INFORMATION RULES - ATEX DIRECTIVES

Santiago Escoin Homs

I) DEFINITIONS

Explosive atmosphere

Atmosphere that could become explosive due to local and operational circumstances.

Explosive Gas Atmospheres

Mixture with air, under atmospheric conditions, of air and flammable substances in the form of gas, vapor, mist or dust in which after ignition, combustion spreads to the entire unburned mixture.

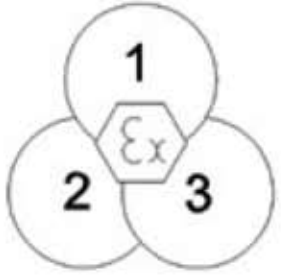
Example of flammable substances that form an explosive atmosphere with air

Gas	Smoke	Polvo
Methane	Carbon sulfide	Aluminum
Butane	Ethyl Alcohol	Starch
Propane	Ethylene oxide	Cereals
Hydrogen	Acetone	Coal

Potentially explosive atmosphere

To trigger an explosion that can be transmitted to the environment must meet three conditions:

- the oxygen in air (fuel) (1)
- a flammable substance (fuel) (2)
- an ignition source (3)



Explosive mix

To be in the presence of an explosive atmosphere, the mixture of flammable substances and oxygen should be (fuel or too poor or too rich) explosive

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Inflammation of a mixture

The explosion of an explosive atmosphere is driven by the addition of a sufficient source of ignition such as electric arc, spark or increased temperature, electrostatic discharge, fire, lightning. The source of ignition must be at least sufficient energy or temperature.

Explosion limit of a mixture

UEL: Upper Explosive Limit of a gas or vapor in air = maximum concentration in the mixture below which can be ignited.

LEL of a flammable substance = lowest concentration in the mixture above which can be ignited.

In the case of steam, the temperature of the flammable liquid must be sufficient to steaming.

The minimum ignition energy

EMI: minimum amount of energy to ignite

Ignition temperature (auto-ignition)

The minimum temperature of a hot surface which can ignite a flammable substance as a gas or vapor with air.

Flash point of a liquid

The minimum temperature at which a flammable liquid emits sufficient vapor to form flammable mixture with air.

Products	Boiling point	Flash point	Ignition temperature	LIE-LSE en %
Benzene	+ 80° C	- 11° C	+498° C	1.3 - 7.9
Ammoniac	- 33° C	Gaz	+650° C	15 - 28
Methane	- 161° C	Gaz	+595° C	5 - 15
Butane	0° C	Gaz	+287° C	1.8 - 8.4
Ethanol	+78.4° C	+12° C	+363° C	3.3 - 19
Kerosene	+40° C	-43° C	+210° C	0.7 - 5
Diesel fuel	+175° C	+70/120° C	+250/280° C	0.6 -
Hydrogen	-275.7° C	+500° C	+560° C	4 - 75
Methanol	+64.7° C	11° C	+385° C	6.7 - 36
Propane	-42.3° C		+470° C	2.2 - 10
Toluene	+110° C	4° C	+480° C	1.2 - 7.1
Nat gas.	-162° C		+670° C	
Fuel	+140° C		+220° C	0.5 - 4
Carbon disulfide			+102° C	
Ethyl ether			+170° C	
Acetylene			+305° C	
Ethylene			+425° C	
Acetylene			+535° C	
Hydrogen			+560° C	
Carbon monoxide			+605°C	

These values "Explosive Mixtures INRS" are given for information only.

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II) GAS FRACTIONATION

The danger of a mixture with air depends on the concentration of flammable substances and its own characteristics. They are classified according to their level of hazard (two classifications).

- **Group**

Group	Drafting	Subdivision	Gases representatives	EMI (µJ)	IEMS (mm)
I	Minas	I	Methane	300	1.14
II	Surface of industries	IIA	Propane	240	0.92
		IIB	Ethylene	70	0.65
		IIC	Acetylene	17	0.37
		IIC	Hydrogen	17	0.29

MI: Minimum ignition / IBMS energy: experimental safe gap

- **Branch gas**

Gpe CEI CENELEC	Cl. & Gpe CA & USA	Gases representatives
IIA	D	Propane, butane, benzene, acetone, alcohol methyl, kerosene, fuel oil, petroleum naphtha
IIB	C	Ethylene, ethyl ether, butadiene
IIC	A	Acetylene
IIC	B	Hydrogen

III) TEMPERATURE CLASSES

The substances can ignite at different temperatures. The higher the temperature, the more dangerous substance.

The materials for use in explosive atmospheres are classified according to the maximum surface temperature (TMS).

T°C	450	300	280	260	230	215	200	180	165	160	135	120	100	85
CENELEC	T1		T2				T3		T4		T5		T6	
NEC	T1	T2	T2A	T2B	T2C	T2D	T3A	T3B	T3C	T3D	T4	T4A	T5	T6

Note: For electrical equipment flameproof gases and vapors are classified according to maximum experimental safe distance (EMSs) in ABC subdivision. The standard NEC 500 establishes a qualifying group.

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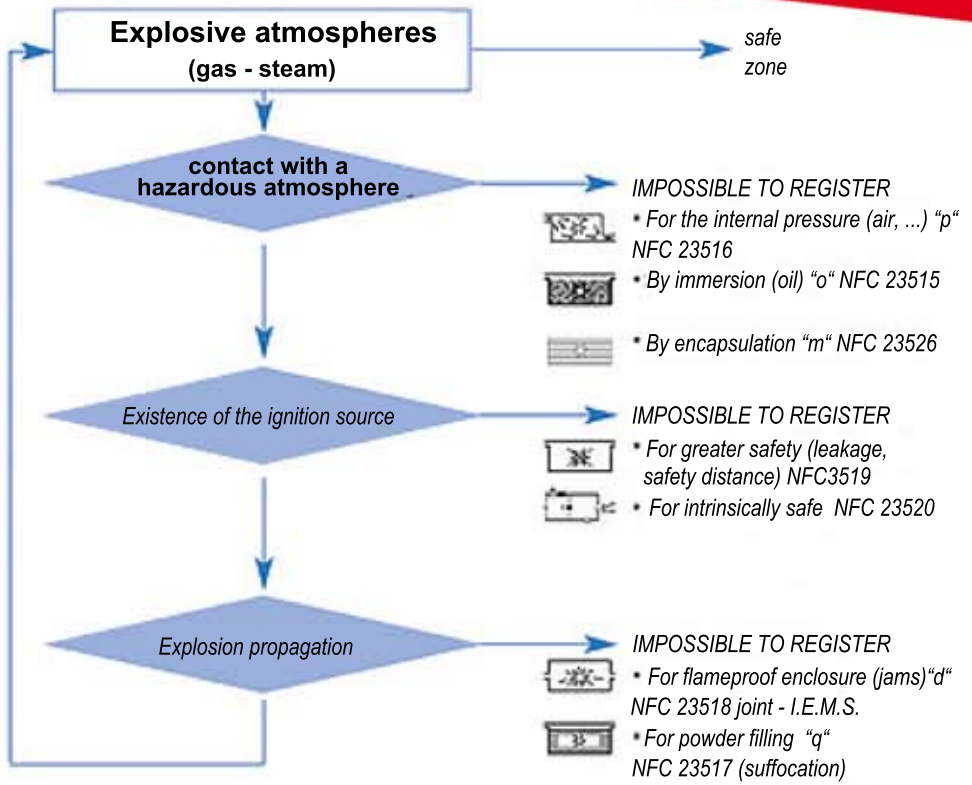
IV) PROTECTION MODE OF ELECTRICAL EQUIPMENT FOR EXPLOSIVE GAS ATMOSPHERE

▪ Standards IEC / CENELEC iEC

EN 50014 (general rules) specifies general rules for the construction, testing and marking of electrical equipment, cable entries, components for use in explosive atmospheres in the form of gases, vapors or mists. Different protection modes using specific concepts can be implemented for the manufacture of electrical equipment. They are described in standards (EN 50015 to 50039) to supplement or amend the EN 50014.

