



Ni-MH

## Technical Instruction

131103

File No	Model	Nominal voltage (V)	Nominal capacity (mAh)
KL—1009033E	3 × HB60	3.6	60

Version	Valid Date	Prepared by	Checked by	Approved by
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1	2011-05- 10	Technical Dept.	Lao Yingbin	Chen Weihe
2/A	2011-11- 12	Technical Dept.	Lao Yingbin	Chen Weihe
2/B	2012-04- 01	Technical Dept.	Lao Yingbin	Chen Weihe

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## 2. Introduction

The Ni-MH battery (3×HB60) is composed of 3 cells with capacity of 60mAh connected in series in a variety of shape design as different customers' demand. The tags of positive and negative pole may be made in different means such as nickel strip, male tab, pin, wire, plug connector, etc. The battery is designed as power supply with voltage of 3.6V, charge and discharge current of no more than 12mA and 30mA respectively to the electric products including meter and instrument, lamp, remote controller, toy and so on. The battery complies with the requirements of ROHS, and can be delivered with the "SGS" inspection report attached if required.

## 3. Referenced document

61951-2 @ IEC:2003 Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – P.2:Nickel-metal hydride/By international electrotechnical commission(IEC) .

## 4. Use of product

4.1 The battery shall not be charged for a long time or at more than 0.2C (12mA). The cell or battery shall not be short or reverse discharged. If a long time charge is required, the charge shall be terminated when the voltage of battery is up to 1.45V/cell (1.45xn/battery) to reduce the impact on its quality.

4.2 The battery shall be charged in an optimized manner such as:

**Charge:** The charge time shall be 14h if the voltage of 4.35-4.95V and current of 6mA are applied to the battery; and the charge time shall be 6h if the current of 12mA is applied.

**Discharge:** The current shall be no more than 30mA, and the final voltage is 3.0V. The battery shall be recharged prior to use.

4.3 For the detailed usage, please contact our Engineering Dept.

## 5. Electrical properties

### 5.1 Electrical properties

Item	Specification	Remarks
Nominal voltage V	3.6	
Nominal capacity mAh	60	In accordance with 5.3.3
Standard charge current mA	6	The charge time is 16h.
Charge current mA	1~12	Available range
Discharge current mA	≤30	
Final voltage V	3.0	
Internal resistance mΩ	≤1600	Measured after fully charged and additional storage time of 24h. (at 1000Hz 25±5°C)
Ambient temperature	Charge 0~45°C Discharge -10~45°C	The property of product will be impacted significantly if this range is exceeded.

### 5.2 Charge and Discharge

Fig.1: Charge (20±5°C)

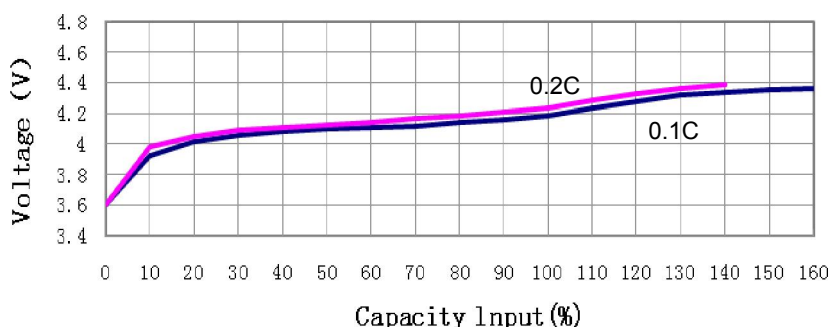
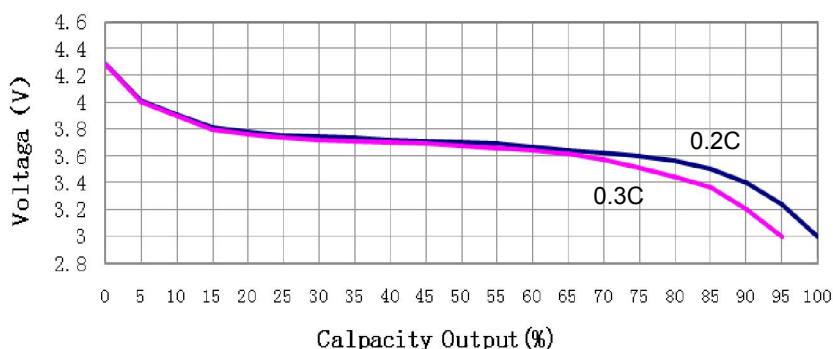


Fig.2: Discharge (20±5°C)



### 5.3 Capacity test

5.3.1 Capacity(mAh)=Discharge current (mA)×Discharge duration(h);

The charge and discharge current is expressed as a multiple of nominal capacity “C” of the cell. For example, “0.2C” means the current is 0.2 times nominal capacity “C”.

