



DPC: 23 / 30454440 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Interested committees:

Title: BS EN IEC 60086-2-1 Primary batteries

Part 2-1: Physical and electrical specifications of batteries with aqueous electrolyte

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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Responsible Committee Secretary: Ms Nicola Young (BSI)

Direct tel:

E-mail: nicola.young@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER:

IEC 60086-2-1 ED1

DATE OF CIRCULATION:

2023-10-20

CLOSING DATE FOR COMMENTS:

2024-01-12

SUPERSEDES DOCUMENTS:

35/1485/RR

IEC TC 35 : PRIMARY CELLS AND BATTERIES

SECRETARIAT:

Japan

SECRETARY:

Mr Takao Uyama

OF INTEREST TO THE FOLLOWING COMMITTEES:

SC 3C,TC 21,SC 21A,TC 61,TC 108

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC☐ ENVIRONMENT☐ QUALITY ASSURANCE☐ SAFETY

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TITLE:

Primary batteries - Part 2-1: Physical and electrical specifications of batteries with aqueous electrolyte

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRIMARY BATTERIES –

**Part 2-1:
Physical and electrical specifications
of batteries with aqueous electrolyte**

FOREWORD

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International Standard IEC 60086-2-1 has been prepared by IEC technical committee 35: Primary cells and batteries.

This first edition cancels and replaces the fourteenth edition of IEC 60086-2 published in 2021. This edition constitutes a technical revision.

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

- a) separation of lithium batteries into a separate Part 2-2: Physical and electrical specifications;
- b) new MAD values of R6S batteries were added for certain application tests ;
- c) modification of high drain application and personal grooming tests of LR6 ;
- d) 4,5V of common designation for 3LR12, 3R12P and 3R12S was added ;

e) Annex D for common designation of IEC 60086-2:2021 was moved to as Annex H of IEC 60086-1 ;

f) **

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

CD	Report on voting
35/XXXX/CD	35/XXXX/XX

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.

193

INTRODUCTION

194 The technical content of this part of IEC 60086 provides physical dimensions, discharge test
195 conditions and discharge performance requirements. IEC 60086-2 complements the general
196 information and requirements of IEC 60086-1.

197 This part was prepared to benefit primary battery users, device designers and battery
198 manufacturers by furnishing the specifics of form, fit and function for individual standardized
199 primary cells and batteries. Over the years, this part has been changed to improve its contents
200 and may again be revised in due course in the light of comments made by national committees
201 and experts on the basis of practical experience and changing technology.

202 This current revision is the result of a reformatting initiative, as well as some content changes,
203 aimed at making this part more user-friendly, less ambiguous, and, from a cross reference basis,
204 fully harmonized with other parts of IEC 60086.

205 NOTE Safety information is available in IEC 60086-5.

206

207

PRIMARY BATTERIES –

Part 2-1:

Physical and electrical specifications of batteries with aqueous electrolyte

1 Scope

This part of IEC 60086 is applicable to primary batteries which are based on standardised electrochemical systems using aqueous electrolytes.

It specifies

- the physical dimensions,
- the discharge test conditions and discharge performance requirements.

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*

ISO 1101, *Geometrical product specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out*

3 Terms, definitions, symbols and abbreviated terms

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 Terms and definitions

3.1.1

application test

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

3.1.2

button cell or battery

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

3.1.3**closed-circuit voltage****CCV**

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

3.1.4**coin <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: Add a reference to IEC 60086-2-2.

3.1.5**end-point voltage****EV**

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

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

3.1.6**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.

3.1.7**nominal voltage (of a primary battery)** **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 U_n .]

3.1.8**open-circuit voltage****OCV**

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

3.1.9**primary (cell or battery)**

cell or battery that is not designed to be electrically recharged

3.1.10**round (cell or battery)**

cell or battery with circular cross section

3.1.11**service output (of a primary battery)**

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

3.1.12**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

a) an application test is too complex to replicate;

b) the duration of an application test would make it impractical for routine testing purposes.

