TEST REPORT
IEC 62133

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications

Report Number. .....:	68.280.17.241.01
Date of issue .....:	2017-06-08
Total number of pages.....	29 pages
Applicant's name.....:	Shenzhen Huanyuyuan Technology Co., Ltd.
Address .....:	Block 72C, Dongyuan Industrial Park, No. 28 Beihuan Road West, Longteng Area, Shiyan Town, Bao'an District, 518108 Shenzhen, PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard .....:	IEC 62133:2012(Second Edition)/EN 62133:2013
Test procedure .....:	Test Report
Non-standard test method.....:	N/A
Test Report Form No.....:	IEC62133B
Test Report Form(s) Originator ....:	UL(Demko)
Master TRF.....:	Dated 2013-03

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description .....:	Lithium-ion Battery
Trade Mark .....:	HUANYUYUAN
Manufacturer.....:	Same as the applicant
Model/Type reference .....:	ICR18650 2200
Ratings .....:	3.7Vd.c., 2200mAh

Testing procedure and testing location:

Testing Laboratory:

Testing location/ address.....: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

No.11, Jukeng Rd., Juling Village, Jutang District, Guanlan, Longhua New District, 518110 Shenzhen, CHINA

Tested by (name + signature).....: Panda Xiong

Approved by (name + signature).: Ryan Jin

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Tests are made with the number of samples specified in Table 2 of IEC 62133: 2012 (Second Edition). cl. 8.3.2 External short circuit (battery) cl. 8.3.3 Free fall cl. 8.3.6 Over-charging of battery cl. 8.3.9 Design evaluation - Forced internal short circuit (cells) (See Remark 2 of General remarks) The samples comply with the requirement of IEC 62133:2012 (Second Edition)	TÜV SÜD Certification and Testing(China) Co., Ltd. Shenzhen Branch No.11, Jukeng Rd., Juling Village, Jutang District, Guanlan, Longhua New District, 518110 Shenzhen, P.R. China

Summary of compliance with National Differences:

Remark: EN Group differences are considered. National differences are not considered.

List of countries addressed: N/A

Copy of marking plate:

The final marking which will be pasted on the battery:

Remark: "YYYY-MM-DDD" represents the date of manufacture. For example, "2016-12-20" represents the battery manufactured on December 20th, 2016.

Test item particulars ..... :	
Classification of installation and use ..... :	Build-in and use in portable applications
Supply connection ..... :	Supply by connector
Recommend charging method declaired by the manufacturer ..... :	Charge at constant current 440mA until voltage reaches 4.2V, then charge at constant voltage 4.2V till charge current is 22mA.
Discharge current (0,2 I_t A) ..... :	440mA
Specified final voltage ..... :	3.0V
Chemistry ..... :	☐nickel systems ..... ☒ lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell ..... :	4.2V
Maximum charging current..... :	1100mA
Charging temperature upper limit..... :	45°C
Charging temperature lower limit ..... :	0°C
Polymer cell electrolyte type..... :	☐ gel polymer ..... ☐ solid polymer
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing ..... :	
Date of receipt of test item..... :	2016-12-15
Date (s) of performance of tests..... :	2016-12-15 to 2016-12-20

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Remark:
1. The samples also comply with the requirement of EN 62133:2013. There is no difference between IEC 62133:2012 and EN 62133:2013.

2. The charging temperature upper limit of the battery is 45°C, the charging temperature lower limit of the battery is 0°C, so based on the CB certificate FI-18097 of the cell, tests of clause 8.3.9 are re-evaluated.

Annex 1: Page 25 – Page 29 for Photo Documentation

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :

☐ **Yes**
☒ **Not applicable**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) ..... : Same as the applicant

General product information:

1. The sample is battery used for portable appliance, model: ICR18650 2200. It consists of single cell. The cell model: 18650 2200mAh, which was approved by CB scheme, CB certificate number: FI-18097.

