Test Report issued under the responsibility of:

TEST REPORT
IEC 62133-2
Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems

Report Number. ..... :	AQUJ-ESH-P23060791
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Total number of pages ..... :	49
Name of Testing Laboratory preparing the Report ..... :	LCIE CHINA COMPANY LIMITED
Applicant's name ..... :	Ninebot (Changzhou)Tech Co.,Ltd.
Address ..... :	16F-17F, Block A, Building 3, No.18, Changwu Mid Rd, Wujin Dist., Changzhou, Jiangsu, China.
Test specification:	
Standard ..... :	IEC 62133-2:2017, IEC 62133-2:2017/AMD1:2021
Test procedure ..... :	CB Scheme
Non-standard test method ..... :	N/A
TRF template used ..... :	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No. ..... :	IEC62133_2C
Test Report Form(s) Originator .... :	DEKRA Certification B.V.
Master TRF ..... :	Dated 2022-07-01

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..... :	Li-ion Battery Pack
Trade Mark(s) ..... :	N/A
Manufacturer ..... :	Same as applicant
Model/Type reference..... :	NZBF4813A, NZBF4816A
Ratings..... :	NZBF4813A: 46,8V, 12,75Ah, 597Wh NZBF4816A: 46,8V, 15,3Ah, 716Wh

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

☒	**CB Testing Laboratory:**	LCIE CHINA COMPANY LIMITED	
Testing location/ address ..... :		Building 4, No. 518, Xin Zhuan Road, CaoHejing Songjiang High-Tech Park, Shanghai P.R.C (201612)	
Tested by (name, function, signature)..... :		Thresh Dong (Project Engineer)	Thresh Dong
Approved by (name, function, signature) .. :		Amy DONG (Project Manager)	Amy Dong
☐	**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):

1. Attachment 1 (National Differences): Page 28 to Page 31
2. Attachment 2 (Pictures for product): Page 32 to Page 45
3. Attachment 3 (circuit diagram): Page 46 to Page 49

Summary of testing:

Tests performed (name of test and test clause):

☒ 5.2 Insulation and wiring

☒ 7.1 Charging procedures for test purposes

☐ 7.2.1 Continuous charging at constant voltage (cells)

☒ 7.2.2 Case stress at high ambient temperature (battery)

☐ 7.3.1 External short-circuit (cell)

☒ 7.3.2 External short-circuit (battery)

☒ 7.3.3 Free fall

☐ 7.3.4 Thermal abuse (cells)

☐ 7.3.5 Crush (cells)

☒ 7.3.6 Over-charging of battery

☐ 7.3.7 Forced discharge (cells)

☒ 7.3.8.1 Vibration

☒ 7.3.8.2 Mechanical shock

☐ 7.3.9 Design evaluation – Forced internal short circuit (cells)

☐ D.2 Measurement of the internal AC resistance for coin cells

Note:

(1) Tests are made with the number of batteries specified in Table 1, and tests are carried out in an ambient temperature of 20 °C±5 °C.

(2) Prior to charging, the battery have been discharged at 20±5°C at a constant current of 0,2 I_t A down to a specified final voltage.

Testing location:

LCIE CHINA COMPANY LIMITED

Building 4, No. 518, Xin Zhuan Road, CaoHejing Songjiang High-Tech Park, Shanghai P.R.C (201612)

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

List of countries addressed: KR

☒ **The product fulfils the requirements of EN 62133-2:2017, EN 62133-2:2017/AMD1:2021 (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)**

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.

AAAA B CC DD E F G HHHH
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Date Code:

④ ----Manufacturing year;

⑤ ----Manufacturing month;

⑥ ----Date of Manufacture;

The date code will be print on the battery when the product is shipped.

Test item particulars..... :	
Classification of installation and use..... :	Battery pack for Personal Light Electric Vehicle (PLEV)
Supply Connection..... :	Terminals
Recommend charging method declared by the manufacturer..... :	constant current 1,3A/2,5A (decided by two different charger) to 54,6V, then constant voltage until the charging current is lower than 0,02C. (for both models)
Discharge current (0,2 It A) ..... :	NZBF4813A: 2550mA NZBF4816A: 3060mA
Specified final voltage..... :	36,4V (for both models)
Upper limit charging voltage per cell..... :	4,25V (for both models)
Maximum charging current..... :	7,5A (for both models)
Charging temperature upper limit..... :	55°C
Charging temperature lower limit..... :	0°C
Polymer cell electrolyte type..... :	☐ gel polymer ☐ solid polymer ☒ N/A
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 ..... :	June 13, 2023
Date (s) of performance of tests..... :	June 13, 2023~ July 20, 2023
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** ☐ **Not applicable**
When differences exist; they shall be identified in the General product information section.	

Name and address of factory (ies) ..... :	Huizhou Desay Battery Co., Ltd. No.15, Zhongkai High-tech Industrial Development Zone, Huizhou, Guangdong, China Yiyang Corun Battery Co.,Ltd. 168# Gaoxin Road, Gaoxin District, Yiyang City, Hunan Province, China. GUANGDONG POW-TECH NEW POWER CO.LTD. No. 9, HengDong 3 Road, Hengkeng Shiling Industry Zone, Liaobu Town Dongguan City, Guangdong Province – CHINA

General product information and other remarks:

The equipment under test (EUT) models: NZBF4813A is Li-ion Battery Pack. And the designation of the battery is 13INR19/66-5.

The equipment under test (EUT) models: NZBF4816A is Li-ion Battery Pack. And the designation of the battery is 13INR19/66-6.

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
4	**PARAMETER MEASUREMENT TOLERANCES**		P
	Parameter measurement tolerances	Both normal and foreseeable misuses are evaluated in the report. All control and measure values were within the tolerances.	P
5	**GENERAL SAFETY CONSIDERATIONS**		P
5.1	**General**		P
	Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse	The batteries are safety under conditions of both intended use and reasonably foreseeable misuse.	P
5.2	**Insulation and wiring**		P
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ	Plastic enclosure, No externally exposed metal surface.	N/A
	Insulation resistance (MΩ) ..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate clearances and creepage distances between conductors		N/A
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		P
5.3	**Venting**		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition		P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief		P
5.4	**Temperature, voltage and current management**		P
	Batteries are designed such that abnormal temperature rise conditions are prevented	Overcharge, over-discharge, overcurrent and short-circuit proof circuit used in this battery. See tests of clause 7.	P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer	See Above	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Batteries are provided with specifications and charging instructions for equipment manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified		P
5.5	**Terminal contacts**		P
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current		P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance		P
	Terminal contacts are arranged to minimize the risk of short circuits		P
5.6	**Assembly of cells into batteries**		P
5.6.1	General		P
	Each battery has an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region		P
	This protection may be provided external to the battery such as within the charger or the end devices		N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery has protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		P
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer		N/A
	Protective circuit components are added as appropriate, and consideration given to the end-device application		P
	The manufacturer of the battery provides a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5.6.2	Design recommendation		P
	For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, by monitoring the voltage of every single cell or the single cellblocks		P
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that charging is stopped when the upper limit of the charging voltage is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		P
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage are not counted as an overcharge protection		P
	For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		P
	It is recommended that the cells and cell blocks are not discharged beyond the cell manufacturer’s specified final voltage		P
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry are incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries		P
	Mechanical protection for cells, cell connections and control circuits within the battery are provided to prevent damage as a result of intended use and reasonably foreseeable misuse		P
	The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product		P
	The battery case and compartments housing cells are designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer		P

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Clause	Requirement + Test	Result - Remark	Verdict
	For batteries intended for building into a portable end product, testing with the battery installed within the end product is considered when conducting mechanical tests		N/A
5.7	**Quality plan**		P
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery	ISO 9001 certified manufacturer.	P
5.8	**Battery safety components**		N/A
6	**TYPE TEST AND SAMPLE SIZE**		**P**
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old		P
	The internal resistance of coin cells are measured in accordance with Annex D. Coin cells with internal resistance less than or equal to 3 Ω are tested in accordance with Table 1	Not coin cell	N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °C		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and over discharge protection		N/A
	When conducting the short-circuit test, consideration is given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test		P
7	**SPECIFIC REQUIREMENTS AND TESTS**		P
7.1	**Charging procedure for test purposes**		P
7.1.1	First procedure		P
	This charging procedure applies to subclauses other than those specified in 7.1.2		P
	Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer		P
	Prior to charging, the battery has been discharged at 20 °C ± 5 °C at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		N/A
	After stabilization for 1 h to 4 h, at an ambient temperature of the highest test temperature and the lowest test temperature, respectively, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant current to constant voltage charging method		N/A
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)		N/A
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer		N/A
	Results: no fire, no explosion, no leakage.....:	(See appended table 7.2.1)	N/A
7.2.2	Case stress at high ambient temperature (battery)		P
	Oven temperature (°C).....:	70°C	—
	Results: no physical distortion of the battery case resulting in exposure of internal protective components and cells		P
7.3	**Reasonably foreseeable misuse**		P
7.3.1	External short-circuit (cell)		N/A
	The cells were tested until one of the following occurred:		N/A
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		N/A
	Results: no fire, no explosion.....:	(See appended table 7.3.1)	N/A
7.3.2	External short-circuit (battery)		P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		P
	- The case temperature declined by 20 % of the maximum temperature rise		N/A
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		N/A
	A single fault in the discharge protection circuit is conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test		P

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Clause	Requirement + Test	Result - Remark	Verdict
	A single fault applies to protective component parts such as MOSFET (metal oxide semiconductor field-effect transistor), fuse, thermostat or positive temperature coefficient (PTC) thermistor	Both models: sample No. Q22N07: single fault on MOSFE(Q16,Q18,Q11,Q25,Q28) Q22N08: single fault on FUSE(F3)	P
	Results: no fire, no explosion ..... :	(See appended table 7.3.2)	P
7.3.3	Free fall	Three batteries were fully charged and tested for this condition.	P
	Results: no fire, no explosion	No fire. No explosion.	P
7.3.4	Thermal abuse (cells)		N/A
	Oven temperature (°C) ..... :		—
	Results: no fire, no explosion		N/A
7.3.5	Crush (cells)		N/A
	The crushing force was released upon:		N/A
	- The maximum force of 13 kN ± 0,78 kN has been applied; or		N/A
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: no fire, no explosion ..... :	(See appended table 7.3.5)	N/A
7.3.6	Over-charging of battery		P
	The supply voltage which is:		P
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or		N/A
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and		P
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached		P
	Test was continued until the temperature of the outer casing:		P
	- Reached steady state conditions (less than 10 °C change in 30-minute period); or		N/A
	- Returned to ambient		P
	Results: no fire, no explosion ..... :	(See appended table 7.3.6)	P
7.3.7	Forced discharge (cells)		N/A
	Discharge a single cell to the lower limit discharge voltage specified by the cell manufacturer		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The discharged cell is then subjected to a forced discharge at 1 It A to the negative value of the upper limit charging voltage		N/A
	- The discharge voltage reaches the negative value of upper limit charging voltage within the testing duration. The voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	- The discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration. The test is terminated at the end of the testing duration		N/A
	Results: no fire, no explosion ..... :	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration		P
	Results: no fire, no explosion, no rupture, no leakage or venting. ..... :	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock		P
	Results: no leakage, no venting, no rupture, no explosion and no fire ..... :	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)		N/A
	The cells complied with national requirement for ..... :	France, Japan, Korea, Switzerland	—
	The pressing was stopped upon:		N/A
	- A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached		N/A
	Results: no fire ..... :	(See appended table 7.3.9)	N/A
8	**INFORMATION FOR SAFETY**		P
8.1	**General**		P
	Manufacturers of secondary cells provides information about current, voltage and temperature limits of their products		P
	Manufacturers of batteries provides information regarding how to minimize and mitigate hazards to equipment manufacturers or end-users		P
	Systems analyses are performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	As appropriate, any information relating to hazard avoidance resulting from a system analysis is provided to the end user		N/A
	Do not allow children to replace batteries without adult supervision		P
8.2	**Small cell and battery safety information**	Not small cell or battery	N/A
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		N/A
	- Keep small cells and batteries which are considered swallowable out of the reach of children		N/A
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		N/A
	- In case of ingestion of a cell or battery, seek medical assistance promptly		N/A
9	**MARKING**		P
9.1	**Cell marking**		N/A
	Cells are marked as specified in IEC 61960, except coin cells		N/A
	Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity		N/A
	By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked		N/A
9.2	**Battery marking**		P
	Batteries are marked as specified in IEC 61960, except for coin batteries	See the copy marking label on page 4	P
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity		N/A
	Batteries are marked with an appropriate caution statement		P
	- Terminals have clear polarity marking on the external surface of the battery, or		P
	- Not be marked with polarity markings if the design of the external connector prevents reverse polarity connections		P
9.3	**Caution for ingestion of small cells and batteries**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Coin cells and batteries identified as small batteries include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A
	Small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion is given on the immediate package		N/A
9.4	**Other information**		P
	The following information are marked on or supplied with the battery:		P
	- Storage and disposal instructions	Added in the specification.	P
	- Recommended charging instructions	Added in the specification.	P
10	**PACKAGING AND TRANSPORT**		P
	Packaging for coin cells shall not be small enough to fit within the limits of the ingestion gauge of Figure 3		P
ANNEX A	**CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE**		N/A
A.1	**General**		N/A
A.2	**Safety of lithium-ion secondary battery**		N/A
A.3	**Consideration on charging voltage**		N/A
A.3.1	General		N/A
A.3.2	Upper limit charging voltage		N/A
A.3.2.1	General		N/A
A.3.2.2	Explanation of safety viewpoint		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		N/A
A.4	**Consideration of temperature and charging current**		N/A
A.4.1	General		N/A
A.4.2	Recommended temperature range		N/A
A.4.2.1	General		N/A
A.4.2.2	Safety consideration when a different recommended temperature range is applied		N/A
A.4.3	High temperature range		N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		N/A
A.4.4	Low temperature range		N/A
A.4.4.1	General		N/A
A.4.4.2	Explanation of safety viewpoint		N/A
A.4.4.3	Safety considerations, when specifying charging conditions in the low temperature range		N/A
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		N/A
A.4.5	Scope of the application of charging current		N/A
A.4.6	Consideration of discharge		N/A
A.4.6.1	General		N/A
A.4.6.2	Final discharge voltage and explanation of safety viewpoint		N/A
A.4.6.3	Discharge current and temperature range		N/A
A.4.6.4	Scope of application of the discharging current		N/A
A.5	**Sample preparation**		N/A
A.5.1	General		N/A
A.5.2	Insertion procedure for nickel particle to generate internal short		N/A
A.5.3	Disassembly of charged cell		N/A
A.5.4	Shape of nickel particle		N/A
A.5.5	Insertion of nickel particle in cylindrical cell		N/A
A.5.5.1	Insertion of nickel particle in winding core		N/A
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		N/A
A.5.6	Insertion of nickel particle in prismatic cell		N/A
A.6	**Experimental procedure of the forced internal short-circuit test**		N/A
A.6.1	Material and tools for preparation of nickel particle		N/A
A.6.2	Example of a nickel particle preparation procedure		N/A
A.6.3	Positioning (or placement) of a nickel particle		N/A
A.6.4	Damaged separator precaution		N/A
A.6.5	Caution for rewinding separator and electrode		N/A
A.6.6	Insulation film for preventing short-circuit		N/A
A.6.7	Caution when disassembling a cell		N/A
A.6.8	Protective equipment for safety		N/A
A.6.9	Caution in the case of fire during disassembling		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.6.10	Caution for the disassembling process and pressing the electrode core		N/A
A.6.11	Recommended specifications for the pressing device		N/A
ANNEX B	**RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS**		P
ANNEX C	**RECOMMENDATIONS TO THE END-USERS**		N/A
ANNEX D	**MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS**		N/A
D.1	**General**		N/A
D.2	**Method**		N/A
	A sample size of three coin cells is required for this measurement		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing .....:	(See appended table D.2)	N/A
	Coin cells with an internal resistance less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
ANNEX E	**PACKAGING AND TRANSPORT**		**P**
ANNEX F	**COMPONENT STANDARDS REFERENCES**		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.2.1	TABLE: Continuous charging at constant voltage (cells)			N/A
Sample No.	**Recommended charging voltage Vc (Vdc)**	**Recommended charging current I_{rec} (A)**	**OCV before test (Vdc)**	**Results**
-	-	-	-	-

Supplementary information:

- No fire or explosion
- No leakage
- Others (please explain)

7.3.1	TABLE: External short circuit (cell)				N/A
Sample No.	**Ambient (°C)**	**OCV at start of test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Results**
Samples charged at charging temperature upper limit:-					
-	-	-	-	-	-
Samples charged at charging temperature lower limit:-					
-	-	-	-	-	-

Supplementary information:

- No fire or explosion
- Others (please explain)

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.2	TABLE: External short circuit (battery)					P
	For model NZBF4813A					
Sample No.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Component single fault condition**	**Results**
NZBF4813A Q22N04	24,2	53,25	76,47	0,6	-	Pass
NZBF4813A Q22N05	24,2	53,18	80,35	0,4	-	Pass
NZBF4813A Q22N06	24,2	53,15	75,58	1,0	-	Pass
NZBF4813A Q22N07	24,2	53,20	80,91	0,8	FUSE(F3)	Pass
NZBF4813A Q22N08	24,2	53,17	77,49	1,1	MOSFET(Q16,Q18,Q11,Q25,Q28)	Pass
Supplementary information: - No fire or explosion - Others: Test for 24h, and the protective device of batteries was operated during the test.						

7.3.2	TABLE: External short circuit (battery)					P
	For model NZBF4816A					
Sample No.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature rise ΔT (K)**	**Component single fault condition**	**Results**
NZBF4816A Q22N04	24,3	53,20	82,35	0,6	-	Pass
NZBF4816A Q22N05	24,3	53,24	76,47	0,2	-	Pass
NZBF4816A Q22N06	24,3	53,21	75,58	0,4	-	Pass
NZBF4816A Q22N07	24,3	53,09	80,93	0,6	FUSE(F3)	Pass
NZBF4816A Q22N08	24,3	53,11	77,49	0,7	MOSFET(Q16,Q18,Q11,Q25,Q28)	Pass
Supplementary information: - No fire or explosion - Others: Test for 24h, and the protective device of batteries was operated during the test.						

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.5	TABLE: Crush (cells)			N/A
Sample No.	**OCV before test (Vdc)**	**OCV at removal of crushing force (Vdc)**	**Maximum force applied to the cell during crush (kN)**	**Results**
Samples charged at charging temperature upper limit: -				
-	-	-	-	-
Samples charged at charging temperature lower limit: -				
-	-	-	-	-

Supplementary information:

- No fire or explosion
- Others (please explain)

7.3.6	TABLE: Over-charging of battery			P
	For model NZBF4813A			
Constant charging current (A) .....:		**25,5**		—
Supply voltage (Vdc) .....:		**66,3**		—
Sample No.	**OCV before charging (Vdc)**	**Total charging time (minute)**	**Maximum outer case temperature (°C)**	**Results**
NZBF4813A Q22N12	37,78	97	25,6	Pass
NZBF4813A Q22N13	37,59	97	24,9	Pass
NZBF4813A Q22N14	37,80	97	25,2	Pass
NZBF4813A Q22N15	37,84	97	25,1	Pass
NZBF4813A Q22N16	37,79	97	24,7	Pass

Supplementary information:

- No fire or explosion
- Others: During the test, the protective device was operated.

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.6	**TABLE: Over-charging of battery**		**P**
	For model NZBF4816A		
Constant charging current (A) .....:		**30,6**	**—**
Supply voltage (Vdc) .....:		**66,3**	**—**

Sample No.	OCV before charging (Vdc)	Total charging time (minute)	Maximum outer case temperature (°C)	Results
NZBF4816A Q22N12	37,97	101	25,0	Pass
NZBF4816A Q22N13	37,92	101	24,8	Pass
NZBF4816A Q22N14	37,82	101	24,7	Pass
NZBF4816A Q22N15	37,77	101	25,5	Pass
NZBF4816A Q22N16	37,90	101	25,7	Pass

Supplementary information:

- No fire or explosion
- Others: During the test, the protective device was operated.

7.3.7	**TABLE: Forced discharge (cells)**			**N/A**

Sample No.	OCV before application of reverse charge (Vdc)	Measured reverse charge I_t (A)	Lower limit discharge voltage (Vdc)	Results
-	-	-	-	-

Supplementary information:

- No fire or explosion
- Others (please explain)

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.8.1	TABLE: Vibration (For model NZBF4813A)				P
Sample No.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (kg)**	**Mass after test (kg)**	**Results**
NZBF4813A Q22N17	53,25	53,24	3,915	3,914	Pass
NZBF4813A Q22N18	53,22	53,21	3,909	3,908	Pass
NZBF4813A Q22N19	53,17	53,17	3,912	3,912	Pass

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting
- Others (please explain)

7.3.8.1	TABLE: Vibration (For model NZBF4816A)				P
Sample No.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (kg)**	**Mass after test (kg)**	**Results**
NZBF4816A Q22N17	52,95	52,95	4,499	4,499	Pass
NZBF4816A Q22N18	52,93	52,92	4,497	4,497	Pass
NZBF4816A Q22N19	53,04	53,04	4,502	4,501	Pass

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting
- Others (please explain)

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.8.2	TABLE: Mechanical shock (For model NZBF4813A)				P
Sample No.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (kg)**	**Mass after test (kg)**	**Results**
NZBF4813A Q22N20	53,24	53,24	3,914	3,913	Pass
NZBF4813A Q22N21	53,21	53,20	3,908	3,908	Pass
NZBF4813A Q22N22	53,17	53,16	3,912	3,911	Pass

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting
- Others (please explain)

7.3.8.2	TABLE: Mechanical shock (For model NZBF4816A)				P
Sample No.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (kg)**	**Mass after test (kg)**	**Results**
NZBF4816A Q22N20	52,95	52,94	4,499	4,498	Pass
NZBF4816A Q22N21	52,92	52,92	4,497	4,497	Pass
NZBF4816A Q22N22	53,04	53,03	4,501	4,501	Pass

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting
- Others (please explain)

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

7.3.9	TABLE: Forced internal short circuit (cells)				N/A
Sample No.	**Chamber ambient T (°C)**	**OCV before test (Vdc)**	**Particle location 1)**	**Maximum applied pressure (N)**	**Results**
Samples charged at charging temperature upper limit:					
-	-	-	-	-	-
Samples charged at charging temperature lower limit:					
-	-	-	-	-	-

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.

- No fire
- Others (please explain)

D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	**Ambient T (°C)**	**Store time (h)**	**Resistance Rac (Ω)**	**Results 1)**
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Supplementary information:

1) Coin cells with an internal resistance less than or equal to 3 Ω, see test result on corresponding tables according to Clause 6 and Table 1.

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Critical components information (for both models)				
Object / part No.	**Manufacturer/ trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity[1)]**
-Cell	EVE Energy Co.,Ltd.	ICR18650/26V	3,6V 2550mAh	IEC 62133-2:2017	CB cert. No.: DK-139070-UL
-AFE (U1)	TI	BQ7695202		IEC62133-2	Tested with appliance
-MCU (U7)	ST	STM32G070CBT6		IEC62133-2	Tested with appliance
-protect IC (U9,U10,U11)	Cellwise	CW1062ALGS		IEC62133-2	Tested with appliance
-NMOS(Q9,Q12, Q19,Q23,Q26, Q30,Q32, Q37)	LRC	LBSS123LT1G	SOT-23_N-MOS_100V/6R/170mA/0.225W/Vgs-20V/Vth-2V	IEC62133-2	Tested with appliance
-NMOS (Q16,Q18,Q11, Q25,Q28,Q15,Q8,Q14)	NCE	NCE82H140D	TO-263_N-MOS_82V/4.3mR/140A/220W/Vgs-20V/Vth-3V	IEC62133-2	Tested with appliance
-PMOS-S(Q20,Q21,Q22,Q31,Q36)	LRC	LP2371LT1G	LP2371LT1G_SOT-23_P-MOS/100V/1.4R/1A/1.3W/Vgs-20V/Vth-3.5V	IEC62133-2	Tested with appliance
-MOS (Q17,Q34)	LRC	L2N7002KLT1G	VDS=60V;VGS=±20V (Id):320mA;	IEC62133-2	Tested with appliance
-Q1	CHANGJING ELEC.TECH	2SC2383	2SC2383_SOT-89_NPN_160V/1A/0.5W	IEC62133-2	Tested with appliance
-FUSE (F3)	ADVANCED SURGETECH MATERIALS LTD	PB06060H	60A	IEC62133-2	Tested with appliance
-FUSE (F2)	AEM COMPONENTS (SUZHOU) CO LTD	AF2-15.0V065TM	15A, 65V	IEC62133-2	Tested with appliance
-PCB	Shenzhen Lutongda Technology Co Ltd	LTD-D	V-0, 130°C	IEC62133-2	Tested with appliance
--Alternative	Interchangeable	Interchangeable	Min V-1, 130	IEC62133-2	Tested with appliance

