

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Explosive atmospheres –  
Part 33: Equipment protection by special protection “s”**  
**ITeH STANDARD PREVIEW**  
**(standards.iteh.ai)**

**Atmosphères explosives –  
Partie 33: Protection du matériel par protection spéciale “s”**  
**IEC 60079-33:2012**  
<https://standards.iteh.ai/catalog/standards/sis/2a5a7014-81a0-4ecb-9a4d-d80fe5a7f239/iec-60079-33-2012>



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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**EXPLOSIVE ATMOSPHERES –**

**Part 33: Equipment protection by special protection “s”**

FOREWORD

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International Standard IEC 60079-33 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

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

FDIS	Report on voting
31/997/FDIS	31/1011/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.

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

A list of all parts in the IEC 60079 series, published under the general title *Explosive atmospheres*, 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,
- withdrawn,
- replaced by a revised edition, or
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## INTRODUCTION

This part of IEC 60079 was created in response to a request from the IECEx certification system to provide a set of requirements to be used for certification within the IECEx product certification scheme when the standards for existing types of protection were not applicable.

The present standard refers to the use of one or more independent verifiers, in accordance with ISO/IEC rules on the writing of standards that mitigate against specifying particular forms of conformity assessment. The IECEx system will specify how the term "independent verifier" will be interpreted for the purposes of the scheme. For example, it may specify that in the case of three independent verifiers they shall all be certification body members of the scheme, each accepted specifically for the purpose of assessing special protection applications and each from a separate member country of the system.

The purpose of IEC 60079-33 special protection "s" for any equipment protection level (EPL) is to allow design, assessment and testing of equipment or parts of equipment that cannot be fully assessed within a recognized type of protection or combination of recognized types of protection because of functional or operational limitations and where the desired equipment protection level can be achieved by the use of this standard.

Special protection "s" allows a design concept that cannot comply in full with recognized types of protection, or where the design concept is not covered by recognized types of protection.

When specification for the equipment includes aspects as given above, additional information and data may be required from

- technical research,
- evaluation of existing data and information.

Manufacturers should first consider the possibilities for design to the recognized types of protection, or to combinations of recognized type of protection, before proceeding to special protection "s".

This standard is intended to provide a framework to demonstrate how essential safety requirements can be met if not covered by established standards, thus allowing for innovation and dealing with unknowns.

When equipment intended to meet a recognized type of protection does not comply with all the provisions of the relevant standard, it is not to be considered under this standard unless:

- it can be clearly demonstrated that complete compliance with the type of protection is not practicable; and
- additional measures have been applied to establish an equivalent protection level.

Special protection "s" is based on identification of failure modes and ignition hazard assessment in the identified modes. In this regard, the assessed safety of the assigned EPL of the equipment will satisfy the EPL requirements and, where appropriate, be at least equivalent to the EPL provided by the defined levels for the recognized types of protection.

IEC 60079-26 [1]<sup>1</sup> provides for requirements for equipment with EPL Ga and Ga/Gb but depends on combining types of protection already described in other parts of the IEC 60079 series.

The responsibility of initially demonstrating the need to design for special protection "s" and establishing the criteria for verification lies with the manufacturer. The specification defines

<sup>1</sup> Figures in square brackets refer to the Bibliography.



the safety concepts and shows how the essential safety requirements are to be achieved. It is likely this will be done in consultation with experts in the assessment of explosion protection techniques.

The requirements in this standard take into account:

- allowance for first, second or third party verification;
- the use of EPLs;
- the use of equipment groups for mining, gas and dust;
- alignment with existing temperature requirements;
- compatibility with the marking requirements given in IEC 60079-0.

Where requirements for a product/design concept are developed and intended for repeated use in subsequent designs, they should be reviewed and, provided the manufacturer is prepared to release the intellectual property, be included initially in an annex of this standard with the intention of being removed and relocated to an appropriate place at a later time, e.g. in an existing or new type of protection standard.

Unlike other recognized types of protection, special protection “s” may require the application of reliability engineering tools and procedures such as failure modes and effects analysis (FMEA), fault tree analysis (FTA) and failure modes, effects and criticality analysis (FMECA) to identify the failure modes of the equipment being tested. This type of analysis will ensure that the failure modes and corresponding mitigation designs are addressed by the most appropriate testing strategies, which simulate the environment in which the equipment will be operated, with appropriate factors of safety applied.

