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Certificate of Compliance

Company Name	Excell Battery Company
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Company City, State, Country, Postal Code	Surrey, British Columbia, Canada V3S7A4
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Contact Phone Number	604-575-5011 Ext:261
Product Name(s)	Rechargeable Lithium Ion Battery Pack
Product Part Number(s)	2EXL7524
Nominal Voltage (V)	3.6
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 12/17/2017



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Document Number: EA-0071, Revision 2

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 EA2435
DATE OF REPORT 12/17/2017
STATUS Compliant
DATE SAMPLES RECEIVED 11/09/2017

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Company Address 133-18525 53rd Ave
Company City, State, Country, Postal Code Surrey, British Columbia, Canada V3S7A4
Product Name(s) Rechargeable Lithium Ion Battery Pack
Product Part Number(s) 2EXL7524

Table with 4 columns: Test Parameter, Value, Limit, and Note. Includes rows for Nominal Voltage (3.600V, 22 Wh), Rated Capacity (6000mAh), Charge Current (4500mA, 0.75C), Maximum Continuous Charge Current (4500mA), Normal Charge Voltage (4.200V), Maximum Charge Voltage (4.200V), End of Charge Current (50mA, 0.01C), Discharge Current (4500mA, 0.75C), Maximum Specified Discharge Current (4500mA), and End of Discharge Voltage (3.000V).

Table with 2 columns: Parameter and Value. Includes Nominal Mass of Battery (98g), Mass Loss Critical Threshold (0.001), Small or Large Battery (Small), and Mass Precision (3 digits).

Table with 3 columns: Legend, Code, and Description. Includes Fresh (cycle 1), fully charged (F), Cycled (cycle 50), fully charged (C), and Spare (S).

V-Check Criteria

Post Test Voltage ≥ 90% Pre-Test Voltage

M-Check Criteria

Table with 2 columns: Mass (M) of cell or and Mass loss limit. Includes rows for M < 1g (0.5%), 1g ≤ M ≤ 75g (0.2%), and 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.

Revision History

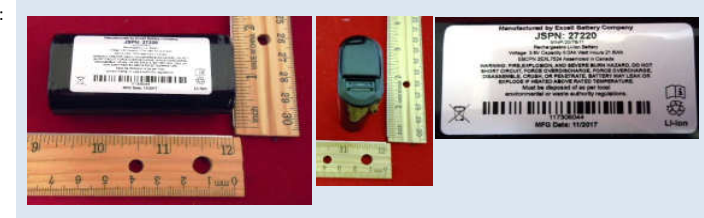
Table with 3 columns: Rev, Date, and Comments. Includes revision 1 dated 12/17/2017 with comment 'Initial issue'.

Reviewed & Released By:

