

Electrical apparatus for potentially explosive atmospheres — Increased safety “e”

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British Standard

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National foreword

This British Standard has been prepared under the direction of the General Electrotechnical Standards Policy Committee and is the English language version of EN 50019:1994 *Electrical apparatus for potentially explosive atmospheres — Increased safety “e”*, including its corrigendum 1994, published by the European Committee for Electrotechnical Standardization (CENELEC).

The standard should be read in conjunction with BS EN 50014:1993 *Electrical apparatus for potentially explosive atmospheres — General requirements*, which it supplements.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 34, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Descriptors: Electrical apparatus, potentially explosive atmosphere, explosive atmosphere, explosion proofing, specific requirement, increased safety "e"

English version

Electrical apparatus for potentially explosive atmospheres — Increased safety "e"

Matériel électrique pour atmosphères
explosibles Sécurité augmentée "e"

Elektrische Betriebsmittel für
explosionsgefährdete Bereiche
Erhöhte Sicherheit "e"

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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

This European Standard was prepared by the secretariat of CENELEC subcommittee SC 31-4, Increased safety “e”.

It was submitted to the CENELEC members for formal vote in November 1992 and was approved by CENELEC as EN 50019 on 1993-07-06.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-10-01
- latest date of withdrawal of conflicting national standards (dow) —

This European Standard is to be read in conjunction with EN 50014:1992 *Electrical apparatus for potentially explosive atmospheres – General requirements*, and with the second editions of the European Standards for the specific types of protection listed in the scope of EN 50014:1992.

This European Standard should not be considered in conjunction with any of the first edition standards and their amendments, published in 1977 or thereafter, listed in EN 50014:1977.

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Section 1. General

1 Scope

This European Standard specifies the specific requirements for the construction, testing and marking of electrical apparatus with type of protection “increased safety “e”” intended for use in explosive gas atmospheres.

These specific requirements are additional to the general requirements in EN 50014 which are applicable to type of protection “e”. This European Standard applies to electrical apparatus with a rated value of supply voltage not exceeding 11 kV (d.c. or a.c. r.m.s.) that does not produce in normal operation sparks, arcs, or dangerous temperatures.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 50014:1992, *Electrical apparatus for potentially explosive atmospheres — General requirements*.

EN 50018, *Electrical apparatus for potentially explosive atmospheres — Flameproof enclosure “d”*.

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety “i”*.

EN 50033, *Electrical apparatus for potentially explosive atmospheres — Caplights for mines susceptible to firedamp*.

EN 50039, *Electrical apparatus for potentially explosive atmospheres — Intrinsically safe electrical systems “i”*.

EN 60034-5, *Rotating electrical machines — Part 5: Classification of degrees of protection provided by enclosures for rotating machines*. (IEC 34-5:1981, modified)

EN 60061-1:1993, *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 1: Lamp caps*.

(IEC 61-1:1969 + supplements A: 1970 to N: 1992, modified)

EN 60061-2:1993, *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 2: Lampholders*.

(IEC 61-2:1969 + supplements A: 1970 to K: 1992, modified)

EN 60064, *Tungsten filament lamps for domestic and similar general lighting purposes — Performance requirements*. (IEC 64:1987 + A1:1988)

EN 60068-2-27:1993, *Basic environmental testing procedures — Part 2: Tests – Test Ea and guidance: Shock*. (IEC 68-2-27:1987)

EN 60238, *Edison screw lampholders*.

(IEC 238:1991 + corrigendum June 1992, modified)

EN 60432, *Safety requirements for tungsten filament lamps for domestic and similar general lighting purposes*. (IEC 432:1984)

EN 60529, *Degrees of protection provided by enclosures (IP Code)*. (IEC 529:1989)

HD 53.1 S2:1985 + A3:1992, *Rotating electrical machines — Part 1: Rating and performance*.

(IEC 34-1:1983 + A1:1987 + A2:1989, modified)

HD 214 S2, *Recommended method for determining the comparative tracking index of solid insulating materials under moist conditions*. (IEC 112:1979)

HD 384.3 S1:1985, *Electrical installations of buildings — Part 3: Assessment of general characteristics*. (IEC 364:1977 + IEC 364-3A:1979 +

IEC 364-3B:1980, modified)

HD 553 S2, *Current transformers*.

