

Product Specification

TITLE: Cylindrical Lithium Ion Cell LR18650

1. SCOPE

The product specification describes the requirement of the Cylindrical Lithium-ion Cell to be supplied to the customer by Bao Tong USA Inc. Should there be any additional information required by the customer, customer are advised to contact Tianjin Lishen Battery J/S Co.,Ltd..

2. DESCRIPTION AND MODEL

2.1. Description : Cylindrical Lithium Ion Cell

2.2. Model : LR1865AH-2200mAh

3. GENERAL SPECIFICATIONS

3.1. Nominal Capacity	2200mAh (at 0.2CmA Discharge)
3.2. Charging Voltage	4.2V±0.05V
3.3. Average working Voltage	3.70V,@0.2CmA
3.4. Standard Charge Method	Constant Current and Constant Voltage (CC/CV) Current 0.5CmA Voltage 4.2 V End Current 100mA
3.5. Maximum Charge Current	1CmA
3.6. Standard Discharge	Constant Current (CC) Current 0.5CmA End Voltage 3.0V
3.7. Maximum Discharge Current	2CmA
3.8. Cycle Life	Capacity≥80% Initial Capacity@300 th cycles
3.9. Weight of Bare Cell	Approx. 45g
3.10. Operating Temperature	Charge 0°C ~ 45 °C Discharge -20°C ~ 60°C
3.11. Storage Temperature	1 month -20°C ~ 45 °C 6 months -20°C ~ 35 °C
3.12. Typical Characteristic	Refer to the attached performance Curve (Page 7)

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4. OUTLINE DIMENSION (UNIT: mm)

4.1. Dimension: Diameter 18.4mm (max), Height 65.5mm (max). Refer to the attached drawing 1.

5. APPEARANCE

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

6. TEST CONDITION AND DEFINITIONS

6.1. Measuring Equipment

1. Voltmeter

Inner impedance > 1000Ω per volt.

2. Ampere-meter

Total external resistance (ammeter and wire) < 0.01Ω.

3. Slide caliper

The slide caliper should have a scale of 0.02mm.

4. Impedance meter

The impedance meter should be operated at AC 1KHz.

6.2. Unless otherwise specified, all tests shall be performed at $(25 \pm 5)^\circ\text{C}$ and humidity of $(65 \pm 20)\%$ RH.

6.3. All tests shall be performed at the same charge voltage, per 7.1.

6.4. Definitions:

6.4.1. C Rate ("C"): The rate (milliamperes) at which a fully charged cell is discharged to its end voltage in one (1) hour.

7. CHARACTERISTICS

7.1. Charge method:

7.1.1. Charging shall consist of charging at a 0.5C constant current rate until the cell voltage reaches 4.2V. The cell shall then be charged at constant voltage of 4.2 volts while tapering the charge current. Charging shall be terminated when the charging current has tapered to $100 \pm 5\text{mA}$.

7.2. Discharge method:

7.2.1. Cells shall be discharged at a constant current of 1C to 3.0 volts @ $20^\circ\text{C} \pm 5^\circ\text{C}$

7.2.2. Cells shall be discharged at a constant current of C/2 to 3.0 volts @ $20^\circ\text{C} \pm 5^\circ\text{C}$

7.2.3. Cells shall be discharged at a constant current of C/5 to 3.0 volts @ $20^\circ\text{C} \pm 5^\circ\text{C}$

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7.3. Weight of Bare Cell

Meet 3.9. by balance.

7.4. Internal Impedance

The impedance shall be measured at AC 1000 Hz initially.

Initial Internal Impedance ≤ 80 mohm

7.5. Discharge capacity(1.0 C)

Within 1 hour after charge as per 7.1.1, discharge at 1.0C until end of discharge voltage.

The capacity $\geq 90\%$ of the nominal capacity

7.6. Cycle Life

Charge cells per 7.1.1. Rest 1 hour. Discharge per 7.2.2. Rest 1 hour before recharge. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 300 cycles.

Discharge capacity (300th Cycle) $\geq 80\%$ Initial Capacity

7.7. Storage Characteristics

After charge as per 7.1.1, store the testing cells at $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ for 28 days. Then discharge at 0.5 C to 3.0 V.

