PHET

Lithium Ion ($LiFePO_4$) Secondary Cell Delivery Specification Product Model: IFR13N0-PE1150

To ： _____

PHET

President Office	Sales Division	QA Division	RD Division

Customer

1 Application Range

This specification is applied to PHET's lithium ion ($LiFePO_4$) cell and used as series and parallel cell pack's power supply for power bank or likewise application.

2 General Specification

2-1	Type	Cylindrical
2-2	Model	IFR13N0-PE1150
2-3	Rate Capacity	Typical: 1100mAh in std charging/discharging
2-4	Nominal Voltage	3.2 – 3.3 V
2-5	Internal Resistance	< 39m□
2-6	Weight	<41g
2-7	Standard Charging	3.65V, 0.5CmA(550mA) – 3CmA(3300mA), 10mA cutoff (23□) (Constant Current, Constant Voltage)
2-8	Quick Charging	3.65V, 4CmA(4400mA),10mA cutoff (23□) (Constant Current, Constant Voltage)
2-9	Charging Voltage	3.65V±0.05V
2-10	Standard Discharging	4CmA(4400mA), 23□ (Constant Current)
2-11	Quick Discharging	10CmA(11000mA), 23□ (Constant Current)
2-12	STD Discharge Cutoff Voltage	2.00V±0.10V. Based on the discharge C-rate, can be lower to 1.80±0.10V.
2-13	Temperature and Humidity Range	0~45□,45~85%RH (in Std. Charging) 10~45□,45~85%RH (in Quick Charging) -20~60□,45~85%RH (in Std. Discharging)
2-14	Storage Temperature and Humidity Range	-20~35□,45~85%RH (within 1 Year) -20~40□,45~85%RH (within 6 Month) -20~45□,45~85%RH (within 1 Month) -20~50□,45~85%RH (within 1 Week)
2-15	Cycle Life-1 (Single cell)	0.5C Charging, 4C Discharging Cycle Life >1000cycle (80%)
2-16	Cycle Life-2 (Single cell)	0.5C Charging, 10C Discharging Cycle Life >500cycle (70%)
2-17	Warranty	Regarding the warranty, it is up to 3 years stand-by warrant for the single cell before packing.
2-18	Energy Density	Gravimetric: 87 Wh/kg Volumetric: 216 Wh/l

PHET reserves the right to change spec. without prior notice.

3 Appearance and Dimensions

3.1 Appearance

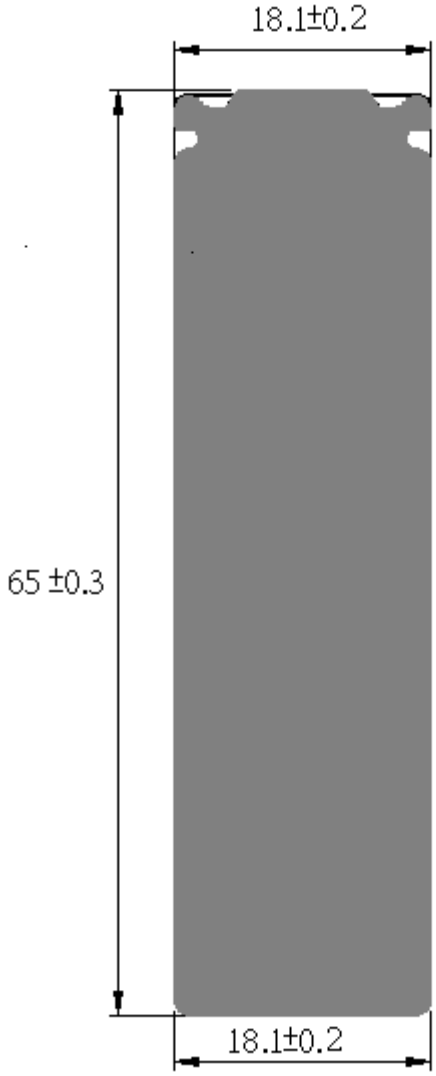
No abnormal stain, No abnormal scratch, No abnormal damage

3.2 Typical Dimension

Typical Diameter: 17.9~18.3mm (with tubing)

Typical Height: 64.7~65.3mm

Reference appearance and dimensions are in following drawing



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4 Standard Test Condition

4-1 Environmental Condition

4-1-1 Cells to be used for testing are those 2 weeks after shipment from our factory and are not to be further used.

4-1-2 Cells to be used for testing shall not be cycled.

4-1-3 Unless otherwise specified, all tests states in this specification shall be conducted at temperature 20±5ºC and humidity 65±20%RH

4-2 Measuring Equipment

4-2-1 Voltmeter: with precision ± 5mV or superior, with internal resistance 1kW/v or more

4-2-2 Ammeter: with precision ± 5mA or superior, with total resistance (including ammeter and external lead wire) 10mW or under.

4-2-3 Calipers: with precision ± 0.02mm or superior

4-2-4 Internal Resistance Meter: 1kHz sinewave, AC, 4 terminal methods.

