

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Primary batteries –
Part 2: Physical and electrical specifications**

**Piles électriques –
Partie 2: Spécifications physiques et électriques**

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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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CONTENTS

| | |
|--|----|
| FOREWORD..... | 4 |
| INTRODUCTION..... | 6 |
| | |
| 1 Scope..... | 7 |
| 2 Normative references | 7 |
| 3 Terms and definitions | 7 |
| 4 Symbols and abbreviations..... | 9 |
| 5 Battery dimensions, symbols | 9 |
| 6 Constitution of the battery specification tables..... | 9 |
| 7 Physical and electrical specifications..... | 12 |
| 7.1 Category 1 batteries..... | 12 |
| 7.1.1 Category 1 – Physical and electrical specifications..... | 12 |
| 7.1.2 Category 1 – Specifications: R1, R03, R6P, R6S..... | 13 |
| 7.1.3 Category 1 – Specifications: R14P, R14S..... | 14 |
| 7.1.4 Category 1 – Specifications: R20P, R20S, 2R10, LR8D425, LR1..... | 15 |
| 7.1.5 Category 1 – Specifications: LR03, LR6, LR14, LR20..... | 17 |
| 7.1.6 Category 1 – Specifications: CR12A604..... | 19 |
| 7.2 Category 2 batteries..... | 20 |
| 7.2.1 Category 2 – Physical and electrical specifications..... | 20 |
| 7.2.2 Category 2 – Specifications: CR14250, CR15H270, CR17345, CR17450, BR17335..... | 21 |
| 7.3 Category 3 batteries..... | 22 |
| 7.3.1 Category 3 – Physical and electrical specifications..... | 22 |
| 7.3.2 Category 3 – Specifications: LR9, LR53, CR11108..... | 23 |
| 7.4 Category 4 batteries..... | 24 |
| 7.4.1 Category 4 – Physical and electrical specifications..... | 24 |
| 7.4.2 Category 4 – Specifications: PR70, PR41, PR48, PR44..... | 25 |
| 7.4.3 Category 4 – Specifications: LR41, LR55, LR54, LR43, LR44..... | 29 |
| 7.4.4 Category 4 – Specifications: SR62, SR63, SR 65, SR64, SR60, SR67, SR66, SR58, SR68, SR59, SR69, SR41, SR57, SR55, SR48..... | 30 |
| 7.4.5 Category 4 – Specifications: SR56, SR54, SR42, SR43, SR44..... | 31 |
| 7.4.6 Category 4 – Specifications: CR1025, CR1216, CR1220, CR1616, CR2012, CR1620, CR2016, CR2025, CR2320, CR2032, CR2330, CR2430, CR2354, CR3032, CR2450..... | 32 |
| 7.4.7 Category 4 – Specifications: BR1225, BR2016, BR2020, BR2320, BR2325, BR3032..... | 33 |
| 7.5 Category 5 batteries..... | 34 |
| 7.5.1 Category 5 – Physical and electrical specifications..... | 34 |
| 7.6 Category 6 batteries..... | 37 |
| 7.6.1 Category 6 – Physical and electrical specifications..... | 37 |
| | |
| Annex A (informative) Tabulation of batteries by application | 50 |
| Annex B (informative) Cross-reference index..... | 54 |
| Annex C (informative) Index..... | 57 |
| | |
| Bibliography..... | 58 |

