Description	Document No.	Date	Rev.
Polymer Lithium Ion CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
Prepared by	*Checked by*	*Approved by*	
Technical Engineer	Technical Manager	General Engineer	

CERRO POWER

PRODUCT SPECIFICATION

Rechargeable Polymer Lithium Battery

Model: CP-PL523450H 900mAh 2.59 Wh

Received Marking

Customer's Name : **C.B.E**

Signature :

Company Stamp :

Prepared by	Checked by	Approved by
YANGXIAOLIANG		Simon

SHENZHEN CERRO POWER COMPANY LTD
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History of revision

Revision	Description	Date	Approved by
1.0	First issue	2014-11-06	RG

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Contents

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1. Scope

This specification is applied to Lithium Polymer Battery manufactured by CERRO POWER Co., Ltd.

Standard: GB/T 18287-2013 UL1642

2. Product and Model

2.1 Product ： Polymer Lithium Battery

2.2 Model ： CP523450

3.Battery protection Characteristics (n=1)

No	Item	Parameter	Condition
01	Overcharge protection Detection voltage	(4.275±0.025)*n (v)	Battery voltage is higher than the protection voltage, and the delay time to reach, then the state of the battery into overcharge protection.
02	Overcharge protection delay time	0.96-1.4S	
03	Overcharge protection release voltage	(4.075±0.025)*n(v)	Battery voltage is less than the release voltage, and the delay time to reach, then the state of the battery into overcharge release.
04	Overcharge protection detection voltage	(2.5±0.05)n(v)	Battery voltage is less than the protection voltage, and the delay time to reach, then the state of the battery into overdischarge protection.
05	Overdischarge protection delay time	115-173ms (typical: 144ms)	
06	Overcharge protection Release voltage	(2.9±0.05)*n(v)	Battery voltage is higher than the release voltage, and the delay time to reach, then the state of the battery into over discharge release.
	Overcurrrent discharge protection current	4.5-9.0A	Battery discharge current is higher than the protection current, and the delay time to reach, then the state of the battery into overcurrent protection.
	Overcurrent protection delay time	7.2-11ms(typical: 9ms)	
	Short-circuit protection Delay time	220-380μs (Typical: 320μs)	/

3.1 condition adapting characteristics (n=1)

No	Item	Test Method	Criteria
01	Free fall testing	The cell is to be dropped from a height of 1 meter into a thickness of 20mm board, dropped one on three direction on the positive, negative of the three mutually perpendicular, X,Y,Z Axes.	No Leakage, No smoke, no fire, no explosion.
02	Vibration	The full charging battery from 90 to 100 minutes at three mutually perpendicular planes with excursion of 0.8mm , and charge the frequency from 10 to 55Hz with 1Hz/Min Speed.	No leakage, no fire, no explosion.
03	Crush	After standard charging, a cell is to be crushed between two flat surface, once the maximum pressure has been to 13KN it is to be released.	No fire, No explosion.
04	Invariableness humid and hot	After put the battery in the invariableness humid and hot box of $40^0C\pm2^0C$ and relative humidity of 90-95% for 48 hours, and with discharging current 1.0C till 3.0*n(v) cut off voltage.	No smoke, no explosion, no corrosion, the residual capacity is not less than 60% of the initial capacity.

3.2 Safety performance(n=1)

No	Items	Test Method	Criteria
01	**Short Circuit protection**	After the battery is fully charged, short circuit the positive and negative terminal with 100Mω wire resistance for 1 hour, then charge with $1C_5A$ for 5s, measure the battery open circuit voltage.	No explosion, no fire, no smoking. OCV>/=3.6*n(V)
02	Overcharge protection	After battery charge finished, then charge the battery for 8 hours with a power which can provide 2 times more than normal voltage and 2 C_5A current.	No explosion, no fire, no smoking, the overcharge protection function should be started. Value of (4.275+/-0.025)*n(v)
03	Overdischarge protection	After the battery is fully charged, discharge at $20+/-5^0C$ conditions with $0.5C_5A$ until the battery voltage drops to the overcharge voltage, then discharge with a 30Ω resister for 24 hours.	No explosion, no fire, no smoking, the discharge protection function should be started. Value of (2.5+/-0.005)*n(v)
04	Thermal exposure test	The battery is fully charged in standard charging condition, and store at (5 ± 2^0C)min rate rose to 130 ± 2^0C for 30 minutes.	No explosion, no fire,

