CORTEM® GROUP

To be sure to be safe.

THE IEC AND NEC® CERTIFICATION SYSTEMS

INDEX

1. FOREWORD

Conformity to the **Atex Directive** is a necessary and sufficient condition in European Union countries for the installation of protected electrical equipment in areas classified as hazardous. In Countries that do not belong to the European Union, but belong to IECEx, protected electrical equipment is still subject to assessment of conformity to the standards of the **IECEx system** (International Electrotechnical Commission System for Certification to Standards Relating to Equipment for use in Explosive Atmospheres), both for general parts and for parts related to protection methods, by a third party entity. This is a voluntary certification scheme of an international character which, in its philosophy, is very similar to the ATEX Directive and calls for both design (Ex-TR) and manufacturing control (QAR) by a Certification Body accredited by this scheme; the certificate of conformity (CoC) may be applied for with these two documents. The regulatory framework is that of the IEC 60079 and IEC 61241 series.

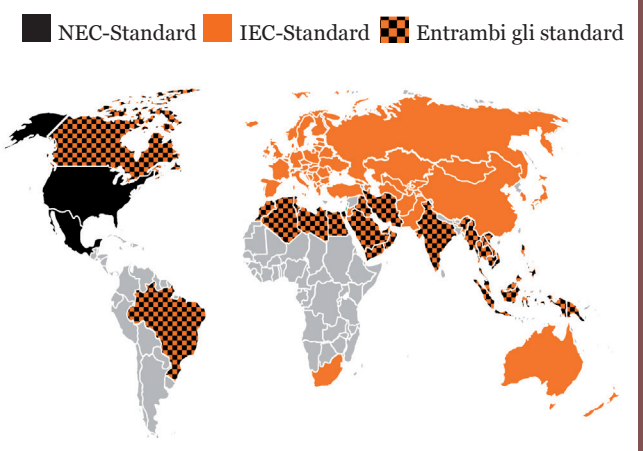
The aim of the IECEx System is to support international trade in equipment intended for environments with explosive atmospheres, maintaining the necessary level of safety:

- reduction in test and certification costs for the manufacturer;
- reduction in time to market;
- international trust in the product assessment process;
- an international database;
- maintaining an international level of trust towards equipment and services subject to IECEx certification.

This scheme, as well as its certificates, is recognised by an ever increasing number of Countries internationally. The certificates issued by the IECEx system are issued as "electronic certificates" and are available on the IECEx website. This allows the public to access them for viewing and printing them.

A similar but not identical system is in force on the other side of the world, the **NEC** system. The purpose of this document is to draw a comparison between internationally used (IECEx) and US (NEC) classification of locations with explosive atmosphere, whether formed by gas and air or combustible dust and air mixtures.
The American classification and marking use the method of Classes and Divisions, unlike the European ATEX praxis and the international IEC one that uses the Zone method. However, article 505 of NEC offers the opportunity of a choice in the way of classifying with the aim of giving to the IECEx system worldwide recognition and support free circulation of equipment suited for the zones classified according to the IECEx system. »

FIG.1 GEOGRAPHIC DISSEMINATION OF NEC AND IEC STANDARDS



1. Foreword

» This means that products may be approved:

• either by Class, Division and Group of Substances

For instance: Class 1, Division 2, A,B,C,D T3;

• or by Class, Division and Group of Gas

For instance: Class 1, Zone 2, IIA, IIB, IIC T3.

Figure 1 on the previous page describes the geographical spread of NEC and IECEx standards, highlighting also those Countries where both are valid and applicable.

To help you to quickly comprehend the acronyms we have used in the text, Table 1 below provides a key to their meaning. ●

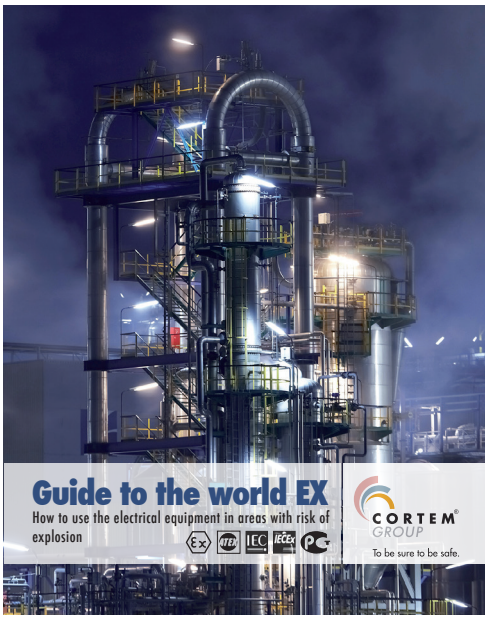
Tab. 1 The main acronyms and their meaning

	ACRONIMO	ACRONIMO	ACRONIMO	ACRONIMO	ACRONIMO
	ANSI	**BIA**	**CAS**	**EN**	**FM**
MEANING	American National Standards Institute	Berufsgenossenschaf-tliches Institut für Arbeitsschutz	Chemical Abstracts Service	European standard	Factory Mutual approval standard
	IEC	**IECEE**	**IECEx**	**ISA**	**MESG**
MEANING	International Electrotechnical Commission	IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components	IEC system for certification to standards relating to equipment for use in explosive atmospheres (IECEx system)	International Society of Automation	Maximum Experimental Safe Gap
	MIC	**NEC®**	**NFPA®**	**ONU**	**NANDO**
MEANING	Minimum Ignition Current	National Electrical Code®	National Fire Protection Association®	Organizzazione delle Nazioni Unite	New Approach Notified and Designated Organisations
	NRTL	**OSHA**	**UL**	**UNECE**	
MEANING	Nationally Recognized Testing Laboratory	Occupational Safety and Health Administration	Underwriters Laboratories	United Nations Economic Commission for Europe	

2. THE CLASSIFICATION *of hazardous locations*

As we have detailed in the *"Guide to the Ex world" (available on www.cortemgroup.com)*, to which reference should be made for a more extensive presentation of the topic, location classification may be defined as *a method to analyse and classify the environment in which explosive atmospheres may form due to the presence of gas and/or combustible dusts, in order to foster correct choice and installation of the electrical equipment intended for it.*

Classification is team work! The classification of the areas should be performed by people who understand the importance and significance of the properties of flammable substances and by people familiar with the process and equipment, jointly with skilled personnel in the field of safety, electrical and mechanical installations and more; in addition, close cooperation is required between safety and equipment specialists.



After the team has been formed, the stages leading to hazardous location classification may seriously be dealt with:

a) identify hazardous substances;
b) identify sources of emission;
c) define the emission rate of sources;
d) establish the degree of ventilation;
e) define hazardous areas;
f) define the extension of hazardous areas.

Let's look at classification *methods* in more detail.

