

INTERNATIONAL STANDARD



Primary batteries –
Part 1: General

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRIMARY BATTERIES –

Part 1: General

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60086-1:2015. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60086-1 has been prepared by IEC technical committee 35: Primary cells and batteries.

This thirteenth edition cancels and replaces the twelfth edition published in 2015. This edition constitutes a technical revision.

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

- a) a compliance checklist was added as an Annex H;
- b) definitions were harmonized with the other 60086 series documents;
- c) the nominal voltage of the zinc air system is now listed as either 1,4 V or 1,45 V;
- d) Annex F for calculation of MAD values was simplified;
- e) a validity period for testing was added;
- f) the accelerated aging test at 45 °C was changed from 13 to 4 weeks;

The text of this International Standard is based on the following documents:

FDIS	Report on voting
35/1465/FDIS	35/1469/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

The contents of the corrigendum 1 (2022-06) have been included in this copy.

INTRODUCTION

The technical content of this part of IEC 60086 provides fundamental requirements and information on primary cells and batteries. All batteries within the IEC 60086 series are considered dry cell batteries. In this sense, IEC 60086-1 is the main component of the IEC 60086 series and forms the basis for the subsequent parts. For example, this part includes elementary information on definitions, nomenclature, dimensions and marking. While specific requirements are included, the content of this part tends to explain methodology (how) and justification (why).

Over the years, this part has been changed to improve its content and remains under continual scrutiny to ensure that the publication is kept up to date with the advances in both battery and battery-powered device technologies.

NOTE Safety ~~information is~~ requirements and recommendations are available in IEC 60086-4, IEC 60086-5 and IEC 62281. Specifications are available in IEC 60086-2 and IEC 60086-3. Environmental aspects are dealt with in IEC 60086-6.

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PRIMARY BATTERIES –

Part 1: General

1 Scope

This part of IEC 60086 is intended to standardize primary batteries with respect to dimensions, nomenclature, terminal configurations, markings, test methods, typical performance, safety and environmental aspects.

~~As a primary battery classification tool, electrochemical systems are also standardized with respect to system letter, electrodes, electrolyte, nominal and maximum open circuit voltage.~~

~~NOTE—The requirements justifying the inclusion or the ongoing retention of batteries in the IEC 60086 series are given in Annex A.~~

This document on one side specifies requirements for primary cells and batteries. On the other side, this document also specifies procedures of how requirements for these batteries are to be standardised.

As a classification tool for primary batteries, this document specifies system letters, electrodes, electrolytes, and nominal as well as maximum open circuit voltage of electrochemical systems.

The object of this part of IEC 60086 is to benefit primary battery users, device designers and battery manufacturers by ensuring that batteries from different manufacturers are interchangeable according to standard form, fit and function. Furthermore, to ensure compliance with the above, this part specifies standard test methods for testing primary cells and batteries.

This document also contains requirements in Annex A justifying the inclusion or the ongoing retention of batteries in the IEC 60086 series.

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 60086-2:2015⁴, *Primary batteries – Part 2: Physical and electrical specifications*

IEC 60086-3:2014, *Primary batteries – Part 3: Watch batteries*

IEC 60086-4:2014, *Primary batteries – Part 4: Safety of lithium batteries*

IEC 60086-5:2014, *Primary batteries – Part 5: Safety of batteries with aqueous electrolyte*

⁴~~To be published.~~

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>

3.1

application test

simulation of the actual use of a battery in a specific application

3.2

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 – removal of "fitted with devices necessary for use.]"

3.3

button (cell or battery)

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

Note 1 to entry: ~~In English, the term "button (cell or battery)" is only used for non-lithium batteries while the term "coin (cell or battery)" is used for lithium batteries only. In languages other than English, the terms "coin" and "button" are often used interchangeably, regardless of the electrochemical system.~~ See coin (cell or battery), lithium button (cell or battery).

[SOURCE: IEC 60050-482:2004 482-02-40]

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3.4

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]

3.5

closed-circuit voltage

CCV

voltage across the terminals of a battery when it is on discharge

[SOURCE:IEC 60050-482:2004, 482-03-28, modified – "voltage between the terminals of a cell or battery" replaced by "voltage across the terminals of a battery".]

3.6

coin (cell or battery)

~~see button (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.

Note 2 to entry: See button (cell or battery).

3.7

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 with "round cell or battery"]

3.8

discharge (of a primary battery)

operation during which a battery delivers current to an external circuit

3.9

dry (primary) **battery**

primary battery in which the liquid electrolyte is essentially immobilized

[SOURCE:IEC 60050-482:2004, 482-04-14, modified – replacement of "containing an immobilized electrolyte.]

