IEC 60086-3

Edition 5.0 2021-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Primary batteries –
Part 3: Watch batteries

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Piles électriques –
Partie 3: Piles pour montres

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PRIMARY BATTERIES –

Part 3: Watch batteries

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International Standard IEC 60086-3 has been prepared by IEC technical committee 35: Primary cells and batteries, and ISO technical committee 114: Horology.

This fifth edition cancels and replaces the fourth edition published in 2016. This edition constitutes a technical revision.

This publication is published as a double logo standard.

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

a) reformatted Table 1 and Table 2. The reformatted tables are now divided by system. Dimensional tolerances were changed when appropriate. Cell sizes were removed or added based on the size prevalence in the market place;
b) in Table 3 the minimum values of l_1 were reformatted;
c) the minimum OCV for the S system in Table 5 was changed to 1,55 V.

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

FDIS	Report on voting
35/1467/FDIS	35/1470/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, published 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- withdrawn,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.

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INTRODUCTION

This part of IEC 60086 provides specific requirements and information for primary watch batteries. This part of IEC 60086 was prepared through joint work between the IEC and ISO to benefit primary battery users, watch designers and battery manufacturers by ensuring the best compatibility between batteries and watches.

This part of IEC 60086 will remain under continual scrutiny to ensure that the publication is kept up to date with the advances in both battery and watch technologies.

NOTE Safety information is available in IEC 60086-4 and IEC 60086-5.

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PRIMARY BATTERIES –

Part 3: Watch batteries

1 Scope

This part of IEC 60086 specifies dimensions, designation, methods of tests and requirements for primary batteries for watches. In several cases, a menu of test methods is given. When presenting battery electrical characteristics and/or performance data, the manufacturer specifies which test method was used.

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*

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

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60086-1 and the following 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
capacitive reactance
part of the internal resistance that leads to a voltage drop during the first seconds under load

3.2
capacity
electric charge (quantity of electricity) which a cell or battery can deliver under specified discharge conditions

Note 1 to entry: The SI unit for electric charge is the coulomb (1 C = 1 As) but, in practice, capacity is usually expressed in ampere hours (Ah).

3.3
fresh battery
undischarged battery 60 days maximum after date of manufacture

3.4
ohmic drop
part of the internal resistance that leads to a voltage drop immediately after switching the load on

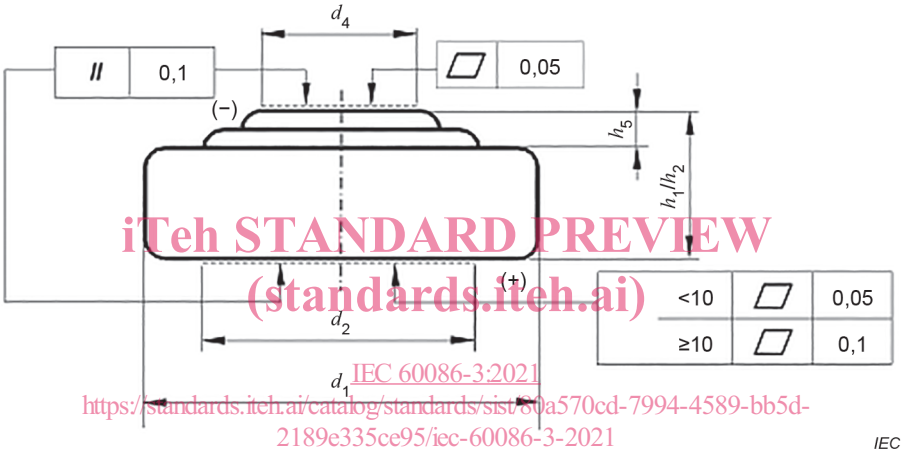
4 Physical requirements

4.1 Battery dimensions, symbols and size codes

Dimensions and tolerances of batteries for watches shall be in accordance with Figure 1, Table 1 and Table 2. The dimensions of the batteries shall be tested in accordance with 7.1.

The symbols used to denote the various dimensions in Figure 1 are in accordance with IEC 60086-2:2021, Clause 4.

Dimensions in millimetres



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Key

h_1 maximum overall height of the battery

h_2 minimum distance between the flats of the positive and negative contacts

h_5 minimum projection of the flat negative contact

d_1 maximum and minimum diameter of the battery

d_2 minimum diameter of the flat positive contact

d_4 minimum diameter of the flat negative contact

NOTE This numbering follows the harmonization in the IEC 60086 series.

