

Lithium Battery Information Sheet

1. Section 1: Identification

Products Name: Primary (non-rechargeable) lithium metal battery models: covers all the TLP models followed with 5 digit number starting with 9XXXX, and may include additional slashes and letters and digits.

Chemical Systems- a PulsesPlus battery that includes Lithium/Thionyl Chloride cells and Hybrid Layer Capacitor (HLC) cells. Both types are hermetically sealed.

Manufacturer Name: Tadiran, US office address- 2001 Marcus Avenue, Suite 125E, Lake Success, NY 11040.

US office address: 2001 Marcus Avenue, Suite 125E, Lake Success, NY 11040

Emergency Telephone No: CHEMTREC: 1-800-424-9300

Tel. for information: 1-516-621-4980

2. Section 2: Hazards Identification

The batteries described in this Battery Information Sheet include hermetically sealed cells, which are not hazardous when used according to the recommendations of the manufacturer and provide that the integrity the cells is maintained.

Under normal condition of use of the batteries, the electrode materials and the liquid electrolyte they contained are non-reactive provided the battery integrity is maintained. Risk of exposure exists only in case of mechanical, electrical or thermal abuse. Thus, the batteries should not short circuit, recharge, puncture, incinerate, crush, immerse in water, force discharge, or expose to temperatures above the temperature range of the cell or battery. In these cases there is a risk of fire or explosion.

Protection from charging:

Whenever lithium batteries are not the single power source in a circuit, the measures recommended by Underwriters Laboratories are relevant. The relevant protection means should be recommended/approved by TADIRAN.

3. Section 3: Composition/Information on Ingredients

| Component | CAS Number | % | ACGIH (TLV)* |
|--|------------------------|------|---|
| Lithium Metal (Li) | 7439-93-2 | <5% | Not Established |
| Thionyl Chloride (SOCl ₂) | 7719-09-7 | <40% | 0.2 ppm |
| Graphite and Carbon (C) | 7782-42-5 1333-86-4 | <10% | 3.5 mg/m ³ TWA for carbon |
| Aluminum Chloride (AlCl ₃) | 7446-70-0 | <5% | 2 mg/m ³ (Al salt, soluble) |
| Lithium Chloride (LiCl) | 7447-41-8 | <2% | Not Established |
| Lithium Cobalt- Nickel Aluminum Oxide | 207803-51-8 | <3% | - 0.02 mg/m ³ as Co dust and fumes. - 0.1 mg/m ³ as soluble Ni |
| Lithium Hexafluoro- Phosphate (LiPF ₆) | 21324-40-3 | <1% | None Established |
| Ethylene Carbonate | 96-49-1 | <2% | None Established |
| Dimethyl Carbonate | 616-38-6 | <2% | None Established |
| Diethyl Carbonate | 105-58-8 | <2% | None Established |
| PVDF | 24937-79-9 | <1 | None Established |
| Copper (Cu) | 7440-50-8 | <4% | 0.2 mg/m ³ , fume 1.0 mg/m ³ , dust and mist |
| Aluminum (Al) | 7429-90-5 | <2% | 10.0 mg/m ³ as dust |
| May be potted in Epoxy, casting resin and hardener | | <30% | None for epoxy resin or hardener components |
| Steel, nickel and inert components | Balance | | |

* TLV- Threshold Limit Value is personal exposure limits determined by ACGIH (American Council of Governmental Industrial Hygienists).

IMPORTANT NOTE: The above levels are not anticipated under normal use conditions.

4. Section 4: First aid measures

In case of battery rupture, explosion, or major leakage, evacuate personnel from contaminated area and provide good ventilation to clear out corrosive fumes, gases or the pungent odor. Seek immediate medical attention.

Eyes - First rinse with plenty of water for 15 minutes (remove contact lenses if easily possible), and then seek medical attention.

Skin - Remove contaminated clothes and rinse skin with plenty of water or shower for 15 min. Refer to medical attention.

Inhalation - Remove to fresh air, rest, and half-upright position, use artificial respiration if needed, and refer to medical attention.

Ingestion - rinse mouth, DO NOT induce vomiting, give plenty of water to drink, and refer to medical attention.

5. Section 5: Fire - fighting measures

FLASH POINT: NA LOWER (LEL): NA

FLAMMABLE LIMIT IN AIR: NA UPPER (LEL): NA

EXTINGUISHING MEDIA:

1. Lith- X (Class D extinguishing media) is the **only** effective on fires involving a few lithium batteries. If the cells are directly involved in a fire **DO NOT USE:** WATER, SAND, CO₂, HALON, and DRY POWDER OR SODA ASH EXTINGUISHERS.
2. If the fire is in adjacent area and the cells that are either packed in their original containers or unpacked, the fire can be fought based on fueling material, e.g., paper and plastic products. In these cases the use of copious amounts of **cold** water is effective extinguishing media. Storage area may also employ sprinkler system with cold water.

AUTO-IGNITION: NA

SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus to avoid breathing of irritant fumes (NIOSH approved SCBA & full protective equipment). Wear protective clothing and equipment to prevent body contact with electrolyte solution. Fire may be fought, but only from safe fire-fighting distance. Evacuate all persons from immediate area of fire.

UNUSUAL EXPLOSION AND FIRE EXPLOSION: Battery may explode when subject to: excessive heat (above 150°C), recharged, over-discharged (discharge below 0V), punctured and crushed. During thermal decomposition generation of chlorine (Cl₂), hydrogen chloride (HCl), and sulfur dioxide (SO₂) can be formed.

6. Section 6: Accidental release measures

PROCEDURES TO CONTAIN AND CLEAN UP LEAKS OR SPILLS: The material contained within the battery would only be released under abusive conditions.

In the event of battery rupture and leakage: contain the spill while wearing proper protective clothing and ventilate the area. Then, cover with sodium carbonate (Na₂CO₃) or 1:1 mixture of soda ash and slaked lime. Keep away from water, rain, and snow. Placed in approved container (after cooling if necessary) and disposed according to the local regulations.

NEUTRALIZING AGENTS: Sodium carbonate (Na₂CO₃) or 1:1 mixture of soda ash and slaked lime.

WASTE DISPOSAL METHOD: Product decomposed by water must be neutralized. if sufficiently diluted, it may be added to waste water if it is sufficiently diluted.

PRECAUTIONS IN HANDLING AND STORAGE: avoid short-circuiting, over-charging and heating to high temperatures. Store the batteries in dry and cool area and keep container dry and tightly closed in well-ventilated area. Store cells away from food and drink.

OTHER PRECAUTIONS; Never attempt to disassemble, machine, or otherwise modify batteries or injury may result.

7. Section 7: Handling and Storage

Charging- the TLP batteries are primary and, as such, are **not** designed to be recharged from external power source. Connecting to any other power supply can result in fire or explosion . The batteries should not be opened, destroyed or incinerate, since they may leak or rupture and release to the environment the ingredients that they normally contained in the hermetically sealed container.

Reverse Polarity- avoid reversing polarity of a cell within battery pack. This can cause the cell to leak or to flame.

HANDLING- Do not short circuit terminals, or expose to temperatures above the temperature rating of the battery, over charge the battery, forced over-discharge (voltage below 0.0V), throw to fire.

Do not crush or puncture the battery, or immerse in liquids.

STORAGE- is preferably done in cool (below 30°C), dry and ventilated area, which is subject to little temperature change.

Do not place the battery near heating equipment, nor expose to direct sunlight for long periods. Elevated temperatures can result in shortened battery life and degrade performance.

Keep batteries in original packaging until use and do not jumble them.

Do not store batteries in high humidity environment for long periods.

OTHER- cells and batteries are not rechargeable batteries and should not be charged.

Applying pressure and deforming the battery may lead to disassembly followed by eye skin and throat irritation.

Follow manufacturer recommendations regarding maximum recommended current and operating temperature range.

8. Section 8: Exposure controls / personal protection

GENERAL- The following safety measures are not necessary in normal use. They need only be applied if there is a risk that, in use or handling, the recommendations, as outlined in Section 3, have not been followed.

RESPIRATORY PROTECTION: In case of abuse or leak of liquid or fumes, use NIOSH approved Acid Gas Filter Mask or Self-Contained Breathing Apparatus.

VENTILATION: In case of abuse, use adequate mechanical ventilation (local exhaust) for battery that vents gas or fumes.

PROTECTIVE GLOVES: In case of spill use PVC or Nitrile gloves of 15 mils (0.015 inch) or thicker.

EYE PROTECTION: Use ANSI approved chemical worker safety goggles or face shield.

OTHER PROTECTIVE EQUIPMENT: In case needed, chemical resistance clothing is recommended along with eye wash station and safety shower should be available meeting ANSI design criteria.

WORK HYGIENIC PRACTICES: Use good hygiene practice. Wash hands after use and before drinking, eating or smoking. Launder contaminated cloth before reuse.

SUPPLEMENTARY SAFETY AND HEALTH DATA: If the battery is broken or leaked the main hazard is the electrolyte. The electrolyte is mainly solution of Lithium chloride (LiCl), and aluminum chloride (AlCl₃) in Thionyl chloride (SOCl₂).

Fires may be fought but only from safe fire fighting distance, evacuate all persons from immediate area of fire. Prevent heating of the battery, charging the battery, discharge to predetermined limit, do not crush, disassemble, incinerate or short circuit.

9. Section 9: Physical and chemical properties

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| (a) Appearance (physical state, color, etc.) | Geometric Solid Object; Depends on design of TLP model and finishing |
| (b) Odor | N/A; If leaking, gives off pungent corrosive odor |
| (c) Odor threshold | NA |
| (d) pH | NA, unless individual components exposed |
| (e) Melting point/freezing point | N/A |
| (f) Initial boiling point and boiling range | NA, unless individual components exposed |
| (g) Flash point | N/A |
| (h) Evaporation rate | NA, unless individual components exposed |
| (i) Flammability (solid, gas) | N/A |
| (j) Upper/lower flammability or explosive limits | N/A |
| (k) Vapor pressure | NA, unless individual components exposed |
| (l) Vapor density | NA, unless individual components exposed |
| (m) Relative density | >1; Depends on design of TLP model and finishing |
| (n) Solubility(ies) | NA, unless individual components exposed |
| (o) Partition coefficient: n-octanol/water | N/A |
| (p) Auto-ignition temperature | N/A |
| (q) Decomposition temperature | N/A Thermal decomposition over 150deg.C |
| (r) Viscosity | N/A |

10. Section 10: Stability and reactivity

| | |
|--|---|
| <u>STABLE OR NOT STABLE</u> | Stable |
| <u>INCOMPATIBILITY (MATERIAL TO AVOID)</u> | Strong mineral acids, water and alkali solutions. |
| <u>HAZARDOUS</u> | 1. Reaction of lithium with water: Hydrogen (H ₂), Lithium hydroxide (LiOH). |
| <u>DECOMPOSITION</u> | 2. Thermal decomposition over 150°C: Sulfur oxides, (SO ₂ , SO ₃), Sulfur |
| <u>PRODUCTS</u> | chlorides (SCL ₂ , S ₂ CL ₂), Chlorine (Cl ₂), Lithium oxide, Li ₂ O |
| | 3. Electrolyte with water: Hydrogen Chloride (HCl) and SO ₂ |
| <u>DECOMPOSITION TEMPERATURE (°F)</u> | NA |
| <u>HAZARDOUS POLYMERIZATION:</u> | May Occur ___ Will Not Occur <u>X</u> |
| <u>CONDITIONS TO AVOID</u> | Avoid mechanical abuse and electrical abuse such as short-circuiting, overcharge, over-discharge, (voltage reversal) and heating. |

11. Section 11: Toxicological information

THRESHOLD LIMIT VALUE (TLV) AND SOURCE: NA

HEALTH HAZARD ACUTE AND CHRONIC: Inhalation, skin contact, eye contact and ingestion are not likely by exposure to sealed battery.

Inhalation, skin contact and eye contact are possible when the battery is opened. Exposure to internal contents, the corrosive fumes will be very irritating to skin, eyes and mucous membranes. Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.

Carcinogenicity- NTP: No

Carcinogenicity- IARC: No

Carcinogenicity- OSHA: No

Explanation of Carcinogenicity- No ingredient of a concentration of 0.1% or greater is listed as a carcinogen or suspected carcinogen.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Exposure to leaking electrolyte from ruptured or leaking battery can cause:

For further information refer to section 4.

12. Section 12: Ecological information

1. When properly used or disposed the battery does not present environmental hazard.
2. Cells do not contain mercury, cadmium, lead or other heavy metals.
3. Do not let internal components enter marine environment. Avoid release to waterways, wastewater or ground water.

13. Section 13: Disposal Considerations

Dispose in accordance with the applicable regulations in country and state.

Disposal should be performed by permitted, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation. The battery should have its terminal insulated in order to prevent short circuit during the transportation to the disposal site.

Incineration should never be performed by battery users, but eventually by trained professional in authorized facility with proper gas and fume treatment.

Battery recycling should be done in authorized facility.

14. Section 14: Transport information

Shipping Name:

| | |
|-----------------|--|
| <u>UN 3090:</u> | Lithium Metal Batteries |
| <u>UN 3091:</u> | Lithium Metal Batteries contained in equipment, or Lithium Metal Batteries packed with equipment. |

Hazard Classification: Class 9

Special provisions and packing instructions:

IATA (65th revised edition)/ICAO (Packing Instructions: PI 968, PI 969, PI 970).

IMDG Code: SP188, SP230, SP310, SP360, SP376, SP377, SP384, P903, P908, P909, P910, P911, LP903, LP904, LP905, LP906.

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Transportation within, to and from the US: are governed by the US DOT CFR 49, Parts 171, 172, 173 and 175. They detail the required packaging and labels and transportation mode of batteries transported separately or in equipment. The battery cannot be shipped, within, to, and from the US by passenger aircraft. Air shipments of batteries can be done only by cargo aircraft.

15. Section 15: Regulatory information

1. All the cells and batteries are defined as “articles” and thus are exempt from the requirements of the Hazard Communication Standard”.
2. The internal component (Thionyl chloride) is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1920.1200.
3. NFPA rating- Lithium batteries are not included in the NFPA material list. Below is the NFPA rating for lithium metal. Lithium metal is an internal component, enclosed by hermetically sealed metallic can. Under normal application is not exposed.

16. Section 16: Other information

The information and the recommendations set forth are made in good faith and believed to be accurate at the date of preparation. The present file refers to normal use of the product in question. Tadiran Batteries makes no warranty expressed or implied.

Assembly of battery packs:

The design and assembly of battery packs require special skills, expertise and experience. Therefore, it is not recommended that the end user will attempt to self-assemble battery packs. It is preferable that any battery using lithium cells will be assembled by TADIRAN to ensure proper battery design and construction. A full assembly service is available from TADIRAN who can be contact for further information. If for any reason, this is not possible, TADIRAN can review the pack design in confidential to ensure that the design is safe and capable of meeting the stated performance requirements.