




02 - Standards

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Grades of protection of a coil or solenoids with a connector

The grade of protection indicates the inherent capacity of an electrical apparatus, when charged, to resist accidental contact or penetration by solid or liquid particles.

It is defined by code "I.P." followed by numbers; the first digit, from 0 to 6 classifies resistance against accidental contact and penetration by dust. The second digit, from 0 to 8, classifies resistance to penetration by liquid. The following are definitions of the various grades.

Grades of protection against contacts or penetration of solid foreign matters

First number	Protection	Explanation
	Denomination	
0	No protection	People are not protected against accidental contacts with charged or moving parts. Machines are not protected against penetration by solid foreign matters.
1	Protection against penetration by large solid matters.	Protects large surfaces from accidental contact with charged or moving parts inside the machine, such as contact with hands, but does not protect against voluntary contact with these parts. Protects machine against penetration by solid matters with a diameter of more than 50 mm.
2	Protection against penetration by medium-sized solid matters.	Protects finger from accidental contact with charged or moving parts inside the machine. Protects against penetration by solid matter with a diameter of more than 12 mm, such as fingers.
3	Protection against penetration by small solid matters.	Protects tools, conductors, and similar objects with a thickness of more than 2,5 mm from contact with charged or moving parts inside the machine. Protects against penetration by solid matters with a diameter of more than 1 mm.
4	Protection against penetration by very small solid matters.	Protects tools, conductors and similar objects with a thickness of more than 1 mm. from contact with charged or moving parts inside the machine. Prevents solid bodies with a diameter of more than 1 mm. such as small particles.
5	Protection against dust deposits.	Completely protects from contact with charged or moving parts inside the machine. Protects against dust deposits. The quantity of dust allowed to enter the machine is reduced to ensure that it functions properly.
6	Protection against the penetration of dust particles.	Completely protects from contact with charged or moving parts inside the machine. Totally prevents dust from entering the machine.

Grades of protection against water penetration

Second number	Protection	Explication
	Denomination	
0	No protection	No particular protection.
1	Protection against water drops moving in a perpendicular direction.	Water drops which fall perpendicularly must not damage the machine.
2	Protection against water drops moving in an oblique direction.	Water drops which fall at any angle up to 15 to the vertical must not damage the machine.
3	Protection against dripping water.	Water which falls at any angle up to 60 to the vertical must not damage the machine.
4	Protection against spraying water.	Water sprayed from any direction against the machine must not cause damage.
5	Protection against jets of water.	Jets of water launched from any direction against the machine must not cause damage.
6	Protection against flooding.	Water which penetrates the machine because of temporary flooding, such as rough sea, must not damage the machine.
7	Protection against immersion.	When the machine is immersed for predetermined time and pressure values, water must not enter in such quantities that it causes damage.
8	Protection against submersion.	When the machine is submerged at a predetermined pressure for an undetermined period of time, water must not enter the machine in such quantities that it causes damage.

94/9/EC DIRECTIVE - ATEX (Atmosphères Explosibles)

The Directive 94/9/EC of the European Community (with mandatory on 1st July 2003) covers equipments and protective systems which may be used in potentially explosive atmosphere.

Among innovative aspects of the directive, regarding all kind of explosion risks, electrical or not, are: introduction of the Essential Health and Safety Requirements (EHSRs), applicable to mining products and surface industry products, classification of equipment into categories according to granted protection level, and production surveillance - based on company quality systems.

The new Directive considers, for the 1st time, explosion risks due to mechanical ignition sources, e.g. spark due to contact use or overheating of mechanical components, and not only electrical risks.

Other important conditions considered by the directive refer to the installation area, storage and function of the machine, in order to gain a classification according to the probable presence of an explosive atmosphere.

Scope of the directive:

To grant security and health to people and goods, with regards to risks due to use of equipment and systems in potentially explosive atmospheres.

Explosive atmosphere:

An explosive atmosphere is defined as a "mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture".

Potentially explosive atmosphere:

An atmosphere, which could become explosive due to local and/or operational conditions.

Classification of hazardous places according to 1999/92/EC Directive

Hazardous places are classified in terms of zones on the basis of the frequency and duration of the occurrence of an explosive atmosphere.

Zone 0

A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.

Zone 1

A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

Zone 2

A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Zone 20

A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.

Zone 21

A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.

