



新普科技股份有限公司
 新世電子(常熟)有限公司
 新普科技(重慶)有限公司
 華普電子(常熟)有限公司

Control Number: SLEU-1807002

Lithium-ion Battery UN38.3 Test Report

Recommendations on the TRANSPORT OF DANGEROUS GOODS

(Manual of Tests and Criteria, Sixth revised edition)

Customer: Lenovo

Model: L18M4PF0

**Rating: 15.36V , TYP 2965mAh / 45Wh
 MIN 2890mAh / 44Wh**

Issue date: 2018/07/17

Approved By	Checked By	Prepared By

SIMPLO TECHNOLOGY CO., LTD.

ADD : No.471, Sec.2, Pa Teh Rd., Hu Kou, Hsin Chu Hsien 303, Taiwan

TEL: +886-3-5695920

FAX: +886-3-5695931



SIMPLO TECHNOLOGY (CHANGSHU) INC.

ADD : No.2 Dong Nan Avenue, Changshu, Jiangsu Province, China

TEL: +86-512-52302255

FAX: +86-512-52302277



SIMPLO TECHNOLOGY (CHONGQING) INC.

ADD : No.2 Zongbao Avenue, Shapingba District, ChongQing, China

TEL: +86-23-61718899

FAX: +86-23-61210488



HUAPU TECHNOLOGY (CHANGSHU) INC.

ADD : No.2 Dong Nan Avenue, Changshu, Jiangsu Province, China

TEL: +86-512-52302255

FAX: +86-512-52302277



Form No. : W11-002-B04

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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, Sixth revised edition, Section 38.3.

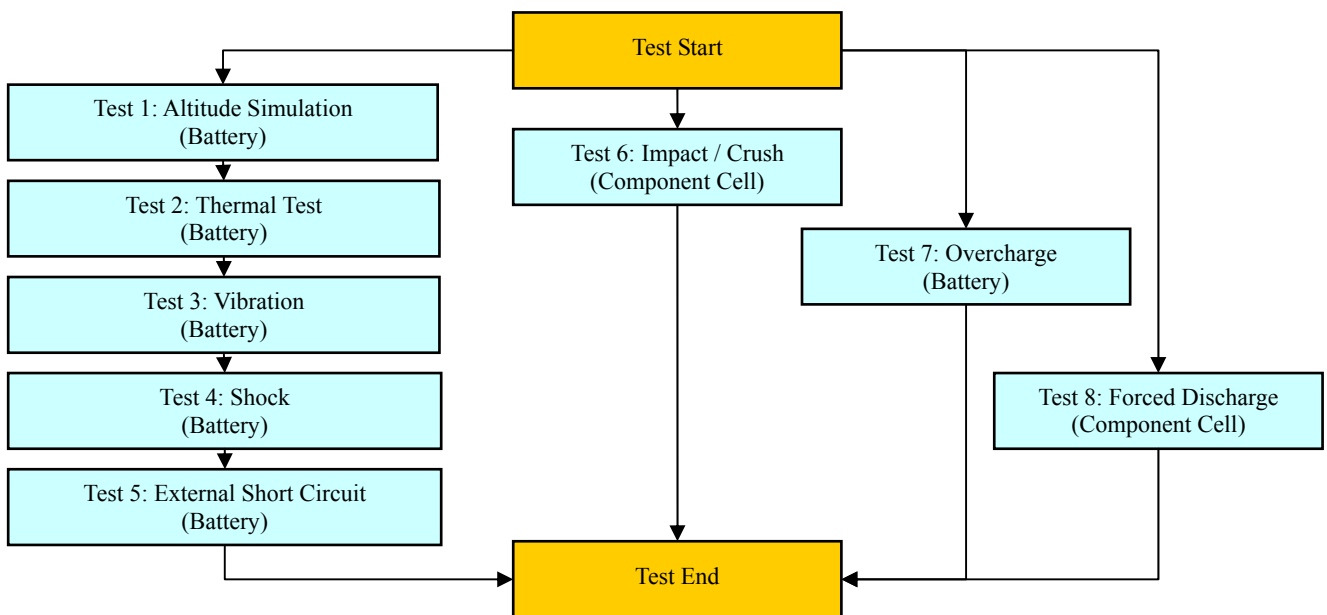
2. Test Quantity :

- 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, Sixth revised edition, Section 38.3.

3.2 Test flow shall be followed as below.



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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% ; $1g \leq M \leq 75g$: 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°C.

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°C.

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.



