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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..... :	241008088GZC-001
Date of issue ..... :	16 Oct., 2024
Total number of pages ..... :	37 pages
Name of Testing Laboratory preparing the Report ..... :	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Applicant's name..... :	Shenzhen Lux Power Technology Co., Ltd
Address ..... :	C501, Building A, Donghua Industrial Park, 5003 Bao'an Avenue, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, China.
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.
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Test item description ..... :	LFP Li-ion Battery
Trademark(s) ..... :	LUX POWER TEK
Manufacturer ..... :	HINAESS TECH CO., LTD No. 2, bonded warehouse in the fence of Gui'an Comprehensive Bonded Zone, Gui'an New District, Guizhou Province, China.
Model/Type reference ..... :	PGEM PRO
Ratings ..... :	51.2V, 280Ah, 14.3kWh

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

☒	**CB Testing Laboratory:**	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch	
Testing location/ address..... :		C2-1, Heping Xu, Yongning Street, Zengcheng District, Guangzhou, China	
Tested by (name, function, signature)..... :		Ricardo Huang Engineer	Ricardo Huang
Approved by (name, function, signature)... :		Carl Chen Reviewer	Carl Chen
☐	**Testing procedure: CTF Stage 1:**	N/A	
Testing location/ address..... :			
Tested by (name, function, signature)..... :			
Approved by (name, function, signature)... :			
☐	**Testing procedure: CTF Stage 2:**	N/A	
Testing location/ address..... :			
Tested by (name + signature) ..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature)... :			
☐	**Testing procedure: CTF Stage 3:**	N/A	
☐	**Testing procedure: CTF Stage 4:**	N/A	
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):

Including 1 page of Appendix: Circuit diagram (Page 24).

Including 3 pages of Appendix: PCB layout (Page 25 to 27).

Including 1 page of Appendix: specification (Page 28).

Including 2 pages of Appendix: User manual (Page 29 to 30).

Including 7 pages of Appendix: Photos (Page 31 to 37).

Summary of testing: From the result of our examination and tests in the submitted samples, conclude they comply with the requirements of the standard IEC 62619: 2022 and EN IEC 62619: 2022.

Tests performed (name of test, test clause and date test performed):	**Testing location:**
cl.7.2.3 Drop test (battery system); cl.8.2.2 Overcharge control of voltage (battery system),; cl.8.2.3 Overcharge control of current (battery system); cl.8.2.4 Overheating control (battery system). The samples comply with the requirement of IEC 62619: 2022.	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch C2-1, Heping Xu, Yongning Street, Zengcheng District, Guangzhou, China

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

Group and National differences of all CENELEC members have been considered but no deviation.

(No national deviation between IEC 62619: 2022 and EN IEC 62619:2022).

☒ **The product fulfils the requirements of IEC 62619: 2022 and 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: … (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

Information on uncertainty of measurement:

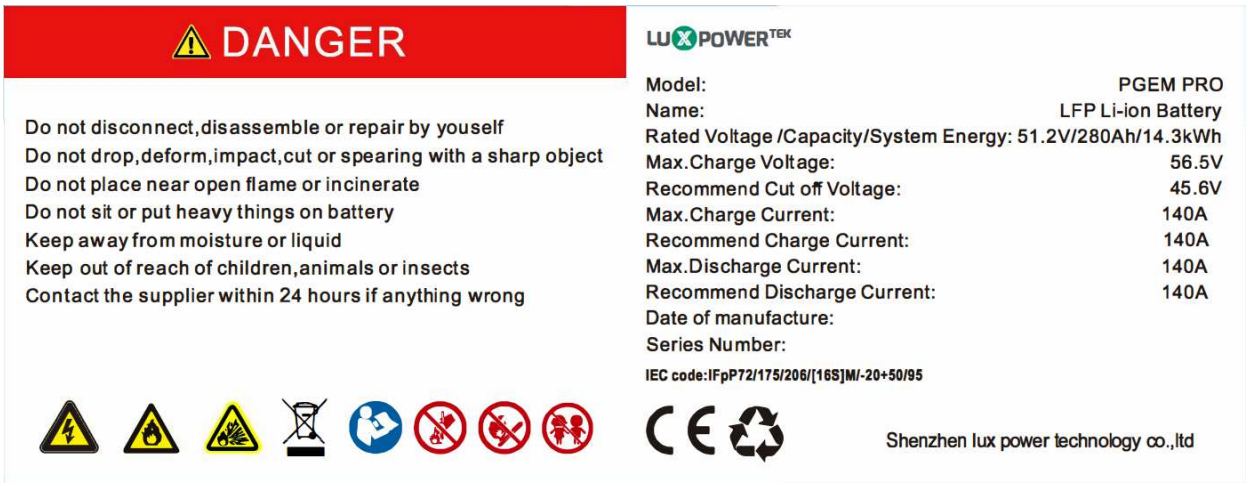
The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.

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.



Note:

Date Code: XXXXXXXXYMXXXXX

Y: Represent year of manufacture;

M: Represent month of manufacture.

Year Code：

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Code	A	B	C	D	E	F	G	H	J	K	L	M

Month Code:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Code	N	P	Q	R	S	T	U	V	W	X	Y	Z

For example “10201021BS00001” “BT” means Manufacture Date“2023-05”

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 .....:	2024-05-28
Date (s) of performance of tests.....:	2024-05-28 to 2024-07-30
General remarks:	

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 testing laboratory.

"(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.

Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

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The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.

This report is based on the CB report 240528042GZC-001 issued on 30 Jul., 2024 with below modifications:

- Changed the applicant name and address from:

HINAESS TECH CO., LTD

Address: No. 2, bonded warehouse in the fence of Gui'an Comprehensive Bonded Zone, Gui'an New District, Guizhou Province, China

to:

Shenzhen Lux Power Technology Co., Ltd

Address: C501, Building A, Donghua Industrial Park, 5003 Bao'an Avenue, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, China

- Changed the brand name from HINAESS to LUXPOWER.
- Changed the model name from: PowerGem Plus to PGEM PRO.
- Updated the marking plate with new brand name and model name.
- Updated the User manual with new model name.
- Updated the photos with new brand name.

Per evaluating, no additional test is necessary.

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ..... :	HINAESS TECH CO., LTD No. 2, bonded warehouse in the fence of Gui'an Comprehensive Bonded Zone, Gui'an New District, Guizhou Province, China.

General product information and other remarks:

The product covered in this report is Lithium ion battery module which consists of 16 cells in 16S. It has overcharge, over-discharge, over-temperature, over current and short-circuits proof circuit.

The battery system provides only primary protections and controls, and the secondary protections should be evaluated when installed in the end product.

The cell (Model LFP71173205E-280Ah) inside the battery module is CB approved according to IEC 62619: 2022. (CB Certificate No.: SG PSB-BT-03452, Report No.: 085-282260319-000).