4-2-5 Balance: with precision ± 0.02g or superior

5 Test Method and Judgment Criteria

Item	Test Method	Judgment Criteria	Remark
Appearance	Visual check	No abnormal stain, No abnormal scratch, No abnormal damage	
Dimension	Calipers	As Item 3-2	
Open Circuit Voltage	Measure open circuit voltage within 1 hour after quick charge	> 3.3V	
Internal Resistance	any status	< 39m□	
Initial Discharge Capacity-1	by 0.5C Charging method, and then discharge cell by 0.5C Discharge method within 1 hour	More than 120 minutes or 1100mAh	100%
Initial Discharge Capacity-2	by Std. Charging method, and then discharge cell by 4C Discharge method within 1 hour	More than 13 minutes or 990mAh	90□
Charge Discharge Cycle Life-1	by 0.5C Charging and 4C Discharging method, the charge-discharge cycles shall be repeated 1000 times and measure the final discharge characteristic	More than 12 minutes or 880mAh	80□
Charge Discharge Cycle Life-2	by 0.5C Charging and 10C Discharging method, the charge-discharge cycles shall be repeated 500 times and measure the final discharge characteristic	More than 4 minutes or 770mAh	70%
Low Temperature Capacity	Under 23□±3□, charge the cell by 0.5C Charging method and then discharge by 0.5C Discharging method within 96 hr at 0□±3□, measure the discharge capacity	More than 90 minutes or 825mAh	75%
Self-Discharge	by 0.5C Charging method, after stored at temperature of 23□±3□ for 21 days, then discharge cell by 0.5C Discharging method within 1 hour	More than 108 minutes or 990mAh	90%
Leakage	After 1C Charging, stored at the temperature of 40□±5□ and 80±5%RH for 96h then discharge the cell by 1C Discharging method.	No leakage by visual inspection, Capacity recovery rate □85%	
Vibration	After 1C Charging, stand for 24 hours, vibrate the cell with vibration: 10 Hz psd: 0.015; 40 Hz psd: 0.015; 400Hz psd: 0.00015 Direction: X/Y/Z axis for 60mins	More than 3.3V	

Drop	After 1C Charge, stand for 24 hours, drop the cell at a height of 1.0m randomly for 3 times, then discharge the cell by 1C Discharging method.	Capacity recovery rate □85%	

