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

1984  Launched FUJITSU brand batteries

2001  Company name changed to FDK Corporation

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

FDK is proud of our battery performance. All are built in accordance with Japanese quality standards, which is truly the result of Japanese technology. Each of our factories, not only in Japan but also in Indonesia, utilize technologies engineered in Japan. We are committed to delivering to the world safe and secure batteries.

※ To better serve our customer’s and fulfill their requirements (cost, delivery, quality) we offer some models made in Indonesia.
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.

Features of FDK nickel metal-hydride batteries

FDK original technology

Positive electrode material

Nickel hydroxide coated with a highly conductive cobalt compound

Examples of long-term storage characteristics (Discharge state)

Temperature: 25°C
Temperature: 40°C

Negative electrode material

Super lattice hydrogen absorbing alloy

Examples of low temperature discharge characteristics (~40°C discharge)

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

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.

<table>
<thead>
<tr>
<th>Applications for FDK Ni-MH Batteries</th>
<th>High Durability for In-Vehicle Applications</th>
<th>High Durability</th>
<th>High-Rate Discharge</th>
<th>Standard</th>
<th>Dry Cell Compatible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
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<td>In-vehicle transportation</td>
<td>eCall · eToll</td>
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<td>Medical &amp; health care</td>
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<td>Power tools</td>
<td></td>
<td>electric tools</td>
<td>electric tools</td>
<td>electric tools</td>
<td>electric tools</td>
</tr>
</tbody>
</table>

The contents of this catalogue are not guaranteed.
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.

**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, efoll, dashboard cameras etc.

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### 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.

#### Temperature cycling characteristics

- **Low-temp discharge model**
  - Temperature : 20°C ± 4h
  - Charge : 0.1It × 9h
  - Off : 1h

- **High durability Ni-MH Battery**
  - Temperature : -20°C ± 5h
  - Capacity Check : Discharge 1It (E.V.=1.0V)

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### T series

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-2/3AAAUT</th>
<th>HR-AAAUT</th>
<th>HR-AAAUTE Low-temp discharge model</th>
<th>HR-AAULT</th>
<th>HR-AAUTE Low-temp discharge model</th>
<th>HR-4/3FAUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
</tr>
<tr>
<td>Typical Capacity</td>
<td>220mAh</td>
<td>500mAh</td>
<td>500mAh</td>
<td>1050mAh</td>
<td>1100mAh</td>
<td>3700mAh</td>
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<tr>
<td>Minimum Capacity</td>
<td>200mAh</td>
<td>460mAh</td>
<td>460mAh</td>
<td>1000mAh</td>
<td>1000mAh</td>
<td>3500mAh</td>
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<tr>
<td>Quick-Charge Current</td>
<td>220mA</td>
<td>500mA</td>
<td>500mA</td>
<td>1050mA</td>
<td>1100mA</td>
<td>3000mA</td>
</tr>
<tr>
<td>Time</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.4h</td>
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<td>Dimensions (incl. tube) Diameter</td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>14.2mm</td>
<td>14.2mm</td>
<td>18.0mm</td>
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<tr>
<td>Height</td>
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<td>44.5mm</td>
<td>49.0mm</td>
<td>50.0mm</td>
<td>67.5mm</td>
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<tr>
<td>Weight</td>
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<td>13g</td>
<td>13g</td>
<td>25g</td>
<td>27g</td>
<td>58g</td>
</tr>
</tbody>
</table>

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

The contents of this catalogue are not guaranteed.
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.

### Specifications

#### C-series

<table>
<thead>
<tr>
<th>C-series Model</th>
<th>HR-AAAUC</th>
<th>HR-4/5AAUC</th>
<th>HR-AAUC</th>
<th>HR-4/5AUC</th>
<th>HR-4/3AUHPC</th>
<th>HR-4/3FAUPC</th>
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</thead>
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<tr>
<td>Nominal Voltage</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
</tr>
<tr>
<td>Typical Capacity</td>
<td>700mAh</td>
<td>1100mAh</td>
<td>840mAh</td>
<td>1200mAh</td>
<td>1700mAh</td>
<td>2700mAh</td>
</tr>
<tr>
<td>Minimum Capacity</td>
<td>650mAh</td>
<td>1000mAh</td>
<td>770mAh</td>
<td>1100mAh</td>
<td>1550mAh</td>
<td>2500mAh</td>
</tr>
<tr>
<td>Quick-Charge Time</td>
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<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
</tr>
<tr>
<td>Dimensions (incl. tube)</td>
<td>10.5mm</td>
<td>14.2mm</td>
<td>14.2mm</td>
<td>18.1mm</td>
<td>17.0mm</td>
<td>23.0mm</td>
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#### T-series