2. Additionally, details information of the cell and battery as following:

Product name	Lithium-ion Battery
Type/model	ICR18650 2200
Nominal voltage	3.7Vd.c.
Rated capacity	2200mAh
Charging voltage recommended by manufacturer	4.2V
Upper limit charging voltage	4.2V
Charging current declared by manufacturer	440mA
Maximum Charging Current	1100mA
Charging temp. upper limit	45°C
Charging temp. lower limit	0°C
First charging procedure at 20°C±5°C	Charge at constant current 440mA until voltage reaches 4.2V, then charge at constant voltage 4.2V till charge current is 22mA.
Second charging procedure at -5°C or 45°C	Store at -5°C or 45°C for 1 to 4 hours, then charge at constant current 1100mA until voltage reaches 4.2V, then charge at constant voltage 4.2V till charge current reduced to $0.05I_t$ A (110mA).
Final voltage	3.0V
Dimensions	Φ×H: Max. (19.5mm × 71.0mm)
Weight	Approx. 47.0g

The final evaluation of the battery must be conducted in the end product for which the battery will be used.

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
4	**Parameter measurement tolerances**		P
	Parameter measurement tolerances		P
5	**General safety considerations**		P
5.1	General		P
5.2	Insulation and wiring		P
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ	No externally exposed metal surfaces	N/A
	Insulation resistance (MΩ) .....:		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate creepage and clearance distances between conductors		P
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		P
5.3	Venting		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition		P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief		N/A
5.4	Temperature/voltage/current management		P
	Batteries are designed such that abnormal temperature rise conditions are prevented		P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		P
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the temperature, voltage and current limits specified		P
5.5	Terminal contacts		P
	Terminals have a clear polarity marking on the external surface of the battery	Connector prevents reverse polarity connections	N/A

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		P
	Terminal contacts are arranged to minimize the risk of short circuits		P
5.6	Assembly of cells into batteries		P
5.6.1	If there is more than one battery housed in a single battery case, cells used in the assembly of each battery have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		N/A
	Each battery has an independent control and protection		N/A
	Manufacturers of cells make recommendations about current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		N/A
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate separate circuitry to prevent the cell reversal caused by uneven discharges		N/A
	Protective circuit components are added as appropriate and consideration given to the end-device application		N/A
	When testing a battery, the manufacturer of the battery provides a test report confirming the compliance according to this standard		N/A
5.6.2	Design recommendation for lithium systems only		P
	For the battery consisting of a single cell or a single cellblock: - Charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Clause 8.1.2, Table 4; or		N/A
	- Charging voltage of the cell does not exceed the different upper limit of the charging voltage determined through Clause 8.1.2, NOTE 1.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - The voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, by monitoring the voltage of every single cell or the single cellblocks; or		N/A
	- The voltages of any one of the single cells or single cellblocks does not exceed the different upper limit of the charging voltage, determined through Clause 8.1.2, NOTE 1, by monitoring the voltage of every single cell or the single cellblocks		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - Charging is stopped when the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks; or		N/A
	- Charging is stopped when the upper limit of the different charging voltage, determined through Clause 8.1.2, NOTE 1, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		N/A
5.7	Quality plan		P
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery		P
6	**Type test conditions**		P
	Tests were made with the number of cells or batteries specified in Table 1 for nickel-cadmium and nickel-metal hydride systems and Table 2 for lithium systems, using cells or batteries that are not more than six months old	Tests are performed according to specified in Table 2 of the standard. The samples are not more than 6 months old.	P
	Unless noted otherwise in the test methods, testing was conducted in an ambient of 20°C ± 5°C.		P
7	**Specific requirements and tests (nickel systems)**		N/A
7.1	Charging procedure for test purposes		N/A
7.2	Intended use		N/A
7.2.1	Continuous low-rate charging (cells)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire. No explosion		N/A
7.2.2	Vibration		N/A
	Results: No fire. No explosion. No leakage	(See Table 7.2.2)	N/A
7.2.3	Moulded case stress at high ambient temperature		N/A
	Oven temperature (°C) ..... :		—
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N/A
7.2.4	Temperature cycling		N/A
	Results: No fire. No explosion. No leakage.		N/A
7.3	Reasonably foreseeable misuse		N/A
7.3.1	Incorrect installation cell		N/A
	The test was carried out using: - Four fully charged cells of the same brand, type, size and age connected in series, with one of them reversed; or		N/A
	- A stabilized dc power supply.		N/A
	Results: No fire. No explosion..... :		N/A
7.3.2	External short circuit		N/A
	The cells or batteries were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.2)	N/A
7.3.3	Free fall		N/A
	Results: No fire. No explosion.		N/A
7.3.4	Mechanical shock (crash hazard)		N/A
	Results: No fire. No explosion. No leakage.		N/A
7.3.5	Thermal abuse		N/A
	Oven temperature (°C) ..... :		—
	Results: No fire. No explosion.		N/A
7.3.6	Crushing of cells		N/A
	The crushing force was released upon: - The maximum force of 13 kN ± 1 kN has been applied; or		N/A
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The cell is prismatic type and a second set of samples was tested, rotated 90° around longitudinal axis compared to the first set		N/A
	Results: No fire. No explosion..... :		N/A
7.3.7	Low pressure		N/A
	Chamber pressure (kPa)..... :		—
	Results: No fire. No explosion. No leakage.		N/A
7.3.8	Overcharge		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.8)	N/A
7.3.9	Forced discharge		N/A
	Results: No fire. No explosion..... :		N/A
8	**Specific requirements and tests (lithium systems)**		P
8.1	Charging procedures for test purposes		P
8.1.1	First procedure: This charging procedure applied to tests other than those specified in 8.1.2		P
8.1.2	Second procedure: This charging procedure applied to the tests of 8.3.1, 8.3.2, 8.3.4, 8.3.5, and 8.3.9		P
	If a cell's specified upper and/or lower charging temperature exceeds values for the upper and/or lower limit test temperatures of Table 4, the cells were charged at the specified values plus 5 °C for the upper limit and minus 5 °C for the lower limit		P
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... :		P
	For a different upper limit charging voltage (i.e. other than for lithium cobalt oxide systems at 4,25 V), the applied upper limit charging voltage and upper limit charging temperatures were adjusted accordingly		P
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... :		P
8.2	Intended use		N/A
8.2.1	Continuous charging at constant voltage (cells)		N/A
	Results: No fire. No explosion..... :	(See Table 8.2.1)	N/A
8.2.2	Moulded case stress at high ambient temperature (battery)	No moulded case	N/A
	Oven temperature (°C)..... :	70°C ± 2°C	—

