BRITISH STANDARD

BS EN
50303:2000

Group I, Category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust

The European Standard EN 50303:2000 has the status of a British Standard

ICS 29.260.20

National foreword

This British Standard is the official English language version of EN 50303:2000.

The UK participation in its preparation was entrusted to Technical Committee GEL/31, Electrical apparatus for use in explosve atomspheres, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

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EUROPEAN STANDARD **EN 50303**

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EUROPÄISCHE NORM July 2000

ICS 29.260.20

English version

Group I, Category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust

Appareils du groupe I de catégorie M1 destinés à rester en opération dans les atmosphères exposées au grisou et/ou à la poussière de charbon

Gruppe I, Kategorie M1 Geräte für den Einsatz in Atmosphären, die durch Grubengas und/oder brennbare Stäube gefährdet sind

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This European Standard was prepared jointly by Working Group 16 of the Technical Committee CENELEC TC 31 and Working Group 2 of the Technical Committee CEN TC 305 to implement the mandate given to CEN and CENELEC by the European Commission and the European Free Trade Association to set down requirements for the design and construction of equipment in support of the essential safety and health requirements described in annex I, clause 1 and annex II, clause 2.0.1 of the European Article 100A Directive 94/9/EC, Equipment and Protective Systems intended for Use in Potentially Explosive Atmospheres.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50303 on 2000-04-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2001-04-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2003-06-30

Introduction

Before the coming into force of the European Directive 94/9/EC, no European Standard existed for the types of equipment intended for continued use in explosive atmospheres of firedamp and/or coal dust in the underground workings, or surface installations, of mines. Most Member State Governments however, had national legislation based on the guidelines of the European Safety and Health Commission for Mining and Other Extractive Industries adopted in Luxembourg during 1986.

These guidelines recommended that the kinds of equipment allowed to remain functional in atmospheres endangered by firedamp and/or coal dust, should be restricted to those which were necessary for the protection of workers and safe with more than one fault applied. With the coming into force of 94/9/EC the fundamental constructional requirements for these kinds of equipment were included in the annexes I and II of the Directive and designated Group I Category M1 Equipment.

This standard is based on these requirements and although it makes reference to other (Category M2) explosion protection standards, it is a “stand alone” document relating to both electrical and non-electrical equipment intended to remain functional in explosive atmospheres of firedamp and/or coal dust.

1 Scope

1.1 This standard specifies the design, construction, testing and marking requirements for Group I, Category M1 equipment intended to remain functional in underground parts of mines, as well as those parts of surface installations of such mines endangered by firedamp and/or coal dust clouds under normal atmospheric conditions of pressures ranging from 0,8 bar to 1,1 bar and temperatures ranging from -20 °C to +60 °C.

1.2 It applies to all electrical and non-electrical equipment capable of causing an explosion through its own potential source of ignition.

1.3 It also applies to cables, pipes and optical fibres, when such items are used to carry energy sources and form part of equipment intended to remain functional in an atmosphere endangered by firedamp and/or coal dust.

1.4 It does not apply to Category M1 Miners’ Caplights, which are dealt with in prEN 62013-1 (in preparation).

NOTE 1 As the energy needed to ignite a coal dust/air cloud is in excess of 600 times* that needed to ignite a firedamp/air mixture, this standard assumes that provided intrinsically safe “ia” circuits are constructed to be safe in an explosive atmosphere of firedamp/air, then such circuits are not capable of directly igniting an explosive atmosphere of coal dust/air.

** Based on tests performed by several member state laboratories. Verified at the UK Health & Safety Laboratories, Buxton - Report by Dr P. Tolson, dated 9 August 1995 – “Ignition of coal dust/air mixtures using a modified IEC spark test apparatus”.*

NOTE 2 In designing equipment for operation in explosive atmospheric conditions other than those given in 1.1 above, this standard may be used as a guide. In such cases, additional testing is recommended to allow the manufacturer to be able to demonstrate that the equipment is suitable for the exceptional conditions of use.

NOTE 3 When an explosive firedamp atmosphere occurs in the underground workings of a mine, or at a surface installation, it is imperative that the ignition risk be kept to a minimum. Member State Governments may therefore prohibit the continued use of certain Category M1 equipment in an atmosphere endangered by firedamp and/or coal dust if it is not necessary for it to remain functional for the protection of workers**.

*** This has its origin in clause 5.1 of the proposals to the Governments of Members States adopted by the Safety and Health Commission for Mining and Other Extractive Industries (SHCMOEI) at its meeting on 29.10.1986. Document No 6374/13/82 – “Electrical apparatus and systems for use when the concentration of firedamp exceeds the statutory limit for electricity”.*

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.

EN 50014		Electrical apparatus for potentially explosive atmospheres - General requirements.
EN 50016		Electrical apparatus for potentially explosive atmospheres - Pressurized apparatus “p”.
EN 50017		Electrical apparatus for potentially explosive atmospheres - Powder filling “q”.
EN 50018		Electrical apparatus for potentially explosive atmospheres - Flameproof enclosure “d”.
EN 50019		Electrical apparatus for potentially explosive atmospheres - Increased safety “e”.
EN 50020		Electrical apparatus for potentially explosive atmospheres - Intrinsic safety “I”.
EN 50028		Electrical apparatus for potentially explosive atmospheres - Encapsulation “m”.
prEN 13463-1		Non-electrical equipment for potentially explosive atmospheres - Part 1: Basic methodology and requirements.
prEN 13463-3		Non-electrical equipment for potentially explosive atmospheres - Part 3: Protection by flameproof enclosure “d”.
prEN 13463-4		Non-electrical equipment for potentially explosive atmospheres - Part 4: Protection by inherent safety.
prEN 13463-5		Non-electrical equipment for potentially explosive atmospheres - Part 5: Protection by constructional safety “c”.
prEN 13463-7		Non-electrical equipment for potentially explosive atmospheres - Part 7: Protection by pressurization “p”.
EN 60529	1991	Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989).
prEN 62013-1		Caplights for use in mines susceptible to firedamp - Part 1: General requirements - Construction and testing in relation to the risk of explosion.

3 Definitions

3.1
explosion protection
any of the types of protection listed in clause 2 that can be applied to equipment to prevent it becoming an igniting source for an explosive atmosphere

3.2
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

NOTE For the purpose of this standard, “equipment” includes systems which are intended to be supplied to the user as a complete entity. It also includes any external electric cables and/or pipes forming part of such systems. Intrinsically safe electrical apparatus and systems are also included in the above definition.

