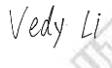
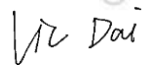
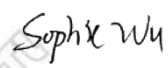




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TEST REPORT IEC 62133-2 Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems	
Report Reference No.	PNS230814164 04001
Date of issue	2023-09-20
Total number of pages	22
Testing Laboratory	GUANGDONG UTL CO., LTD.
Address	Lianding Testing Building, No.18 Center Road of Yayuan Industrial Zone, Nancheng District, Dongguan, Guangdong, China
Tested by (name+signature)	Vedy Li 
Reviewed by (name+ signature)	Vic Dai 
Approved by (name+signature)	Sophie Wu 
Applicant's name	Dongguan CM Batteries Co., Ltd.
Address	8 Floor, 5 Building, Qinggu Intelligent Manufacturing Park, Tiansha Road, Tangxia Town, Dongguan, Guangdong, China.
Manufacturer's name	Dongguan CM Batteries Co., Ltd.
Address	8 Floor, 5 Building, Qinggu Intelligent Manufacturing Park, Tiansha Road, Tangxia Town, Dongguan, Guangdong, China.
Factory's name	Dongguan CM Batteries Co., Ltd.
Address	8 Floor, 5 Building, Qinggu Intelligent Manufacturing Park, Tiansha Road, Tangxia Town, Dongguan, Guangdong, China.
Test specification:	
Standard	IEC 62133-2:2017/A1:2021
Test procedure	N/A
Non-standard test method	N/A
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Test item description	Li-ion Battery
Trade Mark	N/A
Model/Type reference	CMB10040040
Ratings	36.5V, 10.4Ah, 379.6Wh



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List of Attachments (including a total number of pages in each attachment):

- Photos documentation (3 pages)

Summary of testing:

Tests performed (name of test and test clause):

Test items:

cl.7.1 Charging procedure for test purposes;
cl.7.2.1 Continuous charging at constant voltage (cells);
cl.7.2.2 Case stress at high ambient temperature (battery);
cl.7.3.1 External short-circuit (cells);
cl.7.3.2 External short-circuit (batteries);
cl.7.3.3 Free fall (cells and batteries);
cl.7.3.4 Thermal abuse (cells);
cl.7.3.5 Crush (cells);
cl.7.3.6 Over-charging of battery;
cl.7.3.7 Forced discharge (cells);
cl.7.3.8 Mechanical tests (batteries);
- 7.3.8.1 Vibration
- 7.3.8.2 Mechanical shock
cl.7.3.9 Forced internal short-circuit (cells);
cl.8.2 Small cell and battery safety information.

Tests are made with the number of batteries and cells specified in IEC 62133-2:2017/A1:2021 Table 1.

Testing location:

All tests as described in Test Case and Measurement Sections were performed at the laboratory described on page 1.

Summary of compliance with National Differences:

List of countries addressed: N/A

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



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Copy of marking plate:

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

Li-ion Battery

- + Model: CMB10040040
10INR19/66-4
36.5V, 10.4Ah, 379.6Wh
YYYYMMDD
- Dongguan CM Batteries Co., Ltd
Caution: Risk of fire and burn

Date code: YYYYMMDD

YYYY: Four digitals represents Year of manufacture;

MM: Two digitals represents Month of manufacture;

DD: Two digitals represents Day of manufacture.



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Test item particulars	
Classification of installation and use	To be defined in final system
Supply connection	DC wire
Recommend charging method declared by the manufacturer	CCCV
Discharge current (0,2 I_t A)	2080mA
Specified final voltage	28V
Upper limit charging voltage per cell	4.25V
Maximum charging current	5200mA
Charging temperature upper limit	50°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	2023-08-14
Date(s) of performance of test	2023-08-20 to 2023-09-16
General remarks	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.	
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 testing laboratory. Throughout this report a point (comma) is used as the decimal separator.	



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General product information:

The battery consists of ten lithium-ion cells in series and four lithium-ion cells in parallel (10S4P), and has overcharge, over-discharge, over current and short-circuits proof circuit.

Type reference 10INR19/66-4 is standard requirement according to IEC 61960-3 and is identical to Model CMB10040040 except for model designation.

