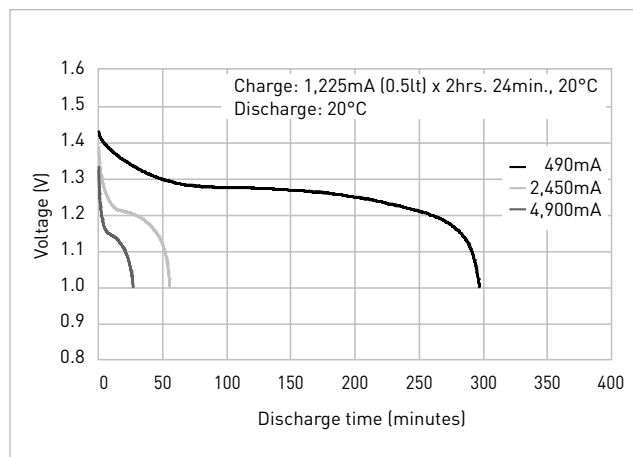
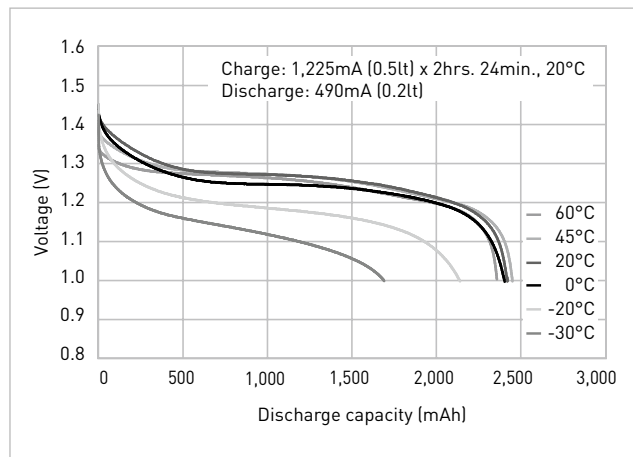


Specifications		BK-250A
Diameter (mm)		17.0 +0/-0.7
Total height (mm)		50.0 +0/-2.0
Approximate weight (g)		40
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	2,600
	Nominal capacity*3 (mAh)	2,450
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	245 x 16
	Rapid*4 (mA x hrs.)	2,450 x 1.2
Charge (°C)	Standard	0 to 45
	Rapid	0 to 40
Discharge (°C)		-10 to 65
Ambient temperature	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55
	<1 week	-20 to 65

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



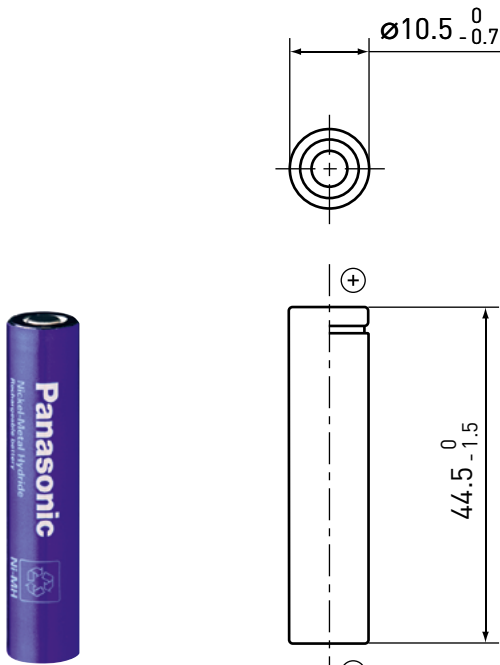
\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

**NEW** BK-60AAAW

WIDE TEMPERATURE TYPE  
AAA SIZE (HR11/45)

**W** TYPE

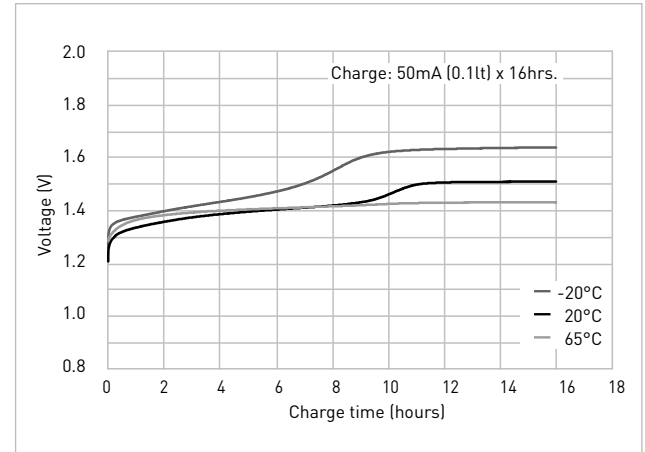
DIMENSIONS (MM)



