

Explosive Atmospheres

Safety
and Reliability



Explosive Atmospheres

When it comes to **hazardous areas**, the utilisation of suitable products and their proper maintenance are mandatory requirements in order to comply with market standards and regulations. However, when we analyze in more detail the importance of effective hazardous area management, it is clear that this is essential for the conservation of your assets and, especially the welfare of the personnel who contribute to and believe in your business.

WEG constantly invests in the development of its products, new technologies and qualification of its employees.

We aim to inform industry of the changes that are taking place in the market and highlighting the importance of hazardous area management as a **means to prevent irreversible damage to your Organisation.**





Standards

In order to make the management of hazardous areas safer, the standards and regulations for explosive atmospheres have been constantly updated.

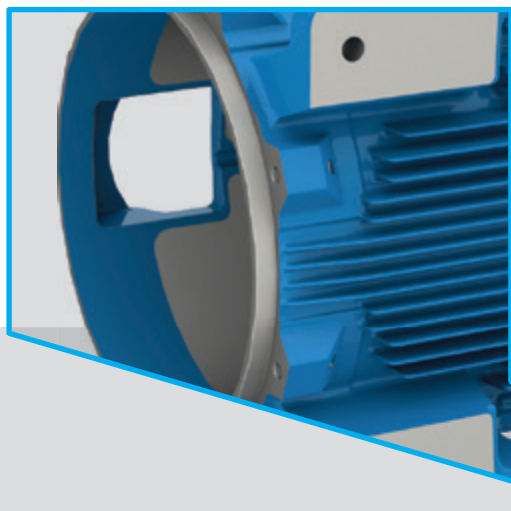
The IEC 60079 series of standards establishes the requirements for classification, design and repair of electrical equipment operating in explosive atmospheres.

Any organisation undertaking service or repair of motors operating in potentially explosive atmospheres, must comply with these standards, in order to ensure the safety of your Company!

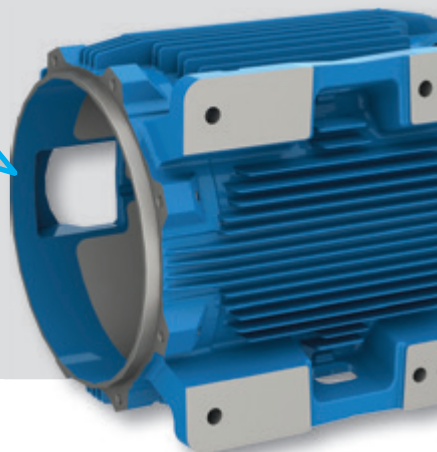


Electric motors may be a source of ignition when operating in potentially explosive atmospheres. In order to prevent such risk, they must incorporate special characteristics which enable them to operate safely within these classified areas.

Consequently, protection techniques have been conceived in order to develop and apply constructional measures to electric motors which permit them to operate in hazardous areas.



Flame retention system for flameproof motors, comprised of carefully designed tolerances on gaps between components.



