PRODUCT SPECIFICATION

Cylindrical Lithium-ion Cell

TERRAE INR 18650 30E

Customer Approval	**Signature**	**Date**
	Company Name：	
	Company Stamp：	

Prepared By	Checked By	QA	Approved By

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History of revision

Revision	Date	Originator	Reason of Revision
0	06/23/2021	HuHai	Original Release

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1 SCOPE

The product specification describes the requirements of the Cylindrical Lithium-ion Cell to be supplied to the customer by Tianjin Lishen Battery J/S Co.,Ltd.. 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	TERRAE INR 18650 30E

3 GENERAL SPECIFICATIONS

3.1	Nominal Capacity	3000mAh (at 0.2C Discharge)		
	Minimum Capacity	2900mAh (at 0.2C Discharge)		
	Nominal capacity is measured by the discharge at 0.2C to 2.5V end voltage after standard fully charged according to specification at 25℃.			
3.2	Maximum Charge Voltage	4.20V±0.03V		
3.3	Average working Voltage	3.65V@0.2C		
3.4	Standard Charge Method (25℃±2℃)	Constant Current and Constant Voltage		
		Current	0.2C (600mA)	
		Voltage	4.2V	
		End Current	60mA±5mA	
3.5	Maximum Charge Current(for continuous charge)	0℃ ≤ T ≤ 10℃	0.1C (300mA)	
		10℃ < T ≤ 20℃	0.2C (600mA)	
		20℃ < T ≤ 45℃	0.3C (900mA)	
	Maximum Charge Current (not for cycle life)	20℃ < T ≤ 45℃	0.5C(1500mA)	
	If charged at high rate(>0.3C) frequently, cell cycle life will be shorten.			
3.6	Charge time	Standard charge	6.0h	
		Rapid charge	4.0h	
3.7	Standard Discharge	Constant Current		
		Current	0.2C (600mA)	
		End Voltage	2.5V	
3.8	Maximum Discharge Current(for continuous discharge)	-20℃≤T ≤ 20℃	1.0C (3000mA)	
		20℃<T ≤ 45℃	2.0C (6000mA)	
		45℃<T ≤55℃	1.0C（3000mA）	

3.9 Cycle Life

500th cycle ≥70% of 1st Capacity (25℃±2℃，4.2V-2.5V)

If charged and discharged at high rate and high temperature (≥35℃) frequently, cell cycle life will be shorten. If charged and discharged at high temperature (≥60℃) frequently, cell safety may be occurred.

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3.10	Weight of Bare Cell	Max.	48g
3.11	Operating Environmental Temperature	Charge	0℃ ~ 45℃
		Discharge	-20℃ ~ 55℃
3.12	Storage Temperature	1 month	-20℃ ~50℃
	（For shipping state）	3 months	-20℃ ~ 40℃
		12 months	-20℃~ 20℃

4 OUTLINE DIMENSION

Dimension: Diameter 18.4mm±0.2mm, Height 65.4mm±0.2mm. Refer to attached drawing 1.

5 APPEARANCE

There shall be no such defect as breakage of tube and deep scratch, flaw, crack, rust, leakage, which may adversely affect performance of the cell.

6 TEST CONDITION AND DEFINITIONS

6.1 Measuring Equipment

6.1.1 Slide caliper

The slide caliper should have a scale of 0.02mm.

6.1.2 Voltage-Impedance meter

The impedance meter should be operated at AC 1kHz, and have a scale of 0.1mΩ/1mV.

6.2 Unless otherwise specified, all tests shall be performed at 25℃±2℃ and humidity of 65%RH±20%RH.

The cells used for the test mentioned should be new ones delivered a week before at most.

6.3 Definitions :

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 0.2C 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 0.02C.

7.1.2 Charging shall consist of charging at a 0.3C 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 0.05C.

7.2 Discharge method :

7.2.1 Cells shall be discharged at a constant current of 0.2C to 2.5 volts

7.2.2 Cells shall be discharged at a constant current of 0.5C to 2.5 volts

7.2.3 Cells shall be discharged at a constant current of 1.0C to 2.5 volts

7.2.4 Cells shall be discharged at a constant current of 2.0C to 2.5 volts

7.3 Internal Impedance

The impedance shall be measured by 6.1.2.

