

INSTRUCTIONS FOR THE SAFE HANDLING OF LITHIUM BATTERIES

1 Identification of Product and Company

1.1 Product

Rechargeable Li Ion Battery

1.2 Trade Name

This Document is valid for the following products:

- Sonnenschein Lithium Battery
- Sonnenschein@home Lithium Battery
- Lithium Traction Block (LTB)

1.3 Manufacturer

Company: GNB Industrial Power
A division of Exide Technologies GmbH

Address: Im Thiergarten, 63654 Büdingen
Germany

Telephone: +49604281-0

Local GNB contact:

GNB Industrial Power
A division of Exide Technologies AS

Brobekkveien 101, Økern
NO-0513, Oslo, Norway

Tel. +47 2207 4700

2 Hazards Identification

Lithium batteries have a gastight seal and are safe insofar as they are used and handled in accordance with the Manufacturer's specifications. Chemicals contained in the battery have been packed in a hermetically sealed enclosure.

2.1 Warning

- When recharging batteries, never use chargers which are unsuitable for the battery type.
- Do not short-circuit them. Do not inflict mechanical damage (puncturing, deforming, disassembling etc.).
- Do not heat them above the permitted temperature or burn them. Store batteries in a dry and cool place.
- When handled properly and in accordance with the parameters specified by the manufacturer, lithium batteries are safe during use and storage.
- Improper handling or conditions leading to improper operation can cause leakage of battery substances and products of decomposition and reactions associated with these, which can cause personal injury and environmental damage.
- Since a wide variety of chemical substances are used, always follow the manufacturer's directions for immediate measures and first-aid measures in the event of an accident. In general, contact with leaking battery substances can pose a danger to personal health and the environment. For this reason, when coming into contact with batteries with a conspicuous appearance (leaking substances, deformed, discoloured, dented or the like), sufficient body and breathing protection is required. Lithium batteries can, for example, react very severely in combination with fire. This can result in battery components being ejected with considerable force.

2.2 Handling and operational safety

Lithium batteries are always to be handled in accordance with the manufacturer's specifications. This is particularly true for complying with the limits for maximum current load, charging and end-point voltages, and mechanical and thermal loads. Usually product packages are marketed that have already been matched. Such products are in no wise to be modified or tampered with, since that could result in substantial safety hazards.

Use the charging process tailored to the respective cell type of a rechargeable battery.

2.3 Danger

As with other batteries, so also for lithium batteries it is true that even when thought to be discharged, they can still represent a source of danger.

Do not short batteries. High short-circuit current. Even in the state of the minimum permitted end-point voltage, lithium batteries with a high voltage (over 75 Volts) can pose a danger of a lethal electric shock.

Do not deep discharge batteries; this leads to permanent damage. Deep-discharged lithium batteries are no longer permitted to be charged or operated.

In all cases, avoid excessive charging voltages and overcharging. They can lead directly to critical situations, but also have a negative impact on battery life.

3 Composition and Information on the main Ingredients

3.1 Battery Cells

The following components are found inside the sealed Li-ion battery. Cells have been further combined as larger modules and systems using mechanical parts.

Component	Chemical name	CAS number
Cathode Lithium-Metal oxide	LFP: Lithium-Iron -Phosphate	15365-14-7
	NMC: Lithium nickel manganese cobalt oxide	182442-95-1
Anode	Graphite	7782-42-5
Binder	Polyvinylidene difluoride	24937-79-9
Electrolyte	Ethyl acetate	141-78-6
	Ethylene carbonate	96-49-1
	Dimethyl carbonate	616-38-6
Cu	Copper	231-159-6
Al	Aluminum	231-072-3

Lithium is a very light metal and reacts violently with water therefore, a water-free solvent is used as electrolyte (which is also inflammable!!)

3.1.1 Li-ion electrode materials

The following Li-Ion electrode materials and their properties are readily available:

	LFP	NMC
Nominal voltage (V)	3,2 / 3,3	3,6/3,7
Volumetric energy density (Wh/l)	160-260	490-580
Gravimetric energy density (Wh/kg)	80-120	180-210
Discharging current (C)	10-50	1-10
Cycle-life(cycles)	2000–5000	500–1000
Applications	High Power	High Energy + Power

Trade name	Cathode	
	LFP	NMC
Sonnenschein Lithium	X	
Sonnenschein@home Lithium		X
Lithium Traction Block		X

3.2 Battery Management System (BMS)

Electronic Components
Contactor

3.3 Battery case

Steel

4 First Aid measures

The chemicals listed in item 3 are enclosed in a sealed housing so that they cannot escape during normal use.

4.1 Skin contact

Contents of an opened battery can cause skin irritation. Wash skin with soap and water.

