



SLOVENSKI STANDARD
SIST EN 50303:2000
01-december-2000

Oprema skupine I, kategorije M1, ki ostane v delovanju v atmosferah, ki jih ogroža jamski eksplozivni plin ali premogov prah

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

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

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

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29.260.20	29.260.20	Electrical apparatus for explosive atmospheres
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EUROPEAN STANDARD

EN 50303

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2000

ICS 29.260.20

English version

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intended to remain functional in atmospheres endangered
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This European Standard was approved by CENELEC on 2000-04-01. CENELEC 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 CENELEC 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 CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Standard was prepared 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
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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 <https://standards.iteh.ai/catalog/standards/sist/59ba8750-51e9-427f-9241-51904641b0a3>
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 characterised 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.

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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, ionising radiation, non-ionising 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 temperature 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 cm² 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 utilised, 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 3000 V (rms) + (2000 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 1000 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 1000 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 2000 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.