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Clause	Requirement + Test	Result - Remark	Verdict
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N/A
8.3	Reasonably foreseeable misuse		P
8.3.1	External short circuit (cell)		N/A
	The cells were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		N/A
	Results: No fire. No explosion..... :	(See Table 8.3.1)	N/A
8.3.2	External short circuit (battery)		P
	The batteries were tested until one of the following occurred: - 24 hours elapsed; or		P
	- The case temperature declined by 20% of the maximum temperature rise		N/A
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		N/A
	Results: No fire. No explosion..... :	(See Table 8.3.2)	P
8.3.3	Free fall		P
	Results: No fire. No explosion.		P
8.3.4	Thermal abuse (cells)		N/A
	The cells were held at 130°C ± 2°C for: - 10 minutes; or		N/A
	- 30 minutes for large cells (gross mass of more than 500 g as defined in IEC 62281)		N/A
	Oven temperature (°C)..... :	130°C	—
	Gross mass of cell (g) ..... :		—
	Results: No fire. No explosion.		N/A
8.3.5	Crush (cells)		N/A
	The crushing force was released upon: - The maximum force of 13 kN ± 1 kN has been applied; or		N/A
	- An abrupt voltage drop of one-third of the original voltage has been obtained; or		N/A
	- 10% of deformation has occurred compared to the initial dimension		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire. No explosion..... :	(See Table 8.3.5)	N/A
8.3.6	Over-charging of battery		P
	Test was continued until the temperature of the outer casing: - Reached steady state conditions (less than 10°C change in 30-minute period); or		N/A
	- Returned to ambient		P
	Results: No fire. No explosion..... :	(See Table 8.3.6)	P
8.3.7	Forced discharge (cells)		N/A
	Results: No fire. No explosion..... :		N/A
8.3.8	Transport tests	UN38.3 test report provided	P
	Manufacturer's documentation provided to show compliance with UN Recommendations on Transport of Dangerous Goods		P
8.3.9	Design evaluation – Forced internal short circuit (cells)		P
	The cells complied with national requirement for .....:		—
	The pressing was stopped upon: - A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached	800N	P
	Results: No fire ..... :	(See Table 8.3.9)	P

9	**Information for safety**		P
	The manufacturer of secondary cells ensures that information is provided about current, voltage and temperature limits of their products.		P
	The manufacturer of batteries ensures that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards.		P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A
	As appropriate, information relating to hazard avoidance resulting from a system analysis is provided to the end user ..... :		N/A

