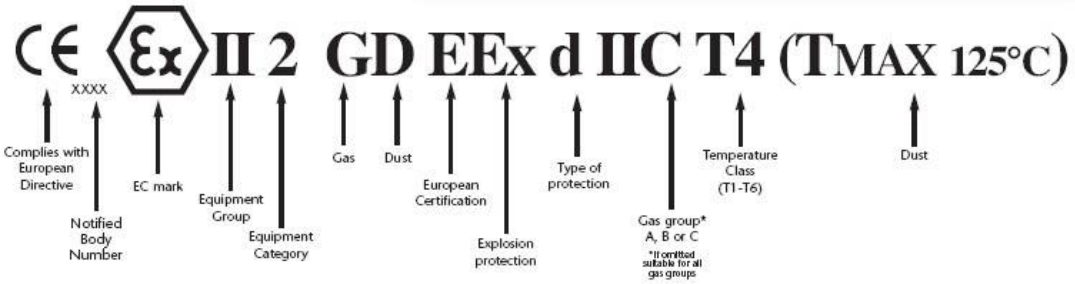

Direttiva 1999/92/CE - ATEX 118a.ATEX 100

Designation examples:

Use in gaseous atmospheres:	Use in dusty atmospheres:	Use for mining applications:
II 1 G EEx ia IIC T4	II 2 D T90°C IP64	I M2 EEx ia I

Temperature classes:
In the event of a malfunction, the maximum temperature of a surface that may be exposed to gas (in normal use with „n" type of protection). (Should not be used for dust ex-designations.)
T1 = 450°C
T2 = 300°C
T3 = 200°C
T4 = 135°C
T5 = 100°C
T6 = 85°C

Explosion group
(Data only for devices used in areas renderedpotentially explosive by gas)
I = Methane (mining)
IIA = such as Propane
IIB = such as Ethylene
IIC = most dangerous group (e.g. hydrogen)

IP Code
(Data only for devices used in areas rendered potentially explosive by dust)
Figure 1 Contact and foreign body protection:
5 = Protection against dust deposits
6 = protection against dust penetration
Figure 2 Water protection
Protection against:
0 = (no protection)
1 = vertically falling drip water
2 = drip water on operating device inclined to 15°
3 = spray water
4 = spray water
5 = jet water
6 = strong jet water
7 = temporary immersion
8 = continuous immersion

Ex	II 1 G	Ex	ia	IIC	T4	
Ex	II 2 D	Ex	td	A21	T90°	IP64

Device group
I = Mining
II = all other explosive areas

Category
1 = can be used in Zones 0 or 20
2 = can be used in Zones 1 or 21
3 = can be used in Zones 2 or 22
M1 = Mining
(In case of firedamp, continuation of operation is possible)
M2 = Mining
(Must be switched off in case of firedamp)

Atmosphere
G = Gas
D = Dust
(Mining – no details)

Types of protection:
o = oil immersion
p = high-pressure encapsulation
q = sand encapsulation
d = pressure-resistant encapsulation
e = increased safety
ia = intrinsic safety(permitted for Zone 0*)
*depending on the device category
ib = intrinsic safety (sufficient for Zone 1 (+ 2))
ma = cast encapsulation (for Zone 0*)
mb = (sufficient for Zone 1 (+ 2))
s = special protection
n = normal operation In normal conditions (only for Zone 2)
nA = non-sparking
nC = enclosed break
nR = vapour-proof housing
nL = energy limited
nZ = high-pressure encapsulation
op = optical radiation (is, pr, sh)
tD = protected by housing (dust)
pD = high-pressure encapsulation (dust)
iD = intrinsic safety (dust)
mD = cast encapsulation (dust)

Max. surface temperature
(Data for devices used in areas rendered potentially explosive by dust - rarely also used in gas ex marking.)
Maximum temperature of a surface during a machine error (normal operation in the case of category 3 devices) that can be reached by the ex atmosphere.
Evaluation by the user:
a.) Limit temperature 1=2/3 of min. igniti on temperature of dust present
b.) Limit temperature 2=min. glow temperature of dust present minus 75k (applies for layer thicknesses of up to 5mm)
The smaller value for the limit temperature must be above the indicated max. surface temperature of the device.

