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# Safety requirements for secondary batteries and battery installations —

Part 4: Batteries for use in portable  
appliances

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## National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Sicherheitsanforderungen an Batterien  
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Teil 4: Batterien für tragbare Geräte

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## Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 21X, Secondary cells and batteries. The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50272-4 on 2006-03-01.

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## Introduction

This standard gives information about the safety and health protection of persons when applying secondary batteries, which are used for DC power supply systems in portable appliances. Therefore the standard applies for commercially available secondary batteries and battery systems according to the requirements of the "Low Voltage Directive".

In the European countries similar relevant standards or specifications or parts of it exist, which shall be taken into account and will be replaced by this new standard.

In certain portable appliances or toys the discharge of both primary and secondary cells or batteries is possible. In case of interchange ability of these cells or batteries the standards for primary batteries of the EN 60086 series, Parts 1 to 5, shall have preference.

## 1 Scope

This standard applies to the safety aspects associated with the accommodation, the arrangements of circuits and the operation of secondary cells and batteries in portable appliances. Requirements are specified which oblige the manufacturers of appliances and secondary batteries to prevent the misuse of batteries in the course of operation to provide protective measures avoiding injury to persons in case of battery failure and to provide sufficient information to users.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50272-2	Safety requirements for secondary batteries and battery installations - Part 2: Stationary batteries
EN 60086-1	Primary batteries - Part 1: General (IEC 60086-1)
EN 60086-2	Primary batteries - Part 2: Physical and electrical specifications (IEC 60086-2)
EN 60086-3	Primary batteries - Part 3: Watch batteries (IEC 60086-3)
EN 60086-4	Primary batteries - Part 4: Safety of lithium batteries (IEC 60086-4)
EN 60086-5	Primary batteries - Part 5: Safety of batteries with aqueous electrolyte (IEC 60086-5)
EN 60335-1	Household and similar electrical appliances - Safety - Part 1: General requirements (IEC 60335-1)
EN 61056-2	General purpose lead-acid batteries (valve-regulated types) - Part 2: Dimensions, terminals and marking (IEC 61056-2)
EN 61429 + A11	Marking of secondary cells and batteries with the international recycling symbol ISO 7000-1135 and indications regarding directives 93/86/EEC and 91/157/EEC (IEC 61429)
EN 61951-1	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Portable sealed rechargeable single cells - Part 1: Nickel-cadmium (IEC 61951-1)

EN 61951-2	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Portable sealed rechargeable single cells - Part 2: Nickel-metal hydride (IEC 61951-2)
EN 61960	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for portable applications (IEC 61960)
EN 62133	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable application (IEC 62133)
IEC 60050-482	International Electrotechnical Vocabulary - Chapter 482: Primary and secondary cells and batteries
IEC 60417 database	Graphical symbols for use on equipment

### 3 Definitions

#### 3.1

##### **battery for use in portable appliances**

mainly used for the power supply of the electrical equipment or parts of it forming an integral, functional unit. Batteries for use in portable equipment are usually maintenance-free types. For further definitions see International Electrotechnical Vocabulary IEC 60050-482

#### 3.2

##### **secondary cell / battery**

cell which is designed to be electrically recharged, basic functional unit providing a source of electrical energy by direct conversion of chemical energy, the cell (or battery) consists of an assembly of electrodes, separators, electrolyte, container and terminals  
[IEV 482-01-03]

### 4 Operating instructions

Users of appliances shall be informed through operating instructions about the following items, with specific reference to batteries:

- a) proposed or applicable battery systems and battery dimensions according to the applicable standard,
- b) correct insertion of batteries into the equipment in terms of polarity,
- c) charging instructions for secondary batteries,
- d) prohibition of charging when using primary batteries,
- e) storage and temperature conditions,
- f) maintenance instructions,
- g) instructions for the prevention of hazard and measures to be taken following an accident,
- h) instructions about disposal.

Operating instructions for batteries in portable appliances must be provided and can be part of the equipment instructions. Required information for safe operation, like polarity, voltage, battery type, etc shall be repeated inside or close to the battery compartment.

## 5 Dimensions and interchange ability of cells and batteries

Cells and batteries with reverse polarity but identical dimensions shall not be sent into the retail market. Compliance with the existing standards is required.

Interchange ability of cells and batteries with the same nominal voltage and identical dimensions, but of different technologies is permitted, if stated by the appliance manufacturer (see EN 60086-1, Subclause 4.1.7).

Cells in a battery string shall be of identical design, type and brand. It is recommended to use cells of same state of charge and same age (see IEC/TR 62188, Subclause 7.9).