The probability of failure of the identified failure modes may need to be demonstrated to be of a similar likelihood as the failures expected in recognized types of protection.

Full life cycle conditions may need to be considered and any restrictions may form part of the mandatory directions for use of the equipment to ensure EPLs are maintained during the operational life of the equipment.

By its very nature, assessment and testing to special protection “s” cannot be as prescriptive as for the recognized types of protection. It is anticipated that considerable dialogue is required between the manufacturer and an independent verifier. Additional assessment and testing may be identified by the independent verifier to ensure the relevant EPL is achieved.

When undertaking verification, it is strongly recommended the guidance provided in this standard is followed including:

- applying different levels of verification to match the EPL (similar in concept to the approach given in the IEC 61508 series);
- always involving at least one independent person/organization (an independent verifier);
- not using personnel who have had any involvement in research or determining the criteria for establishing the essential safety requirements in conjunction with the manufacturer.

Where it is intended to apply the requirements of this standard within a certification system/scheme, the following recommendations are made:

- the requirements laid down in EN 50495 [2] for safety devices are observed;
- an assessment should be performed by independent certification bodies (as the independent verifier) according to the requirements in this standard before issuing a certificate of conformity;
- a certification body performing an assessment for equipment not covered by recognized types of protection should have demonstrated expertise in the field under question.

The need for a standard to address special protection “s” can be justified on the basis that:

- provision has been in IEC 60079-0 for many years with reference Ex “s” in a note in the marking requirements or elsewhere. This reference goes back to IEC standards that pre-date 1957;
- there have been standards used on a national basis for many years for certification to special protection “s”. Examples are SFA 3009 in the UK and AS/NZS 1826 in Australia and New Zealand;
- it is necessary to have an international approach that is consistent;
- there is an identified need and has been a request for a special protection “s” standard from IECEx.

Support for the approach in the standard:

- the approach draws on the experience of the use of verifiers already in other IEC standards.

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## EXPLOSIVE ATMOSPHERES –

### Part 33: Equipment protection by special protection “s”

#### 1 Scope

This part of IEC 60079 gives the specific methodology for the assessment and testing, and requirements for marking of electrical equipment, parts of electrical equipment and Ex components with special protection “s”.

This part of IEC 60079 applies to

- electrical equipment employing a method of protection not covered by any existing standard in the IEC 60079 series,
- electrical equipment employing one or more recognized types of protection where the design and construction is not fully compliant with the standard for the type of protection,
- electrical equipment where the intended use is outside the parameters of the scope of the standard for the type of protection.

This part of IEC 60079 is not intended for equipment that is covered by the scope of other IEC 60079 equipment standards unless

- it is clearly demonstrated that compliance with the type of protection is not feasible, and
- additional measures are applied to establish an equivalent equipment protection level.

This part of IEC 60079 for special protection “s” is applicable to Group I, Group II and Group III and for equipment protection levels Ma, Mb, Ga, Gb, Gc, Da, Db and Dc, as defined in IEC 60079-0.

Certain specific guidance for assessment and testing are provided in the annexes to this standard.

This standard supplements and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirement of this standard shall take precedence.

NOTE 1 This standard may be used where equipment requires a higher EPL than the underlying protection techniques provide. Additional control measures or additional design and test requirements would be applied.

NOTE 2 Parts of equipment that can be designed and tested to standardized techniques should be so designed. Only those parts where conformance with essential safety requirements is achieved through alternative controls should be considered for special protection “s”. Equipment similar in attributes and performance to other equipment within a particular type of protection should be reviewed first to that method of protection prior to being considered for the use of Ex “s”. Some parts of IEC 60079 allow a degree of variance from the equipment requirements and where determined to be close enough by independent verifiers, then it is preferable to prescribe to the original type of protection.

