Lithium-ion Battery UN38.3 Test Report

Recommendations on the TRANSPORT OF DANGEROUS GOODS

(Manual of Tests and Criteria, Fifth revised edition, Amend.2)

Customer: Lenovo
Model: L15M3PB0
Rating: 11.25V , 52.5Wh / 4670mAh

Approved By	Checked By	Prepared By
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1. Purpose of the Test：

To test each cell/battery is of the type proved to meet the requirements in United Nations Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, Fifth revised edition, Amend.2, Section 38.3.

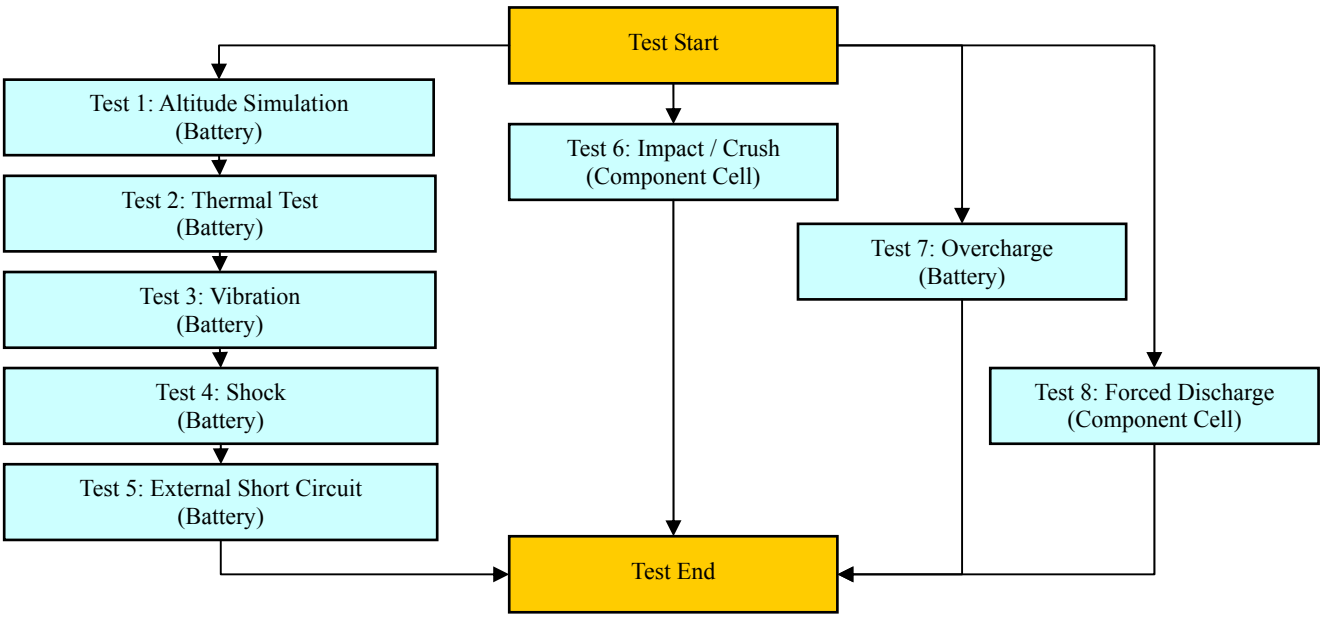
2. Test Quantity：

2.1 Four batteries, at first cycle, in fully charged states. (For T.1~T.5)
2.2 Four batteries, after 50 cycles ending in fully charged states. (For T.1~T.5)
2.3 Five component cells, at first cycle at 50% of the design rated capacity. (For T.6)
2.4 Four batteries, at first cycle, in fully charged states. (For T.7)
2.5 Four batteries, after 50 cycles ending in fully charged states. (For T.7)
2.6 Ten component cells, at first cycle in fully discharge states. (For T.8)
2.7 Ten component cells, after 50 cycles ending in fully discharged states. (For T.8)

3. Test Procedure：

3.1 All detailed test procedures must be based on United Nations Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, Fifth revised edition, Amend.2, Section 38.3.

3.2 Test flow shall be followed as below.



4. Test Result：

4.1 T.1 ~T.4 Test result: **Passed**

4.1.1 All batteries could meet the requirement of Table 38.3.1 Mass loss limit (M<1g: 0.5% ; 1g≦M≦75g: 0.2% ; M>75g: 0.1%) and residual OCV not less than 90% after the test.

