Safety Data Sheet

Primary Li-MnO_2 cells and packs

Saft primary Li-MnO2 cells and packs are manufactured articles which contain hazardous chemicals. Saft batteries are manufactured to specific shapes and designs and have end use functions that are dependent in whole or in part upon those shapes and designs. Under normal conditions of use, Saft batteries do not release hazardous chemicals and do normally not pose a physical hazard or health risk to the end user.
Under situations involving neglect, misuse, abuse, and/or improper handling and storage, exposure to hazardous chemicals normally contained inside the batteries can result.

1. IDENTIFICATION

All data are valid for cells and packs as long as no other information is given.

1.1 Product

Lithium Manganese dioxide primary cells and packs composed of these cells

1.2 Supplier

Headquarters Address Phone/Fax	**Saft S.A.S.** 12 rue Sadi Carnot, 93170 BAGNOLET – France Phone/Fax: +33 (0)1 49 93 19 18 / +33 (0)1 49 93 19 50
Factory Address Phone/Fax	**Friemann & Wolf Batterietechnik GmbH (« FRIWO »)** Industriestrasse 22, 63654 BÜDINGEN - Germany +49 (0)6042 954 150 / +49 (0)6042 954 490
Factory Address Phone/Fax	**Saft Poitiers** Rue Georges Leclanché – BP n°1039, 86060 POITIERS Cedex 9 - France +33 (0)5 49 55 48 48 / +33 (0)5 49 55 48 50
Factory Address Phone/Fax	**Saft Ltd.** River Drive, Tyne & Wear, SOUTH SHIELDS, NE33 2TR - UK +44 191 456 1451 / +44 191 456 6383
Factory Address Phone/Fax	**Saft Valdese** 313 Crescent Street, VALDESE, NC 28690 - USA +1 828 874 4111 / +1 828 874 2431

1.3 Emergency contact

Chemtrec US Service within the USA: +800 424 93 00/outside : +1-202-483-7616 (English)
For Friwo cells: +49(0) 6042-954-599 (German and English)

2. HAZARD IDENTIFICATION

2.1 Electrolyte contained in individual cells

According to regulation 2012 OSHA hazard Communication Standard; 29 CFR part 1910.1200

Electrolyte GHS classification

Flam. Liq.	2	Flammable liquids
Skin Corr./Irrit.	2	Skin corrosion/irritation
Eye Dam./Irrit.	1	Serious eye damage/eye irritation
Car.	2	Carcinogenicity
Repr.	1B (fertility)	Reproductive toxicity
Repr.	1B (unborn child)	Reproductive toxicity
STOT SE	3 (vapors may cause drowsiness and dizziness)	Specific target organ toxicity- single exposure
STOT SE	3 (irritating to respiratory system)	Specific target organ toxicity- single exposure
STOT RE	2	Specific target organ toxicity- repeated exposure

Electrolyte GHS label elements:

- **Pictograms:**

- **Signal word: Danger**
- **Electrolyte hazard statements:**
  - H225 Highly flammable liquid and vapour
  - H318 Causes serious eye damage
  - H315 Causes skin irritation
  - H336 May cause drowsiness and dizziness
  - H335 May cause respiratory irritation
  - H351 Suspected of causing cancer
  - H 373 May cause damage to organs (Thyroid gland) through prolonged or repeated exposure
  - H360 may damage fertility. May damage the unborn child
- **Electrolyte physical hazard:** the products resulting from hydrolysis react strongly acidic.
- **Electrolyte ecological hazard:** there is a high probability that the electrolyte is not acutely harmful to aquatic organisms.

2.2 At cell or pack level

Not chemically dangerous with normal use in accordance with Saft recommendations as stated in the user manuals or other similar documentation. Under normal conditions of use, the electrode materials and electrolyte they contain are not released to the outside, provided that the battery integrity is maintained and seals remain intact. Exposure to the ingredients contained within or their combustion products could be harmful.

Risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery containers. In particular, the battery should not be opened, burned or stored/used above the specified temperature range (for more details see Section 7). Electrolyte leakage or battery venting/explosion/fire may follow, depending upon the circumstances.

