

## 1. Scope

This specification is suitable for the performance of *Lithium Iron Disulfide* battery.

## 2. Model

FR03

## 3. Reference Document

IEC60086-4: 2000 *Primary batteries-Part 4: Safety of lithium batteries*

## 4. Specification

No.	Items	Specification
1	Nominal Voltage	1.5 V
2	Nominal Capacity	1100 mAh @ 300mA discharge
3	Working Voltage	1.30V @ 100mA discharge
4	Max. Discharge Current	1000 mA continuous
5	Discharge Cut-off Voltage	0.80V
6	Volume	3.8 cubic centimeters
7	Weight	Approx. 7.7g
8	Lithium Content	Less than 0.5 gram per cell
9	Dimensions	Diameter: 10.0±0.5 mm
		Height: 43.9±0.6 mm
10	Operating Temp.	-20 °C to 60 °C
11	Storage Temp.	-20 °C to 40 °C
12	Storage Humidity	≤75 %
13	Shell Life	10 Years

## 5. Test Conditions and Performance

### 5.1 Measuring Instrument or Apparatus

#### 5.1.1 Dimension Measuring Instrument

The dimension measurement shall be implemented by calipers with equal or more precision scale of 0.01 mm.

#### 5.1.2 Voltmeter

Standard class specified in the national standard or more sensitive class having inner impedance more than 10 kΩ/V.

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### 5.1.3 Ammeter

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than  $0.01\Omega$ .

## 5.1 Standard Test Conditions

Unless other defined, test and measurement shall be done under temperature of  $20\pm 5^{\circ}\text{C}$  and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature  $10\sim 30^{\circ}\text{C}$  and humidity 25~85%RH.

## 5.2 Basic Characteristics

No.	Item	Measuring Procedure	Criteria
1	Open-Circuit Voltage	The open-circuit voltage shall be measured by voltmeter.	$\geq 1.72\text{ V}$
2	Dimension	Use calipers test cell's dimensions.	As item 4.9
3	Rated Capacity	The capacity means the discharge capacity of the cell, which is measured by continuously discharging with a current of 300 mA to 0.8V.	$\geq 1100\text{ mAh}$
4	External Short Circuit	Positive and negative of fresh battery are connected by a Cu wire. This short-circuit condition is continued for 1 day at room temperature ( $20\pm 2^{\circ}\text{C}$ ).	No leakage; No explosion.
5	Forced Discharge	Discharged to 0.8V at 300mA; And then the sample cell is forced discharged with 300mA for 3 hours.	No explosion; No fire

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#### 5.4 Mechanical Characteristics

No.	Item	Test Method	Criteria
1	Impact	A 15.8 mm diameter bar is vertically placed across the centre of the sample cell. A 9.1 kg mass is dropped from a height of 61cm onto the sample.	No explosion, No fire
2	Vibration	Freq: 10~55hz; Amp: 2mm; Three directions; total 90 min	No leakage, No explosion, no fire 0.02V total maximum OV changes
3	Crush	A sample cell is to be crushed between two flat surfaces. Force: 32mm diameter piston; Max pressure: 17.2MPa; Max force: 13KN; Released when the max pressure obtained.	No explosion, No fire

#### 5.5 Environmental test

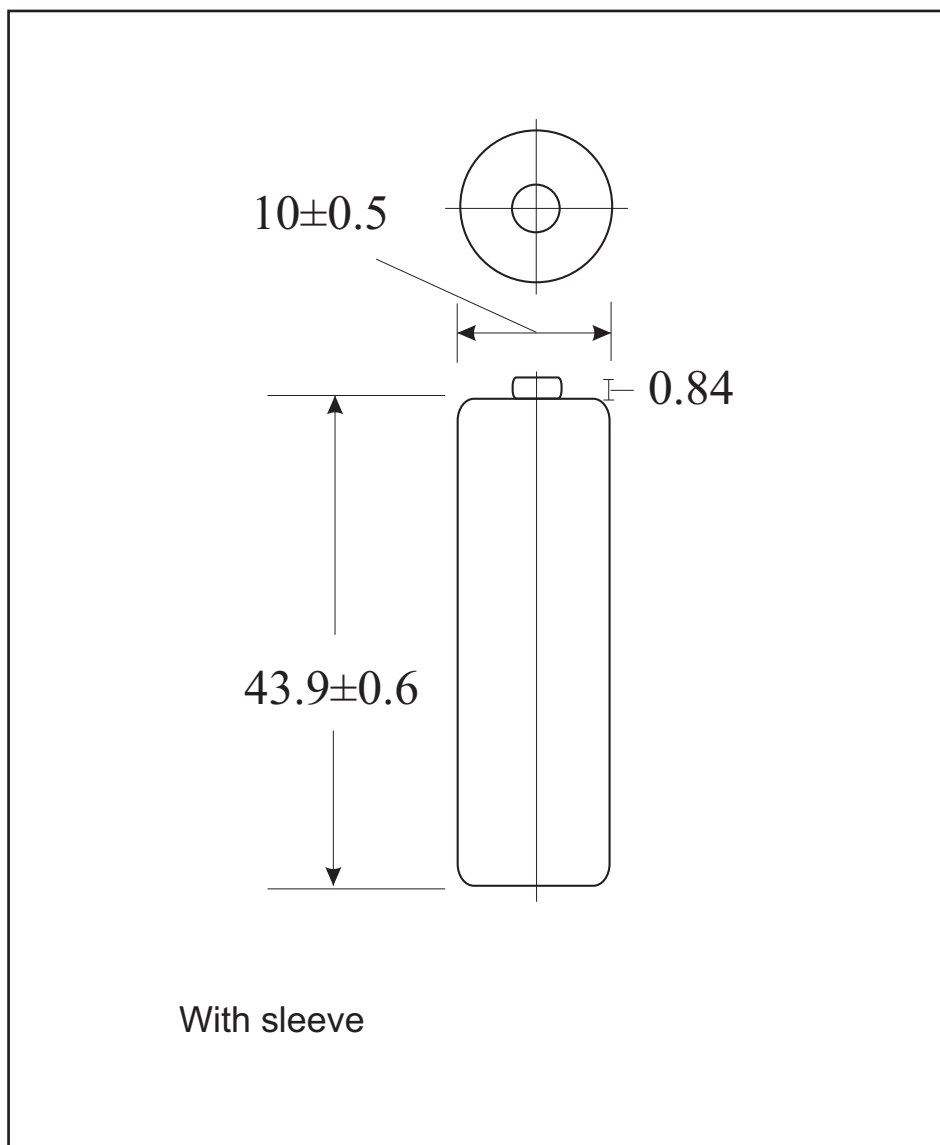
No.	Item	Test Conditions	Criteria
1	Thermal test	Fresh batteries, store at 70 deg. C for 4hs; 20 deg. C for 2hs; -20 deg. C for 4hs; 20 deg. C for 2hs. All cycled 5 times	No leakage No explosion; No fire
2	Heating test	Fresh battery is heated in an oven. The rate of temperature raised: 5±2 °C per minute; Max. Temperature 150±2 °C remaining for 10 minutes.	No explosion; No fire
3	Drop test	Fresh batteries; Height: 1m, 6 times; Each direction two times; Concrete floor	No leakage; No explosion; No fire

