UN38.3 Test Report

	SLAUMXLI280-24PRI
Sample Name &Model	**LiFePO4 Battery 24V 280Ah**
	UltraMax Batteries Ltd
Consignor	UltraMax Batteries Ltd

深圳市倍通检测股份有限公司 检测专用章

Shenzhen BST Technology Co., Ltd.

Sample Name	LiFePO4 Battery		**Sample Model**	24V 280Ah	
Consignor	UltraMax Batteries Ltd				
Address	Watkins House, Pegamoid Road, London N18 2NG				
Manufacturer	UltraMax Batteries Ltd				
Address	Watkins House, Pegamoid Road, London N18 2NG				
Manufacturer Of Cell	UltraMax Batteries Ltd				
Use	--				
	Rechargeable Lithium Ion Battery		**Composing Mode**	8S1P	
Normal Voltage	25.6V	**Rated Capacity**	280Ah	**Limited Charge Voltage**	28.8V
Watt-hour	7168Wh	**Form**	Almost Cuboid	**Charging Cut-off Voltage**	28.8V
	100A	**Max Continuous Charge Current**	200A	**End Charge Current**	4A
Discharge Cut-off Voltage	10.0V	**Max. Continuous Discharge Current**	200A	**Cell Rated Capacity**	100Ah
Cells Number	8	**Cell Model**	LF280K	**Trademark**	--
Test method and criterion	ST/SG/AC.10/11/Rev.6/Amend.1 38.3 UNITED NATIONS " Recommendations in the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria S T/SG/AC.10/11/Rev.6/Amend.1 38.3				
Accepted date	2023-01-29		**Test date**	2023-01-29~2023-02-03	
Test items	Altitude simulation, Thermal test, Vibration, Shock, External short circuit, Impact, Overcharge, Forced discharge.				

Item	Samples Number
Altitude simulation	Z1~Z2 X1~X2
Thermal test	
Vibration	
Shock	
External Short Circuit	
Crush	Z3~Z7 X3~X7
Overcharge	Z8~Z9 X8~X9
Forced discharge	Z10~Z19 X10~X19
Conclusion	The sample has passed the test items of UNITED NATIONS “Recommendations in the TRANSPORT OF DANGEROUS GOODS” Manual of Tests and Criteria ST/SG/A.10/11/Rev.6/Amend.1 38.3. (Issue date)：2023-02-03

Compiler:	颜以波	**Checker:**		**Approver:**	检测专用章

Sample No	Description of the sample
Z1~Z2, Z3~Z7	Batteries at first cycle in fully charged states;
X1~X2, X3~X7	Batteries after 25 cycles ending in fully charged states;
Z8~Z9	Cells at first cycle at 50% of the design rated capacity;
X8~X9	The 25th cycle of charging and discharging 50% of the battery cell in rated capacity state;
Z10~Z19	Cells at first cycle in fully discharged states;
X10~X19	Cells after 25 cycles ending in fully discharge states.
Test case verdicts： Test case does not apply to the test object---------- N/A(Not applicable)— Test item does meet the requirement---------- P(ass) Test item does not meet the requirement---------- F(ail)	

---------- Test Method And Verdict----------

Clause	Requirements	Result	Verdict
38.3.4.1	**Test 1: Altitude simulation**	See Table 1	P
	Test cells and batteries shall be stored at a pressure of 11.6kPa or less for at least six hour at ambient temperature (20±5℃)	No leakage, no venting, no disassemble, no rupture and no fire.	P
	Cells and batteries meet this requirement if there is no leakage, no venting, no disassemble, 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.		