Product name	Rechargeable Li-ion Cell	LFP Li-ion Battery
Model ..... :	LFP71173205E-280Ah	PGEM PRO
Configuration:	/	16S
Capacity [Ah] ..... :	280	280
Nominal voltage [V d.c.]. :	3.2	51.2
Maximum continuous charge current [A] ..... :	280	140
Maximum continuous discharge current [A]..... :	280	140
Standard fully charge voltage [V d.c.] ..... :	3.65	56.5
Maximum charge voltage [V d.c.] ..... :	3.7	56.5
End of discharge voltage [V d.c.]..... :	2	45.6
Charging temperature range [°C]..... :	0 to 50	0 to 48
Discharging temperature range [°C]..... :	-20 to 55	-20 to 53
Storage temperature range [°C]..... :	-30 to 45	-10 to 35
Recommend charging method declared by the manufacturer..... :	At constant current 140A till battery voltage reaches 3.65V, then switch to constant voltage 3.65V till charge current drops to 14A.	At constant current 140A till battery voltage reaches 56.5V, then switch to constant voltage 56.5V till charge current drops to 14A.
Nominal mass [kg] ..... :	≤5.5	≈113
External dimensions ..... :	(71.5±0.5)mm x (173.8±0.5)mm x (205.1±0.6)mm	900mm × 475mm × 237.5mm
Battery designation ..... :	IFpP72/175/206/M/-20+50/95	IFpP72/175/206/[16S]M/-20+50/95

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... :	Clause 6, Clause 7, 8.1, and 8.2. See also table 5.1 for Critical components information	P
	Reduce the risk of injuries from moving parts		P
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		P
	Protect from hazardous live parts, including during installation		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
	Polarity marking not provided for keyed external connector		N/A
	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

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	Independent control and protection method(s)		P
	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		P
	Protective circuit component(s) and consideration to the end-device application		P
5.6.2	Battery system design		P
	The voltage control function		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		N/A
5.9	**Quality plan**		**P**
	Manufacturing quality plan (for example: ISO9001, etc.) prepared and implemented..... :	Reference: ISO 9001:2005 certificate provided.	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		P

7	**SPECIFIC REQUIREMENTS AND TESTS**	**P**
7.1	**Charging procedure for test purposes**	**P**

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	The battery discharged to a specified final voltage prior to charging		P
	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)		P
7.2.3.1	General		P
7.2.3.2	Whole drop test (cell or cell block, and battery system)	Approved cell used.	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)..... :	113kg	—
	Height of drop (mm) ..... :	25mm	—
	Results: no fire, no explosion		P
7.2.4	Thermal abuse test (cell or cell block)	Approved cell used.	N/A
	Results: no fire, no explosion		N/A
7.2.5	Overcharge test (cell or cell block)	Approved cell used.	N/A
	For those battery systems that are provided with only a single protection for the charging voltage control		—
	Results: no fire, no explosion..... :		N/A
7.2.6	Forced discharge test (cell or cell block)	Approved cell used.	N/A
	Cells connected in series in the battery system ..... :		N/A

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	Redundant or single protection for discharge voltage control provided in battery system ..... :		N/A
	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**		**P**
7.3.1	General		P
7.3.2	Internal short-circuit test (cell)	Approved cell used.	N/A
	Samples preparation procedure: 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 .....:	See Attachment # __	—
	The pressing was stopped - When a voltage drop of 50 mV was detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) was reached		N/A
	Results: no fire ..... :		N/A
7.3.3	Propagation test (battery system)	The CB approved cell used have been considered the clause 7.3.2.	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	Comply with Annex H of IEC 60730-1	P
	Conduct of a process hazard analysis for both the cell manufacturing process and the battery system manufacturing process		P
	Conduct of risk assessment and mitigation of the battery system		P
8.2	**Battery management system (or battery management unit)**		**P**

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
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 terminated the charging before exceeding 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
	Elevated temperature for charging, 5 °C above maximum operating temperature ..... :	53 °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	**EMC**		**N/A**
	Battery system fulfil EMC requirements of the end-device application ..... :	Should be considered in the end-device	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

IEC 62619			
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.		P
	Cell or battery system has clear and durable markings		P
	Cell designation		N/A
	Battery designation	IFpP72/175/206/[16S]M/-20+50/95	P
	Battery structure formulation		P
12	**PACKAGING AND TRANSPORT**		P
	Refer to Annex D		P
ANNEX A	**OPERATING REGION OF CELLS FOR SAFE USE**		N/A
A.1	General	Approved cell used	N/A
A.2	Charging conditions for safe use		N/A
A.3	Consideration on charging voltage		N/A
A.4	Consideration on temperature		N/A
A.5	High temperature range		N/A
A.6	Low temperature range		N/A
A.7	Discharging conditions for safe use		N/A
A.8	Example of operating region		N/A
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

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict
	The battery system fully charged according to the manufacturer recommended conditions ..... :		—
	Target cell to be laser irradiated ..... :		—
	The irradiation point on the target cell same or similar as that on the cell test		
	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. 1) Heater (Heater, Burner, Laser, Inductive heating 2) Overcharge 3) Nail penetration of the cell 4) Combination of above methods 5) Other methods..... :		—

ANNEX D	**PACKAGING AND TRANSPORT**		P
	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		P
	Regulations concerning international transport of secondary lithium batteries		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)]**
Enclosure	Suzhou Haobo Electronic Technology Co., LTD	GEM-PLUS	Material: SGCC, Minimum thickness 1.2mm	IEC 62619:2022	Tested with appliance
Power Connector	SUZHOU YINGPUDA ELECTRONICS TECHNOLOGY CO LTD	RD150--010V-RT-2+1P-RD, RD150--010V-RT-2+1P-BK	600V, 150A	UL 1977	UL E499580
Switch	YUEQING QIANNIAN ELECTRONIC CO LTD	C-QN19-C,	250V, 5A, 55ºC	UL 61058-1	UL E489975
Internal Power Wires (for B+and P+)	DONGGUAN DEWEI ELECTRONIC CO LTD	3512	Minimum 50 sq mm^2, minimum 1000V, minimum 200ºC	UL 758	UL E339716
Internal Power Wires (for B+and P+) Alternative	Interchangeable	3512	Minimum 50 sq mm^2, minimum 1000V, minimum 200ºC	UL 758	UL approval
Internal Power Wires (for B-and P-)	DONGGUAN DEWEI ELECTRONIC CO LTD	3512	Minimum 13.3 sq mm^2, minimum 600V, minimum 200ºC	UL 758	UL E339716
Internal Power Wires (for B-and P-) Alternative	Interchangeable	3512	Minimum 13.3 sq mm^2, minimum 600V, minimum 200ºC	UL 758	UL approval
Internal BMS Power Wires	GUANGDONG YONGROI CABLE TECHNOLOGY CO LTD	1015	Minimum 16AWG, minimum 600V, minimum 80ºC	UL 758	UL E204893
Internal BMS Power Wires Alternative	Interchangeable	1015	Minimum 16AWG, minimum 600V, minimum 80ºC	UL 758	UL approval
Internal Signal Wire	DONGGUAN CHUANTAI WIRE PRODUCTS CO LTD	1332	Minimum 24AWG, minimum 300V, minimum200ºC	UL 758	UL E315628

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

Internal Signal Wire Alternative	Interchangeable	1332	Minimum 24AWG, minimum 300V, minimum200ºC	UL 758	UL approval
Insulation sleeving	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO LTD	RSFR-H	600V, 125 ºC, VW-1	UL 224	UL E203950
Insulation sleeving Alternative	Interchangeable	Interchangeable	Min.600V, Min.125°C, VW-1	UL 224	UL approved
Cell	Jiangsu Higee Energy Co., Ltd	LFP71173205E-280Ah	3.2Vdc, 280Ah	IEC 62619:2022	CB Certificate No. SG PSB-BT-03452
BMS board (CN200GA00 V00)					
PWB Board	KINGBOARD LAMINATES HOLDINGS LTD	KB-6165F	130°C, V-0	UL 796	UL E123995
PWB Board Alternative	Interchangeable	Interchangeable	Min.130°C, V-0	UL 796	UL approved
MCU (U1)	RENESAS	R7FA2L1AB2DFP	Supply voltage:-0.5V~6.5V, TA=-40~105ºC	IEC 62619:2022	Tested with appliance
AFE (U2)	SINO WEALTH	SH367309	VBAT: -0.3~70V, TA=-40~85ºC	IEC 62619:2022	Tested with appliance
Discharge MOSFET (Q62 to Q67, Q98 to Q102, Q103 to Q115)	MAGNACHIP	MDE10N026RH	VDS=100V, VGS=±20V, ID=120A, TJ=-55~175ºC	IEC 62619:2022	Tested with appliance
Charge MOSFET (Q77 to Q82, Q116 to Q120, Q121 to Q133)	MAGNACHIP	MDE10N026RH	V_{DS}=100V, V_{GS}=±20V, I_D=135A, T_J=-55~175ºC	IEC 62619:2022	Tested with appliance
Inductance (L1)	Deli	TCB106060-350M-LF	35µH, 130 ºC	IEC 62619:2022	Tested with appliance
NTC (T1 to T4)	ANHUI EAGLE ELECTRON CO LTD	MF58-103X3435YB	Tmoa = 200 ºC, 10k ohm at 25 ºC	UL 1434	UL E502983
Supplementary information: 1) Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