Handwritten signature of Cynthia Millsaps

Name Cynthia Millsaps, President and CEO
Date 12/17/2017

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)	12/07/2017	OS	N
Date (Test Finish)	12/07/2017	Tech	CT
Test Ambient (°C)	21.0		
Model Tested	2EXL7524	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	4.17	97.442	4.17	97.437	Pass	Pass	N	N	N	N	N	None
C2	4.17	97.324	4.17	97.318	Pass	Pass	N	N	N	N	N	None
C3	4.17	97.328	4.17	97.322	Pass	Pass	N	N	N	N	N	None
C4	4.17	97.576	4.17	97.571	Pass	Pass	N	N	N	N	N	None
F1	4.19	97.441	4.17	97.435	Pass	Pass	N	N	N	N	N	None
F2	4.19	97.305	4.17	97.299	Pass	Pass	N	N	N	N	N	None
F3	4.19	97.362	4.17	97.357	Pass	Pass	N	N	N	N	N	None
F4	4.19	97.278	4.17	97.273	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)	12/08/2017	OS	N
Date (Test Finish)	12/13/2017	Tech	CT
Model Tested	2EXL7524	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	4.17	97.437	4.10	97.430	Pass	Pass	N	N	N	N	N	None
C2	4.17	97.318	4.10	97.313	Pass	Pass	N	N	N	N	N	None
C3	4.17	97.322	4.10	97.315	Pass	Pass	N	N	N	N	N	None
C4	4.17	97.571	4.10	97.564	Pass	Pass	N	N	N	N	N	None
F1	4.17	97.435	4.09	97.427	Pass	Pass	N	N	N	N	N	None
F2	4.17	97.299	4.09	97.289	Pass	Pass	N	N	N	N	N	None
F3	4.17	97.357	4.09	97.351	Pass	Pass	N	N	N	N	N	None
F4	4.17	97.273	4.09	97.265	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)	15/14/2017	OS	N
Date (Test Finish)	12/15/2017	Tech	JG
Test Ambient(°C)	20.5		
Model Tested	2EXL7524	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	4.10	97.430	4.10	97.432	Pass	Pass	N	N	N	N	N	None
C2	4.10	97.313	4.09	97.312	Pass	Pass	N	N	N	N	N	None
C3	4.10	97.315	4.10	97.318	Pass	Pass	N	N	N	N	N	None
C4	4.10	97.564	4.10	97.567	Pass	Pass	N	N	N	N	N	None
F1	4.09	97.427	4.09	97.430	Pass	Pass	N	N	N	N	N	None
F2	4.09	97.289	4.09	97.295	Pass	Pass	N	N	N	N	N	None
F3	4.09	97.351	4.09	97.352	Pass	Pass	N	N	N	N	N	None
F4	4.09	97.265	4.09	97.268	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

$$Acceleration (g_n) = \sqrt{\left(\frac{100850}{mass \text{ in kg}}\right)}$$

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

$$Acceleration (g_n) = \sqrt{\left(\frac{30000}{mass \text{ in kg}}\right)}$$

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

Date (Test Start)	12/15/2017
Date (Test Finish)	12/15/2017
Test Ambient (°C)	21.0
Model Tested	2EXL7524

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	4.10	97.432	4.10	97.433	Pass	Pass	N	N	N	N	N	None
C2	4.09	97.312	4.09	97.313	Pass	Pass	N	N	N	N	N	None
C3	4.10	97.318	4.10	97.320	Pass	Pass	N	N	N	N	N	None
C4	4.10	97.567	4.10	97.567	Pass	Pass	N	N	N	N	N	None
F1	4.09	97.430	4.09	97.430	Pass	Pass	N	N	N	N	N	None
F2	4.09	97.295	4.09	97.293	Pass	Pass	N	N	N	N	N	None
F3	4.09	97.352	4.09	97.352	Pass	Pass	N	N	N	N	N	None
F4	4.09	97.268	4.09	97.268	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)	12/15/2017	OS	N
Date (Test Finish)	12/15/2017	Tech	JG
Chamber Ambient Temp at Start of Test (°C)	56.8		
Model Tested	2EXL7524	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	54.8	Pass	N	N	N	Box1-1	81	None
C2	55.1	Pass	N	N	N	Box1-2	80	None
C3	55.7	Pass	N	N	N	Box1-3	79	None
C4	55.8	Pass	N	N	N	Box1-4	83	None
F1	55.0	Pass	N	N	N	Box1-1	81	None
F2	55.5	Pass	N	N	N	Box1-2	80	None
F3	56.0	Pass	N	N	N	Box1-3	79	None
F4	56.0	Pass	N	N	N	Box1-4	83	None
S1		No Data						Spare1
S2		No Data						Spare2

Measurement Equipment Information (Calibration details available upon request)

DMM	HP34401A, S/N MY45004881
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)	12/08/2017	OS	N
Date (Test Finish)	12/17/2017	Tech	JC
Model Tested	2EXL7524	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 9000 mA	C5	N	N	B1-2	Pass	None
	C6	N	N	B1-3	Pass	None
	C7	N	N	B1-4	Pass	None
	C8	N	N	B1-5	Pass	None
	F5	N	N	B1-2	Pass	None
Min Test Voltage 8.40 V	F6	N	N	B1-3	Pass	None
	F7	N	N	B1-4	Pass	None
	F8	N	N	B1-5	Pass	None
Test Ambient 20.5 °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	