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TESTING
CNAS L14701

UN38.3 TEST REPORT

Applicant:	SolaX Power Network Technology (Zhe jiang) Co., Ltd.
Address:	No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province, 310000 P. R. CHINA
EUT Name:	Lithium ion Rechargeable Battery Module
Model Name:	T-BAT LR25
Brand Name:	Triple Power
Test Standard:	ST/SG/AC.10/11/Rev.7 Section 38.3
Sample Arrival Date:	2022.12.06
Testing Date:	2022.12.30 - 2023.01.18
Date of Issue:	2023.02.03

ISSUED BY:

Dongguan BALUN Testing Technology Co., Ltd.

Tested by:	**Checked by:**	**Approved by:**
Van Xu	Hui Yin	Simon Qi

Dongguan BALUN Testing Technology Co., Ltd. TEST REPORT	
Applicant's name..... :	SolaX Power Network Technology (Zhe jiang) Co., Ltd.
Address..... :	No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province, 310000 P. R. CHINA
Testing Laboratory ..... :	Dongguan BALUN Testing Technology Co., Ltd.
Testing Location..... :	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong, China
Name of samples..... :	Lithium ion Rechargeable Battery Module
Model ..... :	T-BAT LR25
Trade Mark..... :	TRIPLE POWER
Ratings ..... :	51.2V, 50Ah, 2.56kWh
Apperance..... :	442*430*130mm, White Cuboid. Weighs approx. 28.03kg.
Battery type..... :	Lithium-ion Battery, 1P16S
Manufacture's name ..... :	SolaX Power Network Technology (Zhe jiang) Co., Ltd.
Manufacture's Address ..... :	No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province, 310000 P. R. CHINA
Name of Factory (ies) ..... :	SolaX Power Network Technology (Zhe jiang) Co., Ltd.
Address of Factory (ies)..... :	No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province, 310000 P. R. CHINA
Conclusion ..... :	The sample has passed the test items of UNITED NATIONS "Recommendations of the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria ST/SG/AC.10/11/Rev.7 Section 38.3
Remark..... :	/

Description and illustration of the sample:	☒ Large cells and batteries ☐ Small cells and batteries
	☐ Primary cells and batteries ☒ Rechargeable cells and batteries

Parameter	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Limited Charge Voltage	Cut-off Voltage
Battery	50Ah	51.2V	30A	30A	50A	50A	58V	45V
Cell	50Ah	3.2V	50A	50A	50A	50A	3.65V	2.5V

Test item	Sample No.	State	Remark
T1~T5	B01~B02	at first cycle, in fully charged state	--
	B03~B04	after twenty five cycles ending in fully charged state	--
T6	C01~C05	at first cycle at 50% of the design rated capacity	--
	C06~C10	after twenty five cycles ending at 50% of the design rated capacity	--
T7	B05~B06	at first cycle, in fully charged state	--
	B07~B08	after twenty five cycles ending in fully charged state	--
T8	C11~C20	at first cycle, in fully discharged state	--
	C21~C30	after twenty five cycles ending in fully discharged state	--

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)

ST/SG/AC.10/11/Rev.7 Section 38.3			
Clause	Requirement	Result	Verdict
38.3 Lithium batteries			
38.3.4	**Procedure**		P
	Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or batteries. Test T.7 may be conducted using undamaged batteries previously used in Tests T.1 to T.5 for purposes of testing on cycled batteries.		--
38.3.4.1	**T.1: Altitude simulation**		P
	Test procedure: Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5) °C.		--
	Requirement Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.	The test results meet the requirements. See table 1.	P
38.3.4.2	**T.2: Thermal test**		P
	Test procedure: Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5) °C. For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.		--
	Requirement: Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The	The test results meet the requirements. See table 1.	P

ST/SG/AC.10/11/Rev.7 Section 38.3			
Clause	Requirement	Result	Verdict
	requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.		
38.3.4.3	**T.3: Vibration**		P
	Test procedure: Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face. The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries). For cells and small batteries: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz. For large batteries: from 7 Hz to a peak acceleration of $1g_n$ is maintained unti18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of $2g_n$ occurs (approximately 25 Hz). A peak acceleration of $2g_n$ is then maintained until the frequency is increased to 200 Hz.		--
	Requirement: Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.	The test results meet the requirements. See table 1.	P

