TEST REPORT
IEC 63056
Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in electrical energy storage systems

Report Number.....:	704082443412-00
Date of issue .....:	2024-12-30
Total number of pages.....:	23
Name of Testing Laboratory preparing the Report.....:	TÜV SÜD New Energy Vehicle Testing (Jiangsu) Co., Ltd.
Applicant's name .....:	Shanghai Elecnova Energy Storage Co., Ltd.
Address .....:	T1-3F, Hongqiao Hui No. 990 Shenchang Road, Minhang District, 201100 Shanghai,PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard.....:	IEC 63056:2020
Test procedure.....:	TÜV Mark
Non-standard test method.....:	N/A
TRF template used.....:	IECEE OD-2020-F1:2020, Ed.1.4
Test Report Form No.....:	IEC 63056A
Test Report Form(s) Originator ....:	UL(Demko)
Master TRF .....:	Dated 2020-10-15

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TÜV SÜD Group
No.15 Factory Building A, Jintong International Industrial Park, No.8 Xihu Road, Changzhou, Jiangsu, 213164, P. R. China

Test item description ..... :	Rechargeable Li-ion Battery System
Trade Mark(s) ..... :	N/A
Manufacturer ..... :	Shanghai Elecnova Energy Storage Co., Ltd. T1-3F, Hongqiao Hui No. 990 Shenchang Road, Minhang District, 201100 Shanghai,PEOPLE'S REPUBLIC OF CHINA
Model/Type reference ..... :	ECO-E64WX, ECO-E101WX(DC)
Ratings ..... :	ECO-E64WX: DC 573.6V, 120Ah ECO-E101WX(DC): DC 844.8V, 120Ah

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) .. :	Xiaohang Chen (Designated Reviewer)	Xiaohang Chen

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

Item	Description	Certificate / Test report No.	Issued by	Model	Pages
1	IEC62619-2022	704082443411-00	TÜV SÜD	ECO-E64WX ECO-E101WX(DC)	27

Summary of testing:

Tests performed (name of test and test clause):

In section 7, test of clause 7.6 were performed with the battery system, model no. ECO-E101WX(DC). Test of clause 7.4 and clause 7.8 was performed with a subsystem combined with one Rechargeable Li-ion Battery Module, model no. ECO-P1P24WX and one high voltage control box. Clause 7.9.3 was performed with a Rechargeable Li-ion Battery Module, model no. ECO-P1P24WX.

- Cl. 7.4 Electric insulation check during transport and installation.
- Cl. 7.6 Protection for short circuit during transport and installation.
- Cl. 7.8 Over discharge control of voltage test (battery system).
- Cl. 7.9.3 Edge or corner drop test.

The samples comply with the above requirements of IEC 63056:2020 (First Edition).

Testing location:

Cl. 7.4 Cl. 7.6 Cl. 7.8 Cl. 7.9.3	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, R. China
Cl. 7.6	Changzhou Huayang Inspection and Testing Technology Co., Ltd. No.160 West Lake Road, Wujin High-tech Zone, Changzhou City, Jiangsu Province

Summary of compliance with National Differences: N/A

List of countries addressed: N/A

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For model: ECO-E64WX

Elecnova

Energy storage system

Product Model	**ECO-E64WX**
Battery Designation	IFpP49/175/171/[((24S)7S)]M/-20+50/95
Rated Capacity	120Ah
Rated Energy	64.512kWh
Rated Voltage	DC 537.6V
Voltage Range	DC 470.4V,...,604.8V
Maximum Current	DC 120A
General Data	
Ingress Protection	IP55
Auxiliary Voltage	1/N/PE AC 230V
Auxiliary Current	AC 15A Max
Auxiliary Frequency	50/60Hz
Operating Ambient Temperature Range	-25℃,...,55℃
Protection Class	I

Shanghai Elecnova Energy Storage CO., LTD.

For model: ECO-E101WX(DC)

Elecnova

Rechargeable Li-ion Battery System

Product Model	**ECO-E101WX(DC)**
Battery Designation	IFpP49/175/171/[((24S)11S)]M/-20+50/95
Rated Capacity	120Ah
Rated Energy	101.376kWh
Rated Voltage	DC 844.8V
Voltage Range	DC 739.2V,...,950.4V
Maximum Continuous Discharing Current	DC 135A
Maximum Continuous Charing Current	DC 120A
Operating Ambient Temperature Range	-25℃,...,50℃
Protection Class	I

Shanghai Elecnova Energy Storage CO., LTD.