<table>
<thead>
<tr>
<th>T-series Model</th>
<th>HR/2/3AAAUTU</th>
<th>HR-AAAUT</th>
<th>HR-AAULTU</th>
<th>HR-AAULT</th>
<th>HR-4/5FAUPT</th>
<th>HR-AUT</th>
<th>HR-5/4SCUT</th>
<th>HR-4/3FAUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
</tr>
<tr>
<td>Typical Capacity</td>
<td>220mAh</td>
<td>500mAh</td>
<td>780mAh</td>
<td>1050mAh</td>
<td>1580mAh</td>
<td>1650mAh</td>
<td>2200mAh</td>
<td>3250mAh</td>
</tr>
<tr>
<td>Minimum Capacity</td>
<td>200mAh</td>
<td>460mAh</td>
<td>700mAh</td>
<td>1000mAh</td>
<td>1500mAh</td>
<td>1500mAh</td>
<td>2000mAh</td>
<td>3000mAh</td>
</tr>
<tr>
<td>Dimensions (incl. tube)</td>
<td>30.0mm</td>
<td>49.0mm</td>
<td>49.0mm</td>
<td>49.0mm</td>
<td>50.0mm</td>
<td>50.0mm</td>
<td>50.0mm</td>
<td>67.5mm</td>
</tr>
<tr>
<td>Weight</td>
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<td>13g</td>
<td>20g</td>
<td>25g</td>
<td>26g</td>
<td>37g</td>
<td>69g</td>
<td>58g</td>
</tr>
</tbody>
</table>

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

### Charge / Discharge Cycle Characteristics

<table>
<thead>
<tr>
<th>Number of Cycles</th>
<th>0</th>
<th>500</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>3000</th>
<th>5000</th>
<th>8000</th>
<th>10000</th>
<th>15000</th>
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<tbody>
<tr>
<td>Discharge Capacity (mAh)</td>
<td>1000</td>
<td>1100</td>
<td>1000</td>
<td>900</td>
<td>800</td>
<td>700</td>
<td>600</td>
<td>500</td>
<td>400</td>
<td>300</td>
</tr>
</tbody>
</table>

#### Handling Precautions

- **Ni-MH BATTERY**

  Charge / Discharge Cycle Characteristics

- **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.

The contents of this catalogue are not guaranteed.
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

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-4/5FAUP</th>
<th>HR-4/3FAUHPC</th>
<th>HR-SCU</th>
<th>HR-4/3FAUPC</th>
<th>HR-4/3FAUP</th>
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</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
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<tr>
<td>Typical Capacity</td>
<td>1950mAh</td>
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<td>3000mAh</td>
<td>3200mAh</td>
<td>3600mAh</td>
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<tr>
<td>Minimum Capacity</td>
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<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
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<tr>
<td>Dimensions (incl. tube)</td>
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<td>59g</td>
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<td>58g</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-5/4AAAU</th>
<th>HR-AAUE Low-temp discharge model</th>
<th>HR-AAU</th>
<th>HR-4/5AU</th>
<th>HR-AU</th>
<th>HR-AUE Low-temp discharge model</th>
<th>HR-4/3AU</th>
<th>HR-4/3FAU</th>
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<tr>
<td>Nominal Voltage</td>
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<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
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<tr>
<td>Typical Capacity</td>
<td>850mAh</td>
<td>1400mAh</td>
<td>1650mAh</td>
<td>2150mAh</td>
<td>2700mAh</td>
<td>2700mAh</td>
<td>4000mAh</td>
<td>4500mAh</td>
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<tr>
<td>Minimum Capacity</td>
<td>760mAh</td>
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<td>1950mAh</td>
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<td>2450mAh</td>
<td>3600mAh</td>
<td>4100mAh</td>
</tr>
<tr>
<td>Quick-Charge</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.4h</td>
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<tr>
<td>Dimensions (incl. tube)</td>
<td>10.5mm</td>
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<td>14.2mm</td>
<td>17.0mm</td>
<td>17.0mm</td>
<td>17.0mm</td>
<td>17.0mm</td>
<td>18.0mm</td>
</tr>
<tr>
<td>Weight</td>
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<td>27g</td>
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<td>37g</td>
<td>39g</td>
<td>53g</td>
<td>59g</td>
</tr>
</tbody>
</table>

