Specification For Lithium-ion Cell

314Ah LFP Prismatic (Z Stacking Type) Cell

Cell Model: CBA71173204 (314Ah)

Prepared Date	Checked Date	Approved Date	Effective date

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Preface

The below standards are mandatory compliance for our company cell products.

The format of this standard conforms to GB/T 1.1-2020 Standardization Guidelines Part 1: Structure and Compilation of Standards.

Based on GB/T 31484-2015 Cycle life requirements and test methods for traction battery of electric vehicle, GB 38031-2020 Safety requirements for traction battery of electric vehicles, GB/T 31486-2015 Electrical performance requirements and test methods for traction battery of electric vehicle, GB/T 36276-2018 Standard for lithium-ion batteries for power energy storage and GB/T 34014-2017 Coding regulation for automotive traction battery, combined with the actual product and test conditions of our company, the CBA71173204-314Ah Lithium -ion Cell Product Specification is specially formulated, and the test method and judgment standard are revised and supplemented so as to guide the manufacture and acceptance of CBA71173204-314Ah cell.

This standard was proposed and drafted by our cell R&D Department.

Developed By	**Reviewed By**
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1. Scope of Application

This product specification regulates the performance requirements, test methods, inspection rules, storage and safety requirements of CBA71173204-314Ah lithium-ion cell produced by Xingdong (Hebei) Lithium Battery Technology Co., Ltd. (hereafter refer to as “XDLE”).

2. Normative Reference

Provisions in the following documents are partly quoted as part of the standard. The latest version of undated reference documents is applicable to this standard.

GB/T 2900.41-2008 Electrotechnical terminology primary and secondary cells and batteries.

GB/T 34014-2017 Coding regulation for automotive traction battery.

GB/T 31484-2015 Cycle life requirements and test methods for traction battery of electric vehicle.

GB 38031-2020 Safety requirements for traction battery of electric vehicles.

GB/T 31486-2015 Electrical performance requirements and test methods for traction battery of electric vehicle.

GB/T 36276-2018 Standard for lithium-ion batteries for power energy storage.

3. Terms and Definitions

Products: The products in this specification refer to the 314Ah 3.2V rechargeable lithium iron phosphate cells produced by XDLE.

Customer: Customer refers to the company, enterprise or individual that purchases the products mentioned in this specification.

Cell: The basic unit that allows the combined conversion of chemical energy and electric energy.

Nominal Voltage: Marking or identified an appropriate of the voltage for a cell or an electrochemical system.

Rated charging or discharging current: The charging or discharging current of the cell can work continuously for a certain period of time under the specified test conditions and methods.

Nominal capacity: The discharge capacity of standard charged cell from rated discharge current to discharge termination voltage under specified test conditions and methods.

Energy density: The ratio of the discharge energy of the cell to the weight or volume of the cell under the specified test conditions and methods.

Shell: The protective component that encapsulates the inner parts of the cell and prevents direct contact with the outside is the container of cell.

Ignition: Any part of the cell burns for longer than 1s, and sparks and arcs do not belong to combustion.

Explosion: Sudden release of sufficient energy to generate pressure waves or ejections may cause structural or physical damage to the surrounding area.

Leakage: The liquid inside the cell leaks to the outside of the shell.

Rate current: Abbreviated symbol C, 1C denotes the current of the cell charged and discharged at 1 hour rate, 2C denotes the current of the cell charged and discharged at 1/2 hour rate.

AC internal resistance: The internal resistance of the cell was measured by AC internal resistance tester with 1KHZ 50mA at room temperature.

Cycle: Means a state when a total of charge and discharge according to rules from a cell as recorded by BMS and it may consist of a summation of a few segments of partial charges and discharges.

Fresh cell: Means the state within 7 days after customer received the product (domestic only).