Figure 1 – Dimensional drawing

Table 1 – Zinc systems L and S dimensions and size codes

Dimensions in millimetres

Diameter				Height h_1/h_2												
				Code[a]												
Code[a]	d_1	Tolerance	d_4	10	12	14	16	20	21	26	27	30	31	36	42	54
				Tolerances												
				0 −0,10	0 −0,15	0 −0,15	0 −0,18	0 −0,20	0 −0,20	0 −0,20	0 −0,20	0 −0,20	0 −0,25	0 −0,25	0 −0,25	0 −0,25
4	4,8	0 −0,15		1,05			1,65		2,15							
5	5,8	0 −0,15	2,6	1,05	1,25		1,65		2,15		2,70					
6	6,8	0 −0,15	3,0			1,45	1,65		2,15	2,60						
7	7,9	0 −0,15	3,5		1,25	1,45	1,65		2,10	2,60			3,10	3,60		5,40
9	9,5	0 −0,15	4,5	1,05	1,25	1,45	1,65	2,05			2,70			3,60		
11	11,6	0 −0,20	6,0				1,65	2,05				3,05		3,60	4,20	5,40

NOTE Open boxes in the above matrix are not necessarily available for standardization due to the concept of overlapping tolerances.

[a] See Annex A.

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Table 2 – Lithium systems B and C dimensions and size codes

Dimensions in millimetres

Diameter				Height h_1/h_2						
				Code[a]						
Code[a]	d_1	Tolerance	d_4	12	16	20	25	30	32	50
				Tolerances						
				0 −0,15	0 −0,18	0 −0,20	0 −0,20	0 −0,20	0 −0,25	0 −0,30
10	10,0	0 −0,15	3,0				2,50			
12	12,5	0 −0,25	4,0		1,60	2,00	2,50			
16	16	0 −0,25	5,0	1,20	1,60	2,00			3,20	
20	20	0 −0,25	8,0	1,20	1,60		2,50		3,20	
23	23	0 −0,25	8,0			2,00	2,50			
24	24,5	0 −0,25	8,0					3,00		5,00

NOTE Open boxes in the above matrix are not necessarily available for standardization due to the concept of overlapping tolerances.

[a] See Annex A.

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4.2 Terminals

Negative contact (–): The negative contact (dimension d_4) shall be in accordance with Table 1 and Table 2. This is not applied to those batteries with a two-step negative contact.

Positive contact (+): The cylindrical surface is connected to the positive terminal. Positive contact should be made to the side of the battery but may be made to the base.

4.3 Projection of the negative terminal (h_5)

The dimension h_5 shall be as follows:

$h_5 \geq 0{,}02$ for $h_1/h_2 \leq 1{,}65$

$h_5 \geq 0{,}06$ for $1{,}65 < h_1/h_2 < 2{,}5$

$h_5 \geq 0{,}08$ for $h_1/h_2 \geq 2{,}5$

The negative contact should be the highest point of the battery.

4.4 Shape of battery

The space requirements shall secure the area enclosed by an angle of 45° (see Figure 2).

The values of l_1, for different heights of h_1/h_2, are given in Table 3.

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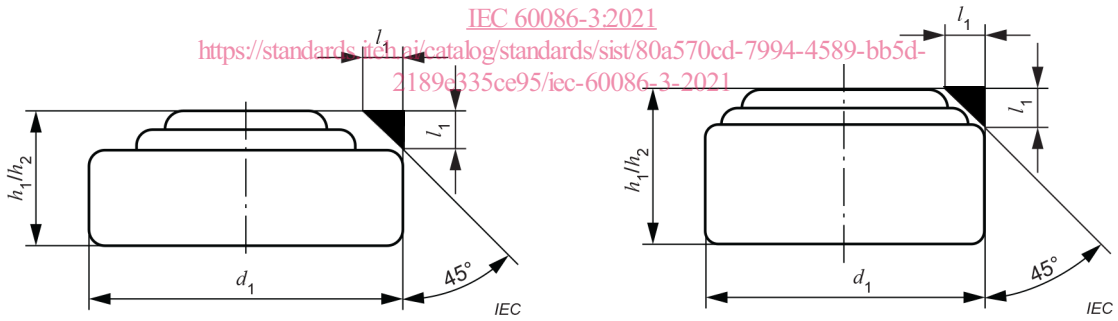

a) Figure 2a b) Figure 2b

Figure 2 – Shape of battery

Table 3 – Values of l_1

Dimensions in millimetres

h_1/h_2	l_1
$1 < h_1/h_2 \leq 1{,}90$	0,20
$1{,}90 < h_1/h_2 \leq 3{,}10$	0,35
$3{,}10 < h_1/h_2 \leq 3{,}60$	0,50
$3{,}60 < h_1/h_2 \leq 4{,}20$	0,70
$4{,}20 < h_1/h_2 \leq 5.40$	0,80
$5{,}40 < h_1/h_2$	0,90