3.3
equipment Group I
equipment intended for use in underground parts of mines, and those parts of surface installations of such mines, liable to be endangered by firedamp and/or coal dust clouds

3.4
potentially explosive atmosphere
an atmosphere which could become explosive due to local and operational conditions

3.5
explosive atmosphere
a mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture

3.6
equipment Category M1
equipment designed and, where necessary, equipped with additional special means 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 underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or coal dust clouds. Equipment in this category is intended to remain functional, even in the event of rare incidents relating to equipment, with an explosive atmosphere present, and is characterized by means of protection such that:

a) either, in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection,

b) or, the requisite level of protection is assured in the event of two faults occurring independently of each other.

3.7
equipment Category M2
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 underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or coal dust clouds. This equipment is intended to be de-energized in the event 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

NOTE Although Category M2 equipment is designed and constructed to be safe in an atmosphere of firedamp and/or coal dust up to concentration level where it changes from being potentially explosive to becoming explosive, Member State Governments may have regulations requiring certain mining equipment to be isolated or made safe at atmospheric concentrations well below the “lower explosive limit” to introduce a safety factor.

3.8
firedamp
flammable mixture of gases or any flammable gas naturally occurring in a mine

NOTE Because firedamp normally consists mainly of methane, the term “firedamp” and “methane” are used frequently in mining practice as synonyms. Where significant proportions of other flammable gases may be present, additional testing is required by 4.1 of EN 50014 and prEN 13463-1.

4 General

4.1 Applicability

4.1.1 The requirements of this standard shall apply in full to equipment intended to remain functional in a mining atmosphere endangered by firedamp and/or coal dust clouds and containing a source of energy greater than 0,2 mJ capable of being converted into an igniting source by a sudden release/discharge, for example, by one or more of the following means - arc, spark, flame, heated surface, discharge, impact, frictional rubbing, adiabatic compression, ionizing radiation, non-ionizing radiation, or chemical reaction.

4.1.2 Equipment containing a convertible energy source less than that stated above, need only comply with 4.2 or 4.3 below (as appropriate) and meet the requirements of 4.5, 4.6 and 4.7 to comply with this standard.

NOTE The application of “double protection” or “safe with two fault” concepts of protection described in 3.6, are over elaborate and unnecessary for equipment which is extremely unlikely to cause an ignition even under multiple fault conditions of use. Examples of such equipment are - that described as "simple apparatus" in EN 50020, or simple mechanical apparatus such as a vane type anemometer used to measure air flow in a mine roadway.

4.2 Requirements for electrical equipment

Electrical equipment shall, in addition to meeting the requirements of this standard, also meet the requirements of Group I equipment in EN 50014 and modified or supplemented by, if appropriate, one or more of the relevant electrical or non-electrical explosion protection concept standards listed in clause 2.

4.3 Requirements for non-electrical equipment

Non-electrical equipment shall, in addition to meeting the requirements of this standard, also meet the Group I requirements in prEN 13463-1 and modified or supplemented by, if appropriate, one or more the relevant electrical or non-electrical explosion protection concept standards listed in clause 2.

4.4 Type testing

Equipment shall be tested according to the relevant subclauses of clause 9.

4.5 Temperature limits

4.5.1 The maximum surface temperature on equipment shall not exceed:

- 150 °C on any surface where coal dust can form a layer,
- 450 °C where coal dust is not expected to form a layer.

4.5.2 The ambient temperatures range shall be –20 °C to +40 °C except where the equipment is designed for use in ambient temperatures outside this range, in which case, the permitted ambient temperature range shall be marked on the equipment.

NOTE The above ambient temperatures are aligned with the scopes of EN 50014 and prEN 13463-1. As a result, certain equipment designed within the scope of this standard, but operating at an ambient temperatures between +40 °C and +60 °C has to be marked with the permitted temperature range.

4.6 Restriction on the use of light metals

4.6.1 Materials used in the construction of enclosures shall not contain by mass:

a) more than 15 % in total of aluminium, magnesium, titanium and zirconium; and

b) more than 6 % in total of magnesium, titanium and zirconium.

4.6.2 No exposed external parts of equipment shall be painted or coated with preparations containing, in metallic form, aluminium, magnesium, titanium or zirconium.

4.6.3 Light metal components, not forming part of the external enclosures, shall be so contained or guarded as to prevent abrupt stress and impact from other extraneous metallic objects during normal operation of the equipment.

4.7 Prevention of dangerous electrostatic charges

Enclosures constructed of plastics or other materials susceptible to being charged by static electricity, for:

- non-fixed equipment (e.g. portable, hand-held, rotating parts, cooling fans); or
- fixed equipment which is likely to be charged by high velocity dust laden air (e.g. equipment intended to be located inside ventilating ducting);

having a surface area projected in any direction of more than 100 cm^2 shall be so designed that under normal conditions of use, maintenance and cleaning, the danger of ignition of firedamp due to electrostatic charges is avoided. This requirement shall be satisfied by either:

- suitable selection of material so that the insulation resistance of the enclosure, measured according to the methods given in EN 50014 and prEN 13463-1, does not exceed 1 GΩ at (23 ± 2) °C and (50 ± 5) % relative humidity; or
- by virtue of the size, shape and layout of the enclosure, or other protective methods utilized, such dangerous electrostatic charges are not likely to occur.

NOTE By virtue of its omission from this text and 7.4.2 of prEN 13463-1, the option described in 7.3.1 of EN 50014 of attaching a warning label, is not a permissible arrangement for Category M1 equipment.

4.8 Electric cables

4.8.1 General

4.8.1.1 Electric cables, forming part of Category M1 equipment, shall be assessed for compliance as part of the equipment to which they are connected. Where cables are incorporated into an intrinsically safe circuit, the integrated equipment shall comply with EN 50020 Category “ia”.

NOTE At the present time, the explosion protection standards listed in clause 2 do not apply to electric cables because they are not within their scope. The following clauses therefore deal with electric cables protected by virtue of containing circuits that are safe with two faults. They repeat the requirements previously incorporated in annex III of European Directive 82/130/EEC and may be amended or revised at a later date when a Group I Intrinsically Safe Systems Standard is published.

4.8.1.2 Electric cables, cable entries and connections shall be constructed according to good engineering practice and provide ingress protection at least equal to that of the equipment to which they are connected.

4.8.2 Cables containing intrinsically safe circuits

Cables containing intrinsically safe circuits shall not contain any non-intrinsically safe circuits.

4.8.3 Additional requirements for cables containing more than one intrinsically safe circuit

4.8.3.1 Where a multicore cable contains more than one intrinsically safe Category “ia” circuit its insulation shall have a radial thickness appropriate to the diameter of the conductor. In the case of polyethylene this shall be a minimum radial thickness of 0,2 mm.