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Initial Internal Impedance ≤35mΩ.

7.4 Discharge Rate characteristics

Cells shall be charged per 7.1.1 (0.2C) at 25℃ and discharged per 7.2.1(0.2C), 7.2.2 (0.5C), 7.2.3 (1C), 7.2.4 (2C) at 25℃. The discharge capacity of each cell at respective discharge rate shall be compared with the discharge capacity at 0.2C and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 1.

Table 1

0.2C	0.5C	1C	2C
100%	≥95%	≥93%	≥90%

7.5 Cycle Life

Charge cells per 7.1.2. Rest 15 minutes. Discharge per 7.2.3. Rest 15 minutes before recharge. The test environmental temperature is 25℃±2℃. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 500 cycles.

Discharge capacity (500th Cycle) ≥70% of 1st Cycle Capacity

7.6 Storage Characteristics

7.6.1 After charge as per 7.1.1, store the testing cells at 25℃±2℃ for 28 days. Then discharge as per 7.2.2. Then the same cell is fully charged as per 7.1.1 again and discharged a second time and measured as per 7.2.2.

The recovery discharge capacity（2nd discharge capacity） ≥90% of initial capacity.

7.6.2 After charge as per 7.1.1, store the testing cells at 55℃±2℃ for 7 days. Then discharge as per 7.2.2. Then the same cell is fully charged as per 7.1.1 again and discharged a second time and measured as per 7.2.2.

The recovery discharge capacity（2nd discharge capacity） ≥90% of initial capacity.

7.7 Temperature Characteristics

Cells shall be charged per 7.1.1 and discharged per 7.2.3. Cells , fully charged, shall be stored for 3 hours at the test temperature .The capacity of a cell at each temperature shall be compared to the capacity achieved at 25℃ and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 2.

Table 2

-10℃	0℃	25℃	45℃	55℃
≥70%	≥80%	100%	≥95%	≥90%

8 SAFETY

8.1 External Short-circuiting Test at 25℃±2℃

Cell fully charged per 7.1.1, is to be short circuited by connecting the positive (+) and negative (-) terminals with a total external resistance of 80±20mohm. Stop the test when the cell voltage falls to below 0.1V and the cell case temperature has returned to a value within 10 ºC of the original testing temperature.

Criteria: No Fire, No Explosion

8.2 Overcharge Test

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Cell fully discharged per 7.2.1, is to be overcharged with 3C to 4.2V while tapering the charge current. Monitoring change of cell temperature during testing. The charge duration is 7 hours. Stop the test when cell temperature decays to room temperature.

Criteria: No Fire, No Explosion

8.3 Heating Test

Cell fully charged per 7.1.1, is to be placed in the hot oven. Store the testing cells connecting with thermocouple in constant temperature box, heating the cells and box (speed of ascending temperature is 5℃±2℃ per min) together at room temperature simultaneity, monitor the temperature change of the box for 30 minutes after the box temperature reaches to 130℃±2℃, then stop the test.

Criteria: No Fire, No Explosion

8.4 Overdischarge Test

Cell fully charged per 7.1.1, is discharged at constant current of 1.0C to 90min;

Criteria: No Fire, No Explosion

8.5 Crush Test

Cell, charged per 7.1.1, is to be crushed between two flat surfaces and with cell longitudinal axis parallel to the flat surfaces of the crushing apparatus.The force for the crushing is to be applied by a hydraulic ram with a 1.25 inch (32 mm) diameter piston. The crushing is to be continued until a pressurereading of 2500 psig (17.2 MPa) is reached on the hydraulic ram, applied force of 3000 pounds (13 kN). Once the maximum pressure has been obtained it is to be released.

Criteria: No Fire, No Explosion

8.6 Drop Test

After charge as per 7.1.1, the cell is dropped from 1.5m above a concrete floor by the positive and negative terminal down. Wait for 1h.

