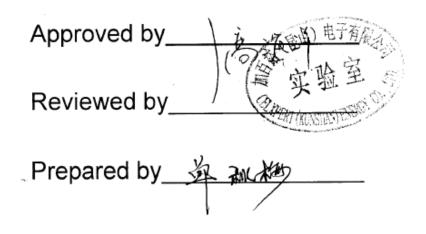


# Battery Pack Test Report UN38.3

Customer: Lenovo Pack Model: L15C3A01 Nominal voltage: 10.8V Nominal capacity: 24Wh Configuration: 3S1P Customer P/N: 5B10L04161 Celxpert P/N: 921300079 Cell Type: LG INR18650S3 2200mAh Jan. 24 . 2018

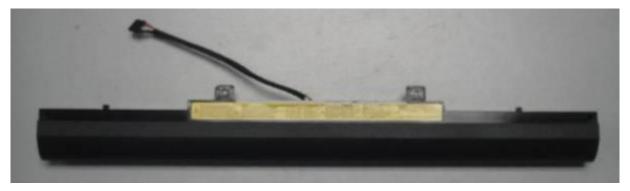




#### Figure photo of the pack

Lenovo

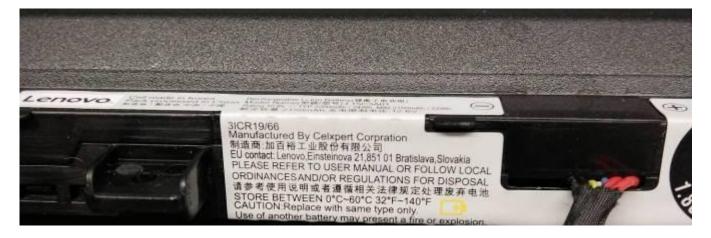




Cell made in Korea Pack processed in China 制造地 / 製造地:中国 / 中國

Rechargeable Li-Ion Battery(锂离子电池组) Model Name(型號/型号):L15C3A01 Rating:10.8V --- TYP 2200mAh / 24Wh MIN 2150mAh / 22Wh 额定容量:2150mAh,充电限制电压:12.6V







1. UN38.3 Test Report										
Test Period	2015/12/15~2	2016/01/12	Test Spec.	ST/SG/AC.10/11/Rev.5 Amend.2						
Parts Name	Battery Pack Application		NB	Quantity	Pack 16PCS/Cell 25pcs					

#### 1.1 Test Summary

Item	Test Item	Test Result	Details
T1	Altitude simulation test (UN38.3-1)	Pass	Page 9
T2	Thermal test (UN38.3-2)	Pass	Page 10
Т3	Vibration test (UN38.3-3)	Pass	Page 11
T4	Shock test (UN38.3-4)	Pass	Page 12
T5	Short Circuit test (UN38.3-5)	Pass	Page 13
Т6	Crush Test (UN38.3-6)	Pass	Page 13
T7	Overcharge test (UN38.3-7)	Pass	Page 14
T8	Forced discharge test (UN38.3-8)	Pass	Page 15

The battery pack passes UN38.3 test.

Cel>(pert Energy Corporation

## 1.2 Test sample list

No.	Pack S/N	Test item	No.	Cell Num.	Test item
1	Sample No:1/16	38.3.1~5	1	LG INR18650 S3 2200mAh	38.3.6
2	Sample No:2/16	38.3.1~5	2	LG INR18650 S3 2200mAh	38.3.6
3	Sample No:3/16	38.3.1~5	3	LG INR18650 S3 2200mAh	38.3.6
4	Sample No:4/16	38.3.1~5	4	LG INR18650 S3 2200mAh	38.3.6
5	Sample No:5/16	38.3.1~5	5	LG INR18650 S3 2200mAh	38.3.6
6	Sample No:6/16	38.3.1~5	6	LG INR18650 S3 2200mAh	38.3.8
7	Sample No:7/16	38.3.1~5	7	LG INR18650 S3 2200mAh	38.3.8
8	Sample No:8/16	38.3.1~5	8	LG INR18650 S3 2200mAh	38.3.8
9	Sample No:9/16	38.3.7	9	LG INR18650 S3 2200mAh	38.3.8
10	Sample No:10/16	38.3.7	10	LG INR18650 S3 2200mAh	38.3.8
11	Sample No:11/16	38.3.7	11	LG INR18650 S3 2200mAh	38.3.8
12	Sample No:12/16	38.3.7	12	LG INR18650 S3 2200mAh	38.3.8
13	Sample No:13/16	38.3.7	13	LG INR18650 S3 2200mAh	38.3.8
14	Sample No:14/16	38.3.7	14	LG INR18650 S3 2200mAh	38.3.8
15	Sample No:15/16	38.3.7	15	LG INR18650 S3 2200mAh	38.3.8
16	Sample No:16/16	38.3.7	16	LG INR18650 S3 2200mAh	38.3.8
			17	LG INR18650 S3 2200mAh	38.3.8
			18	LG INR18650 S3 2200mAh	38.3.8
			19	LG INR18650 S3 2200mAh	38.3.8
			20	LG INR18650 S3 2200mAh	38.3.8
			21	LG INR18650 S3 2200mAh	38.3.8
			22	LG INR18650 S3 2200mAh	38.3.8
			23	LG INR18650 S3 2200mAh	38.3.8
			24	LG INR18650 S3 2200mAh	38.3.8
			25	LG INR18650 S3 2200mAh	38.3.8



#### 1.3 Test result

Item	Test Item		Те	est specificatio	n	Judé	ge criteria	Samp	Sample(s)		
T1	Altitude Simulation (UN38.3-1)	له و له 1-2.E ۲ ۲-3.V ۲-3.V	eatteries ar ending in fu batteries we charged ba neasured a Batteries sh of 11.6Kpa nours at an C. /acuum is neasured.	or less for a nbient tempe released. All	50 times, state. All sured. The ge are d. d at a pressure t least six erature 20+/-5 cells weight is d cell voltage	no leakag no disass rupture ar Battery vo 10%.	loss (<0.1%), je, no venting, embly, no nd no fire. bltage drop <	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)			
Test Per	iod		:: 2015/12		End:2015/	/12/15					
Test Equ					P Q090, 真空		6				
•			电仪仪门	0, 电丁八7	1 2000, 兵主	· / / 14					
Major Pr											
Warning		-	1 44								
Recomm	nendation	The	battery p	backs pass	s the test.						
					Altitude Simulatio	on Test on Cl	narged Packs		I		
			Be	efore	Afte	r	voltage residue	mass loss			
		No	OCV	Weight	OCV	Weight	Volt	Weight	other event		
			(V)	(g)	(V)	(g)	(%)	(%)			
		1	12.523	171.26	12.493	171.25	99.76%	0.00%	0		
		23	12.520	171.13 171.09	12.519 12.520	171.12 171.08	99.99% 99.99%	0.00%	0		
		4	12.521	171.02	12.520	171.21	99.98%	0.00%	0		
		5	12.532	170.73	12.530	170.72	99.98%	0.01%	0		
		6	12.531	170.46	12.528	170.45	99.98%	0.01%	0		
		7	12.535	170.84	12.534	170.83	99.99%	0.01%	0		
		8	12.528	170.92	12.524	170.91	99.97%	0.01%	0		
Rav	w Data		-		sembly ; R-Rupture Disassembly , No F		3				



Item	Test Item		Te	st specification			Juc	dge criteria		Sampl	e(s)
nom	1001110111	2-1		ored for 6 hour				s loss (<0.1%),	4 n		
T2	Thermal test (UN38.3-2)	f - 2-2.R F	ollowed by s The maximur temperatur Repeat 2-1 fo packs at amb weight are m	torage for 6 ho m time interval re extremes is r 10 times. The vient for 24 hou	nours at -40±2°C . no lea al between test no dia s 30 minutes. ruptu Batte hen store the 10%. purs. All packs charged battery			no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop <		4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)	
Test Per	iod	Star	t: 2015/12	/16	End:2015	5/12/	/22				
Test Equ	lipment	數位	電表 Q15	3, 電子天平	Q090. 冷	執種	魣墼機	Q336			
Major Pr		-		-,		/	1 - 1 - 1 - 1				
-		-									
Warning			nacke ne	iss the test							
Recomm	nendation	The	packs pa		•						
							on Char	ged Packs			
		No.		efore		fter		voltage residue	•	mass loss	other event
		NO.	OCV	Weight	OCV		eight	Volt		Weight	
		1	(V) 12.493	(g) 171.25	(V) 12.424		(g) /1.20	<mark>(%)</mark> 99.45%		(%) 0.03%	0
		2	12.519	171.12	12.443		1.05	99.39%		0.04%	0
		3	12.520	171.08	12.445	17	1.01	99.40%		0.04%	0
		4	12.519	171.21	12.445		1.16	99.41%		0.03%	0
		5	12.530	170.72	12.459		0.68	99.43%		0.02%	0
		6	12.528	170.45	12.453		0.38	99.40%		0.04%	0
		7 8	12.534 12.524	170.83 170.91	12.466 12.449		0.79 0.85	99.46%		0.03%	0
				/enting ; D-Disass				· · · · · · · · · · · · · · · · · · ·		0.0170	
			-	No Venting , No I				Fire			
Rav	w Data										



Item	Test Item	Test specification Judge crite				eria	S	ample(s)			
T3	Vibration test (UN38.3-3)	v م الأ 3-2. آ ع-3. 4	ibration mad manner as ibration sha ogarithmic s Hz traverse epeated 12 nutually perp The logarith 7-18 Hz → 18-50 Hz → 50-200 Hz →	0.8mm a	no o fire. ge	charged	states				
Test Per	iod	Sta	rt: 2015/1	2/24	End:2	2015/12/2	5	I			
Test Equ	uipment	數位	雷表 Q15	3, 電子天	平 Q090.	振動測試	機 Q	300			
Major Pi		- -		-, 21/	, 2000,	++74 +/14 UM					
		_									
Warning			n a al ca m								
Kecomn	nendation	ine	packs p	ass the te	<del>.</del>						
		No.				age residue Volt	W	ss loss eight	other event		
		1	(V) 12.424	<mark>(g)</mark> 171.20	(V) 12.417	(g) 171.17		<mark>(%)</mark> 99.94%		<mark>%)</mark> 02%	0
		2	12.443	171.05	12.417	171.03		99.94%		01%	0
		3	12.445	171.01	12.437	170.99		99.94%	0.02%		0
		4	12.445	171.16	12.437	171.14		99.94%	0.01%		0
		5	12.459	170.68	12.451	170.66		99.94%	0.	01%	0
		6	12.453	170.38	12.447	170.35		99.95%		02%	0
		7	12.466	170.79	12.457	170.76		99.93%		02%	0
		8	12.449	170.85	12.442	170.82		99.94%	0.	01%	0
				Venting ; D-Dis		•		·0			
Ra	w Data		U-INO Leakage	e , No Venting , I	Disassemb	ay , No Rupture	H, INO FI	e			



Tost Itom	Test specification						Son	Sample(s)		
Test Item	<u>4-1</u>				nachine	-				
Shock test (UN38.3-4)	b 4-2. F c c t t t 4-3. A c	y means of II mounting Packs shall I of peak acce of 6 millisecc o 3 shocks i hree shocks nutually per he pack for All batteries charged cell	, charged (P 4 packs 50 ending in f	charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)						
od	Star	t: 2015/12	/30	End:201	5/12/30					
ipment	數位	電表 Q15	3, 電子天	平 Q090, 徸	5擊測註	式機 Q154				
oblem	-									
	-									
	The	packs pa	ass the te	est.						
				Shock	Test on C	harged Packs				
		Bet	fore				massloss			
	No.							other event		
							-			
	1	12.417	171.17	12.411			0.00%	0		
	2	12.436	171.03	12.431	171.0	2 99.96%	0.00%	0		
	3	12.437	170.99	12.432			0.00%	0		
								0		
								0		
								0		
	8	12.442	170.82	12.437			0.00%	0		
v Data										
		Shock test (UN38.3-4)       4-1. F         Shock test (UN38.3-4)       4-2. F         iod       Start         iod       Start         ipment       數位         oblem       -         Point       -         nendation       The         1       2         3       4         5       6         7       8	4-1. Packs shall by means of all mounting         4-2. Packs shall of peak access of 6 millisect to 3 shocks in three shocks mutually per the pack for         4-3. All batteries charged cell recorded.         iod       Start: 2015/12         ipment       數位電表Q15         oblem       -         Point       -         nendation       The packs part         No.       0CV (V)         1       12.417         2       12.436         3       12.437         4       12.437         5       12.451         6       12.447         7       12.457         8       12.442	4-1. Packs shall be secured to by means of a rigid mourall mounting surfaces.         4-2. Packs shall be subjected of peak acceleration 150 of 6 milliseconds. Each pto 3 shocks in the positive three shocks in the negamutually perpendicularly the pack for a total of 18         4-3. All batteries weight are no charged cell voltage are recorded.         iod       Start: 2015/12/30         ipment       數位電表Q153,電子天         oblem       -         Point       -         nendation       The packs pass the term         No.       OCV         V(y)       (g)         1       12.417         12.437       171.14         5       12.437         12.437       170.99         4       12.437       170.76         8       12.442       170.82	4-1. Packs shall be secured to the testing r         by means of a rigid mount, which will s         all mounting surfaces.         4-2. Packs shall be subjected to a half-sine         of peak acceleration 150gn and pulse of 6 milliseconds. Each pack shall be s         to 3 shocks in the positive direction of 0         three shocks in the negative direction of mutually perpendicularly mounting post the pack for a total of 18 shocks.         4-3. All batteries weight are measured. The charged cell voltage are measured and recorded.         iod       Start: 2015/12/30       End:2019         ipment       數位電表Q153, 電子天平Q090, 很         oblem       -         Point       -         nendation       The packs pass the test.         Image: Shock in the pack in the positive direction of mutually perpendicularly mounting positive direction of mutualy perpendicularly mounting positive direction	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.           iod         Start: 2015/12/30           End:2015/12/30         End:2015/12/30           ippment         數位電表 Q153, 電子天平 Q090, 衝擊測試 oblem           Point         -           Point         -           No.         Before           V(v)         (g)           1         12.417           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1         12.437           1	4-1. Packs shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces.       No mass loss (<0.1%), no leakage, no venting no disassembly, no eakage, no venting no disassembly, no rupture and no fire.         Shock test (UN38.3-4)       -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.       10%.         4-3. All batteries weight are measured. The charged cell voltage are measured and recorded.       The charged cell voltage are measured and recorded.         ipment <u>b</u> 位 電表 Q153, 電子天平 Q090, 衝擊測試機 Q154         oblem       -         Point       -         Point       -         No. <u>Shock Test on Charged Packs</u> <u>Voltage residue</u> <u>Voltage residue</u> <u>Voltage (%)</u> <u>Voltage (%)</u> <u>1 12.417 171.17 12.411 171.16 99.95%</u> <u>2 12.436 171.03 12.431 171.02 99.96%</u> <u>3 12.437 170.49 12.432 170.98 99.96%</u> <u>4 12.437 171.14 12.431 171.13 99.95%</u> <u>5 12.451 170.66 12.447 170.85 99.97%</u> <u>6 12.447 170.35 12.440 170.35 99.94%</u> <u>7 12.457 170.76 12.451 170.75 99.95%</u> <u>8 12.442 170.82 12.437 170.82 99.96%</u>	4-1. Packs shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces.         No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire.         4 packs sar charged (P 4 packs 50 ending in fi states (UN38.3-4)           Shock test (UN38.3-4)         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.         10%.         10%.         10%.           iod         Start: 2015/12/30         End:2015/12/30         10%.         10%.         10%.           ipment         数位電表 Q153, 電子天平 Q090, 街琴測試機 Q154         00lem         -         -           Point         -         -         -         -         -           No.         Before         After         voltage residue         mass loss           No.         OCV         Weight         Volt         Weight           v(V)         (g)         (V)         (g)         (%)         (%)           ipment         \$         Shock Test on Charged Packs         mass loss           voltage residue         mass loss         -         -         -           1         12.417         171.17		



ltom	Toot Itom	Test specification Judge criteria Sample(s)								
Item	Test Item	5-1 Pac	Test specification ks are placed in to a 55±2°C	oven and		pture, no		Sample(s)		
Т5	Short Circuit Test (UN38.3-5)	ext 5-2.Wh sho wir 5-4. Tho or t	erior packs temperature are en packs exterior reach $55\pm2$ orted by connecting terminals e of resistance less than 100 e short was continued for mo- he cell temperature return to cks are observed for a furthe	monitored $2^{\circ}C$ , they are s with a copper om Ohm. ore than 1hour $0.55^{\circ}C$ . The	disassembly, no explosion, no fire, no smoke. Packs exterior peak			icks are standard ged (Pack#1~4) icks 50 cycled ending Ily charged states ck#5~8)		
Test Per	iod	Start	2016/01/08 E		I					
Test Equ	uipment		表 Q153, 資料收集器(							
Recomm	nendation	The p	acks pass the test.							
			Short Circuit Test on (	Charged Pacl	KS					
		No.	Max. Temp.(°C)	Other ev	/ent					
		1	55.45	0						
		2	55.38	0						
		3	55.49	Ο						
De	Dete	4	55.61	О						
Ra	Raw Data		55.95	0						
	6	55.68	0							
		7	55.77	0						
		8	55.86	0						
		Note:	D-Disassembly ; R-Ruptur	e;F-Fire						
		O- No Disassembly , No Rupture , No Fire								
Item	Test Item		Test specification	n		Judge		Sample(s)		
Т6	Crush test/ Impact test (UN38.3-6)	(A 9.1 k 61±2.50 6-2.Cel (The ce	I's diameter > 20mm, Execut Kg mass is to be dropped fro cm onto the sample.) I's diameter < 20mm, Execut Ils are crushed with a 13 KN Once the force is obtained i	m a height of tion crush test I with the crush	c 1 d w te	External tem cell does no 70°C and t lisassemb ly vithin 6 hou est.	t exceed here is no y and no fi	charged (Cell #1~5)		
Test Per	iod	Start:	2015/12/23 E	nd: 2015/12/2	23					
Test Equ	uipment	-	表 Q153, 資料收集器			Q437/撞	擊測試檢	₹ Q231		
Recomm	nendation	The C	Cells pass the test.				1			
			Impact/Cursh Test on	50% Charge	ed Ce	lls				
		No.	Max. Temp.(°C)	Oth	ier ev	/ent				
		1	25.5		0					
_		2	25.1		0					
Rav	w Data	3	25.4		0					
		4	24.7		0					
		5	25.0		0					
		Note:	D-Disassembly ; F-Fire /	O-No Disasse	mbly	No Fire				
		14040.1	5 5154666611151 <b>y</b> , 1 1116 7							



	corporation											
Item	Test Item		Те	st specification		Judge criteria	Sample(s)					
77	Overcharge test (UN38.3-7)	rec 7-2.The (a) W mc the ba (b) W (b) W tha tim 7-3. Tes	<ul> <li>-1. The charge current shall be twice the Spec's recommended maximum continuous charge current.</li> <li>-2. The minimum voltage of the test shall be as follows: <ul> <li>(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 test shall be than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.</li> <li>-3. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.</li> </ul> </li> <li>No disassembly, a packs ar charged (Pack#9~1) and fire within seven days after the test.</li> <li>A packs ar times cycle ending in fire within 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.</li> <li>-3. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.</li> </ul>									
Test Per	iod	Start:										
Test Equ	uipment	數位電	【表 Q153, 資	料收集器 Q078	, 電源供應器 Q	148/Q149/Q15	0					
Major Pi		-										
Warning		-										
Recomn	nendation	The p	acks pass the	e test.								
			Overcharge Test on Charged Packs           N         Charge         Charge         Offense         Offense									
		No.	Voltage(V)	Current(A)	Max. Temp.(°	C) Other	event					
		9			26.22		0					
		10	22.0 V	2.15A	25.63		0					
		11 12			26.03 25.37		0					
		12			25.73		0					
		14			25.87		0					
		15			27.01		0					
		16			25.96		0					
Rav	w Data	Note:	D-Disassemb	ly ; F-Fire / O	No Disassembly	y ,No Fire						



Item	Test Item			Test specification			Judge criteria	Sample(s)				
Т8	-	conne initial	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. Specified by the manufacturer. No disassembly, no fire within seven days after the test. No disassembly, no fire within seven days after the test. No disassembly, no fire within seven days after the test. No disassembly, no fire within seven days after the test. (Pack#6~15) 10 cells are after 5 cycles ending in fully discharged states (Pack #16~25)									
Test Per	iod	Start	: 2015/12/24	End:2015/	/12/25	;		, , , , , , , , , , , , , , , , , , ,				
Test Equ	lipment	數位	電表 Q153.	資料收集器 Q160,	電源	供應器Q	147/Q236/Q	237				
Major Pr		-				////G 10 -						
Warning		-										
	nendation	The	packs pass	the test.								
			1									
		Ford	ed discharge are fi	rst cycle in fully discharged	Forced	d discharge a	re after 50 cycles	ending in fully discharged				
		No.	Max. Temp.(°C)	Other event	No.	Max. Ten	np.(°C)	Other event				
		6	74.71	0	16	70.8		0				
		7	76.00	0	17	71.29		0				
		8 9	70.51 69.30	0	18	50.6 60.9		0				
		9 10	69.30	0	19 20	55.1		0				
		11	49.10	0	21	50.3		0				
		12	59.41	0	22	47.6	0	0				
		13	56.35	0	23	46.0	1	0				
		14	72.58	0	24	46.9		0				
		15	61.11	0	25	58.4	1	0				
Ra	w Data	Note:D	-Disassembly ; F-Fir	re / O-No Disassembly , No Fi	ire							