3. THE NORTH AMERICAN *approach*

The North American approach, and more specifically the US one, is based on the *"National Electrical Code" (NEC®)*.
The National Electrical Code®, or *NFPA 70®*, is a standard that may be implemented regionally in the US for safe installation of equipment and its wiring. It belongs to the set of National Fire Codes published by the *National Fire Protection Association (NFPA)*. The NEC® is approved as a national American standard by the *American National Standards Institute (ANSI)* and is formally identified as *ANSI / NFPA 70*.
The National Electrical Code® is divided into chapters that deal with topics such as: wiring and relevant methods, equipment for general use, special locations and equipment and communication systems. We might say that, just as for us Europeans the harmonised standards are the reference state of the art that is also valid in jurisprudence, the same applies to US citizens with the National Electrical Code®.
The NEC® also contains information on the official definition of Hazardous Locations and related standards supplied by the *Occupational Safety and Health Administration (OSHA)* which provides legal status to the NEC® and its application.
A substantial part of the NEC® (Chapter 5: special locations) is dedicated to hazardous locations in which electrical equipment may become a source of ignition.
Let's look at articles concerning Ex issues in more detail.

art.500

Hazardous locations (classified), Classes I, II and III, Divisions 1 and 2. Provides the basis for interpretation and correct application of articles from 501 to 517.

art.501

Class I locations.
Article 501 concerns requirements for electrical and electronic equipment for all voltages and relevant wirings of Class I locations, Division 1 and 2 where fires or explosions could occur due to flammable gases or vapours or flammable liquids.
The following sub-articles are present:
I: overview;
II: wirings;
III: equipment.

art.502

Class II locations.
Article 502 concerns requirements for electrical and electronic equipment for all voltages and relevant wirings of Class II locations, Division 1 and 2 where fires or explosions could occur due to combustible dusts.
The following sub-articles are present:
I: overview;
II: wirings;
III: equipment.

art.503

Class III locations.
Article 503 concerns requirements for electrical and electronic equipment for all voltages and relevant wirings of Class III locations, Division 1 and 2 where fires or explosions could occur due to ignitable fibres.
The following sub-articles are present:
I: overview;
II: wirings;
III: equipment.

3. THE NORTH AMERICAN *approach*

art.504

Intrinsic safety systems.
Article 504 concerns the installation of intrinsic safety equipment, and wiring them in Class I, II and III areas.

art.505

Locations of Zone 0, 1 and 2.
It covers the requirements for the classification system in Zones (Zone 0, 1, and 2) as an alternative to the classification system in divisions covered under article 500 for Class I;

art.506

Zone 20, 21 and 22 locations for combustible dusts or ignitable fibres.
It covers the requirements for the classification system in Zones (Zone 20, 21, and 22) as an alternative to the classification system in Divisions covered under articles 500, 502 and 503 for Classes II and III; combustible metal dusts are not covered by this article.

art.510

Hazardous locations (classified) - specific features.
Articles from 511 to 517 cover the locations or parts of locations that are or may be hazardous due to atmospheric concentrations of flammable liquids, gases or vapours, or due to deposits or accumulations of materials that might be easily ignited.

art.511

Commercial, repair and storage garages.
These locations include those used for maintenance and repair of motor vehicles equipped with their own engine (including, but not limited to, cars, buses, trucks and tractors) where volatile flammable liquids or flammable gases are used as fuel.

art.513

This article applies to hangars where aircraft are parked containing Class I (flammable) or Class II (fuels) liquids whose temperatures are higher than the flash point. In these locations aircraft undergo maintenance, repair or modification operations. It does not apply to locations exclusively used for aircraft that have never contained fuel or aircraft discharged of fuel.

art.514

Fuel dispensing installations.
This article applies to fuel dispensing equipment, to distribution facilities of motor fuels, including for maritime use, fuel dispensing facilities located within buildings and facilities for dispensing fuel for vehicle fleets.

art.515

Systems with large amounts in storage.
This article applies to a property or portion of property in which flammable liquids are received from a tanker ship, from pipes, a car tank or tanker truck and are deposited or mixed in large quantities in order to distribute these liquids by tank vessel, piping, car tanks, tanker trucks, portable tank or container.

art.516

Spray, immersion, coating application processes.
This article concerns the regular or frequent application of flammable liquids, combustible liquids and combustible dust from spraying and application of flammable or combustible liquids at temperatures above their flash point, by means of dipping, coating or other means.

art.517

Health service facilities.
The provisions of this article apply to electrical constructions and installation criteria in health facilities that provide services to human beings.

3. THE NORTH AMERICAN *approach*

3.1. ANALYSIS OF THE NORTH AMERICAN APPROACH

In the first instance we might say that, beyond some specific locations identified from art. 511 to art. 517, the North American approach adopts **two classification systems of hazardous locations that it deems as equivalent**:

- **that of the two Divisions**, traditionally used, **(art. from 500 to 503)** which refers to its own set of standards. For instance, for flame-proof enclosures standard FM class 3615 or standard ISA S12.22.01 or standard UL 1203;
- **that of the three Zones (art. 505 and 506)**, which in its turn refers to a whole set of standards. For instance, for flame-proof enclosures standard IEC 60079-1.

Let us turn now to analysing the former classification system and we will deal with the analysis of articles 505 and 506 and European and international approach in the next paragraph.

If we analyse articles from 500 to 503, NEC® classifies hazardous locations taking into account three criteria: **the type, condition and nature**.

3.1.1. THE TYPES OF HAZARDOUS LOCATIONS

a) Class I locations

According to NEC®, there are three types of hazardous location. The first type of hazard is that created by the presence of flammable gases or vapour in the air, such as natural gas or petrol vapours. When these materials are in the atmosphere, there is a potential risk of explosion caused by ignition from an electrical source or other type of source. The authors of NEC® have defined this first type of hazard **"Class I"**. A Class I hazardous location is where flammable gases or vapours may be in the air in a sufficient amount to be explosive or flammable. Some typical Class I locations are:


oil refineries


fuel storage areas


fuel dispensing areas


spray finishing areas


hangars and maintenance areas where fuels are used


gas systems and gas, liquefied petrol and natural gas storage and handling operations

b) Class II locations

The National Electrical Code® identifies **"Class II"** locations as areas where the danger is represented by combustible dusts. Finely pulverised material, suspended in the atmosphere, may cause one or more powerful explosions such as those occurring in an oil refinery, if not more catastrophic. Some typical Class II locations are:


cereal silos


flour and feed mills


producers of plastic materials, drugs and fireworks


producers of starch or confectionery

spice grinding, sugar and cocoa production systems

c) Class III locations

Hazardous **Class III** locations, according to the NEC®, are areas where there are fibres or "solid combustible particles" (flyings) that are easily flammable, due to the types of materials processed, stored or transformed. The fibres and solid particles are not likely to be suspended in the air, but may accumulate around a machine or on lighting fixtures and be triggered by heat, by a spark or a hot metal. Some typical Class III locations are:

textile and cotton gin factories

systems that form, pulverise or cut wood and create sawdust or "solid particles"

3.1.2. THE CONDITIONS OF HAZARDOUS LOCATIONS

In addition to the types of hazardous locations, the National Electrical Code® also deals with the type of conditions where these hazards are present: normal conditions or abnormal conditions. In the **normal condition**, the risk is present in day-to-day production operations or during the frequent repair and maintenance activity.

When the hazardous material is confined within closed containers or closed systems and may only be present following accidental rupture, breakdown or unusual faulty operation, the **condition** is defined as **abnormal**.

The authors of the NEC® have defined these two types of conditions very simply: **Division 1 – normal and Division 2 – abnormal**. All the classes (I, II and III) may be Division 1 or Division 2.

Class I, Division 1 locations are, for instance, areas next to safety valves in an oil refinery or areas close to open loading structures such as those that are created during fuel transfer from/to tanker truck/tank. In these locations, the hazardous material is present during normal system operations (Fig. 2).

