UL 60079-10-2

STANDARD FOR SAFETY

Explosive Atmospheres – Part 10-2: Classification of Areas – Explosive Dust Atmospheres

UL Standard for Safety for Explosive Atmospheres – Part 10-2: Classification of Areas – Explosive Dust Atmospheres, UL 60079-10-2

First Edition, Dated January 8, 2025

Summary of Topics

This First Edition of ANSI/UL 60079-10-2 dated January 8, 2025 is an Adoption of IEC 60079-10-2, Explosive Atmospheres – Part 10-2: Classification of Areas – Explosive Dust Atmospheres, (second edition, issued by IEC January 2015) as a new IEC-based UL Standard, UL 60079-10-2 with US National Differences.

The new requirements are substantially in accordance with Proposal(s) on this subject dated August 23, 2024 and November 22, 2024.

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Standard for Explosive Atmospheres – Part 10-2: Classification of Areas – Explosive Dust Atmospheres

First Edition

January 8, 2025

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 60079-10-2 as an American National Standard (ANSI) occurred on January 8, 2025. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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PREFACE (UL)

This UL Standard is based on IEC Publication 60079-10-2: 2.0 edition, Explosive Atmospheres – Part 10-2: Classification of Areas – Explosive Dust Atmospheres. IEC publication 60079-10-2 is copyrighted by the IEC.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-10-2, Explosive Atmospheres – Part 10-2: Classification of Areas – Explosive Dust Atmospheres, copyright 2015, are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES – Part 10-1: Classification of areas – Explosive gas atmospheres

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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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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

This 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		

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
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	X		
	3.25.2			
	3.25.3			
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.

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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.

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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.

1DV.1 DR *Modification of Clause 1 first paragraph as follows:*

Replace "part of IEC 60079" with "standard"

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.

1DV.2 DR *Modification of Clause 1 second paragraph as follows:*

Replace "explosive" with "explosible"

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).

1DV.3 DR *Modification of Clause 1 fifth paragraph as follows:*

Replace "explosive" with "explosible"

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).

1DV.4 DR *Modification of Clause 1 seventh paragraph as follows:*

Replace "IEC 60079" with "UL 60079"

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.

1DV.5 DR *Modification of Clause 1 eighth paragraph to add the following:*

Explosive atmospheres are identified by the National Electrical Code ®, NFPA 70 as hazardous (classified) locations.

1DV.6 DE *Modification of Clause 1 to add the following:*

With respect to the application of this standard in the US, the classification of a plant is to be recognized as the classification of a facility.

1DV.7 DR *Modification of Clause 1 to add the following:*

Where references are made to IEC, IEC/IEEE, ISO, ISO/IEC standards, the referenced requirements found in these standards apply as modified by any applicable US National Differences for the standard (see Clause 2).

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]

[1] To be published.

2DV DE *Modification of Clause 2 to replace title and add the following:*

References

ASTM E1226, *Standard Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts*

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

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

UL 80079-20-2, *Explosive Atmospheres – Part 20-2: Material Characteristics – Combustible dusts test methods*

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.

3DV DR *Modification for Clause 3 as follows:*

Replace "IEC 60079-0" with "UL 60079-0"

Replace NOTE with the following NOTE 1 and NOTE 2:

NOTE 1 to entry Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

NOTE 2 to entry That the definitions in this standard my differ from those in the IEC standard in order to align with U.S. standards.

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 E11-04 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.

3.4DV DR *Modification of Clause 3.4 to replace with the following:*

Solid particles that are 500 µm or smaller (i.e., material passing a US No. 35 Standard Sieve as defined in ASTM E11-17, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves) that can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature.

NOTE 1 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 2 to entry: Dusts are considered to be combustible dusts unless it has been confirmed by test that they are not combustible dusts per UL 80079-20-2 or ASTM E1226. See 4.2.

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

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.