4.1.2 No leakage, no venting, no disassembly, no rupture and no fire.

4.2 T.5 Test result: **Passed**

4.2.1 All batteries could meet the requirement, external temperature did not exceed 170℃.

4.2.2 All batteries were no disassembly, no rupture and no fire during the test and within six hours after the test.

4.3 T.6 Test result: **Passed**

4.3.1 All component cells could meet the requirement, external temperature did not exceed 170℃.

4.3.2 All component cells were no disassembly and no fire during the test and within six hours after the test.

4.4 T.7 Test result: **Passed**

4.4.1 All batteries could meet no disassembly and no fire during the test and within seven days after the test.

4.5 T.8 Test result: **Passed**

4.5.1 All component cells could meet the requirement, no disassembly and no fire during the test and within seven days after the test.

Conclusion: The samples had passed the test items of UN38.3.

5. Test Equipment：

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Revised Date: 2015-10-27

Test Instruments Reference List

Used	Instrument ID	Instrument Name	Type	Range of use	Manufacturer	Calibration Date_Last	Calibration Date_Next	Remarks
	Pretest							
V	ML-761	Learning	715C	0~18V 0~8A	SMP	2015/3/6	2016/3/6	
V	ML-762	Learning	715C	0~18V 0~8A	SMP	2015/3/6	2016/3/6	
V	ML-763	Learning	715C	0~18V 0~8A	SMP	2015/3/6	2016/3/6	
V	ML-764	Learning	715C	0~18V 0~8A	SMP	2015/3/6	2016/3/6	
	ML-838	Learning	PCP535	1.5V~5.5V 0~2.5A	SMP	2015/9/23	2016/9/23	
	T.1 Altitude Simulation							
V	ML-522	Altitude	SVT-120	Kpa:30~90	HSIN JIANG	2015/8/6	2016/8/6	
V	ML-257	Multimeter	HP 34401A	Note 1	Agilent	2015/3/9	2016/3/9	
	ML-494	Electronic Balance	XS1220M-SCS	1-1200 gf	CHUANHUA	2015/8/6	2016/8/6	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2015/9/23	2016/9/23	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2015/9/23	2016/9/23	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2015/9/24	2016/9/24	
	T.2 Thermal Test							
V	ML-789	Thermal Shock	GTST-080-65-AW	T:-40 to 120℃	GF	2015/1/8	2016/1/8	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2015/3/9	2016/3/9	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2015/8/6	2016/8/6	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2015/9/23	2016/9/23	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2015/9/23	2016/9/23	
	T.3 Vibration							
V	ML-233	Vibration	KD-9636-EM-300F2K-30N80	F:5~2000Hz G:0.2~20G	King Design	2015/9/18	2016/9/18	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2015/3/9	2016/3/9	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2015/8/6	2016/8/6	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2015/9/23	2016/9/23	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2015/9/23	2016/9/23	
V	ML-552	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2015/9/24	2016/9/24	
	T.4 Shock							
V	ML-056	Shock	DP-1200-25	G:10~600G	King Design	2015/9/18	2016/9/18	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2015/3/9	2016/3/9	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2015/8/6	2016/8/6	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2015/9/23	2016/9/23	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2015/9/23	2016/9/23	
V	ML-551	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2015/9/24	2016/9/24	
	T.5 External Short Circuit							
V	ML-534	mΩ Hitester	3540	1mΩ ~ 30kΩ	HIOKI	2015/9/25	2016/9/25	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	
V	ML-521	Oven	9031	30~80 ℃	YEOW LONG	2015/9/23	2016/9/23	
	T.6 Impact / Crush							
V	ML-339	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/5/27	2016/5/27	
	ML-076	Impact Tester			JYI SHENG	2015/1/9	2016/1/9	
	ML-553	Crush Tester	BCT-01		Simplo	2015/7/8	2016/7/8	
V	ML-866	Crush Tester	M0654		JYI SHENG	2015/4/30	2016/4/30	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	

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Test Instruments Reference List

