	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	1 / 12

# SPECIFICATION OF PRODUCT

Rechargeable Lithium Ion Battery  
Model : SPB465060

	Issued	Checked	Approved
Date			

	Issued	Checked	Approved
<b>ENERTECH INTERNATIONAL, INC</b>	<div style="border: 2px solid blue; padding: 5px; display: inline-block;"> <b>Electronic Approval</b> </div>		
Date			


## ENERTECH INTERNATIONAL, INC.

269, Chungjuhosu-ro, ChungJu-city, Chungbuk , Korea

TEL: 82-43-850-1950 FAX: 82-43-855-9175

[www.enertechint.com](http://www.enertechint.com)




	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	3 / 12

## CONTENTS

1. Scope
2. Descriptions and Model
3. Nominal Specifications
4. Outline Dimensions
5. Appearance
6. Standard Test Conditions
7. Characteristics
8. Mechanical Characteristics
9. Environmental Characteristics
10. Safety
11. Shipment
12. Warranty
13. Others

[ Attactched ]

1. Out view drawing for SPB465060
2. Handling Instruction Guide for Lithium Ion Battery

	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	4 / 12

## 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                    SPB465060

## 3. Nominal Specifications

Item		Specification
3.1 Nominal Capacity		1480 mAh(0.2C discharge)
3.2 Energy density	Volumetric	397 Wh/L
	Gravimetric	196 Wh/Kg
3.3 Nominal Voltage		3.7V
3.4 Operating Voltage Range		3.00V ~ 4.20V
3.5 Standard	Charge Current	740mA (0.5C)
	Discharge Current	296mA (0.2C)
3.6 Maximum	Charge Current	1480mA (1.0C)
	Discharge Current	2960mA (2.0C)
3.7 Operating Temperature	Charge	0°C ~ 45°C
	Discharge	-20°C ~ 60°C
3.8 Storage Temperature	0°C ~ 25°C	≤ 1 Year
	0°C ~ 40°C	≤ 3 Month
	-10°C ~ 50°C	≤ 1 Month
3.9 Storage Humidity		45~85%RH
3.10 Cell size	Thickness	4.6 +0.2/-0.4mm (Initial fully charged Cell)
	Width	50.0 +0.0/-2.0mm
	Length	60.0 +2.0/-0.0mm
3.11 AC Impedance		Max. 30mΩ
3.12 Weight		Max. 28.0g

	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	5 / 12

#### 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  $25 \pm 5^\circ\text{C}$  and humidity  $65 \pm 20\%$ .

##### 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 0.05mm 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 740mA(0.5C) and constant voltage of 4.2V until charge current reach to 74mA at  $25 \pm 5^\circ\text{C}$ .

##### 7.2 Rated Charge

This "Rated Charge" means charging the cell with charge current 740mA(0.5C) and constant voltage of 4.2V until charge current reach to 74mA at  $25 \pm 5^\circ\text{C}$ .

##### 7.3 Standard Discharge Capacity


The standard discharge capacity is defined as the initial discharge capacity of the cell, which is measured with limiting 296mA(0.2C) discharge to 3.0V at  $25 \pm 5^\circ\text{C}$  within 1 hour after the standard charge.

$$\underline{\text{Standard Discharge Capacity} \geq 1480\text{mAh}}$$

##### 7.4 Rated Discharge Capacity

The rated discharge capacity is defined as the initial discharge capacity of the cell, which is measured with limiting 740mA(0.5C) discharge to 3.0V at  $25 \pm 5^\circ\text{C}$  within 1 hour after the standard charge.

$$\underline{\text{Rated Discharge Capacity} \geq 1480\text{mAh}}$$

	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	6 / 12

#### 7.5 Initial internal impedance

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

$$\text{Initial internal impedance} \leq 30\text{m}\Omega$$

#### 7.6 Charge Rate Capabilities

Discharge capacity is measured with constant current 740mA and 3.0V cut-off  
After the cell is charged with 4.2V as follows.

Items	Charge Condition			Remarks
	0.2C (296mA)	0.5C (740mA)	1.0C (1480mA)	
Cut-off	7hrs or 0.05C	3hrs or 0.05C	2.5hrs or 0.05C	
Relative Capacity	100%	100%	95%	

Note: Percentage as an index of the rated discharge capacity (=1480mAh) is 100%.

#### 7.7 Discharge Rate Capabilities

Discharge capacity is measured with the various currents in under table and 3.0V cut-off after the rated charge.

