



# Battery Specification Approval Sheet



Cell Model

**LiFePO4-9070220**

PACK Capacity (Ah)

**12**

Model nubber

**5S1P 16V12Ah-PCM**

Total Page

**10**

Registered	Checked	Approve

Customer Approve		
Dept.	Signature	Date
QA Dept.		
R&D Dept.		
Approved		



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**1. Scope**

Following battery group is suitable for UPS/Field Power Supplying, E-bike, E-motor etc.

**2. Battery group specifications**

Cell	Model	12Ah-9070220	
	Capacity (0.5C)	≥12Ah	
	Rated Voltage (V)	3.2V	
	Typical Impedance (mΩ)	≤5mΩ	
	Battery Material	LiFePO4	
PACK	Combination Method	1P5S	
	Minimal Capacity (0.5C)	12Ah	
	Nominal Voltage	16V	
	Max. Charge Voltage	18.25V	
	Discharge Cut-Off Voltage	≤12V	
	Max Charge Current	12A	
	Max Working Current	12A	
	Pack Impedance Standard	≤45mΩ	
	Weight (Approx.)	≤2kg	
	Max. Dimension (L×W×H) (mm)	73*50*250	
	Operating Temperature	Charge Temperature	0°C~45°C
		Discharge Temperature	-10°C~55°C
	Single Cell Over-Charge Cut-Off Voltage	3.85V	
	Over-Charge Release Voltage	3.65V	
	Single Cell Ender-Discharge Cut-Off Voltage	2.3V	
	Discharge Release Voltage	2.5V	
	Over-Discharge Cut-Off Current	30A	
	Over-Discharge Cut-Off Current Delay	1.5S	
	Short-Circuit Protection	YES	
	Short-Circuit Protection Delay	500uS	
	Condition for the Recovery of Over-Current and Short-circuit	Automatic after removing load	
	Balance Current	45mA	
	Balance Condition	3.60V	



**3. Battery Pack Performance**

Items	Test Methods	Acceptance criteria
3.1 Discharge Capacity at -10 °C	<p>Step 1 - The battery should be charged in accordance with 6.1.</p> <p>Step 2 - The battery should be stored, in an ambient temperature of <math>-10\text{ °C} \pm 2\text{ °C}</math>, for no less than 16 hr. and not more than 24 hrs.</p> <p>Step 3 - The battery may discharge, in an ambient temperature of <math>-10\text{ °C} \pm 2\text{ °C}</math>, at a constant current of 0.5 C, until its voltage is equal to the specified end-of-discharge voltage.</p>	<p>Discharge Capacity/Nominal Capacity<math>\times 100\%</math>)</p> <p>0.5C: <math>\geq 70\%</math></p>
3.2 Discharge Capacity at 55 °C	<p>Step 1 - The battery should be charged in accordance with 6.1.</p> <p>Step 2 - The battery should be stored, in an ambient temperature of <math>55\text{ °C} \pm 2\text{ °C}</math>.</p> <p>Step 3 - The battery should be discharge, in an ambient temperature of <math>55\text{ °C} \pm 2\text{ °C}</math>, at a constant current of 0.5 C, until its voltage is equal to the specified end-of-discharge voltage.</p>	<p>0.5C: <math>\geq 95\%</math></p>
3.3 High Rate Discharge Performance at 20 °C	<p>Step 1 - The cell or battery should be charged in accordance with 6.1.</p> <p>Step 2 - The cell or battery should be stored, in an ambient temperature of <math>20\text{ °C} \pm 5\text{ °C}</math>, for not less than 1 hr. and not more than 4 hr.</p> <p>Step 3 - The cell or battery should be discharged, in an ambient temperature of <math>20\text{ °C} \pm 5\text{ °C}</math>, at a constant current of 0.5C/ 1.0 C, until its voltage is equal to the specified end-of-discharge voltage.</p>	<p>0.5C: <math>\geq 100\%</math></p> <p>1C :<math>\geq 98\%</math></p>
3.4 Charge Retention and Recovery	<p>Step 1 - The battery should be charged in accordance with 6.1.</p> <p>Step 2 - The battery should be stored in an ambient temperature of <math>20\text{ °C} \pm 5\text{ °C}</math>, for 28 days.</p> <p>Step 3 - The battery should be discharged, in an ambient temperature of <math>20\text{ °C} \pm 5\text{ °C}</math>, at a constant current of 0.5 C, until its voltage is equal to the specified end-of-discharge voltage.</p>	<p>0.5C: <math>\geq 95\%</math></p>