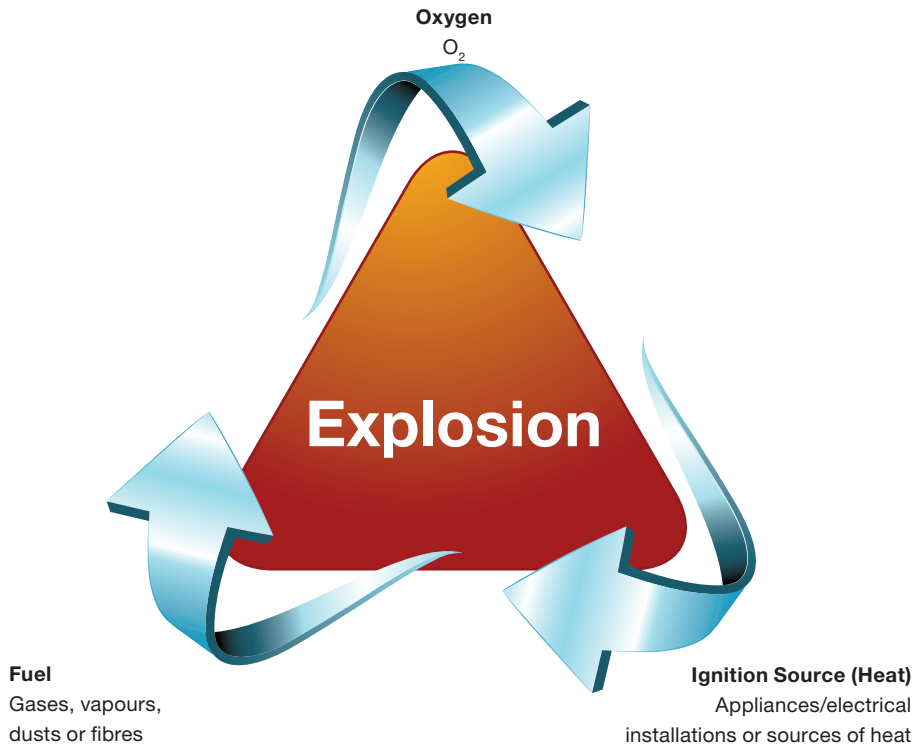
What is an

Explosive Atmosphere

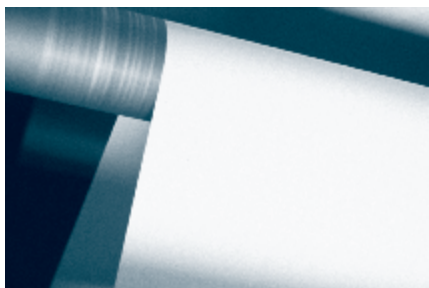


An explosive atmosphere is an environment which contains gas, vapour, dust or fibres with oxygen, in such proportion that a spark from an electric circuit or heating from a device may cause an explosion.

Electrical equipment installed in these environments must eliminate or isolate the source of ignition, thus preventing the simultaneous occurrence of the three components that form the fire triangle: fuel, oxygen and an ignition source (heat).



Atmospheres favorable to an explosion can be found in many different industries, such as Petrochemical, Food, Sugar and Ethanol Plants, Pharmaceuticals, Textiles, Paper and Cellulose, amongst others.





How to identify an **Explosive** Atmosphere?

Characteristics of the Flammable Gases and Vapours, Combustible Dusts and Fibres

In order to classify an industrial plant, it is necessary to determine the type of flammable substance present in the environment, its characteristics, the probability of such substance being released into the surrounding area and the environmental conditions.

Verify which groups of flammable gases and vapours or combustible dusts and fibres may be present in your industrial plant.

IEC designation for Gas and flammable vapours	IEC designation for Combustible dusts and fibres
Group II A - Propane	Group III A - Ignitable Fibres
Group II B - Ethylene	Group III B - Non-conductive dust
Group II C - Acetylene/Hydrogen	Group III C - Conductive dust



In order to prevent risk of explosion, the maximum surface temperature of electric motors must always remain below the ignition temperature* of the explosive mixture.

Temperature classes (°C)	
IEC	Maximum surface temperature
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C
T5	100 °C
T6	85 °C

** The ignition temperature is the lowest temperature at which the mixture of a flammable substance in the form of gas, vapour, dust or fibres and air, or a certain thickness of a dust layer, ignites without contact with a flame.*



