

# FDK

# BATTERY CATALOGUE



FDK CORPORATION



Supporting your life and society with smart energy solutions that utilize safe and secure batteries.



# Smart Ener

FDK started with the manufacture and sale of carbon zinc batteries. With the expertise we gained in related technologies, we have provided products that respond to the demands and changes of the times on a global scale.

As a "Smart Energy Partner" we contribute globally to society with technology that efficiently uses electric energy. In addition, we provide support to solve the problems of society and our customers with products and services that bring together our strengths in battery technologies, circuit technologies and power electronics technologies.



# gy Partner

# FDK Battery Chronology

1950 ● Company founded  
Launched NOVEL brand  
carbon zinc batteries



1953 ● Capital alliance with Fuji Electric  
and Fuji Electric battery production started

1958 ● Company name changed to Fuji Electrochemical Co., Ltd

1967 ● Alkaline battery production started

1983 ● Launched lithium batteries



Takasaki plant

1984 ● Launched FUJITSU brand batteries

2001 ● Company name changed to FDK Corporation



Tottori plant

2010 ● Acquired Sanyo Energy Twicell Co., Ltd.  
and Sanyo Energy Tottori Co., Ltd.

2011 ● Launched thin-type primary lithium batteries



2012 ● Launched FUJITSU brand Ni-MH battery and charger sets

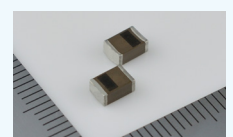


2014 ● Launched FUJITSU brand  
"Premium", "High Power", and "Universal Power" alkaline batteries  
Launched FUJITSU brand low self-discharge "Premium High Capacity",  
and "Standard Capacity" Ni-MH batteries



2020 ● **Under development**

- World's highest standard small all-solid-state SMD batteries
- Next-generation metal-hydride/air batteries



# FDK Product Lineup



## Ni-MH BATTERY P5

Ni-MH are a type of rechargeable batteries. FDK batteries feature stable discharge voltage, high current discharge, are resistant to over-charge and over-discharge, and have excellent safety.

## LITHIUM BATTERY P15



Taking advantage of lithium metal's high per-mass capacity in the negative electrode material, FDK's technology realizes a highly reliable and long-lasting power supply solution over a wide range of temperature conditions.



## ALKALINE BATTERY P25

High power and superior performance batteries. Long duration for high power consumption equipment. FDK Alkaline batteries meet everyone's needs for various equipment with high reliability.

JAPAN  
Quality

### JAPAN Quality

FDK is proud of our battery performance. All are built in accordance with Japanese quality standards, which is truly the result of Japanese technology. We are committed to delivering to the world safe and secure batteries.



Takasaki Plant



Washizu Plant



Tottori Plant



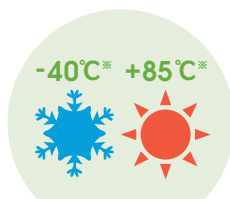
# Ni-MH BATTERY



FDK Ni-MH batteries are resistant to over-charge and over-discharge, have excellent safety, and can be easily transported. In addition, Ni-MH batteries are easy to recycle because they contain a high nickel content.

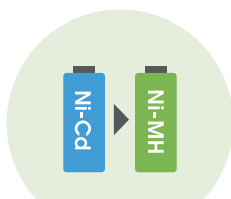


Rechargeable and environmentally friendly



Usable in a wide temperature range

※ limited to in-vehicle Low-temp discharge model



Best for replacing Ni-Cd batteries due to longer life



High recyclability



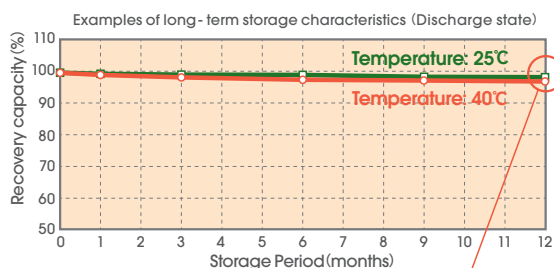
Easy to transport

## Features of FDK nickel metal-hydride batteries

### FDK original technology

#### Positive electrode material

Nickel hydroxide coated with a highly conductive cobalt compound

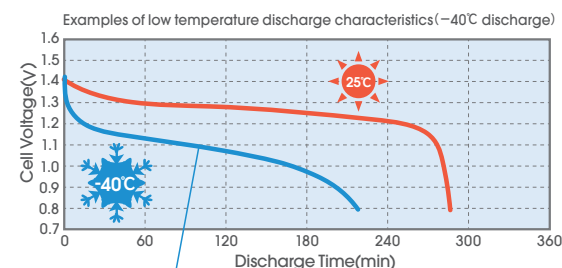


Suppressed capacity deterioration after long-term storage

Model: HR-AAULT Charge: 1000mA (-ΔV=10mV) Rest: 1hr.  
Discharge: 1000mA (End Voltage=1.0V)  
Ambient temperature: 25°C

#### Negative electrode material

Super lattice hydrogen absorbing alloy



Can be used even at -40°C depending on usage conditions

Model: HR-AAUTE Charge: 500mA (-ΔV=10mV) Ambient Temperature: 25°C  
Rest: 3hr. Discharge: 100mA (End Voltage=0.8V)  
Ambient Temperature: -40°C

## Applications for FDK nickel metal-hydride batteries

FDK's line-up of Ni-MH batteries offer an exceptional solution for your energy needs, and may be used in a wide variety of applications to enhance performance while extending runtime.

	High Durability for In-Vehicle Applications	High Durability	High-Rate Discharge	Standard	Dry Cell Compatible
1 Security		security			
2 In-vehicle transportation	eCall · eToll dashboard cameras	reefer containers	electric bikes		
3 Emergency		emergency lighting			
4 Medical & health care		bedside monitors	electric wheelchairs	electric wheelchairs	electric sphygmomanometers
5 Lighting				external camera flashes	flashlights
6 Home appliances		electric shavers		vacuum cleaners	cordless mice remote controllers
7 Information		UPS, base stations		wireless devices	cordless keyboards phone chargers
8 Construction		elevator landing devices		street lights solar systems	transceivers
9 Toys			remote control toys		
10 Power tools			electric tools		

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FDK Ni-MH batteries have a wide operating temperature range (-40 to +85°C) for in-vehicle applications. They work especially well in low temperatures, making them ideal for cold regions.

Wide operating temperature range

[Standard Ni-MH Battery]

0~+50°C

0.2If discharge

[High durability Ni-MH Battery for In-Vehicle Applications]

-20~+85°C<sup>※1</sup>

Low-temp discharge model

-40~+85°C<sup>※1</sup>

## High Durability Ni-MH Battery for In-Vehicle Applications

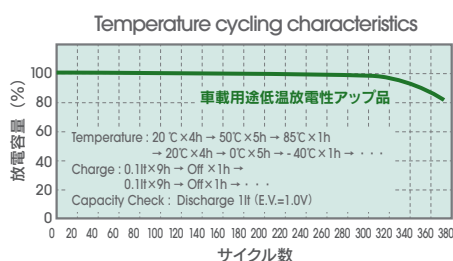
The high durability model for in-vehicle applications allows a long life providing continuous usage over a wide temperature range.



### Features

#### • Usable in a wide temperature range

The high durability model for in-vehicle applications can be used in a wide temperature range (-40°C to +85°C) as is required for in-vehicle applications. The battery life is also significantly longer than the standard Ni-MH Battery. In addition, these batteries utilize a safe, water-based electrolyte and thus are suitable for in-vehicle applications.



### Applications

- eCall, eToll, dashboard cameras etc.



T series Model	HR-2/3AAAUT	HR-AAAUT	HR-AAAUTE Low-temp discharge model	HR-AAULT	HR-AAUTE Low-temp discharge model	HR-4/3FAUT
Nominal Voltage	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V
Typical Capacity <sup>※2</sup>	220mAh	500mAh	500mAh	1050mAh	1100mAh	3700mAh
Minimum Capacity <sup>※3</sup>	200mAh	460mAh	460mAh	1000mAh	1000mAh	3500mAh
Quick-Charge <sup>※4</sup>	Current	220mA	500mA	500mA	1050mA	1100mA
	Time	1.1h	1.1h	1.1h	1.1h	1.4h
Dimensions (incl.tube) <sup>※5</sup>	Diameter	10.5mm	10.5mm	10.5mm	14.2mm	14.2mm
	Height	30.0mm	44.5mm	44.5mm	49.0mm	50.0mm
Weight <sup>※5</sup>	8g	13g	13g	25g	27g	58g

※1: Battery capacity and life may be reduced at extreme temperatures. Please contact us for details. ※2: Typical capacity when a single cell is discharged at 0.2If after being charged at 0.1If for 16 hours. ※3: Minimum capacity when a single cell is discharged at 0.2If after being charged at 0.1If for 16 hours. ※4: Consult FDK according to conditions of use. ※5: Including label / heat shrink tube.

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# High Durability Ni-MH Battery

Long life / high reliability.



## Features

### • Long life

Excellent battery life in repeated charge/discharge conditions. Suitable for nickel cadmium battery replacement (for emergency lights, emergency exit lights, and security equipment), for solar power generation, and wind power generation batteries.

## Applications

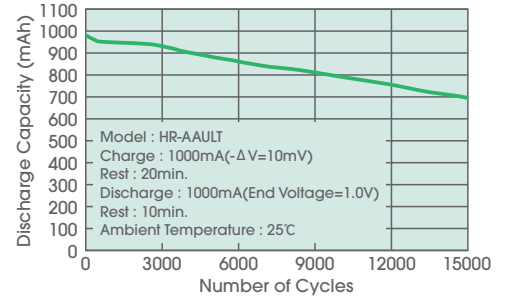
### • T-series (highest grade long life model)

Suitable for emergency lights, emergency exit lights, security equipment, communication base stations, medical equipment, ATMs, POSs, traffic road studs and various backup power supplies. T-series batteries are MT-designated battery defined in IEC61951-2.

### • C-series

Suitable for home appliances (shavers, electric toothbrushes etc.), measuring instruments, medical equipment, elevator B/U, UPS, server backup systems, vending machines and various backup power supplies. C-series batteries can achieve excellent battery life by using an intermittent charging method or a timer charging method for maintenance charging after main charging.

Charge / Discharge Cycle Characteristics



## Specifications

T series Model	HR-2/3AAAUTU High durability model	HR-AAAUT	HR-AAULTU	HR-AAULT	HR-AAUT	HR-4/5FAUPT	HR-AUT	HR-5/4SCUT	HR-4/3FAUT
Nominal Voltage	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V
Typical Capacity <sup>※1</sup>	220mAh	500mAh	780mAh	1050mAh	1580mAh	1650mAh	2200mAh	3250mAh	3700mAh
Minimum Capacity <sup>※2</sup>	200mAh	460mAh	700mAh	1000mAh	1500mAh	1500mAh	2000mAh	3000mAh	3500mAh
Quick-Charge <sup>※3</sup>	Current	220mA	500mA	780mA	1050mA	1580mA	2200mA	3250mA	3000mA
	Time	1.1h	1.1h	1.1h	1.1h	1.1h	1.1h	1.1h	1.4h
Dimensions (incl.tube) <sup>※4</sup>	Diameter	10.5mm	10.5mm	14.2mm	14.2mm	14.2mm	18.1mm <sup>※5</sup>	17.0mm	23.0mm
	Height	30.0mm	44.5mm	49.0mm	49.0mm	50.0mm	43.2mm <sup>※5</sup>	50.0mm	67.5mm
Weight	8g	13g	20g	25g	26g	37g	37g	69g	58g

※1: Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※2: Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※3: Consult FDK according to conditions of use. ※4: Including heat shrink tube. ※5: Including paper tube / heat shrink tube.

C series Model	HR-AAUC	HR-4/5AAUC	HR-AAUC	HR-4/5AUC	HR-4/3FAUHPC	HR-4/3FAUCP
Nominal Voltage	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V
Typical Capacity <sup>※1</sup>	700mAh	1100mAh	840mAh   1200mAh	1700mAh	2700mAh	3200mAh
Minimum Capacity <sup>※2</sup>	650mAh	1000mAh	770mAh   1100mAh	1550mAh	2500mAh	3050mAh
Quick-Charge <sup>※3</sup>	Current	700mA	1100mA	840mAh   1200mA	1700mA	2700mA
	Time	1.1h	1.1h	1.1h	1.1h	1.1h
Dimensions (incl.tube) <sup>※4</sup>	Diameter	10.5mm	14.2mm	14.2mm	17.0mm	18.1mm <sup>※5</sup>
	Height	44.5mm	43.0mm	50.0mm	43.0mm	67.0mm <sup>※5</sup>
Weight	12g	21g	18g   22g	31g	57g	59g

※1: Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※2: Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※3: Consult FDK according to conditions of use. ※4: Including heat shrink tube. ※5: Including paper tube / heat shrink tube.

