

# GUIDE TO HAZARDOUS AREAS

## Atex directive

The Atex Directive is a mandatory requirement for all hazardous area equipment sold in the European Union and equipment must have applicable Atex certificates. Certain other countries accept the IECEx standard, which is derived from similar principles.

In addition to the technical requirements demanded by the appropriate standards for each type of protection concept, the Atex Directive imposes additional requirements on the certificate holder in terms of quality system, product documentation, installation information, possible limitations of use in the relation to its intended environment, labelling information etc.

Zone	Equipment
Zone 0 & 20	Category 1
Zone 1 & 21	Category 2
Zone 2 & 22	Category 3

The marking of the equipment shall include the following typical data:

**Ex II 2 G, Ex II 3 D**

Where II is the gas group;

2 is the category for use (previously known as zone, and still widely used—see table above for equivalence)

G (or D) is the type of explosive atmosphere - G = gas, vapour or mist; and D = Dust

**IIC T4 Ta = -20°C to +55°C**

IIC refers to the gas group, and where the T class will vary against ambient

**IIC T5 Ta = -20°C to +25°C**

The T class marking for dust may also be shown if different to gas



## Ingress protection

In addition to protection against the risk of explosion or ignition, luminaires for use in hazardous areas will also need to provide adequate protection against the ingress of solids or liquids. The degree of classification is denoted by the IP classification system.

A two digit number is used to identify the degree of protection.

The first digit of the code denotes protection against dust and solid objects

The second digit denotes protection against moisture

### INGRESS PROTECTION (IP) CODE BS EN 60529 (IEC 60529)

IP0X No special protection  
IP1X Objects  $\geq 50$ mm diameter (e.g. part of a hand)  
IP2X Objects  $\geq 12.5$ mm diameter (e.g. finger)  
IP3X Objects  $\geq 2.5$ mm diameter (e.g. tool)  
IP4X Objects  $\geq 1.00$ mm diameter (e.g. wire)  
IP5X Dust protection  
IP6X Dust tight

IPX0 No special protection  
IPX1 Vertically dripping water  
IPX2 Vertically dripping water when enclosure tilted by 15°  
IPX3 Sprayed water up to 600mm from vertical  
IPX4 Sprayed water from all directions  
IPX5 Water jets  
IPX6 Powerful water jets  
IPX7 Temporary submersion to a depth of 1m (for half an hour)  
IPX8 Extended submersion to a depth  $\geq 1$ m

# GUIDE TO HAZARDOUS AREAS

## Temperature classification

The temperature classification of a given gas is the temperature above which an appropriate mixture of that gas with air will ignite. It is critical that the maximum surface temperature of any part of the equipment which may come into contact with the gas/air mixture, does not exceed the ignition temperature of the mixture.

The temperature class or 'T rating' is normally based on an ambient temperature of -20°C to +40°C

Class T Rating	Surface Temperature °C Max permitted	Ignition Temperature °C Gas/Air mixture
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

## Categories and Zone definitions for gas and dust

### Gas

- Zone 0** A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.
- Zone 1** A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.
- Zone 2** A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

### Dust

- Zone 20** A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.
- Zone 21** A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.
- Zone 22** A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

The hazardous area zone classification and corresponding equipment categories are:

- Zone 0 or zone 20 - category 1 equipment
- Zone 1 or zone 21 - category 2 equipment
- Zone 2 or zone 22 - category 3 equipment

Category 1 equipment can also be used in zones 1 and 21 and category 1 and 2 equipment can be used in zones 2 and 22.



# GUIDE TO HAZARDOUS AREAS

## Gas Groups

The explosive gases, vapours, and mists present in the atmosphere are grouped into temperature classes and gas groups according to various properties such as ignition temperature, the energy required to ignite the mixture, the energy produced by an explosion, flame transmission capability etc.

Group I Electrical equipment for use underground in mines susceptible to the hazard of firedamp (methane)

Group II Electrical equipment for use in all other hazardous areas. This group is then subdivided into 3 further groups (IIA, IIB and IIC) according to the maximum experimental safety gap for non-transmission of an internal ignition plus the minimum ignition current of the mixture.