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

**Applications**

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

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-4UTG</th>
<th>HR-4UQ</th>
<th>HR-4U</th>
<th>HR-3UTG</th>
<th>HR-3UQ</th>
<th>HR-3UWX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
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<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
<td>1.2V</td>
</tr>
<tr>
<td>Typical Capacity</td>
<td>800mAh</td>
<td>600mAh</td>
<td>1000mAh</td>
<td>2000mAh</td>
<td>1000mAh</td>
<td>2500mAh</td>
</tr>
<tr>
<td>Minimum Capacity</td>
<td>750mAh</td>
<td>550mAh</td>
<td>930mAh</td>
<td>1900mAh</td>
<td>950mAh</td>
<td>2400mAh</td>
</tr>
<tr>
<td>Quick-Charge Current</td>
<td>800mA</td>
<td>600mA</td>
<td>1000mA</td>
<td>2000mA</td>
<td>1000mA</td>
<td>2500mA</td>
</tr>
<tr>
<td>Time</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
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<tr>
<td>Dimensions (excl. tube)**</td>
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<td>14.35mm</td>
<td>14.2mm</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>44.5mm</td>
<td>44.5mm</td>
<td>44.5mm</td>
<td>50.4mm</td>
<td>50.4mm</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>13g</td>
<td>11g</td>
<td>13g</td>
<td>27g</td>
<td>19g</td>
</tr>
</tbody>
</table>

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

The contents of this catalogue are not guaranteed.
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)
- Custom designed battery system
- Standard battery system

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

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.

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.

- PTC
- Breaker
- Thermistor

*PTC and Breaker are resettable 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.

- In-vehicle equipment
- Home security
- Emergency lights
- Electric bicycles
- Power tools
- Wireless devices
- Vacuum cleaners

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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.

- 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 Designed Battery System

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

For medical equipment
- DC12V 70W output
- DC48V 450W output

For servers
- DC12V 280W output
- DC48V 1kW 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.

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

The contents of this catalogue are not guaranteed.
Ni-MH Battery Charger for 10-20 Series Battery Packs

- Designed to charge 10-20 series Ni-MH battery packs.
  ※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.

### Charging Method

<table>
<thead>
<tr>
<th>Charging Method</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main charging</strong></td>
<td><strong>Maintenance charging</strong></td>
</tr>
<tr>
<td>Quick charging</td>
<td>Pulse current charging</td>
</tr>
<tr>
<td>Low rate charging</td>
<td>Intermittent charging</td>
</tr>
<tr>
<td>Peak voltage control charging</td>
<td>Peak voltage control charging</td>
</tr>
<tr>
<td>(\Delta V) control charging</td>
<td>(\Delta V) control charging</td>
</tr>
<tr>
<td>(\Delta T/dt) control charging</td>
<td>Timer control charging</td>
</tr>
<tr>
<td>Terminate charging by detecting battery peak voltage</td>
<td>Charging by pulse current to compensate self-discharge after main charging to keep fully charged state</td>
</tr>
<tr>
<td>Terminate charging by detecting battery temperature rate</td>
<td>Charging intermittently after main charging to return to fully charged state</td>
</tr>
<tr>
<td>Terminate charging by detecting specified battery voltage drop after peak voltage</td>
<td>(Factor of recharging: battery voltage, elapsed time)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charging Time</th>
<th>1~2h</th>
<th>1~2h</th>
<th>1~2h</th>
<th>11~12h</th>
<th>—</th>
<th>—</th>
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</thead>
<tbody>
<tr>
<td>Charging Current</td>
<td>0.5~1.0It</td>
<td>0.5~1.0It</td>
<td>0.5~1.0It</td>
<td>0.1It</td>
<td>1/20~1.0It (Avg. 1/500It)</td>
<td>1/20~1.0It</td>
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<tr>
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<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>High Durability Type</td>
<td>○</td>
<td>○</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
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<td>High-Rate Discharge Type</td>
<td>○</td>
<td>○</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
</tr>
<tr>
<td>Dry Cell Compatible Type</td>
<td>○</td>
<td>○</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
</tr>
</tbody>
</table>

○ Recommended: Suitable to exhibit battery performance.
○ Available: Can be used depending on the specification of equipment.
1 It is rated capacity (Ah) / (It) hr
2 Proper charging method and charging condition are depending on the specification/usage of equipment or structure of battery pack. Please contact us for details.
3 Some charging methods should not be applied to dry cell compatible batteries regardless of equipment specification. Please contact us for details.

