SPECIFICATION OF PRODUCT

Rechargeable Lithium Ion Battery
Model : SPB433462

	Issued	Checked	Approved
Date			

ENERTECH INTERNATIONAL, INC.	Issued	Checked	Approved
		Electronic Approval	
Date			

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Revision History

Revision No	Date	Contents	Remark
0.0	08. Nov. 2005	Initial Release (SPB433462H1)	SAEHAN ENERTECH
1.0	04. Apr. 2008	Transfer of mass production	
2.0	28. Apr. 2008	Change of company name	ENERTECH INTERNATIONAL
3.0	20. Nov. 2011	Change of company name	ENER1KOREA
4.0	18. Jul. 2012	Change of company name Change from version to grade	ENERTECH INTERNATIONAL
5.0	22. Nov. 2012	Change from grade to version	

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1. Scope

This specification defines the characteristics of a rechargeable lithium ion battery manufactured by **ENERTECH INTERNATIONAL INC.**

2. Description and Model

2.1 Description Cell (Rechargeable Lithium ion Battery)

2.2 Model SPB433462

3. Nominal Specifications

Item		Specification
3.1 Nominal Capacity		910 mAh(0.2C discharge)
3.2 Energy density	Volumetric	371 Wh/L
	Gravimetric	168 Wh/Kg
3.3 Nominal Voltage		3.7V
3.4 Operating Voltage Range		2.80V ~ 4.20V
3.5 Standard	Charge Current	455mA (0.5C)
	Discharge Current	455mA (0.5C)
3.6 Maximum	Charge Current	910mA (1.0C)
	Discharge Current	13.65A (15.0C)
3.7 Operating Temperature	Charge	0℃ ~ 45℃
	Discharge	-20℃ ~ 60℃
3.8 Storage Temperature	0℃ ~ 25℃	≤ 1 Year
	0℃ ~ 40℃	≤ 3 Month
	-10℃ ~ 50℃	≤ 1 Month
3.9 Storage Humidity		45~85%RH
3.10 Cell size	Thickness	4.3 ± 0.3mm (Initial fully charged Cell)
	Width	34.0 +1.0/-2.0mm
	Length	62.0 +2.0/-1.0mm
3.11 AC Impedance		Max. 30mΩ
3.12 Weight		Max. 20.0 g

4. Outline Dimensions

See the attachment (Appendix 1)

5. Appearance

There shall be no such defects as scratch, rust, discoloration, leakage which may adversely affect commercial value of the cell.

6. Standard Test Conditions

6.1 Environmental Conditions

Unless otherwise specified, all tests stated in this specification are conducted at temperature 25±5℃ and humidity 65±20%.

6.2 Measuring Equipment

(1) Ammeter and Voltmeter
The ammeter and voltmeter should have an accuracy of the grade 0.5 or higher.
(2) Slide caliper
The slide caliper should have 0.05 mm scale.
(3) Impedance meter
The impedance meter with AC 1kHz should be used.

7. Characteristics

7.1 Standard Charge

This "Standard Charge" means charging the cell with charge current 455mA(0.5C) and constant voltage of 4.2V until charge current reach to 91mA at 25±5℃.

7.2 Rated Charge

This "Rated Charge" means charging the cell with charge current 910mA(1.0C) and constant voltage of 4.2V until charge current reach to 91mA at 25±5℃.

7.3 Standard Discharge Capacity

The standard discharge capacity is defined as the initial discharge capacity of the cell, which is measured with limiting 455mA(0.5C) discharge to 2.8V at 25±5℃ within 1 hour after the standard charge.

Standard Discharge Capacity ≥ 910mAh

7.4 Rated Discharge Capacity

The rated discharge capacity is defined as the initial discharge capacity of the cell, which is measured with limiting 910mA(1.0C) discharge to 2.8V at 25±5℃ within 1 hour after the standard charge.

Rated Discharge Capacity ≥ 910mAh

7.5 Initial internal impedance

Initial internal impedance measured at AC 1kHz after rated charge.

Initial internal impedance ≤ 30mΩ

7.6 Charge Rate Capabilities

Discharge capacity is measured with constant current 910mA and 2.8V cut-off after the cell is charged with 4.2V as follows.

Items	Charge Condition			
Current	0.2C (182mA)	0.5C (455m A)	1.0C (910m A)	2.0C (1.82 A)
Cut-off	7hrs or 0.1C	3hrs or 0.1C	2.5hrs or 0.1C	2.5hrs or 0.1C
Relative Capacity	100%	100%	95%	90%

Note: Percentage as an index of the rated discharge capacity (=910mAh) is 100%.

7.7 Discharge Rate Capabilities

Discharge capacity is measured with the various currents in under table and 2.8V cut-off after the rated charge.

Items	Discharge Condition			
Current	0.5C (455m A)	1.0C (910m A)	10C (9.1 A)	15C (13.65A)
Relative Capacity	100%	100%	95%	90%

Note: Percentage as an index of the rated discharge capacity (=910mAh) is 100%.