The main features of the battery are shown as below (clause 7.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
CMB10040040	10.4Ah	36.5 V	2.08A	2.08A	5.2A	15A	42.0V	28V

The main features of the cell are shown as below (clause 7.1.1):

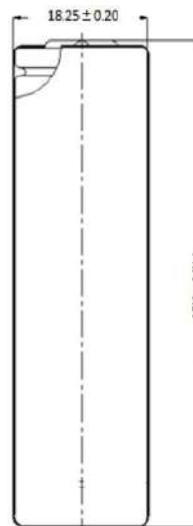
Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
INR18650-26E	2600mAh	3.6V	520mA	520mA	2600mA	7800mA	4.2V	2.75V

The main features of the cell are shown as below (clause 7.1.2):

Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
INR18650-26E	4.25V	130mA	0°C	50°C

Construction:

Cell dimension:



R(max.): H(max.) =18.45mm: 65.15mm



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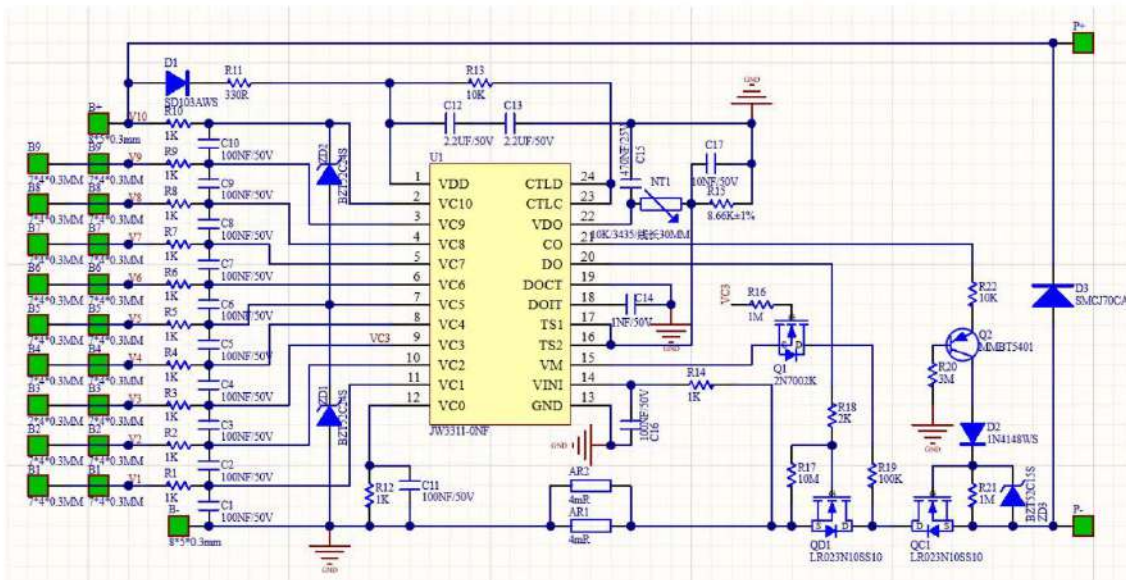
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Battery dimension:



T(max.): W(max.): H(max.) = 40.0mm: 120.0mm: 335.0mm

Circuit diagram:



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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	Battery does not contain any exposed metal surfaces.	N/A
	Insulation resistance (MΩ) :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate 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	Explosion-proof safety valve for venting exists.	P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief	No Encapsulation.	N/A
5.4	Temperature, voltage and current management		P
	Batteries are designed such that abnormal temperature rise conditions are prevented	Overcharge, over discharge, over current and short-circuit proof circuit used in this battery. See tests of clause 7.	P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		P
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified	The charging limits specified in manufacturer's specifications.	P
5.5	Terminal contacts		N/A
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current	DC wire used.	N/A



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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		N/A
	Terminal contacts are arranged to minimize the risk of short-circuit		N/A
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	Protection circuit within the battery	P
	This protection may be provided external to the battery such as within the charger or the end devices		N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery 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	Battery without selective discharge function.	N/A
	Protective circuit components 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		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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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	Upper limit charging voltage: 4.25V/Cell, battery pack consists of 10S-4P, 42V/Pack, voltage of cell does not exceed the upper limit of the charging voltage.	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		P
	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		P
	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		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	This shall be considered in end product.	N/A
	The battery case and compartments housing cells designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer	This shall be considered in end product.	N/A
	For batteries intended for building into a portable end product, testing with the battery installed within the end product considered when conducting mechanical tests	This shall be considered in end product.	N/A
5.7	Quality plan		P



