



Test Report issued under the responsibility of:



**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.....: CN22R1OZ 001

Date of issue.....: 2022-09-16

Total number of pages..... 22 pages

Name of Testing Laboratory preparing the Report..... TÜV Rheinland (Shenzhen) Co., Ltd.

Applicant's name .....: Opal Energy Pte Ltd

Address .....: 18, Boon Lay Way, #06-107 Trade Hub 21 609966, Singapore

**Test specification:**

Standard.....: IEC 62619: 2017

Test procedure .....: CB Scheme

Non-standard test method .....: N/A

Test Report Form No. ....: IEC62619A

Test Report Form(s) Originator ....: UL(Demko)

Master TRF.....: Dated 2018-06-07

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<b>Test item description</b> .....		Power Lite
<b>Trade Mark</b> .....		
<b>Manufacturer</b> .....		Shenzhen UZ Energy Limited ROOM313, 3F 3BLOCK, DUOLI INDUSTRIAL ZONE, 105#MEIHUA RD., SHANGMEILIN, FUTIAN DISTRICT, SHENZHEN, 518049 Guangdong, P.R. China
<b>Model/Type reference</b> .....		OPAL L051100-A1
<b>Ratings</b> .....		51.2 V, 100 Ah
<b>Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):</b>		
<input checked="" type="checkbox"/>	<b>CB Testing Laboratory:</b>	TÜV Rheinland (Shenzhen) Co., Ltd.
<b>Testing location/ address</b> .....		1F East & 3F West -4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, 518057, Shenzhen, China
<b>Tested by (name, function, signature)</b> .....		Xun Yu, Engineer
<b>Approved by (name, function, signature)</b> ...		Corney Zhang, Reviewer
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 1:</b>	
<b>Testing location/ address</b> .....		
<b>Tested by (name, function, signature)</b> .....		
<b>Approved by (name, function, signature)</b> ...		
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 2:</b>	
<b>Testing location/ address</b> .....		
<b>Tested by (name + signature)</b> .....		
<b>Witnessed by (name, function, signature)</b> ..:		
<b>Approved by (name, function, signature)</b> ...		
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 3:</b>	
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 4:</b>	
<b>Testing location/ address</b> .....		
<b>Tested by (name, function, signature)</b> .....		
<b>Witnessed by (name, function, signature)</b> ..:		
<b>Approved by (name, function, signature)</b> ...		
<b>Supervised by (name, function, signature) :</b>		

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

Attachment 1: Photo documentation (4 pages).

**Summary of testing:****Tests performed (name of test and test clause):**

cl.7.2.3.3 Edge and corner drop test (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 component cell (001CB0Y0) used inside was complied with the requirement of IEC 62619:2017, certified by TÜV SÜD, certificate No. SG PSB-BT-01455M1.

The samples comply with the requirement of IEC 62619: 2017.

**Testing location:****TÜV Rheinland (Shenzhen) Co., Ltd.**

1F East &amp; 3F West -4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, 518057, Shenzhen, China

**Summary of compliance with National Differences (List of countries addressed):**

No EU Group Differences

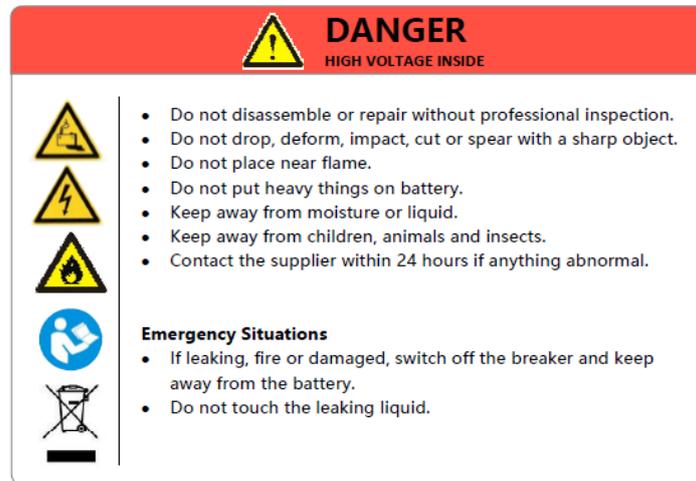
 **The product fulfils the requirement of EN 62619:2017**

