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## Product Specification

-Cylindrical Li-ion cell

**Cell model:** IFR14500-600mAh

**Customer ID:** \_\_\_\_\_

Revision	Revised history	Issue Date
B0	Updated for all	2016-8-30
B1	Updated cycle life, discharge-current etc.	2016-10-20
B2	Add index" instantaneous Max. discharge-current allowed" etc.	2016-11-30
B3	Revised "operation temp. for standard-charge" .	2017-1-13
B4	Revised "operation temp. for Quick charge/discharge" .	2017-3-24
Prepared by	Checked by	Approved by

## Content

1. Scope .....	3
2. Cell type .....	3
3. Basic parameter for cell .....	3~4
4. Performance index for cell .....	4~9
5. Protect circuit.....	9
6. Storage and others .....	10
7. Cell outline and dimensions .....	10
8. Characteristic curve.....	11

## 1. Scope

This specification is based on standard GB 31241-2014, IEC61960:2011, IEC62133:2012, IEC62620:2014 and UL1642:2012 to compile electronic performance, testing condition and testing method etc.for Cylindrical Li-Ion cell as following.

## 2. Cell type : IFR14500-600mAh

## 3. Basic parameter for cell

No.	Items	Specifications	
1	Charging Cut-off Voltage	(3.65±0.03)V	
2	Nominal Voltage	3.2V	
3	Nominal Capacity(C <sub>5</sub> Ah)	600mAh@0.2ItA discharging	
4	Standard Charging Current	0.2ItA	
5	Standard charging method	Charging the cell voltage to (3.65±0.03)V with constant current 0.2ItA, and then constant voltage (3.65±0.03)V to charge cell to charging current is less than 0.02ItA.	
6	Maximum charging current (Quick charging)	1.0 ItA	
7	Standard discharging current	0.2 ItA	
8	Maximum continuous discharging-current (Quick discharging)	2.0 ItA	
9	Instantaneous maximum discharge-current allowed	4.0 ItA(5±0.1S)	
10	Discharging cut-off voltage	2.0 V	
11	Operation temperature	Standard charge/discharge	Charging : 0°C ~ 60°C Discharging : -20°C~60°C (Under - 20 °C ~ 0 °C recycling is not recommended)
		Quick charge/ discharge	Charging : 10°C ~ 60°C Discharging : -10°C~60°C

12	Storage temperature/humidity	≤ 1month	Temperature : -20°C ~ 45°C Humidity : 65%±20% RH
		≤ 3months	Temperature : -20°C ~ 35°C Humidity : 65%±20% RH
		≤ 12months	Temperature : -20°C ~ 25°C Humidity : 65%±20% RH
		Proposed long term storage temperature in 20±5°C.	
13	Weight	About (17.5±2)g	
14	Dimension	High:(49.0±0.5)mm Diameter:(14.2±0.3)mm	

#### 4. Performance index for cell

##### 4.1 Electronic performance index

No.	Item	Performance index		Testing condition and method
1	Initial resistance	≤ 85 mΩ		Internal resistance measured by a sinusoidal alternating current 1KHz for cell with 50% charge in an ambient temperature 25±3°C.
2	Rated capacity	0.2I <sub>t</sub> A	Capacity≥100 %C <sub>5</sub> Ah	1.Charging cell to full by standard charging method under condition with 25+/-3°C and 65±20%RH,. 2. Stored cell without load one hour in an ambient temperature 25±3°C. 3. Discharging with 0.2ItA until final voltage is 2.0V. 4. Five cycles are permitted for this test. The test shall be terminated at the end of the first cycle which meets the requirement.
3	Rated discharging performance	0.5I <sub>t</sub> A	Capacity≥100 %C <sub>5</sub> Ah	1.Charging cell by standard charging method in an ambient temperature 25±3°C. 2.Stored cell without load in one hour. 3.Discharging with 0.5/1.0 I <sub>t</sub> A until final voltage is 2.0V.
		1.0I <sub>t</sub> A	Capacity≥99 %C <sub>5</sub> Ah	

