Model	LF154	Specification code	RD-EVE LF154-S13-LF	Edition	A

Product Delivery Specification

Square Aluminum-Coated Lithium-Ion Battery

Model: LF154

Authorized strength	Product Design Review	Quality audit	Marketing audit	Ratify
Li Tingting	Cheng Cheng	Li Jiaqi	Wang Yu	Yuan Dingding

Customer Inbox
Corporate name：
Ratify：
Date：

September 2021

Hubei Yiwai Power Co., Ltd.

Model	LF154	Specification code	RD-EVE LF154-S13-LF	Edition	A

Customer requirements

Customers are required to submit their requirement specifications and communicate with EVE Power in advance. If customers have specific applications or operational conditions differing from those described in this document, EVE Power may customize product design and production according to their particular requirements.

Order number	Special requirements	Standard
1		
2		
3		
4		
5		

customer code： _____ sign： _____ date： _____

Model	LF154	Specification code	RD-EVE LF154-S13-LF	Edition	A

Change Resume

Edition	Date	Change content	Confirm
A	2021/9/27	New release version	Li Tingting

Model	LF154	Specification code	RD-EVE LF154-S13-LF	Edition	A

Catalogue

Model	LF154	Specification code	RD-EVE LF154-S13-LF	Edition	A

Terminology Definition

Product: The term "product" in this specification refers to the 154Ah rechargeable square aluminum shell lithium ion battery produced by Hubei Eve Energy Co., LTD.

Customer:refers to the buyer in the Product Sales Contract of Hubei Eve Power Co., LTD.

Ambient temperature: The ambient temperature of the battery.

Battery temperature: The temperature of the battery measured by a temperature sensor connected to the battery.

Rate: The ratio of charge/discharge current to the rated capacity of the battery, denoted by the letter C. For example, if the battery capacity is 154Ah and the charge/discharge current is 51.3A, the charge/discharge rate is 1/3C.

State of Charge: The ratio of the battery capacity state measured in ampere-hours or watt-hours under no-load conditions to the rated capacity, abbreviated as SOC. For example, if a capacity of 154Ah is considered as 100% SOC, then when the capacity is 0Ah, the SOC is 0%.

Cycle: A battery cycle refers to a complete charge-discharge process following specified standards. Each cycle combines short-duration normal charging or regenerative charging with discharging phases, where the charging phase may sometimes involve only normal charging without regenerative charging. Discharge events can be formed through combinations of partial discharges.

Standard charging: The charging mode described in Section 3.5 of this specification.

Standard discharge: The discharge mode described in Section 3.6 of this specification.

Open-circuit voltage: The voltage of the battery measured when no load or circuit is connected, abbreviated as OCV.

DC resistance: The ratio of voltage variation to corresponding current variation of the battery under working conditions, abbreviated as DCR, with testing methods as described in Section 3.8.3.8 of this specification.

Module: An intermediate product of battery and pack formed by combining lithium-ion batteries in series and parallel and adding a single battery monitoring and management device.

Pulse current:A current or voltage pulse that appears periodically is called a pulse current. The pulse current may appear in the same direction or alternate directions between positive and negative.

Compression force: The safe boundary of compression force that the battery can withstand during module assembly.

Measurement unit: See table below

Order number	Unit	Write a Chinese character in simplified form	Unit type
1	Volt （Volt）	V	Voltage unit
2	Ampere	A	Unit of current
3	Ampere-hour (Ampere-Hour)	Ah	Volume unit
4	Watt-hour	Wh	Energy unit
5	Ohm （Ohm）	Ω	Unit of resistance
6	Milliohm	mΩ	Unit of resistance
7	Degrees Celsius	℃	Degree-day
8	Millimeter	mm	Linear measure
9	Second	s	Hourly basis
10	Hertz	Hz	Frequency unit

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1. Essential Information

1.1. Scope of Application

This product specification applies to the square aluminum-shell lithium-ion batteries manufactured by Hubei EVE Energy Co., Ltd.