Hazardous Area Classification

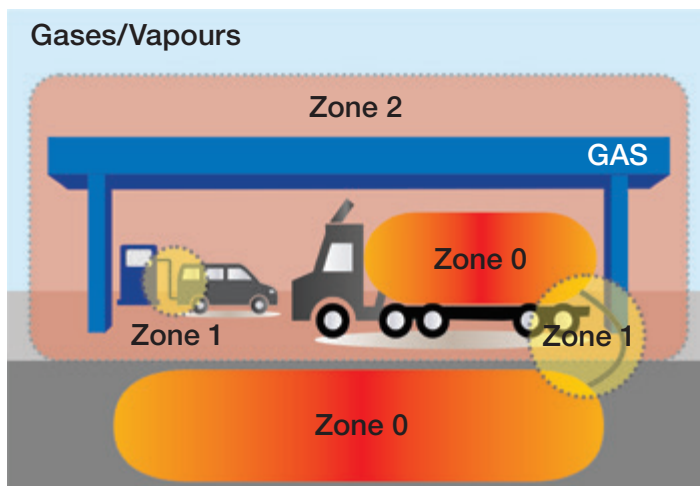
Classification of the Zones for Explosive Atmospheres according to the IEC 60079 standard

1. Flammable Gases and Vapours

Zone 0 - An atmosphere where, under normal operation, a mixture of air and flammable substances in the form of gas, vapour or mist is present frequently, continuously or for long periods.

Zone 1 - An atmosphere where, under normal operation, a mixture of air and flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

Zone 2 - An atmosphere where, under normal operation, a mixture of air and 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 only a short period.

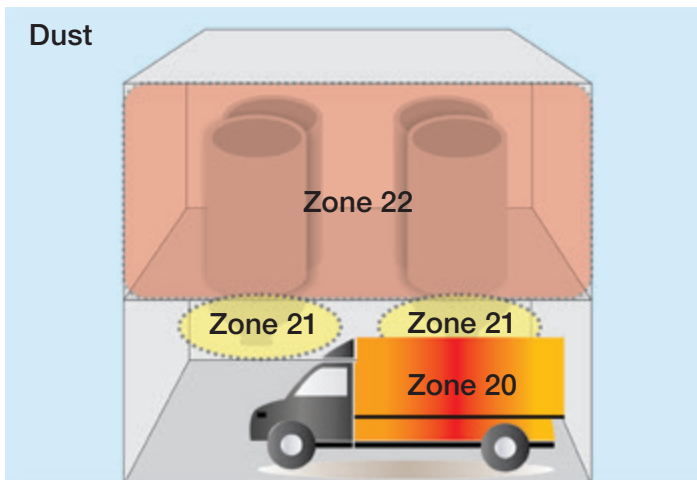


2. Combustible Dusts and Fibres

Zone 20 - An atmosphere where, under normal operation, a cloud of combustible dust in the air is present frequently, continuously or for long periods.

Zone 21 - An atmosphere where, under normal operation, a cloud of combustible dust in the air is likely to occur in normal operation occasionally.

Zone 22 - An atmosphere where, under normal operation, a cloud of combustible dust in the air is not likely to occur in normal operation but, if it does occur, will persist for only a short period.



Equipment Protection Levels - **EPL**

The new version of Standard IEC 60079-0, published in 2011, introduced a new risk assessment approach known as the “Equipment Protection Level” that considers, besides the hazardous location itself, the consequences of a possible explosion. The primary objective of the EPL is to allow flexibility in the use of equipment in the various zones. For example it may be appropriate to use Gc equipment in a Zone 1 area where the amount of flammable gas / vapour is small and the location is unmanned virtually all of the time. Conversely Gb equipment may be selected in Zone 2 to allow this equipment to be used in the event of a persistent emergency condition. IEC 60079-14 explains in detail how to use EPL’s in a risk assessment.

The EPL designations are defined as follows:

- First Indices
 - **‘M’** - Mines
 - **‘G’** - Gas
 - **‘D’** - Dust
- Second Indices
 - **‘a’** - Equipment having a very high level of protection
 - **‘b’** - Equipment having a high level of protection
 - **‘c’** - Equipment having an enhanced high level of protection

Relationship between Groups, Zones and EPL's

Group	Zone	EPL
Group I	-	Ma
		Mb
Group II	0	Ga
	1	Gb
	2	Gc
Group III	20	Da
	21	Db
	22	Dc



How to Prevent an Explosion ???

