Test Report issued under the responsibility of:

DEKRA

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. ..... :	4390774.50
Date of issue..... :	2022-06-21
Total number of pages ..... :	34 pages
Name of Testing Laboratory preparing the Report..... :	DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch
Applicant's name..... :	Springpower Technology (Shenzhen) Co., Ltd.
Address..... :	101,No.2, Chaoshun Industrial Zone, 101 Building 6 and 101 Building 7, No. 221 on Renmin Road, Fumin Community, Fucheng Street, Longhua District, Shenzhen City, Guangdong Province, P. R. 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_2B
Test Report Form(s) Originator.... :	DEKRA Certification B.V.
Master TRF..... :	Dated 2021-08-31

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 IECEE Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
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Test item description .....:	Rechargeable Li-ion Battery		
Trade Mark(s) .....:	--		
Manufacturer .....:	Same as applicant		
Model/Type reference .....:	402339		
Ratings .....:	3,8 Vdc, 450 mAh		
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒ **CB Testing Laboratory:**	DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch		
Testing location/ address .....:	Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China		
Tested by (name, function, signature) .....:	Moira Xiao (Project Engineer)	Moira Xiao	
Approved by (name, function, signature) ..:	Alger Yang (Reviewer)	.....	
☒ **Testing procedure: CTF Stage 1:**	Test Center of Huizhou Highpower Technology Co., Ltd.		
Testing location/ address .....:	Xinhu Industrial Zone, Ma'an Town, Huicheng District, Huizhou City, Guangdong Province, P.R. China		
Tested by (name, function, signature) .....:	Moira Xiao (Project Engineer)	Moira Xiao	
Approved by (name, function, signature) ..:	Alger Yang (Reviewer)	.....	
☐ **Testing procedure: CTF Stage 2:**			
Testing location/ address .....:			
Tested by (name + signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature) ..:			
☐ **Testing procedure: CTF Stage 3:**			
☐ **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):

Attachment 1: National differences of Korea (KR) (3 pages)

Attachment 2: Photos and illustrations (5 pages)

Attachment 3: Equipment list (1 page)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Battery with MOSFET (U2) model PED2310L, tests of cl. 7.2.1, cl. 7.2.2, cl. 7.3.1, cl. 7.3.3, cl. 7.3.4, cl. 7.3.5, cl. 7.3.6, cl. 7.3.7 and cl. 7.3.8 performed at CTF lab, cl. 7.3.2 and cl. 7.3.9 were performed at CBTL. Battery with MOSFET (U2) model CJCD2005, test of cl.7.3.2 was performed at CBTL, cl.7.3.6 was performed at CTF lab.	DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China Test Center of Huizhou Highpower Technology Co., Ltd. Xinhu Industrial Zone, Ma'an Town, Huicheng District, Huizhou City, Guangdong Province, P.R. China

Summary of compliance with National Differences (List of countries addressed):

National differences of Korea (KR), GB have been considered.

Countries outside the CB scheme membership may also accept this report.

The product may be request to be provided and evaluated when submitted for national approval.

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.

1ICP4/23/39 Model型号:402339
Rechargeable Li-ion Battery
可充式锂离子电池组
Nominal Voltage标称电压:3.8V
Limited Charge Voltage充电限制电压:4.35V
Rated Capacity额定容量:450mAh/1.71Wh
Manufacturer: Springpower Technology (Shenzhen) Co., Ltd.
制造商:曙鹏科技(深圳)有限公司 Date日期:YYYYWW
Red wire:"+", Black wire:"-" 红线为正极，黑线为负极

警告：禁止拆解、撞击、挤压或投入火中。
若出现严重鼓胀，请勿继续使用。
请勿置于高温环境中。电池浸水后禁止使用！

Made In China
中国制造

Cautions: Do not disassemble, strike, squeeze, short circuit or put into fire. Do not use the battery after it is immersed in water. Keep small cells and batteries which are considered swallowable out of the reach of children. Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion. In case of ingestion of a cell or battery, seek medical assistance promptly.

Remark:

- The cells were used in the manufacture of a battery.
- The battery surface is too small to accommodate all marking as above, information will be given in specification sheet or in instruction manual or on the immediate package instead of on the battery according to IEC 61960-3:2017.

Test item particulars .....:	Rechargeable Li-ion Battery
Classification of installation and use.....:	Portable use
Supply Connection .....:	N/A
Recommend charging method declared by the manufacturer.....:	CC/CV
Discharge current (0,2 It A).....:	90 mA for cell and battery
Specified final voltage.....:	3,0 Vdc for cell, 3,05 V for battery
Upper limit charging voltage per cell.....:	4,4 Vdc for cell and battery
Maximum charging current.....:	675 mA for cell and battery
Charging temperature upper limit.....:	45 ºC
Charging temperature lower limit .....:	0 ºC
Polymer cell electrolyte type.....:	☐ gel polymer ☐ solid polymer ☒ 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..... :	2022-06-02
Date (s) of performance of tests ..... :	2022-06-02 to 2022-06-15

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 ☒ comma / ☐ point is used as the decimal separator.

The measurement result is considered in conformance with the requirement if it is within the prescribed limit, it is not necessary to calculate the uncertainty associated with the measurement result.

The sample has been tested and found compliant with the requirement of the safety standards listed below:

IEC 62133-2:2017

IEC 62133-2:2017/AMD1:2021

EN 62133-2:2017

EN 62133-2:2017/A1:2021

BS EN 62133-2:2017

BS EN 62133-2:2017/A1:2021

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)..... :	Springpower Technology (Shenzhen) Co., Ltd. 101, No.2, Chaoshun Industrial Zone, 101 Building 6 and 101 Building 7, No. 221 on Renmin Road, Fumin Community, Fucheng Street, Longhua District, Shenzhen City, Guangdong Province, P. R. China
General product information and other remarks: Rechargeable Li-ion Battery, including 1 cell (cell model 402339(cell), 3,8 Vdc, 450 mAh) and protection circuit. The test result in this report considered the worst case if nothing mentioned.	

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		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 creapage 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	Vent design in 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		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		P
5.5	**Terminal contacts**		P

IEC 62133-2			
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		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		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		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

IEC 62133-2			
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		P
	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		P
	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		P
	The battery case and compartments housing cells are designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer		P
	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

IEC 62133-2			
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		P
5.8	**Battery safety components**		P
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		N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 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 ± 5 °C, using the method declared by the manufacturer		P
	Prior to charging, the battery has been discharged at 20 °C ± 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

IEC 62133-2			
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		P
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)		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)		P
	Oven temperature (°C) ..... :	70 °C	—
	Results: no physical distortion of the battery case resulting in exposure of internal protective components and cells		P
7.3	**Reasonably foreseeable misuse**		P
7.3.1	External short-circuit (cell)		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)		P
	The batteries were tested until one of the following occurred:		P
	- 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
	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

IEC 62133-2			
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		P
	Results: no fire, no explosion .....:	(See appended table 7.3.2)	P
7.3.3	Free fall		P
	Results: no fire, no explosion		P
7.3.4	Thermal abuse (cells)		P
	Oven temperature (°C) ..... :	130 °C	—
	Results: no fire, no explosion		P
7.3.5	Crush (cells)		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		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)		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

IEC 62133-2			
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		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		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)		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		P
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached	400 N	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		P
	Manufacturers of batteries provides information regarding how to minimize and mitigate hazards to equipment manufacturers or end-users		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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.2	**Small cell and battery safety information**		P
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		P
	- Keep small cells and batteries which are considered swallowable out of the reach of children		P
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		P
	- In case of ingestion of a cell or battery, seek medical assistance promptly		P
9	**MARKING**		P
9.1	**Cell marking**		P
	Cells are marked as specified in IEC 61960, except coin cells	Cells used in the manufacture of a battery need not be marked.	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		P
	- Not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		N/A
9.3	**Caution for ingestion of small cells and batteries**		P
	Coin cells and batteries identified as small batteries include a caution statement regarding the hazards of ingestion in accordance with 8.2		P

IEC 62133-2			
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		P
	- Recommended charging instructions		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		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		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
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 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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
A.4.4	Low temperature range		P
A.4.4.1	General		P
A.4.4.2	Explanation of safety viewpoint		P
A.4.4.3	Safety considerations, when specifying charging conditions in the low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		P
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		N/A
A.5.5.1	Insertion of nickel particle in winding core		N/A
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		N/A
A.5.6	Insertion of nickel particle in prismatic cell		P
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
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
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**		P
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**		N/A
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 Vc (Vdc)**	**Recommended charging current I_{rec} (A)**	**OCV before test (Vdc)**	**Results**
4390774/C01	4,35	0,225	4,337	P
4390774/C02	4,35	0,225	4,336	P
4390774/C03	4,35	0,225	4,336	P
4390774/C04	4,35	0,225	4,335	P
4390774/C05	4,35	0,225	4,336	P

Supplementary information:

- No fire or explosion
- No leakage

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					
4390774/C06	55,6	4,357	85	49,5	P
4390774/C07	55,6	4,357	83	50,4	P
4390774/C08	55,6	4,356	86	54,1	P
4390774/C09	55,6	4,359	92	55,4	P
4390774/C10	55,6	4,358	81	50,5	P
Samples charged at charging temperature lower limit					
4390774/C11	55,7	4,293	83	50,9	P
4390774/C12	55,7	4,286	84	54,8	P
4390774/C13	55,7	4,291	83	55,0	P
4390774/C14	55,7	4,283	87	55,5	P
4390774/C15	55,7	4,289	88	54,1	P

Supplementary information:

- No fire or explosion
- Remark: Test sample charging temperature upper limit: 45 °C at 4,4 V/ 675 mA.
  Test sample charging temperature lower limit: 0 °C at 4,4 V/ 675 mA.

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

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**
4390774/B01	21,8	4,267	89	0,1	--	P
4390774/B02	21,8	4,255	87	100,6	U2 pin S1-S2/S	P
4390774/B03	21,8	4,256	88	94,7	U2 pin S1-S2/S	P
4390774/B04	21,8	4,258	86	0,1	--	P
4390774/B05	21,8	4,257	85	0,2	--	P

Supplementary information:

- No fire or explosion
- Remark: S: Short-circuited; O: Open-circuited
- Tested with MOSFET (U2) model PED2310L.

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**
4390774/B01-1	20,3	4,307	89	0,1	--	P
4390774/B02-1	20,3	4,307	87	90,6	U2 pin S1-S2/S	P
4390774/B03-1	20,3	4,304	86	93,1	U2 pin S1-S2/S	P
4390774/B04-1	20,3	4,306	90	0,2	--	P
4390774/B05-1	20,3	4,305	85	0,1	--	P

Supplementary information:

- No fire or explosion
- Remark: S: Short-circuited; O: Open-circuited
- Tested with MOSFET (U2) model CJCD2005.

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				
4390774/C29	4,357	--	13,0	P

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

4390774/C30	4,361	--	13,0	P
4390774/C31	4,355	--	13,0	P
4390774/C32	4,355	--	13,0	P
4390774/C33	4,354	--	13,0	P
Samples charged at charging temperature lower limit				
4390774/C34	4,291	--	13,0	P
4390774/C35	4,276	--	13,0	P
4390774/C36	4,286	--	13,0	P
4390774/C37	4,290	--	13,0	P
4390774/C38	4,287	--	13,0	P

Supplementary information:
- No fire or explosion
- Remark 1: The maximum force of 13 kN has been applied.
- Remark 2: Test sample charging temperature upper limit: 45 °C at 4,4 V/ 675 mA.
  Test sample charging temperature lower limit: 0 °C at 4,4 V/ 675 mA.

7.3.6	**TABLE: Over-charging of battery**			**P**
Constant charging current (A) ..... :		**0,9**		**—**
Supply voltage (Vdc) ..... :		**6**		**—**
Sample No.	**OCV before charging (Vdc)**	**Total charging time (minute)**	**Maximum outer case temperature (°C)**	**Results**
4390774/B09	3,444	90	32,1	P
4390774/B10	3,443	90	30,3	P
4390774/B11	3,443	90	33,7	P
4390774/B12	3,441	90	32,2	P
4390774/B13	3,439	90	32,9	P

Supplementary information:
- No fire or explosion
- Tested with MOSFET (U2) model PED2310L.

7.3.6	**TABLE: Over-charging of battery**			**P**
Constant charging current (A) ..... :		**0,9**		**—**
Supply voltage (Vdc) ..... :		**6**		**—**
Sample No.	**OCV before charging (Vdc)**	**Total charging time (minute)**	**Maximum outer case temperature (°C)**	**Results**
4390774/B09-1	3,438	90	34,8	P

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

4390774/B10-1	3,443	90	30,8	P
4390774/B11-1	3,439	90	31,2	P
4390774/B12-1	3,446	90	34,1	P
4390774/B13-1	3,442	90	33,8	P

Supplementary information:
- No fire or explosion
- Tested with MOSFET (U2) model CJCD2005.

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**
4390774/C39	3,453	0,45	-2,929	P
4390774/C40	3,451	0,45	-3,062	P
4390774/C41	3,452	0,45	-3,052	P
4390774/C42	3,452	0,45	-2,916	P
4390774/C43	3,451	0,45	-2,724	P

Supplementary information:
- No fire or explosion
- No leakage

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**
4390774/B14	4,328	4,313	7,4637	7,4635	P
4390774/B15	4,328	4,314	7,4713	7,4712	P
4390774/B16	4,328	4,314	7,4566	7,4564	P

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting

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**
4390774/B17	4,329	4,318	7,4353	7,4352	P
4390774/B18	4,330	4,320	7,4465	7,4465	P
4390774/B19	4,330	4,320	7,4826	7,4825	P

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

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting

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					
4390774/C44	45	4,372	1	400	P
4390774/C45	45	4,381	1	400	P
4390774/C46	45	4,370	1	400	P
4390774/C47	45	4,370	1	400	P
4390774/C48	45	4,379	1	400	P
Samples charged at charging temperature lower limit					
4390774/C49	0	4,304	1	400	P
4390774/C50	0	4,307	1	400	P
4390774/C51	0	4,308	1	400	P
4390774/C52	0	4,307	1	400	P
4390774/C53	0	4,305	1	203,3*	P

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 1: No fire.
- Remark 2: * represents voltage drop of 50 mV has been detected.
- Remark 3: Test sample charging temperature upper limit: 45 °C at 4,4 V/ 675 mA.
  Test sample charging temperature lower limit: 0 °C at 4,4 V/ 675 mA.

D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	**Ambient T (°C)**	**Store time (h)**	**Resistance Rac (Ω)**	**Results [1)]**

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

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	Springpower Technology (Shenzhen) Co., Ltd.	402339(cell)	3,8 Vdc, 450 mAh	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
-Positive electrode	Springpower Technology (Shenzhen) Co., Ltd.	Al foil	$LiCoO_2$, PVDF, NMP, Conductive Additive	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
-Negative electrode	Springpower Technology (Shenzhen) Co., Ltd.	Cu foil	Graphite, CMC, SBR, Distilled Water, Conductive Additive	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
-Electrolyte	Shenzhen capchem Polytron Technologies Inc	A18004	$LiPF_6$ dissolved in organic solvent (EC, PC, DEC)	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
-Separator	Chongqing Yuntianhua Newmi-Tech CO., Ltd.	NM-12μmTC/PVDF	PE + Ceramic + PVDF, shutdown temperature: 130~140°C	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
PCB	SHEN ZHEN JIRUIDA CIRCUIT TECHNOLOGY CO LTD	JRD-S	V-0, 130 ºC	UL 796	UL E340032
PCB alternative	Interchangeable	Interchangeable	V-0, 130 ºC	UL 796	DEKRA or other NRTL
Protective IC (U1)	Nisshinbo Micro Devices, Inc.	R5442L139KM	Overcharge detection voltage: 4,425 ± 0,02 V, Overdischarge detection voltage:3,0 ± 0,035 V	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
MOSFET (U2)	Shenzhen Semi-one Technology Co., Ltd	PED2310L	V_{DS}=18 V, V_{GS}=±12 V, I_D= 8 A	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance
MOSFET (U2) alternative	JIANGSU CHANGJING ELECTRONICS TECHNOLOGY CO., LTD	CJCD2005	V_{DS}=20 V, V_{GS}=±12 V, I_D= 8 A	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021	Tested in appliance

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

Wire	LTK Electric Wire (Huizhou) Ltd	3302	30 Vac, 105 ºC, 28 AWG	UL 758	UL E148000
Wire alternative	Interchangeable	Interchangeable	30 Vac, 105 ºC, 28 AWG	UL 758	DEKRA or other NRTL
Supplementary information: [1)] Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

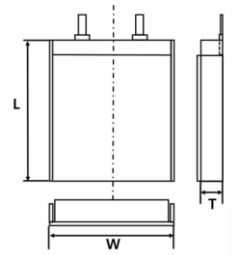
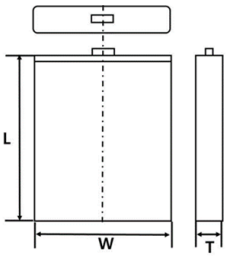
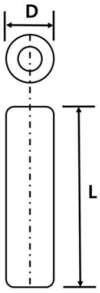
Attachment 1: National differences of Korea (KR)

IEC62133_2B ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
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)			
Differences according to..... :	National standard KC62133-2(2020-07)		
TRF template used:..... :	IECEE OD-2020-F3, Ed. 1.1		
Attachment Form No. ..... : **Attachment Originator.....** : **Master Attachment**..... :	KR_ND_IEC62133_2B KTR 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)	***[Add the bolded text]*** 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: • 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. **• 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.)**		N/A

Attachment 1: National differences of Korea (KR)

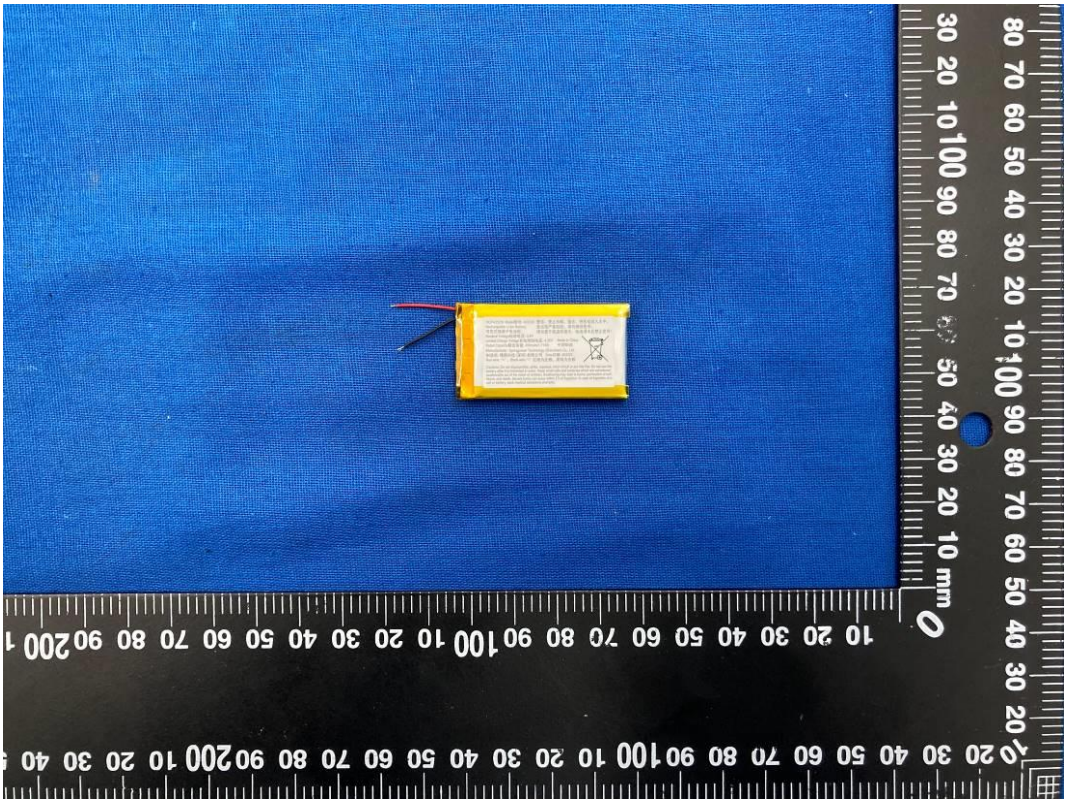
IEC62133_2B ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	[Replace to the following statement] c) Acceptance criteria Filling beyond the manufacturer's specified limits should not result in ignition or explosion		
Annex G	**Definition for shape and materials of outer case for cell**		—
(Addition)	G.1 General Annex G provides definitions for shape and materials of outer case for cell 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. G 2.2 Prismatic cell Cell having the shape of a parallelepiped whose faces are rectangular G.3 Materials of outer case for cell G.3.1 Soft case Non-metallic outer case or container for cell G.3.2 Hard case Metallic outer case or container for cell.	(Shape of outer cases) ☐ Cylindrical ☒ Prismatic (Materials of outer cases) ☐ Hard ☒ Soft	—
Annex H	**Calculation method of the volumetric energy density for cell**		—
(Addition)	Annex H provide a calculation method of the volumetric energy density for cell in use of smart phone, tablet, notebook. 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.	483,185 Wh / L	—

Attachment 1: National differences of Korea (KR)

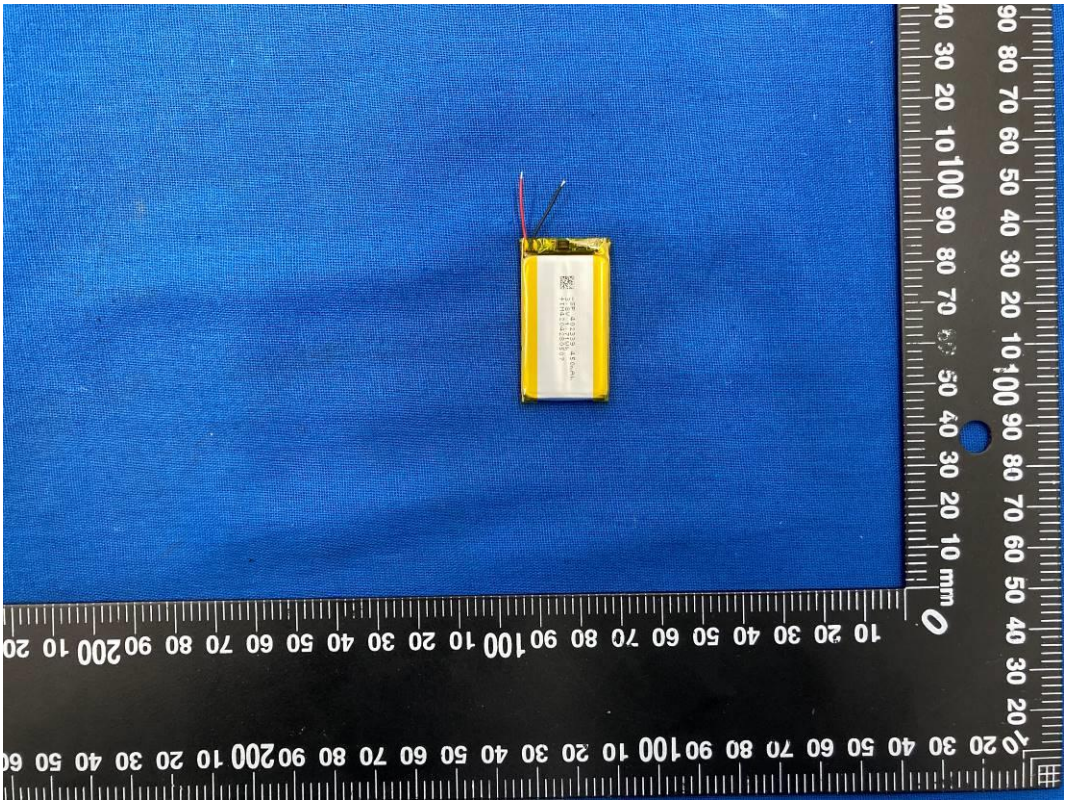
IEC62133_2B ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	H.2 Calculation Method  L : Length (max.) of cell (including terrace) W : Width (max.) of cell T : Thickness (max.) when shipping charge (For reference, Please Exclude the dimension of any tape that Is attached to cell) $Volumetric\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

Annex E	**TABLE: Calculation method of the volumetric energy density for cell**				**--**
Model	**Nominal voltage, (V)**	**Rated capacity, (Ah)**	**Length (L), (m)**	**Width (W), (m)**	**Thickness (T), (m)**
402339(cell)	3,8	0,45	0,039	0,0228	0,00398
Calculation result: Prismatic cell, 483,185 Wh / L.					

Attachment 2: Photos and illustrations

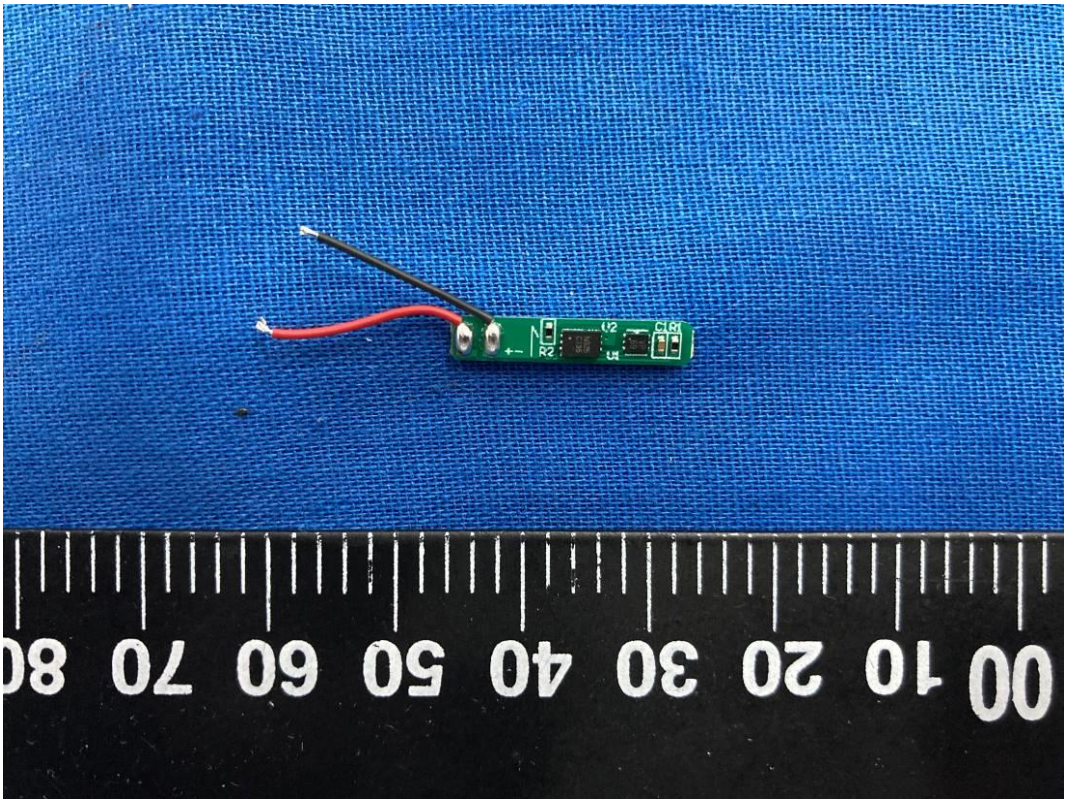


Overview of battery (refer to page 4 for marking plate)

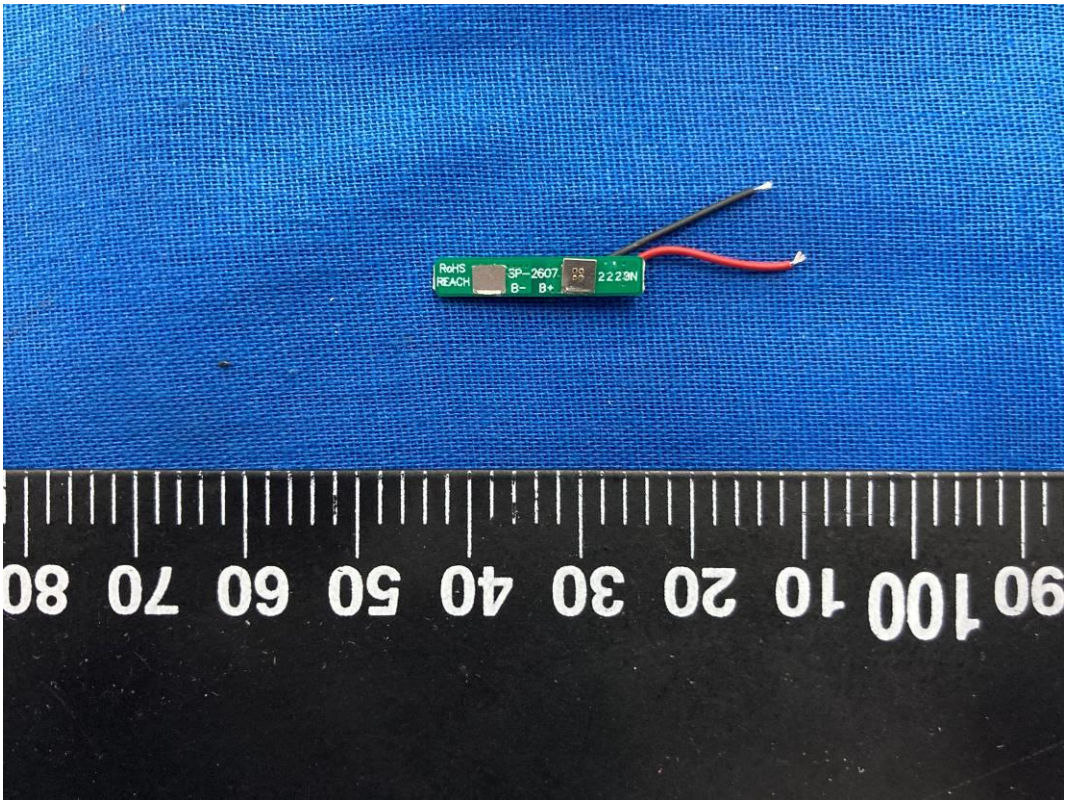


Overview of battery

Attachment 2: Photos and illustrations

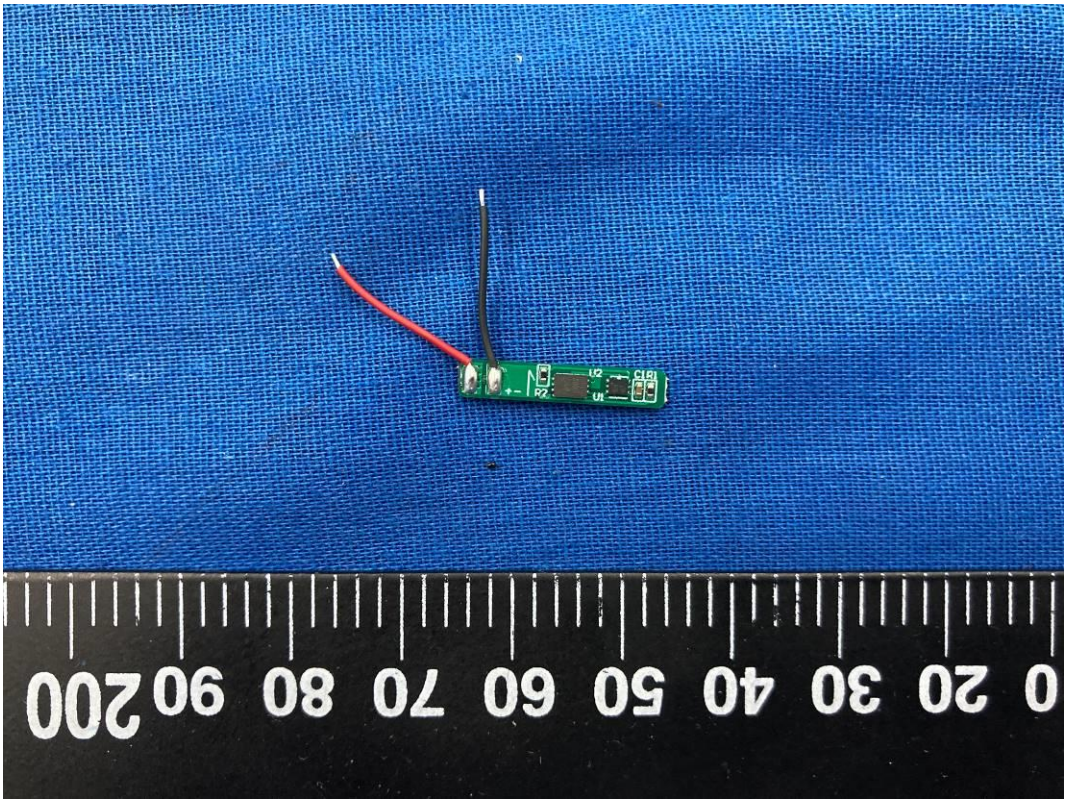


Protective board view with MOSFET (U2) model PED2310L

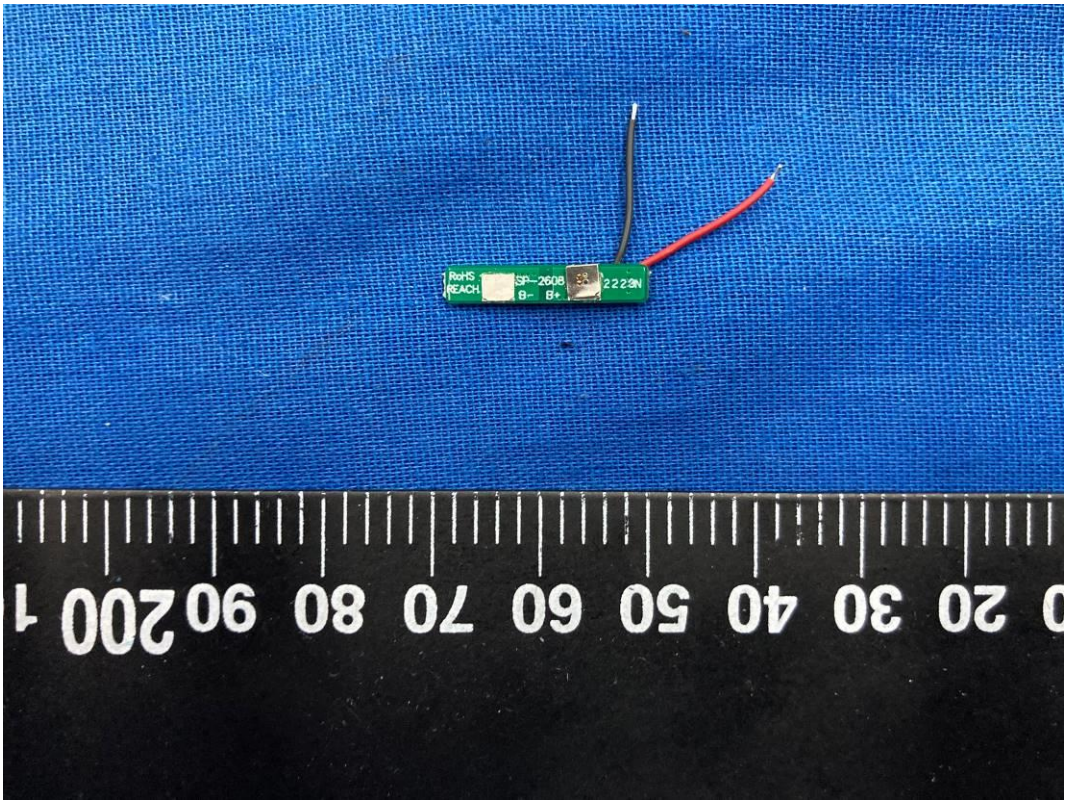


Protective board view with MOSFET (U2) model PED2310L

Attachment 2: Photos and illustrations

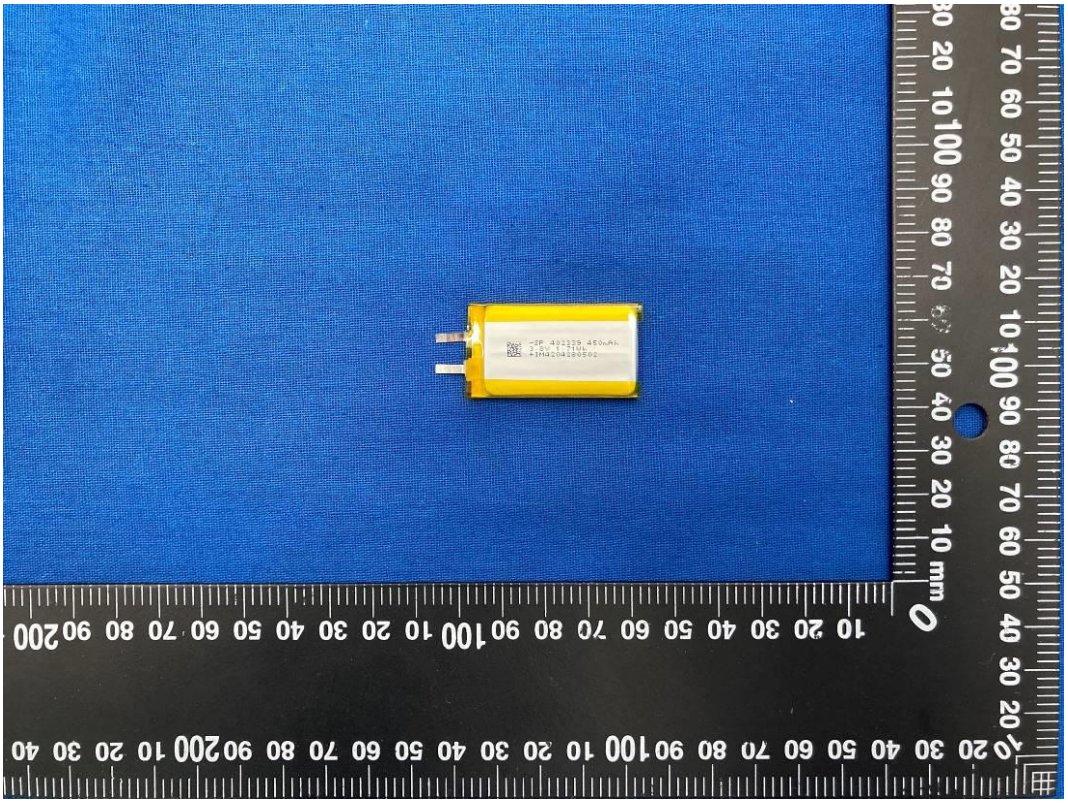


Protective board view with MOSFET (U2) model CJCD2005

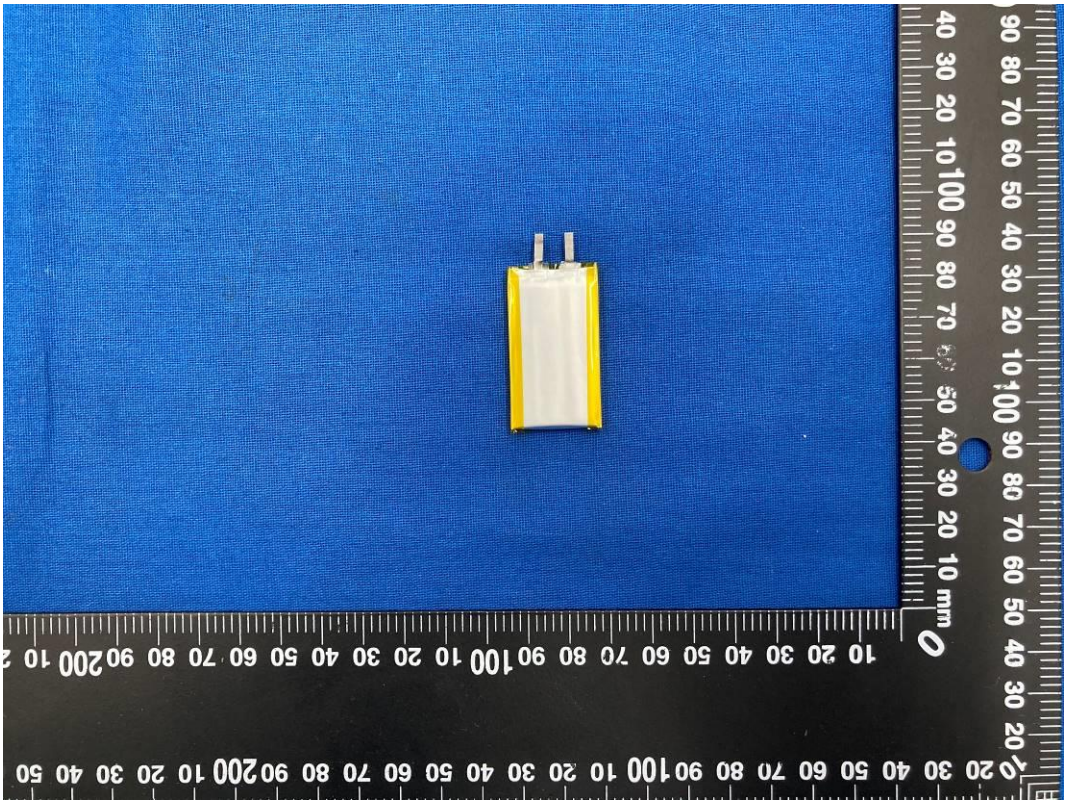


Protective board view with MOSFET (U2) model CJCD2005

Attachment 2: Photos and illustrations

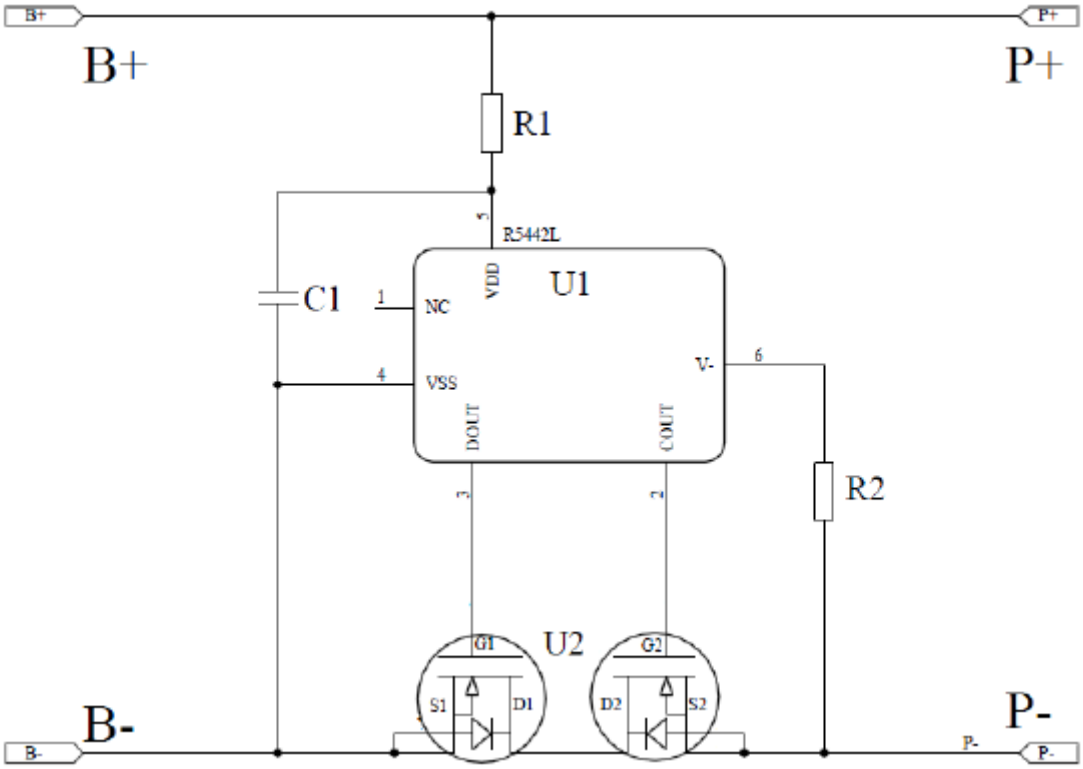


Overview of cell



Overview of cell

Attachment 2: Photos and illustrations



Protective circuit

Attachment 3: Equipment list

Clause	Equipment Name	Specification	Calibration date	Calibration due date
7.1	High/low temperature chamber	Model: GTTH-225 Rage used: -40 °C ~150 °C	2021-10-11	2022-10-10
	Battery testing system	Model: CT-4008T-5V6A-S1 Rage used: 0.1 mV~5 V, 0.1 mA~6 A	2021-10-11	2022-10-10
	Battery testing system	Model: CT-4004-20V20A-NA Rage used: 40mV~20V,40mA~20A	2022-3-11	2023-3-10
7.2.1	Battery testing system	Model: CT-4008T-5V6A-S1 Rage used: 0.1 mV~5 V, 0.1 mA~6 A	2021-10-11	2022-10-10
7.2.2	High/low temperature chamber	Model: GX-5056 Rage used:RT~300℃	2022-3-4	2023-3-3
7.3.1	Short-circuit tester	Model: GX-3020-B Rage used: RT~300 °C	2021-9-14	2022-9-13
	Temperature recorder	Model: 2638A Rage used: -100~1375 °C	2022-5-7	2023-5-6
	DC resistance meter	Model: TH2512B Rage used:1μΩ~20kΩ	2022-3-11	2023-3-10
7.3.3	Drop testing instrument	Model: GX-6052 Rage used: 0~1,5 m	2021-7-2	2022-7-1
7.3.4	Thermal abuse chamber	Model: GX-5056 Rage used: RT~300 °C	2022-3-4	2023-3-3
7.3.5	Crush tester	Model: GX-5067 Rage used: 0~15 KN	2022-3-4	2023-3-3
7.3.6	Battery testing system	Model: CT-4004-30V20A-NA Rage used: 60 mV~30 V, 40 mA~20 A	2022-3-11	2023-3-10
	Temperature recorder	Model: 2635A Rage used: -100~1375 °C	2022-5-7	2023-5-6
7.3.7	Battery testing system	Model: CT-4008-10V10A-NFA Rage used: 20 mV~10 V, 20 mA~10 A	2021-7-2	2022-7-1
7.3.8.1	Vibration platform	Model: HY-ZD-3 Rage used: 5~1000 Hz, 0~1 mm	2022-3-4	2023-3-3
	Electronic balance	Model: XS-204 Rage used: 0~220 g	2021-10-11	2022-10-10
7.3.8.2	Mechanical shock platform	Model: HY-HAS-10 Rage used: 0~175 g	2022-4-7	2023-4-6
	Electronic balance	Model: XS-204 Rage used: 0~220 g	2021-10-11	2022-10-10

-END-