TEST REPORT

Report No.:	DGCTL202309220003A
Product:	Rechargeable Li-ion Cell Pack
Model No.:	18650-3S
Applicant:	Guangdong JCTC Power Co., Ltd
Issued by:	Dongguan CTL Electromagnetic Technology Co., Ltd.
Lab Location:	Room 107, No.2, Block 1, Area 1, Headquarters Road No.2, Songshanhu Hi-tech Development Zone, Dongguan, Guangdong, P.R. China.
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TEST REPORT
IEC 62133-2:2017+AMD1: 2021
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. .....:	DGCTL202309220003A
Date of issue .....:	2023-10-23
Total number of pages.....	25 pages
Applicant's name.....:	Guangdong JCTC Power Co., Ltd
Address .....:	6F, Building 5, Dongsheng Industrial Park, No.100, Taxin Road, Dongkeng Town Dongguan, Guangdong, China
Test specification:	
Standard.....:	IEC 62133-2: 2017+AMD1: 2021
Test procedure .....:	Test Report
Non-standard test method.....:	N/A
Test item description .....:	Rechargeable Li-ion Cell Pack
Trade Mark .....:	/
Manufacturer.....:	ShenZhen Enjapower Technology Co., Ltd Yingjia Industrial Park, No.1 Hekeng Road, Qinghuang Village, Qingxi Town, Dongguan City
Model/Type reference .....:	18650-3S
Ratings .....:	11.1V, 2500mAh, 27.75Wh

Testing procedure and testing location:		
Testing Laboratory .....:	Dongguan CTL Electromagnetic Technology Co., Ltd.	
Testing location/ address .....:	Room 107, No.2, Block 1, Area 1, Headquarters Road No.2, Songshanhu Hi-tech Development Zone, Dongguan, Guangdong, P.R. China.	
Tested by (name + signature) .....:	Leo chen	
Reviewed by (name + signature).....:	Troy huang	
Approved by (name + signature) ..... :	Cantic peng	
List of Attachments (including a total number of pages in each attachment): Attachment NO.1: 3 pages of Photo Documentation		
Summary of testing:		
Tests performed (name of test and test clause): Tests are made with the number of samples specified in Table 2 of IEC 62133-2: 2017+AMD1: 2021. cl. 7.2.1 Continuous charging at constant voltage (cells) cl. 7.3.1 External short-circuit (cell) cl. 7.3.2 External short-circuit (battery) cl. 7.3.3 Free fall (cell and battery) cl. 7.3.4 Thermal abuse (cells) cl. 7.3.5 Crush (cells) cl. 7.3.6 Over-charging of battery cl. 7.3.7 Forced discharge (cells) cl. 7.3.8.1 Vibration cl. 7.3.8.2 Mechanical shock cl. 7.3.9 Forced internal short circuit (cells)	**Testing location:** Dongguan CTL Electromagnetic Technology Co., Ltd. Room 107, No.2, Block 1, Area 1, Headquarters Road No.2, Songshanhu Hi-tech Development Zone, Dongguan, Guangdong, P.R. China.	
Summary of compliance with National Differences List of countries addressed: The product fulfils the requirements of EN62133-2: 2017		

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.

Rechargeable Li-ion Cell Pack

Model: 18650-3S (3ICR19/66)

11.1V 2500mAh 27.75Wh

Red + Black -

Data code: YYYYMMDD

ShenZhen Enjapower Technology Co., Ltd

Test item particulars ..... :	
Classification of installation and use ..... :	Build-in and use in portable applications
Supply connection ..... :	Supply by connector
Recommend charging method declared by the manufacturer ..... :	Charging the battery with 500mA constant current and 12.6V constant voltage until the current reduces to 50mA at ambient 20°C±5°C.
Discharge current (0,2 I_t A) ..... :	500mA
Chemistry ..... :	☐ nickel systems ..... ☒ lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell ..... :	4.2V
Maximum charging current ..... :	2500mA
Charging temperature upper limit ..... :	45°C
Charging temperature lower limit ..... :	0°C
Polymer cell electrolyte type ..... :	☐ gel polymer ..... ☐ solid polymer
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 ..... :	2023-10-08
Date (s) of performance of tests ..... :	2023-10-08 to 2023-10-23

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.

