

Explosion-proof motors

Technical information

Overview

In many industrial and public sectors, explosion protection or explosion hazards are ever-present, e.g. in the chemical industry, in refineries, on drilling platforms, at gas stations, in feed manufacturing and in sewage treatment plants.

The risk of explosion is always present when gases, fumes, mist or dust are mixed with oxygen in the air in an explosive ratio close to sources of ignition that are able to release the so-called minimum ignition energy.

In the chemical and petrochemical industries in particular, when crude oil and natural gas are transported, or in mining, milling (e.g. grain and granular solids), this can result in serious injury to persons and damage to equipment.

To ensure maximum safety in these areas, legislators in most countries have implemented appropriate legislation in the form of laws and regulations based on national and international standards.

Explosion-protected equipment is designed such that an explosion can be prevented when it is used properly.

The explosion-protected equipment can be designed in accordance with various types of protection.

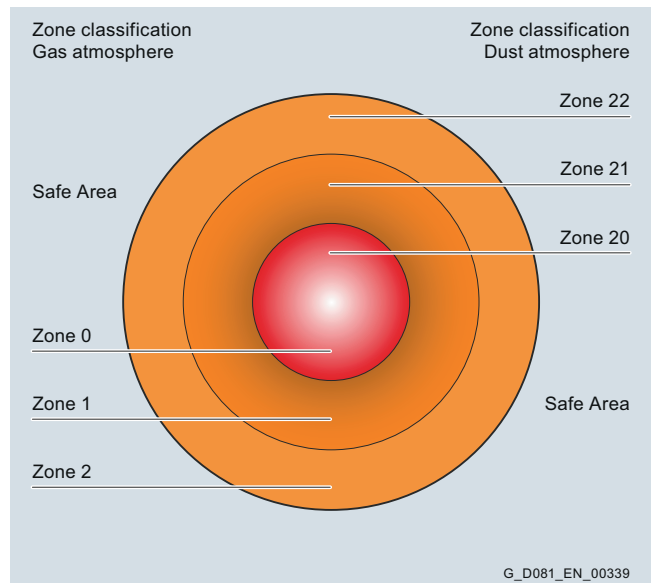
The local conditions must be subdivided into specified zones by the user with the assistance of the responsible authorities in accordance with the frequency of occurrence of an explosion hazard. Device (equipment) categories are assigned to these zones. The zones are then subdivided into possible types of protection and therefore into possible equipment (product) types.

Classification of zones

Areas subject to explosion hazard are divided into zones. Division into zones depends on the chronological and geographical probability of the presence of a hazardous, potentially explosive atmosphere. Information and specifications for classification of the zones are laid down in the following standards:

- IEC/EN 60079-10-1 for gas atmospheres
- IEC/EN 60079-10-2 for dust atmospheres

Further, a distinction is made between various explosion groups as well as temperature classes and these are included in the hazard assessment.



Depending on the particular zone and therefore the associated hazard, operating equipment must comply with defined minimum requirements regarding the type of protection. The different types of protection require corresponding measures to prevent ignition that should be implemented at the motor in order to prevent a surrounding explosive atmosphere from being ignited.

Zone	Gas ¹⁾	Dust ¹⁾	Zone definition acc. to	Assigned types of protection	Category according to 94/9/EC
2	–	–	IEC/EN 60079-10-1 for gas atmospheres IEC/EN 60079-10-2 for dust atmospheres	Ex nA	3G
–	–	22	An area in which in normal operation it is expected that an explosive gas atmosphere will occur only rarely and then only briefly .	Ex tc ²⁾	3D
–	–	22	An area in which in normal operation it is expected that an explosive gas atmosphere in the form of a cloud of dust in air will occur only rarely and then only briefly .		

Types of protection

Type of protection "Non-sparking" **Ex nA** acc. to IEC/EN 60079-15

The type of protection **Ex nA** ensures that a motor in normal operation as well as when operated under deviating conditions as specified in the standard is not in a position to ignite a surrounding explosive gas atmosphere.

