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. .....:	5040823021304-00
Date of issue .....:	2023-11-15
Total number of pages.....:	29 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

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-LFP-HV-10 PowerCool-LFP-HV-15 PowerCool-LFP-HV-20 PowerCool-LFP-HV-25 PowerCool-LFP-HV-30 PowerCool-LFP-HV-35
Ratings ..... :	PowerCool-LFP-HV-10: DC 102.4V, 102Ah PowerCool-LFP-HV-15: DC 153.6V, 102Ah PowerCool-LFP-HV-20: DC 204.8V, 102Ah PowerCool-LFP-HV-25: DC 256.0V, 102Ah PowerCool-LFP-HV-30: DC 307.2V, 102Ah PowerCool-LFP-HV-35: DC 358.4V, 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) ..... :		Jishuai Ban (Project Handler)	Jishuai Ban
Approved by (name, function, signature) ... :		Haiyang Liu (Designated Reviewer)	Haiyang Liu

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

Item	Description	Certificate / Test report No.	Issued by	Model	Pages
1	EMC	4861923320500	TÜV SÜD	PowerCool-LFP-HV-10 PowerCool-LFP-HV-15 PowerCool-LFP-HV-20 PowerCool-LFP-HV-25 PowerCool-LFP-HV-30 PowerCool-LFP-HV-35	28
2	IEC 60730-1:2013, AMD1:2015, AMD2:2020	5040823021304-00 FS	TÜV SÜD	BCMU-AH-M-A0 BCMU-AH-E1-A0 BMU-C16B-A0	28

3	UN 38.3	UNWT(2023)09053	National Lithium Battery Product Quality Inspection and Testing Center	PowerCool-LFP-HV	13

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
In section 7, clause 7.2.3.3 was performed with battery module for PowerCool-LFP-HV. -Cl. 7.2.3.3 Edge or corner drop test (cell or cell block, and battery system); In section 8, The sample model tested in clauses 8.2.2, 8.2.3 and 8.2.4 was performed with PowerCool-LFP-HV-15. - 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 (Edition 2.0). Licence condition The final evaluation of the rechargeable lithium-ion battery systems must be conducted in the end product for which the energy storage system will be used. The battery system is suitable for connecting DC bus port 403.6V system voltage in end-use.	TÜV SÜD New Energy Vehicle Testing (Jiangsu) Co., Ltd. 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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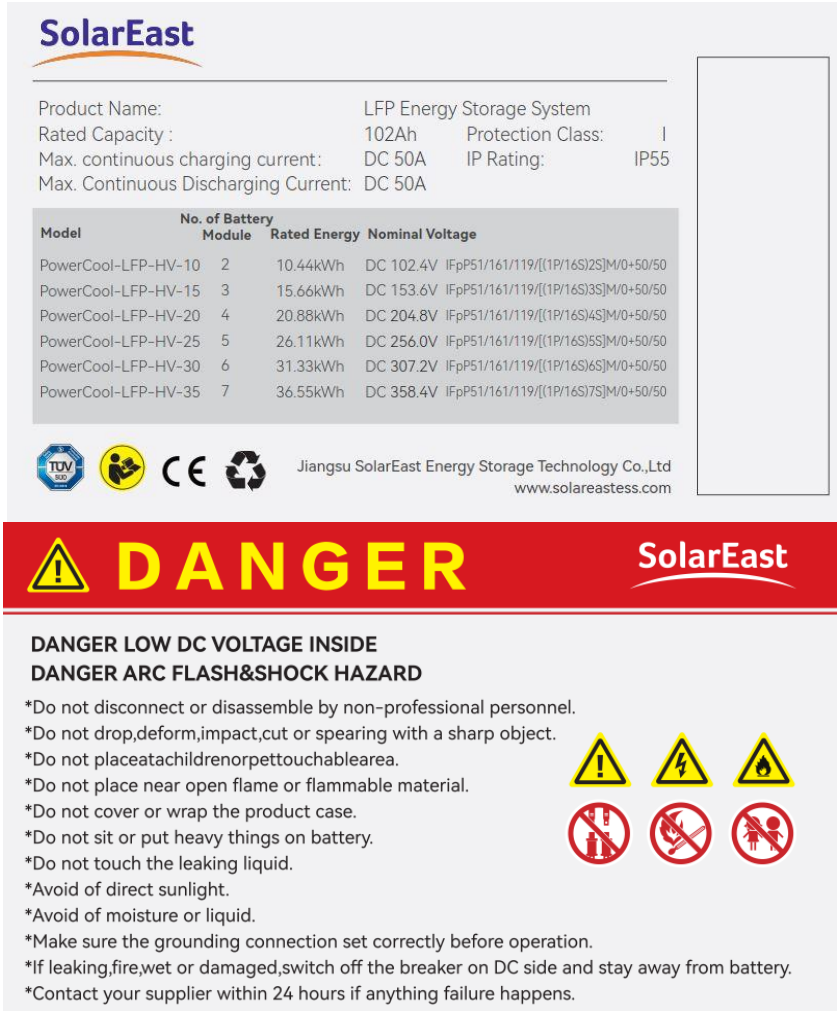
Copy of marking plate:

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



Remark:

1. Serial no. E932U0012304150000 can trace the manufacture information of the battery system. This is not the actual code and only for example.

E9: ESS manufacturer code, E9 represents Jiangsu SolarEast Energy Storage Technology Co., Ltd.

3: brand code, 3 represents ESS.

2U: production code, 2U represents ESS product, 2V represents dummy ESS product, 2W represents Li-ion battery module.

001: production model code, 001 represents one battery module connected in series, 002 represents two battery modules connected in series, 003 represents three battery modules connected in series, 004 represents four battery modules connected in series, 005 represents five battery modules connected in series, 006 represents six battery modules connected in series, 007 represents seven battery modules connected in series.

23: year.

04: month.

15: day.

0000: production serial number.

2.“+”, “-”, are marked near the polarity of the battery system.

“+” represents battery positive.

“-” represents battery negative.

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Test item particulars .....:	
Classification of installation and use .....:	Use in industrial application
Supply Connection.....:	Supply by terminals
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 .....:	2023-08-01
Date (s) of performance of tests.....:	2023-09-01 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.

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

Remark: Photo Documentation: 20 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 Li-ion Battery System PowerCool-LFP-HV-10, PowerCool-LFP-HV-15, PowerCool-LFP-HV-20, PowerCool-LFP-HV-25, PowerCool-LFP-HV-30, PowerCool-LFP-HV-35 are used in industrial application.

2. Rechargeable Li-ion battery system consists of different number of rechargeable Li-on battery with no. PowerCool-LFP-HV connected in series and one controller box. PowerCool-LFP-HV-10 consists of two rechargeable Li-ion batteries and one controller box. PowerCool-LFP-HV-15 consists of three rechargeable Li-ion batteries and one controller box. PowerCool-LFP-HV-20 consists of four rechargeable Li-ion batteries and one controller box. PowerCool-LFP-HV-25 consists of five rechargeable Li-ion batteries and one controller box. PowerCool-LFP-HV-30 consists of six rechargeable Li-ion batteries and one controller box. PowerCool-LFP-HV-35 consists of seven rechargeable Li-ion batteries and one controller box.

3.The rechargeable Li-ion battery PowerCool-LFP-HV consists of 16 Rechargeable Li-ion Cells with model no. IFP50160116A-102Ah connected in series.

