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Harbin Coslight New Energy Co., Ltd.

Rechargeable Lithium-ion Battery Cell

Product Specifications

Product Name	Lithium iron phosphate battery
Model	FP31136255A-100Ah
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Checked By	Shi qing mo
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Effective Date	

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Revision History

Revison	Date	Originator	Description

Contents

1. General Information

Scope

This product specification defines the requirements of the rechargeable lithium ion battery cell to be supplied to the Customer by Harbin Coslight New Energy.

Product Classification: Lithium-ion Battery Cell

Model Name: FP31136255A

2. Nominal Specification

Item	Condition / Note	Specification
2.1 Capacity	Nominal charge / discharge at 25℃	≥100Ah
2.2 Nominal Voltage	Average for nominal discharge	3.2 V
2.3 Operating Voltage Range	0%～100% SOC	2.50 ~ 3.70 V
2.4 Nominal Charge	Constant current Constant voltage End condition (Cut off)	50 A (0.5 C) 3.70 V 2 A
2.5 Charge Current (25℃)	Fast Continuous Charge current	100A (1 C)
	Max Continuous Charge Current	100A (1 C)
2.6 Nominal Discharge	Constant current End voltage(Cut off)	50A (0.5 C) 2.50 V
2.7 Discharge Current (25℃)	Max Continuous Discharge Current	300A （3C）
2.8 Weight	/	2.18±0.04 kg
2.9 Operating Temperature &Humidity	Charge	5 ~ 45℃，≤85%RH
	Discharge	-20～60 ℃，≤85%RH
2.10 Storage Temperature	≤1M	-20 ~ 60℃，50%SOC
	≤3M	-20 ~ 45℃，50%SOC
	≤12M	-20 ~ 25℃，50% SOC After every tree months, 100% DOD is needed before recharged to 50% SOC

1）It can be adjusted upon discussion with Harbin Coslight New Energy because battery life span can be differentiated by user patterns and environment.

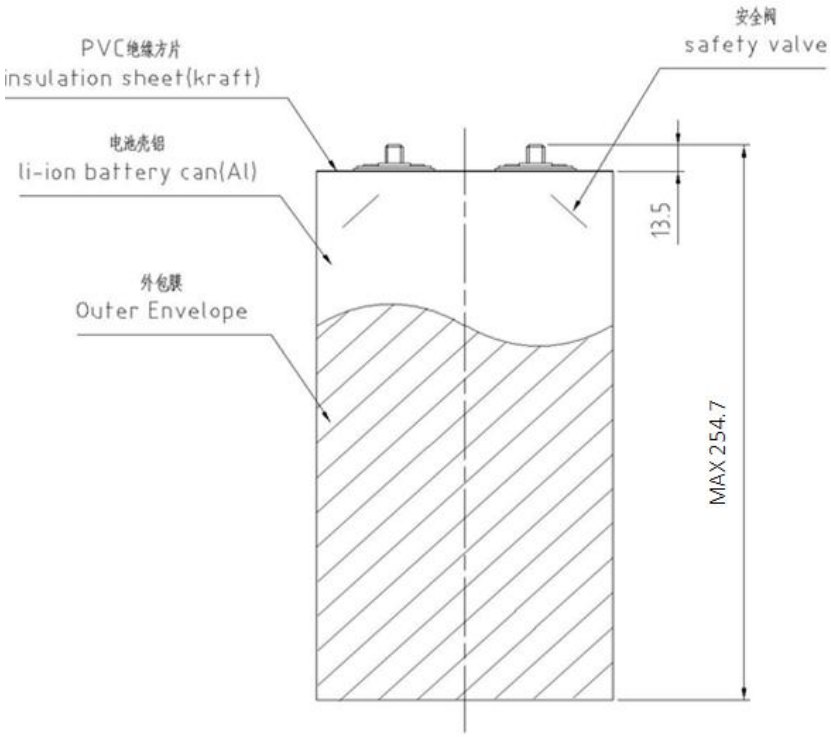
3. Appearance and Dimension

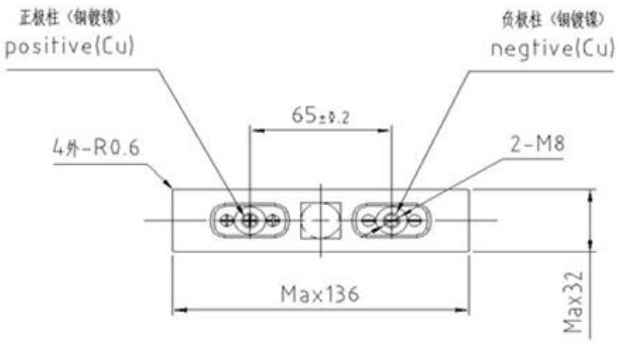
Appearance

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

Dimension

Overall Dimensions(mm)	Thickness*Width*Height	32*136*241.2
	Cell height with terminals	254.7
	Distance between terminals	57±0.5；Symmetry
	Center distance of the terminals	65±0.5
	Terminal position	Symmetry
	Terminal Length*Width*Height	（Φ8±0.05）*（9.5±1）
	Flatness of terminals	<0.25
	Length * width of OPSD	Φ11±0.05





