TEST REPORT
EN 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.....:	KEYS240814047001EN-01
Date of issue.....:	2024.08.23
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Approved by (name + signature).....:	Jason Zhan
Testing Laboratory Name .....:	Guangdong KEYS Testing Technology Co., Ltd.
Address .....:	Building 1, No.18, Shihuan Road, Dongcheng Subdistrict, Dongguan, Guangdong, China
Applicant's name.....:	RACING MOTOR DEVELOPMENT LIMITED
Address.....:	3/F, JONSIM PLACE, 228 QUEEN'S ROAD EAST, WANCHAI, HONG KONG
Test specification:	
Standard.....:	☐ IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021 ☒ EN 62133-2:2017; EN 62133-2:2017/A1:2021.
Test item description.....:	lithium battery
Trade Mark.....:	/
Manufacturer.....:	RACING MOTOR DEVELOPMENT LIMITED
Address.....:	3/F, JONSIM PLACE, 228 QUEEN'S ROAD EAST, WANCHAI, HONG KONG
Model/Type reference.....:	24V2.6Ah5.2Ah
Cell model.....:	18650-2600mAh
Ratings.....:	24V/5.2Ah/124.8Wh

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List of Attachments (including a total number of pages in each attachment): --
Summary of testing: The unit is charging the empty cell and discharging the full charged cell according to the rating. Note: Charging procedures for test purposes: (1) Unless otherwise stated, the charging procedure for test purposes is carried out in an ambient temperature of 20±5°C, using the method declared by the manufacturer. Prior to charging, the battery/cell shall have been discharged at 20±5°Cat a constant current of 0.2 It A down to a specified final voltage. (2) After stabilization for 1 to 4 hours respectively at ambient temperature of highest test temperature 40°C and lowest test temperature 0°C.

Tests performed (name of test and test clause): clause 7.2.2 Case stress at high ambient temperature (battery) clause 7.3.2 External short circuit (battery) clause 7.3.3 Free fall clause 7.3.6 Over-charging of battery clause 7.3.8.1 Vibration clause 7.3.8.2 Mechanical shock The samples comply with the requirements of EN 62133-2:2017; EN 62133-2:2017/A1:2021.	**Testing location:** Guangdong KEYS Testing Technology Co., Ltd. Building 1, No.18, Shihuan Road, Dongcheng Subdistrict, Dongguan, Guangdong, China

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

Republic of Korea

☒ The product fulfils the requirements of EN 62133-2:2017; EN 62133-2:2017/A1:2021.

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

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

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

Information on uncertainty of measurement:

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.
IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.
Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

Copy of marking plate:

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

Remark: “WW” means to years; “YY” means to months;
The “+” represents the anode; The “-” represents the cathode

Test item particulars..... :	lithium battery
Classification of installation and use..... :	To be defined in final product
Supply connection..... :	Supply by connector
Recommend charging method declared by the manufacturer..... :	Charge at constant current 0.2C until voltage reaches 29.4V, then charge at constant voltage 29.4V till charge current is 0.02C.
Discharge current ..... :	0.2C
Maximum discharging current..... :	1C
Specified final voltage..... :	21V
Upper limit charging voltage per battery..... :	29.4V
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell..... :	4.2V
Maximum charging current..... :	1C
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..... :	2024.08.14
Date (s) of performance of tests..... :	2024.08.14~2024.08.23

General remarks:

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

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

"(See Enclosure #)" refers to additional information appended to the report.

"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

General product information:

1. The maximum ambient temperature is specified as 40°C for Charging and 60°C forDischarging.

General product information:

This battery is constructed with 1 Rechargeable Li-ion Battery in 7S2P, and the cells were passed the standard IEC 62133-2:2017.