Criteria: No Fire, No Explosion

9 PACKAGING

The delivery pallet shall meet the IPPC standard, size is 1140mm*800mm. The maximum height of the package shall be less than 1100mm. The weight of the whole pallet battery shall be less than 800kg. There are two ways of packing.

9.1 Non- dangerous goods (Current sea shipping standard)

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

Number of the whole pallet is14000 cells.

9.2 Dangerous goods

Loading 160 cells per box, 2 boxes per case for a total of 320 cells. Refer to attached drawing 3.

Number of the whole pallet is 14400 cells.

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10 LABEL

Each box is pasted with a Lishen label . Refer to attached drawing 4.

Each packing box is pasted with a BMZ label and a Lishen label. Refer to attached drawing 4.

Each pallet has a large white paper label and a list，Refer to attached drawing 4.

11 SHRINK TUBE AND BARCODE

Thickness of the shrink tube is 0.07±0.02mm, Material is PET.

Printing and barcode :

Picture								
Printing	**+**	**TERRAE INR 18650 30E**	**K**	**V**	**01**	**88**	**12345678**	**-**
	Positive	Model	Year	Month	Lot number	Mass production	Serial number	Negative
Barcode								
	KV0112345678							

12 OTHERS

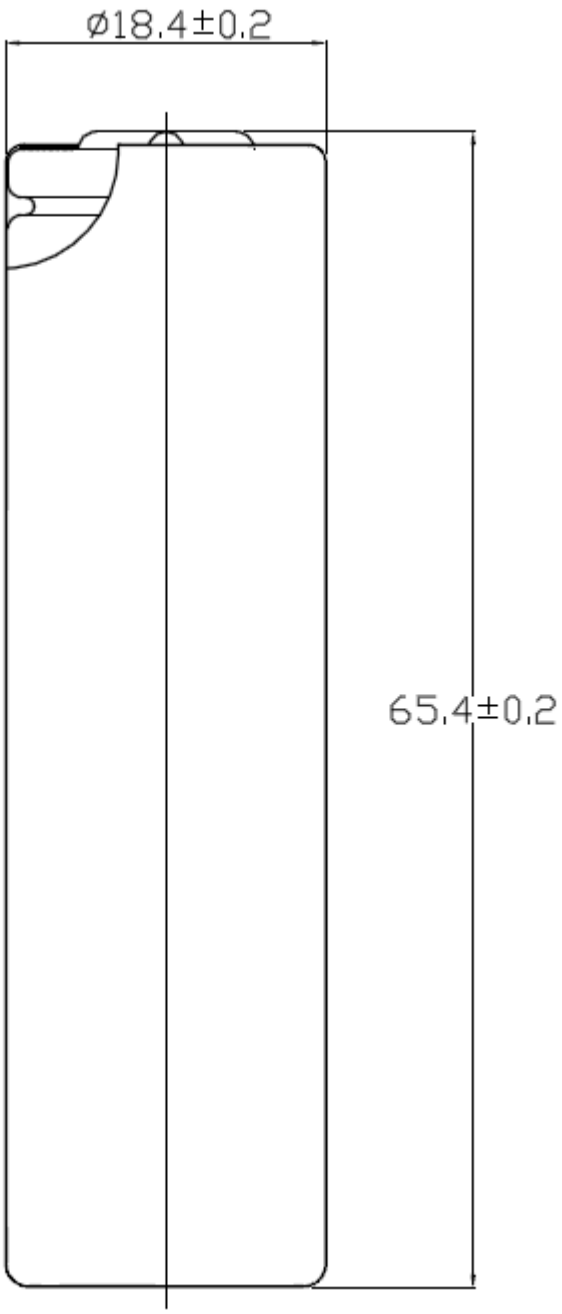
Any matter not included in this specification shall be confered between the both parties.

13 SHIPPING

The capacity of delivery cell is about 30%SOC, the standard as follow table. During transportation, keep the cell from acutely vibration, impacting, solarization, drenching.

