



能元科技股份有限公司
E-One Moli Energy Corp.

**Lithium-Ion Rechargeable Cell
Specification**

Customer	
Model Name	
Document No.	
Revision (Date)	

Customer Approval (Date)

Customer Signature

Approval (Date)	Check (Date)	Originator (Date)

E-One Moli Energy Corp.

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1. SCOPE

This specification defines the characteristics of a lithium ion rechargeable Cell, ICP1003450B, 1.8Ah LiPF₆ cobalt cell, manufactured by E-One Moli Energy Corp.

2. SAFETY STANDARDS AND REGULATIONS

- 2.1 IEC 61960-1 International Electromechanical Commission, Committee Draft
Secondary Lithium Cells and Batteries for Portable Applications, Part 1
- 2.2 UL 1642: Standards for Safety Lithium Cells.
- 2.3 UN ST/SG/AC. 10/11/Rev 3 Transportation of Dangerous Goods

3. APPLIED PRODUCT NAME AND PRODUCT DESIGNATION

3.1 Name

Lithium ion rechargeable Cell, 1003450 size, LiPF₆ electrolyte, LiCoO₂ (cobalt structure) cathode.

3.2 Designation

MOLI I C P 1003450 B

a b c d e f

a Indicates the cell manufactured by E-ONE MOLI ENERGY CORP.

b Indicates the negative electrode system.

The letter 'T' defines the lithium ion system with an intercalation electrode.

c Indicates the positive electrode system.

The letter 'C' defines a cobalt-based electrode.

d Indicates the shape of the cell.

The letter 'P' defines a prismatic shaped cell.

e Indicates the dimensions of the cell.

First two numerical figures define the thickness (typically, cell thickness might be larger).

100=10.4mm

Following two numerical figures define the width.

34=34mm

Following two numerical figures define the overall height.

50=50mm

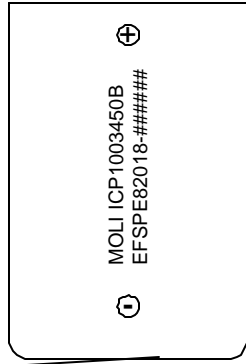
f Indicates the rated capacity of the cell.

The letter "A" defines the current product with 1.6 Ah rated capacity.

The letter "B" defines the current product with 1.8 Ah rated capacity.

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3.3 Cell Marking



Legend:

MOLI: Made by E-ONE MOLLI Energy Corp.

ICP1003450B: Model number.

EFSPE82018: Product number.

#####: Cell lot number.

4. CONSTRUCTION

4.1 Shape: Prismatic

4.2 Dimensions:

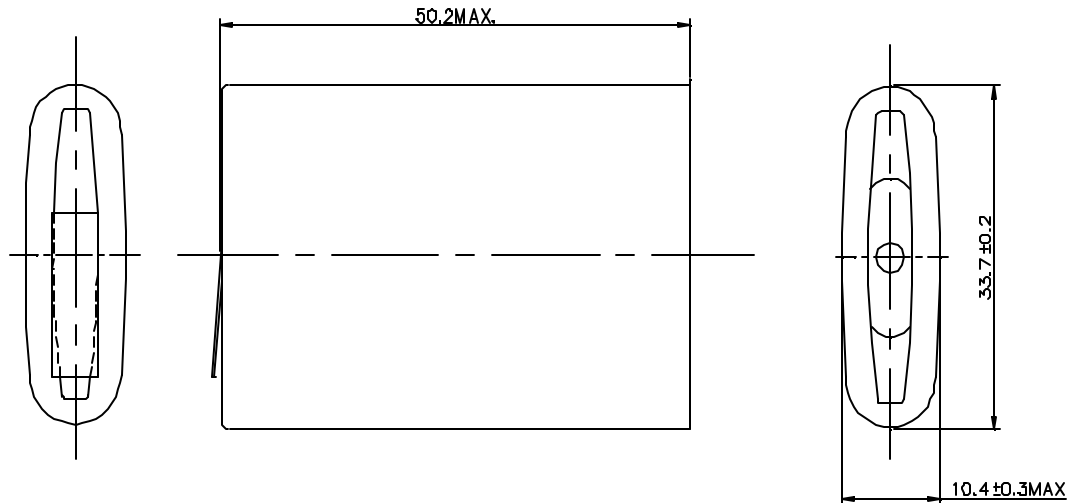
Overall Height: 50.2mm (Max.)