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	Rechargeable Li-ion Battery System
Type/model	IFP50160116A-102Ah	PowerCool-LFP-HV	PowerCool-LFP-HV-10 PowerCool-LFP-HV-15 PowerCool-LFP-HV-20 PowerCool-LFP-HV-25 PowerCool-LFP-HV-30 PowerCool-LFP-HV-35
Nominal voltage	3.2V	51.2V	PowerCool-LFP-HV10: DC 102.4V PowerCool-LFP-HV15: DC 153.6V PowerCool-LFP-HV20: DC 204.8 V PowerCool-LFP-HV25: DC 256.0V PowerCool-LFP-HV30: DC 307.2V PowerCool-LFP-HV35: DC 358.4V
Rated capacity	102Ah	102Ah	102Ah
Charging voltage declared by manufacturer	3.65V	3.6V for cell	3.6V for cell
Upper limit charging voltage	3.9V	3.65V for cell	3.65V for cell
Charging current declared by manufacturer	20.4A	20.4A	20.4A
Maximum continuous charging current	50A	50A	50A

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Discharging current declared by manufacturer	20.4A	20.4A	20.4A
Maximum continuous discharging current	125A	50A	50A
Discharge cut-off voltage	2.0V	2.8V for cell	2.8V for cell
Lower limit discharging voltage	2.0V	2.6V for cell	2.6V for cell
Standard temperature range for charging	0°C to 60°C	0°C to 57°C	0°C to 57°C
Standard temperature range for discharging	-20°C to 65°C	-3°C to 57°C	-3°C to 57°C
Standard charging method by manufacturer	Charge at constant current 20.4A until voltage reaches 3.65V, then charge at constant voltage 3.65V till current is 5.1A.	Charge at constant current 20.4A until the max cell voltage reaches 3.6V. Then still for 30min followed by charging at constant current 5 A until the max cell voltage reaches 3.6V.	PowerCool-LFP-HV-10: Charge at constant current 20.4A until the max cell voltage reaches 3.6V, then still for 30min followed by charging at constant current 5A until the max cell voltage reaches 3.6V. PowerCool-LFP-HV-15: Charge at constant current 20.4A until the max cell voltage reaches 3.6V, then still for 30min followed by charging at constant current 5A until the max cell voltage reaches 3.6V. PowerCool-LFP-HV-20: Charge at constant current 20.4A until the max cell voltage reaches 3.6V, then still for 30min followed by charging at constant current 5A until the max cell voltage reaches 3.6V. PowerCool-LFP-HV-25: Charge at constant current 20.4A until the max cell voltage reaches 3.6V, then still for 30min followed by charging at constant

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			current 5A until the max cell voltage reaches 3.6V. PowerCool-LFP-HV-30: Charge at constant current 20.4A until the max cell voltage reaches 3.6V, then still for 30min followed by charging at constant current 5A until the max cell voltage reaches 3.6V. PowerCool-LFP-HV-35: Charge at constant current 20.4A until the max cell voltage reaches 3.6V, then still for 30min followed by charging at constant current 5A until the max cell voltage reaches 3.6V.
Charging method for internal short-circuit test	Charge at constant current 50A until voltage reaches 3.65 V, then charge at constant voltage 3.65 V till current is $0.05I_t$ A (5.1 A)	-	-
Dimension	LxWxH: (49.9±0.5)x(118.5±0.5)x (160±0.8) mm	LxWxH: (720±2)x(420±2)x(173.7 ±2) mm	PowerCool-LFP-HV-10: (720±2)x(420±2)x(616±3) mm PowerCool-LFP-HV-15: (720±2)x(420±2)x(766±5) mm PowerCool-LFP-HV-20: (720±2)x(420±2)x(916±7) mm PowerCool-LFP-HV-25: (720±2)x(420±2)x(1066±9) mm PowerCool-LFP-HV-30: (720±2)x(420±2)x(1216±11) mm PowerCool-LFP-HV-35: (720±2)x(420±2)x(1366±13) mm
Weight	1.947±0.03 kg	47±2 kg	PowerCool-LFP-HV-10: 116.2±3 kg PowerCool-LFP-HV-15: 163.38±5 kg PowerCool-LFP-HV-20: 210.42±7 kg PowerCool-LFP-HV-25: 257.46±9 kg PowerCool-LFP-HV-30: 304.5±11 kg PowerCool-LFP-HV-35: 351.54±13 kg

