IEC 60079-10-2

Edition 2.0 2015-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 10-2: Classification of areas – Explosive dust atmospheres

Atmosphères explosives –
Partie 10-2: Classement des emplacements – Atmosphères explosives poussiéreuses

IEC 60079-10-2:2015-01(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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FOREWORD

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International Standard IEC 60079-10-2 has been prepared by subcommittee 31J: Classification of hazardous areas and installation requirements, of IEC technical committee 31: Equipment for explosive atmospheres.

This second edition of IEC 60079-10-2 cancels and replaces the first edition of IEC 60079-10-2 published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

		Type		
Explanation of the significance of the changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Definition of “atmospheric conditions” deleted	3	X		
Definition of “combustible dust” aligned with other documents per recommendations of WG 28	3.4	X		
Editorial change to definition of “explosive dust atmosphere” to delete mention of flyings, since the definition of dust according to 60079-10-2 includes flyings.	3.5	X		
Definition of “combustible flyings” aligned with other documents per recommendations of WG 28	3.8	X		
Definition of “continuous formation of a dust cloud” added	3.14	X		
Definition of “catastrophic failure” added	3.20	X		
Definition of “ignition temperature of a dust layer” aligned with other documents per recommendations of WG 28 and to change reference from 61241-2-1 to 80079-20-2	3.22	X		
Definitions of “zone 20, zone 21 and zone 22” added. These were previously incorrectly included in the body of the document.	3.25.1 3.25.2 3.25.3	X		
Dust cloud density and concentration added as factors to consider for a release	4.1		X	
Wording changed to require EPL to be noted on area classification drawing	4.1		X	
Notes 1 and 3 changed to normative text	4.1		X	
Reference to published sources for dust characteristics deleted	4.2	X		
Reference to 80079-20-2 added	4.2 a)		X	
Section on competence of personnel added	4.3		X	
Note on verification dossier deleted	5.2	X		
Example added for continuous grade of release, zone information moved to Clause 6	5.3	X		
Paragraph added about dust layers being raised into a cloud	7		X	
EPLs added to list for documentation, note added warning of variability in published dust data	8.1		X	
Symbol keys are identified as preferred	8.2	X		
Note added to zone 21 and zone 22 clause about distance around source of release	Annex A	X		
Zone 22 paragraph added to this example, and figure modified to show Zone 22 location	A.2	X		
Annex B on hot surfaces deleted	Annex B in previous edition	X		
Annex D on explanation of EPLs deleted	Annex D in previous edition	X		
Annex on hybrid mixtures added	Annex C	X		

Explanation of the types of significant changes:	
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 the 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 the requirements that are fully compliant with the previous standard. Therefore, these will not have to be considered for existing area classifications 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 an existing area classification 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 existing area classifications in conformity with the preceding edition.	

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

FDIS	Report on voting
31J/244/FDIS	31J/248/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 of the IEC 60079 series, 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 website 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
- amended.

INTRODUCTION

Dusts, as defined in this standard, are hazardous because when they are dispersed in air by any means they may form potentially explosive atmospheres. Furthermore, layers of dust may ignite and act as ignition sources for an explosive atmosphere.

This part of IEC 60079 gives guidance on the identification and classification of areas where such hazards from dust can arise. It sets out the essential criteria against which the ignition hazards can be assessed and gives guidance on the design and control parameters which can be used in order to reduce such a hazard. General and special criteria are given for the process of identification and classification of hazardous areas.

This standard contains an informative Annex A giving examples for classifying areas.

EXPLOSIVE ATMOSPHERES –

Part 10-2: Classification of areas – Explosive dust atmospheres

1 Scope

This part of IEC 60079 is concerned with the identification and classification of areas where explosive dust atmospheres and combustible dust layers are present, in order to permit the proper assessment of ignition sources in such areas.

In this standard, explosive dust atmospheres and combustible dust layers are treated separately. In Clause 4, area classification for explosive dusts clouds is described, with dust layers acting as one of the possible sources of release. In Clause 7 other general considerations for dust layers are described.

The examples in this standard are based on a system of effective housekeeping being implemented in the plant to prevent dust layers from accumulating. Where effective housekeeping is not present, the area classification includes the possible formation of explosive dust clouds from dust layers.

The principles of this standard can also be followed when combustible fibres or flyings might cause a hazard.

This standard is intended to be applied where there can be a risk due to the presence of explosive dust atmospheres or combustible dust layers under normal atmospheric conditions (see Note 1).

NOTE 1 Atmospheric conditions include variations in pressure and temperature above and below reference levels of 101,3 kPa (1 013 mbar) and 20 °C (293 K), provided that the variations have a negligible effect on the explosive properties of the combustible materials.

It does not apply to

– underground mining areas,
– dusts of explosives that do not require atmospheric oxygen for combustion such as pyrophoric substances, propellants, pyrotechnics, munitions, peroxides, oxidizers, water-reactive elements or compounds, or other similar materials.
– catastrophic failures which are beyond the concept of abnormality dealt with in this standard,
– any risk arising from an emission of toxic gas from the dust.

This standard does not apply to where a hazard might arise due to the presence of flammable gas or vapour, but the principles may be used in the assessment of a hybrid mixture (see also IEC 60079-10-1).

NOTE 2 Additional guidance on hybrid mixtures is provided in Annex C.

This standard does not take into account the effects of consequential damage following a fire or an explosion.

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 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

ISO/IEC 80079-20-2, *Explosive Atmospheres – Part 20-2: Material Characteristics – Combustible dusts test methods*[1]

3 Terms and definitions

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

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

3.1
area
three-dimensional region or space

3.2
hybrid mixture
mixture of a flammable gas or vapour with a dust

3.3
dust
generic term including both combustible dust and combustible flyings

3.4
combustible dust
finely divided solid particles, 500 μm or less in nominal size, which may form an explosive mixture with air at atmospheric pressure and normal temperatures

Note 1 to entry: This includes dust and grit as defined in ISO 4225.

Note 2 to entry: The term solid particles is intended to address particles in the solid phase and not the gaseous or liquid phase, but does not preclude a hollow particle.

Note 3 to entry: Materials passing a U.S. No. 40 Standard sieve as defined in ASTM E 11–04 are considered to meet the 500 μm criterion.

Note 4 to entry: Combustible dust test methods can be found in ISO/IEC 80079-20-2.

3.5
explosive dust atmosphere
mixture with air, under atmospheric conditions, of flammable substances in the form of dust, which, after ignition, permits self-sustaining propagation

[1] To be published.

3.6
conductive dust
combustible dust with electrical resistivity equal to or less than 10^3 Ωm

Note 1 to entry: Conductive dust is classified as Group IIIC.

3.7
non-conductive dust
combustible dust with electrical resistivity greater than 10^3 Ωm

Note 1 to entry: Non-conductive dust is classified as Group IIIB.

3.8
combustible flyings
solid particles including fibers, greater than 500 μm in nominal size, which may form an explosive mixture with air at atmospheric pressure and normal temperatures

Note 1 to entry: Examples of flyings include rayon, cotton (including cotton linters and cotton waste) sisal, jute, hemp, cocoa fiber, okum and waste kapok.

Note 2 to entry: Combustible flyings are classified as Group IIIA.

3.9
hazardous area (dust)
area in which combustible dust, in the form of a cloud is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment

Note 1 to entry: Hazardous areas are divided into zones based upon the frequency and duration of the occurrence of explosive dust atmospheres (see 6.2 and 6.3).

Note 2 to entry: The potential of creating an explosive dust cloud from a dust layer also needs to be considered.

3.10
non-hazardous area (dust)
area in which combustible dust in the form of a cloud is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment

3.11
dust containment
process equipment housing which is intended to handle, process, transport or store materials inside of it, while minimizing the risk of the release of dust to the surrounding atmosphere

3.12
source of dust release
point or location from which dust may be released into the atmosphere

Note 1 to entry: The source of dust release can be from a dust containment or from a dust layer.

3.13
continuous grade of release
release which is continuous or is expected to occur frequently or for long periods

3.14

continuous formation of a dust cloud
locations in which a dust cloud may exist continuously, or may be expected to continue for long periods or for short periods which occur frequently

3.15
primary grade of release
release which can be expected to occur periodically or occasionally during normal operation

3.16
secondary grade of release
release which is not expected to occur in normal operation and, if it does occur, is likely to do so only infrequently and for short periods

3.17
extent of zone
distance in any direction from the edge of a source of release to the point where the hazard associated with the release is considered to exist no longer

3.18
normal operation
operation of equipment conforming electrically and mechanically with its design specification and used within the limits specified by the manufacturer

Note 1 to entry: Minor releases of dust which may form a cloud or layer (e.g. releases from filters) can be part of normal operation.

3.19
abnormal operation
process-linked malfunctions that occur infrequently

3.20
catastrophic failure
occurrence which exceeds the design parameters of the process plant and control system resulting in major release of flammable material

Note 1 to entry: Catastrophic failure in this context is applied, for example, to the rupture of a storage silo or a pneumatic conveyor.

3.21
equipment (for explosive atmospheres)
general term including apparatus, fittings, devices, components, and the like used as a part of, or in connection with, an installation in an explosive atmosphere

3.22
ignition temperature of a dust layer
lowest temperature of a surface at which ignition occurs in a dust on the surface

Note 1 to entry: The ignition temperature of a dust layer may be determined by the test method given in ISO/IEC 80079-20-2.

3.23
ignition temperature of a dust cloud
lowest temperature of the hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein

Note 1 to entry: The ignition temperature of a dust cloud may be determined by the test method given in ISO/IEC 80079-20-2.

3.24
verification dossier
set of documents showing the compliance of electrical equipment and installations

Note 1 to entry: Requirements for a ‘verification dossier’ are given in IEC 60079-14.

3.25
zones

3.25.1
Zone 20
a place in which an explosive dust atmosphere, in the form of a cloud of dust in air, is present continuously, or for long periods or frequently

3.25.2
Zone 21
a place in which an explosive dust atmosphere, in the form of a cloud of dust in air, is likely to occur in normal operation occasionally

3.25.3
Zone 22
area in which an explosive dust atmosphere, in the form of a cloud of combustible dust in air, is not likely to occur in normal operation but, if it does occur, will persist for a short period only

Note 1 to entry: The potential of creating an explosive dust cloud from a dust layer also needs to be considered.

4 Area classification

4.1 General

This standard adopts the concept, similar to that used for flammable gases and vapour, of using area classification to give an assessment of the likelihood of an explosive dust atmosphere occurring.

Dusts form explosive atmospheres only at concentrations within the explosion range. Although a cloud with a very high concentration may not be explosive, the danger nevertheless exists that, should the concentration fall, it may enter the explosive range. Depending on the circumstances, not every source of release will necessarily produce an explosive dust atmosphere. Dust clouds are also rarely of uniform density and consideration should be given to possible variances in concentration within a cloud for any condition or release.

Dusts that are not removed by mechanical extraction or ventilation, settle out at a rate depending on properties, such as particle size, into layers or accumulations. It shall be taken into account that a dilute or small continuous source of release, in time, is able to produce a potentially hazardous dust layer.

The hazards presented by dusts are as follows:

– the formation of a dust cloud from any source of release, including a layer or accumulation, to form an explosive dust atmosphere (see Clause 5);
– the formation of dust layers, which are not likely to form a dust cloud, but may ignite due to self-heating or exposure to hot surfaces or thermal flux and cause a fire hazard or over-heating of equipment. The ignited layer may also act as an ignition source for an explosive atmosphere.

Since explosive dust clouds and dust layers may exist, any source of ignition should be avoided.

If the source of ignition cannot be avoided, then measures shall be taken to reduce the likelihood of dust and/or ignition sources so that the likelihood of coincidence is so small as to make the risk negligible.

NOTE In some cases, where the risk of explosion cannot be completely avoided, it can be necessary to employ some form of explosion protection such as explosion venting, explosion suppression or explosion isolation.

Subsequent to the completion of the area classification, a risk assessment may be carried out to assess whether the consequences of ignition of an explosive atmosphere requires the use of equipment of a higher equipment protection level (EPL) or may justify the use of equipment with a lower equipment protection level than normally required.

In this standard, explosive dust atmospheres and dust layers are treated separately. In this clause, area classification for explosive dust clouds is described, with dust layers acting as one of the possible sources of release. Considerations for dust layers are described in Clause 7.

4.2 Area classification procedure for explosive dust atmospheres

Area classification is based on a number of factors and may require informed input from a number of sources. These factors include:

- Whether the dust is combustible or not. Dust combustibility can be confirmed by laboratory tests to ISO/IEC 80079-20-2.
- Material characteristics for the dusts that are present. These may be obtained from a variety of published sources, a process specialist or by testing. Characteristics that are obtained from published sources should be validated for the particular application, since there are often significant variations in dust characteristic values from one data source to another.
- Nature of dust releases from particular process sources. Specialist engineering knowledge may be required for this information.
- Operational and maintenance procedures for the plant, including housekeeping.
- Other equipment and safety information.

Close co-operation is necessary from specialists in safety and equipment. Although the definitions for dust zones deal only with the cloud risk, layers that can be disturbed to form a dust cloud shall also be considered. The procedure for identifying zones is as follows.

a) The first step is to identify whether the material is combustible and, for the purpose of assessment of ignition sources, determine the material characteristics. Parameters such as particle size, moisture content, cloud and layer minimum ignition temperature and electrical resistivity shall be considered. The appropriate dust group; Group IIIA for combustible flyings, Group IIIB for non-conductive dust, or Group IIIC for conductive dust shall be identified.

   NOTE Information on dust characteristics can be found in ISO/IEC 80079-20-2.

b) The second step is to identify items of equipment where explosive dust mixtures may be contained or sources of dust release can be present, as given in Clause 5. It may be necessary to consult process line diagrams and plant layout drawings. This step should include the identification of the possibility of the formation of dust layers as given in Clause 7.

c) The third step is to determine the likelihood that dust will be released from those sources and thus, the likelihood of explosive dust atmospheres in various parts of the installation as given in 5.3.

It is only after these steps have been taken that the zones can be identified and their boundaries defined. The decisions on the zone types and extent and the presence of dust layers shall be documented, usually on an area classification drawing. These documents are used subsequently as the basis for the assessment of ignition sources.

The reasons for the decisions taken should be recorded in notes of the area classification study to facilitate understanding at future area classification reviews. Reviews of the area classification shall take place following changes to the process, changes to process materials, or if dust emission becomes more common due to deterioration of the plant. It is expected that a review be made following the commissioning of a plant or process, and thereafter on a periodic basis.