



新普科技股份有限公司  
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 華普電子(常熟)有限公司

Control Number:LE-CU-15-10-021

## Lithium-ion Battery UN38.3 Test Report

### Recommendations on the TRANSPORT OF DANGEROUS GOODS

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

**Customer: Lenovo**

**Model: L15M4PC0**

**Rating: 7.5V, 6135mAh / 46Wh**

Approved By	Checked By	Prepared By
Winel Zhao	Winel Zhao	Happy-Gui

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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.1, Section 38.3.

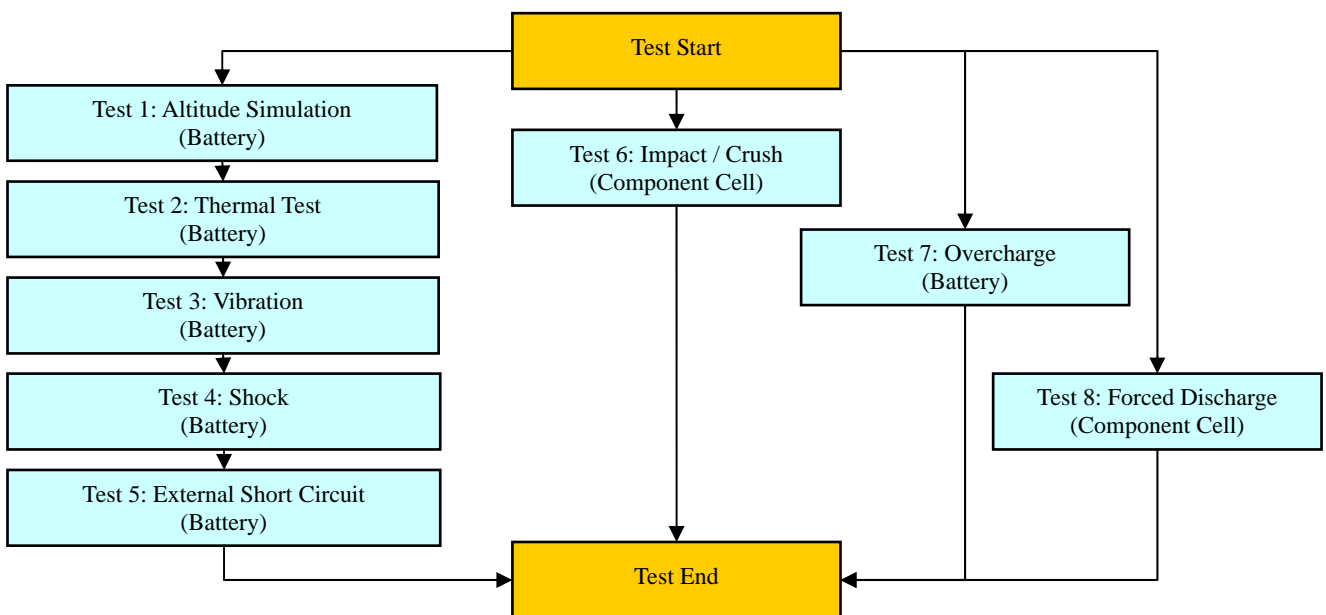
### 2. Test Quantity :

- 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.1, 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.**



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Control Number:LE-CU-15-10-021

## 5. Test Equipment :

SMP 新普科技(重慶)有限公司 SHANGSHI ELECTRONIC CO., LTD. CHONGQING CHINA		Address : No.2 Dong Nan Avenue,Changshu, Jngsu Province, China TEL:0512-52302255 FAX:0512-52302277		Revised date: 2015/8/12	Page:1				
				Date: 2015/7/27~2015/8/25					
				Model name: L14M6P21					
Test Instruments Reference List									
Used	Instrument ID(New)	Instrument ID(Old)	Instrument Name	Type	Range Used	Manufacturer	Calibration Date>Last	Calibration Date Next	Remarks
<b>Pretest</b>									
✓	EE01-CA-100002	C602M00/S0036	715 learning機	新普科技	18V/8A	新普科技	2014/12/30	2015/12/29	
✓	EE03-CA-100018	C602M00/S0107	720 learning機	新普科技	Chang:18V/17A Discharge:16V/18A	新普科技	2015/03/09	2016/03/08	
	EE01-CA-100003	C602M00/S0039	715 learning機	新普科技	18V/8A	新普科技	2015/03/09	2016/03/08	
	EE01-CA-100005	C602M00/S0038	715 learning機	新普科技	18V/8A	新普科技	2015/04/08	2016/04/07	
	EE03-CA-100020	C602M00/S0163	720 learning機	新普科技	Chang:18V/17A Discharge:16V/18A	新普科技	2014/10/21	2015/10/20	
<b>Low Pressure Test</b>									
✓	EC15-CA-E00003	C602M00/0462	Altitude	SVT-110	Kpa: 0~39kpa	HSIN JIANG	2014/03/08	2015/03/07	
✓	EA02-CA-100002	C602M00/0293	mQ Htester	3561	R:10~310mΩ V:20~20V	HIOKI	2014/9/17	2015/9/16	
✓	EF03-CA-100001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2014/10/21	2015/10/20	
✓	ED01-CA-100007	C602M00/T0412	Thermo Meter	TA218	T: -10℃~70℃ RH: 25%~98%	KTJ	2014/8/27	2015/8/26	
<b>Thermal Test</b>									
✓	EC23-CA-E00002	C602M00/0671	Thermal Shock	TSK-A4C-150	T: -65℃ to 150℃	KSON	2014/06/09	2015/06/08	
✓	EA02-CA-100002	C602M00/0293	mQ Htester	3561	R:10~310mΩ V:20~20V	HIOKI	2014/9/17	2015/9/16	
✓	EF03-CA-100001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2014/10/21	2015/10/20	
✓	ED01-CA-100007	C602M00/T0412	Thermo Meter	TA218	T: -10℃~70℃ RH: 25%~98%	KTJ	2014/8/27	2015/8/26	
<b>Vibration Test</b>									
	EC08-CA-E00001	C602M00/0197	Vibration	EM200F2K-25N50	F:3~2000Hz G:0.2~55G	King Design	2015/3/11	2016/3/10	
✓	EC08-CA-E00002	C602M00/0052	Vibration	EM200F2K-25N50	F:3~2000Hz G:0.2~55G	King Design	2014/9/24	2015/9/23	
✓	EA02-CA-100002	C602M00/0293	mQ Htester	3561	R:10~310mΩ V:20~20V	HIOKI	2014/9/17	2015/9/16	
✓	EF03-CA-100001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2014/10/21	2015/10/20	
<b>Shock Test</b>									
✓	EC17-CA-E00001	C602M00/0570	Shock	HS 1545	G:10~2000G	Lansmont	2014/09/08	2015/09/07	
✓	EA02-CA-100002	C602M00/0293	mQ Htester	3561	R:10~310mΩ V:20~20V	HIOKI	2014/9/17	2015/9/16	
✓	EF03-CA-100001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2014/10/21	2015/10/20	
<b>External Short Circuit Test</b>									
✓	EA02-CA-100002	C602M00/0293	mQ Htester	3561	R:10~310mΩ V:20~20V	HIOKI	2014/9/17	2015/9/16	
✓	EA09-CA-100004	C602M00/0207	Data logger	34970A	V:0~300V, T: -150℃~1200℃	Agilent	2014/09/17	2015/09/16	
✓	EC26-CA-100023	C602M00/0518	chamber	WIT TH-2P-E	-40℃ to 150℃	WIT	2015/08/10	2016/08/09	
✓	ED01-CA-100007	C602M00/T0412	Thermo Meter	TA218	T: -10℃~70℃ RH: 25%~98%	KTJ	2014/8/27	2015/8/26	
<b>Impact Test/Crush Test</b>									
	EC17-CA-100001	C602M00/1204	Impact test	100-372	H:60~80cm	JYI SHENG	2014/9/17	2015/9/16	
✓	EC23-CA-E00001	C602M00/0743	Crush Test	BE-6047	1.0KN~15.0KN	BELL	2014/03/08	2015/03/07	
✓	EA09-CA-100005	C602M00/0588	Data logger	34970A	V:0~300V, T: -150℃~1200℃	Agilent	2014/09/17	2015/09/16	
✓	ED01-CA-100010	C602M00/T0581	Thermo Meter	TA218	T: -10℃~70℃ RH: 25%~98%	KTJ	2015/6/21	2016/6/20	
<b>Overcharge Test</b>									
✓	EA06-CA-E00003	C602M00/P0779	Power Supply	DS6024	0~60V 0~24A	MDTECH	2015/03/11	2016/03/10	
✓	EA06-CA-E00002	C602M00/P0777	Power Supply	DS6024	0~60V 0~24A	MDTECH	2015/03/11	2016/03/10	
✓	EA06-CA-E00001	C602M00/P0775	Power Supply	DS6024	0~60V 0~24A	MDTECH	2015/03/11	2016/03/10	
✓	EA06-CA-E00004	C602M00/P0781	Power Supply	DS6024	0~60V 0~24A	MDTECH	2015/03/11	2016/03/10	
✓	ED01-CA-100007	C602M00/T0412	Thermo Meter	TA218	T: -10℃~70℃ RH: 25%~98%	KTJ	2014/8/27	2015/8/26	
<b>Froced Discharge Test</b>									
✓	EA06-CA-100004	/	Power Supply	E3633A	0~8V,20A/0~20V,10A	AGILENT	2014/9/17	2015/9/16	
✓	EA06-CA-100016	/	Power Supply	E3633A	0~8V,20A/0~20V,10A	AGILENT	2015/5/9	2016/5/8	
✓	EA06-CA-100015	C602M00/P0481	Power Supply	E3633A	0~8V,20A/0~20V,10A	AGILENT	2015/5/9	2016/5/8	
✓	EA05-CA-100006	/	Electronic LOAD	3311D	60V/60A, 300W	PRODIGIT	2015/05/11	2016/05/10	
✓	EA05-CA-100009	/	Electronic LOAD	3311F	60V/60A, 300W	PRODIGIT	2015/05/11	2016/05/10	
✓	EA05-CA-100008	C602M00/L0402	Electronic LOAD	3311F	60V/60A, 300W	PRODIGIT	2015/06/12	2016/06/11	

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: 0.01mA~3A at 60Hz, 0.01mA~1A, at 1kHz

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Control Number:LE-CU-15-10-021

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

Control No.:LE-CU-15-10-021

### UN 38.3 Test Datasheet

Customer: Lenovo

Model Name:L15M4PC0

Test Duration: 2015/09/28~2015/10/22

Reviewer: Wind\_Zhao

Test Sample Identification:

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

T.1 Altitude Simulation					Ambient temp.: 20.0 °C				Operator: Happy_Gu			
Start time:2015/10/12 09:20					Finish time:2015/10/12 17:30							
Sample No.: 01					Sample No.: 02							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.380	209.378	Mass loss % 0.00%	P	Mass (g)	209.450	209.447	Mass loss % 0.00%	P			
OCV (V)	8.560	8.555	Residual OCV % 99.94%		OCV (V)	8.570	8.564	Residual OCV % 99.93%				
Sample No.: 03					Sample No.: 04							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.500	209.497	Mass loss % 0.00%	P	Mass (g)	209.420	209.418	Mass loss % 0.00%	P			
OCV (V)	8.584	8.577	Residual OCV % 99.92%		OCV (V)	8.583	8.576	Residual OCV % 99.92%				
Sample No.: 05					Sample No.: 06							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.510	209.508	Mass loss % 0.00%	P	Mass (g)	209.420	209.418	Mass loss % 0.00%	P			
OCV (V)	8.578	8.571	Residual OCV % 99.92%		OCV (V)	8.577	8.572	Residual OCV % 99.94%				
Sample No.: 07					Sample No.: 08							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.390	209.388	Mass loss % 0.00%	P	Mass (g)	209.380	209.378	Mass loss % 0.00%	P			
OCV (V)	8.561	8.555	Residual OCV % 99.93%		OCV (V)	8.585	8.580	Residual OCV % 99.94%				

T.2 Thermal Test					Ambient temp.: 19.5 °C				Operator: Happy_Gu			
Start time:2015/10/12 17:40					Finish time:2015/10/19 08:20							
Sample No.: 01					Sample No.: 02							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.378	209.376	Mass loss % 0.00%	P	Mass (g)	209.447	209.444	Mass loss % 0.00%	P			
OCV (V)	8.555	8.433	Residual OCV % 98.57%		OCV (V)	8.564	8.445	Residual OCV % 98.61%				
Sample No.: 03					Sample No.: 04							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.497	209.495	Mass loss % 0.00%	P	Mass (g)	209.418	209.414	Mass loss % 0.00%	P			
OCV (V)	8.577	8.460	Residual OCV % 98.64%		OCV (V)	8.576	8.452	Residual OCV % 98.55%				
Sample No.: 05					Sample No.: 06							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.508	209.506	Mass loss % 0.00%	P	Mass (g)	209.418	209.414	Mass loss % 0.00%	P			
OCV (V)	8.571	8.450	Residual OCV % 98.59%		OCV (V)	8.572	8.454	Residual OCV % 98.62%				
Sample No.: 07					Sample No.: 08							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.388	209.384	Mass loss % 0.00%	P	Mass (g)	209.378	209.376	Mass loss % 0.00%	P			
OCV (V)	8.555	8.432	Residual OCV % 98.56%		OCV (V)	8.580	8.456	Residual OCV % 98.55%				

T.3 Vibration					Ambient temp.: 20.7 °C				Operator: Happy_Gu			
Start time:2015/10/19 08:40					Finish time:2015/10/20 08:20							
Sample No.: 01					Sample No.: 02							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.376	209.373	Mass loss % 0.00%	P	Mass (g)	209.444	209.441	Mass loss % 0.00%	P			
OCV (V)	8.433	8.424	Residual OCV % 99.89%		OCV (V)	8.445	8.434	Residual OCV % 99.87%				
Sample No.: 03					Sample No.: 04							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.495	209.493	Mass loss % 0.00%	P	Mass (g)	209.414	209.412	Mass loss % 0.00%	P			
OCV (V)	8.460	8.452	Residual OCV % 99.91%		OCV (V)	8.452	8.442	Residual OCV % 99.88%				
Sample No.: 05					Sample No.: 06							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.506	209.504	Mass loss % 0.00%	P	Mass (g)	209.414	209.411	Mass loss % 0.00%	P			
OCV (V)	8.450	8.440	Residual OCV % 99.88%		OCV (V)	8.454	8.446	Residual OCV % 99.91%				
Sample No.: 07					Sample No.: 08							
	Before	After	Variation	Results		Before	After	Variation	Results			
Mass (g)	209.384	209.382	Mass loss % 0.00%	P	Mass (g)	209.376	209.374	Mass loss % 0.00%	P			
OCV (V)	8.432	8.423	Residual OCV % 99.89%		OCV (V)	8.456	8.447	Residual OCV % 99.89%				

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Control Number:LE-CU-15-10-021

T.4 Shock

Start time:2015/10/20 08:40  
 Finish time:2015/10/20 13:30

Ambient temp.: 21.4 ℃

Operator: Happy\_Gu

Sample No.: 01					Sample No.: 02						
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	209.373	209.370	Mass loss %	0.00%	P	Mass (g)	209.441	209.438	Mass loss %	0.00%	P
OCV(V)	8.424	8.421	Residual OCV %	99.96%		OCV(V)	8.434	8.431	Residual OCV %	99.96%	
Sample No.: 03					Sample No.: 04						
Mass (g)	209.493	209.490	Mass loss %	0.00%	P	Mass (g)	209.412	209.409	Mass loss %	0.00%	P
OCV(V)	8.452	8.448	Residual OCV %	99.95%		OCV(V)	8.442	8.438	Residual OCV %	99.95%	
Sample No.: 05					Sample No.: 06						
Mass (g)	209.504	209.501	Mass loss %	0.00%	P	Mass (g)	209.411	209.408	Mass loss %	0.00%	P
OCV(V)	8.440	8.437	Residual OCV %	99.96%		OCV(V)	8.446	8.444	Residual OCV %	99.98%	
Sample No.: 07					Sample No.: 08						
Mass (g)	209.382	209.379	Mass loss %	0.00%	P	Mass (g)	209.374	209.371	Mass loss %	0.00%	P
OCV(V)	8.423	8.421	Residual OCV %	99.98%		OCV(V)	8.447	8.444	Residual OCV %	99.96%	

T.5 External Short Circuit

Start time:2015/10/20 13:50  
 Finish time:2015/10/21 09:10

Ambient temp.: 20.6 ℃

Operator: Happy\_Gu

	Sample No.: 01		Sample No.: 02		Sample No.: 03		Sample No.: 04		Sample No.: 05		Sample No.: 06		Sample No.: 07		Sample No.: 08	
Resistance (<100mΩ)	56.8		59.2		57.3		56.6		55.7		57.9		58.8		57.3	
OCV before test/after short circuit(V)	8.421	0.000	8.431	0.000	8.448	0.000	8.438	0.000	8.437	0.000	8.444	0.000	8.421	0.000	8.444	0.000
Max Temp. (<170℃)	55.2		54.9		55.1		55.1		54.8		55.2		54.7		54.9	
Results	P		P		P		P		P		P		P		P	

T.6 Impact / Crush

Start time:2015/09/30 08:30  
 Finish time:2015/09/30 18:40

Ambient temp.: 19.4 ℃

Operator: Happy\_Gu

- Impact- Cylindrical cells greater than 20mm in diameter  
 Crush- Prismatic, pouch, coin/button cells and cylindrical cells not more than 20mm in diameter

	Sample No.: 01C		Sample No.: 02C		Sample No.: 03C		Sample No.: 04C		Sample No.: 05C	
OCV before test(V)	3.751		3.749		3.751		3.752		3.748	
Max Temp. (<170℃)	28.7		29.6		30.1		31.6		29.1	
Results	P		P		P		P		P	

T.7 Overcharge

Start time:2015/10/12 10:20  
 Finish time:2015/10/22 13:10

Ambient temp.: 18.9 ℃

Operator: Happy\_Gu

	Sample No.: 09	Sample No.: 10	Sample No.: 11	Sample No.: 12	Sample No.: 13	Sample No.: 14	Sample No.: 15	Sample No.: 16
OCV before test(V)	8.561	8.574	8.581	8.569	8.572	8.579	8.566	8.570
Results	P	P	P	P	P	P	P	P

T.8 Forced Discharge

Start time:2015/10/13 08:30  
 Finish time:2015/10/23 09:30

Ambient temp.: 20.4 ℃

Operator: Happy\_Gu

	Sample No.: 06C	Sample No.: 07C	Sample No.: 08C	Sample No.: 09C	Sample No.: 10C
OCV before test(V)	3.371	3.375	3.381	3.384	3.383
Results	P	P	P	P	P
	Sample No.: 11C	Sample No.: 12C	Sample No.: 13C	Sample No.: 14C	Sample No.: 15C
OCV before test(V)	3.375	3.379	3.381	3.384	3.373
Results	P	P	P	P	P
	Sample No.: 16C	Sample No.: 17C	Sample No.: 18C	Sample No.: 19C	Sample No.: 20C
OCV before test(V)	3.380	3.372	3.374	3.380	3.371
Results	P	P	P	P	P
	Sample No.: 21C	Sample No.: 22C	Sample No.: 23C	Sample No.: 24C	Sample No.: 25C
OCV before test(V)	3.372	3.375	3.374	3.370	3.373
Results	P	P	P	P	P

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