4.5 Mechanical resistance to pressure

A force F (N), as specified in Table 4, applied for 10 s through a steel ball of 1 mm diameter, at the centre of each contact area, shall not cause any deformation prejudicial to the proper functioning of the battery, i.e. after this test, the battery shall pass the tests specified in Clause 7.

Table 4 – Applied force F by battery dimensions

Battery dimensions		Force
d_1 mm	h_1/h_2 mm	F N
< 7,9	<3,0	5
	≥3,0	10
≥ 7,9	<3,0	10
	≥3,0	10

4.6 Deformation

Refer to IEC 60086-1 for dimensional stability.

4.7 Leakage

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Undischarged batteries and, if required, batteries tested according to 7.2.6 shall be examined as stated in 7.3. The acceptable number of defects shall be agreed between the manufacturer and the purchaser.

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4.8 Marking

4.8.1 General

The battery and/or its packaging must be marked with the following:

a) designation according to normative Annex A, or common;

b) expiration of a recommended usage period or year and month or week of manufacture.

The year and month or week of manufacture may be in code. The code is composed of the last digit of the year and of a number indicating the month. October, November and December should be represented by the letters O, Y and Z respectively;

EXAMPLE

91: January 2019;

9Y: November 2019.

c) polarity of the positive (+) terminal;

d) nominal voltage;

e) name or trade mark of the supplier;

f) cautionary advice;

g) caution for ingestion of batteries shall be given. Refer to IEC 60086-4:2019, 7.2 a) and 9.2, and IEC 60086-5:2016, 7.1 l) and 9.2, for details.

NOTE Examples of the common designations can be found in Annex D of IEC 60086-2:2015.

Battery marking should not impede electrical contact. The designation and the polarity shall be marked on the battery. All other markings may be given on the packing instead of the battery.

4.8.2 Disposal

Marking of batteries with respect to the method of disposal shall be in accordance with local legal requirements.

5 Electrical requirements

5.1 Electrochemical system, nominal voltage, end-point voltage and open-circuit voltage

The requirements concerning the electrochemical system, the nominal voltage, the end-point voltage and the open-circuit voltage are given in Table 5.

Table 5 – Standardised electrochemical systems

Letter	Negative electrode	Electrolyte	Positive electrode	Nominal voltage (U_n) V	End-point voltage (EV) V	Open-circuit voltage (U_{OC} or OCV) V	
						Max.	Min.
B	Lithium (Li)	Organic electrolyte	Carbon monofluoride $(CF)_x$	3,0	2,0	3,70	3,00
C	Lithium (Li)	Organic electrolyte	Manganese dioxide (MnO_2)	3,0	2,0	3,70	3,00
L	Zinc (Zn)	Alkali metal hydroxide	Manganese dioxide (MnO_2)	1,5	1,0	1,68	1,50
S	Zinc (Zn)	Alkali metal hydroxide	Silver oxide (Ag_2O)	1,55	1,2	1,63	1,55

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5.2 Closed circuit voltage U_{cc} (CCV), internal resistance and impedance

Closed circuit voltage and internal resistance shall be measured according to 7.2.

AC impedance should be measured with an LCR meter.

Limit values shall be agreed between the manufacturer and the purchaser.

5.3 Capacity

The capacity shall be agreed between the manufacturer and the purchaser on the basis of a continuous discharge test, according to 7.2.6.

5.4 Capacity retention

The capacity retention is the ratio between the capacities under the given discharge conditions measured on fresh batteries and a sample of the same lot stored during 365 days at (20 ± 2) °C and a relative humidity between (55 ± 20) %.

The ratio of capacity retention shall be agreed between the manufacturer and the purchaser. The minimum value should be at least 90 % for a period of 12 months. The capacity measurement is carried out according to 7.2.6.

For the purpose of verifying compliance with this document, conditional acceptance may be given after completion of the initial capacity tests.