**Copy of marking plate**

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



and


**SN naming rules:**

For example, 'ALF051100A1022BB0001'

'ALF' means product type; '051' means rated voltage, 51.2Vdc;

'100' means battery Capacity, 100AH; 'A10' means product model;

'22' means the year of manufacture, '22' means 2022, '23' means 2023, ...;

'B' means the month of manufacture, '1' means January, '2' means February, ..., 'A' means October, ...;

'B' means the day of manufacture ('1' means 01, '2' means 02, ..., 'A' means 10...);

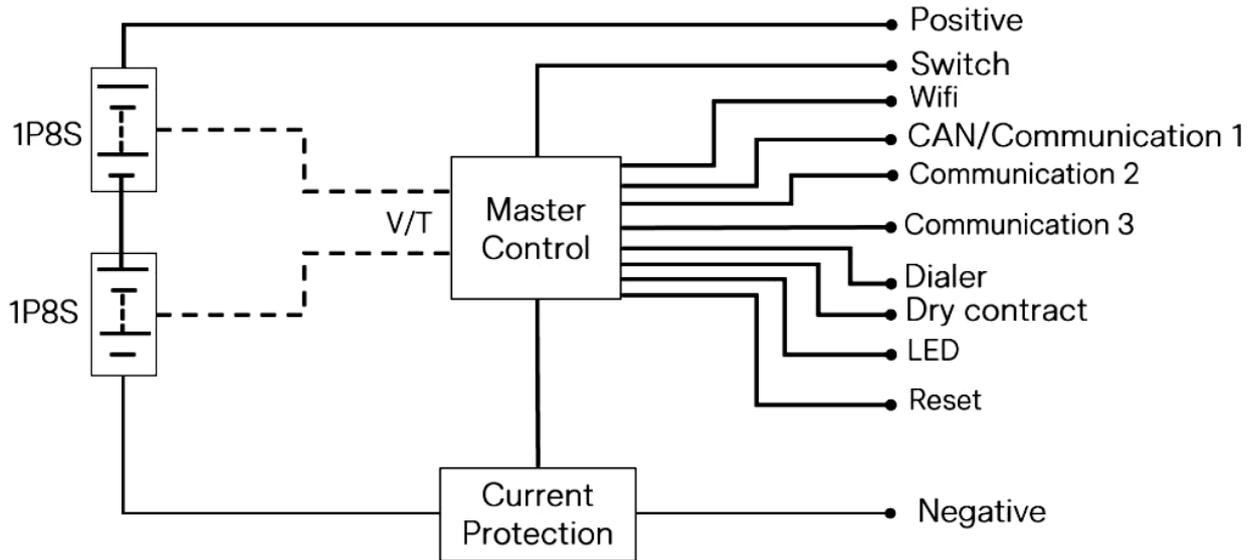
'0001' means serial number, 0001-9999.

**Remark:** The model name and manufacturing traceability shall be marked on the battery surface. The other items listed above can be marked on the smallest package or supplied with the battery.

<b>Test item particulars</b> .....	
<b>Classification of installation and use</b> ..... : To be defined in final product	
<b>Supply Connection</b> ..... : Not directly connected to mains ..... :	
<b>Possible test case verdicts:</b>	
- 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)	
<b>Testing</b> .....	
<b>Date of receipt of test item</b> ..... : 2022-01-22	
<b>Date (s) of performance of tests</b> ..... : 2022-01-22 to 2022-02-18	
<b>General remarks:</b>	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.  <b>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</b>	
<b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:</b>	
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 ..... :	<input type="checkbox"/> <b>Yes</b> <input checked="" type="checkbox"/> <b>Not applicable</b>
<b>When differences exist; they shall be identified in the General product information section.</b>	
<b>Name and address of factory (ies)</b> ..... : <b>Futurepath Electronics Technology (Dongguan)Co, Ltd.</b> No.1 Deye Road, Changxiang Village Changtian Industrial Park, Hengli Town, Dongguan, Guangdong, P.R. China	

**General product information and other remarks:**

- The battery system is constructed with 16 cells in 1P16S connection.
- The electric, electronic and software controls and systems for critical safety was subjected to analysis for functional safety according to IEC 60730-1 Annex H.