Gas Group	Temperature Class					
	T1	T2	T3	T4	T5	T6
I	Methane					
II A	Acetone	Ethanol	Benzene	Acetaldehyde		
	Ethane	i-Amyl acetate	Diesel fuel	Ethyl ether		
	Ethyl ethanoate	n-Butane	Aircraft fuel			
	Ammonia	n-Butyl alcohol	Heating oils			
	Benzol (pure)		n-Hexane			
	Ethanoic acid					
	Carbon oxide					
	Methane					
	Methanol					
	Propane					
II B	Toluene					
	Coal gas	Ethylene				
II C	Hydrogen	Acetylene				Carbon disulphide

Any electrical equipment certified for use in Group II is suitable for use in all Group II categories, IIA, IIB and IIC. Equipment certified for Group IIC is also suitable for IIB and IIA, whilst equipment certified for IIB can also be used in IIA. Group IIA certified equipment can only be used on Group IIA applications.

## Dust Groups

The explosive nature of dusts is generally classified into three groups.

Dust Group	Description	Example
IIIA	Combustible Flyings	Material, fibres and flyings produced by machinery found in industries such as textile, cotton and wood cutting which settles around equipment and is vulnerable to ignition from heat or sparks.
IIIB	Non-conductive dust	Dust with electrical resistivity greater than 10K ohm.m
IIC	Conductive dust	Metal particles such as Aluminium or Titanium that are deposited on equipment as dust layers and form as dust clouds in the local atmosphere



# GUIDE TO HAZARDOUS AREAS

## Protection Concepts

There are established engineering concepts recognised by the IEC for the design of electrical equipment for hazardous area applications. These engineering concepts are the basis of protection against the risk of fire or explosion from gas or dust. Each concept is identified by a protection symbol. If a design relies on more than one concept all symbols are normally shown.

## Gas Protection Concepts

Symbol & EN ref	Concept	Summary	Zone use	Category
Ex ia EN/IEC 60079-11	Intrinsic safety	Limits energy of sparks & surface temperatures (using electronics c/w 2 failure protection devices)	0, 1 & 2	0, 1 & 2
Ex ib EN/IEC 60079-11	Intrinsic safety	Limits energy of sparks & surface temperatures (using electronics c/w 1 failure protection devices)	1 & 2	2 & 3
Ex d EN/IEC 60079-1	Flameproof	Contains explosion quenches flame	1 & 2	2 & 3
Ex e EN/IEC 60079-7	Increased safety	No arcs, sparks or hot surfaces	1 & 2	2 & 3
Ex p EN/IEC 60079-2	Pressurised	Keeps flammable gas out	1 & 2	2 & 3
Ex m EN/IEC 60079-18	Encapsulated	Keeps flammable gas out	1 & 2	2 & 3
Ex q EN/IEC 60079-5	Powder filled	Keeps flammable gas out	1 & 2	2 & 3
Ex o EN/IEC 60079-6	Oil filled	Keeps hazard away from ignition source using inert oil	1 & 2	2 & 3
Ex nA EN/IEC 60079-15	Non-sparking	No arcs, sparks or hot surfaces	2	3
Ex nR EN/IEC 60079-15	Restricted breathing	Gasket restricts air movement	2	3
Ex nP EN/IEC 60079-15	Pressurization	Over pressure prevents air ingress	2	3
Ex nL EN/IEC 60079-15	Energy limiting	Insufficient power to cause explosion	2	3
Ex nC EN/IEC 60079-15	Sealed device/ Enclosed break/ hermetically sealed/ encapsulated	Sealed from air ingress	2	3

## Dust Protection Concepts

Symbol & EN ref	Concept	Zone use	Category
Ex tDA20 EN/IEC 61241-1	Protection by enclosure	20, 21 & 22	1, 2 & 3
Ex tDB20 EN/IEC 61241-1	Protection by enclosure	20, 21 & 22	1, 2 & 3
Ex iaD EN/IEC 61241-11	Intrinsic safety	20, 21 & 22	1, 2 & 3
Ex maD EN/IEC 61241-18	Encapsulation	20, 21 & 22	1, 2 & 3
Ex tDA21 EN/IEC 61241-1	Protection by enclosure	21 & 22	2 & 3
Ex tDB21 EN/IEC 61241-1	Protection by enclosure	21 & 22	2 & 3
Ex ibD EN/IEC 61241-11	Intrinsic safety	21 & 22	2 & 3
Ex mbD EN/IEC 61241-18	Encapsulation	21 & 22	2 & 3
Ex pd EN/IEC 61241-4	Pressurised	21 & 22	2 & 3
Ex tDA22 EN/IEC 61241-1	Protection by enclosure	22	3
Ex tDB22 EN/IEC 61241-1	Protection by enclosure	22	3
Ex icD EN/IEC 61241-11	Intrinsic safety	22	3