

Electrical apparatus for potentially explosive atmospheres — General requirements

The European Standard EN 50014:1992 has the status of a
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 50014:1992 *Electrical apparatus for potentially explosive atmospheres — General requirements*, second edition, which is published by the European Committee for Electrotechnical Standardization (CENELEC).

This British Standard partly supersedes BS 5501-1:1977, which is an identical standard to the first edition of EN 50014 published in 1977. There are many subordinate standards in existence which give particular requirements for different types of protection, and which refer to BS 5501-1. Only when all the subordinate standards have been either withdrawn or revised and published by CENELEC, will it be possible to withdraw BS 5501-1. These subordinate standards are quoted in clause 1 of this standard.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

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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 40, 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; general requirement; oil immersion "o", pressurized apparatus "p", powder filling "q", flameproof enclosure "d", increased safety "e", intrinsic safety "i", encapsulation "m"

English version

Electrical apparatus for potentially explosive atmospheres General requirements

Matériel électrique pour atmosphères
explosibles — Règles générales

Elektrische Betriebsmittel für
explosionsgefährdete Bereiche — Allgemeine
Bestimmungen

This European Standard was approved by CENELEC on 1992-06-16. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard 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 European Standard 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

This European Standard has been prepared by the secretariat of CENELEC Technical Committee TC 31 in accordance with the decisions taken by that committee during its meetings held in

Brussels 1990
Paris 1990

It has been approved by CENELEC on 16th June 1992.
The second edition of EN 50014 is based on the first edition and includes amendments 1, 2, 3, 4 and 5 as well as the interpretation sheets agreed upon till now.

This European Standard is to be read in conjunction with the second editions of the European Standards for the specific types of protection listed in the scope of this standard. It does not apply in conjunction with the first editions of the standards and their amendments published in 1977 and thereafter.

The following dates were accepted:
— latest date of publication of an identical national standard: (dop) 1993-05-01
— latest date of withdrawal of conflicting national standards: (dow) —

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information.

In this standard, Annex A, Annex D and Annex E are informative, Annex B and Annex C are normative.

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General

1 Scope

1.1 This European Standard specifies the general requirements for contraction, testing and marking of:

- electrical apparatus
- Ex cable entries
- Ex components

intended for use in potentially explosive atmospheres of gas, vapour and mist.

1.2 This European Standard is supplemented or modified by the following European Standards concerning the specific types of protection:

- EN 50015, *Electrical apparatus for potentially explosive atmospheres — Oil immersion “o”*.
 EN 50016, *Electrical apparatus for potentially explosive atmospheres — Pressurized apparatus “p”*.
 EN 50017, *Electrical apparatus for potentially explosive atmospheres — Powder filling “q”*.
 EN 50018, *Electrical apparatus for potentially explosive atmospheres — Flameproof enclosure “d”*.
 EN 50019, *Electrical apparatus for potentially explosive atmospheres — Increased safety “e”*.
 EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety “i”*.
 EN 50028, *Electrical apparatus for potentially explosive atmospheres — Encapsulation “m”*.
 EN 50033, *Electrical apparatus for potentially explosive atmosphere — Caplights for mines susceptible to firedamp*.
 EN 50039, *Electrical apparatus for potentially explosive atmospheres — Intrinsically safe electrical systems “i”*.

1.3 The above European Standards and this European Standard are not applicable to the construction of electromedical apparatus, shot firing exploders, test devices for exploders and for shotfiring circuits.

