

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 38: Equipment and components in explosive atmospheres in underground mines

Atmosphères explosives –
Partie 38: Appareils et composants destinés à être utilisés dans les mines souterraines grisouteuses



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NORME INTERNATIONALE

Explosive atmospheres –
Part 38: Equipment and components in explosive atmospheres in underground mines

Atmosphères explosives –
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EXPLOSIVE ATMOSPHERES –

Part 38: Equipment and components in explosive atmospheres in underground mines

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International Standard ISO/IEC 80079-38 has been prepared by subcommittee 31M: Non-electrical equipment and protective systems for explosive atmospheres, of IEC technical committee 31: Equipment for explosive atmospheres.

It is published as a double logo standard.

The text of this standard is based on the following documents of the IEC:

FDIS	Report on voting
31M/105/FDIS	31M/111/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 13 P members out of 21 having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

"A list of all parts in the IEC 60079 series, under the general title *Explosive atmospheres*, as well as the International Standard 80079 series, can be found on the IEC website."

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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INTRODUCTION

This part of ISO/IEC 80079 specifies requirements for the constructional features of equipment and components that may be an individual item or form an assembly, to enable them to be used in mines, or parts of mines, susceptible to explosive atmospheres of firedamp and/or combustible dust.

Most of the electrical equipment used on mining machinery is certified as an individual item of equipment, e.g. the motor, switchgear etc., and meets its own marking requirements. This certification, however, does not deal with the interconnection of these items of equipment by cables or the machine electrical power system as an entity. The equipment and components, including their interconnections, should be assessed, from an ignition point of view, by the manufacturer.

Both non-electrical equipment and the interconnection of electrical/non-electrical equipment require an ignition hazard assessment.

Therefore, it is necessary that not just the equipment, but all its parts, is examined by the manufacturer according to a formally documented ignition hazard assessment that establishes and lists all the possible ignition sources of the equipment including the cables and electrical supply system. The documentation shall list the measures that shall be introduced to keep possible ignition sources from becoming effective.

The need for this International Standard arises because of major operational differences between underground mining operations and those in other industries working with, or in, explosive atmospheres. Examples of these differences are:

- the product being won from the underground strata may be combustible and may continually release firedamp during the winning process;
- the ignitability of the atmosphere around equipment and components usually depends upon the amount of dilution offered by an active ventilating system;
- the atmosphere in the general body of mine air in which machinery is working may change from one that is potentially explosive to one that is explosive (for example, during an outburst of firedamp);
- persons working in the mine are usually situated within the potentially explosive atmosphere;
- there is a need to monitor constantly the mine atmosphere at strategic places to ensure that power can be disconnected from all equipment except Ma equipment which is suitable for use in a constantly explosive atmosphere;
- in gassy coal mines, an explosion of firedamp at a machine can raise a combustible dust cloud that exacerbates the explosion;
- some mining machinery, especially that associated with winning the product, contains cutting devices and drilling devices that are intended to cut into the combustible product as part of their normal operation. This introduces an ignition risk from frictional heating or frictional sparking from contact with strata containing high concentrations of quartz or iron pyrites;
- long roadways in coal mines are equipped with mineral conveying systems carrying a product that has a potential for raising a combustible dust cloud and the production of firedamp.

To decide which equipment or its component parts should merit inclusion in this International Standard, ignition data has been examined based on international experience.

When drafting this International standard, it has been assumed that equipment and components are:

- designed in accordance with good engineering practice, taking account of expected shocks, vibrations and failure modes;
- of sound mechanical and electrical construction;
- made of materials with adequate strength and of suitable quality;
- free from defects; and
- kept in good repair and working order, e.g. so that the required dimensions remain within permissible tolerance despite wear.

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EXPLOSIVE ATMOSPHERES –

Part 38: Equipment and components in explosive atmospheres in underground mines

1 Scope

This part of ISO/IEC 80079 specifies the explosion protection requirements for the design, construction, assessment and information for use (maintenance, repair, marking) of equipment that may be an individual item or form an assembly.