10	**Marking**		P
10.1	Cell marking		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Cells marked as specified in the applicable cell standards: IEC 61951-1, IEC 61951-2 or IEC 61960.		N/A
10.2	Battery marking		P
	Batteries marked in accordance with the requirements for the cells from which they are assembled.	Battery marked as specified in IEC 61960.	P
	Batteries marked with an appropriate caution statement.		P
10.3	Other information		P
	Storage and disposal instructions marked on or supplied with the battery.		P
	Recommended charging instructions marked on or supplied with the battery.		P
11	**Packaging**		P
	The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants.		P
Annex A	**Charging range of secondary lithium ion cells for safe use**		P
A.1	General		P
A.2	Safety of lithium-ion secondary battery		P
A.3	Consideration on charging voltage		P
A.3.1	General		P
A.3.2	Upper limit charging voltage		P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		P
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied		P
A.4.3	High temperature range		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in high temperature range		N/A
A.4.3.4	Safety consideration when specifying new upper limit in high temperature range		N/A
A.4.4	Low temperature range		N/A
A.4.4.1	General		N/A
A.4.4.2	Explanation of safety viewpoint		N/A
A.4.4.3	Safety considerations, when specifying charging conditions in low temperature range		N/A
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		N/A
A.4.5	Scope of the application of charging current		P
A.5	Sample preparation		P
A.5.1	General		P
A.5.2	Insertion procedure for nickel particle to generate internal short		P
	The insertion procedure carried out at 20°C±5°C and under -25 °C of dew point		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle to cylindrical cell		P
A.5.5.1	Insertion of nickel particle to winding core		P
A.5.5.2	Mark the position of nickel particle on the both end of winding core of the separator		P
A.5.6	Insertion of nickel particle to prismatic cell		N/A

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

5.1 – 5.6	TABLE: Critical components information				P
Object/part no.	**Manufacturer/ trademark**	**Type/ model**	**Technical data**	**Standard**	**Mark(s) of conformity**
1.Lithium-ion Cell	Shenzhen Bofuneng Battery Co., Ltd.	18650 2200mAh	3.7Vd.c., 2200mAh	IEC62133 :2012	Ref. Certif. No.: FI-18097, CB report: SZES15030 0060901
2. IC (U1)	Shenzhen Developer Microelectronics Co., Ltd	DPDW01	Over-charge detection voltage: 4.28V±0.05V, Over-discharge detection voltage: 2.40V±0.10V, Discharge overcurrent detection voltage: 0.15V±0.03V, T_a: -40°C to 85°C	-	-
3. MOSFET (U2, U3)	GUANGDONG KEXIN INDUSTRIAL CO., LTD	KI8205A	V_{DS}: 20V V_{GS}: ±10V, I_D: 6.5A (T_A=25°C), T_{ch}/T_{stg}: -55°C to 150°C	-	-
4. PTC(F1)	Dongguan TLC Electronic Technology Co., Ltd.	TLC-MSMD260	V_{MAX}: 6V, I_{MAX}: 100A, I_{hold}: 2.6A (T_A=25°C), I_{trip}: 5.2A (T_A=25°C)		
5. PCB material	SHENZHEN LUTONGDA TECHNOLOGY CO., LTD.	ZPW-17.5-NTC	FR-4, V-0, 130°C	-	-
6.Wire	SHENZHEN DINGYU ELECTRICAL TECHNOLOGY CO LTD	1007	20AWG, 80°C, 300V	-	UL E365423
7.Connector	Fushun Shenzhen Electronic Science and Technology Co., Ltd.	XH2.54-2P	PA, V-0, 3A, 250V	-	-
8.Insulation tape	SHENZHEN SUNTAI HEAT-SHRINKABLE MATERIAL PRODUCTION FACTORY	-	PVC, V-0	-	-
Supplementary information: none					

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous low rate charge (cells)	N/A

Model	Recommended charging method, (CC, CV, or CC/CV)	Recommended charging voltage V_c, (Vdc)	Recommended charging current I_{rec}, (A)	OCV at start of test, (Vdc)	Results

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

7.2.2	TABLE: Vibration	N/A

Model	OCV at start of test, (Vdc)	Results

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.1	TABLE: Incorrect installation (cells)	N/A