		$3.0I_tA$	Capacity $\geq$ 87% $C_5Ah$	
4	Discharging performance at high/low temperature	-20°C	Capacity $\geq$ 50% $C_5Ah$	Charging cell to full by standard charging method and stored it 16hrs at chamber with -20°C/-10°C/0°C /10°C, and then discharging it with $0.2I_tA$ until final voltage is 2.0V.
		-10°C	Capacity $\geq$ 70% $C_5Ah$	
		0°C	Capacity $\geq$ 80% $C_5Ah$	
		10°C	Capacity $\geq$ 90% $C_5Ah$	
		45°C	Capacity $\geq$ 100% $C_5Ah$	Charging cell to full by standard charging method and stored it 2hrs at chamber with 45°C/60°C, and then discharging it with $0.2I_tA$ until final voltage is 2.0V.
		60°C	Capacity $\geq$ 95% $C_5Ah$	
5	Instantaneous maximum discharge-current allowed	No deformation/No leakage/No interrupt during discharge, and discharge capacity $\geq$ 95% $C_5Ah$ (IEC62620:2014)		<ol style="list-style-type: none"> <li>1.Charging cell by standard charging method in an ambient temperature <math>25\pm 3^\circ C</math>.</li> <li>2.Stored cell without load in one hour.</li> <li>3.Discharging with <math>6.0 I_tA</math> and continue time is <math>5\pm 0.1S</math></li> <li>4.Final,discharging cell with <math>0.2 I_tA</math> until final voltage is 2.0V.</li> </ol>
6	Cycle life	$\geq 2000$ Cycles		<ol style="list-style-type: none"> <li>1. Discharging cell with <math>1.0I_tA</math> until its voltage is 2.0V at an ambient temperature <math>25\pm 3^\circ C</math>.</li> <li>2. Charging cell with <math>1.0I_tA</math> until its voltage is 3.65V, and than turns to charging with constant voltage 3.65V until the charging current is less than <math>0.02 I_tA</math>.</li> <li>4. Stored cell 10 minutes.</li> <li>5. Discharging cell with <math>1.0I_tA</math> until its voltage is 2.0V.</li> <li>5. Stored cell 10 minutes.</li> <li>6. Repeat step 1~5 until discharging capacity<math>\leq</math>80% <math>C_5Ah</math>.</li> </ol>
7	Permanent charge life	Discharge capacity $\geq$ 85% $C_5Ah$ (IEC62620:2014)		<ol style="list-style-type: none"> <li>1.Charging cell to full by standard charging method.</li> <li>2. Stored it for 24hrs at 60°C in chamber.</li> <li>3. Charging cell with constant voltage 3.50~3.55V at an ambient temperature 60°C for 90 days.</li> </ol>

			4. After completing test, stored cell at $25\pm 3^{\circ}\text{C}$ for 16hrs. And then discharging with $0.2I_t\text{A}$ until its voltage is 2.0V.		
8	Storage performance	Stored cell with 100% SOC at an ambient temperature $25^{\circ}\text{C}$ .			
		Items	1 month	3 months	6 months
		Capacity retention	$\geq 95\%$	$\geq 90\%$	$\geq 85\%$
		Capacity recovery	$\geq 97\%$	$\geq 93\%$	$\geq 90\%$
		Stored cell with 50% SOC at an ambient temperature $25^{\circ}\text{C}$ .			
		Capacity recovery	$\geq 98.5\%$	$\geq 95\%$	$\geq 93\%$
		Proposed to charge/discharge cell one time per 6 months if customer need to store it long time.			
9	Cell voltage & State of charge (SOC)	For shipment: 1. Voltage: $\geq 3.28\text{V}$ 2. SOC : $\sim 50\%$			

#### 4.2 Safety performance

No.	Testing Items	Criteria	Test Condition
1	Abnormal Charging	No explosion, No fire.	Discharging cell with $0.2I_t\text{A}$ until its voltage is 2.0V, and then charging cell with $3I_t\text{A}$ to 5.0V. Finally, using constant voltage 5.0V to charge cell. Testing is end when charging duration is reach to 7hrs or cell body temperature is lower than peak value of 20%. Remark: test ambient temperature in $25\pm 3^{\circ}\text{C}$ .
2	Forced Discharge	No explosion, No fire	Discharging cell with $0.2I_t\text{A}$ until its voltage is 2.0V in an ambient temperature $25\pm 3^{\circ}\text{C}$ , and then reverse charging with $1.0I_t\text{A}$ for 90mins.
3	Short circuit-room temperature	No explosion, No fire, The highest temperature of the cell surface is less than $150^{\circ}\text{C}$	1. Charging cell to full by standard charging method and stored it in an ambient temperature $25\pm 3^{\circ}\text{C}$ . 2. Waiting for the surface temperature of cell body is reach $25\pm 3^{\circ}\text{C}$ , and then stored it 30mins. 3. Connecting the positive and negative terminals of the cell with a circuit load having a resistance load of $80\pm 20\text{m}\Omega$ . The testing can end when the cell temperature dropped to 20% lower than the peak value or short connecting time is reach 24hrs.

4	Short circuit-high temperature	No explosion, No fire , The highest temperature of the cell surface is less than 150°C	<p>1.Charging cell to full by standard charging method and stored it in an ambient temperature <math>55 \pm 5^{\circ}\text{C}</math>.</p> <p>2.Waiting for the surface temperature of cell body is reach <math>55 \pm 5^{\circ}\text{C}</math>,and then stored it 30mins.</p> <p>3.Connecting the positive and negative terminals of the cell with a circuit load having a resistance load of <math>80 \pm 20\text{m}\Omega</math>.The testing can end when the cell temperature dropped to 20% lower than the peak value or short connecting time is reach 24hrs.</p>
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#### 4.3 Environmental and mechanical performance

No.	Item(s)	Criteria	Testing condition and method
1	Low pressure (Altitude Simulation)	No explosion, No fire, No leakage.	Charging cell to full by standard charging method, and then stored it for 6 hours at an absolute pressure of 11.6 kPa (1.68 psi) and a temperature of $25 \pm 3^{\circ}\text{C}$
2	Temperature Cycling	No explosion, No fire, No leakage.	<p>1. Charging cell to full by standard charging method and stored it in testing chamber.</p> <p>2. Raising the chamber-temperature to <math>75 \pm 2^{\circ}\text{C}</math> within 30 minutes and maintaining this temperature for 6 hours.</p> <p>3. Reducing the chamber-temperature to <math>-40 \pm 2^{\circ}\text{C}</math> within 30 minutes and maintaining this temperature for 6 hours.</p> <p>4. Raising the chamber-temperature to <math>75 \pm 2^{\circ}\text{C}</math> within 30 minutes and maintaining this temperature for 6 hours.</p> <p>5. Repeating step 2~4 for a further 9 cycles.</p>
3	Vibration test	No explosion, No fire, No leakage.	A full-charged cell is to be subjected to simple harmonic motion with amplitude of 1.6 mm total maximum excursion. The frequency is to be varied at the rate of 1 hertz per minute between 10 and 55 hertz. Each axis(X/Y/Z) for 90mins respectively.
4	Shock test	No explosion, No fire, No leakage.	<p>1. Charging cell to full by standard charging method and secured to the testing machine to perform equal magnitude shock test.</p> <p>2.For each shock the cell is to be accelerated in such a manner that during the initial 3 milliseconds the minimum average acceleration is 75 g. The peak acceleration shall be between 125 and 175 g. pulse duration: 5~7ms.</p>