3.1.13**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 – "specified function" replaced by "specified service output".]

3.1.14**terminals** (of a primary battery)

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

3.2 Symbols and abbreviated terms

EV	end-point voltage
MAD	minimum average duration
OCV	open-circuit voltage (off-load voltage)
CCV	closed-circuit voltage (on-load voltage)
R	load resistance
U_n	nominal voltage of a primary battery

4 Battery dimensions, symbols

The symbols used to denote the various dimensions are as follows:

h_1 maximum overall height of the battery;

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

h_3 minimum projection of the flat positive contact;

h_4 maximum recess of the negative flat contact surface;

h_5 minimum projection of the flat negative contact;

d_1 maximum and minimum diameters of the battery;

d_2 minimum diameter of the flat positive contact;

d_3 maximum diameter of the positive contact within the specified projection height;

d_4 minimum diameter of the flat negative contact;

d_5 maximum diameter of the negative contact within the specified projection height;

d_6 minimum outer diameter of the negative flat contact surface;

d_7 maximum inner diameter of the negative flat contact surface;

$\varnothing P$ concentricity of the positive contact.

5 Dimensional stability

Refer to IEC 60086-1 for dimensional stability.

6 Validity of testing

Portable primary batteries shall be subjected to the tests, as required in the IEC 60086 series. Testing remains valid until a design change or requirement revision has been made. Retesting is required when:

- a) a battery specification changes by more than 0,1 g or 20 % mass, whichever is greater, for the cathode, anode or electrolyte;
- b) a battery specification changes that would lead to a failure of any of the tests;
- c) there is an addition of new tests or requirements; or
- d) there is a requirement change that would lead to a failure on any of the tests.

7 Constitution of the battery specification tables

- Batteries are categorized into several groups according to their shapes.
- In each category, batteries having the same shape but belonging to a different electrochemical system are grouped together and shown in succession.
- Batteries are always listed in ascending order of nominal voltage and, within each nominal voltage, in ascending order of volume.
- One common shape drawing of these batteries which fall in the same group is exhibited.
- Designation, nominal voltage, dimensions, discharge conditions, minimum average duration and application for these batteries which fall into the same group are summarized in one table.
- When a drawing represents only one type of battery, the dimensions of the relevant battery may be directly shown on the drawing.
- Batteries are categorized into the following groups:
 - a) Category 1 : Round batteries according to figure 1
R1, R03, R6P, R6S, R14P, R14S, R20P, R20S
LR8D425, LR1, LR03, LR6, LR14, LR20
 - b) Category 2 : Round battery
Not applicable
 - c) Category 3 : Round battery according to figure 7
LR9
 - d) Category 4 : Round batteries according to figure 8
PR70, PR41, PR48, PR44, PR1154
LR41, LR55, LR54, LR43, LR44
SR62, SR63, SR65, SR64, SR60, SR67, SR66, SR58, SR68, SR59, SR69, SR41, SR57,
SR55, SR48, SR54, SR42, SR43, SR44
 - e) Category 5: Other round batteries – Miscellaneous
4LR44
4SR44
8LR932
AR40
5AR40

- 361 6AR40
362 5PR175/172
363 6PR 225/155
364 f) Category 6: Non-round batteries – Miscellaneous
365 3R12P, 3R12S, 3LR12
366 4LR61
367 AS4, AS6P, AS6S, AS8, AS10, AS12, PS8S, PS8P, PS10
368 4R25X, 4LR25X
369 4R25Y
370 4R25-2, 4LR25-2
371 6F22, 6LR61, 6LP3146
372 6AS4S, 6PS4S, 6PS4P
373 6AS6P, 6AS6S, 6PS6P, 6PS6S

374 – The specification drawings show the shape of the relevant batteries. Dimensions for each
375 battery are shown in the tables of Clause 8 and in Figure 1 to Figure 27.