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Configuration	-	16S	PowerCool-LFP-HV-10: 16S(2S) PowerCool-LFP-HV-15: 16S(3S) PowerCool-LFP-HV-20: 16S(4S) PowerCool-LFP-HV-25: 16S(5S) PowerCool-LFP-HV-30: 16S(6S) PowerCool-LFP-HV-35: 16S(7S)

Information for testing sample:

Sample #	Type	Test Item
2023-0979	Rechargeable Li-ion battery system, model no.: PowerCool-LFP-HV-15	tests of clause 8.2.2, 8.2.3 and 8.2.4
2023-0979	Rechargeable Li-ion battery, model no.: PowerCool-LFP-HV, no control box	tests of clause 7.2.3.3

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

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

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	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
	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 7 & 8	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

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	The cells or batteries charged using the method specified by the manufacturer..... :	See page 7 & 8	P
7.2	**Reasonably foreseeable misuse**		P
7.2.1	External short-circuit test (cell or cell block)		N/A
	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..... :	Rechargeable Li-ion battery PowerCool-LFP-HV	—
	Mass of the test unit (kg)..... :	Measured: 47.030 Kg	—
	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

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	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
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	Functional safety analysis has been done according to IEC 60730-1 (Annex H). Refer to test report 5040823021304 -00 FS	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**

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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
	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 ..... :	62°C	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**		P
	Battery system fulfil EMC requirements of the end-device application ..... :	See Table 9 [√] See EMC report no. 4861923320500 for details [ ] Intended for to be tested in the end use application [*include specific application*]	P

10	**INFORMATION FOR SAFETY**		P
	The cell manufacturer provides information about current, voltage and temperature limits of their products		P

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	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
	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		—

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	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		—

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	Refer to UN38.3 test report UNWT(2023)09053	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	Hefei Gotion High-tech Power Energy Co., Ltd	IFP50160116A-102Ah	DC 3.2Vd.c., 102Ah	IEC 62619-2017	IEC Cert. No.: DK-110904-UL Test Report No.: RESS-4789845567-001
2.Busbar between cells	Changzhou Helong-sheng New Energy Technology Co., Ltd	Al1060	500Vd.c., 200A, 104mm^2, Topr: -40°C~80°C	-	-
3.Busbar of modules	Jiangsu Huansheng Alloy Technology Co., Ltd	Cu	500Vd.c., 200A, 104mm^2, Topr: -40°C~80°C	-	-
4.Insulation sheet for module	SICHUAN DONGFANG INSULATING MATERIAL Co., Ltd	DFR117	0.5mm, V-0, Topr: -40°C~80°C	IEC 60695-11-10	UL E199019
5.Cover plate	KING SCI & TECH Co., Ltd	JH960HT(M1)(sr)	1.5mm, V-0, Topr: -40°C~80°C	IEC 60695-11-10	UL E171666
6.Insulation sheet for pack	Shenzhen Futureway Technology Co., Ltd	SRL-1140F	2mm, V-0, Topr: ≤200°C	IEC 60695-11-10	UL E519126
7.Copper busbar	Jiangsu Huansheng Alloy Technology Co., Ltd	Cu	500Vd.c., 220A, 36 mm^2, Topr: -40°C~80°C	-	-
8.Sampling wire	Dongguan Haode Wire & Cable Technology Co., Ltd	1332	24AWG, 300V, V-1, Topr: ≤200°C	UL 758	UL E364036
9.LV Sampling connector (male)	Ningbo Degson Electrical Co., Ltd	15EDGKNHB-3.5-16P-14-14A(H)	8.5A, V-0, Topr: -40°C~105°C	UL 508	UL E228872
-Alternative	Ningbo Degson Electrical Co., Ltd	15EDGKNHB-3.5-18P-15-14A(H)	8.5A, V-0, Topr: -40°C~105°C	UL 508	UL E228872
10.LV Sampling connector (female)	Ningbo Degson Electrical	15EDGKNHB-3.5-16P-14-14A(H)	8.5A, V-0, Topr: -40°C~105°C	UL 508	UL E228872

