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. ..... :	CB250409-06-06-A0
Date of issue ..... :	2025-08-12
Total number of pages ..... :	23
Name of Testing Laboratory preparing the Report ..... :	Prodigy Technology Consultant Co., Ltd.
Applicant's name ..... :	PortaPower Electronics Limited
Address ..... :	1F., No.79 , Ln.271 , Liancun Rd., Fengyuan Dist., Taichung City , 420071 , Taiwan (R.O.C)
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

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-Fe battery pack		
Trade Mark(s) ..... :	N/A		
Manufacturer ..... :	Same as applicant		
Model/Type reference..... :	UTS2A-0803, UTS2B-0803		
Ratings..... :	24Vdc, 45Ah, 1080Wh		
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒ **CB Testing Laboratory:**	Prodigy Technology Consultant Co., Ltd.		
Testing location/ address ..... :	No. 12, Gong 7th Rd., Linkou District, New Taipei City 24450, Taiwan Chinese Taipei		
Tested by (name, function, signature)..... :	Hank Ju / Project Handler		
Approved by (name, function, signature) .. :	Frank Chang / Reviewer		
☐ **Testing procedure: CTF Stage 1:**			
Testing location/ address ..... :			
Tested by (name, function, signature)..... :			
Approved by (name, function, signature) .. :			
☐ **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):

National Differences (16 pages)
- Attachment 1 (Pages 2-5 of 16)
- Attachment 2 (Pages 6-16 of 16)

Enclosures (36 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
For Rechargeable Li-ion Battery Pack, cell type C33 by Qujing EVE Energy Co., Ltd - 7.2.2 CASE STRESS AT HIGH AMBIENT TEMPERATURE - 7.3.2 EXTERNAL SHORT CIRCUIT - 7.3.3 FREE FALL - 7.3.6 OVER-CHARGING OF BATTERY - 7.3.8.1 VIBRATION - 7.3.8.2 MECHANICAL SHOCK	Prodigy Technology Consultant Co., Ltd. / No. 12, Gong 7th Rd., Linkou District, New Taipei City 24450, Taiwan Chinese Taipei

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

EU Group (No National or Group Differences declared), United Kingdom (GB) (per customer's request shown separately), Korea (KR)

☒ **The product fulfils the requirements of EN 62133-2:2017/A1:2021, BS EN 62133-2:2017/A1:2021**

☒ **The product fulfils the requirements of National standard KC62133-2(2020-07)**

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").

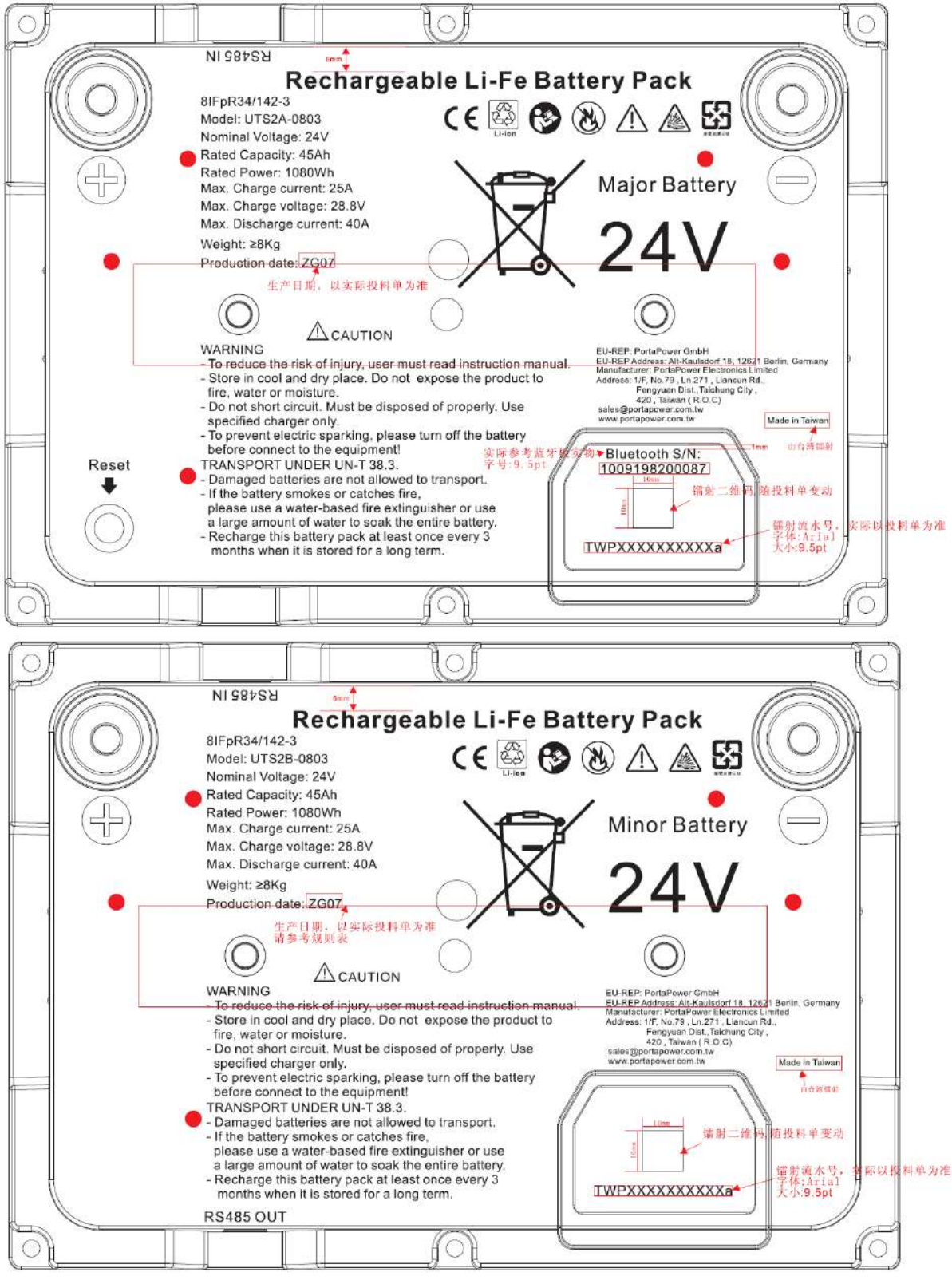
☐ Other:… (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

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.



Test item particulars..... :	
Classification of installation and use..... :	for build-in use
Supply Connection ..... :	N/A
Recommend charging method declared by the manufacturer ..... :	CC/CV
Discharge current (0,2 It A) ..... :	9A
Specified final voltage..... :	20V
Upper limit charging voltage per cell..... :	3.8Vdc
Maximum charging current ..... :	25A
Charging temperature upper limit ..... :	45°C
Charging temperature lower limit..... :	0°C
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 .....:	2025-04-09
Date (s) of performance of tests .....:	2025-05-07 to 2025-05-23
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.**	
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)~~ ..... :	PortaPower Electronics Limited / 1F., No.79 , Ln.271 , Liancun Rd., Fengyuan Dist., Taichung City , 420071 , Taiwan (R.O.C)

General product information and other remarks:

Supplementary Information on National/Group Differences not to be listed on CBTC
- National Differences TRF for Japan is for information only since the ND/GD TRF latest revision does not match the latest revision of IEC Standard TRF used for evaluation

Report Summary
All applicable tests according to the referenced standard(s) have been carried out.

Product Description
The EUT is a Rechargeable Li-Fe battery pack; Electronic components were mounted on PWB with 8-series, 3-parallel IEC 62133-2:2017, IEC62133-2:2017/AMD1:2021 approved cells, housed with a plastic enclosure and secured together by screws.

Model Differences

All models are identical except for model designation

Additional Information

- The results of this investigation indicate that the products evaluated comply with the applicable requirements in the IEC 62133-2:2017, EN 62133-2:2017/A1:2021, BS EN 62133-2:2017/A1:2021 and KC 62133-2(2020-07) and J62133-2(2021).
- Operating temperature: 0~45°C for charge condition, -20~+60°C for discharge condition.
- The charging/discharging specification:

Maximum charge Voltage: 28.6V, Maximum charge current: 25A, Maximum Discharge Current: 40A, end Voltage: 20V, with cell type C33 by Qujing EVE Energy Co., Ltd.

- 8IFpR34/142-3 is a battery designation according to IEC 61960-3:2017.

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	Exposed material is not metal.	N/A
	Insulation resistance (MΩ) ..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements	Sufficiently.	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		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	Controlled by MOSFET, protective IC and thermistor.	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
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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	Fool-proof connector was used.	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	Not such construction	N/A
	This protection may be provided external to the battery such as within the charger or the end devices	Not such construction.	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	Not such construction.	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	Not such construction.	N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly	Provided on cell's Spec.	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	Not such construction.	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	8S3P battery, dose not exceeded 3.8V for cell block.	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	Not such construction.	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	Not such construction.	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	Not such construction.	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	Will evaluated on end product.	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	ISO 9001 certification had provided.	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	Manufacturer date had marked, date code rule as Enclosure ID 7-03 for details.	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	Considered on approval cell.	N/A
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		N/A

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		N/A
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)	Evaluated on approval cell.	N/A
	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		N/A
	Results: no fire, no explosion, no leakage.....:		N/A
7.2.2	Case stress at high ambient temperature (battery)	Subjected Case stress at high ambient temperature test	P
	Oven temperature (°C).....:	70	—
	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**		P
7.3.1	External short-circuit (cell)	Evaluated on approval cell.	N/A
	The cells were tested until one of the following occurred:		N/A
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		N/A
	Results: no fire, no explosion.....:		N/A
7.3.2	External short-circuit (battery)	Subjected short circuit test.	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		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

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	MOSFET and current sensing resistor faulted.	P
	Results: no fire, no explosion ..... :	(See appended table 7.3.2)	P
7.3.3	Free fall	Subjected Free fall test.	P
	Results: no fire, no explosion	No fire. No explosion.	P
7.3.4	Thermal abuse (cells)	Evaluated on approval cell.	N/A
	Oven temperature (°C) ..... :		—
	Results: no fire, no explosion		N/A
7.3.5	Crush (cells)	Evaluated on approval cell.	N/A
	The crushing force was released upon:		N/A
	- The maximum force of 13 kN ± 0,78 kN has been applied; or		N/A
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: no fire, no explosion ..... :		N/A
7.3.6	Over-charging of battery	Subjected Over-charging test.	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		N/A
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and		P
	- 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)	Evaluated on approval cell.	N/A
	Discharge a single cell to the lower limit discharge voltage specified by the cell manufacturer		N/A
	The discharged cell is then subjected to a forced discharge at 1 It A to the negative value of the upper limit charging voltage		N/A

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		N/A
	Results: no fire, no explosion ..... :		N/A
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration	Subjected Vibration test.	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	Subjected Mechanical shock test.	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)	Evaluated on approval cell.	N/A
	The cells complied with national requirement for ..... :		—
	The pressing was stopped upon:		N/A
	- 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		N/A
	Results: no fire ..... :		N/A
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		P
	As appropriate, any information relating to hazard avoidance resulting from a system analysis is provided to the end user		P
8.2	**Small cell and battery safety information**		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		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**	Evaluated on approval cell.	N/A
	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		N/A
9.2	**Battery marking**		P
	Batteries are marked as specified in IEC 61960, except for coin batteries	See Copy of Marking Plate.	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	Fool-proof connector used.	N/A
	- Not be marked with polarity markings if the design of the external connector prevents reverse polarity connections	Fool-proof connector used.	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		N/A
	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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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**		N/A
A.1	**General**	Evaluated on approval cell.	N/A
A.2	**Safety of lithium ion secondary battery**		N/A
A.3	**Consideration on charging voltage**		N/A
A.3.1	General		N/A
A.3.2	Upper limit charging voltage		N/A
A.3.2.1	General		N/A
A.3.2.2	Explanation of safety viewpoint		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		N/A
A.4	**Consideration of temperature and charging current**		N/A
A.4.1	General		N/A
A.4.2	Recommended temperature range		N/A
A.4.2.1	General		N/A
A.4.2.2	Safety consideration when a different recommended temperature range is applied		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
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

