

Battery Pack Test Report ***(UN38.3)***

Customer: Lenovo

Pack Model: L18C4PG0

Nominal voltage: 7.5V

Nominal capacity: 7470mAh/56Wh

Configuration: 2S2P

Customer P/N: 5B10R51232

Celxpert P/N: 921300199

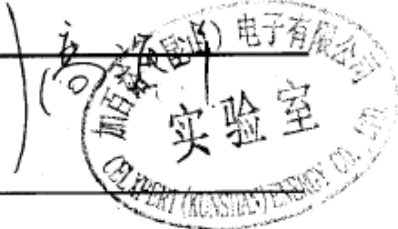
Cell Type: ATL 485490N 3735mAh

Dec.28.2018

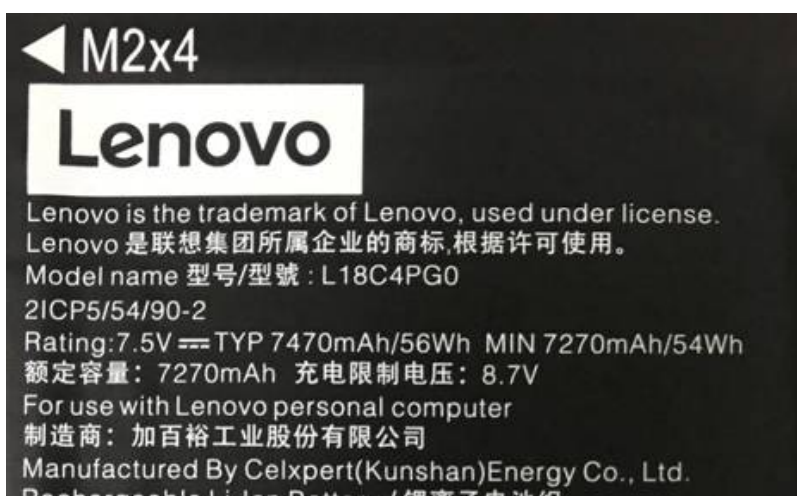
Approved by _____

Reviewed by _____

Prepared by _____



1. Figure photo of the pack.



PS:此報告僅針對送檢樣品有效

The test report is valid for the tested samples only.

2. UN38.3 Test Report

Test Period	2018/04/26~2018/05/13		Test Spec.	ST/SG/AC.10/11/Rev.6/Amend.1	
Parts Name	Battery Pack	Application	NB	Quantity	Pack 16PCS/Cell 30pcs

2.1 Test Summary

Item	Test Item	Test Result	Details
T1	Altitude simulation test (UN38.3-1)	Pass	Page 5
T2	Thermal test (UN38.3-2)	Pass	Page 6
T3	Vibration test (UN38.3-3)	Pass	Page 7
T4	Shock test (UN38.3-4)	Pass	Page 8
T5	Short Circuit test (UN38.3-5)	Pass	Page 9
T6	Impact Test (UN38.3-6)	Pass	Page 9
T7	Overcharge test (UN38.3-7)	Pass	Page 10
T8	Forced discharge test (UN38.3-8)	Pass	Page 11

2.2 Test sample list

No.	Pack S/N	Test item	No.	Cell Num.	Test item
1	Sample No:1/16	38.3.1~5	1	ATL 485490N 3735mAh	38.3.6
2	Sample No:2/16	38.3.1~5	2	ATL 485490N 3735mAh	38.3.6
3	Sample No:3/16	38.3.1~5	3	ATL 485490N 3735mAh	38.3.6
4	Sample No:4/16	38.3.1~5	4	ATL 485490N 3735mAh	38.3.6
5	Sample No:5/16	38.3.1~5	5	ATL 485490N 3735mAh	38.3.6
6	Sample No:6/16	38.3.1~5	6	ATL 485490N 3735mAh	38.3.6
7	Sample No:7/16	38.3.1~5	7	ATL 485490N 3735mAh	38.3.6
8	Sample No:8/16	38.3.1~5	8	ATL 485490N 3735mAh	38.3.6
9	Sample No:9/16	38.3.7	9	ATL 485490N 3735mAh	38.3.6
10	Sample No:10/16	38.3.7	10	ATL 485490N 3735mAh	38.3.6
11	Sample No:11/16	38.3.7	11	ATL 485490N 3735mAh	38.3.8
12	Sample No:12/16	38.3.7	12	ATL 485490N 3735mAh	38.3.8
13	Sample No:13/16	38.3.7	13	ATL 485490N 3735mAh	38.3.8
14	Sample No:14/16	38.3.7	14	ATL 485490N 3735mAh	38.3.8
15	Sample No:15/16	38.3.7	15	ATL 485490N 3735mAh	38.3.8
16	Sample No:16/16	38.3.7	16	ATL 485490N 3735mAh	38.3.8
			17	ATL 485490N 3735mAh	38.3.8
			18	ATL 485490N 3735mAh	38.3.8
			19	ATL 485490N 3735mAh	38.3.8
			20	ATL 485490N 3735mAh	38.3.8
			21	ATL 485490N 3735mAh	38.3.8
			22	ATL 485490N 3735mAh	38.3.8
			23	ATL 485490N 3735mAh	38.3.8
			24	ATL 485490N 3735mAh	38.3.8
			25	ATL 485490N 3735mAh	38.3.8
			26	ATL 485490N 3735mAh	38.3.8
			27	ATL 485490N 3735mAh	38.3.8
			28	ATL 485490N 3735mAh	38.3.8
			29	ATL 485490N 3735mAh	38.3.8
			30	ATL 485490N 3735mAh	38.3.8

2.3 Test result

Item	Test Item	Test specification	Judge criteria	Sample(s)				
T1	Altitude Simulation (UN38.3-1)	<p>1-1. batteries are standard charged. ending in fully charged state. All batteries weight is measured. The charged batteries voltage are measured and recorded.</p> <p>1-2. Batteries shall be stored at a pressure of 11.6Kpa or less for at least six hours at ambient temperature (20±5)°C.</p> <p>1-3. Vacuum is released. All cells weight is measured. The charged cell voltage are measured and recorded.</p>	<p>No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire.</p> <p>Battery voltage drop < 10%.</p>	<p>4 packs are first cycle in fully charged (Pack#1~4)</p> <p>4 packs are 25 times cycled ending in fully charged state (Pack #5~8)</p>				
Test Period		Start: 2018/04/26 End: 2018/04/26						
Test Equipment		數位電表 Q153, 電子天平 Q090, 真空烘箱 Q0443						
Major Problem		-						
Warning Point		-						
Recommendation		The packs pass the test.						
Raw Data	Altitude Simulation Test on Charged Packs							
	No.	Before		After		voltage residue	mass loss	other event
		OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	
	1	8.256	242.95	8.254	242.94	99.98%	0.00%	O
	2	8.248	242.82	8.247	242.81	99.99%	0.00%	O
	3	8.296	242.75	8.295	242.74	99.99%	0.00%	O
	4	8.271	242.59	8.268	242.58	99.96%	0.00%	O
	5	8.029	242.58	8.027	242.57	99.98%	0.00%	O
	6	8.048	242.67	8.045	242.66	99.96%	0.00%	O
	7	8.073	242.54	8.072	242.53	99.99%	0.00%	O
8	8.095	242.72	8.091	242.71	99.95%	0.00%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)																																																																																						
T2	Thermal test (UN38.3-2)	2-1. Packs are stored for 6 hours at (72±2) °C, followed by storage for 6 hours at -40±2°C. The maximum time interval between test temperature extremes is 30 minutes. 2-2.Repeat 2-1 for 10 times. Then store the packs at ambient for 24 hours. All packs weight are measured. The charged battery voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)																																																																																						
Test Period		Start: 2018/04/27 End: 2018/05/03																																																																																								
Test Equipment		數位電表 Q153, 電子天平 Q090, 冷熱衝擊機 Q0446																																																																																								
Major Problem		-																																																																																								
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Raw Data		<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr style="background-color: #ffff00;"> <th colspan="8">Thermal Test on Charged Packs</th> </tr> <tr style="background-color: #ffff00;"> <th rowspan="2">No.</th> <th colspan="2">Before</th> <th colspan="2">After</th> <th>voltage residue</th> <th>mass loss</th> <th rowspan="2">other event</th> </tr> <tr style="background-color: #ffff00;"> <th>OCV (V)</th> <th>Weight (g)</th> <th>OCV (V)</th> <th>Weight (g)</th> <th>Volt (%)</th> <th>Weight (%)</th> </tr> </thead> <tbody> <tr><td>1</td><td>8.254</td><td>242.94</td><td>8.205</td><td>242.92</td><td>99.41%</td><td>0.01%</td><td>O</td></tr> <tr><td>2</td><td>8.247</td><td>242.81</td><td>8.201</td><td>242.79</td><td>99.44%</td><td>0.01%</td><td>O</td></tr> <tr><td>3</td><td>8.295</td><td>242.74</td><td>8.250</td><td>242.72</td><td>99.46%</td><td>0.01%</td><td>O</td></tr> <tr><td>4</td><td>8.268</td><td>242.58</td><td>8.224</td><td>242.57</td><td>99.47%</td><td>0.01%</td><td>O</td></tr> <tr><td>5</td><td>8.027</td><td>242.57</td><td>7.996</td><td>242.55</td><td>99.61%</td><td>0.01%</td><td>O</td></tr> <tr><td>6</td><td>8.045</td><td>242.66</td><td>8.000</td><td>242.64</td><td>99.44%</td><td>0.01%</td><td>O</td></tr> <tr><td>7</td><td>8.072</td><td>242.53</td><td>8.024</td><td>242.51</td><td>99.41%</td><td>0.01%</td><td>O</td></tr> <tr><td>8</td><td>8.091</td><td>242.71</td><td>8.046</td><td>242.69</td><td>99.44%</td><td>0.01%</td><td>O</td></tr> </tbody> </table> <p>Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire</p>			Thermal Test on Charged Packs								No.	Before		After		voltage residue	mass loss	other event	OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	1	8.254	242.94	8.205	242.92	99.41%	0.01%	O	2	8.247	242.81	8.201	242.79	99.44%	0.01%	O	3	8.295	242.74	8.250	242.72	99.46%	0.01%	O	4	8.268	242.58	8.224	242.57	99.47%	0.01%	O	5	8.027	242.57	7.996	242.55	99.61%	0.01%	O	6	8.045	242.66	8.000	242.64	99.44%	0.01%	O	7	8.072	242.53	8.024	242.51	99.41%	0.01%	O	8	8.091	242.71	8.046	242.69	99.44%	0.01%	O
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Item	Test Item	Test specification	Judge criteria	Sample(s)				
T3	Vibration test (UN38.3-3)	3-1. Packs are firmly secured to the platform of the vibration machine without distorting the packs in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of 3 mutually perpendicular to the terminal face. 3-2. The logarithmic frequency sweep is as follows: 7-18 Hz → 1gn 18-50 Hz → 0.8mm amplitude 50-200 Hz → 8gn 3-3. All packs weight are measured. The charged packs voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)				
Test Period		Start: 2018/05/07	End: 2018/05/08					
Test Equipment		數位電表 Q153, 電子天平 Q090, 振動測試機 Q300						
Major Problem		-						
Warning Point		-						
Recommendation		The packs pass the test.						
Raw Data	Vibration Test on Charged Packs							
		Before		After		voltage residue	mass loss	other event
	No.	OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	
	1	8.205	242.92	8.198	242.90	99.91%	0.01%	O
	2	8.201	242.79	8.194	242.77	99.91%	0.01%	O
	3	8.250	242.72	8.242	242.71	99.90%	0.01%	O
	4	8.224	242.57	8.216	242.55	99.90%	0.01%	O
	5	7.996	242.55	7.988	242.53	99.90%	0.01%	O
	6	8.000	242.64	7.994	242.62	99.93%	0.01%	O
	7	8.024	242.51	8.015	242.48	99.89%	0.01%	O
8	8.046	242.69	8.039	242.67	99.91%	0.01%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)				
T4	Shock test (UN38.3-4)	4-1. Packs shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces. 4-2. Packs shall be subjected to a half-sine shock of peak acceleration 150gn and pulse duration of 6 milliseconds. Each pack shall be subjected to 3 shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicularly mounting positions of the pack for a total of 18 shocks. 4-3. All batteries weight are measured. The charged cell voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%.	4 packs are first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)				
Test Period	Start: 2018/05/09 End: 2018/05/09							
Test Equipment	數位電表 Q153, 電子天平 Q090, 衝擊測試機 Q154							
Major Problem	-							
Warning Point	-							
Recommendation	The packs pass the test.							
Raw Data	Shock Test on Charged Packs							
	No.	Before		After		voltage residue	mass loss	other event
		OCV (V)	Weight (g)	OCV (V)	Weight (g)	Volt (%)	Weight (%)	
	1	8.198	242.90	8.192	242.90	99.93%	0.00%	O
	2	8.194	242.77	8.189	242.76	99.94%	0.00%	O
	3	8.242	242.71	8.237	242.70	99.94%	0.00%	O
	4	8.216	242.55	8.210	242.54	99.93%	0.00%	O
	5	7.988	242.53	7.984	242.52	99.95%	0.00%	O
	6	7.994	242.62	7.987	242.61	99.91%	0.00%	O
	7	8.015	242.48	8.009	242.48	99.93%	0.00%	O
8	8.039	242.67	8.034	242.66	99.94%	0.00%	O	
Note: L-Leakage ; V-Venting ; D-Disassembly ; R-Rupture ; F-Fire								
O-No Leakage , No Venting , No Disassembly , No Rupture , No Fire								

Item	Test Item	Test specification	Judge criteria	Sample(s)			
T5	Short Circuit Test (UN38.3-5)	5-1.Packs are placed in to a (57±4) °C oven, and exterior packs temperature are monitored 5-2.When packs exterior reach (57±4)°C, they are shorted by connecting terminals with a copper wire of resistance less than 100m Ohm. 5-4. The short was continued for more than 1hour or the cell temperature return to 57°C. The packs are observed for a further 6 hours.	No rupture, no disassembly, no explosion, no fire, no smoke. Packs exterior peak temperature <170°C.	4 packs are first cycle in fully charged (Pack#1~4) 4 packs are 25 times cycled ending in fully charged state (Pack #5~8)			
Test Period		Start: 2018/05/11 End: 2018/05/13					
Test Equipment		數位電表 Q153, 資料收集器 Q075, 烘箱 Q171					
Recommendation		The packs pass the test.					
Raw Data		Short Circuit Test on Charged Packs					
		No.	Max. Temp.(°C)	Other event			
		1	56.34	O			
		2	56.18	O			
		3	55.75	O			
		4	54.81	O			
5	57.89	O					
6	55.49	O					
7	56.28	O					
8	55.94	O					
		Note: D-Disassembly ; R-Rupture ; F-Fire					
		O- No Disassembly , No Rupture , No Fire					
Item	Test Item	Test specification	Judge criteria	Sample(s)			
T6	Crush/Impact test (UN38.3-6)	6-1.Cell's diameter > 18mm, Execution impact test. (A 9.1 Kg mass is to be dropped from a height of (61±2.5)cm onto the sample.) 6-2.Cell's diameter < 18mm, Execution crush test (The cells are crushed with a 13 KN with the crush tester. Once the force is obtained it is to be released.)	External temperature of cell does not exceed 170°C and there is no disassembly and no fire within 6 hours of the test.	5 cells are first cycle in charged states to 50%. (Pack#1~5) 5 cells are after 25 cycles ending in charged states to 50%. (Pack #6~10)			
Test Period		Start: 2018/04/26 End: 2018/04/26					
Test Equipment		數位電表 Q153, 資料收集器 Q152, 擠壓試驗機 Q437/撞擊測試機 Q231					
Recommendation		The Cells pass the test.					
Raw Data		Crush Test on 50% Charged Cells					
		No.	Max. Temp.(°C)	Other event	No.	Max. Temp.(°C)	Other event
		1	20.34	O	6	20.48	O
		2	21.56	O	7	21.75	O
		3	21.48	O	8	20.56	O
		4	20.16	O	9	20.14	O
5	20.34	O	10	21.38	O		
		Note: D-Disassembly ; F-Fire / O-No Disassembly , No Fire					

Item	Test Item	Test specification	Judge criteria	Sample(s)	
T7	Overcharge test (UN38.3-7)	7-1. The charge current shall be twice the Spec's recommended maximum continuous charge current. 7-2. The minimum voltage of the test shall be as follows: (a) When the Spec's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V. (b) When the Spec's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. 7-3. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.	No disassembly, no fire within seven days of the test.	4 packs are first cycle in fully charged (Pack#9~12) 4 packs are 25 times cycled ending in fully charged state (Pack #13~16)	
Test Period	Start: 2018/05/04 End: 2018/05/07				
Test Equipment	數位電表 Q153, 資料收集器 Q078, 電源供應器 Q148/Q150/Q0236				
Major Problem	-				
Warning Point	-				
Recommendation	The packs pass the test.				
Raw Data	Overcharge Test on Charged Packs				
	No.	Charge Voltage(V)	Charge Current(A)	Max. Temp.(°C)	Other event
	9	17.4 V	7.5	20.46	O
	10			20.18	O
	11			21.59	O
	12			21.75	O
	13			21.36	O
	14			20.84	O
	15			20.59	O
	16			21.47	O
Note: D-Disassembly ; F-Fire / O-No Disassembly ,No Fire					

Item	Test Item	Test specification	Judge criteria	Sample(s)																																																																								
T8	Forced discharge test (UN38.3-8)	Cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current Specified by the manufacturer.	No disassembly, no fire within seven days after the test.	10 cells are first cycle in fully discharged states (Pack#11~20) 10 cells are after 25 cycles ending in fully discharged states (Pack #21~30)																																																																								
Test Period		Start: 2018/05/09 End: 2018/05/10																																																																										
Test Equipment		數位電表 Q153, 資料收集器 Q160, 電源供應器 Q0474/Q0475/Q0476																																																																										
Major Problem		-																																																																										
Warning Point		-																																																																										
Recommendation		The packs pass the test.																																																																										
Raw Data		<table border="1"> <thead> <tr> <th colspan="3">Forced discharge are first cycle in fully discharged</th> <th colspan="3">Forced discharge are after 50 cycles ending in fully discharged</th> </tr> <tr> <th>No.</th> <th>Max. Temp.(°C)</th> <th>Other event</th> <th>No.</th> <th>Max. Temp.(°C)</th> <th>Other event</th> </tr> </thead> <tbody> <tr><td>11</td><td>51.26</td><td>O</td><td>21</td><td>49.86</td><td>O</td></tr> <tr><td>12</td><td>54.26</td><td>O</td><td>22</td><td>52.16</td><td>O</td></tr> <tr><td>13</td><td>49.86</td><td>O</td><td>23</td><td>53.49</td><td>O</td></tr> <tr><td>14</td><td>48.59</td><td>O</td><td>24</td><td>51.78</td><td>O</td></tr> <tr><td>15</td><td>47.56</td><td>O</td><td>25</td><td>56.48</td><td>O</td></tr> <tr><td>16</td><td>53.26</td><td>O</td><td>26</td><td>54.76</td><td>O</td></tr> <tr><td>17</td><td>52.15</td><td>O</td><td>27</td><td>51.59</td><td>O</td></tr> <tr><td>18</td><td>56.58</td><td>O</td><td>28</td><td>48.53</td><td>O</td></tr> <tr><td>19</td><td>51.49</td><td>O</td><td>29</td><td>51.26</td><td>O</td></tr> <tr><td>20</td><td>49.57</td><td>O</td><td>30</td><td>52.47</td><td>O</td></tr> </tbody> </table>			Forced discharge are first cycle in fully discharged			Forced discharge are after 50 cycles ending in fully discharged			No.	Max. Temp.(°C)	Other event	No.	Max. Temp.(°C)	Other event	11	51.26	O	21	49.86	O	12	54.26	O	22	52.16	O	13	49.86	O	23	53.49	O	14	48.59	O	24	51.78	O	15	47.56	O	25	56.48	O	16	53.26	O	26	54.76	O	17	52.15	O	27	51.59	O	18	56.58	O	28	48.53	O	19	51.49	O	29	51.26	O	20	49.57	O	30	52.47	O
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		No.	Max. Temp.(°C)	Other event	No.	Max. Temp.(°C)	Other event																																																																					
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		13	49.86	O	23	53.49	O																																																																					
		14	48.59	O	24	51.78	O																																																																					
		15	47.56	O	25	56.48	O																																																																					
		16	53.26	O	26	54.76	O																																																																					
		17	52.15	O	27	51.59	O																																																																					
		18	56.58	O	28	48.53	O																																																																					
		19	51.49	O	29	51.26	O																																																																					
		20	49.57	O	30	52.47	O																																																																					