Zone
Procedure for determining the housing's leak tightness (A or B)

Introduction

Potentially Explosive Atmospheres exist where there is a risk of explosion due to mixtures of gas/air, vapour/air, dust/air or other flammable combinations.
In such areas there is a necessity to eliminate sources of ignition such as sparks, hot surfaces or static electricity which may ignite these mixtures.
Where electrical equipment has to be used in these areas it must be so designed and constructed as to not create sources of ignition capable of igniting these mixtures.
Before electrical equipment can be used in a potentially explosive atmosphere a representative sample has to be fully tested and certified by an independent authority such as BASEEFA in the U.K. or UL in the U.S.A.
This information is intended as a guide only and further expert guidance should be sought before placing into service, maintaining or repairing any item of equipment in a Potentially Explosive Atmosphere.
Where comparisons are shown between, for example, European and North American practice this may be an approximation and individual standards/codes of practice should be consulted for precise details.

Area Classification

Process plants are divided into Zones (European and IEC method) or Divisions (North American method) according to the likelihood of a potentially explosive atmosphere being present.

European & IEC Classification	Definition of zone or division	North American Classification
Zone 0 (gases)"**G**" Zone 20 (dusts)"**D**"	An area in which an explosive mixture is continuously present or present for long periods	Class I Division 1 (gases) Class II Division 1 (dusts)
Zone 1 (gases)"**G**" Zone 21 (dusts)"**D**"	An area in which an explosive mixture is likely to occur in normal operation	Class I Division 1 (gases) Class II Division 1 (dusts)
Zone 2 (gases)"**G**" Zone 22 (dusts)"**D**"	An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time	Class I Division 2 (gases) Class II Division 2 (dusts) Class III Division 1 (fibres)

Class III Division 2
(fibres)

Gas Groups (plus dusts and fibres)

There are two main gas groups, Group I – Mining only and Group II – Surface Industries These categories are used in European and I.E.C. groupings.

Group I is concerned only with underground mining where methane and coal dust are present.

Group II gases occurring in surface industries, are sub-grouped according to their volatility. This enables electrical equipment to be designed to less onerous tolerances if it is to be used with the least volatile gases.

Typical gas/material	European/I.E.C. Gas Group	North American Gas Group
Methane	I	-
Acetylene	IIC	A
Hydrogen	IIC	B
Ethylene	IIB	C
Propane	IIA	D
Metal dust	-	E
Coal dust	-	F
Grain dust	-	G

Note : North American legislation now allows Zones to be used to classify areas, where this practice is used it follows the IEC Zone method.

Temperature

Hot surfaces can ignite explosive atmospheres. To guard against this all Electrical Equipment intended for use in a potentially explosive atmosphere is classified according to the maximum surface temperature it will reach in service. This temperature is normally based on a surrounding ambient temperature of 40 degrees Centigrade (102 degrees Fahrenheit). This temperature can then be compared to the ignition temperature of the gas(es) which may come into contact with the equipment and a judgement reached as to the suitability of the equipment to be used in that area.

Temperature Classification		Maximum Surface Temperature
European/I.E.C.	North American	
T1	T1	450° C
T2	T2	300° C
	T2A	280° C
	T2B	260° C
	T2C	230° C
	T2D	215° C
T3	T3	200° C
	T3A	180° C
	T3B	165° C
	T3C	160° C
T4	T4	135° C
	T4A	120° C

T5	T5	100° C
T6	T6	85° C

e.g. Butane has an ignition temperature of 365 degrees Centigrade, equipment used in the vicinity of this gas would need a T rating of T2 or higher.

Types of Electrical Equipment Suitable for use in Potentially Explosive Atmospheres

Different techniques are used to prevent electrical equipment from igniting explosive atmospheres. There are restrictions on where these different types of equipment can be used as follows :

.	European - Area of use Designation Standard	IEC - Area of use Designation Standard	USA - Area of use Designation Standard
Flameproof Enclosure – An enclosure used to house electrical equipment, which when subjected to an internal explosion will not ignite a surrounding explosive atmosphere.	Zones 1 & 2 EExd EN50018	Zones 1 & 2 Exd IEC60079-1	Class 1 Divisions 1 & 2 UL1203
Intrinsic Safety – A technique whereby electrical energy is limited such that any sparks or heat generated by electrical equipment is sufficiently low as to not ignite an explosive atmosphere.	Zones 0, 1 & 2 EExi EN50020	Zones 1 & 2 Exi IEC60079-11	Class 1 Divisions 1 & 2 UL913
Increased Safety – This equipment is so designed as to eliminate sparks and hot surfaces capable of igniting an explosive atmosphere.	Zones 1 & 2 EExe EN50019	Zones 1 & 2 Exe IEC60079-7	
Purged and Pressurised – Electrical equipment is housed in an enclosure which is initially purged to remove any explosive mixture, then pressurised to prevent ingress of the surrounding atmosphere prior to energisation.	Zones 1 & 2 EExp EN50016	Zones 1 & 2 Exp IEC60079-2	Class 1 Divisions 1 & 2 NFPA496
Encapsulation – A method of exclusion of the explosive atmosphere by fully encapsulating the electrical components in an approved material.	Zones 1 & 2 EExm EN50028	Zones 1 & 2 Exm IEC60079-18	
Oil Immersion – The electrical components are immersed in oil, thus excluding	Zones 1 & 2 EExo EN50015	Zones 1 & 2 Exo IEC60079-6	Class 1 Division 2 UL698

the explosive atmosphere from any sparks or hot surfaces.			
Powder Filling – Equipment is surrounded with a fine powder, such as quartz, which does not allow the surrounding atmosphere to come into contact with any sparks or hot surfaces.	Zones 1 & 2 EExq EN50017	Zones 1 & 2 Exq IEC60079-5	
Non-sparking – Sparking contacts are sealed against ingress of the surrounding atmosphere, hot surfaces are eliminated.	Zone 2 EExn EN50021	Zone 2 Exn IEC60079-15	
Special Protection – Equipment is certified for use in a Potentially Explosive Atmosphere but does not conform to a type of protection listed above.	Zones 0, 1 & 2 *Exs	Zones 0, 1 & 2 Exs	

* This type of protection is only recognised by National Authorities, not as a European-wide type of protection.

Selection, Installation and Maintenance of Electrical Equipment Intended for use in Potentially Explosive Atmospheres

International and national standards are published giving details of requirements for the safe use of Electrical Equipment in Potentially Explosive Atmospheres as follows :

.	International	U.K.	U.S.A.
General Recommendations	EC60079-14	BS5345:Part 1	N.E.C. Chapter 5
Classification of Hazardous Areas	IEC60079-10		N.E.C. Chapter 5
Inspection and Maintenance of Electrical Equipment	IEC60079-1		
Requirements for Flameproof Enclosures	IEC60079-14	BS5345:Part 3	N.E.C. Chapter 5
Requirements for Intrinsically Safe Equipment	IEC60079-14	BS5345:Part 4	N.E.C. Chapter 5
Requirements for Increased Safety Equipment	IEC60079-14	BS5345:Part 6	N.E.C. Chapter 5
Requirements for Purged and Pressurised Equipment	IEC60079-14	BS5345:Part 5	N.E.C. Chapter 5
Requirements for Non-Sparking Equipment	IEC60079-14	BS5345:Part 7	
Requirements for Equipment with Special Protection	IEC60079-14	BS5345:Part 8	

All Explosion-proof electrical equipment is maintained, by suitably trained personnel, in accordance with the Manufacturers' recommendations.
Any spare parts used should be purchased from the original Manufacturer and repairs should be carried out by the Manufacturer or under his supervision, in order that the item remains in conformance with the certification documents.