In order to avoid the potential occurrence of an explosive atmosphere in the workplace, and the consequential risks to the health and safety protection of personnel, specific duties are placed upon employers to eliminate or control the threats from dangerous substances in hazardous areas.

Flammable Gases and Vapours



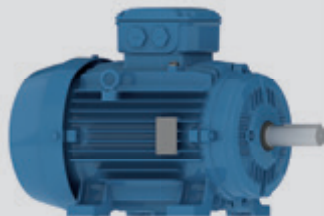
Flameproof - Ex d / Ex de* (EPL Gb): type of protection in which the parts that may cause the ignition of an explosive atmosphere are confined in an enclosure capable of withstanding the pressure developed during an internal explosion of an explosive mixture without allowing propagation to the external environment.

Standard: IEC 60079-1 - Explosive Atmospheres - Part 1: Equipment Protection by Flameproof Enclosures “d”.

** Motors Ex d with terminal box and terminals Ex e.*

Increased Safety - Ex e (EPL Gb): type of protection in which the electrical equipment, under normal operating conditions, will not produce arcs, sparks or heat sufficient to cause the ignition of an explosive atmosphere.

Standard: IEC 60079-7 - Explosive Atmospheres - Part 7: Equipment Protection by Increased Safety “e”.



Non-Sparking - Ex nA (EPL Gc): type of protection applied to electrical equipment that, under normal operation and certain specific abnormal conditions, cannot ignite the explosive atmosphere.

Standard: IEC 60079-15 - Explosive Atmospheres - Part 15: Equipment Protection by Type of Protection “n”.

Types of protection for motors that operate in classified areas.

These involve identification and classification of areas where explosive atmospheres may occur, provision of appropriate clothing, verifying overall explosion safety of the workplace and the selection and maintenance of equipment intended for use in Zoned areas.



Pressurized - Ex p (EPL Gb or Gc): type of protection in which the equipment is manufactured to operate with positive internal pressure so as to avoid the ingress of flammable gases and vapours into the enclosure, where there are parts which may cause the ignition of an explosive atmosphere. Standard: IEC 60079-2 - Explosive Atmospheres - Part 2: Equipment Protection by Pressurized Enclosures “p”.

Combustible dusts and fibres

Protection by enclosure - Ex tb / Ex tc (EPL Db or Dc): type of protection in which the parts that may cause the ignition of an explosive atmosphere are confined in an enclosure totally or partially protected against the ingress of dusts. Standard: IEC 60079-31 – Explosive Atmospheres - Part 31: Equipment Dust Ignition Protection by Enclosure “t”.



For all types of protection, the maximum surface temperature indicated on the motor nameplate must be observed according to the area in which it will operate.

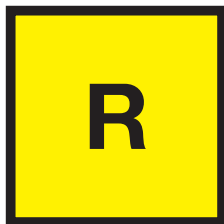
Explosive Atmospheres

According to IEC 60079-19, Explosive Atmospheres: Equipment repair, overhaul and reclamation, it is necessary for organisations undertaking service and repair of electrical equipment in explosive or flammable atmospheres to have in place:

- A Responsible Person with the authority and responsibility to ensure that overhauled / repaired equipment complied with the certification status agreed with the user
- A quality management system meeting requirements of ISO 9000
- Competent professionals qualified to repair / overhaul Ex motors
- Appropriate repair facilities, equipment and processes

After repair or overhaul, the electric motor must be marked with a legible and durable label indicating the Repairer's identity and that it has been subjected to repair or overhaul. There are two kinds of marks indicated by IEC 60079-19:

- 'R' within a square: indicates that the motor repair / overhaul fully complies with the Manufacturer's certification documents and, where applicable, genuine replacement parts from the manufacturer have been used in any repair.
- 'R' within an inverted triangle: indicates that the motor repair / overhaul complies with the repair standard and the standards for the type of protection; however, it no longer complies with the manufacturers certification documents.



