

## Technical Specification

**1. Scope** This specification describes the technological parameters and testing standard for the lithium ion rechargeable cell manufactured and supplied by **Green Energy Co. Ltd.**

### 2. Products specified

- 2.1. Name Cylindrical Lithium Ion Rechargeable Cell
- 2.2. Type **ICR18650H-2200mAh**

**3. References** In this specification reference is made to: GB/T18287-2000, UL1642 and IEC61960-1:2000.

### 4. Caution:

- 4.1. Please read these specifications carefully before testing or using the cell as improper handling of a li-ion cell may result in lose of efficiency, heating, ignition, electrolyte leakage or even explosion.
- 4.2. While testing the cell by charging and discharging, please use test-equipment especially designed for li-ion cell. Do not use ordinary constant current and constant voltage (CC/CV) power supplies. These do not protect the cell from being overcharged and over-discharged, resulting in possible loss of functionality or danger.
- 4.3. When charging and discharging cells or packing them into equipment, reversing the positive and negative terminals will result in overcharging and over-discharging of the cell(s). This could lead to serious loss of efficiency and even explosions.
- 4.4. Do not solder directly on the cell. Do not resolve the cell.
- 4.5. Do not put cell(s) in pockets or bags together with metal products such as necklaces, hairpins, coins, screws, etc. Neither store them together without proper isolation. Do not connect the positive and negative electrode directly with each other through conductive materials. This can result in a short circuit of the cell.
- 4.6. Do not beat, throw or trample the cell, do not put the cell into washing machines or high-pressure containers.
- 4.7. Keep the cell away from heat sources such as fires, heaters, etc. Do not use or store cell(s) at locations where the temperature can exceed 60°C such as in direct sunlight. This may lead to the generation of excessive heat, ignition and lose of efficiency.
- 4.8. Do not get cells wet or throw them into water. When not in use, place the cells in a dry environment at low temperatures.
- 4.9. While during use, testing or storing cells, cells become hot, distribute a smell, change color, deform or show any other abnormalities, please stop using or testing immediately. Attempt to isolate the cell and keep it away from other cells.
- 4.10. Should electrolyte get into the eyes, do not rub the eyes, rinse the eyes with clean water and seek medical attention if problems remain. If electrolyte gets onto the skin or clothing, wash with clean water immediately.

### 5. Basic characteristics

5.1. Capacity	Nominal Capacity : 2200mAh (0.2CA Discharge) Minimum Capacity: 2100mAh (0.2CA Discharge)
5.2. Nominal Voltage	3.7V
5.3. Internal Impedance	≤ 60mΩ
5.4. Discharge Cut-off Voltage	2.8V
5.5. Max Charge Voltage	4.20±0.02V
5.6. Standard Charge Current	0.5CA
5.7. Rapid Charge Current	1CA

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5.8. Standard Discharge Current	0.5CA
5.9. Rapid Discharge Current	1CA
5.10. Max Discharge Current	2.0 CA
5.11. Weight	44±1g
5.12. Max. Dimension	Diameter(Ø): 18.3mm Height (H): 65.2mm ( See Figure 1.)
5.13. Operating Temperature	Charge: 0 ~ 45°C Discharge: -20 ~ 60°C
5.14. Storage Temperature	During 1 month: -5 ~ 35°C During 6 months: 0 ~ 35°C

### 6. Standard conditions for test

6.1. Standard Charge	Constant Current and Constant Voltage (CC/CV) Current = 1100mA Final charge voltage = 4.2V Final charge Current = 21mA
6.2. Standard Discharge	Constant Current (CC) Current = 1100mA End Voltage = 3.0V

**7. Appearance** All surfaces must be clean, without damages, leakage and corrosion. Each product will have a product label identifying the model.

### 8. Characteristics

- In this section, the Standard Conditions of Tests are used as described in part 6.