(IEC 185:1987 + A1:1990, modified)

HD 555, *Specifications for particular types of winding wires*.

HD 555.3 S1:1992, *Part 3: Polyester enamelled round copper wire, class 155*. (IEC 317-3:1990)

HD 555.7 S2:1992, *Part 7: Polyimide enamelled round copper wire, class 200*. (IEC 317-7:1990)

HD 555.8 S2:1992, *Part 8: Polyesterimide enamelled round copper wire, class 180*.

(IEC 317-8:1990)

HD 566 S1, *Thermal evaluation and classification of electrical insulation*. (IEC 85:1984)

IEC 50 (426):1990, *International Electrotechnical Vocabulary Chapter 426: Electrical apparatus for explosive atmospheres*.

IEC 50 (486):1991, *International Electrotechnical Vocabulary Chapter 486: Secondary cells and batteries*.

IEC 79-4, *Electrical apparatus for explosive gas atmospheres — Part 4: Method of test for ignition temperature*.

IEC 664-1:1992, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*.

IEC 755, *General requirements for residual current operated protective devices*.

3 Definitions

For the purposes of this European Standard, the definitions of EN 50014 apply and also the following.

NOTE Where a word, for example “battery”, is shown in parentheses in a term, it may be omitted when no risk of confusion or misunderstanding is likely to arise.

3.1**increased safety “e”**

a type of protection in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks inside and on external parts of electrical apparatus which does not produce arcs or sparks in normal service [IEV 426-08-01]

NOTE 1 This type of protection is denoted by “e” and the “additional measures” are those required for compliance with this European Standard.

NOTE 2 Apparatus producing arcs or sparks in normal service is excluded by this definition.

3.2**limiting temperature**

the maximum permissible temperature of apparatus or parts of apparatus equal to the lower of the two temperatures determined by:

- a) the danger of ignition of the explosive gas atmosphere;
- b) the thermal stability of the materials used. [IEV 426-08-02]

3.3**initial starting current I_A**

highest r.m.s value of current absorbed by an a.c. motor when at rest or by an a.c. magnet with its armature clamped in the position of maximum air gap when supplied at rated voltage and rated frequency

NOTE Transient phenomena are ignored.

3.4**starting current ratio I_A/I_N**

ratio between initial starting current I_A and rated current I_N

3.5**time t_E**

the time taken for a.c. windings, when carrying the starting current I_A , to be heated up from the temperature reached in rated service and at maximum ambient temperature, to the limiting temperature [IEV 426-08-03]

3.6**rated short-time thermal current I_{th}**

R.M.S. value of the current required to heat up the conductor within 1s from the temperature reached in rated service at the maximum ambient temperature to a temperature that does not exceed the limiting temperature

3.7**rated dynamic current I_{dyn}**

peak value of the current, the dynamic effect of which the electrical apparatus can sustain without damage

3.8**short-circuit current I_{sc}**

maximum r.m.s. value of the short-circuit current to which the apparatus may be subjected in service

3.9**creepage distance**

shortest distance along the surface of an insulating material between two conductive parts

3.10**clearance**

shortest distance in air between two conductive parts

3.11**working voltage**

highest r.m.s. value of the a.c. or d.c. voltage across any particular insulation which can occur when the equipment is supplied at rated voltage

NOTE 1 Transients are disregarded.

NOTE 2 Both open circuit conditions and normal operating conditions are taken into account.

[definition 1.3.5 of IEC 664-1: 1992]

3.12 cell or battery

An electrochemical system capable of storing in chemical form the electric energy received and which can give it back by reconversion [IEV 486-01-01]

3.12.1**secondary cell**

an assembly of electrodes and electrolyte which constitutes the basic unit of a secondary battery [IEV 486-01-02]

NOTE 1 A cell consists substantially of positive and negative plates and separators, of the items needed for assembling and connecting (plate lugs, group bars, terminal posts), of the cell container, and the electrolyte.

NOTE 2 A sketch illustrating various parts of a cell is given in Figure 1. This sketch is included for descriptive purposes only and is not intended to imply any requirement or preference for a particular form of construction.

3.12.2**secondary battery**

two or more secondary cells connected together and used as a source of electric energy [IEV 486-01-03]

3.12.3**container (of a cell)**

a container for the plate pack and electrolyte of a cell made of a material impervious to attack by the electrolyte [IEV 486-02-20]

3.12.4**(battery) container**

enclosure to contain the battery

NOTE The cover is a part of the battery container.

3.12.5**battery capacity**

the quantity of electricity or electric charge, which a fully charged battery can deliver under specified conditions [IEV 486-03-01]

NOTE The SI unit for electric charge is the coulomb ($IC = 1A\ s$) but in practice, battery capacity is usually expressed in ampere-hours ($A\ h$).

3.12.6**plate pack**

an assembly of the positive and negative plate groups with separators [IEV 486-02-15]

3.12.7**partition wall**

integral part of a battery container dividing it into individual sections and increasing its mechanical strength

3.12.8**insulating barrier**

electrical insulating material between groups of cells subdividing the battery

3.12.9**intercell connector**

a conductor of electricity used for carrying current between cells [IEV 486-02-31]

3.13 resistance heating device and resistance heating unit**3.13.1****resistance heating device**

part of a resistance heating unit, comprising one or more heating resistors, typically composed of metallic conductors or an electrically conductive compound suitably insulated and protected

3.13.2**resistance heating unit**

apparatus comprising an assembly of one or more resistance heating devices, associated with any devices necessary to ensure that the limiting temperature is not exceeded

NOTE This standard does not require that protective devices outside the hazardous area have type of protection "e".

3.13.3**workpiece**

object to which a resistance heating device or unit is applied

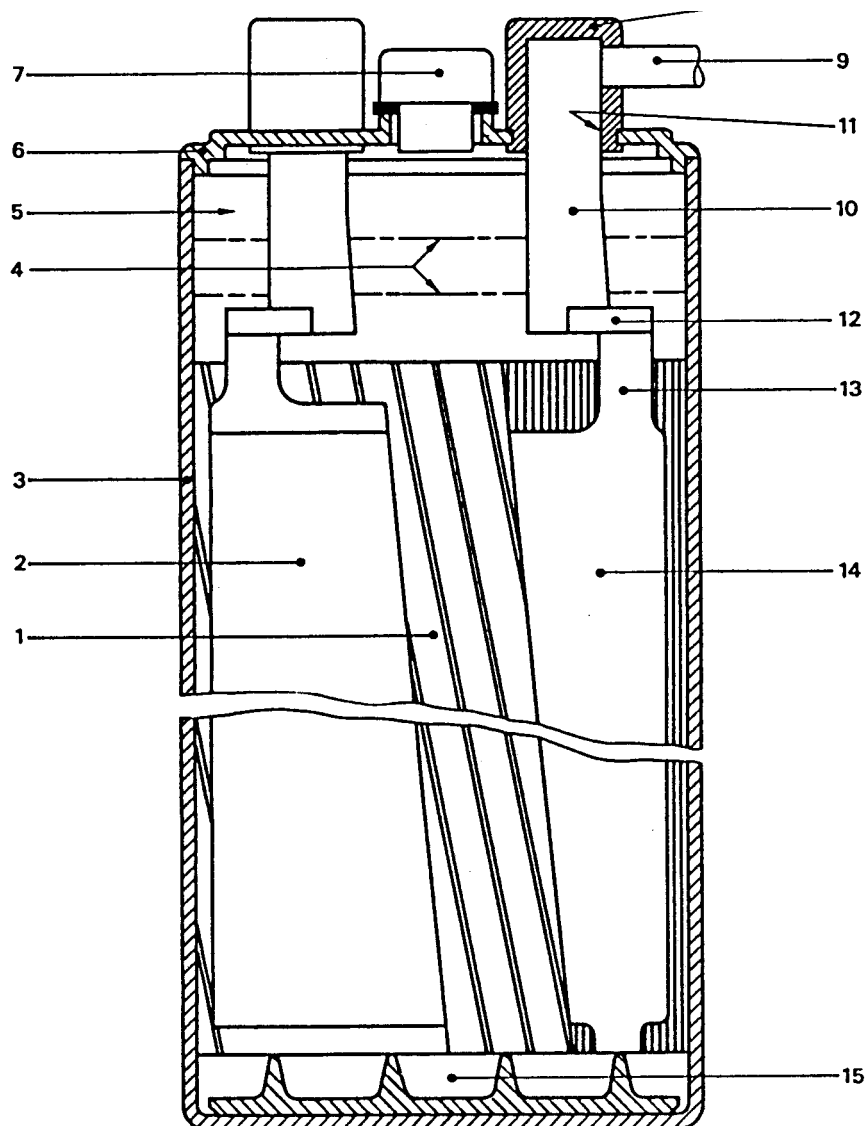
3.13.4**self-limiting characteristic**

characteristic of a resistance heating device, where the thermal output at its rated voltage decreases as the temperature of its surroundings increases until the device reaches a temperature at which its thermal output is reduced to an insignificant amount

NOTE The temperature of the surface of the resistance heating device is then effectively the temperature of the environment.

3.13.5**stabilized design**

concept where the temperature of the resistance heating device or unit will, by design and use, stabilize below the limiting temperature, under the most unfavourable conditions, without the need for a protective system to limit the temperature



NOTE. This sketch is included for descriptive purposes only and is not intended to imply any requirements or preference for a particular form of construction.

- | | | | |
|---|-----------------------------|----|--------------------------------------|
| 1 | Separator | 10 | Terminal post |
| 2 | Positive plate | 11 | Electrolyte-tight terminal post seal |
| 3 | Cell container | 12 | Group bar |
| 4 | Electrolyte level (max/min) | 13 | Plate lug |
| 5 | Headspace | 14 | Negative plate |
| 6 | Electrolyte-tight lid seal | 15 | Slurry space |
| 7 | Filler and vent plug | | |
| 8 | Post encapsulation | | |
| 9 | Intercell connector | | |

Figure 1 — Parts of a cell

Section 2. Specific constructional requirements

4 Requirements for all electrical apparatus

The requirements of this clause apply, unless otherwise stated in clause 5, to all electrical apparatus with type of protection “e”. They are additional to the general requirements of EN 50014 (see clause 1) and are themselves supplemented for certain electrical apparatus by the supplementary requirements in clause 5.

4.1 Terminals for external connections

Terminals for connections to external circuits shall be generously dimensioned to permit the effective connection of conductors of cross-section at least equal to that corresponding to the rated current of the electrical apparatus.

The number and sizes of conductors that can be safely connected to terminals should be specified in the descriptive documents according to 23.2 of EN 50014:1992.

NOTE 1 Service conditions may require the provision of larger terminals and the conductor size corresponding to the rated current may depend upon the application.

These terminals shall:

- be fixed in their mountings without possibility of self-loosening; and
- be constructed in such a way that the conductors cannot slip out from their intended location; and
- be such that proper contact is assured without such damage to the conductors as would impair their ability to fulfil their function, even when multi-stranded conductors are used in terminals intended for direct clamping of a conductor.

NOTE 2 The use of “crimped” cable terminations is not forbidden provided that the above requirements are fulfilled.

In particular, terminals shall not

- have sharp edges which could damage the conductors;
- be able to turn, twist or be permanently deformed during normal tightening, for which the conditions shall be defined by the manufacturer of the apparatus.

Terminals shall be such that the contact they assure is not appreciably impaired by temperature changes occurring in normal service. The contact pressure shall not be transmitted through insulting material.

Terminals intended for clamping stranded conductors shall include a resilient intermediate part. Terminals for connecting conductors of cross sections not exceeding 4 mm² shall also be suitable for the effective connection of conductors having a smaller cross section.

NOTE 3 Special precautions against vibration and mechanical shock may be required.

NOTE 4 Special precautions against electrolytic corrosion should be considered.

4.2 Internal connections (integral part of the apparatus)

Connections within electrical apparatus and forming an integral part of that apparatus shall not be subject to undue mechanical stress. Only the following means for the connection of conductors are permitted:

- a) screwed fasteners with locking;
- b) crimping;
- c) soldering, provided that the conductors are not supported by the soldered connections alone;
- d) brazing;
- e) welding;
- f) any means of connection complying with 4.1.

NOTE Special precautions against electrolytic corrosion should be considered.

4.3 Clearances

Clearances between bare conductive parts at different potentials shall be as given in Table 1 with a minimum value for external connections of 3 mm.

NOTE 1 For the requirements for lamps with screw caps see B.1.4.

Clearances shall be determined as a function of the working voltage (definition 3.11) specified by the manufacturer of the apparatus. Where the apparatus is intended for more than one rated voltage or for a range of rated voltage, the value of working voltage to be used shall be based on the highest value of rated voltage. In determining the clearances, examples 1 to 11 inclusive in Figure 2 illustrate the features to be taken into account and the appropriate clearances.

NOTE 2 These examples are identical with those given in IEC 664-1:1992.

4.4 Creepage distances

4.4.1 The required values of creepage distance are dependent on the working voltage, the resistance to tracking of the electrical insulating material and its surface profile.

Table 1 — Creepage distances and clearances

Working voltage U	Minimum creepage distance			Minimum clearance
	Material group			
V	I	II	IIIa	mm
	mm			
$U \leq 15$	1,6	1,6	1,6	1,6
$15 < U \leq 30$	1,8	1,8	1,8	1,8
$30 < U \leq 60$	2,1	2,6	3,4	2,1
$60 < U \leq 110$	2,5	3,2	4	2,5
$110 < U \leq 175$	3,2	4	5	3,2
$175 < U \leq 275$	5	6,3	8	5
$275 < U \leq 420$	8	10	12,5	6
$420 < U \leq 550$	10	12,5	16	8
$550 < U \leq 750$	12	16	20	10
$750 < U \leq 1\,100$	20	25	32	14
$1\,100 < U \leq 2\,200$	32	36	40	30
$2\,200 < U \leq 3\,300$	40	45	50	36
$3\,300 < U \leq 4\,200$	50	56	63	44
$4\,200 < U \leq 5\,500$	63	71	80	50
$5\,500 < U \leq 6\,600$	80	90	100	60
$6\,600 < U \leq 8\,300$	100	110	125	80
$8\,300 < U \leq 11\,000$	125	140	160	100

Table 2 gives the grouping of electrical insulating materials according to the comparative tracking index (CTI) determined in accordance with HD 214 S2. Inorganic insulating materials, for example glass and ceramics, do not track and need not therefore be subjected to the determination of the CTI. They are conventionally classified in material group I.

The grouping given in Table 2 is applied to insulating parts without ribs or grooves. If there are ribs or grooves in accordance with 4.4.3, the minimum permissible creepage distances for working voltages up to 1 100 V shall be based on the next higher group, for example group I instead of group II.

NOTE 1 The material groups are identical with those given in IEC 664-1:1992.

NOTE 2 Transient overvoltages are ignored as they will not normally influence tracking phenomena. However, temporary and functional overvoltages may have to be considered, depending upon the duration and frequency of occurrence (see IEC 664-1:1992 for additional information).

Table 2 — Tracking resistance of insulating materials

Material Group	Comparative tracking index
I	$600 \leq \text{CTI}$
II	$400 \leq \text{CTI} < 600$
IIIa	$175 \leq \text{CTI} < 400$

4.4.2 Creepage distances between bare conductive parts at different potentials shall be as given in Table 1, with a minimum value for external connections of 3 mm and shall be determined as a function of the working voltage specified by the manufacturer of the apparatus.

NOTE For the requirements for lamps with screw caps see B.1.4.

4.4.3 In determining the creepage distance, example 1 to 11 (see Figure 2) inclusive illustrate the features to be taken into account and the appropriate creepage distance. The value of dimension X is 2,5 mm.