| | |
|---|----|
| Figure 1 – Category 1 dimensional drawings..... | 12 |
| Figure 2 – Category 2 dimensional drawing | 20 |
| Figure 3 – Category 3 dimensional drawings..... | 22 |
| Figure 4 – Category 4 dimensional drawing | 24 |
| Figure 5 – Gauge for Category 4 batteries | 28 |
| Figure 6 – Dimensional drawing: R40..... | 34 |
| Figure 7 – Dimensional drawing: 4LR44, 2CR13252, 4SR44..... | 35 |
| Figure 8 – Dimensional drawing: 5AR40 | 36 |
| Figure 9 – Dimensional drawing: S4..... | 37 |
| Figure 10 – Dimensional drawing: 3R12C,3R12P, 3R12S, 3LR12 | 38 |
| Figure 11 – Dimensional drawing: 4LR61..... | 39 |
| Figure 12 – Dimensional drawing: CR-P2, BR-P2..... | 40 |
| Figure 13 – Dimensional drawing: 2CR5 | 41 |
| Figure 14 – Dimensional drawing: 2EP3863..... | 42 |
| Figure 15 – Dimensional drawing: 4R25X, 4LR25X..... | 43 |
| Figure 16 – Dimensional drawing: 4R25Y | 44 |
| Figure 17 – Dimensional drawing: 4R25-2, 4LR25-2 | 45 |
| Figure 18 – Dimensional drawing: 6AS4..... | 46 |
| Figure 19 – Dimensional drawing: 6AS6..... | 47 |
| Figure 20 – Dimensional drawing: 6F22, 6LR61..... | 48 |
| Figure 21 – Dimensional drawing: 6F100..... | 49 |
| Table A.1 – Road warning lamp | 50 |
| Table A.2 – Industrial equipment..... | 50 |
| Table A.3 – Electrical fence controller..... | 50 |
| Table A.4 – Radio..... | 51 |
| Table A.5 – Electronic equipment | 51 |
| Table A.6 – Paging test..... | 51 |
| Table A.7 – Hearing aid | 51 |
| Table A.8 – Photo..... | 52 |
| Table A.9 – Portable lighting..... | 52 |
| Table A.10 – Smoke detector..... | 52 |
| Table A.11 – Toy (motor) | 53 |
| Table A.12 – Accelerated application test for automatic camera..... | 53 |
| Table A.13 – Tape recorder (personal cassette player)..... | 53 |
| Table B.1 – Category 1 batteries..... | 54 |
| Table B.2 – Category 2 batteries..... | 54 |
| Table B.3 – Category 3 batteries..... | 54 |
| Table B.4 – Category 4 batteries..... | 55 |
| Table B.5 – Category 5 batteries..... | 56 |
| Table B.6 – Category 6 batteries..... | 56 |
| Table C.1 – Index | 57 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRIMARY BATTERIES –

Part 2: Physical and electrical specifications

FOREWORD

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

This eleventh edition cancels and replaces the tenth edition (2000) and its amendments 1 (2001) and 2 (2004), and constitutes a technical revision.

The major technical changes are the addition of a "digital still camera test" for the LR6 battery, the reduction, for selected no letter batteries, from three grades (S, C and P) to two grades (S and P) with appropriate adjustments to MAD values, the deletion of the 3,6 ohm pulse test for the R03 battery, and the addition of new constant current hearing aid tests (standard and high drain) for the PR41, PR44, PR48 and PR70 batteries.

This bilingual version, published in 2007-04, corresponds to the English version.

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

| FDIS | Report on voting |
|--------------|------------------|
| 35/1245/FDIS | 35/1248/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.

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 the 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 maintenance result 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;
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INTRODUCTION

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

This part was prepared to benefit primary battery users, device designers and battery manufacturers by furnishing the specifics of form, fit and function for individual standardized primary cells and batteries. Over the years, this part has been changed to improve its contents and may again be revised in due course in the light of comments made by National Committees and experts on the basis of practical experience and changing technology. This current revision is the result of a reformatting initiative, as well as some content changes, aimed at making this part more user-friendly, less ambiguous, and, from a cross-reference basis, fully harmonized with other parts of IEC 60086.

NOTE Safety information is available in IEC 60086-4, IEC 60086-5 and IEC 62281.

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PRIMARY BATTERIES –

Part 2: Physical and electrical specifications

1 Scope

This part of IEC 60086 is applicable to primary batteries based on standardized electro-chemical systems.

It specifies

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

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 60050-482:2004, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries*

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 and definitions

For the purposes of this document, the definitions given in IEC 60050-482 and IEC 60086-1 (some of which are repeated below for convenience) and the following definitions apply.

3.1 application test

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

3.2 end-point voltage

EV

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

[IEV 482-03-30:2004, modified]

3.3 minimum average duration

MAD

minimum average time on discharge which shall be met by a sample of batteries

NOTE The discharge test is carried out according to the specified methods and designed to show conformity with the standard applicable to the battery types.