Model meaning:

```
C  B  A  71 173 204 – 314Ah
|  |  |  |   |   |      |
|  |  |  |   |   |      |_ _ Cell Minimum Rated Discharge Capacity
|  |  |  |   |   |_ _ _ _ _ _ Cell Height
|  |  |  |   |_ _ _ _ _ _ _ _ Cell Width
|  |  |  |_ _ _ _ _ _ _ _ _ _ Cell Thickness
|  |  |_ _ _ _ _ _ _ _ _ _ _ _ Aluminium Shell
|  |_ _ _ _ _ _ _ _ _ _ _ _ _ Lithium Iron Phosphate Battery Cell
|_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Individual Cell
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4. Basic Performance

Table 1: Basic performance

No.	Parameter	Specification	Conditions
4.1	External appearance	No breakage, scratches, bulging, stain, electrolyte leakage, etc.	N/A
4.2	Dimensions (thick*wide*high)	71mm*173mm*204mm	Refer appendix 13
4.3	Standard rated charge and discharge current	0.5C	157A
4.4	Nominal capacity	314Ah	At standard charge and discharge
4.5	Nominal voltage	3.2V	25±2°C
4.6	Weight	5.6±0.12Kg	N/A
4.7	Maximum charging voltage	3.65V	0°C≤T≤60℃

4.8	Maximum discharging voltage	2.5V	-20°C<T≤60°C
4.9	Maximum instantaneous charging current	2C	10s ≥30%SOC, 25±2°C
4.10	Maximum instantaneous discharging current	2C	10s ≤80%SOC, 25±2°C
4.11	Energy Density	≥179Wh/Kg	Gravimetric
		≥401Wh/L	Volumetric
4.12	AC internal resistance	≤0.25mΩ	New cell, measured at 28% SoC
4.13	Monthly self-discharge	≤3.5% per month	Standard charging to 45% SoC, 25±2°C storage
4.14	Rest SoC	≥5%	SoC interval without load or charging
4.15	Storage temperature	-20~35°C (within 6 months)	Storing humidity ≤85% RH, SoC: 20~50%
4.16	Cycle fading	≤5%	25±2°C, cycle test by the standard charge and discharge method under 300±30Kgf preload for 1000 cycles.
4.17	Storage fading	≤5%	25±2°C, initial clamping force 300 ±30Kgf, standard charge to 100% SOC for 6 months.

5. Electrical Performance

5.1 Test Conditions

Except as otherwise specified, the test shall be carried out in an environment of 25±2°C, 15%RH~ 90%RH and 86kPa~106kPa atmospheric pressure. The room temperature mentioned in this specification refers to 25±2°C.

5.2 Testing Instruments and Equipment Requirements

- Voltage measuring device; accuracy with ±0.5%
- Current measuring device: accuracy with ±0.5%
- Temperature measuring device: accuracy with ±0.5°C
-Dimension measuring device: accuracy with ±0.1%
-Mass measuring device: accuracy with ±0.1%

5.3 Electrical Performance Indicators and Test Methods

Table 2: Electrical performance indicators and test methods

No.	Item	Technical requirement	Test methods
5.3.1	Standard charge	/	25±2°C, the initial clamping force is 300 ± 30kgf, the cell is charged to 3.65V at 0.5C(A) constant current and 3.65V constant voltage until the current drops to 0.05C(A)
5.3.2	Absolute charging	0~60°C	No matter what charging mode the battery is in, stop charging once the cell temperature exceed absolute charging temperature range
5.3.3	Absolute charging voltage	Max 3.65V	No matter what charge mode the battery is in, stop charging once the cell voltage exceeds absolute chargingvoltage.
5.3.4	Standard discharge	/	25±2°C, the initial clamping force is 300 ± 30kgf, the cellis discharged at a constant current of 0.5C(A) to 2.0V.
5.3.5	Absolute discharge temperature	-20~60°C	Stop discharging once cell temperature is outside this range regardless of whether continuous or pulse current isadopted.
