EVE Energy Co., Ltd
Product Specification

File No：LF280-73103

Version：B

Effective Date：May 25th, 2018

Product	LFP Power Battery
Model	LF280
Specification	3.2V 280Ah
Draft	Hua Wang
Checked	Yousheng, Zou
Approved	Zhengzhong, Lv

Tel：0724-6079699

Fax：0724-6079688

Address： No.64, Jingnan Road, Duo Dao District,Jingmen, Hubei, China

ENERGY VERY ENDURE

Contents

History of specification

Date	Contents	Remarks
2017-10-17	First issue	A
2018-05-25	Adjust the cell size	B

1. Scope

This specification is applied to Rechargeable LFP Power Battery with aluminum shell (3.2V 280Ah) manufactured by EVE Energy Co., Ltd., in which the description and model, main performance, test conditions and precautions of the product are included.

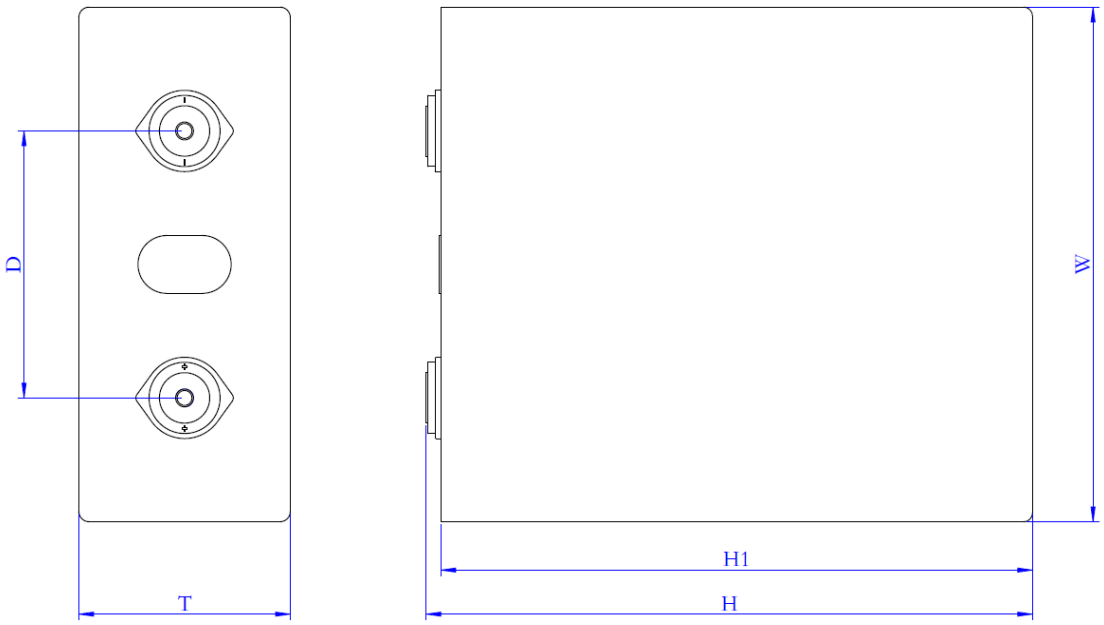
The product can be applied for Vehicle power supply, Storage system, etc.

2. Description and Model

2.1 Description: LFP Li-ion Power Battery with aluminum shell.

2.2 Model: LF280.

3. Drawing



Item	Parameter	Size
L	Width	173.6±0.3mm
W	Thi kness	71.5±0.5mm
H	High（total）	204.8±0.5mm
H1	High（subject）	200.0±0.5mm
D	Tabs Distance	90.0±0.3mm

Remark: The pole is a double aluminum pole structure. The internal screw with size M4 is used in the poles. **The anti-torsion of pole is 8Nm. The torsion should be less than 8Nm when used.** The effective thread hole depth is 6mm.

