EXPLOSION PROTECTION

A REVIEW OF USE OF ELECTRICAL EQUIPMENT IN **HAZARDOUS AREAS**

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What is a HAZARDOUS AREA?

- A *hazardous area* is defined as an area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation, and use of potential ignition sources.

Examples of Industries with Hazardous Areas

- Petrochemical
- Chemical
- Sewerage Treatment
- Grain Handling
- Coal Mining

Hazardous Area Classification

A Hazardous Area is classified according to the following 3 criteria :-

- The type of hazard - gas or dust.
- Probability of explosive atmosphere occurring.
- The nature of the hazard.

Hazardous Area Classification

Type of Hazard

CLASS **I** - Gas/vapour/mist.

CLASS **II** - Dusts.

CLASS III Dusts

Hazardous Area Classification

Probability of Hazard Occurring

- Zone 0 - an area in which an explosive atmosphere is present continuously, or is present for long periods.

Hazardous Area Classification

Probability of Hazard Occurring

- Zone 1 - an area in which an explosive atmosphere is likely to occur periodically in normal operation.

Hazardous Area Classification

Probability of Hazard Occurring

- Zone 2 - an area in which an explosive atmosphere is not likely to occur in normal operation and if it does occur it will exists for a short period only.

Hazardous Area Classification

Nature of Hazard

- Group I - Coal Mining (methane)
- Group II - Other Industries
  - Group IIA (e.g. propane, butane)
  - Group IIB (e.g. ethylene, butadiene)
  - Group IIC (e.g. acetylene, hydrogen)

Explosion Protection Techniques

- In this section we will look at the various ways that electrical equipment can be made safe to use in Hazardous Areas
- This will explain all those ‘funny’ markings on the gas detectors that we sell!

Explosion Protection Techniques

- Ex ia IIC T4

Ex - Explosion protected

ia - Protection technique applied

IIC - Gas group suitability

T4 - Maximum surface temperature

Explosion Protection Techniques

Exclusion

- Ex h - Hermetic sealing
- Ex m - Encapsulation
- Ex n - Non-sparking (sealed)
- Ex o - Oil immersion
- Ex p - Pressurised enclosure
- Ex pl - Purged enclosure
- Ex q - Sand filled enclosure

Explosion Protection Techniques

Explosion Containment

- Ex d - Flameproof enclosure
- Ex n - Non-sparking (enclosed break)

- The Ex d is one that we come across, let's take a closer look.

Explosion Protection Techniques

Explosion Containment

- Ex d - Flameproof enclosure
  - An enclosure for electrical equipment that will withstand, without damage, an explosion of a prescribed flammable mixture within the enclosure and will prevent the transmission of flame such as will ignite the external prescribed mixture for which it is designed, and which operates at such an external temperature that will not ignite a surrounding flammable atmosphere.

Explosion Protection Techniques

Energy Limitation

- Ex i - Intrinsically safe
- Ex n - Non-sparking (non-incendive components and energy limitation)

- The Ex i is one that we come across, again let's take a closer look.

Explosion Protection Techniques

Energy Limitation

- Ex i - Intrinsically safe
  - An intrinsically safe circuit is a circuit in which any spark or thermal effect produced under normal operation and specified fault conditions, is incapable of causing ignition of a given explosive atmosphere.
  - Ex ia vs Ex ib - Ex ia involves more stringent testing conditions, providing a higher safety factor allowing use in zones of higher risk.

Explosion Protection Techniques

Dilution

- Ex v - Ventilation

Explosion Protection Techniques

Avoidance of Ignition Source

- Ex e - Increased safety
- Ex n - Non-sparking (inherent)

Explosion Protection Techniques

Others

- Ex s - Special protection
  - Electrical equipment which does not comply with the constructional or other requirements specified for the other techniques but which, nevertheless, can be shown to be suitable for use in hazardous areas.

  - You will see this on ALL gas detectors with an LEL sensor; the ‘s’ refers to the sinter which prevents propagation of flame from within the sensor.

Explosion Protection Techniques

Selection Guide

Type of protection	Symbol	Zone
Intrinsically safe	Ex ia	0
Special protection	Ex s	0
Intrinsically safe	Ex ib	1
Flameproof enclosure	Ex d	1
Non-sparking	Ex n	2

Equipment suitable for Zone 0 can be used in Zones 1 and 2

Equipment suitable for Zone 1 can be used in Zone 2

Gas Groups

- Substances are classified according to their ability to penetrate through gaps (MESG) in a flameproof enclosure and/or by their (MIC) minimum igniting currents (ignition energy) for intrinsically safe equipment.

Maximum Surface Temperature

- The maximum surface temperature of the equipment should not exceed the ignition temperature of the gas or vapour.

Temperature Class	Maximum Surface Temperature º C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

Maximum Surface Temperature

- Equipment designed for use in a maximum ambient of 40 °C may be used in higher temperatures provided that:
  - the temperature rise of the equipment plus the higher ambient is less than the ignition temperature of the flammable material, or
  - the maximum temperature of the temperature class plus the higher ambient is less than the ignition temperature of the flammable material.

Explosion Protection Techniques

So now you should understand what this means!

- Ex ia IIC T4

Ex - Explosion protected

ia - Protection technique applied

IIC - Gas group suitability

T4 - Maximum surface temperature

The End

- Any questions?