UL 60079-10-1

STANDARD FOR SAFETY

Explosive Atmospheres – Part 10-1: Classification of Areas – Explosive Gas Atmospheres

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UL Standard for Safety for Explosive Atmospheres – Part 10-1: Classification of Areas – Explosive Gas Atmospheres, UL 60079-10-1

First Edition, Dated December 6, 2024

Summary of Topics

This First Edition of ANSI/UL 60079-10-1 dated December 6, 2024 is an Adoption of IEC 60079-10-1, Explosive Atmospheres – Part 10-1: Classification of Areas – Explosive Gas Atmospheres, (third edition, issued by IEC December 2020) as a new IEC-based UL Standard, UL 60079-10-1 with US National Differences.

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

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DECEMBER 6, 2024

ANSI/UL 60079-10-1-2024

UL 60079-10-1

Standard for Explosive Atmospheres – Part 10-1: Classification of Areas – Explosive Gas Atmospheres

First Edition

December 6, 2024

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

The most recent designation of ANSI/UL 60079-10-1 as an American National Standard (ANSI) occurred on December 6, 2024. 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.

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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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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.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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International Standard IEC 60079-10-1 has been prepared by subcommittee 31J: Classification of hazardous areas and installation requirements, of IEC technical committee 31: Equipment for explosive atmospheres.

This third edition of IEC 60079-10-1 cancels and replaces the second edition, published in 2015, and constitutes a technical revision. The significant technical changes with respect to the previous edition are as follows:

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		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Deleting commercial and industrial applications for fuel gas from the Scope exemptions	1			C1
Updating editorial details and notes to the definitions	3		X	
Deletion of the previous edition clause 3.7.3 definition for catastrophic failure (dealt with in clause 4.5)			X	
Introduction of new Subclause **4.4.2 Zone of negligible extent**	4.4.2		X	
Introduction of new clause **5.3.2 Fuel gas installations**	5.3.2		X	
Renumbering of headings	7	X		
Introduction of **Figure 1 – Dilution volume**	7		X	
Upgrading **Table A.1** with UFL and its column 15 heading with the ‘source of data’	A.1	X		
Updating the flow-chart in **Figure B.1**	B.6		X	
Updating equations for evaporation rate to align with the recent source modifications	B.7.3		X	
Updating the chart in **Figure B.2** according to the updated equations for evaporation rate and the ventilation velocity of 0,25 m/s	B.7.3		X	
Restructuring **Table C.1**	C.3.4		X	
Removal of safety factor ***k*** and deleting it from the horizontal axis of the chart in **Figure C.1**	C.3.5			C2
Revising equations (C.2) and (C.3)	C.5.2			C3
Revising equations (C.4) and (C.5)	C.5.3			C4
Revising the chart in **Figure C.6** by changing the label on the horizontal axis	C.5.3			C5
Revising equation (C.6) and deleting equation (C.7)	C.5.4			C6
Removal of safety factor ***k*** and deleting it from the horizontal axis of the charts in **Figure D.1**	D.3			C7
Imposing limitations to the use of the chart in **Figure D.1**	D.3		X	
Updating and corrections in **Annex E**	Annex E		X	
Upgrading **Annex G** on Flammable mists	Annex G		X	
Introducing new items in **Table K.1**	Annex K		X	
Introducing new items in the Bibliography	Bibliography		X	
NOTE 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.				

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Explanations:

A) Definitions

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.

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.

Major technical changes	addition of technical requirements increase of technical requirements

B) Information about the background of changes

C1 The previous edition item e) was: “commercial and industrial applications where only low pressure fuel gas is used for appliances e.g. for cooking, water heating and similar uses, where the installation is compliant with relevant gas codes”. Industrial applications of any kind should not be exempted from the scope of this standard. See also new clause 5.3.2.

C2 The factor ***k*** was initially intended to provide for additional safety for uncertainties in determining LFL for flammable substances, particularly gas mixtures. However, this was considered as unnecessary and confusing considering the derivation of the chart.

C3 The equations are updated to align with BS 5925

C4 The equations are updated to align with BS 5925

C5 The chart is revised to match the new equation (C.4)

C6 The equation is updated to align with BS 5925

C7 See the explanation under C2

These are changes to technical requirements (addition, increase of the level or removal).

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

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

FDIS	Report on voting
31J/307/FDIS	31J/310/RVD

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

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

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

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

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INTRODUCTION

In areas where dangerous quantities and concentrations of flammable gas or vapour may arise, measures need to be applied in order to reduce the risk of explosions. This part of IEC 60079 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 hazards.

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

1 Scope

This part of IEC 60079 is concerned with the classification of areas where flammable gas or vapour hazards may arise and may then be used as a basis to support the proper design, construction, operation and maintenance of equipment for use in hazardous areas.

