TEST REPORT
IEC 62619
Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications

Report Number. .....:	5061723021301-00
Date of issue .....:	2023-07-25
Total number of pages.....:	23 pages
Name of Testing Laboratory preparing the Report .....:	TÜV SÜD New Energy Vehicle Testing (Jiangsu) Co., Ltd.
Applicant's name.....:	Jiangsu SolarEast Energy Storage Technology Co., Ltd
Address .....:	No. 199, Yingzhou South Road Haizhou District 222243 Lianyungang City, Jiangsu Province PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard.....:	IEC 62619:2022
Test procedure .....:	TÜV Mark
Non-standard test method.....:	N/A
TRF template used .....:	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.....:	IEC62619B
Test Report Form(s) Originator.....:	UL(Demko)
Master TRF.....:	Dated 2022-06-23

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This report is not valid as a CB Test Report unless signed by an approved IECEE Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
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Test item description .....:	Rechargeable Li-ion Battery System
Trade Mark(s).....:	N/A
Manufacturer.....:	Jiangsu Solareast Energy Storage Technology Co., Ltd No. 199, Yingzhou South Road Haizhou District 222243 Lianyungang City, Jiangsu Province PEOPLE'S REPUBLIC OF CHINA
Model/Type reference.....:	PowerCool-LFP5000
Ratings .....:	51.2Vd.c., 102Ah

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

☒ **Testing Laboratory:**	TÜV SÜD New Energy Vehicle Testing (Jiangsu) Co., Ltd.
Testing location/ address.....:	No.15 Factory Building A, Jintong International Industrial Park, No.8 Xihu Road, Changzhou, Jiangsu, 213164, P. R. China
Tested by (name, function, signature).....:	Haiyang Liu (Project Handler)
Approved by (name, function, signature)...:	Xiaohang Chen (Designated Reviewer)

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

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
In section 7 and 8, tests of clauses 7.2.3.3, 8.2.2, 8.2.3 and 8.2.4 were performed with battery system PowerCool-LFP5000. - Cl. 7.2.3.3 Edge or corner drop test (cell or cell block, and battery system) - Cl. 8.2.2 Overcharge control of voltage (battery system) - Cl. 8.2.3 Overcharge control of current (battery system) - Cl. 8.2.4 Overheating control (battery system) The samples comply with the above requirements of IEC 62619:2022 (First Edition).	TÜV SÜD New Energy Vehicle Testing (Jiangsu) Co., Ltd. (clause 7.2.3.3) No.15 Factory Building A, Jintong International Industrial Park, No.8 Xihu Road, Changzhou, Jiangsu, 213164, P. R. China

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

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Copy of marking plate:

Below marking plates will be pasted on the surface of the battery system:

Remark:

1. Q95710012304150000
   Q9: Made in SolarEast;
   5: Brand code for SolarEast;
   71: Satus for installation of cells in battery system, “71” stands for installation with cells, “72” stands for installation without cells.
   001: Installation type, 001 stands for Plug-in type for 5kWh, 002 stands for stacked for high voltage 5kWh， 003 stands for stacked low voltage 5kWh;
   230415: Production date;
   - “23” stands for 2023, “24” stands for 2024,…….
   -“04” stands for April, “5” stand for May,…….
   -“15” stands for 15th day in one month, “15”stands for 16th day in one month,…….
   0000: Production line.
2. “+”, “-” are marked near the polarity of the battery system, “+” positive electrode; “-” negative electrode.
3. The code “ Q95710012304150000” can trace the manufacture information of the battery system. This is not the actual code and only for example.

