Current version available under www.coinpower.de

Preface

Lithium batteries provide a high energy density which is often combined with a high-rate capability to the benefit of the customer. Due to these excellent performance properties, Lithium batteries contain a certain safety risk. If short-circuited, heat and sometimes sparks may be generated. Mistreatment beyond the recommended limits can cause gas generation, leakage and fire.

This guideline "Handling Precautions, Prohibitions and General Supply Notices for VARTA Microbattery GmbH CoinPower Batteries" shall be applied to VARTA CoinPower batteries. It shall be brought to the attention of all persons who handle the batteries.

For:

**... *[Company of contracting party]***,
a corporation duly organized and validly existing under the laws of ... ***[State]***,
registered ... ***[Registration]***,
... ***[Address]***

***-hereinafter referred to as "customer"-***

Note (1):

The customer is requested **to contact VARTA Microbattery GmbH in advance**, if and when the customer needs other applications or operating conditions than those described in this document. In this case additional tests and experiments may be necessary to verify performance and safety under such conditions. VARTA Microbattery GmbH shall not be responsible for safety, performance, functionality, compatibility or fitness for a particular purpose unless such features have been expressly communicated and described in the specification.

Note (2):

VARTA Microbattery GmbH will take **no responsibility** for any accident when the cell is used under **other conditions than those described in this guideline**.

Note (3):

VARTA Microbattery GmbH will inform, the customer in writing of improvement(s) regarding proper use and handling of the cell, if deemed necessary.

Note (4):

Do not modify and or open cells or batteries without prior written approval by VARTA Microbattery GmbH.

# 1. Charging

## 1.1 Charging current

Charging current should **not exceed maximum charge current** specified in the Data Sheet.
Charging with higher current than recommended may cause damage to cell performance and safety features and can lead to ***heat generation or leakage***.

## 1.2 Charging voltage

A3/A3X:
Charging at above 4.250 V, which is the absolute maximum voltage, is strictly prohibited. The charging has to be done according to the data sheet. The charger shall be designed accordance with this condition. Use specified charger only.

A4/A4X:
Charging at above 4.350 V, which is the absolute maximum voltage, is strictly prohibited. The charging has to be done according to the data sheet. The charger shall be designed accordance with this condition. Use specified charger only.

Charging with higher voltage than specified may cause damage to cell performance and safety features, and can lead to ***fire, heat generation or cell leakage***.

## 1.3 Charging temperature

The cell shall be charged within the range of specified temperatures in the Data Sheet. If the cell is charged at a temperature out of the specified range, ***leakage, heat generation, or other damages*** may occur.
Repeated charging and discharging at high and low temperature may cause degradation of cell performance even within the specified temperature range.

## 1.4 Prohibition of reverse charging

**Reverse charging is prohibited**. The cell shall be connected correctly. The polarity has to be confirmed **before connecting** any wires.
Reverse charging will cause damage to the cell(s) and will lead to a loss of cell performance and cell safety *(including heat generation or leakage)*.

## 1.5 Prohibition of trickle charging or continuous charging

Trickle charging or continuous charging is prohibited. Trickle charging conditions or continuous charging can lead to overcharging, generation of internal pressure and degeneration of the cell.
The cell shall be charged with constant current until 4.3 V ± 50 mV, then with constant voltage and tapering current. At approx. 0.02 C current the charging must be stopped. Charging should restart only if appreciable capacity has been discharged from the cell, or the cell voltage has fallen itself below a voltage level of 4.0 V.

## 2. Discharging

### 2.1 Discharge current

The cell shall be discharged at **less or equal than the maximum discharge current** specified in the Data Sheet.
High discharge current may reduce the discharging capacity significantly, or cause ***overheating***.

### 2.2 Discharge temperature

The cell shall be discharged within the temperature range that is specified in the Data Sheet.

### 2.3 Overdischarging

**Not using the cell(s) for a long time** may lead to overdischarge**.** In order to prevent overdischarging, the cell(s) shall be charged periodically to maintain a voltage in the range of 3 V to 3.8 V.
Overdischarging may cause loss of cell performance, or damage battery function.
The application device shall be equipped with a device to prevent further discharging below the **cutoff voltage** specified in the Data Sheet.