#### 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 (all parts), *Explosive atmospheres*

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

IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*

IEC 60079-29-2, *Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*

IEC 61511 (all parts), *Functional safety – Safety instrumented systems for the process industry sector*

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

ISO 13849-1:2009, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

ISO 13849-2, *Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

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### 3 Terms and definitions

[IEC 60079-33:2012](https://standards.iteh.ai/catalog/standards/sist/2a3a7b14-81a0-4eeb-9a4d-c80c5a4259cc-iec-60079-33-2012)

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For the purposes of this document the terms and definitions given in IEC 60079-0, as well as the following, apply.

#### 3.1

##### **hybrid mixture**

mixture of a flammable gas with a combustible dust

#### 3.2

##### **special protection “s”**

concept to allow design, assessment and testing of equipment that cannot be fully assessed within a recognized type of protection or combination of recognized types of protection because of functional or operational limitations, but which can be demonstrated to provide the necessary equipment protection level (EPL)

#### 3.3

##### **recognized type of protection**

type of protection, other than special protection “s”, as listed in IEC 60079-0 and with defined design, construction, assessment and test requirements

#### 3.4

##### **independent verifier**

person or organization, with the appropriate competency in the applied explosion protection methodology, responsible for the verification of design calculations, assessment and testing who are separate and distinct by management and other resources including financial, from the person or organizations responsible for all the activities associated with the design, manufacture or sales of the equipment

Note 1 to entry: This may be a second or third party assessor, a test laboratory, a certifying body, etc.

## 4 General

### 4.1 Application

Special protection “s” allows for the design of a product that cannot comply in full with recognized types of protection or where the standards for the recognized types of protection do not cover the required operating conditions such as:

- outside normal atmospheric pressure given in the IEC 60079 series;
- above normal oxygen content;
- outside the temperature ranges given in IEC 60079 series;
- hybrid mixtures (gas and dust).

NOTE Additional consideration and additional testing related specifically to the intended conditions of use could be necessary. This is particularly important when the types of protection “d” (flameproof enclosure – IEC 60079-1 [3]) and “i” (intrinsic safety – IEC 60079-11 [4]) are applied. Such conditions might include hypobaric, hyperbaric and oxygen enriched atmospheres.

The IEC 60079 series for types of protection provide multiple methods to design products for use in explosive atmospheres and is recommended as a first consideration. Where equipment design contains innovative, unique or alternative explosion protection which does not align with the recognized types of protection, the equipment design may be evaluated as special protection “s”.

When equipment is designed with the intention of meeting a recognized type of protection, but does not or cannot comply with all the provisions of the relevant standard it shall not be considered under this standard unless:

- it is clearly demonstrated that compliance with the type of protection is not feasible; and
- additional measures are applied to establish an equivalent equipment protection level.

### 4.2 Equipment group and temperature classification

The equipment grouping and temperature classification defined in IEC 60079-0 for the use of equipment in explosive gas atmospheres apply to special protection “s” equipment. The subdivisions A, B and C for equipment of Group II and Group III also apply.

For temperature classification, the limiting parameters, including external influences, shall be specified such that the maximum permissible temperature is not exceeded taking into account the relevant level of protection “sa”, “sb” or “sc” as required by Clause 7.

Equipment that comprises special protection “s” parts combined with parts with different protection techniques should generally be designed, tested and marked for the equipment grouping, temperature classification and EPL appropriate to the other techniques.

### 4.3 Level of protection (equipment protection level (EPL))

Electrical equipment with special protection “s” shall be either

- level of protection “sa” (EPL “Ma, Ga, Da”), or
- level of protection “sb” (EPL “Mb, Gb, Db”), or
- level of protection “sc” (EPL “Gc, Dc”).

The requirements of this standard shall apply to all levels of special protection “s” (EPLs) unless otherwise stated.

#### 4.4 Manufacturer's justification

The documented justification shall be prepared and provided to the independent verifier for the application of special protection "s" and shall include:

- the details of considerations given to the possibilities for design to the recognized types of protection, or to combinations of recognized types of protection, before proceeding to special protection "s";
- aspects that are covered by the standards for any recognized type of protection applied; and
- those aspects that are not covered by verification to recognized types of protection.

The limiting parameters shall be specified, including all relevant ratings.

The documentation shall provide the evidence to support the claimed level of protection and shall include the proposed schedule of assessment and tests.

