

# INTERNATIONAL STANDARD



**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**

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COMMENTED VERSION

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**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**

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**This commented version (CMV) of the official standard IEC 61960-4:2024 edition 2.0 allows the user to identify the changes made to the previous IEC 61960-4:2020 edition 1.0. Furthermore, comments from IEC SC 21A experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.**

**A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.**

**This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.**

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.

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# 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. **1**

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:~~2004~~, *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 **2**

**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.

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**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.

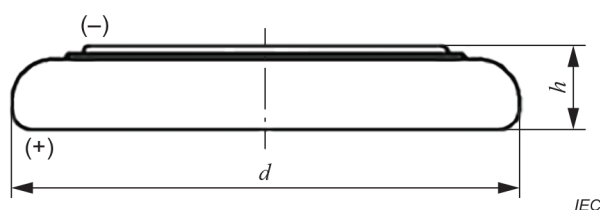
The requirements concerning code letters on electrochemical systems are given in Table 1.

**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	<del>3,7</del> 3,6 to 3,9	UC or MC or NC <sup>a</sup> <b>3</b>
Lithium iron phosphate		Carbon	3,2	FPC <b>4</b>
Lithium cobalt oxide		Lithium titanium oxide	<del>3,0</del> 2,4 <b>5</b>	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.) **6**



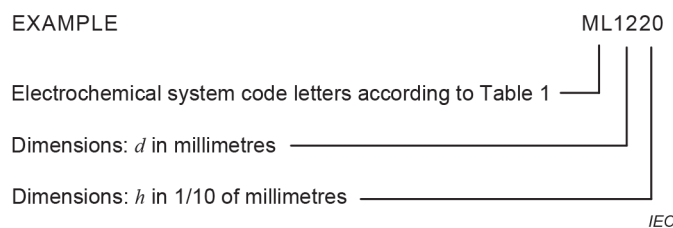
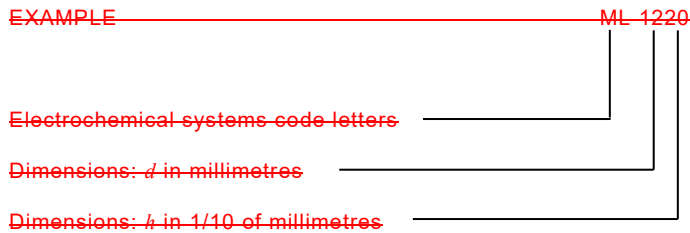
**Key**

$h$  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.



~~NOTE~~ 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 ~~small~~ swallowable cells or batteries (see 5.2.2), each ~~cell or battery~~ of the following pieces of information shall be marked ~~with the following information~~ (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;
- ~~g) caution for ingestion of swallowable cells and batteries (see IEC 60086-4);~~
- 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 ~~Small~~ 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. **7**

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.

All other information shown in 5.2.1 and caution for ingestion of swallowable cells and batteries (see IEC 62133-2:2017, 9.3) should be given in the specification sheet, or in the instruction manual or on the immediate package instead of on the cell or battery.

## 6 Electrical tests

### 6.1 General

Only cell or battery samples which are less than two months (60 days) old from the date of manufacture shall be used for the tests specified in this document.

Unless otherwise stated in this document, the following tests shall be carried out in an ambient temperature of 20 °C  $\pm$  5 °C.

Tested cells or batteries should not exceed the upper limit charge voltage or end-of-discharge voltage limit during the test.

Coin secondary lithium cells or batteries have different characteristics and features in terms of voltage, discharge performance, capacity recovery after storage, and cycling depending on their chemistries. Therefore, conditions specified by the manufacturer shall be used in order to make the most of cell or battery characteristics.

The sample sizes and the sequence of the tests are described in Figure 2.

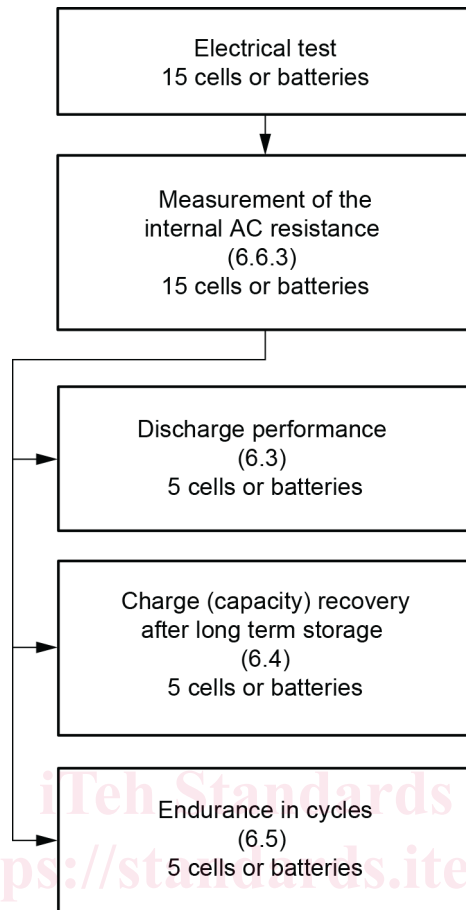


Figure 2 – Sample sizes and sequence of tests

## 6.2 Charging procedure for test purposes

There are two different charging methods for the coin secondary lithium cells or batteries: constant voltage charge and constant current charge. The charge method and conditions specified by the manufacturer shall be used. ~~When such information is not available, the charge voltage shall be in accordance with Table 2.~~ The charge voltages in Table 2 are generally used upper limits, and some manufacturers allow higher values. Contact each manufacturer for details.