<table>
<tr><th colspan="4">ST/SG/AC.10/11/Rev.7 Section 38.3</th></tr>
<tr><th>Clause</th><th>Requirement</th><th>Result</th><th>Verdict</th></tr>
<tr><td rowspan="4">38.3.4.4</td><td colspan="2">T.4: Shock:</td><td>P</td></tr>
<tr><td colspan="2">Test procedure:
Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.
Each cell shall be subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 milliseconds.
Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.
Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.
<table>
<tr><th>Battery</th><th>Minimum peak acceleration</th><th>Pulse duration</th></tr>
<tr><td>Small batteries</td><td>150 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass^*}\right)}$ whichever is smaller</td><td>6 ms</td></tr>
<tr><td>Large batteries</td><td>50 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{30000}{mass^*}\right)}$ whichever is smaller</td><td>11 ms</td></tr>
</table>
* Mass is expressed in kilograms.</td><td>--</td></tr>
<tr><td>Requirement:
Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.</td><td>The test results meet the requirements. See table 1.</td><td>P</td></tr>
<tr><td rowspan="2">38.3.4.5</td><td colspan="2">T.5: External short circuit:</td><td>P</td></tr>
<tr><td colspan="2">Test procedure:</td><td>--</td></tr>
</table>

ST/SG/AC.10/11/Rev.7 Section 38.3			
Clause	Requirement	Result	Verdict
	The cell or battery to be tested shall be shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value. The short circuit and cooling down phases shall be conducted at least at ambient temperature.		
	Requirement: Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire within six hours after this test.	The test results meet the requirements. See table 1.	P
	T.6: Impact / Crush:		P
38.3.4.6	Test procedure: **Impact** (applicable to cylindrical cells not less than 18.0 mm in diameter) *NOTE: Diameter here refers to the design parameter (for example the diameter of 18650 cells is 18.0 mm).* The sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface. The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the center of the test sample. Each sample is to be subjected to		--

ST/SG/AC.10/11/Rev.7 Section 38.3			
Clause	Requirement	Result	Verdict
	only a single impact.		
	Test procedure: **Crush** (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter) *NOTE: Diameter here refers to the design parameter (for example the diameter of 18650 cells is 18.0 mm).* A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached. (a) The applied force reaches 13 kN ± 0.78 kN; Example: The force shall be applied by a hydraulic ram with a 32 mm diameter piston until a pressure of 17 MPa is reached on the hydraulic ram. (b) The voltage of the cell drops by at least 100 mV; or (c) The cell is deformed by 50% or more of its original thickness. Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released. A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis. Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.		--
	Requirement: Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.	The test results meet the requirements. See table 2. ☒ **Crush** ☐ **Impact**	P
38.3.4.7	**T.7: Overcharge:**		P
	Test procedure: The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows: (a) When the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum		--

ST/SG/AC.10/11/Rev.7 Section 38.3			
Clause	Requirement	Result	Verdict
	charge voltage of the battery or 22V. (b) When the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.		
	Requirement: Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.	The test results meet the requirements. See table 3.	P
38.3.4.8	**T.8: Forced discharge:**		P
	Test procedure: Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer. The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in Ampere).		--
	Requirement: Primary or rechargeable cells meet this requirement if there is no disassembly and no fire within seven days of the test.	The test results meet the requirements. See table 4.	P

Testing Results

Table1: T.1-T.5											**P**
Sample No.	Mass prior to test (kg)	OCV prior to test (V)	Test 1: Altitude simulation		Test 2: Thermal test		Test 3: Vibration		Test 4: Shock		Test 5: External Short Circuit
			Mass loss (%)	Voltage after test/ Voltage prior to test (%)	Mass loss (%)	Voltage after test/ Voltage prior to test (%)	Mass loss (%)	Voltage after test/ Voltage prior to test (%)	Mass loss (%)	Voltage after test/ Voltage prior to test (%)	Max. Temp. (°C)
B01	27.97	53.22	0.000	99.98	0.036	99.29	0.000	99.96	0.000	100.00	59.1
B02	27.97	53.14	0.000	100.00	0.036	99.19	0.000	99.98	0.000	100.00	58.8
B03	28.03	53.26	0.000	99.98	0.036	99.15	0.000	99.96	0.000	99.98	59.5
B04	27.99	53.19	0.000	99.96	0.036	99.27	0.000	100.00	0.000	100.00	58.7
Remark: Test 1-Test 4: No leakage, No venting, No disassembly, No rupture and no fire; Mass loss ＜0.1%. Test 5: No disassembly, no rupture and no fire; external temperature does not exceed 170 °C.											