1.2. Product Type: Square Aluminum-Cased Lithium-Ion Battery

1.3. Product Name: LF154

2. Battery Specifications

2.1. Basic Battery Parameters

Project		Standard	Remarks
Minimum capacity		154.0Ah	1/3C，25℃±2℃，2.50-3.65V
Least energy		496.0Wh	1/3C，25℃±2℃，2.50-3.65V
Initial internal resistance		≤0.5mΩ	AC，1kHz，40%SOC
Nominal voltage		3.22V	1/3C，2.50-3.65V
Battery weight		2755±30g	
Charging limit voltage (U_{max})		3.65V	
Discharge cutoff voltage (U_{min})		2.50V(>0℃)， 2.00V（-30℃≤T≤0℃)，	
Fast charging time		40min	25℃±2℃，10-80%SOC
Cycling performance	25°C fast charging cycle	2000 times	Fast charging / 1C,2.50-3.65V,300±20kgf clamp cycles, capacity retention rate ≥80%
	45°C fast charging cycle	1500 times	Fast charging / 1C,2.50-3.65V,300±20kgf clamp cycles, capacity retention rate ≥80%
Working temperature	Charging temperature	-20~55℃	
	Discharge temperature	-30~55℃	
Storage temperature	3 month	0~45℃	Ship SOC status
	1 month	-20~45℃	
Aluminum-Ba We-lding Parameters	Laser welding penetration depth	≤2.5mm	
	The pole axis bears the maximum pressure	900N	The pole shaft bears the maximum vertical force without undergoing deformation.
	Pole shaft bears maximum torque	6N·m	The pole shaft bears the maximum torsional load without loosening.
	Pole shaft withstands maximum temperature	130℃	The pole shaft bears the maximum temperature, and the plastic pad does not deform.

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2.2. size of product

2.2.1. Size and Weight Specifications

Order number	Project		Standard	Testing Methodology Chapter
1	Size	Width (L) (including pole post)	346.4±0.5mm	3.8.1
		Width (l)	341.0±0.5mm	
		Altitude (H)	110.0±0.3mm	
		Thickness (T)	33.7±0.2 mm (thickness at 40% SOC, under 300 kgf pressure)	
2	Weight	Weight (including blue film and top patch)	2755±30g	3.8.2

2.2.2. Electrical performance indicators

Order number	Project		Standard	Testing Methodology Chapter
1	Capacity	1/3C capacity	≥154.0Ah	3.8.3.1
		1C capacity	≥152.0Ah	3.8.3.2
2	Energy	1/3C energy	≥496.0Wh	3.8.3.1
		1C energy	≥486.0Wh	3.8.3.2
3	Discharge performance	-20°C capacity retention rate	≥70%	3.8.3.3
		0°C capacity retention rate	≥85%	3.8.3.4
		25°C capacity retention rate	100%	/
		55℃ capacity retention rate	≥95%	3.8.3.5
4	DCR	25℃，50%SOC，1C，10sec	≤1.5mΩ	3.8.3.8
5	Recurrence	25°C fast charging cycle	2000 cycles, capacity retention rate ≥80%	3.8.3.9
		45°C fast charging cycle	1500 cycles, capacity retention rate ≥80%	3.8.3.10
6	Charge retention and capacity recovery	25°C, 28 days	Volume retention rate ≥96%	3.8.3.11
			Capacity recovery rate ≥98%	
		45°C, 28 days	Volume retention rate ≥93%	3.8.3.12
			Capacity recovery rate ≥97%	

2.2.3. Safety performance indicators

1	Overdischarge	Non-flammable and non-explosive	3.8.4.1
2	Over-charging	Non-flammable and non-explosive	3.8.4.2
3	External short circuit	Non-flammable and non-explosive	3.8.4.3
4	Heat	Non-flammable and non-explosive	3.8.4.4
5	Temperature cycle	Non-flammable and non-explosive	3.8.4.5
6	Crimp	Non-flammable and non-explosive	3.8.4.6

2.3. Battery drawing

See Figure 5.

2.4. surface

The battery should not have obvious scratches, cracks, rust stains, discoloration, or electrolyte leakage, which may affect its commercial value.

3. Condition of Experiment

3.1. ambient condition

Unless otherwise specified, the test shall be conducted in an environment with a temperature of 25°C ±2° C, relative humidity below 10% to 90% RH, and atmospheric pressure ranging from 86 kPa to 106 kPa. The room temperature mentioned in this specification refers to 25°C ±2°C.

3.2. measuring equipment

The accuracy of measuring instruments and meters shall meet the following requirements:

(1) Voltage measurement device: ±0.1%;

(2) Current measurement device: ±0.1%;

(3) Temperature measurement device: ±0.5℃;

(4) Dimension measurement device: ±0.01 mm;

(5) The weight measurement device is ±0.1g.

3.3. Test fixture preparation

The monomer battery must be secured with a clamp plate (aluminum alloy, 12mm thick) that fully covers the battery surface. Six M6 bolts are used to fasten the clamp plates together, and all surfaces must be wrapped with an insulating film (minimum 0.1mm thick). The fixture assembly is shown in the figure below.