In the presence of combustible dust, protection can be assured by the tightness of dust and measures to reduce the temperature of the surface.



▪ Degree of protection

Often it sealing wrappings required. The index indicates the degree of protection against solid objects (first digit of 0-6) and against liquids (second digit from 0 to 8). For protection against electric shock NFC 20030 (IEC 536) standard defines four classes. EN 50014 requires, for the whole team at least one connecting element for the protective conductor or potential compensation of the masses.

Correspondence	NEMA 250 standarts	IP (CEI)
	NEMA 1	IP 10
	NEMA 2	IP 11
	NEMA 3R	IP 14
	NEMA 5-12-12K	IP 52
	NEMA 3-3S-13	IP 54
	NEMA 4-4X	IP 56
	NEMA 6-6P	IP 67

Note: NEMA 250 takes into account the environmental conditions (cold, steam, corrosion) and risks related to mechanical shock. If possible correspondence NEMA to IP, otherwise it is not, the tests and trials are different. National Electrical Manufacturers Association (US)

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V) EU DIRECTIVES

▪ Directive 1999/92 / EC (USER)

It aims to improve the safety and health of workers at risk from explosive atmospheres. The technical and organizational security measures to be taken and documents related to the protection specified. Explosion risks must be and hazardous areas have to be classified in zone.

- Classification of hazardous areas: carried out under the responsibility of the head of the establishment.

Likelihood of ATEX	High	Medium and low	Very weak	Unlikely	
Length of stay	> 1000 hours / year	10 < hours per year < 1000	1 < hours per year < 10	< 1 hours / year	
Definitions	Place in which an explosive atmosphere is present continuously or for long periods or frequently	Place in which an explosive atmosphere is present continuously or for long periods or frequently	Place in which an explosive atmosphere is not likely to occur in normal operation but, if it occur, will only short (foreseeable abnormal operation)	Not hazardous location	
Gases and vapors	Zone 0	Zone 1	Zone 2	Outer regions	CENELEC/CEI
Dust	Zone 20	Zone 21	Zone 22	Outer regions	
	Zone 0	Zone 1	Zone 2		NEC 505 (USA) Class I Gas
	Division 1	Division 1	Division 2		NEC 505 (USA) Class I Gas Dust Class II Class fibers III

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The directive 94/9 / EC (BUILDER)

Classifying materials according to the degree of protection is defined. It applies to devices and systems.

	Appliances categories	flammable substances	Levels of Protection	Defective protections	Comparison with the current practice and CIS
Mines	M1	Methane Dust	Very high level	2 medium of protection or 2 independent faults	Group I
	M2	Methane Dust	High level	1 Medium of protection or 2 independent faults	Group 1
	1	Gas, Vapores Nieblas polvo	Very high level	2 medium of protection or 2 independent faults	Group II Z0 (gas) z20 (Dust)
	2	Gas, Vapores Nieblas polvo	High level	1 Average protection Common and frequent disturbance	Group II ZI (gas) 7Z21 (Dust)
	3	Gas, Vapores Nieblas polvo	Normal	Level of protection required	Group II ZI (gas) 7Z21 (Dust)

The directive specifies the procedure for assessing conformity to implement the following modules depending on the category of equipment.

Certificate of EC type-examination

They are called "components" parts that are essential for the safe operation of equipment and protective systems but have no independent function.

Electrical equipment should conform to a type having obtained around a body a certificate of compliance with European standards. This certificate is established when the material meets the construction requirements, audits and testing standards for the protection mode selected.

