| | | |
|---|---|---|
| | **Test Report issued under the responsibility of:**<br><br>**NCB TÜV SÜD PSB Pte. Ltd.**<br>**15 International Business Park,**<br>**TÜV SÜD @IBP,**<br>**Singapore 609937,**<br>**Singapore** | |

# 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. .....:** | 085-282360233-000 |
| **Date of issue .....:** | 2023-04-19 |
| **Total number of pages.....:** | 19 pages |
| **Name of Testing Laboratory preparing the Report.....:** | TÜV SÜD New Energy Testing (Guangdong) Co., Ltd. |
| **Applicant's name.....:** | COMP Power GmbH |
| **Address .....:** | Schillerstr. 23, 35582 Wetzlar, GERMANY |
| **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 |



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 CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.**

**General disclaimer:**

The test results presented in this report relate only to the object tested.
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| | |
|---|---|
| **Test item description .....:** | Rechargeable Lithium Ion Battery System |
| **Trade Mark .....:** | COMP |
| **Manufacturer.....:** | Dongguan Ensmar New Energy Technology Co., Ltd<br>Room 403, Block 6, No. 169, Xianjiang Road, Dalang Town, 523000 Dongguan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA |
| **Model/Type reference .....:** | COMP Hercules 12050 |
| **Ratings .....:** | 51.2Vd.c., 100Ah |

| | | | |
|---|---|---|---|
| **Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):** | | | |
| ☒ | **CB Testing Laboratory:** | TÜV SÜD New Energy Testing (Guangdong) Co., Ltd. | |
| **Testing location/ address.....:** | | North-1/F, 2/F & Unit 301-3/F, TÜV SÜD Testing Center, D1, No. 63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou 511447, China | |
| **Tested by (name, function, signature) ……:** | | Lena Li<br>(Project Handler) | Lena Li |
| **Approved by (name, function, signature).. :** | | Vitta Wang<br>(Designated Reviewer) | Vitta Wang |
| ☐ | **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 No. 1: photo documentation ( 6 pages)

**Summary of testing:**

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

In section 7 and section 8, tests of clause 7.2.3.3, clause 8.2.2, clause 8.2.3 and clause 8.2.4 were performed on battery, model No.: COMP Hercules 12050.

| Name of test, test clause | Date of test performed |
|---|---|
| - Cl.7.2.3.3 Edge or corner drop test (cell or cell block, and battery system) | 2022-12-21 |
| - Cl.8.2.2 Overcharge control of voltage (battery system) | 2022-12-16 |
| - Cl.8.2.3 Overcharge control of current (battery system) | 2022-12-15 |
| - Cl.8.2.4 Overheating control (battery system) | 2022-12-20 |

All the test data is from report 085-282260504-000.

The samples comply with the above requirements of IEC 62619:2017 (First Edition).

**Testing location:**

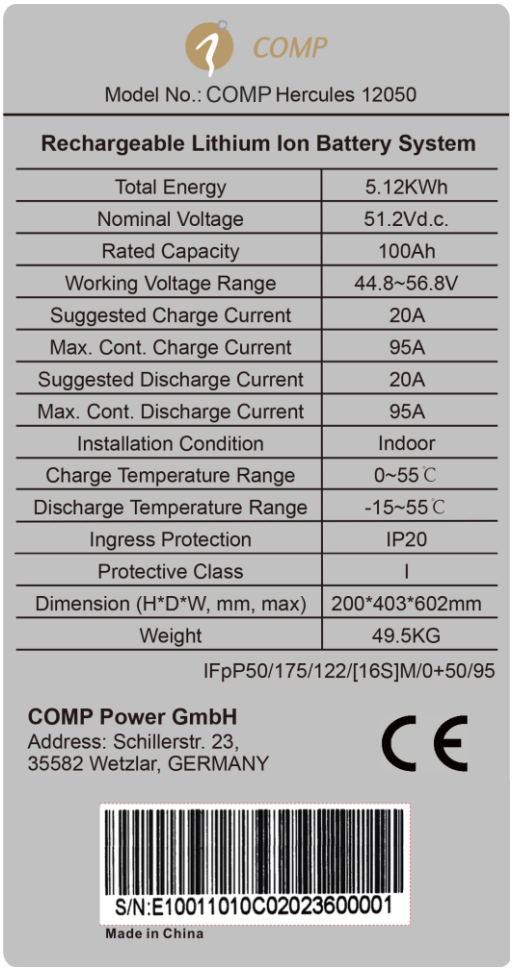
TÜV SÜD New Energy Testing (Guangdong) Co., Ltd.

Address: North-1/F, 2/F & Unit 301-3/F, TÜV SÜD Testing Center, D1, No. 63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou 511447, China

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

**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.**





Remark:

1. There are serial number with 21 characters tracing the detail information of the battery system, such as “E10011010C0203600001”. The 10th to 12th characters represent the manufacture date, and “C02” indicates the manufacture date in the 2nd week of 2023. This is not the serial of actual sample and for example only.

2. “+” “-” are marked near the connectors.

| | |
|---|---|
| **Test item particulars.....:** | Rechargeable Lithium Ion Battery System |
| **Classification of installation and use.....:** | Use in industrial applications |
| **Supply Connection.....:** | Supply by connectors |
| **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 .....:** | 2023-12-08 |
| **Date (s) of performance of tests.....:** | 2022-12-12 to 2023-04-18 |

**General remarks:**

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

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

**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) .....:** | Dongguan Ensmar New Energy Technology Co., Ltd<br>Room 403, Block 6, No. 169, Xianjiang Road, Dalang Town, 523000 Dongguan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA |

**General product information and other remarks:**

The Rechargeable Lithium Ion Battery System is used in industrial application, which consist of cells model no. IFP48173115-100Ah connected in 16S. The cell model No. IFP48173115-100Ah has been approved with IEC 62619:2017 (First Edition) certification.
Additionally, details information of the battery, module and the built-in cell are shown in following table:

| | | |
|---|---|---|
| Product name | Li-ion Prismatic Power Cell | Rechargeable Lithium Ion Battery System |
| Type/model | IFP48173115-100Ah | COMP Hercules 12050 |
| Nominal voltage | 3.2Vd.c. | 51.2Vd.c. |
| Rated capacity | 100Ah | 100Ah |
| Charging voltage declared by manufacturer | 3.65V | 56.8V |
| Upper limit charging voltage | 3.65V | 57.6 V |
| Charging current declared by manufacturer | 50A | 20A |
| Maximum continuous charging current | 100A | 95A |
| Discharging current declared by manufacturer | 50A | 20A |
| Maximum continuous discharging current | 100A | 95A |
| End of discharge voltage | 2.5V | 44.8V or 2.8V/cell |
| Standard temperature range for charging | 0°C to 60°C | 0°C to 55°C |
| Standard temperature range for discharging | -20°C to 60°C | -15°C to 55°C |
| Standard charging method by manufacturer | At 25°C±2°C, Constant-current charge to 3.65V at 50A, constant voltage charge to stop until 5A. | Charge at constant current 20A until total voltage reaches 56.8V, then at constant voltage 56.8V till charge current reduces to 5A |
| Charging method for internal short-circuit test | At constant current 100A till cell voltage reaches 3.65V, then switch to constant voltage 3.65V till charge current drops to 5A (0.05 It) | - |
| Dimension | Thickness x Wide x Height: 49.3mm (max.) x 174.4mm (max.) x 121.6mm (max.) | H × D × W: Max.200mm ×Max.403mm ×Max.602mm |
| Weight | 2.0±0.1kg | 49.5kg |
| Configuration | - | 16S |

The final evaluation of the battery must be conducted in the end product for which the battery will be used.

| 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 |
| **5.2** | **Insulation and wiring** | | P |
| | Voltage, current, altitude, and humidity requirements | | P |
| | Adequate clearances and creepage distances between connectors | | P |
| | The mechanical integrity of internal connections | | P |
| **5.3** | **Venting** | | P |
| | Pressure relief function | | P |
| | Encapsulation used to support cells within an outer casing | | P |
| **5.4** | **Temperature/voltage/current management** | | P |
| | The design prevents abnormal temperature-rise | | P |
| | Voltage, current, and temperature limits of the cells | | P |
| | Specifications and charging instructions for equipment manufacturers | | P |
| **5.5** | **Terminal contacts of the battery pack and/or battery system** | | P |
| | Polarity marking(s) | | P |
| | Capability to carry the maximum anticipated current | | P |
| | External terminal contact surfaces | | P |
| | Terminal contacts are arranged to minimize the risk of short circuits | | P |
| **5.6** | **Assembly of cells, modules, or battery packs into battery systems** | | P |
| 5.6.1 | General | | P |
| | Independent control and protection method(s) | | P |
| | Recommendations of cell operating limits by the cell manufacturer | | P |
| | Batteries designed for the selective discharge of a portion of their series connected cells | | N/A |
| | Protective circuit component(s) and consideration to the end-device application | | P |
| 5.6.2 | Battery system design | | P |
| | The voltage control function | | P |

| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | The voltage control for series-connected batteries | | P |
| **5.7** | **Operating region of lithium cells and battery systems for safe use** | | P |
| | The cell operating region..... : | See page 6 | P |
| | Designation of battery system to comply with the cell operating region | | P |
| **5.8** | **Quality plan** | | P |
| | Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented..... : | Manufacturing quality plan prepared and 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 IEC62619) | | P |
| | Capacity confirmation of the cells or batteries | | P |
| | Default ambient temperature of test, 25 °C ± 5 °C | | P |
| **7** | **SPECIFIC REQUIREMENTS AND TESTS** | | P |
| **7.1** | **Charging procedure for test purposes** | | P |
| | The battery discharged to a specified final voltage prior to charging | | P |
| | The cells or batteries charged using the method specified by the manufacturer..... : | See page 6 | P |
| **7.2** | **Reasonably foreseeable misuse** | | P |
| 7.2.1 | External short-circuit test (cell or cell block) | | N/A |
| | Short circuit with total resistance of 30 mΩ ± 10 mΩ at 25 °C ± 5 °C | | N/A |
| | Results: no fire, no explosion | See Table 7.2.1. | N/A |
| 7.2.2 | Impact test (cell or cell block) | | N/A |
| | Cylindrical cell, longitudinal axis impact | | N/A |
| | Prismatic cell, longitudinal axis and lateral axis impact | | N/A |
| | Results: no fire, no explosion. | | N/A |
| 7.2.3 | Drop test (cell or cell block, and battery system) | | P |
| 7.2.3.1 | General | | P |
| 7.2.3.2 | Whole drop test (cell or cell block, and battery system) | | N/A |

| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | 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..... : | Model:<br>COMP Hercules 12050 | — |
| | Mass of the test unit (kg)..... : | Measured: 49.40kg | — |
| | Height of drop (m)..... : | 0.10m | — |
| | Results: no fire, no explosion | | P |
| 7.2.4 | Thermal abuse test (cell or cell block) | | N/A |
| | Results: no fire, no explosion | | N/A |
| 7.2.5 | Overcharge test (cell or cell block) | | N/A |
| | For those battery systems that are provided with only a single protection for the charging voltage control | | — |
| | Results: no fire, no explosion..... : | See Table 7.2.5. | N/A |
| 7.2.6 | Forced discharge test (cell or cell block) | | N/A |
| | 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 It ..... : | | N/A |
| | Discharging time, t = (1 It / $I_m$ ) x 90 (min.) ..... : | | N/A |
| | Results: no fire, no explosion..... : | See Table 7.2.6. | N/A |
| **7.3** | **Considerations for internal short-circuit – Design evaluation** | | N/A |
| 7.3.1 | General | | N/A |
| 7.3.2 | Internal short-circuit test (cell) | | N/A |
| | Samples preparation procedure:<br>a), in accordance with 8.3.9 of IEC62133:2012; or<br>b), the nickel particle inserted before charging, or<br>c), the nickel particle was inserted before electrolyte filling..... : | | N/A |
| | 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 |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | 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, no explosion ..... : | See Table 7.3.2. | N/A |
| **7.3.3** | **Propagation test (battery system)** | Test of clause 7.3.2 was performed in the approved cell report | N/A |
| | Method to create a thermal runaway in one cell ... : | See Annex B | N/A |
| | Results: No external fire from the battery system or no battery case rupture ..... : | See Table 7.3.3 | N/A |
| **8** | **BATTERY SYSTEM SAFETY (CONSIDERING FUNCTIONAL SAFETY)** | | P |
| **8.1** | **General requirements** | | P |
| | Functional safety analysis for critical controls | | P |
| | Conduct of a process hazard, risk assessment and mitigation of the battery system | | P |
| **8.2** | **Battery management system (or battery management unit)** | | P |
| 8.2.1 | Requirements for the BMS | | P |
| | The safety integrity level (SIL) target of the BMS | | P |
| | The charge control evaluated by tests in clauses 8.2.2 to 8.2.4 | | P |
| 8.2.2 | Overcharge control of voltage (battery system) | | P |
| | The exceeded charging voltage applied to the whole battery system | | P |
| | The exceeded charging voltage applied to only a part of the battery system, such as the cell(s) ..... : | | 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 |
| | The cooling system, if provided, was disconnected | | N/A |

