

Specification for Lithium-ion Battery Pack

Pack Model: 4S1P-12.8V-100Ah

No.: 91410370

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1 Scope

This specification applied to the lithium-ion battery pack, it's the basis of production and test, and it can make customer to learn about the parameter and how to use this battery in a right way.

2 Test Condition

2.1 Test Environmental Condition

All the tests mentioned as above should be under the standard Test Conditions unless the other regulation.

Temperature: 15°C~35°C

Relative Humidity: 45%~75%

Air Pressure: 86kPa~106kPa

Requirement of Facility and Equipment

The precision of the voltage meter should be no less than 0.5 grades. And the inner-resistance should be no less 10KΩ/V

The precision of the current voltage meter should be no less than 0.5 grades.

The relative tolerance of the time meter should be $\pm 0.1\%$.

The relative tolerance of the temperature meter should be $\pm 0.5\%$.

3 Pack

3.1 Specification

Item	Parameter	Remarks
Nominal Capacity	104Ah	0.2C di scharge
Min. Capacity	100Ah	
Nominal Voltage	12.8V	
Internal Impedance	$\leq 150\text{m}\Omega$	AC 1kHz
Combination Mode	4S1P	
Charging Mode	CC/CV	
Standard Charging Current	0.2C	
Max. Charging Current	$\leq 100\text{A}$	

Standard Discharging Current	0.2C	
Max. Discharging Current	≤100A	
Limited Charging Voltage	14.6V	
Discharging Cut-off Voltage	10.8V	
Shi ppi ng Voltage	12V~12.8V	
Weight	11kg±0.5	
Charging Temperature	0°C ~ + 45°C	
Discharging Temperature	-20°C ~ + 60°C	
Storage Temperature	1 month : -20~60°C 3 months : -10~40°C 1 year : -5~20°C	
Relative Humidity	45%~85% RH	

3.2 Nominal Characteristics

Item	Test Methods	Criteria
Standard Charge	Temperature condition (25±2)°C, charging the battery at a 0.2C current until the voltage up to 14.6V, holding this voltage till the final charging current is less than 0.02C. Test finished.	Charging time is less than 8 hours
Rated Capacity	Temperature condition (23±2)°C. Charging it till full capacity and standing 0.5h. Then discharging by 0.2C current until the battery voltage down to 10V. Test finished and record the capacity.	More than the min. capacity
Internal Impedance	Uses AC the 1kHz examination method	Refer to 3.1
Power holding	After standard charged, battery shall be stored in a temperature-controlled environment at 25±2°C for 28 days. After storage, battery shall be discharged with 0.2C to cut-off voltage. Measure the remain capacity and record the discharge time.	More than 85% of standard capacity
Cycle life	Temperature condition 25±2°C, charge it till full and stand for 0.5h, then discharge at 0.2C constant current till cut-off voltage. After 0.5h, do it again till the capacity is less than 80% origin twice in a row.	Cycle times ≥ 500

3.3 Safety Characteristic

Item	Test Method	Criteria
External normal temperature shortage	<p>After the battery is fully charged, place it at the temperature of 25 ° C ±2 ° C. When the temperature of the battery reaches 25 ° C ±2 ° C, connect the positive and negative extremes of the battery with a wire and ensure that all external resistances are 80±20 milliohms (the temperature coefficient of the resistivity of the wire is less than 5*10-3/°C) for 30min. When the following two situations occur, The experiment was terminated: a) the battery temperature dropped to 20% lower than the peak, and b) the short-connection time reached 24H.</p>	<p>Non-explosive, non-fire, and the maximum temperature should not exceed 150°C</p>
High Temperature external shortage	<p>After the battery is fully charged, place it at the temperature of 55 ° C ±5 ° C. When the temperature of the battery reaches 55 ° C ±5 ° C, connect the positive and negative extremes of the battery with a wire and ensure that all external resistances are 80±20 milliohms (the temperature coefficient of the resistivity of the wire is less than 5*10-3/°C) for 30min. When the following two situations occur, The experiment was terminated: a) the battery temperature dropped to 20% lower than the peak, and b) the short-connection time reached 24H.</p>	<p>Non-explosive, non-fire, and the maximum temperature should not exceed 150°C</p>
Combustion injection	<p>After the battery is fully charged, the battery is placed on the wire mesh of the experimental tooling. a single metal wire is required to fix the sample battery on the wire mesh, and the battery is heated with a flame. The heating can be stopped when the following three conditions occur: a) The battery explodes; b) complete combustion of the battery; c) After continuous heating for 30min, the battery does not catch fire or explode.</p>	<p>Components of the battery (other than dust products) or battery products shall not penetrate the aluminum mesh</p>