NOTE Documentation may take the form of a safety file defined in the IEC 61508 series and could include FMEA, HAZOPS, etc. As an example, in an FMEA, a fault may result from a failure of the component parts of the electrical equipment or from anticipated externally applied influences. Two independent malfunctions which may occur more frequently and which, separately, would not create an ignition hazard but which, in combination, could create a potential ignition hazard, should be regarded as occurring together to form a single fault.

#### 4.5 Verification

Explosion protection of electrical equipment is generally achieved through one or more of the following methods of protection:

- containment of internal explosion;
- exclusion of explosive atmosphere; [IEC 60079-33:2012](https://standards.iteh.ai/catalog/standards/sist/2a3a7b14-81a0-4eeb-9a4d-d80fe5a7f239/iec-60079-33-2012)
- avoidance of ignition source; <https://standards.iteh.ai/catalog/standards/sist/2a3a7b14-81a0-4eeb-9a4d-d80fe5a7f239/iec-60079-33-2012>
- energy limitation, both sparking and thermal;
- dilution.

Special protection "s" uses one or a combination of these methods, and the verification shall identify the methods of protection used and how the implementation for each has been achieved.

The independent verifier/s (see Clause 5) shall ensure all applicable requirements of IEC 60079-0 and those other parts of the IEC 60079 series relating to the recognized types of protection identified for the equipment are met, except as varied in Clauses 8, 9, 10 and 11.

### 5 Independent verifier

#### 5.1 General

By its very nature, testing and assessment to special protection "s" cannot be as prescriptive as for other techniques. It is anticipated that considerable dialogue is required between the manufacturer and an independent verifier. Additional tests may be required by an independent verifier to ensure the relevant level of safety is achieved.

NOTE An independent verifier may be an individual or an organization.

#### 5.2 Competence

The process of verification is critical to the correct application of special protection "s" and this requires that the independent verifier shall be able to demonstrate the following knowledge and skills:

- a) a broad knowledge of Ex philosophies including an understanding of
  - i) the ignition properties of flammable and combustible materials,
  - ii) the properties, mechanisms and control of ignition, and
  - iii) the full range of protection techniques in the IEC 60079 series;
- b) access to or involvement in
  - i) IEC or national standards such that there is assured access to knowledge of all current activities related to the equipment being assessed, and
  - ii) research related to the proposed method of protection;
- c) in-depth specific knowledge of the technique or method being assessed;
- d) knowledge of and experience in the assessment of test facilities, equipment, procedures and personnel;
- e) documentation and reporting skills.

### 5.3 Duties

The independent verifier shall

- a) obtain a detailed knowledge of the technique or method being proposed,
- b) review the proposed test specification and verification protocol,
- c) assess the information presented against the appropriate standards and available data,
- d) assess the test facilities, equipment, procedures and personnel,
- e) document the findings in a report detailing how the equipment complies with the objective of this standard,
- f) conduct other duties as assigned.

### 5.4 Acceptance

<https://standards.iteh.ai/catalog/standards/sist/2a3a7b14-81a0-4eeb-9a4d-d80fe5a7f239/iec-60079-33-2012>

Within a certification scheme, the endorsement of the independent verifier shall be included in the scheme rules

Outside of certification, the applicant shall select an independent verifier (1) and, where required, the independent verifier (1), in conjunction with the applicant, shall select the independent verifier (2) and (3), taking into account the stated qualifications and summary of experience of the independent verifier(s).

NOTE An independent verifier can be an individual but more likely will be an organization such as a certification body with total 'corporate' knowledge. The IECEx Equipment Certification Scheme has a protocol to recognize the competence of ExCBs operating to this standard.

### 5.5 Independence

Independent verifiers shall be independent from the applicant and any organization that is involved in the design, manufacture or sale of the equipment. They shall be separate and distinct from those organizations by management and financial or other resources, so that any influence or pressure on the decision-making process, the assessment and the results can be excluded.

## 6 Design and construction

### 6.1 Principles of an integrated approach to explosion safety

Electrical equipment intended for use in explosive atmospheres shall be designed from the point of view of an integrated approach to explosion safety. In this connection, the design shall take into account in order of priority: