

Primary batteries —

Part 2: Physical and electrical specifications

The European Standard EN 60086-2:2007 has the status of a British Standard

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National foreword

This British Standard was published by BSI. It is the UK implementation of EN 60086-2:2007. It is identical with IEC 60086-2:2006. It supersedes BS EN 60086-2:2001, which will be withdrawn on 1 February 2010.

The UK participation in its preparation was entrusted to Technical Committee CPL/35, Primary cells.

A list of organizations represented on CPL/35 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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**Primary batteries –
Part 2: Physical and electrical specifications
(IEC 60086-2:2006)**

Piles électriques –
Partie 2: Spécifications physiques
et électriques
(CEI 60086-2:2006)

Primärbatterien –
Teil 2: Physikalische und elektrische
Spezifikationen
(IEC 60086-2:2006)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 35/1245/FDIS, future edition 11 of IEC 60086-2, prepared by IEC TC 35, Primary cells and batteries, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60086-2 on 2007-02-01.

This European Standard supersedes EN 60086-2:2001 + A1:2001 + A2:2004.

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.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2007-11-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2010-02-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60086-2:2006 was approved by CENELEC as a European Standard without any modification.

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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.

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;
$\varnothing$	maximum and minimum diameters of the battery;
$\varnothing P$	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.

7 Physical and electrical specifications

7.1 Category 1 batteries

7.1.1 Category 1 – Physical and electrical specifications

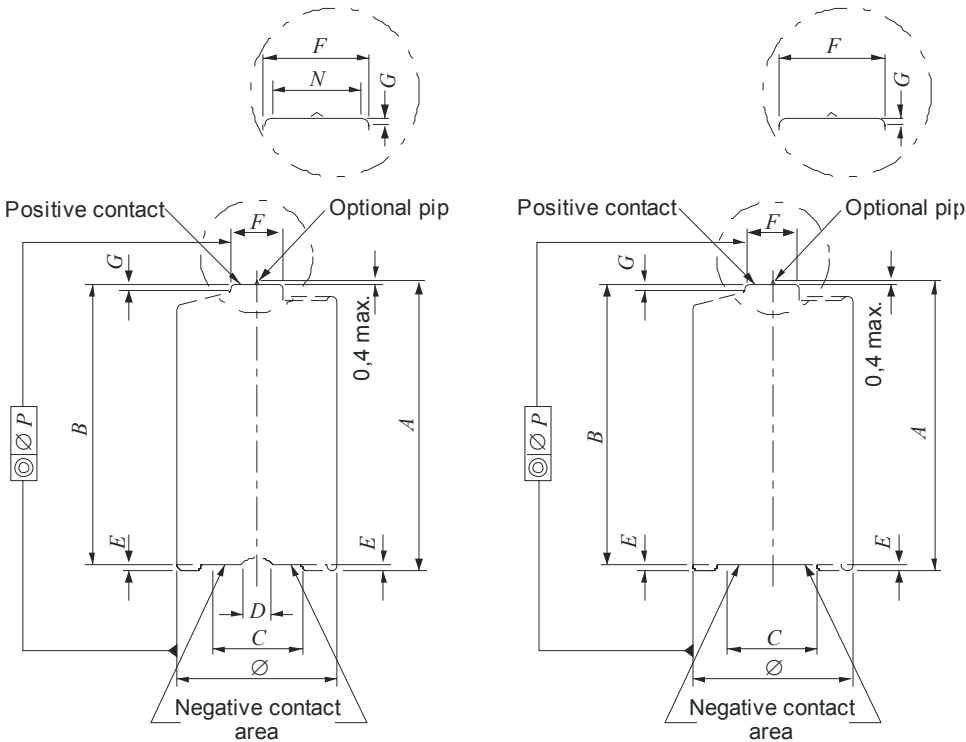


Figure 1a

Figure 1b

Figure 1 – Category 1 dimensional drawings

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

Designation	OCV max. V
R1, R03, R6P, R6S, R14P, R14S 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 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.

7.1.2 Category 1 – Specifications: R1, R03, R6P, R6S

Electro-chemical system letter	Designation	V_n V	Dimensions mm									Discharge conditions			MAD ^a (initial)	Applications
			<i>A</i>	<i>B</i>	<i>C</i>	<i>E</i>	<i>F</i>	<i>G</i>	$\varnothing$		$\varnothing P$	<i>R</i> Ω	Daily period	EV V		
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.					
No letter (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 aid
												5,1	5 min	0,9	30 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	1,5 h	Personal cassette player and tape recorder
												75	4 h	0,9	20 h	Radio
												24	15 s per minute 8 h per day	1,0	4 h	Remote control
												43	4 h	0,9	27 h	Radio
	R6P (high power)	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	3,9	1 h	0,8	60 min	Motor/toy
												10	1 h	0,9	4,0 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	60 pulses	Pulse test
												43	4 h	0,9	22 h	Radio
	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 (see IEC 60086-1, Table 4, Initial discharge test).