In cases where the repaired / overhauled motor no longer complies with the requirements of IEC 60079-19 and the standards for the applicable type of protection, it may no longer operate in a potentially explosive atmosphere. In this case, it will not display the applicable repair mark, and the original manufacturer's label should be removed or changed to clearly indicate that the equipment is not in compliance with the certification documentation until a supplementary certificate is obtained to cover the repair or overhaul. Additionally, it is the responsibility of the user to maintain a file containing all documents relating to the motor, such as copies of certificates, Manufacturers Declaration of Conformity, outline drawings and a record of reports from previous repairs / overhauls.

Compliance with these obligations following repair or overhaul is essential in order to ensure that the the motor remains suitable to operate safely in a hazardous area.



WEG motors for Hazardous Areas



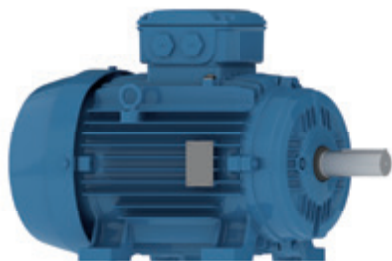
W22Xd

Flameproof motors which incorporate the same innovative concepts of the general purpose W22 line. They represent an evolution in the market of products for classified areas, ensuring high performance levels, energy savings, reduced operating costs, longer service life, low maintenance and, especially, safety! Suitable for use in Zone 1 and Zone 2 classified areas, and certified for Gas Groups IIA, IIB and IIC.



W22XnC

Non-Sparking motors that are flexible to adapt to different applications, can be used in Zone 2 and are ideal for installations where the presence of flammable mixtures occurs infrequently, but may present risks.



W21Xe

Increased Safety motor with reduced surface temperature that, under normal operating conditions or at the start, will not produce arcs, sparks or heat enough to cause the ignition of the explosive atmosphere for which it was designed. It is the ideal motor for application in places where potentially explosive products are manufactured, stored or transformed. They were designed for operation in Zones 1 and 2, and feature Ex-e protection.

WEG develops innovative products for aggressive environments and classified areas. Always focused on the customer's needs, we offer solutions for a wide variety of applications. WEG motors for classified areas represent an evolution on the market, ensuring high performance levels, low operating costs, long service life and, especially, safety!



W22Xtb / W22Xtc

Specially developed to maximize the safety and quality of motors for areas classified as Zone 21 and Zone 22 (processing of grains, cereals, textile fibres, powder coating, and polymers, among others). Ensures reliability and safety in the presence of conductive / non-conductive combustible dusts in suspension or in layers (up to 5 mm).



W22Xd Medium Voltage

Flameproof medium voltage motors designed to meet the latest market requirements and certifications for Hazardous Areas. Suitable to operate in the following classifications:

- Group I (Mines)
- Group II (Gas - Groups IIB and IIC, Zone 1)
- Group III (Dust - Zone 21)

In terms of certification this is a flexible and modular product, allowing the use of the motor frame enclosure with different sizes and types of terminal boxes.

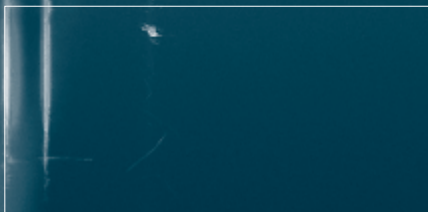


Ex p

WEG pressurized machines (Ex p) have an automatic pressurization system which detects eventual variations on the internal pressure of the equipment with automatic compensation, resulting in increase or reduction of the protection gas flow. These motors can operate in potentially explosive atmospheres, zones 1 and 2.



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The values shown are subject to change without prior notice.