model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

Product delivery specification

Square aluminum-shell lithium-ion battery

model:**A31-V1**

EVE 130ah

authorized strength	Product design review	quality audit	marketing audit	ratify

Customer receiving bar
corporate name:
ratify:
date:

In August, 2022

Hubei Yiwei Power Co., LTD

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

Customer requirements

Ask customers to write their demand information and communicate with Hubei Yiwei Power Co., LTD. (referred to as Yiwei Power) in advance。

The customer has some special applications or operating conditions that are different from the one described in this document and can be based on the special requirements of the customer,

Conduct product design and production。

order number	special requirements	standard
1		
2		
3		
4		
5		

customer code:_____sign:_____date:_____

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

Change the resume

edition	日期	Change the content	Confirmation of the person
A	2021.07.01	A new release	Tan Xianyang

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

目录

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

Terms defined

term	definition
product	The "product" in this specification refers to the production of Hubei Yiwei Power Co., LtdA31-V1Rechgeable square aluminum shell lithium Subbattery。
client	Refers to the buyer in the Product Sales Contract of Hubei Yiwei Power Co., LTD.
ambient temperature	The ambient temperature of the battery.
Battery temperature	The temperature of the cell measured by a temperature sensor connected to the cell.
multiplying power (C)	sufficient/The ratio of the discharge current to the rated capacity value of the battery。
State of charge (SOC)	In no load, to Ampere-Hours or in Watt-Battery capacity status and rated capacity measured in hours The ratio of quantity.
recurrence (Cycle)	The battery is charged in one cycle according to the specified charge and discharge standard. The cycle includes short-of normal charging or regenerative charging and The combination of the discharge process sometimes has only normal charging without regenerative charging during the charging process. The discharge can be made up of one Parts of the discharge form together.
Standard charging	This specification is the first3.5Charging mode as described in the bar.
Standard discharge	This specification is the first3.6Discharge mode as described in the bar。
open circuit voltage (OCV)	No battery voltage measured without any load and circuit.
direct-current resistance (DCR)	The ratio of the voltage change of the battery to the corresponding current change under the working conditions is tested as described in this specification3.8.3.6 Article state.
The Battery Management System (BMS)	An effective tracking and control system for customers to detect and record the operating parameters of the product throughout the life of service. Its tracking and recording parameters include, but are not limited to voltage, current, temperature, etc., to control the operation of the product and ensure the product The operating environment and operating conditions shall comply with the provisions of this specification.
module	Lithium-ion batteries are combined in series and parallel with a single battery monitoring and management devicepackIn the Between the product.
pulse current	A recurring current or voltage pulse is called pulse current, pulse current either in the same direction, or It appears in alternating positive and negative directions.
compressive force	During the module assembly, the battery can withstand the safety boundary of the compression force.
initial status (BOL)	The state of the battery at the beginning of its life. This specification refers to the state where the battery is not charged and discharged after shipment。

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A
End status (EOL)	The status of the battery at the end of life, this specification refers to the capacity of the battery to decay to below after use80%The shape of nominal capacity form.				

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

measurement unit	“V” (Volt) Volt (V), voltage unit “A” (Ampere) Ampere (A), current unit “Ah” (Ampere -Hour) Ampere-Hours (Ah), the load unit “Wh” (Watt-Hour) watt-Hours (Wh), energy units “Ω” (Ohm) Ohm (Ω), resistance unit “mΩ” (MilliOhm) milliohm (m Ω), resistance unit "℃" (degree Celsius) degree Celsius (℃), degree-day "mm" (millimeter) millimetre (mm), linear measure "s" (second) second (s), hourly basis “Hz” (Hertz) hertz (Hz), Frequency unit "g" (Gram) can (g), mass unit “N” (Newton,) Unit of cow (N) force "N·m" (Newton * Meter) Niu rice (N·m), Torque unit “kgf” (Kilogram-Force) kilogram force (kgf), unit of force “Pa” (Pascal) Pascal (Pa), pressure unit

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

1.essential information

1.1.scope of application

This product specification is applicable to the square aluminum shell lithium ion battery produced by Hubei Yiwei Power Co., LTD

1.2., Product type

Square aluminum-shell lithium-ion battery

1.3.product name

A31-V1 EVE 130AH

2. Battery specification parameters

2.1. Basic parameters of battery

Project		standard	remarks
minimum capacity		130Ah	,,1/3C 25±2℃ 2.50V-3.65V
least energy		418.6Wh	,,1/3C 25±2℃ 2.50V-3.65V
Initial internal resistance		≤0.3mΩ	AC， 1kHz， 21%SOC
nominal voltage		3.22V	,,1/3C 25±2℃ 2.50V-3.65V
Battery weight		2370±30g	
Charging limit voltage (U_{max})		3.65V	/
Discharge cut-off voltage (U_{min})		2.50V(>20℃) 2.00V (-30℃≤T≤20℃)	/
Fast charging performance		20min	10%~80%SOC 25±2℃,
Circulating performance	25℃Fast charging cycle	2000 Weeks	3% ~ 100% DOD; fast charge/1Cdischarge, 2.50V-3.65V, 300±20kgfGrip cycle; capacity conservation rate≥80%
	35℃Fast charging cycle	1500 Weeks	3% ~ 100% DOD; fast charge/1Cdischarge, 2.50V-3.65V, 300±200kgfFixture cycle capacity conservation rate≥80%
working temperature	Charging temperature	-20℃~ 55℃	/
	Discharge temperature	-30℃~55℃	/
Storage temperature	⩾30 Days	-40℃~55℃	Shipped SOC status (21%±3%SOC)
	<30 Days	55℃~60℃	

