Introduction

The name ATEX comes from the 2 French words "ATmosphere EXplosible" and is applied to European Directive 2014/34/UE dated 26th February 2014, aimed at the free circulation of products designed for use in potentially explosive areas throughout the European Union. In Italy, the Directive has been enforced through Presidential Decree 19.05.2016, no. 85 (Official Gazzette, 25th May 2016, no. 121).

This Directive regulates legislation from the various States in terms of electrical and mechanical products intended for use in an area which could become explosive due to the presence of flammable substances in gas, vapour, mist or dust form.

For example:

- **Underground mines;**
- **Petrochemical plants;**
- **Energy production plants (power stations);**
- **Premises used for the production and storage of foodstuffs (flour, cereals, etc.);**
- **Carpentry workshops;**
- **Painting workshops or cabins;**
- **Farms or greenhouses.**

ATEX Directive 2014/34/UE replaces the previous 94/9/EC became a compulsory obligation on 1st July 2003: it is one of the directives illustrating the new approach to matters regarding CE labelling and replaces previous directives 76/117/EEC, 79/196/EEC and 82/130/EEC.

Remember that:

- **Areas at risk of explosion** are those in which an explosive atmosphere may form at levels requiring safety precautions in order to ensure the safety of workers.
- **Areas not at risk of explosion** are those in which an explosive atmosphere may form at levels which do not require special safety precautions.
- **Flammable and/or combustible substances** are considered substances which may form an explosive atmosphere, unless an examination of their characteristics has NOT demonstrated that they could cause an explosion when mixed with air.

Explosive atmospheres are classified as follows, according to the substance which could trigger the explosion:

G = gas **D = dust** **GD = gas and dust**

ATEX Directive 2014/34/UE

More commonly known as the ATEX Directive, it applies not only to electrical components, but to all protective equipment and systems intended for use in potentially explosive areas. It also covers all safety, checking and regulatory devices installed just outside the potentially explosive area, where the safety of products installed in areas potentially at risk depends on their efficient operation.
The ATEX Directive lists the product characteristics required for installation in areas at risk of explosion, introducing a classification based on the likelihood of an explosive atmosphere forming.
The aspect of the ATEX Directive lies in its application to all explosion hazards, even those not considered in previous EC legislation, such as: mechanical components, combustible dust, etc.

In short, ATEX Directive 2014/34/EC:

- defines safety requirements for all types of electrical and non-electrical equipment intended for use in the above mentioned environments. The safety requirements set out by the ATEX Directive must be observed by the manufacturer and/or its agents, and are usually identified by the relevant labelling:
- establishes equipment classification criteria based on the guaranteed protection class in the various application zones: it is the employer's responsibility to classify hazardous areas and identify the required protection class for the products installed, based on the regulations set out by European Directive 2014/34/EC (referring to safety in the workplace), which is actually linked to the Atex Directive.
- applies to all equipment (including fans) installed in a classified zone. It is the manufacturer's responsibility to ensure that these products conform to the Directive, which also imposes a series of obligations for those selling the product. The company selling the product must keep the CE conformity declaration at the disposal of the relevant authorities for a period of 10 years from the last noted construction date of that product; anyone who significantly modifies the product becomes the 'manufacturer' and is therefore ultimately and exclusively responsible for ensuring the product conforms to the applicable Directive.
- identifies the officially notified European bodies authorised to examine and verify documentation, and to issue type certificates for the equipment which must be used in zones at risk of explosion.

The following are excluded from the Directive 2014/34/UE field of application:

- medical devices intended for use in a medical environment;
- equipment and protective systems where the explosion hazard results exclusively from the presence of explosive substances or unstable chemical substances;
- equipment intended for use in domestic and non- commercial environments where potentially explosive atmospheres may only rarely be created, solely as a result of the accidental leakage of fuel gas;
- personal protective equipment covered by Council Directive 89/686/EEC of 21 December 1989 on the approximation of the laws of the Member States relating to personal protective equipment ;
- seagoing vessels and mobile offshore units together with equipment on board such vessels or units;
- means of transport, i.e. vehicles and their trailers intended solely for transporting passengers by air or by road, rail or water networks, as well as means of transport in so far as such means are designed for transporting goods by air, by public road or rail networks or by water. Vehicles intended for use in a potentially explosive atmosphere shall not be excluded from the scope of this Directive.