S/N	ECOACJ51P264WB12458193338
Production Date	2024.08.19

Remark:

1. “P+”, “P-” are marked near the polarity of the battery system, “P+” positive electrode output, “P-”

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negative electrode output.
2. Product S/N: ECOACJ51P264WB12458193338
ECO: Product type, Rechargeable Li-ion Battery System and Energy storage system.
AC: A represent Industry and commerce; C represent Cabinet
J5: Cell Type, J represent Hithium,5 represent 120Ah.
1P264W: 1P264 represent 264 cells in series. W represent Wind cooling, L represent Liquid cooling.
B: Version Upgrade.
1: 0 represent displayscreen with protective cover and no ups supply voltage; 1 represent displayscreen outside and no ups supply voltage; 2 represent displayscreen outside and ups supply voltage; 3 represent no displayscreen and ups supply voltage; 4 represent no displayscreen and no ups supply voltage.
24: year,23 represent the year of 2023, 24 represent the year of 2024, 25 represent the year of 2025…
58: month
19: day,19 represent the date of 19th, 20 represent the date of 20th, 21 represent the date of 21th…
3338: serial number.

51	52	53	54	55	56
January	February	March	April	May	June
57	58	59	60	61	62
July	August	September	October	November	December

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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.....:	2024-09-10
Date (s) of performance of tests .....:	2024-10-12 to 2024-10-26

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: 24 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 Sfere Electric Co., Ltd. No.1, Dongding Road 214400 Jiangyin, Jiangsu PEOPLE'S REPUBLIC OF CHINA Jiangsu Sfere Electric Co., Ltd. No.888, Yanling Road East, 214400 Jiangyin, Jiangsu, PEOPLE'S REPUBLIC OF CHINA

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General product information and other remarks:

1. The Rechargeable Li-ion Battery System, ECO-E64WX, ECO-E101WX(DC) are used in industrial appliance. The battery system, ECO-E64WX consist of one high voltage control box and 7 Rechargeable Li-ion Battery Modules with model ECO-P1P24WX connected in series, ECO-E101WX(DC) consist of one high voltage control box and 11 Rechargeable Li-ion Battery Modules with model ECO-P1P24WX connected in series.
2. The Rechargeable Li-ion Module ECO-P1P24WX consists of 24 Rechargeable Li-ion Cells with model HJLFP48173170E-120AH connected in series.
3. The Rechargeable Li-ion Battery System, model no. ECO-E101WX(DC) is used as a component fixed in the energy storage system, mode no. ECO-E101WX.

Table:

Product name	Rechargeable Li-ion Cell	Rechargeable Li-ion Battery Module	Rechargeable Li-ion Battery System
Type/model	LFP71173207	ECO-P1P24WX	ECO-E64WX ECO-E101WX(DC)
Nominal voltage	DC 3.2V	DC 76.8V	ECO-E64WX: DC 537.6V ECO-E101WX(DC): DC 844.8V
Rated capacity	120Ah	120Ah	120Ah
Charging voltage declared by manufacturer	DC 3.65V	DC 86.4V	ECO-E64WX: DC 604.8V ECO-E101WX(DC): DC 950.4V
Upper limit charging voltage	DC 3.7V	DC 87.6V	ECO-E64WX: DC 613.2V ECO-E101WX(DC): DC 963.6V
Charging current declared by manufacturer	DC 120A	DC 120A	DC 120A
Maximum continuous charging current	DC 120A	DC 120A	DC 120A
Discharging current declared by manufacturer	DC 120A	DC 120A	DC 120A
Maximum continuous discharging current	DC 240A	DC 135A	DC 135A
Discharge cut-off voltage	DC 2.5V	DC 67.2V	ECO-E64WX: DC 470.4V ECO-E101WX(DC): DC 739.2V
Standard temperature range for charging	0°C to 50°C	0°C to 50°C	0°C to 50°C
Standard temperature range for discharging	-20°C to 55°C	-20°C to 50°C	-20°C to 50°C
Standard charging method by manufacturer	Charge at constant current 120A until voltage reaches 3.65V, then charge at constant voltage 3.65V till current is 6A.	Charge at constant current 120A until voltage reaches 3.6V	Charge at constant current 120A until voltage reaches 3.6V
Charging method for internal short-circuit test	Charge at constant current 120A until voltage reaches 3.7V, then charge at constant voltage 3.7V till current is 6A.	-	-

Information for testing sample:

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Sample Type	Test Item
ECO-E101WX(DC)	Tests of clause 7.4, 7.6
ECO-P1P24WX combined with one high voltage control box	Tests of clause 7.8, 7.9.3
ECO-P1P24WX	Test of clause 7.9.3

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

5	**GENERAL SAFETY CONSIDERATIONS**		P
5.1	**General**		P
	Battery systems and the cells they contain comply with the applicable general safety considerations of IEC 62619	Refer to IEC 62619 report Battery system: 704082443411-00 Cell: 085-282360508-000	P
	Within the standard temperature range, secondary cells are charged at the maximum charge current		P
	Lithium-ion cells are operated within the operating region and the storage conditions		P
	Cells and battery systems are safe under conditions of both intended use and reasonably foreseeable misuse .....:	See also Table 5.1 for Critical Components information	P
	Moving parts apply appropriate design to reduce the risk of injuries		P
5.2	**Insulation and Wiring**		P
	Sufficient for maximum voltage, current, temperature, altitude, and humidity requirements..:	See also Table 5.1 for Critical Components information	P
	Adequate clearances and creepage distances between connectors according to IEC 60950-1:2005, 3.1 and 3.2		P
	Hazardous live parts are protected to avoid the risk of electric shock		P
	The mechanical integrity of whole battery system and internal connections follow end use equipment manufacturer's requirements or Annex A .....:	See also Annex A	P
	Maximum allowed number of series connections of a module or a battery system is provided in the specifications or instruction manual		P
5.3	**The peak voltage of charging**		P
	Battery system manufacturer ensures the peak voltage of charging current is under the upper limit charging voltage by monitoring the voltage of every single cell or cell block.		P