## 6 Electrical safety

### 6.1 Protection against incorrect connection polarity

Manufacturers of appliances shall provide measures against incorrect polarity connections of the battery to the device. Measures can be, e.g.

- marking of the position of individual cells or batteries,
- polarity marked cables,
- plugs,
- design of compartments and contacts,
- electronics,

(see EN 60086-5, Annex B and EN 60335-1, Annex B).

NOTE Where applicable the battery symbol according to IEC 60417 database shall be used.

### 6.2 Design of battery and battery compartments

Both, the design of battery and battery compartment, shall include provisions to minimize the risk of the battery being reversed (connected the wrong way round) either during use or during charge. The design of terminals and the method of connecting them to the equipment or to the charger shall make wrong connection of the battery impossible (see EN 60086-5).

### 6.3 Compartments for consumer replaceable batteries

Where battery compartments are designed for consumer replaceable batteries the requirements in EN 60086-5 apply.

## 7 Safe handling and protection against misuse

### 7.1 Charging

The charging instructions which apply to the batteries and chargers shall be observed. Where replacement of batteries by the end user is foreseen, the equipment manufacturer shall provide clear instructions about the replacement battery.

## 7.2 Thermal abuse

Battery systems for portable appliances shall not be overheated. Overheating due to service conditions will destroy the battery and, in individual cases, the equipment as well. Depending on the type of battery corrosive and/or toxic liquids or gases may be released. Therefore batteries shall be inserted into the appliances in such a way that their permissible temperature range is not exceeded.

## 7.3 Mechanical impact

Batteries shall be protected from mechanical damage which may cause leakage of hazardous chemicals causing short-circuits which may result in overheating and subsequent rupturing of further cells.

## 7.4 Protection against pole reversal in the event of deep discharge

Secondary batteries shall be charged / discharged, so that each cell gets charged or discharged to the same extent (taps in the battery string lead to uneven discharge condition). Only cells and/or batteries of the same type and age shall be connected in series.

The maximum number of cells specified by the battery manufacturer and any required protective measure for series connection shall be observed in order to avoid pole reversal of individual cells in the event of deep discharge of the battery bank. Depending on the battery system reverse polarity can destroy the battery, damage the appliance, and expose the user to danger e.g. due to battery leakage.

A low voltage protection device may be provided for disconnection of the equipment from the load. If some cell reversal may cause damage to equipment or persons a protective device is required.

## 7.5 Protection against electrical overload

Appliances and batteries shall be protected by short-circuit and overload protection devices, if the available battery power may cause damage to equipment or persons.

## 7.6 Safe handling

To achieve safe handling during transport, installation and replacement the battery terminals and the connection cables shall be designed so that short circuits are not possible.

# 8 Battery compartments

Secondary batteries in portable appliances can be of permanently fixed installation, can be replaceable for recharging separately outside of the appliance or can be replaceable by primary batteries. In case of replaceable batteries the requirements 8.1 to 8.4 apply.

Where watertight equipment is used safety precautions are required to prevent or limit the generation of hydrogen.

## 8.1 Battery accommodation

Battery enclosures for accommodation of batteries in electrical equipment shall be designed, where necessary, to be separate from the functional parts of the equipment and accessible from the outside.

NOTE Cells or batteries may leak electrolyte. Both valve-regulated and gas-tight secondary batteries have a safety device (valve or vent) which release gas when activated.

## 8.2 Replacement battery enclosures

Battery enclosures should be accessible, so that batteries can be replaced, and the enclosure and the contacts can be cleaned.

## 8.3 Battery contacts

Contacts and dimensions shall be designed to minimize the voltage drop and to ensure current flow, e.g. resilient contacts may be provided. The contacts inside the battery compartments shall consist of material resistant against corrosion of battery electrolyte.

## 8.4 Protection against hazards caused by released gas

Batteries can release gas, which may be flammable or explosive.

The released amount of gas is increasing especially in case of malfunction of battery or charger.

The gas can be ignited by energy sources, like sparks, heat or electrostatic discharge when certain limits of gas concentration and volume are exceeded.

Different measures can be applied to protect the user from hazards, e.g.

- ! sparking shall be prevented,
- ! no sparking devices shall be applied inside battery enclosures,
- ! appropriate ventilation of the battery enclosure shall be provided, e.g. by natural or forced ventilation,
- ! reduce gas concentration inside the compartment by use of catalysts or absorbents,
- ! gas concentration shall be reduced by diffusion or membranes to the outside.