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Test item particulars.....:	
Classification of installation and use .....:	Used in industrial application
Supply Connection .....:	Supply by terminal
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 .....:	2023-04-23
Date (s) of performance of tests.....:	2023-04-30 to 2023-05-16

General remarks:

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

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

Remark: Photo Documentation: 11 pages

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).....:	Jiangsu SolarEast Energy Storage Technology Co., Ltd No. 199, Yingzhou South Road Haizhou District 222243 Lianyungang City, Jiangsu Province PEOPLE'S REPUBLIC OF CHINA

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General product information and other remarks:

1. The rechargeable lithium-ion battery system, model no. PowerCool-LFP5000 is used in industrial appliance. Battery system consists of 2 Rechargeable Li-ion Battery Module connected in series.
2. The Rechargeable Li-ion Battery Module consists of 8 approved Rechargeable Li-ion Cell with model no. IFP50160116A-102Ah connected in series.
3. The Rechargeable Li-ion Battery System PowerCool-LFP5000 can be used in parallel. Additionally, details information of the battery and the built-in cell are shown in following table:

Product name	**Rechargeable Li-ion Cell**	**Rechargeable Li-ion Battery Module**	**Rechargeable Li-ion Battery System**
Type/model	IFP50160116A-102Ah	1P8S/102Ah	PowerCool-LFP5000
Nominal voltage	3.2V	25.6V	51.2Vd.c.
Rated capacity	102Ah	102Ah	102Ah
Charging voltage declared by manufacturer	3.65V	3.6V for cell 28.8V for module	3.6V for cell, 57.6V for pack
Upper limit charging voltage	3.9V	3.65 V for cell 29.2 V for module	3.65V for cell, 58.4V for pack
Charging current declared by manufacturer	20.4A	20.4A	20.4A
Maximum continuous charging current	50A	50A	50A
Discharging current declared by manufacturer	20.4 A	20.4A	20.4A
Maximum continuous discharging current	125A	80A	80A
Discharge cut-off voltage	2.0V	2.8V for cell 22.3V for module	2.8V for cell 44.8V for pack
Standard temperature range for charging	0°C to 60°C	0°C to 50°C	0°C to 50°C
Standard temperature range for discharging	-20°C to 65°C	-10°C to 50°C	-10°C to 50°C
Standard charging method by manufacturer	Charge at constant current 20.4A until voltage reaches 3.65 V, then charge at constant voltage 3.65 V till current is 5.1A.	Charge at constant current 20.4A until the max cell voltage reaches 3.6V. Then still for 30 min followed by charging at constant current 5A until the max cell voltage reaches 3.6V.	Charge at constant current 20.4A until the max cell voltage reaches 3.6V or pack voltage reaches 57.6 V, whichever comes first. Then still for 30min followed by charging at constant current 5A until the max cell voltage reaches 3.6V or pack voltage reaches 57.6V whichever comes first.
Charging method for internal short-circuit test	Charge at constant current 50A until voltage reaches 3.65 V, then charge at	—	—

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	constant voltage 3.65 V till current is 0.05I_t A (5.1A)		
Dimension	Height: (118.5±0.5) mm Thickness: (49.9±0.5) mm Width: (160±0.8) mm	Height: (129±2) mm Width: (162±2) mm Length: (455±3) mm	Height: (138±2) mm, Length: (560±2) mm Width: (390±2) mm
Weight	(1947±30) g	(17±0.5) kg	(45±1) kg
Configuration	—	8S	(8S)2S

Information for testing sample:

Sample Type	Test Item
Battery system PowerCool-LFP5000	tests of clause 7.2.3.3, 8.2.2, 8.2.3 and 8.2.4

4	**PARAMETER MEASUREMENT TOLERANCES**		P
	Parameter measurement tolerances		P

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5	**GENERAL SAFETY CONSIDERATIONS**		P
5.1	**General**		P
	Cells and batteries are safe under conditions of both intended use and reasonably foreseeable misuse ...:		P
	Reduce the risk of injuries from moving parts		P
5.2	**Insulation and wiring**		P
	Voltage, current, altitude, and humidity requirements		P
	Adequate clearances and creepage distances between connectors and live parts at different voltages or between live parts and non-current-carrying accessible parts		P
	Protect from hazardous live parts, including during installation		P
	The mechanical integrity of internal connections		P
5.3	**Venting**		P
	Pressure relief function		P
	Encapsulation used to support cells within an outer casing		P
5.4	**Temperature/voltage/current management**		P
	The design prevents abnormal temperature-rise		P
	Voltage, current, and temperature limits of the cells		P
	Specifications and charging instructions for equipment manufacturers		P
5.5	**Terminal contacts of the battery pack and/or battery system**		P
	Polarity marking(s)		P
	Polarity marking not provided for keyed external connector		P
	Capability to carry the maximum anticipated current		P
	External terminal contact surfaces		P
	Terminal contacts are arranged to minimize the risk of short circuits		P
5.6	**Assembly of cells, modules, or battery packs into battery systems**		P
5.6.1	General		P
	Independent control and protection method(s)		P
	Recommendations of cell operating limits, mounting advice, storage conditions and other design recommendations by the cell manufacturer		P
	Batteries designed for the selective discharge of a portion of their series connected cells		N/A

