

Electrical apparatus for explosive gas atmospheres —

Part 10: Classification of hazardous areas

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National foreword

This British Standard has been prepared by Technical Committee GEL/31, and is the English language version of EN 60079-10:1996 *Electrical apparatus for explosive gas atmospheres Part 10: Classification of hazardous areas* including corrigendum 1996, published by the European Committee for Electrotechnical Committee for Standardization (CENELEC). It is identical with IEC 79-10:1995 including corrigendum 1996, published by the International Electrotechnical Commission (IEC).

The British Standard supersedes BS 5345-2:1983 which is withdrawn.

Cross-reference

Publication referred to	Corresponding British Standard
IEC 50 (426)	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 2 <i>Terms particular to power engineering</i> Group 13:1991 <i>Electrical apparatus for explosive atmospheres</i>

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Summary of pages

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English version

Electrical apparatus for explosive gas atmospheres Part 10: Classification of hazardous areas

(IEC 79-10 1995)

Matériel électrique atmosphères explosives
gazeuses
Partie 10: Classement des régions dangereuses
(CEI 79-10:1995)

Elektrische Betriebsmittel für
gasexplosionsgefährdete Bereiche
Teil 10: Einteilung der explosionsgefährdeten
Bereiche
(IEC 79-10:1995)

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of the document 31J/39/FDIS, future edition 3 of IEC 79-10, prepared by SC 31J, Classification of hazardous areas and installation requirements, of IEC TC 31, Electrical apparatus for explosive atmospheres, was submitted to the IEC/CENELEC parallel vote and was approved by CENELEC as EN 60079-10 on 1995-11-28.

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- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-09-01

Annexes designated “normative” are part of the body of this standard. Annexes designated “informative” are given for information only. In this standard, annex ZA is normative and annexes A, B and C are informative. Annex ZA has been added by CENELEC.

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Introduction

In areas where dangerous quantities and concentrations of flammable gas or vapour may arise, protective measures are to be applied in order to reduce the risk of explosions. The objective of this part of IEC 79 is to set out the essential criteria against which the risk of ignition can be assessed, and to give guidance on the design and control parameters which can be used in order to reduce this risk.

In the case of electrical apparatus, this standard is used as a basis for the proper selection and installation of apparatus for use in a hazardous area. Reference should be made to the appropriate standard(s) for details.

1 General

1.1 Scope

This part of IEC 79 is concerned with the classification of hazardous areas where flammable gas or vapour risks may arise, in order to permit the proper selection and installation of apparatus for use in such hazardous areas (see notes 1 and 4).

It is intended to be applied where there may be a risk of ignition due to the presence of flammable gas or vapour, mixed with air under normal atmospheric conditions (see note 2), but it does not apply to:

- a) mines susceptible to firedamp;
- b) the processing and manufacture of explosives;
- c) areas where a risk may arise due to the presence of ignitable dusts or fibres;
- d) catastrophic failures which are beyond the concept of abnormality dealt with in this standard (see note 3);
- e) rooms used for medical purposes;
- f) areas where the presence of flammable mist may give rise to an unpredictable risk and which require special consideration (see note 5).

This standard does not take into account the effects of consequential damage.

Definitions and explanations of terms are given together with the main principles and procedures relating to hazardous area classification.

For detailed recommendations regarding the extent of the hazardous areas in specific industries or applications, reference may be made to the codes relating to those industries or applications.

NOTE 1 For the purpose of this standard, an area is a three-dimensional region or space.

NOTE 2 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 materials.

NOTE 3 Catastrophic failure in this context is applied, for example, to the rupture of a process vessel or pipeline, and such events that are not predictable.

NOTE 4 In any process plant, irrespective of size, there may be numerous sources of ignition apart from those associated with electrical apparatus. Appropriate precautions will be necessary to ensure safety in this context. This standard may be used with judgement for other ignition sources.

NOTE 5 Mists may form or be present at the same time as flammable vapours. This may affect the way flammable material disperses and the extent of any hazardous areas. The strict application of area classification for gases and vapours may not be appropriate because the flammability characteristics of mists are not always predictable. Whilst it can be difficult to decide upon the type and extent of zones, the criteria applicable to gases and vapours will, in most cases, give a safe result. However, special consideration should always be given to the danger of ignition of flammable mists.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 79. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 79 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(426):1990, *International Electrotechnical Vocabulary (IEV) — Chapter 426: Electrical apparatus for explosive atmospheres*.