This includes machinery and components for use in mines susceptible to explosive atmospheres of firedamp and/or combustible dust. The standard atmospheric conditions (relating to the explosion characteristics of the atmosphere) under which it may be assumed that equipment can be operated are:

- temperature -20 °C to +60 °C;
- pressure 80 kPa (0,8 bar) to 110 kPa (1,1 bar); and
- air with normal oxygen content, typically 21 % v/v.

This part of ISO/IEC 80079 applies for equipment and components according to EPL Mb to be used in explosive atmospheres containing firedamp and/or combustible dust.

NOTE 1 In some countries, there might be differences according to the classification, e.g. Mb is similar to category M2 in the European Union.

For equipment and components according to EPL Ma, the requirements of this standard and of ISO 80079-36 and IEC 60079-0 apply.

NOTE 2 A standard with additional requirements for EPL Ma is under preparation.

It is necessary to take account of external conditions to the equipment which may affect the hazard and the resultant protection measures. These measures may include ventilation, gas detection or gas drainage.

This part of ISO/IEC 80079 also deals with the prevention of ignitions of explosive atmospheres caused by burning (or smouldering) of combustible material such as fabric fibres, plastic "O"-rings, rubber seals, lubricating oils or greases used in the construction of the equipment if such items could be an ignition source. For example, the mechanical failure of rotating shaft bearings can result in frictional heating that ignites its plastic cage, plastic seal or lubricating grease.

Detailed requirements and test procedures for the fire protection of conveyer belts are not part of this part of ISO/IEC 80079.

2 Normative references

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

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-25, *Explosive atmospheres – Part 25: Intrinsically safe electrical systems*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60204-11, *Safety of machinery – Electrical equipment of machines – Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV*

IEC 60332-1 (all parts), *Tests on electric and optical fibre cables under fire conditions*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 62061, *Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*

ISO 340, *Conveyor belts – Laboratory scale flammability characteristics – Requirements and test method*

ISO 630-5, *Structural steels – Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance*

ISO 1940-1, *Mechanical vibration – Balance quality requirements for rotors in a constant (rigid) state – Part 1: Specification and verification of balance tolerances*

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

ISO 13849-1, *Safety of Machinery – Safety-related parts of control systems – Part 1: General principles for design*

ISO 14916, *Thermal spraying – Determination of tensile adhesive strength*

ISO 14935, *Petroleum and related products – Determination of wick flame persistence of fire-resistant fluids*

ISO 15029-1, *Petroleum and related products – Determination of spray ignition characteristics of fire-resistant fluids – Part 1: Spray flame persistence – Hollow-cone nozzle method*

ISO/TS 15029-2, *Petroleum and related products – Determination of spray ignition characteristics of fire-resistant fluids – Part 2: Spray test – Stabilized flame heat release method*

ISO 80079-36:2016, *Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements*

ISO 80079-37:2016, *Explosive atmospheres – Part 37: Non-electrical equipment for explosive atmospheres – Non-electrical type of protection constructional safety ‘c’, control of ignition sources ‘b’, liquid immersion ‘k’*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60079-0, ISO/IEC 80079-36, ISO/IEC 80079-37 and the following apply.

3.1**firedamp**

flammable mixture of gases naturally occurring in a mine

Note 1 to entry: As firedamp consists mainly of methane, the terms firedamp and methane are used frequently in mining practice as synonyms.

[SOURCE: IEC 60079-0:2011, 3.34, Note modified]

3.2**protection against firedamp explosions**

explosion prevention and protection in underground parts of mines and those parts of surface installations of such mines liable to be endangered by firedamp and or flammable dust

3.3**flammable substance**

substance in the form of gas, vapour, liquid, solid, or mixtures of these, able to undergo an exothermic reaction with air when ignited

3.4**component**

any item essential to the safe functioning of equipment and protective systems but with no autonomous function

3.5**equipment**

machines, apparatus, fixed or mobile devices, control components and instrumentation thereof and detection and prevention systems which, separately or jointly, are intended for the generation, transfer, storage, measurement, control and conversion of energy, for the processing of material, and which may be capable of causing an explosion through their own source(s) of ignition