2 Publications

2.1 Publications of the commission of the European communities

Sixth Report on the Specifications and Testing Conditions relating to Fire Resistant Hydraulic Fluids used for Power Transmission (Hydrostatic and Hydrokinetic) in Mines. Commission of the European Communities Safety and Health Commission for Mining and Extractive Industries, Luxembourg, 1983. (Document 2786/8/81 E)

2.2 European Standards

- EN 50015:1977¹⁾, *Electrical apparatus for potentially explosive atmospheres — Oil immersion “o”*.
 EN 50016:1977¹⁾, *Electrical apparatus for potentially explosive atmospheres — Pressurized apparatus “p”*.
 EN 50017:1977¹⁾, *Electrical apparatus for potentially explosive atmospheres — Powder filling “q”*.
 EN 50018:1977¹⁾, *Electrical apparatus for potentially explosive atmospheres — Flameproof enclosure “d”*.
 EN 50019:1977¹⁾, *Electrical apparatus for potentially explosive atmospheres — Increased safety “e”*.
 EN 50020:1977¹⁾, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety “i”*.
 EN 50028:1987, *Electrical apparatus for potentially explosive atmospheres — Encapsulation “m”*.
 EN 50033:1991, *Electrical apparatus for potentially explosive atmospheres — Caplights for mines susceptible to firedamp*.
 EN 50039:1980, *Electrical apparatus for potentially explosive atmospheres — Intrinsically safe electrical systems “i”*.
 EN 60034-5:1986, *Rotating electrical machines — Part 5: Classification of degrees of protection provided by enclosures for rotating machines*. (Modified IEC 34-5:1981)
 EN 60529:1991, *Degrees of protection provided by enclosures (IP code)*. IEC 529:1989
 EN 60662:1989, *High pressure sodium vapour lamps*. (Modified IEC 662:1980)

2.3 IEC publications with reference to the relevant European publications

- IEC 79-1A(1975), First supplement to IEC 79-1 (1971) *Electrical apparatus for explosive gas atmospheres — Part 1: Construction and test of flameproof enclosures of electrical apparatus: Appendix D: Method of test for ascertainment of maximum experimental safe gap*.
 IEC 79-4 (1975), *Electrical apparatus for explosive gas atmospheres — Part 4: Method of test for ignition temperature*.
 IEC 192(1973), *Low pressure sodium vapour lamps + Amdt 2 (1988)*. HD 219 S3 (1990)
 IEC 216, *Guide for the determination of thermal endurance properties of electrical insulating materials*.

¹⁾ Second edition in preparation.

IEC 216-1 (1987), *Part 1: General guidelines for ageing and evaluation of test results.*

IEC 216-2 (1974), *Part 2: List of materials and available tests.*

2.4 ISO publications

ISO 48:1979, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD).*

ISO 178:1975, *Plastics — Determination of flexural properties of rigid plastics.*

ISO 179:1982, *Plastics — Determination of Charpy impact strength of rigid materials.*

ISO 262:1973, *ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts.*

ISO 273:1979, *Fasteners — Clearance holes for bolts and screws.*

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

ISO R 527:1966, *Plastics — Determination of tensile properties.*

ISO 965-1:1980, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data.*

ISO 965-2:1980, *ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose bolt and nut threads — Medium quality.*

ISO 1817:1985, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 1818:1975, *Vulcanized rubbers of low hardness (10 to 35 IRHD) — Determination of hardness.*

ISO 4014:1988, *Hexagon head bolts — Product grades A and B.*

ISO 4017:1988, *Hexagon head screws — Product grades A and B.*

ISO 4026:1977, *Hexagon socket set screws with flat point.*

ISO 4027:1977, *Hexagon socket set screws with cone point.*

ISO 4028:1977, *Hexagon socket set screws with dog point.*

ISO 4029:1977, *Hexagon socket set screws with cup point.*

ISO 4032:1986, *Hexagon nuts, style 1 — Product grades A and B.*

ISO 4762:1989, *Hexagon socket head cap screws — Product grade A.*

ISO 4892:1981, *Plastics — Methods of exposure to laboratory light sources.*

3 Definitions and symbols

For the purpose of this European Standard and the European Standards listed in 1.2, the following definitions apply.

3.1

electrical apparatus

items applied as a whole or in part for the utilization of electrical energy. These include, among others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion, and consumption of electrical energy and items for telecommunications

3.2

potentially explosive atmosphere

an atmosphere which could become explosive (the danger is a potential one)

3.3

explosive gas atmosphere

a mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour or mist, in which after ignition, combustion spreads throughout the unconsumed mixture

3.4

explosive test mixture

a specified explosive mixture used for the testing of electrical apparatus for potentially explosive atmospheres

3.5

ignition temperature of an explosive gas atmosphere

the lowest temperature of a heated surface at which, under specified conditions according to IEC 79-4, the ignition of a flammable substance in the form of a gas or vapour mixture with air will occur

3.6

service temperature

the temperature reached when apparatus is operating at its rating

3.7

maximum service temperature

the highest value of the service temperatures

NOTE Each apparatus may reach different service temperatures in different parts.

3.8

maximum surface temperature

the highest temperature which is attained in service under the most adverse conditions (but within the recognized tolerances) by any part or surface of an electrical apparatus, which would be able to produce an ignition of the surrounding explosive atmosphere

NOTE 1 The manufacturer will prescribe the product standard and also in his particular design he should take into account the following other conditions:

- fault conditions specified in the standard for the types of protection concerned;
- all operating conditions specified in any other standard specified by him including recognized overloads;
- any other operating condition specified by him.

NOTE 2 The relevant surface temperature may be internal or external depending upon the type of protection concerned.

3.9 enclosure

all the walls, doors, covers, cable entries, rods, spindles, shafts, etc., which contribute to the type of protection of and/or the degree of protection (IP) of the electrical apparatus

3.10 type of protection

the specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere

3.11 degree of protection of enclosure (IP)

a numerical classification preceded by the symbol “IP” applied to the enclosure of electrical apparatus to provide for:

- protection of persons against contact with or approach to live parts and against contact with moving parts (other than smooth rotating shafts and the like) inside the enclosure, and
- protection of the electrical apparatus against ingress of solid foreign bodies and, where indicated by the classification,
- protection of the electrical apparatus against harmful ingress of water or liquids.

NOTE The enclosure which provides the “degree of protection IP” is not necessarily identical to the apparatus enclosure for the types of protection listed in 1.2.

3.12 rated value

a quantity value assigned, generally by the manufacturer, for a specified operating condition of a component, device or apparatus

3.13 rating

the set of rated values and operating conditions

3.14 cable entry

a device permitting the introduction of one or more electric and/or fibre optics cables into an electrical apparatus so as to maintain the relevant type of protection

3.15 Ex cable entry

a cable entry tested separately from the apparatus enclosure but certified as an apparatus and which can be fitted to the apparatus enclosure during installation without further certification

3.16 conduit entry

a means of introducing a conduit into an electrical apparatus so as to maintain the relevant type of protection

3.17 compression element

an element of a cable entry acting on the sealing ring to enable the latter to fulfil its function

3.18 clamping device

an element of a cable entry for preventing tension or torsion in the cable from being transmitted to the connections

3.19 sealing ring

a ring used in a cable or conduit entry to ensure the sealing between the entry and the cable or conduit

3.20 terminal compartment

a separate compartment or part of a main enclosure, communicating or not with the main enclosure, and containing connection facilities

3.21 connection facilities

terminals, screws and other parts, used for the electrical connection of conductors of external circuits

3.22 bushing

an insulating device carrying one or more conductors through an internal or external wall of an enclosure

3.23 Ex component

a part of electrical apparatus for potentially explosive atmospheres or a module (other than an Ex cable entry), marked with the symbol “U”, which is not intended to be used alone in such atmospheres and requires additional certification when incorporated into electrical apparatus or systems for use in potentially explosive atmospheres

3.24
“X” symbol

“X” is the symbol used as a suffix to a certificate reference to denote special conditions for safe use

3.25 “U” symbol

“U” is the symbol used as a suffix to a certificate reference to denote an Ex component

NOTE The symbols “X” and “U” should not be used together.

4 Apparatus grouping and temperature classification

4.1 Electrical apparatus for potentially explosive atmospheres is divided into:

- Group I, electrical apparatus for mines susceptible to firedamp;
- Group II, electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to firedamp.

Electrical apparatus intended for mines where the atmosphere, in addition to firedamp, may contain significant proportions of other flammable gases (i.e other than methane), shall be constructed and tested in accordance with the requirements relating to Group I and also to the subdivision of Group II corresponding to the other significant flammable gases. This electrical apparatus shall then be marked appropriately (for example “EEx d I/IIB T3” or “EEx d I/II (NH₃)”).

4.2 Electrical apparatus of Group II may be subdivided according to the nature of the potentially explosive atmosphere for which it is intended.

4.2.1 For the types of protection flameproof enclosure “d”, and intrinsic safety “i”, electrical apparatus of Group II is subdivided into IIA, IIB and IIC as required in the specific European Standards concerning these types of protection.

NOTE 1 This subdivision is based on the maximum experimental safe gap (MESG) for flameproof enclosures or the minimum ignition current (MIC) for intrinsically safe electrical apparatus (see Annex A)

NOTE 2 Apparatus marked IIB is suitable for applications requiring Group IIA apparatus. Similarly, apparatus marked IIC is suitable for applications requiring Group IIA or Group IIB apparatus.

4.2.2 For all types of protection, apparatus of Group II shall be marked as a function of its maximum surface temperature according to 5.1.2.

4.3 The electrical apparatus may be tested for a particular explosive atmosphere. In this case it shall be certified and marked accordingly.

5 Temperatures

5.1 Maximum surface temperature

5.1.1 For electrical apparatus in Group I the maximum surface temperature shall be specified in relevant documentation according to 23.2.

This maximum surface temperature shall not exceed:

- 150 °C on any surface where coal dust can form a layer;
- 450 °C where coal dust is not expected to form a layer (for example due to sealing or ventilation), provided that:

- a) the actual maximum surface temperature is marked on the apparatus, or
- b) the symbol “X” is placed after the certificate reference to indicate the conditions for safe use.

NOTE When choosing electrical apparatus of Group I, the user should take into account the influence and the smouldering temperature of coal dusts if they are likely to be deposited in a layer on surfaces with temperatures above 150 °C.

5.1.2 Group II electrical apparatus shall be arranged and marked according to 27.2 6) and shall be either:

- preferably classified in a temperature class given in Table 1;
- or, defined by the actual maximum surface temperature;
- or, if appropriate, restricted to the specific gas for which it is intended.

Table 1 — Classification of maximum surface temperatures for Group II electrical apparatus

Temperature class	Maximum surface temperature(°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

5.2 Ambient temperatures

Electrical apparatus shall normally be designed for use in the ambient temperature range between – 20 °C and + 40 °C; in this case, no additional marking is necessary.

When the electrical apparatus is designed for use in a different range of ambient temperatures, it is considered to be special; the ambient temperature range shall then be stated by the manufacturer and specified in the certificate; the marking shall then include either the symbol " T_a " or " T_{amb} " together with the special range of ambient temperatures or, if this is impracticable, the symbol "X" shall be placed after the certificate reference, according to 27.2 9) of this European Standard (see Table 2).

Table 2 — Ambient temperatures in service and additional marking

Electrical apparatus	Ambient temperature in service	Additional marking
Normal	Maximum: + 40 °C Minimum: – 20 °C	none
Special	Stated by the manufacturer and specified in the certificate	T_a or T_{amb} with the special range, for example "– 30 °C T_a + 40 °C" or the symbol "X"

5.3 Surface temperature and ignition temperature

The lowest ignition temperature of the explosive atmospheres concerned shall be above the maximum surface temperature. However, for components having a total surface area of not more than 10 cm², their surface temperature may exceed that for the temperature class marked on the electrical apparatus for Group II or the corresponding maximum surface temperature for Group I, if there is no risk of ignition from these components, with a safety margin of:

50 K for T1, T2 and T3

25 K for T4, T5 and T6 and Group I

This safety margin shall be ensured by experience of similar components or by tests of the electrical apparatus itself in representative explosive mixtures.

NOTE During the tests, the safety margin may be provided by increasing the ambient temperature.

More specific relaxations for the surface temperature of small components such as are used in "i" circuits are given in 2nd edition EN 50020.

Requirements for all electrical apparatus

6 General

6.1 Electrical apparatus for use in potentially explosive atmospheres shall:

- a) comply with the requirements of this European Standard as modified by the specific European Standards for the type(s) of protection as listed in **1.2**;

NOTE If the electrical apparatus has to withstand particularly adverse service conditions (e.g. rough handling, humidity effects, ambient temperature variations, effects of chemical agents, corrosion) these have to be specified to the manufacturer by the user and are not the responsibility of the testing station.

- b) be constructed in accordance with the principles of good engineering practice in safety matters. The manufacturer shall under his own responsibility indicate compliance by marking the electrical apparatus (in accordance with clause **25**) and the testing station is not required to verify compliance.

6.2 Enclosures which can be opened more quickly than the time necessary:

- to allow incorporated capacitors, charged by a voltage of 200 V or more, to discharge to a value of residual energy of:

0,2 mJ for electrical apparatus of Group I and Group IIA, or

0,06 mJ for electrical apparatus of Group IIB; or

0,02 mJ for electrical apparatus of Group IIC; or

double the above energy levels if the charging voltage is less than 200 V; or

- to allow the cooling of enclosed hot components to a surface temperature below the temperature class of the electrical apparatus;

shall be marked with the warning:

“AFTER DE-ENERGIZING, DELAY X MINUTES BEFORE OPENING”

“X” being the value in minutes of the delay required.

Alternatively the apparatus may be marked with the warning:

“DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT”

7 Non-metallic enclosures and non-metallic parts of enclosures

The following requirements, also those of **23.4.7**, apply to:

- non-metallic enclosures,
- non-metallic parts of enclosures, on which the type of protection depends.

However for sealing rings (see **3.19**) on which the type of protection depends the proof furnished according to **B.3.3** is sufficient.

7.1 Definition of the material

7.1.1 The documents according to **23.2** shall define both the material and the manufacturing process of the enclosure or part of the enclosure.

7.1.2 For plastics materials, the definition shall include:

- the name of the manufacturer of the material;
- the exact and complete reference of the material, its colour, as well as the kind and percentage of fillers and other additives when they are included;

NOTE A standard ISO number should be used where possible.

- the possible surface treatments, such as varnishes, etc.

- the temperature index “TI” corresponding to the 20 000 h point on the thermal endurance graph without loss of flexing strength exceeding 50 % determined in accordance with IEC 216-1 and IEC 216-2 and based on the flexing property in accordance with ISO 178. If the material does not break in this test before exposure to the heat, the index shall be based on the tensile strength in accordance with ISO R527 with test bars of type 1.

The data by which these characteristics are defined shall be supplied by the manufacturer.

7.1.3 The testing station is not required to verify compliance of the material with its definition.

7.2 Thermal endurance

The plastics materials shall have a temperature index “TI” corresponding to the 20 000 h point (see **7.1.2**) of at least 20 K greater than the temperature of the hottest point of the enclosure or the part of the enclosure (see **23.4.6.1**), having regard to the maximum ambient temperature in service (see **5.2**).

The endurance to heat and to cold of the enclosures, or parts of enclosures, of plastics materials shall be satisfactory (see **23.4.7.3** and **23.4.7.4**).

7.3 Electrostatic charges of enclosures or parts of enclosures of plastics material

The following requirements apply only to plastics enclosures, to plastics parts of enclosures and to other exposed plastics parts of electrical apparatus for:

- non-fixed electrical apparatus,
- fixed apparatus with plastics parts that are likely to be rubbed or cleaned on site.