3.3. Ratings

Item		Rating	Note
3.1 Capacity	Nominal	900mAh	Standard charge, 0.5C discharge, 2.75V/cell cut off
	Minimum	880mAh	
3.2 Nominal Voltage		11.1V	Average voltage at 0.5C discharge
3.3 Standard Charge Condition		1C(900mA),4.2V(CC-CV),2.5h	
3.4 Maximum Charge Current		1C(900mA)	
3.5 Maximum Charge Voltage		4.25V	
3.6 Maximum Discharge Current		1C(900mA)	Continuous Current
		2C(1800mA) Peak current: 4.2C 5400mAh	Peak Current on 10 minutes.
3.7 Discharge Cut-off Voltage		2.75V	
3.8 Voltage as of shipment		3.7~3.9V	
3.9 Cell Weight		Approx. 40g/	cell
3.10 Operating Temperature	Charge	0~45℃	90%RH Max.
	Discharge	-20~60℃	90%RH Max.
3.11 Storage Temperature	1 month	-20~45℃	Recommended storage temperature: 20℃ or less, at the shipment state
	3 month	-20~35℃	
	1 year	-20~20℃	

4. Outline Dimensions and Appearance

4.1 Outline Dimensions

See attached drawing for CP523450H

Thickness ： Max.5.2mm (Measured with weighting 300gf at 23±2℃)

Width ： 34.5±0.5mm（measured with weighting 300gf at 23±2℃）

Length ： 50.5±0.5mm（without lead film）

This thickness will be swelling when high temperature storage or operation in high temperature.

4.2 Appearance

There shall be no such defect as remarkable scratches, breaks, crack, discoloration, leakage, or deformation, which may adversely affect commercial value of the cell.

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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5. Performance

5.1 Standard Test Condition

Test should be conducted with new batteries within one month after shipment from our factory and the cells shall not be cycled more than five times before the test. Test condition shall be at 23±2℃ and 65±20%RH as long as there is no doubt. The humidity can be any condition unless it affects the test results.

5.2 Measuring Instrument or Apparatus

5.2.1 Dimension Measuring Instrument

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.

5.2.2 Voltmeter

Standard class specified in the national standard or more sensitive class having inner impedance more than 10 MΩ/V

5.2.3 Ammeter

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω.

5.2.4 Impedance Meter

Impedance shall be measured by a sinusoidal alternating current method (1kHz LCR meter).

5.3 Standard Charge Definition

Standard charge is defined by charging for 2.5hrs at 4.2V of constant voltage and 1.0C (700mA) of constant current.

5.4 Rest Period

Unless otherwise defined, 10min rest period after full charge, 10min rest period after discharge.

5.5 Standard Discharge Definition

Standard Discharge is defined by discharging at 0.5C (350mA) down to 2.75V.

5.6 Initial Performance Test

Item	Test Condition	Criteria
Open-Circuit Voltage	The open-circuit voltage shall be measured within 24 hours after standard charge.	4.15V or more
AC Impedance Resistance	The Impedance shall be measured in an alternating current method (1kHz LCR meter) after standard charge at 23±2℃.	60mΩ or less (bare cell)
Initial Capacity	The capacity on 0.5C(1000mA)discharge to 2.75V shall be measured after standard charge at 23±2℃.	700mAh or more

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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5. 7 Electrical Performance

5.7.1 Discharge Rate Capabilities

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

Discharge Current	0.5C(450mA)	1C(900mA)
Discharge Capacity	100%	99%

Note: Percentage as an index of the rated discharge capacity (=900mAh) is 100%.

5.7.2 Temperature Dependence of Capacity (Discharge)

Cells shall meet the discharge capacity requirements listed in the below table under respective discharge temperatures. The capacities are to be measured with constant discharge current 100mA(2.75V cut-off) after standard charge at 23±2℃.

Discharge Temperature	-10℃	0℃	23℃	60℃
Dischar e Capacity	60%	85%	100%	95%

Note: If charge temperature and discharge temperature are not the same, the interval for temperature change comes to 3 hours.

5.7.3 Cycle Life

Cells shall be charged at constant current of 140mA to 4.2V with end current of 35mA. Cells shall be discharged at constant current of 70mA to2.75V. Cells are to be rest 10minutes after charge and 10 minutes after discharge. A cycle is defined as one charge and one discharge. The capacity shall be measured after 300 cycles of charge and discharge at 23±2℃.