Items	Discharge Condition			
	0.2C (296mA)	0.5C (740mA)	1.0C (1480mA)	2.0C (2960mA)
Relative Capacity	100%	100%	95%	90%

Note: Percentage as an index of the rated discharge capacity (=1480mAh) is 100%.


#### 7.8 Temperature Dependence of Discharge Capacity

Capacity comparison at each temperature, measured with discharge constant current 740mA and 3.0V cut-off after the rated charge is as follows.

Charge Temperature	Discharge temperature					
	-20℃	-10℃	0℃	25℃	40℃	60℃
25±5℃						
Relative Capacity	40%	60%	80%	100%	95%	90%

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 (=1480mAh) is 100%.

	<b>PRODUCT SPECIFICATION</b>	<b>Version</b>	<b>A2</b>
		<b>Revision</b>	<b>4.0</b>
		<b>Date of Issued</b>	<b>22 May. 2007</b>
		<b>Date of revision</b>	<b>22 Nov. 2012</b>
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		<b>Page</b>	<b>7 / 12</b>

### 7.9 Temperature Dependence of Charge Capacity

Capacity comparison at each temperature, measured with discharge constant current 740mA and 3.0V cut-off after the rated charge is as follows.

Items	Charge temperature			Discharge temperature
	0℃	25℃	45℃	
Relative Capacity	80%	100%	95%	25±5℃

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 (=1480mAh) is 100%.

### 7.10 Cycle Life

Each cycle is an interval between the charge (charge current 1480mA) with 2.5hours or 0.05C cut-off and the discharge (discharge current, 1480mA) with 3.0V cut-off. Capacity is measured at 100cycles, 300cycles, 500cycles.

100cyc. Capacity	≥ 1332mAh (90% of the rated discharge capacity)
300cyc. Capacity	≥ 1184mAh (80% of the rated discharge capacity)
500cyc. Capacity	≥ 1036mAh (70% 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 740mA with 3.0V cut-off at 25±5℃.

Capacity retention(after the storage) ≥ 1332mAh (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.

	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	8 / 12

## 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  $-20^{\circ}\text{C}$  and  $65^{\circ}\text{C}$  respectively. Inspect its appearance and measure its thickness right after thermal shock. Measure the recovered capacity by rated charge/discharge cycling after rated discharging(740mA, 3.0V cut-off) at  $25\pm 5^{\circ}\text{C}$ .

Criteria: No leakage, No Fire

Recovery > 1332mAh (90% of the rated discharge capacity)

### 9.2 Humidity

Test method: Cell(rated charged) is exposed to  $50\pm 5^{\circ}\text{C}$ , 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(740mA, 3.0V cut-off) at  $25\pm 5^{\circ}\text{C}$ .

Criteria: No leakage

Recovery > 1332mAh (90% of the rated discharge capacity)

### 9.3 High Temperature Swelling

Test method: Cell(rated charged) is exposed to  $60\pm 5^{\circ}\text{C}$  for 24hours. Measure thickness right after swelling test and the recovered capacity by rated charge/discharge cycling after rated discharging(740mA, 3.0V cut-off) at  $25\pm 5^{\circ}\text{C}$ .

Criteria: No leakage, Cell thickness < 5.06 mm

Recovery > 1332mAh (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  $25\pm 5^{\circ}\text{C}$  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  $100\text{m}\Omega$  wire at  $25\pm 5^{\circ}\text{C}$  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 1.0C at  $25\pm 5^{\circ}\text{C}$  for 2.5 hours.

Criteria: No fire, and no explosion.



	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	9 / 12

#### 10.4 Heating Test

Test method: To heat the standard charged cell at heating rate  $5\pm 2^{\circ}\text{C}$  per minute up to  $130^{\circ}\text{C}$  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  $25\pm 5^{\circ}\text{C}$ .  
(Crushed side is longitudinal and narrow axis.)

Criteria: No fire, and no explosion.

#### 10.6 Impact 15.8 9.1 61

Test method : To place 15.8mm diameter bar across the center of standard charged cell, and drop 9.1kg weight from 61cm height onto the cell at  $25\pm 5^{\circ}\text{C}$ .  
(Impacted side is longitudinal and wide 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