4. General Technical Parameter

#	Item		Parameter	Remark
1	Typical Capacity		285 Ah @ 1.0C discharge	Discharge current 1.0C with 2.5V cut off. (25±2)℃
2	Minimum Capacity		280.0 Ah @ 1.0C discharge	
3	Typical Voltage		3.2V	Under 0.5CA cc-discharge
4	AC Impedance Resistance		≤0.25mΩ	
5	Charge current（CC-CV）	Max Charge Current	1C	The maximum charge current of the battery does not exceed 1C under 0℃～45℃.
		Cut-off Voltage	3.65V	
6	Discharge	Max Discharge Current	1C	Preference value.
		Cut-off Voltage	2.5V	
7	Charging time	Standard	2.0h	0.5C charge (time is reference)
		Quick-charge	1.0h	1C charge (time is reference)
8	Recommend SOC Window		SOC：10%~90%	
9	Charging Temperature		0℃~55℃	See the appendix for details.
10	Discharging Temperature		-20℃~55℃	Battery can work at specified temperature range with capacity loss in tolerance.
11	Storage Temperature	One month	-20℃~45℃	
		One year	0℃~35℃	
12	Storage Humidity		＜70％	
13	Weight		5220g±50g	

5. Test conditions

5.1 Standard Test Conditions

Test should be conducted with new batteries within one month after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise defined, test stated in this specification should be conducted at temperature of 25±2℃, humidity 45~85% and Test should be performed under standard atmospheric conditions with 86KPa~106KPa pressure.

5.2 Measuring Equipment

All equipment and equipment (including test equipment and instruments for monitoring and monitoring test parameters) shall be tested or met according to the relevant national verification procedures or relevant standards and shall be valid for the period of validity. All test instruments, equipment should have sufficient accuracy and stability, the accuracy should be higher than the measured accuracy of an order of magnitude or error is less than one-third of the allowable error of the measured parameters.

5.3 Standard Charge

The standard charge means charging the cell with charge current 0.5CA and constant voltage 3.65V at (25±2)℃, 0.05C cutoff.

5.4 Standard Discharge

The standard discharge means discharging the cell with discharge current 0.5CA and cutoff voltage 2.5V at (25±2) ℃. If required, the battery can be discharged at 1.0CA constant current to a cutoff voltage of 2.5V.

6. Main Performance

6.1 Electrical performance

No.	Item	Requirements	Measuring Procedure
1	Appearance	Battery should be clearly marked without any defect such as breakage, leakage and oil pollution	
2	Normal discharge performance	Discharge capacity/nominal capacity×100％ A）0.33CA ≥100％ B）0.5CA ≥98％ C）1CA ≥97％	After standard charge and 1h rest, discharge to 2.5V cutoff with the current of 0.33C(A), 0.5C(A), 1C(A) respectively. Repeating 3 times, if the capacity is not qualified.
3	Discharge performance at different temperatures	Discharge capacity/nominal capacity×100％ A)55℃≥95% （Cutoff 2.5V） B)-20℃≥70% （Cutoff 2.0V）	Measure the initial capacity and state of the battery, after standard charge and 3h rest at 55℃, discharge to 2.5V cutoff with the current of 1.0C(A), after standard charge at 23±2℃ and 20h rest at -20℃ ±2℃, measure the termination capacity with 0.2C (A)
4	Charge Retention at RT	Capacity Retention≥95％ Capacity Recovery≥97％	Measure the initial capacity and state of the battery, after standard charge and open the circuit for 30 days, discharge to 2.5V cutoff with the current of 1.0C(A), calculate the remaining capacity, the retention can be expressed as a percentage of nominal capacity. After standard charged and 30mins rest, calculate the discharging capacity (Ah), the recovery can be expressed as a percentage of nominal capacity the recovery is measured with discharge current 1.0CA with 2.5V cut-off at (25±2) ℃.
5	cycle life	≥3500cycle	After standard charged and 30mins rest, discharge to 2.5V cutoff with the current of 1.0C(A) at (25±2) ℃, and then start the next cycle, end with the capacity decrease to 80% of the initial capacity. The number of cycles is defined as the cycle life of the battery.
6	Initial Impedance	30% SOC condition，Measure the AC 1 KHz AC impedance	≤0.25mΩ

6.2 Safety performance

No.	Item	Requirements	Measuring Procedure
1	Over Charging	No fire、No explosion	After standard charge and 1h rest at 25±5℃, charge the battery with the current of 1 CA current to 5V.
2	Over Discharge	No fire、No explosion	After standard charge and 1h rest at 25±5℃, discharge the battery with 1CA to cutoff 0V.
3	Short-Circuit Test	No fire、No explosion	After standard charge and 1h rest at 25±5℃, the battery is to be short-circuited with copper wire of a maximum resistance load 10mΩ for 10min.
4	Nail Pricking	No fire、No explosion	After standard charge , Prick through the sample battery from the perpendicular direction of the battery plate with a nail having a diameter of 3mm ~ 8 mm. Steel nail remain in panels.
5	Extrusion Test	No fire、No explosion	After standard charge and 1h rest at 25±5℃, test according to the following conditions: a) extrusion direction: perpendicular to the direction of the battery plate pressure. b) Extrusion degree: until the battery case is broken or the internal short circuit (battery voltage becomes 0V).
6	Drop Test	No fire、No explosion	After standard charge and 1h rest at 25±5℃, the battery is dropped from a height of 1.5 meter twice onto concrete floor.

