Intrinsic Safety

Introduction to Intrinsic Safety

There are many places where an explosive mixture of air and gas or vapour is or may be present continuously, intermittently or as a result of an accident. These are defined as hazardous areas by BS EN 60079, the code of practice for installation and maintenance of electrical apparatus in potentially explosive atmospheres.

Hazardous areas are common in petroleum and chemical engineering plants and in factories processing and storing gases, solvents, paints and other volatile substances.

Electrical equipment for use in these areas needs to be designed so that it cannot ignite an explosive mixture, not only in normal operation but also in fault conditions. There are a number of methods available to achieve this, oil-immersion, pressurised apparatus and powder filling, for example, but the two in most common use are flameproof enclosures and intrinsic safety.

Flameproof equipment is contained in a box so strong that an internal explosion will neither damage the box nor be transmitted outside the box. The surface must remain cool enough not to ignite the explosive mixture.

When flameproof equipment is interconnected, flameproof wiring must be used. This method is most valuable when high power levels are unavoidable but is not acceptable for areas in which an explosive gas/air mixture may be continuously present or present for long periods.

For this reason Apollo fire detectors are made intrinsically safe rather than flameproof. Intrinsically safe equipment operates at such low power and with such small amounts of stored energy that it is incapable of causing ignition:

- In normal conditions
- With a single fault (for ib classification)
- With any combination of two faults (for ia classification)

In any of these conditions every component must remain cool enough not to ignite the gases for which it is approved.

Classification of hazardous areas

BS EN 60079-10-2 defines a hazardous area as one in which explosive gas/air mixtures are, or may be expected to be, present in quantities such as to require special precautions for the construction and use of electrical apparatus.

The degree of risk in any area is a function of:

- The probability of an explosive mixture being present
- The type of gas which may be present
- The temperature at which a gas might ignite spontaneously

These are defined in Table 1, Zone Classification, Table 2, Sub-division of Group II Gases and Table 3, Temperature Classification, respectively.

Table 1: Zone classification

Zone	Definition	Intrinsically safe equipment approval required
0	In which an explosive gas/air mixture is continuously present or present for long periods	Ex ia
1	In which an explosive gas/air mixture is likely to occur in normal operation	Ex ia or Ex ib
2	In which an explosive gas/air mixture is not likely to occur in normal operation and if it occurs will exist only for a short time	Ex ia or Ex ib

Table 2: Subdivision of Group II gases

Zone	Definition	Intrinsically safe equipment approval required
Hydrogen	Carbon Disulphide Acetylene	IIC
Ethylene	Butadiene, Formaldehyde, Diethylether	IIB or IIC
Methane	Acetaldehyde, Acetone, Benzene, Butane, Ethane, Hexane, Heptane, Kerosene, Naptha, Petroleum, Styrene, Xylene	IIA or IIB or IIC

Table 3: Temperature classifications

Temperature class	Max surface temp °C	Gases, Liquids and Vapours	Intrinsically safe equipment approval required
T6	85	-	T6
T5	100	Carbon Disulphide	T5 or T6
T4	135	Acetaldehyde, Diethylether, Isopropylnitrate	T4 or T5 or T6
T3	200	Hexane, Heptane	T3 or T4 or T5 or T6
T2	300	Butane, Butadiene, Ethylene	T2 or T3 or T4 or T5 or T6
T1	450	Acetone, Ammonia, Benzene, Carbon Monoxide, Ethane, Hydrogen, Methane, Propane, Ethylene	T1 or T2 or T3 or T4 or T5 or T6

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