INTERNATIONAL STANDARD

IEC 60086-2

Edition 10.1

2001-10

Edition 10: 2000 consolidated with amendment 1:2001

Primary batteries –

Part 2: Physical and electrical specifications

Piles électriques –

Partie 2:
Spécifications physiques et électriques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRIMARY BATTERIES –

Part 2: Physical and electrical specifications

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 60086-2 has been prepared by IEC technical committee 35: Primary cells and batteries.

This consolidated version of IEC 60086-2 is based on the tenth edition (2000) [documents 35/1136/FDIS and 35/1147/RVD], and its amendment 1 (2001) [documents 35/1157/FDIS and 35/1163/RVD].

It bears the edition number 10.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A, B and C are for information only.

IEC 60086 consists of the following parts under the general title: *Primary batteries*

– Part 1: General
– Part 2: Physical and electrical specifications
– Part 3: Watch batteries
– Part 4: Safety of lithium batteries
– Part 5: Safety of batteries with aqueous electrolyte

The committee has decided that the contents of the base publication and its amendment will remain unchanged until 2002. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this standard may be issued at a later date.

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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 through provision of specification sheets for primary cells and batteries.

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 as been removed from IEC 60086-1, and is now available in IEC 60086-4 and IEC 60086-5.

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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 electrochemical systems.

It specifies – the physical dimensions

– the discharge test conditions and discharge performance requirements.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60086. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60086 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 600050(481):1996, *International Electrotechnical Vocabulary – Chapter 481: Primary cells and batteries*

IEC 60086-1:2000, *Primary batteries – Part 1: General*

ISO 1101:1983, *Technical drawings – Geometrical tolerancing – Tolerancing of form, orientation, location and run out – Generalities, definitions, symbols, indication on drawings*

3 Definitions

For the purpose of this International Standard, the definitions of IEC 60050(481), as well as the following definitions, apply.

3.1
application test
test which simulates the actual use of a battery in a specific application, for example, "portable lighting", "tape recorder" or "transistor radio" test

3.2
end-point voltage (EV)
specified closed circuit voltage at which a service output test is terminated

3.3
minimum average duration (MAD)
that 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

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3.4
nominal voltage of a primary battery (Vn)
suitable approximate value of voltage used to identify the voltage of a primary battery

3.5
on-load voltage
(closed-circuit voltage) (CCV)
voltage across the terminals of a battery when it is on discharge

3.6
open-circuit voltage (OCV)
(off-load voltage)
voltage across the terminals of a battery when no external current is flowing

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

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

3.12
terminals (of a primary battery)
conductive parts provided for the connection of a battery to external conductors

4 Symbols and abbreviations

4.1 **EV**: end-point voltage

4.2 **MAD**: minimum average duration

4.3 **OCV**: open-circuit voltage (off-load voltage)

4.4 **R**: load resistance

4.5 **Vn**: nominal voltage of a battery

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5 Battery dimensions

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
ø: maximum and minimum diameters of the battery
ø 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 electro-chemical 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 are directly shown on the drawing.

6.7 Batteries are categorized into the following groups:

a) Category 1: Round batteries according to figures 1a and 1b

R1, R03, R6C, R6P, R6S, R14C, R14P, R14S, R20C, R20P, R20S, 2R10

LR8D425, LR1, LR03, LR6, LR14, LR20

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b) Category 2: Round batteries

CR14250, CR17345, CR17450

BR17335, BR17345

c) Category 3: Round batteries according to figure 2 and figure 3

LR9, LR53

CR 11108

d) Category 4: Round batteries according to figure 4

PR70, PR41, PR48, PR43, 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 figures 1a and 1b, 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.

7 Battery specification tables and sheets

NOTE See annex C for ease of locating battery sizes.

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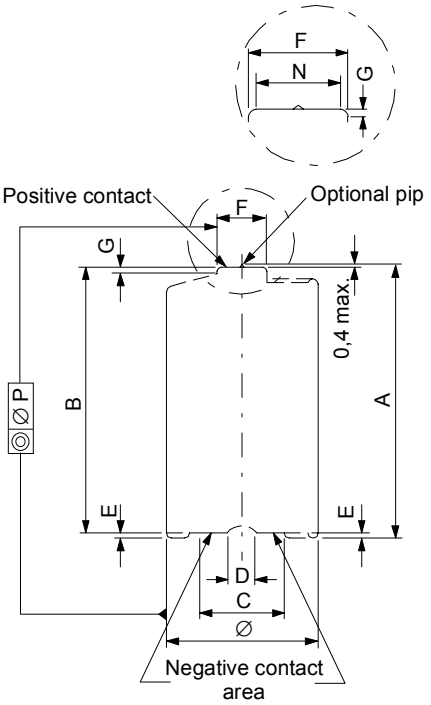

Figure 1a

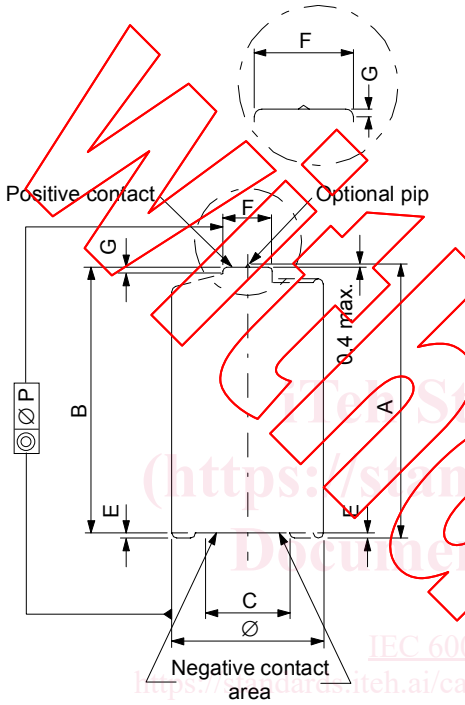

Figure 1b

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.