Tropology diagram:


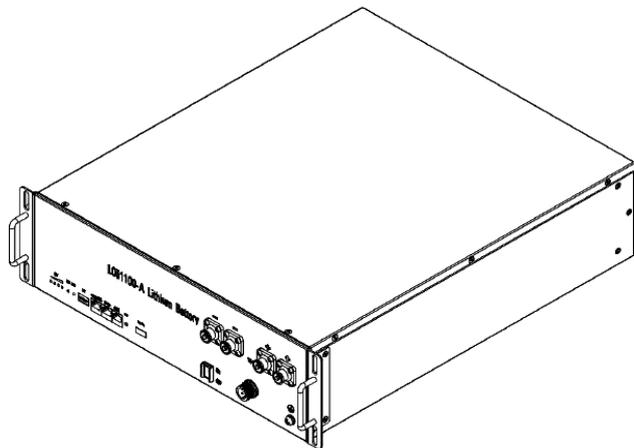
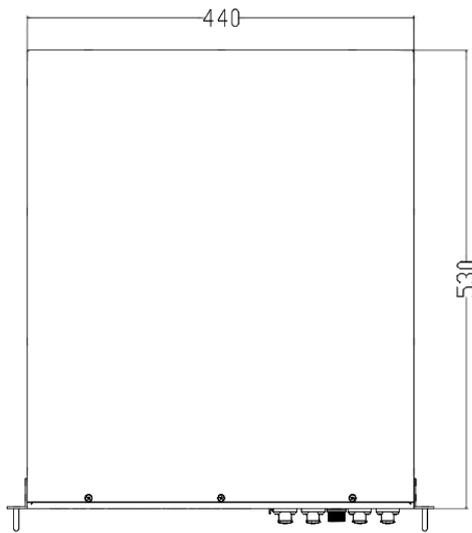
## The main features of Battery System are shown as below:

Product name .....	Power Lite
Model .....	OPAL L051100-A1
Capacity .....	100Ah
Nominal Voltage.....	51.2V DC
Maximum continuous Charge Current .....	50A
Maximum continuous Discharge Current.....	100A
Standard Fully Charge Voltage .....	57.6V DC
Maximum Charge Voltage .....	57.6V DC
End of Discharge Voltage .....	44.8V DC
Charging Temperature Range .....	5°C ~ 55°C
Discharging Temperature Range.....	-20°C ~ 50°C
Storage Temperature Range, recommended .....	-20°C ~ 50°C
Recommend Charging Method declared by the Manufacturer .....	Charged with constant current 50A till battery voltage reaches 57.6V, then switch to constant voltage 57.6V till charging current drops to 5A.
Nominal mass .....	Approx. 45kg
External dimensions (Width, Depth, Height) .....	440.0(±5.0)mm×530.0(±5.0)mm×132.0(±5.0)mm
Battery designation .....	IFpP51/161/120[1P16S]M/0+55/90

Internal cell operating region:

Product name .....	Rechargeable Lithium-ion Cell
Model .....	001CB0Y0
Capacity .....	100Ah
Nominal Voltage.....	3.2V
Maximum continuous Charging Current .....	100A
Maximum continuous Discharging Current.....	100A

Standard Fully Charge Voltage .....	3.65V
Maximum Charge Voltage .....	3.65V
End of Discharge Voltage .....	2.5V
Charging Temperature Range .....	5°C ~ 65°C
Discharging Temperature Range .....	-30°C ~ 65°C
Cell designation.....	IFpP51/161/120/M/-20+60/90