FIG.2 CLASSIFICATION OF HAZARDOUS LOCATIONS DURING FUEL TRANSFER OPERATIONS

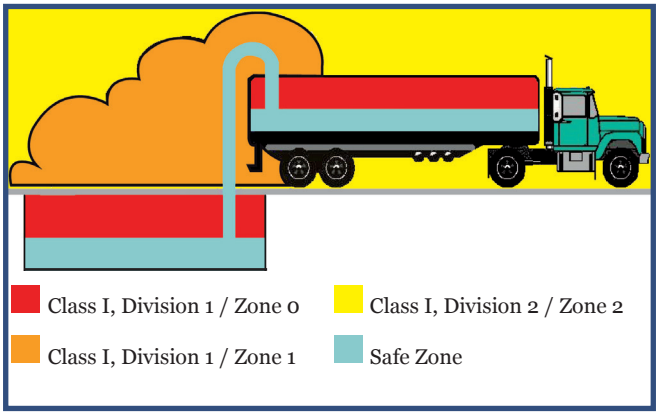
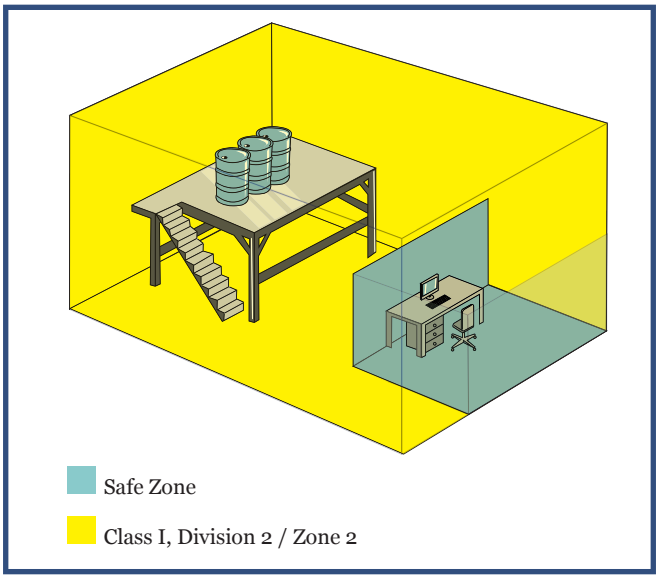


FIG. 3 CLASSIFICATION OF HAZARDOUS LOCATIONS IN A FLAMMABLE LIQUID STORAGE DEPOSIT



Storage drums containing flammable liquids closed in an internal deposit do not normally allow hazardous vapours to escape into the atmosphere. But what happens if one of the containers has leaks? There would be a Division 2 – abnormal condition, more precisely Class I, Division 2 (Fig. 3). »

3. THE NORTH AMERICAN *approach*

TAB. 2 THE TYPES OF HAZARDOUS LOCATIONS AND RISK CONDITIONS ACCORDING TO NEC®

		Division 1	Division 2
Class I	flammable gases, vapours	The risk is present in day-to-day production operations or during the frequent repair and maintenance activity	The risk is present in abnormal operations, i.e. following accidental breakdown, rupture or unusual faulty operation
Class II	combustible dusts		
Class III	solid combustible fibres, particles		

» Table 2 above summarises the types of hazardous locations and risk conditions.

3.1.3. THE NATURE OF HAZARDOUS SUBSTANCES

The NEC® divides gases and vapours of **Class I** into four **Groups**: **A**, **B**, **C** and **D**. These materials are grouped based on the ignition temperature of the substance, its explosion pressure and other flammable characteristics.

The only substance in **Group A** is **acetylene**. Only a small percentage of hazardous locations is characterised by acetylene. Acetylene is a gas with extremely high explosion pressure.

Group B is another relatively small segment of classified areas. This group includes **hydrogen** and other materials with similar features. If certain specific restrictions of the Code are followed, some of these Group B locations, other than hydrogen, may actually be met with Group C and Group D equipment.

Group C and **Group D** are by far the most common Class I groups. They include most of all Class I hazardous locations. Group D includes many of the most common flammable substances such as butane, petrol, natural gas and propane.

TAB. 3 TEMPERATURE CLASS CLASSIFICATION FOR DUSTS

	Equipment not subject to overload		Equipment subject to overload			
			normal operations		abnormal operations	
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
E	200	392	200	392	200	392
F	200	392	150	302	200	392
G	165	329	120	248	165	329

3. THE NORTH AMERICAN *approach*

TAB. 4 CLASS I, II, III HAZARDOUS LOCATIONS

CLASS	GROUPS	DIVISION	
		1	2
I gases, vapours and liquids (art. 501)	A: acetylene B: hydrogen, etc. C: ether, etc. D: hydrocarbons, fuels, solvents, etc.	normally present and hazardous explosive atmosphere	atmosphere normally not present in an explosive concentration (but may be accidentally present)
II dusts (art. 502)	E: metallic dusts (conductive* and explosive) F: coal dusts (some are conductive* and all are explosive) G: flour, starch, wheat, combustible plastic or chemical powder (explosive)	flammable amounts of dust are or may be normally in suspension (cloud), or conductive dusts may be present	dust normally not suspended (cloud) in a flammable concentration (but may accidentally exist). Layers of dust are present.
III solid combustible fibres and particles (art. 503)	textile products, wood processing, etc. (easily flammable, but does not risk being explosive)	handled or used in production	stored or handled in warehouse (excluding production)

**NOTE: electrically conductive dusts are dusts with resistivity less than 10^5 Ω/cm.*

In **Class II** – locations for the presence of dust – hazardous materials are divided into **Groups E**, **F** and **G**. These groups are classified based on ignition temperature and conductivity of the hazardous substances. Conductivity is an important issue in Class II locations, in particular metal dusts.

Metal dusts are classified in the Code as **Group E**: it includes aluminium and magnesium and other metal dusts of similar nature.

Group F contains materials such as carbon black, wood coal dust, pieces of coal and hard coal dust.

Group G includes cereal, flour, starch, cocoa dust and other types of materials.

Table 3 on the previous page shows the classification of temperature classes for dusts.

Class I, gases and vapours, is divided into Groups A, B, C and D, whereas Class II, dusts, into Groups E, F and G.

3.1.4. REVIEW

Let's quickly review what we have seen so far.

Hazardous locations are classified in three ways by the National Electrical Code®: **type**, **status** and **nature**.

There are three types of danger conditions: **Class I** – gas and vapours, **Class II** – dust **Class III** – combustible fibres and solid particles.

There are two types of danger conditions: **Division 1** – normal, **Division 2** – abnormal.

Finally, there is the nature of the hazardous substances which includes Groups A, B, C and D in Class I locations and Groups E, F and G in Class II locations.

Table 4 summarises the various classified hazardous locations.

4. THE EUROPEAN *and international approach*

On the level of technical standards, the European and international approach match since most standards are voted with "parallel vote procedure": the European members of the various national Committees vote the document for it to simultaneously become international as well as European standard. This procedure is also valid for the Ex standard sphere. The following regulatory framework applies:

1 . Location classification

- IEC 60079-10-1: 2020-12 “Explosive atmospheres – Part 10-1: Location classification. Explosive atmospheres due to the presence of gas".
- IEC 60079-10-2: 2015-01 “Explosive atmospheres – Part 10-2: Location classification. Explosive atmospheres due to the presence of combustible dusts".

2. Choice and installation of equipment

- IEC 60079-14:2013-11 “Explosive atmospheres – Part 14: Design, choice and installation of electrical systems".

REGULATORY FRAMEWORK:
IEC 60079-10-1:2020-12
IEC 60079-10-2:2015-01
IEC 60079-14:2013-11

4.1. ANALYSIS OF THE EUROPEAN AND INTERNATIONAL APPROACH

4.1.1. TYPES OF HAZARDOUS LOCATIONS

a) Classification of locations due to gas presence.

On the technical-regulatory level, the locations where there are or may be explosive atmospheres due to the presence of gases in such quantities as to require special precautions for the construction, installation and use of equipment, are those which for the longest time have been regulated technically as well as in terms of legislation by individual States.