The discharge capacity $\geq 80\%$ of Initial capacity

7.8. Temperature Characteristics

Cells shall be charged per 7.1.1. and discharged per 7.2.2. except to be discharged at temperatures per Table 1. Cells, full charged, shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at $25 \text{ }^\circ\text{C}$ and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 1.

Table 1

-10 $^\circ\text{C}$ @ 0.5C	20 $^\circ\text{C}$ @ 0.2C	60 $^\circ\text{C}$ @ 0.5C
$\geq 40\%$ Initial Capacity	2200mAh	$\geq 95\%$ Initial Capacity

8. SAFETY

8.1. External Short-circuiting Test

Cell, charged per 7.1.1, is to be short circuited by connecting the positive and negative terminals of the cell with copper wire having a maximum resistance ≤ 50 mohm. Stop the test when the battery temperature decays to about $10 \text{ }^\circ\text{C}$ from the maximum.

Criteria: No Explosion, No Fire

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8.2. Overcharge Test

Store the testing cell connecting with thermocouple in ventilated cabinet, connect the testing cell to a power supply with constant current-constant voltage function. Adjust current to 4A and voltage to 4.65V. Then charging at 4A until voltage reaches 4.65V, Monitoring change of cell temperature during testing, Stop the test when battery temperature decays to room temperature or the current decays to less than 50mA.

Criteria: No Explosion, No Fire

8.3. Heating Test

Store the testing cells connecting with thermocouple in constant temperature box, heating the cells and box(speed of ascending temperature is $5^{\circ}\text{C}\pm 2^{\circ}\text{C}$ per min) together at room temperature simultaneity, monitor the temperature change of the box , keep for 60 minutes after the box temperature reaches $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$,then stop the test.

Criteria: No Explosion, No Fire

8.4. Drop test

After charge as per 7.1.1, Drop the cells from 4 feet above a wood floor for 9 times.

Criteria: Internal impedance $\leq 130\text{m}\Omega$; Change of open circuit voltage $\leq 10\%$

9 GUARANTEE

Cells are guaranteed to be free from defects in workmanship and materials for a period of half a year provided that the manufacturer can confirm such defects are coming from manufacturing abnormality and not from abusive usage, or else manufacturer will solve the quality problem.

10 PACKAGING

Loading 100 cells per box, 2 boxes per case for a total of 200 cells. Sketch map refer to attached drawing 2

11 OTHERS

Any matter not included in this specification shall be conferred between the both parties.