**Unit (mm):**


IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
<b>4</b>	<b>PARAMETER MEASUREMENT TOLERANCES</b>		<b>P</b>
	Parameter measurement tolerances		P
<b>5</b>	<b>GENERAL SAFETY CONSIDERATIONS</b>		<b>P</b>
<b>5.1</b>	<b>General</b>		<b>P</b>
	Cells and batteries are safe under conditions of both intended use and reasonably foreseeable misuse ...	See also table 5.1 for Critical components information.	P
<b>5.2</b>	<b>Insulation and wiring</b>		<b>P</b>
	Voltage, current, altitude, and humidity requirements		P
	Adequate clearances and creepage distances between connectors		P
	The mechanical integrity of internal connections		P
<b>5.3</b>	<b>Venting</b>		<b>P</b>
	Pressure relief function	Vent designed in cell.	P
	Encapsulation used to support cells within an outer casing		P
<b>5.4</b>	<b>Temperature/voltage/current management</b>		<b>P</b>
	The design prevents abnormal temperature-rise	Integrated in BMS.	P
	Voltage, current, and temperature limits of the cells		P
	Specifications and charging instructions for equipment manufacturers	Provided with product.	P
<b>5.5</b>	<b>Terminal contacts of the battery pack and/or battery system</b>		<b>P</b>
	Polarity marking(s)	Marking near the Power 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
<b>5.6</b>	<b>Assembly of cells, modules, or battery packs into battery systems</b>		<b>P</b>
<b>5.6.1</b>	<b>General</b>		<b>P</b>
	Independent control and protection method(s)		P
	Recommendations of cell operating limits by the cell manufacturer		P
	Batteries designed for the selective discharge of a portion of their series connected cells	No such design.	N/A
	Protective circuit component(s) and consideration to the end-device application		P
<b>5.6.2</b>	<b>Battery system design</b>		<b>P</b>
	The voltage control function		P

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	The voltage control for series-connected batteries		P
<b>5.7</b>	<b>Operating region of lithium cells and battery systems for safe use</b>		<b>P</b>
	The cell operating region .....	Listed in the specification of cell.	P
	Designation of battery system to comply with the cell operating region	Information mentioned in manufacturer's specifications.	P
<b>5.8</b>	<b>Quality plan</b>		<b>P</b>
	Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented .....	ISO 9001:2015 certification provided.	P
	The process capabilities and the process controls		P
<b>6</b>	<b>TYPE TEST CONDITIONS</b>		<b>P</b>
<b>6.1</b>	<b>General</b>		<b>P</b>
<b>6.2</b>	<b>Test items</b>		<b>P</b>
	Cells or batteries that are not more than six months old (See Table 1 of IEC62619)		P
	Capacity confirmation of the cells or batteries		P
	Default ambient temperature of test, 25 °C ± 5 °C	Tests were carried out in an ambient temperature of 25 ± 5°C.	P
<b>7</b>	<b>SPECIFIC REQUIREMENTS AND TESTS</b>		<b>P</b>
<b>7.1</b>	<b>Charging procedure for test purposes</b>		<b>P</b>
	The battery discharged to a specified final voltage prior to charging	44.8V DC.	P
	The cells or batteries charged using the method specified by the manufacturer .....	The method mentioned in manufacturer's specifications.	P
<b>7.2</b>	<b>Reasonably foreseeable misuse</b>		<b>P</b>
7.2.1	External short-circuit test (cell or cell block)	Approved cell used.	N/A
	Short circuit with total resistance of 30 mΩ ± 10 mΩ at 25 °C ± 5 °C		N/A
	Results: no fire, no explosion		N/A
7.2.2	Impact test (cell or cell block)	Approved cell used.	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)	Approved cell used.	P
7.2.3.1	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
7.2.3.2	Whole drop test (cell or cell block, and battery system)	The mass of battery system is more than 20kg.	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 .....	Battery system	—
	Mass of the test unit (kg) .....	45	—
	Height of drop (m) .....	0.1 m	—
	Results: no fire, no explosion		P
7.2.4	Thermal abuse test (cell or cell block)	Approved cell used.	N/A
	Results: no fire, no explosion		N/A
7.2.5	Overcharge test (cell or cell block)	Approved cell used.	N/A
	For those battery systems that are provided with only a single protection for the charging voltage control		—
	Results: no fire, no explosion .....		N/A
7.2.6	Forced discharge test (cell or cell block)	Approved cell used.	N/A
	Upper limit charge voltage of the cell .....		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, $I_m$ .....		N/A
	Discharge current for forced discharge, 1.0 $I_t$ .....		N/A
	Discharging time, $t = (1 I_t / I_m) \times 90$ (min.) .....		N/A
	Results: no fire, no explosion .....		N/A
<b>7.3</b>	<b>Considerations for internal short-circuit – Design evaluation</b>		<b>N/A</b>
7.3.1	General		N/A
7.3.2	Internal short-circuit test (cell)	Approved cell used.	N/A
	Samples preparation procedure: a), in accordance with 8.3.9 of IEC62133:2012; or b), the nickel particle inserted before charging, or c), the nickel particle was inserted before electrolyte filling.....		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Tested according to Cl. 8.3.9 of IEC 62133:2012 test method, except all tests were carried out 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, no explosion .....		N/A
<b>7.3.3</b>	<b>Propagation test (battery system)</b>	<b>Alternate item 7.3.2 for cell performed.</b>	<b>N/A</b>
	Method to create a thermal runaway in one cell ....:		N/A
	Results: No external fire from the battery system or no battery case rupture .....		N/A