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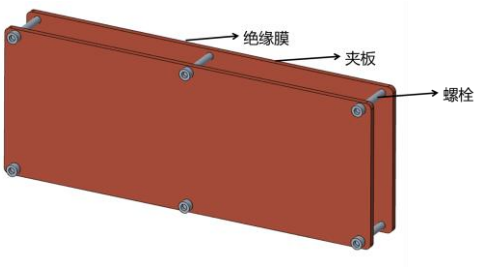

Figure 1 Schematic Diagram of Battery Clamp

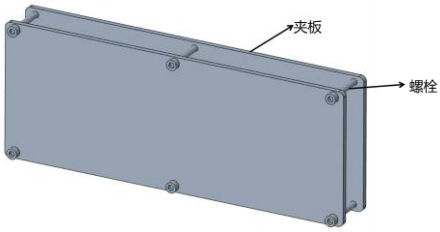

Figure 2 Insulation Film Wrapping for Battery Fixture Pack

3.4. Installation of Test Fixture

Place the battery (approximately 40% SOC) coated with a blue film (material: PET, thickness 0.11mm) and a top patch (material: PC, thickness 0.3mm) into the center of the fixture, securing each bolt with a torque of 0.35N·m.

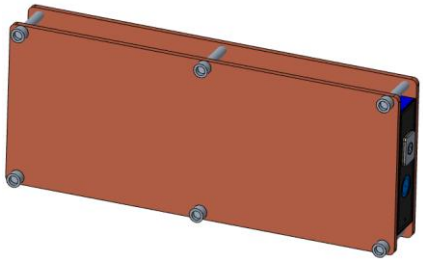

Figure 3 Front View of the Battery

Figure 4 Axial Projection Diagram of the Battery

3.5. Standard Charging Method

Standard charging is performed under ambient temperature conditions of 25°C ±2°C, where the battery is charged at a constant current of 51.3 A until reaching 3.65 V, followed by constant voltage charging at 3.65 V until the charging current is less than or equal to 7.7 A. The battery is then left to rest for 30 minutes.

3.6. Standard Discharge Method

Standard discharge was performed under ambient temperature conditions of 25°C ±2°C, with the battery discharging at a constant current of 51.3 A until the voltage reached the cutoff value of 2.50 V. The battery was then left to stand for 30 minutes.

3.7. Capacity Calibration and Energy Calibration

Capacity calibration is performed under ambient temperature conditions of 25°C ±2°C. The battery is charged according to Standard 3.5 charging method, followed by discharge according to Standard 3.6 discharge method. After resting for 30 minutes, the standard charging and discharge procedures are repeated three times. The average discharge capacity obtained from these three cycles represents the 1/3C discharge capacity, with the recorded discharge capacity designated as calibration capacity C_0. The average discharge energy calculated from these three cycles constitutes the 1/3C discharge energy, recorded as calibration energy E_0.

3.8. Test Method

3.8.1. Size

Testing equipment: Caliper (width/height); Flat plate thickness gauge (thickness*)

experimental method：

a) Measure the battery width and height using a caliper;

b) The thickness of shipped batteries was measured using a flat plate thickness gauge under the following conditions: 300 kgf pressure maintained for 1 second.

*The battery thickness increases with both SOC and usage time. This measurement refers to the battery's thickness at shipment (with a SOC of approximately 40%).

3.8.2. Weight

Test equipment: Electronic balance; Test method: Measure the weight of the battery using an electronic balance.

3.8.3. Electrical Properties

3.8.3.1. 1/3C discharge capacity and energy

Under ambient temperature conditions of 25℃±2℃, the battery was fully charged according to the standard charging method (3.5), then discharged at a constant current of 51.3A to 2.50V for 30 minutes, with the discharge capacity and energy recorded. The above charging and discharging process was repeated three times. The average discharge capacity of the three cycles represents the 1/3C discharge capacity C_0, while the average discharge energy of the three cycles represents the 1/3C discharge energy/E_0.

3.8.3.2. 1C discharge capacity and energy

Under ambient temperature conditions of 25℃±2℃, the battery was fully charged using standard charging methods (3.5), followed by constant-current discharge at 154A to 2.50V. After a 30-minute rest period, the discharge capacity and energy were recorded. The above charging-discharge cycles were repeated three times. The average discharge capacity across three cycles represents the 1C discharge capacity C_1, while the average discharge energy across three cycles corresponds to the 1C discharge energy/E_1.

3.8.3.3. -20°C capacity retention rate

Under ambient temperature conditions of 25℃±2℃, the battery was installed in the test fixture according to Method 3.4, followed by capacity calibration (3.7 Capacity Calibration and Energy Calibration). Under the same ambient temperature conditions, the battery was fully charged using the standard charging method (3.5), then rested at-20℃±2℃ for 6 hours. Subsequently, constant-current discharge was performed at 51.3A to 2.00V under-20℃±2℃ conditions. The discharge capacity C_3, discharge energy E_3, C_3/C_0, and the ratio of C3/C0 were recorded. The C3/C0 value represents the capacity retention rate at-20℃, while the E3/E0 ratio indicates the discharge energy ratio at-20℃.

