Technical Report No. 技术报告编号: 68.282.24.0035.01

Date 日期: 2024-01-30

Client 申请人:	Name 名称:	BMZ Company Limited 比瑞科技(深圳)有限公司
	Address 地址:	Blk B Julong Technology Bldg, Southwest of the intersection of baolong No.1 Rd, and Chenxin Rd, Baolong Street, Longgang District, 518116 Shenzhen, PEOPLE'S REPUBLIC OF CHINA 深圳市龙岗区宝龙街道宝龙一路和诚信路交汇处西南侧巨龙科技大厦 B 栋
	Contact person 联系人:	Vitaly Zhou
Manufacturer 制造商:	Name 名称:	BMZ Company Limited 比瑞科技(深圳)有限公司
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	Contact person 联系人:	Vitaly Zhou
Factory 工厂:	Name 名称:	BMZ Company Limited 比瑞科技(深圳)有限公司
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	Contact person 联系人:	Vitaly Zhou

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Technical Report

Test object 测试对象:	Product 产品名称:	Li-ion Battery
	Model 型号:	BL8091A
	Trade mark 商标:	BMZ THE INNOVATION GROUP
Test specification 测试要求:	ST/SG/AC.10/11/Rev.7 2019/Amend.1 2021/ Manual of Tests and Criteria / Part III, Subsection 38.3, ST/SG/AC.10/11/Rev.7 2019/Amend.1 2021 联合国《关于危险货物运输的建议书/试验和标准手册》/第三部分，38.3 标准要求	
Purpose of examination 测试目的:	• Testing and evaluation according to the test specification 按照测试要求进行测试和评估	
Test result 测试结果:	The test results show that the presented product is in compliance with the above listed test specifications. 测试结果显示产品符合测试规范	
Remark 备注:	The Chinese contents in this report are only for reference. 本报告中中文内容仅供参考	

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1. Description of the test object 测试样品描述

1.1 Picture(s) 照片

1.2 Function 功能

Manufacturer's specification for intended use 参见制造商规格书中的预期用途:
(According to the user manual 按照使用说明书)

1.3 Consideration of the foreseeable use 是否考虑可预见的误用

☐ Not applicable 不适用

☒ Covered through the applied standard 被使用的标准覆盖

☐ Covered by the following comment*被如下内容覆盖*

☐ Covered by attached risk analysis 被附件的风险分析覆盖

*

1.4 Technical Data 技术数据

The battery model: BL8091A, is used in portable applications and consist of 10 cells connected in parallel as a cellblock, and then 14 cellblocks connected in series, cell model: INR 21700 50 E. The cell is tested with battery.(from client's information, manufacturer: BMZ Germany Gmbh).
电池型号：BL8091A用于便携式电器，由单电芯组成，电芯型号为INR 21700 50 E.(制造商：深圳市海雷新能源有限公司.该信息来源于客户).

Additionally, detailed information of the cell and battery are as following 电芯和电池的详细信息如下

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Product name 产品名称	Cylindrical Lithium Ion Cell	Li-ion Battery
Type/model 型号	INR 21700 50 E	BL8091A
Nominal voltage 标称电压(V)	3.6Vd.c.	50.4Vd.c.
Rated capacity/rated energy 额定容量(mAh)/额定能量(Wh)	5000mAh/ 18Wh	50Ah/ 2520Wh
Charging voltage declared by manufacturer 制造商规定标准充电电压(V)	4.2V	58.8V
Maximum charge voltage specified by the manufacturer 制造商规定最大充电电压(V) *	4.23V	58.8V
Charging current declared by manufacturer 制造商规定标准充电电流(mA)	1000mA	15A
Maximum charge current specified by the manufacturer 制造商规定最大充电电流(mA)*	5000mA	25A
Maximum discharge current specified by the manufacturer 制造商规定最大放电电流(mA)	15.0A	70A
Final voltage 放电截止电压(V)	2.5V	44.8V
Standard Charge method 标准充电方法*	Charge at constant current 1000mA until voltage reaches 4.2V, then charge at constant voltage 4.2V till charge current is 100mA.	Charge at constant voltage 58.8V, 1000W till display screen reads 100% (Integrated charging circuit used).
Dimensions 尺寸	(21.7±0.2)mm(D)×(70.9±0.2)mm(H)	Max. (T×W×L): (227.3×470.5×507.2)mm
Weight 重量	(72±4)g	Approx.: 25.5kg