~~3.10~~

~~**effective internal resistance—DC method**~~

~~the internal d.c. resistance of any electrochemical cell is defined by the following relation:~~

$$R_i (\Omega) = \frac{\Delta U (V)}{\Delta i (A)}$$

3.10

end-point voltage

EV

specified voltage of a battery at which the battery discharge is terminated

[SOURCE:IEC 60050-482:2004, 482-03-30]

3.11

leakage

unplanned escape of electrolyte, gas or other material from a cell or battery

Note 1 to entry: Leakage in this sense should not be confused with the test evaluation criteria for leakage specified in Clause 4 and Clause 5 of this document.

[SOURCE:IEC 60050-482:2004, 482-02-32]

3.12

minimum average duration

MAD

minimum average time on discharge which is met by a sample of batteries

Note 1 to entry: The discharge test is carried out according to the specified methods or standards and designed to show conformity with the standard applicable to the battery types.

3.13

nominal voltage (of a primary battery)

V_n U_n

suitable approximate value of the voltage used to designate or identify a cell, a battery or an electrochemical system

[SOURCE:IEC 60050-482:2004, 482-03-31, modified – addition of "(of a primary battery)" and symbol V_n , U_n .]

3.14

open-circuit voltage **OCV**

voltage across the terminals of a cell or battery when it is off discharge

3.15

primary (cell or battery)

cell or battery that is not designed to be electrically recharged

3.16

round (cell or battery)

cell or battery with circular cross section

3.17

service output (of a primary battery)

service life, or capacity, or energy output of a battery under specified conditions of discharge

3.18

service output test

test designed to measure the service output of a battery

Note 1 to entry: A service output test may be prescribed, for example, when

- an application test is too complex to replicate;
- the duration of an application test would make it impractical for routine testing purposes.

3.20

small battery

~~cell or battery fitting entirely within the limits of the truncated cylinder as defined in Figure 1~~

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~~<https://standards.iteh.ai/catalog/standards/iec/9043a152-04ed-4048-941d-7c6451bc3914/iec-60086-1-2021>~~ *Inner dimensions in millimetres (mm)*

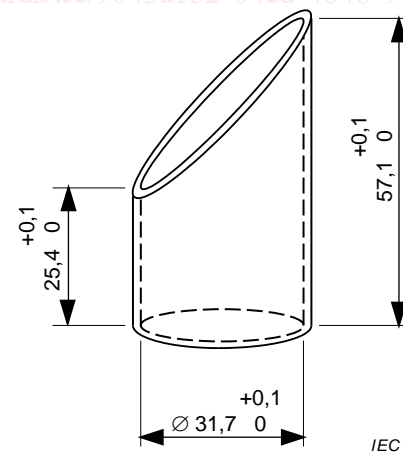


Figure 1 — Ingestion gauge

3.19

storage life

duration under specified conditions at the end of which a battery retains its ability to perform a specified service output

[SOURCE:IEC 60050-482:2004, 482-03-47, modified – "function" replaced by "service output".]

3.20

terminals (of a primary battery)

conductive parts of a battery that provide connection to an external circuit

4 Requirements

4.1 General

4.1.1 Design

Primary batteries are sold mainly in consumer markets. In recent years, they have become more sophisticated in both chemistry and construction, for example both capacity and rate capability have increased to meet the growing demands from new, battery-powered equipment technology.

When designing primary batteries, the aforementioned considerations shall be taken into account. Specifically, their dimensional conformity and stability, their physical and electrical performance and their safe operation under normal use and foreseeable misuse conditions shall be assured.

Additional information on equipment design can be found in Annex B.

4.1.2 Battery dimensions

The dimensions for individual types of batteries are given in IEC 60086-2 and IEC 60086-3.

4.1.3 Terminals

4.1.3.1 General

Terminals shall be in accordance with Clause 6 of IEC 60086-2:2015.

Their physical shape shall be designed in such a way that they ensure that the batteries make and maintain good electrical contact at all times.

They shall be made of materials that provide good electrical conductivity and resistance to corrosion.

4.1.3.2 Contact pressure resistance

Where stated in the battery specification tables or the individual specification sheets in IEC 60086-2, the following applies:

- a force of 10 N applied through a steel ball of 1 mm diameter at the centre of each contact area for a period of 10 s shall not cause any apparent deformation which might prevent satisfactory operation of the battery.

NOTE See also IEC 60086-3 for exceptions.

4.1.3.3 Cap and base

This type of terminal is used for batteries which have their dimensions specified according to Figures 1 to 7 of IEC 60086-2:2015 and which have the cylindrical side of the battery insulated from the terminals.

4.1.3.4 Cap and case

This type of terminal is used for batteries which have their dimensions specified according to Figures 8, 9, 10, 14, 15 and 16 of IEC 60086-2:2015, but in which the cylindrical side of the battery forms part of the positive terminal.