Safety Data Sheet

Product Name: LIFEPAK 1000 - battery

	Australian Sponsor	**New Zealand Sponsor**
Name:	Stryker Australia	Stryker New Zealand
Address:	8 Herbert Street St Leonards, NSW Australia 2065	511 Mt Wellington Highway, Auckland, New Zealand, 1060
Phone No:	+61 02 9467 1000	+64 09 573 1890
Fax No:	+61 02 9467 1010	+64 09 573 1891
Emergency:	Poisons Information Centre: Ph: 131 126	Poisons and hazardous chemicals emergency: Ph: 0800 764 766

SAFETY DATA SHEET

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION			
Product Description Product Identification	Cylindrical Lithium Manganese Dioxide Cells and Batteries (Perchlorate Style)		
Manufacturer Name/Address	Ultralife Corporation 2000 Technology Parkway Newark, NY 14513	24 Hour Emergency Contact	ChemTrec 800-424-9300 (US) 703-527-3887 (International) 800-862-115 (Australia)
Technical Contact	800-332-5000	Issue Date:	02 MAY 01
Prepared By	Dave Gould	Revision Date:	13 JUN 22

Section 2 - HAZARDS IDENTIFICATION

NOTE: This Ultralife battery product meets the definition of an article. Under the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), "Articles" as defined in the Hazard Communication Standard (29 CFR 1910.1200) of the Occupational Safety and Health Administration of the United States of America, or by similar definition, are outside the scope of the system. [Rev. 2 (2007) Part 1.3.2.1.1]

The materials contained in this product may only represent a hazard if the integrity of the cell or battery is compromised; physically or electrically abused.

GHS Classification

Skin irritation (Category 2)
Skin sensation (Category 1)
Eye irritation (Category 2)
Single target organ toxicity, single exposure (Category 3)
Carcinogen (Category 1B)

GHS Label elements, including precautionary statements

Pictogram

Signal word – DANGER

Hazard statements

H315 Causes skin irritation
H317 May cause an allergic skin reaction
H319 Causes serious eye irritation
H335 May cause respiratory irritation
H350 May cause cancer

Precautionary statements

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P312 Call a POISON CENTER or doctor/physician if you feel unwell.

P302 + P350 IF ON SKIN: gently wash with plenty of soap and water.

P301 + P330 + P331 IF SWALLOWED: rinse mouth, DO NOT induce vomiting.

P304 + P340 IF INHALED: Move person to fresh air and keep comfortable for breathing.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes.

P362 + P352 Take off contaminated clothing and wash before re-use.

P501 Dispose of contents/container in accordance with local/national regulations.

WHMIS Classification

D2A Very toxic material causing other toxic effects

Carcinogen

D2B Toxic material causing other toxic effects

Moderate skin irritant

Skin sensitizer

Moderate respiratory irritant

Moderate eye irritant

OSHA Classification

Hazardous

HMIS Classification

Health Hazard: 2

Chronic Hazards: 0

Flammability: 2

Physical Hazards: 0

Additional Notes:

- Do not open or disassemble.
- Do not expose to fire or open flame.
- Do not mix with batteries of varying sizes, chemistries or types.
- Do not puncture, deform, incinerate or heat above 85^{o}C (185^{o}F).

SECTION 3 - COMPOSITION – INGREDIENTS INFORMATION

Under normal use conditions, cells and batteries do not emit hazardous or regulated substances.

Component	CAS Number	EINECS Number	% by Wt.
Manganese Dioxide, MnO_2	1313-13-9	215-202-6	40-45
Lithium Metal, Li	7439-93-2	231-102-5	3-4
Propylene Carbonate, $C_4H_6O_3$	108-32-7	203-572-1	4-5
Ethylene Glycol Dimethyl Ether (1,2-Dimethoxyethane), $C_4H_{10}O_2$	110-71-4	203-794-9	3-4
Tetrahydrofuran, C_4H_8O	109-99-9	203-726-8	5-9
Lithium Perchlorate, $LiClO_4$	7791-03-9	232-237-2	1

Depending on product configuration, components used to assemble battery packs (e.g. housings, electronic components and wiring) may contain additional hazardous materials, such as lead solder.

SECTION 4 - FIRST AID MEASURES

Inhalation	• Avoid inhaling any vented gases. • Remove to fresh air immediately. • If breathing is difficult, seek emergency medical attention.
Ingestion	• Consult a physician or local poison control center immediately
Skin Contact	• Exposure to materials from a ruptured or otherwise damaged cell or battery may cause skin irritation. • Flush immediately with water and wash affected area with soap and water.
Eye Contact	• Exposure to materials from a ruptured or otherwise damaged cell or battery may cause eye irritation. • Flush immediately with copious amounts of water for at least 15 minutes; consult a physician immediately.

SECTION 5 - FIRE FIGHTING MEASURES

Extinguishing Media	• Copious amounts of cold water or water-based foam may be used to cool burning cells or batteries. Do not use warm or hot water. • A carbon dioxide (CO_2) extinguisher is also effective. • For fires involving exposed, raw lithium metal (characterized by deep red flames), use only metal (Class D) fire extinguishers. • Do not use Halon type extinguishing material.
Special Fire Fighting Procedures	• Use a positive pressure self-contained breathing apparatus (SCBA) if cells or batteries are involved in a fire. • Full fire fighting protective clothing is necessary. • During water application, caution is advised as burning pieces of flammable particles may be ejected from the fire.

Unusual Fire and Explosion Hazard	• Cells or batteries that are damaged, opened or exposed to excessive heat/fire may flame or leak potentially hazardous organic vapors.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

- In the event a cell or battery is crushed; releasing its contents, rubber gloves must be used to handle all battery components.
- Avoid inhalation of any vapors that may be emitted.
- Damaged batteries that are not hot or burning should be placed in a sealed plastic bag or container.

SECTION 7 - HANDLING AND STORAGE

Precautions for Safe Handling	• Batteries are not designed to be recharged. Charging a primary cell or battery may result in electrolyte leakage and/or cause the cell or battery to flame. • Never disassemble a battery or bypass any safety device. • More than a momentary short circuit will cause temporary battery voltage loss until the battery is subjected to a charge. Batteries with fuses will no longer be functional after being shorted. • Extended short-circuiting creates high temperatures in the cell. • High temperatures can cause burns in skin or cause the cell to flame. • Avoid reversing battery polarity within the battery assembly. To do so may cause cell to flame or to leak. **Note: Contains a perchlorate material – special handling may apply** **Go to:** www.dtsc.ca.gov/hazardouswaste
Conditions for Safe Storage and Incompatibility	• Batteries should be separated from other materials and stored in a non-combustible, well ventilated structure with sufficient clearance between walls and battery stacks. Do not place batteries near heating equipment, nor expose to direct sunlight for long periods. • Do not store batteries above 60ºC (140ºF) or below -40ºC (-40ºF). Store batteries in a cool (below 25°C (77ºF)), dry area that is subject to little temperature change. Elevated temperatures can result in reduced battery service life. Battery exposure to temperatures in excess of 130°C (266ºF) will result in the battery venting flammable liquid and gases. • Do not store batteries in a manner that allows terminals to short circuit.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION	
Engineering Controls and Work Practices	• Under conditions of normal use, batteries do not emit hazardous or regulated substances. • No engineering controls are required for handling batteries that have not been damaged.
Personal Protective Equipment	• Personal protective equipment for damaged batteries should include chemical resistant gloves and safety glasses. • In the event of a fire, SCBA should be worn along with thermally protective outer garments.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES			
Appearance	Cylindrical Cell pr Pack	UEL/LEL	Not Applicable
Odor	None	Vapor Pressure	Not Applicable
Odor Threshold	Not Applicable	Vapor Density	Not Applicable
pH	Not Applicable	Relative Density	Not Available
Melting Point	Not Available	Solubility	Not Applicable
Boiling Point	Not Available	Partition Coefficient	Not Applicable
Flash Point	Not Applicable	Auto-ignition Temperature	Not Available
Evaporation Rate	Not Applicable	Decomposition Temperature	Not Available
Flammability	Not Applicable	Viscosity	Not Applicable

SECTION 10 - STABILITY AND REACTIVITY	
Stability:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	Prolonged overcharging and/or overheating. It is not recommended that this product be stored above 60°C (140°F).
Hazardous Decomposition:	Carbon Monoxide (CO), and Hydrogen Fluoride (HF)
Reactivity:	Damaged non-discharged batteries contain elemental Lithium that is water reactive. This reaction gives off heat and hydrogen gas

SECTION 11 – TOXICOLOGICAL INFORMATION

- No toxicological impacts are expected under normal use conditions.
- The electrolytes contained in this cell or battery can irritate eyes with any contact.
- Prolonged contact of electrolytes with lung tissue, skin or mucous membranes may cause irritation.
- Detailed information regarding sensitization, carcinogenicity, mutagenicity or reproductive toxicity related to internal cell or battery components has not been included in this document.

Carcinogen References

1. National Toxicology Program (NTP): Yes
2. IARC Monographs: No
3. OSHA: No

SECTION 12 – ECOLOGICAL INFORMATION

- No ecological impacts expected under normal use conditions.
- Information on the ecological impact of internal cell or battery components has not been included in this document.

SECTION 13 - DISPOSAL CONSIDERATIONS

Do not dispose in fire. Battery disposal regulations vary on national, state/provincial and local bases. **Disposal must be conducted in accordance with the applicable regulations.**
These batteries contain recyclable materials and recycling is encouraged over disposal.

SECTION 14 - TRANSPORTATION INFORMATION

Ultralife's lithium metal primary cells and batteries and lithium-ion cells and batteries are classified and regulated as Class 9 dangerous goods (also known as "hazardous materials" in the United States) by the International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), International Maritime Organization (IMO) and many government agencies such as the U.S. Department of Transportation (DOT). These organizations and agencies publish regulations that contain detailed packaging, marking, labeling, documentation, and training requirements that must be followed when offering (shipping) Ultralife's cells and batteries for transportation. **However, small cells and batteries are not subject to certain provisions of the regulations (e.g. Class 9 labeling and UN specification packaging) if they meet specific requirements**. The regulations are based on the UN Recommendations on the Transport of Dangerous Goods Model Regulations and the UN Manual of Tests and Criteria. **These regulations also apply to shipments of cells and batteries that are packed with or contained in equipment.** Failure to comply with these regulations can result in substantial civil or criminal penalties.

The dangerous goods regulations require that each cell and battery design be subject to tests contained in Section 38.3 of the UN Manual of Tests and Criteria prior to being offered for transport.
Approved, production level cells and batteries manufactured and assembled by Ultralife have been tested to Section 38.3 of the UN Manual of Tests and Criteria and passed T1 through T8.
Batteries or battery packs constructed by other parties using Ultralife's cells must be subjected to the tests contained in Section 38.3 of the UN Manual of Tests and Criteria.

Important Note Regarding Prototype Cells and Batteries

Ultralife Corporation is permitted to ship prototype cells and batteries as Class 9 hazardous materials/dangerous goods in accordance with the requirements contained in a competent authority approval; provided by the US Department of Transportation. Recipients of these shipments are prohibited from reshipping unless they have received a similar approval from the governing Competent Authority.

SECTION 14 - TRANSPORTATION INFORMATION (continued)

Air, Sea and Surface Classification	UN 3090, Lithium metal batteries UN 3091, Lithium metal batteries, contained in equipment UN 3091, Lithium metal batteries, packed with equipment

IATA Packaging Guidance

UN3090 Lithium Metal Batteries:

PI968 Section IA Cells with a lithium metal content in excess of 1 gram and batteries with a lithium metal content in excess of 2 grams.

Section IB Cells with a lithium metal content not more than 1 gram and batteries with a lithium metal content not more than 2 grams.

Section II Cells with a lithium metal content not more than 1 gram and batteries with a lithium metal content not more than 2 grams.

UN3091 Lithium Metal Batteries contained in Equipment:

PI970 Section I Cells with a lithium metal content in excess of 1 gram and batteries with a lithium metal content in excess of 2 grams.

Section II Cells with a lithium metal content not more than 1 gram and batteries with a lithium metal content not more than 2 grams

Lithium Metal Batteries packed with equipment:

PI969 Section I Cells with a lithium metal content in excess of 1 gram and batteries with a lithium metal content in excess of 2 grams.

Section II Cells with a lithium metal content not more than 1 gram and batteries with a lithium metal content not more than 2 grams.

Hazard Class	9	Tunnel Code	E		
Stowage Location	A	Marine Pollutant	No		

SECTION 15 - REGULATORY INFORMATION

US	Hazard Communication Standard (29 CFR 1910.1200)	Article
	CERCLA SECTION 304 Hazardous Substances	NA
	EPCRA SECTION 302 Extremely Hazardous Substance	NA
	EPCRA SECTION 313 Toxic Release Inventory	NA
	EPCRA SECTION 312	NA
	Components Listed on US Toxic Substances Control Act (TSCA) Inventory	Yes
	California Prop 65 Classification	None
EU	Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) 1907/2006	Article
	European RoHS 3 Directive 2015/863/EU	NA
	European WEEE Directive 2012/19/EU Note: Applies to cells and batteries incorporated into electrical and electronic equipment, when that equipment becomes waste.	See Note

SECTION 16 - OTHER INFORMATION

If returning product to any division of Ultralife, consult the relevant regulations regarding handling, packaging, labeling and transportation.

Disclaimer

The information contained herein is furnished without warranty of any kind. Users should consider this data only as a supplement to other information gathered by them and must make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of these materials and the safety and health of employees and customers.

Document Number: EA-0073, Revison 1

Energy Assurance, LLC
5202 Belle Wood Court, Suite 106
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Email: information@energy-assurance.com
Office Phone: +1-404-954-2054

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	Tim McGaff
Contact Email	tim.mcgaff@physio-control.com
Contact Phone Number	425-867-4047
Product Name(s)	LP1000 LiMnO2
Product Part Number(s)	3205379-XXX
Nominal Voltage (V)	12
Rated Capacity (mAh)	4500
Product Type	Battery Pack, Primary, 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

**Note: Tests T.6 (Impact/Crush) and T.8 (Forced Discharge) are applicable to cell-level testing only.*
**Note: Test T.7 (Overcharge) is applicable to secondary battery pack-level testing only.*

Release Approved By

Name Cynthia Millsaps
Date 12/14/2016

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	**EA1979BATT**
DATE OF REPORT	**12/14/2016**
STATUS	**Compliant**
DATE SAMPLES RECEIVED	**10/04/2016**

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

http://www.energy-assurance.com

Contact Name	Tim McGaff
Contact Email	tim.mcgaff@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)	LP1000 LiMnO2
Product Part Number(s)	3205379-XXX
Chemistry	LiMnO2
Nominal Voltage (V)	12.000
Rated Capacity (mAh)	4500
Maximum Specified Discharge Current (mA)	1000
End of Discharge Voltage (V)	8.000

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 parter 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	12/14/2016	Initial issue

Nominal Mass of Battery (grams)	419
Mass Loss Critical Threshold (Lookup)	0.001
Small or Large Battery (Lookup)	Small
Mass Precision (Calculated Digits)	2

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

Reviewed & Released By:

Name Cynthia Millsaps
Date 12/14/2016

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%

Product Photo:

Energy Assurance LLC, 5202 Belle Wood Court, Suite 106, Buford, Georgia, 30518 USA
information@energy-assurance.com (404) 954-2054

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)	10/20/2016	OS	N
Date (Test Finish)	10/21/2016	Tech	CT
Test Ambient (°C)	22.0		
Model Tested	3205379-XXX	Rated Capacity (mAh)	4500

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: Leakage	Venting	Dis-Assy	Rupture	Fire	Comments
F1	12.79	417.73	12.79	417.72	Pass	Pass	N	N	N	N	N	None
F2	12.75	419.18	12.75	419.16	Pass	Pass	N	N	N	N	N	None
F3	12.78	420.41	12.77	420.32	Pass	Pass	N	N	N	N	N	None
F4	12.78	420.01	12.77	419.92	Pass	Pass	N	N	N	N	N	None
D1		419.64		419.56	No Data	Pass	N	N	N	N	N	None
D2		419.47		419.40	No Data	Pass	N	N	N	N	N	None
D3		419.22		419.21	No Data	Pass	N	N	N	N	N	None
D4		418.04		418.02	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	A&D GX-4000 (301-4100g), S/N 14554603
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)	10/24/2016	OS	N
Date (Test Finish)	10/31/2016	Tech	CT
Model Tested	3205379-XXX	Rated Capacity (mAh)	4500

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: Leakage	Venting	Dis-Assy	Rupture	Fire	Comments
F1	12.78	417.70	13.14	417.53	Pass	Pass	N	N	N	N	N	None
F2	12.74	419.13	13.13	418.98	Pass	Pass	N	N	N	N	N	None
F3	12.66	420.30	13.03	420.20	Pass	Pass	N	N	N	N	N	None
F4	12.66	419.90	13.14	419.81	Pass	Pass	N	N	N	N	N	None
D1		419.54		419.45	No Data	Pass	N	N	N	N	N	None
D2		419.38		419.29	No Data	Pass	N	N	N	N	N	None
D3		419.20		418.99	No Data	Pass	N	N	N	N	N	None
D4		418.00		417.77	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	A&D GX-4000 (301-4100g), S/N 14554603
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)		OS	N
Date (Test Finish)		Tech	
Test Ambient(°C)			
Model Tested	3205379-XXX	Rated Capacity (mAh)	4500

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: Leakage	Venting	Dis-Assy	Rupture	Fire	Comments
F1	13.14	417.53	13.08	417.57	Pass	Pass	N	N	N	N	N	None
F2	13.13	418.98	13.06	419.01	Pass	Pass	N	N	N	N	N	None
F3	13.03	420.20	12.84	420.24	Pass	Pass	N	N	N	N	N	None
F4	13.14	419.81	13.08	419.85	Pass	Pass	N	N	N	N	N	None
D1		419.45		419.49	No Data	Pass	N	N	N	N	N	None
D2		419.29		419.33	No Data	Pass	N	N	N	N	N	None
D3		418.99		419.03	No Data	Pass	N	N	N	N	N	None
D4		417.77		417.82	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	A&D GX-4000 (301-4100g), S/N 14554603
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 millisecondsfor 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

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

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

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

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

Date (Test Start)	11/03/2016	OS	N	Calculated Required Peak Acceleration (g_n)
Date (Test Finish)	11/03/2016	Tech	JG/CT	150
Test Ambient (°C)	20.5			Calculated Required Pulse Width (ms)
Model Tested	3205379-XXX	Rated Capacity (mAh)	4500	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: Leakage	Venting	Dis-Assy	Rupture	Fire	Comments
F1	13.08	417.57	13.08	417.57	Pass	Pass	N	N	N	N	N	None
F2	13.06	419.01	13.06	419.01	Pass	Pass	N	N	N	N	N	None
F3	12.84	420.24	12.83	420.24	Pass	Pass	N	N	N	N	N	None
F4	13.08	419.85	13.07	419.84	Pass	Pass	N	N	N	N	N	None
D1		419.49		419.48	No Data	Pass	N	N	N	N	N	None
D2		419.33		419.31	No Data	Pass	N	N	N	N	N	None
D3		419.03		419.02	No Data	Pass	N	N	N	N	N	None
D4		417.82		417.81	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	A&D GX-4000 (301-4100g), S/N 14554603
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
Oscillloscope	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)	11/03/2016	OS	N
Date (Test Finish)	11/03/2016	Tech	JG/CT/JC
Chamber Ambient Temp at Start of Test (°C)	22.5		
Model Tested	3205379-XXX	Rated Capacity (mAh)	4500

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	T>170°C	Dis-Assy	Rupture	Fire	Short-Circuit System Ch#	mΩ	Comments
F1	55.7	Pass	N	N	N	BB-2	75	None
F2	55.7	Pass	N	N	N	BB-3	85	None
F3	55.7	Pass	N	N	N	BB-4	72	None
F4	55.8	Pass	N	N	N	BB-5	78	None
D1	58.3	Pass	N	N	N	BB-2	75	None
D2	59.5	Pass	N	N	N	BB-3	85	None
D3	58.9	Pass	N	N	N	BB-4	72	None
D4	55.9	Pass	N	N	N	BB-5	78	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