1DV.1 DE *Modification of Clause 1, first paragraph and additional paragraph as follows:*

Replace "part of IEC 60079" with "document".

Electrical installations in areas where flammable liquids or gases are produced, processed, stored or otherwise handled can be suitably designed if the locations of potential sources of release and accumulation are clearly defined. Once a location has been classified, requirements for electrical equipment and associated wiring should be determined from applicable publications. Applicable publications may include NFPA 70 (NEC) or API RP 14FZ. Reference Section 2 for other possible applicable publications.

It is intended to be applied where there may be an ignition hazard due to the presence of flammable gas or vapour, mixed with air, but it does not apply to:

a) mines susceptible to firedamp;

b) the processing and manufacture of explosives;

c) catastrophic failures or rare malfunctions which are beyond the concept of normality dealt with in this standard (see 3.7.3 and 4.5);

d) rooms used for medical purposes;

e) domestic premises;

f) where a hazard may arise due to the presence of combustible dusts or combustible flyings but the principles may be used in assessment of a hybrid mixture (refer also to IEC 60079-10-2).

NOTE Additional guidance on hybrid mixtures is provided in Annex I.

Flammable mists may form or be present at the same time as flammable vapour. In such case the strict application of the details in this document may not be appropriate. Flammable mists may also form when liquids not considered to be a hazard due to the high flash point are released under pressure. In these cases the classifications and details given in this document do not apply. Information on flammable mists is provided in Annex G.

For the purpose of this document, an area is a three-dimensional region or space.

Atmospheric conditions include variations 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 explosion properties of the flammable substances.

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In any site, irrespective of size, there may be numerous sources of ignition apart from those associated with equipment. Appropriate precautions will be necessary to ensure safety in this context. This standard is applicable with judgement for other ignition sources but in some applications other safeguards may also need to be considered. E.g. larger distances may apply for naked flames when considering hot work permits.

This document does not take into account the consequences of ignition of an explosive atmosphere except where a zone is so small that if ignition did occur it would have negligible consequences (see 3.3.8 and 4.4.2).

1DV.2 DR *Modification of Clause 1, seventh paragraph to add the following as last sentence:*

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

1DV.3 DR *Modification of Clause 1 to add the following paragraphs:*

With respect to the application of this standard in the US, the classification of a plant/plants are to be recognized as the classification of a facility/facilities.

Where references are made to IEC and ISO 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

This document contains no normative references.

2DV DE *Modification of Clause 2 to replace with the following:*

Normative References

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0 and the following 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
explosive atmosphere
mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, or dust which, after ignition, permits self-sustaining propagation

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[SOURCE: IEC 60079-0:2017, 3.38]

3.2
explosive gas atmosphere
mixture with air, under atmospheric conditions, of flammable substances in the form of gas or vapour, which, after ignition, permits self-sustaining flame propagation

Note 1 to entry: Although a mixture which has a concentration above the upper flammable limit (UFL) is not an explosive gas atmosphere, it can readily become so and, generally for hazardous area classification purposes, it is advisable to consider it as an explosive gas atmosphere.

Note 2 to entry: There are some gases and vapours which are explosive with the concentration of 100 % (e.g. acetylene, CAS no. 74-86-2, C_2H_2; monovinyl acetylene, CAS no. 689-97-4, C_4H_4; 1-propyl nitrate (vapour), CAS no. 627-13-4, CH_3 $(CH_2)_2$ NO_3; isopropyl nitrate (vapour), CAS no. 1712-64-7, $(CH_3)_2$ CH ONO_2; ethylene oxide (vapour), CAS no. 75-21-8, $(CH_2)_2$ O; hydrazine (vapour), CAS no. 302-01-2, H_4 N_2.

[SOURCE: IEC 60079-0:2017, 3.40, modified (addition of Notes to entry)]

3.3
hazardous areas and zones

3.3.1
hazardous area <on account of explosive gas atmospheres>
area in which an explosive gas atmosphere is present or can be expected to be present, in quantities such that special precautions for the construction, installation and use of equipment are required

3.3.1DV DR *Modification of Clause 3.3.1 to add the following notes:*

Note 1DV: The interior of many items of process equipment are commonly considered as a hazardous area even though a flammable atmosphere may not normally be present to account for the possibility of air entering the equipment. Where specific controls such as inerting are used the interior of process equipment may not need to be classified as a hazardous area.

Note 2DV: National Electrical Code® defines hazardous areas as hazardous (classified) locations.

3.3.2
non-hazardous area <on account of explosive gas atmospheres>
area in which an explosive gas atmosphere is not expected to be present in quantities such that special precautions for the construction, installation and use of equipment are required

3.3.2DV DR *Modification of Clause 3.3.2 to replace with the following note:*

Note DV: National Electrical Code® does not define a non-hazardous area but instead uses the term unclassified location.

