Explosion - Explosion Proof Equipment Initial Approach

EU Directives → ATEX Directive

- 1999/92/ EC directed towards employers & employees
- 94/9/ EC directed towards suppliers of equipment

Basic Requirements

Compile an "Explosion Protection Document" (*) and keep it updated. It will contain:

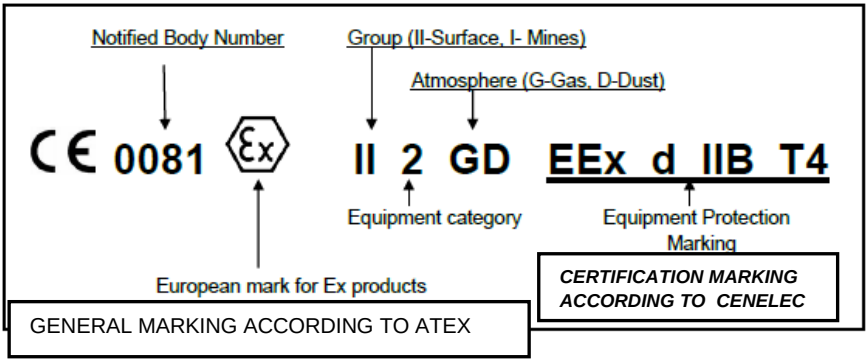
- The explosion risks
- Adequate safety measures
- Area Classification

Technical Measures

- Inerting the atmospheres
- Isolation of heat generation sources
- Explosion proof (Ex) equipment
- Fire suppression
- Gas measurements
- Maintenance
- Earthing and bonding

Explosion-proof equipment/ Marking

- Equipment to be used in explosion-hazard areas must have special design expressed by a special marking as shown below :



Hazardous Areas

- **Hazardous areas** are defined by three main criteria:
  - The type of hazard (*)
    - Gas
    - Dust
    - Fibres
  - The likelihood of the hazard being present in flammable concentrations
  - The (auto)ignition temperature (AIT) of the hazardous material

(*) In this session we shall only consider the gaseous materials.

The type of hazard (Groups)/ ATEX-CENELEC

- The categorization leads to the Gas Groups depending on how easily can be ignited and cause an explosion:

Mining	Surface Industry		
Group I	Group II		
Methane	IIA	IIB	IIC
	Propane	Ethylene	Hydrogen

	LEL	Explosion	UEL
Methane	4,4%	→	16,5%
Propane	1,7%	→	10,6%
Butane	1,4%	→	9,3%

NOTE : Group IIC is the most severe group. Hazards in this group can be ignited very easily indeed.

The likelihood of the hazard being present in flammable concentrations (Zones)/ ATEX

- There are three zones for gases and vapors depending on how likely it is for an explosion to occur during normal or abnormal operation (e.g. failure, leak etc.):

Zone 0	**Flammable atmosphere highly likely to be present - may be present for long periods or even continuously**
Zone 1	**Flammable atmosphere possible but unlikely to be present for long periods**
Zone 2	**Flammable atmosphere unlikely to be present except for short periods of time - typically as a result of a process fault condition.**

NOTE : Zone 0 is the most severe zone (the highest probability of flammable atmosphere presence). Equipment for this zone needs to be very well protected against providing a source of ignition.

The AIT of the hazardous material (Temperature Classes)/ CENELEC

- As well as considering the protection against electrical arcs and sparks igniting a flammable atmosphere, consideration needs to be given to the surface temperature of equipment. (Most electrical apparatus dissipates some heat!) Flammable materials are categorized according to their ignition temperature. Again, rather than work with an infinite range, six temperature classes are defined as follows :

T-Class	Hazards which will not ignite at temperatures below:
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

NOTE : If the hazardous area in which you are installing equipment has gases or vapors with a low AIT then you will need equipment with a bigger T-Class number so as to ensure that any hot surfaces on the equipment will not ignite the hazard.

Explosion-proof equipment / ATEX

- **Equipment specifications: Device Category**
  - 1=Maximum protection → protection against rare events
  - 2=High protection → protection against frequent events
  - 3=Ordinary protection → protection against usual events

DEVICE CATEGORY	ZONE
M = mining	-
M 1	-
M 2	-
G = gas	
1 G	0, 1, 2
2 G	1, 2
3 G	2
D = dust	
1 D	20, 21, 22
2 D	21, 22
3 D	22

Electrical equipment design specifications to prevent ignition during their use in hazardous areas / CENELEC

- Electrical apparatus for use in hazardous areas needs to be designed and constructed in such a way that it will not provide a source of ignition. There are ten recognized types of protection for hazardous area electrical apparatus. Each type of protection achieves its safety from ignition in different ways and not all are equally safe. The different types of protection and the zones for which they are suitable are as at the table:

Equipment Code	Description	Suitable for zones...
Ex ia	Intrinsic safety 'ia'	0, 1, 2
Ex ib	Intrinsic safety 'ib'	1,2
Ex ic	Intrinsic Safety 'ic'	2
Ex d	Flameproof protection	1,2
Ex p	Purge/pressurized protection	1,2
Ex px	Purge/pressurized protection 'px'	1,2
Ex py	Purge/pressurized protection 'py'	1,2
Ex pz	Purge/pressurized protection 'pz'	2
Ex e	Increased safety	1,2
Ex m	Encapsulation	1,2
Ex ma	Encapsulation	0,1,2
Ex mb	Encapsulation	1.2
Ex o	Oil immersion	1,2
Ex q	Sand / powder (quartz) filling	1,2
Ex n	Type - n protection	2
Ex s	Special protection	Normally 1 and 2

Area Marking

- Area Safety Sign to be posted outside all hazardous zone areas