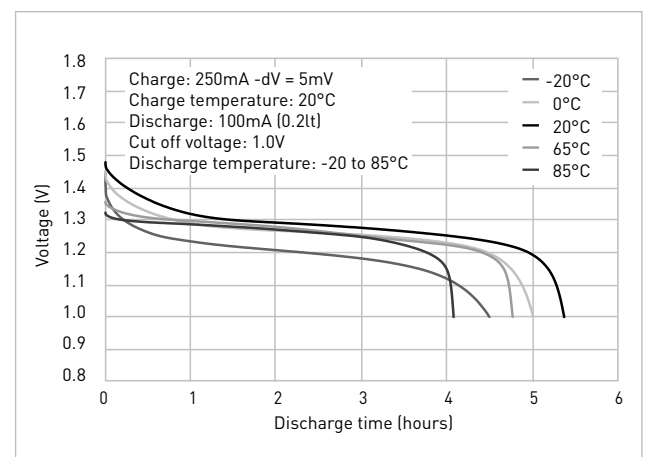
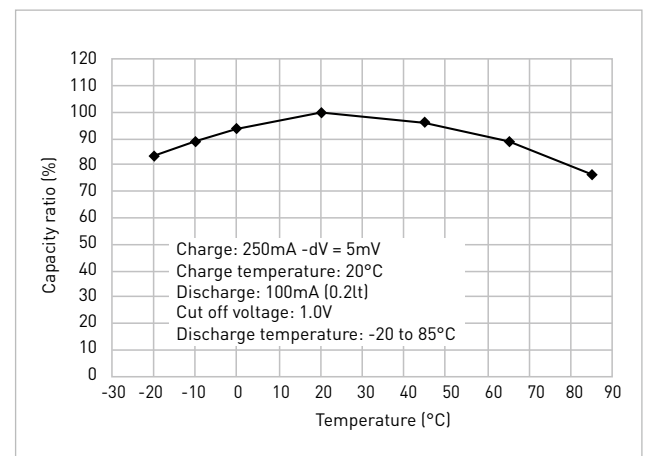
Specifications		BK-60AAAW
Diameter (mm)		10.5 +0/-0.7
Total height (mm)		44.5 +0/-1.5
Approximate weight (g)		13
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	550
	Nominal capacity*3 (mAh)	500
Approx. internal impedance at 1,000Hz at charged state (mΩ)		35
Charge	Standard (mA x hrs.)	50 x 16
	Rapid*4 (mA x hrs.)	250 x 2.4
Charge (°C)	Standard	-20 to 60
	Rapid	-20 to 45
Discharge (°C)		-20 to 85
Ambient temperature	<1 year	-40 to 35
	<6 months	-40 to 45
	<1 month	-40 to 55
	<1 week	-40 to 85

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS

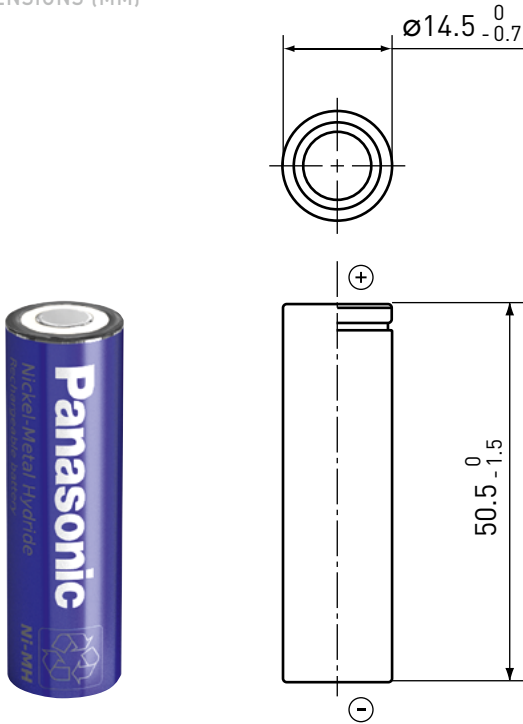


**NEW** BK-120AAW

WIDE TEMPERATURE TYPE  
AA SIZE (HR15/51)

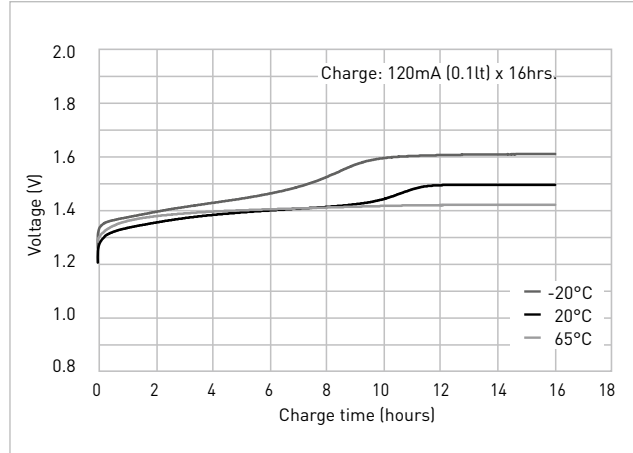


DIMENSIONS (MM)