			3. Shock cell three times for each axis.
5	Free drop test	No explosion, No fire	1. Each fully charged cell is dropped from a height of 1,0 m onto a concrete floor. 2. Total drops 4 times(drop one time for top/bottom/left and right of the body respectively)
6	Crush test	No explosion, No fire	The flat surfaces are to be brought in contact with the full-charged cell and the crushing is to be continued until an applied force of $13 \pm 0.2\text{kN}$ is reached. Once the maximum force has been obtained it is to be released. Remark: 1.Down speed is not over 5mm/s. 2.The cell cannot occur short-circuit during testing.
7	Impact test	No explosion, No fire	1. Charging cell to full by standard charging method and placed on a flat surface. 2. $15.8 \pm 0.2\text{mm}$ diameter bar is to be placed across the center of the sample. 3. $9.1 \pm 0.1$ kg weight is to be dropped from a height of $610 \pm 25$ mm onto the cell. 4. Observing it 6hrs. 5.Cylindrical cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm diameter curved surface lying across the center of the test sample. 6. Impact one time for test sample only.
8	Thermal abuse	No explosion, No fire	1. Charging cell to full by standard charging method and placed it into testing oven. 2. The oven temperature is raised at a rate of $5 \text{ }^\circ\text{C}/\text{min} \pm 2 \text{ }^\circ\text{C}/\text{min}$ to a temperature of $130 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ . 3. Maintaining this temperature for 30mins.



9	Projectile Test	No part of cell or entire cell penetrates the wire screen (Except powder materials)	<p>1.Charging cell to full by standard charging method and placed it on screen that in the center of a platform table.</p> <p>2. It is not required to secure the sample in place unless it is at risk of falling off the screen before the test is completed. When required, the sample shall be secured to the screen with a single wire tied around the sample.</p> <p>3. Using flame to heat the cell. Stopping heat when appearing three kind of situations as below:</p> <p>a) Cell exploding.</p> <p>b) Full burning for cell.</p> <p>c) Continuous heating cell 30mins, but cell has not fire or exploding.</p>
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#### 4.4 Visual inspection

Effecting business value' s defect such as scratch, racking, leakage etc. is not allowed.

#### 4.5 Standard testing condition

All items in this product specification are use testing condition as following unless otherwise noted.

Temperature: ( 25±3 ) °C

Humidity: ( 65±20 ) % RH

#### 5. Protect circuit

Cell must have protection with over-charging, over-discharging, over-current during use, and protect circuit must have functions as following:

##### 5.1 Over-charging protection

Over-charging protect circuit to prevent cell voltage over (3.65±0.03)V.

##### 5.2 Over-discharging protection

Over-discharging protect circuit to prevent cell voltage less than 2.0V.

##### 5.3 Over-current protection

Cell' s discharging current cannot higher than maximum current as mentioned in this specification. Big current discharging will cause cell capacity decrease or over-hot, even the function failure.

## 6. Storage and others

### 6.1 Long term storage

If the cell need to long term storage, its stored voltage shall be in (3.2~3.4) V and stored it based on no. 8 of clause 4.1.

### 6.2 Quality insurance

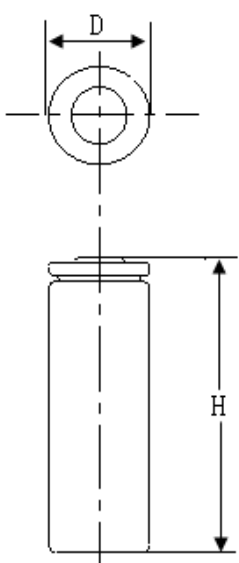
This company' s product insurance by Ping An Property & Casualty Insurance Company of China , Ltd

### 6.3 Others

6.3.1 This product specification may not including other item(s), customer can contact with us to do further discussion. RONDA retains the right to change the specifications.

6.3.2 Please perform testing or sampling check within one month when you receive goods.

## 7. Outline and dimension

	Item(s)	Specification(s)
	D(mm)	14.2±0.3
	H(mm)	49.0±0.5
	Outer diameter for cap (mm)	7.0±0.3

### 8. Characteristic curve

Following charts are actual measurement curves by testing product, so it is for your reference only, not for as inspection standard.