Zone 22

A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Notes:

- 1) Layers, deposits and heaps of combustible dust must be considered as another source which can form an explosive atmosphere.
- 2) "Normal operation" means the situation when installations are used within their design parameters.
- 3) In order to properly define the classification of the different areas it is possible to refer to the following harmonised technical norms: EN 60079-10 for explosive atmosphere deriving from presence of gas; EN 50281-3 for explosive atmosphere deriving from presence of combustible dust



Groups and categories of the equipments

LEVEL OF PROTECTION	CATEGORY		PERFORMANCE OF PROTECTION	INTENDED USE
	GROUP I	GROUP II		
Very high level	M1		Two independent means of protection or safe even when two faults occur independently of each other	Equipment remains energized and functioning when explosive atmosphere is present
Very high level		1	Two independent means of protection or safe even when two faults occur independently of each other	Equipment remains energized and functioning in zones 0,1,2 (G) and/or 20, 21, 22 (D).
High level	M2		Suitable for normal operation and severe operating conditions	These products are intended to be de-energised in the event of an explosive atmosphere in zones 1, 2 (G) and/or 21, 22 (D).
High level		2	Suitable for normal operation and frequently occurring disturbances or equipment where faults are normally taken into account	Equipment remains energized and functioning in zones 1, 2 (G) and/or 21, 22 (D).
Normal level		3	Suitable for normal operation	Equipment remains energized and functioning in zones 2 (G) and/or 22 (D).

Specifications may be subject to change without prior notice.

GROUP I

Category M 1

Comprises equipment designed and, where necessary, equipped with additional special means of protection to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection.

Equipment in this category is intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

Equipment in this category is required to remain functional, even in the event of rare incidents relating to equipment, with an explosive atmosphere present, and is characterized by means of protection such that:

- either, in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection,
- or the requisite level of protection is assured in the event of two faults occurring independently of each other.

Category M 2

Comprises equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a high level of protection.

Equipment in this category is intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust.

This equipment is intended to be de-energized in the event of an explosive atmosphere.

The means of protection relating to equipment in this category assure the requisite level of protection during normal operation and also in the case of more severe operating conditions, in particular those arising from rough handling and changing environmental conditions.

GROUP II

Category 1

Comprises equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection.

Equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dust mixtures are present continuously, for long periods or frequently.

Equipment in this category must ensure the requisite level of protection, even in the event of rare incidents relating to equipment, and is characterized by means of protection such that:

- either, in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection,
- or the requisite level of protection is assured in the event of two faults occurring independently of each other.

Category 2

Comprises equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and of ensuring a high level of protection.

Equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur.

The means of protection relating to equipment in this category ensure the requisite level of protection, even in the event of frequently occurring disturbances or equipment faults which normally have to be taken into account.

Category 3

Comprises equipment designed to be capable of functioning in conformity with the operating parameters established by the manufacturer and ensuring a normal level of protection.

Equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists, or air/dust mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.

Equipment in this category ensures the requisite level of protection during normal operation.

Classification of the maximum surface temperatures (Group IIG)

Temperature class	Max. surface temperature (°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

Correspondence between ZONES and CATEGORIES

ZONE	0		20		1		21		2		22	
	G (gas)	D (dust)	G (gas)	D (dust)	G (gas)	D (dust)	G (gas)	D (dust)	G (gas)	D (dust)	G (gas)	D (dust)
Explosive atmosphere	High probability, always or frequently				Medium probability, some times				Low probability, very rarely			
CATEGORY According to 94/9/EC directive	1				2				3			

The classification of hazardous atmospheres into zones, in an industrial context, is the responsibility of the end user on whose premises/in the course of whose work such hazards may exist or arise.

Manufacturer must state all information regarding products groups and categories, so that final user can decide in which zone ATEX products may work under security condition, even though manufacturer can not forecast where and how actually product will work.

Example of classification for electrical equipment:


CE II 3GD EEx nA II T4 T125°C -5°C ≤ Ta ≤ 70°C


Example of classification for non electrical equipment:

CE II 3GD c T4 T125 °C -5°C ≤ Ta ≤ 70°C



HOMOLOGATION

Products marked  are certified, in accordance with American standards and requirements, by the UL organisation which is the most important and highly valued (both by customers and authorities) independent certifying body in North America (United states and Canada).

The 300 series solenoid valves manufactured by Pneumax and certified UL are marked  (valid in the USA and Canada, file n°E206325-VAIU2, VAIU8) and differ from the standard product for the material used to encapsulate the coil.

The coils comprise a copper wire encapsulated, by injection mould, with RYNITE® (insulation class "F")