Model	OCV of reversed cell, (Vdc)	Results

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

7.3.2	TABLE: External short circuit	N/A

Model	Ambient (at 20°C ± 5°C or 55°C ± 5°C)	OCV at start of test, (Vdc)	Resistance of circuit, (Ω)	Maximum case temperature rise ΔT, (°C)	Results

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.6	TABLE: Crush			N/A
Model	**OCV at start of test, (Vdc)**	**OCV at removal of crushing force, (Vdc)**	**Results**	

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

7.3.8	TABLE: Overcharge			N/A
Model	**OCV prior to charging, (Vdc)**	**Maximum charge current, (A)**	**Time for charging, (hours)**	**Results**

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.9	TABLE: Forced discharge (cells)			N/A
Model	**OCV before application of reverse charge, (Vdc)**	**Measured reverse charge I_t, (A)**	**Time for reversed charge, (minutes)**	**Results**

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.2.1	TABLE: Continuous charging at constant voltage (cells)			N/A
Model	**Recommended charging voltage V_c, (Vdc)**	**Recommended charging current I_{rec}, (A)**	**OCV at start of test, (Vdc)**	**Results**

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.1	TABLE: External short circuit (cell)				N/A
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (K)**	**Results**
Samples charged at charging temperature upper limit					
Samples charged at charging temperature lower limit					

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.2	TABLE: External short circuit (battery)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (K)**	**Results**
Samples charged at charging temperature upper limit					
ICR18650 2200	53.2	4.173	0.075	0.8	A
ICR18650 2200	53.2	4.175	0.077	1.6	A
ICR18650 2200	53.2	4.174	0.078	1.0	A
ICR18650 2200	53.2	4.175	0.078	0.7	A
ICR18650 2200	53.2	4.178	0.075	0.5	A
Samples charged at charging temperature lower limit					
ICR18650 2200	53.2	4.115	0.076	4.5	A
ICR18650 2200	53.2	4.123	0.075	3.1	A
ICR18650 2200	53.2	4.111	0.077	1.7	A
ICR18650 2200	53.2	4.108	0.078	2.2	A
ICR18650 2200	53.2	4.113	0.076	3.7	A

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.5	TABLE: Crush				N/A
Model	**OCV at start of test, (Vdc)**	**OCV at removal of crushing force, (Vdc)**	**Width/ diameter of cell before crush, (mm)**	**Required deformation for crush, (mm)**	**Results**
Samples charged at charging temperature upper limit					
Samples charged at charging temperature lower limit					

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.6	TABLE: Over-charging of battery	P
Constant charging current (A) ..... :	4.4	—
Supply voltage (Vdc) ..... :	5.0	—

Model	OCV before charging, (Vdc)	Resistance of circuit, (Ω)	Maximum outer casing temperature, (°C)	Results
ICR18650 2200	3.143	-	27.8	A
ICR18650 2200	3.132	-	29.5	A
ICR18650 2200	3.185	-	28.9	A
ICR18650 2200	3.119	-	28.8	A
ICR18650 2200	3.150	-	29.2	A

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

8.3.7	TABLE: Forced discharge (cells)	N/A

Model	OCV before application of reverse charge, (Vdc)	Measured Reverse charge I_t, (A)	Time for reversed charge, (minutes)	Results

Supplementary information:

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

IEC 62133			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.9	TABLE: Forced internal short circuit (cells)	P

Model	Chamber ambient, (°C)	OCV at start of test, (Vdc)	Particle location [1)]	Maximum applied pressure, (N)	Results
18650 2200mAh	45.0	4.175	1	800.0	A
18650 2200mAh	45.0	4.176	1	800.0	A
18650 2200mAh	45.0	4.173	1	800.0	A
18650 2200mAh	45.0	4.174	1	800.0	A
18650 2200mAh	45.0	4.175	1	800.0	A
18650 2200mAh	-5.0	4.084	1	800.0	A
18650 2200mAh	-5.0	4.086	1	800.0	A
18650 2200mAh	-5.0	4.087	1	800.0	A
18650 2200mAh	-5.0	4.078	1	800.0	A
18650 2200mAh	-5.0	4.081	1	800.0	A

Supplementary information:

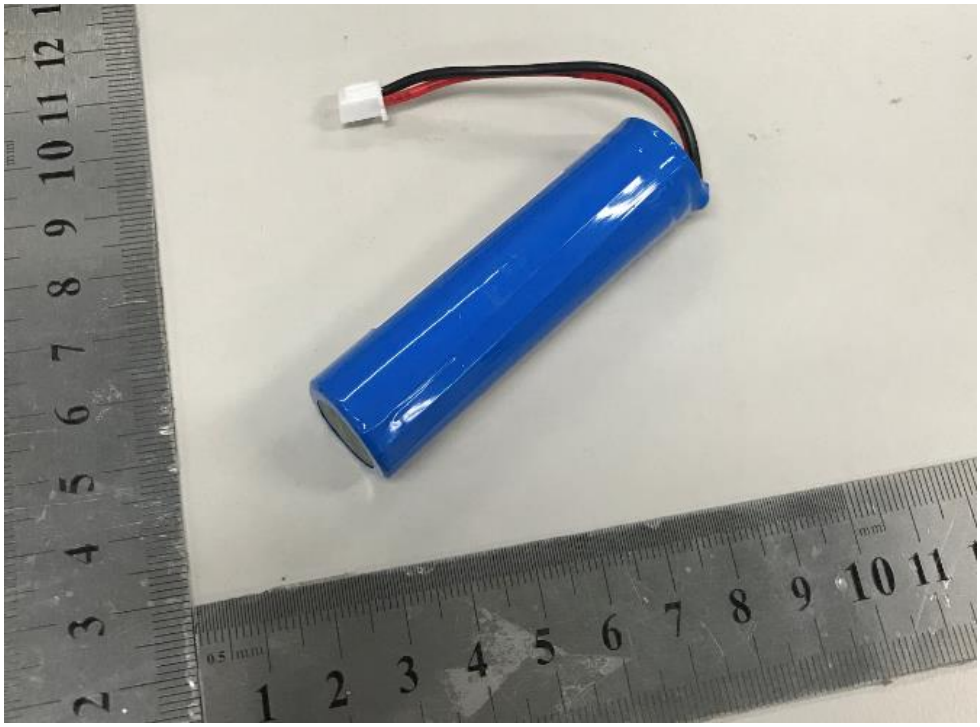
[1)] Identify one of the following**:**
1: Nickel particle inserted between positive and negative (active material) coated area.
2: Nickel particle inserted between positive aluminium foil and negative active material coated area.

Remark: There is no particle location 2 for this cell.

A- No fire or explosion
B- No leakage
C- Leakage
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

