

Primary batteries —

Part 2: Physical and electrical specifications

The European Standard EN 60086-2:2001, with the incorporation of amendments A1:2001 and A2:2004, has the status of a British Standard

ICS 29.220.10

National foreword

This British Standard is the official English language version of EN 60086-2:2001, including amendments A1:2001 and A2:2004. It is identical with IEC 60086-2 (2001-10), Ed. 10.1, including amendment 2:2004. It supersedes BS EN 60086-2:1998 which is withdrawn.

The start and finish of text introduced or altered by IEC amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee CPL/35, Primary cells, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Cross-references

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This British Standard, having been prepared under the direction of the Electrotechnical Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 21 December 2001

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 50, an inside back cover and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments
16297	31 July 2006	See national foreword

Primary batteries
Part 2: Physical and electrical specifications
(IEC 60086-2:2000/A1:2001)

Piles électriques
Partie 2: Spécifications physiques et
électriques
(CEI 60086-2:2000/A1:2001)

Primärbatterien
Teil 2: Physikalische und elektrische
Spezifikationen
(IEC 60086-2:2000/A1:2001)

This amendment A1 modifies the European Standard EN 60086-2:2001; it was approved by CENELEC on 2001-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

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Foreword

The text of document 35/1157/FDIS, future amendment 1 to IEC 60086-2:2000, prepared by IEC TC 35, Primary cells and batteries, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60086-2:2001 on 2001-10-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2002-07-01
- latest date by which the national standards conflicting
with the amendment have to be withdrawn (dow) 2004-10-01

Endorsement notice

The text of amendment 1:2001 to the International Standard IEC 60086-2:2000 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A2

The text of document 35/1199/FDIS, future amendment 2 to IEC 60086-2:2000, prepared by IEC TC 35, Primary cells and batteries, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60086-2:2001 on 2004-04-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2005-01-01
- latest date by which the national standards conflicting
with the amendment have to be withdrawn (dow) 2007-04-01

Endorsement notice

The text of amendment 2:2004 to the International Standard IEC 60086-2:2000 was approved by CENELEC as an amendment to the 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 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.

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 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

3.4

nominal voltage of a primary battery (V_n)

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 V_n : nominal voltage of a battery

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
- ∅: maximum and minimum diameters of the battery
- ∅ 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:

$$\begin{aligned}C &> F \\N &> D \\G &> E\end{aligned}$$

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

CR 12A604



b) Category 2: Round batteries

CR14250, CR15H270, CR17345, CR17450
BR17335

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

NOTE See annex C for ease of locating battery sizes.

PHYSICAL AND ELECTRICAL SPECIFICATIONS

CATEGORY 1 BATTERIES

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.

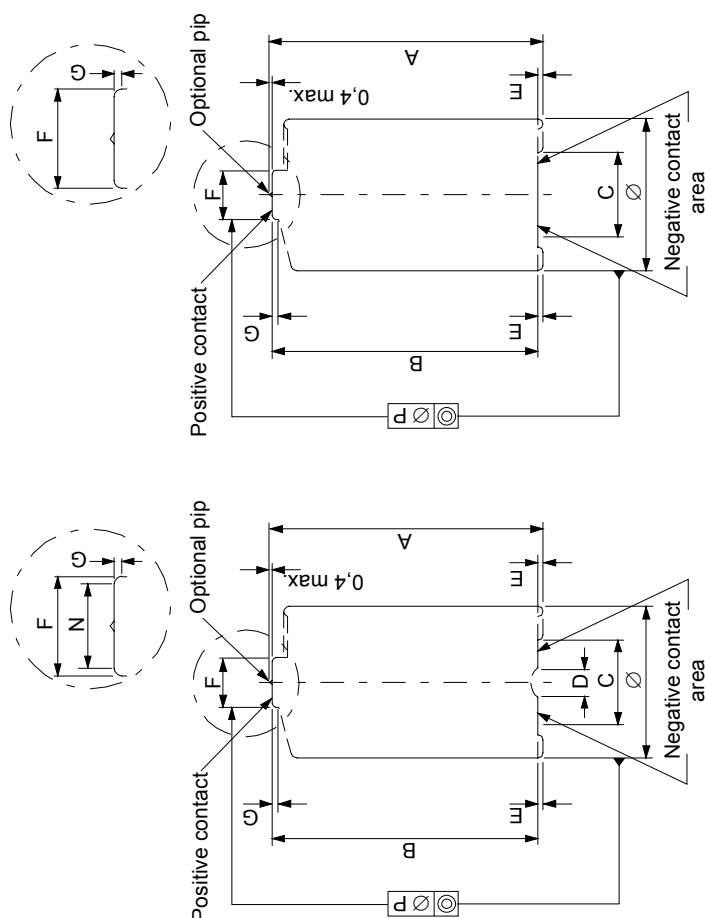
Terminals: flat/cap and base.

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.

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



The profile over the dotted line sections is not specified

IEC 2381/2000

Figure 1a

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.

Figure 1b

The profile over the dotted line sections is not specified

IEC 2380/2000



CATEGORY 1 BATTERIES																
Electro-chemical system	Designation	Vn V	Dimensions mm								Discharge conditions			MAD ^a (initial)	Applications	
			A Max.	B Min.	C Min.	E Max.	F Max.	G Min.	Ø		R Ω	Daily period				
									Max.	Min.						
(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
	R03	1,5	44,5	43,3	4,3	0,5	3,8	0,8	10,5	9,5	0,4	5,1	5 min	0,9	30 min	Portable lighting
												5,1	b	0,9	45 min	Portable lighting
												10	1 h	0,9	1,4 h	Personal cassette player and tape recorder
	R6C (high capacity)	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	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
	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	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
	R6S (standard)	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	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
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	
											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, 6.1, 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.