4.8.3.2 Before the multicore cable leaves the manufacturer's works, the multicore cable shall have been submitted to at least one of the dielectric tests described below and the voltage withstand capability of the insulation confirmed in a document supplied by the cable manufacturer:

- **dielectric test performed before the conductor cores are assembled into the cable:** each core shall be tested at a voltage equal to 3 000 V (rms) + (2 000 times the radial thickness of the insulation in mm) V (rms). The assembled cable is then firstly tested at a voltage value (rms) equal to 500 V applied between all armourings, or screens, of the cable joined together electrically and the bundle of all cores joined together electrically, and secondly at a voltage value (rms) equal to 1 000 V applied between a bundle comprising one half of the cable cores and a bundle comprising the other half of the cores. If the cable manufacturer decides otherwise, the dielectric tests may be performed using a d.c. voltage multiplied by a factor of 1,4 on the a.c. values.
- **dielectric test performed on an assembled cable:** a voltage equal to 1 000 V (rms) is applied between all the armourings and/or screens of the cable joined together electrically and the bundle of all of the conductor cores joined together electrically. It is then tested at a voltage equal to 2 000 V (rms) applied in succession between each conductor core of the cable and the bundle formed by all of the other cores joined together electrically. If the cable manufacturer decides otherwise, the dielectric tests may be performed using a d.c. voltage multiplied by a factor of 1,4 on the a.c. values.

4.8.3.3 Where the above dielectric tests use an a.c. voltage, it shall be substantially of sinusoidal wave form and be at a frequency between 48 Hz and 62 Hz, supplied from a transformer of sufficient power taking account of the cable capacity. In the case of the dielectric tests on an assembled cable, the voltage shall be increased steadily to the specified value in a period not less than 10 seconds and then maintained for at least 60 seconds.

4.8.4 Assessment of equipment having multicore cables containing one or more intrinsically safe circuits

4.8.4.1 In assessing the suitability of a multicore cable containing intrinsically safe Category "ia" circuits, a fault between the cores can be ignored if one of the two following requirements are satisfied:

- the cable has successfully met the requirements of the dielectric tests above and each individual circuit is enclosed in a conducting screen providing at least 60 % coverage.

NOTE The eventual connection of the screen to earth or frame will be specified in the installation rules.

- the cable has successfully met the requirements of the dielectric tests above, is effectively protected against mechanical damage and each circuit within the cable has a peak voltage of equal to or less than 60 V in normal operation.

4.8.4.2 Where a multicore cable has successfully met the requirements of the dielectric tests, but faults between cores cannot be ignored (by virtue of not meeting 4.8.4.1 above), then:

- in the case of a cable containing circuits forming part of a single intrinsically safe system - faults shall be considered between up to 4 cores of the cable in addition to the intrinsically safe system being considered as though it is a single item of intrinsically safe Category "ia" apparatus conforming with EN 50020; and
- in the case of a cable containing circuits forming parts of different intrinsically safe electrical systems - each intrinsically safe circuit contained in the cable shall have a safety factor of at least four times that required if it is considered as being a single item of intrinsically safe Category "ia" apparatus conforming with EN 50020.

4.8.4.3 Where a multicore cable has neither successfully met the requirements of the dielectric tests, nor the requirements of 4.8.4.1 above, all possible combinations of faults between cores of the cable shall be taken into account in addition to each of the circuits being considered as if they were single items of Category "ia" apparatus conforming with EN 50020.

4.8.4.4 The documents produced by the manufacturer of the equipment or intrinsically safe system containing the multicore cables and circuits shall specify the conditions of use resulting from the assessment described in 4.8.

Table 1 — Summary of interconnecting cable requirements

Core insulation 4.8.3.1	Dielectric test 4.8.3.2	Screen (60 %)	Additional conditions	Faults to be considered
Yes	Yes	Yes	None	None
Yes	Yes	No	Fixed and protected, ≤ 60 V	None
Yes	Yes	No	None	Yes (see 4.8.4.2)
No	No	No	None	Yes (see 4.8.4.3)

4.9 External pipes/optical fibres and electromagnetic radiation from equipment

4.9.1 External pipes/optical fibres

4.9.1.1 The total energy, capable of being converted into an ignition capable heated surface or hot particle, delivered by any pipe or fibre intended for continued operation in an explosive atmosphere, shall be restricted to a level incapable of igniting firedamp or an explosive dust cloud in the event of its release, for example, by damage to the pipe or fibre.

4.9.1.2 In the case of optical radiation, which is, or could be directed onto coal dust particles or other particles suspended in the air, either in normal operation or as a result of damage to the conducting medium, the radiated power shall be limited to:

- a radiated power of less than 150 mW, or
- a peak radiation flux of less than 20 mW/mm².

NOTE The above values are derived from levels shown to be safe when optical radiation impinges on dust particles suspended in methane/air mixtures in the form of an explosive atmosphere. They do not apply if the optical radiation can impinge on a coal dust layer and cause local heating in excess of 150 °C. In such cases, the maximum radiation values will have to be determined by tests which are outside the scope of this standard dealing with atmospheres.

4.9.1.3 Where the optically radiated power is not limited by means of an infallible energy source, or by the use of an infallible limiting device, and the optically radiated power is carried in a transmission medium (e.g. an optical fibre cable) which can, if damaged, for example by guillotining, expose the optically radiated power to a potentially explosive coal dust atmosphere, an interlock shall be provided which cuts off the radiated power at the transmitter, if either the transmission medium, or the energy received at the remote receiver becomes interrupted/lost.

4.9.2 Radio-frequency radiation from equipment

The amount of radio-frequency radiated power from equipment shall not exceed 6 W.

NOTE Member State Governments may impose stricter limits for radiated power output for reasons other than the risk of ignition of firedamp and/or coal dust. For example the avoidance of radio frequency ignition of electro-explosive devices (commonly known as detonators) by radio transmitters.

4.10 Protection of cells or batteries

4.10.1 Only cells or batteries meeting the requirements of EN 50020 Category “ia” in full (as described in clause 5) are permissible.

4.10.2 Cells or batteries intended to be re-charged in an explosive atmosphere shall be designed so that they can only be re-charged from an intrinsically safe circuit conforming to Category "ia" in EN 50020.

5 Category M1 equipment having the requisite level of protection in the event of two faults occurring independently of each other

5.1 General

Where equipment is constructed to be safe with two faults, it shall comply with any relevant explosion protection concept standard listed in clause 2 (see 9.1 relating to type testing).

