

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications – Part 4: Coin secondary lithium cells, and batteries made from them**

**Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Accumulateurs au lithium pour applications portables – Partie 4: Éléments et batteries d'accumulateurs boutons au lithium**

<https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024>



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2024 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

#### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

#### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

---

#### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

#### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Recherche de publications IEC -

#### [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications – Part 4: Coin secondary lithium cells, and batteries made from them**

**Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Accumulateurs au lithium pour applications portables – Partie 4: Éléments et batteries d'accumulateurs boutons au lithium**

<https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 29.220.99

ISBN 978-2-8322-9196-2

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 Parameter measurement tolerances .....	8
5 Cell designation and marking.....	8
5.1 Cell designation .....	8
5.2 Marking.....	10
5.2.1 General .....	10
5.2.2 Swallowable cells or batteries.....	10
6 Electrical tests.....	11
6.1 General.....	11
6.2 Charging procedure for test purposes .....	12
6.3 Discharge performance .....	12
6.4 Charge (capacity) recovery after long-term storage.....	13
6.5 Endurance in cycles.....	13
6.6 Cell or battery internal resistance (AC resistance).....	14
6.6.1 General .....	14
6.6.2 Test – General.....	14
6.6.3 Measurement.....	14
6.6.4 Acceptance criterion .....	15
7 Differentiation.....	15
Annex A (normative) Requirements for secondary lithium watch batteries.....	16
A.1 General.....	16
A.2 Physical requirements.....	16
A.2.1 Symbols and shape of cell.....	16
A.2.2 Dimensions and size codes .....	16
A.3 Test methods for determining the resistance to leakage.....	17
A.3.1 Preconditioning and initial visual examination .....	17
A.3.2 High temperature and humidity test .....	17
A.3.3 Test by temperature cycle.....	18
A.4 Visual examination and acceptance criteria.....	18
A.4.1 Preconditioning.....	18
A.4.2 Magnification .....	18
A.4.3 Leakage levels and classification.....	18
A.4.4 Acceptance conditions.....	19
Annex B (informative) Guidelines for designers of equipment using lithium batteries.....	20
Bibliography.....	21
Figure 1 – Dimensional characteristics.....	9
Figure 2 – Sample sizes and sequence of tests .....	11
Figure A.1 – Dimensional drawing.....	16
Figure A.2 – Test by temperature cycles .....	18
Table 1 – Electrochemical systems in current practical use.....	9

Table 2 – Examples of generally used upper limit charge voltage.....	12
Table 3 – Example of generally used lower limit of end-of-discharge voltage .....	13
Table 4 – Minimum number of cycles .....	14
Table A.1 – Dimensions and size codes for watch batteries .....	17
Table A.2 – Storage conditions .....	17
Table B.1 – Equipment design guidelines.....	20

**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[IEC 61960-4:2024](https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024)

<https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SECONDARY LITHIUM CELLS AND BATTERIES FOR PORTABLE APPLICATIONS –****Part 4: Coin secondary lithium cells, and batteries made from them**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61960-4 has been prepared by subcommittee 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC technical committee 21: Secondary cells and batteries, in cooperation with ISO technical committee 114: Horology. It is an International Standard.

This second edition cancels and replaces the first edition published in 2020. This edition constitutes a technical revision.

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

- a) added an annex to standardize requirements for secondary lithium watch batteries;
- b) added new chemistries;

- c) added a table to standardize dimensions and size codes for secondary lithium watch batteries;
- d) modified marking requirements.

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

Draft	Report on voting
21A/880/FDIS	21A/892/RVD

Full information on the voting for its approval 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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

A list of all parts in the IEC 61960 series, published under the general title *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications*, 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 [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

[IEC 61960-4:2024](https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024)

<https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024>

# SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SECONDARY LITHIUM CELLS AND BATTERIES FOR PORTABLE APPLICATIONS –

## Part 4: Coin secondary lithium cells, and batteries made from them

### 1 Scope

This part of IEC 61960 specifies performance tests, designations, markings, dimensions and other requirements for coin secondary lithium cells and batteries for portable applications, watches, and backup power supply such as memory backup applications. In particular, watch-specific requirements are specified in Annex A.

This document provides purchasers and users of coin secondary lithium cells and batteries with a set of criteria with which they can assess the performance of coin secondary lithium cells and batteries offered by various manufacturers.

This document defines a minimum required level of performance and a standardized methodology by which testing is performed and the results of this testing are reported to the user. Hence, users will be able to establish the viability of commercially available cells and batteries via the declared specification and thus be able to select the cell or battery best suited for their intended application.