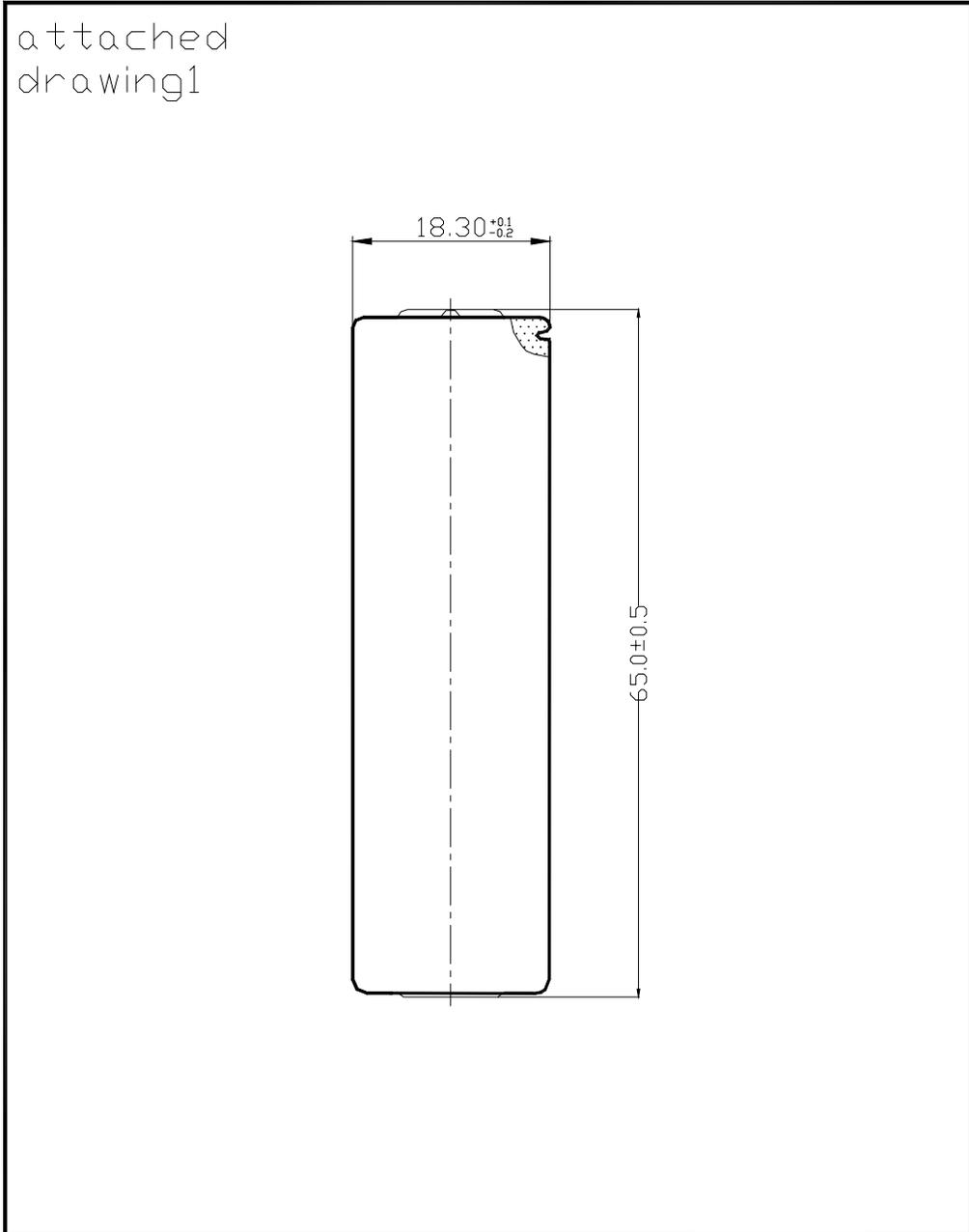
12 SHIPPING

During transportation , keep the battery from acutely vibration, impacting, solarization, drenching, and in half charged condition.