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Control Number: SLEU-1807002

5. Test Equipment :

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Revised Date: 2018-07-17

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	2018/2/26	2019/2/26	
V	ML-762	Learning	715C	0~18V 0~8A	SMP	2018/1/3	2019/1/3	
V	ML-763	Learning	715C	0~18V 0~8A	SMP	2018/2/26	2019/2/26	
V	ML-764	Learning	715C	0~18V 0~8A	SMP	2018/1/3	2019/1/3	
	ML-925	Learning	750C8	0~60V 0~30A	SMP	2018/1/3	2019/1/3	
T.1 Altitude Simulation								
V	ML-522	Altitude	SVT-120	Kpa:30~90	HSIN JIANG	2017/7/19	2018/7/19	
V	ML-257	Multimeter	HP 34401A	Note 1	Agilent	2018/3/1	2019/3/1	
	ML-494	Electronic Balance	XS1220M-SCS	1-1200 gf	CHUANHUA	2017/7/19	2018/7/19	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2017/9/13	2018/9/13	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2017/9/13	2018/9/13	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
T.2 Thermal Test								
V	ML-789	Thermal Shock	GTST-080-65-AW	T:-40 to 120℃	GF	2018/1/3	2019/1/3	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2018/3/1	2019/3/1	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2017/7/19	2018/7/19	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2017/9/13	2018/9/13	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2017/9/13	2018/9/13	
V	ML-551	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
T.3 Vibration								
V	ML-233	Vibration	KD-9636-EM-300F2K-30N80	F:5~2000Hz G:0.2~20G	King Design	2017/8/29	2018/8/29	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2018/3/1	2019/3/1	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2017/7/19	2018/7/19	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2017/9/13	2018/9/13	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2017/9/13	2018/9/13	
V	ML-552	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
T.4 Shock								
V	ML-056	Shock	DP-1200-25	G:10~600G	King Design	2017/8/29	2018/8/29	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2018/3/1	2019/3/1	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2017/7/19	2018/7/19	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2017/9/13	2018/9/13	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2017/9/13	2018/9/13	
V	ML-551	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
T.5 External Short Circuit								
V	ML-534	mΩ Hitester	3540	1mΩ ~ 30kΩ	HIOKI	2017/9/18	2018/9/18	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	
V	ML-521	Oven	9031	30~80 ℃	YEOW LONG	2017/9/13	2018/9/13	
V	ML-549	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
T.6 Impact / Crush								
V	ML-339	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2018/5/17	2019/5/17	
	ML-076	Impact Tester			JYI SHENG	2018/1/3	2019/1/3	
	ML-553	Crush Tester	BCT-01		Simplo	2018/5/16	2019/5/16	
V	ML-866	Crush Tester	M0654		JYI SHENG	2018/4/9	2019/4/9	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	

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Revised Date: 2018-07-17

Test Instruments Reference List								
Used	Instrument ID	Instrument Name	Type	Range of use	Manufacturer	Calibration Date_Last	Calibration Date_Next	Remarks
	T.7 Overcharge							
	ML-482	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-483	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-484	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-486	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-487	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2018/5/17	2019/5/17	
V	ML-549	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	
	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	
V	ML-918	Overcharge & Forced discharge tester	T901	3~30 Vdc, Charge: 0.05~20A Discharge: 0.02~10A	SMP	2018/5/17	2019/5/17	
	T.8 Forced Discharge							
	ML-132	Electronic Load	3311C	60V,55A, 300W	Prodigit	2018/3/1	2019/3/1	
	ML-133	Electronic Load	3311C	60V,55A, 300W	Prodigit	2018/3/1	2019/3/1	
	ML-136	Electronic Load	3311C	60V,55A, 300W	Prodigit	2018/3/1	2019/3/1	
	ML-192	Electronic Load	3311C	60V,55A, 300W	Prodigit	2018/3/1	2019/3/1	
	ML-269	Electronic Load	3311C	60V,55A, 300W	Prodigit	2018/3/1	2019/3/1	
	ML-532	DC Electronic Load	33511-01	120V, 240A, 3600W	Prodigit	2017/7/19	2018/7/19	
	ML-482	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-483	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-484	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-486	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2018/5/17	2019/5/17	
	ML-487	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2018/5/17	2019/5/17	
V	ML-549	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2017/9/18	2018/9/18	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	
	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2017/9/13	2018/9/13	
V	ML-918	Overcharge & Forced discharge tester	T901	3~30 Vdc, Charge: 0.05~20A Discharge: 0.02~10A	SMP	2018/5/17	2019/5/17	
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.								

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Control Number: SLEU-1807002

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

UN 38.3 Test Datasheet UN38.3/ST/SG/AC.10/11/Rev.6

Control Number: SLEU-1807002	Customer: Lenovo	Model Name: L18M4PF0	SMP Project Name: V540
Pack P/N: 928QA243H (A)(B)	Configuration: 4S1P	Test Duration: 2018/06/18~2018/07/16	Reviewer: Esmond

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% SOC
V	09~12	1 Cycle, Fully charged	V	13~16	50 Cycles, Fully charged	V	06C~15C	1 Cycle, Fully discharged (0% SOC)
		25Cycles, Fully charged			25 Cycles, Fully charged	V	16C~25C	50 Cycles, Fully discharged (0% SOC)