3.8.3.4. 0°C capacity retention rate

Under ambient temperature conditions of 25℃±2℃, install the battery with the test fixture as specified in Section 3.4, followed by capacity calibration (3.7 Capacity Calibration and Energy Calibration). Under the same ambient temperature conditions, fully charge the battery using the standard charging method (3.5), then store it at 0℃±2℃ for 6 hours. Discharge the battery at a constant current of 51.3A to 2.00V under 0℃±2℃ conditions. Record the discharge capacity C_5, discharge energy E_5, C_5/C_0 as the 0℃ capacity retention rate, while E_5/E_0 represents the 0℃ discharge energy ratio.

3.8.3.5. 55℃ capacity retention rate

Under ambient temperature conditions of 25℃±2℃, the battery was installed with test fixtures according to Method 3.4, followed by capacity calibration (3.7 Capacity Calibration and Energy Calibration). Under the same ambient temperature conditions, the battery was fully charged using standard charging procedures (3.5), then rested at 55℃±2℃ for 3 hours. Under these conditions, constant-current discharge was performed at 51.3A to 2.50V, with discharge capacity C_7 and discharge energy E_7, C_7/C_0 recorded. The ratio of C7/C0 was calculated as the 55℃ capacity retention rate, while the ratio of E7/E0 represented the 55℃ discharge energy ratio.

3.8.3.6. internal resistance

a) The shipment-ready batteries were tested at an ambient temperature of 25℃±2℃ using an AC frequency of 1kHz.

b) Under ambient temperature conditions of 25℃±2℃, perform battery capacity calibration (3.7 Capacity Calibration and Energy Calibration), then charge according to the standard charging method (3.5). Subsequently, adjust the SOC to 50% through constant current discharge at $0.1C_0$ current, hold for 60 minutes, and record the terminal voltage at the end of holding V_1. Then perform constant current discharge at 154.0A for 10 seconds, record the terminal voltage at the end of discharge V_2, and calculate the DCR as follows: DCR = $(V_1-V_2) \times 1000/154.0$ mΩ.

3.8.3.7. 25°C fast charging cycle

The upper fixture is installed at 40% SOC at room temperature, and the test fixture is installed according to the method in 3.4.

Pre-cycle capacity test: At an ambient temperature of 25℃±2℃, discharge the battery at a constant current of 51.3A to 2.50 V, leave it for 10 minutes, then charge it fully according to the standard charging method (3.5), followed by discharging it according to the standard discharge method (3.6), and record the discharge capacity C_0.

Cyclic test: ambient temperature 25℃±2℃;

a. Charge the battery using the fast charging process (FCH) and leave it for 30 minutes.

b. Perform constant current discharge at 154 A to 2.50 V and hold for 30 minutes.

c. Repeat cycles a) -b) 3000 times.

Cycling capacity test: The battery is discharged at a constant current of 51.3A to 2.50V at an ambient temperature of 25℃±2℃, and then left for 30min. Then, it is fully charged according to the standard charging method (3.5), and then discharged according to the standard discharge method (3.6). The discharge capacity C_6 is recorded, and the capacity retention rate is calculated as $C_6/C_0 \times 100\%$.

3.8.3.8. 45°C fast charging cycle

Pre-test upper fixture: Install the test fixture at room temperature with 40% SOC, then proceed according to method 3.4.

Pre-cycle capacity test: At an ambient temperature of 25℃±2℃, discharge the battery at a constant current of 51.3A to 2.50 V, hold for 30 minutes, then charge it fully according to the standard charging method (3.5), followed by discharging according to the standard discharge method (3.6), and record the discharge capacity C_0.

Cyclic testing: Ambient temperature 45°C ±2°C;

a. Charge the battery using the fast charging process (FCH) and leave it for 30 minutes.

b. The current was 154A and the discharge was constant to 2.50V, and then the current was stopped for 30min.

c. Repeat cycles a) -b) 1500 times.

Cycling capacity test: At an ambient temperature of 25℃±2℃, discharge the battery at a constant current of 51.3A to 2.5V, leave it for 10 minutes, then charge it fully according to the standard charging method (3.5), followed by discharging it according to the standard discharge method (3.6). Record the discharge capacity C_7, and the capacity retention rate is calculated as $C_7/C_0 \times 100\%$.