| IEC 62619 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Elevated temperature for charging, 5 °C above maximum operating temperature..... : | 65°C | P |
| | Results: no fire, no explosion..... : | See Table 8.2.4 | P |
| | The BMS detected the overheat temperature and terminated charging | | P |
| | The battery system operated as designed during test | | P |
| **9** | **INFORMATION FOR SAFETY** | | P |
| | The cell manufacturer provides information about current, voltage and temperature limits of their products | | P |
| | The battery system manufacturer provides information regarding how to mitigate hazards to equipment manufacturers or end-users. | | P |
| **10** | **MARKING AND DESIGNATION (REFER TO CLAUSE 5 OF IEC 62620)** | | P |
| | The marking items shown in Table 1 in IEC 62620 indicated on the cell, battery system or instruction manual. | | P |
| | Cell or battery system has clear and durable markings | | P |
| | Cell designation | | N/A |
| | Battery designation | | P |
| | Battery structure formulation | | P |

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

| **ANNEX A** | **OPERATING REGION OF CELLS FOR SAFE USE** | | P |
|---|---|---|---|
| A.1 | General | | P |
| A.2 | Charging conditions for safe use | | P |
| A.3 | Consideration on charging voltage | | P |
| A.4 | Consideration on temperature | | P |
| A.5 | High temperature range | | N/A |
| A.6 | Low temperature range | | N/A |
| A.7 | Discharging conditions for safe use | | P |
| A.8 | Example of operating region | | P |

| **ANNEX B** | **PROCEDURE OF 7.3.3 PROPAGATION TEST** | | N/A |
|---|---|---|---|
| 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.<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 C** | **PACKAGING** | | P |
|---|---|---|---|
| | 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 | | P |

| 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 | JIANGXI ANCHI NEW ENERGY TECHNOLOGY CO., LTD | IFP48173115-100Ah | 3.2Vd.c., 100Ah | IEC 62619: 2017 | CB cert. No.: JPTUV-129418 Report No.: CN21NGYW 001 |
| 2. BMS | Shanghai Energy Electronic Technology Co., Ltd. | EMU1101 PCBA-V16<br>Hardware version: V16<br>Software version: 16.04 | Overcharge detection voltage for each cell: 3.65 ±0.01V,<br>Overcharge detection voltage for battery: 57.6V,<br>Overdischarge detection voltage for each cell: 2.7±0.01V,<br>Overdischarge detection voltage for battery: 43.2V,<br>Charge overcurrent detection current: 100±1.1A,<br>Discharge overcurrent detection current: 100±1.1A,<br>High temperature charging protection: 55±2°C,<br>High temperature discharging protection: 55±2°C,<br>Low temperature charging protection: 0±2°C,<br>Low temperature discharging protection: -15±2°C | - | - |
| Below list is the critical components of Main Board, Model: 48100-1101-10E-BC17-16S | | | | | |
| - PCB material | JIANGSU COMBO ELECTRONIC TECHNOLOGY CO LTD | CB-D-1 | 130°C, V-0 | UL 796 | UL E307203 |
| - IC for MCU (U5) | Synwit Technology Co., Ltd. | SWM181RCT6 | Supply voltage: 2.3V to 3.6V<br>Operating temperature: -40 to 85°C | - | - |
| - IC for AFE (U6) | LAPIS Semiconductor | ML5238 | $V_{DD}$: -0.3 to 86.5 V,<br>Operating temperature: -40°C to 85°C | - | - |

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

| | | | | | |
|---|---|---|---|---|---|
| - DCDC Converter (U1) | Silicon Content Technology Co., Ltd. | SCT2A23ASTER | Wide Input Range: 4.5V to 100V, Operating junction temperature: -40°C to 150°C | - | - |
| - VOLTAGE REGULATORS (U2) | UNISONIC TECHNOLOGIES CO., LTD. | LD1117/A-3.3V | 3.3V, 1A, $V_{IN}$: 18V, $T_{OPR}$: 20°C to 125°C | - | - |
| - VOLTAGE REGULATORS (U3) | UNISONIC TECHNOLOGIES CO., LTD. | LD1117/A-5.0V | 5.0V, 1A, $V_{IN}$: 18V, $T_{OPR}$: -20°C to 125°C | - | - |
| -Three-terminal adjustable regulator (U4) | LESHAN RADIO COMPANY,LTD. | LTL431ATLT1G | $T_{OPR}$: -40°C to 125°C, $V_{KA}$: 36V, $I_{KA}$: 100mA | - | - |
| - MOSFET for charge (MC1, MC1', MC2', MC3, MC5, MC5', MC6', MC7) | CRMICRO | CRSS042N10N | $V_{DS}$: 100V, $V_{GS}$: ±20V, $I_D$: 120A, $T_J$: -55°C to 150°C | - | - |
| - MOSFET for discharge (MD1, MD1', MD2', MD3, MD5, MD5', MD6', MD7) | CRMICRO | CRSS042N10N | $V_{DS}$: 100V, $V_{GS}$: ±20V, $I_D$: 120A, $T_J$: -55°C to 150°C | - | - |
| - MOSFET for Current limit (MH1) | CRMICRO | CRSS042N10N | $V_{DS}$:100V, $V_{GS}$: ±20V, $I_D$:120A, $T_J$: -55-150°C | - | - |
| - MOSFET for Current limit (ML1) | NCEPOWER | NCEP15T14 | $V_{DS}$:150V, $V_{GS}$: ±20V, $I_D$: 140A, $T_J$: -55°C to175°C | - | - |
| -Inductance (L1) | Moshang Electronic Technology (Jiangsu) Co., Ltd | RPI2714-330K | L: 33µH±10%, $I_{sat}$:2A, $R_{dc}$: 8.0mΩ, -40°C to 150°C | - | - |
| -Shunt (RFL) | Shanghai kaibu Applied Electronics Co., Ltd | SKB300A75EDBK | 300±1.5A, 75mV, $T_J$: -40°C to 170°C | - | - |
| -Transformer (T1) | SUZHOU PENGSHENGHE ELECTRONIC CO LTD | PSH-349A (PSH-130-349A) | Class 130(B); -40°C to 150°C | UL 1466 | UL E341022 |

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

| | | | | | |
|---|---|---|---|---|---|
| 3. NTC (4pcs) | YuanSu Electronics Technology (kunshan)Co.,Ltd | NTC103B23435FH009 | $R_{25}$ =10kΩ±1%, $B_{25/50}$=3435K±1%, $T_{opr}$: -40°C to 125°C | - | - |
| 4. Contactor for charge and discharge protection | DONGGUAN CHUROD ELECTRONICS CO LTD | CHDC-148D200BS | Coil voltage: 48VDC Contact: 60V, 200A | IEC60947-4-1 | UL E341422 |
| 5. Connector for P+ P- | Dongguan Wanlian Electronics Co., LTD | WL-CN-120Z | 1000V, 120A, -40°C to 125°C | - | - |
| - Plastic part of connector | SABIC INNOVATIVE PLASTICS US L LC | EXL9330 | PC9330, 3mm, V-0 | UL94 | UL E121562 |
| 6. Connector for cable gland | Dongguan Wanlian Electronics Co., LTD | WL-CN-120T | 1000V, 120A, -40°C to 125°C | - | - |
| 7. Wiring for Connector (B+, B-) | Zhongshan City Dingxiang Electrical Co Ltd | 3512 | 4AWG, 200°C, 600Va.c. | UL758 | UL E354487 |
| 8. Wiring for Connector (P+,P-) | Zhongshan City Dingxiang Electrical Co Ltd | 3512 | 4AWG, 200°C, 600Va.c. | UL758 | UL E354487 |
| 9. Wiring for voltage sampling | YuanSu Electronics Technology (kun shan)Co.Ltd | 1007 | 28AWG, 80°C, 300Va.c. | - | - |
| 10. Case | Dongguan Dawei Technology Co., LTD | FBC-BT-01-48-120A-2 | SPCC (Steel), Thickness: 1.5mm | - | - |
| Supplementary information: N/A | | | | | |

| 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** |
| - | - | - | - | - | - |
| - | - | - | - | - | - |
| - | - | - | - | - | - |

**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):

Remark: There is no particle location 2 in this product.

| 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:**

**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):

| 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 of Battery System, (V dc)** | **Max. Voltage of Cell/Cell Blocks, (V dc)** | **Results** |
| Battery 1 | 2.922 | 95 | 58.553 | 3.586 | A, D, F |

| | Charge Voltage Applied Battery System: 1) | |
|---|---|---|
| | **Whole(V dc)** | **Part** |
| | 64.24 | - |

**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.

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)

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

| 8.2.3 | TABLE: Overcharge control of current (battery system) | | | P |
|---|---|---|---|---|
| **Sample No.** | **OCV at start of test, (V dc)** | **120% of Max. Charging Current, (A)** | **Max. Charging Voltage, (V dc)** | **Results** |
| Battery 1 | 51.443 | 120 | 54.250 | A, D, F |

**Supplementary information:**

Results:
A – No fire or Explosion
B – Fire
C – Explosion
D - Overcurrent sensing function of BMU did operate and then charging stopped
E - Overcurrent sensing function of BMU did not operate and then charging stopped
F - All function of battery system did operate as intended during the test.
G - All function of battery system did not operate as intended during the test.
H - Other (Please explain):

| 8.2.4 | TABLE: Overheating control (battery system) | | P |
|---|---|---|---|
| **Sample No.** | **OCV at start (SOC 50%) of test, V dc** | **Maximum Charging Current, A** | **Maximum Charging Voltage, V dc** |
| Battery 1 | 52.859 | 20 | 53.797 |
| **Maximum Specified Temperature of Battery System, °C** | | **Maximum Measured Cell Case Temperature, °C** | **Results** |
| 55 | | 55.4 | A, D, F |

