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Certificate of Compliance

Company Name	Excell Battery Compnay
Company Address	#133, 18525 53rd Avenue
Company City, State, Country, Postal Code	Surrey, BC, ,V3S 7A4
Contact Name	Julian Pereira
Contact Email	jpereira@excellbattery.com
Contact Phone Number	604-575-5011 x261
Product Name(s)	Rechargeable Lithium Ion Battery Pack
Product Part Number(s)	2EXL7540 or 28000
Nominal Voltage (V)	7.2
Rated Capacity (mAh)	6000
Product Type	Battery Pack, Secondary, Small
Test Standard	UN38.3, UN Manual of Tests and Criteria, 6th Revised Edition, Effective December 2015
Overall Test Result	COMPLIANT

Component Test Results

Altitude (T.1)	Compliant
Thermal (T.2)	Compliant
Vibration (T.3)	Compliant
Shock (T.4)	Compliant
External Short Circuit (T.5)	Compliant
Overcharge (T.7)	Compliant

**Note: Tests T.6 (Impact/Crush) and T.8 (Forced Discharge) are applicable to cell-level testing only.*

Release Approved By

Name Cynthia Millsaps, President and CEO
Date 2/7/2019

Test Standard: UN38.3, UN Manual of Tests and Criteria, 6th Revised Edition,
Effective December 2015



UN 38.3 Report - Small, Secondary, Battery Packs

PROJECT NUMBER EA2903
DATE OF REPORT 2/7/2019
STATUS Compliant
DATE SAMPLES RECEIVED 11/16/2018

Laboratory Address: Energy Assurance, LLC
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Company Name: Excell Battery Compnay
Company Address: #133, 18525 53rd Avenue
Company City, State, Country, Postal Code: Surrey, BC, ,V3S 7A4
Product Name(s): Rechargeable Lithium Ion Battery Pack
Product Part Number(s): 2EXL7540 or 28000

Nominal Voltage (V)	7.200	43 Wh	Projected 50X Duration
Rated Capacity (mAh)	6000		14 days
Charge Current for 50X cycling - CC mode (mA)	2000	[0.33C]	
Maximum Continuous Charge Current (mA)	3000		
Normal Charge Voltage (V)	8.300		
Maximum Charge Voltage (V)	8.300		
End of Charge Current - CV mode (mA)	200	[0.03C]	
Discharge Current for 50X Cycling (mA)	2250	[0.38C]	
Maximum Specified Discharge Current (mA)	5800		
End of Discharge Voltage (V)	6.000		

Nominal Mass of Battery (grams): 208
Mass Loss Critical Threshold (Lookup): 0.001
Small or Large Battery (Lookup): Small
Mass Precision (Calculated Digits): 3

Sample Numbering Legend: F Fresh (cycle 1); fully charged
C Cycled (cycle 50); fully charged
S (Spare)

V-Check Criteria

Post Test Voltage ≥ 90% Pre-Test Voltage

M-Check Criteria

Mass (M) of cell or	Mass loss limit
M<1g	0.5%
1g≤M≤75g	0.2%
M>75g	0.1%

Report Summary Comments

Samples tested demonstrated compliance to the referenced standard.

General notes regarding this report: Test results relate only to the items tested. Energy Assurance reserves the right to use approved partner laboratories in the delivery of services. This is denoted below by a "Y" in the OS field of each test section below. This report shall not be reproduced except in full without the approval of Energy Assurance, LLC.

Revision History

Rev	Date	Comments
1	2/7/2019	Initial issue

Reviewed & Released By:

Cynthia Millsaps

Name: Cynthia Millsaps, President and CEO
Date: 2/7/2019

Product Photo:



Altitude Simulation (T.1)

Test Procedure: Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5° C).

Date (Test Start)	1/23/2019	OS	N
Date (Test Finish)	1/24/2019	Tech	JG
Test Ambient (°C)	20.0		
Model Tested	2EXL7540 or 28000	Rated Capacity (mAh)	6000

Test Step Notes (T.1) None

	Pre-Test Voltage (Vdc)	Pre-Test Mass (g)	Post-Test Voltage (Vdc)	Post-Test Mass (g)	V-Ck	M-Ck	Observations (Y/N) - Presence is a failure					Comments
							Leakage	Venting	Dis-Assy	Rupture	Fire	
C1	8.25	207.633	8.24	207.626	Pass	Pass	N	N	N	N	N	None
C2	8.26	207.651	8.26	207.642	Pass	Pass	N	N	N	N	N	None
C3	8.25	207.664	8.25	207.656	Pass	Pass	N	N	N	N	N	None
C4	8.25	207.685	8.25	207.676	Pass	Pass	N	N	N	N	N	None
F1	8.27	207.879	8.24	207.869	Pass	Pass	N	N	N	N	N	None
F2	8.26	207.620	8.24	207.614	Pass	Pass	N	N	N	N	N	None
F3	8.27	208.127	8.24	208.117	Pass	Pass	N	N	N	N	N	None
F4	8.26	207.400	8.24	207.391	Pass	Pass	N	N	N	N	N	None
S1					No Data	No Data						Spare1
S2					No Data	No Data						Spare2