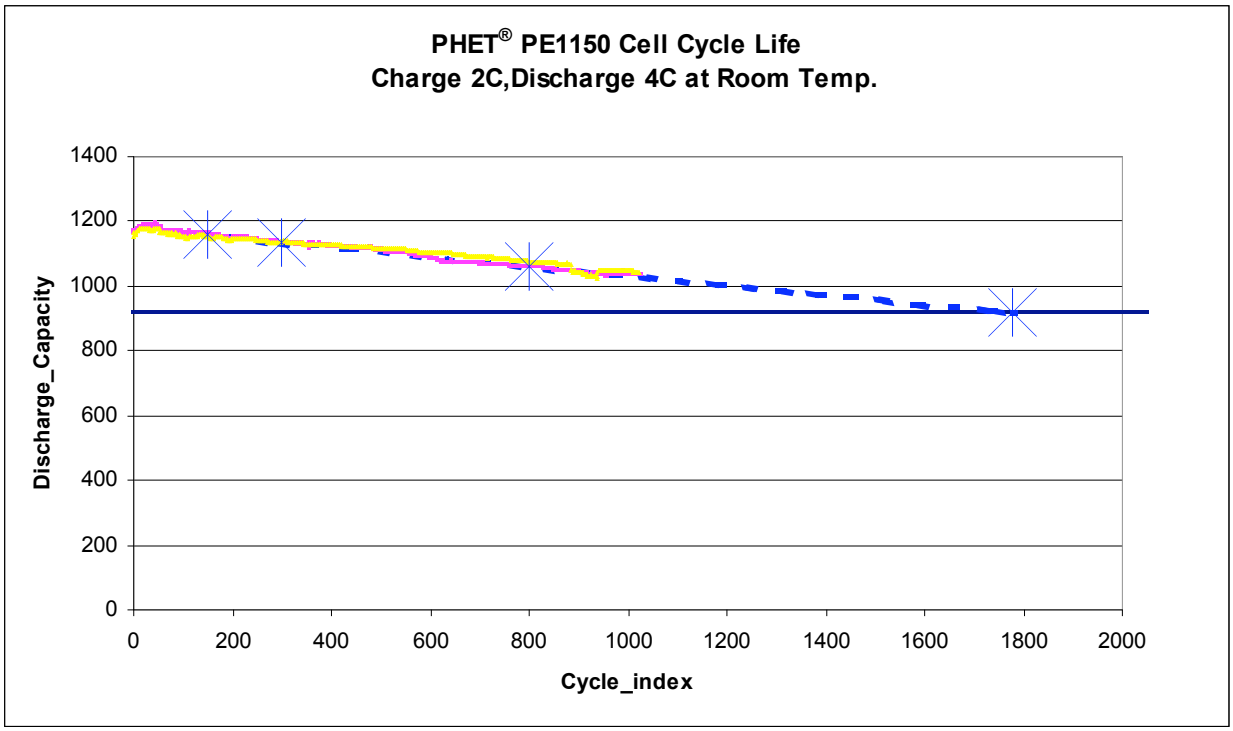
6 Safety Test & Results

Item	Condition and Method	Criteria	Remark
Short Circuit	External short with wire having a maximum resistance load of 50 m□ until the cell temperature has not changed	Cell temperature: <150°C No explosion, No fire No venting	<100℃
	Same as above at 60°C	1.Cell temperature: < 150°C 2.No explosion, No fire	<100℃
Crush	Use a rod with die. 3.2cm then apply a force of 2500 psig on the cell	No explosion, No fire	< 100℃
Impact	Drop the15.8mm round bar by the weight of 9.1kg at a height of 61cm right on the center of the cell	No explosion, No fire	< 100℃
Over-charge test	After 1C discharge, charging at a current of 1CmA to 5V for 8hrs.	No explosion, No fire	Pass
Heating	Place the cell in an oven and heat it up to 150°C at a rate of 5°C/min, and remain for 10 min's at that temperature	No explosion, No fire	Pass
Vibration	After 1C Charging, stand for 24 hours, vibrate the cell with amplitude: 0.8mm peak-peak: 1.6mm vibration: 10~55Hz sweep: 1Hz/min direction: X/Y/Z axis for 90mins	No explosion, No fire	Pass

The above tests are based on UL, SBA and PHET standards.

7 Reference Engineering Data

7.1a 25□Cycle Life, 2C charge/4C discharge:1774



7.1b 25□Cycle Life, 2C charge/10C discharge: 803

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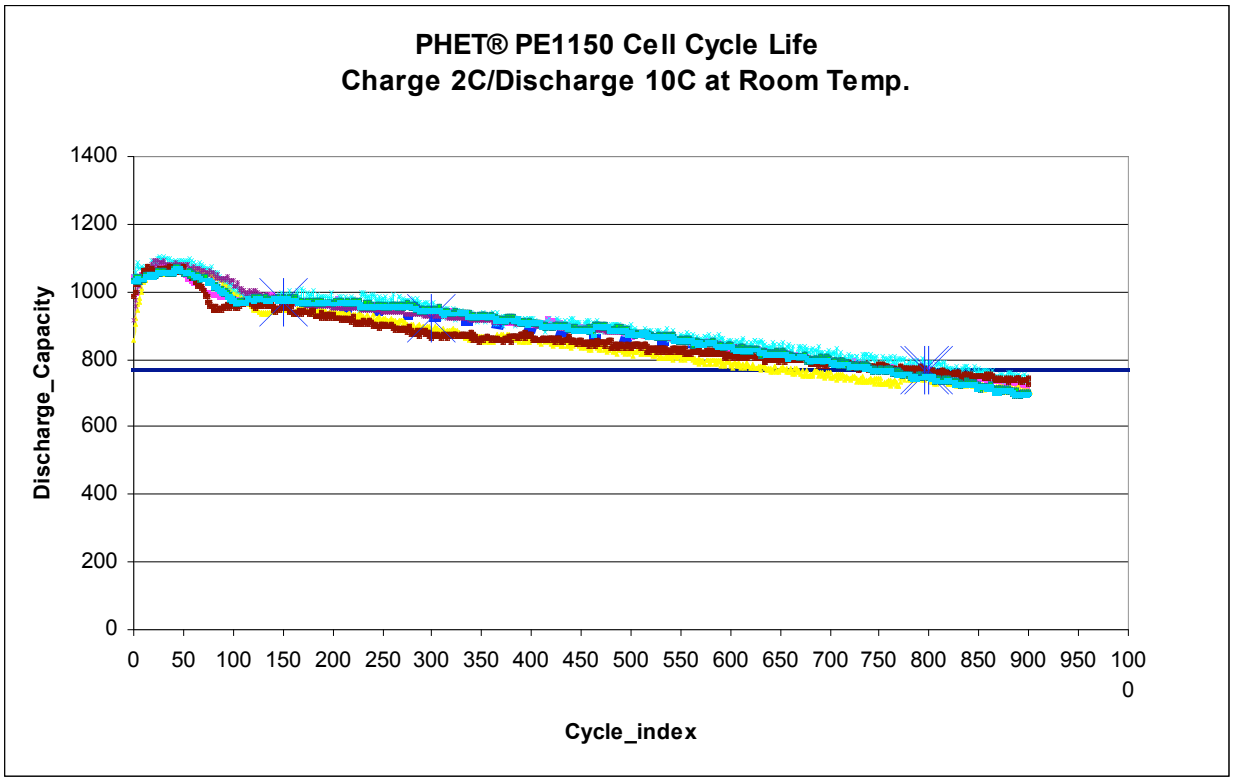

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7.3 Temperature Performance