3.8.3.9. Charge retention and capacity recovery at 25℃

Under ambient temperature conditions of 25℃±2℃, install the test fixture according to method 3.4, then perform capacity calibration (3.7 Capacity Calibration and Energy Calibration) on the battery. Charge the battery using the standard charging method (3.5), then store it at 25℃±2℃ for 28 days. Subsequently, discharge the battery under ambient temperature conditions of 25℃±2℃ using the standard discharge method (3.6) (record discharge capacity C_9). After charging the battery using the quasi-charging method (3.5), discharge it again using the standard discharge method (3.6) (record discharge capacity C_{10}). Capacity retention rate $=C_9/C_0 \times 100\%$, capacity recovery rate $=C_{10}/C_0 \times 100\%$.

3.8.3.10. Charge retention and capacity recovery at 45°C

Under ambient temperature conditions of 25°C ±2°C, install the test fixture according to method 3.4, then perform battery capacity calibration (3.7 Capacity Calibration and Energy Calibration). Subsequently, charge the battery using the standard charging method (3.5). Afterward, store the battery at ambient temperature of 45°C ±2°C for 28 days, followed by ambient temperature conditions.

The battery was left at 25℃±2℃ for 6h, then discharged according to the standard discharge method (3.6) (recorded discharge capacity C_{11}), then charged according to the quasi-charging method (3.5) and discharged according to the standard discharge method (3.6) (recorded discharge capacity C_{12}). Capacity retention rate =C_{11}/C_0 ×100%, capacity recovery rate =C_{12}/C_0 ×100%.

3.8.4. Safety Performance

3.8.4.1. overdischarge

Under ambient temperature conditions of 25°C ±2°C, the battery was fully charged using the standard charging method (2.4.3), followed by installation of the test fixture according to the procedure in Section 3.4. The battery was discharged at a constant current of 154.0A for 90 minutes under a safety test environment with temperature maintained at 25°C ±5°C. Observation was conducted for 1 hour. (Refer to GB 38031-2020 Safety Requirements for Batteries Used in Electric Vehicles)

3.8.4.2. over-charging

Under ambient temperature conditions of 25°C ±2°C, the battery was fully charged using the standard charging method (2.4.3), followed by installation of the test fixture according to Section 3.4. In the safety test environment at 25°C ±5°C, the battery was charged at a constant current of 154.0A until reaching 4.015V or 115% State of Charge (SOC), after which charging was terminated. Observation was conducted for 1 hour. (Refer to GB 38031-2020 Safety Requirements for Batteries Used in Electric Vehicles)

3.8.4.3. External short circuit

Under ambient temperature conditions of 25℃±2℃, the battery shall be fully charged using the standard charging method (2.4.3), followed by installation of the test fixture as specified in Section 3.4. In the safety test environment at 25±5℃, the battery's positive and negative terminals shall be externally short-circuited for 10 minutes, with the external circuit resistance value being less than 5mΩ. Observation shall be conducted for 1 hour. (Refer to GB 38031-2020 Safety Requirements for Batteries Used in Electric Vehicles)

3.8.4.4. Heating (130°C)

Under ambient temperature conditions of 25℃±2℃, the battery was fully charged using the standard charging method (2.4.3), followed by installation of the test fixture according to Section 3.4. The battery was placed in a temperature chamber, which was heated from room temperature to 130℃±2℃ at a rate of 5℃/min. The temperature was maintained at this level for 30 minutes before heating was stopped. Observation was conducted for 1 hour. (Refer to GB 38031-2020 Safety Requirements for Batteries Used in Electric Vehicles)

3.8.4.5. temperature cycle

Under ambient temperature conditions of 25°C ±2°C, the battery was fully charged using the standard charging method (2.4.3), followed by installation of the test fixture according to the procedure in Section 3.4. The battery was then placed in a temperature chamber, which was adjusted as specified in the table and figure below, with 5 cycles performed. (Refer to GB 38031-2020 Safety Requirements for Batteries Used in Electric Vehicles)

Temperature (℃)	Time increment (min)	Cumulative time (min)	Temperature change rate (℃/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

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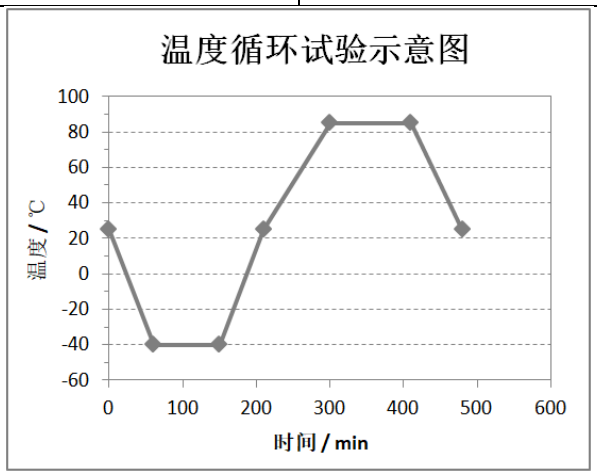
25	70	480	6/7		