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

2.2., Product specification

2.2.1. Dimensions and weight index

number	Project		standard	Section of test method
1	size	altitude1(H) (Including pole column)	112.7±0.4mm	3.8.1
		Height of 2 (h) (No pole column)	109.8±0.4mm	
		width (L1) (No blue film)	194.1±0.3mm	
		width (L2) (With blue membrane)	194.3±0.3mm	
		thickness (T) (With blue membrane)	50.7±0.3mm (21%SOC, 300 ±20kgfThickness under pressure)	
2	weight	Weight (including blue film, top patch)	2370±30g	3.8.2

2.2.2. Electrical performance index

order number	项目		standard	Section of test method
1	capacity	1/3C capacity	≥130Ah	3.8.3.1
		1Ccapacity	≥129Ah	3.8.3.2
2	energy	1 / 3C energy	≥418.6Wh	3.8.3.1
3	Discharge performance	-20℃energy ratio	≥70%	3.8.3.3
		0℃energy ratio	≥85%	3.8.3.4
		25℃energy ratio	100%	/
		45℃energy ratio	≥100%	3.8.3.5
4	DCR	,25℃ 50%SOC 1C 10sec,,	0.650±0.055mΩ	3.8.3.6
5	recurrence	25℃Fast charging cycle	2000 weeks, capacity retention rate≥80%	3.8.3.7
		35℃Fast charging cycle	At 1,500 weeks, and the capacity retention rate≥80%	3.8.3.8
6	The charge is maintained with Capacity recovery	For 25℃ 28 days,	capacity retention ratio≥97%	3.8.3.9
			Capacity recovery rate≥98%	
		For 45℃ 28 days,	capacity retention ratio≥96%	3.8.3.10
			Capacity recovery rate≥97%	

2.2.3. Safety performance indicators

number	Project	standard	Section of test method
1	overdischarge	No fire, no explosion	3.8.4.1

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

2	over-charging	No fire, no explosion	3.8.4.2
3	External short circuit	No fire, no explosion	3.8.4.3
4	heat	No fire, no explosion	3.8.4.4
5	temperature cycle	No fire, no explosion	3.8.4.5
6	crimp	No fire, no explosion	3.8.4.6
7	thermorunaway	No fire, no explosion	3.8.4.7
8	vibrate	No fire, no explosion	3.8.4.8

2.3., Battery drawing

See Figure 1。

2.4.surface

The battery shall be free of obvious abrasions, cracks, rust stains, discoloration, or electrolyte leakage that may affect the commercial value of the battery.

3.condition of experiment

3.1.ambient condition

Unless otherwise noted, the general test mentioned in this specification shall be at ambient temperature with relative humidity below65% RH, An atmospheric pressure of 86 kPa ~ 106 In the context of the kPa. The ambient temperature mentioned in this specification refers to25±2℃。

3.2., measuring equipment

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

Voltage measuring device: ± 0.1%;

Current measuring device: ± 0.1%;

temperature measuring equipment:±0.5℃;

Dimension measuring device: ± 0.01mm;

Weight measuring device:±0.1g。

3.3. Test fixture preparation

3.3.1.plain clamp

Single battery shall be spliced (material 45 steel, thickness:12mm) Fixed, the splint needs to cover the large side of the battery, between the splint using 8M6 The bolts are fixed and each surface of the splint should be covered with insulation film, and the thickness of the insulation film is not less than0.1mm。

3.3.2. Expansion force fixture

Single battery should be pressed plate (material 45 steel thickness: outside 16.5mm, inside16.5mm) Fixed, the pressure plate needs to cover the large surface of the battery

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

Use between pressing plates4Several guide columns are fixed, and each surface of the pressure plate should be covered with insulation film, and the thickness of the insulation film is not less than0.1mm。

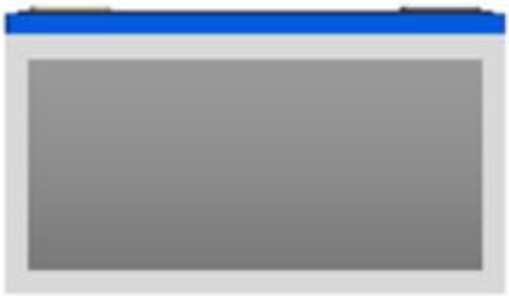
3.4. Test fixture installation

3.4.1. Silicone frame composite aerogel installation

The cycle test requires a silicone gel frame to cover the large surface of the battery.

Note: Both the front and rear sides of the battery must be attached。

The silicone frame composite aerogel is pasted as shown in the following figure:

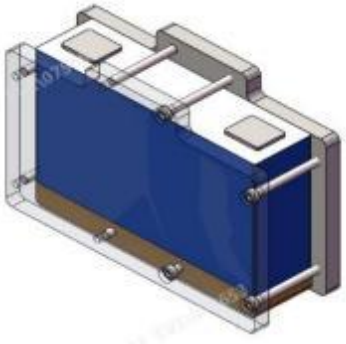


Schematic diagram of composite aerogel

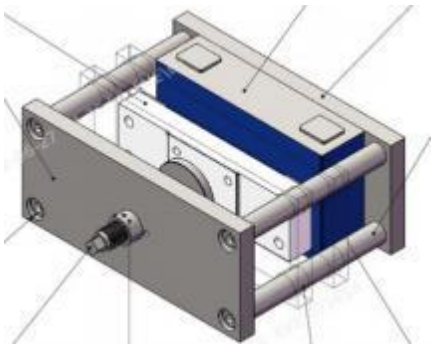
3.4.2. The fixture installation

Cover with blue film (material:PET, thickness0.11mm) And the top patch (material:PC, thickness0.3mm) Battery to be tested (~21%SOC)

In the middle of the splint of the ordinary fixture or expansion clamp300±20 kgfThe torsion fixing bolt, as shown in the figure below.



Installation drawing of the ordinary fixture



Installation drawing of the expansion force fixtur

3.5. Standard charging method

Standard charging is indicated at the ambient temperature25±2℃Under the condition, the battery is charged at 1 / 3C (43.3A) to 3.65V, and then charged at constant voltage at 3.65V until the charging current is less than or equal to0.05C(6.5A), Then stand 30min charging mode.

3.6. Standard discharge mode

Standard discharge is defined at the ambient temperature25±2℃Under the condition, the battery is discharged with a constant current of 1 / 3C (43.3A) until the discharge voltage is reached

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

2.50VTime off, and then stand for 30min, the discharge mode。

3.7. Capacity calibration and energy calibration

At ambient temperature25±2℃Under the conditions, the battery is charged according to the 3.5 standard charging mode, and then discharged according to the 3.6 standard discharge and repeated，3Secondary standard charging mode and standard discharge mode. Repeat the standard charging mode and the standard discharge mode3Times,3The average discharge capacity is 1 / 3C
Discharge capacity, the recorded discharge capacity is the calibration capacityC_0， 3，The average discharge energy of the times is 1 / 3C, and the discharge energy is the calibration energyE_0。

3.8.test method

3.8.1. Size

Test equipment: electronic digital video caliper, flat plate thickness meter。

experimental method:

a)Battery width and height were measured using an electronic digital video caliper

b)Measure the battery thickness using a flat panel thickness gauge, test conditions:300kgfMaintain for 10s under pressure。

*The battery thickness will increase with the increase of SOC and with the increase of use time. Here, the thickness refers to the thickness of the battery in the BOL state (SOC at shipment:21%)。

3.8.2. Weight

Test equipment: electronic scale;

Test method: Measure the weight of the battery using an electronic scale.

3.8.3. Electric performance

3.8.3.1. 1 / 3C discharge capacity and energy (standard discharge mode)

At ambient temperature25℃±2℃Under the condition, the battery is fully charged according to the standard charging mode (3.5), and then discharged according to the standard discharge mode (3.6), recording the discharge capacity and discharge energy. Repeat the standard charging mode and the standard discharge mode3Times,3The average discharge capacity of the times is 1 / 3C discharge capacityC_1，3The average discharge energy of the times is 1 / 3C, and the discharge energyE_1。

3.8.3.2. 1CDischarge capacity and energy

At ambient temperature25℃±2℃Under the condition, the battery is fully charged according to the standard charging mode (3.5), and then the current is 1C (130A)2.5V，Stand for 30min and record the discharge capacity and discharge energy. Above charge and discharge above3Times,3The average discharge capacity of the times is1Cdischarge
capacity C_2，The average discharge energy of 3 times is 1C discharge energy E_2。

3.8.3.3. -20℃energy ratio

At ambient temperature25±2℃Under the condition, the battery is calibrated according to the method of (3.7). At ambient temperature25±2℃Under the conditions, the battery is fully charged in the standard charging mode (3.5), and then in-20±2℃Quiet under the environment8h, In-20±2℃With 1 / 3C (43.3A) current to 2.，0V records the discharge energy E_3，E_3/E_0That is-20℃energy ratio.

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

3.8.3.4. 0℃ energy ratio

At ambient temperature25±2℃Under the condition, the battery is calibrated according to the method of (3.7). At ambient temperature25±2℃Under the conditions, the battery is fully charged in the standard charging mode (3.5), and then in0±2℃Quiet under the environment8h, In0±2℃With 1 / 3C (43.3A) current to 2.0V records the discharge energy E_4, E_4/E_0That is0℃energy ratio.

3.8.3.5. 45℃ energy ratio

At ambient temperature25±2℃Under the condition, the battery is calibrated according to the method of (3.7). At ambient temperature25±2℃Under the conditions, the battery according to the standard charging mode (3.5), fully charged, and then in45±2℃Quiet under the environment4h, In45℃±2℃With 1 / 3C (43.3A) current to 2.5V records the discharge energy E_5, E_5/E_0That is45℃energy ratio。

3.8.3.6 internal resistance

a) At ambient temperature25±2℃Under the condition, the shipment battery was tested using the frequency of AC 1kHz.

b) At the ambient temperature25±2℃Under the condition, the battery is calibrated according to the method of (3.7), then charged according to the standard charging mode (3.5), and then 1 / 3C_0The current discharge 90min (adjusted SOC to 50%)1h, Record the resting stage voltage V_1, And then discharged with a constant current current of 1C (130A)10sec, Record the discharge end-stage voltage V_2, Calculate DCR DCR = (V_1-V_2)*1000/130 mΩ。

3.8.3.7. 25℃Fast charging cycle

Before testing as per (3.3) Make fixpreparation at room temperature21%SOCWhen, according to (3.4) The Method of installing the test fixture。

a)At ambient temperature25±2℃Under the conditions, the battery is charged according to the (3.5) standard charging mode, and then discharged according to the 3.6 standard discharge, and repeated3。The secondary standard charging mode and the standard discharge mode will repeat the standard charging mode and the standard discharge mode3Times,3The average discharge capacity of the times is 1 / 3C discharge capacity, and the recorded discharge capacity is the calibration capacity C_3, if $C_3 \geqslant$130 Jump to work stepb.), if C_3<130, jump to the work stepf.)

b)Charge the battery with a specific fast charging strategy (4.1.2) C=130A and stand for 30m in;

c)Discharge at a constant current current of 1 C (130A)97%C_3,Stand still for 30min;

d)repeatb - cCycle for 47 weeks.

e)repeata - dCycles for 40 weeks.

f)Charge the battery with a specific fast charging strategy (4.1.2) C=C_3Stand still for 30min;

g)With 1 C_3The current constant current discharge97%C_3,Stand still for 30min;

h)repeatf - gCycle for 47 weeks.

i)repeata - gCycles for 40 weeks.

3.8.3.8. 35℃Fast charging cycle

Before testing as per (3.3) Make fixpreparation at room temperature21%SOCWhen, according to (3.4) The Method of installing the test fixture。

a)At ambient temperature35±2℃Under the conditions, the battery is charged according to the (3.5) standard charging mode, and then discharged according to the (3.6) standard discharge, and repeated3The secondary standard charging mode and the standard discharge mode will repeat the standard charging mode and the standard discharge mode。3Times,3The average discharge capacity of the times is 1 / 3C discharge capacity, and the recorded discharge capacity is the calibration capacity C_4, if $C_4 \geqslant$130, jump to work stepb.), if C_4<130, jump to the work stepf.)

b)Charge the battery with a specific fast charging strategy (4.1.2) C=130A and stand for 30min;
c)Discharge at a constant current current of 1 C (130A)97%C_3,Stand still for 30min;

d)repeatb - cCycle for 47 weeks.

e)repeata - dCycles for 40 weeks.

f)Charge the battery with a specific fast charging strategy (4.1.2) C=C_4,Stand still for 30min;

g)With 1 C_4The current constant current discharge97%C_4,Stand still for 30min;

h)repeatf - gCycle for 47 weeks.
i)repeata - gCycles for 40 weeks.

3.8.3.9. 25℃Charge retention along with capacity recovery

At ambient temperature25±2℃,Under the conditions, then the test fixture is installed according to the method 3.4, then the battery is capacity calibrated (3.7), then charged according to the standard charging mode (3.5), and then at the ambient temperature25±2℃Of standing for 28 days and then at ambient temperature25±2℃In accordance with the standard discharge mode (3.6) Discharge (record the discharge capacityC_5), And then follow the quasi-charging mode (3.5) Use the standard discharge mode after charging (3.6) Discharge (record the discharge capacity C_6)。capacity retention ratio =$C_5/C_0\times100\%$, Capacity recovery rate =$C_6/C_0\times100\%$。

3.8.3.10. 45℃Charge retention along with capacity recovery

At ambient temperature25±2℃,Under the conditions, install the test fixture in accordance with (3.4) and then the battery capacity calibrated (3.7), then charge in the standard charging mode (3.5), and then at the ambient temperature45±2℃Of standing for 28 days and then at ambient temperature25℃±2℃Stand still for 6h, and then according to the standard discharge mode (3.6) Discharge (record the discharge capacityC_7), And then follow the quasi-charging mode (3.5) Use standard storage after charging
Electrical mode (3.6) discharge (record discharge capacity C_8) 。capacity retention ratio =$C_7/C_0\times100\%$, Capacity recovery rate =$C_8/C_0\times100\%$。

3.8.4. Safety performance

3.8.4.1. overdischarge
At ambient temperature25±2℃Under the conditions, fully charge the battery according to the standard charging mode (3.5), and then install the test clip as per (3.4)
With. In the safe test of the ambient temperature25±5℃The lower battery is discharged at 130A with constant current90 min. Observed for about 1h.(Refer to the GB 38031-2020 Storage for electric vehicles
Battery safety requirements)

3.8.4.2. over-charging

At ambient temperature25±2℃Under the conditions, fully charge the battery in the standard charging mode (3.5), and then install the test fixture as described in (3.4). In the safe test of the ambient temperature25±5℃The lower battery is charging at 130A to 4.015V or to 115% SOC. Observed for about 1h.(consult
GB 38031-2020Safety requirements for batteries for electric vehicles)

3.8.4.3. External short circuit

At ambient temperature25±2℃Under the conditions, fully charge the battery in the standard charging mode (3.5), and then install the test fixture as described in (3.4). In the safe test of the ambient temperature25±5℃The positive and negative electrode of the battery through the external short circuit of 10min, the external line resistance value should be less than 5m Ω. Observations for 1h。
(consultGB 38031-2020Safety requirements for batteries for electric vehicles)

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

3.8.4.4 heat (130℃)

At ambient temperature25±2℃Under the conditions, fully charge the battery in the standard charging mode (3.5), and then install the test fixture as described in (3.4). Place the battery into the temperature box as5℃/minThe rate of rising from room temperature to130±2℃, And keep this temperature for 30min, and then stop the heating.observe Check 1h.(consultGB 38031-2020Safety requirements for batteries for electric vehicles)

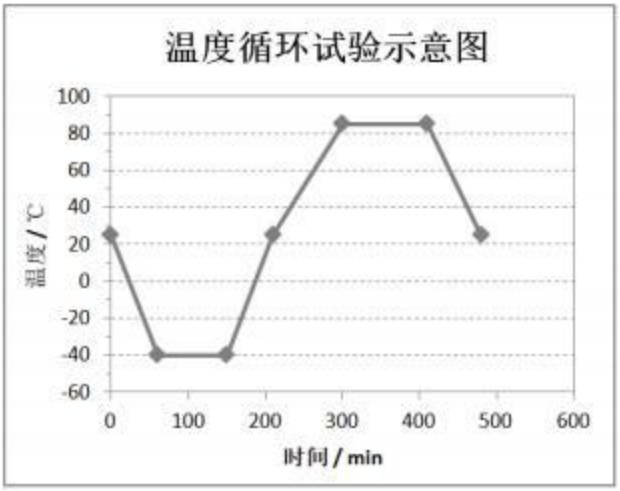
3.8.4.5 temperature cycle

At ambient temperature25±2℃Under the conditions, fully charge the battery according to the standard charging mode (3.5), and then install the test clip as per (3.4)

With. Put the battery into the temperature box, and adjust the temperature box according to the table below and the following figure5Times.(consultGB 38031-2020Electric car use

Battery safety requirements)

temperature (℃)	time increment (min)	Cumulative time (min)	Rate of change of temperature (℃/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



3.8.4.6 crimp

At ambient temperature25±2℃Under the condition, the battery is fully charged according to the standard charging mode (3.5). In the safe test of the ambient temperature25±5℃Under according to

Test it under the following conditions:

a) Extrusion direction: pressure perpendicular to the cell plate, or the same direction as the cell is most vulnerable to extrusion in the vehicle layout

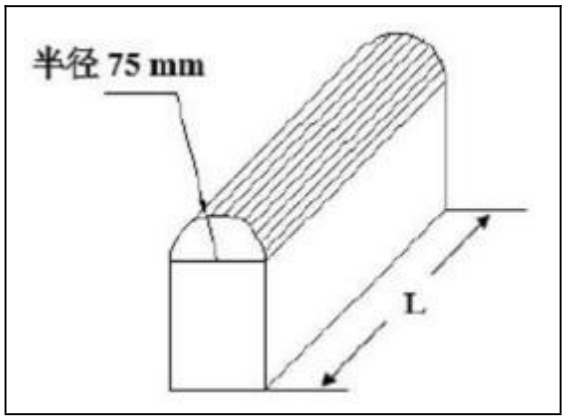
b) Extruded plate form: half cylinder of 75mm radius, the length of half cylinder (L) is greater than the size of the extruded cell (refer to the figure below

show)

c) Extrusion speed: not more than 2mm / s;

d) Extrusion degree: stop the extrusion after the voltage reaches 0V or the deformation amount reaches 15% or the extrusion pressure reaches 100 kN or 1000 times the weight of the test object

e) Hold it for 10min. Observed for about 1h.(Refer to the GB 38031-2020 Safety requirements for electric vehicles)



3.8.4.7 thermorunaway

At 25 ± at the ambient temperature2℃Under the condition, fully charge the battery in the standard charging mode (3.5), and then install the test in (3.4)

fixture.

,A flat or rod heating device is used and the surface shall be covered with ceramic, metal or, insulating layer, and the power requirement of a heating device is 300W~2000W. Complete the assembly of the test object and the heating device, the heating device shall be in direct contact with the battery, and the size of the heating device shall not be greater than The heated surface of the test object; install the temperature monitor, and the monitoring point temperature sensor is located away from the heat conduction, namely, installed on the opposite side of the heating device. The sampling interval of the temperature data should be less than 1s, and the accuracy requirement shall be ±2℃, The diameter of the temperature sensor tip should be less than1 mm. Charge the test object with 1C current 10VVoltage cutoff. Start the heating device immediately, and continuously heat the test object with its maximum power, when the thermal runaway occurs or the temperature of the monitoring point as defined in (5.5) is reached300℃When, stop triggering and turn off the heating device. During and within 1h of the heating, as If a fire or explosion occurs, the test is terminated.(consultGB38032-2020Safety requirements for electric buses).

The following are the conditions for determining the occurrence of thermal runaway:

a) The test object produces a voltage drop, and the drop value exceeds 25% of the initial voltage;

b) The temperature of the monitoring point reaches the maximum operating temperature specified by the battery manufacturer

c) The temperature rise rate of the monitoring point is dT / dt≥1℃/sAnd it lasts for more than 3s.

equala) Andc) perhapsb) Andc) When occurring, the thermal runaway is determined to occur.

3.8.4.8 vibrate

At 25 ± at the ambient temperature2℃Under the condition, fully charge the battery according to the standard charging mode (3.5); place the battery on the vibration test table, fix the fixture; set the vibration test parameters, start the test, conduct simple harmonic vibration in one direction, the amplitude is 0.8mm, the maximum deviation of 1.6mm; the vibration frequency changes

To 1Hz / min, from10Hzarrive55HzBack to10Hz, Minimum time of 90min, but no more than 100min。

The battery should be inX\Y\ZVibrations were tested in all three directions.(Refer to the UL1642-2012 Safety Standard).

4. **BMS** Design parameter recommendations

The following data areA31-V1Battery reference performance data, for the BMS Design reference use, actual use to the use mode and conditions agreed by both parties

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

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4.1. Electrical performance data

4.1.1. SOC~OCV

Battery at the ambient temperature25±2℃Under the condition, the battery is calibrated according to the method of (3.7). At ambient temperature25±2℃The battery is charged according to the standard charging mode (3.5) Fully charged and then at 1 / 3C (43.3A) Of a constant current discharge, with each discharge capacity of10%C_0, shelve 60min, with repeated discharge10Second, record the voltage after each time, as in the discharge stateSOCThe correspondingOCV。

Battery at the ambient temperature25±2℃Under the condition, the battery is calibrated according to the method of (3.7). At ambient temperature25±2℃Under the condition of 1 / 3C (43.3A) current constant current charging, each charging capacity is 10%C_0, shelve180min, Repeat charge 10 times, record after each time Voltage, as in the charging stateSOCThe correspondingOCV。

temperature	OCV (V)											
	SOC%	100	90	80	70	60	50	40	30	20	10	0
25℃	discharge	3.437	3.331	3.329	3.328	3.319	3.290	3.288	3.285	3.254	3.204	2.692
	charge	3.377	3.343	3.343	3.343	3.342	3.310	3.306	3.304	3.286	3.228	3.010

4.1.2. Recommended charging

normal charge (10℃~45℃): 1 / 3C (43.3A) constant current constant voltage charging to 3.65V 0.05C (6.5A) cutoff, quick charge (25℃/35℃, 0% ~ 100% SOC): Standard fast charging model, fast charging strategy is shown below。

25℃/35℃quick charge/Charging method	SOC siding-to-siding block	Charging ratio/C
constant-current charging	0%~5%	1.0
constant-current charging	5%~10%	2.0
constant-current charging	10%~15%	3.0
constant-current charging	15%~20%	3.0
constant-current charging	20%~25%	3.0
constant-current charging	25%~30%	3.0
constant-current charging	30%~35%	3.0
constant-current charging	35%~40%	2.8
constant-current charging	40%~45%	2.6
constant-current charging	45%~50%	2.4

constant-current charging	50%~55%	2.2
constant-current charging	55%~60%	2.0
constant-current charging	60%~65%	1.8
constant-current charging	65%~70%	1.6
constant-current charging	70%~75%	1.4

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

constant-current charging	75%~80%	1.2
constant-current charging	80%~85%	0.85
constant-current charging	85%~90%	0.55
constant-current charging	90%~95%	0.5
constant-current charging	95%~100%	0.33

4.1.3. Pulse discharge and charging power

temperature	way	time	maximum power (W)							
			90% SOC	Imax (A)	80% SOC	Imax (A)	50% SOC	Imax (A)	20% SOC	Imax (A)
35℃	discharge	10sec	3276	1260	3016	1160	2704	1040	2132	820
		30sec	2808	1080	2678	1030	2392	920	1651	635
25℃		10sec	3120	1200	2860	1100	2600	1000	2080	800
		30sec	2730	1050	2600	1000	2340	900	1625	625
0℃		10sec	2185	950	2070	900	1840	800	1380	600
		30sec	2013	875	1955	850	1668	725	1150	500
- 10℃		10sec	1495	650	1380	600	1219	530	805	350
		30sec	1323	575	1265	550	920	400	633	275
25℃	charge	10sec	682	192	1012	285	1463	412	2006	565
		30sec	394	111	738	208	1434	404	1967	554
20℃		10sec	682	192	1012	285	1463	412	2006	565
		30sec	394	111	738	208	1434	404	1967	554
0℃		10sec	160	45	195	55	476	134	572	161
		30sec	114	32	167	47	320	90	362	102
- 10℃		10sec	135	38	170	48	302	85	376	106
		30sec	64	18	53	15	53	15	103	29

4.1.4. DCR

temperature	DC.DCR1C(mΩ)				
	time	90% SOC	80% SOC	50% SOC	20% SOC
45℃	10sec	0.422	0.435	0.439	0.478
	30sec	0.534	0.563	0.558	0.638
25℃	10sec	0.634	0.671	0.697	0.813
	30sec	0.763	0.847	0.846	1.005
-20℃	10sec	4.986	5.202	\	\
	30sec	5.206	5.537	\	\

temperature	CH.DCR1C (mΩ)				
	time	20% SOC	50% SOC	80% SOC	90% SOC
45℃	10sec	0.438	0.458	0.462	0.470

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

	30sec	0.547	0.604	0.629	0.695
25℃	10sec	0.680	0.735	0.723	0.749
	30sec	0.820	0.921	0.951	1.081

4.1.5. Charging capacity at different temperatures

After the standard discharge battery, then the battery temperature and the ambient temperature are balanced at the corresponding temperature, and then 1 / 3C (43.3A)

The current constant current constant voltage charge to the cut-off voltage3.65Vcutoff current0.05C(6.5A) Test the charging capacity at the corresponding temperature.

Charging ratio	temperature (℃)	charge capacity (**Ah**)
1/3C	45	135.6
	25	135.2
	10	135.0

4.1.6. Discharge capacity at different temperatures

The standard charged battery is suspended at the corresponding temperature in the following below, and then at 1 / 3C (43.3A) Of the current constant current discharge to cut-off voltage (T>20℃,2.5V;T ≤20℃,,2.0V) The test capacity is the discharge capacity at the corresponding temperature.

Discharge rate	temperature (℃)	discharge capacity (**Ah**)
1/3C	45	135.3
	25	134.9
	-20	101.5

4.2. Battery safety operation limits

4.2.1. Current limit

4.2.1.1. Discharge operating current limit

temperature (℃)	Discharge operating current limit			
	peak value**Imax**(**A**)	Continuous current limit		
		time (**sec**)	The maximum current is sustained**Imax**	
			last**Imax**(**A**)	Standard of permitted use
-31	0	-	0	-
-30	40	60	25	100%
-25	67	60	50	100%
-20	112	60	84	100%
- 15	160	60	120	100%
- 10	200	60	150	100%

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

-5	400	60	300	100%
0	1000	60	850	100%
5	1050	60	900	100%
10	1100	60	950	100%
15	1150	60	1000	100%
20	1200	60	1050	100%
25	1200	60	1100	100%
30	1230	60	1130	100%
35	1260	60	1160	100%
40	1260	60	1160	100%
45	1260	60	1160	100%
50	1260	60	1160	100%
55	330	60	330	100%
56	0	-	0	-

Note: The tolerance time of the peak current is10s。

4.2.1.2. Charge operating current limit

temperature (℃)	Charge operating current limit			
	peak value**Imax**(**A**)	Continuous current limit		
		time (**sec**)	The maximum current is sustained**Imax**	
			last**Imax**(**A**)	Standard of permitted use
-31	0	-	0	-
-30	9	60	3	100%
-25	9	60	3	100%
-20	15	60	5	100%
- 15	23	60	8	100%
- 10	121	60	20	100%
-5	149	60	23	100%
0	192	60	107	100%
5	222	60	145	100%
10	253	60	193	100%
15	273	60	248	100%
20	377	60	352	100%
25	601	60	561	100%

30	601	60	561	100%
35	601	60	561	100%
40	601	60	561	100%
45	601	60	561	100%
50	601	60	561	100%
55	95	60	89	100%
56	0	-	0	-

Note: The tolerance time of the peak current is10s。

4.2.1.3. Safety current limit

If in 0 msec to 200 msecCurrent in the range exceeds$I_{max\ -safety}$, Battery does not trigger a safety event (EUCARdanger classes ≤L3: cell Leakage, and the electrolyte loss< 50%), However, the battery cannot continue to charge and discharge, and it must be replaced. If used between the operating current limit and the safety current limit, the battery will seriously accelerate the attenuation, but no safety events will occur.Without a specified temperature, the safe limit current can be determined by linear interpolation between two adjacent conditions in the table below.

temperature (℃)	Safety current limit			
	discharge		charge	
	peak value**Imax**(**A**)	time (**msec**)	peak value**Imax**(**A**)	time (**msec**)
56	0	0	0	0
55	357	1000	180	1000
50	1134	1000	294	1000
40	1197	1000	600	1000
35	1228	1000	596	1000
30	1197	1000	593	1000
25	1270	1000	585	1000
20	1270	1000	456	1000
15	1218	1000	369	1000
10	1165	1000	254	1000
5	1113	1000	211	1000
0	1060	1000	153	1000
-5	850	1000	103	1000
- 10	693	1000	60	1000
- 15	556	1000	38	1000
-20	378	1000	24	1000