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

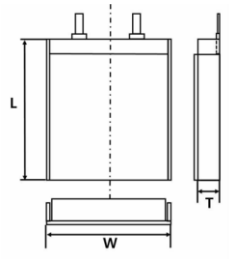
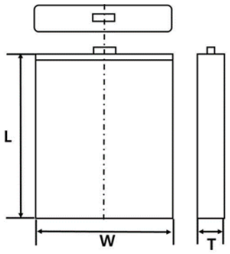
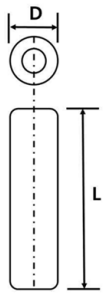
-PTC (PCT3,PTC4,PTC5)	POLYTRONICS TECHNOLOGY CORP.TC	SMD0805P002TF	60V_0805_PTC/0.02A/60V	IEC62133-2	Tested with appliance
-PTC (PCT1,PTC2)	WAYON	LP-ISM005	60V_0805_PTC/0.05A/60V	IEC62133-2	Tested with appliance
Supplementary information: 1) Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

National Differences

National Differences
Republic of Korea

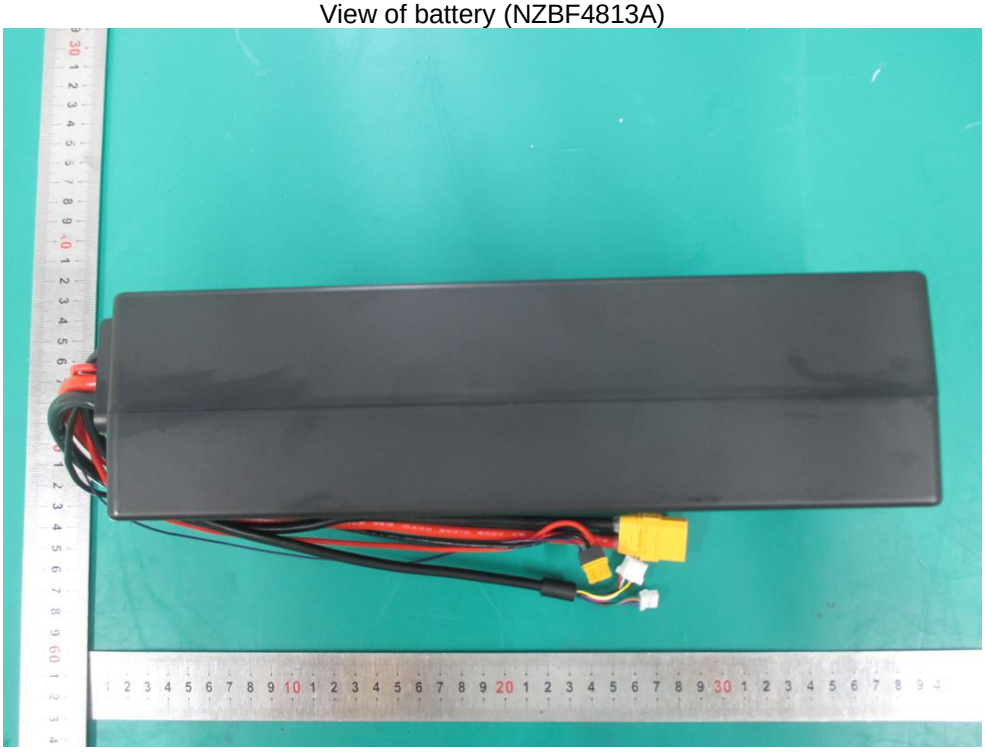
IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
ATTACHMENT TO TEST REPORT **IEC 62133-2** **(REPUBLIC OF KOREA) NATIONAL DIFFERENCES** (SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES - SAFETY REQUIREMENTS FOR PORTABLE SEALED SECONDARY LITHIUM CELLS, AND FOR BATTERIES MADE FROM THEM, FOR USE IN PORTABLE APPLICATIONS - PART 2: LITHIUM SYSTEMS)			
Differences according to .....: National standard KC62133-2(2020-07)			
TRF template used: ..... : IECEE OD-2020-F3, Ed. 1.1			
Attachment Form No.....: KR_ND_IEC62133_2A **Attachment Originator**..... : KTR **Master Attachment**.....: Dated 2020-09-25			
	National Differences		N/A
7.3.6	**Over-charging of battery**		N/A
(Revision)	***[Add the bolded text]*** b) Test The test shall be carried out in an ambient temperature of 20 °C ± 5 °C. Each test battery shall be discharged at a constant current of 0,2 It A, to a final discharge voltage specified by the manufacturer. Sample batteries shall then be charged at a constant current of 2,0 It A, using a supply voltage which is: • 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or • 1,2 times the upper limit charging voltage presented in Table A.1 per cell for series connected multi-cell batteries, and • sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached. **• In case the charging voltage specified by the manufacturer is higher than the overcharge test voltage, the maximum charging voltage specified by manufacturer should be applied with 2.0 ItA,** **(e.g., quick charging power bank, etc.)**		N/A

IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	[Replace to the following statement] c) Acceptance criteria Overcharging exceeding to the limits specified by the manufacturer should not result in fire or explosion.		N/A
Annex G	**Definition for shape and materials of outer case for cell**		—
(Addition)	G.1 General Annex G provides definitions for shape and materials of outer case for cell G.2 Shape of outer case for cell G 2.1 Cylindrical cell Cell with a cylindrical shape in which the overall height is equal to or greater than diameter. G 2.2 Prismatic cell Cell having the shape of a parallelepiped whose faces are rectangular G.3 Materials of outer case for cell G.3.1 Soft case Non-metallic outer case or container for cell G.3.2 Hard case Metallic outer case or container for cell.	(Shape of outer cases) ☒ Cylindrical ☐ Prismatic (Materials of outer cases) ☒ Hard ☐ Soft	—
Annex H	**Calculation method of the volumetric energy density for cell**		—
(Addition)	Annex H provide a calculation method of the volumetric energy density for cell in use of smart phone, tablet, notebook. H.1 General Unless otherwise stated in the Annex E, the dimensions for calculation are based on these for cell before shipment and the volumetric energy density shall be calculated with a maximum values specified by manufacturer. If the specification for cell can't be provided a dimension for calculation, the manufacturer's other documentation shall be provided to demonstrate compliance for its calculation.	537,0Wh / L	—

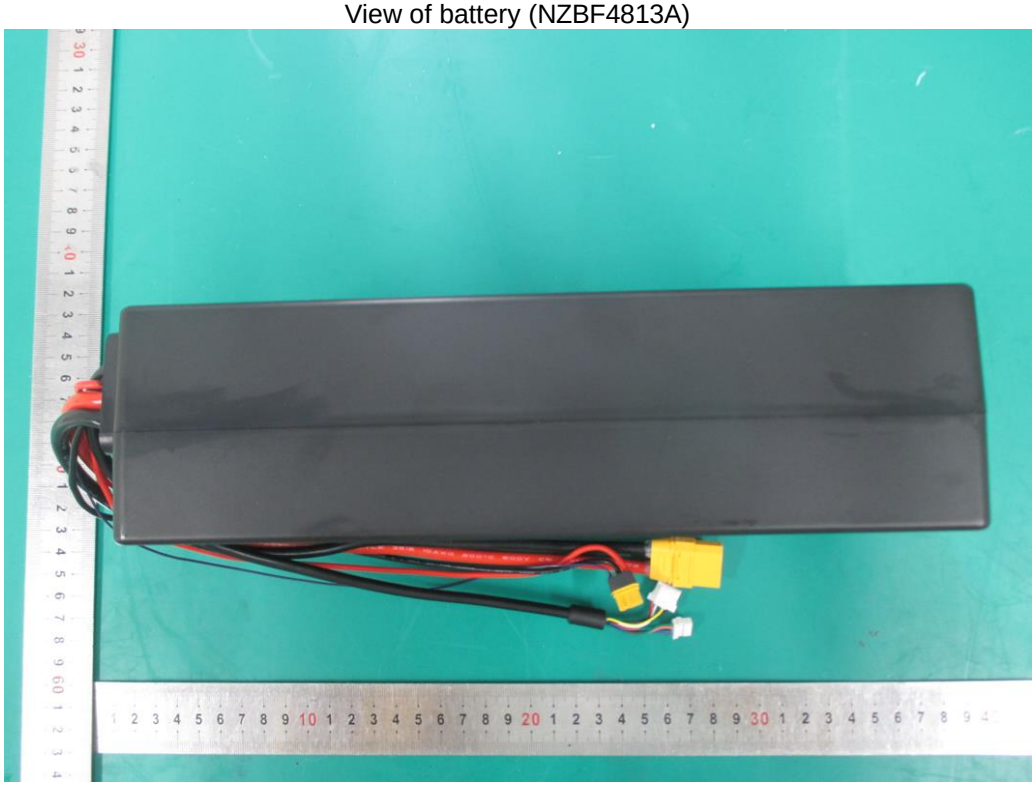
IEC62133_2A ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	H.2 Calculation Method  L : Length (max.) of cell (including terrace) W : Width (max.) of cell T : Thickness (max.) when shipping charge (For reference, Please Exclude the dimension of any tape that Is attached to cell) $Volumetric\ energy\ density\ (Wh/L) = \frac{Nominal\ voltage\ (V) \times Rated\ capacity\ (Ah)}{Length\ (L) \times Width\ (W)\ \times Thickness\ (T)}$ [H.1 – Prismatic cell using soft case]  L : Length (max.) of cell W : Width (max.) of cell T : Thickness when shipping charge (For reference, Please Exclude the dimension of any tape that Is attached to cell) $Volumetric\ energy\ density\ (Wh/L) = \frac{Nominal\ voltage\ (V) \times Rated\ capacity\ (Ah)}{Length\ (L) \times Width\ (W)\ \times Thickness\ (T)}$ [H.2 – Prismatic cell using hard case]  D : Diameter (max.) of cell L : Length (max.) of cell (According to shape of cell at shipping, The dimension of tube for cell may be included In overall dimension of cell) $Volumetric\ energy\ density\ (Wh/L) = \frac{Nominal\ voltage\ (V) \times Rated\ capacity\ (Ah)}{3.14159\ \times \frac{Diameter\ (D)^2}{4} \times Length(L)}$ [H.3 – Cylindrical cell using hard case]		—

View of battery (NZBF4813A)

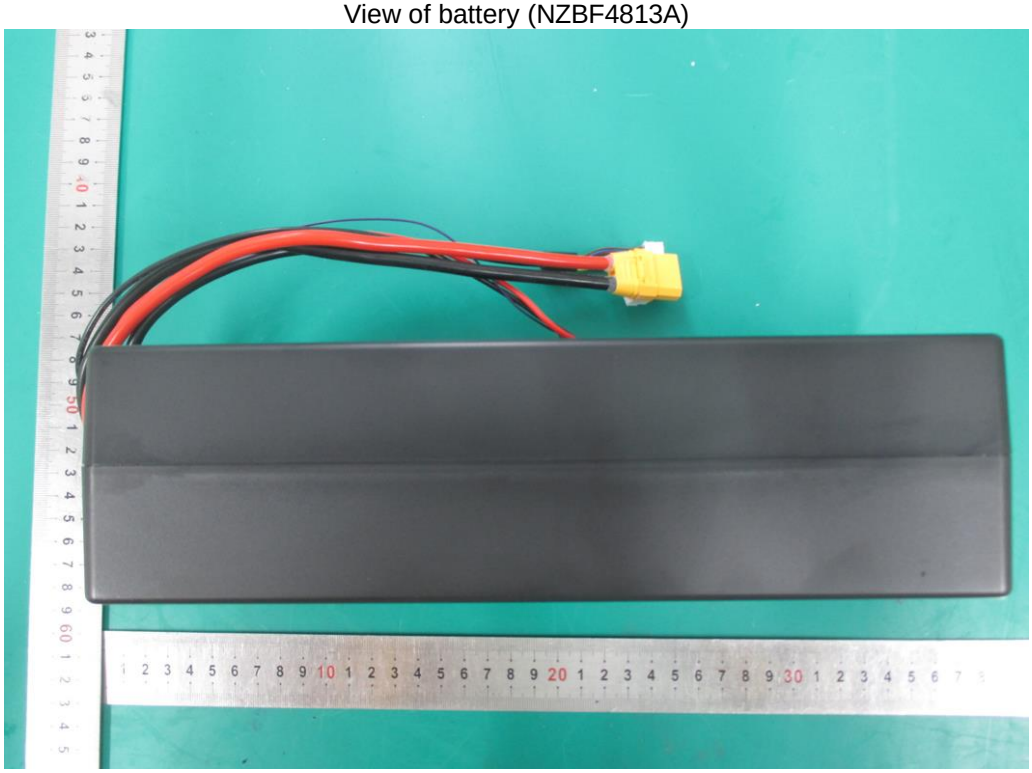
View of battery (NZBF4813A)



View of battery (NZBF4813A)