Type of protection "Dust explosion protection" **Ex tc** acc. to IEC/EN 60079-31

This type of protection applies for electrical equipment protected using an housing and with limited surface temperature for use in areas in which combustible dust can occur in concentration levels that could cause a fire or an explosion.

Explosion-proof motors for converter operation

In principle, explosion-proof motors can be operated with converters. Particular attention must be paid to the interaction between the motor and converter system, especially with regard to the following aspects:

- The harmonic content of the supply voltage increases the motor temperature, so the power of the motor must be reduced (see derating)
- Lower cooling of the motor at speeds below the rated speed
- Voltage stress on the motor winding
- Bearing currents

¹⁾ Motors which are certified for gas or dust protection must not be used in hybrid mixtures! Hybrid mixtures: When explosive gas and dust atmospheres occur simultaneously.

²⁾ Motors are not approved for operation in environments containing conductive dust.

Overview (continued)
Certification

IEC motors for use in hazardous zones are certified according to the IEC/EN 60079-0, IEC/EN 60079-15 or IEC/EN 60079-31 standards and EC Directive 2014/34/EU and are marked according to the following schematic:

Example "explosion-proof enclosure":

CE		0158		II	2	G	Ex	de	IIC	T4	X
CE marking											
Number of the certifying "notified" body (e.g. 0158 = EXAM) (not zones 2, 22)											
Explosion protection marking (symbol)											
Device group:		I = Underground II = All other areas									
Category Part 1 (zone):		1 (Zone 0/20), 2 (Zone 1/21), 3 (Zone 2/22)									
Category Part 2 (Ex atmosphere)		G = Gas D = Dust									
Explosion protected equipment											
Type of protection (e.g. nA or tc)											
Explosion group and explosion subgroup		II = Gas (IIA, IIB or IIC) III = Dust (IIIA, IIIB or IIIC)									
Temperature class or max. surface temperature		T1 = 450 °C T2 = 300 °C T3 = 200 °C T4 = 135 °C									
Special conditions according to the operating instructions or EC type examination certificate											

Additional information on the subject of explosion protection, types of protection and zones is provided in the Siemens brochure "Explosion Protection".

Overview of SIMOTICS FD 1MM, 1MH, 1MQ, 1MN explosion-proof motors

SIMOTICS FD explosion-proof motors (1MM, 1MH, 1MQ, 1MN) correspond to the SIMOTICS FD non-explosion-proof motors (1LM, 1LH, 1LQ, 1LN). All technical data can be found in the selection and ordering data for the non-Ex motors 1LM, 1LH, 1LQ, 1LN (sections 4 to 7 of the catalog), whereby the rated power is derated in accordance with defined factors. For reduction/derating factors, see "Technical specifications" section "Derating".

To order explosion-proof motors, the letter "L" in position 2 of the Article No. for non-Ex motors must be replaced with the letter "M".

The table below contains a complete overview of our explosion-proof motors, their types of protection and their assignment to categories. It is important to note that depending on whether the motor is used for converter operation or line operation, different order codes are required in order to uniquely select the required motor.

Sector	Category	Zone	Frequency of occurrence of the Ex atmosphere	Type of protection	Temperature class, max. surface temperature	Degree of protection	Motor type (pos. 1 to 4 of the Article No.)	Operation	Order code	Utilization acc. to thermal class	Standard
Gases and vapors (G)	3G	2	rarely or briefly	Ex nA IIC (Non-sparking)	T1 – T3	IP55	1MM1 1MH1 1MQ1 ¹⁾ 1MN1	Line (1MH1)	M72	130 (B)	IEC/EN 60079-0
								Converter	M73	155 (F)	IEC/EN 60079-15
Dust (D)	3D	22	rarely or briefly	Ex tc IIIB (non-conductive dust)	T125 °C	IP55	1MM1 1MH1 1MQ1 1MN1	Line (1MH1)	M35	130 (B)	IEC/EN 60079-0
								Converter	M39	155 (F)	IEC/EN 60079-31

¹⁾ 1MQ1 motors are only certified for explosion group/explosion subgroup IIB.