38.3.4.2	**Test 2: Thermal test**	See Table 2	P
	Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72±2℃, followed by storage for at least six hours at a test temperature equal to –40±2℃. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5℃). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.	No leakage, no venting, no disassemble, no rupture and no fire.	P

Clause	Requirements	Result	Verdict
38.3.4.3	Test 3: Vibration	See Table 3	P
	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).	No leakage, no venting, no disassemble, no rupture and no fire.	P

	For cells and small batteries: from 7 Hz a peak acceleration of 1gn 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 8gn occurs (approximately 50 Hz). A peak acceleration of 8gn is then maintained until the frequency is increased to 200 Hz. For large batteries: from 7 Hz to a peak acceleration of 1gn 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 2gn occurs (approximately 25 Hz). A peak acceleration of 2gn is then maintained until the frequency is increased to 200 Hz. Cells and batteries meet this requirement if there is no leakage, no venting, no disassemble, 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.		

38.3.4.4	**Test 4: Shock**	**See Table 4**	**P**
	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 150gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50gn and pulse duration of 11 milliseconds.	No leakage, no venting, no disassemble, no rupture and no fire.	P

38.3.4.5	**Test 5: External Short Circuit**	**See Table 5**	**P**
	The cell or battery to be tested shall be shall be heated for a period oftime necessary to reach a homogeneous stabilized temperature of 57±4℃, 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	No disassemble , no rupture and no fire.	P

Battery	Minimum peak acceleration	Pulse duration
Small batteries	$150g_n$ or result of formula Acceleration $(g_n)=\sqrt{\left(\frac{100850}{mass^*}\right)}$ whichever is smaller	6ms
Large batteries	$50g_n$ or result of formula Acceleration $(g_n)=\sqrt{\left(\frac{3000}{mass^*}\right)}$ whichever is smaller	11ms
* Mass is expressed in kilograms.		

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 is subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.

Cells and batteries meet this requirement if there is no leakage,no venting, no disassemble, 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.

	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℃ 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. Cells and batteries meet this requirement if their external temperature does not exceed 170℃ and there is no disassemble, no rupture and no fire within six hours of this test.		

38.3.4.6	**Test 6: Impact / Crush**	See Table 6	P
	Impact (applicable to cylindrical cells not less than 18mm in diameter) The test sample cell or component cell is to be placed on a flat smooth surface. A 15.8mm±0.1mm diameter, at least 6cm 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 ± 0.1kg 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 friction less, 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 samples is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm±0.1mm diameter curved surface lying across the centre of the test samples. Each sample is to be subjected to only a single impact. Cells and component cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassemble and no fire during the test and within six hours after this test.	N/A	N/A
	Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18mm in diameter) A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5cm/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 13kN±0.78kN; (b) The voltage of the cell drops by at least 100mV; or (c) The cell is deformed by 50% or more of its original thickness.	No disassemble , no rupture and no fire.	P

	Once the maximum pressure has been obtained, the voltage drops by 100mV 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 Samples 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. Cells and component cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassemble and no fire during the test and within six hours after this test.		

38.3.4.7	Test 7: Overcharge	See Table 7	P
	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 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. (c) Tests are to be conducted at ambient temperature; the duration of the test shall be 24 hours	No disassemble and no fire.	P
	Rechargeable batteries meet this requirement if there is no disassemble and no fire during the test and within seven days after the test.		

38.3.4.8	test 8: Forced discharge	See Table 8	P
	Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V 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).	No disassemble and no fire.	P
	Primary or rechargeable cells meet this requirement if there is no disassemble and no fire during the test and within seven days after the test.		

----------Test Data----------

Table 1	Altitude simulation						P
Sample No.	Mass (kg)		Mass loss (%)	Voltage (V)		Voltage loss (%)	Whether leakage, venting,disassemble,rupture, fire (Y/N)
	Pre-test	After test		Pre-test	After test		
Z1	52.2	52.199	0.004	25.6	25.6	0.000	N
Z2	52.2	52.199	0.004	25.6	25.6	0.000	N
X1	52.2	52.199	0.004	25.6	25.6	0.000	N
X2	52.2	52.199	0.004	25.6	25.6	0.000	N