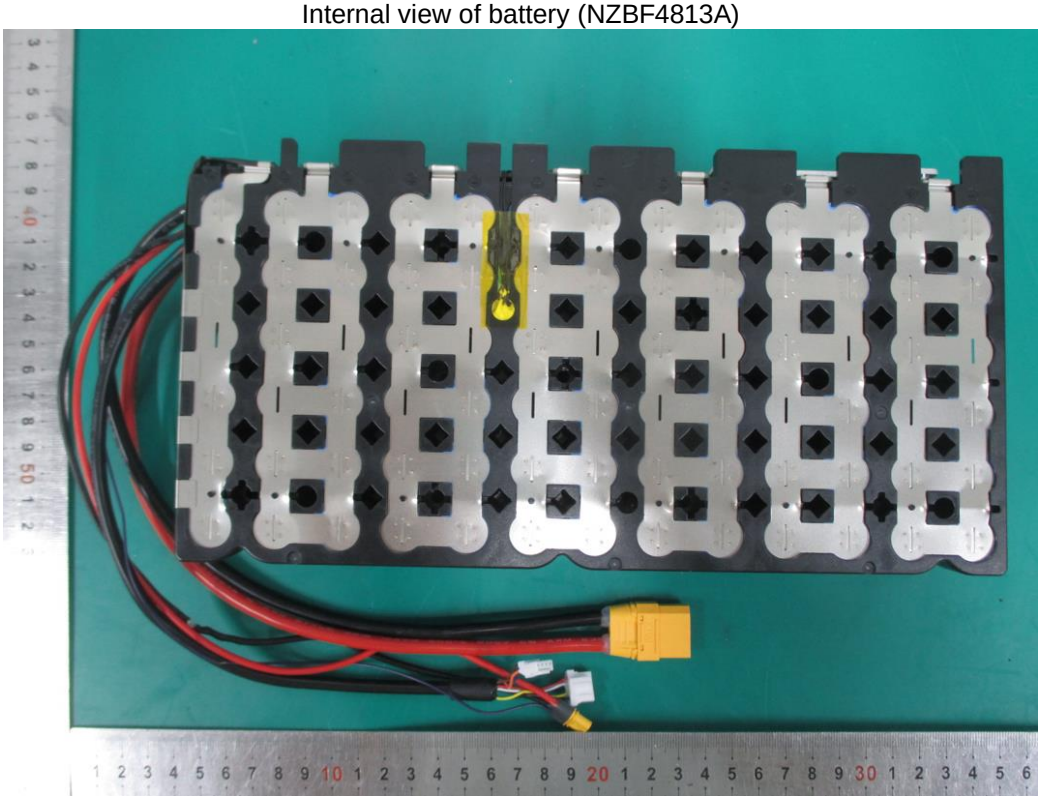
View of battery (NZBF4813A)



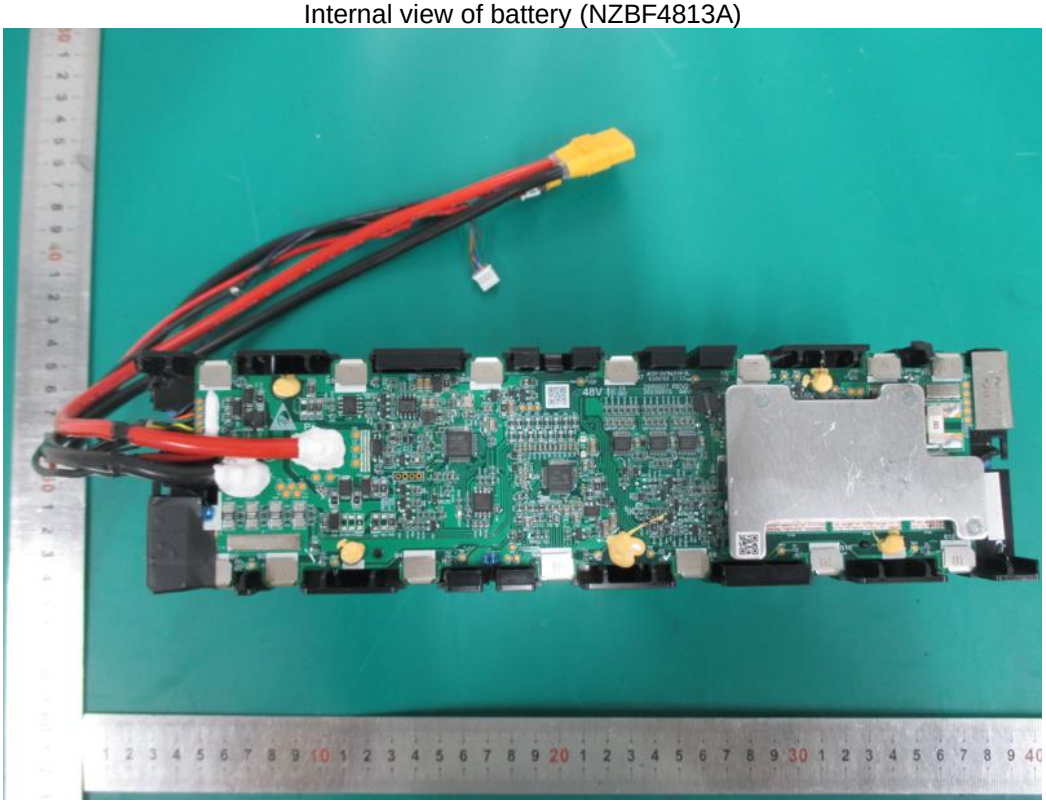
View of battery (NZBF4813A)

View of battery (NZBF4813A)

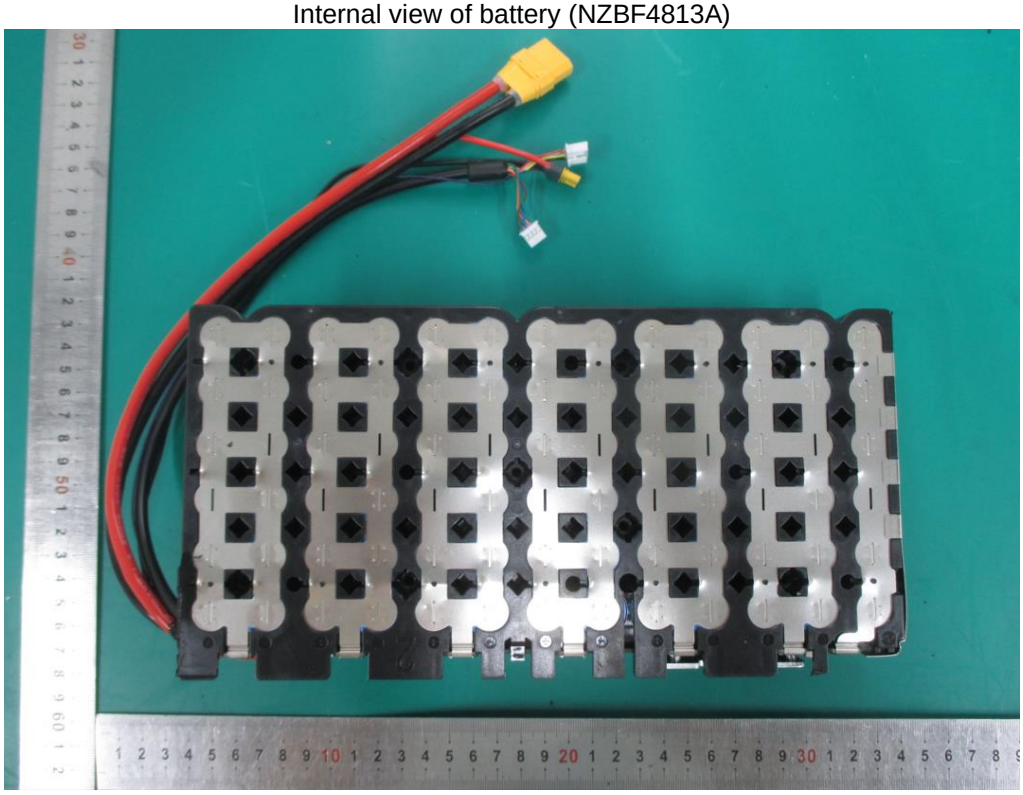
Internal view of battery (NZBF4813A)



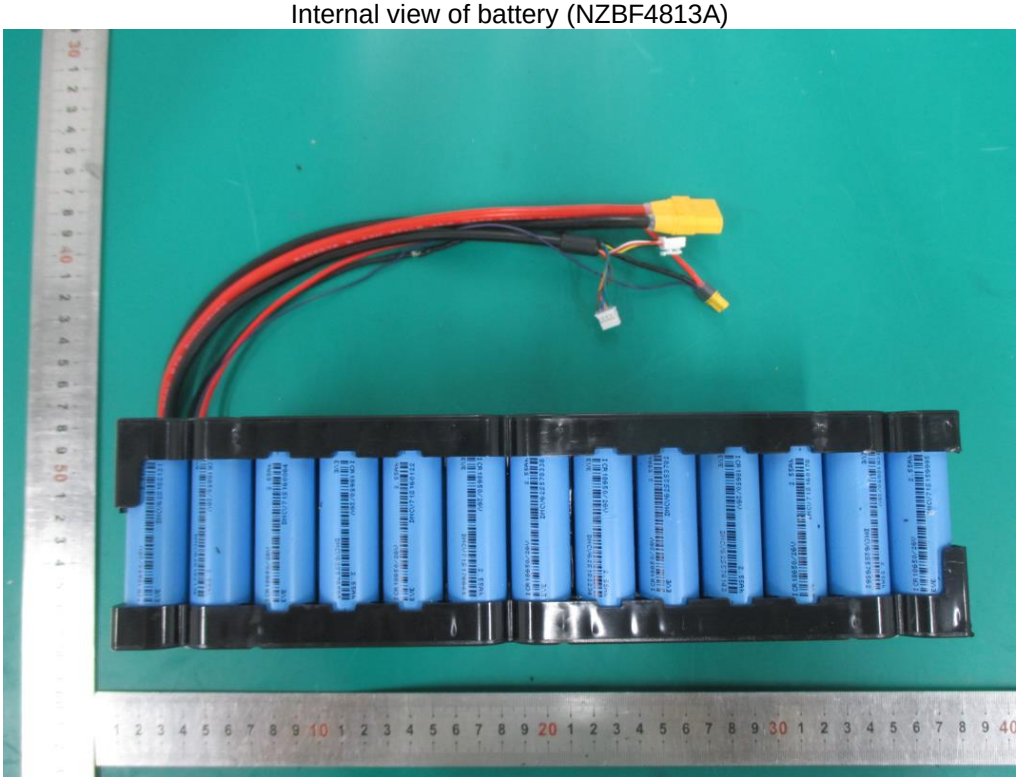
Internal view of battery (NZBF4813A)



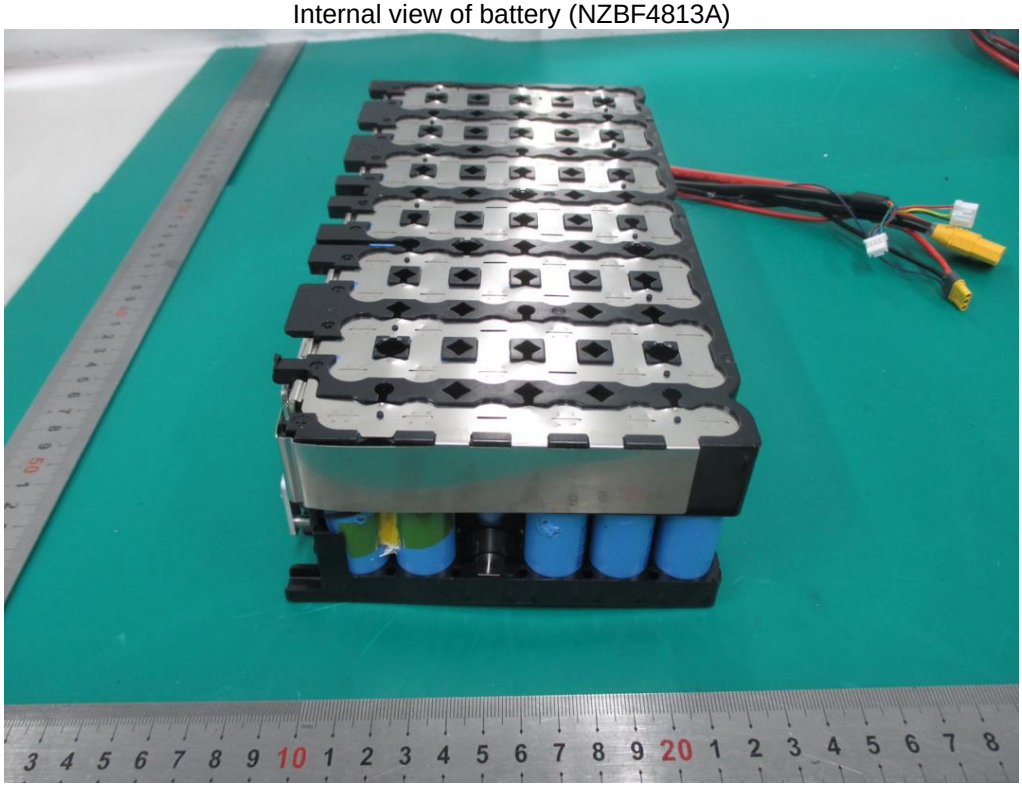
Internal view of battery (NZBF4813A)