Discharge capacity(300th cycle) ≥80%(of 3th cycle discharge capacity); 400th cycle) ≥75%;500th cycle) ≥70%

5.7.4 Shelf Life

Item		Test Condition	Criteria
Storage Characteristics1	1	The capacity on 0.5C discharge shall be measured after standard charge and then storage at 23±2℃ for 28 days.	Remaining Capacity ≥85% Initial capacity
	2	After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge.	Recovery capacity ≥90% Initial capacity
Storage Characteristics2	1	The capacity on 0.5C discharge shall be measured after standard charge and then storage at 60±2℃ for 7 days.	Remaining Capacity ≥60% Initial capacity
	2	After above measured Remaining capacity, the capacity on standard discharge shall be measured after standa d charge.	Recovery capacity ≥80% Initial capacity

5.7.5 High Temperature and High Humidity Test

After standard charge, cells shall be stored at 60℃ (95% RH) for 168 hours. After test, cells are discharged and cycled for 3 cycles to obtain recovered capacity. No leakage. Recovery capacity ≥90% Initial capacity

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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5.7.6 Thermal Shock Test

65℃(8Hrs) ←3hrs → - 20℃ (8Hrs) for 8 cycles with full charged cells. After test, cells are discharged and cycled for 3 cycles to obtain recovered capacity.

No leakage. Recovery capacity ≥90% Initial capacity

5.8 Mechanical Performance

Item	Test Condition	Criteria
Vibration Test	After standard charge, cells are to be tested as following conditions: Amplitude:0.8mm Frequency:10~55Hz(sweep:1Hz/min) Direction: X/Y/Z axis for 90~100min. The battery is to be tested in three mutually perpendicular to each axis.	No leakage, or remarkable defective appearance. Recovery Capacity ≥ 90% Initial capacity
Drop Test	Drop cells in the shipment condition (50% discharge)from 1.2m height onto 5cm or thicker concrete with p-tile on it 3 times each of X, Y, and Z directions at 23±2℃.	No leakage. Recovery Capacity ≥ 90% Initial capacity

5.9 Safety Performance

Item	Test Condition	Criteria
Overcharge Test	After standard discharge, cells are charged at constant current of 75mA and constant voltage of 3.0V while tapering the charge current. Charging is continued for 48 hours.	No explosion, no fire, no smoke.
Heating Test	Cells are to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of 5±2℃/min to a temperature of 130±2℃ at which temperature the oven is to remain for 60 minutes before the test is discontinued.	No explosion, no fire, no smoke.
External Short-Circuit Test	After standard charge, cells are to be short-circuited by connecting the positive and negative terminals of cells with copper wire having a maximum resistance load of 0.1Ω.	No explosion, no fire, no smoke.
Impact Test	After standard charge, cells are impacted with their longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm diameter bar.	No explosion, no fire, no smoke.
Nail Test	A nail (diameter: 2.5~5mm) is penetrated vertically through the center of a fully charged cell and left for 6 hours.	No explosion, no fire, no smoke.
Crush Test	After standard charge, cells are crushed with their longitudinal axis parallel to the flat surface of the crushing apparatus(Per UL1642)	No explosion, no fire, no smoke.

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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6. Period of Warranty

The period of warranty is one year from the date of shipment. CERRO POWER guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customer's abuse and misuse.

7. Shipment

Cells shall be shipped in **50% state of charge.**

8. Amendment of this Specification

This specification is subject to change with prior notice.

9. Others

Any matters that this specification doesn't cover should be conferred between the customer and CERRO POWER

10. Battery structure diagram

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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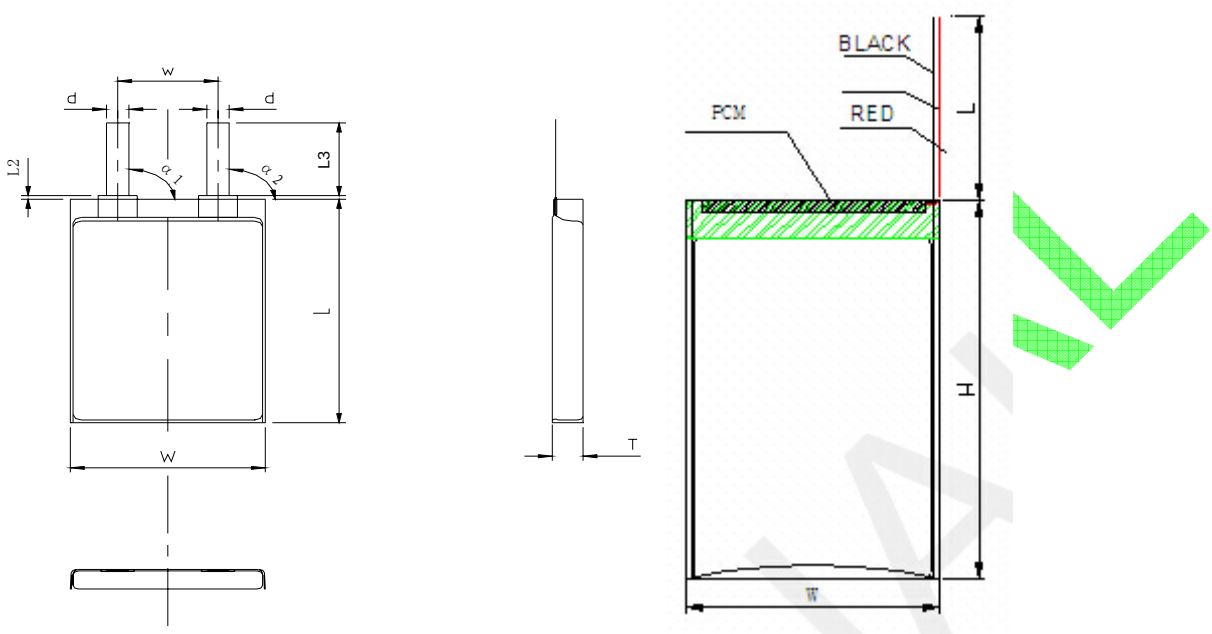
Fig.1 Dimensional Drawing of CP523450H (with date code on the surface)