7. Transportation

Battery for shipping should be packed in boxes with the condition of half charged. The Violent vibration, impact extrusion, sun and rain should be prevented during shipping. The battery is suitable for cars, trains, ships, aircraft and other transportation vehicles.

8. Storage and other matters

8.1 Long-term storage

Batteries should be stored (more than 1 month) indoor with a dry and clean environment at 0 ℃~35 ℃. Avoiding contact with corrosive substances and staying away from fire and heat source. The battery should be charged and discharged every 6 months. The voltage for storage is between 3. 0~3.3 V (30 ~ 50% SOC).

8.2 Other business

Any matters not mentioned in this specification, shall be negotiated by both parties.

9. Handling of Cells

9.1 Charging

9.1.1 Charging current

Charging current shall not exceed the maximum charging current in this specification. Otherwise it would cause the problem in charge and discharge performance, mechanical performance and safety performance, and may cause heat or leakage.

9.1.2 Charging voltage

Charging voltage shall not exceed the maximum charging current in this specification. Otherwise it would cause the problem in charge and discharge performance, mechanical performance and safety performance, and may cause heat or leakage.

9.1.3 Charging temperature

Batteries must be charged within the t ambient temperature range of 0 ℃~55℃ .

9.1.4 Forbidding reverse charge

Battery should be connected correctly. It is strictly prohibited to reverse charge. Otherwise it will cause the battery scrap and produce safe hidden trouble.

9.2 Discharge

9.2.1 Discharging current

Discharge current shall not exceed the maximum charging current in this specification; Otherwise it would cause dramatically capacity loss and overheating.

9.2.2 Discharge temperature

Batteries must be discharge within the ambient temperature range of -20 ℃~55 ℃.

9.2.3 Forbidding over-discharge

Battery management system should be installed to prevent over discharge during the usage. Over discharge will cause the battery scrap and produce safety hazard. It is necessary to state that for the battery not used for a long time, it may over discharge due to the self-discharge characteristics. To prevent the occurrence of over discharge, the battery should be regularly charge and the voltage should be remained above 2.9 V.

9.3 Battery Handling Precautions

9.3.1 Before using the battery, please read the specification and pay attention to the battery surface logo.

9.3.2 Please use the battery in a normal indoor environment, temperature: -20 ℃~55 ℃, relative humidity: 15 ~ 90%, atmospheric pressure: 86~106 Kpa.

9.3.3 During the usage, should be away from heat, fire, to avoid children playing with the battery, do not beat, fall or impact the battery.

9.3.4 The battery can only use the matching charger to charge.

9.3.5 Do not short circuit the battery at any time, otherwise it can cause serious damage to the battery and cause danger.

9.3.6 For the battery not used for a long time, please save the battery in the appropriate way, so that it is in a state of semi-charged, neither full nor finished.

9.3.7 The waste battery should be dealt with in a safe and secure way, do not throw it into fire or water.

9.3.8 Battery box design considerations

a) The battery box should have sufficient mechanical strength to prevent the internal battery from mechanical impact.

b) There should be no sharp corners in the location for placing the battery inside the box.

c) The measurements for increasing air convection, waterproof and dustproof and others are needed.

9.3.9 Connection

a) Polishing the pole with abrasive paper before use, otherwise it would cause bad contact or failure.

b) Using the specific tools, such as spanner, to connect the battery.

10. Announcement

Failure to observe the following precautions may result in battery leakage, overheating, explosion and/ or fire.

Warning!

1. Do not immerse the battery in water or allow it to get wet.
2. Do not strike, throw or subject the battery near a fire or in extremely hot conditions.
3. Charge with specified charge according to charging requirement
4. Do not reverse the positive (+) and negative (-) terminals.
5. Do not put the battery into a fire or apply direct heat to it.
6. Do not short-circuit the battery by connecting wires or other metal objects to the positive (+) and negative (-) terminals.
7. Do not ship or store the battery metal objects, such as necklaces, hairpins, etc.
8. Do not knock, throw, tread, bend, etc.
10. Do not directly solder the battery terminals or pierce the battery casing with a nail or other sharp object.

Caution!

a) Do not use or store the battery where is exposed to extremely hot, such as under window of a car in direct sunlight in a hot day. Otherwise, the battery may be overheated. This can also reduce battery performance and/or shorten service life.

b) Do not use battery in the strong electrostatic and magnetic field, otherwise probably the battery safety protection device and cause insecurity;

c) If the battery leaks and electrolyte gets your eyes, rinse the eyes with clean running water and get medical treatment immediately. Otherwise it will hurt the eyes.

d) Do not use the battery if it gives off an odor, generates heat, changes color or have any problems during usage, storage and discharging.

Appendix: battery product performance curve

Fig.1 C-rate curve

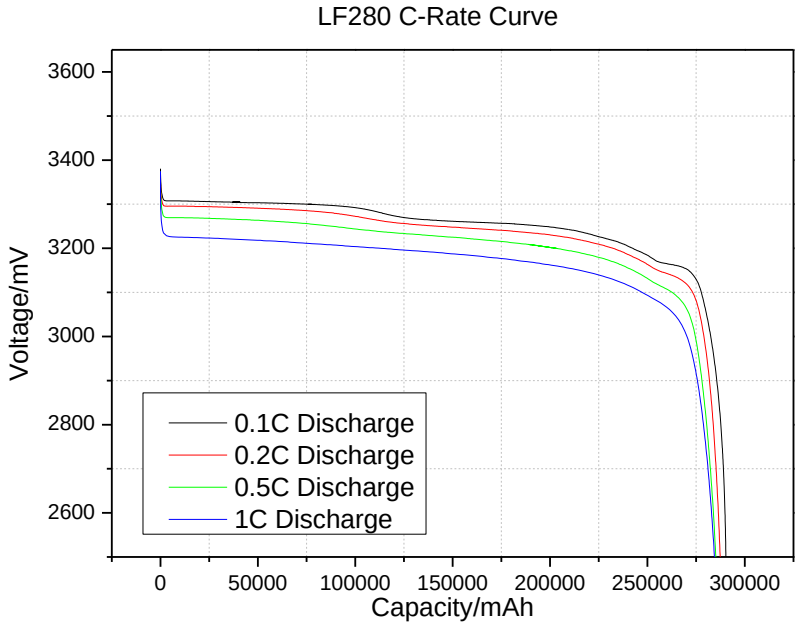


Fig.2 Different temperature discharge curve

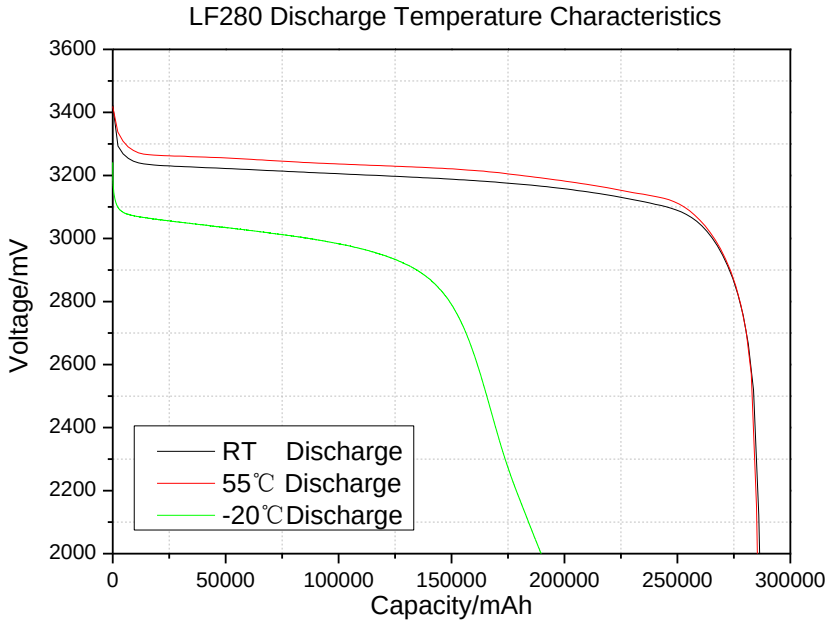
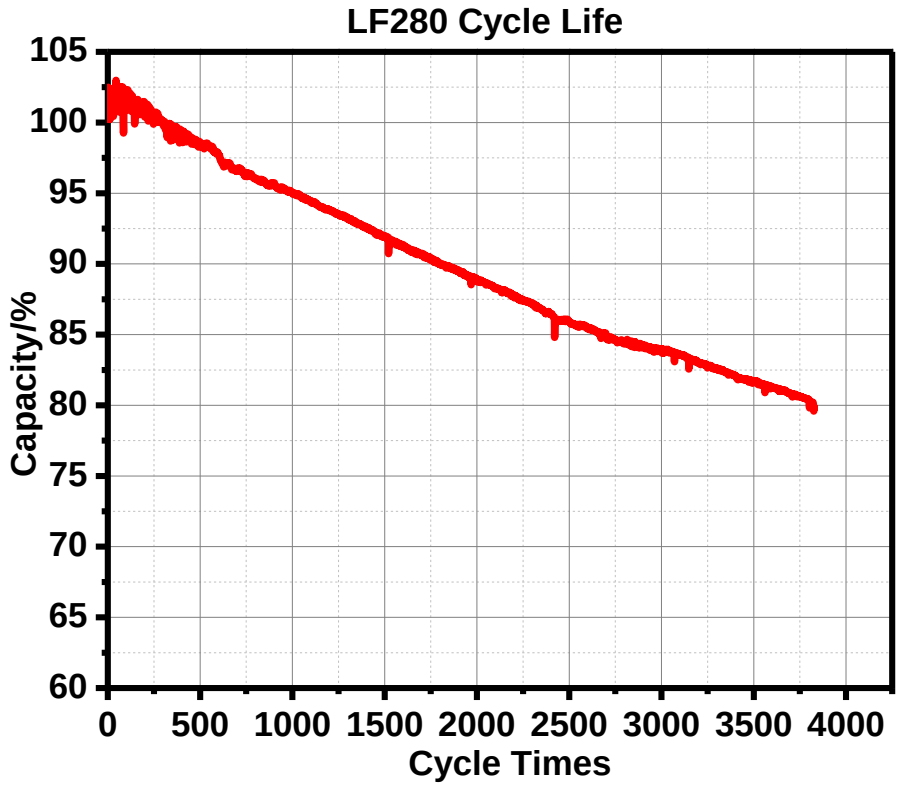