4. Performance Specification

4.1 Standard test condition

4.1.1 Nominal Charge

Unless otherwise specified, “Nominal Charge” shall consist of charging at constant current of 50A to 3.70V. The cell shall then be charged at constant voltage of 3.70V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 2A. For test purposes, charging shall be performed at25 ± 2ºC.

4.1.2 Nominal Discharge

“Nominal Discharge” shall consist of discharging at constant current of 50A to 2.5V. Discharging is to be performed at 25 ± 2 ºC unless otherwise noted (such as capacity versus temperature).

4.1.3 Fast Charge Condition

Cells shall be charged at constant current of 100A to 3.70V. The cell shall then be charged at constant voltage of 3.70V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 2A. For test purposes, charging shall be performed at 25 ± 2ºC.

4.2 Electrical and Environmental Specification

Item	Condition	Specification
4.2.1 Initial AC Impedance	50% SOC cells shall be measured at least 1KHz by internal resistance device	≤1.0 mΩ
4.2.2 Initial Capacity	Cells shall be full charged per 4.1.1 and discharged per 4.1.2within 10min after full charge at 25±2℃.Record discharge capacity. Repeat 3 times. When the range of three consecutive test is less than 3% of Nominal capacity, finish test. Take average of the last 3 times as result.	≥100.0 Ah，
4.2.3 Open circuit voltage	Voltmeter， 50% SOC， 25 ± 2℃.	3.30V±0. 10V
4.2.4 Cycle Life	Cells shall be full charged by 0.5C and discharged per 4.1.2 3000 cycles at 25 ºC. A cycle is defined as one charge and one discharge.	≥ 80 % vs.Initiation Capacity

<table>
<tr><td rowspan="3">4.2.5
Discharge
Temperature
Performance</td><td colspan="2">Cells Shall be full charged per 4.1.1 and discharged per 4.1.2 at following temperature. Record discharge capacity.</td><td>Appearance: no obvious deformation, no rupture, no leakage</td></tr>
<tr><td>Charge</td><td>Discharge</td><td>Capacity (vs. Initial Capacity)</td></tr>
<tr><td>25± 2ºC</td><td>- 20ºC（2.0V cut off）
25ºC
55ºC</td><td>70%
100%
95%</td></tr>
<tr><td rowspan="3">4.2.6
Discharge Ratio
Performance at
25± 2ºC</td><td colspan="2">Cells Shall be full charged per 4.1.1 and discharged according to following discharge current，2.5V cut off. Record discharge capacity.</td><td>Appearance: no obvious deformation, no rupture, no leakage</td></tr>
<tr><td>Charge</td><td>Discharge</td><td>Capacity (vs. Initial Capacity)</td></tr>
<tr><td>0.5C</td><td>0.5C
3C</td><td>100%
95%</td></tr>
<tr><td>4.2.7
Electricity holding capacity</td><td colspan="2">After full charge per 4.1.1, stay in 25±2℃ constant temperature cabinet for 28 days, standard discharge per 4.1.2. Record discharge capacity. Then full charge per 4.1.1 and discharge per 4.1.2, repeat for 3 times. Record the 3 rd discharge capacity as recovery capacity.</td><td>Remaining capacity ≥ rated capacity * 90 %
Recovery capacity ≥ rated capacity * 95%</td></tr>
</table>

4.3 Safety Test Performance

Item	Specification	Test Condition
4.3.1 Over charge performance	No explosion, no fire	After measuring the initial state of the battery, after the battery is charged, the battery is charged with a constant current of 1 CA current to the voltage that reaches 1.5 times the charging termination voltage specified in the enterprise technical conditions or the charging time reaches 1 hour and stops charging. Observe 1 hour and record the failure mode. And the failure time.
4.3.2 Over discharge performance	No explosion, no fire	Measure the initial state of the battery. After the battery is charged, discharge 90 min with 1 CA constant current for 1 hour.
4.3.3 Short circuit performance	No explosion, no fire	After the battery is recharged, the test state of the battery is measured, and then the positive and negative poles are short connected with a wire with a resistance of 5mΩ, and 10min is observed to record the failure mode and the failure time.