7.8 Temperature Dependence of Discharge Capacity

Capacity comparison at each temperature, measured with discharge constant current 455mA and 2.8V cut-off after the rated charge is as follows.

Charge Temperature	Discharge temperature					
25±5℃	-20℃	-10℃	0℃	25℃	40℃	60℃
Relative Capacity	30%	70%	85%	100%	100%	95%

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours.
Percentage as an index of the rated discharge capacity (=910mAh) is 100%.

7.9 Temperature Dependence of Charge Capacity

Capacity comparison at each temperature, measured with discharge constant current 455mA and 2.8V cut-off after the rated charge is as follows.

Items	Charge temperature			Discharge temperature
	0℃	25℃	45℃	25±5℃
Relative Capacity	80%	100%	100%	

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours.
Percentage as an index of the rated discharge capacity (=910mAh) is 100%.

7.10 Cycle Life

Each cycle is an interval between the charge (charge current 910mA) with 2.5 hours or 0.1C cut-off and the discharge (80% of max discharge current, 10.92A) with 2.8V cut-off. Capacity is measured at 50cycles, 100cycles.

50cyc. Capacity ≥ 728mAh (80% of the rated discharge capacity)
100cyc. Capacity ≥ 455mAh (50% of the rated discharge capacity)

7.11 Storage Characteristics

Capacity after storage for 30days at 25±5℃ after the rated charged, measured with discharge current 455mA with 2.8V cut-off at 25±5℃.

Capacity retention(after the storage) ≥ 819mAh (90% of the rated discharge capacity)

8. Mechanical Characteristics

8.1 Vibration Test

Test method: This means the endurance of the cell against vibration.
Frequency and amplitude : 10Hz → 55Hz → 10Hz / 0.8mm
Sweep speed : 1±0.055Hz/min
Criteria: No damage such as leakage , flame, or fire was allowed.

9. Environmental Characteristics

9.1 Thermal Shock

Test method: Cell(rated charged) is repeatedly tested with 20 times heat cycling, which means maintaining the cell for 2hours at –40℃ and 85℃ respectively. Inspect its appearance and measure its thickness right after thermal shock. Measure the recovered capacity by rated charge/discharge cycling after rated discharging(910mA, 2.8V cut-off) at 25±5℃.

Criteria: No leakage, No Fire

Recovery > 637mAh (70% of the rated discharge capacity)

9.2 Humidity

Test method: Cell(rated charged) is exposed to 50±5℃, 95%RH. for 10days Inspect appearance and measure thickness right after humidity test. Measure the recovered capacity by rated charge/discharge cycling after rated discharging(910mA, 2.8V cut-off) at 25±5℃.

Criteria: No leakage

Recovery > 819mAh (90% of the rated discharge capacity)

9.3 High Temperature Swelling

Test method: Cell(rated charged) is exposed to 60±5℃ for 24hours. Measure thickness right after swelling test and the recovered capacity by rated charge/discharge cycling after rated discharging(910mA, 2.8V cut- off) at 25±5℃.

Criteria: No leakage, Cell thickness < 4.6 mm

Recovery > 819mAh (90% of the rated discharge capacity)

10. Safety

10.1 Overcharge Test

Test method: To charge the standard charged cell with 5V and 1.0A at 25±5℃ for 2.5 hours.

Criteria: No fire, and no explosion.

10.2 External Short-circuit Test

Test method: To short-circuit the standard charged cell by connecting positive and negative terminal by less than 100mΩ wire at 25±5℃ for 2.5 hours.

Criteria: No smoke, No fire, and no explosion.

10.3 Reverse Charge Test

Test method: To charge reverse the standard charged cell with charge current 1.0A at 25±5℃ for 2.5 hours.

Criteria: No fire, and no explosion.

10.4 Heating Test

Test method: To heat the standard charged cell at heating rate 5±2℃ per minute up to 130℃ and keep the cell in oven for 60 minutes.

Criteria: No fire, and no explosion within 60 minutes.

10.5 Crush

Test method: To crush the standard charged cell with force of 13kN at 25±5℃.
(Crushed side is longitudinal and narrow axis.)

Criteria: No fire, and no explosion.

11. Shipment

The cell shall be shipped in about 80% charged state.

12. Warranty

ENERTECH INTERNATIONAL INC. will be responsible for replacing the cell against defects or poor workmanship for 6months from the date of shipping. Any other problem caused by malfunction of the equipment or unsuitable use of the cell is not under this warranty.

The warranty set forth in proper using and handling conditions described above and excludes in the case of a defect which is not related to manufacturing of the cell.

