BRITISH STANDARD

BS EN
13463-6:2005

Non-electrical equipment for use in potentially explosive atmospheres —

Part 6: Protection by control of ignition source 'b'

The European Standard EN 13463-6:2005 has the status of a British Standard

ICS 13.230

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 13463-6:2005.

The UK participation in its preparation was entrusted to Technical Committee FSH/23, Fire precautions in industrial and chemical plant, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/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 committee can be obtained on request to its secretary.

Additional information

The contents of informative Annex C were the subject of considerable debate during the development of this European Standard. Those who are familiar with programmable electronic systems and their potentially complex failure modes see the need for much more detailed advice on designing equipment which has reliable protective systems. As pointed out in Annex C, EN 954-1:1996 does not effectively cover all of the principles described in this European Standard for the purposes of assessing ignition control devices.

Those from a mechanical background recognized that very simple devices can sometimes be used as safety systems. If designers were to consider all the issues covered in EN 61508 then this would be a barrier to the successful application of the principles found in this European Standard.

This European Standard will need review and may be subject to amendment at a later date in the light of the full variety of new products that will be developed using its principles and the eventual publication EN 62061.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Appareils non électriques destinés à être utilisés en atmosphères explosibles - Partie 6: Protection par contrôle de la source d'inflammation 'b'

Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 6: Schutz durch Zündquellenüberwachung 'b'

This European Standard was approved by CEN on 15 March 2005.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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Contents

Foreword

This document (EN 13463-6:2005) 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 October 2005, and conflicting national standards shall be withdrawn at the latest by October 2005.

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 of 23 March 1994.

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

This document is to specify the requirements for the type of protection "Control of ignition sources" for equipment intended for use in potentially explosive atmospheres and should be used in conjunction with EN 13463-1 " Non-electrical equipment for potentially explosive atmospheres – Part 1: Basic method and requirements”.

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

Introduction

Many types of non-electrical equipment intended for use in potentially explosive atmospheres of gas, vapour, mist and/or combustible dust, do not contain an effective ignition source in normal operation. However, there is a risk that an ignition source might arise in such equipment if the moving parts suffer a malfunction or an abnormal operation occurs.

An example of this is a fan, having high speed rotating blades fixed to a shaft, supported on rolling element bearings, inside a stator. In normal operation, no frictional ignition sources should be present. However, because the clearances between the rotor and stator are very small, malfunctions such as the collapse of a shaft bearing, distortion of a rotating blade, build up of foreign material on a rotating blade, etc. could cause the clearance to be reduced and frictional sparking, or hot surfaces, to occur.

To prevent potential ignition sources from becoming effective during normal operation, malfunction and rare malfunction, it is possible to incorporate sensors into the equipment to detect impending dangerous conditions and initiate control measures at an early stage of deterioration before the potential sources are converted into effective sources. The control measures applied, may be initiated automatically, via direct connections between the sensors and the ignition prevention system, or manually, by providing a warning to the equipment operator (With the intention of the operator applying the ignition prevention measures e.g. by stopping the equipment).

In this document, the incorporation of such sensors and their associated automatic/manual ignition prevention measures, to prevent potential ignition sources becoming effective ignition sources, is known as protection by “Control of ignition source ‘b’ ”

This type of ignition protection, and the devices used to achieve it, can take many forms. In practice, they may be mechanical, electrical, optical, visual or a combination of all of these. Although this document deals with the ignition protection of non-electrical equipment, it nevertheless has to take account of the fact that an increasing amount of non-electrical equipment makes use of electrical sensors to detect and initiate the ignition prevention measures. It is therefore impossible to produce a non-electrical equipment protection standard without making reference to the use of electrical sensors and their associated ignition prevention system circuits.

Some examples of mechanical sensor / actuator devices are:

a) fuseable plugs (as used in fluid couplings), that melt to release the energy contained in the power transmission fluid before the temperature of ignition capable parts exceed allowable limits;

b) centrifugal speed governors, that directly control the power throttle and prevent rotating parts attaining frictional ignition capable rotational speeds;

c) thermostatic valves, that close to reduce the input energy, or open to increase the amount of coolant, thereby preventing ignition capable temperatures being attained;

d) pressure relief valves (using springs or weights), that open to limit pressure levels and consequent temperature rise during gas compression. Alternatively, to protect against catastrophic failure leading to the exposure of unintended hot surfaces.

Some examples of combined electro-mechanical sensor / actuator devices are:

e) temperature, flow and level monitoring/control devices, that detect temperature / flow / level and initiate a solenoid valve to reduce the input energy, or increase the amount of coolant,

f) optical pulse counters, that sense abnormal rotational speeds on the teeth of gears and send signals to a speed controller,

g) vibration sensors, that detect abnormal vibration, from e.g. rolling element bearings, before they fail (usually indicated by high frequency vibrations), or rotating parts that are becoming out of dynamic balance (usually indicated by low frequency vibrations),

h) conveyor belt alignment devices, that detect unintended frictional rubbing between the moving belt and fixed parts of the supporting structure,

i) power transmission belt tension devices, that detect frictional slippage between the drive pulley and power transmission belt, due to loss of belt tension,

j) wear detectors on clutches, which detect unacceptable wear likely to cause frictional heating by incorrect engagement of the clutch.

Such sensor / actuator control devices may be either, continuously active in normal operation of the equipment (e.g. to control the temperature of category 3 equipment), or be arranged so that they only detect abnormal operation (e.g. to detect impending dangerous over-temperature in category 2 equipment).

As malfunction of any of the above sensors / actuator control devices, may result in failure to apply the appropriate ignition prevention measure, they are critical to the ignition safety related parts of the equipment. This ignition protection standard therefore calls for them to be assessed and suggests a minimum quality for such devices in the form of an ignition prevention level (IPL) that the equipment manufacturer must attempt to achieve.

Thus, to meet the requirements of this document, the non-electrical equipment manufacturer is required to perform both the ignition hazard assessment (required by EN 13463-1), and additionally, an evaluation, to determine the ignition prevention level (IPL) necessary to ensure that the sensors / ignition prevention system function when they are called upon to contain the ignition risk within tolerable limits.

A flow diagram is provided at Annex A (Figure A.1) to assist the non-electrical equipment manufacturer follow the procedural stages described in this document.

1 Scope

This document specifies the requirements for the design and construction of equipment, intended for use in potentially explosive atmospheres, protected by the type of protection: Control of ignition source "b".

This document supplements the requirements in EN 13463-1, the contents of which also apply in full to equipment constructed in accordance with this document.

Equipment conforming with the relevant clauses of this document meet the requirements for the following categories:

— Equipment Group I Category M2 – that does not contain an ignition source arising from severe operating conditions, in particular arising from rough handling and changing environmental conditions in mines;

— Equipment Group II category 3 – that does not contain an ignition source in normal operation;

— Equipment Group II category 2G or 2D – that does not contain an ignition source arising as a result of foreseeable malfunctions;

— Equipment Group II category 1G or 1D – that does not contain an ignition source in normal operation, or under foreseeable malfunctions, or under rare malfunctions.

NOTE The requirements for Group I, Category M1 equipment, are given in EN 50303, which specifies the requirements for both electrical and non-electrical equipment

This type of protection can be used to produce category 3 equipment which otherwise would have an ignition source in normal operation, i.e. it is not able to conform with EN 13463-1

The type of ignition protection described in the standard can be used either on its own or in combination with other types of ignition protection to meet the requirements for equipment of Group I category M2, or Group II categories 1, 2 and 3 depending on the ignition hazard assessment in EN 13463-1.

This document does not apply to:

— control devices which are not intended to provide ignition protection;

— the ignition protection of electrical equipment;

— equipment shut down systems, initiated by flammable gas detectors, explosive atmosphere detectors, carbon monoxide, fire, or smoke detectors.

NOTE This is because this document deals only with the detection and control of impending ignition sources in equipment, not the detection of explosive atmospheres surrounding it.

Ignition protection systems conforming to the relevant clauses of this document are not intended to be autonomous protective systems.

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 954-1, *Safety of Machinery — Safety-related parts of control systems — Part 1: General principles for design.*

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

EN 1127-2:2002, *Explosive atmospheres — Explosion prevention and protection — Part 2: Basic concepts and methodology for mining.*

EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements.*

EN 60079-0:2004, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements*.

3 Terms and definitions

For the purposes of this document, the terms and definitions, specific to the type of protection by “Control of ignition source ‘b’”, and given in EN 13463-1:2001, EN 60079-0:2004, EN 1127-1:1997 and EN 1127-2:2002 and the following apply.

3.1
protection by control of ignition source 'b'
device in non-electrical equipment, whereby (an) integral sensor(s) detect(s) impending operation likely to cause an ignition of the surrounding atmosphere and initiate either automatic or manual ignition control measures to prevent a potential ignition source becoming an effective ignition source.

3.2
automatic control measure
action taken without manual intervention, to prevent a potential ignition source from becoming an effective ignition source

3.3
manual control measure
action taken by a person as a result of a warning, indication, or alarm, to prevent a potential ignition source from becoming an effective ignition source

3.4
ignition prevention system (IPS)
arrangement that converts signals from one or more sensors into an action, or indication, to prevent a potential ignition source becoming an effective ignition source

3.5
ignition prevention level (IPL)
level assigned to the ignition prevention system characterized by its reliability

4 Determination of suitability

Before a decision is made to protect equipment, including interconnecting parts, by the measures described in this document, it shall be subjected to the ignition hazard assessment in accordance with EN 13463-1.

