

INTERNATIONAL STANDARD

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**Primary batteries –
Part 4: Safety of lithium batteries**

**Piles électriques –
Partie 4: Sécurité des piles au lithium**

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Part 4: Safety of lithium batteries**

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Partie 4: Sécurité des piles au lithium**

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PRIMARY BATTERIES –**Part 4: Safety of lithium batteries****FOREWORD**

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International Standard IEC 60086-4 has been prepared by technical committee 35: Primary cells and batteries.

This fifth edition cancels and replaces the fourth edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Revised criteria for an explosion;
- b) Addition of test parameters for the overdischarge test of battery types FR14505 and FR10G445;
- c) Addition of a new subclause 5.1 Validity of Testing;
- d) revised pictogram E in Table D.1;
- e) Addition of Annex E with requirements for child resistant packaging of coin cells;

- f) Addition of Annex F with recommendations on the use of the KEEP OUT OF REACH OF CHILDREN safety sign.

The text of this standard is based on the following documents:

FDIS	Report on voting
35/1420/FDIS	35/1423/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

NOTE The following print types are used:

- instructions/warnings for consumers: *in italic type*.

A list of all parts in the IEC 60086 series, under the general title *Primary batteries*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The concept of safety is closely related to safeguarding the integrity of people and property. This document specifies tests and requirements for lithium batteries and has been prepared in accordance with ISO/IEC guidelines, taking into account all relevant national and international standards which apply.

Lithium batteries are different from conventional primary batteries using aqueous electrolyte in that they contain flammable materials.

Consequently, it is important to carefully consider safety during design, production, distribution, use, and disposal of lithium batteries. Based on such special characteristics, lithium batteries for consumer applications were initially small in size and had low power output. There were also lithium batteries with high power output which were used for special industrial and military applications and were characterized as being “technician replaceable”. The first edition of this document was drafted to accommodate this situation.

However, from around the end of the 1980s, lithium batteries with high power output started to be widely used in the consumer replacement market, mainly as a power source in camera applications. Since the demand for such lithium batteries with high power output significantly increased, various manufacturers started to produce these types of lithium batteries. As a consequence of this situation, the safety aspects for lithium batteries with high power output were included in the second edition of this document.

Primary lithium batteries both for consumer and industrial applications are well-established safe and reliable products in the market, which is at least partly due to the existence of safety standards such as this document and, for transport, IEC 62281. The fourth edition of this document therefore reflects only minor changes which became necessary in order to keep it harmonized with IEC 62281 and to continuously improve the user information about safety related matters.

Guidelines addressing safety issues during the design of lithium batteries are provided in Annex A. Annex B provides guidelines addressing safety issues during the design of equipment where lithium batteries are installed. Both Annex A and B reflect experience with lithium batteries used in camera applications and are based on [23]¹.

Safety is freedom from unacceptable risk. There can be no absolute safety: some risk will remain. Therefore a product, process or service can only be relatively safe. Safety is achieved by reducing risk to a tolerable level determined by the search for an optimal balance between the ideal of absolute safety and the demands to be met by a product, process or service, and factors such as benefit to the user, suitability for purpose, cost effectiveness, and conventions of the society concerned.

As safety will pose different problems, it is impossible to provide a set of precise provisions and recommendations that will apply in every case. However, this document, when followed on a judicious “use when applicable” basis, will provide reasonably consistent standards for safety.

¹ Numbers in square brackets refer to the bibliography.

PRIMARY BATTERIES –

Part 4: Safety of lithium batteries

1 Scope

This part of IEC 60086 specifies tests and requirements for primary lithium batteries to ensure their safe operation under intended use and reasonably foreseeable misuse.

NOTE Primary lithium batteries that are standardized in IEC 60086-2 are expected to meet all applicable requirements herein. It is understood that consideration of this part of IEC 60086 might also be given to measuring and/or ensuring the safety of non-standardized primary lithium batteries. In either case, no claim or warranty is made that compliance or non-compliance with this standard will fulfil or not fulfil any of the user's particular purposes or needs.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60086-1, *Primary batteries – Part 1: General*

IEC 60086-2, *Primary batteries – Part 2: Physical and electrical specifications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE Certain definitions taken from IEC 60050-482, IEC 60086-1, and ISO/IEC Guide 51 are repeated below for convenience.

3.1

battery

one or more cells electrically connected and fitted in a case, with terminals, markings and protective devices etc., as necessary for use

[SOURCE: IEC 60050-482:2004, 482-01-04, modified ("fitted with devices necessary for use, for example case" replaced by "electrically connected and fitted in a case", addition of "etc., as necessary for use")]

3.2**cell**

basic functional unit, consisting of an assembly of electrodes, electrolyte, container, terminals and usually separators, that is a source of electric energy obtained by direct conversion of chemical energy

[SOURCE: IEC 60050-482:2004, 482-01-01]

3.3

coin <cell or battery>

lithium button <cell or battery>

small round cell or battery where the overall height is less than the diameter, containing non-aqueous electrolyte.

Note 1 to entry: The nominal voltage of lithium batteries is typically greater than 2 V.

[SOURCE: IEC 60050-482:2004 482-02-40, modified (terms modified, NOTE "In practice terms, the term coin is used exclusively for non-aqueous lithium cells." replaced with a different note)]

3.4

component cell

cell contained in a battery

3.5

cylindrical <cell or battery>

round cell or battery in which the overall height is equal to or greater than the diameter

[SOURCE: IEC 60050-482:2004, 482-02-39, modified ("cell with a cylindrical shape" replaced by "round cell or battery")]

3.6

depth of discharge

DOD

percentage of rated capacity discharged from a battery

3.7

fully discharged

state of a cell or battery at 100 % depth of discharge

3.8

harm

injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO/IEC Guide 51:2014, 3.1]

3.9

hazard

potential source of harm

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

3.10

intended use

use in accordance with information provided with a product or system, or, in the absence of such information, by generally understood patterns of usage

[SOURCE: ISO/IEC Guide 51:2014, 3.6]