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

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

7.1.3 Category 1 – Specifications: R14P, R14S

Electro-chemical system letter	Designation	V _n V	Dimensions mm									Discharge conditions			MAD ^a (initial)	Applications
			<i>A</i>	<i>B</i>	<i>C</i>	<i>E</i>	<i>F</i>	<i>G</i>	Ø		ØP	<i>R</i> Ω	Daily period	EV V		
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.					
No letter (see note)	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	270 min	Portable lighting
												6,8	1 h	0,9	9 h	Tape recorder
												20	4 h	0,9	27 h	Radio
												3,9	1 h	0,8	3 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 h	Tape recorder
												20	4 h	0,9	15 h	Radio
												3,9	1 h	0,8	1,5 h	Toy

NOTE

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

^a

Standard conditions (see IEC 60086-1, Table 4, Initial discharge test).

^b

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

7.1.4 Category 1 – Specifications: R20P, R20S, 2R10, LR8D425, LR1

Electro-chemical system letter	Designation	V _n V	Dimensions mm									Discharge conditions			MAD ^a (initial)	Applications
			A	B	C	E	F	G	Ø		ØP	R	Daily period	EV V		
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.	Ω				
No letter (see note 1)	R20P (high power)	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	320 min	Portable lighting (1)
												3,9	1 h	0,9	11 h	Tape recorder
												10	4 h	0,9	32 h	Radio
												2,2	1 h	0,8	5 h	Toy
												1,5	4 min per 15 min 8 h per day	0,9	135 min	Portable lighting (2)
	R20S (standard)	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	100 min	Portable lighting (1)
												3,9	1 h	0,9	4 h	Tape recorder
												10	4 h	0,9	18 h	Radio
												2,2	1 h	0,8	2 h	Toy
												1,5	4 min per 15 min 8 h per day	0,9	32 min	Portable lighting (2)
	2R10	3,0	74,6	71,5	9,0	0,8	6,8	1,0	21,8	20,0		6,8	5 min	1,8	85 min	Portable lighting
L (see note 2)	LR8D425	1,5	42,5	41,5	2,3 ^c	0,1	3,8	0,7	8,3	7,7	0,1	5,1	5 min	0,9	90 min	Lighting
												75	1 h	1,1	22 h	Laser pointer
												75	1 h	0,9	27 h	Service output test
	LR1	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	130 h	Hearing aid
												5,1	5 min	0,9	94 min	Portable lighting
												Background: 3 000 ^d Pulse: 10	24 h 5 s per h	0,9	888 h	Paging test

NOTE 1 Delayed discharge performance after 12 months is 80 % of MAD.

NOTE 2 Delayed discharge performance after 12 months is 90 % of MAD.

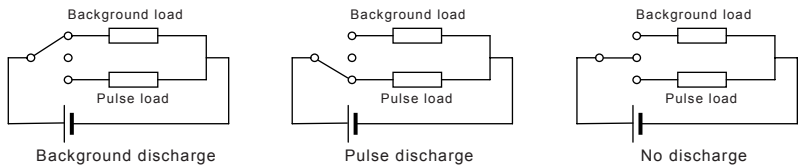
NOTE 1 Delayed discharge performance after 12 months is 80 % of MAD.

NOTE 2 Delayed discharge performance after 12 months is 90 % of MAD.

7.1.4 (continued)

- a Standard conditions (see IEC 60086-1, Table 4, Initial discharge test).
- b 4 min beginning at hourly intervals for 8 h per day.
- c This battery does not fulfill the requirement $C > F$ due to constructional constraints.
- d The pulse load of 10 Ω alone shall be applied across the battery. It is the effective load. It is not added in series or parallel to the 3 000 Ω background load. See Example.

EXAMPLE



7.1.5 Category 1 – Specifications: LR03, LR6, LR14, LR20

Electro-chemical system letter	Designation	V _n V	Dimensions mm									Discharge conditions			MAD ^a (initial)	Applications
			<i>A</i>	<i>B</i>	<i>C</i>	<i>E</i>	<i>F</i>	<i>G</i>	Ø		ØP	<i>R</i> Ω	Daily period	EV V		
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.					
L (see note)	LR03	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	130 min	Portable lighting
												24	15 s per minute 8 h per day	1,0	14,5 h	Remote control
												10	1 h	0,9	5 h	Personal cassette player and tape recorder
												75	4 h	0,9	44 h	Radio
												Current drain 600 mA	c	0,9	140 pulses	Photo flash
	LR6	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	60 h	Radio
												3,9	1 h	0,8	4 h	Motor/toy
												10	1 h	0,9	11,5 h	Personal cassette player and tape recorder
												Current drain 250 mA	1 h	0,9	4,5 h	CD/MD/ Electronic game
												Current drain 1 000 mA	c	0,9	200 pulses	Photo flash
												Power drains 1 500 mW 650 mW 0 mW	5 min ^d 55 min	1,05	40 pulses	Digital still camera
												24	15 s per minute 8 h per day	1,0	31 h	Remote control
	LR14	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	770 min	Portable lighting
												Current drain 400 mA	2 h	0,9	8 h	Portable stereo
												20	4 h	0,9	77 h	Radio
												3,9	1 h	0,8	12 h	Toy