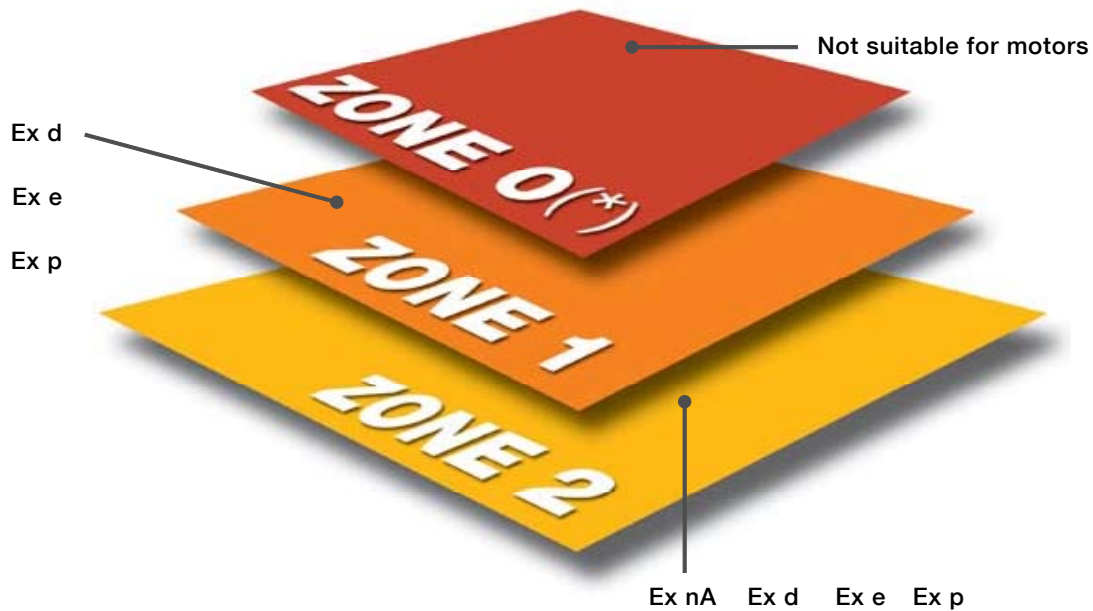


# Technical note

## Principles of Ex protection



### Principles of Explosion (Ex) protection

The atmospheres in which operations in the chemicals, oil and gas industries are carried out are categorized as “non-hazardous” or “hazardous”.

Hazardous environments contain potentially explosive constituents, such as gases, vapours, mists and dust. These atmospheres are classified into risk categories, based on the presence and concentration of explosive substances:

- Zone 0 – An explosive atmosphere is present continuously
- Zone 1 – An explosive atmosphere is present less than 1,000 hrs/year
- Zone 2 – An explosive atmosphere is present less than 10 hrs/year

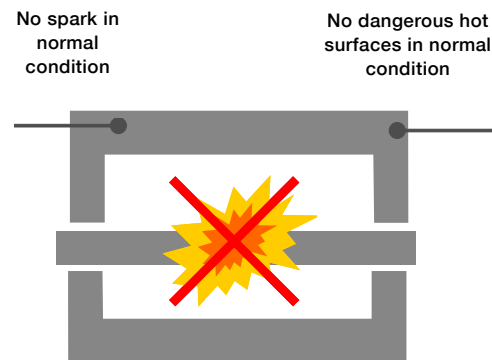
International standards define four types of motor protection that make industrial operations possible in two zones

- Zones 1 and 2. The aim of all motor protection is to avoid potentially explosive sources, which are typically hot surfaces and sparks.

### Non-sparking motors - Ex nA/IEC 60079-15 and EN 60079-15

An Ex n motor is designed to prevent foreseeable ignition sources in situations where the machine is operating within its design parameters in normal operation.

The protection principle limits the maximum temperature of all vital parts of the machine, and defines measures to prevent sparks. An explosive gas can thus penetrate the motor without the risk of explosion. Ex nA motors are designed to be used in Zone 2 locations.



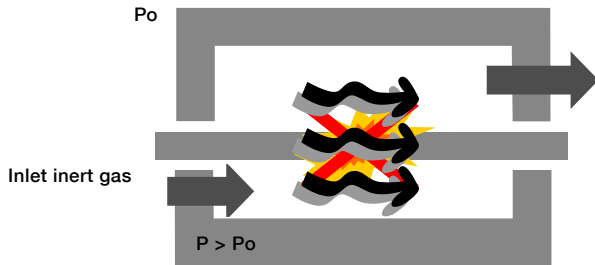
### Increased safety motors - Ex e / IEC 60079-7 and EN 60079-7

An increased safety enclosure means that any items capable of igniting an explosive gas are omitted. The principle of Ex e is to prevent sparks and hot surfaces inside and outside the machine enclosure in normal operations and in one independent abnormal condition, such as the stalled condition, for which the motor has been certified. Ex e motors are designed to be used in Zone 1 and 2 locations.

### Pressurized motors - Ex p / IEC 60079-2 and EN 60079-2

Ex p protection is mainly based on the use of a pressurized and purged enclosure.

A safe gas, typically standard instrument air, is used to pressurise and purge the enclosure, and a control unit mounted on the motor ensures that the operation is safe. The pressurized enclosure houses all parts that could ignite an explosive gas mixture. The control unit maintains the excess pressure in the enclosure during operation. Ex p motors are designed to be used in Zone 1 and 2 locations.



### Flameproof motors - Ex d / IEC 60079-1 and EN 60079-1

Flameproof motors also rely on an enclosure for safe operation. The enclosure is designed such that an explosion inside the enclosure is not transmitted to the explosive atmosphere outside the enclosure.

All parts that could ignite an explosive atmosphere are placed inside this enclosure. Flameproof enclosures are type tested each frame in a test environment with real explosive gas, and the tests are witnessed by a third party. Ex d motors are designed to be used in Zone 1 and 2 locations.

Seals & labyrinths      Strong housing (frame & shields)

