BRITISH STANDARD

BS EN
15198:2007

Methodology for the risk assessment of non-electrical equipment and components for intended use in potentially explosive atmospheres

The European Standard EN 15198:2007 has the status of a British Standard

ICS 13.230

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15198:2007.

The UK participation in its preparation was entrusted to Technical Committee FSH/23, Fire precautions in industrial and chemical plant.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Methodology for the risk assessment of non-electrical equipment and components for intended use in potentially explosive atmospheres

Méthodes pour l'évaluation du risque d'inflammation des appareils et des composants non électriques destinés à être utilisés en atmosphères explosibles

Methodik zur Risikobewertung für nicht-elektrische Geräte und Komponenten zur Verwendung in explosionsgefährdeten Bereichen

This European Standard was approved by CEN on 13 July 2007.

CEN 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 CEN Management Centre or to any CEN 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 CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 15198:2007) 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 February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document 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 94/9/EC.

For relationship with EU Directive 94/9/EC, see informative Annex ZA, which is an integral part of this document.

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

Introduction

The function of this type A standard (description of general principles) as defined in CEN Guide 414 is to describe principles for a consistent systematic procedure for ignition risk assessment depending on Group II or Group I equipment.

Annex A is informative and contains examples for ignition risk assessment.

This European Standard does not provide means to prove the conformity of equipment categories. The procedure of ignition risk assessment for the design of equipment and components lead to a defined safety level which allows categorisation according to the appropriate criteria.

It is in both the manufacturer's and user's interest to establish a common methodology for achieving safety, reliability and efficacy in functioning and operating equipment and components with respect to the ignition hazards. Thus, ignition risk assessment is a tool which provides the essential link between manufacturers and users, but only aspects that directly address manufacturers are incorporated.

Integrated explosion safety is conceived to prevent the formation of explosive atmospheres as well as sources of ignition and, should an explosion nevertheless occur, to halt it immediately and / or to limit its effects. In this connection, the manufacturer must take measures with respect to the potential ignition sources. In addition, equipment and component must be designed and constructed after due analysis of possible operating faults in order as far as possible to preclude dangerous situations taking the misuse which can reasonably be anticipated into account. Therefore it is absolutely necessary to conduct an ignition risk assessment process.

For the equipment and components the identification of the potential ignition sources is the most relevant part of the ignition risk assessment.

1 Scope

This European Standard specifies basic methodology used in achieving safety of equipment for intended use in potentially explosive atmospheres.

The provisions specified in this European Standard are intended for the designer. It also specifies a strategy for standard makers.

This European Standard specifies the procedure and information required to allow ignition risk assessment to be carried out for the design of equipment or component.

This European Standard provides advice for a decision to be made for the categorisation of equipment but does not provide means to prove the conformity of equipment categories.

In this procedure the following information is to be taken into account:

a) Possible occurrence of an explosive atmosphere inside the equipment or component or penetrating the equipment or component from the outside (in normal operation or during malfunctions) and the amount of explosive atmosphere involved leading to possible explosion impact inside of the equipment or component;

b) equipment or components surrounded by an explosive atmosphere (in normal operation or during malfunctions);

c) equipment or components wholly or partly surrounded by an explosive atmosphere considering also any explosive atmosphere in connection (in normal operation or during malfunctions);

d) presence and likelihood (effectiveness) of ignition sources.

The final objective is designing and manufacturing equipment or components intended for use in potentially explosive atmospheres. For this purpose equipment or components if necessary should be designed with adequate preventive and/or protective measures.

This European Standard specifies neither specific methods of analysis associated with ignition risk assessment, nor specific requirements for a category of equipment. It describes the methodology of ignition risk assessment.

This European Standard does not apply to equipment with a potentially explosive atmosphere inside under operating conditions, and without interfaces to an external potentially explosive atmospheres.

This European Standard is applicable to all categories of equipment referred to in EN 13463-1.

This ignition risk assessment procedure does not preclude the conditions prevailing in an installation where the equipment or component is put into operation by a user.

NOTE Functional safety assessment of protective systems is covered by EN 15233.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 1127-2, *Explosive atmospheres — Explosion prevention and protection — Part 2: Basic concepts and methodology for mining*

EN 13237:2003, *Potentially explosive atmospheres – Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13237:2003 and the following apply.