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) ..... :	ShenZhen Enjapower Technology Co., Ltd Yingjia Industrial Park, No.1 Hekeng Road, Qinghuang Village, Qingxi Town, Dongguan City

General product information:

The battery, model no. 18650-3S, is used in portable applications and consists of three Rechargeable Li-ion Cells(3S1P), model no. NCM18650-2500.

Additionally, details information of the battery and the cell built in battery, as following:

Product name	Rechargeable Li-ion Cell	Rechargeable Li-ion Cell Pack
Product model	NCM18650-2500	18650-3S
Rated capacity	2500mAh	2500mAh
Nominal voltage	3.6V	11.1V
Charing current declared by manufacturer	1250mA	500mA
Maximum charging current	2500mA	2500mA
Standard charging voltage	4.2V	12.6V
Upper limit charging voltage	4.2V	12.6V
Charging temperature upper limit	45°C	45°C
Charging temperature lower limit	0°C	0°C
Specified final voltage	2.75V	8.25V

The final evaluation of the battery must be conducted in the end product for which the battery will be used.

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
4	**Parameter measurement tolerances**		**P**
	Parameter measurement tolerances		P
5	**General safety considerations**		**P**
5.1	General		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	No metal surface exists.	N/A
	Insulation resistance (MΩ) ..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate creepage and clearance distances between conductors		P
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		P
5.3	Venting		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition	Venting mechanism exists on the cylindrical cells.	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/current management		N/A
	Batteries are designed such that abnormal temperature rise conditions are prevented		N/A
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		N/A
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the temperature, voltage and current limits specified		N/A
5.5	Terminal contacts		P
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		P

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
	Terminal contacts are arranged to minimize the risk of short circuits		P
5.6	Assembly of cells into batteries		P
5.6.1	General		P
	Each battery 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	3S1P	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		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		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
	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

IEC 62133-2: 2017+AMD1: 2021			
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	Charging voltage: 4.2V, not exceed 4.2V specified in Clause 7.1.2, Table 2.	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		P
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		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		P
5.7	Quality plan		P
	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	The manufacturer has such quality plan	P
5.8	**Battery safety components**		P
	According annex F		P

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
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	Tests are performed according to specified in Table 1of this standard. The samples 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 cell	N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °C	Tests are carried out at 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		P
7	**Specific requirements and tests (lithium systems)**		**P**
7.1	Charging procedures for test purposes		P
7.1.1	First procedure: This charging procedure applied to tests other than those specified in 7.1.2		P
7.1.2	Second procedure: This charging procedure applied to the tests of 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P
	If a cell's specified upper and/or lower charging temperature exceeds values for the upper and/or lower limit test temperatures of Table 2	Charge temperature 0-45°C declared.	P
7.2	Intended use		P
7.2.1	Continuous charging at constant voltage (cells)		P
	Results: No fire. No explosion..... :	(See Table 7.2.1)	P
7.2.2	Moulded case stress at high ambient temperature (battery)	No moulded case exists.	N/A
	Oven temperature (°C).....:		—
	Results: No physical distortion of the battery casing resulting in exposure of internal components		N/A
7.3	Reasonably foreseeable misuse		P
7.3.1	External short-circuit (cell)		P
	The cells were tested until one of the following occurred: - 24 hours elapsed; or		N/A

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
	- The case temperature declined by 20% of the maximum temperature rise		P
	Results: No fire. No explosion..... :	(See Table 7.3.1)	P
7.3.2	External short-circuit (battery)		P
	The batteries were tested until one of the following occurred: - 24 hours elapsed; or		N/A
	- The case temperature declined by 20% of the maximum temperature rise		P
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		P
	A single fault in the discharge protection circuit should be conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test.		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.2)	P
7.3.3	Free fall		P
	Results: No fire. No explosion.	No fire. No explosion.	P
7.3.4	Thermal abuse (cells)		P
	The cells were held at 130°C ± 2°C for: - 30 minutes	130°C, 10 minutes	P
	Oven temperature (°C)..... :	130°C	—
	Results: No fire. No explosion.	No fire, No explosion.	P
7.3.5	Crush (cells)		P
	The crushing force was released upon: - The maximum force of 13 kN ± 0.78 kN has been applied; or		P
	- An abrupt voltage drop of one-third of the original voltage has been obtained; or		N/A
	A cylindrical or prismatic cell is crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus.		P
	Test only the wide side of prismatic cells.		N/A
	A coin cell shall be crushed by applying the force on its flat surface.		N/A
	Results: No fire. No explosion..... :	(See Table 7.3.5)	P
7.3.6	Over-charging of battery		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