	<p>Step 4 - The battery should be charged in accordance with 6.1, within 24 hr. following the discharge of step 3.</p> <p>Step 5 - The cell or battery should be stored, in an ambient temperature of 20 °C ± 5 °C, for no less than 1 hr. and not more than 4 hr.</p> <p>Step 6 - The cell or battery should be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0.5 C, until its voltage is equal to the specified end-of-discharge voltage.</p>	
<p>3.5 Charge Recovery after Storage</p>	<p>Step 1 - The battery shall be charged in accordance with 6.1.</p> <p>Step 2 - The battery should be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0.5 C, for 60 min.</p> <p>Step 3 - The battery should be stored in an ambient temperature of 20 °C ± 2 °C, for 90 days.</p> <p>Step 4 - The battery should be charged, in an ambient temperature of 20 °C ± 5 °C, in accordance with 6.1.</p> <p>Step 5 - The battery should be stored, in an ambient temperature of 20 °C ± 5 °C, for not less than 1 hr. and not more than 4 hr.</p> <p>Step 6 - The battery should be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0.5 C, until its voltage is equal to the specified end-of-discharge voltage. Step 7 - Charge-discharge cycle may be repeated up to four additional times, as necessary to satisfy the requirement.</p>	<p>0.5C: ≥95%</p>
<p>3.6 Endurance in Cycles</p>	<p>Step 1 - The battery should be charged in accordance with 6.1.</p> <p>Step 2 - The battery should be stored in an ambient temperature of 20 °C ± 2 °C, for 30 min.</p> <p>Step 3 - The battery should be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0.3 C, until its voltage is equal to the specified end-of-discharge voltage.</p> <p>Step 4 - The battery should be stored in an ambient temperature of 20 °C ± 2 °C, for 30 min.</p> <p>Step 5 - Repeat step 1 to 4, until the capacity of the battery is less than 80% of its rated capacity.</p>	<p>≥ 1500cycle</p>



**4. Environmental Function**

Items	Test Methods	Acceptance criteria
<p>4.1 Temperature Cycling</p>	<p>Fully charged batteries are subjected to temperature cycling (- 20°C~+75°C) in forced draught chambers, according to the following procedure.</p> <p>Step 1 - Place the battery in an ambient temperature of 75°C ± 2°C for 4 hr.</p> <p>Step 2 - Change the ambient temperature to 20°C ± 5°C with in 30 min and maintain at this temperature for a minimum of 2 hr.</p> <p>Step 3 - Change the ambient temperature to 20°C± 2°C within 30 min and maintain at this temperature for 4 hr.</p> <p>Step 4 - Change the ambient temperature to 20°C± 5°C within 30 min and maintain at this temperature for a minimum of 2 hr.</p> <p>Step 5 - Repeat steps 1 to 4 for four cycles. After the fifth cycle, store the battery for seven days prior to examination.</p>	<p>No fire, No explosion, No leakage</p>
<p>4.2 Vibration</p>	<p>Fully charged batteries are vibration-tested under the following test conditions.</p> <p>Simple harmonic motion is applied to the battery with amplitude of 0.76mm, and a total maximum excursion of 1.52mm. The frequency is varied at the rate of 1 Hz/min between the limits of 10 Hz and 55 Hz. The entire range of frequencies (10 Hz to 55 Hz) and return (55 Hz to 10 Hz) is traversed in 90 min ± 5 min for each mounting position (direction of vibration). The vibration is applied in each of three mutually perpendicular directions, in the sequence specified below.</p> <p>Step 1 - Verify that the measured voltage is typical of the charged product being tested.</p> <p>Steps 2 – 4 - Apply the vibration as specified in table.</p> <p>Step 5 - Rest battery for 1 hr. then make a visual inspection.</p>	<p>No fire, No explosion, No leakage</p>
	<p>Each is fully charged and is placed in a vacuum</p>	



4.3 Low pressure	chamber in an ambient temperature of 20 °C± 5 °C. Once the chamber has been sealed, its internal pressure is gradually reduced to a pressure equal to or less than 11.6 kPa held at that value for 6 hr.	No fire, No explosion, No leakage
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**5. Cell Safety Tests**

