

Test Standard: UN38.3, UN Manual of Tests and Criteria, 6th Revised Edition,
Effective December 2015**UN 38.3 Report - Small, Primary, Battery Packs**

PROJECT NUMBER EA1982Battery
DATE OF REPORT 1/9/2017
STATUS Compliant
DATE SAMPLES RECEIVED 1/15/2015

Contact Name Tim McGaff
Contact Email tim.mcgauff@physio-control.com
Contact Phone Number 425-867-4047
Company Name Physio-Control Inc
Company Address 11811 Willows Road NE
Company City, State, Country, Postal Code Redmond, WA 98052
Product Name(s) LPCR2
Product Part Number(s) 3314533-XXX

Chemistry LiMnO2
Nominal Voltage (V) 12.000
Rated Capacity (mAh) 4650
Maximum Specified Discharge Current (mA) 3000
End of Discharge Voltage (V) 7.000

Nominal Mass of Battery (grams) 283
Mass Loss Critical Threshold (Lookup) 0.001
Small or Large Battery (Lookup) Small
Mass Precision (Calculated Digits) 3

Sample Numbering Legend F Fresh (as received)
D Discharged
S (Spare)

V-Check CriteriaPost Test Voltage \geq 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%

Laboratory Address: Energy Assurance, LLC
5202 Belle Wood Court, Suite 106
Buford, GA 30518-5853 USA

<http://www.energy-assurance.com>**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	1/9/2017	Initial issue

Reviewed & Released By:

Name Cynthia Millsaps
Date 1/9/2017

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)	1/16/2015	OS	N
Date (Test Finish)	1/17/2015	Tech	NM
Test Ambient (°C)	22.8		
Model Tested	3314533-XXX	Rated Capacity (mAh)	4650

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	
F1	12.92	283.970	12.91	283.950	Pass	Pass	N	N	N	N	N	None
F2	12.91	284.200	12.91	284.180	Pass	Pass	N	N	N	N	N	None
F3	12.92	282.920	12.91	282.890	Pass	Pass	N	N	N	N	N	None
F4	12.92	282.680	12.91	282.670	Pass	Pass	N	N	N	N	N	None
D1		283.410		283.350	No Data	Pass	N	N	N	N	N	None
D2		283.650		283.620	No Data	Pass	N	N	N	N	N	None
D3		283.250		283.250	No Data	Pass	N	N	N	N	N	None
D4		284.630		284.630	No Data	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 $72 \pm 2^\circ\text{C}$, followed by storage for at least six hours at a test temperature equal to $-40 \pm 2^\circ\text{C}$. 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 ($20 \pm 5^\circ\text{C}$). For large cells and batteries, the duration of exposure to the test temperature should be at least 12 hours.*

Date (Test Start)	1/20/2015	OS	N
Date (Test Finish)	1/27/2015	Tech	NM/CT
Model Tested	3314533-XXX	Rated Capacity (mAh)	4650

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	
F1	12.91	283.950	12.92	283.829	Pass	Pass	N	N	N	N	N	None
F2	12.91	284.180	12.94	284.078	Pass	Pass	N	N	N	N	N	None
F3	12.91	282.890	12.92	282.720	Pass	Pass	N	N	N	N	N	None
F4	12.91	282.670	12.92	282.545	Pass	Pass	N	N	N	N	N	None
D1		283.350		283.230	No Data	Pass	N	N	N	N	N	None
D2		283.620		283.505	No Data	Pass	N	N	N	N	N	None
D3		283.250		283.129	No Data	Pass	N	N	N	N	N	None
D4		284.630		284.487	No Data	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)	1/27/2015	OS	N
Date (Test Finish)	1/29/2015	Tech	CT/JC
Test Ambient(°C)	20.1		
Model Tested	3314533-XXX	Rated Capacity (mAh)	4650

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	
F1	12.92	283.829	12.97	283.861	Pass	Pass	N	N	N	N	N	None
F2	12.94	284.078	12.98	284.086	Pass	Pass	N	N	N	N	N	None
F3	12.92	282.720	12.97	282.729	Pass	Pass	N	N	N	N	N	None
F4	12.92	282.545	12.98	282.559	Pass	Pass	N	N	N	N	N	None
D1		283.230		283.249	No Data	Pass	N	N	N	N	N	None
D2		283.505		283.528	No Data	Pass	N	N	N	N	N	None
D3		283.129		283.139	No Data	Pass	N	N	N	N	N	None
D4		284.487		284.503	No Data	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 duration.

Date (Test Start)	1/30/2015	OS	N	Calculated Required Peak Acceleration (g _n)
Date (Test Finish)	1/30/2015	Tech	CT	150
Test Ambient (°C)	23.0			Calculated Required Pulse Width (ms)
Model Tested	3314533-XXX	Rated Capacity (mAh)	4650	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	
F1	12.97	283.861	12.91	283.839	Pass	Pass	N	N	N	N	N	None
F2	12.98	284.086	12.92	284.083	Pass	Pass	N	N	N	N	N	None
F3	12.97	282.729	12.92	282.728	Pass	Pass	N	N	N	N	N	None
F4	12.98	282.559	12.91	282.560	Pass	Pass	N	N	N	N	N	None
D1		283.249		283.244	No Data	Pass	N	N	N	N	N	None
D2		283.528		283.517	No Data	Pass	N	N	N	N	N	None
D3		283.139		283.143	No Data	Pass	N	N	N	N	N	None
D4		284.503		284.495	No Data	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 $57 \pm 4^\circ\text{C}$, 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 $57 \pm 4^\circ\text{C}$ 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 $57 \pm 4^\circ\text{C}$, 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)	1/31/2015	OS	N
Date (Test Finish)	1/31/2015	Tech	RA/CT
Chamber Ambient Temp at Start of Test ($^\circ\text{C}$)	55.6		
Model Tested	3314533-XXX	Rated Capacity (mAh)	4650

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		Short-Circuit System			Comments
	$^\circ\text{C}$	T>170 $^\circ\text{C}$	Dis-Assy	Rupture	Fire	
F1	55.9	Pass	N	N	N	None
F2	56.3	Pass	N	N	N	None
F3	56.6	Pass	N	N	N	None
F4	55.6	Pass	N	N	N	None
D1	58.1	Pass	N	N	N	None
D2	57.5	Pass	N	N	N	None
D3	58.2	Pass	N	N	N	None
D4	58.4	Pass	N	N	N	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