Table 2	Thermal test						P
Sample No.	Mass (kg)		Mass loss (%)	Voltage (V)		Voltage loss (%)	Whether leakage, venting,disassemble,rupture, fire (Y/N)
	Pre-test	After test		Pre-test	After test		
Z1	52.2	52.198	0.008	25.6	25.33	2.09	N

Z2	52.2	52.198	0.008	25.6	25.32	2.14	N
X1	52.2	52.198	0.008	25.6	25.33	2.09	N
X2	52.2	52.198	0.008	25.6	25.33	2.09	N

Table 3	Vibration						P
Sample No.	Mass (kg)		Mass loss (%)	Voltage (V)		Voltage loss (%)	Whether leakage, venting,disassemble,rupture, fire (Y/N)
	Pre-test	After test		Pre-test	After test		
Z1	52.2	52.199	0.004	25.6	25.59	0.07	N
Z2	52.2	52.199	0.004	25.6	25.59	0.07	N
X1	52.2	52.199	0.004	25.6	25.58	0.08	N
X2	52.2	52.199	0.004	25.6	25.58	0.08	N

Table 4	Shock						P
Sample No.	Mass (kg)		Mass loss (%)	Voltage (V)		Voltage loss (%)	Whether leakage, venting,disassemble,rupture, fire (Y/N)
	Pre-test	After test		Pre-test	After test		
Z1	52.2	52.2	0.000	25.6	25.6	0.00	N
Z2	52.2	52.2	0.000	25.6	25.6	0.00	N
X1	52.2	52.2	0.000	25.6	25.6	0.00	N
X2	52.2	52.2	0.000	25.6	25.6	0.00	N

Table 5	External short circuit	P
Sample No.	Peak temperature (˚C)	Whether disassemble, rupture, fire (Y/N)
Z1	57.5	N
Z2	57.5	N
X1	57.2	N
X2	57.2	N