3.8.4.6. crimp

The battery was fully charged under standard charging conditions (2.4.3) at an ambient temperature of 25° C ±2°C. The safety test was conducted under the following conditions at an ambient temperature of 25°C ±5°C:

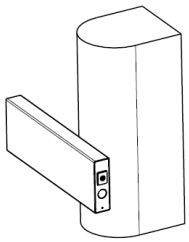
a) Compression direction: The direction where battery cells are most prone to compression in vehicle layout is identical to the standard orientation.

b) Extrusion plate configuration: A semi-cylindrical body with a radius of 75mm, where the length (L) of the semi-cylinder exceeds the dimensions of the battery cells to be extruded (refer to the figure below).

c) Squeeze speed: no more than 2 mm/s;

d) Compression threshold: The process stops when either the voltage reaches 0V, the deformation reaches 15%, the compression force reaches 100kN, or the weight of the test object is exceeded by 1000 times.

e) Maintain for 10 minutes. Observe for 1 hour. (Refer to GB 38031-2020 Safety Requirements for Batteries Used in Electric Vehicles)



4. Charge-Discharge Parameters

4.1. Charging Mode

Parameter	Size of product	Condition
Standard charging current	1/3C	25°C±2°C
Maximum sustainable charging current	1.3C	25°C±2°C
Standard charging voltage	Single-cell battery ≤3.85V	/
Standard charging mode	See 3.5	
Standard charging temperature	25°C±2°C	

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Absolute charging temperature (battery temperature)	-20℃~65℃	Regardless of the charging mode, charging should be stopped once the battery temperature exceeds the absolute charging temperature range.
Absolute charging voltage	Maximum 3.85V	Regardless of the charging mode, charging will stop once the battery voltage exceeds the absolute charging voltage range.

4.2. Other charging modes (unit: C-rate)

Battery temperature/°C		-20	-10	0	2	5	7	10	12	15	20	25	45	48	55	60	65
SOC	0%~10%	0.02	0.02	0.05	0.2	0.4	0.4	0.8	0.8	0.8	0.8	1.3	1.0	0.7	0.5	0.2	0
SOC	10%-50%	0.02	0.02	0.05	0.2	0.4	0.4	0.6	0.6	0.6	0.6	1.3	1.0	0.7	0.5	0.2	0
SOC	50%-80%	0.02	0.02	0.05	0.2	0.2	0.2	0.4	0.4	0.4	0.4	1.0	1.0	0.7	0.5	0.2	0
SOC	80%-90%	0.02	0.02	0.05	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.3	0.2	0
SOC	90%-95%	0.02	0.02	0.05	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0
SOC	95%-100%	0.02	0.02	0.05	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0
SOC	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4.3. Discharge Mode

Parameter	Size of product	Condition
Standard discharge current	1/3C	25℃±2℃
Maximum discharge sustainable current	1.3C	25℃±2℃
Discharge cutoff voltage	2.5V 2.0V	Temperature T>0℃ Temperature T≤0℃
Standard discharge mode	See 3.6	
Standard discharge temperature	25℃±2℃	
Absolute discharge temperature (battery temperature)	-35℃~65℃	Regardless of the charging mode, charging should be stopped once the battery temperature exceeds the absolute charging temperature range.
Absolute discharge voltage	1.75V	Regardless of the charging mode, charging will stop once the battery voltage falls below the absolute charging voltage range.

4.4. Pulse Mode

4.4.1. Pulse Discharge Mode (C-Rate)

60s pulse discharge rate/C																				
SOC\T	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65
100%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
95%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0

Model	LF154	Specification code	RD-EVE LF154-S13-LF	Edition	A

90%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
80%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
70%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
60%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
50%	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
40%	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
30%	0.3	0.3	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
20%	0.2	0.2	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
10%	0.1	0.1	0.3	0.3	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
5%	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0
0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4.4.2. Pulse Feedback Mode (C-Rate)

60s pulse charging rate/C																
SOC\T	-20	-10	0	5	10	15	20	25	30	35	40	45	50	55	60	65
100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95%	0.03	0.03	0.1	0.2	0.2	0.2	0.2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0
90%	0.03	0.03	0.1	0.2	0.4	0.4	0.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
80%	0.03	0.03	0.3	0.4	0.4	0.4	0.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
70%	0.03	0.03	0.3	0.4	0.8	0.8	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
60%	0.03	0.03	0.3	0.4	0.8	0.8	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
50%	0.03	0.03	0.3	0.4	0.8	0.8	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
40%	0.03	0.03	0.3	0.4	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
30%	0.03	0.03	0.3	0.4	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
20%	0.03	0.03	0.3	0.4	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
10%	0.03	0.03	0.3	0.4	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
5%	0.03	0.03	0.5	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0
0%	0.03	0.03	0.5	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	0