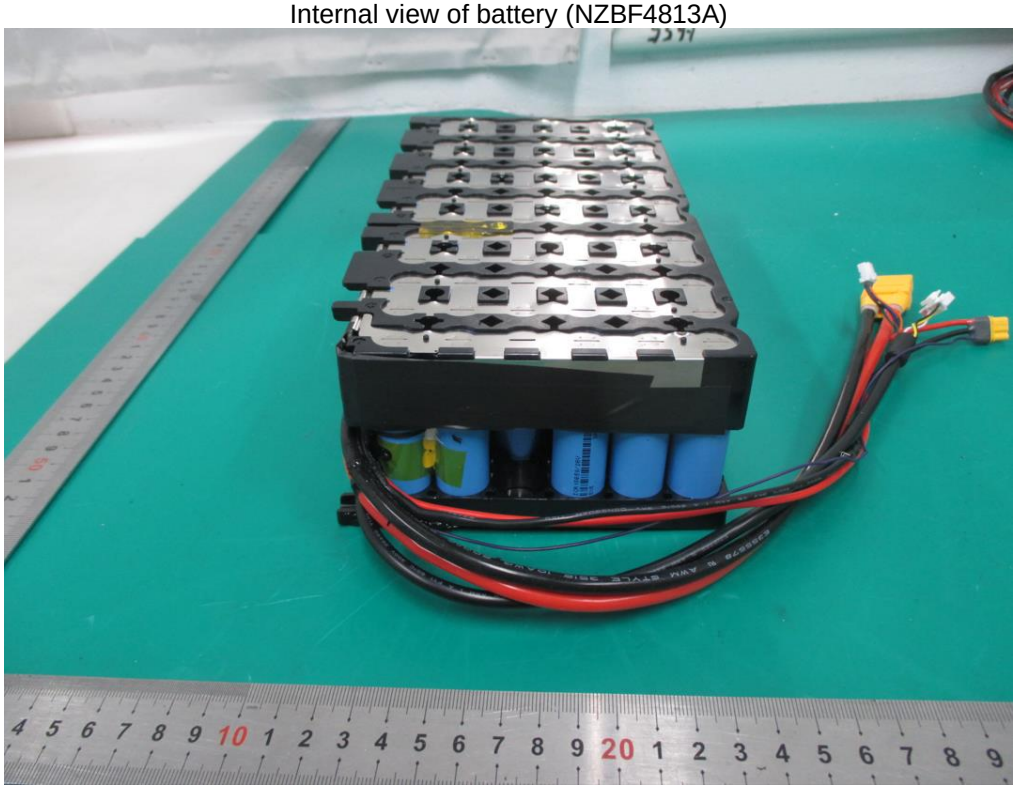
Internal view of battery (NZBF4813A)



Internal view of battery (NZBF4813A)

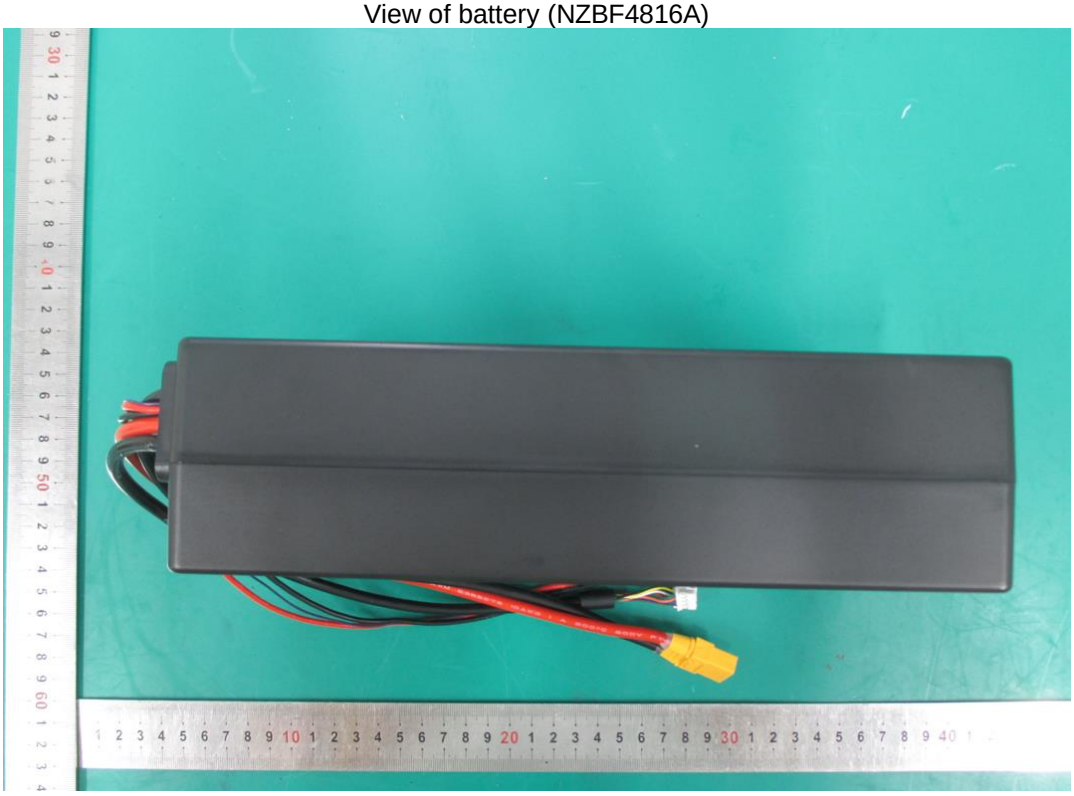


Internal view of battery (NZBF4813A)

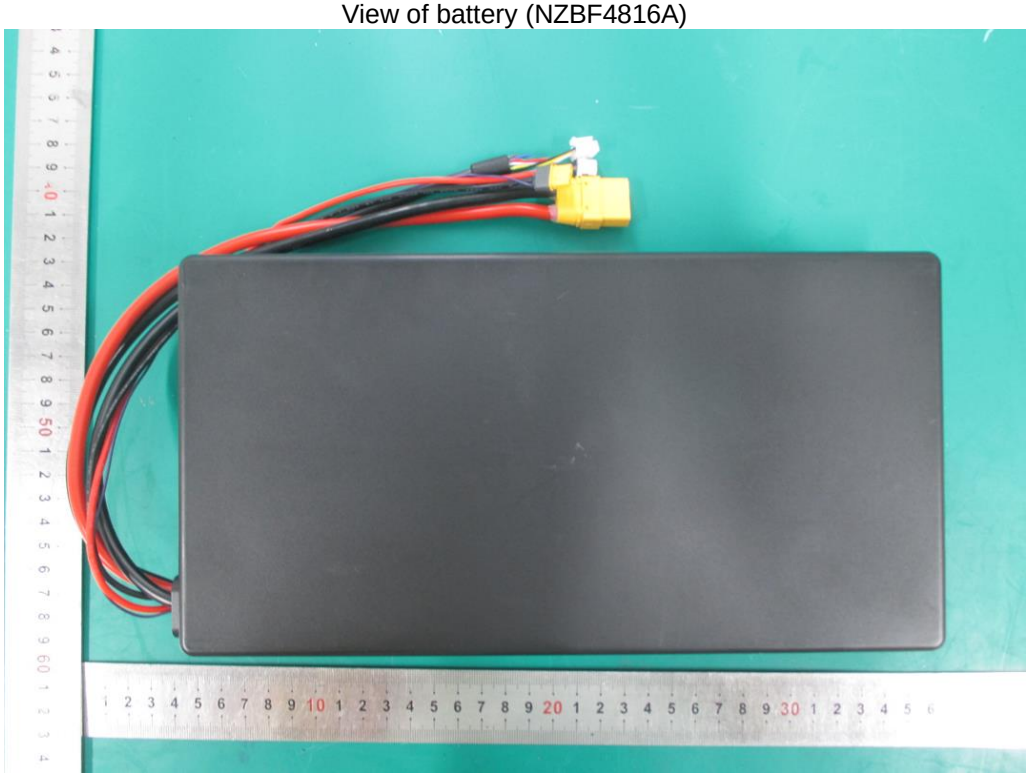


View of battery (NZBF4816A)

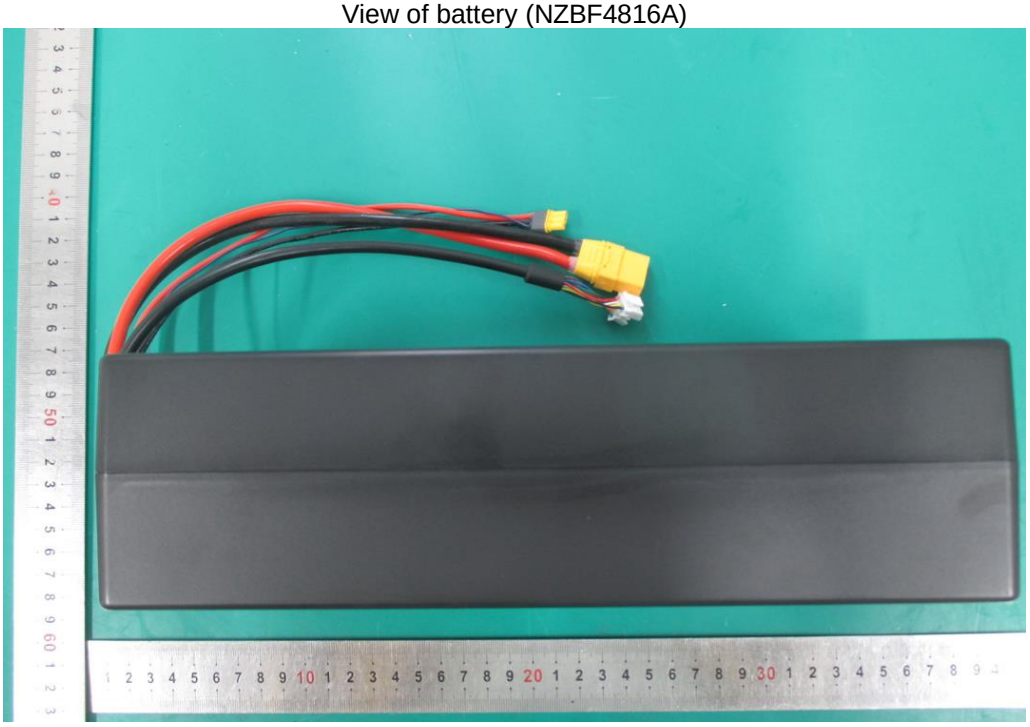
View of battery (NZBF4816A)



View of battery (NZBF4816A)

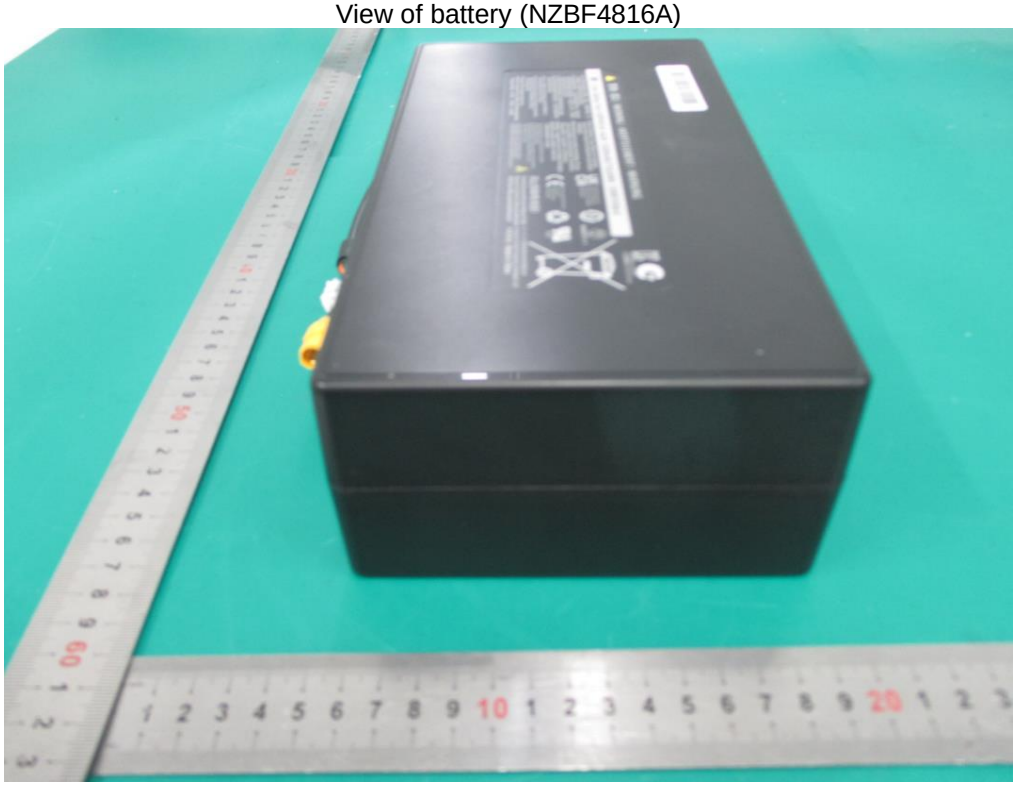


View of battery (NZBF4816A)

