



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-1905002

# Lithium-ion Battery UN38.3 Test Report

## Recommendations on the TRANSPORT OF DANGEROUS GOODS

(Manual of Tests and Criteria, Sixth revised edition, Amend 1)

**Customer: Lenovo**

**Model: L19M4PG0**

**Rating/ Mass: 15.36V, Typical Capacity 3949mAh/ 60Wh**

**Rated Capacity 3853mAh/ 59Wh/ 248 (g)**

**Issue date: 2019/05/10**

Approved By	Checked By	Prepared By
Assistant Manager	Authorized Signatory	Test Engineer
<i>Sung Sin</i>	<i>[Signature]</i>	<i>Mia Deng</i>

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Website : <http://www.simplo.com.tw/>

Form No. : W11-002-B05

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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, Amend 1, Section 38.3.

### 2. Test Result :

Test results of the UN Recommendations on the Transport of Dangerous Goods

No.	Test Item	Test results
T.1	Altitude simulation	PASS
T.2	Thermal test	PASS
T.3	Vibration test	PASS
T.4	Shock test	PASS
T.5	External short circuit	PASS
T.6	Impact, Crush test	PASS
T.7	Overcharge	PASS
T.8	Forced discharge	PASS

### 3. Test Lab: Email : [Test\\_Lab@simplo.com.tw](mailto:Test_Lab@simplo.com.tw) Website : <http://www.simplo.com.tw/>

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**4. Product manufacturer : Email : [Test\\_Lab@simplo.com.tw](mailto:Test_Lab@simplo.com.tw) Website : <http://www.simplo.com.tw/>**

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**5. Test Quantity :**

- 5.1 Four batteries, at first cycle, in fully charged states. (For T.1~T.5)
- 5.2 Four batteries, after 25 cycles ending in fully charged states. (For T.1~T.5)
- 5.3 Five component cells, at first cycle at 50% of the design rated capacity. (For T.6)
- 5.4 Five component cells, after 25 cycles at 50% of the design rated capacity. (For T.6)
- 5.5 Four batteries, at first cycle, in fully charged states. (For T.7)
- 5.6 Four batteries, after 25 cycles ending in fully charged states. (For T.7)
- 5.7 Ten component cells, at first cycle in fully discharge states. (For T.8)
- 5.8 Ten component cells, after 25 cycles ending in fully discharged states. (For T.8)

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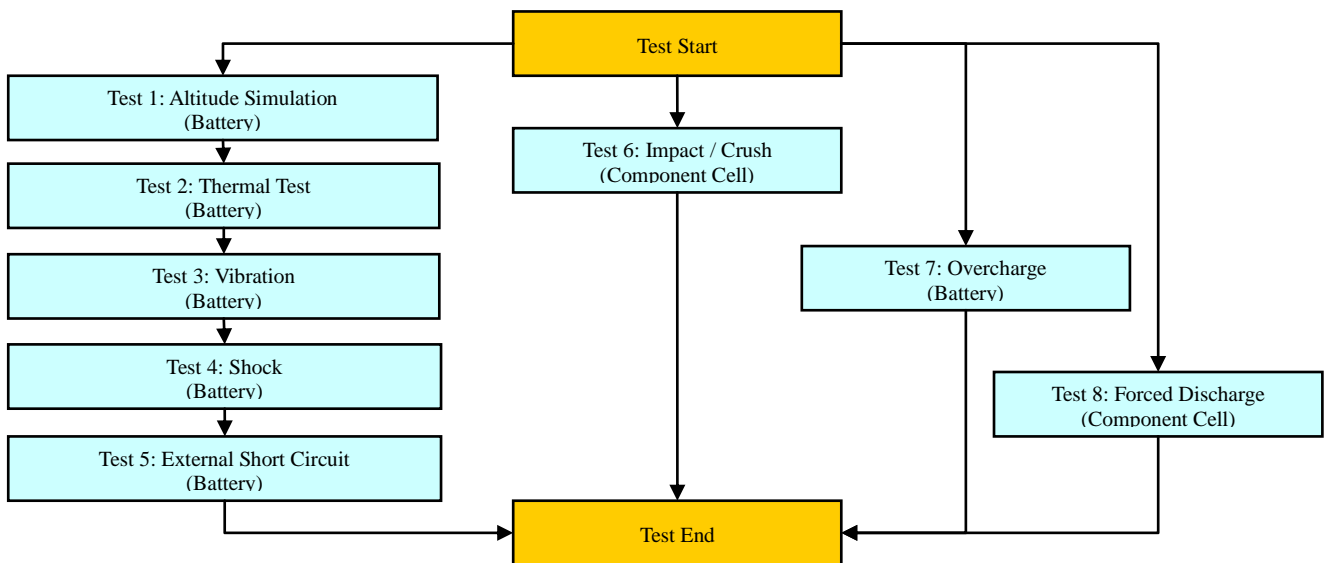
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## 6. Test Procedure :

6.1 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, Amend 1, Section 38.3.

6.2 Test flow shall be followed as below.



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

## 7. Comment : NA



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## 8. Test Equipment :

### SMP SIMPLO TECHNOLOGY CO., LTD.

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Revised Date: 2019-05-09

Test Instruments Reference List								
Used	Instrument ID	Instrument Name	Type	Range of use	Manufacturer	Calibration Date_Last	Calibration Date_Next	Remarks
<b>Pretest</b>								
V	ML-761	Learning	715C	0~18V 0~8A	SMP	2019/2/25	2020/2/25	
V	ML-762	Learning	715C	0~18V 0~8A	SMP	2019/1/3	2020/1/3	
V	ML-763	Learning	715C	0~18V 0~8A	SMP	2019/2/26	2020/2/26	
V	ML-764	Learning	715C	0~18V 0~8A	SMP	2019/1/3	2020/1/3	
	ML-925	Learning	750C8	0~60V 0~30A	SMP	2019/1/3	2020/1/3	
<b>T.1 Altitude Simulation</b>								
V	ML-522	Altitude	SVT-120	kPa:30~90	HSIN JIANG	2018/7/18	2019/7/18	
V	ML-257	Multimeter	34401A	Note 1	Agilent	2019/2/26	2020/2/26	
V	ML-494	Electronic Balance	XS1220M-SCS	1-1220 gf	PRECISA	2018/7/18	2019/7/18	
	ML-523	Electronic Balance	MTW-30K	30*0.005kg		2018/9/12	2019/9/12	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
V	ML-555	Barometric Air Pressure	C300	750 to 1100 mbar	Lufft	2018/9/18	2019/9/18	
<b>T.2 Thermal Test</b>								
V	ML-789	Thermal Shock	GTST-080-65-AW	T:-40 to 100℃	GF	2019/1/3	2020/1/3	
V	ML-257	Multimeter	34401A	note 1	Agilent	2019/2/26	2020/2/26	
V	ML-494	Electronic Balance	XS1220M-SCS	1-1220 gf	PRECISA	2018/7/18	2019/7/18	
	ML-523	Electronic Balance	MTW-30K	30*0.005kg		2018/9/12	2019/9/12	
V	ML-551	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
<b>T.3 Vibration</b>								
V	ML-233	Vibration	KD-9636-EM-300F2K-30N80	F:5~2000Hz G:0.2~20G	King Design	2018/8/24	2019/8/24	
V	ML-257	Multimeter	34401A	note 1	Agilent	2019/2/26	2020/2/26	
V	ML-494	Electronic Balance	XS1220M-SCS	1-1220 gf	PRECISA	2018/7/18	2019/7/18	
	ML-523	Electronic Balance	MTW-30K	30*0.005kg		2018/9/12	2019/9/12	
V	ML-552	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
<b>T.4 Shock</b>								
V	ML-056	Shock	DP-1200-25	G:10~600G	King Design	2018/8/24	2019/8/24	
V	ML-257	Multimeter	34401A	note 1	Agilent	2019/2/26	2020/2/26	
V	ML-494	Electronic Balance	XS1220M-SCS	1-1220 gf	PRECISA	2018/7/18	2019/7/18	
	ML-523	Electronic Balance	MTW-30K	30*0.005kg		2018/9/12	2019/9/12	
V	ML-551	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
<b>T.5 External Short Circuit</b>								
V	ML-894	Battery Hitester	BT3562	1mΩ ~ 30kΩ	HIOKI	2018/6/11	2019/6/11	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	
V	ML-521	Oven	9031	30~80 ℃	YEOW LONG	2018/9/12	2019/9/12	
V	ML-549	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
<b>T.6 Impact / Crush</b>								
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	2019/1/3	2020/1/3	
	ML-553	Crush Tester	BCT-01		Simplo	2018/5/16	2019/5/16	
V	ML-866	Crush Tester	M0654		JYI SHENG	2019/4/8	2020/4/8	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	

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Revised Date: 2019-05-09

Test Instruments Reference List								
Used	Instrument ID	Instrument Name	Type	Range of use	Manufacturer	Calibration Date_Last	Calibration Date_Next	Remarks
<b>T.7 Overcharge</b>								
	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	
<b>V</b>	ML-549	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	
	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	
<b>V</b>	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	
<b>T.8 Forced Discharge</b>								
	ML-132	Electronic Load	3311C	60V,60A, 300W	Prodigit	2019/2/26	2020/2/26	
	ML-133	Electronic Load	3311C	60V,60A, 300W	Prodigit	2019/2/26	2020/2/26	
	ML-136	Electronic Load	3311C	60V,60A, 300W	Prodigit	2019/2/26	2020/2/26	
	ML-192	Electronic Load	3311C	60V,60A, 300W	Prodigit	2019/2/26	2020/2/26	
	ML-269	Electronic Load	3311C	60V,60A, 300W	Prodigit	2019/2/26	2020/2/26	
	ML-532	DC Electronic Load	33511-01	120V, 240A, 3600W	Prodigit	2018/7/18	2019/7/18	
	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	
<b>V</b>	ML-549	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2018/9/18	2019/9/18	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	
	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 200℃	Yokogawa	2018/9/12	2019/9/12	
<b>V</b>	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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## 9. T.1~T.8 Detail Reports:

### UN 38.3 Test Datasheet UN38.3/ST/SG/AC.10/11/Rev.6/Amend.1

Control Number: SLEU-1905002	Customer: Lenovo	Model Name: L19M4PG0	SMP Project Name: Y740s
Pack P/N: 928QA293H (A)(B)	Configuration: 4S1P	Test Duration: 2019/04/17~2019/05/08	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	25 Cycles, Fully charged	V	01C~05C	1 Cycle, 50% SOC
V	09~12	1 Cycle, Fully charged	V	13~16	25 Cycles, Fully charged	V	06C~10C	25 Cycles, 50% SOC
						V	11C~20C	1 Cycle, Fully discharged (0% SOC)
						V	21C~30C	25 Cycles, Fully discharged (0% SOC)

#### T.1 Altitude Simulation

Start time: 2019/04/24 09:00		Ambient temp.: 22.6 °C						Operator: Mia	
Finish time: 2019/04/24 16:20		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	17.010	17.030	17.028	17.003	17.034	17.017	17.033	17.022
	After	16.982	17.004	17.003	16.976	17.010	16.993	17.006	16.996
	Residual OCV %	99.84%	99.85%	99.85%	99.84%	99.86%	99.86%	99.84%	99.85%
Mass (g)	Before	248.430	247.658	248.378	248.529	247.938	248.182	247.815	247.829
	After	248.429	247.655	248.376	248.529	247.936	248.182	247.813	247.828
	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: 2019/04/24 16:40		Ambient temp.: 22.4 °C						Operator: Mia	
Finish time: 2019/05/02 08:40		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	16.982	17.004	17.003	16.976	17.010	16.993	17.006	16.996
	After	16.796	16.814	16.819	16.796	16.820	16.807	16.824	16.815
	Residual OCV %	98.90%	98.88%	98.92%	98.94%	98.88%	98.91%	98.93%	98.94%
Mass (g)	Before	248.429	247.655	248.376	248.529	247.936	248.182	247.813	247.828
	After	248.413	247.638	248.356	248.513	247.922	248.163	247.798	247.815
	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: 2019/05/02 09:00		Ambient temp.: 23.0 °C						Operator: Mia	
Finish time: 2019/05/03 09:00		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	16.796	16.814	16.819	16.796	16.820	16.807	16.824	16.815
	After	16.780	16.799	16.807	16.786	16.803	16.793	16.815	16.808
	Residual OCV %	99.90%	99.91%	99.93%	99.94%	99.90%	99.92%	99.95%	99.96%
Mass (g)	Before	248.413	247.638	248.356	248.513	247.922	248.163	247.798	247.815
	After	248.413	247.636	248.353	248.513	247.920	248.162	247.795	247.815
	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: 2019/05/03 09:20		Ambient temp.: 22.8 °C						Operator: Mia	
Finish time: 2019/05/03 14:00		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	16.780	16.799	16.807	16.786	16.803	16.793	16.815	16.808
	After	16.771	16.786	16.789	16.769	16.795	16.782	16.805	16.795
	Residual OCV %	99.95%	99.92%	99.89%	99.90%	99.95%	99.93%	99.94%	99.92%
Mass (g)	Before	248.413	247.636	248.353	248.513	247.920	248.162	247.795	247.815
	After	248.412	247.634	248.350	248.513	247.920	248.158	247.792	247.813
	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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Control Number: SLEU-1905002

**T.5 External Short Circuit**

Start time: 2019/05/06 08:50		Ambient temp.: 22.2 °C						Operator: Mia	
Finish time: 2019/05/06 17:10		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	16.571	16.566	16.529	16.569	16.585	16.542	16.585	16.565
	After	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resistance (<100mΩ)		59.1	56.4	57.3	60.5	61.1	58.2	59.7	57.9
Max Temp. (< 170°C)		57.4	57.2	57.7	57.3	57.5	57.8	57.6	57.4
Results		P	P	P	P	P	P	P	P

**T.6 Impact / Crush (Component Cell)**

UN38.3/ST/SG/AC.10/11/Rev.6/Amend.1

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: 2019/04/26 08:40		Ambient temp.: 22.2 °C				Operator: Mia	
Finish time: 2019/04/26 17:20		Sample 01C	Sample 02C	Sample 03C	Sample 04C	Sample 05C	
Initial OCV (V)		3.796	3.804	3.801	3.792	3.800	
Max Temp. (< 170°C)		24.4	24.0	23.9	24.1	23.6	
Results		P	P	P	P	P	
Sample No.		Sample 06C	Sample 07C	Sample 08C	Sample 09C	Sample 10C	
Initial OCV (V)		3.795	3.793	3.808	3.806	3.799	
Max Temp. (< 170°C)		23.5	24.7	23.7	23.9	24.2	
Results		P	P	P	P	P	

**T.7 Overcharge**

Start time: 2019/04/30 09:10		Ambient temp.: 22.7 °C								Operator: Mia	
Finish time: 2019/05/08 11:00		Sample 09	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16		
Initial OCV (V)		17.009	17.032	17.031	17.001	17.033	17.021	17.032	17.024		
Results		P	P	P	P	P	P	P	P		

**T.8 Forced Discharge (Component Cell)**

Start time: 2019/04/29 09:00		Ambient temp.: 22.9 °C								Operator: Mia	
Finish time: 2019/05/07 10:30		Sample 11C	Sample 12C	Sample 13C	Sample 14C	Sample 15C	Sample 16C	Sample 17C	Sample 18C		
Initial OCV (V)		3.482	3.453	3.457	3.465	3.488	3.460	3.471	3.492		
Results		P	P	P	P	P	P	P	P		
Sample No.		Sample 19C	Sample 20C	Sample 21C	Sample 22C	Sample 23C	Sample 24C	Sample 25C	Sample 26C		
Initial OCV (V)		3.476	3.469	3.454	3.463	3.474	3.486	3.473	3.480		
Results		P	P	P	P	P	P	P	P		
Sample No.		Sample 27C	Sample 28C	Sample 29C	Sample 30C						
Initial OCV (V)		3.487	3.475	3.466	3.451						
Results		P	P	P	P						

**9. Test Sample:**



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