Test Report issued under the responsibility of:

TÜVRheinland®

# 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. .....:** | CN23YAD2 001 |
| **Date of issue .....:** | 2023-10-09 |
| **Total number of pages.....:** | 21 pages |
| **Name of Testing Laboratory preparing the Report.....:** | TÜV Rheinland (Shenzhen) Co., Ltd. |
| **Applicant's name.....:** | CBQ Auto and Leisure (Aust) Pty Ltd |
| **Address .....:** | Building 9, 83 Burnside Road Stapylton 4207, Australia |
| **Test specification:** | |
| **Standard .....:** | IEC 62619:2022 |
| **Test procedure .....:** | CB Scheme |
| **Non-standard test method.....:** | N/A |
| **TRF template used .....:** | IECEE OD-2020-F1:2022, Ed.1.5 |
| **Test Report Form No.....:** | IEC62619B |
| **Test Report Form(s) Originator ....:** | UL Solutions (Demko) |
| **Master TRF .....:** | Dated 2023-02-24 |



If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

**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.
This report shall not be reproduced, except in full, without the written approval of the Issuing NCB. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

| | |
|---|---|
| **Test item description..... :** | Secondary Li-ion Battery |
| **Trademark(s) ..... :** | **HARD KORR** |
| **Manufacturer ..... :** | [redacted] |
| **Model/Type reference..... :** | HKPBATLSL210 |
| **Ratings..... :** | 12.8Vdc, 210Ah, 2688Wh |

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

| | | | |
|---|---|---|---|
| ☒ | **CB Testing Laboratory:** | TÜV Rheinland (Shenzhen) Co., Ltd. | |
| **Testing location/ address ..... :** | | 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 | |
| **Tested by (name, function, signature)..... :** | | Locs Lai, Engineer | Locs Lai |
| **Approved by (name, function, signature) .. :** | | Alvin Zheng, Reviewer | Alvin Zheng |
| ☐ | **Testing procedure: CTF Stage 1:** | | |
| **Testing location/ address ..... :** | | | |
| **Tested by (name, function, signature)..... :** | | | |
| **Approved by (name, function, signature) .. :** | | | |
| ☐ | **Testing procedure: CTF Stage 2:** | | |
| **Testing location/ address ..... :** | | | |
| **Tested by (name + signature)..... :** | | | |
| **Witnessed by (name, function, signature) . :** | | | |
| **Approved by (name, function, signature) .. :** | | | |
| ☐ | **Testing procedure: CTF Stage 3:** | | |
| ☐ | **Testing procedure: CTF Stage 4:** | | |
| **Testing location/ address ..... :** | | | |
| **Tested by (name, function, signature)..... :** | | | |
| **Witnessed by (name, function, signature) . :** | | | |
| **Approved by (name, function, signature) .. :** | | | |
| **Supervised by (name, function, signature) :** | | | |

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

Attachment 1: Photo documentation (8 pages).

**Summary of testing:**

| **Tests performed (name of test, test clause and date test performed):** | **Testing location:** |
|---|---|
| cl.7.2.3.3 Edge and corner drop test (battery system); 2023-07-26<br>cl.8.2.2 Overcharge control of voltage (battery system); 2023-07-25<br>cl.8.2.3 Overcharge control of current (battery system); 2023-07-25<br>cl.8.2.4 Overheating control (battery system); 2023-07-26<br>The component cell (LF105) used inside was complied with the requirement of IEC 62619:2022, certified by TÜV SUD, Certif. No.: B 098952 0029 Rev. 00.<br>The samples comply with the requirement of IEC 62619: 2022. | **TÜV Rheinland (Shenzhen) Co., Ltd.**<br>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 |

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

No EU Group Differences

☒ **The product fulfils the requirements of EN IEC 62619:2022.**

**Use of uncertainty of measurement for decisions on conformity (decision rule):**

☒ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method").

☐ Other: N/A

**Information on uncertainty of measurement:**

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.

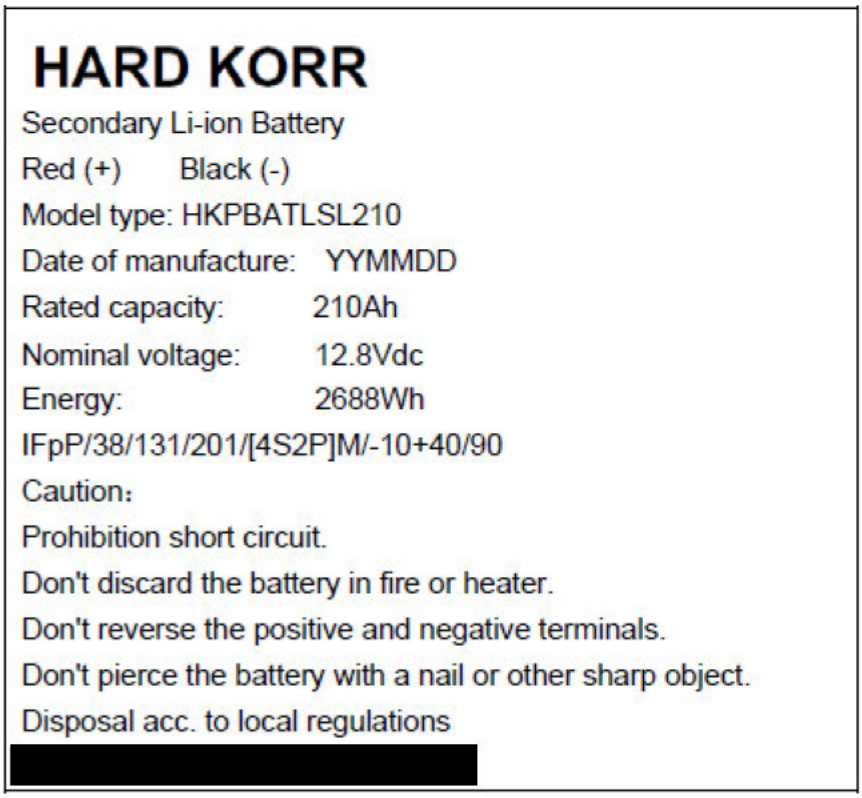
IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

**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.**

The markings below are indicated on the Battery.




The others required marking items below are indicated in the battery specification.

Recommended charge instructions:

## 11. Regulations vary for different countries.

Dispose of in accordance with local regulations.

| | |
|---|---|
| Recommend Charging method declared by the Manufacturer..... | Charged with constant current 42A till battery voltage reaches 14.4V d.c. then switch to constant voltage 14.4V d.c. till charging current drops to 4.2A, at 25±3°C. |

Remark:

YYMMDD means date of manufacture:

YY means year of manufacture, 2021=21, 2022=22, 2023=23…

MM means month of manufacture, Jan.=01, Feb.=02, Mar.=03…

DD means day of manufacture, First day=01, Second day=02, Third day=03.

| | |
|---|---|
| **Test item particulars..... :** | |
| **Classification of installation and use..... :** | To be defined in final system. |
| **Supply Connection ..... :** | Not directly connected mains. |
| **..... :** | |
| **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 .....:** | 2023-07-11 |
| **Date (s) of performance of tests .....:** | 2023-07-18 to 2023-07-26 |

| |
|---|
| **General remarks:** |
| "(See Enclosure #)" refers to additional information appended to the report.<br>"(See appended table)" refers to a table appended to the report.<br><br>**Throughout this report a ☐ comma / ☒ point is used as the decimal separator.** |
| **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**<br>☒ **Not applicable** |

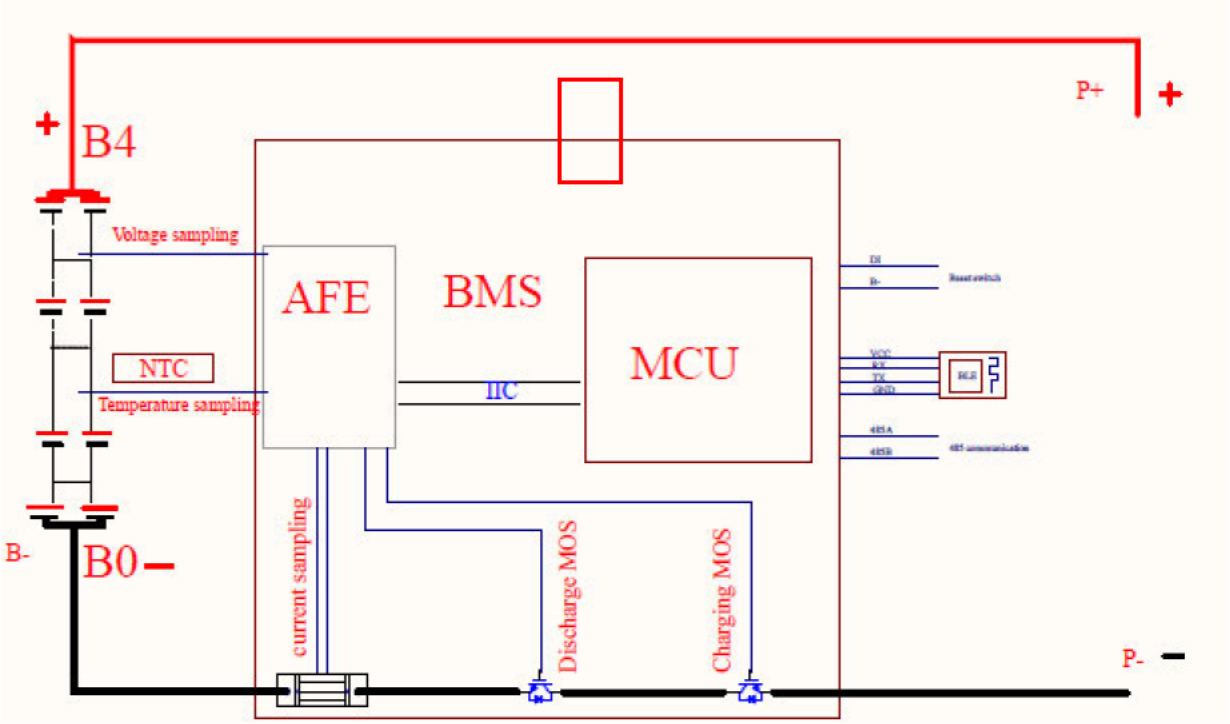
| |
|---|
| **When differences exist; they shall be identified in the General product information section.** |
| **Name and address of factory (ies) ..... :** Same as manufacturer |

**General product information and other remarks:**

-The battery module shown on below has 8 lithium-ion cells in 4S2P connection and monitoring circuit inside management system.

-The electric, electronic and software controls and systems for critical safety were subjected to analysis for functional safety according to IEC 60730-1 Annex H. Redundant protections need to communicate with the end device and relies on the end device to achieve.

Tropology Diagram:




The main features of the battery are shown as below:

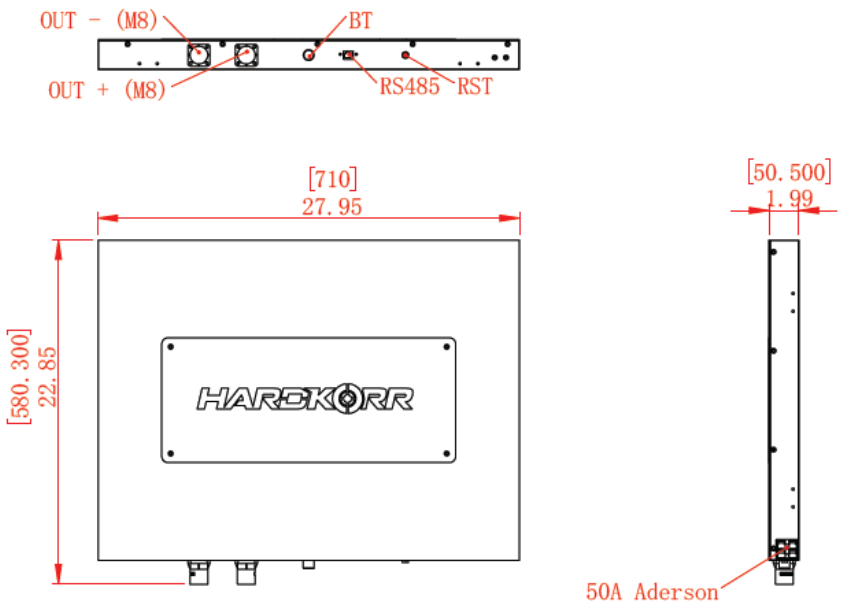
| | |
|---|---|
| Product name..... : | Secondary Li-ion Battery |
| Model ..... : | HKPBATLSL210 |
| Rated Capacity ..... : | 210Ah |
| Nominal voltage ..... : | 12.8V d.c. |
| Energy..... : | 2688Wh |
| Maximum continuous Charging current..... : | 190A |
| Maximum continuous Discharging current..... : | 250A |
| Maximum Charge voltage..... : | 14.4V d.c. |
| End of Discharging voltage..... : | 10.0V d.c. |
| Upper Charge temperature limit ..... : | 65°C |
| Lower Charge temperature limit ..... : | 0°C |
| Upper Discharge temperature limit..... : | 65°C |
| Lower Discharge temperature limit..... : | -20°C |
| Storage temperature range, recommended ..... : | 0°C to 40°C |

| | |
|---|---|
| Recommend Charging method declared by the Manufacturer ..... : | Charged with constant current 42A till battery voltage reaches 14.4V d.c., then switch to constant voltage 14.4V d.c. till charging current drops to 4.2A, at 25±3°C. |
| Recommend Discharging method declared by the Manufacturer ..... : | Discharged with constant current 105A to end off discharging voltage 10.0V d.c., at 25±3°C. |
| Nominal mass ..... : | 25±1kg |
| External dimensions..... : | Length: 710mm (max)<br>Width: 540mm (max)<br>Height: 50mm (max) |
| Battery designation ..... : | IFpP/38/131/201/[4S2P]M/-10+40/90 |

Internal cell operating region:

| | |
|---|---|
| Product name..... : | Rechargeable Lithium-ion Cell |
| Model ..... : | LF105 |
| Rated Capacity ..... : | 105Ah |
| Nominal voltage ..... : | 3.2V |
| Maximum continuous charging current..... : | 105A |
| Maximum continuous discharging current ..... : | 200A |
| Maximum Charge Voltage ..... : | 3.8V |
| End of discharging voltage ..... : | 2.0V |
| Charge temperature range ..... : | 0°C to 65°C |
| Discharge temperature range ..... : | -20°C to 60°C |
| Cell designation ..... : | IFpP/38/131/201/M/-10+40/90 |

Construction unit (mm):



| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **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... : | See also table 5.1 for Critical components information | P |
| | Reduce the risk of injuries from moving parts | | N/A |
| **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 | The battery system was less than 60 V d.c., should be re-evaluated in final system. | P |
| | Protect from hazardous live parts, including during installation | | N/A |
| | The mechanical integrity of internal connections | | P |
| **5.3** | **Venting** | | **P** |
| | Pressure relief function | Explosion-proof safety valve for venting exists, and vent design in cell. | |
| | Encapsulation used to support cells within an outer casing | | P |
| **5.4** | **Temperature/voltage/current management** | | **P** |
| | 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 | | P |
| **5.5** | **Terminal contacts of the battery pack and/or battery system** | | **P** |
| | Polarity marking(s) | | N/A |
| | 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) | No more assembly battery system. | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | 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 | No such design. | 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 | Integrated in BMS. | 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..... : | 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 |
| **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 | No such design. | N/A |
| **5.9** | **Quality plan** | | **P** |
| | Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented..... : | ISO9001 Implemented. | 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 | Tests were carried out in an ambient temperature of 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 |

| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | The cells or batteries charged using the method specified by the manufacturer ..... : | The method mentioned in manufacturer's specifications | P |
| **7.2** | **Reasonably foreseeable misuse** | | **P** |
| 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 |
| 7.2.3.2 | Whole drop test (cell or cell block, and battery system) | Approved cell used. The mass of battery system is more than 20 kg. | 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) ..... : | 25.126kg | — |
| | Height of drop (m)..... : | 10 cm | — |
| | 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 | | N/A |
| | Results: no fire, no explosion ..... : | | N/A |
| 7.2.6 | Forced discharge test (cell or cell block) | Approved cell used | 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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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | 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 ..... : | | N/A |
| **7.3** | **Considerations for internal short-circuit – Design evaluation** | | **N/A** |
| 7.3.1 | General | Approved cell used | N/A |
| 7.3.2 | Internal short-circuit test (cell) | | N/A |
| | Samples preparation procedure:<br>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<br>- 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..... : | | N/A |
| 7.3.3 | Propagation test (battery system) | Alternate test item clause.7.3.2 of cell was performed. | 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 | Evaluated according to IEC 60730-1 Annex H.<br>Full Functional safety needs to be evaluated on the end device.<br>Redundant protections need to communicate with the end device and relies on the end device to achieve. | P |
| | Conduct of a process hazard analysis for both the cell manufacturing process and the<br>battery system manufacturing process | FMEA document were provided. | P |
| | Conduct of risk assessment and mitigation of the battery system | | P |

| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **8.2** | **Battery management system (or battery management unit)** | | **P** |
| 8.2.1 | Requirements for the BMS | Class B according to IEC 60730 Annex H | 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 | 16.72Vd.c applied | 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 terminated the charging before exceeding the upper limit charging voltage | Tested complied. | 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 | No cooling system. | N/A |
| | Elevated temperature for charging, 5 °C above maximum operating temperature ..... : | 65°C applied. | P |
| | Results: no fire, no explosion ..... : | | P |
| | The BMS detected the overheat temperature and terminated charging | See Table 8.2.4 | P |
| | The battery system operated as designed during test | Complied. | P |

| | | | |
|---|---|---|---|
| **9** | **EMC** | | N/A |
| | Battery system fulfil EMC requirements of the end-device application ..... : | Relay on final system. | N/A |