IEC 79-4:1975, *Electrical apparatus for explosive gas atmospheres — Part 4: Method of test for ignition temperature*.

IEC 79-4A:1970, *First supplement to IEC 79-4 (1966)*.

2 Definitions and terms

For the purpose of this part of IEC 79, the following definitions and terms apply.

2.1

explosive gas atmosphere

a mixture with air, under atmospheric conditions, of a flammable material in the form of gas or vapour in which, after ignition, combustion spreads throughout the unconsumed mixture [IEV 426-02-03, modified]

NOTE Although a mixture which has a concentration above the upper explosive limit (UEL) is not an explosive gas atmosphere, it can readily become so and, in certain cases for area classification purposes, it is advisable to consider it as an explosive gas atmosphere.

2.2**hazardous area**

an area in which an explosive gas atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of apparatus [IEV 426-03-01, modified]

2.3**non-hazardous area**

an area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of apparatus [IEV 426-03-02, modified]

2.4 Zones

Hazardous areas are classified into zones based upon the frequency of the occurrence and duration of an explosive gas atmosphere, as follows:

2.4.1**zone 0**

an area in which an explosive gas atmosphere is present continuously or for long periods [IEV 426-03-03, modified]

2.4.2**zone 1**

an area in which an explosive gas atmosphere is likely to occur in normal operation [IEV 426-03-04]

2.4.3**zone 2**

an area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only [IEV 426-03-05, modified]

NOTE Indications of the frequency of the occurrence and duration may be taken from codes relating to specific industries or applications.

2.5**source of release**

a point or location from which a flammable gas, vapour, or liquid may be released into the atmosphere such that an explosive gas atmosphere could be formed [IEV 426-03-06, modified]

2.6 Grades of release

There are three basic grades of release, as listed below in order of decreasing likelihood of the explosive gas atmosphere being present:

- a) continuous grade;
- b) primary grade;
- c) secondary grade.

A source of release may give rise to any one of these grades of release, or to a combination of more than one.

2.6.1**continuous grade of release**

a release which is continuous or is expected to occur for long periods

2.6.2**primary grade of release**

a release which can be expected to occur periodically or occasionally during normal operation

2.6.3**secondary grade of release**

a 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

2.7**release rate**

the quantity of flammable gas or vapour emitted per unit time from the source of release

2.8**normal operation**

the situation when the equipment is operating within its design parameters

NOTE 1 Minor releases of flammable material may be part of normal operation. For example, releases from seals which rely on wetting by the fluid which is being pumped are considered to be minor releases.

NOTE 2 Failures (such as the breakdown of pump seals, flange gaskets or spillages caused by accidents) which involve urgent repair or shut-down are not considered to be part of normal operation.

2.9**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)

2.10 Explosive limits**2.10.1****lower explosive limit (LEL)**

the concentration of flammable gas or vapour in air, below which the gas atmosphere is not explosive [IEV 426-02-09, modified]

2.10.2**upper explosive limit (UEL)**

the concentration of flammable gas or vapour in air, above which the gas atmosphere is not explosive [IEV 426-02-10, modified]

NOTE For the purpose of this standard, the terms “explosive” and “flammable” should be considered synonymous.

2.11**relative density of a gas or a vapour**

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

2.12**flammable material**

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

2.13**flammable liquid**

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

2.14**flammable gas or vapour**

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

2.15**flammable mist**

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

2.16**flashpoint**

the 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 [IEV 426-02-14]

2.17**boiling point**

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

NOTE For liquid mixtures, the initial boiling point should be used. Initial boiling point is 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.

2.18**vapour pressure**

the pressure exerted when a solid or liquid is in equilibrium with its own vapour. It is a function of the substance and of the temperature

2.19**ignition temperature of an explosive gas atmosphere**

the lowest temperature of a heated surface at which, under specified conditions, the ignition of a flammable substance in the form of a gas or vapour mixture with air will occur

NOTE IEC 79-4 and IEC 79-4A standardize a method for the determination of this temperature. [IEV 426-02-01, modified]

3 Safety and area classification**3.1 Safety principles**

Installations in which flammable materials are handled or stored should be designed, operated and maintained so that any releases of flammable material, and consequently the extent of hazardous areas, are kept to a minimum, whether in normal operation or otherwise, with regard to frequency, duration and quantity.

In the case of maintenance activities other than those of normal operation, the extent of the zone may be affected but it is expected that this would be dealt with by a permit-to-work system.