This document covers coin secondary lithium cells and batteries with a range of chemistries. Each electrochemical couple has a characteristic voltage range over which, during discharge, it releases its electrical capacity, a characteristic nominal voltage and a characteristic end-of-discharge voltage. Users of coin secondary lithium cells and batteries are requested to consult the manufacturer for advice. <https://standards.iteh.ai/catalog/standards/iec/9c7bdc30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024>

This document also provides guidelines for designers of equipment using lithium batteries (see Annex B).

### 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 60050-482, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries*

IEC 60086-4:2019, *Primary batteries – Part 4: Safety of lithium batteries*

IEC 62133-2:2017, *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 applications – Part 2: Lithium systems*

IEC 62133-2:2017/AMD1:2021



### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-482 and the following apply.

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

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

#### 3.1

##### **coin cell**

##### **coin battery**

##### **lithium button cell**

##### **lithium button battery**

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

[SOURCE: IEC 60086-4:2019, 3.3, modified – Note to entry omitted.]

#### 3.2

##### **secondary lithium cell**

secondary cell whose electrical energy is derived from oxidation and the reduction of lithium

Note 1 to entry: This cell is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

#### 3.3

##### **secondary lithium battery**

unit which incorporates one or more secondary lithium cells and which is ready for use

Note 1 to entry: This unit incorporates adequate housing and a terminal arrangement and may have electronic control devices.

#### 3.4

##### **nominal voltage**

suitable approximate value of voltage used to designate or identify a cell, or a battery

Note 1 to entry: The nominal voltages of coin secondary lithium cells are shown in Table 1.

[SOURCE: IEC 60050-482:2004, 482-03-31, modified – "electrochemical system" has been omitted from the definition and the note has been added.]

#### 3.5

##### **rated capacity**

quantity of electricity mAh (milliampere-hours) that a single cell or battery can deliver, when charged, stored and discharged under specified conditions and declared by the manufacturer

#### 3.6

##### **end-of-charge voltage**

voltage attained at the end of a charging step, at a specified constant current or a specified constant resistance

Note 1 to entry: The end-of-charge voltage may be used to initiate the termination of the charge process.

[SOURCE: IEC 60050-482:2004, 482-05-55, modified – "or a specified constant resistance" has been added to the definition.]

### 3.7

#### **end-of-discharge voltage**

specified closed circuit voltage at which a discharge of a cell or battery is terminated

[SOURCE: IEC 60050-482:2004, 482-03-30, modified – The synonyms "final voltage", "cut-off voltage", and "end-point voltage" have been omitted and the words "closed circuit" and "cell" have been added to the definition.]

### 3.8

#### **charge recovery**

#### **capacity recovery**

capacity that a cell or battery can deliver with subsequent recharge, after storage at a specific temperature, for a specific time, as a percentage of the rated capacity

## 4 Parameter measurement tolerances

The overall accuracy of controlled or measured values, relative to the specified or actual values, shall be within the following tolerances:

- a)  $\pm 1$  % for voltage;
- b)  $\pm 1$  % for current;
- c)  $\pm 1$  % for capacity;
- d)  $\pm 2$  °C for temperature;
- e)  $\pm 0,1$  % for time;
- f)  $\pm 0,1$  mm for dimensions.

These tolerances comprise the combined accuracy of the measuring instruments, the measurement techniques used, and all other sources of error in the test procedure.

The details of the instrumentation used shall be provided in any report of results.

<https://standards.iteh.ai/catalog/standards/iec/9c7bde30-72c0-46c0-97e4-341643b2ed04/iec-61960-4-2024>

## 5 Cell designation and marking

### 5.1 Cell designation

Cells shall be designated with the following form:

$$A_1A_2DDHH$$

where

$A_1$  designates the positive electrode system in which:

- C or U is lithium cobalt oxide;
- FP is lithium iron phosphate;
- M is lithium manganese oxide;
- N is lithium nickel oxide;
- NB is niobium oxide;
- V is vanadium oxide;
- T is lithium titanium oxide.

$A_2$  designates the negative electrode system in which:

C is carbon;

L is lithium aluminium alloy;

S is lithium silicon oxide/alloy;

T or TL is lithium titanium oxide;

$DD$  designates the diameter in mm;

$HH$  designates the height in 1/10 of mm.

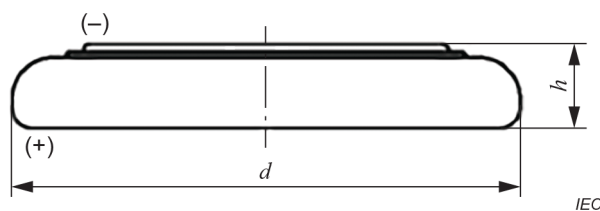
The requirements concerning code letters on electrochemical systems are given in Table 1.