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
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		N/A
A.4.6	Consideration of discharge		N/A
A.4.6.1	General		N/A
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		N/A
A.4.6.3	Discharge current and temperature range		N/A
A.4.6.4	Scope of application of the discharging current		N/A
A.5	**Sample preparation**		N/A
A.5.1	General		N/A
A.5.2	Insertion procedure for nickel particle to generate internal short		N/A
A.5.3	Disassembly of charged cell		N/A
A.5.4	Shape of nickel particle		N/A
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		N/A
A.6	**Experimental procedure of the forced internal short-circuit test**		N/A
A.6.1	Material and tools for preparation of nickel particle		N/A
A.6.2	Example of a nickel particle preparation procedure		N/A
A.6.3	Positioning (or placement) of a nickel particle		N/A
A.6.4	Damaged separator precaution		N/A
A.6.5	Caution for rewinding separator and electrode		N/A
A.6.6	Insulation film for preventing short-circuit		N/A
A.6.7	Caution when disassembling a cell		N/A
A.6.8	Protective equipment for safety		N/A
A.6.9	Caution in the case of fire during disassembling		N/A
A.6.10	Caution for the disassembling process and pressing the electrode core		N/A
A.6.11	Recommended specifications for the pressing device		N/A
ANNEX B	**RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS**		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
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	(See appended table D.2)	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**		P

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

7.2.1	TABLE: Continuous charging at constant voltage (cells)			N/A
Sample No.	**Recommended charging voltage Vc (Vdc)**	**Recommended charging current I_{rec} (A)**	**OCV before test (Vdc)**	**Results**
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

Supplementary information:

- No fire or explosion
- No leakage
- Others (please explain)

7.3.1	TABLE: External short circuit (cell)				N/A
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					
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
Samples charged at charging temperature lower limit					
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--

Supplementary information:

- No fire or explosion
- Others (please explain)

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**
020	21.2	27.63	83.0	0.9	Normal	A,G F2、F3 fuse open
021	21.1	27.61	79.0	2.6	DQ10 pin D to S short	A,F,G F2、F3 fuse open
022	21.1	27.62	81.0	2.4	DQ10 pin D to S short	A,F,G F2、F3 fuse open
023	21.0	27.61	85.0	1.0	DR4 short	A,F,G F2、F3 fuse open
024	21.0	27.61	87.0	1.1	DR4 short	A,F,G F2、F3 fuse open

Supplementary information:

A - No fire or explosion.

B - Fire.

C - Explosion.

D - Leakage.

E - Bulge.

F - Others (please explain).

G – The battery remains on test for 24 h.

H – Until the case temperature of battery declines by 20 % of the maximum temperature rise

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

7.3.5	TABLE: Crush (cells)			N/A
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				
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
Samples charged at charging temperature lower limit				
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

Supplementary information:

- No fire or explosion
- Others (please explain)

7.3.6	TABLE: Over-charging of battery			P
Constant charging current (A) .....:		90		—
Supply voltage (Vdc) .....:		36.48Vdc		—
Sample No.	**OCV before charging (Vdc)**	**Total charging time (minute)**	**Maximum outer case temperature (°C)**	**Results**
004	23.57	456	42.8	A
005	23.55	456	44.2	A
006	23.56	456	46.1	A
007	23.56	475	40.5	A
008	23.55	475	39.2	A

Supplementary information:

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

Note,

- supply voltage according client request, 3.8V*1.2*8=36.48Vdc, worst consideration.

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

7.3.7	TABLE: Forced discharge (cells)			N/A
Sample No.	**OCV before application of reverse charge (Vdc)**	**Measured reverse charge I_t (A)**	**Lower limit discharge voltage (Vdc)**	**Results**
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--	--	--	--	--
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--	--	--	--	--

Supplementary information:

- No fire or explosion
- Others (please explain)

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**
089	27.62	27.57	8507.2	8506.0	A
090	27.62	27.55	8545.3	8545.3	A
091	27.61	27.55	8498.6	8498.2	A

Supplementary information:

A - No fire or explosion
B - No rupture
C - No leakage
D - No venting
E - Others (please explain).

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**
014	27.61	27.61	7583.8	7583.8	A, B, C, D
015	27.62	27.62	7585.6	7585.6	A, B, C, D
016	27.61	27.61	7584.0	7584.0	A, B, C, D

Supplementary information:

A - No fire or explosion
B - No rupture
C - No leakage
D - No venting
E - Others (please explain).

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

7.3.9	TABLE: Forced internal short circuit (cells)				N/A
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					
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
Samples charged at charging temperature lower limit					
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--

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.

- No fire
- Others (please explain)

D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	**Ambient T (°C)**	**Store time (h)**	**Resistance Rac (Ω)**	**Results [1)]**
--	--	--	--	--
--	--	--	--	--
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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)]**
01. Enclosure	Hanwha TotalEnergies Petrochemical Co Ltd	FB51(+)	V-2 minimum, 1.5mm thickness minimum, 130 degree C minimum.	UL94, UL746C	UL*
02. Sealed Secondary Portable Li-Ion Cell (8S3P)	Qujing EVE Energy Co., Ltd	C33	3.2Vdc, 15.2Ah	IEC 62133-2: 2017, IEC 62133-2:2017/AMD1:2021 UL 1642	UL*, TUV R
03. Printed Wiring Board	Interchangeable	Interchangeable	V-1 minimum, 105°C minimum.	UL 796	UL*
04. Mosfet (DQ9, DQ10)	Shanghai Belling Co., Ltd.	BLP02N08	--	--	--
05. AFC IC (U2)	SINOWEALTH Electronic Ltd.	SH367306	--	--	--
06. MCU IC	Wuhan Xinyuan Semiconductor Co., Ltd.	CW32L031	--	--	--
07. Thermistor (NTC1, NTC2)	Guangdong Xinshiheng Technology Co., Ltd.	MF52C103F3435	NTC type,10K ohm at 25 °C	UL 1434	UL*
07a. Alternate Thermistor (NTC1, NTC2)	Interchangeable	Interchangeable	NTC type,10K ohm at 25 °C	UL 1434	UL*
08. Fuse (F2, F3)	DONGGUAN TLC ELECTRONIC TECHNOLOGY CO LTD	WSFD4524	24Vdc, 45A	UL 248-1, UL 248-14, EN 61274:2005+A1+A2	UL*, TUV R
09. Current Sensing Resistor (DR3, DR4, DR5)	Interchangeable	Interchangeable	4m ohm, min. 3W, SMD type.	--	--
10. Internal Plastic Part/Materials	Interchangeable	Interchangeable	Min. V-2	UL 94	UL*

Supplementary information:

[1)] Provided evidence ensures the agreed level of compliance. See OD-CB2039.

[2)] * For UL Standard: License available upon request.

Enclosure

National Differences

Attachment 1
Korea

Attachment 2
Japan

ATTACHMENT to IEC62133_2C			
Clause	Requirement + Test	Result - Remark	Verdict

ATTACHMENT TO TEST REPORT

IEC 62133-2

(Republic of Korea) NATIONAL DIFFERENCES

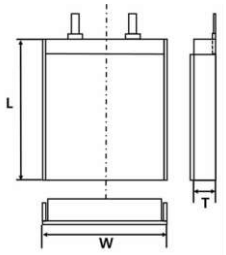
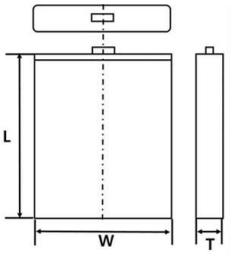
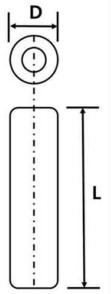
(Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications - Part 2: Lithium systems)

Differences according to ..... :	National standard KC62133-2(2020-07)
TRF template used:.....:	IECEE OD-2020-F3:2022, Ed. 1.2
Attachment Form No. ..... :	KR_ND_IEC62133_2C
Attachment Originator..... :	KTR
Master Attachment..... :	Dated 2023-08-02

	National Differences	
7.3.6	**Over-charging of battery**	P

ATTACHMENT to IEC62133_2C			
Clause	Requirement + Test	Result - Remark	Verdict
(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.)**		P
	[Replace to the following statement] c) Acceptance criteria Overcharging exceeding to the limits specified by the manufacturer should not result in fire or explosion.		
Annex G	**Definition for shape and materials of outer case for cell**		—

ATTACHMENT to IEC62133_2C			
Clause	Requirement + Test	Result - Remark	Verdict
(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.	Not in use of smart phone, tablet, notebook.	—

ATTACHMENT to IEC62133_2C			
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]		—

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

ATTACHMENT TO TEST REPORT

IEC 62133-2

JAPAN NATIONAL DIFFERENCES

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

Differences according to ..... :	J62133-2(2021)
TRF template used:.....:	IECEE OD-2020-F3, Ed. 1.1
Attachment Form No. ..... :	JP_ND_IEC62133_2A
Attachment Originator..... :	Japan Electrical Safety and Environment Technology Laboratories (JET)
Master Attachment..... :	Date 2022-08-23