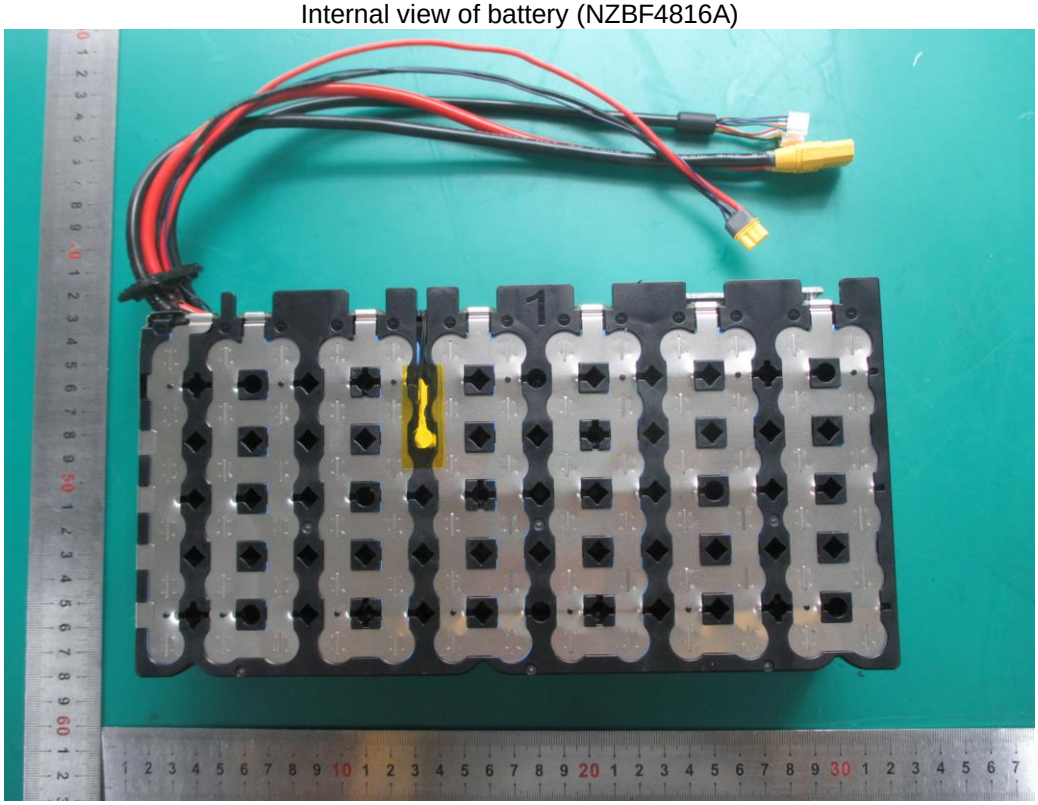


View of battery (NZBF4816A)

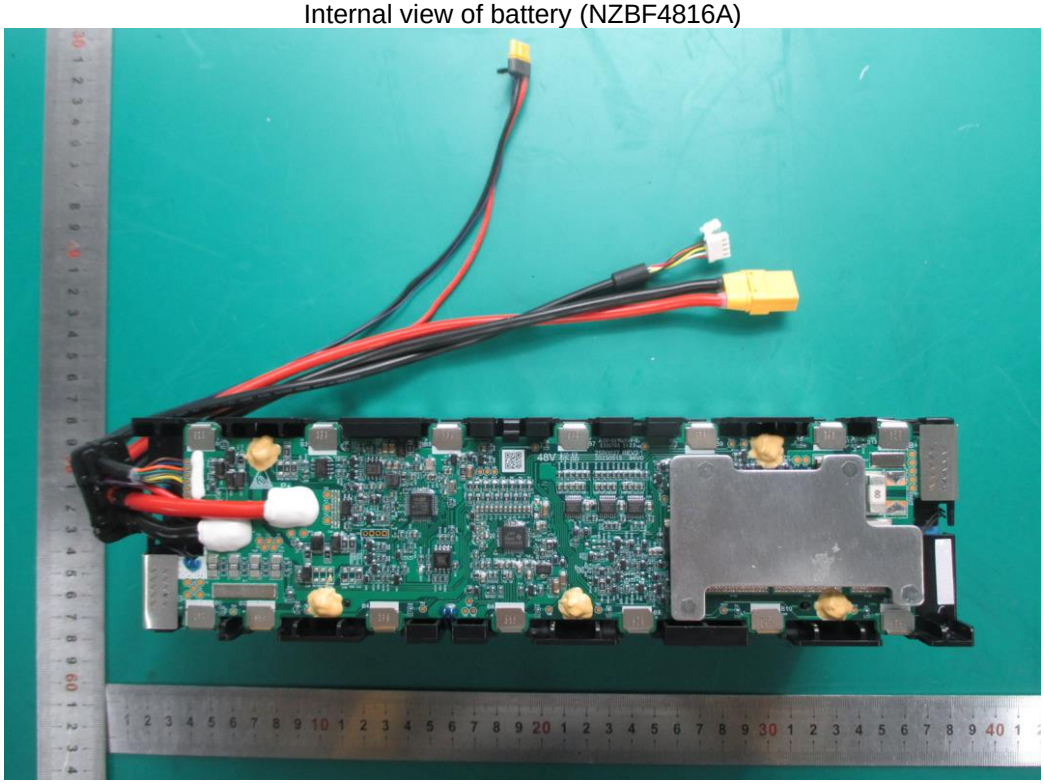
View of battery (NZBF4816A)



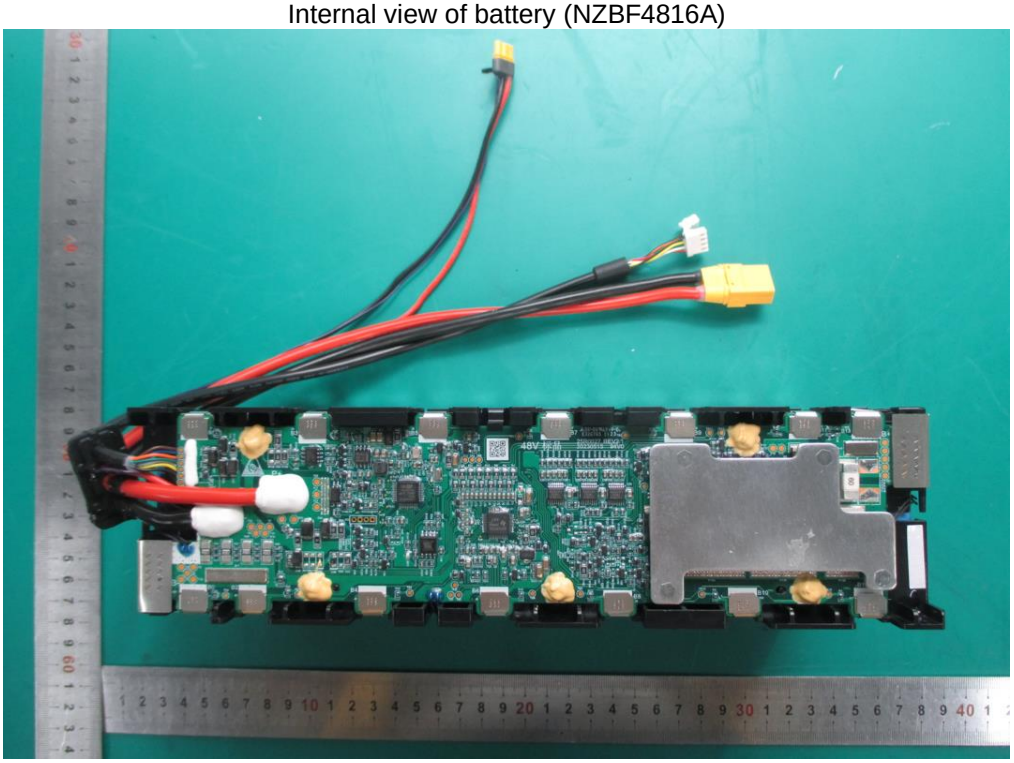
Internal view of battery (NZBF4816A)



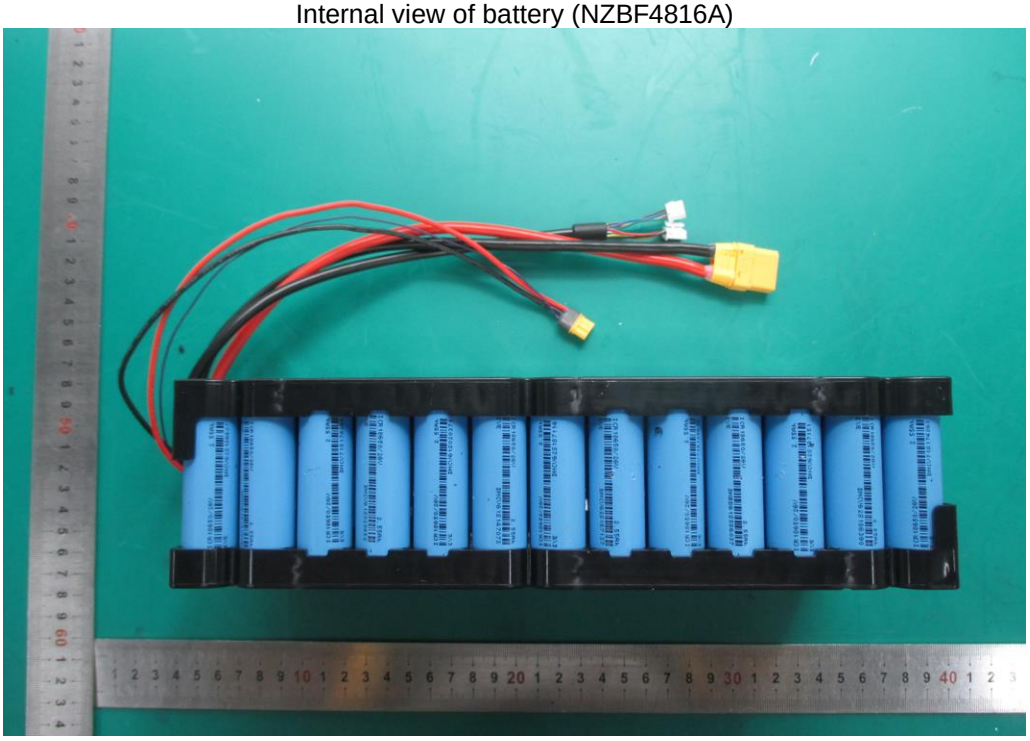
Internal view of battery (NZBF4816A)



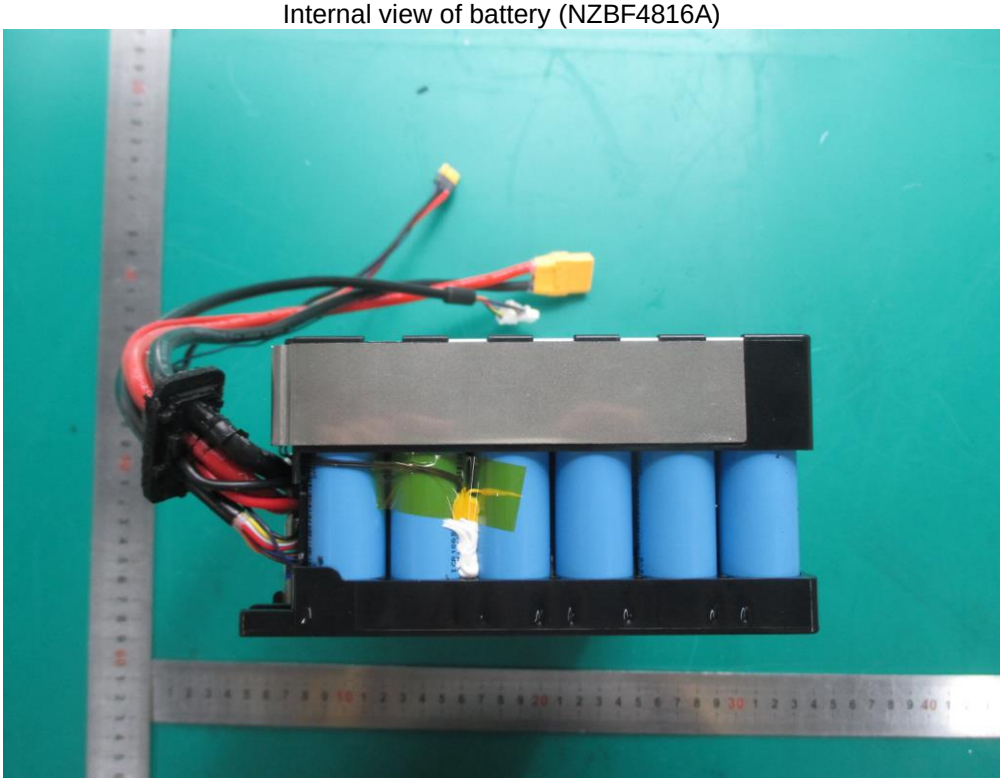
Internal view of battery (NZBF4816A)



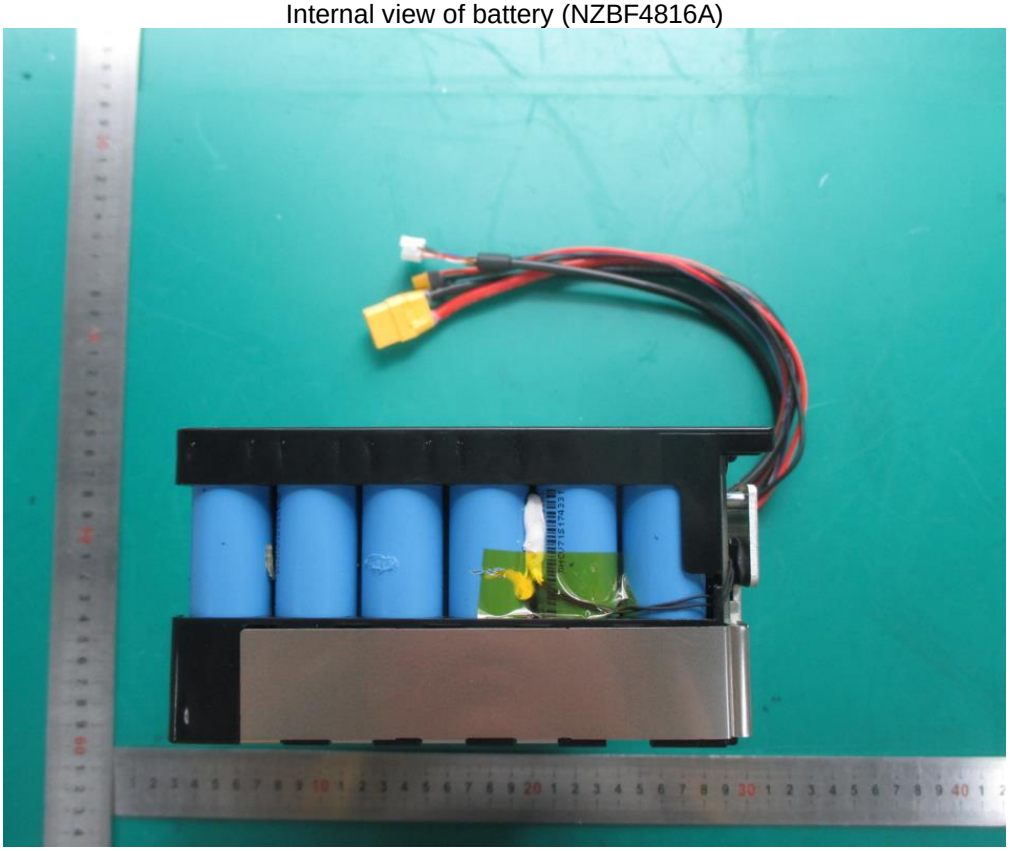
Internal view of battery (NZBF4816A)



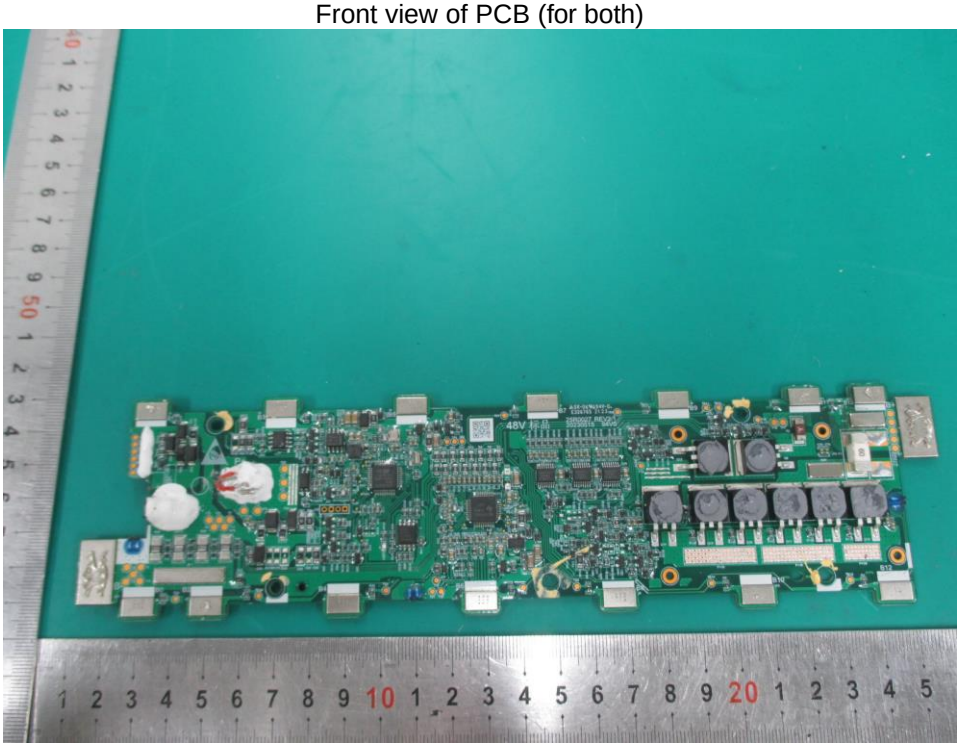
Internal view of battery (NZBF4816A)



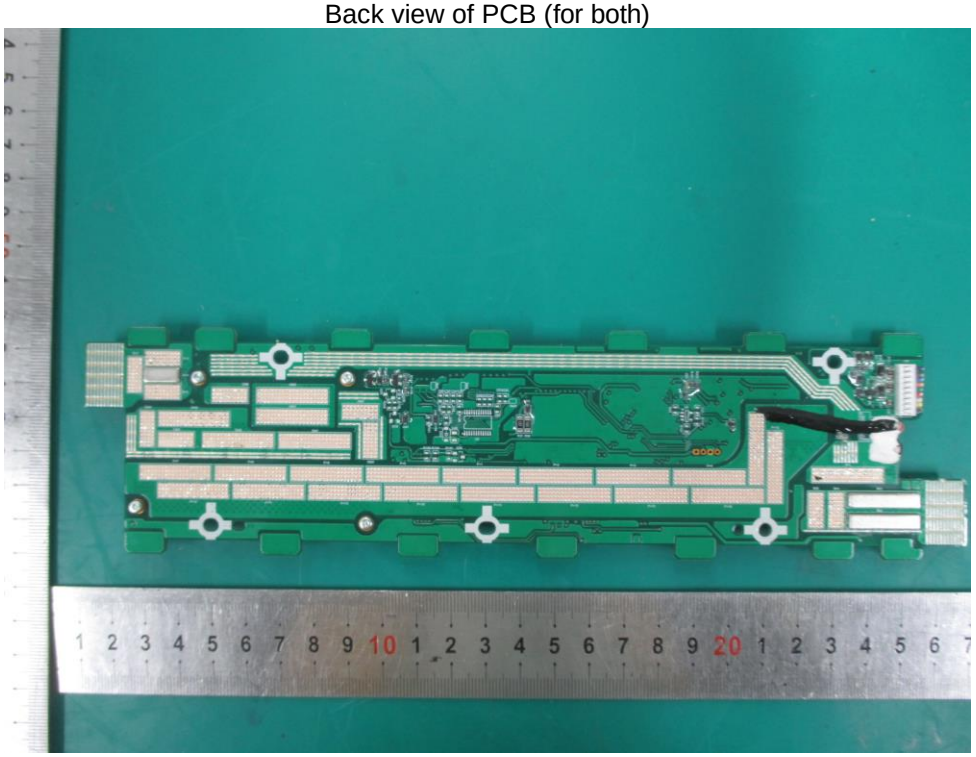
Internal view of battery (NZBF4816A)



Front view of PCB (for both)

