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.
F DK 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
       • New nickel-zinc 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. We are committed to delivering to the world safe and secure batteries.
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.

**Features of FDK nickel metal-hydride batteries**

**FDK original technology**

**Positive electrode material**
- Nickel hydroxide coated with a highly conductive cobalt compound

**Negative electrode material**
- Super lattice hydrogen absorbing alloy

**Examples of long-term storage characteristics**
- Discharge state
- Temperature: 25°C
- Temperature: 40°C

**Examples of low temperature discharge characteristics**
- 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.

<table>
<thead>
<tr>
<th>Applications</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>1 Security</td>
<td>§ Security</td>
<td>§ eCall·eToll</td>
<td>§ electric bikes</td>
<td>§ bedside monitors</td>
<td>§ electric shavers</td>
</tr>
<tr>
<td>2 In-vehicle transportation</td>
<td>§ dashboard cameras</td>
<td>§ wetter</td>
<td>§ electric wheelchairs·rushing lift</td>
<td>§ external camera flashes</td>
<td>§ cordless mice·remote controllers</td>
</tr>
<tr>
<td>3 Emergency</td>
<td>§ emergency lights</td>
<td>§ security</td>
<td>§ electric shavers</td>
<td>§ flashlights</td>
<td>§ transceivers</td>
</tr>
<tr>
<td>4 Medical &amp; health care</td>
<td>§ bedside monitors</td>
<td>§ emergency</td>
<td>§ electric shavers</td>
<td>§ flashlights</td>
<td>§ transceivers</td>
</tr>
<tr>
<td>5 Lighting</td>
<td>§ electric wheelchairs·rushing lift</td>
<td>§ security</td>
<td>§ electric shavers</td>
<td>§ flashlights</td>
<td>§ transceivers</td>
</tr>
<tr>
<td>6 Home appliances</td>
<td>§ elevators·landing devices</td>
<td>§ electric</td>
<td>§ cordless keyboards·phone chargers</td>
<td>§ remote control·toys</td>
<td>§ electric tools</td>
</tr>
<tr>
<td>7 Information</td>
<td>§ UPS, base stations</td>
<td>§ wireless</td>
<td>§ remote control·toys</td>
<td>§ transceivers</td>
<td>§ electric tools</td>
</tr>
<tr>
<td>8 Construction</td>
<td>§ elevator·landing devices</td>
<td>§ street lights</td>
<td>§</td>
<td>§</td>
<td>§</td>
</tr>
<tr>
<td>9 Toys</td>
<td>§</td>
<td>§</td>
<td>§</td>
<td>§</td>
<td>§</td>
</tr>
<tr>
<td>10 Power tools</td>
<td>§</td>
<td>§</td>
<td>§</td>
<td>§</td>
<td>§</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.

### Specifications

**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.

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-2/3AAAUT</th>
<th>HR-AAAUT</th>
<th>HR-AAUATE</th>
<th>HR-AAULT</th>
<th>HR-AAUTE</th>
<th>HR-AAUTEW</th>
<th>HR-4/3FAUT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal Voltage</strong></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><strong>Typical Capacity</strong></td>
<td>220mAh</td>
<td>500mAh</td>
<td>500mAh</td>
<td>1050mAh</td>
<td>1100mAh</td>
<td>1100mAh</td>
<td>1100mAh</td>
</tr>
<tr>
<td><strong>Minimum Capacity</strong></td>
<td>200mAh</td>
<td>460mAh</td>
<td>460mAh</td>
<td>1000mAh</td>
<td>1000mAh</td>
<td>1000mAh</td>
<td>1000mAh</td>
</tr>
<tr>
<td><strong>Quick Charge Current</strong></td>
<td>220mA</td>
<td>500mA</td>
<td>500mA</td>
<td>1050mA</td>
<td>1100mA</td>
<td>1100mA</td>
<td>1100mA</td>
</tr>
<tr>
<td><strong>Dimensions (incl. tube)</strong></td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>14.2mm</td>
<td>14.2mm</td>
<td>14.2mm</td>
<td>18.0mm</td>
</tr>
<tr>
<td><strong>Approx. Weight</strong></td>
<td>8g</td>
<td>13g</td>
<td>13g</td>
<td>25g</td>
<td>27g</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 being discharged at 0.2It until the voltage reaches to 1.00V within 1 hour after a single cell being charged for 16 hours at 0.1It.
3. Minimum capacity when being discharged at 0.2It until the voltage reaches to 1.00V within 1 hour after a single cell being charged for 16 hours at 0.1It.
4. Consult FDK according to conditions of use.
5. Including label / heat shrink tube.

Applications

- eCall, eToll, dashboard cameras etc.

### Applications

**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.
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

- Suitable for emergency lights, emergency exit lights, security equipment, communication base stations, medical equipment, ATMs, POSs, smart meters, road studs (cat's eyes), and various kinds of backup power supply.
- High durability Ni-MH batteries meet the MT/MU classifications defined in IEC 61951-2.¹
- They can also achieve excellent battery life via intermittent or timer charging methods for maintaining charge after main charging.

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-2/3AAUTU</th>
<th>HR-AAAUTU</th>
<th>HR-AAULUT</th>
<th>HR-AAULT</th>
<th>HR-AAULT</th>
<th>HR-4/5FAUPT</th>
<th>HR-AUT</th>
<th>HR-5/4SCUT</th>
<th>HR-4/3FAUT</th>
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<tr>
<td>MU Grade Type</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>Nominal Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical Capacity²</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>
<td>3700mAh</td>
</tr>
<tr>
<td>Minimum Capacity³</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>
<td>3500mAh</td>
</tr>
<tr>
<td>Quick-Charge Current</td>
<td>220mA</td>
<td>500mA</td>
<td>780mA</td>
<td>1050mA</td>
<td>1580mA</td>
<td>1650mA</td>
<td>2200mA</td>
<td>3250mA</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>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
</tr>
<tr>
<td>Dimensions (incl. tube)⁴</td>
<td>10.5mm</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>
<td>18.0mm</td>
<td>67.5mm</td>
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<tr>
<td>Diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td>Height</td>
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<td>Approx. Weight</td>
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<td>37g</td>
<td>37g</td>
<td>69g</td>
<td>58g</td>
</tr>
</tbody>
</table>

¹: Compliance with IEC 61951-2 MT/MU classifications does not guarantee. ²: Typical capacity when being discharged at 0.2It until the voltage reaches to 1.00V within 1 hour after a single cell being charged for 16 hours at 0.1It. ³: Minimum capacity when being discharged at 0.2It until the voltage reaches to 1.00V within 1 hour after a single cell being charged for 16 hours at 0.1It. ⁴: Consult FDK according to conditions of use. ⁵: Including heat shrink tube. ⁶: 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 secures a stable discharge voltage.

Applications

- Electric tools, nursing lift, 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>
</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>
</tr>
<tr>
<td>Typical Capacity</td>
<td>1950mAh</td>
<td>2700mAh</td>
<td>3000mAh</td>
<td>3200mAh</td>
<td>4000mAh</td>
</tr>
<tr>
<td>Minimum Capacity</td>
<td>1800mAh</td>
<td>2500mAh</td>
<td>3000mAh</td>
<td>3200mAh</td>
<td>3750mAh</td>
</tr>
<tr>
<td>Quick-Charge Current</td>
<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>18.1mm x 43.2mm</td>
<td>18.1mm x 43.2mm</td>
<td>23.0mm</td>
<td>18.1mm x 43.2mm</td>
<td>18.1mm x 43.2mm</td>
</tr>
<tr>
<td>Approx. Weight</td>
<td>39g</td>
<td>57g</td>
<td>59g</td>
<td>59g</td>
<td>58g</td>
</tr>
</tbody>
</table>

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.

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-AAUC</th>
<th>HR-5/4AAAU</th>
<th>HR-5/4AAUC</th>
<th>HR-AAUC</th>
<th>HR-4/4AAUC</th>
<th>HR-5/4AAUHPC</th>
<th>HR-AEC</th>
<th>HR-4/5AU</th>
<th>HR-4/3AU</th>
<th>HR-4/3FAU</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>
<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>850mAh</td>
<td>1100mAh</td>
<td>840mAh</td>
<td>1200mAh</td>
<td>1400mAh</td>
<td>1650mAh</td>
<td>2150mAh</td>
<td>2700mAh</td>
<td>4000mAh</td>
</tr>
<tr>
<td>Minimum Capacity</td>
<td>650mAh</td>
<td>760mAh</td>
<td>1000mAh</td>
<td>770mAh</td>
<td>1200mAh</td>
<td>1400mAh</td>
<td>1500mAh</td>
<td>1950mAh</td>
<td>2450mAh</td>
<td>3600mAh</td>
</tr>
<tr>
<td>Quick-Charge Current</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>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
<td>1.1h</td>
</tr>
<tr>
<td>Dimensions (incl. tube)</td>
<td>10.5mm x 44.5mm</td>
<td>14.2mm x 44.5mm</td>
<td>14.2mm</td>
<td>14.2mm x 44.5mm</td>
<td>14.2mm x 44.5mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Approx. Weight</td>
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<td>14g</td>
<td>21g</td>
<td>18g</td>
<td>22g</td>
<td>25g</td>
<td>27g</td>
<td>33g</td>
<td>39g</td>
<td>53g</td>
</tr>
</tbody>
</table>

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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Dry Cell Compatible Ni-MH Battery

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, audio equipment, remote controls, clocks, radio-controlled hobby items, amateur 2-way radio etc.
- Dry cell compatible Ni-MH batteries can also be used for business purposes other than those listed above.
- It is necessary to confirm the application and battery usage conditions to sell dry cell compatible Ni-MH batteries. Please contact us for more details.

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>HR-4UQ</th>
<th>HR-4UTG</th>
<th>HR-4UTG</th>
<th>HR-4UTGX</th>
<th>HR-3UQ</th>
<th>HR-3UTG</th>
<th>HR-3UTG</th>
<th>HR-3UWX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal Voltage</strong></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><strong>Typical Capacity</strong></td>
<td>600mAh</td>
<td>800mAh</td>
<td>800mAh</td>
<td>1000mAh</td>
<td>1000mAh</td>
<td>2000mAh</td>
<td>2000mAh</td>
<td>2500mAh</td>
</tr>
<tr>
<td><strong>Minimum Capacity</strong></td>
<td>550mAh</td>
<td>750mAh</td>
<td>750mAh</td>
<td>930mAh</td>
<td>950mAh</td>
<td>1900mAh</td>
<td>1900mAh</td>
<td>2400mAh</td>
</tr>
<tr>
<td><strong>Quick-Charge</strong></td>
<td>Current</td>
<td>600mAh</td>
<td>800mAh</td>
<td>800mAh</td>
<td>1000mAh</td>
<td>1000mAh</td>
<td>2000mAh</td>
<td>2000mAh</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>
<td>1.1h</td>
<td>1.1h</td>
</tr>
<tr>
<td><strong>Dimensions (excl. tube)</strong></td>
<td>Diameter</td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>10.5mm</td>
<td>14.2mm</td>
<td>14.2mm</td>
<td>14.35mm</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>44.5mm</td>
<td>44.5mm</td>
<td>44.5mm</td>
<td>44.5mm</td>
<td>50.4mm</td>
<td>50.4mm</td>
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</tr>
<tr>
<td><strong>Approx. Weight</strong></td>
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<td>13g</td>
<td>19g</td>
<td>27g</td>
<td>27g</td>
<td>32g</td>
</tr>
</tbody>
</table>

1: Typical capacity when being discharged at 0.2It until the voltage reaches to 1.00V within 1 hour after a single cell being charged for 16 hours at 0.1It.
2: Minimum capacity when being discharged at 0.2It until the voltage reaches to 1.00V within 1 hour after a single cell being charged for 16 hours at 0.1It.
3: Consult FDK according to conditions of use.
4: Including label / heat shrink tube.

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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 lights, home-use, etc. Please contact us about the usage of applications, ambient temperature, charge and discharge conditions, etc.

In-vehicle equipment
Security
Emergency lights

eCall
Nursing lift
Wireless devices
Reefer container

Electric bicycles

The contents of this catalogue are not guaranteed.
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

Battery Management

Examples of Custom Control Functions

- Low temperature charge control function for cold regions
- Lifetime prediction function to reduce the number of battery replacements
- 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.

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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<td></td>
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<td>31kg</td>
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</table>

Handling Precautions

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

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 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.

### Charging Method

#### Charging Method

- **Constant current charging**
- **Main charging**
  - Quick charging
  - Low rate charging
- **Maintenance charging**
  - Pulse current charging
  - Intermittent charging

#### Overview

- **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.

#### Charging Time

- 1~2h
- 1~2h
- 1~2h
- 11~12h
- —
- —

#### Charging Current

- 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

#### Recommended Categories

- Standard Type
- High Durability Type
- High-Rate Discharge Type
- Dry Cell Compatible Type

#### Notes

- Recommended: Suitable to exhibit battery performance. Available: Can be used depending on the specification of equipment.
- *In* (Ah) = 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.
- If your device supports a charge rate of 0.1It or more, please note that the overcharge performance and temperature rise conditions will differ depending on your battery type. Please contact us before deciding on specifications.
- When a large number of cells, a high capacity battery, or a battery assembly that does not dissipate heat effectively is used, abnormal heat generation may occur even if the charging current is less than 0.1It.
- 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.

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 are intended to highlight potential hazards that could 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 informed of the relevant 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.

Batteries of this type are not sold to individual customers. If you wish to replace the battery in your device, please contact the store where you purchased it or the device manufacturer.

**DANGER**

1. Failure to carefully observe the following procedures and precautions can result in leakage of battery fluid (electrolyte), heat generation, burning, fire and serious personal injury. Do not dispose of batteries in a fire or incinerator. 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, burning 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 objects (such as a necklace) or other conductive materials. Doing so may cause short circuit, which would result in excessive current flow and possibly cause leakage of battery fluid, heat generation, burning and fire. When carrying or storing batteries, use an appropriate case.
   - Only charge Ni-MH batteries using chargers that satisfy FDK’s specifications. Do not 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, burning and fire.
   - Never disassemble or use Ni-MH batteries that have been subjected to an internal or external short circuit or result in exposed material of battery reacting chemically with the air. It may also cause heat generation, burning and fire. Also, this is dangerous as it may cause exposure to an alkaline solution.
   - 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, excessively high voltage may result from overcharging or discharging of the battery, leakage of battery fluid, heat generation, burning 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, burning and fire.
   - The (+) (positive) and (-) (negative) terminals of Ni-MH batteries are predetermined. Do not connect the (+) and (-) terminals in series or parallel. Non correct terminals are connected, it may cause abnormal operation in the battery, the flow of abnormal currents, leakage of battery fluid, heat generation, burning 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, burning 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, burning 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, burning 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 your skin, immediately wash your eyes and body with plenty of clean water 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 sharp or abrasive structures as this may lead to the equipment or case being damaged or may be harmful to users.
   - Please contact us before using Ni-MH batteries in waterproof housing or cases. This may lead to the accumulation of gases from the battery which can ignite and cause explosions.

**WARNING**

1. 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 burning.
2. Do not use Ni-MH batteries in series. This may cause corrosion, 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 case of accidental swallowing or swallowing of battery fluid, heat generation, burning and fire.
4. Do not 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 immediately. Excessive charging may cause leakage of battery fluid, heat generation, burning. Be sure to handle recharged batteries carefully as they may be hot.
5. Do not use Ni-MH batteries if the outer tube/label is scratched or damaged. Doing so will expose the battery to a short circuit, and may cause leakage of battery fluid, heat generation, burning and fire.
6. Ni-MH batteries should be charged after first purchase or having not been used for a long period of time.
7. 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, burning and fire.
8. 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, burning and fire.
9. Ni-MH batteries contain strong colorless alkaline solution (electrolyte). If the skin or clothing comes in contact with fluid from a Ni-MH battery, Battery fluid can irritate the skin and cause rust and corrosion problems. (Copper-containing materials can cause rust and corrosion problems).
10. Do not strike or drop Ni-MH batteries. Sharp impacts or concussions to Ni-MH batteries may cause leakage of battery fluid, heat generation, burning and fire.
11. 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.
12. 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.
13. Do not charge Ni-MH batteries if they have been cooled to 0°C or below. Doing so may cause leakage of battery fluid, impact performance or shorten operating life of Ni-MH batteries.
14. Do not use or store Ni-MH batteries at high temperature, such as in strong direct sunlight, in areas exposed to direct heat, or close to a heater or 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.
15. Do not use old and new batteries 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, type, or brand name. This may cause leakage of battery fluid and heat generation.
16. 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.
17. Do not connect Ni-MH batteries in parallel as this may cause leakage of battery fluid, heat generation, burning and fire.
18. For the recommended charging method for Ni-MH batteries, read the battery charger’s instruction manual carefully.
19. 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, burning and fire.
20. Ni-MH batteries do not perform or function well with certain subject, refer to the instruction manual or warnings of the subject equipment.
21. 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, burning and fire. It could also impair performance and shorten battery life of Ni-MH batteries.
22. 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.
23. Be sure to turn off the equipment after use of Ni-MH batteries, as this may result in leakage of battery fluid.
24. 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).
25. 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.
26. 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.
27. 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.
28. 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).
29. Batteries have a limited lifetime. Even in the same equipment, the battery life varies from battery to battery. If the battery life becomes much shorter than its initial operating time, even after recharging, it is most likely near the end of its 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 discharge cycles.
30. Ni-MH batteries should be charged after first purchase or having not been used for a long period of time.
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.

Typical Uses of Lithium Batteries

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

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

10 years 20 years
(Period varies depending on the model, usage and environment.)

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

-40°C +85°C
(Consult FDK when using batteries at temperatures exceeding -20°C to +60°C (-4°F to +140°F) range.)

Advantage ④ Long lasting (B) 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.

(Period varies depending on the model, usage and environment.)

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

Capacity (mAh)

Max. Pulse Current (A)

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)
- Security equipment
- Communication equipment

**Specifications**

<table>
<thead>
<tr>
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<td>23g</td>
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<td>23g</td>
<td>23g</td>
<td>27g</td>
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</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.
- CR17335EG 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.

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

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<tr>
<th>Model</th>
<th>CR14250SE</th>
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※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
- Medical patch

Specifications

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<tr>
<th>Model</th>
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- 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.

The contents of this catalogue are not guaranteed.
Applications

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

Specifications

<table>
<thead>
<tr>
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<td>3V</td>
<td>3V</td>
<td>3V</td>
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<td>6V</td>
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<tr>
<td>Nominal Capacity</td>
<td>36mAh</td>
<td>80mAh</td>
<td>90mAh</td>
<td>170mAh</td>
<td>240mAh</td>
<td>160mAh</td>
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<td>Standard Discharge Current</td>
<td>0.1mA</td>
<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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<td>Dimensions Diameter</td>
<td>12.5mm</td>
<td>16.0mm</td>
<td>20.0mm</td>
<td>20.0mm</td>
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<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>
</tr>
<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>

Notes:
- 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

- Security camera
- Drive recorder
- Keyless entry
- GPS
- Backup power source for RTC

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>ML614</th>
<th>ML621</th>
<th>ML614R (ML614R-TT31)</th>
</tr>
</thead>
<tbody>
<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>
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<td>0.005mA</td>
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<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>-</td>
<td>-</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>
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<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>

- 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 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

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. These batteries are not available for sale to individual customers. If you wish to replace the battery in your device, please contact the store where you purchased the device or the device manufacturer.