Thickness (shipping state): $10.4 \pm 0.3\text{mm}$

Width: $33.7 \pm 0.2\text{mm}$

4.3 Weight: $45.5 \pm 1.0\text{g}$

4.4 Finished Cell Dimension (with shrink tube)



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5. RATED SPECIFICATIONS

Definitions of items are described in accordance with IEC, CD Draft version 1.

Items		Specifications	Remarks
1a	Rated charge	Limiting 1.8A and constant $4.2 \pm 0.05V$ charge for 2.5h at 23 °C.	
1b	Recommended charge	Limiting 1.8A and constant $4.2 \pm 0.05V$ charge for 2.5h at 23 °C.	
2	Rated discharge	Constant 0.36A discharge until 3.0V at 23 °C.	
3	Rated capacity	1.8 Ah (typical)	Nominal of rated discharge capacity after rated charge at cycle 2 of fresh cell.
		1.75 Ah (minimum)	
4	Nominal voltage	3.70 V	Mean voltage during rated discharge after rated charge.
5	Shipping voltage	$3.8V \pm 0.05V$	Nominal. Approximate state of charge =50%.
6	Internal resistance at shipping	70~110mΩ	By AC 1kHz within 3~4 hours after 50% charge.
7	End of charge voltage	$4.20 \pm 0.05V$	
8	End of discharge voltage	3.0V	
9	Charging time	2.5h	Rated and recommended charge.
10	Maximum continuous charging current	1.8A	
	Maximum continuous discharging current	2.5A	Maximum permitted discharge current to avoid activation of PTC at bottom of cell.
11	Operating temperature	Charging	0~45 °C
		Discharging	-20~60 °C
12	Storage temperature	<35 °C	Recommended temperature for long term storage is 23 ± 2 °C.
13	Shelf life	1 year	Typical value at 23 °C from ship state.
14	Cycle life @ 80%	500	0.2C rated discharge current at 23 °C.

6. SAFETY PROTECTION FUNCTIONS

6.1 Safety Valve

Relieve pressure in event of excessive internal build up.

6.2 Meltable Separator

Prevent thermal runaway due to external short.

6.3 Positive Thermal Coefficient (250 PTC) device

Self-resetting, prevents sustained high current overcharge. Prevents prolonged high current flow in the event of an external short circuit.

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7. PERFORMANCE

7.1 Test Condition

7.1.1 The cells used in the tests are sampled after 3 to 7 days storage and are typically tested after 9 standard cycles.

7.1.2 All testing temperature is within ± 2 °C deviation in this specification and at a relative humidity between 45% and 85% except elsewhere noted.

7.1.3 Standard cycling, 1.8A charge and 1.8A discharge to 3.0V.

7.2 Performance

7.2.1 Electrical Performance

Items		Typical	Condition	
1	Discharge capacity (Rate capability) at 23 °C	1.8A	1.71Ah	Discharge capacity at 1.8A to 3.0V after recommended charge.
		0.9A	1.74Ah	Discharge capacity at 0.9A to 3.0V after recommended charge.
		0.36A	1.80Ah	Discharge capacity at 0.36A to 3.0V after recommended charge.
2	Discharge capacity (Temp, capability) at 0.36A	60 °C	1.77Ah	Discharge capacity at 60 °C to 3.0V after recommended charge.
		45 °C	1.80Ah	Discharge capacity at 45 °C to 3.0V after recommended charge.
		-10 °C	1.40Ah	Discharge capacity at -10 °C to 3.0V after recommended charge.
		-20 °C	1.00Ah	Discharge capacity at -20 °C to 3.0V after recommended charge.
3	Energy density	Volumetric	384Wh/l	Calculated energy density based on the volume and weight specifications using 0.36A discharge to 3.0V at 23 °C after recommended charge.
		Gravimetric	148Wh/kg	