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	Protective circuit component(s) and consideration to the end-device application		P
5.6.2	Battery system design		P
	The voltage control function		P
	Maximum charging/discharging current of the cell are not exceeded		P
5.7	**Operating region of lithium cells and battery systems for safe use**		P
	The cell operating region .....:	See page 5 & 6	P
	Designation of battery system to comply with the cell operating region		P
5.8	**System lock (or system lock function)**		P
	Non-resettable function to stop battery operation		P
	Manual with procedure for resetting of battery operation		P
	Emergency battery final discharge		P
5.9	**Quality plan**		P
	Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented .....:	Manufacturing quality plan was implemented ISO9001 certificate provided	P
	The process capabilities and the process controls		P

6	**TYPE TEST CONDITIONS**		P
6.1	**General**		P
6.2	**Test items**		P
	Cells or batteries that are not more than six months old (See Table 1 of IEC 62619)		P
	Capacity confirmation of the cells or batteries		P
	Default ambient temperature of test, 25 °C ± 5 °C		P

7	**SPECIFIC REQUIREMENTS AND TESTS**		P
7.1	**Charging procedure for test purposes**		P
	The battery discharged to a specified final voltage prior to charging		P
	The cells or batteries charged using the method specified by the manufacturer .....:	See page 5 & 6	P
7.2	**Reasonably foreseeable misuse**		P
7.2.1	External short-circuit test (cell or cell block)		N/A

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	Short circuit with total resistance of 30 m ± 10 m at 25 °C ± 5 °C		N/A
	Results: no fire, no explosion	See Table 7.2.1.	N/A
7.2.2	Impact test (cell or cell block)		N/A
	Cylindrical cell, longitudinal axis impact		N/A
	Prismatic cell, longitudinal axis and lateral axis impact		N/A
	Results: no fire, no explosion.		N/A
7.2.3	Drop test (cell or cell block, and battery system)		P
7.2.3.1	General		P
7.2.3.2	Whole drop test (cell or cell block, and battery system)		N/A
	Description of the Test Unit .....:		—
	Mass of the test unit (kg) .....:		—
	Height of drop (m).....:		—
	Results: no fire, no explosion		N/A
7.2.3.3	Edge and corner drop test (cell or cell block, and battery system)		P
	Description of the Test Unit .....:	model: PowerCool-LFP5000	—
	Mass of the test unit (kg) .....:	Measured: 44.50kg	—
	Height of drop (m).....:	0.1m	—
	Results: no fire, no explosion		P
7.2.4	Thermal abuse test (cell or cell block)		N/A
	Results: no fire, no explosion		N/A
7.2.5	Overcharge test (cell or cell block)		N/A
	For those battery systems that are provided with only a single protection for the charging voltage control		-
	Results: no fire, no explosion .....:	See Table 7.2.5.	N/A
7.2.6	Forced discharge test (cell or cell block)		N/A
	Cells connected in series in the battery system.....:		N/A
	Redundant or single protection for discharge voltage control provided in battery system .....:		N/A
	Target Voltage .....:		N/A
	Maximum discharge current of the cell, Im .....:		N/A
	Discharge current for forced discharge, 1.0 It.....:		N/A
	Discharging time, t = (1 It / Im) x 90 (min.).....:		N/A
	Results: no fire, no explosion .....:	See Table 7.2.6.	N/A