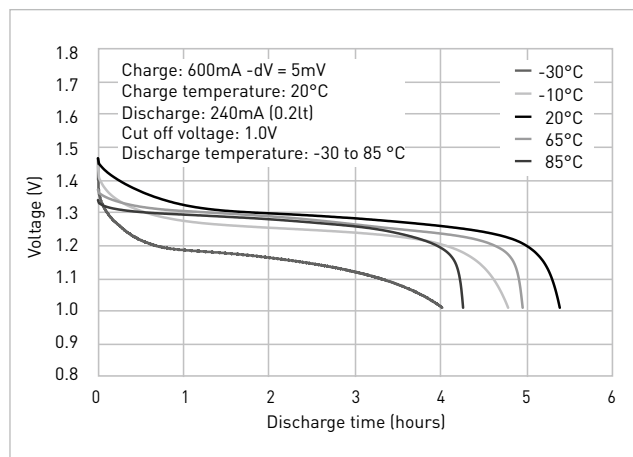
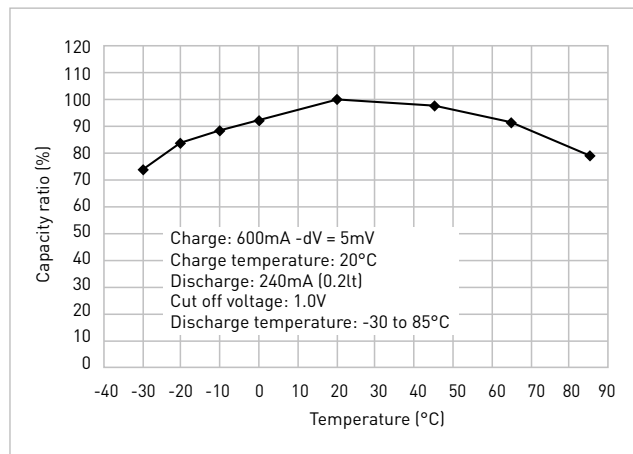


Specifications		BK-120AAW
Diameter (mm)		14.5 +0/-0.7
Total height (mm)		50.5 +0/-1.5
Approximate weight (g)		26
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	1,280
	Nominal capacity*3 (mAh)	1,200
Approx. internal impedance at 1,000Hz at charged state (mΩ)		20
Charge	Standard (mA x hrs.)	120 x 16
	Rapid*4 (mA x hrs.)	600 x 2.4
Charge (°C)	Standard	-20 to 60
	Rapid	-20 to 45
Discharge (°C)		-30 to 85
Ambient temperature	<1 year	-40 to 35
	<6 months	-40 to 45
	<1 month	-40 to 55
	<1 week	-40 to 85

TYPICAL CHARGE CHARACTERISTICS



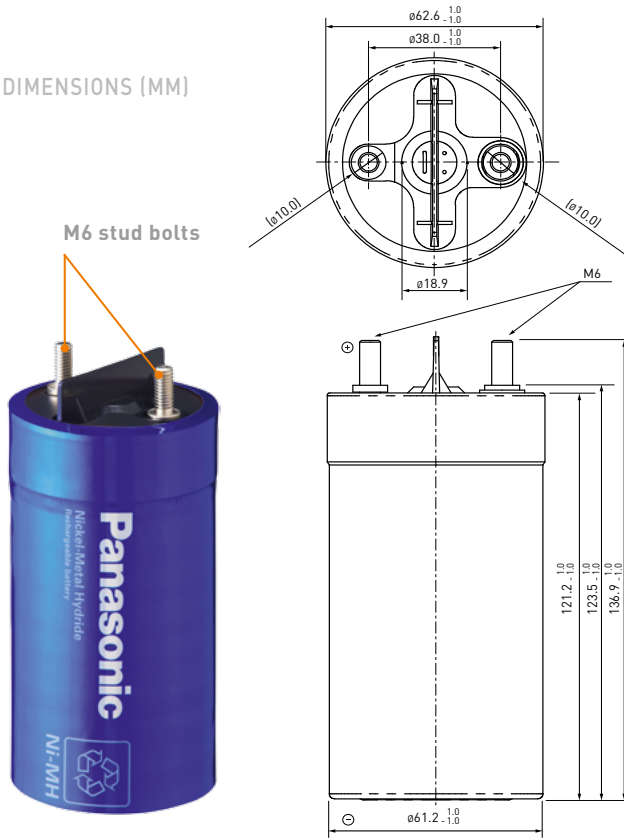
TYPICAL DISCHARGE CHARACTERISTICS



\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

**NEW** BK-06V1S1

DIMENSIONS (MM)

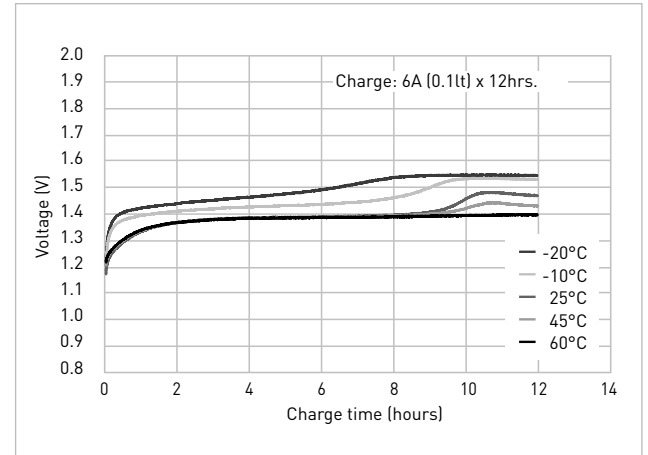


Specifications		BK-06V1S1
Diameter (mm)		62.6 +1.0/-1.0
Total height (mm)		136.9 +1.0/-1.0
Approximate weight (g)		1,100
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	65,000
	Nominal capacity*3 (mAh)	60,000
Approx. internal impedance at 1,000Hz at charged state (mΩ)		1.6
Charge	Standard (A x hrs.)	6 x 11
	Rapid*4 (A x hrs.)	20 x 3.6
Ambient temperature	Charge (°C)	-20 to 60
	Discharge (°C)	-20 to 60
Storage (°C)	<1 year	-20 to 35
	<6 months	-20 to 45
	<1 month	-20 to 55