13. Others

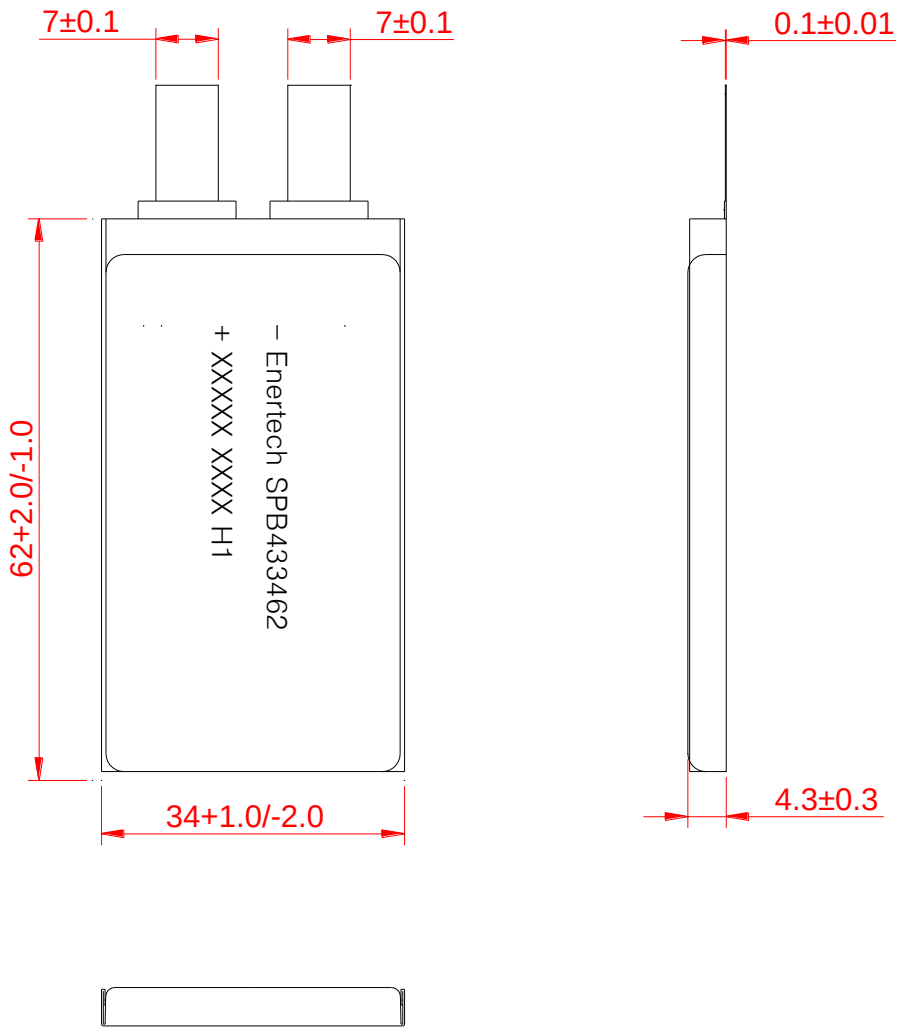
13.1 Storage for a long time

If the cell is kept for a long time (3months or more), It is strongly recommended that the cell is preserved at dry and low-temperature.

13.2 Other

Any matters that specifications does not have, should be conferred with between the both parties.

◆ **Out View drawing for SPB433462**



Handling Instruction Guide for Lithium Ion Battery

1. General

The cells supplied by **ENERTECH INTERNATIONAL INC.**have to be handle carefully according to the specification.
Here are some more to be followed.

2. Storage

The cell requested to be stored under the following conditions:

a. Indoor storage in a cool circumstances without direct sun light.
b. Store the cell in a dry location with low humidity, and a temperature range of –20°C to +30°C.

In case of the long term storage

a. As long-term storage can accelerate battery self-discharge and lead to the deactivation of the cells. To minimize the deactivation effect, store the cell in a temperature range of +10°C to +30°C.
b. When charging for the first time after long-term storage, deactivation of the cells have led to decreased capacity. Recover such cell to original performance through repeating several cycles of full charging and discharging.
c. When store the cell for more than 6 month, charge at least once charing require per 6 months to prevent leakage and deterioration in performance due to self-discharging.

3. Charging

a. Use suitable charger with the specified voltage and current. We strongly recommend the smart battery charger. We can recommend the usage or specification of the charger manufacturing. If you want to get the information about it, please contact us.
b. Never attempt reverse charging. Charging with polarity reversed can cause a reversal in the cell polarity, causing gas pressure inside of the cell to rise, which can be lead to leakage of the cell.
c. Avoid overcharing. Repeated overcharging can be lead to deterioration in cell performance and over-heat occured.
d. Charging efficiency drops at temperatures above 40°C.

4. Protection from unexpected damaged to the cell

a. (+) and/or (-) terminals must not be connected in metal wire, necklace, chaings.
b. Do not drop cells from height in order to prevent them from possible malfunction or damage.
c. Do not twist or bend cells in order to prevent possible damage.

5. For Safety

a. Do not disassemble cells.
b. Do not use the cell when something abnormal found such as smells, deformation, discoloration, and so on.
c. When the electrolyte leakage occurs, do not touch the liquid.
d. Once watered, cells may have potential malfunctions. Do not use those cells.
e. Do not have cells in the hot-temperature (60°C or more).
f. Do not put cells into fire.
g. Do not crush/nail cells.
h. Do not apply solder directly to cells.