<b>8</b>	<b>BATTERY SYSTEM SAFETY (CONSIDERING FUNCTIONAL SAFETY)</b>		<b>P</b>
<b>8.1</b>	<b>General requirements</b>		<b>P</b>
	Functional safety analysis for critical controls	Evaluated according to IEC 60730-1 Annex H.	P
	Conduct of a process hazard, risk assessment and mitigation of the battery system		P
<b>8.2</b>	<b>Battery management system (or battery management unit)</b>		<b>P</b>
8.2.1	Requirements for the BMS		P
	The safety integrity level (SIL) target of the BMS		N/A
	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	64.24V DC.	P
	The exceeded charging voltage applied to only a part of the battery system, such as the cell(s) .....		N/A
	Results: no fire, no explosion .....	See Table 8.2.2.	P
	The BMS interrupted the overcharging before reaching 110% of 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

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Clause	Requirement + Test	Result - Remark	Verdict
	The cooling system, if provided, was disconnected		N/A
	Elevated temperature for charging, 5 °C above maximum operating temperature .....	60	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
<b>9</b>	<b>INFORMATION FOR SAFETY</b>		<b>P</b>
	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
<b>10</b>	<b>MARKING AND DESIGNATION (REFER TO CLAUSE 5 OF IEC 62620)</b>		<b>P</b>
	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	IFpP51/161/120[1P16S]M/0+5 5/90, provided with product (Specification / Manual / Installation instruction).	P
	Battery structure formulation	16S	P

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

<b>ANNEX A</b>	<b>OPERATING REGION OF CELLS FOR SAFE USE</b>		<b>P</b>
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		P
A.6	Low temperature range		P
A.7	Discharging conditions for safe use		P
A.8	Example of operating region		P

<b>ANNEX B</b>	<b>PROCEDURE OF 7.3.3 PROPAGATION TEST</b>		<b>N/A</b>
B.1	General		N/A
B.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.....:		—
B.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.....:		—

<b>ANNEX C</b>	<b>PACKAGING</b>		<b>N/A</b>
	The materials and pack design chosen in such a way as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants	Informative.	N/A

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

5.1	TABLE: Critical components information					P
Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity <sup>1)</sup>	
Enclosure	Futurepath Electronics Technology(Dongguan) Co., Ltd.	EN100	Dimension(LDH): 440 x 530* 132mm); wall thickness 1.2mm, material SGCC galvanized sheet, painted black (color: RAL9011)	IEC 62619:2017	Tested with appliance	
Cell	CATL	001CB0Y0	LFP, 3.2V, 100Ah	IEC 62619:2017	TUV SUD SG PSB-BT-01455M1	
PCB	GUANGDONG CHENGDE ELECTRONIC TECHNOLOGY CO LTD	D1	130°C, V-0, IIIa	UL 94	UL E322995	
(Alternative)	KINGBOARD LAMINATES HOLDINGS LTD	KB-6167F	130°C, V-0, IIIa	UL 94	UL E123995	
IC for control (U14)	STMicroelectronics	STM32F103 VCT6	Core: ARM 32-bit M3 CPU Flash: 256Kbytes Vmax: 3.6V ADC 12-bit:16 Package: LQFP100	IEC 62619:2017	Tested with appliance	
(Alternative)	STMicroelectronics	STM32G0B1VCT6	Core: ARM 32-bit M0+ CPU Flash: 512Kbytes Vmax: 3.6V ADC 12-bit:16 Package: LQFP100	IEC 62619:2017	Tested with appliance	
IC for battery stack monitor (U6)	Panasonic	AN49503A	CELLS: 6-16s, tSTG: -55-125°C, Package: LQFP080-P-1414FZ	IEC 62619:2017	Tested with appliance	
(Alternative)	LAPIS SEMICONDUCTOR CO LTD	ML5238	16cells, operating temperature: -40°C to +85°C, power supply voltage: +7V to +80V	IEC 62619:2017	Tested with appliance	
(Alternative)	Suzhou Novosense Microelectronics Co.,Ltd	NSI8231W1	Insulation voltage: 8000V, Topr: -40-125°C, Cr&cl: ≥8mm	UL 1577	UL E500602	