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 ± 5ºC)**	**OCV at start of test (V dc)**	**Resistance of Circuit (mΩ)**	**Maximum Case Temperature Rise ΔT (°C)**	**Results**
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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**
--	--	--	--	--	--	--
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Supplementary information:

Results:
A – No fire or Explosion
B – Fire
C – Explosion
D – Test concluded when temperature reached a steady state condition
E – Test concluded when temperature returned to ambient
F – Other (Please explain): _____

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.6	TABLE: Forced discharge test (cell or cell block)				N/A
Sample No.	**OCV before applying reverse charge, (V dc)**	**Target Voltage (V dc)**	**Measured Reverse Charge Current It, (A)**	**Total Time for Reversed Charge Application (min)**	**Results**
--	--	--	--	--	--
--	--	--	--	--	--
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Supplementary information:

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

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

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**
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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**
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Method of cell failure [1)]	**Location of target cell**	**Area for fire protection (m^2)**
--	--	--
--	--	--
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Supplementary information:

1) 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

2) If the battery system has no outer covering, the manufacturer is required to specify the area for fire protection.

Results:
A – No fire external to DUT enclosure or area for fire protection or no battery case rupture
B – Fire external to DUT enclosure or area for fire protection
C – Explosion
D – Battery case rupture
E – Other (Please explain): __

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

8.2.2	TABLE: Overcharge control of voltage (battery system)				P
Sample No.	**OCV at start of test for Cell/Cell Blocks, (V dc)**	**Maximum Charging Current, (A)**	**Max. Charging Voltage, (V dc)**	**Max. Voltage of Cell/Cell Blocks, (V dc)**	**Results**
001	2.999~3.064	140	57.9	3.654	A, D, F

	Charge Voltage Applied Battery System: 1)	
	Whole	**Part**
	65.12V	--

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)**	**Max. Charging Current, (A)**	**Max. Charging Voltage, (V dc)**	**Results**
001	48.5	168	56.5	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
Model No.	**OCV at start(SOC 50%) of test, V dc**	**Maximum Charging Current, A**	Measured **Maximum Charging Voltage, V dc**	
PGEM PRO	52.8	140	56.5	
Maximum Specified Temperature of Battery System, °C		**Maximum Measured Cell Case Temperature, °C**	**Results**	
48.0		53.6	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):