Product classification

This European Directive establishes an initial divide between equipment intended for environments with a firedamp (group I) and other environments (group II). Group I therefore includes all equipment intended for use in mines and the associated plants, while group II encompasses a vast range of plant applications, ranging from industrial chemicals to small-scale cake producers.

A further distinction is made for group II products, concerning the classification of equipment intended for areas in which explosive atmospheres may form if gas or dust is present.

In accordance with the ATEX Directive, devices and components are divided into **two groups** depending on their application:

Group I = MINES

Equipment intended for use in underground environments, in mines and their surface plants exposed to the risk of methane leaks (firedamp) and/or combustible dust (from coal). This group is split into **2 categories**, based on the protection level guaranteed by the equipment:

M1 = very high
M2 = high

Group II = SURFACE

Equipment intended for use in other environments (not mines) in which explosive atmospheres are likely to form. This group is split into **3 categories**, based on the protection level guaranteed by the equipment and the type of atmosphere:

1G/1D = very high
2G/2D = high
3G/3D = normal

2014/34/UE Certification							
GROUP I		GROUP II					
equipment intended for use in mines and corresponding surface plants		equipment intended for use in environments where the formation of explosive atmospheres is possible					
CATEGORY							
M1	M2	1G	1D	2G	2D	3G	3D
		Gas	dust	gas	dust	gas	dust
		ZONE					
		0	20	1	21	2	22

CE labelling and CE declaration of conformity

Applications: ATEX Zones and Categories

ZONES

The risk presented by areas with an explosive atmosphere can be very different, depending on the length of time it can effectively manifest itself. An environment in which gas or dust is present at hazardous levels for a few hours cannot be considered the same as an area in which the hazardous mixture is always present. As such, standards in the EN 60079 and EN 61241 series identify three different zones, grouped according to the risk level, and the connection between these and the category of product which can be installed.

Zones in which gas is present

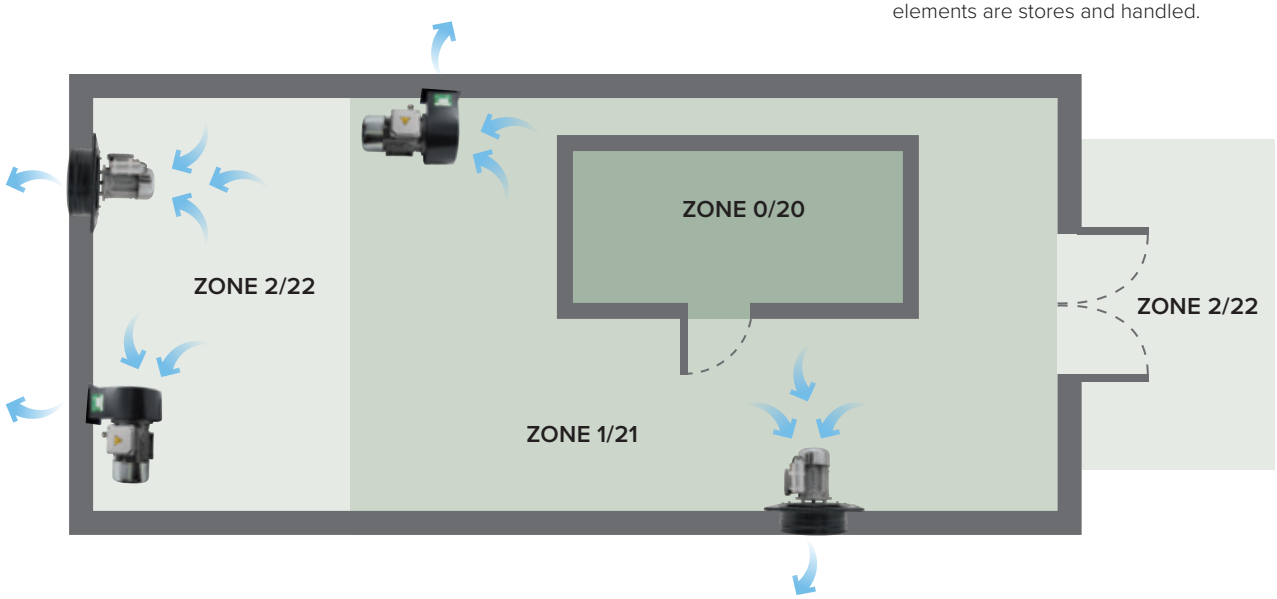
When the hazard is due to the presence of gas, fumes or mist containing flammable substances, European directive 1999/92/EC provides classification for 3 zones as follows:

ZONE 0	ZONE 1	ZONE 2
Area in which an explosive atmosphere is often present, permanently or for long periods of time;	Area in which the formation of an explosive atmosphere is likely to occur occasionally during routine activities;	Area in which, during routine activities, the formation of an explosive atmosphere is unlikely or, if it does occur, it only persists for a short period of time.

Zones in which dust is present

The classification method for areas subject to the formation of explosive atmospheres due to the presence of dust is the same as the method used for gas. The zones in this case are as follows:

ZONE 20	ZONE 21	ZONE 22
Area in which an explosive atmosphere is often present, permanently or for long periods of time, such as dust extraction systems, inside silos;	Area in which the formation of an explosive atmosphere is likely to occur occasionally during routine activities, such as the immediate vicinity of dust loading and unloading areas;	Area in which, during routine activities, the formation of an explosive atmosphere is unlikely or, if it does occur, it only persists for a short period of time, such as areas near extraction inlet nozzles. The latter zone is usually the largest, as the classification includes all the areas next to filter casing vents or equipment which is rarely opened and areas where bags or packaging elements are stores and handled.



ATEX RANGE

Fans for installation in potentially explosive areas

CATEGORIES

CATEGORY 1	CATEGORY 2	CATEGORY 3
Equipment falling into his category is intended for use in environments where explosive atmospherescaused by mixtures of air and gas, fumes or mist, or air and dust mixtures are present, permanently, frequently or for long periods of time. Equipment falling into this category must guarantee the required protection level, even in the event of exceptional faults, and feature protection devices so that: ▪ if one of the protection devices becomes faulty, at least one other independent device will guarantee the required protection level is maintained; ▪ or, if two faults occur independently of one another, the required protection level is guaranteed.	Equipment falling into his category is intended for use in environments where explosive atmospheres caused by mixtures of air and gas, fumes or mist, or air and dust mixtures are likely to occur. The protection devices falling into this category must guarantee the required protection level, even in the event of recurrent faults or operating defects which should usually be noted.	Equipment falling into his category is intended for use in environments where explosive atmospheres caused by mixtures of air and gas, fumes or mist, or air and dust mixtures are unlikely to occur, or where they only occur rarely and for short periods of time. Equipment falling into this category guarantees the required protection level under normal operating conditions.

Zones

(classified in accordance with 1999/92/EC) and equipment protection levels (Categories) can therefore be combined in accordance with the following table:

Explosive atmosphere presence	Equipment protection level	Usage zone with GAS present	Category	Usage zone with DUST present	Category
Always Present (or present for long periods)	Very high	0	1G	20	1D
Very Likely (during routine activities)	High	1	2G	21	2D
Not Likely (occasional or present only for short periods)	Normal	2	3G	22	3D

Note: *Equipment belonging to the higher categories may also be used for lower categories: for example, equipment suitable for zones 20 or 21 may also be used in zone 22.*

All zones at risk of explosion MUST be classified in accordance with European Directive 1999/92/EC.