**Table 1 – Electrochemical systems in current practical use**

Positive electrode	Electrolyte	Negative electrode	Nominal voltage (V)	Code letters
Lithium transition metal (cobalt, manganese, nickel) oxide	Non-aqueous solution with lithium salt	Carbon	3,6 to 3,9	UC or MC or NC <sup>a</sup>
Lithium iron phosphate		Carbon	3,2	FPC
Lithium cobalt oxide		Lithium titanium oxide	2,4	UT
Vanadium oxide		Lithium aluminium alloy	3,0	VL
Lithium manganese oxide		Lithium aluminium alloy	3,0	ML
Lithium manganese oxide		Lithium silicon oxide/alloy	3,0	MS
Lithium cobalt oxide		Lithium titanium oxide	2,3	CTL
Niobium oxide		Lithium aluminium alloy	2,0	NBL
Lithium manganese oxide		Lithium titanium oxide	1,5	MT
Lithium titanium oxide		Lithium-carbon compound	1,5	TC
Lithium titanium oxide		Lithium aluminium alloy	1,5	TL
Lithium titanium oxide		Lithium silicon oxide	1,5	TS

The above code letters are given as examples. Each positive electrode and negative electrode shall be designated with one or two letters. Any code letter can be decided on by agreement between the manufacturer and user when there is a same chemistry which has different nominal voltages.

<sup>a</sup> For lithium transition metal oxide positive electrodes, the symbols for the highest element composition of cobalt, manganese or nickel shall be used. (For example, the symbol for a lithium transition metal oxide with a composition of  $\text{LiNi}_{0,6}\text{Mn}_{0,2}\text{Co}_{0,2}\text{O}_2$  is N.)



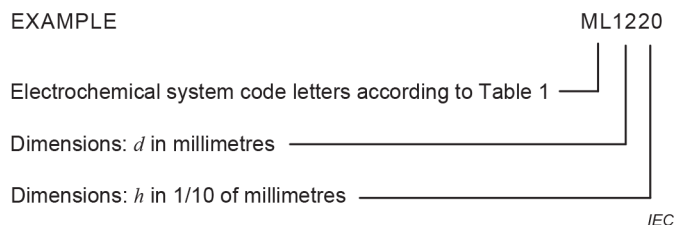
**Key**

$h$  overall height of the cell

$d$  diameter of the cell

**Figure 1 – Dimensional characteristics**

Coin secondary lithium cells complying with this document shall be designated by the following system consisting of code letters and numbers. For the electrochemical systems, the code letters shall be expressed using two letters (a maximum of three letters), followed by diameter and height expressed in that order. See Figure 1.



Notwithstanding the above specification, other designations can be used according to an agreement between manufacturer and user.

## 5.2 Marking

### 5.2.1 General

With the exception of swallowable cells or batteries (see 5.2.2), each of the following pieces of information shall be marked (details on the location of the marking are given after the following list):

- a) cell designation, IEC or common designation;
- b) the year and month or week of manufacture (may be given in code);
- c) polarity of the positive (+) terminal;
- d) nominal voltage;
- e) rated capacity;
- f) name or trademark of the manufacturer or supplier;
- g) cautionary advice;
- h) combination of "secondary (rechargeable)" and "Li", or "secondary (rechargeable)" and "Li-ion".

The designation a) and the polarity c) shall be marked on the cell or battery.

For cells or batteries with an internal AC resistance less than or equal to 3  $\Omega$ , intended to be user replaceable or not contained in the equipment, the additional marking of h) shall be marked on the cell or battery.

Other information shall be either marked on the cell or battery, provided in the specification sheet or instruction manual, or marked on the immediate package.

### 5.2.2 Swallowable cells or batteries

For cells or batteries that fit entirely within the ingestion gauge (Figure 3 in IEC 62133-2:2017), the designation specified in 5.2.1 a) and the polarity specified in 5.2.1 c) shall be marked on the cell or battery.

For cells or batteries that have a diameter of 16 mm or more intended to be user replaceable or not contained in the equipment, the safety sign KEEP OUT OF REACH OF CHILDREN shall be marked on the cell or battery in accordance with Annex F of IEC 60086-4:2019.

For cells or batteries with an internal AC resistance less than or equal to 3  $\Omega$ , intended to be user replaceable or not contained in the equipment, the additional marking of 5.2.1 h) shall be marked on the cell or battery.