Explosive atmospheres for the presence of gas consider flammable substances in gas or vapour form, mixed with air, in atmospheric conditions.

There is no definite list of locations to be taken into account, but there are more than we can imagine! 328 Combustible gases are classified in standard IEC 60079-20-1. Reasoning in terms of macro areas, we might say that we should make the classification in the following locations:


refineries


chemical industry


energy production


painting

4. THE EUROPEAN *and international approach*


pharmaceutical industry


recycling


landfills


gas supply

b) Classification of locations according to the presence of combustible dusts.

The locations where there are or may be explosive atmospheres due to the presence of combustible dusts or solid particles, in such an amount as to require special provisions for construction, installation and use of equipment, are decidedly more recent than those of gases: in fact they are dated 2002.

Also in this case there is no definitive list to be considered, but there are more than we can imagine! If there are 328 classified combustible gases, the BIA report 13/97 mentions more than 4,300 combustible dusts, to include sawdust, flour and bread crumbs! And even more have been classified since 1997!

Reasoning in terms of macro areas, we might say that we should make the classification in the following locations:


wood industry


food and feed industry


metal and plastics industry


pharmaceutical industry

4.1.2. THE CONDITIONS OF HAZARDOUS LOCATIONS

The European and international standards mentioned above classify hazardous locations in Zones based on the frequency of formation and permanence of an explosive atmosphere caused by the presence of gas or combustible dusts (Fig. 4). »

FIG.4 THE DIVISION OF HAZARDOUS LOCATIONS BASED ON THE PRESENCE AND CONCENTRATION OF GASES (ZONE 0, 1 AND 2) AND DUSTS (ZONE 20, 21 AND 22)

GASES	Zone 0	Zone 1	Zone 2
DUSTS	Zone 20	Zone 21	Zone 22

Note: the graphical lines in each box are internationally standardised ones

4. THE EUROPEAN *and international approach*

» It should be noted that, with regards to combustible dusts, the division into zones is exclusively determined by dust in the form of cloud; the layers, deposits and accumulations of dust are considered as "any other source" that might form an explosive atmosphere from dust, but do not determine any zone.

We would like to underline that also in its latest report of 2011 the UN agency UNECE (http://www.unece.org/) refers to international IEC standards as an instrument to be implemented for the division of hazardous locations into zones.

Finally, with regards to the European Union, the "Social Directives" block, i.e. those standards that set forth requirements for improving workers' protection and safety, includes Directive 99/92/EC, known as "ATEX 137" (Tab. 5) (due to the Treaty's article) or more simply as the second "ATEX" Directive. This document is the legal reference for employers of those workers who might be exposed to the hazard of explosive atmospheres.

But where is the difference between the various zones? The difference lies in the likelihood of the explosive atmosphere of reference - within the explosiveness range - being present for a certain length of time over one year (Tab. 6).

TAB. 5 THE "ATEX 137" DIRECTIVE

"ATEX 137" http://ec.europa.eu/social	
	Directive 1999/92/EC of the European Parliament and Council, of 16 December 1999 "Minimum requirements for improving the protection of the safety and health of workers potentially at risk from explosive atmospheres" (XV special Directive pursuant to article 16, paragraph 1 of directive 89/391/EEC) *(EC.O.J. series L, no. 23 of 28 January 2000)*

TAB. 6 THE CLASSIFICATION OF HAZARDOUS ZONES DUE TO THE PRESENCE OF GAS AND DUSTS ACCORDING TO INTERNATIONAL STANDARDS (IEC ZONE SYSTEM)

	Zone 0 / Zone 20	Zone 1 / Zona 21	Zone 2 / Zone 22
GASES 	Location where an explosive atmosphere caused by the presence of gas (Zone 0) or of dust in cloud form (Zone 20) or for long periods or frequently	Location where an explosive atmosphere caused by the presence of gas (Zone 1) or dust in cloud form (Zone 21) is likely to be occasionally present during normal operation	Location where an explosive atmosphere caused by the presence of gas (Zone 2) or dust in cloud form (Zone 22) is not likely to be present during normal operation, but should this occur, it is likely to persist for short periods only
DUSTS 			

4.1.3. THE NATURE OF HAZARDOUS SUBSTANCES

a) Combustible gases.

With regards to combustible gases, they are divided into two Groups ("I" and "II") and Group II is divided into three sub-groups: **A**, **B** and **C**.

This subdivision is based on the maximum safety experimental gap (MESG) or on the minimum ignition current ratio (MIC ratio) of the explosive atmosphere due to the presence of gas where the equipment may be installed.

227 combustible gases belong to group IIA, 66 to group IIB

Application of this concept has resulted in the division represented in Graph 1.

Among all these gases, some representative ones of their group or sub-groups have been identified (Tab. 7).

b) Combustible dusts.

With regards to combustible dusts, they have recently been inserted in a new group (Group "III") and divided into three sub-groups: **A**, **B** and **C**:

- IIIA: combustible particles, i.e."solid particles, including fibres, of nominal dimensions> 500 µm";
- IIIB: non-conductive dust, i.e."solid particles finely subdivided, of nominal dimensions ≤ 500 µm, with electrical resistivity > 10^3 Ωm";
- IIIC: conductive dust, i.e."solid particles finely subdivided, of nominal dimensions ≤ 500 µm, with electrical resistivity ≤ 10^3 Ωm".

Group III has been defined on the technical product standard (IEC 60079-0), on the classification one (IEC 60079-10-2), and on the installation one (IEC 60079-14).

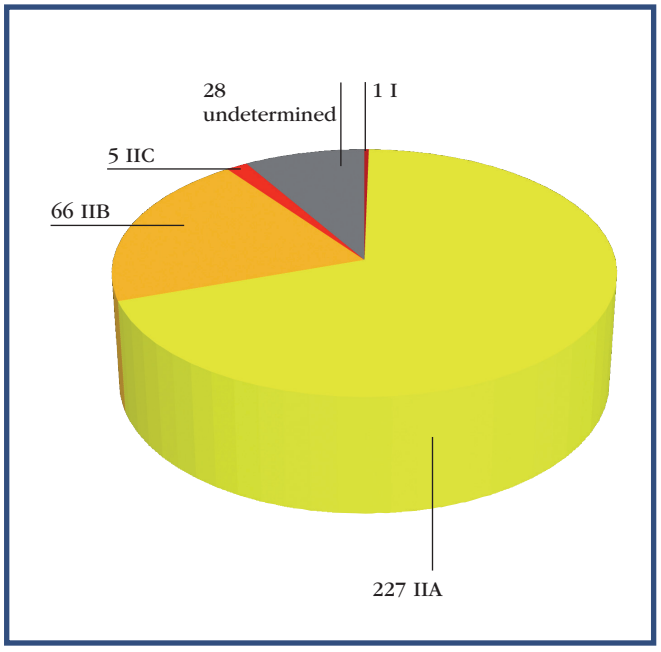
4.1.4. REVIEW

Let's quickly review what we have dealt with in this chapter.

There are two types of hazardous conditions: those caused by gases, vapours, clouds, and those caused by combustible dusts.

There are three types of danger conditions: Zone

GRAPH 1 THE SUBDIVISION OF GASES INTO SUB-GROUPS



TAB. 7 SOME OF THE MOST REPRESENTATIVE GASES

Group	Sub-group	Gas	GAS No.
I		firedamp (methane)	74-82-8
II	IIA	propane	74-98-6
	IIB	ethylene	74-85-1
	IIC	hydrogen	1333-74-0
		acetylene	74-86-2

4. THE EUROPEAN *and international approach*

» 0 or 20 – very high risk, Zone 1 or 21 – high risk, Zone 2 or 22 – normal risk.
And finally, there is the nature of the hazardous substance: Group I, that regards the presence of firedamp and pulverised coal (normally defined as "mine"), Group II and Group III both divided into A, B and C.