5. Security Restrictions

5.1. Voltage limit

Project	Class	Parameter	Protective action
Charging voltage	Charge termination	3.85V	Forceful termination
	First stage overcharge protection	3.70V	Pre-warning
	Secondary overcharge protection	3.80V	Downstream flow or power reduction

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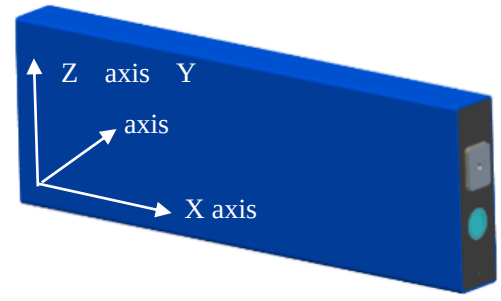
Discharge voltage	Discharge off	1.80V 1.75V	Force stop at temperature T> 0°C Temperature T ≤0°C forced stop
	Level 1 Overdischarge Protection	2.00V 1.90V	Temperature pre-alarm T>0°C Temperature pre-alarm T ≤0°C
	Secondary over-discharge protection	1.90V 1.80V	Temperature T>0°C: Reduce flow rate or power output Temperature T ≤0°C: Reduce flow rate or power output

5.2. Temperature Limitation

Project	Numeric value	Remarks
Recommended operating temperature range	10℃~45℃	Recommended operating temperature range for the battery.
Maximum allowable operating temperature	60℃	If the battery operating temperature exceeds the maximum allowable temperature, the power output must be reduced to 0.
Minimum operating temperature	-30℃	If the battery is used at a temperature above the minimum operating temperature, the power must be reduced to 0.
Maximum safe temperature	65℃	If the battery is used at temperatures exceeding the maximum safe limit, irreversible permanent damage may occur. Users must not operate the device above this temperature threshold.
Minimum safe temperature	-35℃	If the battery is used at temperatures exceeding the minimum safe range, irreversible permanent damage may occur. Users must ensure the operating temperature remains below the minimum safe threshold.

6. Recommended Module Design Parameters

6.1. Battery Direction



6.2. Battery Compression Force

Safety boundary of compressive force that the battery can withstand during module assembly. Test conditions:

-Compressed area: 341.0mm × 110.0mm (L × H)

Compression speed: 0.02 mm/sec

Compression direction: Y-axis

-Battery SOC: 100%

Phenomenon	Compressive force
Internal generation of defects	30kN
Weeping	> 100kN

As shown in the table above, the compression force on the battery must not exceed 30 kN, otherwise it may sustain damage.

6.3. expansion force of battery

6.3.1. Test Condition：

Initial battery preload: 3000N

Charge/discharge conditions:

-Charging: Constant current and constant voltage charging to 3.65V at 51.3A, with cutoff current of 7.7A (0.05C). Left undisturbed for 30 minutes.

-Discharge: Constant current discharge from 51.3A to 2.50V. Hold for 30 minutes.

Perform 1500 cycles under charging and discharging conditions, and record the battery expansion force before and after each cycle.

6.3.2. Test Result：

Expansibility	BOL	3kN
	EOL	< 28kN

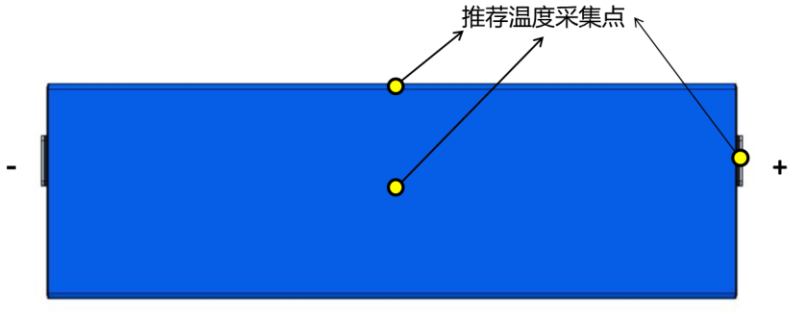
6.4. Thermal Parameters

Testing method: Reference standards: GB/T 10295-2008, ASTM E1269-2011

Mean thermal conductivity	Thermal conductivity (W/mK)	
	X/Z Xiang	Y Xiang
	18~20	1~2
Mean heat capacity	Heat capacity (kJ/(kg·K))	
	0.9~1.2	

6.5. Recommended Temperature Sampling Points (battery Temperature Field Distribution)

For temperature measurement on battery surfaces, the recommended sampling points are located at the positive electrode terminal, the center of the large surface, and the center of the side surface, as shown in the figure below.