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
	1,2 times the upper limit charging voltage presented in Table A.1 per cell for series connected multi-cell batteries, and	3S1P	P
	Test was continued until the temperature of the outer casing: - 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 Table 7.3.6)	P
7.3.7	Forced discharge (cells)		P
	If the discharge voltage reaches the negative value of upper limit charging voltage within the testing duration, the voltage shall be maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration. (Case 1 of Figure 1)		N/A
	If the discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration, the test shall be terminated at the end of the testing duration. (Case 2 of Figure 1)		P
	Results: No fire. No explosion..... :	(See 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 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 Table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short circuit (cells)		P
	The cells complied with national requirement for .....:	France, Japan, Republic of Korea and Switzerland.	—
	The pressing was stopped upon: - 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	P
	Results: No fire ..... :	(See Table 7.3.9)	P

8	**Information for safety**		P
8.1	General		P

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
	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		N/A
8.2	Small cell and battery safety information	Not small 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
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A
9	**Marking**		**P**
9.1	Cell marking		N/A
	Cells marked as specified in IEC 61960, except coin cells	The final product is battery.	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.	P

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
	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	Not coin cell.	N/A
	Terminals have clear polarity marking on the external surface of the battery		N/A
	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	Connector used.	P
9.3	Caution for ingestion of small cells and batteries	Not small battery.	N/A
	Coin cells and batteries identified as small batteries according to 8.2 shall 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 is given in manufacturer's specifications.	P
	Recommended charging instructions	Information is given in manufacturer's specifications.	P
10	**Packaging and transport**		P
	Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3	Not coin cell.	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		P
Annex A	**Charging 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	4.2V applied.	P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		P

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied	4.2V applied.	P
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Charging temperature range declared by client is 0-45°C.	P
A.4.3	High temperature range	Not higher than the temperature range specific in this standard.	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 high temperature range		N/A
A.4.3.4	Safety consideration when specifying new upper limit in high temperature range		N/A
A.4.4	Low temperature range	Charing low temperature declared by client is 0°C.	P
A.4.4.1	General		P
A.4.4.2	Explanation of safety viewpoint		P
A.4.4.3	Safety considerations, when specifying charging conditions in low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range	-5°C applied	P
A.4.5	Scope of the application of charging 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
	The insertion procedure carried out at 20°C±5°C and under -25 °C of dew point		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle to cylindrical cell		P
A.5.5.1	Insertion of nickel particle to winding core		P
A.5.5.2	Mark the position of nickel particle on the both end of winding core of the separator		P
A.5.6	Insertion of nickel particle to prismatic cell		N/A

IEC 62133-2: 2017+AMD1: 2021			
Clause	Requirement + Test	Result - Remark	Verdict
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
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 cell.	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
ANNEX F	**COMPONENT STANDARDS REFERENCES**		N/A