[SOURCE: ISO/IEC 80079-36:2016, 3.10]

3.6**explosion**

sudden increase of pressure and temperature, due to oxidation or other exothermic reaction

[SOURCE: IEC 60050-426:2008, 426-02-13, modified, (removal of "(of an explosive atmosphere)" from the title)]

3.7**explosive atmosphere**

mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, dust, fibres, or flyings which, after ignition, permits self-sustaining propagation

[SOURCE: IEC 60079-0:2011, 3.30]

3.8**intended use**

use of equipment, protective systems and devices in accordance with the equipment group and equipment protection level (EPL), and taking into account all the information supplied by the manufacturer which is required for the safe functioning of equipment, protective systems and devices

3.9 **machinery**

assembly, fitted with or intended to be fitted with a drive system consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application

Note 1 to entry: The term "machinery" also covers an assembly of machines which, in order to achieve the same end, are arranged and controlled so that they function as an integral whole.

[SOURCE: ISO 12100]

3.10 **malfunction**

equipment or components which do not perform their intended function with respect to explosion protection

Note 1 to entry: For the purposes of this standard this can happen due to a variety of reasons, including

- failure of one (or more) of the component parts of the equipment or components;
- external disturbances (e.g. shocks, vibration, electromagnetic fields);
- design error or deficiency (e.g. software errors);
- disturbance of the power supply or other services;
- loss of control by the operator (especially for hand-held machines).

[SOURCE: IEC 60079-0:2011, 3.41]

3.11 **minimum ignition energy** **MIE**

lowest stored energy which upon discharge is sufficient to effect ignition of the most ignitable atmosphere under specified test conditions

3.12 **potentially explosive atmosphere**

atmosphere which could become explosive due to local and operational conditions

3.13 **self-ignition of dust in bulk**

ignition of dusts caused by the rate of heat generation from oxidation and/or decomposition reactions of the dust being greater than the rate of heat loss to the surroundings

3.14 **equipment protection level** **EPL**

level of protection assigned to equipment based on its likelihood of becoming a source of ignition and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres in mines susceptible to firedamp and/or combustible dust

Note 1 to entry: The equipment protection level may optionally be employed as part of a complete risk assessment of an installation.

[SOURCE: IEC 60079-0:2011, 3.26, modified (addition of "combustible dust" and removal of the reference to IEC 60079-14 in the note)]

3.15 **EPL Ma**

equipment for installation in a mine susceptible to firedamp and/or combustible dust, having a "very high" level of protection, which has sufficient security that it is unlikely to become an

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ignition source in normal operation, during expected malfunctions or during rare malfunctions, even when left energized in the presence of an outbreak of gas

[SOURCE: IEC 60079-0:2011, 3.26.1, modified by addition of “combustible dust”]

3.16

EPL Mb

equipment for installation in a mine susceptible to firedamp and/or combustible dust, having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized

[SOURCE: IEC 60079-0:2011, 3.26.2, modified by addition of “combustible dust”]

3.17

maximum surface temperature

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

Note 1 to entry: The surface temperature which is relevant can be internal or external depending upon the type of ignition protection concerned.

Note 2 to entry: In order to avoid ignition it follows that the maximum surface temperature should be lower than the ignition temperature of the explosive atmosphere.

Note 3 to entry: For Ex equipment in an explosive dust atmosphere, this temperature occurs on the external surface of the enclosure and may include a defined dust layer condition

[SOURCE: ISO/IEC 80079-36:2016, 3.4, addition of Note 2]

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3.18

non-electrical equipment

equipment which can achieve its intended function mechanically

Note 1 to entry: Equipment addressed in ISO 80079-36 can be powered by any kind of energy including electrical equipment.

[SOURCE: ISO/IEC 80079-36:2016, 3.7]

3.19

mechanical sparks

sparks, as well as showers of sparks, produced by impact or friction between two similar or dissimilar solid materials

3.20

incendive sparks

mechanical sparks with sufficient thermal energy to ignite a flammable atmosphere

3.21

hydraulic fluids

all fluids and their concentrates for hydraulic transmission and monitoring with exception of water