Table 8 summarises the various classified hazardous locations.

The contents of this paragraph 4 also applies to the National Electrical Code, art. 505 and 506.

TAB. 8 SUMMARY CHART OF THE CLASSIFIED HAZARDOUS LOCATIONS

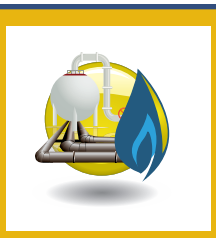
		GROUPS	ZONES		
			0	1	2
GASES		**I**: firedamp			
		IIA: propane **IIB**: ethylene **IIC**: hydrogen and acetylene	The explosive atmosphere is present continuously or for long periods or frequently	The explosive atmosphere is likely to be occasionally present during normal operation	The explosive atmosphere is not likely to be present during normal operation, but should this occur, it is likely to persist for short periods only
			20	21	22
DUSTS		**IIIA**: combustible particles **IIIB**: non-conductive dust **IIIC**: non-conductive dust	The explosive atmosphere is present continuously or for long periods or frequently	The explosive atmosphere is likely to be occasionally present during normal operation	The explosive atmosphere is not likely to be present during normal operation, but should this occur, it is likely to persist for short periods only

5. THE COMPARISON *between the two methods*

As we have seen, problems never end. A potentially explosive mixture consisting of combustible gas and air does not behave differently according to where it is; if ignition conditions are favourable, the explosion risk becomes tangible.
The methods we have presented have been defined by different subjects in order to reduce the initial risk.

Far be it from us, therefore, to establish which of the various methods is the best.
We also remark how it is incorrect to compare the North American approach with the European/international one, as NEC® includes both methods.
With regards to classification, Tables 9 and 10 below highlight the correlations between the two systems. »

TAB. 9 COMPARISON BETWEEN CLASSIFICATION OF HAZARDOUS LOCATIONS DUE TO THE PRESENCE OF GAS ACCORDING TO INTERNATIONAL STANDARDS (IEC ZONE SYSTEM) AND ACCORDING TO NORTH AMERICAN STANDARDS



GAS

art. 505	**Zone 0**: Area where an explosive atmosphere consisting of a mixture of air and flammable substances in gas, vapour or mist form is present permanently or for long periods of time or often.	**Zone 1**: Area where formation of an explosive atmosphere consisting of a mixture of air and flammable substances in gas, vapour or mist form is likely to form during normal activities.	**Zone 2**: Area where formation of an explosive atmosphere consisting of a mixture of air and flammable substances in gas, vapour or mist form is not likely to form during normal activities and, should it occur, it is exclusively for a short time.
art. 501	**Class I, Division 1**		**Class I, Division 2**

5. THE COMPARISON *between the two methods*

TAB. 10 COMPARISON BETWEEN THE CLASSIFICATION OF HAZARDOUS LOCATIONS DUE TO THE PRESENCE OF DUSTS ACCORDING TO INTERNATIONAL STANDARDS (IEC ZONE SYSTEM) AND ACCORDING TO NORTH AMERICAN STANDARDS

	DUSTS		
art. 505	**Zone 20** Area where an explosive atmosphere in the form of combustible dust cloud in the air is present permanently or for long periods or often.	**Zone 21** Area where an explosive atmosphere in the form of combustible dust cloud in the air is occasionally likely to form during normal activities.	**Zone 22** Area where an explosive atmosphere in the form of combustible dust cloud is not likely to form during normal activities and, should it occur, it is only for a short time.
art. 502	**Class II, Division 1**		**Class II, Division 2**

TAB. 11 THE SUBDIVISION OF GASES

	art. 505	art. 501
propane	**IIA**	**D**
ethylene	**IIB**	**C**
hydrogen	**IIC**	**B**
acetylene		**A**

With regards to gas subdivision, the greatest difference lies in the attribution of the order of letters, as shown in Table 11.

With regards to dusts, it is difficult to draw a comparison since the classification criteria of each method are different.

Table 12 describes the comparison between classes of temperature since art. 500 of NEC® entails intermediate ones between those used by the other method.

Furthermore, the two systems have different "normal" ambient temperatures (Tab. 13).

As required by the technical standards, each product is placed on the market with its own identification plate which contains some information. Let us compare an identification plate complying with European/international standards with one com-

5. THE COMPARISON *between the two methods*

TAB. 12 COMPARING EUROPEAN/ INTERNATIONAL AND NORTH AMERICAN CLASSES OF TEMPERATURE FOR GROUP II

[°C]	[°F]	table 505.9(d)(1)	table 500.8(c)
450	842	T1	
300	572	T2	
280	536		T2A
260	500		T2B
230	446		T2C
215	419		T2D
200	392	T3	
180	356		T3A
165	329		T3B
160	320		T3C
135	275	T4	
120	248		T4A
100	212	T5	
85	185	T6	

TAB.13 COMPARISON BETWEEN EUROPEAN/INTERNATIONAL AND NORTH AMERICAN "NORMAL" AMBIENT TEMPERATURES

art. 505	art. 500
-20 ÷ +40 [°C]	-25 ÷ +40 [°C]

plying with art. 500 of NEC® (Fig. 5 and 6 on the following page).

The identification plate complying with European/ international standards (Fig. 5) includes:

- the name or logo of the manufacturer, i.e. the entity responsible for placing the product on the market;
- the year of manufacture ①, the serial number ②, equipment identification by means of product code definition ③;
- equipment data: temperature class ④, maximum surface temperature ⑤, ambient temperature ⑥, electrical data as per certificate ⑦;
- data concerning Ex aspects, i.e. marking, certificate number, etc. ⑧;
- warnings.

The identification plate complying with art. 500 NEC® includes:

- equipment identification through product code definition [1];
- type of protection [2] and serial number [3];
- the name or logo of the manufacturer, i.e. the entity responsible for placing the product on the market [4]; »

-25 ÷ +40 [°C] is the "normal" ambient temperature set forth by art. 500 of NEC®

5. THE COMPARISON *between the two methods*

TAB. 14 HOW THE EQUIPMENT MARKING CHANGES IN THE VARIOUS

	CE 9876	Ex	II	2G	Ex db IIC T4	Gb
			II	2D	Ex tb IIIC T130°C	Db IP66
					Ex db IIC T4	Gb
					Ex tb IIIC T130°C	Db IP66
art. 505	Class I		Zone 1		AEx db IIC T4	Gb
art. 506			Zone 21		AEx tb IIIC T130°C	Db IP66
art. 500	Class I		Division 1		Groups A, B, C, D, T4	
	Class II		Division 1		Groups E, F, G, T4	

» - equipment marking 5;
- the certificate number 6;
- warnings and logo of the notified body, such as, in this case, Underwriters Laboratories (UL).

Finally, we deem it useful to see how the marking of the same equipment might change in the different systems (Tab. 14).

