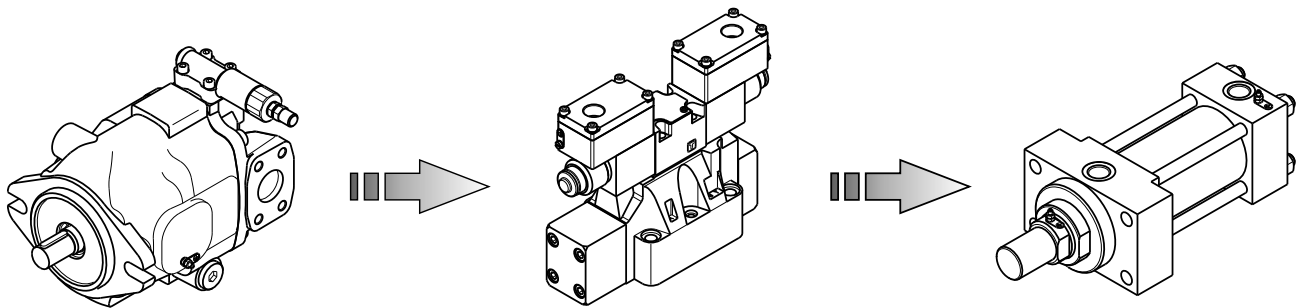


INTRODUCTION

TO EXPLOSION PROOF COMPONENTS PROTECTION



Directives for explosion protection provide an identification and **classification of the areas** where an explosion may occur, according to the **frequency of potentially explosive atmospheres are likely to occur** and according to the **type of inflammable substance** (gases/vapours/mists or dusts).

Components used in these areas involve particular protective system/equipment in order to guarantee safe usage, therefore they must be chosen according to the zone in which they will be installed and operate, and they must respect appropriate requirements of that zone.

They differ between equipment for **mines** (for use in underground parts of mines as well as those parts of surface installations of such mines) or for **surface plants**.

Moreover, technical standards for safety describe which **type of protection** to use in order to **avoid ignition sources** and /or prevent the explosion from spreading, since applicable protection types are differently effective depending from explosive substance peculiarity (type of gas, and /or type of dust / type of equipment) and to its **ignition temperature**.



1 - CLASSIFICATION

1.1 - Equipment categories and protection levels

The ATEX directive applies an initial division into mine / surface equipment established by the groups (I / II) and in areas / categories that is also visible in the marking.

The identification for compliance in IECEx and InMetro standards is based on the 'EPL' (equipment protection level) which defines the suitability of the component as compared to the classified area into it will be installed.

ATEX (2014/34/EU)		IEC std	Zone (99/92/EC)	Level of protection to be guaranteed
Group	Equipment category	EPL		
Equipment for mines endangered by firedamp and/or combustible dust.				
I	M1	Ma		Equipment must be so designed and constructed that sources of ignition do not become active, even in the event of rare incidents relating to equipment . Where necessary, equipment must be equipped with additional special means of protection. It must remain functional with an explosive atmosphere present.
I	M2	Mb		Equipment must be equipped with means of protection ensuring that sources of ignition do not become active during normal operation, even under more severe operating conditions , in particular those arising from rough handling and changing environmental conditions. The equipment is intended to be de-energised in the event of an explosive atmosphere.
Surface plants - gas explosive atmosphere				
II	1G	Ga	Zone 0	Equipment must be so designed and constructed that sources of ignition do not become active, even in event of rare incidents relating to equipment .
II	2G	Gb	Zone 1	Equipment must be so designed and constructed as to prevent ignition sources arising, even in the event of frequently occurring disturbances or equipment operating faults , which normally have to be taken into account.
II	3G	Gc	Zone 2	Equipment must be so designed and constructed as to prevent foreseeable ignition sources which can occur during normal operation .
Surface plants - dusts explosive atmosphere				
II	1D	Da	Zone 20	Equipment must be so designed and constructed that ignition of air/dust mixtures does not occur even in the event of rare incidents relating to equipment .
II	2D	Db	Zone 21	Equipment must be designed and constructed so that ignition of air/dust mixtures is prevented, even in the event of frequently occurring disturbances or equipment operating faults which normally have to be taken into account.
II	3D	Dc	Zone 22	Equipment must be so designed and constructed that air/dust mixtures cannot be ignited by foreseeable ignition sources likely to exist during normal operation .

1.2 - The potentially explosive atmosphere presence: areas

The table shows the definition of hazardous places according to Directive 99/92/EC, which divides the areas on the basis of the frequency and duration of the occurrence of an explosive atmosphere.

frequency	continuously or for long periods or frequently	likely to occur in normal operation occasionally	not likely to occur in normal operation but will persist for a short period only
Gas	Zone 0	Zone 1	Zone 2
Dust	Zone 20	Zone 21	Zone 22



1.3 - Means of protection

The conformity to a certain zone can be reached applying different means of protection. Several means of protection are detailed in the tables below, divided in electrical and non-electrical equipments. The eligible zone in which they can operate is required just for electrical equipments.