	TABLE: Critical components information				P
Object/part no.	**Manufacturer/ trademark**	**Type/model**	**Technical data**	**Standard**	**Mark(s) of conformity**
Cell	Zhongbei Runliang New Energy (Jining) Co.,Ltd.	NCM18650-2500	3.7Vdc, 2600mAh	IEC 62133-2: 2017+AMD1: 2021	Tested with appliance
-Electrolyte	Guangzhou TinciMaterialsTechnology Co., Ltd.	2688A	LiPF6, EC, EMC, DMC	--	--
-Separator	W-SCOPEKOREA CO., LTD	16um	PE, single layer, 16umx61.51mm, shutdown temp:135°C	--	--
-Positive electrode	Xinxiang Tianli Lithium EnergyCo., Ltd.	TL550	iNio5Coo2Mno302NMP, PVDF, Conductive Additive, Aluminum foil	--	--
-Negative electrode	Jiangmen Rongcarbon Electronic Materials Co., Ltd.	ZH-66	Graphite, CMC, SBRConductive Additive, Copper foil	--	--
IC(U1)	ABLIC Inc.	S-8254AAVFT-TB-U	Over charge detection voltage: 4.250V ±0.025V, Over discharge detection voltage: 2.70V±0.080V, Topr: -40°C to 85°C	--	Tested with appliance
MOSFET(Q1-Q4)	ALPHA & OMEGA SEMICONDUCTOR	AO4407C	VDS: -30V, VGS: ±25V, TJ: -55°C to 150°C	--	Tested with appliance
Wring	Dongguan Yongsheng Electronic Technology Co. , Ltd.	3239	22AWG, 300Vac, 80°C	--	Tested with appliance
Blue tubing	Dongguan Huazhiqi Plastic Products Co., Ltd.	V-0	V-0, 75°C	--	Tested with appliance
Connector	ZHEJIANG LIANHE ELECTRONIC CO LTD	XH2.54	V-0, 85°C	--	Tested with appliance
Supplementary information: N/A					

7.2.1	TABLE: Continuous charging at constant voltage (cells)			P
Model	**Recommended charging voltage V_c, (Vdc)**	**Recommended charging current I_{rec}, (A)**	**OCV at start of test, (Vdc)**	**Results**
NCM18650-2500 (#C1)	4.2	1.25	4.18	A,B
NCM18650-2500 (#C2)	4.2	1.25	4.18	A,B
NCM18650-2500 (#C3)	4.2	1.25	4.19	A,B
NCM18650-2500 (#C4)	4.2	1.25	4.17	A,B
NCM18650-2500 (#C5)	4.2	1.25	4.18	A,B

Supplementary information:

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

7.3.1	TABLE: External short circuit (cell)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (°C)**	**Results**
Samples charged at charging temperature upper limit(45ºC)					
NCM18650-2500 (#C6)	55.7	4.17	0.081	57.7	A,B
NCM18650-2500 (#C7)	55.1	4.18	0.083	63.8	A,B
NCM18650-2500 (#C8)	55.1	4.17	0.087	59.4	A,B
NCM18650-2500 (#C9)	55.1	4.16	0.084	62.6	A,B
NCM18650-2500 (#C10)	55.2	4.19	0.086	60.5	A,B
Samples charged at charging temperature lower limit(-5ºC)					
NCM18650-2500 (#C11)	55.1	4.05	0.082	65.4	A,B
NCM18650-2500 (#C12)	55.1	4.06	0.083	66.4	A,B
NCM18650-2500 (#C13)	55.2	4.06	0.081	65.7	A,B

NCM18650-2500 (#C14)	55.2	4.06	0.087	66.2	A,B
NCM18650-2500 (#C15)	55.2	4.05	0.085	66.0	A,B

Supplementary information:

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

7.3.2	TABLE: External short circuit (battery)				P
Model	**Ambient, (°C)**	**OCV at start of test, (Vdc)**	**Resistance of circuit, (Ω)**	**Maximum case temperature rise ΔT, (°C)**	**Results**
Fault condition: /					
18650-3S (#B1)	22.7	12.55	0.082	14.8	A,B
18650-3S (#B2)	22.6	12.55	0.083	15.2	A,B
18650-3S (#B3)	23.0	12.53	0.082	14.9	A,B
18650-3S (#B4)	23.1	12.54	0.081	14.6	A,B
Normal condition					
18650-3S (#B5)	23.0	12.54	0.088	15.4	A,B

Supplementary information:

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

7.3.5	TABLE: Crush				P
Model	**OCV at start of test, (Vdc)**	**OCV at removal of crushing force, (Vdc)**	**Width/ diameter of cell before crush, (mm)**	**Required deformation for crush, (mm)**	**Results**
Samples charged at charging temperature upper limit(45ºC)					
NCM18650-2500 (#C26)	4.18	4.17	-	-	A,B
NCM18650-2500 (#C27)	4.16	4.15	-	-	A,B
NCM18650-2500 (#C28)	4.17	4.16	-	-	A,B
NCM18650-2500	4.17	4.16	-	-	A,B