In emergency situations, reliance should be placed on the isolation of unsuitable electrical equipment, shut-down of the process, isolation of process vessels, containment of spillages and, if possible, the provision of additional emergency ventilation.

In a situation in which there may be an explosive gas atmosphere, the following steps should be taken:

- a) eliminate the likelihood of an explosive gas atmosphere occurring around the source of ignition, or
- b) eliminate the source of ignition.

Where this is not possible, protective measures, process equipment, systems and procedures should be selected and prepared so the likelihood of the coincidence of a) and b) is so small as to be acceptable. Such measures may be used singly if they are recognized as being highly reliable, or in combination to achieve an equivalent level of safety.

3.2 Area classification objectives

Area classification is a method of analysing and classifying the environment where explosive gas atmospheres may occur so as to facilitate the proper selection and installation of apparatus to be used safely in that environment, taking into account gas groups and temperature classes.

In most practical situations where flammable materials are used, it is difficult to ensure that an explosive gas atmosphere will never occur. It may also be difficult to ensure that apparatus will never give rise to a source of ignition. Therefore, in situations where an explosive gas atmosphere has a high likelihood of occurring, reliance is placed on using apparatus which has a low likelihood of creating a source of ignition. Conversely, where the likelihood of an explosive gas atmosphere occurring is reduced, apparatus constructed to a less rigorous standard may be used.

It is rarely possible by a simple examination of a plant or plant design to decide which parts of the plant can be equated to the three zonal definitions (zones 0, 1 and 2). A more detailed approach is therefore necessary and this involves the analysis of the basic possibility of an explosive gas atmosphere occurring.

The first step is to assess the likelihood of this, in accordance with the definitions of zone 0, zone 1 and zone 2. Once the likely frequency and duration of release (and hence the grade of release), the release rate, concentration, velocity, ventilation and other factors which affect the type and/or extent of the zone have been determined, there is then a firm basis on which to determine the likely presence of an explosive gas atmosphere in the surrounding areas. This approach therefore requires detailed consideration to be given to each item of process equipment which contains a flammable material, and which could therefore be a source of release.

In particular, zone 0 or zone 1 areas should be minimized in number and extent by design or suitable operating procedures. In other words, plants and installations should be mainly zone 2 or non-hazardous. Where release of flammable material is unavoidable, process equipment items should be limited to those which give secondary grade releases or, failing this (that is where primary or continuous grade releases are unavoidable), the releases should be of very limited quantity and rate. In carrying out area classification, these principles should receive prime consideration. Where necessary, the design, operation and location of process equipment should ensure that, even when it is operating abnormally, the amount of flammable material released into the atmosphere is minimized, so as to reduce the extent of the hazardous area.

Once a plant has been classified and all necessary records made, it is important that no modification to equipment or operating procedures is made without discussion with those responsible for the area classification. Unauthorized action may invalidate the area classification. It is necessary to ensure that all equipment affecting the area classification which has been subjected to maintenance is carefully checked during and after re-assembly to ensure that the integrity of the original design, as it affects safety, has been maintained before it is returned to service.

4 Area classification procedure

4.1 General

The area classification should be carried out by those who have knowledge of the properties of flammable materials, the process and the equipment, in consultation, as appropriate, with safety, electrical and other engineering personnel.

The following subclauses give guidance on the procedure for classifying areas in which there may be an explosive atmosphere and on the extent of zones 0, 1 and 2. An example of a schematic approach to the classification of hazardous areas is given in Figure C.1.

4.2 Sources of release

The basic elements for establishing the hazardous zone types are the identification of the source of release and the determination of the grade of release.

Since an explosive gas atmosphere can exist only if a flammable gas or vapour is present with air, it is necessary to decide if any of these flammable materials can exist in the area concerned. Generally speaking, such gases and vapours (and flammable liquids and solids which may give rise to them) are contained within process equipment which may or may not be totally enclosed. It is necessary to identify where a flammable atmosphere can exist inside a process plant, or where a release of flammable materials can create a flammable atmosphere outside a process plant.

Each item of process equipment (for example tank, pump, pipeline, vessel, etc.) should be considered as a potential source of release of flammable material. If the item cannot contain flammable material, it will clearly not give rise to a hazardous area around it. The same will apply if the item contains a flammable material but cannot release it into the atmosphere (for example an all-welded pipeline is not considered to be a source of release).