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7.2.2 Storage Performance

Items		Typical		Conditions	
		DOD			
1	Capacity retention	23 °C 30 days	0%	90%	Retained discharge capacity and energy after storage, expressed as a percentage of the “before storage” value, both at 0.36A. (Storage: after recommended charge, i.e., 0% depth of discharge)
		45 °C 30 days	0%	85%	
		60 °C 7 days	0%	86%	
2	Capacity recovery	23 °C 30 days	0%	97%	Recovered discharge capacity and energy after storage, expressed as a percentage of the “before storage” value, both at 0.36A. (Storage: after recommended charge then 0.36A discharge to stated depth of discharge)
			100%	98%	
		45 °C 30 days	0%	91%	
			100%	98%	
		60 °C 7 days	0%	94%	

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7.2.3 Life

Item		Typical	Conditions
1 Cycle life	23°C 1.80A	C50	94%
		C100	90%
		C300	80%
		C500	70%
	23°C 0.90A	C50	94%
		C100	91%
		C300	85%
		C500	75%
	23°C 0.36A	C50	95%
		C100	92%
		C300	85%
		C500	80%
	45°C 1.80A	C50	95%
		C100	91%
		C300	80%
		C500	65%

7.2.4 Quick Reference Guide: Typical Capacity of Fresh Cells

Discharge Temperature (°C)	Capacity (Ah) at various discharge rates		
	0.36A	0.90A	1.80A
-20	1.00	N/A	N/A
-10	1.40	1.05	N/A
23	1.80	1.74	1.71
45	1.80	1.77	1.75
60	1.77	1.76	1.74

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7.2.5 Safety Performance

1) Environmental Endurance Performance

Items	Criteria	Conditions
1	-40 °C, 85 °C temperature cycle Weight loss < 20mg, average of 5 samples Weight loss < 30mg, individually No fire or explosion	Weight loss after storage. (Storage: -40 °C for 1h, 1h ramp to 85 °C, 85 °C for 1h, 1h ramp to -40 °C. Repeat cycle 30 times.)
2	Heating 150 °C Maximum temperature < 180 °C No fire or explosion	Per UL 1642 standard.

2) Electrical Endurance Performance

Items	Criteria	Conditions
1	Short circuit @ 23 °C No fire or explosion Temp. < 150 °C	External circuit impedance is < 100mΩ.
2	Forced discharge No fire or explosion	Discharge at a current of 1.8A for 2.5h.
3	Overcharge No fire or explosion	1. Charging at a current of 1.8A to 12V from the fully discharged state for 4hr. 2. Charging at a current of 5.4A to 12V from the fully discharged state for 4hr.

3) Mechanical Endurance Performance

Items	Criteria	Conditions
1	Crush No fire or explosion	Crush between two flat plates. Applied force is about 13KN.
2	Impact No fire or explosion	Impact by 15.8mmφ bar 9.1kg weight dropped from 61cm height on the flat surface.
3	3ft drop proof Weight loss < 30mg ΔV < -40mV ΔACR < 10mΩ No leakage, weight loss, distortion or out gassing	Drop from a height of 3ft onto a concrete floor 3 times each for bottom, side and header orientations.
4	Vibration proof No leakage, weight loss, distortion or out gassing	Subject to 10~55Hz vibration at an amplitude of 1.6mm for two axes. Rate of change of vibration: 1Hz/minute.

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8. REGULATORY COMPLIANCE

8.1 UL 1642 recognized components.

8.2 Complies with UN amendments to the third revised edition of the recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria.

9. PRECAUTIONS FOR USING LITHIUM ION RECHARGEABLE CELL

The lithium ion rechargeable cell with high power and long life has played a significant role in the rising popularity of portable electronic products such as notebook PC, cellular phone, personal digital assistant, camcorder, etc. E-One Moli Energy Corporation, a pioneer in lithium ion cell development and manufacturing in Taiwan, is capable of providing lithium ion cells with absolute safety, small size, high power, and long life. The precautions described below are important to assure the achievements of designed performance and safety.