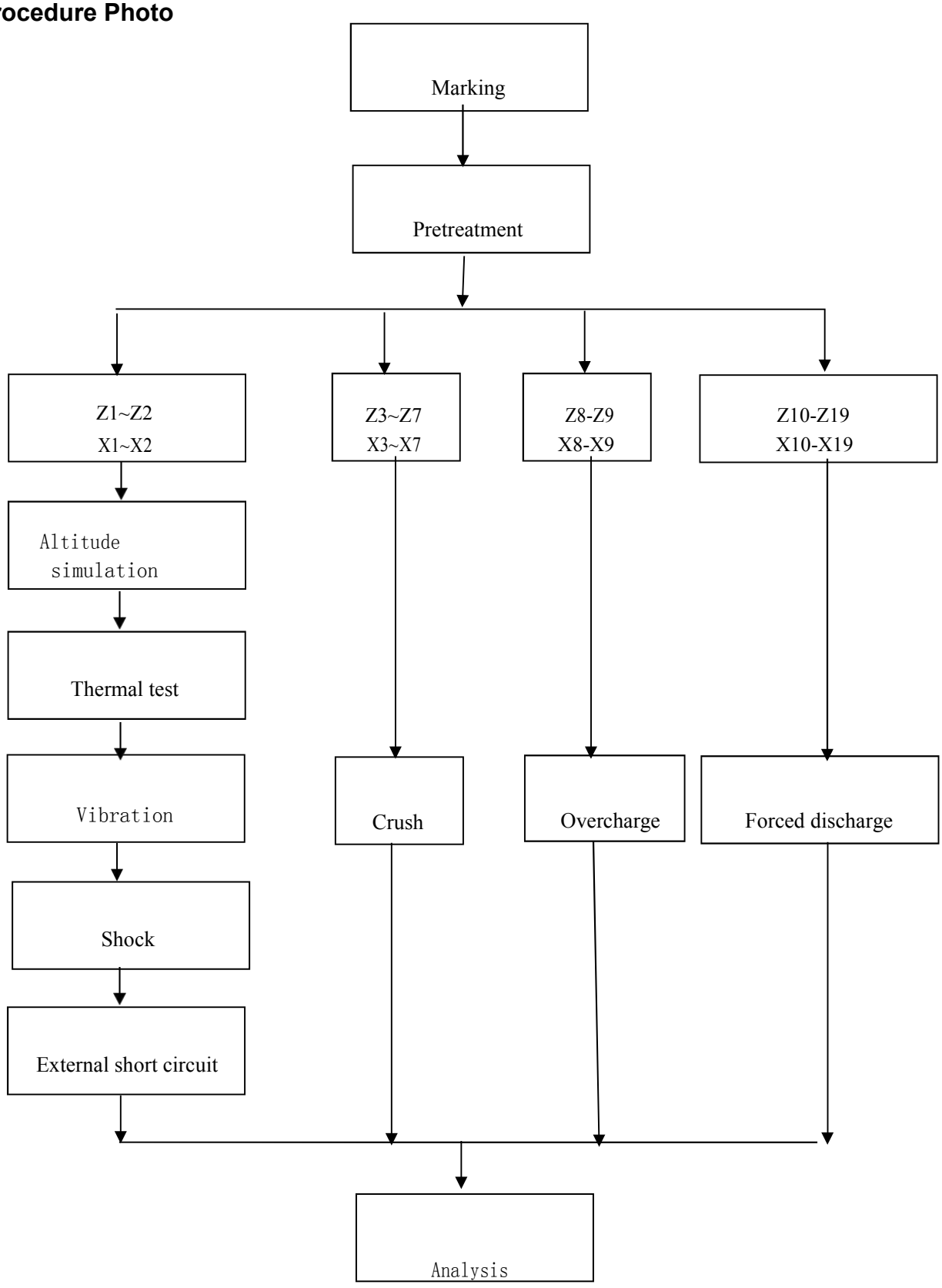
Table 6	Crush	P
Sample No.	Peak temperature (˚C)	Whether disassemble, fire (Y/N)
Z3	23.1	N
Z4	24.0	N
Z5	23.8	N
Z6	24.3	N
Z7	23.9	N
X3	22.5	N
X4	23.1	N
X5	23.3	N
X6	23.2	N
X7	24.0	N

Table 7	Overcharge	P
Sample No.	Whether disassemble, fire (Y/N)	
Z8	N	
Z9	N	
X8	N	
X9	N	

Table 8	Forced discharge	P
Sample No.	Whether disassemble, fire (Y/N)	
Z10	N	
Z11	N	
Z12	N	
Z13	N	
Z14	N	
Z15	N	
Z16	N	
Z17	N	
Z18	N	
Z19	N	
X10	N	

X11	N
X12	N
X13	N
X14	N
X15	N
X16	N
X17	N
X18	N
X19	N

Procedure Photo



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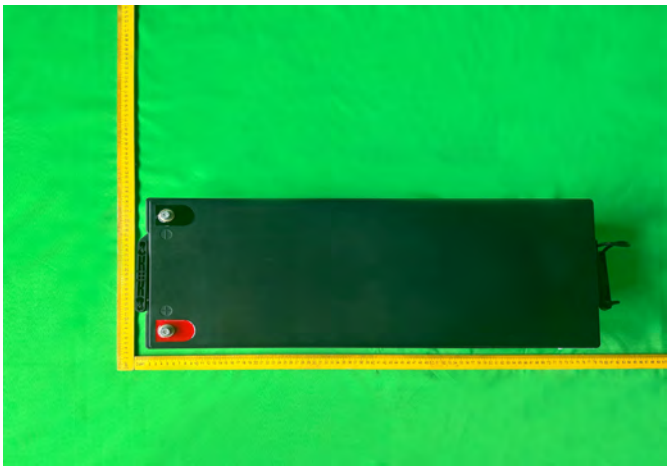

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--End of test report--