Voltage Range	IR Range	Voltage Matching per box	IR Matching per box	Capacity
3510mV-3570mV	15mΩ-30mΩ	△OCV≤8mV	△IR≤7mΩ	≥2900mAh

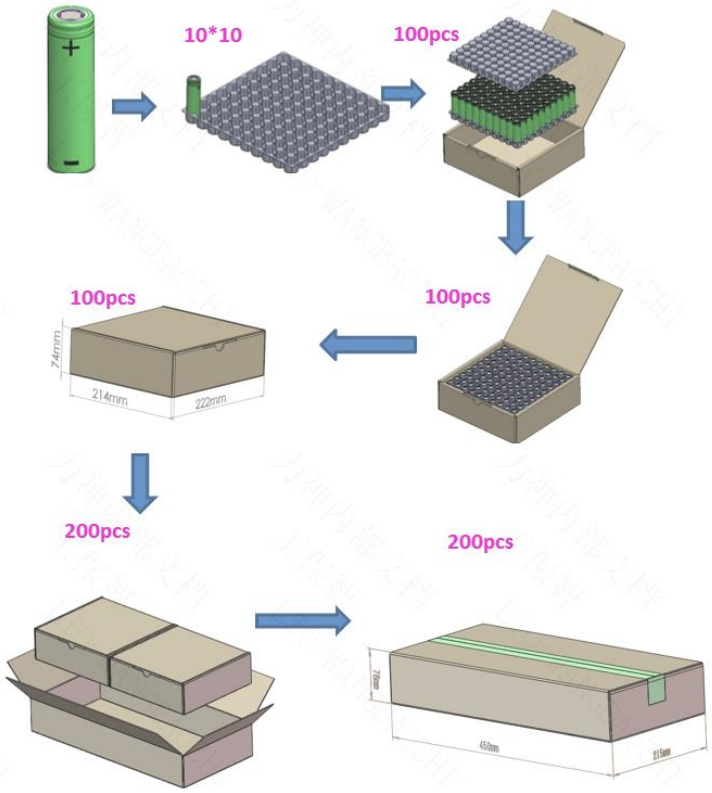
Attached drawing 1



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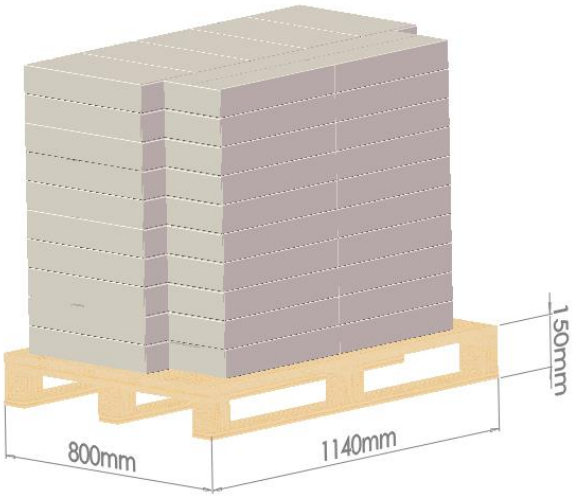
Attached drawing 2(Non-DG package for sea shipping)

Full packing box (200pcs)



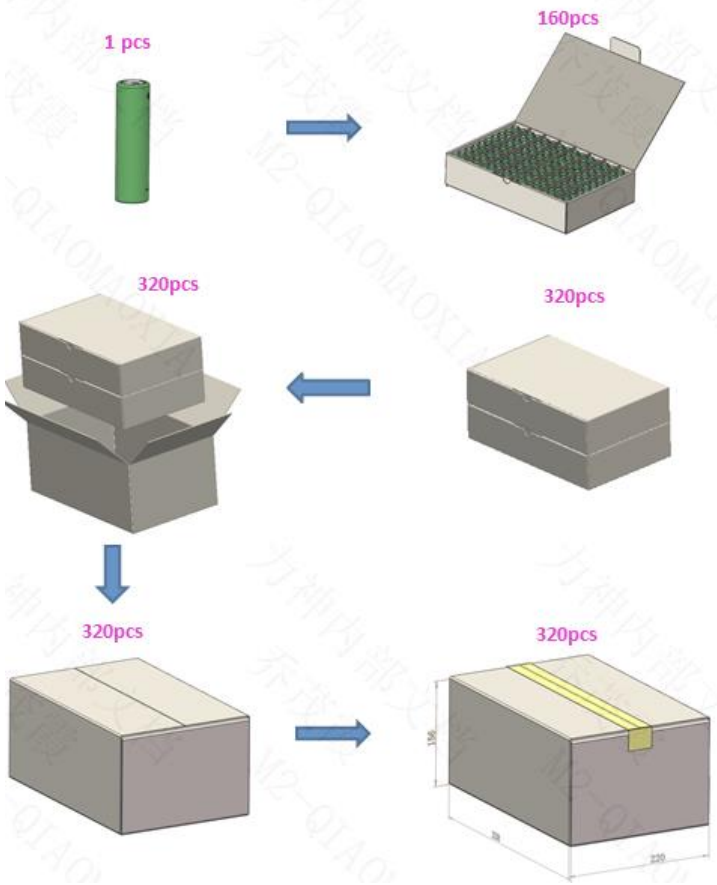
450mm*215mm*76mm

Full Pallet（14000pcs）



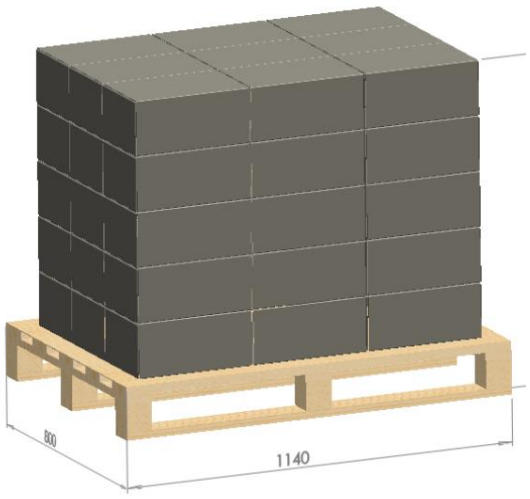
Attached drawing 3 (DG package for sea shipping)

Full packing box (320pcs)



338mm*220mm*156mm

Full pallet（14400pcs）



Attached drawing 4

Box label：



Box

TERRAE INR 18650 30E 3.65V 3000mAH 10.95WH			
型号/BOM	TERRAE INR 18650 30E	批次/Lot	*
数量/Qty	*	档次/Rank	*
电压/V	*-*mV	压差/△V	*mV
内阻/IR	*-*mΩ	阻差/△IR	*mΩ
****			

box label (Lishen label)

Packing Box label：



Packing Box

******

BMZ label (Left side of packing box)

TERRAE INR 18650 30E 3.65V 3000mAH 10.95WH			
型号/BOM	TERRAE INR 18650 30E	箱号/No	*
客户/CSR	BMZ	批次/Lot	*
数量/Qty	*	档次/Rank	*
电压/V	*-*mV	压差/△V	*mV
内阻/IR	*-*mΩ	阻差/△IR	*mΩ
****			

Lishen label (Right side of packing box)

Pallet label:



Pallet

定单号	盘号(PAT)	箱号(NO)	型号(BOM)	批次(Lot)	档次(Rank)	数量(Qty)	日期(Date)
*	*	*	*	*	*	*	*

List

客户/CSR: BMZ
型号/BOM: TERRAE INR 18650 30E
盘号/PAT: *
数量/Qty: *
入库日期/Date: *

White paper label

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 CELL

1 ELECTRIC CAR, CHARGER AND BATTERY PACK DESIGN CONSIDERATIONS

1.1 Charging

1.1.1 Cell must be charged with constant current-constant voltage method. Charging voltage must below 4.20V/cell and the charging cut-off current is greater than or equal to 1/20C. Even if the charge could be out of order, charge voltage of charger should not be above 4.23V/cell to avoid over-charging. Cell life will be shorten by charging voltage above 4.20V.