9.1 Handling Precautions

9.1.1 Charging

The lithium ion rechargeable cell is to be charged by “constant current/constant voltage” method. The lithium ion cell is charged at a constant current (CC Mode) until the cell voltage reaches 4.2 V, followed by a constant voltage charge (CV Mode) at 4.2 V. The charging current at this constant voltage tapers off. As long as the tapering current is down to 2% of 1C rate current or the charging time at CV Mode reaches 2.5 hours (whichever comes first); the charge process is terminated.

1) Charge voltage:

Do not exceed the specified charge voltage (4.2V per single cell). If the cells are used in cell packs, the maximum voltage is 4.2 x N (N= number of cells connected in series) V.

2) Charge current:

Charge the cell at the specified charge current 1.0CmA or less.

3) Charge temperature:

Charge the cell at the temperature range of 0°C ~ 45 °C. Due consideration should also be given to the arrangement of the cell pack so that it is in that temperature range even though it is effected by heat generated in the cell charger.

9.1.2 Reverse charging:

The cell must be prevented from the reverse-polarity charging.

9.1.3 Discharging

A lithium ion rechargeable cell starts to discharge at 4.2V and terminates at a cut off voltage of 3.0V.

1) Discharge current:

Discharge the cell at the specified discharge current 2.0CmA or less. In the case of a pulse discharge, set the average current to 1.0CmA or less. A peak current of higher than 2A

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depending on the pulse interval may reduce the cell capacity.

2) Discharge temperature:

Discharge the cell at temperature range from -20°C to 60°C . At a temperature of -20°C or less, the cell will show a significant decrease in discharge capacity.

3) Discharge termination voltage/Over discharge:

Avoid discharge to voltage less than 3.0V per single cell. A leak current to the equipment may over discharge the cell, which may damage the performance of cell.

9.1.4 Long-term Storage

1) In case of long-term storage, store the cell at temperature range of $-20\sim+35^{\circ}\text{C}$, low humidity, no corrosive gas atmosphere.

2) When storing the cell for a long period longer than one year, charge it at least once a year. And in this case, the cell is recommended to be charged to 50% SOC.

3) No condensation on the cell.

9.2 Safety Precautions

9.2.1 When using the cell

ⓘ WARNING

1) Mistreatment of a cell may cause the cell to generate heat, explode, or ignite and cause serious injury. Be sure to follow the safety rules as follows:

(1) Do not solder directly onto the cell.

(2) Do not place the cell in fire or heat the cell.

(3) Do not install the cell backwards so that the polarity is reversed.

(4) Do not expose the cell to water or salt water, or allow the cell to get wet.

(5) Do not carry or store the cells together with necklaces, hairpins or other metal objects.

(6) Do not place the cells in microwave ovens, high-pressure containers, or on induction cookware.

(7) Do not connect the positive terminal and the negative terminal of the cell to each other with any metal objects such as chains, coins or wire.

(8) Do not pierce the cell with nails, strike the cell with a hammer, step on the cell, or otherwise subject it to strong impacts or shocks.

2) Do not disassemble or modify the cell. The cell contains safety and protection devices, if damaged, may cause the cell to generate heat, explode or ignite.

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- 3) Do not place the cell in or near fire, stoves, or other high-temperature locations. Do not place the cell in direct sunshine, or use or store the cell inside cars in hot weather. Doing so may cause the cell to generate heat, explode, or ignite. Using the cell in this manner may also result in a loss of performance and a shortened life expectancy.

ⓘ CAUTION

- 4) If the device is to be used by small children, the caregiver should explain the contents of the user's manual to the children. The caregiver should provide adequate supervision to ensure that the device is being used as explained in the user's manual.
- 5) When the cell is worn out, insulate the terminals with adhesive tape or similar materials before disposal.
- 6) Immediately discontinue use of the cell if, while using, charging, or storing the cell, the cell emits an unusual smell, feels hot, changes color, changes shape, or appears abnormal in any other way. Contact your sales location or E-One Moli Energy if any of these problems are observed.
- 7) In the event that the cell leaks and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated the cell fluid could cause damage to the eye.