The contents of this catalogue are not guaranteed.
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 evaluated for using Ni-MH batteries and has been 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**

1. Failure to carefully observe the following procedures and precautions can result in leakage of battery fluid (electrolyte), heat generation, bursting, 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 terminals of Ni-MH batteries by electrically conductive materials, including lead wires. Do not transport or store Ni-MH batteries with their terminals uncovered or in contact with a metal objects (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.
   - Keep Ni-MH batteries out of the reach of infants and small children, as they can be harmful to users.

**CAUTION**

1. Never 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.
2. Do not 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 equipment being used.
3. 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 associated with Ni-MH batteries.

**WARNING**

1. Do not apply water, seawater or other ionic 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.
2. Do not use Ni-MH batteries for the 21st Ni-MH batteries in series, as this may cause electrolyte leaks, shocks, leakage of battery fluid and heat generation.
3. 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.
4. Do not charge or use Ni-MH batteries with the 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.
5. 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.
6. Do not connect Ni-MH batteries in series or parallel. This may cause leakage of battery fluid and heat generation.
7. 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.
8. Do not use Ni-MH batteries mixed together, or batteries of different charge levels. Do not use Ni-MH batteries mixed together with a dry cell or other battery of a different capacity, size, or brand name. This may cause leakage of battery fluid and heat generation.
9. In case Ni-MH 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.
10. Do not connect Ni-MH batteries in parallel in this case as this may cause leakage of battery fluid heat generation, bursting and fire.
11. For the recommended charging method for Ni-MH batteries, read the battery charger's instruction manual carefully.
12. 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.
13. If Ni-MH batteries do not perform or function well with certain subject, refer to the instruction manual or warnings of the subject equipment.
14. 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.
15. After long term storage, there's a possibility that a battery cannot be fully charged, in order to fully charge it, charge and discharge the battery a few times.
16. Be sure to turn off the equipment after use of Ni-MH batteries, as this may result in leakage of battery fluid.
17. After Ni-MH batteries 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 50°C for longer battery life.)
18. 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.
19. 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.
20. 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.
21. 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.)
22. 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

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.

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
- Extended usage 20 years

Typical Uses of Lithium Batteries

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

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

The contents of this catalogue are not guaranteed.
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.

![10 years → 20 years](image)

**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.

![-40°C → +85°C](image)

**Advantage 4: Long lasting 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.

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

![Graph showing battery capacities and current ratings](image)

The contents of this catalogue are not guaranteed.
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 (-4°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)

Specifications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
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<tr>
<td>In accordance with IEC standard nomenclature</td>
<td>17335</td>
<td>17450</td>
<td>17450</td>
<td>17E600</td>
<td>17335</td>
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<td>17450</td>
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<td>3V</td>
<td>3V</td>
<td>3V</td>
<td>3V</td>
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<td>Nominal Capacity</td>
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<td>2400mAh</td>
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<td>1400mAh</td>
<td>1600mAh</td>
<td>1700mAh</td>
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<td>Standard Discharge Current</td>
<td>5mA</td>
<td>5mA</td>
<td>5mA</td>
<td>5mA</td>
<td>14mA</td>
<td>14mA</td>
<td>5mA</td>
<td>14mA</td>
<td>5mA</td>
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<tr>
<td>Max. Pulse Current</td>
<td>2500mA</td>
<td>2500mA</td>
<td>3500mA</td>
<td>4000mA</td>
<td>4000mA</td>
<td>3500mA</td>
<td>3000mA</td>
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<tr>
<td>Dimensions</td>
<td>Diameter</td>
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<td>17.0mm</td>
<td>17.0mm</td>
<td>17.4mm</td>
<td>17.0mm</td>
<td>17.0mm</td>
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<td>17.0mm</td>
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<tr>
<td></td>
<td>Height</td>
<td>33.5mm</td>
<td>45.0mm</td>
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<td>50.0mm</td>
<td>33.5mm</td>
<td>33.5mm</td>
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<td>45.0mm</td>
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<tr>
<td></td>
<td>Approx. Weight</td>
<td>17g</td>
<td>23g</td>
<td>23g</td>
<td>27g</td>
<td>17g</td>
<td>17g</td>
<td>17g</td>
<td>23g</td>
<td>23g</td>
</tr>
</tbody>
</table>

- 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.
- 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.