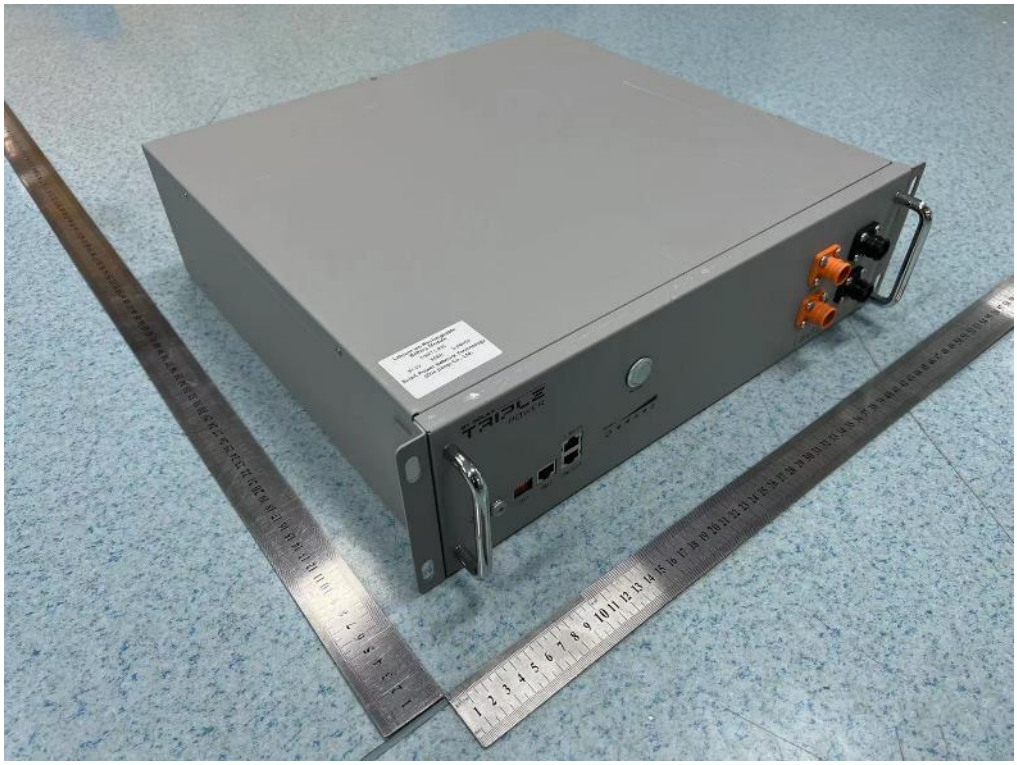
Table2: T.6	☐ **Impact**	☒ **Crush**	**P**
Sample No.	OCV Prior to test (V)	External Peak temperature (°C)	Results
C01	3.188	25.0	P
C02	3.192	26.3	P
C03	3.208	24.2	P
C04	3.203	25.1	P
C05	3.193	25.7	P
C06	3.205	26.0	P
C07	3.210	25.3	P
C08	3.190	24.9	P
C09	3.196	25.1	P
C10	3.201	24.7	P
Remark: No disassembly, no rupture and no fire; external temperature does not exceed 170 °C.			

Testing Results

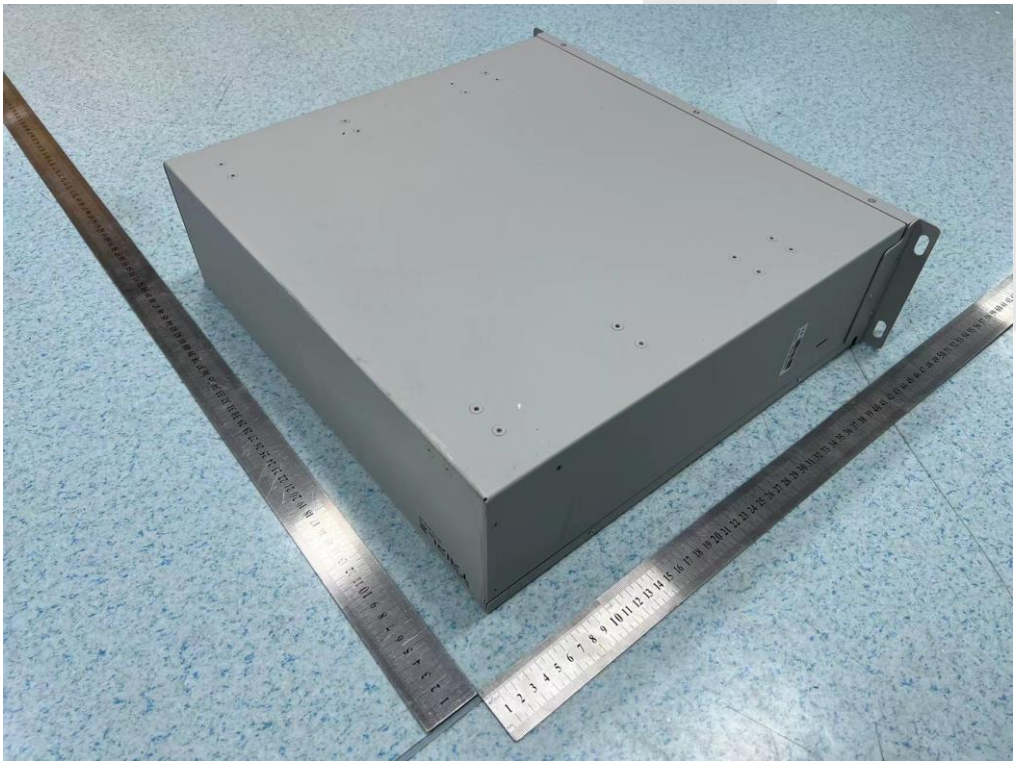
Table3: T.7 Overcharge				**P**
Charge voltage (V)	69.6	Charge current (A)	100	--
Sample No.	OCV Prior to test (V)	Phenomenon		Results
B05	53.24	No disassembly, no fire		P
B06	53.17	No disassembly, no fire		P
B07	53.20	No disassembly, no fire		P
B08	53.20	No disassembly, no fire		P