The Certification Process

All Electrical Equipment, intended for use in a Potentially Explosive Atmosphere, should be certified as suitable for such use.
The methods of obtaining certification differ in detail, see below, between each certifying body or group of bodies (e.g. CENELEC). Basically this process consists of supplying a representative sample of the equipment along with a set of drawings to a recognised test/certification body e.g. BASEEFA who in turn test the equipment against a recognised Standard e.g. EN50018 and issue a Certificate. The user of the equipment can then refer to this Certificate to enable him to safely put the item into service in a zone appropriate to the Certification.
European Practice – after 1st July 2003
After the above date the **ATEX Directive** comes into force throughout the EEC. This becomes a mandatory requirement for all equipment intended for use in a hazardous area. The fundamental difference between current practice and ATEX certification is that ATEX addresses the essential safety requirements for hazardous area equipment and uses Standards as part of the method of conforming to these. Amongst other documentation required by certifying authorities will be Technical Manuals in order that the user is informed of installation methods etc.
ALL EQUIPMENT, BOTH ELECTRICAL AND MECHANICAL, INTENDED TO BE PUT INTO SERVICE WITHIN THE EEC AFTER 1ST July 2003, WILL HAVE TO HAVE BEEN CERTIFIED IN ACCORDANCE WITH THE ATEX DIRECTIVE.
In practice this means re-certification of all currently certified electrical equipment.

It should be noted also that **MECHANICAL** equipment is covered by the ATEX Directive so for the first time items such as gearboxes will have to carry ATEX certification.
The equipment coding will be as the current practice plus an additional code as follows:
ExII2G i.e.
Ex – Explosion proof in accordance with ATEX.
II – Group II surface industries.
2 – category 2 equipment (suitable for use in Zone 1) note: Category 1 is suitable for Zone 0. Category 3 is suitable for Zone 2.
G – suitable for atmospheres containing gas (D is suitable for atmospheres containing dusts).
Equipment will be CE marked when certified to ATEX.
European Practice – Current – until 30th June 2003
The method is basically as above. In addition all electrical equipment intended for use in the European Economic Community (EEC) must comply with Electromagnetic Compatibility regulations (EMC) and manufacturers must issue, on request, an EC Declaration of Conformity in accordance with the EMC regulations.
When certified, an item of equipment and its' certificate, carry a code e.g. EExdIIBT4. This can be broken down as follows:
E – European certificate in accordance with harmonised standards
Ex – Explosion-proof electrical equipment
d – flameproof enclosure type of protection

II – Group II surface industries
B – gas group B
T4 – temperature class T4 (135 degrees centigrade surface temperature).

North American Practice

Sample equipment and supporting documentation are submitted to the appropriate authority e.g. .U.L., F.M., C.S.A.
The equipment is tested in accordance with relevant standards for explosion protection and also for general electrical requirements e.g. light fittings.
After successful testing a listing is issued allowing the manufacturer to place the product on the market.
The product is marked with the certification details such as the gas groups A,B,C,D the area of use e.g. Class 1 Division 1

World-wide Certification

Most countries outside Europe or North America use the IEC Standards as a basis for their own national standards.
The Russian Federation certifies equipment to **GOST** standards, these closely follow CENELEC practice.
There is a scheme in place which will when fully adopted allow for internationally recognised certification to become a reality, this is the IEC EX SCHEME. This uses the IEC standards and IEC recognised test and certification bodies to issue mutually recognised test reports and certificates. The scheme is in its infancy and its level of success cannot yet be measured.

Ingress Protection

2 digits are used to denote the level of ingress protection that a piece of apparatus enjoys :–
(The first digit denotes the level of protection against solid objects and the second against liquids)

.	Solids	.	Liquids
0	No protection.	0	No protection.
1	Protected against solid objects up to 50mm, e.g. hands.	1	Protected against vertically falling drops of water.
2	Protected against solid objects up to 12mm, e.g. fingers.	2	Protected against water spray up to 15 degrees from vertical.
3	Protected against solid objects up to 2.5mm, e.g. tools.	3	Protected against water spray up to 60 degrees from vertical.
4	Protected against solid objects over 1mm, e.g. wires.	4	Protected against water sprays from all directions.
5	Protected against dusts. (No harmful deposits).	5	Protected against water jets from all directions.
6	Totally protected against dust.	6	Protected against strong water jets from all directions, e.g. Offshore.
		7	Protected against immersion between 15cm and 1m in depth.
		8	Protected against long immersion under pressure.

North American practice is to use NEMA standards to describe ingress protection, i.e.:

NEMA 3 is similar to IP 54
NEMA 4 is similar to IP 55
NEMA4x is similar to IP 56
NEMA 6 is similar to IP 67