5.3.6	Nominal capacity	314Ah	25±2°C, after standard charging of the cell, put the cellaside for 30 minutes. Then the standard discharging is performed. If the discharge capacity does not reach the rated capacity, the test is allowed to be repeated five times, taking the average of the last three results.
5.3.7	High temperature discharge capacity	≥95%	a) Standard charging of the cell. b) Put aside for 5hrs at 55±2°C c) Discharge to 2.5V at 55±2°C (for current refer to 5.6.1) d) Calculate the ratio of discharge capacity to rated discharge capacity.
5.3.8	Low temperature discharge capacity	0°C ≥90% -10°C ≥80% -20°C ≥75%	a) Standard charging of the cell. b) Shelving for 24hrs at target low temperature (temperature fluctuation (±2°C). c) Discharge at 0.5C current to cut-off voltage at target lowtemperature (refer to 4.8 for discharge cut-off voltage). d) Calculate the ratio of discharge capacity to rated discharge capacity.
5.3.9	Charge retention and capacity recovery at room temp.	Capacity retention≥94% Capacity recovery≥96%	a) Cell standard charging. b) Store at room temperature for 28 days. c) The standard discharge of the cell is carried out to calculate the charge retention capacity.

			d) Standard charging of the cell and shelving for 1hr. e) Calculate the capacity recovery capability of the cell bystandard discharge.
5.3.10	Charge retention and capacity recovery at high temp.	Capacity retention≥92% Capacity recovery≥95%	a) Cell standard charging. b) Store at 55±2°C temperature for 7 days. c) The standard discharge of the cell is carried out to calculate the charge retention capacity. d) Standard charging of the cell and shelving for 1hr. e) Calculate the capacity recovery capability of the cell bystandard discharge.

5.4 Non-pulse Charging Mode

Table 3: Non-pulse charging

Cell temperature	Standard charging	Fast charging
T<0°C	Charging is not allowed	Charging is not allowed
0°C⩽T<10°C	0.2C(A) constant current charging to 3.65V	0.3C(A) constant current charging to 3.65V
10°C⩽T<15°C	0.3C(A) constant current charging to 3.65V, 3.65V constant voltage charging until the current drops to 0.05V(A)	0.5C(A) constant current charging to 3.65V, 3.65V constant voltage charging until the current drops to 0.05V(A)
15°C⩽T<45°C	0.5C(A) constant current charging to 3.65V, 3.65V constant voltage charging until the current drops to 0.05V(A)	1C(A) constant current charging to 3.65V, 3.65V constant voltage charging until the current drops to 0.05V(A)
45°C⩽T<60°C	0.2C(A) constant current charging to 3.65V	0.3C(A) constant current charging to 3.65V
T>60°C	Charging is not allowed	Charging is not allowed

5.5 Pulse Charging Mode

Table 4: Pulse charging

SoC	**Temperature**				
	T<10°C	10°C ≤T<15°C	15°C ≤T<35°C	35°C ≤T<45°C	≥45°C
≤80%	Not allowed	1.2C for 30s	2C for 30s	1.2C for 30s	Not allowed

5.6 Non-pulse Discharging Mode

Table 5: Non-pulse discharging

No.	Item	Specification	Remark
5.6.1	Standard discharge current	0.5C	-20°C≤T<60°C
5.6.2	Maximum continuous discharge current	1C	-20°C≤T<60°C
5.6.3	Permissible discharge temperature range	-20°C ~60°C	/
5.6.4	Optimum discharge temperature range	15°C~35°C	/

5.7 Pulse Discharging Mode

Table 6: Pulse discharging

SoC	**Temperature**				
	T<10°C	10°C ≤T<15°C	15°C ≤T<35°C	35°C ≤T<45°C	≥45°C