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

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **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. | Name of manufacturer show on label.<br>Trademark belong to applicant. | P |
| | Cell or battery system has clear and durable markings | | P |
| | Cell designation | | N/A |
| | Battery designation | IFpP/38/131/201/[4S2P]M/-10+40/90 | P |
| | Battery structure formulation | 4S2P | P |
| **12** | **PACKAGING AND TRANSPORT** | | N/A |
| | Refer to Annex D | Informative. | N/A |
| **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 | | P |
| A.6 | Low temperature range | | P |
| 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 | | N/A |
| | Repeat of cell test for 3 times | | N/A |
| B.2.2 | Battery system test (main test) | | N/A |
| | The battery system fully charged according to the manufacturer recommended conditions ..... : | | — |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Target cell to be laser irradiated..... : | | — |
| | The irradiation point on the target cell same or similar as that on the cell test | | N/A |
| | Output power of laser irradiation..... : | | — |
| | Tested in an ambient temperature of 25 °C ± 5 °C | | N/A |

| | | | |
|---|---|---|---|
| **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.<br>1) Heater (Heater, Burner, Laser, Inductive heating<br>2) Overcharge<br>3) Nail penetration of the cell<br>4) Combination of above methods<br>5) Other methods..... : | | — |

| | | | |
|---|---|---|---|
| **ANNEX D** | **PACKAGING AND TRANSPORT** | | N/A |
| | 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 | Informative. | N/A |
| | Regulations concerning international transport of secondary lithium batteries | 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[1)]** |
| Cell | EVE Power Co., Ltd | LF105 | 3.2V, 105Ah | IEC 62619: 2022 | TÜV SUD, Certif. No.: B 098952 0029 Rev. 00. |
| BMS | | | | | |
| Metal Enclosure | Zaozhuang Baihui general machinery Co., LTD | 1016 | aluminum, Min. Thickness: 2mm | IEC 62619: 2022 | Tested with appliance |
| Power connector (Red and Black) | Shenzhen Connection Electronic Co., Ltd. | ACTB135-M8 | 1500VDC, 35mm$^2$ | EN 60947-7-1:2009, EN IEC 60947-1:2021, EN 60947-1:2007/A2:2014, IEC 60947-7-1:2009, IEC 60947-1:2020, IEC 60947-1:2007/AMD2:2014 | TÜV SUD, Certif. No.: B 108338 0003 Rev. 00. |
| External connector (Gray) | Anderson Power Products, Inc. | 992Gx (SB 50) | 600V, 50A | EN 61984-1:2009 | TÜV Certif. No: R 72172663 |
| Lead Wire (Red) | DONG GUAN SHENG PAI ELECTRIC WIRE & CABLE CO LTD | 3135 | 10AWG, 200ºC, 600Vac | UL 758 | UL E347603 |
| Lead Wire (Red) (Alternative) | Interchangeable | Interchangeable | Minimum 10AWG, minimum 200ºC, minimum 600Vac | UL 758 | UL approved |
| Lead Wire (Black) | DONG GUAN SHENG PAI ELECTRIC WIRE & CABLE CO LTD | 3512 | 10AWG, 200°C, 600Vac | UL758 | UL E347603 |
| Lead Wire (Black) (Alternative) | Interchangeable | Interchangeable | Minimum 10AWG, minimum 200ºC, minimum 600Vac | UL 758 | UL approved |
| PCB | GUANGDE LONGTAI ELECTRONIC SCI-TECH CO LTD | LT140 | V-0, 130°C | UL 796 | UL E357246 |

| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | | | | | |
|---|---|---|---|---|---|
| PCB (Alternative) | Interchangeable | Interchangeable | V-0, 130°C | UL 796 | UL approved |
| IC(U12) | Geehy Semiconductor | APM32F030C8T6 | VDD: 2.6V - 3.60V, Operating temperature range:-40°C to 85°C | IEC 62619: 2022 | Tested with appliance |
| IC (AFE2) | TEXAS INSTRUMENTS | bq76920 | $V_{BAT}$: -0.3- 36V $T_{OPR}$:-40°C to 85°C | IEC 62619: 2022 | Tested with appliance |
| MOSFET (QC22 to QC28, QC30 to QC34, QC36, QC38, QC39, QC40, QD22 to QD30, QD32 to QD34, QD36, QD37, QD39, QD40) | Chongqing Pingwei Enterprise Co., Ltd. | PW028N10TS | $V_{DSS}$: 100V, $I_D$: 200A, $V_{GS}$: ±20V, $T_j$, $T_{stg}$: -55 to 175°C | IEC 62619: 2022 | Tested with appliance |
| NTC | Guangdong Xinshiheng Technology Co., Ltd. | MF52$103&3435 | R25: 10KΩ±1% B25: 3435K±1% Topr: -40°C to 105°C | UL 1434 | UL E526963 |
| Current Sensing Resistor (RB1 to RB4) | RALEC | 2512 | 2.0mΩ | IEC 62619: 2022 | Tested with appliance |
| Voltage Sensing Resistor (RS3 to RS20) | YAGEO | RC1206 | 2.0mΩ | IEC 62619: 2022 | Tested with appliance |

**Supplementary information:**

[1)] Provided evidence ensures the agreed level of compliance. See OD-CB2039. 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 (°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): _____

| 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 |
|---|---|---|---|---|---|
| -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- |

**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:**

[1)] 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 |
|---|---|---|---|---|---|
| -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- |
| -- | -- | -- | -- | -- | -- |

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

**Supplementary information:**

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

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** |
| A-001 | 2.913~2.917 | 190 | 14.904 | 3.743 | A, D, F |

| | Charge Voltage Applied Battery System: 1) | |
|---|---|---|
| | **Whole** | **Part** |
| | 16.72Vd.c | N/A |

**Supplementary information:**

1) 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 upper limit charge voltage of the internal cell is 3.8V d.c.