PCM overdischarge detection threshold/voltage **must not** be used **as cut-off voltage** for battery.

Also the charger shall be equipped with a device to control the recharging procedures as follows:
In case of overdischarging, the cell(s)/battery pack shall start with a low current (0.01 – 0.07 C) for 15-30 minutes, i.e. precharging, before rapid charging starts. The charging according to the Data Sheet shall be started after the individual cell voltage has risen above about 3 V within 15-30 minutes, which can be determined and controlled by the use of an appropriate timer for precharging.
In case the individual cell voltage does not rise to about 3 V within the pre-charging time, the charger shall have functions to stop the further continuous charging and display that the cell(s) is/are in an abnormal state.

## 3. Protection Circuit Module (PCM)

3.1 The cell(s) shall be provided with a **PCM** which can protect cell(s) properly, e.g. in case of failing Charge Control Circuit.

3.2 PCM shall have functions of (i) overcharging prevention, (ii) over-discharging prevention, and (iii) over current prevention, to maintain safety and prevent significant deterioration of cell performance. The overcurrent can occur by external short circuit.

### 3.3 Overdischarge Prohibition

Overdischarge prevention function shall work to minimize dissipation current to avoid further drop in cell voltage below 2.0 V.
It is recommended that the dissipation current of PCM shall be designed to be minimized to 0.5 microamperes or less after the overdischarge prevention function activates in order to minimize effects on shelf life of the battery.
In case the individual cell voltage falls below 2.0 V PCM shall have functions to disconnect the cell(s) from electronic circuit and cell shall not be recharged in any case.

## 4. Application

For the batteries approved by UL (File MH13654) the intended use is at ordinary temperatures where anticipated high temperature excursions are not expected to exceed 70 °C. Nevertheless under reasonably foreseeable misuse conditions at temperatures up to 85 °C over 4 hours no safety risk occurs.

### 4.1 Technician replaceable appliances

VARTA Lithium Ion batteries of type CoinPower do not fulfil the requirements for being User replaceable, as the reverse polarity installation cannot be prevented. Therefore the VARTA Lithium Ion batteries of Type CoinPower can be used only in devices where servicing of the battery circuit and replacement of the lithium battery will be done by a trained technician.

a) The instruction manual supplied with the end product shall contain the following warning notice:

- „Replacement of battery has to done by trained technician. For replacement only batteries with (Battery Manufacturer's name or endproduct manufacturer's name), Part No. ( ) may be used. Use of another battery may present a risk of fire or explosion."

  or

  „The battery used in the (End Product Name) must be replaced at (End product manufacturers) service center only."

- Caution: The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not disassemble, heat above 100 °C (212°F) or incinerate.

- „Dispose of used battery properly considering local laws and rules. Keep away from children – harmful if swallowed!"

- WARNING: Risk of Fire, Explosion, and Burns. Do Not Disassemble, Crush, Heat above 100°C (212°F), Short-Circuit or Incinerate.

## 5. Storage

### 5.1 Storage of cells

The cells shall be stored within a **proper temperature range** as specified in the Data Sheet. The state of charge shall be 30% of the nominal capacity; open circuit voltage OCV about 3.6 V. When stored for a long time, care has to be taken that the battery voltage does not drop below the cut-off voltage due to self-discharge (see 2.3).

### 5.2 Storage of assembled cells in application

The assembled cells in application shall be stored within a **proper temperature range** as specified in the Data Sheet. When stored for a long time, care has to be taken that the battery voltage in application does not drop below the cut-off voltage due to self-discharge (see 2.3).

## 6. Others

### 6.1 Cell connection

Soldering or welding of wires or other types of connectors **directly to the cell** is strictly prohibited.
A proper cell connection can only be done by the cell manufacturer itself. If soldering or welding of wires or other types of connectors directly to the cell will be done not by the cell manufacturer, all claims regarding warranty, performance and safety will be omitted.

### 6.2 Ultrasonic Welding of Application Housing

Ultrasonic welding of plastic lid to the plastic casing can be applied. However, the welding shall be done **avoiding the application of ultrasonic wave power directly to the cells**. Otherwise, it may cause serious damage to the cells.