#### 8.1. Electrical Performances

Items	Test procedure	Requirements
8.1.1. Nominal Voltage	The average value of the working voltage during the whole discharge process.	3.7V
8.1.2. Discharge Performance	The discharge capacity of the cell, measured with 1CA (or 0.5CA) down to 3.0V within 1 hour after a completed charge.	≥57 ( 120 )min
8.1.3 Capacity Retention	After 28 days storage at 25±5 °C, after having been completely charged and discharged at 0.2CA, discharge to 3.0V, the residual capacity is above 90%	Capacity≥1890mAh
8.1.3 Cycle Life	After 300 cycles at 100% DOD. Charge and discharge at 0.5 CA, the residual discharge capacity is above	≥300 cycles

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	60% of nominal capacity.	
8.1.4 Storage	(Within 3 months after manufactured) The cells is charged with 0.5CA to 40-50% capacity and stored at ambient temperature $25\pm 5^{\circ}\text{C}$ , $65\pm 20\% \text{RH}$ for 12 months. After the 12 months storage period the cell is fully charged and discharged to 3.0V with 0.2CA.	Discharge time $\geq 4\text{h}$

## 8.2 Safety Performances

Items	Test procedure	Requirements
8.2.1 Short Circuit	The cell is to be short-circuited by connecting the positive and negative terminals of the cell directly with copper wire with a resistance of less than $0.05\Omega$ .	No fire, no explosion.
8.2.2 Impact Test	The cell, placed on hard surface, receives impact from a hammer of 10Kg in free fall from 1m height. (See Figure 6)	No fire, no explosion.
8.2.3 Overcharge (3C/10V)	The cell is connected with a thermocouple and put in a fume hood. The positive and negative terminals are connected to a DC power supply set at 3CA and 10V until the cell reaches 10V and the current drops to approximately 0A. Monitor the temperature of cell. When the temperature of the cell is approximately $10^{\circ}\text{C}$ less than the peak value, the test is completed.	No fire, no explosion.
8.2.4 Thermal shock	After standard charging, heat the cell to $150\pm 2^{\circ}\text{C}$ at a rate of $5\pm 2^{\circ}\text{C}/\text{min}$ and keep it at this temperature during 10 minutes.	No fire, no explosion.

## 8.3 Environmental tests

Items	Test procedure	Requirements
8.3.1 High temperature performance	The fully charged cell is put at $55\pm 2^{\circ}\text{C}$ for 2 hours and then discharged to 2.75V at 1CA.	Capacity $\geq 1890\text{mAh}$

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8.3.2 Low temperature performance	The fully charged cell is placed during 16-24 hours at $-20\pm 2^{\circ}\text{C}$ and then discharge to 2.75V at 0.2CA.	Capacity $\geq$ 1470mAh
8.3.3 Anti-vibration	The fully charged cell is fixed on a platform and vibrated in the X , Y and Z directions for 30minutes at the speed 10ct/min Frequency: 10~30Hz, vibration amplitude 0.38mm. Frequency: 30~55Hz, vibration amplitude 0.19mm.	During a visual check no deformation should be visible. The cell should not leak, smoke and/or explode. The cell voltage should be not less than 3.6V.
8.3.4 Drop Test	The fully charged cell is dropped from a height of 1m onto a 15~20mm hard board in X, Y and Z directions once for all axis. Then the cell is discharged at 1CA current rate to 3.0V followed by 3 or more cycles with the standard charge rate and a discharge rate of 1CA.	No fire, no explosion.

**9. Packing** Cells are at a half-charged state when packed. The packing box surface will contain the following: name, type, nominal voltage, quantity, gross weight, date, capacity and impedance.

### 10. Transportation

During transport, do not subject the cell(s) or the box(es) to violent shaking, bumps, rain and direct sunlight. Keep the cell(s) at a half-charged state.

### 11. Storage

Please keep the cell(s) in the cool and dry environment. Allowable temperature range during storage:

- over a period of 1 month:  $-5 \sim 35^{\circ}\text{C}$ , relative humidity:  $\leq 75\%$ .
- over a period of 6 months:  $0 \sim 35^{\circ}\text{C}$ , relative humidity:  $\leq 75\%$ .

Keep the cell(s) at a half-charged state.

### 12. Warranty

12.1. The warranty period of this product is 12 months starting at the date of delivery from the factory.

12.2. Warranty will be void if the cells are used outside these specifications.

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12.3. GREEN ENERGY will not be liable for any damages, personal, material, immaterial or otherwise, when the cells are used outside these specifications.

### 13. Changes of specifications

The information in this specification is subject to change without prior notice.

### 14. For reference only

The information contained in this document is for reference only and should not be used as a basis for product guarantee or warranty. For applications other than those described here, please consult your nearest GREEN ENERGY Sales Office or Distributors

**Fig.1 Dimension**

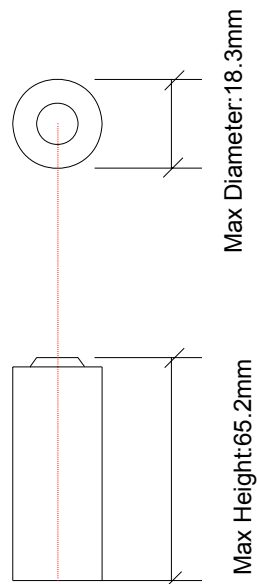


Figure 2. 0.5CA charge Performance Curves

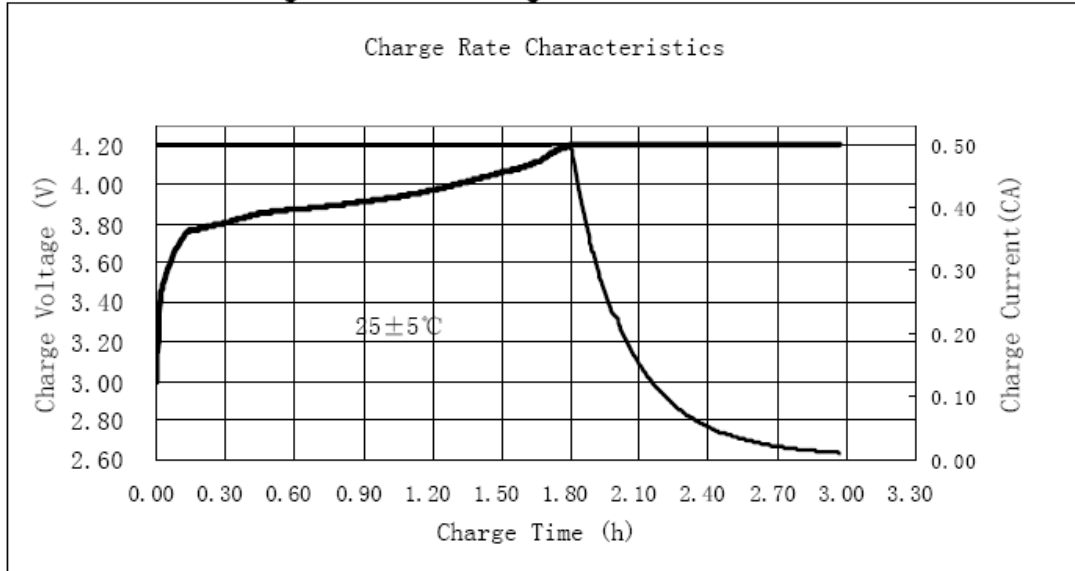


Figure 3. 1CA charge Performance Curves

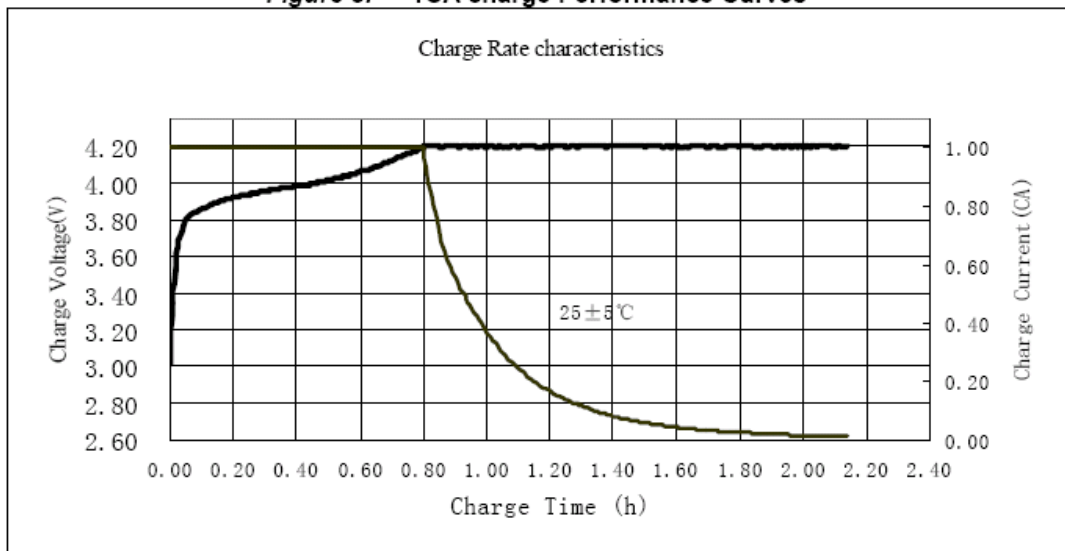


Figure 4. Discharge Rate Performance Curves

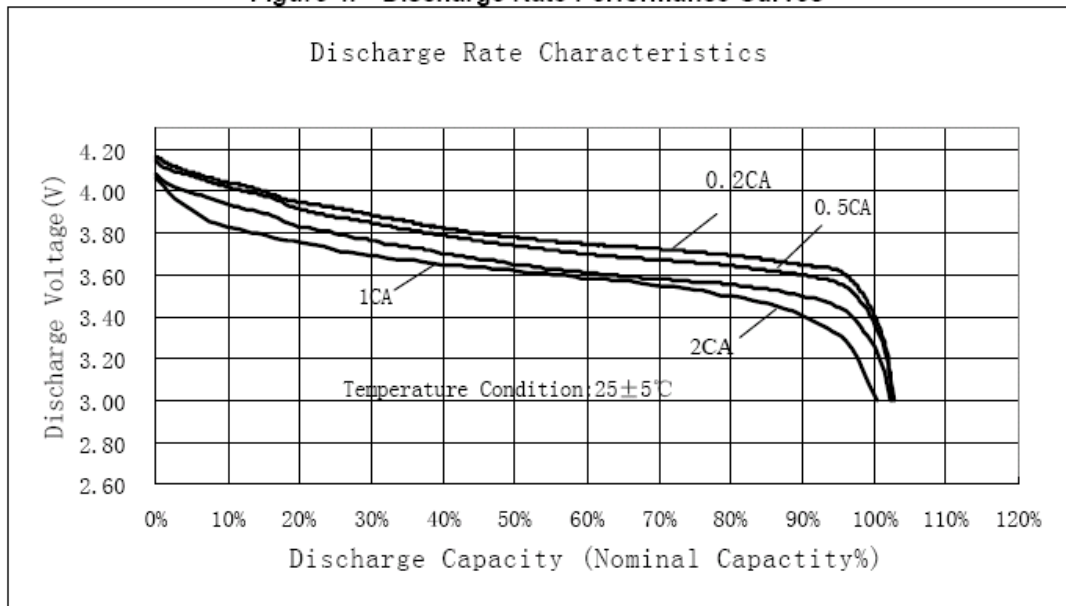


Figure 5. Discharge Performance Curves at Different Temperature