≥30%	Not allowed	1.5C for 30s	2C for 10s	1.5C for 10s	Not allowed

6. Cycle Performance

Table 7: Cycle life test

No.	Item	Specification	Remark
6.1	Cycle performance	>15,000 cycles	a) 25± 2°C temperature and initial clamping pressure 300±30Kgf, 0.3C standard charge and discharge 15,000 cycles to capacity of 70% of the initial capacity; b) At toom temperature, the cell is charged at a constant current of 0.5C(A) to 3.55V, and3.55V constant voltage charging until current drops to 0.05C(A); c) Rest at room temperature for 30 mins; d) At room temperature, the cell is discharged at a constant current of 0.5C(A) to 2.5V; e) Rest at room temperature for 30 mins; f) Repeat from steps **b) to e).**

7. Safety Performance

Table 8: Safety performance

No.	Item	Technical requirement	Test method
7.1	Overcharge	No fire, no explosion.	Charge the cell at 1C(A) constant current until the voltage reaches 1.1 times of the charging termination voltage or 115% SOC, then stop charging and observe for 1hour.
7.2	Over discharge	No fire, no explosion.	The cell was discharged with 1C(A) constant current for 90 mins, then the discharge was stopped and observed for 1 hour.
7.3	External short circuit	No fire, no explosion.	a) The cell is charged with 1C constant current to 3.65V and 3.65V constant voltage to current less than 0.05C(A); b) The positive and negative poles of the cell are short-circuited for 10mins and the external line resistance is less than 5mΩ. c) Observe 1hour.
7.4	Extrusion Pressure Test	No fire, no explosion.	a) The cell is charged with 1C constant current to 3.65V and 3.65V constant voltage to current less than 0.05C(A); b) Conduct tests under the following conditions: 1) Extrusion direction: Pressure perpendicular to the battery plates; 2) Extruded plate form: The length of the half cylinder of the radius 75mm is larger than the size of the extruded battery; 3) Extrusion speed: ≤2mm/s; 4) Extrusion level: Stop extrusion when the voltage reaches 0V or the shape variable reaches 15% or the extrusion pressure reaches 100kN or 1000 times the weight of the test object; 5) Hold for 10 mins; c) Observe 1 hour.
7.5	Temperature cycle	No fire, no explosion.	a) The cell is charged with 1C constant current to 3.65V and 3.65V constant voltage to current less than 0.05C(A); b) Put the cell into the temperature box, and adjust the temperature of the temperature box according to table below, with 5 cycles.

Temperature, °C	Time increment (mins)	Cumulative time (mins)	Temperature change rate, °C/min
25	0	0	0

			-40 / 60 / 60 / 13/12 -40 / 90 / 150 / 0 25 / 60 / 210 / 13/12 85 / 90 / 300 / 2/3 85 / 110 / 410 / 0 25 / 70 / 480 / 6/7 c). Observe 1 hour.
7.6	Heating	No fire, no explosion.	a) The cell is charged with 1C constant current to 3.65V and 3.65V constant voltage to current less than 0.05C(A); b) Put the cell into the heating test box, and raise the temperature from ambient temperature to (130±2)°C at the rate of 5°C /min, and stop heating after 30 mins; c) Observe 1 hour.

8. Product end-of-life management