4.3.4 Overheat performance	The battery shall not fire or explode within 10 min at a temperature of 130 ± 2 °C	After the battery is charged, the test state of the battery is measured, the battery is placed in a drum oven, and the rate of(5 ± 2) °C / min is heated from room temperature to(130 ± 2) °C, and at this temperature, the temperature is constant. 10 min, Record failure mode and time of failure.
4.3.5 Extrusion performance	No explosion, no fire	After the battery is charged, the test state of the battery is measured, that is, the appearance, open-circuit voltage, AC resistance, and thickness before the extrusion test. The maximum plane of the battery is placed parallel to the extrusion table. 1. Squeeze direction: perpendicular to the direction of the battery plate. Pressure. 2. Extrusion head area: not less than 20cm^2; 3.Extrusion degree: Until the battery shell breaks or the internal short circuit(the battery voltage becomes 0V), immediately release the pressure, observe for 1 hour, record the failure mode and the failure time.

4.4 Reliability Characteristics

Item	Specification	Test Condition
4.4.1 Storage performance at 55 °C	Remaining capacity ≥ nominal capacity * 80 % Appearance: no obvious deformation, no leakage, no smoke, no explosion.	Measurement of initial battery capacity; Standard charging into 50 % charged state energy, that is, the initial state before storage; Open circuit holds for 7 days at 55 °C ± 2 °C to measure the process state of the battery, that is, the appearance after storage, open circuit voltage, AC resistance, thickness and weight; Then open the road at room temperature and shelve 2H. The standard discharge to the end voltage measures the remaining capacity of the battery.
4.4.2 Vibration performance	Remaining capacity ≥ nominal capacity * 95 %, Appearance: There should be no obvious damage, no leakage, no deformation, no smoke, no explosion.	Measurement of initial battery capacity; After standard charging, the test state of the battery is measured, that is, the initial state at the beginning of the test; Within 1 hour, the battery is fixed on the vibration table and subjected to vibration tests. The battery is subjected to a frequency of 10 to 55 Hz, an amplitude of 1.6 mm, and a sweep frequency vibration with a sweep rate of 1 oct/min. The frequency is swept in X, Y, and Z directions. 10 times; After the frequency sweep is over, the final state of the battery is measured, that is, the final appearance, open circuit voltage, AC internal resistance, thickness and weight; Standard discharge to termination voltage, measure battery residual capacity and final state.

Remarks: Definition and determination of some terms in the above criteria.

(1) Initial state: including battery initial appearance, open circuit voltage, AC internal resistance, thickness and weight.

(2) Final state: including the final appearance of the battery, open circuit voltage, AC internal resistance, thickness and weight.

(3) Surplus capacity: the first discharge capacity of the battery after a specific detection procedure.

(4) Recovery capacity: After the battery has undergone a specific detection procedure, the discharge capacity after the state is restored through repeated charging and discharge.

(5) Standard cycle: After the battery is charged, it is stationary for 10 minutes. At an ambient temperature of 25 ± 2 °C, the standard discharge is to terminate the voltage.

(6) Deformation: Change in battery size by more than 10 %

(7) Leakage: Leakage of electrolytes, gases or other substances from the battery, if there is no obvious indication, can be determined by the loss of weight of the battery: When the weight of the battery less than 1g is lost by more than 0.5 %, Leakage is determined by loss of more than 0.2 % for batteries weighing more than 1g but less than 5g and 0.1 % for batteries weighing more than 5g.

(8) Pressure discharge: The battery is subjected to internal pressure to cause the safety device to move out of the exhaust or liquid, and the outer part of the shell other than the safety device remains intact.

(9) Fire: Fire and flame appear on the surface of the battery.

(10) Explosion: Instantly ejected solid material from the inside of the battery, the shell is incomplete.

Circulation of charge and discharge currents not specified in the standard is performed in accordance with the standard cycle.

5.Certification

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6.Cautions and Prohibitions in Handling

Warning for using the rechargeable lithium-ion battery cell - Mishandling of the battery may cause heat, fire and deterioration in performance. Be sure to observe the following.

■ Cautions for Use and Handling

- Before using devices equipped with the battery, refer to the user's manual.
- Battery cells must be charged and discharged at operating temperature range.
- Battery cells must be charged and discharged below max. electric current of each operating temperature range.
- Positive (+) and negative (-) direction must be checked before battery pack assembly.
- When a lead plate or wire is connected to the cell for battery pack assembly, check insulation not to make short-circuits.
- Battery cells must be stored separately.
- Battery cells must be stored in a cool, dry place for long-term storage.
- Do not place the battery in direct sunlight or heat.
- Do not use battery cells in high static electricity environment where the protection device can be damaged.
- When rust or odor is detected before initial use, please return the product to the seller immediately.
- Battery cells must be kept away from children or pets
- When cell life span shortens after long usage, please replace with new cell.
- Do insulate between the metal plate and cell or other components not to make an electrical short.
- Battery cells should be handled by and used in Pack / System manufacturing companies only.
- Battery cells should be sold only to Battery Pack Maker(s) or System Integrator(s).
- The cells should not be handled by or sold to individual consumers.
- Be sure to request and confirm the most recent product specifications in advance.