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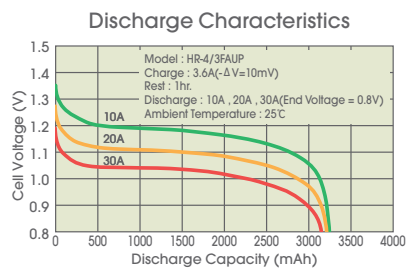
# High-Rate Discharge Ni-MH Battery



Suitable for high drain use with stable voltage.

## Features

- **Superior high-rate discharge characteristics**  
FDK's original electrode manufacturing process, coupled with specialized current collectors minimize internal impedance, which in turn enables high-rate discharging and guarantees a stable discharge voltage.



## Applications

- Power tools, vacuum cleaners, electric motor applications etc.



## Specifications

Model	HR-4/5FAUP	HR-4/3FAUHPC	HR-SCU	HR-4/3FAUPC	HR-4/3FAUP		
Nominal Voltage	1.2V	1.2V	1.2V	1.2V	1.2V		
Typical Capacity <sup>※1</sup>	1950mAh	2700mAh	3000mAh	3200mAh	3600mAh	4000mAh	
Minimum Capacity <sup>※2</sup>	1800mAh	2500mAh	2700mAh	3050mAh	3400mAh	3750mAh	
Quick-Charge <sup>※3</sup>	Current	1950mA	2700mA	3000mA	3200mA	3600mA	4000mA
	Time	1.1h	1.1h	1.1h	1.1h	1.1h	
Dimensions (incl.tube) <sup>※4</sup>	Diameter	18.1mm <sup>※5</sup>	18.1mm <sup>※5</sup>	23.0mm	18.1mm <sup>※5</sup>	18.1mm <sup>※5</sup>	
	Height	43.2mm <sup>※5</sup>	67.0mm <sup>※5</sup>	43.5mm	67.0mm <sup>※5</sup>	67.0mm <sup>※5</sup>	
Weight	39g	57g	59g	59g	59g	58g	

※1: Typical capacity when a single cell is discharged at 0.1It after being charged at 0.1It for 16 hours. ※2: Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※3: Consult FDK according to conditions of use. ※4: Including heat shrink tube. ※5: Including paper tube / heat shrink tube.

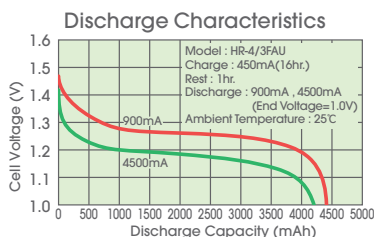
# Standard Ni-MH Battery



For general industrial applications.

## Features

- **High energy density**  
Standard Ni-MH batteries achieve a high energy density by using exclusively developed materials and construction. Standard Ni-MH batteries can allow for an extended run time in various applications.



## Applications

- Audio / video equipment, information / communication devices, lighting equipment, measuring instruments, home appliances, toys etc.



## Specifications

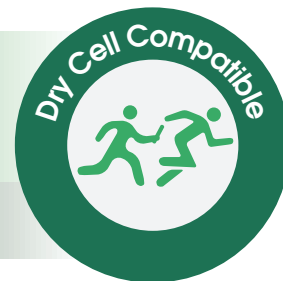
Model	HR-5/4AAAU	HR-AAUE Low-temp discharge model	HR-AAU	HR-4/5AU	HR-AU	HR-AUE Low-temp discharge model	HR-4/3AU	HR-4/3FAU
Nominal Voltage	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V
Typical Capacity <sup>※1</sup>	850mAh	1400mAh	1650mAh	2150mAh	2700mAh	2700mAh	4000mAh	4500mAh
Minimum Capacity <sup>※2</sup>	760mAh	1250mAh	1500mAh	1950mAh	2450mAh	2450mAh	3600mAh	4100mAh
Quick-Charge <sup>※3</sup>	Current	850mA	1400mA	1650mA	2150mA	2700mA	3000mA	3000mA
	Time	1.1h	1.1h	1.1h	1.1h	1.1h	1.1h	1.4h
Dimensions (incl.tube) <sup>※4</sup>	Diameter	10.5mm	14.2mm	14.2mm	17.0mm	17.0mm	17.0mm	18.0mm
	Height	50.0mm	50.0mm	50.0mm	43.0mm	50.0mm	50.0mm	67.5mm
Weight	14g	25g	27g	33g	37g	39g	53g	59g

※1: Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※2: Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※3: Consult FDK according to conditions of use. ※4: Including heat shrink tube.

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# Dry Cell Compatible Ni-MH Battery

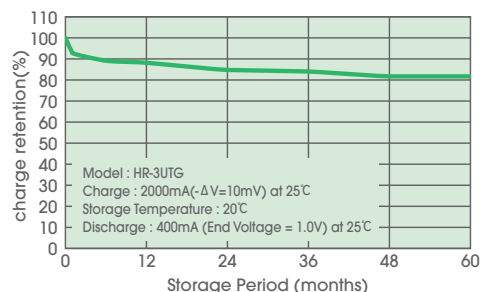
Rechargeable consumer batteries that can save resources.



## Features

- Dry cell compatible form factor**  
 Dry cell compatible Ni-MH batteries can be used in most equipment that use dry cells.
- Cost effectiveness**  
 Economical batteries with less waste due to being rechargeable unlike a dry cell.
- Low self-discharge**  
 Ready to use after purchasing, can be stored as emergency supplies.

Self-Discharge Characteristics



## Applications

- For digital cameras, PDAs, audio equipment, remote controls, clocks, radio-controlled hobby items, amateur 2-way radio etc.



## Specifications

Model	HR-4UTG <sup>※5</sup>	HR-4UQ <sup>※5</sup>	HR-4U	HR-3UTG <sup>※5</sup>	HR-3UQ <sup>※5</sup>	HR-3UWX <sup>※5</sup>	
Nominal Voltage	1.2V	1.2V	1.2V	1.2V	1.2V	1.2V	
Typical Capacity <sup>※1</sup>	800mAh	600mAh	1000mAh	2000mAh	1000mAh	2500mAh	
Minimum Capacity <sup>※2</sup>	750mAh	550mAh	930mAh	1900mAh	950mAh	2400mAh	
Quick-Charge <sup>※3</sup>	Current	800mA	600mA	1000mA	2000mA	1000mA	2500mA
	Time	1.1h	1.1h	1.1h	1.1h	1.1h	1.1h
Dimensions (incl.tube) <sup>※4</sup>	Diameter	10.5mm	10.5mm	10.5mm	14.35mm	14.2mm	14.5mm
	Height	44.5mm	44.5mm	44.5mm	50.4mm	50.4mm	50.4mm
Weight	13g	11g	13g	27g	19g	32g	

※1: Typical capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※2: Minimum capacity when a single cell is discharged at 0.2It after being charged at 0.1It for 16 hours. ※3: Consult FDK according to conditions of use. ※4: Including label / heat shrink tube. ※5: Low self-discharge model

# Battery Pack, Battery System

FDK provides options for battery packs and battery systems depending on the requirements of each application.

When batteries are used in equipment, most instances are as battery packs or battery systems. FDK has a wealth of experience with battery packs, as well as both custom designed and standard battery systems. We design and manufacture with consideration of battery safety and reliability for each application.

- Battery pack (assembly of multiple cells)
- Battery system (assembly of multiple cells with BMS that controls charge and discharge)



## Incorporating Battery Packs

### Standard Configuration

When using batteries in equipment, battery model, number of cells and shape will differ depending on rated power, space and usage conditions of equipment.

#### ● Connection shape

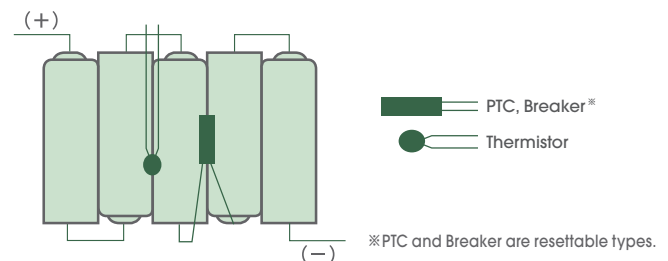


#### ● Terminal direction



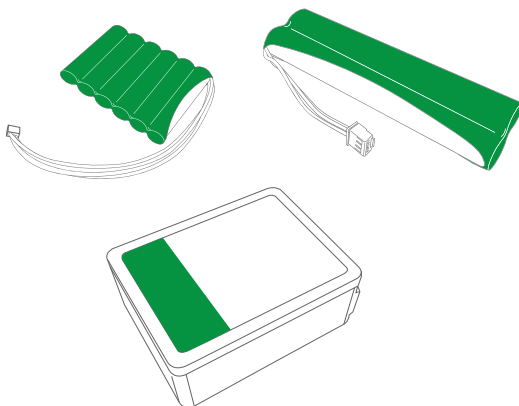
### Safety Device

When designing an assembled battery, it is necessary to install a safety device in case of charger failure and external short circuit. FDK recommends that the following parts are built into the assembled battery.



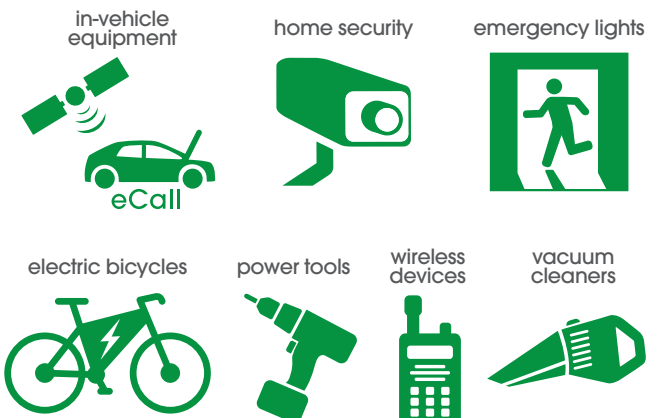
### Battery Pack Shape Example

FDK can produce battery packs with various shapes according to usage. Our cases can be made from heat shrink tubing, resin, metal etc. Please consult us regarding the electrical wiring and terminal types.



### Usage of Battery Packs

Our products are used in various applications such as in-vehicle applications, emergency lighting, home-use, etc. Please contact us about the usage of applications, ambient temperature, charge and discharge conditions, etc.



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# Battery System

FDK save our customers' development resources by providing batteries with control functions according to the application.

Our battery packs include a battery management system (BMS) that controls charging and discharging. This brings out the best performance of Ni-MH batteries and contributes to improving the function of our customers' products while reducing development time.

## Battery Management System

FDK's BMS is an original system that has functions to control charge and discharge, as well as diagnose and predict battery life etc.

### Battery Management

- **Charge/discharge control:**  
Prevents over-charge and discharge, and minimizes battery performance degradation
- **Self-diagnosis function:**  
Diagnosis of charge circuit and discharge circuits  
High reliability (internal resistance and self-discharge rate) through battery diagnostics
- **Lifetime prediction function(Options):**  
Capable of predicting battery lifetime through usage and environmental history and giving advanced notice

### Custom Control

### Function Development

### Example

- ① Low temperature charge control function for cold regions
- ② Lifetime prediction function to reduce the number of battery replacements
- ③ Charge control function with built-in charge circuit




## Custom Designed Battery System

Our battery systems have achieved use in many applications requiring high reliability such as medical equipment, infrastructure, and information equipment.

<b>Data centers</b> For servers DC12V 280W output	For medical equipment DC12V 70W output	For elevator automatic landings DC48V 1kW output
	For disaster response vending machines DC48V 450W output	For base stations DC48V 2kW output

## Standard Battery System

We offer standard battery systems with DC12V, DC24V, and DC48V input and output.