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** |
| A-001 | 12.866 | 212.1 | 13.637 | A, D, F |
| A-001 | 12.826 | 228.0 | 13.645 | A, D, F |
| A-001 | 12.887 | 252.0 | 13.646 | A, D, F |

**Supplementary information:**

The maximum charging current of the internal cell is 105A

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 |

| 8.2.4 | TABLE: Overheating control (battery system) | | P |
|---|---|---|---|
| **Model No.** | **OCV at start(SOC 50%) of test, V dc** | **Maximum Charging Current, A** | **Measured Maximum Charging Voltage, V dc** |
| A-001 | 13.178 | 190 | 14.400 |
| **Maximum Specified Temperature of Battery System, °C** | | **Maximum Measured Cell Case Temperature, °C** | **Results** |
| 65 | | 64 | A, D, F |

**Supplementary information:**

The charging temperature limit of the internal 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): ____

| 9 | TABLE: EMC | | | | N/A |
|---|---|---|---|---|---|
| Standard used for EMC test: | | | | | |
| **Sample No.** | **EMC Test Item** | **Battery Condition** | **EMC Test Level/ Parameters** | **Compliance Criteria** | **Results** |
| -- | -- | -- | -- | -- | -- |

**Supplementary information:**

Battery Condition During EMC test

1 – In Operation Mode, [ ] Supplied at ____, [ ] Load at____

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 -**

# Attachment 1 Photo Documentation



Product: Secondary Li-ion Battery