4.1 Eye contact

Contents of an opened battery can cause eye irritation. Immediately flush eyes thoroughly with water for 15 minutes and seek medical attention

4.2 Respiratory tract

Leave the room immediately if there is an intensive smoke build-up or release of gas. Seek advice of a medical doctor if there are large quantities and irritation of the respiratory tract. If possible provide for sufficient ventilation.

5 Fire-fighting measures

Fires from lithium batteries in use can in principle be fought with water. Other suitable extinguishing media are CO₂ or Chemical Powder. Differentiating between various systems of lithium batteries at the time of a fire is generally not possible and is unnecessary.

Due to the design and the battery properties, no additional or special extinguishing agents need to be available, since the batteries are protected accordingly. Fire surrounding the batteries is to be fought with conventional extinguishing agents. The fire of a battery cannot be considered separately from the surrounding fire. The cooling effect of water effectively impedes fire from spreading to battery cells which still have not reached the critical ignition temperature ("thermal runaway").

Use of water is also favorable in light of its wide availability. Hybrid or fully electric vehicles pose no greater risk with the high-voltage batteries switched off than conventional vehicles. As with all fires, inhalation of the gases produced by the fire can harm one's health. For this reason, provide for sufficient ventilation and protective clothing including self-contained breathing apparatus.

Hazardous combustion components might be generated like:

- Carbon Monoxide and Carbon Dioxide
- Fluor compounds as pyrolysis products
- Hydrogen Fluoride gas
-

6 Measures to be taken in case of accidental release

If the battery housing gets damaged, electrolyte can leak out. Seal batteries in an airtight plastic bag, having added dry sand, chalk powder (CaCO₃) or vermiculite. Traces of electrolyte can be soaked up with dry paper towels. When doing so, prevent direct contact with skin by wearing safety gloves. Thoroughly rinse with water. Use personal safety equipment appropriate for the situation (safety gloves, protective clothing, safety mask, breathing protection).

7 Handling and Storage

7.1 Handling

Do not open the battery. Do not crush, disassemble, drop or solder. Incorrect handling can lead to explosion or fire.

7.1.1 Charging

Charge within limits of 0°C to +45 °C temperature. Charge only with specified charger designed for this battery.

7.1.2 Discharging

Discharge within limits of -10 °C to +50°C temperature.

7.2 Storage

Lithium batteries are preferably to be stored at room temperature and in a dry location); large temperature fluctuations are to be avoided. (For example, do not store in the vicinity of eating elements, do not expose to sunshine for long periods).

If substances leak out due to damage or improper handling, be sure to comply with the manufacturer's instructions. This particularly includes the use of personal safety equipment. When storing great quantities of lithium batteries make an arrangement with the local authorities. In general and independent of batteries: A building permit is required for storage buildings.

8 Exposure controls and personal protection

Lithium batteries are products from which no substance is released under normal and reasonably foreseeable conditions of use.

Skin protection: Not necessary under normal conditions. Wear nitrile, neoprene, or natural rubber gloves when handling an open or leaking battery.

Eye protection: Not necessary under normal conditions. Wear nitrile, neoprene, or natural rubber gloves when handling an open or leaking battery

Respiratory protection: Not necessary under normal conditions. In the event battery case ruptured inside an enclosed space, use self-contained breathing apparatus.

Ventilation Not necessary under normal conditions

9 Physical and Chemical properties

Appearance form:	solid Battery
Colour:	n.a.
Odour:	n.a. If leaking smells of medical ether
pH:	n.a.
Flash point:	n.a.
Flammability:	n.a.
Density:	n.a.
Solubility in Water:	not soluble
Stability:	stable

Chemical properties: see point 3

9.1 Stability and Reactivity

Reactivity: n.a

Chemical Stability: The product is chemically stable under normal conditions. Do not expose the batteries to fire or other high temperature sources.

Conditions to avoid: Do not disassemble batteries, avoid turning, twisting puncture or break batteries. Do not short circuit batteries. Excess temperatures $T > 50^{\circ} \text{C}$ must be avoided in order to avoid damage of the battery. Comply during discharge and charge with the voltage limits defined for the battery.

Hazardous decomposition Products: Exposure to fire may cause emission of flammable and dangerous fumes or gases like organics or HF.

10 Toxicological Information

10.1 Acute toxicity

Unbroken cells or batteries do not represent toxicity

10.2 Irritation and corrosion

Risk of thermally or electrically abuse causing cells to open. Electrolyte is corrosive. It causes chemical burns on contact with skin. Inhalation of fine mist or vapors is irritating to the respiratory system. Prolonged contact with the skin or mucous membranes may cause irritation.