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Attached drawing 1

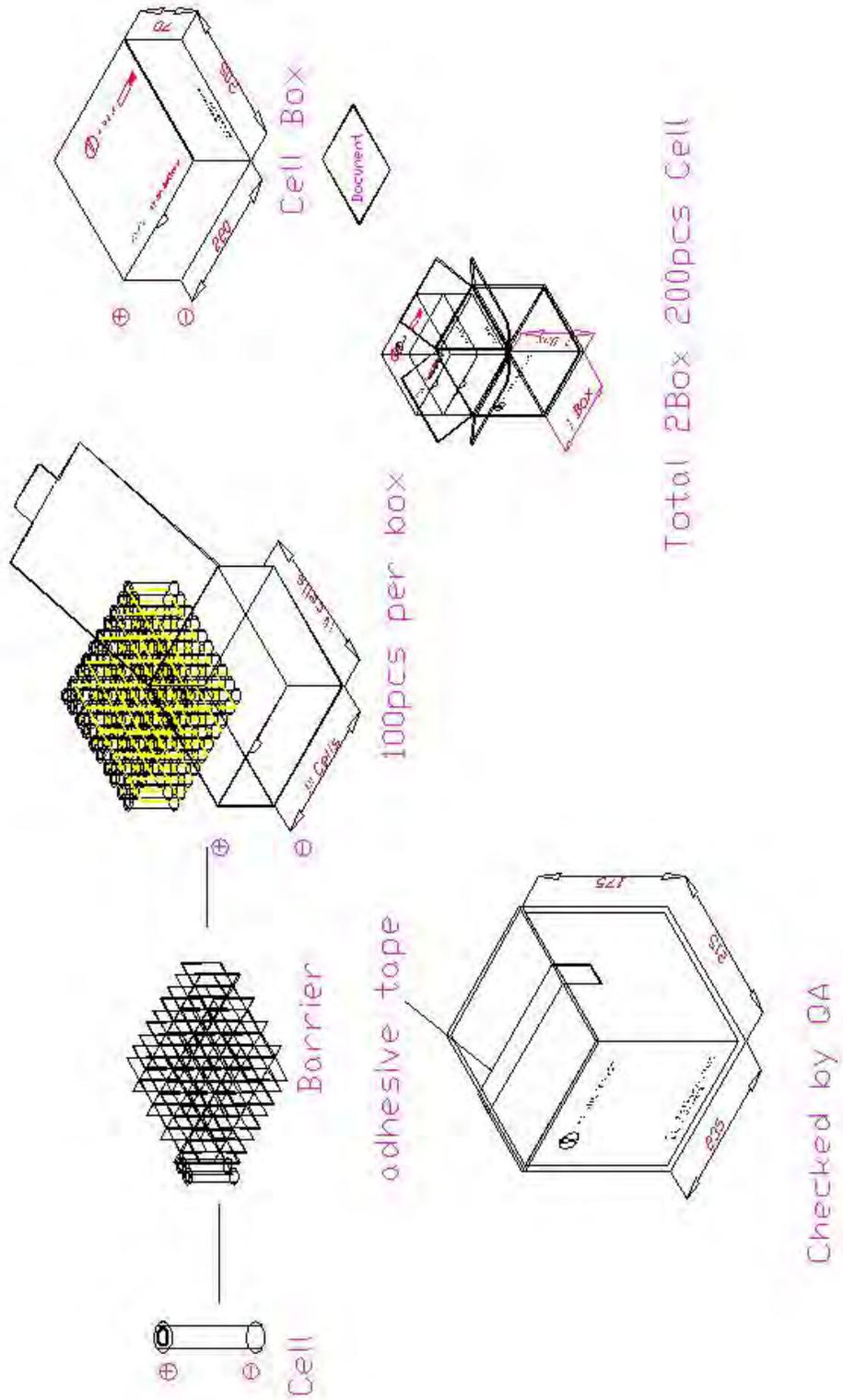


				18650 outline chart					
Changing mark	Sum	Number	Signature		Date	Grade	Mark	Weight	Scale
Designer									
Press-corrector									
Assessor									
Technologist									
Normalizer									
Ratifier									
					No: 1		Sum: 1		
					TIANJIN LISHEN BATTERY JOINT-STOCK, , LED				

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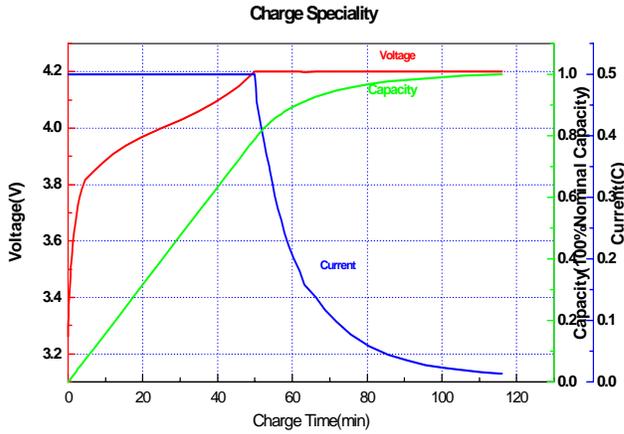
Attached drawing 2



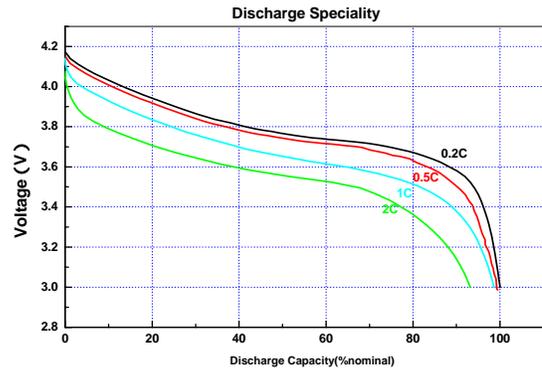
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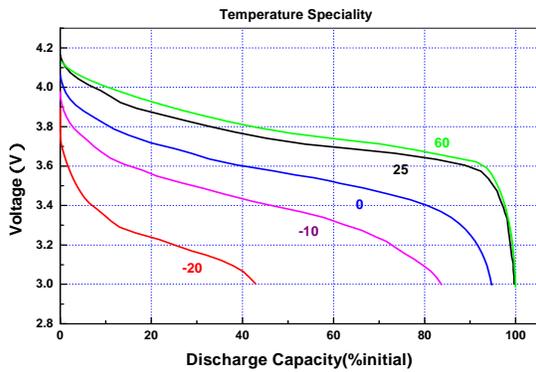
Performance Curve



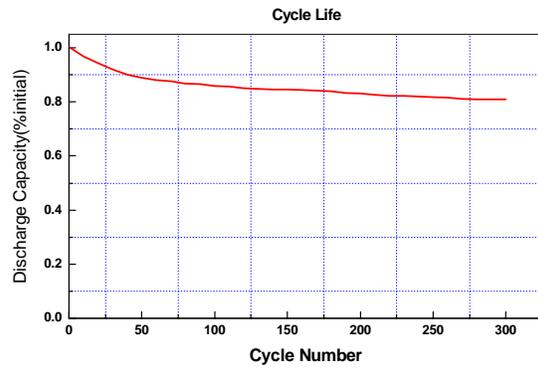
Charge: CC/CV 0.5CmA, 4.2V, 20mA cut off at RT.



Charge: CC/CV 0.5CmA, 4.2V, 20mA cut off at RT
Discharge: 3.0V cut off at RT.



Charge: CC/CV 0.5CmA, 4.2V, 20mA cut off
Discharge: 3.0V cut off



Charge: CC/CV 0.5CmA, 4.2V, 20mA cut off at RT
Discharge: CC 0.5CmA, 3.0 V cut off at RT.

Note:
CC represent constant current
CV represent constant voltage
1C represent multiple current
RT represent room temperature

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The following caution and warning should appear in manuals and/or instructions for users, especially at the point of use.

HANDLING INSTRUCTIONS FOR LITHIUM ION RECHARGEABLE BATTERY

1. **CAUTION**

1.1 Charging

- a) Avoid over-charging voltage of charging not over 4.25V.
- b) Charger should start charging at temperature range 0 ~ 45 °C.
- c) No reverse charging

1.2 Discharging

- a) Discharge current must be below 2CmA/cell.
- b) Discharge end voltage must be over 2.75V.
- c) Discharge temperature range should be -20 °C ~ 60 °C.

1.3 Environmental using conditions:

When the battery is charged	:	0°C ~+45°C
When the battery is discharged	:	-20°C ~+60°C
When stored within 1 month	:	-20°C ~+45°C
When stored within 6 months	:	-20°C ~+35°C

1.4 Storage

For any long time storage, cell should be in a dry area and at 20±5 °C at half charged stage.

1.5 Battery position in equipment and charger.

To avoid degradation of battery performance by heat, a battery should set the place apart from heat generating electronic parts inside equipment and charger.

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2. **WARNING**

2.1 Don't heat or disposed in fire or water .Don't modify or disassemble the battery. It will be dangerous, and may cause ignition, heating, leakage or explosion.

2.2 Don't short-circuit positive(+) and negative(-) terminals. Keep away from metal or other conductive materials. Jumbling the batteries of direct contact with positive(+) and negative(-) terminals or other conductive materials may cause short-circuit.

2.3 Don't reverse the positive (+) and negative (-) terminals.

2.4 If the battery gives off an odor, generates heat, becomes discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it from the device or battery charger and stop using it.

2.5 Don't solder the battery directly. Excessive heating may cause deformation of the battery components such as the gasket, which may lead to the battery swelling,leakage, explosion,or ignition.

2.6 Don't use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.
