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Responsible committee: EXL/31 Equipment for explosive atmospheres

Interested committees:

Title: BS EN IEC 60079-28 Explosive atmospheres

Part 28: Protection of equipment and transmission systems using optical radiation

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



31/1726/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER: IEC 60079-28 ED3	
DATE OF CIRCULATION: 2023-09-22	CLOSING DATE FOR COMMENTS: 2024-01-12
SUPERSEDES DOCUMENTS: 31/1725/RR	

IEC TC 31 : EQUIPMENT FOR EXPLOSIVE ATMOSPHERES	
SECRETARIAT: United Kingdom	SECRETARY: Mr Tom Stack
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE AC/22/2007 OR NEW GUIDANCE DOC).

TITLE: Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation
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NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –

**Part 28: Protection of equipment and transmission
systems using optical radiation**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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 - 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.
- International Standard IEC 60079-28 has been prepared by MT60079-28, of IEC technical committee 31 Equipment for explosive atmospheres.
- This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.
- The significance of the changes between IEC 60079-28, Edition 3 and IEC 60079-28, Edition 2 is as listed below:

123

Significance of changes with respect to IEC 60079-28:2015

		Type		
Significant Changes	Clause	Minor and editorial changes	Extension	Major technical changes

NOTE 1 The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version. More guidance may be found by referring to the Redline Version of the standard.

Explanation of the Types of Significant Changes:**A) Definitions**

- 1) Minor and editorial changes:** clarification
decrease of technical requirements
minor technical change
editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

- 2) Extension:** addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products in conformity with the preceding edition.

- 3) Major technical changes:** addition of technical requirements
increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below.

NOTE 2 These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of changes

- A1 xxx.
B1 xxx.
C1 xxx.

127

128 The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

129

130 Full information on the voting for the approval of this International Standard can be found in the
131 report on voting indicated in the above table.

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

133 The committee has decided that the contents of this document will remain unchanged until the
134 stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to
135 the specific document. At this date, the document will be

- 136 • reconfirmed,
- 137 • withdrawn,
- 138 • replaced by a revised edition, or
- 139 • amended.

140

141 The National Committees are requested to note that for this document the stability date
142 is 20XX.

143 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED
144 AT THE PUBLICATION STAGE.

145

INTRODUCTION

Optical systems in the form of light sources utilizing optical components such as filters or lenses, optical fibers etc. include but are not limited to communications, surveying, sensing and measurement. In material processing, optical radiation of high irradiance is used. Where the installation is inside or close to explosive atmospheres, the radiation from such systems may pass through these atmospheres. Depending on the characteristics of the radiation it might then be able to ignite a surrounding explosive atmosphere. The presence or absence of an additional absorber, such as particles, significantly influences the ignition.

There are four possible ignition mechanisms:

- a) Optical radiation is absorbed by surfaces or particles, causing them to heat up, and under certain circumstances this may allow them to attain a temperature which will ignite a surrounding explosive atmosphere.
- b) Thermal ignition of a gas volume, where the optical wavelength matches an absorption band of the gas or vapour.
- c) Photochemical ignition due to photo dissociation of oxygen molecules by radiation in the ultraviolet wavelength range.
- d) Direct laser induced breakdown of the gas or vapour at the focus of a strong beam, producing plasma and a shock wave both eventually acting as ignition source. These processes can be supported by a solid material close to the breakdown point.

The most likely case of ignition occurring in practice with lowest radiation power of ignition capability is case a). Under some conditions for pulsed radiation case d) also will become relevant. These two cases are addressed in this standard. Although one should be aware of ignition mechanism b) and c) explained above, they are not addressed in this standard due to the very special situation with ultraviolet radiation and with the absorption properties of most gases (see Annex B).

This standard describes precautions and requirements to be taken when using optical radiation in explosive gas or dust atmospheres. It also outlines a test method, which can be used in special cases to verify that a beam is not ignition capable under selected test conditions, if the optical limit values cannot be guaranteed by assessment or beam strength measurement.

There are optical systems outside the scope of this standard because the optical radiation associated with this systems are considered not to be a risk of ignition for the following reasons:

- due to low radiated power or divergent light; and
- as hot surfaces created due to a too small distance from the radiation source to an absorber which is already considered by general requirements for lighting equipment.

When optical systems are associated with electrical Ex Equipment and where the electrical Ex Equipment is located in a hazardous area then other parts of the IEC 60079 series will also apply. This standard provides guidance for:

- Ignition hazards associated with optical systems in explosive atmospheres as defined in IEC 60079-10-1 and IEC 60079-10-2; and
- Control of ignition hazards from Ex Equipment using optical radiation in explosive atmospheres.

EXPLOSIVE ATMOSPHERES –

Part 28: Protection of equipment and transmission systems using optical radiation

Scope

This part of IEC 60079 specifies additional requirements for Ex Equipment, Ex associated equipment or Ex Components containing optical systems emitting optical radiation, which is exposed to explosive atmospheres. These additional requirements are applicable for all equipment groups and all Equipment Protection Levels (EPL).

This standard contains requirements for optical radiation in the wavelength range from 380 nm to 10 µm. It covers the following ignition mechanisms:

- Optical radiation is absorbed by surfaces or particles, causing them to heat up, and under certain circumstances this may allow them to attain a temperature which will ignite a surrounding explosive atmosphere.
- In rare special cases, direct laser induced breakdown of the gas at the focus of a strong beam, producing plasma and a shock wave both eventually acting as ignition source. These processes can be supported by a solid material close to the breakdown point.

NOTE 1 See a) and d) of the introduction.

This standard applies to

- i) laser equipment; and
- ii) optical fibre equipment; and
- iii) any optical system that converts light into convergent beams with focal points within the hazardous area.

This standard does not apply to:

- 1) laser equipment for EPL Mb, Gb or Gc and Db or Dc applications which complies with Class 1 limits in accordance with IEC 60825-1; or

NOTE 2 The referenced Class 1 limits are those that involve emission limits below 15 mW measured at a distance from the optical radiation source in accordance with IEC 60825-1, with this measured distance reflected in the Ex application.

- 2) Single or multiple optical fibre cables not part of optical fibre equipment if the cables:
 - a) comply with the relevant industrial standards, along with additional protective means, for example robust cabling, conduit or raceway (for EPL Gb, Db, Mb, Gc or Dc); or
 - b) comply with the relevant industrial standards (for EPL Gc or Dc); or
- 3) Optical radiation sources as defined in i. to iii. above where the optical radiation is fully contained in an enclosure complying with one of the following Types of Protection suitable for the EPL, or the minimum ingress protection rating specified:
 - a) flameproof "d" enclosures (IEC 60079-1); or

NOTE 3 A flameproof "d" enclosure is suitable because an ignition due to optical radiation in combination with absorbers inside the enclosure is contained.

- b) pressurized "p" enclosures (IEC 60079-2); or

NOTE 4 A pressurized "p" enclosure is suitable because there is protection against ingress of an explosive atmosphere.

- c) restricted breathing "nR" enclosure (IEC 60079-15); or

NOTE 5 A restricted breathing "nR" enclosure is suitable because there is protection against ingress of an explosive atmosphere.

d) dust protection "t" enclosures" (IEC 60079-31); or

NOTE 6 A dust protection "t" enclosure is suitable because there is protection against ingress of an explosive dust atmosphere.

e) an enclosure that provides a minimum ingress protection of IP 6X and where no internal absorbers are to be expected and complying with "Tests of enclosures" in IEC 60079-0.

NOTE 7 An enclosure of a minimum ingress protection of IP 6X and complying with "Tests of enclosures" in IEC 60079-0 is suitable because there is protection against the ingress of absorbers. It is anticipated that when the enclosures are opened, entrance of any absorbers is avoided.

This standard does not cover ignition by ultraviolet radiation and by absorption of the radiation in the explosive mixture itself. Explosive absorbers or absorbers that contain their own oxidizer as well as catalytic absorbers are also outside the scope of 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 takes precedence.

Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050, *International Electrotechnical Vocabulary*

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

IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"*

IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1**absorption**

in a propagation medium, the conversion of electromagnetic wave energy into another form of energy, for instance heat

[SOURCE: IEC 60050-731:1991, 731-03-14]

3.2**beam diameter (or beam width)**

distance between two diametrically opposed points where the irradiance is a specified fraction of the beam's peak irradiance

Note 1 to entry: Most commonly applied to beams that are circular or nearly circular in cross section.

[SOURCE: IEC 60050-731:1991, 731-01-35]

3.3**beam strength**

optical beam's power, irradiance, energy, or radiant exposure

3.4**core**

central region of an optical fibre through which most of the optical power is transmitted

[SOURCE: IEC 60050-731:1991, 731-02-04]

3.5**cladding**

dielectric material of an optical fibre surrounding the core

[SOURCE: IEC 60050-731:1991, 731-02-05]

3.6**fibre bundle**

assembly of unbuffered optical fibres

[SOURCE: IEC 60050-731:1991, 731-04-09]

3.7**fibre optic terminal device**

assembly including one or more opto-electronic devices which converts an electrical signal into an optical signal, and/or vice versa, which is designed to be connected to at least one optical fibre

Note 1 to entry: A fibre optic terminal device always has one or more integral fibre optic connector(s) or optical fibre pigtail(s).

[SOURCE: IEC 60050-731:1991, 731-06-44]

3.8**optical radiation types of protection****3.8.1****inherently safe optical radiation****“op is”**

visible or infrared radiation that is incapable of producing sufficient energy under normal or specified fault conditions to ignite a specific explosive atmosphere

Note 1 to entry: This definition is analogous to the term “intrinsically safe” applied to electrical circuits.