



POTENTIALLY EXPLOSIVE ATMOSPHERES EU DIRECTIVE 1999/92/EC

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL



AVENUE DE L'ASTRONOMIE 30 • B – 1210 BRUSSELS

Tel: +32 2 217 70 98

E-mail: info@eiga.eu • Internet: www.eiga.eu





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Prepared by AHG-S.14 of Safety Advisory Council

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL
Avenue de l'Astronomie 30 B 1210 Brussels Tel: 32 2 217 70 98
E-mail: info@eiga.eu Internet: www.eiga.eu



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Amendments to 134/12

Section	Change
	Editorial to align style with EIGA style manual
1, 2	Update to reflect updated EU directive
3	Updated to definitions following updated directive and standards
5	Update for new directive
6	Update to references
7	Updated section structure, and revised wording
12	Updated guidance on storage and references
13	New section

NOTE Technical changes from the previous edition are underlined

REV1 Correction of reference 18

1 Introduction

Directive 1999/92/EC, on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres, also known as ATEX 137, defines the minimum requirements to protect workers from potentially explosive atmospheres [1].¹ This publication has been issued to facilitate and harmonise the interpretation and implementation among EIGA members of the required risk assessments and specifically the classification of areas where an explosive atmosphere can occur according to the directive and related standards.

The three key principles for prevention and protection against explosions taken from Directive 1999/92/EC are given in Article 6(2), in order of priority [1]:

1. The prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow that.
2. The avoidance of the ignition of explosive atmospheres.
3. The mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers.

2 Scope and purpose

The scope includes handling and storage of flammable gases and liquids where an explosive atmosphere with air under atmospheric conditions might arise at industrial gases company's plants. The publication does not apply to the use of flammable medical gases or the risk arising in piping systems, cylinders and vessels with increased pressure. Directive 1999/92/EC also applies to potentially explosive atmospheres involving dust [1]. This publication does not provide guidance on dust explosions, however members may have potentially explosive atmospheres involving dust that require assessment, for example painting facilities.

This publication covers potentially explosive atmospheres that form in the open air, it does not cover potentially flammable or explosive mixtures within a process, for example flammable gas cylinder mixtures.

This publication also provides guidance on the storage of flammable gas cylinders in open air.

The classification of hazardous areas according to this publication and EC Directive 1999/92 can also be used for the selection of Ex-classified equipment and systems as required by Directive 2014/34/EU concerning equipment and protection systems intended for use in potentially explosives atmospheres, (also known as ATEX 100a) [1, 2].

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

¹ References are shown by bracketed numbers and are listed in order of appearance in the reference section.

3.1.3 **May**

Indicates that the procedure is optional.

3.1.4 **Will**

Is used only to indicate the future, not a degree of requirement.

3.1.5 **Can**

Indicates a possibility or ability.

3.2 **Technical definitions**

3.2.1 **Explosive atmosphere**

A mixture with air, under atmospheric conditions of flammable substances in the form of gases, vapours, dust, fibres, or flyings, in which, after ignition permits self-sustaining flame propagation.

NOTE The definition is taken from IEC 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements* [3].

3.2.2 **Explosive limit, lower (LEL)**

Concentration of flammable gas or vapour in air, below which the gas atmosphere is not explosive.

3.2.3 **Explosive limit, upper (UEL)**

Concentration of flammable gas or vapour in air, above which the gas atmosphere is not explosive.

3.2.4 **Hazardous area**

An area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment.

NOTE The definition is taken from IEC 60079-0 [3].

3.2.5 **Ignition temperature**

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.

3.2.6 **Open air storage**

A storage area with at least 25% of the sides open to atmosphere and without a roof.

3.2.7 **Temperature class**

Equipment is classified by temperature class according to its maximum surface temperature.

3.2.8 **Zone 0**

A place in which an explosive atmosphere consisting of a mixture with air of flammable gas, vapour or mist is present continuously or for long periods or frequently.

NOTE Generally accepted guidance for Zone 0 is where explosive atmospheres are present for more than 1000 hours per year.

3.2.9 Zone 1

A place in which an explosive atmosphere consisting of a mixture with air of flammable gas, vapour or mist is likely to occur in normal operation occasionally.

NOTE Generally accepted guidance for Zone 1 is where explosive atmospheres are present for more than 10 but less than 1000 hours per year.

3.2.10 Zone 2

A place in which an explosive atmosphere consisting of a mixture with air of flammable gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

NOTE Generally accepted guidance for Zone 2 is where explosive atmospheres are present for less than 10 hours per year.

NOTE Zone 20, 21 and 22 are only valid for dusts and are not defined here.

4 EU Directive 1999/92/EC (ATEX 137) [1]

The directive specifies the minimum requirements for the protection of workers potentially at risk from explosive atmospheres. It requires the employer to carry out an explosion risk assessment including a classification of the areas and take necessary measures to not endanger the safety and health of workers. It includes organisational measures such as training of workers, work permit system, the need for work instructions, and the use of warning signs as well as the responsibility to coordinate work of employees belonging to different employers. Furthermore, the directive details some specific requirements on the work equipment and workplaces where explosive atmosphere can arise.

The actions required shall be described in an explosion protection document, (refer to Section 14).

5 EU Directive 2014/34 (ATEX 100a) [2]

This publication is issued to harmonise the interpretation of EU Directive 1999/92 [1]. However, it is necessary to review the content of Directive 2014/34 due to its high importance for work in areas with a risk for explosive atmosphere [2]. Directive 2014/34 concerning mechanical and electrical equipment and protective systems intended for use in potentially explosive areas is valid when the equipment has an own source of ignition of any kind [2]. It also applies to safety, regulating and controlling devices not placed in explosive atmospheres but forming an integral part of those protective devices.