9.2.2 When charging the cell

ⓘ WARNING

- 1) Be sure to follow the rules listed below while charging the cell. Failure to do so may cause the cell to become hot, explode, or ignite and cause serious injury.
 - (1) Do not attach the cells to a power supply plug or directly to a car's cigarette plug.
 - (2) When charging the cell, either use a specified cell charger or otherwise ensure that the cell charging conditions specified by E-One Moli Energy are met.
 - (3) Do not place the cells in or near fire, or into direct sunlight. When the cell becomes hot, the built in safety equipment is activated, preventing the cell from charging further, and heating the cell can destroy the safety equipment and can cause additional heating, breaking, or ignition of the cell.
- 2) Do not continue charging the cell if it does not recharge within the specified charging time. Doing so may cause the cell to become hot, explode, or ignite.

ⓘ CAUTION

- 3) The temperature range over which the cell can be charged is 0°C to 45 °C. Charging the cell at temperatures outside of this range may cause the cell to become hot or to break. Charging the cell outside of this temperature range may also harm the performance of the

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cell or reduce the cell's life expectancy.

9.2.3 When Discharging the Cell

ⓘ WARNING

- 1) Do not discharge the cell using any device except for the specified device. When the cell is used in devices aside from the specified device it may damage the performance of the cell or reduce its life expectancy, and if the device causes an abnormal current to flow, it may cause the cell to become hot, explode, or ignite and cause serious injury.

ⓘ CAUTION

- 2) The temperature range over which the cell can be discharged is -20°C to 60°C (Consult E-One Moli Energy if you plan to discharge the cells at temperature less than -10°C). Use of the cell outside of this temperature range may damage the performance of the cell or may reduce its life expectancy.

Please note

E-One Moli Energy recommends that cells be assembled in a pack with protection circuit. Various protection circuit modules are available for applications of multiple series and parallel configurations. For multi-cell application, the over-current protective devices (PTC or thermal fuse) is NEEDED on each cell or between cells connected in parallel. In order to ensure safe use of cell, be sure to consult with E-One Moli Energy regarding charging and discharging specifications and contact E-One Moli Energy in advance when designing a device with this cell.

10. WARRANTY OF CELL

Warranty period is one year after factory delivery under normal conditions.

11. SHIPPING STATE OF CELL

The capacity of delivery cell is approximately at 50% of charging.

12. PACKING SPECIFICATION

The maximum quantity of the cells in a master carton box is 150pcs.

13. AMENDMENT OF SPECIFICATION CONTENT

It is necessary to have mutual discussion before making any change of the specification.

Fig. 1. Charge Characteristics for ICP1003450B Cell.

