

Electrical apparatus for use in the presence of combustible dust —

Part 1-1: Electrical apparatus protected by enclosures — Construction and testing

The European Standard EN 50281-1-1:1998, with the incorporation of amendment A1:2002, has the status of a British Standard

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National foreword

This British Standard is the English language version of EN 50281-1-1:1998, including Corrigendum August 1999 and amendment A1:2002.
BS EN 50281-1-1 and BS EN 50281-1-2 supersede BS 6467-1:1985 and BS 6467-2:1988 which will be withdrawn on 2003-06-30.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Electrical apparatus for use in explosive atmospheres, to Subcommittee GEL/31/20, Apparatus for use in the presence of ignitable dust, which has the responsibility to:

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

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Electrical apparatus for use in the presence of combustible dust —

Part 1-1: Electrical apparatus protected by enclosures — Construction and testing

(includes amendment A1:2002)

Matériels électriques destinés à être utilisés en
présence du poussières combustible —

Partie 1-1: Matériels électrique protégés par
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Elektrische betriebsmittel zur Verwendung in
bereichen mit brennbarem Staub —

Teil 1-1: Elektrische Betriebsmittel mit Schutz
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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 Technical Committee CENELEC TC 31, Electrical apparatus for explosive atmospheres. The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50281-1-1 on 1 September 1998.

This European Standard was prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and supports the essential safety requirements of the EC Directive 94/9/EC.

This European Standard is to be read in conjunction with EN 50014:1997.

The following dates have been 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) 1999-09-01
- latest date by which national standards conflicting with the EN have to be withdrawn (dow) 2003-06-30

Foreword to amendment A1

This amendment to the European Standard EN 50281-1-1:1998 was prepared by the Technical Committee CENELEC TC 31, Electrical apparatus for explosive atmospheres — General requirements.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A1 to EN 50281-1-1:1998 on 2001-12-01.

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) 2002-12-01
- latest date by which national standards conflicting with the amendment have to be withdrawn (dow) 2004-12-01

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Introduction

Combustible dust can be ignited by electrical apparatus in several main ways:

- by surfaces of the apparatus that are above the ignition temperature of the dust concerned; the temperature at which a dust ignites is a function of the properties of the dust, whether the dust is in a cloud or layer, the thickness of the layer and the geometry of the heat source;
- by arcing or sparking of electrical parts such as switches, contacts, commutators, brushes, or the like;
- by discharge of an accumulated electrostatic charge;
- by radiated energy (e.g. electromagnetic radiation);
- by mechanical sparking or frictional sparking or heating associated with the apparatus.

In order to avoid ignition hazards it is necessary that:

- the temperature of surfaces, on which dust can be deposited, or which would be in contact with a dust cloud, is kept below the temperature limitation specified in EN 50281-1-2;
- any electrical sparking parts, or parts having a temperature above the ignition temperature of the dust:
 - are contained in an enclosure which adequately prevents the ingress of dust; or
 - the energy of electrical circuits is limited as to avoid arcs, sparks or temperatures capable of igniting combustible dust;
 - any other ignition sources are avoided.

Where the apparatus has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, the method of protection used shall not adversely affect the integrity of the enclosure.

The protection specified in this standard will not provide the required level of safety unless the electrical apparatus is operated within its rating and is installed and maintained according to the relevant codes of practice or requirements, for example in respect of protection against over-currents, internal short circuits, and other electrical faults. In particular, it is essential that the severity and duration of an internal or external fault be limited to values that can be sustained by the electrical apparatus without damage.

1 Scope

This European Standard is applicable to electrical apparatus protected by enclosure and temperature limitation for use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard.

This standard specifies requirements for design, construction, and testing of electrical apparatus.

NOTE EN 50281-1-2 gives guidance on the selection, installation and maintenance of the apparatus.

The ignition protection is based on the limitation of the maximum surface temperature of the enclosure and on the restriction of dust ingress into the enclosure by the use of “dust-tight” or “dust-protected” enclosures.

Apparatus within the scope of this standard may also be subjected to additional requirements in other publications – for example, EN 50014, Electrical apparatus for potentially explosive atmospheres.

The application of electrical apparatus in atmospheres which may contain explosive gas as well as combustible dust, whether simultaneously or separately, requires additional protective measures.

The principles of this standard may also be followed when combustible fibres or flyings cause a hazard.

This standard does not apply to dusts of explosives which do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard is not applicable to electrical apparatus for use in mines susceptible to firedamp; nor does it take account of any risk caused by an emission of flammable or toxic gas from the dust.

This standard does not include other types of protection and is only applicable to protection by enclosure and temperature limitation.

2 Normative references

- EN 50014:1997, *Electrical apparatus for potentially explosive atmospheres — General requirements*.
- EN 50019, *Electrical apparatus for potentially explosive atmospheres — Increased safety “e”*.
- EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety “i”*.
- EN 50281-1-2, *Electrical apparatus for use in the presence of combustible dust — Part 1-2: Electrical apparatus protected by enclosures — Selection, installation and maintenance*.
- EN 50281-2-1, *Electrical apparatus for use in the presence of combustible dust — Part 2-1: Test methods — Methods for determining the minimum ignition temperatures of dust*.
- EN 60034-1, *Rotating electrical machines — Part 1: Rating and performance*.
(IEC 60034-1:1996, modified)
- EN 60034-5, *Rotating electrical machines — Part 5: Classification of degrees of protection provided by enclosures for rotating machinery*.
(IEC 60034-5:1981, modified)
- EN 60192, *Low pressure sodium vapour lamps*.
(IEC 60192:1973 + A1:1979 + A2:1988 + A3:1992)
- EN 60243-1, *Electrical strength of insulating materials — Test methods — Part 1: Tests at power frequencies*.
(IEC 60243-1:1998)
- EN 60529, *Degrees of protection provided by enclosures*.
(IP Code) (IEC 60529:1989)
- EN 60662, *High pressure sodium vapour lamps*.
(IEC 60662:1980 and amendments)
- HD 429, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*.
(IEC 60093:1980)
- HD 611.1 S1, *Guide for the determination of thermal endurance properties of electrical insulating materials — Part 1: General guidelines for ageing procedures and evaluation of test results*.
(IEC 60216-1:1990)
- HD 611.2 S1, *Guide for the determination of thermal endurance properties of electrical insulating materials — Part 2: Choice of test criteria*.
(IEC 60216-2:1990)
- ISO 178, *Plastics — Determination of flexural properties*.
- ISO 4225, *Air Quality — General aspects — Vocabulary*.
- ISO 527 (series), *Plastics — Determination of tensile properties*.

3 Definitions

For the purpose of this European Standard the following definitions apply.

3.1

dust

small solid particles in the atmosphere which settle out under their own weight, but which may remain suspended in air for some time (includes dust and grit as defined in ISO 4225)

3.2

combustible dust

dust that can burn or glow in air and form explosive mixtures with air at atmospheric pressure and normal temperature

3.3

conductive dust

dust with electrical resistivity equal to or less than $10^3 \Omega \cdot m$

3.4

explosive dust atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of dust or fibres in which, after ignition, combustion spreads throughout the unconsumed mixture (see IEV 426-02-4)

3.5

ignition temperature of a dust layer

lowest temperature of a hot surface at which ignition occurs in a dust layer of specified thickness on this hot surface (see EN 50281-2-1)

3.6

ignition temperature of a dust cloud

lowest temperature of the hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein (see EN 50281-2-1)

3.7

dust ignition protection

all relevant measures specified in this standard (e.g. dust ingress protection and surface temperature limitation) applied to electrical apparatus to avoid ignition of a dust layer or cloud

3.8

dust-tight enclosure

enclosure capable of preventing the ingress of all observable dust particles

3.9

dust-protected enclosure

enclosure in which the ingress of dust is not totally prevented but dust does not enter in sufficient quantity to interfere with the safe operation of the equipment; dust shall not accumulate in a position within the enclosure where it is liable to cause an ignition hazard

3.10

maximum surface temperature

highest temperature which is attained by any part of the surface of electrical apparatus when tested under the defined dust free conditions

NOTE This temperature is attained under the test condition. Increasing the layer thickness can increase this temperature due to the thermal insulation properties of dust.

3.11

maximum permissible surface temperature

highest temperature a surface of electrical apparatus is allowed to reach in practical service to avoid ignition; the maximum permissible surface temperature will depend upon the type of dust; its layer thickness, and the application of a safety factor

NOTE For details see EN 50281-1-2, clause 6.

3.12

equipment group II category 1

equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection

Equipment in this category is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are present continuously, for long periods or frequently.

Equipment in this category must ensure the requisite level of protection, even in the event of rare incidents relating to equipment, and is characterized by means of protection such that:

- in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection; or
- the requisite level of protection is assured in the event of two faults occurring independently of each other.

3.13

equipment group II category 2

equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and of ensuring a high level of protection

Equipment in this category is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are likely to occur.

The means of protection relating to equipment in this category ensure the requisite level of protection, even in the event of frequently occurring disturbances or equipment faults which normally have to be taken into account.

3.14

equipment group II category 3

equipment designed to be capable of functioning in conformity with the operating parameters established by the manufacturer and ensuring a normal level of protection

Equipment in this category is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for short periods only.

Equipment in this category ensures the requisite level of protection during normal operation.

4 Requirements for all category 1 and 2 electrical apparatus

4.1 General

4.1.1 Electrical apparatus for use in potentially explosive atmospheres shall:

- a) comply with the requirements of this European Standard;

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) comply with the requirements for dust ingress protection, see **9.1**;
- c) 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 and the testing station is not required to verify compliance.