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

	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery		P
5.8	Battery safety components		N/A
	According annex F		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	Test sample not more than six months old.	P
	Coin cells with resistance $\leq 3 \Omega$ (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 $20^\circ\text{C} \pm 5^\circ\text{C}$		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		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 $20^\circ\text{C} \pm 5^\circ\text{C}$, using the method declared by the manufacturer		P
	Prior to charging, the battery have been discharged at $20^\circ\text{C} \pm 5^\circ\text{C}$ at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		P
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P



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IEC 62133-2			
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		P
7.2	Intended use		P
7.2.1	Continuous charging at constant voltage (cells)		P
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer	Tested complied.	P
	Results: No fire. No explosion. No leakage	(See appended table 7.2.1)	P
7.2.2	Case stress at high ambient temperature (battery)	Battery with not moulded case, test for reference.	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 resulting in exposure of internal protective components and cells.	P
7.3	Reasonably foreseeable misuse		P
7.3.1	External short-circuit (cell)		P
	The cells were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	Results: No fire. No explosion.....	(See appended table 7.3.1)	P
7.3.2	External short-circuit (battery)		P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- 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 conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		P



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IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor		P
	Results: No fire. No explosion..... :	(See appended table 7.3.2)	P
7.3.3	Free fall	Tested complied.	P
	Results: No fire. No explosion	No fire. No explosion.	P
7.3.4	Thermal abuse (cells)		P
	Oven temperature (°C) :	130	—
	Results: No fire. No explosion	No fire. No explosion.	P
7.3.5	Crush (cells)		P
	The crushing force was released upon:		P
	- The maximum force of 13 kN ± 0,78 kN has been applied; or	Tested complied.	P
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery		P
	The supply voltage which is:		P
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or		N/A
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and	51V applied.	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		P
	- Returned to ambient		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.6)	P
7.3.7	Forced discharge (cells)		P
	Discharge a single cell to the lower limit discharge voltage specified by the cell manufacturer		P
	The discharged cell is then subjected to a forced discharge at 1 It A to the negative value of the upper limit charging voltage		P



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IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- The discharge voltage reaches the negative value of upper limit charging voltage within the testing duration. The voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	- The discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration. The test is terminated at the end of the testing duration		P
	Results: No fire. No explosion..... :	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration		P
	Results: No fire, no explosion, no rupture, no leakage or venting. :	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock		P
	Results: No leakage, no venting, no rupture, no explosion and no fire :	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)	Tested complied.	P
	The cells complied with national requirement for :	France, Japan, Korea, Switzerland	—
	The pressing was stopped upon:		P
	- A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached	800N, cylindrica cells	P
	Results: No fire :	(See appended table 7.3.9)	P

8	INFORMATION FOR SAFETY		P
8.1	General		P
	Manufacturers of secondary cells provides information about current, voltage and temperature limits of their products	Information is provided in manufacturer's specification.	P
	Manufacturers of batteries provides information regarding how to minimize and mitigate hazards to equipment manufacturers or end-users	Information is provided in manufacturer's specification.	P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product	Considered in end product.	N/A
	As appropriate, any information relating to hazard avoidance resulting from a system analysis provided to the end user	Considered in end product.	N/A
8.2	Small cell and battery safety information	Not Small cell and battery	N/A



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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	The final product is battery.	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	IEC Designation: 10INR19/66-4	P
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity		N/A
	Batteries are marked with an appropriate caution statement		P
	- Terminals have clear polarity marking on the external surface of the battery, or		P
	- Not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		N/A
9.3	Caution for ingestion of small cells and batteries	Not Small cell and battery	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



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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	Not coin cells.	N/A

ANNEX A	CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE		P
A.1	General		P
A.2	Safety of lithium ion secondary battery		P
A.3	Consideration on charging voltage		P
A.3.1	General		P
A.3.2	Upper limit charging voltage		P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		P
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range	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		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
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