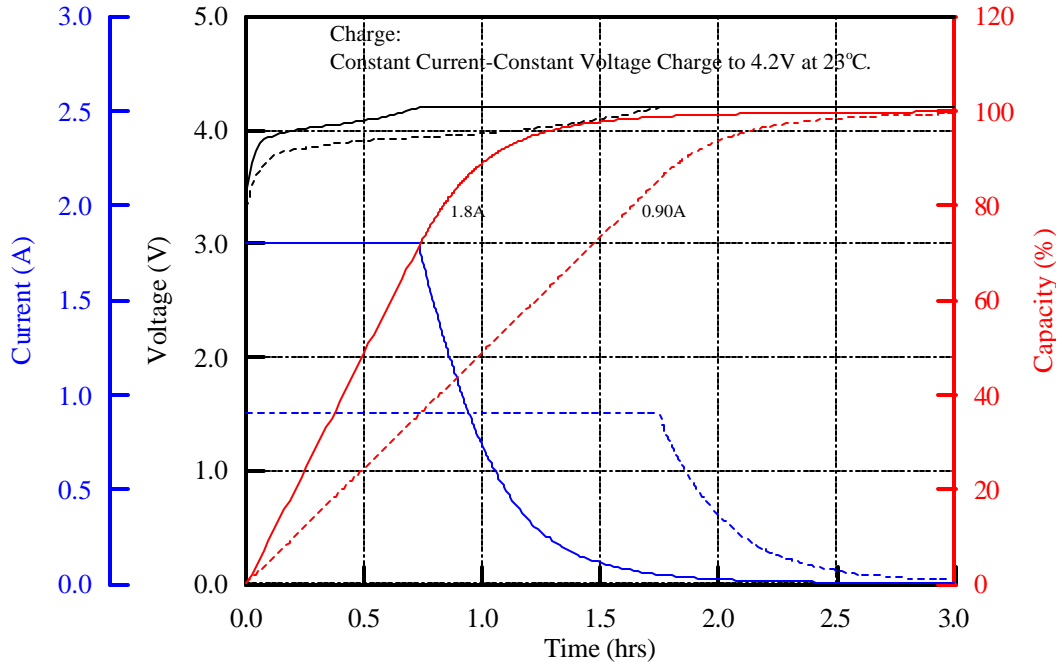


Fig. 2. Discharge Characteristics for ICP1003450B Cell.

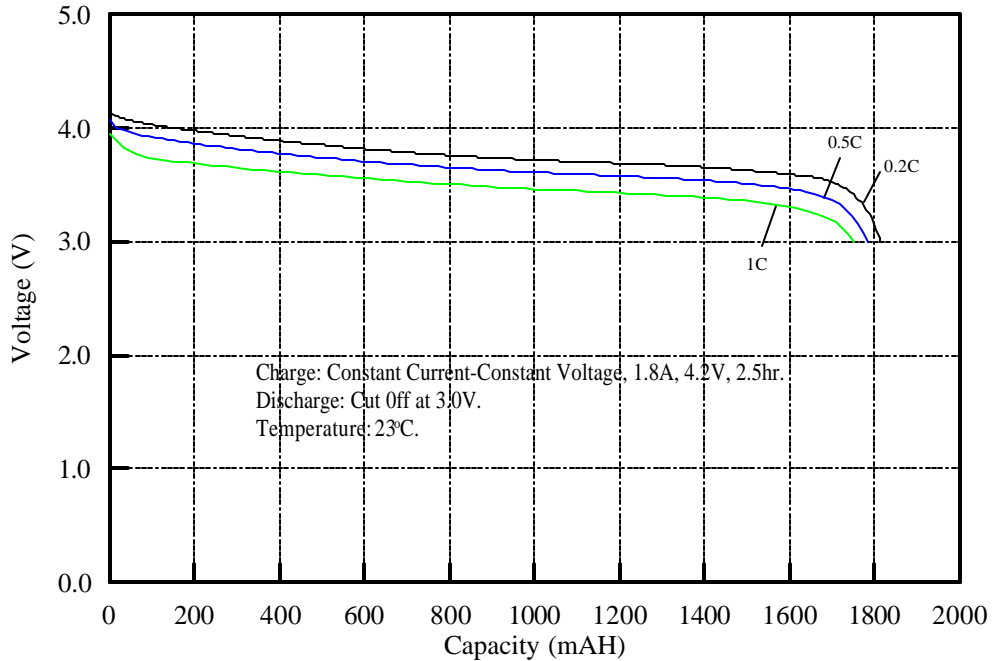


Fig. 3. Discharge Characteristics for ICP1003450B Cell.