Max: T5.0 W 34.00x H50mm

Item	Specification
T	**Max: 5.2mm**
W	**Cell: 30.5±0.5mm**
L	**Cell: 50.0±0.5mm**
L2	1.5-1.0mm
L3	10.0±1.0 mm
W（Connector）	30.0±2.0mm
D	3.0±0.1mm
α1	90±5°
α2	90±5°

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-903450H-E01	2014-11-06	1.0
Prepared by	Checked by	Approved by	
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APPENDIX

Handling Precautions and Prohibitions for Polymer Lithium Ion Batteries

Preface

This document of "Handling Precautions and Prohibitions for Polymer Lithium Ion Batteries" shall be applied to the battery cells manufactured by SHENZHEN CERRO POWER COMPANY LTD.

Note (1):
The customer had better contact in advance, if and when the customer needs other applications or operating conditions than those described in this document. Additional experimentation may be necessary to verify performance and safety under such conditions.

Note (2):
will take no responsibility for any accident when the cell is used under other conditions than those described in this document.

Note (3):
will inform, in a written form, improvements from practical view of proper using and handling of the cell to customer, if it is deemed necessary.

1. Charging

1.1 Charging current

Charging current should be less than maximum charge current specified in this Product Specification. Charging with higher current than recommended value may cause damage to cell electrical, mechanical, and safety performance badly and could lead to heat generation or leakage.

1.2 Charging voltage

Charging shall be done by voltage less than that specified in the Product Specification (4.2V/cell). Charging beyond 4.25V, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply with this condition.

It is very dangerous that charging with higher voltage than specified value may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation or leakage.

1.3 Charging temperature

The cell shall be charged within the specified temperature range in the Product Specification.

1.4 Prohibition of reverse charging

Reverse charging is prohibited. The cell shall be connected correctly. The polarity has to be confirmed before wiring. In case of the cell is connected improperly, the cell cannot be charged. Simultaneously, the reverse charging may cause damaging to the cell which may lead to degradation of cell performance and damage the cell safety, and could cause heat generation or leakage.

Description	Document No.	Date	Rev.
Polymer Lithium CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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2. Discharging

2.1 Discharging current

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

2.2 Discharging temperature

The cell shall be discharged within the temperature range specified in the Product Specification.

2.3 Over-discharging

It should be noted that the cell would be at an over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged periodically to maintain between 11.1V and3.9V. Over-discharging may causes loss of cell performance, characteristics, or battery functions.

The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voyage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging procedures as follows:

The cell battery pack shall start with a low current (0.01C) for 15 - 30 minutes, i.e. pre-charging, before rapid charging starts. The rapid charging shall be started after the individual cell voltage has been reached above 3V within 15 - 30 minutes that can be determined with the use of an appropriate timer for pre-charging.

In case the individual cell voltage does not rise to 3V within the pre-charging time, then the charger shall have functions to stop further charging and display the cell/pack is at abnormal state.

3. Protection Circuit Module (PCM)

The cell/battery pack shall be with a PCM that can protect cell/battery pack properly. PCM shall have functions of (1) overcharging prevention, (2) over-discharging prevention, and (3) over current prevention to maintain safety and prevent significant deterioration of cell performance. The over current can occur by external short circuit at any rate.

3.1 Overcharging prohibition

Overcharging prevention function shall work if any one of the cells of the battery pack reaches to the PCM overcharge protection voltage above which the charging shall be stopped.