NOTE At the present time only intrinsically safe "ia" equipment constructed in accordance with EN 50020 meets this requirement.

5.2 Intrinsically safe Category M1 electrical equipment

Intrinsically safe Category M1 electrical equipment shall meet the requirements of Intrinsically safe apparatus and associated apparatus as specified in EN 50020 Category "ia". Two examples of equipment that are safe with two faults are shown below in Figures 1 and 2.

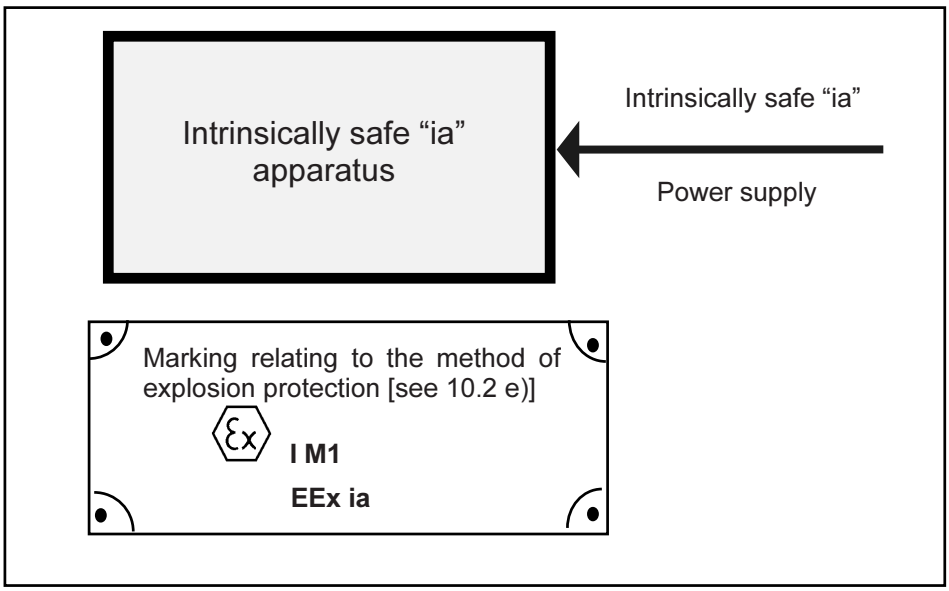

Figure 1 — Category "M1" intrinsically safe "ia" equipment

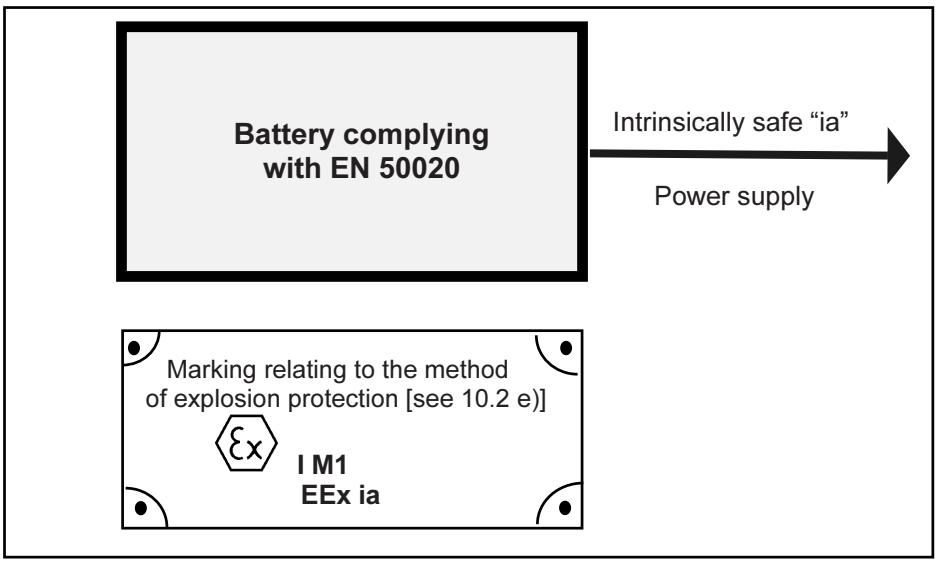

Figure 2 — Category “M1” intrinsically safe “ia” battery power supply

6 Category M1 equipment having the requisite level of protection using a second independent means

6.1 General

Where equipment is protected by two independent means of explosion protection, as described in 3.6 a), both forms of protection shall fully comply with the relevant explosion protection concept standard, as listed in clause 2, to which they are constructed (see 9.2.1 relating to type testing). It shall be possible to check each type of protection individually. If two protection measures are combined which both rely on the integrity of an enclosure, one of the following requirements shall be met.

a) There shall be two independent enclosures, each satisfying the requirements for the relevant type of explosion protection; or

b) There shall be a single enclosure, satisfying the requirements for both types of explosion protection and additionally capable of passing the mechanical impact test in EN 50014 at a value of 20 J; or

c) There shall be a single enclosure, satisfying the requirements for both types of explosion protection (including the relevant mechanical strength tests according to EN 50014, specified for unprotected locations), but with a restriction on use to locations which provide protection against mechanical damage. In this case the equipment is marked “X” and information provided in the instructions.

6.2 Requirements for an outer enclosure as the second independent means

6.2.1 Temperature rise limits

For equipment utilizing an outer enclosure as the second independent means of protection:

- the surface temperature of the first independent means (inner apparatus) shall not exceed the temperature values stated in 4.5.1 during normal working; and
- the outer enclosure shall not exceed the temperature values stated in 4.5.1 with the most arduous fault applied to the inner apparatus.

6.2.2 Outer enclosure with free space inside

Where the second independent means of protection is an enclosure and free space exists around the first independent means of protection inside the enclosure, only the following types of outer enclosure are permitted:

- a flameproof enclosure “d”,
- a pressurized enclosure “p” - with leakage compensation by an inert gas, or air which can be guaranteed to be free of flammable gas.

6.2.3 Outer enclosure with no free space inside

Where the second independent means of protection is an enclosure and no free space exists around the first independent means of protection inside the enclosure, only the following types of outer enclosure are permitted:

- an enclosure with encapsulation “m”;
- an enclosure with powder filling “q”.

6.2.4 Prevention of ingress of flammable dust and water

Where equipment is protected by two concepts of protection and the appropriate standard relating to the outer enclosure does not specify an “IP rating” in accordance with EN 60529, then the outer enclosure shall be at least IP54.

NOTE The above is based on the commonly used rating for increased safety “e” and intrinsically safe “i” equipment. In the case of flameproof enclosures, an IP rating is not normally specified; it will therefore be necessary to design the flameproof joints to provide appropriate sealing.

6.3 Restriction on Internal apparatus

6.3.1 Only the following types of explosion protected apparatus shall be used inside the types of outer enclosure with internal free space as described in 6.2.2. Examples and relevant marking are shown in Figures 3, 4 and 5.

- powder filling “q” (EN 50017)
- increased safety “e” (EN 50019)
- intrinsically safe “i” (EN 50020)
- encapsulation “m” (EN 50028)
- constructional safety “c” (EN 13463-5)

Additionally a flameproof “d” enclosure inside a pressurized “p” enclosure is permitted, but not the converse.

6.3.2 Only the following types of explosion protected apparatus shall be used inside the types of enclosure with no internal free space, described in 6.2.3. An example and relevant marking is shown in Figure 6.

- increased safety “e” (EN 50019)
- intrinsically safe “i” (EN 50020)
- encapsulated “m” (EN 50028) - providing it is inside a powder filled enclosure “q” (EN 50017)

6.4 Additional type testing for equipment utilizing a combination of flameproof and pressurization concepts of protection

Equipment utilizing a combination of flameproof and pressurization concepts of protection shall be submitted to the additional type testing described in 9.2.2.

6.5 Examples of Category M1 Equipment having two forms of protection listed in clause 2

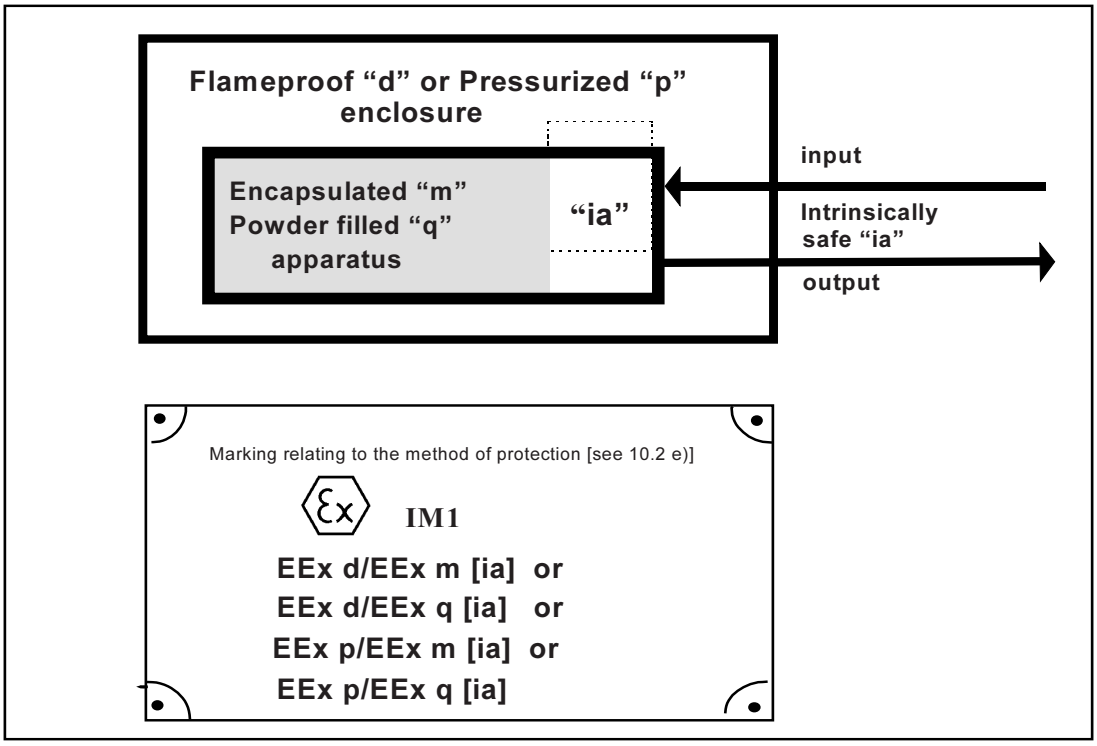

Figure 3 — Category “M1” encapsulated “m” or powder filled “q” apparatus inside a flameproof “d” or pressurized “p” enclosure (with optional power supplies)

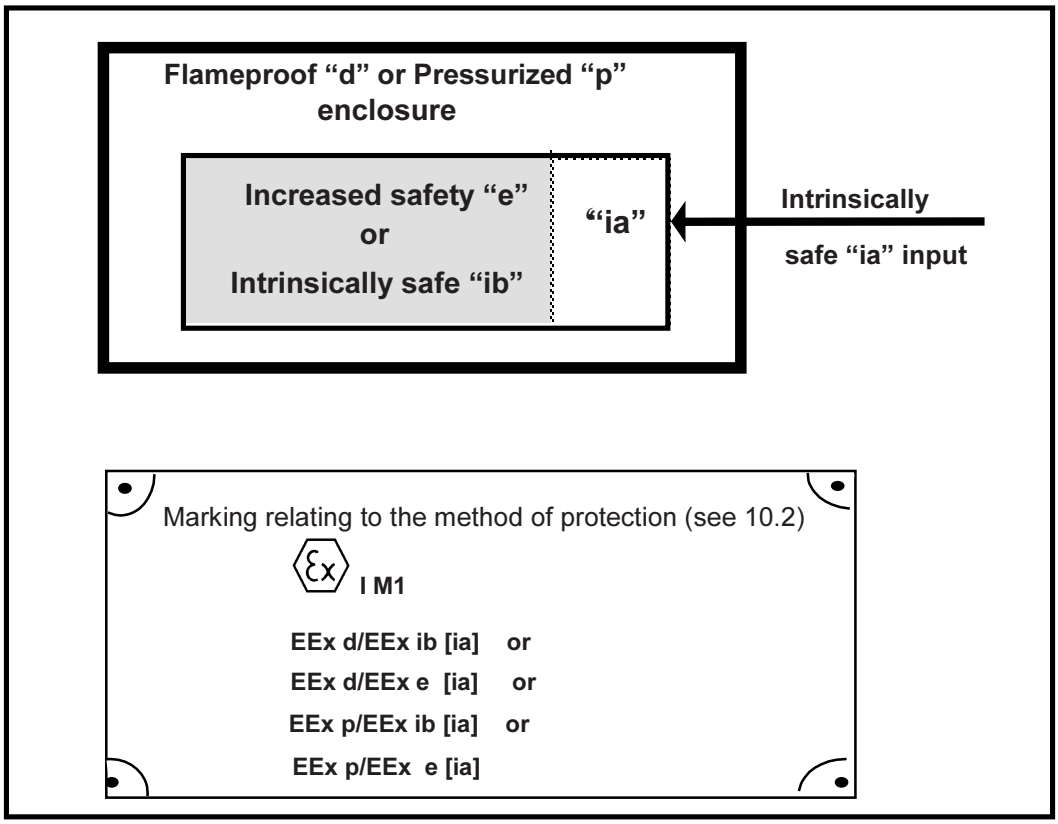

Figure 4 — Category "M1" increased safety “e” or intrinsically safe “ib” apparatus inside a flameproof “d” or a pressurized “p” enclosure