Means of protection for electrical equipment	marking	eligible for zone		technical standard
		gas	dusts	
flameproof enclosures	da	0		IEC 60079-1
	d, db	1		
	dc	2		
pressurized enclosures	px, pxb	1	21	IEC 60079-2
	py, pyb	1	21	
	pz, pzc	2	22	
powder filling	q, qb	1		IEC 60079-5
oil immersion	o, ob	1		IEC 60079-6
	oc	2		
increased safety	e, eb	1		IEC 60079-7
	e, ec	2		
intrinsic safety	ia	0	20	IEC 60079-11 IEC 60079-25
	ib	1	21	
	ic	2	22	
non-sparkling dev.	nA	2		IEC 60079-15
sealed device	nC	2		
restricted breathing	nR	2		
encapsulation	ma	0	20	IEC 60079-18
	mb	1	21	
	mc	2	22	
protection by enclosures	ta		20	IEC 60079-31
	tb		21	
	tc		22	

Means of protection for NON-electrical equipment	marking	technical standard
flameproof enclosures	d	EN 13463-3
constructional safety	c	EN 13463-5
control of ignition source	b	EN 13463-6
pressurized enclosures	p	EN 60079-2
liquid immersion	k	EN 13463-8

1.4 - Gas / dust groups: typical substances

Within each zone there is a subdivision according to the nature of gas/dust. The table shows typical gases / dusts for each group.

Devices can also be suitable for groups less restrictive than those for which they are certified. (E.g.: a device approved for IIC / IIIC group it is also suitable for IIB / IIIB and IIA / IIIA groups.)

Group I	Mines
	methane
Group II	Gas explosive atmospheres
IIA	propane
IIB	ethylene
IIC	hydrogen, acetylene
Group III	Dusts explosive atmospheres
III A	combustible flyings
III B	non-conductive dust
III C	conductive dust



1.5 - Classification of the maximum surface temperature

The equipment must be marked with a sign of the maximum surface temperature they reach during operation. The maximum surface temperature must be lower than the ignition temperature of the gases, vapors and dusts for which the equipment is intended to be installed in and used.

The standard defines a reference standard ambient temperature range of -20 °C to +40 °C for measuring the maximum surface temperature. If the device is approved within an ambient temperature range that differs from the standard, this should be explicitly stated in marking.

Equipment can also be suitable for temperature classes less restrictive (i.e. highest allowable surface temperature) than those for which they are certified. (Eg: T6 (T85 °C) certified equipment it is suitable to be used also in T5 classified areas (T100 °C) etc..).

maximum surface temperature	marking for GAS	marking for DUST
450 °C	T1	maximum surface temperature in °C (eg: T154 °C)
300 °C	T2	
200 °C	T3	
135 °C	T4	
100 °C	T5	
85 °C	T6	

1.6 - IP Code

The IP code inside the making is required just for dusts potentially explosive atmospheres.

The technical reference standard is IEC 60529, which classifies and rates the degree of protection provided against intrusion (body parts such as hands and fingers), dust, accidental contact, and water by mechanical casings and electrical enclosures. Where there is no data available to specify a protection rating with regard to one of the criteria, the digit is replaced with the letter X. (Example: IP X6)

First digit: Solid particle protection	
0	No protection against contact and ingress of objects
1	Any large surface of the body, such as the back of a hand, but no protection against deliberate contact with a body part (50 mm)
2	Effective against foreign objects bigger than 12 mm (fingers)
3	Effective against foreign objects bigger than 2,5 mm (tools, thick wires, etc)
4	Effective against foreign objects bigger than 1 mm (wires, slender screws, large ants)
5	Dust protected (Not dust tight, but enough to ensure the proper functioning)
6	Dust tight; No ingress of dust; complete protection against contact (dust tight).

Second digit: liquid ingress protection	
0	No protection
1	Dripping water (vertically falling drops)
2	Dripping water (falling drops with maximum 15° tilt)
3	Spraying water
4	Splashing of water
5	Water jets
6	Powerful water jets
7	Temporary immersion
8	Continuous immersion in water
9	Protected against close-range high pressure, high temperature spray downs.

NOTE: The IP69K rating is not defined in IEC 60529 standard, but in ISO 20653 (IP codes for road vehicles). IP69 and IP69K offers equal protection level.

⚠ IMPORTANT: As regards the liquid ingress protection (second digit), there are three means of protection. Codes from 1 to 6 are related to water jets, rates 7 and 8 are related to immersion, rate 9 is reserved for high pressure and temperature water jets. This means that IPX6 covers all the lower steps, rate IPX8 covers IPX7 but not IPX6 and lower, instead IPX9 does not cover any of them.

Whether a device meets two types of protection requirements it must be indicated by listing both the tests separated by a slash. (E.g. a marking of an equipment covered both by temporary immersion and water jets is IP66 / IP68.)

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