3.3.3
zone
hazardous area classification based on the frequency of the occurrence and duration of the explosive atmosphere

3.3.4
Zone 0
area in which an explosive gas atmosphere is present continuously, or for long periods, or frequently

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Note 1 to entry: Both “long” and “frequently” are the terms which are intended to describe a very high likelihood of a potentially explosive atmosphere in the area. In that respect, those terms do not necessarily need to be quantified.

3.3.4DV DR *Modification of Clause 3.3.4 to replace with the following:*

A Zone 0 location is a location (1) in which ignitible concentrations of flammable gases or vapor are present continuously; or (2) in which ignitible concentrations of flammable gases or vapors are present for long periods of time.

Note 1 to entry: The term “long periods of time” is intended to describe a very high likelihood of a potentially explosive atmosphere in the area.

3.3.5
Zone 1
area in which an explosive gas atmosphere is likely to occur occasionally in normal operation

3.3.5DV DR *Modification of Clause 3.3.5 to replace with the following:*

A Zone 1 location is a location (1) in which ignitible concentrations of flammable gases or vapors are likely to exist under normal operating conditions; or (2) in which ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or (3) in which equipment is operated or processes are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition; or (4) that is adjacent to a Class I, Zone 0 location from which ignitible concentrations of vapors could be communicated, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

3.3.6
Zone 2
area in which an explosive gas atmosphere is not likely to occur in normal operation, but, if it does occur, will exist for a short period only

Note 1 to entry: Indications of the frequency of the occurrence and duration of the explosive atmosphere can be taken from codes or standards relating to specific industries or applications.

[SOURCE: IEC 60050-426:2020, 426-03-05]

3.3.6DV DR *Modification of Clause 3.3.6 to replace definition with the following:*

A Zone 2 location is a location (1) in which ignitible concentrations of flammable gases or vapors are not likely to occur in normal operation and, if they do occur, will exist only for a short period; or (2) in which volatile flammable liquids, flammable gases, or flammable vapors are handled, processed, or used but in which the liquids, gases, or vapors normally are confined within closed containers of closed systems from which they can escape, only as a result of accidental rupture or breakdown of the containers or system, or as a result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used; or (3) in which ignitible concentrations of flammable gases or vapors normally are prevented by positive mechanical ventilation but which may become hazardous as a result of failure or abnormal operation of the ventilation equipment; or (4) that is adjacent to a Zone 1 location, from which ignitible concentrations of flammable

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gases or vapors could be communicated, unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

3.3.7
extent of zone
distance in any direction from the source of release to where a gas/air mixture will be diluted by air to a concentration below the lower flammable limit

3.3.8
Zone NE
zone of negligible extent such that if ignition did occur it would have negligible consequences

Note 1 to entry: Zones of negligible extent could be Zone 0 NE, Zone 1 NE or Zone 2 NE.

3.4
releases

3.4.1
source of release
point or location from which a flammable gas, vapour, mist or liquid may be released into the atmosphere so that an explosive gas atmosphere could be formed

[SOURCE: IEC 60050-426:2020, 426-03-06]

3.4.2
continuous grade of release
release which is continuous or is expected to occur frequently or for long periods

Note 1 to entry: Both “frequently” and “long” are the terms which are intended to describe a very high likelihood of a potential release. In that respect, those terms do not necessarily need to be quantified.

3.4.2DV DR *Modification of Clause 3.4.2 as follows:*

Delete "frequently or" and note 1 from the definition.

3.4.3
primary grade of release
release which can be expected to occur periodically or occasionally during normal operation

3.4.4
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

3.4.4DV DR *Modification of Clause 3.4.4 as follows:*

Delete "only infrequently and" from the definition.

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3.4.5
release rate
quantity of flammable gas, liquid, vapour or mist emitted per unit time from the source of release

3.5
ventilation and dilution

3.5.1
ventilation
movement of air and its replacement with fresh air due to the effects of wind, temperature gradients, or artificial means (for example, fans or extractors)

Note 1 to entry: Fresh air is intended to be synomonous with the term ‘clean air’ used in IEC 60079-13. Both terms mean air that is essentially free of flammable gas or vapour.

3.5.2
dilution
mixing of flammable vapour or gas with air which, over time, will reduce the flammable concentration

3.5.3
dilution volume
volume in the vicinity of a source of release where the concentration of flammable gas or vapour is not diluted to a safe level

Note 1 to entry: In certain instances, the volumes under 3.5.3 and 3.5.5 could be the same.