**3.4
nominal voltage of a primary battery**

V_n
suitable approximate value of voltage used to identify the voltage of a primary battery

[IEV 482-03-31:2004, modified]

**3.5
on-load voltage**

closed-circuit voltage

CCV

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

[IEV 482-03-28:2004, modified]

**3.6
open-circuit voltage**

off-load voltage

OCV

voltage across the terminals of a battery when no current is flowing

[IEV 482-03-32:2004, modified]

**3.7
primary battery**

one or more primary cells, including case, terminals and marking

**3.8
primary cell**

source of electrical energy obtained by the direct conversion of chemical energy that is not designed to be charged by any other electrical source

[IEV 482-01-02:2004, modified]

**3.9
service output (of a primary battery)**

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

**3.10
service output test**

test designed to measure the service output of a battery

NOTE 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.

**3.11
storage life**

duration under specified conditions at the end of which a battery retains its ability to perform a specified service output

[IEV 482-03-47:2004, modified]

**3.12
terminals (of a primary battery)**

conductive parts provided for the connection of a battery to external conductors

4 Symbols and abbreviations

| | |
|-------|---|
| EV | end-point voltage |
| MAD | minimum average duration |
| OCV | open-circuit voltage (off-load voltage) |
| R | load resistance |
| V_n | nominal voltage of a battery |

5 Battery dimensions, symbols

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

| | |
|---------------|--|
| A | maximum overall height of the battery; |
| B | minimum distance between the flats of the positive and negative contacts; |
| C | minimum outer diameter of the negative flat contact surface; |
| D | maximum inner diameter of the negative flat contact surface; |
| E | maximum recess of the negative flat contact surface; |
| F | maximum diameter of the positive contact within the specified projection height; |
| G | minimum projection of the flat positive contact; |
| K | minimum projection of the flat negative contact; |
| L | maximum diameter of the negative contact within the specified projection height; |
| M | minimum diameter of the flat negative contact; |
| N | minimum diameter of the flat positive contact; |
| \emptyset | maximum and minimum diameters of the battery; |
| $\emptyset P$ | concentricity of the positive contact. |

Recesses are permitted in the negative flat contact surface defined by dimensions C and D 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 must be satisfied:

$$C > F$$

$$N > D$$

$$G > E$$

6 Constitution of the battery specification tables

6.1 Batteries are categorized into several groups according to their shapes.

6.2 In each category, batteries having the same shape but belonging to a different electrochemical system are grouped together and shown in succession.

6.3 Batteries are always listed in ascending order of nominal voltage and, within each nominal voltage, in ascending order of volume.

6.4 One common shape drawing of these batteries which fall in the same group is exhibited.

6.5 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.

6.6 When a drawing represents only one type of battery, the dimensions of the relevant battery may be directly shown on the drawing.

6.7 Batteries are categorized into the following groups:

a) Category 1: Round batteries according to Figure 1

R1, R03, R6P, R6S, R14P, R14S,
R20P, R20S, 2R10, LR8D425, LR1,
LR03, LR6, LR14, LR20
CR12A604

b) Category 2: Round batteries according to Figure 2

CR14250, CR15H270, CR17345, CR17450, BR17335

c) Category 3: Round batteries according to Figure 3

LR9, LR53, CR11108

d) Category 4: Round batteries according to Figure 4

PR70, PR41, PR48, PR44
LR41, LR55, LR54, LR43, LR44
SR62, SR63, SR65, SR64, SR60, SR67, SR66, SR58, SR68, SR59, SR69, SR41, SR57,
SR55, SR48, SR56, SR54, SR42, SR43, SR44
CR1025, CR1216, CR1220, CR1616, CR2012, CR1620, CR2016, CR2025, CR2320,
CR2032, CR2330, CR2430, CR2354, CR3032, CR2450
BR1225, BR2016, BR2020, BR2320, BR2325, BR3032

e) Category 5: Other round batteries – Miscellaneous

R40
4LR44
2CR13252
4SR44
5AR40

f) Category 6: Non-round batteries – Miscellaneous

S4
3R12C, 3R12P, 3R12S, 3LR12
4LR61
BR-P2, CR-P2
2CR5
2EP3863
4R25X, 4LR25X
4R25Y
4R25-2, 4LR25-2
6AS4
6AS6
6F22, 6LR61
6F100

6.8 Drawings of round batteries which correspond to Figure 1, Figure 2, Figure 3 and Figure 4 are prepared by reduction or enlargement of the relevant original drawings. The other drawings are prepared by reduction or enlargement of conventional specification drawings.