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7.3	**Considerations for internal short-circuit – Design evaluation**		N/A
7.3.1	General		N/A
7.3.2	Internal short-circuit test (cell)		N/A
	Samples preparation procedure: In accordance with Clause A.5 and A.6 of IEC 62133-2:2017		N/A
	Tested per 7.3.2 b) in an ambient temperature of 25 °C ± 5 °C.		N/A
	The appearance of the short-circuit location recorded by photograph or other means .....:		—
	The pressing was stopped - When a voltage drop of 50 mV was detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) was reached		N/A
	Results: no fire.....:	See Table 7.3.2.	N/A
7.3.3	Propagation test (battery system)	Test of clause 7.3.2 was performed in the approved cell report	N/A
	Method to create a thermal runaway in one cell ....:		N/A
	Results: No external fire from the battery system, no battery case rupture.....:		N/A

8	**BATTERY SYSTEM SAFETY (CONSIDERING FUNCTIONAL SAFETY)**		P
8.1	**General requirements**		**P**
	Functional safety analysis for critical controls		P
	Conduct of a process hazard analysis for both the cell manufacturing process and the battery system manufacturing process		P
	Conduct of risk assessment and mitigation of the battery system		P
8.2	**Battery management system (or battery management unit)**		**P**
8.2.1	Requirements for the BMS		P
	The safety integrity level (SIL) target of the BMS		P
	The charge control evaluated by tests in clauses 8.2.2 to 8.2.4		P
8.2.2	Overcharge control of voltage (battery system)		P
	The exceeded charging voltage applied to the whole battery system		P
	The exceeded charging voltage applied to only a part of the battery system, such as the cell(s).....:		P

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	Results: no fire, no explosion .....:	See Table 8.2.2.	P
	The BMS terminated the charging before exceeding the upper limit charging voltage		P
8.2.3	Overcharge control of current (battery system)		P
	Results: no fire, no explosion .....:	See Table 8.2.3	P
	The BMS detected the overcharging current and controlled the charging to a level below the maximum charging current		P
8.2.4	Overheating control (battery system)		P
	The cooling system, if provided, was disconnected		N/A
	Elevated temperature for charging, 5 °C above maximum operating temperature .....:		P
	Results: no fire, no explosion .....:	See Table 8.2.4	P
	The BMS detected the overheat temperature and terminated charging		P
	The battery system operated as designed during test		P

9	**EMC**		N/A
	Battery system fulfil EMC requirements of the end-device application .....:	See Table 9 [√] See attachment [4861923258000A] for detail EMC report [ ] Intended for to be tested in the end use application [*include specific application*]	N/A

10	**INFORMATION FOR SAFETY**		P
	The cell manufacturer provides information about current, voltage and temperature limits of their products		P
	The battery system manufacturer provides information regarding how to mitigate hazards to equipment manufacturers or end-users.		P

11	**MARKING AND DESIGNATION (REFER TO CLAUSE 5 OF IEC 62620)**		P
	The marking items shown in Table 1 in IEC 62620 indicated on the cell, battery system or instruction manual.		P
	Cell or battery system has clear and durable markings		P

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	Cell designation		N/A
	Battery designation		P
	Battery structure formulation		P

12	**PACKAGING AND TRANSPORT**		P
	Refer to Annex D		P

ANNEX A	**OPERATING REGION OF CELLS FOR SAFE USE**		P
A.1	General		P
A.2	Charging conditions for safe use		P
A.3	Consideration on charging voltage		P
A.4	Consideration on temperature		P
A.5	High temperature range		N/A
A.6	Low temperature range		N/A
A.7	Discharging conditions for safe use		P
A.8	Example of operating region		P

ANNEX B	**PROCEDURE OF 7.3.3 PROPAGATION TEST BY LASER IRRADIATION**		N/A
B.1	**General**		N/A
B.2	**Test conditions**		N/A
B.2.1	Cell test (preliminary test)		N/A
	The cell fully charged according to the manufacturer recommended conditions .....:		—
	Laser irradiation point on the cell .....:		—
	Output power of laser irradiation .....:		—
	Tested in an ambient temperature of 25 °C ± 5 °C		—
	Repeat of cell test for 3 times		—
B.2.2	Battery system test (main test)		N/A
	The battery system fully charged according to the manufacturer recommended conditions.....:		—
	Target cell to be laser irradiated.....:		—
	The irradiation point on the target cell same or similar as that on the cell test		—
	Output power of laser irradiation .....:		—
	Tested in an ambient temperature of 25 °C ± 5 °C		—