## 9 Measures in the event of accidents with batteries

### 9.1 Swallowing button cells

It is possible that button cells can be swallowed because of the dimensions. Due to the gastric juices it must be assumed that the cells can leak within a few hours causing burns to the mucous membranes and possibly poisoning. The operating instructions must state that medical assistance is immediately required.

The warning "Keep out of the reach of children" shall be printed on the packaging of button cells.

### 9.2 Burns or poisoning caused by leaking batteries

If in extreme cases batteries start to leak, leakage of electrolyte or gases can be expected. To prevent burns or possibly poisoning users shall be informed of this potential hazard in the operating instructions.

## 10 Marking and disposal of batteries for use in portable appliances

All cells and batteries containing the electro-chemically active substances mercury, cadmium or lead shall be marked with the recycling symbol ISO 7000-1135 according to EN 61429, respectively with the crossed-out waste bin and the ISO symbol in accordance with EN 61429/A11.

When used cells or batteries are subjected to disposal and recycling, the following EC Directives must be followed:

! 91/157/EEC (Council Directive) "Batteries and accumulators containing certain dangerous substances";

! 93/86/EEC (Commission Directive) "Adaptation to technical progress of Council Directive 91/157/EEC".

## **Annex A** (informative)

### **Instructions for use and recommendations to the end-users**

(Reference is also made to EN 60086-5 and EN 62133)

#### **A.1 Instructions for use**

- a) Always select the correct size and grade of battery most suitable for the intended use. Information provided with the equipment to assist correct battery selection should be retained for reference
- b) Replace all batteries of a set at the same time.
- c) Clean the battery contacts and also those of the equipment prior to battery installation.
- d) Ensure that the batteries are installed correctly with regard to polarity (+ and –).
- e) Remove batteries from equipment which is not to be used for an extended period of time.
- f) Remove exhausted batteries promptly.

#### **A.2 Recommendations to the end-users**

The following represents a list of good advice to be provided by the equipment manufacturer to the end-user.

- a) Do not dismantle, open or shred cells or batteries.
- b) Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.
- c) Do not short-circuit a cell or a battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- d) Do not remove a cell or battery from its original packaging until required for use.
- e) Do not subject cells or batteries to mechanical shock.
- f) In the event of a cell leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- g) Do not use any charger other than that specifically provided for use with the equipment.
- h) Do not incline valve-regulated lead-acid cells or batteries beyond 90° from the upright position, in any direction, while charging.
- i) Observe the plus (+) and minus (–) marks on the cell, battery and equipment and ensure correct use.
- j) Do not use any cell or battery which is not designed for use with the equipment.
- k) Do not mix cells of different manufacture, capacity, size or type within a device.

- l) Keep cells and batteries out of the reach of children.
- m) Seek medical advice immediately if a cell or a battery has been swallowed.
- n) Always purchase the correct cell or battery for the equipment.
- o) Keep cells and batteries clean and dry.
- p) Wipe the cell or battery terminals with a clean dry cloth if they become dirty. When cleaning surfaces of plastic material, like containers or lids, only a moist cloth may be used. Never use cleaning agents.
- q) Do not allow cells or batteries to contact organic solvents, such as thinner, alcohol, oil, and anti-rusting treatments or surface-active agents such as detergents.
- r) Secondary cells and batteries need to be charged before use. Always use the correct charger and refer to the manufacturer's instructions or equipment manual for proper charging instructions.
- s) Do not leave a battery on prolonged charge when not in use.
- t) After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to recover their performance.
- u) Secondary cells and batteries give their best performance when they are operated at normal room temperature ( $20\text{ °C} \pm 5\text{ K}$ ).
- v) Retain the original product literature for future reference.
- w) Use only the cell or battery in the application for which it was intended.
- x) When possible, remove the battery from the equipment when not in use.
- y) Specific disposal instructions for the battery system(s) fitted should be followed.

### Bibliography

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Part 1: General requirements, functional characteristics - Methods of test  
(IEC 61056-1)
- EN 61959      Secondary cells and batteries containing alkaline or other non-acid electrolytes -  
Mechanical tests for sealed portable secondary cells and batteries  
(IEC 61959)
- EN 62281      Safety of primary and secondary lithium cells and batteries during transport  
(IEC 62281)
- IEC/TR 62188    Secondary cells and batteries containing alkaline or other non-acid electrolytes -  
Design and manufacturing recommendations for portable batteries made from  
sealed secondary cells
- IEC/TS 61438    Possible safety and health hazards in the use of alkaline secondary cells and  
batteries - Guide to equipment manufacturers and users





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