Vortice equipment falls into GROUP II category 2GD (zone 1-21) and it is this group which is examined most widely.
NOTE: These products are also suitable for zone 2-22.

Environments in which gas is present (category G)

If the equipment must be used in areas where gas is present **(category G)**, it must be categorised further, by gas group and on the basis of the maximum surface temperatures, as described in the table below:

GAS GROUP	TEMPERATURE CLASS					
	T1 = 450° C	T2 = 300° C	T3 = 200° C	T4 = 135° C	T5 = 100° C	T6 = 85° C
IIC	Hydrogen	Acetylene				Ethyl Nitrate Carbon Disulfide
IIB	Coke gases Water gases	1,3-Butadiene Ethylbenzene Ethylene Ethylene Oxide	Hydrosulfuric Acid Isoprene Petroleum	Diethyl Ether		
IIA	Ethyl Acetate Methyl Acetate Acetone Acetic Acid Methyl Alcohol Ammonia Benzene Benzol Butanone Chloromethylene Ethane Methane Methanol Carbon Monoxide Naphthalene Propane Toluene Xylene	Butyl Acetate Propyl Acetate Amyl Alcohol Ethyl Alcohol Isobutyl Alcohol n-Butyl Alcohol Acetic Anhydride Cyclohexanone Liquid gas Natural gas Monoamyl Acetate n-Butane	Cyclohexane Cyclohexanol Decane Heptane Hexane Diesel oil Kerosene Naphtha Pentane	Acetaldehyde Ether		
I	Methane					

By Temperature Class (T1-T6) we mean the maximum surface temperature, at any point, reached by the equipment during operation under the specified conditions and in the event of any foreseeable breakdown conditions.

Note: *The gas groups and temperature classes were devised so that the highest also include the categories below them:*
- *equipment belonging to a specific gas group is also suitable for 'lower' gas groups: for example, a motor for group IIB is also suitable for group IIA;*
- *a motor for group IIC is also suitable for groups IIA and IIB;*
- *a machine which reaches maximum surface temperatures of 85°C (T6) includes T5-T4-T3...: 85°C is, in fact, the maximum temperature reached by the appliance, and as it is a low value, the risk of triggering an explosion is also very low.*

The T6 surface temperature, even lower, is therefore the most restrictive condition.

ATEX products from Vortice have motors suitable for group II and are therefore suitable for groups IIC, IIB and IIA.

Environments in which dust is present (category D)

To protect against flammable dust, its ignition temperature must be taken into account, both in cloud form and deposited layer form. The surface temperature of the casing, indicated on the motor rating plate, must be lower than the ignition temperature used as a reference. The reference temperature is the lower of the two values; below is a theoretical example of how to calculate the reference temperature when choosing the most suitable product:

How to determine the maximum surface temperature of the motor	Cloud	5mm Dust Layer
Ignition temperature	T_{cl}	T_{5mm}
Safety temperature	$T_{Scl} = 2/3T_{cl}$	$T_{S5mm} = T_{5mm}$ -75° C
Maximum allowable temperature	T_{MAX} = equal to the lower value between T_{cl} and T_{5mm}	
Maximum surface temperature of the motor	$\leq T_{MAX}$	

Source: *Article published in 'Ambiente & Sicurezza' (Environment & Safety) magazine from "Sole 24 Ore" on 20/02/2007: "Presenza di polveri combustibili o esplodenti base della classificazione dei luoghi pericolosi" (Presence of combustible or exploding dust based on the classification of hazardous areas) by Gianluca Saputi P.I. di III U.F. di ISPESL (National Institute for Occupational Safety and Prevention).*

Vortice ATEX products are suitable for applications when the maximum surface temperature is equal to or higher than 135 °C