Table4: T.8 Forced discharge		**P**
Sample No.	Phenomenon	Results
C11	No disassembly, no fire	P
C12	No disassembly, no fire	P
C13	No disassembly, no fire	P
C14	No disassembly, no fire	P
C15	No disassembly, no fire	P
C16	No disassembly, no fire	P
C17	No disassembly, no fire	P
C18	No disassembly, no fire	P
C19	No disassembly, no fire	P
C20	No disassembly, no fire	P
C21	No disassembly, no fire	P
C22	No disassembly, no fire	P
C23	No disassembly, no fire	P
C24	No disassembly, no fire	P
C25	No disassembly, no fire	P
C26	No disassembly, no fire	P
C27	No disassembly, no fire	P
C28	No disassembly, no fire	P
C29	No disassembly, no fire	P
C30	No disassembly, no fire	P

Sample Photos

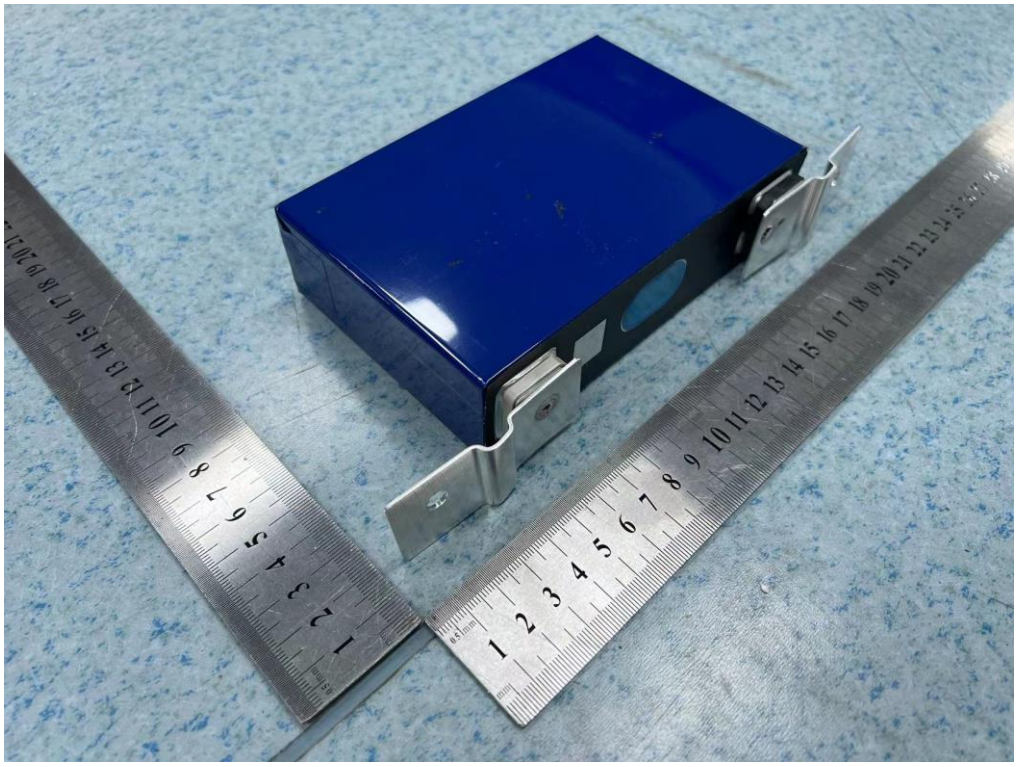


Picture 1 Side view of Lithium ion Rechargeable Battery Module



Picture 2 Back view of Lithium ion Rechargeable Battery Module

Sample Photos



Picture 3 Side view of cell

Picture 4 Label of Lithium ion Rechargeable Battery Module

Statement

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--End of report--