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### 5.6 Visual inspection

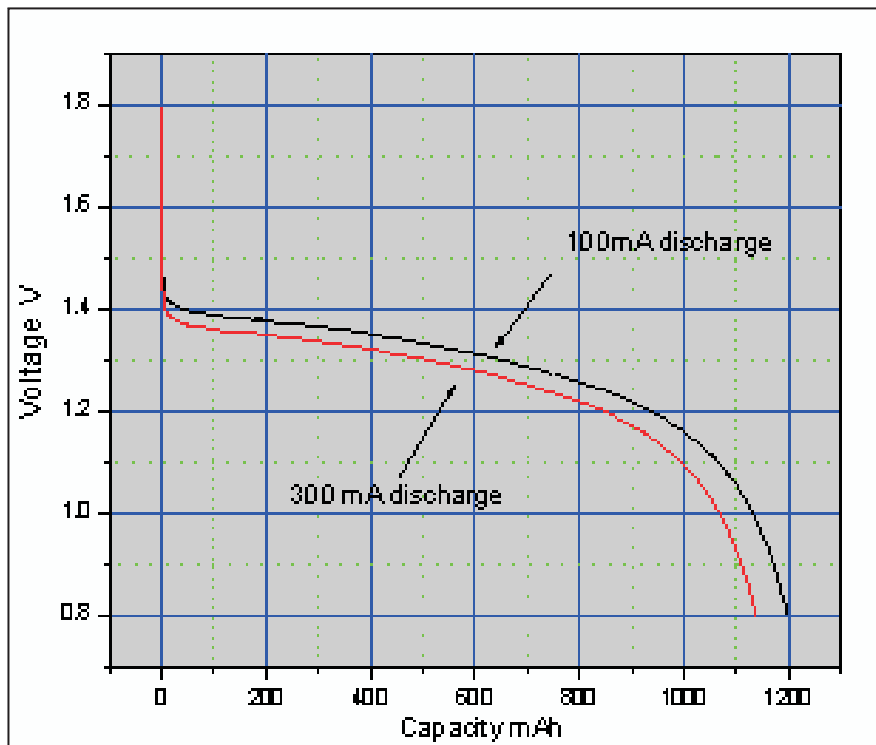
There shall be no such defect as scratch, flaw, crack, and leakage, which may adversely affect commercial value of cell.

### 6. Drawing (at unit in mm, not in scale)



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## 7. Discharge with 300mA and 100mA to 0.8V



## 8. Cautions in use

To ensure proper use of the battery please read the manual carefully before using it.

### - Handling

- Do not expose to, dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with used or other different make, type, model batteries.
- Keep out of the reach of children.

### - Storage

- Store the battery in a cool (we recommend 20°C), dry and well-ventilated area.

### - Disposal

- Regulations vary for different countries.
- Dispose of in accordance with local regulations.

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## **9. Battery operation instruction**

### **9.1 Discharging current**

The discharging current does not have to surpass this specification book stipulation the biggest discharging current, the oversized electric current electric discharge can cause the battery capacity play to reduce and to cause the battery heat.

### **9.2 Electric discharge temperature**

The battery discharge must carry on in the ambient temperature scope which this specification book stipulated.

### **9.3 Storing the Batteries**

The battery should store in the product specification book stipulation temperature range. If has surpasses above for six months the long time storage, the discharge capacity will decrease sharply.

## **10. Period of Warranty**

The warranty period of our batteries is one year from the date of shipment under proper storage conditions or usage. Minamoto guarantees replacement in case the batteries are found to be defective due to manufacturing process instead of the customer abuse and misuse.

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