5 Determination of the control parameters

5.1 Where the ignition hazard assessment described in Clause 4 has revealed potential ignition sources and the manufacturer has decided to prevent them from becoming effective by the application of the protection described in this document, the equipment manufacturer shall determine, by calculation or type tests, the control parameters associated with those potential ignition sources.

5.2 Each control parameter (e.g temperature, T, speed, S and pressure, P) shall be expressed as a value in normal operation (e.g. $T_{\text{norm,}}$ $S_{\text{norm,}}$ P_{norm}) and a value in mal-operation that does not result in the potential ignition source becoming effective (e.g. T_{crit}, S_{crit}, P_{crit}).

NOTE Examples of the above control parameters are the determination of the:

a) normal operating temperature (T_{norm}) and the maximum allowable hot surface temperatures (T_{crit}) arising from abnormal frictional heating;

b) normal operating speed (S_{norm}) and the maximum allowable over-speed (S_{crit}) just before that which produces ignition capable frictional sparking;

c) normal operating pressure (P_{norm}) and maximum allowable over-pressure (P_{crit}) just before that which produces an ignition capable hot surface;

d) normal and maximum allowable vibration, before clearances between fixed and moving parts are reduced to ignition capable levels;

e) maximum allowable amount of wear on brake linings / clutch linings before slippage or frictional rubbing results in an ignition capable hot surface;

f) normal amount of coolant and the minimum flow of coolant needed to keep hot surfaces below the ignition temperature of the atmosphere;

g) normal level of lubricant and the minimum level of lubricant needed to prevent ignition capable frictional heating;

h) normal alignment and maximum allowable mis-alignment to prevent moving parts making contact with fixed parts.

6 Ignition prevention system design and settings

6.1 The manufacturer shall specify the settings, or operating characteristics (e.g. if the device is a fuseable plug), of the ignition prevention system intended to be used in the equipment, taking into account among others of the:

— speed of change of the potential source becoming an effective source;

— response time of the sensor / detector;

— response time of the ignition prevention system;

— difference in level between the potential source and effective source (e.g. T_{norm} to T_{crit});

— safety factor considered necessary.

NOTE Some industries require the ignition prevention detection system to have at least two levels. The first, to provide a warning to the operator and a second, to actuate the system. In some cases the warning can be used to prevent spurious activation. Equipment manufacturers might need to take this into account when designing their control of ignition prevention system.

6.2 The settings of the ignition prevention system specified by the manufacturer shall be included in the instructions given to the user.

6.3 Where the ignition prevention system is a safety related device it shall operate independently of the normal operating controls of the equipment being protected by it.

6.4 Where the ignition prevention system (IPS) is constructed to stop the equipment operating and thereby prevent a potential ignition source from becoming an effective ignition source, the IPS shall be arranged so that the stop function locks-out, preventing the equipment from being re-started without re-setting of the IP system lockout,

6.5 Where the ignition prevention system (IPS) is constructed to indicate, provide a warning or display to the operator, thereby calling for an operator response to prevent a potential ignition source from becoming an effective ignition, that indication, warning or display shall be arranged in accordance with ergonomic principles and avoid operator confusion or misunderstanding with regard to the preventative action required.

7 Ignition protection of sensors and actuators

Parts of the ignition prevention system that may be located in a potentially explosive atmosphere shall themselves not be an ignition source (see EN 13463-1 and EN 60079-0).

8 Ignition prevention levels (IPL) of the ignition prevention system

8.1 Ignition prevention level 1

An ignition prevention system of level 1 shall comprise well tried components having a proven history of reliability, assembled and installed in accordance with any relevant standards, adopting well tried safety principles, able to withstand expected influences during operation of the system and so arranged that:

- if a control parameter critical value (e.g. P_{crit}, T_{crit}) is exceeded either the ignition source is prevented from becoming effective or a warning is given that an ignition source can develop;

- the ignition prevention system is capable of being checked[1)] at suitable intervals and the loss of safety function shall be detected by the check;

- the equipment manufacturer's instructions required by EN 13463-1 shall specify the interval between the periodic maintenance checks[1)] and include advice on the methods of detecting faulty sensors / ignition prevention systems (e.g. the tests to be performed). They shall also specify the action to be taken by the user if faults on the sensors or ignition prevention systems are detected during the maintenance checks.

  NOTE Normally, the instructions will specify that such faults need to be remedied before the equipment is put back into service.

8.2 Ignition prevention level 2

An ignition prevention system of level 2 shall meet the requirements of 8.1 and in addition shall comprise well tried components having proven history of reliability, assembled and installed in accordance with any relevant standards, adopting well tried safety principles, able to withstand expected influences during operation of the system and so arranged that:

- if a control parameter critical value (e.g. P_{crit}, T_{crit} etc.) is exceeded, the ignition source is prevented from becoming effective;

- if a single fault occurs in the ignition prevention system it does not lead to loss of the prevention system safety function.

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1) Routine checking systems are usually based on the user simulating operation of the protection system and checking the response. This may be achieved in simple systems, by the user operating the limit switch / limiting device and noting if the ignition prevention system responds accordingly. In more complicated systems, by injecting a signal into the ignition prevention system to simulate an abnormal condition and noting if it produces the desired action/ reaction. Alternatively (but less reliable), by increasing / lowering the sensor setting to produce an action output level under normal healthy conditions and noting the response (then making sure then sensor is reset it back to its original protective setting, as recommended by the manufacturer).

– the equipment manufacturer's instructions required by EN 13463-1 shall specify the interval between checks[1)] on the sensor and ignition prevention system.

NOTE 1 This interval could be very small if the sensors and ignition prevention systems are arranged to be checked or monitored by the equipment's control system. Alternatively, the interval could be a few hours if the risk assessment indicates that manual checking is sufficient.

The manufacturer's instructions shall describe the action to be taken if faults on the ignition prevention systems are detected.

NOTE 2 The latter might, for example, vary in degree, between immediate stopping of the equipment, to the performance of repairs to the faulty sensors / ignition prevention systems without stopping the, otherwise ignition safe, equipment from operating.

8.3 The ignition prevention system is critical to the ignition safety of the equipment and the minimum ignition prevention levels in Table 1 or Table 2 shall be met, as appropriate for the equipment's group and category.

NOTE As a consequence, a warning only (with consecutive manual action) cannot be used in this case.

Table 1 — Minimum IPL requirements for an ignition prevention system used to protect Group II equipment

Occurrence of potential ignition source	Category 3	Category 2	Category 1
In normal operation	IPL 1	IPL 2	
During foreseeable malfunction	Not relevant for category 3	IPL 1	IPL 2
During rare malfunction	Not relevant for category 3	Not relevant for category 2	IPL 1

Where IPL 1 is used for category 1 equipment the ignition source shall be prevented from becoming effective if any control parameter critical value is exceeded.

Table 2 — Minimum IPL requirement for an ignition prevention system used to protect Group I (mining) equipment

Category M2
IPL 2
NOTE Category M2 mining equipment is intended to be de-energised in the presence of an explosive atmosphere.

8.4 The ignition prevention level shall be achieved either by:

a) installing an ignition prevention system that has been shown to comply with the required IPL by previous evaluation and operating experience

NOTE 1 For example, an ignition prevention level or safety integrity level evaluation performed by the ignition prevention system manufacturer or a third party competent body.

or by

b) installing an ignition prevention system for IPL 1 that complies with category 2 of EN 954-1 and/or an ignition prevention system for IPL 2 that complies with category 3 of EN 954-1 or by

c) evaluating the particular requirements necessary for the equipment, taking account of its intended use and category, and construct them to that level. This evaluation shall take account of:

c1) the types of ignition prevention system used to protect the equipment,

c2) whether or not, they are single line or duplicated (e.g. by other independent devices),

c3) their individual resistance to faults,

c4) whether faults are self revealing or not,

c5) whether the ignition prevention system is fail safe or not,

c6) the probability of failure, resulting in the ignition protection being lost at the same time as a potential source of ignition (being protected by them) converts to an effective ignition source relating to the category of the equipment.

NOTE 2 See also Annex B for the thought process used to assign IPLs to the different categories of equipment and Annex C for some background information on EN 954-1 and EN 61508.

8.5 Programmable electronic devices

Where programmable electronic devices are used as part of the ignition protection system they shall comply with the requirements for the appropriate ignition protection level. This can be achieved for example by complying with the requirements of EN 61508-3 with an appropriate safety integrity level (see Annex C).

9 Type tests

9.1 Determination of control parameters

In accordance with 5.1 of this document, where the manufacturer does not know the control parameters, or is unable to calculate them, or obtain them from recognised reference literature, a type test shall be performed to determine the normal operating level and the maximum allowable level. For example, the normal and maximum level of vibration allowed, the maximum allowable wear allowed from new, the normal and minimum flow of coolant required.