#### 5.3.2 Nominal capacity

Nominal capacity: 60mAh

The capacity test of battery will vary with these factors, such as the accuracy of test device, operation condition and ambient environment. For the test result, the allowed error is 4%.

### 5.3.3 Nominal capacity test (Abbr. IEC) :

The capacity and internal resistance shall be tested at 20±5°C within 1 month before ex-factory.

Discharge the battery at 0.2C (12 mA) to a final voltage of 3.0V, and rest for 1~4h.

When the voltage applied to the battery is up to 1.7V/cell(1.7Vxn /battery), charge at 0.1C (6mA) for 16h, rest for 1~4h, then discharge at 0.2C (12mA) to a final voltage of 3.0V. The battery is acceptable only when the discharge duration is not less than 5h.

Ambient temperature	Discharge current (mA)	Final voltage (V)	Rest time (h)	Charge current (mA)	Charging duration (h)	Rest time (h)	Discharge current (mA)	Final voltage (V)	Minimum discharge duration (h)
20±5°C	12	3.0	1~4	6	16	1~4	12	3.0	≥5

Five cycles are permitted for this test. The test shall be terminated at the end of the first cycle which meets the requirement.

### 5.3.4 Actual capacity

In an ambient temperature of 20±5°C, discharge the battery at 0.2C(12mA) down to 3.0V, and rest for 1-4h, and then start the capacity test. The table below shows the available capacity after the charge and discharge cycles at different rate.

Charge rate	Charge Current (mA)	Charge time	rest time (h)	Discharge rate	Discharge Current (mA)	Final voltage (V)	Capacity (mAh)
0.1C	6	16h	1~4	0.2C	12	3.0	≥60
				0.3C	18	3.0	≥54
				0.5C	30	3.0	≥48
0.2C	12	7h	1~4	0.2C	12	3.0	≥54

### 5.4 Charge retention

Discharge the battery at 0.2C (12mA) down to 3.0V, and then Charge the battery for 16h at 0.1C(6mA), and after 28 days storage at 20±5°C, the capacity at a discharge rate of 0.2C shall be no less than 60% of nominal capacity (i.e. Charge retention capability ≥ 60%).

### 5.5 Overcharge

The battery shall be discharged at 20±5°C, at a constant current of 0.2C(12mA) down to a final voltage of 3.0V, and then be stored for not less than 1h and not more than 4h. After this storage, the battery shall be charged in an ambient temperature of 20±5°C, at 0.1C(6mA) for 48h, and then there shall be no leakage of electrolyte or deformation of the battery.

After rest for 1-4h, the capacity at a discharge rate of 0.2C (12mA) shall reach the nominal value.