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ANNEX C	**PROCEDURE OF 7.3.3 PROPAGATION TEST BY METHODS OTHER THAN LASER**		N/A
C.1	General		N/A
C.2	Test conditions:		N/A
	– The battery fully charged according to the manufacturer recommended conditions.....:		—
	– Target cell forced into thermal runaway.....:		—
	– A specially prepared sample (e.g. a heater or a hole for nail penetration provided) used for ease of testing .....:		—
C.3	Method used for initiating the thermal runaway. 1) Heater (Heater, Burner, Laser, Inductive heating 2) Overcharge 3) Nail penetration of the cell 4) Combination of above methods 5) Other methods.....:		—

ANNEX D	**PACKAGING AND TRANSPORT**		P
	The materials and pack design chosen in a way as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants		P
	Regulations concerning international transport of secondary lithium batteries		P

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5.1	TABLE: Critical components information				
Object/part No.	**Manufacturer/ trademark**	**Type/Model**	**Technical Data**	**Standard**	**Marks of Conformity**
1.Cell (8pcs for one module)	Hefei Gotion High-tech Power Energy Co.,Ltd.	IFP50160116A-102Ah	3.2 Vd.c., 102Ah	IEC62619-2017	UL DK-110904-UL Report No.: RESS-4789845567-001
2.Busbar between cells	Changzhou Helong-sheng New Energy Technology Co., Ltd	Al1060	220 A, 500 V, -40~80°C, 104 mm^2	—	—
3.Busbar of modules	Changzhou Helong-sheng New Energy Technology Co., Ltd	Al1060	220 A, 500 V, -40~80°C, 104 mm^2	—	—
4.Cover plate	KING SCI & TECH CO LTD	JH960HT(M1)(sr)	1.5mm V-0 T_{opr}: -40~80°C,		UL E171666
5.Endplate plastic part	KING SCI & TECH CO LTD	JH960HT(M1)(sr)	2.0mm V-0 T_{opr}: -40~80°C,		UL E171666
6.Insulation sheet for module	SICHUAN DONGFANG INSULATING MATERIAL CO LTD	DFR117	0.5mm V-0 T_{opr}: -40~80°C,		UL E199019
7.Insulation sheet for pack	Shenzhen Futureway Technology Co., Ltd	SRL-1140F	2mm, V-0, -40 ~ +150°C		UL E519126
8. NTC (2pcs for one module)	Suzhou Xinliben Electronics Co., Ltd	SK103F6R1000ST-22#	R_{25} =10KΩ±1%, $B_{25/85}$=3435K±1%, T_{opr}: -40°C～150°C	—	—
9. Copper busbar	Changzhou Helong-sheng New Energy Technology Co., Ltd	Cu	220 A,500 V, -40~80°C, 36 mm^2	—	—
10. Sampling wire	Dongguan Haode Wire & Cable Technology Co Ltd	1332	24AWG, 300V, 200°C Flame class:V-1	UL758	UL E364036
11. LV Sampling connector	Molex	Receptacle Housing: 1729521601 Plug Housing: 0430201600	8.5 A, -40~+105°C, V-0	—	—