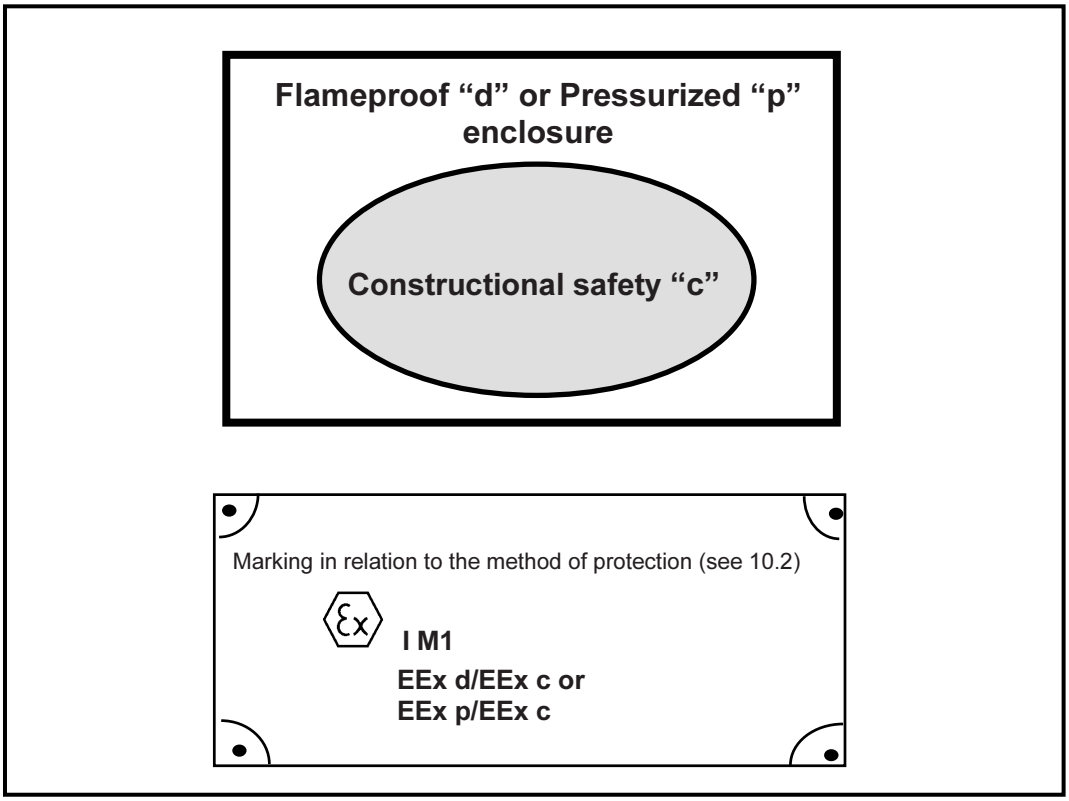

Figure 5 — Category “M1” constructional safety ‘c’ inside a flameproof ‘d’ or pressurized ‘p’ enclosure

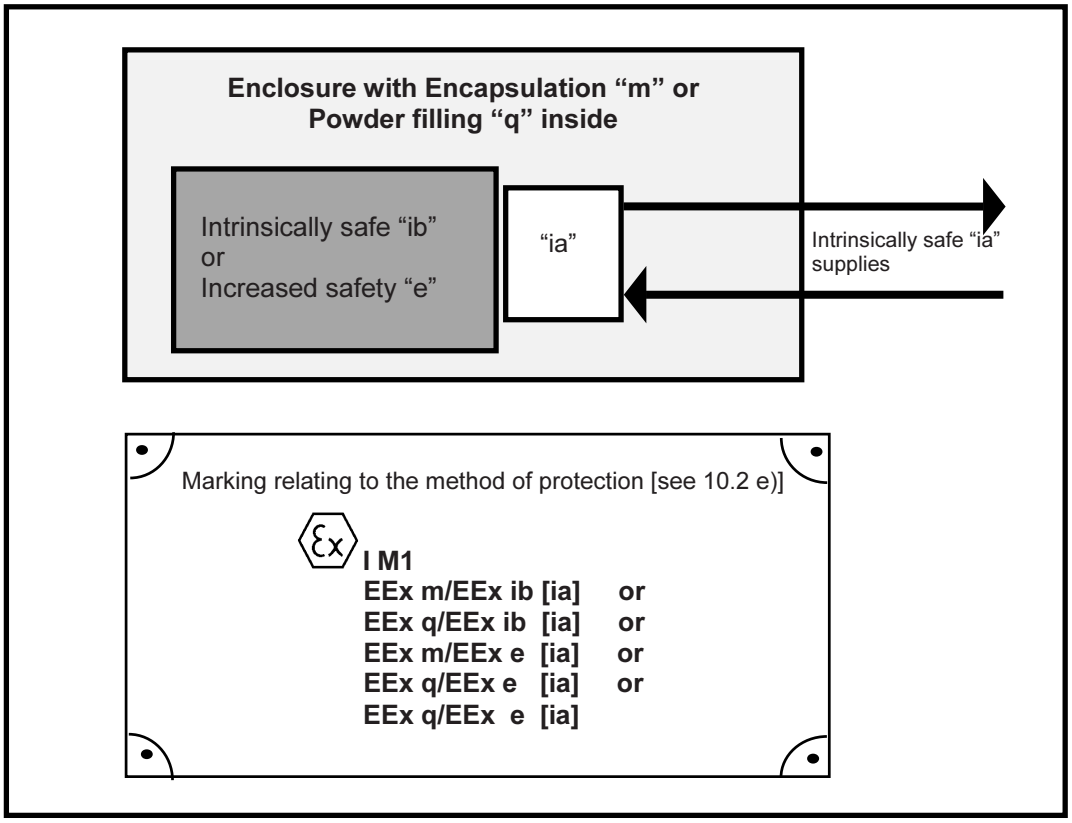

Figure 6 — Category "M1" intrinsically safe "ib" or increased safety "e" apparatus inside an enclosure with encapsulation "m" or powder filling "q"

7 Requirements for Category M1 flammable gas detectors with hot wire or hot pellistor sensing heads

7.1 General

All flammable gas detectors using a hot wire or hot pellistor sensing head inside a sampling chamber shall be either:

a) protected by two independent means of explosion protection, for example, by complying with 7.2 below; or

b) safe with two independent faults, for example conforming with EN 50020 in full, with the hot wire/pellistor tested in accordance with 10.7 of EN 50020 as a small (hot) component.