3.6DV DR *Modification of Clause 3.6 to replace term and definition with the following:*

metal dust
metal combustible dust

Note 1 to entry: The term "conductive dust" is not considered to be the proper technical designation of "metal dust" but is maintained to support consistency across the UL 60079 documents at this time.

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.

3.7DV DR *Modification of Clause 3.7 to replace term and definition with the following:*

Non-conductive dust
non-metal combustible dust

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.

3.8DV DR *Modification of Clause 3.8 to replace term and definition with the following:*

combustible flyings
combustible fibers
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: Non-metal combustible fibers and flyings are classified as Group IIIA. Metal fibers and flyings are classified as Group IIIC. For combustible metal fibers/flyings, there shall only be Zone 20 or 21 locations.

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.

3.9DV DR *Modification of Clause 3.9 to replace term and definition with the following:*

hazardous area (dust)
hazardous (classified) area
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).

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

NOTE 3 to entry: NFPA 70 (NEC ®) uses the term "hazardous (classified) locations" to describe these areas.

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

3.10DV DR *Modification of Clause 3.10 to add the following note:*

NOTE 1 to entry: National Electrical Code® does not define a non-hazardous area but instead uses the term unclassified location.

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

3.11DV DR *Modification of Clause 3.11 to replace definition with the following:*

equipment 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

3.14DV DR *Modification of Clause 3.14 to replace with the following:*

Reserved

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.

3.22DV DR *Modification of Clause 3.22 Note 1 as follows:*

Replace "ISO/IEC 80079-20-2" with "UL 80079-20-2" and add "or ASTM E2021"

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.

3.23DV DR *Modification of Clause 3.23 term and Note 1 as follows:*

Add "autoignition temperature" after "ignition temperature of a dust cloud"

Replace "ISO/IEC 80079-20-2" with "UL 80079-20-2" and add "or ASTM E2021"

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.

3.24DV DR *Modification of Clause 3.24 term and add Note 2 as follows:*

Add "documentation for industrial occupancies" after "verification dossier"

Note 2 This is what is referred to in NFPA 70 (NEC ®) as "documentation for industrial occupancies". Areas designated as hazardous (classified) or unclassified locations shall be documented on an area classification drawing and other associated documentation. This documentation shall be made available to the AHJ and to those authorized to design, install, inspect, maintain, or operate electrical equipment.

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

3.25.1DV DR *Modification of Clause 3.25.1 to replace definition with the following:*

a location where one of the following apply:

a) Ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings are present continuously or for long periods of time.

b) Group IIIC combustible dusts are present in hazardous quantities continuously or for long periods of time.

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

3.25.2DV DR *Modification of Clause 3.25.2 to replace definition with the following:*

A Zone 21 location is a location where one of the following apply:

a) Ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings are likely to exist occasionally under normal operating conditions.

b) Ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings might exist frequently because of repair or maintenance operations or because of leakage.

c) Equipment is operated or processes are carried on of such a nature that equipment breakdown or faulty operations could result in the release of ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition.

d) The location is adjacent to a Zone 20 location from which ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings could be communicated.

Exception: When communication from an adjacent Zone 20 location is minimized by adequate positive pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

e) Group IIIC combustible dusts are present in hazardous quantities occasionally, under normal or abnormal operating conditions, or frequently because of repair or maintenance operations or because of leakage.

NOTE 1 to entry: This classification usually includes the following:

a) Locations outside dust containment and in the immediate vicinity of access doors subject to frequent removal or opening for operation purposes when internal combustible mixtures are present.

b) Locations outside dust containment in the proximity of filling and emptying points, feed belts, sampling points, truck dump stations, belt dump over points, and so on, where no measures are employed to prevent the formation of combustible mixtures.

c) Locations outside dust containment where dust accumulates and where, due to process operations, the dust layer is likely to be disturbed and form combustible mixtures.

d) Locations inside dust containment where explosible dust clouds are likely to occur (but neither continuously, nor for long periods, nor frequently), for example, silos (if filled and/or emptied only occasionally) and the dirty side of filters if large self-cleaning intervals are occurring.

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.