6	**TYPE TEST CONDITIONS**		P
6.1	**General**		P

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6.2	**Test items**		P
	DUT (device under test) is stored under conditions specified by cell manufacturer and is not more than six months old		P
	Capacity confirmation of the DUT		P
	Default ambient temperature of test, 25 °C ± 5 °C		P
	See Table 1 of IEC 63056 for the type tests and the sample quantity for each tests		P

7	**SPECIFIC REQUIREMENTS AND TESTS**		P
7.1	**Basic requirement**		P
	Cells and batteries used in battery systems evaluated to this standard comply with the test requirements of IEC62619 and this standard	Refer to IEC 62619 report Battery system: 704082443411-00 Cell: 085-282360508-000	P
7.2	**Resistance of abnormal heat**		P
	Non-metallic materials, on which parts at hazardous voltage are directly mounted, are resistant to abnormal heat and comply with ball pressure test in IEC 60695-10-2.....:	See the data form for critical components and material information	P
	Results: The dimension *d* of indentation does not exceed 2 mm		P
	Dimension *d* is the largest distance that can be measured across the indentation from one clearly defined edge of the indentation to another		—
7.3	**Casing material of a battery system which can be transported for installation or maintenance**		N/A
	The class of thermoplastic casing (V-2 or higher) .....:		—
	Where components cannot be protected against overheating under fault conditions, the following additional requirements are met:		—
	(1) Mounted on V-1 or higher class material, and .....:		—
	(2) Separated from the V-2 class case material by min. 13 mm of air, or by a solid barrier of V-1 or higher class material.....:		—
	Materials are tested at a thickness equal to the smallest thickness used in the application and classified according to IEC 60695-11-10 (mm) ....:	Thickness:	N/A
7.4	**Electric insulation check during transport and installation**		P
	The hazardous live parts of battery or cell are covered or insulated from personnel		P

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	Unless the end use equipment has specific requirements, the test method is in accordance with the insulation resistance test of IEC 62133:2017, Clause 5.2	Insulation voltage: 500Vd.c.	P
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery is not less than 5 MΩ at 500 Vdc when measured 60 s after applying the voltage		P
	Results: The insulation resistance is equal to or higher than 5 MΩ.....:	See Table 7.4	P
7.5	**Charging procedures for test purposes**		P
	The battery is discharged at a constant current of 0,2 *I*t A to a specified final voltage prior to charging		P
	Discharge current, 0,2 *I*t A……..…..:	24 A	—
	The cells or batteries are charged using the method specified by the manufacturer .....:	See page 5	—
7.6	**Protection for short circuit during transport and installation**		P
	A safeguard is provided to prevent the risk of short circuit for personnel during transport and installation		P
	Safeguards are provided for battery system and for each part when the battery system is divided into parts for transportation		P
	Fully charged DUT is discharged to SOC (state of charge) for installation or maintenance, which is specified by the manufacturer		P
	Unless otherwise specified by the manufacturer, tests are carried out without discharging after charging in accordance with 7.2.		P
	DUT is stored in an ambient temperature until its temperature is stabilized at 25 °C ± 5 °C. Then, DUT is short-circuited by connecting the positive and negative terminals.		P
	The external resistance to short circuits is (30 mΩ ± 10 mΩ) × module configuration (= number of series connections / number of parallel connections) or less than 5 mΩ, whichever is higher; total external resistance less than 100 mΩ.		P
	Test is continued for 6 hours or the case temperature declined by 80 % of maximum temperature rise, whichever is sooner		P
	Results: No rupture, no fire, no explosion .....:	See Table 7.6	P
7.7	**Protection for reverse connection**		N/A