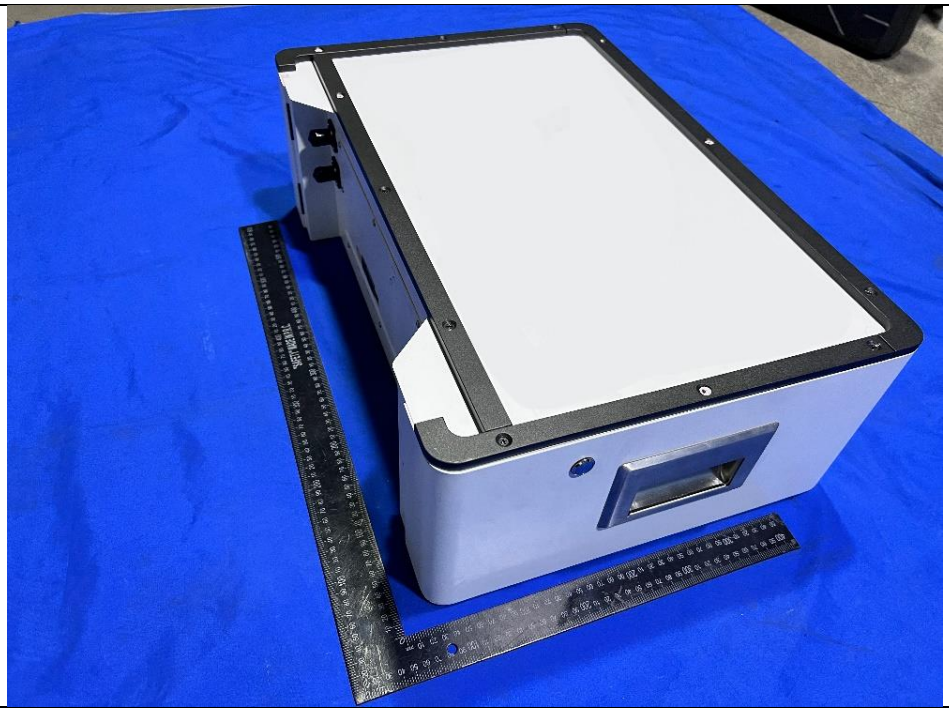
**Supplementary information:**

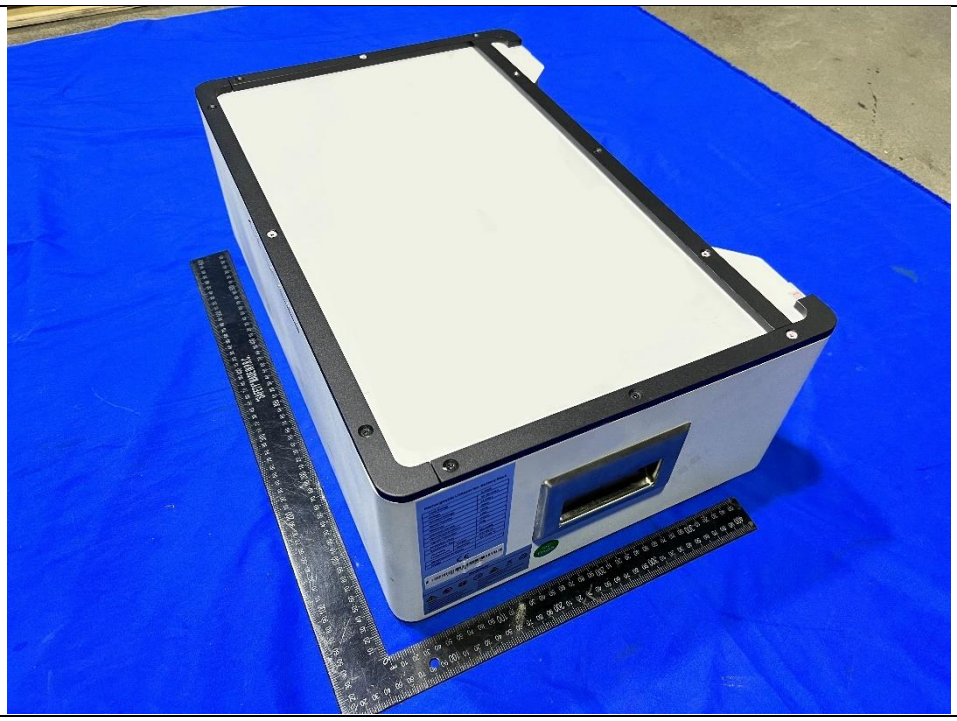
Results:
A – No fire or Explosion
B – Fire
C – Explosion
D - Temperature sensing function of BMU did operate and then charging stopped
E - Temperature sensing function of BMU did not operate and then charging stopped
F - All function of battery system did operate as intended during the test.
G - All function of battery system did not operate as intended during the test.
H - Other (Please explain):

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

**Attachment No. 1:**
**Photo Documentation**



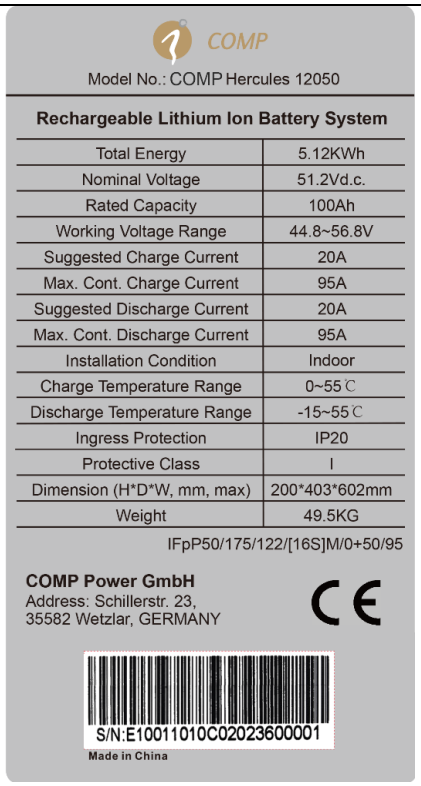
| Details of: | Fig.1 Overview 1 of Rechargeable Lithium Ion Battery System, model: COMP Hercules 12050 |
|---|---|
| |  |

| Details of: | Fig.2 Overview 2 of Rechargeable Lithium Ion Battery System, model: COMP Hercules 12050 |
|---|---|
| |  |

**Attachment No. 1:**
**Photo Documentation**



| Details of: | Fig.3 Overview of Connector |
|---|---|
| |  |

| Details of: | Fig. 4 Marking plate of Rechargeable Lithium Ion Battery System, model: COMP Hercules 12050 |
|---|---|
| |  |

COMP

Model No.: COMP Hercules 12050

**Rechargeable Lithium Ion Battery System**

| | |
|---|---|
| Total Energy | 5.12KWh |
| Nominal Voltage | 51.2Vd.c. |
| Rated Capacity | 100Ah |
| Working Voltage Range | 44.8~56.8V |
| Suggested Charge Current | 20A |
| Max. Cont. Charge Current | 95A |
| Suggested Discharge Current | 20A |
| Max. Cont. Discharge Current | 95A |
| Installation Condition | Indoor |
| Charge Temperature Range | 0~55℃ |
| Discharge Temperature Range | -15~55℃ |
| Ingress Protection | IP20 |
| Protective Class | I |
| Dimension (H*D*W, mm, max) | 200*403*602mm |
| Weight | 49.5KG |