7. Battery Operation Instructions and Precautions

7.1. Product Life Termination Management

Batteries have a limited service life, and customers must establish an effective tracking system to monitor and record the internal resistance and capacity of batteries during each usage period. The measurement and calculation methods for internal resistance and capacity require joint discussion and mutual agreement between the customer and Hubei EVE Energy Co., Ltd. If the internal resistance of a battery in use exceeds 150% of its initial value or its capacity falls below 70% of the rated capacity (at 25°C), the battery should be discontinued. Failure to comply with these requirements will exempt Hubei EVE Energy Co., Ltd. from any product quality warranty obligations under the sales agreement and this specification document.

7.2. Long Term Storage

After charging, batteries should be used promptly to avoid capacity loss due to self-discharge. If storage is required, batteries must be stored at a low State of Charge (SOC). Recommended storage conditions are: 40%±10% SOC, 0–25°C, and relative humidity (RH) ≤ 60%.

7.3. Transport

The product shall be packed in boxes during transportation at a SOC (Specific Oxygen Content) not exceeding 40%. During transit, vigorous vibration, impact, or compression must be avoided, and exposure to sunlight or rain should be prevented. This method is applicable for transportation via vehicles such as automobiles, trains, ships, and aircraft.

7.4. Operation Declaration

- Reverse charging is prohibited. Connect the battery terminals correctly; reverse charging is strictly forbidden.
- Over-discharge is prohibited. During normal battery operation, to prevent over-discharge, the battery should be charged periodically and the voltage should be maintained above 2.50V.

- Batteries must not be immersed in water. When not in use, they should be stored in a cool and dry environment.
- Do not place batteries near heat sources such as fire or heaters for use or storage.
- When charging, use a charger specifically designed for lithium-ion batteries.
- During use, it is strictly prohibited to reverse the positive and negative terminals of the battery.
- Do not leave batteries in fire or heat batteries.
- Do not use metal to directly conduct the positive and negative terminals of the battery.
- Do not transport or store batteries with metals such as hair clips, necklaces, etc.
- It is prohibited to strike, throw, step on, or bend batteries.
- Do not directly weld batteries.
- Do not puncture batteries with nails or other sharp objects.
- Do not use batteries in extremely hot environments, such as direct sunlight or inside a hot car.
- Use is prohibited in areas with strong static electricity and strong magnetic fields.
- If the battery leaks liquid and the electrolyte splashes onto the skin or clothing, immediately wash the affected area with running water.
- Do not use the battery if it exhibits any unusual odors, heating, discoloration, deformation, or abnormalities during use, storage, or charging.

7.5. Disclaimer

If the product user fails to comply with the instructions specified in this manual, resulting in social consequences and damage to the reputation of Hubei EVE Power Co., Ltd., the company will hold the responsible party accountable. Depending on the extent of the impact, the user shall provide compensation to Hubei EVE Power Co., Ltd.

7.6. Else

Any matters not mentioned in this specification shall be determined through mutual consultation between both parties.

8. Contact Way

Contact address: No.68 Jingnan Avenue, High-tech Zone, Jingmen Economic Development Zone, Hubei Province, Hubei Yiwei Power Co., LTD.

Contact number: 86-0724-6079699

Fax: 86-0724-6079688

Website:http://www.evejq.com

9. Figure: LF154 Battery Diagram

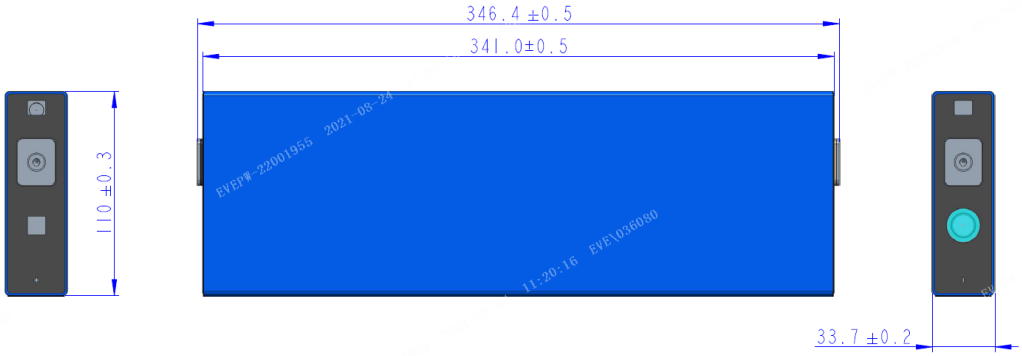


Figure 5. LF154 Battery