3.5.4
background concentration
mean concentration of flammable substance within the volume under consideration outside of the release plume or jet

3.5.5
volume under consideration
volume served by the ventilation in the vicinity of the release being considered

Note 1 to entry: For an enclosed space this could be an entire room or part of a larger space where the considered ventilation will dilute the gas or vapour from a given source of release. Outdoors, this is the volume around a source of release where an explosive mixture could form. In congested outdoor places this volume could be dictated by the partial enclosure provided by the surrounding objects.

3.6
properties of flammable substance

3.6.1
flammable substance
substance which is itself flammable, or is capable of producing a flammable gas, vapour or mist

3.6.2
flammable liquid
liquid capable of producing a flammable vapour under any foreseeable operating conditions

Note 1 to entry: An example of a foreseeable operating condition is one in which the flammable liquid is handled at temperatures close to or above its flash point.

Note 2 to entry: This definition is used for the classification of hazardous areas and may be different from the definition of flammable liquids used for other purposes e.g. codes for classification of flammable liquids for transport.

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3.6.3
liquefied flammable gas
flammable substance which is stored or handled as a liquid and which at ambient temperature and atmospheric pressure is a flammable gas

3.6.4
flammable gas or vapour
gas or vapour which, when mixed with air in certain proportions, will form an explosive gas atmosphere

3.6.5
flammable mist
droplets of liquid, dispersed in air so as to form an explosive atmosphere

Note 1 to entry: Mists are also known as aerosols.

3.6.6
hybrid mixture
mixture of a flammable gas or vapour with a dust.

Note 1 to entry: According to IEC 60079-10-2 the term “dust” is defined as including both combustible dust and combustible flyings.

3.6.7
relative density of a gas or a vapour
density of a gas or a vapour relative to the density of air at the same pressure and temperature (air is equal to 1,0)

3.6.8
flashpoint
lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in a quantity such as to be capable of forming an ignitable vapour/air mixture

3.6.9
boiling point
temperature of a liquid boiling at an ambient pressure of 101,3 kPa (1 013 mbar)

Note 1 to entry: The initial boiling point used for liquid mixtures to indicate the lowest value of the boiling point for the range of liquids present, as determined in a standard laboratory distillation without fractionation.

3.6.10
vapour pressure
pressure exerted when a solid or liquid is in equilibrium with its own vapour

Note 1 to entry: This is also, the partial pressure of the substance in the atmosphere above the liquid. It is a function of the substance and of the temperature.

3.6.11
auto-ignition temperature (AIT)
lowest temperature (of a surface) at which under specified test conditions an ignition of a flammable gas or vapour in mixture with air or air-inert gas occurs

[SOURCE: ISO/IEC 80079-20-1:2017, 3.3]

3.6.12
lower flammable limit (LFL)
concentration of flammable gas or vapour in air below which an explosive gas atmosphere does not form

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Note 1 to entry: The term “lower explosive limit” is used especially in European standardization and regulations interchangeably to describe this limit.

[SOURCE: ISO/IEC 80079-20-1:2017, 3.6.1]

3.6.13
upper flammable limit (UFL)
concentration of flammable gas or vapour in air above which an explosive gas atmosphere does not form

Note 1 to entry: The term “upper explosive limit” is used especially in European standardization and regulations interchangeably to describe this limit.

[SOURCE: ISO/IEC 80079-20-1:2017, 3.6.2]

3.7
operation

3.7.1
normal operation
situation when the equipment is operating within its designed parameters

Note 1 to entry: Failures (such as the breakdown of pump seals, flange gaskets or spillages) caused by accidents which involve repair or shut-down are not considered to be part of normal operation.

Note 2 to entry: Normal operation includes start-up and shut-down conditions and routine maintenance, but excludes initial start up as part of commissioning.

3.7.2
routine maintenance
action to be performed occasionally or periodically in normal operation to maintain proper performance of equipment

Note 1 to entry: Routine maintenance does not include activities where the amount released or the rate of release is greater than that used for the area classification. E.g. Where equipment or systems require either partial dismantling or deliberate venting to atmosphere is required to enable the maintenance activity to be performed.

3.7.3
rare malfunction
type of malfunction which may happen only in rare instances

Note 1 to entry: Rare malfunctions in the context of this standard include failure of separate and independent process controls, that may be either automated or manual, that could trigger a chain of events that would lead to major release of flammable substance.

Note 2 to entry: Rare malfunctions could also include unanticipated conditions that are not covered by the plant design such as unexpected corrosion that results in a release. Where releases due to corrosion or similar conditions may or could reasonably be expected as part of the plant operations then this is not considered as a rare malfunction.

3.101DV DR *Add the following definition to Clause 3:*

unclassified location
locations determined to be neither Zone 0; Zone 1; Zone 2; nor any combination thereof.

3.102DV DR *Add the following definition to Clause 3:*

vaportight barrier

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