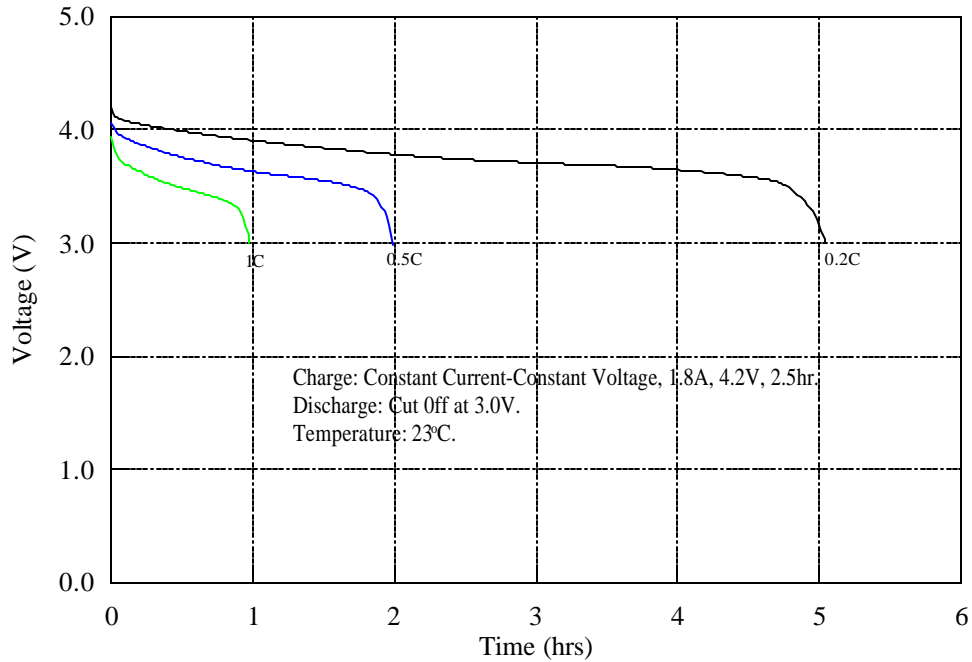


Fig. 4. Discharge Temperature Characteristics for ICP1003450B Cell.

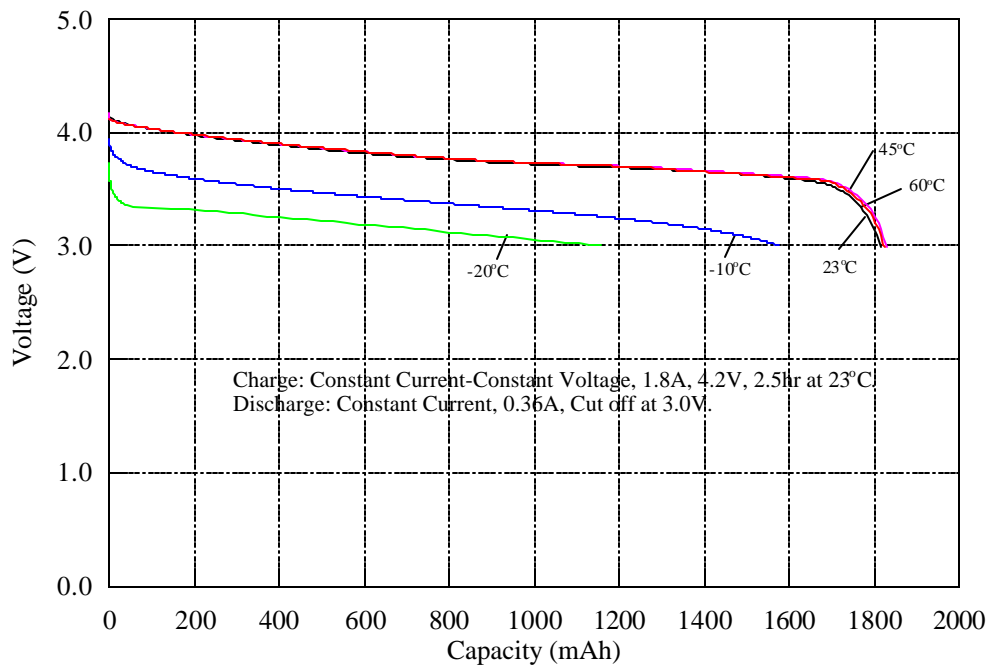


Fig. 5. Discharge Temperature Characteristics for ICP1003450B Cell.

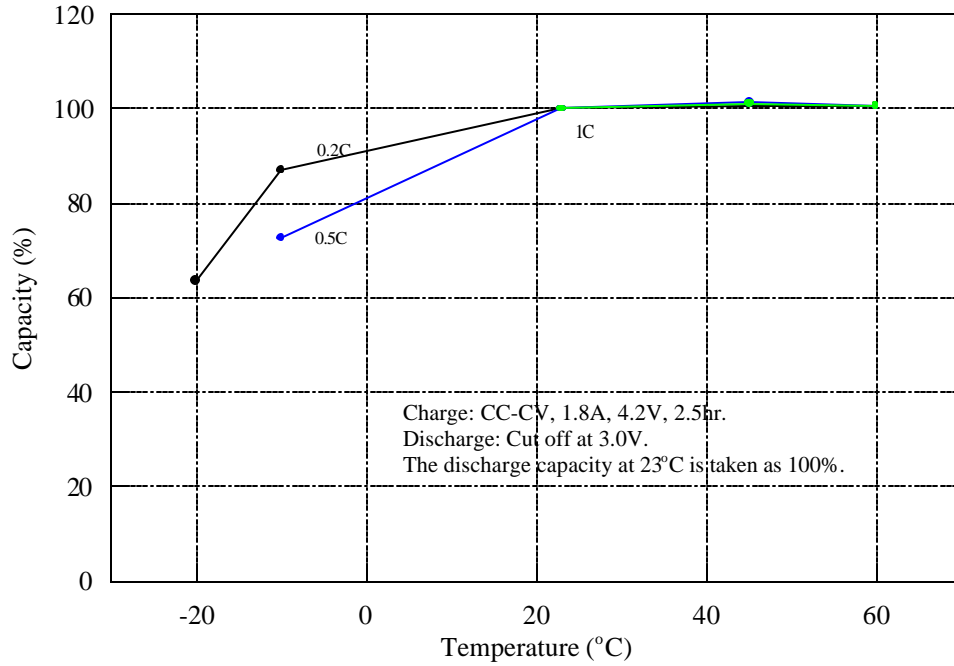


Fig. 6. Cycle Life Characteristics for ICP1003450B Cell at 23°C

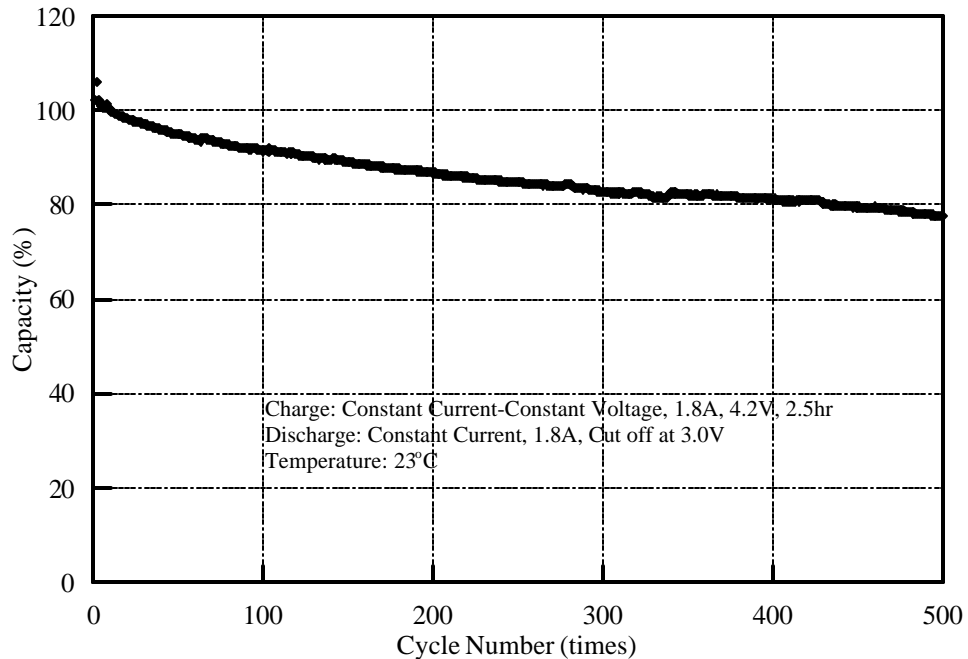


Fig. 7. Cycle Life Characteristics for ICP1003450B Cell at 45 °C

