MAIN PROTECTION METHODS

We begin this new year analyzing some of the main ways of protection used in systems installed in areas with potentially explosive atmosphere for the presence of gas.
Relating with the three main protection techniques (containment, prevention and segregation), exist many others ways to apply the basic principle of the method.
Each method is specific to certain applications and impossible to apply to others. Over the time, unspecific techniques have been attempts to adopt to certain applications, leading to disastrous consequences and, often, major damage.
In recent years, standards have been heavily modified, and, even if existing, have been amended to be harmonized with international standards IECEx.
Therefore, it's necessary to assess the application limits of each method and decide which one is the best one in each case.
Choosing the right protection method for a specific electrical construction depends on a variety of factors, firstly, the zone where the equipments is going to be installed, and secondly, other characteristics such as:

- physical dimensions of the electrical material to be protected;
- level of ordinary and extraordinary maintenance operations;
- reliability and flexibility of the system;
- manufacturing and maintenance costs.

Below are described some of the main aspects of these protection methods, which conform to specific EC standards.

Ex "d" – Explosion Proof

Basic principle
In this protection method, the energized electrical circuits can be in contact with the explosive atmosphere.
However, they have to be enclosed within an enclosure specially designed to withstand the pressure caused by a possible explosion occurred inside the case itself and to prevent the spread of flames outside the enclosure that could ignite the external explosive atmosphere.
This method is based on the concept that it's impossible to prevent a gas from spreading. Hence it's impossible to produce electrical equipment inside an airtight enclosure which prevents the ingress of gas.
These enclosures are, therefore, built to allow the ingress of gas, but if it comes in contact with the ignition source (an arc or a spark) the explosion will be contained inside and the combusted gases will escape through the fittings between the parts of the enclosure. These fittings are specifically designed to allow the flame to cool as it escapes, so that only the product of combustion reaches outside the enclosure; and by then, it has cooled down and it is unable to ignite the surrounding atmosphere.

Applications
This method can be applied to all low-voltage equipment such as lighting fixtures, panel boards, switches, command, control and signaling units, transformers, low and high-voltage motors and, generally, all equipment which can cause sparks or over temperature during normal operation.

Main features
The main feature is a strong construction, which guarantees reliability in the long terms.

Reference Standards

- IEC 60079 –1:2007 (International)
- EN 60079-1:2007 (Europe)

Ex “e” – Increased safety

Basis principle
This protection method applies measures in order to prevent the formation of arcs, sparks or temperatures which can ignite the explosive mixture, therefore guaranteeing a high safety coefficient.

Applications
This principle is only applicable to non-sparking equipment, such as enclosures or terminals. Combining it with other protection methods, highly complex equipment were designed with the Ex ”e” construction simplicity integrating it with individually protected parts and other protection methods.
You can apply it to low voltage equipment, enclosures with terminal blocks, coils, solenoids, some types of motors, lighting fixtures, electrical resistance heaters, meters, moving coil.
It can be applied combined with other protection methods, such as Ex ”d”, Ex ”q” or Ex ”m”.

Main features
The equipment is designed to prevent sparks even in irregular operating conditions.

Reference Standards
- IEC 60079-7:2006 (International)
- EN 60079-7:2007 (Europe)

Ex ”i” – Intrinsic safety

Basic principle
In this constructive method, the electrical equipment is characterized by circuits that are considered intrinsically safe, unable to cause an explosion in the surrounding atmosphere.
We can consider an intrinsically safe circuit when, in any condition of normal work or failure, it can’t cause sparks or any over temperature that can ignite the explosive atmosphere.

Applications
It can be applied to measurement and control instruments and to the regulation of production process in explosion-proof plants.

Main features
The application of this method is, obviously, limited to low power circuits. It’s not possible, in fact, to start an engine or to illuminate a plant using intrinsic safety equipments. For it’s proper application, it’s the best choice because of it’s high safety and it’s cheapness in installation and in maintenance.

Reference standards
- IEC 60079-11: 2006 (International)
- EN 60079-11:2007 (Europe)

Ex “n” – Simplified

Basic principle
This protection method uses other protection methods such as d, e, i, p in a simplified way. It’ s application to electrical equipment makes them unable to cause the ignition of an explosive atmosphere even during the normal operation.

Applications
Lighting fixtures, electrical panel, command, control and signaling units and other equipment for BT electrical plant. It can be use only in Zone 2.

Main features
In zone 2, this is an alternative to the protection methods used in Zone 1. It has not met a great success because it is less safe than Ex ”d” and Ex ”e” systems, despite the cost is the same.

Reference standards
- IEC 60079-15: 2005 (International)
- EN 60079-15: 2005 (Europe)

Conclusions

We can, therefore, conclude that there isn’t an universal or a perfect protection method. Each method has been conceived for any particular plant-engineering applications and adapted to other applications over the years. The important thing to remember is that all the method are effective if they are applied correctly following their construction criteria, and that the equipment is kept in its original condition of safety by careful maintenance. No system is infallible, but if you keep the equipment in the same condition as when it was installed, you are on the right track to guaranteeing a safe system