IEC 62619			
Clause	Requirement + Test	Result - Remark	Verdict

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

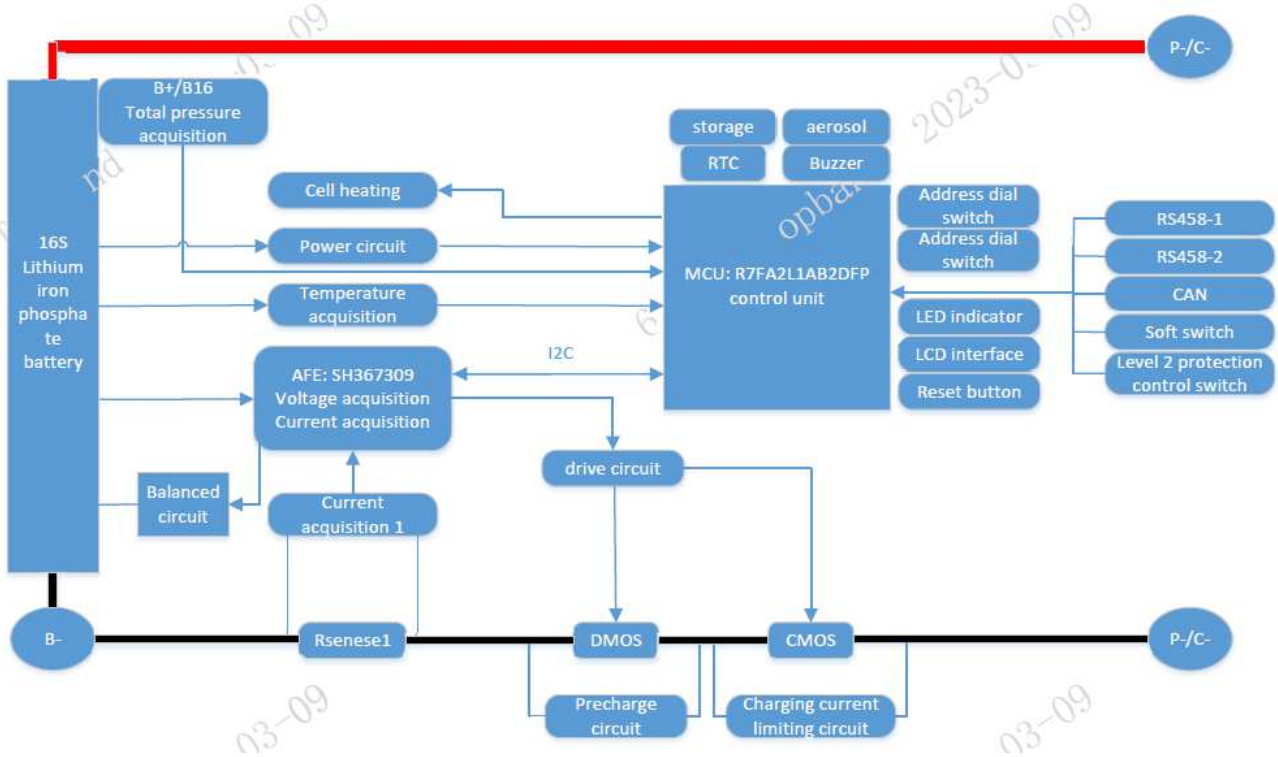
Battery Condition During EMC test

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

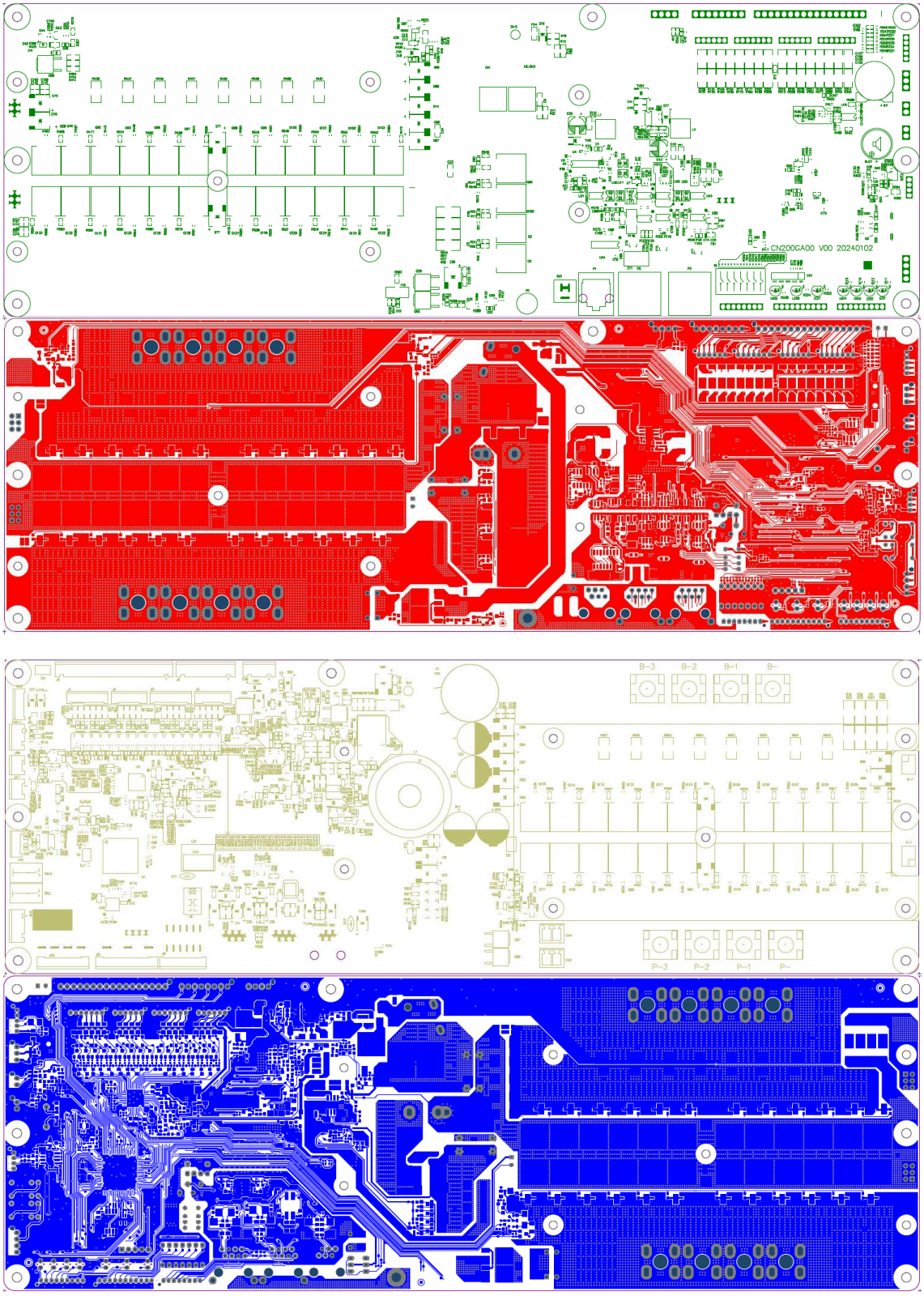
2 – In non-operation Mode, Battery state of charge (SOC) before test at around____