FIG. 5 IDENTIFICATION PLATE COMPLYING WITH EUROPEAN/ INTERNATIONAL STANDARDS

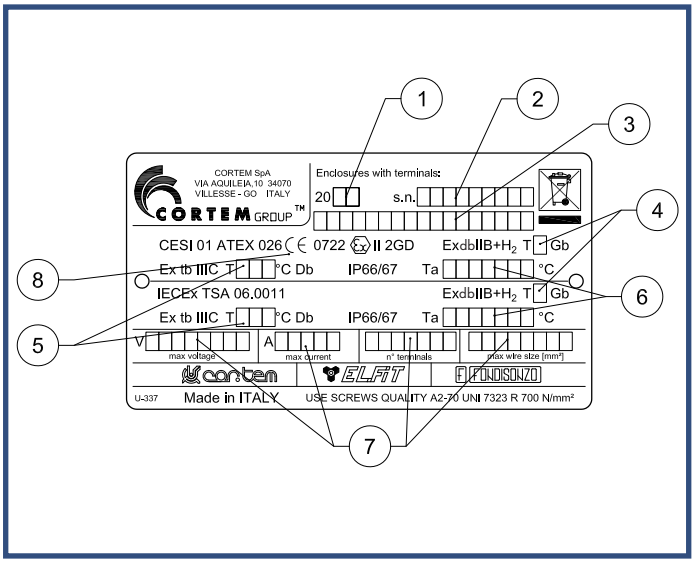
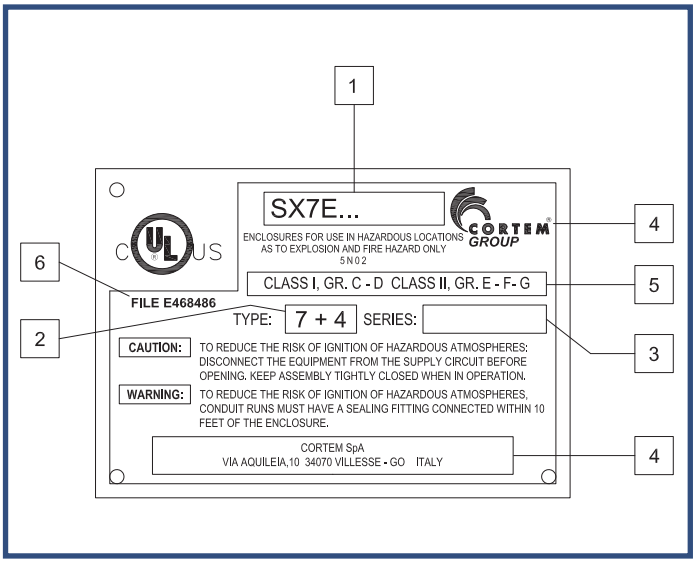


FIG. 6 IDENTIFICATION PLATE COMPLYING WITH ART. 500 OF NEC



6. THE PRODUCT *certification*

Conformity assessment, be it of products, processes or services, is quite similar in the various parts of the world and is based on the trust the "certifier" is able to inspire in the concerned parties (manufacturers, users, Authorities, etc.) through impartiality, competency and confidentiality of its operations.

In the following table (Tab. 15) we have set out the three entities we deal with and which "qualify" conformity assessment bodies to perform their task at the end of a pathway.

It should be noted that little more than ten years ago IEC created its own certification scheme dedicated to the "Ex" sector which, as well as certifying products, also certifies persons' skills.

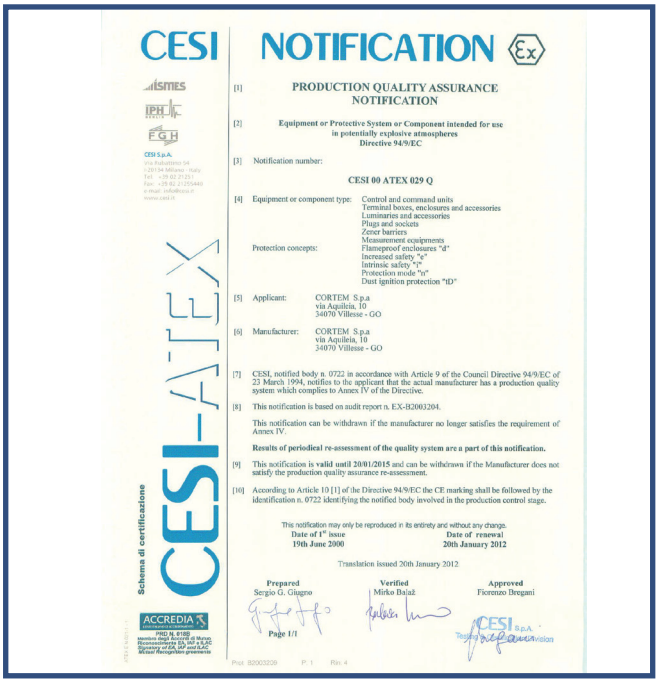
Table 16 on the next page summarises regulatory agencies and the number of bodies assessing conformity of products in general and Ex ones.

The last table highlights numbers that it is likely we have never taken into consideration because of a certain tradition.

Although all these schemes call for the products to meet industrial standards before "Ex" ones (see graph 2 in the next paragraph), and for the manufacturer to keep under control both the design and the production stage in order to be able to place the product on the market, there is a substantial difference between the various systems on the control of the latter stage.

Both the EC "ATEX" Directive and the IECEx certification scheme entail the possibility that a different »

FIG. 7 ATEX CERTIFICATION OF PRODUCTION QUALITY



CESI NOTIFICATION

PRODUCTION QUALITY ASSURANCE NOTIFICATION

[2] Equipment or Protective System or Component intended for use in potentially explosive atmospheres Directive 94/9/EC

[3] Notification number:

CESI 00 ATEX 029 Q

[4] Equipment or component type: Control and command units, Terminal boxes, enclosures and accessories, Luminaries and accessories, Plugs and sockets, Zener barriers, Measurement equipments

Protection concepts: Flameproof enclosures "d", Increased safety "e", Intrinsic safety "i", Protection mode "n", Dust ignition protection "tD"

[5] Applicant: CORTEM S.p.a, via Aquileia, 10, 34070 Villesse - GO

[6] Manufacturer: CORTEM S.p.a, via Aquileia, 10, 34070 Villesse - GO

[7] CESI, notified body n. 0722 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, notifies to the applicant that the actual manufacturer has a production quality system which complies to Annex IV of the Directive.

[8] This notification is based on audit report n. EX-B2003204.

This notification can be withdrawn if the manufacturer no longer satisfies the requirement of Annex IV.

Results of periodical re-assessment of the quality system are a part of this notification.

[9] This notification is valid until 20/01/2015 and can be withdrawn if the Manufacturer does not satisfy the production quality assurance re-assessment.

[10] According to Article 10 [1] of the Directive 94/9/EC the CE marking shall be followed by the identification n. 0722 identifying the notified body involved in the production control stage.

This notification may only be reproduced in its entirety and without any change.

Date of 1st issue: 19th June 2000 — Date of renewal: 20th January 2012

Translation issued 20th January 2012

Prepared: Sergio G. Giugno — Verified: Mirko Bajaz — Approved: Fiorenzo Bregani

Page 1/1

Schema di certificazione CESI-ATEX

ACCREDIA

TAB. 15 REGULATORY AGENCIES DIVIDED BY TERRITORIAL COMPETENCE

• Ministry of Labour • Occupational Safety and Health Administration (OSHA) • Nationally Recognized Testing Laboratory (NRTL)	• European Union • European Commission • New Approach Notified and Designated Organisations (NANDO)	• International Electrotechnical Commission • IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components (IECEE)

6. THE PRODUCT *certification*

TAB. 16 NUMBER OF CONFORMITY ASSESSMENT BODIES AND NUMBER OF EX SECTOR CONFORMITY ASSESSMENT BODIES OVERSEEN BY REGULATORY BODIES

	• Nationally Recognized Testing Laboratory (NRTL)	• New Approach Notified and Designated Organisations (NANDO)	• IEC system for certification to standards relating to equipment for use in explosive atmospheres (IECEx system)
No. of conformity assessment bodies:	15	1.564	
No. of Ex sector conformity assessment bodies:	8	69	48

Body from the one that issued the project certificate might oversee the manufacture of the product. Furthermore, the custom is for the overseeing action to be carried out with yearly frequency (the interval between one audit and the next one is about 12 months). According to the US scheme, however, manufacturing is overseen by the same body that issued the project certificate and frequency is four times a year. Therefore, in the event a manufacturer should have several project certificates with various bodies, they will receive as many audits (4 a year) as the number of bodies from which they have obtained the project certificates.