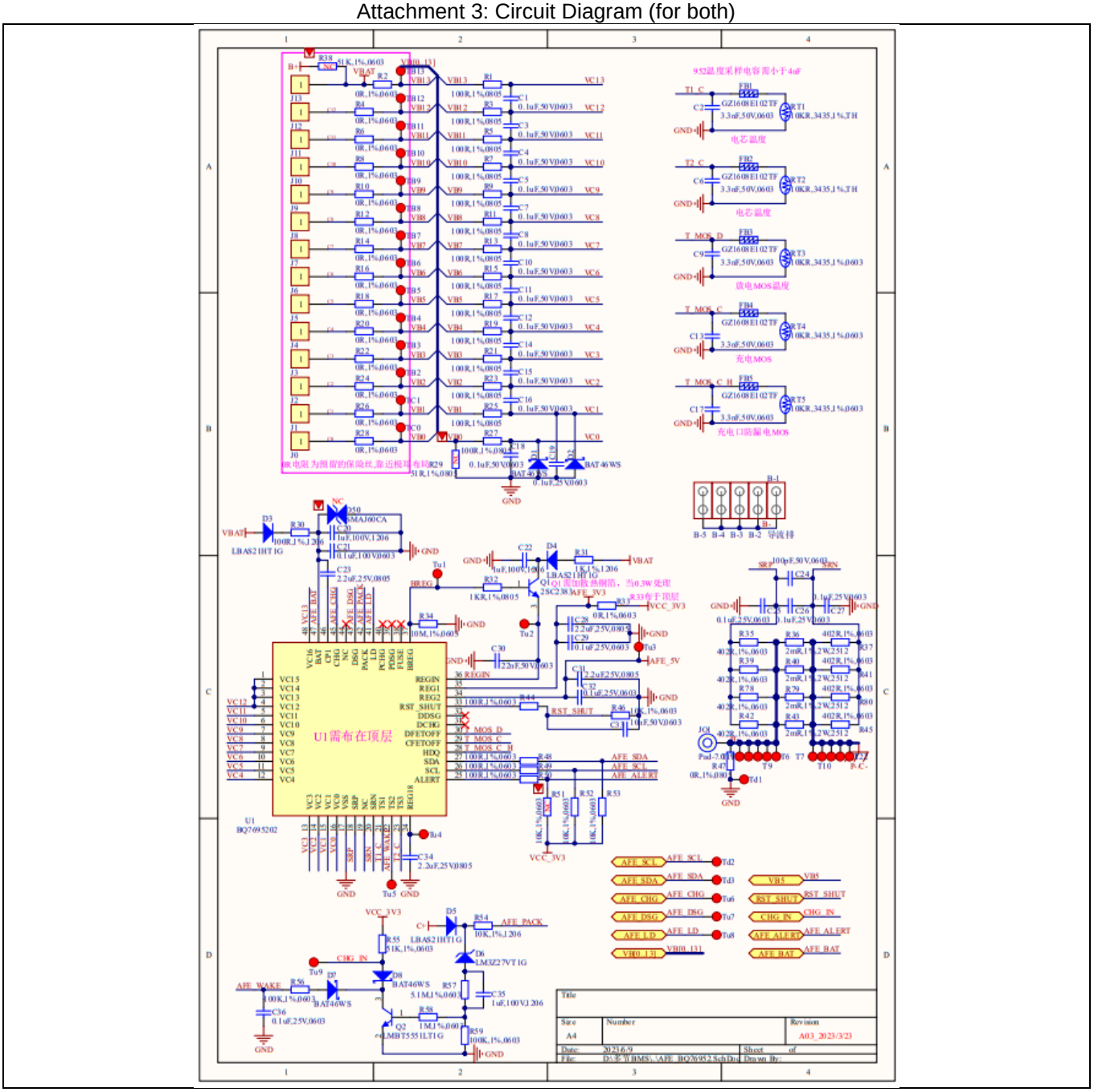


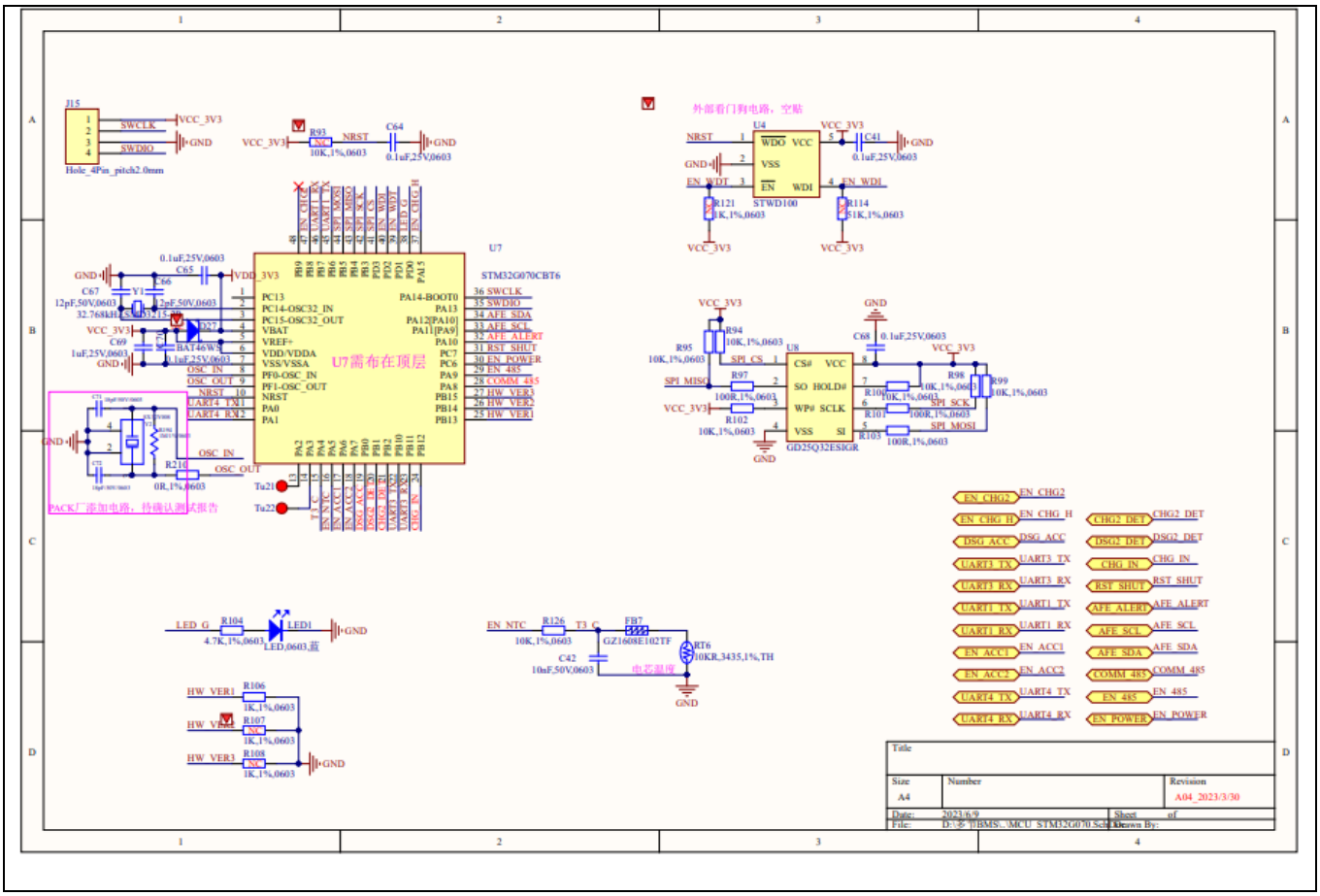
Back view of PCB (for both)

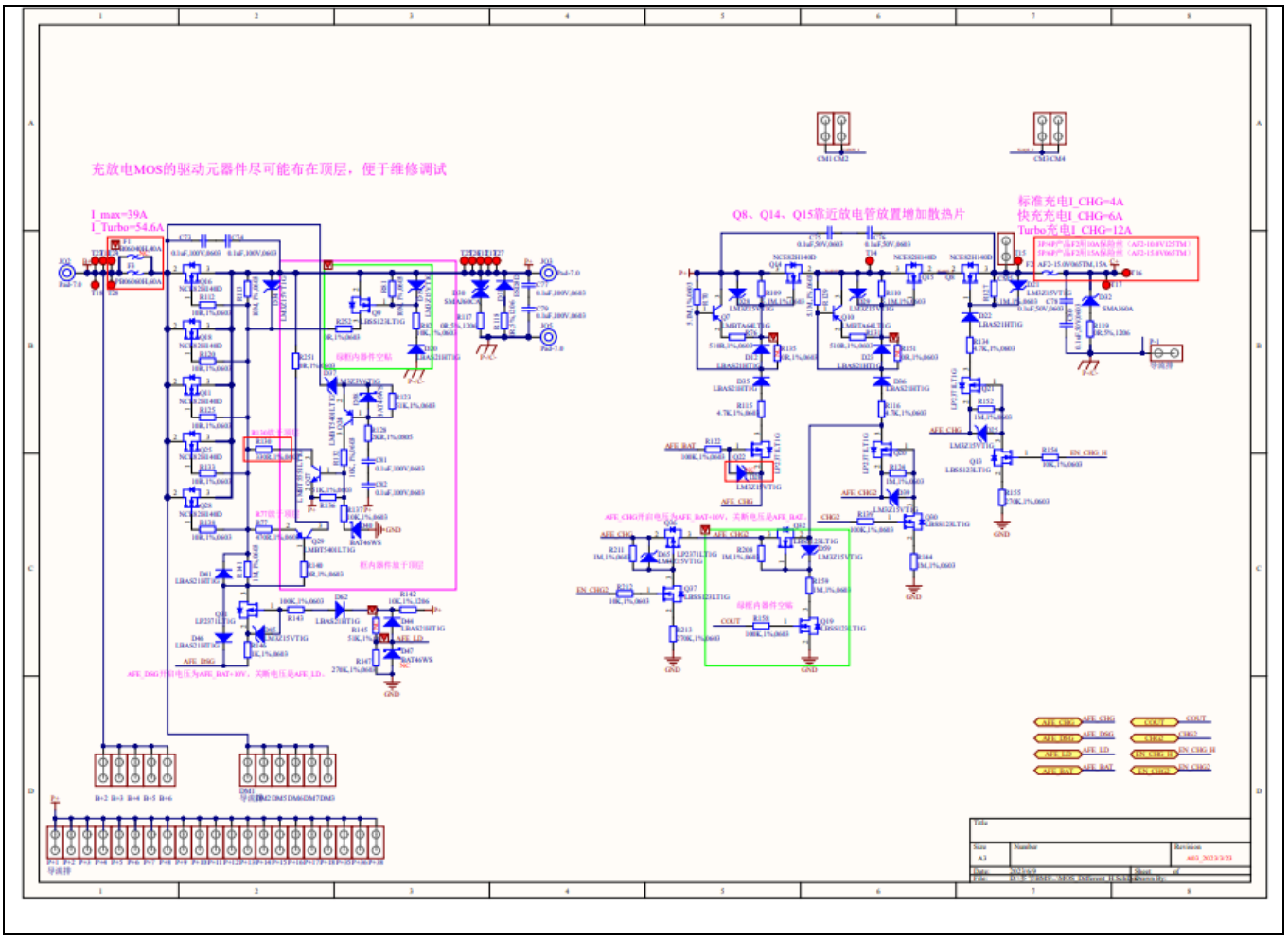


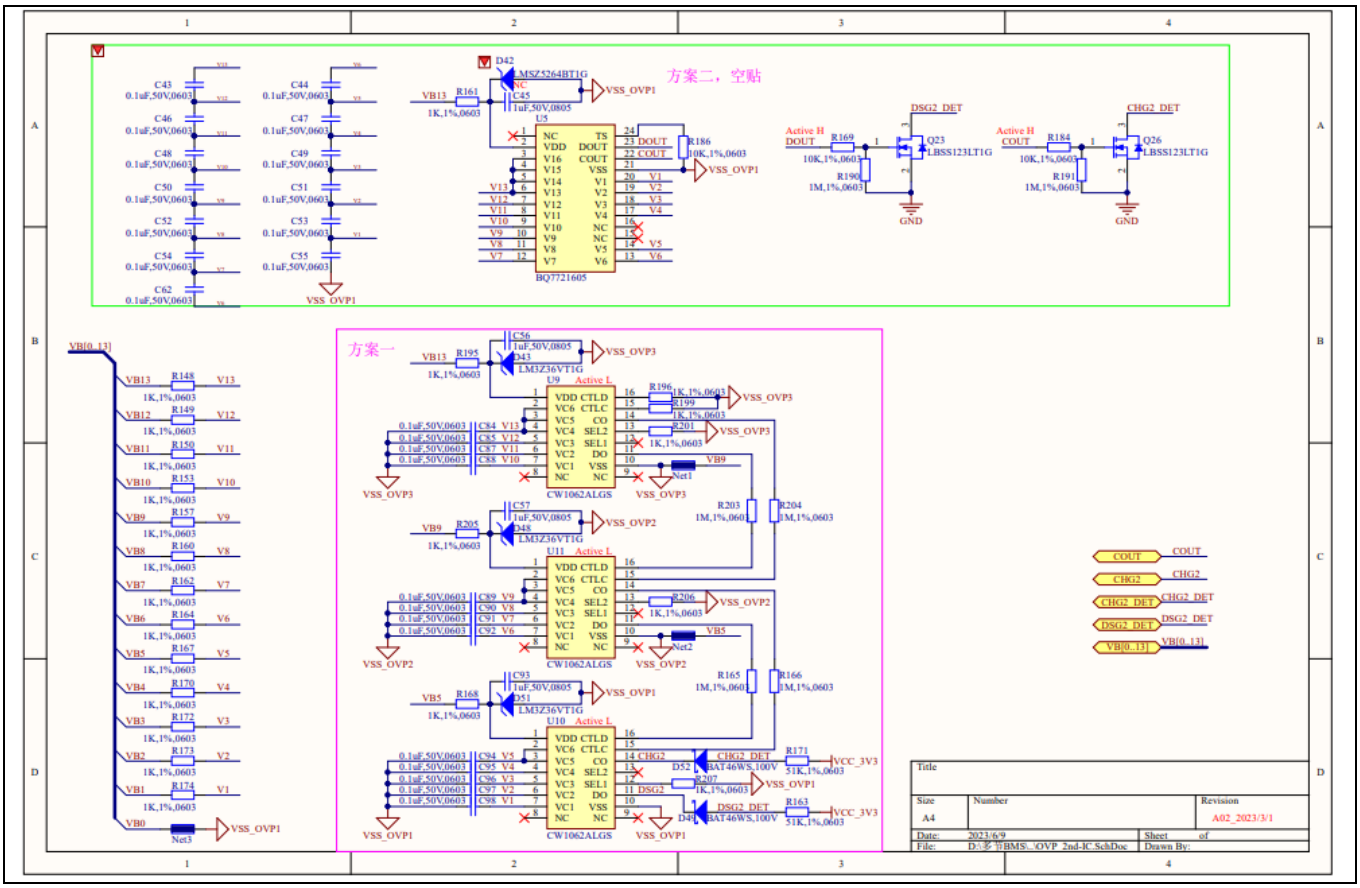
Cell (for both)

Attachment 3: Circuit Diagram (for both)




U7需布在顶层
外部看门狗电路，空贴
PACK厂商加电路，待确认测试报告
STM32G070CBT6
GD25Q32ESIGR
STWD100
Title
Size
A4
Number
Revision
A04_2023/3/30
Date: 2023/6/9
Sheet of
File: D:\步 TBMS\...\MCU_STM32G070.SchDoc
Drawn By:


充放电MOS的驱动元器件尽可能布在顶层，便于维修调试
I_max=39A
I_Turbo=54.6A
Q8、Q14、Q15靠近放电管放置增加散热片
标准充电I_CHG=4A
快充充电I_CHG=6A
Turbo充电I_CHG=12A


方案二，空贴
方案一
BQ7721605
CW1062ALGS
LM3Z36VT1G
LMSZ5264BT1G
LBSS123LT1G
BAT46WS,100V
DSG2_DET
CHG2_DET
VSS_OVP1
VSS_OVP2
VSS_OVP3
VCC_3V3
GND
Title
Size
A4
Number
Revision
A02_2023/3/1
Date: 2023/6/9
Sheet of
Drawn By: