IEC 60086-3

Edition 3.0 2011-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Primary batteries –
Part 3: Watch batteries

Piles électriques –
Partie 3: Piles pour montres

IEC 60086-3:2011-01(EN-FR)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRIMARY BATTERIES –

Part 3: Watch batteries

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.
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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 third edition cancels and replaces the second edition (2004) and constitutes a technical revision.

The major technical changes with respect to the previous edition are the drawings, a review of the table of electrochemical systems and a harmonization of the marking clause with the other standards of the IEC 60086 series. Moreover, the table of the leakage levels was extended by adding drawings with better visualization.

This publication is published as a double logo standard.

This bilingual version (2014-01) corresponds to the monolingual English version, published in 2011-01.

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

FDIS	Report on voting
35/1286/FDIS	35/1289/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. In ISO, the standard has been approved by 8 P members out of 8 having cast a vote.

The French version of this standard has not been voted upon.

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

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.

INTRODUCTION

The technical content of this part of IEC 60086 provides specific requirements and information for primary watch batteries. This part was prepared through joint work between IEC TC 35 and ISO TC 114 to benefit primary battery users, watch designers and battery manufacturers by ensuring the best compatibility between batteries and watches.

This part 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 can be found in IEC 60086-4 and IEC 60086-5.

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 referenced documents are indispensable for the application 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:-[1], *Primary batteries – Part 1: General*

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

IEC 60086-4:2007, *Primary batteries – Part 4: Safety of lithium batteries*

IEC 60086-5:-[3], *Primary batteries – Part 5: Safety of batteries with aqueous electrolyte*

IEC 60410, *Sampling plans and procedures for inspection by attributes*

ISO 2859 (all parts), *Sampling procedures for inspection by attributes*

ISO 3951(all parts as applicable), *Sampling procedures for inspection by variables*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60086-1 as well as the following terms and definitions apply.

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

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1 To be published in 2011.

2 To be published in 2011.

3 To be published in 2011.

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

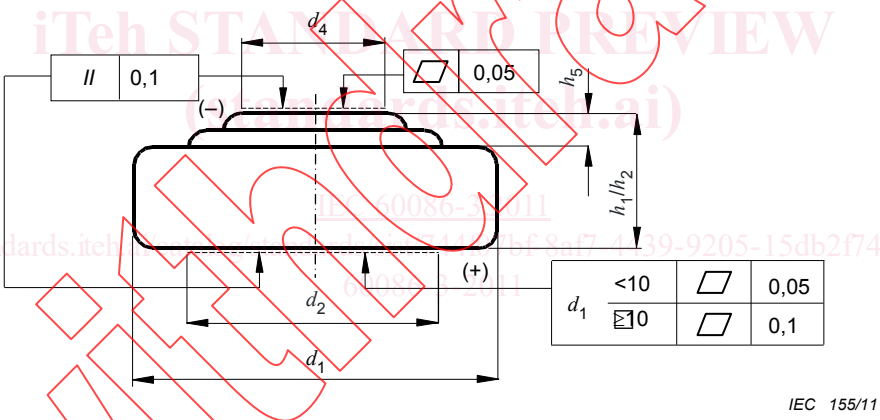
4 Physical requirements

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, Clause 4.

Dimensions in millimetres



IEC 155/11

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 – Dimensions and size codes

Dimensions in millimetres

Diameter			d_4	Height h_1/h_2													
				Code [a]													
Code[a]	d_1	Tolerance		10	12	14	16	20	21	25	26	27	30	31	32	36	42	54
				Tolerance														
				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	0 −0,25	0 −0,25
4	4,8	0 −0,15					1,65		2,15									
5	5,8	0 −0,15	2,6	1,05	1,25	1,45	1,65		2,15			2,70						
6	6,8	0 −0,15	3,0	1,05	1,25	1,45	1,65		2,15		2,60							
7	7,9	0 −0,15	3,5	1,05	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	1,05	1,25	1,45	1,65	2,05			2,60		3,05			3,60	4,20	5,40
12	12,5	0 −0,25	4,0		1,20		1,60	2,00		2,50								

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

[a] See Annex A.