In each case the drawings show the shape of the relevant batteries. Dimensions for each battery are shown in the tables.

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

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7 Physical and electrical specifications

7.1 Category 1 batteries

7.1.1 Category 1 – Physical and electrical specifications

Batteries complying with these physical and electrical specifications are as follows:

| Designation | OCV max. V |
|--|----------------|
| R1, R03, R6P, R6S, R14P, R14S R20P, R20S 2R10 | 1,725 3,450 |
| LR8D425, LR1, LR03, LR6, LR14, LR20 CR12A604 | 1,65 3,7 |

For the definition of the dimensions, see Clause 5.
The cylindrical surface is insulated from the contacts.

Terminals: flat/cap and base.

For general information, see IEC 60086-1.

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

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

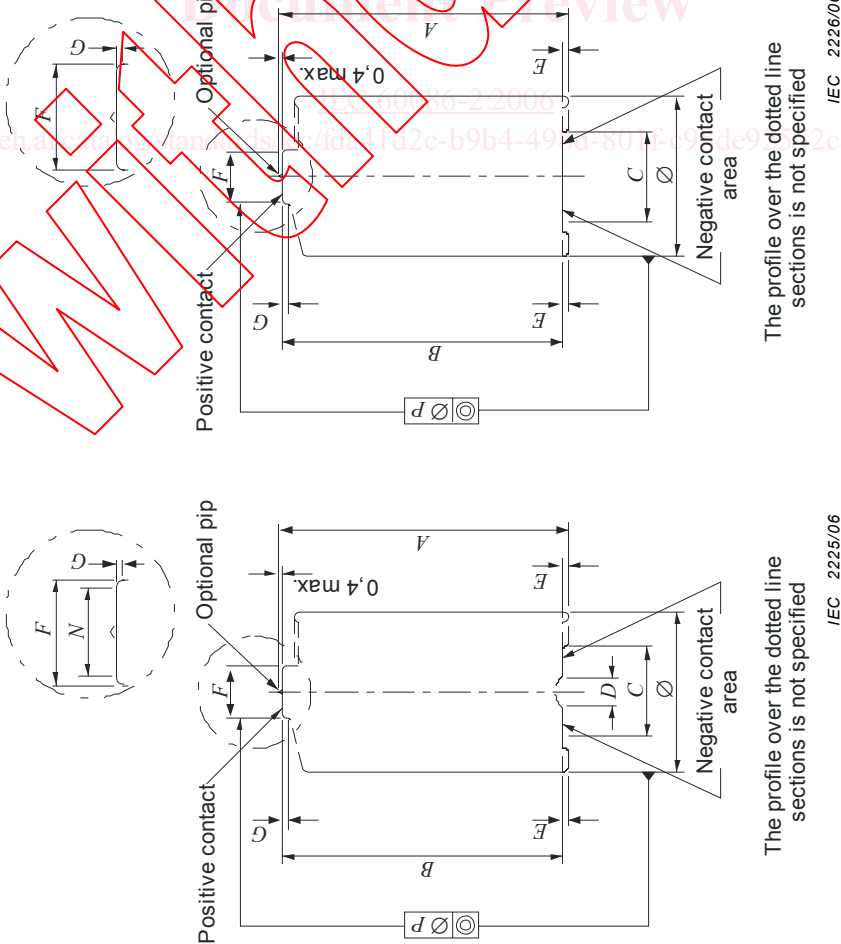


Figure 1a

Figure 1b

Figure 1 – Category 1 dimensional drawings

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

When the flat negative contact surface forms the lower part of the battery, dimensions "A" and "B" are both measured from the surface and dimension "E" is zero.

Dimension "P" to be measured in accordance with ISO 1101.