3.1
ignition risk
probability of occurrence of an ignition source that is capable of igniting an explosive atmosphere

3.2
ignition hazard
occurrence of a potential ignition source that is capable of igniting an explosive atmosphere

3.3
potential ignition source
equipment related ignition source that has the capability to ignite an explosive atmosphere (i.e. to become an effective ignition source)

3.4
protective measure
means used to reduce the probability of an ignition source to become effective

3.5
ignition risk estimation
determination of the probability of the occurrence of an ignition source

3.6
ignition risk evaluation
procedure to determine whether the intended level of protection (related to the equipment category) has been achieved

4 General requirements

4.1 Basic concept

Ignition risk assessment is a series of logical steps (see Figure 1) that enable designers and safety engineers to examine in a systematic way, the function of an equipment or component arising from its use in a potentially explosive atmosphere and to decide whether protective measures and/or type of protection are needed. The objective shall be to achieve an adequate level of safety.

Ignition risk assessment includes the following four steps:

a) product description: performance, lifetime, configuration (see 5.2),

b) identification of ignition hazards (see 5.3),

c) ignition risk estimation (see 5.4),

d) ignition risk evaluation (see 5.5).

These four steps are the basis for the decision whether the intended safety level is achieved (see 5.6). The result of the assessment shall be detailed in the technical documentation (see Clause 6).

If the intended level of protection is not achieved, it shall be necessary after redesign, to reassess the procedure to obtain the correct category or use of suitable protective measures.

NOTE The determination of correct categories and the selection of the suitable protective measures is not part of this standard.

4.2 Extent of ignition risk assessment

Initially the boundary or limit of the equipment and/or components must be specified under which the ignition risk assessment has to be carried out.

The limit is determined by the extent of explosive atmosphere or the ignition sources which are originated by the considered equipment and/or components.

The ignition risk assessment shall be limited to equipment and/or components and not extended to aspects for which the user is responsible.

The extent of the ignition risk assessment, which includes all operations, shall take into account:

a) intended use; and

b) misuse which can be reasonably anticipated.

An ignition risk assessment shall also include the possibility of an explosion inside the equipment and/or components causing an impact on the outside.

NOTE Misuse that can be reasonably anticipated indicates incorrect use and/or operation of the equipment and/or components by the operator due to carelessness or misunderstanding. Misuse is not part of the normal operation. Intent is not included in misuse that can reasonably be anticipated.

4.3 Information needed for ignition risk assessment

The information needed to perform the ignition risk assessment shall include the following where appropriate:

a) intended use referring to group I or group II and categories 1, 2, 3;

b) initial appraisal of the equipment or component;

c) materials to be processed (or necessary safety data);

d) requirements for maintenance including cleaning;

e) design drawings;

f) results of design calculations made, examinations carried out.

If available:

g) test reports, if they allow the evaluation of the probability of occurrence and/or the efficiency of ignition sources;

h) accident history;

i) information on relevant safety aspects.

If an accident history is not available for the equipment and/or components, available information for similar equipment and/or components shall be used as it is unlikely that equipment and/or components are so unique that similar equipment and/or components cannot be found. The absence of an accident history, a small

number of accidents or low severities of accidents shall not be taken as an automatic presumption of a low ignition risk.

The information shall be updated as the design develops and modifications are required.

For quantitative assessment, data from data bases, handbooks, laboratories and manufacturers specifications shall be used provided that there is confidence in its suitability. Any uncertainty associated with the data shall be recorded in the documentation (see Clause 6).

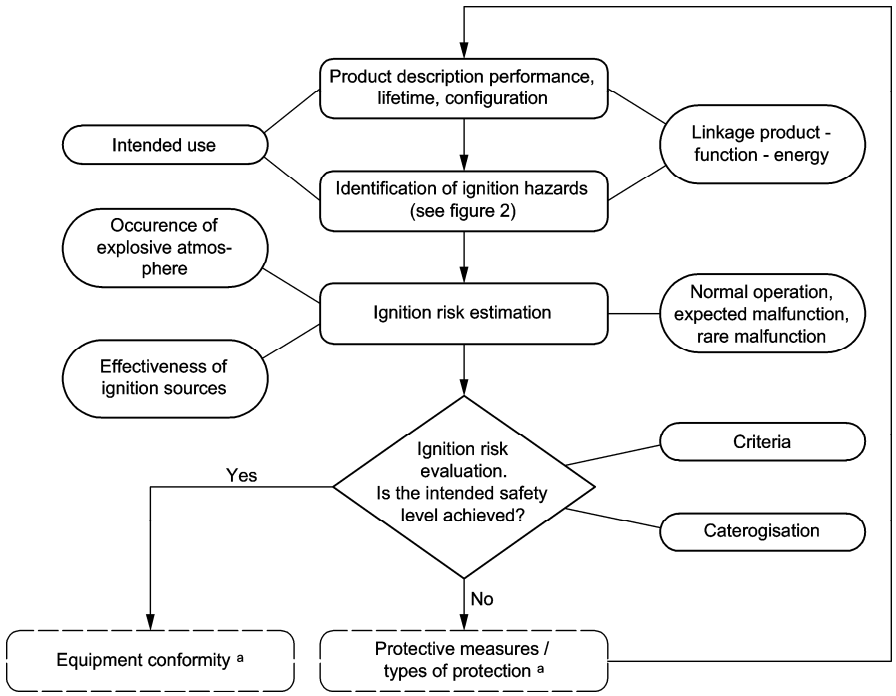
NOTE Data is used to define foreseeable operations requirements related to reliability, serviceability, durability, disposability, benign failure and failsafe characteristics and labelling, warnings, identification, traceability requirements and instructions. Data based on the consensus of expert opinion derived indirectly from experience as opposed to measured data, may be used to supplement qualitative assessment.

5 Ignition risk assessment Procedure

5.1 Principle Procedure

The principal steps for the ignition risk assessment procedure are shown in Figure 1. It is comprised of four steps taking into consideration the assessment criteria in the oval blocks.

To guarantee the intended level of protection maintenance and installation requirements shall also be considered.



Key

a Protective measures / types of protection and equipment conformity are not part of ignition risk assessment

Figure 1 — Ignition risk assessment for design of equipment or component

5.2 Product description: Performance, lifetime, configuration

The step-approach shall be carried out with an understanding of the functioning of the equipment and/or components and of the types of substances processed, used or released. A functional and state analysis for the intended use shall be undertaken for this purpose.

Intended use shall consider, for example, the following items:

a) life cycles of equipment and/or components;

b) limits in terms of use, time and space;

c) accurate definition of the function

d) selection of materials for construction;

e) performance, lifetime and configuration;

f) description of the type of substances that shall be processed and process conditions.

Constructive attributes of the material (e.g. non-conductive or non-sparking) may be presupposed provided that their application shall be implemented. It is not permissible to change the material due to constructional demands. Types of protection (e.g. liquid immersion "k" or control of ignition source "b") shall be regarded as non-existent in this step.

5.3 Identification of ignition hazards

5.3.1 General

Generally, an equipment and/or component shall be assessed by considering the probability and amount of explosive atmosphere.

The block diagram in Figure 2 provides the aspects for determination whether ignition hazards are present.

Block 1: It shall be decided if the intended use is the use in an explosive atmosphere (i.e. surrounding the equipment or component). If equipment or a component containing a potentially explosive atmosphere can, due to its construction, operation etc. create a potentially explosive atmosphere, which wholly or partially surrounds it, then such equipment or a component is in effect in a potentially explosive atmosphere.

Block 2: It shall be analysed, whether an explosive atmosphere will occur inside the equipment or component either from the process itself or from a connection to the surrounding area. This is necessary because an internal explosion, which can ignite the explosive atmosphere in the surrounding of the equipment, shall be considered as an ignition source of its own. Therefore the likelihood and duration of occurrence of an internal explosive atmosphere shall be determined.

Block 3: It shall be decided if the present ignition source is able to ignite the atmosphere, i.e. the ignition source is a potential ignition source. It is to consider if this ignition source becomes effective under normal conditions, foreseeable malfunctions or rare malfunctions.

NOTE The energy required to ignite an explosive atmospheres depends on its nature. Thus, non electrical equipment or a component that moves very slowly or has low power may not ignite the particular explosive atmosphere present during intended use.

Block 4: Ignition hazard of equipment or component shall be determined for each part of the equipment or component that comes into contact with or is connected to an “external” explosive atmosphere.

Regarding the following aspects, reference shall be made to EN 1127-1.

a) Combustion properties (see 5.3.2);

b) determining the amount and likelihood of an occurrence of an explosive atmosphere (see 5.3.3);

c) ignition requirements (see 5.3.4).

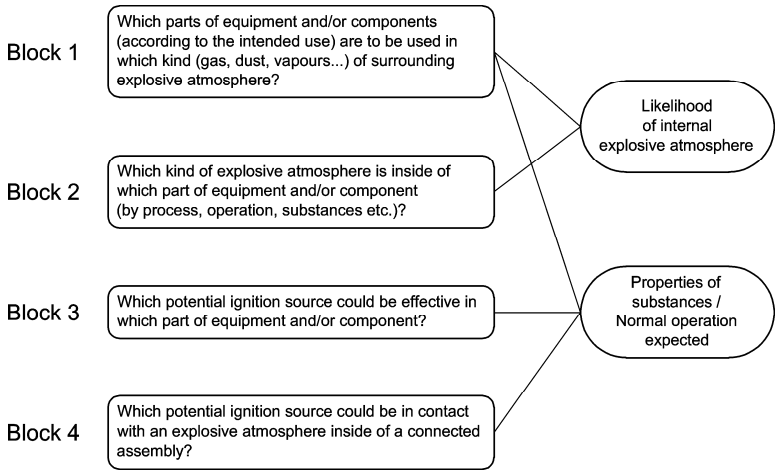


Figure 2 — Identification of ignition hazards

5.3.2 Safety characteristics

Since in this context it is e.g. not the substance itself that represents the potential hazard but its contact or mixing with the air, the properties of the mixture of the flammable substance with air shall be determined. These properties give information about a substance's burning behaviour and whether it could give rise to fire or explosions. Flammable and / or combustible substances can occur as solids, liquids or gases and different safety characteristics shall be taken into account. Also properties of possible dust layers shall be considered.

5.3.3 Likelihood and duration of occurrence of an internal explosive atmosphere

An internal explosive atmosphere will only occur if the concentration of mixtures of air and gases, vapours, mists or dusts mixtures is above the lower explosion limit. Concentration variations by start up and shut down processes shall be taken into consideration. Additional concentration variation due to process conditions shall be considered. If the concentration is above the upper explosion limit, hazards, such as fire, have to be considered.

In assessing the likelihood of the occurrence of a hazardous explosive atmosphere, possible formation of the explosive atmosphere through chemical reactions, pyrolysis and biological processes from the materials present shall be taken into account.

If it is impossible to estimate the likelihood of occurrence of a hazardous explosive atmosphere, the assumption shall be made that such an atmosphere is always present, except when a reliable monitoring device of the concentration of the flammable substance in the atmosphere is present.

The occurrence of a hazardous explosive atmosphere depends on the following:

a) presence of a flammable substance;

b) degree of dispersion of the flammable substance (e.g. gases, vapours, mists, dusts);

c) concentration of the flammable substance in air within the explosion range;

d) amount of explosive atmosphere sufficient to cause injury or damage by ignition.

The influence of the equipment and/or components on the properties of the state of the substances (e.g. dust layers) in its external environment shall be taken into account.

5.3.4 Ignition sources

This step shall result in a complete list of all ignition hazards of the equipment or component type or the equipment or component. Therefore, the known list of ignition sources representing different physical ignition mechanisms given in EN 1127-1 or EN 1127-2 shall be examined.

At first it shall be determined which types of ignition sources are possible. The significance of all ignition sources that could come into contact with the explosive atmosphere has to be considered. Afterwards the chain of cause and effect leading to ignition sources that could become effective shall be analysed. The potential ignition sources shall be examined through functional and state analysis and shall be considered separately with regard to differences in

a) energy levels (temperature, pressure, friction, electromagnetic fields, electrostatic discharge),

b) constructional variants,

c) operating conditions or working cycles including their variations (start, stop, load alternations etc.),

d) influences of the ambience (temperature, pressure, humidity, energy supply etc.),

e) material parameters or their interdependencies (metal, synthetic material, electrostatic chargeable liquids etc.),

f) interdependencies with components or other pieces of equipment,

g) interdependencies with persons (including misuse which can reasonably be anticipated),

h) if necessary, combinations of malfunctions.

The identification of ignition sources shall include the intended use and misuse which can reasonably be anticipated.

NOTE For identification of all possible ignition hazards it is important to proceed systematically and do it without any assessment aspects to avoid restrictions in thinking. For the analysis of the possible ignition hazards, all utilisable information sources should be used (discussions with experts from test houses, universities, users, other manufactures etc.) and all accessible examples should be examined to perceive analogy.

5.4 Ignition risk estimation

In the ignition risk estimation the manufacturer has to decide the probability of the ignition hazard occurring.

The decision shall be based on the following three different types of situations:

a) normal operation and misuse which can reasonably be anticipated,

b) frequently occurring disturbances or equipment faults which normally have to be taken into account (expected malfunctions) and

c) rare incidents (rare malfunctions).

Ignition hazards caused by a combination of

d) more than two independent malfunctions,

e) two independent rare malfunctions, or

f) independent rare and expected malfunctions at the same time, are not to be considered.

To determine the significance of the ignition source the explosion properties caused by mixtures of air and gases, vapours, mists or dusts mixtures shall be taken into account. The restriction of the type of explosive atmosphere shall be included in the instructions for use.

Individual ignition sources shall be considered for each different type of situation exactly in the form that is described in 5.3.

If an ignition hazard is identified inside the equipment or component, the manufacturer shall estimate the probability of an ignition hazard outside.

5.5 Ignition risk evaluation

Ignition risk evaluation is the comparison of the estimated ignition risk against given criteria to determine the intended level of protection.

The level of protection is related to the defined categories and the related requirements. From the ignition risk evaluation emerges whether additional measures shall be required in order to meet the target category.

If the prevention of explosive atmospheres is not possible, preventive and protective measures / types of protection shall be considered in the following order:

a) Ensure that ignition sources cannot arise;

b) Ensure that ignition sources cannot become effective;

c) Prevent explosive atmosphere reaching the ignition source;

d) Either contain the explosion within the equipment and/or component or reduce the effect of the explosion to an acceptable level and prevent flame propagation.

NOTE Preventive measures and protective measures and types of ignition protection according the relevant standards are specified in European standards (see bibliography) for example:

a) Standards to ensure that the ignition source cannot arise:
   — Constructional Safety “c”;
b) Standards to ensure that the ignition source cannot become active:
   — Control of Ignition Sources “b”;
c) Standards to prevent the explosive atmosphere from reaching ignition source:
   Liquid Immersion “k”,
   Pressurisation “p”,
   Flow Restricting Enclosures “fr”;
d) Standards to contain the explosion and prevent flame propagation:
   1) Flameproof Enclosures “d”,
   2) Flame arresters,
   3) Explosion-resistant design;
e) Standards for protective measures are:
   1) Explosion relief,
   2) Explosion suppression,
   3) Explosion Isolation Systems.

5.6 Categorisation

The procedure of ignition risk assessment for the design of equipment and components leads to a defined safety level that allows categorisation according to the appropriate criteria. If the manufacturer has not achieved the intended level of protection with this categorisation, he has to start a new ignition risk assessment taking into account different design and/or taking further measures until he reaches a level of protection as high as necessary to achieve the intended category.

6 Documentation

For the purpose of this standard, documentation of ignition risk assessment shall demonstrate the procedure which has been followed and the results which have been achieved. This documentation includes when relevant for the ignition risk assessment:

a) description of the equipment or component for which the assessment has been made (e.g. specifications, limits, intended use) (see 4.2 and 5.2);

b) any relevant assumptions which have been made (e.g. loads, strengths, safety factors);

c) information on which ignition risk assessment was based (see 4.3);

d) data used and the sources e.g. accident histories, experiences gained from ignition risk reduction applied to similar machinery (the uncertainty associated with the data used and its impact on the ignition risk assessment has to be taken into account);

e) ignition hazards identified (see 5.3):

f) combustion properties;

g) likelihood of explosive atmosphere;

h) ignition sources;

i) residual ignition risks associated with the equipment or component;

j) safety measures implemented to eliminate or reduce identified ignition risks (e.g. from standards or others specifications);

k) result of the final ignition risk evaluation (see 5.5);

l) resulting categorisation (see 5.6).

NOTE This documentation is only a part of the technical documentation required by directive 94/9/EC.

Annex A
(informative)

Example of a reporting scheme for the ignition risk assessment

It is essential to record the ignition risk assessment in a well-structured way to ensure clearness and transparency, but it is not essential to record the assessment in a specific manner. The use of a table representing the structure of the assessment procedure is recommended, thus allowing for easy reassessment and fulfilling the documentation requirements (see Clause 6).

Table A.1 shows an example of an adequate table to record the information collected during an ignition risk assessment. Before using the table, a description of the equipment and/or the component (see 5.2) and the identification of the explosion hazards caused by the equipment and/or the component itself (see 5.3) is required. Unused parts of the table may be left blank or may be deleted.

The reporting scheme (see Table A.1), as well as the assessment procedure itself can be divided into the following steps:

1) Identification of ignition hazards (Column 1; analysis of the ignition hazards and their causes; see 5.3.4),

2) First ignition risk estimation and evaluation (Column 2; estimation of the ignition hazards determined in step 1 regarding the probability of their occurrence and comparison with the category requirements; see 5.4 and 5.5),

3) Determination of measures (Column 3; determination of preventive and/or protective measures, if necessary or desired, to reduce the probability of an ignition hazard according to step 2; not part of this standard),

4) Concluding ignition risk estimation and evaluation (column 4; estimation of the ignition hazards regarding the probability of occurrence and including preventive and/or protective measures determined in step 3 and comparison with the category requirements; see 5.4 and 5.5),

5) Concluding determination of the equipment category (last row of the table; not part of this standard).

Table A.1 — Reporting scheme with cross references to the documentation requirements of Clause 6

Ignition Risk Assessment Report: … ***(name and type of the product)*** **(see 6a))**																	
	1		2					3			4						
	ignition hazard (see 6 e))		risk estimation without application of an additional measure					measures applied to avoid the ignition source becoming effective			risk estimation including the measures applied						
	a	b	a	b	c	d	e	a	b	c	a	b	c	d	e	f	
			see 6 h) and also column 4 f					see 6 g)	see 6 d)		see 6 f) and also column 4 f						
No.	potential ignition source	description / basic cause *(which conditions originate which ignition hazard?)*	during normal operation	during foreseeable malfunction	during rare malfunction	not to be considered	reasons for risk estimation	description of the measure applied	basis *(citation of standards, technical rules, experimental results)*	technical documentation *(evidence including relevant features listed in column 1)*	during normal operation	during foreseeable malfunction	during rare malfunction	not to be considered	resulting equipment category in respect of this ignition hazard	necessary restriction	
1	electrostatic discharge						see 6 b)										
2	hot surface							citation, see 6 c)							see 6 i)		
3	mechanical spark																
4	…																
Resulting equipment category considering all existing ignition hazards and all measures determined:																	

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 94/9/EC of 23 March 1994 concerning equipment and protective systems intended for use in potentially explosive atmospheres.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 94/9/EC

Clauses of this EN	Essential Requirements (ERs) of EU Directive 94/9/EC	Qualifying remarks / Notes
	1 Common requirements for equipment and protective systems	
	1.0 General requirements	
All Clauses	1.0.1 Principles of integrated explosion safety	
Clause 4, 5.3, 5.4	1.0.2 Equipment and protective systems must be designed and manufactured after due analysis of possible operating faults in order as far as possible to preclude dangerous situations	
4.3, 5.2	1.0.3 Special checking and maintenance conditions	
4.3, 5.2	1.0.4 Surrounding area conditions	
4.3, 5.3	1.0.6 Instructions	
	1.2 Design and Construction	
All Clauses	1.2.1 Equipment and protective systems must be designed and constructed with due regard to technological knowledge of explosion protection so that they can be safely operated throughout their foreseeable lifetime.	
5.5	1.2.5 Additional means of protection	
5.4	1.2.8 Overloading of equipment	
5.3	1.3 Potential ignition sources	
5.3.3	1.4 Hazards arising from external effects	
	1.6 Integration of safety requirements relating to the system	
5.3.4, 5.4	1.6.3 Hazards arising from power failure	
5.3.4, 5.4	1.6.4 Hazards arising from connections	

Table ZA.1 *(continued)*

Clauses of this EN	Essential Requirements (ERs) of EU Directive 94/9/EC	Qualifying remarks / Notes
	2 Supplementary requirements in respect of equipment	
	2.0 Requirements applicable to equipment in category M of equipment-group I	
	2.0.1 Requirements applicable to equipment in category M 1 of equipment-group I	
All Clauses	2.0.1.1 Equipment must be so designed and constructed that sources of ignition do not become active, even in the event of rare incidents relating to equipment.	
All Clauses	2.0.2.1 Equipment must be equipped with means of protection ensuring that sources of ignition do not become active during normal operation, even under more severe operating conditions, in particular those arising from rough handling and changing environmental conditions.	
	2.1 Requirements applicable to equipment in category 1 of equipment-group II	
	2.1.1 Explosive atmospheres caused by gases, vapours or hazes	
All Clauses	2.1.1.1 Equipment must be so designed and constructed that sources of ignition do not become active, even in event of rare incidents relating to equipment.	
All Clauses	2.1.2.1 Equipment must be so designed and constructed that ignition of air/dust mixtures does not occur even in the event of rare incidents relating to equipment.	
	2.2 Requirements for category 2 of equipment-group II	
	2.2.1 Explosive atmospheres caused by gases, vapours or mists	
All Clauses	2.2.1.1 Equipment must be so designed and constructed as to prevent ignition sources arising, even in the event of frequently occurring disturbances or equipment operating faults, which normally have to be taken into account.	
All Clauses	2.2.2.1 Equipment must be designed and constructed so that ignition of air/dust mixtures is prevented, even in the event of frequently occurring disturbances or equipment operating faults which normally have to be taken into account.	
	2.3 Requirements applicable to equipment in category 3 of equipment-group II	
	2.3.1 Explosive atmospheres caused by gases, vapours or mists	
All Clauses	2.3.1.1 Equipment must be so designed and constructed as to prevent foreseeable ignition sources which can occur during normal operation	
All Clauses	2.3.2.1 Equipment must be so designed and constructed that air/dust mixtures cannot be ignited by foreseeable ignition sources likely to exist during normal operation.	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 1050, Safety of machinery – Principles for risk assessment.

[2] EN 1710, Equipment and components intended for use in potentially explosive atmospheres in underground mines

[3] EN 13463-1, Non-electrical equipment for potentially explosive atmospheres – Part 1: Basic method and requirements

[4] EN 13463-2, Non-electrical equipment for use in potentially explosive atmospheres – Part 2: Protection by flow restricting enclosure 'fr'.

[5] EN 13463-3, Non-electrical equipment for use in potentially explosive atmospheres – Part 3: Protection by flameproof enclosure 'd'.

[6] EN 13463-5, Non-electrical equipment intended for use in potentially explosive atmospheres – Part 5: Protection by constructional safety 'c'.

[7] EN 13463-6, Non-electrical equipment for use in potentially explosive atmospheres – Part 6: Protection by control of ignition source 'b'.

[8] prEN 13463-7, Non-electrical equipment for potentially explosive atmospheres – Part 7: Protection by pressurisation 'p.'

[9] EN 13463-8, Non-electrical equipment for potentially explosive atmospheres – Part 8: Protection by liquid immersion "k".

[10] EN 15233, Methodology for functional safety assessment of protective systems for potentially explosive atmospheres

[11] EN 45020, Standardization and related activities – General vocabulary (ISO/IEC Guide 2:2004).

[12] EN 50020, Electrical apparatus for potentially explosive atmospheres – Intrinsic safety "i".

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