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

-25	240	1000	14	1000
-30	220	1000	12	1000
-31	/	/	/	/

4.2.2. Voltage limit

项目	class	parameter	Protect the action
charge voltage	Charging termination	3.65V	When the voltage of the battery reaches the3.65VStop charging at the time
	First-stage overcharge protection	3.67V	Charging is prohibited, but discharge is allowed
	Second level of overcharge protection	3.70V	No charging, and allow a small current to discharge
	Third-level level of overcharge protection	3.75V	Off the high voltage protection, no charging, no discharge. Lower power recovery
	Level IV overcharge protection	3.80V	Off the high voltage protection, beyond this voltage, the battery is damaged
discharge voltage	discharge off	2.5V 2.0V	temperature T>20℃ Stop the discharge temperature T when the battery discharge reaches 2.5V20℃Stop the discharge when the battery discharge reaches 2.0V
	First level overrelease protection	2.30V 1.97V	temperature T> / ≤ 20℃ Discharge and feedback power decreased by 50%. Charging can be charged map charge
	Second level of overrelease protection	2.15V 1.95V	temperature T>/ ≤20℃ Only low current discharge and feedback are allowed. Charging can be charged Map
	Third level of overrelease protection	2.10V 1.90V	temperature T>/ ≤20℃ High voltage protection, allowing charging according to the MAP table, the battery is not damaged
	Level 4 overrelease protection	2.0V 1.85V	temperature T> / ≤20℃ Break the high pressure protection, allow to press Map Of the 30% charge, the battery Not damaged
	Extreme overrelease protection	1.9V 1.8V	temperature T>/ ≤20℃ The battery has been damaged and the battery is no longer available

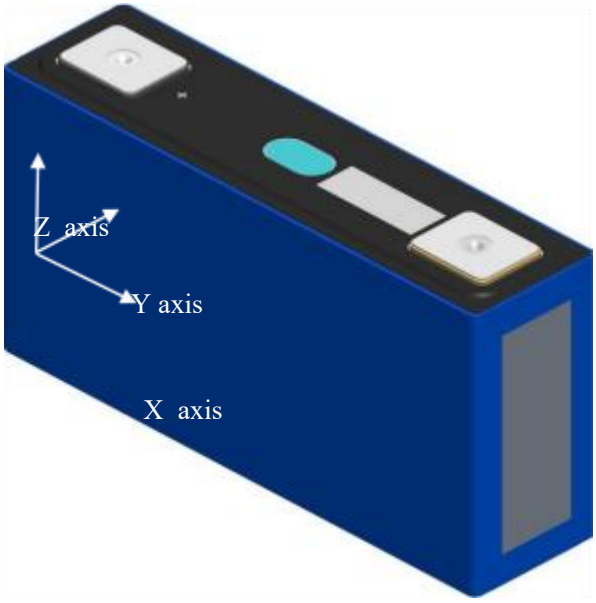
model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A

4.2.3. Temperature limit

项目	numeric value	remarks
Recommended operating temperature range	10℃~45℃	The battery temperature range is recommended.
maximum allowable operating temperature	55℃	If the battery use temperature exceeds the maximum operating temperature, the power needs to be reduced to 0。
Minimum operating temperature	-30℃	If the battery use temperature exceeds the minimum operating temperature, the power needs to be reduced to 0。
Maximum safety temperature	65℃	If the battery use temperature exceeds the maximum safe temperature, the battery will not be used ，The reversible permanent damage shall not be above the maximum safe temperature.
Minimum safety temperature	-35℃	If the battery use temperature exceeds the minimum safe temperature, the battery will not be used， The reversible permanent damage shall not be used below the minimum safe temperature.

5. Suggestions for the module design parameters

5.1. Battery direction



5.2. Battery compression force

，Safety boundary where the battery can withstand the compression force during module assembly。

test condition:

Compressed area: 194.3mm 109.8mm (LH)

Compression speed: 0.02mm / s

Compression direction Y direction

cell SOC： 21%

phenomenon	compressive force
Internal defects	30kN
weeping	>100kN

As can be seen from the above table, the compression force of the battery should not exceed 30 kN, otherwise the battery may be damaged.

5.3. Battery expansion force

5.3.1.test condition

Before testing as per (3.3.2) To perform the fixture, prepare, in the21%SOCWhen, according to (3.4) The Method of installing the test fixture。

sufficient/Discharge conditions:
Charge Press (4.1.2) Recommended fast charging strategy charging stand 30min，
discharge130A(1C) Constant flow discharge to2.5V，Stand still for 30min。

According to the above charging&Discharge conditions, cycle for 2000 weeks, record the cell expansion force during the cycle.

5.3.2.test result

expansibility	BOL	≤3000N
	80% SOH	≤15000N

5.4.thermodynamic parameter

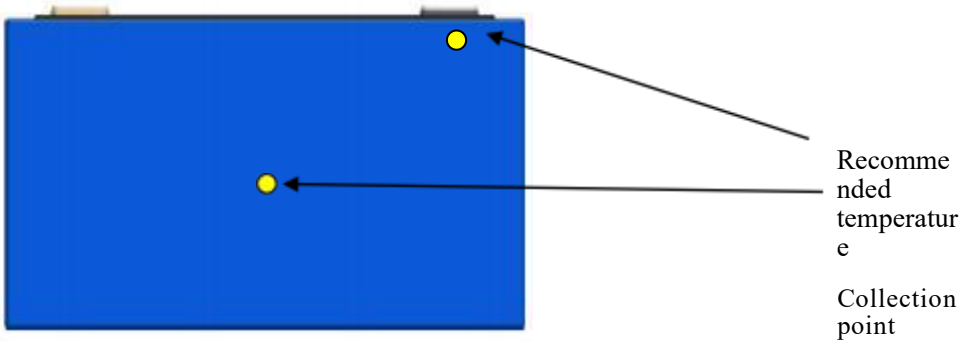
Test method: Reference standard: GB / T 10295-2008, ASTM E1269-2011