### 6.3 Prevention of short-circuit within application

Enough **insulation layer(s)** between wiring and the cells shall be used to maintain multiple safety protection.
The battery housing shall be designed to prevent short-circuits while cell is assembled and during usage of device.
This is because short circuits may cause **generation of smoke or fire**.

### 6.4 Assembly

(1) **Important:** Always avoid any possible contact of cell housing with sharp objects, corners, or points which could puncture or damage the cell.

(2) Avoid applying mechanical stress (such as tension, pressure) to cell itself during assembly. Do not remove or disassemble any component from the original VARTA supply configuration.

(3) Do not subject cell to higher temperatures than specified in datasheet provided.

(4) Do not subject cell to ultrasonic weld process vibration or energy.

(5) Avoid accidental short-circuit of cell during assembly and finishing processes.

(6) Avoid accidental mechanical damage to cell during assembly and finishing processes.

(7) Packaging for cell has to be made of insulating material, avoiding discharge or short-circuiting.

## 6.5 Prohibition of Disassembly

(1) Never disassemble the cells.

(2) **Disassembling cells** may cause an internal short-circuit in the cell, which could further ***cause gassing, fire, or other problems***.

Harmful Electrolytes:

An electrolyte which leaks out from the cells is harmful to the human body. If the electrolyte comes into contact with the skin, eyes or other parts of body, the electrolyte shall **be flushed immediately with water. Seek medical advice from a physician.**

## 6.6 Prohibition of short-circuit

Never short-circuit the cells. It causes generation of very high currents resulting in heating of the cells, which may cause electrolyte ***leakage, gassing or fire***.

## 6.7 Prohibition of dumping of cells into fire

Never incinerate nor dispose of cells into fire.

## 6.8 Prohibition of cells immersion into liquid such as water

The cells shall never be soaked with liquids such as water, sea water, drinks such as soft drinks, juices, coffee or others.

## 6.9 Battery cells replacement

The battery replacement shall be done **only by device supplier** and never be done by the user.

## 6.10 Prohibition of use of damaged cells

Cells may be damaged during shipping by shocks, or other causes.

If any abnormal features of the cells are found such as: damage to the stainless steel housing of the cell, deformation of the cell container, smell of electrolyte, an electrolyte leakage, or other abnormalities, the cells **shall not be used any more**.
Cells with a smell of electrolyte or leakage shall be kept away from fire to avoid ***ignition***.

6.11 General supply notices and responsibilities

The customer agrees to manufacture, assemble, sell, transport and/or dispose of the Finished Products in a way that the health and safety of people, including workers and general public, and environmental protection can always be assured. customer agrees and guarantees to comply with any and all relevant safety and environmental requirements, laws and regulations in the countries where the Products are sold, manufactured, transported, stored or disposed.

The customer shall be solely responsible for health, safety and environmental matters arising from its manufacture, assembly, sales, use, transportation and/or disposal of the Finished Products, and shall defend, indemnify, and hold VARTA Microbattery GmbH, its subsidiaries, customers, and suppliers and its and their respective representatives and employees harmless from and against all costs, liabilities, claims, lawsuit, including but not limited to attorney's fees, with respect to any pollution, threat to the environment, or death, disease or injury to any person or damage to any property resulting, directly or indirectly, from the manufacture, assembly, purchase, sales, use, operation, transportation or disposal of the Finished Products; except to the extent that the customer shall be exempted from such obligation if and so long as the cause of such damage is attributable directly and solely to VARTA Microbattery GmbH.

6.12 Battery compartment design

(1) Protection circuit shall be isolated from the cell to diminish damage from any electrolyte leakage which may occur by mishap. The battery compartment shall be designed not to allow leaked electrolyte access to protection circuit.

(2) Battery case material resistance for electrolyte shall be considered when battery case material is selected.

(3) Under abusive conditions the cell may vent. To ensure venting cell has venting holes in cup on the circumference of cell. Care has to be taken, that overpressure can be released in any abusive condition. Assembly must not interfere with venting mechanism.