If it is established that the item may release flammable material into the atmosphere, it is necessary, first of all, to determine the grade of release in accordance with the definitions, by establishing the likely frequency and duration of the release. It should be recognized that the opening-up of parts of enclosed process systems (for example during filter changing or batch filling) should also be considered as sources of release when developing the area classification. By means of this procedure, each release will be graded either "continuous", "primary" or "secondary".

Having established the grade of the release, it is necessary to determine the release rate and other factors which may influence the type and extent of the zone.

4.3 Type of zone

The likelihood of the presence of an explosive gas atmosphere and hence the type of zone depends mainly on the grade of release and the ventilation.

NOTE A continuous grade of release normally leads to a zone 0, a primary grade to zone 1 and a secondary grade to zone 2 (see annex B).

4.4 Extent of zone

The extent of the zone is mainly affected by the following chemical and physical parameters, some of which are intrinsic properties of the flammable material; others are specific to the process. For simplicity, the effect of each parameter listed below assumes that the other parameters remain unchanged.

4.4.1 Release rate of gas or vapour

The greater the release rate the larger the extent of the zone. The release rate depends itself on other parameters, namely:

a) Geometry of the source of release

This is related to the physical characteristics of the source of release, for example an open surface, leaking flange, etc. (see annex A).

b) Release velocity

For a given source of release, the release rate increases with the release velocity. In the case of a product contained within process equipment, the release velocity is related to the process pressure and the geometry of the source of release. The size of a cloud of flammable gas or vapour is determined by the rate of flammable vapour release and the rate of dispersion. Gas and vapour flowing from a leak at high velocity will develop a cone-shaped jet which will entrain air and be self-diluting. The extent of the explosive atmosphere will be almost independent of wind velocity. If the release is at low velocity or if its velocity is destroyed by impingement on a solid object, it will be carried by the wind and its dilution and extent will depend on wind velocity.

c) Concentration

The release rate increases with the concentration of flammable vapour or gas in the released mixture.

d) Volatility of a flammable liquid

This is related principally to the vapour pressure, and the heat of vaporization. If the vapour pressure is not known, the boiling point and flashpoint can be used as a guide.

An explosive atmosphere cannot exist if the flashpoint is above the relevant maximum temperature of the flammable liquid. The lower the flashpoint, the greater may be the extent of the zone. If a flammable material is released in a way that forms a mist (for example by spraying) an explosive atmosphere may be formed below the flashpoint of the material for example.

NOTE 1 Flashpoints of flammable liquids are not precise physical quantities, particularly where mixtures are involved.

NOTE 2 Some liquids (for example certain halogenated hydrocarbons) do not possess a flashpoint although they are capable of producing an explosive gas atmosphere. In these cases, the equilibrium liquid temperature which corresponds to the saturated concentration at the lower explosive limit should be compared with the relevant maximum liquid temperature.

e) Liquid temperature

The vapour pressure increases with temperature, thus increasing the release rate due to evaporation.

NOTE The temperature of the liquid after it has been released may be increased, for example, by a hot surface or by a high ambient temperature.

4.4.2 Lower explosive limit (LEL)

For a given release volume, the lower the LEL the greater will be the extent of the zone.

4.4.3 Ventilation

With increased ventilation, the extent of the zone will be reduced. Obstacles which impede the ventilation may increase the extent of the zone. On the other hand, some obstacles, for example dykes, walls or ceilings, may limit the extent.

4.4.4 Relative density of the gas or vapour when it is released

If the gas or vapour is significantly lighter than air, it will tend to move upwards. If significantly heavier, it will tend to accumulate at ground level. The horizontal extent of the zone at ground level will increase with increasing relative density and the vertical extent above the source will increase with decreasing relative density.

NOTE 1 For practical applications, a gas or vapour which has a relative density below 0,8 is regarded as being lighter than air. If the relative density is above 1,2 it is regarded as being heavier than air. Between these values, both of these possibilities should be considered.

NOTE 2 Experience has shown that ammonia is hard to ignite and a gas release will dissipate rapidly in the open air, so any explosive gas atmosphere will be of negligible extent.

4.4.5 Other parameters to be considered

a) Climatic conditions.

b) Topography.

4.4.6 Illustrative examples

Some ways in which the above-mentioned parameters affect the vapour or gas release rate and hence the extent of the zone are demonstrated in the examples in annex C.

a) Source of release: open surface of liquid

In most cases, the liquid temperature will be below the boiling point and the vapour release rate will depend principally on the following parameters:

- liquid temperature;
- vapour pressure of the liquid at its surface temperature;
- dimensions of the evaporation surface.

b) Source of release: virtually instantaneous evaporation of a liquid (for example from a jet or spray)

Since the discharged liquid vaporizes virtually instantaneously, the vapour release rate is equal to the liquid flow rate and this depends on the following parameters:

- liquid pressure;
- geometry of the source of release.