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): ____

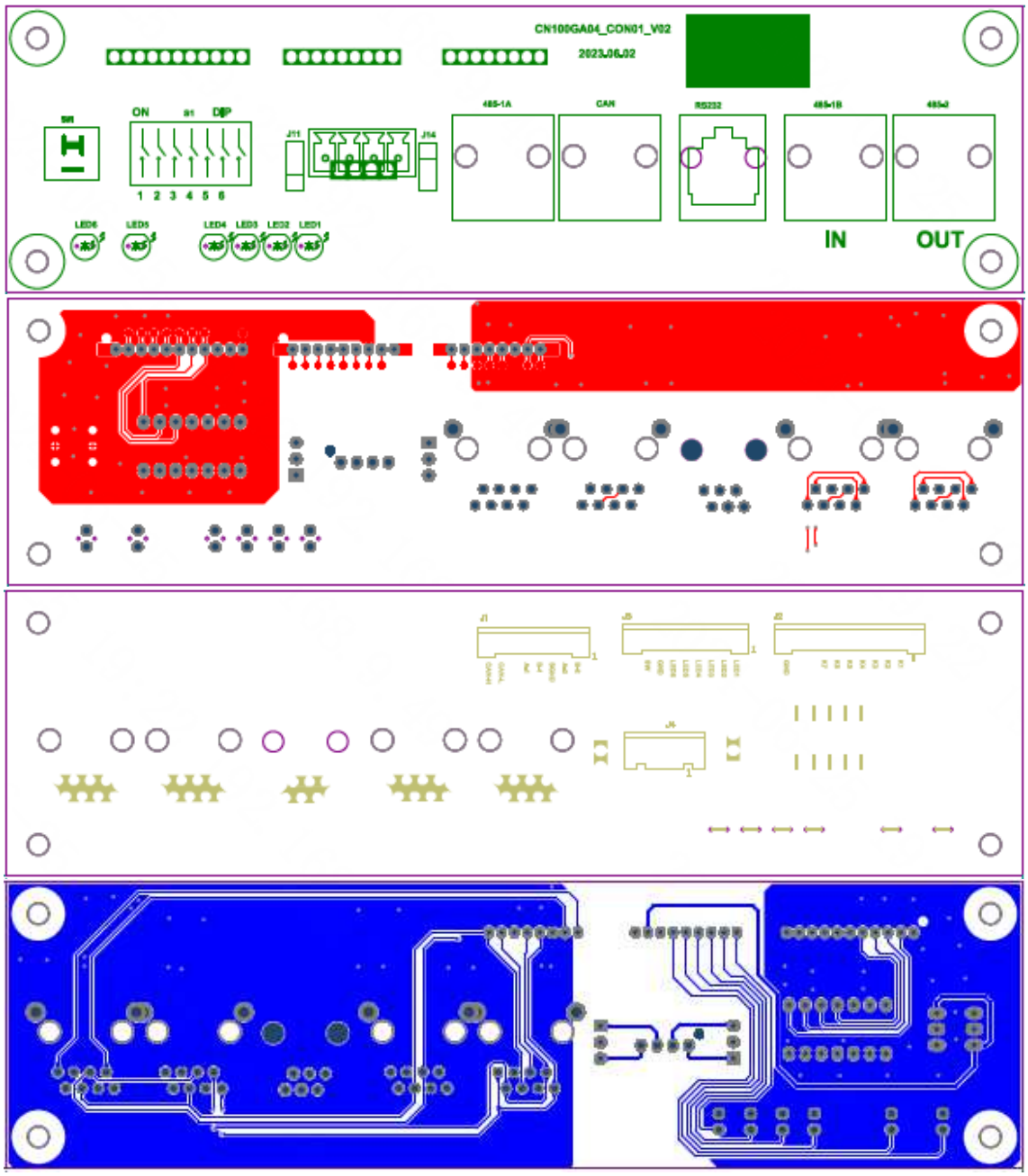
Appendix: Circuit diagram



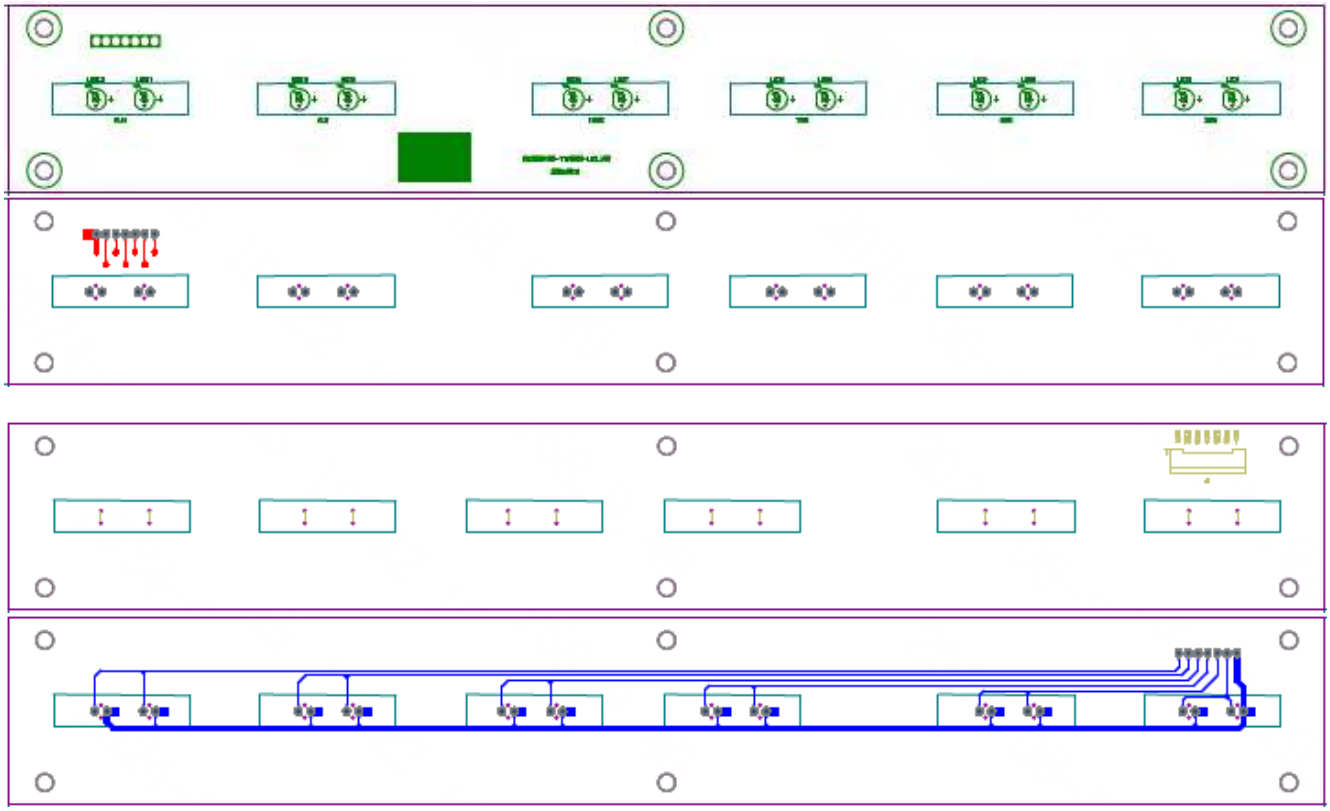
Appendix: PCB Layout



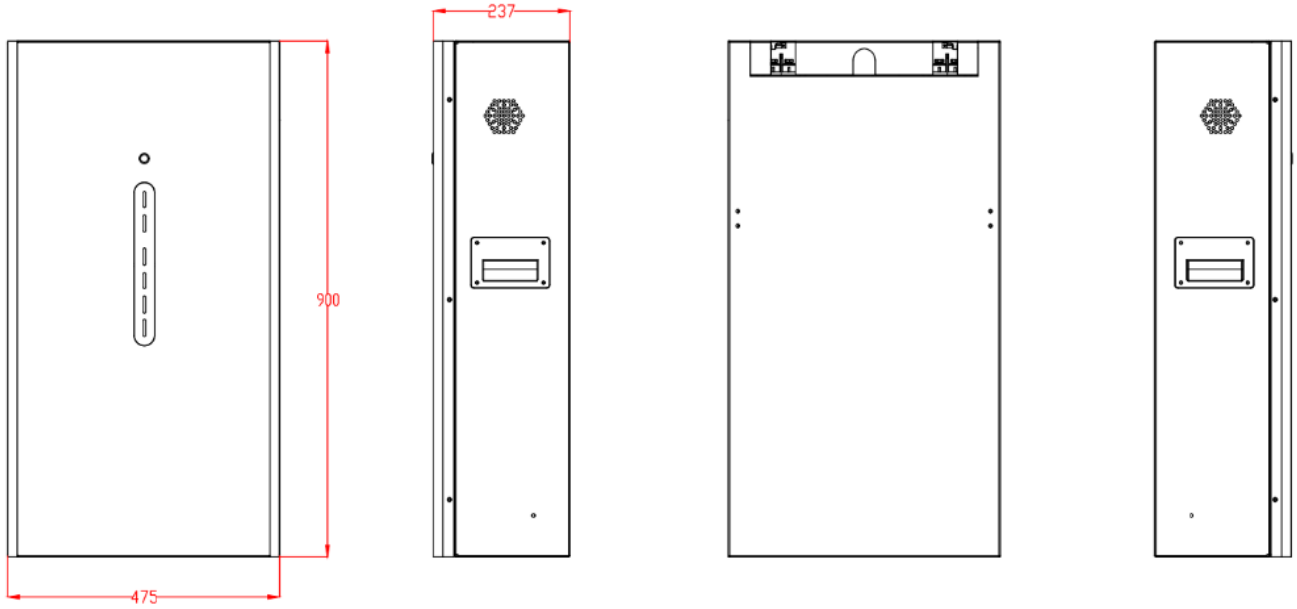
Appendix: PCB Layout



Appendix: PCB Layout



Appendix: Specification



Unit: mm

Appendix: User manual

4. Use, maintenance and troubleshooting

4.1 Battery system usage and operation instructions

After completing the electrical installation, follow these steps to start the battery system.

1. Generally you no need setup DIP for master and slaves, but please connect comm cable between batteries, it's from **last OUT to next IN**.
2. After the indicator self-test, the RUN indicator will light and the SOC indicator will be on according to actual SOC.
3. If you want to turn off the battery, please stop the charge or discharge firstly, then turn off the SW button.

Figure4-1

⚠ CAUTION

- After waking up the battery, if the ALM light is flashing or on, please refer to the "4.2 Alarm description and processing". If the failure cannot be eliminated, please contact the dealer timely.
- Use a voltmeter to measure whether the voltage of the circuit breaker battery access terminal is higher than 45.6V, and check whether the voltage polarity is consistent with the inverter input polarity. If the circuit breaker battery input terminal has a voltage output and is greater than 45.6V, then the battery begun to work normally.
- After confirming that the battery output voltage and polarity are correct, turn on the DC breaker.
- Check if the indicator of the inverter and battery connection (communication indicator and battery access status indicator) is normal. If it is normal, successfully complete the connection between the battery and the inverter. If the indicator light is abnormal, please refer to the inverter manual for the cause or contact the dealer.

Appendix: User manual

2.4.4 Other Protection

Short Circuit Protection:

Each time when short circuit appears, BMS will be locked and shows red light solid on, then you need to check the power cables connection, and long press RESET key more than 6s to remove.

Reverse Connect Protection:

Yes, generally it can protect BMS in reverse connection, but you should avoid reverse connection to prevent irreversible damage to the BMS in extreme cases.

4.3 Analysis and treatment of common faults

Analysis and treatment of common faults in the Table 4-2:

Table 4-2 Analysis and treatment of common faults

No.	Fault phenomenon	Reason analysis	Solution
1	The indicator does not respond after the power on	Total voltage lower than 35V, or force sleep.	Check the total voltage,or long press RESET 3~5s.
2	No DC output	Battery status is abnormal. Battery gets into some protection states.	Read the battery information on the monitor.
3	The DC power supply time is too short	SOC is not accurate. Battery capacity become smaller.	Fully charge the battery to calibrate SOC. Replace new or add more modules.
4	The battery can't be fully charged to 100%	Charging voltage is too low.	Adjust charging voltage at 56.5V.
5	The power cable sparks once power on and ALM light RED	Power connection short-circuit.	Turn off the battery, check the cause of the short circuit.
6	Communication fault	Battery type on the inverter is wrong/Communication cable pinout is incorrect/The communication cable is incorrectly connected on the battery communication port or the inverter communication port.	Check these possible causes one by one.