Mean of thermal conductivity	Thermal conductivity (W / m. K)	
	X/Z direction	Y direction
	15~20	1~2
Mean heat capacity	Heat capacity (kJ / (kg·K))	
	0.9~1.2	

5.5. Recommended temperature acquisition point (battery temperature field distribution)

When collecting the temperature on the battery surface, it is recommended that the temperature acquisition point be arranged at the positive pole column and the center of the large surface, as shown in the figure below.

model	A31-V1	Specification No	PBRI-A31-V1-D06-02	edition	A



6. Battery operation instructions and precautions

6.1. Product end of life management

The battery service life is limited, and the customer should establish an effective tracking system to monitor and record the internal resistance and capacity of the battery during each service life. Internal resistance and The measurement method and calculation method of the capacity require mutual discussion and agreement between the customer and Hubei Yiwei Power Co., Ltd. When the internal resistance of the battery in use exceeds the above Initial internal resistance of the battery150%Or the capacity is less than the nominal capacity80%The application of the battery should be stopped immediately. Violation of this requirement, will be exempted from Hubei Yiwei The Power Company Limited shall undertake the product quality assurance responsibility according to the Product Sales Agreement and this Specification.

6.2.long term storage

After the battery is charged, it should be used as soon as possible to avoid the loss of available capacity caused by self-discharge. If the storage is needed, the battery needs to be low SOC form

Storage is performed in the state. Recommended battery storage conditions:20%~50%SOC,0℃~25℃ ≤60%RH,

6.3.transport

The transportation of the products shall be no greater than30%SOCLower packaging into boxes. Severe vibration, impact or extrusion should be avoided during transportation The sun rain. Suitable for car, train, ship, aircraft and other transportation transportation.

6.4.operation declaration

- It is strictly prohibited to immerse the battery in water. When stored or unused, it should be placed in a cool and dry environment;
- It is forbidden to use and detain the battery beside the hot and high temperature sources, such as fire, heater, etc;
- Please choose a special charger for lithium-ion battery when charging;
- In the process of use, it is strictly prohibited to reverse the positive and negative poles of the battery;
- Do not throw the battery in a fire or in a heater;
- No metal direct short connection to the positive and negative electrodes of the battery;
- Do not transport or store batteries together with metal, such as hairpins, necklaces, etc;
- Do not knocking or throwing, trampling, or bending batteries;
- Do not weld the battery directly and puncture it with nails or other sharp tools;
- Do not use or place batteries in high temperature (under hot sunlight), otherwise it may cause battery overheating or function failure and shorten its life;
- Use in places with strong static electricity and strong magnetic fields is prohibited,Otherwise, it is easy to destroy the battery safety protection device, bringing unsafe hidden danger;
- If the battery leaks and the electrolyte enters the eyes, please do not rub it, rinse the eyes with water, and immediately send them to the doctor for treatment, otherwise it will hurt the eyes

eyeball;

- If the battery emits odor, heat, discoloration, deformation or any abnormality during use, storage or charging, remove the battery from the device or charge immediately

Appliance is removed and discontinued。

6.5.disclaimer

If the product demand unit is not used according to the provisions in this manual, it will cause a social impact and the sound of Hubei Yiwei Power Co., LTD,

,Hubei Yiwei Power Co., LTD., will hold the product demand unit responsible according to the impact on Hubei Yiwei Power Co., LTD。

Degree, the product demand unit needs to provide compensation to Hubei Yiwei Power Co., Ltd。

6.6. Other

Any matters not mentioned in this specification shall be determined by both parties through negotiation.

7.contact way

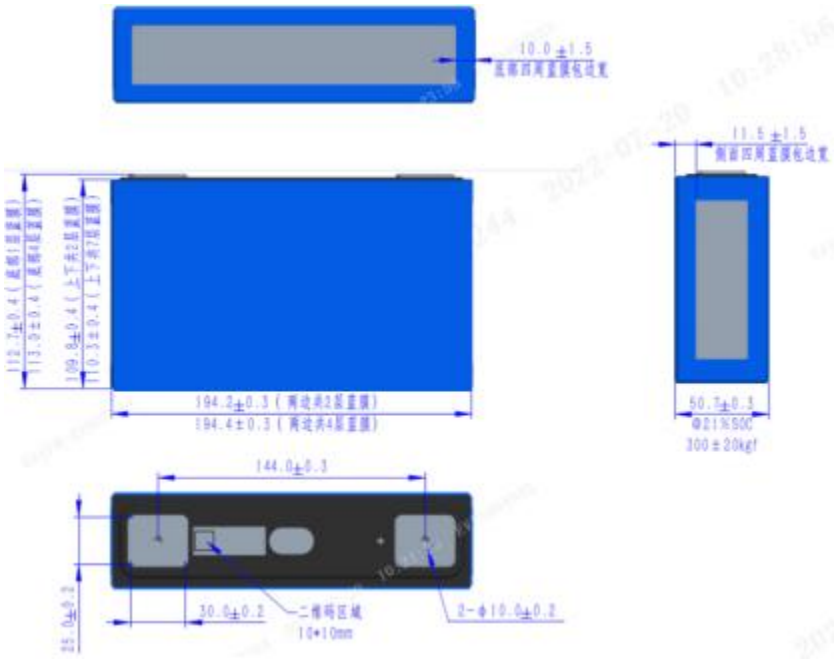
Address: Jingnan Avenue, High-tech Zone, Jingmen Economic Development Zone, Hubei Province68No., Hubei Yiwei Power Co., LTD

:Contact phone number: 86-0724-6079699

Fax: 86-0724-6079688

URL:http://www.eve battery.com

8. A31-V1Battery drawings



graph 1A31-V1 Battery Drawing (unit: mm)