IEC 62619					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	Suzhou Novosense Microelectronics Co.,Ltd	NSI8131W1	Insulation voltage: 5300V Topr: -40-125°C Cr&cl: ≥4mm	UL 1577	UL E500602
MOSFET for charge (M2,M4,M6, M8,M10,M12,M14,M16)	CRMICRO	CRSS028N10N	VDS: 100V VGS: ±20V ID: 180A (Tc=25°C) TJ: -55-150°C Package: TO-263	IEC 62619:2017	Tested with appliance
(Alternative)	TOSHIBA	TK160F10N1	VDS: 100V, VGS: ±20V, ID: 160A (TA=25°C), TJ: -55-175°C	IEC 62619:2017	Tested with appliance
MOSFET for discharge (M1, M3, M5, M7, M9, M11, M13, M15)	CRMICRO	CRSS028N10N	VDS: 100V, VGS: ±20V ID: 180A (Tc=25°C) TJ: -55-150°C Package: TO-263	IEC 62619:2017	Tested with appliance
(Alternative)	TOSHIBA	TK160F10N1	VDS:100V, VGS:±20V, ID:160A (TA=25°C), TJ:-55-175°C	IEC 62619:2017	Tested with appliance
Isolated power supply	MORNSUN GUANGZHOU SCIENCE & TECHNOLOGY CO., LTD.	H1212S-2WR2	Input: DC12V Output: DC12V	UL 60601-1	UL E347375
Wire for BMS power supply	DONGGUAN ZHONGZHEN ENERGY TECHNOLOGY CO.,LTD	3135 16AWG	120mm, 16AWG, Red	UL 758	UL E355578
(Alternative)	DONGGUAN WENCHANG ELECTRONIC CO LTD	3135 16AWG	120mm, 16AWG, Red	UL 758	UL E214500

IEC 62619					
Clause	Requirement + Test		Result - Remark	Verdict	
Connector	General Connectivity System co., LTD	PSR6XAB25 / PSR6XBB25	Nominal Voltage: 1000V DC Nominal Current: 16 mm <sup>2</sup> 100A, 25 mm <sup>2</sup> 120A Dielectric Voltage Withstand Test: 3500VAC, <1mA Insulation Resistance: 5000MΩ (MIN) Working Temperature: -40°C ~+105°C, IP Classification (mated): IP67/IPXXD, Fire Retardant: UL94-V0, Mating Cycle: ≥100 times	EN 61984:2009	TUV Rh R 50420157
(Alternative)	Sanco Intelligent Connector Technology Co., Ltd	ES090-01M6-1SY( )-01 (Black) ES090-01M6-2SY( )-01 (Orange)	Voltage Rating: DC 1000V/AC 800V, Current Rating: 120A (25 mm <sup>2</sup> ), 150A(35mm <sup>2</sup> ), Insulation Resistance: >500MΩ Withstand Voltage: 3000V DC, Tested to 200 mating cycles	EN 61984:2009	TUV Rh R 50524172
(Alternative)	GENERAL CONNECTIVITY SYSTEM CO., LTD	PSR6XABM 5/ PSR6XBBM 5	Nominal Voltage: 1000V DC Nominal Current: 25 mm <sup>2</sup> 120A, Dielectric Voltage Withstand Test: 3500VAC, <1mA, Insulation Resistance: 5000MΩ(MIN) Working Temperature: -40°C ~ +105°C, IP Classification (mated): IP67/IPXXD, Fire Retardant: UL94-V0, Mating Cycle: ≥100 times	EN 61984:2009	TUV Rh R 50420157
Wire	Shenzhen Longshengda Wire&Cable Co.,Ltd.	3530 4/8AWG	120mm, 4/8 AWG	UL 758	UL E472430
(Alternative)	DONGGUAN ZHONGZHEN ENERGY TECHNOLOGY CO.,LTD	3512 4/8AWG	120mm, 4/8 AWG	UL 758	UL E355578
(Alternative)	DONGGUAN WENCHANG ELECTRONIC CO LTD	3512 4/8AWG	120mm,4/8 AWG	UL 758	UL E214500
(Alternative)	GUANGDONG HAERKN NEW ENERGY CO.,LTD	3512 4/8AWG	12mm 4/8 AWG	UL 758	UL E300956