(#C29)					
NCM18650-2500 (#C30)	4.18	4.17	-	-	A,B
Samples charged at charging temperature lower limit(-5ºC)					
NCM18650-2500 (#C31)	4.05	4.04	-	-	A,B
NCM18650-2500 (#C32)	4.06	4.05	-	-	A,B
NCM18650-2500 (#C33)	4.06	4.05	-	-	A,B
NCM18650-2500 (#C34)	4.06	4.05	-	-	A,B
NCM18650-2500 (#C35)	4.05	4.04	-	-	A,B

Supplementary information:

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

7.3.6	**TABLE: Over-charging of battery**	**P**
Constant charging current (A) .....:	**5**	**—**
Supply voltage (Vdc) .....:	**15.12**	**—**

Model	OCV before charging, (Vdc)	Resistance of circuit, (mΩ)	Maximum outer casing temperature, (°C)	Results
18650-3S (#B9)	9.90	88	52.9	A,B
18650-3S (#B10)	9.92	91	59.8	A,B
18650-3S (#B11)	9.91	86	56.4	A,B
18650-3S (#B12)	9.94	93	53.7	A,B
18650-3S (#B13)	9.96	85	55.5	A,B

Supplementary information:

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

7.3.7	**TABLE: Forced discharge (cells)**	**P**

Model	OCV before application of reverse charge, (Vdc)	Measured Reverse charge I_t, (A)	Time for reversed charge, (minutes)	Results
NCM18650-2500 (#C36)	3.32	2.5	90	A,B
NCM18650-2500 (#C37)	3.30	2.5	90	A,B
NCM18650-2500 (#C38)	3.33	2.5	90	A,B
NCM18650-2500 (#C39)	3.31	2.5	90	A,B
NCM18650-2500 (#C40)	3.30	2.5	90	A,B

Supplementary information:

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

7.3.8.1	TABLE: Vibration	P

Model	Pre-test Mass (g)	Pre-test Voltage (V)	After test Mass (g)	After test Voltage (V)	Results
18650-3S (#B14)	143.217	12.53	143.215	12.53	A,B
18650-3S (#B15)	143.395	12.55	143.393	12.54	A,B
18650-3S (#B16)	143.384	12.55	143.382	12.54	A,B

Supplementary information:

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

7.3.8.2	TABLE: Mechanical shock	P

Model	Pre-test Mass (g)	Pre-test Voltage (V)	After test Mass (g)	After test Voltage (V)	Results
18650-3S (#B17)	143.404	12.54	143.404	12.54	A,B
18650-3S (#B18)	143.226	12.55	143.226	12.55	A,B
18650-3S (#B19)	143.393	12.54	143.393	12.54	A,B

Supplementary information:
A- No fire or explosion
B- No leakage or rupture or venting
C- Leakage or rupture or venting
D- Fire
E- Explosion
F- Bulge
G- Others (please explain)

7.3.9	TABLE: Forced internal short circuit (cells)				N/A
Model	**Chamber ambient, (°C)**	**OCV at start of test, (Vdc)**	**Particle location [1)]**	**Maximum applied pressure, (N)**	**Results**
NCM18650-2500 (#C41)	10	4.08	1	800	A
NCM18650-2500 (#C42)	10	4.07	1	800	A
NCM18650-2500 (#C43)	10	4.07	1	800	A
NCM18650-2500 (#C44)	10	4.07	1	800	A
NCM18650-2500 (#C45)	10	4.08	1	800	A
NCM18650-2500 (#C46)	45	4.18	1	800	A
NCM18650-2500 (#C47)	45	4.17	1	800	A
NCM18650-2500 (#C48)	45	4.17	1	800	A
NCM18650-2500 (#C49)	45	4.18	1	800	A
NCM18650-2500 (#C50)	45	4.18	1	800	A

Supplementary information:
[1)] Identify one of the following**:**
1: Nickel particle inserted between positive and negative (active material) coated area.
2: Nickel particle inserted between positive aluminium foil and negative active material coated area.