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2. Order 订单

2.1 Date of Purchase Order, Customer's Reference 订单日期，客户的参考文件

2023-11-15

2.2 Test Sample(s) 测试样品

- Reception date(s) 收样日期: 2024-01-08
- Location(s) of reception 接收地点: Shenzhen ENE-BAT department 深圳 ENE-BAT 部门
- Condition of test sample(s) 测试样品状态: complete 完好

2.3 Testing 测试

- Testing date(s) 测试日期: 2024-01-09 to 2024-01-30
- Location(s) of testing 测试地点: Name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
  南德认证检测(中国)有限公司深圳分公司
  Address: Building A2, Jin'ao Industrial Park, No.150, Jingfang Road, Fuhai, Bao'an District, Shenzhen, Guangdong 518103, China
  深圳市宝安区福海街道景芳路 150 号金澳工业园 A2 栋

2.4 Points of Non-Compliance or Exceptions of the Test Procedure

测试程序中不符合或者豁免的点

- None 无

3. Test Results 测试结果

☒ Decision rule according to ILAC-G8:09/2019 clause 4.2.1 Binary statement for simple acceptance rule or IEC Guide 115:2023, clause 4.3.3 Simple acceptance was applied.

☐ Decision rule according to customer's requirements was applied. It is:

☐ Decision rule according to ILAC-G8:09/2019 clause 4.2.2 Binary statement with guard band - guard band length = 95 % extended measurement uncertainty, was applied.

☐ Decision rule (based on ILAC-G8:09/2019 clause 4.2.3 Non-binary statement with guard band, guard band length = 95 % extended measurement uncertainty) for an upper specification limit (A lower limit or specification with an up-per and a lower limit is treated similarly.):

- Compliance with the requirement: If a specification limit is not breached by a measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification will be stated (e. g. Pass).
- Non-compliance with the requirement: If a specification limit is exceeded by the measurement result minus the expanded uncertainty with a 95% coverage probability, then non-compliance with the specification will be stated (e. g. Fail).
- Inconclusive result: If a measurement result plus/minus the expanded uncertainty with a 95 % coverage probability overlaps the limit it will be stated that it is not possible to state compliance or non-compliance.

☐ There are no statements to conformity or no results with measurand stated in this report, no decision rule has been applied.

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3.1 Procedure 测试程序

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and Test T.8 shall be conducted using not otherwise tested cells or batteries. Test T.7 may be conducted using undamaged batteries previously used in tests T.1 to T.5 for purposes of testing on cycled batteries.

Type	State	T.1	T.2	T.3	T.4	T.5	T.6	T.7	T.8
Large batteries	first cycle, fully charged state	Sample No: N1 to N2						Sample No: N8 to N9	
	25th cycle, fully charged state	Sample No: C1 to C2							
	first cycle, 50% charged state						Sample No: N3 to N7		
	25th cycle, 50% charged state						Sample No: C3 to C7		
	25th cycle, fully charged state							Sample No: C8 to C9	
	first cycle, fully discharged state								Sample No: N10 to N19
	25th cycle, fully discharged state								Sample No: C10 to C19

3.2 Clause 38.3.4.1 Test T.1: Altitude simulation 测试T. 1高度模拟

3.2.1 Purpose

This test simulates air transport under low-pressure conditions.

3.2.2 Test procedure

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

3.2.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

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Test result:

State of batteries	Sample No.	Pre-test		After test		Mass loss, %	Voltage after test/Voltage pre-test, %	Results
		Mass, kg	Voltage, V	Mass, kg	Voltage, V			
first cycle, fully charged state	N1	25.43	57.73	25.43	57.69	0.000	99.93	Pass
	N2	25.41	57.78	25.41	57.72	0.000	99.90	Pass
25th cycle, fully charged state	C1	25.44	57.88	25.44	57.78	0.000	99.83	Pass
	C2	25.52	57.85	25.52	57.75	0.000	99.83	Pass