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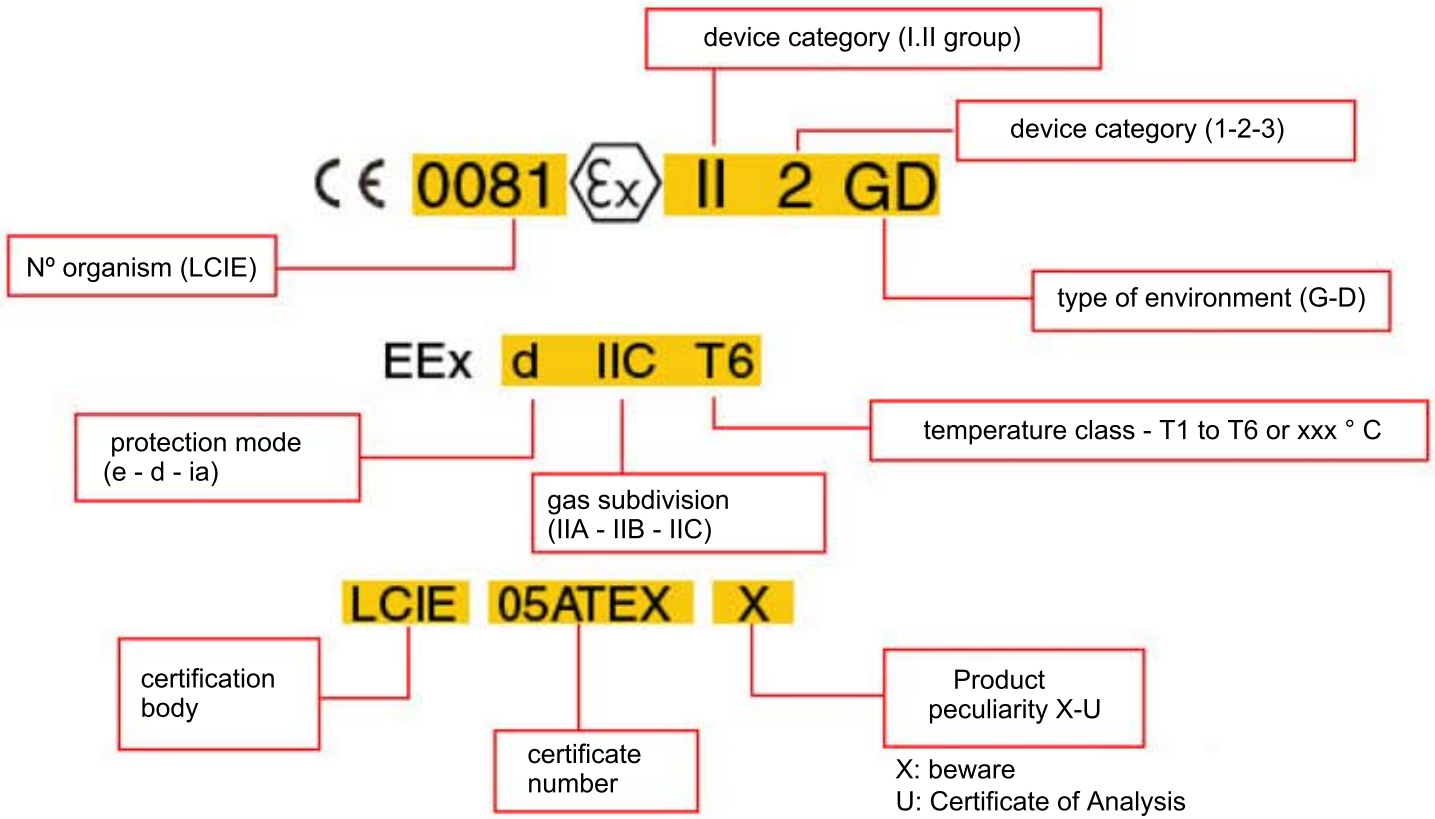
- **CE marked**

It is specified in Directive 94/9 / EC



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VI) EQUIPMENT FOR EXPLOSIVE

▪ Installations in explosive gas atmospheres

Four criteria must be met in explosive gas atmosphere

1) Defined category of material in accordance with the degree of explosion protection

2) Gas Group and subdivision

3) Temperature class

4) Operating temperature: Escoin expanded the range defined by the standard (-20ºC <Te <40ºC) a (-40ºC <Te <60 ° C).