8.1 This cell is designed to service with a finite life time. The customer shall develop and implement an active tracking system to monitor and record impedance of each product in its entire service life. XDLE and its customer shall come into agreement about internal resistance and capacity measurement methods, XDLE and/or its customer shall stop using any of the products when its resistance exceeds 200% of its internal resistance or it capacity fading to 60% of typical capacity (25±2) °C. Failure to comply with these requirements shall render XDLE's warranties under the Contract inapplicable, thereby releasing XDLE from any liability in connection therewith.

8.2 The cell life determination conditions can refer to paragraph 6.1 Cycle performance.

9. Application Conditions

Customer shall ensure that the following application conditions in connection with the products are strictly.

9.1 The customer shall configure a battery management system to closely monitor, manage and protect each battery. When the cell is first used, it must be fully charged and discharged for activating it and giving fully capacity.

9.2 Customer shall provide detailed information of the BMS, including but not limited to its design, features, setting and data file format to XDLE for design review and record keeping.

9.3 The customer may not modify or change the design and framework of the battery management system without the consent of XDLE to affect the performance of the battery.

9.4 Customer shall maintain complete battery operation monitoring data for reference in the division of product quality responsibility. Without complete monitoring data for the life of the battery system, XDLE is not responsible for product quality assurance.

9.5 The battery management system must meet the following basic test and control requirements:

No.	Item	Specification	Protection
9.5.1	Stop charge	3.65V	Stop charging
9.5.2	First level over-charge protection	3.7V	Stop charging
9.5.3	Second level over-charge protection	3.8V	Stop charging and lock the BMS
9.5.4	Stop discharge	2.6V (>0°C)	Stop discharging
9.5.5	First level over-discharge protection	2.5V (≥0°C)	Stop discharging
9.5.6	Second level over-discharge protection	2.0V (≥0°C)	Stop discharging and lock the BMS
9.5.7	Short circuit protection	Short circuit not allowed	Circuit disconnection
9.5.8	Over current protection	Refer to 5.4 to 5.7	Management system control current meets the specification
9.5.9	Overtemperature protection	Refer to 5.3.2 to 5.3.5	Stop operating in case of heating
9.5.10	Charging time out limit	Charging time to be completed in 8 hours	Stop charging if charging time exceeds specification

Note: The above No. 9.5.2, 9.5.3, 9.5.5, 9.5.6 are the warning clause, draw the attention of customers: When the battery reaches any of the terms described in the above, means that the battery has been used beyond the specifications, the customer shall take protective measures on the battery in accordance with the "protection action" and other relevant provisions of this specification. At the same time, the XDLE shall not take any responsibility for the damage in connection therewith.

9.6 Avoid over-discharge of the battery. If the battery voltage falls below 2.5V, there is a risk of permanent internal damage, which invalidates XDLE's warranty.