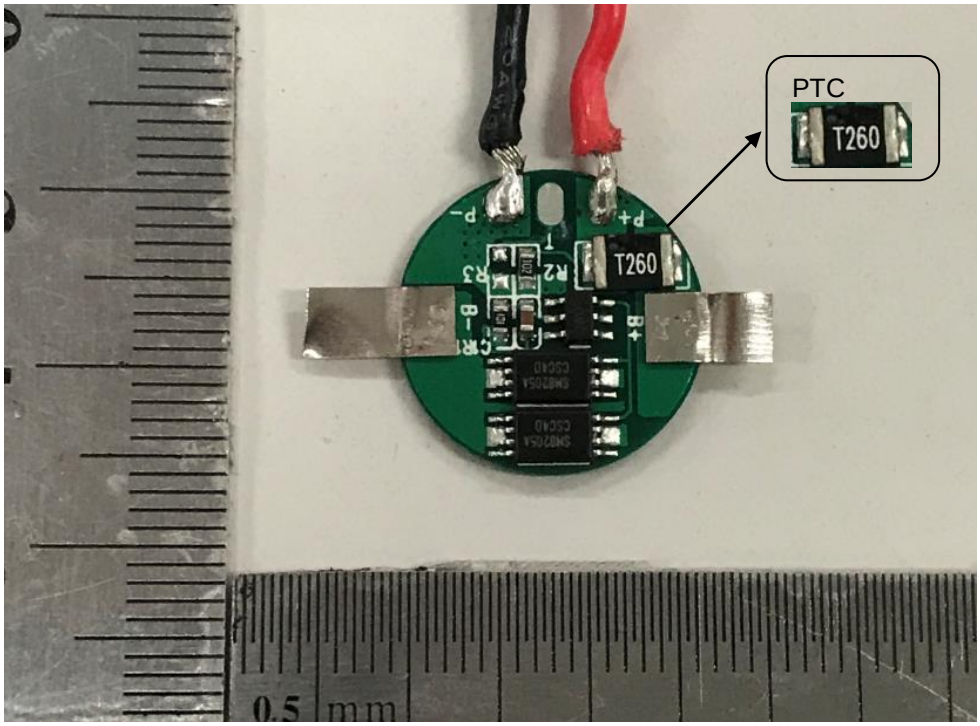
Annex 1: Photo Documentation

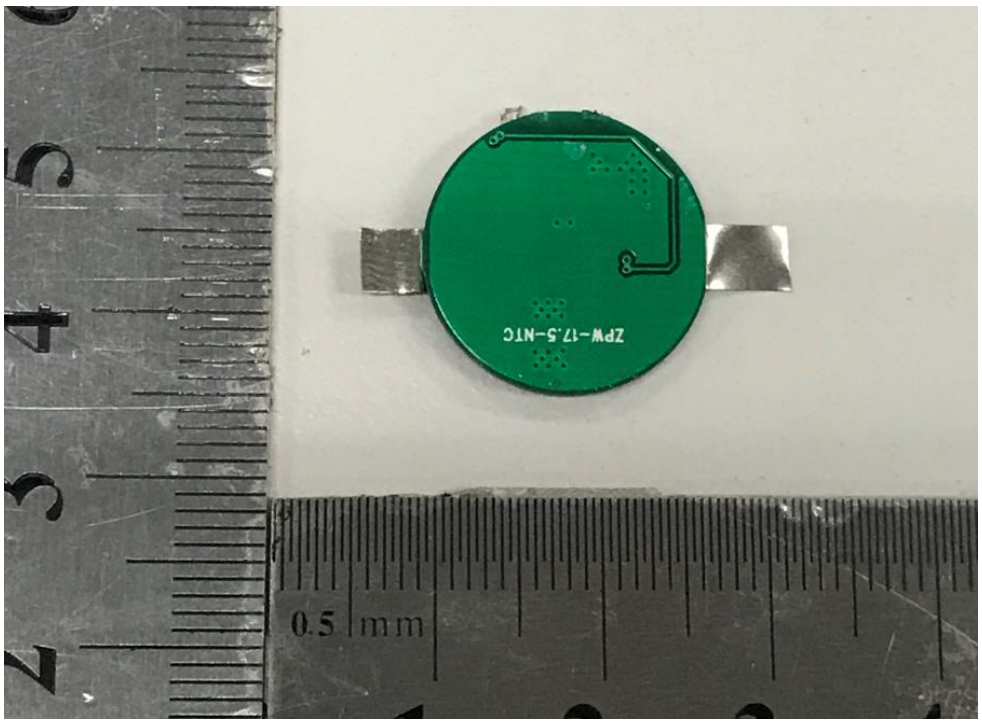
Details of:	Picture 1: View 1 of the battery, model: ICR18650 2200
	

Details of:	Picture 2: View 2 of the battery, model: ICR18650 2200
	

Details of:	Picture 3: The final marking which will be pasted on the battery and replace the marking in picture 1
	HUANYUYUAN Lithium-ion Battery ICR18650 2200 (1ICR19/66) 3.7V,2200mAh,8.14Wh LPS Do not short circuit or dispose into fire Made In China Shenzhen Huan Yu Yuan Technology Co. Ltd. Date: YYYY-MM-DD Remark: "YYYY-MM-DDD" represents the date of manufacture. For example, "2016-12-20" represents the battery manufactured on December 20th, 2016.