The main features of the battery are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
24V2.6Ah5.2Ah	5.2Ah	24V	1A	1A	5.2A	5.2A	29.7V	21V

The main features of the battery are shown as below (clause 8.1.2):

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
24V2.6Ah 5.2Ah	29.7V	260mA	0°C	45°C

The main features of the cell in the battery are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
18650-2600mAh	2600mAh	3.7V	500mA	500mA	2600mA	2600mA	4.2V	3V

The main features of the cell in the battery are shown as below (clause 8.1.2):

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
18650-2600mAh	4.2V	130mA	0°C	45°C

Construction:

N/A

Circuit diagram:

N/A

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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		P
	Insulation resistance (MΩ)..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate clearance 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	Overcharge, over discharge, over current and short-circuit proof circuit used in this battery. See tests of clause 7.	P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer	See above.	P
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified	The charging limits specified in the user manual.	P
5.5	**Terminal contacts**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current	Copper plate contacts complied with the requirements.	P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		P
	Terminal contacts are arranged to minimize the risk of short-circuit		P
5.6	**Assembly of cells into batteries**		P
5.6.1	General		P
	Each battery 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	Protective circuit equipped on battery.	P
	This protection may be provided external to the battery such as within the charger or the end devices		P
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		P
	If there is more than one battery housed in a single battery case, each battery have protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly	Current, voltage and temperature limits specified by cell manufacturer.	P
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer		N/A
	Protective circuit components added as appropriate and consideration given to the end-device application		N/A
	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		N/A
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		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, by monitoring the voltage of every single cell or the single cellblocks		P
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that charging is stopped when the upper limit of the charging voltage is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		N/A
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage not be counted as an overcharge protection		P
	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		P
	It is recommended that the cells and cell blocks not discharged beyond the cell manufacturer's specified final voltage	.	N/A
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries	Consider in end product	P
	Mechanical protection for cells, cell connections and control circuits within the battery 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 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 considered when conducting mechanical tests		N/A
5.7	**Quality plan**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery	Complied. ISO 9001: 2008 certificate provided.	P
5.8	**Battery safety components**		N/A
	According annex F	See TABLE: Critical components information	N/A
6	**TYPE TEST AND SAMPLE SIZE**		P
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old		P
	Coin cells with resistance ≤ 3 Ω (measured according annex D) are tested according table 1	Not coin cells	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 overdischarge protection		P
	When conducting the short-circuit test, consideration 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	See clause 7.3.2.	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 have 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		N/A
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization for 1 h and 4 h, respectively, at ambient temperature of highest test temperature and lowest test temperature, 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 voltage charging method		N/A
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)		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)		P
	Oven temperature (°C)..... :	70±2°C, 7hours	—
	Results: No physical distortion of the battery case resulting in exposure of internal protective components and cells	No physical distortion of the battery casing.	P
7.3	**Reasonably foreseeable misuse**		P
7.3.1	External short-circuit (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)	Tested complied.	P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		P
	- The case temperature declined by 20 % of the maximum temperature rise		N/A
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		N/A
	A single fault in the discharge protection circuit conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test	Single fault conducted on three samples.	P
	A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor	Single fault applies on MOSFET.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire. No explosion..... :	(See appended table 7.3.2)	P
7.3.3	Free fall	Tested complied.	P
	Results: No fire. No explosion	No fire. No explosion	P
7.3.4	Thermal abuse (cells)		N/A
	Oven temperature (°C)..... :		N/A
	Results: No fire. No explosion		N/A
7.3.5	Crush (cells)		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		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)		N/A
	If 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
	If 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..... :	(See appended table 7.3.7)	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration	Tested complied.	P
	Results: No fire, no explosion, no rupture, no leakage or venting.....:	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock	Tested complied.	P
	Results: No leakage, no venting, no rupture, no explosion and no fire.....:	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)		N/A
	The cells complied with national requirement for.....:		N/A
	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 ensure that information is provided about current, voltage and temperature limits of their products	Information for safety mentioned in manufacturer's specifications.	P
	Manufacturers of batteries ensure that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards	Information for safety mentioned in manufacturer's specifications.	P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A
	As appropriate, any information relating to hazard avoidance resulting from a system analysis provided to the end user		N/A
	Do not allow children to replace batteries without adult supervision		P
8.2	**Small cell and battery safety information**	Not small cell and battery.	N/A
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A
9	**MARKING**		P
9.1	**Cell marking**	The final product is battery	N/A
	Cells 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 marked as specified in IEC 61960, except for coin batteries	Battery marked as specified in IEC 61960-3: 2017	P
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity. Batteries also marked with an appropriate caution statement		N/A
	Terminals have clear polarity marking on the external surface of the battery		P
	Batteries with keyed external connectors designed for connection to specific end products need not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		P
9.3	**Caution for ingestion of small cells and batteries**	Not small cell and battery.	N/A
	Coin cells and batteries identified as small batteries according to 8.2 include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A
	When small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion given on the immediate package		N/A
9.4	**Other information**		P
	Storage and disposal instructions	Information for storage and disposal instructions mentioned in manufacturer's specifications.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Recommended charging instructions	Information for recommended charging instructions mentioned in manufacturer's specifications.	P
10	**PACKAGING AND TRANSPORT**		N/A
	Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3	Not coin cells.	N/A
	The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants		N/A
ANNEX A	**CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE**		P
A.1	**General**		P
A.2	**Safety of lithium ion secondary battery**		P
A.3	**Consideration on charging voltage**		P
A.3.1	General		P
A.3.2	Upper limit charging voltage		P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		N/A
A.4	**Consideration of temperature and charging current**		P
A.4.1	General		P
A.4.2	Recommended temperature range	See A.4.2.2.	P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Consider in end product	P
A.4.3	High temperature range		N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		N/A
A.4.4	Low temperature range		N/A
A.4.4.1	General		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.4.2	Explanation of safety viewpoint	Consider in end product	N/A
A.4.4.3	Safety considerations, when specifying charging conditions in the low temperature range		N/A
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		N/A
A.4.5	Scope of the application of charging current		P
A.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint	Consider in end product	N/A
A.4.6.3	Discharge current and temperature range	NTC provided, consider in end product	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