Documents

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CATEGORY 1 BATTERIES																
PHYSICAL AND ELECTRICAL SPECIFICATIONS																
Electro-chemical system	Designation	V _n V	Dimensions mm								Discharge conditions			MAD ^a (initial)	Applications	
			A Max.	B Min.	C Min.	E Max.	F Max.	G Min.	Ø		R Ω	Daily period	EV V			
(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/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 (see IEC 60086-1, 6.1 Table 4, Initial discharge test).																
4 min beginning at hourly intervals for 8 h per day																





PHYSICAL AND ELECTRICAL SPECIFICATIONS													
CATEGORY 1 BATTERIES													
Electro-chemical system	Designation	V _n V	Dimensions mm						Discharge conditions			MAD ^a (initial)	Applications
			A Max.	B Min.	C Min.	E Max.	F Max.	G Min.	Ø Max.	Ø Min.	ØP Max.		
(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		Portable lighting (1)
	R20S (standard)	1,5	61,5	59,5	18,0	1,0	9,5	1,5	34,2	32,3	1,0		Tape recorders
(see note 2)	2R10	3,0	74,6	71,5	9,0	0,8	6,8	1,0	21,8	20,0			Portable lighting (2)
	LR8D425	1,5	42,5	41,5	2,3 ^c	0,1	3,8	0,7	8,3	7,7	0,1		Laser pointer
(see note 2)	LR1	1,5	30,2	29,1	5,0	0,2	4,0	0,5	12,0	10,9	0,5		Hearing aids

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

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

Standard conditions (see IEC 60086-1, 6.1, Table 4, Initial discharge test).

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

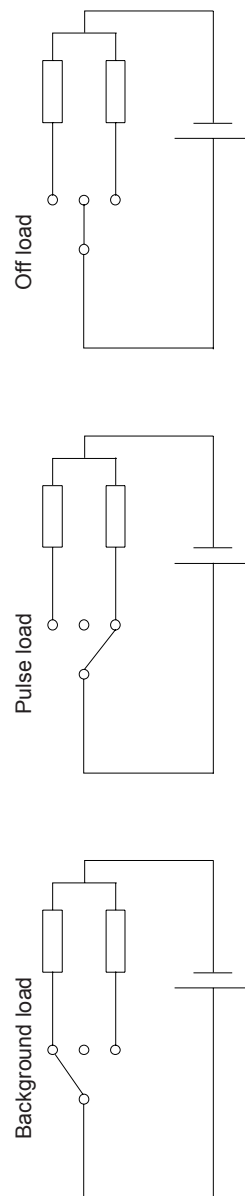
^b This battery does not fulfill the requirement

^c $\rho > F$ due to constructional constraints.

^d 4 h per day, plus 10 Ω for 5 s at hourly

intervals for 24 h per day. See example.

Example



CATEGORY 1 BATTERIES

PHYSICAL AND ELECTRICAL SPECIFICATIONS

Electro-chemical system	Designation	Vn V	Dimensions mm								Discharge conditions			MAD ^a (initial)	Applications												
			A	B	C	E	F	G	Ø		R	Daily period	EV														
			Max.	Min.	Min.	Max.	Max.	Min.	Max.	Min.	Max.	Ω				V											
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											
																	(current drain) 600 mA	4 h	0,9	140 pulses	Photo flash						
																						43	4 h	0,9	60 h	Radio	
																											3,9
	LR6	1,5	50,5	49,2	7,0	0,5	5,5	1,0	14,5	13,5	0,5	(current drain) 250 mA	1 h	0,9	11,5 h	4,5 h	CD/MD/ Electronic game										
																		(current drain) 1 000 mA	c	0,9	200 pulses	Photo flash					
																							24	15 s per min 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	(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	
																											2,2
LR20	1,5	61,5	59,5	18,0	1,0	9,5	1,5	34,2	32,3	1,0	(current drain) 600 mA	2 h	0,9	11 h	Portable stereo												
																10	4 h	0,9	81 h	Radio							
																					2,2	1 h	0,8	15 h	Toy		
																										1,5	4 min per 15 min 8 h per day



N/E Delayed discharge performance after 12 months is 90 % of MAD.

^a standard conditions (see IEC 60086-1, 6.1, Table 4, Initial discharge test).^b min beginning at hourly intervals for 8 h per day.^c 10 s on, 50 s off for 1 h per day.

PHYSICAL AND ELECTRICAL SPECIFICATIONS													CATEGORY 1 BATTERIES				
Electro-chemical system	Designation	Vn V	Dimensions mm								Discharge conditions			MAD ^a (initial)	Applications		
			A Max.	B Min.	C Min.	E Max.	F Max.	G Min.	Ø		R Ω	Daily period	EV V				
									Max.	Min.							
C (see note)	CR12A604 ^b	3	60,4	58,0	4,8	–	4,5	0,3	12,0	10,7	2 000	24 h	2,0	840 h	Service output test		
NOTE Delayed discharge performance after 12 months is 98 % of MAD.																	
^a Standard conditions (see IEC 60086-1, 6.1 Table 4, Initial discharge test).																	
^b Marking: subclause 4.1.6.2 of IEC 60086-1 is applicable.																	

PHYSICAL AND ELECTRICAL SPECIFICATIONS

CATEGORY 2 BATTERIES

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

Designation	OCV Max. V
CR14250, CR15H270, CR17345, CR17450, BR17335	3,7 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.