9.2 Function and accuracy check of the ignition prevention system

Sensors shall be checked to ensure they produce the correct output signal in response to the characteristic being monitored and their accuracy is within the range described in this document.

The ignition prevention systems shall be checked for correct operation as intended, also to see if they indicate a “fault” condition when defect or if a signal outside of the limits of the pre-determined maximum / minimum range is applied to it.

10 Instructions for use

10.1 Equipment conforming with the requirements of this document shall be accompanied by the user instructions and particulars required by EN 13463-1 and if applicable additionally:

a) instructions relating to the action /reaction level settings of ignition prevention systems (see Clauses 5 and 6),

b) the method and the frequency of routinely checking that the ignition prevention system is functioning and calibrated correctly.

10.2 Indicator(s), or gauge(s) or other similar types of monitoring device, shall be marked with the correct level, or if more appropriate the correct pressure and flow rate, of any coolant, lubricant or protective liquid necessary to maintain the ignition protection commensurate with the equipment’s category when in service. Where necessary, indicators or gauges intended for operator controlled equipment, shall be so arranged that they can be easily seen by the operator responsible for applying the control measures.

10.3 Where appropriate, indicating device(s) shall also be marked to indicate the maximum and minimum operating levels.

11 Marking

11.1 In addition to the marking requirements of EN 13463-1, the marking shall include: The symbol 'b' (designating the type of explosion protection).

11.2 An ignition prevention system which can be used or supplied separately shall in addition to the marking requirements of EN 13463-1 be marked by the symbol 'b' followed by the ignition protection level ‘1’ or ‘2’ enclosed in brackets.

11.3 Example of the marking in relation to the explosion protection for Group II, Category 2 temperature class T4 equipment, intended for use in a potentially explosive atmosphere of gas:

II 2 G b T4

11.4 Example of the marking in relation to the explosion protection for Group I, Category M 2 equipment:

I M2 b

11.5 Example of the marking in relation to the explosion protection of an ignition prevention system of IPL 1, which itself is a category 2 temperature class T4 equipment intended for use in a potentially explosive atmosphere of gas.

II 2 G c T4 (b1)

Annex A
(informative)

