



# UN38.3 Test Report

Sample Name:	Li-ion Battery
Sample Model:	UE48LI1003U
Applicant:	Master Battery, S.L.
Issue Date:	2022-04-20



<u>2 - 1</u>9

Sample Description				
Sample Name	Li-ion Battery	Sample Model	UE48LI1003U	
Testing laboratory	Guangdong ESTL Techno	logy Co., Ltd.		
Testing Address	Room 101, 201-208, Unit <sup>2</sup> Songshan Lake Park, Don	1, Building 1, No. 9 Head gguan, Guangdong, Chir	quarters 2nd Road, na.	
Applicant	Master Battery, S.L.			
Applicant Address	Paseo de Extremadura, 39 28935 Móstoles, Madrid, 5	) Spain		
Manufacturer	Master Battery, S.L.			
Manufacturer Address	Paseo de Extremadura, 39 28935 Móstoles, Madrid, Spain			
Factory of Cell	UPOWER, LTD			
Standard	UNITED NATIONS the "Manual of Test and Criteria" (ST/SG/AC.10/11/Rev.7) Section 38.3.			
Date of sample receipt	2021-10-25			
Tested date	2021-10-26 to 2021-11-10			

Test conclusion:

The Li-ion Battery submitted by Master Battery, S.L. are tested according to UNITED NATIONS the "Manual of Test and Criteria" (ST/SG/AC.10/11/Rev.7) Section 38.3. The test items are full items. The test results comply with the relevant requirements of the standard.

Tested by



3	-	1	9

Sample Information					
Nominal Voltage	48V	Rated Capacity	100Ah		
Watt-hour	4800Wh	Trade mark			
Limited Charge Voltage	53.5V	Discharge Cut-Off Voltage	37.5V		
Charge Current	100A	Max. Continuous Charge Current	100A		
Discharge Current	100A	Max. Continuous Discharge Current	100A		
End Charge Current	20A	Battery dimensions	483.0mm*450.0mm*133.5 mm		
Cell Model	IFP50160116A- 102Ah	Cell Rated Capacity	102Ah		
Compound mode	mpound mode 15S1P				

Description of the sampling procedure: /

Description of the deviation from the standard, if any: /

Remarks:

1. Throughout this report a comma is used as the decimal separator.

2. As for the Verdict, "-" means "no need for judgement", "P" means "pass", "F" means "fail" and "N/A" means "not applicable".

3. This report is based on the original report, The report number is: S03A21090545U01401. Date of issue: 2021- 11-23. Change of applicant, manufacturer and factory address, without additional testing.

## <u>4 - 19</u>

Su	mmary of testing:		
Tests performed (name of test and test clause):		Testing location:	
	Test items	Sample Number	
	T.1: Altitude simulation		Guangdong ESTL Technology Co., Ltd.
	T.2: Thermal test		Room 101, 201-208, Unit 1, Building 1, No. 9 Headquarters 2nd Road, Songshan Lake
	T.3: Vibration	B1# - B4#	Park, Dongguan, Guangdong, China.
	T.4: Shock		
	T.5: External short circuit		
	T.6: Crush or Impact	C1# - C10#	
	T.7 Overcharge	B5# - B8#	
	T.8: Forced discharge	C11# - C30#	
Thu firs Lau 25 <sup>t</sup> Re sta Re sta Re dis	e samples' state is good. rge Batteries of B1#~B2# B5#~B6 t cycle; rge Batteries of B3#~B4# B7#~B8 h cycles; chargeable component cells of C te after first cycle; chargeable component cells of C te after 25 <sup>th</sup> cycles; chargeable component cells of C chargeable component cells of C chargeable component cells of C chargeable component cells of C chargeable component cells of C	er er d	

#### Test Procedure:

1.Each battery type is subjected to tests T.1 to T.8. Tests T.1 to T.5 are conducted in sequence on the same battery. Tests 6 and 8 are conducted using not otherwise tested 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.

2.In order to quantify the mass loss, the following procedure is provided:

Mass loss(%)= $(M_1-M_2)/M_1 \times 100$ 

Where  $M_1$  is the mass before the test and  $M_2$  is the mass after the test. When mass loss does not exceed the values in Table below, it is considered as "no mass loss".