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	Battery systems consisting of multiple battery packs or modules - that are not designed to prevent a reverse polarity connection or - that are not connected into the battery system with the BMS at the factory	The positive and negative connectors are designed to prevent a reverse polarity connection.	N/A
	Fully charged DUT is discharged to SOC (state of charge) for installation or maintenance, which is specified by the manufacturer		N/A
	One of the DUTs of battery system is connected with opposite polarity		N/A
	The battery system is fully charged or stopped by a safety protection, and then rested for one hour		N/A
	If the battery system can be discharged, - with the maximum discharge current until it stops discharging, and it's rested for one hour.		N/A
	If the battery system cannot be discharged, it is rested for one hour.		N/A
	Results: No rupture, no fire, no explosion .....:		N/A
7.8	**Overdischarge control of voltage test (battery system)**		P
	The BMS controls the cell voltage during discharging above the lower limit discharging voltage of the cells		—
	The cooling system remains functional during the test and the main contactors are closed with the battery system controlled by the BMS		P
	The battery system is discharged at a constant current of 0,2 *I*t A to 30 % of the rated capacity, and then is discharged at the specified maximum discharging current		P
	The discharge is continued until the BMS terminates the discharging before exceeding the lower limit discharging voltage of the cells		P
	If difficult to overdischarge the whole system, the exceeded voltage applied to the cell(s) in the battery system		P
	Data acquisition/monitoring was continued for 1 h after discharging is stopped		P
	Results: No fire, no explosion.....:	See Table 7.8	P
	The BMS interrupts the discharging before exceeding the lower limit discharging voltage of the cells		P
	All functions of the battery system are fully operational as designed during the test		P
7.9	**Drop test**		P

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7.9.1	General		P
	For the simulation of a drop during installation and maintenance		P
	The DUT is (Cell, Module or Battery System)……:	Battery Module (Pack)	—
7.9.2	Whole drop test		N/A
	For DUT's mass less than 50 kg		N/A
	Fully charged DUT is discharged to SOC (state of charge) for installation or maintenance, which is specified by the manufacturer.		N/A
	Where SOC for installation or maintenance is not specified by the manufacturer, tests carried out without discharging after charging per clause 7.2.		N/A
	Description of the DUT.....:		—
	The DUT is dropped one time from a height shown in Table 2 of IEC63056		N/A
	For DUT's mass less than 7 kg, it drops so as to obtain impact in random orientation		N/A
	For DUT's mass between 7 kg and 50 kg, it drops in the bottom down direction. The bottom surface of the DUT is specified by the manufacturer		N/A
	After the test, the DUT is put on rest for 1 h, and a visual inspection is performed		N/A
	Results: No fire, no explosion.....:	See Table 7.9.2	N/A
7.9.3	Edge and corner drop test		P
	For DUT's mass equal to or more than 50 kg		P
	Fully charged DUT is discharged to SOC (state of charge) for installation or maintenance, which is specified by the manufacturer.		P
	Unless otherwise specified by the manufacturer, tests are carried out without discharging after charging in accordance with 7.2.		P
	Description of the DUT.....:	Rechargeable Li-ion Battery Pack, model no. ECO-P1P24WX	—
	The DUT is dropped two times from a height shown in Table 2 of IEC63056		P
	Test is arranged for reproducible impact points for the shortest edge drop impact and the corner impacted		P
	The two impacts, per impact type, are on the same corner and on the same shortest edge		P
	After the test, the DUT is put on rest for 1 h, and a visual inspection is performed		P

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	Results: No fire, no explosion..... :	See Table 7.9.3	N/A

8	**INFORMATION FOR SAFETY**		P
	Information for safety in accordance with IEC 62619 was provided	Refer to IEC 62619 report Battery system: 704082443411-00 Cell: 085-282360508-000	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

9	**MARKING AND DESIGNATION**		N/A
	The marking items shown in Table 1 of 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

ANNEX A	**WIRING, CONNETIONS AND SUPPLY**		P
Table A.1	Wiring, connections and supply requirement, as addressed in IEC 60950-1:2005		P
Table A.2	Wiring, connections and supply requirement, as addressed in IEC 62368-1		N/A

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5.1	TABLE: Critical components information				
Object/part No.	Manufacturer/ trademark	Type/Model	Technical Data	Standard	Marks of SConformity
For battery module ECO-P1P24WX					
1.Cell (20pcs)	Jiangsu Higee Energy Co., Ltd.	HJLFP48173170 E-120AH/120Ah	DC 3.2V 120Ah	IEC 62619:2022	TÜV SÜD CB No.: SG PSB-BT-04164 Report No.: 085-282360508-000
2.Copper bar between B- and connector	Jiangsu Huasen Precision Technology Co., Ltd	25*3	Materials:Red Copper Cross-section: 25*3(mm2) Rated current: 276A	IEC 62477-1	Test with unit
3.Heat-shrinkable Tube	Changyuan	CB-HFT	Flame class: V-0 70°C	UL 94	CTI CNAS No.A223043 8524101C
4.FUSE	We, Eaton Bussmann Xi'an Fusegear Co., Ltd.	ESP2D-750	Voltage: 250V Current: 750A Topr: -40°C - 120°C	EN 60269-1 EN 60269-4	TÜV Rheinland R 50576949 0001
5.CCS	Shenzhen TOPOS Sensor Technology co,. LTD.	1P10S A/B	For voltage and temperature sampling	IEC 62477-1	Test with unit
-FPCA	ALLSTAR TECH(ZHONGSHAN)TO LTD	ASC-FC-H	Flame class: V-0	IEC 60695	UL E301444
-Plastic uptake	TEESUN	CL8811	Flame class: V-0 80°C	UL 94 UL 746	UL E329660
-Connector	POLYPLASTICS CO LTD	13065B	Flame class: V-0 130°C	UL 94 UL 746	UL E109088
-NTC (8pcs)	Shenzhen TOPOS Sensor Technology co,. LTD.	103KT1608T-1P	R25 =10KΩ±1% B25/85=3435K±1% Topr: -40°C - 85°C	IEC 62477-1	Test with unit
- Temperature sampling wire	SUZHOU XINCHENGDA WIRE&CABLE CO.,LTD	1332	Flame class: VW-1 Voltage: 300V 22 AWG Topr: 200°C	UL 758	UL E537778
-Voltage sampling line	SUZHOU XINCHENGDA WIRE&CABLE CO.,LTD	1332	Flame class: VW-1 Voltage: 300V AWG 22 Topr: 200°C	UL 758	UL E537778
6.HV connector (B+)	Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.	C-ES-FTB-IP20-120 OG	Rated current: 280A Operating voltage: DC1500V	UL 1059 UL 60947-1 UL 508	UL E40625

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			Topr: -40°C - 70°C V-0		
7. HV connector (B-)	Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.	C-ES-FTB-IP20-120 BK	Rated current: 280A Operating voltage: DC1500V Topr: -40°C - 70°C V-0	UL 1059 UL 60947-1 UL 508	UL E40625
8.Plastic material for Cover of CCS	CHENGDU KANGLONGXIN PLASTICS CO LTD	KLX FRPC-1860B	Flame class: V-0 80°C	UL 94	UL E315185
9.Fan	TINGXIANG ELECTRIC (SHANGHAI) CO LTD	TX9238H24B	Rated Voltage: 24V Topr: -20°C - 70°C V-0	UL 507	UL E526072
10.Bumper Strip	JUWAN	EPDM	Flame class:V-0	IEC 62477-1	Test with unit
11. Enclosure	Wuxi Huineng Automation Equipment Co, Ltd.	470×950×231	Material: SPCC T=2.0mm	IEC 62477-1	Test with unit
For Slave board in battery box, model: ESBMM-2412-F HV7.0.1					
13.Slave board in battery box	GOLD	ESBMM-2412-F Hardware version: HV7.0.1 Software version: SV_M2412_63_7.1.2-PWO.1	Monitoring the cells' temperature and voltage	IEC 62619: 2022 IEC 60730-1:2013 IEC 60664-3	Test with unit TÜV SÜD Report No.70.409.22.690.01-00
-PCB material	Kingbrother	KB-04	UL 94V-0	UL 796	UL E225430
-Coating material	BT	BT51	UL 94V-0,130°C	IEC 60695-11-10	UL E531378
-MCU(U12)	GD	GD32F303RCT6	-40°C -85°C Voltage: 3V - 5.5V	IEC 62477-1	Test with unit
-AFE chip(U8_1, U8_2)	GOLD	GT1812	Operational voltage: 10V~60 V Operational temp: -40°C-+125°C	IEC 62477-1	Test with unit
-Balanced resistance (R38_1, R38_2, R40_1, R40_2, R43_1, R43_2,	YAGEO	RC1206FR	62Ω /200V/1%/1/4W/100PPM/-55-155°C	IEC 62477-1	Test with unit

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R47_1, R47_2, R48_1, R48_2, R49_1, R49_2, R50_1, R50_2, R51_1, R51_2, R52_1, R52_2, R53_1, R53_2, R54_1, R54_2, R55_1, R55_2, R57_1, R57_2, R58_1, R58_2, R66_1, R66_2, R67_1, R67_2, R68_1, R68_2, R69_1, R69_2, R70_1, R70_2, R71_1, R71_2, R72_1, R72_2, R73_1, R73_2, R74_1, R74_2, R75_1, R75_2)					
-Optical Couple (U3_1, U3_2, U5_1, U5_2, U6_1, U6_2, U7_1, U7_2)	UMW	EL1018	Isolation voltage: 5000 Vrms Topr: -55°C-+110°C	UL 1577	UL E214129
Digital isolator(U4_1, U4_2)	Chipanalog	CA-IS3841HWW	Isolation voltage: 5700 Vrms Topr: -40°C-+125°C	UL 1577	UL E511334

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Shell	Henan Shenma Huawei Plastic CO.,Ltd	27GF-3	V-0, 65°C Min. thickness 1,5mm,	UL 94	UL E318518
Socket (J8)	LOTES	AAUS01AP2-028K02	1000V DC Topr: -40-125°C Flame class: UL94V-0	UL 94 UL 1977	UL E187055
Socket (J7)	LOTES	AAUS01BP2-028K02	voltage:1000V DC Topr: -40-125°C Flame class: UL94V-0	UL 94 UL 1977	UL E187055
-Relay (K1)	HF	HFD4/5	HFD4/5-S"/Standard SMT/Monostable/Operating current: approx. 30mA/Withstand voltage-Coil and electric shock: 1.6kVAC- Disconnect contact: 1kVA- Contact group: 1.8kAC/Switching capacity: 1A-30VDC&0.3A-125VAC/Coil voltage: 5V	UL 60947	UL E133481
-FUSE (F6)	BrightKing	SMD2920B185TF	Current: 1.85A Voltage: 33v Topr: -40-85℃	-	UL E482628
For high voltage control box: contain BCU board, controller and protect devices					
1.HV Switch	Shanghai Liangxin Electric Appliance Co., Ltd	NDG3VH-315	Rated current: 315A Rated insulation voltage: DC1500V Topr: -40°C - 85°C IC: 10 KA	EN 60947-3	TÜV Rheinland R 50531200
2.Main positive / Main negative Contactor	Join Electric (ShangHai) Co.,Ltd	EVHB250A-24B	Max Load Voltage: DC1500V Contact Rating Current: 250A Topr: -40°C - 85°C IC: 2.5 KA	EN 60947-4-1	TÜV SÜD N8A 109076 0001 Rev.02
3.AC/DC	MORNSUN Guangzhou Science & Technology Co., Ltd.	LMF500-23B24UH	Rated voltage: 85-305VAC/120-430VDC Rated insulation voltage: 4000VAC Topr: -40°C - 85°C	EN 62368-1	UL E235235

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4.DC/DC	MORNSUN Guangzhou Science & Technology Co., Ltd.	PV200-29B24R3	Rated voltage: 250-1500VDC Rated insulation voltage: 4000VAC Topr: -40°C - 70°C	UL 1741	UL E492461
5.HALL	Sinomags Technology Co., Ltd.	STB-CAB500M-22	Supply voltage: 12V Topr: -40°C - 85°C	IEC 62477-1	Test with unit
6.Fuse	We, Eaton Bussmann Xi'an Fusegear Co., Ltd.	ESS2H-250	Voltage: DC1500V Current: 250A Breaking capacity: 250kA, TC≤4mS Topr: -5°C - 40°C	EN 60269	TÜV Rheinland R50627994 0001
7.Insulation Pillar for fuse	HAITAN	SM51	Isolation voltage: 1500V Icc: 63KA	GB/T 10316-2013	CCDT CNAS No.2024WT0393-7
8.HV Connector (B+, P+ Socket)	Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.	ES-BPC-C 50-70 OG	Rated current: 250A Operating voltage: DC1500V Topr: -40°C - 125°C V-0	PPP51090A:2018	TÜV SÜD Z2 077026 0023 Rev.03
9.HV Connector (B+, P+ Plug)	Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.	ES-FT-BPC-B/S 35-70 OG	Rated current: 250A Operating voltage: DC1500V Topr: -40°C - 125°C V-0	PPP51090A:2018	TÜV SÜD Z2 077026 0023 Rev.03
10.HV Connector (B-, P- Socket)	Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.	ES-BPC-C 50-70 BK	Rated current: 250A Operating voltage: DC1500V Topr: -40°C - 125°C V-0	PPP51090A:2018	TÜV SÜD Z2 077026 0023 Rev.03
11.HV Connector (B-, P- Plug)	Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.	ES-FT-BPC-B/S 35-70 BK	Rated current: 250A Operating voltage: DC1500V Topr: -40°C - 125°C V-0	PPP51090A:2018	TÜV SÜD Z2 077026 0023 Rev.03

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12.AC Breaker	Shanghai Liangxin Electric Appliance Co., Ltd	NDB2-63	Rated current:63A Rated insulation voltage: AC 690V Topr: -40°C - 70°C	EN 60898-1 EN 60898-2	TÜV Rheinland R 50436891
13.Diode	Liujing Rectifier Co., Ltd.	LJ-MD25A	Voltage: AC1500V Current: 25A Topr: 160°C	IEC 60747-2:2016	TÜV Rheinland R 50606763 0001
14.KA3 Relay	HONGFA	HF115F	Max Load Voltage: DC300V Contact Rating Current: 16A Topr: -40°C - 85°C	UL 60947-1 UL 60947-4-1	UL E134517
15.DC Wiring	Jiukai Special Cable(Shanghai) Co.,Ltd.	UL 10271	Flame class: VW-1 Voltage:1000V AWG 3 Topr:105°C	UL 758	UL E342399
BMS main board in voltage control box, model: ESBCM-F133-L-S, HV5.0.1					
16.BMS (Main board)	GOLD	Model: ESBCM-F133-L Hardware version: HV5.0.1 Software version: SV_CF133_b3_5.0.1_GB1.10_20230303036_01.09	Over-charge detection voltage for each cell: 3.65 Over-discharge detection voltage for each cell: 2.7V Charge overcurrent detection current: 121A Discharge overcurrent detection current: 140A Charge high temperature protection: 50°C Charge low temperature protection: 0°C Discharge high temperature protection: 55°C Discharge low temperature protection: -20°C	IEC 62619: 2022 IEC 60730-1:2013 IEC 60664-3	Test with unit TÜV SÜD Report No.70.409.22.690.01-00
-PCB	SHENZHEN KING BROTHER ELECTRONICS TECHNOLOGY CO LTD	KB-04	UL 94V-0	UL 796	UL E225430
-MCU(U16)	Beijing Zhixin Microelectronics Technology Co., Ltd	SCM620L144MJA0	3.0V-3.6V, -40°C-+105°C	IEC 62477-1	Test with unit

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-IC for DC/DC POWER (U1)	SCT	SCT2430	Voltage range: 0.8V~40V Topr: -40°C to 125°C	IEC 62477-1	Test with unit
-IC for digital isolator (U31 U33 U26)	Suzhou Novosense Microelectronics Co., Ltd	NSi8221N1	3750 Vrms 2.5V-5V -40°C-+125°C	IEC 62477-1	Test with unit
-IC for EEPROM(U20)	Shanghai beiling Company Limited	BL24C512A	Supply voltage: 1.7V-5.5V Topr: -40°C to 125°C	IEC 62477-1	Test with unit
-IC for WDT (U18)	IMP	IMP706SESA	1.2V-5.5V -40°C -+85°C	IEC 62477-1	Test with unit
-Alternative	SGMICRO	SGM706B-SXS8G/TR	-0.6V-6V -40°C -+125°C	IEC 62477-1	Test with unit
-IC for Flash (U22,U23)	WINBOND	W25Q128FV	2.7V-3.6V -40-+85℃	IEC 62477-1	Test with unit
-Connector (CN1)	CZT	11110205D001	-55 -+105 °C	UL 94	UL E28476
-IC for CAN (U24 U32 U33)	SIT	SIT1051T	4.5V-5.5V -40°C-+150°C	IEC 62477-1	Test with unit
-IC for RS485 (U27)	SIT	SIT65176B	4.5V~5.5V -40°C -+105 °C	IEC 62477-1	Test with unit
- Transformer (T2 T3 T4 T5 T7 T8)	Hanrun Electronics Company Limited	HR600781	Isolation voltage:3750 Vac -40°C-+125°C	IEC 62477-1	Test with unit
-Case	WAH HONG INDUSTRIAL CORP	WH-9100	V-0, 130°C, CTI I	UL 94	UL E150608
-Cover	POLYPLASTICS CO LTD	E130i	V-0, 130°C	UL 746C	UL E106764
-Wire	HUIZHOU CITY DENGGAODA ELECTROTECH CO LTD	FIW F	155°C 0.094-0.039mm	UL 60950-1	UL E501004
- Transformer (T6 T10)	Mianyang Dunyuan Electronics Technology Co.,Ltd	ST06709A0	Isolation voltage: 4300VDC 1mA 60s or 2600VAC Topr: -40°C to 125°C	IEC 62477-1	Test with unit
-IC for HV sampling (U43, U45)	Suzhou Novosense Microelectronics Co., Ltd	NSI1311-DSWVR	Supply voltage: 0.3V-6.5V, Isolation voltage: 5000 Vrms Topr: -40-+125°C	UL 1577	UL E500602
- Optocoupler (U35,	Everlight Electronics., Ltd.	EL1019	Supply voltage: 1.45V, Isolation voltage: 5000 Vrms	UL 1577	UL E214129

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U37, U39, U41, U42)			Topr: -55-+110°C		
-Relay(K1)	XIAmen Hongfa ELectroacoustic Co.Ltd	HF D3-VI/5	VDC:5V Operation temperature：-40°C -+85°C	IEC 62776-1	UL E133481
-Resettable fuse (F2 F3 F5 F6 F7 F8 F9 F10 F11 F12)	POLYTRONICS TECHNOLOGY CORP	SMD1206P035TF	33V, Ih: 0,35A, It: 0,75A, Imax: 100A	UL 1434	UL E201431
-Shell	HENAN SHENMA HUAWEI PLASTIC ENGINEERING CO LTD	27GF(a)	V-0, Min thickness: 1.5mm	UL 94	UL E318518
-Coating material	Guangdong Raise BT Technology Co Ltd	BT51	Coating Flame Class: V-0	IEC 60695-11-10	UL E531378

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7.2	TABLE: Resistance of abnormal heat		N/A
Allowed impression diameter (mm) .....:			¾
Object/ Part No./ Material	Manufacturer/ trademark	Test temperature (°C)	Impression diameter (mm)

Supplementary information:

The test is made in a heating cabinet at a temperature of (ΔT + Tmax + 15 °C) ± 2 °C.

- ΔT means the maximum temperature rise of thermoplastic parts during the most adverse operation specified by the battery system manufacturer at 25 °C ± 5 °C.
- Tmax means upper limit ambient temperature specified by the battery system manufacturer.

7.4	TABLE: Electric insulation check during transport and installation	P

Sample No.	Insulation resistance (MΩ) (1)	Results
ECO-P1P24WX with one high voltage box	49600	A

Supplementary information:

1. The insulation resistance is measured between the positive terminal and externally exposed metal surfaces of the battery at 500 Vdc when measured 60 s after applying the voltage

Results:

A – The insulation resistance is equal to or higher than 5 MΩ
B – The insulation resistance is less than 5 MΩ
C – Other (Please explain): ___

7.6	TABLE: Protection for short circuit during transport and installation	P
Constant discharging current, 0,2 *I*t (A)……:	24A	—
SOC for installation or maintenance (Ah or Wh)……..:	120 Ah	—
Battery configuration (XS/YP)……..:	(1P24S)11S/(1P24S)	—

Sample No.	DUT's temperature at start of test (°C) (1)	External resistance (mΩ) (2)	Results
ECO-E101WX(DC)	32.000	48.090	A, E
ECO-P1P24WX	24.900	99.750	A, E

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Supplementary information:

1. Prior to test, the DUT is stored in an ambient temperature until its temperature is stabilized at 25 °C ± 5 °C.

2. The external resistance to short circuits is (30 mΩ ± 10 mΩ) × battery configuration (= number of series connections / number of parallel connections) or less than 5 mΩ, whichever is higher. Total external resistance is less than 100 mΩ.

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

7.7	TABLE: Protection for reverse connection				N/A
Constant discharging current, 0,2 *I*t (A) ..... :					¾
SOC for installation or maintenance (Ah or Wh) .....:					—
Sample No.	**Charging voltage (Vdc)**	**Charging current (A)**	**Maximum discharging current (A)**	**Results**	

Supplementary information:

Results:
A – No fire or explosion
B – Fire
C – Explosion
D – The DUT is fully charged and then is rested for one hour
E – The charging is stopped by a safety protection and then is rested for one hour
F – The DUT can be discharged with maximum discharge current until stopped by itself and then is rested for one hour
G – The DUT can't be discharged and then is rested for one hour
H – Other (Please explain): ___

7.8	TABLE: Overdischarge control of voltage test (battery system)					P
Constant discharging current, 0,2 *I*t (A)……:		24 A				—
30% of rated capacity (Ah)……:		36 Ah				—
Sample No.	**Maximum discharging current applying to battery (A)(1)**		**OCV at end of the test (Vdc)**		**Lower limit discharging voltage of the cell (Vdc)**	**Results**
	Whole system	**Cell(s)**	**Whole system**	**Cell(s)**		

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ECO-P1P24WX with one high voltage box	135	240	64.120	2.710/2.740/ 2.710	2.500	A, D

Supplementary information:

1. If it is difficult to overdischarge the whole system, the exceeded voltage can be applied to a part of the system such as the cell(s) in the 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 lower limit discharging voltage
E - The voltage of the measured cells or cell blocks did exceed the lower limit discharging voltage
F – Other (Please explain): ___

7.9.2	**TABLE: Whole drop test**				**N/A**
Constant discharging current, 0,2 *I*t (A)……:					—
SOC for installation or maintenance (Ah or Wh)……..:					—
Sample No.	**Mass of DUT (kg)**	**Height of drop (m)(1)**	**OCV at start of the test (Vdc)**	**Impacted points (2)**	**Results**

Supplementary information:

Mass of the DUT, *m*	Test method	Orientation	Height of drop
m < 7 kg	Whole	Random	100,0 cm
7 kg ≤ *m* < 20 kg	Whole	Bottom down direction (Note)	100,0 cm
20 kg ≤ *m* < 50 kg	Whole	Bottom down direction (Note)	50,0 cm
50 kg ≤ *m* < 100 kg	Edge and corner	--	5,0 cm
m ≥ 100 kg	Edge and corner	--	2,5 cm
Note – The bottom surface of the DUT is specified by the manufacturer			

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

7.9.3	**TABLE: Edge and corner drop test**				**P**
Constant discharging current, 0,2 *I*t (A)..... :	24 A				—
SOC for installation or maintenance (Ah or Wh) .....:	120 Ah				—
Sample No.	**Mass of DUT (kg)**	**Height of drop (m)(1)**	**OCV at start of the test (Vdc)**	**Impacted points (2)**	**Results**

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ECO-P1P24WX	96.195	0.500	79.900	Edge and corner	A

Supplementary information:

Mass of the DUT, *m*	Test method	Orientation	Height of drop
m < 7 kg	Whole	Random	100,0 cm
7 kg ≤ *m* < 20 kg	Whole	Bottom down direction (Note)	100,0 cm
20 kg ≤ *m* < 50 kg	Whole	Bottom down direction (Note)	50,0 cm
50 kg ≤ *m* < 100 kg	Edge and corner	--	5,0 cm
m ≥ 100 kg	Edge and corner	--	2,5 cm
Note – The bottom surface of the DUT is specified by the manufacturer			

Results:

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

--- End of test report ---

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