Used	Instrument ID	Instrument Name	Type	Range of use	Manufacturer	Calibration Date_Last	Calibration Date_Next	Remarks
	T.7 Overcharge							
V	ML-482	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-483	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-484	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-485	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-486	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-487	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2015/5/27	2016/5/27	
V	ML-488	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2015/5/27	2016/5/27	
V	ML-489	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2015/5/27	2016/5/27	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2015/9/24	2016/9/24	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	
	T.8 Forced Discharge							
V	ML-132	Electronic Load	3311C	60V,55A, 300W	Prodigit	2015/3/5	2016/3/5	
V	ML-133	Electronic Load	3311C	60V,55A, 300W	Prodigit	2015/3/5	2016/3/5	
V	ML-136	Electronic Load	3311C	60V,55A, 300W	Prodigit	2015/3/5	2016/3/5	
V	ML-192	Electronic Load	3311C	60V,55A, 300W	Prodigit	2015/3/5	2016/3/5	
V	ML-269	Electronic Load	3311C	60V,55A, 300W	Prodigit	2015/3/5	2016/3/5	
V	ML-532	DC Electronic Load	33511-01	120V, 240A, 3600W	Prodigit	2015/8/6	2016/8/6	
V	ML-482	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-483	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-484	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-485	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-486	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2015/5/27	2016/5/27	
V	ML-487	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2015/5/27	2016/5/27	
V	ML-488	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2015/5/27	2016/5/27	
V	ML-489	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2015/5/27	2016/5/27	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2015/9/24	2016/9/24	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2015/10/1	2016/10/1	

Note 1: DC Voltage: 0.1-1000V; AC Voltage: 0.5-700V at 60Hz, 1kHz; Resistance: 10Ω-10MΩ; DC Current: 0.1mA-3A; AC Current: 0.01-3A at 60Hz, 0.01-1A, at 1kHz.

6. T.1~T.8 Detail Reports:

UN 38.3 Test Datasheet

UN38.3/ST/SG/AC.10/11/Rev.5/Amend.2

Control Number: SLEU-1510002	Customer: Lenovo	Model Name: L15M3PB0	SMP Project Name: Supra
Pack P/N: 928QA131H (A)	Configuration: 3S1P	Test Duration: 2015/09/21~2015/10/27	Reviewer: Sting

Test Sample Identification: ☐ Large Battery ■ Small Battery ☐ Single-cell Battery

Battery Pack						Component Cell		
Used	Sample No.	Sample State	Used	Sample No.	Sample State	Used	Sample No.	Sample State
V	01~04	1 Cycle, Fully charged	V	05~08	50 Cycles, Fully charged	V	01C~05C	1 Cycle, 50% charged
V	09~12	1 Cycle, Fully charged	V	13~16	50 Cycles, Fully charged	V	06C~15C	1 Cycle, 0% discharged
		25Cycles, Fully charged			25 Cycles, Fully charged	V	16C~25C	50 Cycles, 0% discharged

T.1 Altitude Simulation

Start time: 2015/09/30 09:20						Ambient temp.: 24.0 ℃		Operator: Esmond	
Finish time: 2015/09/30 15:30		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	12.933	12.932	12.935	12.930	12.937	12.937	12.931	12.932
	After	12.932	12.931	12.934	12.929	12.936	12.936	12.930	12.931
	Residual OCV %	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%
Mass (g)	Before	211.354	211.963	211.840	211.133	211.408	212.037	211.168	211.403
	After	211.353	211.961	211.840	211.133	211.407	212.035	211.167	211.403
	Mass loss %	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Results		P	P	P	P	P	P	P	P

T.2 Thermal Test

Start time: 2015/09/30 15:50						Ambient temp.: 24.8 ℃		Operator: Esmond	
Finish time: 2015/10/07 08:30		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	12.932	12.931	12.934	12.929	12.936	12.936	12.930	12.931
	After	12.779	12.777	12.779	12.778	12.782	12.784	12.776	12.780
	Residual OCV %	98.82%	98.81%	98.80%	98.83%	98.81%	98.82%	98.81%	98.83%
Mass (g)	Before	211.353	211.961	211.840	211.133	211.407	212.035	211.167	211.403
	After	211.339	211.950	211.827	211.122	211.397	212.026	211.154	211.392
	Mass loss %	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.01%	0.01%
Results		P	P	P	P	P	P	P	P

T.3 Vibration

Start time: 2015/10/07 08:50						Ambient temp.: 24.1 ℃		Operator: Esmond	
Finish time: 2015/10/07 19:30		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	12.779	12.777	12.779	12.778	12.782	12.784	12.776	12.780
	After	12.771	12.770	12.772	12.770	12.774	12.777	12.768	12.773
	Residual OCV %	99.94%	99.95%	99.95%	99.94%	99.94%	99.95%	99.94%	99.95%
Mass (g)	Before	211.339	211.950	211.827	211.122	211.397	212.026	211.154	211.392
	After	211.339	211.949	211.827	211.122	211.397	212.025	211.153	211.392
	Mass loss %	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Results		P	P	P	P	P	P	P	P

T.4 Shock

Start time: 2015/10/08 08:50						Ambient temp.: 23.9 ℃		Operator: Esmond	
Finish time: 2015/10/08 10:20		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	12.757	12.755	12.757	12.757	12.759	12.763	12.753	12.759
	After	12.757	12.755	12.757	12.757	12.759	12.763	12.753	12.759
	Residual OCV %	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Mass (g)	Before	211.339	211.949	211.827	211.122	211.397	212.025	211.153	211.392
	After	211.339	211.949	211.826	211.121	211.397	212.025	211.153	211.392
	Mass loss %	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Results		P	P	P	P	P	P	P	P

T.5 External Short Circuit

Start time: 2015/10/08 10:40						Ambient temp.: 24.7 ℃			Operator: Esmond
Finish time: 2015/10/08 18:00		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	12.757	12.755	12.757	12.757	12.759	12.763	12.753	12.759
	After	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resistance (<100mΩ)		55.6	51.3	59.5	54.0	57.2	58.6	54.2	56.3
Max Temp. (< 170℃)		55.7	55.6	55.7	55.8	55.6	55.8	55.5	55.7
Results		P	P	P	P	P	P	P	P

T.6 Impact / Crush

UN38.3/ST/SG/AC.10/11/Rev.5/Amend.2

☐ Impact-Cylindrical cells not less than 18.0 mm in diameter

■ Crush- Prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter

Start time: 2015/10/05 09:50			Ambient temp.: 24.6 ℃		Operator: Esmond
Finish time: 2015/10/05 16:30	Sample 01C	Sample 02C	Sample 03C	Sample 04C	Sample 05C
Initial OCV (V)	3.721	3.728	3.723	3.729	3.720
Max Temp. (< 170℃)	24.9	24.7	24.7	25.0	24.8
Results	P	P	P	P	P

T.7 Overcharge

Start time: 2015/10/12 09:20					Ambient temp.: 24.7 ℃			Operator: Esmond
Finish time: 2015/10/20 09:40	Sample 09	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16
Initial OCV (V)	12.931	12.931	12.932	12.931	12.935	12.943	12.932	12.930
Results	P	P	P	P	P	P	P	P

T.8 Forced Discharge

Start time: 2015/10/20 10:30					Ambient temp.: 24.6 ℃			Operator: Esmond
Finish time: 2015/10/27 15:10	Sample 06C	Sample 07C	Sample 08C	Sample 09C	Sample 10C	Sample 11C	Sample 12C	Sample 13C
Initial OCV (V)	3.294	3.308	3.281	3.286	3.294	3.301	3.308	3.299
Results	P	P	P	P	P	P	P	P
Sample No.	Sample 14C	Sample 15C	Sample 16C	Sample 17C	Sample 18C	Sample 19C	Sample 20C	Sample 21C
Initial OCV (V)	3.297	3.302	3.278	3.296	3.301	3.286	3.274	3.306
Results	P	P	P	P	P	P	P	P
Sample No.	Sample 22C	Sample 23C	Sample 24C	Sample 25C				
Initial OCV (V)	3.276	3.291	3.306	3.274				
Results	P	P	P	P				

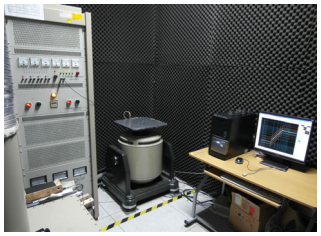
7. Equipment for Test:

Pretest

T.1 Altitude Simulation

T.2 Thermal Test

T.3 Vibration



T.4 Shock

T.5 External Short Circuit

T.6 Impact / Crush

T.7 Overcharge

T.8 Forced Discharge