Mass M of cell or battery	Mass loss limit
M<1g	0.5%
1g≤M≤75g	0.2%
M>75g	0.1%

3. In test T.1 to T.4, 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 battery after testing is not less than 90% of its voltage immediately prior to this procedure.

#### Report No.: S03A22040417U00101 6 - 19



#### Report No.: S03A22040417U00101 7 - 19



38.3.4	Procedure		Verdict
38.3.4.1	Test 1: Altitude simulation		Р
	Test cells and batteries shall be stored at a pressure of 11.6kPa or less for at least six hour at ambient temperature ( $20\pm5^{\circ}$ C).		Р
	Requirement <b>:</b> 1. Cells and batteries Mass loss limit: ≤0.1%.	No leakage, no venting, no disassembly, no	P
	2. Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states.		
		The data see table 1.	
	3. No leakage, no venting, no disassembly, no rupture		

#### Report No.: S03A22040417U00101 9 - 19

38.3.4.2	Test 2: Thermal test		Р
	Test cells and batteries are to be stored for		Р
	1. one temperature cycle: 72±2°C(6h) — -40±2°C(6h).		
	2. The maximum time interval between test temperature extremes is 30 minutes.		
	3. This procedure is to be repeated 10 times.		
	4. after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20±5°C).		
	5.For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.		
	Requirements:	No leakage, no	Р
	1. Cells and batteries Mass loss limit: ≤0.1%.	venting, no disassembly, no rupture and no fire.	
	2. Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states.		
		The data see table 1.	
	3. No leakage, no venting, no disassembly, no rupture		

38.3.4.3	Test 3: Vibration	Р
	1. Cells and batteries are firmly secured to the platform of the vibration machine.	Р
	2. The vibration :a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes.	
	3. For cells and small batteries. The logarithmic frequency sweep is as follows: 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 50Hz), A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.	
	4. For large batteries: from 7 Hz to 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 2 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.	
	5. This cycle repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting position of the cell. One of the directions of vibration must be perpendicular to the terminal face.	

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	Requirem 1. Cells ar 2. Open c	ents: nd batteries Mass loss limit: : ircuit voltage not less than 90	≤0.1%. 0%, The		No leakage, no venting, no disassembly, no rupture and no fire.	Р
	requireme cells and l	ent relating to voltage is not a batteries at full discharged st	applicable to ates.	test		
	3. No leak and no fire	age, no venting, no disasser e.	mbly, no rup	ture	The data see table 1.	
38.3.4.4	Test 4: SI	hock				Р
	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 or battery shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 gn 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.				Ρ	
					Ρ	
	Battery	Minimum peak acceleration	Pulse duration			
	Small batteries	150 gn or result of formula Acceleration (gn) $= \sqrt{\left(\frac{100850}{mass*}\right)}$ Whichever is smaller	6ms			
	Large batteries	50 gn or result of formula Acceleration (gn) $= \sqrt{\left(\frac{30000}{mass*}\right)}$ Whichever is smaller	11ms			

9

			12 - 1
	Each cell or battery is 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.		Ρ
	Requirements: 1. Cells and batteries Mass loss limit: ≤0.1%.	No leakage, no venting, no disassembly, no rupture and no fire.	Р
	2. Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states.	The date are table 1	
	3. No leakage, no venting, no disassembly, no rupture and no fire.		
38.3.4.5	Test 5: External Short Circuit / 测试5 外接短路		Р
	1. The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches 57±4℃.		Ρ
	2. The cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at $57\pm4^{\circ}$ C, This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $57\pm4^{\circ}$ C.		
	3. The small cell and small battery must be observed for a further six hour for the test to be concluded and 12 hours for large cells and large batteries		
	Requirements: During the test and within six hours after test, the cells or batteries.	External temperature not exceed 170°C	Р
	1. External temperature not exceed 170°C.	No disassembly, no rupture and no fire.	
	2. No disassembly, no rupture and no fire.	The data see table 1.	