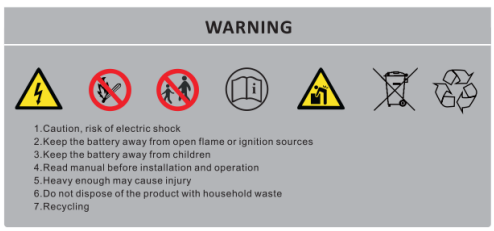
IFpP50/175/122/[16S]M/0+50/95

**COMP Power GmbH**
Address: Schillerstr. 23,
35582 Wetzlar, GERMANY

CE

S/N:E10011010C02023600001

Made in China



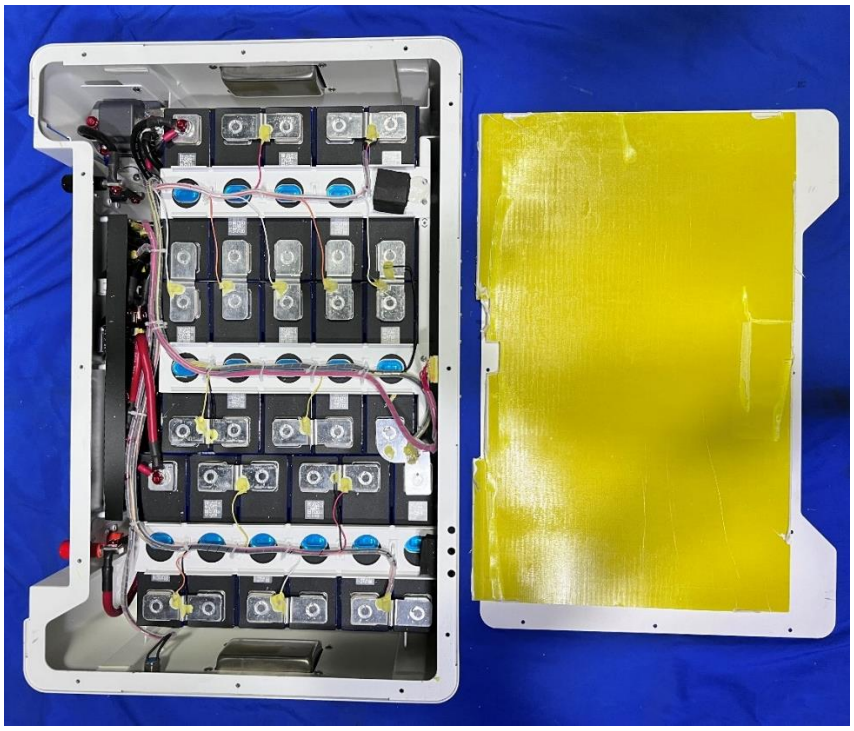

Remark:

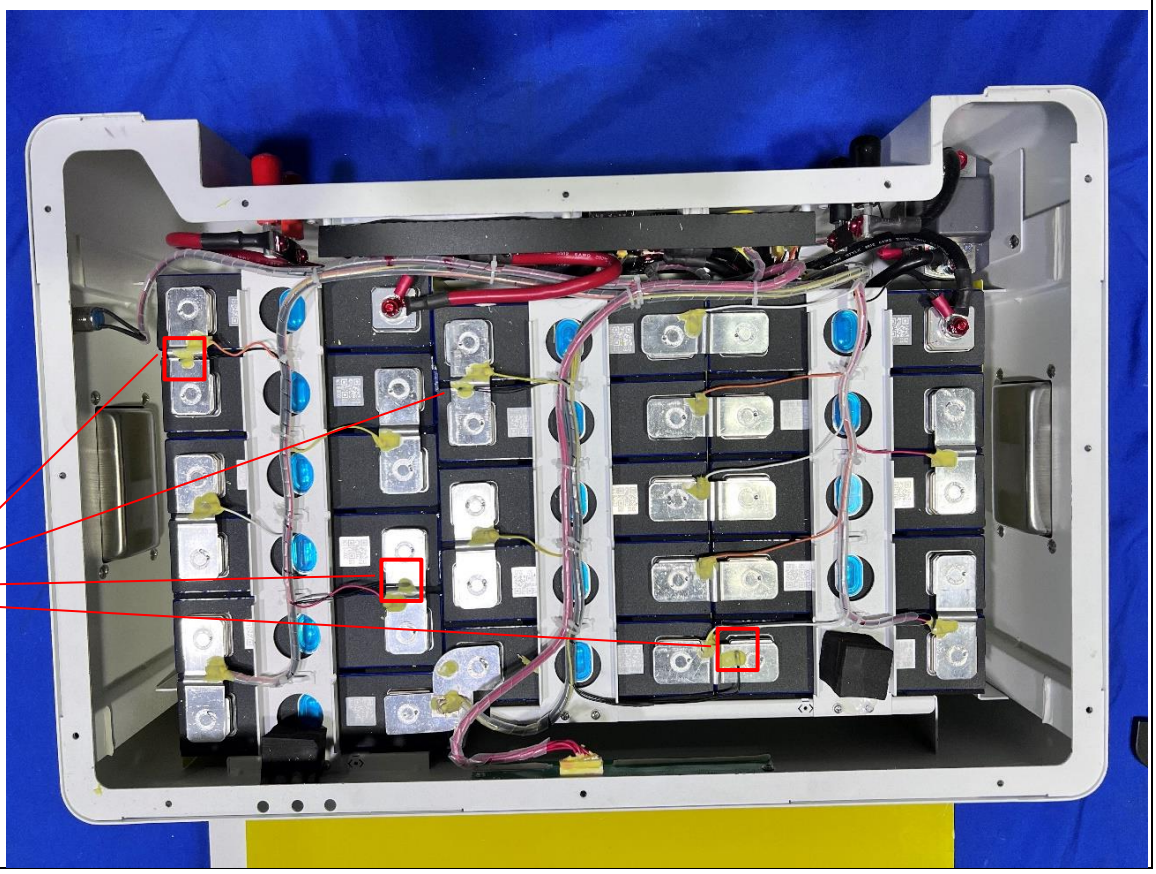
1. There are serial number with 21 characters tracing the detail information of the battery system, such as “E10011010C0203600001”. The 10th to 12th characters represent the manufacture date, and “C02” indicates the manufacture date in the 2nd week of 2023. This is not the serial of actual sample and for example only.

2. “+” “-” are marked near the connectors.

**Attachment No. 1:**
**Photo Documentation**

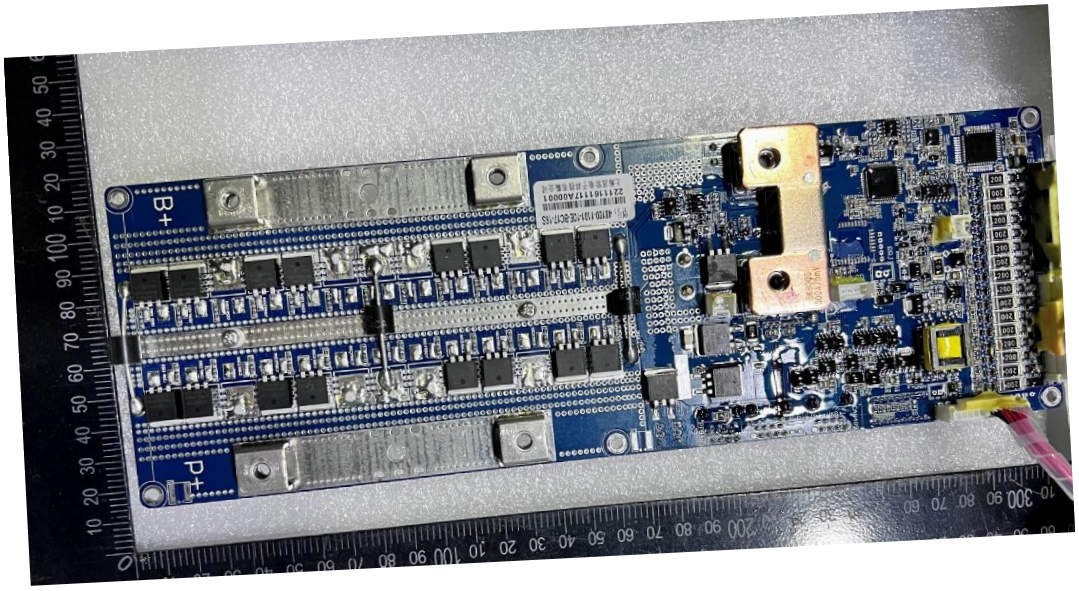


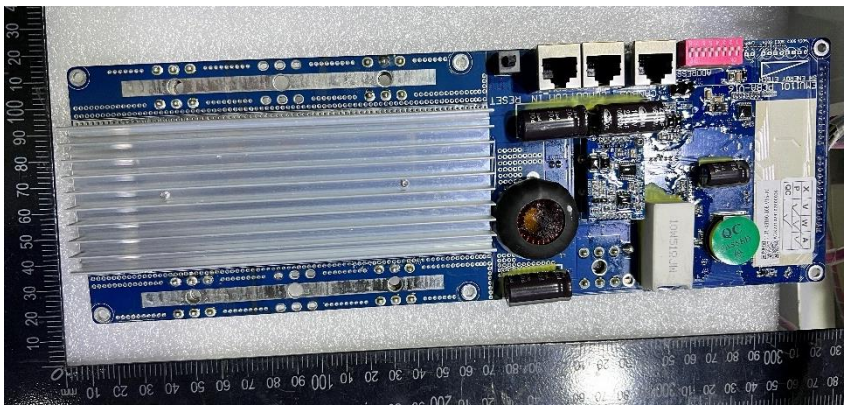
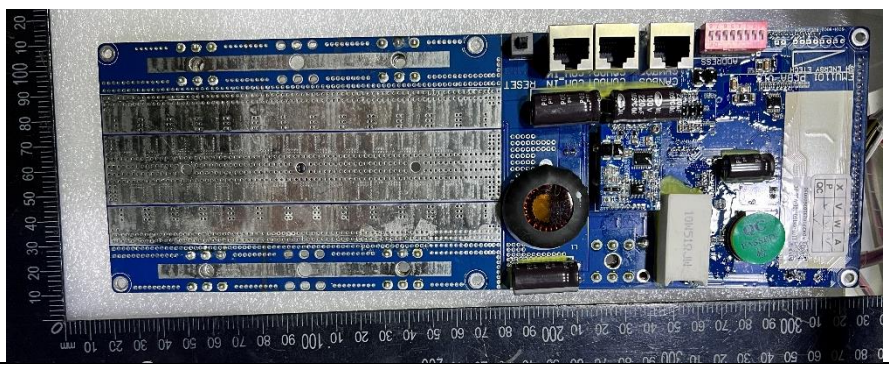
| Details of: | Fig. 5 Inside view 1 of Rechargeable Lithium Ion Battery System, model: COMP Hercules 12050 (Open the cover) |
|---|---|
| |  |

| Details of: | Fig. 6 Overview of battery module with (16S)cells, model: COMP Hercules 12050 |
|---|---|
| NTC (4pcs) |  |

**Attachment No. 1:**
**Photo Documentation**

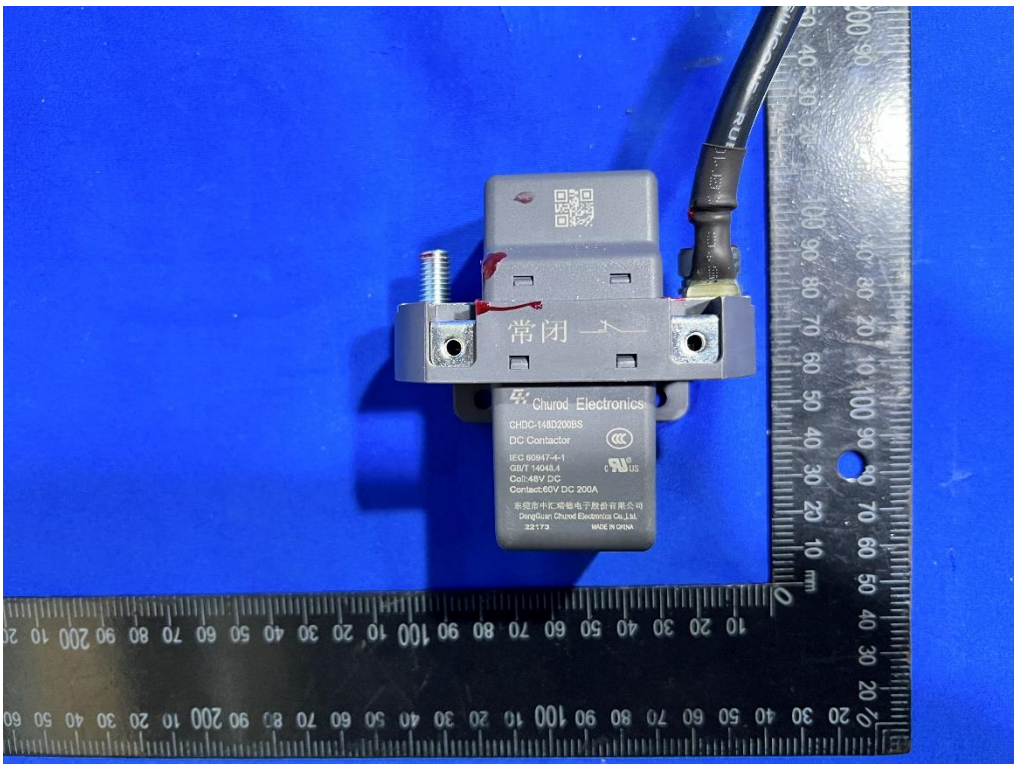


| Details of: | Fig. 7 Top view of BMS Main board, model: 48100-1101-10E-BC17-16S |
|---|---|
| |  |

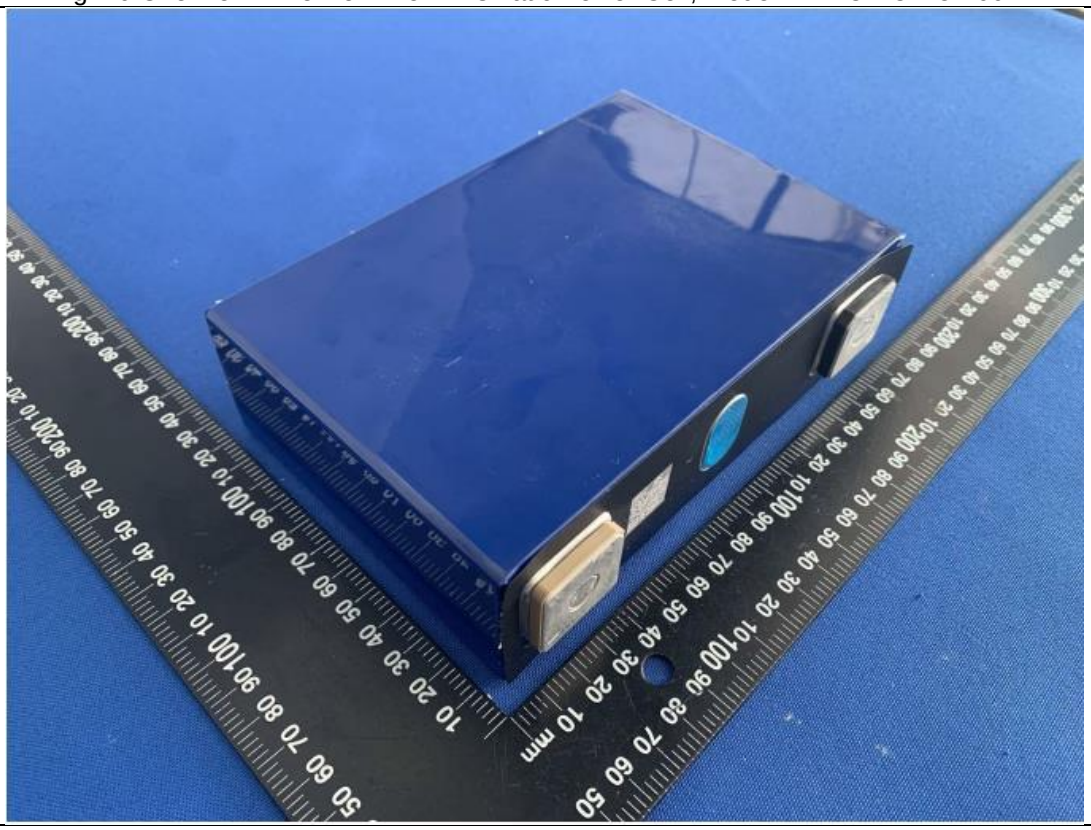
| Details of: | Fig. 8 Bottom view of BMS Main board, model: 48100-1101-10E-BC17-16S |
|---|---|
| |  <br>  |

**Attachment No. 1:**
**Photo Documentation**



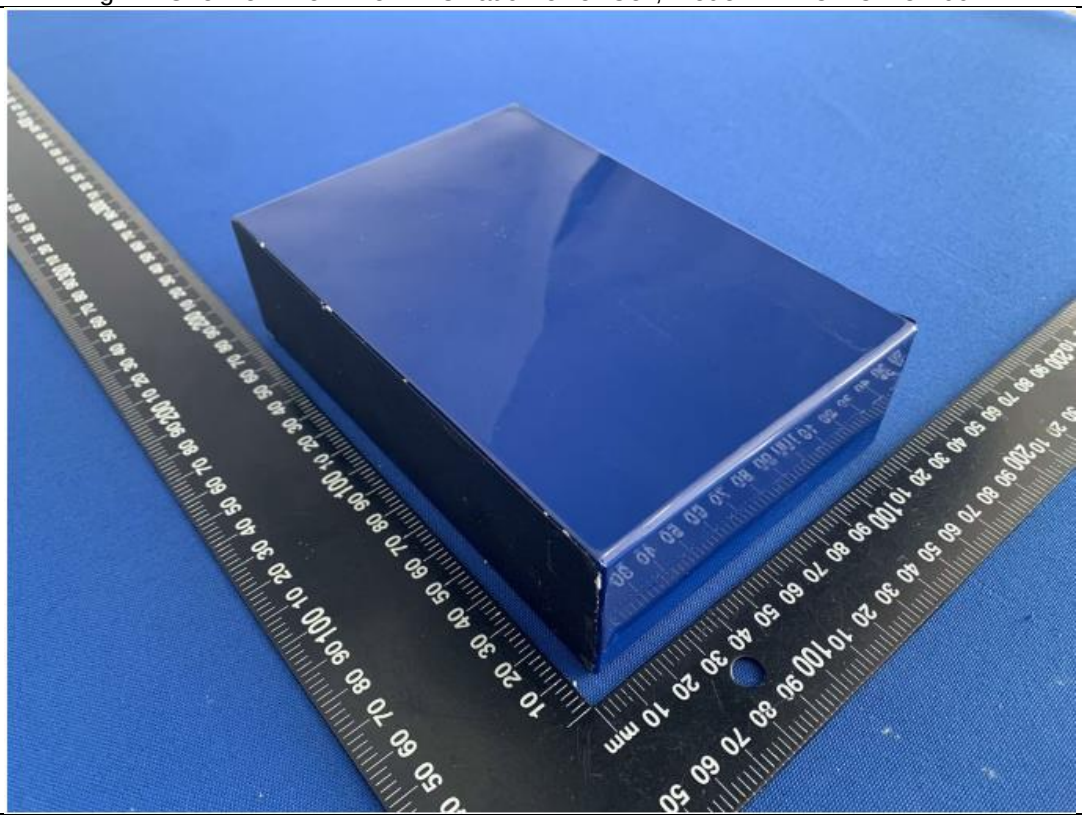
| Details of: | Fig. 9 Overview of Contactor, model: CHDC-148D200BS |
|---|---|
| |  |



| Details of: | Fig. 10 Overview 1 view of Li-ion Prismatic Power Cell, model: IFP48173115-100Ah |
|---|---|
| |  |

**Attachment No. 1:**
**Photo Documentation**



| Details of: | Fig. 11 Overview 1 of Li-ion Prismatic Power Cell, model: IFP48173115-100Ah |
|---|---|
| |  |

**-- End --**