<p>Over charge</p>	<p>Single cell (excluding protection board circuit), under the ambient temperature of $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ at 0.2C constant current to the termination voltage, then set the constant current of 3C, the voltage of 3.65V, until the voltage reaches the maximum value, the battery charging time reaches 7 hours, the battery temperature drops to 20% lower than the peak.</p>	<p>Non explosive and non-fire</p>
<p>Acceleration impact</p>	<p>After the battery was fully charged, the battery was fixed on the impact platform, and the half-sinusoidal impulse impact experiment was carried out. In the first 3ms, the minimum average acceleration was 75gm, the peak acceleration was $150\pm 25\text{gm}$, and the pulse duration was $6\text{ms}\pm 1\text{ms}$. Three times of acceleration impact were carried out successively in three perpendicular directions of the battery.</p>	<p>The battery should not explode, not fire, not crack, not smoke, not leakage and not deflated</p>
<p>Heat abuse</p>	<p>After the battery is fully charged, it is placed in a hot box, where the temperature rises to $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$ at the rate of $(5^{\circ}\text{C}\pm 2^{\circ}\text{C})/\text{min}$ and is kept warm for 30min.</p>	<p>The battery should not explode or catch fire</p>
<p>Temperature cycle</p>	<p>After the battery is fully charged according to the standard charge, the battery is placed in a temperature control chamber with a temperature of $(25\pm 2)^{\circ}\text{C}$ for the following steps: (1) The sample is placed in an experimental chamber with a temperature of $75^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for 6H; (2) Reduce the temperature of the test chamber to $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$ and keep it for 6H; (3) The conversion time of the above temperatures does not exceed 30min; (4) Repeat steps 1-2 for a total of 10 cycles.</p>	<p>Battery does not leak, do not deflate do not explode, do not fire and do not crack</p>

<p>Forced Discharge</p>	<p>When the ambient temperature is $(25\pm 2)^{\circ}\text{C}$, discharge the battery at 0.2C to the termination voltage, and then reverse charge the battery at 1C. The charging time is required to be no less than 90 minutes.</p>	<p>The battery shall not catch fire or explode</p>
<p>Over-Voltage charge</p>	<p>After the battery is fully charged, continue to charge with the maximum charging current constant current to $n*6.0\text{V}$ or the highest voltage that can be borne (whichever is higher), and maintain the voltage for constant voltage charging. Charge the battery with the protection circuit removed or without the protection circuit for 1H, and charge the battery with the protection circuit to the protection board circuit.</p>	<p>Battery should not leak, not deflated, not explosion, not fire</p>
<p>Over-Current charge</p>	<p>After the battery discharge, then with 1.5 times the overcurrent charging protection current (1.5C) for constant current charging, for the battery with removed protection circuit or no protection circuit to charge to the upper voltage, for the battery with protection circuit to charge to the protection board circuit action.</p>	<p>Battery should not leak, do not deflate, do not explode, do not fire</p>
<p>Under-Voltage discharge</p>	<p>After the battery is fully charged, the maximum discharge current is used to discharge electricity to $(n*0.15)\text{V}$ for the battery with or without the protection circuit, and charge the battery with the protection circuit to the protection plate circuit. Let it sit for 10 minutes after discharge and continue to be fully charged as per standard.</p>	<p>Battery should not leak, do not deflate, do not explode, do not fire</p>
<p>Over-load</p>	<p>After the battery is fully charged, and then with 1.5 times the overdischarge electric protection current (1.5C) for constant current discharge, and remove the protection circuit or no protection circuit of the battery discharge to discharge cut-off voltage, and with the protection circuit of the battery charging to the protection board circuit action.</p>	<p>Battery should not leak, do not deflate, do not explode, do not fire</p>

3.4 Environment accommodation

Item	Test method	Criteria
<p>High Temperature Usage</p>	<p>Put full charge battery in high temperature box with a temperature which is the maximum of charge upper temperature, discharge upper temperature and 80°C, after temperature stabilized, keep 7H.</p>	<p>No explosion、fire、fume and leakage.</p>
<p>Vibration</p>	<p>A cell is charged and then installed onto the vibration desk with clamps. Vibrated by sine wave, equipment parameters of frequency and amplitude are as follows (the frequency is to be varied from 7Hz to 200 Hz in 15min. The cell is to be tested in three mutually perpendicular directions, each direction repeats 12 times, vibrate 3H). In the method of:7Hz to 18Hz keep 9.8 mm/s² peak accelerated speed, amplitude is 0.8mm to peak accelerated speed is 78.4mm/s² (frequency is about 50Hz), keep the speed until frequency is 200Hz.</p>	<p>No explosion、fire、fume and leakage.</p>