38.3.4.6	Test 6: Impact / Crush	Р

#### 13 - 19

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	Impact (applicable to cylindrical cells not less than 18mm in diameter).		N/A
	1. The test sample cell or component cell is to be placed on a flat smooth surface.		N/A
	2. A 15.8mm±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 ± 0.1kg mass is to be dropped from a height of $61 \pm 2.5$ 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.		
	3. The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm±0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.		
	Requirements:		N/A
	1. Test cells or component cells external temperature not exceed 170°C.		
	2. No disassembly and no fire within six hours of this test.		
	Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18mm in diameter).		Ρ
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	<u> 14 – 19</u>
1. 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.	Ρ
(a) The applied force reaches 13 kN $\pm$ 0.78 kN.	
(b) The voltage of the cell drops by at least 100 mV.	
(c) The cell is deformed by 50% or more of its original thickness.	
2. 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.	
Requirements: 1. Test cells or component cells external temperature not	Р
2. No disassembly and no fire within six hours of this	

38.3.4.7	Test 7: Overcharge		Р
	1. The charge current shall be twice the manufacturer's recommended maximum continuous charge current.	The voltage of the test is 64.2V, and the current is 200A.	Р
	2. The minimum voltage of the test shall be as follows:		
	a) When the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22 V.		
	b) When the manufacturer's recommended charge voltage is more than 18 V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.		
	3. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.		
	Requirements: No disassembly and no fire within seven days of this test.	No disassembly and no fire.	Р
		The data see table 2.	
38.3.4.8	Test 8: Forced discharge		Р
	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.		Ρ
	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).		P

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Requirements:	No disassembly and no	Р
No disassembly and no fire within seven days of this test.	fire.	
	The data see table 2.	

17 - 19

Table 1: T1-T5													
Sample No.	Mass prior to test(g)	OCV prior to test (V)	Test 1: simu	: Altitude Test 2: The ulation		Test 2: Thermal test		Test 2: Thermal test		Vibration	Test 4:	Shock	Test 5: External Short Circuit
			Mass loss (%)	Change ratio (%)	Mass loss (%)	Change ratio (%)	Mass loss (%)	Change ratio (%)	Mass loss (%)	Change ratio (%)	Temp. (°C)		
B1#	39150	52.46	0.000	99.96	0.000	98.47	0.000	99.96	0.000	100.00	56.0		
B2#	39153	52.37	0.000	99.94	0.000	98.76	0.000	99.94	0.000	99.98	55.9		
B3#	39148	52.41	0.000	99.96	0.000	98.78	0.000	99.92	0.000	100.00	56.3		
B4#	39151	52.44	0.000	99.92	0.000	98.51	0.000	99.96	0.000	99.98	56.0		

Table 2: T6-T8								
Test 6: Impact / Crus			Test 7: O	vercharge	Test 8: Forced discharge			
Sample No.	OCV prior to test (V)	Temp. (°C)	Sample No. / OCV prior to test (V)		Sample No.	OCV prior to test (V)		
C1#	3.375	23.3	B5#	52.43	C11#	3.198		
C2#	3.364	23.1	B6#	52.35	C12#	3.174		
C3#	3.373	23.5	B7#	52.33	C13#	3.089		
C4#	3.382	23.3	B8#	52.39	C14#	3.156		
C5#	3.371	23.4			C15#	3.183		
C6#	3.365	23.6			C16#	3.188		
C7#	3.369	23.5			C17#	3.164		
C8#	3.372	23.7			C18#	3.152		
C9#	3.384	23.6			C19#	3.164		
C10#	3.380	23.6			C20#	3.173		
					C21#	3.168		
					C22#	3.190		
					C23#	3.185		
					C24#	3.094		
					C25#	3.106		
					C26#	3.164		
					C27#	3.175		
					C28#	3.153		
					C29#	3.159		
					C30#	3.146		

# Declaration

- 1. The test report is invalid without the signatures of Ratifier, Reviewer and Testing engineer.
- 2. Objections to the test report must be submitted to ESTL within 15 days.
- 3. Nobody is allowed to photocopy or partly photocopy this test report without written permission of ESTL.
- 4. The client should provide samples and relevant data, at the same time, they should guarantee the consistence of the product's name the declared, the samples they provided and the goods to be transported. Otherwise we will not bear any relevant responsibilities.
- 5. The test report is valid for the tested samples only.
- 6. ESTL's liability under no circumstance will exceed the testing fee received from applicant for test conducted hereof this testing report.
- 7. The test report is invalid if altered.

--- End of report ---