3.3 Clause 38.3.4.2 Test T.2: Thermal test 测试T. 2温度试验

3.3.1 Purpose

This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

3.3.2 Test procedure

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

3.3.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

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Test result:

State of batteries	Sample No.	Pre-test		After test		Mass loss, %	Voltage after test/Voltage pre-test, %	Results
		Mass, kg	Voltage, V	Mass, kg	Voltage, V			
first cycle, fully charged state	N1	25.43	57.69	25.43	57.22	0.000	99.19	Pass
	N2	25.41	57.72	25.41	57.28	0.000	99.24	Pass
25th cycle, fully charged state	C1	25.44	57.78	25.44	57.34	0.000	99.24	Pass
	C2	25.52	57.75	25.52	57.30	0.000	99.22	Pass

3.4 Clause 38.3.4.3 Test T.3: Vibration 测试T.3振动

3.4.1 Purpose

This test simulates vibration during transport.

3.4.2 Test procedure

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz
is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.

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3.4.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test result:

State of batteries	Sample No.	Pre-test		After test		Mass loss, %	Voltage after test/Voltage pre-test, %	Results
		Mass, kg	Voltage, V	Mass, kg	Voltage, V			
first cycle, fully charged state	N1	25.43	57.22	25.43	57.21	0.000	99.98	Pass
	N2	25.41	57.28	25.41	57.26	0.000	99.97	Pass
25th cycle, fully charged state	C1	25.44	57.34	25.44	57.32	0.000	99.97	Pass
	C2	25.52	57.30	25.52	57.28	0.000	99.97	Pass

3.5 Clause 38.3.4.4 Test T.4: Shock 测试T.4冲击

3.5.1 Purpose

This test simulates possible impacts during transport.

3.5.2 Test procedure

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 gn and pulse duration of 11 milliseconds

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass*}\right)}$ whichever is smaller	6 ms
Large batteries	50 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{30000}{mass*}\right)}$ whichever is smaller	11 ms

* Mass is expressed in kilograms.

***NOTE**: IEC Standard 60068-2-27 (Fourth Edition 2008-02): Environmental testing-Part 2-27: Tests – Test Ea and guidance: Shock provides guidance on tolerance for acceleration and pulse duration.*

The relationship between minimum peak acceleration and mass is illustrated in Figure 38.3.4.1 for small batteries and Figure 38.3.4.2 for large batteries.

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

3.5.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test result:

State of batteries	Sample No.	Pre-test		After test		Mass loss, %	Voltage after test/Voltage pre-test, %	Results
		Mass, kg	Voltage, V	Mass, kg	Voltage, V			
first cycle, fully charged state	N1	25.43	57.21	25.43	57.20	0.000	99.98	Pass
	N2	25.41	57.26	25.41	57.24	0.000	99.97	Pass
25th cycle, fully charged state	C1	25.44	57.32	25.44	57.30	0.000	99.97	Pass
	C2	25.52	57.28	25.52	57.27	0.000	99.98	Pass

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3.6 Clause 38.3.4.5 Test T.5: External short circuit 测试 T. 5 外部短路

3.6.1 Purpose

This test simulates an external short circuit.

3.6.2 Test procedure

The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.

The short circuit and cooling down phase shall be conducted at least at ambient temperature.

3.6.3 Requirement

Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.

Test result:

State of batteries	No.	External Peak temperature, °C	Results
first cycle, fully charged state	N1	57.4	Pass
	N2	57.3	Pass
25th cycle, fully charged state	C1	57.5	Pass
	C2	57.5	Pass

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3.7 Clause 38.3.4.6 Test T.6: Impact 测试T. 6撞击

3.7.1 Purpose

These tests simulate mechanical abuse from an impact or crush that may result in an internal
short circuit.[move “short-cicuit” up]

3.7.2 Test Procedure – Impact (applicable to cylindrical cells not less than 18mm in diameter)

The sample cell or component cell is to be placed on a flat smooth surface. A 15.8mm±0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1kg±0.1kg mass is to be dropped from a height of 61±2.5cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and per pendicular to the longitudinal axis of the 15.8mm±0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

3.7.3 Requirement

Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and
within six hours after this test.