Free Fall	After rapid charged, a cell is dropped from a height of 1000mm to a wooden board which is placed on the concrete ground. Cells shall be dropped in each of three mutually perpendicular directions. Total drop Times are 6. (More than 1000mAh, height is 1000mm, lower than 1000mAh, height is 1500mm) .	No Leakage explosion and fire
Low Air pressure	After rapid battery charging or standard charging, the sample was placed in an empty chamber at (25±2) °C. After the empty chamber was closed, the internal pressure was gradually reduced to no more than 11.6kPa(simulated altitude 15240m) and maintained for 6H.	No explosion, fire, fume and leakage.

4 Components

4.1 Cell

Manufacturer	Depends	Type	3.2V 100Ah LiFePO4
Rated Capacity	104Ah	Rated Volt	3.2V
Internal Impedance	<1.2mΩ	Upper charge voltage	3.65V
Weight	1909g ± 50g	Discharge Cut-off Voltage	2.5V

4.2 B M S Specification

function	project	specifications			unit
		least value	representative value	crest value	
Single overpressure protection	Overpressure protects voltage	3.70	3.75	3.80	V
	Overcharge protection delay time	1000	2000	3000	mS
	Overcharge protection recovery voltage	3.55	3.60	3.65	V
Single over-release protection	Overdischarge protection voltage	2.10	2.20	2.30	V
	Overrelease protection delay time	1000	2000	3000	mS
	Overput protection recovery voltage	2.50	2.60	2.70	V
	Recovery conditions for overrelease protection	Voltage self-recovery or charge recovery			
Charging over-current protection	Charge the overcurrent protection value	105	110	115	A
	Charge over time delay	7	10	13	S
	Charging and overcurrent release conditions	Delayed for 32S, and then automatically recovered			
Discharge overcurrent protection	Primary discharge of overcurrent protection current	105	110	115	A
	Primary discharge over1 protection delay	7	10	13	S
	Secondary discharge over-current protection current value	300	320	340	A
	Secondary discharge overcurrent 2 protection delay	150	320	500	mS
	Discharge and overcurrent protection and recovery conditions	Delayed for 32S, and then automatically recovered			

short-circuit protection	circuit				
	Short-circuit protection delay time	-	600	900	uS
	Short circuit protection recovery	Delay of 5S recovery after disconnecting the load.			
	Short circuit instructions	Short circuit description: the short circuit current is less than the minimum value or high At the maximum value may cause a short circuit protection failure, short circuit Current over 2000A, not guaranteed with short circuit protection, also Short-circuit protection test is not recommended.			
Discharge high temperature protection (outlay)	Temperature protection value	70	75	80	℃
	Temperature protection release value	60	65	70	℃
Discharge low temperature protection (outlay)	Temperature protection value	-25	-20	-15	℃
	Temperature protection release value	-15	-10	-5	℃
Charging high temperature protection	Temperature protection value	60	65	70	℃



(outlay)	Temperature protection release value	50	55	60	℃
Charging temperature protection (external) (with heating)	Temperature protection value	-5	0	5	℃
	Temperature protection release value	0	5	10	℃
FET discharge heat protection (built-in curing)	Temperature protection value	85	90	95	℃
	Temperature protection release value	50	65	80	℃
Balanced function	cut-in voltage	3.25	3.30	3.35	V
	Turn on the pressure difference		15		mV
	equalizing current	150		250	mA
	Balanced way	static equilibrium			
	Balanced type	Time-sharing equilibrium \ pulse equilibrium			

5 Package、Storage、Shipping

5.1 Package

- 1) The packaging box containing battery products should be placed in a dry, dustproof and moisture-proof packing box.
- 2) Packing diagram



5.2 Storage

- 1) Products should be stored in dry, ventilated, rain and snow proof indoor, should not be stored together with active chemicals or dust, box should be properly padded, not less than 100mm away from the ground.
- 2) Products should avoid direct sunlight, away from the heat source (heating equipment, etc.) should not be less than 2m.
- 3) The product should not be upside down or lying down, and should not be subjected to any mechanical impact or pressure.
- 4) The battery or battery pack should be stored or transported under the condition that the charge does not exceed 30% to 50% and the ambient temperature is 5°C to 35°C.

5.3 Shipping

1)

In the transportation process, the product should not be subjected to severe mechanical impact, exposure to the sun, rain, should not be inverted.