NOTE The directive applies to equipment and systems that are placed on the market after 26th February 2014. It replaced directive 94/9/EC which applied to equipment placed on the market after 1st July 2003 [4].

Equipment and devices included in the scope shall:

- bear CE as well as Ex proof marking and additional marking according to the directive and be accompanied by a declaration of conformity;
- be accompanied at delivery with comprehensive and detailed instructions (user manual); and
- be classified in Group I or II, where Group I is intended for use in mines and Group II is for other applications.

NOTE Only Group II equipment is in the scope of this publication.

Equipment / devices shall be classified in a Category (1, 2 or 3), as described in 5.1 to 5.4. The category selected will then allow the use of the equipment in the corresponding area where the risk of explosive atmosphere has been defined.

5.1 Category 1 equipment

Category 1 equipment shall have a very high level of protection even for rare equipment failures and it can be used in zone 0 areas. In the conformity assessment there is a requirement that the:

- equipment is CE and Ex marked against ATEX Directive 2014/34 [2];
- equipment has passed an EC-type certification by a notified body; and
- manufacturer of the equipment has an approved quality assurance system for the production, inspection and testing of the equipment

5.2 Electrical equipment in category 2

Category 2 equipment can be used in zone 1 areas. There is a requirement that the:

- equipment is CE and Ex marked against ATEX Directive 2014/34 [2];
- equipment has passed an EC-type certification by a notified body; and
- manufacturer shall have an approved quality assurance system for the production, inspection and testing of the equipment.

5.3 Category 2 non-electrical equipment

Category 2 equipment can be used in zone 1 areas. There is a requirement that the:

- Equipment is CE and Ex marked against ATEX Directive 2014/34 [2];
- manufacturer has checked and verified that the equipment conforms to the essential health and safety requirement in the Directive [2];
- manufacturer shall have an approved quality assurance system for the production, inspection and testing of the equipment; and
- manufacturer shall provide a technical file to a notified body and the production process shall ensure compliance of the manufactured equipment with the technical documentation.

5.4 Category 3 equipment

Category 3 equipment is allowed only in Zone 2 areas. There is a requirement that the:

- equipment is CE and Ex marked against ATEX Directive 2014/34 [2];
- manufacturer has checked and verified that the equipment conforms to the essential health and safety requirement in the Directive [2];
- manufacturer shall have an approved quality assurance system for the production, inspection and testing of the equipment; and
- manufacturer shall provide a technical file to a notified body and the production process shall ensure compliance of the manufactured equipment with the technical documentation.

For all equipment there is also an alternative to send each single equipment item to a notified body and have it inspected, tested and categorised.

NOTE Category 2 non-electrical equipment and Category 3 equipment do not require type approval by a notified according to the directive, however it is common in the industry for manufacturers to have a type approval under the IEC Ex system [5].

6 Data for the assessment of explosion risks

6.1 General

The risk assessment process should assess the likelihood that an explosive atmosphere will occur and the likelihood that ignition sources are present. It shall include normal operations, start up, shut down and dismantling of the process / equipment, inspection, maintenance and repair activities, cleaning of facilities, common malfunctions and failures as well as foreseeable misuse. The assessment shall also include the risk of flammable atmosphere spreading to neighbouring areas through openings, ventilation ducts, etc. Equipment, devices and components installed in classified areas before 1st July 2003 do not need to comply with EU Directive 2014/34, but a separate risk assessment of the design may be required [2].

NOTE All changes of procedures, equipment and facilities in hazardous areas shall be risk assessed – the management of change is essential, see EIGA Doc 51, *Management of Change* [6].

Emergency scenarios such as rupture of pipe lines and vessels followed by a release of flammable gases, sudden rupture of a gas cylinder at use, filling or handling and release of the content, etc. should be handled in the site emergency plans, see EIGA Doc 233, *Emergency Response Planning*, or other dedicated documents, for example Seveso documentation, see EIGA Doc 60, *Seveso Documents - Guidance on Applicability, Assessment and Legal Documents for Demonstrating Compliance of Industrial Gases Facilities with Seveso Directive(s)* [7, 8]. These scenarios are not considered as expected failures or malfunctions and the consequence should not be a basis for the risk assessment and classification of hazardous areas according to this publication and the ATEX directives.

6.2 Ignition energy

The energy needed to ignite gases and vapours commonly found in the gas industry can be found in Table 2. A general assumption is that ignition of a flammable gas / air mixture requires an ignition source with an energy less than 1 mJ, and vapour from many solvents requires 0.1 – 3 mJ. The ignition energy given refers to the stoichiometric mixture, closer to the upper and lower explosion limits the required energy can be up to a hundred times greater.

The energy needed to ignite a mixture should be compared to the possible energy generated by some common sources, some examples are given in Table 1.

It is very clear that all these sources are fully capable of igniting a gas mixture and the same applies to mobile phones, calculators, PC's and many other electrical devices without any explosion protection. However, the use of ordinary wristwatches, hearing aids and remote-control key fobs powered by primary button cells (non-rechargeable) in Zone 1 and 2 can be allowed due to the fact the possibly generated ignition energy is very low and gas penetration into the device is very slow, for more information see *Safety notice: Electrical/electronic devices energised by button cells in hazardous areas (potentially explosive atmospheres)* from the Energy Institute [9].

Table 1 – Example ignition sources

Description	Energy
Electrostatically charged person	10-100 mJ
Dropped mobile phone	10-20 mJ

6.3 Properties of involved substances

Physical data of some substances commonly used by EIGA member companies is shown in Table 2.

NOTE The values of the minimum ignition energy in air differs significantly in the literature.