Test result:

State of cells	No.	External Peak temperature, °C	Results
first cycle, 50% charged state	N3	55.4	Pass
	N4	30.0	Pass
	N5	21.5	Pass
	N6	22.2	Pass
	N7	22.9	Pass
25th cycle, 50% charged state	C3	56.8	Pass
	C4	21.5	Pass
	C5	21.6	Pass
	C6	22.4	Pass
	C7	22.1	Pass

3.8 Clause 38.3.4.7 Test T.7: Overcharge 测试T. 7过充电

3.8.1 Purpose

This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.

3.8.2 Test procedure

The charge current shall be twice the manufacturer's recommended maximum continuous charge current.The minimum voltage of the test shall be as follows:

(a) when the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.

(b) when the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

3.8.3 Requirement

Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.
Test result:

State of batteries	No.	Results
first cycle, fully charged state	N8	Pass
	N9	Pass
25th cycle, fully charged state	C8	Pass
	C9	Pass

3.9 Clause 38.3.4.8 Test T.8: Forced discharge 测试T. 8强制放电

3.9.1 Purpose

This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.

3.9.2 Test procedure

Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

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The specified discharge current is to be obtained by connecting a resistive load of theappropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

3.9.3 Requirement

Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

Test results:

State of cells	No.	Results
first cycle, fully discharged state	N10	Pass
	N11	Pass
	N12	Pass
	N13	Pass
	N14	Pass
	N15	Pass
	N16	Pass
	N17	Pass
	N18	Pass
	N19	Pass
25th cycle, fully discharged state	C10	Pass
	C11	Pass
	C12	Pass
	C13	Pass
	C14	Pass
	C15	Pass
	C16	Pass
	C17	Pass
	C18	Pass
	C19	Pass

4. Test History 测试历史

N/A

5. Remarks备注

1) The results relate only to the items tested
2) Samples are tested as received.

6. Documentation 文件

File	File name	Date
Photo documentation 照片:	68.282.24.0035.01 DOC	2024-01-30

7. Summary

List of tests conducted:

Clause	Test item	Result
38.3.4.1	Test T.1: Altitude simulation	Pass
38.3.4.2	Test T.2: Thermal test	Pass
38.3.4.3	Test T.3: Vibration	Pass
38.3.4.4	Test T.4: Shock	Pass
38.3.4.5	Test T.5: External short circuit	Pass
38.3.4.6	Test T.6: Impact	Pass
38.3.4.7	Test T.7: Overcharge	Pass
38.3.4.8	Test T.8: Forced discharge	Pass

The test specifications are met. 测试样品满足测试要求

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Tested by:

Saga Shen 申富锋, Project Handler

printed name, function & signature

Reviewed by:

Charlie Zeng 曾昭雄, Project Reviewer

printed name, function & signature

Approved by:

Andy Ren 任晓伟, Lab Manager

printed name, function & signature

--- End of Report ---

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Photo Documentation

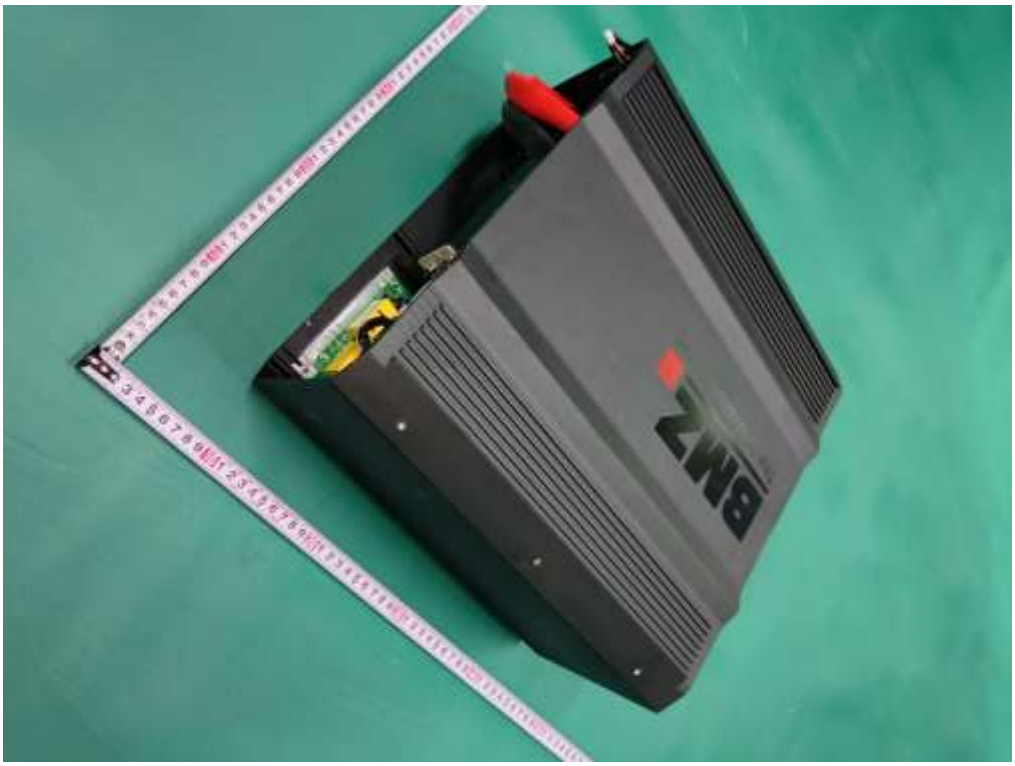
Report No.: 68.282.24.0035.01

Details of:	Picture 1: View 1 of the battery, model: BL8091A
	

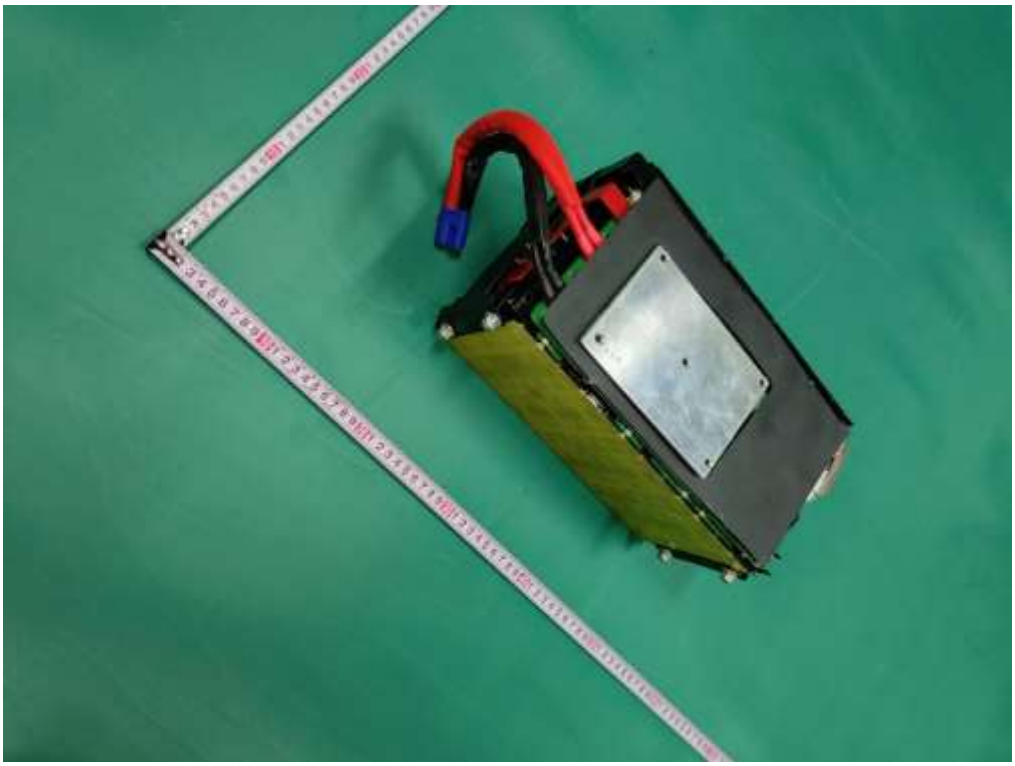
Details of:	Picture 2: View 2 of the battery
	

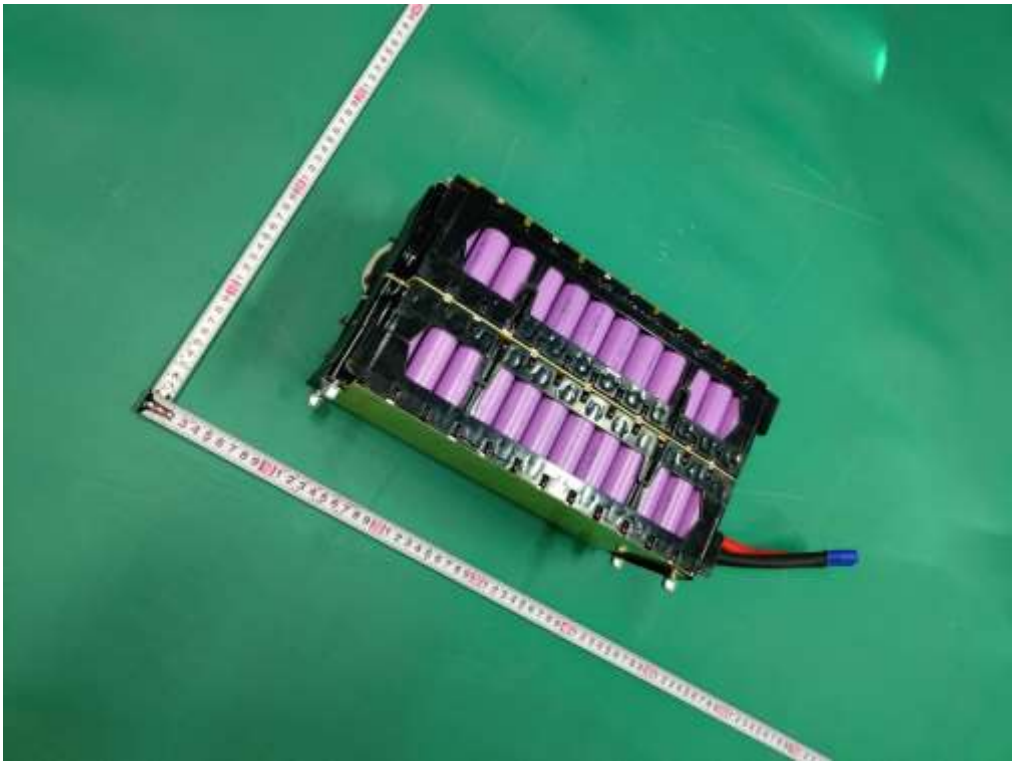
Details of:	Picture 3: The final marking label will be pasted or printed on the battery
	

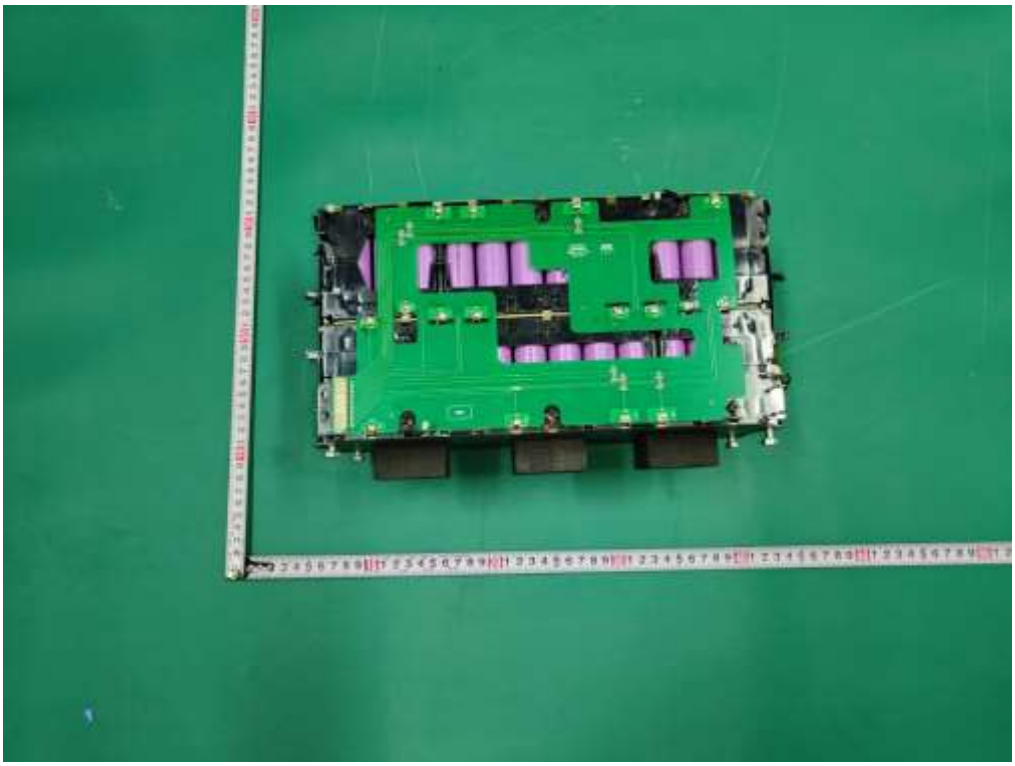
Details of:	Picture 4: View 1 of battery with plastic enclosure opened
	