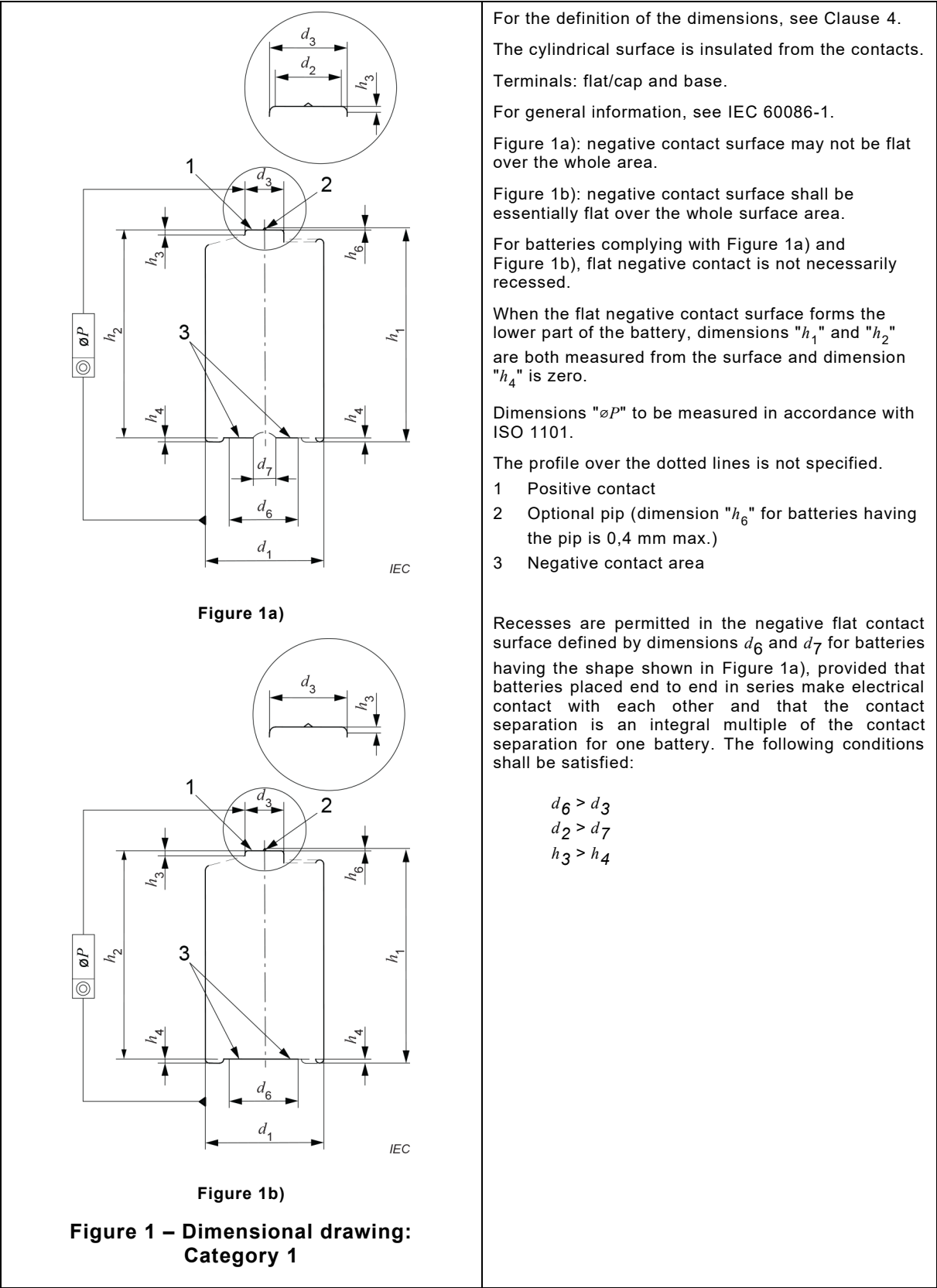
376 NOTE See Annex A, Annex B and Annex C for ease of locating battery sizes.

377 NOTE For lithium batteries, see IEC 60086-2-2: Physical and electrical specifications of lithium batteries.

8 Physical and electrical specifications

8.1 Category 1 batteries

8.1.1 General



For the definition of the dimensions, see Clause 4.
The cylindrical surface is insulated from the contacts.