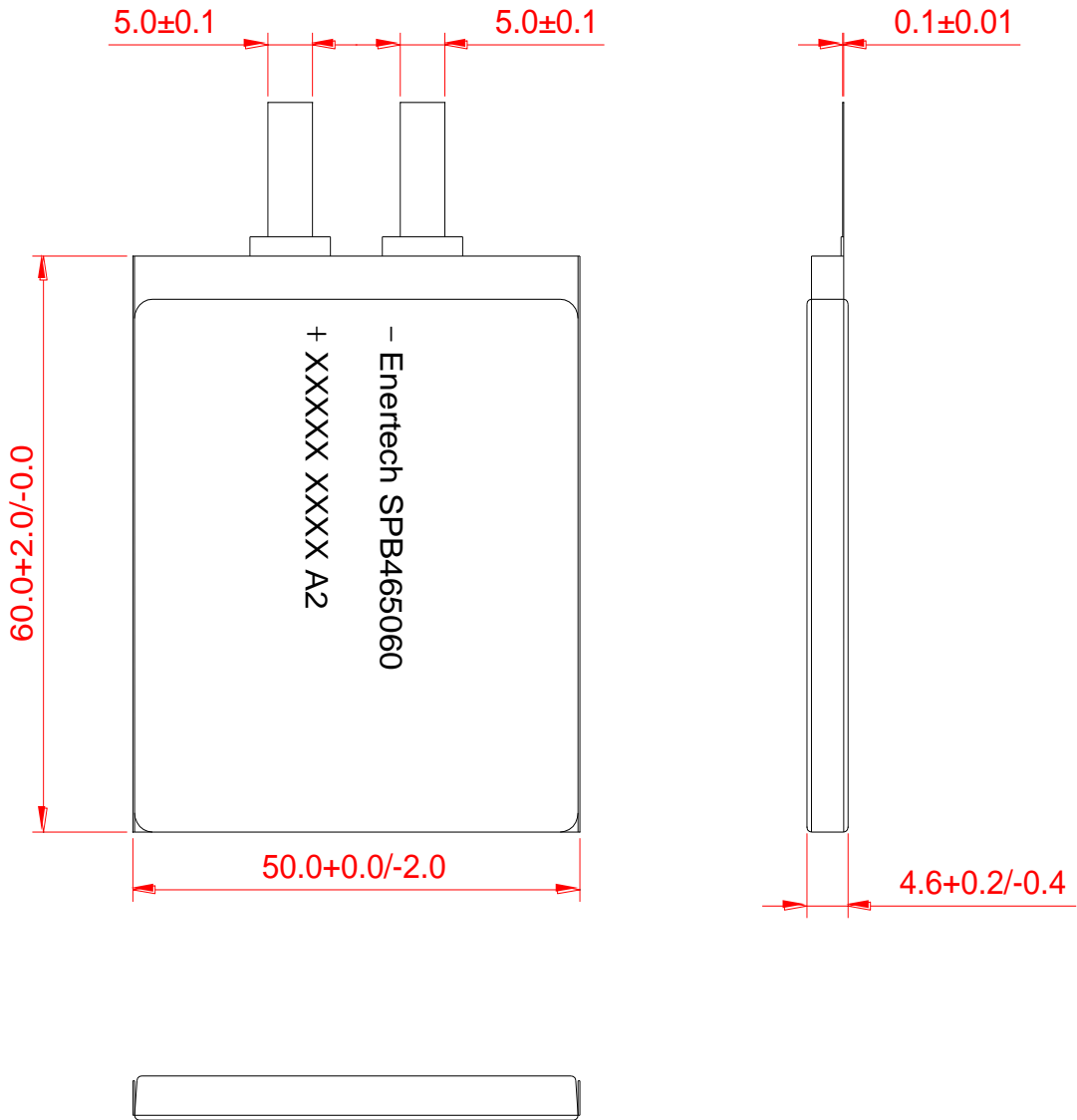
If the cell is kept for a long time (3months or more), It is strongly recommended that the cell is preserved at dry and low-temperature.


#### 13.2 Other

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

	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	10 / 12

◆ Out view drawing for SPB465060



	<b>PRODUCT SPECIFICATION</b>	Version	A2
		Revision	4.0
		Date of Issued	22 May. 2007
		Date of revision	22 Nov. 2012
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		Page	11 / 12

## 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  $-20^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$ .

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  $+10^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$ .
- 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 charging 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 overcharging. Repeated overcharging can be lead to deterioration in cell performance and over-heat occurred.
- d. Charging efficiency drops at temperatures above  $40^{\circ}\text{C}$ .

### 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.

	<b>PRODUCT SPECIFICATION</b>	<b>Version</b>	<b>A2</b>
		<b>Revision</b>	<b>4.0</b>
		<b>Date of Issued</b>	<b>22 May. 2007</b>
		<b>Date of revision</b>	<b>22 Nov. 2012</b>
<b>SPB465060(Rechargeable Lithium Ion Battery)</b>		<b>Page</b>	<b>12 / 12</b>

## 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.