If you need any technical help or have any question, please contact the dealer in time.

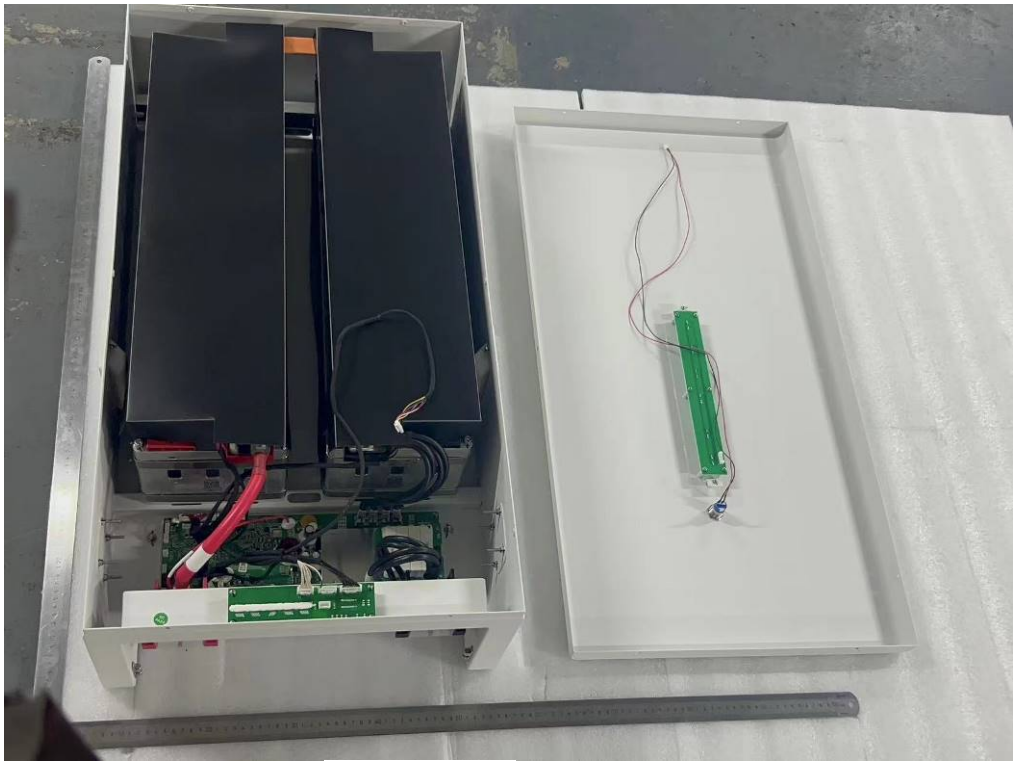
Appendix: Photos

Overall View of battery module

Overall View of battery module

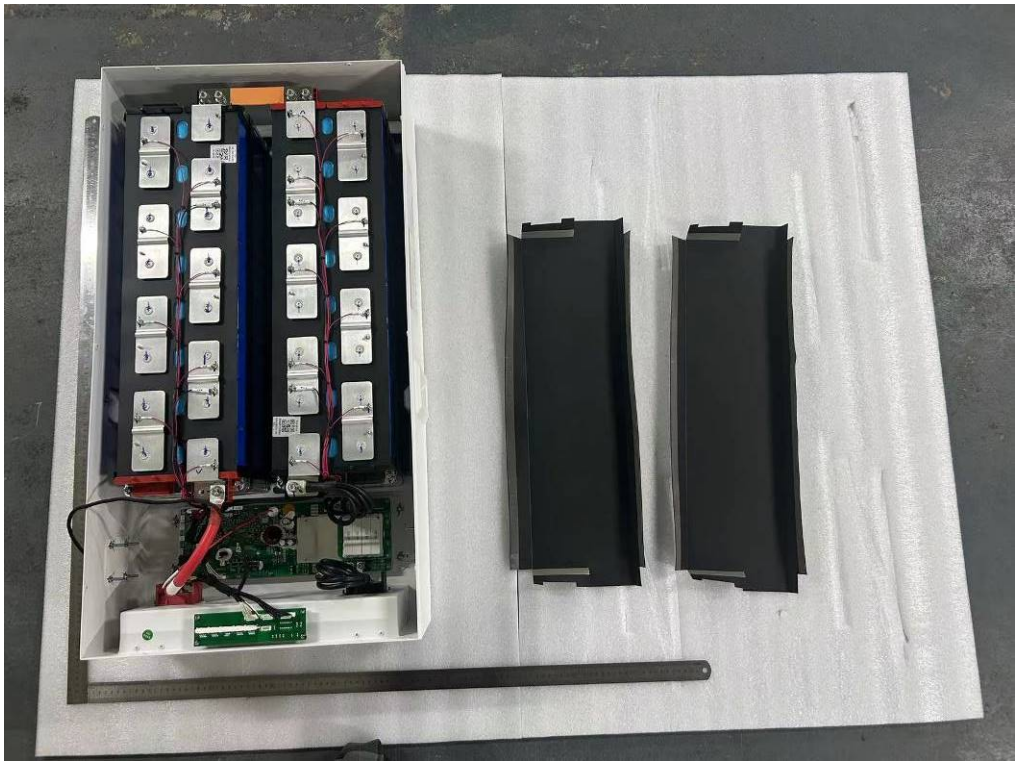
Appendix: Photos

Overall View of connection port

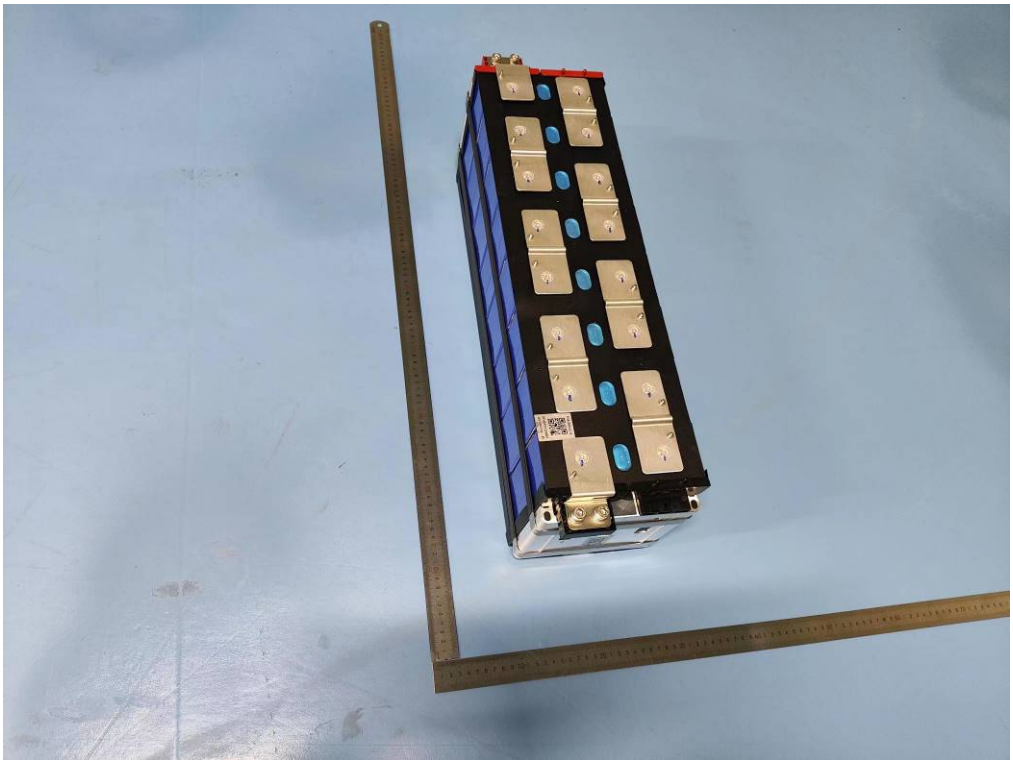


Internal View of battery module

Appendix: Photos

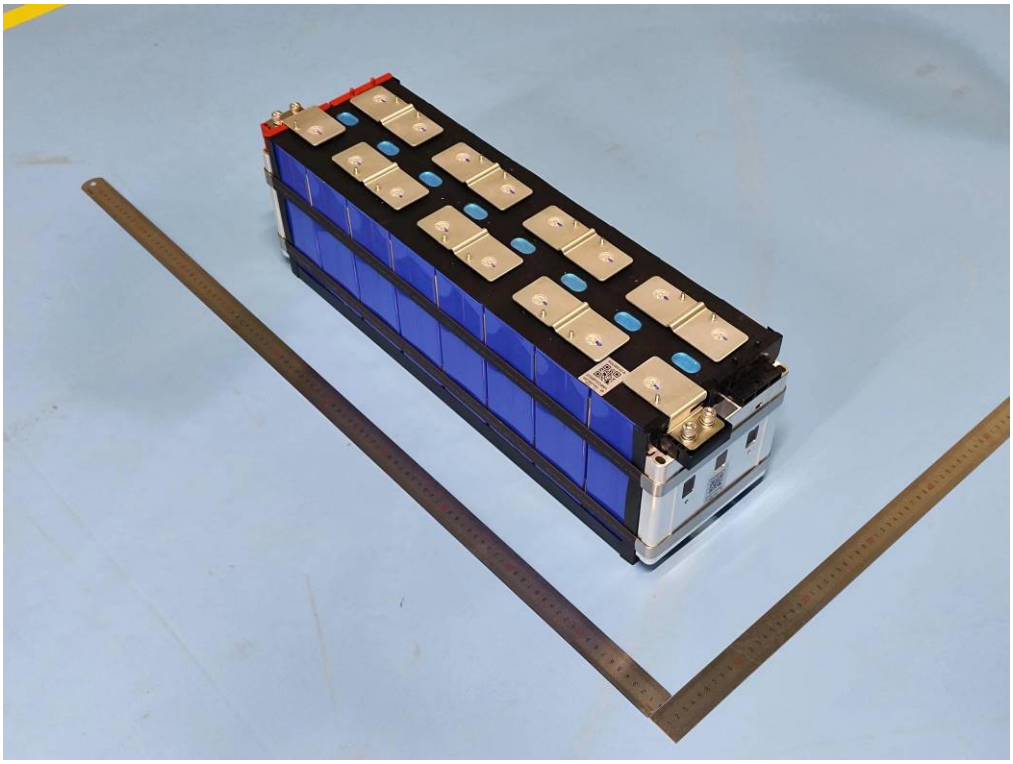


Internal View of battery module

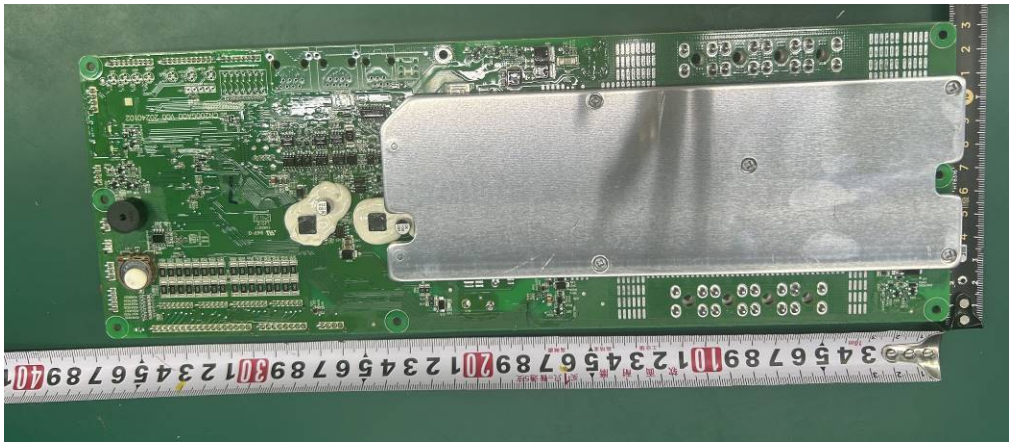


Overall View of cell pack

Appendix: Photos

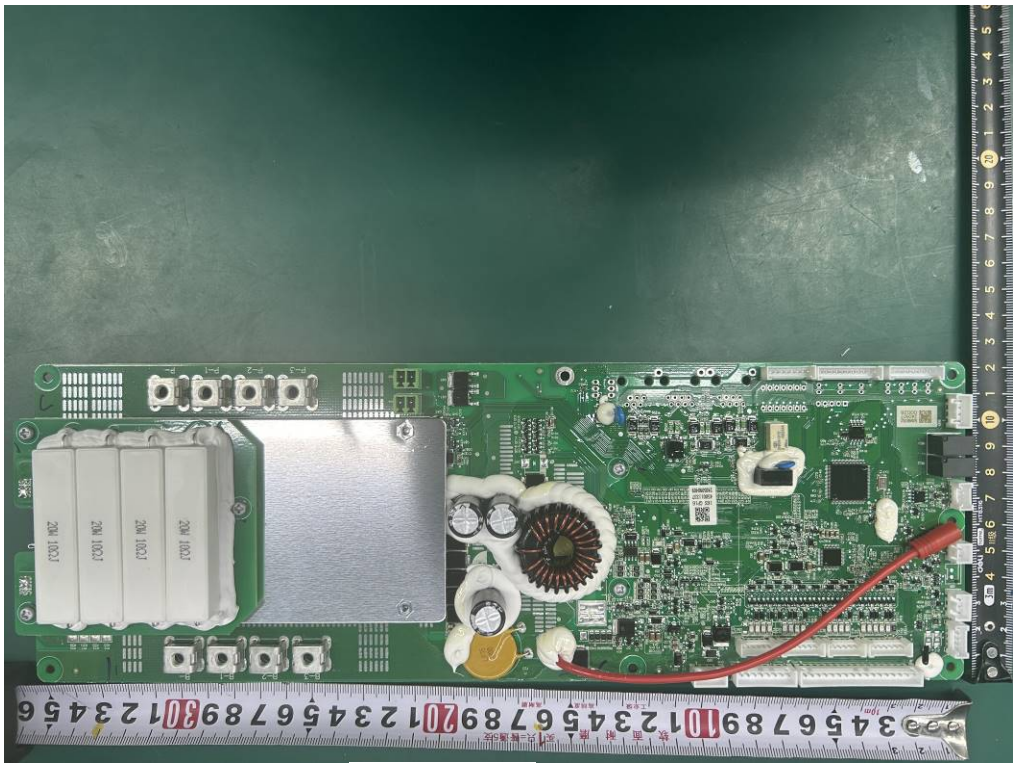


Overall View of cell pack

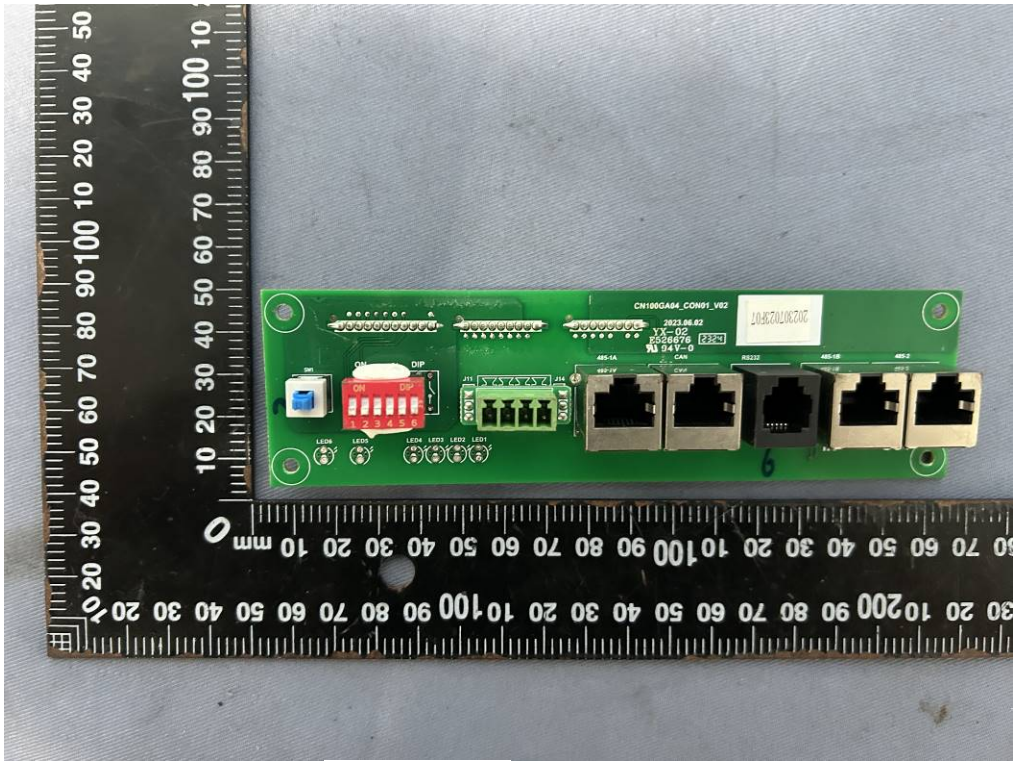