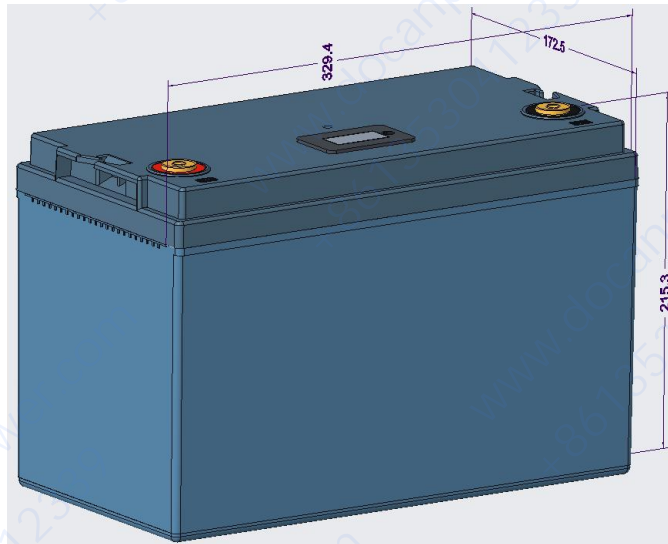
2)

In the process of loading and unloading the product should be handled lightly to prevent throwing, rolling and heavy pressure

6 Dimensions and Connector Description

Dimension: 329.34*172.5*215.3mm Units: mm

Connector: M8 screw, red positive, black negative.



7 Description of Usage and Notes

7.1 Description of Usage

1. Before using the battery, please read the instruction manual and the battery surface label carefully. 2. Please use batteries in a normal indoor environment. Temperature: $-20 \sim +35^{\circ}\text{C}$, relative humidity: $55 \pm 20\%$.

3. During use, keep away from heat source and high pressure to avoid children playing with the battery. Do not break the battery. This battery can only be charged using the accompanying charger. Don't leave the battery in the charger for more than 24 hours.

4. Do not short circuit the positive and negative terminals of the battery, do not disassemble the battery, and do not let the battery damp, so as to avoid danger.

5. If not used for a long time, please store the battery in good condition. Leave the battery half charged. Wrap batteries with non-conductive materials to avoid direct metal contact, which may cause battery damage. Store the battery in a cool, dry place.

6. Dispose of waste batteries safely and properly. Do not put them into fire or liquid.

7.2 Notes

*Please do not use the battery in the environment of strong sunlight, so as to avoid heat, deformation and smoke. At least avoid battery performance degradation and reduced life

*The battery is equipped with a protective circuit to avoid all kinds of accidents.

*Do not use batteries in places where static electricity is generated.

*High voltage static electricity may damage the protection board and cause the battery to work improperly, heat, deformation, smoke, or fire.

*The recommended charging temperature range is $0-45^{\circ}\text{C}$. Charging in an environment beyond this range may degrade battery performance and reduce battery life.

*Before using the battery, please read the manual carefully and read it as often as necessary.

*Please use the special charger and the recommended charging method to charge the battery under the recommended environmental conditions.

*When using the battery for the first time, if the battery is found to be untidy, smelly and other abnormal phenomena, do not continue to use the battery, the battery should be returned to the seller.

*Children should be guided by their parents before using batteries, and supervised to see if they are correct in use.

*Batteries should be placed where children cannot get to them.

Avoid children taking the battery out of the charger and playing with it.

If your skin or clothing comes into contact with the battery leakage, rinse with clean water to avoid skin discomfort.

*When purchasing batteries, please pay attention to the seller's contact method. In order to timely contact with the seller when needed, get consultation.

*The warranty period is twelve months from the date of delivery. However, the use of improper rather than quality problems, even in the warranty period manufacturers will not be free to replace the new battery.

*If the battery is used for other devices, please discuss with the supplier about the completeness of the protection function. At the very least, you should consult the battery's high current, fast charging, special use problems.

7.3 Warnings

Do not mix with other types of primary or secondary batteries, otherwise it will cause heat, smoke, deformation or combustion of the battery due to abnormal charging and discharging.

Keep batteries out of reach of children to prevent them from biting or swallowing them. If you swallow a battery, get it to the hospital quickly.

If the charger is still charging for a long time after the normal charging time, it should stop charging. Improper charging may cause the battery to heat, smoke, distort, or burn.

Do not place in the microwave oven or other pressure vessels, instant heating or structural damage will make the battery heat, smoke, deformation or combustion.

If battery leakage (or odor) is found, keep the battery away from the fire. Otherwise, the leaking electrolyte will catch fire and even cause other dangers.

If the battery is found to be smelly, deformed, discolored or distorted, leave the battery away from the phone or charger and discard it. Using an abnormal battery can heat, smoke, distort, or burn.