1.1.2 Charger should be equipped with a complete charging detection device including the timer inspection, current and open circuit voltage to detect the current state of charge. When one of the detection such as timer, current and voltage detected the full charge, charge should be completely cut off the charging circuit, avoid produce turbulence.

1.1.3 Charger should start charging at temperature range 0℃~ +45℃(see spec 3.5).When the cell temperature exceeds this range, it should be placed in the battery temperature to teach the above range before recharging.

1.1.4 For cycle life, use the normal charging or trickle charging method and minimize the fast charge.

1.2 Discharging

1.2.1 Discharge end voltage must be over 2.5V.

1.2.2 Discharge temperature range should be -20℃ ~ +55℃(see spec 3.8). If surface temperature exceeds 70 degrees, the discharge must be stopped.

1.3 Storage

Any storage, cell should be in low humidity （less than 70%RH）, no corrosive gas atmosphere area. And there is no press and condensation on the cell. Best temperature range -20℃~20℃. The capacity of cell is 25%-35% SOC.

When stored within 1 month : -20℃ ~ 50℃
When stored within 3 months : -20℃ ~ 40℃
When stored within 12 months : -20℃ ~ 20℃

1.4 Precautions on battery pack design

1.4.1 Battery pack Shape, Mechanism and Material

The battery pack should be designed to ensure that it can not be charged by an unauthorized charger. The battery pack should be designed to ensure that it can not be connected to unauthorized equipment and equipment; both ends of the battery pack should be designed to avoid short circuits or positive and negative The battery pack design should have anti-static function and can prevent the dust , The battery should be designed so that even if the battery leakage occurs, the electrolyte can not reach the protection circuit board; battery design should ensure that the battery is fixed in the battery pack, can not move; battery pack in the structure should ensure that The use of materials such as double-sided tape and rubber should verify its flammability; welding mold should be sealed with glue; if the welding die in the sealed when the welding of the mold can not be used, The use of ultrasonic welding method, for the emergence of any defects, God does not bear anything Either.

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1.4.2 Battery pack structure (battery pack limits the number of batteries used)

The number of parallel connections is unlimited, but the battery pack must pass the overcharge test (the charging current of the overcharge test is the maximum charge current of the charger and the product of the parallel quantity); the number of series is unlimited and the fuse is required; the battery should be away from the heat Device to avoid deterioration of battery performance; PCBA circuit board and battery pack should be insulated between the insulation material (such as plastic barrier to provide air isolation or non-conducting thermal insulation material).

If charged and discharged at high rate and high temperature (≥35℃) frequently, cell cycle life will be shorten. If charged and discharged at high temperature (≥60℃) frequently, cell safety may be occurred.

1.4.3 Protection Circuit insure safety of battery

The following protection circuit should be installed in the battery pack:

Overcharge protection. For safety reasons and in order not to shorten the cycle life, the maximum overcharge protection voltage for the individual cells within each module should be less than 4.23V (including tolerances);

Over discharge protection. If the single cell voltage reaches 2.5V, we recommend that the discharge protection should cut off the discharge current, the circuit current consumption should be as small as possible;

Overcurrent protection. If the discharge current of the single cell exceeds about 2C, the overcurrent protection should cut off the discharge current circuit.

External short protection: The battery pack has function not to cause external short cut.

Over temperature protection: Set the temperature protection of pack according to the cell use condition in SPEC.

Battery pack should have cell voltage balancing function and cell imbalance protection circuit.

Battery pack should have function to avoid thermal propagation when the cell is failure.

Weld spot welding lead plate onto cell, and solder lead wire or lead plate. the battery pack in the discharge, the internal cell temperature difference should be less than or equal to 5 ℃.

In order to avoid long-term storage over discharge mode, battery pack protection circuit current consumption should be set as small as possible. Long-term use, to regularly check the remaining state of electricity, to ensure that the battery within the single cell can not achieve over-discharge state.