Type Designation: HKPBATLSL210

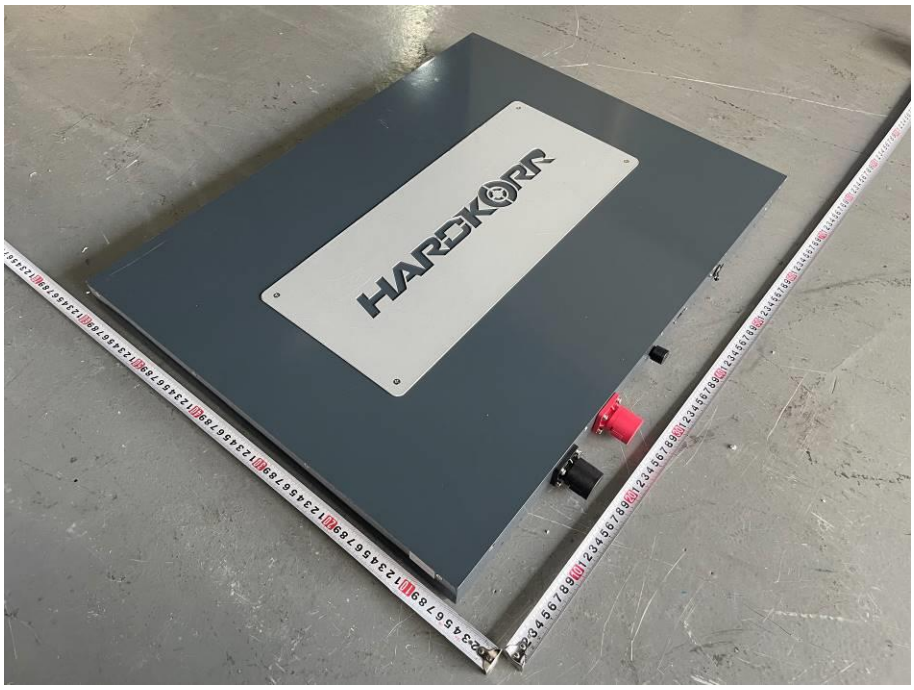


Figure 1 Overall view 1 of battery

Figure 2 Overall view 2 of battery

Product: Secondary Li-ion Battery

Type Designation: HKPBATLSL210


Figure 3 Overall view 3 of battery

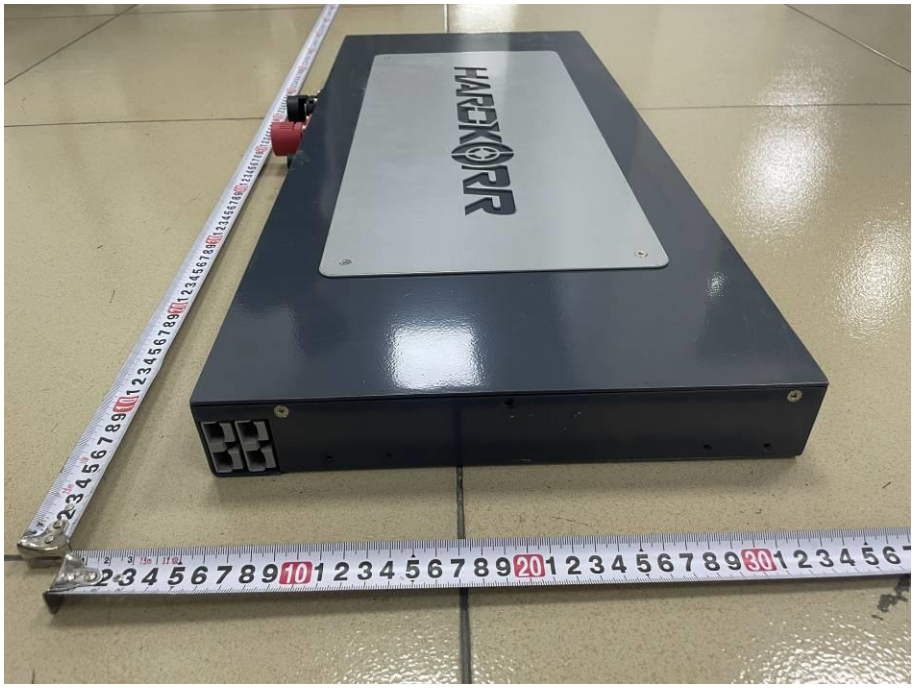


Figure 4 Overall view 4 of battery

Product: Secondary Li-ion Battery

Type Designation: HKPBATLSL210

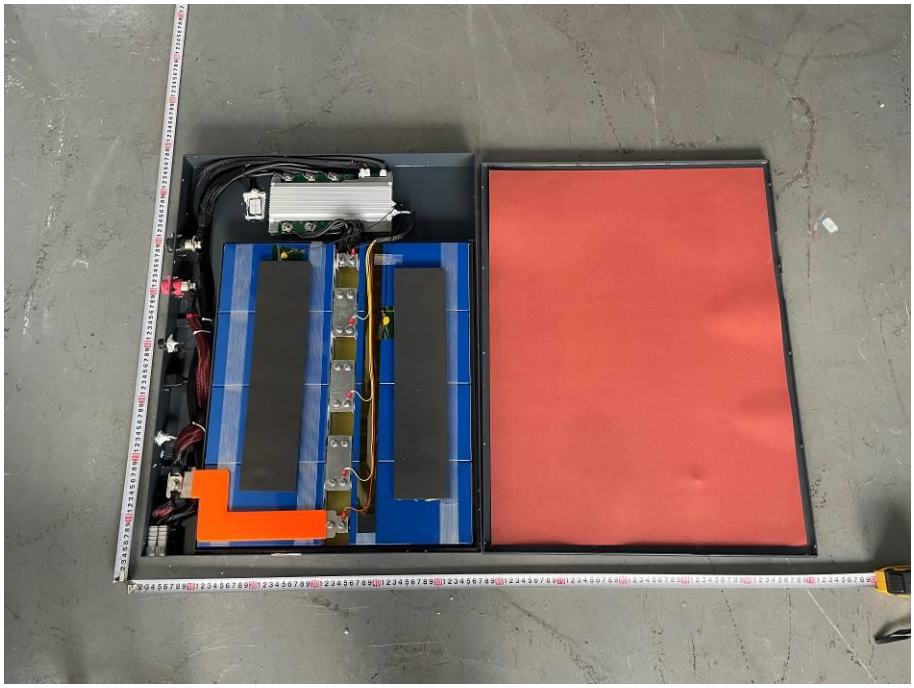

Figure 5 Internal view 1 of battery

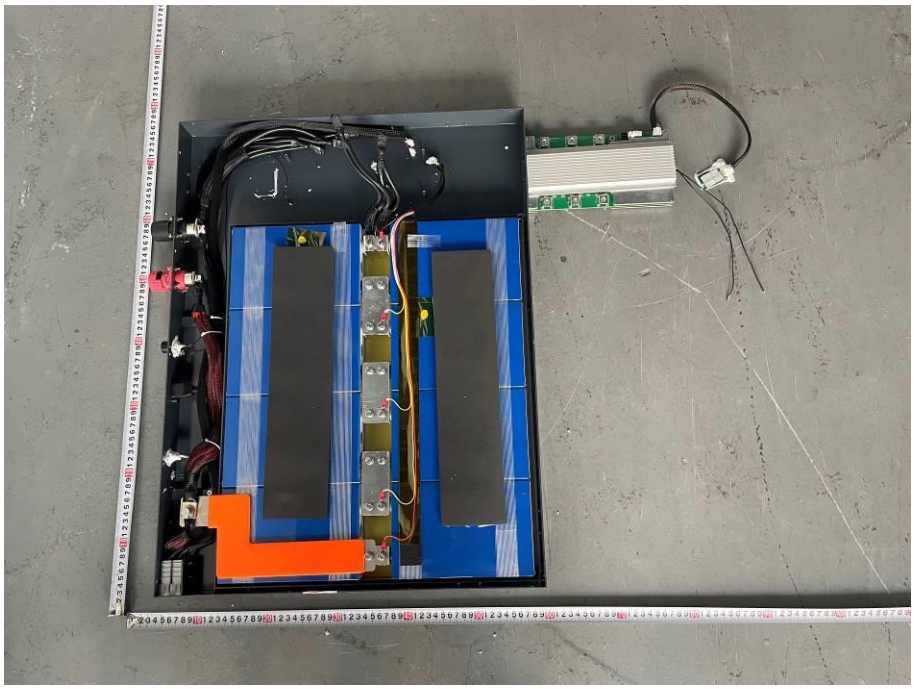

Figure 6 Internal view 2 of battery

Product: Secondary Li-ion Battery

Type Designation: HKPBATLSL210

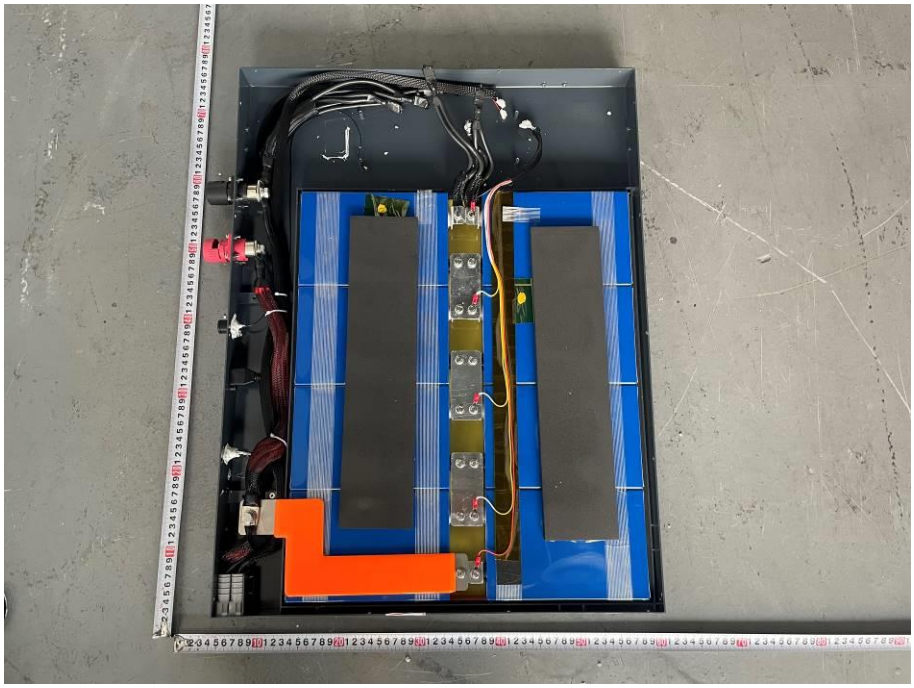

Figure 7 Internal view 3 of battery