Measurement Equipment Information (Calibration details available upon request)

DMM	HP34401A, S/N MY45004881
Scale	Ohaus AV313CU (0-300g), S/N 8031501103
Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 15
Timer	Accurite Timer, S/N 2312
Vacuum Gauge	Wika 0-30IN-HG, S/N PG-02

Thermal Test (T.2) --- Note: Battery size is Small

Test Procedure: *Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2° C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2° C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5° C). For large cells and batteries, the duration of exposure to the test temperature should be at least 12 hours.*

Date (Test Start)	1/24/2019	OS	N
Date (Test Finish)	1/30/2019	Tech	JG
Model Tested	2EXL7540 or 28000	Rated Capacity (mAh)	6000

Test Step Notes (T.2) None

	Pre-Test Voltage (Vdc)	Pre-Test Mass (g)	Post-Test Voltage (Vdc)	Post-Test Mass (g)	V-Ck	M-Ck	Observations (Y/N) - Presence is a failure					Comments
							Leakage	Venting	Dis-Assy	Rupture	Fire	
C1	8.24	207.626	8.16	207.613	Pass	Pass	N	N	N	N	N	None
C2	8.26	207.642	8.17	207.628	Pass	Pass	N	N	N	N	N	None
C3	8.25	207.656	8.16	207.644	Pass	Pass	N	N	N	N	N	None
C4	8.25	207.676	8.16	207.668	Pass	Pass	N	N	N	N	N	None
F1	8.24	207.869	8.16	207.854	Pass	Pass	N	N	N	N	N	None
F2	8.24	207.614	8.16	207.595	Pass	Pass	N	N	N	N	N	None
F3	8.24	208.117	8.16	208.101	Pass	Pass	N	N	N	N	N	None
F4	8.24	207.391	8.16	207.377	Pass	Pass	N	N	N	N	N	None
S1					No Data	No Data						Spare1
S2					No Data	No Data						Spare2

Measurement Equipment Information (Calibration details available upon request)

DMM	HP34401A, S/N MY45004881
Scale	Ohaus AV313CU (0-300g), S/N 8031501103
Temperature Chamber	Test Equity 1007H, S/N 61593

Vibration (T.3) --- Note: Battery size is Small

Test Procedure: Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz 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 three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency is increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency is increased until a peak acceleration of 2 g_n occurs (approximately 25 Hz). A peak acceleration of 2 g_n is then maintained until the frequency is increased to 200 Hz.

Date (Test Start)	2/1/2019	OS	N
Date (Test Finish)	2/4/2019	Tech	JG
Test Ambient(°C)	20.5		
Model Tested	2EXL7540 or 28000	Rated Capacity (mAh)	6000

Test Step Notes (T.3) None

	Pre-Test Voltage (Vdc)	Pre-Test Mass (g)	Post-Test Voltage (Vdc)	Post-Test Mass (g)	V-Ck	M-Ck	Observations (Y/N) - Presence is a failure					Comments
							Leakage	Venting	Dis-Assy	Rupture	Fire	
C1	8.16	207.613	8.16	207.640	Pass	Pass	N	N	N	N	N	None
C2	8.17	207.628	8.16	207.657	Pass	Pass	N	N	N	N	N	None
C3	8.16	207.644	8.16	207.673	Pass	Pass	N	N	N	N	N	None
C4	8.16	207.668	8.16	207.696	Pass	Pass	N	N	N	N	N	None
F1	8.16	207.854	8.15	207.882	Pass	Pass	N	N	N	N	N	None
F2	8.16	207.595	8.15	207.623	Pass	Pass	N	N	N	N	N	None
F3	8.16	208.101	8.15	208.128	Pass	Pass	N	N	N	N	N	None
F4	8.16	207.377	8.15	207.402	Pass	Pass	N	N	N	N	N	None
S1					No Data	No Data						Spare1
S2					No Data	No Data						Spare2

Measurement Equipment Information (Calibration details available upon request)

DMM	HP34401A, S/N MY45004881
Scale	Ohaus AV313CU (0-300g), S/N 8031501103
Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 13
Vibration Controller	Vibration Research VR9500, S/N 950C75B4
ICP Accelerometer	PCB Piezotronics 352C03 (10mV/G), S/N LW136337

Shock (T.4) --- Note: Battery size is Small

Test Procedure:

Cells and batteries are firmly secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 g_n and a pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g_n and a pulse duration of 11 milliseconds.

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

Small batteries: 150 g_n or result of formula, whichever is smaller

$$Acceleration (g_n) = \sqrt{((100850 / (\text{mass in kg})))}$$

Large batteries: 50 g_n or result of formula, whichever is smaller

$$Acceleration (g_n) = \sqrt{((30000 / (\text{mass in kg})))}$$

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

NOTE: IEC Standard 60086-2-27 (Fourth Edition 2008-02): Environmental testing-Part 2-27: Tests - Ea and guidance: Shock provides guidance on tolerance for acceleration and pulse duration.

