

SAFETY PRECAUTIONS FOR LITHIUM-MANGANESE DIOXIDE (Li-MnO₂) CELLS AND BATTERIES

A. GENERAL¹

- 1) Lithium-Manganese Dioxide (Li-MnO₂) primary (non-rechargeable) cells and batteries have higher energy on a weight and volume basis than conventional batteries such as carbon-zinc and alkaline. Li-MnO₂ cells have a typical open circuit voltage (OCV) of 3.3 volts, and a normal operating voltage range of 2.5 to 3.0 volts depending on device current drain and ambient operating temperature. The chemical components that are responsible for their superior energy density may also contribute to an increased safety hazard if they are misused or abused. Li-MnO₂ batteries can be used with minimal risk if attention is given to both safety and enhanced performance capability.
- 2) Personnel who use or handle Li-MnO₂ cells and batteries must be familiar with their properties, safety precautions, handling procedures, and transportation and disposal requirements. For information on transportation regulations for lithium batteries refer to Ultralife document UBI-5120: [Ultralife Batteries Lithium Battery Transportation Regulations](#).
- 3) Insure that batteries are protected from heat, short circuits, compaction, mutilation, or other abusive physical or electrical conditions during storage, use and disposal. Dispose of lithium batteries in accordance with all applicable federal, state and local regulations.
- 4) Contact Ultralife for questions regarding the proper use and limitations of cells and batteries.

B. HANDLING¹

Observe the following guidelines when handling lithium cells and batteries:

- 1) Store batteries in a cool, dry, ventilated area.
- 2) Keep batteries in their original packaging until ready for use. Do not store cells or batteries loosely in boxes or bins.
- 3) Use special care in handling batteries. Make sure they are not punctured, crushed, mishandled, disassembled or exposed to storage temperatures exceeding the maximum specified temperature on the product technical data sheet.
- 4) Inspect batteries prior to use and do not use if there is any evidence of leakage or deformity. Consult the Material Safety Data Sheet (MSDS) for precautions to use when handling leaking batteries.
- 5) Turn off equipment if battery becomes hot. Wait for battery to cool before removing from equipment.
- 6) Use batteries only for the application for which they were designed.
- 7) Take warning labels seriously and follow all safety precautions.
- 8) Control battery fires in accordance with instructions on the MSDS.

¹ Information Source: RTCA Document No. RTCA/DO-227, June 23, 1995; Appendix C, Lithium Battery Safety Guidelines

SAFETY PRECAUTIONS FOR LITHIUM-MANGANESE DIOXIDE (Li-MnO₂) CELLS AND BATTERIES

Observe the following precautions when handling lithium cells and batteries:

- 1) Do not store batteries with other hazardous or combustible materials.
- 2) Do not heat or incinerate batteries. Do not dispose of batteries with other waste unless permitted by applicable regulations.
- 3) Do not open, puncture, crush, disassemble, or subject batteries to physical abuse.
- 4) Do not damage cell fill ports or glass-to-metal seals, as electrolyte leakage can result.
- 5) Do not charge primary lithium batteries. Charging is considered severe abuse and may result in venting, fire or explosion under some conditions.
- 6) Do not use a lithium battery in any application except the one for which it is intended.
- 7) Do not short circuit battery terminals. High current may lead to excessive heating.
- 8) Do not replace fuses if they activate.

C. INSTALLATION

- 1) **Installing Battery Packs in the Equipment:** To avoid damage to the battery pack, make sure the battery pack is positioned away from heat sources in the equipment.
- 2) **Mechanisms to Prevent Dropping:** Be sure to use a battery pack locking mechanism to prevent the battery pack from being ejected if the equipment is dropped or receives a sudden impact.
- 3) **Preventing Short Circuits and Reversed Connections:** Use a terminal structure that makes it unlikely the terminals will be shorted by metallic objects such as rings, necklaces, clips, hairpins, etc. Structure the battery and the terminals to the battery in such a way that the battery pack cannot be put in backwards when installed in the equipment.
- 4) **Inclusion in Other Equipment:** If the battery is built into other equipment, use caution to strictly avoid designing airtight battery compartments.
- 5) **Terminal Materials in the External Equipment:** Use materials that are highly resistant to corrosion (such as nickel or nickel-plated copper). If contact resistance is an issue, we recommend you use contact plating (such as gold plating) on the terminals.

D. USE OF THE BATTERY

See next section on "Safety Warnings for Lithium-Manganese Dioxide Cells and Batteries."

E. PLEASE NOTE

The performance and life expectancy of batteries depends heavily on how the batteries are used. In order to ensure safety, be sure to consult with Ultralife in advance regarding battery storage and operating specifications and equipment structures when designing equipment that includes these batteries.

**SAFETY WARNINGS FOR LITHIUM-MANGANESE DIOXIDE (Li-MnO₂)
CELLS AND BATTERIES****A. WHEN USING THE BATTERY****! WARNING !**

- 1) Lithium cells and batteries may get hot, explode or ignite and cause serious injury if exposed to abuse conditions. Be sure to follow the safety warnings listed below:
 - Do not place the battery in fire or heat the battery.
 - Do not install the battery backwards so the polarity is reversed.
 - Do not connect the positive terminal and negative terminal of the battery to each other with any metal object (such as wire).
 - Do not carry or store battery together with bracelets, necklaces, hairpins or other metal objects.
 - Do not pierce the battery with nails, strike the battery with a hammer, step on the battery or otherwise subject it to strong impacts or shocks.
 - Do not solder directly onto the battery.
 - Do not expose battery to water or salt water, or allow the battery to get wet.
- 2) Do not disassemble or modify the battery. The battery contains safety and protection devices, which, if damaged, may cause the battery to generate heat, explode or ignite.
- 3) Do not place the battery in or near fire, on stoves or other high temperature locations. Do not place the battery in direct sunlight, or use or store the battery inside cars in hot weather. Doing so may cause the battery to generate heat, explode or ignite. Using the battery in this manner may also result in a loss of performance and a shortened life expectancy.

! WARNING !

- 4) If the device is to be used by small children, the caregiver should explain the contents of this document to the children and provide adequate supervision to ensure the device is being used appropriately.
- 5) When the battery is discharged, insulate the terminals with adhesive tape or similar materials before disposal.
- 6) Immediately discontinue use of the battery if, while using or storing the battery, the battery emits an unusual smell, feels hot, changes color or shape, or appears abnormal in any other way. Contact Ultralife if any of these problems are observed.
- 7) Do not place the battery in microwave ovens, high-pressure containers or on induction cookware.
- 8) In the event the battery leaks and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated, the battery fluid could cause damage to the eye. Refer to the MSDS for additional safety and handling instructions.

**SAFETY WARNINGS FOR LITHIUM-MANGANESE DIOXIDE (Li-MnO₂)
CELLS AND BATTERIES****B. WHEN DISCHARGING THE BATTERY****! WARNING !**

Do not discharge the battery using any device except for the specified device. When the battery is used in devices other than the specified device, it may damage the battery or reduce its life expectancy. If the device causes an abnormal current to flow, it may cause the battery to become hot, explode or ignite and cause serious injury.

Refer to the technical data sheets for the temperature ranges over which the battery can be discharged. Use of the battery outside this temperature range may damage performance of the battery or may reduce its life expectancy.

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**To ensure user safety, please contact Ultralife Batteries, Inc.
when designing a device for use with Ultralife lithium cells and batteries**