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Clause	Requirement + Test	Result - Remark	Verdict
A.6.11	Recommended specifications for the pressing device		N/A
ANNEX B	**RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS**		P
ANNEX C	**RECOMMENDATIONS TO THE END-USERS**		P
ANNEX D	**MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS**		N/A
D.1	**General**	Not coin cells.	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 of less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing		N/A
ANNEX E	**PACKAGING AND TRANSPORT**		N/A
ANNEX F	**COMPONENT STANDARDS REFERENCES**		N/A

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

--	TABLE: Critical components information				P
Object/part no.	**Manufacturer/ trademark**	**Type/model**	**Technical data**	**Standard**	**Mark(s) of conformity[1)]**
PCB	Interchangeable	Interchangeable	Min. V-0, Min. 130ºC	UL 94 UL 796,	UL
Protective IC (U1)	Interchangeable	Interchangeable	Overcharge detection voltage: 29.4V±0.025V, Overdischarge detection voltage: 21V±0.05V	--	Tested with appliance
MOS(U2)	Interchangeable	Interchangeable	VDS: 29.4V, VGS: ±20V,	--	Tested with appliance
NTC	Interchangeable	Interchangeable	25°C Minimum 5.0A, 3Ω	--	Tested with appliance
Cell					
lithium ion battery	RACING MOTOR DEVELOPMENT LIMITED	18650-2600mAh	3.7V 2600mAh	IEC 62133-2:2017/AMD1:2017	--
Supplementary information: **[1)] Provided evidence ensures the agreed level of compliance.**					

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

7.3.1	TABLE: External short-circuit (cell)	N/A

Sample no.	Ambient T (°C)	OCV before test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT, °C	Results
Samples charged at charging temperature upper limit (40°C)					
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
Samples charged at charging temperature lower limit (0°C)					
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Supplementary information:
- No fire or explosion

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, °C	Component single fault condition	Results
Battery #1	24.4	29.25	80	38.2	MOSFET	P
Battery #2	24.5	29.28	80	37.7	MOSFET	P

Battery #3	23.5	29.22	80	37.4	MOSFET	P
Battery #4	23.8	29.20	80	29.3	--	P
Battery #5	24.6	29.21	80	27.5	--	P

Supplementary information:
- No fire or explosion

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 (40°C)				
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Samples charged at charging temperature lower limit (0°C)				
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Supplementary information:
- No fire or explosion

7.3.6	TABLE: Over-charging of battery	P
Constant charging current (A) :	10.4	—
Supply voltage (Vdc) :	35.28	—

Sample no.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
Battery #6	21.44	120	35.2	P
Battery #7	21.38	120	37.4	P
Battery #8	21.40	120	34.6	P
Battery #9	21.43	120	38.2	P
Battery #10	21.39	120	39.4	P

Supplementary information:
- No fire or explosion

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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Supplementary information:
- No fire or explosion

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
Battery #11	29.28	29.25	840.6	840.5	P
Battery #12	29.24	29.23	840.2	840.1	P
Battery #13	29.26	29.25	841.5	841.5	P

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

7.3.8.2	TABLE: Mechanical shock	P

Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results
Battery #14	29.26	29.25	842.3	842.1	P
Battery #15	29.22	29.20	841.7	841.6	P
Battery #16	29.28	29.27	840.9	840.6	P

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

0

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 (40°C)					
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Samples charged at charging temperature lower limit (0°C)					
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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 or explosion

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:

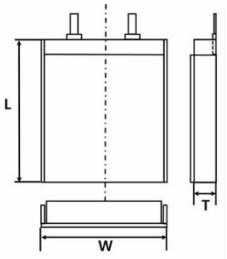
[1)] Coin cells with internal resistance less than or equal to 3 Ω, see test result on corresponding tables

ATTACHMENT to EN 62133-2017		
Clause	Requirement + Test	Result - Remark
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_EN 62133-2017	
Attachment Originator ..... :	KTR	
Master Attachment..... :	2023-08-02	
	National Differences	
7.3.6	Over-charging of battery	
(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 It A, (e.g., quick charging power bank, etc.)	No this condition

ATTACHMENT to EN 62133-2017		
Clause	Requirement + Test	Result - Remark
	[Replace to the following statement] c) Acceptance criteria Filling beyond the manufacturer's specified limits should not result in ignition or explosion	
Annex G	Definition for shape and materials of outer case for cell	
(Addition)	General Annex G provides definitions for shape and materials of outer case for cell 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 Materials of outer case for cell Soft case Non-metallic outer case or container for cell 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 use for smart phone, tablet, notebook. Wh / L
ATTACHMENT to EN 62133-2017		

Clause	Requirement + Test	Result - Remark

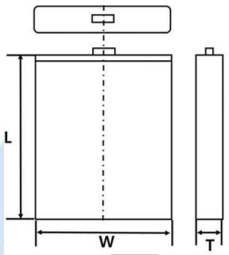
H.2 Calculation Method



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)

$$Volumetric\ energy\ density\ (Wh/L) = \frac{Nominal\ voltage\ (V) \times Rated\ capacity\ (Ah)}{Length\ (L) \times Width\ (W)\ \times Thickness\ (T)}$$

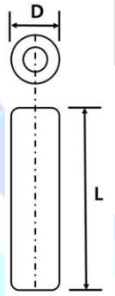
[H.1 – Prismatic cell using soft case]



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]



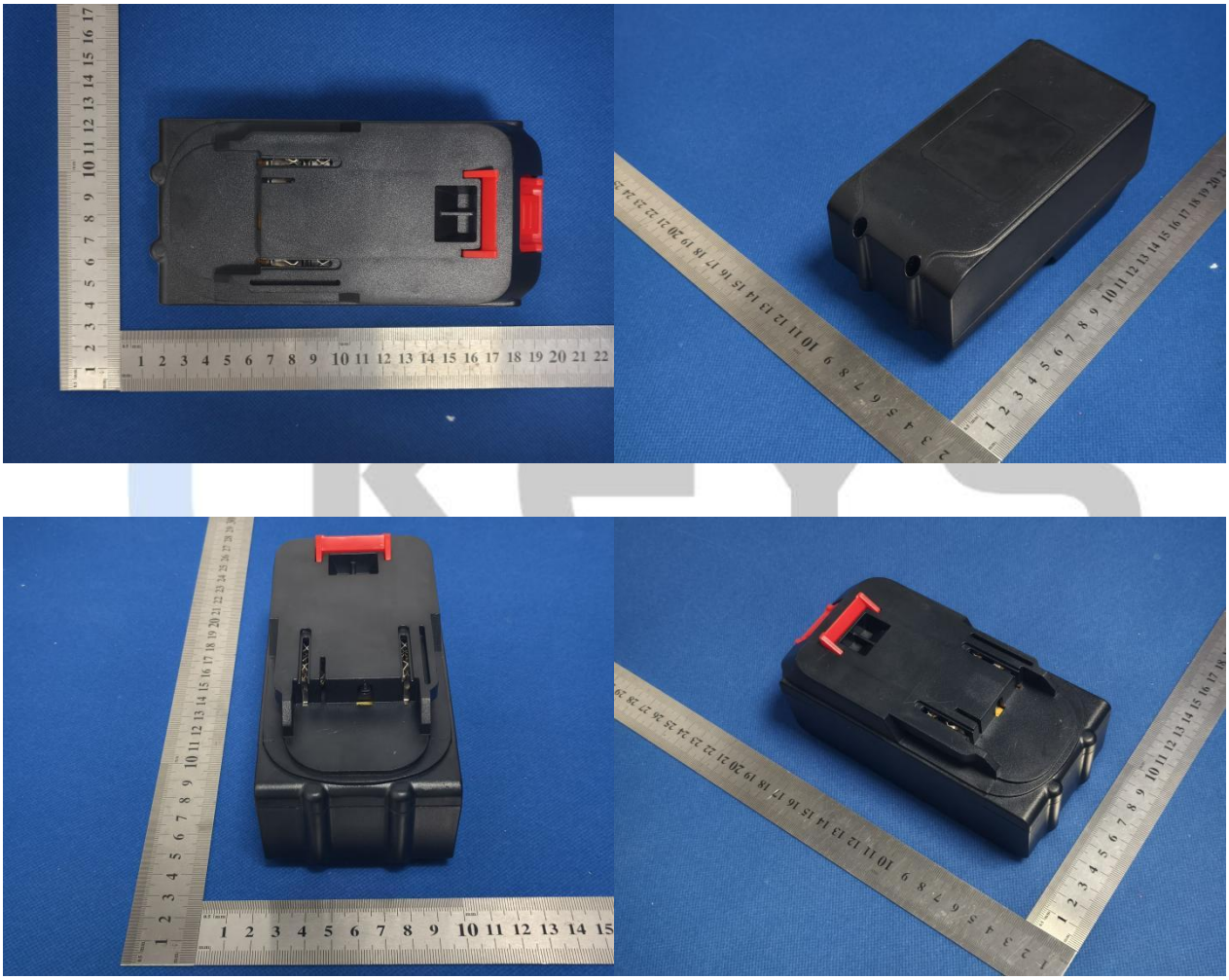
D : Diameter (max.) of cell
L : Length (max.) of cell

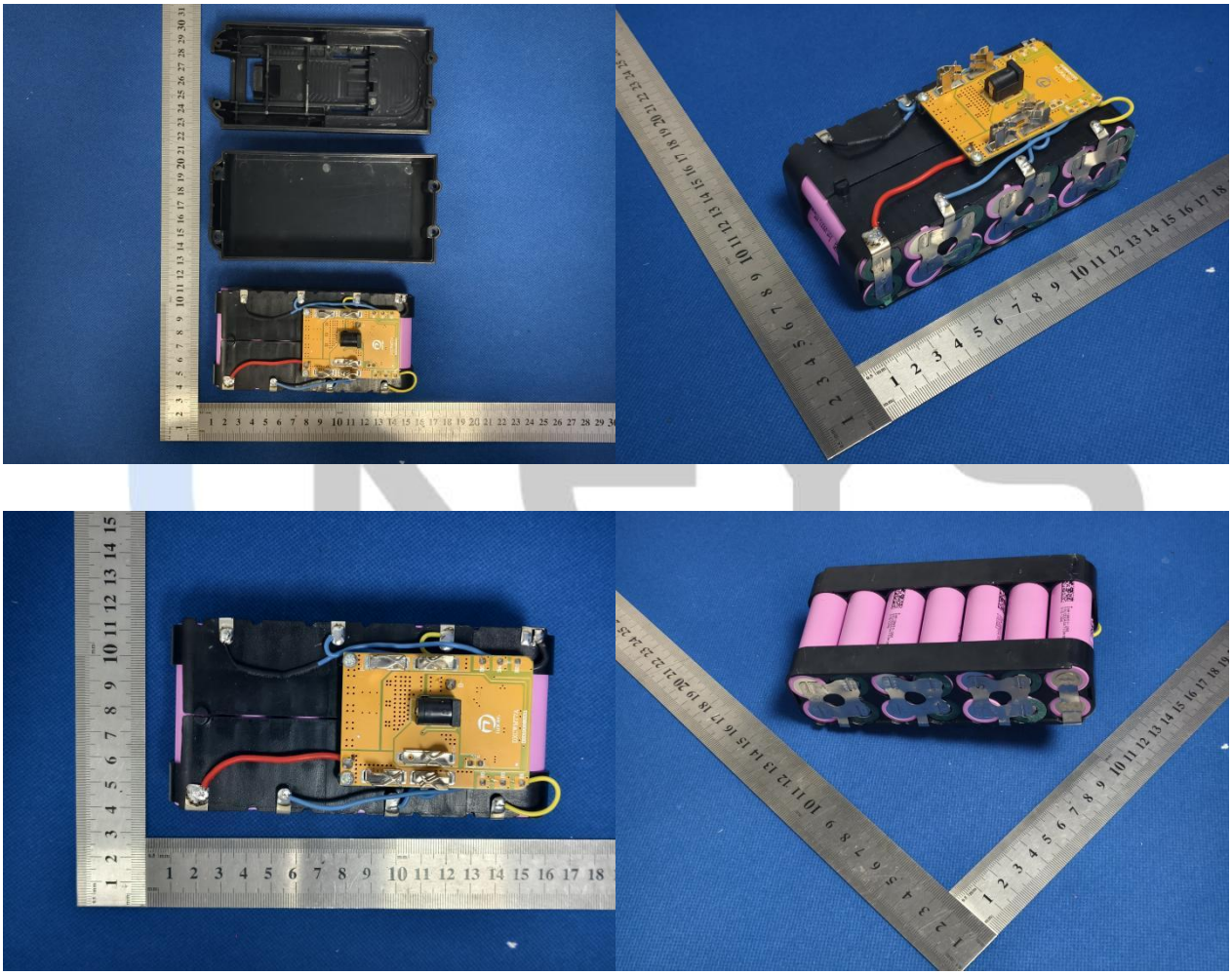
(According to shape of cell at shipping,
The dimension of tube for cell may be included
In overall dimension of cell)

$$Volumetric\ energy\ density\ (Wh/L) = \frac{Nominal\ voltage\ (V) \times Rated\ capacity\ (Ah)}{3.14159 \times \frac{Diameter\ (D)^2}{4} \times Length(L)}$$

[H.3 – Cylindrical cell using hard case]

Photos





--- End of Report ---