Flow diagram of the procedures described in this document

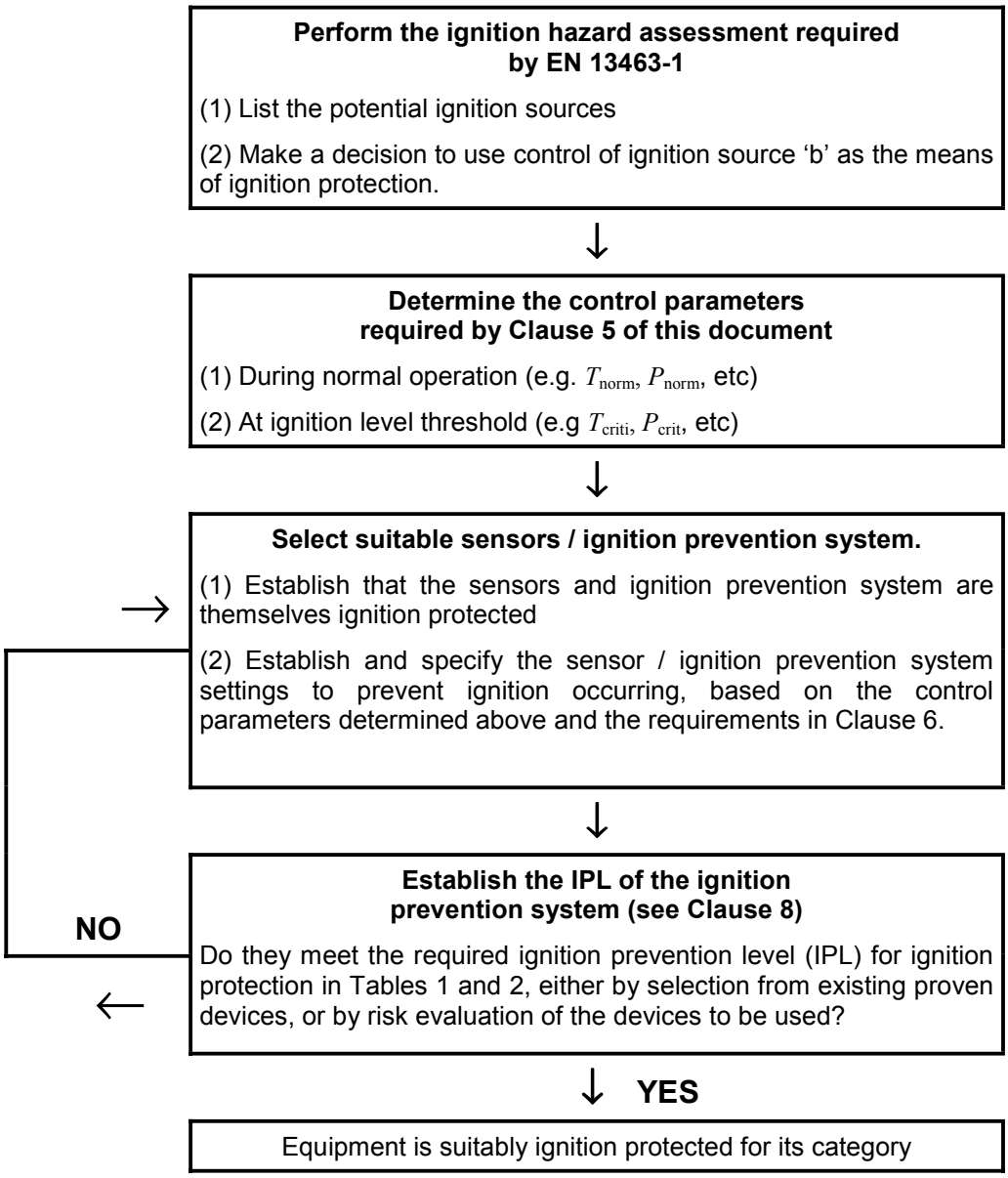

Figure A.1 — Flow diagram of the procedures described in this document

Annex B
(informative)

Thought process used to assign IPLs to different categories of equipment

B.1 For Category 3 non-electrical equipment

This equipment, by definition, does not contain sources of ignition in normal operation. To meet this basic requirement, it will not therefore usually be necessary to apply additional Control of Ignition Source 'b' protection to cater for abnormal operation of the equipment. The exception to this is equipment that has to be controlled by some device as part of its normal operation. For example, a speed control device fitted to ensure that a rotating part of a machine maintains the correct speed in normal operation. In this case, the speed control device can be interpreted as an ignition prevention system as described in this document.

It might also be possible to fit a Control of Ignition Source 'b' device to normal industrial equipment, thereby convert it from equipment that is not intended for use in a potentially explosive atmosphere to a type that meets the definition of category 3 equipment.

In all of the above cases, the probability of the ignition prevention system failing at the same time as an explosive atmosphere occurs will be rare and consequently, a low ignition protection level should suffice.

B.2 For Category 2 non-electrical equipment,

This category of equipment needs to be protected against ignition sources occurring in normal operation and also with foreseeable faults on the equipment. In this case, the probability of an ignition source developing in the equipment at the same time as the ignition prevention system is faulty and an explosive atmosphere is present is higher than for category 3 equipment. IPL 2 has therefore been assigned by this document to the ignition prevention systems used to protect category 2 equipment that would otherwise have a potential ignition source in normal operation. Where the ignition source is only likely to occur in foreseeable malfunctions an ignition prevention system with IPL1 is sufficient to achieve the required degree of protection.

B.3 For Category M2 non-electrical equipment

Category M2 equipment needs to be ignition protected and suitable for the severe operating conditions of use found in gassy mines, but it is intended to be de-energised if an explosive atmosphere occurs. The probability of an ignition source developing in the equipment at the same time as its associated ignition prevention system is faulty and an explosive atmosphere is present is therefore higher than category 3, but not as high as category 2 because of its intended short time exposure to an explosive atmosphere. IPL 2 has therefore been assigned by this document to the ignition prevention system used to protect category M2 equipment.

B.4 For Category 1 and non-electrical equipment

Category 1 equipment needs to be ignition protected in normal operation, also with foreseeable faults and rare faults applied to the equipment.

The definitions and requirements for this category of equipment also include reference to such equipment being either safe with more than one fault applied, or protected by two protection methods. For this reason, for category 1 equipment this form of protection can only be applied to equipment that does not have an ignition source in normal operation. Where the ignition source is only likely to occur in rare malfunctions an ignition prevention system with IPL1 is sufficient to achieve the required degree of protection provided the ignition source is prevented from becoming effective if any control parameter critical is exceeded. Where the ignition source is likely to occur in foreseeable malfunctions an ignition prevention system with IPL2 is sufficient to achieve the required degree of protection.

Annex C
(informative)

Background information on EN 954-1 and EN 61508

C.1 European Standard EN 954-1 “Safety of machinery – Safety related parts of control systems – Part 1: General principles for design” has been prepared by CEN/TC 114 "Safety of machinery" to assist machinery manufacturers. It describes 5 categories (B, 1, 2, 3 and 4) that can be applied to assess the quality of the safety related parts of machinery control systems. Although not specifically written for the purpose of assessing ignition control devices, some of the principles described in that standard might be helpful to manufacturers of equipment intended for use in potentially explosive atmospheres.