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

**WARNING**

1. 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.
2. 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.
   In case of ingestion of a cell or battery, seek medical assistance promptly. Swallowing coin cells or batteries can cause chemical burns, perforation of soft tissue, and in severe cases can cause death. They need to be removed immediately if swallowed.
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 use the battery with the + and – terminals reversed.
   Doing so may cause the battery to short-circuit, resulting in leakage, overheating, rupture, or catch fire due to abnormal reactions during charging or short circuit.
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 connect the + and – of the battery with a wire, etc., and do not carry or store the battery with metal necklaces, hairpins, etc., as this may cause the batteries to short-circuit, resulting in excessive current flow and battery leakage, overheating, rupture, or fire.
9. If this battery is leaking or has a strange odor, keep it away from fire immediately as the leaked electrolyte may ignite.
10. Do not solder directly on the battery.
   Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
11. 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.
12. 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.
13. Do not stick batteries on the skin.
   Doing so may cause skin injury.

**CAUTION**

1. Do not drop the battery, give it a strong shock, or deform it.
   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. 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.
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 charge.
   When the battery is charged, gas is generated inside and it raises internal pressure, resulting in leakage, heat generation, explosion or fire.
2. 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.
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. Do not store batteries with the positive + and negative – terminals reversed.
   Doing so may damage insulation, which can lead to leakage, heat generation, explosion or fire.
6. Do not throw batteries into fire. Do not heat or disassemble batteries.
   Doing so may cause the battery to leak, overheating, rupture, or catch fire due to abnormal reactions during charging or short circuit.
7. 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. Do not connect the + and – of the battery with a wire, etc., and do not carry or store the battery with metal necklaces, hairpins, etc., as this may cause the batteries to short-circuit, resulting in excessive current flow and battery leakage, overheating, rupture, or fire.
9. Difference in their characteristics may cause leakage, heat generation, explosion or fire.
10. Do not use new and used batteries together. Do not use different types of batteries together.
   The specifications or performance of these batteries may not match some usages or types of application.
11. Do not solder directly on the battery.
   Doing so may cause damage insulation, which can lead to leakage, heat generation, explosion or fire.
12. Do not remove or damage the outer label of the battery.
   Doing so may cause the battery to short-circuit, resulting in leakage, overheating, rupture, or fire.
13. Do not drop the battery, give it a strong shock, or deform it.
   Doing so may cause the battery to leak, overheat, explode, or catch fire.
14. Do not deform the battery in any way.
   Doing so may cause damage insulation or gas release vent resulting in leakage, heat generation, explosion or fire.
15. 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.

**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

- Connecting batteries in series or in parallel on circuits.
- Molding batteries with resin.
- Welding terminals onto batteries.
- Cleaning batteries or sensitive means of Ultrasonic.
- Setting the battery life for your application.
- Using the batteries for medical devices.
- Using other power supply on the same circuit with thin-, coin- and cylindrical-type primary lithium batteries.
- Using contact methods such as battery holder for thin- and cylindrical-type primary lithium batteries and coin- type rechargeable lithium batteries.

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) or ISO standards of lithium metal batteries permitted to be transported by cargo aircraft only.

- **Transportation as Section A**
  - Cells containing more than 1g of lithium or batteries (battery packs) containing more than 2g of lithium are applicable to Section 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 A.

- **Transportation as Section B**
  - Cells containing no more than 1g of lithium or batteries (battery packs) containing no more than 2g of lithium are applicable to Section B, and it is permitted to transport them without using a Class 9 Dangerous Goods container (packaging group II) if they comply with all requirements of the transport conditions of Section B.

- **Transporting as Packaged with equipment or Contained in equipment**
  - If lithium content of cells is no more than 1g or total lithium content of batteries is no more than 2g, they are permitted to transport without using a Class 9 Dangerous Goods container (packaging group II) if they comply with all requirements of the transport conditions of Section B.

- **Transporting as Packaging in equipment or Contained in equipment**
  - Cells containing no more than 1g of lithium or batteries (battery packs) containing no more than 2g of lithium are applicable to Section B, and it is permitted to transport them without using a Class 9 Dangerous Goods container (packaging group II) if they comply with all requirements of the transport conditions of Section B.

**Air transportation of our lithium batteries**

1. **Transporting of batteries (UN3090)**
   - Lithium metal batteries are classified into two categories based on Packing Instruction 968 of the IATA Dangerous Goods Regulations (IATA-DGR) or ISO standards. Lithium metal batteries permitted to be transported by cargo aircraft only.

2. **Transporting as Section A**
   - Cells containing more than 1g of lithium or batteries (battery packs) containing more than 2g of lithium are applicable to Section 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 A.

3. **Transporting as Section B**
   - Cells containing no more than 1g of lithium or batteries (battery packs) containing no more than 2g of lithium are applicable to Section B, and it is permitted to transport them without using a Class 9 Dangerous Goods container (packaging group II) if they comply with all requirements of the transport conditions of Section B.

**Regulation for air transportation in the USA**

In the case of air transportation of lithium metal batteries in/no/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.

**Maritime transportation of our lithium batteries**

1. **Transporting as batteries (UN3090) and, Packaged with equipment / Contained in equipment (UN3091)**
   - Lithium metal batteries and, lithium metal batteries packed with equipment or contained in equipment are classified into two categories according to the International Maritime Dangerous Goods Code (IMDG-Code) as follows.

2. **Transporting as Dangerous Goods**
   - Cells containing more than 1g of lithium or batteries (battery packs) containing more than 2g of lithium are applicable to Class 9 Dangerous Goods, and it is permitted to transport as Class 9 Dangerous Goods when they comply with all requirements of the transport conditions of Special provisions 230 (Packing Instruction 903).

3. **Transporting as Specified goods**
   - Cells containing no more than 1g of lithium or batteries (battery packs) containing no more than 2g of lithium are applicable to exempted Class 9 Dangerous Goods, and it is permitted to transport them without using a Class 9 Dangerous Goods container (packaging group II) if they comply with all requirements of the transport conditions of Special provisions 198.

**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 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.

**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 applicable to batteries used in Electrical and Electronic Equipment (EEE), whereas the Battery Directive (2006/66/EC) is applied.

**Response to RoHS Directive**

- Battery Directive on RoHS 2 Directive lists the 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.

**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.
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.

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.

Adoption of rare metal coating

Rare metal coating on the cathode can prevent the rise of internal resistance resulting from oxidation and also prevent 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.

The contents of this catalogue are not guaranteed.
Alkaline Batteries - Premium

Best Performance for All Devices.

Features

Maximum runtime for all devices.

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>
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<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>
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<td>7,500mAh (20Ω cont. discharge)</td>
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<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>
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<td>Nominal Voltage</td>
<td>1.5V</td>
<td>1.5V</td>
<td>1.5V</td>
<td>1.5V</td>
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<tr>
<td>Nominal Capacity</td>
<td>14,750mAh (20Ω cont. discharge)</td>
<td>7,000mAh (20Ω cont. discharge)</td>
<td>2,700mAh (75Ω cont. discharge)</td>
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<td>Outer Dimensions</td>
<td>Height 60.9mm</td>
<td>49.6mm</td>
<td>50.1mm</td>
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<tr>
<td></td>
<td>Diameter 33.0mm</td>
<td>25.6mm</td>
<td>14.0mm</td>
<td>10.3mm</td>
</tr>
</tbody>
</table>

Handling Precautions

The contents of this catalogue are not guaranteed.
Alkaline Batteries - Long Life

Power for Everyday Life.

Features
Providing the best value for everyday-use devices.

5 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 Long Life</th>
<th>LR14 Long Life</th>
<th>LR6 Long Life</th>
<th>LR03 Long Life</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>14,000mAh (20Ω cont. discharge)</td>
<td>6,600mAh (20Ω cont. discharge)</td>
<td>2,600mAh (75Ω cont. discharge)</td>
<td>1,260mAh (300Ω cont. discharge)</td>
</tr>
<tr>
<td>Outer Dimensions</td>
<td>Height</td>
<td>60.9mm</td>
<td>49.6mm</td>
<td>50.1mm</td>
</tr>
<tr>
<td></td>
<td>Diameter</td>
<td>33.0mm</td>
<td>25.6mm</td>
<td>14.0mm</td>
</tr>
</tbody>
</table>

The contents of this catalogue are not guaranteed.
**WARNING**

1. Always keep batteries correctly according to the designation of polarity (+ and −) in the battery and the equipment. Batteries which are incorrectly placed into equipment may short-circuit, or be charged, and result in a high risk of fire and electric shock and lead to explosion and leakage.

2. Do not short-circuit or charge batteries.

3. Batteries should not be stored in moist or high temperature conditions. Batteries should be stored in a cool and dry place.

4. Batteries should not be exposed to direct sunlight or rain. If exposed, the batteries may become deformed and leak.

5. Batteries should not be exposed to temperatures below 0°C or above 45°C. Batteries should be stored in a cool and dry place.

6. Batteries should not be exposed to direct sunlight or rain. If exposed, the batteries may become deformed and leak.

7. Batteries should not be exposed to temperatures below 0°C or above 45°C. Batteries should be stored in a cool and dry place.

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24. Batteries should not be exposed to direct sunlight or rain. If exposed, the batteries may become deformed and leak.

25. Batteries should not be exposed to temperatures below 0°C or above 45°C. Batteries should be stored in a cool and dry place.

26. Batteries should not be exposed to direct sunlight or rain. If exposed, the batteries may become deformed and leak.

27. Batteries should not be exposed to temperatures below 0°C or above 45°C. Batteries should be stored in a cool and dry place.

28. Batteries should not be exposed to direct sunlight or rain. If exposed, the batteries may become deformed and leak.

29. Batteries should not be exposed to temperatures below 0°C or above 45°C. Batteries should be stored in a cool and dry place.

30. Batteries should not be exposed to direct sunlight or rain. If exposed, the batteries may become deformed and leak.

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

**Response to REACH Regulation**

1. It is necessary to register a battery in accordance with the REACH Regulation.

2. Batteries are classified as ‘focal chemical’ under REACH. A Product Information File (PIF) for REACH should be submitted for each battery under the Battery Directive. Reaching is carried out in accordance with the REACH Directive, the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation (EC) No 1907/2006 of the European Parliament and of the Council. The battery Directive is implemented by the EU Member States and is based on the REACH Regulation.

3. The battery Directive is based on the REACH Regulation and is implemented in accordance with the REACH Regulation.

4. The battery Directive is based on the REACH Regulation and is implemented in accordance with the REACH Regulation.

5. The battery Directive is based on the REACH Regulation and is implemented in accordance with the REACH Regulation.

6. The battery Directive is based on the REACH Regulation and is implemented in accordance with the REACH Regulation.

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10. The battery Directive is based on the REACH Regulation and is implemented in accordance with the REACH Regulation.

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**Response to SVHC Candidates**

SVHC candidates can become subject to authorization and as a result. It’s 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 candidates are relevant to our components or not. Confirmation from our suppliers can take multiple days, so we will appreciate your understanding in case our response to any queries is delayed. Please feel free to contact our sales representatives for questions about SVHC candidate list.