3.25.3DV DR *Modification of Clause 3.25.3 to replace definition with the following:*

a location where one of the following apply:

a) Ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings are not likely to occur in normal operation and, if they do occur, will only persist for a short period.

b) Combustible dust, combustible fibers/flyings, or ignitible fibers/flyings are handled, processed, or used, but the dust or fibers/flyings are normally confined within closed containers of closed systems from which they can escape only as a result of the abnormal operation of the equipment with which the dust or fibers/flyings are handled, processed, or used.

c) The location is adjacent to a Zone 21 location, from which ignitible concentrations of combustible dust, combustible fibers/flyings, or ignitible fibers/flyings could be communicated.

Exception No. 1: When communication from an adjacent Zone 21 location is minimized by adequate positive pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

Exception No. 2: For Group IIIC combustible dusts or metal combustible fibers/flyings, there shall only be Zone 20 or 21 locations.

NOTE 1 to entry: Zone 22 locations usually include the following:

a) Outlets from bag filter vents (in the event of a malfunction, there can be emission of combustible mixtures).

b) Locations near equipment that has to be opened at infrequent intervals or equipment that from experience can easily form leaks where, due to pressure above atmospheric, dust will blow out.

c) Pneumatic equipment or flexible connections that can become damaged.

d) Storage locations for bags containing dusty product (failure of bags can occur during handling, causing dust leakage).

e) Locations where controllable dust layers are formed that are likely to be raised into explosible dust-air mixtures. Only if the layer is removed by cleaning before hazardous dust–air mixtures can be formed is the area designated unclassified.

NOTE 2 to entry: Protective measures to reduce the formation of explosible dust–air mixtures can often result in a Zone 21 location being classified as a Zone 22 location, or possibly unclassified. Such measures include local exhaust ventilation (dust extraction).

3.26ADV DR *Addition of Clause 3.26ADV.1 as follows:*

3.26ADV.1
Unclassified location
locations determined to be neither Zone 20; Zone 21; Zone 22; nor any combination thereof.

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.

4.1DV.1 DR *Modification of Clause 4.1, second paragraph as follows:*

Replace "explosive" with "explosible"

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.

4.1DV.2 DR *Modification of Clause 4.1, fourth paragraph, dashed items as follows:*

Replace "explosive" with "explosible"

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.

4.1DV.3 DR *Modification of Clause 4.1 note as follows:*

Replace "NOTE" with "NOTE 1 to entry"

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.

4.1DV.4 DR *Modification of Clause 4.1 seventh paragraph to replace with the following:*

Subsequent to the completion of the area classification, if the use of equipment with a higher than normally required equipment protection level (EPL), or lower than normally required equipment protection level (EPL), is to be permitted, a risk assessment in accordance with one of the risk assessment methods in IEC 31010 shall be carried out to assess the consequences of ignition of an explosive atmosphere. This risk assessment shall consider the need for risk identification, risk analysis (e.g. consequence, likelihood, level of risk) and risk evaluation.

NOTE 2 to entry: Examples of risk assessments in accordance with IEC 31010 for which risk identification, risk analysis (e.g. consequence, likelihood, level of risk) and risk evaluation are applicable (including strongly applicable) are Layers of protection analysis (LOPA), Failure modes, effects and criticality analysis (FMECA) and Structured what if technique (SWIFT).

The EPL requirements shall be recorded on the area classification drawings to allow proper selection of equipment.

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.

4.2DV.1 DR *Modification of Clause 4.2 first bulleted item to replace with the following:*

• Dust explosibility confirmed by laboratory tests to UL 80079-20-2 or ASTM E1226.

• 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.

4.2DV.2 DR *Modification of Clause 4.2, second paragraph, item (a) to replace last sentence with the following:*

The appropriate dust group; Group IIIA for combustible flyings, Group IIIB for non-conductive dust, or Group IIIC for conductive metal 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.