Model	BBUS-100012-01	BBUS-122024-02	BBUS-921048-01	BBUS-192048-01
Output Voltage	DC12V	DC24V	DC48V	
Capacity	10Wh	1100Wh	920Wh	1900Wh
Output current/power	50W	30A	45A	1kW
Dimensions	W 101mm D 150mm H 20mm	W 300mm D 422mm H 150mm	W 375mm D 235mm H 191mm	W 448mm D 460mm H 85.8mm
Weight	460g	25kg	19.5kg	31kg
Utility	Power supply backup for industrial computers and surveillance cameras 	Power supply backup for communication equipment, railway signal equipment, and surveillance cameras 	Power supply backup for communication devices, base stations, and surveillance cameras 	

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# Ni-MH Battery Charger for 10-20 Series Battery Packs

- ✓ Designed to charge 10-20 series Ni-MH battery pack.  
※Please contact us if you have a request in regards to other series.
- ✓ Offers most suitable charge control.
- ✓ Includes refresh discharge function.
- ✓ Includes overcharging and overheating prevention function.



Item	Contents	Item	Contents
Input	AC100~240V 50-60Hz	Indicators	Charging: Red light
Rating Output Voltage	10 Cells: DC14V 20 Cells: DC28V		Fully charged: Green light
Charging Current	1.65A (Constant current)		Refreshing: Orange light
Charging Time	Approx. 2 hours (Capacity: 3200mAh)	Safety Approval	PSE
	Approx. 2.5 hours (Capacity: 4000mAh)	Dimensions	170(L) × 95(W) × 59(H) mm
Charging Control	-ΔV, battery temperature detection, timer	Weight	600g
Refresh Discharge Function	Refresh discharge time: Approx. 9 hours (Capacity: 3200mAh)	Operating Temperature	0°C ~ +40°C
		Storage Temperature	-20°C ~ +60°C

## Charging Method

Charging Method	Constant current charging					
	Main charging				Maintenance charging	
	Quick charging			Low rate charging	Pulse current charging	Intermittent charging
Overview	Peak voltage control charging	dT/dt control charging	-ΔV control charging	Timer control charging		
V : Battery voltage I : Charge current T : Battery temperature						
	Terminate charging by detecting battery peak voltage	Terminate charging by detecting battery temperature rate	Terminate charging by detecting specified battery voltage drop after peak voltage	Terminate charging by counting elapsed time	Charging by pulse current to compensate self-discharge after main charging to keep fully charged state	Charging intermittently after main charging to return to fully charged state (Factor of recharging: battery voltage, elapsed time)
Charging Time	1~2h	1~2h	1~2h	11~12h	—	—
Charging Current <sup>※1</sup>	0.5~1.0It	0.5~1.0It	0.5~1.0It	0.1It	1/20~1.0It (Avg.1/500It)	1/20~1.0It
High Capacity Type	◎	◎	◎	○	◎	◎
High Durability Type	◎	◎	◎	—	○	○
High-Rate Discharge Type	◎	◎	◎	—	○	○
Dry Cell Compatible Type	◎	○	◎	○ <sup>※2</sup>	—	○

◎ Recommended : Suitable to exhibit battery performance. ○ Available : Can be used depending on the specification of equipment.

● 1It(A) = Rated capacity (Ah) / 1 (h)

● Proper charging method and charging condition are depending on the specification/usage of equipment or structure of battery pack. Please contact us for details.

※1 Charging current is just a reference, please contact us for details.

※2 Some charging methods should not be applied to dry cell compatible batteries regardless of equipment specification. Please contact us for details.

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## Ni-MH Batteries Handling Precautions for Safe Use

Carefully read these instructions before using Ni-MH batteries for the first time.

For your safety and that of your customers, observe all cautionary information provided in this manual. Save this manual for future reference. The following information is intended to highlight potential safety hazards that can be associated with the misuse, misapplication or damage of Ni-MH batteries. Please carefully evaluate the information in this section when using Ni-MH batteries (single cells or assembled batteries) or when using or manufacturing equipment incorporating Ni-MH batteries. This catalogue is not a substitute for independent evaluation of equipment incorporating Ni-MH batteries. Customers incorporating Ni-MH batteries into their equipment must assure that their completed product has been properly designed, manufactured and tested. End users of equipment incorporating Ni-MH batteries should also be provided with sufficient warnings and instructions on their safe operation. As appropriate, some or all of the following warnings and information should be incorporated into the instruction manual accompanying your equipment.

### ⚠ DANGER

- Failure to carefully observe the following procedures and precautions can result in leakage of battery fluid (electrolyte), heat generation, bursting, fire and serious personal injury.
  - Never dispose of Ni-MH batteries in a fire or heat them. Doing so may melt the insulation, damage the gas release vents or protective devices, ignite hydrogen gas, and cause leakage of battery fluid (electrolyte), heat generation, bursting and fire.
  - Do not connect the ⊕ (positive) and ⊖ (negative) terminals of Ni-MH batteries together with electrically conductive materials, including lead wires. Do not transport or store Ni-MH batteries with their terminals uncovered or in contact with a metal object (such as a necklace) or other conductive material. Doing so may cause short circuit, which would result in excessive current flow and possibly cause leakage of battery fluid, heat generation, bursting and fire. When carrying or storing batteries, use an appropriate case.
  - Only charge Ni-MH batteries using chargers that satisfy FDK's specifications. Only charge batteries under the conditions specified by FDK. Failure to follow proper charging procedures may cause excessive current flow, loss of control during charging, leakage of battery fluid, heat generation, bursting and fire.
  - Never disassemble Ni-MH batteries. Doing so may cause an internal or external short circuit or result in exposed material of battery reacting chemically with the air. It may also cause heat generation, bursting and fire. Also, this is dangerous as it may cause exposure to alkaline fluid.
  - Never modify or reconstruct Ni-MH batteries. Protective devices to prevent danger are built into batteries (single cells or assembled batteries). If these are damaged, excessive current flow may cause loss of control during charging or discharging of the battery, leakage of battery fluid, heat generation, bursting and fire.
  - Never solder lead wires directly on to Ni-MH batteries. The heat of the soldering operation may melt the insulation, damage the gas release vents or protective devices, cause leakage of battery fluid, heat generation, bursting and fire.
  - The ⊕ (positive) and ⊖ (negative) terminals of Ni-MH batteries are predetermined. Do not force the terminal connection to a charger or equipment. If the terminals cannot be easily connected to the charger or equipment, check if the ⊕ and ⊖ terminals are correctly positioned. If the terminals are reversed, during charging the battery may be discharged rather than charged. Furthermore, reversed connections may cause abnormal chemical reaction in the battery, the flow of abnormal currents, leakage of battery fluid, heat generation, bursting and fire.
  - The gas release vent which releases internal gas is located in the ⊕ positive terminal of the Ni-MH batteries. For this reason, never deform this section or cover or obstruct its gas release structure. If this section is deformed or covered or obstructed, the gas release vent will not function properly, possibly causing leakage of battery fluid, heat generation, bursting and fire.
  - Do not directly connect Ni-MH batteries to a direct power source or the cigarette lighter socket in a car. High voltage may cause excessive current flow, leakage of battery fluid, heat generation, bursting and fire.
  - Do not use Ni-MH batteries in any equipment other than those specified by FDK. Depending on the equipment being used, doing so may cause abnormal current flow, leakage of battery fluid, heat generation, bursting and fire.
- Ni-MH batteries contain a strong colorless alkaline solution (electrolyte). Alkaline solution is extremely corrosive and will cause skin damage. If any fluid from Ni-MH batteries comes in contact with a user's eyes, they should immediately flush their eyes and wash them thoroughly with clean water from a tap or another source and consult a doctor immediately. Strong alkaline solution can damage eyes and lead to permanent loss of eyesight.
- When Ni-MH batteries are to be incorporated in equipment or housed within a case, avoid airtight structures as this may lead to the equipment or case being damaged or may be harmful to users.

### ⚠ WARNING

- Do not apply water, seawater or other oxidizing reagents to Ni-MH batteries, as this can cause rust and heat generation. If a battery becomes rusted, the gas release vent may no longer operate, and can result in bursting.
- Do not connect more than 21 Ni-MH batteries in series, as this may cause electrical shocks, leakage of battery fluid and heat generation.
- Keep Ni-MH batteries or the equipment out of the reach of infants and small children, in order to avoid them swallowing batteries. In the event the batteries are swallowed, consult a doctor immediately.
- Do not charge or use Ni-MH batteries with the ⊕ and ⊖ terminals reversed. Charging batteries with the terminals reversed may discharge rather than charge the batteries, or it may cause abnormal chemical reaction in the batteries. Using batteries with the terminals reversed may discharge with of abnormal current, leakage of battery fluid, heat generation, bursting and fire.
- Do not over-charge Ni-MH batteries by exceeding the predetermined charging period specified by the battery charger's instructions or indicator. If Ni-MH batteries are not fully charged after the battery charger's predetermined charging period has elapsed, stop the charging process. Prolonged charging may cause leakage of battery fluid, heat generation, bursting. Be sure to handle recharged batteries carefully as they may be hot.
- Do not use Ni-MH batteries if the outer tube/label is scratched or damaged. Doing so will expose the battery to the risk of a short circuit, and may cause leakage of battery fluid, heat generation, bursting and fire.

- Do not remove the outer tube from a battery or damage it. Doing so will expose the battery to the risk of a short circuit, and may cause leakage of battery fluid, heat generation, bursting and fire.
- If Ni-MH batteries leak fluid, change color, change shape, or change in any other way, do not use them, otherwise they may cause heat generation, bursting and fire.
- Ni-MH batteries contain strong colorless alkaline solution (electrolyte). If the skin or clothing comes in contact with fluid from a Ni-MH batteries. Battery fluid can irritate the skin thoroughly wash the area immediately with clean water from the tap or another source.
- When transporting Ni-MH batteries, pack them carefully so that the batteries inside the case are not moved.

### ⚠ CAUTION

- Do not strike or drop Ni-MH batteries. Sharp impacts or concussions to Ni-MH batteries may cause leakage of battery fluid, heat generation, bursting and fire.
- Store Ni-MH batteries out of the reach of infants and small children. When charging or using a battery, do not let infants or small children remove the battery from the charger or the equipment being used.
- Children should not use Ni-MH batteries unless they have been carefully instructed on the contents of this instruction manual and their parents or guardians have confirmed that the children understand and appreciate the proper usage and safety hazards presented by the batteries.
- Do not charge Ni-MH batteries if they have been cooled to 0°C or below. Doing so may cause leakage of battery fluid, impair performance or shorten operating life of Ni-MH batteries.
- Do not use or store Ni-MH batteries at high temperature, such as in strong direct sunlight, in cars during hot weather, or directly in front of a heater. This may cause leakage of battery fluid. It could also impair performance and shorten battery life of Ni-MH batteries.
- Do not use old and new batteries mixed together, or batteries at different charge levels. Do not use Ni-MH batteries mixed together with a dry cell or other battery of a different capacity, type, or brand name. This may cause leakage of battery fluid and heat generation.
- When more than two batteries are to be used together, charge them simultaneously prior to use. If they are not charged at the same time, it could cause leakage of battery fluid and heat generation.
- Do not connect Ni-MH batteries in parallel as this may cause leakage of battery fluid, heat generation, bursting and fire.
- For the recommended charging method for Ni-MH batteries, read the battery charger's instruction manual carefully.
- Do not place or cover flammable materials on the battery while charging or discharging the Ni-MH batteries. It may cause leakage of battery fluid, heat generation, bursting and fire.
- If Ni-MH batteries do not perform or function well with certain subject, refer to the instruction manual or warnings of the subject equipment.
- Do not charge Ni-MH batteries beyond the recommended time described in the instruction manual for the charger or equipment. Overcharging cause leakage of battery fluid, heat generation, bursting and fire. It could also impair performance and shorten battery life of Ni-MH batteries.
- After long term storage, there is a possibility that a battery cannot be fully charged. In order to fully charge it, charge and discharge the battery a few times.
- Be sure to turn off the equipment after use of Ni-MH batteries, as this may result in leakage of battery fluid.
- After they have been removed from equipment, store Ni-MH batteries in a dry place and within the recommended storage temperature range. This will help preserve the batteries' performance and durability and to minimize the possibility of leakage of battery fluid or corrosion. (For the indicated storage temperature range, refer to the rating table of this catalogue. FDK recommends a temperature range from -20 to 30 °C for longer battery life).
- Before using Ni-MH batteries, be sure to read the instruction manual and all precautions carefully, then store the manual and precautions carefully to use as reference when the need arises. If you have specific questions about the instruction manual or the precautions, contact FDK at the location listed on the last page of this catalogue.
- If corrosion, heat generation or other abnormalities with new Ni-MH batteries are detected, immediately stop using them and return them to the store or FDK that they were purchased from.
- If the Ni-MH battery terminals become dirty, clean them with a soft dry cloth prior to use. Dirt on the terminals can result in poor contact with the equipment, loss of power, or inability to charge.
- When incorporating Ni-MH batteries into their equipment or case, use materials with alkali resistance for the contact point and terminal of the battery. (Copper-containing materials can cause rust and corrosion problems.)
- Batteries have a limited lifetime. Even in the same equipment, the battery life varies depending on the ambient temperature during operation and number of charge/discharge cycles. Therefore, if the operating time of a Ni-MH battery becomes much shorter than its initial operating time, even after recharging, it is most likely near the end of its battery life and should be replaced with a new battery.



# LITHIUM BATTERY





# Strong Lineup of Cylindrical, Thin and Coin types. Made-in-Japan Quality and Reliability.

FDK's technology adds long-term reliability to lithium batteries' original features such as high energy density and superior shelf life. No toxic substances restricted by the RoHS Directive are used in FDK's environmentally-conscious lithium batteries.



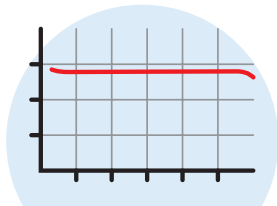
Environmentally friendly



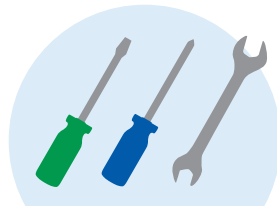
Cylindrical-type, Thin-type and Coin-type.

## FDK's Lithium Battery Advantages

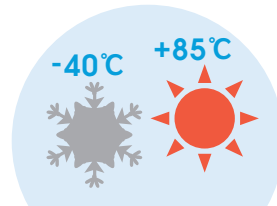
A variety of shapes and sizes make your application design easy. Stable and long-lasting power supply under a wide range of temperature conditions.



Stable discharge current



High flexibility for application design



Wide range of operating temperatures  
-40°C to +85°C\*1

\*1 In the case of cylindrical-type



Extended usage  
20 years\*2

\*2 In the case of CR17500EP. Expected life at room temperature. Expected life varies depending on usage and environment.

## Typical Uses of Lithium Batteries

Reliable power sources for a wide range of applications from every corner of society



Thin-type



Cylindrical-type



Coin-type

### [cards, thin modules]



- cards with dynamic code display
- beacon modules
- electronic tags

### [utility meters]



- gas meters
- electricity meters
- water meters
- HCAs

### [home security]



- fire alarms
- gas alarms
- electronic locks

### [medical devices]



- medical patches
- AEDs
- memory backup
- surgical powered tools

### [in-vehicle equipment]



- eCall
- dashboard cameras
- keyless entry

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# Stable performance and long life Long-term reliability proven in the market Best fit for smart meter solutions

## Advantage ① Long-lasting reliability

Optimized material design and laser-sealing ensure extended long life. This supports your application operating just as you would expect.



## Advantage ② Excellent capacity retention

A very low self-discharge rate (0.5% per year at room temperature) means at least 95% or more capacity is retained after 10-year storage.



Capacity **95%** (10 years at RT)

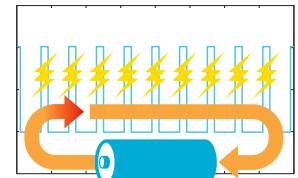
## Advantage ③ Wide operating temperature range

Non-aqueous electrolyte does not freeze easily. This supports your application's operation across a wide temperature range.



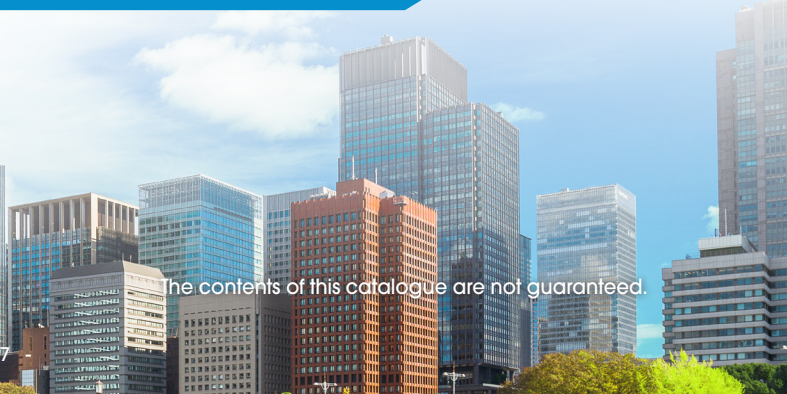
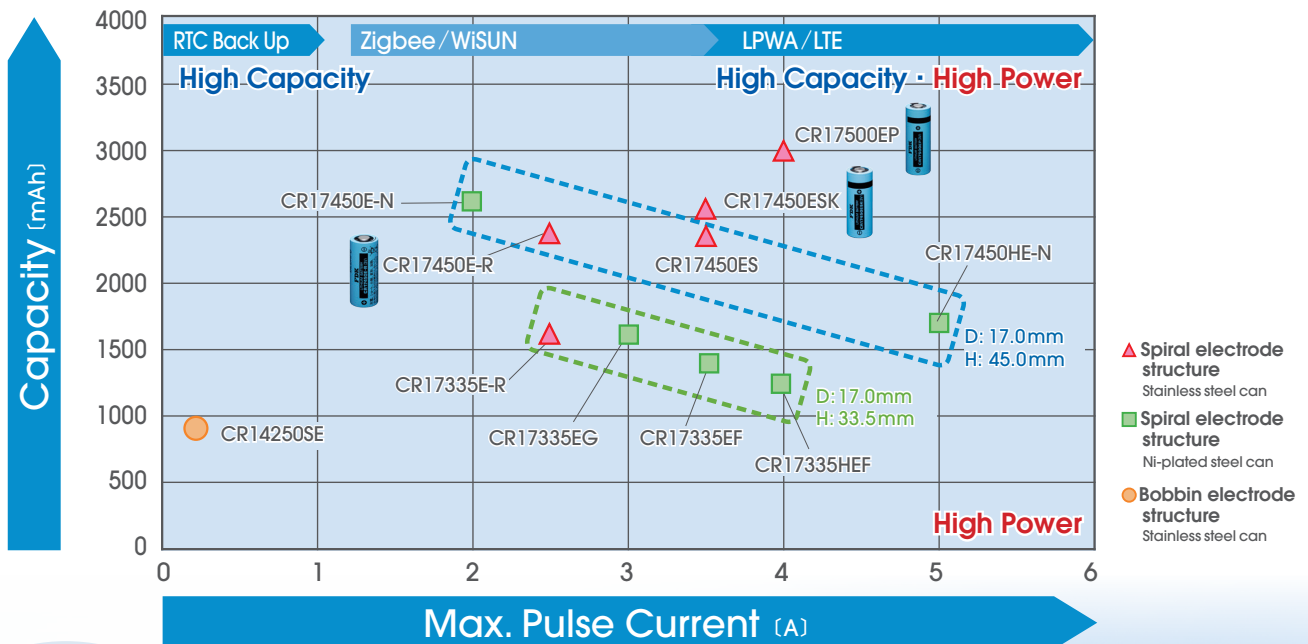
## Advantage ④ Long lasting<sup>(\*)</sup> high discharge current over a long period

Spiral electrode structure and optimized electrolyte composition supply power for high demanding applications such as repeated radio communication and emergency valve shut-off operation.



<sup>\*</sup>Length varies depending on usage and environment.

## Supporting the various needs of meters with a combination of high power and high capacity.



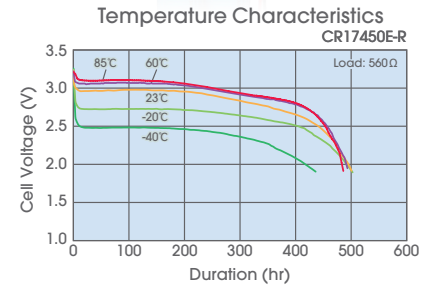
# Cylindrical-type Primary Lithium Batteries - High Power

Utilizes a spiral electrode structure to provide a high discharge current.  
Laser sealing ensures an extended lifetime.

## Features

- Spiral electrode structure ensures high-rate current discharge.
- Low self-discharge rate and long life.  
Self-discharge rate: less than 0.5% per year at room temperature.
- Usable over a wide temperature range  
Operational temperature range : -40°C to +85°C (-40°F to +185°F)  
Consult with FDK when using batteries at temperatures exceeding -20°C to +60°C (-4°F to +140°F) range.

- UL recognition (File No. MH13421) 



## Applications

- Gas, electricity, and water meters
- Fire and gas alarms
- In-vehicle applications  
(ETCs, eCall systems, etc)



## Other

- Please use tabs or connectors when connecting these batteries to applications.

## Specifications

Model	CR17335-R	CR17450-R	CR17450ES	CR17500EP	CR17335HEF	CR17335EF	CR17335EG	CR17450HE-N	CR17450ESK	CR17450E-N
In accordance with IEC standard nomenclature	17335	17450	17450	17E500	17335	17335	17335	17450	17E450	17450
Nominal Voltage	3V	3V	3V	3V	3V	3V	3V	3V	3V	3V
Nominal Capacity <sup>※1</sup>	1600mAh	2400mAh	2400mAh	3000mAh	1200mAh	1400mAh	1600mAh	1700mAh	2600mAh	2600mAh
Standard Discharge Current	5mA	5mA	5mA	5mA	14mA	5mA	5mA	14mA	5mA	5mA
Max. Pulse Current <sup>※2</sup>	2500mA	2500mA	3500mA	4000mA	4000mA	3500mA	3000mA	5000mA	3500mA	2000mA
Dimensions	Diameter	17.0mm	17.0mm	17.4mm	17.0mm	17.0mm	17.0mm	17.0mm	17.4mm	17.0mm
	Height	33.5mm	45.0mm	45.0mm	50.0mm	33.5mm	33.5mm	33.5mm	45.0mm	45.0mm
Approx. Weight	17g	23g	23g	27g	17g	17g	17g	23g	23g	23g

※Expected life at room temperature : CR17500EP 20 years , other models 10 years.

Expected life is reference only and is not intended to imply any guarantee or warranty. Actual life depends on condition of use.

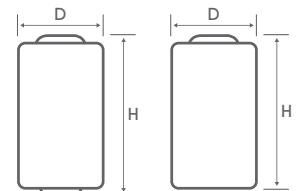
※Consult with FDK when considering connection method and multiple-cell configuration.

※CR17450EG (not shown in the table) has the same set of specifications as CR17450ES.

※CR17335HEF, CR17335EF, CR17335EG, CR17450HE-N, CR17450EG and CR17450E-N have the outer can made of nickel plated steel.

※1 Nominal capacity is determined at an end voltage of 2.0V when the battery is allowed to discharge at a standard current level at +23°C.

※2 Current value for obtaining 1.0V cell voltage when pulse is applied for 15 seconds at 50% discharge depth (50% of the nominal capacity) at +23°C.



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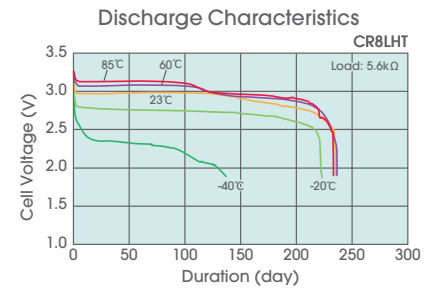
# Cylindrical-type Primary Lithium Batteries - High Capacity

Utilizes a unique bobbin electrode structure to provide high capacity.

## Features

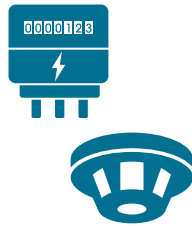
- Bobbin electrode structure ensures high-capacity performance.
- Low self-discharge rate and long life.  
Self-discharge rate : less than 0.5% per year at room temperature.
- Usable over a wide temperature range.  
Operational temperature range : -40°C to +85°C (-40°F to +185°F)  
Consult with FDK when using batteries at temperatures exceeding -20°C to +60°C (-4°F to +140°F) range.

- UL recognition (File No. MH13421) 



## Applications

- Electricity and water meters
- Fire alarms
- Memory backup power source



## Other

- Please use tabs or connectors when connecting these batteries to application.

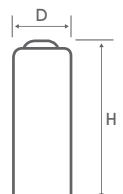
## Specifications

Model	CR14250SE	CR2/3 8-L	CR8-LHC	CR8LHT
In accordance with IEC standard nomenclature	14250	17335	17450	17450
Nominal Voltage	3V	3V	3V	3V
Nominal Capacity <sup>※1</sup>	850mAh	1900mAh	3000mAh	2850mAh
Standard Discharge Current	0.5mA	0.5mA	0.5mA	0.5mA
Dimensions	Diameter	14.5mm	17.0mm	17.0mm
	Height	25.0mm	33.5mm	45.0mm
Approx. Weight	9g	16g	23g	23g

※Expected life is 10 years at room temperature.

Expected life is reference only and is not intended to imply any guarantee or warranty. Actual life depends on condition of use.

※Consult with FDK when considering connection method and multiple-cell configuration.




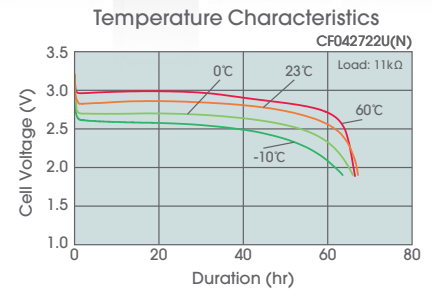
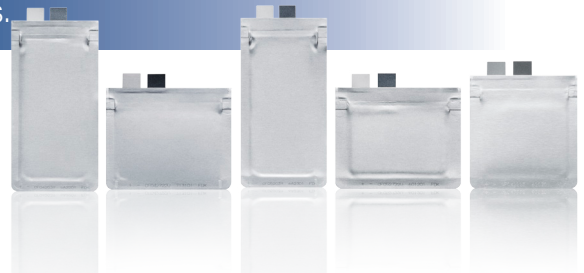
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# Thin-type Primary Lithium Batteries

For overall thickness and weight reduction in devices.

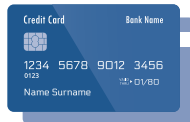
## Features

- Low self-discharge rate and long life.  
Self-discharge rate: less than 3% per year at room temperature.
- Usable over wide temperature range.  
Operational temperature range : -10°C to +60°C (+14°F to +140°F)
- UL recognition (File No. MH13421) 



## Applications

- Credit cards with dynamic code display
- Card type security systems
- Electronic tags
- Gift cards



## Other

- Can be connected via thermal compression bonding.
- Consult with FDK when using multiple cells.

## Specifications

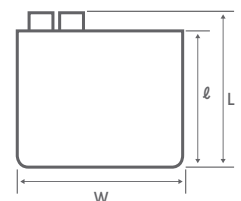
Model	CF042223 (N)	CF042722U (N)	CF042039 (N)	CF052722U (N)	CF052039 (N)	
Nominal Voltage	3V	3V	3V	3V	3V	
Nominal Capacity <sup>※1</sup>	12mAh	15mAh	25mAh	22mAh	35mAh	
Standard Discharge Current	0.25mA	0.25mA	0.25mA	0.25mA	0.25mA	
Dimensions	Length	L:27.0mm (ℓ:24.0mm)	L:25.5mm (ℓ:22.5mm)	L:42.5mm (ℓ:39.5mm)	L:25.5mm (ℓ:22.5mm)	L:42.5mm (ℓ:39.5mm)
	Width	23.0mm	27.5mm	20.5mm	27.5mm	20.5mm
	Thickness	0.45mm	0.45mm	0.45mm	0.55mm	0.55mm
Approx. Weight	0.4g	0.4g	0.5g	0.5g	0.6g	

※Expected life is 5 years at room temperature.

Expected life is reference only and is not intended to imply any guarantee or warranty. Actual life depends on condition of use.

※Consult with FDK about installation method.

※1 Nominal capacity is determined at an end voltage of 2.0V when the battery is allowed to discharge at a standard current level at +23°C.




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# Coin-type Primary Lithium Batteries

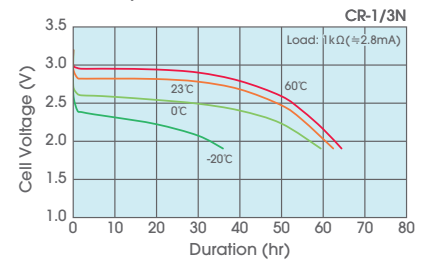
Manganese dioxide for the positive electrode material and lithium for the negative electrode material



## Features

- Low self-discharge rate and long life.  
Self-discharge rate : Approx. 1% per year at room temperature.
- Usable over wide temperature range.  
Operational temperature range: -20°C to +60°C (-4°F to +140°F) (CR-1/3N, 2CR-1/3N)  
-20°C to +70°C (-4°F to +158°F) (other models)
- UL recognition (File No. MH13421) 

Temperature Characteristics



## Applications

- Electronic notebooks
- Electronic automobile keys (keyless entry)
- LED-related devices
- Memory backup power source



## Other

- Available with secondary processing (multiple cells, tabs, connectors, etc) in accordance with use.
- Nickel-plated phosphor bronze or stainless steel should be used for battery contact terminal materials. To ensure stable contact conditions, contact pressure of several newtons is recommended when attaching.

## Specifications

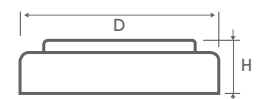
Model	CR1220	CR1620	CR2016	CR2025	CR2032	CR-1/3N	2CR-1/3N	
In accordance with IEC standard nomenclature	1220	1620	2016	2025	2032	11108	-	
Nominal Voltage	3V	3V	3V	3V	3V	3V	6V	
Nominal Capacity <sup>※1</sup>	36mAh	80mAh	90mAh	170mAh	240mAh	160mAh	160mAh	
Standard Discharge Current	0.1mA	0.1mA	0.2mA	0.2mA	0.2mA	2.7mA	2.7mA	
Dimensions	Diameter	12.5mm	16.0mm	20.0mm	20.0mm	20.0mm	11.6mm	13.0mm
	Height	2.0mm	2.0mm	1.6mm	2.5mm	3.2mm	10.8mm	25.2mm
Approx. Weight	0.8g	1.3g	1.7g	2.5g	3.0g	3.3g	9.1g	

※Expected life is 5 years at room temperature.

Expected life is reference only and is not intended to imply any guarantee or warranty. Actual life depends on condition of use.

※Consult with FDK when considering connection method and multiple-cell configuration.

※1 Nominal capacity is determined at an end voltage of 2.0V (4.0V for 2CR-1/3N) when the battery is allowed to discharge at a standard current level at +23°C.




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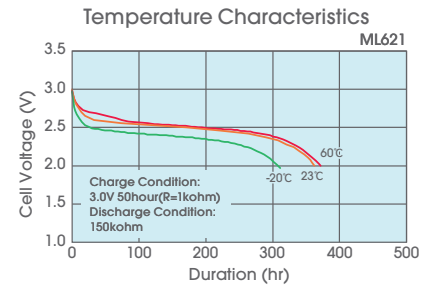
# Coin-type Rechargeable Lithium Batteries

Manganese composite oxide for the positive electrode material and lithium aluminium alloy for the negative electrode material.



## Features

- Compatible with reflow soldering (Max. 260°C) (ML614R)
- Stable operating voltage of 2.5V.
- Capable of being charged at 2.8V.
- Low self-discharge rate and long life  
Self-discharge rate: Approx. 2% per year at room temperature.
- Usable over a wide temperature range.  
Operational temperature range : -20°C to +60°C (-4°F to +140°F)
- UL recognition (File No. MH13421) 



## Applications

- Memory backup power source for laptop PCs, dashboard cameras, cell phones, DSCs and camcorders. Electronic automobile keys (keyless entry)



## Other

- Available with secondary tab processing in accordance with use.
- ML614R is available with dedicated tab only.
- Nickel-plated phosphor bronze or stainless steel should be used for battery contact terminal materials. To ensure stable contact conditions, contact pressure of several newtons is recommended when attaching.

## Specifications

Model	ML614	ML621	ML614R
Nominal Voltage	3V	3V	3V
Nominal Capacity <sup>※1</sup>	3.4mAh	5.8mAh	2.5mAh
Standard Charge/Discharge Current	0.015mA	0.015mA	0.005mA
Max. Pulse Current <sup>※2</sup>	1.5mA	1.5mA	-
Charge/Discharge Cycle Characteristics	300 (Discharge depth of 20%)		300 (Discharge depth of 10%)
Charging Method	Constant voltage charge 2.8~3.25V		2.8~3.1V
Dimensions	Diameter	6.8mm	6.8mm
	Height	1.4mm	2.1mm
Approx. Weight	0.16g	0.22g	0.19g
for Reflow Soldering	-	-	○

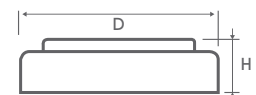
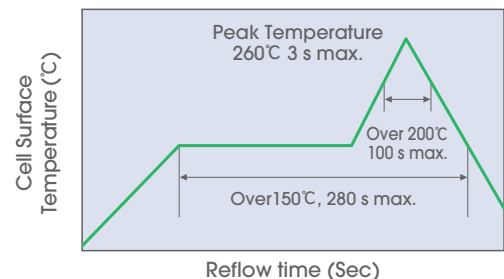
※Expected life is 5 years at room temperature.

Expected life is reference only and is not intended to imply any guarantee or warranty. Actual life depends on condition of use.

※Consult with FDK when considering connection method and multiple-cell configuration.

※1 Nominal capacity is determined at an end voltage of 2.0V when the battery is allowed to discharge at a standard current level at +23°C.

※2 Current value for obtaining 2.0V cell voltage when pulse is applied for 15 seconds at 50% discharge depth (50% of the nominal capacity) at +23°C.



The contents of this catalogue are not guaranteed.

# Lithium batteries Handling Precautions for Safe Use

Carefully read these instructions manual before using lithium batteries for the first time.

Lithium batteries contain combustible materials such as lithium metal, lithium alloy and organic solvent. Improper handling can lead to leakage, heat generation, explosion or fire. To prevent accidents, pay sufficient attention to the following precautions. Also refer to them when you are describing in your instruction manual how to handle lithium batteries used in your application.

## ●Thin-type primary and coin-type primary/rechargeable lithium batteries

### ⚠ DANGER (Coin-type batteries)

1. **Keep batteries out of infants' reach.**  
If a battery is swallowed, it can lead to chemical burns, penetration of mucosal tissue and, in the worst case, death. A swallowed battery must be removed urgently. Contact a doctor immediately for instructions.

### ⚠ WARNING

1. **Do not use batteries for unspecified purposes.**  
Different terminal structure may suffer from contact failure. Differences in specifications may damage the battery or application, which can lead to leakage, heat generation, explosion or fire.
2. **Do not charge (Primary batteries: CF and CR series).**  
When the battery is charged, gas is generated inside and it raises internal pressure, resulting in leakage, heat generation, explosion or fire.
3. **Do not charge with unspecified conditions (Rechargeable batteries: ML series)**  
Doing so may generate gas inside the battery, resulting in leakage, heat generation, explosion or fire.
4. **Do not throw batteries into fire. Do not heat or disassemble batteries.**  
Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
5. **Do not insert batteries with the positive ⊕ and negative ⊖ polarities reversed.**  
Make sure the polarities are in the right position when inserting the batteries into the application. When using 3 or more batteries, the application may operate even though one of the batteries is improperly inserted but this may cause leakage, heat generation, explosion or fire.
6. **If leaked liquid gets in the eyes, it can cause eye injury.**  
Wash the eye(s) with clean water and receive medical care immediately.
7. **If leaked liquid gets into the mouth, rinse the mouth well and consult with a doctor immediately.**
8. **Do not short-circuit.**  
If the positive ⊕ and negative ⊖ terminals come into contact with metal objects, short circuit occurs and excessive current flows at once resulting in leakage, heat generation, explosion or fire. When carrying or storing the batteries, avoid direct contact with metal objects such as bracelets or key chains by putting them in a separate container.
9. **In case of leakage or a strange smell, move the battery away from possible sources of fire immediately.**  
Leaked electrolyte may catch fire.
10. **Do not solder directly on the battery.**  
Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
11. **Do not apply strong pressure to the batteries nor handle roughly.**  
Doing so may cause leakage, heat generation, explosion or fire. Do not use a dropped battery as it may have been damaged.
12. **Make sure to insulate battery terminals with vinyl tape when disposing of or storing them to avoid short circuit.**  
Putting batteries together disorderly or in contact with metal objects may cause short-circuit, resulting in leakage, heat generation, explosion or fire.
13. **Do not use new and used batteries together. Do not use different types of batteries together.**  
Difference in their characteristics may cause leakage, heat generation, explosion or fire.
14. **Do not stick batteries on the skin.**  
Doing so may cause skin injury.

### ⚠ CAUTION

1. **Make sure to insert batteries in the application so that the positive ⊕ and negative ⊖ terminals may not come into contact with metal parts of the application.**
2. **Do not use or leave the batteries exposed to heat such as a front of window in direct sunlight or inside a car under sunlight.**  
Doing so may cause leakage, heat generation, explosion or fire.
3. **Avoid contact with water.**  
Doing so may cause leakage, heat generation, explosion or fire.
4. **Read the application's instruction manual and precautions carefully before use.**  
The specifications or performance of these batteries may not match some usages or types of application.
5. **Store and use the batteries away from direct sunlight, high temperature and high humidity**  
Otherwise, it can lead to leakage, heat generation, explosion or fire. If stored or used in such environment, batteries may suffer from deteriorated performance and life.
6. **Do not use the batteries if you notice heat generation, deformation or other abnormal situations while using or storing them.**  
These can lead to leakage, heat generation or explosion.
7. **For proper disposal of batteries, refer to local regulations.**

## ●Cylindrical-type primary lithium batteries

### ⚠ WARNING

1. **Do not use batteries for unspecified purposes.**  
Different terminal structure may suffer from contact failure. Differences in specifications may damage the battery or application, which can lead to leakage, heat generation, explosion or fire.
2. **Do not charge.**  
Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
3. **Do not throw batteries into fire. Do not heat or disassemble batteries.**  
Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
4. **Do not insert batteries with the positive ⊕ and negative ⊖ polarities reversed.**  
Make sure the polarities are in the right position when inserting the batteries into the application. When using 3 or more batteries, the application may operate even though one of the batteries is improperly inserted but this may cause leakage, heat generation, explosion or fire.
5. **If leaked liquid gets in the eyes, it can cause eye injury.**  
Wash the eye(s) with clean water and receive medical care immediately.
6. **If leaked liquid gets into the mouth, rinse the mouth well and consult with a doctor immediately.**
7. **Do not short-circuit.**  
If the positive ⊕ and negative ⊖ terminals come into contact with metal objects, short circuit occurs and excessive current flows at once resulting in leakage, heat generation, explosion or fire. When carrying or storing the batteries, avoid direct contact with metal objects such as bracelets or key chains by putting them in a separate container.
8. **In case of leakage or a strange smell, move the battery away from possible sources of fire immediately.**  
Leaked electrolyte may catch fire.
9. **Do not solder directly on the battery.**  
Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
10. **Do not scratch nor peel off the resin film on the surface of the battery.**  
The battery surface is covered with thin vinyl film to prevent short-circuit. Cutting with an edged tool or peeling off this film may cause short-circuit, resulting in leakage, heat generation, explosion or fire.
11. **Do not apply strong pressure to the batteries or handle roughly.**  
Doing so may cause leakage, heat generation, explosion or fire. Do not use a dropped battery as it may have been damaged.
12. **Do not deform the battery in any way.**  
Doing so may damage insulation or gas release vent resulting in leakage, heat generation, explosion or fire.
13. **Make sure to insulate battery terminals with vinyl tape when disposing of or storing them to avoid short circuit.**  
Putting batteries together disorderly or in contact with metal objects may cause short-circuit, resulting in leakage, heat generation, explosion or fire.
14. **Do not use new and used batteries together. Do not use different types of batteries together.**  
Difference in their characteristics may cause leakage, heat generation, explosion or fire.
15. **Do not force-discharge.**  
When a battery is forced to discharge by an external power source, the voltage drops to 0 or below (voltage reversal) and gas is generated inside the battery. This may cause leakage, heat generation, explosion or fire.

### ⚠ CAUTION

1. **Do not use or leave the batteries exposed to heat such as a front of window in direct sunlight or inside a car under sunlight.**  
Doing so may cause leakage, heat generation, explosion or fire.
2. **Avoid contact with water.**  
Doing so may cause leakage, heat generation, explosion or fire.
3. **Read the application's instruction manual and precautions carefully before use.**  
The specifications or performance of these batteries may not match some usages or types of application.
4. **Remove batteries from the application if you do not use it for a long time.**
5. **Store and use the batteries away from direct sunlight, high temperature and high humidity.**  
Otherwise, it can lead to leakage, heat generation, explosion or fire. If stored or used in such environment, batteries may suffer from deteriorated performance and life.
6. **Do not use the batteries if you notice heat generation, deformation or other abnormal situations while using or storing them.**  
It can lead to leakage, heat generation or explosion.
7. **Check batteries inside emergency-use applications periodically.**  
Applications may not work properly in emergency due to batteries' deterioration, or may be damaged by leakage.
8. **For proper disposal of batteries, refer to local regulations.**

## Requests Regarding Quality Assurance and Ensuring Safety

When considering the following please contact FDK beforehand to ensure quality and safety standards:

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>① Connecting batteries in series or in parallel on circuits.</li><li>② Molding batteries with resin.</li><li>③ Welding terminals onto batteries.</li><li>④ Cleaning or welding by means of ultrasonic.</li><li>⑤ Setting the battery life for your application.</li></ul> | <ul style="list-style-type: none"><li>⑥ Using the batteries for medical devices.</li><li>⑦ Using other power supply on the same circuit with thin-, coin- and cylindrical-type primary lithium batteries.</li><li>⑧ Using contact method such as battery holder for thin- and cylindrical-type primary lithium batteries and coin-type rechargeable lithium batteries.</li></ul> |
|---|--|

## Connection Terminal Specification

Each model is available with connectors, tabs, etc. which facilitate battery installation process onto user applications. Our standard connection terminal specifications are described in a separate document "Connection Terminal Specifications for Lithium Batteries and Key Circuit Design". Please consult with FDK for details.

## Notes on Transportation

Lithium metal batteries are classified as Class 9 dangerous goods in the United Nations Recommendations, and given UN numbers UN3090 and UN3091. All the relevant requirements of UN Recommendations as well as other related regulations such as IATA Dangerous Goods Regulation (IATA-DGR), International Maritime Dangerous Code (IMDG-Code) and, in the case of air transportation in the USA, Title 49 of Code of Federal Regulations (49 CFR) shall be met for transportation of lithium metal batteries as described below. Please note that air transportation regulations for lithium batteries will be amended irregularly as required and that it is important to refer to the latest IATA-DGR (61th edition).

### Special Notes Regarding FDK Lithium Batteries

- All of our lithium batteries are categorized as lithium metal batteries from a transportation regulation perspective.
- Our lithium batteries and shipping packages meet the requirements of subsection 38.3, Part III, UN Manual of Test and Criteria.
- Package specifications of our lithium batteries comply with all requirements set down in the above-mentioned transportation regulations and requirements. When you want to use our original package for shipping and require related certification, please contact our relevant department through your distribution channel.
- If you pack lithium batteries for shipping, please note that you will be responsible for related tests and certificates.
- Shipping agents may set their own rules of transportation, so please contact them in advance.



## Air transportation of our lithium batteries

### 1. Transportation of batteries packed by themselves (UN3090)

Air transportation of lithium cells and batteries by themselves is permitted on cargo aircraft only. The Packing Instruction 968 (PI968) of the IATA Dangerous Goods Regulation (IATA-DGR) sets down three Sections for transport of lithium metal batteries packed by themselves as follows:

#### • Transport of batteries in accordance with Section IA

Cells containing more than 1g of lithium or batteries (battery packs) containing more than 2g of lithium are applicable to Section IA, and it is permitted to transport them as Class 9 Dangerous Goods when they comply with all requirements\*1 of the transport conditions of Section IA.

#### • Transport of batteries in accordance with Section IB

Cells containing more than 0.3g and less than 1g of lithium or batteries (battery packs) containing more than 0.3g and less than 2g of lithium are applicable to Section IB, and it is permitted to transport them without using a Class 9 Dangerous Goods container (packing group II) when they comply with all requirements\*1 of the transport conditions of Section IB.

#### • Transport of batteries in accordance with Section II

Cells or batteries (battery packs) containing less than 0.3g of lithium are applicable to Section II, and it is permitted to transport them as exempted Class 9 Dangerous Goods when they comply with all requirements\*1 of the transport conditions of Section II. In the case of cells or batteries applicable to Section IB when the number of cells per one package is 8 pieces or less, or the number of batteries per package is 2 pieces or less, it is permitted to transport them as exempted Class 9 Dangerous Goods when they comply with all requirements\*1 of the transport conditions of Section II. However, the number of package prepared to transport in accordance with Section II with a single air waybill is limited to one.

### 2. Transportation of batteries mounted on applications or packed with applications

If lithium content of cells is 1g or less or total lithium content of batteries is 2g or less, they are applicable to Section II and permitted for transport as exempted Class 9 Dangerous Goods when they comply with all requirements\*1 of the transport conditions of Section II. If the lithium content is over the aforementioned values, they are applicable to Section I and permitted for transport as Class 9 Dangerous Goods when they comply with all requirements\*1 of the transport conditions of Section IA.

\*1: For more detailed information of transport conditions, please refer to IATA-DGR 61th edition

## Sea transportation of our lithium batteries

If lithium content of cells is 1g or less or total lithium content of batteries (battery packs) is 2g or less, Special Provision 188, International Maritime Dangerous Code (IMDG-Code) applies to them and they are permitted for transport as exempted dangerous goods when they comply with all requirements\*2 of the transport conditions.

\*2: For more detailed information of transport conditions, please refer to the latest version of IMDG-Code.

## Regulation for air transportation in the USA

In the case of air transportation of lithium metal batteries in/to/from the USA, transport by passenger aircraft is forbidden and the "LITHIUM METAL BATTERIES FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT". Please refer to the latest version of Parts 171, 172, 173 and 175 of 49CFR (Code of Federal Regulations, Title 49) for more details.

## Notes on Environmental Regulations

In line with the increasing awareness of the need to protect the global environment, unified environmental regulations such as RoHS, WEEE or REACH in EU countries and various local regulations in other countries have been established. In EU countries the RoHS Directive is not applied to batteries used in Electrical and Electronic Equipment (EEE), whereas the Battery Directive (2006/66/EC) is applied. Batteries are subject to the WEEE Directive while they are mounted in EEE. Please note that regulations applicable to batteries are different from those for EEE. For further information, please consult with FDK. Our lithium batteries do not contain mercury, lead, cadmium, hexavalent chromium or other hazardous materials. However, lithium batteries contain flammable substances such as lithium metal and organic electrolyte, and safety requirements for lithium batteries may be set by local governments. Please confirm your local rules and regulations when you dispose of lithium batteries.

## Certificate of Conformity to Battery Directive

We hereby certify that our lithium batteries delivered to you conform to Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators (referred to as the "Battery Directive"). According to the Directive, the following restricted substances and labeling requirement are set down and our batteries conform to these requirements. In addition, easy removal of batteries from the application is also set down in the Directive, therefore your taking into consideration this requirement in the design stage of your applications is appreciated.

#### 1. Restricted substances (Article 4)

Batteries containing the following substances with more than the designated content by weight are prohibited to be placed on EU market:  
Mercury: 5ppm / Cadmium: 20ppm

#### 2. Labeling (Article 21)

A mark meaning separate waste collection should be placed on all batteries and accumulators in EU member states. We put marks on the body of the battery for cylindrical and prismatic batteries, or on the packaging for small batteries such as coin-type batteries.

#### 3. Easy removal of waste batteries (Article 11)

Manufacturers shall design products in such a way that waste batteries can be readily removed. This requirement is deemed to comply with in such cases where batteries can be removed by end-users or independent qualified professionals.

## Response to RoHS 2 Directive

#### 1. Basic view

The recital 14 of RoHS 2 Directive explicitly states the following:

"This Directive should apply without prejudice to Union legislation on safety and health requirements and specific Union waste management legislation, in particular Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and Regulation (EC) No 850/2004." This means the Battery Directive has precedence over the RoHS 2 Directive for batteries and accumulators. Therefore, we are not in a position to submit a certificate or an agreement for batteries and accumulators regarding conformity with the RoHS 2 Directive. We appreciate your understanding.

#### 2. Restricted substances

RoHS 2 Directive regulates the restriction of maximum concentration value by weight in homogeneous materials\* of electrical and electronic equipment (EEE) in Annex II as shown below. \* homogeneous materials means uniform composition that cannot be disintegrated or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes.

i. Mercury 0.1% / ii. Lead 0.1% / iii. Cadmium 0.01% / iv. Cr+6 0.1% / v. PBBs 0.1% / vi. PBDEs 0.1% / vii. DEHP 0.1% / viii. BBP 0.1% / ix. DBP 0.1% / x. DIBP 0.1%

Since RoHS 2 Directive does not apply to batteries and accumulators as aforementioned, the restriction of use of the above 10 materials is not applicable to our batteries. However, our lithium batteries do not contain any of these 10 materials, so we can deliver an analysis report for our batteries simply as a certificate of non-use. The rule about homogenous materials described in article 3 (20) of RoHS 2 Directive is not applicable to batteries and accumulators, so we provide data analysis reporting based on battery weight.

### 3. CE marking (not applicable to batteries)

Article 7 of RoHS 2 Directive sets down the manufacturer's obligations when they place their products on EU market. Products bearing CE marking is one part of these obligations. However, as aforementioned, RoHS 2 Directive does not apply to batteries and accumulators, hence our batteries and accumulators do not bear CE marking.

## Correlation between Battery Directive and WEEE/RoHS Directive

If you are concerned about the correlation between Battery Directive (applied to batteries and accumulators) and the WEEE/RoHS Directives (also known as EU environmental regulations), we would like to introduce the website of the Battery Association of Japan (BAJ), where you can find BAJ's official view on this matter. <http://www.baj.or.jp/e/recycle/recycle09.html>

## Response to REACH Regulation

### 1. Is it necessary to register a battery in accordance with the REACH Regulation?

Batteries are categorized as "articles" by REACH. Articles 7 (1) and 7 (5) of the REACH Regulation state that a producer or an importer of articles should register to the agency any substance contained in those articles, if both the following conditions are met:

- The substance is intended to be released under normal or reasonably foreseeable conditions of use, and
- The total weight of the substance contained in the article(s) exceeds one ton per producer or importer per year.

Batteries are not such articles that contain substances that are intended to be released, but rather batteries are intended to supply electricity generated by an internal chemical reaction of the positive and negative electrodes. Therefore condition a) is not applicable and there is no obligation to register to the agency. For this reason, we cannot submit a certificate or an agreement for batteries in regard to compliance with the REACH Regulation. We appreciate your understanding.

### 2. Our obligation to the REACH Regulation

(1) Duty to communicate information on substances in articles

Article 33 states "Any supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1 % weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance."

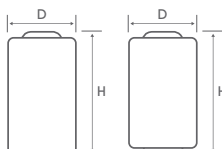
(2) Duty of compliance with restricted substances

Article 67 states "A substance on its own, in a preparation or in an article, for which Annex XVII contains a restriction shall not be manufactured, placed on the market or used unless it complies with the conditions of that restriction." We comply with these requirements.

## Response to SVHC Candidates

SVHC candidates can become subject to authorization and as a result, it is important to be aware of the most recent situation. We always monitor relevant information such as news releases from ECHA and carefully check whether newly announced SVHC candidate substances are contained in our components or not. Confirmation from our suppliers can take multiple days, so we would appreciate your understanding in case our response to any queries is delayed. Please feel free to contact our sales representatives for requests about SVHC candidate list.

## FDK Lithium Battery Models and Dimensions



### ■ Cylindrical-type Primary Batteries

Diameter Height	(Unit : mm)		
	14.5	17.0	17.4
25.0	CR14250SE		
33.5		CR17335E-R	
		CR17335HEF	
		CR17335EF	
		CR17335EG	
		CR2/3 8-L	
		CR17450E-R	CR17450ESK
		CR17450ES	
		CR17450HE-N	
		CR17450EG	
		CR17450E-N	
45.0		CR8-LHC	
		CR8LHT	
50.0			CR17500EP

### ■ Coin-type Batteries

Height	(Unit : mm)					
	Diameter	6.8	11.6	12.5	16.0	20.0
1.4		ML614				
		ML614R				
1.6						CR2016
2.0				CR1220	CR1620	
2.1		ML621				
2.5						CR2025
3.2						CR2032
10.8			CR-1/3N			





# ALKALINE BATTERY



# These alkaline dry batteries are long lasting, easy to use, and safe.

Alkaline dry batteries perform a critical function in devices used throughout our lives. With high power and long duration delivering optimal performance in support of various devices, our batteries are proudly made in Japan according to the highest quality standards.



WASHIZU Plant

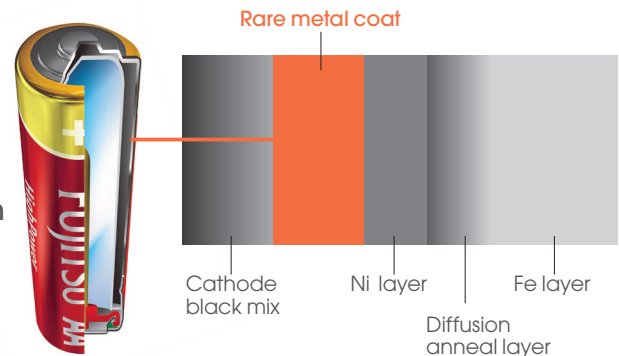
## Features of FDK's alkaline batteries

FDK's unique technology allows our alkaline batteries to maintain low impedance over long-term storage, and they include leak proof mechanisms.

### FDK's technology

#### Adoption of rare metal coating

Rare metal coating on the cathode can prevent the rise of internal resistance resulting from oxidation and also prevents gas generation resulting in corrosion inside the battery.

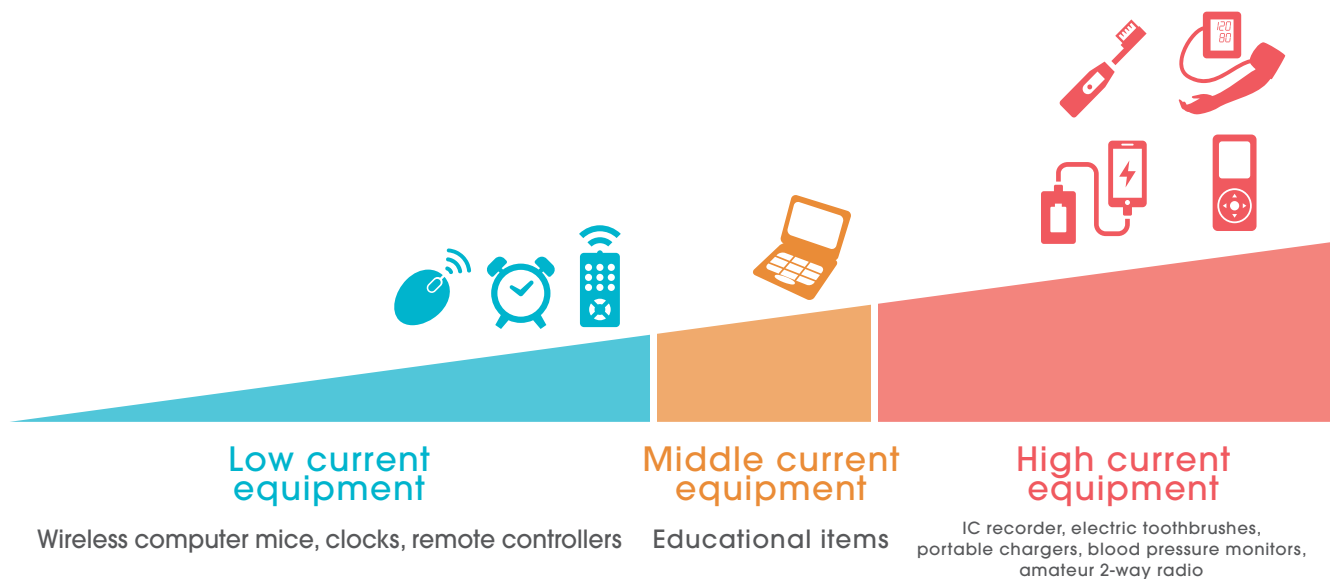


Contact connection

Anti-corrosion

## Uses of FDK's alkaline batteries

FDK's alkaline batteries support various aspects of our daily lives.



# Alkaline Batteries - Premium

Best Performance for All Devices.



## Features

Maximum runtime for all devices.

10 years  
storage

One-year  
warranty

Leakage  
protection

## Applications

digital still cameras, electric shavers, LED lanterns, gaming devices, electronic dictionaries, LED flashlights, portable chargers, IC recorders, electric toothbrushes, remote controllers, wireless computer mice, clocks



## Technical data & discharging times

		LR20 Premium	LR14 Premium	LR6 Premium	LR03 Premium
Model					
Nominal Voltage		1.5V	1.5V	1.5V	1.5V
Nominal Capacity		15,500mAh (20Ω cont. discharge)	7,600mAh (20Ω cont. discharge)	2,875mAh (75Ω cont. discharge)	1,340mAh (300Ω cont. discharge)
Outer Dimensions	Height	60.9mm	49.6mm	50.1mm	44.2mm
	Diameter	33.0mm	25.6mm	14.0mm	10.3mm

The contents of this catalogue are not guaranteed.

# Alkaline Batteries - High Power

Great for High Drain Devices.



## Features

The perfect battery for any device (low to high drain).

10 years storage

One-year warranty

Leakage protection

## Applications

- digital still cameras, electric shavers, LED lanterns, gaming devices, electronic dictionaries, LED flashlights, portable chargers, IC recorders, electric toothbrushes



## Technical data & discharging times

Model		LR20 High Power	LR14 High Power	LR6 High Power	LR03 High Power
Nominal Voltage		1.5V	1.5V	1.5V	1.5V
Nominal Capacity		15,250mAh (20Ω cont. discharge)	7,550mAh (20Ω cont. discharge)	2,800mAh (75Ω cont. discharge)	1,300mAh (300Ω cont. discharge)
Outer Dimensions	Height	60.9mm	49.6mm	50.1mm	44.2mm
	Diameter	33.0mm	25.6mm	14.0mm	10.3mm

The contents of this catalogue are not guaranteed.

# Alkaline Batteries - Universal Power

Power for Everyday Life.



## Features

Providing the best value for everyday-use devices.

7 years storage

One-year warranty

Leakage protection

## Applications

• remote controllers, wireless computer mice, clocks, educational items



## Technical data & discharging times

Model		LR20 Universal Power	LR14 Universal Power	LR6 Universal Power	LR03 Universal Power
Nominal Voltage		1.5V	1.5V	1.5V	1.5V
Nominal Capacity		15,000mAh (20Ω cont. discharge)	7,500mAh (20Ω cont. discharge)	2,700mAh (75Ω cont. discharge)	1,260mAh (300Ω cont. discharge)
Outer Dimensions	Height	60.9mm	49.6mm	50.1mm	44.2mm
	Diameter	33.0mm	25.6mm	14.0mm	10.3mm

The contents of this catalogue are not guaranteed.

# Alkaline Batteries Handling Precautions for Safe Use

Carefully read these instructions manual before using alkaline batteries for the first time.

In normal use, alkaline manganese batteries provide a safe and dependable source of power. If they are misused or abused, leakage, heating or explosion in extreme cases may occur. Care must be taken according to the following precautions.

## **⚠ DANGER**

1. Take care not to touch the chemicals and electrolyte from inside the batteries directly. Since alkaline solution is used in this battery system, there are risks of not only damage to cloth and skin resulting from adhesion of the solution, but also loss of eyesight if the solution gets into the eyes.
  - In case of such an emergency where the solution gets into the eye, wash immediately with plenty of water and receive medical treatment from a doctor.
  - If the solution adheres to the skin and/or clothes, wash with water and consult a doctor.
2. These batteries are equipped with a mechanism that releases excessive internal pressure to prevent explosion. During charge, short-circuit, and overdischarge of batteries, the internal pressure may rise abnormally and result in electrolyte leakage via venting. However, in extreme circumstances, the vent mechanism may not work normally, and explosion can occur.
3. In the event of short-circuit, battery surface temperature may rise above 100°C.

## **⚠ WARNING**

1. **Always take care to insert batteries correctly according to the designation of polarity (⊕ and ⊖) on the batteries and the equipment.**  
Batteries which are incorrectly placed into equipment may short-circuit, or be charged. This can result in a rapid temperature rise and venting leading to leakage and explosion.
2. **Do not short-circuit batteries.**  
When the positive ⊕ and negative ⊖ terminals of batteries come into direct contact with each other via mixing or storing batteries together, short-circuit can occur. If batteries are short-circuited, excess current flows instantaneously, which leads to heat generation, damaging the internal structure of the batteries, and causing risk of electrolyte leakage, explosion, etc.
3. **Do not charge batteries.**  
These batteries are not rechargeable. Charging may result in electrolyte leakage and/or damage. If charged, gas can be abnormally generated inside of the cell, resulting in increased internal pressure, which may cause electrolyte leakage and/or damage of cell. If the charging current is excessively large, the cell could be at risk of explosion due to gas generation. When unused cells are charged, the risk of electrolyte leakage, damage, explosion, etc. is especially higher.
4. **Do not overdischarge batteries.**  
When a battery is kept connected with an electrical circuit even after the equipment is not in use (due to forgetting to switch off the equipment or possible misuse), the battery will continue to supply energy and reach an overdischarged state. This can result in internal gas generation and electrolyte leakage or explosion. When two or more batteries are connected in series and are overdischarged, the voltage may reach zero or minus volts (polarity change) and such a condition may increase the risk of electrolyte leakage and explosion.

5. **Do not discharge forcibly.**  
When batteries are discharged by an external power supply, the battery voltage becomes extremely low. This can cause internal gas generation and it may increase the risk of electrolyte leakage and explosion.
6. **Do not mix batteries.**  
When replacing batteries, replace all of them at the same time with new batteries of the same brand and type. When batteries of different kinds are used together, or new and old batteries are used together, some batteries may be overdischarged due to a difference of voltage or capacity. This can result in risk of leakage and explosion.
7. **Exhausted batteries should be immediately removed from the equipment and disposed of.**  
When discharged batteries are kept in equipment for extended periods, electrolyte leakage may occur causing damage to the equipment.
8. **Do not heat batteries.**  
If batteries are heated, the resin used in the batteries may melt and deform due to temperature rise, and electrolyte leakage and explosion may occur.
9. **Do not directly solder batteries.**  
If a battery is directly soldered, it may be damaged by heat. This may result in leakage, explosion, etc.
10. **Do not disassemble batteries.**  
Improper disassembly of a battery may result in injury of the fingers, damage to the eyes and skin resulting from leakage of chemicals inside the battery.
11. **Do not deform batteries.**  
Batteries should not be dropped, crushed, punctured, or otherwise damaged. Such abuse may result in leakage, heat generation or explosion.
12. **Do not dispose of batteries in fire.**  
When batteries are disposed of in fire, the heat build-up may cause explosion.
13. **Do not allow children to replace batteries without adult supervision.**
14. **Keep batteries out of the reach of children.**  
Keep batteries which are small enough to be swallowed out of the reach of children. In case of ingestion of a cell or battery, seek medical assistance immediately.
15. **Do not modify batteries.**  
Modification of batteries may cause blockage of the pressure relief vent mechanism and may increase the risk of explosion.
16. **Store unused batteries in their original packaging and keep them away from metal objects which may short-circuit them.**
17. **Remove discharged batteries from equipment.**  
Remove batteries from equipment when they do not work, or when a long period of disuse is anticipated (e.g. video cameras, camera flashes, etc.). A battery partially or completely exhausted may be more at risk of leakage than an unused battery.

## Precautions during handling, transportation, display, storage, and disposal

1. **Avoid rough handling of battery cartons.**  
Rough handling of battery cartons may lead to battery damage and impaired electrical performance and may result in leakage, explosion or heat generation.
2. **Battery cartons should not be stacked in multiple layers (or should not exceed a specified height).**  
If too many battery cartons are stacked, the batteries in the cartons at the bottom may become deformed and leak. As a general guide, the height should not exceed 1.5 m for cardboard packs.
3. **Batteries shall be stored in well-ventilated, dry and cool conditions.**  
Storage at high temperature and high humidity leads to deterioration of the battery performance and electrolyte leakage. For normal storage, the temperature should be between +10°C and +25°C and never exceed +30°C. Extreme humidity (over 95% RH for example) for sustained periods should be avoided since this is detrimental to both batteries and packaging. Batteries should not be stored near radiators, boilers or in direct sunlight.
4. **When batteries are stored in warehouses or displayed in storefronts, they should not be exposed to direct sunlight or rain water for extended periods.**  
Exposure to high temperature may increase performance deterioration and risk of electrolyte leakage. If batteries get wet, their insulation resistance decreases, increasing the risk of self-discharge and generation of rust.
5. **Do not mix unpackaged batteries so as to avoid mechanical damage and/or short-circuit of each other.**  
When batteries are mixed together, external short circuit may occur, possibly resulting in physical damage, heat generation, leakage and/or explosion. To avoid these possible hazards, batteries should be kept in their packaging until use.
6. **In the distribution process such as transportation, display, and storage, practice first in, first out and take care to avoid storage over a long period.**
7. **Batteries shall be disposed of in accordance with local regulations.**  
For disposal of batteries, insulate terminals with tape to prevent external short circuit resulting from terminal shape, such as 9V prismatic batteries.

## Battery compartment guidelines

1. **Technical Liaison**  
It is recommended that companies producing battery-powered equipment should maintain close liaison with the battery industry. The capabilities of existing batteries should be taken into account at design inception. Whenever possible, the battery type selected should be one included in IEC 60086-2. The equipment should be permanently marked with the IEC designation, grade and size of battery which will give optimum performance.
2. **Battery Compartment**
  - a) Battery compartments should be easily accessible. Design compartments so that batteries are easily inserted and do not fall out. The dimensions and design of compartments and contacts should be such that batteries complying with this standard will be accepted. In particular, the equipment designer should not ignore the tolerances given in this standard, even if a national standard or a battery manufacturer calls for smaller battery tolerances.
  - b) The design of the negative contact should make allowance for any recess of the battery terminal.
  - c) Equipment intended for use by children should have battery compartments which are tamper-proof.
  - d) Clearly indicate the type of battery to use, the correct polarity alignment and directions for insertion.
  - e) Use the shape and/or the dimensions of the positive ⊕ and negative ⊖ battery terminals in compartment designs to prevent the reverse connection of batteries. Positive ⊕ and negative ⊖ battery contacts should be visibly different in form to avoid confusion when inserting batteries.
- f) Battery compartments should be electrically insulated from the electric circuit and positioned so as to minimize possible damage and/or risk of injury. Only the battery terminals should physically contact the electric circuit. Care should be taken in the choice of materials and the design of contacts to ensure that effective electrical contact is made and maintained under conditions of use even with batteries at the extremes of dimensions permitted by this standard. Battery and equipment terminals should be of compatible material and low electrical resistance.
- g) Battery compartments with parallel connections are not recommended since a wrongly placed battery will result in charging conditions.
- h) Although batteries are very much improved regarding their resistance to leakage, it can still occur occasionally. When the battery compartment cannot be completely isolated from the equipment, it should be positioned so as to minimize possible damage.
- i) The battery compartment shall be clearly and permanently marked to show the correct orientation of the batteries. The reversed placement of one battery in a set, which may result in battery leakage and/or explosion and/or fire. To minimize this hazard, battery compartments should be designed so that a reversed battery will result in no electrical circuit.
- j) The associated circuitry should not make physical contact with any part of the battery except at the surfaces intended for this purpose.
- k) Designers are strongly advised to refer to IEC 60086-5 for comprehensive safety considerations.

## Notes on Environmental Regulations

### Certificate of Conformity to Battery Directive

We hereby certify that our alkaline batteries delivered to you conform to Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators (referred to as the "Battery Directive"). According to the Directive, the following restricted substances and labeling requirements are set down and our batteries conform to these requirements. In addition, easy removal of batteries from the applications is also set down in the Directive, therefore your taking into consideration this requirement in the design stage of your application is appreciated.

1. **Restricted substances (Article 4)**  
Batteries containing the following substances with more than the designated content by weight are prohibited to be placed on EU market:  
Mercury: 5ppm / Cadmium: 20ppm
2. **Labeling (Article 12)**  
A mark meaning separate waste collection should be placed on all batteries and accumulators in EU member states. We put marks on the body of the battery for cylindrical and prismatic batteries, or on the packaging for small batteries such as coin-type batteries.
3. **Easy removal of waste batteries (Article 11)**  
Manufacturers shall design products in such a way that waste batteries can be readily removed. This requirement is deemed to comply with in such cases where batteries can be removed by end-users or independent qualified professionals.

### Response to RoHS 2 Directive

1. **Basic view**  
The recital 14 of RoHS 2 Directive explicitly states the following:  
"This Directive should apply without prejudice to Union legislation on safety and health requirements and specific Union waste management legislation, in particular Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and Regulation (EC) No 850/2004." This means the Battery Directive has precedence over the RoHS 2 Directive for batteries and accumulators. Therefore, we are not in a position to submit a certificate or an agreement for batteries and accumulators regarding conformity with the RoHS 2 Directive. We appreciate your understanding.
2. **Restricted substances**  
RoHS 2 Directive regulates the restriction of maximum concentration value by weight in homogeneous materials<sup>®</sup> of electrical and electronic equipment (EEE) in Annex I as shown below. <sup>®</sup>homogeneous materials means uniform composition that cannot be disjoined or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes.  
I. Mercury 0.1% / II. Lead 0.1% / III. Cadmium 0.01% / IV. Cr+6 0.1% / V. PBBs 0.1% / VI. PBDEs 0.1% / VII. DEHP 0.1% / VIII. BBP 0.1% / IX. DBP 0.1% / X. DIBP 0.1%  
Since RoHS 2 Directive does not apply to batteries and accumulators as aforementioned, the restriction of use of the above 10 materials is not applicable to our batteries. However, our alkaline batteries do not contain any of these 10 materials, so we can deliver an analysis report for our batteries simply as a certificate of non-use. The rule about homogeneous materials described in article 3 (20) of RoHS 2 Directive is not applicable to batteries and accumulators, so we provide data analysis reporting based on battery weight.

3. **CE marking (not applicable to batteries)**  
Article 7 of RoHS 2 Directive sets down the manufacturer's obligations when they place their products on EU market. Products bearing the CE marking is one part of these obligations. However, as aforementioned, RoHS 2 Directive does not apply to batteries and accumulators, hence our batteries and accumulators do not bear CE marking.

### Correlation between Battery Directive and WEEE/RoHS Directive

If you are concerned about the correlation between the Battery Directive (applied to batteries and accumulators) and the WEEE/RoHS Directives (also known as EU environmental regulations), we would like to introduce the website of the battery Association of Japan (BAJ), where you can find BAJ's official view on this matter.  
<http://www.baj.or.jp/e/recycle/recycle09.html>

### Response to REACH Regulation

1. **Is it necessary to register a battery in accordance with the REACH Regulation?**  
Batteries are categorized as "articles" by REACH. Articles 7 (1) and 7 (5) of the REACH Regulation state that a producer or an importer of articles should register to the agency any substance contained in those articles, if both the following conditions are met:
  - a) The substance is intended to be released under normal or reasonably foreseeable conditions of use, and
  - b) The total weight of the substance contained in the article(s) exceeds one ton per producer or importer per year.Batteries are not such articles that contain substances that are intended to be released, but rather batteries are intended to supply electricity generated by an internal chemical reaction of the positive and negative electrodes.  
Therefore condition a) is not applicable and there is no obligation to register to the agency. For this reason, we cannot submit a certificate or an agreement for batteries in regards to compliance with the REACH Regulation. We appreciate your understanding.
2. **Our obligation to the REACH Regulation**
  - (1) Duty to communicate information on substances in articles  
Article 33 states "Any supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1 % weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance."  
(2) Duty of compliance with restricted substances  
Article 67 states "A substance on its own, in a preparation or in an article, for which Annex XVII contains a restriction shall not be manufactured, placed on the market or used unless it complies with the conditions of that restriction."  
We comply with these requirements.

### Response to SVHC Candidates

SVHC candidates can become subject to authorization and as a result, it is important to be aware of the most recent situation. We always monitor relevant information such as news releases from ECHA and carefully check whether newly announced SVHC candidate substances are contained in our components or not. Confirmation from our suppliers can take multiple days, so we would appreciate your understanding in case our response to any queries is delayed. Please feel free to contact our sales representatives for requests about SVHC candidate list.

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