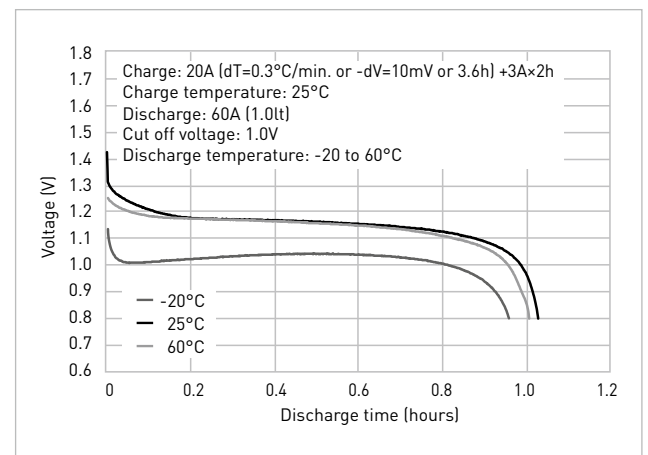
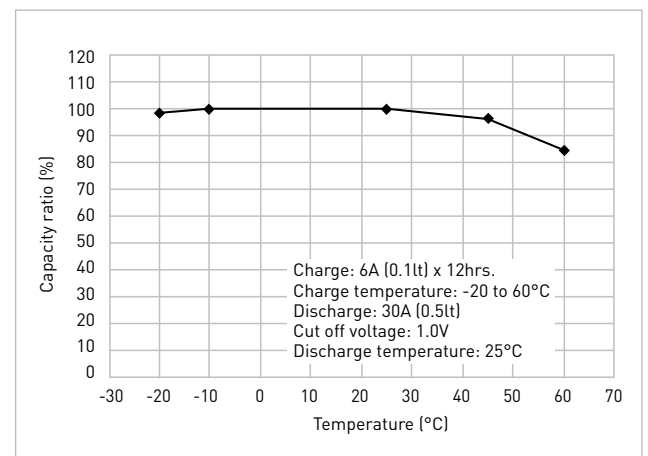
\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

INFRASTRUCTURE TYPE  
V SIZE

TYPICAL CHARGE CHARACTERISTICS



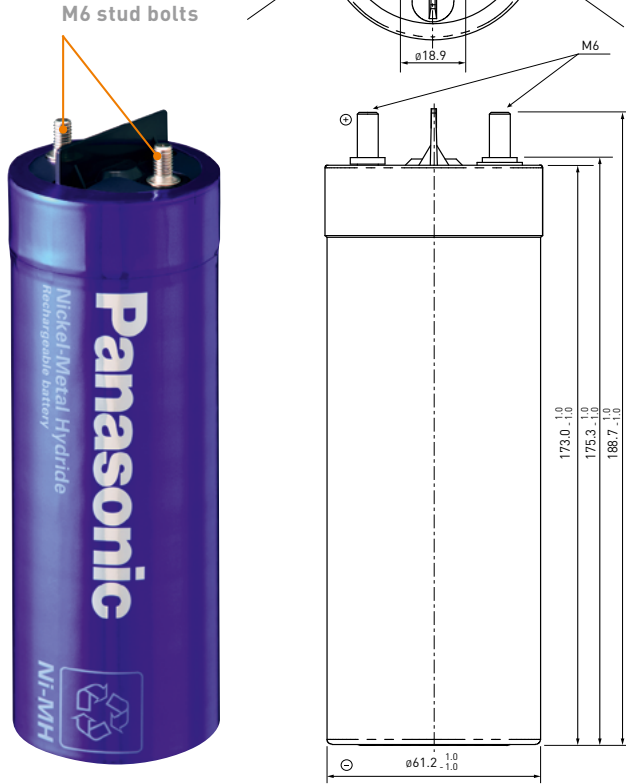
TYPICAL DISCHARGE CHARACTERISTICS



Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

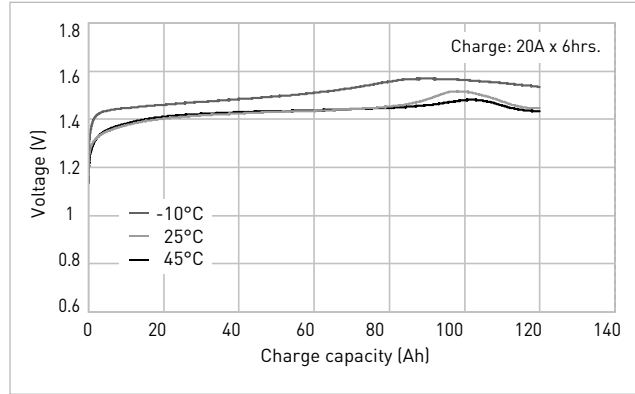
# BK-10V1S

## DIMENSIONS (MM)

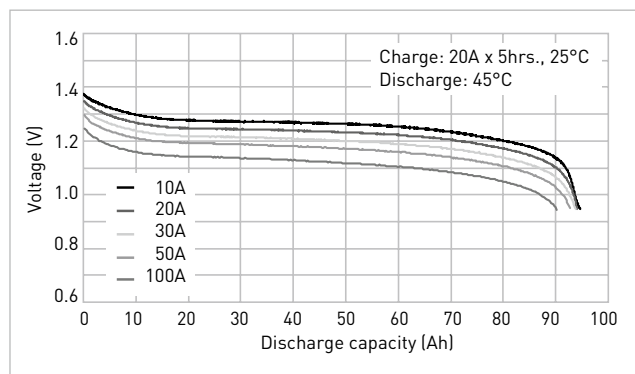
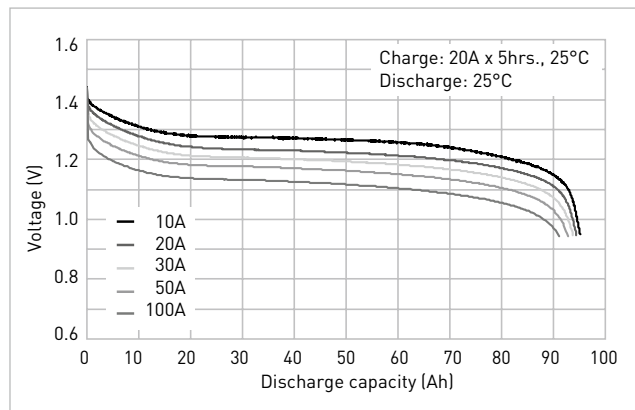
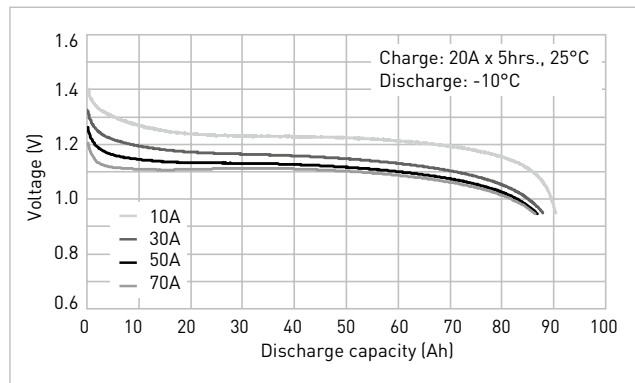


INFRASTRUCTURE TYPE  
V SIZE

## TYPICAL CHARGE CHARACTERISTICS



## TYPICAL DISCHARGE CHARACTERISTICS

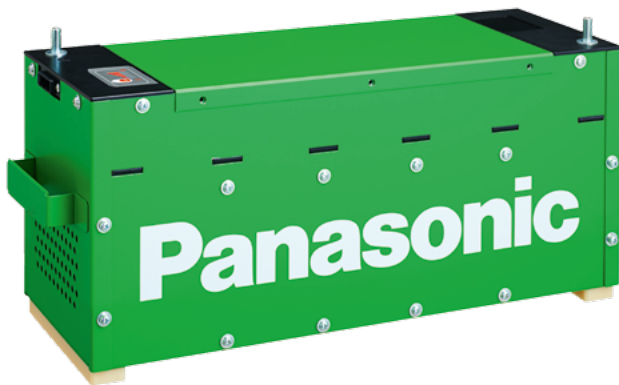
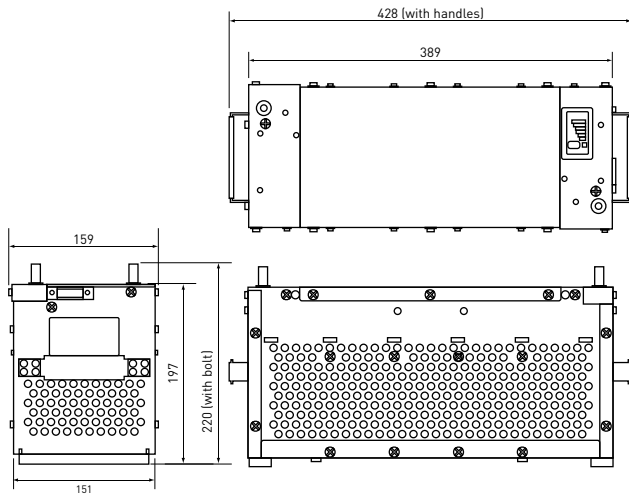


Specifications		BK-10V1S
Diameter (mm)		62.6 +1.0/-1.0
Total height (mm)		188.7 +1.0/-1.0
Approximate weight (g)		1,700
Nominal voltage (V)		1.2
Discharge capacity*1	Typical capacity*2 (mAh)	95,000
	Nominal capacity*3 (mAh)	90,000
Approx. internal impedance at 1,000Hz at charged state (mΩ)		1.6
Charge	Standard (A x hrs.)	10 x 12
	Rapid*4 (A x hrs.)	20 x 5
Ambient temperature	Charge (°C)	Standard Rapid
	Discharge (°C)	-20 to 55
Storage (°C)	<1 year	-20 to 60
	<6 months	-20 to 35
	<1 month	-20 to 45
		-20 to 55

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).  
 \*4 Need specially designed control system. Please contact Panasonic for details.

**NEW** BK-06V10T1

DIMENSIONS (MM)

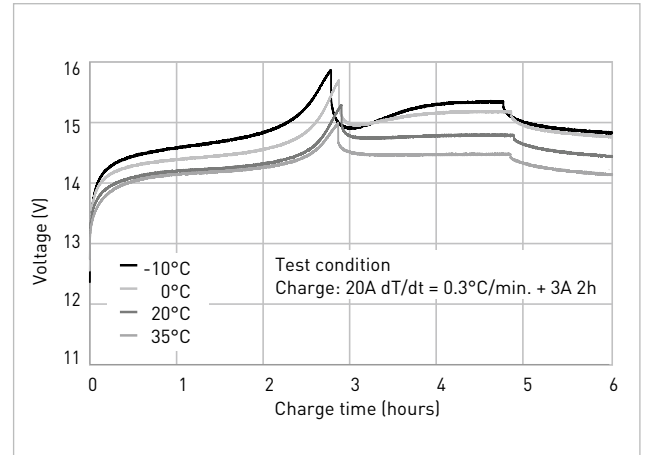


Specifications	BK-06V10T1	
Diameter (mm)	428.0 x 159.0	
Total height (mm)	220.0	
Approximate weight (g)	19,000	
Nominal voltage (V)	12.0	
Discharge capacity*1	Typical capacity*2 (mAh)	63,000
	Nominal capacity*3 (mAh)	60,000
Volume (l)	15.0	
Discharge current (A)	60	
Battery cell	10 x BK-06V1S1	
Rated (battery pack)	12V/60Ah	
Operating temperature range (°C)	-20 to 60	
Display function	Remaining capacity	

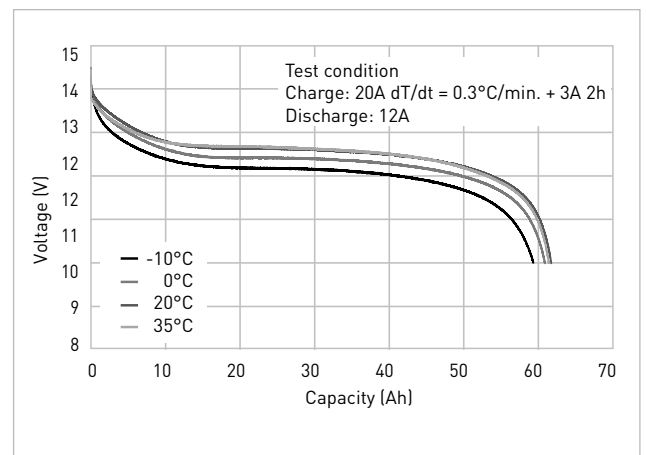
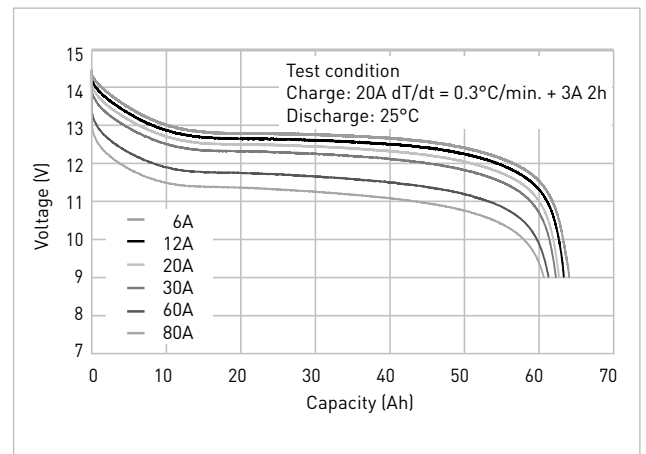
\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.  
 \*2 Average capacity (mAh). For reference only.  
 \*3 Rated capacity (mAh).

INFRASTRUCTURE TYPE  
PACK SIZE

TYPICAL CHARGE CHARACTERISTICS



TYPICAL DISCHARGE CHARACTERISTICS



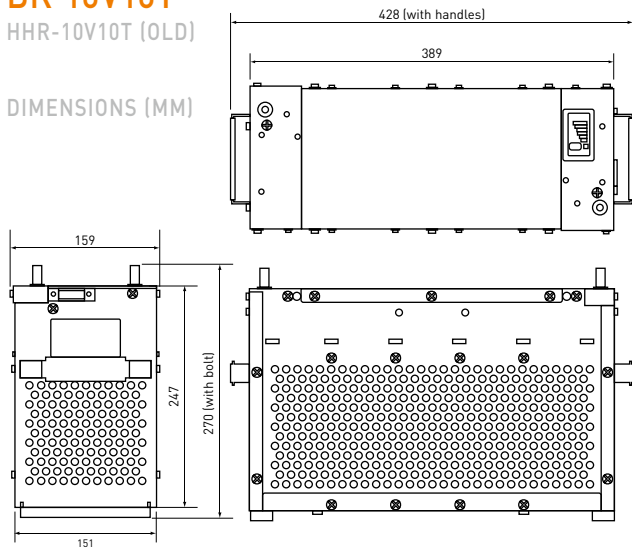
Battery performance and cycle life are strongly affected by how they are used. In order to maximise battery safety, please consult Panasonic when determining charge/discharge specs, warning label contents and design. The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.