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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		P
A.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		P
A.4.6.3	Discharge current and temperature range		P
A.4.6.4	Scope of application of the discharging current		P
A.5	Sample preparation		P
A.5.1	General		P
A.5.2	Insertion procedure for nickel particle to generate internal short		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle in cylindrical cell		P
A.5.5.1	Insertion of nickel particle in winding core		P
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		P
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	Experimental procedure of the forced internal short-circuit test		P
A.6.1	Material and tools for preparation of nickel particle		P
A.6.2	Example of a nickel particle preparation procedure		P
A.6.3	Positioning (or placement) of a nickel particle		P
A.6.4	Damaged separator precaution		P
A.6.5	Caution for rewinding separator and electrode		P
A.6.6	Insulation film for preventing short-circuit		P
A.6.7	Caution when disassembling a cell		P
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P
A.6.10	Caution for the disassembling process and pressing the electrode core		P
A.6.11	Recommended specifications for the pressing device		P
ANNEX B	RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS		P



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

ANNEX C	RECOMMENDATIONS TO THE END-USERS	N/A
----------------	---	------------

ANNEX D	MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS	N/A
D.1	General	N/A
D.2	Method	N/A
	A sample size of three coin cells is required for this measurement..... :	N/A
	Coin cells with an internal resistance 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	P
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ANNEX F	COMPONENT STANDARDS REFERENCES	N/A
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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	SHENZHEN FUSHENG ELECTRONICS CO LTD	CB-D	130°C , V-0	UL 796	UL E308301
Wire	Interchangeable	Interchangeable	Min: 14AWG, Min: 200°C, Min: 300V	UL758	UL approved
Resistance (AR1, AR2)	Interchangeable	Interchangeable	4mR±1%, 2W	--	--
Protective IC(U1)	Joulwatt Technology Co., Ltd	JW3311-0NF	VCU: 4.25±0.03V, VDL: 2.8±0.08V	--	Tested with appliance
MOSFET(Q C1, QD1)	Chongqing Pingchuang Institute of Semiconductors Co., Ltd	PCSL016N08NL	V _{DS} : 80V, V _{GS} : 20V, I _D :260A R _{ds} =1.6mΩ	--	Tested with appliance
Cell	Hengdian Group DMEGC Magnetism Co., Ltd.	INR18650-26E	3.6V, 2600mAh	IEC 62133-2:2017/A1: 2021	Tested with appliance
-Electrolyte	Shenzhen Capchem Technology Co., Ltd	LBC3012D24	EC+EMC+DMC	--	--
-Separator	CANZHOU MINGZHU PLAS TIC Co., LTD	61mm*12+4μm	Size: 61mm*12+4μm, material: PE, shutdown temperature: 138 ± 10°C	--	--
-Positive electrode	GEM (WUXI) ENERGY MATERIAL Co., LTD	L5550	LiNixCoyMnzO2,	--	--
-Negative electrode	JiangXi ZiChen Technology Co.,Ltd	8C	Compound graphite	--	--

Supplementary information:

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



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Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous charging at constant voltage (cells)				P
Sample no.	Recommended charging voltage Vc (Vdc)	Recommended charging current I _{rec} (mA)	OCV before test (Vdc)	Results	
SLine-1-1	4.20	520	4.179	P	
SLine-1-2	4.20	520	4.178	P	
SLine-1-3	4.20	520	4.180	P	
SLine-1-4	4.20	520	4.178	P	
SLine-1-5	4.20	520	4.179	P	
Supplementary information:					
- No fire or explosion					
- No leakage					

7.3.1	TABLE: External short-circuit (cell)				P
Sample no.	Ambient T (°C)	OCV before test (Vdc)	Resistance of circuit (mΩ)	Maximum case temperature rise ΔT (K)	Results
Samples charged at charging temperature upper limit (50°C)					
SLine-1-6	56.1	4.230	84.2	53.0	P
SLine-1-7	56.1	4.231	80.4	52.4	P
SLine-1-8	56.1	4.232	81.5	56.0	P
SLine-1-9	56.1	4.234	82.6	49.6	P
SLine-1-10	56.1	4.232	83.3	48.9	P
Samples charged at charging temperature lower limit (0°C)					
SLine-1-11	56.1	4.172	88.2	43.0	P
SLine-1-12	56.1	4.175	82.5	41.9	P
SLine-1-13	56.1	4.176	81.6	43.0	P
SLine-1-14	56.1	4.173	82.3	44.0	P
SLine-1-15	56.1	4.172	81.6	43.0	P
Supplementary information:					
- No fire or explosion					
- The test was completed after the cell casing cooled to 20% of the maximum temperature rise.					