	National Differences		--
4	**PARAMETER MEASUREMENT TOLERANCES**		N/A
	e) ± 0.1 mm for dimension		N/A
	f) ± 1 % for capacity[1)]. Note [1)]: Capacity is expressed as the product of current and time.		N/A
5	**GENERAL SAFETY CONSIDERATIONS**		N/A
5.2	Internal wiring and insulation shall be sufficient to withstand the maximum anticipated current, voltage and temperature requirements.		N/A
	The orientation of wiring shall be such that adequate clearances and creepage distances are maintained between conductors.		N/A
	The mechanical integrity of internal connections shall be sufficient to accommodate conditions of intended use.		N/A
5.4	Cell manufacturers shall be provided with specifications and charging instructions for battery manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified.		N/A
5.6.1	Each battery shall have 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.		N/A
5.6.2	Design recommendation		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	The voltage of each cell, or each cellblock consisting of parallel-connected plural cells, shall not exceed the upper limit of the charging voltage specified in Table 2, where the portable electronic devices or similar devices have the function to limit the charging voltage of each cell or cellblock below the upper limit, the devices shall be inspected that the charging voltage is not exceeded the upper limit.		N/A
	The requirements and recommendations for secondary battery designer are follows.		N/A
	• For the battery consisting of a single cell or a single cellblock, the charging voltage of the cell shall not exceed the upper limit of the charging voltage specified in Table 2;		N/A
	• For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, the voltages of any one of the single cells or single cellblocks shall 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, charging shall be 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 shall not be counted as an overcharge protection.		N/A
	• For batteries consisting of series-connected cells or cell blocks, cells should 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 should not be discharged beyond the cell manufacturer's specified final voltage.		N/A
	• For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry should be incorporated into the battery management system.		N/A
5.6.3A	Prevention of Harm from Sharp Corners		N/A
	Cells and batteries shall not have any rough or sharp corners that can cause harm in their intended use, unless necessary for their function.		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	If such corners are necessary for the function of the containers, connections, etc. of cells and batteries, structural protection measures shall be taken to prevent the user (consumer) from touching them.		N/A
	However, in the case of cells or specially constructed batteries that are not intended to be handled by users (consumers), measures may be taken by agreement between the delivering parties.		N/A
6	**TYPE TEST AND SAMPLE SIZE**		N/A
	Coin cells with internal resistance greater than 3 Ω are not required to be tested.		N/A
7	**SPECIFIC REQUIREMENTS AND TESTS**		N/A
7.0A	The test is performed on the number of cells or batteries specified in Table 1. The test temperature conditions are as specified in each test item in Clause 7. However, these tests may be performed under harsh conditions or methods that make the test results severe. In addition, cells and batteries are tested for each model. However, if a part of the structure of the battery is changed and the test result before the change can be substituted, the test specified in this clause may be omitted.		N/A
7.1.0A	The first procedure and the second procedure are specified as the charging procedure for performing the test. However, these charging procedures do not apply to 7.3.6, 7.3.7, 7.3.8B and 7.3.8D where the charging process is the purpose of the test.		N/A
7.1.1	This charging procedure applies to 7.2.1, 7.2.2, 7.2.2A, 7.3.2, 7.3.3, 7.3.8.1, 7.3.8.2, 7.3.8A and 7.3.8C.		N/A
7.1.2	Upper limit charging voltage: 4.25 V/cell		N/A
	Upper limit test temperature: 45 °C		N/A
	Lower limit test temperature: 10 °C		N/A
	In case of new application or modification of the upper limit charging voltage, upper limit test temperature or lower limit test temperature, cell manufacturer shall keep the relevant documents according to the procedure specified in Annex A. And the relevant value shall be applied as the upper limit charging voltage, upper limit test temperature or lower limit test temperature.		N/A
7.2.1	Replace item b) as following:		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	b) Test Fully charged cells, according to the first procedure in 7.1.1, are subjected for 28 days to a charge using the upper limit charging voltage and upper limit test temperature.		N/A
7.2.2A	Temperature cycle		N/A
	a) Requirement Repeated exposure of cells and batteries to high and low temperatures shall not cause fire, explosion, or leakage.		N/A
	b) Test Fully charged cells or batteries, according to the first procedure in 7.1.1, are subjected the temperature cycling of -20°C to 75 °C in the chamber(s), according to following procedure and the temperature profile shown in Figure 0A.		N/A
	1) cells or batteries are maintained in the ambient temperature of 75 °C ± 2 °C for 4 hours;		N/A
	2) the ambient temperature is changed to 20 °C ± 5 °C within 30 minutes, and maintain for at least 2 hours;		N/A
	3) the ambient temperature is changed to -20 °C ± 2 °C within 30 minutes, and maintain for 4 hours;		N/A
	4) the ambient temperature is changed to 20 °C ± 5 °C within 30 minutes, and maintain for at least 2 hours;		N/A
	5) The steps from 1) to 4) are as one cycle, and repeat 4 more cycles. The transition time from 4) to 1) is within 30 minutes;		N/A
	6) after the 5th cycle, cells or batteries are maintained in the ambient temperature of 20 °C ± 5 °C for 7days, and then checked by visual inspection.		N/A
	c) Acceptance criteria No fire, no explosion, no leakage		N/A
7.3.1	Replace “20 %” with “80 %” in item b).		N/A
7.3.2	a) This requirement does not apply to the specially constructed batteries.		N/A
	Replace “20 %” with “80 %” in item b).		N/A
7.3.3	a) This requirement does not apply to the batteries with a mass exceeding 7 kg or the specially constructed batteries.		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
7.3.6	a) This requirement does not apply to the specially constructed batteries.		N/A
7.3.8.1	a) This requirement does not apply to the specially constructed batteries.		N/A
	c) No fire, no explosion, no leakage.		N/A
7.3.8.2	a) This requirement does not apply to the specially constructed batteries.		N/A
	b) For wave form, peak acceleration and pulse duration, see JIS C 60068-2-27.		N/A
	c) There shall be no leakage, no explosion and no fire during this test.		N/A
7.3.8A	Low pressure (cells)		N/A
	a) Requirement Low pressure (e.g. in case of air transport) shall not cause leakage, fire or explosion.		N/A
	b) Test Fully charged cells, according to the first procedure in 7.1.1, are placed in the vacuum chamber at an ambient temperature of 20 °C ± 5 °C. After closing the chamber, the pressure shall be gradually reduced to an internal pressure of 11.6 kPa (equivalent to an altitude of 15 240 m) or less, and kept this pressure for 6 hours. After the test, conduct a visual inspection.		N/A
	c) Acceptance criteria No fire, no explosion, no leakage.		N/A
7.3.8B	High rate charge (cells)		N/A
	a) Requirement Excessive current flow in the batteries with cell connected in parallel as result of battery charger failure shall not cause fire or explosion of cells. In case of the protective device is provided in the devices or batteries which the cell is used, the cell may be tested with the protective device.		N/A
	b) Test Test is conducted at upper limit test temperature and lower limit test temperature. Discharged cell shall be fully charged at a charging current of 3 times the maximum charging current. In case of the protective device is provided in the corresponding device or battery, and the protective device operate before being fully charged, test is conducted until the protective device operates and interrupts the charging current.		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	c) Acceptance criteria No fire, no explosion.		N/A
7.3.8C	Free fall of battery installed in the device (batteries)		N/A
	a) Requirement Free fall with the battery installed in a load equivalent to the maximum mass of the device to which it is installed shall not cause an external short circuit inside the battery, nor shall it cause an internal short circuit in the cells inside the battery.		N/A
	b) Test Fully charged batteries, according to the first procedure in 7.1.1, are installed in a portable device intended for use or simulated to be installed, and dropped once from the drop test height specified in JIS C 6950-1 or JIS C 6065, depending on the intended use, onto a concrete floor in a direction that is the most adverse effect on the batteries, or subjected to an equivalent load. The floor to drop the batteries can be a metal plate instead of the concrete floor. For test conditions where optional parts can be attached to the device, the test shall be performed with the optional parts specified by the manufacturer that are required for the basic operation of the device (excluding those connected by cords). If there are multiple combinations of optional parts, the test shall be conducted with the combination that gives the most favourable test results.		N/A
	The drop test height is in accordance with 4.2.6 of JIS C 6950-1 and 12.1.5 of JIS C 6065. However, this is not applicable to the devices that the mass of the device with the battery is greater than 7 kg for portable devices and 5 kg for desktop devices (excluding the device may be portable). This test allows with the batteries installed in the equivalent load to the device that intended to be used. For example, if a minor change product (series product) of a certain device installed a battery of the same design, and the battery is tested with a load equivalent to the device, and the test conditions meet the test conditions for all series products, there is no need to conduct the test again.		N/A
	Mass of the device with the battery (kg).....:		—
	Drop height (mm) .....:		—
	c) Acceptance criteria No external short circuit inside the battery, no internal short circuit in the cells inside the battery.		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
7.3.8D	Protection against overcharge (batteries)		N/A
	a) Requirement The charge voltage of a cell or a cell block with cells connected in parallel in a battery shall not exceed the upper limit charging voltage specified in Table 2, regardless of the parameter measurement tolerances. This test is not applicable where the device or other controls the charging voltage so that it does not exceed the upper limit charging voltage.		N/A
	b) Test The test is conducted at an ambient temperature of 20 °C ± 5 °C by one of the methods of following 1) to 3). The examples of circuit configuration of the test for over charge protection are shown in Figure 1A. However, since this circuit configuration is only an example, the actual test may be conducted with the test method determined in advance between the battery manufacturer and the testing engineer. The purpose of this test is to verify that adequate overcharge protection is provided as a control for the battery, and the overcharge protection may be provided in the battery or in the device in which the battery is installed or the battery charger.		N/A
	1) For the battery consists of a single cell or a single cell block, the voltage applied to the cell or cell block during charging is measured.		—
	2) For the battery consists of two or more cells or cell blocks connected in series, charging is performed while measuring the voltage of each cell or cell block, and at the same time a single cell or cell block is gradually forced to discharge, and the voltage of each other cell or cell block is measured.		—
	3) For the battery consists of two or more cells or cell blocks connected in series, the voltage is applied to a single cell or cell block until the upper charging voltage in Table 2 is exceeded while measuring the voltage of each cell or cell block, and the voltage when charging stops is measured.		—
	c) Acceptance criteria The measured voltage shall not exceed the upper limit charging voltage. However, voltage fluctuations (e.g., voltage fluctuations of AC components above 50 kHz assuming ripple, noise, etc.) that are not followed by lithium-ion migration in the battery is excluded.		N/A
7.3.9	Forced internal short-circuit (cells)		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	This sub-clause is not applicable to coin cells and lithium ion polymer cells.		N/A
	a) A forced internal short-circuit test for cells shall not cause a fire.		N/A
	b) Test 1) Number of samples This test shall be carried out until the total number of samples with observed internal short-circuits reaches 5. However, when the number of samples tested reaches 10, the test shall be terminated even if the total number of samples with observed internal short-circuits does not reach 5. For the test each at the upper limit test temperature and lower limit test temperature, 5 to 10 samples each with a nickel particle placed between the positive active material area and the negative active material area shall be prepared. In addition, when aluminium foil of positive electrode is exposed at outer turn and the aluminium foil is facing the coated negative active material, for the test each at the upper limit test temperature and lower limit test temperature, 5 to 10 samples each with a nickel particle placed at that area shall be prepared.		N/A
8	**INFORMATION FOR SAFETY**		N/A
8.2	This is not applicable to specially constructed batteries that cannot be removed by user.		N/A
	Equipment using small cells and batteries should be provided with information regarding ingestion hazards.		N/A
	The warning language should be provided with the information packaged with the small cells and batteries, and equipment using them:		N/A
9	**MARKING**		N/A
9.1	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. However, the cell marking shall be indicated with the battery, the instructions or the specifications.		N/A
10	**PACKAGING AND TRANSPORT**		N/A
	Replace “Packaging for coin cells” with “Packaging for coin cells and small batteries”.		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