## 5.6 Cycle life

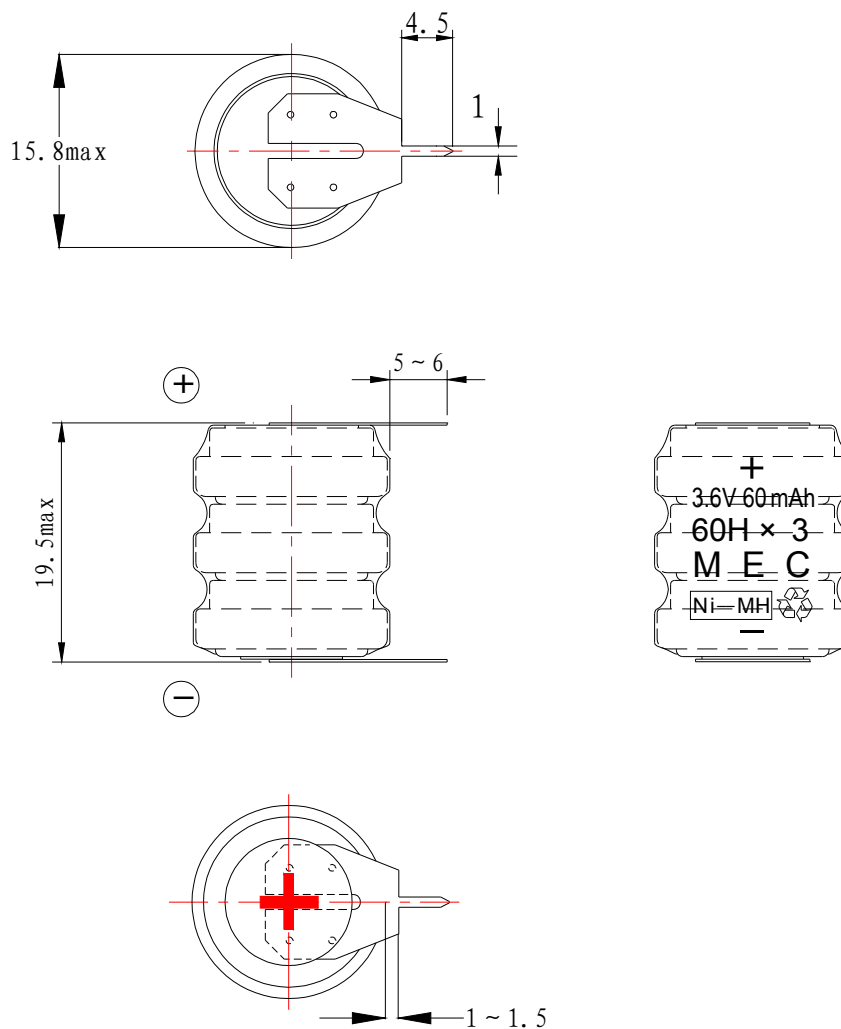
Prior to cycle life test, discharge the battery at 0.2C down to 3.0V. In an ambient temperature of  $20\pm 5^{\circ}\text{C}$ , the available capacity of battery shall be 60% rated capacity after 500 cycles according to the conditions described in the table below. During test, the enclosure of battery shall be protected from the battery's temperature more than  $35^{\circ}\text{C}$ .

Cycle number	Charge	Rest	Discharge
1	0.1C×16h	NO	0.25C×2h20min
2~48	0.25C×3h10min	NO	0.25C×2h20min
49	0.25C×3h10min	NO	0.25C to 3.0V
50	0.1C×16h	1h - 4h	0.20C to 3.0V

It is permissible to allow sufficient rest time after completion of discharge at cycle 50, so as to start cycle 51. A similar procedure may be adopted at cycle 100,150,200,250,300,350,400 and 450.

Cycle 1 to 50 shall be repeated until the discharge time on any 50<sup>th</sup> cycle becomes less than 3h. Repeat the cycle, and if the discharge time is less than 3h again, the cycle life of battery shall be considered to be ended.

## 5.7 Dimension



## 5.8 Storage

The battery shall be stored in a cool and dry place where the temperature and relative humidity are  $-0\sim 25^{\circ}\text{C}$  and  $65\pm 20\%$  respectively. After the battery has been stored for 6 months or the voltage dropped below  $1.0\text{V}/\text{cell}$  ( $1.0\text{V} \times \text{number of cells for a battery}$ ), the charge and discharge cycle shall be carried out to ensure that the battery can be used at an optimized state for the first time. For the details, please contact out Engineering Dept.

## 6. Cautions

- 6.1 The battery shall be used within half a year after delivery, during which any issue on quality of battery may be set forth by customer.
- 6.2 The battery shall be charged and discharged as specified in 4.1 and 4.2, and the improper charging and discharging procedures are prohibited from the impact on quality of battery.
- 6.3 The overcharge and over-discharge shall be avoided considering the serious overcharge and over-discharge may cause damage to the battery.
- 6.4 Do not connect + and – terminals with wire or other metal, or connect other cell in series.
- 6.5 Do not mix different types (chemistries) of batteries or charge or discharge reversely.
- 6.6 Do not dispose in fire or soak in water.
- 6.7 Do not modify and remodel for installation.
- 6.8 The battery shall be kept dry and away from any corrosive gas to avoid short-circuit during transportation, storage and operation.
- 6.9 This technical specification is subject to change without notice.