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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
SLine-2-4	22.6	41.76	84.2	0.5	Short QD1 Pin D Pin S	P
SLine-2-5	22.6	41.79	90.5	0.5	Short QD1 Pin D Pin S	P
SLine-2-6	22.6	41.78	78.6	0.3	Short AR1	P
SLine-2-7	22.6	41.78	84.3	0.3	Short AR1	P
SLine-2-8	22.6	41.77	79.5	0.4	Normal	P

Supplementary information:

- No fire or explosion
- The test was completed after the cell casing cooled to 20% of the maximum temperature rise.(for single fault condition)
- No obvious temperature rise due to the protection of short circuit, the battery pack should remain on test for an additional one hour after the current reaches a low end steady state condition (for normal condition)

Comments: The positive line of the battery pack cannot withstand the high current and is disconnected.

7.3.5	TABLE: Crush (cells)			P
Sample no.	OCV before test (Vdc)	OCV at removal of crushing force (Vdc)	Maximum force applied to the cell during crush (kN)	Results
Samples charged at charging temperature upper limit (50°C)				
SLine-1-29	4.231	4.230	13.124	P
SLine-1-30	4.232	4.231	13.152	P
SLine-1-31	4.230	4.239	13.145	P
SLine-1-32	4.234	4.233	13.136	P
SLine-1-33	4.233	4.232	13.123	P
Samples charged at charging temperature lower limit (0°C)				
SLine-1-34	4.172	4.171	13.142	P
SLine-1-35	4.174	4.172	13.155	P
SLine-1-36	4.175	4.174	13.164	P
SLine-1-37	4.176	4.173	13.126	P
SLine-1-38	4.173	4.170	13.152	P

Supplementary information:

- No fire or explosion
- Force released after maximum level reached

7.3.6	TABLE: Over-charging of battery	P
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Constant charging current (A)		20.8		—
Supply voltage (Vdc)		51		—
Sample no.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
SLine-2-12	30.12	172	23.1	P
SLine-2-13	30.14	172	23.0	P
SLine-2-14	30.13	172	23.1	P
SLine-2-15	30.15	172	23.0	P
SLine-2-16	30.14	172	23.1	P
Supplementary information: - No fire or explosion				

7.3.7	TABLE: Forced discharge (cells)				P
Sample no.	OCV before application of reverse charge (Vdc)	Measured reverse charge I _t (A)	Lower limit discharge voltage (Vdc)	Results	
SLine-1-39	3.142	2.6	2.75	P	
SLine-1-40	3.143	2.6	2.75	P	
SLine-1-41	3.146	2.6	2.75	P	
SLine-1-42	3.145	2.6	2.75	P	
SLine-1-43	3.142	2.6	2.75	P	
Supplementary information: - No fire or explosion - The voltage did not reach negative value of upper limit charging voltage.					

7.3.8.1	TABLE: Vibration					P
Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results	
SLine-2-17	41.78	41.76	1921	1920	P	
SLine-2-18	41.78	41.78	1923	1922	P	
SLine-2-19	41.79	41.77	1920	1919	P	
Supplementary information: - No fire or explosion - No rupture - No leakage - No venting						



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Clause	Requirement + Test	Result - Remark	Verdict

7.3.8.2	TABLE: Mechanical shock					P
Sample no.	OCV before test (Vdc)	OCV after test (Vdc)	Mass before test (g)	Mass after test (g)	Results	
SLine-2-20	41.76	41.75	1922	1921	P	
SLine-2-21	41.79	41.78	1923	1922	P	
SLine-2-22	41.78	41.77	1924	1922	P	

Supplementary information:

- No fire or explosion
- No rupture
- No leakage
- No venting

7.3.9	TABLE: Forced internal short circuit (cells)					P
Sample no.	Chamber ambient T (°C)	OCV before test (Vdc)	Particle location ¹⁾	Maximum applied pressure (N)	Results	
SLine-1-44	50.03	4.232	1	800.5	P	
SLine-1-45	50.04	4.233	1	800.4	P	
SLine-1-46	50.05	4.232	1	800.6	P	
SLine-1-47	50.02	4.234	1	800.2	P	
SLine-1-48	50.06	4.232	1	800.5	P	
SLine-1-49	0.03	4.172	1	800.6	P	
SLine-1-50	0.02	4.175	1	800.3	P	
SLine-1-51	0.05	4.176	1	800.2	P	
SLine-1-52	0.01	4.173	1	800.5	P	
SLine-1-53	0.03	4.175	1	800.6	P	

Supplementary information:

¹⁾ Identify one of the following:

- 1: Nickel particle inserted between positive and negative (active material) coated area.
- 2: Nickel particle inserted between positive aluminium foil and negative active material coated area.