Date (Test Start)	2/4/2019
Date (Test Finish)	2/5/2019
Test Ambient (°C)	20.5
Model Tested	2EXL7540 or 28000

OS	N
Tech	JG
Rated Capacity (mAh)	6000

Calculated Required Peak Acceleration (g _n)	150
Calculated Required Pulse Width (ms)	6

Test Step Notes (T.4)

None

	Pre-Test Voltage (Vdc)	Pre-Test Mass (g)	Post-Test Voltage (Vdc)	Post-Test Mass (g)	V-Ck	M-Ck	Observations (Y/N) - Presence is a failure					Comments
							Leakage	Venting	Dis-Assy	Rupture	Fire	
C1	8.16	207.640	8.15	207.658	Pass	Pass	N	N	N	N	N	None
C2	8.16	207.657	8.16	207.671	Pass	Pass	N	N	N	N	N	None
C3	8.16	207.673	8.15	207.687	Pass	Pass	N	N	N	N	N	None
C4	8.16	207.696	8.15	207.709	Pass	Pass	N	N	N	N	N	None
F1	8.15	207.882	8.15	207.894	Pass	Pass	N	N	N	N	N	None
F2	8.15	207.623	8.15	207.639	Pass	Pass	N	N	N	N	N	None
F3	8.15	208.128	8.15	208.145	Pass	Pass	N	N	N	N	N	None
F4	8.15	207.402	8.15	207.417	Pass	Pass	N	N	N	N	N	None
S1					No Data	No Data						Spare1
S2					No Data	No Data						Spare2

Measurement Equipment Information (Calibration details available upon request)

DMM	HP34401A, S/N MY45004881
Scale	Ohaus AV313CU (0-300g), S/N 8031501103
Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 13
Signal Conditioner	PCB Piezotronics 4-Channel 482A22, S/N 772
ICP Shock Sensor	PCB Piezotronics 350A14, S/N 40088
Oscilloscope	Atten ADS 1102CAL, S/N ADS00003110272

External Short Circuit (T.5)

Test Procedure:

The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.

Date (Test Start)	2/7/2019	OS	N
Date (Test Finish)	2/7/2019	Tech	JG
Chamber Ambient Temp at Start of Test (°C)	55.0		
Model Tested	2EXL7540 or 28000	Rated Capacity (mAh)	6000

Test Step Notes (T.5)

None

Observations (Y/N) - Presence is a failure.

**For Dis-Assy, Rupture, & Fire, observation period is test completion + 6 hours.*

	MaxTemp	Observations (Y/N)			Short-Circuit System		Comments	
	°C	T>170°C	Dis-Assy	Rupture	Fire	Ch#		mΩ
C1	56.2	Pass	N	N	N	BB-2	73	None
C2	56.8	Pass	N	N	N	BB-3	72	None
C3	56.9	Pass	N	N	N	BB-4	82	None
C4	55.8	Pass	N	N	N	BB-5	72	None
F1	56.0	Pass	N	N	N	BB-2	73	None
F2	56.6	Pass	N	N	N	BB-3	72	None
F3	56.7	Pass	N	N	N	BB-4	82	None
F4	55.5	Pass	N	N	N	BB-5	72	None
S1		No Data						Spare1
S2		No Data						Spare2

Measurement Equipment Information (Calibration details available upon request)

Impedance Meter	ESI Model 253, S/N L2030988253
Datalogger	HP34970A, S/N MY44028320
Short Circuit System	Short-Circuit Test Apparatus, HOTBOX2-BB

< For short-circuit resistance verification

Overcharge (T.7)

Test Procedure:

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

(a) when the manufacturer'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 manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

Date (Test Start)	1/24/2019	OS	N
Date (Test Finish)	2/1/2019	Tech	
Model Tested	2EXL7540 or 28000	Rated Capacity (mAh)	6000

Test Step Notes (T.7)

None

**For Dis-Assy & Fire, observation period is test completion + 7 days.*

Setup Conditions

		Dis-Assy	Fire	Overcharge Channel	Pass/Fail	Comments
Charge Current 6000 mA	C5	N	N	Box1-1	Pass	None
	C6	N	N	Box1-2	Pass	None
	C7	N	N	Box1-3	Pass	None
	C8	N	N	Box1-4	Pass	None
Min Test Voltage 16.60 V	F5	N	N	Box1-1	Pass	None
	F6	N	N	Box1-2	Pass	None
	F7	N	N	Box1-3	Pass	None
	F8	N	N	Box1-4	Pass	None
Test Ambient 19.0 °C	S3				No Data	Spare3
	S4				No Data	Spare4

Measurement Equipment Information (Calibration details available upon request)

Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 10
Overcharge System1	Overcharge Test Apparatus, 5 Channel, BOX1-20
Overcharge System2	