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

Attachment 1: Photo documentation

Fig.1-Front view of battery

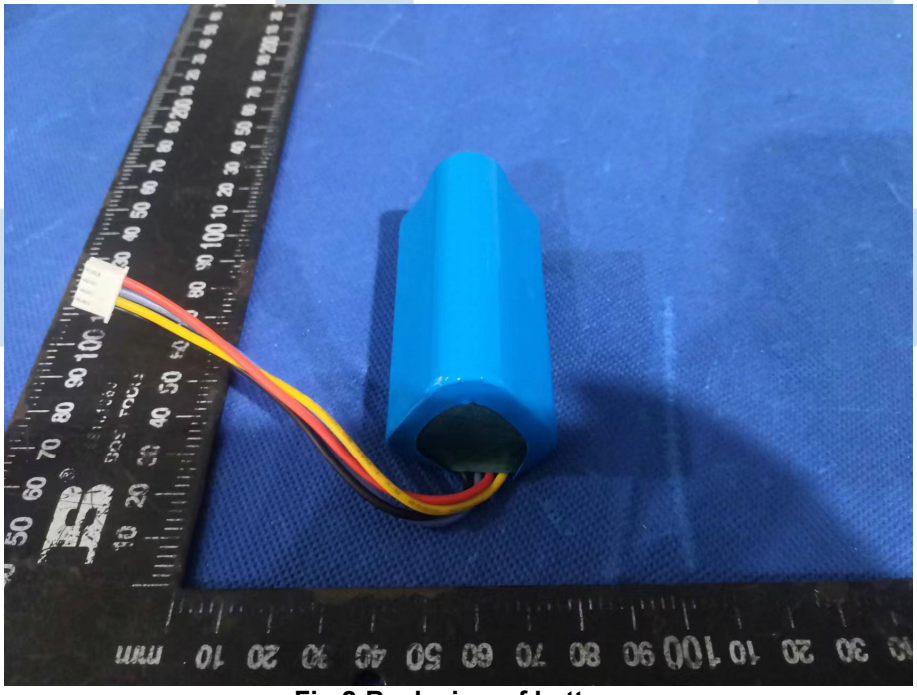

Fig.2-Back view of battery

Attachment 1: Photo documentation

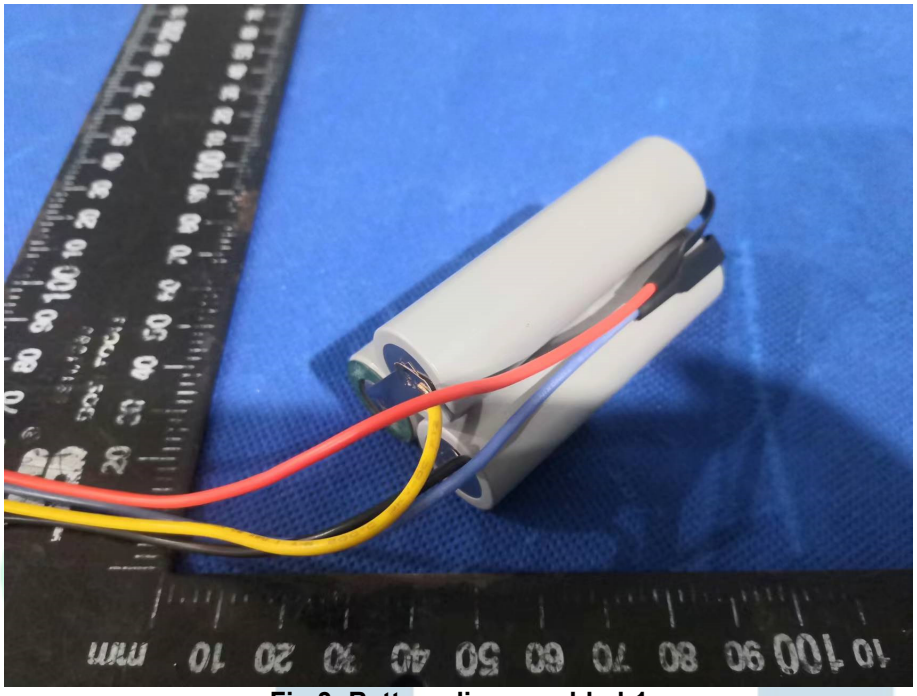