- **Protection from charging:**

Whenever lithium batteries are not the single power source in a circuit, the following measures recommended by Underwriters Laboratories are relevant. The cells should not be connected with an electrical power source that would increase the load through the cells. The electronic circuit shall include one of the following:

A. Two suitable diodes or the equivalent in series with the cells to prevent any reverse (charging) current. The second diode is used to provide protection in the event that one would fail. Quality control, or equivalent procedures, shall be established by the device manufacturer to check that the diode polarity is correct for each unit.

or

B. A blocking diode or the equivalent to prevent any reverse (charging) current and a resistor to limit current in case of diode failure. The resistor should be sized to limit the reverse (charging) current to the maximum value according to the data sheet of the cell.

- **Hazards in case of opened cells by released material:**

EYE CONTACT: Can cause eye irritation. Dust may cause inflammation of eyelids.
SKIN CONTACT: Can cause skin irritation.
INHALATION: Can cause respiratory tract and mucus membrane irritation. If gas is generated during battery disassembly, throat irritation may occur.
INGESTION: Can be poisoning if swallowed.

3. COMPOSITION, INFORMATION OR INGREDIENTS

3.1 At cell level

Component	CAS Number	EINECS/ELINCS	Content (wt. %)*
Lithium	7439-93-2	231-102-5	3-4
Manganese dioxide	1313-13-9	215-202-6	40-50
Organic electrolyte**	N/A	N/A	15-25
Carbon	1338-86-4		1-5
Copper	7440-50-8	231-159-6	1-15
Aluminium	7429-90-5	231-072-3	1-20
Stainless steel, Nickel, inert material	N/A	N/A	remainder

** Quantities vary with cell type*
*** All LM/M cells excepted Saft's LM17500, LM26500, LM33600 and M20Ex contain 1,2-Dimethoxyethane (CAS 110-71-4, EINECS 603-031-00-3), (content < 3 %) listed on REACH candidate list since June 2012*

3.2 At battery pack level

Depending on the type of battery pack the content may vary but will not exceed the given content ranges.

4. FIRST AID MEASURES (not anticipated under normal use)

4.1. Electrolyte contact

EYE CONTACT: Irrigate thoroughly with water for at least 15 minutes. Obtain medical attention.

SKIN CONTACT: Wash off skin thoroughly with tap water. Remove contaminated clothing and wash before reuse. In severe cases obtain medical attention.

INHALATION: Remove from exposure, rest and keep warm. In severe cases obtain medical attention.

INGESTION: Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.

FURTHER TREATMENT: All cases of eye contamination, persistent skin irritation and casualties who have swallowed this substance or been affected by breathing its vapours should be seen by a doctor.

4.2. Lithium metal contact

EYE CONTACT: Immediately flush with large quantities of water for at least 15 minutes, with open eyelids, and get medical attention.

SKIN CONTACT: Remove particles of lithium from skin as quick as possible. Immediately flush with plenty of water for at least 15 minutes and get medical attention.

INHALATION/INGESTION: Contents of an opened cell may cause respiratory tract and mucus membrane irritation. Remove from exposure, rest and keep warm. Immediately inhale Cortisone spray. In severe cases, track medical surveillance for 48 hours.

5. FIRE FIGHTING MEASURES (not anticipated under normal use)

ESTINGUISHING MEDIA:

- Li-MnO_2 cells and batteries: CO_2 extinguishers or, even preferably, copious quantities of water or water-based foam can be used to cool down burning Li-MnO_2 cells and batteries, as long as the extent of the fire has not progressed to the point that the lithium metal they contain is exposed (marked by deep red flames).
- Raw lithium: **Use only metal (Class D) extinguishers**
- Do not use sand, dry powder or soda ash, graphite powder or fire blankets.

SPECIAL FIRE FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus.
Use approved / certified vapour respirator to avoid breathing toxic fumes. Wear protective clothing and equipment to prevent potential body contact with electrolyte solution. It is permissible to use any class of extinguishing medium, specified above, on these batteries or their packing material. Cool exterior of batteries if exposed to fire to prevent rupture.

PARTICULAR HAZARDS RESULTING FROM EXPOSURE TO THE SUBSTANCE/PREPARATION, TO COMBUSTION AND GAS PRODUCTS: The cell can release vaporized or decomposed electrolyte fumes when being heated to temperatures above their temperature rating. Solvents within the electrolyte are flammable liquids and must be kept away from any kind of ignition source.
Above 160°C (+356°F) cells / packs may explode and release sparks, metallic parts and burning lithium.

6. ACCIDENTAL RELEASE MEASURES (not anticipated under normal use)

INDIVIDUAL PRECAUTIONS: Evacuate the employees from the contaminated area until fumes dispersal. In case of electrolyte leakage from a cell or battery, do not inhale the gas as possible. In case of skin or eye contact, inhalation or ingestion, follow the measures described in section 4.

ENVIRONMENTAL PRECAUTION: Avoid sewage, surface water and underground water contamination. Avoid ground and atmosphere contamination.

WAYS OF CLEANING: Wearing protective glasses and gloves, use absorbent material (sand, earth or vermiculite) to absorb any exuded material. Seal leaking battery (unless hot) and contaminated absorbent material in plastic bag and dispose of as Special waste in accordance with local regulations.

7. HANDLING AND STORAGE

IMPORTANT NOTICE: The battery should not be opened without Saft approval, destroyed or incinerated since the battery may cause fire or the ingredients contained in the cells could be harmful under some circumstances if exposed.

The Lithium Manganese dioxide cells described in this Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer.

STORAGE:

- Store in a cool, dry place but prevent condensation on cells and batteries.

- Elevated temperatures can result in shortened battery life and degrade performance.
- Do not store batteries in high humidity environments for long periods of times.
- Since short circuit can cause burn hazard, leakage or explosion hazard, keep batteries in original packaging until use and do not mix them.
- Keep original packaging for return of cells or battery packs to the supplier.

HANDLING:

- Do not recharge
- Do not over-discharge or force discharge
- Do not short (+) or (-) terminal with conductors.
- Do not reverse the polarity
- Do not open the battery packs or cells
- Do not submit to excessive mechanical stress (puncture, crush, deformation etc.).
- Do not expose to water or condensation, oxidizing or reducing agents, acids or bases.
- Do not expose to temperatures above the temperature rating of battery.
- Do not directly heat, solder or throw into fire.
- Immediately disconnect the batteries if, during operation, they emit an unusual smell, feel hot, change shape, or appear abnormal in any other way. Put straight into a bucket of water. Contact Saft if any of these problems are observed.

BATTERY PACK ASSEMBLY:
The design and assembly of battery packs require special skills, expertise and experience. Therefore it is not recommended that the end user attempts to self-assemble battery packs. It is preferable that any battery using lithium cells is fabricated by Saft to ensure proper battery design and construction. A full battery assembly service is available from Saft which can be contacted for further information. If for any reason, this is not possible, Saft can review the pack design in confidence to ensure that the design is safe (in assembly and use) and capable of meeting stated performance requirements.

OTHER:
Follow Manufacturers recommendations regarding maximum recommended currents and operating temperature range.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION* (not necessary under normal use)

Component of the electrolyte with occupational exposure limits: tetrahydrofuran :

- OSHA PEL: PEL 200 ppm 590 mg/m3; STEL value 250 ppm 735 mg/m3; TWA value 200 ppm 590 mg/m3
- ACGIH TLV: TWA value 50 ppm; STEL value 100 ppm; skin designation: the substance can be absorbed through the skin

Handle an opened battery or cell only in a well-ventilated place.

	**Respiratory protection**	In case of incident or after an abusive use, in case of a cell opening or a leak, use gas mask which covers the whole face and equipped with ABEK type filters or escape mask type Self-Contained Breathing Apparatus. Fire fighters should wear self-contained breathing apparatus.
	**Hand protection**	Use polypropylene, polyethylene, rubber or Viton gloves when handling leaking or ruptured cells.
	**Eye protection**	In case of incident or after an abusive use, in case of a leak or cell opening, wear safety glasses with protected side shields or a mask covering the whole face when handling leaking or ruptured cells
	**Other**	In the event of leakage or ruptured cells, wear a rubber apron and protective clothes.

**AFNOR pictograms*

9. PHYSICAL AND CHEMICAL PROPERTIES

The lithium-MnO_2 cells or batteries described by this Safety Data Sheet are sealed units when offered for sale. They are manufactured “articles” and do not expose the user to hazardous chemicals when used in accordance with manufacturer specifications.

10. STABILITY AND REACTIVITY

Product is stable under conditions described in Section 7.
The following hazards may occur under abuse conditions in case of cell opening:

HAZARDOUS REACTIONS: Lithium released from the cell may react with water in the atmosphere and produce hydrogen, which is a highly flammable gas.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition of the cell may release electrolyte liquid and vapour, harmful materials, and dusts.

MATERIALS TO AVOID: Oxidizing agents, bases, water.

CONDITIONS TO AVOID: Do not heat above the temperature given in the data sheet of the specified cell or incinerate. Do not disassemble, crush, pierce, short, charge or recharge. Avoid mechanical or electrical abuse.

11. TOXICOLOGICAL INFORMATION

Risk of irritation occurs only if the cell is mechanically, thermally or electrically abused to the point of compromising the enclosure. If this occurs, irritation to the skin, eyes and respiratory tract may occur.

1,2-Dimethoxyethane (EGDME) may impair fertility and may cause harm to unborn child. EGDME is listed on the REACH candidate list as SVHC since June 2012.

12. ECOLOGICAL INFORMATION

None known if used/disposed of correctly

13. DISPOSAL CONSIDERATIONS

Battery recycling is either mandatory (European Directive 2006/66/EC) or recommended.
Since even cells and batteries discharged to their cut-off voltage can still contain considerable amounts of energy, terminals should always be protected to avoid short circuits.
Dispose in accordance with local laws and regulations (contact your local dealer). Store material for disposal as indicated in Section 7.
Do NOT dump into any sewers, on the ground or into any body of water.
For large quantities a disposal service is offered on request.

See the section on “Sustainability & Environment” on http://www.saftbatteries.com

14. TRANSPORTATION INFORMATION

14.1 UN Transport regulations

Lithium MnO_2 cells and battery packs are listed in the hazardous materials list according to UN Recommendations on Dangerous Goods Transportation. Depending on their lithium metal content, the transport of some single cells and small battery packs may be non-restricted (refer to the respective transport certificate)

UN Number	UN 3090 (cells and batteries shipped in bulk)
	UN 3091 (cells and batteries shipped in or with equipment)
ADR class:	Class 9
Packaging group:	II
Shipping name:	Lithium metal batteries

14.2 Label for conveyance

For single cells and battery packs which are non-restricted to transport, use “lithium batteries inside” label.
For single cells and battery packs which are restricted to transport (assigned to Class 9), use the Class 9 Miscellaneous Dangerous Goods and UN Identification Number labels.
In all cases, refer to the product transport certificate issued by the Manufacturer.

14.3 International agreements

By Air International:	IATA A88, A99, A154, A164, P968, P969, P970	
By Sea International:	IMDG 188, 230, 310, P903	
	EmS No.	F-A, S-I
	Marine pollutant	No
	Storage and segregation:	Category A
European road transportation:	ADR 188, 230, 310, 636, P903, P903a, P903b	
European rail transportation:	RID 188, 230, 310, 636, P903, P903a, P903b	

In all cases, refer to the product transport certificate issued by the manufacturer.

15. REGULATORY INFORMATION

Marking Consideration
European Union: According to directive 2006/66/EC, the batteries have to be marked with the crossed wheel bin symbol.

16. OTHER INFORMATION

This Safety Data Sheet was reviewed on August 9, 2016.

Friemann & Wolf Lithium MnO_2-cells are registered by Underwriters Laboratories, Northbrook, USA under File-No. MH 46385, Project-No.: 08CA08489.

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, neither exhaustively nor perfect reliability can be granted. Information does not imply implicit or specific warranty of it.

This information relates to the specific products designated and may not be valid for such products used in combination with any other materials or in any process. It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his particular use.

Saft does not accept liability for any loss or damage that may occur, whether direct, indirect, incidental or consequential, from the use of this SDS. Saft does not offer warranty against patent infringement.

12, rue Sadi Carnot
93170 Bagnolet – France
Tel.: +33 (0)1 49 93 19 18
Fax: +33 (0)1 49 93 19 69
www.saftbatteries.com

www.friwo-batterien.de

Edition: October 2016
Version 10

Data in this document is subject to change without notice and becomes contractual only after written confirmation.