NOTE Gas sampling chambers may need to incorporate ingress protection to prevent coal dust entering and making contact with the hot components.

7.2 Flammable gas detectors having hot wire/component sensing heads, which are safe with one fault, applied and are additionally protected by an enclosure meeting the requirements of EN 50018

7.2.1 All parts of the instrument's electrical circuitry, except for the sensing head, shall meet the requirements of EN 50020 Category "ia" and any hot components/wires associated with the sensing head, operating at a temperature exceeding 530 °C, shall be protected as follows:

- mounting the hot component(s)/wires inside a sampling chamber which also acts as a flame arresting enclosure by virtue of complying with the relevant requirements of EN 50018; and
- arranging the hot component(s)/wires so that they are not able to come into contact with coal dust layers; and
- verifying that the hot component (s)/wires do not ignite the test mixture when subjected to the test in 9.3 with one fault applied.

NOTE 1 Countable faults include an increase in the power supply voltage, or loss of the catalytic action on the pellistor.

NOTE 2 For the purpose of this standard, 530 °C is assumed to be the hot surface ignition temperature of firedamp/air at normal atmospheric pressure.

7.2.2 Figures 7 and 8 show the typical arrangement of a fixed intrinsically safe firedamp monitoring transducer and a hand-held flammable gas detector protected by this arrangement.