3.2 Over-discharge prohibition

Over-discharging prevention function shall work to minimize a dissipation current to avoid further drop under the PCM over-discharge protection voltage in any cell of the battery pack. It is recommended that the dissipation current of PCM shall be designed to be minimized such as 0.5 μ A or less after the over-discharge prevention function works.

The protection function shall keep each bank of the battery pack and control the current all time.

4. Storage

The cell should be stored within the proper voltage and temperature range specified in the Product Specification.

Description	Document No.	Date	Rev.
Polymer Lithium Ion CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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5. Handling of Bare Cells

5.1 Consideration of strength of film package

(1) Aluminum Laminate foil

Easily damaged by sharp edge parts such as Ni-tabs, pins and needles, comparing with metal can case LIB.

(2) Film sealed parts

May be damaged by heat above approximately 100℃ (Seal break may cause electrolyte leakage).

Don't bend or fold sealing edge.

(3)Folding edge

Don't open or deform folding edge.

5.2 Short-circuit prohibition

Don't make the cell short-circuit. It makes generation of very high currents which subsidiary cause heating of the cells, which may cause electrolyte leakage, gassing, explosion which are very dangerous.

The tabs may be easily short-circuited by putting them on conductive surface. An appropriate circuitry with PCM shall be applied to protect accidental short-circuit of battery pack.

5.3 Mechanical Shock

EPT cells have less endurance than metal can case LIB. Falling, hitting, bending etc., may cause cells performance degradation.

5.4 Handling of Tabs

The cells tabs are not so strong especially for Aluminum tab as positive terminal compared with nickel tab of negative terminal. Don't put much force on tabs. Aluminum tab may easily be torn off by shear force. Don't bend tab many times.

6. Notice for Designing Battery Pack

6.1 Battery pack should have sufficient strength and cell should be protected from mechanical shock. No sharp edge components should be inside the pack containing the battery.

6.2 Cell Fixing

The cell should be fixed in the battery pack to be able to contact with together tightly. No cell movement in the battery pack should be allowed.

6.3 Tab Connection

Ultrasonic welding or spot welding is recommended to connect cell with PCM or other components.

6.4 For Unexpected Accidents or Incidents

Battery pack should be designed not to generate heat even when leakage occurred by accident.

Isolate PCM from leaked electrolyte as perfectly as possible.

Avoid narrow distance between bare circuit patterns with different voltage. (Including connector area)

If leaked electrolyte has soaked into bare circuit patterns may cause short circuit or damage. The design of PCM must be considered for safety in such case.

7. Notice for Assembling Battery Pack

Shocks, high temperature, or contacts of sharp edge components should be not allowed in battery pack assembling process.

Don't solder directly to tabs. Don't bring heated tools such as solder tip close to cells. Temperature above 80℃ may cause damage to the cell and degrade its performance.

Description	Document No.	Date	Rev.
Polymer Lithium Ion CP523450H	PS-PLIB-CP523450H-E01	2014-11-06	1.0
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In case that the battery pack is fixed by ultrasonic welding, it is necessary to consider not to apply too much ultrasonic welding power to cell and electronic circuits such as PCM.

Otherwise it may cause serious damage to the cells and electronic circuit.

8. Others

8.1 Cell Connection

1) Direct soldering of wire leads or parts to the cells is strictly prohibited.

2) Lead tabs with pre-soldered wiring shall be spot welded to the cells.

Direct soldering may cause damage of components, such as separator or insulator, and punch by heat generation.

8.2 Prevention of Short Circuit within a Battery Pack

Enough insulation layers between wiring and the cells shall be used to maintain extra safety protection.

The battery pack shall be structured with no short circuit within the battery pack, which may cause generation of smoke or firing.

8.3 Prohibition of Disassembly

1) Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, fining, explosion, or other problems.

2) Electrolyte is Harmful

The leaked electrolyte is a sort of harmful materials to the human body. In case the electrolyte is contacted with the skin, eyes or others, the electrolyte shall be flushed immediately with fresh water and seek medical advice by physicians.

8.4 Prohibition of Dumping of Cells into Fire

Never incinerate nor dispose the cells in fire. These may cause explosion of the cells, which is very dangerous and is prohibited.

8.5 Prohibition of Cells immersion into liquid such as water

The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others.

8.6 Battery Cells Replacement

The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

8.7 Prohibition of Use of damaged Cells

The cells would be able to get any damage during shipping by any shocks. If any abnormal features of the cells are found such as damages in a plastic envelop of the cell, deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more.

The cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing or explosion.