(4) Venting Requirements according to IEC 62133:
*'Battery cases and cells shall incorporate a pressure relief mechanism or shall be so constructed that they will relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition. If encapsulation is used to support cells within an outer case, the type of encapsulant and the method of encapsulation shall neither cause the battery to overheat during normal operation nor inhibit pressure relief.'*

Specific VARTA safety mechanism activation point

**A3**

| Cell Type | Venting Holes open | CID Breakage | Pressure Release Vent |
|---|---|---|---|
| CP7840 A3 | n.a. | n.a. | 0.5 mm |
| CP0854 A3 | n.a. | n.a. | 0.5 mm |
| CP9440 A3 | n.a. | n.a. | 0.5 mm |
| CP1240 A3 | 0.5 mm | 1.0 mm | n.a. |
| CP1254 A3 | 0.7 mm | 1.5 mm | n.a. |
| CP1454 A3 | 0.7 mm | 1.5 mm | n.a. |
| CP1654 A3 | 0.7 mm | 1.5 mm | n.a. |

**A4**

| Cell Type | Venting Holes open | CID Breakage | Pressure Release Vent |
|---|---|---|---|
| CP9440 A4X | n.a. | n.a. | 0.5 mm |
| CP9454 A4X | n.a. | n.a. | 0.5 mm |
| CP1240 A4 | 0.5 mm | 1.0 mm | n.a. |
| CP1240 A4X | 0.5 mm | n.a. | n.a. |
| CP1250 A4 | 0.7 mm | 1.5 mm | n.a. |
| CP1250 A4X | 0.7 mm | n.a. | n.a. |
| CP1254 A4 | 0.7 mm | 1.5 mm | n.a. |
| CP1254 A4X | 0.7 mm | n.a. | n.a. |
| CP1454 A4 | 0.7 mm | 1.5 mm | n.a. |
| CP1454 A4X | 0.7 mm | n.a. | n.a. |
| CP1654 A4 | 0.7 mm | 1.5 mm | n.a. |
| CP1654 A4X | 0.7 mm | n.a. | n.a. |

**A5**

| Cell Type | Venting Holes open | CID Breakage | Pressure Release Vent |
|---|---|---|---|
| CP1054 A5X | 0.7 mm | n.a. | n.a. |

X-Version: Cells without CID. Different UL recognition, with different overcharge approval (see technical datasheet – datasheet is available with your respective sales person)

If breaking of CID is not possible due to CID is not applicable or due to limited venting space, it must be secured that charging is stopped in case of cell venting.

6.13 Protection circuit module design

(1) Electrolyte has corrosive characteristics. Protection circuit module may not work correctly if exposed to electrolyte.

(2) This should be considered in protection circuit module design.
Main wiring patterns shall be separated from each other as much as possible.

Conductive patterns and connection terminals which may be short-circuited by electrolyte leakage should be separated from each other as much as possible. Another method is coating the whole surface of the module by conformal coating material.

6.14 Warning

- Keep small cells and batteries which are considered swallowable out of the reach of children
- Swallowing may lead to burns, perforation of soft tissue and death. Severe burns can occur within 2h of ingestion
- In case of ingestion of a cell or battery, seek medical assistance promptly

This warning is also to be provided with the information packaged with these cells and batteries or equipment using them.

7. Marking

The customer shall prepare comprehensive instructions and appropriate markings for end users.
The assembled device shall be provided with **packing, handling and safety instructions** regarding cell usage, storage, and replacement, and shall be marked with information in accordance with applicable regulations. **The prohibitions mentioned in this document, regulations in UL 1642 (and other specifications) shall be clearly explained to the users.**

The markings shall also be done in accordance with requirements based on guidelines for rechargeable Lithium-Ion batteries for maintaining safety of the cells.

Example for marking according to the UL 1642 regulation:

(1) Mark the manufacturer's name, business name or trademark, and specified model name.

(2) Use the word "Warning" and indicate the statement "Risk of Fire, Explosion, and Burns. Do Not Disassemble, Crush, Heat Above 100 °C (212°F), Short-Circuit or Incinerate" or equivalent.

(3) Final product shall be marked with following statement or equivalent: "Replacement may only be made with cell specified by the final product manufacturer, with correct Part Number. Fire or burning may occur if the customer uses cell other than specified by the final product manufacturer. The customer shall refer to the handling instruction issued by the final product manufacturer."

If it is not possible to mark the warnings mentioned above on the final products, the final product manufacturer shall mark and print the warnings in the handling or maintenance instructions or manuals of the products.

Especially the marking shall contain the advice in Chapter 4 according to the type of usage.