Terminals: flat/cap and base.

For general information, see IEC 60086-1.

Figure 1a): negative contact surface may not be flat over the whole area.

Figure 1b): negative contact surface shall be essentially flat over the whole surface area.

For batteries complying with Figure 1a) and Figure 1b), flat negative contact is not necessarily recessed.

When the flat negative contact surface forms the lower part of the battery, dimensions " h_1 " and " h_2 " are both measured from the surface and dimension " h_4 " is zero.

Dimensions " $\varnothing P$ " to be measured in accordance with ISO 1101.

The profile over the dotted lines is not specified.

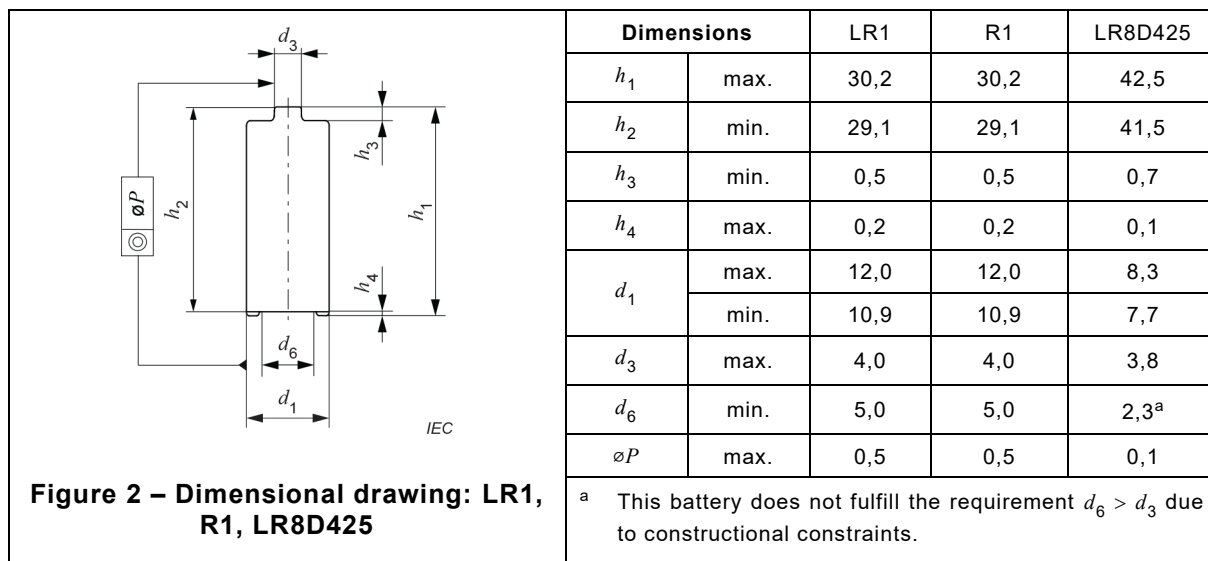
- 1 Positive contact
- 2 Optional pip (dimension " h_6 " for batteries having the pip is 0,4 mm max.)
- 3 Negative contact area

Recesses are permitted in the negative flat contact surface defined by dimensions d_6 and d_7 for batteries having the shape shown in Figure 1a), provided that batteries placed end to end in series make electrical contact with each other and that the contact separation is an integral multiple of the contact separation for one battery. The following conditions shall be satisfied:

$$\begin{aligned}d_6 &> d_3 \\d_2 &> d_7 \\h_3 &> h_4\end{aligned}$$

8.1.2 Category 1 – Specifications: LR1, R1, LR8D425

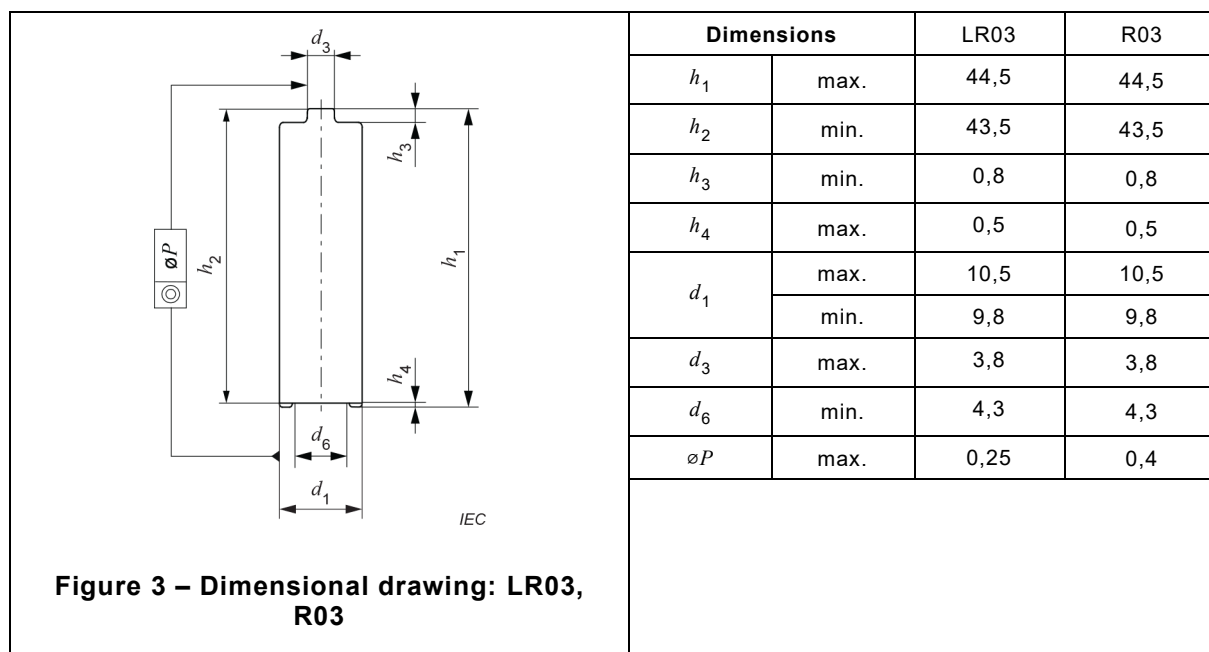
Dimensions in millimetres



Electrochemical system letter				L	No letter	L
IEC designation				LR1	R1	LR8D425
Common designation				N	N	AAAA
U_n (V)				1,5	1,5	1,5
OCV max. (V)				1,68	1,73	1,68
Delayed discharge performance after 12 months (% of MAD)				90	80	90
Applications	Load	Daily Period	EV (V)	MAD ^a (initial)		
Portable lighting	5,1 Ω	5 min	0,9	94 min	30 min	90 min
Laser pointer	75 Ω	1 h	1,1	No test	No test	22 h
Service output test	75 Ω	1 h	0,9	38 h	18 h	27 h
^a Standard conditions (see IEC 60086-1: 2021, Table 3, Initial discharge test).						

8.1.3 Category 1 – Specifications: LR03, R03

Dimensions in millimetres



Electrochemical system letter				L	No letter
IEC designation				LR03	R03
Common designation				AAA	AAA
U_n (V)				1,5	1,5
OCV max. (V)				1,68	1,73
Delayed discharge performance after 12 months (% of MAD)				90	80
Applications	Load	Daily Period	EV (V)	MAD ^a (Initial)	
Portable lighting	5,1 Ω	4 min on, 56 min off for 8 h per day	0,9	130 min	50 min
Toy	5,1 Ω	1 h	0,8	120 min	30 min
Digital audio	50 mA	1 h on, 11 hr off for 24 h	0,9	12 h	3 h
Remote control	24 Ω	15 s per min 8 h per day	1,0	14,5 h	4 h
Radio	75 Ω	4 h	0,9	No test	20 h

^a Standard conditions (see IEC 60086-1:2021, Table 3, Initial discharge test).