According to Clause 4.8 of this technical Agreement, when the actual discharge cut-off voltage is lower than the standard discharge cut-off voltage, the internal energy consumption of the system is reduced to a minimum and the sleep time is extended before recharging. The customer needs to train the user to recharge the battery in the shortest possible time to prevent the battery from over-discharge.

9.7 During battery storage, it is recommended to adjust SOC to about 50% every 3 months.

9.8 Batteries shall avoid charging at low temperatures prohibited by this Technical Agreement (including standard charging, fast charging and emergency charging), otherwise accidental capacity reduction may occur. Battery management system shall be controlled according to the minimum charging temperature. It is forbidden to charge under the temperature stipulated in this technical agreement. Otherwise, XDLE will not undertake the responsibility of quality assurance.

9.9 The design of the electric box must fully consider the heat dissipation problem of the cell. XDLE does not take the responsibility due to the overheating of the cell or batteries caused by the thermal design problem of the electric box.

9.10 The design of the electric box should comply with the relevant specifications (anti-fire, anti-water, anti-dust, etc.), otherwise, XDLE does not bear the quality loss for the battery damage and system risk caused by.

10. Safety Precautions

10.1 Immersing cells into water is prohibited.

10.2 Dropping cells into fire or expose them to any high temperature environment exceeding operation temperature as set out in paragraphs 5.3.2, 5.3.5 and 4.16 are forbidden, otherwise it may cause fire. At all use time, cell temperature should not exceed 60°C; if the temperature of the battery cell exceeds 60℃, the battery management system shall shut down the battery and stop the battery running.

10.3 Do not short circuit the positive and negative battery terminals. Otherwise, strong current and high temperature may cause personal injury or fire. When the battery system is assembled and connected, adequate safety protection shall be provided to avoid short circuit.

10.4 Always connect cell terminals according to its label(s) in right polarity. Reverse charging is strictly prohibited.

10.5 Do not exceed the maximum current for battery charging, and do not overcharge the battery. Multiple level of fail-safe overcharge protection should be implemented by hardware and software. See paragraph 9.5.1~9.5.6 for minimum requirement to be adopted by the BMS for protection.

10.6 Products should be securely fixed to solid platform, and power cables should be securely attached by fastener to avoid intermittent contact which may cause arcing and sparks.

10.7 Do not service cells and electrical connections within plastic package of cell. Improper electrical connection within a cell may cause overheating in service.

10.8 When the electrolyte leaks, skin and eye contact with the electrolyte should be avoided. In case of contact, a large amount of clean water should be used to clean the contact area and seek help from the doctor. It is forbidden for any person or animal to swallow any part or substance contained in the battery.

10.9 Protect cells from mechanical shock, impact and pressure. Internal electrical circuit may short circuit to generate high temperature and fire hazards.