1.4.4 Cell connection

Do not solder onto a cell in order to avoid a damage on the cell. The battery pack should be equipped with appropriate shock absorbers in the pack in order to minimize shock, which can damage the cells.

1.5 Cell usage

1.5.1 When using batteries for serial and use, use the same gear, the same batch and the same state of charge batteries, you can get this information from the inside and outside the box label. Batteries need to be used before the detection of voltage resistance, and in accordance with its use for the combination, God recommended at least to ensure that the use of batteries within 30mV voltage within the internal resistance within 6mohm.

1.5.2 Battery pack before shipment Check the voltage, internal resistance, protection line function, thermistor, thermal fuse.

1.5.3 Transfer the batteries to the assembly process to pay special attention to prohibit the transport process caused by external damage, the transport process is recommended to use the same transport packaging, even if there is a process of opening the package.

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1.5.4 Do not use damaged or leaked batteries due to transport damage, drop, short circuit or other reasons.

2 SAFETY INSTRUCTIONS

Batteries containing organic solvents and other flammable substances, such as improper use may cause the core heat or fire, resulting in damage to the battery or personal injury. Please pay attention to the use of prohibited items, while the protection device should be added to avoid the use of equipment caused by abnormal batteries accident. Before using lithium-ion rechargeable batteries, please read the following safety guidelines carefully. In addition, God strongly recommends adding these instructions to the user manual.

2.1 Dangerous matter

2.1.1 Don't use or place batteries in high temperature (above 70℃) environment. Do not put it into fire, water or make it moisture. Do not repair or disassemble batteries, there is a risk of causing the batteries to ignite, overheat, leak or explode.

2.1.2 Don't place the batteries in a chaotic manner, away from metal and other conductive materials to avoid positive (+) negative (-) short circuit, do not reverse the positive (+) negative (-) pole

2.1.3 Don't use non-specified charging equipment and violate charging requirements. Non-specified conditions charge will cause the battery to overcharge or abnormal chemical reactions, heat generation, smoke, rupture or fire.

2.1.4 Don't connect the battery to the AC plug (outlet) or the car plug. The battery needs to have a specific charger. If the battery is connected directly to the plug, the battery may catch fire, smoke, explode, or cause heat.

2.1.5 Don't overcharge, over-discharge, drive nail into the cell, strike it by hammer or tread and step on it

2.1.6 Don't hit or throw batteries. If the batteries appear to fall, please treat the waste, can not continue to use.

2.1.7 Don't dissect the battery. If the protection line is damaged, the battery will no longer be protected. Then, the battery may fire, smoke, explode or cause heat.

2.1.8 Don't charge near high temperatures. If the battery is charged near the high temperature, the battery can not be recharged due to the protection line. In this case, the protection circuit may be interrupted, the battery may fire, smoke, explode or cause heat.

2.1.9 Don't use batteries that are clearly damaged or deformed. May cause fever, smoke, rupture or burning.

2.1.10 Don't direct soldering of batteries, overheating will lead to insulation gaskets and other parts of the deformation, causing cell deformation, leakage, explosion or fire.

2.1.11 Don't reverse polarity charge. In the case of charging, the battery is reverse charging will be abnormal chemical reaction. In addition, there is an unpredictable high current through the discharge. These may cause heat, smoke, rupture or burning.

2.2 Warning

2.2.1 Batteries should be kept away from infants and young children. In case of swallowing the battery, please seek medical attention immediately.

2.2.2 Don't place the battery in a microwave oven or other cooking utensils. Due to the heating and electrical shock of the microwave oven, the battery may ignite, smoke, explode or cause heat.

2.2.3 Don't mix with other batteries. The battery can not be mixed with other different capacities, chemical systems, or manufacturers' batteries. Do not connect other batteries or mix other batteries. The battery may catch fire, smoke, explode or cause heat.

2.2.4 Don't use an abnormal battery. If there are obvious abnormalities, such as odor, fever, deformity or discoloration, stop using the battery. Such batteries may be defective and, if used, may cause fire, smoke, heat or explosion.