4.2DV.3 DR *Modification of Clause 4.2, fourth paragraph first sentence as follows:*

Replace "study" with "documentation"

Because this standard covers a wide range of circumstances, no exact identification of necessary measures can be given for each individual case. It is important, therefore, that the recommended procedure should be carried out by personnel having knowledge of the principles of area classification, the process material used, the specific plant involved and its functioning.

4.3 Competence of personnel

The area classification should be carried out by those who are competent and understand the relevance and significance of the characteristics of dust and those who are familiar with the process and the equipment, along with safety, electrical, mechanical, and other qualified engineering personnel.

NOTE These elements are covered in several personnel certification schemes, such as the IECEx Unit of Competence Ex002 according to IECEx OD 504.

4.3DV DR *Modification of Clause 4.3 to delete the NOTE.*

NOTE does not apply.

5 Sources of release

5.1 General

Explosive dust atmospheres are formed from sources of dust release. A source of dust release is a point or location from which dust can be released or raised, such that an explosive dust atmosphere can be formed. This definition includes layers of dust capable of being dispersed to form a dust cloud.

Depending on the circumstances, not every source of release will necessarily produce an explosive dust atmosphere. However, a dilute or small continuous source of release in time can produce a dust layer.

The conditions need to be identified under which process equipment, process steps or other actions expected in plants, can form explosive dust atmospheres or create dust layers. It is necessary to consider separately the inside and outside of a dust containment.

5.2 Dust containment

Inside a dust containment, dust is not released into the outside atmosphere but as part of the process, continuous dust clouds may form inside the containment. These clouds may exist continuously or may be expected to continue for long periods or for short periods. The frequency of their appearance depends on the process cycle. The equipment shall be studied for normal operation, abnormal operation and in the start up and shut-down conditions so that the incidence of cloud and layer presence can be identified and

the results of this study shall be included in the verification dossier. Where layers are formed, these should be noted (see Clause 7 for dust layers).

5.3 Identification and grading of sources of release

Outside the dust containment, many factors can influence the area classification. Where higher than atmospheric pressures are used within the dust containment (e.g. positive pressure pneumatic transfer) dust can easily be blown out of leaking equipment. In the case of negative pressure within the dust containment, the likelihood of formation of dusty areas outside the equipment is very low. Dust particle size, moisture content and, where applicable, factors such as transport velocity, dust extraction rate and fall height can influence release rate potential. Once the process potential for release is known, each source of release shall be identified and its grade or grades of release determined.

Grades of release are as follows:

– continuous grade of release:

> release that exists continuously, or may be expected to continue for long periods, or for short periods that occur frequently. For example, the inside of a mixing vessel or a storage silo that is filled and emptied often;

– primary grade of release:

> release that can be expected to occur periodically or occasionally during normal operation. For example, the close vicinity around an open bag filling or emptying point;

– secondary grade of release:

> release that is not expected to occur in normal operation and, if it does occur, is likely to do so only infrequently and for short periods. For example, a dust handling plant where deposits of dust are present.

Consideration of catastrophic failures is not required in assessing potential sources of release. For example some of the items that should not be regarded as sources of release during normal and abnormal operation include:

– pressure vessels, the main structure of the shell including closed nozzles and man-holes;

– pipes, ducting and trunking without joints;

– valve glands and flanged joints, provided that in the design and construction, adequate consideration has been given to the prevention of the release of dust.

6 Zones

6.1 General

Areas classified for explosive dust atmosphere are divided into zones, which are identified according to the frequency and duration of the occurrence of explosive dust atmosphere. Some examples of zones are given in Annex A. Layers, deposits and heaps of dust shall be considered as ‘any other source’ which can form an explosive dust atmosphere.

6.1DV DR *Modification of Clause 6.1 to add the following note:*

NOTE 1 to entry: Through the exercise of ingenuity in the layout of electrical systems, it is frequently possible to locate much of the equipment in a reduced level of classification, and, thus, to reduce the amount of special equipment required.

6.2 Extent of zones

6.2.1 General

The extent of a zone for explosive dust atmospheres is defined as the distance in any direction from the edge of a source of dust release to the point where the hazard associated with that zone is considered to no longer exist.

Explosive dust atmospheres from a dust cloud would normally be deemed not to exist if the dust concentration is a suitable safety margin less than the minimum dust concentration required for an explosive dust atmosphere to exist. Consideration should be given to the fact that fine dust can be carried from a source of release by air movement within a building.

Where the classification gives rise to small unclassified areas between classified areas, the classification should be extended to the full area. For Zone 21 and Zone 22 areas located outside buildings (open air), the zones can be altered due to weather effects such as wind, rain, etc. For outdoor areas the boundaries of the zones should provide for such variances.

NOTE While natural ventilation (wind) may cause dilution to below the explosive limit (therefore reducing the extent of the zone) it might also cause disturbance of any existing dust layer (thereby increasing the extent of a zone).

6.2.2 Zone 20

The extent of zone 20 includes the inside of ducts, producing and handling equipment in which explosive dust atmospheres are present continuously, for long periods, or frequently.

If an explosive dust atmosphere outside dust containment is continuously present, a Zone 20 classification is required.

6.2.3 Zone 21

In most circumstances, the extent of Zone 21 can be defined by evaluating sources of release in relation to the environment causing explosive dust atmospheres.

The extent of Zone 21 is as follows:

– the inside of some dust handling equipment in which an explosive dust atmosphere is likely to occur periodically, for example starting and stopping of filling equipment;

– the Zone 21 formed outside the equipment by a primary grade of release, depends on several dust parameters, such as; dust amounts, flow rate, particle size and the dust moisture content. Consideration needs to be given to the source of release taking into account the conditions leading to the release in order to determine the appropriate extent of the zone.

– where the spread of dust is limited by mechanical structures (walls, etc.), their surfaces can be taken as the boundary of the zone.

A non-confined Zone 21 (not limited by mechanical structures, e.g. a vessel with an open man-hole) located inside, will usually be surrounded by a Zone 22.

NOTE 1 If dust layers are found to have accumulated outside the original Zone 21, then the classification of the zone 21 area might be required to be extended (it could become a Zone 22) taking into account the extent of the layer and any disturbance of the layer that produces a cloud.

NOTE 2 If the boundary between Zone 21 and Zone 22 is difficult to determine, it might be practical to classify the entire area or room as Zone 21.

6.2.4 Zone 22

In most circumstances, the extent of Zone 22 can be defined by evaluating secondary grade sources of release in relation to the environment causing the explosive dust atmospheres.

The extent of Zone 22 is as follows:

– the extent of an area formed by a secondary grade source of release depends on several dust parameters such as dust amounts, flow rate, particle size and the dust moisture content. Consideration needs to be given to the source of release taking into account the conditions leading to the release in order to determine the appropriate extent of the zone.

– where the spread of dust is limited by mechanical structures (walls, etc.), their surfaces can be taken as the boundary of the zone.

NOTE If dust layers are found to have accumulated outside the original zone 22, then the classification of the Zone 22 area may be required to be extended taking into account the extent of the layer and any disturbance of the layer which produces a cloud.

Based on the likelihood of the formation of explosive dust atmospheres, the areas can be designated according to Table 1.

Table 1
Designation of zones depending on presence of dust

Presence of dust	Resulting zone classification of area of dust clouds
Continuous grade of release	20
Primary grade of release	21
Secondary grade of release	22

7 Dust layers

Inside containment, where dusts are handled or processed, layers of dust of uncontrolled thickness often cannot be prevented because they are an integral part of the process.

Outside containment the thickness of dust layers should be controlled by housekeeping and the level of housekeeping shall be known for the purpose of classification. It is essential to agree the nature of the housekeeping arrangements with plant management. Other risks associated with dust layers and the effect of housekeeping are discussed in Annex B.

Conditions that may cause dust layers to be raised to form a dust cloud, such as ventilation, wind or other conditions, must be taken into consideration during the area classification.

8 Documentation

8.1 General

Area classification, and the various steps taken which lead to the area classification, shall be documented.

All relevant information used shall be referred to. Examples of such information include:

a) recommendations from relevant codes and standards,

b) assessment of dust dispersion from all sources of release,

c) process parameters and dust mitigation measures, which influence the formation of explosive dust atmospheres and dust layers,

d) operational and maintenance parameters,

e) housekeeping programs;

f) assigned EPLs.

The results of the area classification study and any subsequent alteration to it shall be included in the verification dossier.

8.1DV.1 DR *Modification of Clause 8.1, third paragraph to replace "verification dossier" with "documentation"*

The properties, or basis for properties, used for the area classification concerning all process materials used on the plant shall be listed. The information should include items such as:

– ignition temperatures of a dust clouds,

– ignition temperatures of dust layers,

– minimum ignition energy of a dust cloud,

– the dust group,

– explosive limits,

– electrical resistivity,

– moisture content,

– particle size.

8.1DV.2 DR *Modification of Clause 8.1, to delete sixth dashed item "– electrical resistivity,".*

NOTE There are reference materials available that may provide some of the dust parameters related to explosive atmosphere safety, but there is a wide variability in dusts and testing may be necessary to determine all of the relevant parameters.

8.2 Drawings, data sheets and tables

8.2.1 Content of documents

Area classification documents may be in hard copy or electronic form and should include plans and elevations or three dimensional models, as appropriate, which show both the type and extent of zones, the extent and permitted thickness of dust layers, the minimum ignition temperature of the dust cloud and the dust layer. The documents should also include other relevant information such as:

a) the location and identification of sources of release. For large and complex plants or process areas, it may be helpful to itemize or number the sources of release so as to facilitate cross-referencing between the area classification data sheets and the drawings;

b) information about housekeeping and other preventative measures to obtain the classification made;

c) methods for maintaining and regularly reviewing the classification, as well as methods for reviewing when process materials, methods and equipment change;

d) distribution list of the classification;

e) the reasons for the decisions taken to establish the type and extent of zones and the extent of dust layers.

A symbol key shall always be provided on each drawing.

The preferred area classification symbols shown in Figure 1 may be varied,, e.g. for drawing clarity or to show differing dust characteristics.

8.2.2 Preferred Symbol key for area classification zones

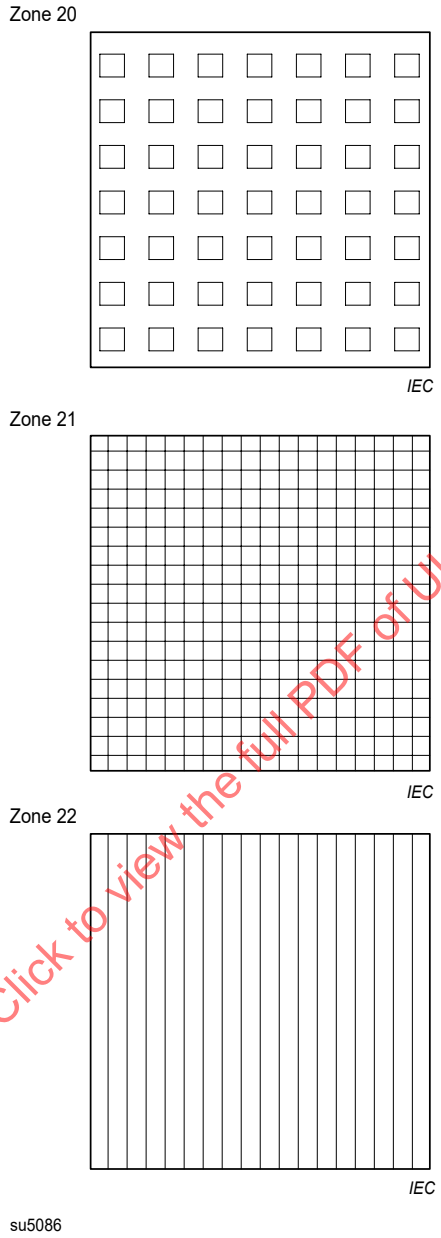

Figure 1

Identification of zones on drawings

Annex A
(informative)

Area classification examples

A.1 Examples of zones

A.1.1 General

The following examples are not intended to be rigidly applied, and may need to be varied to suit particular process equipment and the situation. It also needs to be recognized that some equipment may exhibit more than one grade of release.

A.1.2 Zone 20

Examples of locations that may give rise to Zone 20:

– locations inside the dust containment;

– hoppers, silos, cyclones and filters, etc;

– dust transport systems, except some parts of belt and chain conveyors, etc;

– blenders, mills, dryers, bagging equipment, etc.

A.1.3 Zone 21

Examples of locations that may give rise to Zone 21:

– areas adjacent to dust containment and in the immediate vicinity of access doors subject to frequent removal or opening for operation purposes when internal explosive dust atmospheres are present;

– areas outside dust containment in the proximity of filling and emptying points, feed belts, sampling points, truck dump stations, belt dump over points, etc. where no measures are employed to prevent the formation of explosive dust atmospheres;

– areas outside dust containment where dust accumulates and where, due to process operations, the dust layer is likely to be disturbed and form explosive dust atmospheres;

– areas inside dust containment where explosive dust clouds are likely to occur (but neither continuously, nor for long periods, nor frequently), e.g. filling of a silo with bulk material with a low dust content and the dirty side of filters, if large self-cleaning intervals exist.

NOTE In many situations a distance of approximately 1 m around the source of release is often sufficient (with a vertical downwards extension to the ground or to the level of a solid floor) in considering a Zone 21.

A.1.4 Zone 22

Examples of locations that may give rise to Zone 22:

– outlets from bag filter vents which, in the event of a malfunction, can emit explosive dust atmospheres;

– locations near equipment opened at infrequent intervals or locations near equipment, that from experience can easily form leaks where dust is blown out, for example, pneumatic equipment or flexible connections that can become damaged, etc;

– storage of bags containing dusty products. Failure of bags can occur during handling, causing dust emission;

– areas that are normally classified as Zone 21 can fall into Zone 22 when measures, including exhaust ventilation, are employed to prevent the formation of explosive dust atmospheres. The measures should be carried out in the vicinity of (bag) filling and emptying points, feed belts, sampling points, truck dump stations and belt dump over points, etc;

– areas where controllable dust layers are formed that are likely to be disturbed and create explosive dust atmospheres. Only if the layer is removed by cleaning before hazardous dust atmospheres can be formed, is the area designated non-hazardous. This is the major purpose of good house keeping.

NOTE In many situations a distance of approximately 3 m around the source of release is often sufficient (with a vertical downwards extension to the ground or to the level of a solid floor) in considering a Zone 22.

A.2 Bag emptying station within a building and without exhaust ventilation

In this example, shown in Figure A.1, bags are manually emptied frequently into a hopper from which the contents are conveyed pneumatically into some other part of the plant without exhaust ventilation. Part of the hopper is normally filled with product.

Zone 20	Inside the hopper because an explosive dust atmosphere is present frequently or even continuously.
Zone 21	The open man-hole has no exhaust ventilation and is a primary grade source of release. Consequently, a Zone 21 is defined around this man-hole, extending some distance from the edge of the man-hole and extending down to the floor.
Zone 22	A Zone 22 could occur adjacent to the Zone 21 due to accumulation of dust as a layer, or if the dust release is composed of very fine particles that could occasionally travel outside the normal Zone 21 boundary under abnormal operating conditions.

NOTE If dust layers accumulate, then further classification may be required taking into account the extent of the layer and any disturbance of the layer which produces a cloud, together with the level of housekeeping (see Annex B). Any air movements during the discharge of bags may occasionally carry the dust cloud beyond Zone 21 under abnormal operating conditions, in which case a Zone 22 may be required in accordance with 6.2.4.