Where the liquid is not instantaneously vaporized, the situation is complex because droplets, liquid jets and pools may create separate sources of release.

c) Source of release: leakage of a gas mixture

The gas release rate is affected by the following parameters:

- pressure within the equipment which contains the gas;
- geometry of the source of release;
- concentration of flammable gas in the released mixture.

For examples of sources of release see clause A.2.

4.5 Extent of zone – General comments

4.5.1 Consideration should always be given to the possibility that a gas which is heavier than air may flow into areas below ground level for example pits or depressions and that a gas which is lighter than air may be retained at high level for example in a roof space.

4.5.2 Where the source of release is situated outside an area or in an adjoining area, the penetration of a significant quantity of flammable gas or vapour into the area can be prevented by suitable means such as:

a) physical barriers;

b) maintaining a static overpressure in the area relative to the adjacent hazardous areas, so preventing the ingress of the hazardous atmosphere;

c) purging the area with a significant flow of air, so ensuring that the air escapes from all openings where the hazardous gas or vapour may enter.

5 Ventilation

5.1 General

Gas or vapour released into the atmosphere can be diluted by dispersion or diffusion into the air until its concentration is below the lower explosion limit. Ventilation, i.e. air movement leading to replacement of the atmosphere in a (hypothetical) volume around the source of release by fresh air, will promote dispersion. Suitable ventilation rates can also avoid persistence of an explosive gas atmosphere thus influencing the type of zone.

5.2 Main types of ventilation

Ventilation can be accomplished by the movement of air due to the wind and/or by temperature gradients or by artificial means such as fans. So two main types of ventilation are thus recognized:

- a) natural ventilation;
- b) artificial ventilation, general or local.

5.3 Degree of ventilation

The most important factor is that the degree or amount of ventilation is directly related to the types of sources of release and their corresponding release rates. This is irrespective of the type of ventilation, whether it be wind speed or the number of air changes per time unit. Thus optimal ventilation conditions in the hazardous area can be achieved and the higher the amount of ventilation in respect of the possible release rates, the smaller will be the extent of the zones (hazardous areas), in some cases reducing them to a negligible extent (non-hazardous area).

Practical examples for guidance on the degree of ventilation to be used are given in annex B.

5.4 Availability of ventilation

The availability of ventilation has an influence on the presence or formation of an explosive atmosphere and thus also on the type of zone. Guidance on availability is given in annex B.

NOTE Combining the concepts of degree of ventilation and level of availability results in a quantitative method for the evaluation of zone type (see annex B).

6 Documentation

6.1 General

It is recommended that area classification is undertaken in such a way that the various steps which lead to the final area classification are properly documented.

All relevant information used should be referred to. Examples of such information, or of a method used, would be:

- a) recommendations from relevant codes and standards;
- b) gas and vapour dispersion characteristics and calculations;
- c) a study of ventilation characteristics in relation to flammable material release parameters so that the effectiveness of the ventilation can be evaluated.

The results of the area classification study and any subsequent alterations to it shall be placed on record.

Those properties which are relevant to area classification of all process materials used on the plant should be listed and should include flashpoint, boiling point, ignition temperature, vapour pressure, vapour density, explosive limits, gas group and temperature class. An example is given in Table C.1 and Table C.2.

6.2 Drawings, data sheets and tables

Area classification documents should include plans and elevations, as appropriate, which show both the type and extent of zones, ignition temperature and hence temperature class and gas group.

Where the topography of an area influences the extent of the zones, this should be documented.

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) the position of openings in buildings (for example doors, windows and inlets and outlets of air for ventilation).

The area classification symbols which are shown in Figure C.2 are the preferred ones, but alternatives may be used provided that they are clearly defined in the documents.

Annex A (informative)

Examples of sources of release

A.1 Process plant

The following examples are not intended to be rigidly applied and may need to be varied to suit particular process equipment and situations.

A.1.1 Sources giving a continuous grade of release

- a) the surface of a flammable liquid in a fixed roof tank, with a permanent vent to the atmosphere;
- b) the surface of a flammable liquid which is open to the atmosphere continuously or for long periods (for example an oil/water separator).