## BK-10V10T

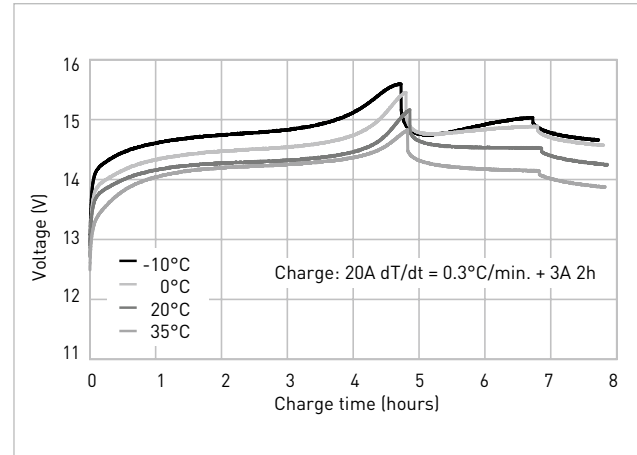
HHR-10V10T (OLD)

### DIMENSIONS (MM)

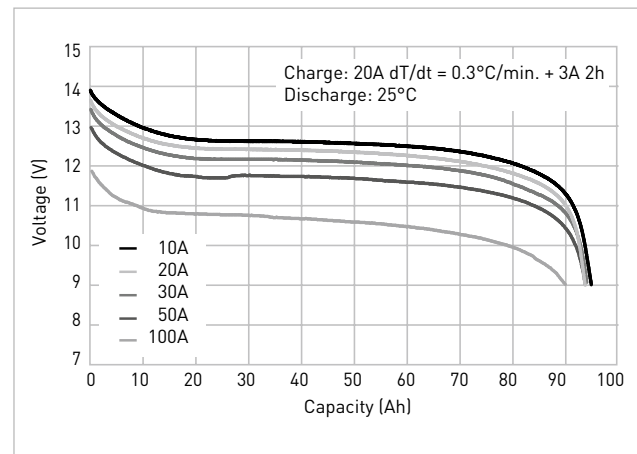


### INFRASTRUCTURE TYPE PACK SIZE

### TYPICAL CHARGE CHARACTERISTICS



### TYPICAL DISCHARGE CHARACTERISTICS

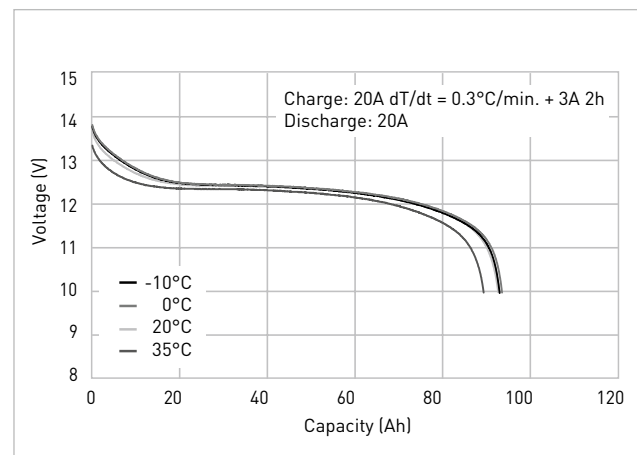


Specifications	BK-10V10T	
Diameter (mm)	428.0 x 159.0	
Total height (mm)	270.0	
Approximate weight (g)	23,000	
Nominal voltage (V)	12.0	
Discharge capacity*1	Typical capacity*2 (mAh)	95,000
	Nominal capacity*3 (mAh)	90,000
Volume (l)	18.4	
Discharge current (A)	100	
Battery cell	10 x BK-10V1S	
Rated (battery pack)	12V/90Ah	
Operating temperature range (°C)	-20 to 60	
Display function	Remaining capacity	

\*1 After charging at 0.1It for 16 hours, discharging at 0.2It.

\*2 Average capacity (mAh). For reference only.

\*3 Rated capacity (mAh).



**STRUCTURAL-RELATED ITEMS****Active material**

The electro-chemical materials of the electrodes. In rechargeable Ni-MH battery, Nickel-hydroxide is the active material of the positive electrode and hydrogen absorbing alloy is the active material of the negative electrode.

**Cell**

Each of the individual batteries which comprise a rechargeable battery.

**Electrolyte**

The medium through which ions are conducted during the electro-chemical reaction inside a rechargeable battery. In rechargeable Ni-MH battery, a potassium hydroxide water solution is generally used as the electrolyte.

**Hydrogen absorbing alloy**

Alloy which can absorb/release hydrogen reversibly.  $AB_5$  or  $AB_2$  type alloy is used for batteries. (MmNi<sub>5</sub>)  $AB_5$  type is employed in Panasonic's products.

**Negative electrode**

The electrode that has a lower electrical potential than the positive electrode to which electrical current flows from the external circuit during the discharge of a storage battery.

**Nickel Oxyhydroxide**

Expressed in chemical notation as NiOOH, this indicates that the positive electrode material of the Ni-MH battery is in a charged state. When in the discharged state, the positive electrode material becomes Nickel hydroxide, or Ni(OH)<sub>2</sub>.

**Pasted type electrode plate**

An electrode plate made by applying the active material (hydrogen absorbing compound) in a paste form onto a Nickel-plated steel porous plate. Used as the negative electrode.

**Positive electrode**

The positive electrode that has a higher electrical potential than the negative electrode from which electrical current flows to the external circuit during the discharge of a rechargeable battery.

**Safety vent**

Functions to release the gas when the internal pressure exceeds a predetermined level. In addition to preventing the absorption of external air into the rechargeable

battery, this vent also prevents the rupture of the rechargeable battery that would result from the increase in the internal pressure caused by the generation of gas during charge or at other times.

**Separator**

A porous or micro-porous thin plate, cloth, bar or frame which is inserted as a spacer between the positive and negative electrode plates for the purpose of preventing short-circuits. The separator must be non-oxidizing, resistant to chemicals, and be an electrical insulator, and it must not obstruct in any way the ionic conduction or diffusion of the electrolyte. The separator also functions to retain the electrolyte.

**ELECTRICAL-RELATED ITEMS****Capacity**

The electrical capacity of a rechargeable battery. Normally used to mean the capacity as measured in ampere-hours. Indicated in units of Ah (ampere-hours) or C (coulombs).

**Charge efficiency**

A general term meaning either ampere-hour efficiency or watt-hour efficiency. More commonly used to mean ampere-hour efficiency.

**Charge level**

The amount of electricity used for charge. For constant current charge, it is the product of multiplying the current value by the charge time. Measured in units of ampere-hours (Ah).

**C (Coulomb)**

Used to express the amount of the charge or discharge current. Expressed by attaching the current units to a numerical multiple that represents the rated capacity of the battery. The charge and discharge current are generally expressed using a C multiple. For example, for a battery having a rated capacity of 1,500mAh:

$$0.1\text{ItmA} = 0.1 \times 1,500 = 150\text{mA}$$

$$0.2\text{ItmA} = 0.2 \times 1,500 = 300\text{mA}$$

**Cut-off discharge voltage**

The voltage that indicates the limit at which discharge is completed. In practical use, this voltage is the limit to which the battery can be used.

**Electrolyte leakage**

The penetration of the electrolyte to the outside of the battery.

**Energy density**

The amount of energy that can be obtained per unit weight or per unit volume of a rechargeable battery. Unit: wh/kg, wh/l.

**Excessive discharge**

The discharge of a rechargeable battery to lower than the specified cut-off discharge voltage may cause negative impact.

**High rate discharge**

Discharge at a relatively large current with respect to the battery capacity. Also called high efficiency discharge and high-current discharge.

**Nominal voltage**

The voltage used to indicate the battery voltage. Generally a value slightly lower than the electromotive force is used. For example, the nominal voltage of rechargeable Ni-MH batteries is 1.2V per cell.

**Open circuit voltage**

The voltage of a battery when that battery is electrically cut-off from the external circuit.

**Overcharge current**

Charge after the fully charged state has been reached. In a rechargeable battery that requires water replenishment, the electrolysis of the water causes a sharp decrease in the amount of electrolyte. Generally, the overcharge of a rechargeable battery will shorten the battery's cycle life.

**Rapid charge**

Charge quickly using a large current.

**Rated capacity**

The standard value for the amount of electricity which can be obtained from the battery in a fully charged state at the specified temperature, discharge current, and cut-off discharge voltage. Measured in units of ampere-hours (Ah). Note that CN is used as a symbol to express the rated capacity at a rate of N hours.

**Reverse charge**

Charge with the polarities reversed. If the polarities are reversed, all of the electrical energy will be used to generate gas.

**Self-discharge**

A decrease in the capacity of a rechargeable battery without any discharge of current to the external circuit.

**OTHER TERMS****Alkaline storage battery**

A storage battery that uses an Alkaline water solution as its electrolyte. Generally refers to Ni-MH batteries.

**Cycle use**

A method of use in which charge and discharge are repeated over and over again.

**IEC standards**

The standards established by the International Electro-technical Commission (IEC).

**Our Panasonic batteries are in compliance with the following standards: IEC61951-2, IEC45014, IEC62133**

Please contact Panasonic in order to get more details.



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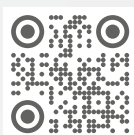
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The Panasonic Battery Finder App is available for Android and iOS (iPhone) devices and can be downloaded free of charge in both stores. Scan QR code to be redirected to the appropriate store and download app.



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