Fig.3 Cycle performance (1.0 C) curve



Tab.1 The allowable continuous charging current for the cell under different temperature

Temperature of battery	Standard charge	Fast charge	Pulse charge
<0℃	Not allowed to charge	Not allowed to charge	Not allowed to charge
0~10℃	charge to 3.60V cutoff with the current of 0.2C	Not allowed to charge	Not allowed to charge
10~45℃	charge to 3.65V cutoff with the current of 0.5C	Charge current is 1.0C	Refer to Tab. 3
45~50℃	When voltage<3.60V, charge below 0.2C		
50~55℃	When voltage<3.60V, charge below 0.1C		
>55℃	Not allowed to charge		

Note: During the charging and discharging process, the temperature of cell is not allowed to exceed 55 ℃.

Table 2 Table of the current MAP of continuous charging at different temperature and SOC conditions

SOC/%	55℃	50℃	45℃	25℃	10℃	0℃	-10℃	-20℃
100	140	140	280	280	280	84	56	56
90	140	140	280	280	280	84	56	56
80	140	140	280	280	140	84	56	56
70	280	280	280	280	140	56	56	28
60	280	280	280	280	84	56	28	28
50	280	140	280	280	84	56	28	28
40	140	140	140	140	56	28	28	28
30	84	84	84	84	56	28	28	14
20	90	84	84	84	56	28	14	0
10	84	84	56	56	28	14	0	0
0	0	0	0	0	0	0	0	0

Table 3 The permissible transient (30S) maximum charge current (Ic) of the cell at different temperature and SOC conditions

SOC(%) / Temperature	100	90	80	70	60	50	40	30	20	10	0
55℃	0	28	28	28	28	56	56	56	56	56	56
50℃	0	56	56	56	56	140	140	140	140	140	140
45℃	0	140	140	140	140	280	280	280	280	280	280
25℃	0	140	280	280	280	280	280	280	280	280	280
10℃	0	28	56	140	280	280	280	280	280	280	280
0℃	0	0	56	56	56	56	140	140	140	140	140

Table 4 The permissible transient (30S) maximum discharge current (Id)of the cell at different temperature and SOC conditions

SOC(%) / Temperature	100	90	80	70	60	50	40	30	20	10	0
55℃	280	280	280	280	280	280	280	280	280	280	0
25℃	280	280	280	280	280	280	280	280	280	280	0
10℃	280	280	280	280	280	280	280	280	56	56	0
0℃	280	280	280	280	280	280	140	140	140	140	0
-10℃	280	280	280	280	140	140	140	140	140	0	0
-20℃	140	140	140	140	84	84	84	28	28	0	0