

MSDS No.: TLM_HP-01 (Rev. D)

MATERIAL SAFETY DATA SHEET

SECTION 1- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer Name- Tadiran Batteries Ltd.

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

Tel. for information 972-8-944-4503

Product Name and Description: TLM, 4.1V primary lithium cell.

Chemical System and Nominal Voltage- primary lithium cells with layered structured electrodes, with nominal voltage up to 4.1V

Models: Cylindrical batteries of types

Designated for Recharge: No

Products Name: Non-rechargeable cells and batteries which include the following models of: TLM-1520/HP, TLM-1530/HP, TLM-1550/HP, TLM-1020/HP, TLM-1030/HP and TLM-1050/HP with all their finishing versions and batteries assembled from them, denoted by “/” followed up by letters or digits..

SECTION 2- COMPOSITION AND INFORMATION ON INGREDIENTS

Ingredient Name	CAS #	% of wt.	ACGIH (TLV)	OSHA (PEL)
Lithium Cobalt- Nickel Oxide	193214-24-3	10-30	- 0.02 mg/m ³ as Co dust and fumes. - 0.1 mg/m ³ as soluble Ni	- 0.1mg/m ³ as Co dust, and fumes. - 0.015 mg/m ³ as Ni
Graphite and Carbons	7782-42-5 1333-86-4	10-20	3.5 mg/m ³ TWA for carbon	2.0 mg/m ³ as respirable fraction (dust)
Lithium Hexafluoro Phosphate (LiPF ₆)	21324-40-3	1-2	None Established	None Established
Ethylene Carbonate	96-49-1	3-12	None Established	None Established
Dimethyl Carbonate	616-38-6	3-12	None Established	None Established
Diethyl Carbonate	105-58-8	3-12	None Established	None Established
PVDF	24937-79-9	<1	None Established	None Established
Copper (Cu)	7440-50-8	7-15	0.2 mg/m ³ , fume 1.0 mg/m ³ , dust and mist	0.1 mg/m ³ , fume. 1.0 mg/m ³ , dust and mist.
Aluminum (Al)	7429-50-5	3-8	10.0 mg/m ³ as dust	2 mg/m ³ , as soluble salt.
Steel, nickel and inert components		Balance		

ACGIH: American Council of Governmental Industrial Hygienists.

TLV- Threshold Limit Value are personal exposure limits determined by ACGIH.

IMPORTANT NOTE-1: The above levels are not anticipated under normal consumer use conditions.

IMPORTANT NOTE-2: The cell/battery should not be opened or exposed to water and heat because exposure to the following ingredients contained within the battery could be harmful under some circumstances.

SECTION 3- HAZARD IDENTIFICATION

The cells described in this MSDS are hermetically sealed units, which are not hazardous when used according to the recommendations of the manufacturer and provide that the integrity the cells is maintained

Emergency overview: Do not short circuit, crush, immerse in water, charge, force discharge or expose to temperature above the declared operation temperature range of the product.

Potential health effects: Under normal conditions of use, the materials contained in the cells are not exposed to the outside, provided the battery integrity is maintained and seal remained intact. The risk of exposure to the internal ingredients occurs only in case of physical (mechanical) thermal or electrical abuses.

Acute exposure- electrolyte may irritate skin and eyes.

SECTION 4 – FIRST AID MEASURES

General introduction- the chemical ingredients are contained in a hermetically sealed cans. Thus, adequate hazard warnings are included on cell and on the package. Practically, there is no potential for exposure to these ingredients unless the cell leaks, or opened when exposed to high temperature, opened mechanically or electrically abused.

On contact with eyes – Is not anticipated under normal use. If cell is leaking and material contacts eyes, flush with copious amounts of clear, tepid water for at least 15 minutes (remove contact lenses if easily possible). Get medical attention at once.

On contact with skin - Is not anticipated under normal use. If cell is leaking and material contacts the skin, flush immediately with copious amounts of clear, tepid water and wash affected area with soap and water. In severe cases obtain medical attention.

If inhaled – Is not anticipated under normal use. If cell is leaking, remove to fresh air. Avoid inhaling any vented gases. If irritation persists, obtain medial attention.

On ingestion – Is not anticipated under normal use. If cell is leaking, rinse mouth and surrounding area with clear, tepid water for at least 15 minutes. Give plenty of water to drink. Obtain medical attention.

Further Treatment- All cases of eye contamination, persistent skin irritation, breathing of vapors and swallowed internal ingredients, should be seen by a Doctor.

SECTION 5- FIRE FIGHTING MEASURES

Extinguishing Media- Dry chemical type extinguishers, or CO₂ extinguishers or water extinguishers can be used effectively for burning cells or batteries. Water-based foam or copious quantities of water can be used to cool down burning cell.

Fire Fighting Procedures- If cells are involved in the fire, one should wear self-contained breathing apparatus (SCBA) to avoid breathing of irritant fumes. Full

protective clothing is necessary. During water application, caution should be exercised as burning pieces of flammable particles may be ejected from the fire. Evacuate all persons from immediate area of fire. DO NOT re-enter the area until it has been thoroughly ventilated (purged) of the fire vapors and extinguishing agent.

