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 新世電子(常熟)有限公司  
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 華普電子(常熟)有限公司

Control Number: SLEU-1702001

## 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: L16M3P71**

**Rating: 11.46V , 2.095Ah / 24Wh**

Approved By	Checked By	Prepared By
<i>Max Lu</i>	<i>[Signature]</i>	<i>[Signature]</i>

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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.

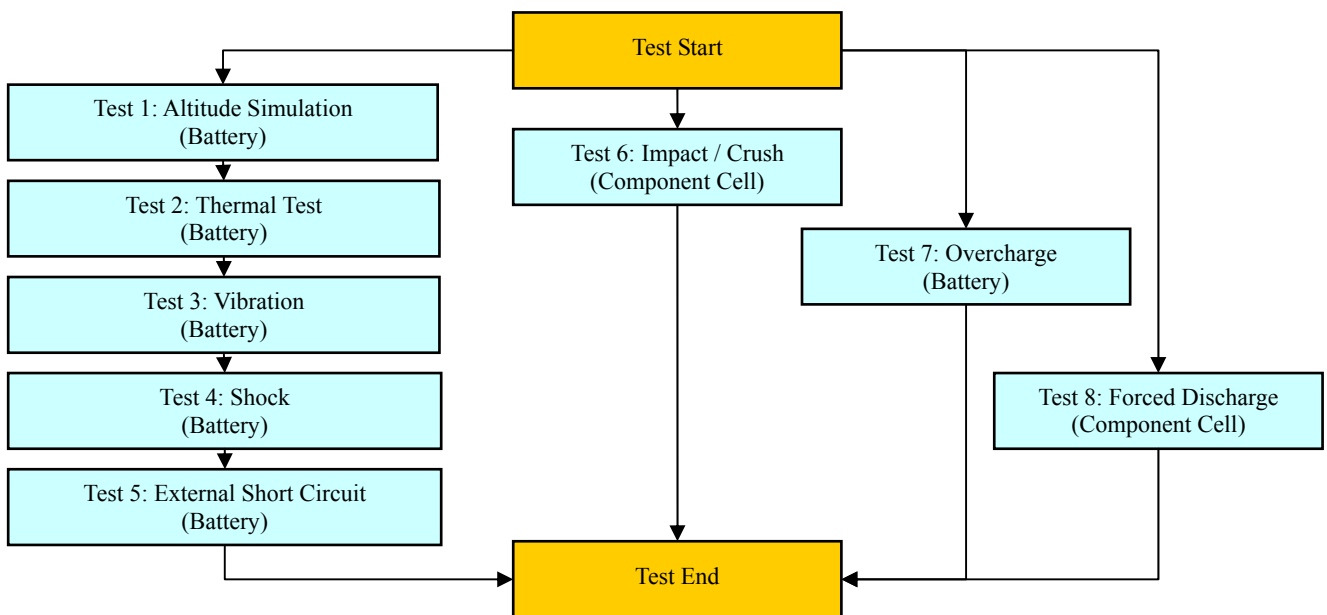
### 2. Test Quantity :

- 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.





#### 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-1702001

## 5. Test Equipment :

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Revised Date: 2017-02-20

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	2016/3/2	2017/3/2	
V	ML-762	Learning	715C	0~18V 0~8A	SMP	2017/1/4	2018/1/4	
V	ML-763	Learning	715C	0~18V 0~8A	SMP	2016/3/2	2017/3/2	
V	ML-764	Learning	715C	0~18V 0~8A	SMP	2017/1/4	2018/1/4	
	ML-514	Learning	750R	0~60V 0~60A	SMP	2017/2/6	2018/2/6	
<b>T.1 Altitude Simulation</b>								
V	ML-522	Altitude	SVT-120	Kpa:30~90	HSIN JIANG	2016/7/28	2017/7/28	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2016/3/4	2017/3/4	
	ML-494	Electronic Balance	XS1220M-SCS	1-1200 gf	CHUANHUA	2016/7/28	2017/7/28	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2016/9/21	2017/9/21	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2016/9/21	2017/9/21	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2016/9/21	2017/9/21	
<b>T.2 Thermal Test</b>								
V	ML-789	Thermal Shock	GTST-080-65-AW	T:-40 to 120℃	GF	2017/1/4	2018/1/4	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2016/3/4	2017/3/4	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2016/7/28	2017/7/28	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2016/9/21	2017/9/21	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2016/9/21	2017/9/21	
<b>T.3 Vibration</b>								
V	ML-233	Vibration	KD-9636-EM-300F2K-30N80	F:5~2000Hz G:0.2~20G	King Design	2016/9/2	2017/9/2	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2016/3/4	2017/3/4	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2016/7/28	2017/7/28	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2016/9/21	2017/9/21	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2016/9/21	2017/9/21	
V	ML-552	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2016/9/21	2017/9/21	
<b>T.4 Shock</b>								
V	ML-056	Shock	DP-1200-25	G:10~600G	King Design	2016/9/2	2017/9/2	
V	ML-257	Multimeter	HP 34401A	note 1	Agilent	2016/3/4	2017/3/4	
	ML-494	Electronic Balance	XS1220M-SCS	1-1000 gf	CHUANHUA	2016/7/28	2017/7/28	
V	TD-166	Electronic Balance	PG603-S	1-610 gf	METTLER TOLEDO	2016/9/21	2017/9/21	
	ML-523	Electronic Balance	MTW-30K	30*0.005Kg		2016/9/21	2017/9/21	
V	ML-551	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2016/9/21	2017/9/21	
<b>T.5 External Short Circuit</b>								
V	ML-534	mΩ Hitester	3540	1mΩ ~ 30kΩ	HIOKI	2016/9/23	2017/9/23	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	
V	ML-521	Oven	9031	30~80 ℃	YEOW LONG	2016/9/21	2017/9/21	
<b>T.6 Impact / Crush</b>								
V	ML-339	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/5/19	2017/5/19	
	ML-076	Impact Tester			JYI SHENG	2017/1/3	2018/1/3	
	ML-553	Crush Tester	BCT-01		Simplo	2016/6/1	2017/6/1	
V	ML-866	Crush Tester	M0654		JYI SHENG	2016/4/28	2017/4/28	
	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	

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Revised Date: 2017-02-20

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>							
V	ML-482	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-483	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-484	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-486	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-487	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2016/5/19	2017/5/19	
V	ML-488	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2016/5/19	2017/5/19	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2016/9/21	2017/9/21	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	
	<b>T.8 Forced Discharge</b>							
V	ML-132	Electronic Load	3311C	60V,55A, 300W	Prodigit	2016/3/4	2017/3/4	
V	ML-133	Electronic Load	3311C	60V,55A, 300W	Prodigit	2016/3/4	2017/3/4	
V	ML-136	Electronic Load	3311C	60V,55A, 300W	Prodigit	2016/3/4	2017/3/4	
V	ML-192	Electronic Load	3311C	60V,55A, 300W	Prodigit	2016/3/4	2017/3/4	
V	ML-269	Electronic Load	3311C	60V,55A, 300W	Prodigit	2016/3/4	2017/3/4	
V	ML-532	DC Electronic Load	33511-01	120V, 240A, 3600W	Prodigit	2016/7/29	2017/7/29	
V	ML-482	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-483	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-484	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-486	Programmable DC Source	DS10014	1-100Vdc, 0.3-14.4A	MOTECH	2016/5/19	2017/5/19	
V	ML-487	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2016/5/19	2017/5/19	
V	ML-488	Programmable DC Source	DS6024	1-60 Vdc, 0.3-24A	MOTECH	2016/5/19	2017/5/19	
V	ML-550	Data Logger	313	15~35 ℃; 30~80 %RH	CENTER	2016/9/21	2017/9/21	
V	ML-459	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	
V	ML-460	Data Acquisition	MX100-E-1D	1-100 Vdc, -50 to 150℃	Yokogawa	2016/9/21	2017/9/21	
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-1702001

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

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

Control Number: SLEU-1702001	Customer: Lenovo	Model Name: L16M3P71	SMP Project Name: Rogue Front
Pack P/N: 931QA070H (A)(B)	Configuration: 3S1P	Test Duration: 2017/01/23~2017/02/20	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% 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: 2017/02/08 08:50	Ambient temp.: 19.7 °C								Operator: Stephy
Finish time: 2017/02/08 15:10	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	12.972	12.974	12.970	12.976	12.975	12.971	12.976	12.972
	After	12.967	12.969	12.965	12.971	12.970	12.966	12.971	12.967
	Residual OCV %	99.96%	99.96%	99.96%	99.96%	99.96%	99.96%	99.96%	99.96%
Mass (g)	Before	113.895	114.234	114.037	113.762	114.358	114.497	114.632	114.278
	After	113.895	114.234	114.037	113.761	114.358	114.494	114.631	114.278
	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: 2017/02/08 15:30	Ambient temp.: 22.5 °C								Operator: Stephy
Finish time: 2017/02/15 08:50	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	12.967	12.969	12.965	12.971	12.970	12.966	12.971	12.967
	After	12.801	12.801	12.795	12.800	12.806	12.804	12.803	12.795
	Residual OCV %	98.72%	98.70%	98.69%	98.68%	98.74%	98.75%	98.70%	98.67%
Mass (g)	Before	113.895	114.234	114.037	113.761	114.358	114.494	114.631	114.278
	After	113.877	114.214	114.016	113.745	114.341	114.472	114.612	114.257
	Mass loss %	0.02%	0.02%	0.02%	0.01%	0.01%	0.02%	0.02%	0.02%
Results	P	P	P	P	P	P	P	P	

#### T.3 Vibration

Start time: 2017/02/15 09:10	Ambient temp.: 20.3 °C								Operator: Stephy
Finish time: 2017/02/16 09:00	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	12.801	12.801	12.795	12.800	12.806	12.804	12.803	12.795
	After	12.780	12.782	12.776	12.781	12.786	12.784	12.782	12.776
	Residual OCV %	99.84%	99.85%	99.85%	99.85%	99.84%	99.84%	99.84%	99.85%
Mass (g)	Before	113.877	114.214	114.016	113.745	114.341	114.472	114.612	114.257
	After	113.874	114.214	114.015	113.745	114.339	114.472	114.611	114.257
	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: 2017/02/16 09:20	Ambient temp.: 20.6 °C								Operator: Stephy
Finish time: 2017/02/16 11:10	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08	
OCV (V)	Before	12.780	12.782	12.776	12.781	12.786	12.784	12.782	12.776
	After	12.779	12.781	12.775	12.780	12.785	12.783	12.781	12.775
	Residual OCV %	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%
Mass (g)	Before	113.874	114.214	114.015	113.745	114.339	114.472	114.611	114.257
	After	113.874	114.214	114.015	113.744	114.339	114.472	114.611	114.255
	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-1702001

**T.5 External Short Circuit**

Start time: 2017/02/16 11:30		Ambient temp.: 19.6 °C						Operator: Stephy	
Finish time: 2017/02/17 08:50		Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
OCV (V)	Before	12.779	12.781	12.775	12.780	12.785	12.783	12.781	12.775
	After	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resistance (<100mΩ)		53.4	58.9	51.2	50.7	53.6	56.3	55.4	53.8
Max Temp. (< 170°C)		56.9	57.1	57.1	57.0	56.8	57.1	57.0	57.1
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: 2017/02/13 09:30		Ambient temp.: 19.6 °C				Operator: Stephy	
Finish time: 2017/02/13 16:20		Sample 01C	Sample 02C	Sample 03C	Sample 04C	Sample 05C	
Initial OCV (V)		3.802	3.799	3.796	3.804	3.806	
Max Temp. (< 170°C)		20.0	19.8	19.8	19.9	20.1	
Results		P	P	P	P	P	

**T.7 Overcharge**

Start time: 2017/02/09 09:40		Ambient temp.: 19.6 °C						Operator: Stephy	
Finish time: 2017/02/20 14:40		Sample 09	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16
Initial OCV (V)		12.971	12.972	12.974	12.974	12.976	12.972	12.974	12.969
Results		P	P	P	P	P	P	P	P

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

Start time: 2017/02/09 09:50		Ambient temp.: 19.9 °C							Operator: Stephy	
Finish time: 2017/02/17 18:10		Sample 06C	Sample 07C	Sample 08C	Sample 09C	Sample 10C	Sample 11C	Sample 12C	Sample 13C	
Initial OCV (V)		3.368	3.386	3.374	3.361	3.382	3.390	3.368	3.378	
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)		3.393	3.388	3.370	3.363	3.388	3.373	3.391	3.384	
Results		P	P	P	P	P	P	P	P	
Sample No.		Sample 22C	Sample 23C	Sample 24C	Sample 25C					
Initial OCV (V)		3.385	3.366	3.373	3.369					
Results		P	P	P	P					

**7. Test Sample:**



Form No. : W11-002-B04

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