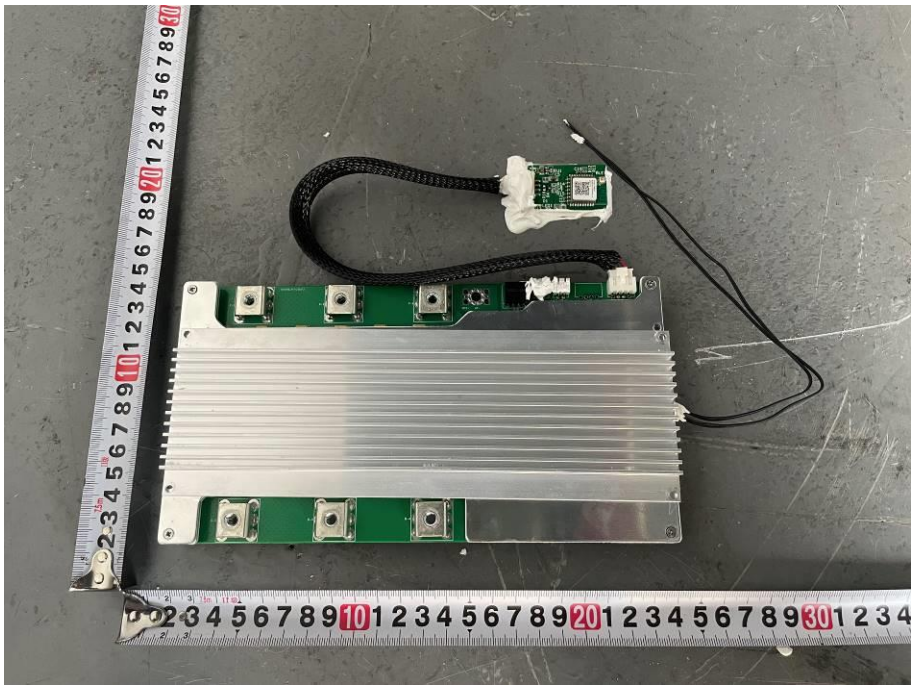

Figure 8 Front view of PCB with BMS and Bluetooth

Product: Secondary Li-ion Battery

Type Designation: HKPBATLSL210

Figure 9 Front view 1 of PCB with BMS

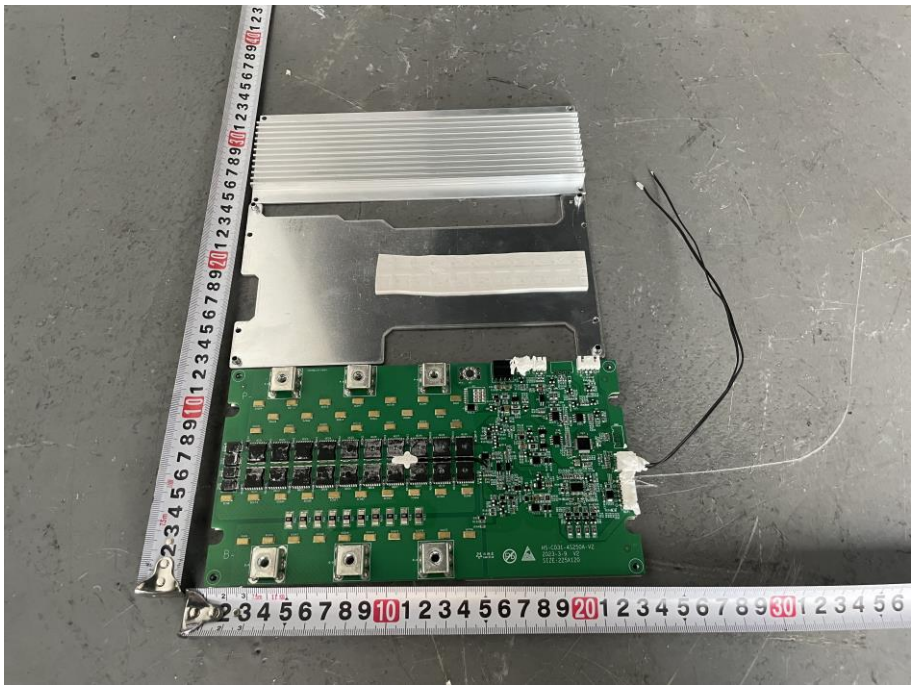

Figure 10 Front view 2 of PCB with BMS

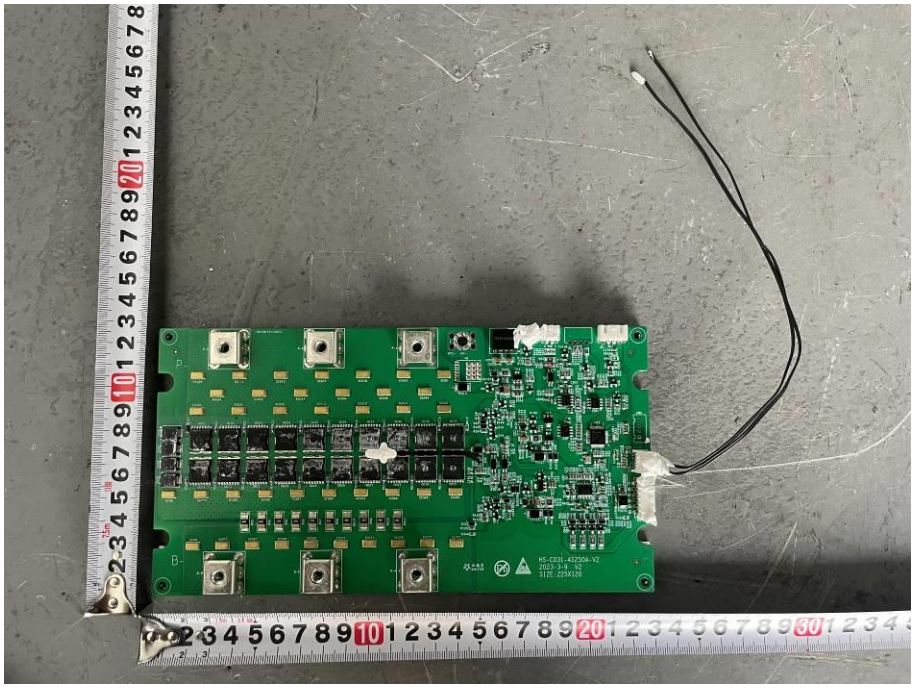

Figure 11 Front view 3 of PCB with BMS

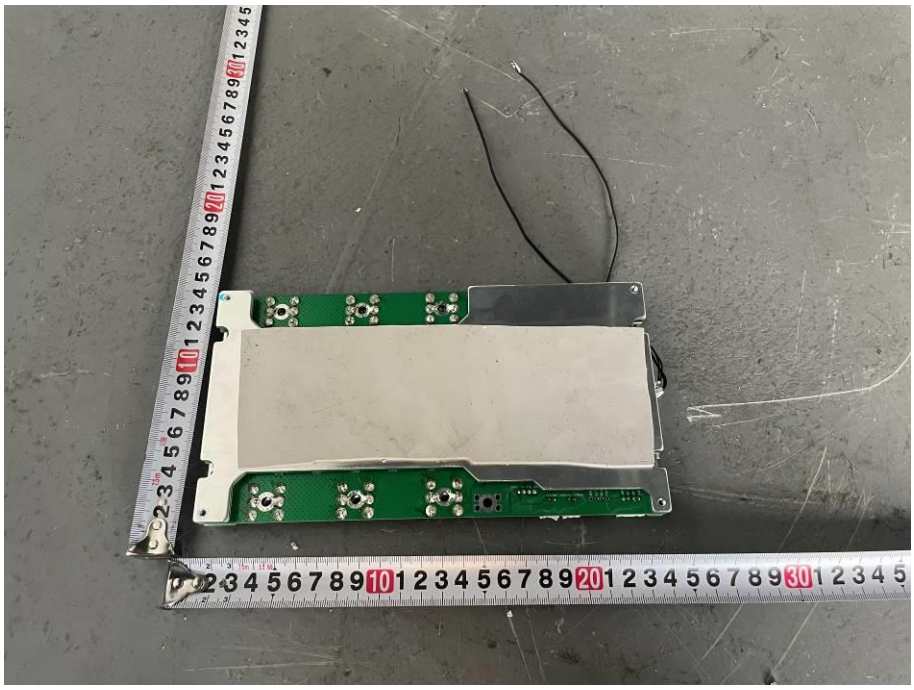

Figure 12 Back view 1 of PCB with BMS

Product: Secondary Li-ion Battery

Type Designation: HKPBATLSL210

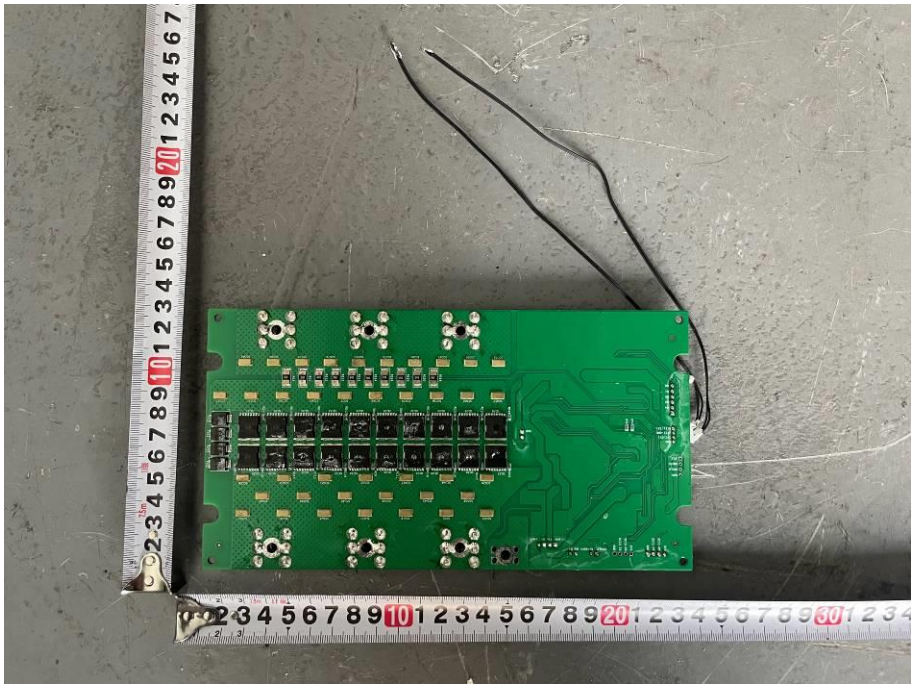

Figure 13 Back view 2 of PCB with BMS


Figure 14 Front view 1 of PCB with Bluetooth


Figure 15 Front view 2 of PCB with Bluetooth