A	**ANNEX A (NORMATIVE)** **CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE**		N/A
A.2	In case of a different upper limit charging voltage (other than 4.25 V of lithium-cobalt-oxide system), it may be appropriate to adjust the upper limit charging voltage and upper limit charging temperatures accordingly to fulfil the criteria of the tests.		N/A
A.3.2.1	In this battery, the upper limit charging voltage, as specified in 7.1.2 is based on the permissible upper limit charging voltage (4,25 V) from a safety viewpoint.		N/A
A.3.2.2	Replace “should” with “shall” in 3rd paragraph.		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		N/A
	The upper limit charging voltage of a lithium ion secondary cell could be other than 4.25 V in the following cases:		N/A
	• positive active material, other than lithium-cobalt-oxide is employed;		N/A
	• ratio of the capacity of the positive electrode and the negative electrode is changed from the design viewpoint		N/A
	When an upper limit charging voltage different from 4.25 V is to be applied for lithium ion secondary cells, following relevant documents explaining reasons for the change of upper limit charging voltage shall be kept so that said different voltage can be used as the new upper limit charging voltage.		N/A
	a) test results which verify that the stability of the positive active material (including lithium-cobalt-oxide), the structural stability of the electrolyte, and the lithium acceptability of the negative active material of lithium secondary cells charged at the new upper charging voltage limit are as safe or safer than those of typical lithium secondary cells charged at 4.25 V;		N/A
	b) the following relevant documents explaining the reason for the change if it differs from the upper limit charge voltage specified in Table 2;		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	1) test results which verify that lithium secondary cells charged at the new upper limit charging voltage and at a temperature 5 °C higher than the upper limit test temperature comply with the tests in 7.3.1, 7.3.4, 7.3.5, and 7.3.9 at a temperature 5 °C higher than the upper limit test temperature;		N/A
	2) test results which verify that lithium secondary cells charged at the new upper limit charge voltage and at a temperature 5 °C below the lower limit test temperature comply with the tests in 7.3.1, 7.3.4, 7.3.5, and 7.3.9 at a temperature 5 °C below the lower limit test temperature;		N/A
	3) test results which verify compliance of cells charged at the upper limit of the high temperature range of the test accordance with 7.3.1, 7.3.4, 7.3.5 and 7.3.9. The charging voltage and the charging current at the upper limit of the high temperature range are specified by the battery manufacturer.		N/A
A.4.2.1	Replace “the battery” with “the cell”.		N/A
A.4.2.2	Safety consideration when a different recommended temperature range is applied		N/A
	For lithium secondary cells, a temperature range other than 10 °C to 45 °C may be recommended, depending on the thermal stability of the electrolyte and other factors.		N/A
	When new standard temperature ranges are applied, the tests specified in 7.3.1, 7.3.4, 7.3.5 and 7.3.9 shall be carried out using batteries charged at different test temperatures.		N/A
	However, if there are test results for cells specified in 7.3.1, 7.3.4, 7.3.5 and 7.3.9 at test temperatures higher than the new upper limit test temperature or at test temperatures lower than the new lower limit test temperature, the test of cells at the new upper or new lower limit test temperature using the same upper limit charging voltage as in these clauses 7.3.1, 7.3.4, 7.3.5 and 7.3.9 may be omitted. In addition, relevant documents explaining the reason for the change of the test temperature shall be kept to allow testing at different test temperatures.		N/A
	Examples of the documents, explaining reasons of the change of test temperature are as follows:		N/A
	a) For upper limit test temperature higher than the value specified in Table 2:		N/A

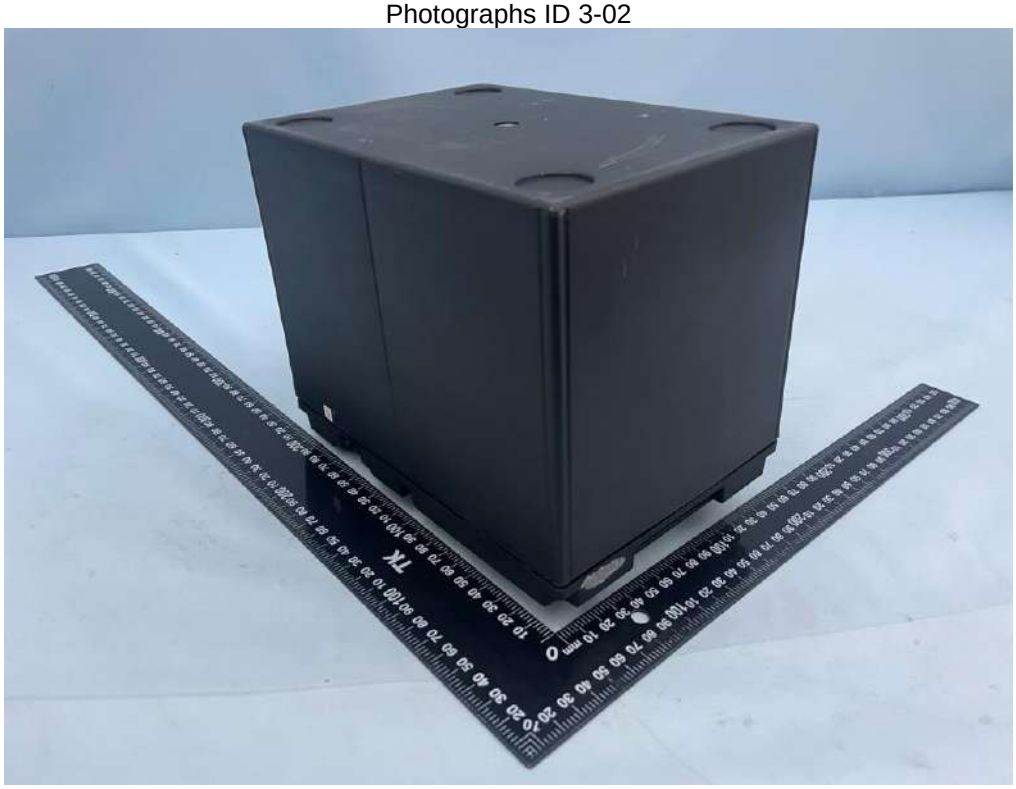
IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	1) test results which verify that the stability of the crystal structure of the positive active electrode material, when the cell is charged at the new upper limit of test temperature, higher than 45 °C (highest limit of the standard temperature range for typical lithium ion cells), is equivalent to or higher than that when the cell is charged at 45 °C;		N/A
	2) test results which verify that the cells, charged at the new upper limit of test temperature (higher than 45 °C + 5 °C) and by using the upper limit charging voltage, are tested by the test methods specified in 7.3.1, 7.3.4, 7.3.5 and 7.3.9;		N/A
	b) For lower limit test temperature lower than the value specified in Table 2:		N/A
	1) test results which verify that the acceptance of lithium into the negative active material, when the cell is charged at the new lower limit of test temperature, lower than 10 °C, is equivalent to or higher than that when the cell is charged at 10 °C;		N/A
	2) test results which verify that the cells, charged at the new lower limit of test temperature (lower than 10 °C to 5 °C) and by using the upper limit of charging voltage, are tested by the test methods specified in 7.3.1, 7.3.4, 7.3.5 and 7.3.9.		N/A
A.4.3.1	General		N/A
	Within the high temperature range, charging is permissible by charging at a lower value than the upper limit charging voltage and/or maximum charging current which is specified for the standard temperature range.		N/A
A.4.3.4	b) The charging voltage and the charging current for the test are specified by the battery manufacturer.		N/A
A.4.4.1	Replace “the battery” with “the cell”.		N/A
A.4.4.4	b) The charging voltage and the charging current for the test are specified by the battery manufacturer.		N/A
A.5.6	Replace “Figure A.7” with “Figure A.9”.		N/A

ENCLOSURES

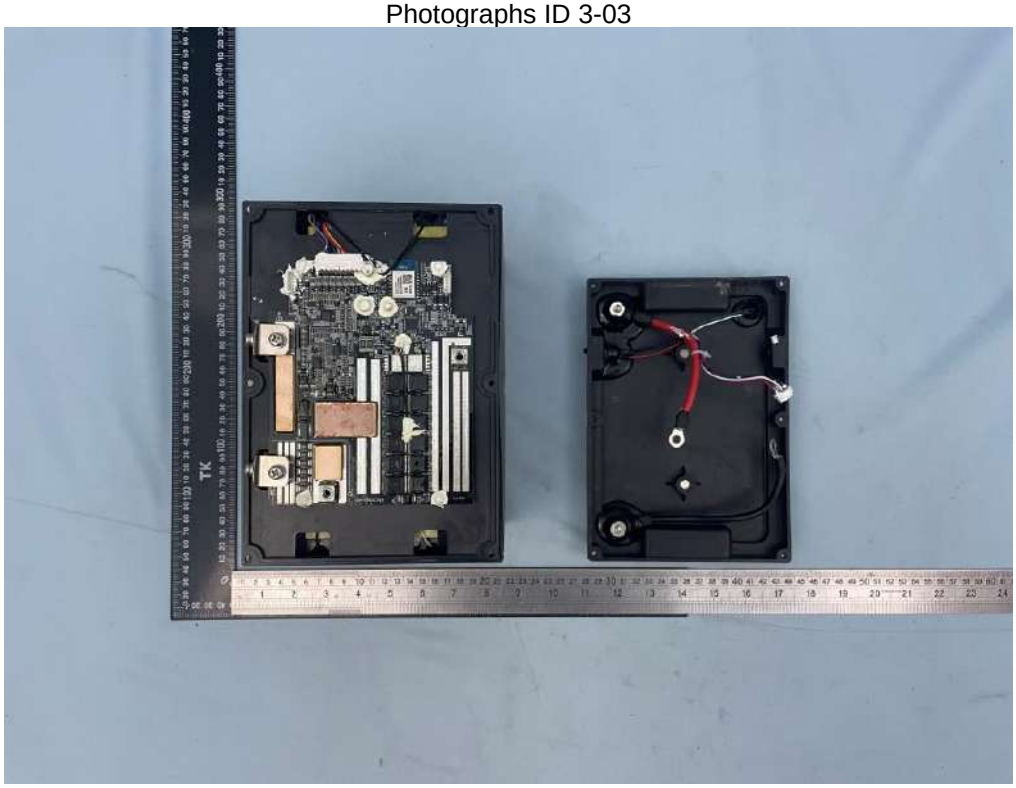
Type	Supplement Id	Description
Photographs	3-01	Overall View-1
Photographs	3-02	Overall View-2
Photographs	3-03	Internal View-1
Photographs	3-04	Internal View-2
Photographs	3-05	PCB board top side view
Photographs	3-06	PCB board bottom side view
Diagrams	4-01	Enclosure Drawing
Schematics + PWB	5-01	PCB Layout
Manuals	6-01	Information for safety
Miscellaneous	7-01	Quality plan certification
Miscellaneous	7-02	Packaging drawing
Miscellaneous	7-03	Date code rule
Licenses	8-01	Cell Cert
Licenses	8-02	Test Report of UN38.3

Photographs ID 3-01

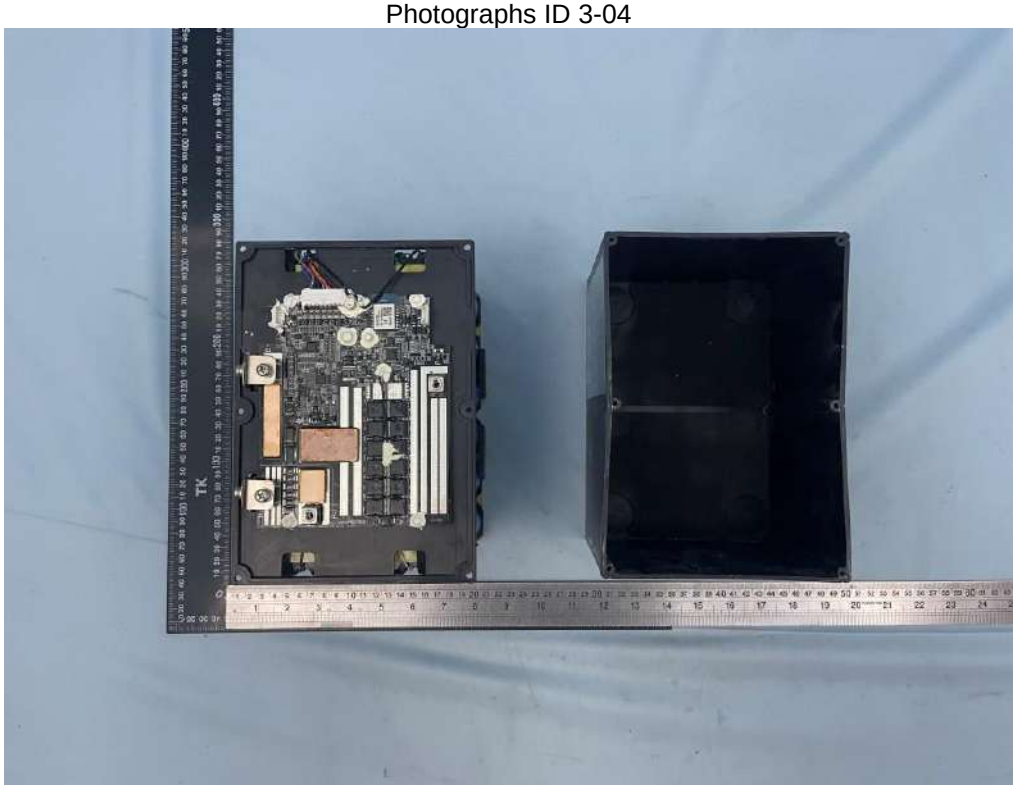
Photographs ID 3-02



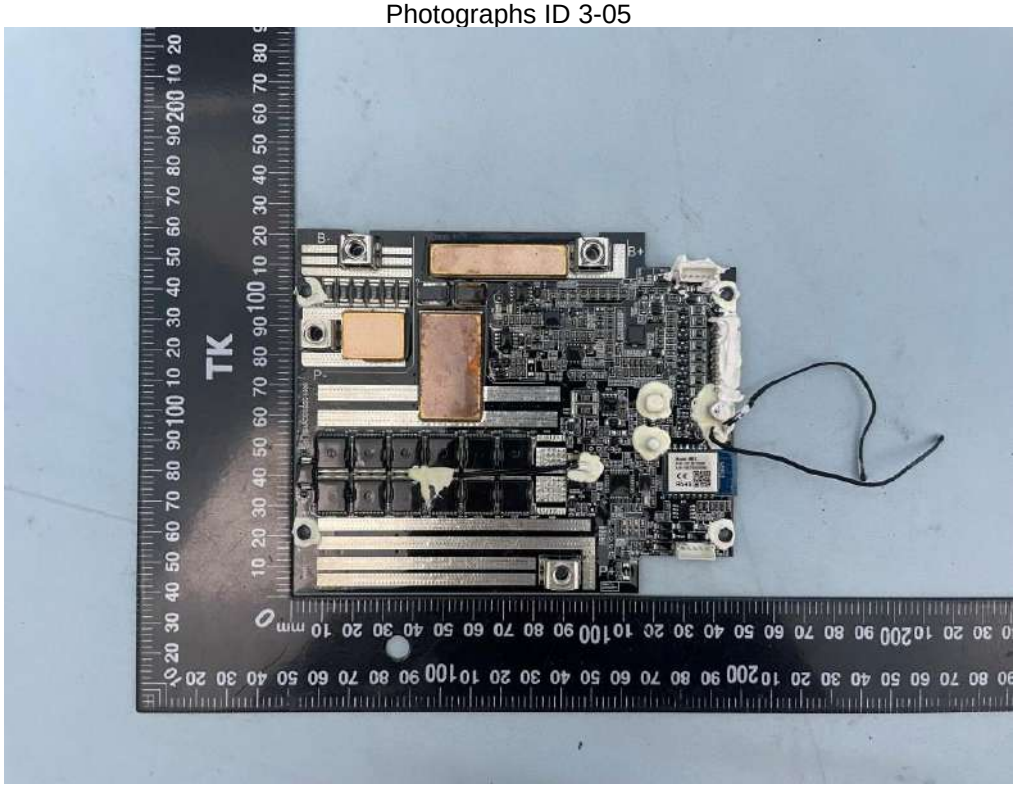
Photographs ID 3-03



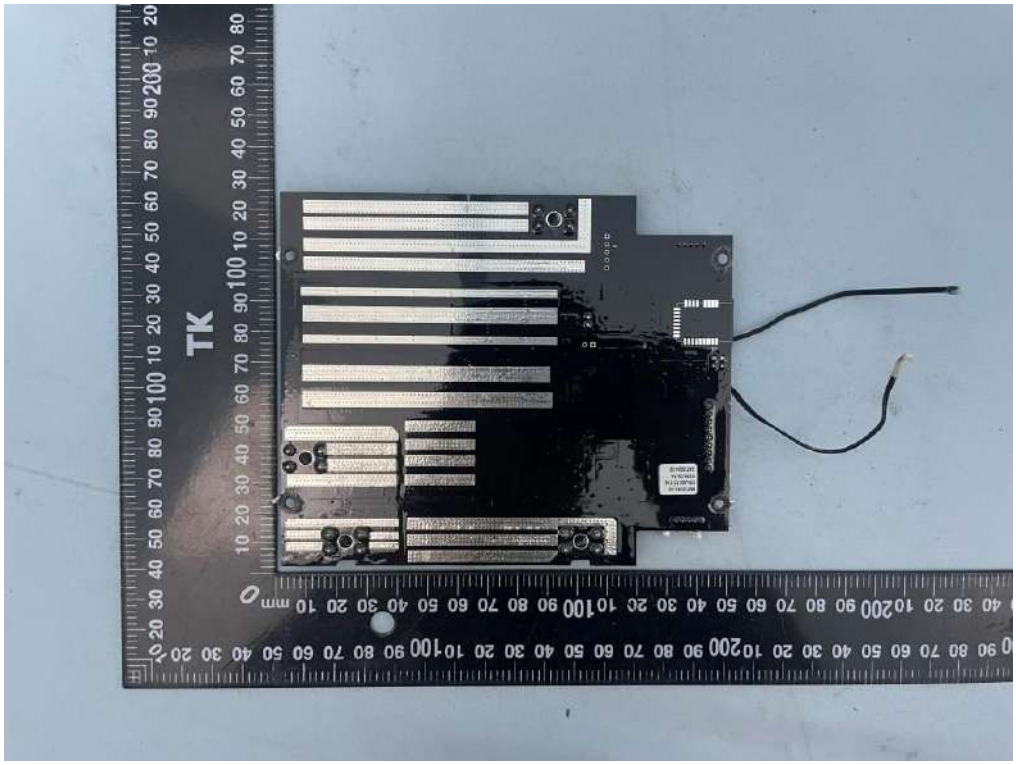
Photographs ID 3-04



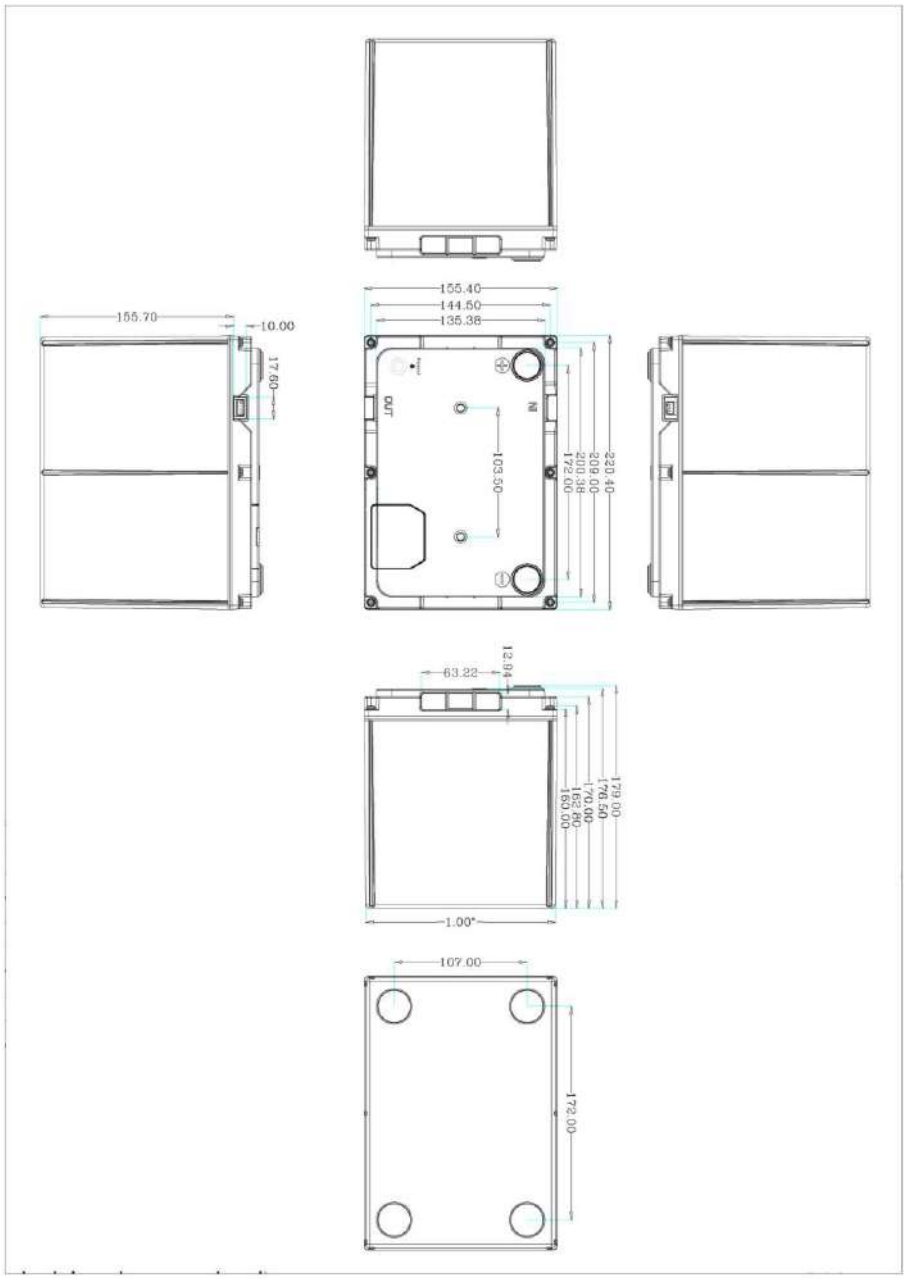
Photographs ID 3-05



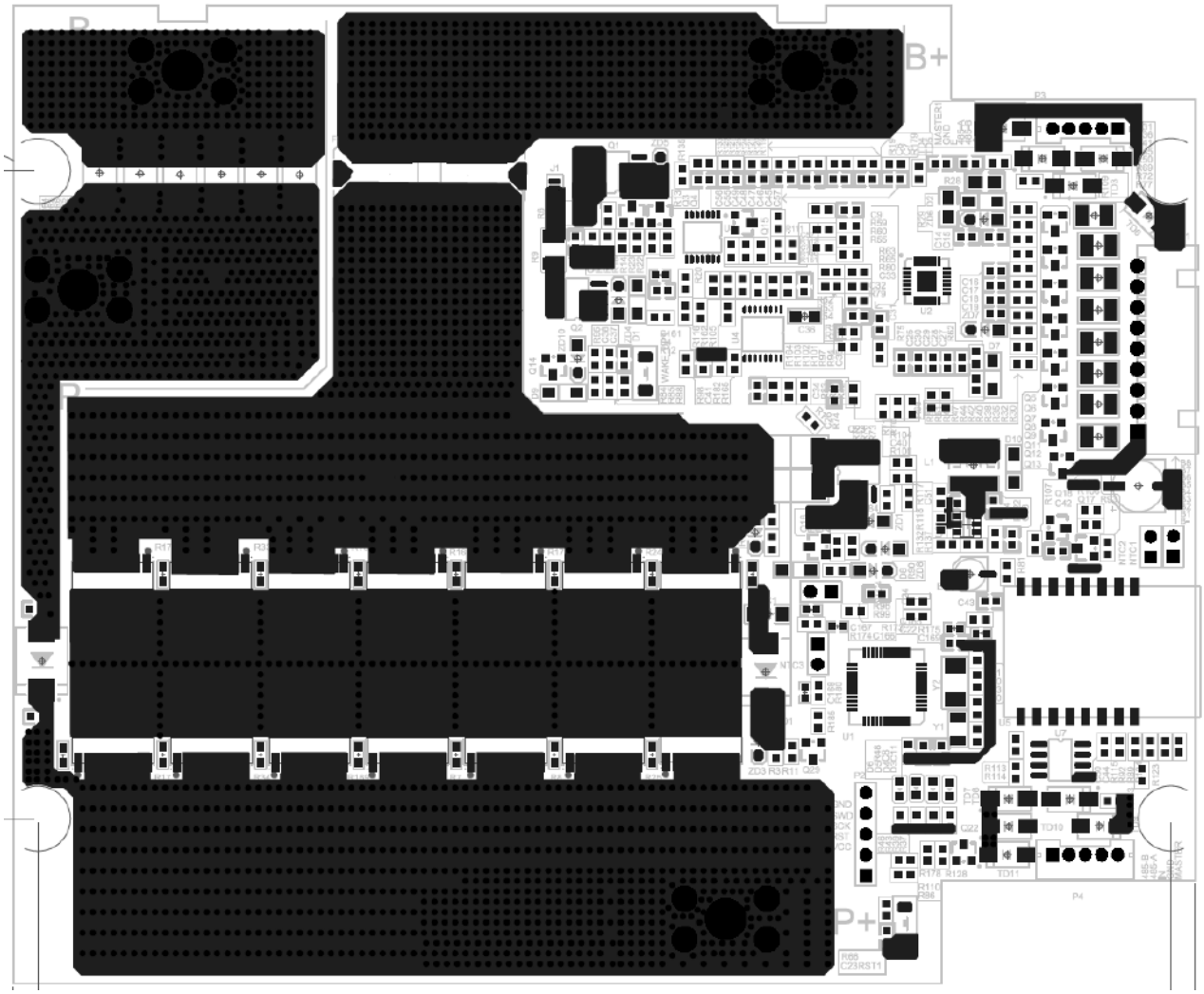
Photographs ID 3-06



Diagrams ID 4-01



Schematics + PWB ID 5-01



Recommendations to equipment manufacturers and battery assemblers

The following represents a typical, but non-exhaustive, list of good advice to be provided by the manufacturer of secondary cells and batteries to equipment manufacturers and battery assemblers.

a) Do not dismantle, open or shred cells. Batteries should be dismantled only by trained personnel. Multicell battery cases should be designed so that they can be opened only with the aid of a tool.

b) Do not short-circuit a cell or battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by conductive materials.

c) Do not remove a cell or battery from its original packaging until required for use.

d) Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.

e) Do not subject cells or batteries to mechanical shock.

f) In the event of a cell leaking, do not allow the liquid to come into contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.

g) Equipment should be designed to prohibit the incorrect insertion of cells or batteries and should have clear polarity marks. Always observe the polarity marks on the cell, battery and equipment and ensure correct use.

h) Do not mix cells of different manufacture, capacity, size or type within a battery.

i) Seek medical advice immediately if a cell or battery has been swallowed.

j) Consult the cell/battery manufacturer on the maximum number of cells, which may be assembled in a battery and on the safest way in which cells may be connected.

k) A dedicated charger should be provided for each equipment. Complete charging instructions should be provided for all secondary cells and batteries offered for sale.

l) Keep cells and batteries clean and dry.

m) Wipe the cell or battery terminals with a clean dry cloth if they become dirty.

n) Secondary cells and batteries need to be charged before use. Always refer to the cell or battery manufacturer's instructions and use the correct charging procedure.

o) Do not maintain secondary cells and batteries on charge when not in use.

p) After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.

q) Secondary cells and batteries give their best performance when they are operated at normal room temperature.

r) Retain the original cell and battery literature for future reference.

s) When disposing of secondary cells or batteries, keep cells or batteries of different electrochemical systems separate from each other.

Recommendations to the end-users

The following represents a typical, but not exhaustive list of good advice to be provided by the equipment manufacturer to the end-user.

a) Do not dismantle, open or shred secondary cells or batteries.

b) Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.

c) Do not short-circuit a cell or a battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.

d) Do not remove a cell or battery from its original packaging until required for use.

e) Do not subject cells or batteries to mechanical shock.

f) In the event of a cell leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.

g) Do not use any charger other than that specifically provided for use with the equipment.

h) Observe the plus (+) and minus (–) marks on the cell, battery and equipment and ensure correct use.

i) Do not use any cell or battery which is not designed for use with the equipment.

j) Do not mix cells of different manufacture, capacity, size or type within a device.

k) Keep cells and batteries out of the reach of children.

l) Seek medical advice immediately if a cell or a battery has been swallowed.

m) Always purchase the correct cell or battery for the equipment.

n) Keep cells and batteries clean and dry.

o) Wipe the cell or battery terminals with a clean dry cloth if they become dirty.

p) Secondary cells and batteries need to be charged before use. Always use the correct charger and refer to the manufacturer's instructions or equipment manual for proper charging instructions.

q) Do not leave a battery on prolonged charge when not in use.

r) After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.

s) Secondary cells and batteries give their best performance when they are operated at normal room temperature (20 °C ± 5 °C).

t) Retain the original product literature for future reference.

u) Use only the cell or battery in the application for which it was intended.

v) When possible, remove the battery from the equipment when not in use.

w) Dispose of properly.

Miscellaneous ID 7-01

intertek
Total Quality. Assured.

CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

PortaPower Electronics Limited

1F., No. 79, Ln. 271, Liancun Rd., Fengyuan Dist., Taichung City 420071, Taiwan (R.O.C.)

has been registered by Intertek as conforming to the requirements of:

ISO 9001:2015

The management system is applicable to:

Assembly and Sales of Rechargeable Batteries, Chargers, Motors, Sensors, Meters, Controllers and Portable Energy Storage Uninterruptible Power Supply.

Certificate Number:
0126098

Initial Certification Date:
27 July 2022

Date of Certification Decision:
25 July 2025

Issuing Date:
25 July 2025

Valid Until:
26 July 2028

intertek UKAS MANAGEMENT SYSTEMS 0014

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

Rathin Grover
President, Business Assurance

Intertek Certification Limited, 10A Victory Park, Victory Road, Derby DE24 8ZF, United Kingdom

Intertek Certification Limited is a UKAS accredited body under schedule of accreditation no. 014.

In the issuance of this certificate, Intertek assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification Agreement. This certificate's validity is subject to the organisation maintaining their system in accordance with Intertek's requirements for systems certification. Validity may be confirmed via email at certificate.validation@intertek.com or by scanning the code to the right with a smartp hone. The certificate remains the property of Intertek, to whom it must be returned upon request.

Miscellaneous ID 7-02

Production Batch Date code Structure							
Year	Date Code	Month	Date Code	Date	Date Code	Date	Date Code
24	Z	1	A	1	01	16	16
25	Y	2	B	2	02	17	17
26	X	3	C	3	03	18	18
27	W	4	D	4	04	19	19
28	V	5	E	5	05	20	20
29	U	6	F	6	06	21	21
30	T	7	G	7	07	22	22
31	S	8	H	8	08	23	23
32	R	9	I	9	09	24	24
33	Q	10	J	10	10	25	25
34	P	11	K	11	11	26	26
35	O	12	L	12	12	27	27
36	N			13	13	28	28
37	M			14	14	29	29
38	L			15	15	30	30
39	K					31	31
40	J						

Miscellaneous ID 7-03

	Ref. Certif. No.
IEC IECEE	JPTUV-161574

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

CB TEST CERTIFICATE

Product	Sealed Secondary Portable Li-Ion Cell
Name and address of the applicant	EVE Energy Co., Ltd. No. 38, Hui Feng 7th Road, Zhongkai Hi-Tech Zone, Huizhou, Guangdong P.R. China
Name and address of the manufacturer	Qujing EVE Energy Co., Ltd. No.88, Cuifeng Road, Economic and Technological Development Zone, Qujing City, Yunnan P.R. China
Name and address of the factory *Note: When more than one factory, please report on page 2*	Qujing EVE Energy Co., Ltd. No.88, Cuifeng Road, Economic and Technological Development Zone, Qujing City, Yunnan P.R. China
Ratings and principal characteristics	3.2V, 16.2Ah
Trademark / Brand (if any)	
Customer's Testing Facility (CTF) Stage used	N/A
Model / Type Ref.	C33
Additional information (if necessary may also be reported on page 2)	N/A
A sample of the product was tested and found to be in conformity with	IEC 62133-2:2017 IEC 62133-2:2017/AMD1:2021 See Test Report for National Differences
As shown in the Test Report Ref. No. which forms part of this Certificate	CN24HK6G 001

This CB Test Certificate is issued by the National Certification Body

TÜVRheinland®

TÜV Rheinland Japan Ltd.
4-25-2 Kita-Yamata, Tsuzuki-ku
Yokohama 224-0021, Japan
Mail: info@jpn.tuv.com

Date: 2024-07-03

Signature: Jason Tang

10/0613MD 2022-07 rie-fx

Test Report issued under the responsibility of:

Prodigy Technology Consultant Co., Ltd.

Test Report No.:	P250409-06-XP-A0	Page 1 of 24
Client		
Name :	PortaPower Electronics Limited	
Address :	1F., No.79 , Ln.271 , Liancun Rd., Fengyuan Dist., Taichung City , 420071 , Taiwan (R.O.C)	
Phone :	886-4 2539 3829	
Email :	peishang.chung@portapower.com.tw	
Website :	https://www.portapower.com.tw	
Product Name :	Rechargeable Li-Fe battery pack	
Model Name :	UTS2A-0803, UTS2B-0803	
Testing laboratory		
Name :	Prodigy Technology Consultant Co., Ltd.	
Address :	No. 12, Gong 7th Rd., Linkou Dist., New Taipei City 24450, Taiwan, Chinese Taipei	
Phone :	886-2-2603-7288	
Emaill :	ptc.pe.cb@prodigy-tech.com.tw	
Website :	http://www.prodigy-tech.com.tw/	
Test specification Standard :	UN Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.8) Section 38.3	
Test Result :	The sample has passed the test items of UN38.3.	
Test Report Form No:	DTL-077-A20	
Test Report Form Originator:	Prodigy Technology Consultant Co., Ltd.	
Master TRF:	Dated 2025-06-16	
Prepared By :	Signature Tony Hsu Senior Engineer	2025-08-08 Date
Approved By :	Signature Frank Chang Project Leader Engineer	2025-08-08 Date

Other Aspects:

The completed test report includes the following documents:

■ 24 pages

General disclaimer:

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

▪ Measurement uncertainty will not be included in the conformity assessment statement.

▪ Without permission of Prodigy Technology Consultant Co., Ltd. this test report is not permitted to be duplicated in extracts.

Licenses ID 8-02

Test Report issued under the responsibility of:

Prodigy Technology Consultant Co., Ltd.

■ This test report does not entitle to carry any safety mark on this or similar products.

TEST REPORT UN38.3	
Report	
Date of sample accepted	2025-04-09
Date of test	2025-04-22 to 2025-08-01
Date of issue	2025-08-11
Battery Information :	
Battery Model	UTS2A-0803, UTS2B-0803
Composing Mode	8 Series, 3 Parallel
Electrochemistry System	Li-ion
Manufacturer of Cell	Qujing EVE Energy Co., Ltd
Cell Model	C33
Cell Capacity (mAh)	15200mAh
Use	--
Contained in equipment during transportation (Yes or No)	☐ Yes ☒ No
Transportation Mode	--
Inner package	--
Outer package	--
Interleave material	--
Gross weight (kg)	--
Dimensions (mm^3)	--
Battery number	--
Sample Parameter :	
Nominal Voltage (V)	24
Rated Capacity (mAh)	45000
Rated Power (Wh)	1080
Max. Charging Voltage (V)	28.6
Max. Charging Current (mA)	25000
Charging Current (mA)	10000
Discharge Cut-off Voltage (V)	20
Max. Discharging Current (mA)	40000
Dimensions (mm^3)	222 by 179 by 155 max.
Mass (kg)	8530 max.

Possible test case verdicts:	
test case does not apply to the test object ..... :	N/A
test object does meet the requirement ..... :	Pass (P)
test object does not meet the requirement ..... :	Fail (F)

Model Differences

All models are identical except for model designation

Test Results:

Test item No.	Name of Test items	Sample No	Test Result	Conclusion	Remark
T1	Altitude simulation	C1-C4, D1-D4	Pass	See Appendix 1	
T2	Thermal test	C1-C4, D1-D4	Pass	See Appendix 2	
T3	Vibration	C1-C4, D1-D4	Pass	See Appendix 3	
T4	Shock	C1-C4, D1-D4	Pass	See Appendix 4	
T5	External short circuit	C1-C4, D1-D4	Pass	See Appendix 5	
T7	Overcharge	C5-C8, D5-D8	Pass	See Appendix 7	
Supplementary information: C1-C8: batteries for first cycle, fully charged state D1-D8: batteries for 25th cycle, fully charged state					

Additional information:
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.

38.3.4 Procedure

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or batteries. Test T.7 may be conducted using undamaged batteries previously used in tests T.1 toT.5 for purposes of testing on cycled batteries.

38.3.4.1 Test T.1: Altitude simulation

38.3.4.1.1 Purpose

This test simulates air transport under low-pressure conditions.

38.3.4.1.2 Test procedure

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

38.3.4.1.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.2 Test T.2: Thermal test

38.3.4.2.1 Purpose

This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

38.3.4.2.2 Test procedure

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

38.3.4.2.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.3 Test T.3: Vibration

38.3.4.3.1 Purpose

This test simulates vibration during transport.

38.3.4.3.2 Test procedure

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1 6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.

38.3.4.3.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.4 Test T.4: Shock

38.3.4.4.1 Purpose

This test simulates possible impacts during transport.

38.3.4.4.2 Test procedure

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 gn and pulse duration of 11 milliseconds.
Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass^a}\right)}$ whichever is smaller	6 ms
Large batteries	50 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{30000}{mass^a}\right)}$ whichever is smaller	11 ms

[a] Mass is expressed in kilograms.

NOTE: IEC Standard 60068-2-27 (Fourth Edition 2008-02): Environmental testing-Part 2-27: Tests – Test Ea and guidance: Shock provides guidance on tolerance for acceleration and pulse duration.

The relationship between minimum peak acceleration and mass is illustrated in Figure 38.3.4.1 for small batteries and Figure 38.3.4.2 for large batteries.

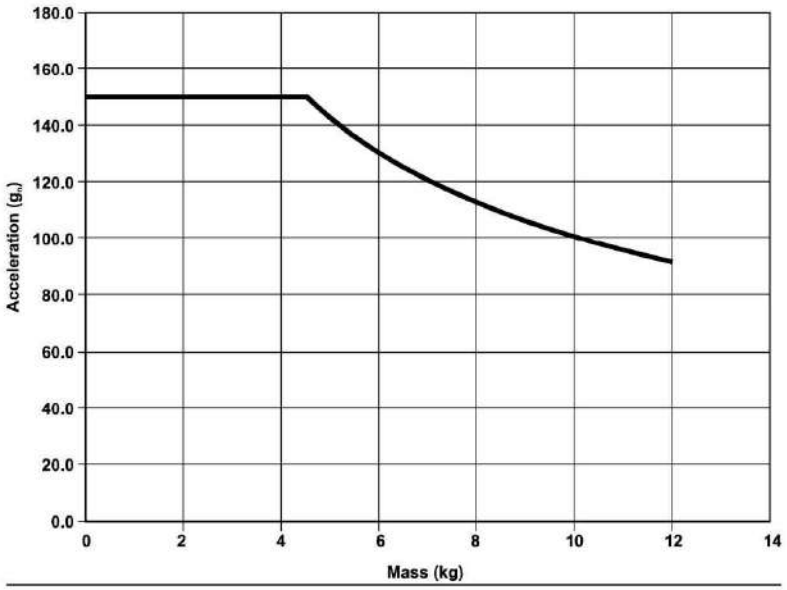


Figure 38.3.4.1: RELATION BETWEEN THE PEAK ACCELERATION AND THE MASS FOR SMALL BATTERIES (below 12.0 kg)

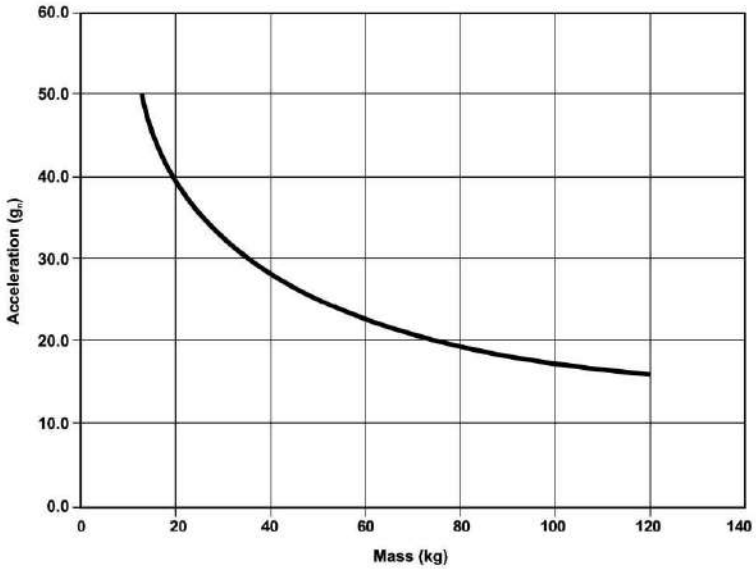


Figure 38.3.4.2: RELATION BETWEEN THE PEAK ACCELERATION AND THE MASS FOR LARGE BATTERIES (equal or above 12.0 kg)

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

38.3.4.4.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.5 Test T.5: External short circuit

38.3.4.5.1 Purpose

This test simulates an external short circuit.

38.3.4.5.2 Test procedure

The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.
This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.
The short circuit and cooling down phases shall be conducted at least at ambient temperature.

38.3.4.5.3 Requirement

Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.

38.3.4.6 Test T.6: Impact / Crush

38.3.4.6.1 Purpose

These tests simulate mechanical abuse from an impact or crush that may result in an internal short circuit.

38.3.4.6.2 Test procedure – Impact (applicable to cylindrical cells not less than 18.0 mm in diameter)

The sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

38.3.4.6.3 Test Procedure – Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)

A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.

(a) The applied force reaches 13 kN ± 0.78 kN;

Example: The force shall be applied by a hydraulic ram with a 32 mm diameter piston until a pressure of 17 MPa is reached on the hydraulic ram.

(b) The voltage of the cell drops by at least 100mV; or

(c) The cell is deformed by 50% or more of its original thickness.

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

38.3.4.6.3 Requirement

Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.

38.3.4.7 Test T.7: Overcharge

38.3.4.7.1 Purpose

This test evaluates the ability of a rechargeable battery or a single cell rechargeable battery to withstand an overcharge condition.

38.3.4.7.2 Test procedure

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

(a) when the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.

(b) when the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

38.3.4.7.3 Requirement

Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

38.3.4.8 Test T.8: Forced discharge

38.3.4.8.1 Purpose

This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.

38.3.4.8.2 Test procedure

Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

38.3.4.8.3 Requirement

Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

Test sequence

38.3.3.1 Provisions 38.3.2.1 and 38.3.3 are summarized in the following table.

Table 38.3.2: Summary table of required tests for primary cells and batteries

Primary cells and batteries										
		T.1	T.2	T.3	T.4	T.5	T.6	T.7	T.8	Sum[c]
Cells not transported separately	undischarged state						5			20
	fully discharged state						5		10	
Cells	undischarged state	10					5			40
	fully discharged state	10					5		10	
Single cell batteries[a]	undischarged state	10					5			40
	fully discharged state	10					5		10	
Small batteries	undischarged state	4								8
	fully discharged state	4								
Large Batteries	undischarged state	4								8
	fully discharged state	4								
Batteries assembled with tested batteries ≤ 500 g Li	undischarged state			1						1
Batteries assembled with tested batteries > 500 g[b] Li										0

[a] *A single cell battery containing one tested cell does not require testing unless a change in cell design could result in the failure of any test.*

[b] *If the assembled battery is of a type that has been verified as preventing:*

(i) Overcharge;

(ii) Short circuits; and

(iii) Over discharge between the batteries.

[c] *The sum represents the number of tests required, not the number of cells or batteries tested.*

Table 38.3.3: Summary table of required tests for rechargeable cells and batteries

Rechargeable cells and batteries										
		T.1	T.2	T.3	T.4	T.5	T.6	T.7[a]	T.8	Sum[d]
Cells not transported separately from a battery	first cycle, 50% charged state						5			30
	25th cycle, 50% charged state						5			
	first cycle, fully discharged state								10	
	25th cycle, fully discharged state								10	
Cells	first cycle, fully charged state	5								40
	25th cycle, fully charged state	5								
	first cycle, 50% charged state						5			
	25th cycle, 50% charged state						5			
	first cycle, fully discharged state								10	
	25th cycle, fully discharged state								10	
Single cell batteries[b]	first cycle, fully charged state	5						4		48
	25th cycle, fully charged state	5								
	first cycle, 50% charged state						5			
	25th cycle, 50% charged state						5			
	25th cycle, fully charged state							4		
	first cycle, fully discharged state								10	
	25th cycle, fully discharged state								10	
Small batteries	first cycle, fully charged state	4						4		16
	25th cycle, fully charged state	4						4		
Large batteries	first cycle, fully charged state	2						2		8
	25th cycle, fully charged state	2						2		
Batteries assembled with tested batteries ≤ 6 200 Wh or ≤500 g Li	fully charged state			1				1		2
Batteries assembled with tested batteries > 6 200 Wh or or >500 g Li[c]										0

[a] *Batteries or single cell batteries not equipped with battery overcharge protection that are designed for use only as a component in another battery or in equipment, which affords such protection, are not subject to the requirements of this test;*

[b] *Except for the T.7 Overcharge test, a single cell battery containing one tested cell does not require testing unless a change in cell design could result in the failure of any test;*

[c] *If the assembled battery is of a type that has been verified as preventing:*

(i) Overcharge;

(ii) Short circuits; and

(iii) Over discharge between the batteries.