10.10 When cells charging is terminated improperly for reasons such as exceeding allowable charging time, cut-off due to exceeding charging voltage or cut-off due to exceeding charging current, all these events are defined as "improper charge termination". Such event may indicate that there is current leaking within a cell system or some components have started to malfunction and subsequent charging of such cell system without finding and fixing root cause of problem may cause potential overheat or fire hazards. When such event occurs, the BMS should lock itself up to prevent subsequent charging and notice should be given to the user to return the vehicle to dealer for servicing. Subsequent charging should only be resumed after the system has been thoroughly checked by qualified technician who can identify and fix root cause attributed to the "improper charge termination".

10.11 Battery fire or explosion may be caused by improper operation during abuse test. The test can only be carried out in a professional laboratory by professionals equipped with appropriate protective equipment. Otherwise, it may lead to serious personal injury and property loss.

11. Disclaimer

11.1 If the customer does not use the product according to the provisions mentioned in the specification datasheet, XDLE will not undertake any responsibility for quality assurance.

11.2 XDLE reserves the right to modify the specifications and performance parameters of the cell. Before placing an order with XDLE, buyer needs to confirm the latest updated datasheet of the cell from XDLE.

12. Risk Warning

12.1 Warning Statement

BATTERY IS POTENTIALLY DANGEROUS AND PROPER PRECAUTIONS MUST BE OBSERVED IN HANDLING AND MAINTENANCE.RUNNING TESTS ON THE BATTERY IMPROPERLY MAY RESULT IN SEVERE PERSONAL BODY INJURY OR PROPERTY DAMAGES. WORK ON CELLS MUST BE PERFORMED ONLY WITH PROPER TOOLS AND PROTECTIVE EQUIPMENT MUST BE USED. BATTERY MAINTENANCE MUST BE CARRIED OUT BY PERSONNEL KNOWLEDGEABLE OF CELLS AND TRAINED IN THE SAFETY PRECAUTIONS INVOLVED. FAILURE TO OBSERVE THE ABOVE MAY CAUSE VARIOUS HAZARDS. BATTERY USE AND STORAGE REQUIRES COMPOSITE SPECIFICATION REQUIREMENTS, OTHERWISE IT WILL CAUSE IRREVERSIBLE DAMAGE TO THE BATTERY，EVEN RAISES RISKS.

12.2 Types of Hazards

Customer acknowledges the following potential hazards in connection with the usage and handling of the Products:

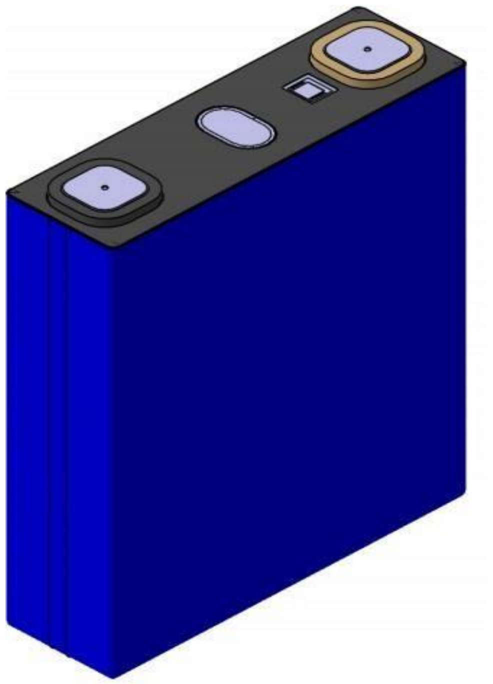
12.2.1 Working with battery can expose the handler to chemical, shock and/or arcing hazards. Although a person’s body might react to contact with direct current voltage differently than from contact with alternate current voltage, Customer shall take a conservative position and consider the risk of shock or electrocution to be the same for both alternate current and direct current exposures greater than 50V.

12.2.2 Cells expose its handler to chemical hazards associated with the electrolyte used in the cell.

12.2.3 When selecting work practices and personal protective equipment, customer and its employees should consider potential exposure to these hazards and therefore prevent accidental short-circuit that can result in electrical arcing, explosion, and/or “thermal runaway” of the cells.

13. Appendix

a. Cell Outside View Drawing



b. Cell Dimensions Drawing