■ Prohibitions

- Do not charge with constant current higher than maximum charge current.
- Do not attempt to disassemble or alter battery cells.
- Do not throw or subject the battery to severe impacts.
- Do not puncture or otherwise damage a battery with sharp objects (e.g. nail, knife, pencil, drill)
- Do not use with other batteries or cells.
- Do not directly solder on battery.
- Do not press the battery with overload in manufacturing process, especially while undergoing ultrasonic welding.
- Do not use old and new cells together for battery pack assembly.
- Do not expose the battery to high heat.
  (such as a fire).
- Do not microwave or put batteries under high pressure.
- Do not use the battery in reverse.
- Do not connect positive(+) and negative(-) terminals with conductive materials (such as metal, wire, etc.)
- Do not immerge or wet batteries with water or sea-water.
- Do not give immoderate heat and force to cell during a welding process of metal plates on it.
- Do not bend or apply excessive force to the welded part of terminals.

■ Cautions for the battery and the pack

- Pack shall meet under condition to maintain battery safety and last long performance of the rechargeable lithium-ion cells.

◆ Installing the battery into the pack

- Battery cells should be inspected visually before battery pack assembly
- Damaged cell should not be used.
- Different types of cells, or same types but different cell maker's should not be used together.

◆ Design of battery pack

- The battery pack must be designed to prevent external short circuit.
- The design of battery pack and its structure should be reviewed physically, mechanically and electrically not to cause cell imbalance.
- The battery pack for multiple cells should be designed to monitor the voltage.

◆ Charge

- Charging should be operating under maximum charge voltage and current which is specified in product specification.
- The battery should be charged under operating temperature specified in product specification. (Refer to 2.9)

◆ Discharge

- Discharging should be operating under maximum discharge voltage and current which is specified in product specification.
- Discharging should be done by cut off voltage which is specified in product specification. (Refer to 2.6)
- The battery should be discharged under operating temperature specified in product specification. (Refer to 2.9)

◆ Protection Circuit

- The protection circuit should be installed in the battery pack.
- Battery pack should have voltage sensing system to control over charge or discharge.
- Battery pack should have warning system for over temperature, over voltage and over current

When battery packs for any applications are assembled with cells, following functions must be designed into the battery packs.

The detailed levels, values, conditions for each following functions should be referring to the contents

specified in this Product Specification. If one or more than one function is/are to be omitted, the Packer Company (and/or System Integration Company) must be informing to Harbin Coslight New Energy or to Harbin Coslight New Energy's Marketing Department. Without informing to Harbin Coslight New Energy, Harbin Coslight New Energy will not be liable for any field quality issues happened due to exclusion of following functions.

(1) Over voltage protection circuit
(2) Under voltage protection circuit
(3) Over Charge current protection circuit
(4) Over Discharge current protection circuit
(5) Short circuit protection
(6) Over Temperature protection circuit
(7) 2nd over voltage protection
(8) Cell imbalance protection circuit (only for battery packs assembled with more than one cell)
(9) Cell Voltage balancing function (only for battery packs assembled with more than one cell)

7. Exclusion of Liability

The warranty shall not cover defects caused by normal wear and tear, inadequate maintenance, handling, storage, faulty repair, modification to the battery or pack by a third party other than Harbin Coslight New Energy or Harbin Coslight New Energy's agent approved by Harbin Coslight New Energy, failure to observe the product specification provided herein or improper use of installation, including but not limited to, the following:

- Damage during transport or storage
- Incorrect installation of battery into pack or maintenance
- Use of battery cell or battery pack in inappropriate environment
- Improper, or incorrect charge / discharge, or protection of circuits other than stipulated herein
- Incorrect use or inappropriate use
- Insufficient ventilation
- Ignoring applicable safety warnings and instructions
- Any attempt to alter or repair by unauthorized personnel
- In case of force majeure (Ex. Lightening, Storm, Flood, Fire, Earthquake, etc.)

There are no warranties – implied or express – other than those stipulated herein. Harbin Coslight New Energy shall not be liable for any consequential or indirect damages arising out of or in connection with the product specification, battery or pack