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

Batteries complying with these physical and electrical specifications are:

Designation	OCV Max. V
R1, R03, R6C, R6P, R6S, R14C, R14P, R14S R20C, R20P, R20S	1,725
2R10	3,450
LR8D425, LR1, LR03, LR6, LR14, LR20	1,65
CR12A604	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 terminal details, see respectively 4.1.3.5 and 4.1.3.2 of IEC 60086-1.

For general information, see IEC 60086-1.

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

Figure1b: negative contact shall be essentially flat over the whole surface area.

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PHYSICAL AND ELECTRICAL SPECIFICATIONS												CATEGORY 1 BATTERIES				
Electro-chemical system	**Designation**	**Vn** V	**Dimensions** mm									**Discharge conditions**			**MAD [a] (initial)**	**Applications**
			A	B	C	E	F	G	∅		∅P	R Ω	Daily period	EV V		
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.					
(see note)	R1	1,5	30,2	29,1	5,0	0,2	4,0	0,5	12,0	10,9	0,5	300	12 h	0,9	76 h	Hearing aids
												5,1	5 min	0,9	57 min	Portable lighting
	R03	1,5	44,5	43,3	4,3	0,5	3,8	0,8	10,5	9,5	0,4	5,1	[b]	0,9	45 min	Portable lighting
												10	1 h	0,9	1,4 h	Personal cassette player and tape recorder
												75	4 h	0,9	20 h	Radio
												24	15 s per min 8 h per day	1,0	4 h	Remote control
												3,6	[c]	0,9	120 pulses	Pulse test
	R6C (high capacity)	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	43	4 h	0,9	25 h	Radio
												3,9	1 h	0,8	47 min	Motor/toy
												10	1 h	0,9	3,5 h	Personal cassette player and tape recorder
												24	15 s per min 8 h per day	1,0	10,9 h	Remote control
												1,8	[c]	0,9	46 pulses	Pulse test
	R6P (high power)	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	43	4 h	0,9	27 h	Radio
												3,9	1 h	0,8	60 min	Motor/toy
												10	1 h	0,9	4,1 h	Personal cassette player and tape recorder
												24	15 s per min 8 h per day	1,0	11 h	Remote control
												1,8	[c]	0,9	75 pulses	Pulse test
	R6S (standard)	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	43	4 h	0,9	22 h	Radio

NOTE Delayed discharge performance after 12 months is 80 % of MAD.

[a] Standard conditions.

[b] 4 min beginning at hourly intervals for 8 h per day.

[c] 15 s on, 45 s off for 24 h per day.

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PHYSICAL AND ELECTRICAL SPECIFICATIONS													CATEGORY 1 BATTERIES			
Electro-chemical system	**Designation**	**Vn** V	**Dimensions** mm										**Discharge conditions**			**MAD [a] (initial)**	**Applications**
			A	B	C	E	F	G	∅		∅P		R Ω	Daily period	EV V		
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.						
(see note)	R14C (high capacity)	1,5	50,0	48,6	13,0	0,9	7,5	1,5	26,2	24,9	1,0		3,9	[b]	0,9	250 min	Portable lighting
													6,8	1 h	0,9	7 h	Tape recorders
													20	4 h	0,9	25 h	Radio
													3,9	1 h	0,8	2,5 h	Toy
	R14P (high power)	1,5	50,0	48,6	13,0	0,9	7,5	1,5	26,2	24,9	1,0		3,9	[b]	0,9	300 min	Portable lighting
													6,8	1 h	0,9	9 h	Tape recorders
													20	4 h	0,9	30 h	Radio
													3,9	1 h	0,8	4,8 h	Toy
	R14S (standard)	1,5	50,0	48,6	13,0	0,9	7,5	1,5	26,2	24,9	1,0		3,9	[b]	0,9	120 min	Portable lighting
													6,8	1 h	0,9	3,0 h	Tape recorders
													20	4 h	0,9	15 h	Radio
													3,9	1 h	0,8	1,5 h	Toy
	R20C (high capacity)	1,5	61,5	59,5	18,0	1,0	9,5	1,5	34,2	32,3	1,0		2,2	[b]	0,9	300 min	Portable lighting (1)
													3,9	1 h	0,9	9 h	Tape recorders
													10	4 h	0,9	30 h	Radio
													2,2	1 h	0,8	4 h	Toy
													1,5	4 min per 15 min 8 h per day	0,9	130 min	Portable lighting (2)

NOTE Delayed discharge performance after 12 months is 80 % of MAD.

[a] Standard conditions.

[b] 4 min beginning at hourly intervals for 8 h per day.

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