A few calculation examples are provided below:

Dust	Cloud ignition temperatures (°C) T_{cl}	Cloud safety temperature (°C) T_{Scl}	5mm layer ignition temperatures (°C) T_{5mm}	5mm layer safety temperature (°C) T_{S5mm}
Alluminium	590	**442**	< 450	**375**
Coal dust	380	**285**	225	**150**
Flour	490	**367**	390	**315**
Corn dust	510	**382**	300	**225**
Methyl cellulose	420	**315**	320	**245**
Soot	810	**607**	570	**495**
PVC	700	**525**	< 450	**375**
Sugar	490	**367**	460	**385**

Protection methods

Non-electrical and electrical equipment in potentially explosive areas is constructed so as to avoid risking an explosion: various prevention and protection methods are used to prevent this risk from arising.

The basic **prevention** methods are as follows:

- measures to ensure that the ignition source does not manifest itself (methods c e g);
- measures to ensure that the ignition source does not become effective (method b);
- measures to ensure that the ignition source does not come into contact with the atmosphere (methods fr, k and p).

Prevention method	Labelling
Construction safety	c
Intrinsic safety	g
Construction safety and ignition source control	h
Ignition source control	b
Restricted breathing	fr
Pressurisation	p
Liquid immersion	k

All ATEX products from Vortice are labelled as 'b' for the non-electrical part, meaning that specific construction and size-related instructions must be applied regarding:

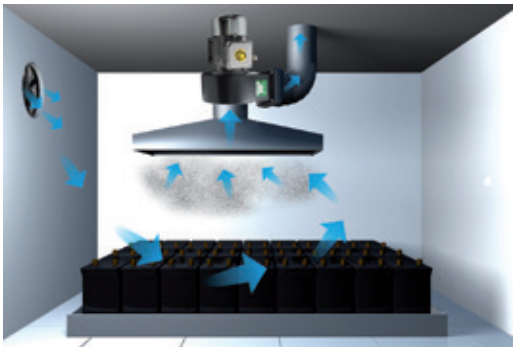
- minimum distance values, both through the air and over surfaces;
- the use of insulating materials with a high trace resistance;
- the elimination of corners in which static electricity could accumulate;
- ensuring that both electrical and mechanical parts are coupled correctly and securely;
- minimum distance values between fixed and rotary parts (e.g. between iron, rotor stator, ventilation, etc.);
- temperatureincreaselimits,consideringajammedrotorsituation,andnormaloperation under the least favourable heat conditions (least favourable power supply voltage).

The basic **protection** methods are as follows:

- keep hazardous parts separated in casing, so as to contain the explosion (method d);
- avoid contact between hot points and the potentially explosive atmosphere by placing solids, liquids or gases in between (methods m, p, q, o, t);
- take measures to limit the generation of hazardous hot points to eliminate the risk of faults and limit the energy to a level which is not high enough to cause ignition (methods e, n, ia, ib, t).

Prevention method	Labelling
For prevention	n
Explosion proof casing	d
Pressurisation	p
Encapsulation	m
Oil immersion	o
Sand filled	q
Increased safety	**e**
Intrinsic safety cat. a	ia
Intrinsic safety cat. b	ib
Intrinsic safety cat. c	ic

All ATEX products from Vortice are labelled as 'e' therefore electrical parts must be fitted with suitable devices protecting against inverse time overloads in compliance with ATEX 2014/34/UE and according to the following labelling: II (2) G/D. These devices prevent sparks, electrical arcs and surface overheating from occurring during service (including non-standard startup and operating conditions while the rotor is jammed), which could cause ignition of the potentially explosive atmosphere surrounding both internal and external parts of the motor.



Example of a battery room (classified as zone 1), in which HYDROGEN is released: under these conditions, the use of extractor fans in the immediate vicinity of the batteries is compulsory and a further installation near the ceiling is also recoafication of these environments must be carried out by the relevant authorities.