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ICS 13.230

English version

Non-electrical equipment for potentially explosive atmospheres - Part 1: Basic method and requirements

Matériels non électriques pour utilisation en atmosphères
explosibles - Partie 1: Prescriptions et méthode de base

Nicht-elektrische Geräte für den Einsatz in
explosionsgefährdeten Bereichen - Teil 1: Grundlagen und
Anforderungen

This European Standard was approved by CEN on 14 October 2001.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 305 "Potentially explosive atmospheres - Explosion prevention and protection", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2002, and conflicting national standards shall be withdrawn at the latest by May 2002.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

Annexes A and C are normative.

Annexes B and D are informative.

This standard includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European Standard specifies the basic method and requirements for design, construction, testing and marking of non-electrical equipment intended for use in potentially explosive atmospheres in air of gas, vapour, mist and dusts. This standard is valid for atmospheres having pressures ranging from 0,8 bar to 1,1 bar and temperatures ranging from –20 °C to + 60 °C. Such atmospheres can also exist inside the equipment. The external atmosphere can be drawn inside the equipment by natural breathing produced as a result of fluctuations in the equipment's internal operating pressure, and/or temperature.

This standard can also be helpful for the design, construction, testing and marking of equipment intended for use in atmospheres outside the validity range stated above, but in this case, the ignition risk assessment, ignition protection provided, additional testing (if necessary), manufacturer's technical documentation and instructions to the user, should clearly demonstrate and indicate the equipment's suitability for the conditions it may encounter.

NOTE 1 This standard does not cover additional marking for equipment intended for use outside the scope of its validity such as an oxygen enriched atmosphere.

It specifies the requirements for the design and construction of equipment, intended for use in potentially explosive atmospheres in conformity with all categories of Group I and II. This European Standard can be supplemented by European Standards concerning the specific types of ignition protection currently in preparation:

NOTE 2 These standards are given below:

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- prEN 13463-2: Non-electrical equipment for use in potentially explosive atmospheres
– Protection by flow restricting enclosure (fr)
- prEN 13463- 3: *Non-electrical equipment for use in potentially explosive atmospheres*
– Protection by flameproof enclosure (d)
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- prEN 13463- 4: *Non-electrical equipment for use in potentially explosive atmospheres*
– Protection by inherent safety (g)
- prEN 13463- 5: *Non-electrical equipment for use in potentially explosive atmospheres*
– Protection by constructional safety (c)
- prEN 13463- 6: *Non-electrical equipment for use in potentially explosive atmospheres*
– Protection by control of ignition sources (b)
- prEN 13463- 7: *Non-electrical equipment for use in potentially explosive atmospheres*
– Protection by pressurisation (p)
- prEN 13463- 8: *Non-electrical equipment for use in potentially explosive atmospheres*
– Protection by liquid immersion (k)

EN 50303 Group I, category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust.

NOTE 3 Where it is impracticable to avoid all effective sources of ignition, explosion protection can also be achieved by e.g. inerting, suppression, venting or containment as described in EN 1127-1, for Group II equipment or for example by dilution, drainage, monitoring and shut-down as described in prEN 1127-2 for Group I equipment. Such explosion protection methods are outside the scope of this standard.

NOTE 4 This European Standard specifies methods of controlling the risk of ignition of explosive atmospheres by equipment. These can not be sufficient for some types of powder handling equipment that create a dust cloud inside an enclosure during normal operation. In such cases one or more of the protective systems described in 6.5 of EN 1127-1:1997 should be adopted. The means adopted for limiting the effects of ignitions in mining systems are described in 6.5 of prEN 1127-2:2001. Equipment protected in this way is outside the scope of this standard.

NOTE 5 Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres can be applicable to the type of machine or equipment covered by this European Standard. The present standard is not intended to provide means of complying with the essential health and safety requirements of Directive 94/9/EC.

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 (including amendments).

EN 292-1:1991, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

EN 1127-1:1997, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology.*

prEN 1127-2:2001, *Explosive atmospheres — Explosion prevention and protection — Part 2: Basic concepts and methodology in mining.*

EN 50014:1997, *Electrical apparatus for potentially explosive atmospheres — General requirements.*

EN 50102, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code).*

EN 50303, *Group I, category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust.*

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3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

NOTE Some definitions given in prEN 13237-1 are repeated for clarity.

3.1 equipment

machines, apparatus, fixed or mobile devices, control components and instrumentation thereof and detection or prevention systems which, separately or jointly are intended for the generation, transfer, storage, measurement, control and conversion of energy and/or the processing of material and which are capable of causing an explosion through their own potential sources of ignition [prEN 13237-1]

NOTE If equipment supplied to the user as a complete entity contains any interconnecting parts e.g. fastenings, pipes, etc. these form part of the equipment.

3.2 equipment category

3.2.1 equipment Group I category M 1

equipment designed and, where necessary, equipped with additional special means of protection to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection

Equipment of this category is intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

Equipment of this category is required to remain functional even in the event of rare incidents relating to equipment, with an explosive atmosphere present, and is characterised by means of protection such that:

- either, 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 [prEN 13237-1].

3.2.2

equipment Group I category M 2

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

Equipment of this category is intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust.

This equipment is intended to be de-energised in the presence of an explosive atmosphere.

The means of protection relating to equipment in this category assure the requisite level of protection during normal operation and also in the case of more severe operating conditions, in particular, those arising from rough handling and changing environmental conditions [prEN 13237-1].

3.2.3

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 mixtures of air and gases, vapours or mists or by air/dusts mixtures are present continuously, for long periods or frequently.

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

- either, 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. [prEN 13237-1].

3.2.4

equipment Group II category 2

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

Equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dusts mixtures are likely to occur.

The means of protection relating to equipment in this category shall 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. [prEN 13237-1].

3.2.5

equipment Group II category 3

equipment designed to be capable of functioning in conformity with the operational 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 mixtures of air and gases, vapours or mists or by air/dusts mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.

EN 13463-1:2001 (E)

Equipment of this category ensures the requisite level of protection during normal operation. [prEN 13237-1].

3.3

normal operation

situation when the equipment, protective systems, and components perform their intended use within their design parameters (see also 5.2.2 of EN 292:1991)

Minor release of flammable material may be part of normal operation. For example, releases of substances from seals which rely on wetting by the fluid which is being pumped are considered to be minor releases.

Failures (such as a breakdown of pump seals, flange gaskets or releases of substances caused by accidents) which involve repair or shut-down are not considered to be part of normal operation [prEN 13237-1].

3.4

malfunction

equipment, protective systems and components do not perform the intended function

(see also 5.2.2.b of EN 292-1:1991).

NOTE For the purposes of this standard this can happen due to a variety of reasons, including

- variation of a property or of a dimension of the processed material or of the workpiece;
- failure of one (or more) of the component parts of the equipment, protective systems and components;
- external disturbances (e.g. shocks, vibration, electromagnetic fields);
- design error or deficiency (e.g. software errors);
- disturbance of the power supply or other services;
- loss of control by the operator (especially for hand-held machines) [3.25 of EN 1127-1:1997].

3.4.1

expected malfunction

disturbances or equipment faults which normally occur in practice

3.4.2

rare malfunction

type of malfunction which is known to happen but only in rare instances. Two independent foreseeable malfunctions which, separately, would not create an ignition hazard but which, in combination, do create an ignition hazard, are regarded as a single rare malfunction

3.5

maximum surface temperature

highest temperature attained in service as determined in 13.3.3 under the most adverse operating conditions (but within the recognised tolerance) by any part or surface of equipment, protective system or component which can produce an ignition of the surrounding explosive atmosphere

NOTE 1 The relevant surface temperature can be internal or external depending upon the type of ignition protection concerned.

NOTE 2 In order to avoid ignition it follows that the maximum surface temperature should be lower than the ignition temperature of the explosive atmosphere (see EN 1127-1).

NOTE 3 On the aspects of dust layers and their ignition see EN 50281-1-2 [prEN 13237-1].

3.6

type of ignition protection

types of protection listed in the scope

3.7**non-electrical equipment**

equipment which can achieve its intended function without the use of electrical energy

3.8**potential ignition source**

any ignition source which may occur in the equipment

3.9**effective ignition source**

ignition source which is capable of igniting the explosive atmosphere

4 Equipment categories and explosion groups**4.1 Equipment category**

Equipment for potentially explosive atmospheres is divided into:

- Group I equipment for mines susceptible to firedamp; this group comprises two categories according to the level of safety provided

Category M1

Category M2

- Group II Equipment for places with a potentially explosive atmosphere, other than mines susceptible to firedamp; this group comprises three categories according to the level of safety provided

Category 1

Category 2

Category 3

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Equipment intended for mines where the atmosphere, in addition to firedamp, may contain significant proportions of other flammable gases and/or combustible dusts (i.e. other than methane or coal dust), 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 equipment shall then be marked appropriately.

NOTE Group I equipment tested in a firedamp air mixture does not need any additional testing to demonstrate its suitability for use in an explosive coal dust atmosphere.

This European Standard may be used in conjunction with one or more types of protection described in the standards listed in clause 1, depending on the ignition hazard assessment in 5.2, to provide the protection required.

4.2 Explosion groups (subdivisions)

For some specific types of protection, equipment of Group II intended for use in explosive gas atmospheres are classified according to the nature of the potentially explosive atmosphere for which it is intended. This equipment is classified according to the explosion groups (subdivisions) IIA, IIB and IIC.

NOTE 1 This classification is based on the maximum experimental safe gap for flameproof enclosures or the minimum ignition current for intrinsically safe electrical equipment. See annex A of EN 50 014.

NOTE 2 Equipment marked IIB is suitable for applications requiring IIA equipment. Similarly, equipment marked IIC is suitable for applications requiring IIA or IIB equipment.

4.3 Specific explosive atmospheres

The equipment may be tested for a specific explosive atmosphere. In this case it shall be marked accordingly.

5 General

5.1 General requirements

Equipment for use in potentially explosive atmospheres shall comply with the requirements of this European Standard and if relevant modified by the specific European Standards for the type(s) of ignition protection

All intended service conditions for the equipment (e.g. rough handling, humidity effects, ambient temperature and pressure variations, effects of chemical agents, corrosion, vibration) shall be specified by the manufacturer and included in the required instructions for use (see clause 15).

If equipment is designed and constructed according to good engineering practice and the ignition hazard assessment ensures that the equipment does not contain any effective ignition sources in normal operation, the equipment can be classified as category 3 equipment.

Similarly where the ignition hazard assessment ensures that the equipment does not contain any effective ignition sources during expected malfunctions or rare malfunctions, the equipment may be classified as category 2 or category 1 equipment respectively.

5.2 Ignition hazard assessment

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5.2.1 Formal analysis

All equipment and all parts of it shall be subjected to a formal documented hazard analysis that identifies and lists all of the potential sources of ignition by the equipment and the measures to be applied to prevent them becoming effective. Examples of such sources include hot surfaces, naked flames, hot gases/liquids, mechanically generated sparks, adiabatic compression, shock waves, exothermic chemical reaction, thermite reactions, self ignition of dust, electrical arcing and static electricity discharge.

Protective measures/types of protection shall be considered and/or applied in the following order:

- ensure that ignition sources cannot arise;
- ensure that ignition sources cannot become effective;
- prevent explosive atmosphere reaching the ignition source;
- contain the explosion and prevent flame propagation.

5.2.2 Assessment for equipment-group I

5.2.2.1

In the case of Group I, category M1 equipment the assessment shall list all of the potential ignition sources that are either effective or likely to become effective, taking account of the need to have a very high level of protection and the fact that category M1 equipment is required to be either safe with two faults applied, or protected by two independent means of protection. The assessment shall indicate this by showing either a type of ignition protection that prevents ignition under two fault conditions, or identifying the two independent measures to prevent the ignition used according to this standard and to the ignition protection standards listed in the scope of this standard which have been applied.

5.2.2.2

In the case of Group I, category M2 equipment, the assessment shall list all of the potential ignition sources that are either effective or likely to become effective, in normal operation. It shall also list those sources where the risk of them becoming effective cannot be disregarded by virtue of the equipment being designed to be de-energised in the event of an explosive atmosphere occurring. The assessment shall indicate the measures to prevent the ignition used according to this standard and to the ignition protection standards listed in the scope of this standard which have been applied to render such ignition sources ineffective during the period from the occurrence of the explosive atmosphere, its detection and the de-energisation of the equipment.

5.2.3 Assessment for equipment-group II

5.2.3.1

In the case of category 1 equipment, the list shall include all potential ignition sources that are effective or may become effective during expected malfunction and rare malfunction. It shall also indicate the measures to prevent the ignition used according to this standard and to the ignition protection standards listed in the scope of this standard which have been applied. Category 1 equipment shall not have an ignition source that is effective or may become effective in normal operation.

5.2.3.2

In the case of category 2 equipment, the list shall include all potential ignition sources that are effective or may become effective during normal operation and expected malfunction. It shall also indicate the measures to prevent the ignition used according to this standard and to the ignition protection standards listed in the scope of this standard which have been applied.

5.2.3.3

In the case of category 3 equipment, the list shall include all potential ignition sources that are effective or may become effective during normal operation. It shall also indicate the measures to prevent the ignition used according to this standard and to the ignition protection standards listed in the scope of this standard which have been applied.

5.2.4 Assessment with faults

Where the category requires the assessment to include malfunction, it shall include those components which, if they failed, could ignite any flammable substance (e.g. lubricating oil) contained within the equipment and which could consequently become or create an ignition source.

5.2.5 Establishing the maximum surface temperature

As part of the assessment, the maximum surface temperature of the equipment has to be established. This is the highest surface temperature of any part of the equipment that could be exposed to the potentially explosive atmosphere, or where a dust layer could form, taking account of its size and ability to become an ignition source. The assessment shall also take account of any integral device(s) fitted to limit the maximum surface temperature (e.g. the use of a low melting point fusible drain plug in a fluid coupling).

The measurement, or determination by calculation, of the maximum surface temperature shall be made with the equipment at full load, but with those failures tolerated by the applied type of ignition protection. In the case of Group II equipment the measurement, or determination by calculation of the maximum surface temperature shall include the conditions of operation of expected malfunction for category 2 equipment and of rare malfunction for category 1 equipment.

5.2.6 Dust deposits and other material in the gap of moving parts

The ignition hazard assessment shall consider the ignition risk that arises from dust or other material trapped between two moving parts or a moving part and a fixed part. If dust or other material remains in contact with the same moving