



Test Report issued under the responsibility of:



TEST REPORT

IEC 62133-2

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 – Part 2: Lithium systems

Report Number.....: S03A23030274S001

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Name of Testing Laboratory

preparing the Report.....: Guangdong ESTL Technology Co., Ltd.

Applicant's name.....: HOWELL ENERGY CO LTD

Address.....: B1010, GENZON TIMES SQUARE, LONGGANG CENTER,
Shenzhen, Guangdong, 518172, China

Test specification:

Standard.....: IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021

Test procedure.....: CB Scheme

Non-standard test method.....: N/A

TRF template used.....: IECEE OD-2020-F1:2021, Ed.1.4

Test Report Form No.....: IEC62133_2C

Test Report Form(s) Originator.....: DEKRA Certification B.V.

Master TRF.....: Dated 2022-07-01

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General disclaimer:

The test results presented in this report relate only to the object tested.

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Test item description.....:	Li-ion Battery	
Trade Mark(s).....:	N/A	
Manufacturer.....:	Same as applicant	
Model/Type reference.....:	18650-25SPV	
Ratings.....:	3.7V, 2500mAh, 9.25Wh	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	Guangdong ESTL Technology Co., Ltd.
Testing location/ address.....:		No. 9 & 11 Headquarters 2nd Road, Songshan Lake Park, Dongguan, Guangdong 523808 China
Tested by (name, function, signature).....:		Mina Li/ Project Handler 
Approved by (name, function, signature)....:		Jason Xu/ Reviewer 
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
Testing location/ address.....:		
Tested by (name, function, signature).....:		
Approved by (name, function, signature)....:		
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
Testing location/ address.....:		
Tested by (name + signature).....:		
Witnessed by (name, function, signature)..:		
Approved by (name, function, signature)....:		
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
Testing location/ address.....:		
Tested by (name, function, signature).....:		
Witnessed by (name, function, signature)..:		
Approved by (name, function, signature)....:		
Supervised by (name, function, signature) :		

List of Attachments (including a total number of pages in each attachment): - National Differences (3 pages) - Enclosure (12 pages)	
Summary of testing:	
Tests performed (name of test and test clause): Test items: cl.7.2.1 Continuous charging at constant voltage (cells); cl.7.2.2 Case stress at high ambient temperature (battery); cl.7.3.1 External short-circuit (cell); cl.7.3.2 External short-circuit (battery); cl.7.3.3 Free fall (cell and battery); cl.7.3.4 Thermal abuse (cells); cl.7.3.5 Crush (cells); cl.7.3.6 Over-charging of battery; cl.7.3.7 Forced discharge (cells); cl.7.3.8 Mechanical tests (batteries); - 7.3.8.1 Vibration - 7.3.8.2 Mechanical shock cl.7.3.9 Forced internal short-circuit (cells). Tests are made with the number of cells and batteries specified in IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021 Table 1.	Testing location: Guangdong ESTL Technology Co., Ltd. No. 9 & 11 Headquarters 2nd Road, Songshan Lake Park, Dongguan, Guangdong 523808 China
Summary of compliance with National Differences (List of countries addressed): EU Group* *= No National or Group Differences declared <input checked="" type="checkbox"/> The product fulfils the requirements of EN 62133-2: 2017, EN 62133-2:2017/A1:2021	

Use of uncertainty of measurement for decisions on conformity (decision rule) :

☒ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method").

☐ Other:... (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

Information on uncertainty of measurement:

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.

IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Li-ion Battery 18650-25SPV 1INR19/66 3.7V, 2500mAh, 9.25Wh YYYYMMDD HOWELL ENERGY CO LTD

Remark:

Date Code YYYYMMDD.

YYYY: Four digitals represent year of manufacture.

MM: Two digitals represent month of manufacture.

DD: Two digitals represent day of manufactur

Test item particulars..... :	
Classification of installation and use..... : To be defined in final system	
Supply Connection..... : DC Connector	
Recommend charging method declared by the manufacturer..... : CC/CV	
Discharge current (0,2 It A)..... : 500mA	
Specified final voltage..... : 2.75V	
Upper limit charging voltage per cell..... : 4.2V	
Maximum charging current..... : 2500mA	
Charging temperature upper limit..... : 50°C	
Charging temperature lower limit..... : 0°C	
Polymer cell electrolyte type..... : <input type="checkbox"/> gel polymer <input type="checkbox"/> solid polymer <input checked="" type="checkbox"/> N/A	
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..... : 2023-03-22	
Date (s) of performance of tests..... : 2023-03-22 to 2023-04-06	
General remarks:	
"(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 <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62 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.....:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)..... : Same as applicant	

General product information and other remarks:

This battery is constructed with single Li-ion Cell, and has overcharge, over-discharge, over current and short-circuits proof circuit.

11NR19/66 is the marking of IEC 61960 requirement for the model 18650-25SPV.

Supplementary Information on National / Group Differences not to be listed on CBTC:

National Differences TRF for Korea is for information only since the ND / GD TRF latest revision does not match the latest revision of IEC Standard TRF used for evaluation.

The main features of the battery are shown as below:

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Limited Charge Voltage	Cut-off Voltage
18650-25SPV	2500mAh	3.7V	500mA	500mA	2500mA	6000mA	4.2V	2.75V

The main features of the battery are shown as below:

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
18650-25SPV	4.2V	25mA	0°C	50°C

The main features of the cell in the battery are shown as below:

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Limited Charge Voltage	Cut-off Voltage
18650-25SPV (Cell)	2500mAh	3.7V	500mA	500mA	2500mA	6000mA	4.2V	2.75V

The main features of the cell in the battery are shown as below:

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
18650-25SPV (Cell)	4.2V	25mA	0°C	50°C

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
4	PARAMETER MEASUREMENT TOLERANCES		P
	Parameter measurement tolerances		P
5	GENERAL SAFETY CONSIDERATIONS		P
5.1	General		P
	Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse		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	Not metal surfaces exists.	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 clearances and creepage 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	Venting mechanism exists on the top of the cylindrical cell	P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief		P
5.4	Temperature, voltage and current management		P
	Batteries are designed such that abnormal temperature rise conditions are prevented	Overcharge, over discharge, over current and short-circuit proof circuit used in this battery. See tests of clause 7.	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 specified chargers are designed to maintain charging within the temperature, voltage and current limits specified	The charging limits specified in manufacturer's specifications.	P
5.5	Terminal contacts		P

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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	General		P
	Each battery has an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region		P
	This protection may be provided external to the battery such as within the charger or the end devices	Protection circuit within the battery	N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery has protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly	Current, voltage and temperature limits specified by cell manufacturer.	P
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer	Battery without selective discharge function.	N/A
	Protective circuit components are added as appropriate and consideration given to the end-device application		P
	The manufacturer of the battery provide a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance		P
5.6.2	Design recommendation		P
	For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2		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, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, 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, it is recommended that charging is stopped when the upper limit of the charging voltage 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
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage are not counted as an overcharge protection		N/A
	For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		N/A
	It is recommended that the cells and cell blocks are not discharged beyond the cell manufacturer's specified final voltage		P
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry are incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries		N/A
	Mechanical protection for cells, cell connections and control circuits within the battery are provided to prevent damage as a result of intended use and reasonably foreseeable misuse		N/A
	The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product		N/A
	The battery case and compartments housing cells are designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer		N/A
	For batteries intended for building into a portable end product, testing with the battery installed within the end product is considered when conducting mechanical tests		N/A
5.7	Quality plan		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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	Complied. ISO9001:2015 has provided.	P
5.8	Battery safety components		N/A

6	TYPE TEST AND SAMPLE SIZE		P
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old		P
	The internal resistance of coin cells are measured in accordance with Annex D. Coin cells with internal resistance less than or equal to 3 Ω are tested in accordance with Table 1	Not Coin cells	N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C \pm 5 °C		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and over discharge protection		P
	When conducting the short-circuit test, consideration is given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test		P

7	SPECIFIC REQUIREMENTS AND TESTS		P
7.1	Charging procedure for test purposes		P
7.1.1	First procedure		P
	This charging procedure applies to subclauses other than those specified in 7.1.2		P
	Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C \pm 5 °C, using the method declared by the manufacturer		P
	Prior to charging, the battery has been discharged at 20 °C \pm 5 °C at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		P
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P

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Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization for 1 h to 4 h, at an ambient temperature of the highest test temperature and the lowest test temperature, respectively, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant current to constant voltage charging method	Charge temperature 0-50°C declared.	P
7.2	Intended use		P
7.2.1	Continuous charging at constant voltage (cells)	Tests Complied.	P
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer		P
	Results: no fire, no explosion, no leakage..... :	(See appended table 7.2.1)	P
7.2.2	Case stress at high ambient temperature (battery)	Tests Complied.	P
	Oven temperature (°C)..... :	70°C±2°C	—
	Results: no physical distortion of the battery case resulting in exposure of internal protective components and cells	No physical distortion of the battery case resulting in exposure of internal protective components and cells	P
7.3	Reasonably foreseeable misuse	See below	P
7.3.1	External short-circuit (cell)	Tests Complied.	P
	The cells were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	Results: no fire, no explosion..... :	(See appended table 7.3.1)	P
7.3.2	External short-circuit (battery)	Tests Complied.	P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	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		P
	A single fault in the discharge protection circuit is conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		P

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Clause	Requirement + Test	Result - Remark	Verdict
	A single fault applies to protective component parts such as MOSFET (metal oxide semiconductor field-effect transistor), fuse, thermostat or positive temperature coefficient (PTC) thermistor	Single fault applies on MOSFET (U2&U3)	P
	Results: no fire, no explosion.....:	(See appended table 7.3.2)	P
7.3.3	Free fall	Tests Complied.	P
	Results: no fire, no explosion	No fire. No explosion	P
7.3.4	Thermal abuse (cells)	Tests Complied.	P
	Oven temperature (°C).....:	130°C±2°C	—
	Results: no fire, no explosion	No fire. No explosion	P
7.3.5	Crush (cells)	Tests Complied.	P
	The crushing force was released upon:		P
	- The maximum force of 13 kN ± 0,78 kN has been applied; or		P
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: no fire, no explosion.....:	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery	Tests Complied.	P
	The supply voltage which is:		P
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or		P
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and		N/A
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached		P
	Test was continued until the temperature of the outer casing:		P
	- 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 appended table 7.3.6)	P
7.3.7	Forced discharge (cells)	Tests Complied.	P
	Discharge a single cell to the lower limit discharge voltage specified by the cell manufacturer		P
	The discharged cell is then subjected to a forced discharge at 1 It A to the negative value of the upper limit charging voltage		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- The discharge voltage reaches the negative value of upper limit charging voltage within the testing duration. The voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	- The discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration. The test is terminated at the end of the testing duration		P
	Results: no fire, no explosion.....:	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration	Tests Complied.	P
	Results: no fire, no explosion, no rupture, no leakage or venting.....:	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock	Tests Complied.	P
	Results: no leakage, no venting, no rupture, no explosion and no fire.....:	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)	Tests Complied.	P
	The cells complied with national requirement for.....:	France, Japan, Korea, Switzerland	—
	The pressing was stopped upon:		P
	- 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, cylindrical cells	P
	Results: no fire.....:	(See appended table 7.3.9)	P

8	INFORMATION FOR SAFETY		P
8.1	General		P
	Manufacturers of secondary cells provides information about current, voltage and temperature limits of their products	Information is provided in manufacturer's specification.	P
	Manufacturers of batteries provides information regarding how to minimize and mitigate hazards to equipment manufacturers or end-users	Information is provided in manufacturer's specification.	P
	Systems analyses are performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A
	As appropriate, any information relating to hazard avoidance resulting from a system analysis is provided to the end user		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Do not allow children to replace batteries without adult supervision		P
8.2	Small cell and battery safety information		NA
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:	Not small cell and battery	N/A
	- Keep small cells and batteries which are considered swallowable out of the reach of children		N/A
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		N/A
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A

9	MARKING		P
9.1	Cell marking		P
	Cells are marked as specified in IEC 61960, except coin cells		N/A
	Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity		N/A
	By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked		P
9.2	Battery marking		P
	Batteries are marked as specified in IEC 61960, except for coin batteries		P
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity		N/A
	Batteries are marked with an appropriate caution statement		P
	- Terminals have clear polarity marking on the external surface of the battery, or		N/A
	- Not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		P
9.3	Caution for ingestion of small cells and batteries		N/A
	Coin cells and batteries identified as small batteries include a caution statement regarding the hazards of ingestion in accordance with 8.2	Not small cell and battery	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion is given on the immediate package		N/A
9.4	Other information		P
	The following information are marked on or supplied with the battery:		P
	- Storage and disposal instructions	Information for storage and disposal instructions mentioned in manufacturer's specifications.	P
	- Recommended charging instructions	Information for recommended charging instructions mentioned in manufacturer's specifications.	P

10	PACKAGING AND TRANSPORT		P
	Packaging for coin cells are not be small enough to fit within the limits of the ingestion gauge of Figure 3	Not Coin cells.	N/A

ANNEX A	CHARGING AND DISCHARGING 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	Charging voltage is 4.2V.	P
A.3.2	Upper limit charging voltage	4.2V	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	See A.4.2.2	P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Charging temperature declared by client is: 0-50°C.	N/A
A.4.3	High temperature range		N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A
A.4.3.4	Safety considerations when specifying a new upper limit in the 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 the 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.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		P
A.4.6.3	Discharge current and temperature range		P
A.4.6.4	Scope of application of the discharging 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
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle in cylindrical cell		P
A.5.5.1	Insertion of nickel particle in winding core		P
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		P
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	Experimental procedure of the forced internal short-circuit test		P
A.6.1	Material and tools for preparation of nickel particle		P
A.6.2	Example of a nickel particle preparation procedure		P
A.6.3	Positioning (or placement) of a nickel particle		P
A.6.4	Damaged separator precaution		P
A.6.5	Caution for rewinding separator and electrode		P
A.6.6	Insulation film for preventing short-circuit		P
A.6.7	Caution when disassembling a cell		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P
A.6.10	Caution for the disassembling process and pressing the electrode core		P
A.6.11	Recommended specifications for the pressing device		P
ANNEX B	RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS		P
ANNEX C	RECOMMENDATIONS TO THE END-USERS		N/A
ANNEX D	MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS		N/A
D.1	General		N/A
D.2	Method		N/A
	A sample size of three coin cells is required for this measurement		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing..... :	(See appended table D.2)	N/A
	Coin cells with an internal resistance less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
ANNEX E	PACKAGING AND TRANSPORT		P
ANNEX F	COMPONENT STANDARDS REFERENCES		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous charging at constant voltage (cells)				P
Sample No.	Recommended charging voltage V _c (Vdc)	Recommended charging current I _{rec} (A)	OCV before test (Vdc)	Results	
C1	4.2	0.5	4.185	A	
C2	4.2	0.5	4.184	A	
C3	4.2	0.5	4.185	A	
C4	4.2	0.5	4.186	A	
C5	4.2	0.5	4.186	A	
Supplementary information: A - No fire. No explosion. No leakage. B - Fire. C - Explosion. D - Leakage. E - Bulge. F - Others (please explain).					

7.3.1	TABLE: External short circuit (cell)					P
Sample No.	Ambient (°C)	OCV at start of test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT (K)	Results	
Samples charged at charging temperature upper limit(50°C)						
C6	54.4	4.178	82	49.7	A, H	
C7	55.2	4.181	89	49.5	A, H	
C8	54.7	4.178	87	53.7	A, H	
C9	55.1	4.182	84	52.1	A, H	
C10	55.0	4.180	92	48.0	A, H	
Samples charged at charging temperature lower limit(0°C)						
C11	56.4	4.134	82	66.3	A, H	
C12	55.3	4.129	86	59.0	A, H	
C13	55.2	4.130	83	62.0	A, H	
C14	54.7	4.129	88	66.7	A, H	
C15	55.4	4.131	86	69.3	A, H	

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

A - No fire. No explosion.

B - Fire.

C - Explosion.

D - Leakage.

E - Bulge.

F - Others (please explain).

G - The test was completed after 24 h.

H - The test was completed after the cell casing cooled to 20% of the maximum temperature rise.

7.3.2	TABLE: External short circuit (battery)					P
Sample No.	Ambient T (°C)	OCV before test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT (K)	Component single fault condition	Results
B4	22.9	4.185	84	97.4	SC-U2	A, H
B5	23.1	4.186	89	88.3	SC-U2	A, H
B6	22.8	4.184	80	81.2	SC-U3	A, H
B7	22.9	4.185	87	79.8	SC-U3	A, H
B8	22.8	4.186	83	0.8	Normal	A, F

Supplementary information:
SC: short circuit
OC: open circuit
A - No fire. No explosion.
B - Fire.
C - Explosion.
D - Leakage.
E - Bulge.
F - Others (please explain). -rapid decline in short circuit current, the battery pack should remain on test for an additional one hour after the current reaches a low end steady state condition.
G - The test was completed after 24 h.
H - The test was completed after the cell casing cooled to 20% of the maximum temperature rise.
I - Others

7.3.5	TABLE: Crush (cells)			P
Sample No.	OCV before test (Vdc)	OCV at removal of crushing force (Vdc)	Maximum force applied to the cell during crush (kN)	Results
Samples charged at charging temperature upper limit(50°C)				
C29	4.183	--	13.0	A, G
C30	4.180	--	13.0	A, G
C31	4.178	--	13.0	A, G
C32	4.181	--	13.0	A, G
C33	4.177	--	13.0	A, G

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

Samples charged at charging temperature lower limit(0°C)				
C34	4.131	--	13.0	A, G
C35	4.127	--	13.0	A, G
C36	4.130	--	13.0	A, G
C37	4.126	--	13.0	A, G
C38	4.126	--	13.0	A, G

Supplementary information:

A - No fire. No explosion.

B - Fire.

C - Explosion.

D - Leakage.

E - Bulge.

F - Others (please explain).

G – Force released after maximum level reached

H – Force released after abrupt voltage drop of one-third the original value.

7.3.6	TABLE: Over-charging of battery			P
Constant charging current (A).....:		5.0		—
Supply voltage (Vdc).....:		5.88		—
Sample No.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
B12	3.158	373	52.3	A
B13	3.147	373	52.7	A
B14	3.144	373	54.1	A
B15	3.148	373	55.3	A
B16	3.152	373	50.2	A

Supplementary information:

A - No fire. No explosion.

B - Fire.

C - Explosion.

D - Leakage.

E - Bulge.

F - Others (please explain).

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.7	TABLE: Forced discharge (cells)				P
Sample No.	OCV before application of reverse charge (Vdc)	Measured reverse charge I_t (A)	Lower limit discharge voltage (Vdc)	Results	
C39	3.179	2.5	2.75	A, H	
C40	3.142	2.5	2.75	A, H	
C41	3.153	2.5	2.75	A, H	
C42	3.162	2.5	2.75	A, H	
C43	3.161	2.5	2.75	A, H	
Supplementary information: A - No fire. No explosion. B - Fire. C - Explosion. D - Leakage. E - Bulge. F - Others (please explain). G – The voltage reached negative value of upper limit charging voltage within 90 min. H - The voltage did not reach negative value of upper limit charging voltage.					

7.3.8.1	TABLE: Vibration					P
Sample No.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results	
B17	4.185	4.181	47.922	47.922	A	
B18	4.187	4.184	47.649	47.648	A	
B19	4.187	4.185	47.819	47.817	A	
Supplementary information: A - No fire. No explosion. No leakage. No venting. No rupture. B - Fire. C - Explosion. D - Leakage. E - Bulge. F - Others (please explain).						

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.8.2	TABLE: Mechanical shock					P
Sample No.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results	
B20	4.186	4.186	47.833	47.833	A	
B21	4.185	4.185	47.881	47.881	A	
B22	4.187	4.187	47.783	47.783	A	
Supplementary information: A - No fire. No explosion. No leakage. No venting. No rupture. B - Fire. C - Explosion. D - Leakage. E – Venting. F – Rupture. G - Bulge. H - Others (please explain).						

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.9	TABLE: Forced internal short circuit (cells)					P
Sample No.	Chamber ambient T (°C)	OCV before test (Vdc)	Particle location ¹⁾	Maximum applied pressure (N)	Results	
Samples charged at charging temperature upper limit(50°C)						
C44	50	4.172	1	800	A, H	
C45	50	4.170	1	800	A, H	
C46	50	4.173	1	800	A, H	
C47	50	4.170	1	800	A, H	
C48	50	4.168	1	800	A, H	
Samples charged at charging temperature lower limit(0°C)						
C49	0	4.124	1	800	A, H	
C50	0	4.122	1	800	A, H	
C51	0	4.125	1	800	A, H	
C52	0	4.121	1	800	A, H	
C53	0	4.118	1	800	A, H	
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. A – No fire B – Fire C - Explosion. D - Leakage. E - Bulge. F - Others (please explain). G – Test concluded when 50 mV voltage drop occurred prior to reaching force limit H – Test concluded when 800 N pressure was reached and 50 mV voltage drop was not achieved I – Test was concluded when fire occurred						

D.2	TABLE: Internal AC resistance for coin cells				N/A
Sample no.	Ambient T (°C)	Store time (h)	Resistance Rac (Ω)	Results ¹⁾	
Supplementary information: ¹⁾ Coin cells with an internal resistance less than or equal to 3 Ω, see test result on corresponding tables according to Clause 6 and Table 1.					

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

TABLE: Critical components information					P
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾
Cell	HOWELL ENERGY CO LTD	18650-25SPV	3.7V, 2500mAh	IEC 62133-2: 2017, IEC 62133-2:2017/AM D1:2021	Tested with appliance
-Positive electrode	Shenzhen BTR Materials Science & Technology Co., LTD	TG03	LiNiCoAlO ₂ , Ni:Al:Co=8:1:1	--	--
-Negative electrode	Shijiazhuang Shangtai Technology Co., LTD	NK01	Graphite	--	--
-Separator	Shanghai Enjie Technology CO., LTD	GJ1603	PE, 16μm, Shut down temperature: 128-135°C	--	--
-Electrolyte	Dongguan Shanshan Technology Co., LTD	E12	LiPF ₆ , EC+EMC+DMC	--	--
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 796	UL approved
MOSFET (U2, U3)	Shenzhen Developer Microelectronics Co.,Ltd.	DP8205	VDS :20V, VGS: ±12 ID: 5.0A(T _J =25°C)	--	Tested with appliance
IC (U1)	RICOH	R5478N101CD	Overcharge detection voltage: 4.250±0.025V, Overdischarge detection voltage: 2.438~2.563V, Topr: -40°C to 85°C	--	Tested with appliance
Lead wire	Interchangeable	Interchangeable	24AWG, 80°C, 300V	UL 758	UL approved
Connector	Interchangeable	Interchangeable	3Pin, 4A, V-0, -25°C to 85°C	UL 94	UL approved
PVC	SHENZHEN GOLDEN OCEAN INDUSTRIAL DEVELOPMENT CO LTD	Interchangeable	Fire rating: VTM-0	UL 94	SGS report no. GZIN210402 1182MR

IEC 62133-2					
Clause	Requirement + Test			Result - Remark	Verdict
Flame-retardant insulation paper	Dongguan Cengci New Material Co., LTD	Interchangeable	Fire rating: V-0	UL 94	SGS report no. SHAEC1239 23404 A01
Supplementary information: 1) Provided evidence ensures the agreed level of compliance. See OD-2039.					

IEC62133_2B ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
<p align="center">ATTACHMENT TO TEST REPORT IEC 62133-2 (Republic of Korea) NATIONAL DIFFERENCES (Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications - Part 2: Lithium systems)</p>			
Differences according to.....: National standard KC62133-2(2020-07)			
TRF template used:.....: IECEE OD-2020-F3, Ed. 1.1			
Attachment Form No.....: KR_ND_IEC62133_2B			
Attachment Originator.....: KTR			
Master Attachment.....: Dated 2022-05-27			
Copyright © 2020 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.			
	National Differences		
7.3.6	Over-charging of battery		N/A
(Revision)	<p>[Add the bolded text]</p> <p>b) Test The test shall be carried out in an ambient temperature of 20 °C ± 5 °C. Each test battery shall be discharged at a constant current of 0,2 It A, to a final discharge voltage specified by the manufacturer. Sample batteries shall then be charged at a constant current of 2,0 It A, using a supply voltage which is:</p> <ul style="list-style-type: none"> • 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or • 1,2 times the upper limit charging voltage presented in Table A.1 per cell for series connected multi-cell batteries, and • sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached. <p><u>• In case the charging voltage specified by the manufacturer is higher than the overcharge test voltage, the maximum charging voltage specified by manufacturer should be applied with 2.0 ItA, (e.g., quick charging power bank, etc.)</u></p>		N/A
	[Replace to the following statement]		N/A

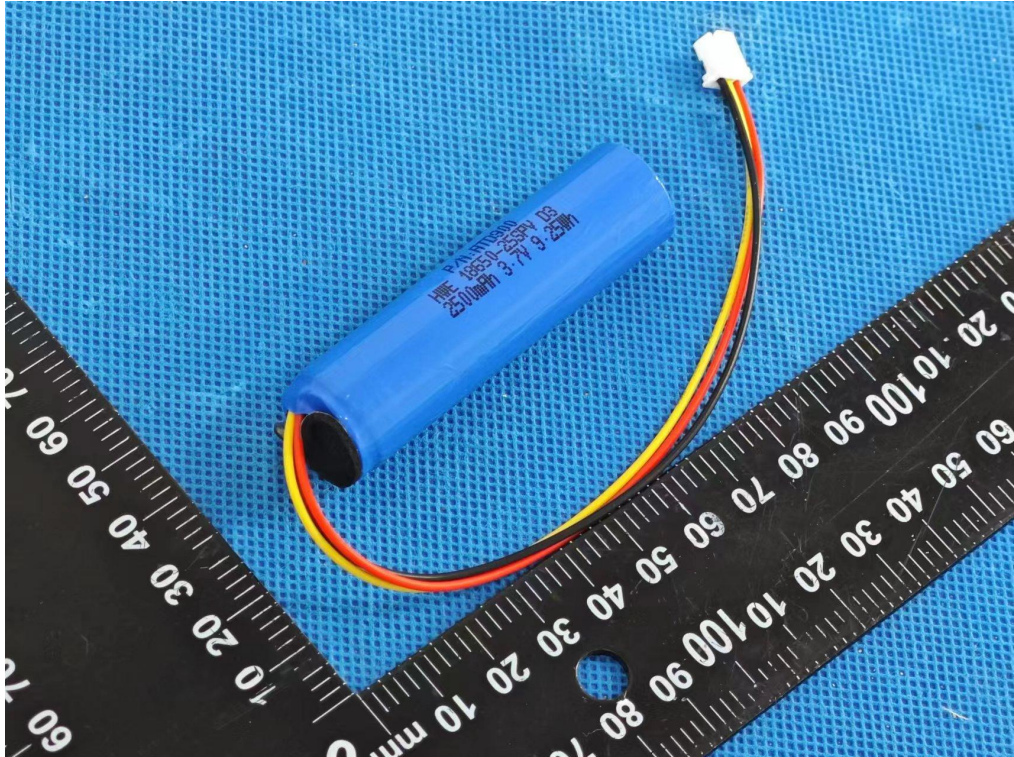
IEC62133_2B ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	c) Acceptance criteria Filling beyond the manufacturer's specified limits should not result in ignition or explosion		N/A
Annex G	Definition for shape and materials of outer case for cell		—
<i>(Addition)</i>	<p>G.1 General Annex G provides definitions for shape and materials of outer case for cell</p> <p>G.2 Shape of outer case for cell G.2.1 Cylindrical cell Cell with a cylindrical shape in which the overall height is equal to or greater than diameter.</p> <p>G.2.2 Prismatic cell Cell having the shape of a parallelepiped whose faces are rectangular</p> <p>G.3 Materials of outer case for cell G.3.1 Soft case Non-metallic outer case or container for cell</p> <p>G.3.2 Hard case Metallic outer case or container for cell.</p>	<p>(Shape of outer cases) <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Prismatic</p> <p>(Materials of outer cases) <input checked="" type="checkbox"/> Hard <input type="checkbox"/> Soft</p>	—
Annex H	Calculation method of the volumetric energy density for cell		—
<i>(Addition)</i>	<p>Annex H provide a calculation method of the volumetric energy density for cell in use of smart phone, tablet, notebook.</p> <p>H.1 General Unless otherwise stated in the Annex E, the dimensions for calculation are based on these for cell before shipment and the volumetric energy density shall be calculated with a maximum values specified by manufacturer. If the specification for cell can't be provided a dimension for calculation, the manufacturer's other documentation shall be provided to demonstrate compliance for its calculation.</p>	527.8Wh / L	—
			—

IEC62133_2B ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>H.2 Calculation Method</p> <p>L : Length (max.) of cell (including terrace) W : Width (max.) of cell T : Thickness (max.) when shipping charge (For reference, Please Exclude the dimension of any tape that is attached to cell)</p> $\text{Volumetric energy density (Wh/L)} = \frac{\text{Nominal voltage (V)} \times \text{Rated capacity (Ah)}}{\text{Length (L)} \times \text{Width (W)} \times \text{Thickness (T)}}$ <p>[H.1 – Prismatic cell using soft case]</p> <p>L : Length (max.) of cell W : Width (max.) of cell T : Thickness when shipping charge (For reference, Please Exclude the dimension of any tape that is attached to cell)</p> $\text{Volumetric energy density (Wh/L)} = \frac{\text{Nominal voltage (V)} \times \text{Rated capacity (Ah)}}{\text{Length (L)} \times \text{Width (W)} \times \text{Thickness (T)}}$ <p>[H.2 – Prismatic cell using hard case]</p> <p>D : Diameter (max.) of cell L : Length (max.) of cell (According to shape of cell at shipping, The dimension of tube for cell may be included in overall dimension of cell)</p> $\text{Volumetric energy density (Wh/L)} = \frac{\text{Nominal voltage (V)} \times \text{Rated capacity (Ah)}}{3.14159 \times \frac{\text{Diameter (D)}^2}{4} \times \text{Length(L)}}$ <p>[H.3 – Cylindrical cell using hard case]</p>		

ENCLOSURE

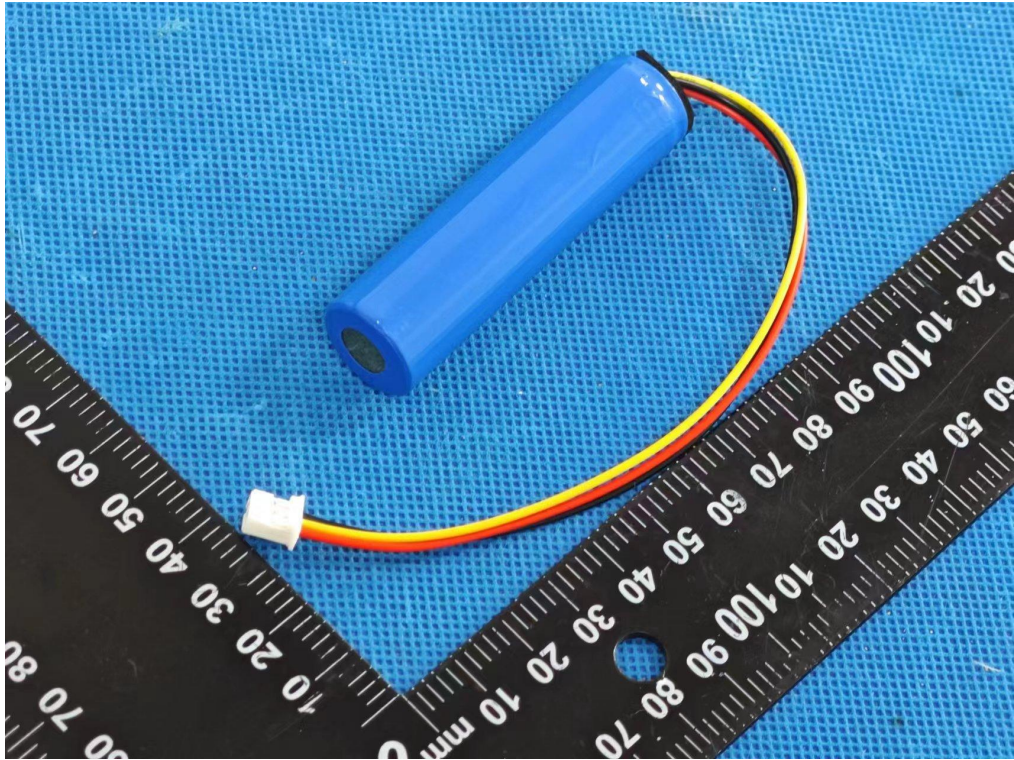
Supplement ID	Description
01-1	Overall View 1 of Battery
01-2	Overall View 2 of Battery
01-3	Internal View of Battery
01-4	Overall View 1 of PCB
01-5	Overall View 2 of PCB
01-6	Overall View 1 of Cell
01-7	Overall View 2 of Cell
02	Schematics
03-01	PCB Layout
03-02	PCB Layout
04	Enclosure Drawing

ID 01-1



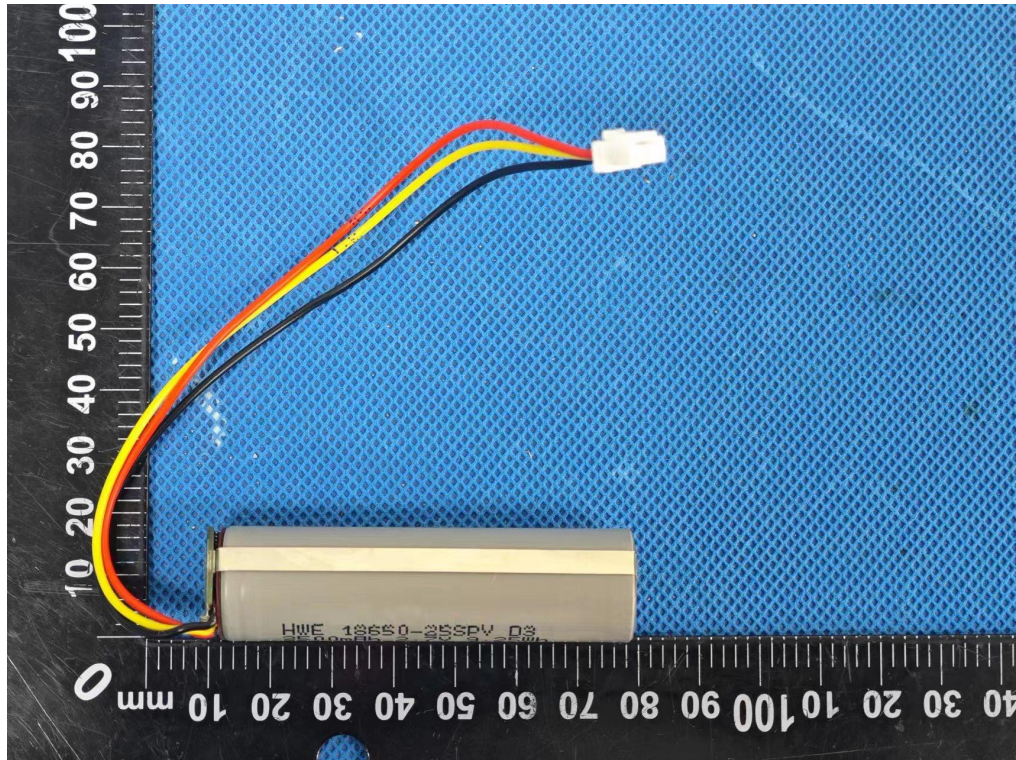
Overall View 1 of Battery

ID 01-2



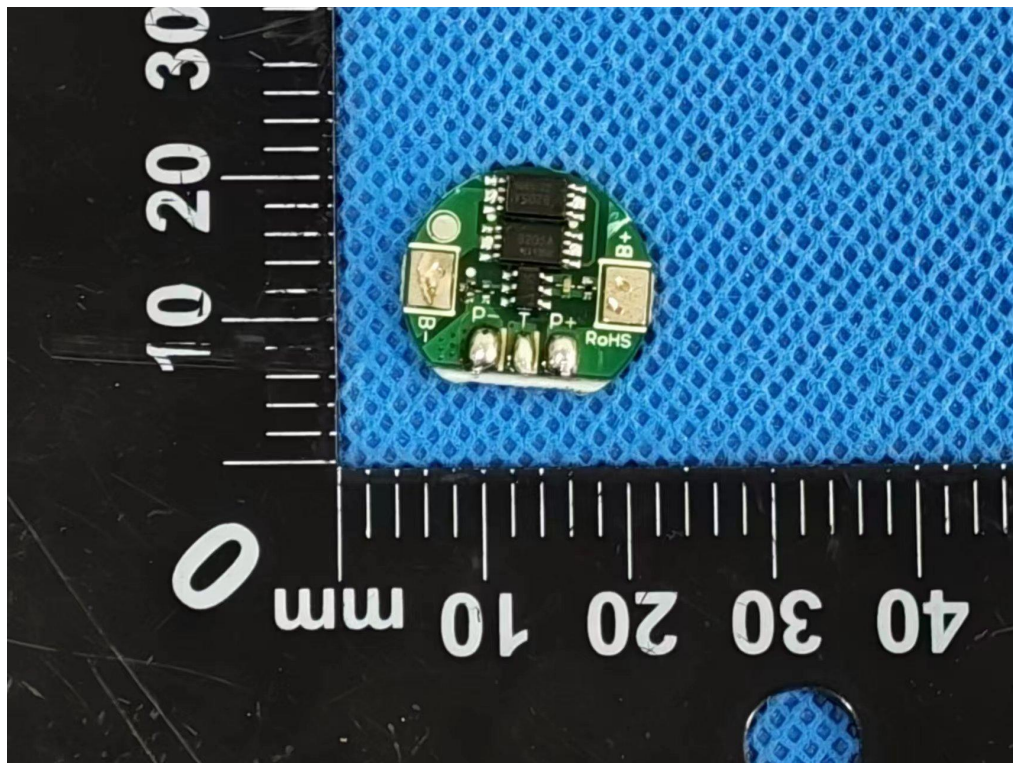
Overall View 2 of Battery

ID 01-3



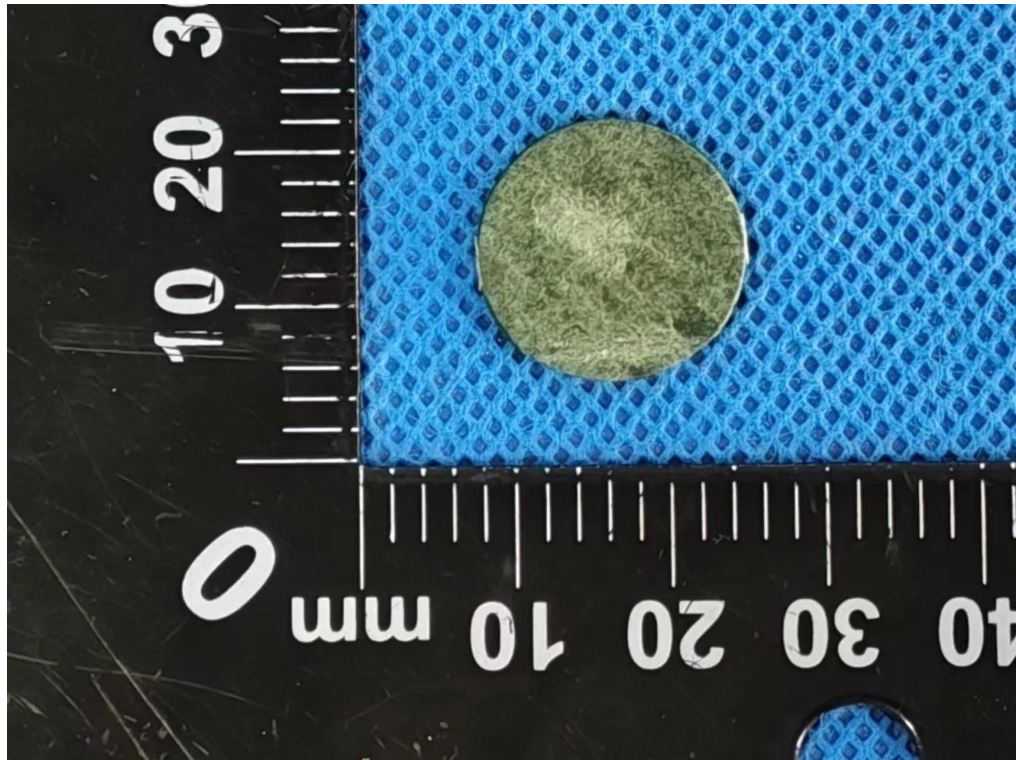
Internal View of Battery

ID 01-4



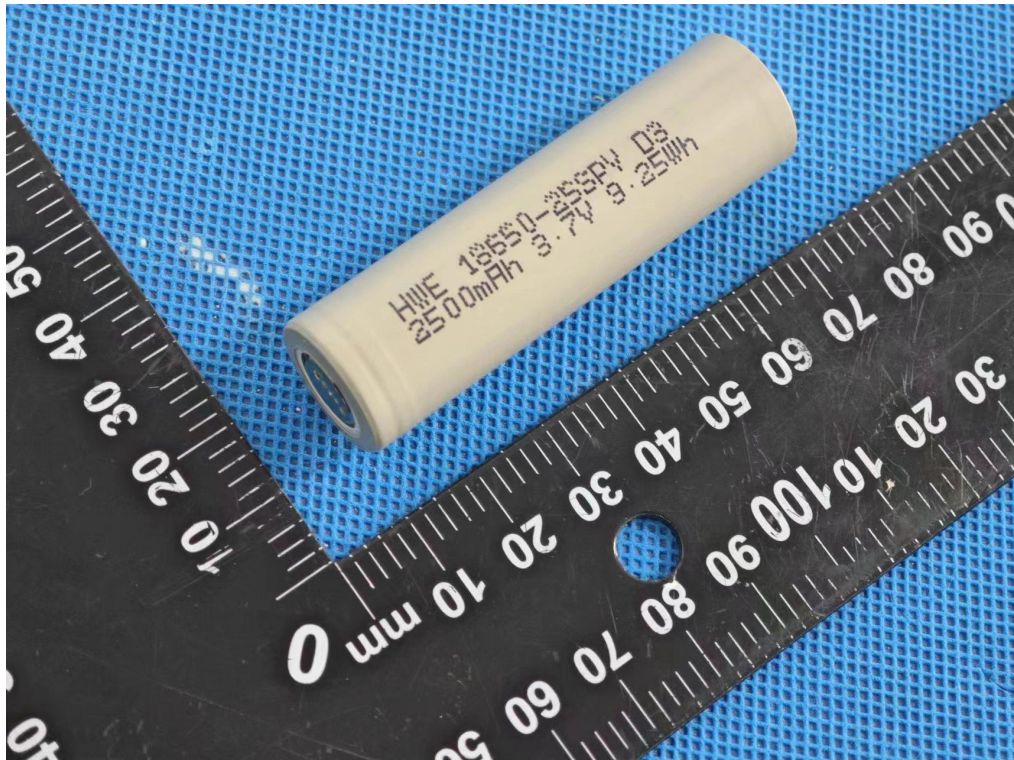
Overall View 1 of PCB

ID 01-5



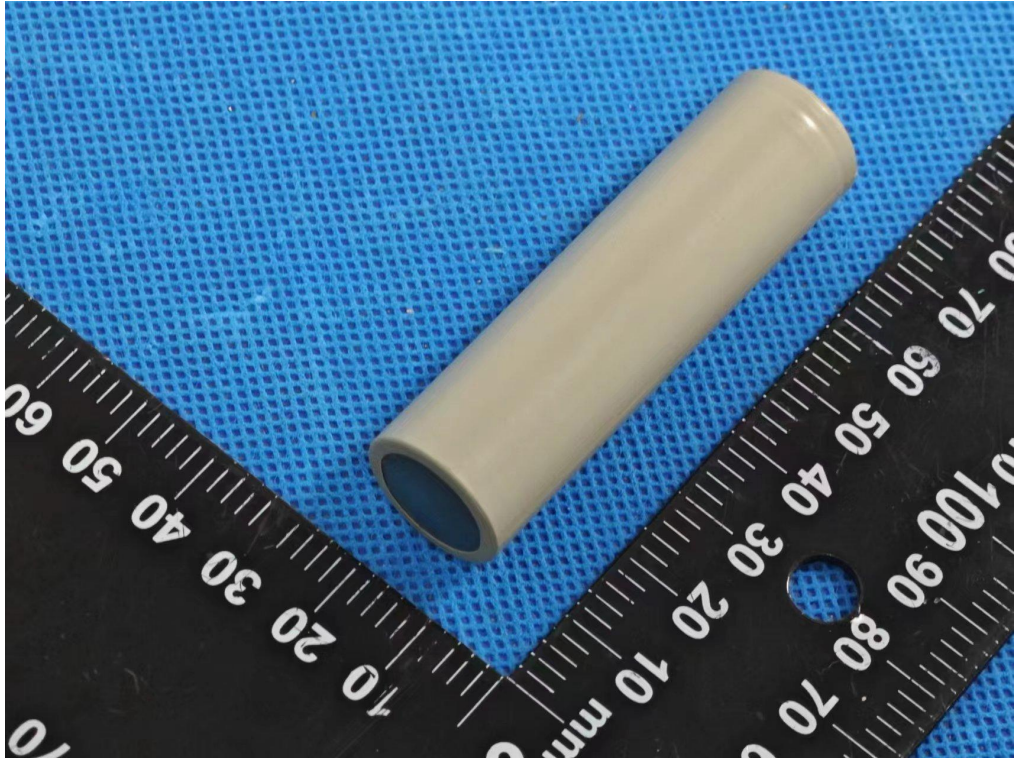
Overall View 2 of PCB

ID 01-6



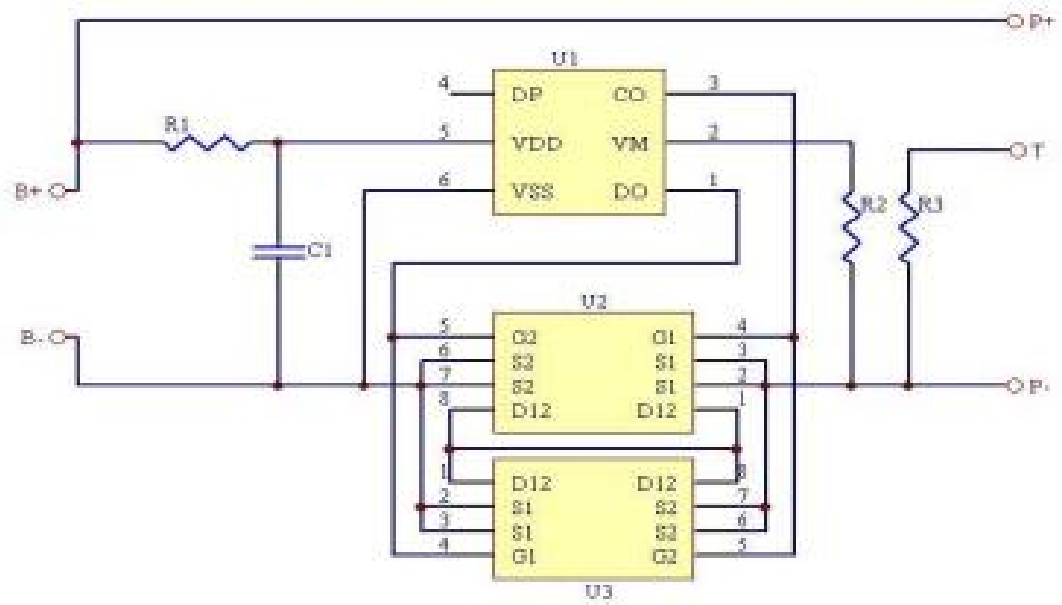
Overall View 1 of Cell

ID 01-7

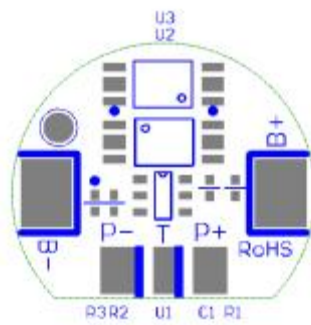


Overall View 2 of Cell

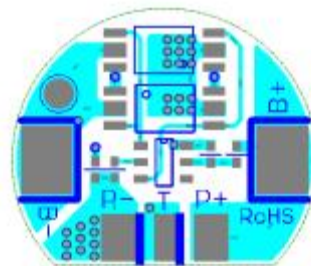
ID 02



ID 03-1



顶层线路图



底层线路图

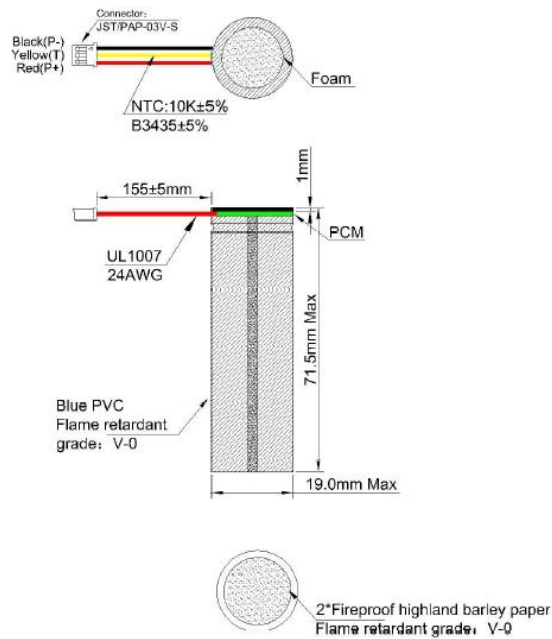
ID 03-2



底层焊盘图

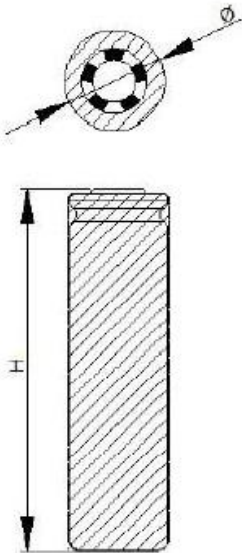
ID 04

Battery Drawing:



Diameter (max.): H(max.)=19.0mm: 71.5mm

Cell Drawing:



Diameter (max.): H(max.)=18.5mm: 65.2mm