Overall View of BMS board

Appendix: Photos

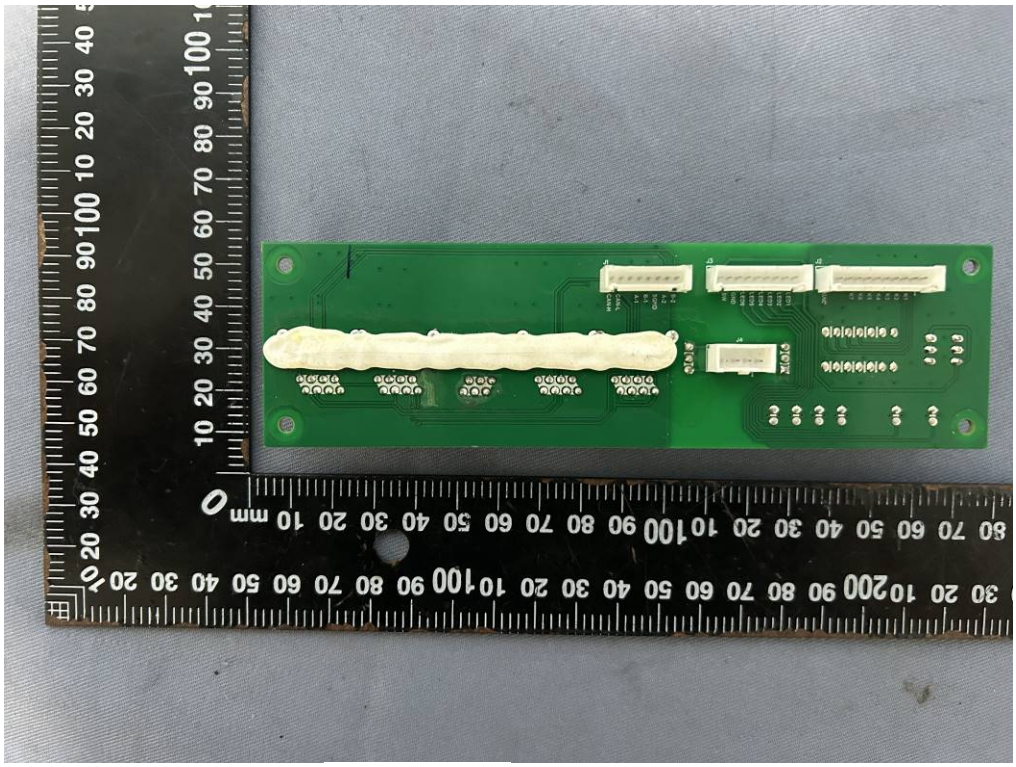


Overall View of BMS board

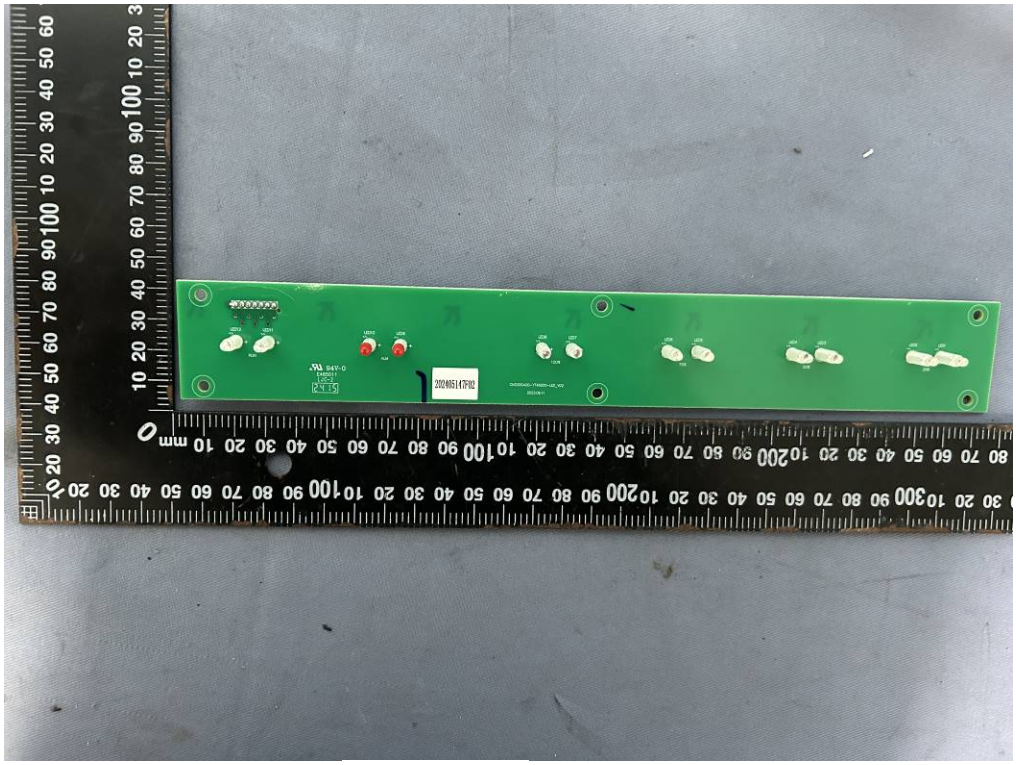


Overall View of Adapter board

Appendix: Photos



Overall View of Adapter board



Overall View of Light board

Appendix: Photos

Overall View of Light board