Table 2 – Dimensions and size codes

Dimensions in millimetres

Diameter			d_4	Height h_1/h_2					
Code [a]	d_1	Tolerance		Code [a]					
				12	16	20	25	30	32
				Tolerances					
				0 –0,20 [b]	0 –0,20 [b]	0 –0,25 [b]	0 –0,30 [b]	0 –0,30 [b]	0 –0,30 [b]
16	16	0 –0,25	5,00	1,20	1,60	2,00	2,50		3,20
20	20	0 –0,25	8,00	1,20	1,60	2,00	2,50		3,20
23	23	0 –0,30	8,00	1,20	1,60	2,00	2,50		
24	24,5	0 –0,30	8,00	1,20	1,60			3,00	
NOTE Open boxes in the above matrix are not necessarily available for standardisation due to the concept of overlapping tolerances.									
[a] See Annex A. [b] To be reduced in the future.									

4.2 Terminals

Negative contact (–): the negative contact (dimension d_4) shall be in accordance with Tables 1 and 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 $h_1/h_2 \geq 2{,}5$

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

4.4 Shape of negative terminal

The space requirements shall be contained within an angle of 45° (see Figure 2).

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

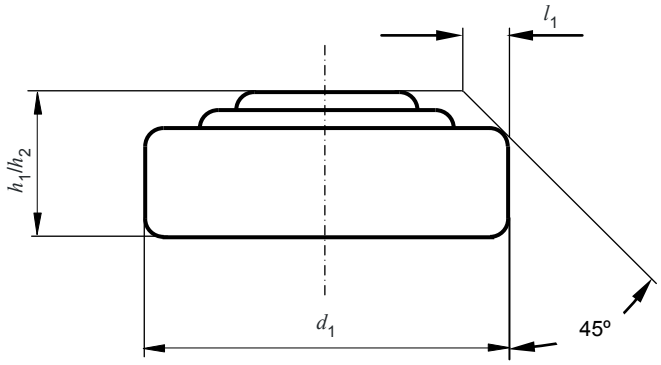


Figure 2 – Shape of negative terminal

Table 3 – Minimum values of l_1

Dimensions in millimetres

h_1/h_2	$l_{1\ min}$
$1 < h_1/h_2 \leq 1{,}90$	0,20
$1{,}90 < h_1/h_2 \leq 3{,}10$	0,35
$3{,}60 \leq h_1/h_2 \leq 4{,}20$	0,70
$5{,}40 \leq h_1/h_2$	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

The dimensions of batteries shall conform with the relevant specified dimensions at all times including discharge to the defined end-point voltage.

NOTE 1 A battery height increase up to 0,25 mm can occur in B, C, L and S systems, if discharged below this voltage.

NOTE 2 A battery height decrease can occur in B and C systems as discharge continues.

4.7 Leakage

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.

4.8 Marking

4.8.1 General

The designation and the polarity shall be marked on the battery. All other markings may be given on the packing instead of on the battery:

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 by the last digit of the year and by a number indicating the month. October, November and December should be represented by the letters O, Y and Z respectively.

EXAMPLE

41: January 2014;

4Y: November 2014.

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 swallowable batteries shall be given. Refer to IEC 60086-4:2007 (7.2 m) and 9.2) and IEC 60086-5:- (7.1 l) and 9.2) for details.

NOTE 1 Battery marking should not impede electrical contact.

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

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 (V_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	1,57

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 lasting approximately 30 days, 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 45 % and 75 %.

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.

6 Sampling and quality assurance

6.1 General

The use of sampling plans or product quality indices may be agreed between manufacturer and purchaser. Where no agreement is specified, the options in 6.2 and/or 6.3 are recommended.

6.2 Sampling

6.2.1 Testing by attributes

When testing by attributes is required, the sampling plan chosen shall be in accordance with the specifications of IEC 60410 and/or ISO 2859. The individual parameters to be tested and the acceptance quality level (AQL) values shall be defined (a minimum of three batteries of the same type shall be tested).