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	Co., Ltd				
-Alternative	Ningbo Degson Electrical Co., Ltd	15EDGKNHB-3.5-18P-15-14A(H)	8.5A, V-0, Topr: -40°C~105°C	UL 508	UL E228872
11.Enclosure	Nantong Xingmingjiang Precision Hardware Co., Ltd	Zn-Mg-Al	V-0, 5VB, L*W*H: 720mm*420mm*173mm	UL 94	UL E171666
12.NTC (2pcs for one module)	Suzhou Xinliben Electronics Co., Ltd	SK103F6R1000ST-22#	10KΩ±1%, Topr: -40°C~125°C	-	-
13.FUSE	Xi'an Sinofuse Electric Co., Ltd	RS308-HB-4G100A	AC690V/DC550V, 10A~100A, Ic=50kA, Topr: -40°C~85°C	UL 248-13	UL E353337
14.Connector (Socket/plug)	Amphenol technology(zhuhai)Co.,Ltd	C10-781650-1000/C10-781651-1000	DC 1000V, 120A, Topr: -40°C~125°C	UL 4128	TÜVRheinland Cert No. AK505910490001
15.Module case	Changzhou Helong-sheng New Energy Technology Co., Ltd	ABS+PC	Topr: -20°C~120°C	-	
16.Wiring	WuxiHUAhao Electric Co.,Ltd	10269 4AWG	DC 1000V, Topr: 105°C	UL 758	UL E231903
For high voltage controller box					
17.Positive connector (Socket/plug)	Huizhou Futronics Electronic Technology Co., Ltd	FSPC80160Z-25A4/FSPC80160Z-M6A	600Vd.c., 125 A, V-0, Topr: -40°C~125°C	UL 4128	UL E524083
18.Negative connector (Socket/plug)	Huizhou Futronics Electronic Technology Co., Ltd	FSPC80160W-25B4/FSPC80160WZ-M6B	600Vd.c., 125 A, V-0, Topr: -40°C~125°C	UL 4128	UL E524083
19.Relay	Xiamen Hongfa Electroacoustic Co., Ltd.	HFZ16V-150/900-24-SHSAL5E-1	750Vd.c., 150A, Coil DC 24V, Ic=1500A, Topr: -40°C~85°C	UL 60947-4-1	UL E133481
20.DC Shunt	Doublecircle	UFL-100A	L*W*H: (18±0.2)*(8.4±0.5)*(25±2)mm, 100A, Topr: ≤125°C	-	
21.BMS (Bottom board)	Hangzhou LiDe Communicati	BCMU-AH-M-A0-1.0.0.3	Monitoring the cells' temperature and voltage	-	-