Unusual Fire and Explosion Hazard- If cells or batteries are exposed to excessive heat or fire they may flame or leak of potentially hazardous decomposition products.

Heat, charging or over-discharge they may produce hazardous decomposition products. Burning cells emit acrid smoke, irritating fumes, and toxic fumes of hazardous oxides of carbons, hydrofluoric acid and other toxic by-products (e.g., lithium oxide, aluminum, aluminum oxide, cobalt oxide, copper, copper oxide, phosphorus pentafluoride, etc.).

Damaged or opened cells/batteries or batteries can result in rapid heating and release of flammable vapors.

SECTION 6- SPILL OR LEAKAGE PROCEDURES

PROCEDURES TO CONTAIN AND CLEAN UP LEAKS OR SPILLS: In case of electrolyte leakage from a cell, the leaked materials should be removed using protective glass and protective gloves. Do not inhale the gas as much as possible. In addition, avoid touching the material as much as possible. Remove personnel from area until fumes dissipate. If skin has come into contact with the electrolyte, it should be washed thoroughly with water.

NEUTRALIZING AGENTS: Sodium carbonate (Na_2CO_3) or 1:1 mixture of soda ash with slaked lime.

WASTE DISPOSAL METHOD: Damaged cells that are not hot or burning should be placed in a sealed plastic bag or container. The removal of the cells should be dealt carefully using protective glasses and protective gloves.

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.

SECTION 7- HANDLING AND STORAGE

Cell Charging:

The TLM cells are primary cells 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.

Cell Disassembly

The cells should never be disassembled, or mechanically abused.

Should a cell unintentionally crushed or opened and thus releasing its content, rubber gloves should be used to handle all cell components. The inhalation of any vapor that may be emitted should be avoided.

In event of inhalation, eye and skin exposure to the electrolyte, refer to Section 4 “First Aid Measures”.

Short Circuiting

As with any cell, short circuit causes heating. In addition, short circuit reduces the life of the cell and can lead to ignition of surrounding materials. Physical contact with short-circuited battery can cause skin burns.

Reverse Polarity

Avoid reversing polarity of a cell within battery pack. This can cause the cell to leak or to flame.

Storage

Stored preferably in cool (below 30°C), dry and ventilated area, which is subject to little temperature change. Elevated temperatures may result in shortened cell life and degrade performance. Temperatures above 85°C may result in cell leakage.

Do not place cell near heating equipment, nor expose to direct sunlight for long period

Keep cells in original packaging until use and do not jumble them in order to prevent short circuit.

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

Cells should be stored separately from other material and in non-combustible, well ventilated and sprinkler-protected structure with sufficient clearance between walls and cell packages.

Labeling

If the Tadiran label or package warning is not visible, it is important to provide the cell sleeve or device a label stating:

Warning: Do not short circuit, charge, puncture, incinerate, crush, immerse in water, force discharge, or expose to temperatures above the temperature range of the battery or battery. Risk of fire and explosion.

Others

The cell should not be immersed in water.

The cell should not be thrown in fire or expose to high temperature

Applying pressure and deforming the cell may lead to disassembly followed by electrolyte leakage.

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

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.

ENGINEERING CONTROLS:

Handling of undamaged cells requires no engineering controls. The cell should be

kept away from heat and open flame and stored in a cool dry place. When a cell is being damaged or in the event of fire than:

OCCUPATIONAL EXPOSURE STANDARD:

The occupational exposure limits according to ACGIH and OSHA are given in Section 2, “Composition and Information on Ingredients” along with CAS number and their percentage range. For all ingredients no available Biological Exposure Indices (BEI) exist.

RESPIRATORY PROTECTION: None necessary under normal use. In case electrolyte leakage from cells, protect hand with chemical resistant rubber gloves. If cells are burning, leave the area immediately. In all fire situations, use contained breathing apparatus.

VENTILATION: Not necessary under normal use. In case of abuse, use adequate mechanical ventilation (local exhaust) for cell 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.

SKIN AND BODY PROTECTION: Not necessary under normal use. Use chemical apron and protective gloves working in case of handling of a ruptured cell or battery

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 with moisture the electrolyte can release Hydrofluoric Acid (HF)

Fires may be fought but only from safe fire fighting distance, evacuate all persons from immediate area of fire.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE:	Solid
APPEARANCE:	Cylindrical Solid Object
ODOR:	No odor. If leaking, gives off organic order
PH:	Not Applicable, unless individual cell or internal components is exposed to water.
VAPOR PRESSURE	Not applicable
VAPOR DENSITY	Not applicable
BOILING POINT	Not applicable
FLAMMABILITY	Not applicable
MELTING AND BOILING POINTS	Not applicable
MELTING AND BOILING RANGES	Not applicable

IGNITION TEMPERATURE	Not applicable
% VOLATILES	Not applicable
FLASH POINT	Not applicable
DENSITY (gr/cc):	> 1.5 gr/cc
SOLUBILITY IN WATER AND OTHER SOLVENTS	Not Applicable, unless individual components exposed
EXPLOSION PROPERTIES	Not applicable

SECTION 10- STABILITY AND REACTIVITY

STABILITY

The cell is stable under normal use and storage as described in Section 7.

HAZARDOUS REACTIONS OCCURRING UNDER SPECIFIC CONDITIONS:

INCOMPATIBILITY

None during normal operation conditions. Avoid exposure to heat, open flam and corrosives.

CONDITIONS TO AVOID:

Mechanical abuse such as crushing, piercing, and disassembly.

Electrical abuse such as short-circuiting, charging, over-discharge, (voltage reversal).

Heating above 85°C, exposure to open flame and incineration

MATERIALS TO AVOID:

Strong mineral acids, water, alkali solutions, strong oxidizing materials and conductive materials

HAZARDOUS DECOMPOSITION PRODUCTS:

None during normal operating conditions. If cell are opened:

1. Thermal decomposition during fire produces hazardous oxides of carbon (mainly CO and other VOC's) and phosphorous, hydrofluoric acid, metal oxides as that of aluminum, nickel, cobalt and lithium and other toxic by-products.

2. Electrolyte with water: Hydrofluoric acid (HF).

SECTION 11 – TOXICOLOGICAL INFORMATION

Toxicity information for cell ingredients is given in Section 2, “Composition and Information on Ingredients”. This information is generally not applicable to the intact cells normally used in application. Internal components of the cell are irritants and sensitizes. Exposure to the internal contents can occur only if the cells or battery are being ruptured.

1. Irritancy- in event of exposure to internal content, corrosive fumes are can result in irritation to skin, eyes and mucous membranes. Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.

2. Sensitisation- no information is available at this time for the cell.
3. Carcinogenicity- no information is available at this time for the cell
4. Teragenocicity- no information is available at this time for the cell
5. Reproductive toxicity- no information is available at this time for the cell
6. Acute toxicity- not applicable to intact cell: Nickel and Cobalt compounds are listed as possible carcinogen by the International Agency for Research on Cancer (IARC).

SECTION 12. - ECOLOGICAL INFORMATION

When properly used and disposed, cells and batteries do not present environmental hazard. Some materials within the cells are bioaccumulative, so do not bury or throw out into the environment.

SECTION 13- DISPOSAL CONSIDERATIONS

Waste disposal must be in accordance with the applicable Federal, State and the Local regulations.

Disposal of cells and batteries should be performed by permitted, professional disposal company knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation.

Incineration should never be performed by battery users.

The TLM cells contain recyclable materials. Recycling options available in your local area should be considered when disposing of this product, through licensed waste carrier.

The cell should have its terminal insulated in order to prevent short circuit during the transportation to the disposal site.

RCRA Waste Code- Nonregulated.

SECTION 14- TRANSPORTATION /SHIPPING

Shipping name: Lithium metal cells and batteries, they are considered as Dangerous Goods, e.g., UN-3090 for cells and batteries and UN-3091 for cells or batteries in equipment or with equipment.

Shipping information- the TLM cells have been successfully passed the tests defined in "UN Manual of Tests and Criteria", Section 38.3 (the UN tests).

Hazard Classification:

1. Worldwide besides the United State- the TLM cells and all its finishing versions are not subject to the Dangerous Goods Regulation, e.g., it is not restricted, since it passed the UN-defined transport tests, and its lithium content is below 1 gram. The cells or equipment with cells must be packed in accordance with the Packing Instructions of the applicable code, e.g., IATA/ICAO (P968, P969 and P970), IMO (SP188, SP230 and P903) and ADR (SP188, SP230 and P903).

2. Transportation within, to and from the US- are governed by the US DOT CFR 49, Parts 171, 172, 173 and 175. Special Provision 188 (in Part 172.102) defines the TLM cells and all its finishing versions as "*small lithium cells and batteries*" and

thus, they are not considered as Class 9. Special Provision 188 details the required packaging and labels and transportation mode of cells transported separately or in equipment. The TLM cells cannot be shipped, within, to, and from the US by passenger aircraft. Air shipments of cells can be done only by cargo aircraft.

Identification and labeling in compliance with the product drawing should include the battery title, nominal voltage, lot number and warning.

BUILDING OF NEW BATTERY PACK- when manufacturing a new battery pack using Tadiran TLM cells one must assure that they are being tested in accordance with the UN Model Regulation, Manual of Test and Criteria, Part III, subsection 38.3.

SECTION 15- REGULATORY INFORMATION

Regulations specifically applicable to the product:

1. ACGIH and OSHA- see exposure limits of the internal ingredients of the battery in Section 2.
2. IATA/ICAO (air transportation)- UN 3090 or 3091
3. IMDG (sea transportation)- UN 3090 or 3091
4. Transportation within the US- US DOT, 49 Code of Federal Regulations

SECTION 16- OTHER INFORMATION/DISCLAIMER

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 TLM cells are high power cells and thus 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.

REVISIONS

REVISION D- includes changes in Section 1 was revised to include new address of US office and addition of 3 models, in Section 2 the new CAS number of Lithium Cobalt Nickel Oxide was added, in Section 14 the transportation regulation were revised, in Section 16 we added information about battery pack assembly and general minor changes in other sections.

Effective, February 11, 2010