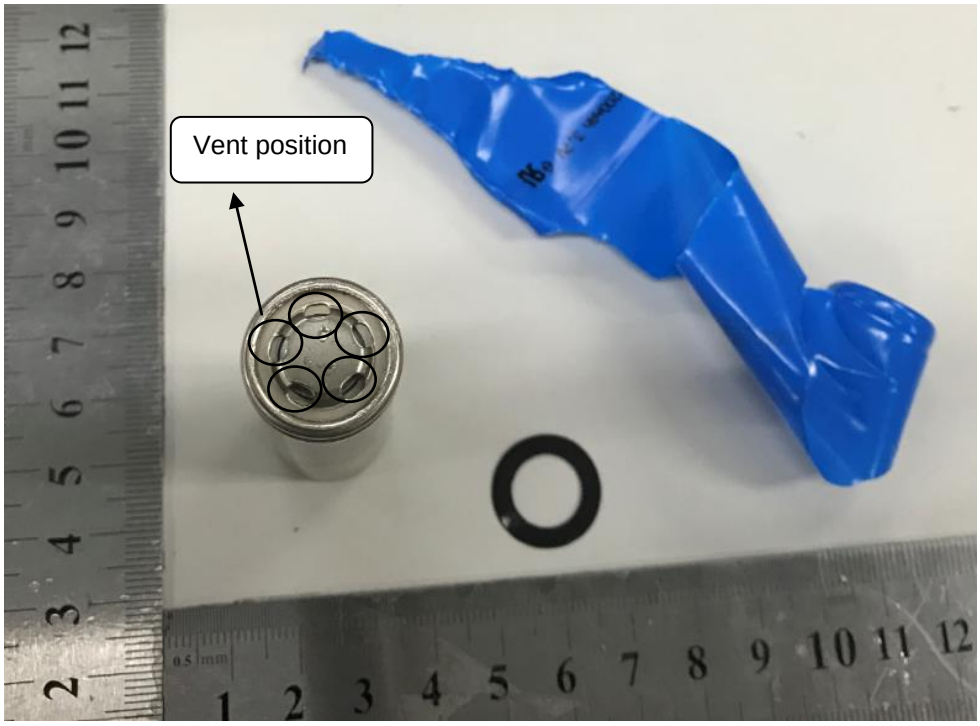
Details of:	Picture 4: View of the battery without insulation film
	

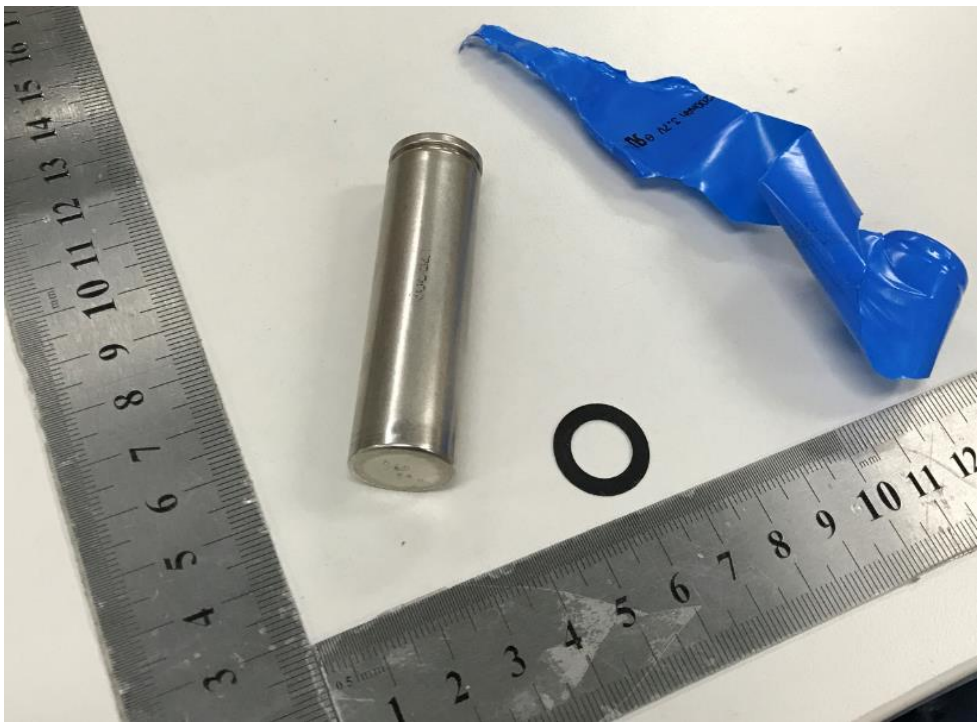
Details of:	Picture 5: Top view of the PCM
	

Details of:	Picture 6: Bottom view of the PCM
	

Details of:	Picture 7: View 1 of the cell, model: 18650 2200mAh
	

Details of:	Picture 8: View 2 of the cell, model: 18650 2200mAh
	

Details of:	Picture 9: Top view of the cell without insulation film
	

Details of:	Picture 10: Bottom view of the cell without insulation film
	

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