5.1 External Short Circuit	Fully charged batteries are stored in an ambient temperature of 20°C±5C, battery is then short-circuited by connecting the positive and negative terminals with a total external resistance of less than 5mΩ. The batteries remain on test for 10Min.	No fire, No explosion, No leakage
5.2 Free Fall	Each fully charged battery is dropped three times from a height of 1.0 m onto a concrete floor. The batteries are dropped so as to obtain impacts in random orientations.	No fire, No explosion
5.3 Mechanical Shock	The fully charged battery is secured to the testing machine by means of a rigid mount which will support all mounting surfaces of the battery. The battery is subjected to a total of three shocks of equal magnitude. The shocks are applied in each of three mutually perpendicular directions. At least one of them shall be perpendicular to a flat face. For each shock the battery is accelerated in such a manner that during the initial milliseconds the minimum average acceleration is 75 g <sub>n</sub> . The peak acceleration shall be between 125 g <sub>n</sub> and 175 g <sub>n</sub> . The batter is tested in an ambient temperature of 20 °C ± 5 °C.	No fire, No explosion, No leakage
5.4 Thermal Abuse	Each fully charged cell, stabilized at room temperature is placed in a gravity or circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2 °C/min to a temperature of 130°C ± 2°C. The cell remains at this temperature for 10 min before the test is discontinued.	No fire, No explosion, No leakage
5.5 Crushing of Cells	Put the fully charged single cell in the condition of 20°C±5°C. Extrusion direction: Pressure on the direction of perpendicular to the battery plate Extrusion size: not less than 20 c m <sup>2</sup> . Extrusion Level: until the battery case rupture or the internal circuit (battery voltage is 0V).	No fire, No explosion



5.6 Overcharge	The cell is discharged with 0.5 C to the end-of-discharge voltage, then charged from a power supply of 5 V, at the charging current 0.2 C for 12.5 hr.	No fire, No explosion, No leakage
5.7 Forced Discharge	20°C±5°C, 0.5C discharge. If it has electronic protection circuits, the electronic discharge protection circuit should be temporarily removed. The test ends when a single battery voltage reaches 0V.	No fire, No explosion, No leakage
5.8	Prong it by direction of perpendicular to the battery, with φ3mm-φ8mm high thermal resistant needle by the speed of 10mm/s-40mm/s. The steel needle stays on top of the battery.	No fire, No explosion, No leakage

**6. Test Conditions**

Unless otherwise stated, all tests that are described in this clause shall be performed in still air.

**6.1 Charge procedure**

Prior to charging, the battery should be discharged at 20 °C ± 5 °C at a constant current of 0.5 C, down to the specified end-of-discharge voltage. Unless otherwise stated, the battery should be charged at constant current 0.2 C and limited volt at 3.60V\*N, then end until the current is down to 0.02 C.

**6.2 Ambient**

Temperature: 20±5°C

Humidity: 25-85 % RH

Air pressure: 86KPa~106 kPa

**7. Storage and Others**

**7.1 Long Time Storage**

If the cell is stored for longer than three months, the cell should be stored in a dry and cool place. The cell should be charged and discharged every six months.

**7.2 Others**

Any matters that this specification does not cover should be covered between the customer and factory/supplier.

**8. Warranty Period& Product Liability**

8.1 Warranty period begins from the delivery date, and is exclusively made in the sale contract.

8.2 The factory and Supplier will not be responsible for any accidents caused by not following the precaution methods or directions.

8.3 If problems arise; not caused by our production process, but due to customer’s negligence or improper usage, factory and supplier will not be responsible for any replacements.

8.4 Specification subject to change without notice.

**9. Caution**

9.1 Do not dismantle, open or shred the battery.

9.2 Do not expose battery to heat or fire. Avoid storage in direct sun light.

9.3 Do not short-circuit the battery. Do not store battery haphazardly in a box or drawer where they may





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be short-circuited by other metal objects.

9.4 Do not confuse using the charge socket and discharge socket, or accidents may occurred.

9.5 Do not subject battery to mechanical shock.

9.6 In the event of a cell leak, do not allow the liquid to come in contact with skin or eyes. If contact has been made, wash the affected area with copious amounts of water and immediately seek medical advice.

9.7 Observe the plus (+) and minus (-) marks on the battery and equipment to ensure correct use.

9.8 Keep battery out of the reach of children.

9.9 Keep battery clean and dry.

9.10 Wipe the battery terminals with a clean dry cloth if they become dirty.

9.11 Battery needs to be fully charged before use. Always use the correct charger and refer to the manufacturer's instructions or equipment manual for proper charging instructions.

9.12 Do not leave the battery on prolonged charge when not in use.

9.13 After extended periods of storage, it is necessary to charge and discharge the battery several times to obtain maximum performance.

9.14 The battery gives its best performance when it is operated at normal room temperature ( $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ).

9.15 Retain the original product literature for future reference.

9.16 Use only the battery in the application for which it was intended.

9.17 When possible, remove the battery from the equipment when not in use.

9.18 Dispose of the battery properly.

9.19 Cells used as E-motor or storage power should be matched with controller or related equipment. The battery piles are matched with a protection board, you cannot drive the pure inductance equipment otherwise you could damage the whole system.

#### **10. Free-Responsibility Declaration**

Before using the battery, please read the specifications, usage instruction and carefully learn its application method and areas. In the event that the user creates a wrong circuit connection, we are not responsible for battery replacement.

#### **11. Appendix**

##### 11.1 Battery Group dimensions