The contents of this catalogue are not guaranteed.
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 (-4°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**

<table>
<thead>
<tr>
<th>Model</th>
<th>CR14250SE</th>
<th>CR2/3 8 ·L</th>
<th>CR8·LHC</th>
<th>CR8LHT</th>
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<td>17335</td>
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<tr>
<td>Nominal Voltage</td>
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<td>3V</td>
<td>3V</td>
<td>3V</td>
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<tr>
<td>Nominal Capacity</td>
<td>850mAh</td>
<td>1900mAh</td>
<td>3000mAh</td>
<td>2850mAh</td>
</tr>
<tr>
<td>Standard Discharge Current</td>
<td>0.5mA</td>
<td>0.5mA</td>
<td>0.5mA</td>
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<tr>
<td>Dimensions</td>
<td>Diameter: 14.5mm</td>
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<td>Height: 25.0mm</td>
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<td></td>
<td>Approx. Weight</td>
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<td>16g</td>
<td>23g</td>
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</table>

※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.

The contents of this catalogue are not guaranteed.
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

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>CF042223 (N)</th>
<th>CF042722U (N)</th>
<th>CF042039 (N)</th>
<th>CF052722U (N)</th>
<th>CF052039 (N)</th>
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<tr>
<td>Nominal Voltage</td>
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<td>3V</td>
<td>3V</td>
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<tr>
<td>Nominal Capacity</td>
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<td>25mAh</td>
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<td>Standard Discharge Current</td>
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<td>0.25mA</td>
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<td>Dimensions</td>
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<tr>
<td>Length</td>
<td>L:27.0mm (≤:24.0mm)</td>
<td>L:25.5mm (≤:22.5mm)</td>
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<td>Thickness</td>
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<td>Approx. Weight</td>
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<td>0.5g</td>
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</table>

- 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.
- 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.

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

The contents of this catalogue are not guaranteed.
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)

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>In accordance with IEC standard nomenclature</td>
<td>1220</td>
<td>1620</td>
<td>2016</td>
<td>2025</td>
<td>2032</td>
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<tr>
<td>Nominal Voltage</td>
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<td>3V</td>
<td>3V</td>
<td>3V</td>
<td>3V</td>
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<td>6V</td>
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<td>Nominal Capacity</td>
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<td>80mAh</td>
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<td>Standard Discharge Current</td>
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<td>0.1mA</td>
<td>0.2mA</td>
<td>0.2mA</td>
<td>0.2mA</td>
<td>2.7mA</td>
<td>2.7mA</td>
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<tr>
<td>Dimensions</td>
<td>Diameter</td>
<td>12.5mm</td>
<td>16.0mm</td>
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<tr>
<td></td>
<td>Height</td>
<td>2.0mm</td>
<td>2.0mm</td>
<td>1.6mm</td>
<td>2.5mm</td>
<td>3.2mm</td>
<td>10.8mm</td>
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<tr>
<td></td>
<td>Approx. Weight</td>
<td>0.8g</td>
<td>1.3g</td>
<td>1.7g</td>
<td>2.5g</td>
<td>3.0g</td>
<td>3.3g</td>
</tr>
</tbody>
</table>

*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.

*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.

The contents of this catalogue are not guaranteed.
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

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

Temperature Characteristics

- 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.
- 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.
- 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 lithium 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 batteries under specified conditions (Rechargeable batteries: ML series).

Doing so may generate gas inside the battery, resulting in leakage, heat generation, explosion or fire.

4. Do not short-circuit the 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 poles reversed.

Make sure the poles 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 the may cause leakage, heat generation, explosion or fire.

6. If leaked liquid gets in the eyes, it can cause eye injury.

Wash the eyes 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 charging 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.

**CAUTION**

1. Make sure to insert batteries in the application so that the positive and negative terminals do 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 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.

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 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 poles reversed.

Make sure the poles 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 the may cause leakage, heat generation, explosion or fire.