T.1 Altitude Simulation

Start time: 2018/07/02 09:00	Ambient temp.: 23.5 °C						Operator: Stephy		
Finish time: 2018/07/02 15:10	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	17.343	17.346	17.340	17.342	17.344	17.340	17.345	17.341
	After	17.333	17.335	17.329	17.332	17.333	17.329	17.334	17.330
	Residual OCV %	99.94%	99.94%	99.94%	99.94%	99.94%	99.94%	99.94%	99.94%
Mass (g)	Before	180.726	180.963	180.715	181.136	180.694	180.841	180.743	181.224
	After	180.726	180.963	180.715	181.131	180.691	180.841	180.743	181.220
	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: 2018/07/02 15:30	Ambient temp.: 24.7 °C						Operator: Stephy		
Finish time: 2018/07/09 08:50	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	17.333	17.335	17.329	17.332	17.333	17.329	17.334	17.330
	After	17.095	17.091	17.087	17.078	17.086	17.074	17.076	17.087
	Residual OCV %	98.63%	98.59%	98.60%	98.53%	98.57%	98.53%	98.51%	98.60%
Mass (g)	Before	180.726	180.963	180.715	181.131	180.691	180.841	180.743	181.220
	After	180.709	180.941	180.700	181.114	180.670	180.821	180.719	181.200
	Mass loss %	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Results	P	P	P	P	P	P	P	P	

T.3 Vibration

Start time: 2018/07/09 09:10	Ambient temp.: 23.4 °C						Operator: Stephy		
Finish time: 2018/07/10 08:40	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	17.095	17.091	17.087	17.078	17.086	17.074	17.076	17.087
	After	17.075	17.070	17.066	17.057	17.066	17.054	17.055	17.067
	Residual OCV %	99.88%	99.88%	99.88%	99.88%	99.88%	99.88%	99.88%	99.88%
Mass (g)	Before	180.709	180.941	180.700	181.114	180.670	180.821	180.719	181.200
	After	180.706	180.941	180.700	181.112	180.666	180.821	180.719	181.195
	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: 2018/07/10 09:00	Ambient temp.: 24.3 °C						Operator: Stephy		
Finish time: 2018/07/10 11:10	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	17.075	17.070	17.066	17.057	17.066	17.054	17.055	17.067
	After	17.073	17.068	17.064	17.055	17.064	17.052	17.053	17.065
	Residual OCV %	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%
Mass (g)	Before	180.706	180.941	180.700	181.112	180.666	180.821	180.719	181.195
	After	180.706	180.941	180.697	181.112	180.665	180.821	180.714	181.195
	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	

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T.5 External Short Circuit

Start time: 2018/07/10 11:30		Ambient temp.: 23.7 °C						Operator: Stephy	
Finish time: 2018/07/11 08:50		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	17.073	17.068	17.064	17.055	17.064	17.052	17.053	17.065
	After	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resistance (<100mΩ)		57.4	59.6	55.8	60.4	57.3	61.6	59.0	58.3
Max Temp. (< 170°C)		57.9	57.8	58.1	58.1	57.9	58.0	58.0	58.2
Results		P	P	P	P	P	P	P	P

T.6 Impact / Crush (Component Cell)

UN38.3/ST/SG/AC.10/11/Rev.6

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: 2018/07/04 09:20		Ambient temp.: 23.8 °C				Operator: Stephy	
Finish time: 2018/07/04 18:00		Sample 01C	Sample 02C	Sample 03C	Sample 04C	Sample 05C	
Initial OCV (V)		3.792	3.788	3.797	3.786	3.794	
Max Temp. (< 170°C)		23.9	23.8	23.8	23.8	24.0	
Results		P	P	P	P	P	

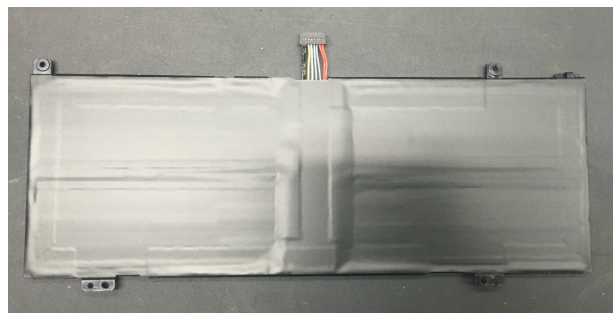
T.7 Overcharge

Start time: 2018/07/06 09:40		Ambient temp.: 23.7 °C								Operator: Stephy	
Finish time: 2018/07/16 10:50		Sample 09	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16		
Initial OCV (V)		17.341	17.343	17.343	17.340	17.343	17.341	17.346	17.340		
Results		P	P	P	P	P	P	P	P		

T.8 Forced Discharge (Component Cell)

Start time: 2018/07/05 09:20		Ambient temp.: 23.8 °C								Operator: Stephy	
Finish time: 2018/07/13 08:50		Sample 06C	Sample 07C	Sample 08C	Sample 09C	Sample 10C	Sample 11C	Sample 12C	Sample 13C		
Initial OCV (V)		3.703	3.698	3.711	3.708	3.694	3.690	3.712	3.707		
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)		3.699	3.706	3.715	3.702	3.696	3.708	3.713	3.701		
Results		P	P	P	P	P	P	P	P		
Sample No.		Sample 22C	Sample 23C	Sample 24C	Sample 25C						
Initial OCV (V)		3.713	3.693	3.704	3.713						
Results		P	P	P	P						

7. Test Sample:



Form No. : W11-002-B04

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This test report is valid only to the items, Invalid for separation using.