- Sensitization: No information is available at this time.
- Carcinogenicity: No information is available at this time.
- Reproductive toxicity: No information is available at this time.
- Teratogenicity: No information is available at this time.
- Mutagenicity: No information is available at this time

11 Ecological Information

11.1 Eco-toxicity

Not applicable for undamaged product. Data in case of damaged cells or battery not available

11.2 Persistence and degradability

Not applicable

11.3 Bio-accumulative potential

Not applicable

11.4 Mobility in soil

Not applicable

11.5 Results from PBT –and vPvB assessment

Not applicable

Note: (P) persistent; (B) bioaccumulative; (T) toxic; (vP) very persistent; (vB) very bioaccumulative

11.6 Other adverse effects

In case of an accident emissions may be harmful to environment

12 Disposal Considerations

According to the principles defined in EU battery Directive (2006/66/EU), Lithium Ion Batteries must be collected separately from other wastes. Spent batteries will be collected from the point of sales free of charge. To prevent short circuits and associated heating up, lithium batteries are never permitted to be stored or transported in bulk form and unprotected. Suitable measures against short circuits include:

- Placing the batteries in original packaging or a plastic bag
- Masking the poles
- Embedding in dry sand

Disposal of waste industrial and automotive batteries by incineration or in landfills is prohibited. However, residues of any batteries and accumulators that have undergone both treatment and recycling may be disposed of in landfills or by incineration.

13 Transport Regulation

Important note!

Commercial transport of lithium batteries is subject to dangerous goods regulations. Transport and transport preparations are exclusively to be carried out by appropriately trained persons and/or the process has to be accompanied by corresponding experts or qualified companies.

14.1 General

Lithium batteries are subject to the following dangerous goods regulations and exceptions to them - in the version applicable in each case:

- Hazard Class: 9
- UN 3480: LITHIUM ION BATTERIES (including lithium-ion-polymer batteries)
- UN 3481: LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT, or
- LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium-ion-polymer batteries)

14.2 Land transport

- Tunnel category E
- Special provisions and packing instructions: ADR, RID: 188, 230, 310, 636, P903, P903a, P903b; SV 661
- Note: For ADR, www.unece.org/trans/danger/publi/adr/adr2011/11contentse.html

14.3 Air transport

- IATA: A88, A99, A154, A164, P965, P966, P967, P968, P969, P970
- Note: For the IATA Guidance Document on lithium batteries, www.iata.org/whatwedo/cargo/dangerous_goods/Pages/lithium_batteries.aspx

14.4 Sea transport

- IMDG Code: 188, 230, 310, P903
- EmS: F-A, S-I
- Stowage category A

14.5 Test and inspection specifications

In accordance with the dangerous goods regulations for lithium batteries, each new type of cell or battery must have passed all tests listed in the UN Manual of Tests and Criteria, Part III, Section 38.3. This particularly applies also if multiple cells or batteries have been assembled into new batteries (battery packs or battery assemblies). Note: For the UN Manual, see www.unece.org/trans/danger/publi/manual/Rev5/ManRev5-files_e.html

Used batteries are also subject to these regulations. In the case of used batteries which are intact and undamaged, usually the regulations for new batteries can be applied.

Used or damaged batteries are subject to more stringent regulations, ranging all the way to complete prohibition of transport. The prohibition of transport applies to air transport carriers (ICAO T.I., IATA DGR - special provision A154).

However, for the transport of used — but not damaged — batteries, refer also to the corresponding special regulations (636), and/or packaging instructions (P903a and P903b / ADR). Waste batteries and batteries which are sent for recycling or disposal are prohibited from air transport (IATA Special provision A 183). Exceptions are to be approved by the competent authority of the country of origin and the respective country of the airline.

14 Regulatory Information

In accordance with EU Battery Directive and the respective national legislation, Lithium-Ion batteries are labelled by a crossed-out dust bin together with the ISO return/recycling symbol.



The symbol reminds the end user that batteries are not permitted to be disposed of with household waste, but must be collected separately.

15 Other Information

The European Directive 91/155/EEC which described the requirements for Material Safety Data Sheets had been repealed by the Regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals on June 1st, 2007 (REACH-Regulation 1907/2006/EC). The requirement to publish a Material Safety Data Sheet applies to all suppliers of substances and preparations. As already defined under the former Directive there is no requirement to develop and maintain a Material Safety Data Sheet for products such as Batteries.

The information and instructions provide help for complying with legal specifications, but do not replace them.

The foregoing information was compiled to the best of our knowledge and belief.

It does not represent any guarantee of properties. Distributors and users of the product have their own responsibility for observing applicable laws and regulations.