Fig.3- Battery disassembled-1

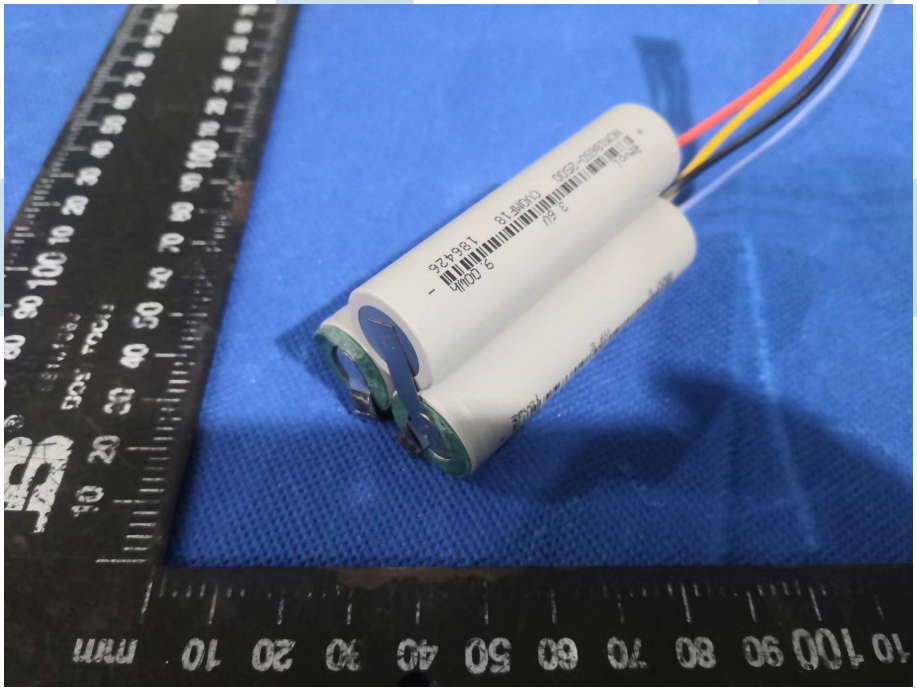

Fig.4- Battery disassembled-2

Attachment 1: Photo documentation

Fig.5-Front view of Cell

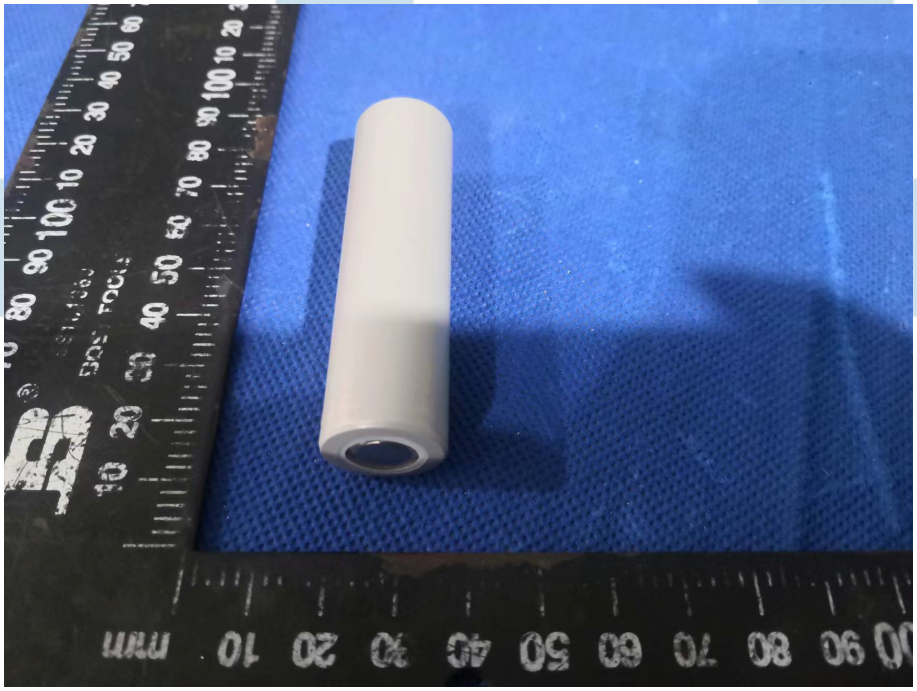

Fig.6-Back view of Cell

--End of Test Report--