A.1.2 Sources giving a primary grade of release

- a) seals of pumps, compressors or valves if release of flammable material during normal operation is expected;
- b) water drainage points on vessels which contain flammable liquids, which may release flammable material into the atmosphere while draining off water during normal operation;
- c) sample points which are expected to release flammable material into the atmosphere during normal operation;
- d) relief valves, vents and other openings which are expected to release flammable material into the atmosphere during normal operation.

A.1.3 Sources giving a secondary grade of release

- a) seals of pumps, compressors and valves where release of flammable material during normal operation of the equipment is not expected;
- b) flanges, connections and pipe fittings, where release of flammable material is not expected during normal operation;
- c) sample points which are not expected to release flammable material during normal operation;
- d) relief valves, vents and other openings which are not expected to release flammable material into the atmosphere during normal operation.

A.2 Openings

The following examples are not intended to be rigidly applied, but may need to be varied to suit particular situations.

A.2.1 Openings as possible sources of release

Openings between areas should be considered as possible sources of release. The grade of release will depend upon:

- the zone type of the adjoining area;
- the frequency and duration of opening periods;
- the effectiveness of seals or joints;
- the difference in pressure between the areas involved.

A.2.2 Openings classification

Openings are classified as A, B, C, D with the following characteristics:

A.2.2.1 Type A – Openings not conforming to the characteristics specified for types B, C or D.

Examples:

- open passages for access or utilities, for example ducts, pipes through walls, ceilings and floors;
- fixed ventilation outlets in rooms, buildings and similar openings of types B, C and D which are opened frequently or for long periods.

A.2.2.2 Type B – Openings which are normally closed (for example automatic closing) and infrequently opened, and which are close-fitting.

A.2.2.3 Type C – Openings normally closed and infrequently opened, conforming to type B, which are also fitted with sealing devices (for example a gasket) along the whole perimeter; or two openings type B in series, having independent automatic closing devices.

A.2.2.4 Type D – Openings normally closed conforming to type C which can only be opened by special means or in an emergency.

Type D openings are effectively sealed, such as in utility passages (for example ducts, pipes) or can be a combination of one opening type C adjacent to a hazardous area and one opening type B in series.

Table A.1 — Effect of openings on grade of release

Zone upstream of opening	Opening type	Grade of release of openings considered as sources of release
Zone 0	A	Continuous
	B	(Continuous)/primary
	C	Secondary
	D	No release
Zone 1	A	Primary
	B	(Primary)/secondary
	C	(Secondary)/no release
	D	No release
Zone 2	A	Secondary
	B	(Secondary)/no release
	C	No release
	D	No release

NOTE For grades of release shown in brackets, the frequency of operation of the openings should be considered in the design.

Annex B (informative) Ventilation

Introduction

The purpose of this annex is to assess the degree of ventilation and to extend clause 5 by defining ventilation conditions and by means of explanations, examples and calculation, so giving guidance on the design of artificial ventilation systems, since these are of paramount importance in the control of the dispersion of releases of flammable gases and vapours.

The methods developed allow the determination of the type of zone by:

- estimating the minimum ventilation rate required to prevent significant build-up of an explosive atmosphere and using this to calculate a hypothetical volume, V_z which, with an estimated dispersion time, t , allows determination of the degree of ventilation. It is not intended that these calculations are used to determine the extent of the hazardous areas;
- determining the type of zone from the degree and availability of ventilation and the grade of release.

Although primarily of direct use in indoor situations, the concepts explained may assist in outdoor locations, for example by determination of the application of Table B.1.

B.1 Natural ventilation

This is a type of ventilation which is accomplished by the movement of air caused by the wind and/or by temperature gradients. In open air situations, natural ventilation will often be sufficient to ensure dispersal of any explosive atmosphere which arises in the area. Natural ventilation may also be effective in certain indoor situations (for example where a building has openings in its walls and/or roof).

NOTE For outdoor areas the evaluation of ventilation should normally be based on an assumed minimum wind speed of 0,5 m/s, which will be present virtually continuously. The wind speed will frequently be above 2 m/s.

Examples of natural ventilation:

- open air situations typical of those in the chemical and petroleum industries for example open structures, pipe racks, pump bays and the like;
- an open building which, having regard to the relative density of the gases and/or vapours involved, has openings in the walls and/or roof so dimensioned and located that the ventilation inside the building, for the purpose of area classification, can be regarded as equivalent to that in an open air situation;
- a building which is not an open building but which has natural ventilation (generally less than that of an open building) provided by permanent openings made for ventilation purposes.