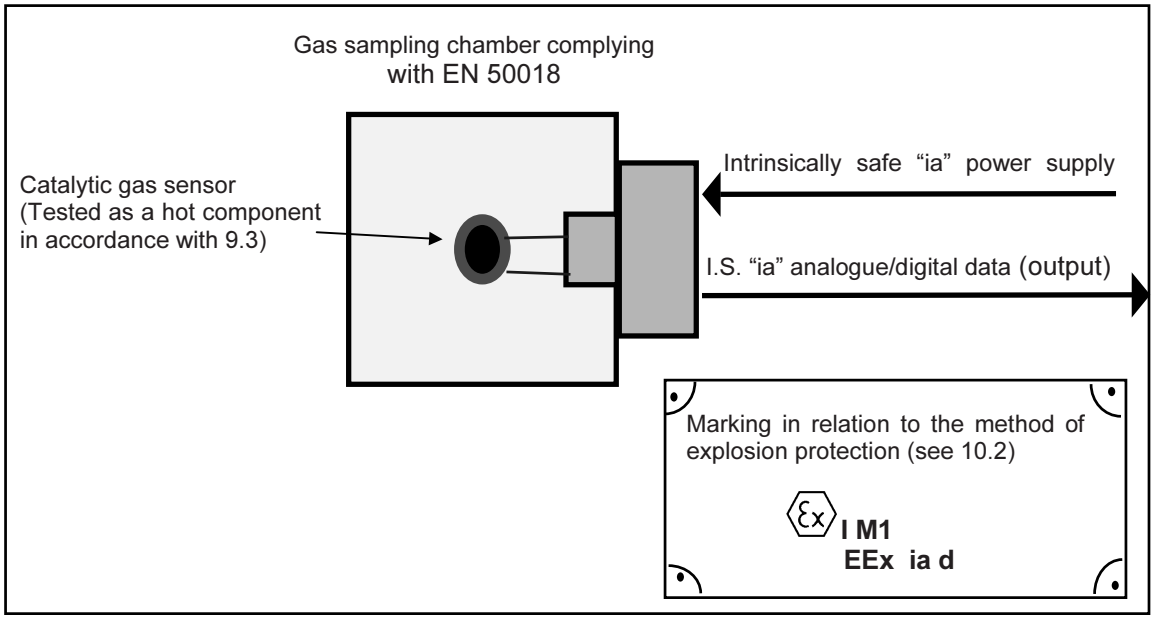

Figure 7 — Category M1 "ia d" fixed monitoring transducer

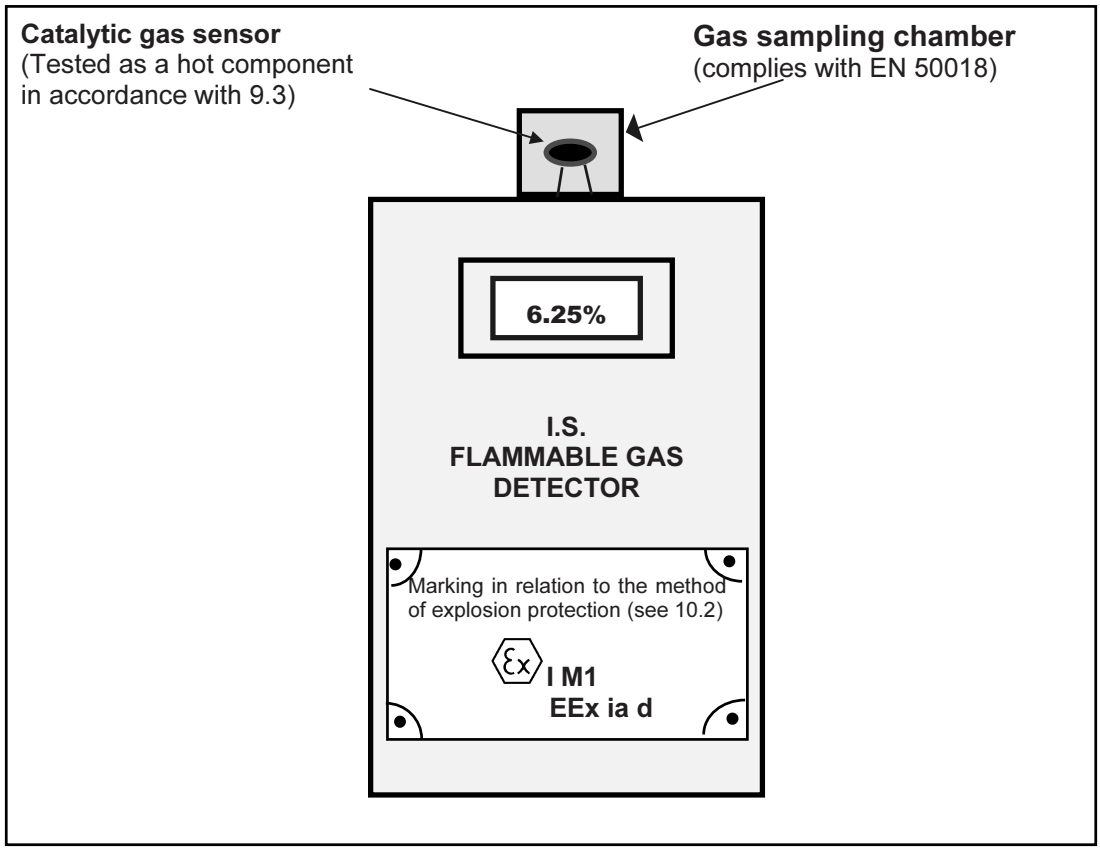

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Figure 8 — Category M1 "ia d" hand-held flammable gas detector

8 Requirements for Category M1 systems

8.1 Every Category M1 system shall be accompanied by a document listing the equipment and parts that may be connected into the system. This document shall also indicate how they are to be connected together and indicate any restrictions or limitations necessary to preserve the explosion protection.

8.2 Intrinsically safe electrical systems, or parts thereof, are Category M1 if they comply with the requirements for electrical equipment in clauses 4, 5 and 6, except that the intrinsically safe electrical system as a whole shall be considered as a single item of equipment and marked as such according to clause 10.

NOTE An intrinsically safe electrical system may also be placed on the market and put into service if it complies with EN 50039 after it has been amended to comply with the requirements of EU Directive 94/9/EC.

9 Type testing

9.1 Equipment meeting the requisite level of protection in the event of two faults, as described in clasue 5

Where only one type of explosion protection concept is utilized to meet the requisite level of protection for Category M1, as described in clause 5, the equipment shall be subjected to the type tests specified in the relevant explosion protection concept standard for that type of protection (e.g. EN 50020).

9.2 Equipment meeting the requisite level of protection by a second independent means, as described in clause 6

9.2.1 Where equipment meets the requisite level of protection for Category M1 using a combination of two or more of the protection concepts listed in clause 2, each type of protection shall be tested independently according to its relevant concept standard (based on the assumption that any protection offered by the second means is not effective). It shall then be tested to demonstrate that, in complying with this standard, none of the concepts used causes a reduction in the level of explosion protection offered by the other(s).

9.2.2 Where a flameproof enclosure is contained inside a pressurized enclosure the test for determining explosion pressure, over-pressure and non-transmission of flame, described in the relevant explosion protection concept standard (e.g. EN 50018) shall be performed at both normal atmospheric pressure and at the maximum normal working pressure used inside the pressurized enclosure.

9.3 Type test for hot pellistors/hot wires used in flammable gas detector sensing heads

9.3.1 The number of items tested shall be ten hot components/wires of the same type, having the same constructional dimensions and chemical composition. In the case of catalytic pellistors, the test shall be performed on ten pellistors incorporating their normal catalysts and ten pellistors without their normal catalytic preparation. If the catalytic pellistors are located inside a small container, the container shall be removed for the test.

9.3.2 Whenever practical, the component/wire shall be subjected to the test while mounted as it is intended to be used in service. If this is not practical, then the test shall be performed in such a way as to best simulate its conditions of usage, taking account of other adjacent components and/or parts which may affect its operating temperature, the flow of gases over its surface and the ventilation around it. If the instrument contains more than one hot component/wire in normal operation, the test shall be performed with all hot components at their maximum surface temperature.

9.3.3 The test shall be conducted under the conditions that produce the maximum release of thermal energy from the component/wire with any user adjustable settings arranged to represent the most unfavourable circumstances.

9.3.4 The method of test shall be as follows.

a) Surround the component/wire with an explosive gas mixture of 6,5 % ± 0,2 % methane in air.

b) Apply power to the component/wire, with the voltage set to the maximum normally applied in service.

c) Gradually increase the voltage until 1,5 times the normal power consumption of the component is reached.

d) Continue the test with the component/wire surrounded by the test mixture until thermal equilibrium of the component/wire is obtained. That is, when three successive readings taken at 10 % of the previously elapsed duration of the test (but not less than 5 minutes) indicates less than a 5 % change in temperature, or until either:

   — the temperature of the component/wire falls below 530 °C; or
   — the device is dissipating less than 5% of its maximum power,

   as result of failure of the component/ wire.

e) If the test is terminated by failure of the component/wire, any remaining samples shall be tested with the power reduced to a level marginally below that which causes failure of the component/wire.

f) Record any ignition of the test gas mixture. The appearance of a cool flame shall be considered as an ignition. Detection of ignition shall either be visual, or by measurement of the temperature e.g. by thermocouple.

g) If no ignition of the test mixture occurs during the test, the presence of an explosive test mixture shall be verified by igniting it after each test by some other means.

10 Marking requirements

10.1 All Category M1 equipment conforming to this standard shall be marked on the main part in a visible place. This marking shall be legible and durable, taking into account possible chemical corrosion.

10.2 The marking shall contain any information required as a result of it complying with the requirements of 4.2 and/or 4.3 and, if not otherwise required, at least the following:

a) the name and address of the manufacturer;

b) the designation of series or type;

c) the serial number, if any;

d) the year of construction;

e) the specific marking of explosion protection  followed by:

1) the figure “I” to indicate Group I;
2) the figures “M1” to indicate the category within Group I;
3) the figures “Eex”;
4) the symbol(s) to indicate the explosion protection concept(s) used (see clause 2);

NOTE 1 See Figures 1 – 8 which only include the above marking.

f) the symbol “X” or a warning if special conditions of safe use apply.

NOTE 1 For equipment certified as complying with 94/9/EC, the CE marking and the number of the Notified Body responsible for the production control phase should also be shown.

10.3 Where different types of protection are used on different parts of the equipment, each respective part shall bear the symbol for the type of explosion protection used. Where more than one type of explosion protection is used, the symbol for the main type of protection shall appear first and be followed by the symbols for the other types of protection.

10.4 On very small equipment where there is limited space the marking required by 10.2 may be put on a tag or label attached or near the equipment.

11 Instructions

All equipment shall be accompanied by the instructions required as a result of it complying with the requirements of 4.2 and/or 4.3 and additionally, any other instructions necessary for the safe installation, assembly/dismantling, operation, maintenance, adjustment and use of any interconnecting parts of the equipment, including interconnecting cables and pipes.

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