C.2 European standards series EN 61508 is based on International standards series IEC 61508 “Functional safety of electrical/electronic/programmable electronic safety-related systems” which has been prepared by sub-committee 65A of the International Electrotechnical Commission, IEC/SC 65A "System aspects", to assist manufacturers of safety related systems. It contains the requirements for four Safety Integrity Levels (SIL 1, 2, 3 and 4) that can be applied to describe the quality of the safety related parts of a control system. Following the recent publication of the seven parts of EN 61508, some national test authorities have announced their intention to offer a service for checking such safety related components and protective systems and provide manufacturers with an attestation of its Safety Integrity Level (SIL) rating.

At the present time however, most sensors and ignition prevention systems used for the purpose of this document, will not have been assessed or given a SIL rating, and the ignition protected equipment manufacturer has to attempt this task according to the appropriate IPL described in this document.

C.3 CENELEC technical committee CLC/TC 44X "Safety of machinery: electrotechnical aspects" is elaborating a European standard that is the equivalent of EN 954-1 for electrical/electronic and programmable controlled machine safety. The project is based on EN 61508. The current document is the CENELEC enquiry draft, prEN 62061:2004 "Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061)", which was circulated for voting until January 2004. When published this latter document will give more definitive guidance on the SILs of safety related parts of machines. As an indication IPL 1 would appear to be met by SIL 1 and IPL 2 by SIL 2, though this is still under consideration and may be changed.

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 1993 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 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.

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

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

Essential Requirements (ERs) of EU Directive 94/9/EC		Clauses of this EN	Reference in other standards
1	**Common Requirements**		
1.0.1	Principles of integrated explosion safety	Clause 4	
1.0.2	Design considerations, take account of faults/misuse	Clauses 4, 8 and 9	
1.0.3	Special checking and maintenance conditions	Clause 8	
1.0.4	Foreseeable area conditions	Clause 4	
1.0.5	Marking	Clause 11	
1.0.6	Manufacturer's instructions	Clause 10	
1.1	Selection of materials		
1.1.1	Must not trigger an explosion	Clause 4	
1.1.2	Limits of operation	Clause 5	
1.1.3	Effects on predictable changes in materials characteristics	Clause 9	
1.2	Design and construction		
1.2.1	State of the art design of explosion protection	Clauses 4, 5, 6, 7 and 8	
1.2.2	Safe functioning of replacement components	Clauses 5, 6, 7 and 8	
1.2.3	Enclosed structures and prevention of leaks	Clause 8	
1.2.4	Safety with dust deposits	Clause 4	
1.2.5	Additional means of protection for external stresses	Clause 9	Dealt with in EN 13463-1 (impact and drop tests)
1.2.6	Safe opening		Dealt with in EN 13463-1

Table ZA.1 *(continued)*

Essential Safety Requirement		Reference in this standard	Reference in other standards
1.2.7	Other hazards		
a)	Electrical dangers,	The danger of skin burns and electric shock are not dealt with in the explosion protection standards.	
b)	Surface temperatures		Dealt with in EN 13463-1
c)	Non-electrical dangers		Dealt with in EN 13463-1
1.2.8	Overloading of equipment, control devices, power limitation.	Overloading is not specifically dealt with.	
1.2.9	Flameproof enclosure systems	Not applicable to the type of protection covered by this standard	
1.3	Prevention of potential ignition sources		
1.3.1	Hazards arising from hot surfaces and mechanical sparks.	Clauses 4, 5, 6, 7 and 8	Dealt with in EN 13463-1
1.3.2	Hazards arising from static electricity		Dealt with in EN 13463-1
1.3.3	Hazards arising from stray electric and leakage currents	Not dealt with in this standard	
1.3.4	Hazards arising from overheating		Dealt with in EN 13463-1
1.3.5	Hazards arising from pressure compensation operations or shock waves.	Not dealt with in this standard	
1.4	Hazards rising from external effects		
1.4.1	Safe functioning	Pollutants are not dealt with in this standard. Other external effects are the subject of agreement between the manufacturer and user.	
1.4.2	Mechanical and thermal stresses and withstanding attack by existing or on foreseeable aggressive substances	Clauses 8 and 9	Resistance to chemical attack is subject to agreement between the manufacturer and user.
1.5	Requirements in respect of safety-related devices		
1.5.1	Independent function of any measurement or control device required for operation	6.3	
1.5.2	In the event of a safety device failure, equipment and/or protective systems shall, wherever possible, be secured	Clause 8	
1.5.3	Emergency stop controls fitted with restart lockouts	6.4	
1.5.4	Control and display units designed in accordance with ergonomic principles .	6.5	
1.5.6	Reading accuracy and serviceability of devices checked	Clause 5	
1.5.7	Safety factor incorporated in the design of devices with a measuring function.	6.1 and Clause 8	
1.5.8	Risks arising from software	8.5	
1.6	Integration of safety requirements relating to the system		