FIG. 8 EXAMPLE OF IECEX CERTIFICATE

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx ITS 11.0018 Issue No.:0
Certificate history: Issue No. 1 (2012-8-30), Issue No. 0 (2011-12-1)
Status: Current
Date of Issue: 2011-12-01 Page 1 of 3

Applicant: Cortem S.p.A
Via Aquileia,
10 34070 Vilesse,
Gorizia,
Italy
Italy

Electrical Apparatus: EWL LED Lamp
Optional accessory:

Type of Protection: Ex d, e and t

Marking: Ex d e IIC T5 (Tamb -20°C to +60°C) Gb
Ex tb IIIC T100°C (Tamb -20°C to +60°C) Db IP66

Approved for issue on behalf of the IECEx Certification Body: V K Varma

Position: Certification Officer

Signature: (for printed version)

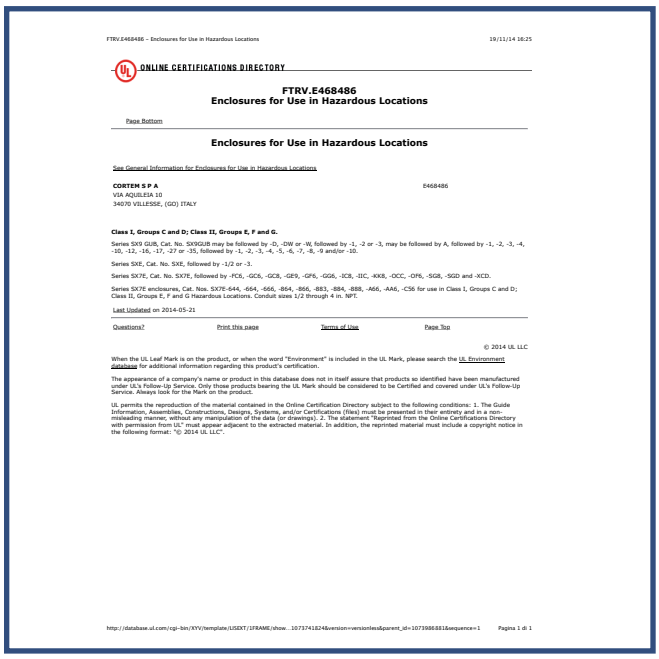
Date:

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:
Intertek Testing & Certification Limited
ITS House, Cleeve Road,
Leatherhead,
Surrey, KT22 7SB
United Kingdom

Intertek

FIG. 9 EXAMPLE OF UL CERTIFICATE



FTRV.E468486 - Enclosures for Use in Hazardous Locations 19/11/14 18:25

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FTRV.E468486
Enclosures for Use in Hazardous Locations

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Enclosures for Use in Hazardous Locations

See General Information for Enclosures for Use in Hazardous Locations

CORTEM S P A E468486
VIA AQUILEIA 10
34070 VILLESSE, (GO) ITALY

Class I, Groups C and D; Class II, Groups E, F and G.

Series SX9 GUB, Cat. No. SX9GUB may be followed by -D, -DW or -W, followed by -1, -2 or -3, may be followed by A, followed by -1, -2, -3, -4, -10, -12, -16, -17, -27 or -35, followed by -1, -2, -3, -4, -5, -6, -7, -8, -9 and/or -10.

Series SXE, Cat. No. SXE, followed by -1/2 or -3.

Series SX7E, Cat. No. SX7E, followed by -FC6, -GC6, -GC8, -GE9, -GF6, -GG6, -IC8, -IIC, -KK8, -OCC, -OF6, -SG8, -SGD and -XCD.

Series SX7E enclosures, Cat. Nos. SX7E-644, -654, -666, -864, -866, -883, -884, -888, -A66, -AA6, -CS6 for use in Class I, Groups C and D; Class II, Groups E, F and G Hazardous Locations. Conduit sizes 1/2 through 4 in. NPT.

Last Updated on 2014-05-21

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7. THE STANDARDS *supporting certification*

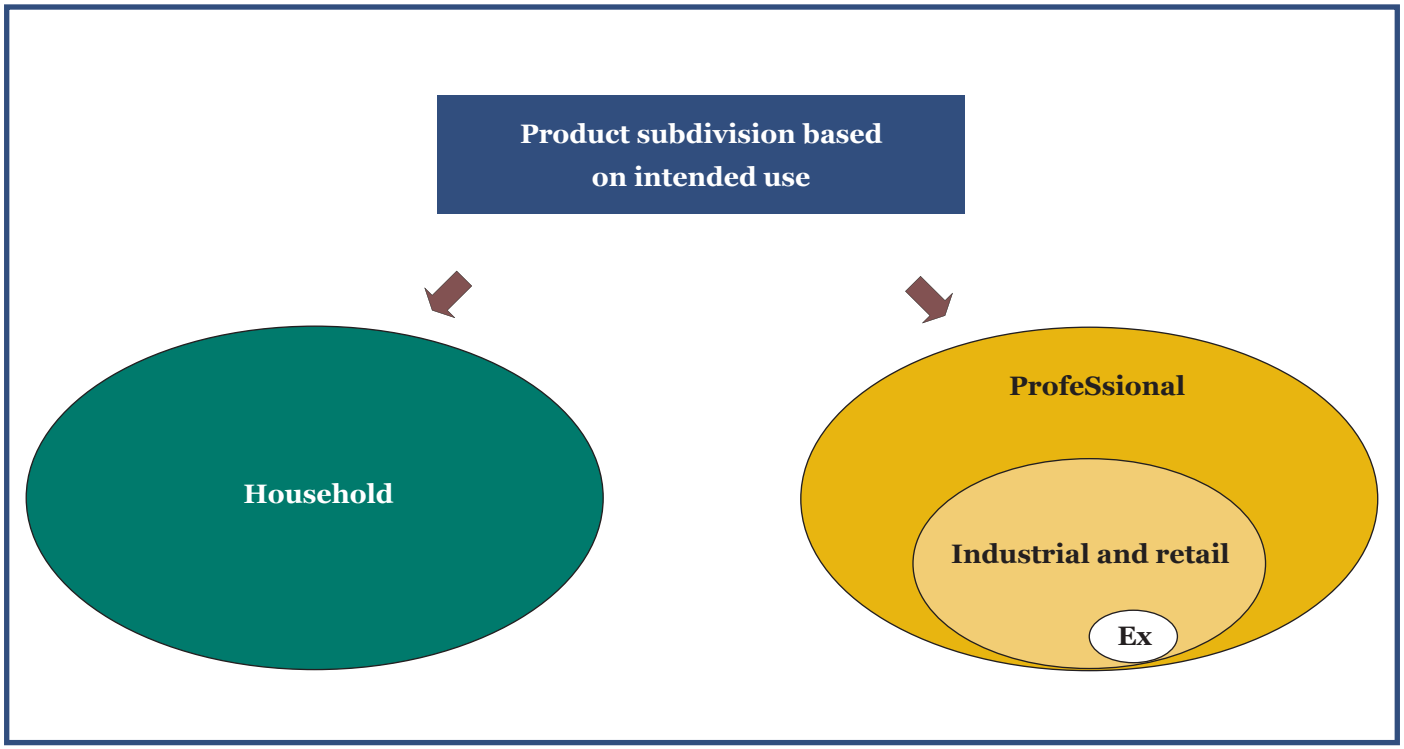
To go back to what has been introduced in the previous paragraph, products tend to be subdivided by the market and by manufacturers based on the intended use, as shown in the following graph (Graph 2).