5. If leaked liquid gets in the eyes, it can cause eye injury.

Wash the eyes 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.

8. Do not scratch nor peel off the thin film on the surface of the battery.

The battery surface is covered with thin film to prevent short-circuit. Cutting with an edged tool or peeling off the film may cause short-circuit, resulting in leakage, heat generation, explosion or fire.

9. 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.

10. Do not deform the battery in any way.

Doing so may cause damage or gas release vent resulting in leakage, heat generation, explosion or fire.

11. Make sure to inspectate 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 leakage, heat generation, explosion or fire.

12. Do not use new and used batteries together. Do use different types of batteries together.

Difference in their characteristics may cause leakage, heat generation, explosion or fire.

13. 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 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.

**Requests Regarding Quality Assurance and Ensuring Safety**

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

1. Connecting batteries in series or in parallel on circuits.

2. Molding batteries with resin.

3. Welding terminals onto batteries.

4. Connecting batteries in series or in parallel on circuits.

5. Do not scratch nor peel off the thin film on the surface of the battery.

6. Avoid contact with water.

7. Contact method such as battery holder for thin- and cylindrical-type primary lithium batteries and coin-type rechargeable lithium batteries.

**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 UN3290 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 (MDG-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 it is important to refer to the latest IATA-DGR (6th Edition).

**Special Notes Regarding FDK Lithium Batteries**

- Package specifications of our lithium batteries comply with all regulations 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.
- Shipping agents may have their own rules of transportation, so please contact them in advance.

**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 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. These 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.
Air transportation of our lithium batteries

1. Transportation of batteries packed by themselves (UN3090)

Air transportation of lithium cells and batteries is permitted on cargo aircraft only. The Packing Instruction 968 (PI 968) 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 I A**
  - Cells containing more than 1g or less than 2g of lithium or 2g of lithium metal are applicable to Section I A, and it is permitted to transport them as Class 9 Dangerous Goods when they comply with all requirements of the transport conditions of Section I A.

- **Transport of batteries in accordance with Section I B**
  - Cells containing more than 0.5g and less than 1g of lithium or batteries (battery packs) containing more than 0.5g and less than 2g of lithium are applicable to Section I B, and it is permitted to transport them without using a Class 9 Dangerous Goods container (packing group II) when they comply with all requirements of the transport conditions of Section I B.

- **Transport of batteries in accordance with Section I C**
  - Cells containing more than 0.5g of lithium are applicable to Section I C, and it is permitted to transport them as exempted Class 9 Dangerous Goods when they comply with all requirements of the transport conditions of Section I C. However, the number of package prepared to transport in accordance with Section I C with a single airway is limited to one.

Sea transportation of our lithium batteries

- **Regulation for air transportation in the USA**
  - For more detailed information of transport conditions, please refer to IATA DGR 6th edition.

Sea transportation of our lithium batteries

- **If lithium content of cells is 1g or less, or total lithium content of batteries 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 of the transport conditions of Section I A.

**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 when they are used in Electrical and Electronic Equipment (EEE). Please refer to the latest version of RoHS 2 Directive or the local regulations applicable to batteries in different countries. For further information, please visit the website of FDK.

**FDK Lithium Battery Models and Dimensions**

- **Cylindrical-type Primary Batteries**

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<thead>
<tr>
<th>Diameter (mm)</th>
<th>Height (mm)</th>
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<tbody>
<tr>
<td>25.0</td>
<td>45.0</td>
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<tr>
<td>33.5</td>
<td>50.0</td>
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<td>45.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>

- **Coin-type Batteries**

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Height (mm)</th>
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</thead>
<tbody>
<tr>
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<td>1.6</td>
<td>15.6</td>
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<td>2.5</td>
<td>14.8</td>
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<tr>
<td>3.2</td>
<td>14.6</td>
</tr>
<tr>
<td>10.8</td>
<td>14.8</td>
</tr>
</tbody>
</table>

**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, this means the Battery Directive has precedence over the RoHS 2 Directive. In the case of battery Directive, the following restricted substances 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.

**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.org.jp/recycle/recycle06.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 theagency 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.

2. Our obligation to the REACH Regulation
   a. 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 the user of the article including, as a minimum, the name of that substance.”
   b. Duty of compliance with restricted substances Article 67 states “A substance in 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 new releases from ECHA and carefully check whether newly announced SVHC candidate substances are contained in our components or not. Confirmation of your supplier 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.
ALKALINE BATTERY
These alkaline dry batteries are long lasting, easy to use, and safe.

