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Certificate of Compliance

Company Name	Physio-Control Inc
Company Address	11811 Willows Road NE
Company City, State, Country, Postal Code	Redmond, WA 98052
Contact Name	Heber Farnsworth
Contact Email	heber.farnsworth@physio-control.com
Contact Phone Number	425-867-4820
Product Name(s)	LP15 and LP20 (by similarity)
Product Part Number(s)	3206735-XXX, 3205296-XXX
Nominal Voltage (V)	10.8
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
<u>Component Test Results</u>	
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

Date 11/22/2016

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: EA1927
 DATE OF REPORT: 11/22/2016
 STATUS: Compliant
 DATE SAMPLES RECEIVED: 9/22/2015

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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.

Test data is a reuse from EA1508 dated 10/26/2016. No changes to product, only moving to add IEC 62281 and UN 6th edition based on previous testing.

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.

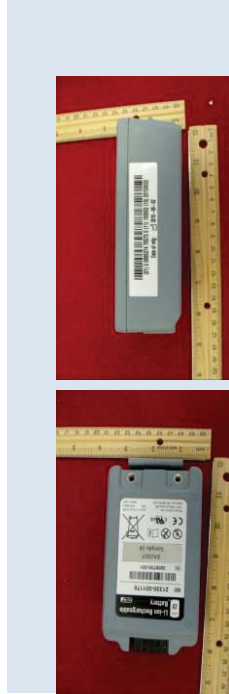
Revision History

Rev	Date	Comments
1	11/22/2016	Initial issue

Reviewed & Released By:

Cynthia Millsaps
 Name: Cynthia Millsaps
 Date: 11/22/2016

V-Check Criteria	
Post Test Voltage ≥ 90% Pre-Test Voltage	
Mass (M) of cell or	Mass loss limit
M < 1g	0.5%
1g ≤ M ≤ 75g	0.2%
M > 75g	0.1%



Product Photo:

Nominal Voltage (V): 10.800
 Rated Capacity (mAh): 6000
 Charge Current for 50X cycling - CC mode (mA): 4300
 Maximum Continuous Charge Current (mA): 12.700
 Normal Charge Voltage (V): 12.700
 Maximum Charge Voltage (V): 150
 End of Charge Current - CV mode (mA): 6000
 Discharge Current for 50X Cycling (mA): 10000
 Maximum Specified Discharge Current (mA): 9.000
 End of Discharge Voltage (V):

Nominal Mass of Battery (grams): 546
 Mass Loss Critical Threshold (Lookup): 0.001
 Small or Large Battery (Lookup): Small
 Mass Precision (Calculated Digits): 2

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

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)	9/24/2015
Date (Test Finish)	9/25/2015
Test Ambient (°C)	22.4
Model Tested	3206735-XXX, 3205296-XXX

OS	N
Tech	JC/JG
Rated Capacity (mAh)	6000

Test Step Notes (T.1) Remove auxiliary screws from positive & negative terminals prior to mass measurement.

	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				Fire	Comments
							Leakage	Venting	Dis-Assy	Rupture		
C1	12.54	546.520	12.53	546.530	Pass	Pass	N	N	N	N	N	None
C2	12.55	546.280	12.54	546.290	Pass	Pass	N	N	N	N	N	None
C3	12.55	546.060	12.54	546.080	Pass	Pass	N	N	N	N	N	None
C4	12.54	546.790	12.53	546.820	Pass	Pass	N	N	N	N	N	None
F1	12.53	545.050	12.51	545.080	Pass	Pass	N	N	N	N	N	None
F2	12.53	546.010	12.52	546.040	Pass	Pass	N	N	N	N	N	None
F3	12.53	547.000	12.52	547.020	Pass	Pass	N	N	N	N	N	None
F4	12.53	545.870	12.52	545.900	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	A&D GX-4000 (301-4100g), S/N 14554603
Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 2
Timer	Accurite Timer, S/N 2312
Vacuum Gauge	Wika 0-30IN-HG, S/N PG-01

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)	10/2/2015	OS	N
Date (Test Finish)	10/9/2015	Tech	JG/JC
Model Tested	3206735-XXX, 3205296-XXX	Rated Capacity (mAh)	6000

Test Step Notes (T.2)

Remove auxiliary screws from positive & negative terminals prior to mass measurement.

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	12.53	546.530	12.38	546.340	Pass	N	N	N	N	N	None
C2	12.54	546.290	12.39	546.160	Pass	N	N	N	N	N	None
C3	12.54	546.080	12.39	545.940	Pass	N	N	N	N	N	None
C4	12.53	546.820	12.38	546.700	Pass	N	N	N	N	N	None
F1	12.51	545.080	12.34	544.930	Pass	N	N	N	N	N	None
F2	12.52	546.040	12.34	545.880	Pass	N	N	N	N	N	None
F3	12.52	547.020	12.34	546.890	Pass	N	N	N	N	N	None
F4	12.52	545.900	12.34	545.740	Pass	N	N	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
Scale	A&D GX-4000 (301-4100g), S/N 14554603
Temperature Chamber	Test Equity 1007H, S/N 61593

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_r 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_r occurs (approximately 50 Hz). A peak acceleration of 8 g_r is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz a peak acceleration of 1 g_r 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_r occurs (approximately 25 Hz). A peak acceleration of 2 g_r is then maintained until the frequency is increased to 200 Hz.

Date (Test Start)	10/15/2015	OS	N
Date (Test Finish)	10/16/2015	Tech	JC/JG
Test Ambient(°C)	22.6		
Model Tested	3206735-XXX; 3205296-XXX	Rated Capacity (mAh)	6000

Test Step Notes (T.3) Remove auxiliary screws from positive & negative terminals prior to mass measurement.

	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	12.38	546.340	12.36	546.370	Pass	Pass	N	N	N	N	N	None
C2	12.39	546.160	12.36	546.170	Pass	Pass	N	N	N	N	N	None
C3	12.39	545.940	12.37	545.940	Pass	Pass	N	N	N	N	N	None
C4	12.38	546.700	12.36	546.740	Pass	Pass	N	N	N	N	N	None
F1	12.34	544.930	12.31	544.970	Pass	Pass	N	N	N	N	N	None
F2	12.34	545.880	12.32	545.920	Pass	Pass	N	N	N	N	N	None
F3	12.34	546.890	12.32	546.910	Pass	Pass	N	N	N	N	N	None
F4	12.34	545.740	12.32	545.780	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	A&D GX-4000 (301-4100g), S/N 14554603
Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 3
Vibration Controller	Vibration Research VR9500, S/N 950C75B4
ICP Accelerometer	PCB Piezotronics 352C03 (10mV/g), S/N LW136337

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

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

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

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

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)	10/17/2015
Date (Test Finish)	10/17/2015
Test Ambient (°C)	22.8
Model Tested	3206735-XX, 3205296-XXX

OS	N	Calculated Required Peak Acceleration (g _n)	150
	Tech		
		Calculated Required Pulse Width (ms)	6
		Rated Capacity (mAh)	6000

Test Step Notes (T.4)

Remove auxiliary screws from positive & negative terminals prior to mass measurement.

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	12.36	546.370	12.36	546.390	Pass	Pass	N	N	N	N	N	None
C2	12.36	546.170	12.36	546.180	Pass	Pass	N	N	N	N	N	None
C3	12.37	545.940	12.37	545.930	Pass	Pass	N	N	N	N	N	None
C4	12.36	546.740	12.36	546.720	Pass	Pass	N	N	N	N	N	None
F1	12.31	544.970	12.31	544.950	Pass	Pass	N	N	N	N	N	None
F2	12.32	545.920	12.32	545.890	Pass	Pass	N	N	N	N	N	None
F3	12.32	546.910	12.32	546.890	Pass	Pass	N	N	N	N	N	None
F4	12.32	545.780	12.32	545.760	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	A&D GX-4000 (301-4100g), S/N 14554603
Ambient Temp Gauge	Digital Temperature-Humidity Meter, S/N 3
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)	10/20/2015	OS	N
Date (Test Finish)	10/21/2015	Tech	JC/JG
Chamber Ambient Temp at Start of Test (°C)	55.6	Rated Capacity (mAh)	6000
Model Tested	3206735-XXX, 3205296-XXX		

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 °C	Short-Circuit System				Comments
		T>170°C	Dis-Assy	Rupture	Fire	
C1	54.9	Pass	N	N	N	None
C2	54.3	Pass	N	N	N	None
C3	55.5	Pass	N	N	N	None
C4	54.7	Pass	N	N	N	None
F1	54.9	Pass	N	N	N	None
F2	55.3	Pass	N	N	N	None
F3	55.3	Pass	N	N	N	None
F4	55.0	Pass	N	N	N	None
S1		No Data				Spare1
S2		No Data				Spare2

Measurement Equipment Information (Calibration details available upon request)

DMM	Shenzhen Sampo Model SM8124, S/N S645832
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)	9/24/2015	OS	N
Date (Test Finish)	10/9/2015	Tech	JG/CT
Model Tested	3206735-XXX, 3205296-XXX	Rated Capacity (mAh)	6000

Test Step Notes (T.7) None

Setup Conditions

Charge Current mA
 Min Test Voltage V
 Test Ambient °C

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

	Dis-Assy	Fire	Overcharge Channel	Pass/Fail	Comments
C5	N	N	B2-2	Pass	None
C6	N	N	B2-3	Pass	None
C7	N	N	B2-4	Pass	None
C8	N	N	B2-5	Pass	None
F5	N	N	B2-2	Pass	None
F6	N	N	B2-3	Pass	None
F7	N	N	B2-4	Pass	None
F8	N	N	B2-5	Pass	None
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 1
Overcharge System 1	Overcharge Test Apparatus, 5 Channel, BOX2-35
Overcharge System 2	