This implies that "Ex" products are a "whereof" and therefore must first meet industrial regulations and then, in addition, specific "Ex" ones.

Table 17 shows the main Ex standards for each certification scheme (for practical reasons we exclusively show the standards whose protection method is applicable to different types of equipment) used for certification purposes.

Finally, in Table 18 we deem it useful to indicate some "Ex" standards that are specific for a certain family of products.

GRAPH 2 PRODUCT SUBDIVISION BASED ON INTENDED USE



7. THE STANDARDS *supporting certification*

TAB. 17 MAIN EX STANDARDS FOR GASES AND DUSTS USED FOR CERTIFICATION PURPOSES

		art. 501	art. 505		
GAS	General rules	FM 3600	ANSI/ISA 60079-0 UL 60079-0	EN 60079-0	IEC 60079-0
	Flame-proof enclosures – "d"	FM 3615 UL 1203	ANSI/ISA 60079-1 UL 60079-1	EN 60079-1	IEC 60079-1
	Pressurised equipment– "p"	ANSI/ISA 12.04.04 FM 3620 NFPA 496	ANSI/ISA 60079-2	EN 60079-2	IEC 60079-2
	Filling equipment – "q"		ANSI/ISA 60079-5 UL 60079-5	EN 60079-5	IEC 60079-5
	Equipment immersed in oil – "o"		ANSI/ISA 60079-6 UL 60079-6	EN 60079-6	IEC 60079-6
	Equipment with enhanced safety – "e"		ANSI/ISA 60079-7 UL 60079-7	EN 60079-7	IEC 60079-7
	Equipment with intrinsic safety – "i"	FM 3610 UL 913	ANSI/ISA 60079-11 UL 60079-11	EN 60079-11	IEC 60079-11
	Equipment with protection mode "n"	ANSI/ISA 12.12.01 FM 3611	ANSI/ISA 60079-15 UL 60079-15	EN 60079-15	IEC 60079-15
	Encapsulated equipment – "m"		ANSI/ISA 60079-18 UL 60079-18	EN 60079-18	IEC 60079-18
	systems with intrinsic safety – "i"		ANSI/ISA 60079-25	EN 60079-25	IEC 60079-25
	Equipment with optical radiation – "op"	ANSI/ISA-TR 12.21.01	ANSI/ISA 60079-28	EN 60079-28	IEC 60079-28
	Equipment with special protection – "s"				IEC 60079-33

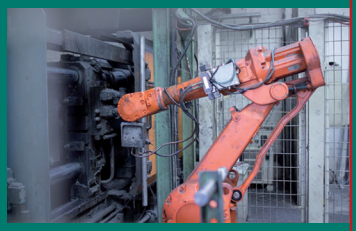
		art. 502	art. 505		
POLVERI	General rules		ANSI/ISA 60079-0 UL 60079-0	EN 60079-0	IEC 60079-0
	Flame-proof enclosures – "d"	UL 1203			
	Pressurised equipment– "p"	NFPA 496	ANSI/ISA 61241-2	EN 61241-4	IEC 61241-4
	Equipment with intrinsic safety – "i"	UL 913	ANSI/ISA 60079-11 UL 60079-11	EN 60079-11	IEC 60079-11
	Equipment with protection mode "n"	ISA 12.12.01			
	Encapsulated equipment – "m"		ANSI/ISA 60079-18 UL 60079-18	EN 60079-18	IEC 60079-18
	Equipment protected by enclosures – "t"	FM 3616	ANSI/ISA 60079-31	EN 60079-31	IEC 60079-31

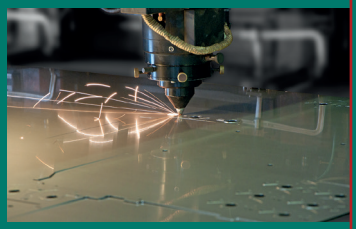
7. THE STANDARDS *supporting certification*

TABLE 18 SPECIFIC EX STANDARDS FOR CERTAIN FAMILIES OF PRODUCTS

	art. 501	art. 505		
Portable electronic products	ANSI/ISA 12.12.03			
Land mobile radios	FM 3640			
Submersible electric motors	FM 3650			
Electric motors and generators	UL 674			
Industrial control panels	UL 698A			
Electrical torches and lanterns	FM 3613 UL 783			
Electrical heaters	FM 7320 UL 823			
Lighting fixtures	UL 844			
Cables and accessories for cables	UL 2225			
Explosion venting devices	FM 7730		EN 14797	
Industrial trucks			EN 1755	
Alternative internal combustion engines	ANSI/ISA 12.20.01		EN 1834	
Service stations			EN 13012 EN 13617	
Non-electrical equipment			ISO 80079-36 ISO 80079-37	
Suppression systems			EN 14373	
Fans			EN 14983	
Transportable vented booths			EN 50381	
Pressurised premises – “p”			EN 60079-13	IEC 60079-13
Gas detectors		ANSI/ISA 60079-29	EN 60079-29	IEC 60079-29

CORTEM GROUP
To be sure to be safe





Since 1968 Cortem S.p.A. has been designing and manufacturing protected electrical equipment intended for installation in areas at risk of explosion and fire. Thanks to constant technological innovation and continuous improvement, today it is a leading company in the industry, able to offer a wide range of solutions suitable for on-shore and off-shore applications. The special feature of Cortem Group - which includes the Cortem, Elfit e Fondisonzo brands - consists in its long-standing experience accrued in the sector, resulting in the ability to not merely supply Ex products, but custom-made solutions as well.

All of our products are designed and manufactured in-house with various protection methods such as 'Ex-db' explosion proof, 'Ex-eb' enhanced safety, 'Ex de' mixed, 'Ex-nR' restricted breathing, using aluminium alloy, stainless steel and top quality plastics materials. The aluminium alloy used by Cortem has exceeded the tests required by standards EN60068-2-30 (hot/humid cycles) and EN60068-2-11 (salt mist tests). All our aluminium alloy products are protected by RAL 7035 epoxy coating. This treatment is a Cortem Group exclusive and assures long-term protection.

Cortem Group's production may be summarised as follows:

- Lighting fixtures, lighting fixtures for signalling obstacles, floodlights and portable lamps.
- Junction and pulling boxes, control stations.
- Signalling and control equipment, sockets and plugs.
- Cable glands and fittings.
- Special designs: electrical panels and control batteries based on the customer's requirements.

90% of our production is intended for the Oil & Gas sector, both off-shore and on-shore, but also chemical and pharmaceutical industries, as well as all those process areas characterised by the presence of explosive atmospheres such as grain silos, wood mills and paper mills. Every year we invest part of our resources in developing innovative products to address the market's needs. That is why our R&D department devises the best solutions considering regulatory, installation, safety and market price aspects.

With over 30 agencies, 90 distributors, 7 partners and 3 de-centralised production facilities, Cortem assures a qualified local presence in the world. For Cortem "de-localising" does not mean transferring plants, means, know-how and resources to low-cost Countries, but rather replicating a winning model of industrial organisation where environmental safety, product quality, compliance with standards, technical support and market after-sale support are the foundations of our Corporate Mission.

The Pay Off "to be sure to be safe" represents the pride and passion for what we design and produce.

Certification systems
IEC E NEC®

Ed. May 2023

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