Materials that can be installed in:	Authorized categories
Zone 0	1G
Zone 1	1G
	2G
Zone 2	1G
	2G
	3G

▪ Installations in explosive dust atmospheres

Four criteria must be met in the atmosphere of explosive dust

1) Defined category of material in accordance with the degree of explosion protection

2) Sealing equipment

3) Surface temperature

Operating temperature:
ESCOIN expanded the defined range by standard
(-20ºC <Te <40ºC) a (-40ºC <Te <60 ° C)

Materials that can be installed on:		Authorized categories	Sealing necessary
Zone 20		1D	IP6X
Zone 221		1D	IP6X
		2D	IP6X
Zone 222	conductive powder	1D	IP6X
		2D	IP6X
	insulating powder	3D	IP5X

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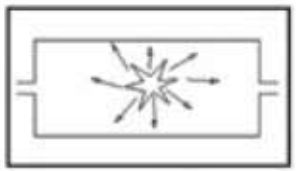
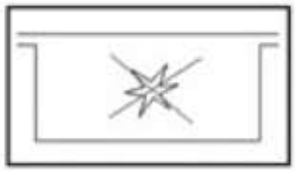
Proposed solutions

To meet the needs of industry, Escoin implements the type of protection "e" (EN 50019 increased safety), "d" (flameproof enclosure EN 50018) and "i" (intrinsic safety EN 50020).



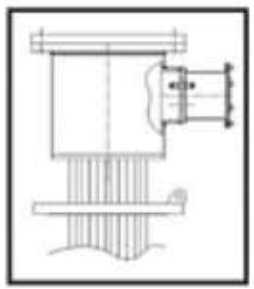
Mode of protection flameproof enclosure "d"

The housing (casing) must contain the explosion, ensure that the ignition can not be transmitted and present at any point lower than the ignition temperature of the gases and vapors of the surrounding temperature. The quality of the seal (cylindrical plane, threading), the length of the board and the gap is based on the free internal volume of the envelope and the subdivision of classified gas (following CENELEC) or group (following NEC); values make it impossible to spread of inflammation to the atmosphere in question.



Protection mode increased safety "e"

This protection method is perfectly applicable to junction boxes. It is to make impossible any accidental event of an ignition source (electric arc heating) by using insulation material of high quality, the sizing of lines and distance flight in the air, the quality of the electrical connections. Note that this protection mode is suitable for any subdivision of gases or vapors.



Type of protection "de"

The combination of the types of sealing protection against explosions and security "de". There are different solutions to adapt the equipment to the installation conditions:

All terminals of the equipment and measuring heaters are mounted in a flameproof enclosure. The electrical connection is made in a housing of increased safety.

All terminals of the elements are arranged in a housing of increased safety. The temperature control device, a type of certificate is mounted on an auxiliary housing.

All equipment used in explosive environments manufactured and marketed by Escoin meets the certificates of conformity or component. It also complies with the new European directive ATEX.

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Cable entry

Whenever possible, use cables and accessories that are not exposed to mechanical damage, corrosive or chemical influences and the effects of heat. Where a risk exists, you must take the necessary measures and select the appropriate cables (shielded cables with isolated minerals with reinforced section to limit the allowable current). You must know the methods and installation requirements that differ between countries. Unless otherwise stated, the selection of PE is made for unshielded cable.