- No fire
- Test concluded when 800 N pressure was reached and 50 mV voltage drop was not achieved.

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

Supplementary information:

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



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Photos



Fig.1 General view I of battery

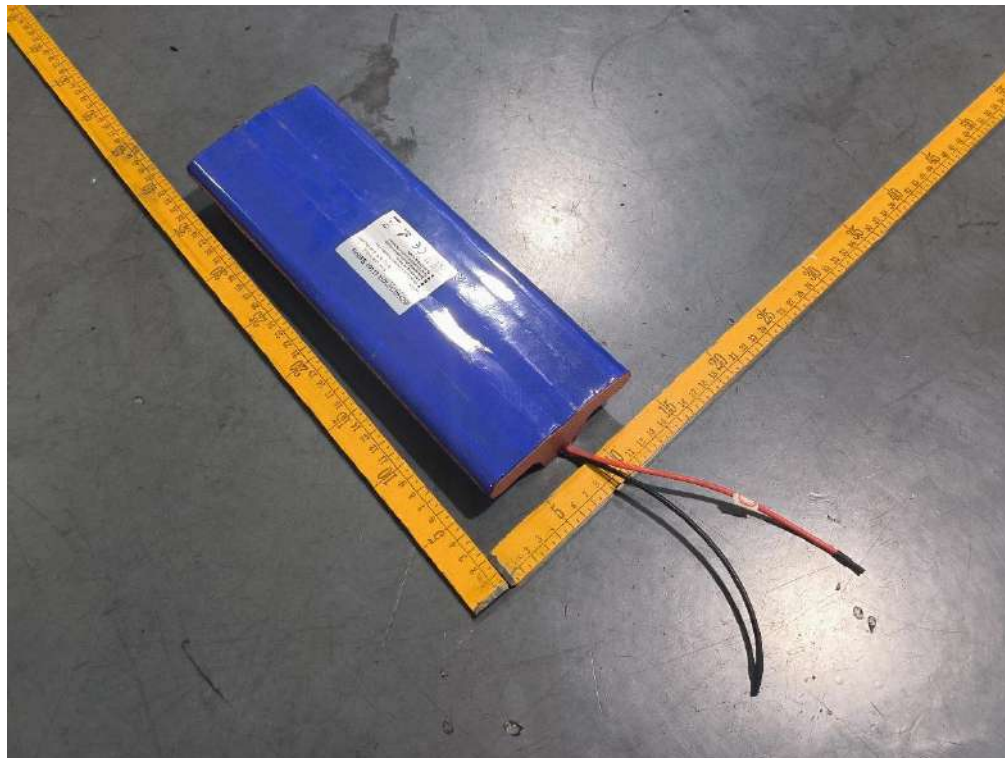


Fig.2 General view II of battery



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Photos

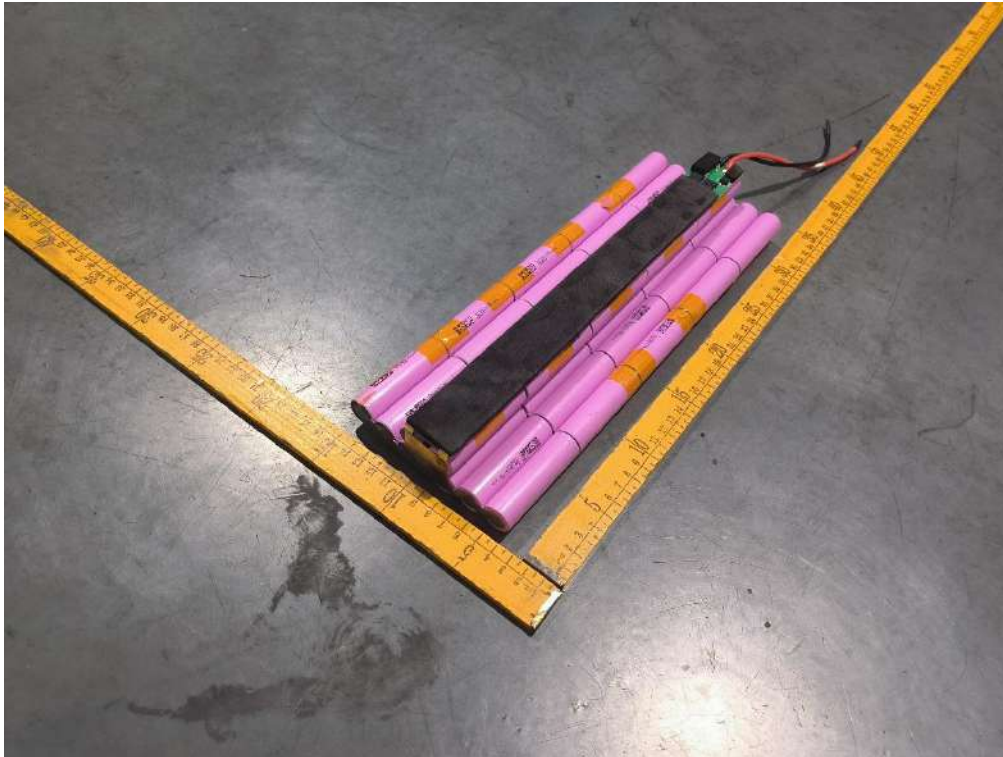


Fig.3 internal view I battery

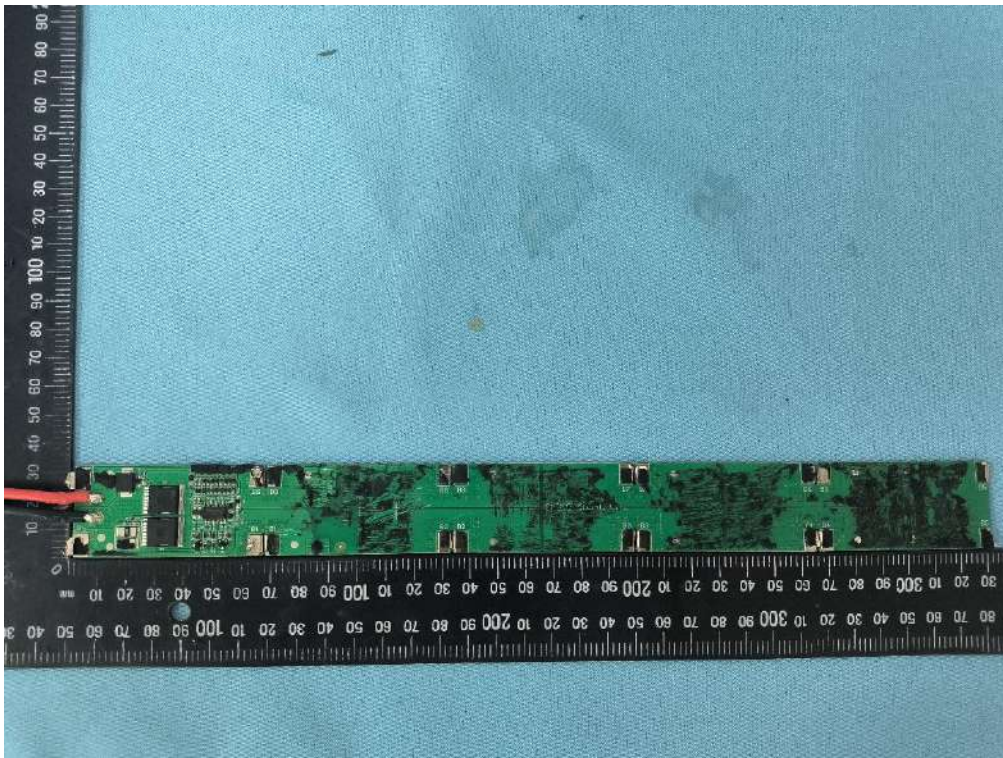


Fig.4 Component side view of PCB



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Photos



Fig.5 Trace side view of PCB



Fig.6 General view I of cell

