Hazardous areas

Hazardous areas are defined by three main criteria:

The type of hazard
The likelihood of the hazard being present in flammable concentrations
The (auto) ignition temperature of the hazardous material

The type of hazard (Groups)

The hazard will be in the form of a gas, vapour, dust or fibre.

Gases and Vapours

Gases and vapours are categorized in terms of their ignition energy or the maximum experimental safe gap (in respect of flameproof protection). This categorization leads to the Gas Groups:

Mining	Surface Industry		
Group I	Group II		
Methane	IIA	IIB	IIC
	Propane	Ethylene	Hydrogen

(The gases noted in the table are typical gases for each group.)

Group IIC is the most severe group. Hazards in this group can be ignited very easily indeed.

Dusts and Fibres (Group III)

Dusts and fibres are also defined in terms of their ignition properties including dust cloud ignition properties.

The likelihood of the hazard being present in flammable concentrations (Zones)

The likelihood of the hazard being present in flammable concentrations will vary from place to place. A location very close to an open source of hazard will have a high likelihood of a flammable atmosphere. On the other hand, outside a flanged pipe containing a flammable liquid, the likelihood of a flammable atmosphere being present is much lower since it will only occur if the flange leaks. Rather than work with an infinite range of possibilities, three zones are defined.

Gases and Vapours

There are three zones for gases and vapours:

Zone 0	**Flammable atmosphere highly likely to be present - may be present for long periods or even continuously**
Zone 1	**Flammable atmosphere possible but unlikely to be present for long periods**
Zone 2	**Flammable atmosphere unlikely to be present except for short periods of time - typically as a result of a process fault condition.**

Zone zero is the most severe zone (the highest probability of flammable atmosphere presence). Equipment for this zone needs to be very well protected against providing a source of ignition.

Dusts

There are three zones for dusts:

Zone 20	**Dust cloud likely to be present continuously or for long periods**
Zone 21	**Dust cloud likely to be present occasionally in normal operation**
Zone 22	**Dust cloud unlikely to occur in normal operation, but if it does, will only exist for a short period**

(The presence of dust layers does not automatically lead to the dust zone. The likelihood of the dust layer being disturbed to create a cloud needs to be considered. Dust layers also need careful consideration in terms of ignition temperature. Because the dust layer can make the equipment under it hotter then normal, a factor of safety is applied to the layer ignition temperature.)

The (auto) ignition temperature of the hazardous material (Temperature Classes)

As well as considering the protection against electrical arcs and sparks igniting a flammable atmosphere, consideration needs to be given to the surface temperature of equipment. (Most electrical apparatus dissipates some heat!) Flammable materials are categorized according to their ignition temperature. Again, rather than work with an infinite range, six temperature classes are defined as follows:

T-Class	Hazards which will not ignite at temperatures below:
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

The bigger the T-number the lower is the ignition temperature of the hazard. So equipment to be installed in hazardous areas where the hazard has temperature class T5 or T6 must be ensured not to get hot. Electrical equipment is marked with a T-Class. The T-Class on the equipment states that the equipment will not provide an ignition capable surface hotter than the temperature represented by the stated T-Class. For equipment in hazardous areas, the bigger the T-Number on the equipment the less hot it will get.

Protecting Electrical Apparatus to make it suitable for use in hazardous areas

Electrical apparatus for use in hazardous areas needs to be designed and constructed in such a way that it will not provide a source of ignition. There are ten recognized types of protection for hazardous area electrical apparatus. Each type of protection achieves its safety from ignition in different ways and not all are equally safe. In addition to the equipment being suitable for the Gas Group and the Temperature Class required, the type of protection must be suitable for the zone in which it is to be installed. The different types of protection and the zones for which they are suitable are as follows:

Equipment Code	Description	Suitable for zones...
Ex ia	Intrinsic safety 'ia'	0, 1, 2
Ex ib	Intrinsic safety 'ib'	1,2
Ex ic	Intrinsic Safety 'ic'	2
Ex d	Flameproof protection	1,2
Ex p	Purge/pressurized protection	1,2
Ex px	Purge/pressurized protection 'px'	1,2
Ex py	Purge/pressurized protection 'py'	1,2
Ex pz	Purge/pressurized protection 'pz'	2
Ex e	Increased safety	1,2
Ex m	Encapsulation	1,2
Ex ma	Encapsulation	0,1,2
Ex mb	Encapsulation	1.2
Ex o	Oil immersion	1,2
Ex q	Sand / powder (quartz) filling	1,2
Ex n	Type - n protection	2
Ex s	Special protection	Normally 1 and 2

Equipment complying with European (CENELEC) standards will bear the code EEx..

Equipment Protection Levels - EPL

From 2007 onwards, the IEC Technical Standards in the series IEC 60079, and in particular IEC 60079 Part 14, have recognised that there may be occasions where it is necessary to increase, above the normal levels, the protection against ignition sources. This concept allows for consideration of risk (ie consequences of an explosion) as opposed to just the probability of a flammable atmosphere existing - the conventional selection criteria between the types of protection and the zone of use.

Three Equipment Protection Levels are specified as shown in the table below.

In normal circumstances the effect of these EPLs will be to retain the normal zone/ equipment protection relationship. If, however, the risk is considered especially severe, then the required EPL for the zone may be increased. Similarly, if the risk is deemed to be especially small or negligible, the EPL may be reduced from the norm.

The following two tables show the normal relationship between EPL and zone, and the EPL awarded to each type of protection.

Equipment Protection Level (EPL)	Normal Applicable Zone(s)
Ga	0 (and 1 and 2)
Gb	1 (and 2)
Gc	2

Equipment Code	Description	EPL
Ex ia	Intrinsic safety 'ia'	Ga
Ex ib	Intrinsic safety 'ib'	Gb
Ex ic	Intrinsic Safety 'ic'	Gc
Ex d	Flameproof protection	Gb
Ex p	Purge/pressurized protection	Gb
Ex px	Purge/pressurized protection 'px'	Gb
Ex py	Purge/pressurized protection 'py'	Gb
Ex pz	Purge/pressurized protection 'pz'	Gc
Ex e	Increased safety	Gb
Ex m	Encapsulation	Gb
Ex ma	Encapsulation	Ga
Ex mb	Encapsulation	Gb
Ex o	Oil immersion	Gb
Ex q	Sand / powder (quartz) filling	Gb
Ex n	Type - n protection	Gc
Ex s	Special protection	Refer to equipment marking and documentation