IEC 62619					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	DONG GUAN DEWEI DELCTRONIC CO LTD	3512 4/8AWG	120mm, 4/8 AWG	UL 758	UL E339716
(Alternative)	ELETECK WIRE & CABLE CO., LTD	3512 4/8AWG	120mm, 4/8 AWG	UL 758	UL E254881
Wire	ELETECK WIRE & CABLE CO., LTD	3530 3/6AWG	Nominal Voltage: 300V DC, Dielectric Voltage Withstand Test: 3kV(MIN), Insulation Resistance(withstand current): ≥120A	UL758	UL E254881
(Alternative)	DONG GUAN DEWEI DELCTRONIC CO LTD	3132 3/6AWG	Nominal Voltage: 300V DC Dielectric Voltage Withstand Test: 3kV(MIN), Insulation Resistance(withstand current): ≥120A	UL 758	UL E339716
(Alternative)	ELETECK WIRE & CABLE CO., LTD	3530 3/6AWG	Nominal Voltage: 300V DC Dielectric Voltage Withstand Test: 3kV(MIN), Insulation Resistance(withstand current): ≥120A	UL758	UL E254881
(Alternative)	DONG GUAN DEWEI DELCTRONIC CO LTD	3132 3/6AWG	Nominal Voltage: 300V DC Dielectric Voltage Withstand Test: 3kV(MIN), Insulation Resistance(withstand current): ≥120A	UL 758	UL E339716
<b>Supplementary information:</b>					
1) Provided evidence ensures the agreed level of compliance. See OD-2039. License available upon request.					

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

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 (K)	Results	
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**Supplementary information:**
**Results:**

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
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**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): \_\_\_\_\_

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

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 <sup>1)</sup>	Maximum applied pressure, (N)	Results	
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**Supplementary information:**  
<sup>1)</sup> 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): \_\_\_\_

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

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	
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Method of cell failure <sup>1)</sup>		Location of target cell		Area for fire protection (m <sup>2</sup> )		
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**Supplementary information:**

- 1) Cell can be failed through 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): \_\_\_\_\_

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

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	
B1	3.176 ~ 3.205	50	56.75	3.648	A, D, F	
			<b>Charge Voltage Applied Battery System: 1)</b>			
			<b>Whole</b>	<b>Part</b>		
			64.24	--		

**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.
- The maximum charging voltage limit of single cell is 3.65V.

**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	
B1	51.02	60	52.56	A, D, F	

**Supplementary information:**

- The maximum charging current limit of single cell is 100A.

**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): \_\_\_\_\_

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

<b>8.2.4</b>	<b>TABLE: Overheating control (battery system)</b>			<b>P</b>
Model No.	OCV at start(SOC 50%) of test, V dc	Maximum Charging Current, A	Maximum Charging Voltage, V dc	
B1	52.76	50	53.78	
Maximum Specified Temperature of Battery System, °C		Maximum Measured Cell Case Temperature, °C	Results	
55		60	A, D, F	

**Supplementary information:**

1. The charging upper temperature limit of single cell is 65°C.

**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): \_\_\_\_\_

**-- End of test report --**