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	ons Co., Ltd				
-PCB material	YING PAI TECHNOLOGY Co., Ltd	YP-04	130°C, V-0	UL 746A	UL E492700
-Isolation transformer (T7, T8, T9, T10	TNK	TSQ331	VISO: 1500Vd.c., Topr: -40°C~125°C	-	-
Case	Wan Hong Industrial Corp.	WH-8100	130°C, V-0	IEC 60695-11-10	UL E150608
Varnishes	GUANGDONG JIANXIN TECHNOLOGY CO., Ltd	JS-812	155°C	UL 1446	UL E339578
Wire	SUZHOU YUSHENG ELECTRONIC CO., Ltd	FLW-B*	130°C	UL 60950-1	UL E332529
-Isolation transformer (T1)	TNK	TDB2327	VISO: 3750Vd.c., Topr: -25°C~125°C	-	-
Platics	Chang Chun Plastics Co., Ltd	T375HF	150°C, V0	UL 94	UL E59481
Varnishes	Guangdong Jianxin Technology Co., Ltd	JS-812	150°C	UL 1446	UL E339578
Magnet Wire	Guangdong Suntek wire Co.,Ltd	xUEW180	180°C	UL1446	UL E234867
Tape	Suzhou Mailaduona Electric Material Co., Ltd	JY313	130°C	UL 510A	UL E188295
Winding Wire	Suzhou Yusheng Electronic Co., Ltd	TIW-B*	34-18 AWG, 130°C	UL 60950-1	UL E332529
-Isolation IC for communication (U35, U36, U37, U43)	2PAI Semiconductor	π122M31	3~5.5V, AC 3750Vrms, Topr: -40°C~125°C	UL 1577	UL E494497
Opticalcoupler (U29, U30, U31)	APSEMI	APV278AE	VISO: AC 5000V, Topr: -40°C~85°C	UL 1577	UL E534710
Opticalcoupler (PC1)	Toshiba Electronic Devices & Storage Corporation	TLP291-GB	VISO: AC 3750V, Topr: -55°C~110°C	IEC 60747-5-5:2020	VDE 40009347
Opticalcoupler (PC2, PC19)	EVERLIGHT	EL817S1(C)(TU)-F	VISO: AC 5000V, Topr: -55°C~110°C	UL 1577	UL E214129
-Relay	HONGFA	HFE80V-20C	24Vd.c.,	UL 508	UL E133481

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(G1)			Topr: -40°C~85°C		
Fuse (F7)	Shanghai Fullness Electrical Co., Ltd	SPT1800100	1000Vd.c., 30A, Ic=10kA~33kA	IEC 60269-6:2011	TÜVRheinland Report No. R50585551
Fuse (F17)	Xi 'an Zhongrong Electric Co., Ltd	RS309-MF-S100A-3SA	700Vd.c., 100A, Ic=AC100kA or DC50kA, Topr: -40°C~85°C	UL 248	UL E353337
-CAN Communication chip (U40, U41, U54)	Tokmas	TJA1051T	4.5V~5.25V, Topr: -40°C~150°C	-	-
-RS485 Communication chip (U50, U51)	MaxLinear	SP485EEN	4.75V~5.5V, Topr: -40°C~125°C	-	-
-Pre-charge resistance (R110, R113, R116)	Doublecircle	RX27-4A	300Ω, ±5%, 100W, Topr: -55°C~155°C	-	-
-Voltage sampling resistance (R231, R232, R234, R235, R237, R238, R239, R240, R241, R247, R249, R251, R253)	Guangdong Fenghua Advance Technology Holding Co.,Ltd	CSR0204DTDV	1MΩ,±0.1%, Topr: -55°C~125°C	-	-
-NTC on PCB (R303)	XinLan Technology	MF52A$_1$103F3950	10KΩ,±1%, Topr: -55°C~125°C	-	-
-Power Management IC (U15)	Richtek Technology Corporation	RT8068AZQW	2.7V ~ 5.5V, Topr: -40°C~125°C	-	-
-Power Management IC for current and total voltage sampling (U3)	ADI	AD7606BSTZ	2.3V~5.25V, Topr: -40°C~85°C	-	-
-Fuse (F1, F2, F3, F4, F5, F6, F20)	Wayon	1206WHF500A072V	125Vd.c., 150A, Topr: -55°C~150°C	UL 248-1	UL E311435
Y capacitor (C28, C29)	SHM	DCF472M46Y5VG6BL0A0	4.7nF, 20%, DIP, Topr: -40°C~125°C	UL 60384-14	UL E154899
22.BMS (Core board)	Hangzhou LiDe Communications Co., Ltd	BCMU-AH-E1-A0-1.0.0.1	Monitoring the cells' temperature and voltage	-	-
-PCB material	YING PAI TECHNOLOGY Co., Ltd	YP-04	130°C, V-0	UL 746A	UL E492700
-MCU (U16)	NXP	MIMXRT1061CVL5B	3V~3.6V, Topr: -40°C~125°C	-	-

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-WIFI Communication chip (U2)	Espressif	ESP32-WROOM-32UE	3V~3.6V, Topr: -40°C~85°C	-	-
-Memory chip (U53)	HuaDa Semiconductor	BL24C512A	1.7V~5.5V, Topr: -40°C~85°C	-	-
-Memory chip (U54, U55)	Macronix International Co., Ltd	MX25L12833FM2I-10G	2.7V~3.6V, Topr: -40°C~85°C	-	-
-Watchdog (U21)	VP	VP706TESA/T	3.3V~5.5V, Topr: -40°C~85℃	-	-
23.BMS (Slave board)	Hangzhou LiDe Communications Co., Ltd	BMU-C16B-A0-1.0.0.2	Overcharge detection voltage for each cell: 3.65 V, 116.8V/175.2V/233.6V/292V/350.4V/408.8V for battery system PowerCool-LFP-HV-10/ PowerCool-LFP-HV-15/ PowerCool-LFP-HV-20/ PowerCool-LFP-HV-25/ PowerCool-LFP-HV-30/ PowerCool-LFP-HV-35. Over discharge detection voltage for each cell: 2.60V, 83.2V/124.8V/166.4V/208V/249.6V/291.2V for battery system PowerCool-LFP-HV-10/ PowerCool-LFP-HV-15/ PowerCool-LFP-HV-20/ PowerCool-LFP-HV-25/ PowerCool-LFP-HV-30/ PowerCool-LFP-HV-35. Charge overcurrent detection current: 60A, Discharge overcurrent detection current: 60A, High temperature protection: 57°C Low temperature protection: -3°C	-	-
-PCB material	YING PAI TECHNOLOGY Co., Ltd	YP-04	130°C, V-0	UL 746A	UL E492700
-Balanced resistance (R48, R49, R50, R51, R58, R59, R60, R61, R62, R63, R73, R74, R75, R76, R77,	EVER OHMS	2512	10Ω, ±1%, 1W, 200V	-	-

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R78, R796)					
-AFE (U3)	Texas Instruments	BQ79616PAPRQ1	11V~80V, Topr: -40°C~150°C	-	-
-Opticalcoupler (PC3)	Toshiba Electronic Devices & Storage Corporation	TLP291-GB	VISO: AC 3750V, Topr: -55°C~110°C	IEC 60747-5-5:2020	VDE 40009347
-Diodes (Q3)	ZETEX	ZXTN4004KTC	Topr: -55°C~150°C	-	-
Supplementary information:					

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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**
2023-0979	2.917	50	169.277	3.514	A, D, F
			Charge Voltage Applied Battery System: 1)		
			Whole	**Part**	
			205.920	-	

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**
2023-0979	142.193	60	147.767	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**
2023-0979	158.310	20.4	162.193
Maximum Specified Temperature of Battery System, °C		**Maximum Measured Cell Case Temperature, °C**	**Results**
57		58.2	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-LFP-HV-15	Emission - Enclosure port	Charging and discharge mode	EN IEC 61000-6-3:2021, Clause11 Table 1; 1.1.4	-	A, D, E
Battery system PowerCool-LFP-HV-15	Emission – DC power port	Charging and discharge mode	EN IEC 61000-6-3:2021, Clause 11 Table 2; 2.1,	-	A, D, E
Battery system PowerCool-LFP-HV-15	Immunity - Enclosure ports - Power-frequency magnetic field	Charging and discharge mode	EN IEC 61000-6-1: 2019, Clause 11 Table 1; 1.1	IEC 61000-4-8	A, D, E
Battery system PowerCool-LFP-HV-15	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-LFP-HV-15	Immunity - Enclosure Port - 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-LFP-HV-15	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-LFP-HV-15	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-LFP-HV-15	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 153.6V, [√] Load at 50A

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

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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