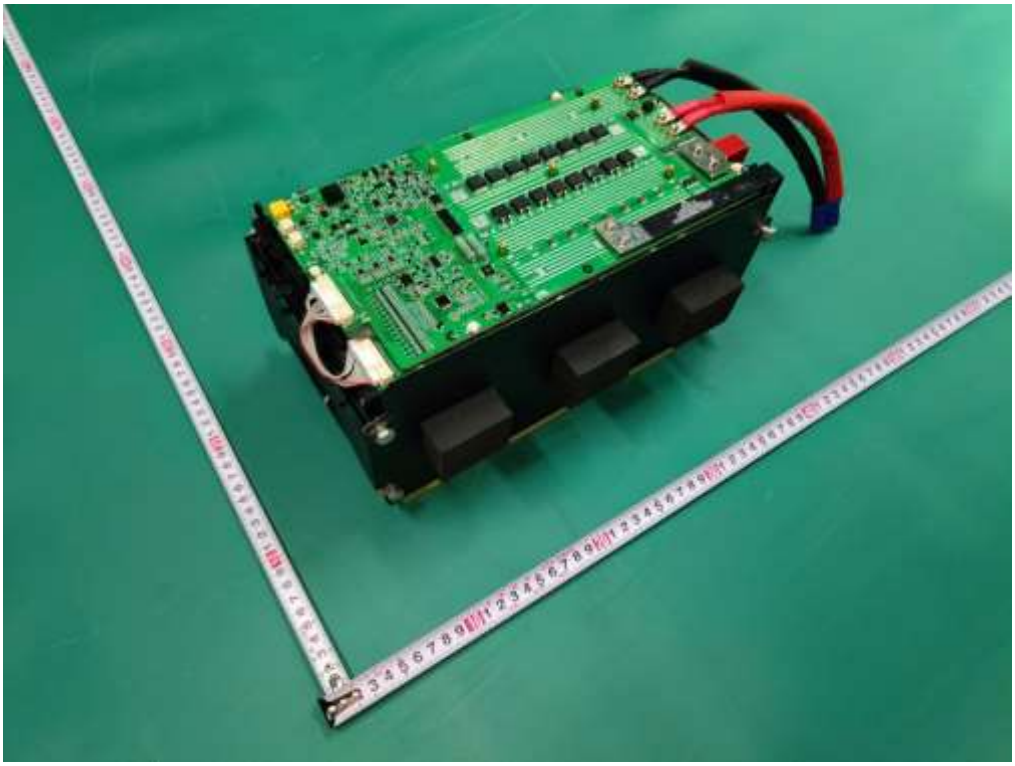
Details of:	Picture 5: View 2 of battery with plastic enclosure opened
	

Details of:	Picture 6: View 3 of battery with plastic enclosure opened
	

Details of:	Picture 7: View 1 of the internal battery
	

Details of:	Picture 8: View 2 of the internal battery
	

Details of:	Picture 9: View 3 of the internal battery
	

Details of:	Picture 10: View 4 of the internal battery
	

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