[d] *The sum represents the number of tests required, not the number of cells or batteries tested.*

Table 38.3.4: Summary table of required tests for sodium ion rechargeable cells and batteries

Rechargeable cells and batteries										
		T.1	T.2	T.3	T.4	T.5	T.6	T.7[a]	T.8	Sum[d]
Cells not transported separately from a battery	first cycle, 50 % charged state						5			10
	25th cycle, 50 % charged state						5			
Cells	first cycle, fully charged state	5					5			20
	25th cycle, fully charged state	5					5			
Single cell batteries[b]	first cycle, fully charged state	5					5	4		28
	25th cycle, fully charged state	5					5	4		
Small batteries	first cycle, fully charged state	4						4		16
	25th cycle, fully charged state	4						4		
Large batteries	first cycle, fully charged state	2						2		8
	25th cycle, fully charged state	2						2		
Batteries assembled with tested batteries ≤ 6 200 Wh	fully charged state			1				1		2
Batteries assembled with tested batteries > 6 200 Wh[c]										0

[a] *Batteries or single cell batteries not equipped with battery overcharge protection that are designed for use only as a component in another battery or in equipment, which affords such protection, are not subject to the requirements of this test;*

[b] *Except for the T.7 Overcharge test, a single cell battery containing one tested cell does not require testing unless a change in cell design could result in the failure of any test;*

[c] *If the assembled battery is of a type that has been verified as preventing:*

(i) Overcharge;

(ii) Short circuits; and

(iii) Over discharge between the batteries.

[d] *The sum represents the number of tests required, not the number of cells or batteries tested.*

Altitude simulation test (Appendix 1)

Test item No.	T1	Name of Test items		Altitude simulation Test			
Sample No.	Before Test	After Test	Residual OCV	Before Test (M1)	After Test (M2)	Mass loss	Result after test
	OCV (V)	OCV (V)	(%)	Mass (g)	Mass (g)	(%)	
C1	27.59	27.40	99.31	8531.4	8531.0	0.005	P
C2	27.60	27.47	99.52	8501.2	8500.6	0.008	P
C3	27.61	27.52	99.67	8516.8	8516.4	0.005	P
C4	27.61	27.31	98.91	8504.1	8503.5	0.008	P
D1	27.60	27.16	98.40	8521.7	8521.3	0.005	P
D2	27.60	27.52	99.71	8516.7	8516.2	0.006	P
D3	27.59	27.25	98.76	8530.4	8530.0	0.005	P
D4	27.59	27.42	99.38	8519.0	8518.5	0.006	P

Note 1:
L-Leakage,
V-Venting,
D-Disassembly,
R-Rupture,
F-Fire,
P-No Leakage, No Venting, No Disassembly, No Rupture, No Fire.

Note 2: Mass loss limit

Mass *M* of cell or battery	Mass loss limit
$M < 1$ g	0.5%
1 g $\leq M \leq$ 75 g	0.2%
$M >$ 75 g	0.1%

Mass loss (%)= [(M1-M2)/M1]*100%

Thermal test (Appendix 2)

Test item No.	T2	Name of Test items		Thermal test			
Sample No.	Before Test	After Test	Residual OCV	Before Test (M1)	After Test (M2)	Mass loss	Result after test
	OCV (V)	OCV (V)	(%)	Mass (g)	Mass (g)	(%)	
C1	27.40	26.78	97.73	8531.0	8529.0	0.024	P
C2	27.47	26.87	97.81	8500.6	8498.6	0.024	P
C3	27.52	26.87	97.63	8516.4	8514.3	0.025	P
C4	27.31	26.77	98.02	8503.5	8501.8	0.020	P
D1	27.16	26.74	98.45	8521.3	8518.0	0.039	P
D2	27.52	26.91	97.78	8516.2	8513.8	0.029	P
D3	27.25	26.88	98.64	8530.0	8527.5	0.030	P
D4	27.42	26.86	97.95	8518.5	8516.9	0.019	P

Note 1:
L-Leakage,
V-Venting,
D-Disassembly,
R-Rupture,
F-Fire,
P-No Leakage, No Venting, No Disassembly, No Rupture, No Fire.

Note 2: Mass loss limit

Mass *M* of cell or battery	Mass loss limit
$M < 1$ g	0.5%
1 g $\leq M \leq$ 75 g	0.2%
$M >$ 75 g	0.1%

Mass loss (%)= [(M1-M2)/M1]*100%

Vibration test (Appendix 3)

Test item No.	T3	Name of Test items		Vibration Test			
Sample No.	Before Test	After Test	Residual OCV	Before Test (M1)	After Test (M2)	Mass loss	Result after test
	OCV (V)	OCV (V)	(%)	Mass (g)	Mass (g)	(%)	
C1	26.78	26.73	99.81	8529.0	8527.8	0.015	P
C2	26.87	26.81	99.77	8498.6	8497.6	0.012	P
C3	26.87	26.82	99.81	8514.3	8513.0	0.016	P
C4	26.77	26.74	99.88	8501.8	8500.9	0.011	P
D1	26.74	26.69	99.81	8518.0	8517.0	0.012	P
D2	26.91	26.87	99.85	8513.8	8513.0	0.010	P
D3	26.88	26.83	99.81	8527.5	8526.1	0.017	P
D4	26.86	26.82	99.85	8516.9	8515.7	0.015	P

Note 1:
L-Leakage,
V-Venting,
D-Disassembly,
R-Rupture,
F-Fire,
P-No Leakage, No Venting, No Disassembly, No Rupture, No Fire.

Note 2: Mass loss limit

Mass *M* of cell or battery	Mass loss limit
$M < 1$ g	0.5%
1 g $\leq M \leq$ 75 g	0.2%
$M >$ 75 g	0.1%

Mass loss (%)= [(M1-M2)/M1]*100%

Shock test (Appendix 4)

Test item No.	T4	Name of Test items		Shock Test			
Sample No.	Before Test	After Test	Residual OCV	Before Test (M1)	After Test (M2)	Mass loss	Result after test
	OCV (V)	OCV (V)	(%)	Mass (g)	Mass (g)	(%)	
C1	26.73	26.73	100.00	8527.8	8527.8	0.000	P
C2	26.81	26.81	100.00	8497.6	8497.6	0.000	P
C3	26.82	26.81	99.96	8513.0	8513.0	0.000	P
C4	26.74	26.74	100.00	8500.9	8500.9	0.000	P
D1	26.69	26.68	99.96	8517.0	8517.0	0.000	P
D2	26.87	26.87	100.00	8513.0	8513.0	0.000	P
D3	26.83	26.83	100.00	8526.1	8526.1	0.000	P
D4	26.82	26.82	100.00	8515.7	8515.7	0.000	P

Note 1:
L-Leakage,
V-Venting,
D-Disassembly,
R-Rupture,
F-Fire,
P-No Leakage, No Venting, No Disassembly, No Rupture, No Fire.

Note 2: Mass loss limit

Mass *M* of cell or battery	Mass loss limit
$M < 1$ g	0.5%
$1 g \leq M \leq 75$ g	0.2%
$M > 75$ g	0.1%

Mass loss (%)= [(M1-M2)/M1]*100%

External short circuit test (Appendix 5)

Test item No.	T5	Name of Test items	External short circuit Test	
Sample No.	Test Ambient T (°C)	Resistance of Circuit (mΩ)	Max. External Temperature (°C)	Result after test
C1	57.5	81.3	58.4	P
C2	57.5	85.4	58.0	P
C3	57.5	83.7	58.2	P
C4	57.5	82.9	57.7	P
D1	57.5	86.5	58.1	P
D2	57.5	84.1	58.1	P
D3	57.5	83.3	58.1	P
D4	57.5	84.6	58.1	P

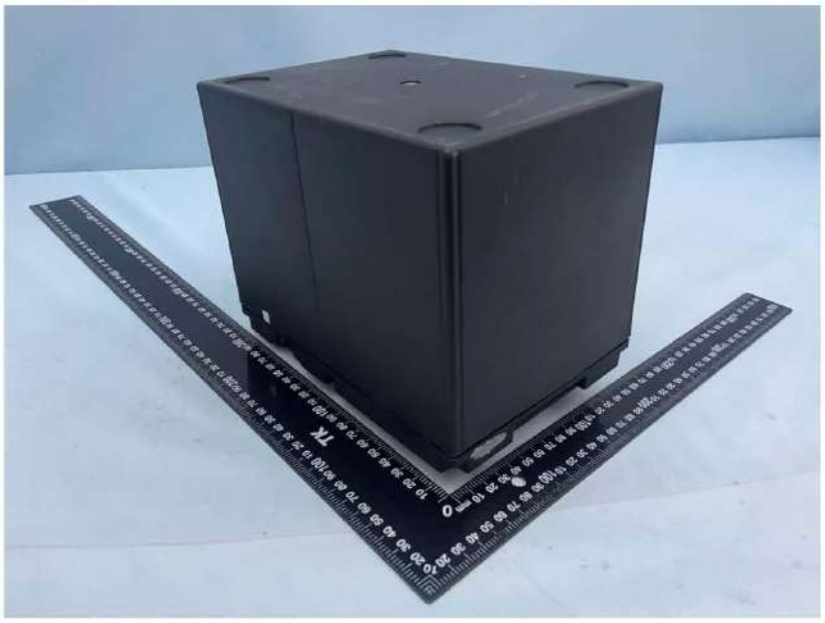
Note:
D-Disassembly,
R-Rupture,
F-Fire,
P- No Disassembly, No Rupture, No Fire.

Overcharge test (Appendix 7)

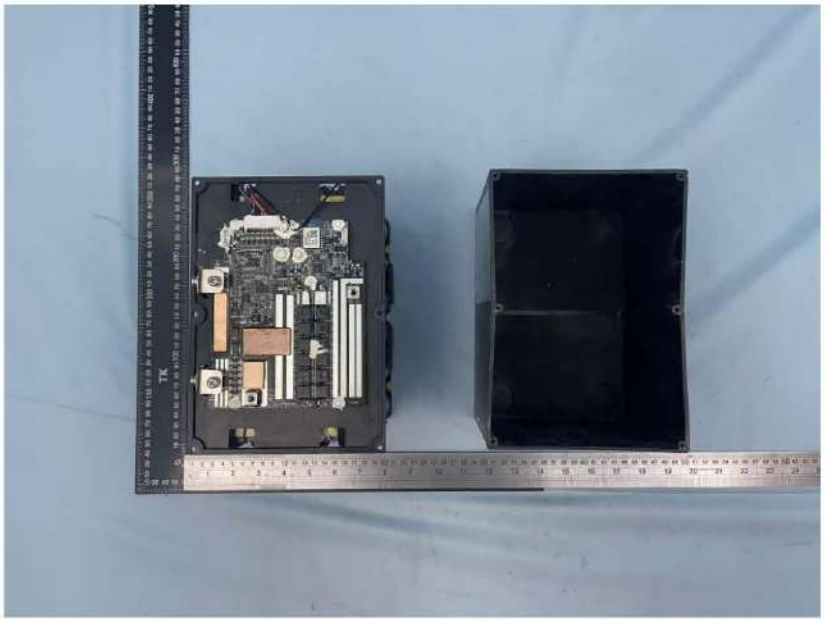
Test item No.	T7	Name of Test items	Overcharge Test
Sample No.	Result after test		
C5	P		
C6	P		
C7	P		
C8	P		
D5	P		
D6	P		
D7	P		
D8	P		
Note: D-Disassembly, F-Fire, P- No Disassembly, No Fire.			

Photos:

01. Overall view



02. Internal view



03. PWB board view