2.2.5 If the charging process does not end, stop charging. If the battery can not complete the charging process for a specified period of time, stop the charging step. The battery may catch fire, smoke, explode or cause heat.

2.2.6 Don't use a leaky battery near a flame. If the battery or liquid out of the battery produces a pungent odor, the battery should remain away from the flame. The battery may be ignited or exploded.

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2.2.7 Don't touch the leaky battery. If the liquid leaked from the battery into the eyes, will cause serious damage. If you come from your leaked liquid into your eyes, rinse your eyes with water immediately. Please consult a doctor immediately. If the liquid is left in the eyes, it will cause serious damage.

2.2.8 In order to avoid short circuit or damage, please tightly put the battery into a box or carton.

2.2.9 Don't store the cell in a pocket or a bag together with metallic objects such as keys, necklaces, hairpins, coins, or screws.

2.3 Precautions

2.3.1 Don't use or place batteries in high temperature environments, such as in direct sunlight. The battery may catch fire, smoke, explode or cause heat. At the same time, may cause battery performance and life degradation.

2.3.2 Battery pack has a protective line. Do not use batteries in places where static electricity (over 100V) is generated, which may damage the protection circuit. If the protective line of the battery is damaged, the battery may catch fire, smoke, explode or cause heat. Do not use Lithium ion cell with the primary batteries or secondary batteries whose capacity or kinds or maker is different. If do that, the cell will be discharged or charged excessively in use. And it may cause the generating heat, smoke, rupture or flame because of the abnormal chemical reaction in cells.

2.3.3 Specified the charging temperature range. Do not charge the battery outside the specified temperature range. Failure to do so may result in heat, leakage, or serious damage. In addition, battery performance and life degradation may occur.

2.3 4 Please read the manual before use. Please keep this manual for future reference.

2.3.5 Please read the charging method of the charger manual.

2.3.6 In the first use, if the battery has an abnormal smell, heat or rust, please contact the supplier.

2.3.7 Keep away from flammable materials during charging and discharging. May cause fire, smoke, explosion or cause heat.

2.3.8 If the electrolyte leaks from the battery, gets on the clothes or on the skin, rinse it immediately with water. Otherwise it may irritate the skin.

2.3.9 If wires or metal objects come out of the battery, completely seal and insulate them. Otherwise, the battery may cause a short circuit, fire, smoke, explosion, or cause heat.

2.3.10 After use, please carry out battery recycling according to local laws and regulations.

3 EXCLUSION LIABILITY

3.1 Lishen is not liable for any loss caused by breach of notice in the specification;

3.2 Lishen is not responsible for any problems caused by design defects in battery packs, electric cars and chargers;

3.3 Lishen does not accept abnormal batteries caused by improper assembly;

3.4 Lishen is not liable for any loss caused by incorrect or incongruent with the SPEC charge and discharge method and inappropriate environment;

3.5 Lishen is not liable for any force majeure (ex. Lightening, storm, flood, fire, earthquake, etc)

3.6 In order to standardize the use of sample batteries, the rights, obligations and responsibilities of every customer and Lishen are clarified. Before using the battery, please read carefully and thoroughly understand the contents of the specification. In order to ensure the safety of the battery, please contact LISHEN to discuss design of the application. Also, if there are special usage conditions (for example: a large current load, a quick charge method, or a special usage pattern), please consult LISHEN before finalizing the product specification.

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If you choose to use this battery, your use will be regarded as an endorsement of all the contents of this statement.

The amendment, renewal and final interpretation of this statement are belong to Lishen.

4 CONSULTATION

If there is any problem in this specification, please contact us as following:

Add: 38 Haitai South Road, Binhai Hi-Tech Industry Park, Tianjin, China

Tianjin Lishen Battery Joint-Stock Co., Ltd.

Tel No.: 0086-22-23866002

Fax No.: 0086-22-23866800

URL.:http://www.lishen.com.cn

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium-ion cell with Lishen in advance. And consult about the high rate current, rapid charge and special application in the same way.

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