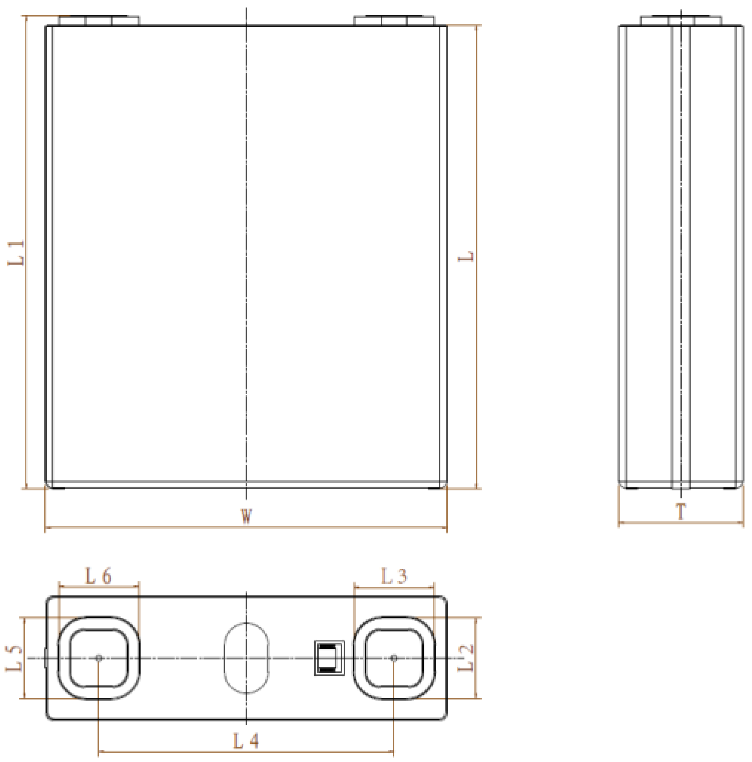


Table 9: Cell dimension

No	Name	Dimension parameters
1	T	71.4±0.8mm
2	W	173.8±0.6mm
3	L	204.96±0.95mm
4	L1	208.83±0.95mm
5	L2=L3=L5=L6	34.8±0.5mm
6	L4	128.0±0.5mm

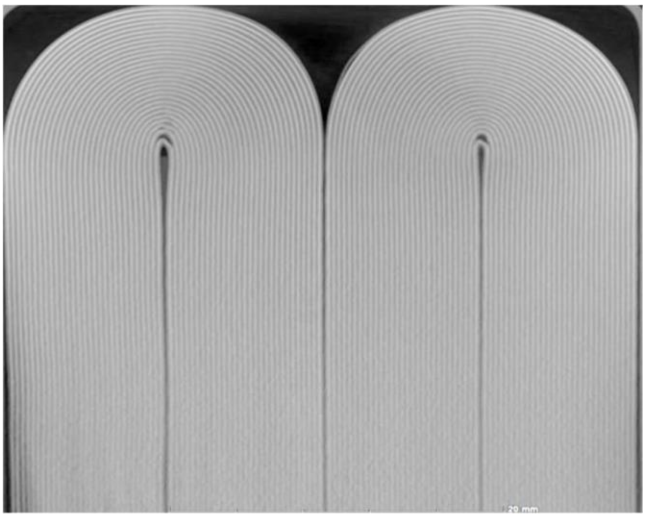
Remarks:

a) Allowable welding depth on terminal ≤2.0mm
b) 300±30Kgf pressure is applied in the thickness direction during the measurement of cell size.
c) Cell surface insulation, test pressure 300±30Kgf, AC1500V, leakage current ≤10mA.
d) Our cell has been updated with bigger terminals that allows higher current carrying capacity.

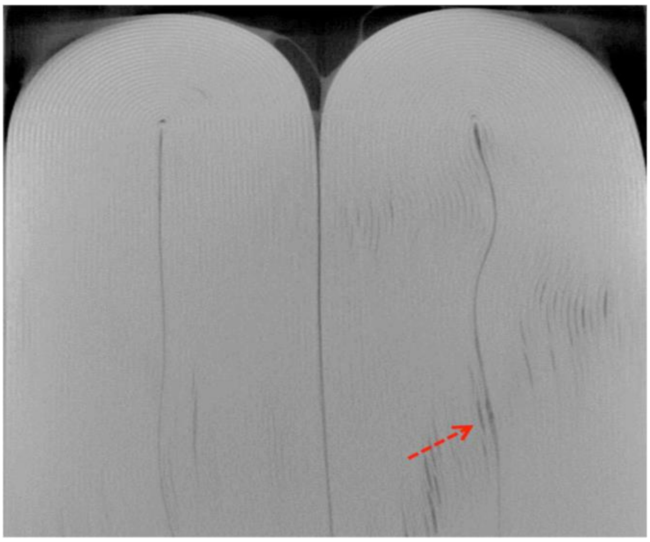
14. Advantages of Z Stacking (Laminated) Prismatic Cell

Traditionally prismatic cells have been manufactured using winding method and we are the one of the few companies who have adopted Z stacking (laminated) method for manufacturing prismatic cells. The following are the several advantages for adopting Z stacking method of cell manufacturing:

CT scans of winding method cell for new cell and after 1000 cycles:



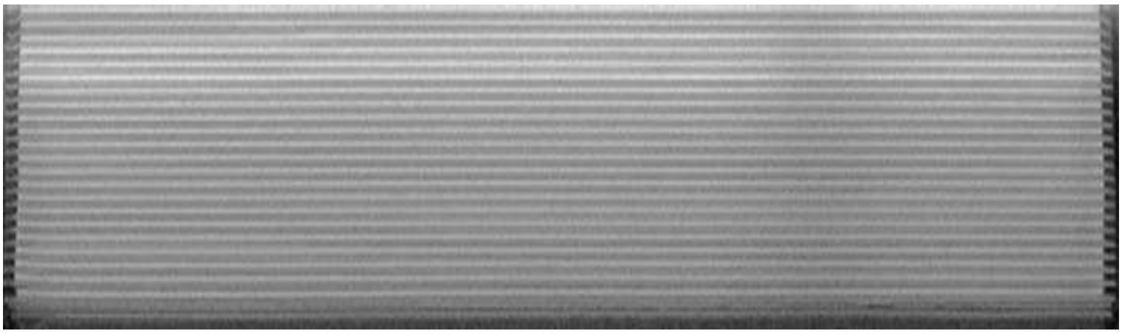
New Cell



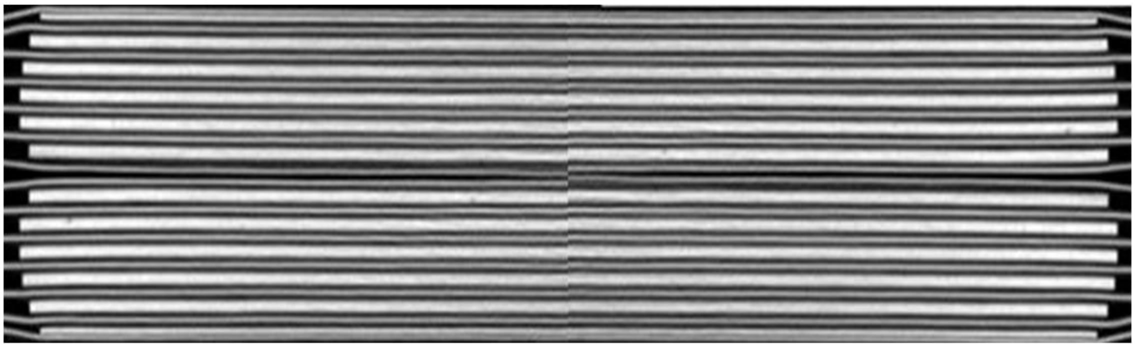
After 1000 cycles

By comparing the condition of the cell core before and after 1000 cycles, the internal stress of the winding cell is easy to change after long cycling. Bending occurs, which will lead to deformation of the winding core and affects the stability and safety of the battery cell core.

CT scans of Z stacking method cell for new cell and after 1000 cycles:



New Cell



After 1000 Cycles

Z stacked cells have alternate stacking of positive and negative electrodes between which there is a separator for insulation. There is a 1mm gap between the left and right edges of the pole piece and the folded part of the diaphragm, and the diaphragm has no tension on the sides.

The positive and negative electrodes are loose and open all around, even if the thickness of the electrode sheet changes during the cycle

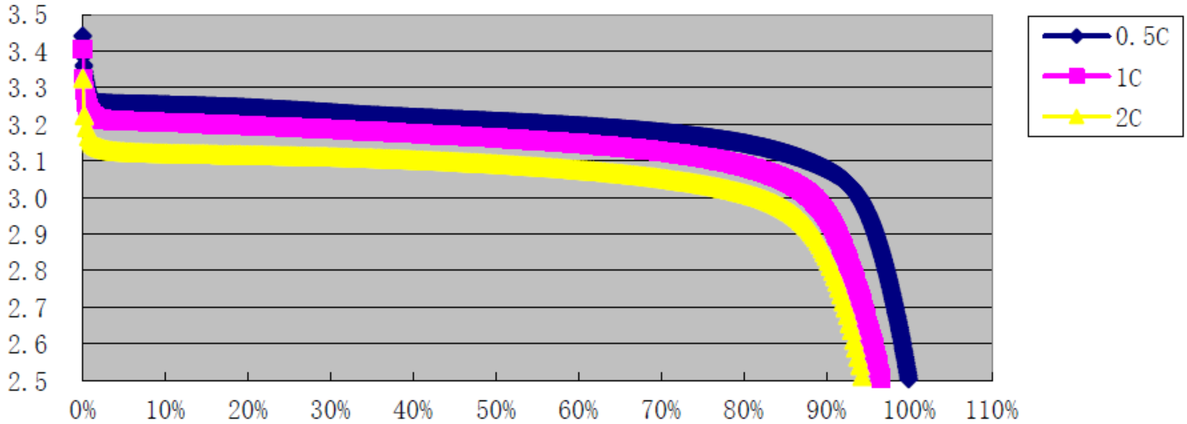
Constantly expanding, the stress generated can also be released to the surroundings at any time, and the electrodes will not break after cycling.

The internal structure of the battery cell is relatively stable, which allows for a stable end-of-life working condition for the cell until it reaches to 60%. This method of cell production also ensures ultra-long cycle life and safer cell characteristics.

The tab from each electrode of positive and negative electrodes form a stable and uniform connection with the positive and negative poles respectively. Thereby reducing the overall internal resistance of the cells and this allows for less heat generation during cell charging and discharging and leads to better cell efficiency.

Comparison of Cell Temperature Rise and Discharge Capacity for various C Rates for Winding Cell vs. Z Stacking (Laminated) Cell:

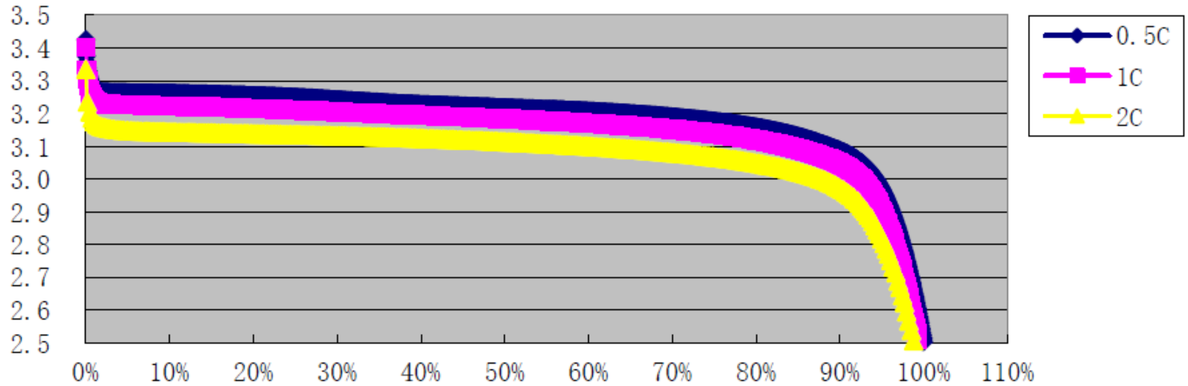
a. Winding Type Cell



Voltage vs. Discharge Capacity Curve for Winding Type Cell

C Rate of Operation	Retention Capacity	Temperature Rise
0.5C	100.00%	4.9℃
1C	96.71%	11.5℃
2C	94.47%	17.4℃

b. Z Stacking Type Cell



Voltage vs. Discharge Capacity Curve for Z Stacking Type Cell

C Rate of Operation	Retention Capacity	Temperature Rise
0.5C	100.00%	3.7℃
1C	99.40%	8.4℃
2C	98.92%	12.5℃