

ATEX Directive

The acronym ATEX (**A**tmospheres **E**xplosives) refers to two European directives concerning the risk of deflagration in potentially explosive atmospheres:

- ATEX 2014/34/EU: concerns the requirements for electrical and non-electrical equipment for use in potentially explosive environments. According to this directive, the manufacturer has to comply with the provided requirements and mark its articles according to specific categories.
- ATEX 99/92/EC: lays down minimum requirements for the safety and health protection of workers potentially at risk from explosive atmospheres.

These directives define the requirements for the protection of safety and health of persons, domestic animals and property, as well as the conformity assessment procedures to prove that the devices comply with the directives' requirements.

Classification of potentially explosive atmospheres

A potentially explosive atmosphere is an atmosphere which could become explosive due to local and/or operational conditions. These environments present a mixture with air under atmospheric conditions of flammable substances in the form of in the form of gases, vapours, mists or dusts.

The ATEX 99/92/EC Directive classifies two types of potentially explosive atmospheres, depending on presence of combustible gases or dusts in the zone. These two types of explosive atmospheres are in turn classified in three zones each, according to the frequency and duration of the explosive atmosphere. Areas in atmospheres with explosive gases are classified in zones 0, 1 and 2; whereas in atmospheres with explosive dusts in zones 20, 21 and 22:

- **Zone 0/20:** A place in which the presence of flammable gas or dust is continuously present. Constant danger. It requires at least Category 1 equipment.
- **Zone 1/21:** A place in which the presence of flammable gas or dust is likely to occur in normal operation occasionally. Potential danger. It requires at least Category 2 equipment.
- **Zone 2/22:** A place in which the presence of flammable gas or dust is not likely to occur in normal operation or, if it does occur, will persist for a short period only. Or it occurs due to a failure. Lower danger. It requires at least Category 3 equipment.

The end user has the responsibility to identify and classify the different zones and to install appropriate equipment.

Equipment categories acc. to ATEX directive and IEC standards

According to the ATEX Directive 2014/34/EU equipment is classified into two main groups:

- **Group I:** equipment and systems for mining
- **Group II:** equipment and systems for all other applications

Equipment of the group I is divided in two further categories according to the required protection level:

- **Category M1:** Equipment designed to ensure a very high level of protection
- **Category M2:** Equipment designed to ensure a high level of protection

Equipment of the group II is further subdivided into three categories according to the required protection level:

- **Category 1:** Equipment designed to ensure a very high level of protection (for use in zone 0 and 20, 1 and 21, 2 and 22)
- **Category 2:** Equipment designed to ensure a high level of protection (for use in zone 1 and 21, 2 and 22)
- **Category 3:** Equipment designed to ensure a normal level of protection (for use in zone 2 and 22)

A comparison between the EPL (Equipment Protection Levels) defined by the IEC 60079-0 standard and the categories and applications of the ATEX Directive are shown in the table below.

Table 1 – Classification of environment and equipment according to ATEX directive and IEC 60079-0 standard

Environment features				Equipment features				
Field of application	Flammable substance	Potentially explosive atmosphere	Classification of potentially explosive atmospheres: ZONE	acc. to ATEX 2014/34/EU		acc. to IEC 60079-0		Required protection level
				Required marking of the device: CATEGORY	Required marking of the device: GROUP	Group	EPL	
Mining				M1	I	I	Ma	very high
				M2			Mb	high
Surface	Gases	It is present continuously, or for long periods or frequently	0	1G	II	II	Ga	very high
		It is likely to occur	1	2G			Gb	high
		It is not likely to occur but, if it does occur, will persist for a short period only	2	3G			Gc	normal
	Dusts	It is present continuously, or for long periods or frequently	20	1D		III	Da	very high
		It is likely to occur	21	2D			Db	high
		It is not likely to occur but, if it does occur, will persist for a short period only	22	3D			Dc	normal



Protective measures

To avoid the risk of explosions caused by an electrical trigger in a potentially explosive atmosphere, different protective measures can be taken:

- use of enclosures to encapsulate dangerous part in order to limit explosions to the inside of the housing itself;
- avoid contact between hot spots and the potentially explosive atmosphere by interposing solid, liquid or gaseous bodies;
- take measures to limit the generation of dangerous hot spots, eliminating the possibility of failures or limiting the system power so that it is insufficient to cause the ignition.

Various protective modes have been developed and standardised for each of these modes as listed in the following table:

Table 2 - Protective measures and applicable standards

Protective measure	Symbol	Engraving	Zone GAS	Zone DUSTS	IEC / EN standard
General requirements	/	/	0, 1, 2	20, 21, 22	IEC 60079-0 EN 60079-0
Oil immersion		Ex ob Ex oc	1 2	/	IEC 60079-6 EN 60079-6
Pressurized enclosure		Ex pv Ex pxb Ex pyb Ex pzc	1, 2 1 1 2	/ 21 21 22	IEC 60079-2 EN 60079-2
Powder filling		Ex q	1	/	IEC 60079-5 EN 60079-5
Flameproof enclosure		Ex da Ex db Ex dc	0 1 2	/	IEC 60079-1 EN 60079-1
Increased safety		Ex eb Ex ec	1 2	/	IEC 60079-7 EN 60079-7
Intrinsic safety		Ex ia Ex ib Ex ic	0 1 2	20 21 22	IEC 60079-11 EN 60079-11
Encapsulation		Ex ma Ex mb Ex mc	0 1 2	20 21 22	IEC 60079-18 EN 60079-18
Non sparking		Ex nA Ex nC Ex nR	2 2 2	/	IEC 60079-15 EN 60079-15
Protective housing		Ex ta Ex tb Ex tc	/	20 21 22	IEC 60079-31 EN 60079-31
Optical radiation		Ex op is Ex op pr Ex op sh	0, 1, 2 1, 2 0, 1, 2	20, 21, 22 21, 22 20, 21, 22	IEC 60079-28 EN 60079-28

Marking examples

Devices for places with presence of gas

II 2G Ex ia IICT6 Gb

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① EU marking
- ② Equipment group (see table 1)
- ③ Protection category (see table 1)
- ④ Prefix for safety devices according to the IEC / EN standards
- ⑤ Type of protection (see table 2)
- ⑥ Classification of gases (see table 3)
- ⑦ Temperature class (see table 3)
- ⑧ EPL acc. to IEC 60079-0 (see table 1)

Devices for places with presence of dusts

II 3D Ex tc IIIC T80°C Dc

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① EU marking
- ② Equipment group (see table 1)
- ③ Protection category (see table 1)
- ④ Prefix for safety devices according to the IEC / EN standards
- ⑤ Type of protection (see table 2)
- ⑥ Classification of dusts (see table 5)
- ⑦ Maximum surface temperature of the equipment
- ⑧ EPL acc. to IEC 60079-0 (see table 1)

Temperature classes

Table 3

Class	T1	T2	T3	T4	T5	T6
Maximum surface temperature of the equipment	450 °C	300 °C	200 °C	135 °C	100 °C	85 °C

Classification of gases

Table 4

excerpt from standard IEC/CENELEC/NEC 505

	I	IIA	IIB	IIC
T1	methane	propane, industrial methane, ethane, benzene, ammoniac, acetic acid, carbon monoxide, methanol, toluene	acrylonitrile	hydrogen
T2		ethanol, amyl acetate, butane	ethylene	acetylene
T3		nafta, benzine, esano	hydrogen sulfide	
T4		acetaldehyde	ethyl ether	
T5				
T6				carbon disulfide

Classification of dusts

Table 5

IIIA	IIB	IIC
combustible particles	non-conductive powder	conductive powder