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5.1	TABLE: Critical components information				
Object/part No.	**Manufacturer/ trademark**	**Type/Model**	**Technical Data**	**Standard**	**Marks of Conformity**
12. Pre-charge wire	Dongguan Haode Wire & Cable Technology Co Ltd	1332	18AWG, 300V, 200°C	UL758	UL E364036
13. Insulator	Zhejiang Chloe Electronic Co., Ltd	BMC	-40~140°C, V-0	—	—
14. Positive connector (Socket/plug)	Huizhou Futronics Electronic Technology Co., Ltd	FSPC80160Z-25A4/FSPC80160Z-M6A	600 Vdc, 125 A, -40~+125°C, V-0	UL4128	UL-US-2217043-0
15. Negative connector (Socket/plug)	Huizhou Futronics Electronic Technology Co., Ltd	FSPC80160W-25B4/FSPC80160WZ-M6B	600 Vdc, 125 A, -40~+125°C, V-0	UL4128	UL-US-2217043-0
16. Fuse	Xi'an Sinofuse Electric Co., Ltd	RS308-HB-2G	170 Vdc, 160 A, DC170V@50kA	UL 248-1	UL E353337
17. Relay	Zhejiang Innuovo New Energy Technology Co., Ltd	INVE01-100NA/12HT	200 V,100 A, 12 V, -40 ~ +85°C	—	UDEM CE M.2023.206. C83625
18. DC SHUNT	Yueqing Xiqi Electric Technology Co., Ltd.	FL-2 100A/75mV	75 mV, 100 A, 120°C	—	—
19. Enclosure	Jiangsu Ketedi	Q235-A	1.2 mm	—	—
20. BMS	Hangzhou LiDe Communications., Ltd	Model: IBMS-16-M Hardware version: IBMS-16-M-1.0.0.1 Software version: SDK_2_13_0	Overcharge detection voltage for each cell 3.65 V, 58.4 for system. Over discharge detection voltage for each cell 2.70V, 44V for system Charge overcurrent detection current 55 A, Discharge overcurrent detection current: 90 A. High temperature protection: 52°C Low temperature protection: -10°C	—	—
-PCB material	YING PAI TECHNOLOGY	YP-04	130°C, V-0	UL 746A	UL E492700
-AFE (U24)	Texas Instruments Incorporated	BQ79616-Q1	11.0V-80.0V –40°C ~ +125°C	—	—

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5.1	TABLE: Critical components information				
Object/part No.	**Manufacturer/ trademark**	**Type/Model**	**Technical Data**	**Standard**	**Marks of Conformity**
-MCU (U16)	NXP	MIMXRT1051	2.0V-3.6V Topr: -40 ~ 105°C;	—	—
-CAN Communication chip (U2, U18, U37)	NXP	TJA1051T	-40°C ~ 125°C 4.5 V ~ 5.5 V	—	—
-RS485 Communication chip (U7)	TI	THVD1500	-40°C ~ 125°C 4.5V ~ 5.5V	—	—
-WIFI Communication chip (U15)	Espressif	ESP32-WROOM-32D	LCC, 18mm*19.2mm*3.2mm, -40°C ~85°C	—	Component test
-Isolation IC for communication (U36, U5, U17, U12)	2PAI Semiconductor	π122M31	3~5.5V, 3750V, -40°C ~ 125°C	UL 1577	UL E494497
-Isolation IC for communication (U23)	2PAI Semiconductor	π141M31	3~5.5V, 3750V, -40°C ~ 125°C	UL 1577	UL E494497
-Pre-charge resistance (R264)	Zhuhai Qinda Electronic Technology Co., LTD	15W60RJ	15W, 60Ω±5%	—	—
-Voltage sampling resistance (6, R154, R158, R174, R234, R245, R253)	YAGEO	RC0805	1/8W, 510kΩ±0.1%	—	—
-Balanced resistance (17, R221, R222, R225, R226, R229, R230, R233, R235, R238, R239, R242, R244, R248, R252, R255, R258, R262)	EVEROHMS	MA2512	1W, 10Ω±1%	—	—
-NTC on PCB (RT1)	YYFTR	SDNT1608X103 F3380FTF	R_{25} =10KΩ±1%, $B_{25/50}$=3435K±1%, T_{opr}: -55°C～125°C	—	—
-Memory chip (U53)	HDSC	BL24C512A	T_{opr}:-40°C ~ +85°C Voltage:1.7V to 5.5V	—	—
-Memory chip (U9, U54)	Integrated Silicon Solution, Inc	IS25LP064A-JBLE	T_{opr}:-40°C ~+85°C Voltage:2.3V to 3.6V	—	—

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5.1	TABLE: Critical components information				
Object/part No.	**Manufacturer/ trademark**	**Type/Model**	**Technical Data**	**Standard**	**Marks of Conformity**
-Power Management IC (U2)	Richtek	RT8068AZQW	T_{opr}:-40~125°C Voltage:2.7V to 5.5V	—	—
-Watchdog (U21)	3PEAK	TPV706S	T_{opr}:-40~125°C Voltage:3V to 5.5V	—	—
-Power Management IC for current and total voltage sampling (U19)	AMS	AS8510	T_{opr}:-40~125°C Voltage:3V to 3.6V	—	—
-Fuse (F5, F8, F9, F10)	Wayon	1206WCF200A0 63V	2A, 63V	—	—
-transformer (T6)	Vpsc	VPT85BB-01A	5.0V-5.0V,0.1A -40~125°C	—	—
-Relay (G1)	XIAMEN HONGFA ELECTROACOU STIC CO LTD	HF3FF-012-1ZS	12VDC 10A/277VAC T_{opr}:-40~105°C	UL 60947-1	UL E134517
-Optocoupler (T12)	Toshiba Electronic Devices & Storage Corporation	TLP291-GB	V_R=5V -55~110 °C	UL1577	UL E67349

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7.2.1	TABLE: External short-circuit test (cell or cell block)				N/A
Sample No.	**Ambient (at 25°C ± 5°C)**	**OCV at start of test (V dc)**	**Resistance of Circuit (mΩ)**	**Maximum Case Temperature Rise ΔT (°C)**	**Results**
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Supplementary information:

A – No fire or Explosion
B – Fire
C – Explosion
D – The test was completed after 6 h
E – The test was completed after the cell casing cooled to 20% of the maximum temperature rise
F – Other (Please explain):___

7.2.5	TABLE: Overcharge test (cell or cell block)					N/A
Sample No.	**OCV at start of test (V dc)**	**OCV at end of test (V dc)**	**Measured Maximum Charging Current (A)**	**Measured Maximum Charging Voltage (V dc)**	**Max. Cell Case Temperature, (°C)**	**Results**
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Supplementary information:

Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Test concluded when temperature reached a steady state condition
E – Test concluded when temperature returned to ambient
F – Other (Please explain): _____

7.2.6	TABLE: Forced discharge test (cell or cell block)				N/A
Sample No.	**OCV before applying reverse charge, (V dc)**	**Target Voltage (V dc)**	**Measured Reverse Charge Current It, (A)**	**Total Time for Reversed Charge Application (min)**	**Results**
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

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Supplementary information:

Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Other (Please explain): ___

7.3.2	TABLE: Internal short-circuit test (cell)	N/A

Sample No.	OCV at start of test, (V dc)	Particle location 1)	Maximum applied pressure, (N)	Results
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Supplementary information:

8) 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.

Results:

A – No fire or explosion
B – Fire
C – Explosion
D – Test concluded when 50 mV voltage drop occurred prior to reaching force limit
E – Test concluded when 800/400 N pressure was reached and 50 mV voltage drop was not achieved
F – Test was concluded when fire or explosion occurred
G – Other (Please explain): __

7.3.3	TABLE: Propagation test (battery system)	N/A

Sample No.	OCV of Battery System Before Test, (V dc)	OCV of Target Cell Before Test, (V dc)	Maximum Cell Case Temperature, (°C)	Maximum DUT Enclosure Temperature, (°C)	Results
-	-	-	-	-	-

Method of cell failure 1)	Location of target cell	Area for fire protection (m^2)
-	-	-

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Supplementary information:

1) Cell can be failed through laser exposure, applied heat, overcharge, nail penetration or combinations of these failures or other acceptable methods. See supporting documentation for details on cell failure method

2) If the battery system has no outer covering, the manufacturer is required to specify the area for fire protection.

Results:
A – No fire external to DUT enclosure or area for fire protection or no battery case rupture
B – Fire external to DUT enclosure or area for fire protection
C – Explosion
D – Battery case rupture
E – Other (Please explain): __

8.2.2	TABLE: Overcharge control of voltage (battery system)				P
Sample No.	**OCV at start of test for Cell/Cell Blocks, (V dc)**	**Maximum Charging Current, (A)**	**Max. Charging Voltage, (V dc)**	**Max. Voltage of Cell/Cell Blocks, (V dc)**	**Results**
PowerCool-LFP5000	2.888	50	57.303	3.595	A, D, F

	Charge Voltage Applied Battery System: 1)	
	Whole	**Part**
	68.640	-

Supplementary information:

The exceeded voltage can be applied to only a part of the system such as the cell(s) in the battery system per Figure 6 of IEC 62619, if it is difficult to do it in using the whole battery system.

Results:
A – No Fire or Explosion
B – Fire
C – Explosion
D – The voltage of the measured cells or cell blocks did not exceed the upper limit charging voltage
E – The voltage of the measured cells or cell blocks did exceed the upper limit charging voltage
F – All function of battery system did operate as intended during the test.
G – All function of battery system did not operate as intended during the test.
H – Other (Please explain): ___

8.2.3	TABLE: Overcharge control of current (battery system)			P
Sample No.	**OCV at start of test, (V dc)**	**Max. Charging Current, (A)**	**Max. Charging Voltage, (V dc)**	**Results**
PowerCool-LFP5000	47.139	60	48.470	A, D, F

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Supplementary information:

Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Overcurrent sensing function of BMU did operate and then charging stopped
E – Overcurrent sensing function of BMU did not operate and then charging stopped
F – All function of battery system did operate as intended during the test.
G – All function of battery system did not operate as intended during the test.
H – Other (Please explain): ____

8.2.4	TABLE: Overheating control (battery system)		P
Model No.	**OCV at start (SOC 50%) of test, V dc**	**Maximum Charging Current, A**	**Maximum Charging Voltage, V dc**
PowerCool-LFP5000	52.791	50	53.964
Maximum Specified Temperature of Battery System, °C		**Maximum Measured Cell Case Temperature, °C**	**Results**
50		50.9	A, D, F

Supplementary information:

Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Temperature sensing function of BMU did operate and then charging stopped
E – Temperature sensing function of BMU did not operate and then charging stopped
F – All function of battery system did operate as intended during the test.
G – All function of battery system did not operate as intended during the test.
H – Other (Please explain): ____

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9	TABLE: EMC				P
Standard used for EMC test:			EN IEC 61000-6-1:2019, EN IEC 61000-6-3:2021		
Sample No.	**EMC Test Item**	**Battery Condition**	**EMC Test Level/ Parameters**	**Compliance Criteria**	**Results**
Battery system PowerCool-LFP5000	Emission - Enclosure port	Charging and discharge mode	EN IEC 61000-6-3:2021, Clause 11 Table 1; 1.1, 1.4	-	A, D, E
Battery system PowerCool-LFP5000	Emission - Conducted Disturbance	Charging and discharge mode	EN IEC 61000-6-3:2021, Clause 11 Table 2; 2.1	-	A, D, E
Battery system PowerCool-LFP5000	Immunity - Enclosure ports - Power-frequency magnetic field	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 9 Table 1, 1.1	IEC 61000-4-8	A, D, E
Battery system PowerCool-LFP5000	Immunity - Enclosure ports - Radio-frequency electromagnetic field. Amplitude modulated	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 9 Table 1; 1.2, 1.3	IEC 61000-4-3	A, D, E
Battery system PowerCool-LFP5000	Immunity - Enclosure ports - Electrostatic Discharge	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 9 Table 1; 1.4	IEC 61000-4-2	A, D, E
Battery system PowerCool-LFP5000	Immunity - Radio-frequency common mode	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 9 Table 4; 4.1	IEC 61000-4-6	A, D, E
Battery system PowerCool-LFP5000	Immunity - Surges	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 9 Table 4; 4.4	IEC 61000-4-5	A, D, E
Battery system PowerCool-LFP5000	Immunity - Fast transients	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 9 Table 4; 4.5	IEC 61000-4-4	A, D, E

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Supplementary information:

Battery Condition During EMC test

1 – In Operation Mode, [√] Supplied at 51.2Vd.c., [√] Load at 20.4A

2 – In non-operation Mode, Battery state of charge (SOC) before test at around 30%

Compliance Criteria and Test Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Battery system did operate as intended during the test.
E - All function of battery system did operate as intended after the test.
F - All function of battery system did not operate as intended during the test, (Please explain): ____
G - Other (Please explain): ____

--- End of test report ---

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