Alkaline dry batteries are an active part of the devices in our lives with their high power and long duration which deliver high performance for different applications. Our batteries are made in Japan and Indonesia according to the highest quality standards.

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 prevents the rise of internal resistance resulting from oxidation and also prevents gas generation resulting in corrosion inside the battery.

Uses of FDK’s alkaline batteries

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

- Low current equipment
  - Wireless computer mice, clocks, remote controllers

- Middle current equipment
  - Educational items

- High current equipment
  - IC recorder, electric toothbrushes, portable chargers, blood pressure monitors, amateur 2-way radio

The contents of this catalogue are not guaranteed.
# 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

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

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).

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

**Technical data & discharging times**

<table>
<thead>
<tr>
<th>Model</th>
<th>LR20 High Power</th>
<th>LR14 High Power</th>
<th>LR6 High Power</th>
<th>LR03 High Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>1.5V</td>
<td>1.5V</td>
<td>1.5V</td>
<td>1.5V</td>
</tr>
<tr>
<td>Nominal Capacity</td>
<td>15,250mAh (20Ω cont. discharge)</td>
<td>7,550mAh (20Ω cont. discharge)</td>
<td>2,800mAh (75Ω cont. discharge)</td>
<td>1,300mAh (300Ω cont. discharge)</td>
</tr>
<tr>
<td>Outer Dimensions</td>
<td>Height</td>
<td>Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>LR20 High Power</td>
<td>LR14 High Power</td>
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<td>LR03 High Power</td>
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<tr>
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<td>LR20 High Power</td>
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<tr>
<td>LR14 High Power</td>
<td>49.6mm</td>
<td>25.6mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LR6 High Power</td>
<td>50.1mm</td>
<td>14.0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LR03 High Power</td>
<td>44.2mm</td>
<td>10.3mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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.

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 mixing alkaline 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, new and old batteries are used together, some batteries may be overcharged due to different load conditions which may result in leakage of electrolyte and explosion.

7. Exposed 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 surrounding equipment.

8. Do not heat batteries.
If a battery is heated, the risk 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.
When a battery is directly soldered, it may be damaged by heat. This may result in leakage, explosion or fire.

10. Do not dispose of batteries in the fire.
When batteries are disposed of in the fire, the heat build-up may cause explosion.

11. Do not allow children to replace batteries without adult supervision.
To keep batteries out of the reach of children. If a child ingests a cell or battery, seek medical assistance immediately.

12. Do not disassemble batteries.
Improper disposal of a battery may result in injury of the fingers, damage to the eyes and skin resulting from leakage of chemicals inside the battery.

13. Do not short the cells.
Batteries should not be dropped, crushed, punctured, or otherwise damaged. Such abuse may result in leakage, explosion, fire, or shock.

14. In order to prevent leakage resulting from a battery being driven into reverse, the equipment voltage cut-off that is below the battery manufacturer's recommendation.

Notes on Environmental Regulations

10. Do not disassemble batteries.

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ALKALINE BATTERY
ALKALINE BATTERY
Handling Precautions

1. Avoid rough handling of batteries.

- Rough handling of battery cartons may lead to battery damage and impaired electrical performance and may result in leakage, explosion or heat generation.

- Battery cartons should not be handled by more than two people

- Bubbles should be well ventilated in dry and cool conditions.

- Adhesive tapes should not exceed a specified height.

- If any battery cartons are stacked, the batteries in the carton may become deformed and leak.

- As a general rule, batteries should be handled in such a way that they do not come into contact with each other.

- Bubbles should be well ventilated in dry and cool conditions.

- Normal storage temperature should be between +10°C and +40°C and never exceed +30°C. Extreme humidity (over 95% RH for wet or saturated places) should not be used. These conditions are detrimental to both batteries and equipment.

- Bubbles should not be stored near radiators, on or in direct sunlight.

Our obligation to the REACH Regulation

- Battery compartments should be electrically insulated from the cell compartment designs to prevent reverse connection of batteries. Positive and negative battery terminals should be effectively insulated from each other.

- Batteries are not such articles that contain substances that are intended to be released, but rather batteries are intended to supply electrical energy.

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The contents of this catalogue are subject to change for improvement without notice.

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