1.6.1 to 1.6.5	Integrated systems are not intended to be within the scope of this standard		
2.0	**Supplementary requirements in respect of equipment**		
2.0.1	Requirements for Group I category M1 Equipment		
2.0.1.1	Source of ignition not to become active		Group I (Mining) Category M 1 equipment is dealt with in EN 50303. This standard is relevant if protection type 'b' forms one of the two means required.

Table ZA.1 *(continued)*

Essential Safety Requirement		Reference in this standard	Reference in other standards
2.0.1.3	Surface temperature to be below ignition temperature to prevent the ignition of suspend dust		Group I (Mining) Category M 1 equipment is dealt with in EN 50303. This standard is relevant if protection type 'b' forms one of the two means required.
2.0.1.4	Avoidance of opening of equipment with sources of ignition		Group I (Mining) Category M 1 equipment is dealt with in EN 50303. This standard is relevant if protection type 'b' forms one of the two means required.
2.0.2	Requirements for Group I category M 2 equipment		
2.0.2.1	Sources of ignition not to become active in normal operation	Clause 4	
2.0.2.2	Opening of equipment only under non-active conditions	Not covered	
2.0.2.3	Requirement for explosion hazards from dust category M1	Clause 8	
2.1	Requirements for Group II category 1 equipment		
2.1.1	Explosive atmospheres caused by gases, vapours or hazes		Group II Category 1 equipment is dealt with in EN 13463-1 and is relevant to this standard if protection type 'b' forms one of the two means required.
2.1.1.1	Sources of ignition not to become active in normal operation	Clause 4; see 2.1.1 above.	
2.1.1.2	Surface temperatures not exceeded	Clause 4; see 2.1.1 above	
2.1.1.3	Opening of equipment only under non-active conditions	Clause 4; see 2.1.1 above	
2.1.2	Surface temperatures to be kept below ignition temperatures of suspended dust	Clause 4 see 2.1.1 above	
2.1.2.4	Opening of equipment only under non-active conditions	Clause 4; see 2.1.1 above	
2.2	Requirements for Group II category 2 equipment		
2.2.1	Explosive atmospheres caused by gases, vapours or mists	Clause 4	
2.2.1.1.	Design and construction of equipment to prevent ignition sources arising	Clause 4	
2.2.1.2	Design and construction of equipment so that surface temperatures is not exceeded	Clauses 4 and 8	
2.2.1.3	Design of equipment for operating under non-active conditions/interlocking systems	Not covered	
2.2.2.1	Design and protection of equipment to prevent sources of dust ignition becoming active	Clauses 4 and 8	

Table ZA.1 *(concluded)*

Essential Safety Requirement		Reference in this standard	Reference in other standards
2.2.2.2	Stated max. surface temperatures not to be exceeded, no dust penetration	Clause 8	
2.3	Requirements for Group II category 3 equipment		
2.3.1.1	Design and construction of equipment to prevent foreseeable ignition of gas or mist during normal operation	Equipment constructed in accordance with this standard will prevent ignition by virtue of the fact that impending abnormal operation is detected and control measures applied before potential sources become effective sources.	
2.3.1.2	Surface temperatures not to exceed stated figures	Clause 8	EN 13463-1 (temperature limitation)
2.3.1.3	Explosive atmospheres caused by air/dust mixtures		
	Design and construction of equipment to prevent ignition of air/dust mixtures during normal operation	Not covered by this standard.	
2.3.2.3	Prevention of dust particles mixing with air in equipment to cause ignition inside the equipment.	Clauses 4 and 8	
3	**Requirements for 'Protective Systems'**		
	Protective systems are not within the scope of this standard.		

Bibliography

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

[2] EN 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General requirements (IEC 61508-1:1998 + Corrigendum 1999).*

[3] EN 61508-2, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2:2000).*

[4] EN 61508-3, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements (IEC 61508-3:1998 + Corrigendum 1999)*.

[5] EN 61508-4, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 4: Definitions and abbreviations (IEC 61508-4:1998 + Corrigendum 1999).*

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[7] EN 61508-6, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3 (IEC 61508-6:2000).*

[8] EN 61508-7, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 7: Overview of techniques and measures (IEC 61508-7:2000).*

[9] prEN 62061:2004, *Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061).*

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